FIRST FLUSH PHENOMENON

DATA APPENDIX (1999-2003)

September 2004

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Figure I.1.2.3a ~ Figure I.1.2.3l Polluto-graphs for the Event 1/30/00 from UCLA 2 in 1999~2000 **422~427**

Figure I.1.2.4a ~ Figure I.1.2.4l Polluto-graphs for the Event 2/10/00 from UCLA 2 in 1999~2000 **428~433**

Figure I.1.2.5a ~ Figure I.1.2.5l Polluto-graphs for the Event 2/11/00 from UCLA 2 in 1999~2000 **434~439**

Figure I.1.2.6a ~ Figure I.1.2.6l Polluto-graphs for the Event 2/20/00 from UCLA 2 in 1999~2000 **440~445**

Figure I.1.2.7a ~ Figure I.1.2.7l Polluto-graphs for the Event 2/27/00 from UCLA 2 in 1999~2000 **446~451**

Figure I.1.2.8a ~ Figure I.1.2.8l Polluto-graphs for the Event 4/17/00 from UCLA 2 in 1999~2000 **452~457**

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Figure I.1.3.2a ~ Figure I.1.3.2l Polluto-graphs for the Event 1/25/00 from UCLA 3 in 1999~2000 **464~469**

Figure I.1.3.3a ~ Figure I.1.3.3l Polluto-graphs for the Event 1/30/00 from UCLA 3 in 1999~2000 **470~475**

Figure I.1.3.4a ~ Figure I.1.3.4l Polluto-graphs and the Event 2/10/00 from UCLA 3 in 1999~2000 **476~481**

Figure I.1.3.5a ~ Figure I.1.3.5l Polluto-graphs for the Event 2/12/00 from UCLA 3 in 1999~2000 **482~487**

Figure I.1.3.6a ~ Figure I.1.3.6l Polluto-graphs for the Event 2/20/00 from UCLA 3 in 1999~2000 **488~493**

Figure I.1.3.7a ~ Figure I.1.3.7l Polluto-graphs for the Event 2/27/00 from UCLA 3 in 1999~2000 **494~499**

Figure I.1.3.8a ~ Figure I.1.3.8l Polluto-graphs for the Event 3/4/00 from UCLA 3 in 1999~2000 **500~505**

Figure I.1.3.9a ~ Figure I.1.3.9l Polluto-graphs for the Event 3/8/00 from UCLA 3 in 1999~2000 **506~511**

Figure I.1.3.10a ~ Figure I.1.3.10l Polluto-graphs for the Event 4/17/00 from UCLA 3 in 1999~2000 **512~517**

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Figure I.2.1.2a ~ Figure I.2.1.2g Polluto-graphs for the Event 1/8/01 from UCLA 1 in 2000~2001 **522~525**

Figure I.2.1.3a ~ Figure I.2.1.3g Polluto-graphs for the Event 1/10/01 from UCLA 1 in 2000~2001 **526~529**
Figure I.2.1.4a ~ Figure I.2.1.4g Polluto-graphs and the Event 2/10/01 from UCLA 1 in 2000~2001 **530~533**
Figure I.2.1.5a ~ Figure I.2.1.5g Polluto-graphs for the Event 2/19/01 from UCLA 1 in 2000~2001 **534~537**
Figure I.2.1.6a ~ Figure I.2.1.6g Polluto-graphs for the Event 3/4/01 from UCLA 1 in 2000~2001 **538~541**
Figure I.2.1.7a ~ Figure I.2.1.7g Polluto-graphs for the Event 4/21/01 from UCLA 1 in 2000~2001 **542~545**
Figure I.2.2.1a ~ Figure I.2.2.1g Polluto-graphs for the Event 10/26/00 from UCLA 2 in 2000~2001 **546~549**
Figure I.2.2.2a ~ Figure I.2.2.2g Polluto-graphs for the Event 1/8/01 from UCLA 2 in 2000~2001 **550~553**
Figure I.2.2.3a ~ Figure I.2.2.3g Polluto-graphs for the Event 1/10/01 from UCLA 2 in 2000~2001 **554~557**
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Figure I.2.2.5a ~ Figure I.2.2.5g Polluto-graphs for the Event 2/24/01 from UCLA 2 in 2000~2001 **562~565**
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Figure I.2.3.1a ~ Figure I.2.3.1g Polluto-graphs for the Event 10/26/00 from UCLA 3 in 2000~2001 **574~577**
Figure I.2.3.2a ~ Figure I.2.3.2g Polluto-graphs for the Event 1/8/01 from UCLA 3 in 2000~2001 **578~581**
Figure I.2.3.3a ~ Figure I.2.3.3g Polluto-graphs for the Event 1/10/01 from UCLA 3 in 2000~2001 **582~585**
Figure I.2.3.4a ~ Figure I.2.3.4g Polluto-graphs for the Event 2/10/01 from UCLA 3 in 2000~2001 **586~589**
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Figure I.2.3.6a ~ Figure I.2.3.6g Polluto-graphs for the Event 2/24/01 from UCLA 3 in 2000~2001 **594~597**

Figure I.2.3.7a ~ Figure I.2.3.7g Polluto-graphs for the Event 3/4/01 from UCLA 3 in 2000~2001 **598~601**
Figure I.2.3.8a ~ Figure I.2.3.8g Polluto-graphs for the Event 4/7/01 from UCLA 3 in 2000~2001 **602~605**
Figure I.3.1.1a ~ Figure I.3.1.1g Polluto-graphs and Load-graphs for the Event 11/12/01 from UCLA 1 in 2001~2002 **606~612**
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Figure I.3.1.3a ~ Figure I.3.1.3g Polluto-graphs and Load-graphs for the Event 12/20/01 from UCLA 1 in 2001~2002 **620~626**
Figure I.3.1.4a ~ Figure I.3.1.4g Polluto-graphs and Load-graphs for the Event 1/27/02 from UCLA 1 in 2001~2002 **627~633**
Figure I.3.1.5a ~ Figure I.3.1.5g Polluto-graphs and Load-graphs for the Event 2/17/02 from UCLA 1 in 2001~2002 **634~640**
Figure I.3.2.1a ~ Figure I.3.2.1g Polluto-graphs and Load-graphs for the Event 10/30/01 from UCLA 2 in 2001~2002 **641~647**
Figure I.3.2.2a ~ Figure I.3.2.2g Polluto-graphs and Load-graphs for the Event 11/12/01 from UCLA 2 in 2001~2002 **648~654**
Figure I.3.2.3a ~ Figure I.3.2.3g Polluto-graphs and Load-graphs for the Event 11/24/01 from UCLA 2 in 2001~2002 **655~661**
Figure I.3.2.4a ~ Figure I.3.2.4g Polluto-graphs and Load-graphs for the Event 12/14/01 from UCLA 2 in 2001~2002 **662~668**
Figure I.3.2.5a ~ Figure I.3.2.5g Polluto-graphs and Load-graphs for the Event 1/27/02 from UCLA 2 in 2001~2002 **669~675**
Figure I.3.2.6a ~ Figure I.3.2.6g Polluto-graphs and Load-graphs for the Event 2/17/02 from UCLA 2 in 2001~2002 **676~682**
Figure I.3.2.7a ~ Figure I.3.2.7g Polluto-graphs and Load-graphs for the Event 3/6/02 from UCLA 2 in 2001~2002 **683~689**
Figure I.3.2.8a ~ Figure I.3.2.8g Polluto-graphs and Load-graphs for the Event 3/17/02 from UCLA 2 in 2001~2002 **690~696**
Figure I.3.3.1a ~ Figure I.3.3.1g Polluto-graphs and Load-graphs for the Event 10/30/01 from UCLA 3 in 2001~2002 **697~703**
Figure I.3.3.2a ~ Figure I.3.3.2g Polluto-graphs and Load-graphs for the Event 11/12/01 from UCLA 3 in 2001~2002 **704~710**
Figure I.3.3.3a ~ Figure I.3.3.3g Polluto-graphs and Load-graphs for the Event 11/24/01 from UCLA 3 in 2001~2002 **711~717**

Figure I.3.3.4a ~ Figure I.3.3.4g Polluto-graphs and Load-graphs for the Event 12/20/01 from UCLA 3 in 2001~2002 **718~724**
Figure I.3.3.5a ~ Figure I.3.3.5g Polluto-graphs and Load-graphs for the Event 1/27/02 from UCLA 3 in 2001~2002 **725~731**
Figure I.3.3.6a ~ Figure I.3.3.6g Polluto-graphs and Load-graphs for the Event 2/17/02 from UCLA 3 in 2001~2002 **732~738**
Figure I.3.3.7a ~ Figure I.3.3.7g Polluto-graphs and Load-graphs for the Event 3/6/02 from UCLA 3 in 2001~2002 **739~745**
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Figure I.4.1.5a ~ Figure I.4.1.5d Polluto-graphs and Load-graphs for the Event 3/15/03 from UCLA 1 in 2002~2003 **777~780**
Figure I.4.1.6a ~ Figure I.4.1.6d Polluto-graphs and Load-graphs for the Event 5/13/03 from UCLA 1 in 2002~2003 **781~784**
Figure I.4.2.1a ~ Figure I.4.2.1i Polluto-graphs and Load-graphs for the Event 11/7/02 from UCLA 2 in 2002~2003 **785~793**
Figure I.4.2.2a ~ Figure I.4.2.2i Polluto-graphs and Load-graphs for the Event 11/29/02 from UCLA 2 in 2002~2003 **794~802**
Figure I.4.2.3a ~ Figure I.4.2.3i Polluto-graphs and Load-graphs for the Event 12/15/02 from UCLA 2 in 2002~2003 **803~811**
Figure I.4.2.4a ~ Figure I.4.2.4i Polluto-graphs and Load-graphs for the Event 12/16/02from UCLA 2 in 2002~2003 **812~820**
Figure I.4.2.5a ~ Figure I.4.2.5i Polluto-graphs and Load-graphs for the Event 2/11/03 from UCLA 2 in 2002~2003 **821~829**
Figure I.4.2.6a ~ Figure I.4.2.6d Polluto-graphs and Load-graphs for the Event 4/14/03 from UCLA 2 in 2002~2003 **830~833**
Figure I.4.3.1a ~ Figure I.4.3.1i Polluto-graphs and Load-graphs for the Event 11/7/02 from UCLA 3 in 2002~2003 **834~842**

Figure I.4.3.2a ~ Figure I.4.3.2i Polluto-graphs and Load-graphs for the Event 11/29/02 from UCLA 3 in 2002~2003 **843~851**
Figure I.4.3.3a ~ Figure I.4.3.3i Polluto-graphs and Load-graphs for the Event 12/16/02 from UCLA 3 in 2002~2003 **852~860**
Figure I.4.3.4a ~ Figure I.4.3.4i Polluto-graphs and Load-graphs for the Event 12/19/02 from UCLA 3 in 2002~2003 **861~869**
Figure I.4.3.5a ~ Figure I.4.3.5i Polluto-graphs and Load-graphs for the Event 2/11/03 from UCLA 3 in 2002~2003 **870~878**
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This collection of appendices complements the four-year first flush report, and shows data associated with each event, as well as the calculated values, such as mass first flush factors. The appendices are book marked for convenience and the major content of each appendix is summarized below.

Appendix A: Event Summary

This appendix includes three tables that show greater detail about each storm event than provided in the text. The tables show the events by site, with date, time of the beginning of rainfall, time of the end of rainfall, total rainfall, maximum intensity (15 minute maximum), antecedent dry days (ADD), antecedent rainfall (the total rainfall of the previous storm event), the storm duration (the elapsed time from the beginning to the end of rainfall), and the beginning and end of observed runoff. The UCLA sites, designated as UCLA1, UCLA2 and UCLA3 correspond to Caltrans site ID 7-201, 7-202 and 7-203, respectively. The sites monitored by CDM in 1999-2000 and the sites monitored by URS in 2000-2001 are also included, but the antecedent rainfall is not available.

Appendix B: Event Mean Concentrations

This appendix shows the event mean concentrations that were calculated from the series of grab samples. The term “BL” refers to samples that were below detection limits. If there is not reported value (blank) there was no sample analyzed. The data collected by the CDM and URS are also reported. There are more missing values associated with consultants monitoring data, because additional constituents/parameters were included in the UCLA protocol.

Appendix C: Total Mass Loading

This appendix shows the total pollutant mass discharged during the storm event, in g or kg depending on the constituent. The format is the same as the EMC presented in Appendix B. If the EMC data were missing, the total mass loading data will also be missing.

Appendix D: Mass First Flush Ratios

This appendix reports the mass first flush ratio (MFF_n) for each pollutant for each storm event. The MFF ratio is defined using a graph constructed from the following equation:

$$\frac{y}{x} = \frac{\dfrac{\int_0^{t_1} C(t)Q(t)dt}{\mathbf{M}}}{\dfrac{\int_0^{t_1} Q(t)dt}{\mathbf{V}}} = \frac{\dfrac{\int_0^{t_1} C(t)Q(t)dt}{\int_0^{t_1} Q(t)dt}}{\dfrac{\mathbf{M}}{\mathbf{V}}} \qquad \text{(A1)}$$

where:

C(t) = pollutant concentration,

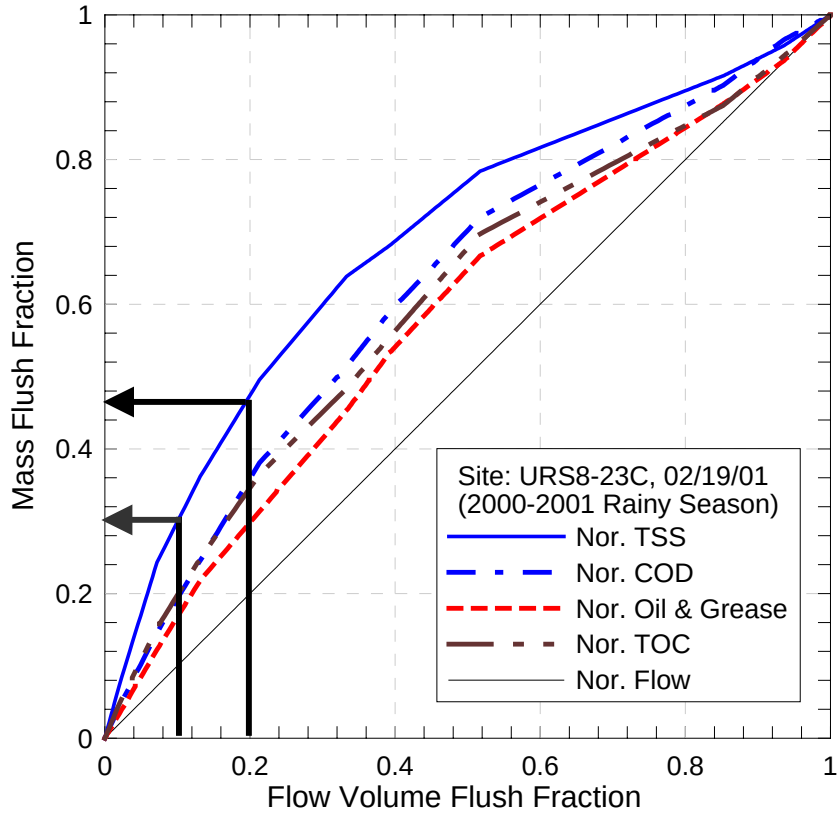
Q(t) = stormwater flow discharged at time t,

M = total pollutant mass,

V = total flow volume, and

t_1 = elapsed time.

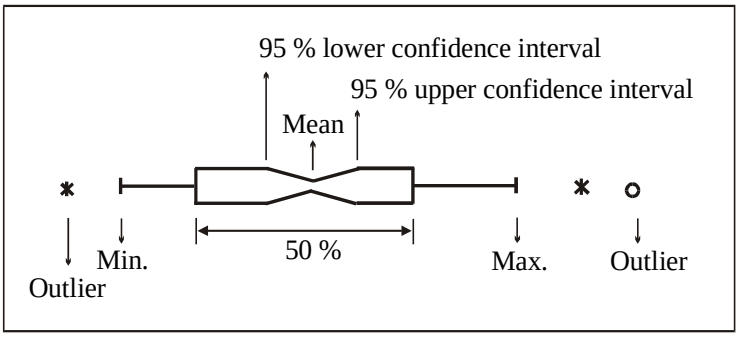
Equation (A1) describes the normalized mass, and if plotted versus the normalized runoff volume, creates a graph that shows the discharged normalized mass versus normalized runoff volume, as shown below for COD, TSS, O&G and TOC for the storm monitored at site URS8-23C on 2/19/01.



The intersection of the a vertical line at a specific normalized volume and the mass line is used to calculate the MFF_n, by dividing the normalized mass at same normalized volume, designated as n, which is expressed as a percentage from 0 to 100%. Therefore, the MFF_{10} and MFF_{20} for TSS at 10 and 20% of the runoff volume are 3.0 and 2.35, respectively.

The MFF ratios are tabulated over 10 to 50% of the flow, by 10% intervals. Beginning with Table D.4 to Table D.6, the MFF ratios are ranked by pollutant and by site from high to low. Table D.7 shows the means, medians, minimums, maximums and standard deviations of the storm characteristics, which are correlated to MFF ratios. The correlations are shown in Tables D.8 to Table D.27. Correlations among MFF ratios for different pollutants are also shown.

The MFF ratios are also shown in Figures D.1.1 to Figure D.6.4c. The figures are notched box plots, and are interpreted as follows:



These plots were produced by SYSTAT (Chicago, Illinois) and their manuals can be consulted for more information.

Appendix E: Correlation among Constituents/Parameters

This appendix shows the correlation among measured parameters measured using grab samples. The values above the diagonal are the correlation coefficient (Pearson's product moment, r) and the values below the diagonal are the probabilities of a random event being significant. Figure E.1.1a to Figure E.3.4c graphically show the correlations in a matrix format. The ellipses enclosing some of the points show the 90 % confidence interval.

Appendix F: Particles Size Fraction and Particles First Flush

This appendix contains detailed particle data that are too lengthy to be reported in the text. In Table F.1a to Table F.4, Concentrations, numbers, size fractions and NFF_{20} of different size particles from the grab samples are summarized based on the statistical parameters such as mean, median, min, max, Standard Deviation (SD) and Confidence Interval (CI). Particle number first flush ratio (NFF_n) has the same definition with MFF_n except using total particle number instead of total mass. Table F.5 shows EMCs of different size particles for each storm event. The NFF ratios are also shown in Figures F.1.1 to Figure F.5.4 as the notched box plots.

Appendix G: Preliminary Toxicity Data

This appendix includes the results from the toxicity tests for grab and composite samples

that were taken during the three storm events (2/11/03, 3/15/03 and 4/14/03). Test samples and holding times are summarized in Table G.1. The toxic end points, which are represented by EC50s (50% effect concentration) and NOECs (highest concentration not producing a significant toxic response) for the composite samples using five different test species are shown in Table G.2 to Table G.4. Logistic regression equations parameters were calculated for three individual storm events from the monitoring sites, UCLA 1, 2 and 3. These results are summarized in Table G.5 and plotted in Figure G 4.1 and Figure G 4.2. The portions of toxicity discharged during the first 20% and 30% of total discharge are also calculated in Table G.6. Plots for the toxic responses with dose and elapsed time, survival endpoints, weight endpoints and cell densities for each grab and composite sample using different test species are provided in Figures G 1.1 to Figure G 3.13. Normalized toxicity and flow plots for grab samples are also shown in Figures G 4.3 and G 4.4.

Appendix H: Composite Samples

This appendix is composed of six tables that show the concentrations of each parameter for the composite samples from UCLA 1 (site 7-201), UCLA 2 (site 7-202) and UCLA 3 (site 7-203) in years 2000-2003. The format is same as that of Appendix B. These composite samples were collected by American Sigma flow-weighted composite samplers, and are different from previously reported composites, which were calculated from a series of grab samples.

Appendix I: Polluto-Graphs and Load-Graphs

This appendix shows the polluto-graphs and load-graphs for every measured constituents/parameter for each storm event. The observed constituent concentration and mass loading during the monitoring periods for each storm event are shown in the polluto-graphs and the load-graphs, respectively. The parameters are grouped in a logical fashion (e.g., oxygen demanding or hydrocarbon describing parameters together, metals together, nutrient together, etc.).

Appendix J: Site Maps and Aerial Photographs

This appendix include few of the aerial photographs that shows the detail of transportation land use relative to the other land uses in three monitoring sites area.

Appendix K: Technical Memorandums

This appendix includes copies of Technical Memorandums prepared at various times during the study, which are listed below:

- Seasonal First Flush Phenomenon (Dec. 2003)
- Event Mean Concentration and Loading of Litter from Highways during Storms (Feb. 2004)
- Particle Size Distribution in Highway Runoff (Feb. 2004)
- Oil and Grease Measurement in Highway Runoff - Sampling Time and Event Mean Concentrations (Feb. 2004)

Nomenclature

EMC	Event Mean Concentration
MFF	Mass First Flush Ratio
MFF_{10}	Ratio of the discharged pollutant mass to the runoff volume in the first 10% of the runoff
MFF_{20}	Ratio of the discharged pollutant mass to the runoff volume in the first 20% of the runoff
MFF_{30}	Ratio of the discharged pollutant mass to the runoff volume in the first 30% of the runoff
MFF_{40}	Ratio of the discharged pollutant mass to the runoff volume in the first 40% of the runoff
MFF_{50}	Ratio of the discharged pollutant mass to the runoff volume in the first 50% of the runoff
NFF	First flush ration of the particle number

NFF_{10}	Ratio of the discharged particle number to the runoff volume in the first 10% of the runoff
NFF_{20}	Ratio of the discharged particle number to the runoff volume in the first 20% of the runoff
NFF_{30}	Ratio of the discharged particle number to the runoff volume in the first 30% of the runoff
NFF_{40}	Ratio of the discharged particle number to the runoff volume in the first 40% of the runoff
NFF_{50}	Ratio of the discharged particle number to the runoff volume in the first 50% of the runoff

APPENDIX A
EVENT SUMMARY

Table A.1 Event Summary for UCLA 1, 2 and 3 (1999~2002)

Site	Event ID	Rain				Total Rainfall	Max Intensity	Ante. Dry Days	Ante. Rain	Storm Duration	Runoff			
		Start		End							Start		End	
		Date	Time	Date	Time	(in)	(in/hr)	(days)	(inch)	(hr)	Date	Time	Date	Time
UCLA1	1999-01	01/17/2000	06:51	01/17/2000	16:25	0.05	0.02	17.00	0.00	9.6	01/17/2000	07:27	01/17/2000	22:45
	1999-02	01/25/2000	01:09	01/25/2000	20:30	0.67	0.13	8.00	0.05	19.4	01/25/2000	02:00	01/26/2000	06:00
	1999-03	01/30/2000	17:53	01/31/2000	05:42	0.10	0.02	5.00	0.67	11.8	01/30/2000	18:45	01/31/2000	03:49
	1999-04	02/10/2000	07:51	02/10/2000	20:17	0.29	0.06	10.00	0.10	12.9	02/10/2000	09:23	02/11/2000	00:10
	1999-05	02/11/2000	23:54	02/12/2000	02:42	0.73	0.34	1.00	0.29	2.8	02/11/2000	23:53	02/12/2000	11:57
	1999-06	02/20/2000	04:19	02/21/2000	19:55	3.57	0.76	4.00	0.42	39.6	02/20/2000	05:57	02/22/2000	12:40
	1999-07	02/27/2000	11:12	02/27/2000	16:38	0.13	0.09	4.00	1.60	5.4	02/27/2000	11:15	02/27/2000	17:07
	1999-08	03/05/2000	00:08	03/06/2000	12:24	1.80	0.48	2.00	0.30	36.3	03/05/2000	00:58	03/06/2000	16:00
	1999-09	03/08/2000	00:14	03/08/2000	11:01	0.70	0.16	2.00	1.80	10.8	03/08/2000	01:41	03/08/2000	19:11
	1999-10	04/17/2000	08:58	04/17/2000	10:59	0.52	0.32	40.00	0.70	2.0	04/17/2000	09:17	04/17/2000	15:00
	2000-01	10/26/2000	17:06	10/27/2000	4:03	0.94	0.24	33.63	0.14	11.0	10/26/2000	19:08	10/27/2000	10:19
	2000-02	1/8/2001	11:11	1/8/2001	17:45	0.15	0.07	69.39	0.65	6.6	1/8/2001	11:41	1/8/2001	16:02
	2000-03	1/10/2001	14:12	1/11/2001	6:31	5.00	1.19	1.85	0.15	16.3	1/10/2001	14:20	1/11/2001	13:17
	2000-04	2/10/2001	1:42	2/10/2001	8:53	0.52	0.31	14.20	0.48	7.2	2/10/2001	1:46	2/10/2001	13:41
	2000-05	2/19/2001	13:41	2/19/2001	17:49	0.28	0.11	5.36	5.07	4.1	2/19/2001	13:42	2/19/2001	18:44
	2000-06	2/24/2001	9:15	2/25/2001	4:20	0.57	0.07	0.97	0.08	19.1	2/24/2001	9:40	2/25/2001	6:43
	2000-07	3/4/2001	15:05	3/5/2001	1:37	0.47	0.12	4.00	0.42	10.5	3/4/2001	15:40	3/5/2001	5:42
	2000-09	4/20/2001	18:57	4/21/2001	1:09	0.32	0.11	13.17	1.32	6.2	4/20/2001	19:38	4/21/2001	1:35
	2001-01	11/12/2001	16:05	11/12/2001	20:38	0.31	0.07	11.90	0.06	4.6	11/12/2001	17:08	11/12/2001	20:48
	2001-02	11/24/2001	11:32	11/24/2001	17:10	1.86	0.68	11.56	0.31	5.6	11/24/2001	12:04	11/24/2001	16:20
	2001-03	12/20/2001	19:34	12/21/2001	10:57	0.42	0.23	6.27	0.04	15.4	12/20/2001	19:47	12/21/2001	11:13
	2001-04	1/27/2002	13:04	1/27/2002	23:11	0.47	0.12	27.13	0.42	10.1	1/27/2002	13:14	1/27/2002	23:25
	2001-05	2/17/2002	6:07	2/17/2002	8:07	0.08	0.04	20.38	0.47	2.0	2/17/2002	6:27	2/17/2002	9:42
	2002-01	11/7/2002	17:03	11/9/2002	16:34	1.14	0.25	40.13	0.05	47.5	11/7/2002	23:47	11/9/2002	19:55
	2002-02	11/29/2002	22:12	11/30/2002	0:17	0.38	0.37	20.23	1.14	2.1	11/29/2002	22:15	11/30/2002	7:25
	2002-04	12/16/2002	10:40	12/16/2002	16:39	1.17	0.39	16.43	0.38	6.0	12/16/2002	12:08	12/17/2002	10:05
	2002-05	12/19/2002	22:39	12/20/2002	5:48	1.42	0.46	3.25	1.44	7.2	12/19/2002	22:42	12/20/2002	13:38
	2002-06	2/11/2003	2:34	2/11/2003	13:04	0.92	0.72	44.27	0.38	10.5	2/11/2003	2:51	2/11/2003	17:54
	2002-07	3/15/2003	4:20	3/15/2003	22:46	2.62	1.80	11.68	0.06	18.4	3/15/2003	4:22	3/16/2003	0:10
	2002-09	5/2/2003	19:54	5/3/2003	10:51	1.97	2.04	18.10	0.84	15.0	5/2/2003	21:43	5/3/2003	11:20

Table A.1 *(Continued)*

Site	Event ID	Rain				Total Rainfall (in)	Max Intensity (in/hr)	Ante. Dry Days (days)	Ante. Rain (inch)	Storm Duration (hr)	Runoff			
		Start		End							Start		End	
		Date	Time	Date	Time						Date	Time	Date	Time
UCLA2	1999-01	11/20/1999	03:08	11/20/1999	03:37	0.07	0.07	12.00	0.00	0.5	11/20/1999	03:19	11/20/1999	04:14
	1999-02	01/17/2000	07:17	01/17/2000	17:31	0.07	0.03	17.00	0.00	10.2	01/17/2000	07:34	01/17/2000	18:20
	1999-03	01/25/2000	00:22	01/25/2000	19:45	0.99	0.17	8.00	0.07	19.4	01/25/2000	01:24	01/25/2000	20:46
	1999-04	01/30/2000	14:23	01/31/2000	11:13	0.50	0.10	5.00	0.99	2.1	01/30/2000	15:42	01/31/2000	03:25
	1999-05	02/10/2000	00:14	02/10/2000	19:15	0.46	0.22	10.00	0.50	19.0	02/20/2000	03:57	02/11/2000	19:57
	1999-06	02/11/2000	23:47	02/12/2000	04:21	0.99	0.50	1.00	0.46	4.6	02/11/2000	23:54	02/12/2000	06:31
	1999-07	02/20/2000	05:40	02/21/2000	19:52	3.64	0.93	4.00	0.75	38.2	02/20/2000	05:47	02/22/2000	12:46
	1999-08	02/27/2000	11:04	02/27/2000	16:08	0.29	0.11	4.00	1.76	5.1	02/27/2000	11:20	02/27/2000	16:31
	1999-09	03/05/2000	00:08	03/06/2000	12:24	2.00	0.55	2.00	0.34	36.3	03/05/2000	00:45	03/06/2000	14:38
	1999-10	03/08/2000	00:07	03/08/2000	10:42	0.92	0.27	2.00	2.00	10.6	03/08/2000	12:30	03/08/2000	17:00
	1999-11	04/17/2000	08:13	04/17/2000	16:47	1.75	0.38	40.00	0.92	8.6	04/17/2000	08:17	04/17/2000	17:46
	2000-01	10/26/2000	17:06	10/27/2000	4:03	0.94	0.23	33.63	0.14	9.0	10/26/2000	17:16	10/27/2000	5:24
	2000-02	1/8/2001	11:00	1/8/2001	15:18	0.20	0.07	69.39	0.65	4.3	1/8/2001	11:05	1/8/2001	16:30
	2000-03	1/10/2001	14:01	1/11/2001	7:17	6.14	1.27	1.94	0.20	17.3	1/10/2001	14:10	1/11/2001	13:37
	2000-05	2/19/2001	11:15	2/19/2001	20:08	0.94	0.28	4.84	5.07	8.9	2/19/2001	11:36	2/19/2001	22:09
	2000-06	2/24/2001	9:42	2/25/2001	4:53	0.75	0.09	0.99	0.08	19.2	2/24/2001	10:21	2/25/2001	6:59
	2000-07	3/4/2001	15:01	3/4/2001	20:06	0.35	0.19	4.00	0.42	5.1	3/4/2001	15:16	3/4/2001	22:13
	2000-08	4/6/2001	23:06	4/7/2001	8:24	1.19	0.21	31.54	1.48	9.3	4/6/2001	23:28	4/7/2001	10:38
	2001-01	10/30/2001	12:58	10/30/2001	17:13	0.13	0.08	192.20	0.35	4.3	10/30/2001	13:04	10/30/2001	18:22
	2001-02	11/12/2001	16:55	11/12/2001	18:36	0.47	0.39	12.98	0.13	1.7	11/12/2001	17:01	11/12/2001	20:15
	2001-03	11/24/2001	11:09	11/24/2001	15:38	1.98	1.05	11.69	0.47	4.5	11/24/2001	11:20	11/24/2001	16:16
	2001-04	12/14/2001	10:02	12/14/2001	14:00	0.14	0.08	19.73	1.99	4.0	12/14/2001	10:16	12/14/2001	14:49
	2001-05	1/27/2002	12:59	1/27/2002	21:37	1.25	0.32	27.13	0.89	8.6	1/27/2002	13:06	1/27/2002	22:05
	2001-06	2/17/2002	4:13	2/17/2002	8:18	0.29	0.14	20.27	1.25	2.1	2/17/2002	4:22	2/17/2002	8:23
	2001-07	3/6/2002	22:36	3/7/2002	2:44	0.10	0.05	17.44	0.29	4.1	3/6/2002	23:20	3/7/2002	4:12
	2001-08	3/17/2002	18:30	3/17/2002	19:26	0.09	0.24	10.69	0.10	0.9	3/17/2002	18:35	3/17/2002	20:21
	2002-01	11/7/2002	18:08	11/9/2002	11:48	2.31	0.37	41.21	0.05	39.7	11/7/2002	20:40	11/9/2002	13:38
	2002-02	11/29/2002	15:56	11/29/2002	23:38	0.07	0.05	20.17	2.25	7.7	11/29/2002	16:03	11/30/2002	0:15
	2002-03	12/15/2002	2:16	12/15/2002	5:34	0.10	0.04	16.11	0.07	3.3	12/15/2002	2:26	12/15/2002	6:58
	2002-04	12/16/2002	10:39	12/16/2002	16:39	2.32	1.23	1.21	0.08	6.0	12/16/2002	11:52	12/16/2002	22:07
	2002-06	2/11/2003	2:16	2/11/2003	14:11	0.96	0.60	44.26	0.38	11.9	2/11/2003	2:20	2/11/2003	15:17
	2002-08	4/14/2003	1:31	4/14/2003	17:29	0.84	0.84	27.85	0.65	16.0	4/14/2003	2:39	4/14/2003	18:53

Table A.1 *(Continued)*

Site	Event ID	Rain				Total Rainfall (in)	Max Intensity (in/hr)	Ante. Dry Days (days)	Ante. Rain (inch)	Storm Duration (hr)	Runoff			
		Start		End							Start		End	
		Date	Time	Date	Time						Date	Time	Date	Time
UCLA3	1999-01	11/8/1999	00:30	11/08/1999	03:00	0.05	0.01	-	0.00	2.5	11/08/1999	01:00	11/08/1999	03:20
	1999-02	12/31/1999	10:00	12/31/1999	13:00	0.02	0.01	41.00	0.03	3.0	12/31/1999	10:30	12/31/1999	14:00
	1999-03	01/17/2000	07:25	01/17/2000	17:36	0.06	0.02	17.00	0.02	10.2	01/17/2000	08:00	01/17/2000	19:00
	1999-04	01/25/2000	01:18	01/25/2000	19:11	0.72	0.16	8.00	0.06	17.9	01/25/2000	02:48	01/25/2000	19:55
	1999-05	01/30/2000	14:17	01/31/2000	04:25	0.53	0.12	5.00	0.72	14.1	01/30/2000	16:00	01/31/2000	08:00
	1999-06	02/10/2000	12:10	02/10/2000	19:30	0.59	0.24	10.00	0.53	7.3	02/10/2000	13:00	02/11/2000	13:00
	1999-07	02/12/2000	00:03	02/12/2000	04:45	0.83	0.37	2.00	0.59	4.7	02/12/2000	01:00	02/12/2000	08:00
	1999-08	02/20/2000	05:50	02/22/2000	19:18	2.32	0.41	4.00	0.87	52.2	02/20/2000	05:57	02/22/2000	19:59
	1999-09	02/27/2000	10:19	02/27/2000	14:51	0.40	0.21	4.00	1.21	4.5	02/27/2000	10:21	02/27/2000	15:22
	1999-10	03/04/2000	22:28	03/05/2000	00:01	0.23	0.15	6.00	0.40	2.5	03/04/2000	22:30	03/05/2000	03:00
	1999-11	03/08/2000	01:32	03/08/2000	10:22	0.74	0.18	2.00	1.61	8.8	03/08/2000	02:00	03/08/2000	14:50
	1999-12	04/17/2000	10:29	04/18/2000	04:37	2.22	0.39	40.00	0.74	16.1	04/17/2000	11:00	04/18/2000	16:00
	2000-01	10/26/2000	16:51	10/27/2001	4:38	1.02	0.16	33.58	0.14	11.8	10/26/2000	16:54	10/27/2001	4:52
	2000-02	1/8/2001	10:44	1/8/2001	15:07	0.21	0.08	69.36	0.65	4.4	1/8/2001	10:50	1/8/2001	15:05
	2000-03	1/10/2001	14:12	1/11/2001	4:48	5.06	0.88	1.96	0.21	14.6	1/10/2001	14:17	1/11/2001	5:25
	2000-04	2/10/2001	1:47	2/10/2001	7:30	0.61	0.18	14.20	0.48	5.7	2/10/2001	1:59	2/10/2001	8:07
	2000-05	2/19/2001	13:01	2/19/2001	19:57	1.19	0.48	5.33	5.07	6.9	2/19/2001	13:06	2/19/2001	20:20
	2000-06	2/24/2001	9:49	2/24/2001	21:25	0.45	0.09	0.99	0.08	11.6	2/24/2001	9:51	2/24/2001	23:12
	2000-07	3/4/2001	15:32	3/4/2001	19:13	0.20	0.09	4.02	0.42	3.7	3/4/2001	15:37	3/4/2001	19:30
	2000-08	4/6/2001	23:38	4/7/2001	10:24	1.00	0.30	31.57	1.48	10.8	4/6/2001	23:42	4/7/2001	10:59
	2001-01	10/30/2001	13:07	10/30/2001	17:23	0.11	0.09	192.3	0.34	4.3	10/30/2001	13:23	10/30/2001	17:15
	2001-02	11/12/2001	17:03	11/12/2001	18:24	0.29	0.21	13.0	0.11	1.4	11/12/2001	17:07	11/12/2001	18:48
	2001-03	11/24/2001	10:57	11/24/2001	15:31	1.17	0.57	11.6	0.29	4.6	11/24/2001	11:09	11/24/2001	16:15
	2001-04	12/20/2001	19:56	12/21/2001	8:40	0.48	0.29	6.3	0.08	12.7	12/20/2001	19:59	12/21/2001	9:01
	2001-05	1/27/2002	13:04	1/27/2002	21:40	0.97	0.20	27.1	0.64	8.6	1/27/2002	13:08	1/27/2002	22:10
	2001-06	2/17/2002	5:20	2/17/2002	7:22	0.29	0.17	20.3	0.97	2.0	2/17/2002	5:24	2/17/2002	7:44
	2001-07	3/7/2002	1:12	3/7/2002	2:45	0.18	0.13	17.7	0.29	1.6	3/7/2002	1:26	3/7/2002	3:06
	2001-08	3/17/2002	18:06	3/17/2002	19:32	0.41	0.37	10.7	0.18	1.4	3/17/2002	18:11	3/17/2002	19:51
	2002-01	11/7/2002	17:49	11/9/2002	10:48	2.81	0.29	40.2	0.05	41.0	11/7/2002	17:52	11/9/2002	17:29
	2002-02	11/29/2002	15:56	11/29/2002	22:47	0.06	0.04	20.2	2.81	6.9	11/29/2002	15:56	11/29/2002	23:15
	2002-04	12/16/2002	12:05	12/16/2002	16:39	1.60	0.95	0.3	0.10	4.6	12/16/2002	12:11	12/16/2002	16:53
	2002-05	12/19/2002	18:48	12/20/2002	5:14	1.28	0.40	3.1	1.60	10.4	12/19/2002	22:07	12/20/2002	5:44
	2002-06	2/10/2003	22:55	2/11/2003	14:31	0.79	0.60	44.1	0.38	15.6	2/11/2003	2:12	2/11/2003	14:58
	2002-07	3/15/2003	4:15	3/16/2003	1:56	4.85	1.56	11.7	0.06	21.7	3/15/2003	4:17	3/16/2003	2:39
	2002-08	4/14/2003	3:20	4/14/2003	18:59	0.78	1.20	27.8	0.65	15.7	4/14/2003	4:22	4/14/2003	21:48

Table A.2 Event Summary for CDM 7-10 and 7-185 (1999~2000)

Site	Event ID	Rain				Total Rainfall (in)	Max Intensity (in/hr)	Ante. Dry Days (days)	Ante. Rain (inch)	Storm Duration (hr)	Runoff			
		Start		End							Start		End	
		Date	Time	Date	Time						Date	Time	Date	Time
CDM 7-10	1999-01	1/25/2000	1:35	1/25/2000	11:39	0.60	0.16	25.00		10.1	1/25/2000	3:00	1/25/2000	15:40
	1999-02	2/12/2000	1:20	2/12/2000	4:10	0.91	0.49	2.00		2.8	2/12/2000	1:15	2/12/2000	6:45
	1999-03	2/20/2000	0:34	02/21/2000	16:14	1.05	0.28	4.00		33.7	02/20/2000	6:40	02/21/2000	18:30
	1999-04	02/23/2000	5:15	02/23/2000	18:15	1.67	0.46	2.00		13.0	02/23/2000	5:15	02/23/2000	23:05
	1999-05	02/27/2000	12:40	02/27/2000	18:25	0.43	0.23	4.00		5.6	02/27/2000	12:40	02/27/2000	20:10
	1999-06	03/04/2000	16:20	03/05/2000	11:29	0.78	0.16	1.00		19.2	03/05/2000	04:20	03/05/2000	17:45
	1999-07	03/08/2000	1:29	03/08/2000	11:35	1.08	0.24	1.00		10.1	03/08/2000	01:29	03/08/2000	14:29
	1999-08	04/17/2000	10:55	04/17/2000	22:50	1.69	0.33	39.00		11.9	04/17/2000	11:00	04/17/2000	23:55
CDM 7-185	1999-01					1.32					1/25/2000	3:00	1/25/2000	23:55
	1999-02	2/12/2000	1:10	2/12/2000	3:40	0.76	0.45	2.00		2.5	2/12/2000	1:45	2/12/2000	4:35
	1999-03	2/20/2000	5:50	2/21/2000	17:20	2.14	0.31	4.00		35.5	2/20/2000	6:05	2/21/2000	18:40
	1999-04	2/23/2000	4:55	2/23/2000	14:30	0.98	0.30	2.00		9.6	2/23/2000	5:25	2/23/2000	15:25
	1999-05	2/27/2000	13:05	2/27/2000	18:00	0.16	0.14	4.00		4.9	2/27/2000	13:30	2/27/2000	14:55
	1999-06	3/4/2000	17:50	3/5/2000	10:40	0.62	0.22	1.00		16.8	3/5/2000	0:25	3/5/2000	11:20
	1999-07	3/8/2000	2:10	3/8/2000	10:55	0.83	0.25	3.00		8.8	3/8/2000	3:00	3/8/2000	11:35
	1999-08	4/17/2000	11:30	4/17/2000	18:25	1.26	0.58	39.00		6.9	4/17/2000	12:55	4/17/2000	19:00

Table A.3 Event Summary for URS 23, 6-20F and 8-23C (2000~2001)

Site	Event ID	Rain				Total Rainfall	Max Intensity	Ante. Dry Days	Ante. Rain	Storm Duration	Runoff			
		Start		End							Start		End	
		Date	Time	Date	Time	(in)	(in/hr)	(days)	(inch)	(hr)	Date	Time	Date	Time
URS 23	2000-8	1/26/2001	6:10	1/26/2001	18:55	0.57	0.84	1.70		12.8	1/26/2001	6:10	1/26/2001	19:55
	2000-9	2/10/2001	3:50	2/10/2001	16:25	0.48	0.36	2.90		12.7	2/10/2001	3:50	2/10/2001	17:25
	2000-11	2/19/2001	12:45	02/19/2001	19:50	0.37	0.24	5.50		7.2	02/19/2001	12:45	02/19/2001	20:50
	2000-12	02/24/2001	8:40	02/26/2001	04:50	2.53	0.48	4.50		44.3	02/24/2001	8:40	02/26/2001	7:50
URS 6-20F	2000-2	10/26/2000	20:35	10/27/2000	06:12	1.25	0.60			9.6	10/26/2000	20:35	10/27/2000	7:12
	2000-8	01/26/2001	6:25	01/26/2001	14:10	0.47	0.24	1.70		7.8	01/26/2001	06:25	01/26/2001	15:10
	2000-9	02/10/2001	4:50	02/10/2001	14:00	0.31	0.24	14.60		9.2	02/10/2001	04:50	02/10/2001	15:00
	2000-11	02/19/2001	15:00	02/19/2001	21:25	0.41	0.24	5.70		6.4	02/19/2001	15:00	02/19/2001	22:25
URS 8-23C	2000-2	10/26/2000	19:42	10/27/2000	5:42	0.34	0.30			10.0	10/26/2000	19:42	10/27/2000	6:42
	2000-8	1/26/2001	6:25	1/26/2001	13:45	0.26	0.24	1.70		7.3	1/26/2001	6:25	1/26/2001	14:45
	2000-11	2/19/2001	14:10	2/19/2001	19:55	0.17	0.06	5.60		5.8	2/19/2001	14:10	2/19/2001	20:55

APPENDIX B
EVENT MEAN CONCENTRATIONS

Table B.1a Event Mean Concentrations of Non-metal Parameters for UCLA Sites of Year 1999-2000

Sites	Date	TSS (mg/L)	VSS (mg/L)	Turb. (NTU)	Cond. (mmho/cm)	Alkalinity (mg/L as $CaCO^3$)	Hard. (mg/L)	COD (mg/l)	DOC (mg C/L)	O&G (mg/l)	NH_3-N (mg/l)
UCLA 1	01/25/00	5.04	1.02	7.94		25.40	44.80	139.50		5.66	3.29
	01/30/00	24.63	15.01	60.15		63.86	81.49	209.55		18.58	4.83
	02/10/00	26.60	11.21	28.88		39.26	48.85	92.76		10.47	2.19
	02/12/00	18.99	6.18	5.03		16.05	20.87	28.19		1.84	0.42
	02/20/00	32.02	6.87	30.11		26.27	30.55	46.73		2.76	0.75
	02/27/00	46.75	12.12	31.44		34.66	46.05	87.94		6.52	2.64
	03/08/00	9.46	4.12	12.49		21.84	24.46	32.52		2.12	1.27
UCLA 2	01/25/00	19.05	6.92	18.50		25.17	45.35	76.69		6.26	3.92
	01/30/00	23.56	9.77	56.22		23.82	34.10	91.30		6.76	3.80
	02/10/00	332.62	45.73	85.91		24.31	41.63	110.46		7.90	2.89
	02/12/00	88.34	16.63	84.79		16.37	25.32	39.00		1.45	0.62
	02/20/00	365.37	42.19	291.39		26.34	79.70	64.87		2.50	1.15
	02/27/00	85.66	20.41	32.27		13.98	44.29	71.21		4.35	3.37
	04/17/00	257.03	42.49	29.16		10.51	29.81	80.09		4.40	1.54
UCLA 3	01/25/00	16.43	5.68	17.01	98.97	21.02	32.30	70.38	10.47	4.38	2.10
	01/30/00	17.86	7.86	15.78	79.03	16.15	21.63	52.76	10.23	3.66	2.08
	02/10/00	29.69	10.09	21.95	110.41	24.25	35.16	63.61	13.04	5.13	1.36
	02/12/00	19.79	5.95	10.70	46.27	11.40	17.62	25.65	4.43	1.66	0.50
	02/20/00	23.29	9.86	14.21	85.54	18.86	29.58	70.66	11.31	2.55	1.12
	02/27/00	63.25	19.68	21.78	85.93	13.34	22.60	46.18	11.77	3.75	2.21
	03/04/00	41.41	11.44	10.57	63.04	9.67	17.28	34.33	7.77	2.63	1.63
	03/08/00	20.27	6.64	22.20	66.88	15.48	18.96	30.30	5.10	2.29	1.08

Table B.1a *(Continued)*

Sites	Date	NO_3-N (mg/L)	NO_2-N (mg/l)	Total P (mg/L)	PO_4^3-P (mg/L)	Dissolved P (mg/L)	Particulate P (mg/l)	SO_4^{2-} (mg/L)	Total coli. (MPN/100 ml)	Fecal coli. (MPN/100 ml)	F^- (mg/L)	Cl^- (mg/L)
UCLA 1	01/25/00	1.60	0.21									
	01/30/00	3.32	0.51									
	02/10/00	6.90	0.27									
	02/12/00	0.72	0.07									
	02/20/00	1.05	0.09									
	02/27/00	2.33	0.21									
	03/08/00	0.69	0.15									
UCLA 2	01/25/00	0.97	0.22									
	01/30/00	2.32	0.19									
	02/10/00	1.19	0.17									
	02/12/00	0.40	0.08									
	02/20/00	0.62	0.08									
	02/27/00	1.74	0.08									
	04/17/00	1.08	0.06									
UCLA 3	01/25/00	0.70	0.11	0.20	0.11	0.14	0.07	8.87	171305.50	6981.89	2.84	3.93
	01/30/00	0.44	0.11	0.19	0.09	0.13	0.07	7.09	7585.47	389.52	1.46	2.46
	02/10/00	0.70	0.16	0.26	0.07	0.15	0.11	9.49	33199.26	2614.95	1.69	5.82
	02/12/00	0.34	0.06	0.13	0.03	0.09	0.05	3.98	4518.88	618.16	0.70	3.34
	02/20/00	0.64	0.11	0.16	0.03	0.12	0.04	9.89	34409.90	351.43	1.30	2.47
	02/27/00	1.14	0.09	0.12	0.03	0.06	0.06	10.28	22589.29	407.72	0.93	3.36
	03/04/00	1.20	0.12	0.07	0.03	0.03	0.04	5.26	11703.13	333.63	0.60	3.29
	03/08/00	0.35	0.10	0.13	0.16	0.09	0.04	4.69	36172.46	3425.82	0.40	4.01

Table B.1b Event Mean Concentrations of Metals for UCLA Sites of Year 1999-2000

Sites	Date	Total As (ug/L)	Total Cd (ug/L)	Total Cr (ug/L)	Total Cu (ug/L)	Total Ni (ug/L)	Total Pb (ug/L)	Total Zn (ug/L)	Diss. As (ug/L)	Diss. Cd (ug/L)	Diss. Cr (ug/L)	Diss. Cu (ug/L)
UCLA 1	01/25/00		0.16	3.44	32.18	6.64	6.21	196.96		0.12	1.69	26.48
	01/30/00		0.52	6.29	63.42	17.21	10.69	251.91		0.44	3.47	50.10
	02/10/00		1.09	4.67	54.30	14.41	27.73	282.33		0.98	1.40	30.01
	02/12/00		BL	4.81	17.47	5.62	29.85	82.06		BL	1.93	8.34
	02/20/00		BL	3.31	17.03	5.38	35.70	76.87		BL	1.00	12.60
	02/27/00		BL	4.64	34.11	9.51	17.93	104.67		BL	2.23	21.69
	03/08/00		1.00	2.34	15.39	6.25	9.68	66.37		1.00	1.00	10.40
UCLA 2	01/25/00		0.51	4.48	35.64	7.30	26.37	138.32		0.50	2.43	27.85
	01/30/00		0.40	8.28	44.12	10.27	24.60	114.76		0.31	4.60	28.34
	02/10/00		1.91	10.59	53.62	14.43	63.63	223.05		1.28	2.87	30.36
	02/12/00		BL	10.65	24.08	8.00	130.55	119.56		BL	2.80	6.79
	02/20/00		BL	16.09	27.84	13.84	162.03	123.86		BL	3.74	8.36
	02/27/00		0.64	6.28	34.04	8.03	24.09	113.74		0.64	1.82	17.86
	04/17/00		1.12	3.11	21.72	7.33	28.34	138.78		1.00	1.37	15.02
UCLA 3	01/25/00	2.57	0.58	3.69	24.54	6.66	16.19	100.58	1.27	0.28	1.54	17.64
	01/30/00			2.90	18.55	9.27	13.00	54.69	1.65	0.15	1.32	13.74
	02/10/00			4.91	27.57	6.96	40.82	135.65			2.62	18.68
	02/12/00			3.66	17.01	5.23	35.78	95.03	0.53	0.50	0.54	8.22
	02/20/00			2.21	18.56	5.58	18.52	71.32	0.61		0.90	14.13
	02/27/00		1.01	5.53	29.64	7.84	40.50	94.57	0.74	0.66	0.84	14.13
	03/04/00			3.90	19.32	5.17	30.34	87.25	0.82		1.23	10.44
	03/08/00			2.82	13.79	4.62	27.94	69.35	0.52		0.56	7.61

Table B.1b *(Continued)*

Sites	Date	Diss. Ni (ug/L)	Diss. Pb (ug/L)	Diss. Zn (ug/L)	Part. As (ug/L)	Part. Cd (ug/L)	Part. Cr (ug/L)	Part. Cu (ug/L)	Part. Ni (ug/L)	Part. Pb (ug/L)	Part. Zn (ug/L)
UCLA 1	01/25/00	5.78	1.03	177.01							
	01/30/00	14.26	1.91	179.30							
	02/10/00	9.82	8.53	179.71							
	02/12/00	3.40	1.64	49.41							
	02/20/00	4.38	15.51	57.87							
	02/27/00	6.27	5.47	33.99							
	03/08/00	4.25	2.17	21.29							
UCLA 2	01/25/00	5.79	1.09	101.27							
	01/30/00	7.69	2.02	56.86							
	02/10/00	8.97	3.83	97.63							
	02/12/00	2.31	2.67	21.75							
	02/20/00	3.66	3.26	27.33							
	02/27/00	5.20	2.90	65.80							
	04/17/00	5.70	BL	81.13							
UCLA 3	01/25/00	4.61	3.50	67.20	1.30	0.30	2.15	6.90	2.05	12.69	33.38
	01/30/00	7.46	0.77	36.65			1.59	4.81	1.81	12.22	18.04
	02/10/00	4.63	4.13	53.75	0.59	0.67	2.29	8.90	2.33	36.68	81.90
	02/12/00	2.52	3.05	32.10			3.13	8.79	2.71	32.73	62.93
	02/20/00	4.18	2.10	52.61		0.50	1.30	4.43	1.41	16.42	18.71
	02/27/00	3.65	3.64	48.95		0.34	4.70	15.51	4.19	36.87	45.62
	03/04/00	2.79	1.87	41.33		0.27	2.66	8.88	2.37	28.47	45.93
	03/08/00	2.99	0.87	30.80			2.27	6.18	1.63	27.07	38.55

Table B.2a Event Mean Concentrations of Non-metal Parameters for UCLA Sites of Year 2000-2001

Sites	Date	TSS (mg/L)	Turb. (NTU)	Cond. (mmho/cm)	Hard. (mg/L)	COD (mg/l)	DOC (mg C/L)	O&G (mg/l)	NH_3-N (mg/l)	NO_2-N (mg/l)	NO_3-N (mg/L)	TKN (mg/l)	PO_4^3-P (mg/L)	Diss. P (mg/L)	Part. P (mg/l)
UCLA 1	10/26/00	38.82	30.31	178.40	58.94	116.57	31.98	9.80	2.18	0.12	4.15	6.18	0.10	0.24	0.10
	01/08/01	86.30	113.98	936.00	222.35	819.72	125.13	33.85	1.33	1.07	1.82	35.68	1.95	1.33	0.23
	01/10/01	22.19	10.90	56.54	21.08	31.73	7.61	1.87	0.06	0.10	1.34	1.29	na	0.08	0.12
	02/10/01	21.63	22.35	127.23	39.43	101.16	19.12	7.52	0.31	0.15	1.57	3.93	na	0.21	0.10
	02/19/01	33.27	30.83	133.97	35.78	75.39	14.74	6.28	0.18	0.20	0.83	3.31	na	0.18	0.09
	03/04/01	24.52	23.96	233.87	77.66	55.78	12.81	4.59	0.15	0.39	1.82	2.35	na	0.24	0.06
	04/20/01	22.13	32.82	171.41	40.68	90.40	21.14	10.31	0.29	0.18	1.26	4.11	na	0.21	0.08
UCLA 2	10/26/00	82.26	65.52	118.50	37.47	133.74	29.67	12.26	3.23	0.16	1.96	5.26	0.12	0.22	0.10
	01/08/01	92.18	161.05	350.59	153.79	516.08	88.53	35.34	0.99	0.87	2.68	23.18	0.85	0.68	0.20
	01/10/01	62.30	14.93	135.96	66.61	31.31	5.39	1.54	0.08	0.09	0.67	1.24	na	0.07	0.07
	02/19/01	71.10	48.95	244.86	76.49	76.55	11.67	4.20	0.18	0.14	0.64	3.41	na	0.21	0.08
	02/24/01	42.57	39.78	164.76	60.03	67.48	17.17	7.46	0.27	0.22	0.94	4.32	na	0.30	0.08
	03/04/01	66.61	38.36	238.86	95.47	93.11	15.76	5.76	0.31	0.23	0.83	4.72	na	0.18	0.08
	04/07/01	38.47	16.88	113.66	40.36	58.18	12.73	6.48	0.18	0.06	0.68	2.84	na	0.12	0.05
UCLA 3	10/26/00	53.81	34.18	51.19	20.08	55.90	13.44	5.54	1.16	0.06	0.63	2.50	na	0.12	0.05
	01/08/01	84.33	56.31	166.39	51.59	358.13	74.27	18.37	0.75	0.43	1.81	15.43	0.14	0.53	0.12
	01/10/01	48.83	12.26	24.84	14.83	22.01	3.75	1.52	0.05	0.10	0.30	1.50	na	0.07	0.08
	02/10/01	27.83	16.66	59.48	21.56	78.28	14.26	5.88	0.16	0.12	0.71	4.09	na	0.20	0.06
	02/19/01	84.96	16.48	54.71	18.32	32.75	8.88	3.40	0.13	0.14	0.45	2.69	na	0.13	0.04
	02/24/01	25.23	19.15	88.93	28.80	71.43	24.39	9.53	0.23	0.17	0.69	3.86	na	0.25	0.04
	03/04/01	61.80	20.41	126.90	42.73	164.46	38.37	13.31	0.35	0.18	1.11	5.59	na	0.14	0.07
	04/07/01	42.55	18.79	155.18	79.19	163.72	47.45	14.04	0.43	0.11	1.12	7.36	na	0.33	0.07

Table B.2b Event Mean Concentrations of Metals for UCLA Sites of Year 2000-2001

Sites	Date	Diss. Cd (ug/L)	Diss. Cr (ug/L)	Diss. Cu (ug/L)	Diss. Ni (ug/L)	Diss. Pb (ug/L)	Diss. Zn (ug/L)	Part. Cd (ug/L)	Part. Cr (ug/L)	Part. Cu (ug/L)	Part. Ni (ug/L)	Part. Pb (ug/L)	Part. Zn (ug/L)
UCLA 1	10/26/00	na	1.77	35.57	9.90	2.40	199.37	0.46	3.28	18.79	2.99	12.21	72.57
	01/08/01	1.09	4.76	130.61	28.51	6.50	312.05	1.00	10.67	42.94	7.34	232.59	134.01
	01/10/01	na	0.98	12.90	1.41	na	56.79	na	4.28	16.91	3.00	19.53	62.72
	02/10/01	na	1.40	21.92	4.89	na	119.26	na	3.37	11.65	2.18	9.05	39.01
	02/19/01	na	1.87	16.78	3.57	na	80.72	na	4.81	19.93	3.73	10.33	83.86
	03/04/01	na	2.93	13.37	2.19	na	47.73	na	4.22	12.16	2.47	7.54	63.95
	04/20/01	na	na	32.61	8.28	na	168.03	na	4.96	21.24	2.71	8.69	47.34
UCLA 2	10/26/00	na	1.72	38.59	10.72	6.24	68.62	0.84	6.60	39.43	7.00	29.10	170.72
	01/08/01	1.79	6.74	127.49	30.64	4.46	346.42	1.08	11.46	62.82	10.27	38.54	301.57
	01/10/01	na	1.94	8.28	3.26	na	47.61	na	4.46	18.64	3.40	30.44	66.66
	02/19/01	na	2.39	11.63	1.93	na	66.65	na	6.35	22.72	4.44	14.88	68.80
	02/24/01	na	2.59	14.49	2.63	na	60.30	na	7.15	31.44	4.58	15.09	67.46
	03/04/01	na	2.06	21.71	4.44	na	94.73	na	7.15	31.44	4.58	15.09	67.46
	04/07/01	na	na	19.35	4.31	na	89.54	na	3.89	17.53	2.38	10.85	53.49
UCLA 3	10/26/00	na	0.77	9.68	4.68	4.41	103.59	0.35	3.34	10.76	2.94	24.46	49.54
	01/08/01	na	2.26	97.79	20.18	na	414.53	na	6.43	17.54	4.19	19.56	66.07
	01/10/01	na	1.02	8.89	2.57	2.74	50.32	na	3.19	12.40	2.25	32.20	47.24
	02/10/01	na	na	11.14	1.40	na	96.65	na	2.74	7.08	1.90	15.02	30.43
	02/19/01	na	1.62	8.78	0.95	na	65.13	na	2.63	10.96	2.47	25.84	42.85
	02/24/01	na	1.21	20.14	2.69	na	102.22	na	3.01	8.46	1.65	13.06	31.22
	03/04/01	na	na	42.92	8.62	na	202.10	na	3.94	15.26	2.84	19.44	72.21
	04/07/01	0.98	0.88	73.22	13.36	6.70	351.88	na	3.60	11.80	2.26	14.42	54.23

Table B.3a Event Mean Concentrations of Non-metal Parameters for UCLA Sites of Year 2001-2002

Sites	Date	TSS (mg/L)	VSS (mg/L)	Turb. (NTU)	Cond. (mmho/cm)	Alkalinity (mg/L as $CaCO^3$)	Hard. (mg/L)	COD (mg/l)	DOC (mg C/L)	O&G (mg/l)	TKN (mg/l)
UCLA 1	11/12/01	61.98	28.25	16.52	344.59	23.17	98.92	280.27	45.96	5.95	6.56
	11/24/01	23.08	13.13	26.72	211.99	29.08	63.22	150.4	41.59	9.75	3.12
	12/20/01	10.75	6.97	16.64	258.77	58.34	69.53	115.11	37.81	6.65	1.88
	01/27/02	29.53	14.81	46.76	250.22	44.79	67.79	156.66	56.98	11.94	4.67
	02/17/02	51.6	25.84	33.18	937.77	110.76	250.91	218.06	67.96	13.45	6.04
UCLA 2	10/30/01	466.44	252.48	169.55	1991.69	53.4	598	2282.8	848.77	80.15	111.34
	11/12/01	99.01	27.8	21.57	77.39	8.06	20.77	63.49	18.74	4.84	4.08
	11/24/01	76.55	19.07	14.66	75.61	5.96	36.15	32.57	11.29	3.13	1.55
	12/14/01	105.41	50.81	170.51	315.83	21.27	92.89	424.41	139.68	32.54	14.68
	01/27/02	53.51	21.68	24.04	88.7	8.11	25.47	67.15	28.56	7.7	3.61
	02/17/02	139.59	67.99	87.8	514.03	18.16	50.54	309.79	87.74	18.53	10.62
	03/06/02	55.32	33.4	78.12	402.47	15.86	134.69	700.66	212.67	33.13	20.93
	03/17/02	102.33	60.59	95.19	222.22	10.85	68.62	421.37	129.37	31.13	13.85
UCLA 3	10/30/01	81.38	45.92	70.65	833.39	29.74	318.28	1109.89	383.58	41.63	40.6
	11/12/01	84.5	24.29	20.13	71.4	9.83	21.34	57.26	14.99	4.6	3.23
	11/24/01	59.46	18.88	43.48	104.54	11.85	31.75	130.55	44.21	9.39	3.86
	12/20/01	81.27	24.84	58.07	113.12	12.98	28.94	160.32	35.84	7.95	4.13
	01/27/02	49.6	20.09	42.82	102.5	12.41	32.11	129.68	45.46	10.11	3.73
	02/17/02	80.83	34.66	39.47	108.59	10.24	171.13	202.59	43.57	12.34	3.45
	03/07/02	88.64	32.02	48.17	555.75	30.99	335.46	1304.84	399.99	32.18	36.68
	03/17/02	111.91	42.23	77.65	133.75	8.97	51.04	313.94	81.89	14.66	8.53

Table B.3a *(Continued)*

Sites	Date	NH_3-N (mg/l)	NO_2-N (mg/l)	NO_3-N (mg/L)	F^- (mg/L)	Cl^- (mg/L)	PO_4^{3-}P (mg/L)	Total P (mg/l)	Diss. P (mg/L)	Part. P (mg/l)	SO_4^{2-} (mg/L)
UCLA 1	11/12/01	1.99	0.31	5.18	2.03	11.62	0.13	0.77671	0.37904	0.39767	60.14
	11/24/01	1.53	0.35	2.92	3.37	6.48	0.11	0.80183	0.29766	0.50418	40.98
	12/20/01	1.48	0.18	1.93	2.59	12.27	0.05	0.29806	0.19581	0.10225	27.46
	01/27/02	2.96	1.05	2.19	3.44	11.46	0.07	0.43589	0.19005	0.24585	29.01
	02/17/02	0.46	0.66	34.74	2.97	55.33	0.4	0.93668	0.63577	0.3009	333.49
UCLA 2	10/30/01	64.95	0.68	23.86	15.33	99.54	2.67	8.23718	7.32785	0.90933	343.63
	11/12/01	1.99	0.15	0.86	1.16	2.4	0.11	0.4202	0.19397	0.22623	9.27
	11/24/01	1	0.17	0.58	0.39	3.11	0.15	0.44418	0.10943	0.33475	23.71
	12/14/01	13.3	1.02	0.8	4.35	15.37	0.09	1.13576	0.51865	0.61711	34.65
	01/27/02	2.86	0.48	0.9	1.62	4.01	0.09	0.44376	0.19906	0.2447	12.67
	02/17/02	8.1	0.4	1.22	7.81	11.36	0.24	0.63624	0.52166	0.11457	20.31
	03/06/02	16.03	0.25	2.01	11.02	25.19	0.54	5.51147	5.40484	0.10664	38.17
	03/17/02	9.99	0.26	0.81	8.42	10.98	0.3	4.83919	4.71794	0.12125	17.71
UCLA 3	10/30/01	19.2	0.58	5.24	7.05	91.81	0.53	1.58136	1.32092	0.26044	119.96
	11/12/01	1.29	0.14	0.83	2.48	3.05	0.21	0.45295	0.15934	0.29361	6.25
	11/24/01	3.05	0.23	0.92	1.49	6.33	0.23	0.50505	0.24499	0.26006	10.66
	12/20/01	2.7	0.16	0.57	1.52	9.38	0.14	0.26096	0.18527	0.07569	10.09
	01/27/02	3.07	0.84	0.92	1.99	4.46	0.1	0.2762	0.20393	0.07227	9.36
	02/17/02	2.74	0.41	0.73	0.77	4.33	0.14	0.34494	0.26637	0.07857	13.27
	03/07/02	22.25	0.31	5.06	6.17	30.96	0.4	1.05752	0.93707	0.12045	75.59
	03/17/02	4.7	0.14	0.94	2.79	8.36	0.16	1.17495	1.05452	0.12042	12.59

Table B.3b Event Mean Concentrations of Metals for UCLA Sites of Year 2001-2002

Sites	Date	Total As (ug/L)	Total Cd (ug/L)	Total Cr (ug/L)	Total Cu (ug/L)	Total Ni (ug/L)	Total Pb (ug/L)	Total Zn (ug/L)	Diss. As (ug/l)	Diss. Cd (ug/L)	Diss. Cr (ug/L)	Diss. Cu (ug/L)
UCLA 1	11/12/01	5.94	1.52	12	103.62	25.06	25.88	593.31	1.06	0.64	1.79	68.95
	11/24/01	3.76	0.16	6.85	61.9	16.68	12.21	331.2	1.05	0.51	1.77	47.66
	12/20/01	2.88	1	6.81	52.1	9.8	7.9	301.08	1.00	0.5	2.62	38.92
	01/27/02	4.14	1.18	12.39	75.8	15.3	9.01	342.09	1.00	0.5	1.91	56.25
	02/17/02	2	1.45	9.83	92.12	18.63	18.33	472.35	1.00	0.89	1.79	77.53
UCLA 2	10/30/01	17.99	20.19	40.08	920.76	253.73	151.64	8881.32	13.31	17.79	19.26	735.27
	11/12/01	3.35	1.13	12.77	66.06	17.76	38.97	271.84	1.00	0.54	2.81	35.61
	11/24/01	3.36	1.09	11.33	47.41	11.55	28.54	185.65	1.00	0.56	2.75	20.3
	12/14/01	4.62	2.73	23.35	178.74	39.24	44.28	707.06	1.22	1.34	5.02	107.56
	01/27/02	3.05	1.4	12.02	76.64	10.73	19.94	280.65	1.15	0.76	3.84	44.44
	02/17/02	3.36	1.88	13.07	138.19	18.34	21.21	626.54	1.38	1.26	2.7	96.35
	03/06/02	4.79	4.81	15.57	216.67	41.94	26.78	1213.28	3.37	4.16	4.66	185.92
	03/17/02	6.11	2.89	20.1	197.02	29.25	23.99	964.3	3.53	2.15	5.18	157.53
UCLA 3	10/30/01	7.01	4.92	15.37	211.46	91.7	22.32	1747.86	3.74	4.11	8.35	193.86
	11/12/01	3.36	1.02	7.8	41.07	14	25.23	205.84	1.16	0.52	1.78	21.53
	11/24/01	2.47	1.17	13	56.83	12.94	33.71	271.34	1.08	0.65	4.17	35.26
	12/20/01	2.03	1.12	9.01	43.73	7.08	25	189.9	1.00	0.62	2.29	28.19
	01/27/02	2.33	1.19	10.02	64.47	9.05	26.47	264.46	1.15	0.67	2.22	43.74
	02/17/02	2.21	1.08	11.84	52.36	7.32	22.51	254.84	1.02	0.56	2.53	35.15
	03/07/02	5.59	1.4	12.41	38.28	7.91	23.5	182.87	4.44	0.79	1.72	15.84
	03/17/02	4.35	1.51	15.52	67.1	10.82	44.91	354.4	3.03	0.94	4.5	42.12

Table B.3b *(Continued)*

Sites	Date	Diss. Ni (ug/L)	Diss. Pb (ug/L)	Diss. Zn (ug/L)	Part. As (ug/l)	Part. Cd (ug/L)	Part. Cr (ug/L)	Part. Cu (ug/L)	Part. Ni (ug/L)	Part. Pb (ug/L)	Part. Zn (ug/L)
UCLA 1	11/12/01	19.19	3.64	416.04	4.87	0.88	10.2	34.68	5.87	22.24	177.27
	11/24/01	14.4	4.87	274.99	2.71	0.51	5.09	14.24	2.28	7.34	56.21
	12/20/01	8.84	4.06	266.94	1.88	0.5	4.19	13.18	0.96	3.84	34.14
	01/27/02	11.91	0.64	274.87	3.15	0.67	10.48	19.55	3.39	8.36	67.22
	02/17/02	16.44	0.5	345.39	1	0.55	8.03	14.58	2.19	17.83	126.97
UCLA 2	10/30/01	229.22	43.45	8149.95	4.68	2.39	20.82	185.5	24.5	108.19	731.36
	11/12/01	13.01	2.56	169.07	2.35	0.6	9.96	30.45	4.75	36.41	102.77
	11/24/01	7.88	2.54	101.18	2.36	0.54	8.58	27.11	3.67	26	84.47
	12/14/01	26.97	2.76	478.14	3.4	1.39	18.33	71.18	12.27	41.52	228.92
	01/27/02	7.35	1.56	200.01	1.91	0.63	8.17	32.19	3.38	18.38	80.64
	02/17/02	13.98	2.16	506.5	1.97	0.62	10.37	41.84	4.36	19.05	120.03
	03/06/02	37.69	11.11	1148.54	1.41	0.66	10.91	30.75	4.24	15.67	64.74
	03/17/02	25.68	7.17	853.61	2.58	0.74	14.92	39.5	3.57	16.82	110.69
UCLA 3	10/30/01	87.88	10.66	1689.19	3.27	0.81	7.02	17.6	3.82	11.66	58.67
	11/12/01	10.87	4.09	139.2	2.2	0.5	6.02	19.54	3.13	21.14	66.63
	11/24/01	8.38	5.24	196.17	1.39	0.52	8.83	21.58	4.56	28.47	75.17
	12/20/01	4.34	2.88	138.7	1.03	0.5	6.71	15.54	2.74	22.12	51.2
	01/27/02	6.41	2.86	203.06	1.18	0.52	7.79	20.74	2.65	23.61	61.4
	02/17/02	4.4	1.15	186.37	1.19	0.52	9.31	17.21	2.92	21.37	68.48
	03/07/02	2.99	3.94	99.61	1.15	0.61	10.69	22.44	4.92	19.56	83.26
	03/17/02	6.67	7.75	249.79	1.32	0.56	11.02	24.98	4.15	37.16	104.61

Table B.4a Event Mean Concentrations of Non-metal Parameters for UCLA Sites of Year 2002-2003

Sites	Date	TSS (mg/L)	Turb. (NTU)	Cond. (mmho/cm)	Hard. (mg/L)	COD (mg/l)	DOC (mg C/L)	O&G (mg/l)	TKN (mg/l)	NH_3-N (mg/l)	NO_2-N (mg/l)	NO_3-N (mg/L)	PO_4^{3}-P (mg/L)	Total P (mg/l)	Diss. P (mg/L)
UCLA 1	11/07/02	26.57	38.38	279.28	92.54	286.11	57.46	14.58	13.37	3.83	0.33	6.20	0.07	0.65	0.58
	12/16/02	26.33	26.73	152.12	50.77	76.68	16.82	5.96	1.77	0.88	0.11	3.26	0.05	0.31	0.17
	12/19/02	9.64	14.10	92.94	36.71	40.11	8.17	3.71	1.02	0.45	0.12	2.40	0.05	0.19	0.1
	02/11/03	16.76	28.91	170.69	54.57	146.34	24.68	13.71	4.05	2.33	0.19	3.23	0.05	0.28	0.18
	03/15/03	8.81	15.69	92.47	6.75	32.51	50.54	9.74	8.62	1.09	0.62	0.06	1.66	0.05	0.77
	05/02/03	22.18	16.07	99.41	27.12	78.37	15.62	6.86	1.91	0.98	0.08	0.00	0.00	1.29	1.27
UCLA 2	11/07/02	75.95	35.15	127.75	43.24	176.60	31.24	9.11	5.52	2.95	0.35	1.88	0.07	0.43	0.33
	11/29/02	208.02	150.99	547.82	140.60	799.49	176.64	49.97	34.90	24.47	0.32	9.21	1.07	1.73	1.59
	12/15/02	55.71	107.75	255.39	53.89	506.41	92.24	44.39	18.71	15.98	0.25	5.26	0.38	1.31	1.13
	12/16/02	132.10	63.62	239.13	118.77	84.56	10.52	4.84	2.13	1.75	0.09	1.28	0.05	0.39	0.18
	02/11/03	66.67	71.27	121.61	41.30	202.02	30.69	12.43	6.72	4.56	0.14	2.14	0.05	0.4	0.29
	04/15/03	44.39	57.56	163.87	60.29	122.98	13.73	6.07	3.43	2.62	3.01	1.37	0.05	1.7	1.63
UCLA 3	11/07/02	36.90	31.14	69.27	21.39	94.17	13.95	6.89	2.77	1.30	0.12	1.01	0.06	0.22	0.16
	11/29/02	112.78	63.74	482.69	139.47	749.18	175.52	41.80	35.27	18.10	0.23	5.06	0.05	1.34	1.21
	12/16/02	82.63	28.37	48.74	13.74	66.38	8.98	3.17	2.39	1.36	0.05	0.70	0.05	0.28	0.15
	12/19/02	29.07	13.06	32.53	12.42	19.28	2.92	1.73	0.78	0.66	0.05	0.51	0.05	0.14	0.08
	02/11/03	68.73	46.32	108.02	46.86	171.33	29.21	11.37	4.17	3.07	0.16	1.52	0.12	0.33	0.25
	03/15/03	54.03	16.99	23.42	10.77	52.20	2.97	3.16	0.79	0.44	0.03	0.54	0.05	1.52	1.44
	04/15/03	73.48	28.94	65.53	21.48	93.33	12.20	8.06	2.56	1.47	0.08	0.78	0.05	1.46	1.11

Table B.4b Event Mean Concentrations of Metals for UCLA Sites of Year 2002-2003

Sites	Date	Total As (ug/L)	Total Cd (ug/L)	Total Cr (ug/L)	Total Cu (ug/L)	Total Ni (ug/L)	Total Pb (ug/L)	Total Zn (ug/L)	Diss. As (ug/l)	Diss. Cd (ug/L)	Diss. Cr (ug/L)	Diss. Cu (ug/L)	Diss. Ni (ug/L)	Diss. Pb (ug/L)	Diss. Zn (ug/L)
UCLA 1	11/07/02	1.00	0.75	11.83	146.95	21.72	6.65	727.01	1.24	1.01	2.76	131.54	19.46	1.28	660.6
	12/16/02	1.09	0.62	4.65	45.42	7.61	11.93	190.52	1.09	0.50	1.62	23.04	4.95	3.15	131.66
	12/19/02	1.17	0.54	2.45	19.56	3.71	5.35	83.37	1.17	0.50	0.78	12.56	2.31	0.54	59.42
	02/11/03	1.08	0.51	4.29	76.27	11.55	6.89	304.05	1.08	0.51	1.59	58.46	8.64	0.63	255.96
	03/15/03	3.40	0.50	3.70	34.46	6.22	11.82	118.28	3.55	0.50	0.82	24.37	3.62	4.25	83.20
	05/02/03	4.80	0.50	3.54	40.12	10.21	4.61	183.24	5.16	0.50	1.87	31.16	8.98	0.88	157.76
UCLA 2	11/07/02	1.00	1.05	10.98	95.42	15.02	23.09	459.53	1.00	0.81	1.97	60.20	10.72	1.38	348.47
	11/29/02	2.36	3.66	24.00	368.02	66.24	26.32	1791.47	2.36	3.25	8.46	315.15	61.47	7.13	1693.78
	12/15/02	1.08	1.73	13.86	182.29	32.77	16.74	882.05	1.08	1.50	4.05	154.90	28.74	5.01	830.24
	12/16/02	1.00	1.29	13.63	69.32	14.89	67.77	280.72	1.00	0.73	2.17	23.95	6.26	2.18	122.3
	02/11/03	1.12	0.91	8.87	113.47	14.83	20.85	435.60	1.12	0.85	2.51	71.38	9.94	1.18	355.96
	04/15/03	1.04	0.89	7.84	68.53	11.48	26.32	217.35	1.50	0.61	1.97	33.77	7.93	6.06	138.51
UCLA 3	11/07/02	1.16	0.09	8.16	113.48	24.67	22.07	361.99	1.16	0.51	0.86	45.64	5.32	2.51	265.86
	11/29/02	1.73	2.00	12.90	173.66	43.45	28.31	961.92	1.45	1.55	3.08	152.14	39.74	12.61	879.36
	12/16/02	1.00	0.61	7.99	35.78	8.16	37.96	167.25	1.00	0.50	0.86	10.72	1.72	1.63	62.76
	12/19/02	1.00	0.50	2.44	16.17	2.27	24.59	87.35	1.00	0.50	0.50	5.32	0.86	0.51	45.13
	02/11/03	1.05	0.64	4.80	54.57	10.06	51.44	317.74	1.05	0.64	1.74	40.51	7.08	7.27	265.81
	03/15/03	1.96	1.04	7.16	27.75	8.13	49.71	121.12	1.96	0.51	1.38	7.25	3.94	9.03	42.35
	04/15/03	1.91	0.53	6.59	50.93	8.48	39.76	227.91	1.42	0.53	0.85	20.74	4.24	5.92	124.13

Table B.5a Event Mean Concentrations of Non-Metal Parameters from CDM and URS Sites

Sites	Date	Event Rainfall (mm)	TSS (mg/L)	TOC (mg/L)	O&G	Hard. (mg/L)	NO_3-N (mg/L)	TP (mg/L)	PO_4-P (mg/L)	Total Coli.	Fecal Coli.	E. C. (umho /cm)	pH	Temp.	TDS (mg/L)	Turbi-dity (NTU)	COD (mg/L)	DOC (mg/L)	NH_3-N (mg/L)	TKN (mg/L)
CDM	01/25/00	15.24	461.87	44.20	4.02	187.84	2.83	0.96	0.80	3889.85	459.69	139.11	8.50	15.32						
7-10	02/12/00	23.11	753.99	15.40	0.52	58.26	0.86	12.18	4.82	2613.24	83.11	36.82	5.64	8.86						
	02/20/00	26.67	221.05	8.10	1.55	31.78	0.54	0.33	0.09	594.80	422.05	82.38	7.95							
	02/23/00	42.42	155.57	7.77	1.41	41.53	0.45	0.38	0.16	1362.60	307.26		7.35	11.80						
	02/27/00	10.92	125.51	10.66	2.25	40.10	1.33	0.40	0.15	473.86	63.74	77.24	8.03	12.96						
	03/05/00	19.81	25.20	4.19	1.22	25.31	0.43	0.20	0.13	80.02	12.58	47.54	6.77	10.39						
	03/08/00	27.43	131.88	7.46	4.06	44.26	0.47	0.27	0.11	598.32	189.66	64.76	7.68	10.57						
	04/17/00	42.93	196.32	16.28	6.19	84.80	1.68	0.63	0.26	2392.78	1327.88	164.80	9.67							
CDM	01/25/00		138.19	64.46	13.95	99.61	2.50	0.80	0.67	4807.49	1821.63	240.06	7.85	15.15						
7-185	02/12/00	19.30	277.61	10.39	1.42	36.68	0.23	8.32	4.06	4138.42	96.86	35.55	9.73	12.93						
	02/20/00	20.57	153.72	8.66	4.00	33.85	0.36	0.33	0.12	227.05	68.22	56.78	7.36	14.35						
	02/23/00	24.89	108.33	13.87	4.51	38.84	0.46	0.33	0.18	4893.88	1845.45	72.59	8.52	13.07						
	02/27/00	4.06	45.36	20.31	8.12	42.57	0.83	0.31	0.22	576.88	85.96	102.45	8.29	15.32						
	03/05/00	15.75	49.56	5.32	2.99	25.91	0.29	0.21	0.08	107.31	26.61	634.58	6.87	10.88						
	03/08/00	21.08	157.16	10.79	4.16	44.55	0.48	0.36	0.14	4080.67	749.33	85.76	8.03	12.07						
	04/17/00	32.00	319.21	22.43	8.95	69.19	0.99	1.39	0.29	1260.01	302.82	93.50	7.08	16.21						
URS	01/26/01	14.48	81.62	10.54	2.50	50.93	1.29	0.16	0.10			114.64	7.96		139.32	76.02	96.44	9.64	0.65	1.89
23	02/10/01	12.45	68.34	7.95	2.50	34.73	0.98	0.12	0.09			106.34	7.82		89.34	77.47	60.93	7.62	0.78	3.11
	02/19/01	9.40	48.71	11.36	3.27	31.79	1.04	0.21	0.11			90.51	7.31		70.08	66.31	130.21	10.54	0.92	2.94
	02/24/01	64.26	49.61	5.14	2.59	35.13	0.58	0.10	0.08			64.33	7.83		61.81	45.85	113.65	4.70	0.24	0.88
URS	10/26/00	32.00	267.31	14.13	4.58	201.06	1.81	6.95	0.22			118.86	8.49		109.15	166.27	146.59	13.97	0.85	2.41
6-20F	01/26/01	11.94	445.13	16.40	9.99	138.18	1.48	0.33	0.18			168.52	8.15		206.77	560.79	408.43	15.63	0.99	3.01
	02/10/01	7.87	623.09	40.77	16.89	186.42	2.71	0.27	0.19			299.49	7.87		304.79	709.18	576.30	38.91	1.83	7.38
	02/19/01	10.41	283.03	26.76	18.98	115.98	1.30	0.13	0.16			183.74	6.98		161.48	465.53	394.78	22.15	1.32	3.81
URS	10/26/00	8.89	1083.15	25.94	3.67	272.49	3.79	50.87	0.45			233.93	8.17		298.29	594.38	316.19	22.45	1.26	7.91
8-23C	01/26/01	7.11	300.42	11.03	4.53	102.68	1.08	0.24	0.14			331.14	8.32		187.89	373.57	191.24	10.27	0.77	2.16
	02/19/01	4.32	217.88	13.80	12.86	89.29	1.02	0.35	0.15			139.54	7.38		129.96	294.86	302.75	13.08	0.75	2.50

Table B.5b Event Mean Concentrations of Metals from CDM and URS Sites

Sites	Date	Event Rainfall (mm)	Total Cd (ug/L)	Total Cr (ug/L)	Total Cu (ug/L)	Total Ni (ug/L)	Total Pb (ug/L)	Total Zn (ug/L)	Total As (ug/L)	Soluble Cd (ug/L)	Soluble Cr (ug/L)	Soluble Cu (ug/L)	Soluble Ni (ug/L)	Soluble Pb (ug/L)	Soluble Zn (ug/L)	Soluble As (ug/L)
CDM	01/25/00	15.24	2.35	19.87	91.82	23.04	690.03	416.06		0.25	2.71	24.45	4.94	4.73	35.86	
7-10	02/12/00	23.11	1.77	24.06	74.25	22.75	505.33	420.75		0.37	1.64	10.96	1.94	58.78	50.90	
	02/20/00	26.67	0.31	4.45	18.35	4.73	94.19	95.89		0.25	2.43	5.19	1.00	10.21	14.63	
	02/23/00	42.42	0.94	8.37	35.53	7.70	198.77	174.80		0.25	1.96	6.09	0.80	11.28	15.05	
	02/27/00	10.92	0.71	11.63	30.64	6.43	123.58	162.13		0.25	1.91	8.20	1.89	9.06	31.83	
	03/05/00	19.81	0.25	2.04	12.84	2.30	48.46	72.24		0.25	1.14	3.83	0.57	4.72	19.33	
	03/08/00	27.43	0.86	6.27	30.67	6.71	167.98	168.69		0.25	1.89	10.55	1.00	10.64	16.58	
	04/17/00	42.93	1.27	9.39	51.25	11.28	238.12	243.20		0.25	2.48	14.87	3.66	13.39	41.35	
CDM	01/25/00		2.50	13.65	123.00	22.77	250.64	644.18		0.57	2.57	52.05	12.87	4.46	235.87	
7-185	02/12/00	19.30	1.70	13.31	68.28	11.96	147.95	484.29		0.25	0.64	5.35	1.11	2.46	44.23	
	02/20/00	20.57	1.98	8.68	52.23	8.98	97.75	403.36		0.25	2.15	7.42	1.67	3.11	44.28	
	02/23/00	24.89	1.68	10.48	60.04	9.93	140.13	340.81		0.25	2.06	9.59	2.15	7.06	40.32	
	02/27/00	4.06	0.82	4.88	43.12	8.39	52.79	245.44		0.25	2.05	18.95	4.87	4.62	172.98	
	03/05/00	15.75	0.72	3.90	24.71	4.91	43.47	173.60		0.25	0.74	5.81	1.06	2.03	42.59	
	03/08/00	21.08	1.61	8.86	58.89	9.96	136.50	341.00		0.25	1.83	10.22	2.55	7.02	51.49	
	04/17/00	32.00	2.89	16.71	109.36	21.91	244.49	639.46		0.29	2.48	22.04	7.10	10.32	76.71	
URS	01/26/01	14.48	0.84	7.46	39.51	7.21	40.46	173.06	0.69	0.12	3.09	13.77	2.82	3.71	37.95	0.46
23	02/10/01	12.45	0.64	11.04	28.11	4.53	25.92	126.71	0.67	0.15	1.80	12.86	2.31	2.57	37.62	0.46
	02/19/01	9.40	0.88	7.85	30.02	6.58	25.25	124.23	0.71	0.25	2.35	14.83	2.49	3.23	34.46	0.63
	02/24/01	64.26	0.56	6.33	29.62	4.75	23.13	127.07	0.56	0.10	2.92	10.25	1.40	1.08	30.60	0.31
URS	10/26/00	32.00	1.82	14.39	91.86	16.10	268.68	621.23	0.95	0.26	6.65	31.71	5.20	16.62	45.38	0.45
6-20F	01/26/01	11.94	3.64	26.43	159.96	26.43	664.40	532.60	4.31	0.19	3.93	28.09	3.91	22.08	42.73	1.03
	02/10/01	7.87	3.20	23.42	178.93	24.12	557.34	494.45	3.03	0.29	3.09	57.78	7.53	19.29	46.72	0.94
	02/19/01	10.41	2.61	17.08	115.36	17.81	395.82	343.21	3.10	0.19	1.90	31.13	4.42	13.97	32.71	0.78
URS	10/26/00	8.89	51.11	48.14	194.14	50.90	975.83	719.43	4.22	1.56	4.17	44.57	8.58	17.65	64.28	1.30
8-23C	01/26/01	7.11	2.06	18.22	91.88	19.17	342.28	356.46	3.09	0.11	3.34	17.66	2.81	15.26	28.89	0.76
	02/19/01	4.32	1.64	16.75	73.46	16.15	223.07	273.09	1.47	0.12	1.55	20.94	3.07	11.55	24.84	0.60

APPENDIX C
TOTAL MASS LOADING

Table C.1 Total Mass Loading of Constituents for UCLA sites of year 1999-2000

Sites	Date	TSS (kg)	VSS (kg)	Alkalinity (kg as CaCO3)	Hard. (kg)	COD (kg)	DOC (kg C)	O&G (kg)	NH_3^-N (kg)	NH_4-N (kg)	NO_3-N (kg)
UCLA 1	01/25/00	1.31	0.27	6.62	11.68	36.38		1.48		0.86	0.42
	01/30/00	0.17	0.10	0.44	0.56	1.45		0.13		0.03	0.02
	02/10/00	2.41	1.02	3.56	4.43	8.42		0.95		0.20	0.63
	02/12/00	4.87	1.59	4.12	5.35	7.23		0.47		0.11	0.18
	02/20/00	5.61	1.20	4.61	5.36	8.19		0.48		0.13	0.18
	02/27/00	0.93	0.24	0.69	0.92	1.76		0.13		0.05	0.05
	03/08/00	0.36	0.16	0.84	0.94	1.25		0.08		0.05	0.03
UCLA 2	01/25/00	6.92	2.51	9.14	16.47	27.86		2.27		1.42	0.35
	01/30/00	1.79	0.74	1.81	2.59	6.94		0.51		0.29	0.18
	02/10/00	48.69	6.69	3.56	6.09	16.17		1.16		0.42	0.17
	02/12/00	27.70	5.22	5.13	7.94	12.23		0.45		0.19	0.13
	02/20/00	64.06	7.40	4.62	13.97	11.37		0.44		0.20	0.11
	02/27/00	4.62	1.10	0.75	2.39	3.84		0.23		0.18	0.09
	04/17/00	33.80	5.59	1.38	3.92	10.53		0.58		0.20	0.14
UCLA 3	01/25/00	1.12	0.39	1.44	2.21	4.81	0.72	0.30	0.14	0.00	0.05
	01/30/00	0.75	0.33	0.68	0.91	2.23	0.43	0.15	0.09	0.00	0.02
	02/10/00	1.60	0.54	1.31	1.90	3.43	0.70	0.28	0.07	0.00	0.04
	02/12/00	1.39	0.42	0.80	1.24	1.80	0.31	0.12	0.04	0.00	0.02
	02/20/00	0.32	0.13	0.26	0.40	0.97	0.15	0.03	0.02	0.00	0.01
	02/27/00	2.23	0.69	0.47	0.80	1.63	0.41	0.13	0.08	0.00	0.04
	03/04/00	0.94	0.26	0.22	0.39	0.78	0.18	0.06	0.04	0.00	0.03
	03/08/00	1.35	0.44	1.03	1.26	2.02	0.34	0.15	0.07	0.00	0.02

Table C.1 *(Continued)*

Sites	Date	NO_2-N (kg)	Total P (kg)	PO_4^{3}-P (kg)	Diss. P (kg)	Part. P (kg)	SO_4^{2-} (kg)	F^- (kg)	Cl^- (kg)
UCLA 1	01/25/00	0.05							
	01/30/00	0.00							
	02/10/00	0.02							
	02/12/00	0.02							
	02/20/00	0.02							
	02/27/00	0.00							
	03/08/00	0.01							
UCLA 2	01/25/00	0.08							
	01/30/00	0.01							
	02/10/00	0.02							
	02/12/00	0.03							
	02/20/00	0.01							
	02/27/00	0.00							
	04/17/00	0.01							
UCLA 3	01/25/00	0.01	0.01	0.01	0.01	0.00	0.61	0.19	0.27
	01/30/00	0.00	0.01	0.00	0.01	0.00	0.30	0.06	0.10
	02/10/00	0.01	0.01	0.00	0.01	0.01	0.51	0.09	0.31
	02/12/00	0.00	0.01	0.00	0.01	0.00	0.28	0.05	0.24
	02/20/00	0.00	0.00	0.00	0.00	0.00	0.14	0.02	0.03
	02/27/00	0.00	0.00	0.00	0.00	0.00	0.36	0.03	0.12
	03/04/00	0.00	0.00	0.00	0.00	0.00	0.12	0.01	0.07
	03/08/00	0.01	0.01	0.01	0.01	0.00	0.31	0.03	0.27

Table C.1 *(Continued)*

Sites	Date	Total As (g)	Total Cd (g)	Total Cr (g)	Total Cu (g)	Total Ni (g)	Total Pb (g)	Total Zn (g)	Diss. As (g)	Diss. Cd (g)	Diss. Cr (g)	Diss. Cu (g)
UCLA 1	01/25/00		0.04	0.90	8.39	1.73	1.62	51.36		0.03	0.44	6.91
	01/30/00		0.00	0.04	0.44	0.12	0.07	1.74		0.00	0.02	0.35
	02/10/00		0.10	0.42	4.93	1.31	2.52	25.61		0.09	0.13	2.72
	02/12/00		na	1.23	4.48	1.44	7.66	21.05		na	0.50	2.14
	02/20/00		na	0.58	2.99	0.94	6.26	13.48		na	0.18	2.21
	02/27/00		na	0.09	0.68	0.19	0.36	2.09		na	0.04	0.43
	03/08/00		0.04	0.09	0.59	0.24	0.37	2.55		0.04	0.04	0.40
UCLA 2	01/25/00		0.19	1.63	12.95	2.65	9.58	50.25		0.18	0.88	10.12
	01/30/00		0.03	0.63	3.35	0.78	1.87	8.72		0.02	0.35	2.15
	02/10/00		0.28	1.55	7.85	2.11	9.31	32.65		0.19	0.42	4.44
	02/12/00		na	3.34	7.55	2.51	40.94	37.49		na	0.88	2.13
	02/20/00		na	2.82	4.88	2.43	28.41	21.72		na	0.66	1.47
	02/27/00		0.03	0.34	1.83	0.43	1.30	6.13		0.03	0.10	0.96
	04/17/00		0.15	0.41	2.86	0.96	3.73	18.25		0.13	0.18	1.98
UCLA 3	01/25/00	0.18	0.04	0.25	1.68	0.46	1.11	6.88	0.09	0.02	0.11	1.21
	01/30/00			0.12	0.78	0.39	0.55	2.31	0.07	0.01	0.06	0.58
	02/10/00			0.26	1.49	0.38	2.20	7.31			0.14	1.01
	02/12/00			0.26	1.20	0.37	2.52	6.69	0.04	0.04	0.04	0.58
	02/20/00			0.03	0.25	0.08	0.25	0.98	0.01		0.01	0.19
	02/27/00		0.04	0.20	1.04	0.28	1.43	3.33	0.03	0.02	0.03	0.50
	03/04/00			0.09	0.44	0.12	0.69	1.99	0.02		0.03	0.24
	03/08/00			0.19	0.92	0.31	1.86	4.62	0.03		0.04	0.51

Table C.1 *(Continued)*

Sites	Date	Diss. Ni (g)	Diss. Pb (g)	Diss. Zn (g)	Part. As (g)	Part. Cd (g)	Part. Cr (g)	Part. Cu (g)	Part. Ni (g)	Part. Pb (g)	Part. Zn (g)
UCLA 1	01/25/00	1.51	0.27	46.16							
	01/30/00	0.10	0.01	1.24							
	02/10/00	0.89	0.77	16.30							
	02/12/00	0.87	0.42	12.67							
	02/20/00	0.77	2.72	10.15							
	02/27/00	0.13	0.11	0.68							
	03/08/00	0.16	0.08	0.82							
UCLA 2	01/25/00	2.10	0.40	36.79							
	01/30/00	0.58	0.15	4.32							
	02/10/00	1.31	0.56	14.29							
	02/12/00	0.72	0.84	6.82							
	02/20/00	0.64	0.57	4.79							
	02/27/00	0.28	0.16	3.55							
	04/17/00	0.75	na	10.67							
UCLA 3	01/25/00	0.32	0.24	4.59	0.09	0.02	0.15	0.47	0.14	0.87	2.28
	01/30/00	0.31	0.03	1.55			0.07	0.20	0.08	0.52	0.76
	02/10/00	0.25	0.22	2.90	0.03	0.04	0.12	0.48	0.13	1.98	4.41
	02/12/00	0.18	0.21	2.26			0.22	0.62	0.19	2.30	4.43
	02/20/00	0.06	0.03	0.72		0.01	0.02	0.06	0.02	0.22	0.26
	02/27/00	0.13	0.13	1.73		0.01	0.17	0.55	0.15	1.30	1.61
	03/04/00	0.06	0.04	0.94		0.01	0.06	0.20	0.05	0.65	1.04
	03/08/00	0.20	0.06	2.05			0.15	0.41	0.11	1.80	2.57

Table C.2 Total Mass Loading of Constituents for UCLA Sites of year 2000-2001

Sites	Date	TSS (kg)	Turb. (kg)	Hard. (kg)	COD (kg)	DOC (kg)	O&G (kg)	NH_3-N (kg)	NO_2-N (kg)	NO_3-N (kg)	TKN (kg)	PO_4^{3-}P (kg)	Diss. P (kg)	Part.P (kg)
UCLA 1	10/26/00	10.12	7.90	15.37	30.40	8.34	2.56	0.57	0.03	1.08	1.61	0.03	0.06	0.03
	01/08/01	3.77	4.98	9.72	35.82	5.47	1.48	0.06	0.05	0.08	1.56	0.08	0.06	0.01
	01/10/01	29.46	14.47	27.98	42.12	10.10	2.48	0.08	0.13	1.78	1.72	na	0.10	0.16
	02/10/01	3.36	3.47	6.12	15.70	2.97	1.17	0.05	0.02	0.24	0.61	na	0.03	0.02
	02/19/01	2.69	2.49	2.89	6.10	1.19	0.51	0.01	0.02	0.07	0.27	na	0.01	0.01
	03/04/01	3.41	3.33	10.80	7.76	1.78	0.64	0.02	0.05	0.25	0.33	na	0.03	0.01
	04/20/01	1.69	2.50	3.10	6.89	1.61	0.79	0.02	0.01	0.10	0.31	na	0.02	0.01
UCLA 2	10/26/00	16.52	13.16	7.53	26.86	5.96	2.46	0.65	0.03	0.39	1.06	0.02	0.04	0.02
	01/08/01	4.81	8.41	8.03	26.94	4.62	1.84	0.05	0.05	0.14	1.21	0.04	0.04	0.01
	01/10/01	88.23	21.15	94.33	44.34	7.63	2.18	0.11	0.13	0.95	1.76	na	0.10	0.10
	02/19/01	18.60	12.80	20.01	20.02	3.05	1.10	0.05	0.04	0.17	0.89	na	0.05	0.02
	02/24/01	10.28	9.61	14.50	16.30	4.15	1.80	0.07	0.05	0.23	1.04	na	0.07	0.02
	03/04/01	9.34	5.38	13.38	13.05	2.21	0.81	0.04	0.03	0.12	0.66	na	0.03	0.02
	04/07/01	19.31	8.47	20.25	29.20	6.39	3.25	0.09	0.03	0.34	1.42	na	0.06	0.03
UCLA 3	10/26/00	5.10	3.24	1.90	5.29	1.27	0.52	0.11	0.01	0.06	0.24	na	0.01	0.01
	01/08/01	1.51	1.01	0.92	6.40	1.33	0.33	0.01	0.01	0.03	0.28	0.00	0.01	0.00
	01/10/01	23.49	5.90	7.13	10.59	1.80	0.73	0.02	0.05	0.14	0.72	na	0.03	0.04
	02/10/01	1.63	0.98	1.26	4.59	0.84	0.34	0.01	0.01	0.04	0.24	na	0.01	0.00
	02/19/01	9.55	1.85	2.06	3.68	1.00	0.38	0.01	0.02	0.05	0.30	na	0.02	0.00
	02/24/01	0.96	0.73	1.10	2.72	0.93	0.36	0.01	0.01	0.03	0.15	na	0.01	0.00
	03/04/01	0.71	0.23	0.49	1.88	0.44	0.15	0.00	0.00	0.01	0.06	na	0.00	0.00
	04/07/01	2.77	1.23	5.16	10.68	3.09	0.92	0.03	0.01	0.07	0.48	na	0.02	0.00

Table C.2 *(Continued)*

Sites	Date	Diss. Cd (g)	Diss. Cr (g)	Diss. Cu (g)	Diss. Ni (g)	Diss. Pb (g)	Diss. Zn (g)	Part. Cd (g)	Part. Cr (g)	Part. Cu (g)	Part. Ni (g)	Part. Pb (g)	Part. Zn (g)
UCLA 1	10/26/00	na	0.46	9.27	2.58	0.63	51.98	0.12	0.86	4.90	0.78	3.18	18.92
	01/08/01	0.05	0.21	5.71	1.25	0.28	13.64	0.04	0.47	1.88	0.32	10.16	5.86
	01/10/01	na	1.30	17.13	1.87	na	75.38	na	5.68	22.45	3.99	25.92	83.25
	02/10/01	na	0.22	3.40	0.76	na	18.51	na	0.52	1.81	0.34	1.40	6.05
	02/19/01	na	0.15	1.36	0.29	na	6.53	na	0.39	1.61	0.30	0.84	6.78
	03/04/01	na	0.41	1.86	0.31	na	6.64	na	0.59	1.69	0.34	1.05	8.90
	04/20/01	na	na	2.49	0.63	na	12.81	na	0.38	1.62	0.21	0.66	3.61
UCLA 2	10/26/00	na	0.34	7.75	2.15	1.25	13.78	0.17	1.33	7.92	1.41	5.84	34.28
	01/08/01	0.09	0.35	6.66	1.60	0.23	18.08	0.06	0.60	3.28	0.54	2.01	15.74
	01/10/01	na	2.75	11.73	4.62	na	67.42	na	6.31	26.39	4.81	43.11	94.40
	02/19/01	na	0.62	3.04	0.50	na	17.43	na	1.66	5.94	1.16	3.89	18.00
	02/24/01	na	0.63	3.50	0.63	na	14.57	na	1.73	7.60	1.11	3.65	16.30
	03/04/01	na	0.29	3.04	0.62	na	13.28	na	1.73	7.60	1.11	3.65	16.30
	04/07/01	na	na	9.71	2.16	na	44.94	na	1.95	8.80	1.20	5.45	26.84
UCLA 3	10/26/00	na	0.07	0.92	0.44	0.42	9.81	0.03	0.32	1.02	0.28	2.32	4.69
	01/08/01	na	0.04	1.75	0.36	na	7.40	na	0.11	0.31	0.07	0.35	1.18
	01/10/01	na	0.49	4.28	1.24	1.32	24.21	na	1.53	5.97	1.08	15.49	22.73
	02/10/01	na	na	0.65	0.08	na	5.67	na	0.16	0.41	0.11	0.88	1.78
	02/19/01	na	0.18	0.99	0.11	na	7.32	na	0.30	1.23	0.28	2.90	4.82
	02/24/01	na	0.05	0.77	0.10	na	3.90	na	0.11	0.32	0.06	0.50	1.19
	03/04/01	na	na	0.49	0.10	na	2.31	na	0.05	0.17	0.03	0.22	0.83
	04/07/01	0.06	0.06	4.77	0.87	0.44	22.95	na	0.23	0.77	0.15	0.94	3.54

Table C.3 Total Mass Loading of Constituents for UCLA Sites of Year 2001-2002

Sites	Date	TSS (kg)	VSS (kg)	Alkal. (kg)	Hard. (kg)	COD (kg)	DOC (kg)	O&G (kg)	TKN (kg)	NH_3-N (kg)	NO_2^-N (kg)
UCLA 1	11/12/01	5.203	2.371	1.945	8.303	23.526	3.858	0.499	0.551	0.167	0.026
	11/24/01	12.448	7.082	15.685	34.098	81.120	22.432	5.259	1.683	0.825	0.189
	12/20/01	1.268	0.822	6.884	8.204	13.582	4.461	0.785	0.222	0.175	0.021
	01/27/02	3.761	1.886	5.705	8.634	19.954	7.258	1.521	0.595	0.377	0.134
	02/17/02	0.871	0.436	1.870	4.235	3.681	1.147	0.227	0.102	0.008	0.011
UCLA 2	10/30/01	22.165	11.998	2.538	28.417	108.479	40.334	3.809	5.291	3.086	0.032
	11/12/01	17.059	4.790	1.389	3.579	10.939	3.229	0.834	0.703	0.343	0.026
	11/24/01	56.482	14.071	4.398	26.673	24.031	8.330	2.309	1.144	0.738	0.125
	12/14/01	5.484	2.644	1.107	4.833	22.082	7.268	1.693	0.764	0.692	0.053
	01/27/02	23.844	9.661	3.614	11.349	29.922	12.726	3.431	1.609	1.274	0.214
	02/17/02	12.287	5.984	1.598	4.449	27.268	7.723	1.631	0.935	0.713	0.035
	03/06/02	1.424	0.860	0.408	3.468	18.042	5.476	0.853	0.539	0.413	0.006
	03/17/02	2.408	1.426	0.255	1.615	9.915	3.044	0.732	0.326	0.235	0.006
UCLA 3	10/30/01	0.662	0.373	0.242	2.588	9.023	3.119	0.338	0.330	0.156	0.005
	11/12/01	2.096	0.602	0.244	0.529	1.420	0.372	0.114	0.080	0.032	0.003
	11/24/01	6.463	2.052	1.288	3.451	14.191	4.806	1.021	0.420	0.332	0.025
	12/20/01	3.199	0.978	0.511	1.139	6.310	1.411	0.313	0.163	0.106	0.006
	01/27/02	4.572	1.852	1.144	2.960	11.953	4.190	0.932	0.344	0.283	0.077
	02/17/02	2.065	0.886	0.262	4.372	5.176	1.113	0.315	0.088	0.070	0.010
	03/07/02	1.279	0.462	0.447	4.841	18.829	5.772	0.464	0.529	0.321	0.004
	03/17/02	4.140	1.562	0.332	1.888	11.613	3.029	0.542	0.316	0.174	0.005

Table C.3 *(Continued)*

Sites	Date	NO_3^-N (kg)	$PO_4^{3-}P$ (kg)	Total P (kg)	Diss. P (kg)	Part.P (kg)	F^- (kg)	Cl^- (kg)	SO_4^{2-} (mg/L)
UCLA 1	11/12/01	0.435	0.011	0.065	0.032	0.033	0.170	0.975	5.048
	11/24/01	1.575	0.059	0.432	0.161	0.272	1.818	3.495	22.103
	12/20/01	0.228	0.006	0.035	0.023	0.012	0.306	1.448	3.240
	01/27/02	0.279	0.009	0.056	0.024	0.031	0.438	1.460	3.695
	02/17/02	0.586	0.007	0.016	0.011	0.005	0.050	0.934	5.629
UCLA 2	10/30/01	1.134	0.127	0.391	0.348	0.043	0.728	4.730	16.329
	11/12/01	0.148	0.019	0.072	0.033	0.039	0.200	0.414	1.597
	11/24/01	0.428	0.111	0.328	0.081	0.247	0.288	2.295	17.494
	12/14/01	0.042	0.005	0.059	0.027	0.032	0.226	0.800	1.803
	01/27/02	0.401	0.040	0.198	0.089	0.109	0.722	1.787	5.646
	02/17/02	0.107	0.021	0.056	0.046	0.010	0.687	1.000	1.788
	03/06/02	0.052	0.014	0.142	0.139	0.003	0.284	0.649	0.983
	03/17/02	0.019	0.007	0.114	0.111	0.003	0.198	0.258	0.417
UCLA 3	10/30/01	0.043	0.004	0.013	0.011	0.002	0.057	0.746	0.975
	11/12/01	0.021	0.005	0.011	0.004	0.007	0.062	0.076	0.155
	11/24/01	0.100	0.025	0.055	0.027	0.028	0.162	0.688	1.159
	12/20/01	0.022	0.006	0.010	0.007	0.003	0.060	0.369	0.397
	01/27/02	0.085	0.009	0.025	0.019	0.007	0.183	0.411	0.863
	02/17/02	0.019	0.004	0.009	0.007	0.002	0.020	0.111	0.339
	03/07/02	0.073	0.006	0.015	0.014	0.002	0.089	0.447	1.091
	03/17/02	0.035	0.006	0.043	0.039	0.004	0.103	0.309	0.466

Table C.3 *(Continued)*

Sites	Date	Total As (g)	Total Cd (g)	Total Cr (g)	Total Cu (g)	Total Ni (g)	Total Pb (g)	Total Zn (g)	Diss. As (g)	Diss. Cd (g)	Diss. Cr (g)	Diss. Cu (g)
UCLA 1	11/12/01	0.499	0.128	1.007	8.698	2.104	2.172	49.802	0.089	0.054	0.150	5.788
	11/24/01	2.028	0.086	3.695	33.386	8.997	6.586	178.636	0.566	0.275	0.955	25.706
	12/20/01	0.340	0.118	0.804	6.147	1.156	0.932	35.524	0.118	0.059	0.309	4.592
	01/27/02	0.527	0.150	1.578	9.655	1.949	1.148	43.572	0.127	0.064	0.243	7.165
	02/17/02	0.034	0.024	0.166	1.555	0.314	0.309	7.973	0.017	0.015	0.030	1.309
UCLA 2	10/30/01	0.855	0.959	1.905	43.755	12.057	7.206	422.040	0.632	0.845	0.915	34.940
	11/12/01	0.577	0.195	2.200	11.382	3.060	6.715	46.838	0.172	0.093	0.484	6.136
	11/24/01	2.479	0.804	8.360	34.981	8.522	21.058	136.980	0.738	0.413	2.029	14.978
	12/14/01	0.240	0.142	1.215	9.300	2.042	2.304	36.788	0.063	0.070	0.261	5.596
	01/27/02	1.359	0.624	5.356	34.151	4.781	8.885	125.058	0.512	0.339	1.711	19.802
	02/17/02	0.296	0.165	1.150	12.163	1.614	1.867	55.148	0.121	0.111	0.238	8.481
	03/06/02	0.123	0.124	0.401	5.579	1.080	0.690	31.242	0.087	0.107	0.120	4.787
	03/17/02	0.144	0.068	0.473	4.636	0.688	0.564	22.690	0.083	0.051	0.122	3.707
UCLA 3	10/30/01	0.057	0.040	0.125	1.719	0.746	0.181	14.210	0.030	0.033	0.068	1.576
	11/12/01	0.083	0.025	0.193	1.019	0.347	0.626	5.105	0.029	0.013	0.044	0.534
	11/24/01	0.268	0.127	1.413	6.177	1.407	3.664	29.495	0.117	0.071	0.453	3.833
	12/20/01	0.080	0.044	0.355	1.721	0.279	0.984	7.474	0.039	0.024	0.090	1.110
	01/27/02	0.215	0.110	0.924	5.942	0.834	2.440	24.375	0.106	0.062	0.205	4.032
	02/17/02	0.056	0.028	0.303	1.338	0.187	0.575	6.511	0.026	0.014	0.065	0.898
	03/07/02	0.081	0.020	0.179	0.552	0.114	0.339	2.639	0.064	0.011	0.025	0.229
	03/17/02	0.161	0.056	0.574	2.482	0.400	1.661	13.109	0.112	0.035	0.166	1.558

Table C.3 *(Continued)*

Sites	Date	Diss. Ni (g)	Diss. Pb (g)	Diss. Zn (g)	Part. As (g)	Part. Cd (g)	Part. Cr (g)	Part. Cu (g)	Part. Ni (g)	Part. Pb (g)	Part. Zn (g)
UCLA 1	11/12/01	1.611	0.306	34.922	0.409	0.074	0.856	2.911	0.493	1.867	14.880
	11/24/01	7.767	2.627	148.319	1.462	0.275	2.745	7.680	1.230	3.959	30.317
	12/20/01	1.043	0.479	31.496	0.222	0.059	0.494	1.555	0.113	0.453	4.028
	01/27/02	1.517	0.082	35.010	0.401	0.085	1.335	2.490	0.432	1.065	8.562
	02/17/02	0.278	0.008	5.830	0.017	0.009	0.136	0.246	0.037	0.301	2.143
UCLA 2	10/30/01	10.893	2.065	387.286	0.222	0.114	0.989	8.815	1.164	5.141	34.754
	11/12/01	2.242	0.441	29.131	0.405	0.103	1.716	5.247	0.818	6.273	17.707
	11/24/01	5.814	1.874	74.655	1.741	0.398	6.331	20.003	2.708	19.184	62.325
	12/14/01	1.403	0.144	24.878	0.177	0.072	0.954	3.703	0.638	2.160	11.911
	01/27/02	3.275	0.695	89.124	0.851	0.281	3.641	14.344	1.506	8.190	35.933
	02/17/02	1.231	0.190	44.582	0.173	0.055	0.913	3.683	0.384	1.677	10.565
	03/06/02	0.971	0.286	29.575	0.036	0.017	0.281	0.792	0.109	0.404	1.667
	03/17/02	0.604	0.169	20.085	0.061	0.017	0.351	0.929	0.084	0.396	2.605
UCLA 3	10/30/01	0.714	0.087	13.733	0.027	0.007	0.057	0.143	0.031	0.095	0.477
	11/12/01	0.270	0.101	3.452	0.055	0.012	0.149	0.485	0.078	0.524	1.652
	11/24/01	0.911	0.570	21.324	0.151	0.057	0.960	2.346	0.496	3.095	8.171
	12/20/01	0.171	0.113	5.459	0.041	0.020	0.264	0.612	0.108	0.871	2.015
	01/27/02	0.591	0.264	18.716	0.109	0.048	0.718	1.912	0.244	2.176	5.659
	02/17/02	0.112	0.029	4.762	0.030	0.013	0.238	0.440	0.075	0.546	1.750
	03/07/02	0.043	0.057	1.437	0.017	0.009	0.154	0.324	0.071	0.282	1.201
	03/17/02	0.247	0.287	9.240	0.049	0.021	0.408	0.924	0.154	1.375	3.870

Table C.4 Total Mass Loading of Constituents for UCLA Sites of Year 2002-2003

Sites	Date	TSS (kg)	Turb. (kg)	Hard. (kg)	COD (kg)	DOC (kg)	O&G (kg)	TKN (kg)	NH_3-N (kg)	NO_2-N (kg)	NO_3-N (kg)	PO_4^{3}-P (kg)	Total P (kg)	Diss. P (kg)
UCLA 1	11/07/02	5.59	8.08	19.48	60.23	12.10	3.07	2.81	0.81	0.07	1.31	0.01	0.14	0.12
	12/16/02	9.17	9.31	17.69	26.71	5.86	2.07	0.62	0.31	0.04	1.14	0.02	0.11	0.06
	12/19/02	4.21	6.16	16.02	17.50	3.57	1.62	0.44	0.19	0.05	1.05	0.02	0.08	0.04
	02/11/03	3.94	6.80	12.84	34.44	5.81	3.23	0.95	0.55	0.05	0.76	0.01	0.07	0.04
	03/15/03	4.24	7.55	15.64	24.31	4.68	4.15	0.52	0.3	0.03	0.8	0.02	0.37	0.35
	05/02/03	7.15	5.18	8.74	25.26	5.04	2.21	0.61	0.32	0.02	0.00	0.00	0.42	0.41
UCLA 2	11/07/02	62.72	29.03	35.71	145.83	25.80	7.53	4.56	2.44	0.29	1.55	0.06	0.36	0.27
	11/29/02	4.84	3.52	3.27	18.61	4.11	1.16	0.81	0.57	0.01	0.21	0.02	0.04	0.04
	12/15/02	1.69	3.27	1.64	15.37	2.80	1.35	0.57	0.48	0.01	0.16	0.01	0.04	0.03
	12/16/02	109.07	52.53	98.06	69.82	8.69	4.00	1.76	1.45	0.07	1.06	0.04	0.32	0.15
	02/11/03	22.62	24.18	14.01	68.53	10.41	4.22	2.28	1.55	0.05	0.73	0.02	0.14	0.10
	04/15/03	13.82	17.92	18.77	38.28	4.27	1.89	1.07	0.82	0.94	0.43	0.02	0.53	0.51
UCLA 3	11/07/02	6.57	5.54	3.81	16.76	2.48	1.23	0.49	0.23	0.02	0.18	0.01	0.04	0.03
	11/29/02	0.08	0.05	0.10	0.53	0.13	0.03	0.03	0.01	0.00	0.00	0.00	0.00	0.00
	12/16/02	10.33	3.55	1.72	8.30	1.12	0.40	0.30	0.17	0.01	0.09	0.01	0.04	0.02
	12/19/02	3.13	1.41	1.34	2.08	0.31	0.19	0.08	0.07	0.01	0.05	0.01	0.01	0.01
	02/11/03	3.04	2.05	2.07	7.58	1.29	0.50	0.18	0.14	0.01	0.07	0.01	0.01	0.01
	03/15/03	22.20	6.98	4.42	21.44	1.22	1.30	0.32	0.18	0.01	0.22	0.02	0.62	0.59
	04/15/03	3.90	1.53	1.14	4.95	0.65	0.43	0.14	0.08	0.00	0.04	0.00	0.08	0.06

Table C.4 *(Continued)*

Sites	Date	Diss. As (g)	Diss. Cd (g)	Diss. Cr (g)	Diss. Cu (g)	Diss. Ni (g)	Diss. Pb (g)	Diss. Zn (g)	Total As (g)	Total Cd (g)	Total Cr (g)	Total Cu (g)	Total Ni (g)	Total Pb (g)	Total Zn (g)
UCLA 1	11/07/02	0.26	0.21	0.58	27.69	4.10	0.27	139.06	0.21	0.16	2.49	30.93	4.57	1.40	153.04
	12/16/02	0.38	0.17	0.56	8.03	1.72	1.10	45.86	0.38	0.21	1.62	15.82	2.65	4.16	66.37
	12/19/02	0.51	0.22	0.34	5.48	1.01	0.24	25.93	0.51	0.24	1.07	8.54	1.62	2.33	36.38
	02/11/03	0.25	0.12	0.38	13.76	2.03	0.15	60.23	0.25	0.12	1.01	17.95	2.72	1.62	71.55
	03/15/03	1.71	0.24	0.39	11.73	1.74	2.05	40.03	1.64	0.24	1.78	16.58	2.99	5.69	56.91
	05/02/03	1.66	0.16	0.60	10.04	2.90	0.28	50.86	1.55	0.16	1.14	12.93	3.29	1.48	59.07
UCLA 2	11/07/02	0.83	0.67	1.62	49.71	8.85	1.14	287.76	0.83	0.87	9.07	78.79	12.40	19.06	379.47
	11/29/02	0.05	0.08	0.20	7.34	1.43	0.17	39.43	0.05	0.09	0.56	8.57	1.54	0.61	41.71
	12/15/02	0.03	0.05	0.12	4.70	0.87	0.15	25.20	0.03	0.05	0.42	5.53	0.99	0.51	26.77
	12/16/02	0.83	0.6	1.80	19.78	5.17	1.80	100.98	0.83	1.07	11.25	57.24	12.30	55.95	231.77
	02/11/03	0.38	0.29	0.85	24.21	3.37	0.40	120.76	0.38	0.31	3.01	38.49	5.03	7.07	147.77
	04/15/03	0.47	0.19	0.61	10.51	2.47	1.89	43.11	0.32	0.28	2.44	21.33	3.57	8.19	67.65
UCLA 3	11/07/02	0.21	0.09	0.15	8.13	0.95	0.45	47.33	0.21	0.02	1.45	20.20	4.39	3.93	64.45
	11/29/02	0	0	0.00	0.11	0.03	0.01	0.63	0.00	0.00	0.01	0.12	0.03	0.02	0.69
	12/16/02	0.12	0.06	0.11	1.34	0.22	0.20	7.84	0.12	0.08	1.00	4.47	1.02	4.74	20.90
	12/19/02	0.11	0.05	0.05	0.57	0.09	0.05	4.87	0.11	0.05	0.26	1.74	0.25	2.65	9.42
	02/11/03	0.05	0.03	0.08	1.79	0.31	0.32	11.75	0.05	0.03	0.21	2.41	0.44	2.27	14.05
	03/15/03	0.8	0.21	0.57	2.98	1.62	3.71	17.40	0.80	0.43	2.94	11.40	3.34	20.42	49.76
	04/15/03	0.08	0.03	0.04	1.10	0.22	0.31	6.58	0.10	0.03	0.35	2.70	0.45	2.11	12.09

Table C.5 Total Mass Loading of Constituents for CDM and URS Sites

Sites	Date	TSS (kg)	TOC (kg)	O&G (kg)	Hard. (kg)	NO3-N (kg)	TP (kg)	PO4P (kg)	TDS (kg)	COD (kg)	DOC (mg/L)	NH3-N (kg)	TKN (kg)
CDM	01/25/00	261.89	25.06	2.28	106.51	1.61	0.55	0.45					
7-10	02/12/00	716.95	14.65	0.49	55.40	0.82	11.58	4.58					
	02/20/00	271.82	9.96	1.91	39.08	0.66	0.41	0.12					
	02/23/00	270.45	13.51	2.44	72.21	0.79	0.67	0.28					
	02/27/00	50.30	4.27	0.90	16.07	0.53	0.16	0.06					
	03/05/00	19.22	3.19	0.93	19.30	0.33	0.15	0.10					
	03/08/00	151.15	8.55	4.66	50.73	0.54	0.31	0.12					
	04/17/00	224.25	18.59	7.07	96.86	1.92	0.72	0.30					
CDM	01/25/00												
7-185	02/12/00	10.57	0.40	0.05	1.40	0.01	0.32	0.15					
	02/20/00	4.79	0.27	0.12	1.06	0.01	0.01	0.00					
	02/23/00	7.17	0.92	0.30	2.57	0.03	0.02	0.01					
	02/27/00	0.19	0.09	0.03	0.18	0.00	0.00	0.00					
	03/05/00	1.96	0.21	0.12	1.03	0.01	0.01	0.00					
	03/08/00	8.99	0.62	0.24	2.55	0.03	0.02	0.01					
	04/17/00	22.70	1.59	0.64	4.92	0.07	0.10	0.02					
URS	01/26/01	12.74	1.65	0.39	7.95	0.20	0.03	0.02	21.74	15.05	1.50	0.10	0.29
23	02/10/01	10.44	1.21	0.38	5.30	0.15	0.02	0.01	13.64	9.30	1.16	0.12	0.48
	02/19/01	5.73	1.34	0.39	3.74	0.12	0.02	0.01	8.24	15.31	1.24	0.11	0.35
	02/24/01	51.96	5.38	2.71	36.79	0.60	0.11	0.08	64.74	119.03	4.92	0.25	0.92
URS	10/26/00	9.06	0.48	0.16	6.82	0.06	0.24	0.01	3.70	4.97	0.47	0.03	0.08
6-20F	01/26/01	4.77	0.18	0.11	1.48	0.02	0.00	0.00	2.21	4.37	0.17	0.01	0.03
	02/10/01	2.71	0.18	0.07	0.81	0.01	0.00	0.00	1.32	2.50	0.17	0.01	0.03
	02/19/01	2.22	0.21	0.15	0.91	0.01	0.00	0.00	1.27	3.10	0.17	0.01	0.03
URS	10/26/00	12.11	0.29	0.04	3.05	0.04	0.57	0.01	3.33	3.53	0.25	0.01	0.09
8-23C	01/26/01	4.39	0.16	0.07	1.50	0.02	0.00	0.00	2.74	2.79	0.15	0.01	0.03
	02/19/01	2.62	0.17	0.15	1.07	0.01	0.00	0.00	1.56	3.64	0.16	0.01	0.03

Table C.5 *(Continued)*

Sites	Date	Total Cd (ug/L)	Total Cr (ug/L)	Total Cu (ug/L)	Total Ni (ug/L)	Total Pb (ug/L)	Total Zn (ug/L)	Total As (ug/L)	Soluble Cd (ug/L)	Soluble Cr (ug/L)	Soluble Cu (ug/L)	Soluble Ni (ug/L)	Soluble Pb (ug/L)	Soluble Zn (ug/L)	Soluble As (ug/L)
CDM	01/25/00	1.33	11.26	52.06	13.07	391.26	235.91	0.00	0.14	1.53	13.86	2.80	2.68	20.33	
7-10	02/12/00	1.68	22.87	70.60	21.64	480.50	400.08	0.00	0.35	1.56	10.43	1.85	55.90	48.40	
	02/20/00	0.38	5.47	22.57	5.82	115.82	117.91	0.00	0.31	2.99	6.38	1.23	12.55	17.98	
	02/23/00	1.63	14.55	61.76	13.39	345.56	303.89	0.00	0.43	3.41	10.59	1.38	19.60	26.16	
	02/27/00	0.29	4.66	12.28	2.58	49.52	64.97	0.00	0.10	0.77	3.29	0.76	3.63	12.75	
	03/05/00	0.19	1.56	9.80	1.76	36.96	55.10	0.00	0.19	0.87	2.92	0.44	3.60	14.74	
	03/08/00	0.98	7.19	35.15	7.69	192.53	193.35	0.00	0.29	2.17	12.10	1.14	12.19	19.01	
	04/17/00	1.45	10.73	58.54	12.88	272.00	277.80	0.00	0.29	2.84	16.99	4.18	15.29	47.23	
CDM	01/25/00														
7-185	02/12/00	0.06	0.51	2.60	0.46	5.63	18.43	0.00	0.01	0.02	0.20	0.04	0.09	1.68	
	02/20/00	0.06	0.27	1.63	0.28	3.05	12.58	0.00	0.01	0.07	0.23	0.05	0.10	1.38	
	02/23/00	0.11	0.69	3.98	0.66	9.28	22.57	0.00	0.02	0.14	0.63	0.14	0.47	2.67	
	02/27/00	0.00	0.02	0.18	0.04	0.23	1.05	0.00	0.00	0.01	0.08	0.02	0.02	0.74	
	03/05/00	0.03	0.15	0.98	0.19	1.72	6.88	0.00	0.01	0.03	0.23	0.04	0.08	1.69	
	03/08/00	0.09	0.51	3.37	0.57	7.81	19.51	0.00	0.01	0.10	0.58	0.15	0.40	2.95	
	04/17/00	0.21	1.19	7.78	1.56	17.39	45.48	0.00	0.02	0.18	1.57	0.50	0.73	5.46	
URS	01/26/01	0.13	1.16	6.17	1.12	6.31	27.01	0.11	0.02	0.48	2.15	0.44	0.58	5.92	0.07
23	02/10/01	0.10	1.69	4.29	0.69	3.96	19.35	0.10	0.02	0.27	1.96	0.35	0.39	5.75	0.07
	02/19/01	0.10	0.92	3.53	0.77	2.97	14.60	0.08	0.03	0.28	1.74	0.29	0.38	4.05	0.07
	02/24/01	0.59	6.63	31.02	4.97	24.22	133.09	0.59	0.10	3.05	10.74	1.47	1.13	32.04	0.32
URS	10/26/00	0.06	0.49	3.11	0.55	9.11	21.06	0.03	0.01	0.23	1.07	0.18	0.56	1.54	0.02
6-20F	01/26/01	0.04	0.28	1.71	0.28	7.12	5.70	0.05	0.00	0.04	0.30	0.04	0.24	0.46	0.01
	02/10/01	0.01	0.10	0.78	0.10	2.42	2.15	0.01	0.00	0.01	0.25	0.03	0.08	0.20	0.00
	02/19/01	0.02	0.13	0.91	0.14	3.11	2.69	0.02	0.00	0.01	0.24	0.03	0.11	0.26	0.01
URS	10/26/00	0.57	0.54	2.17	0.57	10.91	8.04	0.05	0.02	0.05	0.50	0.10	0.20	0.72	0.01
8-23C	01/26/01	0.03	0.27	1.34	0.28	5.00	5.20	0.05	0.00	0.05	0.26	0.04	0.22	0.42	0.01
	02/19/01	0.02	0.20	0.88	0.19	2.68	3.29	0.02	0.00	0.02	0.25	0.04	0.14	0.30	0.01

APPENDIX D
MASS FIRST FLUSH RATIOS

Table D.1 Basic Statistics of MFF for UCLA 1, 2 and 3 (2000-2003)

Parameters		UCLA 1					UCLA 2					UCLA 3					Combined UCLA				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
TSS	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.487	0.574	0.752	0.843	0.898	0.682	0.675	0.570	0.513	0.548	0.459	0.459	0.459	0.459	0.459	0.459	0.459	0.459	0.459	0.459
	Maximum	3.525	2.746	2.354	1.970	1.693	4.972	3.051	2.302	1.880	1.620	3.673	3.387	2.553	2.039	1.779	4.972	3.387	2.553	2.039	1.779
	Median	1.911	1.559	1.487	1.347	1.211	1.560	1.416	1.520	1.385	1.404	1.980	1.980	1.751	1.526	1.348	1.711	1.718	1.576	1.397	1.347
	Mean	1.844	1.682	1.532	1.381	1.266	1.976	1.716	1.522	1.405	1.308	1.995	1.937	1.654	1.445	1.304	1.945	1.788	1.574	1.413	1.294
	Standard Dev.	0.816	0.644	0.466	0.334	0.241	1.103	0.773	0.540	0.379	0.282	0.855	0.745	0.555	0.395	0.294	0.923	0.725	0.521	0.368	0.272
Turbidity	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.485	0.756	0.858	0.873	0.856	0.262	0.242	0.312	0.350	0.506	0.537	0.537	0.587	0.587	0.587	0.262	0.242	0.312	0.350	0.506
	Maximum	3.072	2.210	2.010	1.709	1.504	4.136	3.320	2.500	1.954	1.681	2.558	2.161	1.767	1.519	1.406	4.136	3.320	2.500	1.954	1.681
	Median	1.435	1.299	1.199	1.141	1.113	1.449	1.429	1.307	1.179	1.112	1.196	1.093	1.116	1.120	1.080	1.270	1.288	1.235	1.168	1.110
	Mean	1.496	1.381	1.283	1.193	1.129	1.682	1.490	1.319	1.200	1.130	1.262	1.220	1.166	1.119	1.081	1.472	1.358	1.252	1.168	1.111
	Standard Dev.	0.605	0.431	0.342	0.250	0.190	0.993	0.769	0.545	0.425	0.346	0.495	0.413	0.324	0.258	0.209	0.739	0.566	0.415	0.319	0.256
Conductivity	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.858	0.689	0.585	0.571	0.596	0.458	0.503	0.586	0.604	0.557	0.967	0.966	0.952	0.872	0.804	0.458	0.503	0.585	0.571	0.557
	Maximum	3.548	2.404	2.074	1.720	1.525	4.232	3.012	2.659	2.079	1.717	4.464	2.986	2.242	1.855	1.583	4.464	3.012	2.659	2.079	1.717
	Median	1.878	1.416	1.240	1.152	1.080	1.614	1.214	1.164	1.106	1.070	2.276	1.741	1.465	1.367	1.298	2.070	1.538	1.373	1.271	1.210
	Mean	1.968	1.507	1.294	1.165	1.092	1.870	1.475	1.268	1.125	1.047	2.403	1.848	1.562	1.387	1.268	2.096	1.622	1.385	1.234	1.142
	Standard Dev.	0.828	0.483	0.365	0.266	0.208	1.128	0.691	0.529	0.411	0.341	0.955	0.543	0.355	0.251	0.180	0.998	0.599	0.440	0.335	0.268
Hardness	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.777	0.613	0.509	0.500	0.530	0.394	0.370	0.333	0.293	0.268	0.925	0.924	0.924	0.936	0.881	0.394	0.370	0.333	0.293	0.268
	Maximum	4.043	2.576	2.128	1.748	1.539	4.646	3.309	2.827	2.167	1.757	5.405	3.676	2.626	2.048	1.709	5.405	3.676	2.827	2.167	1.757
	Median	1.543	1.200	1.126	1.069	1.036	1.713	1.227	1.131	1.213	1.207	1.933	1.607	1.444	1.314	1.223	1.750	1.484	1.302	1.215	1.176
	Mean	1.780	1.378	1.199	1.089	1.031	2.033	1.562	1.314	1.152	1.062	2.410	1.820	1.527	1.366	1.260	2.099	1.604	1.360	1.213	1.127
	Standard Dev.	0.924	0.508	0.390	0.294	0.239	1.377	0.893	0.654	0.498	0.408	1.310	0.700	0.438	0.301	0.210	1.244	0.737	0.520	0.391	0.312

Table D.1 *(Continued)*

Parameters		UCLA 1					UCLA 2					UCLA 3					Combined UCLA				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
COD	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.947	0.971	0.955	0.985	0.985	0.356	0.323	0.378	0.407	0.546	0.893	0.893	0.893	0.822	0.748	0.356	0.323	0.378	0.407	0.546
	Maximum	4.026	2.689	2.217	1.784	1.539	6.680	3.757	2.840	2.195	1.794	6.261	3.809	2.793	2.153	1.766	6.680	3.809	2.840	2.195	1.794
	Median	2.184	1.740	1.430	1.269	1.168	2.409	1.948	1.573	1.377	1.267	2.789	2.326	1.872	1.553	1.388	2.410	1.883	1.605	1.424	1.296
	Mean	2.123	1.664	1.444	1.297	1.204	2.674	2.079	1.701	1.457	1.304	3.041	2.234	1.798	1.538	1.360	2.650	2.016	1.662	1.440	1.296
	Standard Dev.	0.876	0.521	0.375	0.250	0.177	1.563	0.934	0.626	0.454	0.340	1.407	0.818	0.531	0.377	0.276	1.367	0.812	0.539	0.382	0.280
DOC	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.723	1.010	0.962	0.885	0.866	0.283	0.298	0.341	0.364	0.505	0.898	0.898	0.876	0.767	0.673	0.283	0.298	0.341	0.364	0.505
	Maximum	4.104	2.624	2.127	1.711	1.481	6.108	3.299	2.844	2.196	1.793	6.301	3.873	2.758	2.136	1.780	6.301	3.873	2.844	2.196	1.793
	Median	1.792	1.522	1.358	1.238	1.174	2.585	2.005	1.671	1.484	1.320	3.462	2.511	2.083	1.716	1.459	2.465	1.942	1.623	1.441	1.325
	Mean	1.979	1.615	1.417	1.276	1.188	2.646	2.015	1.651	1.418	1.277	3.354	2.378	1.896	1.609	1.412	2.715	2.033	1.674	1.448	1.301
	Standard Dev.	0.811	0.444	0.317	0.222	0.166	1.498	0.855	0.594	0.428	0.317	1.507	0.828	0.540	0.379	0.272	1.433	0.799	0.536	0.380	0.275
Oil & Grease	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.972	0.972	0.888	0.805	0.872	0.394	0.342	0.450	0.508	0.494	0.779	0.779	0.779	0.821	0.861	0.394	0.342	0.450	0.508	0.494
	Maximum	3.857	2.532	2.077	1.788	1.547	4.605	3.217	2.404	1.940	1.707	4.586	3.123	2.345	2.007	1.683	4.605	3.217	2.404	2.007	1.707
	Median	1.834	1.567	1.355	1.181	1.126	2.317	1.709	1.494	1.318	1.209	2.277	1.787	1.610	1.421	1.294	2.091	1.699	1.431	1.317	1.223
	Mean	1.845	1.515	1.339	1.226	1.149	2.191	1.772	1.499	1.316	1.206	2.549	1.951	1.643	1.448	1.308	2.224	1.764	1.506	1.339	1.227
	Standard Dev.	0.715	0.445	0.359	0.273	0.197	1.041	0.704	0.497	0.376	0.289	1.053	0.642	0.461	0.341	0.241	0.990	0.631	0.457	0.343	0.252
TKN	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.896	0.947	0.947	0.925	0.888	0.521	0.442	0.503	0.537	0.678	1.076	1.076	1.053	0.924	0.812	0.521	0.442	0.503	0.537	0.678
	Maximum	4.027	2.784	2.287	1.897	1.647	5.907	3.279	2.713	2.106	1.729	5.128	3.717	2.647	2.049	1.712	5.907	3.717	2.713	2.106	1.729
	Median	1.991	1.589	1.380	1.257	1.197	2.155	1.944	1.651	1.462	1.310	2.977	2.180	1.754	1.528	1.380	2.346	1.895	1.634	1.454	1.303
	Mean	2.148	1.671	1.455	1.307	1.206	2.606	2.039	1.690	1.464	1.320	3.083	2.260	1.824	1.565	1.388	2.650	2.014	1.671	1.456	1.312
	Standard Dev.	0.890	0.491	0.355	0.251	0.190	1.422	0.800	0.523	0.356	0.247	1.219	0.662	0.403	0.274	0.200	1.251	0.702	0.454	0.311	0.223

Table D.1 *(Continued)*

Parameters		UCLA 1					UCLA 2					UCLA 3					Combined UCLA				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
NH_3-N	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.874	0.941	0.965	0.977	0.985	0.485	0.452	0.527	0.569	0.672	0.927	0.907	0.759	0.688	0.627	0.485	0.452	0.527	0.569	0.627
	Maximum	3.453	2.523	2.154	1.793	1.733	5.941	3.305	2.646	2.069	1.765	5.742	3.616	2.601	2.157	1.781	5.941	3.616	2.646	2.157	1.781
	Median	1.795	1.558	1.448	1.333	1.231	2.271	2.000	1.698	1.479	1.336	2.890	2.099	1.714	1.511	1.380	2.219	1.882	1.642	1.458	1.339
	Mean	1.832	1.596	1.455	1.351	1.265	2.652	2.048	1.691	1.457	1.313	3.117	2.237	1.797	1.547	1.380	2.586	1.987	1.662	1.460	1.324
	Standard Dev.	0.621	0.372	0.281	0.230	0.195	1.437	0.809	0.538	0.376	0.276	1.436	0.744	0.477	0.338	0.247	1.343	0.723	0.468	0.330	0.245
NO_2-N	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.902	0.902	0.889	0.759	0.683	0.468	0.569	0.554	0.547	0.612	0.742	0.742	0.723	0.713	0.704	0.468	0.569	0.554	0.547	0.612
	Maximum	3.347	2.164	1.818	1.576	1.433	7.856	4.077	2.790	2.112	1.739	2.853	2.294	1.844	1.574	1.385	7.856	4.077	2.790	2.112	1.739
	Median	1.688	1.392	1.238	1.168	1.113	1.384	1.251	1.210	1.171	1.162	1.420	1.369	1.217	1.178	1.084	1.493	1.371	1.219	1.175	1.134
	Mean	1.791	1.480	1.318	1.190	1.109	1.869	1.538	1.344	1.218	1.142	1.608	1.387	1.267	1.171	1.101	1.749	1.465	1.308	1.192	1.117
	Standard Dev.	0.655	0.402	0.319	0.245	0.205	1.559	0.806	0.517	0.365	0.277	0.579	0.427	0.345	0.266	0.200	1.025	0.573	0.400	0.294	0.227
NO_3-N	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.459	0.238	0.171	0.413	0.426	0.106	0.151	0.414	0.542	0.598	0.024	0.024	0.445	0.647	0.780	0.024	0.024	0.171	0.413	0.426
	Maximum	2.954	2.213	1.863	1.575	1.402	4.960	2.852	2.430	1.919	1.602	4.369	2.826	2.104	1.866	1.572	4.960	2.852	2.430	1.919	1.602
	Median	1.100	0.983	0.956	0.961	0.975	1.777	1.486	1.286	1.205	1.137	1.704	1.573	1.409	1.241	1.164	1.638	1.345	1.200	1.147	1.103
	Mean	1.263	1.060	0.957	0.924	0.913	2.127	1.612	1.394	1.249	1.161	1.932	1.592	1.413	1.297	1.220	1.804	1.444	1.275	1.172	1.111
	Standard Dev.	0.648	0.484	0.410	0.325	0.282	1.339	0.770	0.534	0.378	0.289	1.091	0.685	0.454	0.327	0.218	1.124	0.700	0.507	0.375	0.289
PO_4-P	No. of Cases	18	18	18	18	18	21	21	21	21	21	23	23	23	23	23	62	62	62	62	62
	Minimum	0.602	0.913	0.949	0.966	0.972	0.446	0.446	0.446	0.446	0.446	0.342	0.342	0.342	0.563	0.717	0.342	0.342	0.342	0.446	0.446
	Maximum	5.871	3.258	2.848	2.184	1.818	4.693	4.379	3.193	2.397	1.942	5.915	3.257	2.290	1.811	1.650	5.915	4.379	3.193	2.397	1.942
	Median	1.000	1.000	1.000	1.000	1.000	1.628	1.366	1.383	1.290	1.202	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Mean	1.719	1.484	1.334	1.209	1.135	1.906	1.746	1.527	1.336	1.220	1.615	1.296	1.162	1.112	1.100	1.744	1.503	1.335	1.216	1.151
	Standard Dev.	1.353	0.740	0.562	0.361	0.246	1.098	0.993	0.752	0.519	0.392	1.239	0.662	0.440	0.311	0.241	1.214	0.819	0.606	0.411	0.302

Table D.1 *(Continued)*

Parameters		UCLA 1					UCLA 2					UCLA 3					Combined UCLA				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Dissolved P	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.829	0.919	0.953	0.956	0.931	0.713	0.713	0.689	0.654	0.636	0.870	0.870	0.870	0.934	0.991	0.713	0.713	0.689	0.654	0.636
	Maximum	4.056	2.622	2.133	1.992	1.651	5.086	3.211	2.832	2.210	1.816	3.869	2.582	2.008	1.820	1.572	5.086	3.211	2.832	2.210	1.816
	Median	1.865	1.688	1.410	1.264	1.176	2.122	1.862	1.636	1.440	1.286	2.186	1.747	1.537	1.377	1.260	2.170	1.748	1.512	1.363	1.260
	Mean	1.941	1.625	1.439	1.306	1.204	2.542	1.978	1.659	1.441	1.302	2.225	1.806	1.545	1.386	1.274	2.251	1.812	1.553	1.382	1.263
	Standard Dev.	0.915	0.495	0.374	0.293	0.208	1.239	0.678	0.482	0.334	0.252	0.824	0.501	0.329	0.232	0.155	1.021	0.575	0.403	0.288	0.208
Dissolved Cd	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.692	0.854	0.915	0.943	0.963	0.594	0.593	0.592	0.725	0.817	0.851	0.830	0.824	0.821	0.857	0.594	0.593	0.592	0.725	0.817
	Maximum	3.757	2.260	1.743	1.477	1.311	4.637	3.281	2.885	2.234	1.826	4.087	2.534	2.018	1.719	1.486	4.637	3.281	2.885	2.234	1.826
	Median	1.003	1.001	1.001	1.001	1.000	1.465	1.307	1.202	1.230	1.155	1.347	1.091	1.177	1.140	1.093	1.137	1.087	1.080	1.034	1.015
	Mean	1.288	1.146	1.091	1.059	1.038	2.120	1.659	1.418	1.283	1.197	1.807	1.453	1.292	1.203	1.138	1.763	1.434	1.277	1.188	1.129
	Standard Dev.	0.691	0.321	0.197	0.130	0.089	1.316	0.812	0.563	0.372	0.261	1.026	0.573	0.361	0.251	0.175	1.092	0.637	0.424	0.285	0.200
Dissolved Cr	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.152	0.736	0.687	0.684	0.695	0.640	0.450	0.438	0.528	0.678	0.596	0.543	0.622	0.564	0.584	0.152	0.450	0.438	0.528	0.584
	Maximum	3.198	2.308	2.066	1.690	1.411	3.340	2.880	2.554	2.018	1.681	4.038	2.589	1.992	1.652	1.430	4.038	2.880	2.554	2.018	1.681
	Median	1.218	1.152	1.031	0.974	0.964	1.493	1.349	1.239	1.164	1.145	1.134	1.040	1.040	1.040	1.073	1.268	1.172	1.104	1.109	1.070
	Mean	1.358	1.231	1.147	1.066	1.016	1.536	1.393	1.278	1.181	1.121	1.480	1.279	1.164	1.107	1.073	1.464	1.304	1.198	1.120	1.073
	Standard Dev.	0.724	0.459	0.375	0.262	0.199	0.704	0.541	0.435	0.330	0.270	0.850	0.557	0.373	0.266	0.206	0.756	0.520	0.394	0.288	0.228
Dissolved Cu	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.608	0.933	0.933	0.862	0.802	0.827	0.827	0.775	0.699	0.659	1.026	0.746	0.623	0.579	0.729	0.608	0.746	0.623	0.579	0.659
	Maximum	3.095	2.224	1.945	1.625	1.466	4.336	3.181	2.800	2.172	1.781	4.280	3.187	2.390	1.958	1.679	4.336	3.187	2.800	2.172	1.781
	Median	1.541	1.401	1.219	1.132	1.091	2.605	1.982	1.625	1.397	1.271	2.768	2.122	1.626	1.510	1.341	2.206	1.680	1.478	1.351	1.235
	Mean	1.561	1.383	1.264	1.174	1.120	2.513	1.958	1.621	1.404	1.260	2.719	2.007	1.653	1.458	1.326	2.309	1.808	1.528	1.356	1.243
	Standard Dev.	0.620	0.383	0.287	0.204	0.158	1.040	0.638	0.458	0.336	0.264	1.118	0.684	0.472	0.353	0.238	1.072	0.646	0.448	0.328	0.239

Table D.1 *(Continued)*

Parameters		UCLA 1					UCLA 2					UCLA 3					Combined UCLA				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Dissolved Ni	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.634	0.908	0.908	0.939	0.905	0.756	0.756	0.677	0.720	0.708	1.002	0.811	0.741	0.971	0.963	0.634	0.756	0.677	0.720	0.708
	Maximum	4.516	3.063	2.495	1.963	1.641	4.819	3.683	2.907	2.225	1.805	5.366	3.649	2.707	2.181	1.859	5.366	3.683	2.907	2.225	1.859
	Median	1.772	1.577	1.362	1.237	1.182	2.497	2.086	1.666	1.409	1.224	2.645	2.405	1.896	1.576	1.383	2.416	1.943	1.628	1.409	1.260
	Mean	1.949	1.620	1.437	1.289	1.197	2.629	1.998	1.633	1.394	1.254	3.140	2.214	1.758	1.537	1.378	2.615	1.965	1.621	1.415	1.282
	Standard Dev.	1.012	0.592	0.430	0.293	0.209	1.341	0.852	0.602	0.412	0.299	1.453	0.82	0.535	0.366	0.262	1.364	0.797	0.539	0.372	0.268
Dissolved Pb	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.449	0.756	0.803	0.777	0.677	0.694	0.694	0.661	0.614	0.589	0.965	0.877	0.798	0.834	0.965	0.449	0.694	0.661	0.614	0.589
	Maximum	2.697	2.596	2.435	1.931	1.620	5.912	3.308	2.904	2.303	1.916	4.366	3.045	2.263	1.889	1.597	5.912	3.308	2.904	2.303	1.916
	Median	1.000	1.000	1.000	1.000	1.000	1.410	1.377	1.289	1.258	1.190	1.369	1.339	1.307	1.286	1.195	1.298	1.206	1.234	1.193	1.093
	Mean	1.277	1.242	1.174	1.087	1.036	2.177	1.693	1.437	1.292	1.193	1.805	1.500	1.371	1.308	1.228	1.779	1.491	1.336	1.238	1.160
	Standard Dev.	0.639	0.473	0.386	0.261	0.195	1.507	0.840	0.584	0.418	0.335	1.093	0.615	0.404	0.299	0.199	1.192	0.681	0.474	0.344	0.262
Dissolved Zn	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.348	0.953	0.965	0.892	0.843	0.484	0.410	0.359	0.447	0.631	0.885	0.885	0.885	0.951	1.010	0.348	0.410	0.359	0.447	0.631
	Maximum	2.361	1.858	1.710	1.514	1.397	7.361	4.271	2.957	2.275	1.849	4.750	2.943	2.234	1.946	1.634	7.361	4.271	2.957	2.275	1.849
	Median	1.514	1.428	1.261	1.256	1.194	2.537	1.927	1.581	1.339	1.214	2.173	1.661	1.423	1.332	1.268	1.976	1.657	1.426	1.300	1.204
	Mean	1.492	1.384	1.291	1.215	1.161	2.984	2.155	1.720	1.451	1.295	2.421	1.827	1.540	1.385	1.276	2.343	1.810	1.529	1.358	1.249
	Standard Dev.	0.613	0.356	0.245	0.181	0.143	1.945	1.043	0.711	0.496	0.359	1.168	0.644	0.410	0.284	0.195	1.486	0.800	0.523	0.359	0.256
Total P	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.801	0.906	0.945	0.963	0.976	0.747	0.747	0.759	0.778	0.788	0.959	0.959	0.959	0.959	0.959	0.747	0.747	0.759	0.778	0.788
	Maximum	3.890	2.566	2.139	1.938	1.615	5.298	3.189	2.814	2.198	1.807	3.248	2.437	1.976	1.789	1.552	5.298	3.189	2.814	2.198	1.807
	Median	1.792	1.706	1.503	1.316	1.209	1.960	1.703	1.561	1.358	1.261	2.035	1.747	1.455	1.332	1.228	1.956	1.717	1.476	1.333	1.235
	Mean	1.818	1.636	1.483	1.342	1.236	2.338	1.851	1.587	1.406	1.284	2.054	1.726	1.501	1.351	1.247	2.083	1.743	1.526	1.368	1.257
	Standard Dev.	0.764	0.408	0.326	0.254	0.178	1.204	0.685	0.489	0.329	0.235	0.640	0.419	0.272	0.199	0.141	0.914	0.522	0.371	0.262	0.186

Table D.1 *(Continued)*

Parameters		UCLA 1					UCLA 2					UCLA 3					Combined UCLA				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Total Cd	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.782	0.897	0.940	0.960	0.974	0.807	0.773	0.762	0.839	0.891	0.924	0.909	0.904	0.902	0.922	0.782	0.773	0.762	0.839	0.891
	Maximum	4.248	2.543	1.910	1.584	1.381	3.478	3.058	2.701	2.113	1.745	3.042	2.021	1.673	1.481	1.321	4.248	3.058	2.701	2.113	1.745
	Median	1.071	1.074	1.052	1.033	1.022	1.586	1.459	1.381	1.267	1.165	1.422	1.269	1.244	1.144	1.074	1.378	1.264	1.205	1.141	1.072
	Mean	1.429	1.248	1.168	1.107	1.069	1.985	1.622	1.404	1.273	1.189	1.623	1.364	1.236	1.160	1.108	1.691	1.419	1.274	1.183	1.124
	Standard Dev.	0.817	0.400	0.246	0.159	0.104	0.987	0.637	0.448	0.298	0.210	0.678	0.395	0.254	0.179	0.128	0.852	0.509	0.341	0.229	0.161
Total Cr	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.718	0.899	0.903	0.917	0.906	0.793	0.793	0.746	0.731	0.726	0.662	0.730	0.730	0.730	0.730	0.662	0.730	0.730	0.730	0.726
	Maximum	2.318	2.166	1.898	1.696	1.462	3.396	2.293	1.946	1.631	1.456	2.591	2.306	1.825	1.545	1.369	3.396	2.306	1.946	1.696	1.462
	Median	1.180	1.358	1.293	1.233	1.113	1.253	1.200	1.138	1.169	1.130	1.241	1.224	1.201	1.144	1.112	1.237	1.223	1.175	1.169	1.119
	Mean	1.368	1.364	1.282	1.189	1.118	1.528	1.365	1.254	1.185	1.132	1.367	1.287	1.200	1.131	1.092	1.423	1.336	1.243	1.166	1.113
	Standard Dev.	0.515	0.382	0.297	0.207	0.140	0.686	0.456	0.334	0.251	0.207	0.431	0.371	0.254	0.197	0.160	0.550	0.400	0.293	0.217	0.170
Total Cu	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.803	0.914	0.950	0.967	0.978	0.835	0.835	0.820	0.797	0.785	0.695	0.502	0.423	0.371	0.643	0.695	0.502	0.423	0.371	0.643
	Maximum	2.550	2.058	1.957	1.711	1.524	4.109	3.044	2.688	2.103	1.738	3.745	2.623	2.154	1.897	1.635	4.109	3.044	2.688	2.103	1.738
	Median	1.377	1.396	1.259	1.177	1.150	1.956	1.714	1.480	1.313	1.217	2.193	1.792	1.526	1.388	1.291	1.885	1.644	1.481	1.339	1.231
	Mean	1.525	1.436	1.334	1.238	1.169	2.159	1.777	1.525	1.357	1.241	2.226	1.774	1.516	1.357	1.257	1.997	1.676	1.466	1.322	1.226
	Standard Dev.	0.519	0.356	0.276	0.199	0.143	0.932	0.606	0.435	0.308	0.234	0.876	0.566	0.408	0.326	0.220	0.854	0.543	0.388	0.288	0.206
Total Ni	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.728	0.905	0.945	0.963	0.976	0.761	0.761	0.772	0.788	0.796	0.667	0.461	0.383	0.339	0.660	0.667	0.461	0.383	0.339	0.660
	Maximum	2.985	2.325	2.064	1.764	1.539	4.475	3.222	2.829	2.183	1.783	4.473	2.873	2.348	2.050	1.694	4.475	3.222	2.829	2.183	1.783
	Median	1.720	1.489	1.351	1.227	1.172	1.974	1.845	1.538	1.359	1.231	2.254	1.864	1.601	1.413	1.331	1.974	1.680	1.489	1.333	1.223
	Mean	1.683	1.522	1.389	1.267	1.185	2.319	1.846	1.562	1.371	1.250	2.429	1.873	1.564	1.390	1.284	2.173	1.761	1.512	1.347	1.243
	Standard Dev.	0.645	0.443	0.342	0.239	0.169	1.134	0.728	0.521	0.351	0.254	1.124	0.700	0.493	0.386	0.266	1.045	0.654	0.464	0.335	0.236

Table D.1 *(Continued)*

Parameters		UCLA 1					UCLA 2					UCLA 3					Combined UCLA				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Total Pb	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.374	0.704	0.827	0.885	0.894	0.610	0.610	0.722	0.829	0.844	0.478	0.487	0.361	0.557	0.577	0.374	0.487	0.361	0.557	0.577
	Maximum	2.284	2.161	1.986	1.662	1.445	3.884	2.688	2.405	1.940	1.647	2.824	2.282	1.825	1.591	1.391	3.884	2.688	2.405	1.940	1.647
	Median	1.296	1.225	1.200	1.148	1.130	1.309	1.323	1.274	1.233	1.221	1.139	1.131	1.258	1.167	1.085	1.258	1.230	1.261	1.184	1.143
	Mean	1.302	1.325	1.263	1.166	1.103	1.628	1.402	1.314	1.252	1.200	1.221	1.216	1.175	1.116	1.080	1.385	1.312	1.249	1.178	1.128
	Standard Dev.	0.528	0.412	0.327	0.226	0.157	0.986	0.655	0.456	0.293	0.208	0.573	0.498	0.383	0.285	0.213	0.742	0.533	0.393	0.273	0.200
Total Zn	No. of Cases	17	17	17	17	17	20	20	20	20	20	21	21	21	21	21	58	58	58	58	58
	Minimum	0.774	0.959	0.976	0.981	0.981	0.844	0.844	0.835	0.822	0.815	0.852	0.852	0.852	0.852	0.852	0.774	0.844	0.835	0.822	0.815
	Maximum	2.299	2.001	1.779	1.615	1.459	5.368	3.312	2.908	2.244	1.830	4.169	2.708	2.228	1.937	1.631	5.368	3.312	2.908	2.244	1.830
	Median	1.475	1.484	1.377	1.259	1.170	2.326	1.999	1.643	1.452	1.301	1.878	1.652	1.518	1.369	1.268	1.927	1.666	1.464	1.358	1.250
	Mean	1.575	1.485	1.370	1.263	1.187	2.534	1.967	1.642	1.430	1.294	2.216	1.771	1.526	1.367	1.260	2.138	1.755	1.520	1.358	1.250
	Standard Dev.	0.487	0.333	0.251	0.182	0.131	1.333	0.757	0.524	0.349	0.249	0.945	0.532	0.353	0.255	0.182	1.060	0.599	0.406	0.278	0.197

Table D.2 Basic Statistics of MFF for CDM 7-10 and CDM 7-185 (1999-2000)

Parameters		CDM 7-10					CDM 7-185					Combined CDM				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
TSS	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.389	0.330	0.361	0.680	0.717	0.686	0.494	0.424	0.427	0.496	0.389	0.330	0.361	0.427	0.496
	Maximum	3.565	3.070	2.549	2.056	1.717	2.778	2.527	2.231	1.962	1.694	3.565	3.070	2.549	2.056	1.717
	Median	1.641	1.438	1.279	1.194	1.303	1.028	0.884	1.050	1.048	1.042	1.354	1.101	1.050	1.048	1.230
	Mean	1.777	1.517	1.357	1.283	1.233	1.275	1.145	1.121	1.099	1.075	1.543	1.343	1.247	1.197	1.159
	Standard Dev.	1.170	0.949	0.755	0.502	0.352	0.716	0.671	0.580	0.503	0.386	0.985	0.825	0.667	0.493	0.364
Hardness	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	1.088	1.098	1.098	1.057	1.064	1.035	0.924	0.910	0.967	1.023	1.035	0.924	0.910	0.967	1.023
	Maximum	1.693	1.533	1.376	1.295	1.261	2.613	1.982	1.668	1.449	1.255	2.613	1.982	1.668	1.449	1.261
	Median	1.493	1.311	1.233	1.175	1.173	1.249	1.249	1.204	1.177	1.114	1.282	1.255	1.225	1.175	1.136
	Mean	1.436	1.301	1.216	1.171	1.172	1.401	1.271	1.215	1.160	1.112	1.420	1.287	1.216	1.166	1.144
	Standard Dev.	0.256	0.154	0.090	0.074	0.075	0.552	0.343	0.236	0.152	0.078	0.405	0.250	0.167	0.113	0.080
TOC	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.890	0.890	0.890	0.890	0.889	1.297	1.151	0.977	1.135	1.058	0.890	0.890	0.890	0.890	0.889
	Maximum	2.371	2.033	1.841	1.582	1.416	3.216	2.099	1.629	1.382	1.266	3.216	2.099	1.841	1.582	1.416
	Median	1.544	1.310	1.194	1.221	1.190	1.467	1.318	1.318	1.267	1.201	1.487	1.318	1.299	1.241	1.201
	Mean	1.541	1.383	1.285	1.213	1.163	1.683	1.425	1.302	1.262	1.189	1.607	1.403	1.293	1.236	1.175
	Standard Dev.	0.505	0.406	0.327	0.234	0.182	0.682	0.317	0.193	0.074	0.067	0.576	0.355	0.263	0.174	0.137
Oil & Grease	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.616	0.561	0.591	0.566	0.555	0.999	0.818	0.640	0.711	0.855	0.616	0.561	0.591	0.566	0.555
	Maximum	2.239	2.200	1.728	1.703	1.545	2.454	2.095	1.721	1.505	1.336	2.454	2.200	1.728	1.703	1.545
	Median	1.374	1.322	1.381	1.307	1.223	1.266	1.188	1.182	1.169	1.162	1.332	1.290	1.332	1.247	1.191
	Mean	1.478	1.368	1.315	1.249	1.161	1.496	1.348	1.222	1.161	1.142	1.487	1.358	1.272	1.208	1.152
	Standard Dev.	0.622	0.541	0.402	0.376	0.324	0.593	0.485	0.362	0.261	0.169	0.587	0.497	0.373	0.320	0.254

Table D.2 *(Continued)*

Parameters		CDM 7-10					CDM 7-185					Combined CDM				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
NH_3-N	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	1.195	1.276	1.276	1.204	1.120	0.868	0.868	0.868	0.868	0.989	0.868	0.868	0.868	0.868	0.989
	Maximum	2.431	2.217	1.990	1.689	1.501	3.495	2.293	1.779	1.596	1.423	3.495	2.293	1.990	1.689	1.501
	Median	1.798	1.570	1.482	1.363	1.283	1.714	1.491	1.464	1.377	1.251	1.714	1.497	1.464	1.367	1.267
	Mean	1.782	1.644	1.529	1.391	1.293	1.808	1.537	1.401	1.305	1.231	1.794	1.594	1.469	1.351	1.264
	Standard Dev.	0.448	0.319	0.237	0.159	0.120	0.809	0.430	0.318	0.240	0.134	0.618	0.365	0.275	0.198	0.126
Ortho-P	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.109	0.091	0.151	0.822	0.927	0.891	0.891	0.891	0.891	0.949	0.109	0.091	0.151	0.822	0.927
	Maximum	1.711	1.711	1.572	1.423	1.328	2.077	1.648	1.413	1.275	1.252	2.077	1.711	1.572	1.423	1.328
	Median	1.242	1.172	1.095	1.092	1.097	1.279	1.230	1.230	1.137	1.082	1.257	1.230	1.125	1.121	1.082
	Mean	1.145	1.062	1.041	1.081	1.111	1.456	1.272	1.180	1.133	1.099	1.290	1.160	1.106	1.105	1.105
	Standard Dev.	0.499	0.480	0.434	0.203	0.149	0.416	0.238	0.168	0.133	0.094	0.474	0.389	0.334	0.170	0.122
Total P	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.055	0.046	0.114	0.814	0.868	1.004	1.004	0.823	0.816	0.832	0.055	0.046	0.114	0.814	0.832
	Maximum	2.151	2.151	1.869	1.638	1.421	5.036	3.148	2.367	1.967	1.682	5.036	3.148	2.367	1.967	1.682
	Median	1.330	1.158	1.092	1.040	1.200	1.322	1.112	1.080	1.080	1.045	1.322	1.112	1.080	1.080	1.059
	Mean	1.269	1.180	1.156	1.168	1.162	1.804	1.393	1.235	1.157	1.103	1.519	1.279	1.193	1.163	1.134
	Standard Dev.	0.653	0.645	0.584	0.348	0.223	1.436	0.778	0.513	0.375	0.273	1.083	0.692	0.534	0.347	0.240
Dissolved Cd	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.777	1.000	1.000	1.000	1.000	0.996	0.996	0.996	0.996	0.996	0.777	0.996	0.996	0.996	0.996
	Maximum	1.000	1.222	1.508	1.331	1.219	1.853	1.370	1.293	1.242	1.095	1.853	1.370	1.508	1.331	1.219
	Median	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Mean	0.972	1.028	1.063	1.041	1.027	1.159	1.106	1.075	1.056	1.027	1.059	1.064	1.069	1.048	1.027
	Standard Dev.	0.079	0.078	0.179	0.117	0.077	0.319	0.171	0.124	0.097	0.045	0.237	0.131	0.151	0.105	0.062

Table D.2 *(Continued)*

Parameters		CDM 7-10					CDM 7-185					Combined CDM				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Dissolved Cr	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.455	0.398	0.397	0.399	0.412	1.188	0.953	0.833	0.965	1.059	0.455	0.398	0.397	0.399	0.412
	Maximum	2.127	1.942	2.231	1.803	1.530	2.339	1.765	1.467	1.275	1.236	2.339	1.942	2.231	1.803	1.530
	Median	1.443	1.492	1.328	1.210	1.137	1.318	1.287	1.260	1.201	1.119	1.398	1.308	1.260	1.201	1.119
	Mean	1.398	1.380	1.348	1.216	1.129	1.447	1.297	1.219	1.183	1.137	1.421	1.342	1.288	1.200	1.133
	Standard Dev.	0.512	0.504	0.549	0.426	0.353	0.399	0.241	0.193	0.111	0.065	0.447	0.392	0.413	0.311	0.253
Dissolved Cu	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.856	0.856	0.856	0.856	0.856	1.209	1.115	0.959	1.065	1.115	0.856	0.856	0.856	0.856	0.856
	Maximum	2.312	2.246	2.527	1.996	1.658	3.248	2.149	1.673	1.402	1.293	3.248	2.246	2.527	1.996	1.658
	Median	1.939	1.534	1.543	1.375	1.271	1.473	1.411	1.362	1.301	1.201	1.474	1.414	1.409	1.308	1.236
	Mean	1.712	1.631	1.570	1.378	1.260	1.693	1.453	1.333	1.274	1.204	1.703	1.548	1.459	1.329	1.234
	Standard Dev.	0.508	0.486	0.500	0.339	0.240	0.700	0.333	0.220	0.129	0.071	0.582	0.418	0.401	0.259	0.178
Dissolved Ni	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.342	0.738	0.898	0.949	0.959	0.308	0.425	0.445	0.598	0.758	0.308	0.425	0.445	0.598	0.758
	Maximum	1.873	1.952	2.941	2.262	1.831	1.268	1.223	1.216	1.215	1.178	1.873	1.952	2.941	2.262	1.831
	Median	1.014	1.160	1.134	1.096	1.075	0.894	0.953	0.962	0.912	0.861	0.924	0.971	1.005	0.971	1.003
	Mean	1.064	1.254	1.357	1.248	1.163	0.800	0.853	0.873	0.889	0.925	0.941	1.067	1.131	1.080	1.052
	Standard Dev.	0.576	0.445	0.671	0.438	0.287	0.312	0.278	0.280	0.227	0.151	0.476	0.418	0.567	0.390	0.257
Dissolved Pb	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.549	0.873	0.899	0.939	0.985	0.718	0.718	0.718	0.718	0.727	0.549	0.718	0.718	0.718	0.727
	Maximum	2.423	1.942	2.395	1.909	1.601	2.607	1.728	1.589	1.454	1.293	2.607	1.942	2.395	1.909	1.601
	Median	1.125	1.376	1.319	1.248	1.184	1.289	1.235	1.235	1.198	1.146	1.235	1.364	1.248	1.198	1.146
	Mean	1.329	1.409	1.434	1.299	1.212	1.436	1.276	1.166	1.106	1.064	1.379	1.347	1.309	1.209	1.143
	Standard Dev.	0.589	0.377	0.481	0.316	0.214	0.637	0.380	0.309	0.271	0.217	0.592	0.371	0.419	0.302	0.221

Table D.2 *(Continued)*

Parameters		CDM 7-10					CDM 7-185					Combined CDM				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Dissolved Zn	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.549	0.873	0.899	0.939	0.985	0.718	0.718	0.718	0.718	0.727	0.549	0.718	0.718	0.718	0.727
	Maximum	2.423	1.942	2.395	1.909	1.601	2.607	1.728	1.589	1.454	1.293	2.607	1.942	2.395	1.909	1.601
	Median	1.125	1.376	1.319	1.248	1.184	1.289	1.235	1.235	1.198	1.146	1.235	1.364	1.248	1.198	1.146
	Mean	1.329	1.409	1.434	1.299	1.212	1.436	1.276	1.166	1.106	1.064	1.379	1.347	1.309	1.209	1.143
	Standard Dev.	0.589	0.377	0.481	0.316	0.214	0.637	0.380	0.309	0.271	0.217	0.592	0.371	0.419	0.302	0.221
Particulate Cd	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.000	0.000	0.325	0.245	0.208	0.382	0.276	0.279	0.389	0.540	0.000	0.000	0.279	0.245	0.208
	Maximum	2.052	2.052	1.850	1.669	1.530	2.079	1.987	1.924	1.924	1.641	2.079	2.052	1.924	1.924	1.641
	Median	1.580	1.221	1.148	1.202	1.218	0.916	0.916	0.983	1.019	1.006	1.327	1.151	1.023	1.185	1.154
	Mean	1.297	1.211	1.193	1.154	1.127	1.151	1.107	1.118	1.105	1.062	1.229	1.163	1.158	1.131	1.097
	Standard Dev.	0.691	0.655	0.517	0.452	0.427	0.649	0.636	0.568	0.516	0.389	0.652	0.625	0.522	0.466	0.396
Particulate Cr	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.215	0.215	0.215	0.215	0.234	0.463	0.310	0.289	0.369	0.483	0.215	0.215	0.215	0.215	0.234
	Maximum	6.070	3.658	2.683	2.098	1.755	2.275	2.114	1.927	1.725	1.512	6.070	3.658	2.683	2.098	1.755
	Median	1.437	1.262	1.319	1.227	1.231	0.764	0.742	0.964	1.008	0.999	1.368	1.064	1.101	1.173	1.159
	Mean	1.802	1.412	1.261	1.187	1.135	1.066	0.976	0.996	1.018	1.009	1.458	1.208	1.137	1.108	1.076
	Standard Dev.	1.814	1.044	0.745	0.538	0.438	0.659	0.612	0.547	0.472	0.356	1.405	0.870	0.652	0.498	0.393
Particulate Cu	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.559	0.658	0.733	0.789	0.801	0.429	0.333	0.333	0.417	0.560	0.429	0.333	0.333	0.417	0.560
	Maximum	1.898	1.863	1.648	1.482	1.413	1.704	1.700	1.603	1.468	1.318	1.898	1.863	1.648	1.482	1.413
	Median	1.376	1.325	1.330	1.284	1.257	0.855	0.855	1.001	1.035	1.030	1.199	1.138	1.165	1.155	1.179
	Mean	1.334	1.268	1.226	1.219	1.207	0.965	0.963	0.986	1.002	1.007	1.162	1.126	1.114	1.118	1.113
	Standard Dev.	0.482	0.399	0.317	0.214	0.188	0.438	0.435	0.402	0.343	0.250	0.484	0.431	0.368	0.293	0.235

Table D.2 *(Continued)*

Parameters		CDM 7-10					CDM 7-185					Combined CDM				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Particulate Ni	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.442	0.566	0.665	0.947	0.947	0.423	0.331	0.323	0.393	0.523	0.423	0.331	0.323	0.393	0.523
	Maximum	1.933	1.757	1.557	1.435	1.359	2.199	2.171	1.907	1.697	1.498	2.199	2.171	1.907	1.697	1.498
	Median	1.365	1.310	1.341	1.259	1.229	0.809	0.793	1.016	1.044	1.014	1.292	1.080	1.134	1.152	1.157
	Mean	1.361	1.295	1.233	1.214	1.185	0.993	0.959	0.973	0.989	0.987	1.189	1.138	1.112	1.109	1.093
	Standard Dev.	0.486	0.426	0.334	0.206	0.157	0.647	0.631	0.543	0.470	0.360	0.578	0.540	0.447	0.360	0.280
Particulate Pb	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.824	0.815	0.790	0.824	0.833	0.363	0.310	0.309	0.445	0.617	0.363	0.310	0.309	0.445	0.617
	Maximum	1.878	1.878	1.673	1.491	1.376	1.683	1.641	1.569	1.519	1.331	1.878	1.878	1.673	1.519	1.376
	Median	1.417	1.274	1.244	1.189	1.215	0.830	0.830	1.032	1.106	1.075	1.056	0.983	1.073	1.118	1.204
	Mean	1.372	1.295	1.225	1.197	1.174	0.975	0.972	1.026	1.057	1.050	1.187	1.144	1.132	1.131	1.116
	Standard Dev.	0.489	0.416	0.323	0.228	0.197	0.481	0.461	0.433	0.375	0.261	0.511	0.453	0.378	0.303	0.230
Particulate Zn	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.556	0.566	0.602	0.999	1.007	0.590	0.377	0.357	0.425	0.567	0.556	0.377	0.357	0.425	0.567
	Maximum	1.915	1.915	1.716	1.523	1.367	2.069	2.096	1.907	1.705	1.493	2.069	2.096	1.907	1.705	1.493
	Median	1.493	1.341	1.293	1.237	1.213	0.900	0.881	1.051	1.058	1.015	1.373	1.083	1.134	1.134	1.138
	Mean	1.418	1.304	1.246	1.225	1.201	1.048	0.990	1.015	1.040	1.052	1.245	1.157	1.138	1.139	1.132
	Standard Dev.	0.436	0.414	0.350	0.192	0.130	0.537	0.552	0.495	0.430	0.334	0.505	0.492	0.425	0.327	0.249
Total Cd	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.681	0.831	0.892	0.879	0.873	0.482	0.394	0.396	0.488	0.615	0.482	0.394	0.396	0.488	0.615
	Maximum	1.856	1.856	1.693	1.508	1.386	2.054	1.919	1.871	1.871	1.605	2.054	1.919	1.871	1.871	1.605
	Median	1.409	1.157	1.106	1.185	1.180	0.956	0.956	0.989	1.018	1.006	1.227	1.105	1.016	1.143	1.110
	Mean	1.292	1.242	1.209	1.183	1.163	1.167	1.129	1.132	1.124	1.079	1.234	1.190	1.173	1.155	1.124
	Standard Dev.	0.409	0.373	0.300	0.229	0.202	0.589	0.567	0.503	0.452	0.329	0.486	0.459	0.394	0.339	0.262

Table D.2 *(Continued)*

Parameters		CDM 7-10					CDM 7-185					Combined CDM				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Total Cr	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.502	0.589	0.672	0.890	0.894	0.528	0.383	0.366	0.470	0.592	0.502	0.383	0.366	0.470	0.592
	Maximum	5.283	3.246	2.423	1.929	1.639	2.113	1.955	1.775	1.605	1.435	5.283	3.246	2.423	1.929	1.639
	Median	1.459	1.324	1.297	1.219	1.225	0.822	0.816	0.986	1.020	1.024	1.220	1.101	1.040	1.081	1.107
	Mean	1.776	1.466	1.322	1.257	1.212	1.049	0.981	0.993	1.013	1.006	1.437	1.240	1.169	1.143	1.116
	Standard Dev.	1.473	0.806	0.538	0.331	0.232	0.532	0.498	0.435	0.359	0.268	1.161	0.703	0.505	0.354	0.263
Total Cu	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.678	0.818	0.848	0.848	0.851	0.587	0.451	0.428	0.521	0.655	0.587	0.451	0.428	0.521	0.655
	Maximum	1.856	1.856	1.661	1.488	1.346	1.845	1.715	1.573	1.426	1.272	1.856	1.856	1.661	1.488	1.346
	Median	1.369	1.275	1.257	1.212	1.220	0.963	0.963	1.055	1.076	1.063	1.233	1.167	1.150	1.154	1.140
	Mean	1.299	1.247	1.207	1.183	1.159	1.097	1.059	1.054	1.051	1.037	1.205	1.159	1.136	1.121	1.102
	Standard Dev.	0.383	0.354	0.285	0.212	0.176	0.401	0.387	0.350	0.287	0.200	0.391	0.369	0.315	0.250	0.191
Total Ni	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.545	0.684	0.796	0.923	0.923	0.731	0.552	0.502	0.583	0.700	0.545	0.552	0.502	0.583	0.700
	Maximum	1.824	1.824	1.658	1.459	1.359	2.570	2.163	1.824	1.593	1.390	2.570	2.163	1.824	1.593	1.390
	Median	1.516	1.382	1.335	1.272	1.259	1.021	1.033	1.117	1.123	1.082	1.330	1.253	1.221	1.181	1.169
	Mean	1.403	1.325	1.265	1.227	1.192	1.245	1.147	1.111	1.090	1.057	1.329	1.242	1.193	1.163	1.129
	Standard Dev.	0.446	0.392	0.314	0.197	0.156	0.624	0.514	0.411	0.328	0.234	0.523	0.445	0.358	0.266	0.201
Total Pb	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.792	0.841	0.841	0.841	0.848	0.360	0.317	0.318	0.456	0.632	0.360	0.317	0.318	0.456	0.632
	Maximum	1.838	1.836	1.640	1.468	1.374	1.643	1.605	1.537	1.495	1.316	1.838	1.836	1.640	1.495	1.374
	Median	1.386	1.254	1.231	1.223	1.208	0.839	0.839	1.010	1.113	1.081	1.024	0.965	1.081	1.126	1.176
	Mean	1.352	1.298	1.241	1.205	1.177	0.964	0.966	1.019	1.050	1.044	1.171	1.143	1.137	1.133	1.115
	Standard Dev.	0.491	0.395	0.285	0.217	0.195	0.464	0.444	0.419	0.360	0.246	0.503	0.438	0.359	0.292	0.223

Table D.2 *(Continued)*

Parameters		CDM 7-10					CDM 7-185					Combined CDM				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Total Zn	No. of Cases	8	8	8	8	8	7	7	7	7	7	15	15	15	15	15
	Minimum	0.555	0.664	0.761	0.993	1.005	0.705	0.515	0.478	0.555	0.682	0.555	0.515	0.478	0.555	0.682
	Maximum	1.932	1.898	1.698	1.504	1.354	2.150	2.038	1.819	1.616	1.413	2.150	2.038	1.819	1.616	1.413
	Median	1.456	1.329	1.284	1.226	1.215	1.028	1.068	1.083	1.090	1.042	1.236	1.083	1.097	1.109	1.133
	Mean	1.411	1.313	1.263	1.231	1.201	1.146	1.089	1.075	1.064	1.049	1.288	1.208	1.175	1.153	1.130
	Standard Dev.	0.449	0.393	0.313	0.183	0.133	0.474	0.467	0.402	0.323	0.225	0.465	0.429	0.357	0.263	0.191

Table D.3 Basic Statistics of MFF for URS 23, 6-20F and 8-23C (2000-2001)

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
TDS	No. of Cases	4	4	4	4	4	6	6	6	6	6	7	7	7	7	7	17	17	17	17	17
	Minimum	0.440	0.839	0.906	0.940	0.929	0.423	0.423	0.423	0.423	0.423	0.643	0.813	0.813	0.813	0.813	0.423	0.423	0.423	0.423	0.423
	Maximum	1.510	1.575	1.448	1.317	1.235	1.827	1.514	1.643	1.425	1.282	2.808	2.119	1.640	1.385	1.244	2.808	2.119	1.643	1.425	1.282
	Median	1.335	1.225	1.061	0.971	0.950	1.529	1.397	1.220	1.130	1.110	1.044	0.939	1.063	1.180	1.107	1.168	1.218	1.092	1.103	1.039
	Mean	1.155	1.216	1.119	1.050	1.016	1.344	1.213	1.165	1.081	1.028	1.197	1.143	1.095	1.110	1.075	1.239	1.185	1.125	1.086	1.044
	Standard Dev.	0.503	0.300	0.231	0.180	0.146	0.518	0.414	0.410	0.347	0.313	0.752	0.460	0.275	0.212	0.166	0.592	0.389	0.303	0.247	0.214
TSS	No. of Cases	4	4	4	4	4	6	6	6	6	6	7	7	7	7	7	17	17	17	17	17
	Minimum	0.938	0.936	1.108	1.249	1.340	0.590	0.590	0.590	0.590	0.590	0.690	0.690	0.690	0.690	0.690	0.590	0.590	0.590	0.590	0.590
	Maximum	4.889	2.894	2.105	2.054	1.819	3.022	2.318	1.952	1.662	1.487	2.559	2.145	1.867	1.671	1.535	4.889	2.894	2.105	2.054	1.819
	Median	1.852	1.850	1.630	1.625	1.445	2.023	1.715	1.564	1.466	1.323	1.815	1.603	1.426	1.299	1.309	1.815	1.654	1.584	1.459	1.340
	Mean	2.383	1.883	1.618	1.638	1.512	1.918	1.585	1.436	1.329	1.231	1.745	1.543	1.417	1.286	1.210	1.956	1.638	1.471	1.384	1.288
	Standard Dev.	1.733	0.816	0.409	0.336	0.212	1.047	0.658	0.495	0.392	0.326	0.621	0.443	0.386	0.315	0.269	1.056	0.595	0.413	0.358	0.292
Turbidity	No. of Cases	4	4	4	4	4	6	6	6	6	6	7	7	7	7	7	17	17	17	17	17
	Minimum	1.104	1.016	1.060	1.108	1.129	0.796	0.796	0.796	0.796	0.796	0.937	0.937	0.937	0.937	0.937	0.796	0.796	0.796	0.796	0.796
	Maximum	2.027	1.516	1.328	1.444	1.402	2.736	1.993	1.931	1.646	1.428	2.638	2.325	1.856	1.867	1.694	2.736	2.325	1.931	1.867	1.694
	Median	1.377	1.352	1.299	1.239	1.192	1.503	1.375	1.261	1.172	1.095	1.341	1.296	1.275	1.243	1.199	1.341	1.305	1.296	1.202	1.138
	Mean	1.472	1.309	1.247	1.257	1.229	1.601	1.395	1.305	1.206	1.123	1.492	1.454	1.363	1.300	1.219	1.526	1.399	1.315	1.257	1.187
	Standard Dev.	0.403	0.213	0.125	0.144	0.127	0.805	0.538	0.453	0.343	0.261	0.610	0.494	0.363	0.322	0.255	0.613	0.440	0.344	0.285	0.226
Conductivity	No. of Cases	4	4	4	4	4	6	6	6	6	6	7	7	7	7	7	17	17	17	17	17
	Minimum	0.707	0.825	0.898	0.897	0.905	0.639	0.535	0.786	0.786	0.786	0.796	0.796	0.796	0.796	0.796	0.639	0.535	0.786	0.786	0.786
	Maximum	1.363	1.244	1.167	1.151	1.141	2.001	1.662	1.655	1.454	1.516	1.620	1.376	1.340	1.392	1.312	2.001	1.662	1.655	1.454	1.516
	Median	1.109	1.141	1.051	1.026	1.016	1.124	1.133	1.051	1.123	1.163	1.152	1.092	1.062	1.053	1.060	1.111	1.092	1.062	1.053	1.075
	Mean	1.072	1.088	1.041	1.025	1.019	1.176	1.097	1.123	1.145	1.153	1.130	1.108	1.081	1.075	1.049	1.133	1.099	1.086	1.088	1.079
	Standard Dev.	0.271	0.191	0.135	0.128	0.108	0.488	0.404	0.315	0.250	0.252	0.287	0.213	0.187	0.194	0.171	0.348	0.274	0.220	0.197	0.190

Table D.3 *(Continued)*

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Hardness	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.580	0.714	0.833	0.893	0.895	0.923	0.796	0.876	0.923	0.923	0.722	0.722	0.722	0.726	0.737	0.580	0.714	0.722	0.726	0.737
	Maximum	1.352	2.025	1.790	1.506	1.323	1.484	1.539	1.455	1.351	1.313	3.141	2.519	2.201	1.883	1.585	3.141	2.519	2.201	1.883	1.585
	Median	1.028	1.151	1.103	1.076	1.037	1.174	1.245	1.230	1.149	1.070	1.644	1.470	1.343	1.240	1.177	1.174	1.245	1.230	1.191	1.146
	Mean	0.997	1.260	1.207	1.138	1.073	1.164	1.191	1.159	1.139	1.106	1.740	1.504	1.355	1.249	1.159	1.328	1.318	1.240	1.177	1.117
	Standard Dev.	0.401	0.575	0.436	0.298	0.201	0.184	0.262	0.211	0.180	0.152	0.962	0.667	0.516	0.394	0.286	0.660	0.498	0.379	0.283	0.207
COD	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.145	1.085	0.998	1.193	1.161	0.930	0.924	0.860	0.813	0.930	0.898	0.898	0.898	0.898	0.898	0.898	0.898	0.860	0.813	0.898
	Maximum	2.966	1.874	1.510	1.345	1.263	2.751	2.199	1.710	1.701	1.570	3.096	2.336	2.141	1.800	1.530	3.096	2.336	2.141	1.800	1.570
	Median	1.516	1.348	1.251	1.266	1.206	1.404	1.310	1.205	1.163	1.111	1.608	1.505	1.340	1.156	1.074	1.503	1.404	1.253	1.195	1.161
	Mean	1.785	1.414	1.252	1.268	1.209	1.561	1.378	1.254	1.186	1.153	1.667	1.483	1.364	1.233	1.154	1.651	1.424	1.293	1.222	1.167
	Standard Dev.	0.816	0.334	0.210	0.079	0.043	0.626	0.453	0.340	0.301	0.224	0.804	0.536	0.458	0.339	0.238	0.694	0.435	0.347	0.269	0.194
DOC	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.738	0.833	0.903	0.937	0.958	0.828	0.828	0.828	0.828	0.828	0.872	0.872	0.872	0.872	0.872	0.738	0.828	0.828	0.828	0.828
	Maximum	1.986	1.645	1.383	1.243	1.175	2.701	2.059	1.636	1.474	1.372	2.541	1.997	1.879	1.602	1.399	2.701	2.059	1.879	1.602	1.399
	Median	1.529	1.320	1.168	1.149	1.061	1.324	1.274	1.156	1.112	1.090	1.726	1.511	1.307	1.192	1.111	1.444	1.388	1.191	1.112	1.090
	Mean	1.446	1.279	1.156	1.119	1.064	1.428	1.336	1.232	1.184	1.122	1.621	1.452	1.337	1.210	1.123	1.500	1.364	1.251	1.178	1.109
	Standard Dev.	0.561	0.412	0.253	0.138	0.097	0.622	0.418	0.290	0.249	0.203	0.618	0.456	0.394	0.285	0.215	0.576	0.409	0.312	0.231	0.180
TOC	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.696	0.813	0.891	0.930	0.953	0.809	0.809	0.809	0.809	0.809	0.872	0.872	0.872	0.872	0.872	0.696	0.809	0.809	0.809	0.809
	Maximum	1.981	1.630	1.373	1.234	1.167	2.770	2.088	1.653	1.501	1.391	2.787	2.151	2.001	1.673	1.446	2.787	2.151	2.001	1.673	1.446
	Median	1.507	1.296	1.151	1.137	1.053	1.299	1.267	1.161	1.113	1.092	1.756	1.515	1.312	1.197	1.097	1.459	1.380	1.191	1.113	1.092
	Mean	1.423	1.259	1.141	1.110	1.056	1.419	1.333	1.250	1.199	1.133	1.674	1.475	1.351	1.217	1.128	1.510	1.366	1.260	1.185	1.113
	Standard Dev.	0.584	0.422	0.258	0.138	0.095	0.654	0.436	0.323	0.274	0.222	0.700	0.494	0.424	0.302	0.226	0.627	0.434	0.338	0.249	0.193

Table D.3 *(Continued)*

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Oil & Grease	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.993	0.999	0.918	0.878	0.855	0.622	0.781	0.788	0.788	0.788	0.752	0.641	0.598	0.580	0.567	0.622	0.641	0.598	0.580	0.567
	Maximum	1.249	1.026	1.015	1.010	1.007	2.158	2.311	1.772	1.699	1.487	2.328	1.926	1.751	1.479	1.318	2.328	2.311	1.772	1.699	1.487
	Median	1.000	1.000	1.000	1.000	1.000	1.431	1.192	1.111	1.072	1.048	1.069	1.091	1.043	1.039	1.039	1.078	1.064	1.008	1.000	1.007
	Mean	1.061	1.006	0.983	0.972	0.965	1.355	1.322	1.199	1.148	1.102	1.305	1.198	1.128	1.054	1.002	1.268	1.204	1.123	1.073	1.035
	Standard Dev.	0.126	0.013	0.044	0.063	0.074	0.547	0.551	0.391	0.343	0.236	0.575	0.438	0.386	0.318	0.283	0.482	0.435	0.334	0.286	0.225
TKN	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.100	1.122	1.021	1.011	0.977	0.732	0.877	0.929	0.856	0.862	0.894	0.894	0.894	0.894	0.894	0.732	0.877	0.894	0.856	0.862
	Maximum	1.732	1.628	1.484	1.410	1.402	2.457	1.954	1.543	1.322	1.250	3.946	2.524	2.015	1.733	1.574	3.946	2.524	2.015	1.733	1.574
	Median	1.315	1.190	1.106	1.093	1.062	1.177	1.185	1.070	1.033	1.033	1.648	1.438	1.315	1.256	1.194	1.346	1.240	1.150	1.091	1.060
	Mean	1.366	1.282	1.179	1.152	1.126	1.303	1.238	1.155	1.097	1.065	2.034	1.599	1.422	1.313	1.217	1.576	1.376	1.255	1.186	1.133
	Standard Dev.	0.295	0.239	0.210	0.176	0.188	0.555	0.349	0.213	0.190	0.144	1.211	0.666	0.480	0.372	0.288	0.844	0.473	0.337	0.269	0.212
NH_3-N	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.079	1.001	1.004	1.011	0.987	0.689	0.689	0.689	0.689	0.689	0.706	0.706	0.706	0.706	0.706	0.689	0.689	0.689	0.689	0.689
	Maximum	1.909	1.814	1.662	1.577	1.505	2.218	1.757	1.685	1.678	1.553	2.544	2.100	1.955	1.864	1.599	2.544	2.100	1.955	1.864	1.599
	Median	1.266	1.156	1.084	1.068	1.057	1.208	1.157	1.131	1.126	1.136	1.532	1.485	1.397	1.286	1.175	1.245	1.204	1.131	1.126	1.136
	Mean	1.380	1.282	1.208	1.181	1.151	1.295	1.236	1.165	1.119	1.080	1.583	1.495	1.393	1.282	1.161	1.417	1.338	1.256	1.192	1.125
	Standard Dev.	0.368	0.364	0.306	0.265	0.238	0.542	0.398	0.329	0.320	0.278	0.762	0.561	0.475	0.416	0.318	0.578	0.444	0.374	0.334	0.270
NO_3-N	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.765	0.837	0.905	0.939	0.959	0.610	0.610	0.610	0.610	0.610	0.756	0.756	0.756	0.756	0.756	0.610	0.610	0.610	0.610	0.610
	Maximum	1.718	1.729	1.484	1.283	1.154	2.722	2.125	1.673	1.431	1.291	2.499	1.931	1.841	1.577	1.382	2.722	2.125	1.841	1.577	1.382
	Median	1.410	1.286	1.154	1.108	1.061	1.186	1.275	1.210	1.170	1.086	1.338	1.284	1.153	1.093	1.078	1.302	1.275	1.185	1.109	1.081
	Mean	1.326	1.285	1.174	1.109	1.059	1.308	1.247	1.161	1.116	1.068	1.407	1.303	1.240	1.153	1.091	1.347	1.276	1.192	1.128	1.074
	Standard Dev.	0.403	0.369	0.240	0.141	0.080	0.668	0.463	0.323	0.267	0.230	0.595	0.405	0.381	0.290	0.232	0.558	0.397	0.311	0.239	0.195

Table D.3 *(Continued)*

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Ortho-P	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.869	0.937	0.963	0.976	0.984	0.518	0.518	0.518	0.518	0.518	0.935	0.938	0.980	1.002	1.006	0.518	0.518	0.518	0.518	0.518
	Maximum	1.604	1.392	1.244	1.188	1.158	1.668	1.492	1.756	1.657	1.533	1.569	1.308	1.327	1.325	1.324	1.668	1.492	1.756	1.657	1.533
	Median	1.299	1.225	1.144	1.111	1.075	0.986	1.182	1.106	1.068	1.072	1.193	1.197	1.160	1.155	1.137	1.151	1.210	1.151	1.122	1.088
	Mean	1.267	1.195	1.124	1.097	1.073	1.116	1.106	1.107	1.079	1.049	1.208	1.150	1.154	1.148	1.130	1.184	1.143	1.128	1.108	1.083
	Standard Dev.	0.329	0.189	0.118	0.094	0.072	0.389	0.342	0.377	0.334	0.296	0.232	0.148	0.141	0.127	0.116	0.313	0.242	0.250	0.222	0.199
Total P	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.865	0.677	0.633	0.642	0.681	0.813	0.847	0.907	0.960	0.953	0.612	0.698	0.683	0.675	0.722	0.612	0.677	0.633	0.642	0.681
	Maximum	1.934	1.649	1.424	1.278	1.184	3.389	2.188	1.681	1.469	1.345	1.354	1.456	1.401	1.278	1.262	3.389	2.188	1.681	1.469	1.345
	Median	0.961	0.926	0.993	1.027	1.033	0.960	1.211	1.130	1.045	1.059	1.298	1.067	1.073	1.061	1.028	1.025	1.025	1.086	1.045	1.059
	Mean	1.181	1.045	1.011	0.993	0.983	1.406	1.265	1.204	1.149	1.094	1.137	1.076	1.067	1.042	1.026	1.258	1.146	1.110	1.074	1.044
	Standard Dev.	0.507	0.427	0.332	0.273	0.222	0.928	0.446	0.277	0.212	0.155	0.309	0.270	0.267	0.234	0.200	0.646	0.377	0.281	0.229	0.181
Dissolved As	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.490	0.708	0.829	0.890	0.927	0.690	0.806	0.806	0.806	0.806	0.703	0.703	0.703	0.703	0.703	0.490	0.703	0.703	0.703	0.703
	Maximum	2.552	2.389	1.959	1.631	1.459	3.269	2.253	1.841	1.670	1.528	2.247	1.996	1.741	1.560	1.526	3.269	2.389	1.959	1.670	1.528
	Median	1.260	1.489	1.581	1.456	1.357	1.297	1.064	1.060	1.174	1.080	1.406	1.373	1.359	1.341	1.254	1.307	1.353	1.446	1.438	1.294
	Mean	1.391	1.518	1.488	1.358	1.275	1.496	1.299	1.264	1.267	1.205	1.513	1.393	1.300	1.255	1.189	1.477	1.384	1.329	1.284	1.216
	Standard Dev.	0.856	0.689	0.478	0.323	0.243	0.964	0.574	0.424	0.354	0.302	0.579	0.449	0.363	0.330	0.286	0.770	0.532	0.400	0.320	0.268
Dissolved Cd	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.000	0.968	0.940	0.933	0.898	0.691	0.716	0.736	0.755	0.799	0.405	0.263	0.647	0.849	0.849	0.405	0.263	0.647	0.755	0.799
	Maximum	1.440	1.578	1.465	1.396	1.361	3.224	2.069	1.792	1.666	1.571	1.000	1.328	1.249	1.240	1.631	3.224	2.069	1.792	1.666	1.631
	Median	1.191	1.162	1.066	0.995	1.049	1.253	1.277	1.028	1.000	1.000	0.893	0.910	0.910	0.963	0.963	1.000	1.000	1.000	1.000	1.000
	Mean	1.205	1.218	1.134	1.080	1.089	1.541	1.265	1.129	1.086	1.053	0.828	0.877	0.927	1.012	1.068	1.210	1.117	1.059	1.058	1.067
	Standard Dev.	0.213	0.289	0.235	0.213	0.198	0.929	0.486	0.366	0.323	0.285	0.213	0.346	0.197	0.156	0.290	0.670	0.419	0.288	0.238	0.254

Table D.3 *(Continued)*

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Dissolved Cr	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.710	0.721	0.708	0.697	0.691	0.695	0.695	0.695	0.695	0.695	0.770	0.770	0.770	0.770	0.770	0.695	0.695	0.695	0.695	0.691
	Maximum	1.415	1.343	1.290	1.281	1.319	2.832	3.547	2.614	2.059	1.725	2.115	1.690	1.747	1.548	1.317	2.832	3.547	2.614	2.059	1.725
	Median	0.796	0.974	1.056	1.100	1.118	1.098	1.082	1.075	1.065	1.050	1.244	1.244	1.199	1.144	1.107	1.098	1.082	1.100	1.065	1.050
	Mean	0.929	1.003	1.028	1.045	1.062	1.335	1.460	1.330	1.271	1.201	1.334	1.258	1.233	1.166	1.084	1.239	1.281	1.225	1.181	1.127
	Standard Dev.	0.332	0.259	0.253	0.268	0.287	0.718	0.965	0.638	0.477	0.371	0.506	0.384	0.378	0.309	0.226	0.570	0.664	0.473	0.370	0.295
Dissolved Cu	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.026	0.912	0.913	1.024	0.953	0.760	0.760	0.760	0.760	0.760	0.889	0.889	0.889	0.889	0.874	0.760	0.760	0.760	0.760	0.760
	Maximum	1.799	1.631	1.463	1.381	1.407	1.763	1.578	1.491	1.488	1.411	1.893	1.617	1.615	1.541	1.341	1.893	1.631	1.615	1.541	1.411
	Median	1.402	1.219	1.098	1.064	1.037	1.110	1.081	1.064	1.047	1.044	1.236	1.142	1.108	1.101	1.088	1.163	1.081	1.064	1.047	1.044
	Mean	1.407	1.245	1.143	1.133	1.109	1.163	1.138	1.118	1.129	1.101	1.282	1.212	1.198	1.147	1.086	1.262	1.190	1.152	1.136	1.097
	Standard Dev.	0.424	0.320	0.236	0.168	0.204	0.355	0.287	0.257	0.275	0.239	0.369	0.305	0.318	0.273	0.205	0.365	0.285	0.261	0.239	0.206
Dissolved Ni	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.624	0.786	0.875	0.920	0.928	0.669	0.669	0.669	0.669	0.669	0.753	0.753	0.753	0.753	0.753	0.624	0.669	0.669	0.669	0.669
	Maximum	2.088	1.865	1.603	1.467	1.430	2.863	1.964	1.624	1.603	1.511	2.904	2.411	2.272	1.815	1.540	2.904	2.411	2.272	1.815	1.540
	Median	1.333	1.159	1.060	1.069	1.021	1.028	1.011	0.965	0.973	0.982	1.496	1.332	1.232	1.167	1.141	1.372	1.201	1.075	0.990	0.982
	Mean	1.345	1.242	1.149	1.131	1.100	1.374	1.240	1.171	1.151	1.110	1.588	1.431	1.359	1.249	1.150	1.443	1.308	1.232	1.181	1.122
	Standard Dev.	0.609	0.456	0.315	0.243	0.232	0.750	0.468	0.376	0.355	0.312	0.764	0.597	0.551	0.409	0.306	0.690	0.491	0.420	0.337	0.276
Dissolved Pb	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.781	0.915	0.951	0.968	0.979	0.623	0.697	0.697	0.697	0.697	0.846	0.831	0.829	0.846	0.846	0.623	0.697	0.697	0.697	0.697
	Maximum	2.967	2.047	1.693	1.520	1.444	1.424	1.431	1.508	1.540	1.459	1.449	1.605	1.496	1.407	1.248	2.967	2.047	1.693	1.540	1.459
	Median	1.128	1.142	1.106	1.043	1.030	1.101	1.042	1.025	1.016	1.011	1.047	0.989	0.948	0.916	0.906	1.101	1.042	1.025	1.016	1.011
	Mean	1.501	1.312	1.214	1.144	1.121	1.024	1.063	1.076	1.087	1.073	1.078	1.063	1.063	1.027	0.988	1.155	1.121	1.104	1.079	1.054
	Standard Dev.	1.010	0.508	0.329	0.254	0.217	0.292	0.294	0.307	0.311	0.278	0.219	0.291	0.276	0.224	0.162	0.527	0.345	0.289	0.257	0.221

Table D.3 *(Continued)*

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Dissolved Zn	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.511	0.651	0.797	0.869	0.843	0.706	0.706	0.706	0.706	0.706	0.927	0.860	0.836	0.843	0.848	0.511	0.651	0.706	0.706	0.706
	Maximum	1.579	1.546	1.400	1.324	1.316	1.533	1.643	1.541	1.496	1.413	2.493	1.575	1.437	1.422	1.362	2.493	1.643	1.541	1.496	1.413
	Median	1.070	1.021	0.943	0.932	0.903	0.836	0.866	0.922	0.913	0.967	1.066	1.190	1.180	1.111	1.077	1.019	1.019	1.014	0.934	0.967
	Mean	1.057	1.060	1.021	1.014	0.991	1.021	1.060	1.015	1.011	1.015	1.335	1.209	1.165	1.128	1.089	1.140	1.113	1.069	1.053	1.035
	Standard Dev.	0.471	0.414	0.284	0.208	0.219	0.339	0.355	0.312	0.284	0.251	0.607	0.312	0.269	0.235	0.204	0.471	0.340	0.282	0.243	0.218
Particulate As	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.263	0.134	0.463	0.423	0.344	1.114	1.160	1.156	1.101	1.067	0.896	0.862	0.915	0.925	0.925	0.263	0.134	0.463	0.423	0.344
	Maximum	8.626	4.996	3.332	2.497	2.000	3.705	3.569	2.483	2.189	1.982	5.779	3.652	3.332	2.488	1.986	8.626	4.996	3.332	2.497	2.000
	Median	1.302	0.646	0.615	0.837	0.925	1.249	1.289	1.236	1.160	1.173	1.757	1.591	1.458	1.331	1.219	1.249	1.268	1.221	1.159	1.160
	Mean	2.873	1.606	1.256	1.149	1.049	1.752	1.735	1.563	1.410	1.316	2.469	1.898	1.691	1.462	1.317	2.269	1.762	1.536	1.367	1.253
	Standard Dev.	3.881	2.279	1.386	0.923	0.691	0.958	0.900	0.610	0.434	0.326	1.959	1.141	0.935	0.591	0.420	2.142	1.303	0.895	0.596	0.445
Particulate Cd	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.805	0.775	0.919	1.040	0.986	0.851	0.990	0.990	0.990	0.969	0.203	0.217	0.208	0.189	0.176	0.203	0.217	0.208	0.189	0.176
	Maximum	8.677	4.996	3.332	2.497	2.000	1.828	1.643	1.702	1.681	1.529	2.833	2.169	1.917	1.720	1.477	8.677	4.996	3.332	2.497	2.000
	Median	1.332	1.244	1.201	1.369	1.356	1.411	1.370	1.215	1.134	1.071	1.747	1.519	1.398	1.322	1.234	1.411	1.370	1.281	1.139	1.118
	Mean	3.036	2.065	1.663	1.569	1.425	1.380	1.302	1.249	1.204	1.146	1.667	1.396	1.255	1.162	1.064	1.871	1.515	1.349	1.275	1.183
	Standard Dev.	3.771	1.987	1.133	0.692	0.464	0.385	0.255	0.251	0.252	0.205	1.051	0.769	0.642	0.571	0.496	1.878	1.025	0.652	0.494	0.392
Particulate Cr	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.736	0.552	0.985	1.048	1.047	0.956	0.892	0.910	0.945	0.959	0.691	0.691	0.691	0.691	0.691	0.691	0.552	0.691	0.691	0.691
	Maximum	7.815	4.996	3.332	2.497	2.000	2.698	1.780	1.716	1.600	1.450	2.485	2.143	1.911	1.638	1.448	7.815	4.996	3.332	2.497	2.000
	Median	1.352	1.372	1.308	1.507	1.537	1.326	1.179	1.131	1.139	1.126	1.504	1.531	1.412	1.335	1.242	1.326	1.279	1.260	1.293	1.195
	Mean	2.814	2.073	1.733	1.640	1.530	1.541	1.287	1.228	1.189	1.143	1.581	1.494	1.375	1.267	1.179	1.855	1.545	1.399	1.323	1.247
	Standard Dev.	3.348	2.007	1.099	0.623	0.393	0.630	0.354	0.277	0.218	0.161	0.762	0.581	0.446	0.333	0.261	1.653	1.004	0.599	0.399	0.294

Table D.3 *(Continued)*

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Particulate Cu	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.612	0.632	0.811	0.955	0.942	0.993	1.012	1.012	1.012	1.012	0.736	0.853	0.878	0.878	0.878	0.612	0.632	0.811	0.878	0.878
	Maximum	3.726	2.353	1.790	1.886	1.701	2.447	2.066	1.769	1.658	1.498	2.510	1.905	1.667	1.488	1.324	3.726	2.353	1.790	1.886	1.701
	Median	1.427	1.305	1.277	1.268	1.193	1.300	1.220	1.157	1.134	1.110	1.654	1.495	1.390	1.312	1.226	1.344	1.302	1.310	1.277	1.174
	Mean	1.798	1.399	1.289	1.344	1.257	1.457	1.380	1.303	1.233	1.167	1.609	1.401	1.289	1.212	1.146	1.591	1.392	1.295	1.252	1.181
	Standard Dev.	1.351	0.808	0.475	0.436	0.340	0.535	0.382	0.287	0.228	0.170	0.733	0.455	0.331	0.258	0.202	0.797	0.492	0.328	0.281	0.217
Particulate Ni	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.134	1.300	1.167	1.108	1.079	0.994	1.049	1.049	1.049	1.049	0.830	0.903	0.903	0.903	0.903	0.830	0.903	0.903	0.903	0.903
	Maximum	6.497	3.826	2.649	2.059	1.707	1.902	1.745	1.765	1.691	1.542	2.260	2.058	1.946	1.694	1.509	6.497	3.826	2.649	2.059	1.707
	Median	1.969	1.588	1.484	1.588	1.522	1.494	1.356	1.241	1.181	1.146	1.624	1.514	1.411	1.348	1.256	1.678	1.398	1.314	1.221	1.155
	Mean	2.892	2.075	1.696	1.586	1.458	1.452	1.342	1.287	1.240	1.184	1.572	1.468	1.385	1.306	1.222	1.833	1.559	1.418	1.345	1.262
	Standard Dev.	2.436	1.185	0.653	0.402	0.271	0.386	0.235	0.228	0.207	0.162	0.639	0.471	0.378	0.279	0.203	1.290	0.666	0.414	0.301	0.222
Particulate Pb	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.969	0.861	0.913	0.941	0.914	0.964	0.971	0.971	0.971	0.971	0.620	0.401	0.501	0.724	0.814	0.620	0.401	0.501	0.724	0.814
	Maximum	3.367	2.106	1.645	1.646	1.521	2.932	2.266	1.822	1.796	1.629	2.327	1.922	1.611	1.483	1.382	3.367	2.266	1.822	1.796	1.629
	Median	1.306	1.329	1.284	1.291	1.239	1.373	1.232	1.194	1.168	1.146	1.701	1.412	1.311	1.212	1.126	1.373	1.232	1.194	1.172	1.146
	Mean	1.737	1.406	1.281	1.292	1.228	1.558	1.446	1.352	1.292	1.216	1.569	1.283	1.184	1.141	1.098	1.604	1.379	1.276	1.239	1.177
	Standard Dev.	1.111	0.563	0.330	0.305	0.250	0.697	0.450	0.326	0.284	0.224	0.787	0.593	0.446	0.310	0.221	0.783	0.501	0.358	0.288	0.222
Particulate Zn	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.070	0.946	1.051	1.048	1.007	0.928	1.002	1.001	0.994	0.974	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695
	Maximum	6.661	3.902	2.694	2.088	1.726	1.938	1.822	1.854	1.757	1.547	2.597	2.023	1.704	1.520	1.391	6.661	3.902	2.694	2.088	1.726
	Median	1.540	1.332	1.279	1.510	1.481	1.247	1.193	1.154	1.111	1.084	1.514	1.360	1.283	1.236	1.164	1.396	1.228	1.173	1.209	1.165
	Mean	2.703	1.878	1.576	1.539	1.424	1.324	1.248	1.239	1.210	1.159	1.540	1.297	1.188	1.130	1.075	1.724	1.414	1.300	1.259	1.192
	Standard Dev.	2.651	1.379	0.770	0.492	0.339	0.381	0.290	0.297	0.266	0.196	0.793	0.502	0.371	0.303	0.252	1.375	0.734	0.461	0.357	0.273

Table D.3 *(Continued)*

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Total As	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.988	0.793	0.997	0.935	0.824	1.001	1.001	1.001	1.001	1.001	0.870	0.870	0.870	0.870	0.870	0.870	0.793	0.870	0.870	0.824
	Maximum	2.521	1.837	1.488	1.314	1.209	3.489	2.918	2.165	1.915	1.778	3.909	2.775	2.490	1.951	1.630	3.909	2.918	2.490	1.951	1.778
	Median	1.708	1.459	1.226	1.165	1.121	1.202	1.203	1.180	1.151	1.133	1.686	1.549	1.442	1.341	1.227	1.456	1.410	1.252	1.247	1.160
	Mean	1.731	1.387	1.234	1.145	1.069	1.600	1.522	1.414	1.329	1.257	2.028	1.674	1.512	1.368	1.258	1.782	1.544	1.406	1.300	1.213
	Standard Dev.	0.633	0.435	0.217	0.173	0.183	0.888	0.684	0.472	0.364	0.286	1.227	0.769	0.598	0.392	0.275	0.938	0.639	0.465	0.334	0.260
Total Cd	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.001	0.944	0.984	1.024	1.050	0.885	0.974	0.974	0.974	0.960	0.211	0.219	0.225	0.231	0.235	0.211	0.219	0.225	0.231	0.235
	Maximum	4.642	2.896	2.106	1.710	1.501	1.911	1.610	1.631	1.613	1.476	2.529	2.070	1.764	1.600	1.420	4.642	2.896	2.106	1.710	1.501
	Median	1.312	1.282	1.224	1.347	1.283	1.398	1.395	1.234	1.151	1.101	1.679	1.463	1.349	1.278	1.197	1.398	1.395	1.293	1.199	1.112
	Mean	2.067	1.601	1.384	1.357	1.279	1.398	1.299	1.239	1.195	1.140	1.572	1.337	1.211	1.131	1.046	1.617	1.383	1.263	1.211	1.139
	Standard Dev.	1.725	0.892	0.501	0.326	0.241	0.422	0.262	0.238	0.234	0.189	0.950	0.713	0.593	0.521	0.451	0.989	0.591	0.428	0.365	0.310
Total Cr	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	0.733	0.595	0.916	1.101	1.128	0.958	0.973	0.973	0.973	0.973	0.702	0.702	0.702	0.702	0.702	0.702	0.595	0.702	0.702	0.702
	Maximum	2.169	1.693	1.450	1.486	1.376	2.228	1.739	1.693	1.603	1.462	2.374	2.098	1.877	1.629	1.435	2.374	2.098	1.877	1.629	1.462
	Median	1.263	1.287	1.238	1.228	1.273	1.319	1.286	1.276	1.211	1.140	1.443	1.465	1.370	1.284	1.196	1.319	1.286	1.276	1.211	1.172
	Mean	1.357	1.215	1.210	1.261	1.263	1.499	1.344	1.264	1.215	1.161	1.521	1.443	1.340	1.239	1.155	1.474	1.349	1.278	1.234	1.183
	Standard Dev.	0.612	0.505	0.259	0.163	0.131	0.544	0.296	0.238	0.201	0.154	0.703	0.543	0.423	0.318	0.248	0.583	0.425	0.304	0.229	0.183
Total Cu	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.058	0.953	0.954	0.968	0.977	0.934	0.934	0.934	0.934	0.934	0.860	0.882	0.882	0.882	0.882	0.860	0.882	0.882	0.882	0.882
	Maximum	2.370	1.699	1.408	1.508	1.394	2.105	1.813	1.658	1.608	1.472	2.317	1.815	1.651	1.448	1.320	2.370	1.815	1.658	1.608	1.472
	Median	1.419	1.287	1.234	1.229	1.169	1.282	1.129	1.126	1.105	1.088	1.496	1.354	1.264	1.198	1.130	1.336	1.213	1.200	1.196	1.150
	Mean	1.566	1.307	1.207	1.234	1.177	1.361	1.306	1.247	1.201	1.146	1.512	1.343	1.259	1.187	1.123	1.462	1.319	1.242	1.204	1.145
	Standard Dev.	0.566	0.311	0.190	0.222	0.170	0.426	0.322	0.263	0.233	0.184	0.618	0.394	0.303	0.228	0.172	0.505	0.325	0.248	0.215	0.167

Table D.3 *(Continued)*

Parameters		URS 23					URS 6-20F					URS 8-23C					Combined URS				
		MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50	MFF10	MFF20	MFF30	MFF40	MFF50
Total Ni	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.331	1.306	1.239	1.187	1.154	0.949	0.949	0.949	0.949	0.949	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856
	Maximum	2.494	1.754	1.440	1.427	1.334	2.036	1.662	1.661	1.628	1.502	2.414	2.000	1.893	1.676	1.484	2.494	2.000	1.893	1.676	1.502
	Median	1.790	1.467	1.302	1.263	1.200	1.463	1.207	1.136	1.140	1.112	1.554	1.462	1.347	1.252	1.173	1.547	1.422	1.272	1.243	1.189
	Mean	1.851	1.499	1.320	1.285	1.222	1.410	1.304	1.249	1.212	1.162	1.566	1.453	1.372	1.284	1.198	1.569	1.402	1.309	1.255	1.189
	Standard Dev.	0.504	0.190	0.088	0.103	0.078	0.410	0.274	0.241	0.222	0.178	0.648	0.476	0.389	0.296	0.215	0.523	0.337	0.271	0.222	0.168
Total Pb	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.129	0.969	0.984	0.993	0.962	0.959	0.959	0.959	0.959	0.959	0.628	0.410	0.508	0.727	0.816	0.628	0.410	0.508	0.727	0.816
	Maximum	3.118	1.991	1.578	1.569	1.462	2.837	2.207	1.796	1.773	1.614	2.282	1.905	1.605	1.479	1.375	3.118	2.207	1.796	1.773	1.614
	Median	1.294	1.305	1.262	1.263	1.214	1.369	1.212	1.174	1.152	1.132	1.641	1.375	1.284	1.188	1.106	1.369	1.212	1.174	1.155	1.132
	Mean	1.709	1.393	1.271	1.272	1.213	1.527	1.425	1.337	1.281	1.209	1.535	1.265	1.172	1.131	1.089	1.572	1.361	1.264	1.226	1.167
	Standard Dev.	0.950	0.469	0.271	0.251	0.206	0.667	0.435	0.320	0.281	0.223	0.757	0.578	0.437	0.303	0.216	0.722	0.471	0.342	0.275	0.211
Total Zn	No. of Cases	4	4	4	4	4	7	7	7	7	7	6	6	6	6	6	17	17	17	17	17
	Minimum	1.151	1.061	1.079	1.107	1.092	0.951	0.964	0.964	0.964	0.963	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760
	Maximum	2.515	1.711	1.415	1.501	1.397	1.669	1.574	1.587	1.538	1.416	2.493	1.975	1.678	1.511	1.380	2.515	1.975	1.678	1.538	1.416
	Median	1.419	1.255	1.195	1.195	1.151	1.193	1.149	1.118	1.076	1.059	1.448	1.304	1.233	1.190	1.131	1.391	1.196	1.147	1.170	1.127
	Mean	1.626	1.320	1.221	1.249	1.198	1.249	1.196	1.186	1.166	1.130	1.499	1.285	1.188	1.130	1.077	1.426	1.257	1.195	1.173	1.127
	Standard Dev.	0.607	0.280	0.146	0.182	0.137	0.281	0.216	0.220	0.208	0.168	0.687	0.454	0.337	0.269	0.217	0.521	0.316	0.241	0.217	0.176

Table D.4 MFF Ranking by Median Value for UCLA1, 2 and 3 (2000~2003)

Rank	UCLA 1									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	COD	2.184	COD	1.740	Total P	1.503	TSS	1.347	NH3-N	1.231
2	TKN	1.991	Total P	1.706	TSS	1.487	NH3-N	1.333	TSS	1.211
3	TSS	1.911	Dissolved P	1.688	NH3-N	1.448	Total P	1.316	Total P	1.209
4	Conductivity	1.878	TKN	1.589	COD	1.430	COD	1.269	TKN	1.197
5	Dissolved P	1.865	Dissolved Ni	1.577	Dissolved P	1.410	Dissolved P	1.264	Dissolved Zn	1.194
6	Oil & Grease	1.834	Oil & Grease	1.567	TKN	1.380	Total Zn	1.259	Dissolved Ni	1.182
7	NH3-N	1.795	TSS	1.559	Total Zn	1.377	TKN	1.257	Dissolved P	1.176
8	DOC	1.792	NH3-N	1.558	Dissolved Ni	1.362	Dissolved Zn	1.256	DOC	1.174
9	Total P	1.792	DOC	1.522	DOC	1.358	DOC	1.238	Total Ni	1.172
10	Dissolved Ni	1.772	Total Ni	1.489	Oil & Grease	1.355	Dissolved Ni	1.237	Total Zn	1.170
11	Total Ni	1.720	Total Zn	1.484	Total Ni	1.351	Total Cr	1.233	COD	1.168
12	NO2-N	1.688	Dissolved Zn	1.428	Total Cr	1.293	Total Ni	1.227	Total Cu	1.150
13	Hardness	1.543	Conductivity	1.416	Dissolved Zn	1.261	Oil & Grease	1.181	Total Pb	1.130
14	Dissolved Cu	1.541	Dissolved Cu	1.401	Total Cu	1.259	Total Cu	1.177	Oil & Grease	1.126
15	Dissolved Zn	1.514	Total Cu	1.396	Conductivity	1.240	NO2-N	1.168	Total Cr	1.113
16	Total Zn	1.475	NO2-N	1.392	NO2-N	1.238	Conductivity	1.152	NO2-N	1.113
17	Turbidity	1.435	Total Cr	1.358	Dissolved Cu	1.219	Total Pb	1.148	Turbidity	1.113
18	Total Cu	1.377	Turbidity	1.299	Total Pb	1.200	Turbidity	1.141	Dissolved Cu	1.091
19	Total Pb	1.296	Total Pb	1.225	Turbidity	1.199	Dissolved Cu	1.132	Conductivity	1.080
20	Dissolved Cr	1.218	Hardness	1.200	Hardness	1.126	Hardness	1.069	Hardness	1.036
21	Total Cr	1.180	Dissolved Cr	1.152	Total Cd	1.052	Total Cd	1.033	Total Cd	1.022
22	NO3-N	1.100	Total Cd	1.074	Dissolved Cr	1.031	Dissolved Cd	1.001	Dissolved Cd	1.000
23	Total Cd	1.071	Dissolved Cd	1.001	Dissolved Cd	1.001	Dissolved Pb	1.000	Dissolved Pb	1.000
24	Dissolved Cd	1.003	Dissolved Pb	1.000	Dissolved Pb	1.000	PO4-P	1.000	PO4-P	1.000
25	Dissolved Pb	1.000	PO4-P	1.000	PO4-P	1.000	Dissolved Cr	0.974	NO3-N	0.975
26	PO4-P	1.000	NO3-N	0.983	NO3-N	0.956	NO3-N	0.961	Dissolved Cr	0.964

Table D.4 *(Continued)*

Rank	UCLA 2									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	Dissolved Cu	2.605	Dissolved Ni	2.086	NH3-N	1.698	DOC	1.484	TSS	1.404
2	DOC	2.585	DOC	2.005	DOC	1.671	NH3-N	1.479	NH3-N	1.336
3	Dissolved Zn	2.537	NH3-N	2.000	Dissolved Ni	1.666	TKN	1.462	DOC	1.320
4	Dissolved Ni	2.497	Total Zn	1.999	TKN	1.651	Total Zn	1.452	TKN	1.310
5	COD	2.409	Dissolved Cu	1.982	Total Zn	1.643	Dissolved P	1.440	Total Zn	1.301
6	Total Zn	2.326	COD	1.948	Dissolved P	1.636	Dissolved Ni	1.409	Dissolved P	1.286
7	Oil & Grease	2.317	TKN	1.944	Dissolved Cu	1.625	Dissolved Cu	1.397	Dissolved Cu	1.271
8	NH3-N	2.271	Dissolved Zn	1.927	Dissolved Zn	1.581	TSS	1.385	COD	1.267
9	TKN	2.155	Dissolved P	1.862	COD	1.573	COD	1.377	Total P	1.261
10	Dissolved P	2.122	Total Ni	1.845	Total P	1.561	Total Ni	1.359	Total Ni	1.231
11	Total Ni	1.974	Total Cu	1.714	Total Ni	1.538	Total P	1.358	Dissolved Ni	1.224
12	Total P	1.960	Oil & Grease	1.709	TSS	1.520	Dissolved Zn	1.339	Total Pb	1.221
13	Total Cu	1.956	Total P	1.703	Oil & Grease	1.494	Oil & Grease	1.318	Total Cu	1.217
14	NO3-N	1.777	NO3-N	1.486	Total Cu	1.480	Total Cu	1.313	Dissolved Zn	1.214
15	Hardness	1.713	Total Cd	1.459	PO4-P	1.383	PO4-P	1.290	Oil & Grease	1.209
16	PO4-P	1.628	Turbidity	1.429	Total Cd	1.381	Total Cd	1.267	Hardness	1.207
17	Conductivity	1.614	TSS	1.416	Turbidity	1.307	Dissolved Pb	1.258	PO4-P	1.202
18	Total Cd	1.586	Dissolved Pb	1.377	Dissolved Pb	1.289	Total Pb	1.233	Dissolved Pb	1.190
19	TSS	1.560	PO4-P	1.366	NO3-N	1.286	Dissolved Cd	1.230	Total Cd	1.165
20	Dissolved Cr	1.493	Dissolved Cr	1.349	Total Pb	1.274	Hardness	1.213	NO2-N	1.162
21	Dissolved Cd	1.465	Total Pb	1.323	Dissolved Cr	1.239	NO3-N	1.205	Dissolved Cd	1.155
22	Turbidity	1.449	Dissolved Cd	1.307	NO2-N	1.210	Turbidity	1.179	Dissolved Cr	1.145
23	Dissolved Pb	1.410	NO2-N	1.251	Dissolved Cd	1.202	NO2-N	1.171	NO3-N	1.137
24	NO2-N	1.384	Hardness	1.227	Conductivity	1.164	Total Cr	1.169	Total Cr	1.130
25	Total Pb	1.309	Conductivity	1.214	Total Cr	1.138	Dissolved Cr	1.164	Turbidity	1.112
26	Total Cr	1.253	Total Cr	1.200	Hardness	1.131	Conductivity	1.106	Conductivity	1.070

Table D.4 *(Continued)*

Rank	UCLA 3									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	DOC	3.462	DOC	2.511	DOC	2.083	DOC	1.716	DOC	1.459
2	TKN	2.977	Dissolved Ni	2.405	Dissolved Ni	1.896	Dissolved Ni	1.576	COD	1.388
3	NH3-N	2.890	COD	2.326	COD	1.872	COD	1.553	Dissolved Ni	1.383
4	COD	2.789	TKN	2.180	TKN	1.754	TKN	1.528	TKN	1.380
5	Dissolved Cu	2.768	Dissolved Cu	2.122	TSS	1.751	TSS	1.526	NH3-N	1.380
6	Dissolved Ni	2.645	NH3-N	2.099	NH3-N	1.714	NH3-N	1.511	TSS	1.348
7	Oil & Grease	2.277	TSS	1.980	Dissolved Cu	1.626	Dissolved Cu	1.510	Dissolved Cu	1.341
8	Conductivity	2.276	Total Ni	1.864	Oil & Grease	1.610	Oil & Grease	1.421	Total Ni	1.331
9	Total Ni	2.254	Total Cu	1.792	Total Ni	1.601	Total Ni	1.413	Conductivity	1.298
10	Total Cu	2.193	Oil & Grease	1.787	Dissolved P	1.537	Total Cu	1.388	Oil & Grease	1.294
11	Dissolved P	2.186	Dissolved P	1.747	Total Cu	1.526	Dissolved P	1.377	Total Cu	1.291
12	Dissolved Zn	2.173	Total P	1.747	Total Zn	1.518	Total Zn	1.369	Dissolved Zn	1.268
13	Total P	2.035	Conductivity	1.741	Conductivity	1.465	Conductivity	1.367	Total Zn	1.268
14	TSS	1.980	Dissolved Zn	1.661	Total P	1.455	Dissolved Zn	1.332	Dissolved P	1.260
15	Hardness	1.933	Total Zn	1.652	Hardness	1.444	Total P	1.332	Total P	1.228
16	Total Zn	1.878	Hardness	1.607	Dissolved Zn	1.423	Hardness	1.314	Hardness	1.223
17	NO3-N	1.704	NO3-N	1.573	NO3-N	1.409	Dissolved Pb	1.286	Dissolved Pb	1.195
18	Total Cd	1.422	NO2-N	1.369	Dissolved Pb	1.307	NO3-N	1.241	NO3-N	1.164
19	NO2-N	1.420	Dissolved Pb	1.339	Total Pb	1.258	NO2-N	1.178	Total Cr	1.112
20	Dissolved Pb	1.369	Total Cd	1.269	Total Cd	1.244	Total Pb	1.167	Dissolved Cd	1.093
21	Dissolved Cd	1.347	Total Cr	1.224	NO2-N	1.217	Total Cd	1.144	Total Pb	1.085
22	Total Cr	1.241	Total Pb	1.131	Total Cr	1.201	Total Cr	1.144	NO2-N	1.084
23	Turbidity	1.196	Turbidity	1.093	Dissolved Cd	1.177	Dissolved Cd	1.140	Turbidity	1.080
24	Total Pb	1.139	Dissolved Cd	1.091	Turbidity	1.116	Turbidity	1.120	Total Cd	1.074
25	Dissolved Cr	1.134	Dissolved Cr	1.040	Dissolved Cr	1.040	Dissolved Cr	1.040	Dissolved Cr	1.073
26	PO4-P	1.000	PO4-P	1.000	PO4-P	1.000	PO4-P	1.000	PO4-P	1.000

Table D.4 *(Continued)*

Rank	Combined UCLA									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	DOC	2.465	Dissolved Ni	1.943	NH3-N	1.642	NH3-N	1.458	TSS	1.347
2	Dissolved Ni	2.416	DOC	1.942	TKN	1.634	TKN	1.454	NH3-N	1.339
3	COD	2.410	TKN	1.895	Dissolved Ni	1.628	DOC	1.441	DOC	1.325
4	TKN	2.346	COD	1.883	DOC	1.623	COD	1.424	TKN	1.303
5	NH3-N	2.219	NH3-N	1.882	COD	1.605	Dissolved Ni	1.409	COD	1.296
6	Dissolved Cu	2.206	Dissolved P	1.748	TSS	1.576	TSS	1.397	Dissolved Ni	1.260
7	Dissolved P	2.170	TSS	1.718	Dissolved P	1.512	Dissolved P	1.363	Dissolved P	1.260
8	Oil & Grease	2.091	Total P	1.717	Total Ni	1.489	Total Zn	1.358	Total Zn	1.250
9	Conductivity	2.070	Oil & Grease	1.699	Total Cu	1.481	Dissolved Cu	1.351	Dissolved Cu	1.235
10	Dissolved Zn	1.976	Dissolved Cu	1.680	Dissolved Cu	1.478	Total Cu	1.339	Total P	1.235
11	Total Ni	1.974	Total Ni	1.680	Total P	1.476	Total Ni	1.333	Total Cu	1.231
12	Total P	1.956	Total Zn	1.666	Total Zn	1.464	Total P	1.333	Total Ni	1.223
13	Total Zn	1.927	Dissolved Zn	1.657	Oil & Grease	1.431	Oil & Grease	1.317	Oil & Grease	1.223
14	Total Cu	1.885	Total Cu	1.644	Dissolved Zn	1.426	Dissolved Zn	1.300	Conductivity	1.210
15	Hardness	1.750	Conductivity	1.538	Conductivity	1.373	Conductivity	1.271	Dissolved Zn	1.204
16	TSS	1.711	Hardness	1.484	Hardness	1.302	Hardness	1.215	Hardness	1.176
17	NO3-N	1.638	NO2-N	1.371	Total Pb	1.261	Dissolved Pb	1.193	Total Pb	1.143
18	NO2-N	1.493	NO3-N	1.345	Turbidity	1.235	Total Pb	1.184	NO2-N	1.134
19	Total Cd	1.378	Turbidity	1.288	Dissolved Pb	1.234	NO2-N	1.175	Total Cr	1.119
20	Dissolved Pb	1.298	Total Cd	1.264	NO2-N	1.219	Total Cr	1.169	Turbidity	1.110
21	Turbidity	1.270	Total Pb	1.230	Total Cd	1.205	Turbidity	1.168	NO3-N	1.103
22	Dissolved Cr	1.268	Total Cr	1.223	NO3-N	1.200	NO3-N	1.147	Dissolved Pb	1.093
23	Total Pb	1.258	Dissolved Pb	1.206	Total Cr	1.175	Total Cd	1.141	Total Cd	1.072
24	Total Cr	1.237	Dissolved Cr	1.172	Dissolved Cr	1.104	Dissolved Cr	1.109	Dissolved Cr	1.070
25	Dissolved Cd	1.137	Dissolved Cd	1.087	Dissolved Cd	1.080	Dissolved Cd	1.034	Dissolved Cd	1.015
26	PO4-P	1.000	PO4-P	1.000	PO4-P	1.000	PO4-P	1.000	PO4-P	1.000

Table D.5 MFF Ranking by Median Value for CDM 7-10 and 7-185 (1999~2000)

Rank	CDM 7-10									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	Dissolved Ni	1.939	NH_3-N	1.570	Dissolved Ni	1.543	Dissolved Ni	1.375	TSS	1.303
2	NH_3-N	1.798	Dissolved Ni	1.534	NH_3-N	1.482	NH_3-N	1.363	NH_3-N	1.283
3	TSS	1.641	Dissolved Cu	1.492	Oil & Grease	1.381	Oil & Grease	1.307	Dissolved Ni	1.271
4	Particulate Cd	1.580	TSS	1.438	Particulate Ni	1.341	Particulate Cu	1.284	Total Ni	1.259
5	TOC	1.544	Total Ni	1.382	Total Ni	1.335	Total Ni	1.272	Particulate Cu	1.257
6	Total Ni	1.516	Dissolved Zn	1.376	Particulate Cu	1.330	Particulate Ni	1.259	Particulate Cr	1.231
7	Hardness	1.493	Particulate Zn	1.341	Dissolved Cu	1.328	Dissolved Zn	1.248	Particulate Ni	1.229
8	Particulate Zn	1.493	Total Zn	1.329	Dissolved Zn	1.319	Particulate Zn	1.237	Total Cr	1.225
9	Total Cr	1.459	Dissolved Cr	1.326	Particulate Cr	1.319	Particulate Cr	1.227	Oil & Grease	1.223
10	Total Zn	1.456	Particulate Cu	1.325	Total Cr	1.297	Total Zn	1.226	Total Cu	1.220
11	Dissolved Cu	1.443	Total Cr	1.324	Particulate Zn	1.293	Total Pb	1.223	Particulate Cd	1.218
12	Particulate Cr	1.437	Oil & Grease	1.322	Total Zn	1.284	TOC	1.221	Particulate Pb	1.215
13	Particulate Pb	1.417	Hardness	1.311	TSS	1.279	Total Cr	1.219	Total Zn	1.215
14	Total Cd	1.409	TOC	1.310	Total Cu	1.257	Total Cu	1.212	Particulate Zn	1.213
15	Total Pb	1.386	Particulate Ni	1.310	Dissolved Cr	1.248	Dissolved Cu	1.210	Total Pb	1.208
16	Particulate Cu	1.376	Total Cu	1.275	Particulate Pb	1.244	Dissolved Cr	1.209	Total P	1.200
17	Oil & Grease	1.374	Particulate Pb	1.274	Hardness	1.233	Particulate Cd	1.202	TOC	1.190
18	Total Cu	1.369	Particulate Cr	1.262	Total Pb	1.231	TSS	1.194	Dissolved Zn	1.184
19	Particulate Ni	1.365	Total Pb	1.254	TOC	1.194	Particulate Pb	1.189	Total Cd	1.180
20	Total P	1.330	Particulate Cd	1.221	Particulate Cd	1.148	Total Cd	1.185	Hardness	1.173
21	Ortho-P	1.242	Ortho-P	1.172	Dissolved Pb	1.134	Hardness	1.175	Dissolved Cr	1.156
22	Dissolved Cr	1.216	Dissolved Pb	1.160	Total Cd	1.106	Dissolved Pb	1.096	Dissolved Cu	1.137
23	Dissolved Zn	1.125	Total P	1.158	Ortho-P	1.095	Ortho-P	1.092	Ortho-P	1.097
24	Dissolved Pb	1.014	Total Cd	1.157	Total P	1.092	Total P	1.040	Dissolved Pb	1.075
26	Dissolved Cd	1.000	Dissolved Cd	1.000	Dissolved Cd	1.000	Dissolved Cd	1.000	Dissolved Cd	1.000

Table D.5 *(Continued)*

Rank	CDM 7-185									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	NH_3-N	1.714	NH_3-N	1.491	NH_3-N	1.464	NH_3-N	1.377	NH_3-N	1.251
2	Dissolved Ni	1.473	Dissolved Ni	1.411	Dissolved Ni	1.362	Dissolved Ni	1.301	TOC	1.201
3	TOC	1.467	TOC	1.318	TOC	1.318	TOC	1.267	Dissolved Ni	1.201
4	Total P	1.322	Dissolved Cu	1.287	Dissolved Cu	1.260	Dissolved Cu	1.201	Oil & Grease	1.162
5	Dissolved Cu	1.318	Hardness	1.249	Dissolved Zn	1.235	Dissolved Zn	1.198	Dissolved Zn	1.146
6	Dissolved Zn	1.289	Dissolved Zn	1.235	Ortho-P	1.230	Hardness	1.177	Dissolved Cu	1.119
7	Ortho-P	1.279	Ortho-P	1.230	Hardness	1.204	Oil & Grease	1.169	Hardness	1.114
8	Oil & Grease	1.266	Oil & Grease	1.188	Oil & Grease	1.182	Ortho-P	1.137	Ortho-P	1.082
9	Hardness	1.249	Total P	1.112	Total Ni	1.117	Total Ni	1.123	Total Ni	1.082
10	Dissolved Cr	1.069	Dissolved Cr	1.074	Total Zn	1.083	Total Pb	1.113	Total Pb	1.081
11	TSS	1.028	Total Zn	1.068	Total P	1.080	Particulate Pb	1.106	Particulate Pb	1.075
12	Total Zn	1.028	Total Ni	1.033	Dissolved Cr	1.079	Total Zn	1.090	Total Cu	1.063
13	Total Ni	1.021	Dissolved Cd	1.000	Total Cu	1.055	Total P	1.080	Total P	1.045
14	Dissolved Cd	1.000	Total Cu	0.963	Particulate Zn	1.051	Total Cu	1.076	TSS	1.042
15	Total Cu	0.963	Total Cd	0.956	TSS	1.050	Particulate Zn	1.058	Total Zn	1.042
16	Total Cd	0.956	Dissolved Pb	0.953	Particulate Pb	1.032	Dissolved Cr	1.051	Dissolved Cr	1.034
17	Particulate Cd	0.916	Particulate Cd	0.916	Particulate Ni	1.016	TSS	1.048	Particulate Cu	1.030
18	Particulate Zn	0.900	TSS	0.884	Total Pb	1.010	Particulate Ni	1.044	Total Cr	1.024
19	Dissolved Pb	0.894	Particulate Zn	0.881	Particulate Cu	1.001	Particulate Cu	1.035	Particulate Zn	1.015
20	Particulate Cu	0.855	Particulate Cu	0.855	Dissolved Cd	1.000	Total Cr	1.020	Particulate Ni	1.014
21	Total Pb	0.839	Total Pb	0.839	Total Cd	0.989	Particulate Cd	1.019	Particulate Cd	1.006
22	Particulate Pb	0.830	Particulate Pb	0.830	Total Cr	0.986	Total Cd	1.018	Total Cd	1.006
23	Total Cr	0.822	Total Cr	0.816	Particulate Cd	0.983	Particulate Cr	1.008	Dissolved Cd	1.000
24	Particulate Ni	0.809	Particulate Ni	0.793	Particulate Cr	0.964	Dissolved Cd	1.000	Particulate Cr	0.999
26	Particulate Cr	0.764	Particulate Cr	0.742	Dissolved Pb	0.962	Dissolved Pb	0.912	Dissolved Pb	0.861

Table D.5 *(Continued)*

Rank	Combined CDM									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	NH_3-N	1.714	NH_3-N	1.497	NH_3-N	1.464	NH_3-N	1.367	NH_3-N	1.267
2	TOC	1.487	Dissolved Ni	1.414	Dissolved Ni	1.409	Dissolved Ni	1.308	Dissolved Ni	1.236
3	Dissolved Ni	1.474	Dissolved Zn	1.364	Oil & Grease	1.332	Oil & Grease	1.247	TSS	1.230
4	Dissolved Cu	1.398	TOC	1.318	TOC	1.299	TOC	1.241	Particulate Pb	1.204
5	Particulate Zn	1.373	Dissolved Cu	1.308	Dissolved Cu	1.260	Dissolved Cu	1.201	TOC	1.201
6	Particulate Cr	1.368	Oil & Grease	1.290	Dissolved Zn	1.248	Dissolved Zn	1.198	Oil & Grease	1.191
7	TSS	1.354	Hardness	1.255	Hardness	1.225	Particulate Cd	1.185	Particulate Cu	1.179
8	Oil & Grease	1.332	Total Ni	1.253	Total Ni	1.221	Total Ni	1.181	Total Pb	1.176
9	Total Ni	1.330	Ortho-P	1.230	Particulate Cu	1.165	Hardness	1.175	Total Ni	1.169
10	Particulate Cd	1.327	Dissolved Cr	1.168	Total Cu	1.150	Particulate Cr	1.173	Particulate Cr	1.159
11	Total P	1.322	Total Cu	1.167	Particulate Ni	1.134	Particulate Cu	1.155	Particulate Ni	1.157
12	Particulate Ni	1.292	Particulate Cd	1.151	Particulate Zn	1.134	Total Cu	1.154	Particulate Cd	1.154
13	Hardness	1.282	Particulate Cu	1.138	Ortho-P	1.125	Particulate Ni	1.152	Dissolved Zn	1.146
14	Ortho-P	1.257	Total P	1.112	Dissolved Cr	1.107	Total Cd	1.143	Total Cu	1.140
15	Total Zn	1.236	Total Cd	1.105	Particulate Cr	1.101	Particulate Zn	1.134	Particulate Zn	1.138
16	Dissolved Zn	1.235	TSS	1.101	Total Zn	1.097	Total Pb	1.126	Hardness	1.136
17	Total Cu	1.233	Total Cr	1.101	Total Pb	1.081	Ortho-P	1.121	Total Zn	1.133
18	Total Cd	1.227	Particulate Zn	1.083	Total P	1.080	Particulate Pb	1.118	Dissolved Cu	1.119
19	Total Cr	1.220	Total Zn	1.083	Particulate Pb	1.073	Total Zn	1.109	Total Cd	1.110
20	Particulate Cu	1.199	Particulate Ni	1.080	TSS	1.050	Dissolved Cr	1.107	Dissolved Cr	1.107
21	Dissolved Cr	1.134	Particulate Cr	1.064	Total Cr	1.040	Total Cr	1.081	Total Cr	1.107
22	Particulate Pb	1.056	Dissolved Cd	1.000	Particulate Cd	1.023	Total P	1.080	Ortho-P	1.082
23	Total Pb	1.024	Particulate Pb	0.983	Total Cd	1.016	TSS	1.048	Total P	1.059
24	Dissolved Cd	1.000	Dissolved Pb	0.971	Dissolved Pb	1.005	Dissolved Cd	1.000	Dissolved Pb	1.003
26	Dissolved Pb	0.924	Total Pb	0.965	Dissolved Cd	1.000	Dissolved Pb	0.971	Dissolved Cd	1.000

Table D.6 MFF Ranking by Median Value for URS 23, 6-20F and 8-23C (2000~2001)

Rank	URS 23									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	Particulate Ni	1.969	TSS	1.850	TSS	1.630	TSS	1.625	Particulate Cr	1.537
2	TSS	1.852	Particulate Ni	1.588	Dissolved As	1.581	Particulate Ni	1.588	Particulate Ni	1.522
3	Total Ni	1.790	Dissolved As	1.489	Particulate Ni	1.484	Particulate Zn	1.510	Particulate Zn	1.481
4	Total As	1.708	Total Ni	1.467	Particulate Cr	1.308	Particulate Cr	1.507	TSS	1.445
5	Particulate Zn	1.540	Total As	1.459	Total Ni	1.302	Dissolved As	1.456	Dissolved As	1.357
6	DOC	1.529	Particulate Cr	1.372	Turbidity	1.299	Particulate Cd	1.369	Particulate Cd	1.356
7	COD	1.516	Turbidity	1.352	Particulate Pb	1.284	Total Cd	1.347	Total Cd	1.283
8	TOC	1.507	COD	1.348	Particulate Zn	1.279	Particulate Pb	1.291	Total Cr	1.273
9	Particulate Cu	1.427	Particulate Zn	1.332	Particulate Cu	1.277	Particulate Cu	1.268	Particulate Pb	1.239
10	Total Cu	1.419	Particulate Pb	1.329	Total Pb	1.262	COD	1.266	Total Pb	1.214
11	Total Zn	1.419	DOC	1.320	COD	1.251	Total Ni	1.263	COD	1.206
12	NO_3-N	1.410	Particulate Cu	1.305	Total Cr	1.238	Total Pb	1.263	Total Ni	1.200
13	Dissolved Cu	1.402	Total Pb	1.305	Total Cu	1.234	Turbidity	1.239	Particulate Cu	1.193
14	Turbidity	1.377	TOC	1.296	Total As	1.226	Total Cu	1.229	Turbidity	1.192
15	Particulate Cr	1.352	Total Cr	1.287	Total Cd	1.224	Total Cr	1.228	Total Cu	1.169
16	TDS	1.335	Total Cu	1.287	Particulate Cd	1.201	Total Zn	1.195	Total Zn	1.151
17	Dissolved Ni	1.333	NO_3-N	1.286	Total Zn	1.195	Total As	1.165	Total As	1.121
18	Particulate Cd	1.332	Total Cd	1.282	DOC	1.168	DOC	1.149	Dissolved Cr	1.118
19	TKN	1.315	Total Zn	1.255	NO_3-N	1.154	TOC	1.137	Ortho-P	1.075
20	Total Cd	1.312	Particulate Cd	1.244	TOC	1.151	Ortho-P	1.111	TKN	1.062
21	Particulate Pb	1.306	TDS	1.225	Ortho-P	1.144	NO_3-N	1.108	DOC	1.061
22	Particulate As	1.302	Ortho-P	1.225	TKN	1.106	Dissolved Cr	1.100	NO_3-N	1.061
23	Ortho-P	1.299	Dissolved Cu	1.219	Dissolved Pb	1.106	TKN	1.093	NH_3-N	1.057
24	Total Pb	1.294	TKN	1.190	Hardness	1.103	Hardness	1.076	TOC	1.053
25	NH_3-N	1.266	Dissolved Cd	1.162	Dissolved Cu	1.098	Dissolved Ni	1.069	Dissolved Cd	1.049
26	Total Cr	1.263	Dissolved Ni	1.159	NH_3-N	1.084	NH_3-N	1.068	Hardness	1.037
27	Dissolved As	1.260	NH_3-N	1.156	Dissolved Cd	1.066	Dissolved Cu	1.064	Dissolved Cu	1.037
28	Dissolved Cd	1.191	Hardness	1.151	TDS	1.061	Dissolved Pb	1.043	Total P	1.033
29	Dissolved Pb	1.128	Dissolved Pb	1.142	Dissolved Ni	1.060	Total P	1.027	Dissolved Pb	1.030
30	Conductivity	1.109	Conductivity	1.141	Dissolved Cr	1.056	Conductivity	1.026	Dissolved Ni	1.021
31	Dissolved Zn	1.070	Dissolved Zn	1.021	Conductivity	1.051	Oil & Grease	1.000	Conductivity	1.016
32	Hardness	1.028	Oil & Grease	1.000	Oil & Grease	1.000	Dissolved Cd	0.995	Oil & Grease	1.000
33	Oil & Grease	1.000	Dissolved Cr	0.974	Total P	0.993	TDS	0.971	TDS	0.950
34	Total P	0.961	Total P	0.926	Dissolved Zn	0.943	Dissolved Zn	0.932	Particulate As	0.925
35	Dissolved Cr	0.796	Particulate As	0.646	Particulate As	0.615	Particulate As	0.837	Dissolved Zn	0.903

Table D.6 *(Continued)*

Rank	URS 6-20F									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	TSS	1.815	TSS	1.603	TSS	1.426	TSS	1.299	TSS	1.309
2	Particulate Ni	1.494	Total Cd	1.395	Total Cr	1.276	Turbidity	1.243	Turbidity	1.199
3	Total Ni	1.463	Particulate Cd	1.370	Turbidity	1.275	Total Cr	1.211	Particulate As	1.173
4	Oil & Grease	1.431	Particulate Ni	1.356	Particulate Ni	1.241	Particulate Ni	1.181	Particulate Ni	1.146
5	Particulate Cd	1.411	COD	1.310	Particulate As	1.236	TDS	1.180	Particulate Pb	1.146
6	COD	1.404	Turbidity	1.296	Total Cd	1.234	Dissolved As	1.174	Total Cr	1.140
7	Total Cd	1.398	Particulate As	1.289	Hardness	1.230	NO_3-N	1.170	NH_3-N	1.136
8	Particulate Pb	1.373	Total Cr	1.286	Particulate Cd	1.215	Particulate Pb	1.168	Total As	1.133
9	Total Pb	1.369	Dissolved Cd	1.277	NO_3-N	1.210	COD	1.163	Total Pb	1.132
10	Turbidity	1.341	NO_3-N	1.275	COD	1.205	Particulate As	1.160	Particulate Cr	1.126
11	Particulate Cr	1.326	DOC	1.274	Particulate Pb	1.194	Total Pb	1.152	Total Ni	1.112
12	DOC	1.324	TOC	1.267	Total As	1.180	Total As	1.151	COD	1.111
13	Total Cr	1.319	Hardness	1.245	Total Pb	1.174	Total Cd	1.151	Particulate Cu	1.110
14	Particulate Cu	1.300	Particulate Pb	1.232	TOC	1.161	Hardness	1.149	TDS	1.107
15	TOC	1.299	Particulate Cu	1.220	Particulate Cu	1.157	Total Ni	1.140	Total Cd	1.101
16	Dissolved As	1.297	Total Pb	1.212	DOC	1.156	Particulate Cr	1.139	TOC	1.092
17	Total Cu	1.282	Total P	1.211	Particulate Zn	1.154	Particulate Cd	1.134	DOC	1.090
18	Dissolved Cd	1.253	Total Ni	1.207	Total Ni	1.136	Particulate Cu	1.134	Total Cu	1.088
19	Particulate As	1.249	Total As	1.203	NH_3-N	1.131	NH_3-N	1.126	NO_3-N	1.086
20	Particulate Zn	1.247	Particulate Zn	1.193	Particulate Cr	1.131	TOC	1.113	Particulate Zn	1.084
21	NH_3-N	1.208	Oil & Grease	1.192	Total P	1.130	DOC	1.112	Dissolved As	1.080
22	Total As	1.202	TKN	1.185	Total Cu	1.126	Particulate Zn	1.111	Ortho-P	1.072
23	Total Zn	1.193	Ortho-P	1.182	Total Zn	1.118	Total Cu	1.105	Particulate Cd	1.071
24	NO_3-N	1.186	Particulate Cr	1.179	Oil & Grease	1.111	Total Zn	1.076	Hardness	1.070
25	TKN	1.177	NH_3-N	1.157	Ortho-P	1.106	Oil & Grease	1.072	Conductivity	1.060
26	Hardness	1.174	Total Zn	1.149	Dissolved Cr	1.075	Ortho-P	1.068	Total P	1.059
27	Conductivity	1.152	Total Cu	1.129	TKN	1.070	Dissolved Cr	1.065	Total Zn	1.059
28	Dissolved Cu	1.110	Conductivity	1.092	Dissolved Cu	1.064	Conductivity	1.053	Dissolved Cr	1.050
29	Dissolved Pb	1.101	Dissolved Cr	1.082	TDS	1.063	Dissolved Cu	1.047	Oil & Grease	1.048
30	Dissolved Cr	1.098	Dissolved Cu	1.081	Conductivity	1.062	Total P	1.045	Dissolved Cu	1.044
31	TDS	1.044	Dissolved As	1.064	Dissolved As	1.060	TKN	1.033	TKN	1.033
32	Dissolved Ni	1.028	Dissolved Pb	1.042	Dissolved Cd	1.028	Dissolved Pb	1.016	Dissolved Pb	1.011
33	Ortho-P	0.986	Dissolved Ni	1.011	Dissolved Pb	1.025	Dissolved Cd	1.000	Dissolved Cd	1.000
34	Total P	0.960	TDS	0.939	Dissolved Ni	0.965	Dissolved Ni	0.973	Dissolved Ni	0.982
35	Dissolved Zn	0.836	Dissolved Zn	0.866	Dissolved Zn	0.922	Dissolved Zn	0.913	Dissolved Zn	0.967

Table D.6 *(Continued)*

Rank	URS 8-23C									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	TSS	2.023	TSS	1.715	TSS	1.564	TSS	1.466	TSS	1.323
2	Particulate As	1.757	Particulate As	1.591	Particulate As	1.458	Particulate Ni	1.348	Particulate Ni	1.256
3	TOC	1.756	Total As	1.549	Total As	1.442	Dissolved As	1.341	Dissolved As	1.254
4	Particulate Cd	1.747	Particulate Cr	1.531	Particulate Cr	1.412	Total As	1.341	Particulate Cr	1.242
5	DOC	1.726	Particulate Cd	1.519	Particulate Ni	1.411	Particulate Cr	1.335	Particulate Cd	1.234
6	Particulate Pb	1.701	TOC	1.515	Particulate Cd	1.398	Particulate As	1.331	Total As	1.227
7	Total As	1.686	Particulate Ni	1.514	NH_3-N	1.397	Particulate Cd	1.322	Particulate Cu	1.226
8	Total Cd	1.679	DOC	1.511	Particulate Cu	1.390	Particulate Cu	1.312	Particulate As	1.219
9	Particulate Cu	1.654	COD	1.505	Total Cr	1.370	NH_3-N	1.286	Total Cd	1.197
10	TKN	1.648	Particulate Cu	1.495	Dissolved As	1.359	Total Cr	1.284	Total Cr	1.196
11	Hardness	1.644	NH_3-N	1.485	Total Cd	1.349	Total Cd	1.278	TKN	1.194
12	Total Pb	1.641	Hardness	1.470	Total Ni	1.347	TKN	1.256	Hardness	1.177
13	Particulate Ni	1.624	Total Cr	1.465	Hardness	1.343	Total Ni	1.252	NH_3-N	1.175
14	COD	1.608	Total Cd	1.463	COD	1.340	Hardness	1.240	Total Ni	1.173
15	Total Ni	1.554	Total Ni	1.462	TKN	1.315	Particulate Zn	1.236	Particulate Zn	1.164
16	NH_3-N	1.532	TKN	1.438	TOC	1.312	Particulate Pb	1.212	Conductivity	1.163
17	TDS	1.529	Particulate Pb	1.412	Particulate Pb	1.311	Total Cu	1.198	Dissolved Ni	1.141
18	Particulate Zn	1.514	TDS	1.397	DOC	1.307	TOC	1.197	Ortho-P	1.137
19	Particulate Cr	1.504	Turbidity	1.375	Total Pb	1.284	DOC	1.192	Total Zn	1.131
20	Turbidity	1.503	Total Pb	1.375	Particulate Zn	1.283	Total Zn	1.190	Total Cu	1.130
21	Dissolved Ni	1.496	Dissolved As	1.373	Total Cu	1.264	Total Pb	1.188	Particulate Pb	1.126
22	Total Cu	1.496	Particulate Zn	1.360	Turbidity	1.261	Turbidity	1.172	DOC	1.111
23	Total Zn	1.448	Total Cu	1.354	Total Zn	1.233	Dissolved Ni	1.167	TDS	1.110
24	Total Cr	1.443	Dissolved Ni	1.332	Dissolved Ni	1.232	COD	1.156	Dissolved Cr	1.107
25	Dissolved As	1.406	Total Zn	1.304	TDS	1.220	Ortho-P	1.155	Total Pb	1.106
26	NO_3-N	1.338	NO_3-N	1.284	Dissolved Cr	1.199	Dissolved Cr	1.144	TOC	1.097
27	Total P	1.298	Dissolved Cr	1.244	Dissolved Zn	1.180	TDS	1.130	Turbidity	1.095
28	Dissolved Cr	1.244	Ortho-P	1.197	Ortho-P	1.160	Conductivity	1.123	Dissolved Cu	1.088
29	Dissolved Cu	1.236	Dissolved Zn	1.190	NO_3-N	1.153	Dissolved Zn	1.111	NO_3-N	1.078
30	Ortho-P	1.193	Dissolved Cu	1.142	Dissolved Cu	1.108	Dissolved Cu	1.101	Dissolved Zn	1.077
31	Conductivity	1.124	Conductivity	1.133	Total P	1.073	NO_3-N	1.093	COD	1.074
32	Oil & Grease	1.069	Oil & Grease	1.091	Conductivity	1.051	Total P	1.061	Oil & Grease	1.039
33	Dissolved Zn	1.066	Total P	1.067	Oil & Grease	1.043	Oil & Grease	1.039	Total P	1.028
34	Dissolved Pb	1.047	Dissolved Pb	0.989	Dissolved Pb	0.948	Dissolved Cd	0.963	Dissolved Cd	0.963
35	Dissolved Cd	0.893	Dissolved Cd	0.910	Dissolved Cd	0.910	Dissolved Pb	0.916	Dissolved Pb	0.906

Table D.6 *(Continued)*

Rank	Combined URS									
	MFF10		MFF20		MFF30		MFF40		MFF50	
	Variables	Median	Variables	Median	Variables	Median	Variables	Median	Variables	Median
1	TSS	1.815	TSS	1.654	TSS	1.584	TSS	1.459	TSS	1.340
2	Particulate Ni	1.678	Total Ni	1.422	Dissolved As	1.446	Dissolved As	1.438	Dissolved As	1.294
3	Total Ni	1.547	Total As	1.410	Particulate Ni	1.314	Particulate Cr	1.293	Particulate Cr	1.195
4	COD	1.503	COD	1.404	Particulate Cu	1.310	Particulate Cu	1.277	Total Ni	1.189
5	TOC	1.459	Particulate Ni	1.398	Turbidity	1.296	Total As	1.247	Particulate Cu	1.174
6	Total As	1.456	Total Cd	1.395	Total Cd	1.293	Total Ni	1.243	Total Cr	1.172
7	DOC	1.444	DOC	1.388	Particulate Cd	1.281	Particulate Ni	1.221	Particulate Zn	1.165
8	Particulate Cd	1.411	TOC	1.380	Total Cr	1.276	Total Cr	1.211	COD	1.161
9	Total Cd	1.398	Particulate Cd	1.370	Total Ni	1.272	Particulate Zn	1.209	Particulate As	1.160
10	Particulate Zn	1.396	Dissolved As	1.353	Particulate Cr	1.260	Turbidity	1.202	Total As	1.160
11	Total Zn	1.391	Turbidity	1.305	COD	1.253	Total Cd	1.199	Particulate Ni	1.155
12	Particulate Pb	1.373	Particulate Cu	1.302	Total As	1.252	Total Cu	1.196	Total Cu	1.150
13	Dissolved Ni	1.372	Total Cr	1.286	Hardness	1.230	COD	1.195	Hardness	1.146
14	Total Pb	1.369	Particulate Cr	1.279	Particulate As	1.221	Hardness	1.191	Particulate Pb	1.146
15	TKN	1.346	NO_3-N	1.275	Total Cu	1.200	Particulate Pb	1.172	Turbidity	1.138
16	Particulate Cu	1.344	Particulate As	1.268	Particulate Pb	1.194	Total Zn	1.170	NH_3-N	1.136
17	Turbidity	1.341	Hardness	1.245	DOC	1.191	Particulate As	1.159	Total Pb	1.132
18	Total Cu	1.336	TKN	1.240	TOC	1.191	Total Pb	1.155	Total Zn	1.127
19	Particulate Cr	1.326	Particulate Pb	1.232	NO_3-N	1.185	Particulate Cd	1.139	Particulate Cd	1.118
20	Total Cr	1.319	Particulate Zn	1.228	Total Pb	1.174	NH_3-N	1.126	Total Cd	1.112
21	Dissolved As	1.307	TDS	1.218	Particulate Zn	1.173	Ortho-P	1.122	TOC	1.092
22	NO_3-N	1.302	Total Cu	1.213	Ortho-P	1.151	TOC	1.113	DOC	1.090
23	Particulate As	1.249	Total Pb	1.212	TKN	1.150	DOC	1.112	Ortho-P	1.088
24	NH_3-N	1.245	Ortho-P	1.210	Total Zn	1.147	NO_3-N	1.109	NO_3-N	1.081
25	Hardness	1.174	NH_3-N	1.204	NH_3-N	1.131	TDS	1.103	Conductivity	1.075
26	TDS	1.168	Dissolved Ni	1.201	Dissolved Cr	1.100	TKN	1.091	TKN	1.060
27	Dissolved Cu	1.163	Total Zn	1.196	TDS	1.092	Dissolved Cr	1.065	Total P	1.059
28	Ortho-P	1.151	Conductivity	1.092	Total P	1.086	Conductivity	1.053	Dissolved Cr	1.050
29	Conductivity	1.111	Dissolved Cr	1.082	Dissolved Ni	1.075	Dissolved Cu	1.047	Dissolved Cu	1.044
30	Dissolved Pb	1.101	Dissolved Cu	1.081	Dissolved Cu	1.064	Total P	1.045	TDS	1.039
31	Dissolved Cr	1.098	Oil & Grease	1.064	Conductivity	1.062	Dissolved Pb	1.016	Dissolved Pb	1.011
32	Oil & Grease	1.078	Dissolved Pb	1.042	Dissolved Pb	1.025	Oil & Grease	1.000	Oil & Grease	1.007
33	Total P	1.025	Total P	1.025	Dissolved Zn	1.014	Dissolved Cd	1.000	Dissolved Cd	1.000
34	Dissolved Zn	1.019	Dissolved Zn	1.019	Oil & Grease	1.008	Dissolved Ni	0.990	Dissolved Ni	0.982
35	Dissolved Cd	1.000	Dissolved Cd	1.000	Dissolved Cd	1.000	Dissolved Zn	0.934	Dissolved Zn	0.967

Table D.7 Basic statistics of Storm Characteristics (UCLA, 2000-2003)

		Total Rainfall	Max. Intensity	15 Min. Max. Intensity	ADD	Ante. Event Rainfall	Storm Duration	Ave. Rainfall Intensity
UCLA1	No. of cases	18	18	18	18	18	18	18
	Minimum	2.032	3.048	2.032	1.977	1.016	2.000	0.610
	Maximum	127.000	51.816	40.640	69.385	128.778	47.500	10.737
	Median	18.288	15.240	12.700	13.682	10.160	8.617	1.925
	Mean	28.321	20.320	15.579	19.605	17.893	10.695	2.953
	Standard Dev.	30.477	17.834	13.434	17.544	29.518	10.283	2.683
UCLA2	No. of cases	21	21	21	21	21	21	21
	Minimum	1.778	3.048	2.032	0.990	1.270	0.933	0.231
	Maximum	155.956	60.960	51.816	192.200	128.778	46.467	11.259
	Median	19.050	12.192	8.128	19.767	9.652	6.000	2.046
	Mean	26.126	17.272	12.434	28.999	20.622	9.294	3.185
	Standard Dev.	34.910	16.338	13.706	40.989	29.732	9.962	3.257
UCLA3	No. of cases	23	23	23	23	23	23	23
	Minimum	1.524	6.096	2.032	0.266	1.270	1.350	0.222
	Maximum	128.524	39.624	33.528	192.300	128.778	47.067	8.932
	Median	19.810	21.336	14.224	14.206	8.636	6.933	2.511
	Mean	28.536	21.071	14.401	26.391	23.500	9.933	3.288
	Standard Dev.	34.480	11.177	8.754	39.851	36.299	9.741	2.598
Combined Sites	No. of cases	62	62	62	62	62	62	62
	Minimum	1.524	3.048	2.032	0.266	1.016	0.933	0.222
	Maximum	155.956	60.960	51.816	192.300	128.778	47.500	11.259
	Median	19.430	15.240	10.160	16.271	9.652	7.167	2.155
	Mean	27.645	19.566	14.077	25.304	20.898	9.938	3.155
	Standard Dev.	32.990	14.968	11.881	34.988	31.829	9.826	2.817

Table D.8 Correlation Analysis Results for Storm Characteristics and MFF10 (UCLA1, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.84	-0.30	-0.22	0.32	0.69	-0.04	0.28	-0.05	-0.07	0.12	0.24	-0.01	0.20	0.49	0.33	-0.01
Max. Rain	0.00	1	0.99	-0.35	-0.20	0.17	0.76	-0.24	0.21	-0.07	-0.06	0.10	0.22	-0.07	0.12	0.20	0.34	-0.02
15m. Rain	0.00	0.00	1	-0.35	-0.23	0.18	0.81	-0.21	0.24	-0.05	-0.05	0.13	0.26	-0.03	0.13	0.24	0.34	0.00
ADD	0.23	0.15	0.16	1	-0.21	0.18	-0.36	-0.26	-0.44	0.52	0.64	0.32	-0.13	0.16	0.31	0.23	-0.16	-0.03
Ante. Rain	0.37	0.43	0.37	0.39	1	-0.27	-0.11	0.30	0.30	-0.01	-0.04	0.08	0.06	0.06	-0.16	-0.19	0.52	0.19
Duration	0.20	0.49	0.48	0.47	0.29	1	-0.13	-0.02	-0.05	-0.11	-0.13	-0.14	0.08	-0.20	-0.08	0.13	0.16	-0.06
Ave_Rain	0.00	0.00	0.00	0.15	0.68	0.62	1	0.04	0.32	0.11	0.11	0.20	0.24	0.11	0.13	0.21	0.40	0.15
TSS	0.88	0.34	0.41	0.31	0.23	0.94	0.86	1	0.44	-0.03	-0.18	0.13	0.22	0.06	0.05	0.11	0.33	0.17
Turb.	0.26	0.40	0.34	0.07	0.23	0.86	0.20	0.07	1	0.04	-0.17	0.50	0.53	0.51	0.36	0.42	0.50	0.05
Cond.	0.85	0.78	0.85	0.03	0.96	0.66	0.65	0.92	0.86	1	0.91	0.58	0.44	0.71	0.71	0.53	0.35	0.53
Hard.	0.77	0.80	0.85	0.00	0.88	0.62	0.65	0.47	0.50	0.00	1	0.50	0.21	0.53	0.54	0.42	0.23	0.47
COD	0.63	0.70	0.61	0.19	0.76	0.59	0.43	0.60	0.03	0.01	0.04	1	0.62	0.75	0.82	0.73	0.41	0.25
DOC	0.35	0.38	0.31	0.62	0.81	0.75	0.33	0.39	0.02	0.07	0.41	0.01	1	0.70	0.62	0.63	0.49	0.66
O & G	0.98	0.80	0.92	0.53	0.81	0.43	0.66	0.80	0.03	0.00	0.03	0.00	0.00	1	0.75	0.72	0.26	0.46
TKN	0.42	0.65	0.61	0.21	0.53	0.76	0.62	0.85	0.14	0.00	0.02	0.00	0.01	0.00	1	0.80	0.33	0.30
NH_3-N	0.04	0.42	0.33	0.36	0.46	0.61	0.40	0.66	0.08	0.02	0.08	0.00	0.01	0.00	0.00	1	0.21	0.34
NO_2-N	0.18	0.18	0.16	0.52	0.03	0.53	0.10	0.18	0.03	0.15	0.37	0.09	0.04	0.30	0.18	0.40	1	0.29
NO_3-N	0.97	0.95	0.99	0.91	0.45	0.80	0.55	0.50	0.85	0.02	0.05	0.32	0.00	0.06	0.23	0.17	0.24	1
PO_4-P	0.72	0.29	0.24	0.96	0.37	0.55	0.05	0.82	0.76	0.04	0.04	0.86	0.17	0.28	0.64	0.81	0.37	0.00
Diss. P	0.52	0.75	0.60	0.26	0.20	0.31	0.39	0.56	0.86	0.01	0.06	0.17	0.01	0.03	0.09	0.02	0.84	0.00
Diss. Cd	0.68	0.14	0.12	0.72	0.54	0.87	0.01	0.83	0.64	0.04	0.02	0.66	0.55	0.50	0.54	0.97	0.23	0.09
Diss. Cr	0.98	0.77	0.77	0.18	0.09	0.90	0.86	0.18	0.01	0.42	0.63	0.13	0.00	0.04	0.10	0.35	0.02	0.08
Diss. Cu	0.27	0.28	0.24	0.28	0.65	0.86	0.23	0.32	0.01	0.19	0.73	0.01	0.00	0.00	0.01	0.00	0.07	0.01
Diss. Ni	0.00	0.03	0.03	0.12	0.83	0.64	0.05	0.24	0.00	0.62	0.84	0.08	0.00	0.05	0.04	0.00	0.07	0.22
Diss. Pb	0.30	0.13	0.15	0.27	0.49	0.30	0.40	0.70	0.29	0.32	0.40	0.18	0.09	0.60	0.49	0.30	0.59	0.84
Diss. Zn	0.01	0.01	0.00	0.48	0.14	0.34	0.03	0.93	0.10	0.56	0.90	0.11	0.00	0.12	0.09	0.03	0.30	0.27
Tot. P	0.93	0.89	0.92	0.17	0.46	0.31	0.62	0.56	0.41	0.01	0.05	0.02	0.00	0.00	0.07	0.02	0.60	0.01
Tot. Cd	0.57	0.11	0.08	0.84	0.56	0.55	0.01	0.96	0.91	0.22	0.14	0.69	0.64	0.74	0.96	0.78	0.17	0.32
Tot. Cr	0.93	0.65	0.56	0.23	0.15	0.75	0.18	0.10	0.00	0.66	0.78	0.03	0.02	0.04	0.41	0.56	0.04	0.35
Tot. Cu	0.57	0.33	0.28	0.22	0.64	0.74	0.15	0.13	0.00	0.28	0.82	0.00	0.00	0.00	0.03	0.04	0.06	0.08
Tot. Ni	0.21	0.35	0.27	0.19	0.53	0.87	0.17	0.08	0.00	0.41	0.97	0.01	0.00	0.00	0.05	0.01	0.06	0.11
Tot. Pb	0.15	0.11	0.14	0.26	0.62	0.26	0.43	0.12	0.41	0.19	0.27	0.51	0.78	0.51	0.91	0.86	0.46	0.86
Tot. Zn	0.24	0.08	0.06	0.39	0.85	0.66	0.05	0.17	0.00	0.46	0.97	0.02	0.00	0.04	0.12	0.11	0.05	0.28

Table D.8 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	0.09	0.17	0.11	0.01	0.28	0.74	-0.27	0.59	-0.02	0.15	-0.02	0.15	0.32	-0.37	0.30
Max. Rain	0.26	0.08	0.38	0.08	0.28	0.52	-0.38	0.65	-0.04	0.41	0.12	0.25	0.24	-0.41	0.44
15m. Rain	0.29	0.14	0.40	0.08	0.30	0.54	-0.37	0.67	0.03	0.44	0.15	0.28	0.28	-0.38	0.47
ADD	0.01	0.29	0.10	-0.34	-0.28	-0.39	0.28	-0.18	0.35	0.05	-0.31	-0.31	-0.34	0.29	-0.23
Ante. Rain	-0.22	-0.33	-0.16	0.42	0.12	0.06	-0.18	-0.38	-0.19	-0.15	0.36	0.12	0.16	0.13	-0.05
Duration	0.15	0.27	-0.04	-0.03	-0.05	0.12	0.27	0.25	0.26	0.16	-0.08	-0.09	0.04	0.29	0.12
Ave_Rain	0.48	0.22	0.62	0.05	0.31	0.49	-0.22	0.52	0.13	0.65	0.34	0.37	0.35	-0.21	0.48
TSS	-0.06	0.15	-0.06	0.35	0.26	0.30	0.10	-0.02	0.15	0.01	0.42	0.38	0.44	0.39	0.35
Turb.	-0.08	0.05	-0.12	0.60	0.65	0.68	-0.27	0.41	0.21	0.03	0.81	0.77	0.87	0.21	0.69
Cond.	0.49	0.58	0.51	0.21	0.33	0.13	0.26	0.15	0.58	0.31	0.12	0.28	0.21	0.33	0.19
Hard.	0.48	0.47	0.56	-0.13	0.09	-0.05	0.22	-0.03	0.49	0.38	-0.08	0.06	0.01	0.29	-0.01
COD	0.05	0.35	0.11	0.38	0.65	0.44	-0.35	0.41	0.55	0.10	0.52	0.65	0.60	0.17	0.57
DOC	0.34	0.62	0.16	0.75	0.94	0.69	-0.42	0.77	0.68	0.12	0.57	0.85	0.82	-0.07	0.79
O & G	0.27	0.53	0.18	0.50	0.74	0.49	-0.14	0.39	0.67	0.09	0.50	0.71	0.70	0.17	0.50
TKN	0.12	0.42	0.16	0.41	0.64	0.50	-0.18	0.43	0.46	0.01	0.21	0.54	0.48	0.03	0.39
NH_3-N	0.06	0.57	-0.01	0.24	0.66	0.76	-0.27	0.54	0.56	-0.07	0.15	0.50	0.63	-0.05	0.41
NO_2-N	0.23	0.05	0.31	0.56	0.44	0.46	-0.14	0.27	0.14	0.35	0.51	0.47	0.47	0.19	0.48
NO_3-N	0.64	0.71	0.42	0.44	0.58	0.32	-0.05	0.28	0.63	0.26	0.24	0.44	0.40	0.05	0.28
PO_4-P	1	0.67	0.89	0.09	0.27	0.04	0.29	0.32	0.61	0.83	0.23	0.32	0.18	0.26	0.32
Diss. P	0.00	1	0.44	0.25	0.51	0.34	0.17	0.54	0.90	0.39	0.21	0.41	0.42	0.21	0.45
Diss. Cd	0.00	0.08	1	-0.06	0.11	-0.07	0.22	0.17	0.41	0.92	0.17	0.22	0.03	0.20	0.23
Diss. Cr	0.74	0.34	0.83	1	0.78	0.50	-0.23	0.44	0.32	-0.06	0.68	0.71	0.64	0.04	0.58
Diss. Cu	0.30	0.04	0.68	0.00	1	0.77	-0.49	0.70	0.58	0.08	0.64	0.92	0.88	-0.12	0.74
Diss. Ni	0.88	0.18	0.80	0.04	0.00	1	-0.44	0.66	0.28	-0.04	0.38	0.63	0.81	-0.26	0.56
Diss. Pb	0.26	0.51	0.39	0.38	0.05	0.08	1	-0.40	0.07	0.22	-0.19	-0.42	-0.40	0.70	-0.34
Diss. Zn	0.22	0.02	0.52	0.08	0.00	0.00	0.11	1	0.51	0.23	0.40	0.64	0.64	-0.29	0.82
Tot. P	0.01	0.00	0.10	0.21	0.01	0.28	0.80	0.04	1	0.44	0.46	0.59	0.56	0.37	0.58
Tot. Cd	0.00	0.12	0.00	0.81	0.76	0.87	0.40	0.38	0.08	1	0.35	0.28	0.13	0.32	0.36
Tot. Cr	0.37	0.42	0.51	0.00	0.01	0.13	0.47	0.11	0.07	0.17	1	0.82	0.77	0.36	0.78
Tot. Cu	0.20	0.10	0.39	0.00	0.00	0.01	0.09	0.01	0.01	0.29	0.00	1	0.92	0.08	0.86
Tot. Ni	0.49	0.10	0.92	0.01	0.00	0.00	0.11	0.01	0.02	0.63	0.00	0.00	1	0.08	0.82
Tot. Pb	0.32	0.43	0.44	0.87	0.64	0.32	0.00	0.27	0.14	0.20	0.15	0.77	0.76	1	0.09
Tot. Zn	0.21	0.07	0.38	0.01	0.00	0.02	0.18	0.00	0.01	0.15	0.00	0.00	0.00	0.73	1

Table D.9 Correlation Analysis Results for Storm Characteristics and MFF10 (UCLA2, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.87	-0.23	-0.16	0.44	0.65	0.03	0.39	-0.17	-0.27	0.24	0.21	0.37	0.23	0.24	0.29	0.18
Max. Rain	0.00	1	0.98	-0.30	-0.16	0.13	0.92	-0.18	0.20	-0.37	-0.46	0.02	-0.04	0.15	0.02	0.00	0.06	-0.03
15m. Rain	0.00	0.00	1	-0.26	-0.19	0.18	0.90	-0.16	0.25	-0.37	-0.46	0.05	0.00	0.22	0.06	0.06	0.09	0.00
ADD	0.32	0.19	0.25	1	-0.12	-0.08	-0.23	-0.12	-0.24	0.06	-0.01	-0.15	-0.14	-0.20	-0.09	-0.06	-0.09	-0.01
Ante. Rain	0.49	0.48	0.40	0.60	1	-0.12	-0.19	0.19	0.32	-0.10	-0.01	0.16	0.08	0.00	-0.01	-0.06	0.06	-0.01
Duration	0.05	0.57	0.45	0.74	0.61	1	-0.11	0.51	0.40	0.32	0.15	0.38	0.42	0.45	0.42	0.42	0.75	0.46
Ave_Rain	0.00	0.00	0.00	0.32	0.42	0.63	1	-0.25	0.21	-0.39	-0.46	0.03	-0.06	0.18	0.02	0.02	-0.04	-0.05
TSS	0.90	0.43	0.48	0.62	0.41	0.02	0.27	1	0.59	0.49	0.38	0.59	0.55	0.46	0.52	0.49	0.71	0.55
Turb.	0.08	0.38	0.27	0.30	0.16	0.07	0.37	0.01	1	0.33	0.19	0.78	0.68	0.80	0.66	0.63	0.78	0.56
Cond.	0.47	0.10	0.10	0.81	0.68	0.16	0.08	0.02	0.14	1	0.86	0.73	0.78	0.54	0.78	0.76	0.54	0.76
Hard.	0.24	0.04	0.04	0.97	0.97	0.52	0.04	0.09	0.42	0.00	1	0.64	0.78	0.47	0.74	0.70	0.44	0.61
COD	0.30	0.95	0.83	0.53	0.48	0.09	0.88	0.01	0.00	0.00	0.00	1	0.94	0.88	0.93	0.90	0.75	0.82
DOC	0.35	0.87	0.99	0.53	0.73	0.06	0.80	0.01	0.00	0.00	0.00	0.00	1	0.87	0.95	0.92	0.77	0.83
O & G	0.10	0.51	0.35	0.38	0.99	0.04	0.43	0.04	0.00	0.01	0.03	0.00	0.00	1	0.85	0.85	0.80	0.68
TKN	0.31	0.94	0.80	0.71	0.96	0.06	0.94	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1	0.99	0.76	0.86
NH_3-N	0.29	0.99	0.81	0.81	0.81	0.06	0.95	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.73	0.84
NO_2-N	0.20	0.81	0.71	0.71	0.81	0.00	0.88	0.00	0.00	0.01	0.05	0.00	0.00	0.00	0.00	0.00	1	0.63
NO_3-N	0.44	0.90	1.00	0.96	0.98	0.04	0.82	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
PO_4-P	0.59	0.27	0.35	0.95	0.37	0.62	0.38	0.02	0.41	0.02	0.02	0.06	0.04	0.06	0.06	0.04	0.14	0.04
Diss. P	0.56	0.68	0.92	0.91	0.58	0.18	0.52	0.16	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Diss. Cd	0.17	0.05	0.08	0.61	0.69	0.93	0.06	0.60	0.94	0.00	0.00	0.07	0.02	0.32	0.00	0.00	0.48	0.04
Diss. Cr	0.68	0.43	0.55	0.94	0.52	0.07	0.38	0.03	0.09	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.01
Diss. Cu	0.43	0.86	0.93	0.48	0.51	0.15	0.64	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Ni	0.68	0.22	0.32	0.75	0.22	0.25	0.19	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Pb	0.68	0.21	0.29	0.49	0.53	0.05	0.10	0.07	0.37	0.00	0.00	0.01	0.00	0.05	0.00	0.00	0.01	0.00
Diss. Zn	0.38	0.10	0.20	0.62	0.82	0.59	0.15	0.54	0.35	0.01	0.02	0.02	0.02	0.07	0.01	0.00	0.25	0.03
Tot. P	0.74	0.47	0.65	0.94	0.83	0.10	0.38	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Tot. Cd	0.40	0.11	0.17	0.81	0.47	0.34	0.11	0.09	0.35	0.00	0.00	0.01	0.00	0.04	0.00	0.00	0.05	0.00
Tot. Cr	0.43	0.89	0.97	0.73	0.30	0.01	0.71	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cu	0.74	0.57	0.73	0.63	0.67	0.06	0.46	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.81	0.24	0.34	0.79	0.39	0.11	0.19	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.66	0.14	0.18	0.99	0.40	0.05	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Tot. Zn	0.67	0.18	0.27	0.90	0.87	0.19	0.16	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Table D.9 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.12	0.14	-0.32	-0.10	0.19	-0.10	-0.10	-0.21	0.08	-0.20	0.19	0.08	-0.06	-0.11	-0.10
Max. Rain	-0.25	-0.10	-0.44	-0.19	-0.04	-0.29	-0.29	-0.38	-0.17	-0.37	-0.03	-0.14	-0.28	-0.34	-0.31
15m. Rain	-0.22	-0.02	-0.40	-0.14	0.02	-0.24	-0.25	-0.30	-0.11	-0.32	0.01	-0.08	-0.23	-0.32	-0.26
ADD	-0.02	-0.03	0.12	0.02	-0.17	-0.08	0.16	0.12	-0.02	0.06	-0.08	-0.12	-0.06	0.01	0.03
Ante. Rain	-0.21	-0.13	-0.10	-0.15	0.16	0.29	-0.15	-0.05	-0.05	-0.17	0.25	0.10	0.20	0.20	0.04
Duration	0.12	0.32	-0.02	0.41	0.34	0.27	0.45	0.13	0.38	0.22	0.61	0.42	0.37	0.44	0.31
Ave_Rain	-0.20	-0.15	-0.42	-0.21	-0.11	-0.31	-0.38	-0.34	-0.21	-0.37	-0.09	-0.18	-0.31	-0.38	-0.32
TSS	0.50	0.33	0.12	0.49	0.38	0.41	0.41	0.15	0.51	0.39	0.74	0.58	0.54	0.81	0.45
Turb.	0.19	0.43	-0.02	0.39	0.66	0.58	0.21	0.22	0.53	0.22	0.87	0.69	0.62	0.63	0.45
Cond.	0.49	0.74	0.69	0.62	0.69	0.69	0.82	0.60	0.78	0.79	0.57	0.77	0.75	0.72	0.84
Hard.	0.49	0.69	0.79	0.64	0.68	0.74	0.76	0.51	0.72	0.82	0.48	0.74	0.77	0.62	0.79
COD	0.42	0.80	0.42	0.54	0.90	0.82	0.56	0.50	0.88	0.60	0.88	0.93	0.86	0.77	0.82
DOC	0.44	0.80	0.51	0.65	0.91	0.85	0.66	0.51	0.85	0.70	0.82	0.93	0.89	0.71	0.83
O & G	0.41	0.71	0.24	0.57	0.81	0.69	0.45	0.42	0.73	0.46	0.78	0.81	0.72	0.54	0.63
TKN	0.42	0.88	0.62	0.71	0.92	0.86	0.77	0.60	0.91	0.79	0.80	0.94	0.90	0.66	0.89
NH_3-N	0.45	0.90	0.66	0.70	0.91	0.85	0.80	0.67	0.91	0.81	0.76	0.92	0.89	0.62	0.91
NO_2-N	0.33	0.49	0.17	0.67	0.63	0.59	0.55	0.27	0.60	0.45	0.89	0.75	0.69	0.70	0.55
NO_3-N	0.46	0.77	0.47	0.58	0.75	0.74	0.68	0.48	0.83	0.70	0.71	0.80	0.79	0.65	0.80
PO_4-P	1	0.48	0.40	0.45	0.36	0.38	0.46	0.33	0.53	0.51	0.30	0.50	0.48	0.56	0.48
Diss. P	0.03	1	0.71	0.52	0.87	0.80	0.75	0.71	0.96	0.77	0.57	0.83	0.81	0.55	0.88
Diss. Cd	0.08	0.00	1	0.63	0.64	0.71	0.84	0.75	0.67	0.91	0.26	0.63	0.71	0.37	0.83
Diss. Cr	0.05	0.02	0.00	1	0.61	0.66	0.79	0.45	0.58	0.82	0.63	0.75	0.74	0.56	0.68
Diss. Cu	0.12	0.00	0.00	0.00	1	0.93	0.66	0.66	0.87	0.74	0.74	0.94	0.92	0.62	0.89
Diss. Ni	0.10	0.00	0.00	0.00	0.00	1	0.71	0.71	0.84	0.79	0.74	0.92	0.98	0.66	0.92
Diss. Pb	0.04	0.00	0.00	0.00	0.00	0.00	1	0.67	0.75	0.90	0.52	0.73	0.76	0.55	0.85
Diss. Zn	0.16	0.00	0.00	0.05	0.00	0.00	0.00	1	0.67	0.69	0.34	0.60	0.67	0.38	0.82
Tot. P	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	1	0.79	0.73	0.91	0.89	0.74	0.92
Tot. Cd	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.52	0.80	0.83	0.56	0.90
Tot. Cr	0.19	0.01	0.26	0.00	0.00	0.00	0.02	0.14	0.00	0.02	1	0.87	0.83	0.86	0.69
Tot. Cu	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	1	0.97	0.80	0.91
Tot. Ni	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.78	0.94
Tot. Pb	0.01	0.01	0.11	0.01	0.00	0.00	0.01	0.10	0.00	0.01	0.00	0.00	0.00	1	0.70
Tot. Zn	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

Table D.10 Correlation Analysis Results for Storm Characteristics and MFF10 (UCLA3, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.57	0.72	-0.22	-0.15	0.56	0.54	0.35	0.72	-0.02	-0.12	0.02	0.12	0.31	0.01	0.01	0.52	0.05
Max. Rain	0.00	1	0.92	-0.39	-0.06	0.08	0.70	0.36	0.42	0.11	0.04	0.16	0.24	0.27	0.22	0.24	0.39	0.12
15m. Rain	0.00	0.00	1	-0.41	-0.07	0.14	0.83	0.39	0.58	0.13	0.01	0.15	0.28	0.36	0.20	0.19	0.56	0.09
ADD	0.31	0.06	0.06	1	-0.08	-0.06	-0.32	-0.16	-0.33	-0.07	0.00	-0.16	-0.20	-0.28	-0.11	-0.14	-0.36	-0.33
Ante. Rain	0.51	0.78	0.77	0.72	1	-0.04	-0.21	0.34	0.04	-0.22	-0.15	-0.03	-0.10	-0.04	-0.19	-0.26	0.08	0.03
Duration	0.01	0.73	0.54	0.80	0.86	1	-0.17	0.46	0.46	-0.13	-0.12	-0.05	-0.17	0.02	-0.04	-0.09	0.30	0.06
Ave_Rain	0.01	0.00	0.00	0.14	0.35	0.44	1	0.16	0.42	0.24	0.10	0.27	0.39	0.32	0.25	0.25	0.54	0.16
TSS	0.10	0.09	0.07	0.47	0.11	0.03	0.46	1	0.50	0.17	0.20	0.33	0.21	0.19	0.37	0.26	0.35	0.11
Turb.	0.00	0.05	0.00	0.12	0.86	0.03	0.05	0.02	1	0.04	-0.09	0.13	0.17	0.42	0.11	0.05	0.59	0.07
Cond.	0.93	0.63	0.55	0.76	0.32	0.56	0.26	0.45	0.85	1	0.93	0.84	0.94	0.72	0.94	0.93	0.30	0.72
Hard.	0.58	0.85	0.97	0.99	0.49	0.57	0.66	0.35	0.69	0.00	1	0.75	0.82	0.62	0.85	0.85	0.11	0.69
COD	0.92	0.46	0.48	0.46	0.88	0.82	0.21	0.13	0.55	0.00	0.00	1	0.90	0.62	0.86	0.85	0.49	0.71
DOC	0.60	0.28	0.21	0.37	0.66	0.44	0.06	0.33	0.44	0.00	0.00	0.00	1	0.81	0.91	0.90	0.48	0.69
O & G	0.15	0.21	0.09	0.20	0.86	0.92	0.14	0.39	0.04	0.00	0.00	0.00	0.00	1	0.66	0.62	0.56	0.54
TKN	0.95	0.30	0.35	0.63	0.38	0.87	0.25	0.09	0.63	0.00	0.00	0.00	0.00	0.00	1	0.97	0.35	0.63
NH_3-N	0.97	0.27	0.38	0.52	0.23	0.69	0.24	0.23	0.83	0.00	0.00	0.00	0.00	0.00	0.00	1	0.27	0.62
NO_2-N	0.01	0.06	0.01	0.10	0.72	0.16	0.01	0.10	0.00	0.17	0.63	0.02	0.02	0.01	0.10	0.22	1	0.37
NO_3-N	0.81	0.58	0.68	0.13	0.90	0.80	0.47	0.62	0.74	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.08	1
PO_4-P	0.86	0.82	0.78	0.82	0.54	0.27	0.67	0.27	0.96	0.00	0.00	0.05	0.04	0.27	0.00	0.00	0.99	0.00
Diss. P	0.41	0.58	0.53	0.87	0.90	0.62	0.68	0.15	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00
Diss. Cd	0.29	0.82	0.64	0.48	0.74	0.42	0.78	0.31	0.50	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.77	0.03
Diss. Cr	0.44	0.36	0.24	0.10	0.98	0.81	0.15	0.15	0.80	0.03	0.01	0.12	0.20	0.26	0.05	0.07	0.26	0.39
Diss. Cu	0.54	0.41	0.57	0.56	0.76	0.24	0.62	0.52	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00
Diss. Ni	0.46	0.86	0.83	0.37	0.28	0.49	0.86	0.15	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00
Diss. Pb	0.44	0.43	0.33	0.55	0.94	0.46	0.52	0.13	0.76	0.04	0.04	0.08	0.09	0.29	0.02	0.03	0.53	0.48
Diss. Zn	0.69	0.78	0.98	0.80	0.86	0.82	0.88	0.20	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00
Tot. P	0.45	0.90	0.77	0.75	0.97	0.39	0.85	0.05	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00
Tot. Cd	0.63	0.72	0.75	0.30	0.56	0.69	0.79	0.14	0.77	0.00	0.00	0.01	0.01	0.02	0.00	0.00	0.97	0.03
Tot. Cr	0.50	0.86	0.93	0.13	0.73	0.33	0.96	0.01	0.08	0.07	0.06	0.05	0.16	0.25	0.05	0.13	0.54	0.58
Tot. Cu	0.39	0.72	0.84	0.90	0.84	0.15	0.78	0.38	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.01
Tot. Ni	0.41	0.92	0.95	0.73	0.80	0.24	0.98	0.29	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00
Tot. Pb	0.78	0.22	0.29	0.15	0.45	0.23	0.34	0.01	0.36	0.95	0.49	0.82	0.81	0.71	0.74	0.97	0.63	0.37
Tot. Zn	0.95	0.71	0.86	0.92	0.93	0.94	0.94	0.08	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00

Table D.10 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.04	0.19	-0.24	-0.18	-0.14	-0.17	-0.18	-0.09	0.18	-0.11	0.16	-0.20	-0.19	0.07	-0.01
Max. Rain	-0.05	0.13	-0.05	-0.21	0.19	0.04	-0.18	0.06	0.03	-0.08	-0.04	0.08	0.03	-0.28	0.09
15m. Rain	-0.06	0.14	-0.11	-0.27	0.13	0.05	-0.22	-0.01	0.07	-0.07	0.02	0.05	-0.02	-0.24	0.04
ADD	0.05	0.04	0.16	0.37	-0.13	-0.21	0.14	-0.06	0.08	0.24	0.34	-0.03	-0.08	0.33	-0.02
Ante. Rain	-0.13	-0.03	-0.08	0.01	0.07	0.25	0.02	0.04	-0.01	-0.14	0.08	0.05	0.06	0.17	0.02
Duration	0.24	0.11	-0.19	0.06	-0.27	-0.16	-0.17	-0.05	0.20	0.09	0.22	-0.33	-0.27	0.27	-0.02
Ave_Rain	-0.09	0.10	-0.07	-0.33	0.12	0.04	-0.15	-0.04	0.04	-0.06	-0.01	0.07	0.01	-0.22	0.02
TSS	0.24	0.32	0.23	0.33	0.15	0.32	0.34	0.29	0.43	0.34	0.54	0.20	0.24	0.59	0.39
Turb.	0.01	0.18	-0.16	0.06	-0.07	-0.07	-0.07	-0.10	0.23	0.07	0.39	-0.13	-0.16	0.21	-0.01
Cond.	0.61	0.84	0.82	0.47	0.90	0.82	0.45	0.90	0.83	0.79	0.40	0.89	0.85	0.01	0.90
Hard.	0.60	0.73	0.87	0.58	0.82	0.75	0.45	0.90	0.75	0.81	0.42	0.85	0.82	0.16	0.89
COD	0.41	0.82	0.60	0.35	0.83	0.83	0.39	0.80	0.80	0.58	0.43	0.76	0.77	0.05	0.81
DOC	0.43	0.79	0.67	0.29	0.91	0.85	0.38	0.84	0.75	0.59	0.32	0.84	0.82	-0.06	0.83
O & G	0.24	0.64	0.55	0.26	0.86	0.79	0.25	0.71	0.62	0.49	0.26	0.74	0.70	-0.09	0.67
TKN	0.64	0.82	0.74	0.44	0.86	0.81	0.50	0.87	0.81	0.74	0.44	0.83	0.82	0.08	0.89
NH_3-N	0.59	0.80	0.75	0.41	0.85	0.77	0.49	0.87	0.76	0.71	0.34	0.82	0.79	-0.01	0.87
NO_2-N	0.00	0.27	-0.07	-0.26	0.26	0.34	-0.15	0.13	0.24	0.01	0.14	0.10	0.13	-0.11	0.16
NO_3-N	0.60	0.64	0.48	0.20	0.67	0.66	0.16	0.74	0.63	0.47	0.13	0.57	0.60	-0.21	0.71
PO_4-P	1	0.61	0.56	0.57	0.42	0.41	0.38	0.62	0.68	0.71	0.47	0.46	0.45	0.11	0.67
Diss. P	0.00	1	0.74	0.57	0.80	0.72	0.49	0.87	0.97	0.78	0.53	0.81	0.78	0.10	0.90
Diss. Cd	0.01	0.00	1	0.75	0.75	0.63	0.71	0.86	0.75	0.91	0.50	0.85	0.80	0.31	0.87
Diss. Cr	0.01	0.01	0.00	1	0.40	0.31	0.67	0.54	0.67	0.81	0.82	0.57	0.51	0.60	0.62
Diss. Cu	0.06	0.00	0.00	0.07	1	0.91	0.47	0.90	0.75	0.61	0.27	0.95	0.92	-0.10	0.87
Diss. Ni	0.07	0.00	0.00	0.18	0.00	1	0.47	0.87	0.72	0.52	0.23	0.87	0.91	-0.03	0.84
Diss. Pb	0.09	0.02	0.00	0.00	0.03	0.03	1	0.58	0.57	0.59	0.50	0.62	0.65	0.48	0.65
Diss. Zn	0.00	0.00	0.00	0.01	0.00	0.00	0.01	1	0.86	0.76	0.34	0.90	0.91	0.05	0.98
Tot. P	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	1	0.83	0.65	0.79	0.78	0.26	0.92
Tot. Cd	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	1	0.66	0.72	0.64	0.38	0.81
Tot. Cr	0.03	0.01	0.02	0.00	0.23	0.32	0.02	0.14	0.00	0.00	1	0.43	0.39	0.75	0.49
Tot. Cu	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1	0.97	0.11	0.91
Tot. Ni	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	1	0.13	0.92
Tot. Pb	0.62	0.68	0.17	0.00	0.66	0.89	0.03	0.84	0.26	0.09	0.00	0.64	0.56	1	0.19
Tot. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.42	1

Table D.11 Correlation Analysis Results for Storm Characteristics and MFF10 (Combined UCLA, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.73	0.80	-0.23	-0.17	0.45	0.62	0.13	0.42	-0.08	-0.16	0.12	0.16	0.26	0.14	0.15	0.32	0.09
Max. Rain	0.00	1	0.97	-0.31	-0.13	0.13	0.80	-0.06	0.21	-0.12	-0.18	0.08	0.11	0.13	0.10	0.11	0.15	0.00
15m. Rain	0.00	0.00	1	-0.31	-0.16	0.17	0.83	-0.04	0.28	-0.13	-0.21	0.08	0.11	0.17	0.10	0.09	0.20	-0.01
ADD	0.07	0.01	0.02	1	-0.10	-0.03	-0.27	-0.14	-0.26	0.06	0.08	-0.08	-0.13	-0.17	-0.03	-0.04	-0.15	-0.10
Ante. Rain	0.19	0.31	0.23	0.42	1	-0.13	-0.17	0.27	0.19	-0.11	-0.06	0.07	0.02	0.02	-0.09	-0.13	0.13	0.05
Duration	0.00	0.31	0.19	0.80	0.33	1	-0.14	0.35	0.28	0.05	-0.02	0.09	0.09	0.11	0.12	0.12	0.47	0.17
Ave_Rain	0.00	0.00	0.00	0.04	0.20	0.29	1	-0.05	0.26	-0.06	-0.13	0.15	0.17	0.22	0.13	0.14	0.15	0.06
TSS	0.33	0.65	0.75	0.29	0.03	0.01	0.70	1	0.51	0.27	0.21	0.41	0.36	0.29	0.38	0.34	0.54	0.34
Turb.	0.00	0.11	0.03	0.04	0.13	0.03	0.04	0.00	1	0.13	0.01	0.47	0.37	0.52	0.37	0.31	0.70	0.33
Cond.	0.55	0.35	0.32	0.65	0.40	0.69	0.65	0.03	0.32	1	0.89	0.74	0.78	0.65	0.82	0.76	0.39	0.66
Hard.	0.21	0.17	0.11	0.56	0.64	0.85	0.32	0.10	0.97	0.00	1	0.68	0.73	0.57	0.76	0.74	0.28	0.62
COD	0.34	0.55	0.55	0.53	0.57	0.48	0.23	0.00	0.00	0.00	0.00	1	0.89	0.77	0.89	0.87	0.56	0.71
DOC	0.22	0.41	0.40	0.34	0.87	0.51	0.19	0.01	0.00	0.00	0.00	0.00	1	0.84	0.90	0.90	0.52	0.74
O & G	0.04	0.32	0.18	0.20	0.91	0.38	0.09	0.02	0.00	0.00	0.00	0.00	0.00	1	0.77	0.74	0.55	0.60
TKN	0.30	0.43	0.46	0.83	0.49	0.35	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.95	0.52	0.70
NH_3-N	0.24	0.42	0.47	0.77	0.32	0.36	0.27	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1	0.44	0.71
NO_2-N	0.01	0.24	0.12	0.26	0.34	0.00	0.26	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	1	0.48
NO_3-N	0.51	0.99	0.95	0.43	0.68	0.18	0.63	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
PO_4-P	0.81	0.94	0.98	0.87	0.16	0.19	0.76	0.06	0.52	0.00	0.00	0.02	0.01	0.03	0.00	0.00	0.11	0.00
Diss. P	0.25	0.97	0.78	0.66	0.30	0.10	0.88	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Cd	0.12	0.26	0.22	0.23	0.55	0.47	0.49	0.31	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00
Diss. Cr	0.46	0.42	0.41	0.29	0.58	0.31	0.19	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Cu	0.69	0.49	0.60	0.48	0.39	0.87	0.60	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Ni	0.74	0.78	0.83	0.33	0.11	0.77	0.92	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Pb	0.29	0.05	0.05	0.17	0.58	0.22	0.07	0.01	0.42	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00
Diss. Zn	0.64	0.44	0.43	0.59	0.77	0.72	0.46	0.21	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
Tot. P	0.58	0.44	0.67	0.57	0.64	0.04	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cd	0.57	0.60	0.69	0.31	0.30	0.28	0.99	0.03	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Tot. Cr	0.36	0.99	0.74	0.78	0.08	0.03	0.74	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cu	0.90	0.91	0.97	0.71	0.50	0.99	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.75	0.67	0.62	0.66	0.30	0.84	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.44	0.01	0.02	0.27	0.20	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.01	0.04	0.00	0.01
Tot. Zn	0.89	0.57	0.54	0.82	0.81	0.38	0.58	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D.11 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.03	0.15	-0.21	-0.10	0.05	0.04	-0.14	-0.06	0.07	-0.08	0.12	-0.02	-0.04	-0.10	-0.02
Max. Rain	-0.01	-0.01	-0.15	-0.11	0.09	0.04	-0.26	-0.10	-0.10	-0.07	0.00	0.02	-0.06	-0.34	-0.08
15m. Rain	0.00	0.04	-0.17	-0.11	0.07	0.03	-0.26	-0.11	-0.06	-0.05	0.04	0.01	-0.07	-0.31	-0.08
ADD	0.02	0.06	0.16	0.14	-0.10	-0.13	0.19	0.07	0.08	0.14	0.04	-0.05	-0.06	0.15	0.03
Ante. Rain	-0.18	-0.14	-0.08	0.07	0.12	0.21	-0.07	-0.04	-0.06	-0.14	0.23	0.09	0.14	0.17	0.03
Duration	0.17	0.22	-0.10	0.13	-0.02	0.04	0.16	0.05	0.27	0.14	0.29	0.00	0.03	0.33	0.12
Ave_Rain	0.04	0.02	-0.09	-0.18	0.07	0.01	-0.24	-0.10	-0.06	0.00	0.04	0.03	-0.05	-0.29	-0.07
TSS	0.24	0.29	0.14	0.39	0.24	0.33	0.34	0.17	0.41	0.29	0.62	0.39	0.39	0.66	0.40
Turb.	0.08	0.31	-0.02	0.32	0.33	0.30	0.11	0.20	0.42	0.19	0.76	0.40	0.37	0.51	0.36
Cond.	0.48	0.68	0.65	0.45	0.68	0.64	0.56	0.55	0.69	0.61	0.37	0.70	0.69	0.37	0.70
Hard.	0.50	0.63	0.76	0.44	0.67	0.63	0.56	0.55	0.65	0.68	0.32	0.70	0.70	0.37	0.70
COD	0.30	0.69	0.47	0.42	0.85	0.79	0.42	0.59	0.75	0.48	0.62	0.84	0.81	0.41	0.77
DOC	0.35	0.70	0.53	0.47	0.92	0.85	0.44	0.62	0.71	0.50	0.52	0.88	0.86	0.27	0.78
O & G	0.27	0.63	0.38	0.42	0.83	0.73	0.32	0.52	0.66	0.38	0.52	0.78	0.73	0.25	0.62
TKN	0.38	0.73	0.60	0.51	0.85	0.80	0.56	0.64	0.75	0.57	0.53	0.85	0.82	0.33	0.80
NH_3-N	0.38	0.75	0.63	0.46	0.88	0.82	0.59	0.71	0.73	0.58	0.45	0.85	0.83	0.27	0.83
NO_2-N	0.21	0.37	0.14	0.36	0.39	0.40	0.32	0.24	0.46	0.34	0.68	0.47	0.44	0.51	0.43
NO_3-N	0.50	0.72	0.52	0.39	0.72	0.66	0.48	0.60	0.74	0.56	0.45	0.70	0.69	0.33	0.75
PO_4-P	1	0.56	0.53	0.39	0.32	0.28	0.37	0.38	0.56	0.66	0.33	0.41	0.37	0.33	0.47
Diss. P	0.00	1	0.68	0.46	0.73	0.64	0.61	0.72	0.95	0.69	0.48	0.73	0.71	0.40	0.81
Diss. Cd	0.00	0.00	1	0.53	0.63	0.57	0.76	0.75	0.66	0.90	0.32	0.69	0.68	0.35	0.81
Diss. Cr	0.00	0.00	0.00	1	0.51	0.45	0.55	0.44	0.52	0.56	0.68	0.63	0.60	0.44	0.59
Diss. Cu	0.01	0.00	0.00	0.00	1	0.90	0.50	0.74	0.72	0.54	0.49	0.94	0.92	0.24	0.85
Diss. Ni	0.04	0.00	0.00	0.00	0.00	1	0.47	0.71	0.64	0.48	0.44	0.86	0.92	0.23	0.80
Diss. Pb	0.00	0.00	0.00	0.00	0.00	0.00	1	0.61	0.62	0.70	0.41	0.60	0.61	0.56	0.72
Diss. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.69	0.65	0.35	0.71	0.74	0.27	0.88
Tot. P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.72	0.65	0.78	0.76	0.59	0.85
Tot. Cd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.52	0.66	0.62	0.49	0.78
Tot. Cr	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	1	0.66	0.63	0.74	0.61
Tot. Cu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.97	0.45	0.90
Tot. Ni	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.43	0.90
Tot. Pb	0.01	0.00	0.01	0.00	0.07	0.09	0.00	0.04	0.00	0.00	0.00	0.00	0.00	1	0.50
Tot. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

Table D.12 Correlation Analysis Results for Storm Characteristics and MFF20 (UCLA 1, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.84	-0.30	-0.22	0.32	0.69	0.03	0.21	-0.06	-0.07	0.16	0.21	-0.01	0.16	0.48	0.28	-0.03
Max. Rain	0.00	1	0.99	-0.35	-0.20	0.17	0.76	-0.25	0.18	-0.05	-0.03	0.18	0.24	0.04	0.11	0.23	0.31	-0.01
15m. Rain	0.00	0.00	1	-0.35	-0.23	0.18	0.81	-0.20	0.22	-0.02	-0.01	0.21	0.28	0.09	0.12	0.29	0.33	0.00
ADD	0.23	0.15	0.16	1	-0.21	0.18	-0.36	-0.22	-0.35	0.52	0.64	0.24	-0.06	0.11	0.23	0.18	-0.10	-0.07
Ante. Rain	0.37	0.43	0.37	0.39	1	-0.27	-0.11	0.06	0.24	0.03	0.01	0.14	0.09	0.06	-0.11	-0.19	0.42	0.22
Duration	0.20	0.49	0.48	0.47	0.29	1	-0.13	-0.03	-0.10	-0.16	-0.15	-0.17	-0.01	-0.30	-0.15	0.15	-0.08	-0.04
Ave_Rain	0.00	0.00	0.00	0.15	0.68	0.62	1	0.13	0.38	0.14	0.13	0.27	0.30	0.33	0.19	0.36	0.46	0.07
TSS	0.91	0.31	0.42	0.38	0.81	0.90	0.60	1	0.33	0.03	-0.13	0.03	0.08	0.13	0.15	0.26	0.14	0.05
Turb.	0.41	0.48	0.39	0.16	0.34	0.69	0.12	0.18	1	0.16	-0.06	0.67	0.72	0.61	0.54	0.61	0.68	0.16
Cond.	0.80	0.86	0.93	0.03	0.92	0.52	0.59	0.91	0.54	1	0.92	0.57	0.54	0.70	0.69	0.45	0.49	0.40
Hard.	0.78	0.92	0.96	0.00	0.99	0.56	0.61	0.60	0.81	0.00	1	0.44	0.31	0.54	0.48	0.34	0.35	0.35
COD	0.54	0.48	0.41	0.33	0.59	0.50	0.27	0.91	0.00	0.01	0.07	1	0.82	0.74	0.83	0.75	0.74	0.24
DOC	0.40	0.34	0.27	0.83	0.71	0.98	0.23	0.74	0.00	0.02	0.22	0.00	1	0.76	0.76	0.70	0.76	0.53
O & G	0.96	0.88	0.72	0.66	0.81	0.22	0.18	0.62	0.01	0.00	0.02	0.00	0.00	1	0.69	0.66	0.54	0.38
TKN	0.52	0.67	0.62	0.37	0.66	0.55	0.46	0.55	0.02	0.00	0.05	0.00	0.00	0.00	1	0.69	0.61	0.20
NH_3-N	0.04	0.37	0.25	0.47	0.46	0.55	0.14	0.29	0.01	0.06	0.17	0.00	0.00	0.00	0.00	1	0.49	0.22
NO_2-N	0.26	0.21	0.18	0.70	0.09	0.74	0.05	0.59	0.00	0.04	0.15	0.00	0.00	0.02	0.01	0.04	1	0.26
NO_3-N	0.89	0.96	0.99	0.78	0.39	0.86	0.77	0.86	0.52	0.10	0.15	0.33	0.02	0.12	0.43	0.37	0.30	1
PO_4-P	0.85	0.88	0.80	0.08	0.35	0.90	0.26	0.96	0.80	0.00	0.00	0.24	0.22	0.04	0.14	0.17	0.28	0.05
Diss. P	0.31	0.36	0.29	0.17	0.11	0.23	0.44	0.57	0.55	0.02	0.05	0.07	0.01	0.06	0.04	0.01	0.31	0.02
Diss. Cd	0.61	0.14	0.12	0.51	0.52	0.96	0.01	0.86	0.97	0.02	0.01	0.50	0.47	0.12	0.38	0.59	0.20	0.37
Diss. Cr	1.00	0.80	0.80	0.69	0.35	0.83	0.98	0.88	0.01	0.05	0.40	0.00	0.00	0.02	0.00	0.10	0.01	0.02
Diss. Cu	0.51	0.37	0.33	0.68	0.49	0.66	0.28	0.74	0.00	0.10	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Diss. Ni	0.00	0.02	0.02	0.23	0.79	0.74	0.04	0.36	0.01	0.53	0.99	0.01	0.00	0.06	0.01	0.00	0.01	0.43
Diss. Pb	0.47	0.18	0.21	0.16	0.35	0.02	0.26	0.30	0.47	0.49	0.50	0.19	0.30	0.59	0.65	0.72	0.29	0.55
Diss. Zn	0.06	0.02	0.01	0.91	0.35	0.39	0.07	0.97	0.02	0.36	0.87	0.01	0.00	0.03	0.03	0.00	0.03	0.40
Tot. P	0.21	0.28	0.20	0.29	0.18	0.23	0.23	0.32	0.09	0.02	0.06	0.01	0.00	0.01	0.01	0.00	0.11	0.06
Tot. Cd	0.62	0.17	0.13	0.72	0.47	0.70	0.01	0.43	0.39	0.16	0.10	0.50	0.49	0.12	0.65	0.46	0.25	0.73
Tot. Cr	0.25	0.38	0.29	0.25	0.53	0.65	0.04	0.04	0.00	0.31	0.81	0.01	0.01	0.01	0.04	0.01	0.02	0.33
Tot. Cu	0.14	0.18	0.13	0.28	0.79	0.66	0.05	0.14	0.00	0.23	0.76	0.00	0.00	0.00	0.00	0.00	0.01	0.27
Tot. Ni	0.02	0.11	0.08	0.22	0.65	0.96	0.04	0.12	0.00	0.42	0.93	0.00	0.00	0.01	0.01	0.00	0.01	0.41
Tot. Pb	0.88	0.31	0.41	0.67	0.96	0.31	0.96	0.00	0.37	0.24	0.39	0.84	0.96	0.42	0.75	0.37	0.92	0.99
Tot. Zn	0.04	0.05	0.03	0.46	0.93	0.71	0.02	0.09	0.00	0.31	0.92	0.00	0.00	0.01	0.02	0.00	0.01	0.56

Table D.12 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.05	0.26	0.13	0.00	0.17	0.74	-0.19	0.47	0.32	0.13	0.30	0.37	0.57	-0.04	0.51
Max. Rain	0.04	0.24	0.37	0.07	0.23	0.55	-0.34	0.55	0.28	0.35	0.23	0.34	0.40	-0.26	0.49
15m. Rain	0.06	0.27	0.39	0.07	0.25	0.57	-0.32	0.58	0.33	0.39	0.27	0.38	0.44	-0.21	0.53
ADD	0.42	0.35	0.17	-0.10	-0.11	-0.31	0.36	-0.03	0.28	0.10	-0.30	-0.28	-0.32	0.11	-0.19
Ante. Rain	-0.23	-0.41	-0.17	0.24	0.18	0.07	-0.24	-0.24	-0.34	-0.19	0.16	0.07	0.12	-0.01	-0.02
Duration	0.03	0.31	-0.01	-0.06	-0.12	0.09	0.57	0.22	0.31	0.10	-0.12	-0.12	0.01	0.26	0.10
Ave_Rain	0.28	0.20	0.61	0.01	0.28	0.51	-0.29	0.46	0.31	0.64	0.49	0.49	0.51	-0.01	0.58
TSS	0.01	0.15	0.05	0.04	0.09	0.24	0.27	-0.01	0.26	0.21	0.50	0.38	0.39	0.66	0.42
Turb.	0.06	0.16	0.01	0.62	0.75	0.64	-0.19	0.57	0.42	0.22	0.91	0.85	0.82	0.23	0.78
Cond.	0.71	0.57	0.54	0.48	0.41	0.17	0.18	0.24	0.58	0.36	0.26	0.31	0.21	0.30	0.26
Hard.	0.81	0.48	0.63	0.22	0.19	0.00	0.18	0.04	0.46	0.41	0.06	0.08	0.02	0.22	0.03
COD	0.29	0.45	0.18	0.68	0.86	0.62	-0.33	0.65	0.60	0.18	0.59	0.76	0.67	-0.05	0.67
DOC	0.31	0.62	0.19	0.88	0.94	0.68	-0.27	0.80	0.73	0.18	0.63	0.81	0.71	-0.01	0.75
O & G	0.50	0.47	0.39	0.57	0.78	0.46	-0.14	0.54	0.61	0.39	0.62	0.78	0.63	0.21	0.63
TKN	0.36	0.50	0.23	0.70	0.74	0.59	-0.12	0.54	0.58	0.12	0.51	0.70	0.61	0.08	0.55
NH_3-N	0.34	0.64	0.14	0.41	0.69	0.78	-0.10	0.69	0.80	0.19	0.61	0.77	0.82	0.23	0.75
NO_2-N	0.27	0.26	0.33	0.64	0.67	0.62	-0.28	0.53	0.40	0.30	0.56	0.62	0.64	-0.03	0.62
NO_3-N	0.46	0.57	0.23	0.57	0.49	0.20	-0.16	0.22	0.47	0.09	0.25	0.28	0.22	0.00	0.15
PO_4-P	1	0.57	0.82	0.15	0.18	-0.05	0.30	0.09	0.57	0.70	0.18	0.15	0.06	0.32	0.06
Diss. P	0.02	1	0.36	0.44	0.48	0.34	0.09	0.66	0.94	0.30	0.23	0.38	0.31	0.15	0.50
Diss. Cd	0.00	0.16	1	-0.03	0.09	-0.03	0.18	0.11	0.36	0.89	0.13	0.15	0.04	0.20	0.14
Diss. Cr	0.56	0.08	0.92	1	0.84	0.50	-0.17	0.55	0.50	-0.06	0.55	0.64	0.52	0.02	0.52
Diss. Cu	0.50	0.05	0.73	0.00	1	0.72	-0.39	0.74	0.60	0.11	0.66	0.89	0.78	-0.08	0.74
Diss. Ni	0.86	0.19	0.92	0.04	0.00	1	-0.38	0.66	0.47	-0.02	0.61	0.82	0.94	-0.03	0.76
Diss. Pb	0.24	0.73	0.48	0.52	0.12	0.14	1	-0.28	0.14	0.30	-0.01	-0.29	-0.27	0.79	-0.16
Diss. Zn	0.73	0.00	0.67	0.02	0.00	0.00	0.28	1	0.74	0.22	0.49	0.69	0.64	-0.15	0.85
Tot. P	0.02	0.00	0.15	0.04	0.01	0.06	0.60	0.00	1	0.41	0.49	0.58	0.52	0.32	0.69
Tot. Cd	0.00	0.24	0.00	0.82	0.68	0.93	0.24	0.39	0.11	1	0.36	0.26	0.13	0.37	0.34
Tot. Cr	0.49	0.37	0.61	0.02	0.00	0.01	0.96	0.05	0.05	0.16	1	0.83	0.80	0.46	0.79
Tot. Cu	0.56	0.13	0.55	0.01	0.00	0.00	0.27	0.00	0.01	0.32	0.00	1	0.93	0.16	0.87
Tot. Ni	0.83	0.23	0.89	0.03	0.00	0.00	0.30	0.01	0.03	0.61	0.00	0.00	1	0.17	0.84
Tot. Pb	0.21	0.57	0.45	0.95	0.77	0.91	0.00	0.57	0.21	0.14	0.07	0.54	0.51	1	0.21
Tot. Zn	0.81	0.04	0.58	0.03	0.00	0.00	0.54	0.00	0.00	0.19	0.00	0.00	0.00	0.41	1

Table D.13 Correlation Analysis Results for Storm Characteristics and MFF20 (UCLA 2, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.87	-0.23	-0.16	0.44	0.65	-0.04	0.24	-0.33	-0.39	0.19	0.12	0.24	0.16	0.17	0.28	0.14
Max. Rain	0.00	1	0.98	-0.30	-0.16	0.13	0.92	-0.21	0.14	-0.52	-0.56	0.00	-0.10	0.06	0.01	-0.05	0.05	-0.05
15m. Rain	0.00	0.00	1	-0.26	-0.19	0.18	0.90	-0.19	0.19	-0.51	-0.55	0.05	-0.05	0.13	0.05	0.02	0.10	-0.01
ADD	0.32	0.19	0.25	1	-0.12	-0.08	-0.23	-0.18	-0.29	0.08	0.01	-0.21	-0.19	-0.23	-0.18	-0.11	-0.17	-0.01
Ante. Rain	0.49	0.48	0.40	0.60	1	-0.12	-0.19	0.28	0.32	-0.14	-0.02	0.23	0.08	-0.02	-0.02	-0.04	0.05	0.02
Duration	0.05	0.57	0.45	0.74	0.61	1	-0.11	0.21	0.11	0.14	0.00	0.18	0.20	0.19	0.18	0.21	0.58	0.36
Ave_Rain	0.00	0.00	0.00	0.32	0.42	0.63	1	-0.17	0.23	-0.50	-0.54	0.09	-0.05	0.18	0.09	0.03	0.02	-0.03
TSS	0.85	0.35	0.41	0.42	0.22	0.36	0.45	1	0.62	0.34	0.32	0.61	0.53	0.43	0.54	0.46	0.64	0.50
Turb.	0.29	0.56	0.40	0.20	0.16	0.64	0.31	0.00	1	0.15	0.06	0.83	0.65	0.77	0.65	0.61	0.74	0.50
Cond.	0.15	0.02	0.02	0.75	0.55	0.54	0.02	0.13	0.51	1	0.81	0.48	0.65	0.36	0.58	0.58	0.42	0.50
Hard.	0.09	0.01	0.01	0.98	0.92	1.00	0.01	0.16	0.81	0.00	1	0.43	0.69	0.34	0.61	0.59	0.36	0.31
COD	0.42	0.99	0.84	0.37	0.33	0.44	0.69	0.00	0.00	0.03	0.05	1	0.91	0.88	0.89	0.88	0.80	0.67
DOC	0.60	0.67	0.83	0.41	0.72	0.39	0.83	0.01	0.00	0.00	0.00	0.00	1	0.84	0.94	0.92	0.78	0.64
O & G	0.30	0.80	0.57	0.32	0.95	0.42	0.44	0.05	0.00	0.11	0.13	0.00	0.00	1	0.81	0.84	0.77	0.56
TKN	0.49	0.96	0.82	0.44	0.93	0.44	0.70	0.01	0.00	0.01	0.00	0.00	0.00	0.00	1	0.96	0.77	0.66
NH_3-N	0.46	0.82	0.95	0.63	0.85	0.36	0.91	0.04	0.00	0.01	0.01	0.00	0.00	0.00	0.00	1	0.74	0.66
NO_2-N	0.23	0.82	0.66	0.46	0.84	0.01	0.92	0.00	0.00	0.06	0.11	0.00	0.00	0.00	0.00	0.00	1	0.57
NO_3-N	0.55	0.83	0.97	0.96	0.93	0.11	0.89	0.02	0.02	0.02	0.17	0.00	0.00	0.01	0.00	0.00	0.01	1
PO_4-P	0.46	0.32	0.41	0.91	0.47	0.64	0.57	0.22	0.71	0.13	0.20	0.42	0.36	0.35	0.20	0.17	0.67	0.10
Diss. P	0.70	0.54	0.85	0.77	0.60	0.44	0.49	0.14	0.07	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Diss. Cd	0.07	0.03	0.04	0.73	0.81	0.54	0.04	0.55	0.98	0.00	0.00	0.12	0.01	0.30	0.01	0.00	0.40	0.28
Diss. Cr	0.28	0.30	0.41	0.84	0.71	0.63	0.45	0.07	0.04	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.04
Diss. Cu	0.70	0.68	0.94	0.35	0.60	0.56	0.61	0.17	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Diss. Ni	0.30	0.10	0.16	0.67	0.15	0.78	0.13	0.09	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Diss. Pb	0.49	0.20	0.27	0.55	0.65	0.20	0.11	0.33	0.86	0.00	0.00	0.08	0.01	0.27	0.00	0.00	0.07	0.05
Diss. Zn	0.15	0.04	0.09	0.70	0.94	0.99	0.08	0.61	0.33	0.00	0.01	0.02	0.01	0.05	0.01	0.00	0.15	0.07
Tot. P	0.95	0.31	0.53	0.79	0.90	0.33	0.33	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cd	0.23	0.10	0.17	0.96	0.49	1.00	0.16	0.07	0.16	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.04	0.03
Tot. Cr	0.74	0.76	0.96	0.54	0.20	0.14	0.86	0.00	0.00	0.20	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Tot. Cu	0.99	0.50	0.70	0.42	0.59	0.46	0.56	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.45	0.14	0.22	0.65	0.25	0.54	0.16	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.38	0.07	0.10	0.98	0.25	0.28	0.06	0.00	0.02	0.01	0.02	0.00	0.01	0.11	0.02	0.04	0.01	0.01
Tot. Zn	0.41	0.11	0.20	0.90	0.74	0.57	0.15	0.05	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Table D.13 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.17	0.09	-0.42	-0.26	0.09	-0.24	-0.16	-0.34	0.02	-0.28	0.08	0.00	-0.18	-0.21	-0.20
Max. Rain	-0.23	-0.15	-0.49	-0.24	-0.10	-0.38	-0.30	-0.47	-0.24	-0.38	-0.07	-0.16	-0.35	-0.42	-0.37
15m. Rain	-0.19	-0.05	-0.46	-0.19	-0.02	-0.32	-0.26	-0.39	-0.15	-0.32	-0.01	-0.09	-0.29	-0.38	-0.30
ADD	0.03	-0.07	0.08	-0.05	-0.22	-0.10	0.14	0.09	-0.06	-0.01	-0.15	-0.19	-0.11	-0.01	-0.03
Ante. Rain	-0.17	-0.13	-0.06	-0.09	0.13	0.34	-0.11	-0.02	-0.03	-0.17	0.30	0.13	0.27	0.27	0.08
Duration	-0.11	0.18	-0.15	0.11	0.14	0.07	0.30	0.00	0.23	0.00	0.34	0.18	0.15	0.25	0.14
Ave_Rain	-0.13	-0.16	-0.47	-0.18	-0.12	-0.35	-0.37	-0.40	-0.23	-0.33	-0.04	-0.14	-0.33	-0.43	-0.34
TSS	0.28	0.35	0.14	0.41	0.32	0.39	0.23	0.12	0.57	0.42	0.75	0.57	0.52	0.78	0.45
Turb.	0.09	0.41	0.01	0.47	0.63	0.56	0.04	0.23	0.52	0.33	0.86	0.73	0.62	0.50	0.47
Cond.	0.34	0.57	0.70	0.59	0.53	0.53	0.81	0.63	0.60	0.68	0.30	0.55	0.58	0.60	0.72
Hard.	0.29	0.59	0.84	0.59	0.59	0.68	0.70	0.58	0.60	0.75	0.29	0.58	0.69	0.53	0.71
COD	0.19	0.73	0.36	0.56	0.87	0.77	0.40	0.50	0.80	0.58	0.87	0.93	0.83	0.62	0.80
DOC	0.21	0.79	0.55	0.67	0.91	0.83	0.56	0.57	0.81	0.71	0.73	0.91	0.87	0.58	0.84
O & G	0.21	0.66	0.25	0.62	0.80	0.64	0.26	0.45	0.66	0.52	0.71	0.82	0.69	0.37	0.63
TKN	0.29	0.85	0.61	0.66	0.87	0.79	0.63	0.58	0.86	0.79	0.73	0.91	0.85	0.52	0.87
NH_3-N	0.31	0.91	0.63	0.61	0.89	0.80	0.65	0.72	0.88	0.77	0.66	0.88	0.84	0.46	0.90
NO_2-N	0.10	0.54	0.20	0.62	0.66	0.58	0.42	0.33	0.63	0.47	0.85	0.77	0.68	0.60	0.60
NO_3-N	0.37	0.63	0.26	0.47	0.55	0.56	0.44	0.41	0.73	0.50	0.58	0.64	0.64	0.58	0.66
PO_4-P	1	0.38	0.42	0.32	0.20	0.24	0.42	0.34	0.39	0.45	0.06	0.29	0.30	0.37	0.38
Diss. P	0.10	1	0.70	0.53	0.85	0.74	0.69	0.73	0.95	0.76	0.53	0.82	0.79	0.51	0.88
Diss. Cd	0.07	0.00	1	0.62	0.65	0.72	0.80	0.77	0.63	0.87	0.21	0.60	0.70	0.38	0.80
Diss. Cr	0.17	0.02	0.00	1	0.66	0.70	0.60	0.56	0.58	0.79	0.61	0.75	0.75	0.53	0.70
Diss. Cu	0.40	0.00	0.00	0.00	1	0.89	0.56	0.70	0.81	0.74	0.67	0.94	0.90	0.51	0.88
Diss. Ni	0.31	0.00	0.00	0.00	0.00	1	0.57	0.77	0.77	0.77	0.68	0.89	0.98	0.59	0.91
Diss. Pb	0.06	0.00	0.00	0.01	0.01	0.01	1	0.67	0.64	0.70	0.30	0.55	0.61	0.52	0.75
Diss. Zn	0.14	0.00	0.00	0.01	0.00	0.00	0.00	1	0.67	0.69	0.34	0.63	0.72	0.37	0.85
Tot. P	0.09	0.00	0.00	0.01	0.00	0.00	0.00	0.00	1	0.78	0.72	0.88	0.86	0.72	0.91
Tot. Cd	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.49	0.80	0.81	0.49	0.87
Tot. Cr	0.79	0.02	0.38	0.00	0.00	0.00	0.20	0.15	0.00	0.03	1	0.84	0.78	0.78	0.66
Tot. Cu	0.21	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	1	0.95	0.70	0.90
Tot. Ni	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.71	0.94
Tot. Pb	0.11	0.02	0.10	0.02	0.02	0.01	0.02	0.11	0.00	0.03	0.00	0.00	0.00	1	0.65
Tot. Zn	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

Table D.14 Correlation Analysis Results for Storm Characteristics and MFF20 (UCLA 3, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.57	0.72	-0.22	-0.15	0.56	0.54	0.01	0.43	-0.06	-0.13	-0.11	0.05	0.22	-0.10	-0.04	0.40	0.01
Max. Rain	0.00	1	0.92	-0.39	-0.06	0.08	0.70	0.12	0.41	0.00	-0.07	0.08	0.13	0.20	0.11	0.15	0.38	0.12
15m. Rain	0.00	0.00	1	-0.41	-0.07	0.14	0.83	0.18	0.51	0.08	-0.04	0.11	0.22	0.31	0.16	0.15	0.54	0.08
ADD	0.31	0.06	0.06	1	-0.08	-0.06	-0.32	-0.25	-0.41	0.11	0.17	-0.06	-0.04	-0.19	0.04	-0.03	-0.34	-0.45
Ante. Rain	0.51	0.78	0.77	0.72	1	-0.04	-0.21	0.37	0.04	-0.23	-0.15	-0.05	-0.12	0.02	-0.19	-0.31	0.04	0.08
Duration	0.01	0.73	0.54	0.80	0.86	1	-0.17	0.10	0.22	-0.22	-0.19	-0.26	-0.30	-0.08	-0.24	-0.21	0.07	0.00
Ave_Rain	0.01	0.00	0.00	0.14	0.35	0.44	1	0.08	0.39	0.28	0.12	0.33	0.43	0.36	0.37	0.32	0.62	0.16
TSS	0.96	0.59	0.40	0.26	0.08	0.65	0.70	1	0.44	0.07	0.13	0.24	0.08	0.02	0.30	0.15	0.09	0.03
Turb.	0.04	0.06	0.01	0.05	0.85	0.31	0.06	0.04	1	0.12	-0.04	0.30	0.25	0.30	0.24	0.22	0.48	0.05
Cond.	0.80	0.99	0.71	0.63	0.30	0.32	0.20	0.76	0.59	1	0.90	0.83	0.93	0.75	0.93	0.91	0.32	0.58
Hard.	0.55	0.77	0.84	0.44	0.49	0.39	0.58	0.57	0.85	0.00	1	0.64	0.77	0.62	0.86	0.83	0.08	0.56
COD	0.63	0.72	0.63	0.80	0.83	0.23	0.12	0.28	0.17	0.00	0.00	1	0.89	0.65	0.86	0.86	0.42	0.54
DOC	0.83	0.55	0.32	0.87	0.59	0.16	0.04	0.70	0.24	0.00	0.00	0.00	1	0.84	0.90	0.90	0.46	0.58
O & G	0.32	0.37	0.16	0.38	0.92	0.71	0.09	0.93	0.17	0.00	0.00	0.00	0.00	1	0.66	0.68	0.61	0.60
TKN	0.67	0.61	0.46	0.86	0.39	0.28	0.08	0.17	0.27	0.00	0.00	0.00	0.00	0.00	1	0.93	0.35	0.53
NH_3-N	0.88	0.49	0.48	0.88	0.15	0.34	0.14	0.51	0.31	0.00	0.00	0.00	0.00	0.00	0.00	1	0.31	0.59
NO_2-N	0.06	0.07	0.01	0.12	0.87	0.75	0.00	0.70	0.02	0.13	0.72	0.05	0.03	0.00	0.11	0.15	1	0.37
NO_3-N	0.96	0.60	0.73	0.03	0.71	0.99	0.46	0.88	0.83	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.09	1
PO_4-P	0.84	0.81	0.82	0.92	0.59	0.39	0.91	0.32	0.82	0.01	0.00	0.15	0.10	0.32	0.01	0.02	0.92	0.01
Diss. P	0.61	0.82	0.49	0.36	0.94	0.95	0.28	0.74	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.01
Diss. Cd	0.14	0.35	0.31	0.10	0.78	0.26	0.63	0.82	0.30	0.00	0.00	0.04	0.01	0.04	0.00	0.00	0.53	0.12
Diss. Cr	0.39	0.16	0.13	0.01	0.97	0.58	0.09	0.49	0.81	0.06	0.04	0.20	0.34	0.69	0.12	0.19	0.17	0.93
Diss. Cu	0.25	0.66	0.74	0.87	0.86	0.06	0.47	0.99	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00
Diss. Ni	0.14	0.76	0.94	0.77	0.46	0.16	0.76	0.14	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.01
Diss. Pb	0.46	0.36	0.40	0.24	0.93	0.25	0.85	0.10	0.82	0.08	0.04	0.15	0.14	0.58	0.04	0.06	0.78	0.89
Diss. Zn	0.60	0.83	0.70	0.73	0.77	0.84	0.81	0.60	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00
Tot. P	0.95	0.78	0.76	0.32	0.90	0.94	0.38	0.27	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.02
Tot. Cd	0.35	0.35	0.55	0.05	0.62	0.73	0.97	0.66	1.00	0.00	0.00	0.01	0.00	0.05	0.00	0.00	0.89	0.23
Tot. Cr	0.83	0.45	0.81	0.12	0.48	0.93	0.90	0.04	0.12	0.04	0.10	0.05	0.11	0.27	0.04	0.19	0.53	0.80
Tot. Cu	0.12	0.89	0.98	0.61	0.67	0.01	0.62	0.37	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.04
Tot. Ni	0.12	0.63	0.67	0.85	0.66	0.04	0.94	0.20	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.03
Tot. Pb	0.57	0.10	0.18	0.21	0.29	0.78	0.29	0.01	0.45	0.84	0.48	0.91	0.85	0.60	0.66	0.77	0.47	0.24
Tot. Zn	0.66	0.80	0.89	0.70	0.73	0.69	0.91	0.15	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.00

Table D.14 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.05	0.12	-0.34	-0.20	-0.26	-0.33	-0.17	-0.12	0.01	-0.21	-0.05	-0.35	-0.35	-0.13	-0.10
Max. Rain	-0.05	0.05	-0.22	-0.32	0.10	-0.07	-0.21	-0.05	-0.07	-0.22	-0.17	-0.03	-0.11	-0.37	-0.06
15m. Rain	-0.05	0.16	-0.24	-0.34	0.08	-0.02	-0.19	-0.09	0.07	-0.14	-0.06	-0.01	-0.10	-0.30	-0.03
ADD	0.02	0.21	0.37	0.55	0.04	-0.07	0.27	0.08	0.23	0.43	0.35	0.12	0.05	0.29	0.09
Ante. Rain	-0.12	-0.02	-0.07	0.01	0.04	0.17	0.02	0.07	0.03	-0.12	0.16	0.10	0.10	0.24	0.08
Duration	0.19	-0.02	-0.26	0.13	-0.42	-0.32	-0.26	-0.05	-0.02	-0.08	0.02	-0.53	-0.45	0.06	-0.09
Ave_Rain	-0.02	0.25	-0.11	-0.38	0.17	0.07	-0.04	-0.06	0.20	-0.01	-0.03	0.11	0.02	-0.24	0.03
TSS	0.22	0.08	0.05	0.16	0.00	0.33	0.37	0.12	0.25	0.10	0.45	0.21	0.29	0.55	0.32
Turb.	-0.05	0.05	-0.24	0.06	-0.06	-0.04	-0.05	-0.18	0.10	0.00	0.35	-0.05	-0.11	0.18	-0.03
Cond.	0.53	0.95	0.77	0.42	0.89	0.83	0.39	0.81	0.93	0.81	0.46	0.85	0.80	0.05	0.87
Hard.	0.58	0.83	0.90	0.46	0.79	0.76	0.46	0.91	0.85	0.83	0.37	0.79	0.78	0.16	0.91
COD	0.31	0.81	0.46	0.29	0.79	0.77	0.32	0.63	0.77	0.54	0.44	0.73	0.68	0.03	0.71
DOC	0.35	0.89	0.58	0.22	0.90	0.81	0.33	0.71	0.83	0.61	0.36	0.82	0.75	-0.04	0.76
O & G	0.22	0.73	0.45	0.09	0.84	0.73	0.13	0.63	0.68	0.44	0.25	0.68	0.62	-0.12	0.63
TKN	0.56	0.87	0.69	0.35	0.82	0.82	0.45	0.76	0.89	0.76	0.46	0.80	0.76	0.10	0.85
NH_3-N	0.49	0.86	0.68	0.30	0.85	0.78	0.42	0.80	0.81	0.68	0.30	0.77	0.73	-0.07	0.83
NO_2-N	-0.02	0.29	-0.15	-0.31	0.28	0.27	-0.06	0.03	0.26	-0.03	0.15	0.15	0.11	-0.17	0.10
NO_3-N	0.54	0.56	0.35	-0.02	0.60	0.59	0.03	0.68	0.50	0.27	-0.06	0.45	0.48	-0.27	0.61
PO_4-P	1	0.56	0.46	0.30	0.32	0.41	0.28	0.61	0.62	0.52	0.18	0.31	0.38	-0.06	0.62
Diss. P	0.01	1	0.71	0.44	0.80	0.73	0.40	0.81	0.96	0.80	0.43	0.75	0.69	0.03	0.86
Diss. Cd	0.04	0.00	1	0.63	0.70	0.65	0.64	0.83	0.75	0.90	0.43	0.78	0.75	0.30	0.84
Diss. Cr	0.18	0.05	0.00	1	0.25	0.20	0.45	0.39	0.51	0.73	0.75	0.38	0.32	0.57	0.47
Diss. Cu	0.15	0.00	0.00	0.28	1	0.88	0.33	0.79	0.74	0.61	0.27	0.92	0.86	-0.08	0.79
Diss. Ni	0.06	0.00	0.00	0.38	0.00	1	0.42	0.80	0.76	0.56	0.30	0.88	0.92	0.08	0.85
Diss. Pb	0.23	0.08	0.00	0.04	0.15	0.06	1	0.43	0.50	0.56	0.47	0.54	0.58	0.51	0.58
Diss. Zn	0.00	0.00	0.00	0.08	0.00	0.00	0.05	1	0.79	0.70	0.21	0.74	0.78	0.03	0.95
Tot. P	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	1	0.87	0.57	0.76	0.73	0.21	0.88
Tot. Cd	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	1	0.60	0.68	0.60	0.33	0.77
Tot. Cr	0.43	0.05	0.06	0.00	0.25	0.19	0.03	0.37	0.01	0.00	1	0.48	0.43	0.76	0.45
Tot. Cu	0.17	0.00	0.00	0.09	0.00	0.00	0.01	0.00	0.00	0.00	0.03	1	0.96	0.22	0.84
Tot. Ni	0.09	0.00	0.00	0.16	0.00	0.00	0.01	0.00	0.00	0.00	0.05	0.00	1	0.27	0.88
Tot. Pb	0.80	0.91	0.19	0.01	0.72	0.74	0.02	0.89	0.36	0.15	0.00	0.34	0.24	1	0.25
Tot. Zn	0.00	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.04	0.00	0.00	0.28	1

Table D.15 Correlation Analysis Results for Storm Characteristics and MFF20 (Combined UCLA, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.73	0.80	-0.23	-0.17	0.45	0.62	0.00	0.27	-0.16	-0.22	0.06	0.10	0.17	0.06	0.12	0.29	0.05
Max. Rain	0.00	1	0.97	-0.31	-0.13	0.13	0.80	-0.11	0.17	-0.20	-0.26	0.06	0.05	0.09	0.06	0.06	0.17	-0.01
15m. Rain	0.00	0.00	1	-0.31	-0.16	0.17	0.83	-0.08	0.24	-0.20	-0.27	0.07	0.07	0.15	0.07	0.07	0.23	-0.02
ADD	0.07	0.01	0.02	1	-0.10	-0.03	-0.27	-0.20	-0.31	0.14	0.15	-0.07	-0.07	-0.15	-0.01	-0.02	-0.20	-0.15
Ante. Rain	0.19	0.31	0.23	0.42	1	-0.13	-0.17	0.27	0.18	-0.11	-0.05	0.10	0.02	0.04	-0.08	-0.15	0.10	0.10
Duration	0.00	0.31	0.19	0.80	0.33	1	-0.14	0.10	0.08	-0.05	-0.10	-0.07	-0.06	-0.03	-0.05	0.01	0.27	0.11
Ave_Rain	0.00	0.00	0.00	0.04	0.20	0.29	1	0.00	0.29	-0.10	-0.17	0.21	0.19	0.27	0.21	0.19	0.25	0.07
TSS	0.99	0.39	0.53	0.12	0.03	0.43	0.98	1	0.45	0.21	0.19	0.38	0.30	0.24	0.39	0.32	0.35	0.25
Turb.	0.04	0.19	0.06	0.01	0.16	0.53	0.02	0.00	1	0.08	-0.03	0.57	0.42	0.52	0.44	0.40	0.68	0.27
Cond.	0.22	0.12	0.12	0.29	0.39	0.68	0.46	0.10	0.56	1	0.86	0.62	0.74	0.58	0.72	0.68	0.35	0.50
Hard.	0.09	0.04	0.03	0.26	0.71	0.44	0.18	0.13	0.85	0.00	1	0.54	0.70	0.51	0.70	0.68	0.25	0.44
COD	0.65	0.65	0.57	0.60	0.43	0.59	0.10	0.00	0.00	0.00	0.00	1	0.90	0.79	0.88	0.87	0.62	0.60
DOC	0.47	0.68	0.57	0.60	0.89	0.67	0.14	0.02	0.00	0.00	0.00	0.00	1	0.84	0.91	0.90	0.57	0.63
O & G	0.18	0.48	0.26	0.26	0.78	0.81	0.03	0.06	0.00	0.00	0.00	0.00	0.00	1	0.76	0.77	0.62	0.58
TKN	0.65	0.63	0.57	0.92	0.56	0.68	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.92	0.56	0.59
NH_3-N	0.38	0.64	0.57	0.90	0.26	0.94	0.14	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.50	0.62
NO_2-N	0.02	0.20	0.07	0.11	0.43	0.03	0.05	0.01	0.00	0.01	0.05	0.00	0.00	0.00	0.00	0.00	1	0.42
NO_3-N	0.73	0.97	0.91	0.23	0.44	0.42	0.60	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
PO_4-P	0.42	0.33	0.45	0.53	0.20	0.92	0.99	0.22	0.46	0.00	0.00	0.10	0.12	0.08	0.01	0.01	0.34	0.00
Diss. P	0.32	1.00	0.63	0.42	0.28	0.32	0.69	0.13	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Cd	0.03	0.07	0.06	0.10	0.67	0.22	0.23	0.48	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.01
Diss. Cr	0.20	0.20	0.23	0.10	0.77	0.63	0.14	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
Diss. Cu	0.78	0.79	0.81	0.81	0.43	0.25	0.57	0.24	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Ni	0.61	0.79	0.85	0.57	0.11	0.52	0.98	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Pb	0.22	0.04	0.05	0.08	0.57	0.28	0.09	0.04	0.93	0.00	0.00	0.02	0.00	0.14	0.00	0.00	0.13	0.04
Diss. Zn	0.28	0.18	0.20	0.40	0.98	0.97	0.29	0.46	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Tot. P	0.55	0.59	0.99	0.51	0.58	0.23	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cd	0.24	0.25	0.40	0.21	0.32	0.93	0.95	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Tot. Cr	0.45	0.94	0.64	0.85	0.11	0.42	0.47	0.00	0.00	0.03	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Tot. Cu	0.66	0.96	0.91	0.83	0.41	0.22	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.47	0.50	0.58	0.80	0.19	0.35	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.30	0.01	0.02	0.37	0.15	0.16	0.03	0.00	0.00	0.02	0.02	0.05	0.16	0.31	0.06	0.17	0.02	0.22
Tot. Zn	0.71	0.38	0.49	0.79	0.60	0.84	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D.15 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.10	0.13	-0.28	-0.17	-0.04	-0.07	-0.16	-0.14	0.08	-0.16	0.10	-0.06	-0.10	-0.14	-0.05
Max. Rain	-0.13	0.00	-0.24	-0.17	0.04	-0.04	-0.28	-0.18	-0.07	-0.15	-0.01	-0.01	-0.09	-0.36	-0.12
15m. Rain	-0.10	0.07	-0.25	-0.16	0.03	-0.03	-0.26	-0.17	0.00	-0.11	0.06	0.02	-0.08	-0.31	-0.09
ADD	0.08	0.11	0.22	0.22	-0.03	-0.08	0.23	0.11	0.09	0.17	0.03	-0.03	-0.03	0.12	0.04
Ante. Rain	-0.16	-0.15	-0.06	0.04	0.11	0.21	-0.08	0.00	-0.07	-0.13	0.21	0.11	0.17	0.19	0.07
Duration	0.01	0.13	-0.16	0.07	-0.15	-0.09	0.14	-0.01	0.16	-0.01	0.11	-0.17	-0.12	0.19	0.03
Ave_Rain	0.00	0.05	-0.16	-0.20	0.08	0.00	-0.23	-0.14	0.01	-0.01	0.10	0.08	-0.03	-0.28	-0.05
TSS	0.16	0.20	0.09	0.22	0.16	0.35	0.28	0.10	0.39	0.25	0.57	0.38	0.40	0.64	0.37
Turb.	0.10	0.28	-0.02	0.37	0.34	0.32	0.01	0.19	0.42	0.27	0.73	0.46	0.39	0.39	0.39
Cond.	0.38	0.63	0.63	0.47	0.63	0.59	0.52	0.55	0.63	0.56	0.29	0.61	0.59	0.31	0.63
Hard.	0.41	0.63	0.80	0.46	0.64	0.63	0.54	0.61	0.63	0.67	0.24	0.61	0.64	0.32	0.68
COD	0.21	0.69	0.41	0.46	0.85	0.77	0.31	0.57	0.72	0.49	0.59	0.83	0.76	0.26	0.74
DOC	0.20	0.74	0.53	0.47	0.91	0.81	0.38	0.62	0.73	0.54	0.47	0.85	0.79	0.19	0.76
O & G	0.22	0.65	0.38	0.39	0.83	0.68	0.19	0.53	0.64	0.46	0.48	0.77	0.67	0.14	0.63
TKN	0.33	0.76	0.60	0.52	0.85	0.79	0.47	0.63	0.77	0.62	0.51	0.84	0.78	0.25	0.80
NH_3-N	0.31	0.80	0.62	0.42	0.87	0.80	0.49	0.73	0.78	0.62	0.43	0.83	0.79	0.18	0.83
NO_2-N	0.12	0.42	0.13	0.34	0.45	0.43	0.20	0.28	0.52	0.34	0.60	0.52	0.46	0.32	0.46
NO_3-N	0.40	0.61	0.36	0.30	0.63	0.56	0.27	0.53	0.61	0.40	0.25	0.56	0.55	0.16	0.61
PO_4-P	1	0.48	0.48	0.29	0.21	0.20	0.37	0.38	0.49	0.54	0.14	0.26	0.26	0.26	0.40
Diss. P	0.00	1	0.67	0.48	0.74	0.65	0.52	0.74	0.94	0.70	0.42	0.72	0.67	0.30	0.82
Diss. Cd	0.00	0.00	1	0.52	0.64	0.60	0.71	0.77	0.63	0.87	0.24	0.64	0.65	0.32	0.78
Diss. Cr	0.03	0.00	0.00	1	0.48	0.44	0.42	0.48	0.54	0.59	0.64	0.57	0.53	0.44	0.58
Diss. Cu	0.11	0.00	0.00	0.00	1	0.86	0.39	0.73	0.71	0.58	0.43	0.92	0.86	0.16	0.81
Diss. Ni	0.14	0.00	0.00	0.00	0.00	1	0.38	0.73	0.69	0.53	0.48	0.88	0.94	0.26	0.84
Diss. Pb	0.00	0.00	0.00	0.00	0.00	0.00	1	0.55	0.54	0.62	0.28	0.46	0.50	0.55	0.62
Diss. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.70	0.66	0.28	0.68	0.72	0.21	0.89
Tot. P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.74	0.61	0.78	0.74	0.51	0.86
Tot. Cd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.46	0.67	0.62	0.43	0.78
Tot. Cr	0.30	0.00	0.07	0.00	0.00	0.00	0.04	0.04	0.00	0.00	1	0.65	0.62	0.70	0.56
Tot. Cu	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.95	0.41	0.87
Tot. Ni	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.44	0.89
Tot. Pb	0.05	0.02	0.01	0.00	0.25	0.05	0.00	0.11	0.00	0.00	0.00	0.00	0.00	1	0.45
Tot. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

Table D.16 Correlation Analysis Results for Storm Characteristics and MFF30 (UCLA 1, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.84	-0.30	-0.22	0.32	0.69	0.02	0.16	-0.07	-0.05	0.13	0.15	-0.05	0.13	0.38	0.19	0.00
Max. Rain	0.00	1	0.99	-0.35	-0.20	0.17	0.76	-0.27	0.17	-0.01	0.01	0.18	0.22	0.11	0.12	0.22	0.26	0.04
15m. Rain	0.00	0.00	1	-0.35	-0.23	0.18	0.81	-0.21	0.21	0.00	0.02	0.20	0.26	0.15	0.13	0.28	0.27	0.04
ADD	0.23	0.15	0.16	1	-0.21	0.18	-0.36	-0.11	-0.23	0.55	0.62	0.24	0.10	0.15	0.22	0.18	0.04	-0.11
Ante. Rain	0.37	0.43	0.37	0.39	1	-0.27	-0.11	-0.01	0.20	0.07	0.04	0.18	0.11	0.08	-0.05	-0.18	0.33	0.21
Duration	0.20	0.49	0.48	0.47	0.29	1	-0.13	-0.03	-0.13	-0.16	-0.13	-0.21	-0.06	-0.33	-0.18	0.15	-0.21	0.03
Ave_Rain	0.00	0.00	0.00	0.15	0.68	0.62	1	0.15	0.41	0.15	0.14	0.31	0.31	0.44	0.23	0.41	0.41	0.06
TSS	0.95	0.27	0.39	0.66	0.96	0.90	0.54	1	0.29	0.09	-0.01	0.07	0.09	0.20	0.17	0.35	0.11	0.09
Turb.	0.52	0.51	0.40	0.36	0.43	0.61	0.09	0.24	1	0.30	0.13	0.75	0.77	0.68	0.61	0.78	0.69	0.33
Cond.	0.80	0.96	0.99	0.02	0.77	0.53	0.56	0.71	0.24	1	0.94	0.68	0.67	0.71	0.70	0.47	0.60	0.32
Hard.	0.84	0.98	0.95	0.01	0.87	0.62	0.59	0.98	0.62	0.00	1	0.55	0.50	0.59	0.50	0.34	0.49	0.32
COD	0.62	0.49	0.43	0.34	0.47	0.40	0.21	0.79	0.00	0.00	0.02	1	0.91	0.78	0.86	0.79	0.91	0.29
DOC	0.55	0.37	0.30	0.70	0.67	0.82	0.20	0.73	0.00	0.00	0.04	0.00	1	0.78	0.81	0.78	0.85	0.47
O & G	0.86	0.67	0.54	0.57	0.77	0.18	0.07	0.44	0.00	0.00	0.01	0.00	0.00	1	0.68	0.66	0.69	0.38
TKN	0.60	0.64	0.60	0.39	0.84	0.47	0.36	0.51	0.01	0.00	0.04	0.00	0.00	0.00	1	0.74	0.77	0.14
NH_3-N	0.12	0.38	0.26	0.47	0.49	0.55	0.09	0.16	0.00	0.05	0.17	0.00	0.00	0.00	0.00	1	0.66	0.20
NO_2-N	0.44	0.31	0.27	0.86	0.19	0.41	0.09	0.67	0.00	0.01	0.04	0.00	0.00	0.00	0.00	0.00	1	0.31
NO_3-N	0.99	0.88	0.87	0.66	0.41	0.91	0.81	0.74	0.18	0.20	0.20	0.25	0.05	0.12	0.57	0.43	0.21	1
PO_4-P	0.65	0.81	0.86	0.00	0.49	0.88	0.57	0.67	0.54	0.00	0.00	0.04	0.13	0.02	0.05	0.08	0.08	0.66
Diss. P	0.24	0.16	0.16	0.18	0.14	0.19	0.52	0.67	0.28	0.04	0.07	0.03	0.01	0.20	0.03	0.01	0.06	0.08
Diss. Cd	0.62	0.16	0.15	0.26	0.55	0.97	0.02	0.61	0.57	0.01	0.00	0.16	0.20	0.02	0.19	0.21	0.09	0.66
Diss. Cr	1.00	0.86	0.86	0.79	0.58	0.89	0.93	0.85	0.00	0.02	0.10	0.00	0.00	0.03	0.00	0.02	0.00	0.02
Diss. Cu	0.71	0.48	0.43	0.88	0.44	0.64	0.32	0.83	0.00	0.03	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Diss. Ni	0.00	0.02	0.02	0.43	0.78	0.74	0.04	0.41	0.01	0.30	0.55	0.00	0.01	0.15	0.01	0.00	0.00	0.38
Diss. Pb	0.56	0.27	0.31	0.08	0.41	0.00	0.20	0.55	0.17	0.87	0.79	0.13	0.23	0.26	0.32	0.62	0.08	0.29
Diss. Zn	0.20	0.10	0.07	0.75	0.58	0.37	0.15	0.88	0.00	0.25	0.60	0.00	0.00	0.01	0.01	0.00	0.00	0.35
Tot. P	0.09	0.09	0.07	0.38	0.17	0.22	0.21	0.30	0.06	0.03	0.07	0.01	0.00	0.10	0.02	0.00	0.03	0.16
Tot. Cd	0.71	0.28	0.21	0.48	0.42	0.93	0.01	0.15	0.09	0.05	0.04	0.14	0.14	0.00	0.25	0.05	0.16	0.69
Tot. Cr	0.23	0.44	0.34	0.52	0.69	0.63	0.06	0.03	0.00	0.10	0.29	0.01	0.00	0.00	0.01	0.00	0.02	0.14
Tot. Cu	0.15	0.23	0.17	0.55	0.86	0.67	0.05	0.12	0.00	0.13	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.25
Tot. Ni	0.01	0.10	0.07	0.44	0.68	0.99	0.03	0.14	0.00	0.21	0.45	0.00	0.00	0.02	0.00	0.00	0.00	0.35
Tot. Pb	1.00	0.31	0.43	0.52	0.73	0.37	0.93	0.00	0.49	0.20	0.25	0.93	0.83	0.46	0.79	0.25	0.61	0.66
Tot. Zn	0.04	0.08	0.05	0.78	0.89	0.64	0.02	0.09	0.00	0.14	0.46	0.00	0.00	0.00	0.00	0.00	0.01	0.38

Table D.16 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.11	0.30	0.13	0.00	0.10	0.74	-0.15	0.33	0.42	0.10	0.31	0.36	0.59	0.00	0.51
Max. Rain	-0.06	0.35	0.35	0.05	0.19	0.56	-0.28	0.42	0.43	0.28	0.20	0.31	0.42	-0.26	0.44
15m. Rain	-0.05	0.36	0.37	0.05	0.20	0.57	-0.26	0.45	0.45	0.32	0.25	0.35	0.45	-0.20	0.49
ADD	0.66	0.34	0.29	0.07	0.04	-0.21	0.44	0.08	0.23	0.18	-0.17	-0.16	-0.20	0.17	-0.07
Ante. Rain	-0.17	-0.37	-0.16	0.15	0.20	0.08	-0.21	-0.15	-0.35	-0.21	0.11	0.05	0.11	-0.09	-0.04
Duration	-0.04	0.33	0.01	-0.04	-0.12	0.09	0.69	0.23	0.31	0.02	-0.13	-0.11	0.00	0.23	0.12
Ave_Rain	0.14	0.17	0.57	-0.02	0.25	0.51	-0.33	0.37	0.32	0.61	0.47	0.48	0.53	-0.02	0.57
TSS	0.11	0.11	0.13	0.05	0.06	0.22	0.16	0.04	0.27	0.36	0.53	0.40	0.37	0.75	0.43
Turb.	0.16	0.28	0.15	0.66	0.83	0.61	-0.35	0.70	0.47	0.42	0.89	0.86	0.78	0.18	0.81
Cond.	0.79	0.50	0.61	0.57	0.52	0.27	0.04	0.30	0.52	0.49	0.42	0.38	0.32	0.33	0.37
Hard.	0.88	0.45	0.68	0.41	0.35	0.16	0.07	0.14	0.45	0.51	0.27	0.21	0.20	0.30	0.19
COD	0.48	0.52	0.36	0.75	0.92	0.66	-0.38	0.75	0.58	0.37	0.64	0.79	0.71	-0.02	0.72
DOC	0.37	0.65	0.33	0.87	0.92	0.64	-0.31	0.81	0.71	0.37	0.67	0.77	0.68	0.06	0.76
O & G	0.53	0.33	0.57	0.53	0.79	0.37	-0.29	0.61	0.42	0.66	0.66	0.74	0.55	0.19	0.67
TKN	0.48	0.52	0.33	0.73	0.79	0.64	-0.26	0.63	0.57	0.29	0.59	0.75	0.67	0.07	0.66
NH_3-N	0.42	0.58	0.32	0.57	0.78	0.75	-0.13	0.83	0.73	0.49	0.77	0.87	0.85	0.30	0.90
NO_2-N	0.43	0.46	0.43	0.68	0.82	0.68	-0.44	0.67	0.52	0.36	0.55	0.70	0.69	-0.14	0.65
NO_3-N	0.11	0.43	0.11	0.57	0.47	0.23	-0.27	0.24	0.36	0.11	0.38	0.30	0.24	0.12	0.23
PO_4-P	1	0.41	0.79	0.24	0.26	0.06	0.18	0.15	0.42	0.67	0.23	0.20	0.15	0.31	0.16
Diss. P	0.11	1	0.33	0.64	0.47	0.40	-0.02	0.65	0.94	0.29	0.28	0.35	0.31	0.11	0.49
Diss. Cd	0.00	0.20	1	0.04	0.20	0.09	0.13	0.20	0.35	0.87	0.19	0.22	0.15	0.18	0.24
Diss. Cr	0.36	0.01	0.89	1	0.81	0.52	-0.28	0.61	0.66	0.10	0.59	0.62	0.53	0.11	0.55
Diss. Cu	0.32	0.06	0.44	0.00	1	0.66	-0.41	0.81	0.52	0.29	0.69	0.86	0.73	-0.02	0.76
Diss. Ni	0.82	0.11	0.74	0.03	0.00	1	-0.38	0.62	0.54	0.10	0.66	0.81	0.94	0.06	0.79
Diss. Pb	0.50	0.93	0.62	0.28	0.10	0.14	1	-0.21	-0.02	0.17	-0.21	-0.38	-0.34	0.52	-0.16
Diss. Zn	0.57	0.01	0.44	0.01	0.00	0.01	0.42	1	0.69	0.34	0.52	0.74	0.64	-0.09	0.83
Tot. P	0.09	0.00	0.16	0.00	0.03	0.02	0.94	0.00	1	0.42	0.51	0.52	0.51	0.29	0.67
Tot. Cd	0.00	0.26	0.00	0.71	0.26	0.70	0.52	0.18	0.09	1	0.47	0.40	0.28	0.41	0.46
Tot. Cr	0.38	0.28	0.46	0.01	0.00	0.00	0.42	0.03	0.04	0.05	1	0.86	0.83	0.50	0.84
Tot. Cu	0.44	0.17	0.40	0.01	0.00	0.00	0.14	0.00	0.03	0.11	0.00	1	0.93	0.24	0.91
Tot. Ni	0.56	0.23	0.56	0.03	0.00	0.00	0.18	0.01	0.04	0.28	0.00	0.00	1	0.24	0.88
Tot. Pb	0.22	0.67	0.49	0.69	0.93	0.82	0.03	0.73	0.25	0.10	0.04	0.35	0.35	1	0.30
Tot. Zn	0.55	0.05	0.36	0.02	0.00	0.00	0.53	0.00	0.00	0.06	0.00	0.00	0.00	0.24	1

Table D.17 Correlation Analysis Results for Storm Characteristics and MFF30 (UCLA 2, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.87	-0.23	-0.16	0.44	0.65	-0.08	0.16	-0.35	-0.41	0.13	0.06	0.15	0.09	0.11	0.25	0.05
Max. Rain	0.00	1	0.98	-0.30	-0.16	0.13	0.92	-0.23	0.03	-0.56	-0.61	-0.10	-0.17	-0.04	-0.06	-0.14	0.01	-0.14
15m. Rain	0.00	0.00	1	-0.26	-0.19	0.18	0.90	-0.21	0.10	-0.54	-0.59	-0.03	-0.12	0.04	-0.01	-0.06	0.07	-0.10
ADD	0.32	0.19	0.25	1	-0.12	-0.08	-0.23	-0.20	-0.30	0.12	0.05	-0.17	-0.15	-0.18	-0.16	-0.09	-0.19	0.02
Ante. Rain	0.49	0.48	0.40	0.60	1	-0.12	-0.19	0.28	0.32	-0.19	-0.07	0.19	0.05	-0.03	-0.01	-0.04	0.02	0.06
Duration	0.05	0.57	0.45	0.74	0.61	1	-0.11	0.08	0.01	0.07	-0.04	0.11	0.11	0.09	0.09	0.13	0.50	0.28
Ave_Rain	0.00	0.00	0.00	0.32	0.42	0.63	1	-0.14	0.14	-0.54	-0.58	0.01	-0.10	0.08	0.04	-0.04	0.00	-0.11
TSS	0.72	0.31	0.36	0.38	0.22	0.72	0.54	1	0.68	0.28	0.32	0.64	0.55	0.47	0.57	0.48	0.63	0.51
Turb.	0.50	0.89	0.67	0.19	0.16	0.96	0.55	0.00	1	0.18	0.16	0.83	0.70	0.78	0.69	0.66	0.75	0.48
Cond.	0.12	0.01	0.01	0.60	0.41	0.75	0.01	0.21	0.44	1	0.81	0.48	0.63	0.41	0.55	0.57	0.40	0.45
Hard.	0.07	0.00	0.01	0.82	0.75	0.87	0.01	0.16	0.48	0.00	1	0.47	0.69	0.41	0.61	0.61	0.40	0.34
COD	0.58	0.68	0.88	0.46	0.40	0.63	0.97	0.00	0.00	0.03	0.03	1	0.93	0.91	0.91	0.91	0.82	0.67
DOC	0.81	0.45	0.61	0.53	0.83	0.65	0.65	0.01	0.00	0.00	0.00	0.00	1	0.88	0.94	0.93	0.79	0.64
O & G	0.51	0.86	0.86	0.44	0.90	0.69	0.72	0.03	0.00	0.07	0.06	0.00	0.00	1	0.82	0.86	0.78	0.58
TKN	0.69	0.81	0.95	0.48	0.96	0.69	0.86	0.01	0.00	0.01	0.00	0.00	0.00	0.00	1	0.95	0.79	0.65
NH_3-N	0.65	0.55	0.79	0.71	0.87	0.58	0.85	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1	0.76	0.65
NO_2-N	0.27	0.96	0.76	0.41	0.94	0.02	1.00	0.00	0.00	0.07	0.08	0.00	0.00	0.00	0.00	0.00	1	0.55
NO_3-N	0.84	0.54	0.68	0.93	0.81	0.22	0.64	0.02	0.03	0.04	0.13	0.00	0.00	0.01	0.00	0.00	0.01	1
PO_4-P	0.45	0.31	0.44	0.67	0.57	0.54	0.60	0.27	0.56	0.24	0.32	0.38	0.47	0.38	0.19	0.13	0.71	0.14
Diss. P	0.85	0.37	0.66	0.91	0.67	0.61	0.33	0.12	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Cd	0.03	0.01	0.02	0.68	0.83	0.43	0.02	0.42	0.51	0.00	0.00	0.05	0.01	0.11	0.00	0.00	0.26	0.15
Diss. Cr	0.14	0.18	0.26	0.87	0.99	0.96	0.35	0.04	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.02
Diss. Cu	0.93	0.42	0.67	0.49	0.78	0.80	0.38	0.14	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Diss. Ni	0.15	0.04	0.08	0.81	0.15	0.97	0.06	0.06	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Pb	0.39	0.16	0.23	0.54	0.66	0.36	0.11	0.34	0.59	0.00	0.00	0.05	0.01	0.13	0.00	0.00	0.05	0.05
Diss. Zn	0.06	0.01	0.03	0.62	0.98	0.82	0.04	0.42	0.16	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.09	0.02
Tot. P	0.88	0.22	0.41	0.89	0.95	0.54	0.26	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cd	0.13	0.06	0.11	0.97	0.50	0.70	0.11	0.06	0.05	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.02
Tot. Cr	0.89	0.55	0.74	0.56	0.14	0.44	0.75	0.00	0.00	0.40	0.28	0.00	0.00	0.00	0.00	0.01	0.00	0.02
Tot. Cu	0.78	0.33	0.53	0.49	0.62	0.77	0.41	0.01	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.28	0.07	0.13	0.73	0.24	0.85	0.10	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.25	0.05	0.08	0.95	0.21	0.56	0.07	0.00	0.01	0.02	0.02	0.00	0.00	0.05	0.01	0.02	0.01	0.00
Tot. Zn	0.25	0.06	0.11	0.97	0.73	0.83	0.09	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Table D.17 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.18	0.04	-0.48	-0.35	0.02	-0.33	-0.21	-0.43	-0.04	-0.35	-0.03	-0.07	-0.26	-0.27	-0.27
Max. Rain	-0.23	-0.21	-0.54	-0.31	-0.19	-0.46	-0.33	-0.55	-0.29	-0.43	-0.14	-0.23	-0.41	-0.44	-0.44
15m. Rain	-0.18	-0.10	-0.51	-0.27	-0.10	-0.41	-0.28	-0.48	-0.19	-0.37	-0.08	-0.15	-0.35	-0.40	-0.37
ADD	0.10	-0.03	0.10	-0.04	-0.16	-0.06	0.15	0.12	-0.03	0.01	-0.14	-0.16	-0.08	-0.02	-0.01
Ante. Rain	-0.13	-0.10	-0.05	0.00	0.07	0.33	-0.10	-0.01	-0.02	-0.16	0.34	0.12	0.27	0.29	0.08
Duration	-0.14	0.12	-0.19	-0.01	0.06	-0.01	0.22	-0.05	0.15	-0.09	0.18	0.07	0.05	0.14	0.05
Ave_Rain	-0.12	-0.23	-0.51	-0.22	-0.21	-0.43	-0.37	-0.47	-0.27	-0.37	-0.08	-0.19	-0.38	-0.42	-0.39
TSS	0.25	0.36	0.19	0.47	0.35	0.42	0.23	0.19	0.60	0.44	0.78	0.60	0.57	0.83	0.48
Turb.	0.13	0.47	0.16	0.58	0.68	0.63	0.13	0.33	0.56	0.44	0.86	0.79	0.70	0.57	0.55
Cond.	0.27	0.55	0.73	0.57	0.55	0.52	0.72	0.67	0.55	0.68	0.20	0.51	0.54	0.53	0.68
Hard.	0.23	0.59	0.86	0.59	0.60	0.65	0.72	0.64	0.59	0.75	0.26	0.55	0.65	0.52	0.70
COD	0.20	0.78	0.45	0.63	0.88	0.80	0.45	0.59	0.84	0.64	0.81	0.93	0.86	0.67	0.83
DOC	0.17	0.81	0.60	0.69	0.91	0.82	0.58	0.63	0.82	0.74	0.67	0.90	0.86	0.62	0.86
O & G	0.20	0.72	0.37	0.67	0.84	0.68	0.35	0.54	0.70	0.60	0.67	0.85	0.73	0.44	0.69
TKN	0.30	0.85	0.64	0.67	0.86	0.79	0.67	0.62	0.86	0.78	0.66	0.88	0.84	0.60	0.87
NH_3-N	0.34	0.92	0.65	0.61	0.90	0.80	0.65	0.76	0.88	0.76	0.58	0.86	0.83	0.51	0.90
NO_2-N	0.09	0.56	0.26	0.61	0.67	0.58	0.44	0.39	0.63	0.49	0.77	0.76	0.67	0.59	0.60
NO_3-N	0.33	0.64	0.34	0.53	0.59	0.63	0.45	0.50	0.75	0.53	0.53	0.67	0.69	0.62	0.71
PO_4-P	1	0.43	0.45	0.30	0.23	0.25	0.53	0.42	0.42	0.42	0.03	0.28	0.29	0.32	0.40
Diss. P	0.06	1	0.71	0.53	0.88	0.75	0.71	0.76	0.94	0.76	0.48	0.82	0.79	0.56	0.89
Diss. Cd	0.05	0.00	1	0.67	0.68	0.75	0.83	0.80	0.66	0.88	0.24	0.62	0.72	0.46	0.81
Diss. Cr	0.20	0.02	0.00	1	0.68	0.74	0.62	0.62	0.60	0.83	0.65	0.78	0.79	0.64	0.74
Diss. Cu	0.34	0.00	0.00	0.00	1	0.87	0.57	0.74	0.84	0.77	0.61	0.94	0.90	0.57	0.88
Diss. Ni	0.28	0.00	0.00	0.00	0.00	1	0.60	0.82	0.78	0.78	0.67	0.88	0.98	0.67	0.93
Diss. Pb	0.02	0.00	0.00	0.00	0.01	0.01	1	0.66	0.67	0.72	0.29	0.55	0.62	0.54	0.73
Diss. Zn	0.06	0.00	0.00	0.00	0.00	0.00	0.00	1	0.71	0.74	0.37	0.68	0.77	0.46	0.88
Tot. P	0.07	0.00	0.00	0.01	0.00	0.00	0.00	0.00	1	0.78	0.67	0.89	0.86	0.76	0.92
Tot. Cd	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.48	0.80	0.81	0.58	0.87
Tot. Cr	0.90	0.03	0.32	0.00	0.00	0.00	0.22	0.11	0.00	0.03	1	0.81	0.77	0.82	0.63
Tot. Cu	0.23	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	1	0.95	0.76	0.90
Tot. Ni	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.78	0.94
Tot. Pb	0.18	0.01	0.04	0.00	0.01	0.00	0.01	0.04	0.00	0.01	0.00	0.00	0.00	1	0.72
Tot. Zn	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

Table D.18 Correlation Analysis Results for Storm Characteristics and MFF30 (UCLA 3, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.57	0.72	-0.22	-0.15	0.56	0.54	-0.03	0.38	0.02	-0.12	-0.16	0.10	0.24	-0.11	-0.03	0.40	-0.01
Max. Rain	0.00	1	0.92	-0.39	-0.06	0.08	0.70	0.07	0.40	-0.02	-0.12	0.01	0.11	0.15	0.05	0.09	0.35	0.09
15m. Rain	0.00	0.00	1	-0.41	-0.07	0.14	0.83	0.12	0.47	0.09	-0.07	0.04	0.21	0.26	0.11	0.10	0.49	0.04
ADD	0.31	0.06	0.06	1	-0.08	-0.06	-0.32	-0.29	-0.42	0.10	0.19	-0.05	-0.02	-0.17	0.06	0.00	-0.30	-0.40
Ante. Rain	0.51	0.78	0.77	0.72	1	-0.04	-0.21	0.34	0.06	-0.23	-0.13	-0.07	-0.16	0.01	-0.24	-0.34	-0.06	0.08
Duration	0.01	0.73	0.54	0.80	0.86	1	-0.17	0.09	0.17	-0.21	-0.23	-0.33	-0.30	-0.09	-0.30	-0.25	0.03	-0.04
Ave_Rain	0.01	0.00	0.00	0.14	0.35	0.44	1	0.06	0.36	0.28	0.11	0.30	0.41	0.32	0.38	0.29	0.53	0.14
TSS	0.88	0.75	0.59	0.18	0.11	0.68	0.77	1	0.49	-0.08	0.05	0.18	-0.07	-0.13	0.19	-0.03	-0.13	-0.03
Turb.	0.07	0.06	0.03	0.05	0.80	0.45	0.10	0.02	1	0.18	0.01	0.34	0.30	0.24	0.26	0.25	0.44	0.14
Cond.	0.92	0.93	0.67	0.65	0.29	0.33	0.19	0.73	0.42	1	0.88	0.77	0.94	0.80	0.89	0.90	0.39	0.62
Hard.	0.60	0.60	0.74	0.39	0.55	0.29	0.61	0.83	0.96	0.00	1	0.62	0.77	0.61	0.85	0.83	0.11	0.58
COD	0.47	0.95	0.85	0.81	0.76	0.12	0.17	0.42	0.11	0.00	0.00	1	0.83	0.60	0.82	0.84	0.29	0.55
DOC	0.64	0.63	0.34	0.91	0.47	0.16	0.05	0.76	0.17	0.00	0.00	0.00	1	0.86	0.84	0.89	0.47	0.60
O & G	0.27	0.49	0.23	0.43	0.98	0.68	0.14	0.55	0.27	0.00	0.00	0.00	0.00	1	0.58	0.69	0.63	0.64
TKN	0.61	0.81	0.62	0.78	0.26	0.16	0.08	0.39	0.23	0.00	0.00	0.00	0.00	0.00	1	0.90	0.26	0.56
NH_3-N	0.90	0.69	0.65	0.99	0.12	0.26	0.18	0.91	0.25	0.00	0.00	0.00	0.00	0.00	0.00	1	0.33	0.64
NO_2-N	0.06	0.10	0.02	0.16	0.78	0.90	0.01	0.55	0.04	0.06	0.62	0.18	0.02	0.00	0.24	0.12	1	0.37
NO_3-N	0.97	0.68	0.84	0.06	0.70	0.85	0.54	0.91	0.53	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.08	1
PO_4-P	0.88	0.81	0.90	0.95	0.67	0.46	0.87	0.42	0.66	0.04	0.01	0.28	0.19	0.40	0.01	0.07	0.89	0.01
Diss. P	0.60	0.98	0.58	0.39	0.93	0.87	0.35	0.92	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.01
Diss. Cd	0.07	0.25	0.19	0.07	0.90	0.22	0.44	0.90	0.52	0.00	0.00	0.06	0.01	0.12	0.00	0.00	0.46	0.13
Diss. Cr	0.43	0.15	0.14	0.02	0.63	0.64	0.09	0.53	0.52	0.12	0.09	0.25	0.40	0.92	0.17	0.27	0.11	0.94
Diss. Cu	0.15	0.84	0.97	0.81	0.81	0.03	0.64	0.57	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00
Diss. Ni	0.07	0.58	0.74	0.91	0.46	0.11	0.89	0.33	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00
Diss. Pb	0.39	0.62	0.45	0.21	0.99	0.19	0.83	0.20	0.49	0.14	0.03	0.12	0.18	0.61	0.06	0.05	0.94	0.81
Diss. Zn	0.54	0.62	0.52	0.66	0.70	0.85	0.63	0.91	0.57	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.93	0.00
Tot. P	0.96	0.61	0.88	0.40	0.78	0.75	0.42	0.37	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.01
Tot. Cd	0.24	0.24	0.39	0.04	0.78	0.63	0.78	0.71	0.95	0.00	0.00	0.03	0.01	0.15	0.00	0.00	0.61	0.26
Tot. Cr	0.80	0.46	0.80	0.30	0.26	0.66	0.98	0.03	0.05	0.03	0.07	0.01	0.06	0.22	0.02	0.16	0.77	0.88
Tot. Cu	0.09	0.84	0.90	0.69	0.51	0.00	0.66	0.64	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.03
Tot. Ni	0.08	0.57	0.60	0.88	0.47	0.01	0.97	0.35	1.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.58	0.02
Tot. Pb	0.56	0.20	0.26	0.49	0.17	0.88	0.42	0.00	0.11	0.82	0.47	0.58	0.97	0.72	0.56	0.78	0.37	0.46
Tot. Zn	0.64	0.63	0.75	0.77	0.57	0.55	1.00	0.24	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00

Table D.18 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.03	0.12	-0.40	-0.18	-0.32	-0.40	-0.20	-0.14	0.01	-0.27	-0.06	-0.38	-0.39	-0.14	-0.11
Max. Rain	-0.05	0.01	-0.26	-0.32	0.05	-0.13	-0.12	-0.11	-0.12	-0.27	-0.17	-0.05	-0.13	-0.29	-0.11
15m. Rain	-0.03	0.13	-0.30	-0.33	0.01	-0.08	-0.18	-0.15	0.04	-0.20	-0.06	-0.03	-0.12	-0.26	-0.07
ADD	-0.01	0.20	0.40	0.51	0.06	-0.03	0.29	0.10	0.19	0.45	0.24	0.09	0.04	0.16	0.07
Ante. Rain	-0.09	0.02	-0.03	0.11	0.06	0.17	0.00	0.09	0.07	-0.07	0.26	0.15	0.17	0.31	0.13
Duration	0.16	-0.04	-0.28	0.11	-0.48	-0.36	-0.30	-0.04	-0.08	-0.11	-0.10	-0.63	-0.54	-0.04	-0.14
Ave_Rain	0.04	0.22	-0.18	-0.38	0.11	0.03	-0.05	-0.11	0.19	-0.07	0.01	0.10	0.01	-0.19	0.00
TSS	0.18	-0.02	0.03	0.15	-0.13	0.22	0.29	0.03	0.21	0.09	0.47	0.11	0.21	0.60	0.27
Turb.	-0.10	0.05	-0.15	0.15	-0.05	0.02	0.16	-0.13	0.08	0.02	0.44	0.02	0.00	0.36	0.05
Cond.	0.43	0.95	0.71	0.35	0.87	0.83	0.34	0.80	0.91	0.75	0.47	0.81	0.77	0.05	0.83
Hard.	0.54	0.83	0.89	0.38	0.76	0.79	0.49	0.90	0.87	0.81	0.41	0.76	0.78	0.17	0.90
COD	0.23	0.79	0.42	0.27	0.77	0.74	0.35	0.58	0.73	0.49	0.53	0.72	0.68	0.13	0.68
DOC	0.29	0.89	0.53	0.20	0.88	0.78	0.31	0.68	0.81	0.56	0.42	0.80	0.73	0.01	0.73
O & G	0.18	0.76	0.35	0.02	0.82	0.67	0.12	0.61	0.66	0.33	0.28	0.65	0.59	-0.08	0.60
TKN	0.52	0.84	0.71	0.31	0.76	0.80	0.42	0.73	0.88	0.77	0.49	0.76	0.73	0.13	0.81
NH_3-N	0.38	0.87	0.68	0.25	0.84	0.77	0.44	0.80	0.80	0.66	0.32	0.74	0.70	-0.06	0.79
NO_2-N	-0.03	0.27	-0.17	-0.36	0.31	0.24	0.02	0.02	0.19	-0.12	0.07	0.18	0.13	-0.21	0.05
NO_3-N	0.51	0.59	0.34	-0.02	0.64	0.62	0.06	0.71	0.53	0.26	0.04	0.48	0.51	-0.17	0.63
PO_4-P	1	0.49	0.36	0.09	0.25	0.42	0.07	0.55	0.55	0.41	0.01	0.20	0.30	-0.19	0.51
Diss. P	0.02	1	0.66	0.37	0.76	0.73	0.31	0.80	0.94	0.73	0.44	0.70	0.66	0.01	0.83
Diss. Cd	0.11	0.00	1	0.59	0.64	0.65	0.60	0.81	0.73	0.90	0.46	0.71	0.70	0.31	0.80
Diss. Cr	0.71	0.10	0.01	1	0.17	0.18	0.41	0.33	0.43	0.70	0.73	0.29	0.25	0.55	0.41
Diss. Cu	0.27	0.00	0.00	0.47	1	0.86	0.32	0.75	0.70	0.53	0.30	0.90	0.84	-0.03	0.74
Diss. Ni	0.06	0.00	0.00	0.44	0.00	1	0.35	0.79	0.78	0.57	0.36	0.86	0.90	0.13	0.84
Diss. Pb	0.75	0.17	0.00	0.06	0.16	0.12	1	0.36	0.43	0.50	0.53	0.48	0.51	0.52	0.49
Diss. Zn	0.01	0.00	0.00	0.14	0.00	0.00	0.11	1	0.79	0.67	0.26	0.68	0.74	0.06	0.93
Tot. P	0.01	0.00	0.00	0.05	0.00	0.00	0.05	0.00	1	0.82	0.57	0.72	0.72	0.22	0.89
Tot. Cd	0.07	0.00	0.00	0.00	0.01	0.01	0.02	0.00	0.00	1	0.58	0.58	0.54	0.30	0.71
Tot. Cr	0.98	0.05	0.04	0.00	0.18	0.11	0.01	0.26	0.01	0.01	1	0.53	0.50	0.79	0.52
Tot. Cu	0.39	0.00	0.00	0.20	0.00	0.00	0.03	0.00	0.00	0.01	0.01	1	0.96	0.27	0.81
Tot. Ni	0.18	0.00	0.00	0.28	0.00	0.00	0.02	0.00	0.00	0.01	0.02	0.00	1	0.31	0.86
Tot. Pb	0.41	0.95	0.18	0.01	0.89	0.58	0.02	0.80	0.35	0.18	0.00	0.25	0.17	1	0.30
Tot. Zn	0.02	0.00	0.00	0.07	0.00	0.00	0.03	0.00	0.00	0.00	0.02	0.00	0.00	0.19	1

Table D.19 Correlation Analysis Results for Storm Characteristics and MFF30 (Combined UCLA, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.73	0.80	-0.23	-0.17	0.45	0.62	-0.04	0.22	-0.15	-0.22	0.01	0.09	0.14	0.03	0.09	0.28	0.01
Max. Rain	0.00	1	0.97	-0.31	-0.13	0.13	0.80	-0.14	0.13	-0.22	-0.29	0.00	0.02	0.06	0.02	0.01	0.15	-0.03
15m. Rain	0.00	0.00	1	-0.31	-0.16	0.17	0.83	-0.11	0.19	-0.22	-0.30	0.02	0.04	0.12	0.04	0.04	0.21	-0.05
ADD	0.07	0.01	0.02	1	-0.10	-0.03	-0.27	-0.22	-0.31	0.16	0.17	-0.05	-0.04	-0.11	0.00	0.01	-0.20	-0.11
Ante. Rain	0.19	0.31	0.23	0.42	1	-0.13	-0.17	0.24	0.18	-0.11	-0.05	0.09	-0.01	0.03	-0.08	-0.16	0.05	0.12
Duration	0.00	0.31	0.19	0.80	0.33	1	-0.14	0.06	0.02	-0.07	-0.12	-0.13	-0.09	-0.08	-0.11	-0.03	0.18	0.07
Ave_Rain	0.00	0.00	0.00	0.04	0.20	0.29	1	0.01	0.25	-0.13	-0.21	0.17	0.16	0.24	0.19	0.16	0.24	0.03
TSS	0.77	0.29	0.41	0.09	0.06	0.67	0.95	1	0.49	0.15	0.18	0.35	0.23	0.19	0.35	0.26	0.25	0.22
Turb.	0.09	0.31	0.13	0.01	0.16	0.89	0.05	0.00	1	0.14	0.08	0.60	0.48	0.52	0.48	0.48	0.66	0.29
Cond.	0.25	0.09	0.09	0.22	0.38	0.59	0.33	0.25	0.29	1	0.86	0.61	0.74	0.61	0.68	0.65	0.39	0.47
Hard.	0.09	0.02	0.02	0.18	0.72	0.36	0.11	0.17	0.56	0.00	1	0.55	0.71	0.54	0.68	0.66	0.30	0.44
COD	0.92	0.98	0.86	0.70	0.47	0.32	0.18	0.01	0.00	0.00	0.00	1	0.89	0.78	0.88	0.88	0.62	0.60
DOC	0.51	0.91	0.74	0.77	0.97	0.48	0.21	0.07	0.00	0.00	0.00	0.00	1	0.86	0.89	0.90	0.61	0.63
O & G	0.28	0.64	0.37	0.40	0.83	0.52	0.06	0.14	0.00	0.00	0.00	0.00	0.00	1	0.73	0.78	0.66	0.59
TKN	0.84	0.85	0.78	0.99	0.53	0.38	0.13	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1	0.90	0.57	0.57
NH_3-N	0.49	0.93	0.78	0.97	0.21	0.84	0.22	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.55	0.61
NO_2-N	0.03	0.26	0.10	0.13	0.71	0.17	0.06	0.06	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	1	0.40
NO_3-N	0.94	0.80	0.71	0.39	0.36	0.58	0.82	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
PO_4-P	0.35	0.21	0.35	0.29	0.32	0.79	0.90	0.24	0.34	0.01	0.00	0.08	0.22	0.10	0.01	0.02	0.25	0.03
Diss. P	0.34	0.99	0.65	0.37	0.35	0.38	0.98	0.23	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Cd	0.01	0.03	0.02	0.07	0.77	0.17	0.10	0.42	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00
Diss. Cr	0.13	0.12	0.15	0.13	0.55	0.91	0.11	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Diss. Cu	0.48	0.87	0.87	0.98	0.47	0.13	0.88	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Ni	0.39	0.54	0.60	0.78	0.11	0.38	0.71	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Pb	0.16	0.05	0.05	0.07	0.53	0.25	0.06	0.09	0.77	0.00	0.00	0.02	0.01	0.17	0.00	0.00	0.24	0.06
Diss. Zn	0.10	0.05	0.06	0.31	0.90	0.86	0.11	0.46	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Tot. P	0.51	0.67	0.90	0.56	0.59	0.36	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cd	0.10	0.09	0.18	0.17	0.37	0.56	0.60	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Tot. Cr	0.66	0.75	0.81	0.94	0.07	0.96	0.49	0.00	0.00	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Tot. Cu	0.50	0.75	0.92	0.85	0.37	0.07	0.68	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.34	0.38	0.47	0.86	0.14	0.15	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.23	0.01	0.02	0.56	0.13	0.45	0.06	0.00	0.00	0.03	0.01	0.02	0.09	0.22	0.04	0.11	0.09	0.12
Tot. Zn	0.56	0.22	0.33	0.76	0.54	0.93	0.52	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D.19 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.12	0.13	-0.34	-0.20	-0.10	-0.12	-0.19	-0.22	0.09	-0.22	0.06	-0.09	-0.13	-0.16	-0.08
Max. Rain	-0.16	0.00	-0.29	-0.21	-0.02	-0.08	-0.26	-0.26	-0.06	-0.22	-0.04	-0.04	-0.12	-0.35	-0.16
15m. Rain	-0.12	0.06	-0.30	-0.19	-0.02	-0.07	-0.26	-0.25	0.02	-0.18	0.03	-0.01	-0.10	-0.31	-0.13
ADD	0.14	0.12	0.24	0.20	0.00	-0.04	0.24	0.14	0.08	0.19	-0.01	-0.03	-0.02	0.08	0.04
Ante. Rain	-0.13	-0.13	-0.04	0.08	0.10	0.21	-0.08	0.02	-0.07	-0.12	0.24	0.12	0.20	0.20	0.08
Duration	-0.03	0.12	-0.18	0.02	-0.20	-0.12	0.15	-0.02	0.12	-0.08	0.01	-0.24	-0.19	0.10	-0.01
Ave_Rain	-0.02	0.00	-0.22	-0.21	0.02	-0.05	-0.25	-0.21	-0.01	-0.07	0.09	0.06	-0.05	-0.25	-0.09
TSS	0.15	0.16	0.11	0.23	0.09	0.30	0.23	0.10	0.38	0.27	0.58	0.35	0.37	0.70	0.36
Turb.	0.12	0.33	0.09	0.48	0.39	0.39	0.04	0.26	0.45	0.36	0.75	0.52	0.47	0.44	0.45
Cond.	0.32	0.59	0.63	0.45	0.63	0.57	0.46	0.57	0.57	0.57	0.27	0.56	0.55	0.28	0.61
Hard.	0.36	0.61	0.81	0.46	0.63	0.62	0.54	0.62	0.60	0.68	0.25	0.57	0.62	0.32	0.66
COD	0.22	0.71	0.46	0.51	0.86	0.77	0.31	0.60	0.71	0.53	0.59	0.83	0.76	0.30	0.76
DOC	0.16	0.75	0.55	0.49	0.90	0.78	0.37	0.64	0.71	0.57	0.47	0.83	0.77	0.23	0.76
O & G	0.21	0.63	0.40	0.39	0.83	0.64	0.18	0.55	0.59	0.50	0.47	0.75	0.65	0.16	0.65
TKN	0.32	0.74	0.62	0.54	0.82	0.77	0.43	0.64	0.74	0.64	0.50	0.81	0.76	0.28	0.79
NH_3-N	0.30	0.80	0.63	0.45	0.87	0.79	0.48	0.75	0.76	0.65	0.44	0.82	0.78	0.22	0.84
NO_2-N	0.15	0.46	0.17	0.35	0.50	0.46	0.16	0.32	0.51	0.33	0.53	0.53	0.48	0.23	0.45
NO_3-N	0.28	0.58	0.38	0.35	0.65	0.57	0.25	0.56	0.56	0.40	0.26	0.56	0.55	0.21	0.62
PO_4-P	1	0.45	0.46	0.25	0.21	0.21	0.34	0.41	0.45	0.49	0.09	0.23	0.25	0.21	0.38
Diss. P	0.00	1	0.64	0.52	0.73	0.65	0.47	0.74	0.93	0.67	0.40	0.69	0.65	0.30	0.80
Diss. Cd	0.00	0.00	1	0.54	0.63	0.62	0.69	0.78	0.62	0.88	0.25	0.62	0.64	0.36	0.78
Diss. Cr	0.06	0.00	0.00	1	0.48	0.48	0.37	0.52	0.57	0.64	0.65	0.56	0.53	0.49	0.60
Diss. Cu	0.12	0.00	0.00	0.00	1	0.83	0.36	0.74	0.67	0.60	0.43	0.90	0.84	0.20	0.80
Diss. Ni	0.11	0.00	0.00	0.00	0.00	1	0.35	0.74	0.70	0.57	0.52	0.86	0.94	0.32	0.85
Diss. Pb	0.01	0.00	0.00	0.01	0.01	0.01	1	0.51	0.48	0.58	0.21	0.39	0.43	0.52	0.55
Diss. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.70	0.70	0.31	0.68	0.72	0.26	0.89
Tot. P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.72	0.59	0.74	0.73	0.52	0.85
Tot. Cd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.46	0.66	0.63	0.47	0.79
Tot. Cr	0.48	0.00	0.06	0.00	0.00	0.00	0.12	0.02	0.00	0.00	1	0.67	0.65	0.73	0.58
Tot. Cu	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.95	0.46	0.86
Tot. Ni	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.49	0.89
Tot. Pb	0.12	0.02	0.01	0.00	0.14	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.00	1	0.50
Tot. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

Table D.20 Correlation Analysis Results for Storm Characteristics and MFF40 (UCLA 1, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.84	-0.30	-0.22	0.32	0.69	0.00	0.15	-0.05	-0.03	0.09	0.13	-0.08	0.10	0.25	0.18	0.01
Max. Rain	0.00	1	0.99	-0.35	-0.20	0.17	0.76	-0.28	0.17	0.01	0.02	0.16	0.22	0.09	0.09	0.17	0.28	0.03
15m. Rain	0.00	0.00	1	-0.35	-0.23	0.18	0.81	-0.21	0.21	0.02	0.03	0.18	0.25	0.13	0.10	0.22	0.29	0.02
ADD	0.23	0.15	0.16	1	-0.21	0.18	-0.36	-0.08	-0.21	0.56	0.61	0.24	0.17	0.14	0.20	0.13	0.03	-0.02
Ante. Rain	0.37	0.43	0.37	0.39	1	-0.27	-0.11	-0.04	0.23	0.08	0.05	0.21	0.14	0.14	0.00	-0.14	0.30	0.20
Duration	0.20	0.49	0.48	0.47	0.29	1	-0.13	-0.05	-0.18	-0.09	-0.06	-0.23	-0.05	-0.32	-0.18	0.14	-0.27	0.13
Ave_Rain	0.00	0.00	0.00	0.15	0.68	0.62	1	0.15	0.42	0.11	0.09	0.30	0.30	0.40	0.20	0.33	0.40	-0.02
TSS	0.99	0.27	0.40	0.76	0.88	0.85	0.54	1	0.28	0.04	-0.04	0.10	0.04	0.16	0.14	0.27	0.05	0.04
Turb.	0.56	0.50	0.41	0.40	0.36	0.48	0.08	0.26	1	0.28	0.11	0.77	0.73	0.67	0.64	0.80	0.68	0.25
Cond.	0.84	0.98	0.95	0.02	0.74	0.71	0.65	0.87	0.27	1	0.95	0.70	0.71	0.67	0.62	0.38	0.52	0.39
Hard.	0.90	0.92	0.92	0.01	0.85	0.80	0.71	0.89	0.66	0.00	1	0.56	0.54	0.53	0.43	0.18	0.41	0.44
COD	0.72	0.54	0.49	0.35	0.41	0.36	0.23	0.71	0.00	0.00	0.02	1	0.93	0.82	0.89	0.79	0.91	0.29
DOC	0.62	0.38	0.31	0.51	0.59	0.85	0.23	0.88	0.00	0.00	0.02	0.00	1	0.79	0.80	0.78	0.82	0.42
O & G	0.75	0.71	0.60	0.57	0.58	0.19	0.10	0.52	0.00	0.00	0.03	0.00	0.00	1	0.67	0.65	0.70	0.34
TKN	0.69	0.72	0.70	0.43	0.99	0.47	0.43	0.58	0.00	0.01	0.08	0.00	0.00	0.00	1	0.81	0.76	0.12
NH_3-N	0.32	0.51	0.39	0.62	0.58	0.59	0.19	0.28	0.00	0.12	0.46	0.00	0.00	0.00	0.00	1	0.64	0.12
NO_2-N	0.48	0.26	0.25	0.90	0.23	0.29	0.11	0.85	0.00	0.03	0.09	0.00	0.00	0.00	0.00	0.00	1	0.29
NO_3-N	0.98	0.90	0.93	0.93	0.44	0.60	0.93	0.88	0.32	0.11	0.07	0.24	0.08	0.17	0.63	0.63	0.24	1
PO_4-P	0.69	0.86	0.91	0.00	0.52	0.92	0.56	0.59	0.41	0.00	0.00	0.02	0.07	0.04	0.04	0.16	0.10	0.54
Diss. P	0.26	0.16	0.17	0.25	0.18	0.13	0.75	0.79	0.40	0.09	0.12	0.06	0.01	0.53	0.07	0.07	0.09	0.10
Diss. Cd	0.62	0.17	0.16	0.19	0.57	0.83	0.03	0.62	0.50	0.01	0.01	0.11	0.13	0.03	0.19	0.27	0.12	0.71
Diss. Cr	0.95	0.85	0.87	0.55	0.61	0.94	0.92	0.82	0.01	0.01	0.03	0.00	0.00	0.03	0.00	0.01	0.01	0.01
Diss. Cu	0.80	0.54	0.52	0.73	0.34	0.80	0.42	0.97	0.00	0.04	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Diss. Ni	0.00	0.02	0.02	0.47	0.66	0.67	0.04	0.44	0.01	0.25	0.44	0.00	0.01	0.16	0.01	0.00	0.00	0.32
Diss. Pb	0.53	0.28	0.32	0.09	0.53	0.00	0.22	0.83	0.09	1.00	0.94	0.10	0.24	0.34	0.14	0.64	0.03	0.59
Diss. Zn	0.32	0.20	0.16	0.71	0.78	0.25	0.26	0.75	0.00	0.45	0.82	0.00	0.00	0.02	0.01	0.00	0.00	0.54
Tot. P	0.11	0.08	0.08	0.45	0.21	0.17	0.36	0.43	0.12	0.08	0.13	0.03	0.01	0.39	0.05	0.02	0.07	0.19
Tot. Cd	0.72	0.29	0.21	0.45	0.44	0.90	0.01	0.11	0.06	0.06	0.06	0.09	0.11	0.01	0.23	0.08	0.20	0.87
Tot. Cr	0.32	0.55	0.44	0.75	0.75	0.65	0.09	0.03	0.00	0.06	0.18	0.00	0.01	0.01	0.01	0.00	0.05	0.14
Tot. Cu	0.26	0.33	0.27	0.68	0.79	0.77	0.11	0.15	0.00	0.18	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.34
Tot. Ni	0.02	0.12	0.09	0.48	0.63	0.92	0.04	0.17	0.00	0.22	0.43	0.00	0.00	0.03	0.00	0.00	0.00	0.37
Tot. Pb	0.89	0.24	0.34	0.50	0.82	0.64	0.83	0.00	0.64	0.22	0.24	0.95	0.92	0.61	0.95	0.68	0.39	0.49
Tot. Zn	0.08	0.13	0.08	0.99	0.91	0.46	0.04	0.12	0.00	0.16	0.47	0.00	0.00	0.01	0.01	0.00	0.01	0.45

Table D.20 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.10	0.29	0.13	0.02	0.07	0.71	-0.16	0.26	0.40	0.09	0.26	0.29	0.55	-0.04	0.44
Max. Rain	-0.05	0.36	0.35	0.05	0.16	0.55	-0.28	0.33	0.44	0.28	0.16	0.25	0.40	-0.30	0.38
15m. Rain	-0.03	0.35	0.36	0.04	0.17	0.56	-0.26	0.36	0.44	0.32	0.20	0.29	0.43	-0.25	0.43
ADD	0.66	0.30	0.34	0.16	0.09	-0.19	0.43	0.10	0.20	0.20	-0.08	-0.11	-0.18	0.18	0.00
Ante. Rain	-0.16	-0.34	-0.15	0.13	0.25	0.12	-0.17	-0.07	-0.32	-0.20	0.08	0.07	0.13	-0.06	-0.03
Duration	-0.02	0.38	0.06	0.02	-0.07	0.11	0.67	0.30	0.35	-0.03	-0.12	-0.08	0.03	0.12	0.19
Ave_Rain	0.15	0.08	0.54	-0.03	0.21	0.50	-0.31	0.29	0.24	0.61	0.42	0.41	0.50	-0.06	0.50
TSS	0.14	0.07	0.13	0.06	0.01	0.20	0.06	0.08	0.21	0.40	0.52	0.36	0.35	0.78	0.39
Turb.	0.21	0.22	0.18	0.62	0.82	0.64	-0.43	0.68	0.39	0.46	0.86	0.87	0.81	0.12	0.80
Cond.	0.76	0.43	0.59	0.65	0.51	0.29	0.00	0.20	0.44	0.46	0.46	0.34	0.32	0.32	0.36
Hard.	0.83	0.39	0.65	0.53	0.36	0.20	0.02	0.06	0.38	0.46	0.35	0.18	0.20	0.30	0.19
COD	0.54	0.46	0.40	0.77	0.91	0.66	-0.41	0.68	0.52	0.42	0.67	0.80	0.72	0.02	0.72
DOC	0.44	0.59	0.38	0.84	0.89	0.63	-0.30	0.71	0.65	0.40	0.65	0.73	0.66	0.03	0.74
O & G	0.50	0.16	0.53	0.52	0.79	0.36	-0.25	0.55	0.22	0.61	0.65	0.73	0.53	0.13	0.65
TKN	0.48	0.45	0.33	0.72	0.79	0.64	-0.37	0.59	0.49	0.31	0.59	0.77	0.67	0.02	0.65
NH_3-N	0.34	0.45	0.28	0.60	0.83	0.68	-0.12	0.86	0.55	0.43	0.72	0.88	0.79	0.11	0.91
NO_2-N	0.40	0.43	0.39	0.65	0.83	0.69	-0.52	0.67	0.45	0.33	0.49	0.70	0.67	-0.22	0.62
NO_3-N	0.16	0.41	0.10	0.59	0.44	0.26	-0.14	0.16	0.34	0.04	0.38	0.25	0.23	0.18	0.20
PO_4-P	1	0.34	0.81	0.35	0.32	0.13	0.07	0.21	0.37	0.70	0.34	0.26	0.22	0.28	0.24
Diss. P	0.18	1	0.25	0.68	0.39	0.42	-0.11	0.51	0.95	0.18	0.23	0.27	0.28	0.04	0.42
Diss. Cd	0.00	0.34	1	0.12	0.24	0.13	0.12	0.24	0.29	0.86	0.23	0.22	0.19	0.12	0.28
Diss. Cr	0.17	0.00	0.66	1	0.75	0.58	-0.32	0.51	0.70	0.16	0.62	0.59	0.56	0.16	0.56
Diss. Cu	0.21	0.13	0.35	0.00	1	0.65	-0.35	0.79	0.42	0.31	0.66	0.86	0.73	-0.05	0.77
Diss. Ni	0.62	0.09	0.61	0.02	0.01	1	-0.39	0.60	0.54	0.16	0.66	0.77	0.93	0.08	0.77
Diss. Pb	0.81	0.68	0.66	0.21	0.17	0.12	1	-0.12	-0.16	0.05	-0.27	-0.37	-0.38	0.30	-0.13
Diss. Zn	0.43	0.04	0.36	0.04	0.00	0.01	0.64	1	0.56	0.35	0.45	0.76	0.66	-0.13	0.85
Tot. P	0.14	0.00	0.26	0.00	0.10	0.03	0.55	0.02	1	0.32	0.43	0.40	0.46	0.18	0.57
Tot. Cd	0.00	0.50	0.00	0.55	0.24	0.54	0.85	0.17	0.21	1	0.53	0.43	0.34	0.35	0.50
Tot. Cr	0.19	0.37	0.37	0.01	0.00	0.00	0.30	0.07	0.09	0.03	1	0.83	0.83	0.54	0.79
Tot. Cu	0.32	0.30	0.39	0.01	0.00	0.00	0.14	0.00	0.11	0.09	0.00	1	0.91	0.22	0.90
Tot. Ni	0.39	0.27	0.48	0.02	0.00	0.00	0.14	0.00	0.06	0.18	0.00	0.00	1	0.24	0.88
Tot. Pb	0.27	0.88	0.66	0.55	0.86	0.77	0.24	0.63	0.48	0.17	0.03	0.40	0.35	1	0.27
Tot. Zn	0.35	0.09	0.28	0.02	0.00	0.00	0.63	0.00	0.02	0.04	0.00	0.00	0.00	0.30	1

Table D.21 Correlation Analysis Results for Storm Characteristics and MFF40 (UCLA 2, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.87	-0.23	-0.16	0.44	0.65	-0.07	0.10	-0.38	-0.44	0.09	0.02	0.10	0.08	0.07	0.21	-0.01
Max. Rain	0.00	1	0.98	-0.30	-0.16	0.13	0.92	-0.15	-0.04	-0.60	-0.67	-0.17	-0.22	-0.11	-0.09	-0.20	-0.02	-0.22
15m. Rain	0.00	0.00	1	-0.26	-0.19	0.18	0.90	-0.15	0.03	-0.58	-0.65	-0.10	-0.16	-0.02	-0.05	-0.12	0.04	-0.16
ADD	0.32	0.19	0.25	1	-0.12	-0.08	-0.23	-0.21	-0.30	0.20	0.14	-0.12	-0.10	-0.13	-0.13	-0.05	-0.19	0.09
Ante. Rain	0.49	0.48	0.40	0.60	1	-0.12	-0.19	0.21	0.30	-0.22	-0.09	0.18	0.05	-0.01	-0.01	-0.02	0.01	0.08
Duration	0.05	0.57	0.45	0.74	0.61	1	-0.11	0.00	-0.06	0.02	-0.08	0.08	0.03	0.02	0.04	0.06	0.41	0.23
Ave_Rain	0.00	0.00	0.00	0.32	0.42	0.63	1	-0.03	0.07	-0.58	-0.64	-0.05	-0.13	0.02	0.02	-0.09	0.00	-0.18
TSS	0.78	0.51	0.53	0.36	0.35	1.00	0.92	1	0.65	0.16	0.24	0.62	0.56	0.46	0.62	0.51	0.60	0.50
Turb.	0.66	0.86	0.88	0.19	0.20	0.78	0.76	0.00	1	0.15	0.22	0.83	0.75	0.80	0.73	0.72	0.76	0.45
Cond.	0.09	0.00	0.01	0.39	0.35	0.93	0.01	0.48	0.51	1	0.79	0.41	0.55	0.34	0.45	0.50	0.34	0.33
Hard.	0.04	0.00	0.00	0.56	0.71	0.73	0.00	0.29	0.33	0.00	1	0.46	0.65	0.39	0.57	0.59	0.37	0.30
COD	0.70	0.46	0.68	0.61	0.43	0.74	0.82	0.00	0.00	0.07	0.04	1	0.94	0.90	0.91	0.93	0.83	0.62
DOC	0.93	0.33	0.48	0.68	0.83	0.89	0.57	0.01	0.00	0.01	0.00	0.00	1	0.88	0.95	0.94	0.79	0.57
O & G	0.66	0.65	0.95	0.57	0.96	0.93	0.92	0.04	0.00	0.13	0.08	0.00	0.00	1	0.80	0.87	0.78	0.50
TKN	0.72	0.69	0.85	0.57	0.96	0.87	0.93	0.00	0.00	0.04	0.01	0.00	0.00	0.00	1	0.95	0.81	0.57
NH_3-N	0.77	0.39	0.62	0.82	0.92	0.79	0.69	0.02	0.00	0.02	0.01	0.00	0.00	0.00	0.00	1	0.78	0.61
NO_2-N	0.37	0.93	0.86	0.40	0.98	0.07	1.00	0.00	0.00	0.14	0.10	0.00	0.00	0.00	0.00	0.00	1	0.47
NO_3-N	0.97	0.33	0.48	0.70	0.74	0.33	0.44	0.02	0.04	0.15	0.19	0.00	0.01	0.02	0.01	0.00	0.03	1
PO_4-P	0.46	0.28	0.43	0.56	0.67	0.56	0.55	0.26	0.59	0.34	0.28	0.32	0.47	0.42	0.22	0.15	0.62	0.10
Diss. P	0.97	0.23	0.50	0.94	0.80	0.70	0.21	0.13	0.02	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Cd	0.02	0.01	0.01	0.54	0.88	0.37	0.01	0.61	0.31	0.00	0.00	0.03	0.00	0.10	0.00	0.00	0.22	0.12
Diss. Cr	0.08	0.11	0.17	0.93	0.86	0.62	0.28	0.06	0.00	0.05	0.02	0.00	0.00	0.00	0.01	0.01	0.01	0.04
Diss. Cu	0.92	0.32	0.59	0.65	0.80	0.96	0.29	0.27	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Diss. Ni	0.11	0.02	0.05	0.97	0.16	0.80	0.04	0.15	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Pb	0.65	0.21	0.34	0.52	0.71	0.42	0.14	0.44	0.64	0.02	0.00	0.06	0.02	0.25	0.00	0.01	0.09	0.11
Diss. Zn	0.03	0.00	0.01	0.51	0.92	0.70	0.01	0.50	0.08	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.07	0.01
Tot. P	0.86	0.20	0.42	0.98	0.97	0.66	0.26	0.01	0.01	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cd	0.10	0.04	0.09	0.83	0.53	0.51	0.10	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02
Tot. Cr	0.83	0.65	0.87	0.62	0.18	0.81	0.96	0.00	0.00	0.86	0.56	0.00	0.01	0.00	0.01	0.02	0.00	0.06
Tot. Cu	0.82	0.33	0.57	0.57	0.73	1.00	0.44	0.01	0.00	0.11	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.25	0.06	0.13	0.82	0.27	0.95	0.09	0.02	0.00	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.30	0.12	0.17	0.91	0.26	0.74	0.18	0.00	0.01	0.16	0.09	0.00	0.01	0.08	0.01	0.04	0.01	0.01
Tot. Zn	0.19	0.04	0.09	0.92	0.74	0.99	0.07	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Table D.21 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.17	0.01	-0.51	-0.40	0.03	-0.37	-0.11	-0.49	-0.04	-0.38	-0.05	-0.06	-0.27	-0.25	-0.30
Max. Rain	-0.25	-0.28	-0.59	-0.37	-0.23	-0.51	-0.29	-0.62	-0.30	-0.47	-0.11	-0.23	-0.43	-0.36	-0.47
15m. Rain	-0.18	-0.16	-0.56	-0.32	-0.13	-0.45	-0.23	-0.55	-0.19	-0.39	-0.04	-0.14	-0.35	-0.32	-0.39
ADD	0.13	0.02	0.15	0.02	-0.11	-0.01	0.16	0.16	-0.01	0.05	-0.12	-0.14	-0.06	-0.03	0.02
Ante. Rain	-0.10	-0.06	-0.04	0.04	0.06	0.33	-0.09	0.03	-0.01	-0.15	0.31	0.08	0.26	0.26	0.08
Duration	-0.14	0.09	-0.21	-0.12	0.01	-0.06	0.19	-0.09	0.11	-0.16	0.06	0.00	-0.02	0.08	0.00
Ave_Rain	-0.14	-0.29	-0.56	-0.25	-0.25	-0.47	-0.35	-0.55	-0.27	-0.38	-0.01	-0.18	-0.39	-0.31	-0.42
TSS	0.26	0.35	0.12	0.43	0.26	0.34	0.18	0.16	0.59	0.40	0.71	0.54	0.51	0.83	0.44
Turb.	0.13	0.53	0.24	0.65	0.72	0.68	0.11	0.40	0.59	0.53	0.84	0.82	0.76	0.55	0.60
Cond.	0.22	0.46	0.71	0.45	0.46	0.45	0.53	0.64	0.41	0.61	0.04	0.37	0.42	0.33	0.57
Hard.	0.25	0.57	0.87	0.51	0.56	0.62	0.68	0.68	0.52	0.70	0.14	0.45	0.58	0.39	0.66
COD	0.23	0.82	0.48	0.63	0.89	0.79	0.42	0.62	0.85	0.66	0.74	0.92	0.87	0.63	0.84
DOC	0.17	0.83	0.62	0.64	0.90	0.81	0.52	0.65	0.81	0.74	0.60	0.89	0.86	0.58	0.86
O & G	0.19	0.73	0.38	0.66	0.84	0.68	0.27	0.55	0.68	0.62	0.62	0.85	0.74	0.40	0.70
TKN	0.28	0.84	0.62	0.60	0.83	0.76	0.62	0.61	0.85	0.75	0.60	0.86	0.83	0.60	0.85
NH_3-N	0.32	0.92	0.65	0.59	0.90	0.80	0.58	0.76	0.87	0.75	0.53	0.86	0.83	0.47	0.89
NO_2-N	0.12	0.56	0.29	0.61	0.66	0.57	0.39	0.42	0.61	0.48	0.72	0.75	0.67	0.57	0.60
NO_3-N	0.37	0.65	0.36	0.46	0.57	0.62	0.37	0.54	0.76	0.53	0.43	0.64	0.68	0.59	0.72
PO_4-P	1	0.42	0.41	0.30	0.20	0.24	0.60	0.38	0.44	0.40	0.01	0.26	0.28	0.31	0.39
Diss. P	0.07	1	0.69	0.52	0.88	0.76	0.67	0.75	0.94	0.75	0.46	0.83	0.81	0.53	0.89
Diss. Cd	0.07	0.00	1	0.68	0.66	0.76	0.74	0.83	0.62	0.86	0.20	0.58	0.71	0.40	0.80
Diss. Cr	0.19	0.02	0.00	1	0.63	0.76	0.44	0.68	0.59	0.84	0.67	0.76	0.79	0.60	0.75
Diss. Cu	0.40	0.00	0.00	0.00	1	0.85	0.47	0.73	0.82	0.74	0.55	0.93	0.88	0.49	0.86
Diss. Ni	0.31	0.00	0.00	0.00	0.00	1	0.50	0.85	0.75	0.78	0.61	0.84	0.97	0.59	0.92
Diss. Pb	0.01	0.00	0.00	0.05	0.04	0.03	1	0.52	0.63	0.60	0.17	0.43	0.51	0.48	0.62
Diss. Zn	0.10	0.00	0.00	0.00	0.00	0.00	0.02	1	0.70	0.76	0.37	0.68	0.79	0.40	0.89
Tot. P	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.00	1	0.77	0.63	0.88	0.85	0.74	0.91
Tot. Cd	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	1	0.46	0.78	0.82	0.55	0.87
Tot. Cr	0.97	0.04	0.40	0.00	0.01	0.01	0.46	0.11	0.00	0.04	1	0.77	0.73	0.78	0.59
Tot. Cu	0.27	0.00	0.01	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	1	0.94	0.72	0.89
Tot. Ni	0.24	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	1	0.72	0.94
Tot. Pb	0.18	0.02	0.08	0.01	0.03	0.01	0.03	0.08	0.00	0.01	0.00	0.00	0.00	1	0.67
Tot. Zn	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	1

Table D.22 Correlation Analysis Results for Storm Characteristics and MFF40 (UCLA 3, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.57	0.72	-0.22	-0.15	0.56	0.54	-0.05	0.33	0.01	-0.13	-0.21	0.09	0.19	-0.15	-0.04	0.34	-0.03
Max. Rain	0.00	1	0.92	-0.39	-0.06	0.08	0.70	0.11	0.41	-0.07	-0.18	-0.05	0.04	0.08	-0.03	0.03	0.30	0.05
15m. Rain	0.00	0.00	1	-0.41	-0.07	0.14	0.83	0.14	0.43	0.04	-0.12	-0.04	0.15	0.17	0.03	0.04	0.41	0.00
ADD	0.31	0.06	0.06	1	-0.08	-0.06	-0.32	-0.30	-0.43	0.11	0.21	-0.04	0.00	-0.15	0.10	0.03	-0.32	-0.35
Ante. Rain	0.51	0.78	0.77	0.72	1	-0.04	-0.21	0.40	0.10	-0.23	-0.12	-0.07	-0.19	-0.04	-0.26	-0.35	-0.11	0.10
Duration	0.01	0.73	0.54	0.80	0.86	1	-0.17	0.03	0.05	-0.23	-0.28	-0.38	-0.32	-0.12	-0.32	-0.28	-0.04	-0.06
Ave_Rain	0.01	0.00	0.00	0.14	0.35	0.44	1	0.10	0.37	0.25	0.09	0.25	0.36	0.25	0.32	0.25	0.48	0.11
TSS	0.84	0.62	0.53	0.17	0.06	0.90	0.65	1	0.53	-0.12	0.01	0.20	-0.10	-0.17	0.17	-0.08	-0.12	-0.02
Turb.	0.12	0.05	0.04	0.04	0.66	0.82	0.09	0.01	1	0.23	0.08	0.39	0.34	0.23	0.32	0.31	0.42	0.28
Cond.	0.95	0.75	0.86	0.62	0.29	0.29	0.26	0.59	0.30	1	0.89	0.75	0.95	0.82	0.87	0.90	0.45	0.65
Hard.	0.57	0.42	0.57	0.33	0.58	0.20	0.68	0.96	0.72	0.00	1	0.64	0.79	0.63	0.83	0.82	0.18	0.60
COD	0.34	0.81	0.87	0.86	0.75	0.08	0.26	0.36	0.07	0.00	0.00	1	0.81	0.60	0.82	0.83	0.29	0.56
DOC	0.70	0.84	0.51	0.99	0.39	0.14	0.10	0.64	0.12	0.00	0.00	0.00	1	0.86	0.82	0.90	0.49	0.62
O & G	0.40	0.73	0.45	0.51	0.87	0.59	0.25	0.43	0.30	0.00	0.00	0.00	0.00	1	0.54	0.72	0.67	0.69
TKN	0.50	0.91	0.90	0.65	0.23	0.13	0.13	0.43	0.13	0.00	0.00	0.00	0.00	0.01	1	0.88	0.25	0.56
NH_3-N	0.86	0.89	0.84	0.90	0.10	0.19	0.26	0.71	0.16	0.00	0.00	0.00	0.00	0.00	0.00	1	0.40	0.64
NO_2-N	0.11	0.16	0.06	0.14	0.62	0.88	0.02	0.58	0.05	0.03	0.41	0.18	0.02	0.00	0.26	0.06	1	0.45
NO_3-N	0.91	0.81	0.99	0.10	0.65	0.78	0.60	0.94	0.20	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.03	1
PO_4-P	0.84	0.80	0.94	0.91	0.68	0.62	0.64	0.60	0.75	0.04	0.01	0.33	0.22	0.37	0.02	0.13	0.71	0.01
Diss. P	0.75	0.88	0.71	0.39	0.80	0.79	0.47	0.94	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00
Diss. Cd	0.04	0.25	0.16	0.07	0.97	0.20	0.30	0.86	0.85	0.00	0.00	0.06	0.02	0.26	0.00	0.00	0.29	0.19
Diss. Cr	0.78	0.24	0.27	0.03	0.41	0.76	0.17	0.68	0.49	0.30	0.25	0.38	0.51	0.71	0.25	0.46	0.06	0.74
Diss. Cu	0.09	0.98	0.82	0.82	0.75	0.01	0.81	0.58	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00
Diss. Ni	0.21	0.52	0.76	0.85	0.47	0.16	0.82	0.42	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00
Diss. Pb	0.54	0.93	0.52	0.20	0.72	0.58	0.63	0.35	0.17	0.22	0.05	0.12	0.25	0.50	0.10	0.04	0.85	0.65
Diss. Zn	0.42	0.42	0.32	0.64	0.61	0.88	0.43	0.98	0.88	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.86	0.00
Tot. P	0.92	0.54	0.99	0.43	0.56	0.61	0.54	0.31	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.01
Tot. Cd	0.12	0.25	0.33	0.04	0.97	0.39	0.64	0.78	0.84	0.00	0.00	0.03	0.01	0.27	0.00	0.00	0.36	0.30
Tot. Cr	0.85	0.76	0.99	0.44	0.12	0.30	0.73	0.02	0.01	0.05	0.06	0.01	0.05	0.38	0.01	0.15	0.95	0.69
Tot. Cu	0.09	0.86	0.85	0.76	0.37	0.00	0.70	0.55	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.03
Tot. Ni	0.16	0.63	0.68	0.98	0.33	0.01	0.86	0.34	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.02
Tot. Pb	0.64	0.48	0.45	0.54	0.09	0.64	0.61	0.00	0.02	0.77	0.39	0.31	0.78	0.61	0.29	0.98	0.24	0.70
Tot. Zn	0.60	0.55	0.64	0.76	0.36	0.48	0.89	0.19	0.38	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.83	0.00

Table D.22 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.05	0.08	-0.45	-0.07	-0.38	-0.29	-0.14	-0.19	-0.02	-0.35	-0.04	-0.39	-0.32	-0.11	-0.12
Max. Rain	-0.06	-0.04	-0.26	-0.27	-0.01	-0.15	0.02	-0.19	-0.14	-0.26	-0.07	-0.04	-0.11	-0.16	-0.14
15m. Rain	-0.02	0.09	-0.32	-0.25	-0.05	-0.07	-0.15	-0.23	0.00	-0.22	0.00	-0.05	-0.09	-0.17	-0.11
ADD	-0.03	0.20	0.40	0.48	0.05	-0.04	0.30	0.11	0.18	0.45	0.18	0.07	0.01	0.14	0.07
Ante. Rain	-0.09	0.06	0.01	0.19	0.08	0.17	-0.08	0.12	0.14	-0.01	0.35	0.21	0.23	0.38	0.21
Duration	0.11	-0.06	-0.29	0.07	-0.53	-0.32	-0.13	-0.03	-0.12	-0.20	-0.24	-0.69	-0.57	-0.11	-0.16
Ave_Rain	0.10	0.17	-0.24	-0.31	0.06	0.05	-0.11	-0.18	0.14	-0.11	0.08	0.09	0.04	-0.12	-0.03
TSS	0.12	0.02	0.04	0.10	-0.13	0.19	0.22	0.01	0.24	0.07	0.50	0.14	0.22	0.63	0.30
Turb.	-0.07	0.11	-0.04	0.16	0.03	0.10	0.31	-0.04	0.17	0.05	0.54	0.17	0.16	0.51	0.20
Cond.	0.43	0.95	0.66	0.24	0.86	0.86	0.28	0.80	0.91	0.71	0.44	0.77	0.75	0.07	0.81
Hard.	0.53	0.86	0.83	0.26	0.75	0.82	0.44	0.89	0.90	0.78	0.42	0.74	0.78	0.20	0.89
COD	0.21	0.79	0.42	0.20	0.76	0.76	0.35	0.57	0.75	0.49	0.56	0.73	0.70	0.23	0.69
DOC	0.27	0.88	0.49	0.15	0.87	0.82	0.27	0.66	0.81	0.54	0.43	0.79	0.74	0.06	0.72
O & G	0.20	0.74	0.26	-0.09	0.82	0.73	0.16	0.60	0.65	0.25	0.20	0.63	0.59	-0.12	0.57
TKN	0.49	0.85	0.71	0.27	0.71	0.78	0.37	0.71	0.89	0.79	0.53	0.72	0.69	0.24	0.81
NH_3-N	0.32	0.87	0.65	0.17	0.82	0.77	0.46	0.77	0.79	0.64	0.32	0.72	0.68	-0.01	0.76
NO_2-N	0.08	0.26	-0.24	-0.42	0.35	0.27	0.05	0.04	0.19	-0.21	0.01	0.21	0.16	-0.27	0.05
NO_3-N	0.52	0.61	0.30	-0.08	0.63	0.66	0.11	0.72	0.56	0.24	0.09	0.48	0.51	-0.09	0.63
PO_4-P	1	0.50	0.28	-0.12	0.24	0.44	0.02	0.53	0.53	0.32	-0.08	0.17	0.26	-0.19	0.47
Diss. P	0.02	1	0.63	0.30	0.73	0.81	0.26	0.80	0.95	0.70	0.41	0.66	0.66	0.06	0.83
Diss. Cd	0.21	0.00	1	0.52	0.58	0.59	0.49	0.77	0.69	0.92	0.45	0.63	0.62	0.34	0.75
Diss. Cr	0.61	0.19	0.02	1	0.03	0.04	0.34	0.21	0.35	0.62	0.67	0.20	0.15	0.55	0.32
Diss. Cu	0.30	0.00	0.01	0.88	1	0.84	0.29	0.70	0.68	0.51	0.30	0.89	0.82	0.01	0.69
Diss. Ni	0.05	0.00	0.01	0.88	0.00	1	0.18	0.81	0.84	0.54	0.36	0.83	0.87	0.14	0.86
Diss. Pb	0.94	0.25	0.03	0.14	0.20	0.45	1	0.31	0.34	0.42	0.45	0.31	0.27	0.46	0.36
Diss. Zn	0.01	0.00	0.00	0.36	0.00	0.00	0.17	1	0.80	0.64	0.25	0.63	0.70	0.11	0.91
Tot. P	0.01	0.00	0.00	0.13	0.00	0.00	0.14	0.00	1	0.76	0.54	0.70	0.73	0.25	0.90
Tot. Cd	0.15	0.00	0.00	0.00	0.02	0.01	0.06	0.00	0.00	1	0.54	0.55	0.51	0.33	0.68
Tot. Cr	0.74	0.06	0.04	0.00	0.18	0.11	0.04	0.27	0.01	0.01	1	0.57	0.56	0.84	0.56
Tot. Cu	0.47	0.00	0.00	0.39	0.00	0.00	0.17	0.00	0.00	0.01	0.01	1	0.96	0.32	0.77
Tot. Ni	0.25	0.00	0.00	0.52	0.00	0.00	0.23	0.00	0.00	0.02	0.01	0.00	1	0.37	0.85
Tot. Pb	0.42	0.80	0.13	0.01	0.96	0.55	0.04	0.65	0.27	0.14	0.00	0.15	0.10	1	0.39
Tot. Zn	0.03	0.00	0.00	0.16	0.00	0.00	0.11	0.00	0.00	0.00	0.01	0.00	0.00	0.08	1

Table D.23 Correlation Analysis Results for Storm Characteristics and MFF40 (Combined UCLA, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.87	-0.23	-0.16	0.44	0.65	-0.07	0.10	-0.38	-0.44	0.09	0.02	0.10	0.08	0.07	0.21	-0.01
Max. Rain	0.00	1	0.98	-0.30	-0.16	0.13	0.92	-0.15	-0.04	-0.60	-0.67	-0.17	-0.22	-0.11	-0.09	-0.20	-0.02	-0.22
15m. Rain	0.00	0.00	1	-0.26	-0.19	0.18	0.90	-0.15	0.03	-0.58	-0.65	-0.10	-0.16	-0.02	-0.05	-0.12	0.04	-0.16
ADD	0.32	0.19	0.25	1	-0.12	-0.08	-0.23	-0.21	-0.30	0.20	0.14	-0.12	-0.10	-0.13	-0.13	-0.05	-0.19	0.09
Ante. Rain	0.49	0.48	0.40	0.60	1	-0.12	-0.19	0.21	0.30	-0.22	-0.09	0.18	0.05	-0.01	-0.01	-0.02	0.01	0.08
Duration	0.05	0.57	0.45	0.74	0.61	1	-0.11	0.00	-0.06	0.02	-0.08	0.08	0.03	0.02	0.04	0.06	0.41	0.23
Ave_Rain	0.00	0.00	0.00	0.32	0.42	0.63	1	-0.03	0.07	-0.58	-0.64	-0.05	-0.13	0.02	0.02	-0.09	0.00	-0.18
TSS	0.78	0.51	0.53	0.36	0.35	1.00	0.92	1	0.65	0.16	0.24	0.62	0.56	0.46	0.62	0.51	0.60	0.50
Turb.	0.66	0.86	0.88	0.19	0.20	0.78	0.76	0.00	1	0.15	0.22	0.83	0.75	0.80	0.73	0.72	0.76	0.45
Cond.	0.09	0.00	0.01	0.39	0.35	0.93	0.01	0.48	0.51	1	0.79	0.41	0.55	0.34	0.45	0.50	0.34	0.33
Hard.	0.04	0.00	0.00	0.56	0.71	0.73	0.00	0.29	0.33	0.00	1	0.46	0.65	0.39	0.57	0.59	0.37	0.30
COD	0.70	0.46	0.68	0.61	0.43	0.74	0.82	0.00	0.00	0.07	0.04	1	0.94	0.90	0.91	0.93	0.83	0.62
DOC	0.93	0.33	0.48	0.68	0.83	0.89	0.57	0.01	0.00	0.01	0.00	0.00	1	0.88	0.95	0.94	0.79	0.57
O & G	0.66	0.65	0.95	0.57	0.96	0.93	0.92	0.04	0.00	0.13	0.08	0.00	0.00	1	0.80	0.87	0.78	0.50
TKN	0.72	0.69	0.85	0.57	0.96	0.87	0.93	0.00	0.00	0.04	0.01	0.00	0.00	0.00	1	0.95	0.81	0.57
NH_3-N	0.77	0.39	0.62	0.82	0.92	0.79	0.69	0.02	0.00	0.02	0.01	0.00	0.00	0.00	0.00	1	0.78	0.61
NO_2-N	0.37	0.93	0.86	0.40	0.98	0.07	1.00	0.00	0.00	0.14	0.10	0.00	0.00	0.00	0.00	0.00	1	0.47
NO_3-N	0.97	0.33	0.48	0.70	0.74	0.33	0.44	0.02	0.04	0.15	0.19	0.00	0.01	0.02	0.01	0.00	0.03	1
PO_4-P	0.46	0.28	0.43	0.56	0.67	0.56	0.55	0.26	0.59	0.34	0.28	0.32	0.47	0.42	0.22	0.15	0.62	0.10
Diss. P	0.97	0.23	0.50	0.94	0.80	0.70	0.21	0.13	0.02	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Cd	0.02	0.01	0.01	0.54	0.88	0.37	0.01	0.61	0.31	0.00	0.00	0.03	0.00	0.10	0.00	0.00	0.22	0.12
Diss. Cr	0.08	0.11	0.17	0.93	0.86	0.62	0.28	0.06	0.00	0.05	0.02	0.00	0.00	0.00	0.01	0.01	0.01	0.04
Diss. Cu	0.92	0.32	0.59	0.65	0.80	0.96	0.29	0.27	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Diss. Ni	0.11	0.02	0.05	0.97	0.16	0.80	0.04	0.15	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Pb	0.65	0.21	0.34	0.52	0.71	0.42	0.14	0.44	0.64	0.02	0.00	0.06	0.02	0.25	0.00	0.01	0.09	0.11
Diss. Zn	0.03	0.00	0.01	0.51	0.92	0.70	0.01	0.50	0.08	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.07	0.01
Tot. P	0.86	0.20	0.42	0.98	0.97	0.66	0.26	0.01	0.01	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cd	0.10	0.04	0.09	0.83	0.53	0.51	0.10	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02
Tot. Cr	0.83	0.65	0.87	0.62	0.18	0.81	0.96	0.00	0.00	0.86	0.56	0.00	0.01	0.00	0.01	0.02	0.00	0.06
Tot. Cu	0.82	0.33	0.57	0.57	0.73	1.00	0.44	0.01	0.00	0.11	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.25	0.06	0.13	0.82	0.27	0.95	0.09	0.02	0.00	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.30	0.12	0.17	0.91	0.26	0.74	0.18	0.00	0.01	0.16	0.09	0.00	0.01	0.08	0.01	0.04	0.01	0.01
Tot. Zn	0.19	0.04	0.09	0.92	0.74	0.99	0.07	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Table D.23 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.17	0.01	-0.51	-0.40	0.03	-0.37	-0.11	-0.49	-0.04	-0.38	-0.05	-0.06	-0.27	-0.25	-0.30
Max. Rain	-0.25	-0.28	-0.59	-0.37	-0.23	-0.51	-0.29	-0.62	-0.30	-0.47	-0.11	-0.23	-0.43	-0.36	-0.47
15m. Rain	-0.18	-0.16	-0.56	-0.32	-0.13	-0.45	-0.23	-0.55	-0.19	-0.39	-0.04	-0.14	-0.35	-0.32	-0.39
ADD	0.13	0.02	0.15	0.02	-0.11	-0.01	0.16	0.16	-0.01	0.05	-0.12	-0.14	-0.06	-0.03	0.02
Ante. Rain	-0.10	-0.06	-0.04	0.04	0.06	0.33	-0.09	0.03	-0.01	-0.15	0.31	0.08	0.26	0.26	0.08
Duration	-0.14	0.09	-0.21	-0.12	0.01	-0.06	0.19	-0.09	0.11	-0.16	0.06	0.00	-0.02	0.08	0.00
Ave_Rain	-0.14	-0.29	-0.56	-0.25	-0.25	-0.47	-0.35	-0.55	-0.27	-0.38	-0.01	-0.18	-0.39	-0.31	-0.42
TSS	0.26	0.35	0.12	0.43	0.26	0.34	0.18	0.16	0.59	0.40	0.71	0.54	0.51	0.83	0.44
Turb.	0.13	0.53	0.24	0.65	0.72	0.68	0.11	0.40	0.59	0.53	0.84	0.82	0.76	0.55	0.60
Cond.	0.22	0.46	0.71	0.45	0.46	0.45	0.53	0.64	0.41	0.61	0.04	0.37	0.42	0.33	0.57
Hard.	0.25	0.57	0.87	0.51	0.56	0.62	0.68	0.68	0.52	0.70	0.14	0.45	0.58	0.39	0.66
COD	0.23	0.82	0.48	0.63	0.89	0.79	0.42	0.62	0.85	0.66	0.74	0.92	0.87	0.63	0.84
DOC	0.17	0.83	0.62	0.64	0.90	0.81	0.52	0.65	0.81	0.74	0.60	0.89	0.86	0.58	0.86
O & G	0.19	0.73	0.38	0.66	0.84	0.68	0.27	0.55	0.68	0.62	0.62	0.85	0.74	0.40	0.70
TKN	0.28	0.84	0.62	0.60	0.83	0.76	0.62	0.61	0.85	0.75	0.60	0.86	0.83	0.60	0.85
NH_3-N	0.32	0.92	0.65	0.59	0.90	0.80	0.58	0.76	0.87	0.75	0.53	0.86	0.83	0.47	0.89
NO_2-N	0.12	0.56	0.29	0.61	0.66	0.57	0.39	0.42	0.61	0.48	0.72	0.75	0.67	0.57	0.60
NO_3-N	0.37	0.65	0.36	0.46	0.57	0.62	0.37	0.54	0.76	0.53	0.43	0.64	0.68	0.59	0.72
PO_4-P	1	0.42	0.41	0.30	0.20	0.24	0.60	0.38	0.44	0.40	0.01	0.26	0.28	0.31	0.39
Diss. P	0.07	1	0.69	0.52	0.88	0.76	0.67	0.75	0.94	0.75	0.46	0.83	0.81	0.53	0.89
Diss. Cd	0.07	0.00	1	0.68	0.66	0.76	0.74	0.83	0.62	0.86	0.20	0.58	0.71	0.40	0.80
Diss. Cr	0.19	0.02	0.00	1	0.63	0.76	0.44	0.68	0.59	0.84	0.67	0.76	0.79	0.60	0.75
Diss. Cu	0.40	0.00	0.00	0.00	1	0.85	0.47	0.73	0.82	0.74	0.55	0.93	0.88	0.49	0.86
Diss. Ni	0.31	0.00	0.00	0.00	0.00	1	0.50	0.85	0.75	0.78	0.61	0.84	0.97	0.59	0.92
Diss. Pb	0.01	0.00	0.00	0.05	0.04	0.03	1	0.52	0.63	0.60	0.17	0.43	0.51	0.48	0.62
Diss. Zn	0.10	0.00	0.00	0.00	0.00	0.00	0.02	1	0.70	0.76	0.37	0.68	0.79	0.40	0.89
Tot. P	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.00	1	0.77	0.63	0.88	0.85	0.74	0.91
Tot. Cd	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	1	0.46	0.78	0.82	0.55	0.87
Tot. Cr	0.97	0.04	0.40	0.00	0.01	0.01	0.46	0.11	0.00	0.04	1	0.77	0.73	0.78	0.59
Tot. Cu	0.27	0.00	0.01	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	1	0.94	0.72	0.89
Tot. Ni	0.24	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	1	0.72	0.94
Tot. Pb	0.18	0.02	0.08	0.01	0.03	0.01	0.03	0.08	0.00	0.01	0.00	0.00	0.00	1	0.67
Tot. Zn	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	1

Table D.24 Correlation Analysis Results for Storm Characteristics and MFF50 (UCLA 1, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.57	0.72	-0.22	-0.15	0.56	0.54	-0.05	0.33	0.01	-0.13	-0.21	0.09	0.19	-0.15	-0.04	0.34	-0.03
Max. Rain	0.00	1	0.92	-0.39	-0.06	0.08	0.70	0.11	0.41	-0.07	-0.18	-0.05	0.04	0.08	-0.03	0.03	0.30	0.05
15m. Rain	0.00	0.00	1	-0.41	-0.07	0.14	0.83	0.14	0.43	0.04	-0.12	-0.04	0.15	0.17	0.03	0.04	0.41	0.00
ADD	0.31	0.06	0.06	1	-0.08	-0.06	-0.32	-0.30	-0.43	0.11	0.21	-0.04	0.00	-0.15	0.10	0.03	-0.32	-0.35
Ante. Rain	0.51	0.78	0.77	0.72	1	-0.04	-0.21	0.40	0.10	-0.23	-0.12	-0.07	-0.19	-0.04	-0.26	-0.35	-0.11	0.10
Duration	0.01	0.73	0.54	0.80	0.86	1	-0.17	0.03	0.05	-0.23	-0.28	-0.38	-0.32	-0.12	-0.32	-0.28	-0.04	-0.06
Ave_Rain	0.01	0.00	0.00	0.14	0.35	0.44	1	0.10	0.37	0.25	0.09	0.25	0.36	0.25	0.32	0.25	0.48	0.11
TSS	0.84	0.62	0.53	0.17	0.06	0.90	0.65	1	0.53	-0.12	0.01	0.20	-0.10	-0.17	0.17	-0.08	-0.12	-0.02
Turb.	0.12	0.05	0.04	0.04	0.66	0.82	0.09	0.01	1	0.23	0.08	0.39	0.34	0.23	0.32	0.31	0.42	0.28
Cond.	0.95	0.75	0.86	0.62	0.29	0.29	0.26	0.59	0.30	1	0.89	0.75	0.95	0.82	0.87	0.90	0.45	0.65
Hard.	0.57	0.42	0.57	0.33	0.58	0.20	0.68	0.96	0.72	0.00	1	0.64	0.79	0.63	0.83	0.82	0.18	0.60
COD	0.34	0.81	0.87	0.86	0.75	0.08	0.26	0.36	0.07	0.00	0.00	1	0.81	0.60	0.82	0.83	0.29	0.56
DOC	0.70	0.84	0.51	0.99	0.39	0.14	0.10	0.64	0.12	0.00	0.00	0.00	1	0.86	0.82	0.90	0.49	0.62
O & G	0.40	0.73	0.45	0.51	0.87	0.59	0.25	0.43	0.30	0.00	0.00	0.00	0.00	1	0.54	0.72	0.67	0.69
TKN	0.50	0.91	0.90	0.65	0.23	0.13	0.13	0.43	0.13	0.00	0.00	0.00	0.00	0.01	1	0.88	0.25	0.56
NH_3-N	0.86	0.89	0.84	0.90	0.10	0.19	0.26	0.71	0.16	0.00	0.00	0.00	0.00	0.00	0.00	1	0.40	0.64
NO_2-N	0.11	0.16	0.06	0.14	0.62	0.88	0.02	0.58	0.05	0.03	0.41	0.18	0.02	0.00	0.26	0.06	1	0.45
NO_3-N	0.91	0.81	0.99	0.10	0.65	0.78	0.60	0.94	0.20	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.03	1
PO_4-P	0.84	0.80	0.94	0.91	0.68	0.62	0.64	0.60	0.75	0.04	0.01	0.33	0.22	0.37	0.02	0.13	0.71	0.01
Diss. P	0.75	0.88	0.71	0.39	0.80	0.79	0.47	0.94	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00
Diss. Cd	0.04	0.25	0.16	0.07	0.97	0.20	0.30	0.86	0.85	0.00	0.00	0.06	0.02	0.26	0.00	0.00	0.29	0.19
Diss. Cr	0.78	0.24	0.27	0.03	0.41	0.76	0.17	0.68	0.49	0.30	0.25	0.38	0.51	0.71	0.25	0.46	0.06	0.74
Diss. Cu	0.09	0.98	0.82	0.82	0.75	0.01	0.81	0.58	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00
Diss. Ni	0.21	0.52	0.76	0.85	0.47	0.16	0.82	0.42	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00
Diss. Pb	0.54	0.93	0.52	0.20	0.72	0.58	0.63	0.35	0.17	0.22	0.05	0.12	0.25	0.50	0.10	0.04	0.85	0.65
Diss. Zn	0.42	0.42	0.32	0.64	0.61	0.88	0.43	0.98	0.88	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.86	0.00
Tot. P	0.92	0.54	0.99	0.43	0.56	0.61	0.54	0.31	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.01
Tot. Cd	0.12	0.25	0.33	0.04	0.97	0.39	0.64	0.78	0.84	0.00	0.00	0.03	0.01	0.27	0.00	0.00	0.36	0.30
Tot. Cr	0.85	0.76	0.99	0.44	0.12	0.30	0.73	0.02	0.01	0.05	0.06	0.01	0.05	0.38	0.01	0.15	0.95	0.69
Tot. Cu	0.09	0.86	0.85	0.76	0.37	0.00	0.70	0.55	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.03
Tot. Ni	0.16	0.63	0.68	0.98	0.33	0.01	0.86	0.34	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.02
Tot. Pb	0.64	0.48	0.45	0.54	0.09	0.64	0.61	0.00	0.02	0.77	0.39	0.31	0.78	0.61	0.29	0.98	0.24	0.70
Tot. Zn	0.60	0.55	0.64	0.76	0.36	0.48	0.89	0.19	0.38	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.83	0.00

Table D.24 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.05	0.08	-0.45	-0.07	-0.38	-0.29	-0.14	-0.19	-0.02	-0.35	-0.04	-0.39	-0.32	-0.11	-0.12
Max. Rain	-0.06	-0.04	-0.26	-0.27	-0.01	-0.15	0.02	-0.19	-0.14	-0.26	-0.07	-0.04	-0.11	-0.16	-0.14
15m. Rain	-0.02	0.09	-0.32	-0.25	-0.05	-0.07	-0.15	-0.23	0.00	-0.22	0.00	-0.05	-0.09	-0.17	-0.11
ADD	-0.03	0.20	0.40	0.48	0.05	-0.04	0.30	0.11	0.18	0.45	0.18	0.07	0.01	0.14	0.07
Ante. Rain	-0.09	0.06	0.01	0.19	0.08	0.17	-0.08	0.12	0.14	-0.01	0.35	0.21	0.23	0.38	0.21
Duration	0.11	-0.06	-0.29	0.07	-0.53	-0.32	-0.13	-0.03	-0.12	-0.20	-0.24	-0.69	-0.57	-0.11	-0.16
Ave_Rain	0.10	0.17	-0.24	-0.31	0.06	0.05	-0.11	-0.18	0.14	-0.11	0.08	0.09	0.04	-0.12	-0.03
TSS	0.12	0.02	0.04	0.10	-0.13	0.19	0.22	0.01	0.24	0.07	0.50	0.14	0.22	0.63	0.30
Turb.	-0.07	0.11	-0.04	0.16	0.03	0.10	0.31	-0.04	0.17	0.05	0.54	0.17	0.16	0.51	0.20
Cond.	0.43	0.95	0.66	0.24	0.86	0.86	0.28	0.80	0.91	0.71	0.44	0.77	0.75	0.07	0.81
Hard.	0.53	0.86	0.83	0.26	0.75	0.82	0.44	0.89	0.90	0.78	0.42	0.74	0.78	0.20	0.89
COD	0.21	0.79	0.42	0.20	0.76	0.76	0.35	0.57	0.75	0.49	0.56	0.73	0.70	0.23	0.69
DOC	0.27	0.88	0.49	0.15	0.87	0.82	0.27	0.66	0.81	0.54	0.43	0.79	0.74	0.06	0.72
O & G	0.20	0.74	0.26	-0.09	0.82	0.73	0.16	0.60	0.65	0.25	0.20	0.63	0.59	-0.12	0.57
TKN	0.49	0.85	0.71	0.27	0.71	0.78	0.37	0.71	0.89	0.79	0.53	0.72	0.69	0.24	0.81
NH_3-N	0.32	0.87	0.65	0.17	0.82	0.77	0.46	0.77	0.79	0.64	0.32	0.72	0.68	-0.01	0.76
NO_2-N	0.08	0.26	-0.24	-0.42	0.35	0.27	0.05	0.04	0.19	-0.21	0.01	0.21	0.16	-0.27	0.05
NO_3-N	0.52	0.61	0.30	-0.08	0.63	0.66	0.11	0.72	0.56	0.24	0.09	0.48	0.51	-0.09	0.63
PO_4-P	1	0.50	0.28	-0.12	0.24	0.44	0.02	0.53	0.53	0.32	-0.08	0.17	0.26	-0.19	0.47
Diss. P	0.02	1	0.63	0.30	0.73	0.81	0.26	0.80	0.95	0.70	0.41	0.66	0.66	0.06	0.83
Diss. Cd	0.21	0.00	1	0.52	0.58	0.59	0.49	0.77	0.69	0.92	0.45	0.63	0.62	0.34	0.75
Diss. Cr	0.61	0.19	0.02	1	0.03	0.04	0.34	0.21	0.35	0.62	0.67	0.20	0.15	0.55	0.32
Diss. Cu	0.30	0.00	0.01	0.88	1	0.84	0.29	0.70	0.68	0.51	0.30	0.89	0.82	0.01	0.69
Diss. Ni	0.05	0.00	0.01	0.88	0.00	1	0.18	0.81	0.84	0.54	0.36	0.83	0.87	0.14	0.86
Diss. Pb	0.94	0.25	0.03	0.14	0.20	0.45	1	0.31	0.34	0.42	0.45	0.31	0.27	0.46	0.36
Diss. Zn	0.01	0.00	0.00	0.36	0.00	0.00	0.17	1	0.80	0.64	0.25	0.63	0.70	0.11	0.91
Tot. P	0.01	0.00	0.00	0.13	0.00	0.00	0.14	0.00	1	0.76	0.54	0.70	0.73	0.25	0.90
Tot. Cd	0.15	0.00	0.00	0.00	0.02	0.01	0.06	0.00	0.00	1	0.54	0.55	0.51	0.33	0.68
Tot. Cr	0.74	0.06	0.04	0.00	0.18	0.11	0.04	0.27	0.01	0.01	1	0.57	0.56	0.84	0.56
Tot. Cu	0.47	0.00	0.00	0.39	0.00	0.00	0.17	0.00	0.00	0.01	0.01	1	0.96	0.32	0.77
Tot. Ni	0.25	0.00	0.00	0.52	0.00	0.00	0.23	0.00	0.00	0.02	0.01	0.00	1	0.37	0.85
Tot. Pb	0.42	0.80	0.13	0.01	0.96	0.55	0.04	0.65	0.27	0.14	0.00	0.15	0.10	1	0.39
Tot. Zn	0.03	0.00	0.00	0.16	0.00	0.00	0.11	0.00	0.00	0.00	0.01	0.00	0.00	0.08	1

Table D.25 Correlation Analysis Results for Storm Characteristics and MFF50 (UCLA 2, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.82	0.87	-0.23	-0.16	0.44	0.65	-0.08	0.05	-0.36	-0.42	0.04	-0.01	0.06	0.03	0.02	0.17	-0.03
Max. Rain	0.00	1	0.98	-0.30	-0.16	0.13	0.92	-0.06	-0.10	-0.60	-0.69	-0.24	-0.27	-0.16	-0.16	-0.27	-0.04	-0.28
15m. Rain	0.00	0.00	1	-0.26	-0.19	0.18	0.90	-0.07	-0.03	-0.57	-0.66	-0.16	-0.21	-0.06	-0.11	-0.18	0.03	-0.21
ADD	0.32	0.19	0.25	1	-0.12	-0.08	-0.23	-0.19	-0.29	0.26	0.21	-0.06	-0.04	-0.09	-0.07	0.00	-0.20	0.16
Ante. Rain	0.49	0.48	0.40	0.60	1	-0.12	-0.19	0.16	0.30	-0.24	-0.11	0.18	0.05	0.02	0.01	0.00	0.00	0.09
Duration	0.05	0.57	0.45	0.74	0.61	1	-0.11	-0.13	-0.10	0.03	-0.06	0.05	0.01	0.00	0.00	0.04	0.33	0.22
Ave_Rain	0.00	0.00	0.00	0.32	0.42	0.63	1	0.12	-0.01	-0.61	-0.68	-0.13	-0.18	-0.05	-0.04	-0.17	0.00	-0.25
TSS	0.73	0.81	0.76	0.40	0.50	0.59	0.61	1	0.60	0.01	0.14	0.53	0.52	0.40	0.62	0.46	0.53	0.45
Turb.	0.84	0.66	0.92	0.20	0.19	0.68	0.96	0.00	1	0.12	0.27	0.83	0.76	0.81	0.74	0.73	0.76	0.41
Cond.	0.11	0.00	0.01	0.25	0.29	0.89	0.00	0.98	0.61	1	0.79	0.36	0.50	0.29	0.39	0.45	0.28	0.23
Hard.	0.06	0.00	0.00	0.37	0.64	0.81	0.00	0.56	0.24	0.00	1	0.48	0.62	0.38	0.56	0.60	0.35	0.29
COD	0.85	0.29	0.50	0.80	0.43	0.84	0.57	0.01	0.00	0.11	0.03	1	0.94	0.91	0.90	0.94	0.81	0.56
DOC	0.95	0.24	0.37	0.87	0.83	0.98	0.44	0.02	0.00	0.02	0.00	0.00	1	0.88	0.95	0.95	0.78	0.51
O & G	0.79	0.49	0.80	0.70	0.95	0.99	0.83	0.07	0.00	0.20	0.09	0.00	0.00	1	0.79	0.87	0.77	0.42
TKN	0.91	0.50	0.64	0.75	0.98	0.99	0.85	0.00	0.00	0.08	0.01	0.00	0.00	0.00	1	0.94	0.81	0.51
NH_3-N	0.93	0.24	0.44	0.99	1.00	0.88	0.47	0.04	0.00	0.04	0.00	0.00	0.00	0.00	0.00	1	0.77	0.56
NO_2-N	0.47	0.88	0.91	0.38	1.00	0.15	0.99	0.01	0.00	0.22	0.12	0.00	0.00	0.00	0.00	0.00	1	0.37
NO_3-N	0.89	0.22	0.37	0.49	0.69	0.34	0.28	0.04	0.07	0.31	0.20	0.01	0.02	0.06	0.02	0.01	0.10	1
PO_4-P	0.48	0.24	0.41	0.45	0.80	0.61	0.47	0.29	0.55	0.52	0.29	0.25	0.46	0.42	0.27	0.16	0.59	0.08
Diss. P	0.93	0.14	0.38	0.72	0.95	0.68	0.12	0.27	0.01	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Cd	0.02	0.00	0.01	0.38	0.98	0.33	0.01	0.78	0.18	0.00	0.00	0.02	0.00	0.07	0.00	0.00	0.22	0.10
Diss. Cr	0.11	0.11	0.21	0.78	0.74	0.43	0.31	0.09	0.00	0.15	0.06	0.00	0.00	0.00	0.01	0.01	0.01	0.07
Diss. Cu	0.97	0.20	0.43	0.91	0.81	0.95	0.17	0.54	0.00	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Diss. Ni	0.11	0.01	0.04	0.81	0.16	0.81	0.02	0.32	0.00	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Diss. Pb	0.57	0.14	0.25	0.42	0.81	0.55	0.10	0.51	0.51	0.07	0.00	0.05	0.03	0.23	0.01	0.01	0.13	0.11
Diss. Zn	0.03	0.00	0.01	0.38	0.84	0.77	0.00	0.69	0.05	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.01
Tot. P	0.82	0.20	0.44	0.83	0.99	0.74	0.26	0.02	0.00	0.24	0.05	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Tot. Cd	0.08	0.03	0.08	0.64	0.63	0.34	0.10	0.10	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.02
Tot. Cr	0.80	0.83	0.95	0.72	0.20	0.80	0.79	0.00	0.00	0.71	0.86	0.00	0.02	0.01	0.01	0.05	0.00	0.17
Tot. Cu	0.77	0.31	0.57	0.73	0.80	0.84	0.45	0.04	0.00	0.24	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.24	0.05	0.12	0.98	0.28	0.83	0.09	0.06	0.00	0.18	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.25	0.27	0.32	0.92	0.30	0.74	0.49	0.00	0.02	0.76	0.38	0.02	0.04	0.13	0.01	0.12	0.04	0.03
Tot. Zn	0.18	0.03	0.08	0.74	0.75	0.93	0.06	0.08	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Table D.25 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.16	-0.02	-0.54	-0.37	-0.01	-0.37	-0.14	-0.49	-0.06	-0.40	-0.06	-0.07	-0.28	-0.27	-0.31
Max. Rain	-0.27	-0.34	-0.63	-0.37	-0.30	-0.55	-0.34	-0.67	-0.30	-0.48	-0.05	-0.24	-0.44	-0.26	-0.49
15m. Rain	-0.19	-0.21	-0.59	-0.30	-0.19	-0.48	-0.27	-0.59	-0.19	-0.40	0.01	-0.14	-0.36	-0.23	-0.40
ADD	0.18	0.09	0.21	0.07	-0.03	0.06	0.19	0.21	0.05	0.11	-0.09	-0.08	-0.01	-0.02	0.08
Ante. Rain	-0.06	-0.01	-0.01	0.08	0.06	0.32	-0.06	0.05	0.00	-0.12	0.30	0.06	0.26	0.25	0.08
Duration	-0.12	0.10	-0.23	-0.19	0.01	-0.06	0.14	-0.07	0.08	-0.23	-0.06	-0.05	-0.05	-0.08	-0.02
Ave_Rain	-0.17	-0.36	-0.60	-0.24	-0.32	-0.52	-0.38	-0.62	-0.26	-0.38	0.06	-0.18	-0.39	-0.16	-0.43
TSS	0.24	0.26	0.07	0.40	0.15	0.23	0.16	0.09	0.54	0.38	0.65	0.47	0.44	0.85	0.40
Turb.	0.14	0.59	0.31	0.72	0.74	0.70	0.16	0.45	0.63	0.60	0.78	0.83	0.79	0.52	0.64
Cond.	0.15	0.40	0.68	0.34	0.44	0.40	0.41	0.61	0.28	0.51	-0.09	0.27	0.31	0.07	0.46
Hard.	0.24	0.57	0.86	0.43	0.57	0.60	0.65	0.70	0.45	0.63	0.04	0.39	0.52	0.21	0.61
COD	0.26	0.86	0.52	0.65	0.90	0.81	0.44	0.68	0.84	0.68	0.64	0.91	0.87	0.52	0.85
DOC	0.17	0.84	0.63	0.62	0.90	0.81	0.50	0.69	0.79	0.74	0.51	0.86	0.85	0.46	0.85
O & G	0.19	0.76	0.42	0.68	0.84	0.71	0.28	0.57	0.69	0.65	0.57	0.85	0.77	0.35	0.72
TKN	0.26	0.82	0.63	0.59	0.84	0.76	0.59	0.65	0.83	0.72	0.55	0.85	0.84	0.54	0.86
NH_3-N	0.32	0.92	0.65	0.59	0.91	0.82	0.57	0.78	0.85	0.73	0.45	0.84	0.84	0.36	0.89
NO_2-N	0.12	0.56	0.29	0.60	0.65	0.56	0.35	0.44	0.59	0.44	0.66	0.74	0.66	0.47	0.60
NO_3-N	0.40	0.65	0.38	0.41	0.56	0.62	0.37	0.56	0.76	0.52	0.32	0.61	0.67	0.49	0.72
PO_4-P	1	0.43	0.38	0.26	0.19	0.24	0.68	0.35	0.48	0.38	0.01	0.26	0.28	0.33	0.40
Diss. P	0.06	1	0.69	0.53	0.89	0.78	0.65	0.78	0.93	0.75	0.41	0.82	0.82	0.44	0.90
Diss. Cd	0.10	0.00	1	0.64	0.67	0.77	0.67	0.85	0.59	0.82	0.16	0.56	0.70	0.31	0.79
Diss. Cr	0.26	0.02	0.00	1	0.65	0.75	0.32	0.66	0.60	0.83	0.69	0.77	0.80	0.56	0.73
Diss. Cu	0.41	0.00	0.00	0.00	1	0.86	0.43	0.77	0.80	0.75	0.48	0.91	0.89	0.36	0.87
Diss. Ni	0.31	0.00	0.00	0.00	0.00	1	0.46	0.87	0.75	0.77	0.51	0.82	0.96	0.46	0.91
Diss. Pb	0.00	0.00	0.00	0.16	0.06	0.04	1	0.50	0.62	0.52	0.14	0.38	0.47	0.43	0.59
Diss. Zn	0.13	0.00	0.00	0.00	0.00	0.00	0.03	1	0.70	0.75	0.31	0.68	0.80	0.30	0.90
Tot. P	0.03	0.00	0.01	0.01	0.00	0.00	0.00	0.00	1	0.77	0.58	0.88	0.85	0.68	0.91
Tot. Cd	0.10	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	1	0.44	0.79	0.82	0.52	0.85
Tot. Cr	0.96	0.08	0.50	0.00	0.03	0.02	0.56	0.18	0.01	0.05	1	0.72	0.66	0.77	0.53
Tot. Cu	0.27	0.00	0.01	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	1	0.93	0.65	0.88
Tot. Ni	0.24	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	1	0.63	0.94
Tot. Pb	0.16	0.05	0.19	0.01	0.11	0.04	0.06	0.19	0.00	0.02	0.00	0.00	0.00	1	0.59
Tot. Zn	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.01	1

Table D.26 Correlation Analysis Results for Storm Characteristics and MFF50 (UCLA 3, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.57	0.72	-0.22	-0.15	0.56	0.54	-0.03	0.30	-0.01	-0.16	-0.26	0.07	0.15	-0.18	-0.05	0.33	-0.08
Max. Rain	0.00	1	0.92	-0.39	-0.06	0.08	0.70	0.14	0.39	-0.14	-0.27	-0.13	-0.03	0.00	-0.11	-0.04	0.24	-0.02
15m. Rain	0.00	0.00	1	-0.41	-0.07	0.14	0.83	0.16	0.39	-0.02	-0.20	-0.12	0.08	0.09	-0.06	-0.01	0.34	-0.07
ADD	0.31	0.06	0.06	1	-0.08	-0.06	-0.32	-0.30	-0.42	0.04	0.16	-0.07	-0.04	-0.16	0.06	0.01	-0.37	-0.29
Ante. Rain	0.51	0.78	0.77	0.72	1	-0.04	-0.21	0.42	0.11	-0.27	-0.15	-0.11	-0.27	-0.13	-0.31	-0.39	-0.20	0.08
Duration	0.01	0.73	0.54	0.80	0.86	1	-0.17	0.03	0.04	-0.25	-0.32	-0.37	-0.30	-0.15	-0.34	-0.29	-0.02	-0.11
Ave_Rain	0.01	0.00	0.00	0.14	0.35	0.44	1	0.14	0.37	0.23	0.07	0.20	0.32	0.23	0.27	0.22	0.46	0.10
TSS	0.90	0.52	0.47	0.17	0.05	0.91	0.54	1	0.60	-0.12	0.02	0.26	-0.12	-0.16	0.15	-0.10	0.00	0.03
Turb.	0.16	0.07	0.07	0.05	0.63	0.87	0.08	0.00	1	0.25	0.12	0.40	0.33	0.21	0.37	0.30	0.44	0.31
Cond.	0.97	0.53	0.92	0.85	0.21	0.26	0.30	0.59	0.24	1	0.87	0.71	0.95	0.84	0.87	0.90	0.46	0.71
Hard.	0.46	0.21	0.35	0.46	0.49	0.14	0.76	0.92	0.58	0.00	1	0.64	0.77	0.64	0.81	0.80	0.21	0.62
COD	0.24	0.55	0.59	0.76	0.63	0.08	0.36	0.22	0.06	0.00	0.00	1	0.77	0.58	0.84	0.80	0.25	0.59
DOC	0.74	0.91	0.70	0.86	0.21	0.17	0.14	0.60	0.13	0.00	0.00	0.00	1	0.88	0.82	0.91	0.48	0.65
O & G	0.50	0.99	0.68	0.47	0.55	0.50	0.29	0.47	0.34	0.00	0.00	0.00	0.00	1	0.58	0.75	0.63	0.69
TKN	0.41	0.61	0.78	0.77	0.15	0.12	0.21	0.48	0.09	0.00	0.00	0.00	0.00	0.00	1	0.88	0.27	0.62
NH_3-N	0.83	0.87	0.95	0.98	0.06	0.18	0.32	0.66	0.16	0.00	0.00	0.00	0.00	0.00	0.00	1	0.42	0.67
NO_2-N	0.12	0.27	0.11	0.08	0.37	0.92	0.03	1.00	0.04	0.03	0.35	0.25	0.02	0.00	0.22	0.04	1	0.42
NO_3-N	0.71	0.94	0.77	0.17	0.73	0.62	0.66	0.91	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1
PO_4-P	0.74	0.94	0.98	0.83	0.61	0.86	0.52	0.48	0.75	0.05	0.01	0.29	0.28	0.53	0.04	0.19	0.53	0.01
Diss. P	0.90	0.85	0.75	0.58	0.74	0.72	0.48	0.61	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00
Diss. Cd	0.03	0.22	0.13	0.13	0.76	0.23	0.24	0.97	0.93	0.00	0.00	0.06	0.03	0.26	0.00	0.00	0.17	0.09
Diss. Cr	0.81	0.34	0.37	0.11	0.26	0.88	0.21	0.75	0.42	0.69	0.62	0.62	0.88	0.31	0.41	0.74	0.02	0.69
Diss. Cu	0.06	0.82	0.66	0.97	0.74	0.01	0.91	0.72	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00
Diss. Ni	0.32	0.47	0.76	0.62	0.55	0.21	0.81	0.43	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00
Diss. Pb	0.54	0.79	0.66	0.22	0.62	0.77	0.59	0.34	0.19	0.53	0.09	0.22	0.56	0.93	0.11	0.09	0.59	0.92
Diss. Zn	0.28	0.22	0.16	0.79	0.55	0.91	0.28	1.00	0.98	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.88	0.00
Tot. P	0.91	0.59	0.99	0.66	0.42	0.58	0.57	0.19	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00
Tot. Cd	0.10	0.26	0.30	0.08	0.81	0.32	0.59	0.90	0.72	0.00	0.00	0.02	0.01	0.26	0.00	0.00	0.23	0.14
Tot. Cr	0.93	0.86	0.82	0.72	0.07	0.25	0.62	0.01	0.00	0.10	0.08	0.01	0.09	0.53	0.01	0.17	0.91	0.44
Tot. Cu	0.10	0.88	0.82	0.88	0.26	0.00	0.72	0.30	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.01
Tot. Ni	0.31	0.63	0.69	0.84	0.24	0.03	0.90	0.17	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.01
Tot. Pb	0.87	0.92	0.78	0.64	0.05	0.69	0.80	0.00	0.00	0.68	0.28	0.13	0.69	0.56	0.12	0.78	0.30	0.86
Tot. Zn	0.60	0.47	0.52	0.91	0.22	0.57	0.80	0.10	0.17	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.00

Table D.26 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.07	0.03	-0.47	-0.06	-0.42	-0.23	-0.14	-0.25	-0.03	-0.37	-0.02	-0.37	-0.23	-0.04	-0.12
Max. Rain	-0.02	-0.04	-0.28	-0.22	-0.05	-0.17	0.06	-0.28	-0.13	-0.26	0.04	-0.04	-0.11	-0.02	-0.17
15m. Rain	-0.01	0.08	-0.34	-0.21	-0.10	-0.07	-0.10	-0.32	0.00	-0.24	0.05	-0.05	-0.09	-0.07	-0.15
ADD	-0.05	0.13	0.34	0.36	0.01	-0.11	0.28	0.06	0.10	0.39	0.09	0.04	-0.05	0.11	0.03
Ante. Rain	-0.11	0.08	0.07	0.26	0.08	0.14	-0.12	0.14	0.19	0.06	0.40	0.26	0.27	0.44	0.28
Duration	0.04	-0.09	-0.28	0.04	-0.54	-0.28	-0.07	-0.03	-0.13	-0.23	-0.26	-0.64	-0.47	-0.09	-0.13
Ave_Rain	0.14	0.16	-0.27	-0.28	0.03	0.06	-0.13	-0.25	0.13	-0.13	0.11	0.09	0.03	-0.06	-0.06
TSS	0.16	0.12	-0.01	0.08	-0.08	0.18	0.22	0.00	0.30	0.03	0.54	0.24	0.31	0.65	0.37
Turb.	0.07	0.15	-0.02	0.19	0.04	0.10	0.30	-0.01	0.26	0.08	0.67	0.26	0.26	0.66	0.31
Cond.	0.41	0.94	0.65	0.09	0.86	0.84	0.15	0.78	0.90	0.70	0.37	0.77	0.74	0.10	0.78
Hard.	0.52	0.84	0.78	0.11	0.73	0.78	0.38	0.85	0.89	0.74	0.39	0.76	0.78	0.25	0.86
COD	0.23	0.77	0.42	0.12	0.72	0.75	0.28	0.53	0.78	0.49	0.57	0.74	0.72	0.34	0.69
DOC	0.24	0.86	0.48	0.04	0.86	0.81	0.14	0.63	0.81	0.54	0.38	0.77	0.73	0.09	0.68
O & G	0.14	0.71	0.26	-0.24	0.82	0.74	-0.02	0.57	0.65	0.26	0.15	0.63	0.61	-0.14	0.53
TKN	0.44	0.87	0.73	0.19	0.72	0.71	0.36	0.69	0.89	0.80	0.53	0.75	0.68	0.36	0.81
NH_3-N	0.29	0.87	0.65	0.08	0.81	0.71	0.38	0.71	0.80	0.63	0.31	0.71	0.64	0.07	0.70
NO_2-N	0.14	0.18	-0.31	-0.49	0.26	0.19	-0.13	-0.04	0.17	-0.28	0.03	0.14	0.10	-0.24	-0.01
NO_3-N	0.53	0.64	0.38	-0.09	0.65	0.64	-0.03	0.74	0.62	0.34	0.18	0.53	0.54	0.04	0.66
PO_4-P	1	0.49	0.28	-0.19	0.24	0.39	0.03	0.52	0.50	0.30	-0.02	0.21	0.29	0.00	0.46
Diss. P	0.03	1	0.64	0.16	0.71	0.77	0.21	0.77	0.96	0.71	0.35	0.68	0.67	0.14	0.82
Diss. Cd	0.21	0.00	1	0.44	0.58	0.50	0.51	0.77	0.68	0.93	0.38	0.61	0.55	0.34	0.72
Diss. Cr	0.40	0.50	0.05	1	-0.07	-0.10	0.37	0.10	0.19	0.53	0.60	0.14	0.08	0.58	0.24
Diss. Cu	0.31	0.00	0.01	0.75	1	0.79	0.16	0.67	0.67	0.53	0.30	0.88	0.78	0.05	0.65
Diss. Ni	0.08	0.00	0.02	0.68	0.00	1	-0.05	0.76	0.81	0.48	0.26	0.78	0.87	0.13	0.80
Diss. Pb	0.90	0.37	0.02	0.10	0.49	0.84	1	0.20	0.28	0.48	0.45	0.23	0.11	0.45	0.26
Diss. Zn	0.02	0.00	0.00	0.66	0.00	0.00	0.40	1	0.78	0.65	0.23	0.61	0.71	0.18	0.88
Tot. P	0.02	0.00	0.00	0.40	0.00	0.00	0.22	0.00	1	0.73	0.48	0.72	0.75	0.31	0.89
Tot. Cd	0.19	0.00	0.00	0.01	0.01	0.03	0.03	0.00	0.00	1	0.46	0.57	0.48	0.36	0.67
Tot. Cr	0.95	0.12	0.09	0.00	0.18	0.25	0.04	0.31	0.03	0.04	1	0.61	0.57	0.88	0.58
Tot. Cu	0.36	0.00	0.00	0.55	0.00	0.00	0.32	0.00	0.00	0.01	0.00	1	0.93	0.43	0.78
Tot. Ni	0.20	0.00	0.01	0.74	0.00	0.00	0.62	0.00	0.00	0.03	0.01	0.00	1	0.46	0.87
Tot. Pb	0.99	0.54	0.13	0.01	0.83	0.56	0.04	0.44	0.17	0.11	0.00	0.05	0.04	1	0.52
Tot. Zn	0.04	0.00	0.00	0.29	0.00	0.00	0.25	0.00	0.00	0.00	0.01	0.00	0.00	0.02	1

Table D.27 Correlation Analysis Results for Storm Characteristics and MFF50 (Combined UCLA, 2000-2003)

UCLA1_10	Tot. Rain	Max. Rain	15m. Rain	ADD	Ante. Rain	Duration	Ave_Rain	TSS	Turb.	Cond.	Hard.	COD	DOC	O & G	TKN	NH_3-N	NO_2-N	NO_3-N
Tot. Rain	1	0.73	0.80	-0.23	-0.17	0.45	0.62	-0.04	0.18	-0.16	-0.23	-0.03	0.06	0.09	0.01	0.06	0.24	-0.01
Max. Rain	0.00	1	0.97	-0.31	-0.13	0.13	0.80	-0.11	0.11	-0.25	-0.32	-0.05	-0.02	0.02	-0.01	-0.03	0.13	-0.07
15m. Rain	0.00	0.00	1	-0.31	-0.16	0.17	0.83	-0.08	0.16	-0.24	-0.33	-0.03	0.01	0.07	0.00	0.00	0.19	-0.09
ADD	0.07	0.01	0.02	1	-0.10	-0.03	-0.27	-0.22	-0.32	0.19	0.21	-0.03	-0.01	-0.08	0.03	0.02	-0.21	-0.05
Ante. Rain	0.19	0.31	0.23	0.42	1	-0.13	-0.17	0.24	0.19	-0.11	-0.04	0.09	-0.01	0.03	-0.07	-0.16	0.02	0.13
Duration	0.00	0.31	0.19	0.80	0.33	1	-0.14	0.00	-0.06	-0.07	-0.13	-0.16	-0.12	-0.12	-0.14	-0.06	0.09	0.07
Ave_Rain	0.00	0.00	0.00	0.04	0.20	0.29	1	0.07	0.22	-0.17	-0.26	0.12	0.12	0.19	0.16	0.12	0.23	-0.02
TSS	0.75	0.42	0.54	0.09	0.06	0.97	0.61	1	0.51	0.06	0.12	0.36	0.21	0.16	0.35	0.23	0.22	0.20
Turb.	0.17	0.42	0.22	0.01	0.14	0.67	0.09	0.00	1	0.14	0.13	0.63	0.52	0.54	0.53	0.55	0.65	0.29
Cond.	0.21	0.06	0.06	0.13	0.38	0.58	0.18	0.62	0.29	1	0.85	0.56	0.71	0.57	0.61	0.60	0.35	0.44
Hard.	0.07	0.01	0.01	0.10	0.75	0.33	0.05	0.34	0.34	0.00	1	0.55	0.70	0.52	0.64	0.62	0.29	0.45
COD	0.84	0.70	0.82	0.85	0.48	0.22	0.35	0.00	0.00	0.00	0.00	1	0.89	0.78	0.88	0.88	0.62	0.57
DOC	0.64	0.87	0.96	0.97	0.91	0.37	0.34	0.11	0.00	0.00	0.00	0.00	1	0.86	0.88	0.91	0.62	0.60
O & G	0.47	0.91	0.61	0.53	0.82	0.37	0.14	0.22	0.00	0.00	0.00	0.00	0.00	1	0.71	0.78	0.69	0.56
TKN	0.97	0.92	0.98	0.82	0.57	0.27	0.21	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1	0.90	0.58	0.53
NH_3-N	0.66	0.83	1.00	0.88	0.21	0.64	0.37	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.59	0.55
NO_2-N	0.06	0.30	0.14	0.11	0.86	0.49	0.07	0.09	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	1	0.38
NO_3-N	0.92	0.60	0.50	0.69	0.31	0.59	0.88	0.12	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
PO_4-P	0.36	0.21	0.37	0.26	0.39	0.76	0.95	0.20	0.36	0.03	0.01	0.06	0.19	0.12	0.01	0.03	0.17	0.02
Diss. P	0.44	0.86	0.78	0.31	0.47	0.36	0.68	0.24	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Cd	0.00	0.02	0.01	0.04	0.89	0.15	0.05	0.48	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00
Diss. Cr	0.15	0.09	0.13	0.09	0.37	0.85	0.13	0.12	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01
Diss. Cu	0.37	0.67	0.68	0.85	0.43	0.09	0.86	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Ni	0.44	0.43	0.51	0.87	0.11	0.38	0.61	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diss. Pb	0.33	0.14	0.10	0.06	0.52	0.19	0.07	0.21	0.72	0.00	0.00	0.01	0.01	0.16	0.00	0.00	0.43	0.03
Diss. Zn	0.04	0.01	0.02	0.24	0.73	0.85	0.03	0.49	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Tot. P	0.54	0.75	0.83	0.51	0.70	0.41	0.84	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Cd	0.05	0.07	0.13	0.11	0.47	0.28	0.50	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Tot. Cr	0.79	0.85	0.76	0.98	0.05	0.54	0.36	0.00	0.00	0.19	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Tot. Cu	0.40	0.70	0.87	0.92	0.31	0.02	0.74	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Ni	0.37	0.40	0.50	0.87	0.10	0.07	0.79	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Pb	0.29	0.03	0.05	0.57	0.09	0.90	0.18	0.00	0.00	0.24	0.07	0.02	0.12	0.41	0.03	0.18	0.30	0.11
Tot. Zn	0.44	0.16	0.25	0.64	0.43	0.82	0.41	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D.27 ***(Continued)***

UCLA1_10	PO_4-P	Diss. P	Diss. Cd	Diss. Cr	Diss. Cu	Diss. Ni	Diss. Pb	Diss. Zn	Tot. P	Tot. Cd	Tot. Cr	Tot. Cu	Tot. Ni	Tot. Pb	Tot. Zn
Tot. Rain	-0.12	0.10	-0.37	-0.19	-0.12	-0.10	-0.13	-0.27	0.08	-0.26	0.04	-0.11	-0.12	-0.14	-0.10
Max. Rain	-0.16	-0.02	-0.32	-0.22	-0.06	-0.11	-0.20	-0.32	-0.04	-0.24	-0.03	-0.05	-0.11	-0.29	-0.19
15m. Rain	-0.12	0.04	-0.33	-0.20	-0.06	-0.09	-0.22	-0.31	0.03	-0.20	0.04	-0.02	-0.09	-0.26	-0.15
ADD	0.15	0.14	0.27	0.22	0.03	-0.02	0.25	0.16	0.09	0.21	0.00	-0.01	-0.02	0.08	0.06
Ante. Rain	-0.11	-0.10	-0.02	0.12	0.11	0.21	-0.09	0.05	-0.05	-0.10	0.26	0.13	0.22	0.23	0.11
Duration	-0.04	0.12	-0.19	-0.03	-0.23	-0.12	0.17	-0.03	0.11	-0.15	-0.08	-0.30	-0.24	0.02	-0.03
Ave_Rain	-0.01	-0.06	-0.26	-0.20	-0.02	-0.07	-0.24	-0.28	-0.03	-0.09	0.12	0.04	-0.04	-0.18	-0.11
TSS	0.16	0.16	0.09	0.21	0.05	0.24	0.17	0.09	0.36	0.27	0.56	0.32	0.34	0.71	0.36
Turb.	0.12	0.34	0.15	0.51	0.42	0.43	0.05	0.31	0.45	0.40	0.76	0.56	0.52	0.46	0.50
Cond.	0.27	0.51	0.60	0.39	0.58	0.56	0.38	0.56	0.46	0.50	0.18	0.46	0.48	0.16	0.54
Hard.	0.34	0.57	0.78	0.42	0.60	0.63	0.52	0.63	0.53	0.62	0.20	0.50	0.57	0.24	0.62
COD	0.24	0.71	0.48	0.50	0.85	0.77	0.33	0.62	0.70	0.55	0.58	0.81	0.76	0.32	0.76
DOC	0.17	0.74	0.55	0.47	0.89	0.80	0.36	0.64	0.69	0.57	0.44	0.80	0.76	0.21	0.75
O & G	0.20	0.58	0.37	0.36	0.83	0.66	0.19	0.55	0.52	0.48	0.43	0.73	0.64	0.11	0.63
TKN	0.32	0.71	0.60	0.51	0.79	0.75	0.40	0.62	0.70	0.62	0.48	0.77	0.72	0.28	0.77
NH_3-N	0.28	0.77	0.60	0.44	0.87	0.78	0.46	0.75	0.73	0.62	0.44	0.80	0.76	0.18	0.83
NO_2-N	0.18	0.45	0.15	0.32	0.52	0.46	0.11	0.34	0.48	0.29	0.46	0.52	0.46	0.14	0.44
NO_3-N	0.30	0.57	0.37	0.33	0.63	0.58	0.28	0.55	0.54	0.37	0.24	0.52	0.53	0.21	0.60
PO_4-P	1	0.42	0.42	0.22	0.20	0.22	0.32	0.38	0.45	0.46	0.09	0.22	0.24	0.19	0.39
Diss. P	0.00	1	0.60	0.52	0.70	0.67	0.40	0.70	0.94	0.62	0.37	0.64	0.63	0.27	0.77
Diss. Cd	0.00	0.00	1	0.55	0.60	0.61	0.62	0.79	0.57	0.87	0.25	0.56	0.60	0.34	0.75
Diss. Cr	0.09	0.00	0.00	1	0.42	0.46	0.27	0.52	0.56	0.65	0.65	0.51	0.49	0.49	0.59
Diss. Cu	0.14	0.00	0.00	0.00	1	0.82	0.35	0.71	0.63	0.58	0.40	0.89	0.82	0.17	0.77
Diss. Ni	0.09	0.00	0.00	0.00	0.00	1	0.28	0.77	0.69	0.56	0.48	0.82	0.91	0.27	0.84
Diss. Pb	0.01	0.00	0.00	0.04	0.01	0.04	1	0.42	0.38	0.48	0.13	0.29	0.30	0.41	0.46
Diss. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.67	0.70	0.31	0.65	0.71	0.24	0.89
Tot. P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.67	0.55	0.69	0.69	0.46	0.82
Tot. Cd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.47	0.63	0.60	0.46	0.77
Tot. Cr	0.52	0.00	0.06	0.00	0.00	0.00	0.33	0.02	0.00	0.00	1	0.66	0.64	0.74	0.58
Tot. Cu	0.10	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	1	0.94	0.45	0.84
Tot. Ni	0.07	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	1	0.46	0.88
Tot. Pb	0.15	0.04	0.01	0.00	0.20	0.04	0.00	0.07	0.00	0.00	0.00	0.00	0.00	1	0.50
Tot. Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

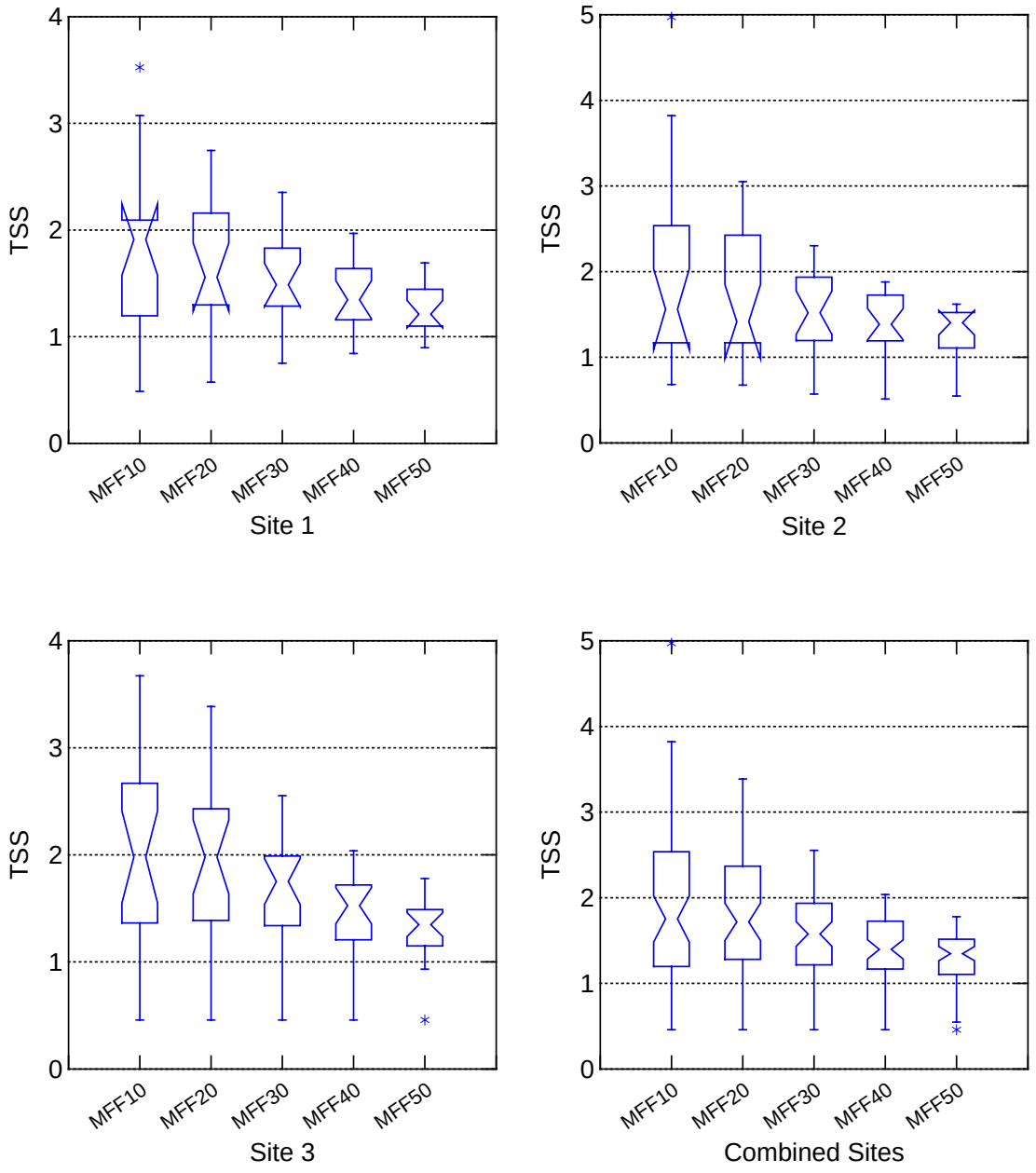


Figure D.1.1 MFF for TSS from UCLA

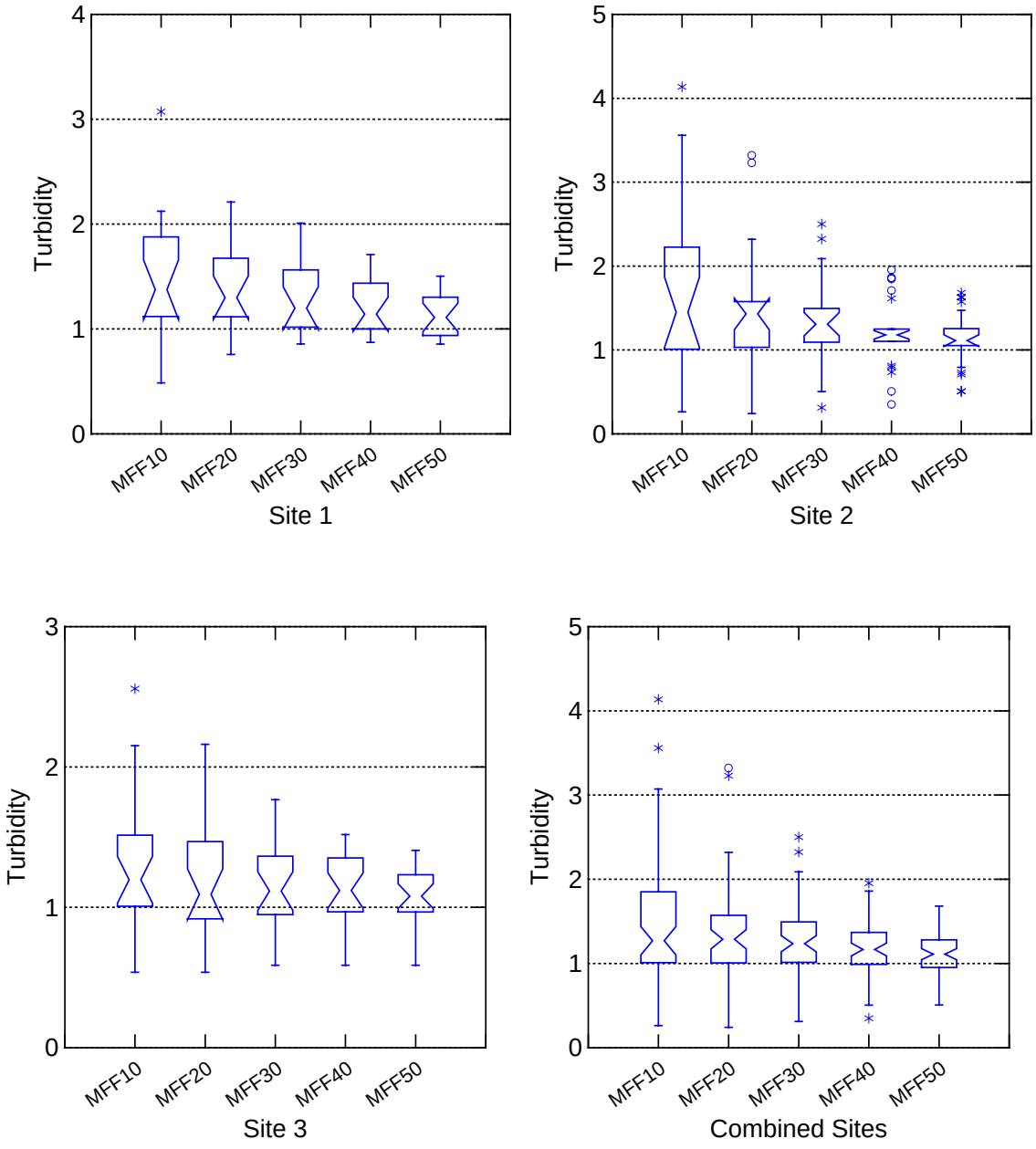


Figure D.1.2 MFF for Turbidity from UCLA

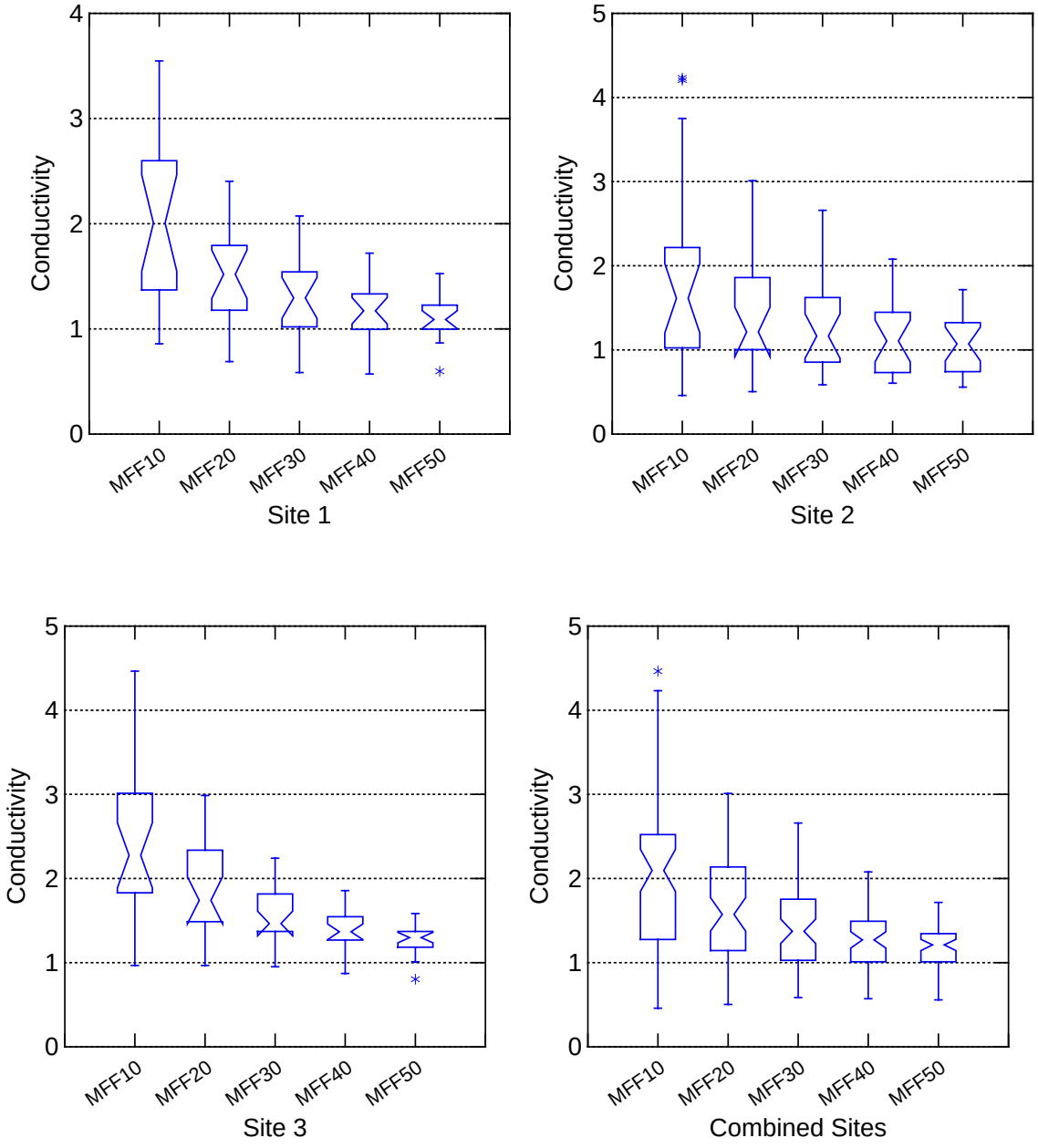


Figure D.1.3 MFF for Conductivity from UCLA

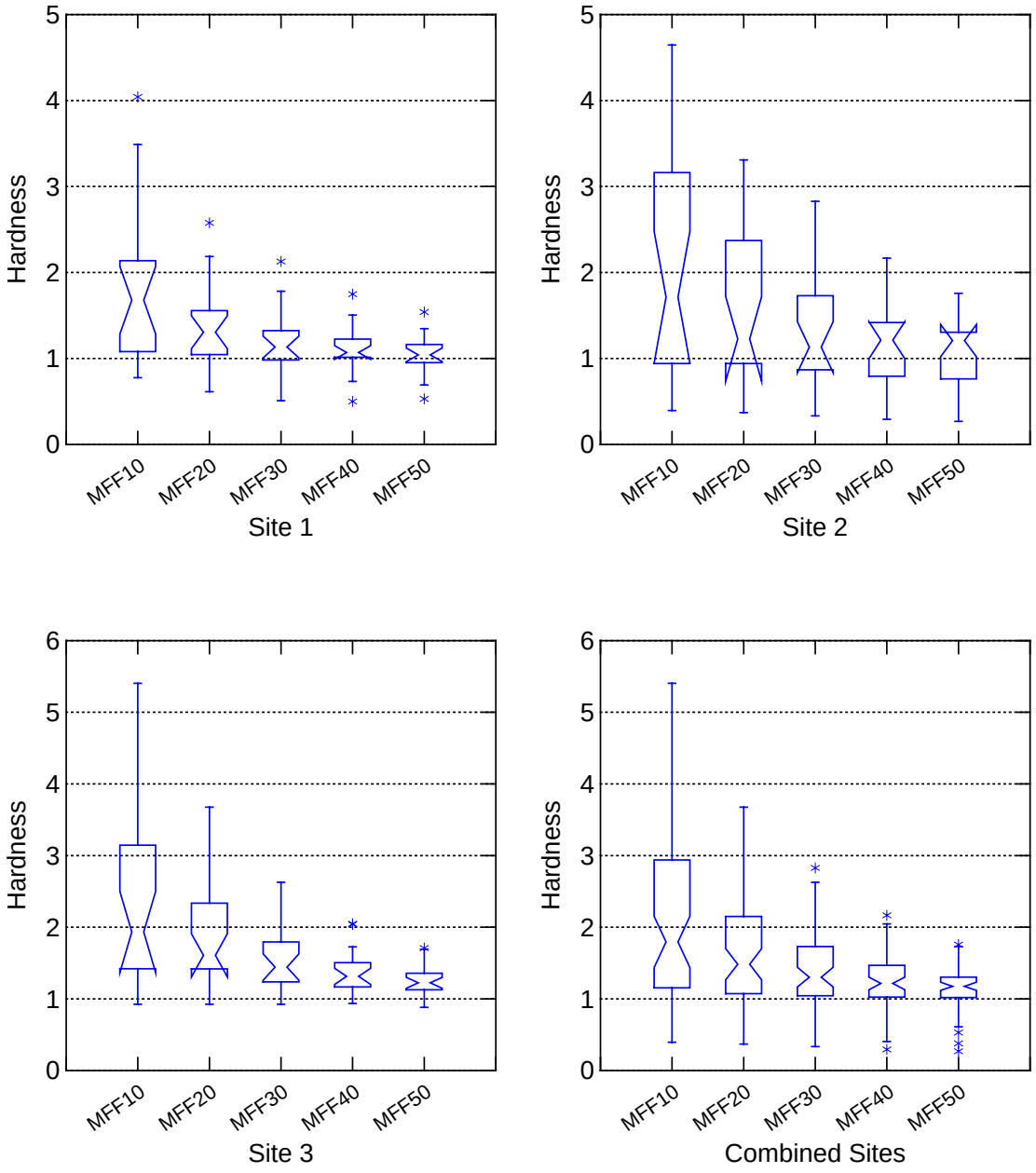


Figure D.1.4 MFF for Hardness from UCLA

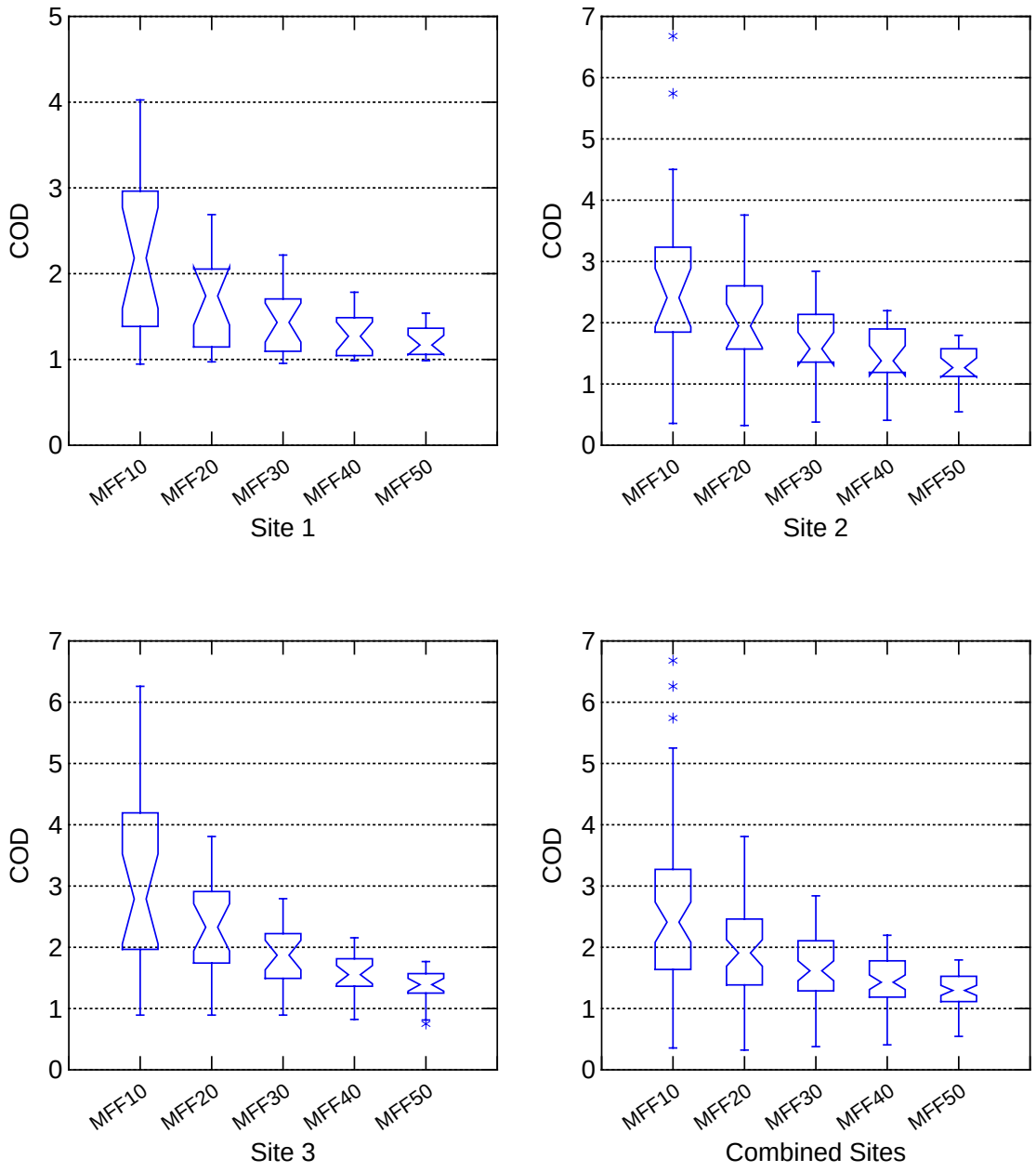


Figure D.1.5 MFF for COD from UCLA

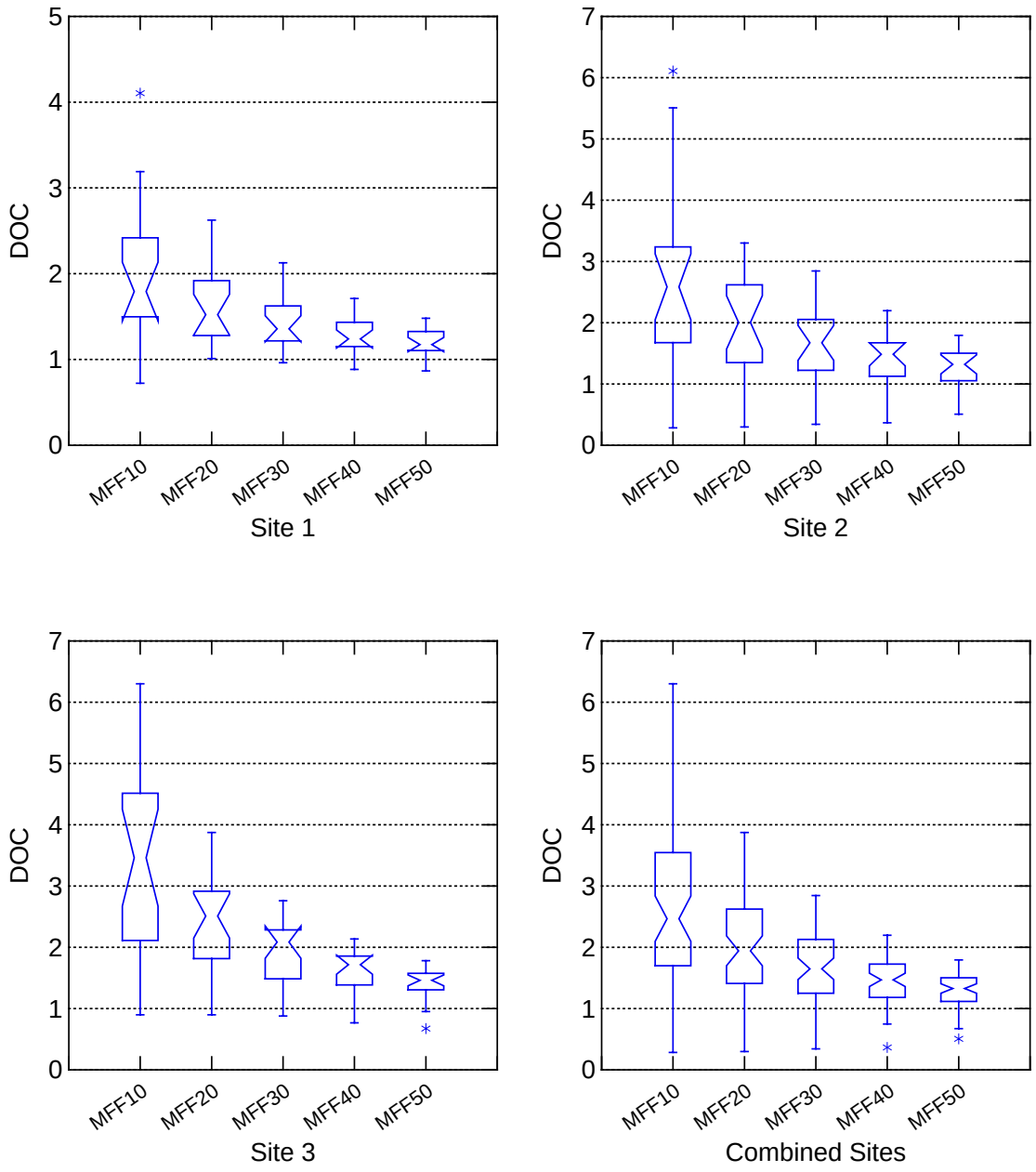


Figure D.1.6 MFF for DOC from UCLA

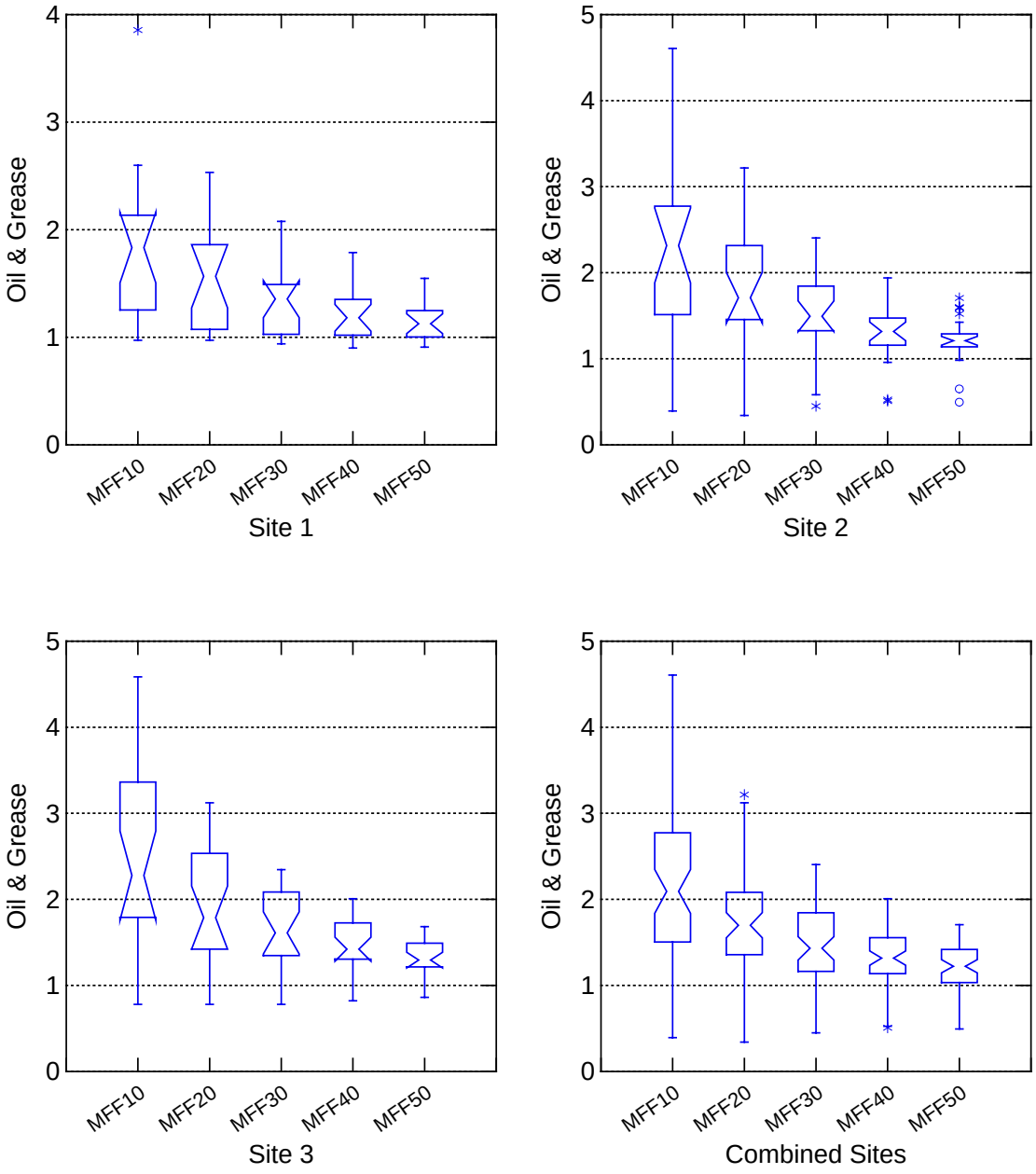


Figure D.1.7 MFF for Oil & Grease from UCLA

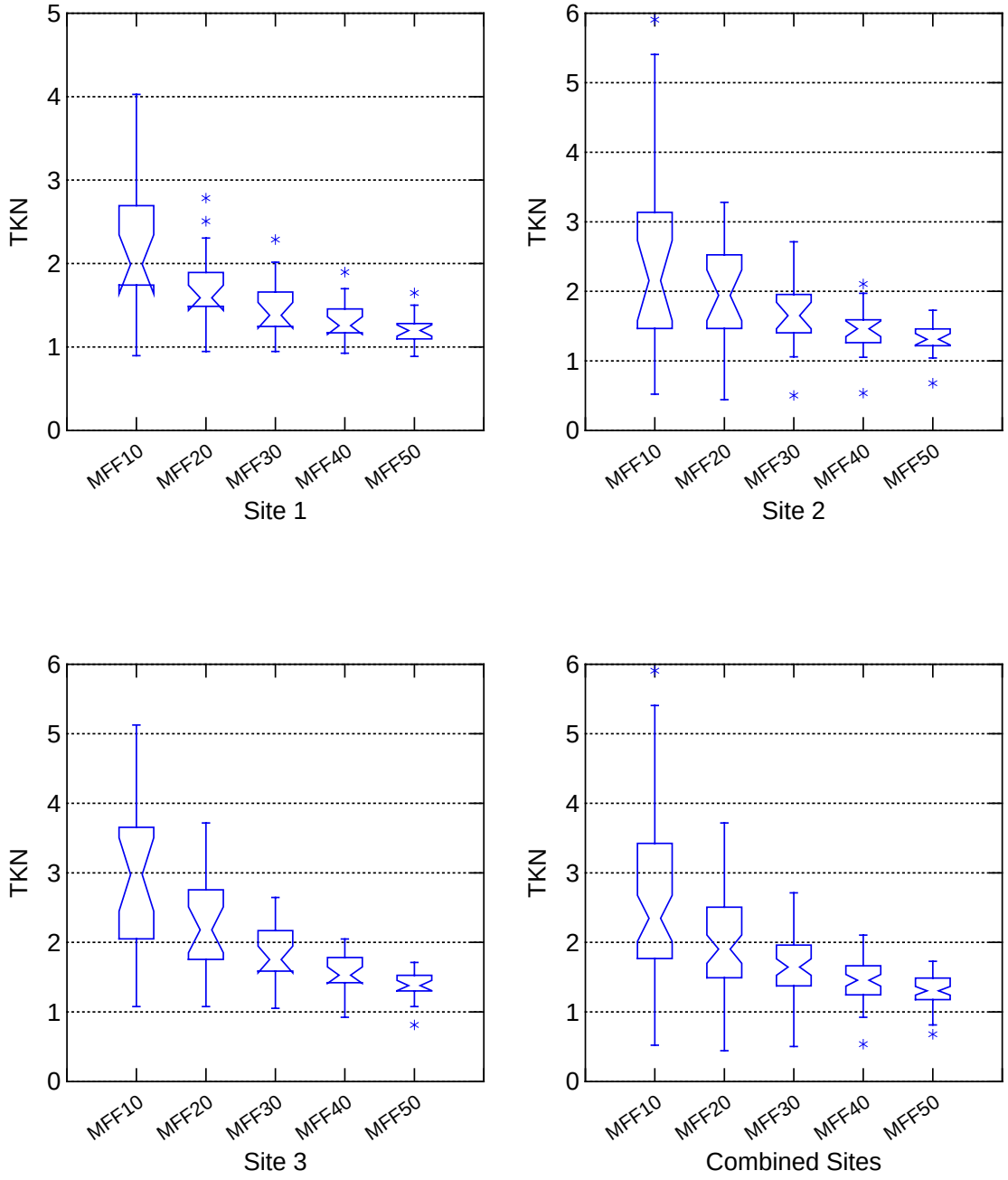


Figure D.1.8 MFF for TKN from UCLA

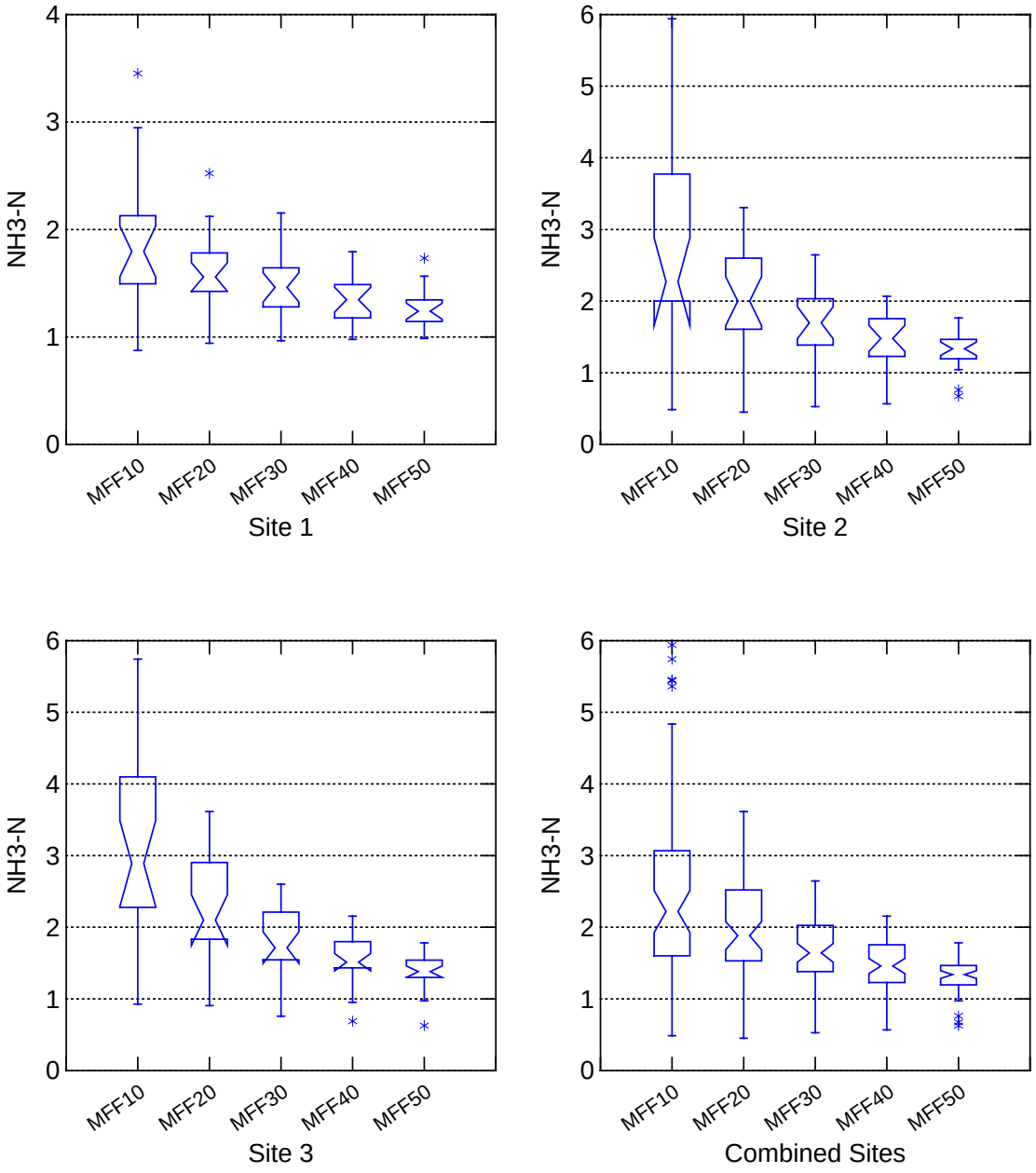


Figure D.1.9 MFF for NH_3-N from UCLA

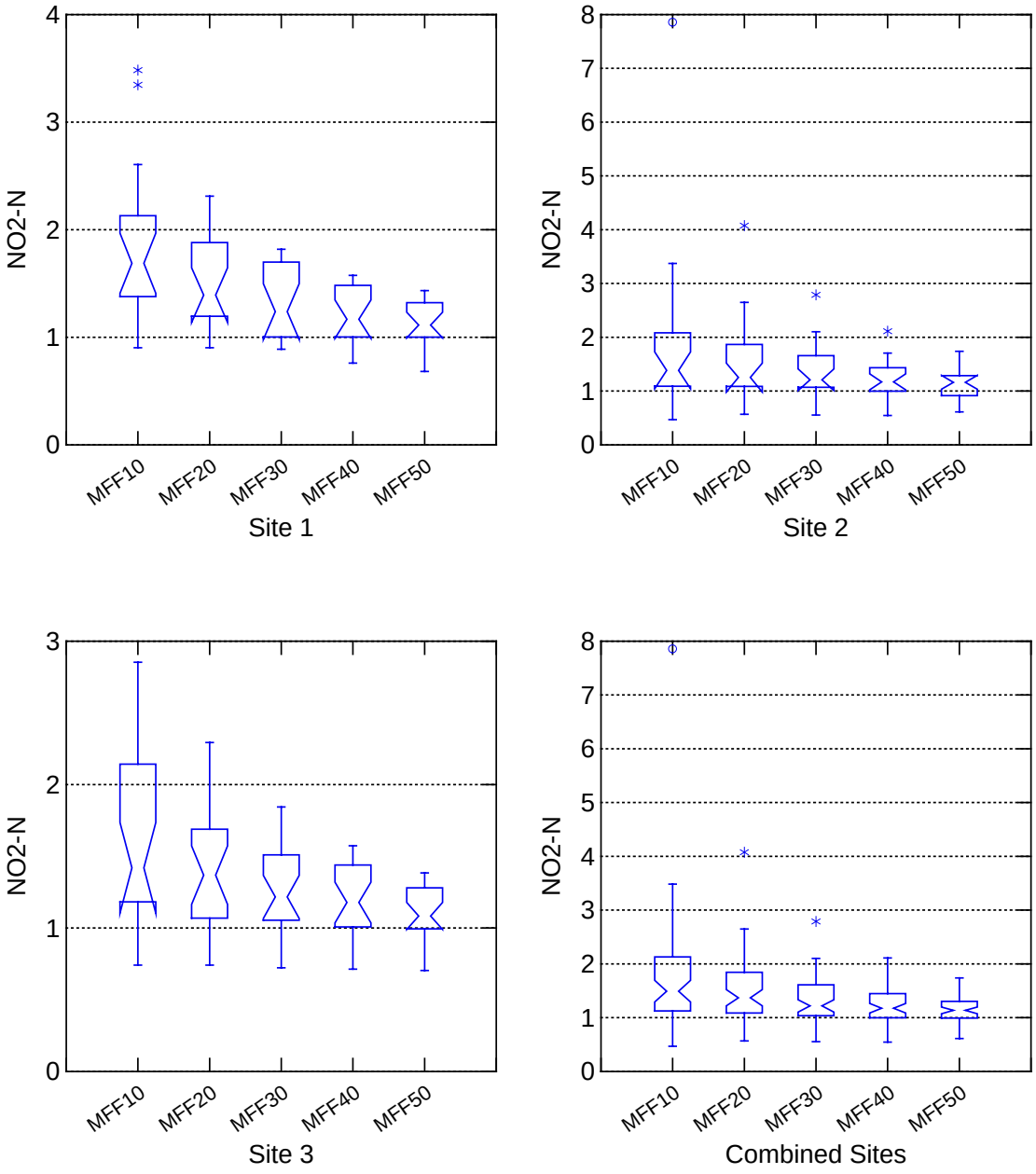


Figure D.1.10 MFF for NO_2-N from UCLA

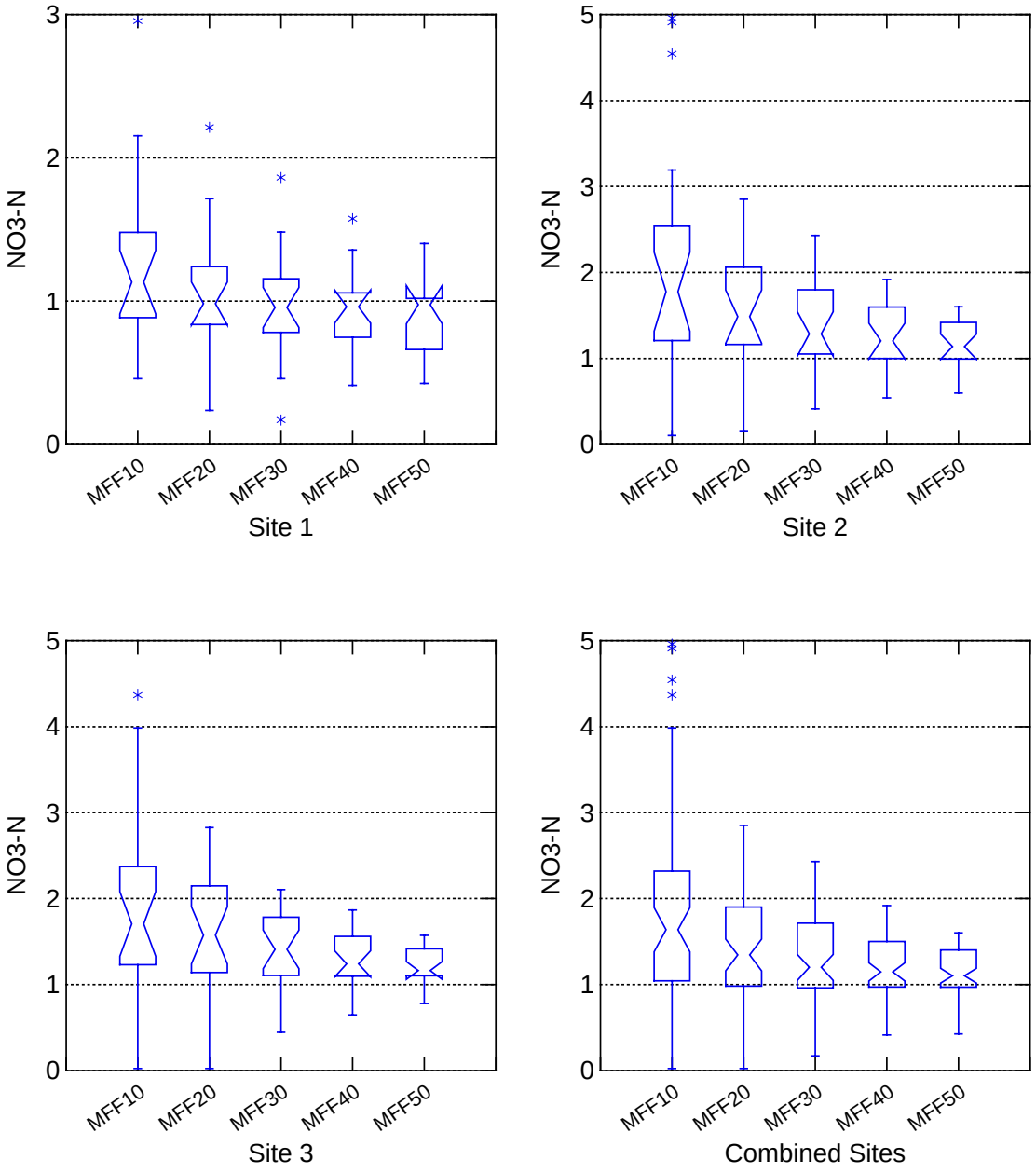


Figure D.1.11 MFF for NO_3-N from UCLA

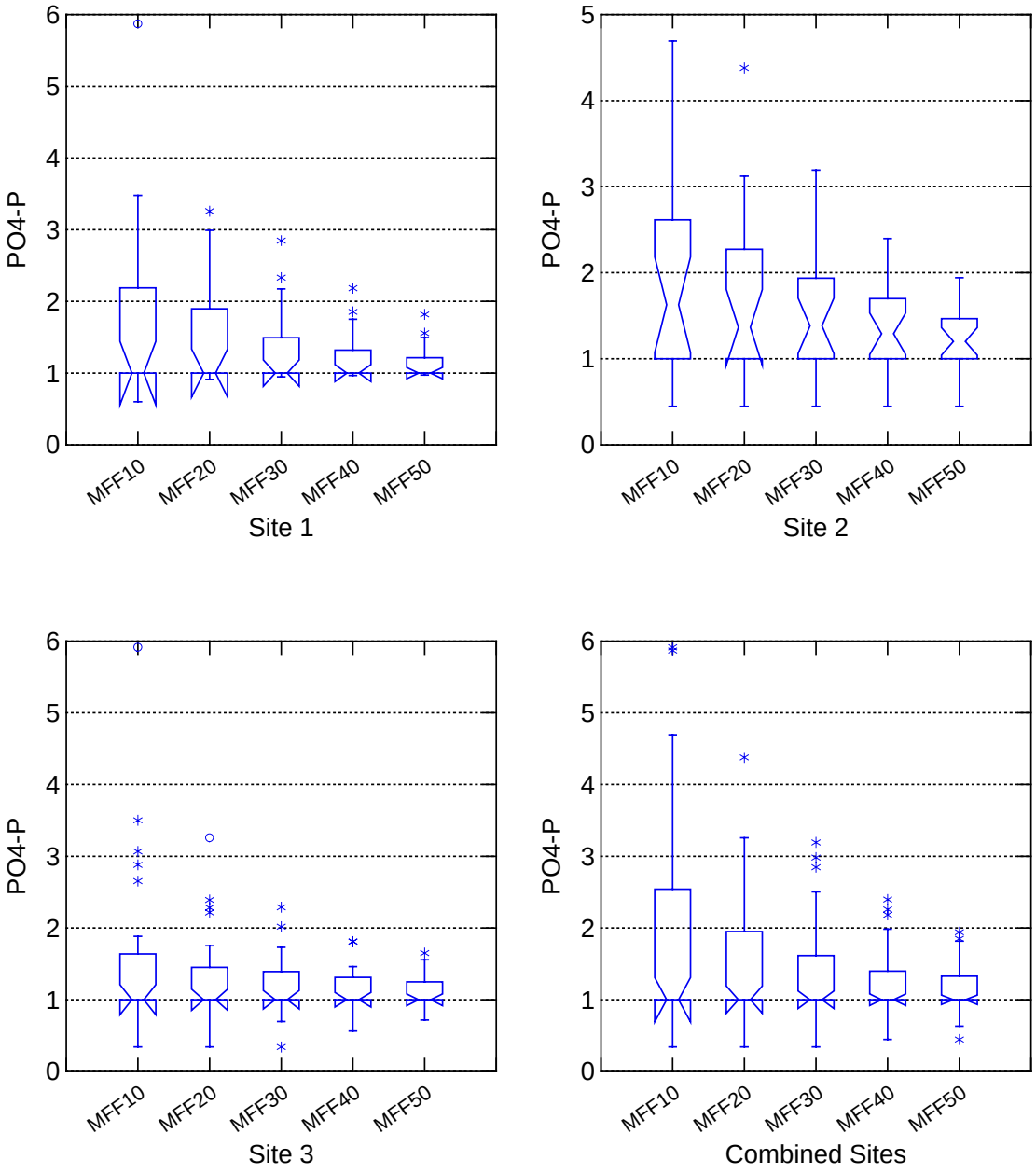


Figure D.1.12 MFF for PO_4-P from UCLA

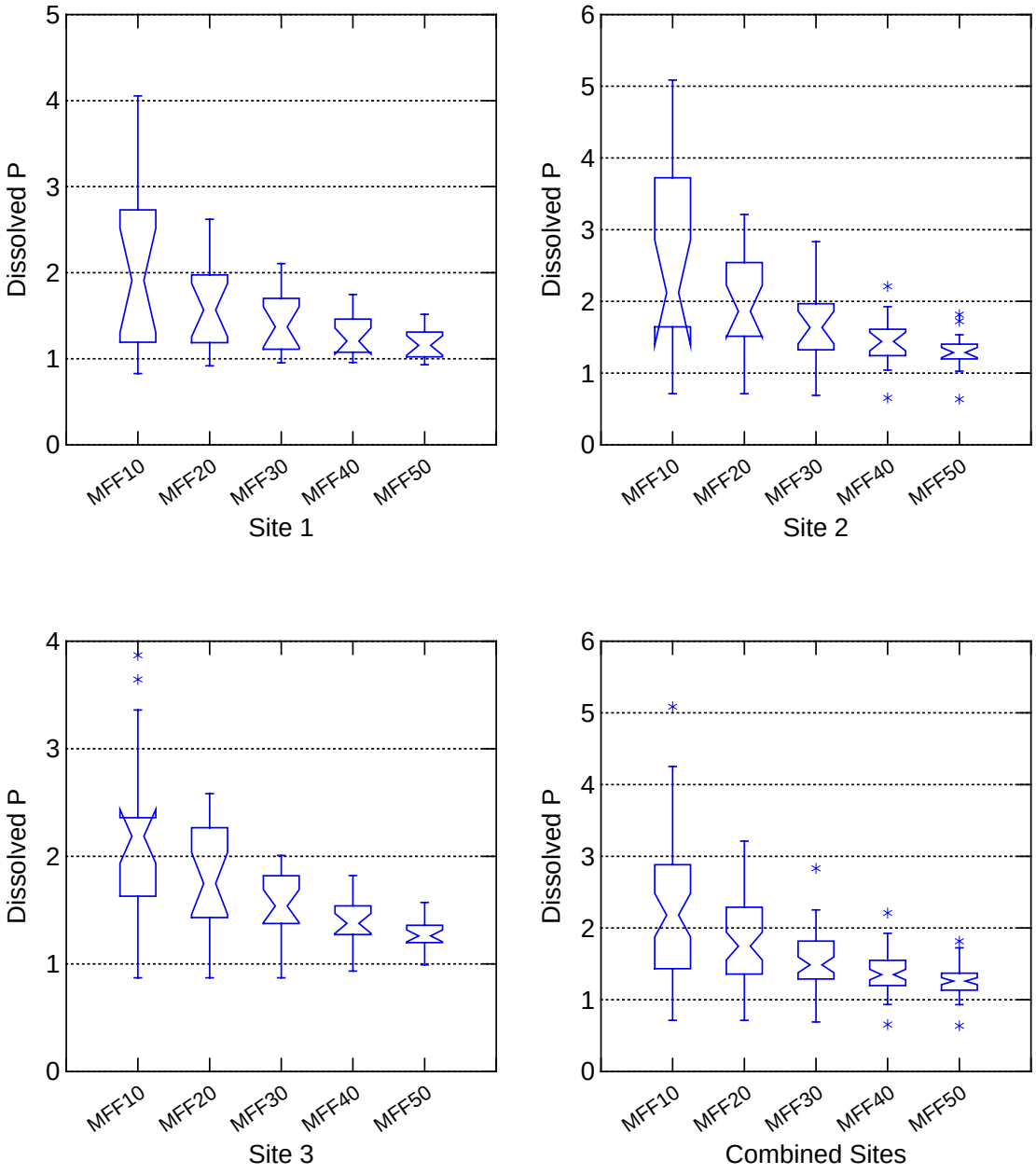


Figure D.1.13 MFF for Dissolved P from UCLA

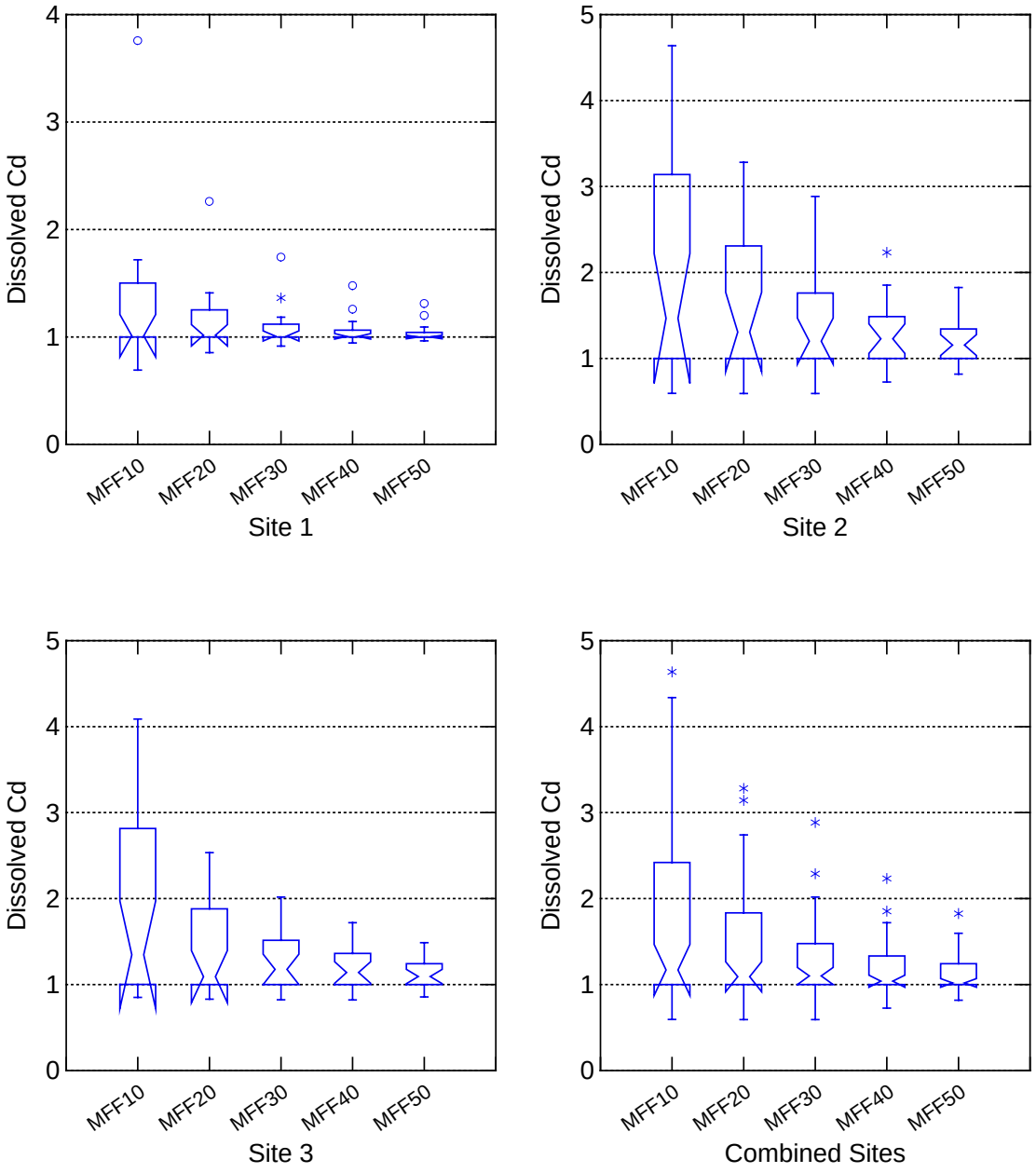


Figure D.1.14 MFF for Dissolved Cd from UCLA

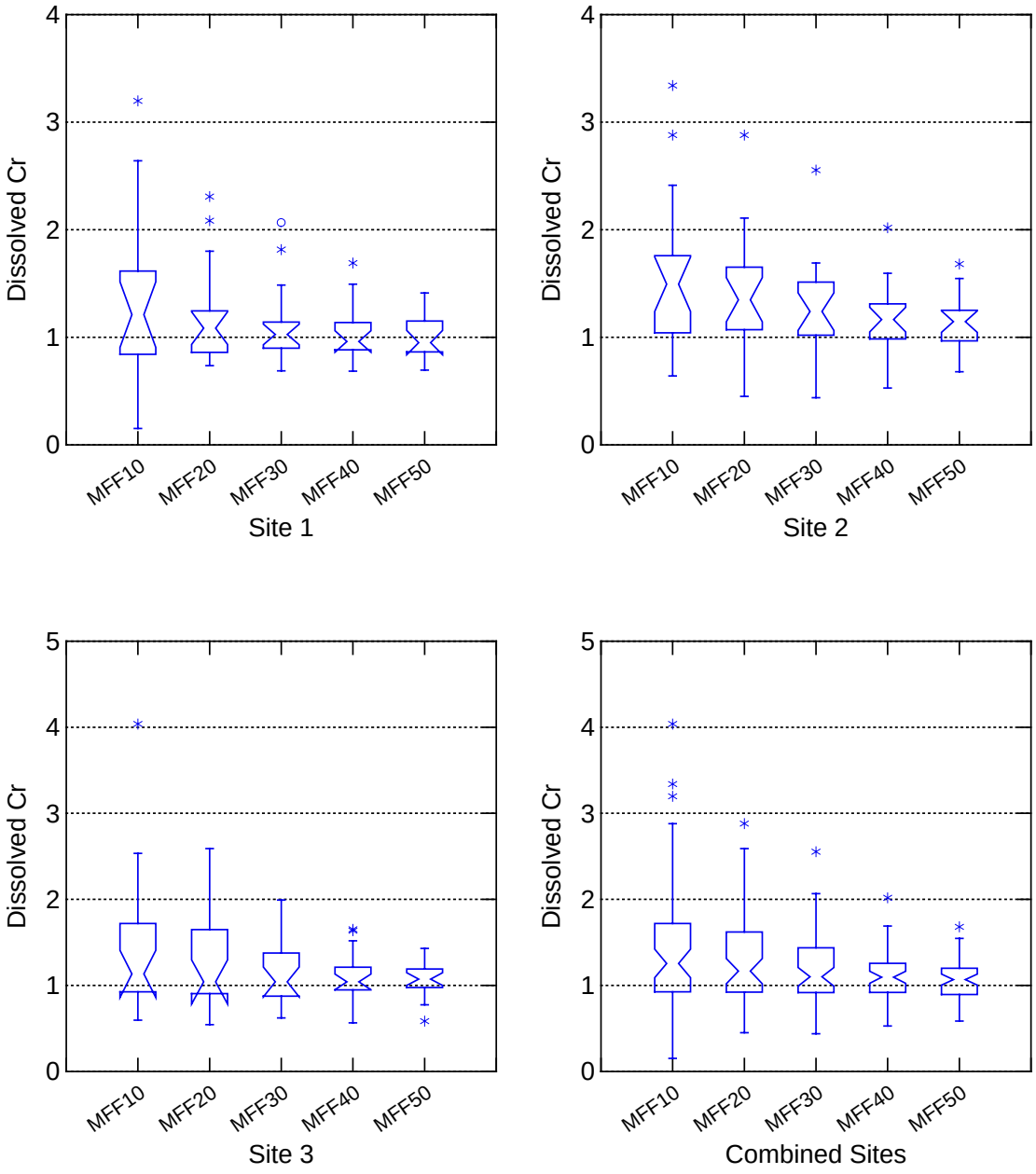


Figure D.1.15 MFF for Dissolved Cr from UCLA

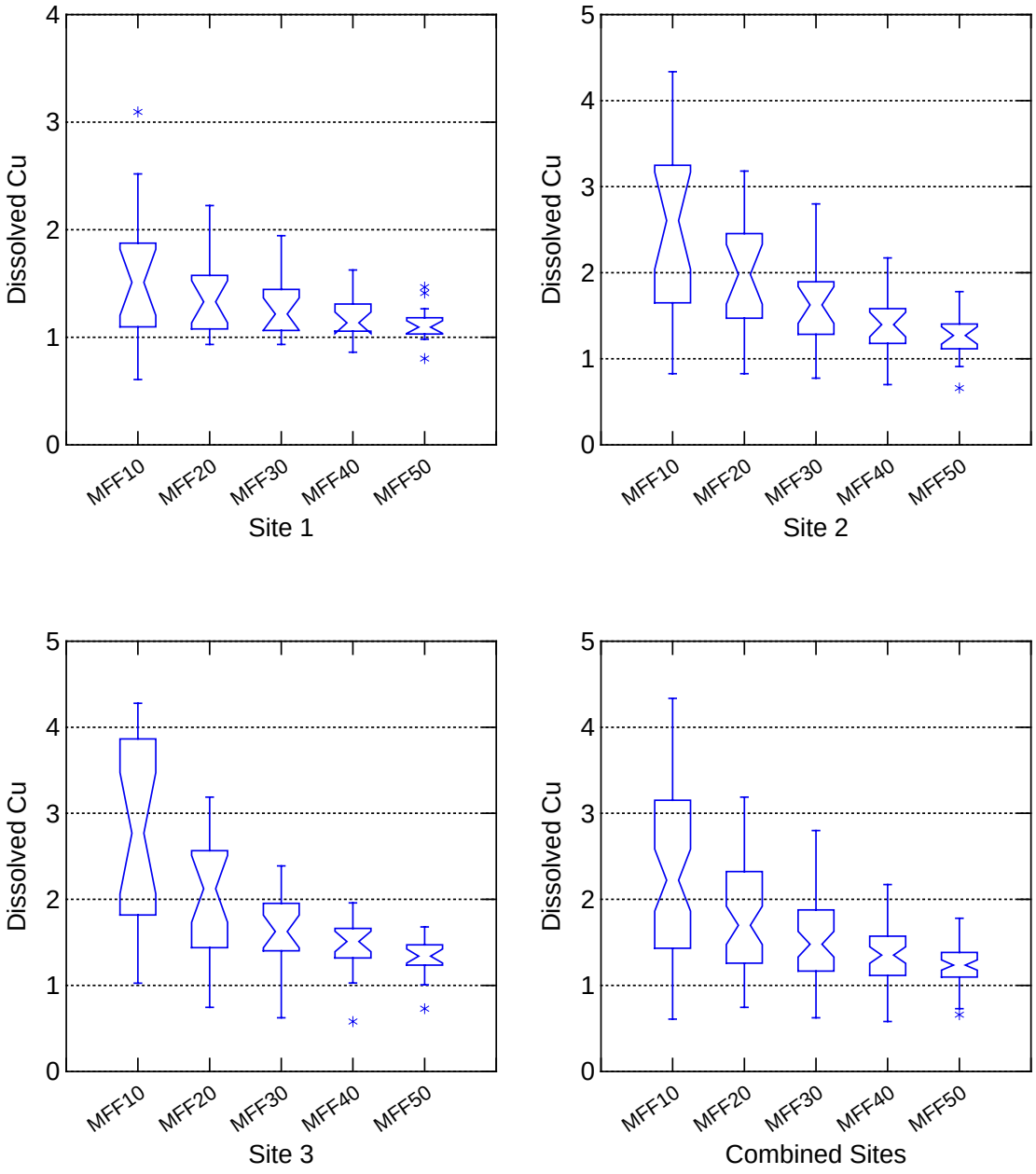


Figure D.1.16 MFF for Dissolved Cu from UCLA

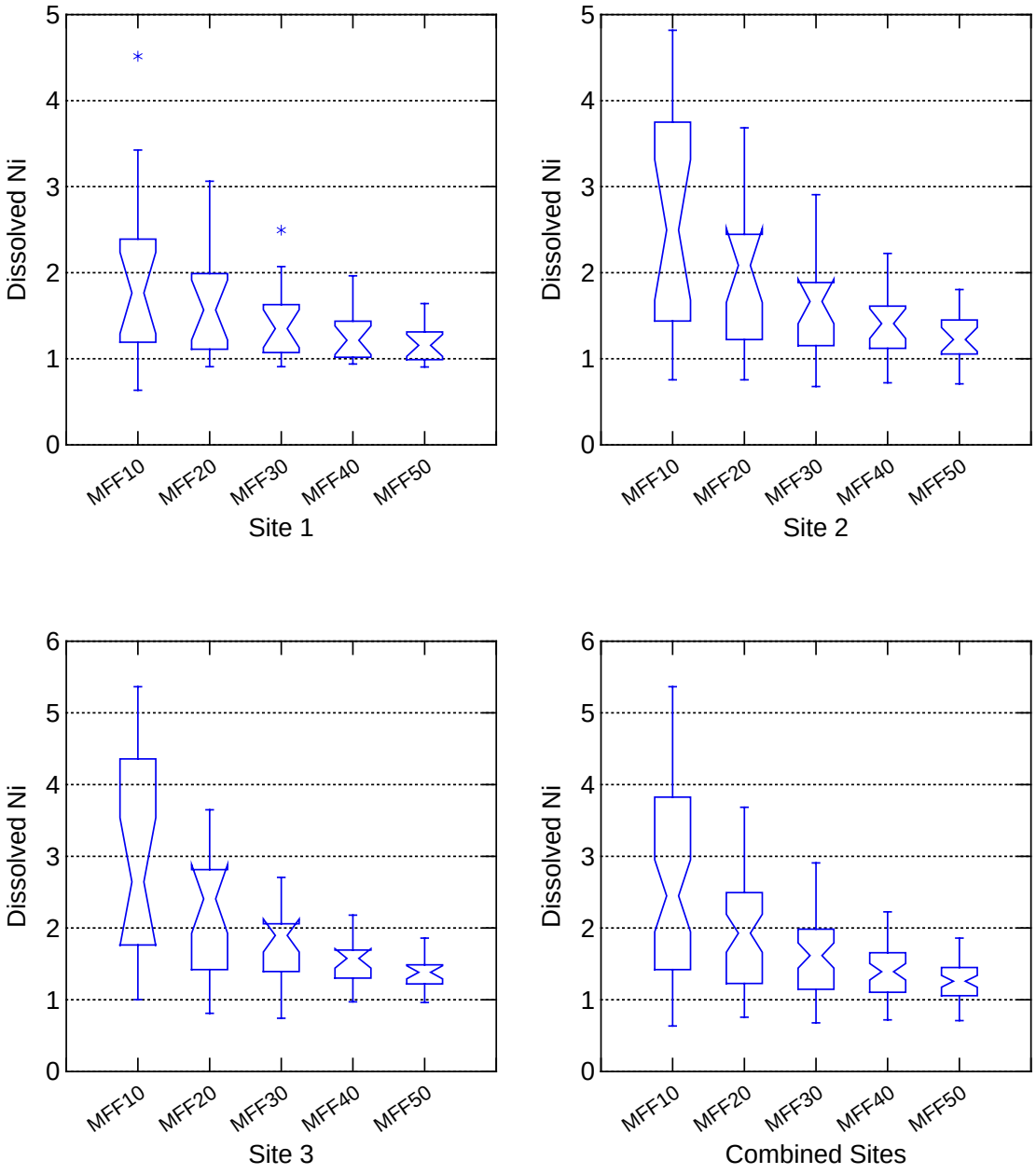


Figure D.1.17 MFF for Dissolved Ni from UCLA

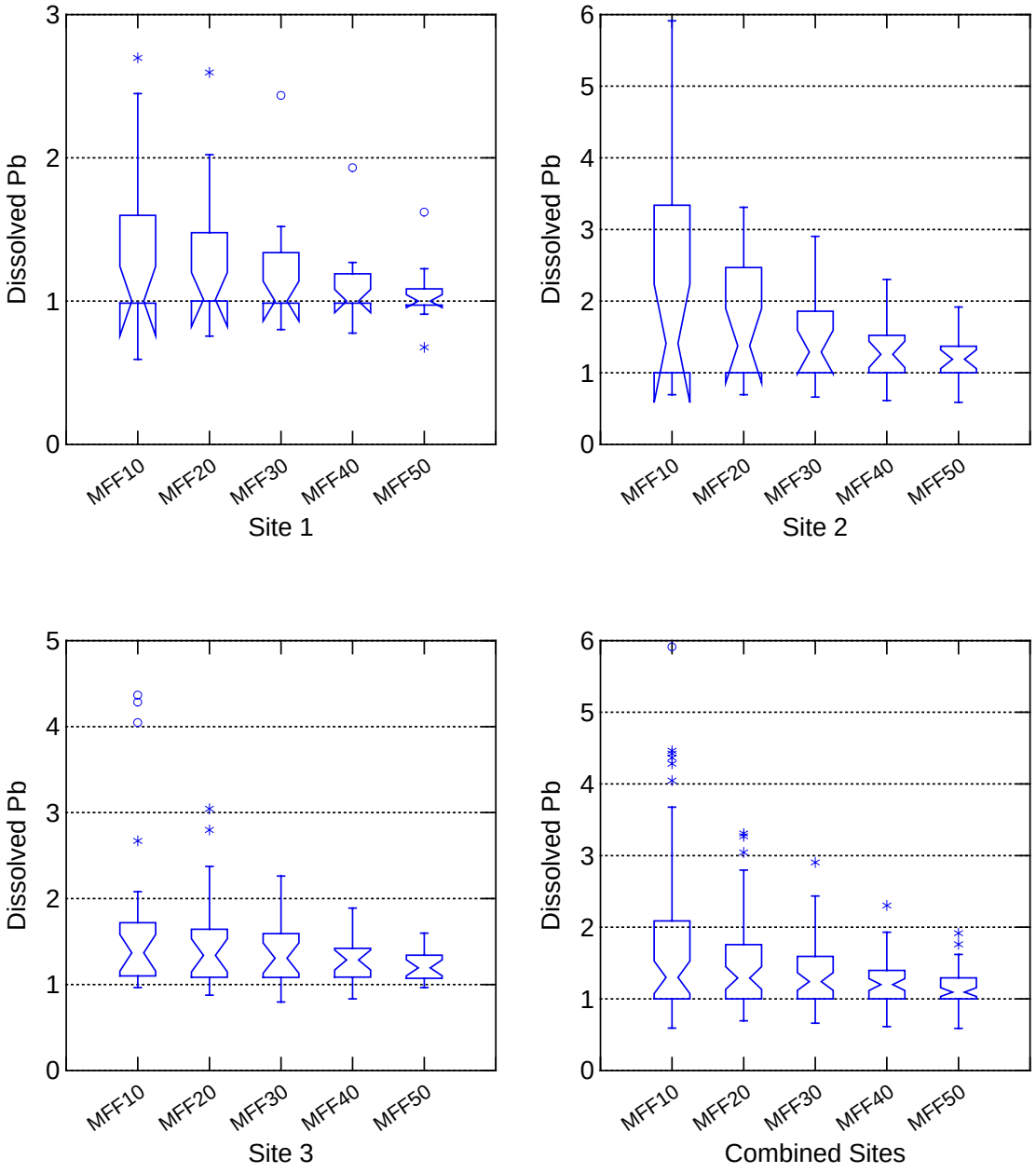


Figure D.1.18 MFF for Dissolved Pb from UCLA

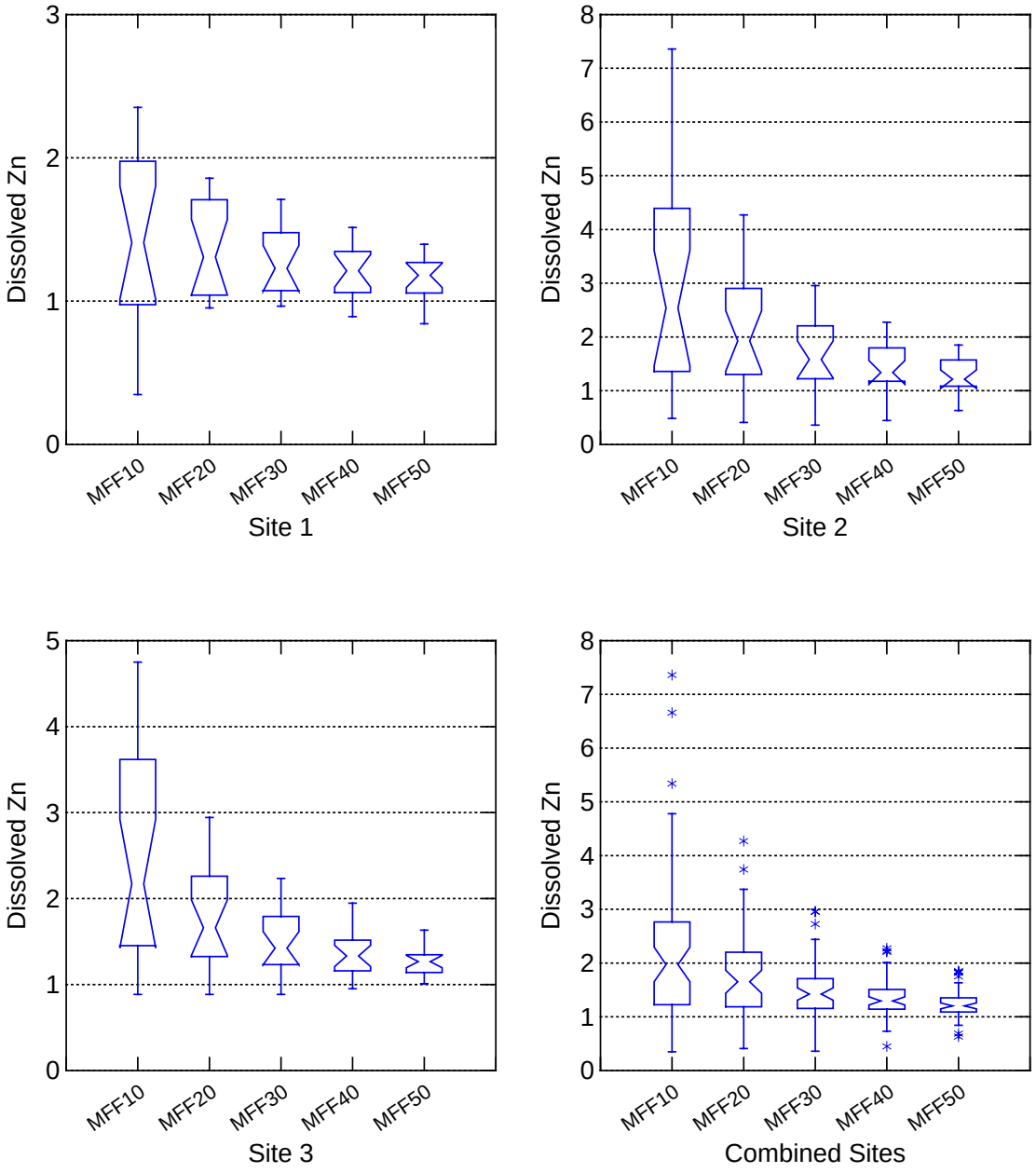


Figure D.1.19 MFF for Dissolved Zn from UCLA

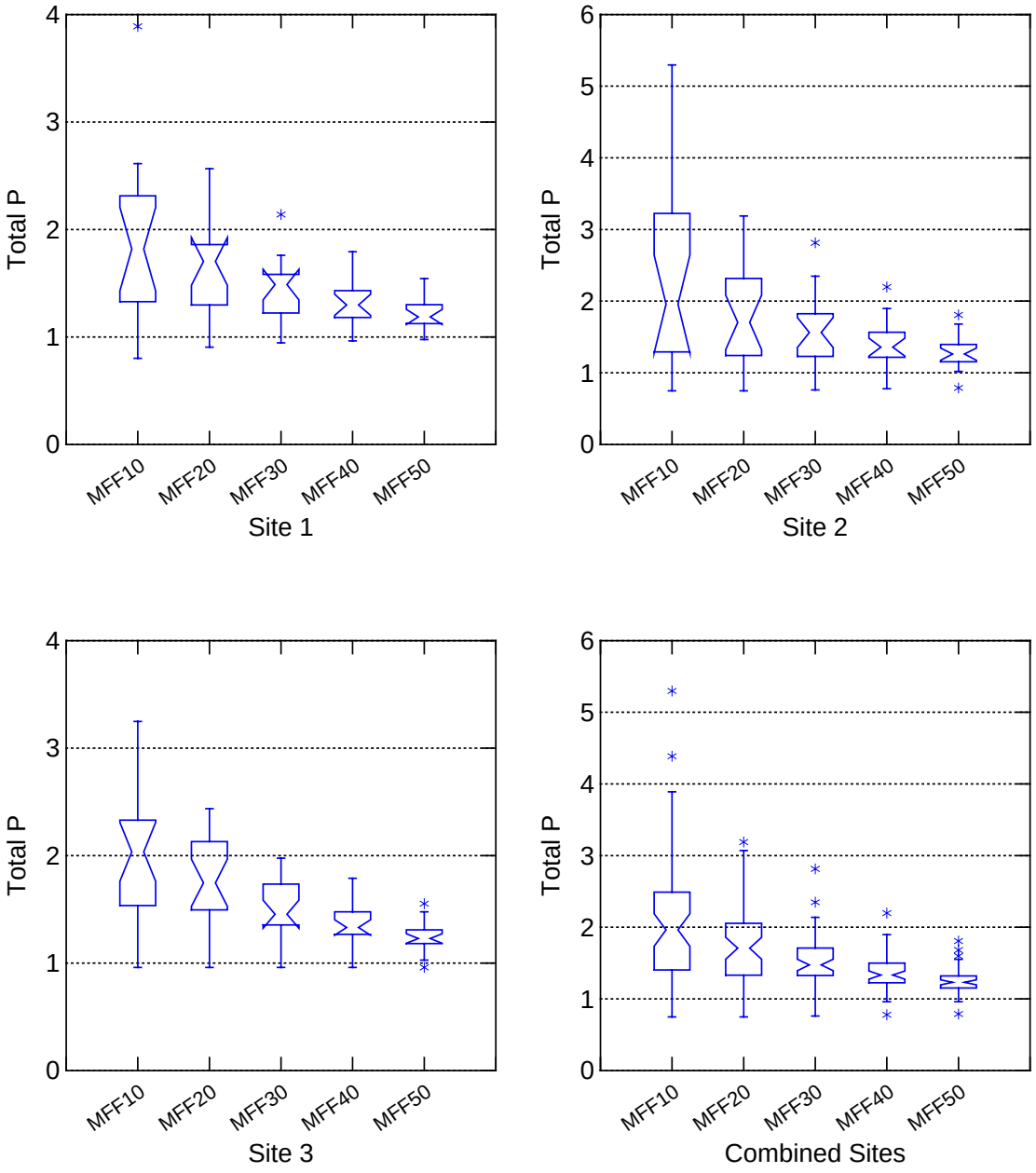


Figure D.1.20 MFF for Total P from UCLA

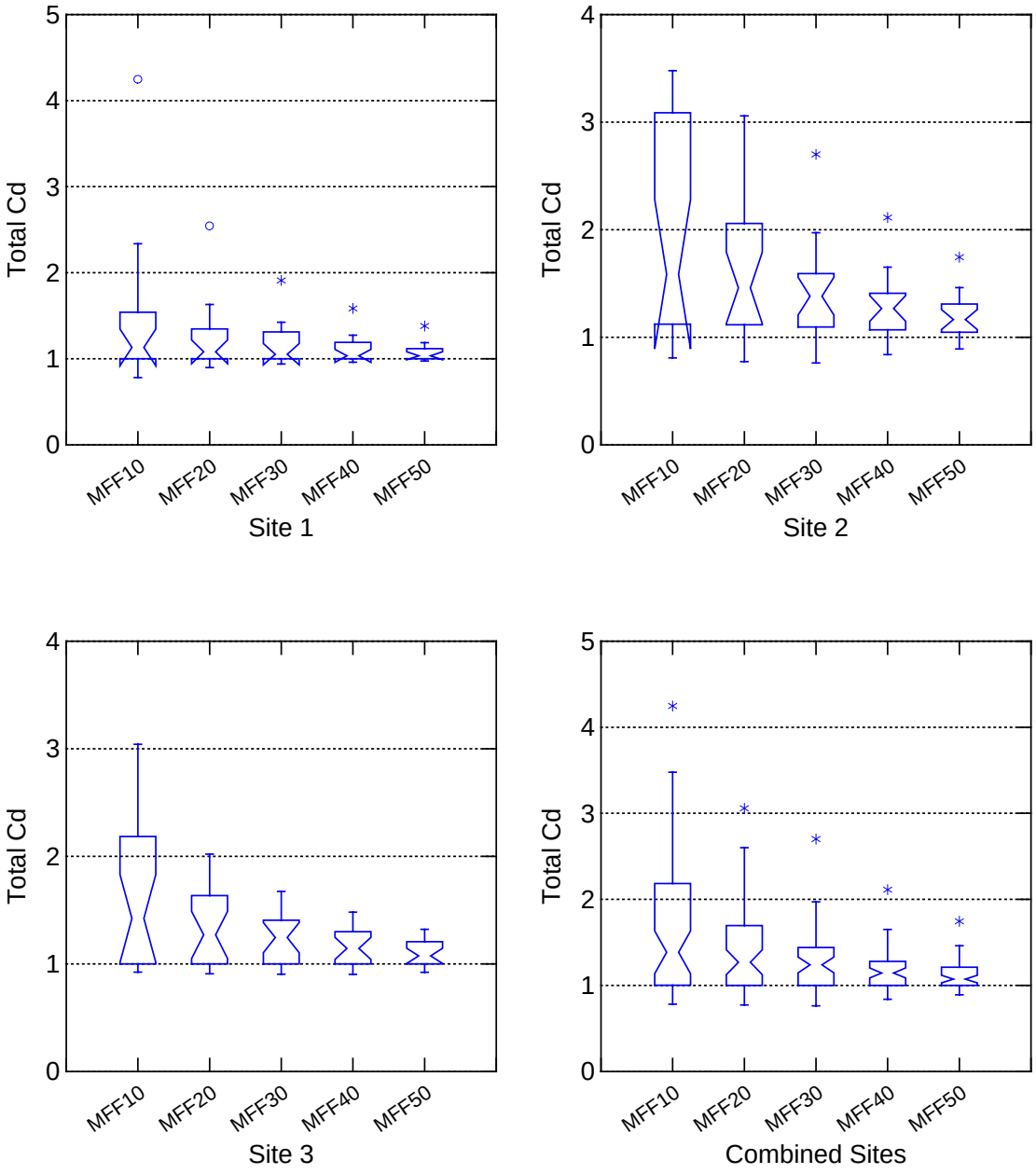


Figure D.1.21 MFF for Total Cd from UCLA

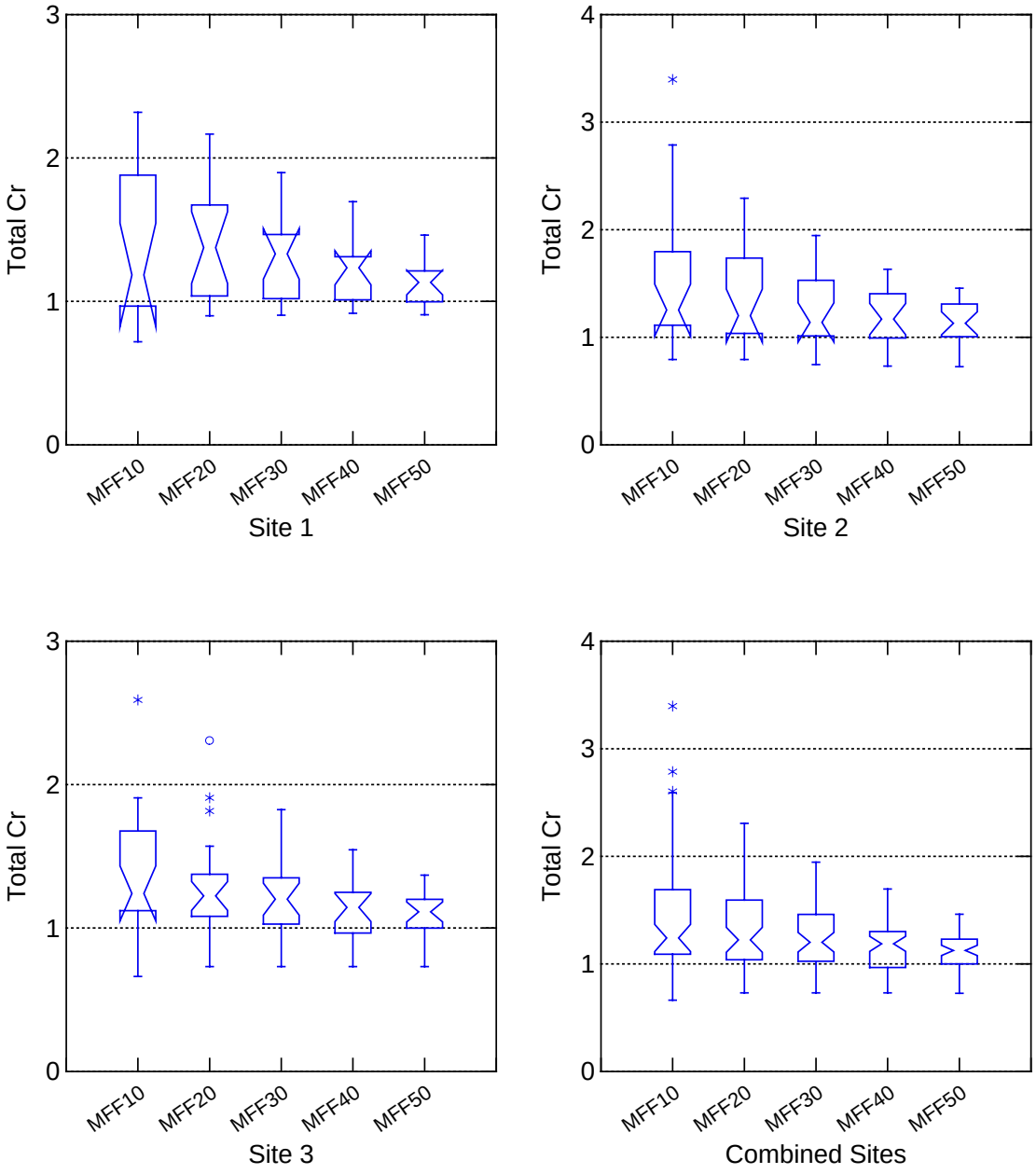


Figure D.1.22 MFF for Total Cr from UCLA

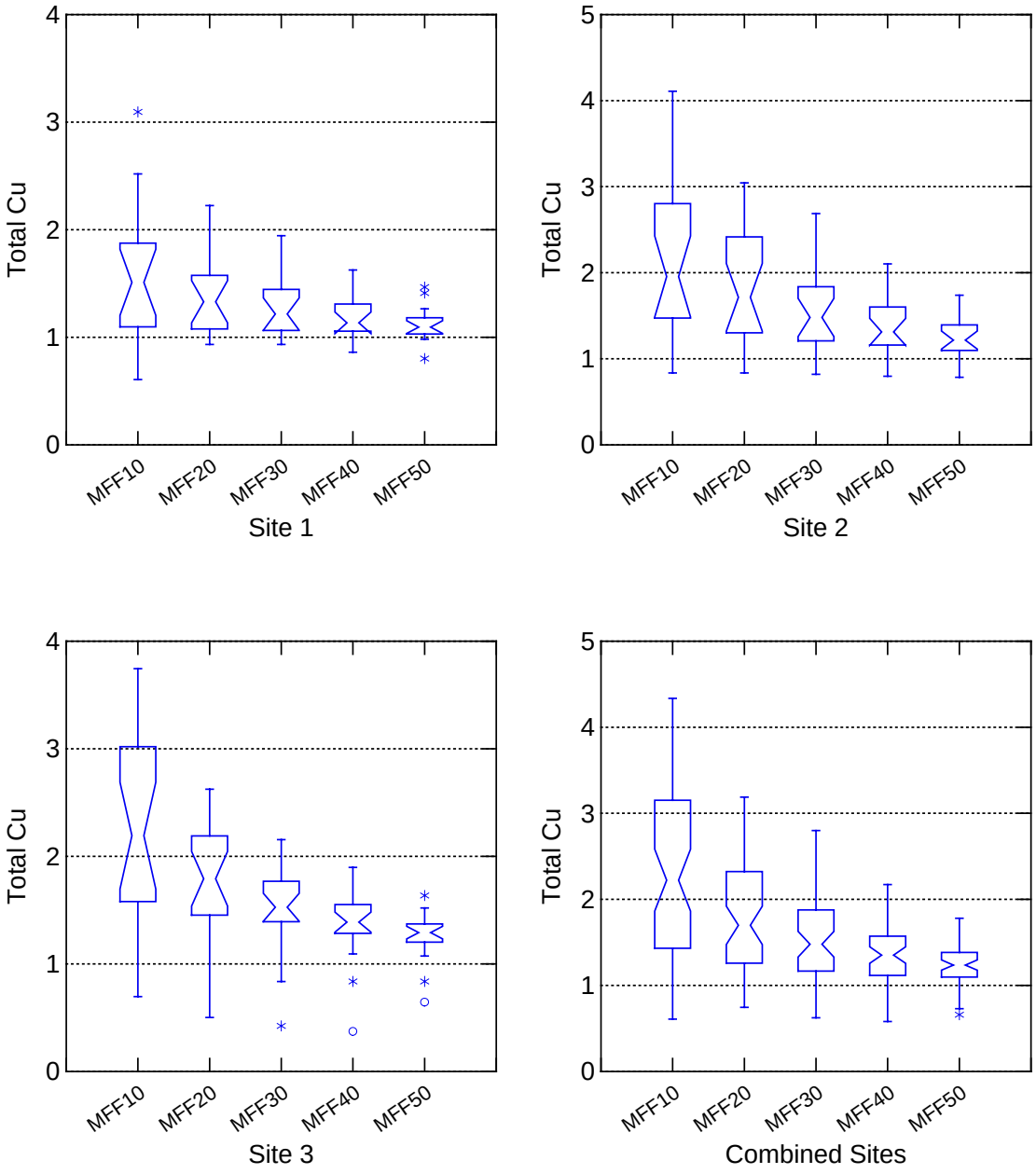


Figure D.1.23 MFF for Total Cu from UCLA

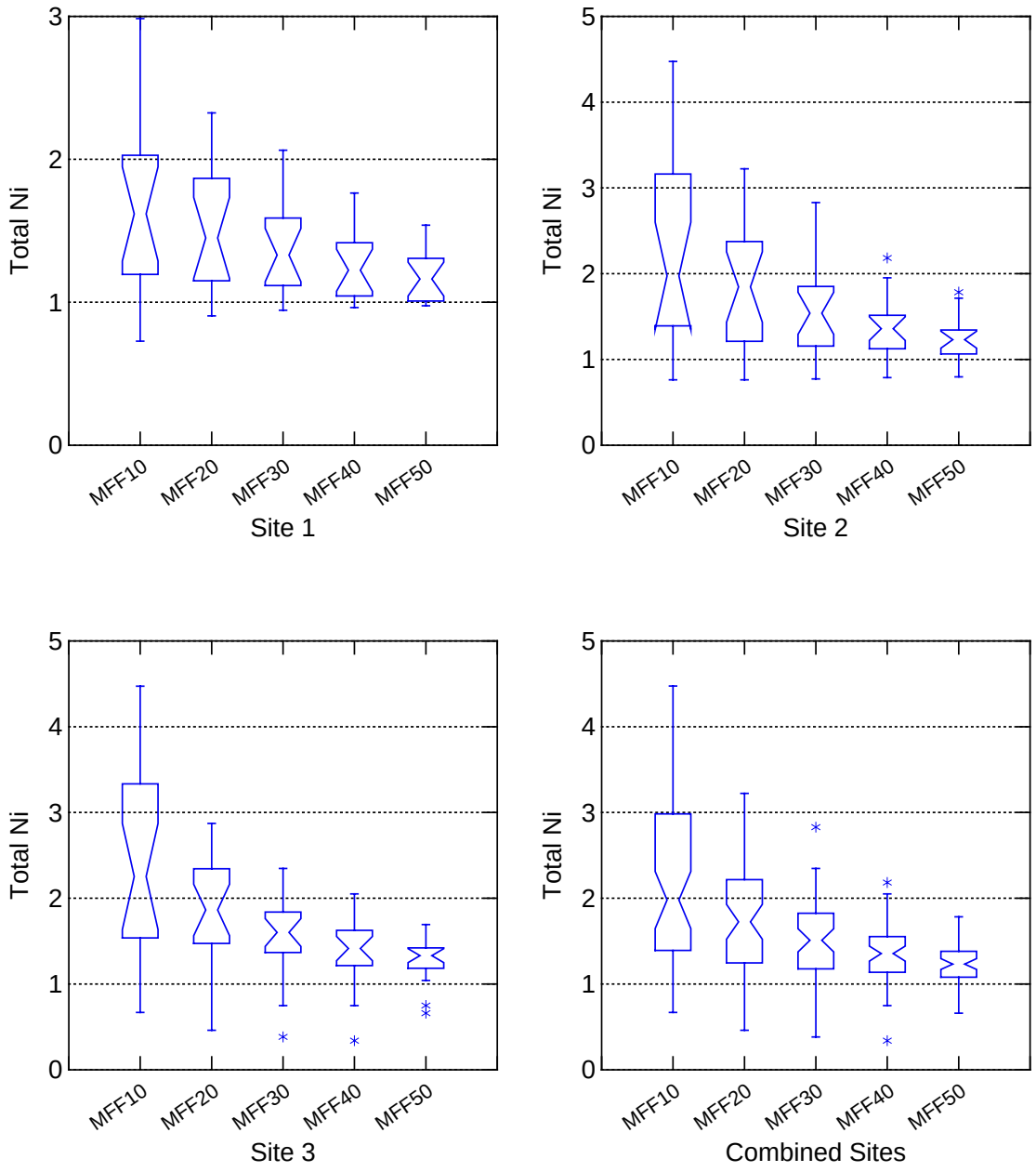


Figure D.1.24 MFF for Total Ni from UCLA

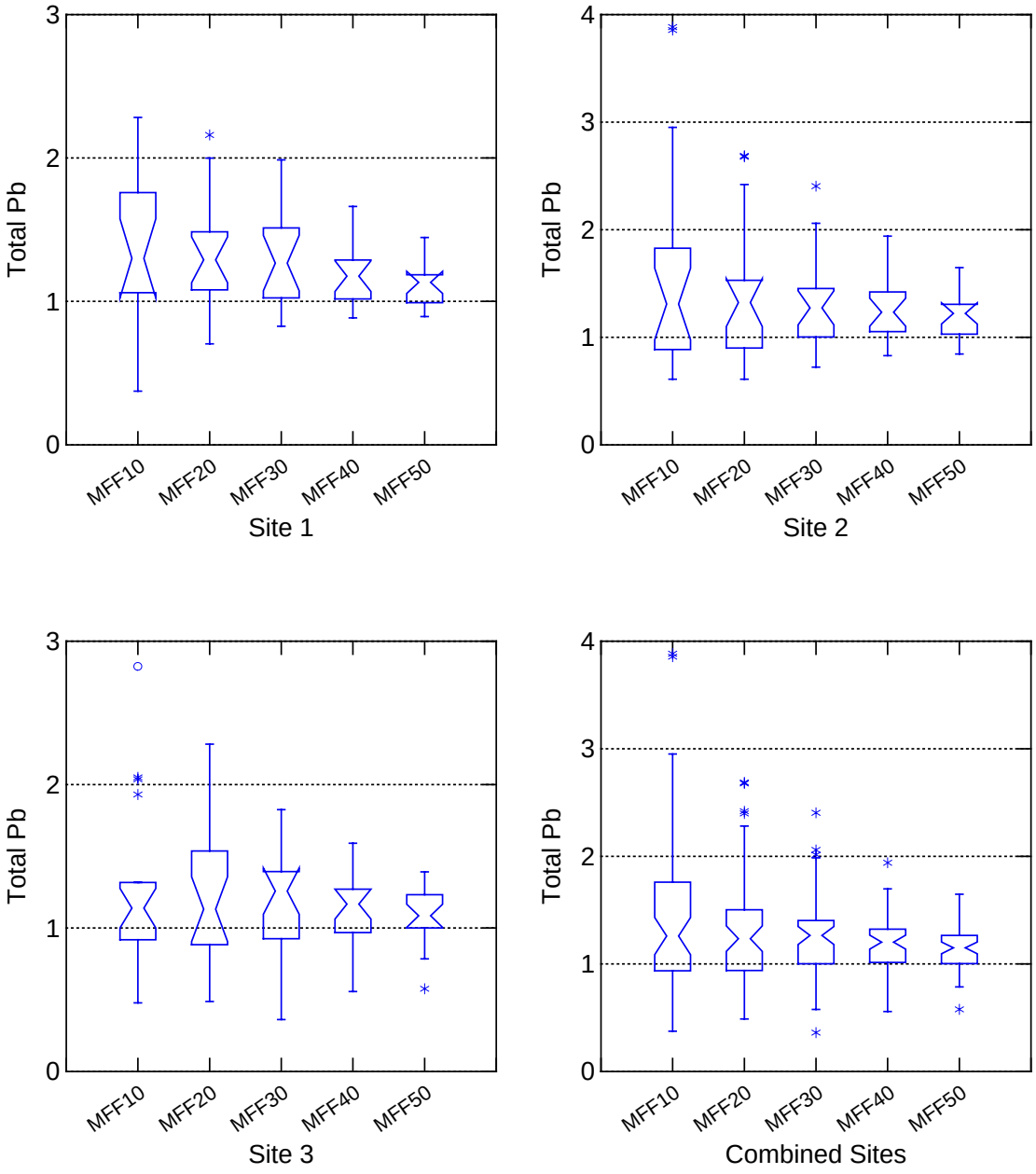


Figure D.1.25 MFF for Total Pb from UCLA

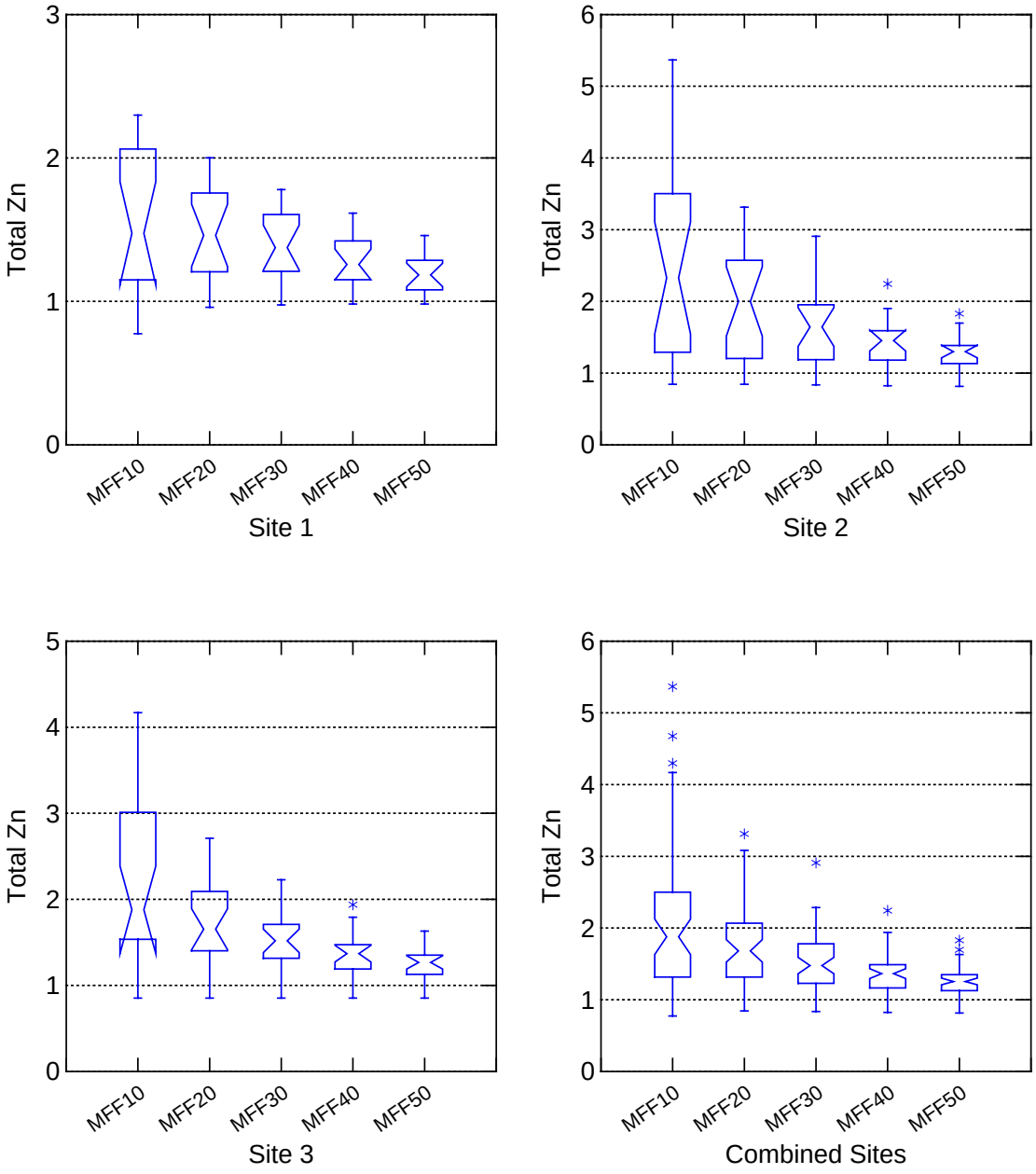
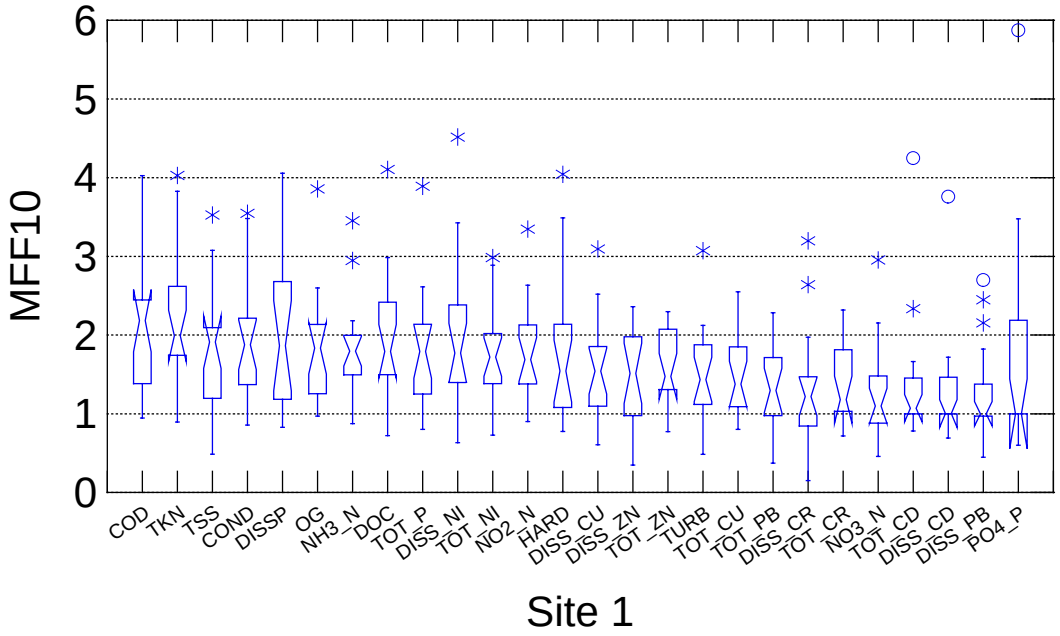


Figure D.1.26 MFF for Total Zn from UCLA



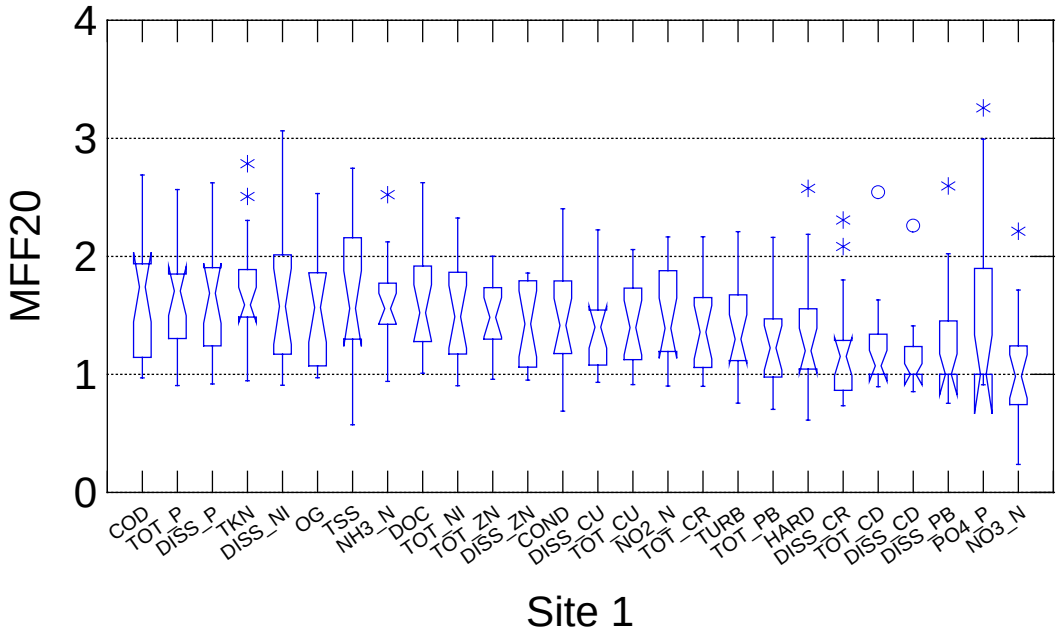
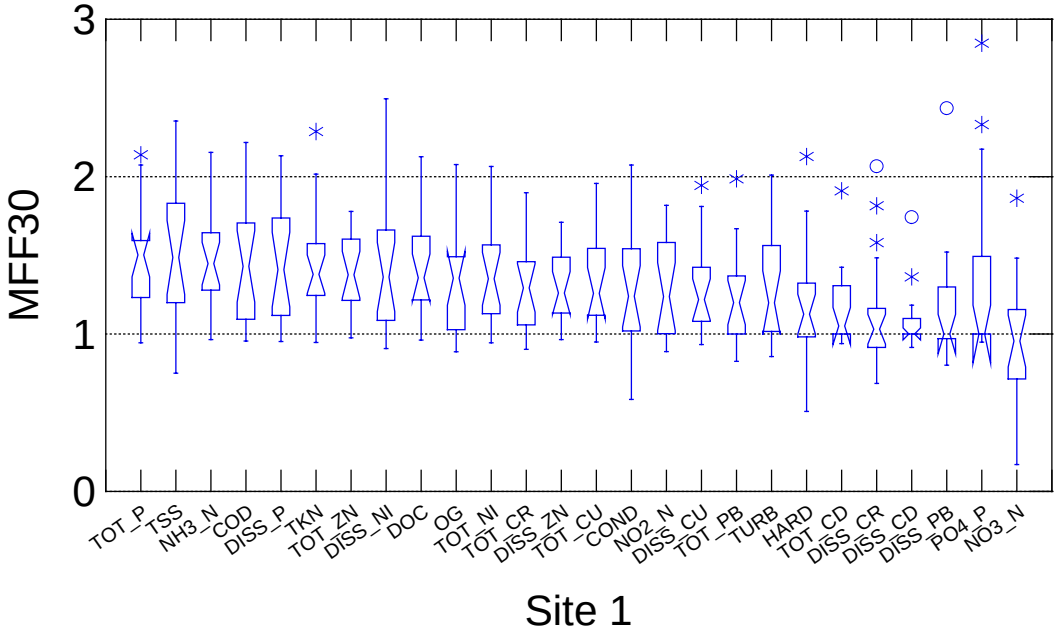


Figure D.2.1a MFF10 and 20 by Ranking for UCLA 1



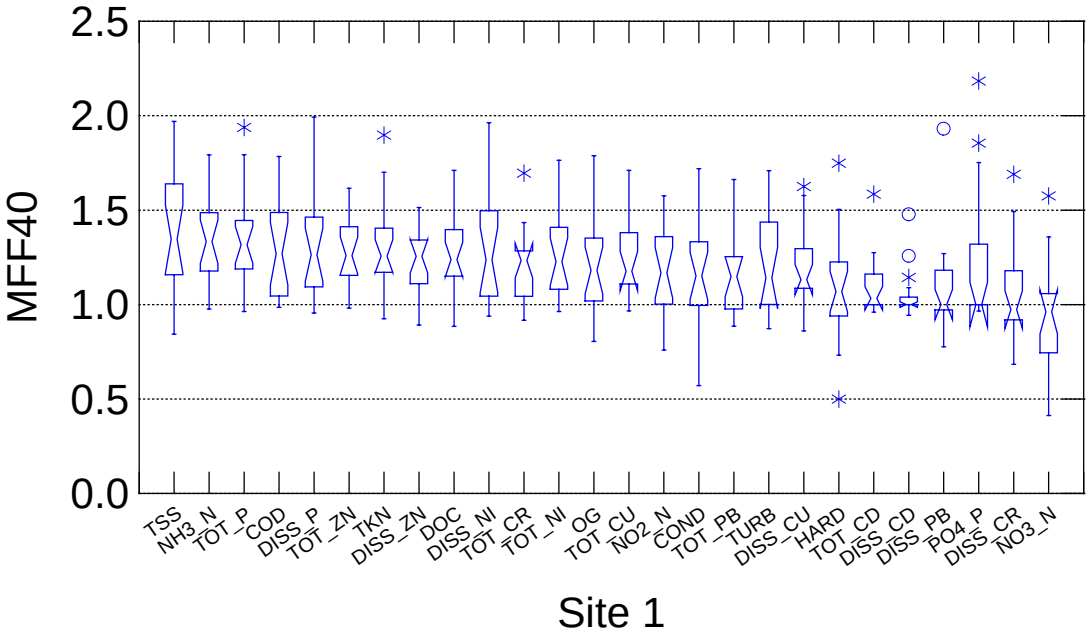


Figure D.2.1b MFF30 and 40 by Ranking for UCLA 1

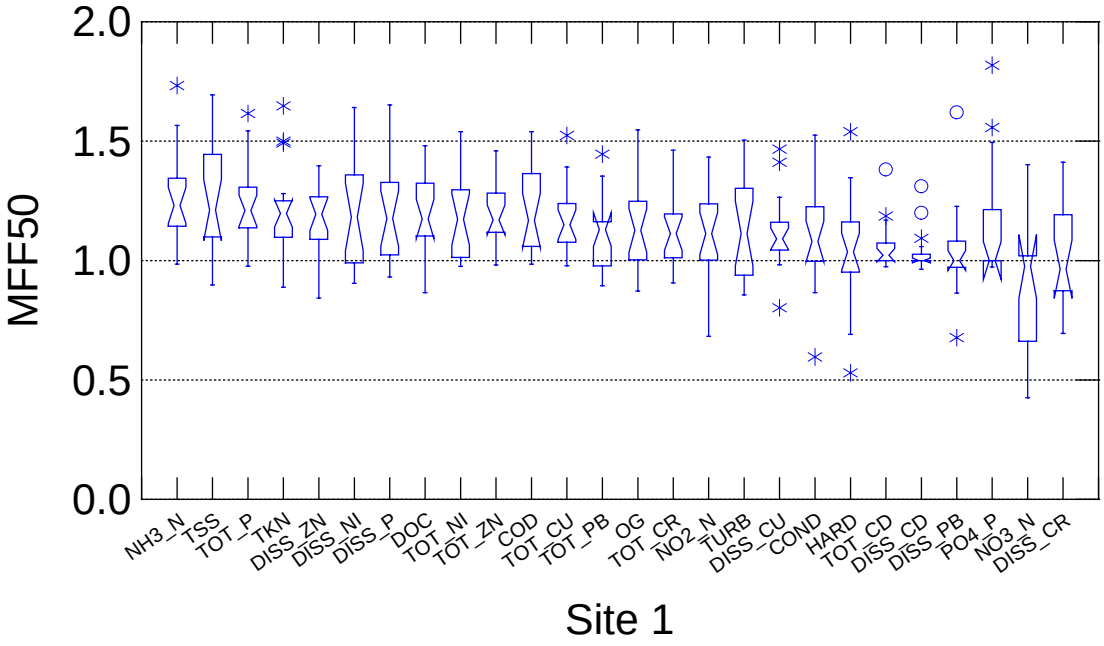
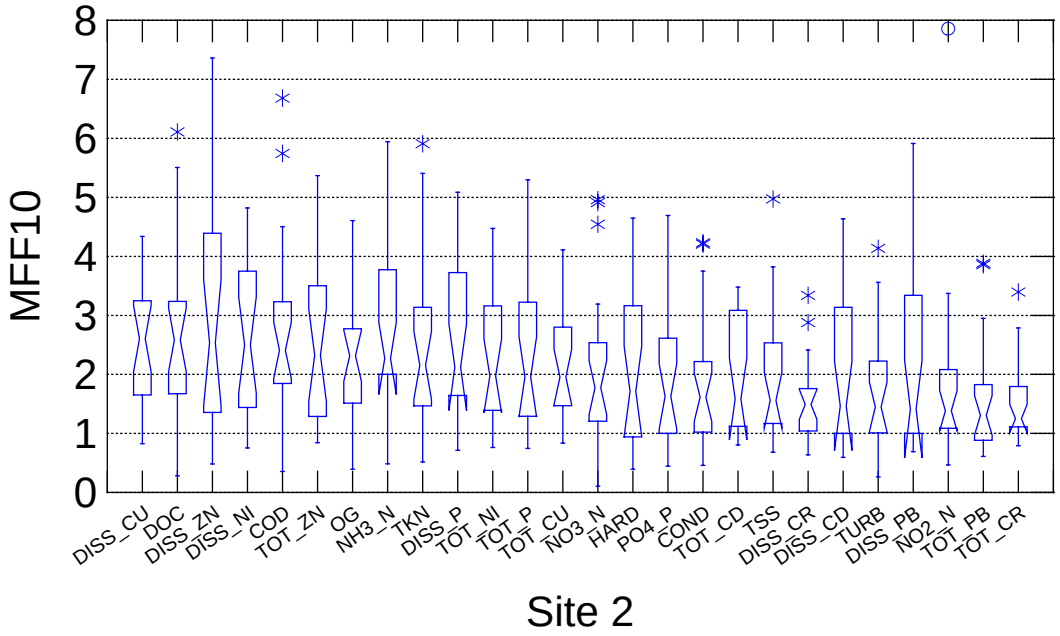


Figure D.2.1c MFF50 by Ranking for UCLA 1



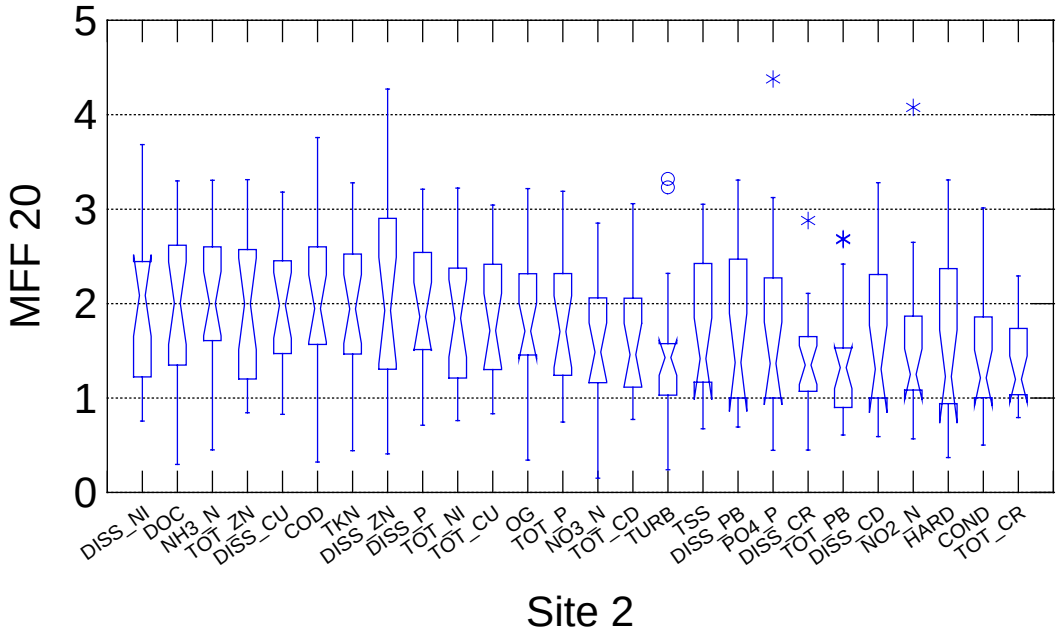
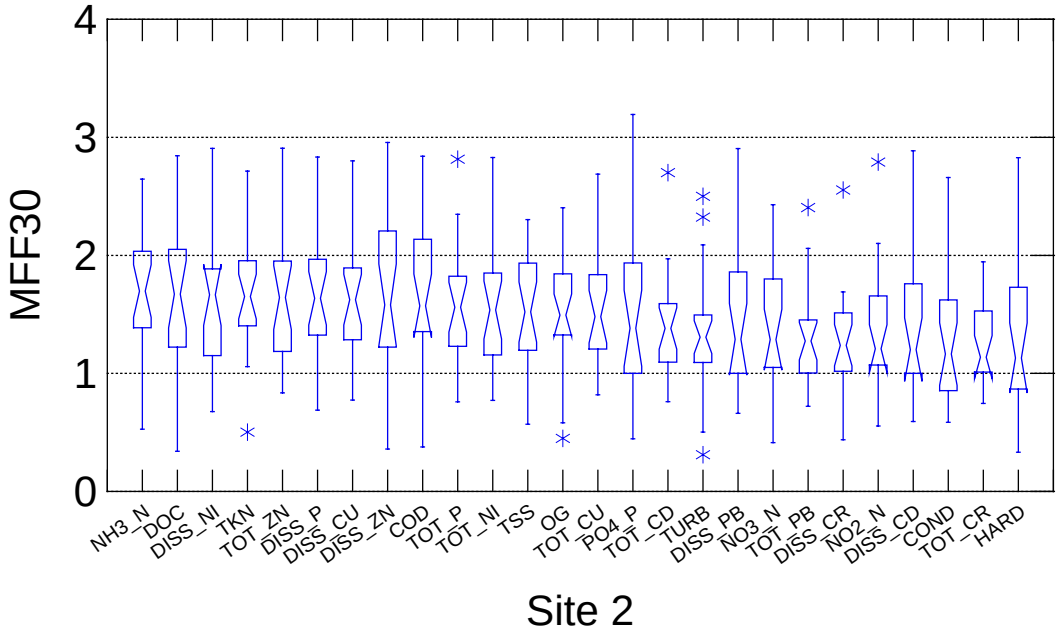


Figure D.2.2a MFF10 and 20 by Ranking for UCLA 2



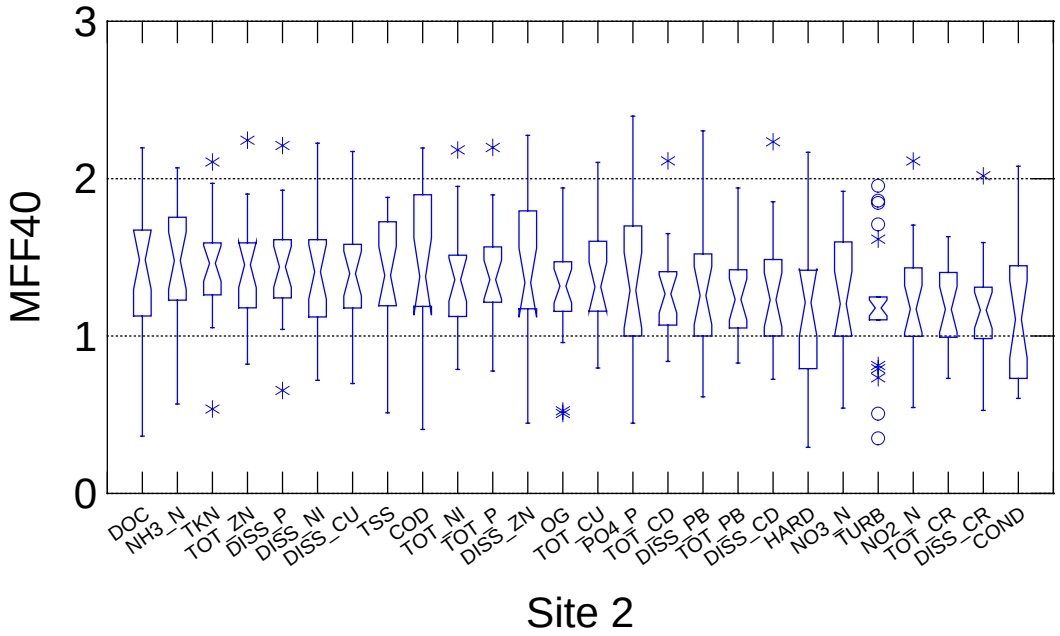


Figure D.2.2b MFF30 and 40 by Ranking for UCLA 2

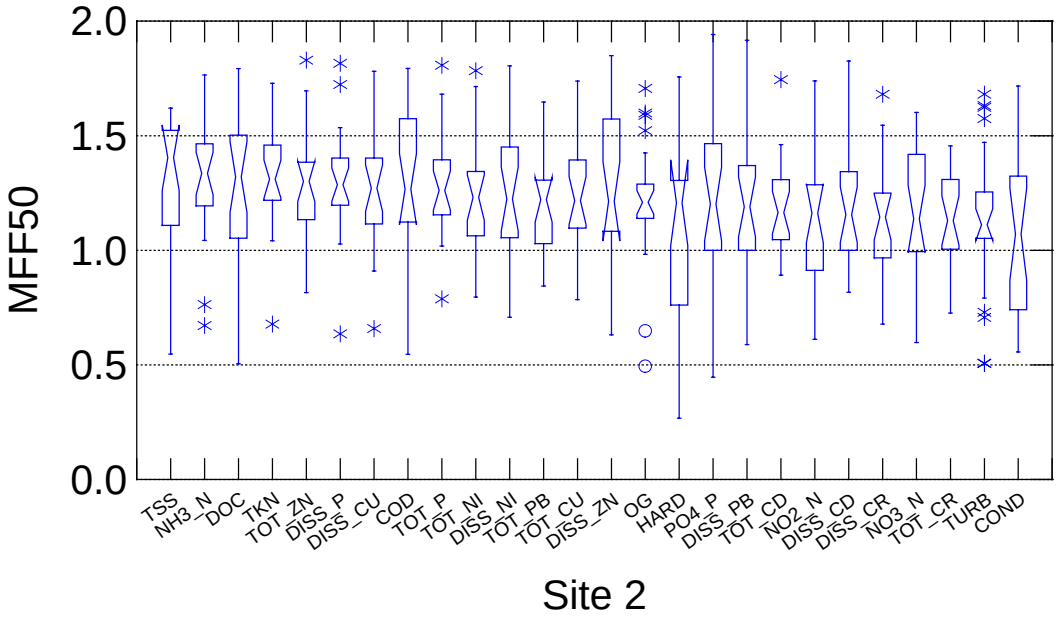
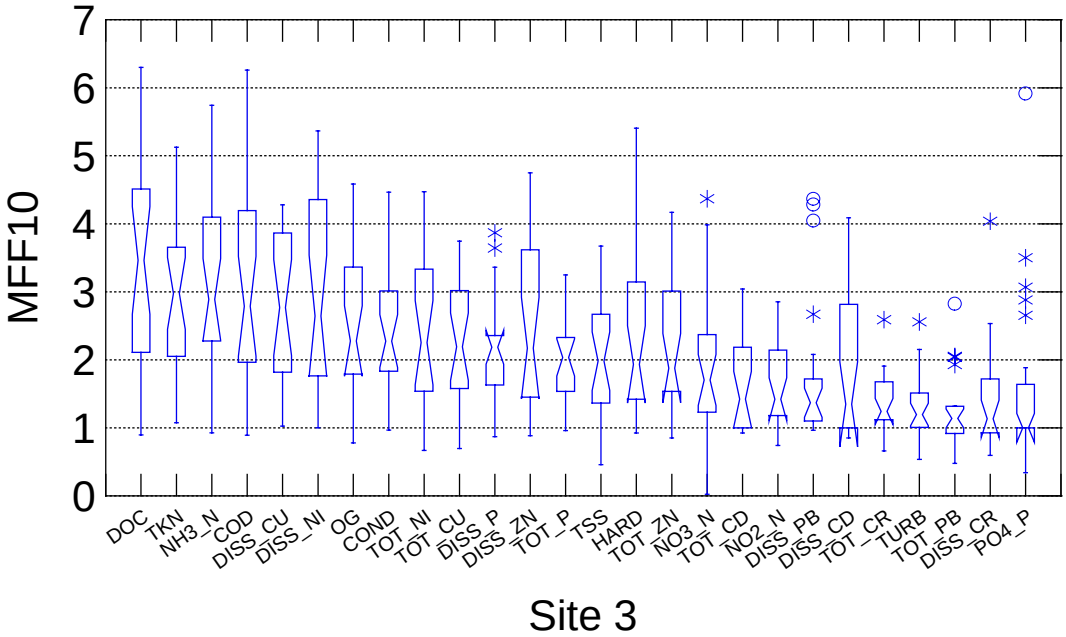


Figure D.2.2c MFF50 by Ranking for UCLA 2



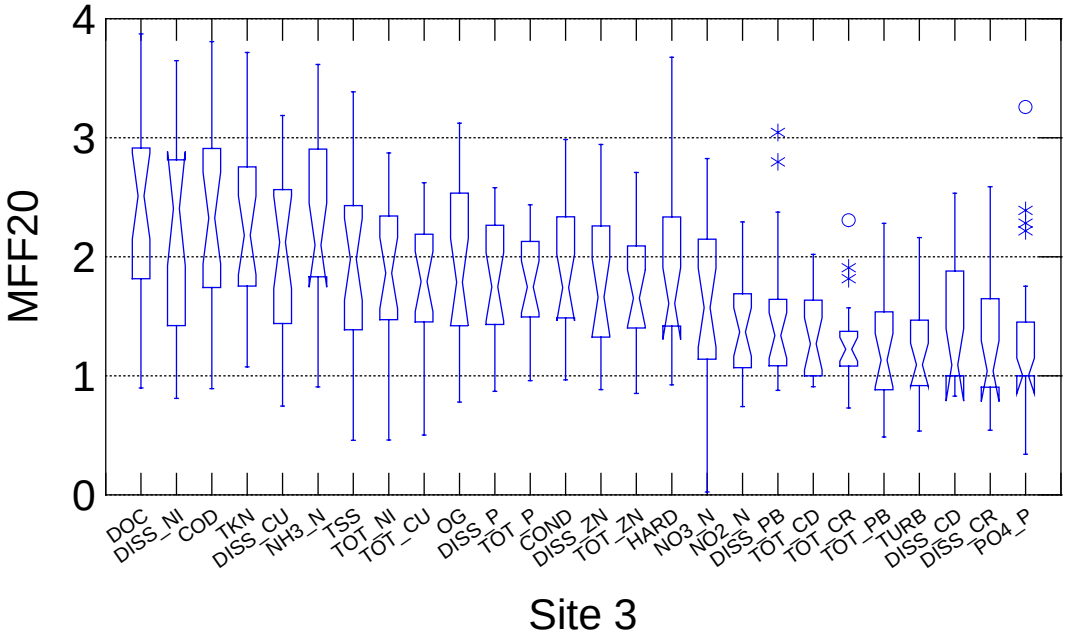
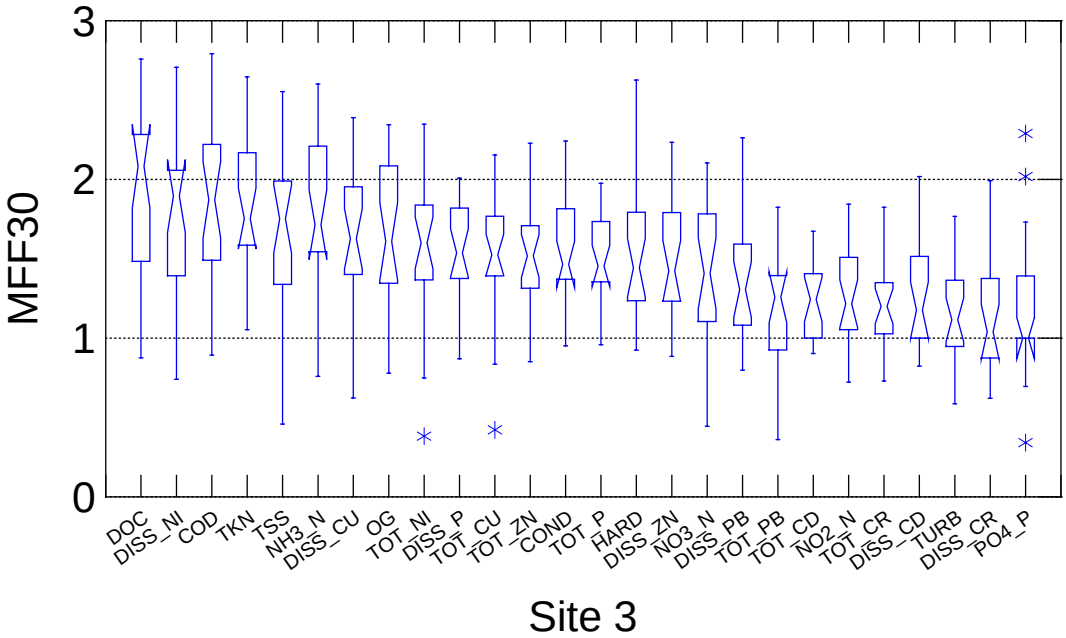


Figure D.2.3a MFF10 and 20 by Ranking for UCLA 3



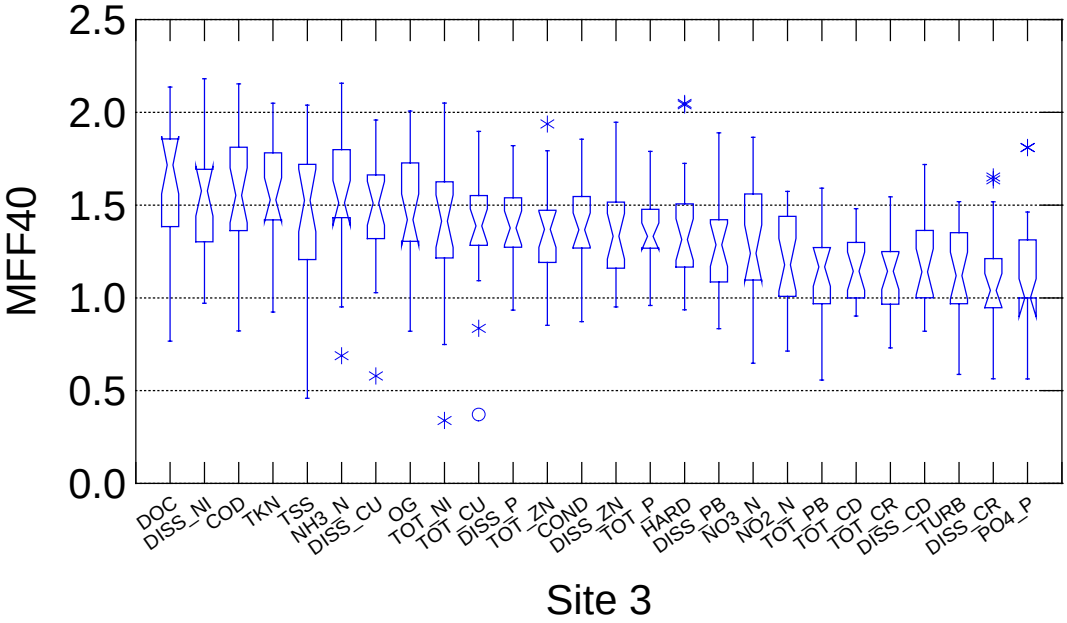


Figure D.2.3b MFF30 and 40 by Ranking for UCLA 3

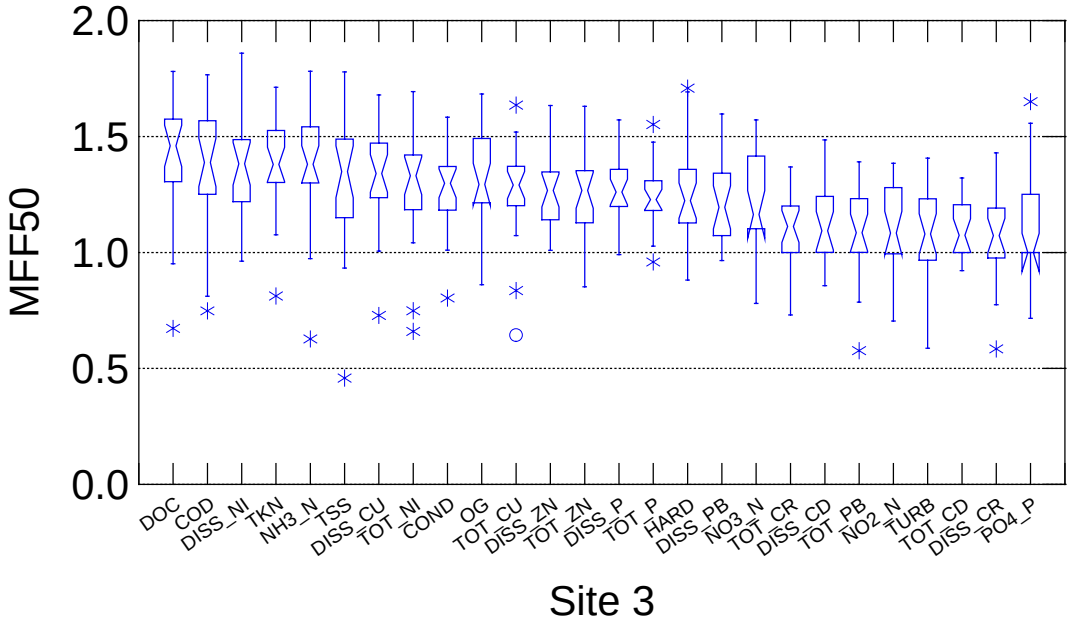
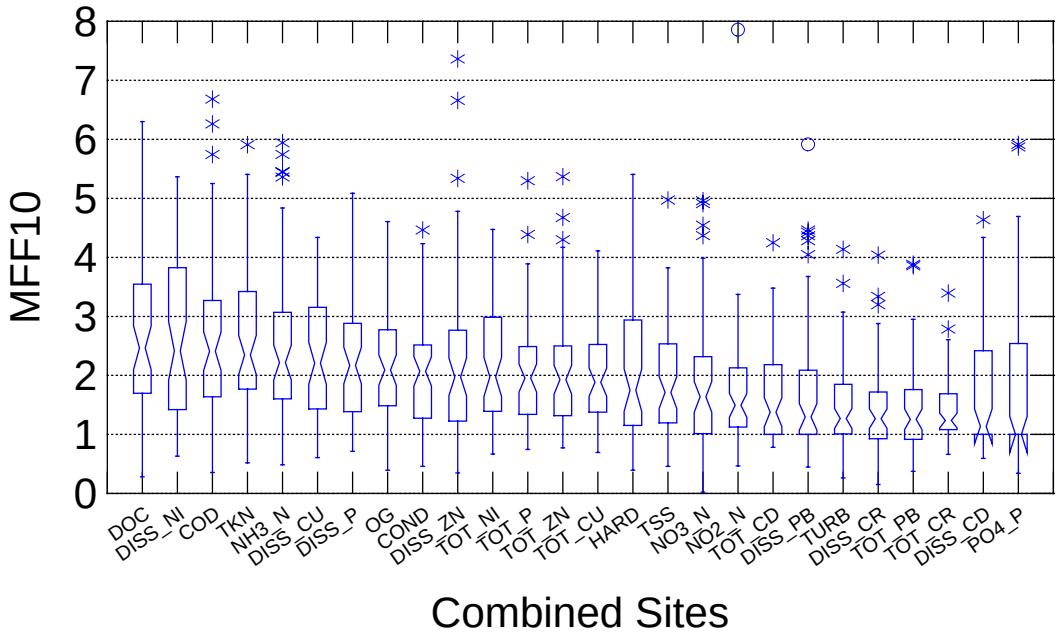


Figure D.2.3c MFF50 by Ranking for UCLA 3



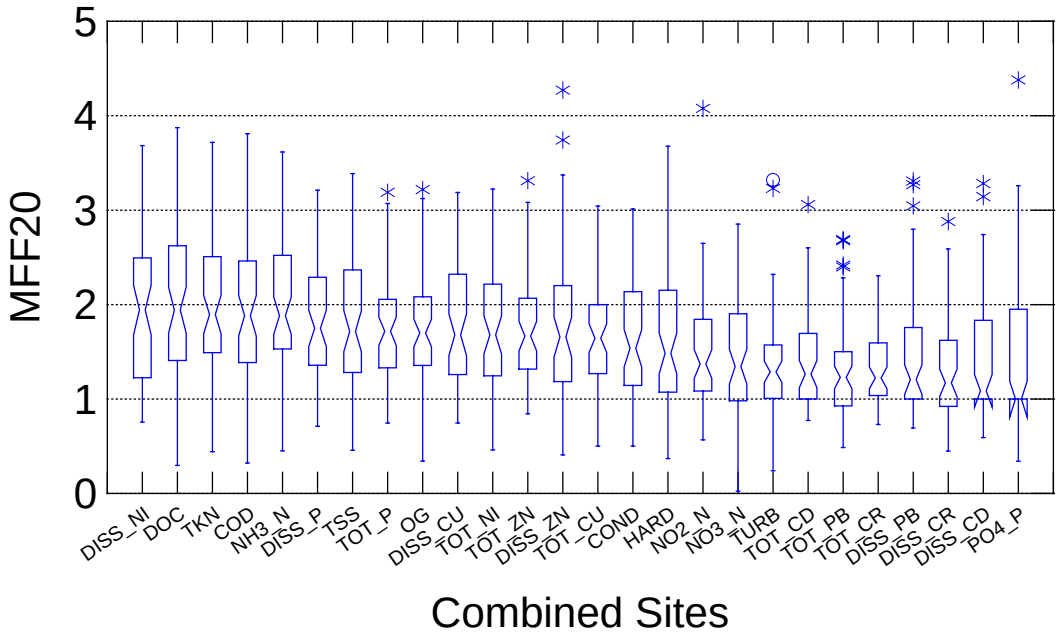
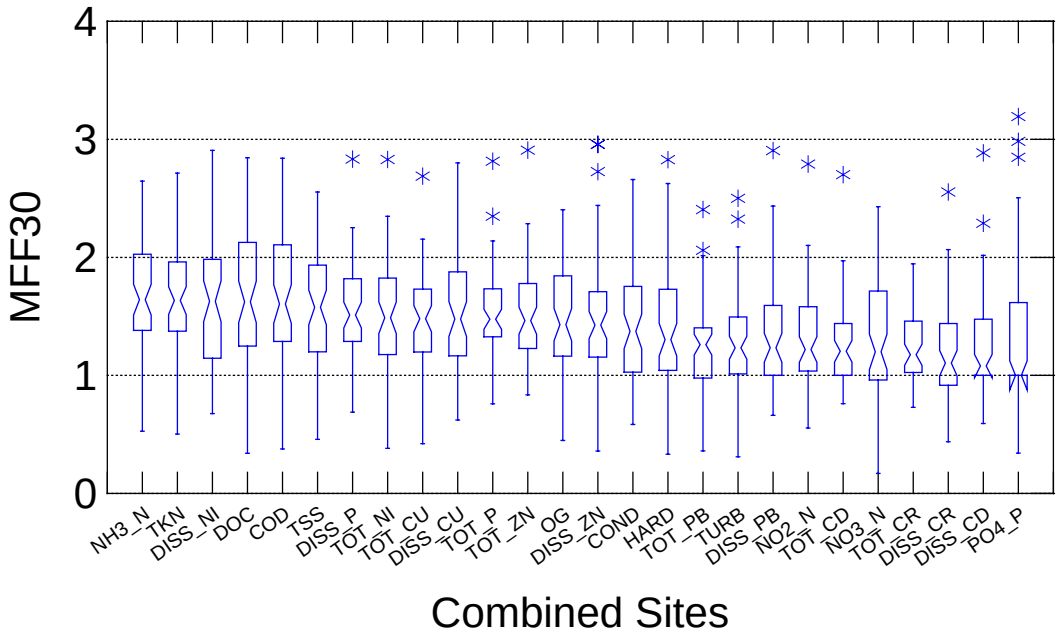


Figure D.2.4a MFF10 and 20 by Ranking from Combined UCLA



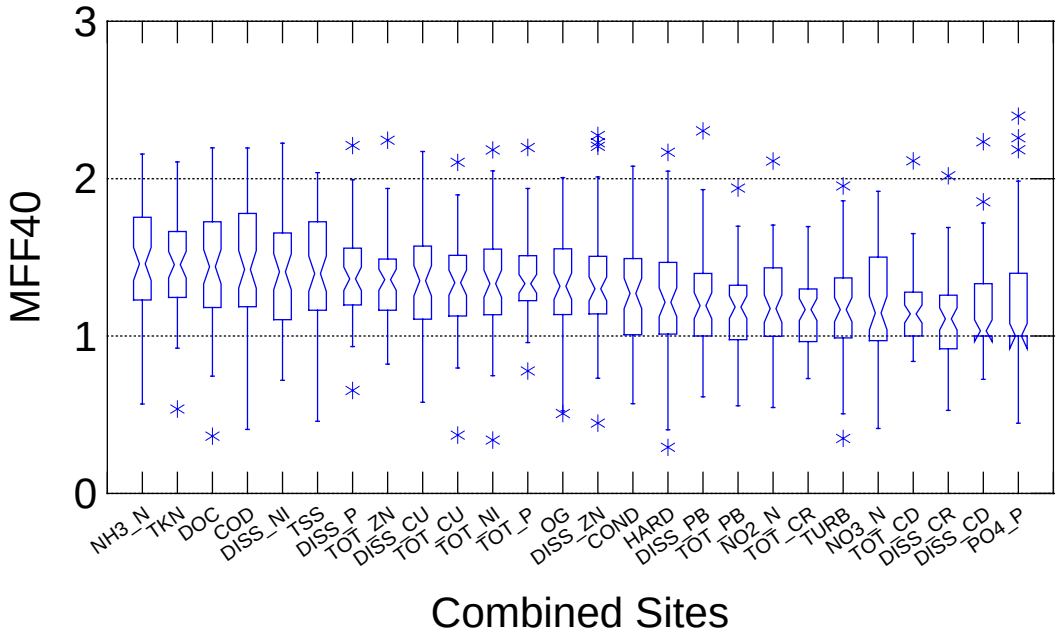


Figure D.2.4b MFF30 and 40 by Ranking from Combined UCLA

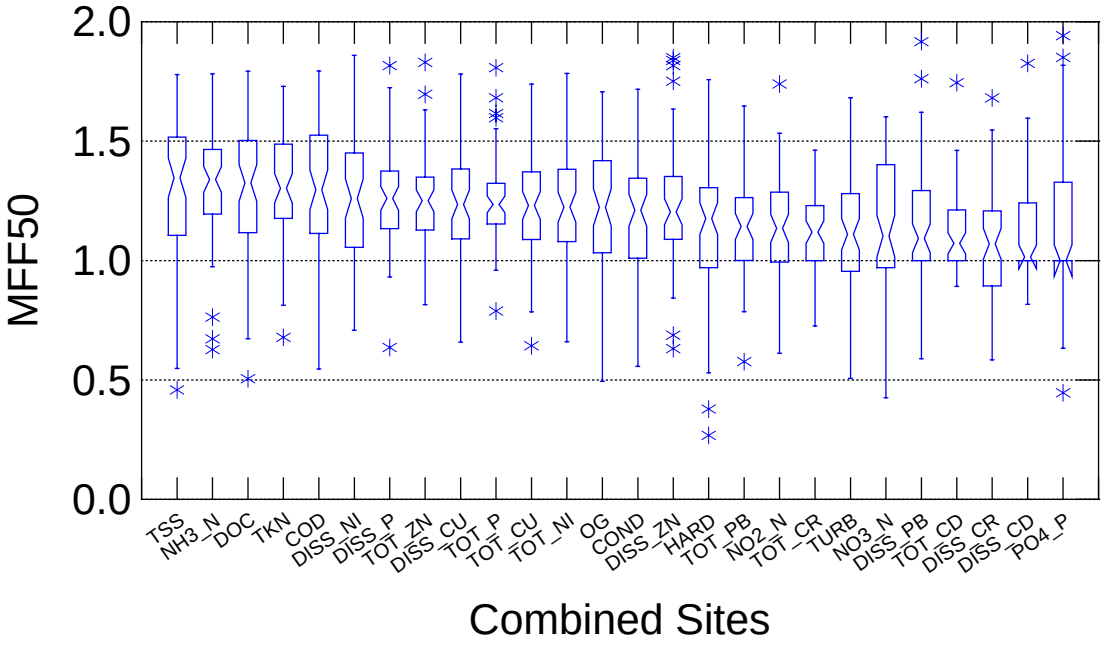


Figure D.2.4c MFF50 by Ranking from Combined UCLA

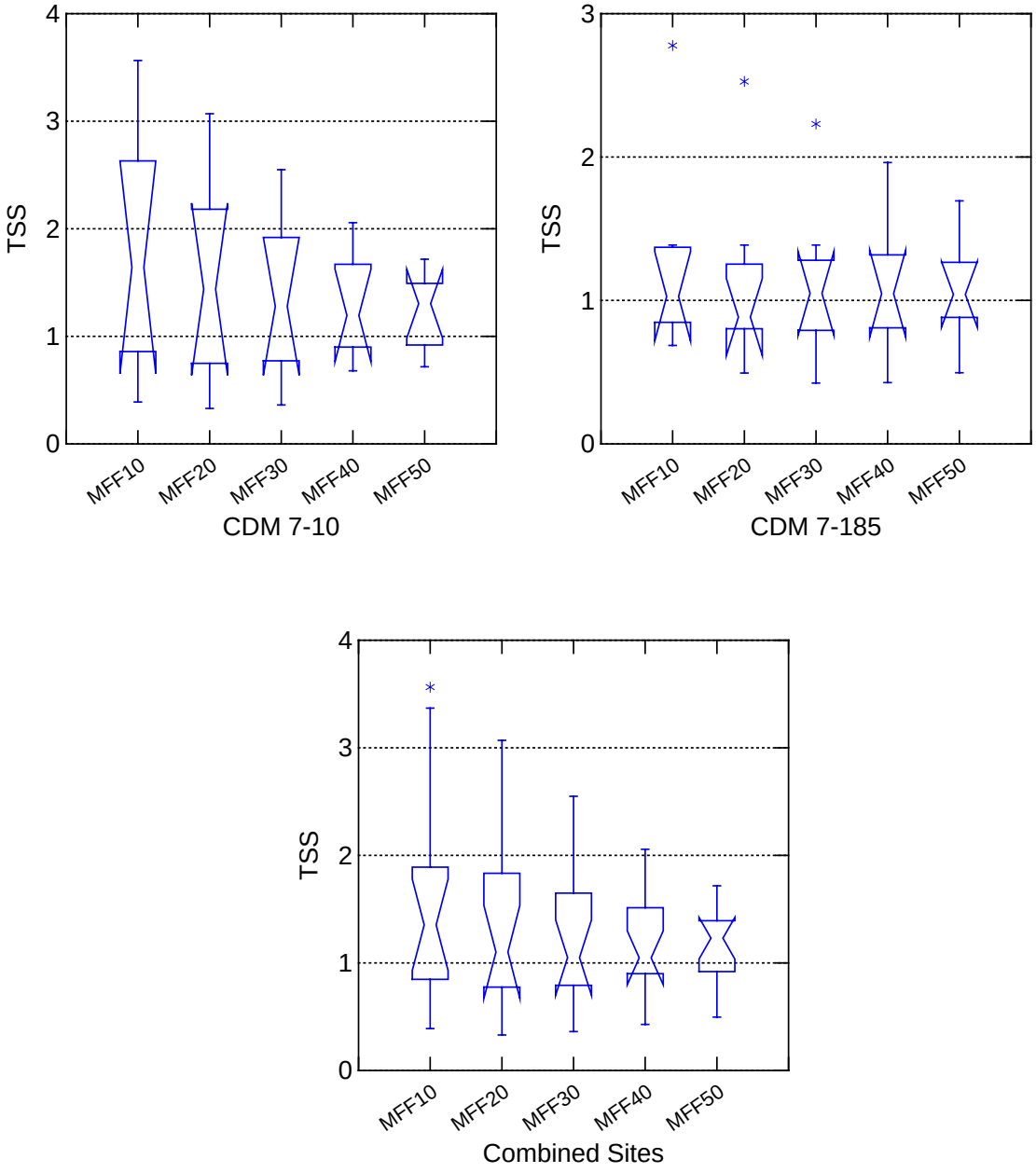


Figure D.3.1 MFF for TSS from CDM

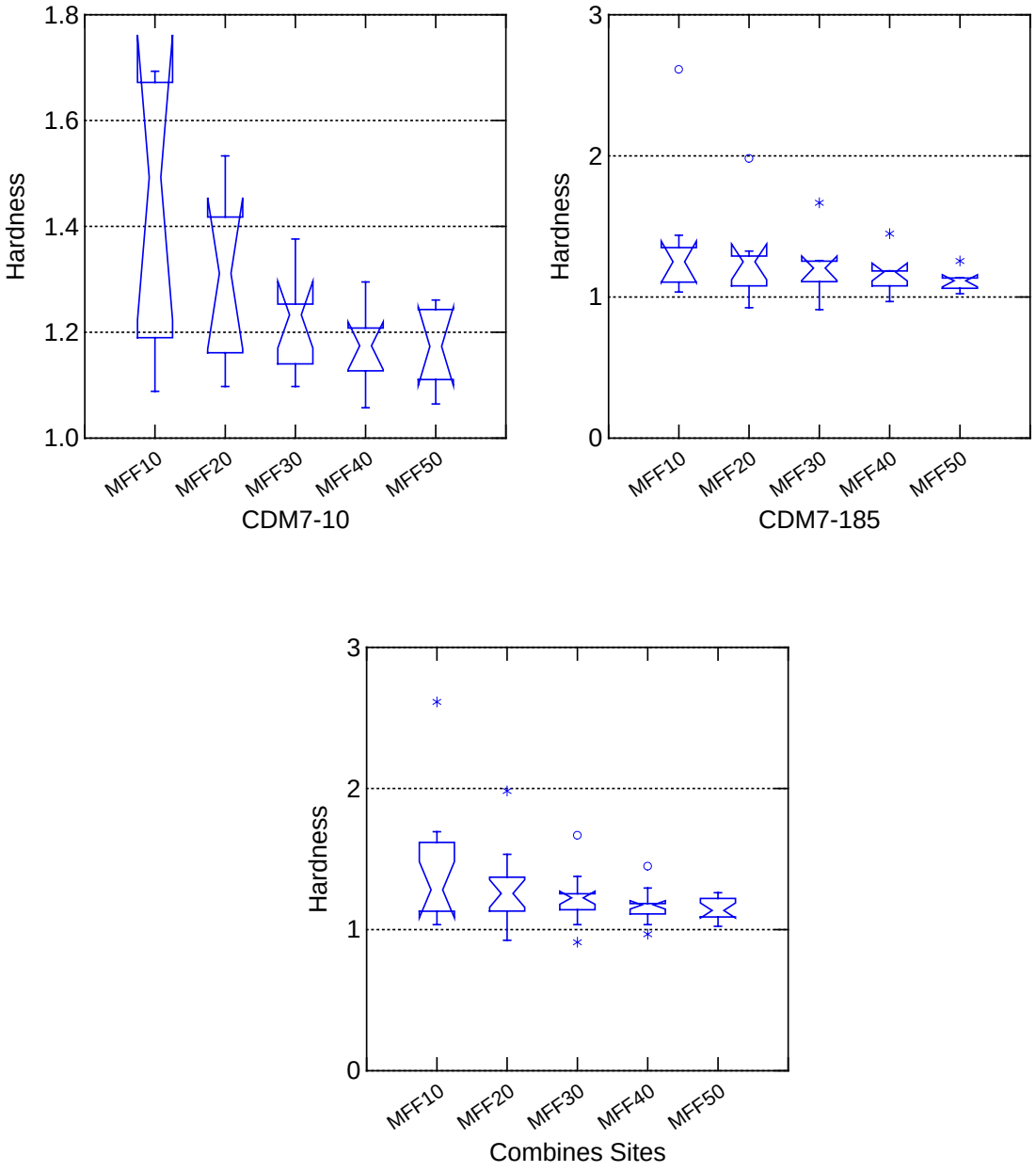


Figure D.3.2 MFF for Hardness from CDM

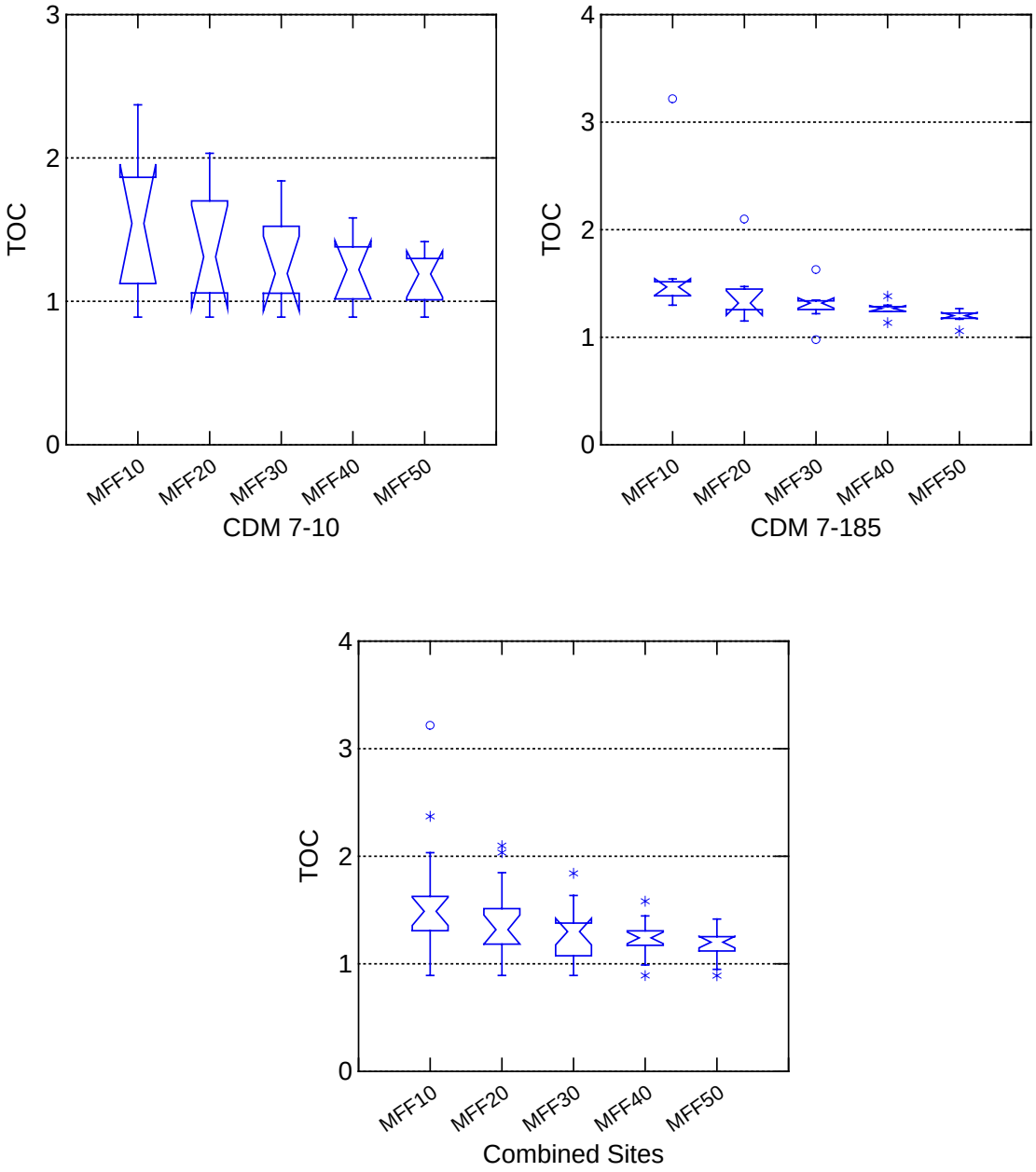


Figure D.3.3 MFF for TOC from CDM

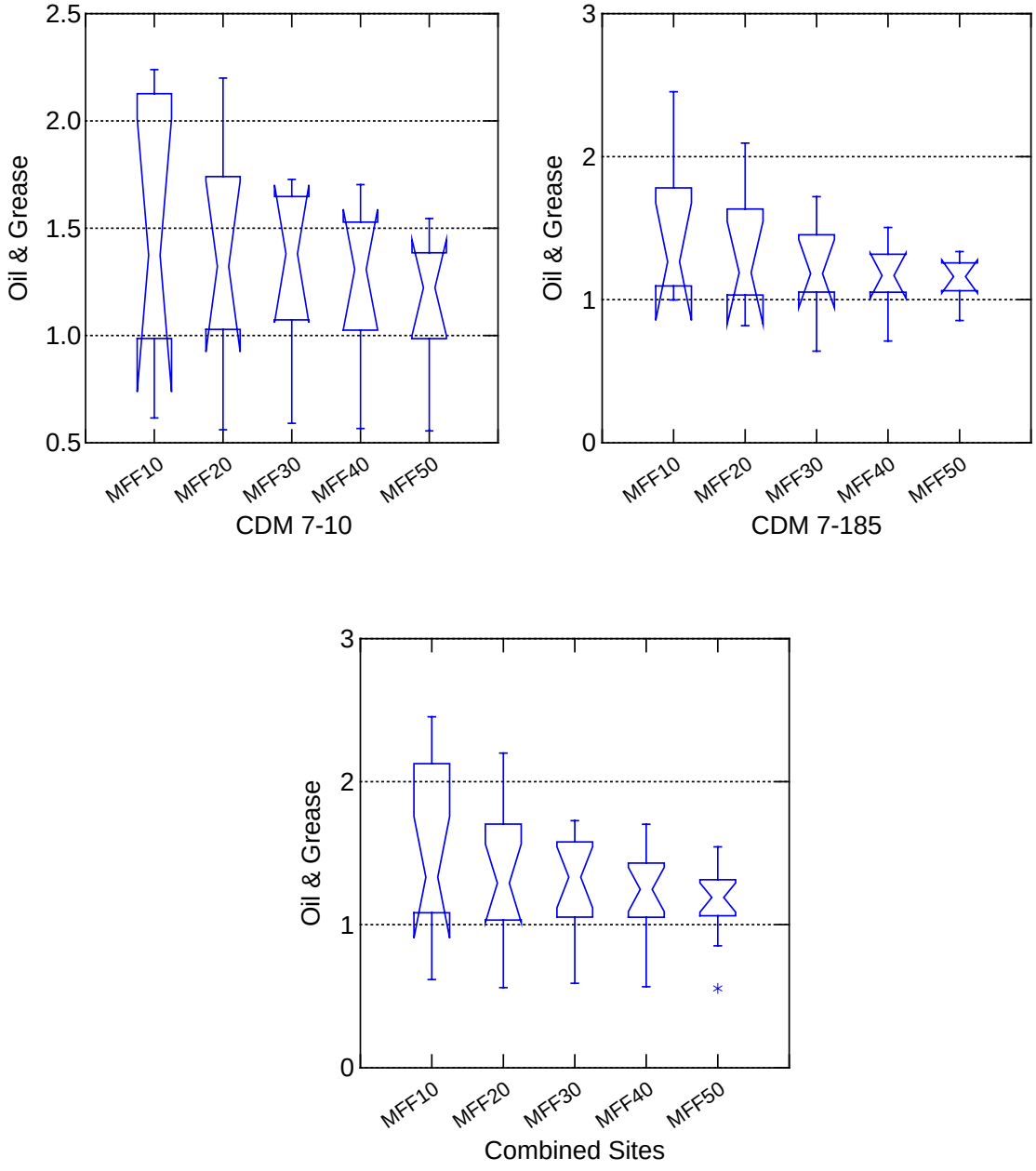


Figure D.3.4 MFF for Oil & Grease from CDM

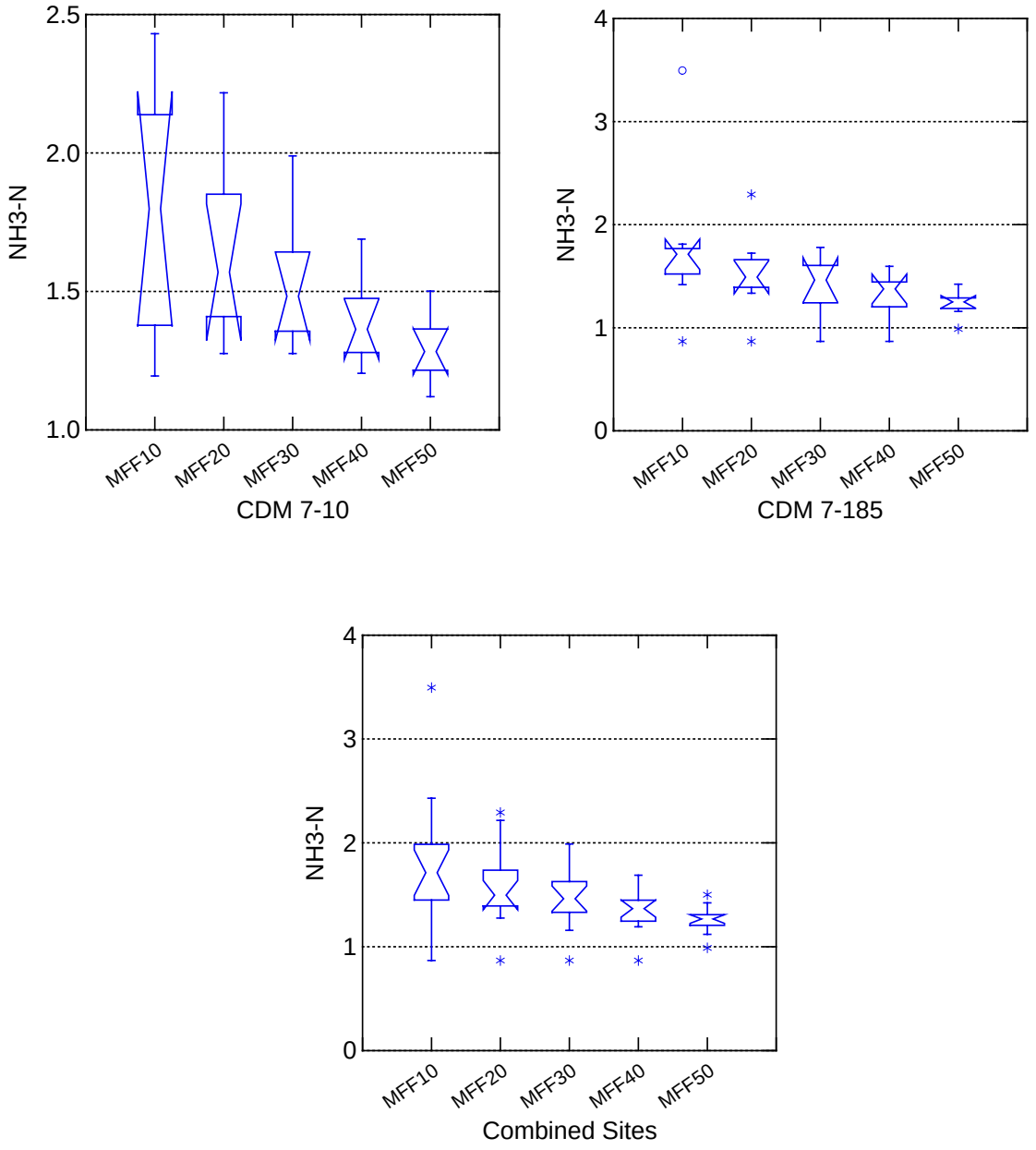


Figure D.3.5 MFF for NH_3-N from CDM

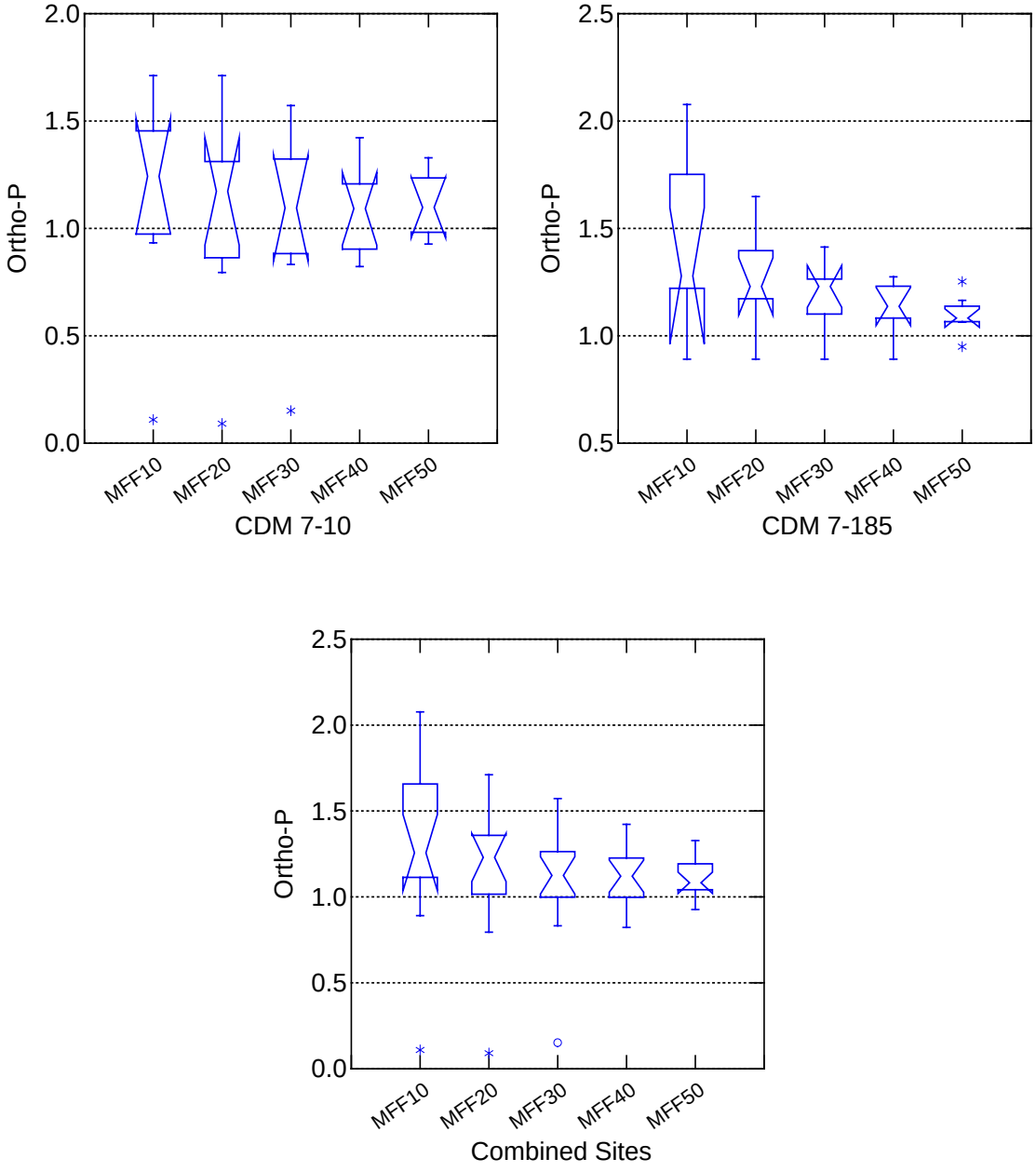


Figure D.3.6 MFF for Ortho-P from CDM

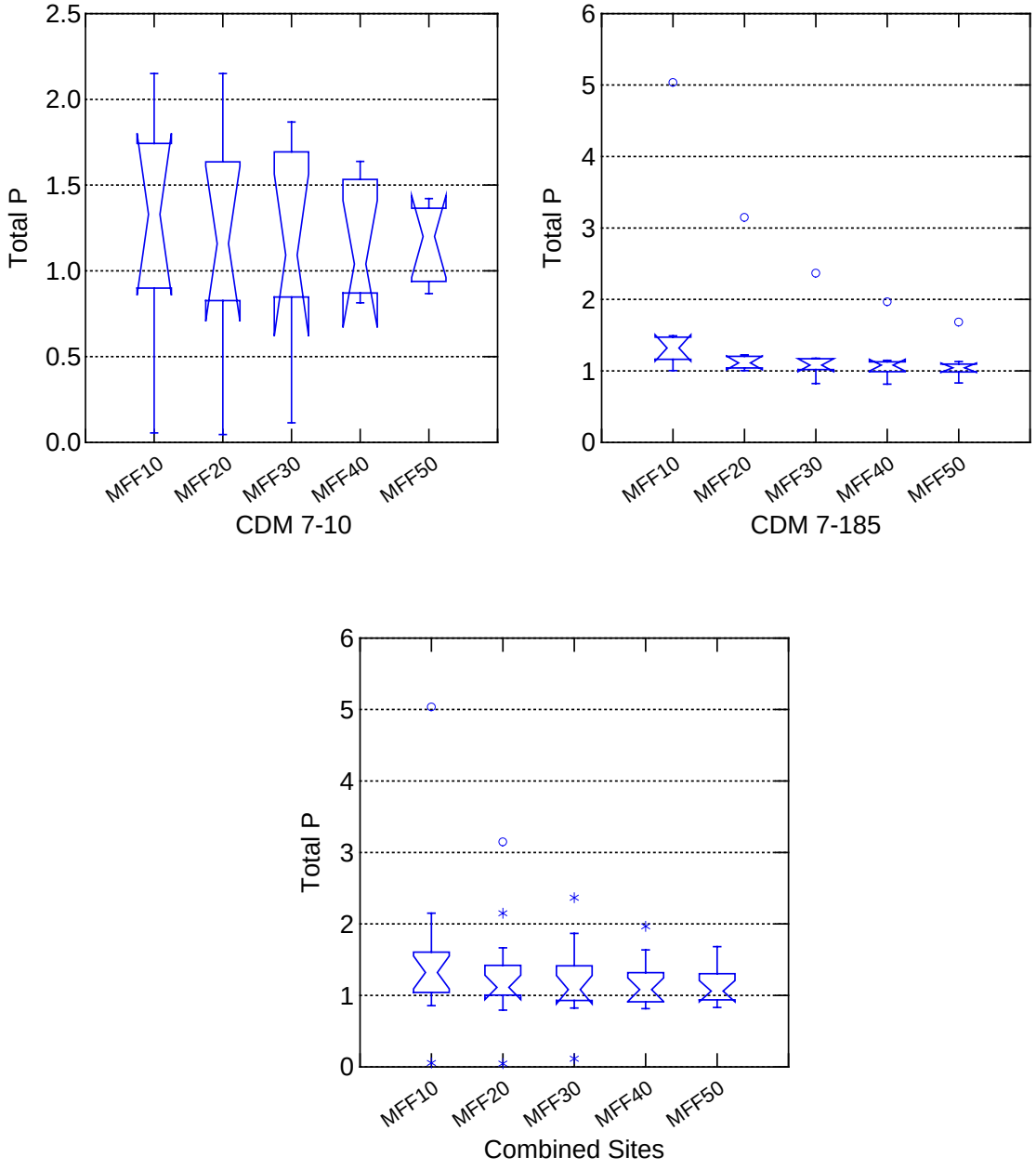


Figure D.3.7 MFF for Total P from CDM

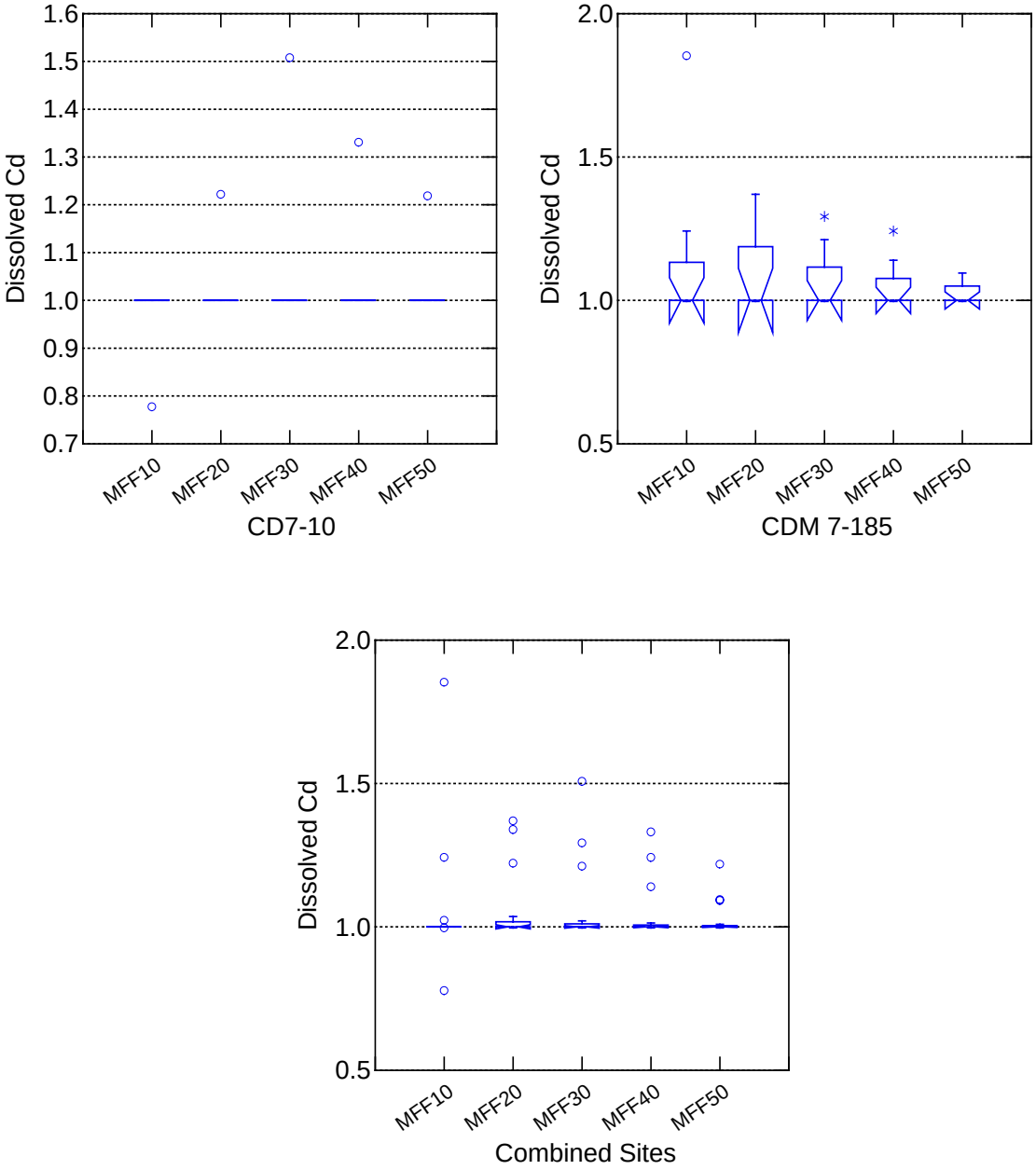


Figure D.3.8 MFF for Dissolved Cd from CDM

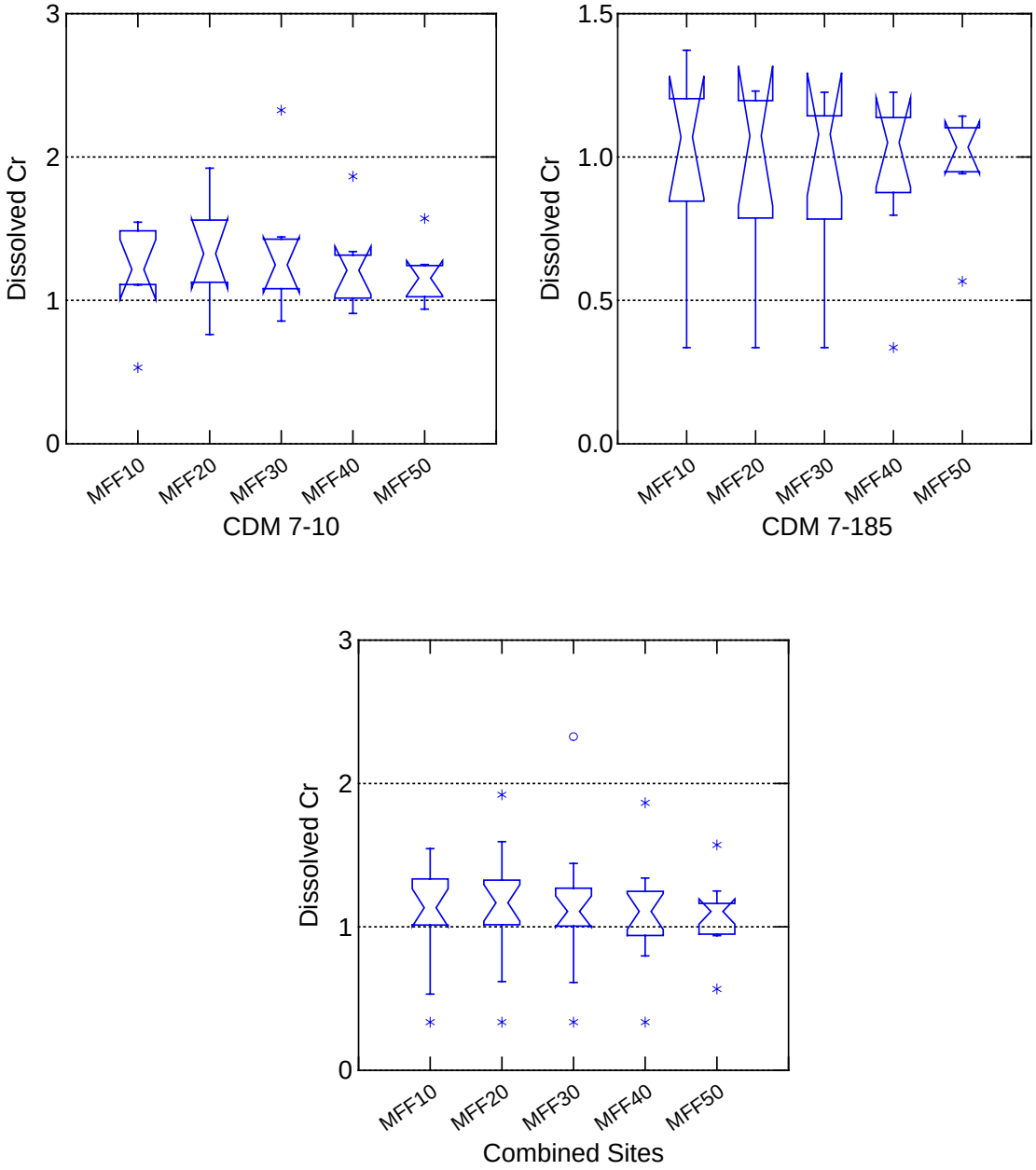


Figure D.3.9 MFF for Dissolved Cr from CDM

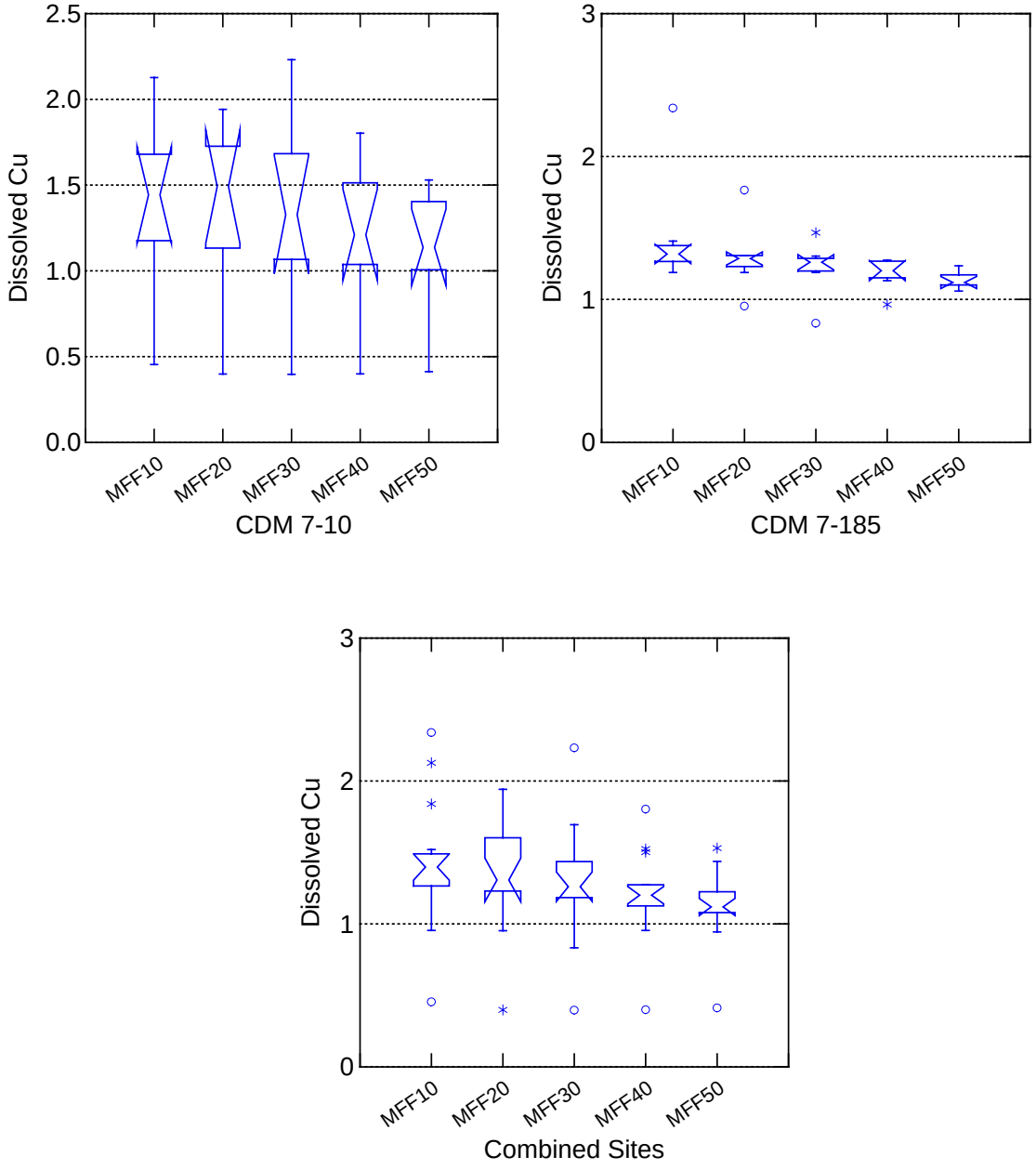


Figure D.3.10 MFF for Dissolved Cu from CDM

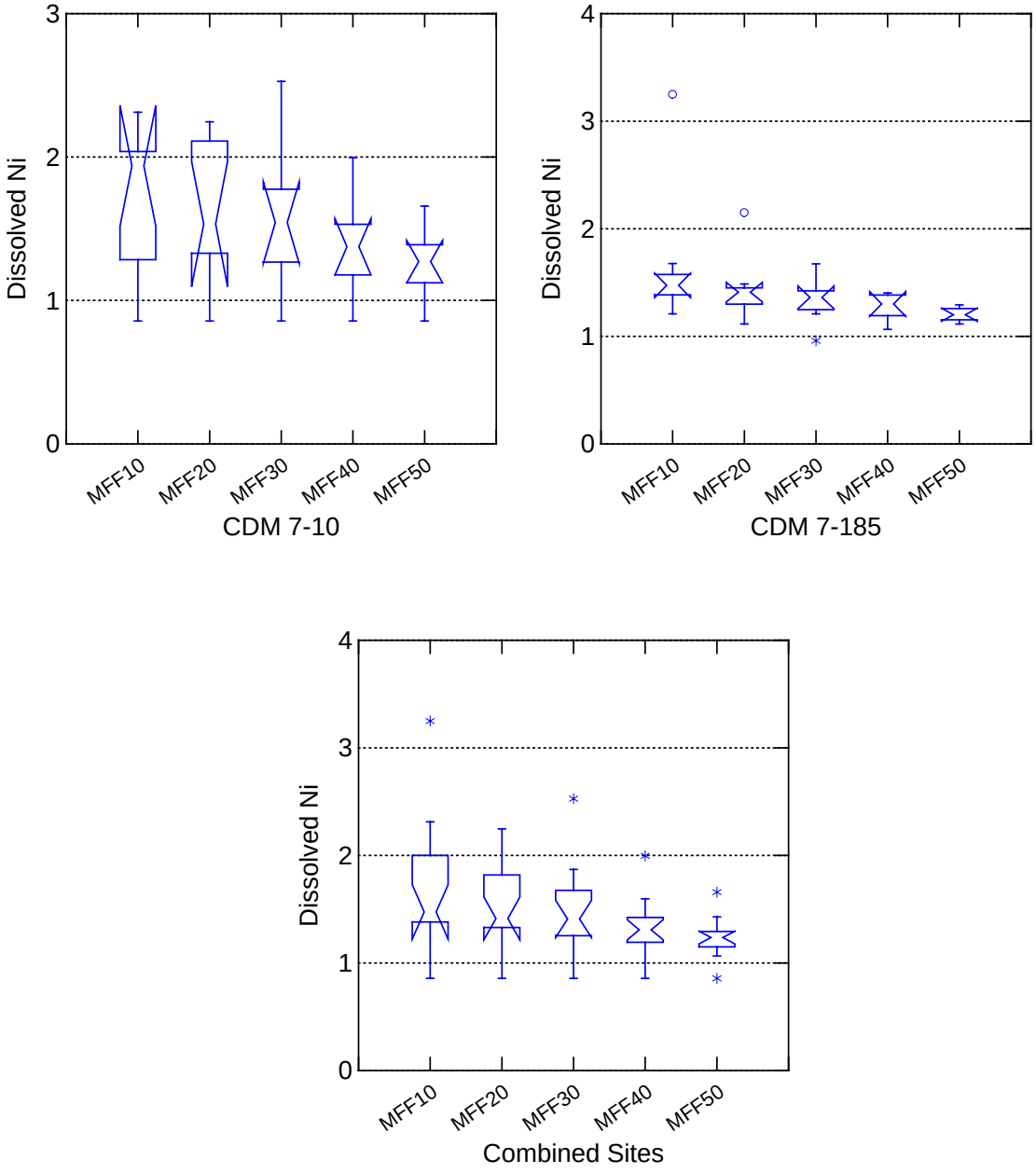


Figure D.3.11 MFF for Dissolved Ni from CDM

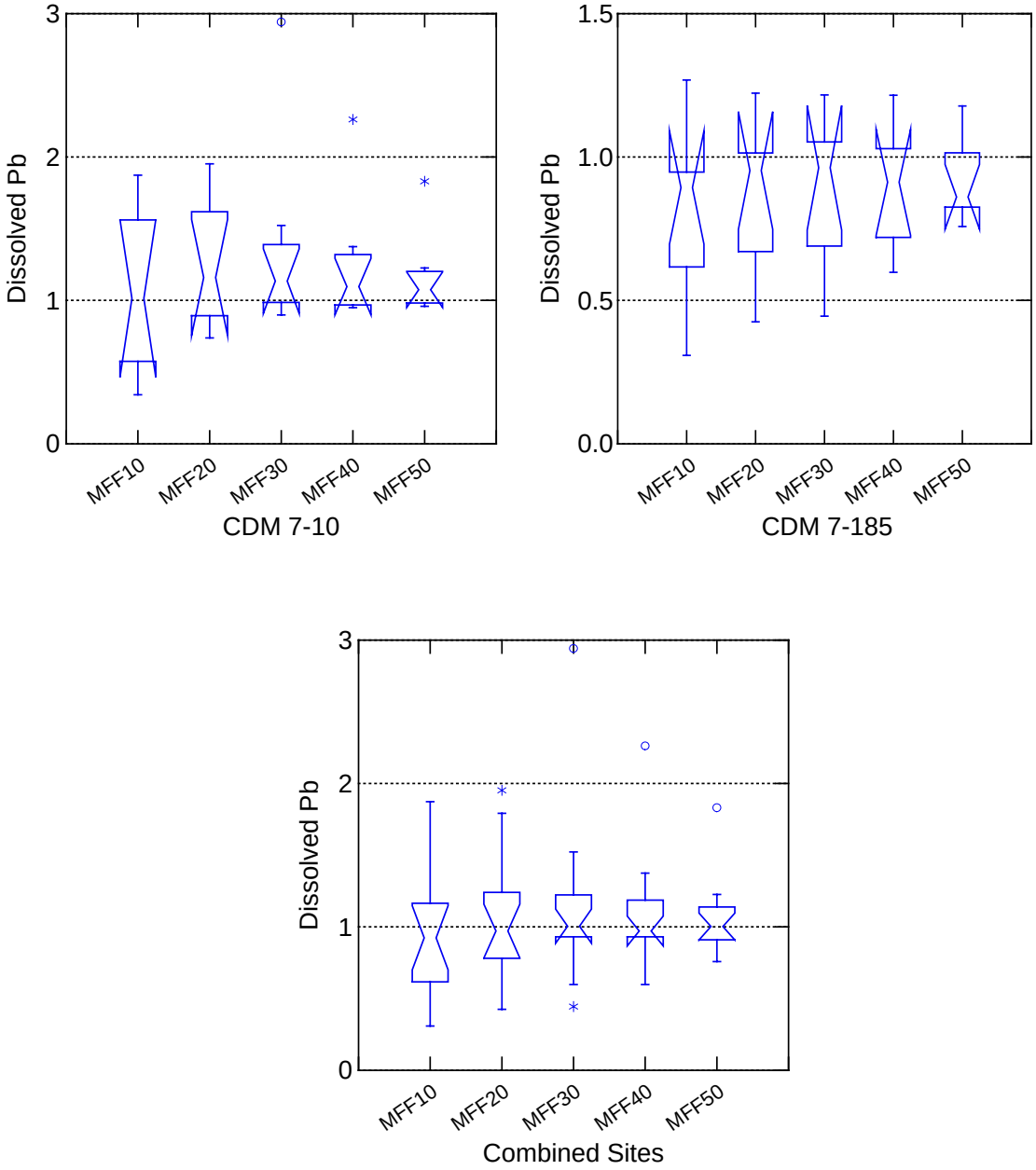


Figure D.3.12 MFF for Dissolved Pb from CDM

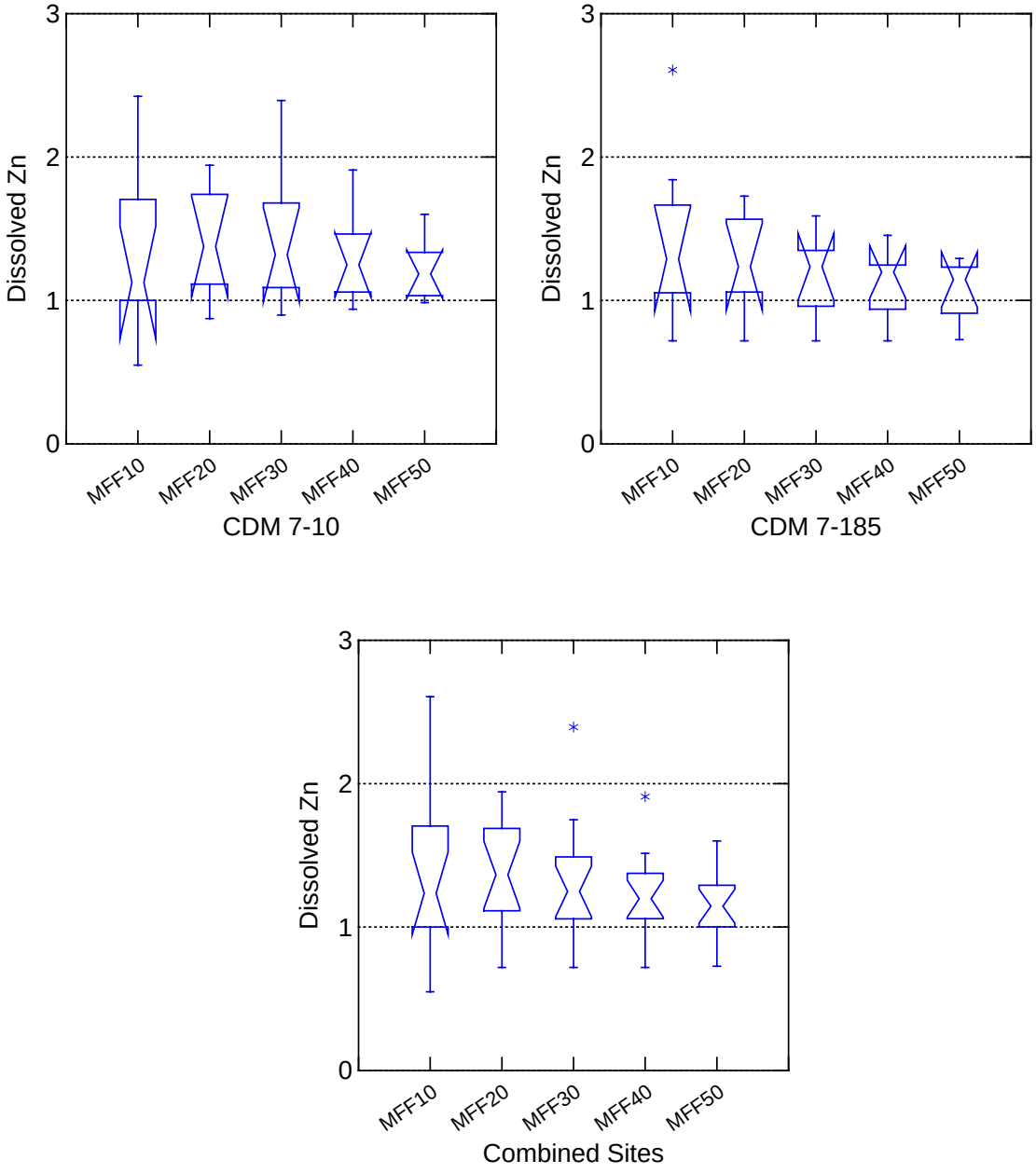


Figure D.3.13 MFF for Dissolved Zn from CDM

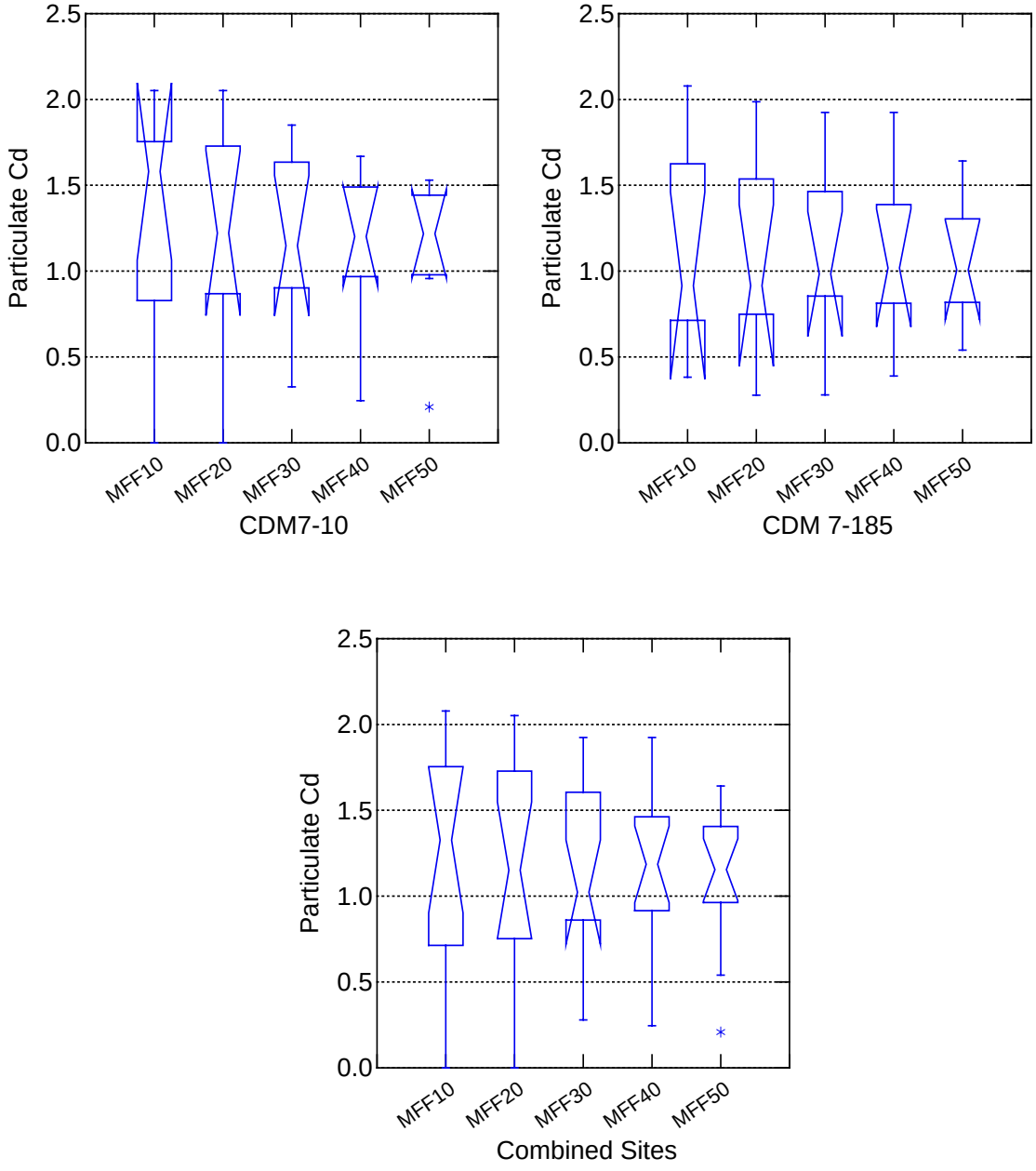


Figure D.3.14 MFF for Particulate Cd from CDM

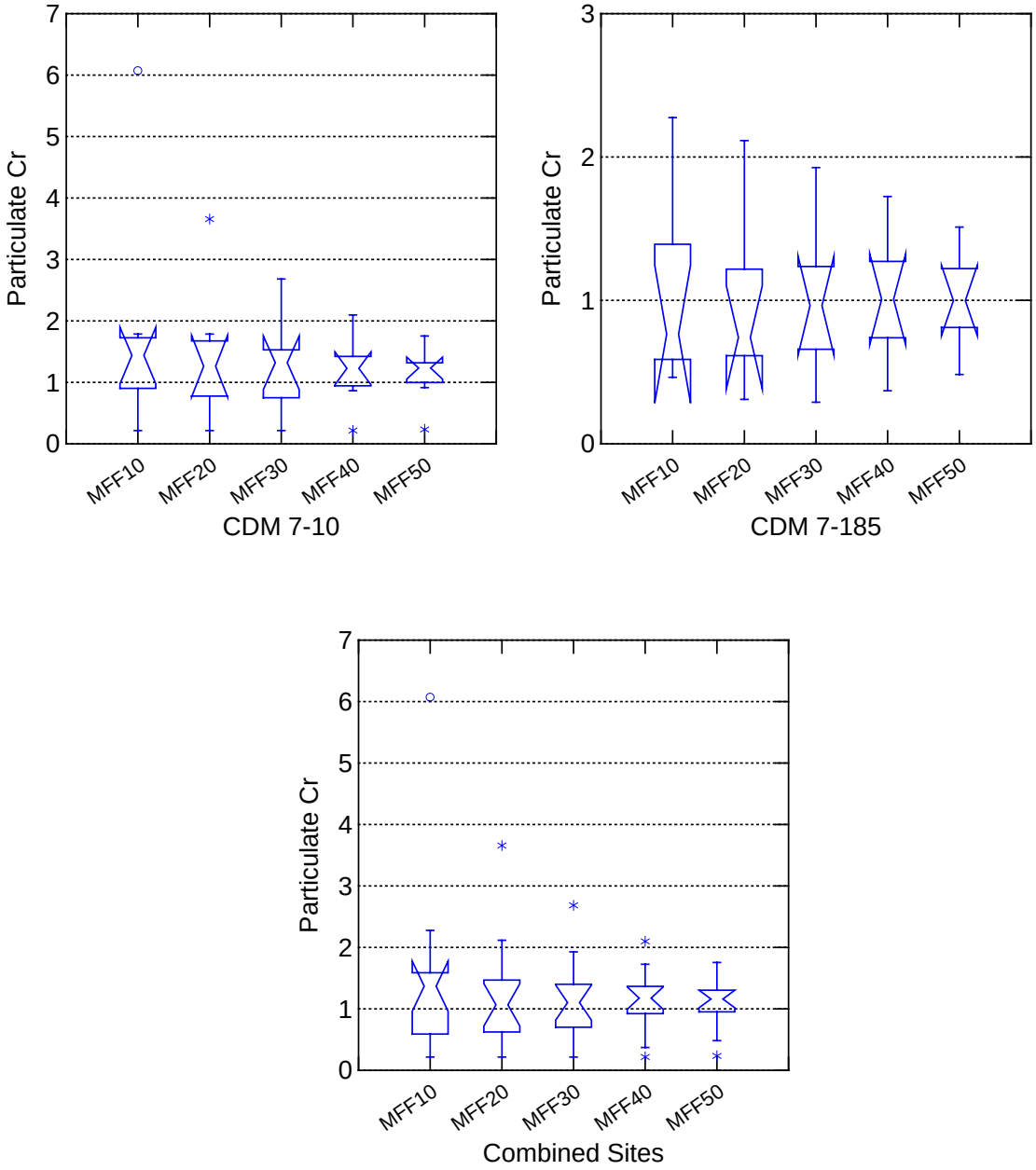


Figure D.3.15 MFF for Particulate Cr from CDM

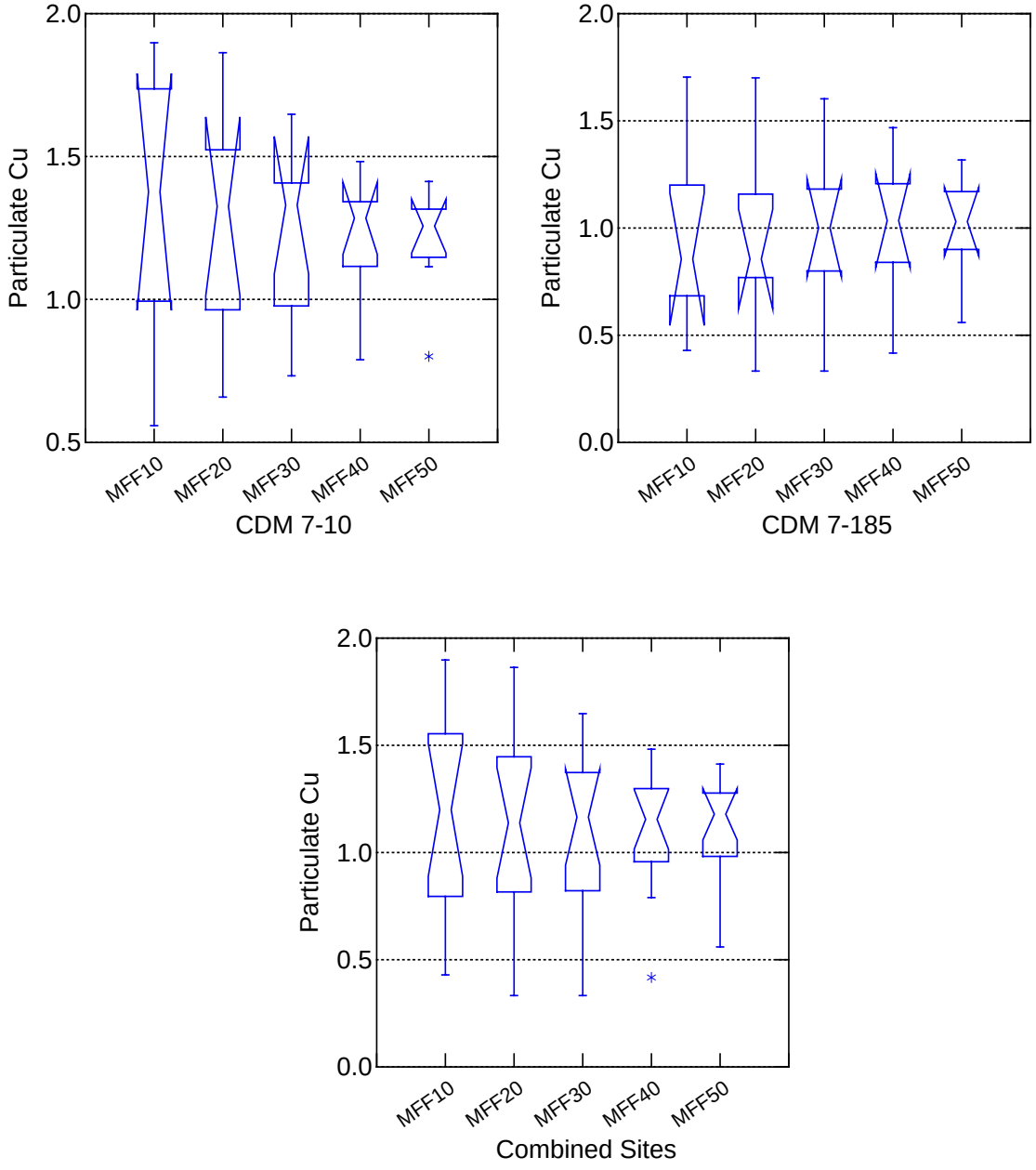


Figure D.3.16 MFF for Particulate Cu from CDM

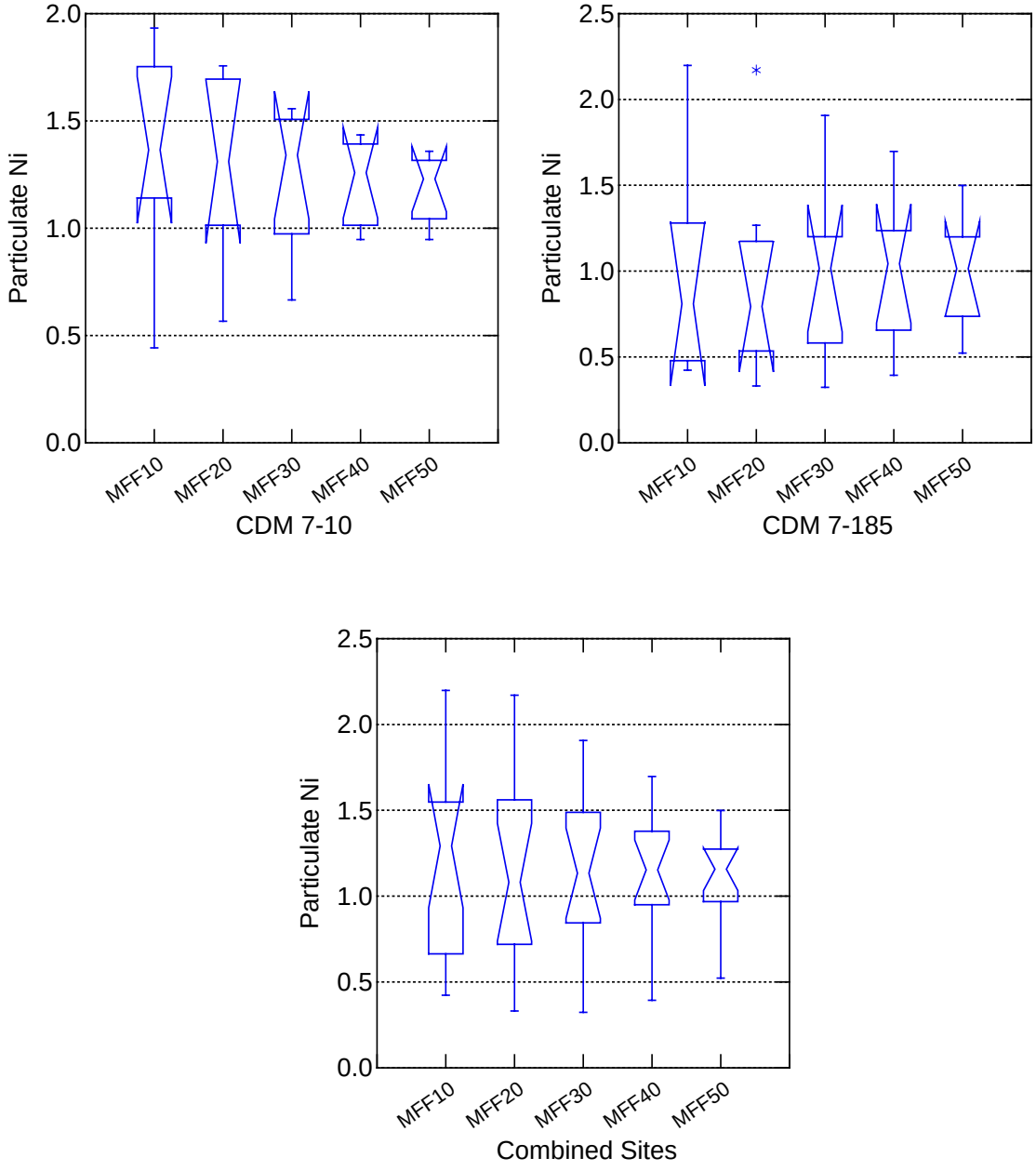


Figure D.3.17 MFF for Particulate Ni from CDM

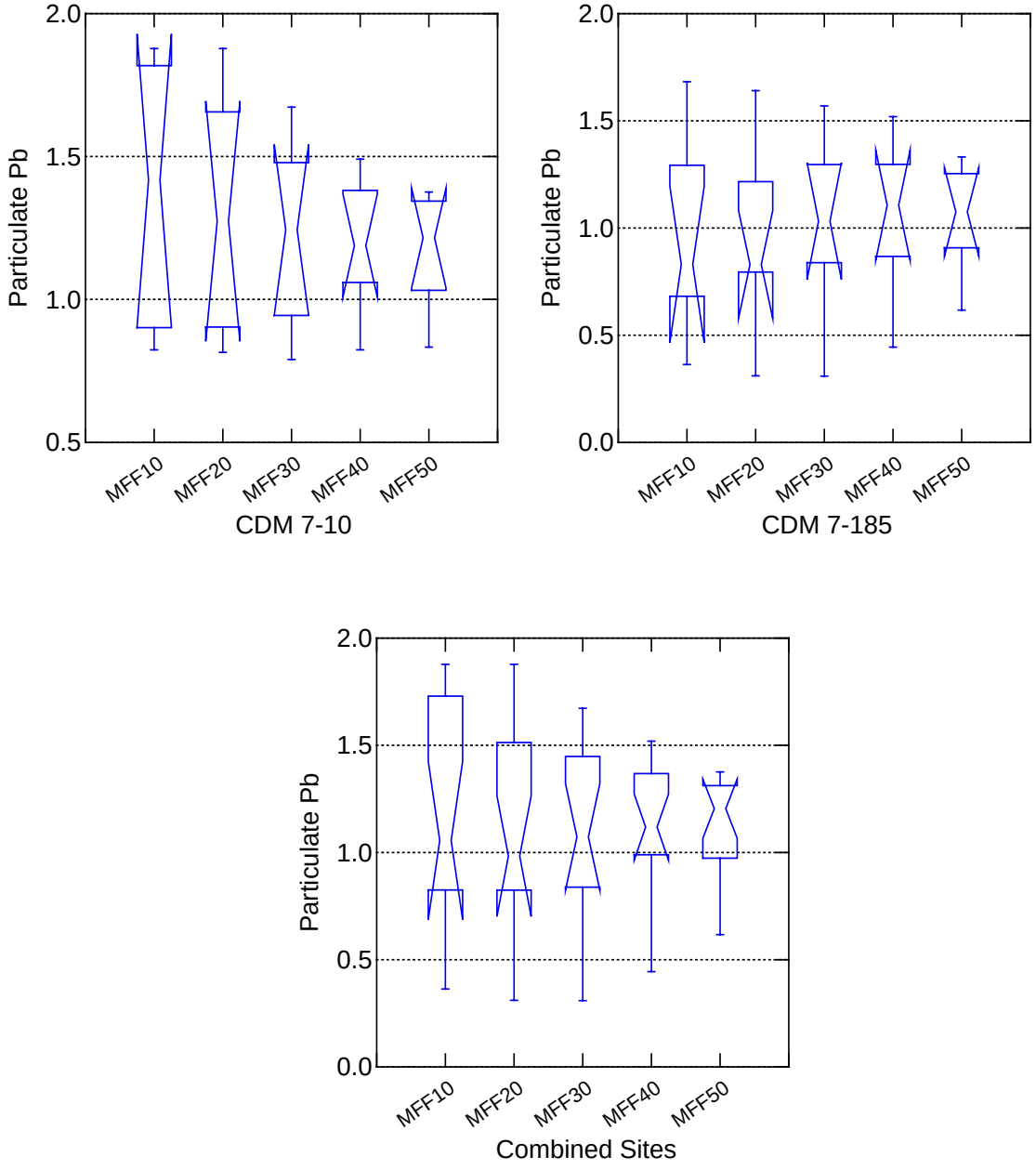


Figure D.3.18 MFF for Particulate Pb from CDM

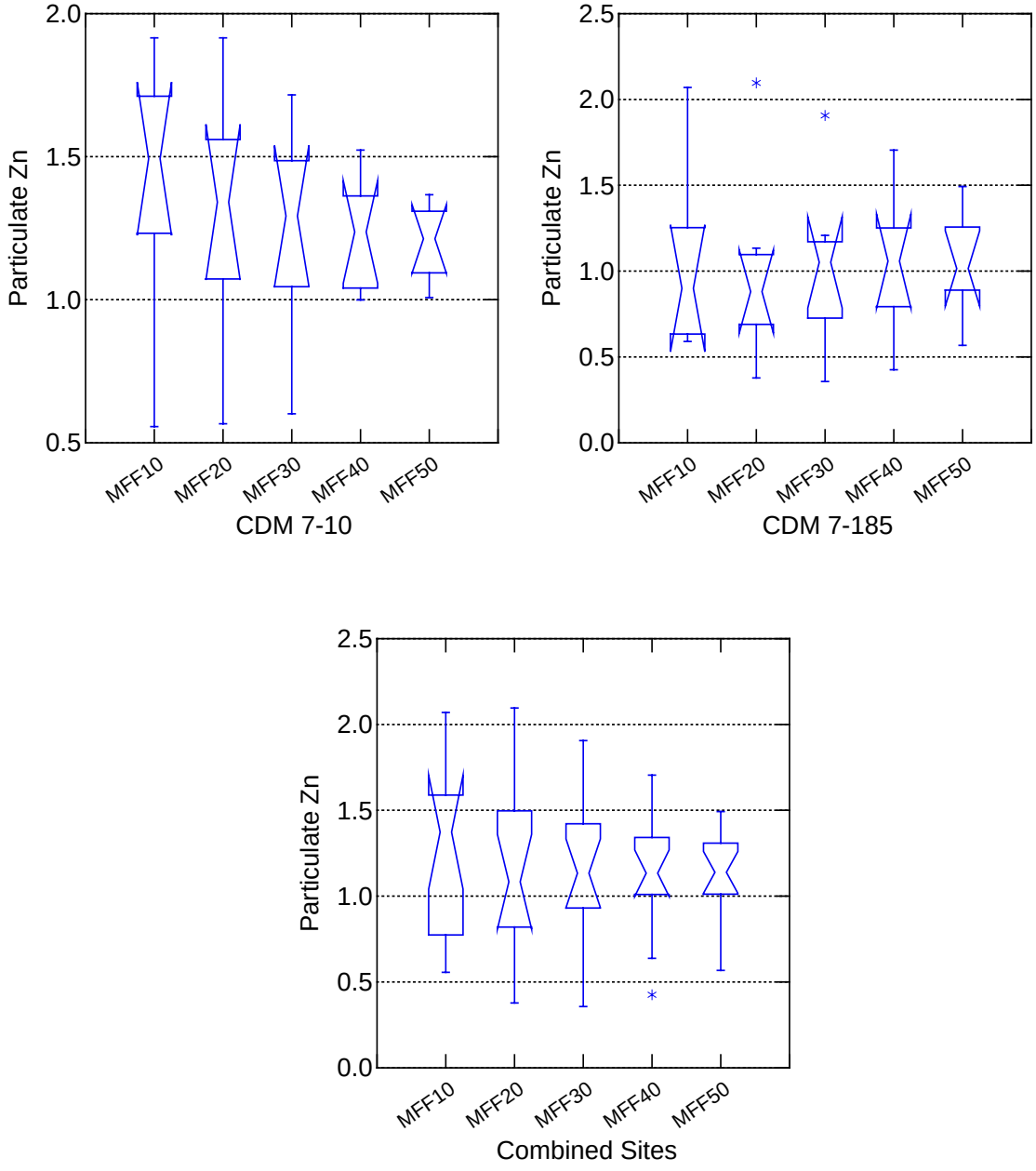


Figure D.3.19 MFF for Particulate Zn from CDM

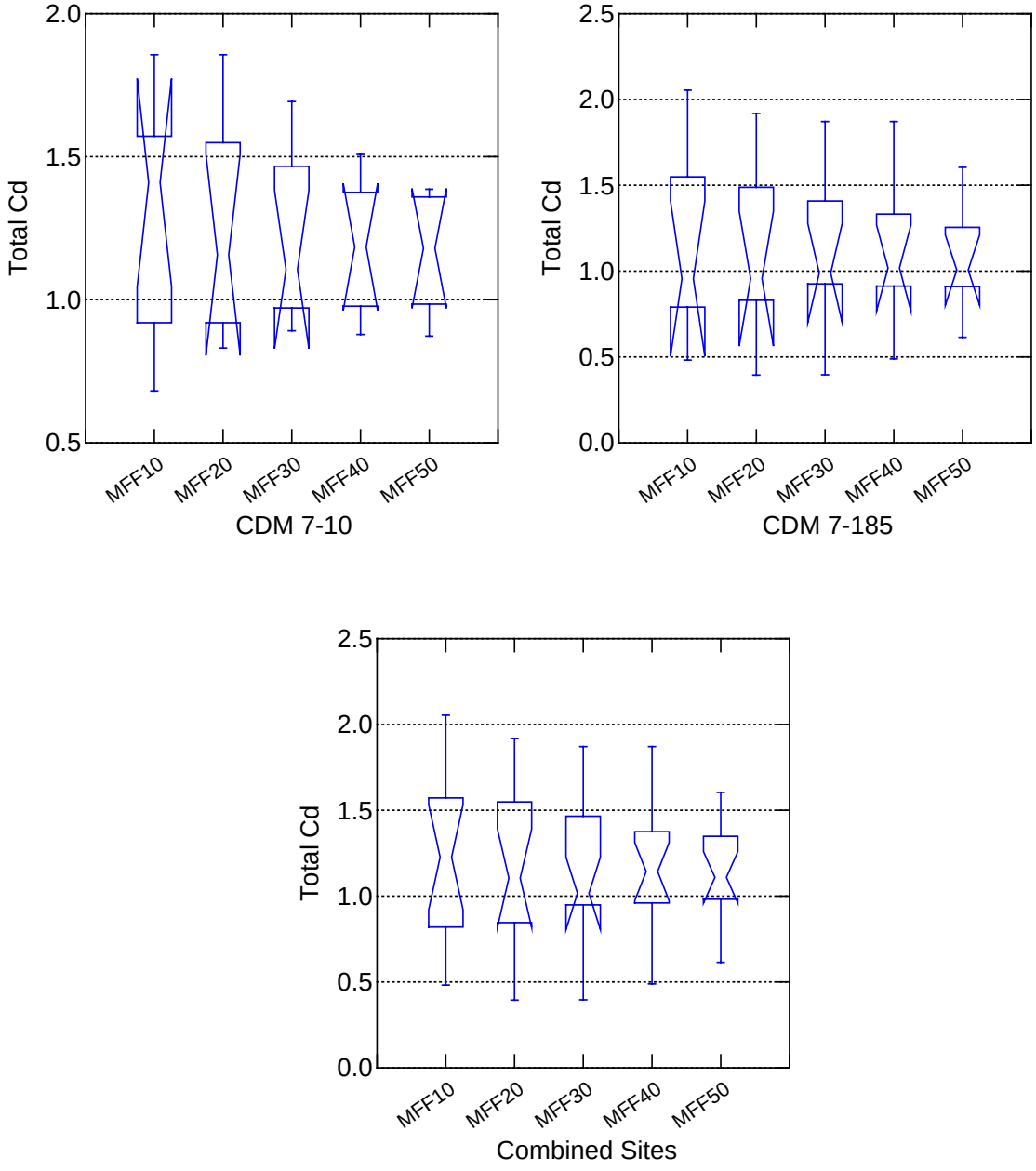


Figure D.3.20 MFF for Total Cd from CDM

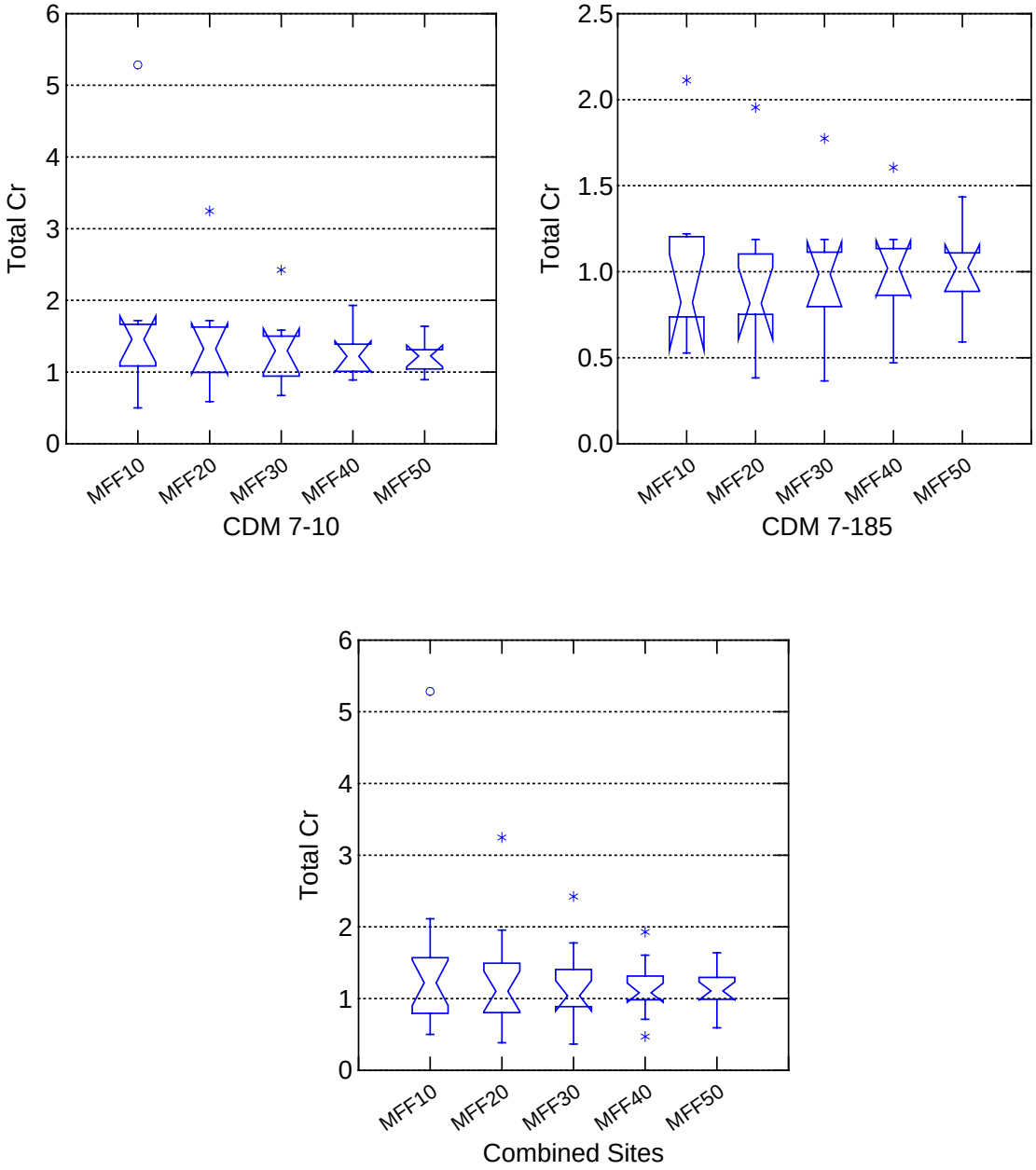


Figure D.3.21 MFF for Total Cr from CDM

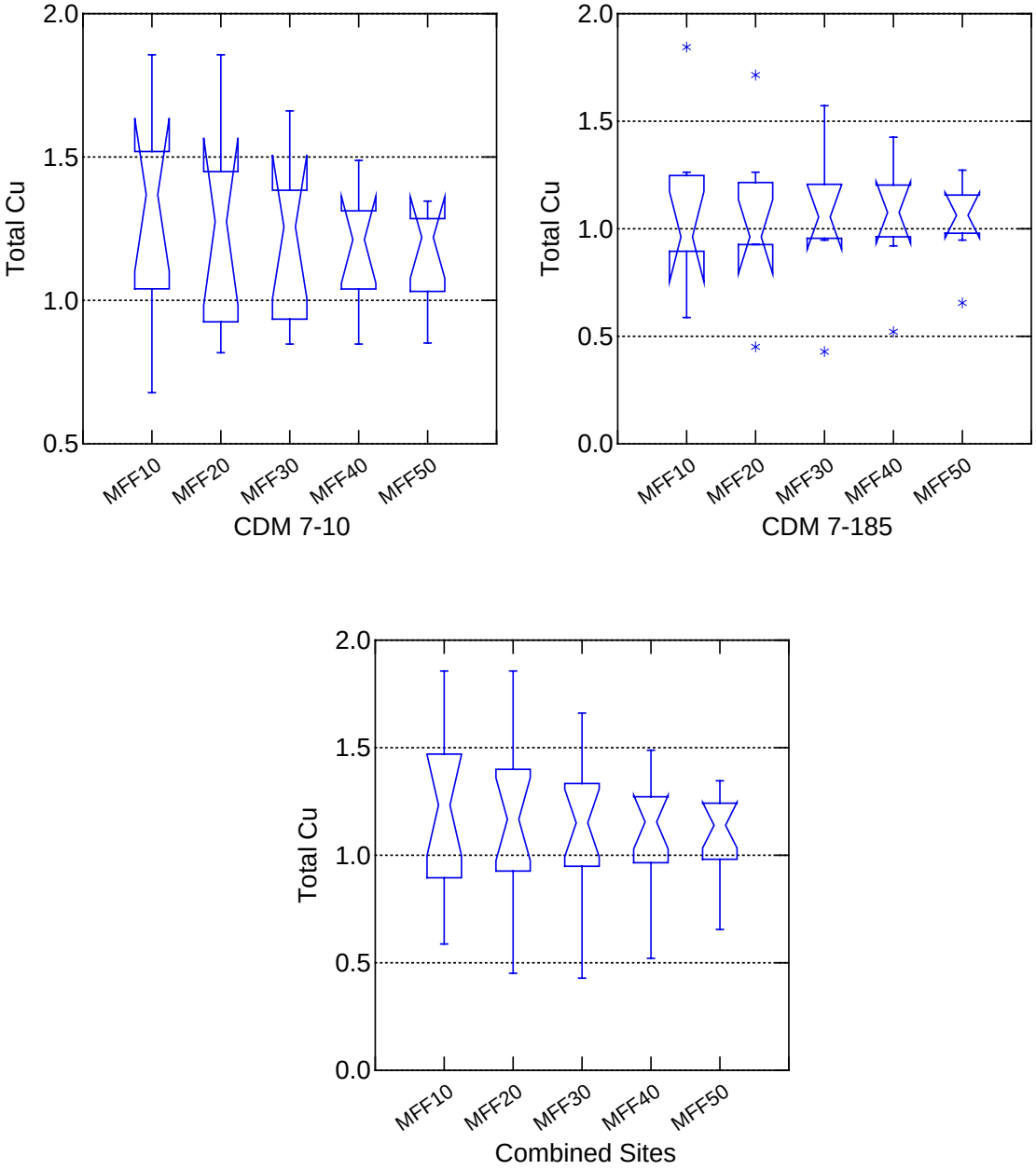


Figure D.3.22 MFF for Total Cu from CDM

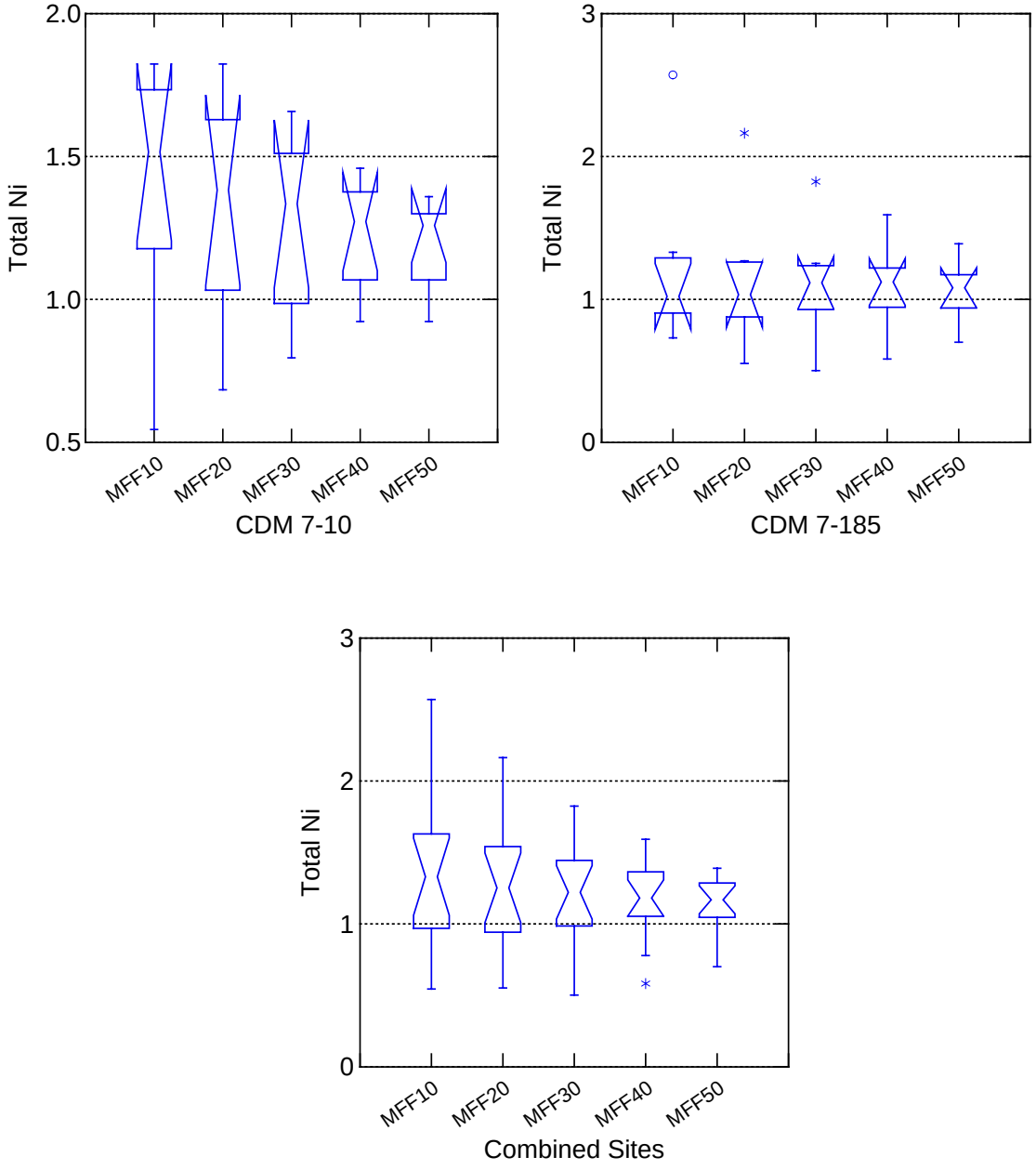


Figure D.3.23 MFF for Total Ni from CDM

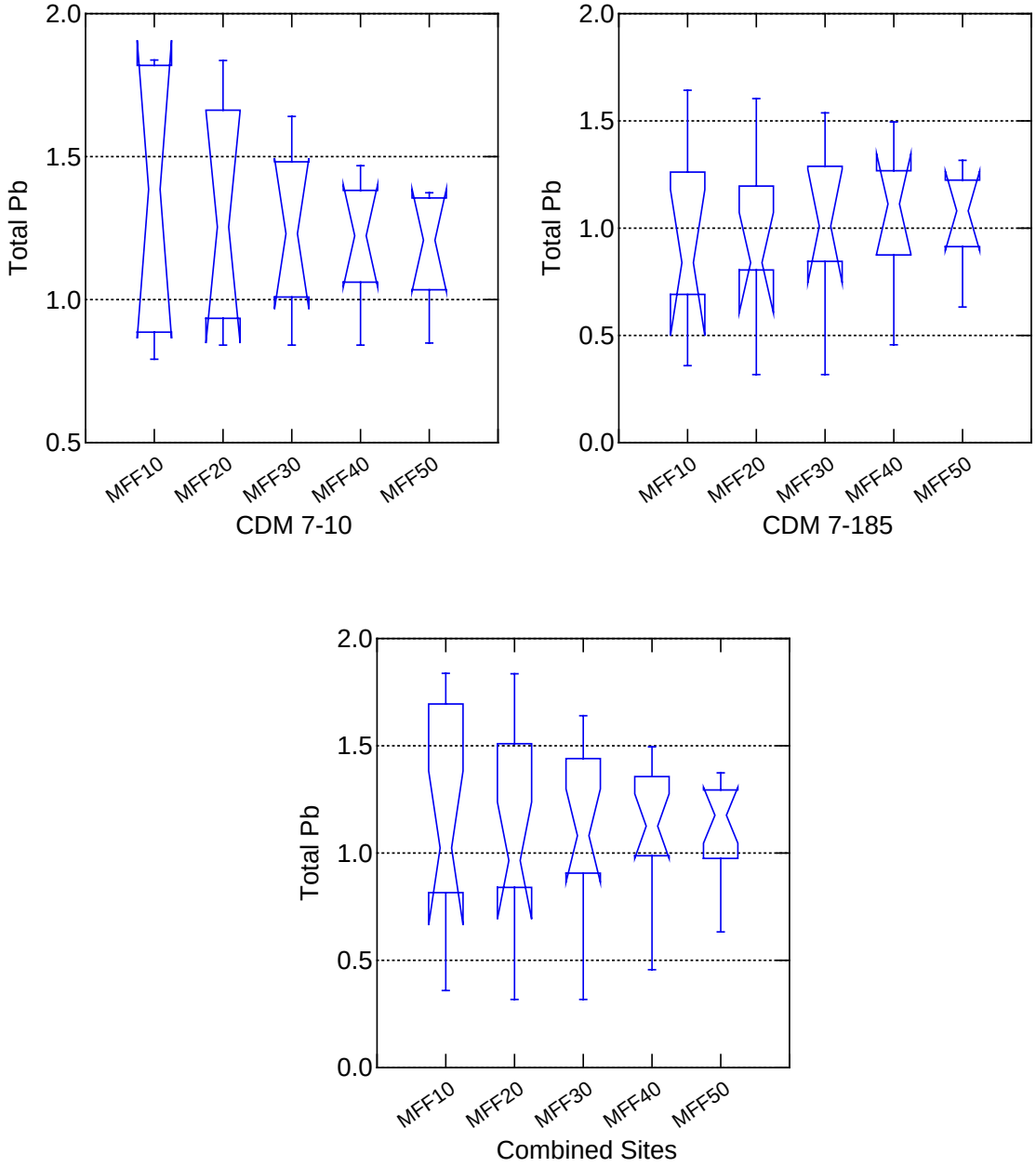


Figure D.3.24 MFF for Total Pb from CDM

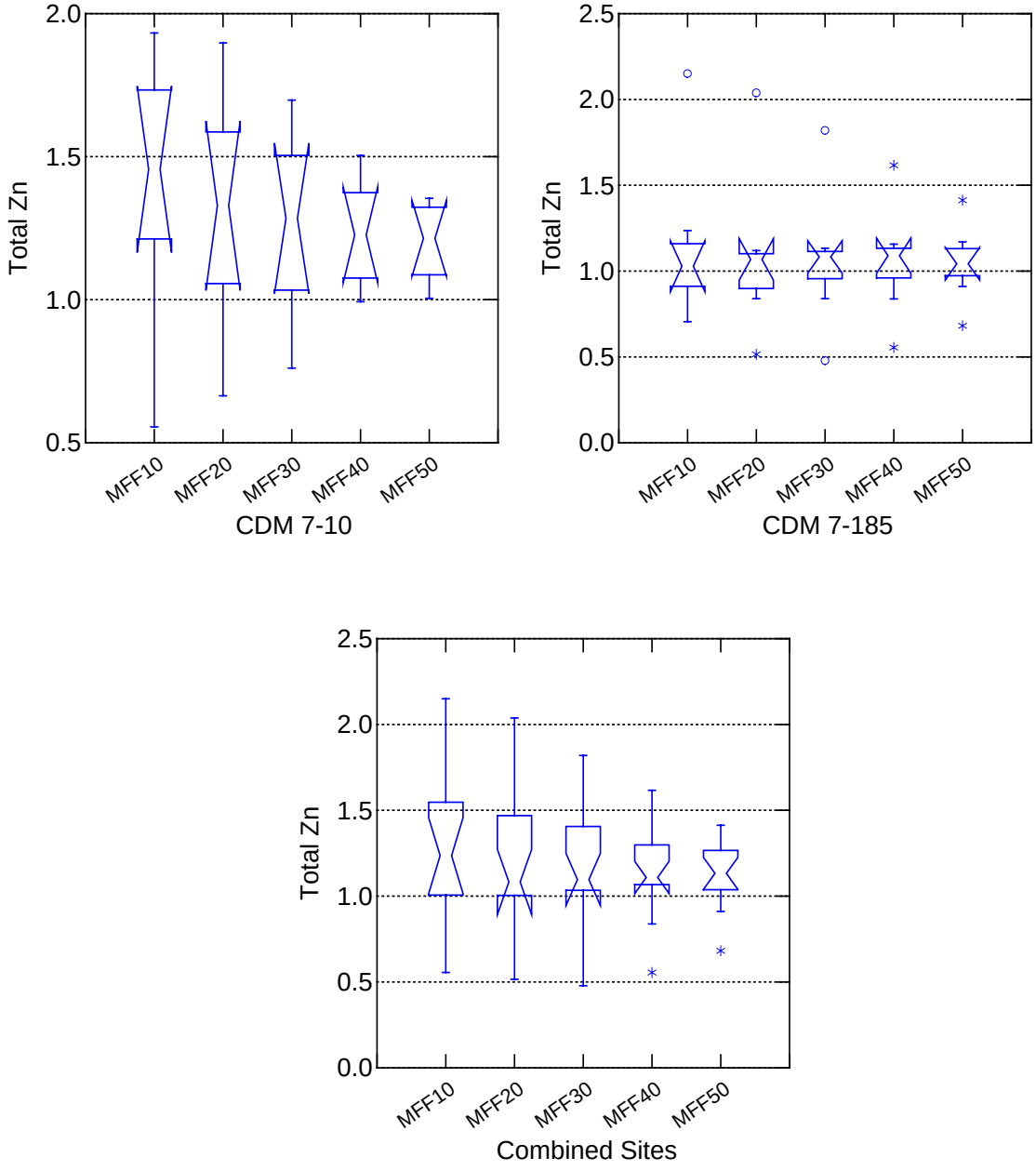
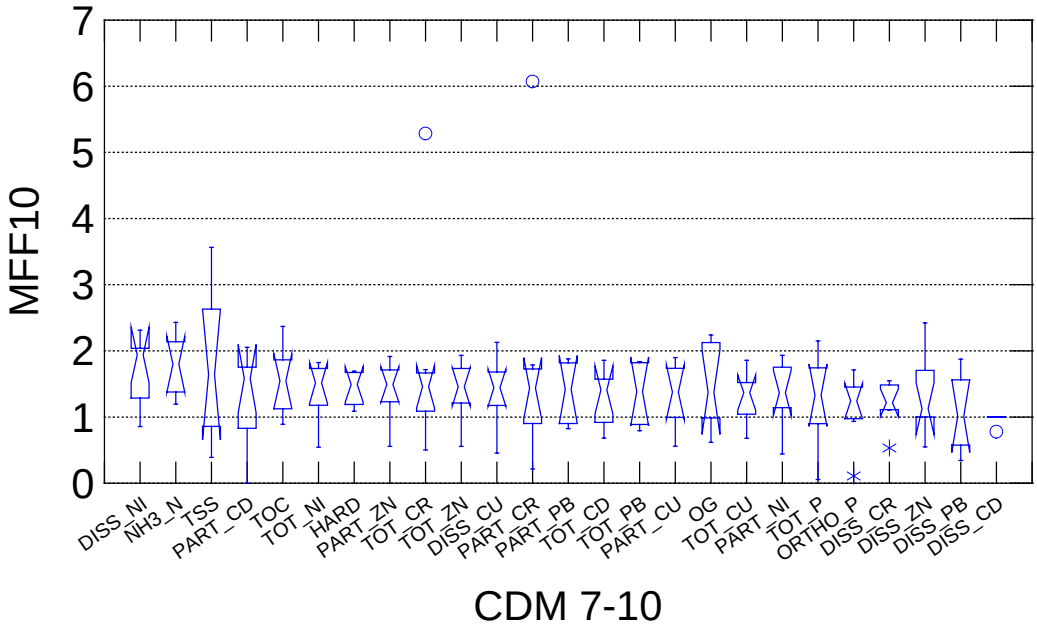


Figure D.3.25 MFF for Total Zn from CDM



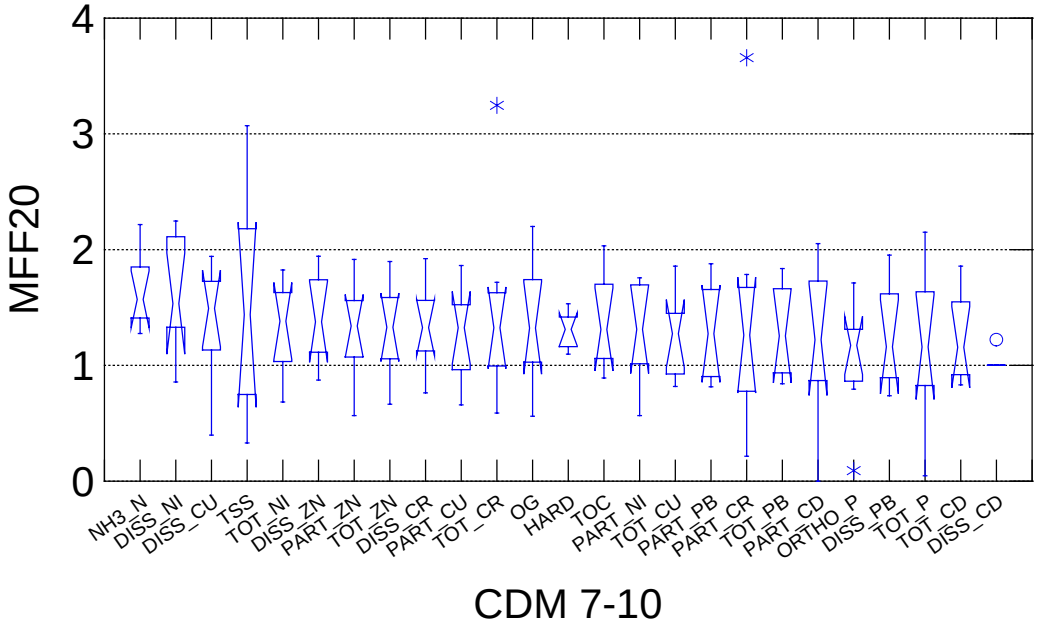
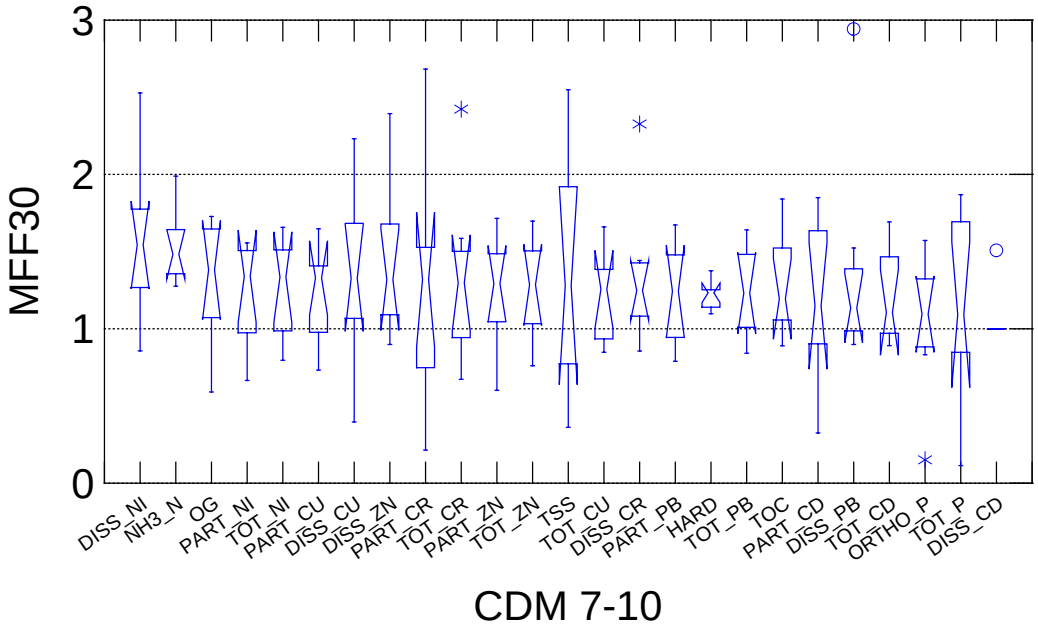


Figure D.4.1a MFF10 and 20 by Ranking for CDM 7-10



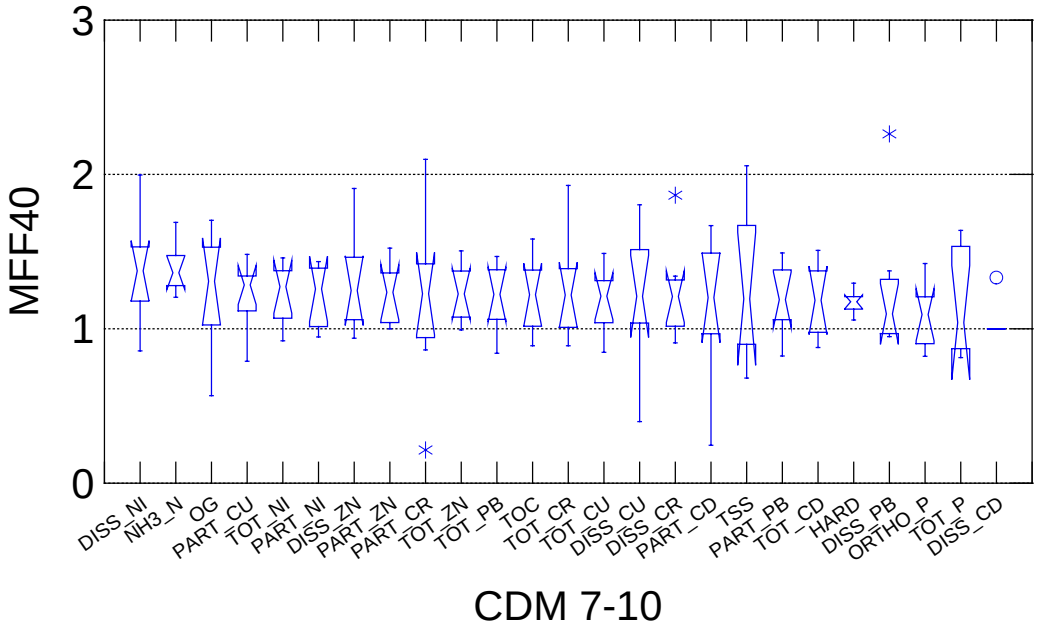


Figure D.4.1b MFF 30 and 40 by Ranking for CDM 7-10

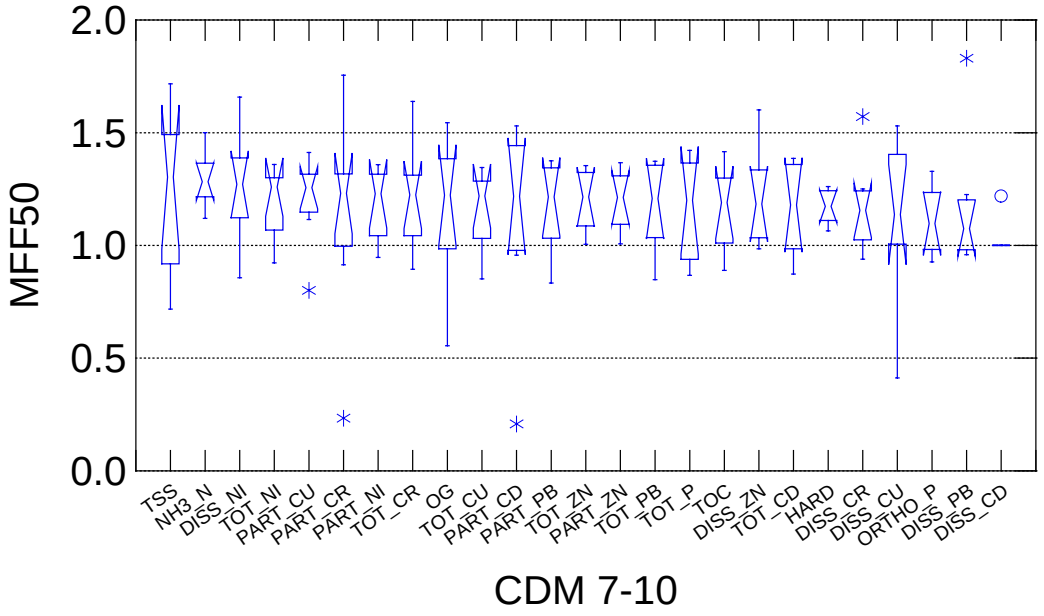
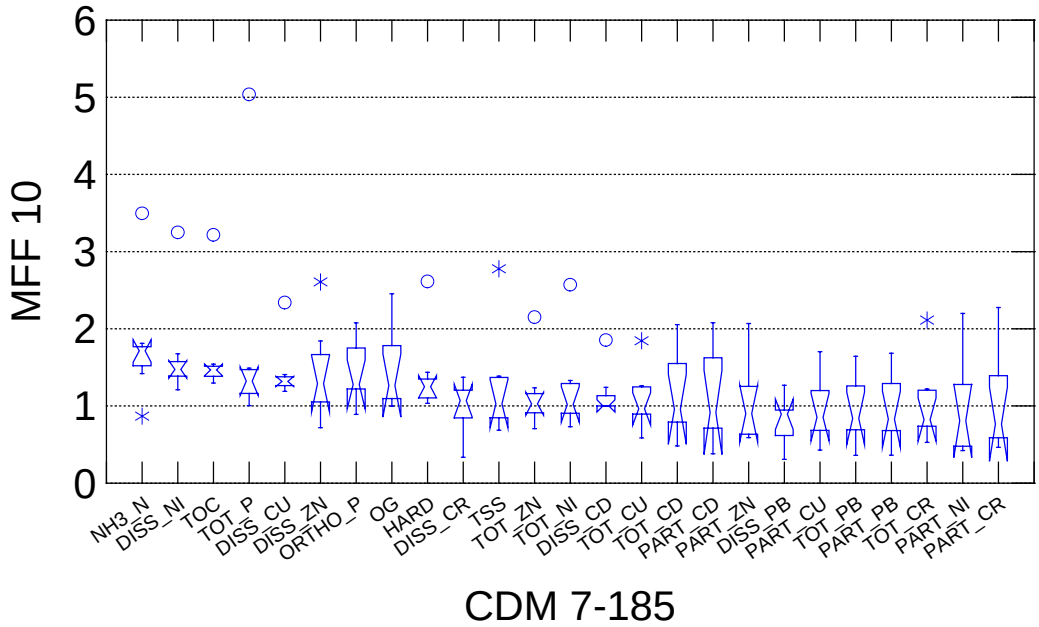


Figure D.4.1c MFF50 by Ranking for CDM 7-10



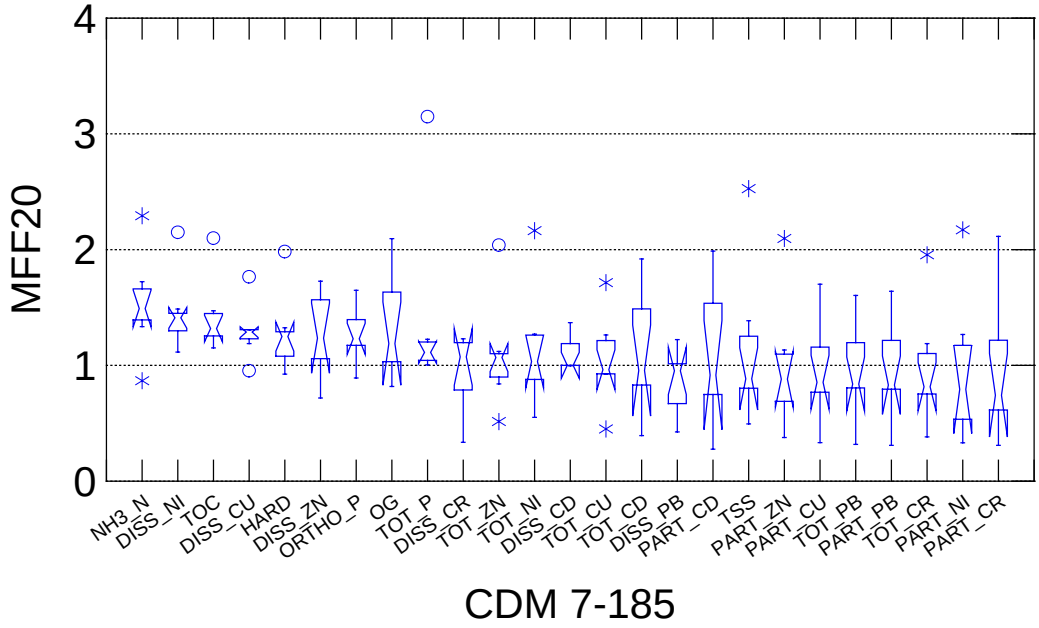
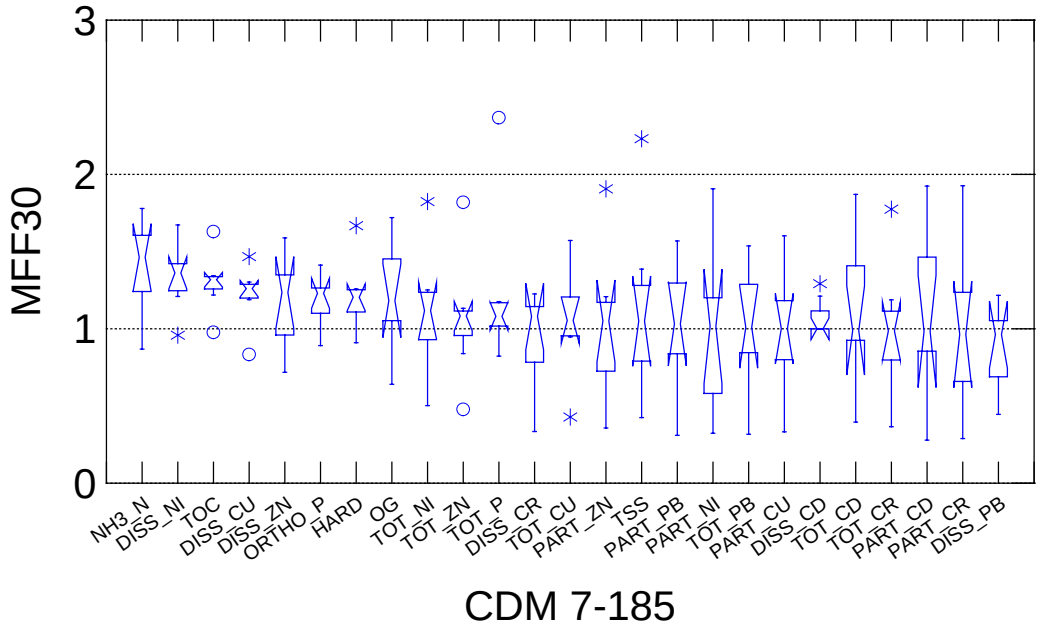


Figure D.4.2a MFF10 and 20 by Ranking for CDM 7-185



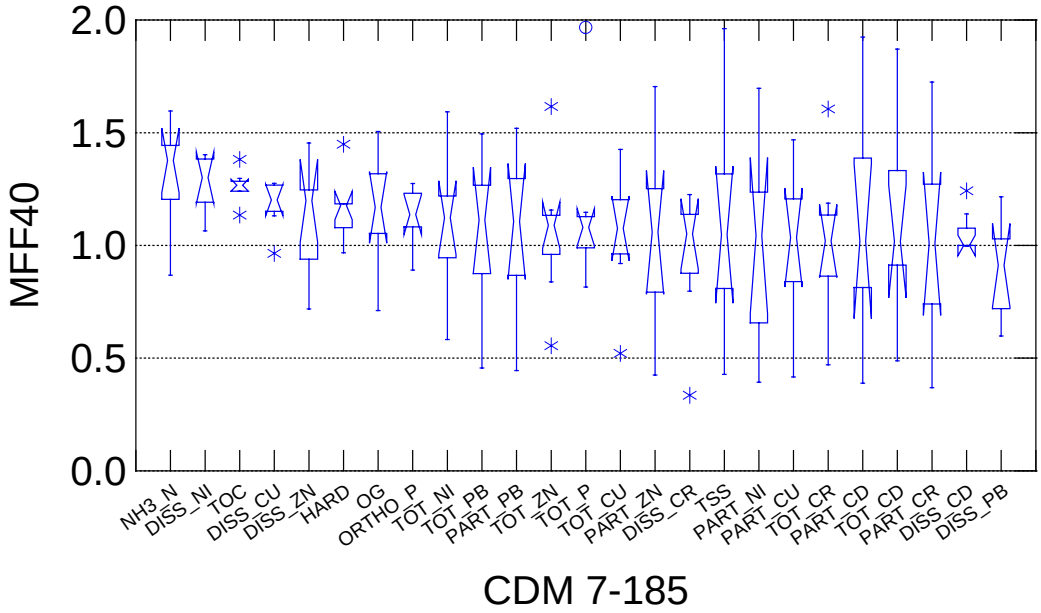


Figure D.4.2b MFF30 and 40 by Ranking for CDM 7-185

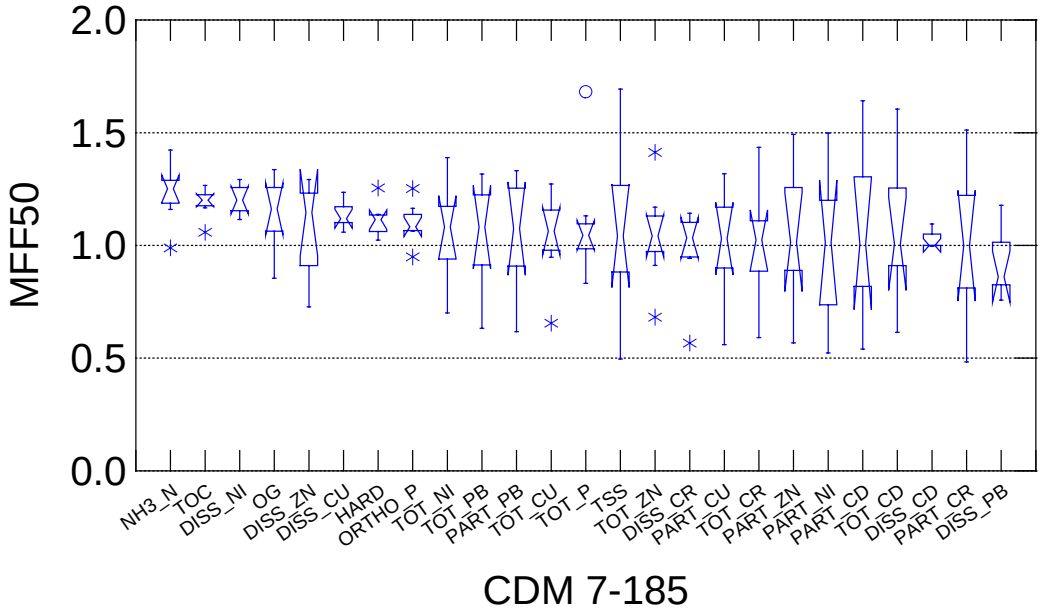


Figure D.4.2c MFF50 by Ranking for CDM 7-185

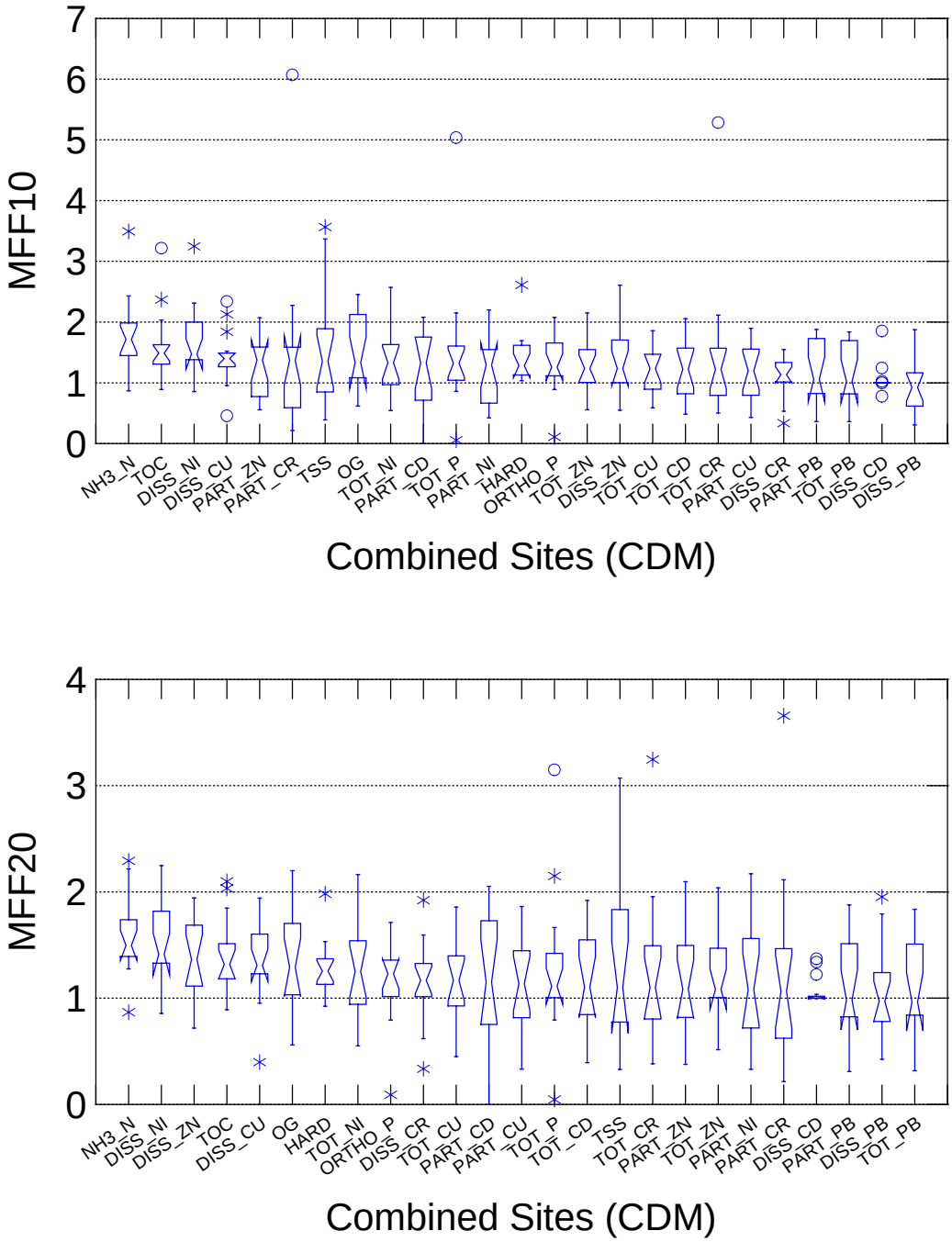


Figure D.4.3a MFF10 and 20 by Ranking from Combined CDM

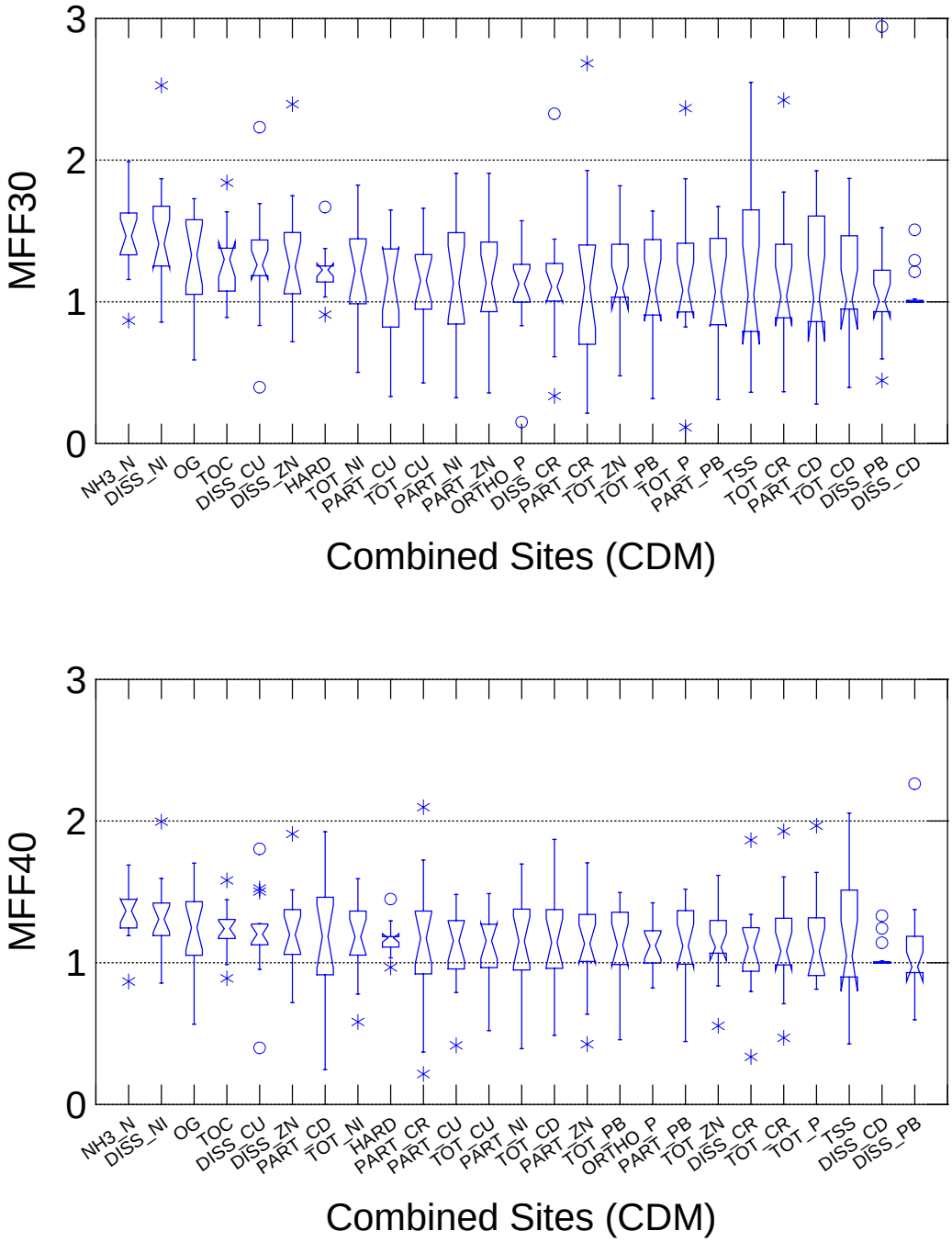


Figure D.4.3b MFF30 and 40 by Ranking from Combined CDM

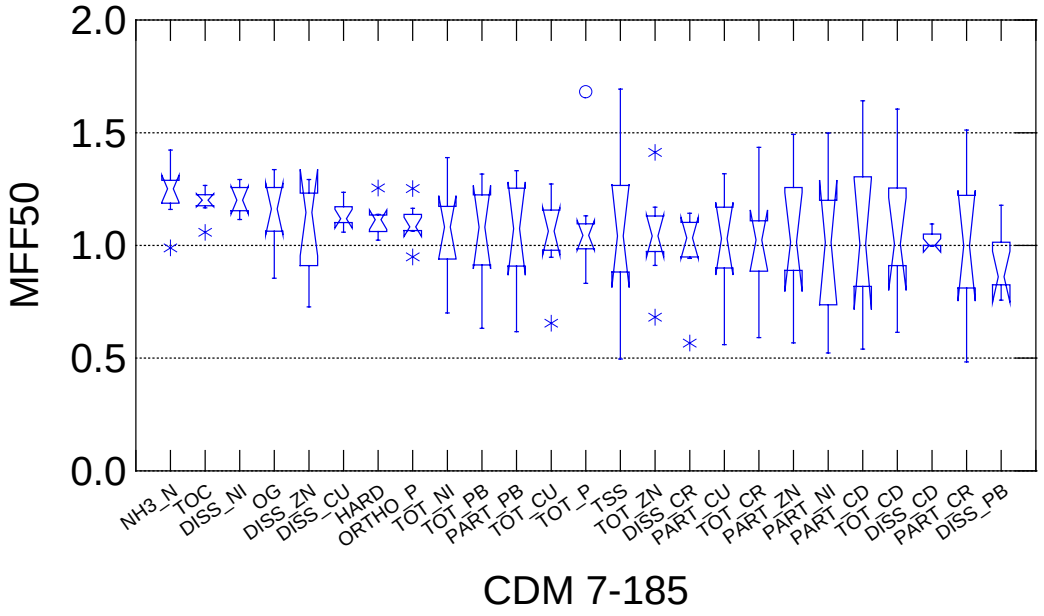


Figure D.4.3c MFF50 by Ranking from Combined CDM

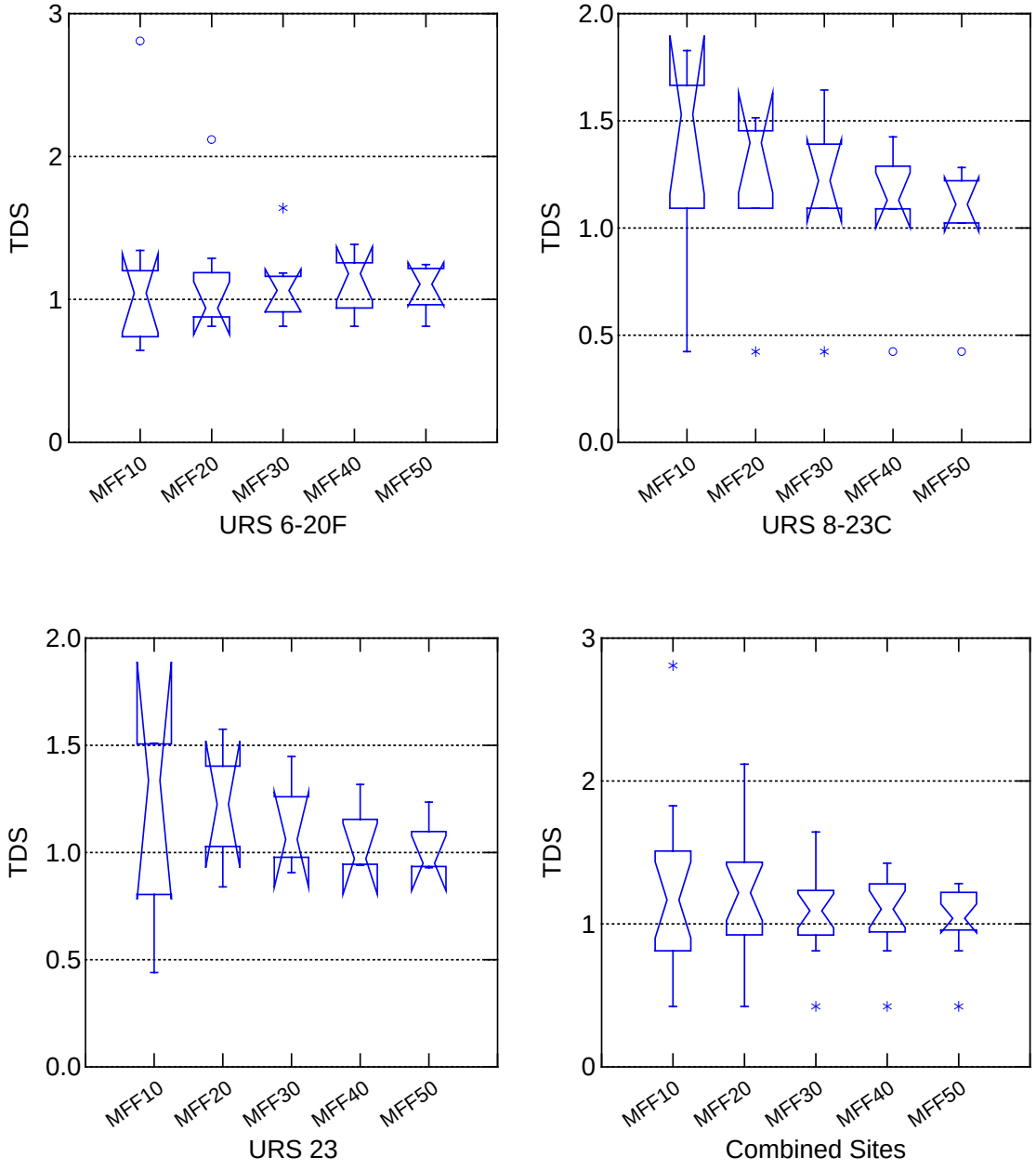


Figure D.5.1 MFF for TDS from URS

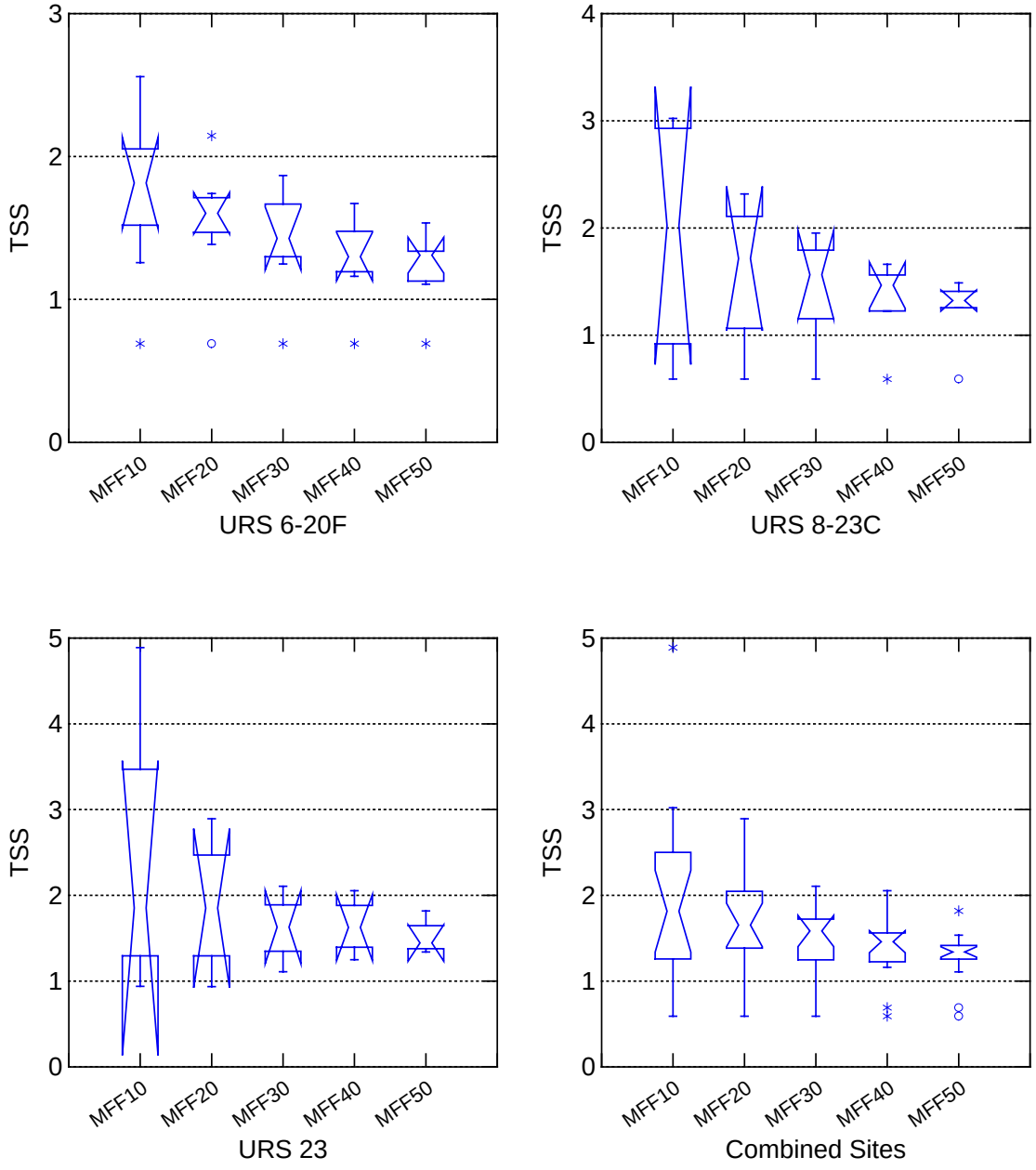


Figure D.5.2 MFF for TSS from URS

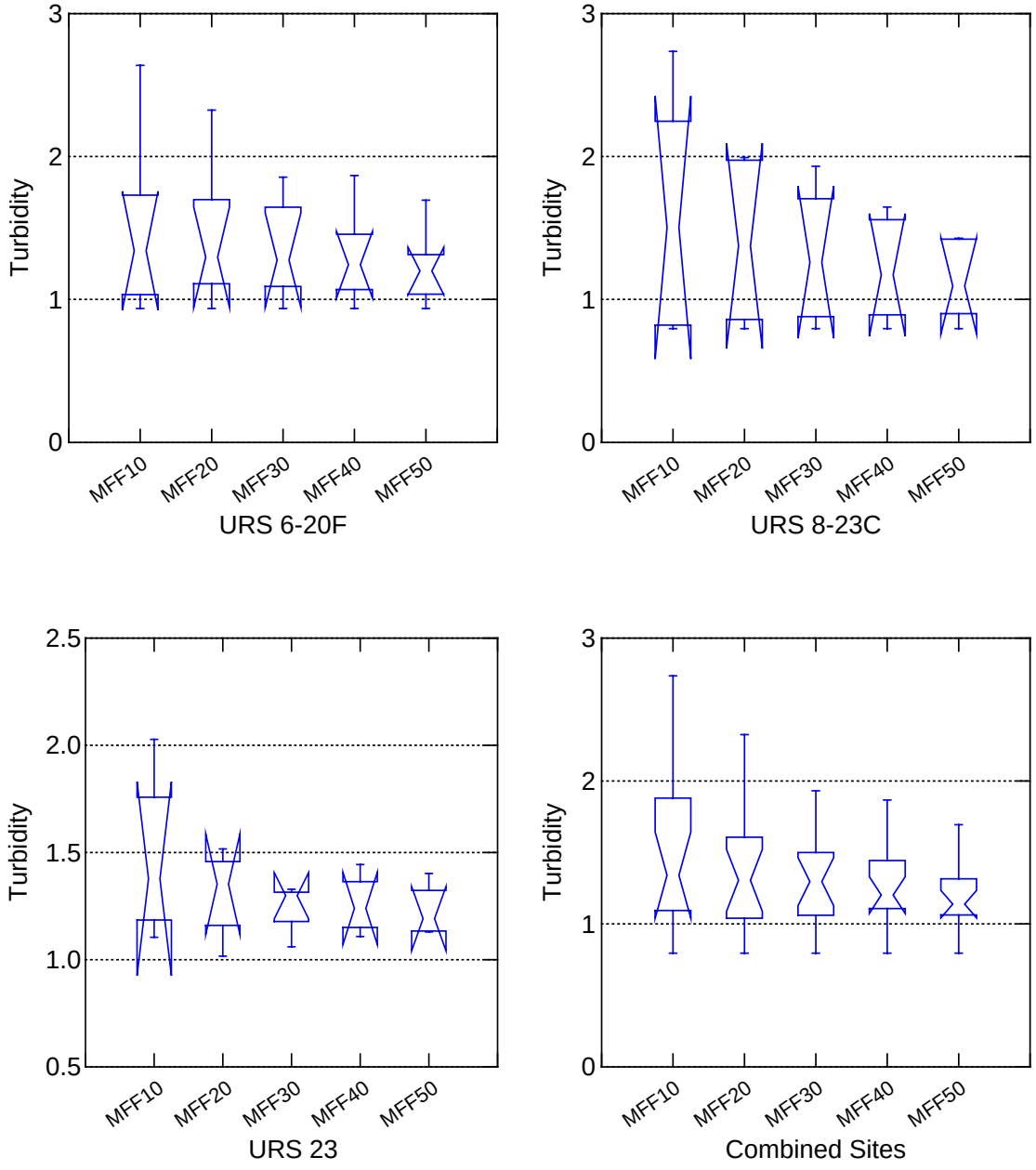


Figure D.5.3 MFF for Turbidity from URS

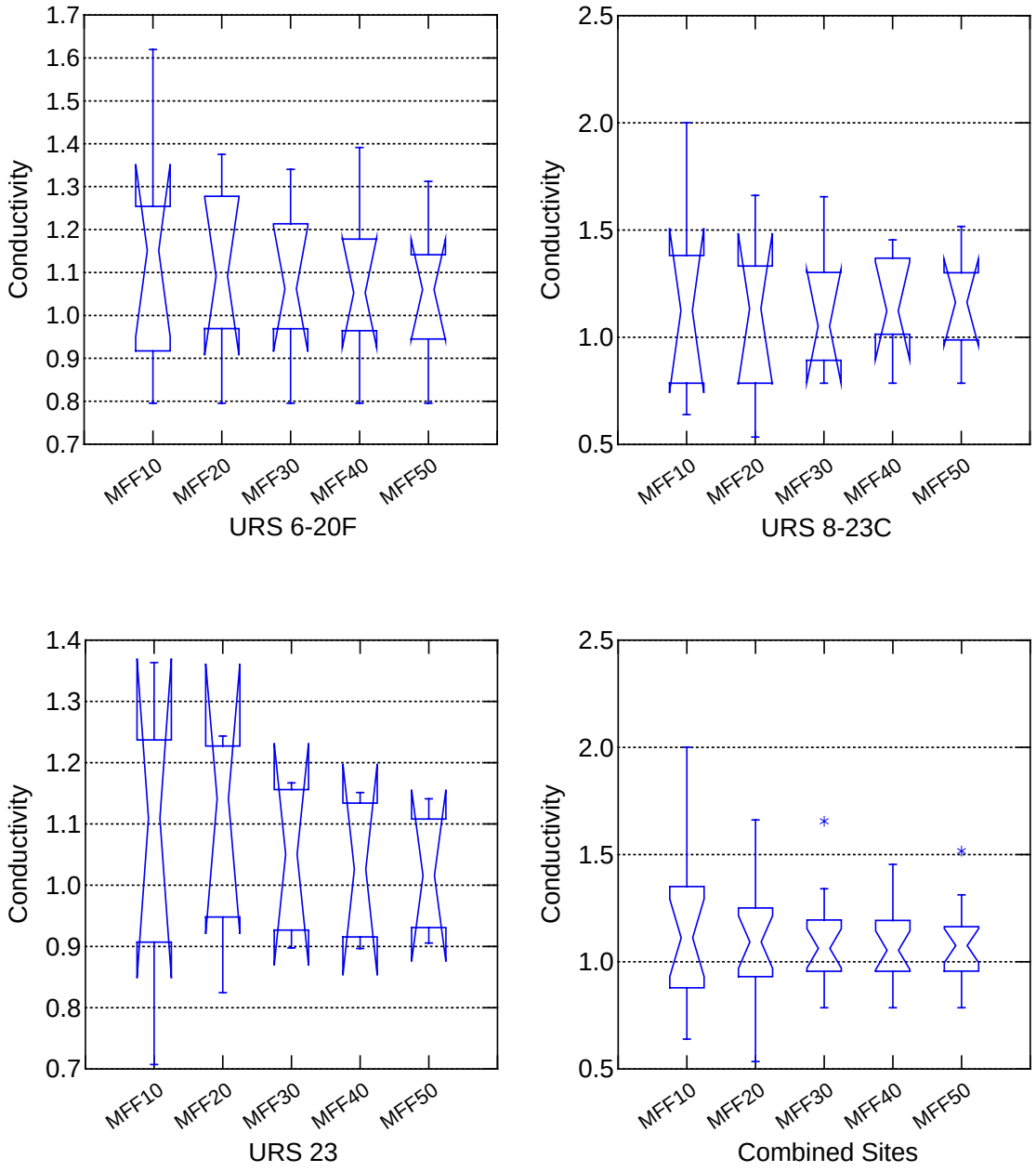


Figure D.5.4 MFF for Conductivity from URS

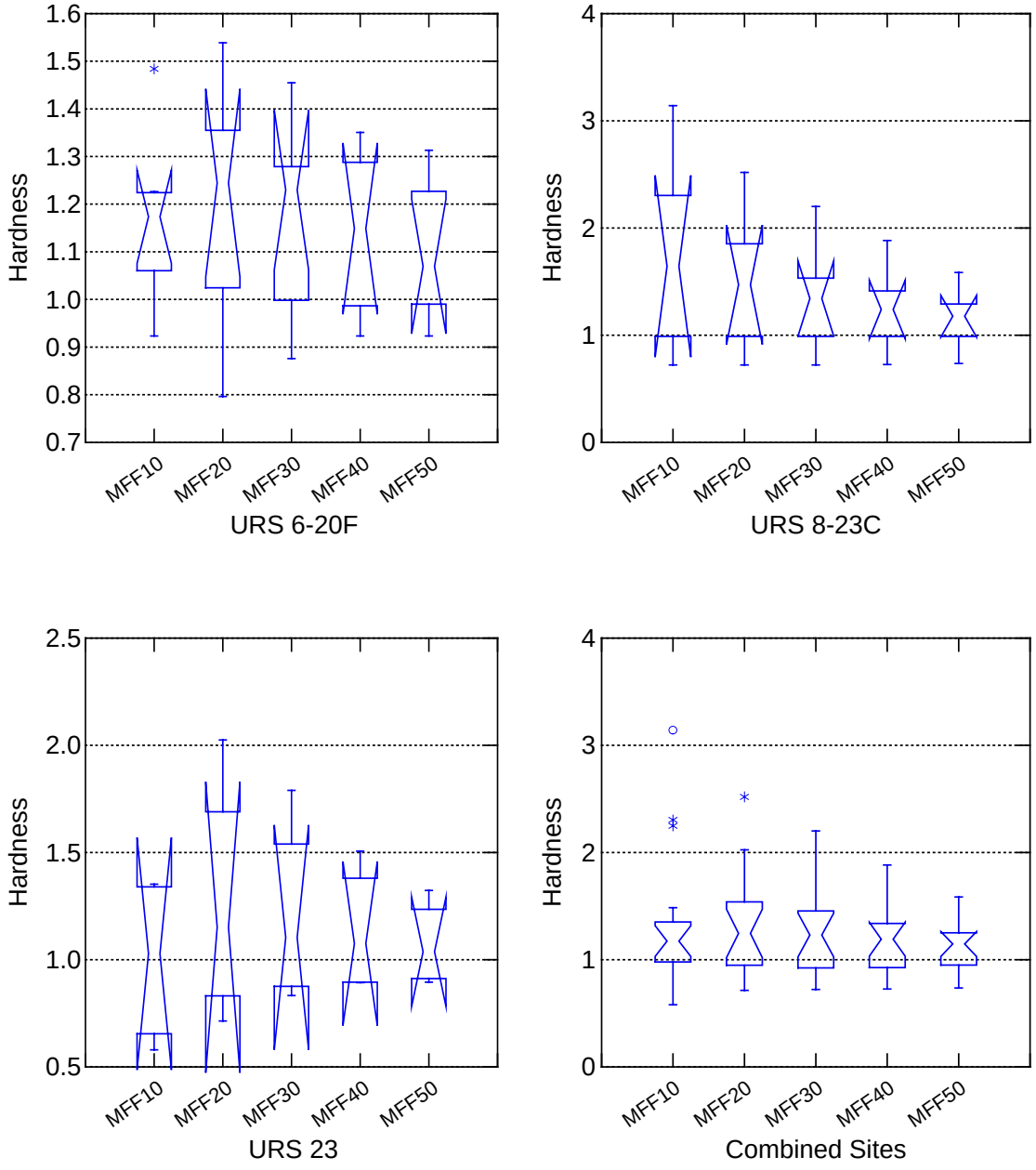


Figure D.5.5 MFF for Hardness from URS

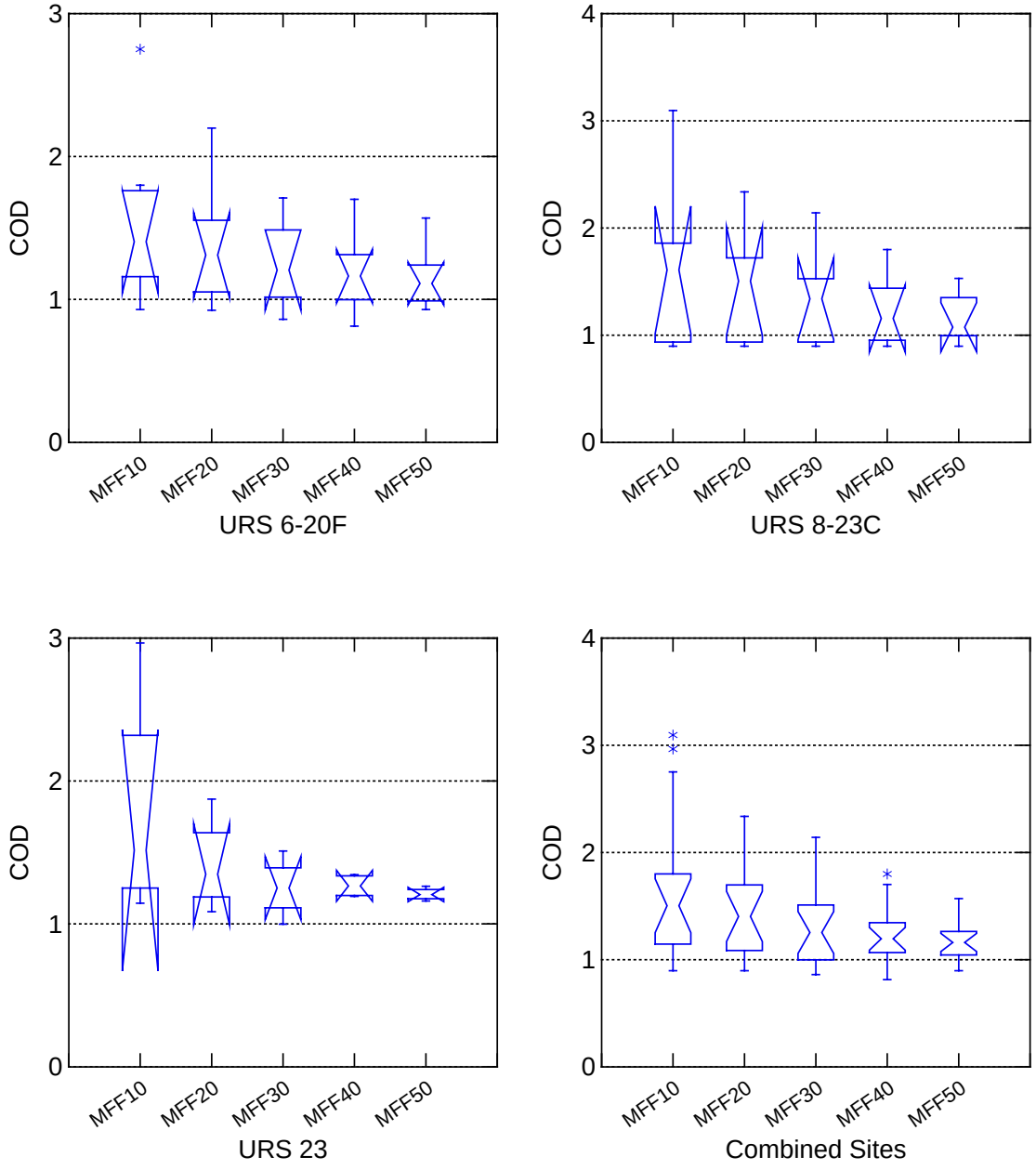


Figure D.5.6 MFF for COD from URS

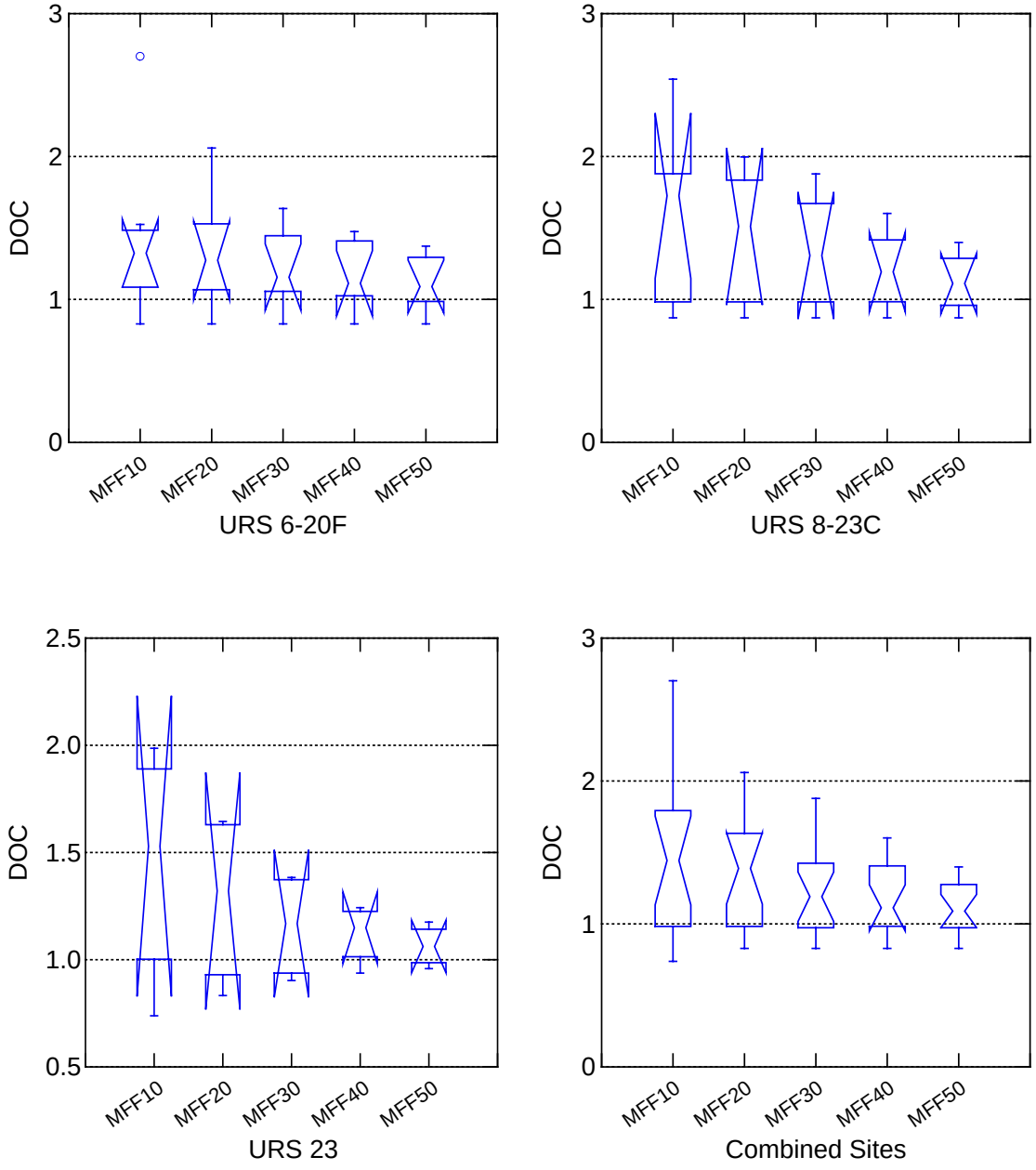


Figure D.5.7 MFF for DOC from URS

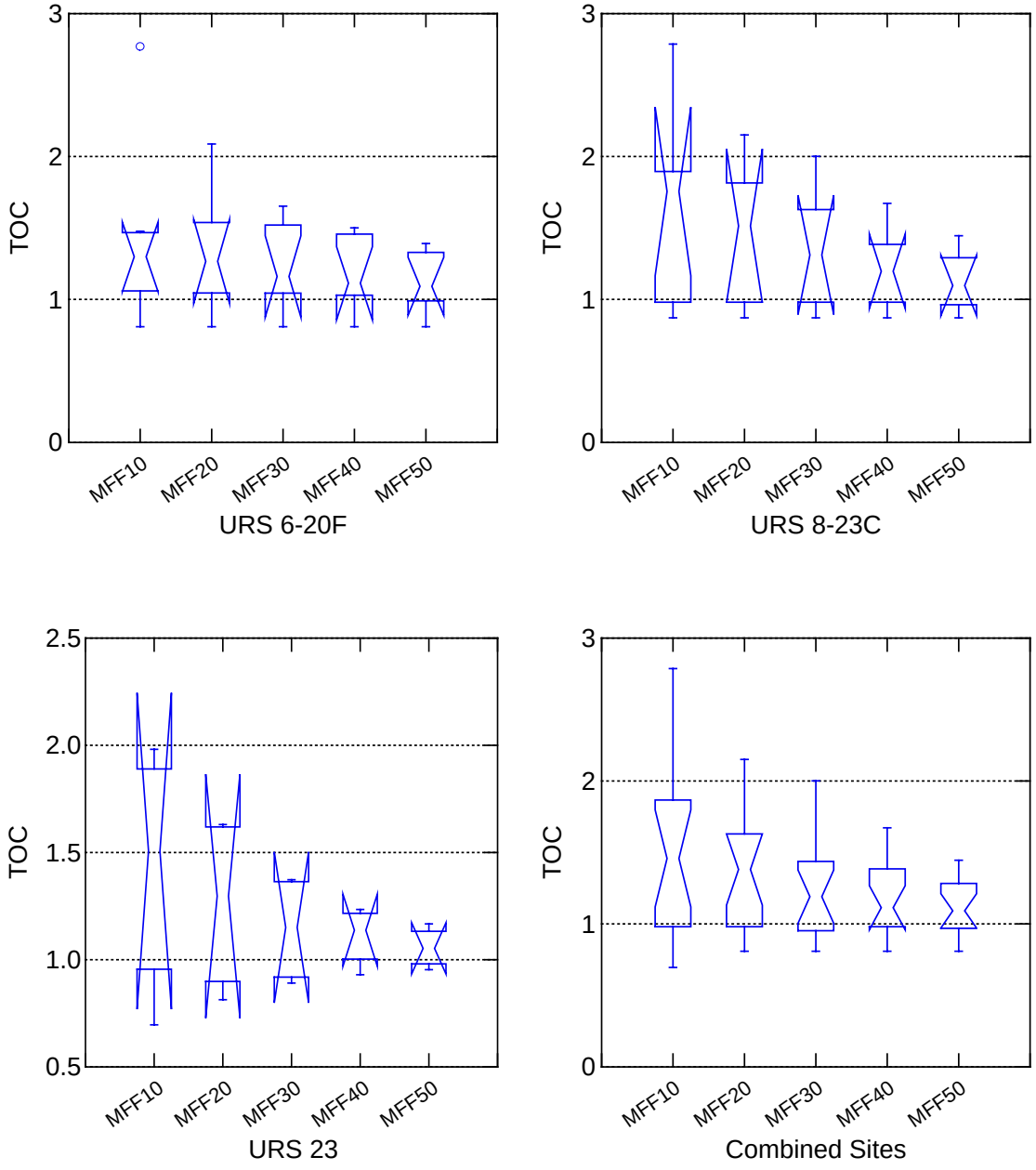


Figure D.5.8 MFF for TOC from URS

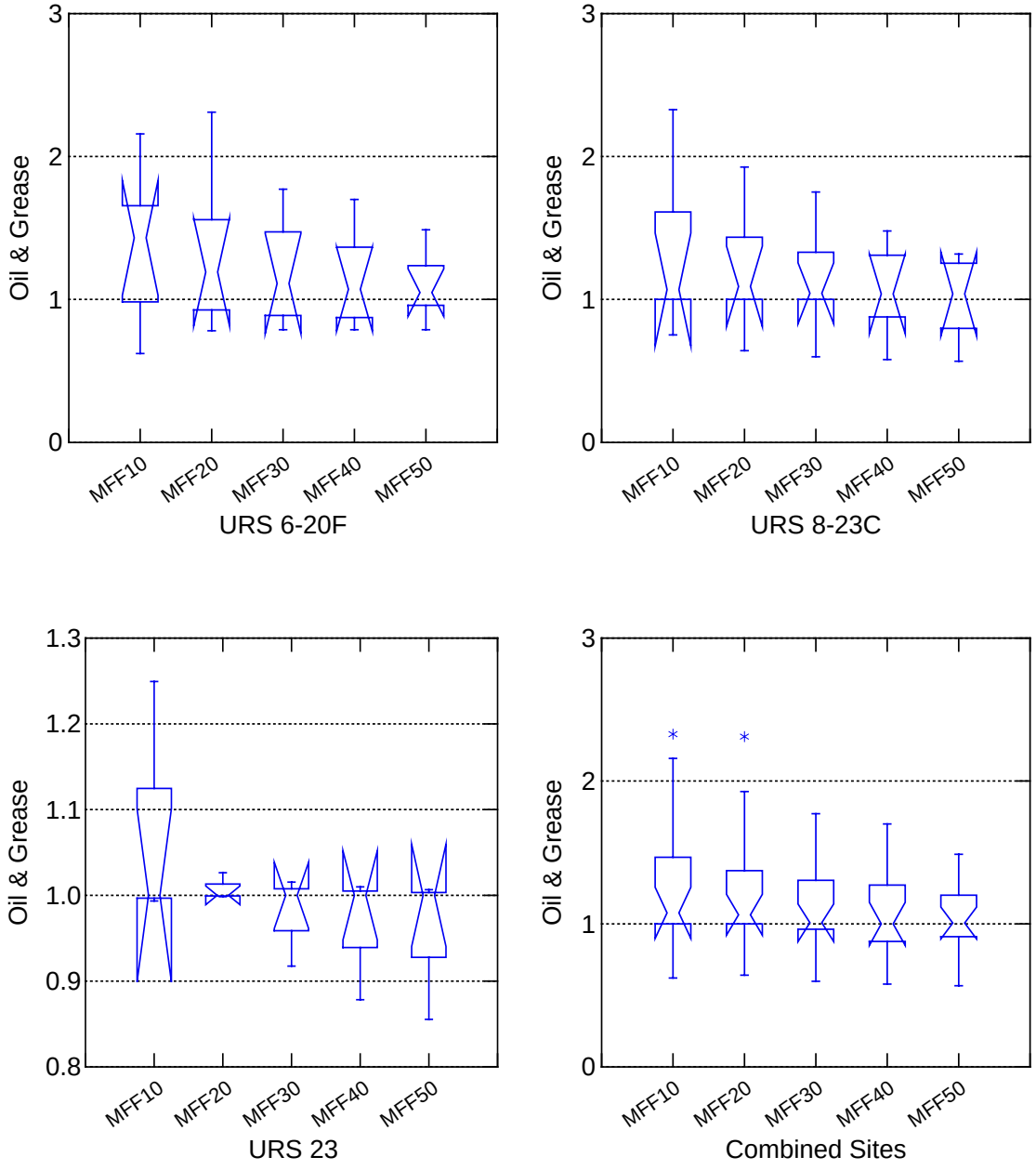


Figure D.5.9 MFF for Oil & Grease from URS

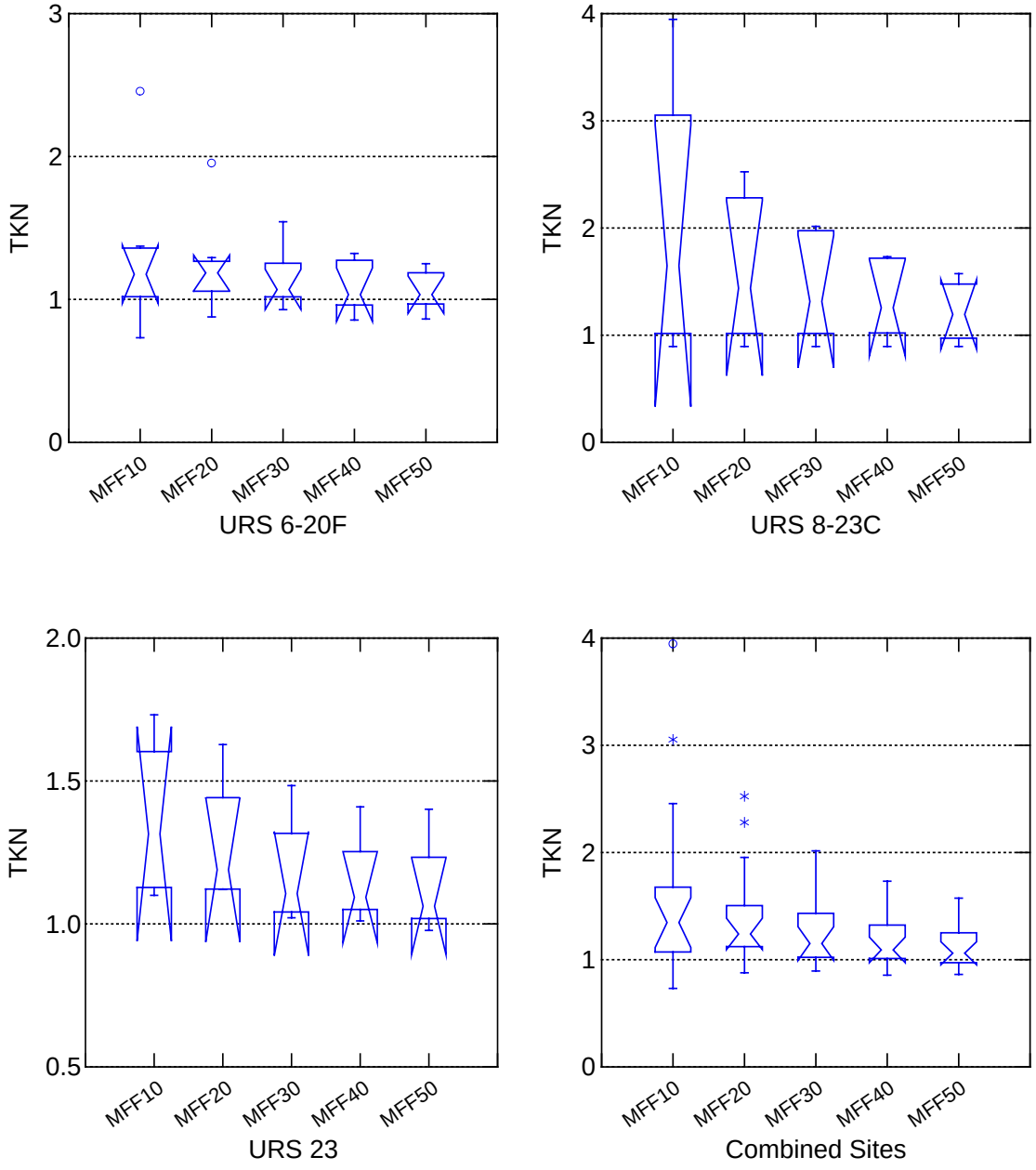


Figure D.5.10 MFF for TKN from URS

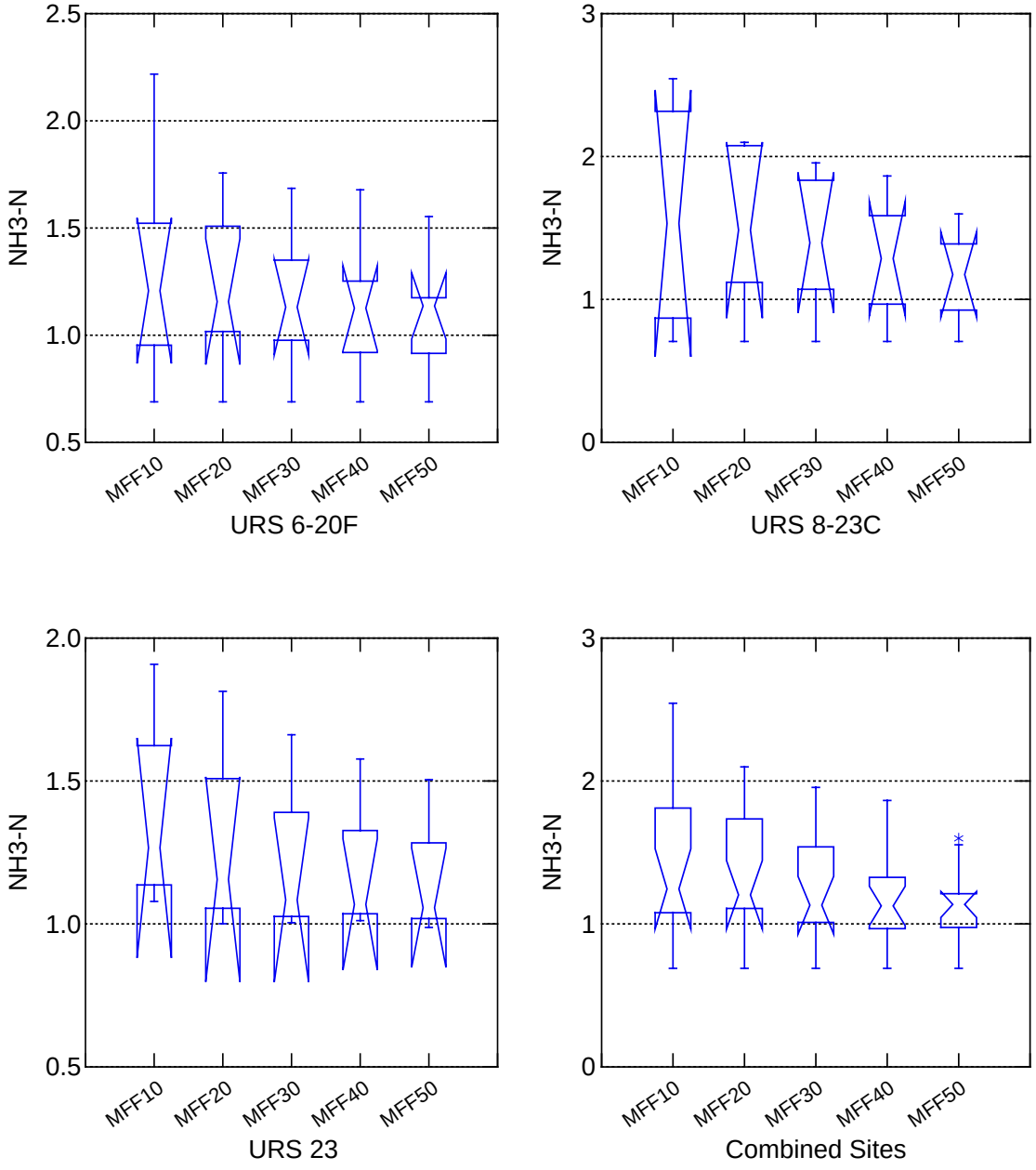


Figure D.5.11 MFF for NH_3-N from URS

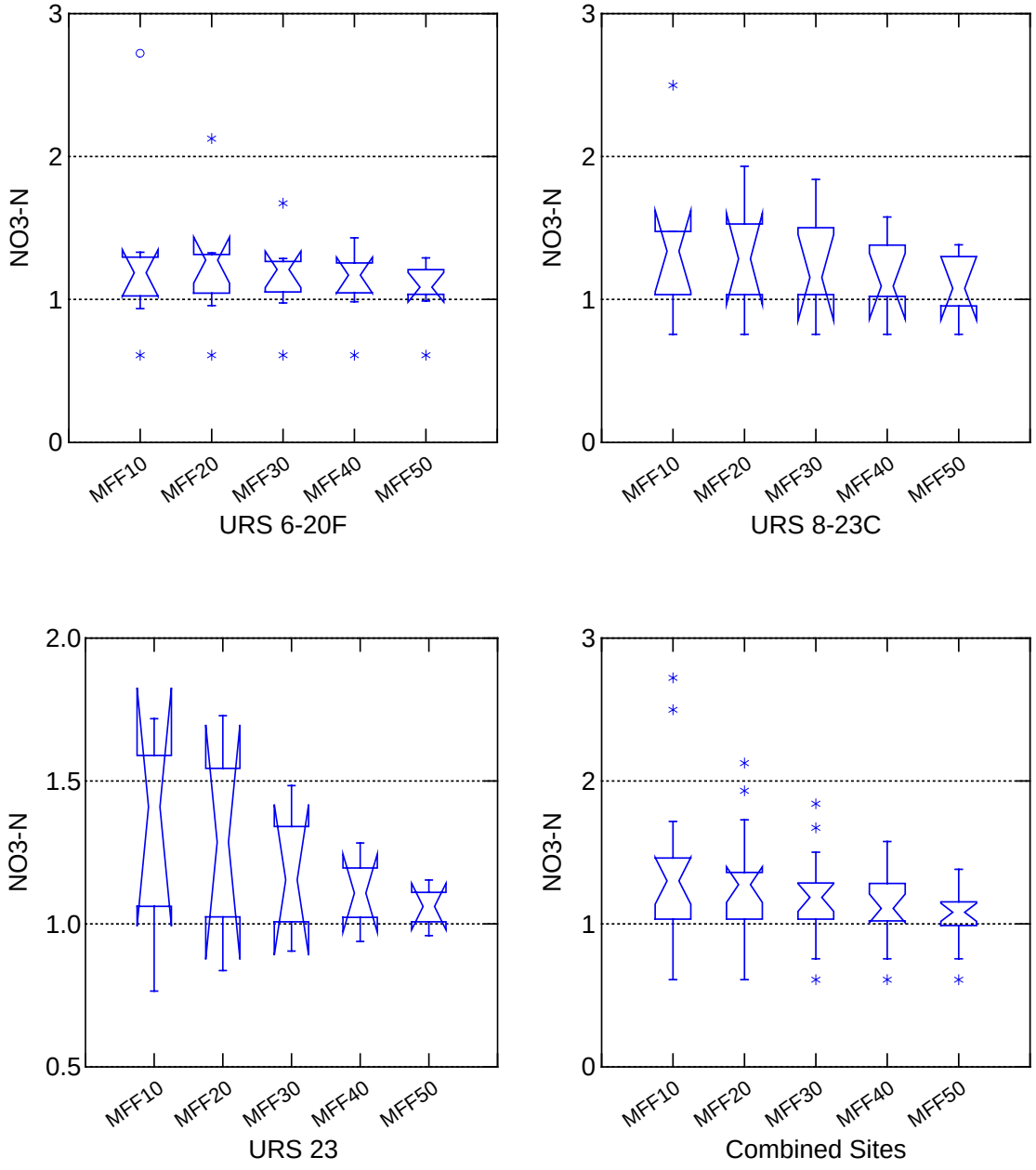


Figure D.5.12 MFF for NO_3-N from URS

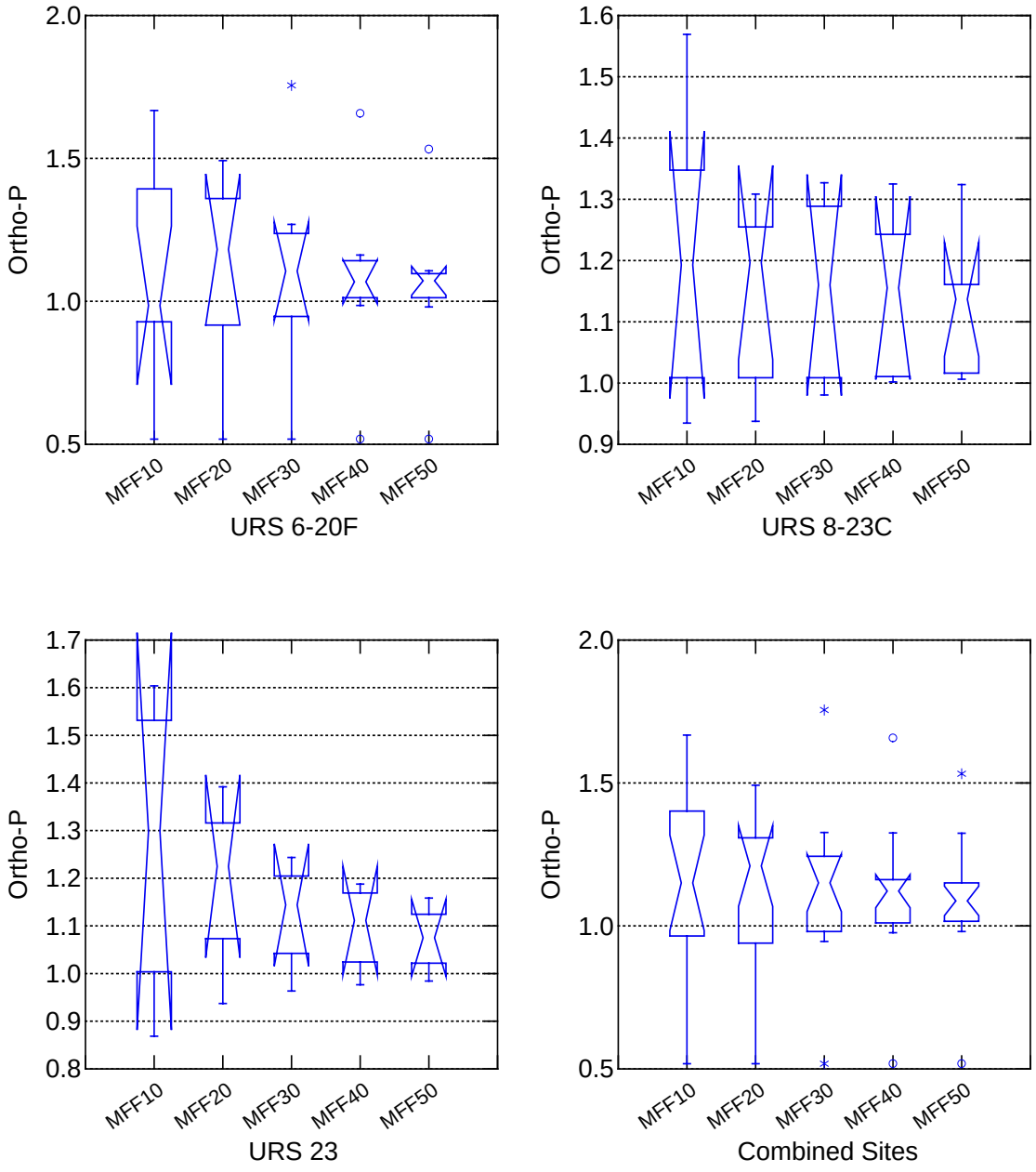


Figure D.5.13 MFF for Ortho-P from URS

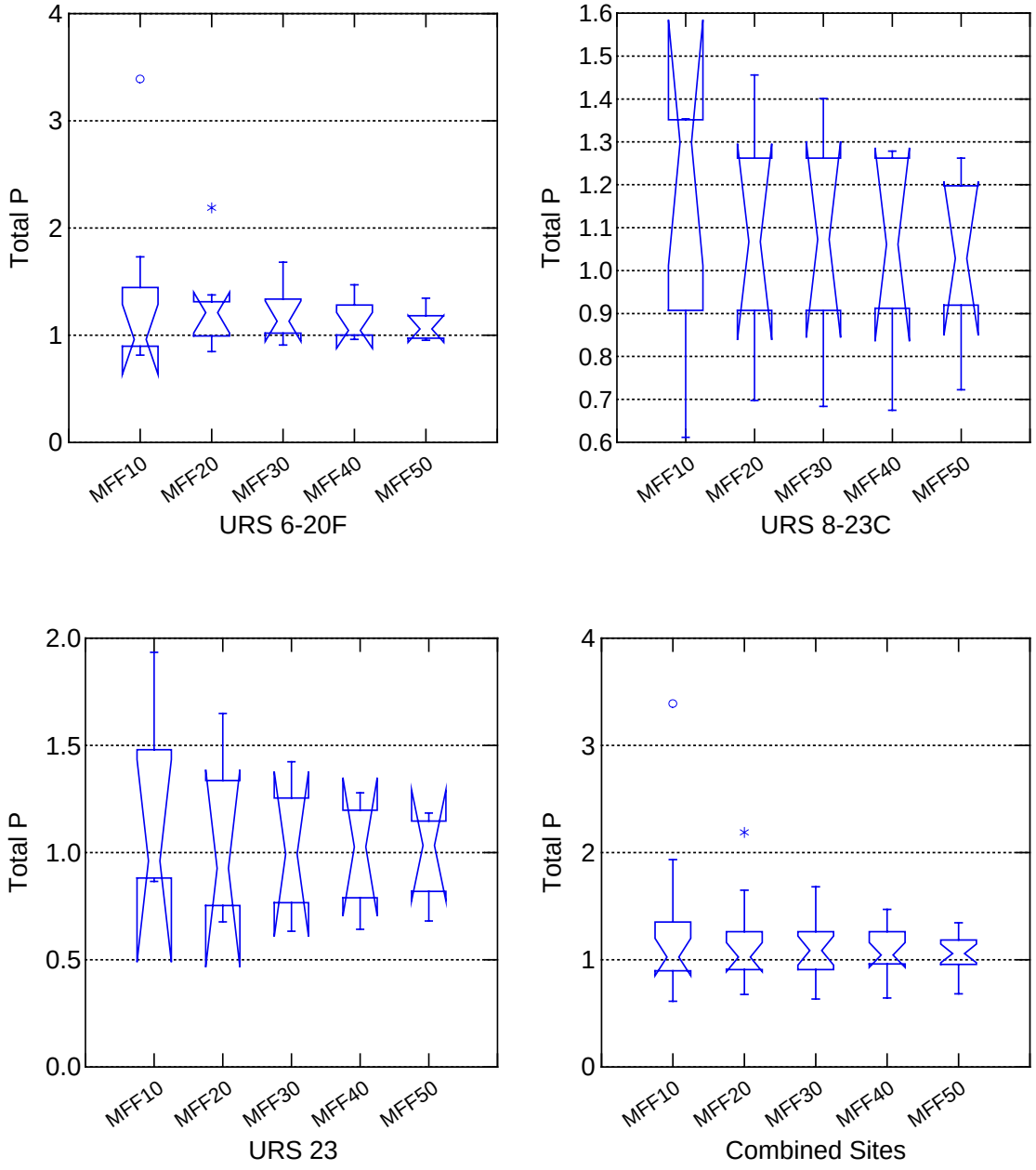


Figure D.5.14 MFF for Total P from URS

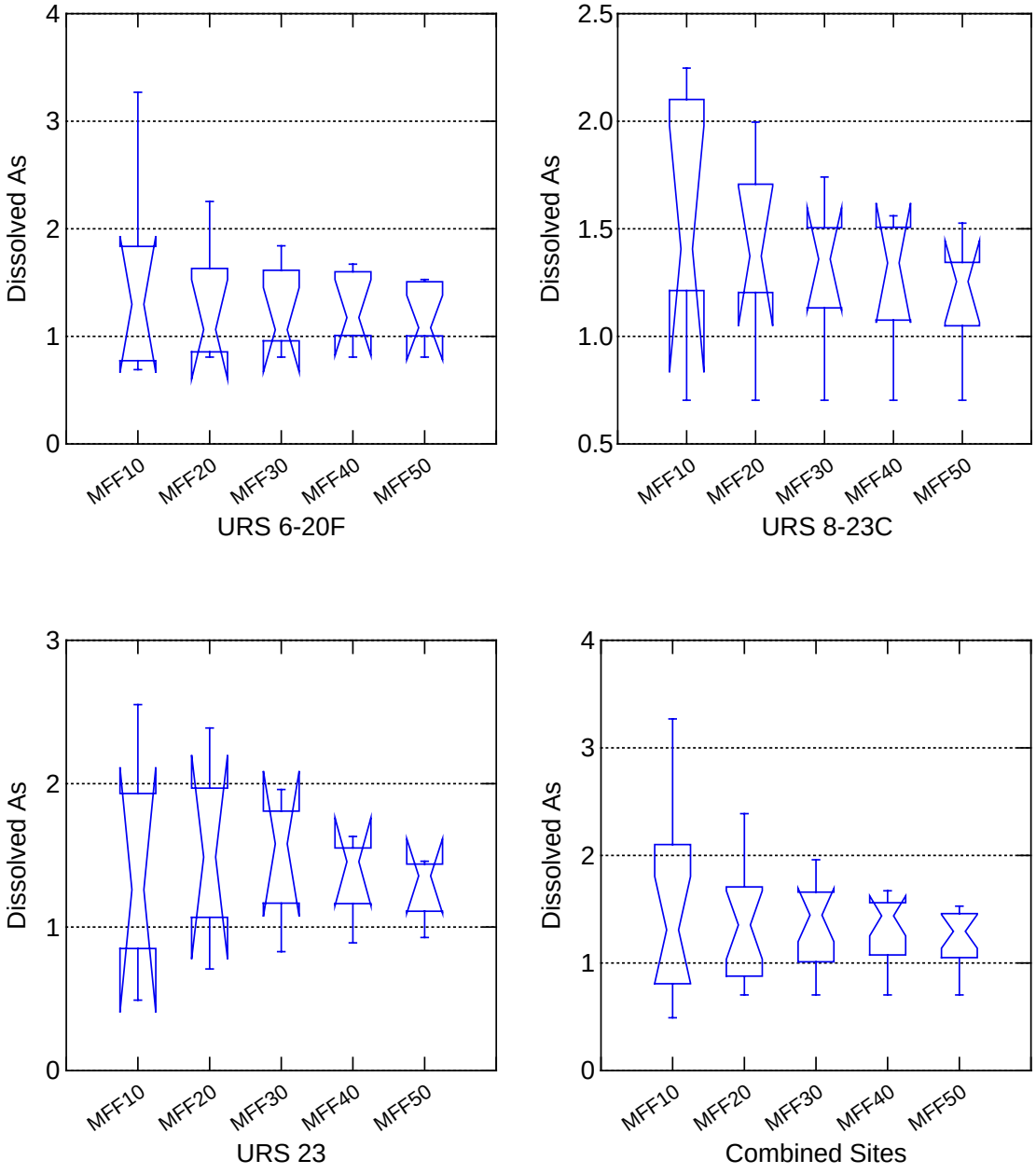


Figure D.5.15 MFF for Dissolved As from URS

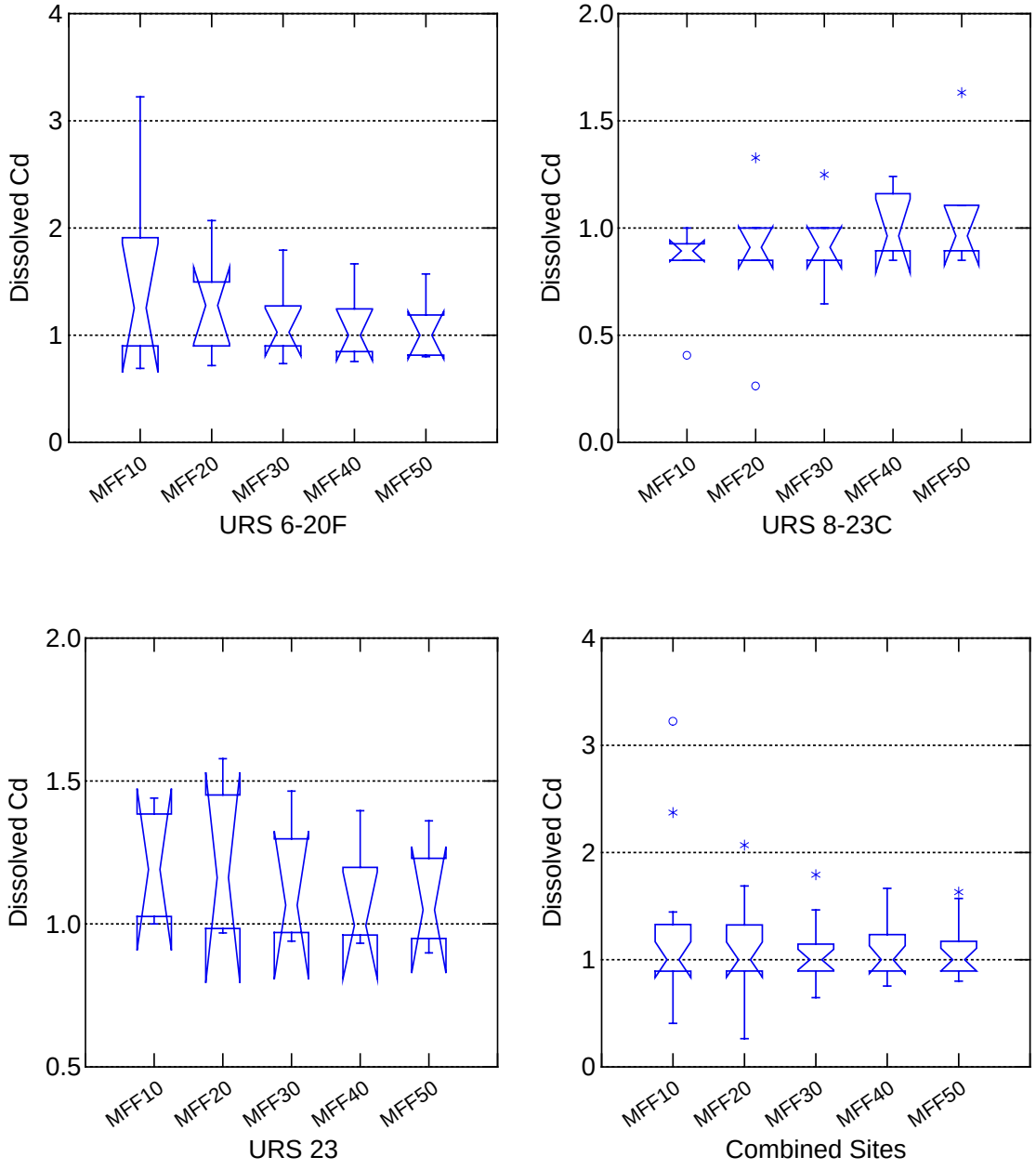


Figure D.5.16 MFF for Dissolved Cd from URS

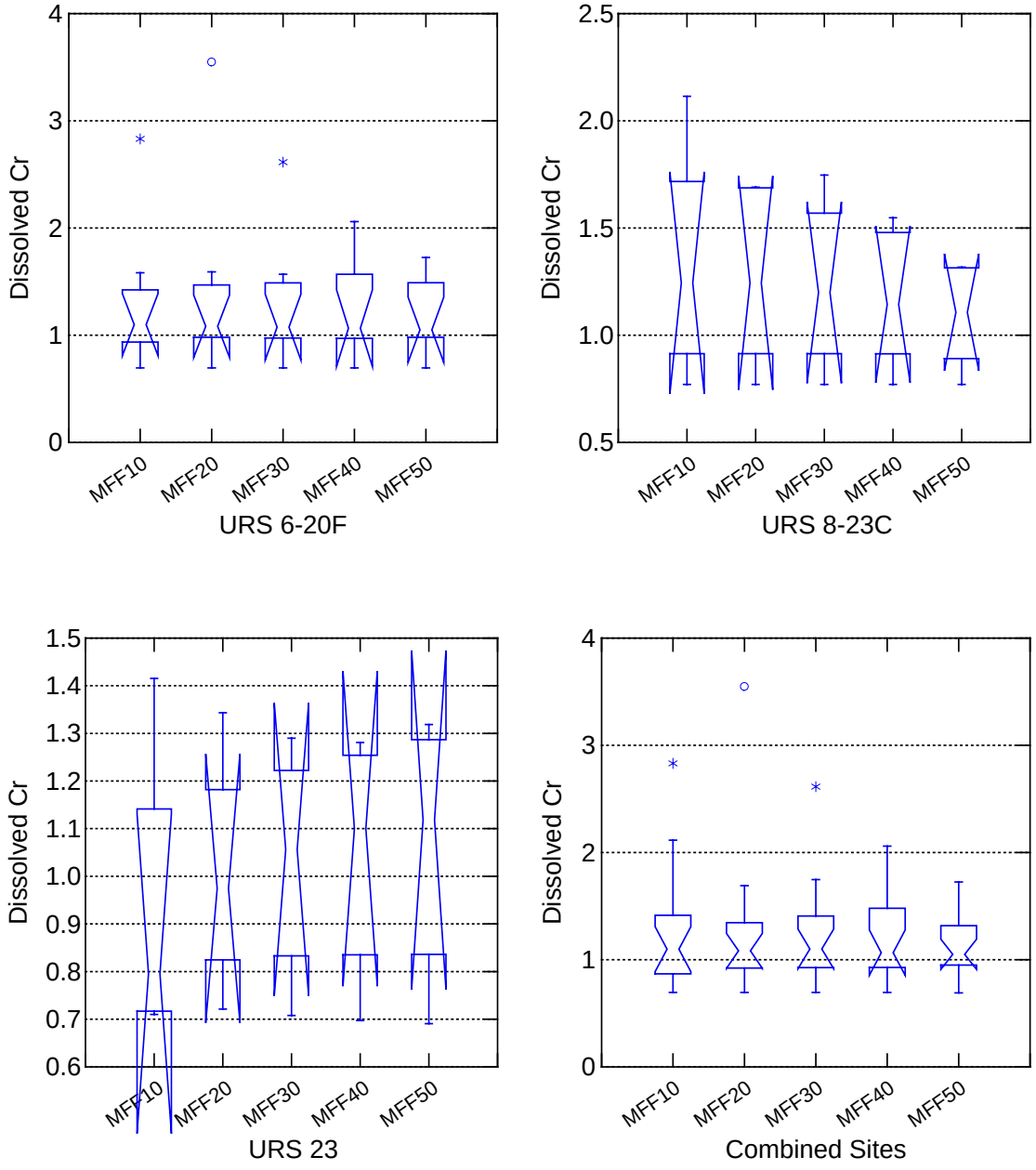


Figure D.5.17 MFF for Dissolved Cr from URS

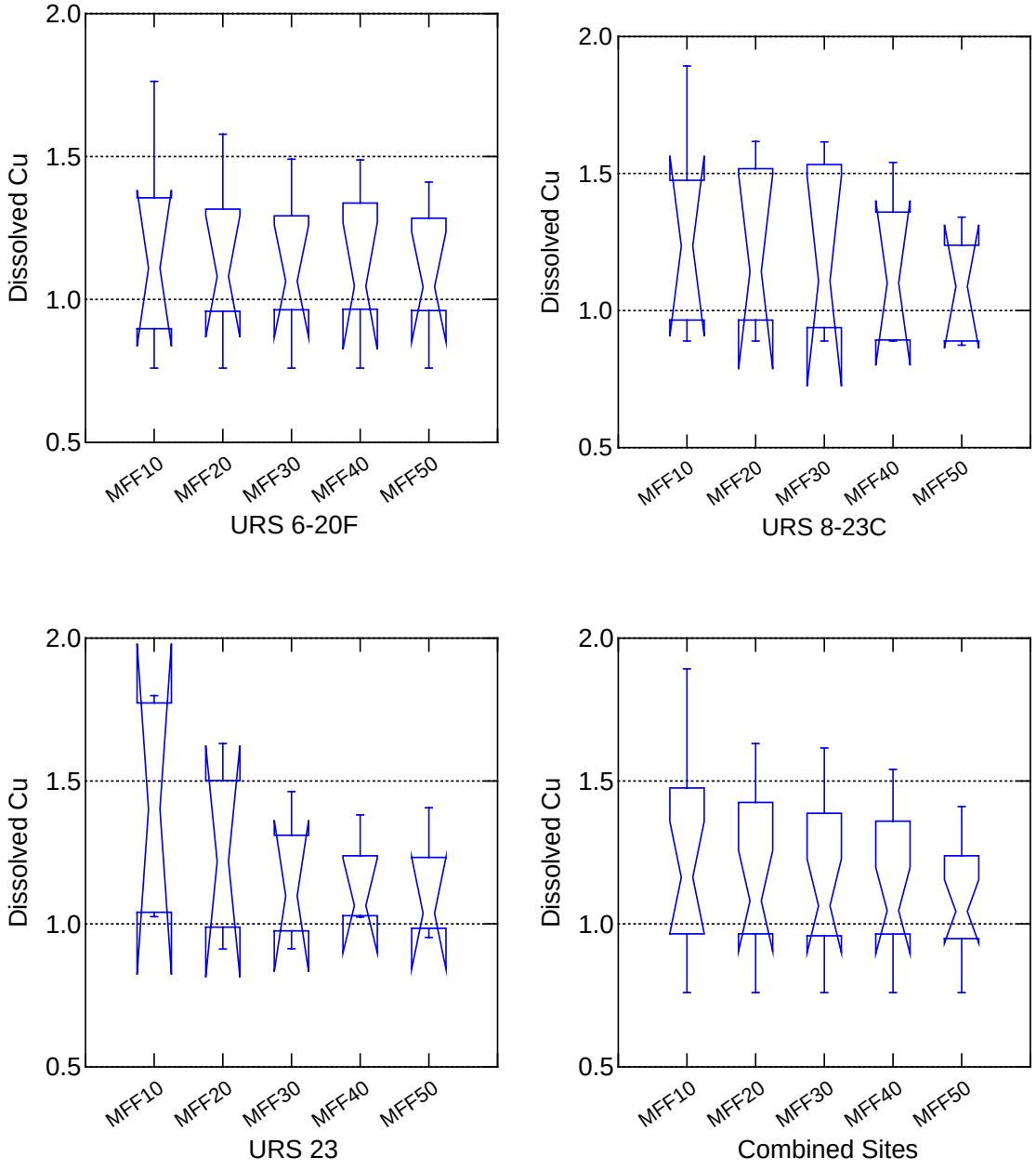


Figure D.5.18 MFF for Dissolved Cu from URS

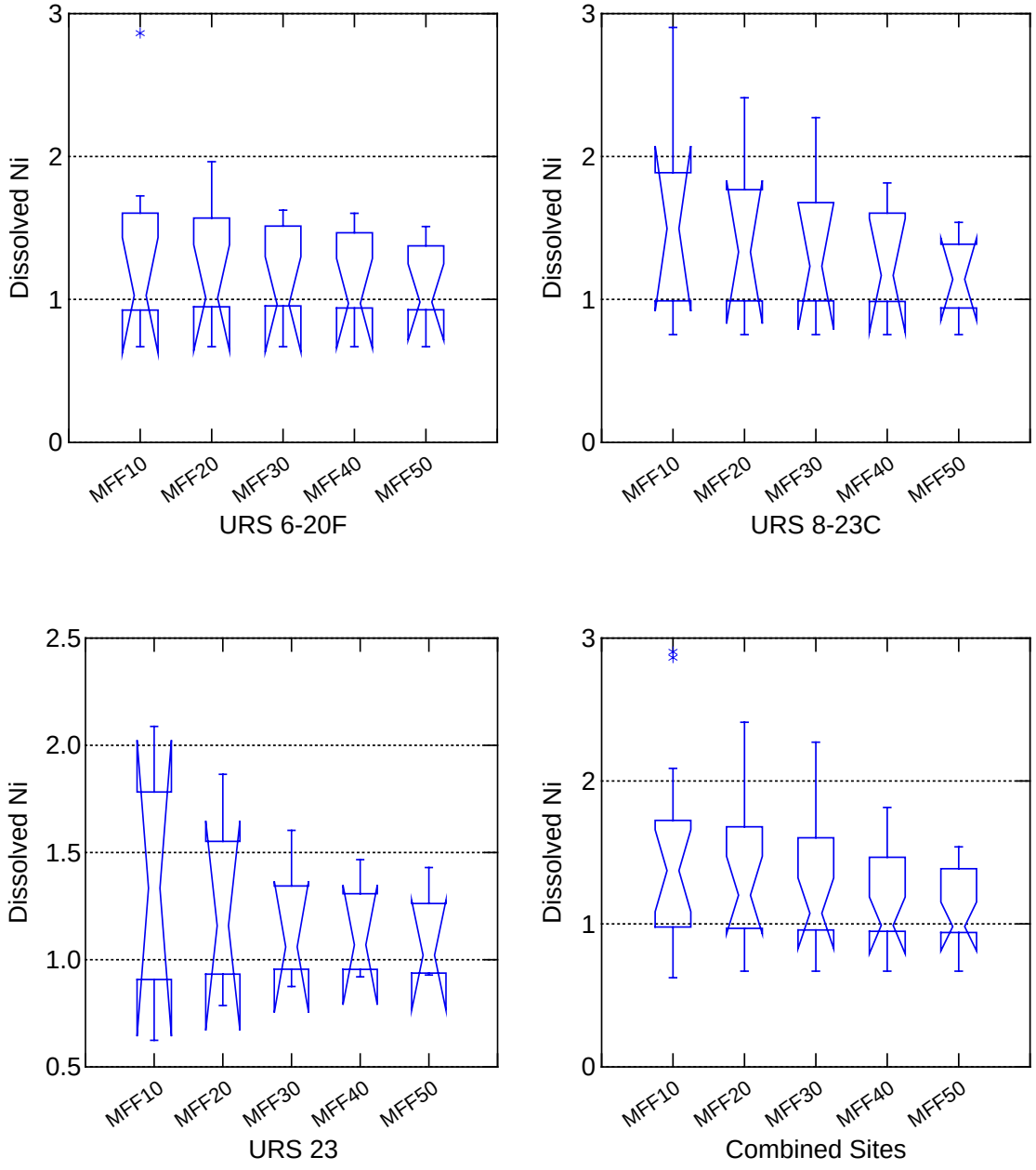


Figure D.5.19 MFF for Dissolved Ni from URS

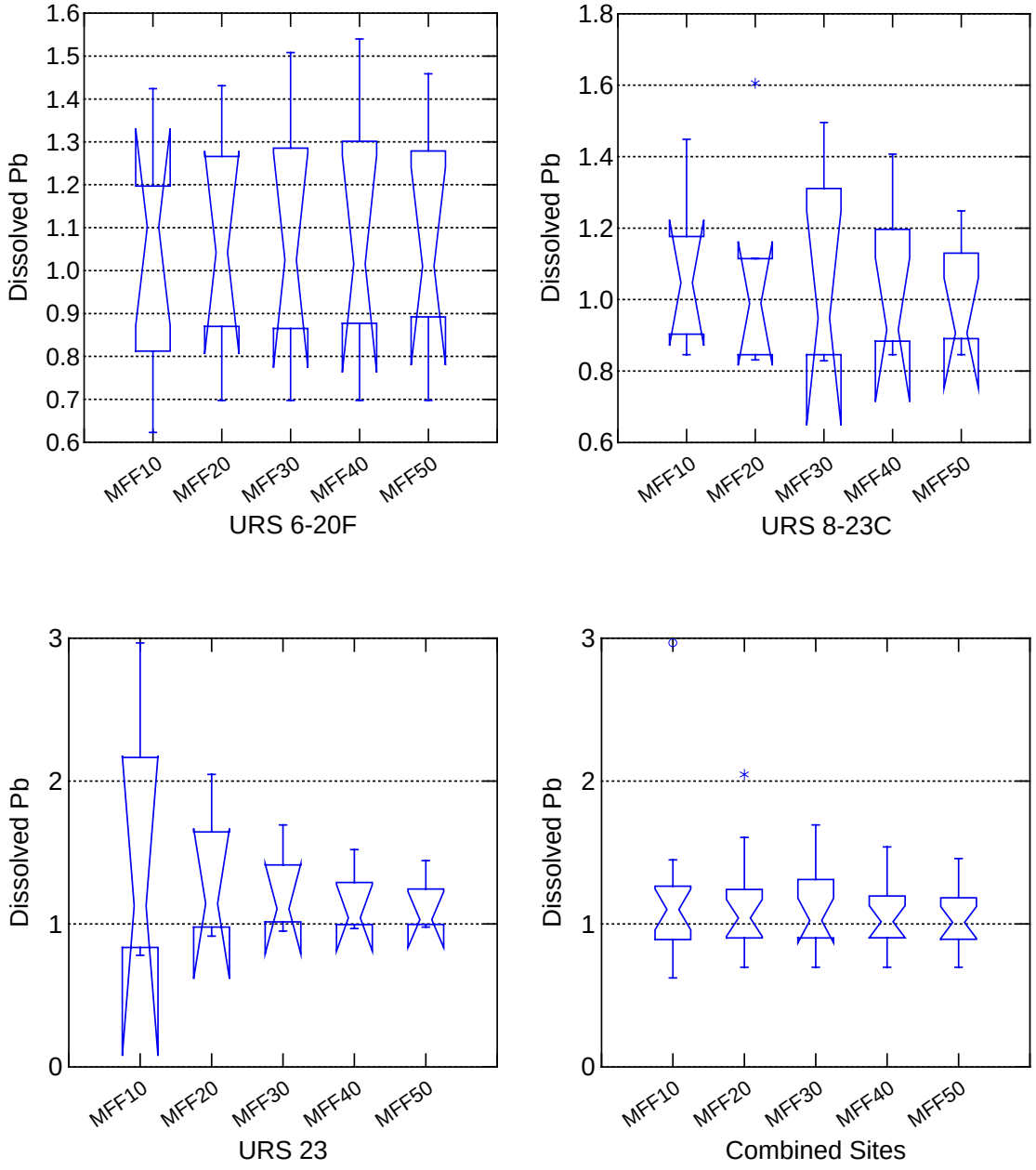


Figure D.5.20 MFF for Dissolved Pb from URS

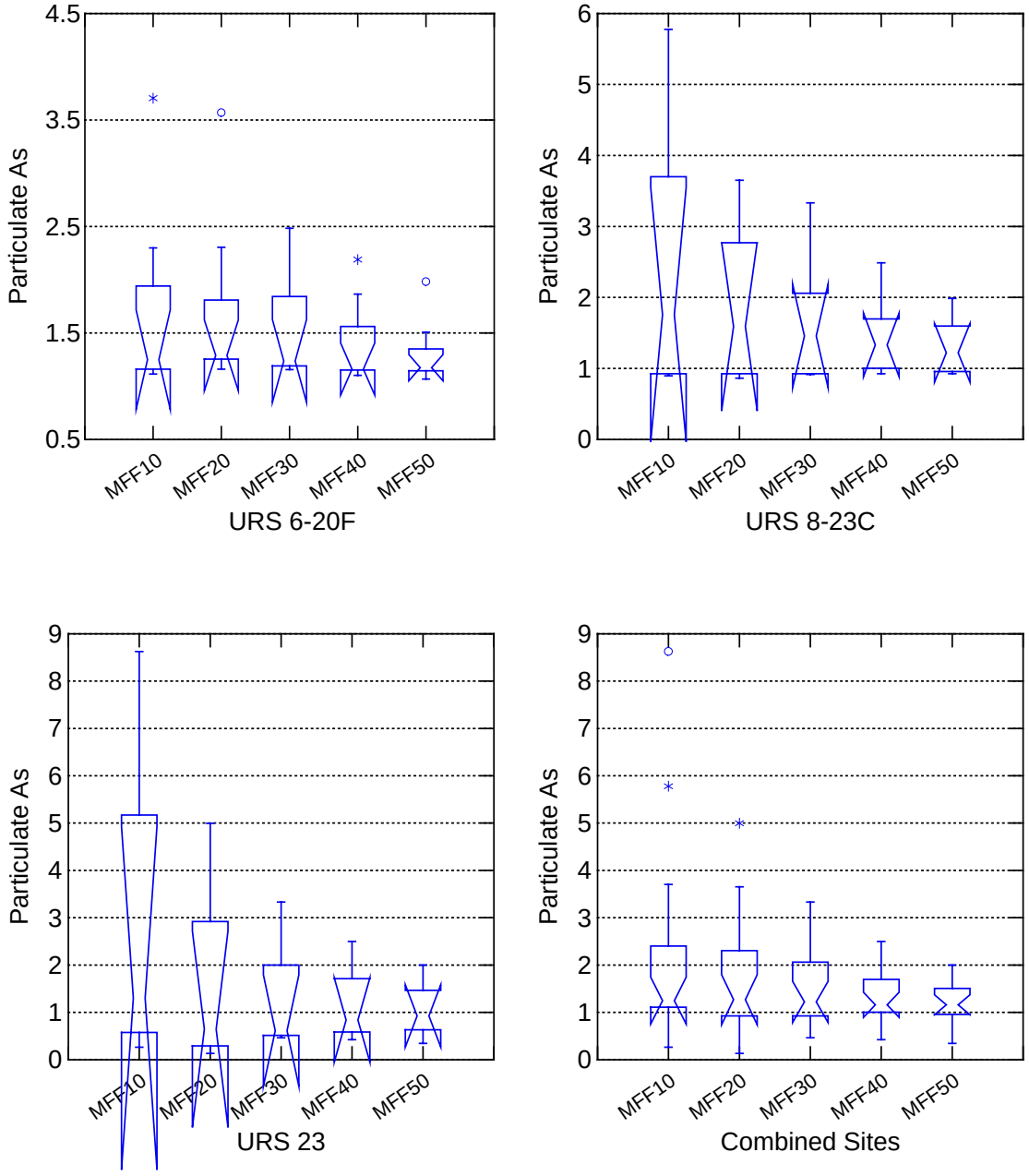


Figure D.5.21 MFF for Particulate As from URS

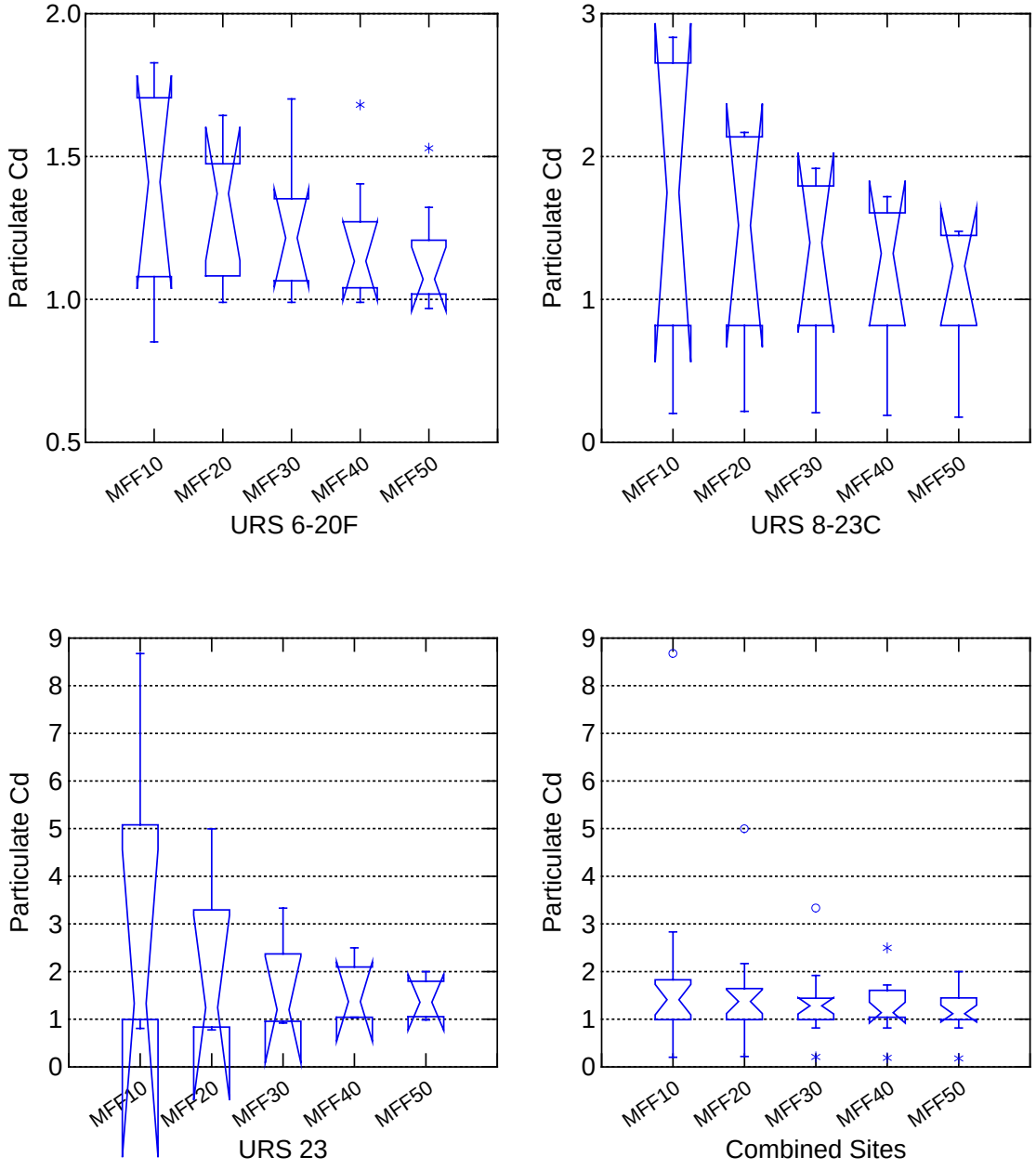


Figure D.5.22 MFF for Particulate Cd from URS

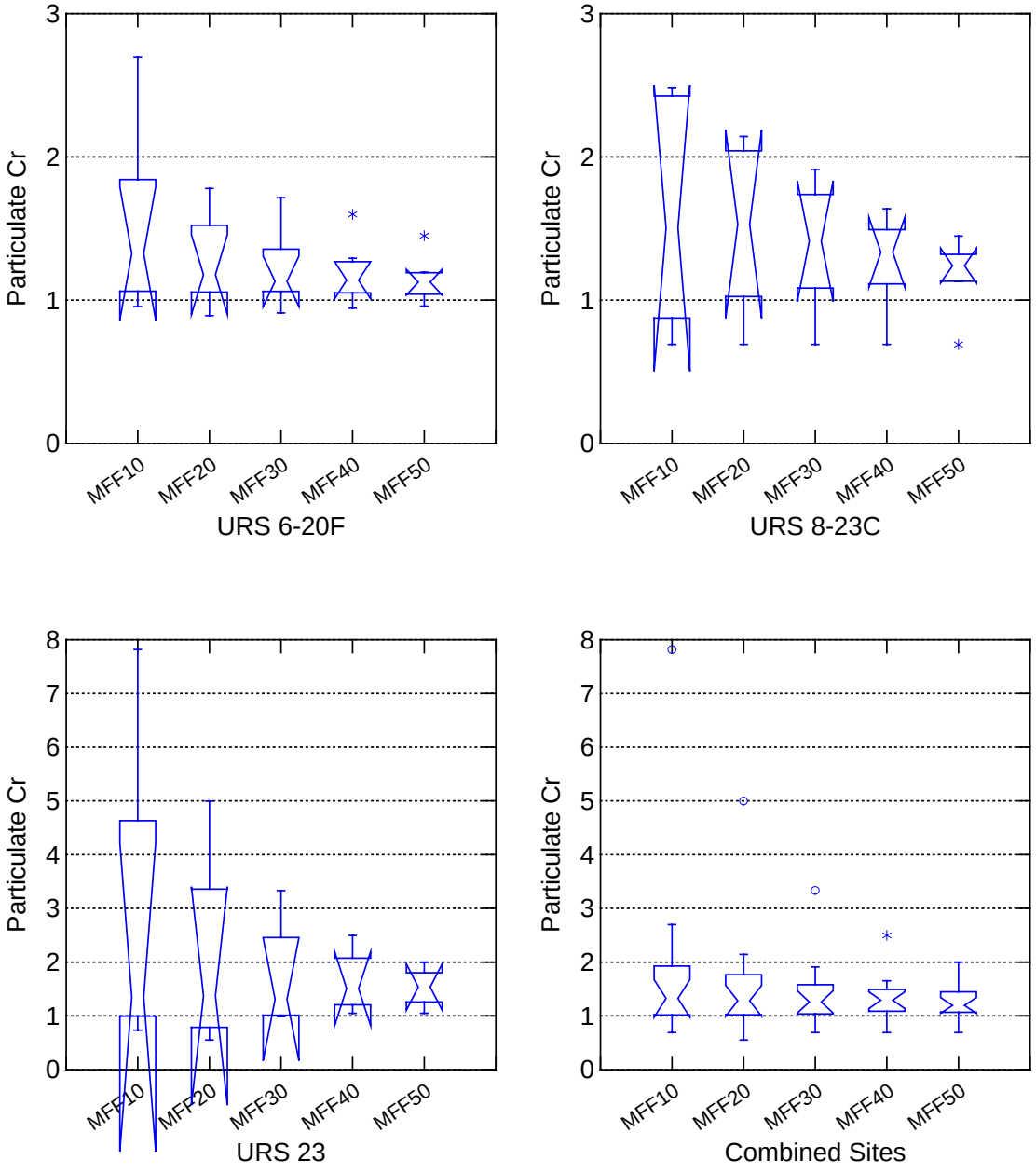


Figure D.5.23 MFF for Particulate Cr from URS

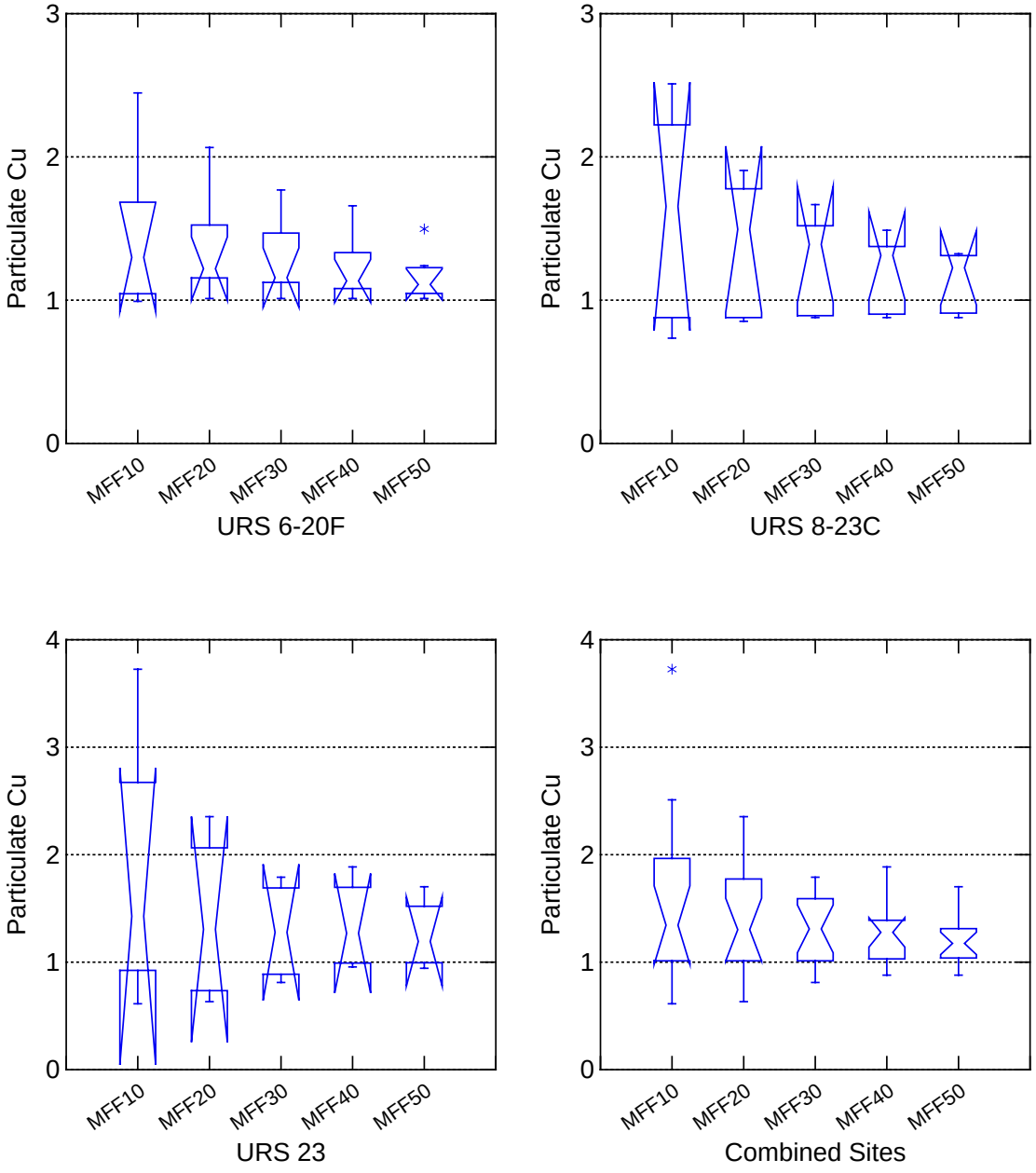


Figure D.5.24 MFF for Particulate Cu from URS

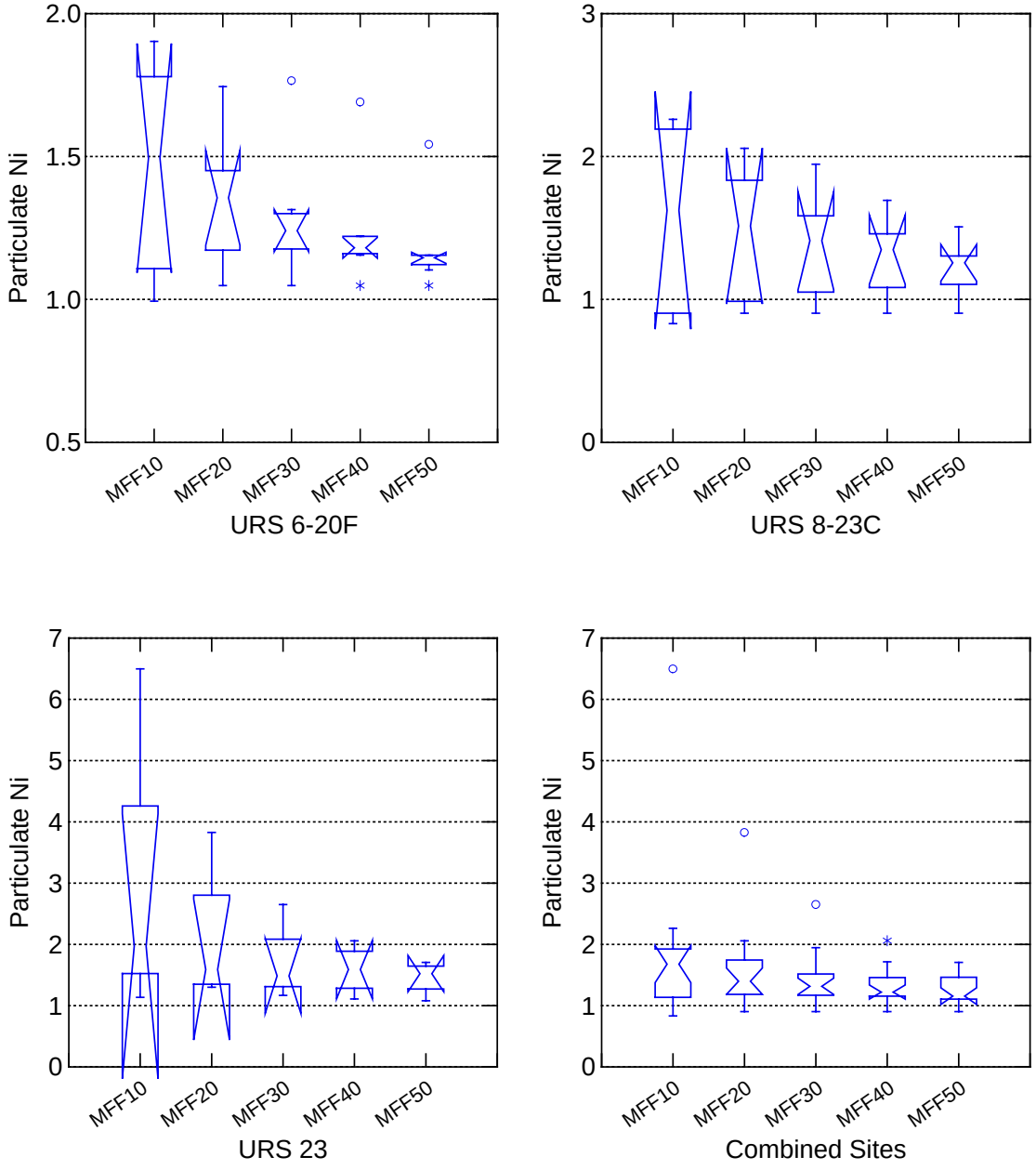


Figure D.5.25 MFF for Particulate Ni from URS

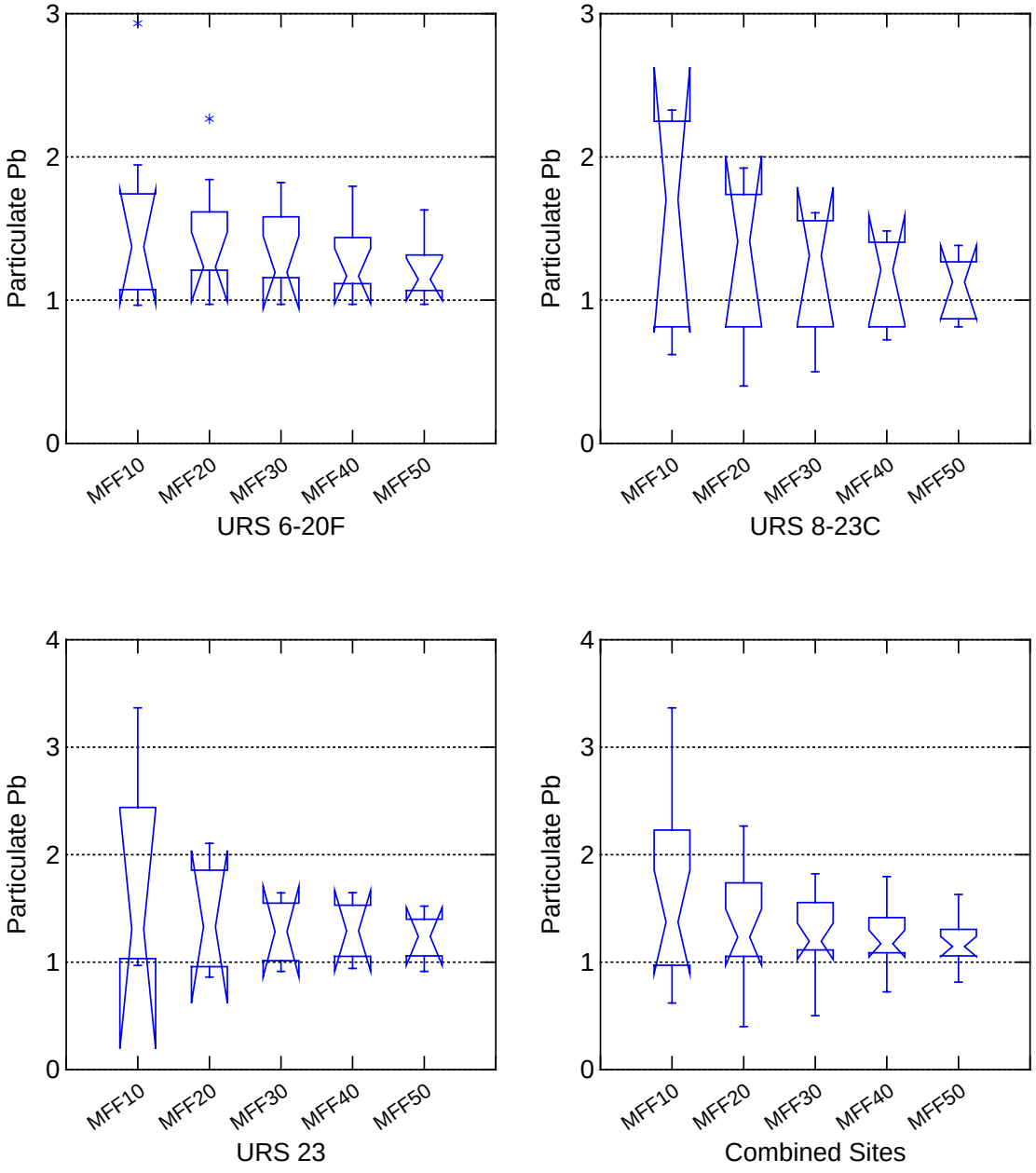


Figure D.5.26 MFF for Particulate Pb from URS

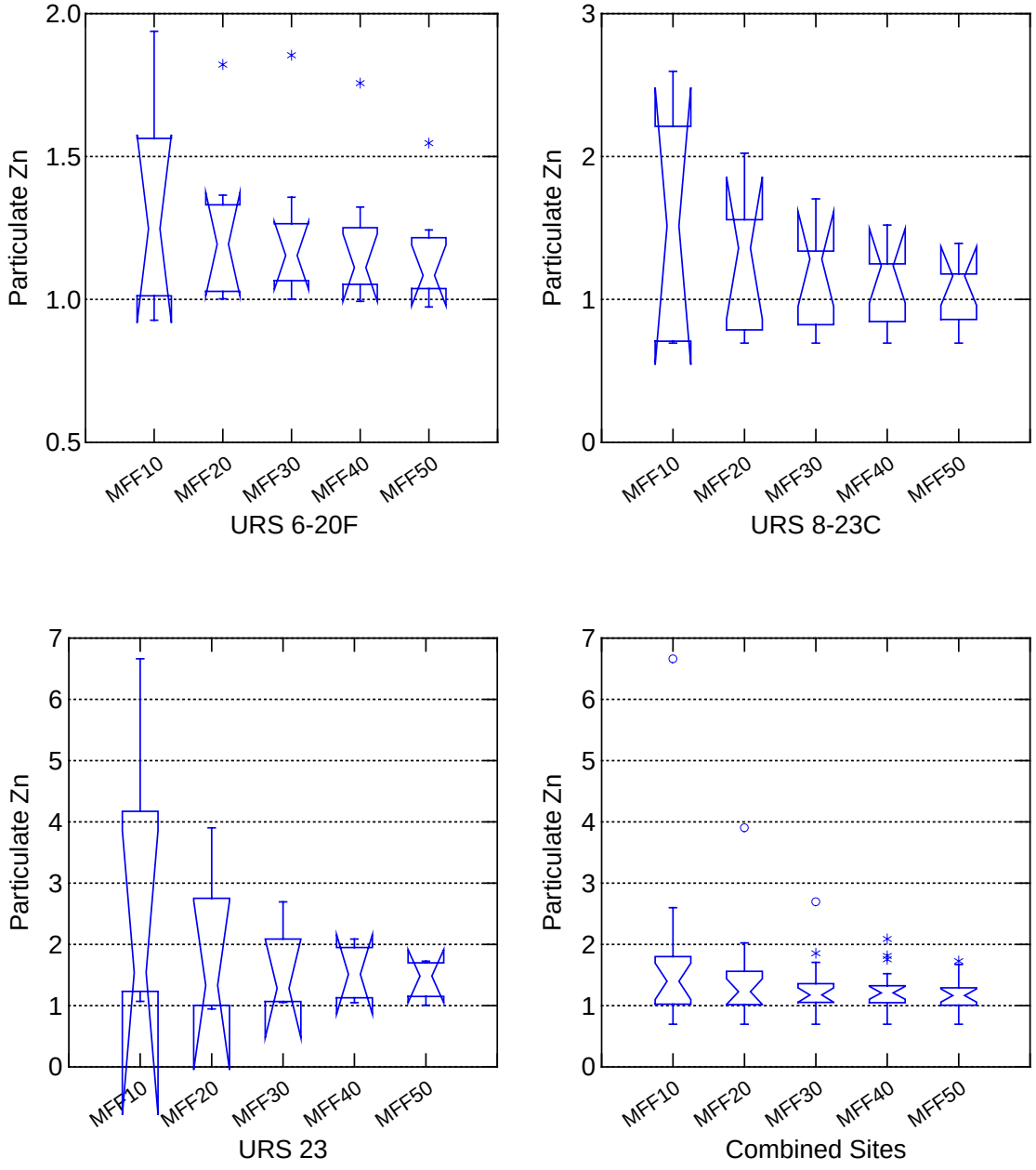


Figure D.5.27 MFF for Particulate Zn from URS

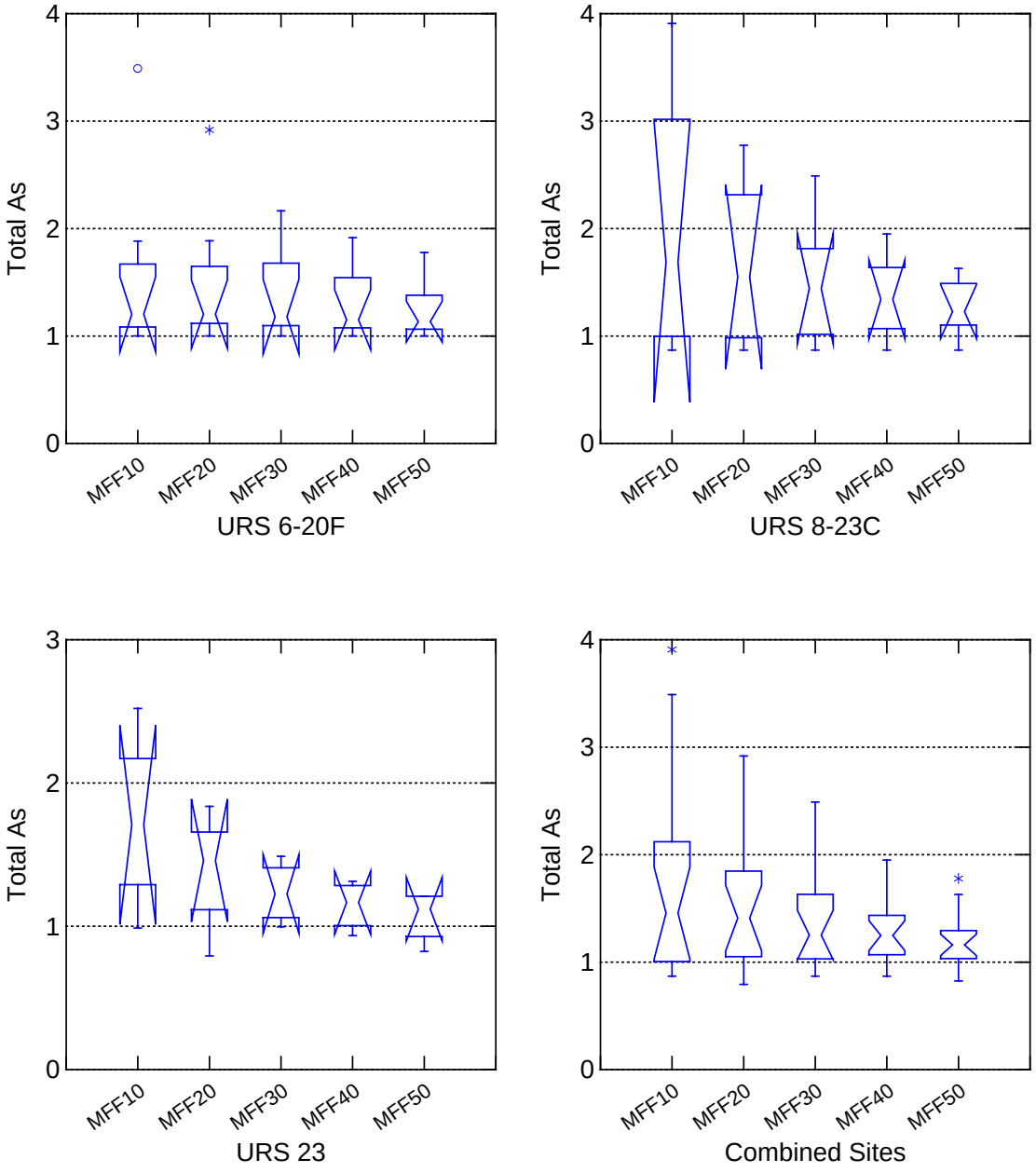


Figure D.5.28 MFF for Total As from URS

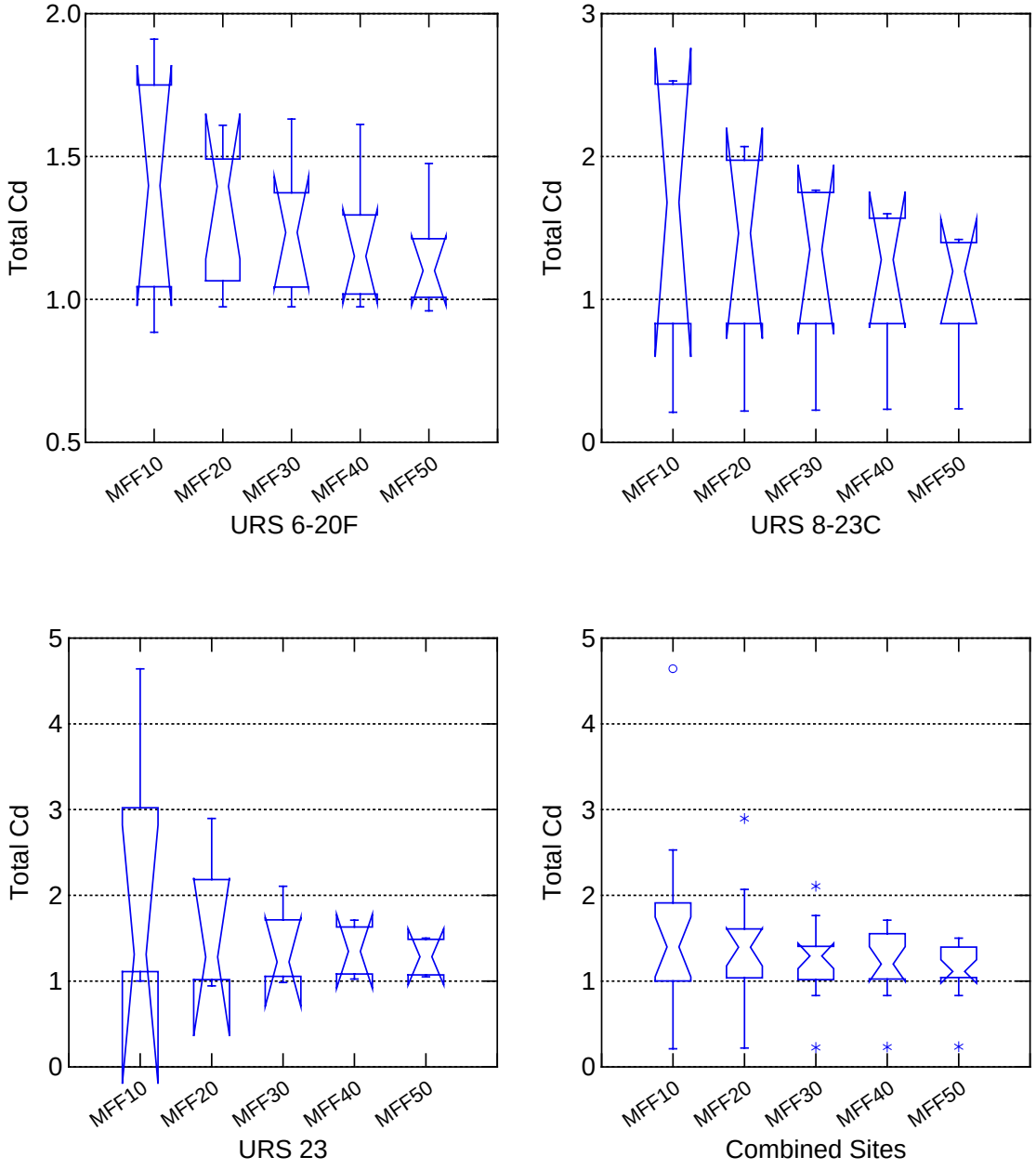


Figure D.5.29 MFF for Total Cd from URS

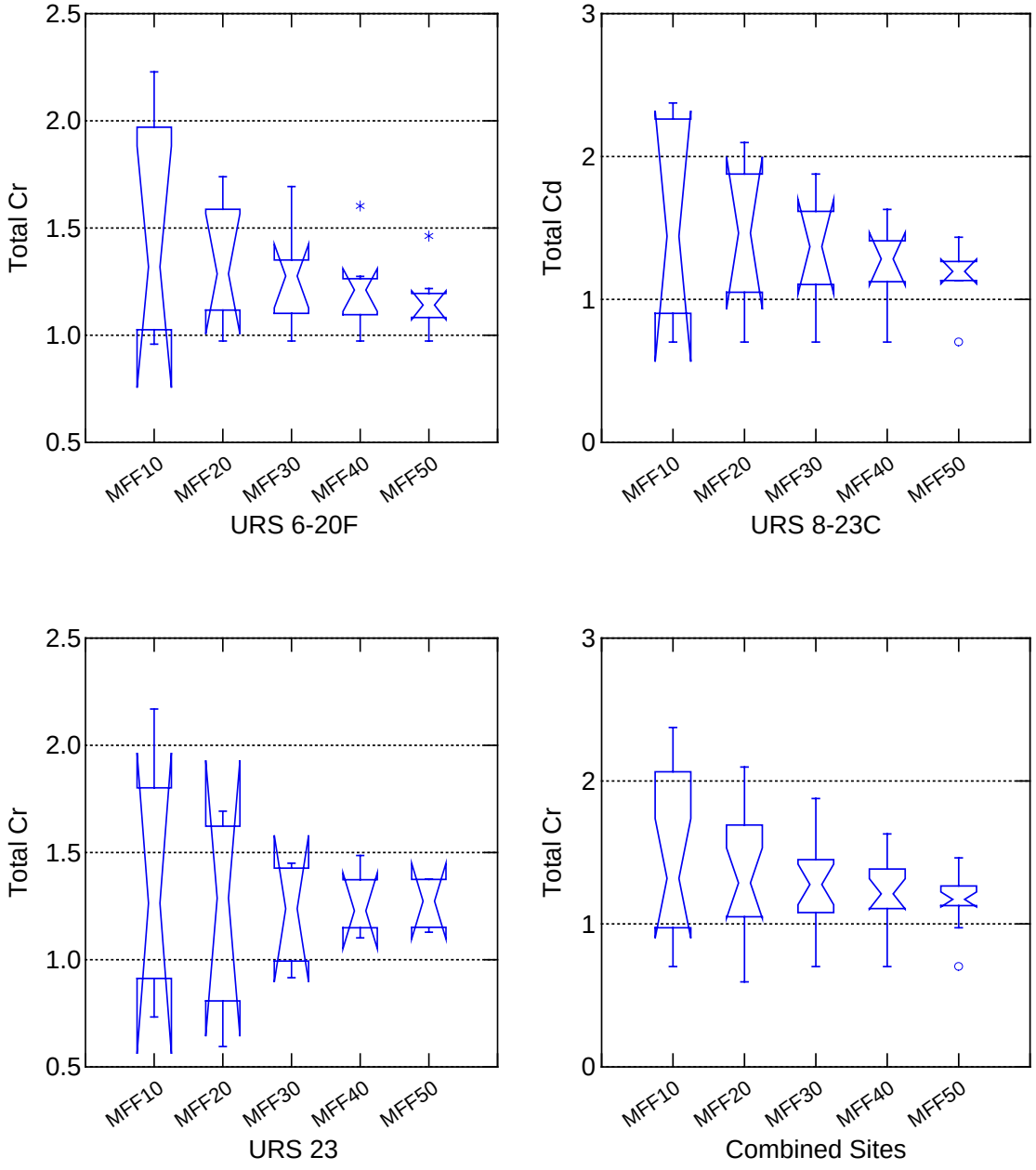


Figure D.5.30 MFF for Total Cr from URS

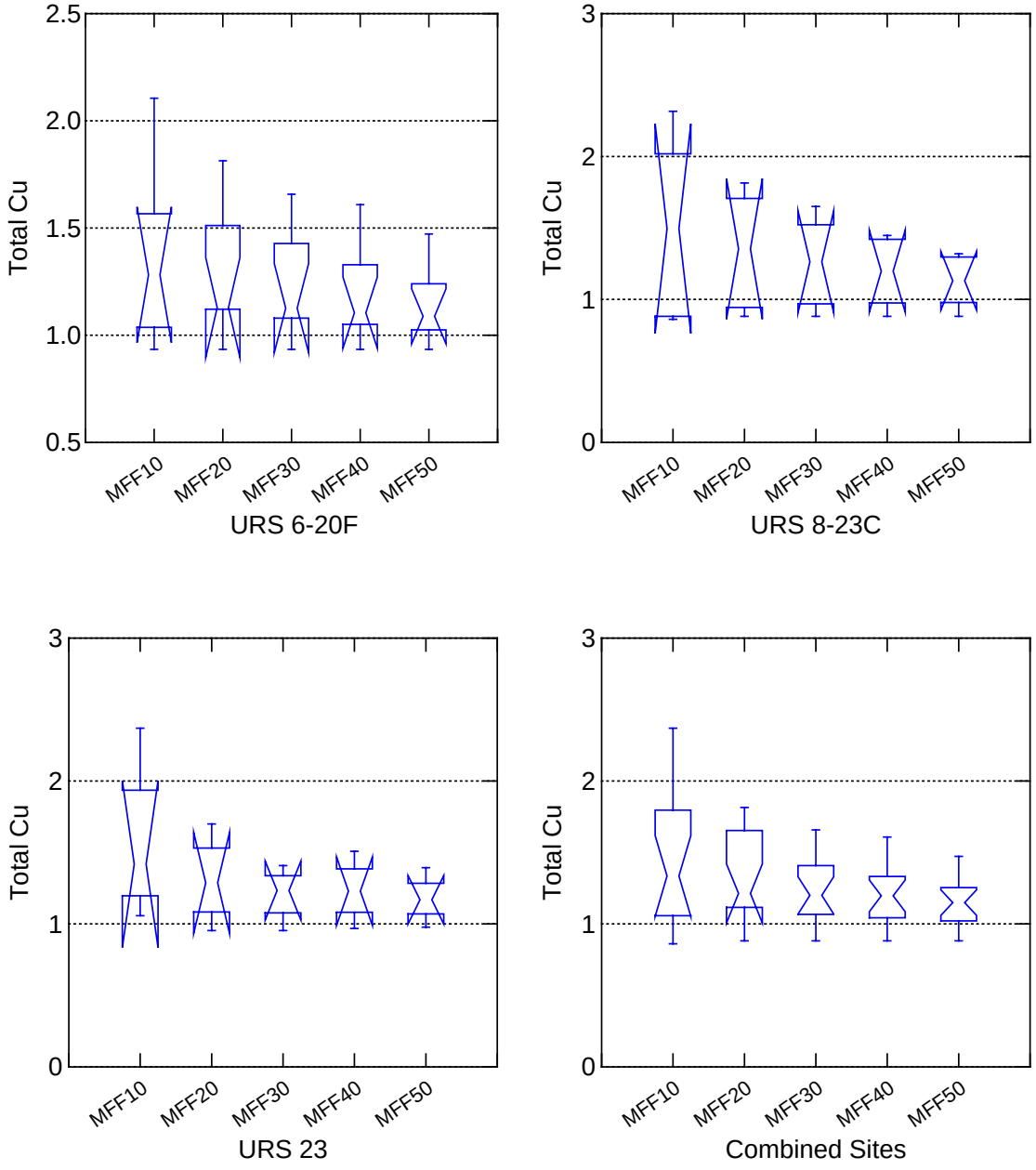


Figure D.5.31 MFF for Total Cu from URS

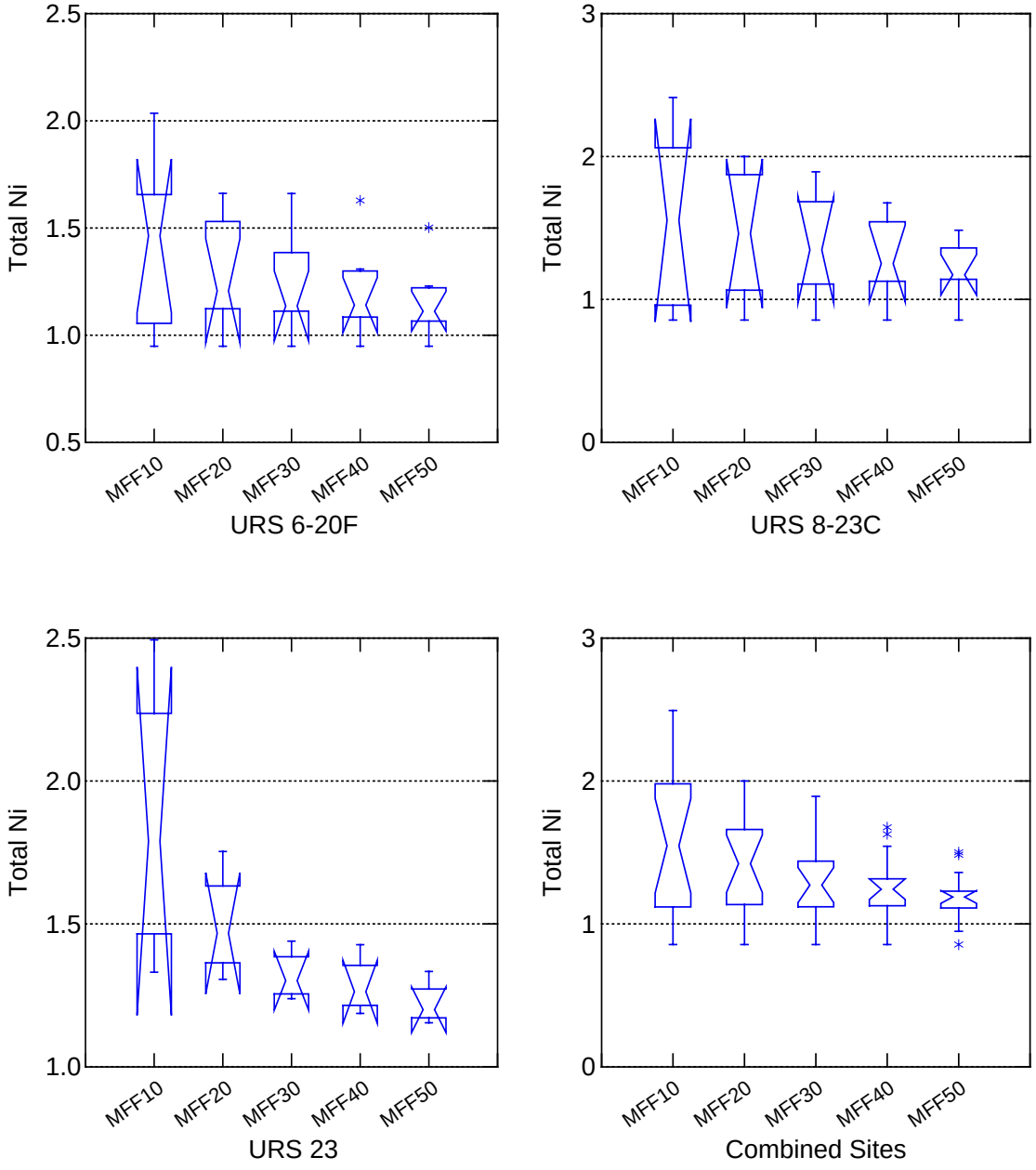


Figure D.5.32 MFF for Total Ni from URS

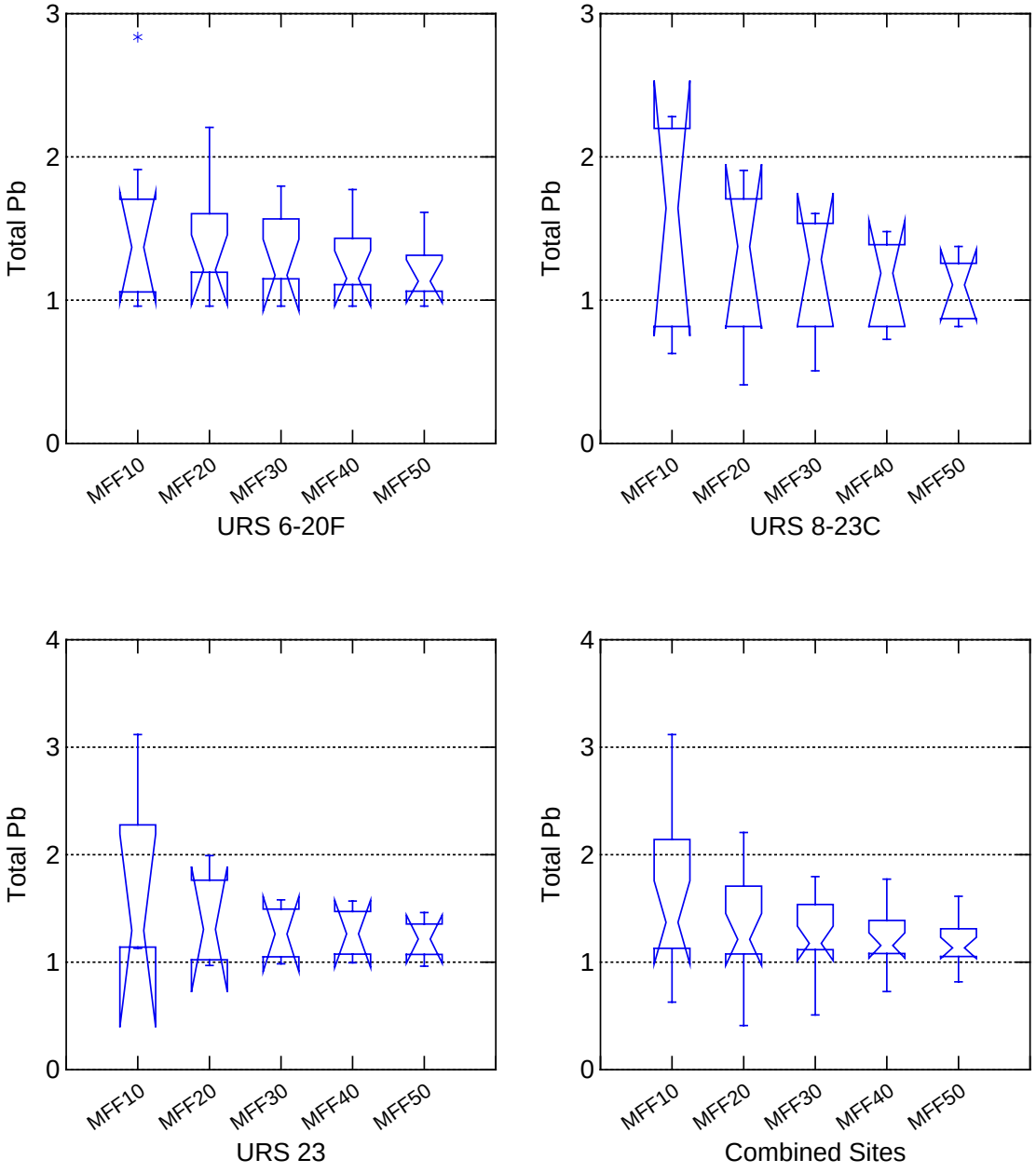


Figure D.5.33 MFF for Total Pb from URS

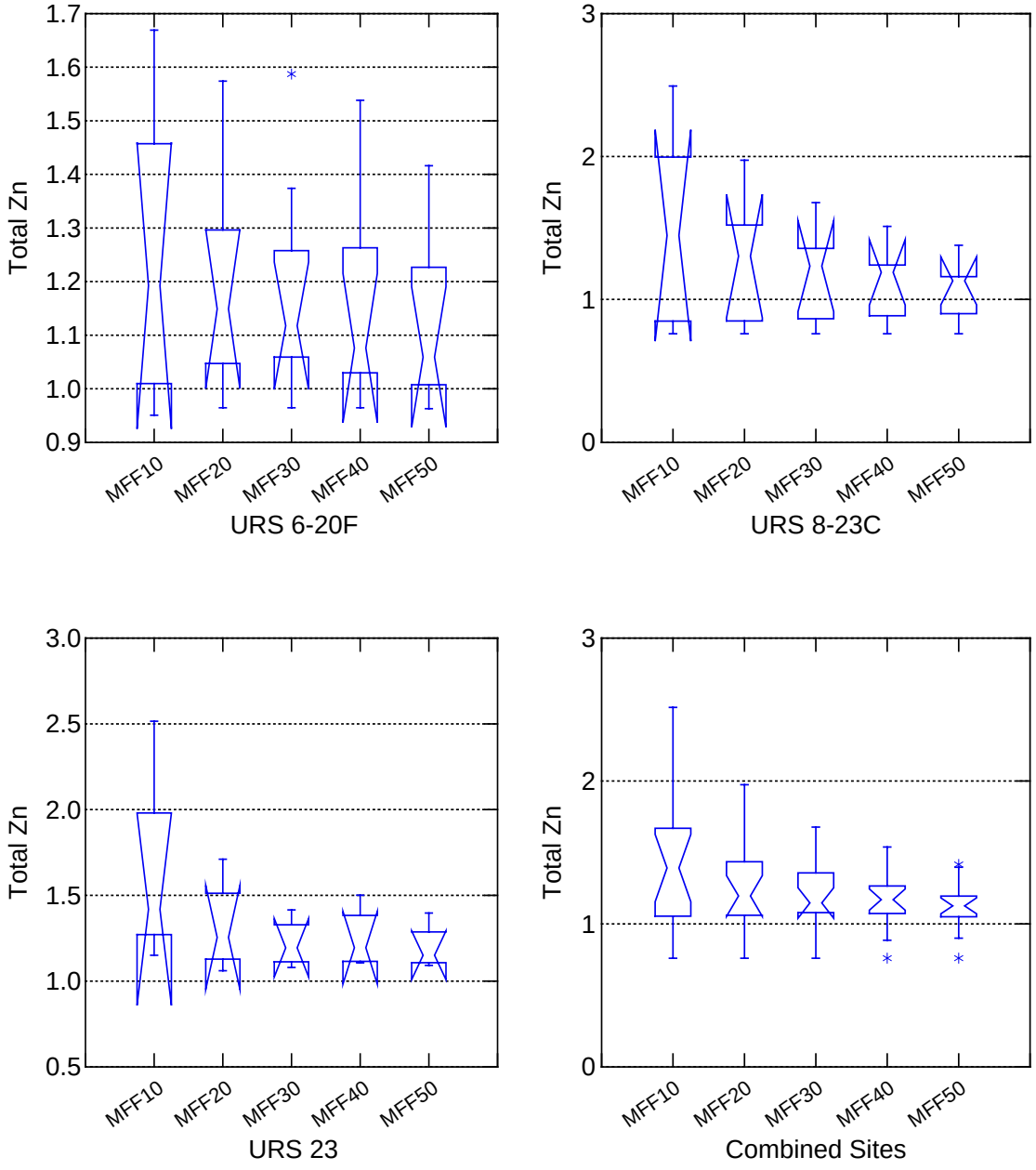
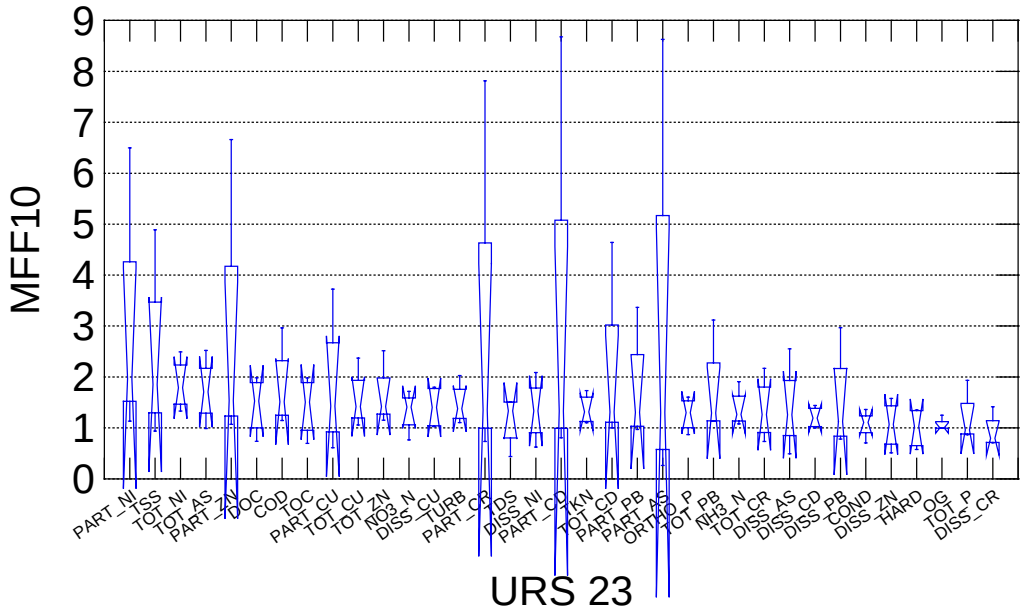


Figure D.5.34 MFF for Total Zn from URS



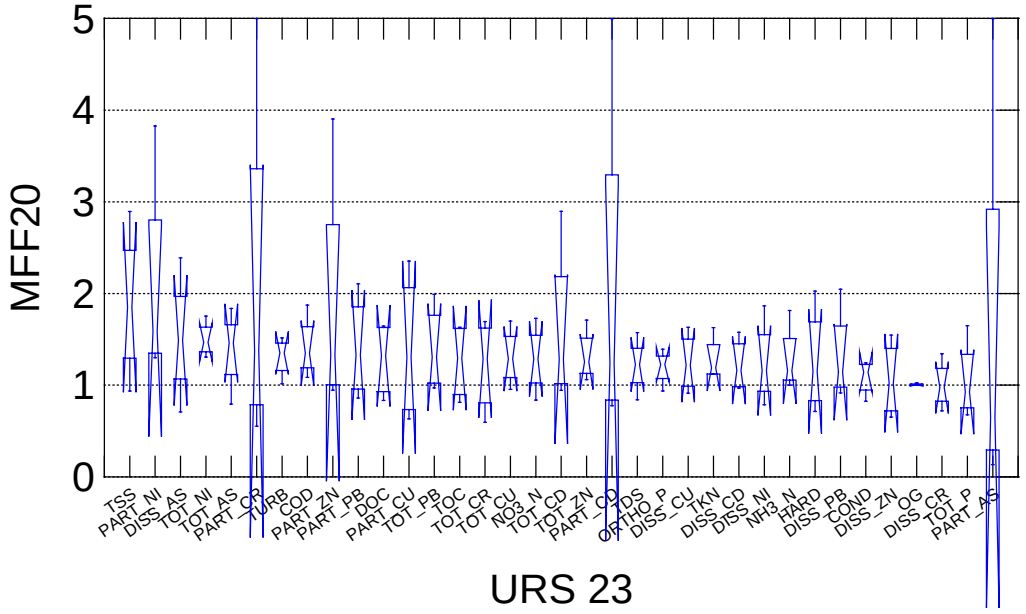
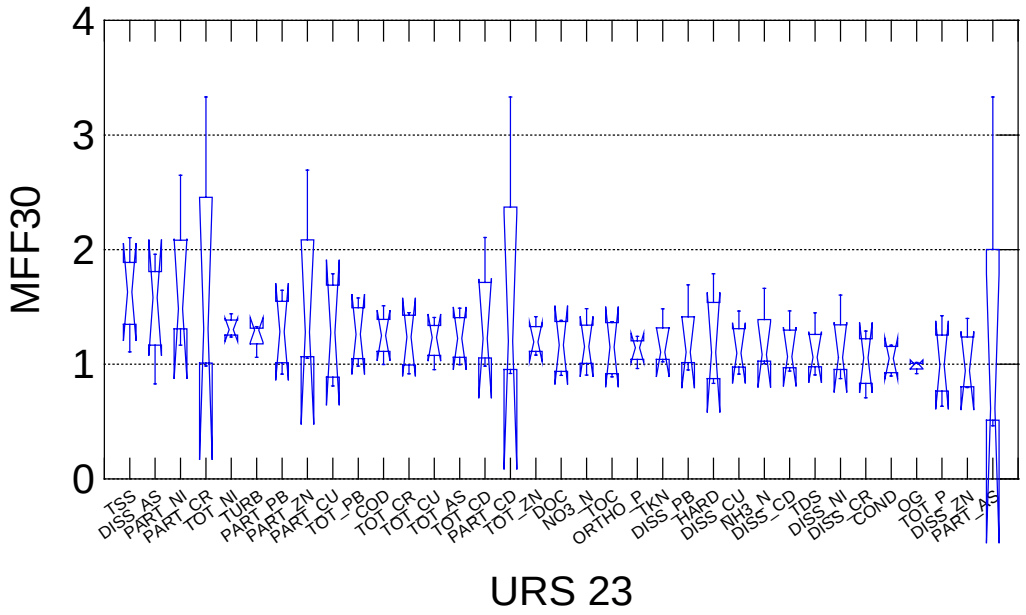


Figure D.6.1a MFF10 and 20 by Ranking for URS 23



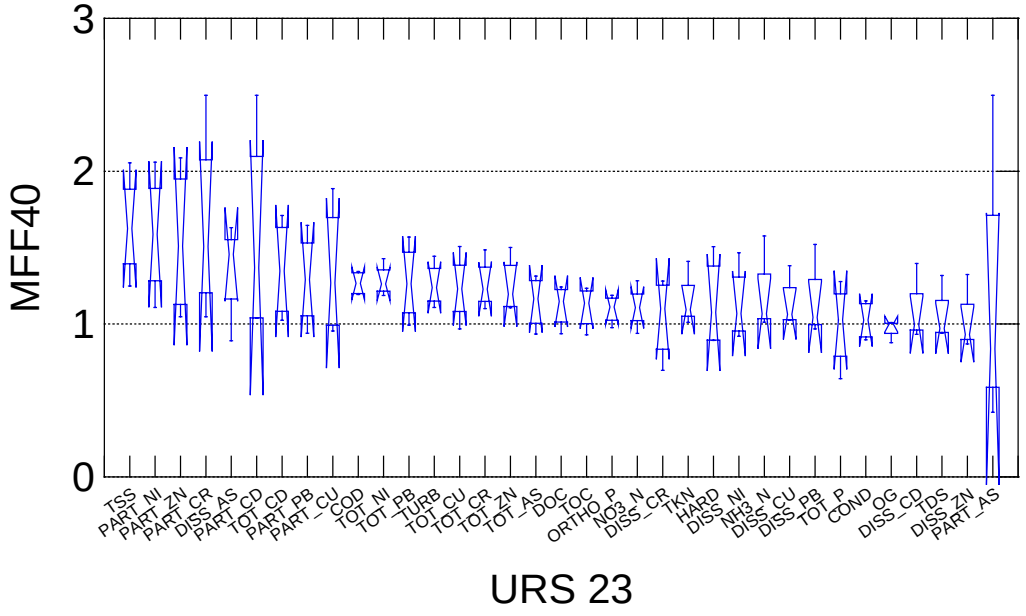


Figure D.6.1b MFF30 and 40 by Ranking for URS 23

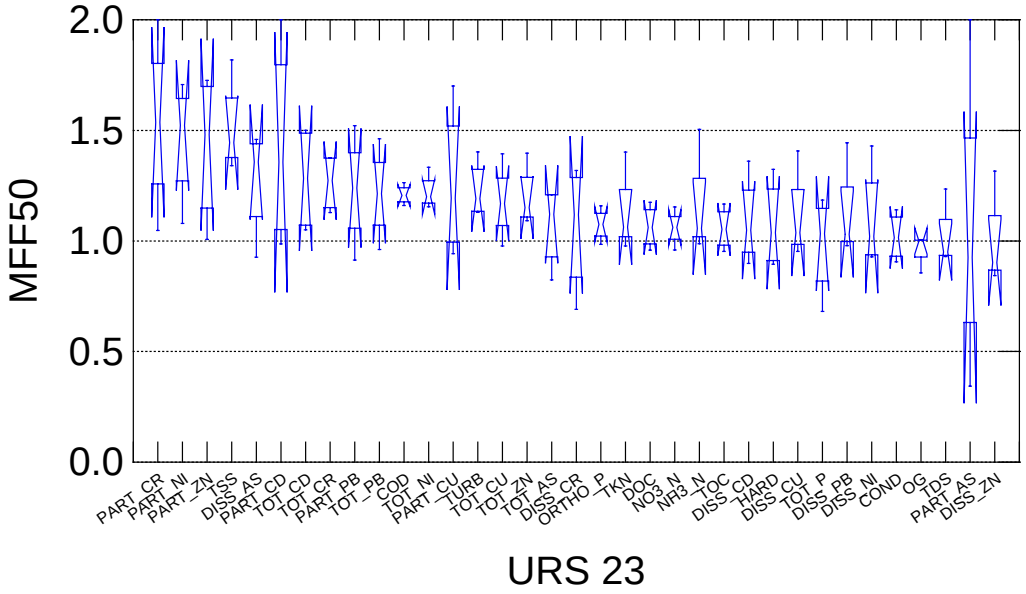
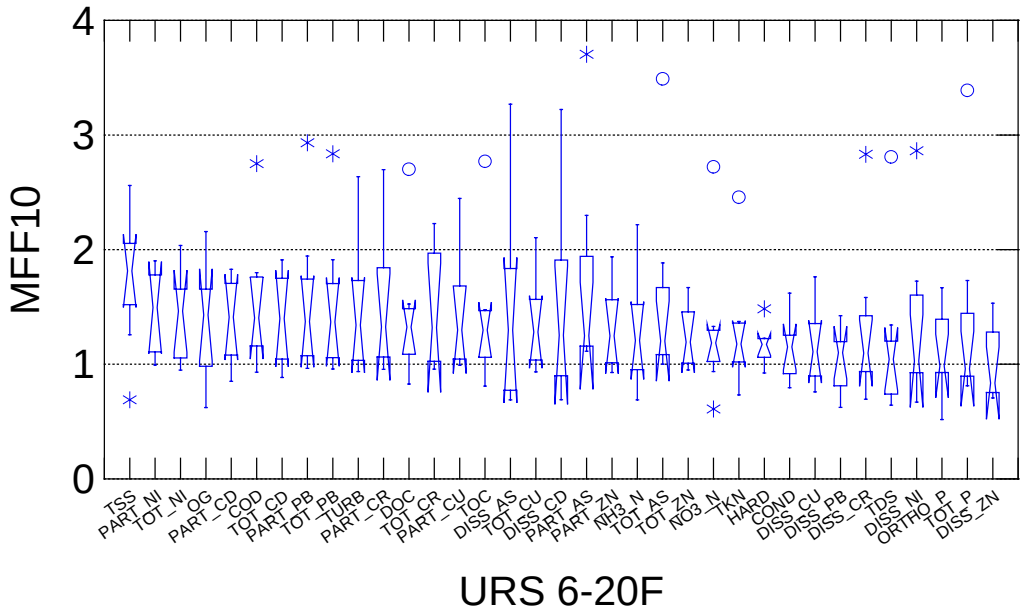


Figure D.6.1c MFF50 by Ranking for URS 23



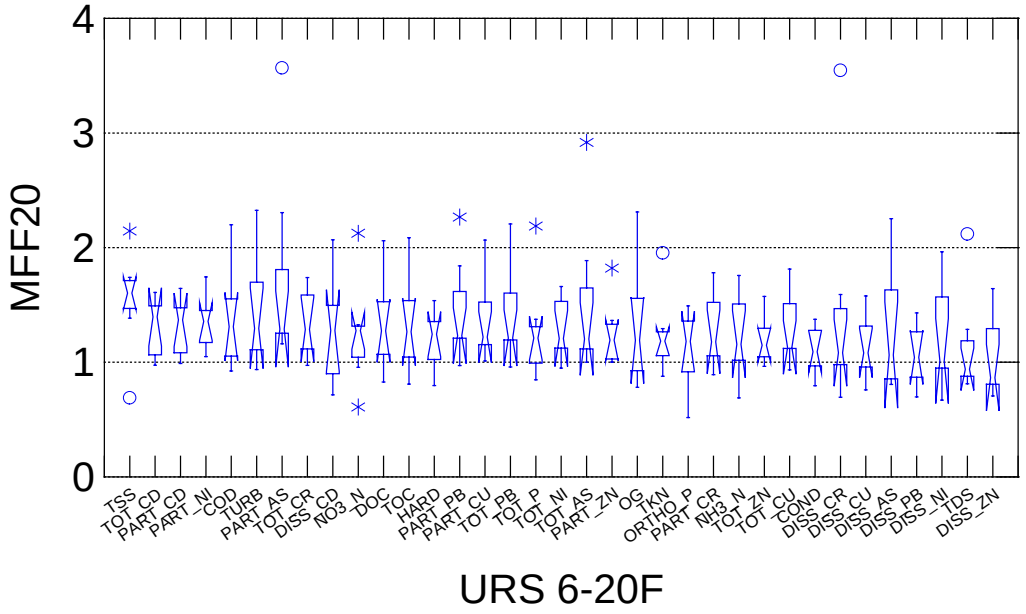
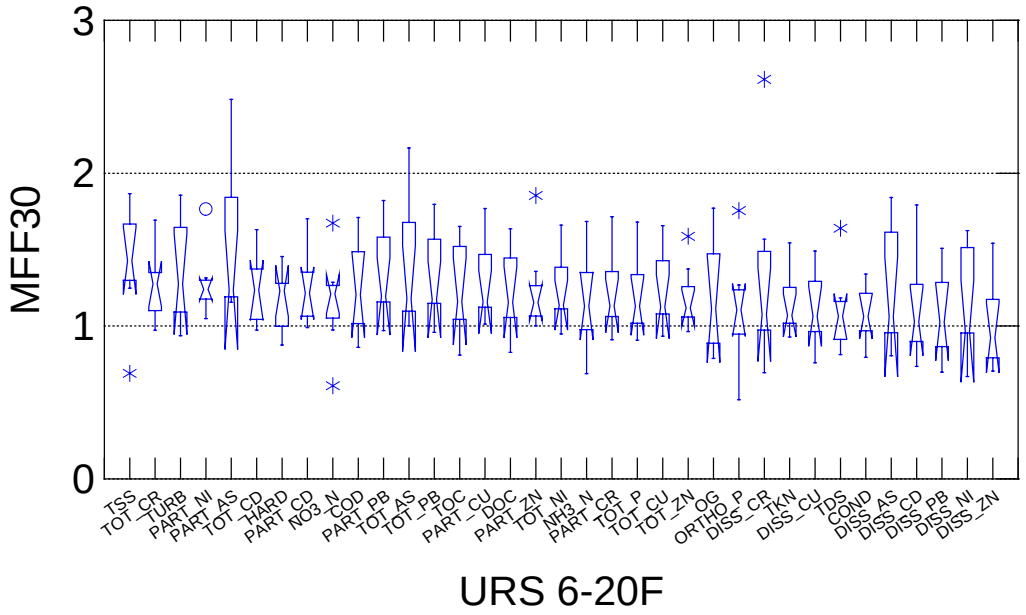


Figure D.6.2a MFF10 and 20 by Ranking for URS 6-20F



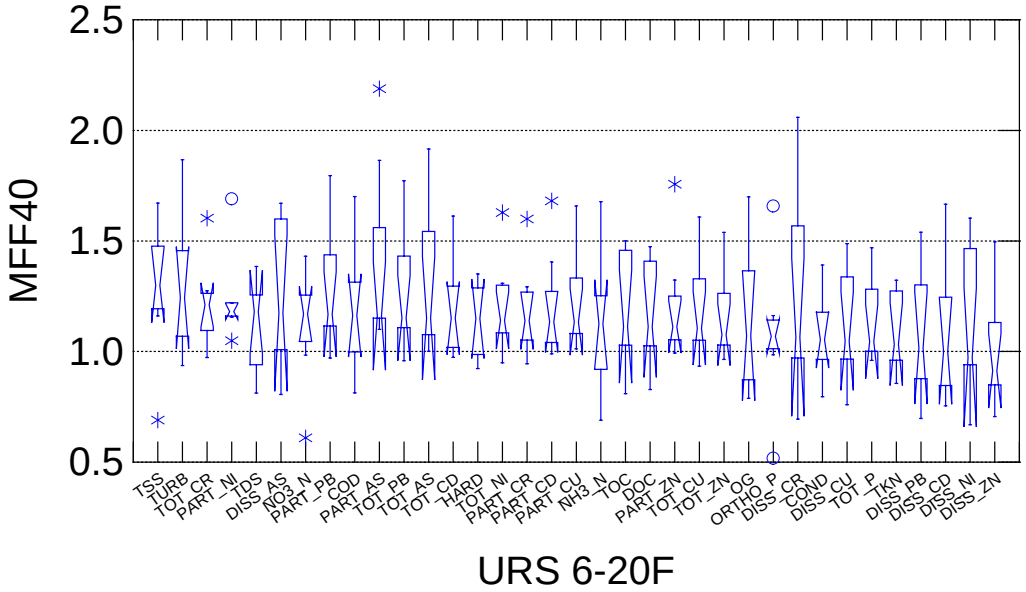


Figure D.6.2b MFF30 and 40 by Ranking for URS 6-20F

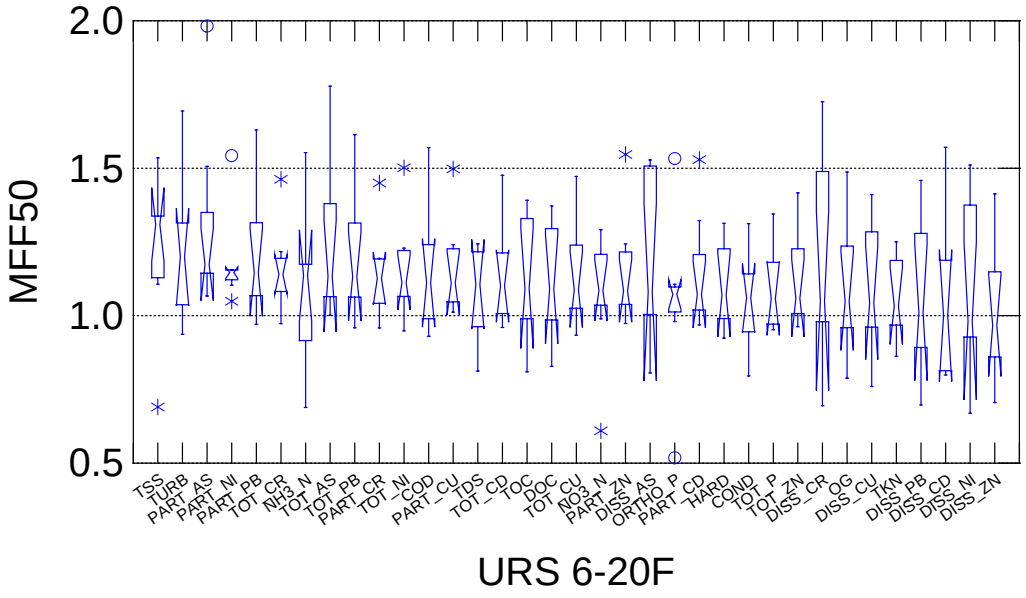
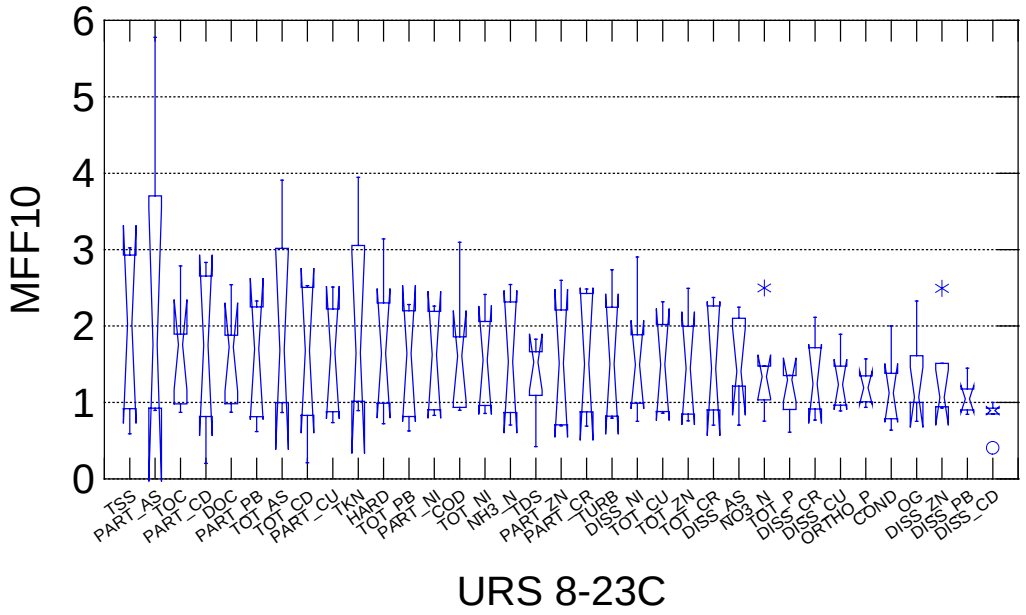


Figure D.6.2c MFF50 by Ranking for URS 6-20F



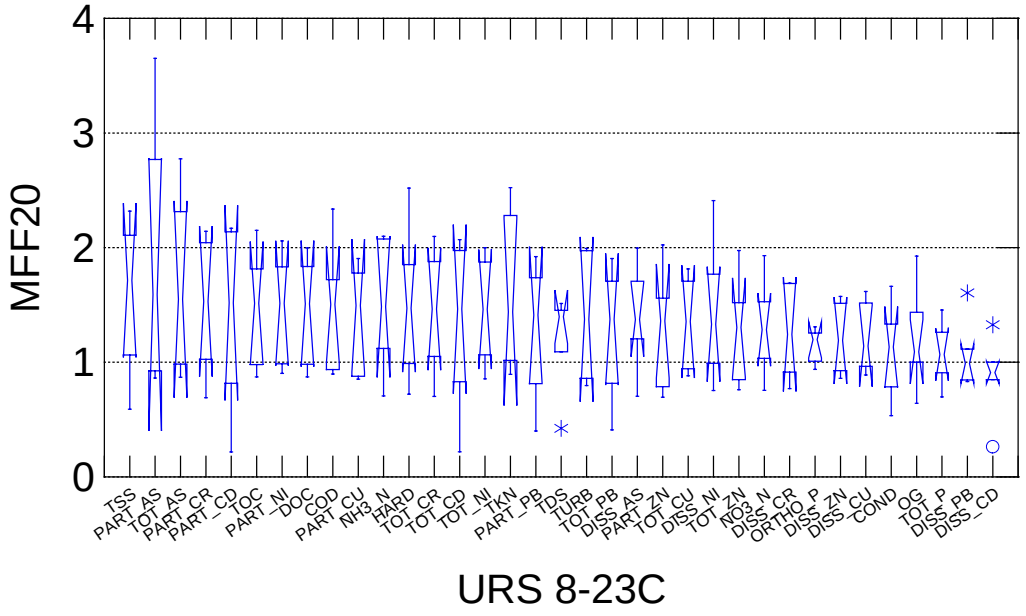
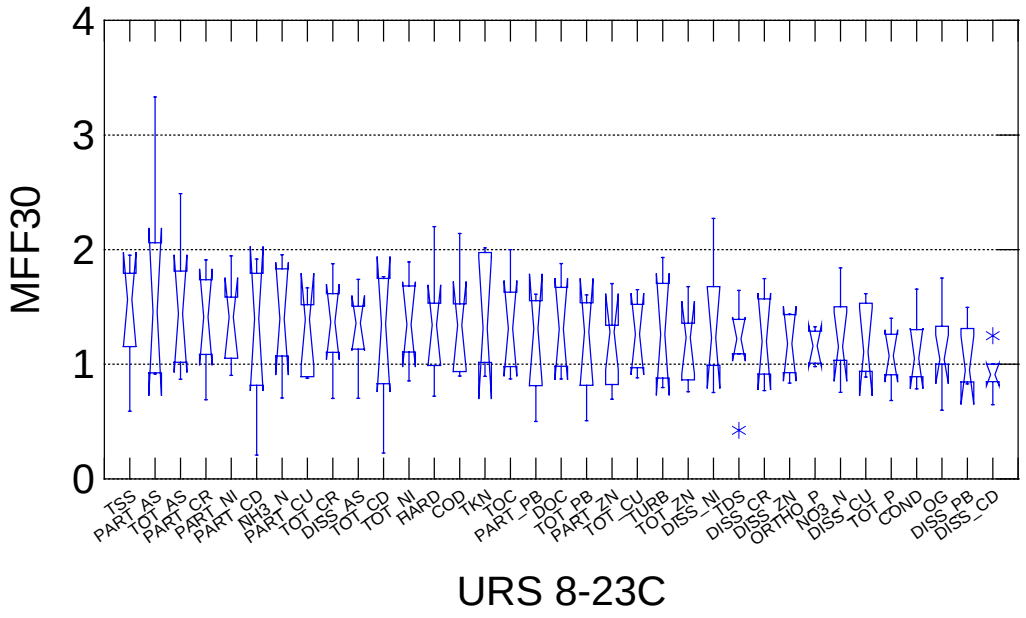


Figure D.6.3a MFF10 and 20 by Ranking for URS 8-23C



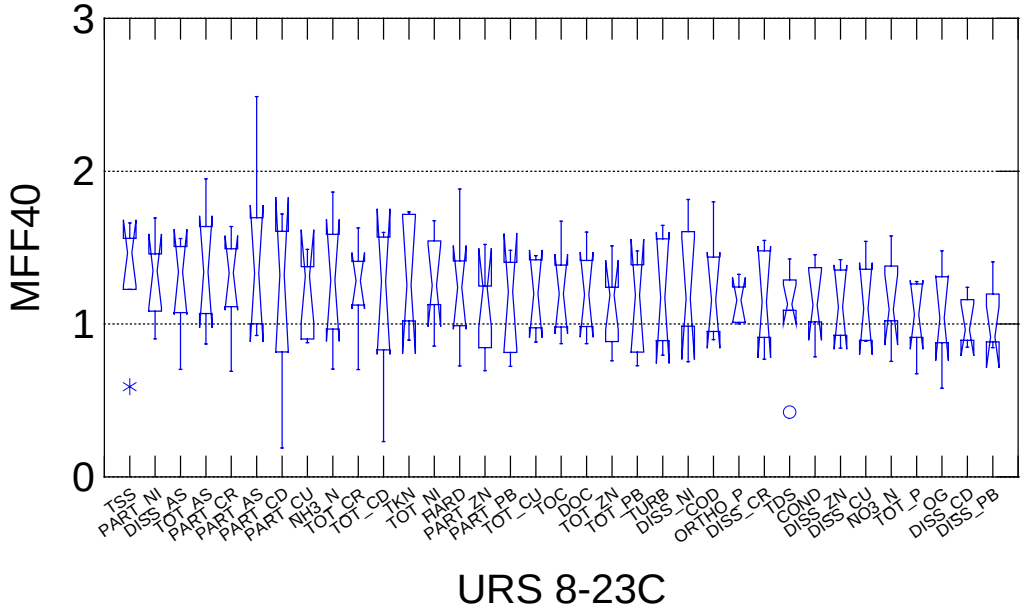


Figure D.6.3b MFF30 and 40 by Ranking for URS 8-23C

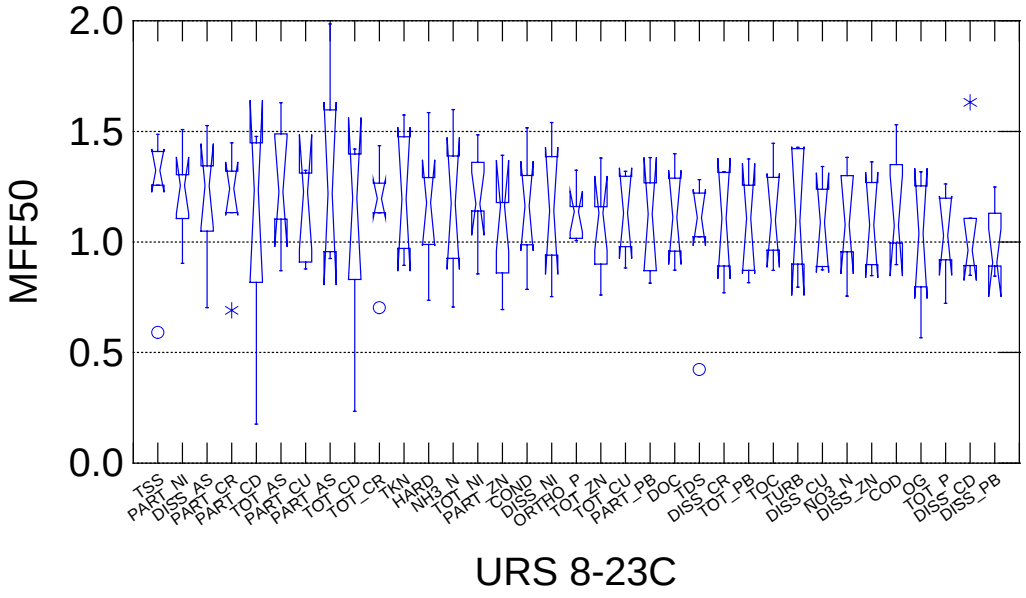
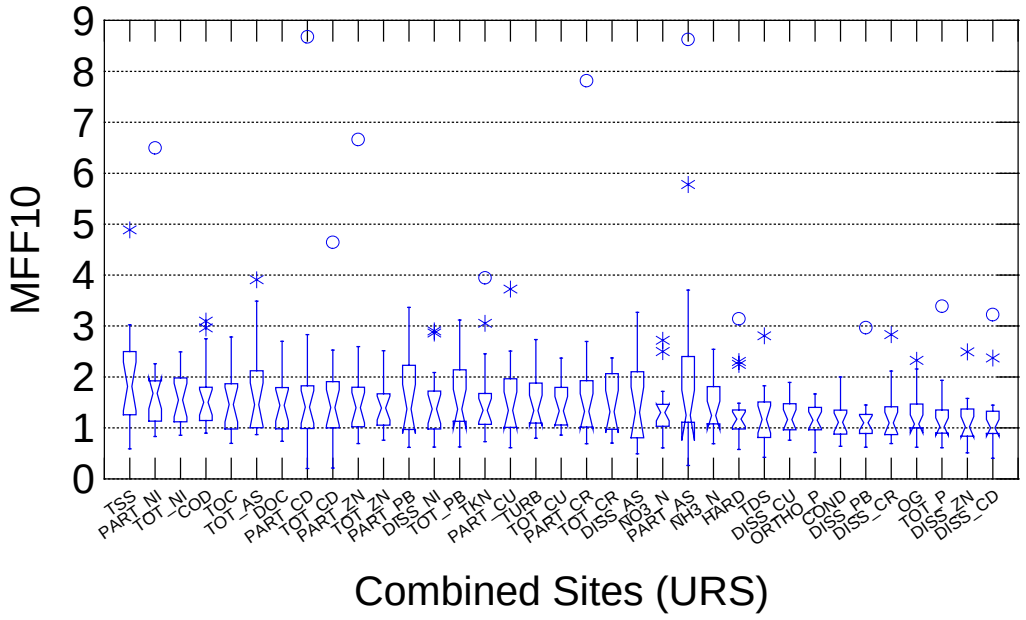


Figure D.6.3c MFF50 by Ranking for URS 8-23C



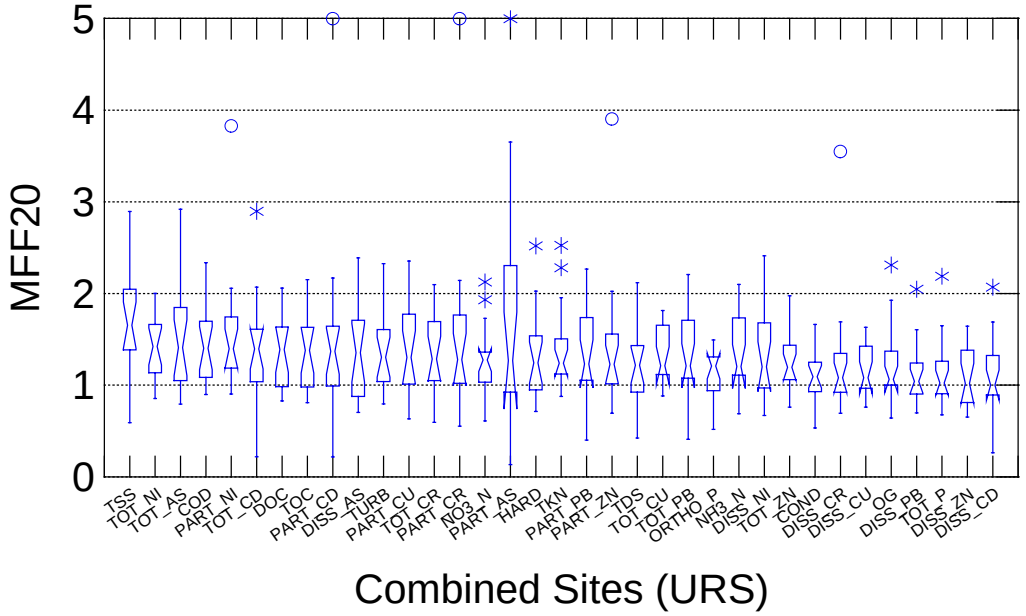
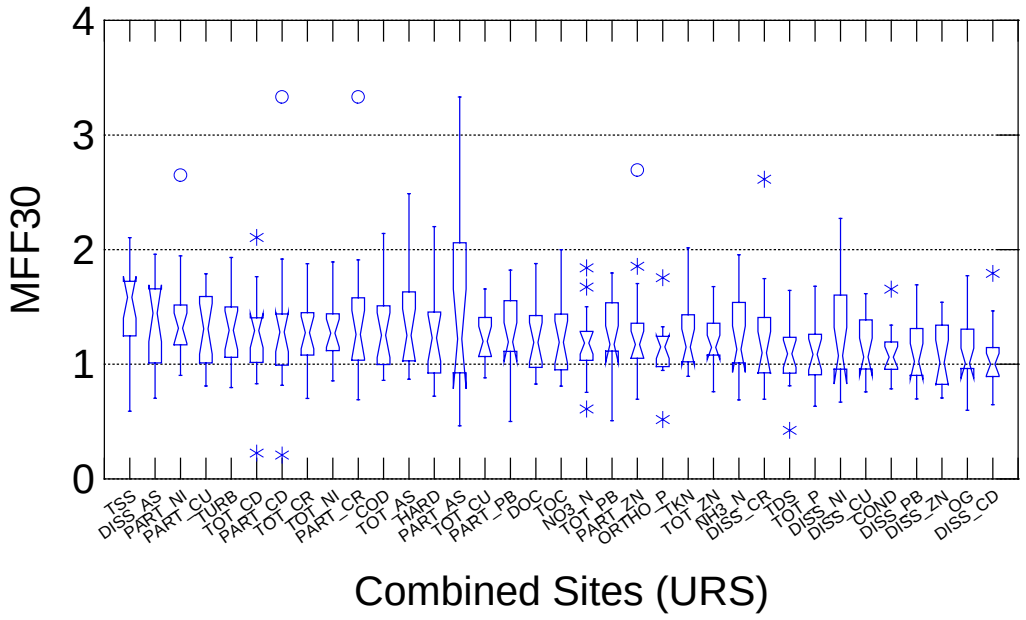


Figure D.6.4a MFF10 and 20 by Ranking from Combined URS



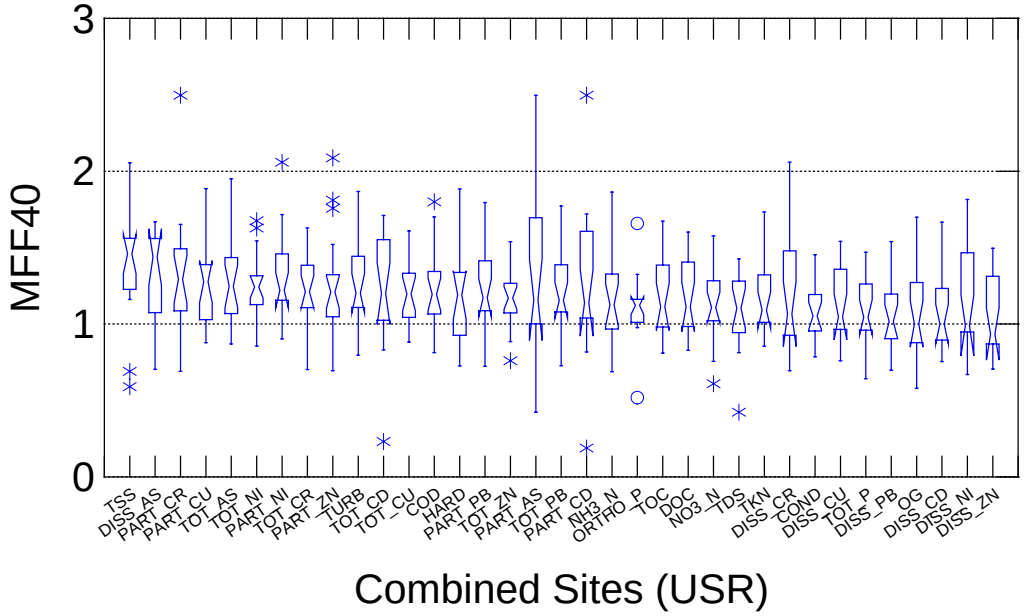


Figure D.6.4b MFF30 and 40 by Ranking from Combined URS

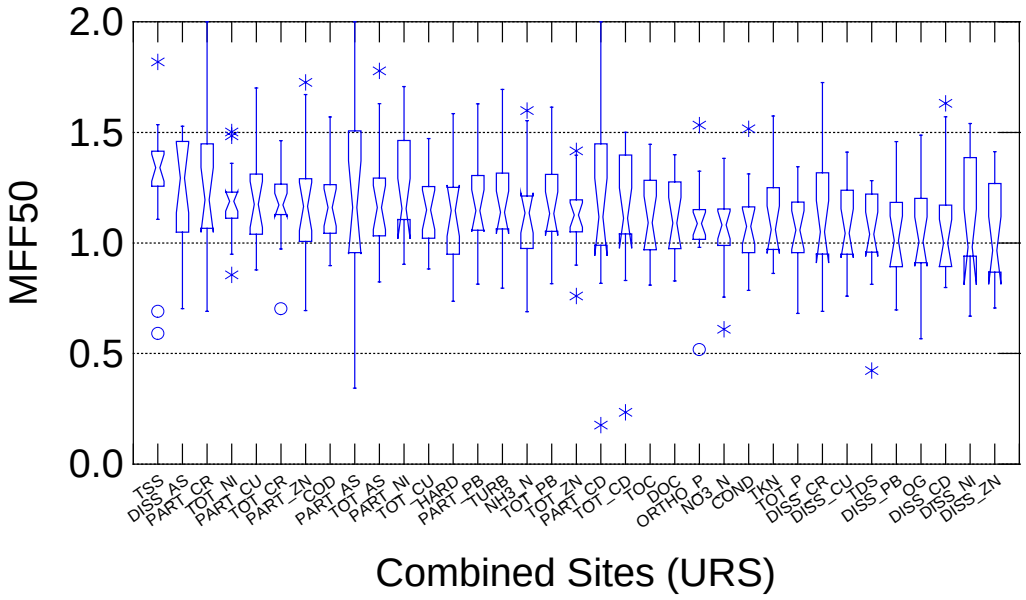


Figure D.6.4c MFF50 by Ranking from Combined URS

APPENDIX E
CORRELATION AMONG CONSTITUENTS/PARAMETERS

Table E.1a Correlation Table for Non-Metal Parameters from UCLA (2000~2003)

Correlation 'r' & P-Value	TSS		VSS		Turb.		Cond.		pH		Alk.		Hard.		COD		DOC		O & G		TKN		NH_3-N	
TSS		1	0.93	0.94	0.57	0.47	0.36	0.32	0.05	-0.18	0.25	0.19	0.39	0.13	0.39	0.48	0.37	0.45	0.39	0.42	0.40	0.46	0.24	0.45
	0		0.92	0.93	0.63	0.57	0.26	0.23	-0.23	-0.20	0.02	0.01	0.24	0.19	0.26	0.40	0.20	0.34	0.27	0.38	0.30	0.40	0.24	0.39
VSS	0.00	0.00		1	0.70	0.65	0.56	0.59	-0.03	-0.34	0.37	0.29	0.51	0.41	0.54	0.73	0.51	0.65	0.56	0.66	0.56	0.69	0.32	0.64
	0.00	0.00	0		0.41	0.62	0.26	0.42	-0.43	-0.28	0.10	0.09	0.25	0.35	0.27	0.48	0.23	0.41	0.29	0.53	0.27	0.53	0.22	0.47
Turb.	0.00	0.00	0.00	0.00		1	0.27	0.36	0.05	-0.12	0.27	0.37	0.25	0.15	0.43	0.48	0.28	0.41	0.51	0.67	0.46	0.58	0.22	0.48
	0.00	0.00	0.00	0.00	0		0.40	0.29	-0.17	-0.10	0.09	0.15	0.36	0.24	0.34	0.43	0.29	0.35	0.46	0.58	0.41	0.51	0.36	0.45
Cond.	0.00	0.00	0.00	0.00	0.00	0.00		1	-0.05	-0.20	0.83	0.58	0.83	0.90	0.81	0.60	0.88	0.68	0.71	0.66	0.78	0.71	0.67	0.68
	0.00	0.00	0.00	0.00	0.00	0.00	0		-0.66	-0.11	0.91	0.70	0.94	0.81	0.96	0.62	0.93	0.63	0.91	0.61	0.98	0.70	0.93	0.56
pH	0.51	0.01	0.80	0.00	0.51	0.11	0.53	0.01		1	0.31	0.32	0.05	-0.05	-0.21	-0.32	-0.26	-0.39	-0.13	-0.40	-0.23	-0.40	-0.41	-0.50
	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.01	0		-0.47	0.31	-0.63	-0.09	-0.68	-0.36	-0.66	-0.41	-0.66	-0.40	-0.66	-0.40	-0.67	-0.48
Alk,	0.01	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00		1	0.86	0.58	0.43	0.46	0.54	0.46	0.54	0.46	0.39	0.44	0.17	0.26
	0.79	0.83	0.25	0.08	0.31	0.00	0.00	0.00	0.00	0.00	0		0.87	0.57	0.89	0.32	0.88	0.25	0.82	0.31	0.89	0.32	0.81	0.15
Hard.	0.00	0.08	0.00	0.00	0.00	0.03	0.00	0.00	0.54	0.53	0.00	0.00		1	0.75	0.34	0.66	0.40	0.72	0.39	0.71	0.43	0.40	0.39
	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0		0.94	0.55	0.92	0.59	0.83	0.55	0.92	0.62	0.84	0.52
COD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00		1	0.93	0.94	0.85	0.82	0.96	0.75	0.61	0.72
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.98	0.95	0.84	0.83	0.95	0.84	0.94	0.79
DOC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		1	0.76	0.84	0.93	0.85	0.89	0.86
	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.80	0.82	0.92	0.89	0.92	0.88
O & G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		1	0.82	0.89	0.60	0.89
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.92	0.89	0.84	0.85
TKN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		1	0.61	0.82
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.93	0.84
NH_3-N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		1
	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

UCLA 1	UCLA 2
UCLA 3	Combined UCLA

Table E.1a ***(Continued)***

Correlation 'r' & P-Value	TSS		VSS		Turb.		Cond.		pH		Alk.		Hard.		COD		DOC		O & G		TKN		NH_3-N	
NO_2-N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_3-N	0.27	0.00	0.36	0.00	0.89	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.10	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PO_4-P	0.44	0.00	0.03	0.01	0.77	0.01	0.00	0.00	0.00	0.68	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
	0.44	0.00	0.99	0.00	0.03	0.00	0.00	0.00	0.00	0.21	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dis. P	0.01	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Par. P	0.02	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.17	0.00	0.00	0.17	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total P	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO_4	0.00	0.12	0.00	0.00	0.00	0.31	0.00	0.00	0.79	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	0.10	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fecal Col.	0.88	0.28	0.54	0.48	0.04	0.10	0.92	0.66	0.18	0.21	0.87	0.18	0.74	0.75	0.00	0.92	0.08	0.97	0.02	0.74	0.03	0.94	0.61	0.60
	0.34	0.10	0.31	0.21	0.12	0.00	0.00	0.14	0.00	0.47	0.00	0.24	0.00	0.18	0.00	0.26	0.00	0.33	0.00	0.44	0.00	0.30	0.00	0.65
Total Col.	0.96	0.01	0.49	0.00	0.07	0.03	0.69	0.06	0.01	0.55	0.30	0.01	0.89	0.35	0.00	0.05	0.01	0.21	0.01	0.19	0.00	0.03	0.31	0.31
	0.40	0.66	0.31	0.94	0.93	0.92	0.49	0.30	0.48	0.96	0.23	0.21	0.79	0.90	0.52	0.59	0.63	0.62	0.62	0.96	0.32	0.51	0.75	0.32

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

UCLA 1	UCLA 2
UCLA 3	Combined UCLA

Table E.1a ***(Continued)***

Correlation 'r' & P-Value	NO_2-N		NO_3-N		F		Cl		PO_4-P		Dis. P		Par. P		Total P		SO_4		Fecal Col.		Total Col.	
TSS	0.32	0.23	0.09	0.46	0.39	0.39	0.34	0.51	0.16	0.41	0.19	0.36	0.25	0.56	0.25	0.40	0.36	0.23	-0.02	0.11	0.01	0.26
	0.40	0.29	0.32	0.20	0.19	0.36	0.15	0.27	-0.11	0.36	0.30	0.31	0.49	0.38	0.38	0.35	0.15	0.19	0.11	0.11	0.10	-0.03
VSS	0.61	0.57	0.09	0.78	0.57	0.55	0.55	0.64	0.26	0.40	0.53	0.51	0.40	0.58	0.55	0.52	0.53	0.31	0.10	0.08	0.10	0.33
	0.23	0.38	0.25	0.29	0.34	0.52	0.25	0.39	0.00	0.37	0.31	0.48	0.45	0.43	0.36	0.49	0.25	0.28	0.12	0.09	0.11	-0.01
Turb.	0.31	0.38	-0.01	0.50	0.63	0.45	0.48	0.43	-0.06	0.34	0.10	0.37	0.17	0.31	0.13	0.33	0.35	0.09	0.28	0.17	0.24	0.22
	0.85	0.51	0.61	0.28	0.28	0.49	0.23	0.30	0.30	0.39	0.34	0.33	0.33	0.27	0.40	0.56	0.21	0.17	0.18	0.20	0.01	0.01
Cond.	0.84	0.34	0.71	0.64	0.66	0.69	0.91	0.88	0.86	0.45	0.69	0.51	0.47	0.28	0.72	0.49	0.97	0.83	0.01	0.05	0.05	0.19
	0.53	0.55	0.79	0.70	0.79	0.59	0.91	0.89	0.50	0.49	0.65	0.54	0.34	0.35	0.67	0.63	0.99	0.90	0.55	0.10	0.08	0.07
pH	-0.03	-0.16	-0.03	-0.31	-0.05	-0.48	-0.03	-0.43	-0.63	-0.06	-0.23	-0.41	-0.14	-0.31	-0.23	-0.41	0.03	-0.15	-0.18	0.13	-0.33	0.06
	-0.19	-0.10	-0.57	-0.08	-0.72	-0.35	-0.61	-0.25	-0.44	-0.11	-0.54	-0.33	-0.37	-0.12	-0.54	-0.37	-0.70	-0.04	-0.36	0.05	-0.08	0.00
Alk.	0.65	0.49	0.52	0.37	0.47	0.35	0.63	0.41	0.53	0.55	0.37	0.19	0.47	0.13	0.50	0.12	0.80	0.49	-0.03	0.16	-0.15	0.31
	0.61	0.58	0.70	0.55	0.63	0.22	0.80	0.54	0.61	0.26	0.65	0.12	0.24	0.35	0.65	0.16	0.92	0.70	0.53	0.08	0.14	0.09
Hard.	0.49	0.19	0.57	0.41	0.64	0.55	0.88	0.78	0.53	0.29	0.48	0.32	0.52	0.23	0.56	0.30	0.96	0.93	0.05	0.03	0.02	0.09
	0.45	0.33	0.75	0.46	0.77	0.54	0.84	0.80	0.41	0.29	0.55	0.39	0.25	0.27	0.57	0.55	0.93	0.84	0.51	0.09	0.03	0.01
COD	0.61	0.62	0.41	0.70	0.75	0.84	0.92	0.92	0.62	0.64	0.57	0.66	0.56	0.39	0.60	0.63	0.75	0.53	0.42	0.01	0.51	0.20
	0.43	0.53	0.80	0.49	0.79	0.67	0.82	0.78	0.41	0.56	0.63	0.61	0.30	0.22	0.64	0.74	0.96	0.55	0.49	0.07	0.07	0.04
DOC	0.87	0.52	0.73	0.66	0.81	0.83	0.70	0.94	0.92	0.80	0.71	0.72	0.65	0.37	0.75	0.73	0.64	0.56	0.26	0.00	0.38	0.13
	0.39	0.46	0.75	0.47	0.76	0.65	0.83	0.81	0.33	0.55	0.60	0.59	0.30	0.21	0.61	0.60	0.96	0.51	0.48	0.07	0.06	0.03
O & G	0.49	0.48	0.43	0.75	0.85	0.87	0.82	0.87	0.50	0.52	0.50	0.67	0.41	0.36	0.55	0.63	0.70	0.46	0.31	-0.03	0.34	0.13
	0.62	0.51	0.77	0.49	0.77	0.77	0.76	0.72	0.63	0.49	0.64	0.59	0.29	0.25	0.67	0.84	0.90	0.50	0.45	0.05	0.06	0.00
TKN	0.60	0.40	0.38	0.81	0.72	0.81	0.93	0.89	0.58	0.47	0.53	0.66	0.25	0.40	0.55	0.58	0.74	0.50	0.29	-0.01	0.53	0.21
	0.54	0.48	0.78	0.53	0.78	0.72	0.88	0.82	0.53	0.46	0.64	0.60	0.31	0.24	0.66	0.87	0.97	0.57	0.50	0.07	0.11	0.04
NH_3-N	0.73	0.37	0.56	0.76	0.56	0.81	0.30	0.85	0.75	0.39	0.63	0.67	0.26	0.41	0.63	0.71	0.28	0.47	0.07	-0.05	0.13	0.10
	0.51	0.41	0.80	0.48	0.73	0.70	0.74	0.59	0.55	0.38	0.64	0.59	0.30	0.25	0.65	0.81	0.90	0.39	0.44	0.03	-0.04	-0.07

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

UCLA 1	UCLA 2
UCLA 3	Combined UCLA

Table E.1a ***(Continued)***

Correlation 'r' & P-Value	NO_2-N		NO_3-N		F		Cl		PO_4-P		Dis. P		Par. P		Total P		SO_4		Fecal Col.		Total Col.	
NO_2-N		1	0.66	0.41	0.62	0.66	0.51	0.61	0.91	0.40	0.68	0.38	0.48	0.65	0.70	0.36	0.58	0.32	0.11	0.03	0.01	0.16
	0		0.65	0.51	0.54	0.48	0.40	0.50	0.49	0.51	0.37	0.43	0.21	0.48	0.42	0.45	0.60	0.50	0.44	0.07	0.16	0.08
NO_3-N	0.00	0.00		1	0.18	0.59	0.21	0.72	0.66	0.49	0.63	0.51	0.29	0.46	0.65	0.50	0.40	0.43	-0.09	-0.04	-0.08	0.22
	0.00	0.00	0		0.86	0.34	0.52	0.38	0.61	0.46	0.46	0.46	0.19	0.34	0.49	0.47	0.78	0.46	0.40	-0.01	0.06	0.03
F	0.00	0.00	0.08	0.00		1	0.68	0.85	0.38	0.27	0.74	0.60	0.48	0.25	0.71	0.54	0.58	0.36	0.44	0.01	0.47	0.06
	0.00	0.00	0.00	0.00	0		0.64	0.57	0.77	0.37	0.61	0.62	0.22	0.24	0.61	0.57	0.75	0.36	0.39	0.08	0.07	0.01
Cl	0.00	0.00	0.04	0.00	0.00	0.00		1	0.35	0.44	0.59	0.66	0.34	0.33	0.54	0.60	0.91	0.66	0.05	0.11	0.12	0.30
	0.00	0.00	0.00	0.00	0.00	0.00	0		0.65	0.30	0.67	0.46	0.39	0.29	0.69	0.46	0.91	0.79	0.56	0.14	0.12	0.10
PO_4-P	0.00	0.00	0.00	0.00	0.06	0.07	0.09	0.00		1	0.94	0.35	0.79	0.39	0.98	0.30	0.42	0.27	0.50	0.23	0.73	0.50
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.38	0.49	0.10	0.45	0.37	0.45	0.73	0.25	0.58	0.12	-0.13	-0.01
Dis. P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01		1	0.52	0.20	0.98	0.97	0.00	0.00	0.00	0.59	0.00	0.48
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0		0.30	0.19	0.98	0.97	0.00	0.00	0.01	0.14	0.81	0.87
Par. P	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.03		1	0.89	0.32	0.00	0.06	0.01	0.78	0.09	0.05
	0.02	0.00	0.04	0.00	0.02	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0		0.43	0.35	0.00	0.00	0.00	0.05	0.01	0.00
Total P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00		1	0.00	0.00	0.00	0.55	0.00	0.46
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0		0.00	0.00	0.00	0.09	0.61	0.61
SO_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.50	0.31	0.49	0.17	0.57	0.29		1	-0.01	0.08	0.02	0.24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.74	0.29	0.35	0.35	0.75	0.32	0		0.57	0.10	0.13	0.09
Fecal Col.	0.40	0.80	0.51	0.74	0.00	0.95	0.75	0.34	0.10	0.14	0.45	0.06	0.41	0.04	0.49	0.06	0.95	0.50		1	0.65	0.67
	0.00	0.30	0.00	0.90	0.00	0.27	0.00	0.05	0.00	0.28	0.30	0.10	0.40	0.14	0.34	0.11	0.00	0.15	0		0.26	0.32
Total Col.	0.96	0.11	0.52	0.03	0.00	0.64	0.44	0.01	0.01	0.00	0.62	0.07	0.27	0.24	0.58	0.08	0.88	0.04	0.00	0.00		1
	0.15	0.21	0.60	0.66	0.53	0.87	0.29	0.17	0.47	0.96	0.03	0.01	0.28	0.22	0.06	0.03	0.25	0.18	0.02	0.00	0	

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

UCLA 1	UCLA 2
UCLA 3	Combined UCLA

Table E.1b Correlation Table for Metals from UCLA (2000~2003)

Correlation 'r' & P-Value	Dis. As		Dis. Cd		Dis. Cr		Dis. Cu		Dis. Ni		Dis. Pb		Dis. Zn		Par. As		Par. Cd		Par. Cr		Par. Cu	
Dis. As		1	-0.05	0.75	-0.08	0.47	-0.01	0.66	0.01	0.67	0.10	0.68	-0.04	0.71	-0.32	0.25	-0.13	0.41	-0.15	0.20	-0.02	0.47
	0		0.63	0.37	0.52	0.37	0.51	0.49	0.55	0.51	0.52	0.53	0.52	0.53	0.13	-0.02	-0.12	-0.06	0.11	0.11	0.12	0.25
Dis. Cd	0.68	0.00		1	0.76	0.67	0.51	0.91	-0.21	0.93	-0.14	0.91	0.06	0.93	0.38	0.23	0.96	0.38	-0.35	0.32	0.57	0.57
	0.00	0.00	0		0.86	0.49	0.92	0.54	0.94	0.41	0.87	0.45	0.97	0.60	0.42	0.35	0.19	0.87	0.22	-0.03	0.28	0.46
Dis. Cr	0.40	0.00	0.00	0.00		1	0.44	0.78	0.14	0.80	0.17	0.65	-0.05	0.77	0.36	0.22	0.70	0.36	-0.16	0.37	0.35	0.51
	0.00	0.00	0.00	0.00	0		0.90	0.79	0.91	0.79	0.71	0.64	0.89	0.74	0.38	0.16	0.20	0.16	0.42	0.35	0.38	0.46
Dis. Cu	0.92	0.00	0.00	0.00	0.00	0.00		1	0.73	0.97	0.02	0.84	0.83	0.96	0.29	0.40	0.64	0.38	-0.08	0.41	0.44	0.59
	0.00	0.00	0.00	0.00	0.00	0.00	0		0.95	0.95	0.82	0.78	0.96	0.94	0.40	0.26	0.28	0.11	0.36	0.36	0.37	0.48
Dis. Ni	0.95	0.00	0.07	0.00	0.08	0.00	0.00	0.00		1	0.44	0.87	0.86	0.97	0.03	0.42	-0.47	0.46	0.24	0.39	0.06	0.64
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.76	0.80	0.97	0.94	0.49	0.21	0.27	-0.09	0.32	0.36	0.34	0.45
Dis. Pb	0.44	0.00	0.29	0.00	0.14	0.00	0.35	0.00	0.00	0.00		1	0.18	0.87	0.12	0.16	-0.12	0.39	-0.15	0.32	0.09	0.54
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.82	0.78	0.34	0.05	0.18	-0.07	0.31	0.26	0.31	0.33
Dis. Zn	0.68	0.00	0.58	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.11	0.00		1	0.18	0.35	-0.34	0.46	0.22	0.38	0.27	0.64
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.51	0.23	0.28	-0.01	0.35	0.37	0.34	0.52
Par. As	0.07	0.07	0.03	0.13	0.03	0.11	0.08	0.00	0.85	0.00	0.51	0.28	0.31	0.01		1	0.42	0.46	0.21	0.44	0.41	0.51
	0.52	0.84	0.04	0.00	0.05	0.08	0.03	0.00	0.01	0.02	0.07	0.63	0.01	0.01	0		0.59	0.38	0.22	0.26	0.18	0.43
Par. Cd	0.48	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.04	0.00	0.03	0.00		1	-0.38	0.69	0.80	0.91
	0.52	0.47	0.34	0.00	0.27	0.06	0.11	0.19	0.11	0.26	0.28	0.47	0.10	0.92	0.01	0.00	0		0.68	-0.19	0.71	0.32
Par. Cr	0.20	0.04	0.01	0.01	0.14	0.00	0.43	0.00	0.02	0.00	0.30	0.00	0.04	0.00	0.21	0.00	0.02	0.00		1	0.30	0.82
	0.37	0.08	0.51	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.02	0		0.86	0.73
Par. Cu	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.83	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00		1
	0.34	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0	

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

UCLA 1	UCLA 2
UCLA 3	Combined UCLA

Table E.1b ***(Continued)***

Correlation 'r' & P-Value	Dis. As	Dis. Cd	Dis. Cr	Dis. Cu	Dis. Ni	Dis. Pb	Dis. Zn	Par. As	Par. Cd	Par. Cr	Par. Cu
Par. Ni	0.84 0.00 0.20 0.00	0.00 0.00 0.16 0.00	0.00 0.00 0.00 0.00	0.01 0.00 0.01 0.00	0.38 0.00 0.00 0.00	0.61 0.00 0.02 0.00	0.37 0.00 0.01 0.00	0.00 0.00 0.59 0.00	0.00 0.00 0.00 0.00	0.01 0.00 0.00 0.00	0.00 0.00 0.00 0.00
Par. Pb	0.73 0.00 0.12 0.00	0.59 0.00 0.29 0.00	0.64 0.00 0.63 0.00	0.53 0.00 0.39 0.00	0.93 0.00 0.31 0.00	1.00 0.00 0.75 0.00	0.88 0.00 0.25 0.00	0.50 0.01 0.66 0.03	0.00 0.00 0.01 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00
Par. Zn	0.67 0.00 0.65 0.00	0.39 0.00 0.29 0.00	0.06 0.00 0.05 0.00	0.36 0.00 0.02 0.00	0.06 0.00 0.04 0.00	0.76 0.00 0.07 0.00	0.01 0.00 0.04 0.00	0.22 0.00 0.74 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00
Total As	0.00 0.00 0.00 0.00	0.10 0.00 0.00 0.00	0.26 0.00 0.00 0.00	0.27 0.00 0.00 0.00	0.99 0.00 0.00 0.00	0.56 0.00 0.00 0.00	0.62 0.00 0.00 0.00	0.00 0.00 0.02 0.00	0.58 0.00 0.14 0.51	0.39 0.00 0.00 0.00	0.06 0.00 0.01 0.00
Total Cd	0.48 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.05 0.00 0.00 0.00	0.26 0.00 0.00 0.00	0.88 0.00 0.00 0.00	0.01 0.02 0.01 0.00	0.00 0.00 0.07 0.00	0.03 0.00 0.00 0.45	0.00 0.00 0.00 0.00
Total Cr	0.08 0.00 0.00 0.00	0.50 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.76 0.00 0.00 0.00	0.01 0.00 0.00 0.00	0.00 0.00 0.04 0.00	0.59 0.00 0.00 0.77	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00
Total Cu	0.90 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.30 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.02 0.00 0.03 0.00	0.00 0.00 0.05 0.07	0.70 0.00 0.00 0.00	0.00 0.00 0.00 0.00
Total Ni	0.97 0.00 0.00 0.00	0.38 0.00 0.00 0.00	0.01 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.18 0.00 0.01 0.01	0.09 0.00 0.07 0.43	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00
Total Pb	0.42 0.00 0.04 0.00	0.18 0.00 0.00 0.00	0.88 0.00 0.00 0.00	0.15 0.00 0.00 0.00	0.01 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.21 0.00 0.00 0.00	0.38 0.01 0.38 0.03	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00
Total Zn	0.56 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.54 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.19 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.04 0.00 0.01 0.00	0.00 0.00 0.05 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

UCLA 1	UCLA 2
UCLA 3	Combined UCLA

Table E.1b ***(Continued)***

Correlation 'r' & P-Value	Par. Ni		Par. Pb		Par. Zn		Total As		Total Cd		Total Cr		Total Cu		Total Ni		Total Pb		Total Zn	
Dis. As	-0.02	0.37	0.04	0.38	-0.05	0.50	0.52	0.86	-0.09	0.71	-0.17	0.37	-0.01	0.67	0.00	0.67	0.08	0.55	-0.06	0.72
	0.15	0.23	-0.18	0.21	0.06	0.26	0.92	0.79	0.59	0.20	0.37	0.23	0.50	0.49	0.55	0.51	0.21	0.36	0.52	0.53
Dis. Cd	0.52	0.48	0.08	0.39	0.13	0.52	0.24	0.80	0.99	0.99	0.08	0.50	0.61	0.90	-0.10	0.92	0.16	0.60	0.94	0.93
	0.17	0.38	-0.13	0.33	0.13	0.40	0.80	0.43	0.98	0.98	0.63	0.26	0.91	0.57	0.92	0.42	0.51	0.58	0.96	0.93
Dis. Cr	0.36	0.38	-0.05	0.31	0.21	0.40	0.15	0.51	0.64	0.71	0.51	0.78	0.45	0.79	0.22	0.80	-0.01	0.47	0.05	0.77
	0.27	0.38	0.05	0.26	0.19	0.33	0.71	0.51	0.90	0.40	0.83	0.77	0.90	0.80	0.91	0.80	0.38	0.43	0.89	0.75
Dis. Cu	0.27	0.40	-0.07	0.39	0.10	0.48	0.14	0.73	0.48	0.92	0.39	0.67	0.97	0.99	0.75	0.96	0.11	0.54	0.87	0.96
	0.25	0.35	-0.08	0.26	0.21	0.35	0.66	0.62	0.92	0.41	0.77	0.68	0.99	0.99	0.95	0.94	0.31	0.45	0.96	0.93
Dis. Ni	-0.09	0.48	0.01	0.44	0.21	0.53	0.00	0.79	-0.20	0.94	0.38	0.65	0.68	0.96	0.98	1.00	0.20	0.59	0.86	0.96
	0.26	0.37	-0.09	0.28	0.19	0.38	0.73	0.66	0.94	0.27	0.74	0.67	0.94	0.94	0.99	0.99	0.28	0.48	0.97	0.94
Dis. Pb	-0.08	0.52	0.00	0.46	-0.05	0.55	-0.08	0.76	-0.14	0.88	0.03	0.51	0.12	0.84	0.42	0.87	0.44	0.64	0.15	0.87
	0.21	0.32	-0.03	0.26	0.17	0.30	0.65	0.57	0.81	0.29	0.54	0.48	0.81	0.76	0.75	0.79	0.47	0.57	0.82	0.77
Dis. Zn	-0.10	0.46	0.02	0.45	0.29	0.56	-0.07	0.79	0.02	0.94	0.22	0.64	0.78	0.96	0.82	0.96	0.10	0.59	0.99	1.00
	0.23	0.39	-0.11	0.33	0.19	0.43	0.72	0.67	0.96	0.45	0.71	0.62	0.95	0.93	0.96	0.93	0.29	0.47	1.00	1.00
Par. As	0.49	0.45	0.12	0.34	0.22	0.45	0.68	0.58	0.42	0.32	0.45	0.41	0.37	0.44	0.22	0.44	0.16	0.34	0.37	0.37
	0.11	0.38	-0.09	0.20	0.07	0.35	0.46	0.53	0.48	0.39	0.39	0.27	0.40	0.31	0.49	0.24	0.17	0.20	0.50	0.28
Par. Cd	0.68	0.85	0.76	0.74	0.65	0.86	0.12	0.63	0.99	0.47	0.09	0.67	0.75	0.48	-0.28	0.52	0.78	0.74	0.51	0.51
	0.62	0.24	0.43	0.71	0.63	0.79	0.32	0.07	0.31	0.95	0.56	-0.02	0.32	0.15	0.31	-0.07	0.51	0.69	0.33	0.48
Par. Cr	0.52	0.79	0.65	0.77	0.55	0.75	0.13	0.46	0.29	0.34	0.83	0.88	0.04	0.50	0.41	0.45	0.65	0.72	0.39	0.43
	0.79	0.77	0.55	0.71	0.74	0.71	0.38	0.40	0.33	-0.05	0.85	0.88	0.43	0.46	0.37	0.43	0.64	0.68	0.40	0.43
Par. Cu	0.77	0.88	0.70	0.83	0.72	0.93	0.28	0.71	0.56	0.61	0.47	0.83	0.70	0.69	0.31	0.70	0.72	0.85	0.61	0.68
	0.90	0.87	0.68	0.76	0.90	0.86	0.35	0.56	0.33	0.40	0.74	0.74	0.45	0.61	0.40	0.53	0.75	0.76	0.41	0.60

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

UCLA 1	UCLA 2
UCLA 3	Combined UCLA

Table E.1b ***(Continued)***

Correlation 'r' & P-Value	Par. Ni	Par. Pb	Par. Zn	Total As	Total Cd	Total Cr	Total Cu	Total Ni	Total Pb	Total Zn
Par. Ni	1	0.92 0.84	0.74 0.87	0.38 0.65	0.52 0.41	0.68 0.75	0.49 0.50	0.23 0.57	0.89 0.81	0.28 0.51
	0	0.67 0.81	0.91 0.84	0.32 0.55	0.20 0.30	0.62 0.73	0.32 0.47	0.33 0.46	0.68 0.78	0.31 0.47
Par. Pb	0.00 0.00	1	0.77 0.89	0.08 0.54	0.25 0.43	0.56 0.69	0.32 0.48	0.26 0.50	0.98 0.96	0.33 0.51
	0.00 0.00	0	0.71 0.79	-0.06 0.37	-0.14 0.35	0.34 0.61	-0.01 0.37	-0.05 0.35	0.81 0.94	-0.04 0.40
Par. Zn	0.00 0.00	0.00 0.00	1	0.01 0.68	0.39 0.53	0.59 0.72	0.46 0.59	0.40 0.60	0.76 0.90	0.65 0.62
	0.00 0.00	0.00 0.00	0	0.25 0.48	0.13 0.42	0.54 0.65	0.29 0.47	0.25 0.45	0.68 0.77	0.27 0.51
Total As	0.01 0.00	0.62 0.00	0.97 0.00	1	0.27 0.83	0.29 0.54	0.21 0.77	0.13 0.81	0.08 0.68	0.01 0.81
	0.02 0.00	0.67 0.00	0.07 0.00	0	0.81 0.35	0.58 0.50	0.66 0.65	0.72 0.67	0.32 0.49	0.71 0.69
Total Cd	0.00 0.00	0.07 0.00	0.00 0.00	0.05 0.00	1	0.10 0.58	0.57 0.92	-0.10 0.94	0.23 0.64	0.92 0.94
	0.08 0.00	0.22 0.00	0.25 0.00	0.00 0.00	0	0.72 0.21	0.91 0.44	0.93 0.29	0.43 0.58	0.95 0.94
Total Cr	0.00 0.00	0.00 0.00	0.00 0.00	0.02 0.00	0.34 0.00	1	0.48 0.74	0.50 0.70	0.52 0.70	0.30 0.68
	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0	0.81 0.75	0.78 0.72	0.52 0.63	0.76 0.66
Total Cu	0.00 0.00	0.00 0.00	0.00 0.00	0.09 0.00	0.00 0.00	0.00 0.00	1	0.74 0.97	0.32 0.62	0.88 0.97
	0.00 0.00	0.89 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0	0.95 0.95	0.37 0.54	0.96 0.94
Total Ni	0.03 0.00	0.01 0.00	0.00 0.00	0.32 0.00	0.33 0.00	0.00 0.00	0.00 0.00	1	0.35 0.64	0.85 0.97
	0.00 0.00	0.61 0.00	0.01 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0	0.33 0.54	0.96 0.94
Total Pb	0.00 0.00	0.00 0.00	0.00 0.00	0.56 0.00	0.03 0.00	0.00 0.00	0.00 0.00	0.00 0.00	1	0.22 0.64
	0.00 0.00	0.00 0.00	0.00 0.00	0.01 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0	0.36 0.53
Total Zn	0.01 0.00	0.00 0.00	0.00 0.00	0.97 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.01 0.00	1
	0.00 0.00	0.67 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

UCLA 1	UCLA 2
UCLA 3	Combined UCLA

Table E.2a Correlation Table for Non-Metal Parameters from CDM (1999~2000)

Correlation 'r' & P-Value	TSS	TOC	O & G	Hardness	Conductivity	NO_3-N	TP	PO_4-P
TSS	1 0	0.58 0.62 0.50	0.09 0.63 0.33	0.48 0.78 0.60	0.54 0.05 0.07	0.45 0.58 0.50	0.78 0.63 0.72	0.80 0.37 0.66
TOC	0.00 0.00 0.00	1 0	0.30 0.89 0.81	0.87 0.95 0.80	0.69 0.22 0.29	0.91 0.96 0.92	0.16 0.35 0.20	0.22 0.23 0.17
O & G	0.42 0.00 0.00	0.01 0.00 0.00	1 0	0.28 0.89 0.56	0.46 0.18 0.27	0.39 0.86 0.70	-0.06 0.32 0.11	-0.06 0.18 0.05
Hardness	0.00 0.00 0.00	0.00 0.00 0.00	0.01 0.00 0.00	1 0	0.64 0.20 0.19	0.78 0.93 0.83	0.08 0.46 0.19	0.14 0.24 0.17
Conductivity	0.00 0.65 0.40	0.00 0.04 0.00	0.00 0.09 0.00	0.00 0.06 0.02	1 0	0.78 0.28 0.28	0.72 0.01 0.06	0.54 -0.04 0.01
NO_3-N	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.01 0.00	1 0	0.02 0.33 0.14	0.07 0.20 0.11
TP	0.00 0.00 0.00	0.15 0.00 0.01	0.57 0.00 0.15	0.48 0.00 0.01	0.00 0.95 0.48	0.877 0.001 0.066	1 0	1.00 0.87 0.97
PO_4-P	0.00 0.00 0.00	0.04 0.03 0.02	0.59 0.09 0.51	0.20 0.02 0.03	0.00 0.68 0.94	0.55 0.06 0.14	0.00 0.00 0.00	1 0

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

CDM 7-10	CDM 7-185
Combined CDM	

Table E.2b Correlation Table for Metals from CDM (1999~2000)

Correlation 'r' & P-Value	Total CD	Total Cr	Total Cu	Total Ni	Total Pb	Total Zn	Soluble Cd	Soluble Cr	Soluble Cu	Soluble Ni	Soluble Pb	Soluble Zn
Total CD	1 0	0.71 0.81 0.67	0.98 0.80 0.86	0.96 0.75 0.80	0.96 0.75 0.52	0.96 0.80 0.85	0.12 0.46 0.44	0.39 0.50 0.41	0.56 0.55 0.59	0.73 0.54 0.58	0.12 0.14 0.01	0.43 0.38 0.45
Total Cr	0.00 0.00 0.00	1 0	0.73 0.95 0.76	0.75 0.88 0.76	0.65 0.86 0.65	0.79 0.95 0.76	0.09 0.55 0.34	0.13 0.55 0.32	0.37 0.64 0.47	0.50 0.61 0.43	0.05 0.20 0.06	0.44 0.45 0.31
Total Cu	0.00 0.00 0.00	0.00 0.00 0.00	1 0	0.98 0.92 0.93	0.95 0.89 0.60	0.97 0.97 0.97	0.14 0.67 0.60	0.34 0.61 0.47	0.58 0.79 0.76	0.76 0.72 0.71	0.12 0.23 0.04	0.48 0.62 0.62
Total Ni	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	1 0	0.95 0.69 0.60	0.98 0.93 0.92	0.15 0.84 0.72	0.30 0.65 0.50	0.51 0.86 0.78	0.67 0.91 0.83	0.12 0.11 0.05	0.41 0.74 0.66
Total Pb	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	1 0	0.91 0.84 0.49	0.11 0.35 0.09	0.36 0.45 0.35	0.53 0.52 0.28	0.66 0.41 0.17	0.10 0.44 0.17	0.34 0.31 0.03
Total Zn	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	1 0	0.12 0.66 0.62	0.26 0.57 0.42	0.52 0.75 0.74	0.68 0.72 0.72	0.11 0.14 0.00	0.43 0.60 0.63
Soluble Cd	0.26 0.00 0.00	0.43 0.00 0.00	0.20 0.00 0.00	0.18 0.00 0.00	0.31 0.00 0.24	0.26 0.00 0.00	1 0	0.21 0.58 0.43	0.17 0.89 0.81	0.19 0.94 0.91	0.97 -0.11 0.15	0.70 0.88 0.85
Soluble Cr	0.00 0.00 0.00	0.23 0.00 0.00	0.00 0.00 0.00	0.01 0.00 0.00	0.00 0.00 0.00	0.01 0.00 0.00	0.05 0.00 0.00	1 0	0.34 0.66 0.51	0.47 0.66 0.50	0.28 0.39 0.25	0.35 0.60 0.41
Soluble Cu	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.11 0.00 0.00	0.00 0.00 0.00	1 0	0.68 0.91 0.87	0.16 0.05 0.02	0.52 0.93 0.87
Soluble Ni	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.02	0.00 0.00 0.00	0.08 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	1 0	0.19 0.02 -0.02	0.71 0.88 0.88
Soluble Pb	0.28 0.19 0.88	0.64 0.06 0.40	0.27 0.03 0.63	0.25 0.31 0.53	0.36 0.00 0.02	0.32 0.20 0.98	0.00 0.30 0.04	0.01 0.00 0.00	0.15 0.65 0.81	0.08 0.85 0.82	1 0	0.67 -0.02 0.02
Soluble Zn	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.72	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.84 0.84	1 0

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

CDM 7-10	CDM 7-185
Combined CDM	

Table E.3a Correlation Table for Non-Metal Parameters from URS (2000~2001)

Correlation 'r' & P-Value	TDS	TSS	Turbidity	COD	DOC	O & G	TOC	NH_3-N	NO_3-N	TKN	PO_4-P	TP	Cond.	Hard.
TDS	1 0	0.39 0.85 0.86 0.77	0.50 0.58 0.81 0.64	0.69 0.79 0.77 0.76	0.48 0.89 0.88 0.85	0.13 0.37 -0.09 0.34	0.84 0.87 0.86 0.84	0.80 0.82 0.75 0.78	0.84 0.88 0.82 0.87	0.79 0.91 0.46 0.49	0.77 0.67 0.82 0.73	0.73 0.60 0.73 0.53	0.85 0.94 0.52 0.81	0.81 0.84 0.90 0.84
TSS	0.00 0.00 0.00 0.00	1 0	0.62 0.67 0.78 0.78	0.69 0.79 0.65 0.75	0.41 0.74 0.72 0.69	0.17 0.42 -0.14 0.39	0.45 0.71 0.67 0.56	0.52 0.81 0.61 0.56	0.47 0.73 0.80 0.69	0.51 0.82 0.17 0.31	0.34 0.46 0.81 0.51	0.36 0.55 0.71 0.63	0.45 0.81 0.45 0.62	0.39 0.87 0.94 0.90
Turbidity	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	1 0	0.63 0.52 0.76 0.69	0.73 0.39 0.68 0.52	0.43 0.62 0.21 0.65	0.47 0.38 0.66 0.41	0.46 0.51 0.60 0.41	0.59 0.39 0.63 0.49	0.54 0.54 0.18 0.26	0.38 0.29 0.60 0.37	0.52 0.21 0.54 0.40	0.67 0.58 0.42 0.57	0.62 0.52 0.83 0.74
COD	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	1 0	0.67 0.84 0.81 0.85	0.20 0.47 0.22 0.59	0.86 0.83 0.81 0.77	0.87 0.86 0.75 0.73	0.84 0.61 0.62 0.63	0.84 0.76 0.29 0.34	0.77 0.49 0.66 0.52	0.80 0.27 0.62 0.33	0.80 0.83 0.40 0.70	0.68 0.69 0.74 0.76
DOC	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	1 0	0.00 0.40 0.04 0.46	1.00 1.00 0.99 1.00	0.83 0.88 0.82 0.88	0.94 0.81 0.90 0.83	0.87 0.91 0.48 0.42	0.55 0.70 0.79 0.72	0.56 0.39 0.79 0.38	0.61 0.90 0.45 0.76	0.52 0.73 0.82 0.74
O & G	0.27 0.00 0.53 0.00	0.16 0.00 0.31 0.00	0.00 0.00 0.13 0.00	0.09 0.00 0.11 0.00	0.97 0.00 0.78 0.00	1 0	0.15 0.40 0.02 0.36	0.09 0.50 0.02 0.36	0.12 0.18 -0.13 0.21	0.11 0.43 -0.06 0.12	0.13 0.30 -0.19 0.21	0.15 -0.13 -0.32 -0.08	0.23 0.46 -0.10 0.39	0.19 0.26 -0.09 0.38
TOC	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.22 0.00 0.90 0.00	1 0	0.97 0.86 0.84 0.89	0.95 0.81 0.85 0.83	0.93 0.90 0.55 0.45	0.95 0.69 0.80 0.77	0.91 0.37 0.81 0.32	0.88 0.90 0.44 0.77	0.75 0.72 0.78 0.66
NH_3-N	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.48 0.00 0.92 0.00	0.00 0.00 0.00 0.00	1 0	0.91 0.63 0.70 0.70	0.95 0.85 0.54 0.45	0.89 0.53 0.75 0.68	0.86 0.35 0.74 0.31	0.83 0.83 0.38 0.70	0.69 0.70 0.66 0.59
NO_3-N	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.30 0.14 0.34 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	1 0	0.93 0.80 0.26 0.39	0.89 0.72 0.83 0.79	0.90 0.77 0.85 0.64	0.89 0.84 0.43 0.74	0.83 0.83 0.85 0.81
TKN	0.00 0.00 0.00 0.00	0.00 0.00 0.22 0.00	0.00 0.00 0.18 0.00	0.00 0.00 0.03 0.00	0.00 0.00 0.00 0.00	0.34 0.00 0.66 0.10	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.06 0.00	1 0	0.84 0.58 0.48 0.42	0.82 0.47 0.36 0.37	0.80 0.90 0.16 0.34	0.72 0.76 0.23 0.34
PO_4-P	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.02 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.30 0.01 0.16 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	1 0	0.92 0.50 0.89 0.52	0.81 0.62 0.45 0.63	0.67 0.55 0.82 0.60
TP	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.08 0.00 0.00	0.00 0.03 0.00 0.00	0.00 0.00 0.00 0.00	0.21 0.31 0.02 0.28	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.01 0.00	0.00 0.00 0.00 0.00	1 0	0.86 0.46 0.39 0.35	0.70 0.68 0.75 0.63
Cond.	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.05 0.00 0.49 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.01 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.26 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	1 0	0.80 0.82 0.46 0.70
Hard.	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.10 0.03 0.51 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.10 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	1 0

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

URS 23	URS 6-20F
URS 8-23C	Combined URS

Table E.3b Correlation Table for Metals from URS (2000~2001)

Correlation 'r' & P-Value	Total Cd		Total Cr		Total Cu		Total Ni		Total Pb		Total Zn		Soluble Cd		Soluble Cr		Soluble Cu		Soluble Ni		Soluble Pb		Soluble Zn	
Total Cd		1	0.51	0.87	0.73	0.97	0.66	0.91	0.70	0.94	0.64	0.92	0.42	0.40	0.22	0.43	0.44	0.73	0.41	0.65	0.42	0.56	0.30	0.24
	0		0.08	0.13	0.15	0.13	0.11	0.14	0.09	0.12	0.17	0.16	0.04	0.04	0.11	0.06	0.02	0.05	0.04	0.05	0.06	0.10	-0.05	-0.03
Total Cr	0.00	0.00		1	0.17	0.85	0.15	0.91	0.33	0.93	0.13	0.72	-0.01	0.56	0.30	0.51	-0.01	0.63	-0.07	0.68	0.12	0.57	-0.19	0.18
	0.57	0.07	0		0.92	0.84	0.95	0.92	0.82	0.88	0.87	0.79	0.41	0.45	0.76	0.50	0.77	0.59	0.67	0.53	0.49	0.66	0.15	0.06
Total Cu	0.00	0.00	0.14	0.00		1	0.87	0.94	0.64	0.93	0.89	0.92	0.55	0.44	0.27	0.46	0.78	0.81	0.77	0.72	0.48	0.48	0.75	0.30
	0.28	0.06	0.00	0.00	0		0.96	0.91	0.88	0.93	0.94	0.94	0.34	0.42	0.75	0.52	0.75	0.80	0.69	0.68	0.48	0.68	0.17	0.22
Total Ni	0.00	0.00	0.22	0.00	0.00	0.00		1	0.50	0.94	0.73	0.86	0.64	0.55	0.29	0.53	0.87	0.81	0.89	0.84	0.71	0.44	0.81	0.42
	0.45	0.05	0.00	0.00	0.00	0.00	0		0.87	0.90	0.88	0.87	0.44	0.49	0.78	0.53	0.80	0.75	0.75	0.72	0.44	0.62	0.21	0.28
Total Pb	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00		1	0.62	0.80	0.10	0.55	0.24	0.52	0.32	0.70	0.33	0.68	0.42	0.50	0.21	0.17
	0.52	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0		0.85	0.85	0.45	0.50	0.67	0.53	0.65	0.67	0.59	0.58	0.54	0.69	0.15	0.09
Total Zn	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00		1	0.45	0.31	0.09	0.45	0.57	0.76	0.56	0.67	0.37	0.50	0.57	0.40
	0.22	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.31	0.34	0.66	0.48	0.68	0.74	0.64	0.64	0.48	0.65	0.22	0.28
Soluble Cd	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.01		1	0.02	0.40	0.67	0.51	0.68	0.54	0.37	0.31	0.67	0.28
	0.80	0.58	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0		0.28	0.37	0.46	0.50	0.45	0.52	0.22	0.29	0.35	0.30
Soluble Cr	0.06	0.00	0.01	0.00	0.02	0.00	0.01	0.00	0.04	0.00	0.45	0.00	0.87	0.00		1	0.33	0.41	0.30	0.47	0.38	0.31	0.21	0.19
	0.42	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0		0.78	0.49	0.69	0.49	0.70	0.40	0.26	0.18
Soluble Cu	0.00	0.00	0.94	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00		1	0.96	0.78	0.61	0.41	0.93	0.57
	0.92	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.94	0.85	0.57	0.56	0.60	0.59
Soluble Ni	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00		1	0.61	0.27	0.96	0.70
	0.79	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.45	0.40	0.73	0.74
Soluble Pb	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.03		1	0.48	0.20
	0.65	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		0.36	0.17
Soluble Zn	0.01	0.05	0.12	0.15	0.00	0.01	0.00	0.00	0.08	0.17	0.00	0.00	0.00	0.02	0.07	0.11	0.00	0.00	0.00	0.00	0.00	0.10		1
	0.73	0.70	0.27	0.39	0.23	0.00	0.12	0.00	0.28	0.21	0.11	0.00	0.01	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.01	0.02	0	

1. Correlation Coefficient "r" is the Pearson's Product moment and appears above the diagonal
2. Probability Values (P-Value) appear below the diagonal. P-Value, 0.00. Means less than 0.05
3. The values in individual cell is arranged as follows:

URS 23	URS 6-20F
URS 8-23C	Combined URS

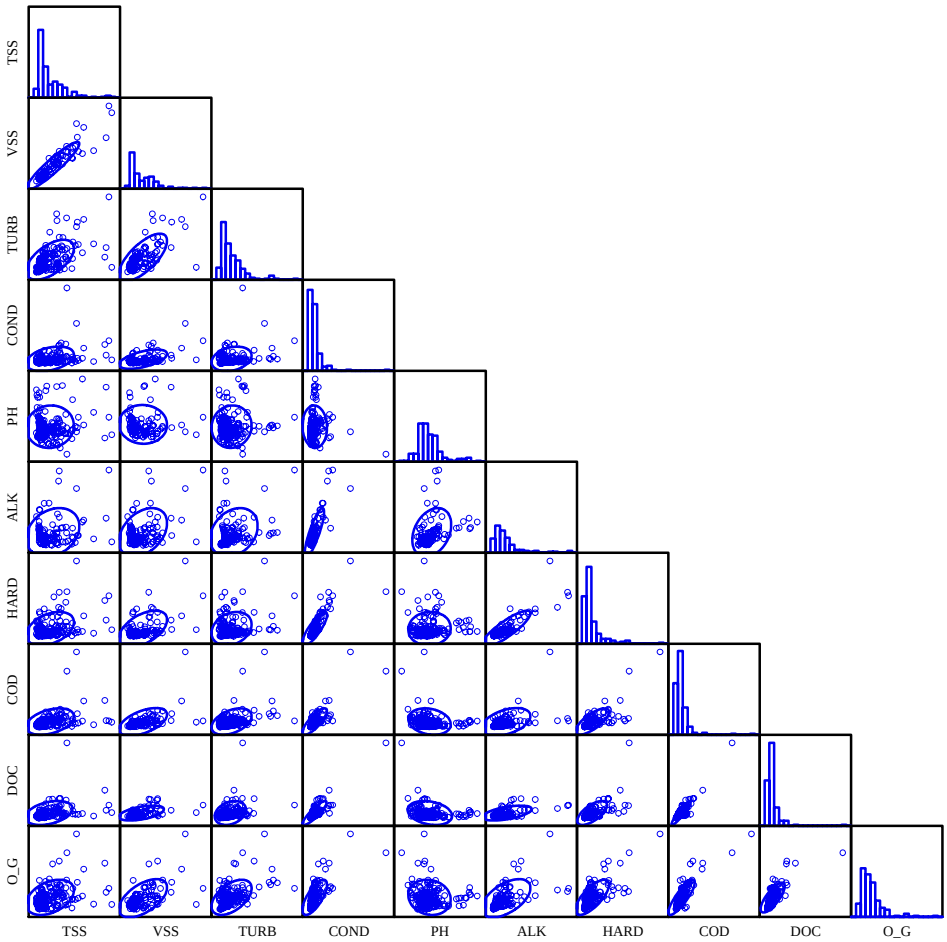


Figure E.1.1a Correlation Chart between Non-Metal Parameters from UCLA 1

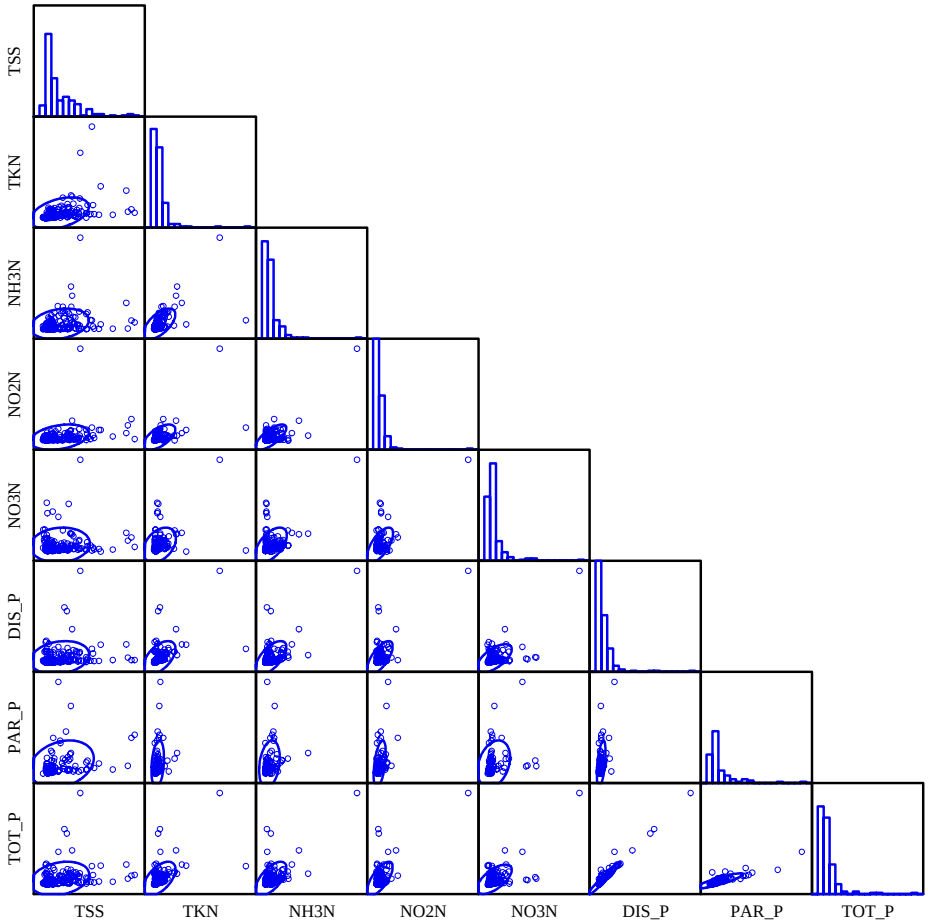


Figure E.1.1a Correlation Chart between Non-Metal Parameters from UCLA 1 ***(Continued)***

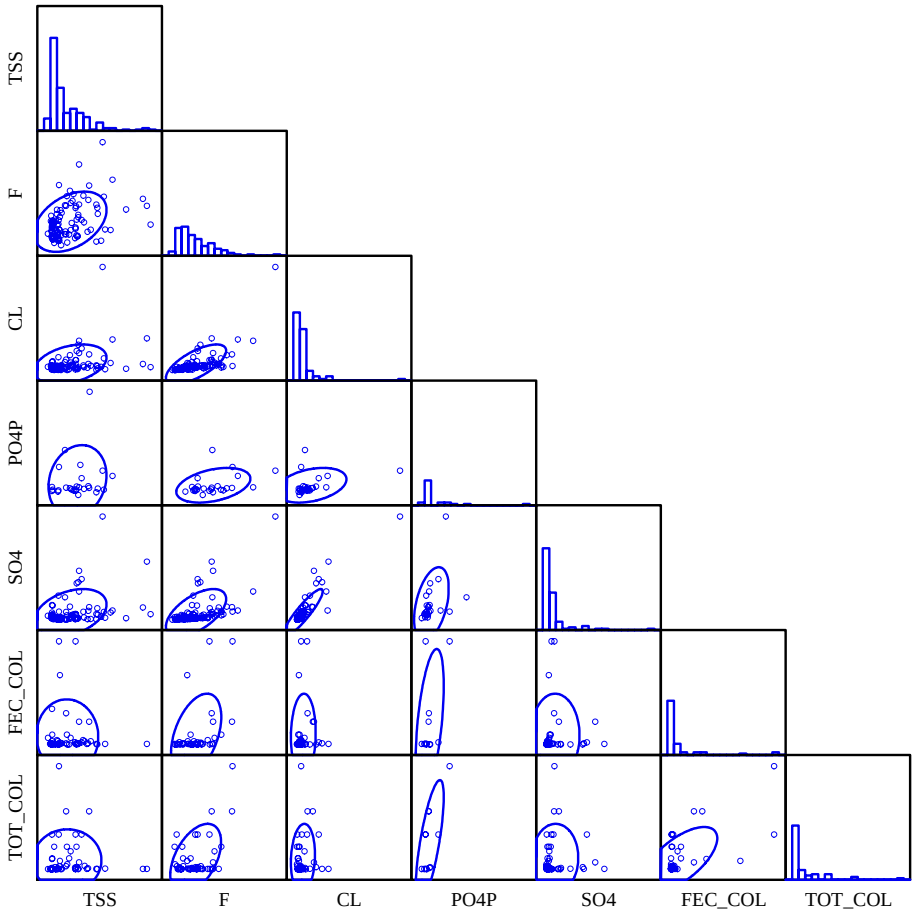


Figure E.1.1a Correlation Chart between Non-Metal Parameters from UCLA 1 ***(Continued)***

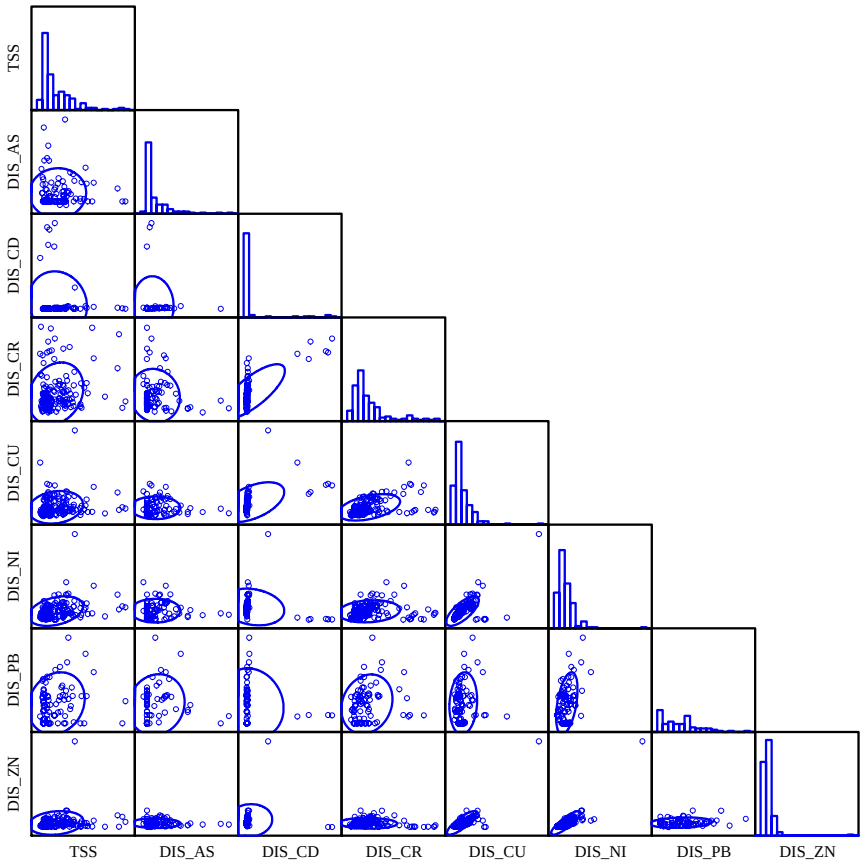


Figure E.1.1b Correlation Chart between TSS and Selected Dissolved Metals from UCLA 1

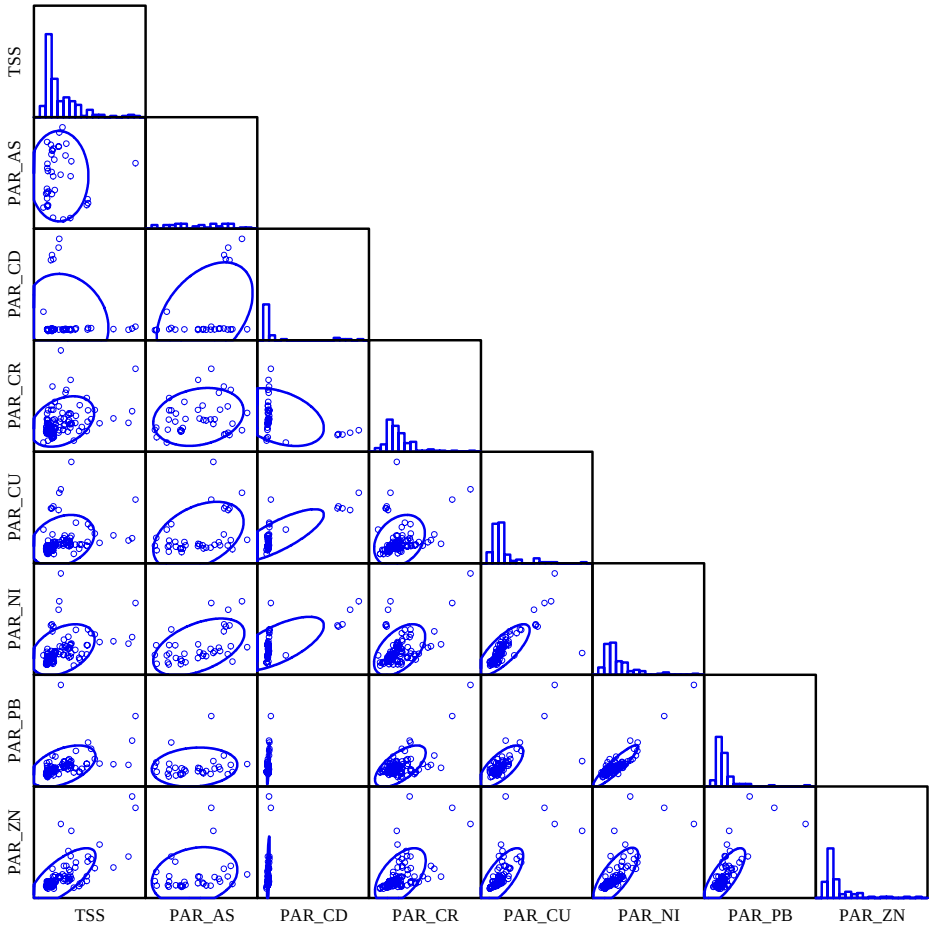


Figure E.1.1c Correlation Chart between TSS and Selected Particulate Metals from UCLA 1

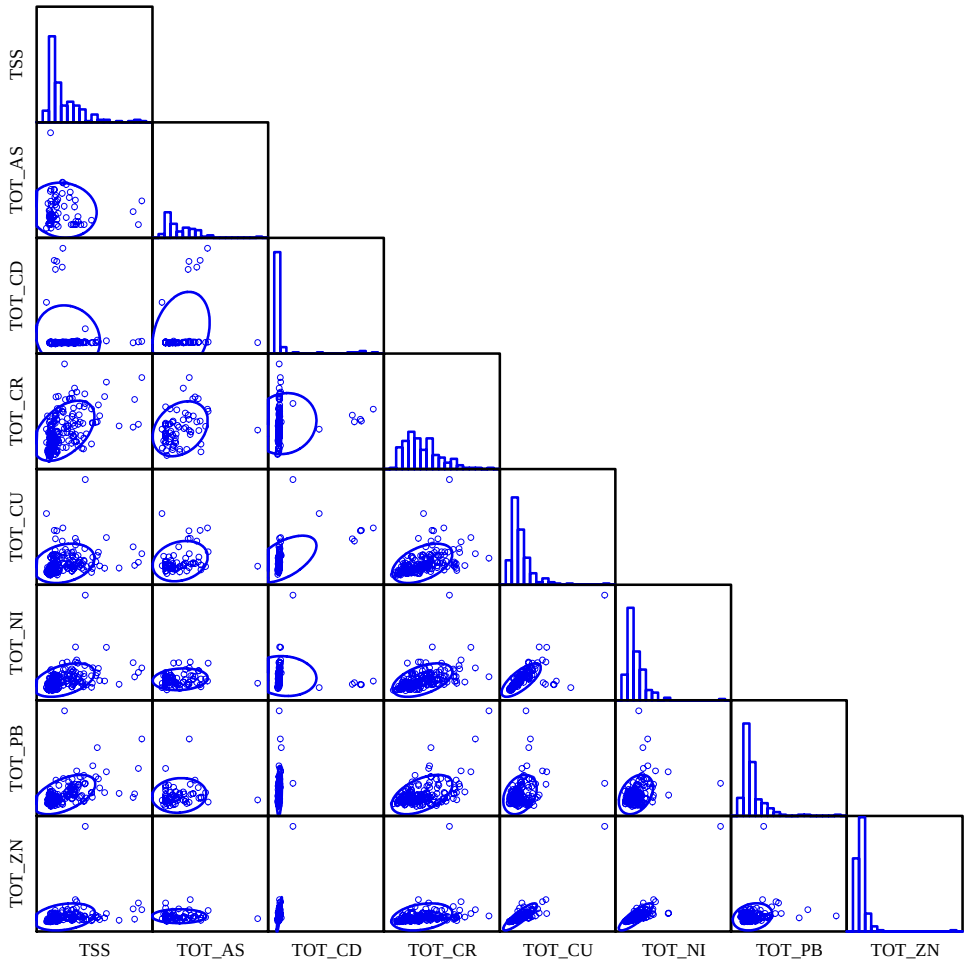


Figure E.1.1d Correlation Chart between TSS and Selected Total Metals from UCLA 1

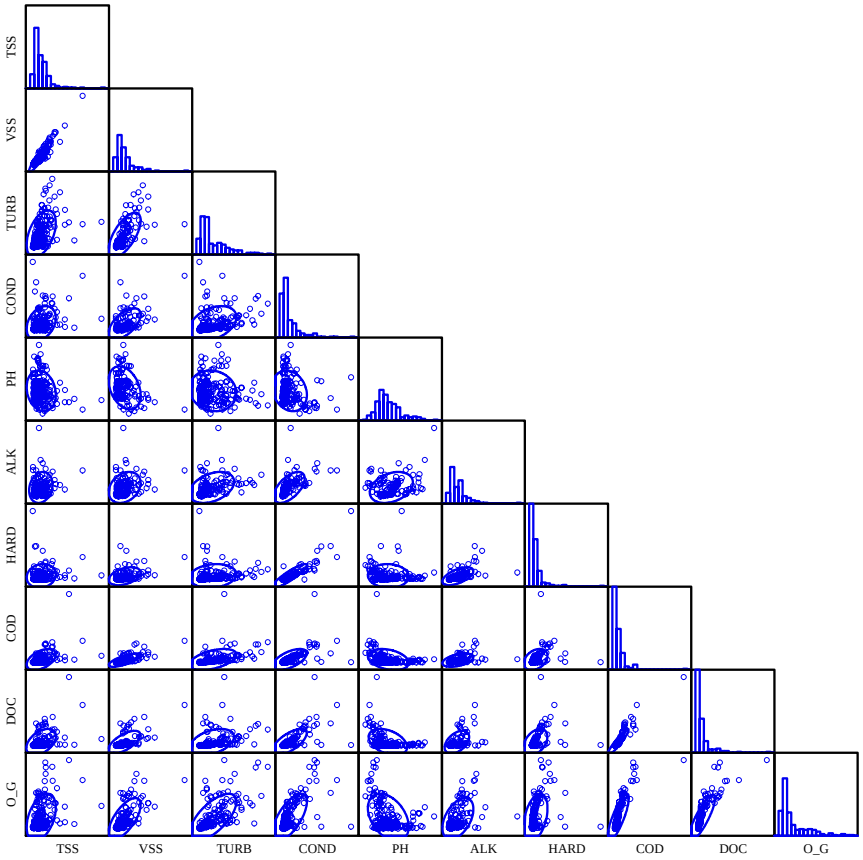


Figure E.1.2a Correlation Chart between Non-Metal Parameters from UCLA 2

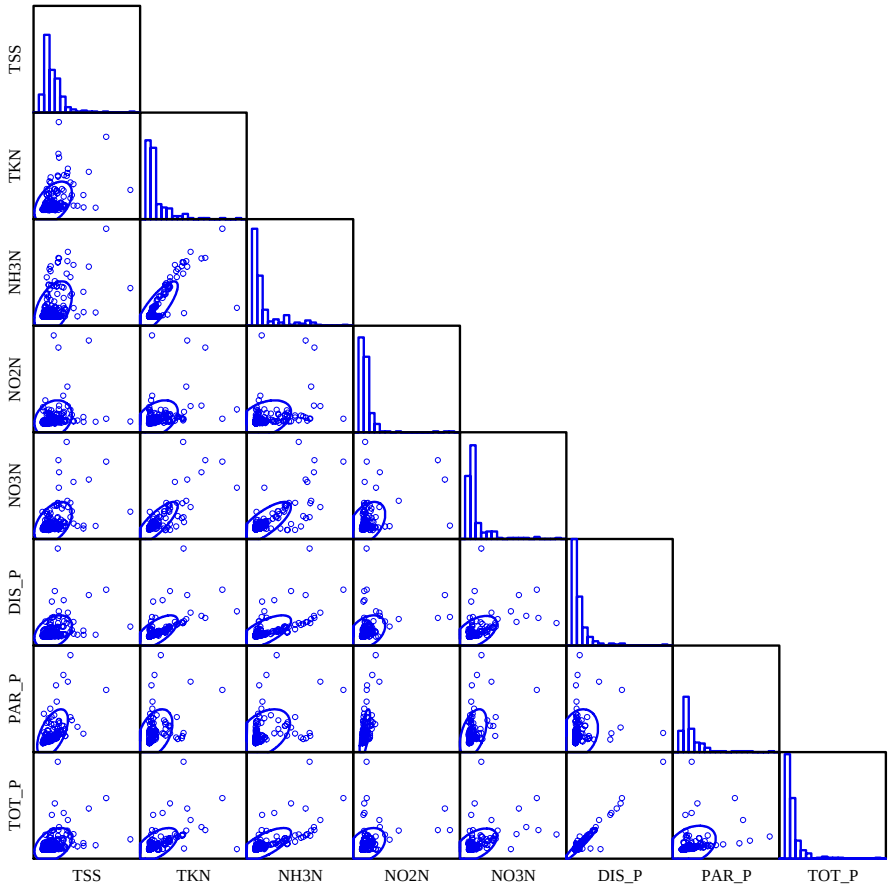


Figure E.1.2a Correlation Chart between Non-Metal Parameters from UCLA 2 ***(Continued)***

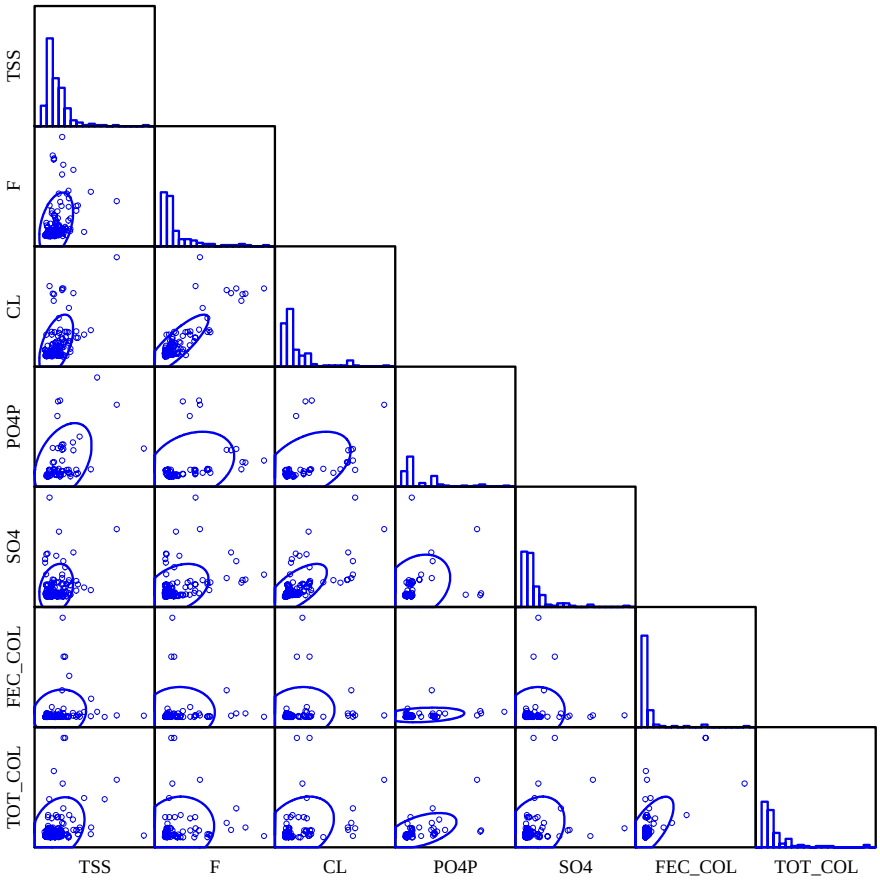


Figure E.1.2a Correlation Chart between Non-Metal Parameters from UCLA 2 ***(Continued)***

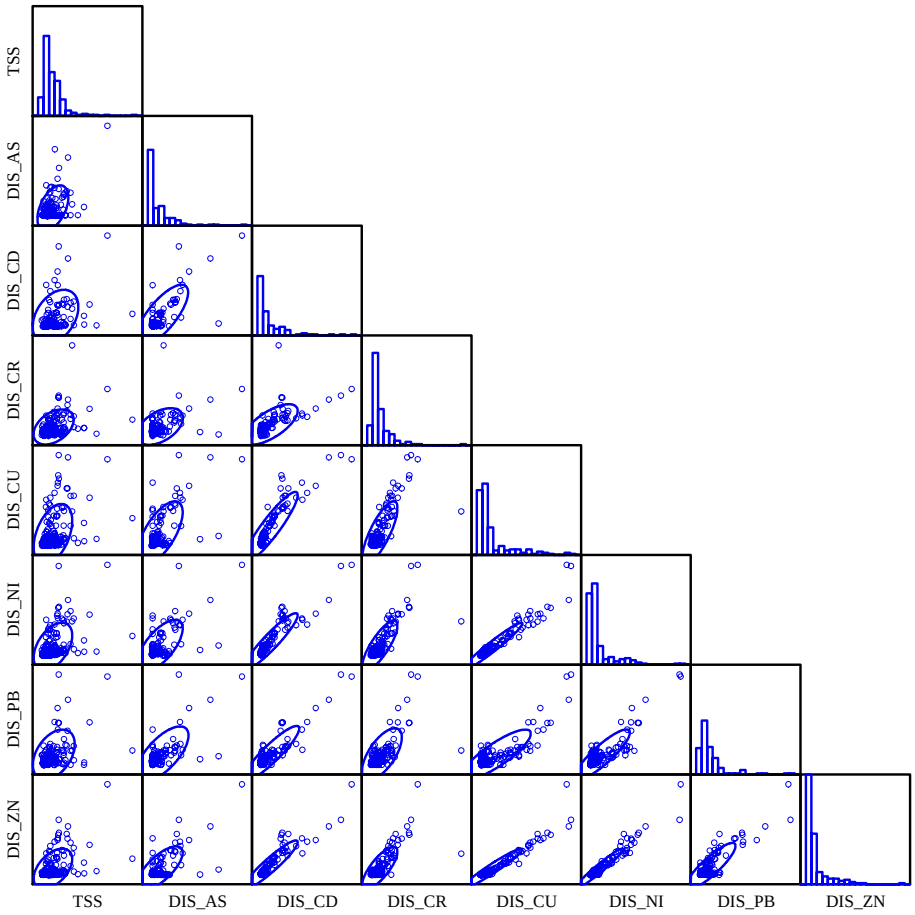


Figure E.1.2b Correlation Chart between TSS and Selected Dissolved Metals from UCLA 2

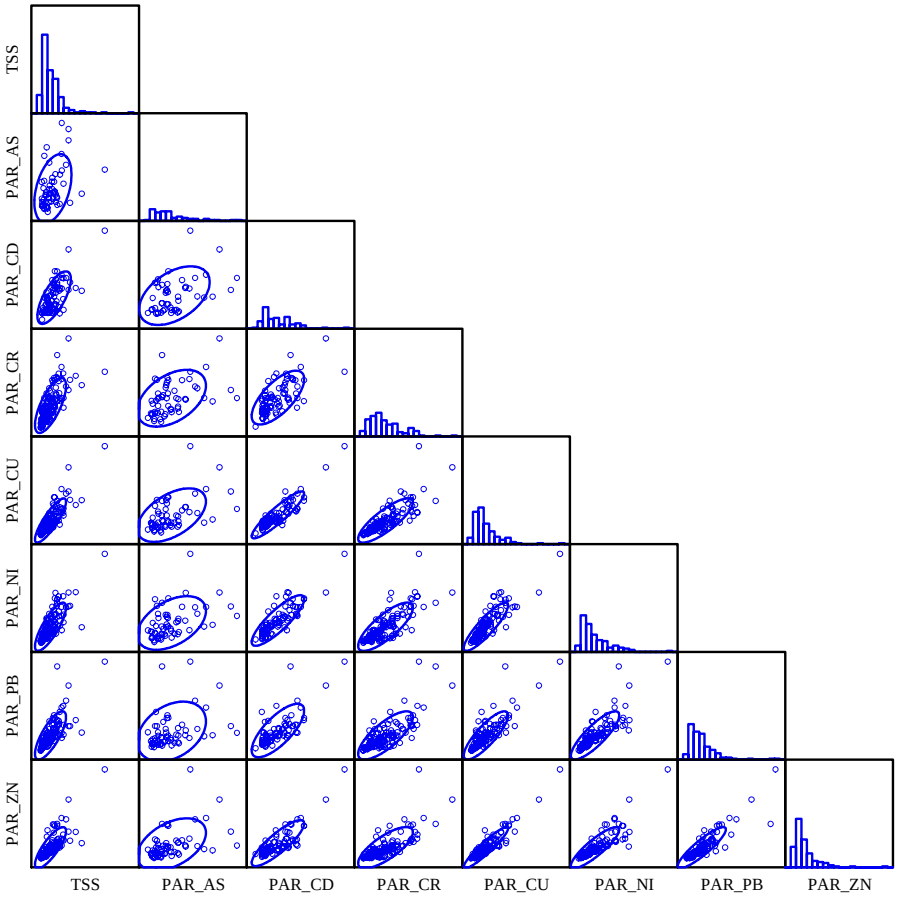


Figure E.1.2c Correlation Chart between TSS and Selected Particulate Metals from UCLA 2

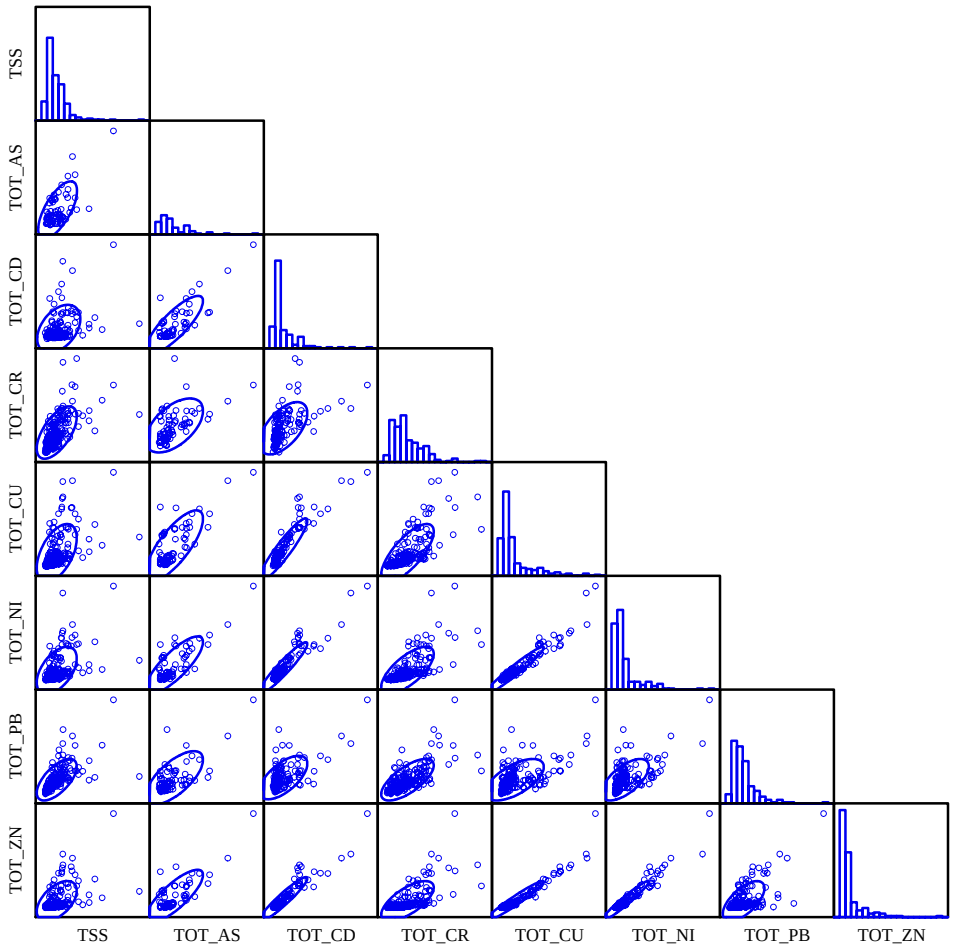


Figure E.1.2d Correlation Chart between TSS and Selected Total Metals from UCLA 2

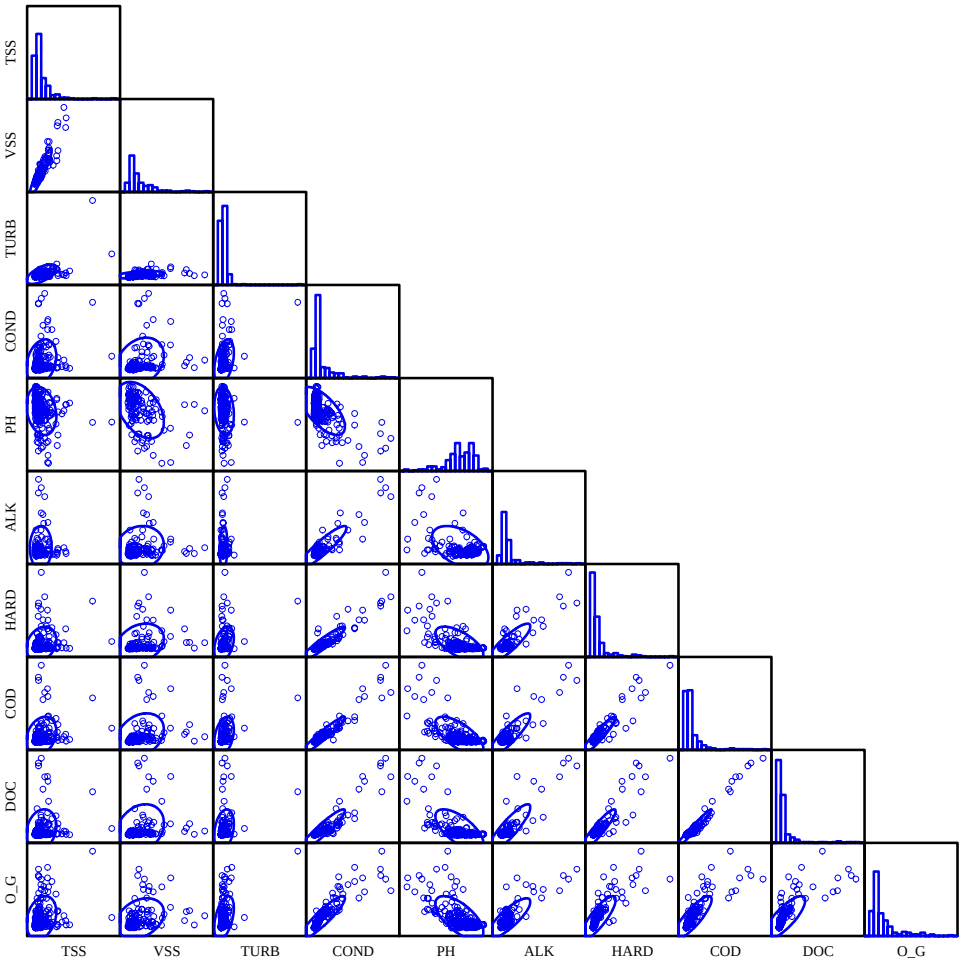


Figure E.1.3a Correlation Chart between Non-Metal Parameters from UCLA 3

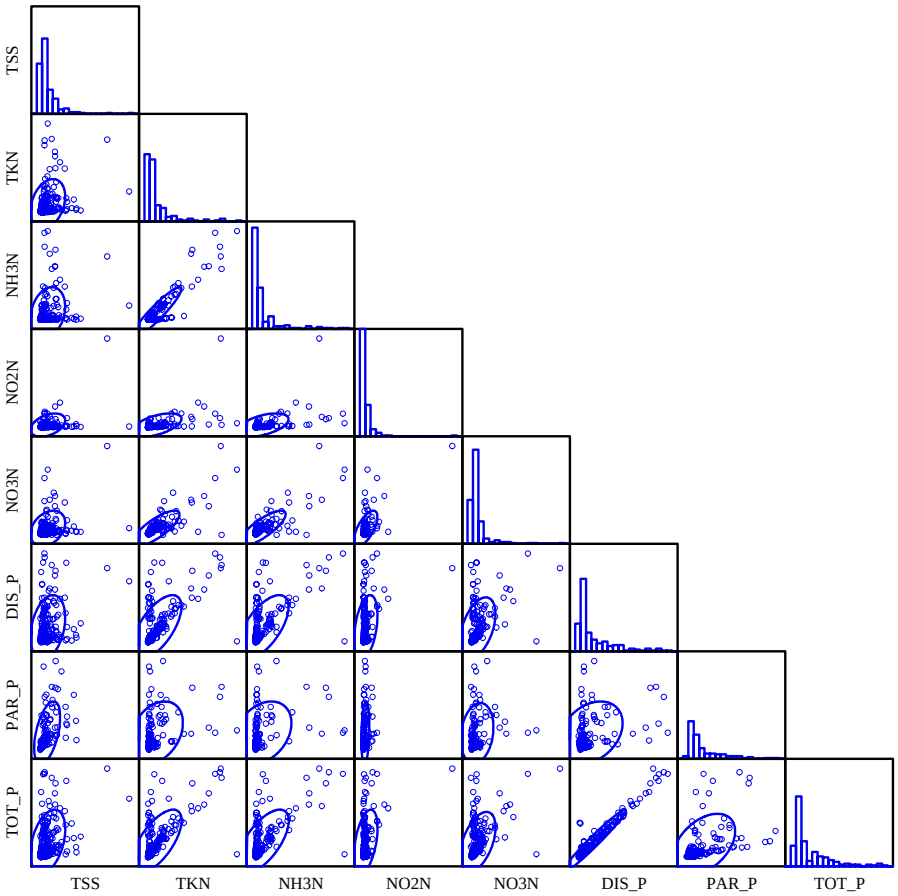


Figure E.1.3a Correlation Chart between Non-Metal Parameters from UCLA 3 ***(Continued)***

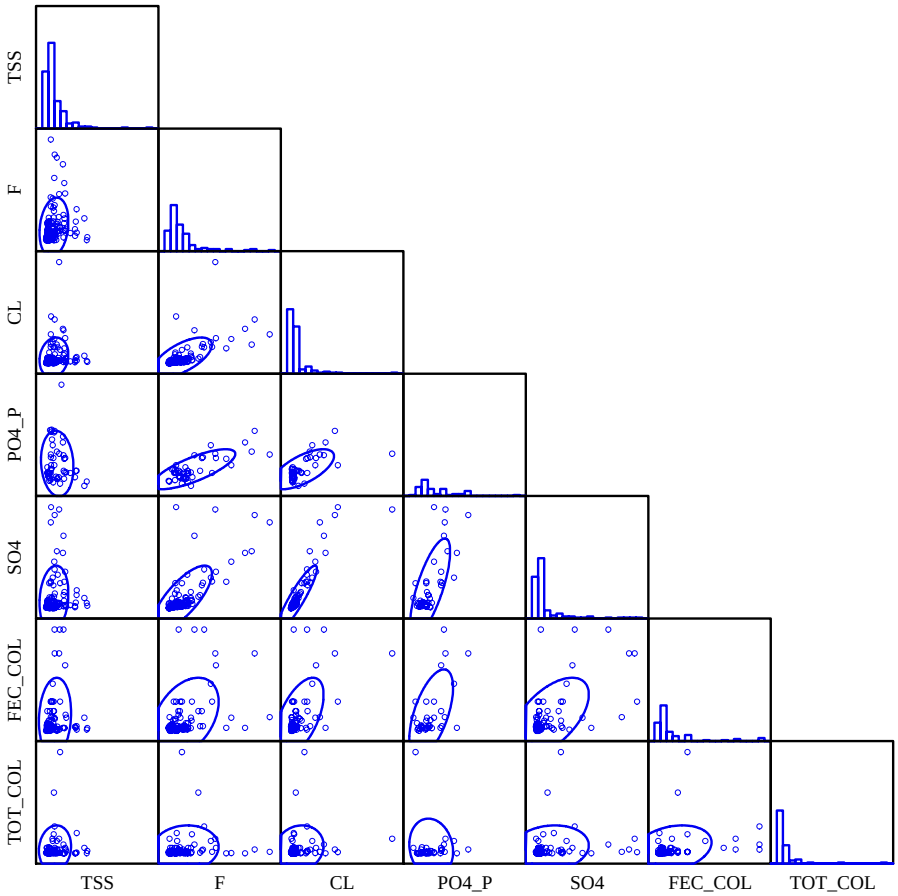


Figure E.1.3a Correlation Chart between Non-Metal Parameters from UCLA 3 ***(Continued)***

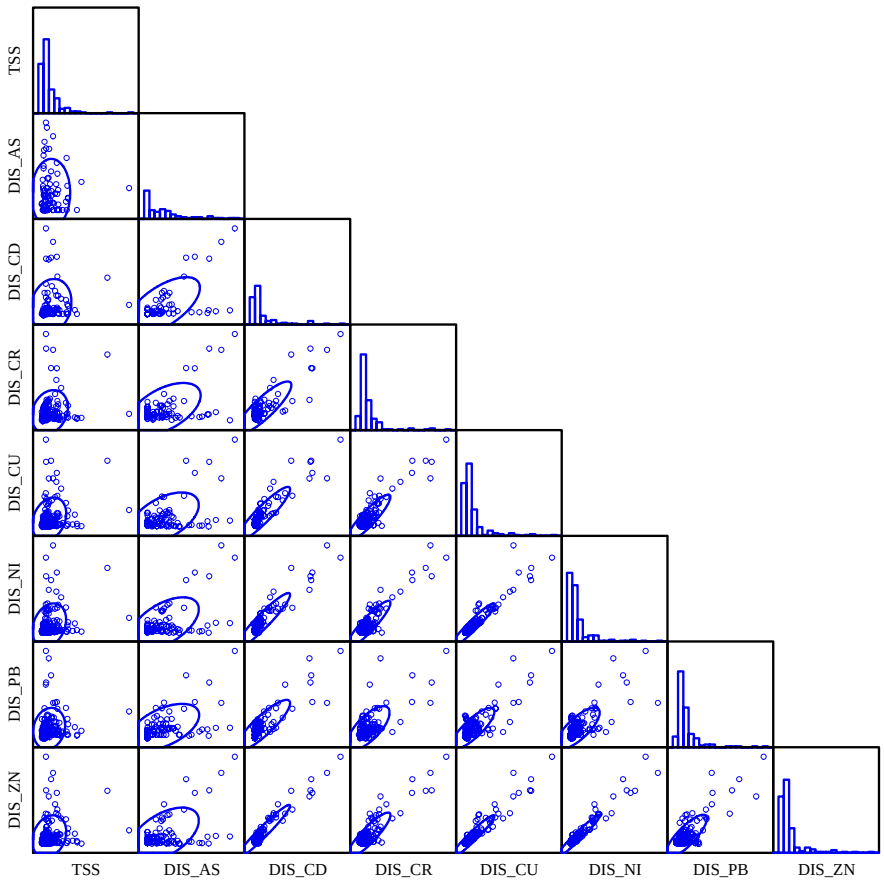


Figure E.1.3b Correlation Chart between TSS and Selected Dissolved Metals from UCLA 3

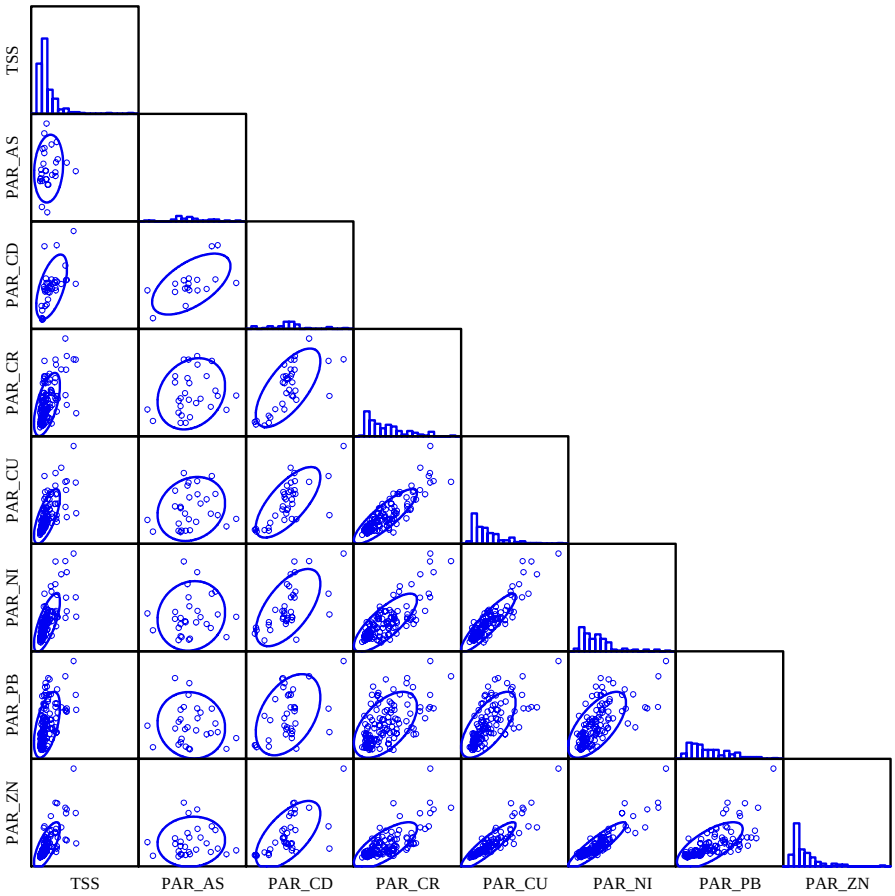


Figure E.1.3c Correlation Chart between TSS and Selected Particulate Metals from UCLA 3

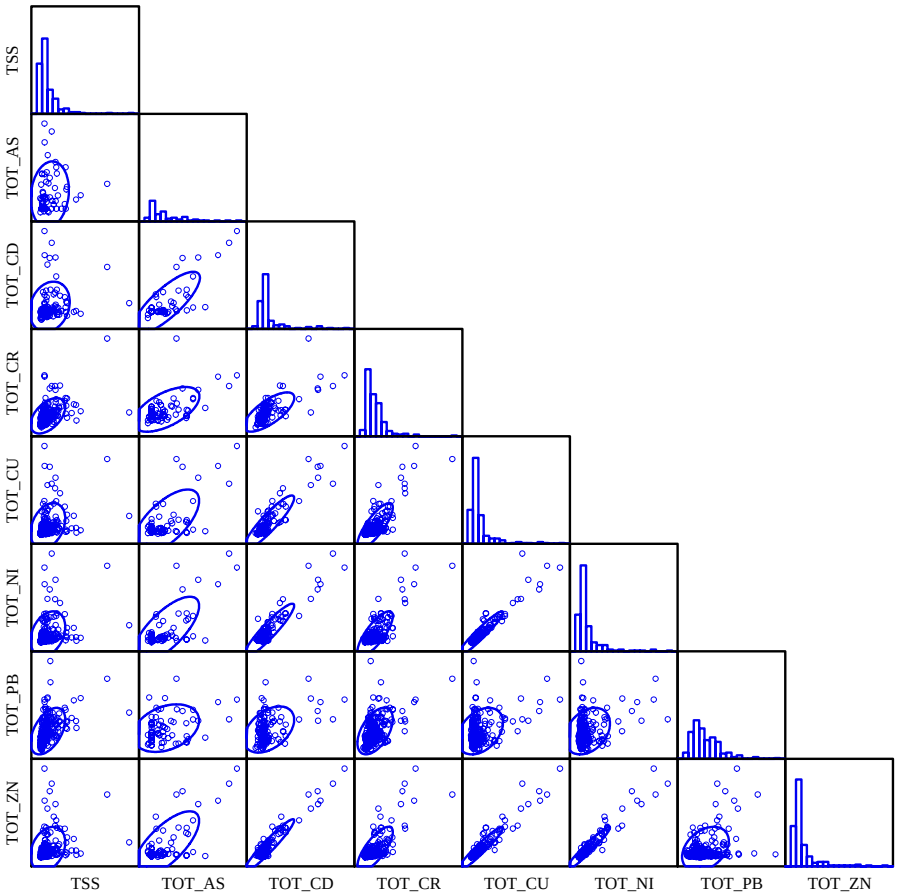


Figure E.1.3d Correlation Chart between TSS and Selected Total Metals from UCLA 3

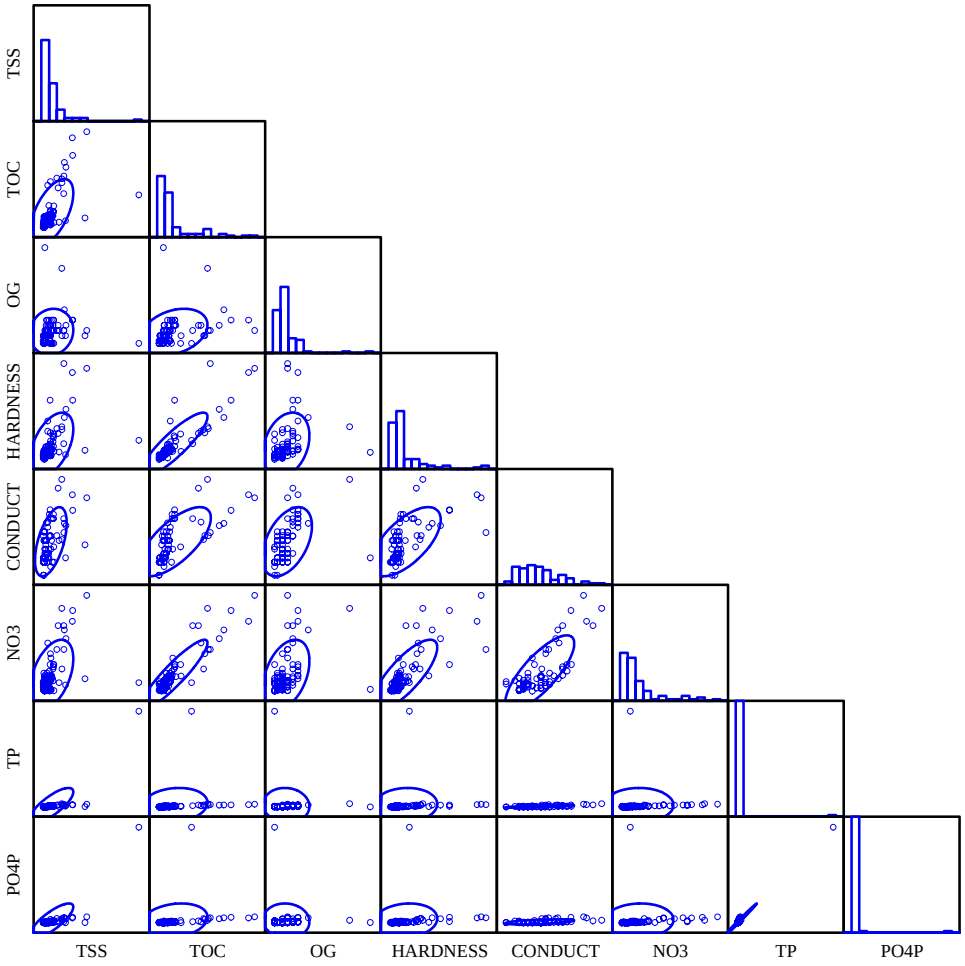


Figure E.2.1a Correlation Chart between Non-Metal Parameters from CDM 7-10

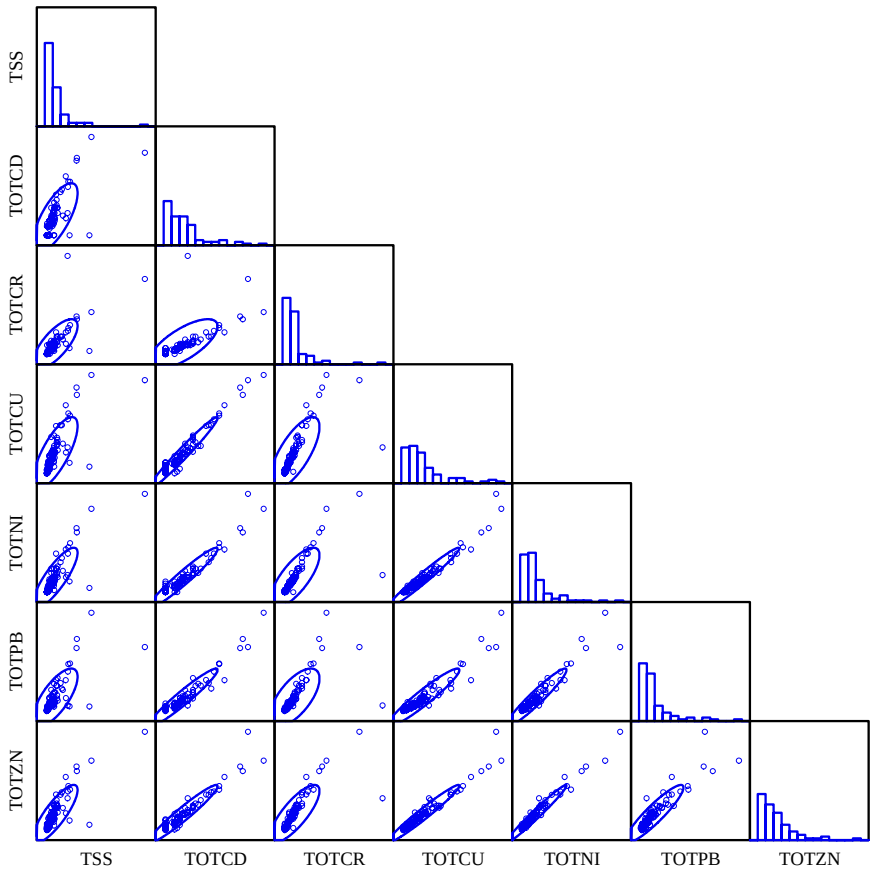


Figure E.2.1b Correlation Chart between TSS and Selected Total Metals from CDM 7-10

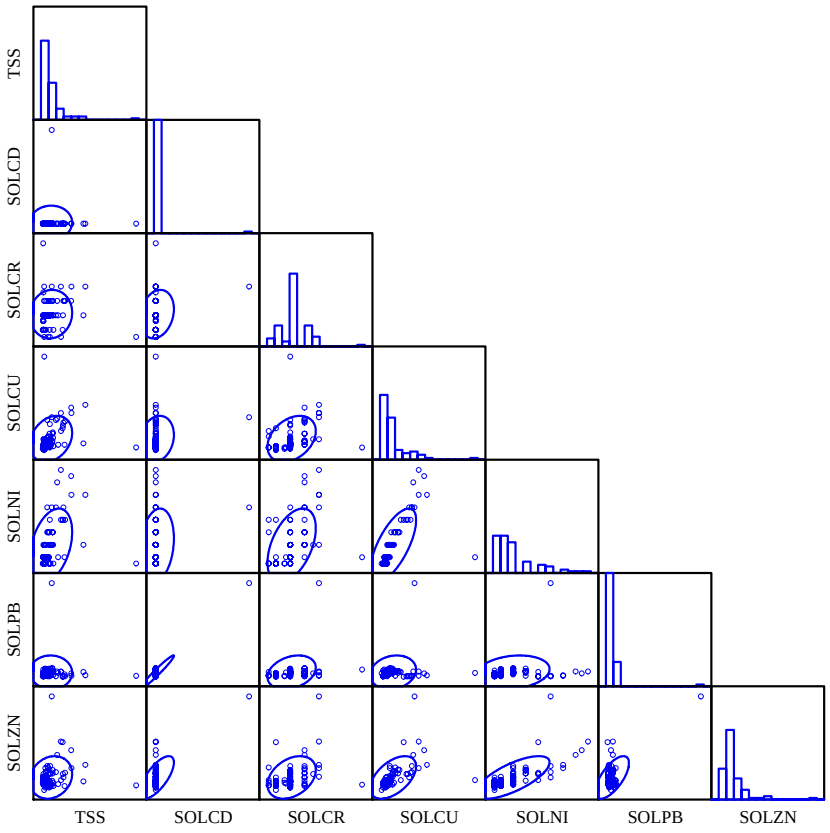


Figure E.2.1c Correlation Chart between TSS and Selected Dissolved Metals from CDM 7-10

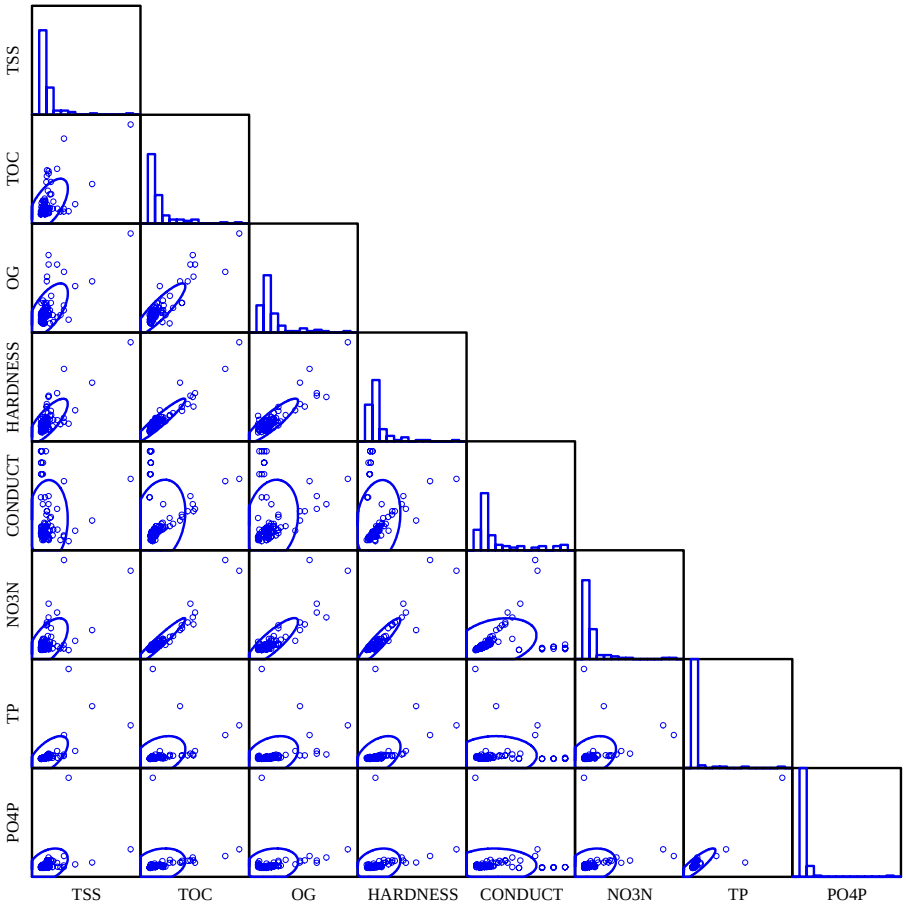


Figure E.2.2a Correlation Chart between Non-Metal Parameters from CDM 7-185

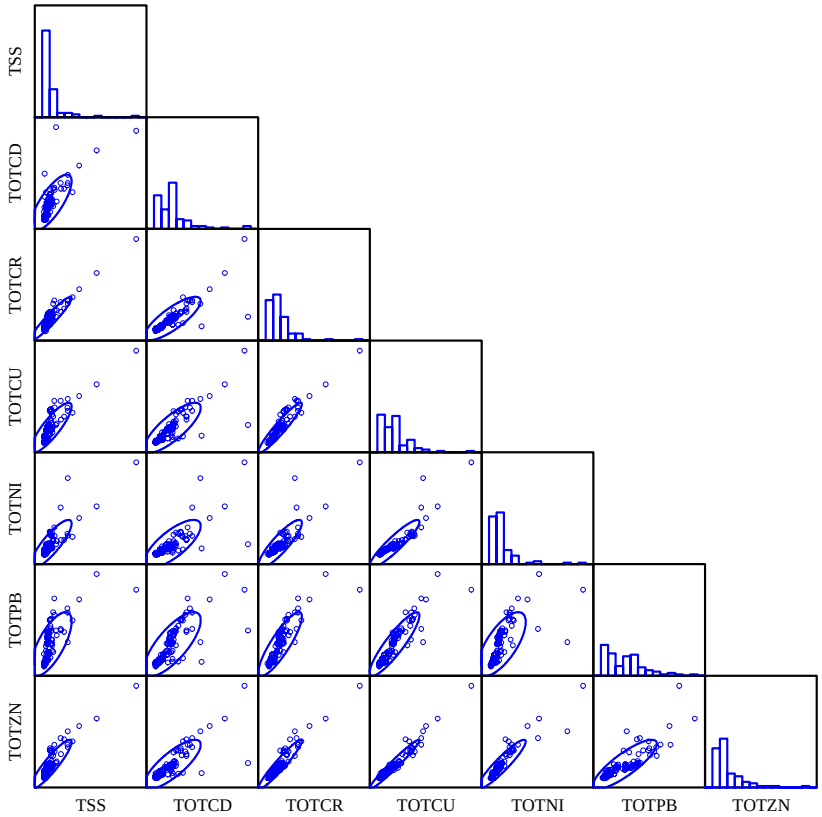


Figure E.2.2b Correlation Chart between TSS and Selected Total Metals from CDM 7-185

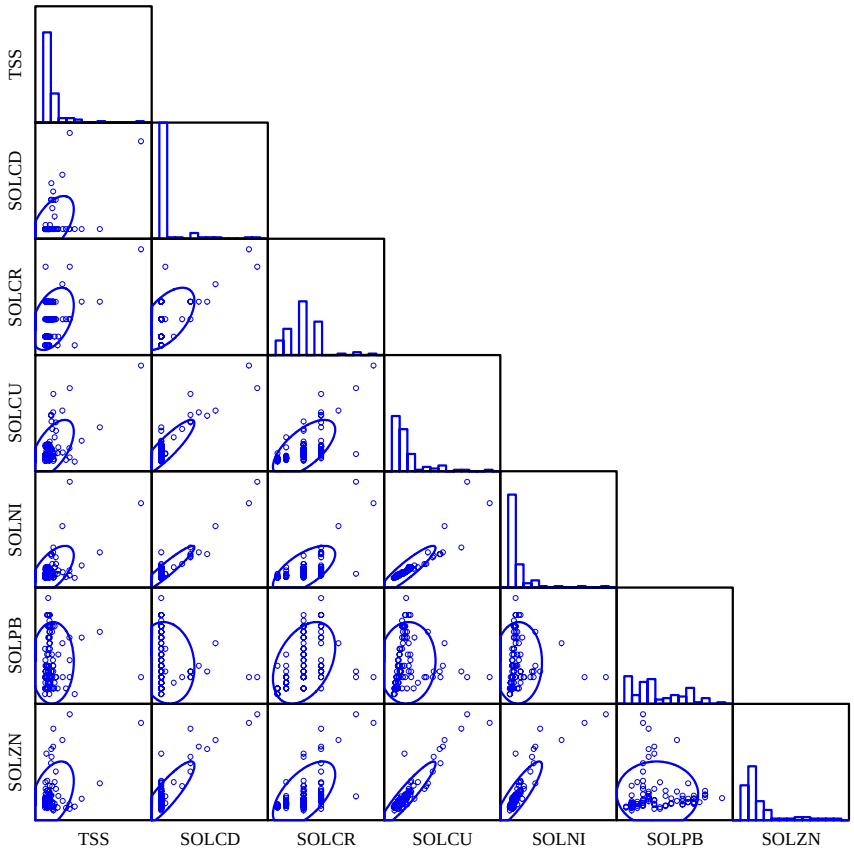


Figure E.2.2c Correlation Chart between TSS and Selected Dissolved Metals from CDM 7-185

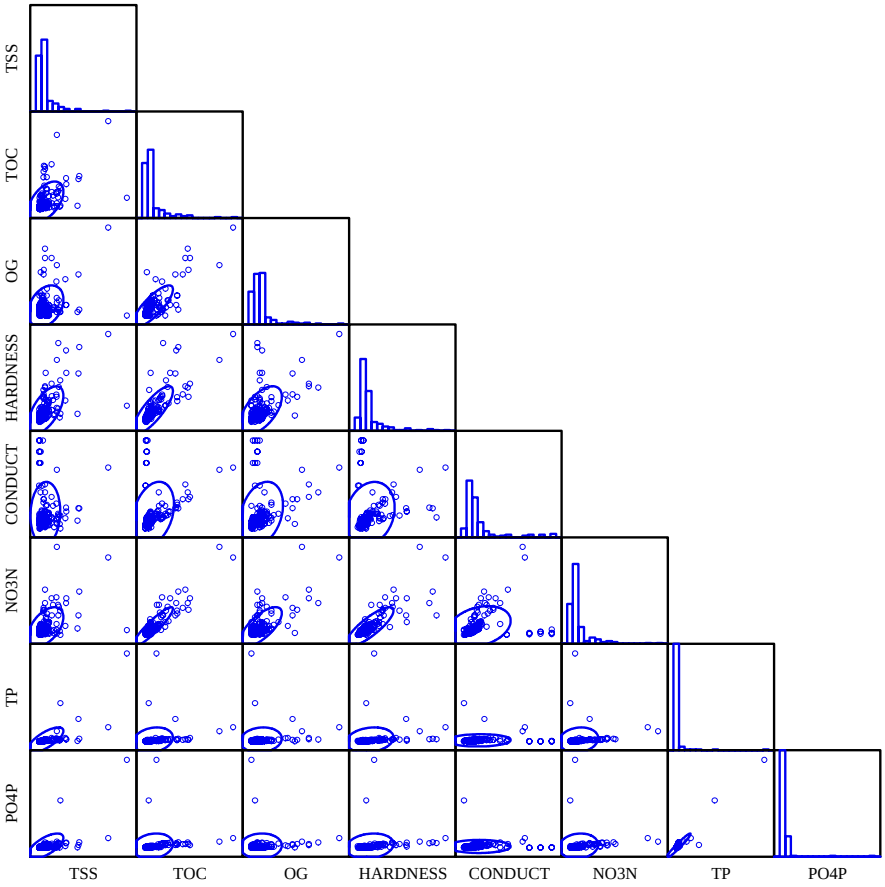


Figure E.2.3a Correlation Chart between Non-Metal Parameters from 1999-2000 Grab Samples from CDM 7-10 and 7-185

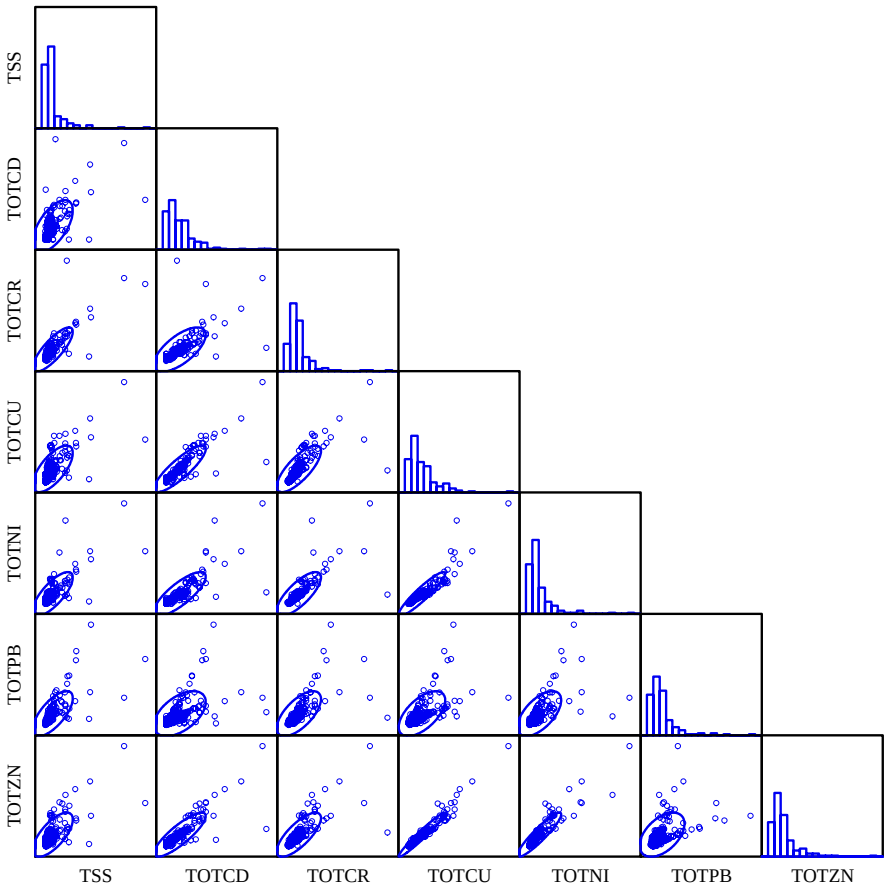


Figure E.2.3b Correlation Chart between TSS and Selected Total Metals from 1999-2000 Grab Samples from CDM 7-10 and 7-185

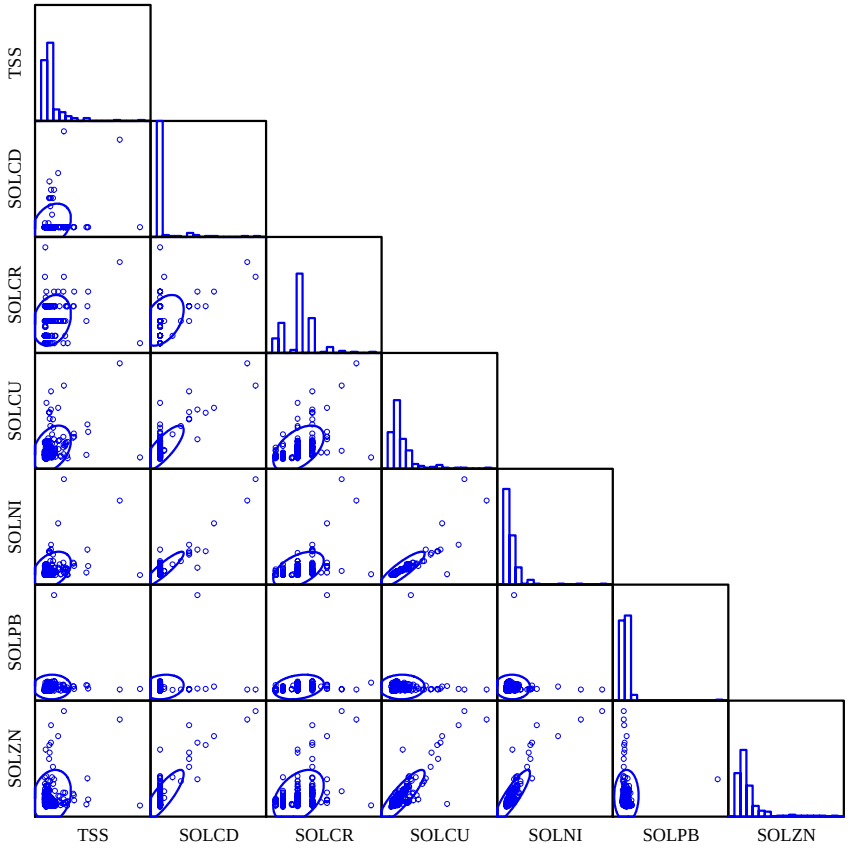


Figure E.2.3c Correlation Chart between TSS and Selected Dissolved Metals from 1999-2000 Grab Samples from CDM 7-10 and 7-185

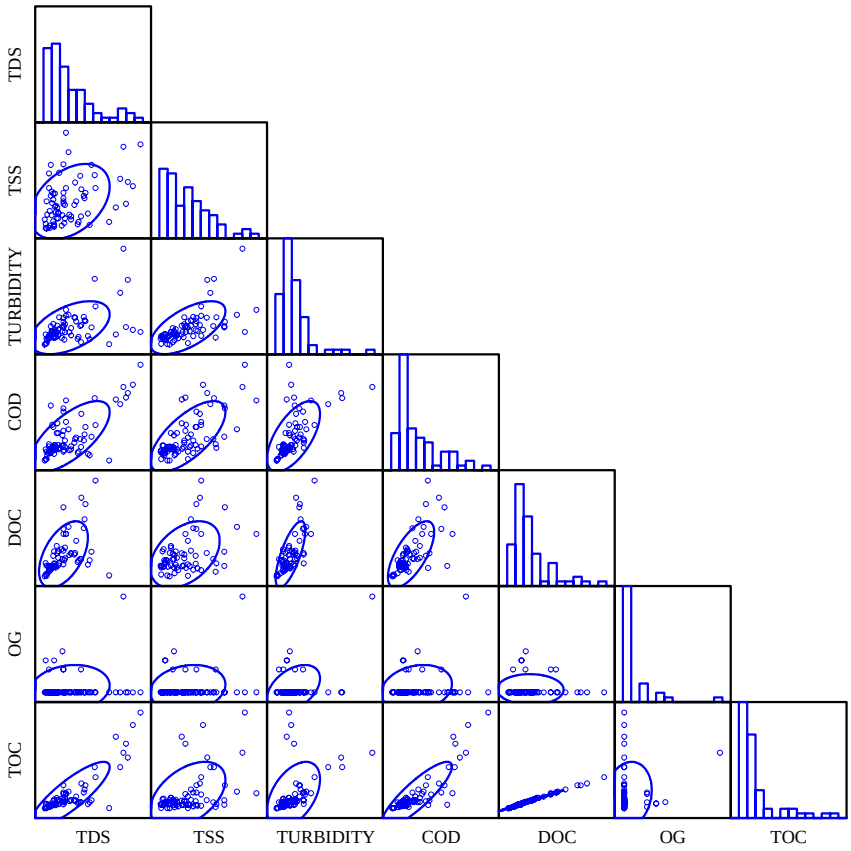


Figure E.3.1a Correlation Chart between Non-Metal Parameters from URS 23

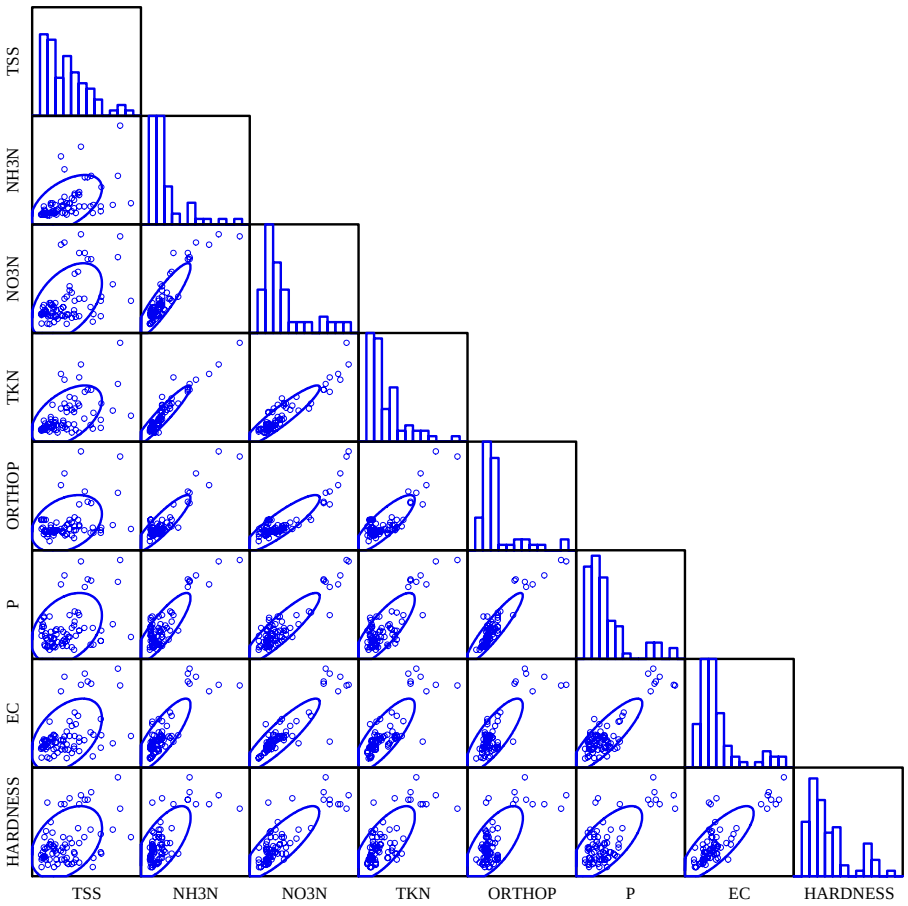


Figure E.3.1a Correlation Chart between Non-Metal Parameters from URS 23 ***(Continued)***

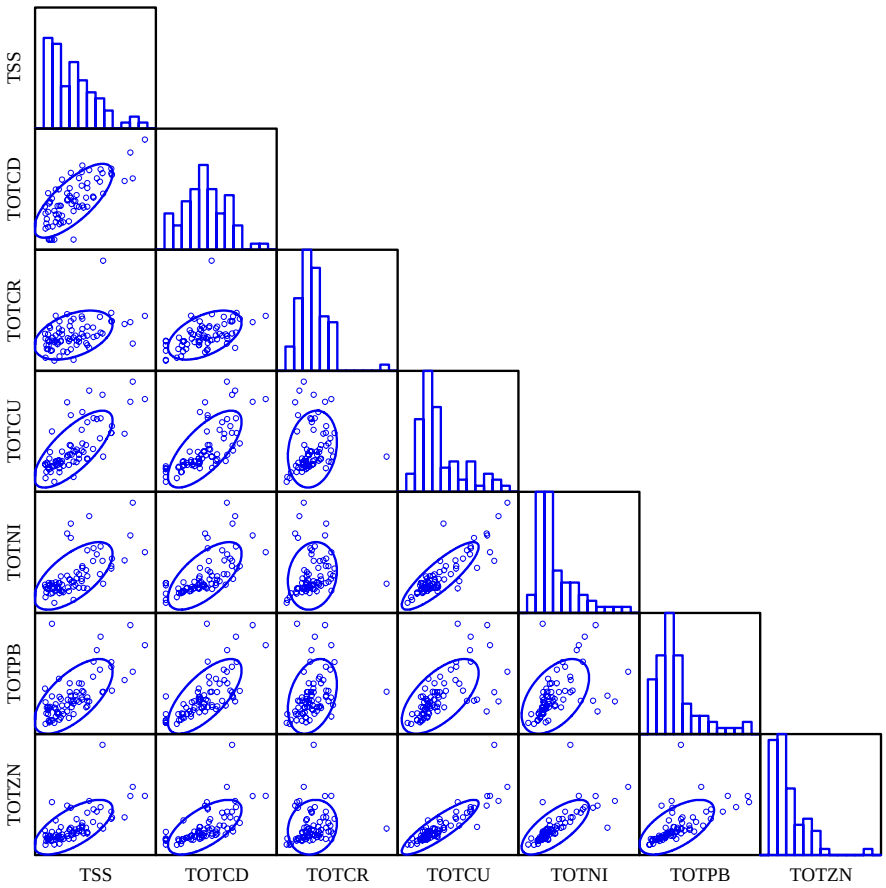


Figure E.3.1b Correlation Chart between TSS and Selected Total Metals from URS 23

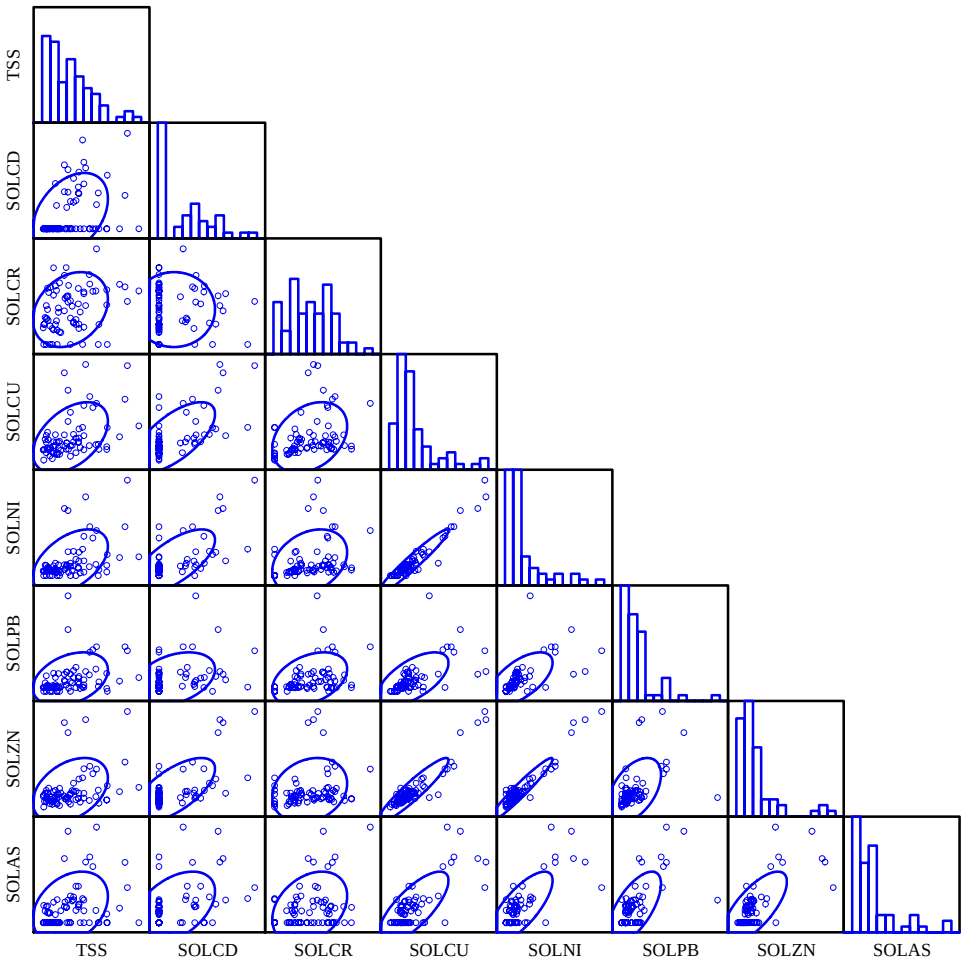


Figure E.3.1c Correlation Chart between TSS and Selected Dissolved Metals from URS 23

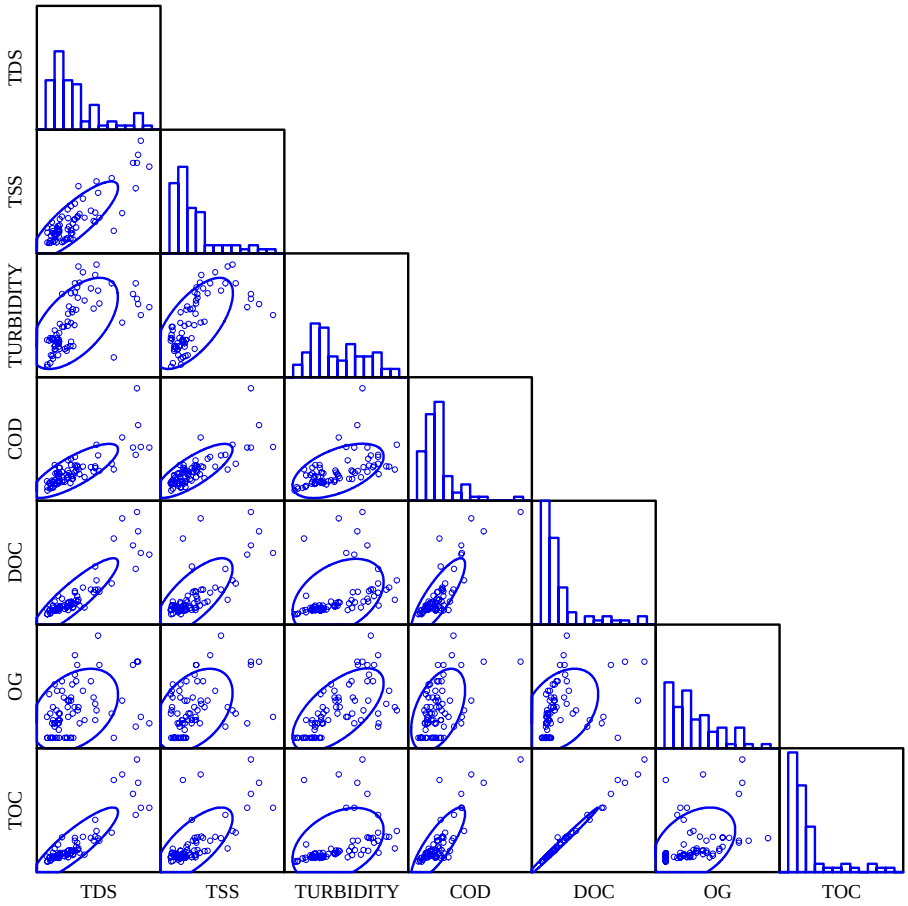


Figure E.3.2a Correlation Chart between Non-Metal Parameters from URS 6-20F

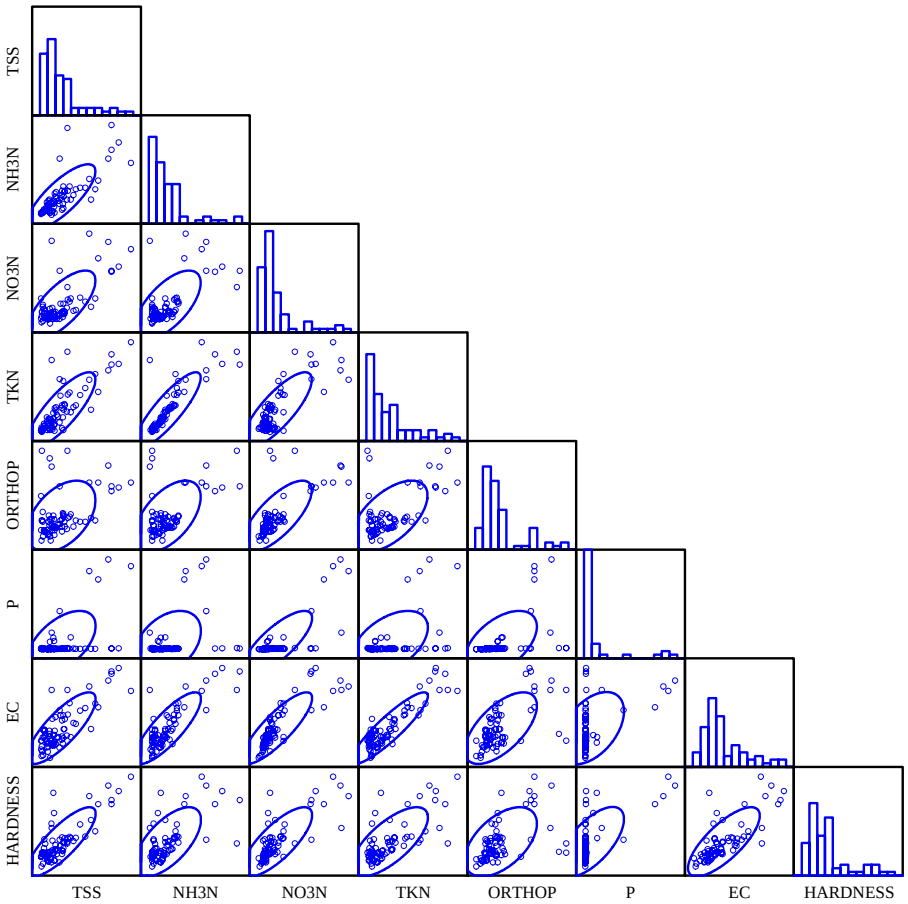


Figure E.3.2a Correlation Chart between Non-Metal Parameters from URS 6-20F ***(Continued)***

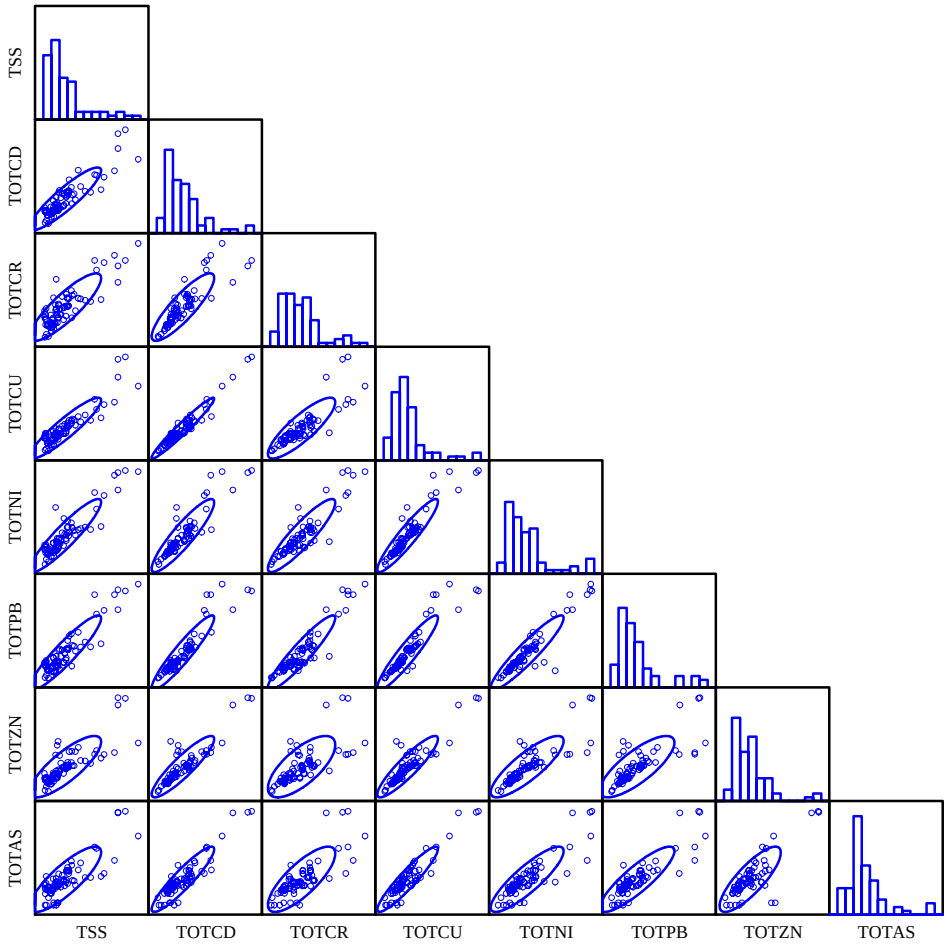


Figure E.3.2b Correlation Chart between TSS and Selected Total Metals from URS 6-20F

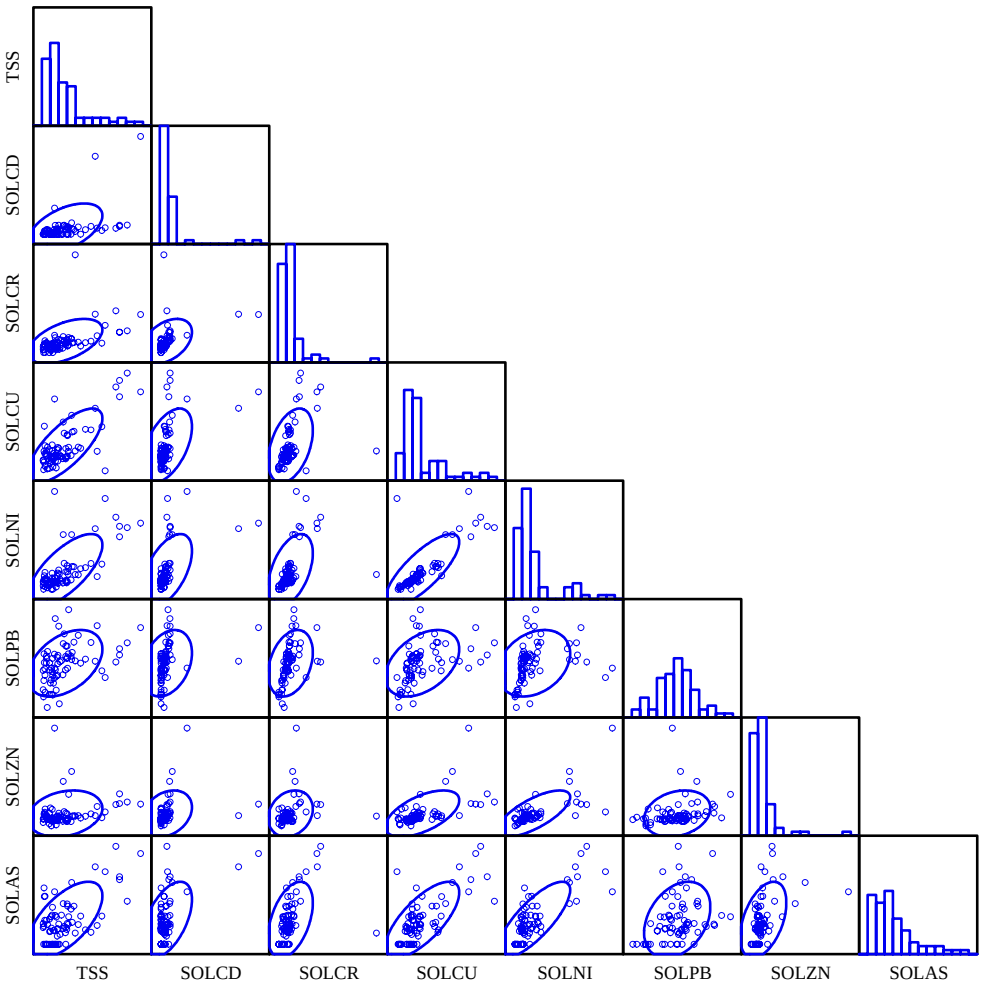


Figure E.3.2c Correlation Chart between TSS and Selected Dissolved Metals from URS 6-20F

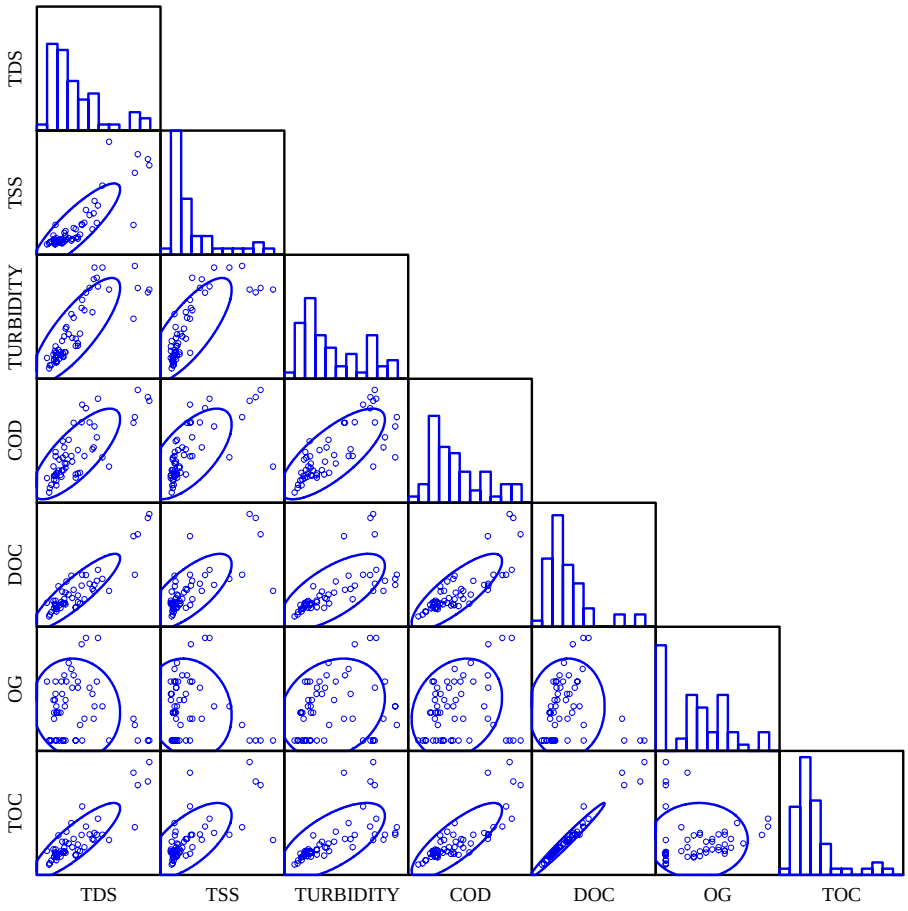


Figure E.3.3a Correlation Chart between Non-Metal Parameters from URS 8-23C

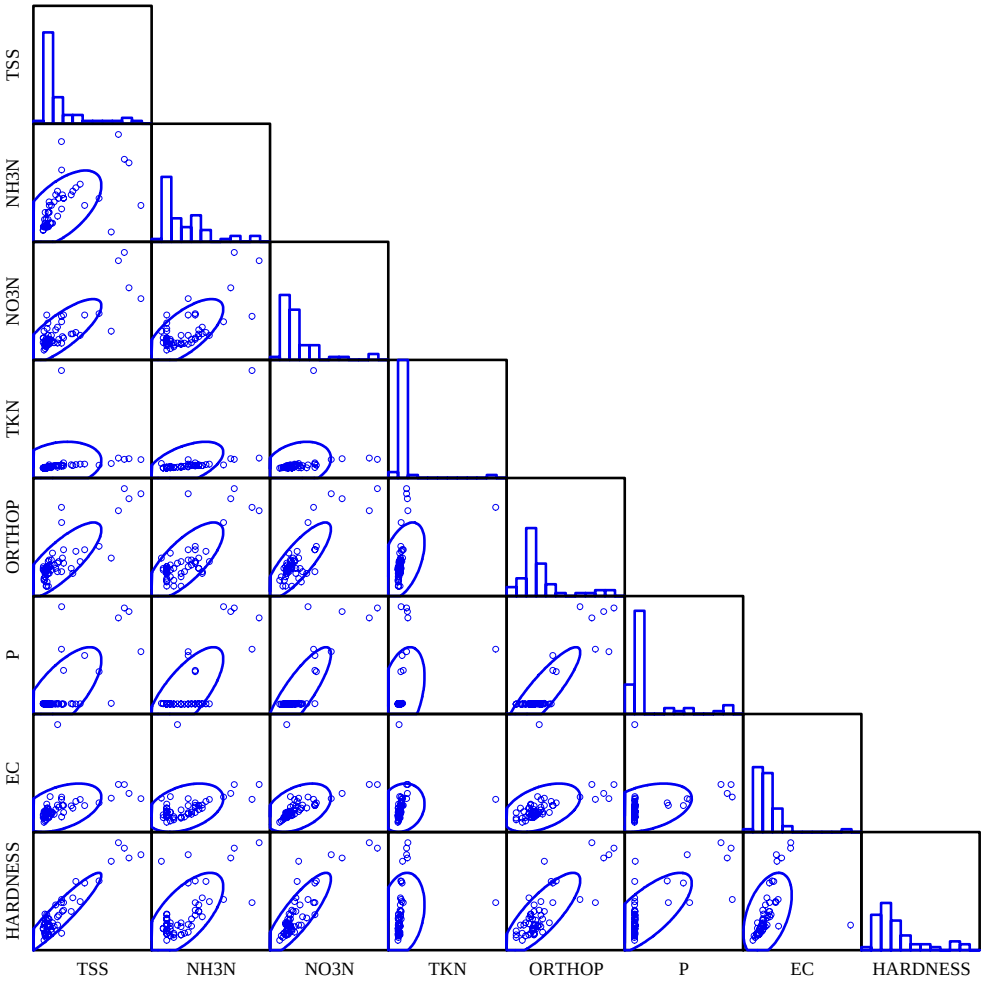


Figure E.3.3a Correlation Chart between Non-Metal Parameters from URS 8-23C ***(Continued)***

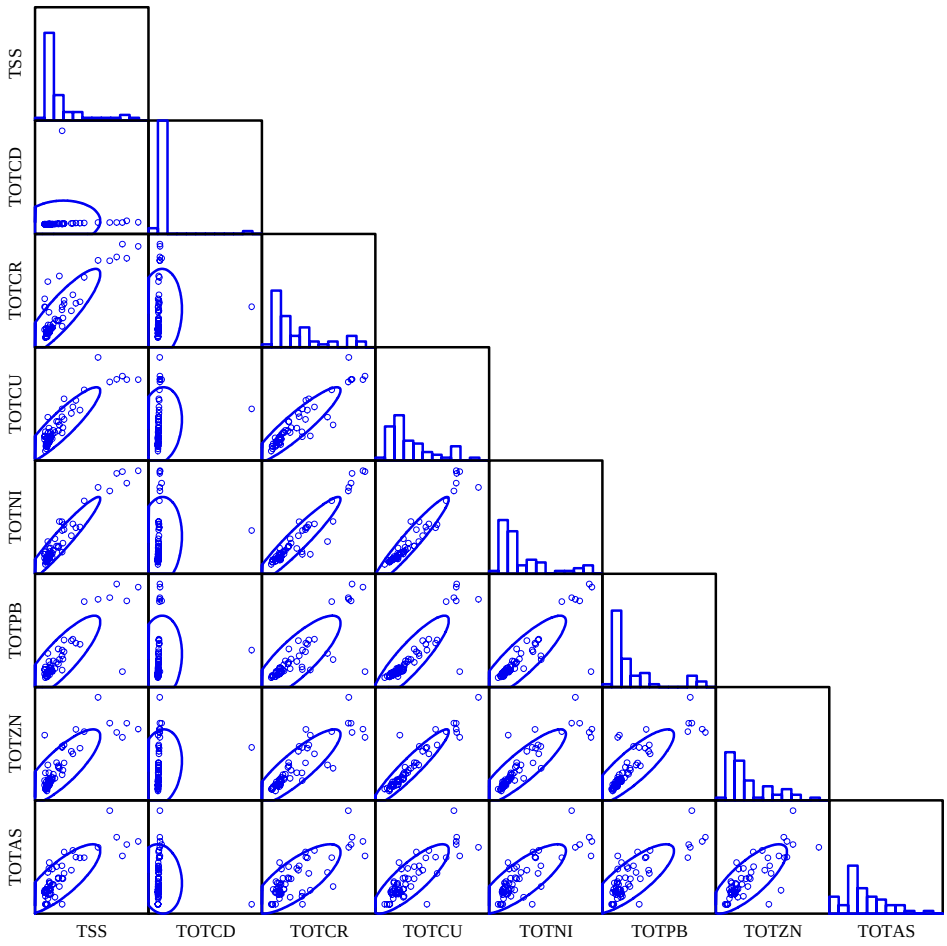


Figure E.3.3b Correlation Chart between TSS and Selected Total Metals from URS 8-23C

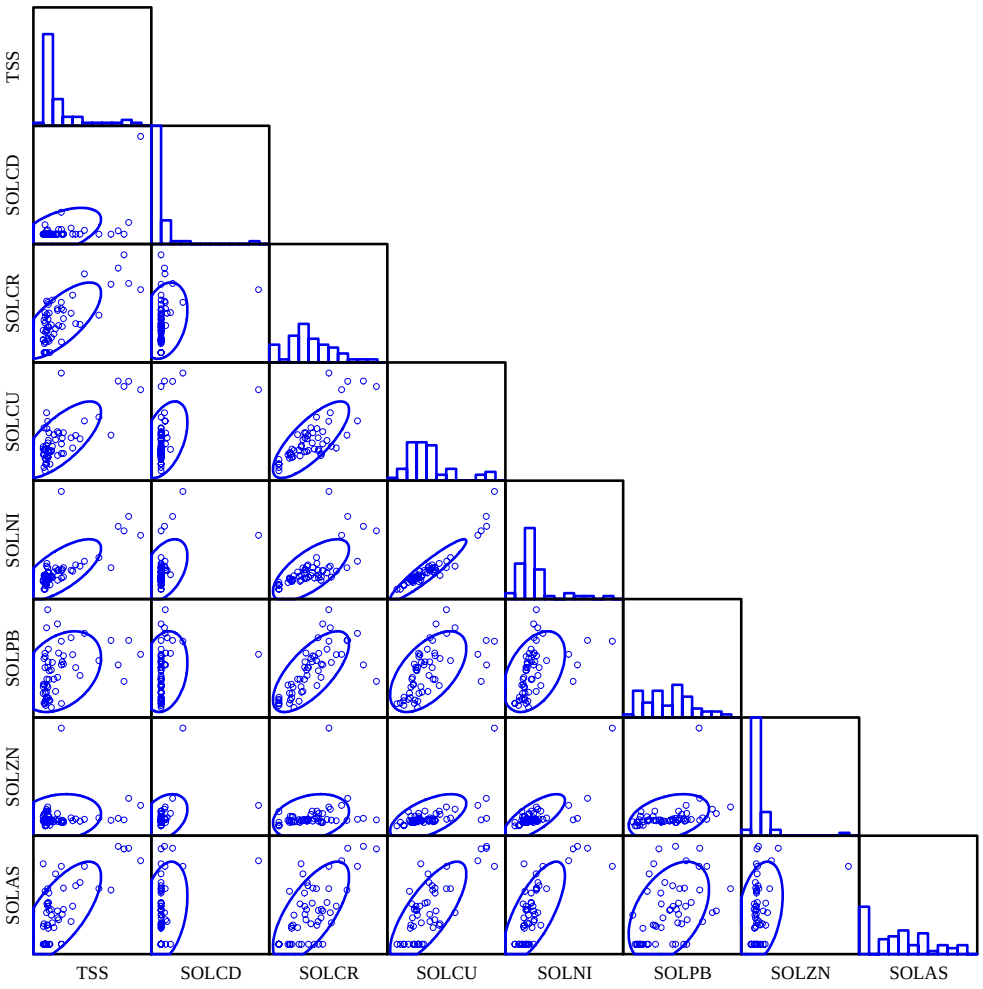


Figure E.3.3c Correlation Chart between TSS and Selected Dissolved Metals from URS 8-23C

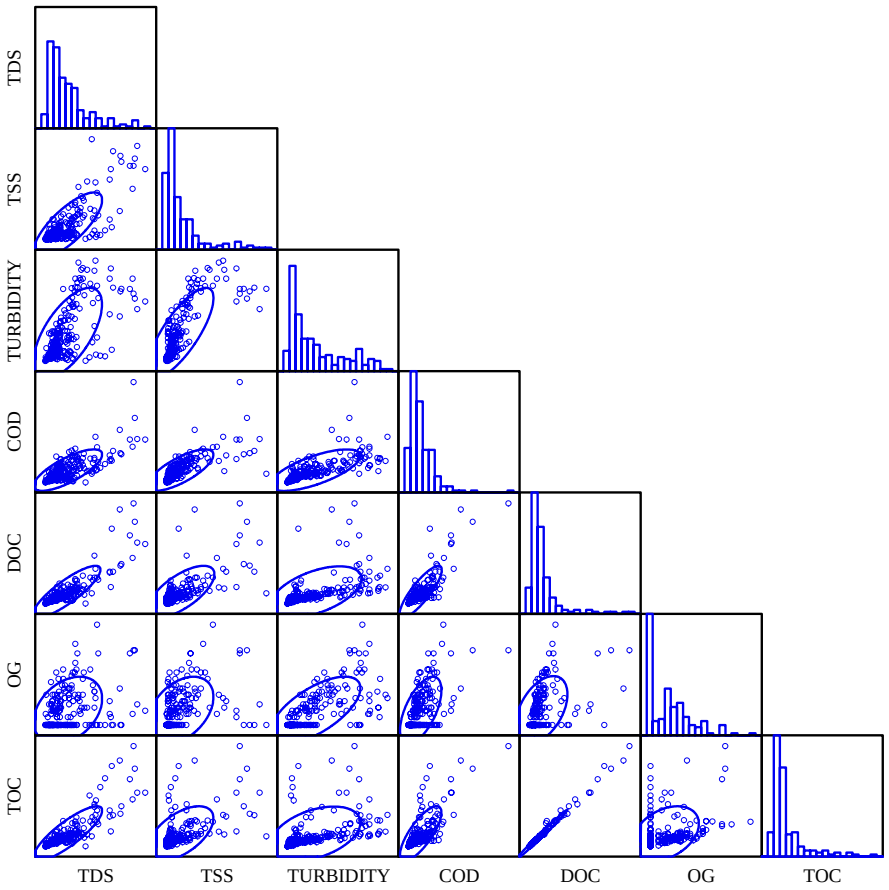


Figure E.3.4a Correlation Chart between Non-Metal Parameters from 2000-2001 Grab Samples from URS 23, 6-20F and 8-23C

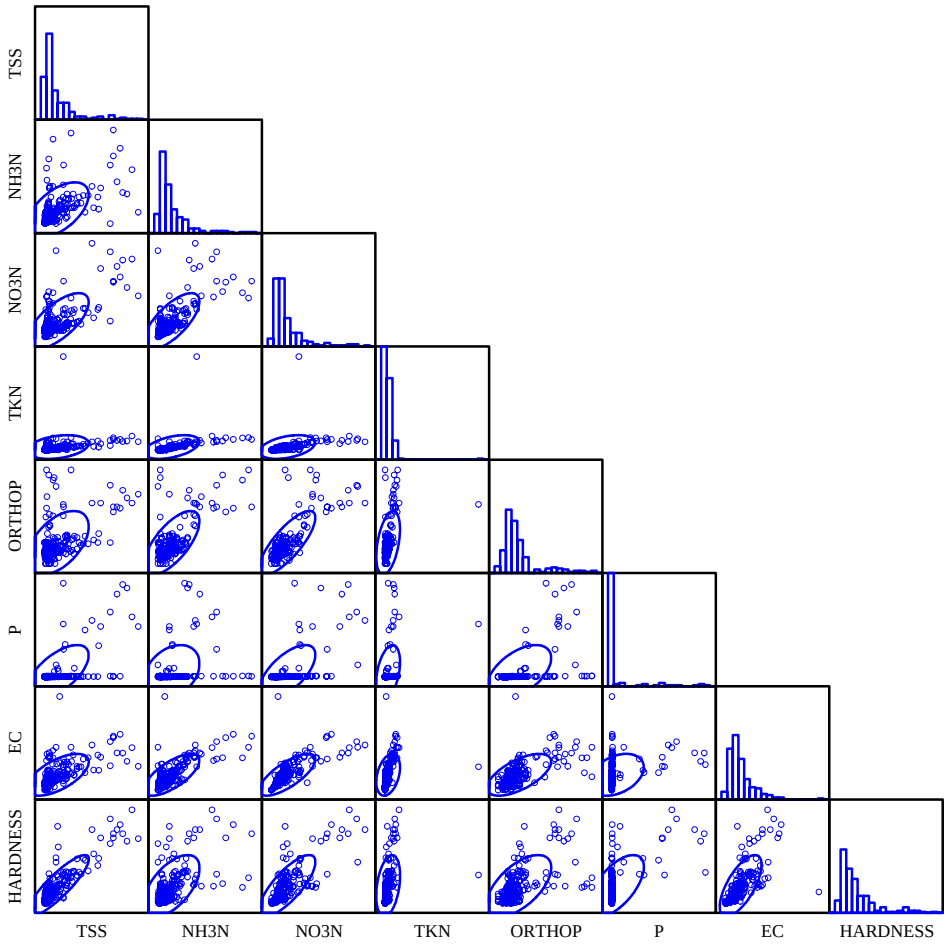


Figure E.3.4a Correlation Chart between Non-Metal Parameters from 2000-2001 Grab Samples from URS 23, 6-20F and 8-23C *(Continued)*

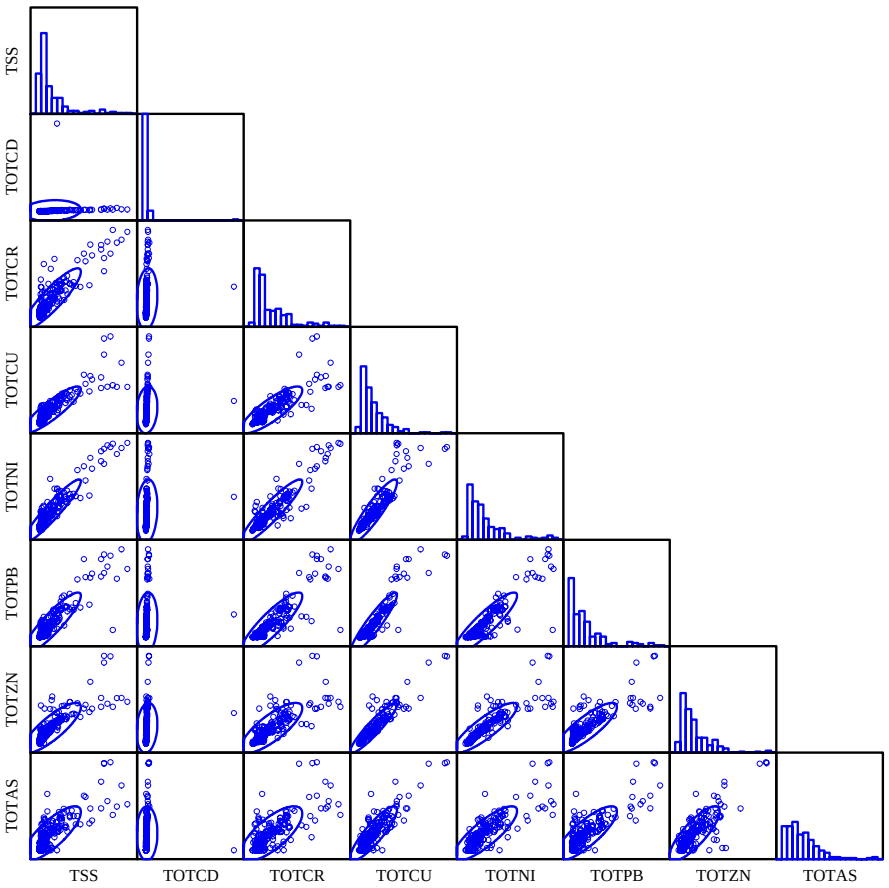


Figure E.3.4b Correlation Chart between TSS and Selected Total Metals from 2000-2001 Grab Samples from URS 23, 6-20F and 8-23C

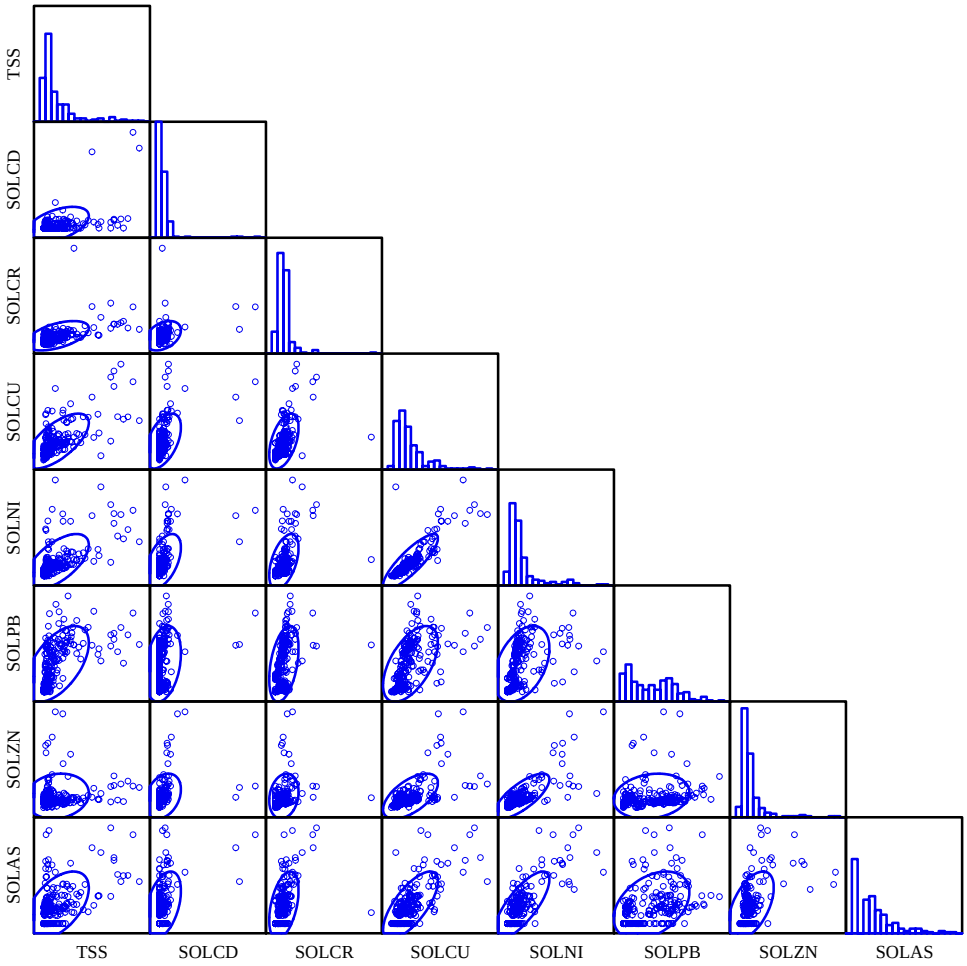


Figure E.3.4c Correlation Chart between TSS and Selected Dissolved Metals from 2000-2001 Grab Samples from URS 23, 6-20F and 8-23C

APPENDIX F
PARTICLE SIZE FRACTIONS AND PARTICLE FIRST FLUSH

Table F.1a Statistical Summary of Particle Concentration for 2002-2003 Grab Samples (Measured with 2-1000µm Sensor)

Size Range[a]	Site ID	N	%D	Mean[b]	SD[b]	Median[b]	Min[b]	Max[b]
2-1000	UCLA 1	50	100	110691	81752.7	86308	4118	334846
	UCLA 2	61	100	312959	297570.9	195068	11884	1243431
	UCLA 3	61	100	290681	496650.7	157488	50727	3741716
2-50	UCLA 1	50	100	110628	81702.3	86145	4112	334610
	UCLA 2	61	100	312823	297412.9	195010	11874	1243305
	UCLA 3	61	100	290584	496528.8	157468	50719	3740831
50-100	UCLA 1	50	100	50	122.0	11	0	790
	UCLA 2	61	100	103	226.4	41	3	1698
	UCLA 3	61	100	66	81.7	35	4	436
100-400	UCLA 1	50	100	13	18.7	6	0	113
	UCLA 2	61	100	32	62.2	14	2	422
	UCLA 3	61	100	30	58.1	11	1	414
400-1000	UCLA 1	50	100	0	0.3	0	0	1
	UCLA 2	61	100	1	2.6	0	0	14
	UCLA 3	61	100	1	5.4	0	0	35
2-3	UCLA 1	50	100	44390	28568.4	35440	2306	108226
	UCLA 2	61	100	123849	138609.5	72170	6191	647787
	UCLA 3	61	100	106340	169348.2	58416	22903	1257268
3-5	UCLA 1	50	100	38031	28493.2	28756	1212	109737
	UCLA 2	61	100	111324	105845.4	70769	3564	458895
	UCLA 3	61	100	103404	178278.1	54316	17505	1341084
5-7	UCLA 1	50	100	13622	12305.9	8902	302	48777
	UCLA 2	61	100	39323	35388.2	26836	965	187625
	UCLA 3	61	100	40835	76370.7	20300	4275	577778
7-10	UCLA 1	50	100	7967	8350.9	4327	160	34031
	UCLA 2	61	100	21686	21992.2	14709	563	128652
	UCLA 3	61	100	23663	46239.5	10620	1631	348922
10-20	UCLA 1	50	100	5622	7095.6	2860	115	33713
	UCLA 2	61	100	14344	16799.2	8543	495	96576
	UCLA 3	61	100	14549	26734.4	7618	635	199596
20-30	UCLA 1	50	100	774	1356.9	269	13	7993
	UCLA 2	61	100	1811	2380.4	998	59	12704
	UCLA 3	61	100	1467	2080.4	999	54	14212
30-50	UCLA 1	50	100	222	476.0	55	2	3015
	UCLA 2	61	100	486	714.8	253	21	4486
	UCLA 3	61	100	325	364.6	205	16	1971
50-100	UCLA 1	50	100	50	122.0	11	0	790
	UCLA 2	61	100	103	226.4	41	3	1698
	UCLA 3	61	100	66	81.7	35	4	436
100-200	UCLA 1	50	100	10	17.2	4	0	107
	UCLA 2	61	100	25	49.7	11	2	353
	UCLA 3	61	100	21	30.5	9	1	189
200-400	UCLA 1	50	100	2	2.8	1	0	13
	UCLA 2	61	100	8	14.6	2	0	69
	UCLA 3	61	100	9	29.6	2	0	225
400-1000	UCLA 1	50	100	0	0.3	0	0	1
	UCLA 2	61	100	1	2.6	0	0	14
	UCLA 3	61	100	1	5.4	0	0	35

a: µm b: #/ml

Table F.1b Statistical Summary of Particle Concentration for 2002-2003 Grab Samples (Measured with 0.5-400µm Sensor)

Size Range[a]	Site ID	N	%D	Mean[b]	SD[b]	Median[b]	Min[b]	Max[b]
0.5-400	UCLA 1	24	100	4477638	2231143.8	4130536	1642456	11152890
	UCLA 2	12	100	10843326	6863006.0	10150453	2900310	25243120
0.5-0.8	UCLA 1	24	100	3276361	1694386.6	3171444	1189477	8132360
	UCLA 2	12	100	6565516	4182687.4	6254006	1796650	15329673
0.8-1.2	UCLA 1	24	100	841608	464844.4	711662	289605	2258278
	UCLA 2	12	100	2589786	1706217.9	2334026	680544	6272311
1.2-2	UCLA 1	24	100	279065	135419.6	240501	113138	637008
	UCLA 2	12	100	1123456	853932.8	885720	294747	2950148
2-3	UCLA 1	24	100	44764	23078.7	37991	16932	92013
	UCLA 2	12	100	264055	286403.4	159547	63193	1065129
3-5	UCLA 1	24	100	20639	11815.6	18316	5775	47323
	UCLA 2	12	100	158871	209876.4	83687	35234	776110
5-7	UCLA 1	24	100	7498	4898.3	6478	1213	17748
	UCLA 2	12	100	71497	112137.7	32023	12626	411207
7-10	UCLA 1	24	100	4304	2914.0	3593	618	12014
	UCLA 2	12	100	43401	77171.2	15062	4936	281061
10-20	UCLA 1	24	100	2657	2214.1	1940	314	9652
	UCLA 2	12	100	23753	41542.2	8891	2352	150865
20-30	UCLA 1	24	100	442	602.4	219	28	2548
	UCLA 2	12	100	2350	3653.5	1011	279	13262
30-50	UCLA 1	24	100	221	363.1	67	0	1382
	UCLA 2	12	100	552	810.3	289	77	2960
50-100	UCLA 1	24	100	70	120.9	19	0	414
	UCLA 2	12	100	74	90.1	61	0	323
100-200	UCLA 1	24	100	7	14.7	0	0	51
	UCLA 2	12	100	13	26.0	0	0	81
200-400	UCLA 1	24	100	3	6.2	0	0	24
	UCLA 2	12	100	2	5.8	0	0	20

a: µm b: #/ml

Table F.2 Statistical Summary of Total Number of Particle for 2002-2003 Events (Measured with 2-1000µm Sensor)

Size Range[a]	Site ID	N	Mean[b]	Median[b]	Min[b]	Max[b]	SD[b]	95%CI[b]
2-1000	UCLA 1	4	27.48	24.855	22.6	37.61	6.8958	10.973
	UCLA 2	6	91.353	66	6.2	280.41	103.44	108.55
	UCLA 3	6	13.752	11.855	0.34	25.3	9.9133	10.403
2-50	UCLA 1	4	27.473	24.85	22.6	37.59	6.8867	10.958
	UCLA 2	6	91.308	65.965	6.2	280.28	103.39	108.5
	UCLA 3	6	13.745	11.85	0.34	25.29	9.9096	10.399
50-100	UCLA 1	4	0.005	0.005	0	0.01	0.0058	0.0092
	UCLA 2	6	0.0317	0.025	0	0.1	0.0382	0.0401
	UCLA 3	6	0.0017	0	0	0.01	0.0041	0.0043
100-400	UCLA 1	4	0.0025	0	0	0.01	0.005	0.008
	UCLA 2	6	0.0083	0.005	0	0.03	0.0117	0.0123
	UCLA 3	6	0	0	0	0	0	0
400-1000	UCLA 1	4	0	0	0	0	0	0
	UCLA 2	6	0	0	0	0	0	0
	UCLA 3	6	0	0	0	0	0	0
2-3	UCLA 1	4	11.718	11.345	9.4	14.78	2.2401	3.5644
	UCLA 2	6	31.898	23.325	2.18	94.54	35.313	37.058
	UCLA 3	6	5.0333	4.46	0.13	9.94	3.5232	3.6973
3-5	UCLA 1	4	9.6225	8.685	7.99	13.13	2.376	3.7808
	UCLA 2	6	31.38	22.685	2.58	95.27	35.162	36.9
	UCLA 3	6	4.8667	4.285	0.12	9.08	3.5465	3.7218
5-7	UCLA 1	4	3.19	2.785	2.39	4.8	1.0921	1.7378
	UCLA 2	6	12.85	9.465	0.94	40.18	14.656	15.38
	UCLA 3	6	1.915	1.595	0.05	3.91	1.4554	1.5274
7-10	UCLA 1	4	1.705	1.485	1.12	2.73	0.7052	1.1222
	UCLA 2	6	8.0667	5.815	0.36	26.01	9.5232	9.994
	UCLA 3	6	1.1117	0.88	0.03	2.49	0.893	0.9371
10-20	UCLA 1	4	1.09	0.955	0.58	1.87	0.5494	0.8742
	UCLA 2	6	6.09	4.08	0.12	20.71	7.6531	8.0315
	UCLA 3	6	0.72	0.55	0.02	1.66	0.5724	0.6007
20-30	UCLA 1	4	0.1175	0.1	0.05	0.22	0.0723	0.115
	UCLA 2	6	0.8217	0.475	0.01	2.9	1.0877	1.1414
	UCLA 3	6	0.0817	0.065	0	0.19	0.0637	0.0668
30-50	UCLA 1	4	0.025	0.02	0.01	0.05	0.0173	0.0276
	UCLA 2	6	0.2	0.125	0	0.67	0.2512	0.2637
	UCLA 3	6	0.0183	0.015	0	0.05	0.0172	0.0181
50-100	UCLA 1	4	0.005	0.005	0	0.01	0.0058	0.0092
	UCLA 2	6	0.0317	0.025	0	0.1	0.0382	0.0401
	UCLA 3	6	0.0017	0	0	0.01	0.0041	0.0043
100-200	UCLA 1	4	0	0	0	0	0	0
	UCLA 2	6	0.0067	0.005	0	0.02	0.0082	0.0086
	UCLA 3	6	0	0	0	0	0	0
200-400	UCLA 1	4	0	0	0	0	0	0
	UCLA 2	6	0.0017	0	0	0.01	0.0041	0.0043
	UCLA 3	6	0	0	0	0	0	0
400-1000	UCLA 1	4	0	0	0	0	0	0
	UCLA 2	6	0	0	0	0	0	0
	UCLA 3	6	0	0	0	0	0	0

a: µm b: 10e12

Table F.3 Statistical Summary of Particle Different Size Proportion to 2-1000µm for 2002-2003 Events (Measured with 2-1000µm Sensor)

Size Range[a]	Site ID	N	Mean	Median	Min	Max	SD	95%CI
2-3	UCLA 1	4	0.4308	0.4287	0.3930	0.4728	0.0343	0.0546
	UCLA 2	6	0.3516	0.3601	0.2776	0.3947	0.0416	0.0436
	UCLA 3	6	0.3747	0.3800	0.3162	0.4036	0.0305	0.0320
3-5	UCLA 1	4	0.3504	0.3506	0.3471	0.3535	0.0029	0.0046
	UCLA 2	6	0.3574	0.3497	0.3144	0.4161	0.0348	0.0365
	UCLA 3	6	0.3517	0.3529	0.3289	0.3666	0.0126	0.0133
5-7	UCLA 1	4	0.1146	0.1150	0.1006	0.1276	0.0115	0.0183
	UCLA 2	6	0.1440	0.1377	0.1294	0.1754	0.0176	0.0184
	UCLA 3	6	0.1383	0.1338	0.1289	0.1573	0.0115	0.0121
7-10	UCLA 1	4	0.0606	0.0614	0.0472	0.0726	0.0107	0.0170
	UCLA 2	6	0.0826	0.0788	0.0581	0.1235	0.0236	0.0247
	UCLA 3	6	0.0801	0.0745	0.0708	0.1002	0.0117	0.0123
10-20	UCLA 1	4	0.0383	0.0395	0.0244	0.0497	0.0106	0.0168
	UCLA 2	6	0.0553	0.0554	0.0194	0.0952	0.0275	0.0289
	UCLA 3	6	0.0533	0.0548	0.0418	0.0668	0.0096	0.0101
20-30	UCLA 1	4	0.0041	0.0041	0.0021	0.0058	0.0015	0.0025
	UCLA 2	6	0.0067	0.0074	0.0016	0.0108	0.0039	0.0041
	UCLA 3	6	0.0052	0.0056	0	0.0084	0.0031	0.0033
30-50	UCLA 1	4	0.0009	0.0008	0.0004	0.0013	0.0004	0.0006
	UCLA 2	6	0.0016	0.0020	0	0.0026	0.0010	0.0011
	UCLA 3	6	0.0012	0.0010	0	0.0024	0.0009	0.0009
50-100	UCLA 1	4	0.0002	0.0001	0	0.0004	0.0002	0.0003
	UCLA 2	6	0.0002	0.0003	0	0.0004	0.0002	0.0002
	UCLA 3	6	7E-05	0	0	0.0004	0.0002	0.0002
100-200	UCLA 1	4	0	0	0	0	0	0
	UCLA 2	6	4E-05	4E-05	0	0.0001	5E-05	5E-05
	UCLA 3	6	0	0	0	0	0	0
200-400	UCLA 1	4	0	0	0	0	0	0
	UCLA 2	6	6E-06	0	0	4E-05	1E-05	2E-05
	UCLA 3	6	0	0	0	0	0	0
400-1000	UCLA 1	4	0	0	0	0	0	0
	UCLA 2	6	0	0	0	0	0	0
	UCLA 3	6	0	0	0	0	0	0

a: µm

Table F.4 Statistical Summary of NFF20 Ratios of Particles in 2002-2003 Events (Measured with 2-1000 µm Sensor)

Size range[a]	Site ID	Mean	Median	Min	Max	SD	N>1.1
2-1000	UCLA 1	1.75	1.92	0.99	2.15	0.51	3/4
	UCLA 2	1.56	1.48	0.58	2.68	0.78	4/6
	UCLA 3	1.79	1.75	1.28	2.37	0.51	6/6
2-3	UCLA 1	1.62	1.79	0.93	1.97	0.48	3/4
	UCLA 2	1.57	1.34	0.78	2.79	0.83	3/6
	UCLA 3	1.68	1.59	1.21	2.37	0.48	6/6
3-5	UCLA 1	1.75	1.96	0.97	2.10	0.53	3/4
	UCLA 2	1.53	1.41	0.59	2.68	0.77	4/6
	UCLA 3	1.77	1.75	1.27	2.34	0.49	6/6
5-7	UCLA 1	1.91	2.14	1.06	2.30	0.58	3/4
	UCLA 2	1.57	1.63	0.46	2.63	0.74	5/6
	UCLA 3	1.90	1.89	1.34	2.49	0.59	6/6
7-10	UCLA 1	2.05	2.25	1.17	2.55	0.66	4/4
	UCLA 2	1.67	1.89	0.40	2.59	0.76	5/6
	UCLA 3	2.01	2.01	1.31	2.70	0.67	6/6
10-20	UCLA 1	2.14	2.22	1.32	2.80	0.74	4/4
	UCLA 2	1.80	2.12	0.43	2.46	0.81	5/6
	UCLA 3	2.09	2.07	1.33	2.96	0.72	6/6
20-30	UCLA 1	2.21	2.13	1.43	3.17	0.82	4/4
	UCLA 2	1.99	2.33	0.63	2.84	0.85	5/6
	UCLA 3	2.14	2.00	1.40	3.15	0.69	6/6
30-50	UCLA 1	2.27	2.11	1.45	3.41	0.85	4/4
	UCLA 2	2.20	2.46	0.88	3.19	0.85	5/6
	UCLA 3	2.17	2.11	1.40	2.94	0.57	6/6
50-100	UCLA 1	2.40	2.31	1.42	3.57	0.95	4/4
	UCLA 2	2.51	2.71	1.15	3.45	0.85	6/6
	UCLA 3	2.22	2.43	0.99	2.83	0.73	5/6
100-200	UCLA 1	1.83	1.89	1.01	2.55	0.64	3/4
	UCLA 2	2.38	2.42	0.84	3.80	1.12	5/6
	UCLA 3	2.07	2.14	0.63	3.15	0.93	5/6
200-400	UCLA 1	1.27	1.48	0.33	1.79	0.65	3/4
	UCLA 2	2.69	2.94	0.30	4.92	1.86	4/6
	UCLA 3	1.95	1.74	0.31	3.68	1.32	4/6
400-1000	UCLA 1	2.51	2.51	0.00	5.00	2.85	2/4
	UCLA 2	2.14	0.99	0.19	4.92	2.10	2/5
	UCLA 3	2.38	2.29	0.00	5.00	2.36	3/5

a: µm

Table F.5 Event Mean Concentrations of Particles for UCLA 1, 2 and 3

Event	Site ID	Grab no	Volume (gal)	Total Rain (in)	2-1000 (10e6/l)	2-50 (10e6/l)	50-100 (10e6/l)	100-400 (10e6/l)	400-1000 (10e6/l)	0.5-400 (10e6/l)	0.5-0.8 (10e6/l)	0.8-1.2 (10e6/l)	1.2-2 (10e6/l)
11/7/02	UCLA 1	14	55608.2	1.14	112.85	112.83	0.01	0.01	0	na	na	na	na
12/16/02	UCLA 1	11	92023	1.44	107.95	107.91	0.03	0.02	0	na	na	na	na
12/19/02	UCLA 1	13	115286	1.4	59.48	59.47	0.01	0	0	na	na	na	na
2/11/03	UCLA 1	12	62165.4	0.92	96.05	96.02	0.02	0.01	0	na	na	na	na
3/15/03	UCLA 1	12	776213	2.62	na	na	na	na	na	3332.01	2217.86	760.21	274.43
5/2/03	UCLA 1	12	85159.9	1.98	na	na	na	na	na	4441.64	3428.14	786.15	197.46
11/7/02	UCLA 2	14	218146	2.25	143.55	143.48	0.05	0.01	0	na	na	na	na
11/29/02	UCLA 2	5	6149.99	0.07	471.08	470.95	0.08	0.04	0	na	na	na	na
12/15/02	UCLA 2	8	8017.99	0.08	204.25	204.22	0.02	0	0	na	na	na	na
12/16/02	UCLA 2	10	218116	2.32	339.62	339.46	0.12	0.04	0	na	na	na	na
2/11/03	UCLA 2	12	89618.3	0.96	288.12	287.97	0.11	0.04	0	na	na	na	na
4/15/03	UCLA 2	12	82227.1	0.84	110.06	110.01	0.04	0.01	0	na	na	na	na
11/7/02	UCLA 3	14	47030.7	2.81	142.1	142.07	0.02	0.01	0	na	na	na	na
11/29/02	UCLA 3	6	188.484	0.06	477.53	477.37	0.12	0.04	0	na	na	na	na
12/16/02	UCLA 3	8	33014.1	1.62	198.9	198.82	0.06	0.03	0	na	na	na	na
12/19/02	UCLA 3	11	28487.1	1.31	82.27	82.25	0.02	0.01	0	na	na	na	na
2/11/03	UCLA 3	12	11682.5	0.79	335.52	335.41	0.08	0.03	0	na	na	na	na
3/15/03	UCLA 3	12	108520	0.65	na	na	na	na	na	4354.38	2657.24	1016.55	459.71
4/15/03	UCLA 3	10	14010	0.87	156.49	156.39	0.07	0.03	0	na	na	na	na

Table F.5 *(Continued)*

Event	Site ID	2-3 (10e6/l)	3-5 (10e6/l)	5-7 (10e6/l)	7-10 (10e6/l)	10-20 (10e6/l)	20-30 (10e6/l)	30-50 (10e6/l)	50-100 (10e6/l)	100-200 (10e6/l)	200-400 (10e6/l)	400-1000 (10e6/l)
11/7/02	UCLA 1	53.36	39.71	11.37	5.32	2.76	0.26	0.06	0.01	0.01	0	0
12/16/02	UCLA 1	42.42	37.69	13.78	7.85	5.37	0.64	0.15	0.03	0.01	0.01	0
12/19/02	UCLA 1	26.27	20.63	6.6	3.47	2.21	0.23	0.05	0.01	0	0	0
2/11/03	UCLA 1	39.94	33.95	11.41	6.17	3.99	0.45	0.11	0.02	0	0	0
3/15/03	UCLA 1	45.85	20.75	7.32	3.73	1.71	0.12	0.03	0.01	0	0	na
5/2/03	UCLA 1	19.94	6.9	1.58	0.84	0.45	0.12	0.05	0.01	0	0	na
11/7/02	UCLA 2	52.91	49.6	18.93	11.75	8.71	1.26	0.33	0.05	0.01	0	0
11/29/02	UCLA 2	185.88	176.63	61.19	30.15	15.32	1.43	0.36	0.08	0.03	0.01	0
12/15/02	UCLA 2	71.91	85.09	30.86	12.02	3.96	0.3	0.08	0.02	0	0	0
12/16/02	UCLA 2	114.5	115.39	48.66	31.51	25.08	3.51	0.82	0.12	0.03	0.01	0
2/11/03	UCLA 2	109.48	101.99	38.09	21.81	14.43	1.71	0.46	0.11	0.03	0.01	0
4/15/03	UCLA 2	30.55	34.6	19.3	13.6	10.48	1.19	0.28	0.04	0.01	0	0
11/7/02	UCLA 3	55.82	51	18.34	10.06	6.09	0.64	0.13	0.02	0.01	0	0
11/29/02	UCLA 3	175.23	170.66	66.45	39.29	23.23	2.05	0.46	0.12	0.03	0.01	0
12/16/02	UCLA 3	62.86	69.58	31.31	19.93	13.25	1.52	0.37	0.06	0.02	0.01	0
12/19/02	UCLA 3	31.06	28.99	10.76	6.26	4.5	0.56	0.13	0.02	0	0	0
2/11/03	UCLA 3	125.85	123.11	45.95	24.73	14.08	1.35	0.33	0.08	0.02	0.01	0
3/15/03	UCLA 3	105.52	60.84	26.66	16.33	9.98	1.15	0.31	0.06	0.01	0.01	na
4/15/03	UCLA 3	63.15	51.44	20.24	11.23	8.69	1.28	0.35	0.07	0.02	0.01	0

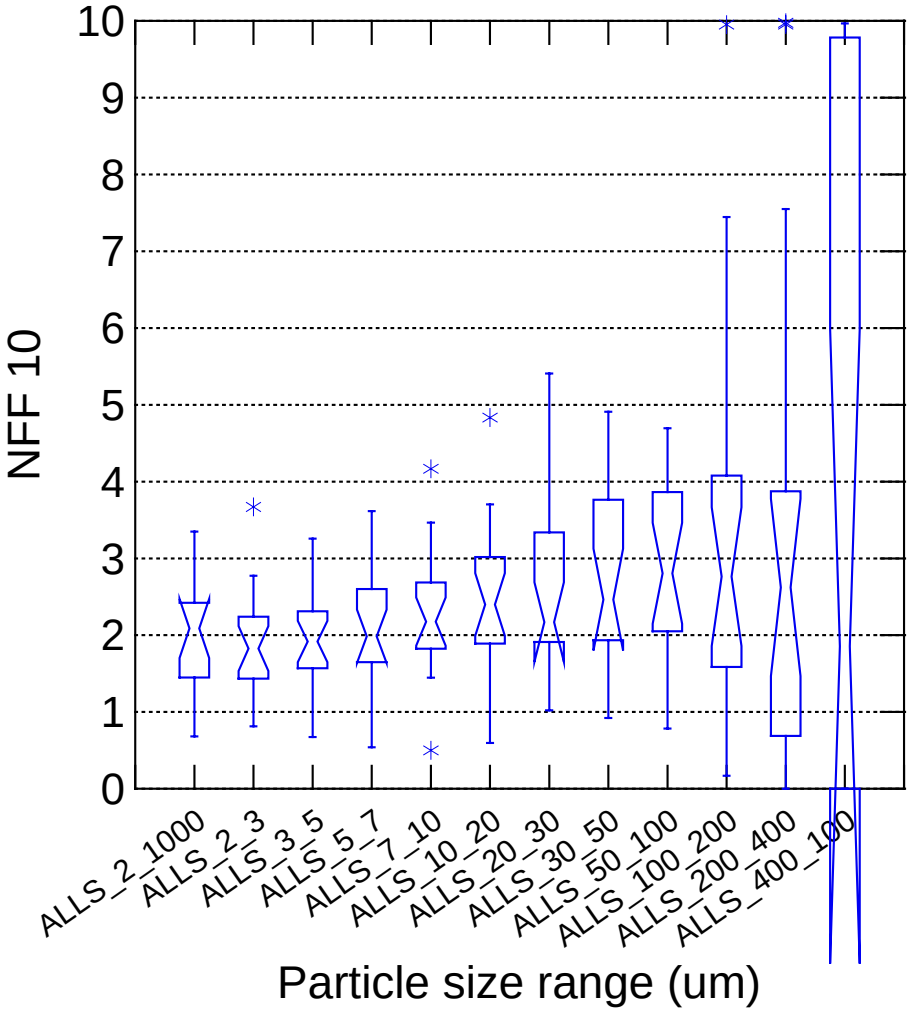


Figure F.1.1 NFF 10 of Particles for Combined UCLA sites

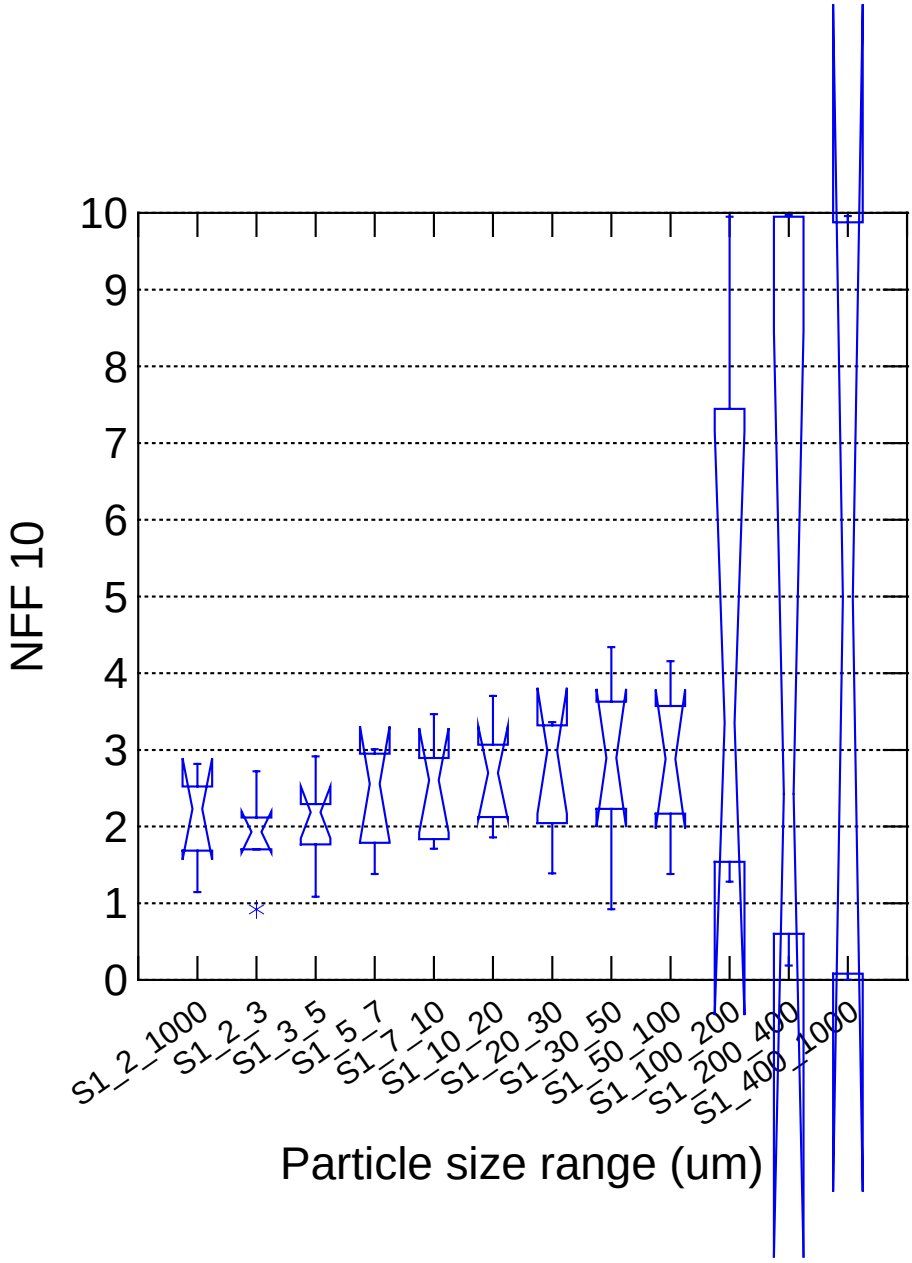


Figure F.1.2 NFF 10 of Particles for UCLA 1

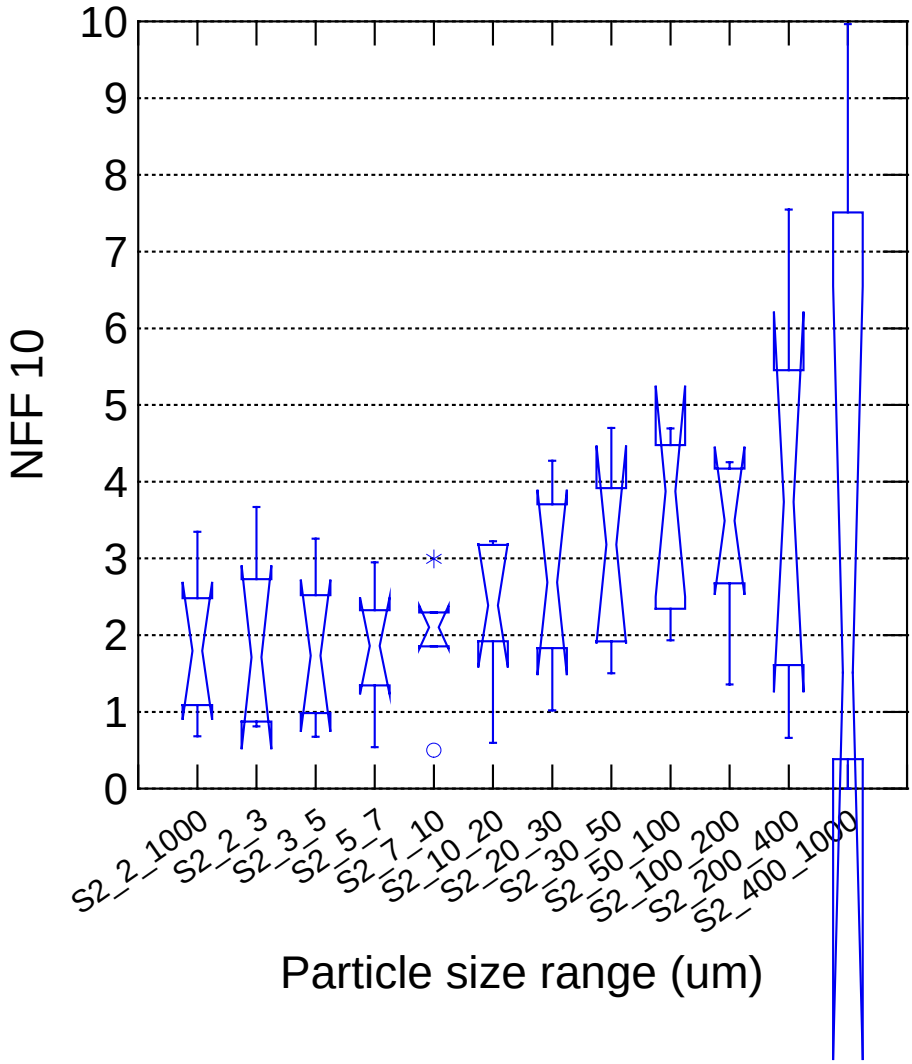


Figure F.1.3 NFF 10 of Particles for UCLA 2

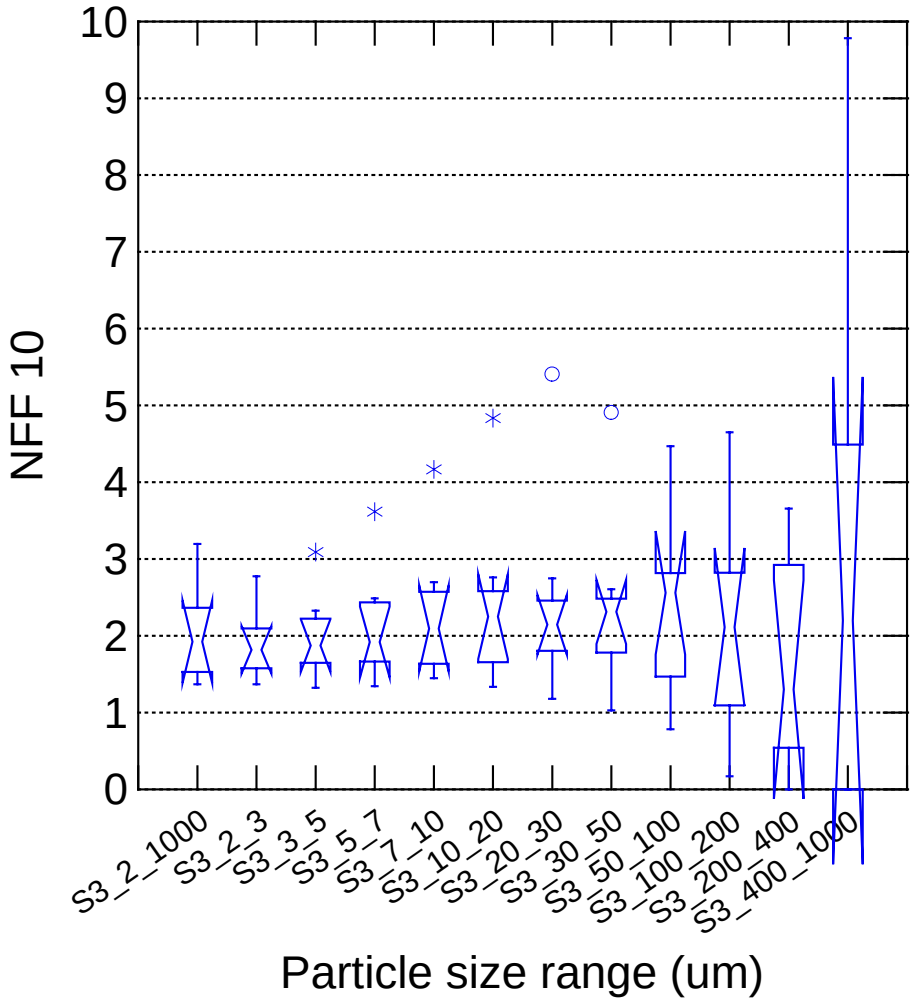


Figure F.1.4 NFF 10 of Particles for UCLA 3

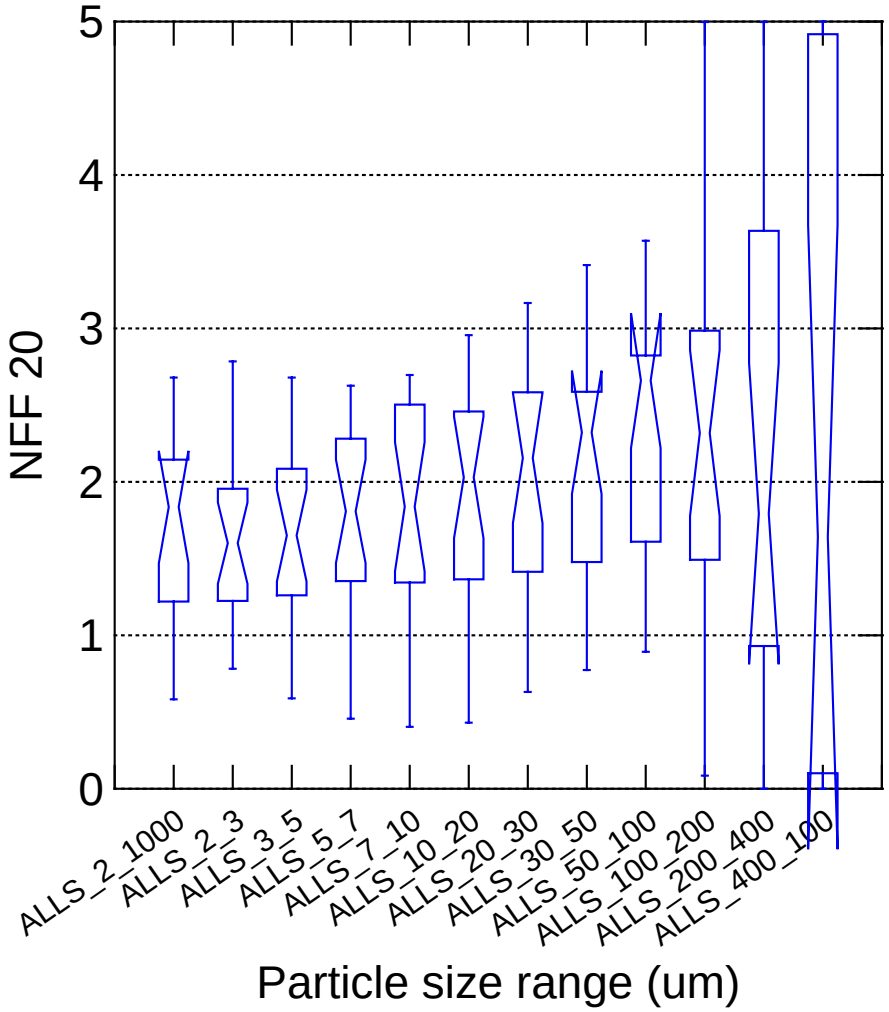


Figure F.2.1 NFF 20 of Particles for Combined UCLA sites

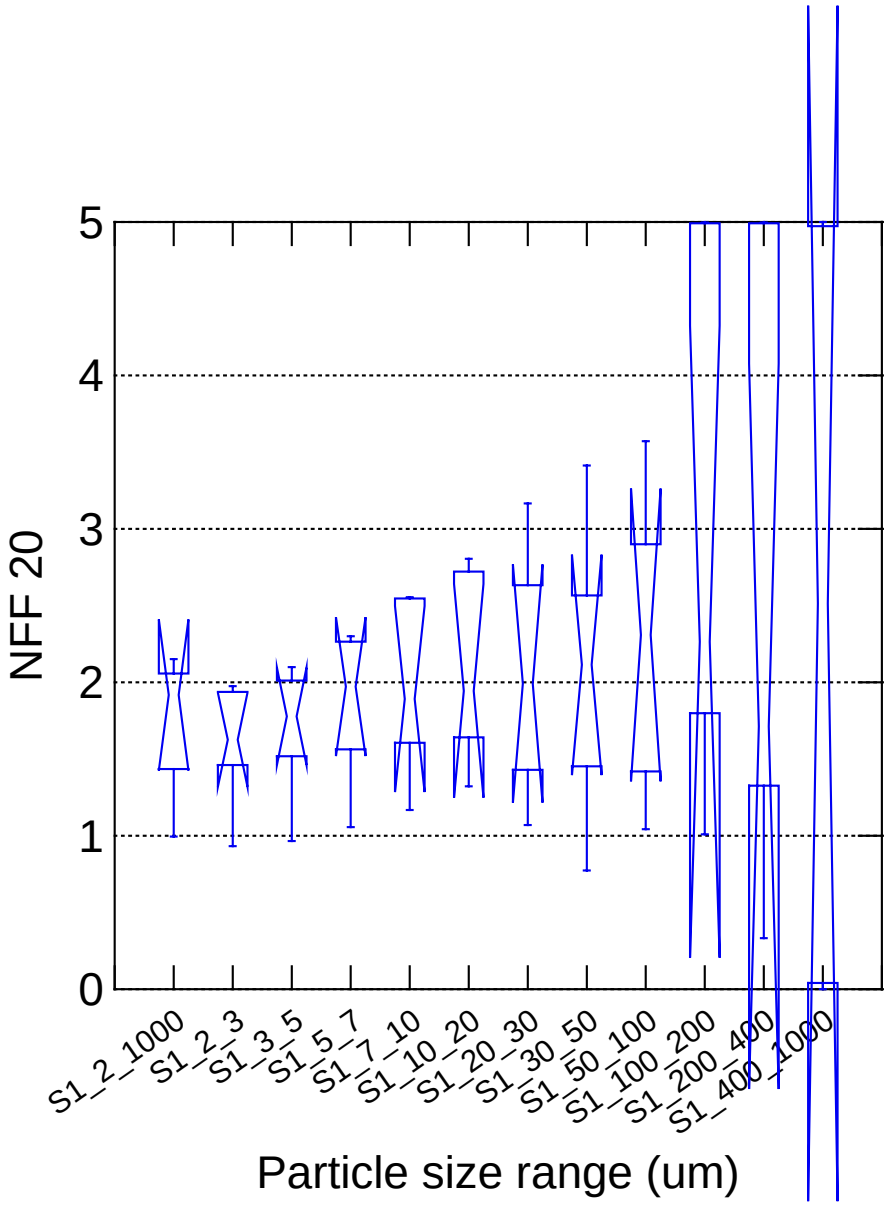


Figure F.2.2 NFF 20 of Particles for UCLA 1

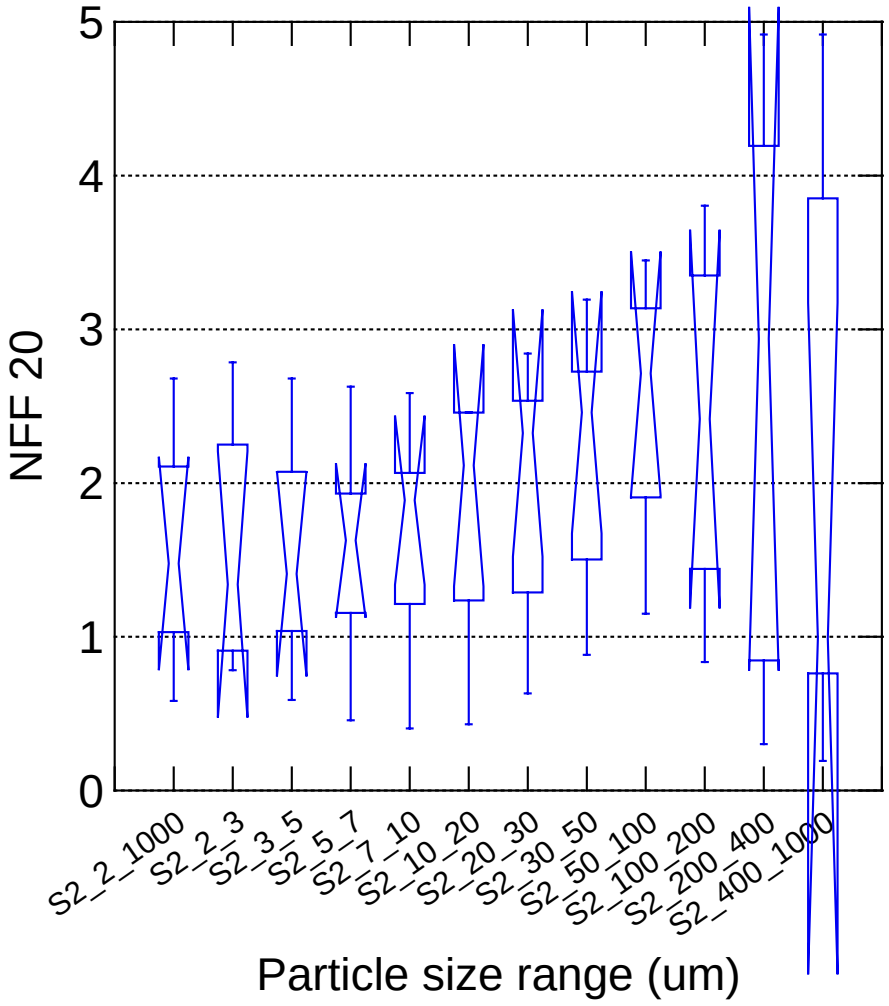


Figure F.2.3 NFF 20 of Particles for UCLA 2

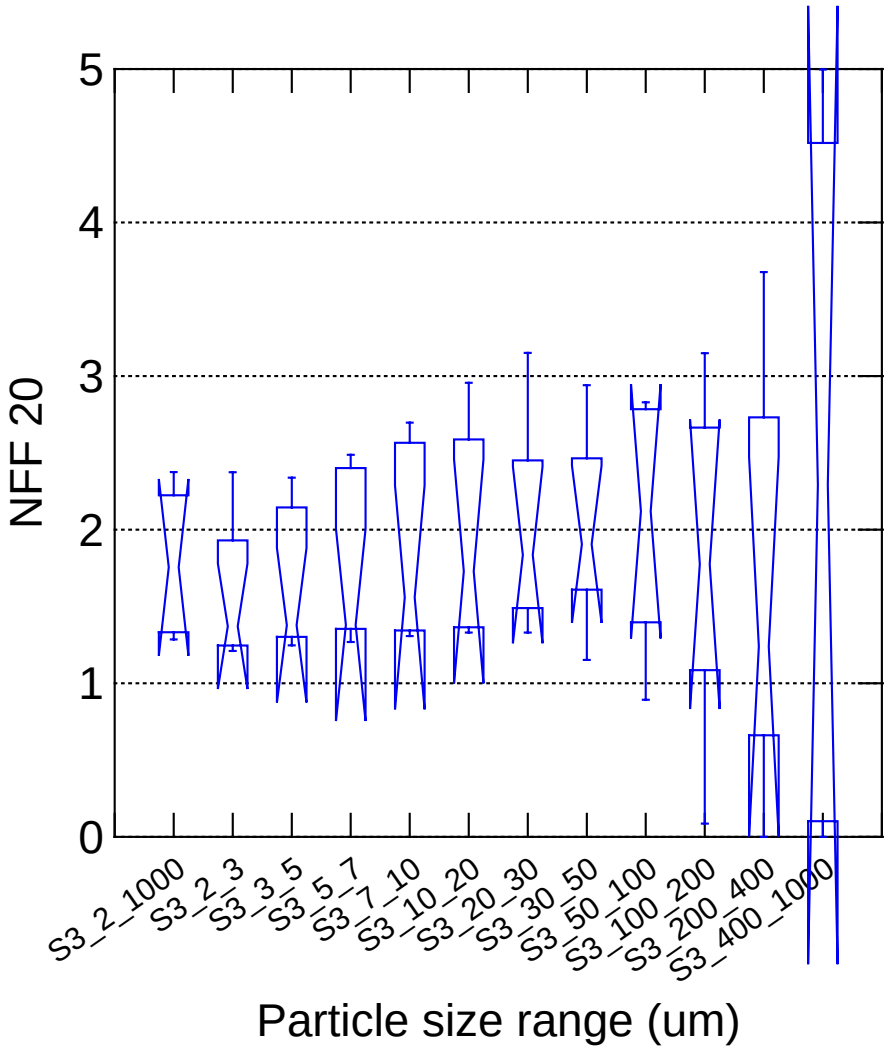


Figure F.2.4 NFF 20 of Particles for UCLA 3

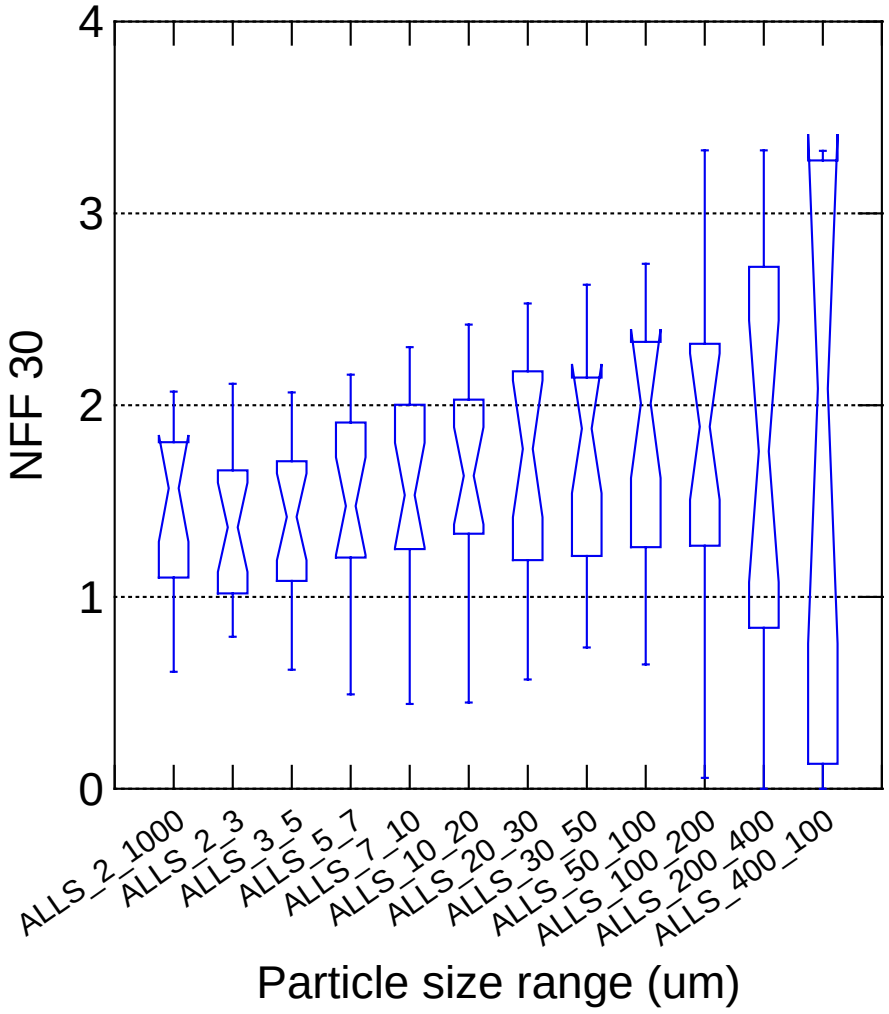


Figure F.3.1 NFF 30 of Particles for Combined UCLA sites

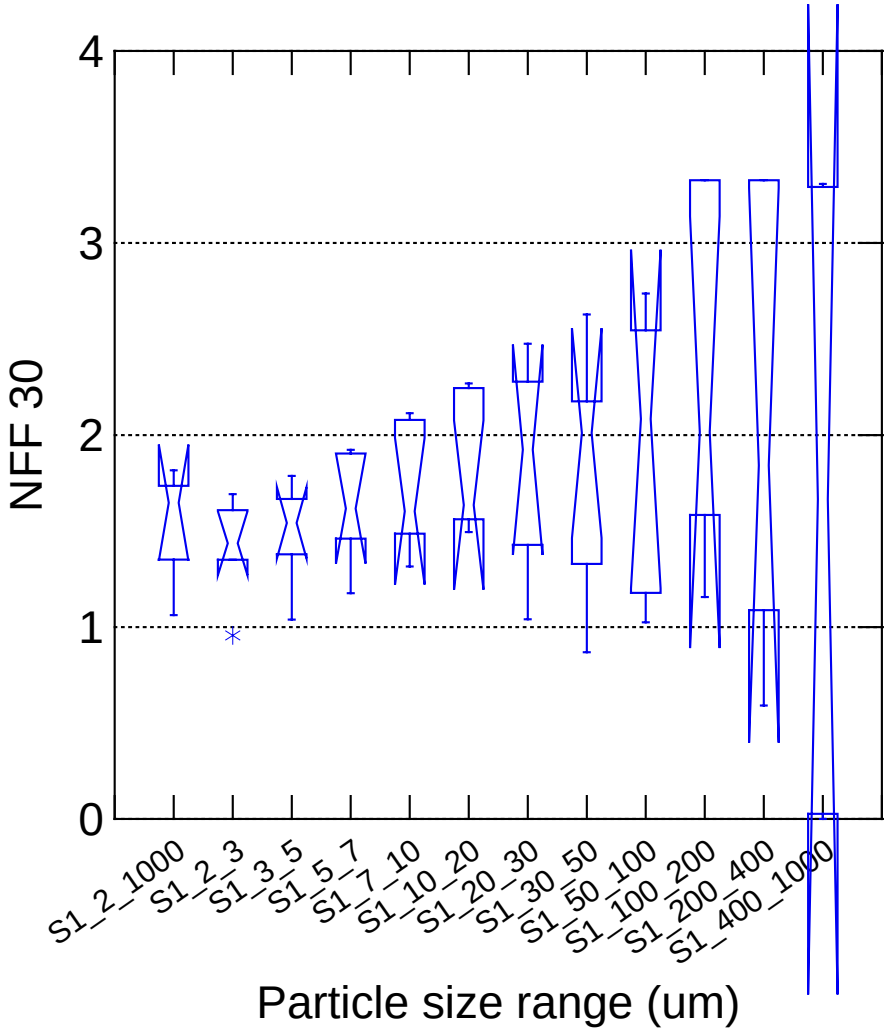


Figure F.3.2 NFF 30 of Particles for UCLA 1

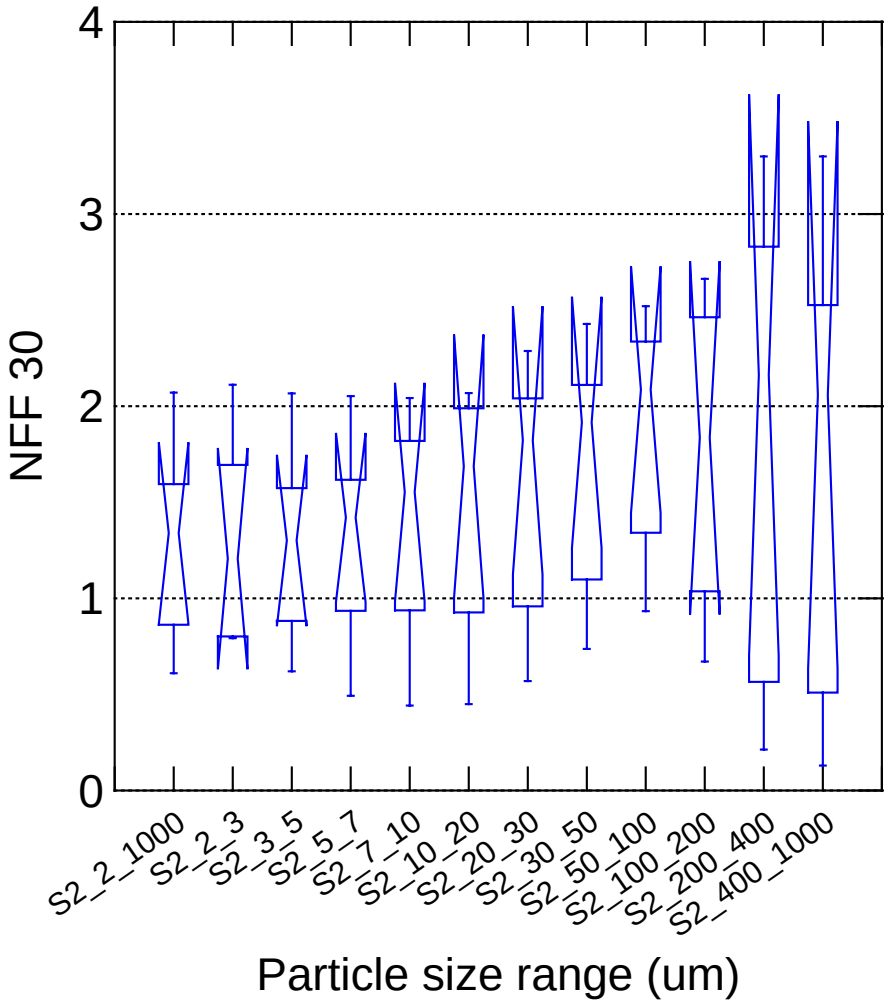


Figure F.3.3 NFF 30 of Particles for UCLA 2

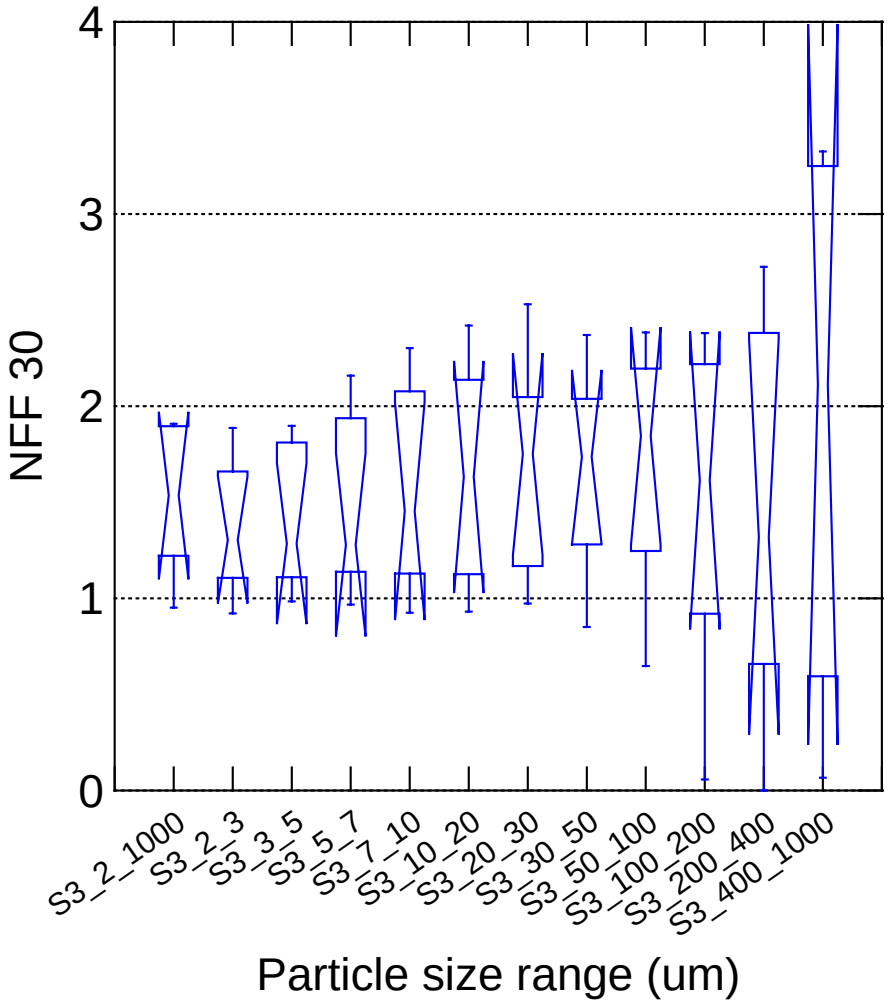


Figure F.3.4 NFF 30 of Particles for UCLA 3

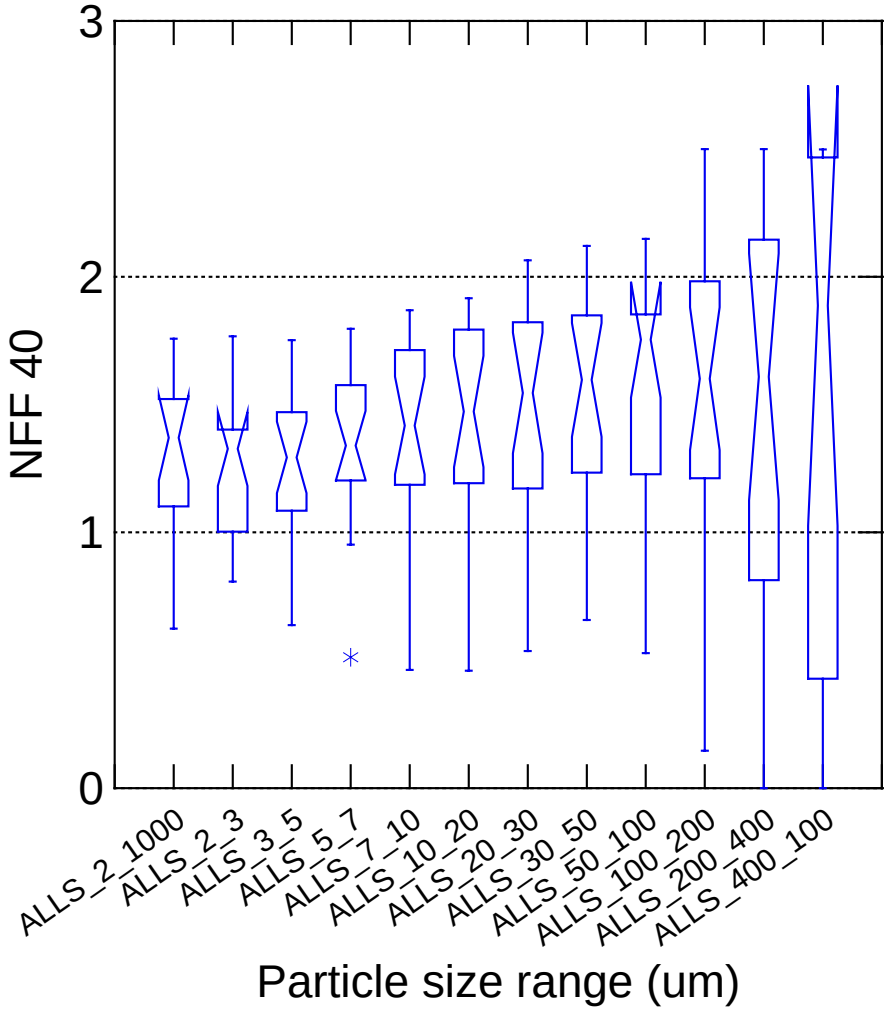


Figure F.4.1 NFF 40 of Particles for Combined UCLA sites

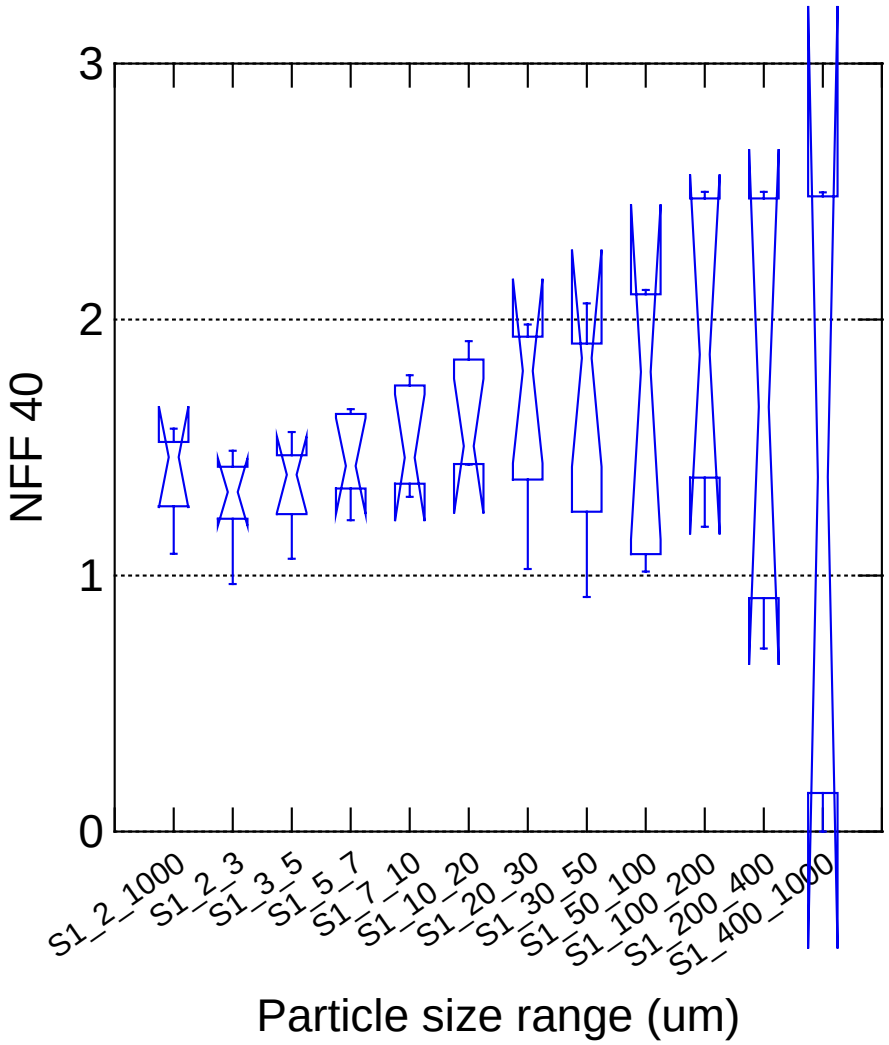


Figure F.4.2 NFF 40 of Particles for UCLA 1

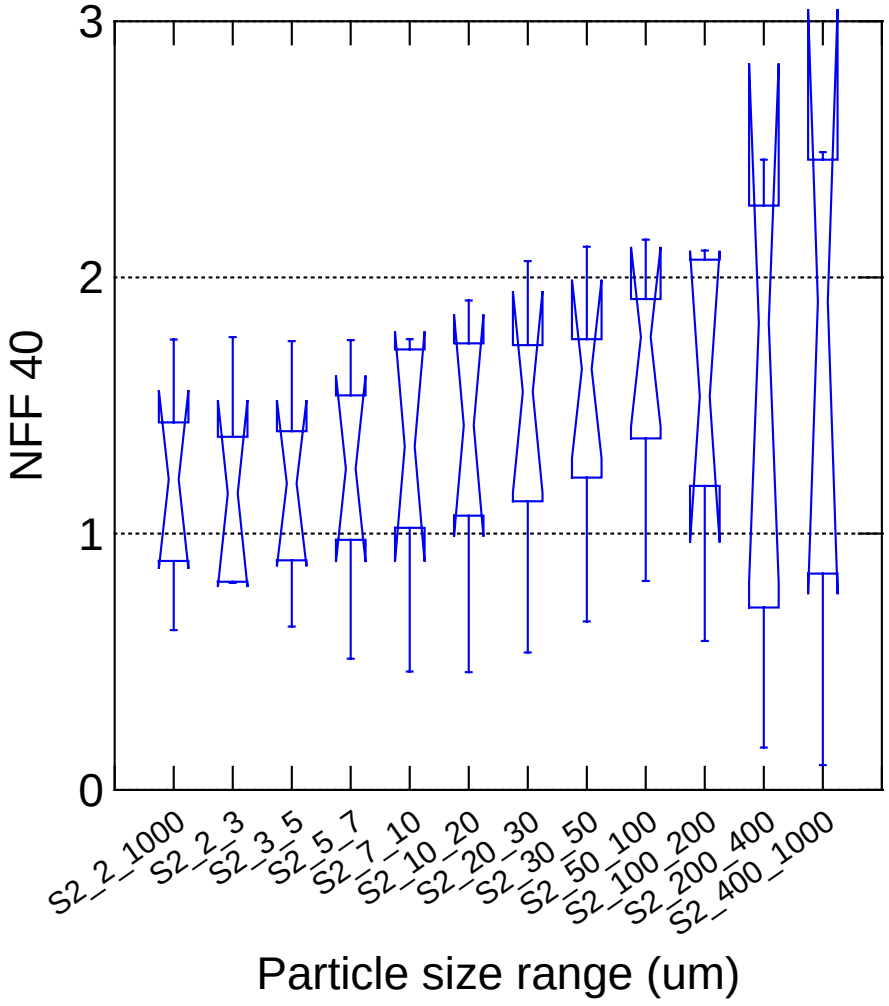


Figure F.4.3 NFF40 of Particles for UCLA 2

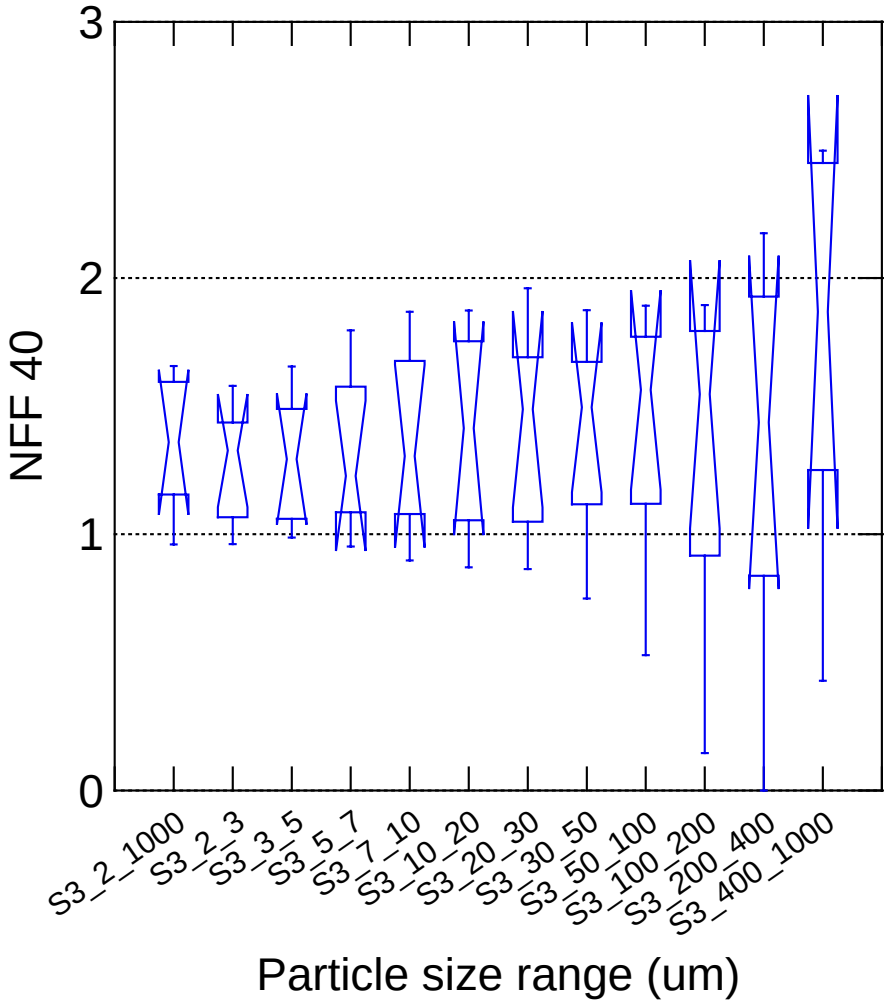


Figure F.4.4 NFF 40 of Particles for UCLA 3

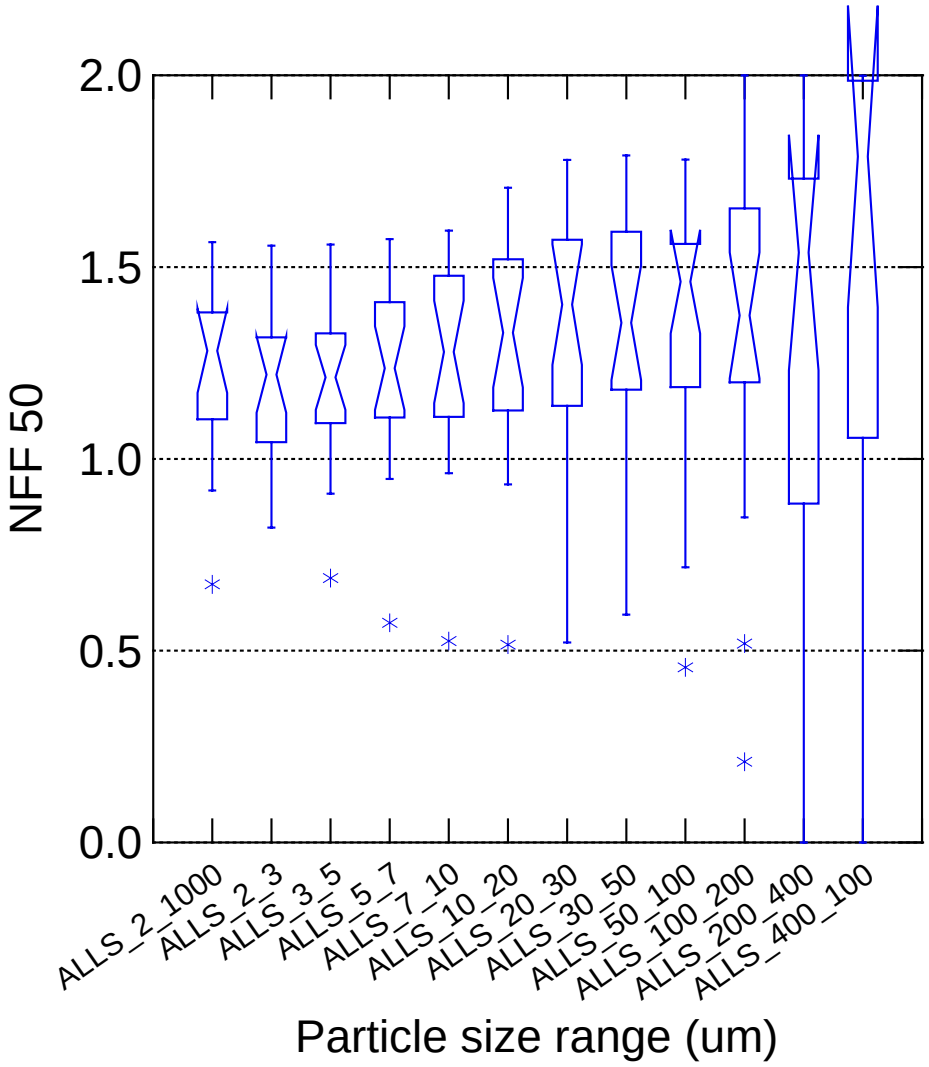


Figure F.5.1 NFF50 of Particles for Combined UCLA sites

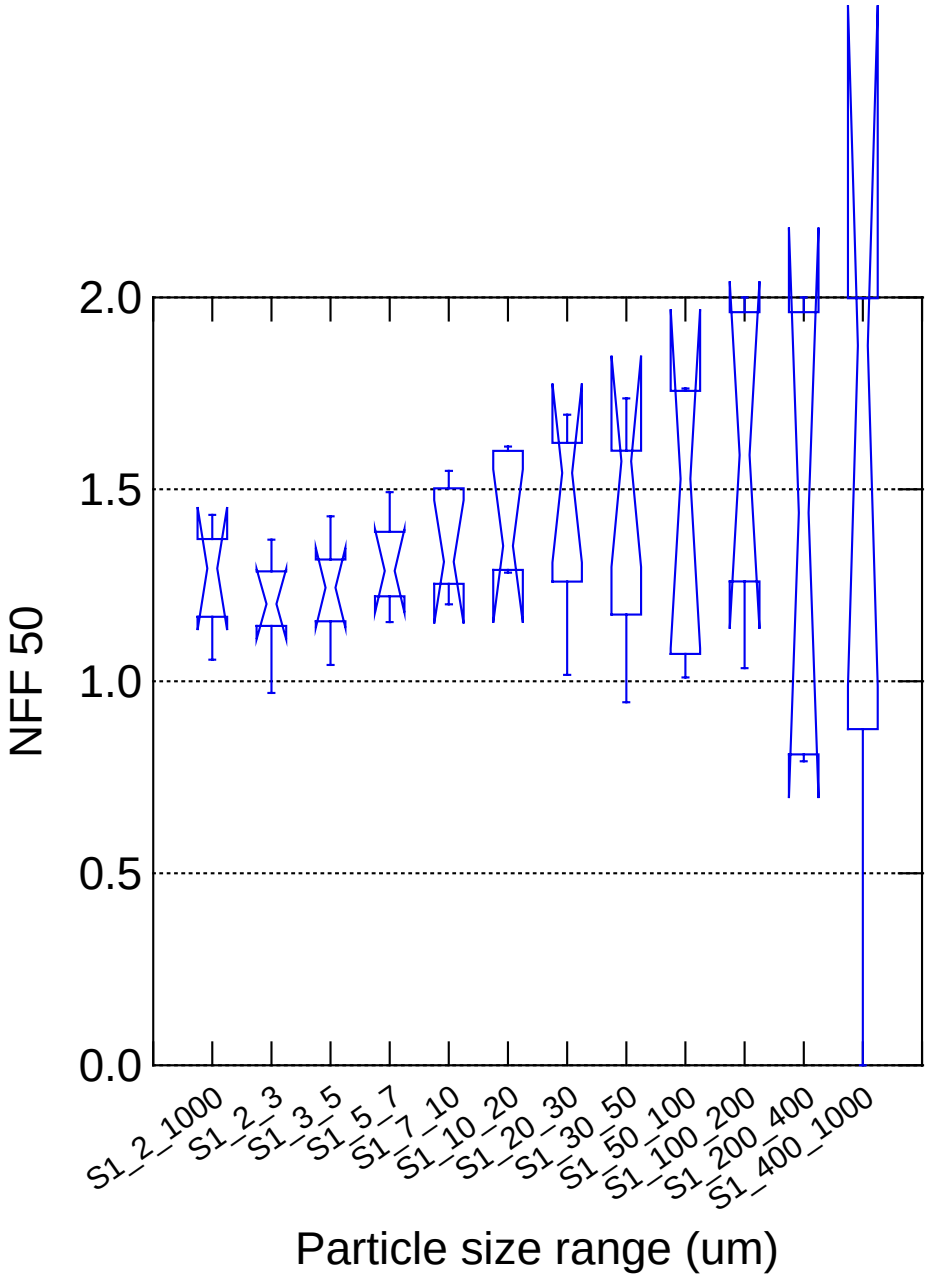


Figure F.5.2 NFF 50 of Particles for UCLA 1

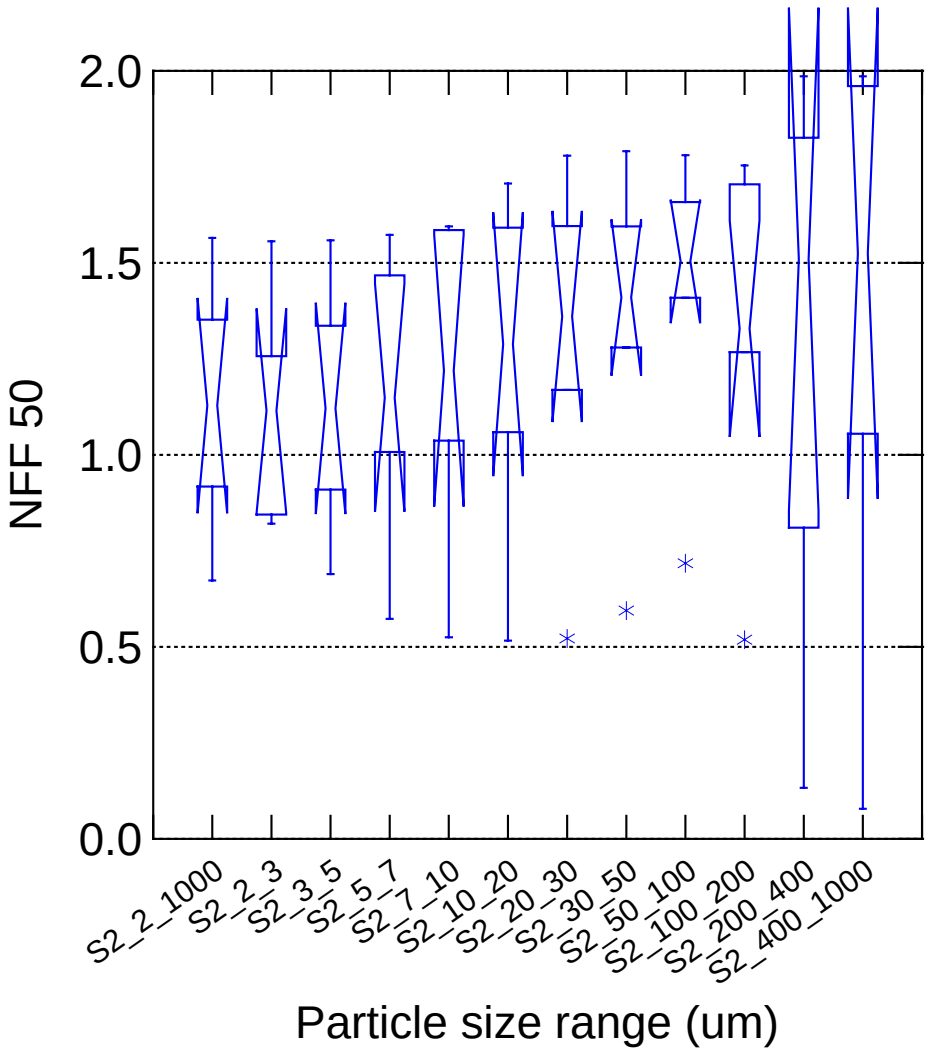


Figure F.5.3 NFF 50 of Particles for UCLA 2

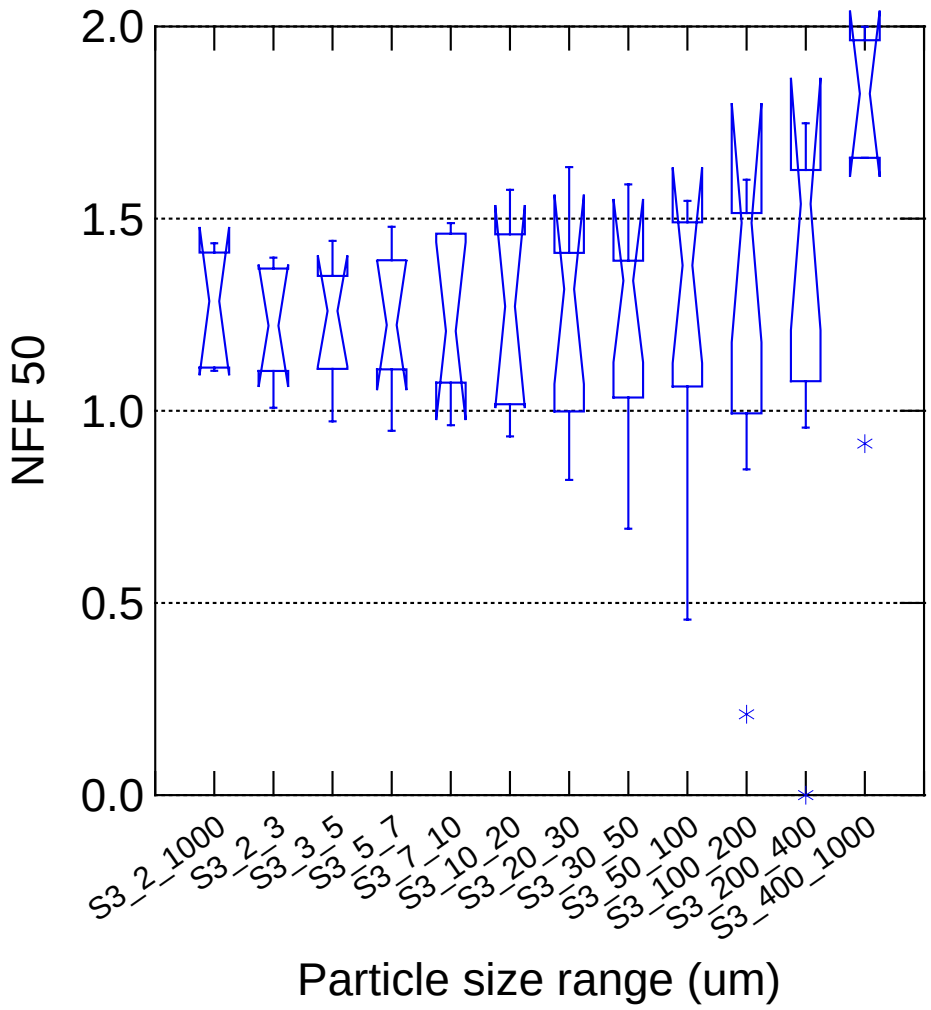


Figure F.5.4 NFF 50 of Particles for UCLA 3

APPENDIX G
PRELIMINARY TOXICITY DATA

Table G.1 Summary of UCLA Storm Water Site Composite and Grab Samples Tested with Each Toxicity Test (Holding time is from collection of last grab sample to start of toxicity test, in hours)

	2/11/03			3/15/03			4/14/03		
Test	Comp.	Grabs	Hold	Comp.	Grabs	Hold	Comp.	Grabs	Hold
Sea Urchin	1,2,3	1,2,3	30	1	1,3	22	2	2,3	21
Microtox™	1,2,3	1,2,3	31	1	1,3	23	2	2,3	22
Ceriodaphnia	1,2,3		31	1	1,3	26	2	2,3	24
Fathead Minnow	1,2,3		30	1	1,3	28	2	2,3	24
Selenastrum	1,2,3		31	1	1,3	28		2,3	24/167[a]

[a] *Due to control problems, test was repeated. The second time indicated was for repeat test.*

Table G.2 Summary of Toxicity Endpoints for 2/11/03 Composite Samples

Test	UCLA1		UCLA2		UCLA3	
	EC50	NOEC	EC50	NOEC	EC50	NOEC
Sea Urchin Fertilization	15.20%	6.20%	10.30%	6.20%	12.50%	6.20%
Microtox™	-[a]	18.80%	-[a]	0.75	-[a]	9.40%
Ceriodaphnia Survival	NC	NC	NC	NC	NC	NC
Reproduction	NC	NC	NC	NC	NC	NC
Minnow Survival	NC	NC	NC	NC	NC	NC
Growth	NC	NC	NC	NC	NC	NC
Selenastrum Density	NC	NC	NC	NC	NC	NC

[a] *The dose response did not allow EC50 to be calculated.* *NC=Sample not collected.*

Table G.3 Summary of Toxicity Endpoints for 3/15/03 Composite Samples

Test	UCLA1		UCLA2		UCLA3	
	EC50	NOEC	EC50	NOEC	EC50	NOEC
Sea Urchin Fertilization	25.20%	3%	NC	NC	NC	NC
Microtox™	-[a]	37.50%	NC	NC	NC	NC
Ceriodaphnia Survival	>100%	1	NC	NC	NC	NC
Reproduction	>100%	1	NC	NC	NC	NC
Minnow Survival	>100%	1	NC	NC	NC	NC
Growth	>100%	1	NC	NC	NC	NC
Selenastrum Density	>100%	1	NC	NC	NC	NC

[a] *The dose response did not allow EC50 to be calculated.* *NC=Sample not collected*

Table G.4 Summary of Toxicity Endpoints for 4/14/03 Composite Samples

Test	UCLA1		UCLA2		UCLA3	
	EC50	NOEC	EC50	NOEC	EC50	NOEC
Sea Urchin Fertilization	NC	NC	27.90%	12.50%	NC	NC
Microtox™	NC	NC	-[a]	18.70%	NC	NC
Ceriodaphnia Survival	NC	NC	>100%	1	NC	NC
Reproduction	NC	NC	>100%	50%	NC	NC
Minnow Survival	NC	NC	>100%	1	NC	NC
Growth	NC	NC	>100%	1	NC	NC
Selenastrum Density	NC	NC	NA	NA	NC	NC

[a] *The dose response did not allow EC50 to be calculated.*
NC=Sample not collected
NA=Due to problems with the control density, no data were available for analysis

Table G.5 Summary of Logistic Regression Equation Parameters

Test Species	Storm	Site	a	b	X0	R2
Sea Urchin	2/11/2003	UCLA1	77.9664	1.48475	17.1858	0.968
	2/11/2003	UCLA2	82.5298	5.00336	11.707	0.997
	2/11/2003	UCLA3	76.6795	1.80402	15.3088	0.969
	3/15/2003	UCLA1	92.9318	1.32762	20.1567	0.998
	4/14/2003	UCLA2	98.3939	6.73905	27.2181	0.999
Microtox ™	3/15/2003	UCLA1	233110	1.85183	28.0294	1
	4/14/2003	UCLA2	99621.9	4.33852	16.8890	0.999
	4/14/2003	UCLA3	136721	9.25472	10.8185	1

Table G.6 Estimated Proportion of Toxicity discharged at Normalized Volumes of 0.2 and 0.3

Site	Test	2/11/03		3/15/03	
		0.2	0.3	0.2	0.3
UCLA1	Sea Urchin Fertilization	0.42	0.43		
	Microtox™			0.20	0.30
	Fathead Minnow Survival			0.51	0.57
UCLA2	Sea Urchin Fertilization	0.48	0.88		
UCLA3	Sea Urchin Fertilization	0.19	0.20		
	Ceriodaphnia Survival	0.44	0.45	0.26	0.26
	Fathead Minnow Survival			0.27	0.31

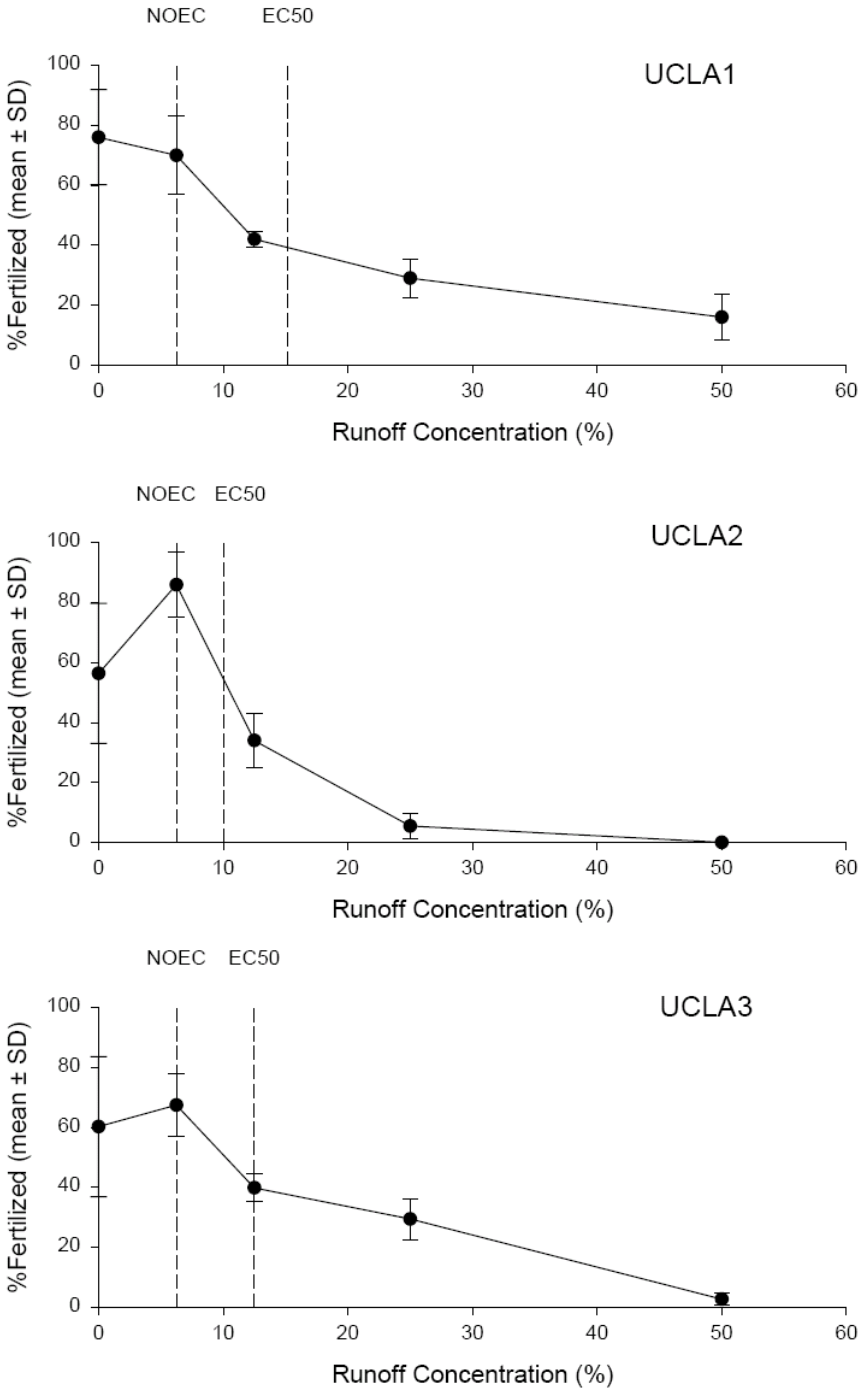


Figure G.1.1 Dose-Response Plots of UCLA Composites using the Sea Urchin Fertilization Test from 2/11/03

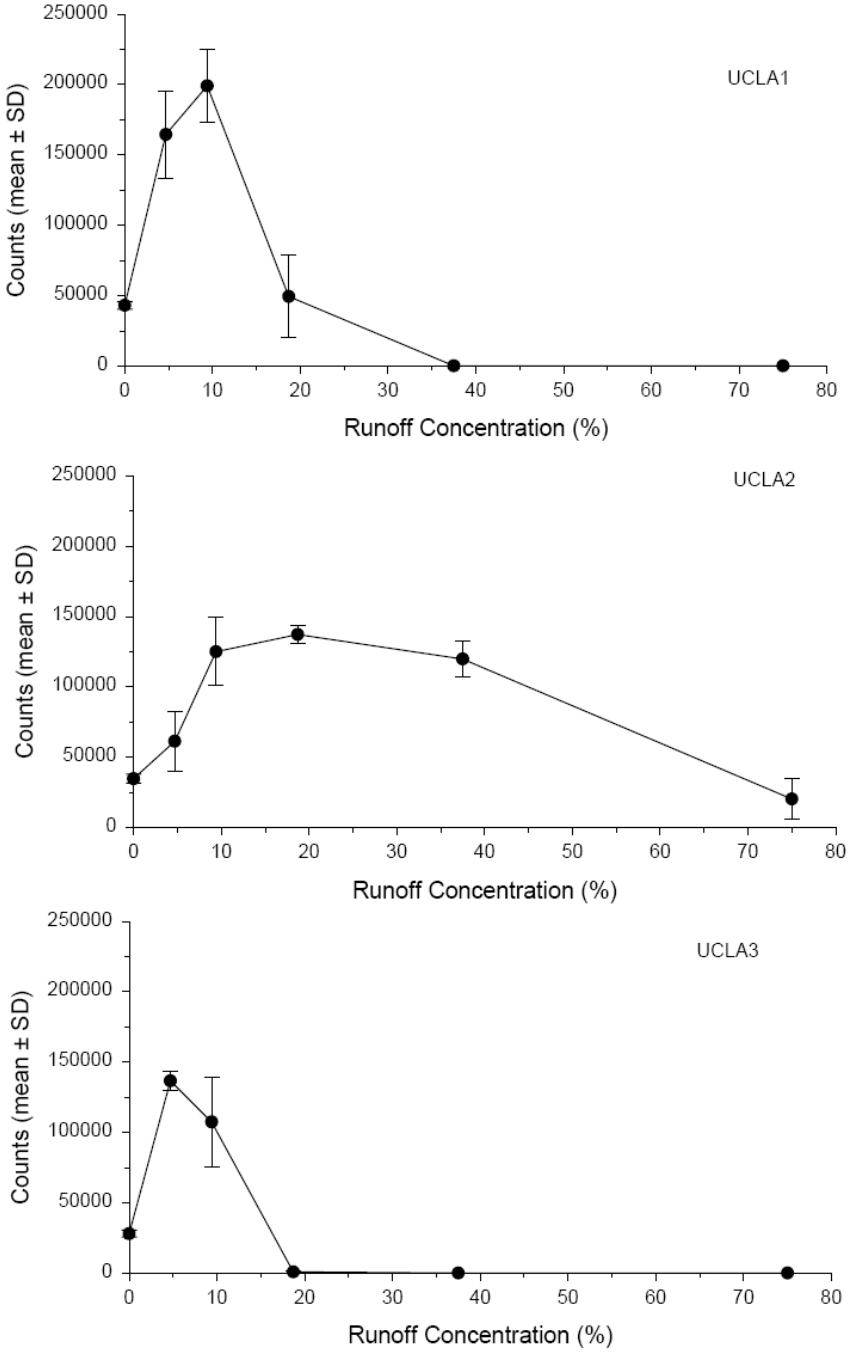


Figure G.1.2 Dose-Response Plots of UCLA Composites using the Microtox™ Test from 2/11/03

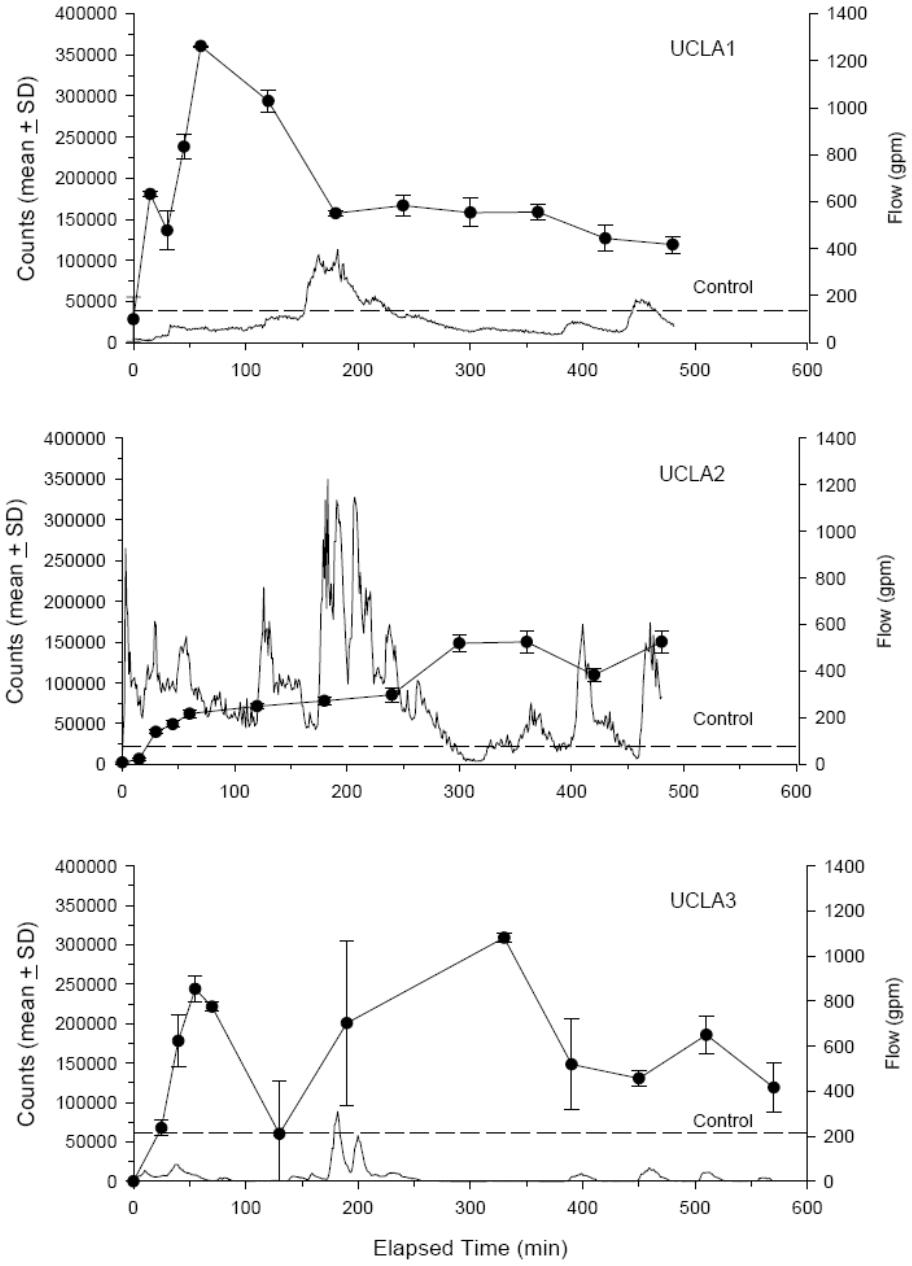


Figure G.1.3 Plots of results from UCLA Grab Samples using the Microtox™ Test from 2/11/03 (All samples were tested at 9.4% runoff)

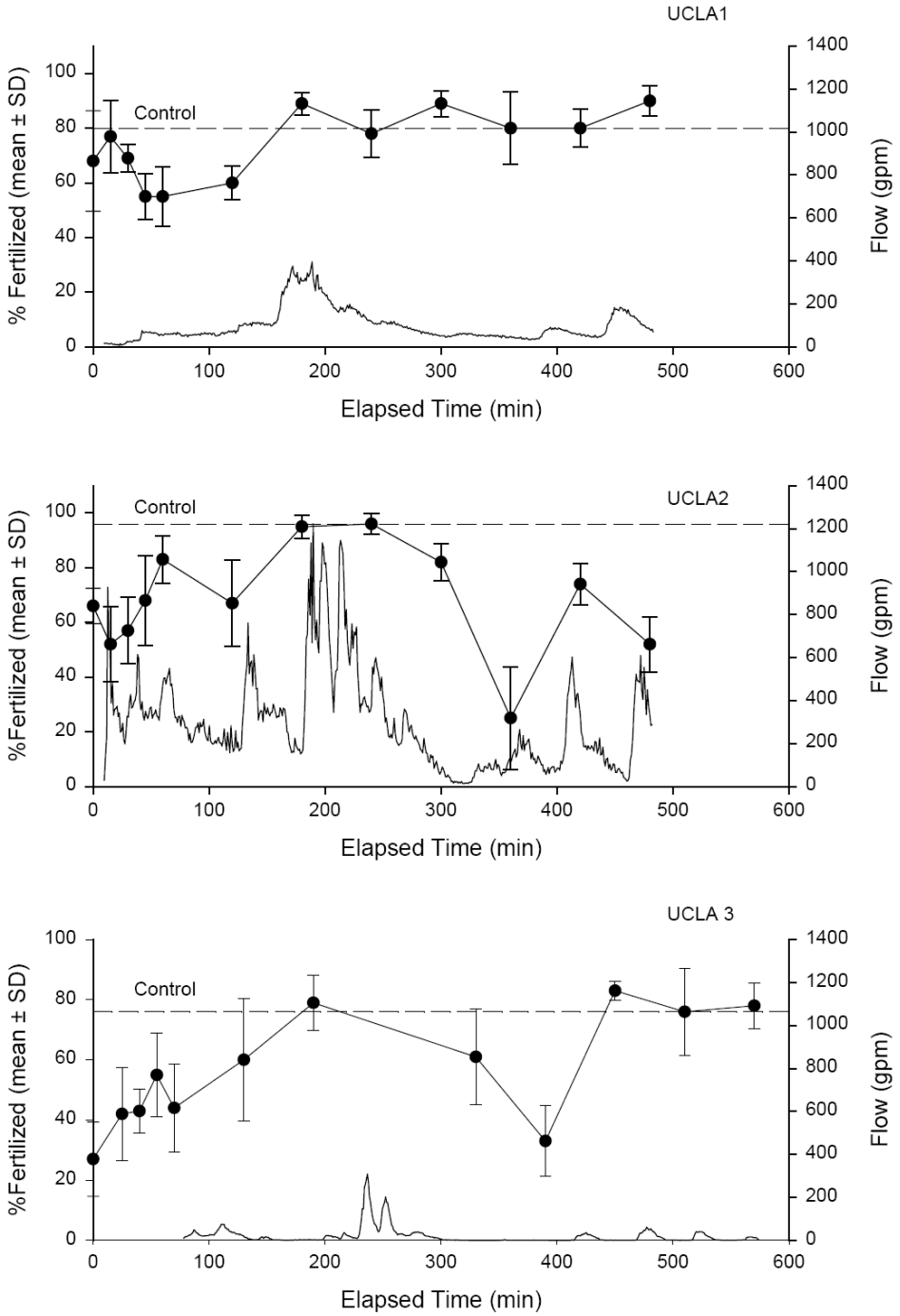


Figure G.1.4 Plots of Results from UCLA Grab Samples using the Sea Urchin Fertilization Test from 2/11/03 (All samples were tested at 12.5% runoff)

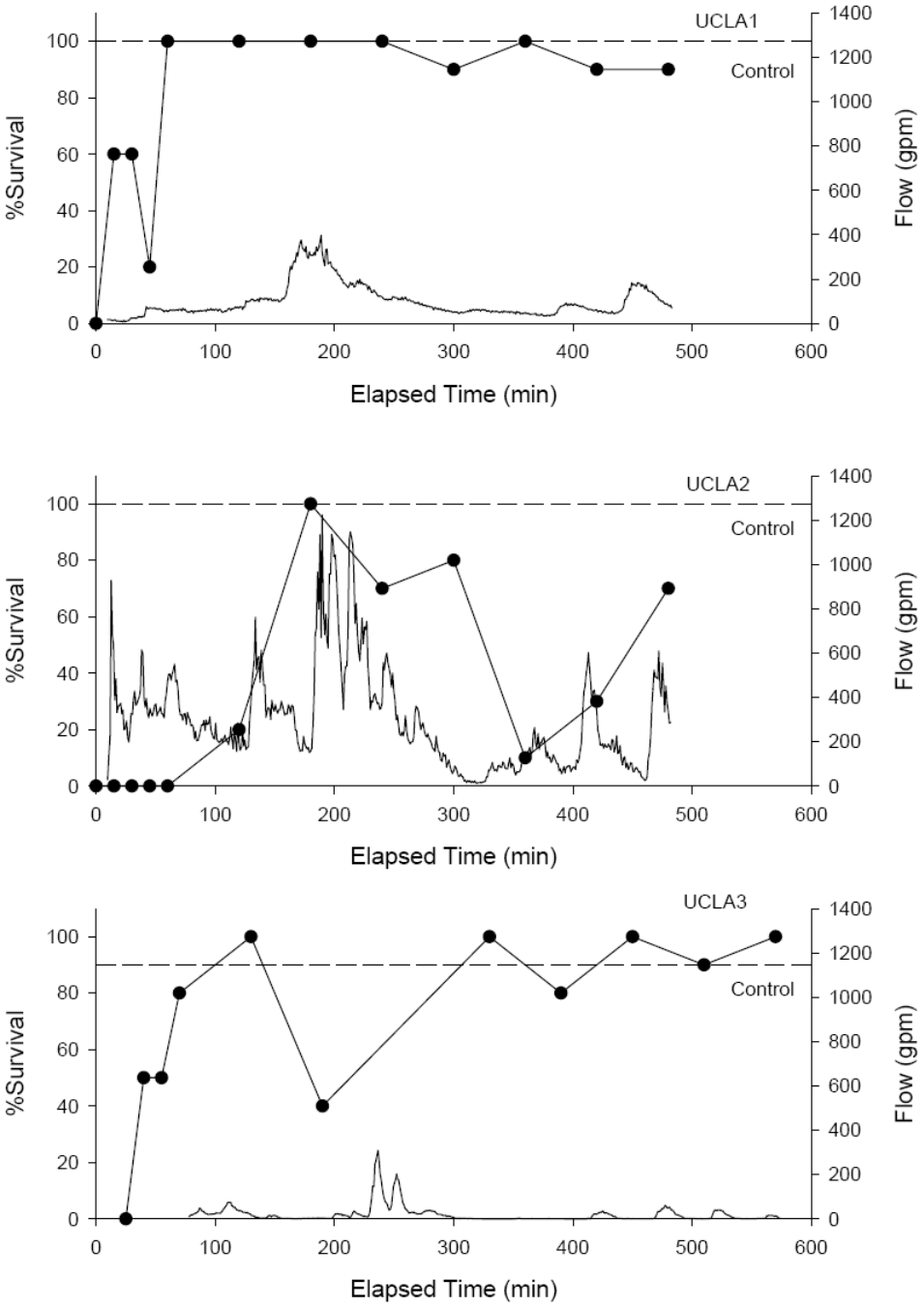


Figure G.1.5 Plots of Results from UCLA Grab Samples using the *Ceriodaphnia* Survival Test from 2/11/03 (All samples tested at 100% runoff)

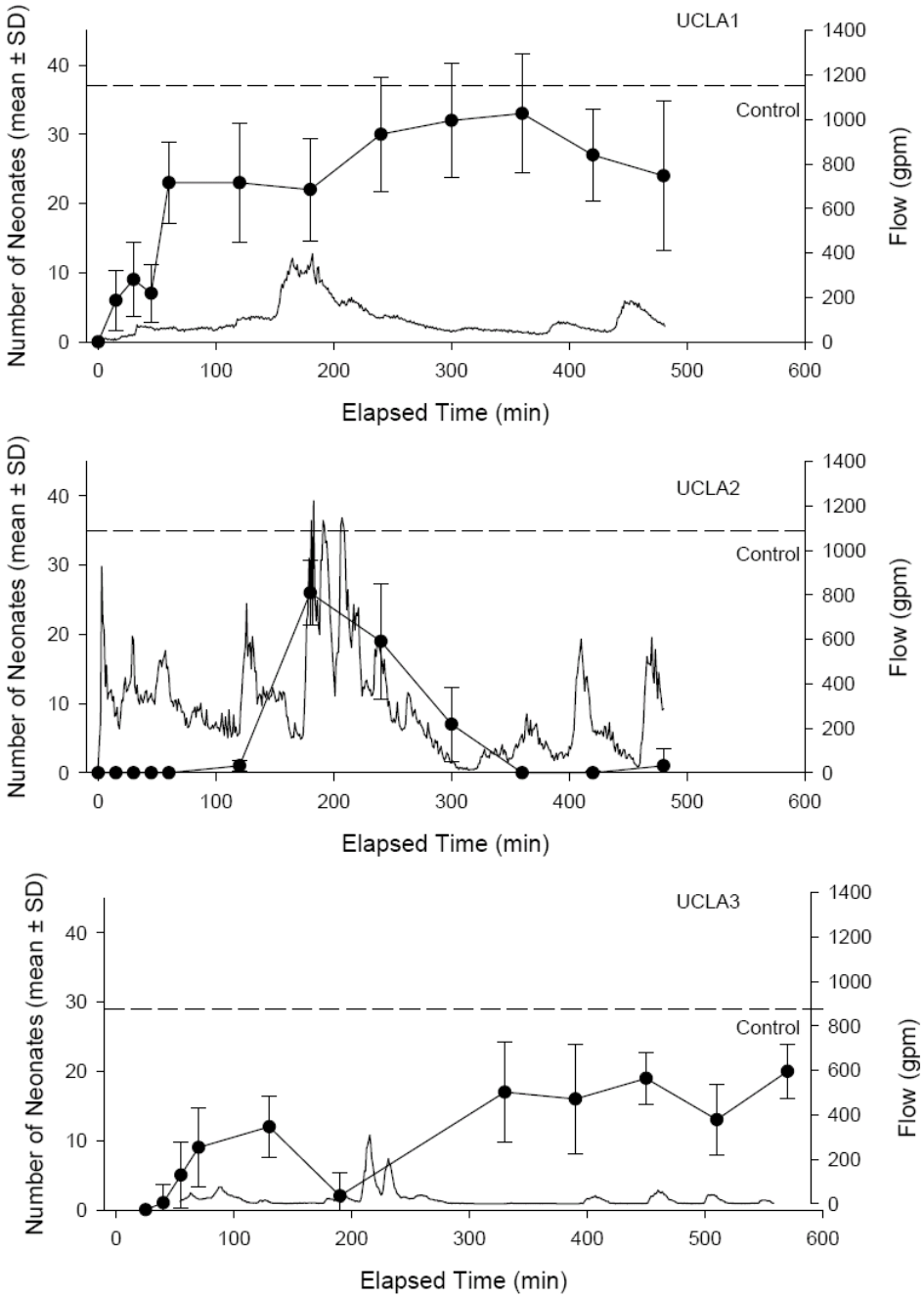


Figure G.1.6 ***Ceriodaphnia*** **Reproduction Endpoint Results for Grab Samples from UCLA1 from 2/11/03 (All samples tested at 100% runoff)**

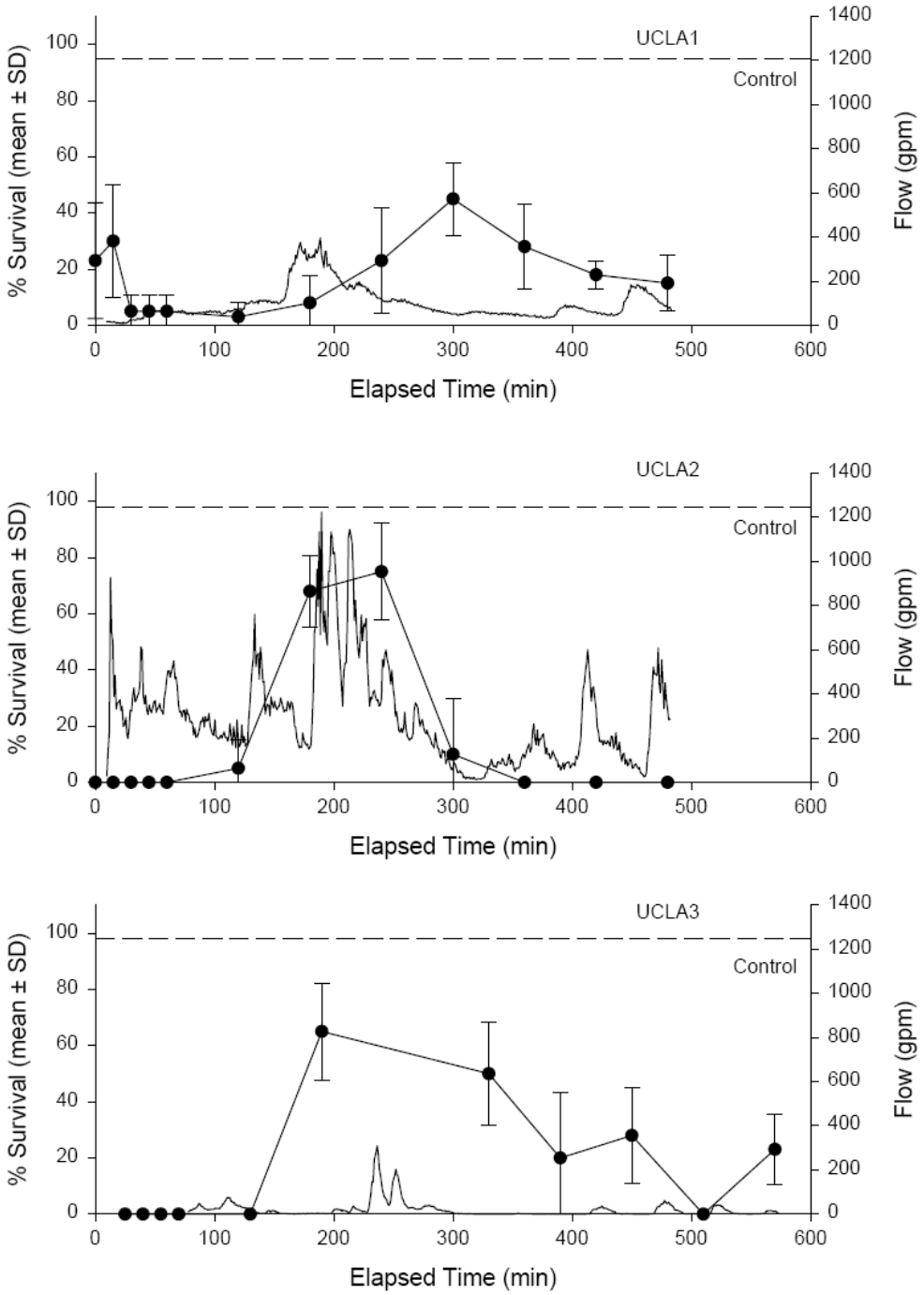


Figure G.1.7 Plots of Survival Endpoint Results from UCLA Grab Samples using the Fathead Minnow Survival and Growth Test from 2/11/03 (All samples tested at 100% runoff)

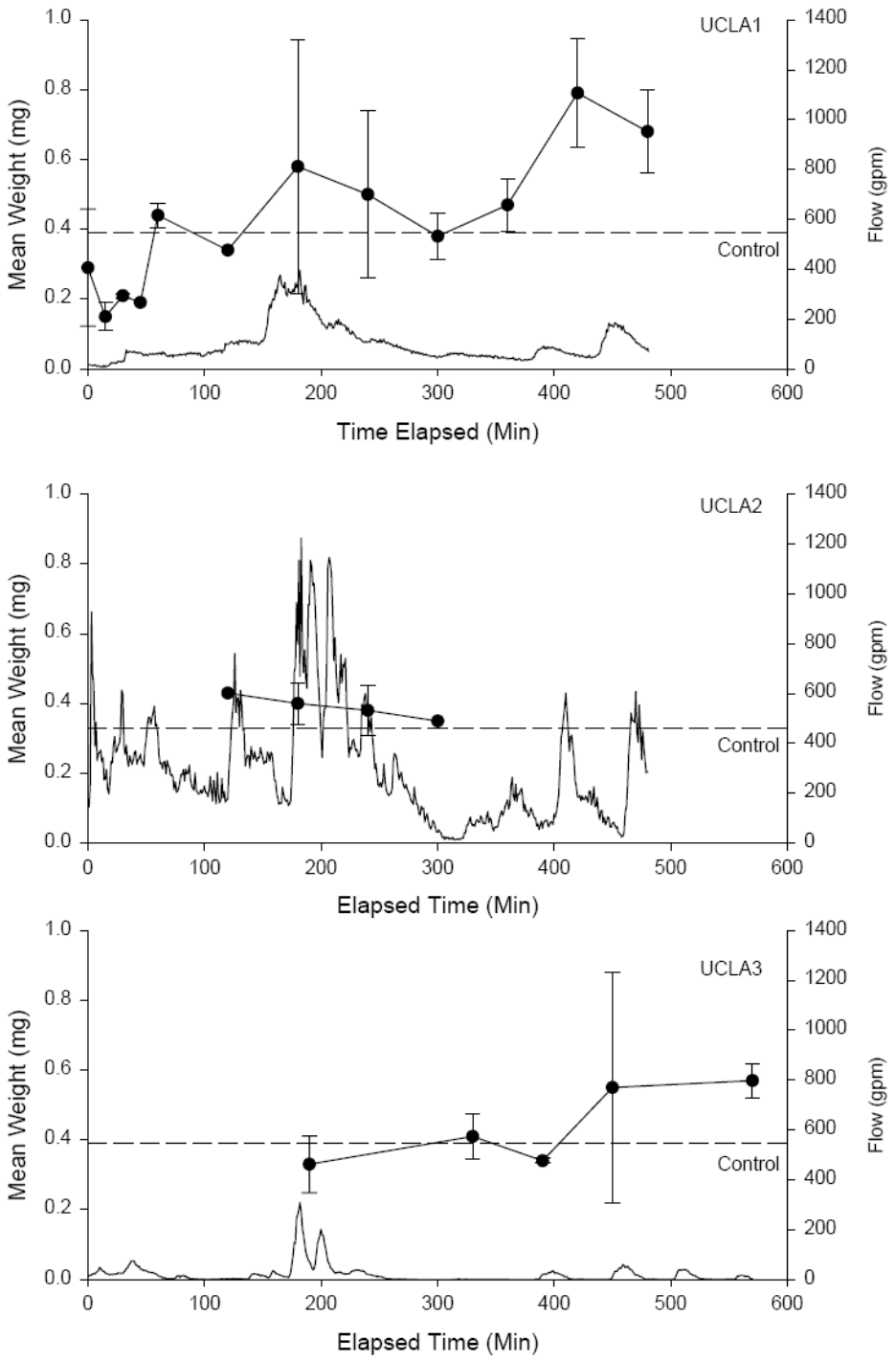


Figure G.1.8 Plots of Weight Endpoint Results from UCLA Grab Samples using the Fathead Minnow Survival and Growth Test from 2/11/03 (Missing data is from grabs where there was no survival. All samples tested at 100%)

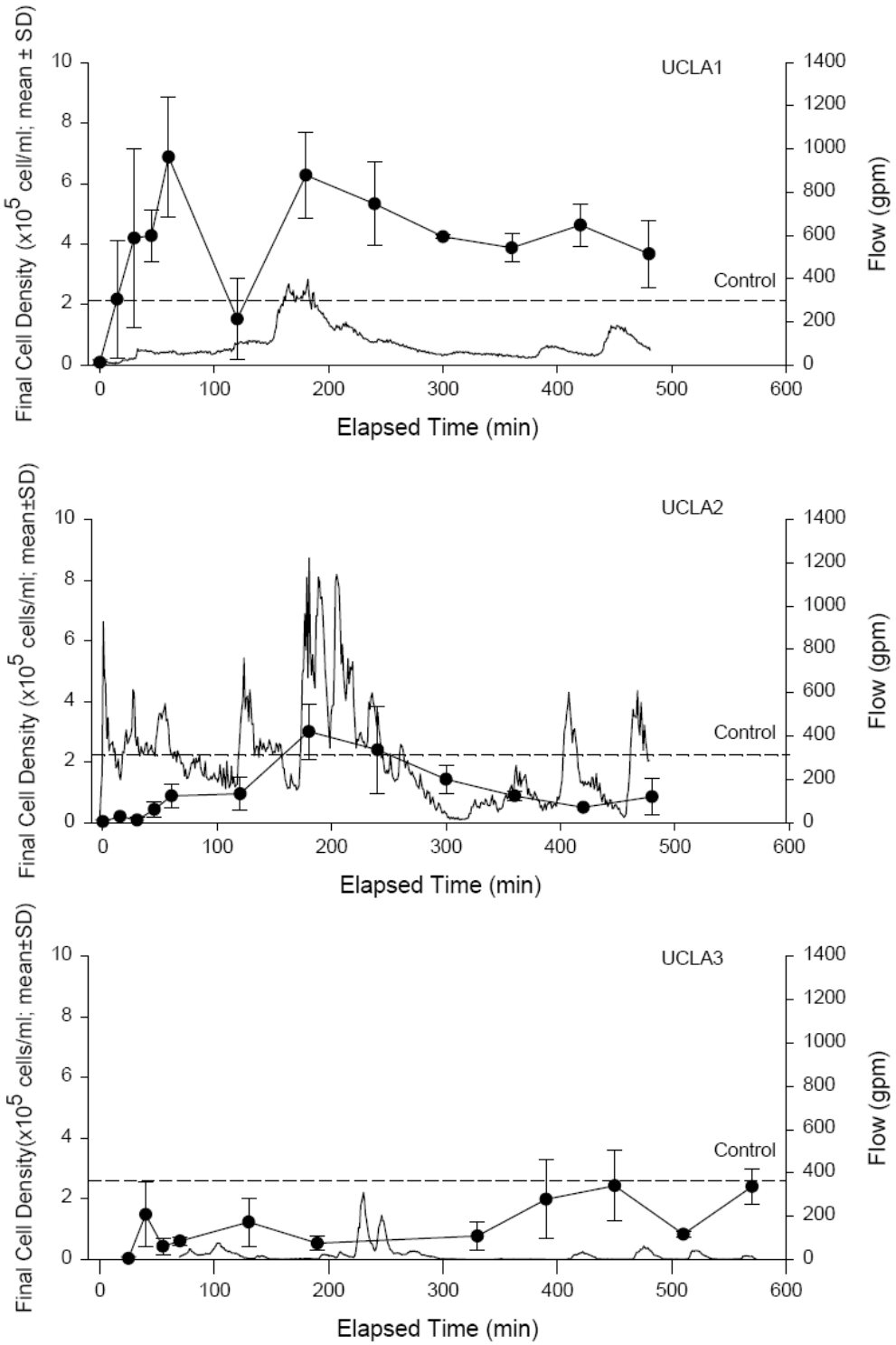


Figure G.1.9 Plots of Cell Density Results from UCLA Grab Samples using the *Selenastrum* Growth Test from 2/11/03 (All samples tested at 100%)

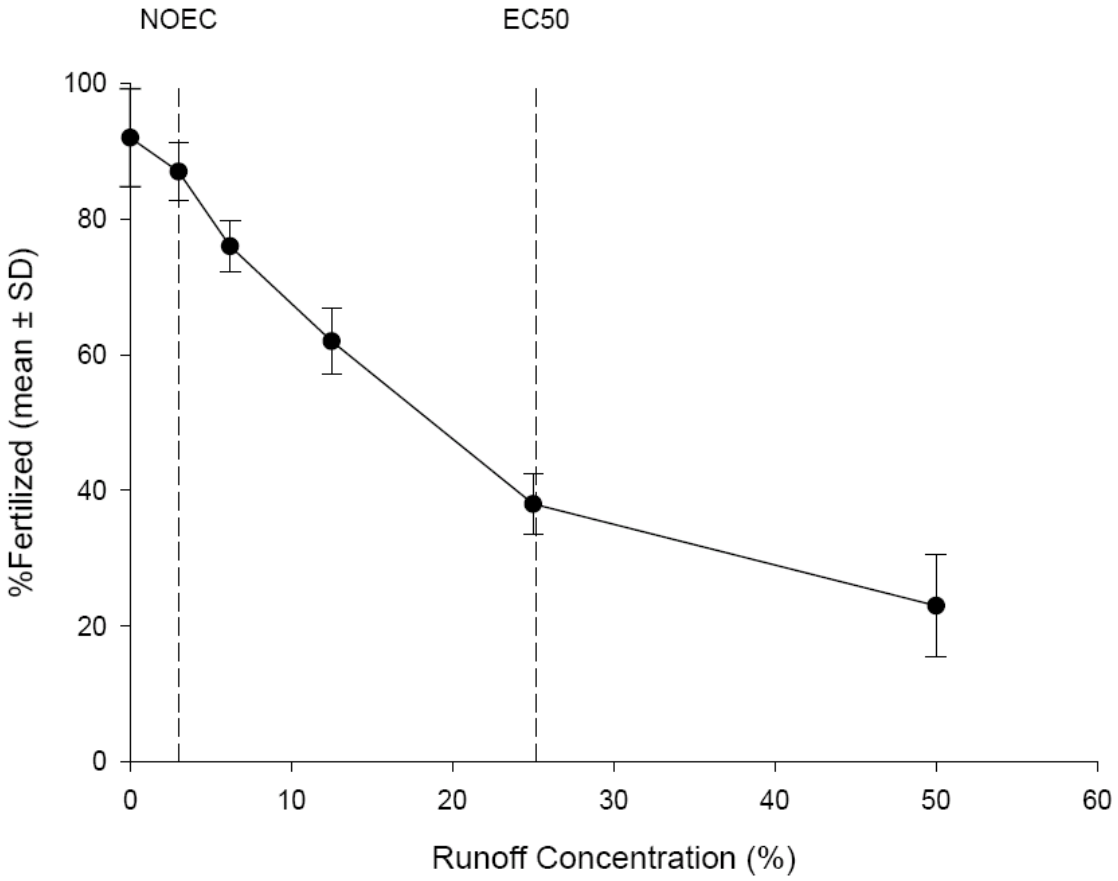


Figure G.2.1 Dose-response Plot of UCLA1 Composite using the Sea Urchin Fertilization Test from 3/15/03

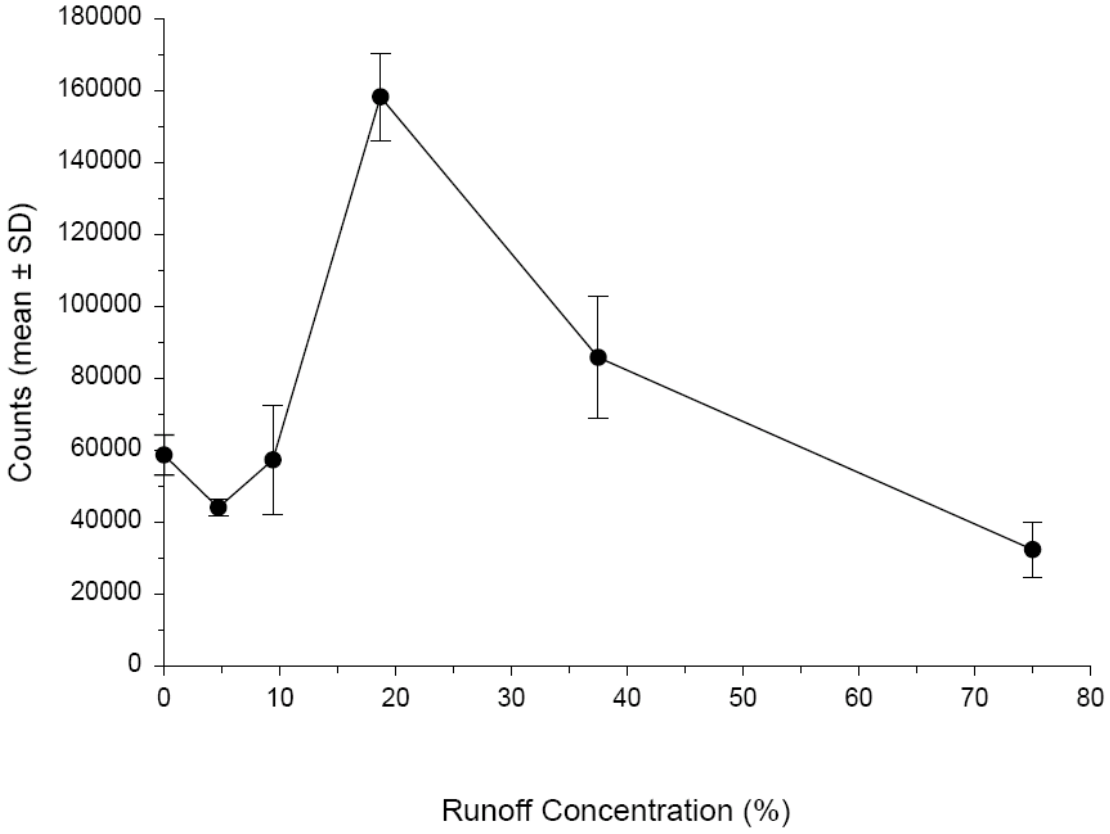


Figure G.2.2 Dose-Response Plot of UCLA1 Composite using the Microtox™ Test from 3/15/03

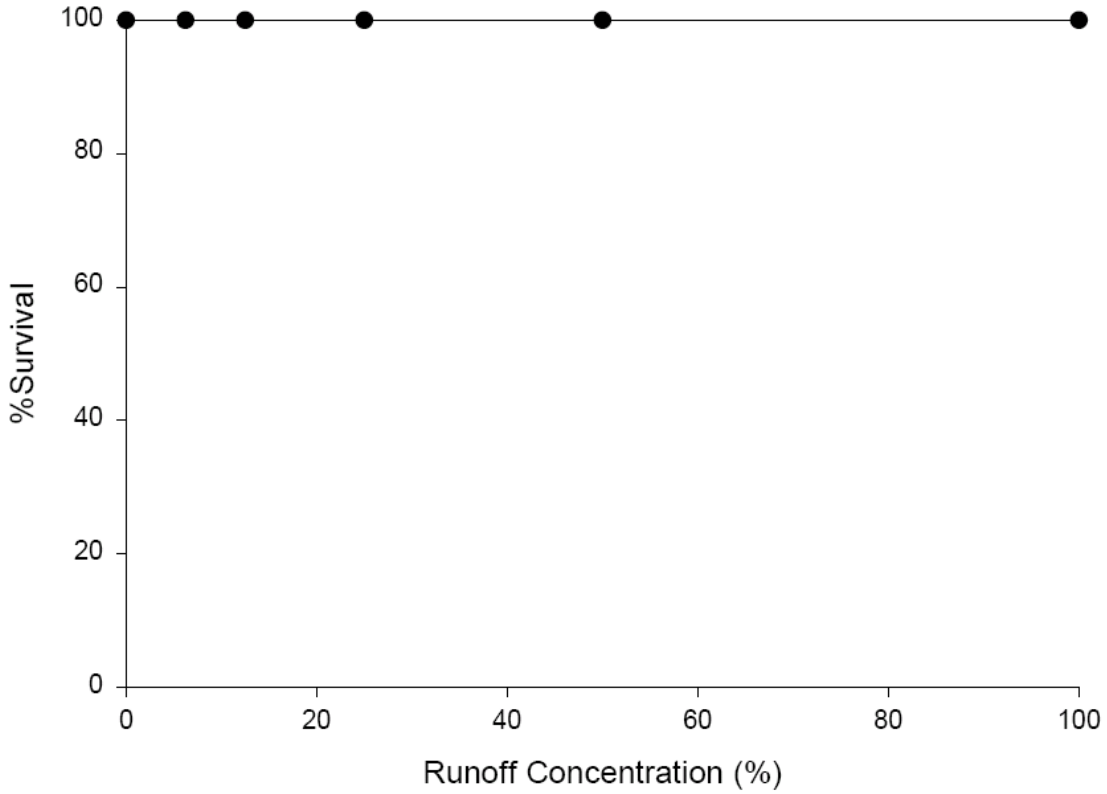


Figure G.2.3 Dose-Response Plot of UCLA1 Composite using the *Ceriodaphnia* Survival Test from 3/15/03

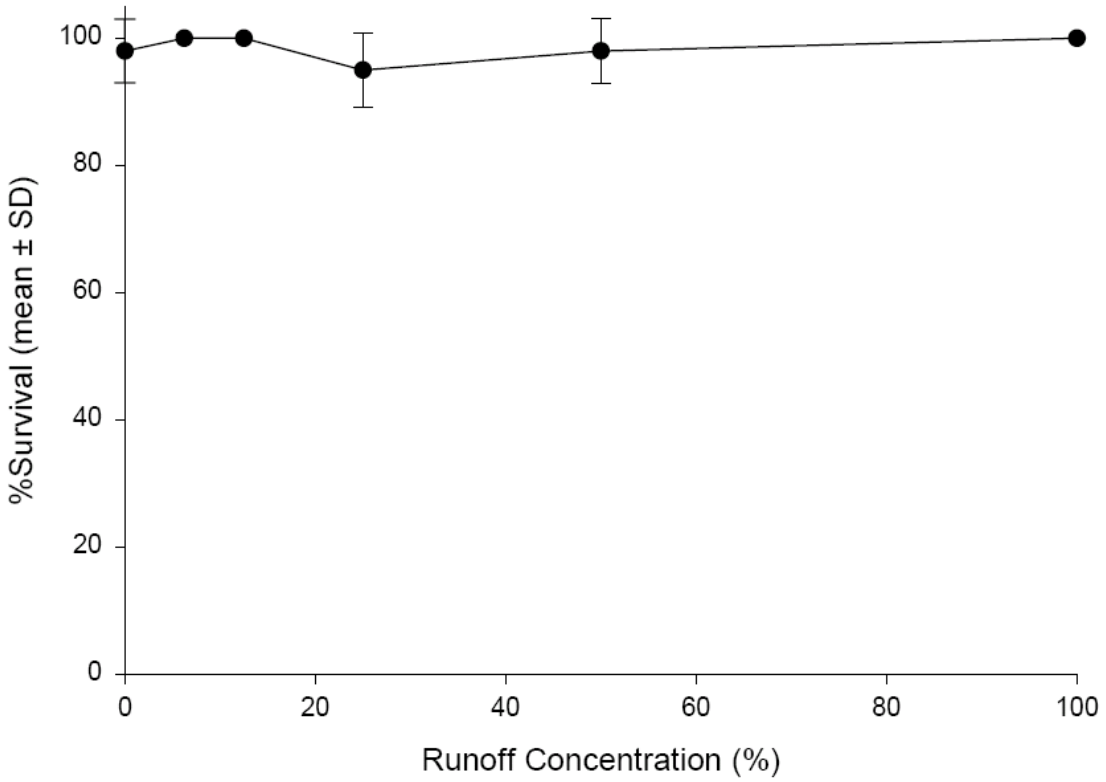


Figure G.2.4 Dose-Response Plot of UCLA1 Composite using the Fathead Minnow Survival and Growth Test from 3/15/03

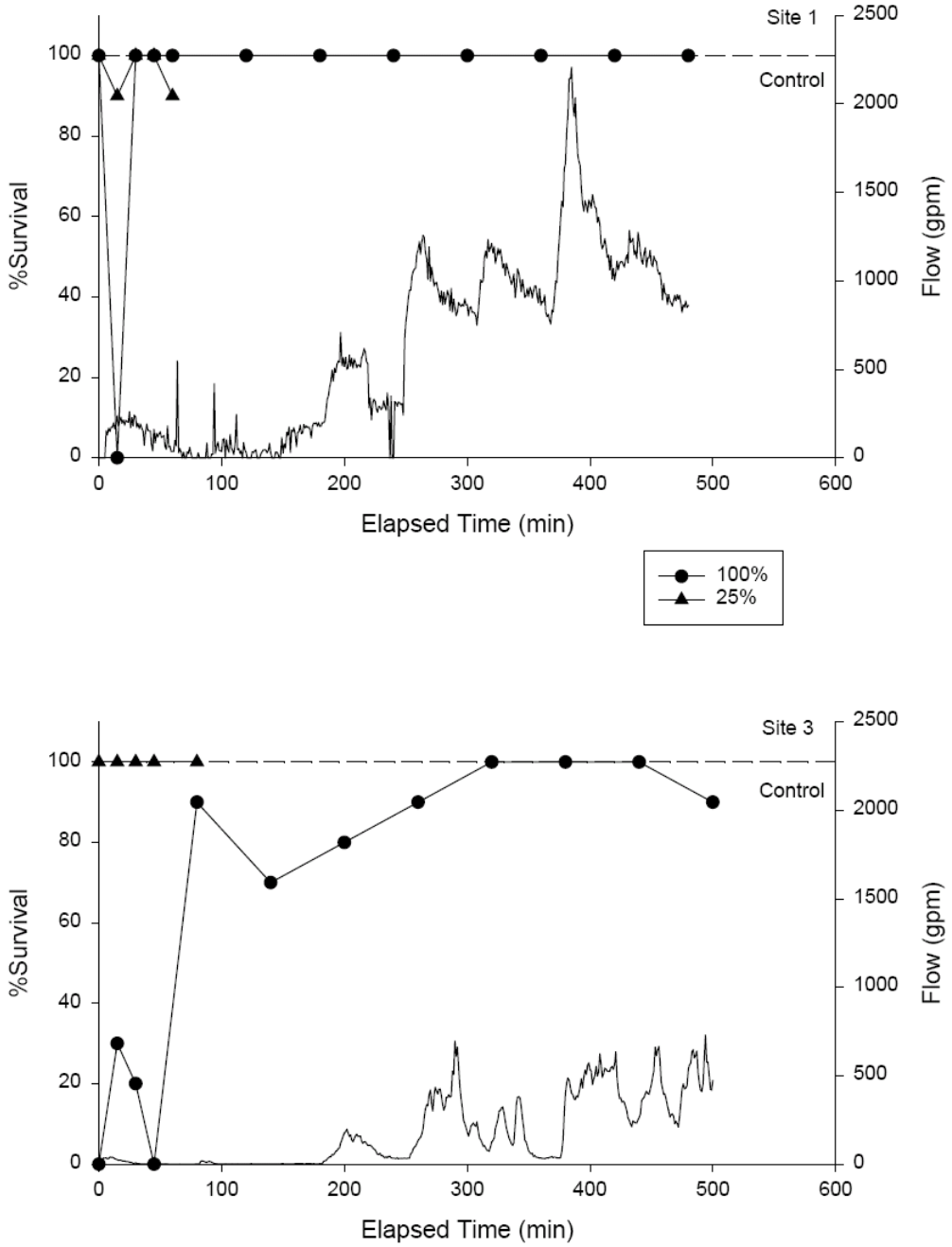


Figure G.2.5 Plots of Results from UCLA Grab Samples using the *Ceriodaphnia* Survival Test from 3/15/03

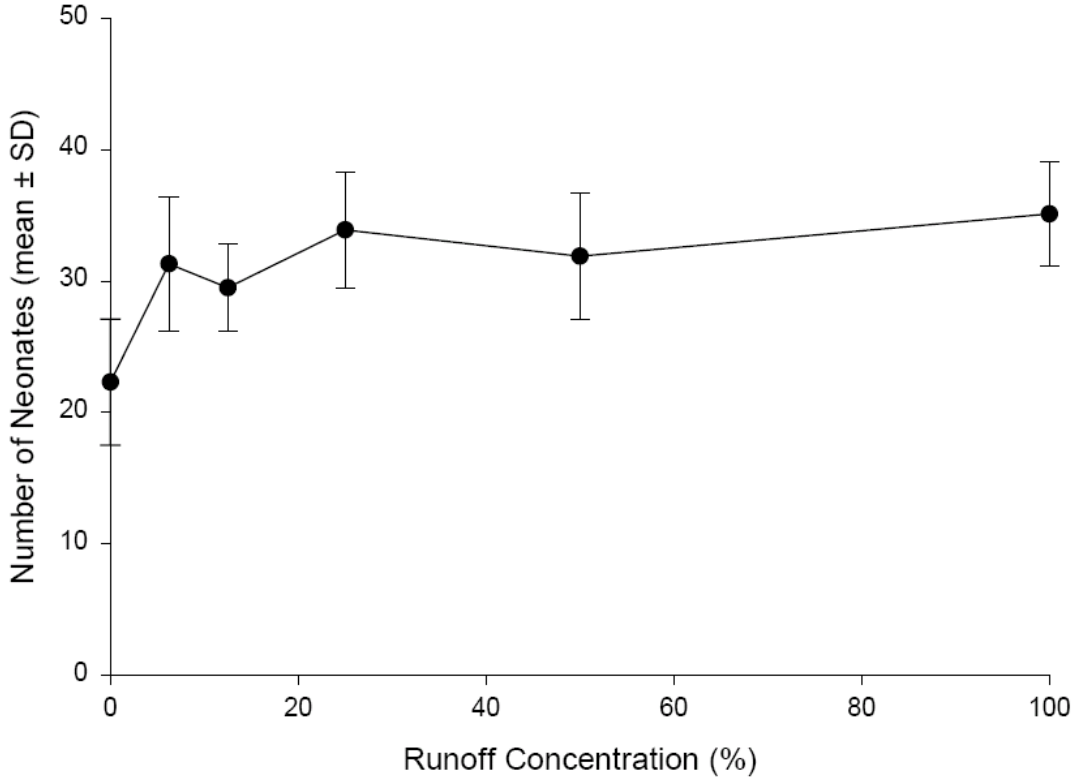
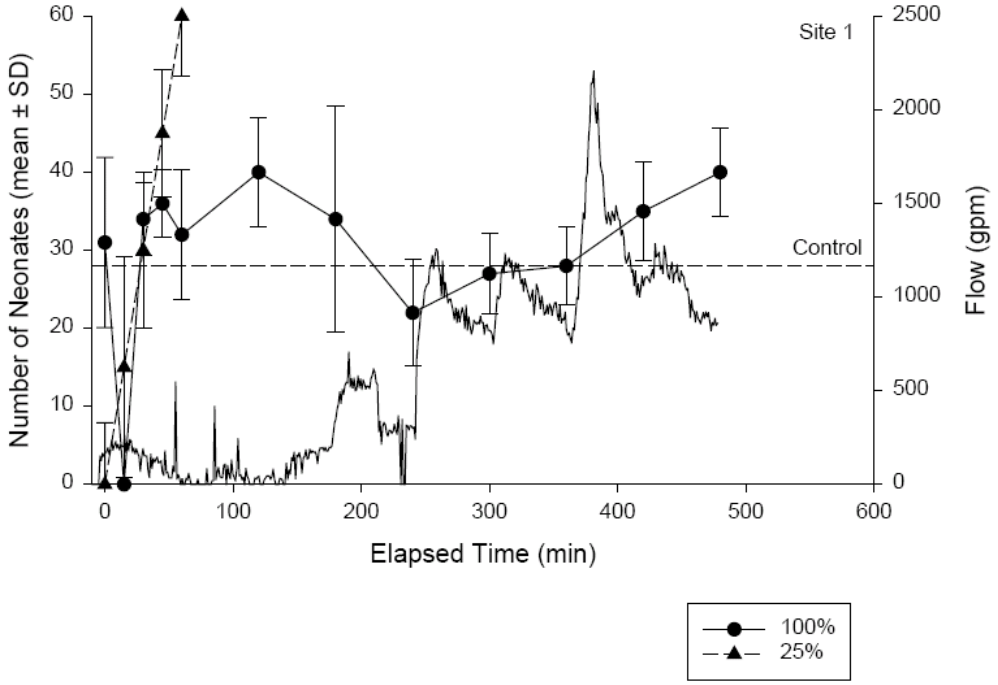


Figure G.2.6 Reproduction Endpoint Dose-Response Plot of UCLA1 Composite using the *Ceriodaphnia* Survival and Reproduction Test from 3/15/03



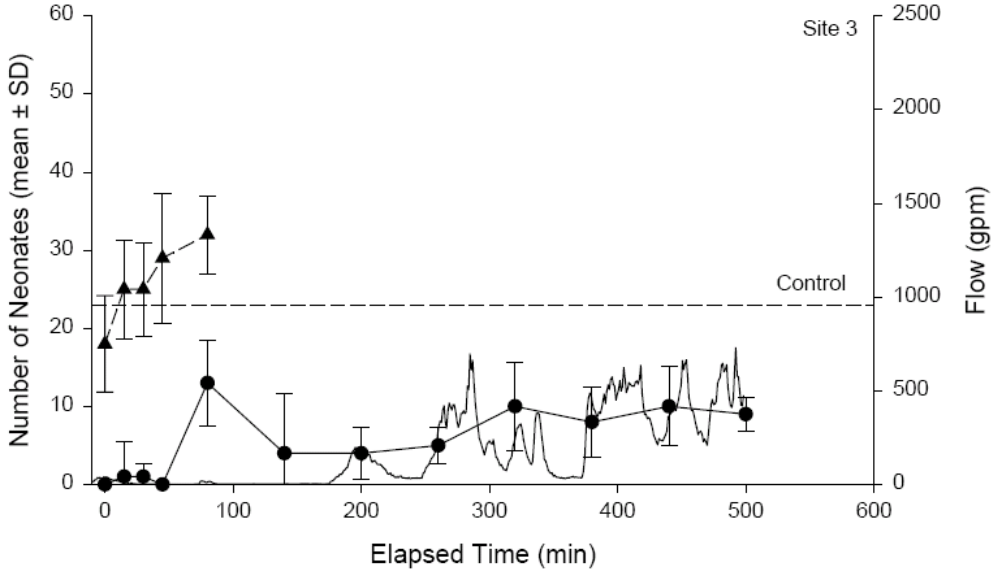


Figure G.2.7 Plots of Reproduction Endpoint Results from UCLA Grab Samples using the *Ceriodaphnia* Survival and Reproduction Test from 3/15/03

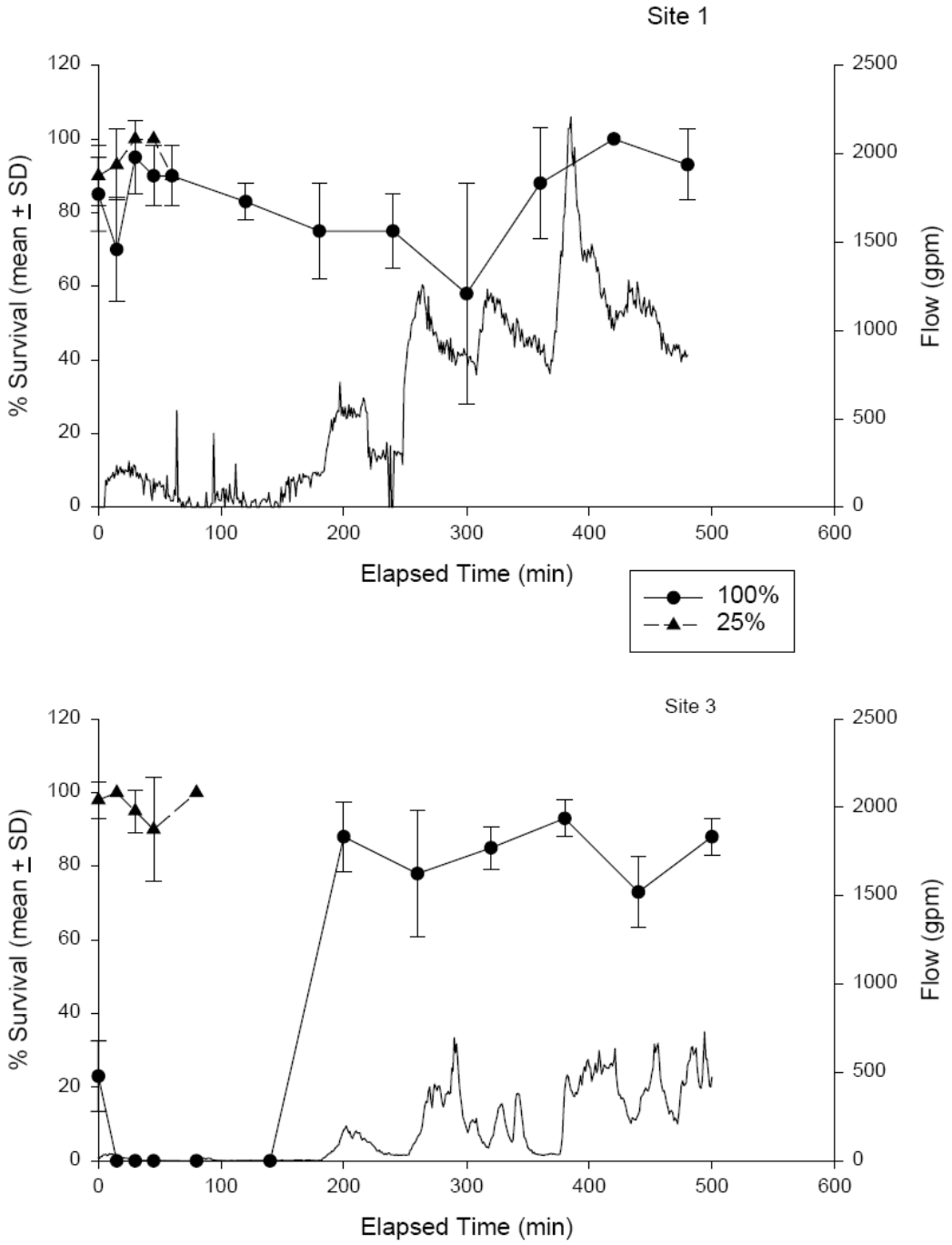


Figure G.2.8 Plots of Survival Endpoint Results from UCLA Grab Samples using the Fathead Minnow Survival and Growth Test from 3/15/03

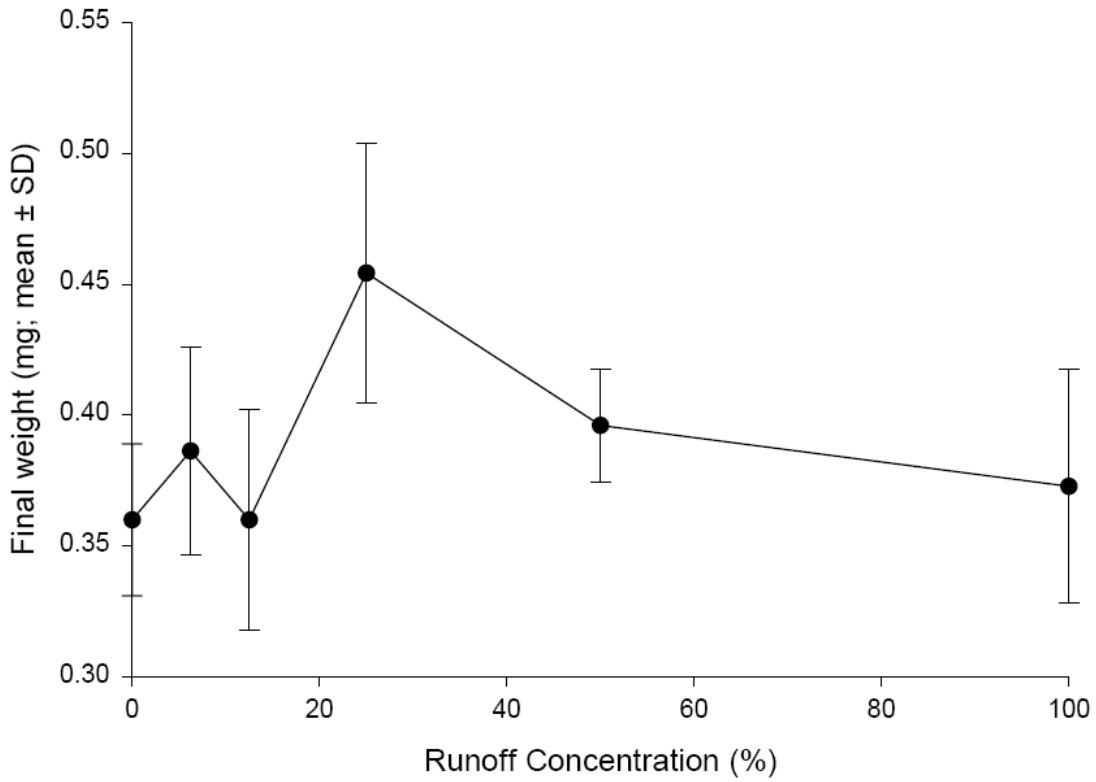


Figure G.2.9 Final Weight Dose-Response Plot of UCLA1 Composite using the Fathead Minnow Survival and Growth Test from 3/15/03

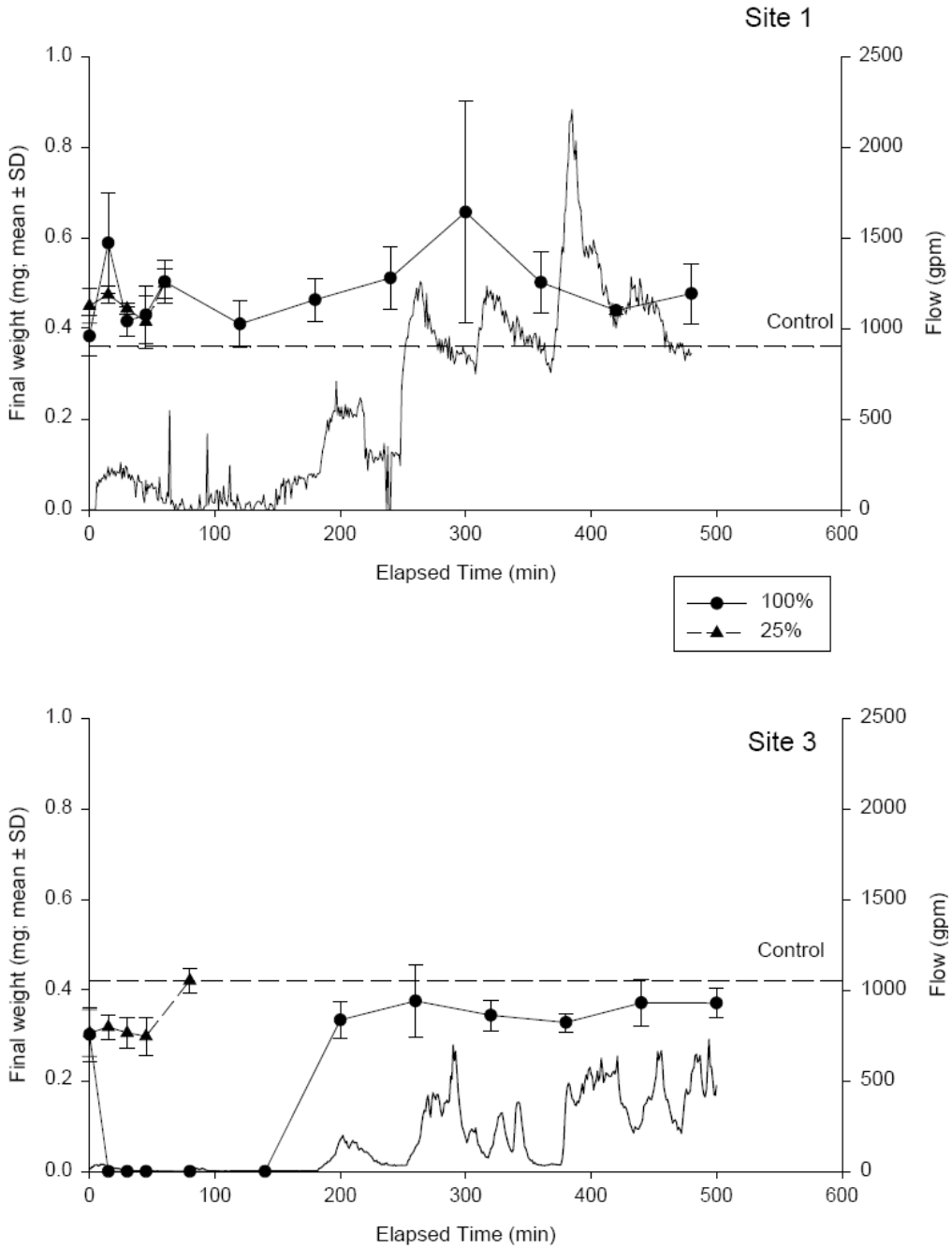


Figure G.2.10 Plots of Final Fish Weight Endpoint Results from UCLA Grab Samples using the Fathead Minnow Survival and Growth Test from 3/15/03

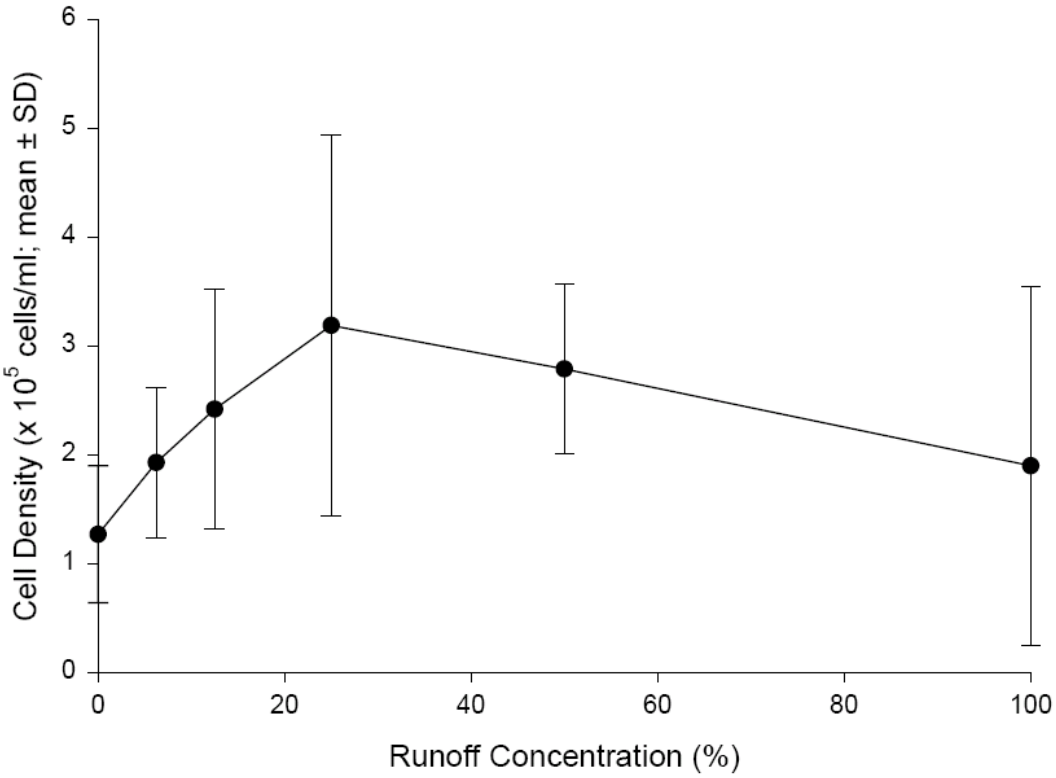
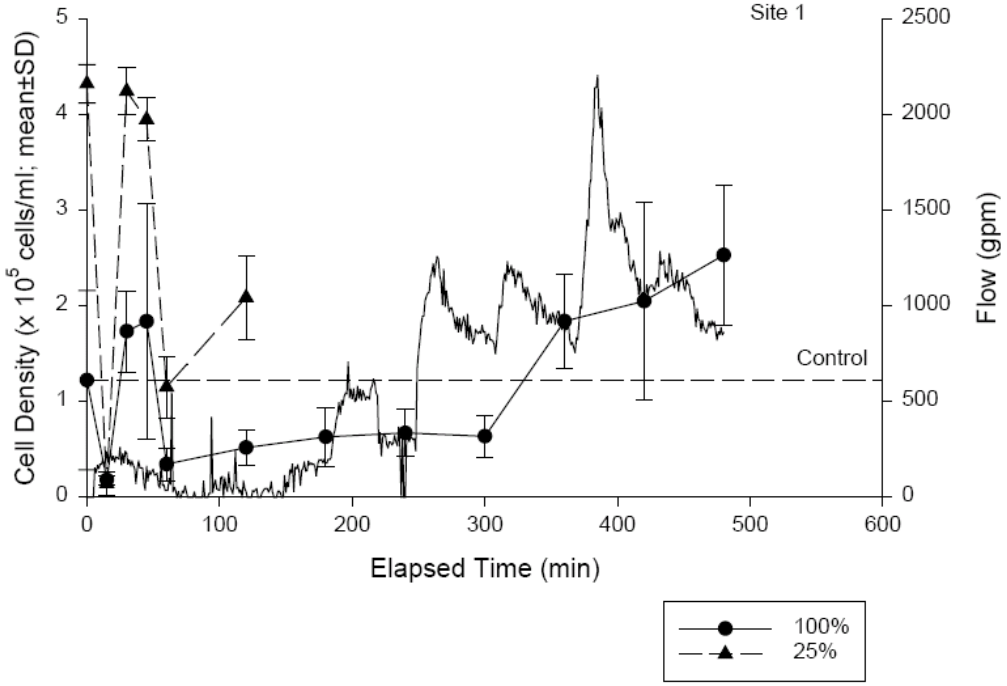


Figure G.2.11 Cell Density Dose-Response Plot of UCLA1 Composite using the *Selenastrum* Growth Test from 3/15/03



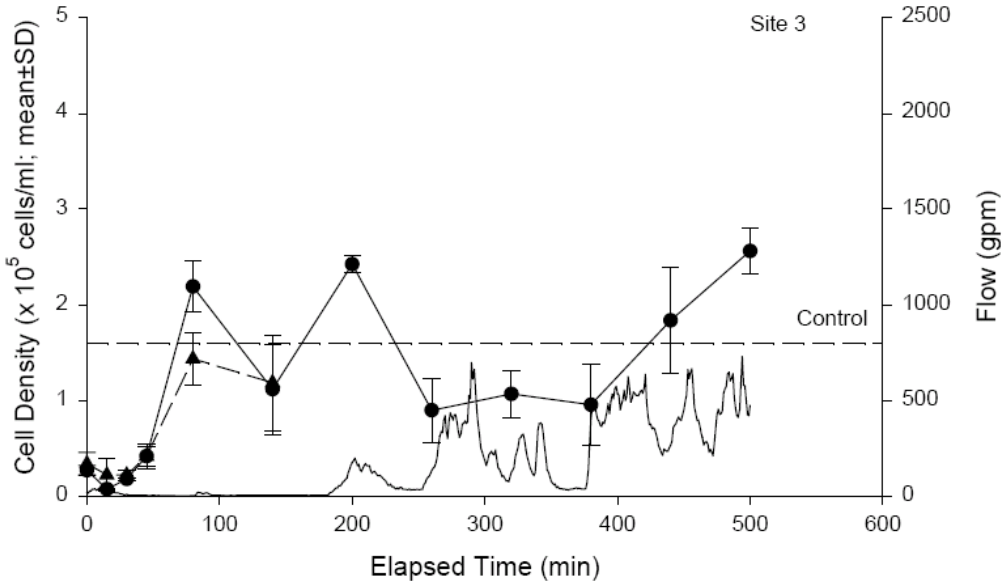


Figure G.2.12 Plots of Cell Density Results from USLA Grab Samples using the *Selenastrum* Growth Test from 3/15/03

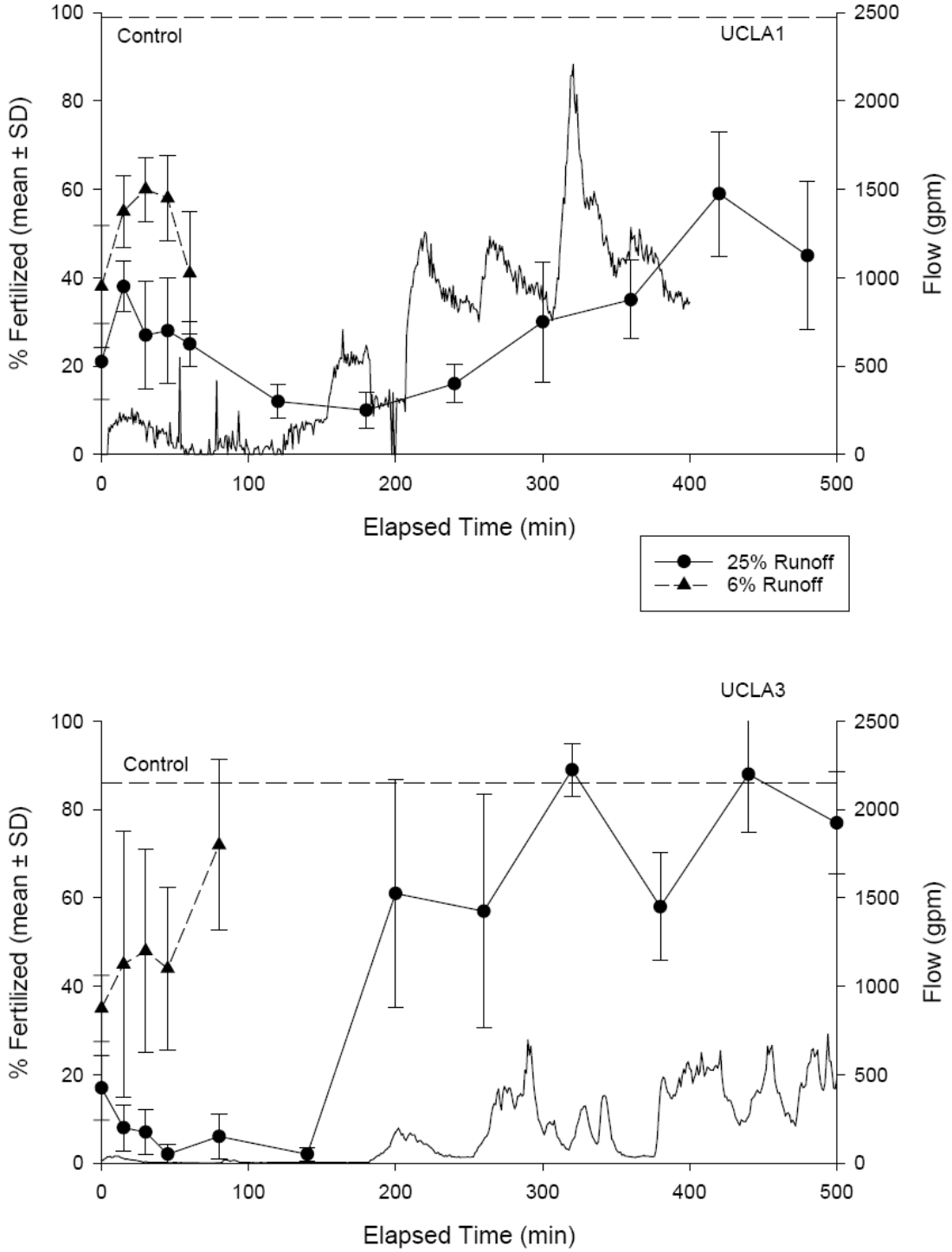


Figure G.2.13 Plots of Results from UCLA Grab Samples using the Sea Urchin Fertilization Test from 3/15/03

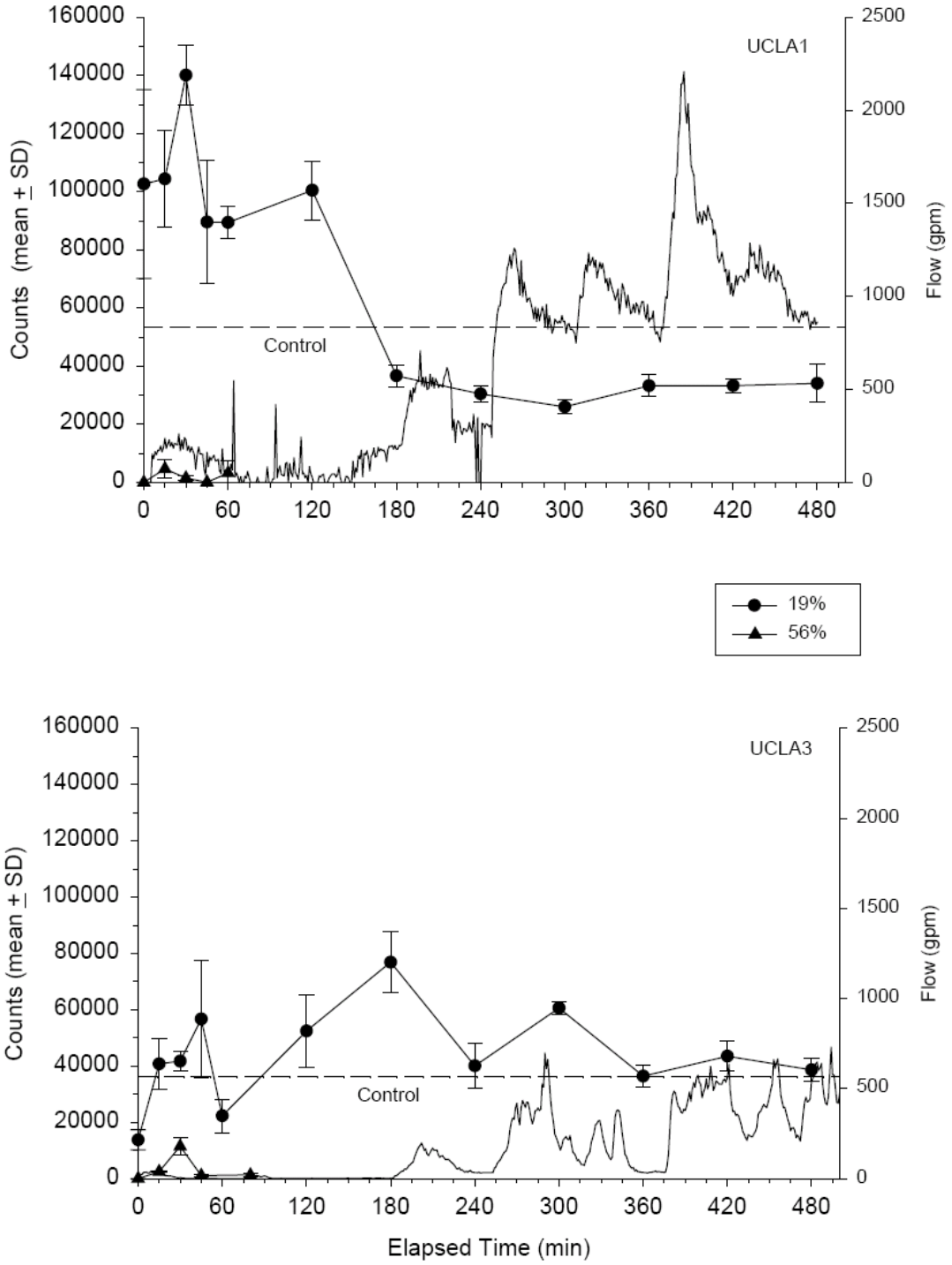


Figure G.2.14 Plots of Results from UCLA Grab Samples using the Microtox™ Test from 3/15/03

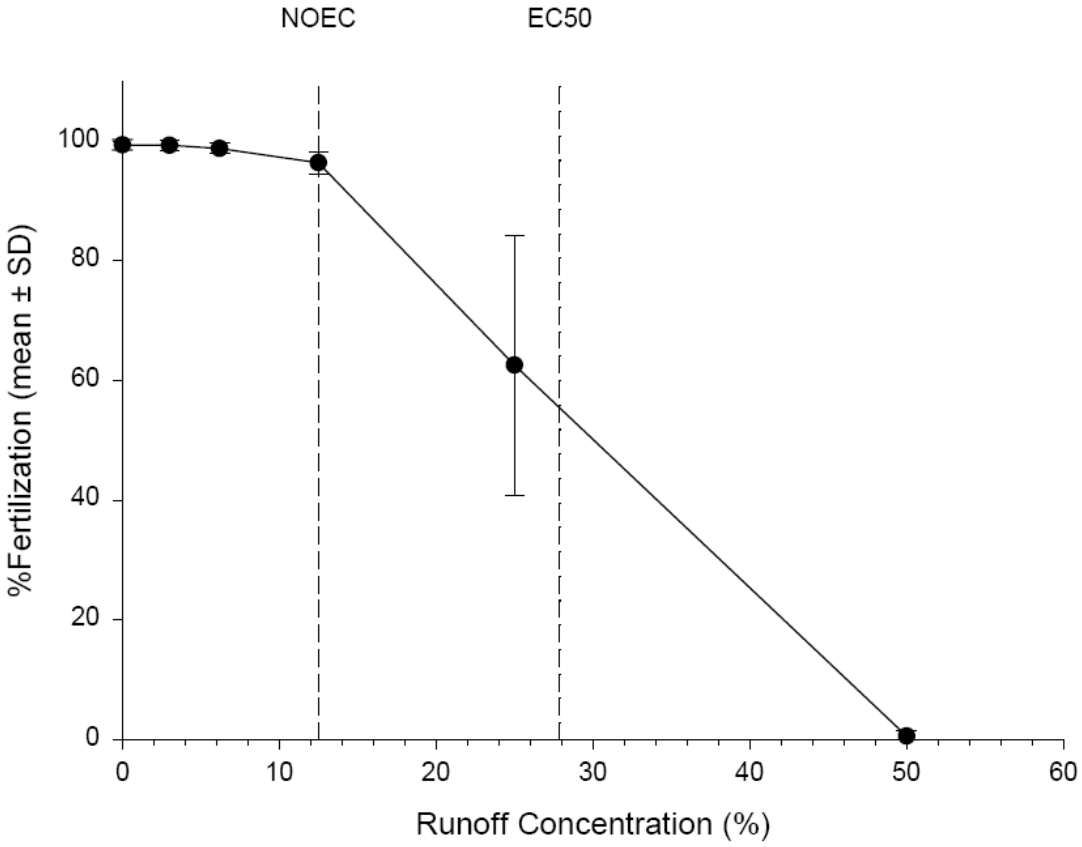


Figure G.3.1 Dose-Response Plot of UCLA2 Composite using the Sea Urchin Fertilization Test from 4/14/03

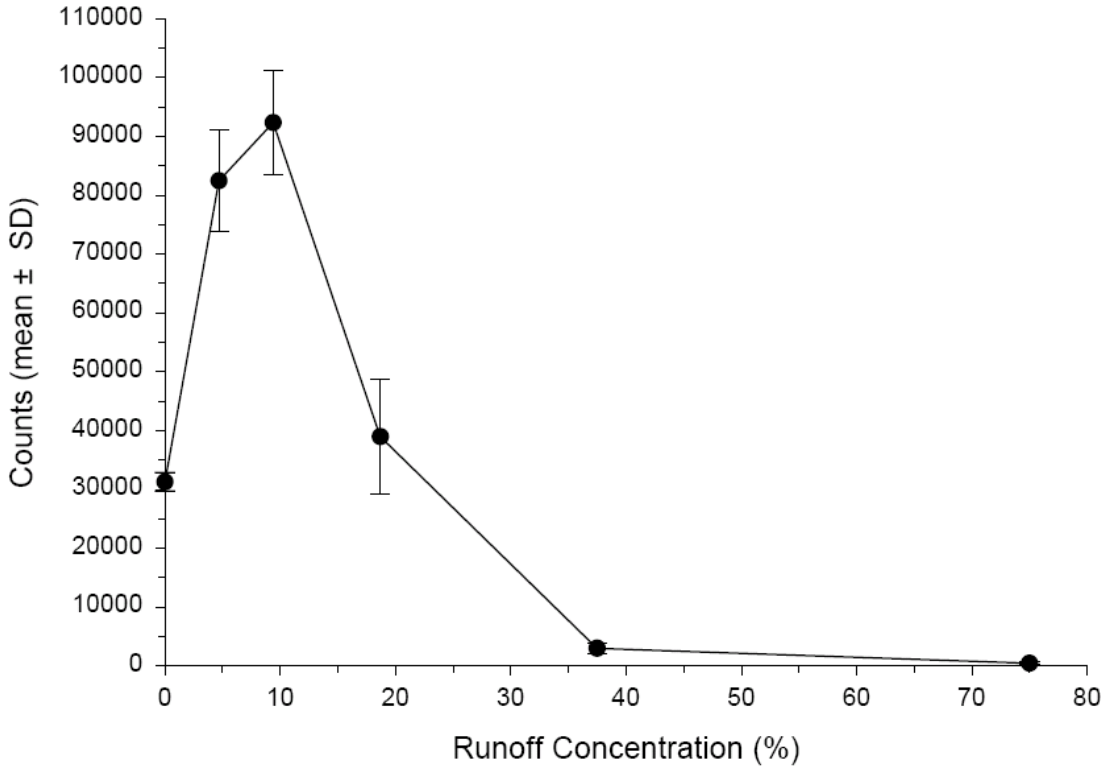


Figure G.3.2 Dose-Response Plot of UCLA2 Composite using the Microtox™ Test from 4/14/03

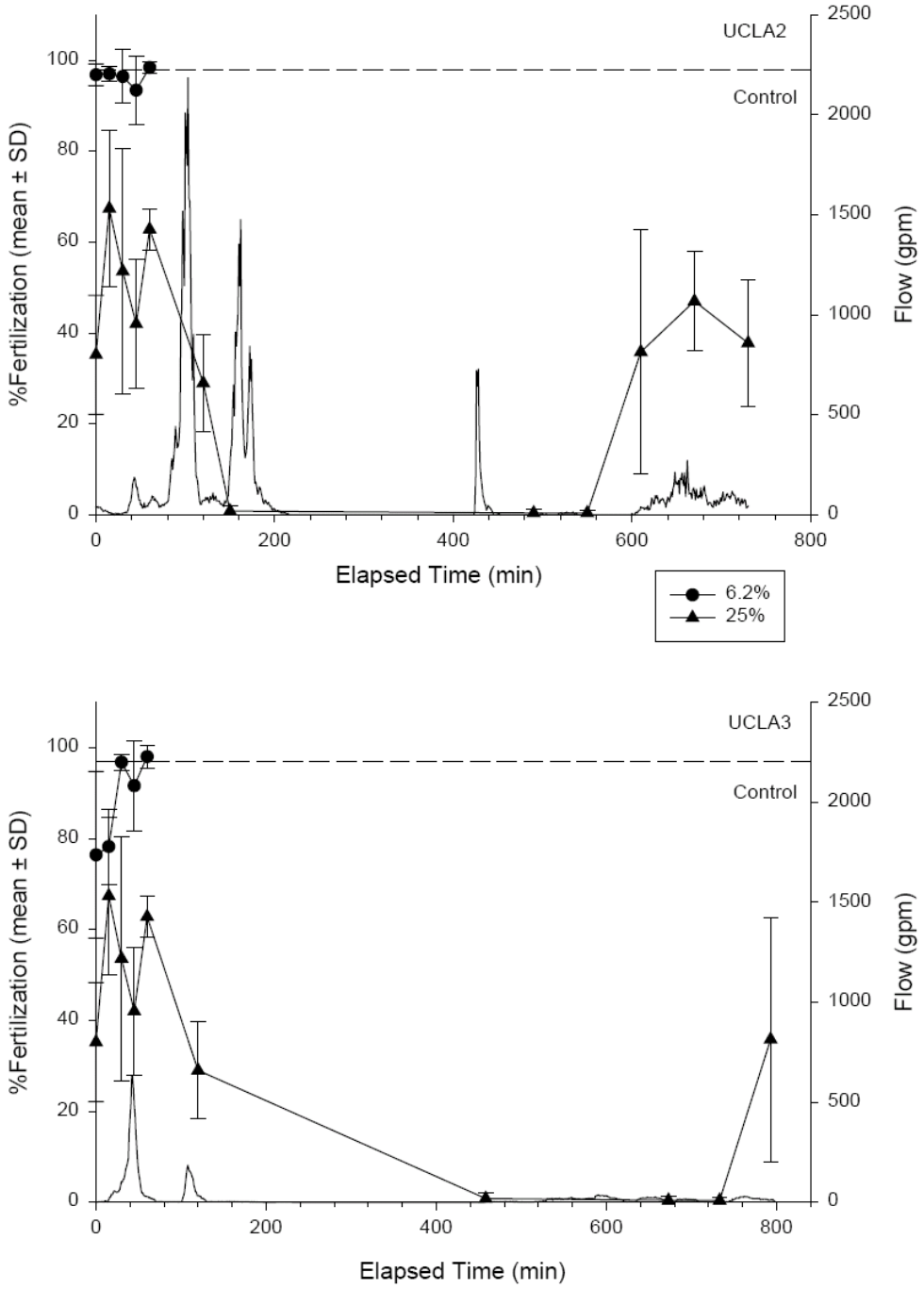


Figure G.3.3 Plots of Results from UCLA Grab Samples using the Sea Urchin Fertilization Test from 4/14/03

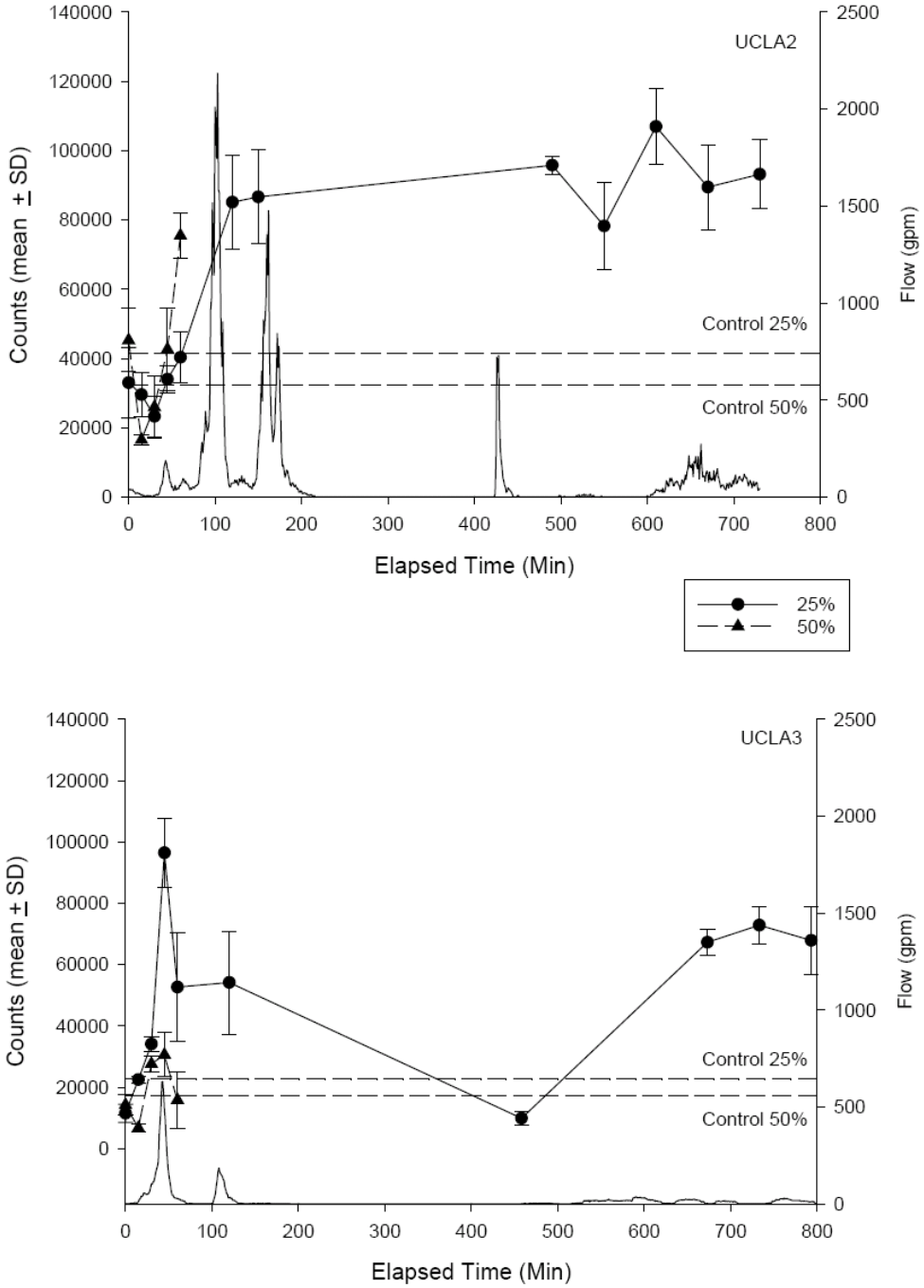


Figure G.3.4 Plots of Results from UCLA Grab Samples using the Microtox™ Test from 4/14/03

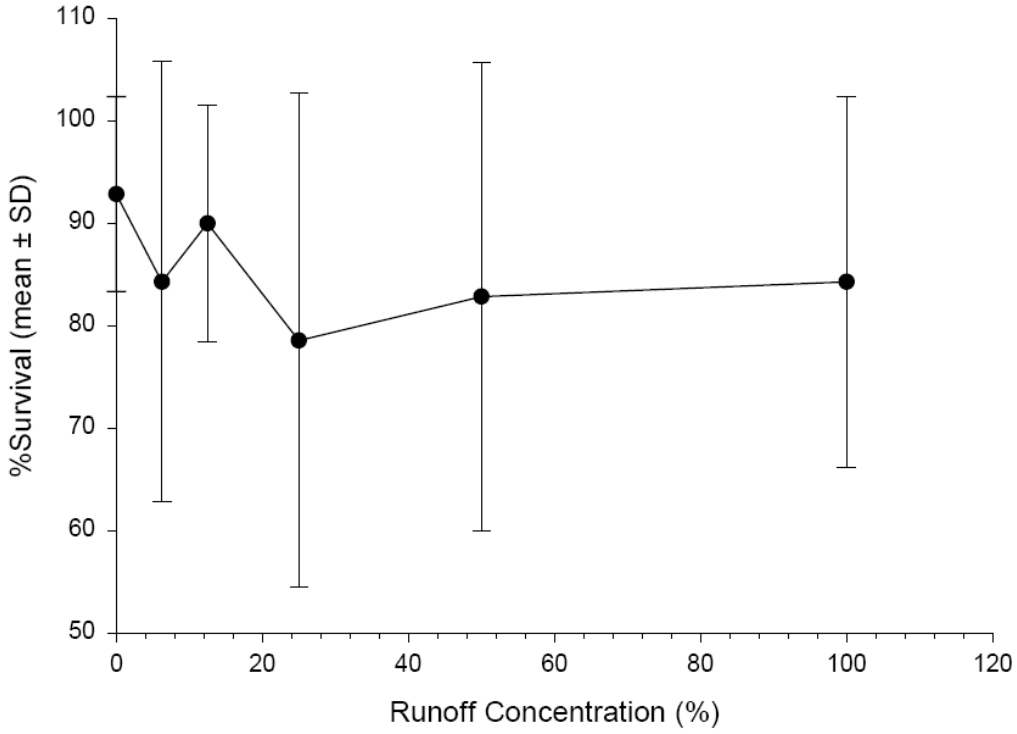


Figure G.3.5 Survival Dose-Response Plot of UCLA2 Composite using the *Ceriodaphnia* Survival and Reproduction Test from 4/14/03

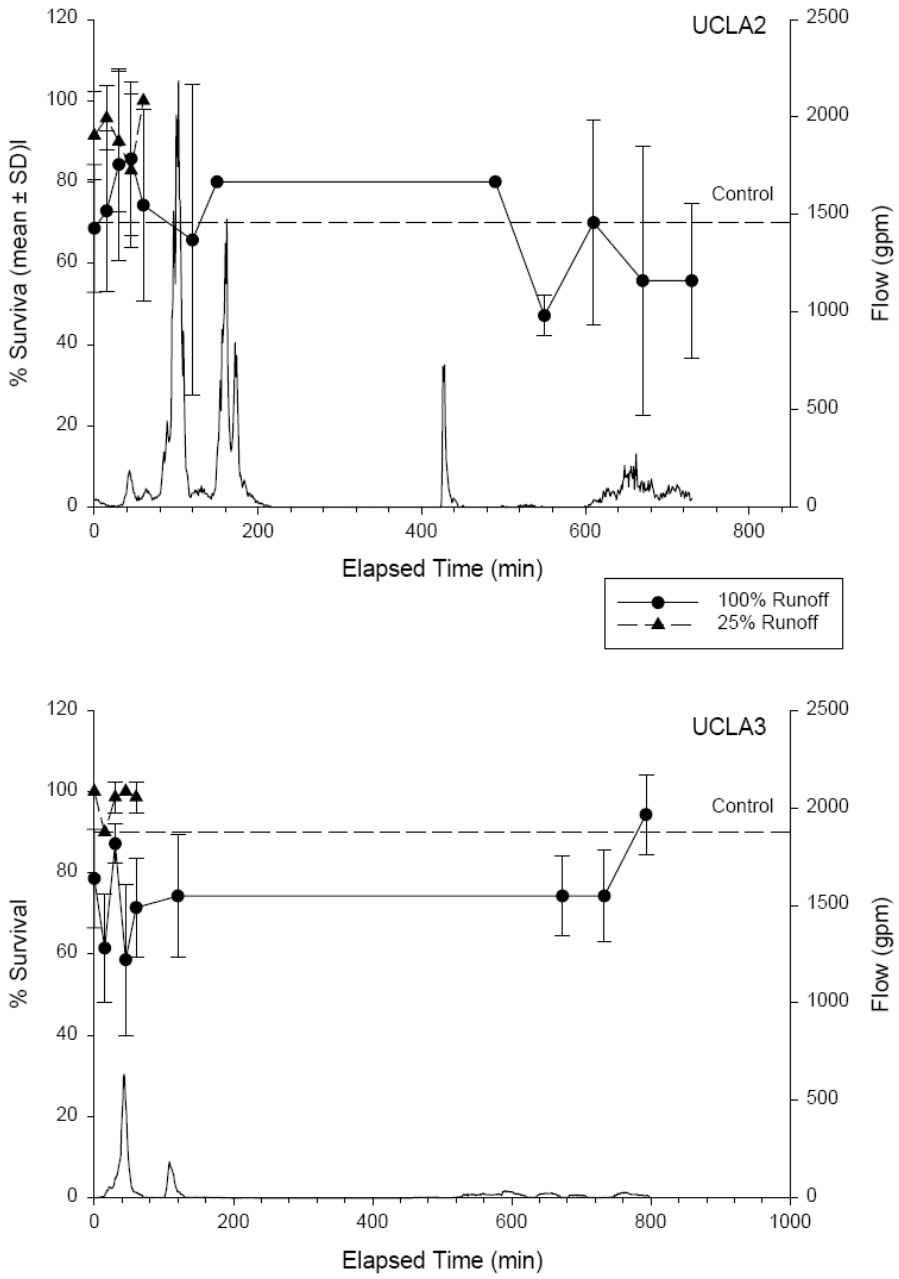


Figure G.3.6 Plots of Survival Results from UCLA Grab Samples using the *Ceriodaphnia* Survival and Reproduction Test from 4/14/03

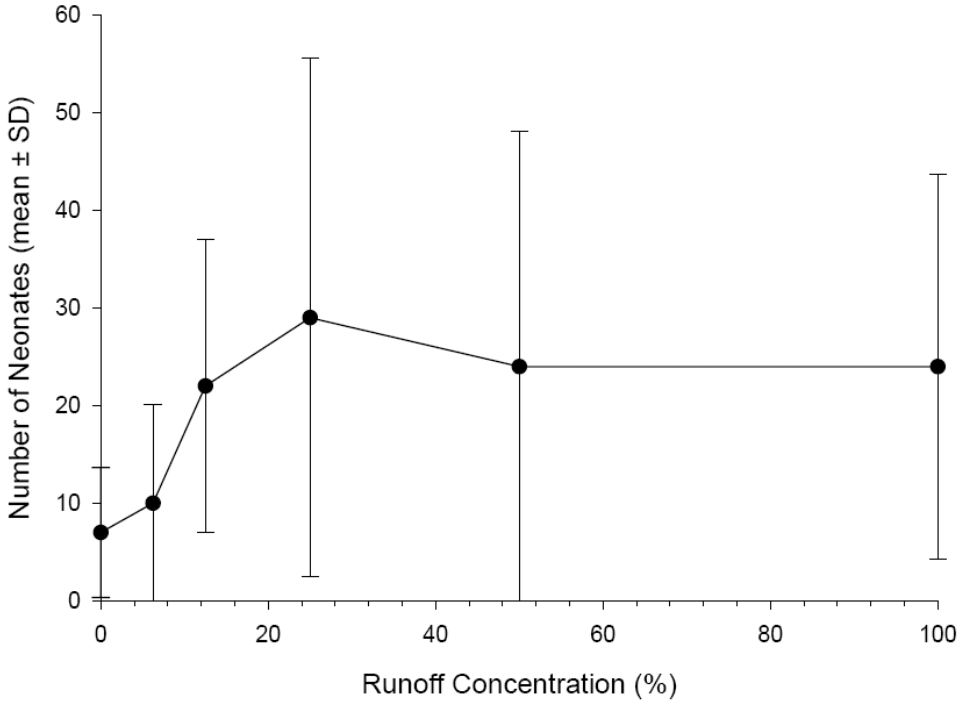


Figure G.3.7 Reproduction Dose-Response Plot of UCLA2 Composite using the *Ceriodaphnia* Survival and Reproduction Test from 4/14/03

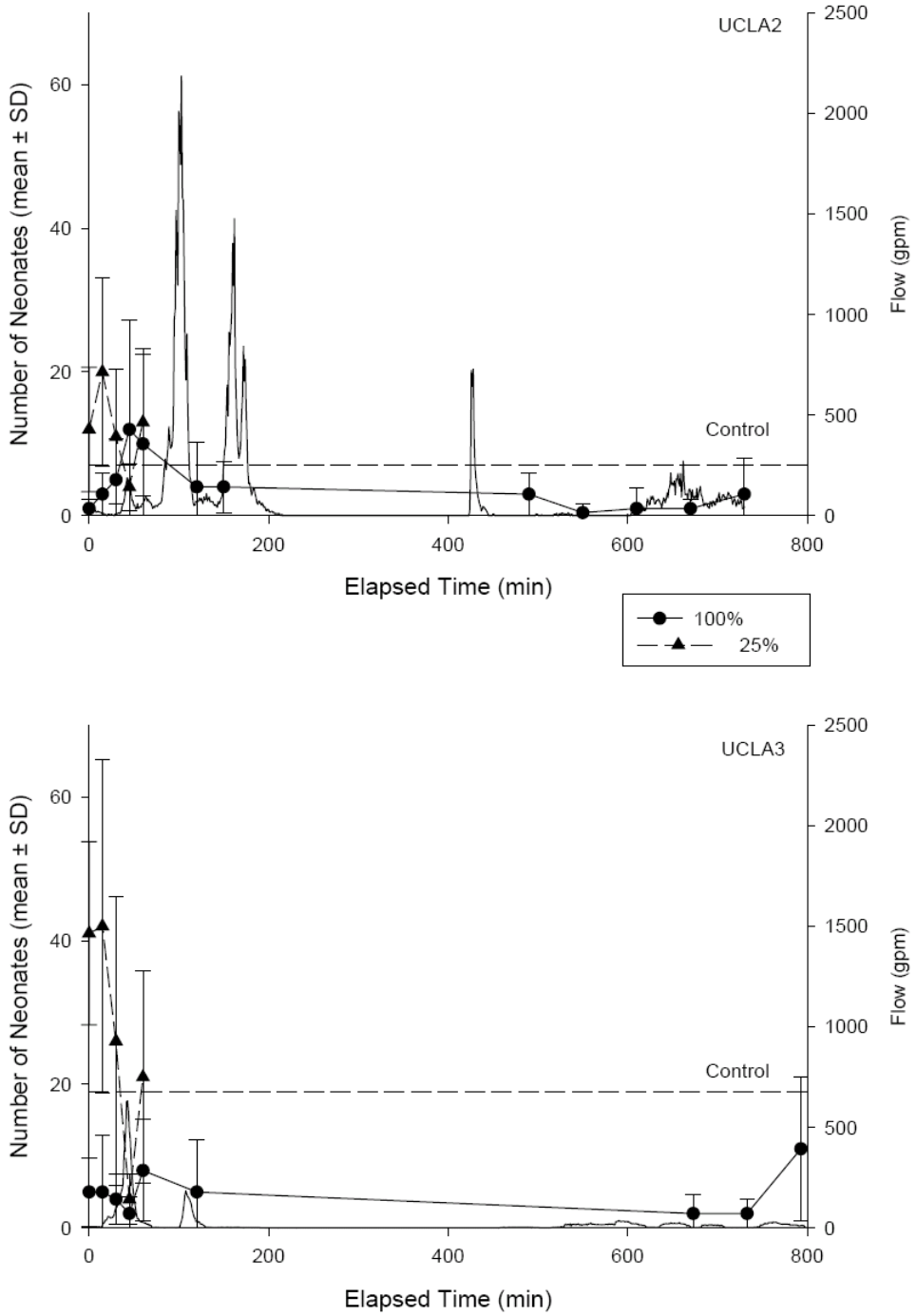


Figure G.3.8 Plots of Reproduction Results from UCLA Grab Samples using the *Ceriodaphnia* Survival and Reproduction Test from 4/14/03

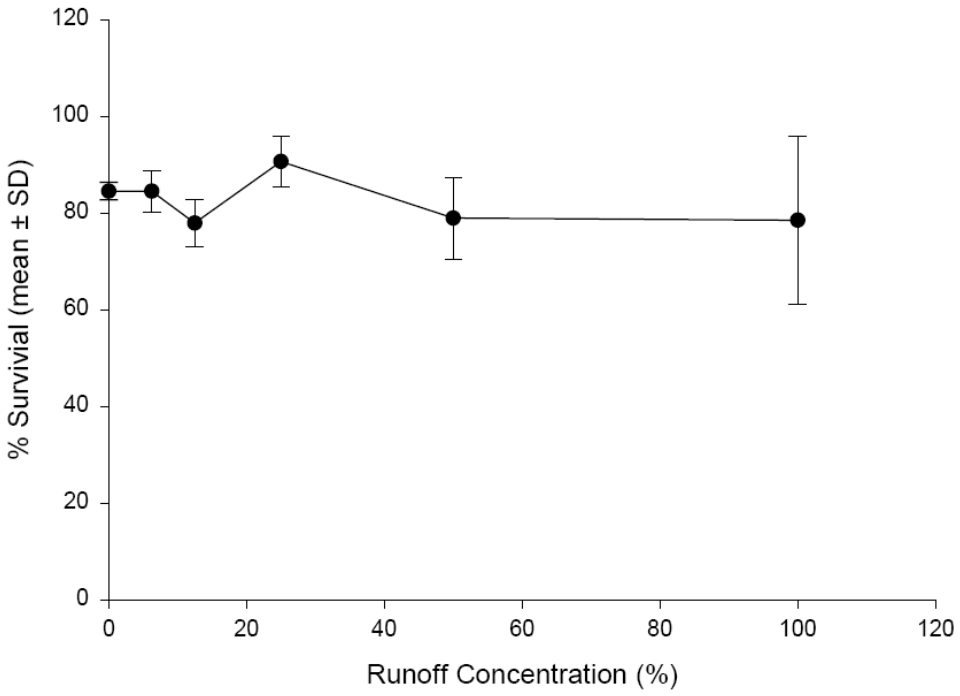


Figure G.3.9 Survival Dose-Response Plot of UCLA2 Composite using the Fathead Minnow Survival and Growth Test from 4/14/03

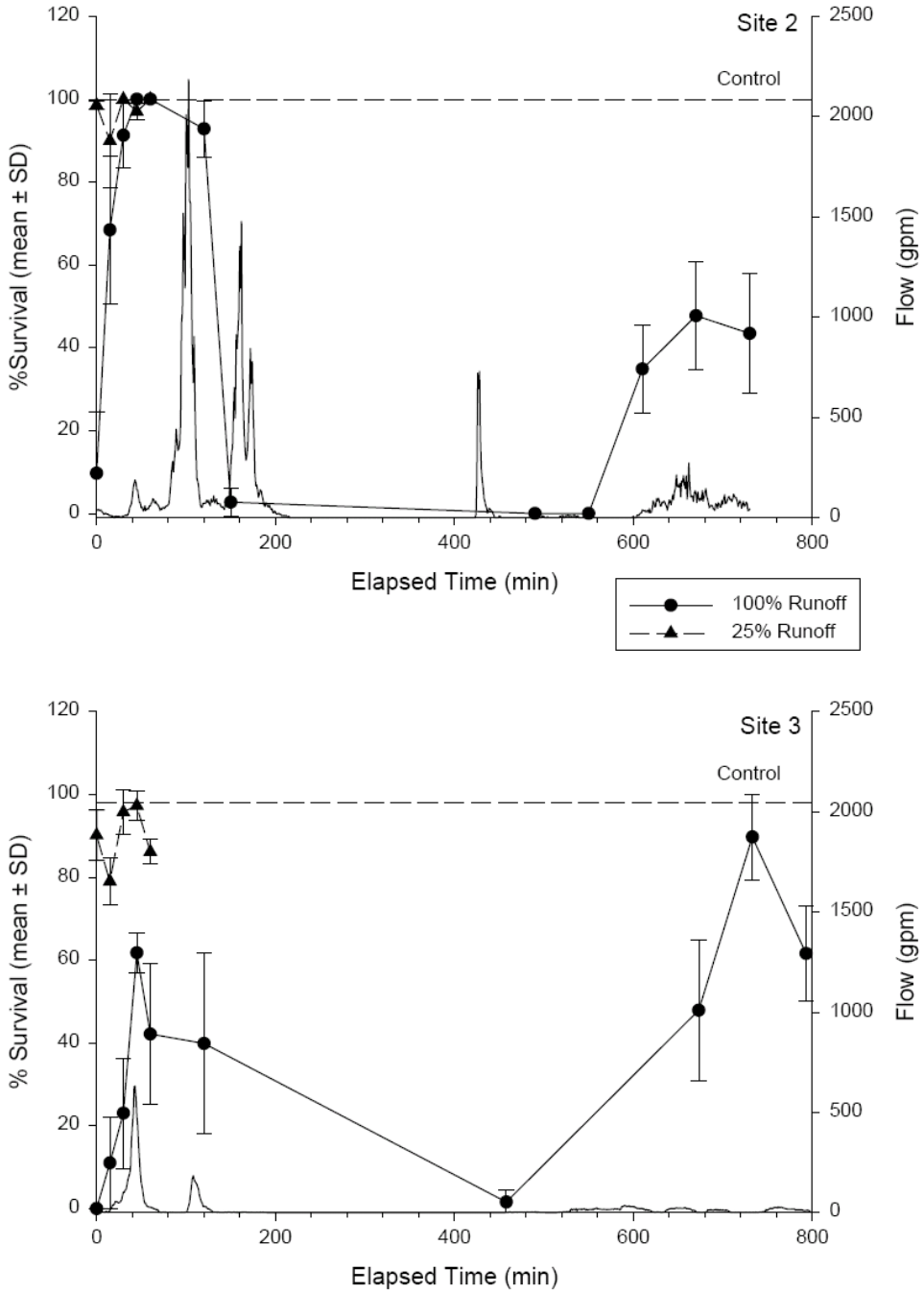


Figure G.3.10 Plots of Survival Results from UCLA Grab Samples using the Fathead Minnow Survival and Growth Test from 4/14/03

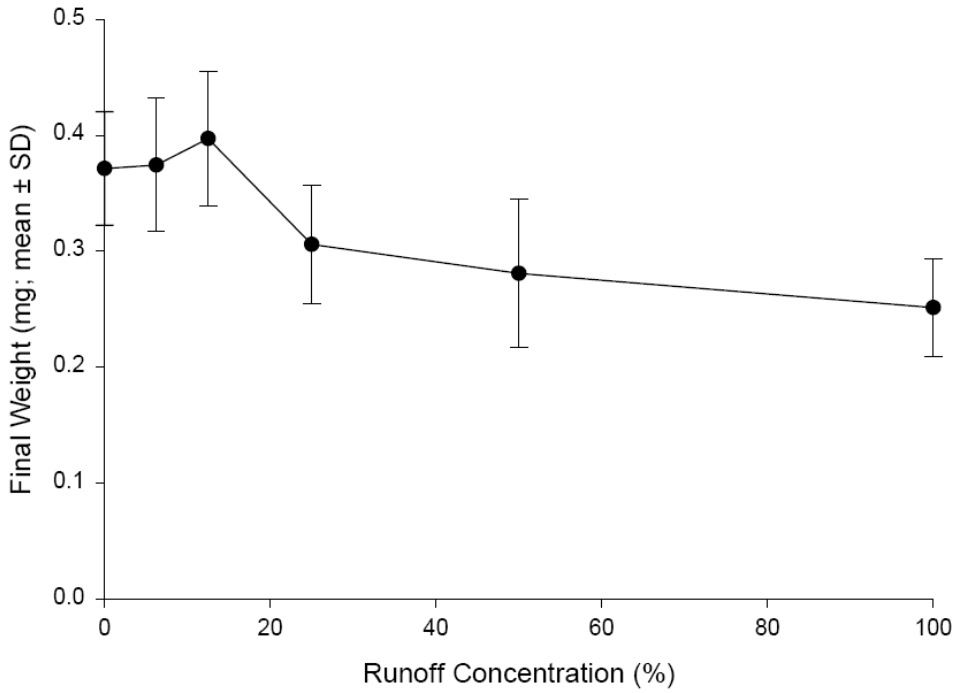


Figure G.3.11 Weight Dose-Response Plot of UCLA2 Composite using the Fathead Minnow Survival and Growth Test from 4/14/03

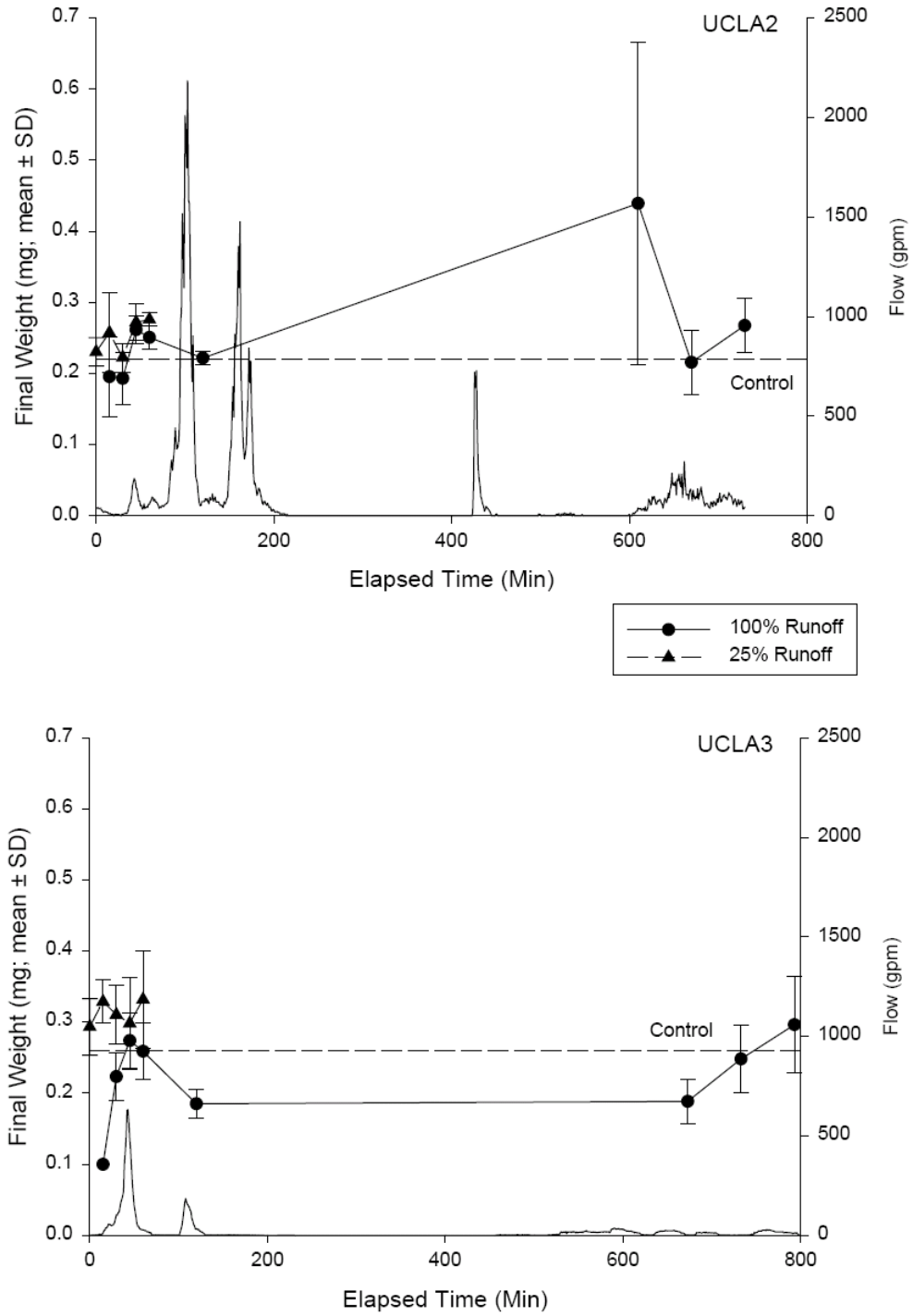
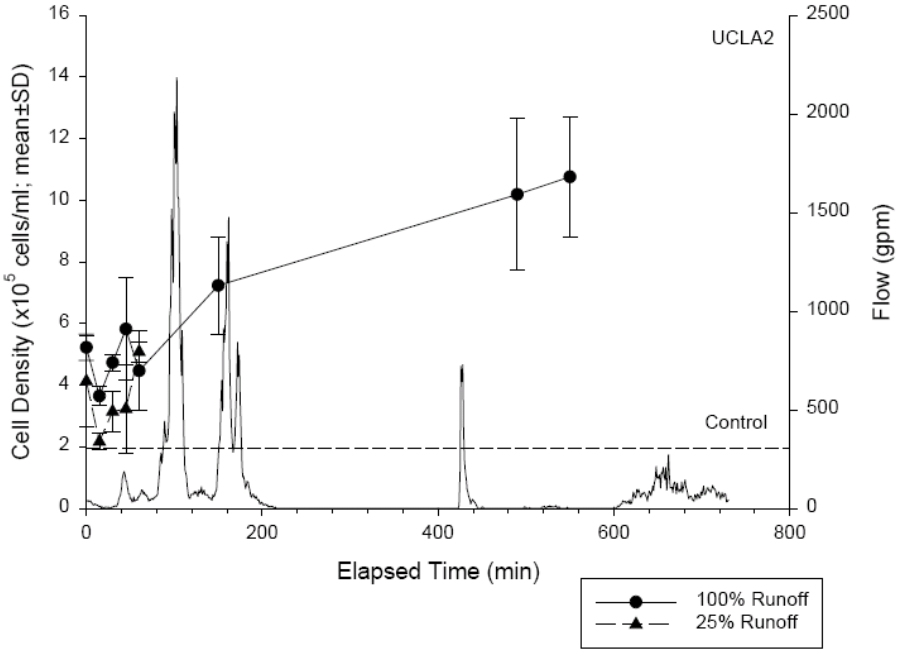


Figure G.3.12 Weight Results from UCLA Grab Samples using the Fathead Minnow Survival and Growth Test from 4/14/03



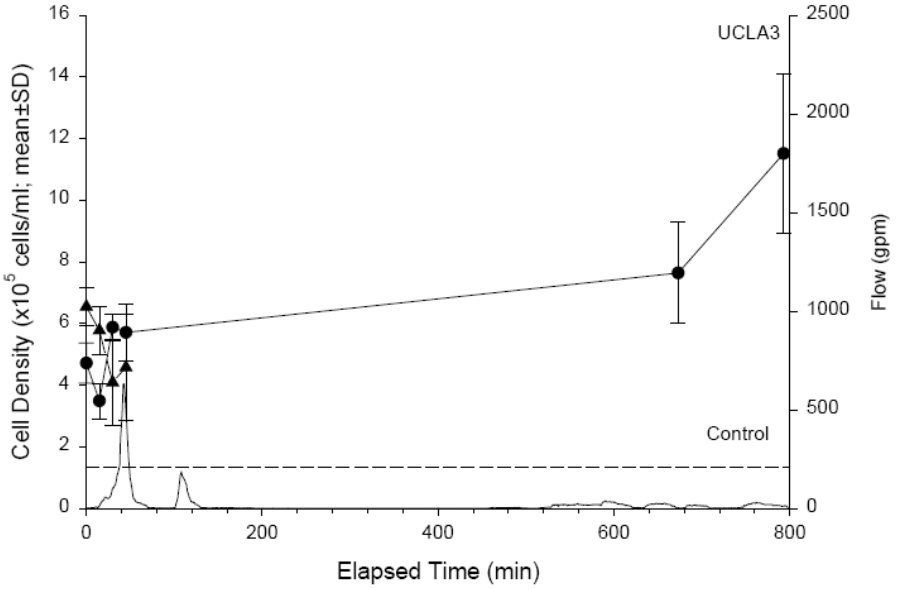


Figure G.3.13 Plots of Cell Density Results from UCLA Grab Samples using the *Selenastrum* Growth Test from 4/14/03 (The data presented is from a re-test of the samples. The original test had low control performance. There was not sufficient sample to re-test all grabs)

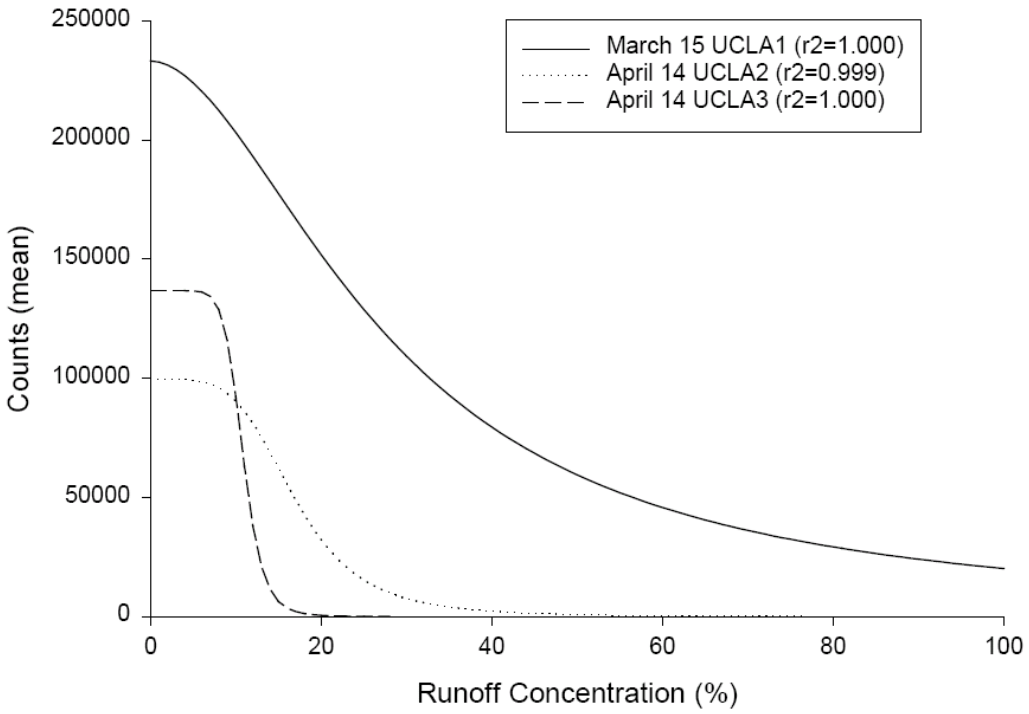


Figure G.4.1 Logistic Regression Plots of Microtox™ Results from UCLA Composite Samples

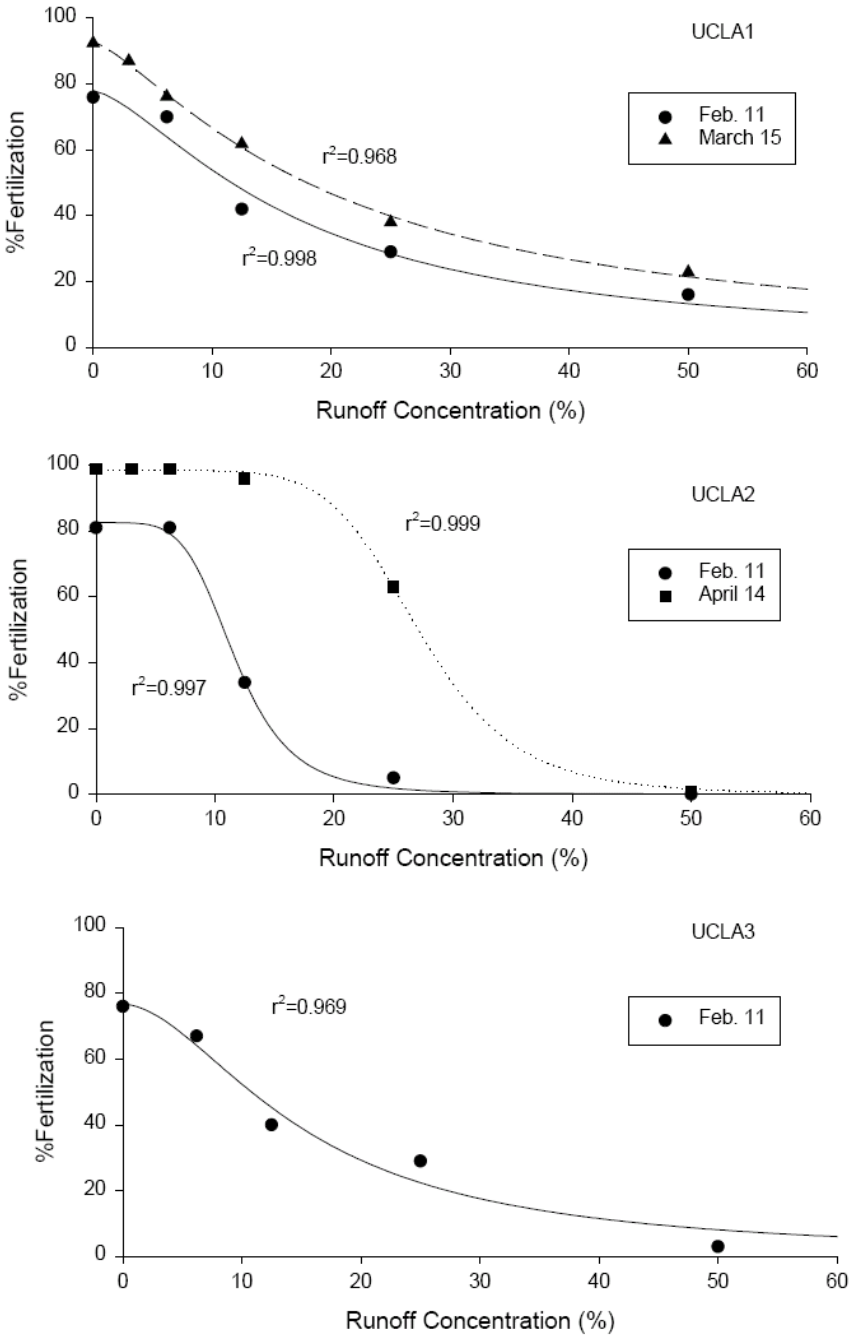


Figure G.4.2 Logistic Plots of Sea Urchin Fertilization Results from UCLA Composite Samples

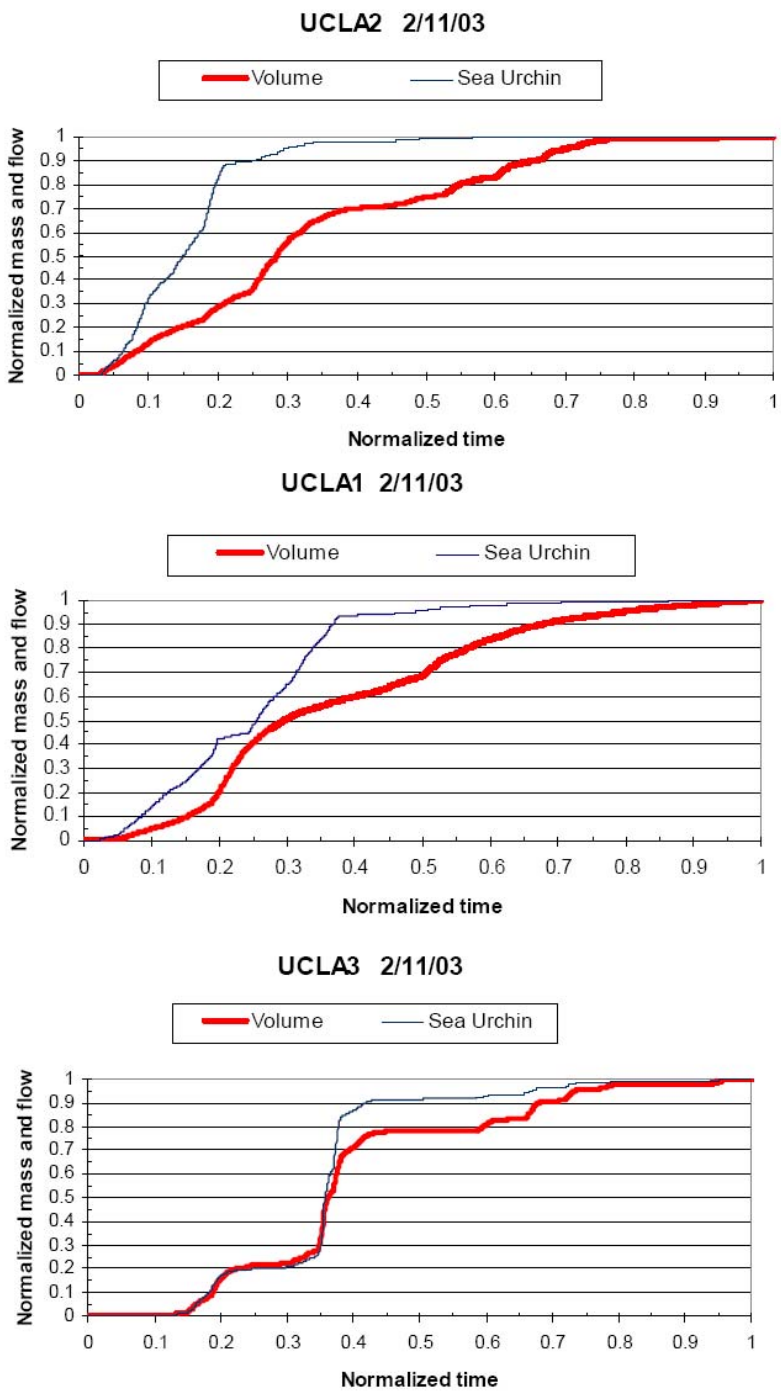
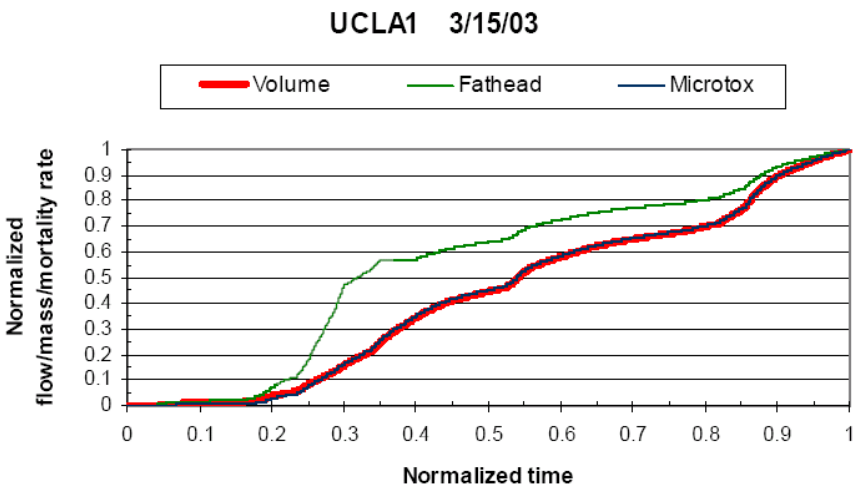


Figure G.4.3 Normalized Toxicity and Flow Plots for Sea Urchin Fertilization Tests of Runoff Grab Samples from 2/11/03



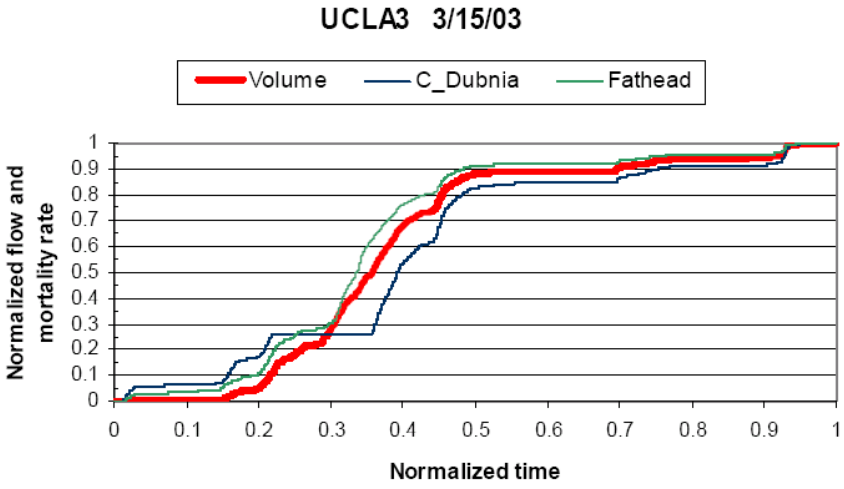


Figure G.4.4 Normalized Toxicity and Flow Plots for Tests of Runoff Grab Samples from 3/15/03

APPENDIX H
COMPOSITE SAMPLES

Table H.1a Concentrations of Non-metal Parameters for Composite Samples from UCLA Sites of Year 2000-2001

Sites	Date	TSS (mg/L)	Turb. (NTU)	Cond. (mmho/cm)	Hard. (mg/L)	COD (mg/l)	DOC (mg C/L)	O&G (mg/l)	NH_3-N (mg/l)	NO_2-N (mg/l)	NO_3-N (mg/L)	TKN (mg/l)	PO_4^3-P (mg/L)	Diss. P (mg/L)	Part. P (mg/l)
UCLA 1	10/26/00														
	01/08/01														
	01/10/01														
	02/10/01														
	02/19/01														
	03/04/01														
	04/20/01	33.69	31.10	133.00	34.00	80.52	17.60		0.29	0.15	0.98	4.29	< 0.1	0.15	0.08
UCLA 2	10/26/00														
	01/08/01														
	01/10/01														
	02/19/01														
	02/24/01														
	03/04/01														
	04/07/01	127.07	22.10	870.00	302.00	56.10	17.19		0.14	0.10	0.74	2.47	< 0.1	0.13	0.11
UCLA 3	10/26/00														
	01/08/01														
	01/10/01														
	02/10/01														
	02/19/01	80.57	15.00	45.30	16.00	46.51	5.54		0.09	0.12	0.35	1.65	< 0.1	0.16	0.56
	02/24/01	62.66	5.20	36.50	17.00	13.89	3.19		0.08	0.05	0.19	1.71	< 0.1	0.06	0.12
	03/04/01	69.38	4.30	52.00	20.40	2.44	3.56		0.08	0.07	0.33	1.58	< 0.1		0.11
	04/07/01	56.38	15.10	59.90	23.00	43.90	13.27		0.10	0.08	0.49	1.86	< 0.1	0.15	0.71

Table H.1b Concentrations of Metals for Composite Samples from UCLA Sites of Year 2000-2001

Sites	Date	Diss. Cd (ug/L)	Diss. Cr (ug/L)	Diss. Cu (ug/L)	Diss. Ni (ug/L)	Diss. Pb (ug/L)	Diss. Zn (ug/L)	Part. Cd (ug/L)	Part. Cr (ug/L)	Part. Cu (ug/L)	Part. Ni (ug/L)	Part. Pb (ug/L)	Part. Zn (ug/L)
UCLA 1	10/26/00												
	01/08/01												
	01/10/01												
	02/10/01												
	02/19/01												
	03/04/01												
	04/20/01	<0.50	0.60	27.35	5.67	0.76	151.99	0.50	4.84	16.94	2.75	9.58	50.80
UCLA 2	10/26/00												
	01/08/01												
	01/10/01												
	02/19/01												
	02/24/01												
	03/04/01												
	04/07/01	<0.5	<0.5	25.79	7.62	1.80	100.83	0.72	6.58	30.83	4.44	21.17	141.33
UCLA 3	10/26/00												
	01/08/01												
	01/10/01												
	02/10/01												
	02/19/01	<0.5	1.47	6.98	<0.5	2.50	54.85	<0.5	3.07	13.38	2.80	31.94	57.26
	02/24/01	0.50	0.87	5.41	<0.5	2.50	42.05	0.61	7.61	26.62	4.77	52.62	94.51
	03/04/01							<0.5	6.34	24.36	5.05	40.11	77.63
	04/07/01	<0.5	0.50	16.16	4.00	1.08	107.43	<0.5	4.15	16.08	2.69	23.96	76.73

Table H.2a Concentrations of Non-metal Parameters for Composite Samples from UCLA Sites of Year 2001-2002

Sites	Date	TSS (mg/L)	VSS (mg/L)	Turb. (NTU)	Cond. (mmho/cm)	Alkalinity (mg/L as $CaCO^3$)	Hard. (mg/L)	COD (mg/l)	DOC (mg C/L)	O&G (mg/l)	TKN (mg/l)
UCLA 1	11/12/01	61.02	27.79	20.6	420	120	26.6	219.51			6.33
	11/24/01	29.77	16.57	22.7	305	98	40.6	178.31			3.41
	12/20/01	10.33	6.96	15.9	297	81.2	66.5	112.5			
	01/27/02	25.36	21.52	36	274	75.4	57	134.94			
	02/17/02	41.44	21.36	30	689	189	101.5	195.12	61.86		4.96
UCLA 2	10/30/01	513.83	260.00	235	724	190	34	1038.46	293.7		35.91
	11/12/01	59.07	25.80	62.3	145.9	38.6	16.2	169.23	40.77		5.26
	11/24/01	205.51	72.10	32.8	431	178.8	17.1	79.52			3.36
	12/14/01	163.37	64.95	157.3	231	58.4	26	361.45	109.7		12.52
	01/27/02	115.08	47.08	30	324	119	18.5	81.93	26.55		3.22
	02/17/02	169.53	74.27	111	257	64	12	317.07	120.76		14.20
	03/06/02	46.3	27.55	71.6	377	88.8	14.7	608.7	32.16		27.42
	03/17/02	134.9	71.00	97	262	107	12.2	531.65	151.95		13.64
UCLA 3	10/30/01	234.45	84.36	65.7	734	220	28	1012.82	330.5		36.15
	11/12/01	138.29	32.71	23	85.5	25.2	11.2	64.1	15.29		2.33
	11/24/01	146.57	32.86	39.8	65.1	20	10.8	57.83	18.68		1.96
	12/20/01	214.92	48.48	39.1	85.5	20	11.4	85	24.44		2.66
	01/27/02	91.65	32.11	35.6	97.8	24.4	11.8	118.07	40.96		4.58
	02/17/02	94.72	41.32	45	104.6	27.8	10	195.12	44.76		3.83
	03/07/02	169.37	54.84	89.5	80.5	30.8	10.3	311.11	33.27		3.66
	03/17/02	185.57	66.72	150.7	103.1	25.4	8.9	278.48	52.89		4.23

Table H.2a *(Continued)*

Sites	Date	NH_3-N (mg/l)	NO_2-N (mg/l)	NO_3-N (mg/L)	F^- (mg/L)	Cl^- (mg/L)	PO_4^{3-}P (mg/L)	Diss. P (mg/L)	Part. P (mg/l)	SO_4^{2-} (mg/L)
UCLA 1	11/12/01	2.07	0.41					0.46	0.41	
	11/24/01	1.07	0.40					0.44	0.62	
	12/20/01	1.21	0.20					0.15	0.05	
	01/27/02	2.45	1.31					0.14	0.12	
	02/17/02	1.41	0.76	9.34	3.38	32.53	0.23	0.40	0.17	126.59
UCLA 2	10/30/01	24.76	1.80	14.24	19.07	36.22	0.43	1.87	0.72	105.71
	11/12/01	3.68	0.29	2.10	2.67	5.91	0.31	0.37	0.40	19.91
	11/24/01	1.81	0.17	1.20	0.72	15.87	< 0.1	0.20	1.04	141.81
	12/14/01	9.99	0.87	< 0.1	3.28	10.48	0.37	0.50	0.80	22.68
	01/27/02	2.71	0.75	1.31	1.05	6.53	< 0.1	0.20	0.10	107.03
	02/17/02	10.85	0.26	3.90	0.98	14.43	0.36	0.68	0.11	27.64
	03/06/02	13.72	0.23	< 0.1	10.07	22.56	0.35	5.16	0.11	33.78
	03/17/02	11.87	0.27	0.10	10.36	16.67	0.31	4.12	0.12	22.82
UCLA 3	10/30/01	24.66	2.44	16.79	11.47	72.31	0.83	1.03	0.43	210.04
	11/12/01	1.09	0.18	0.95	3.01	3.89	< 0.1	0.15	0.37	8.13
	11/24/01	1.38	0.18	0.81	1.22	3.79	< 0.1	0.19	0.24	5.75
	12/20/01	1.46	0.16	0.51	1.15	6.96	< 0.1	0.16	0.23	6.20
	01/27/02	2.72	1.06	1.23	2.29	4.83	< 0.1	0.20	0.10	9.07
	02/17/02	2.46	0.53	1.02	2.75	4.62	0.21	0.27	0.13	13.61
	03/07/02	2.02	0.14	0.61	2.34	3.60	< 0.1	1.40	0.13	8.39
	03/17/02	2.66	0.22	0.83	2.42	6.74	0.22	6.97	0.22	9.56

Table H.2b Concentrations of Metals for Composite Samples from UCLA Sites of Year 2001-2002

Sites	Date	Diss. As (ug/l)	Diss. Cd (ug/L)	Diss. Cr (ug/L)	Diss. Cu (ug/L)	Diss. Ni (ug/L)	Diss. Pb (ug/L)	Diss. Zn (ug/L)	Part. As (ug/l)	Part. Cd (ug/L)	Part. Cr (ug/L)	Part. Cu (ug/L)	Part. Ni (ug/L)	Part. Pb (ug/L)	Part. Zn (ug/L)
UCLA 1	11/12/01	<2	0.54	1.84	75.35	22.99	6.00	443.29	2.01	0.85	10.48	26.98	5.30	26.18	174.10
	11/24/01	<2	<1	1.75	54.15	16.12	2.70	333.95	< 2	< 1	5.24	16.03	2.04	8.65	74.88
	12/20/01	<2	<1	2.64	41.17	8.97	1.43	218.79	1.53	< 1	4.28	11.21	0.66	5.23	35.07
	01/27/02	<2	<1	3.14	67.43	9.09	<1	283.27	< 2	< 1	8.00	16.26	2.45	5.13	51.34
	02/17/02	<2	<1	1.79	51.75	15.74	<1	252.41	< 2	< 1	7.50	7.82	1.07	4.46	62.82
UCLA 2	10/30/01	4.33	5.34	8.10	291.72	109.25	7.68	2879.73	3.89	2.03	23.31	165.67	17.99	61.15	398.79
	11/12/01	<2	0.85	4.58	76.90	25.72	6.85	348.74	4.41	0.90	14.14	34.23	5.77	42.80	125.53
	11/24/01	<2	1.26	4.56	35.94	17.46	3.48	235.78	2.15	1.44	23.37	74.89	10.97	75.81	339.51
	12/14/01	<2	1.17	4.66	103.59	23.47	5.88	407.63	< 2	1.39	18.82	62.08	9.40	39.99	188.76
	01/27/02	<2	<1	4.16	43.49	7.76	<1	208.03	< 2	< 1	11.74	38.60	3.92	19.17	100.15
	02/17/02	<2	1.54	2.79	124.90	22.51	1.13	683.82	< 2	0.61	12.97	37.92	3.50	17.84	83.82
	03/06/02	3.79	3.58	4.19	174.71	33.29	10.32	1040.98	< 2	0.68	12.31	27.96	3.17	13.59	59.19
	03/17/02	3.24	2.58	4.76	167.20	25.63	11.22	951.32	< 2	0.77	17.52	41.56	5.61	16.95	103.04
UCLA 3	10/30/01	<2	4.21	7.16	181.76	81.82	8.53	1766.24	4.77	0.86	8.66	27.18	4.51	15.27	62.95
	11/12/01	<2	<1	2.17	24.15	10.22	4.64	159.20	2.45	< 1	6.81	16.99	4.42	19.47	62.64
	11/24/01	<2	<1	3.87	24.65	3.99	<1	109.06	2.31	0.56	8.37	28.06	4.74	40.24	93.19
	12/20/01	<2	<1	2.51	22.84	3.24	<1	109.72	2.53	0.60	10.24	35.80	7.34	49.40	137.05
	01/27/02	<2	<1	3.22	39.56	4.40	2.28	198.54	1.75	< 1	10.88	26.08	3.82	27.40	86.00
	02/17/02	<2	<1	2.24	34.13	3.78	2.55	156.59	< 2	0.73	11.90	28.95	3.77	29.21	162.97
	03/07/02	2.81	0.87	0.97	40.68	7.76	0.72	174.68	< 2	0.60	9.67	22.65	4.56	26.34	123.64
	03/17/02	4.39	2.87	6.23	194.83	35.05	7.83	1076.17	2.00	1.03	20.83	49.19	8.67	49.42	209.32

Table H.3a Concentrations of Non-metal Parameters for Composite Samples from UCLA Sites of Year 2002-2003

Sites	Date	TSS (mg/L)	Turb. (NTU)	Cond. (mmho/cm)	Hard. (mg/L)	COD (mg/l)	DOC (mg C/L)	O&G (mg/l)	TKN (mg/l)	NH_3-N (mg/l)	NO_2-N (mg/l)	NO_3-N (mg/L)	PO_4^{3}-P (mg/L)	Total P (mg/l)	Diss. P (mg/L)
UCLA 1	11/07/02														
	12/16/02														
	12/19/02														
	02/11/03	22.49	25.60	254.00	94.00	219.51	28.02		4.88	2.80	0.20	6.10	< 0.1	0.40	0.30
	03/15/03	21.83	15.80	244.70	57.60	104.23	18.88		2.24	0.75	0.23	2.38	< 0.1		
	05/02/03	31.45	19.30	201.50	58.00	111.39	17.73		4.10	1.49	0.12				
UCLA 2	11/07/02	141.91	77.70	1,830.00	582.00	329.41	71.14		15.15	5.47	0.54	4.32	< 0.1	0.88	0.73
	11/29/02	106.00	122.00	580.00	154.00	847.06	191.70		34.45	23.46	0.51	7.81	< 0.1	1.50	1.36
	12/15/02	63.08	113.10	251.00	62.00	494.38	78.39		20.07	12.50	0.49	4.01	< 0.1	1.26	0.91
	12/16/02	67.57	59.40	140.00	440.00	157.30	14.60		3.24	2.22	0.12	2.36	< 0.1	0.45	0.25
	02/11/03	93.67	92.10	701.00	415.00	243.90	37.63		6.44	4.40	0.28	10.32	< 0.1	0.32	0.25
	04/15/03	93.63	54.00	762.00	377.00	238.10	14.14		3.58	2.46	18.85	1.54	< 0.1		
UCLA 3	11/07/02	144.50	69.80	206.00	80.80	79.49	14.52		2.42	1.41	0.11	1.38	< 0.1	0.37	0.17
	11/29/02	90.64	37.70	312.00	87.40	447.06	94.61		19.40	11.91	0.17	2.24	< 0.1	0.84	0.72
	12/16/02	54.44	36.40	666.00	30.20	35.90	5.78		1.13	0.77	0.07	0.74	< 0.1	0.28	0.17
	12/19/02	25.66	15.00	35.50	13.00	30.38	3.95		0.81	0.63	0.06	0.56	< 0.1	0.14	0.09
	02/11/03	67.50	63.20	212.00	71.00	317.07	57.94		10.86	7.03	0.17	2.81	< 0.1	0.51	0.39
	03/15/03														
	04/15/03														

Table H.3b Concentrations of Metals for Composite Samples from UCLA Sites of Year 2002-2003

Sites	Date	Total As (ug/L)	Total Cd (ug/L)	Total Cr (ug/L)	Total Cu (ug/L)	Total Ni (ug/L)	Total Pb (ug/L)	Total Zn (ug/L)	Diss. As (ug/l)	Diss. Cd (ug/L)	Diss. Cr (ug/L)	Diss. Cu (ug/L)	Diss. Ni (ug/L)	Diss. Pb (ug/L)	Diss. Zn (ug/L)
UCLA 1	11/07/02														
	12/16/02														
	12/19/02														
	02/11/03	<2	<1	4.13	75.51	11.82	7.00	336.80	<2	<1	1.95	59.88	9.99	<1	278.50
	03/15/03														
	05/02/03														
UCLA 2	11/07/02	<2	1.47	12.82	147.05	29.44	15.02	774.85	<2	1.09	3.58	119.71	26.48	3.11	706.19
	11/29/02	<2	3.36	22.76	308.66	69.20	23.31	1665.45	<2	2.81	8.49	271.08	66.23	7.49	1582.40
	12/15/02	<2	1.84	10.38	174.10	30.77	22.04	808.82	<2	1.36	3.94	146.13	26.17	7.11	747.49
	12/16/02	<2	1.65	10.21	60.85	12.46	31.60	301.33	<2	1.07	2.64	31.05	7.94	1.87	206.64
	02/11/03	<2	1.15	6.42	93.57	15.82	15.35	413.10	<2	0.89	1.97	65.25	12.33	<1	341.82
	04/15/03														
UCLA 3	11/07/02	<2	0.54	17.16	69.69	13.52	41.87	438.30	<2	<1	1.58	40.68	7.06	<1	331.24
	11/29/02	2.64	1.33	10.03	120.79	26.46	25.09	592.23	2.64	0.93	2.15	102.98	23.74	11.82	546.37
	12/16/02	<2	<1	6.25	32.63	9.57	30.76	151.10	<2	<1	1.22	10.91	1.98	6.00	87.98
	12/19/02	<2	<1	1.52	18.20	1.70	22.30	89.84	<2	<1	<1	9.03	<1	<1	53.28
	02/11/03	<2	1.12	9.21	105.60	19.63	78.55	590.34	<2	0.77	2.33	77.46	14.22	16.91	509.41
	03/15/03														
	04/15/03														

APPENDIX I
POLLUTO-GRAPHS AND LOAD-GRAPHS

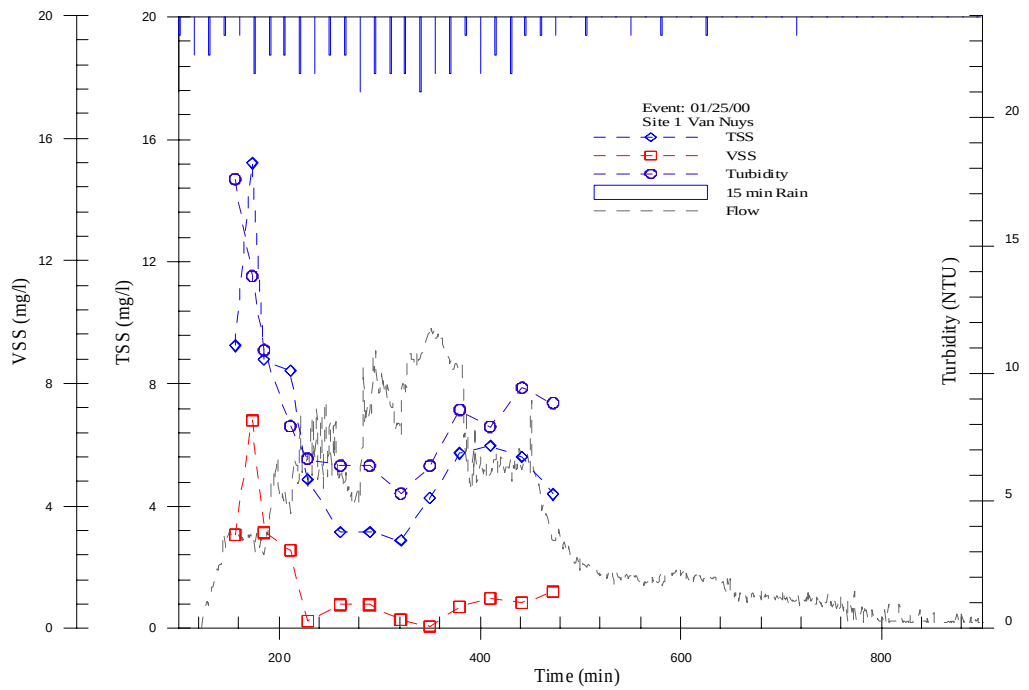


Figure I.1.1.1a (Y1-UCLA1-E2-1) Polluto-graph for TSS, VSS and Turbidity

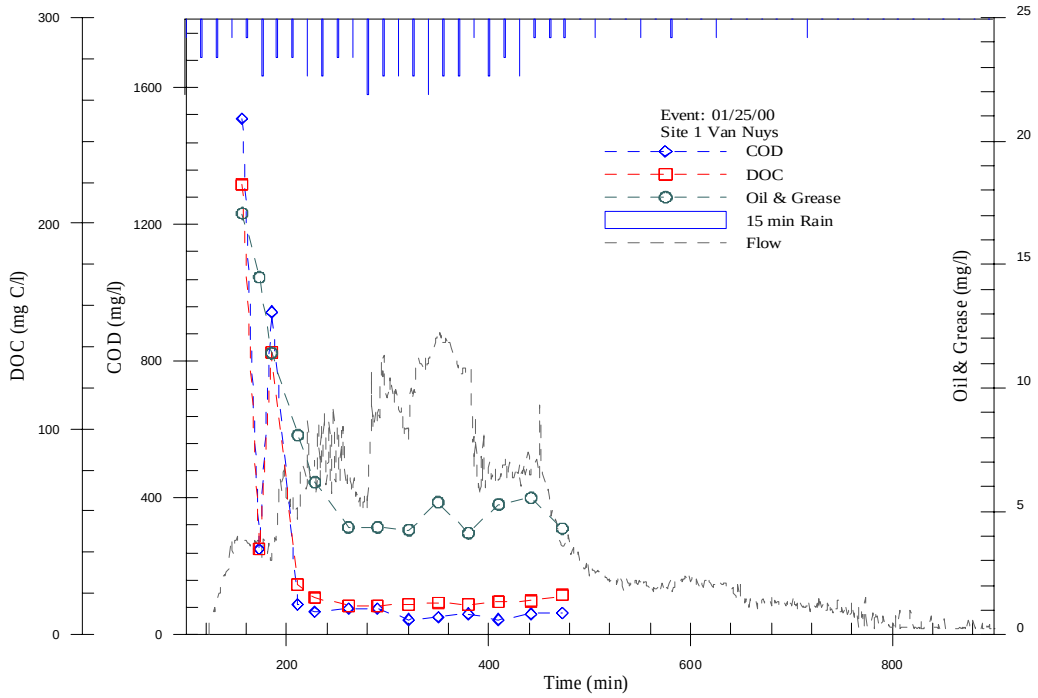


Figure I.1.1.1b (Y1-UCLA1-E2-2.) Polluto-graph for DOC, COD and Oil & Grease

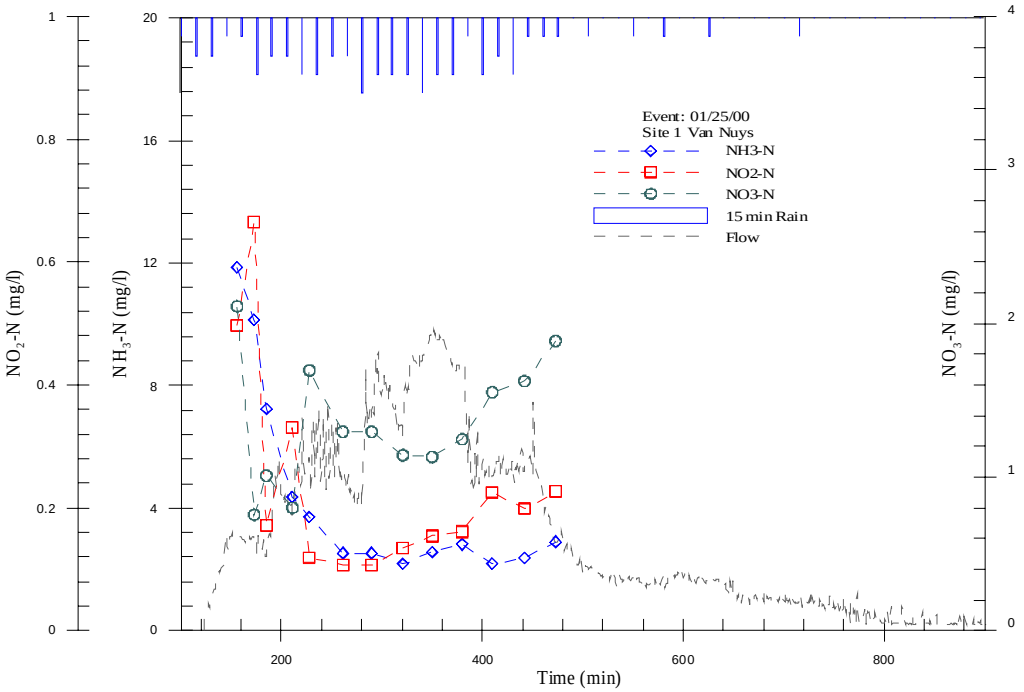


Figure I.1.1.1c (Y1-UCLA1-E2-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

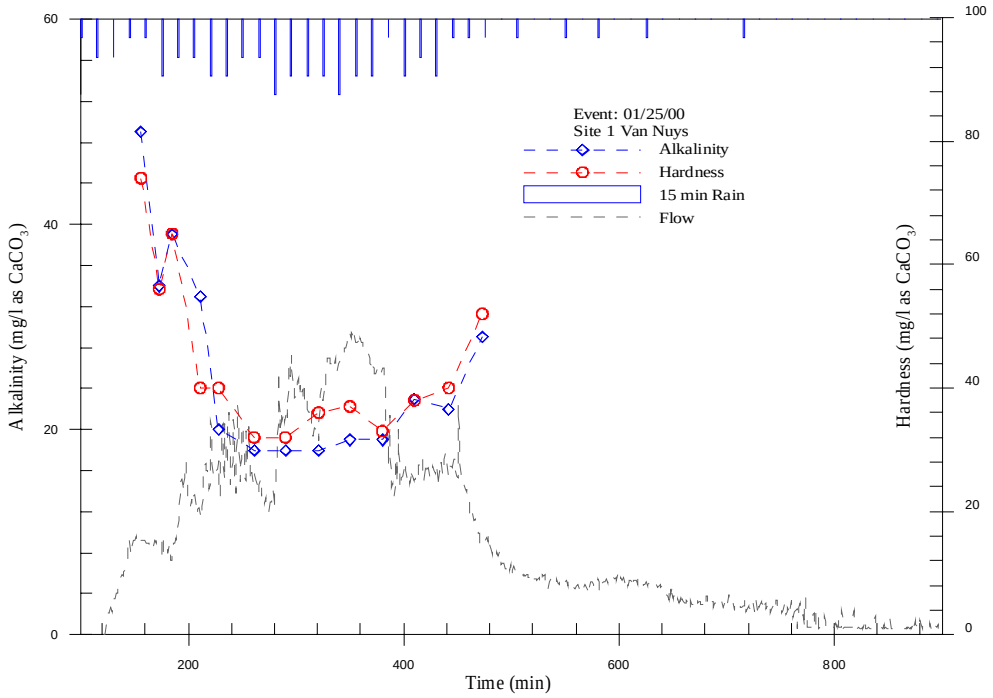


Figure I.1.1.1d (Y1-UCLA1-E2-4.) Polluto-graph for Alkalinity and Hardness

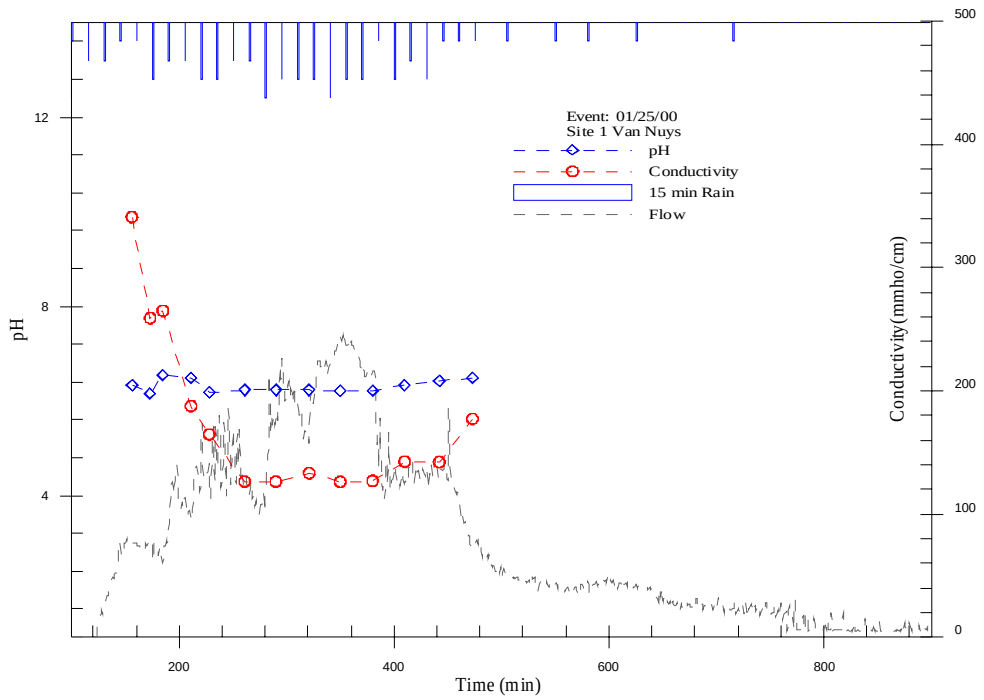


Figure I.1.1.1e (Y1-UCLA1-E2-5.) Polluto-graph for pH and Conductivity

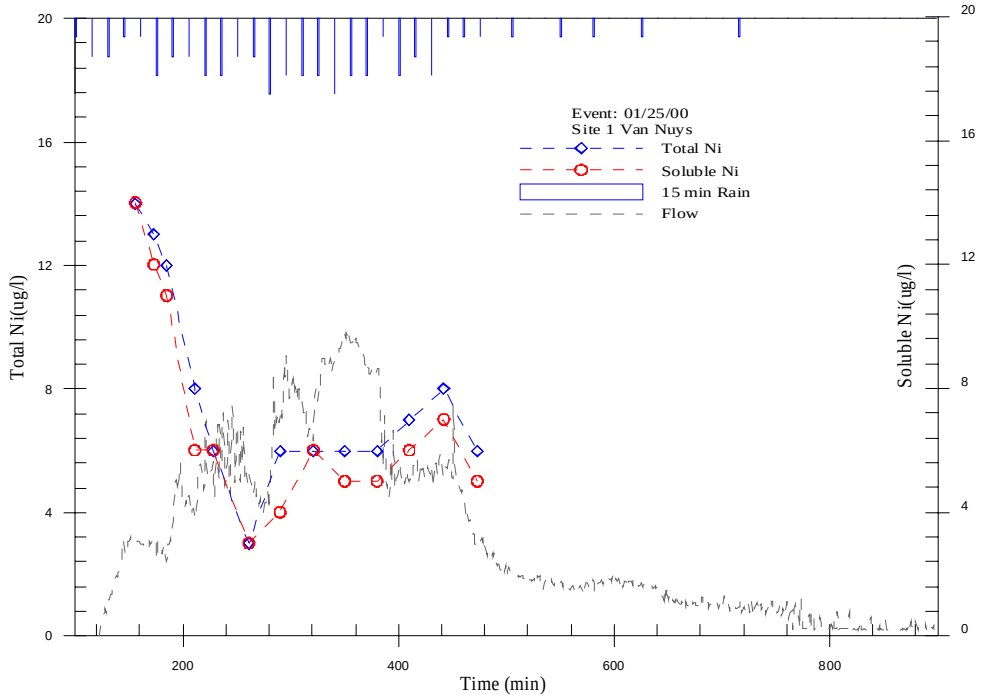


Figure I.1.1.1f (Y1-UCLA1-E2-6.) Polluto-graph for Total Ni / Dissolved Ni

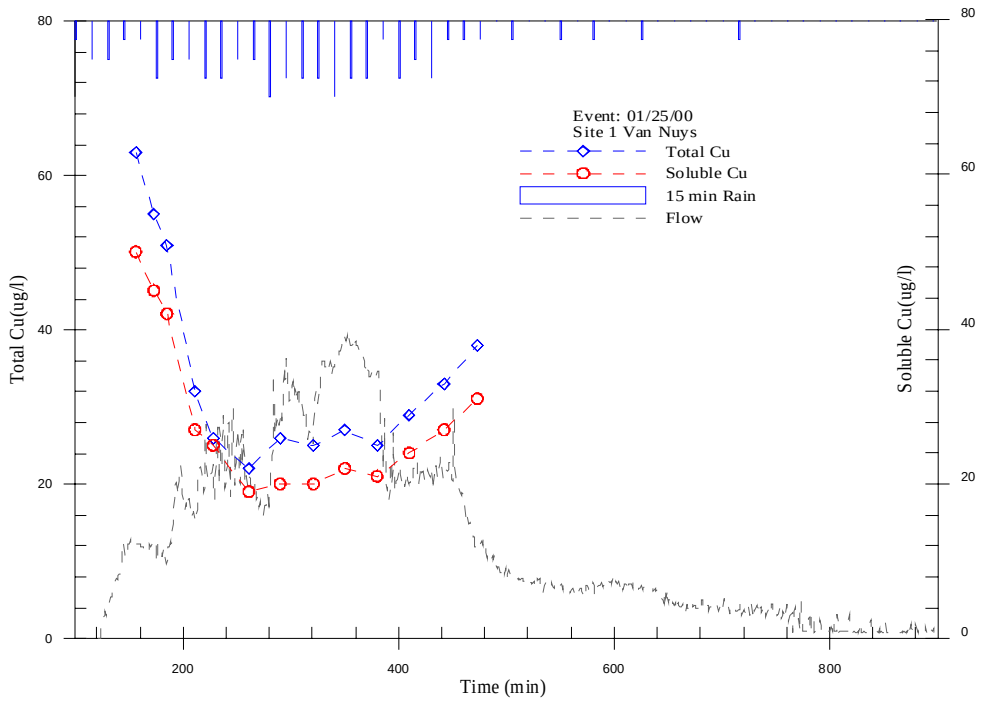


Figure I.1.1.1g (Y1-UCLA1-E2-7.) Polluto-graph for Total Cu / Dissolved Cu

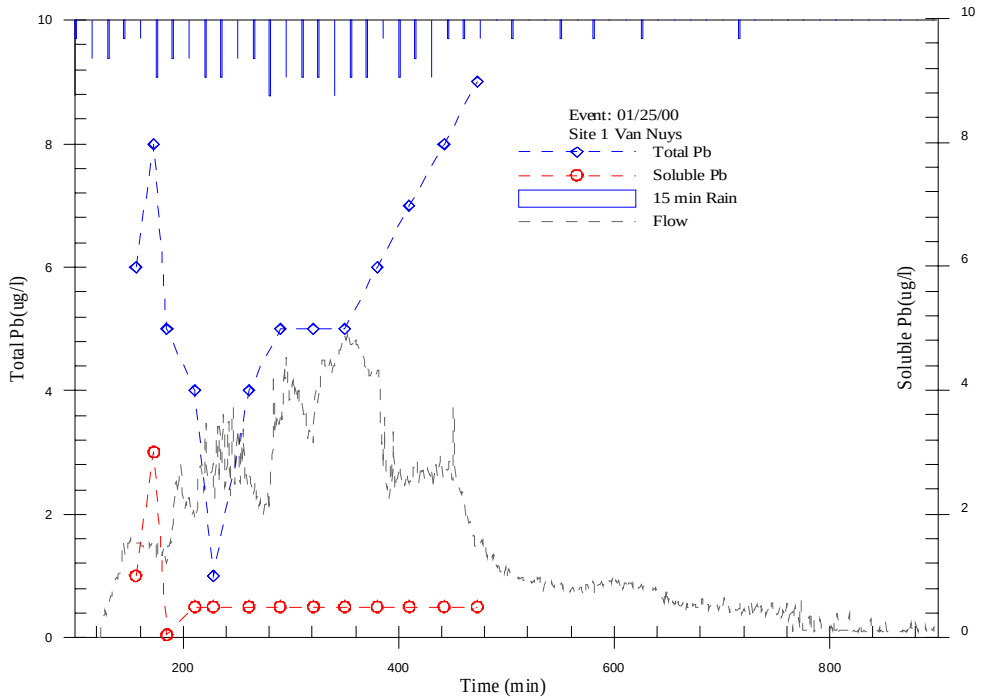


Figure I.1.1.1h (Y1-UCLA1-E2-8.) Polluto-graph for Total Pb / Dissolved Pb

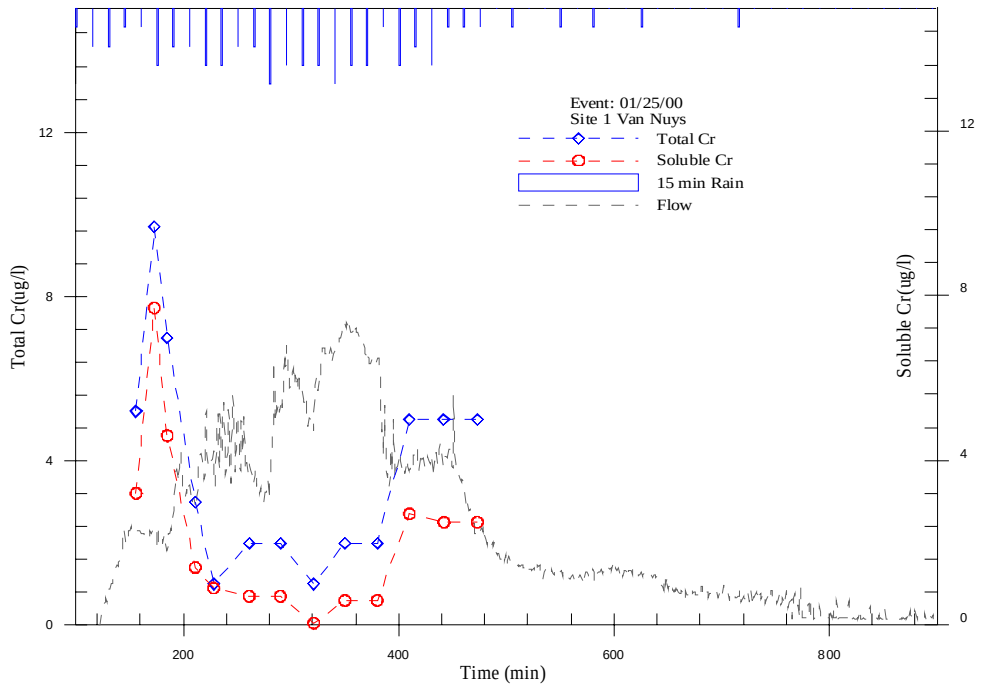


Figure I.1.1.1i (Y1-UCLA1-E2-9.) Polluto-graph for Total Cr / Dissolved Cr

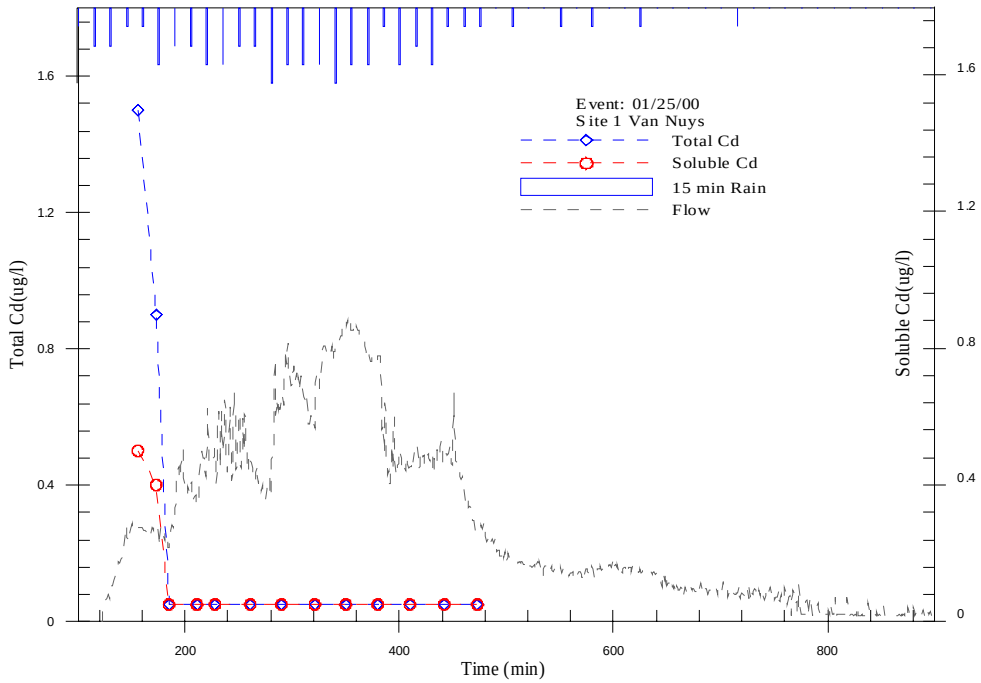


Figure I.1.1.1j (Y1-UCLA1-E2-10.) Polluto-graph for Total Cd / Dissolved Cd

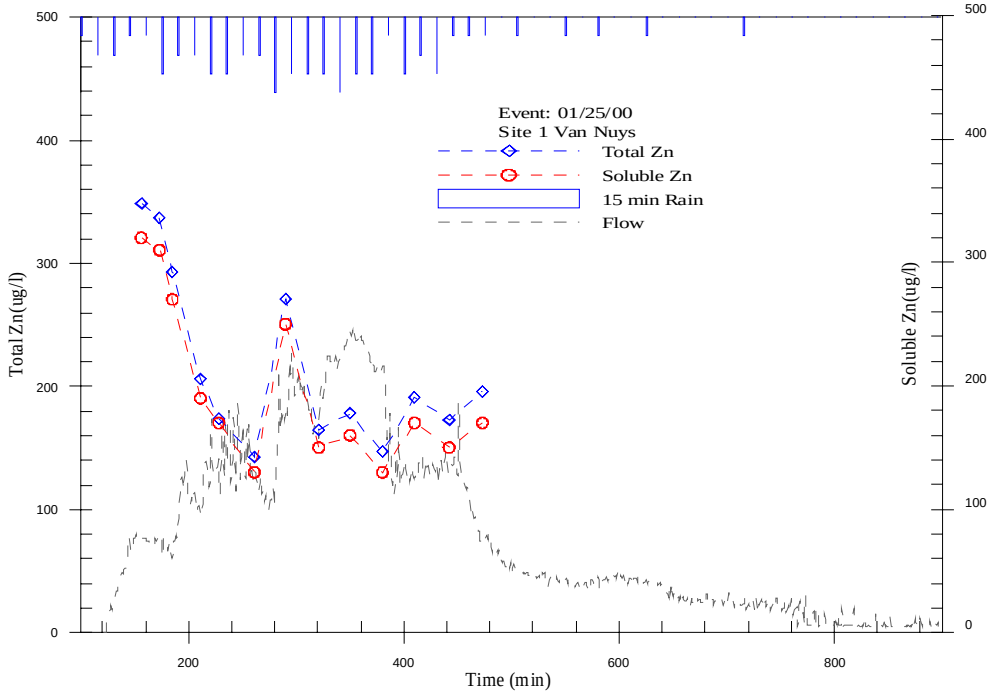


Figure I.1.1.1k (Y1-UCLA1-E2-11.) Polluto-graph for Total Zn / Dissolved Zn

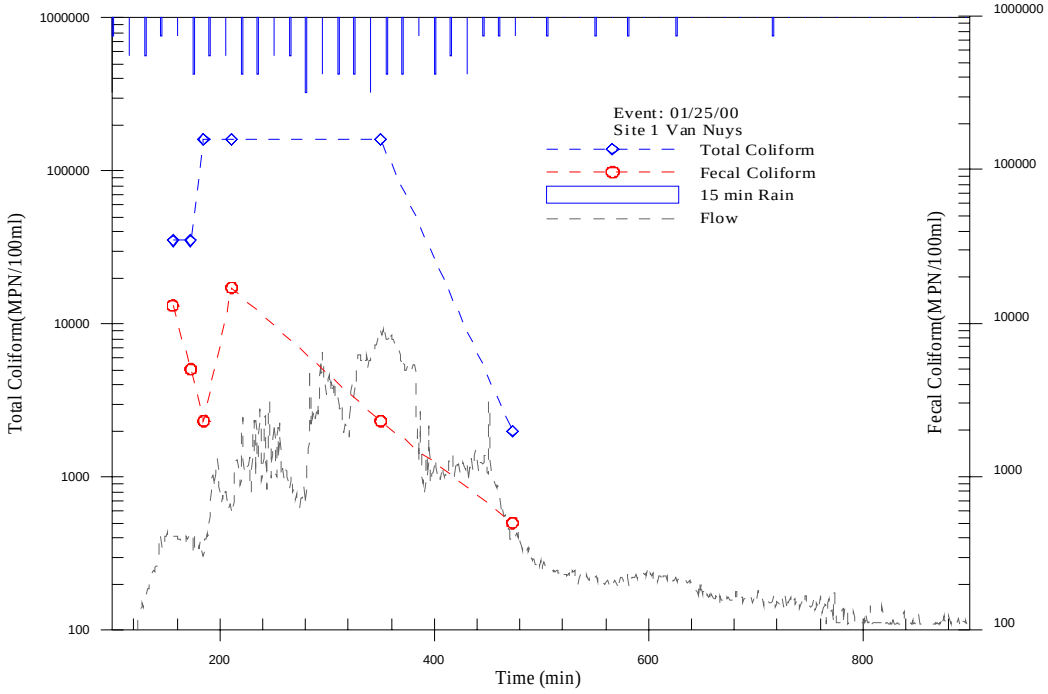


Figure I.1.1.1l (Y1-UCLA1-E2-12.) Polluto-graph for Total Coliform / Fecal Coliform

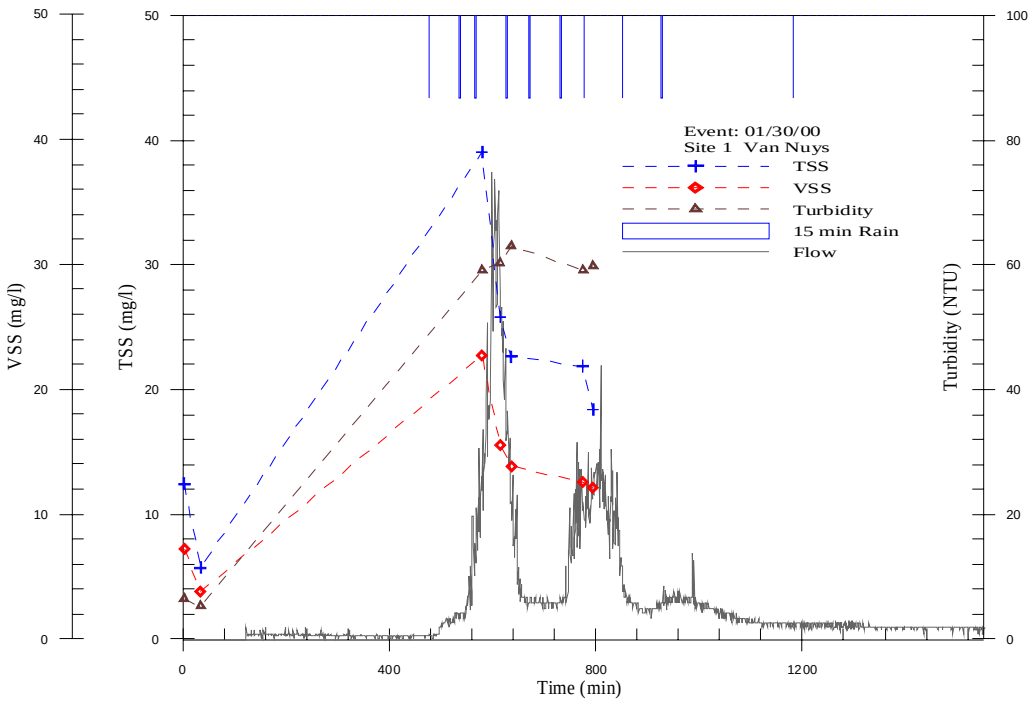


Figure I.1.1.2a (Y1-UCLA1-E3-1.) Polluto-graph for TSS, VSS and Turbidity

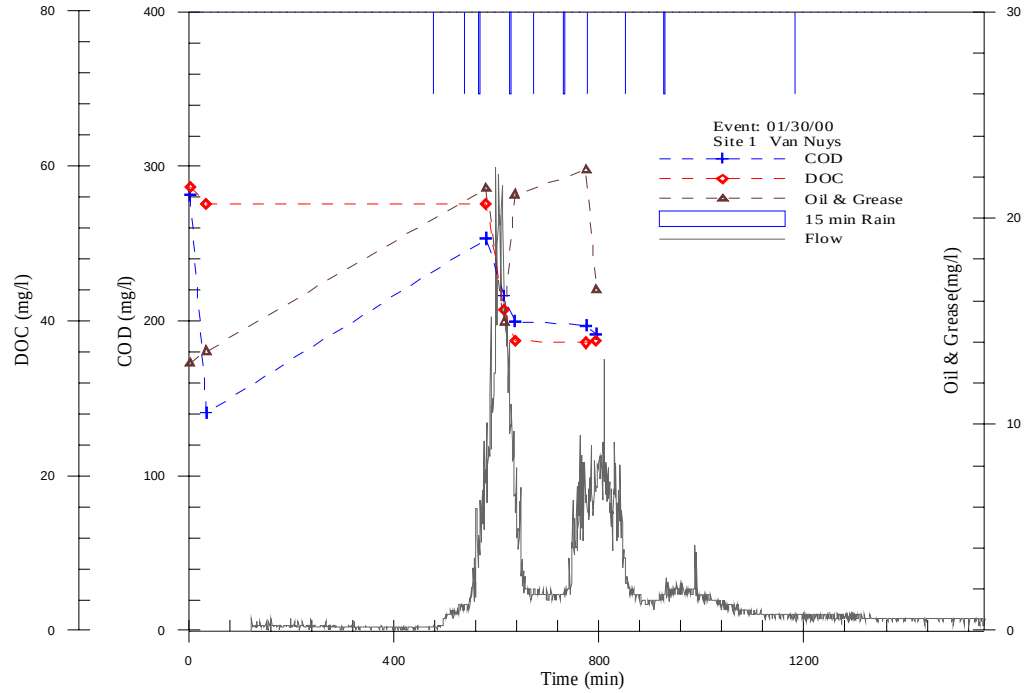


Figure I.1.1.2b (Y1-UCLA1-E3-2.) Polluto-graph for DOC, COD and Oil & Grease

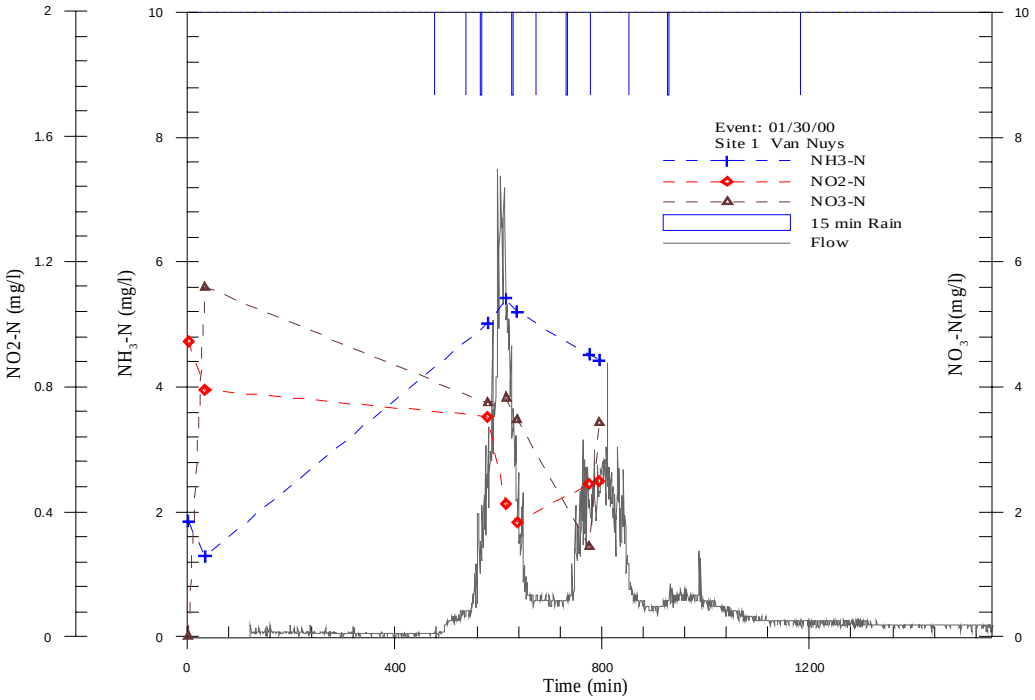


Figure I.1.1.2c (Y1-UCLA1-E3-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

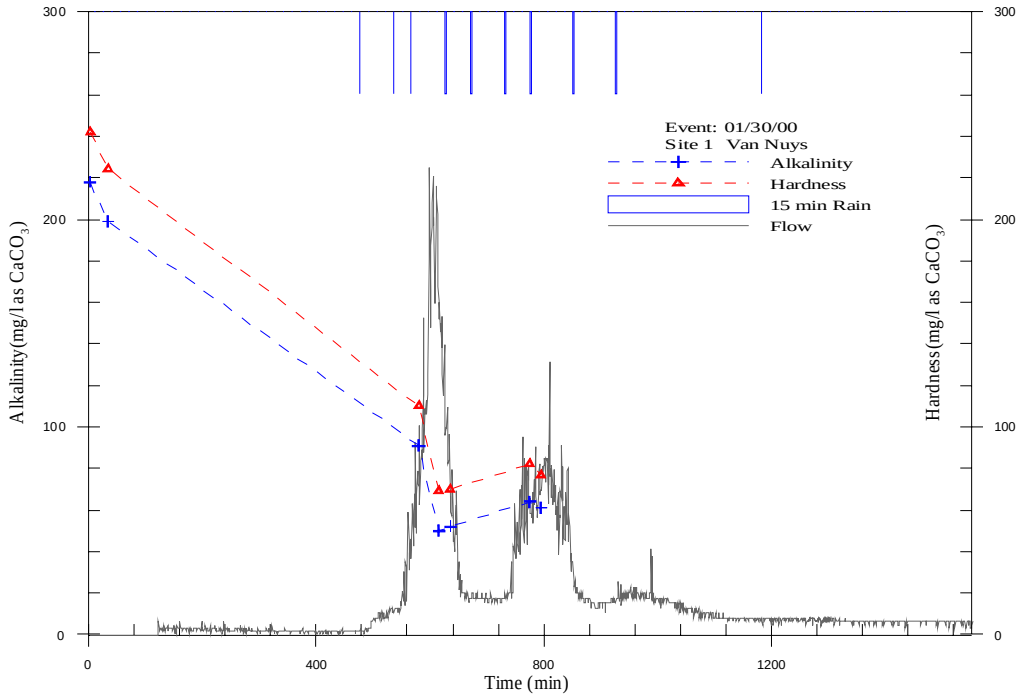


Figure I.1.1.2d (Y1-UCLA1-E3-4.) Polluto-graph for Alkalinity and Hardness

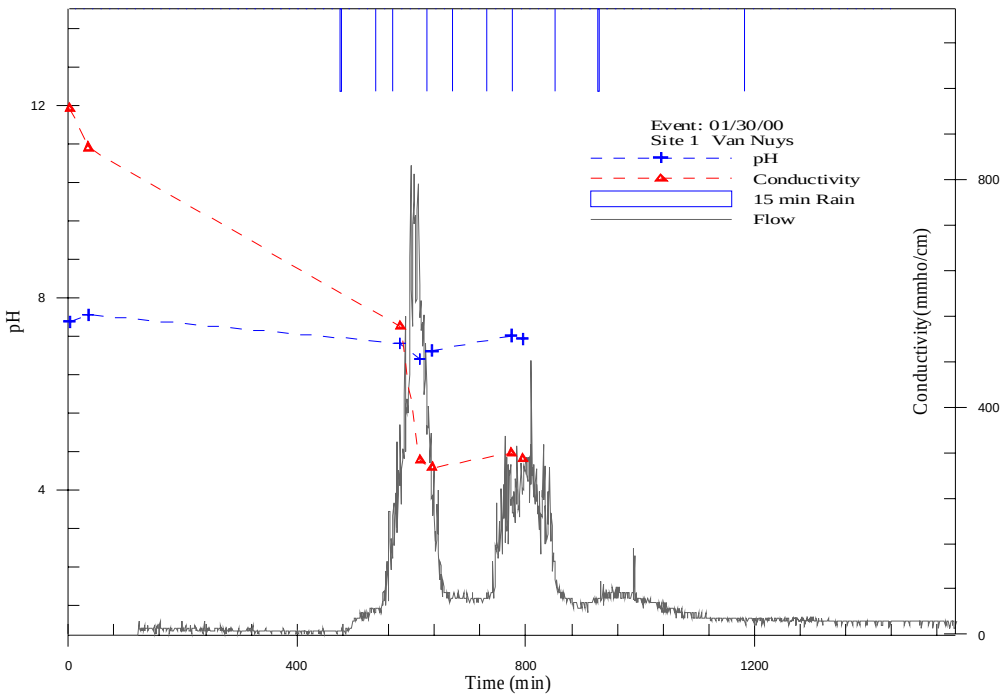


Figure I.1.1.2e (Y1-UCLA1-E3-5.) Polluto-graph for pH and Conductivity

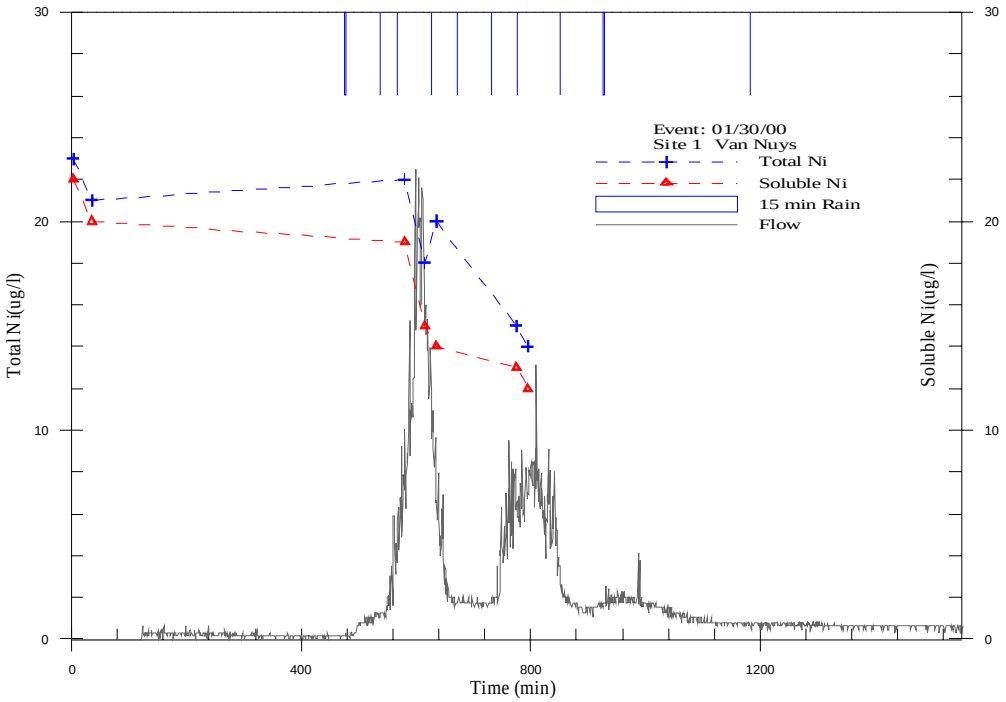


Figure I.1.1.2f (Y1-UCLA1-E3-6.) Polluto-graph for Total Ni / Dissolved Ni

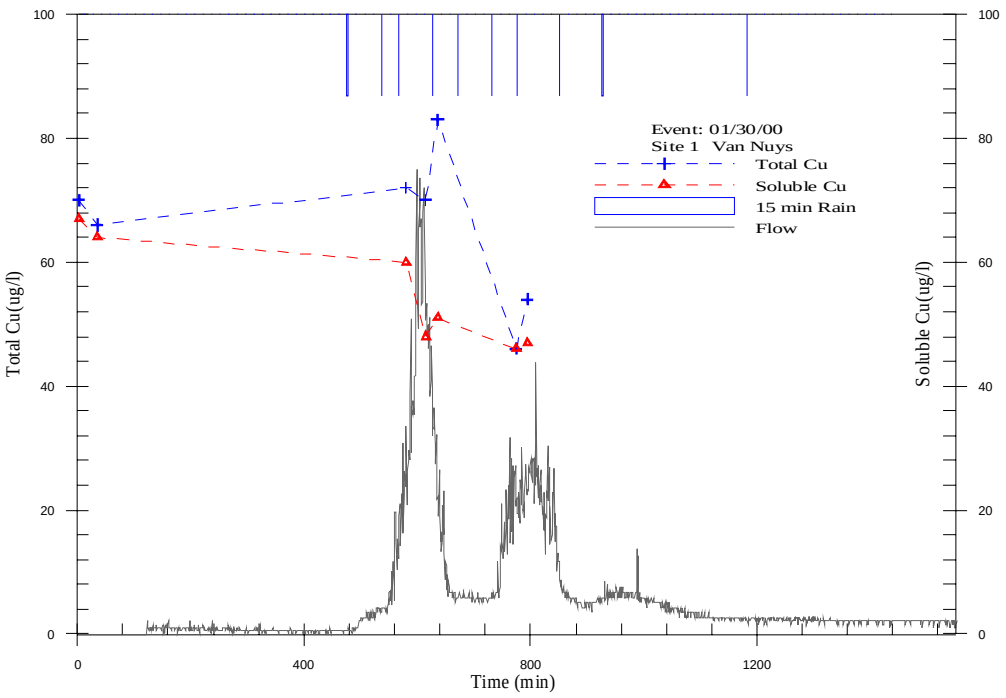


Figure I.1.1.2g (Y1-UCLA1-E3-7.) Polluto-graph for Total Cu / Dissolved Cu

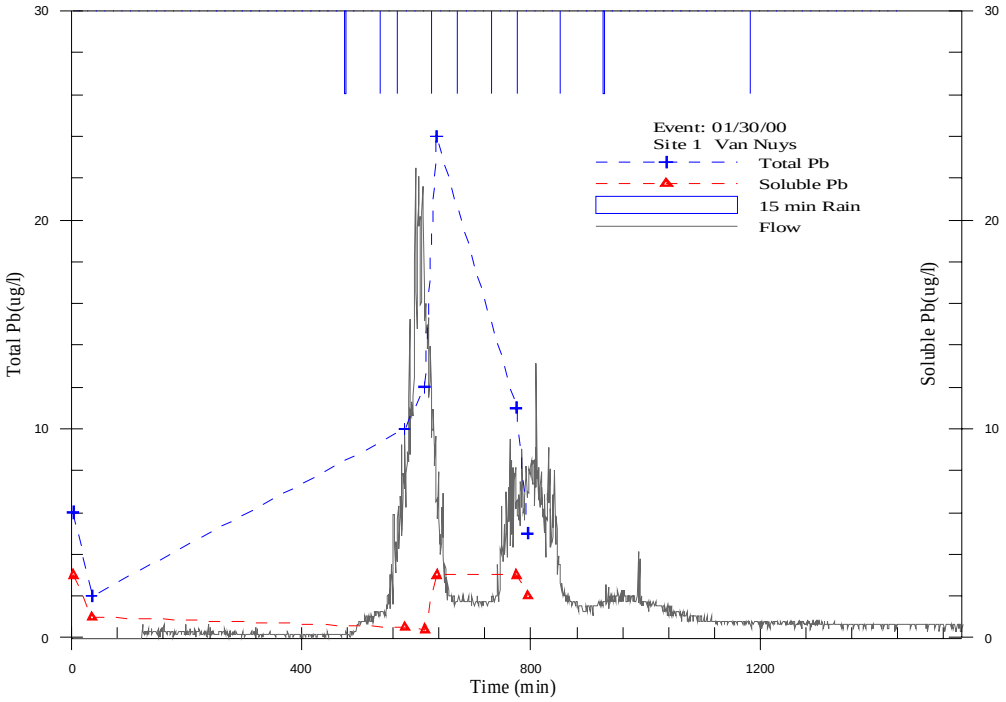


Figure I.1.1.2h (Y1-UCLA1-E3-8.) Polluto-graph for Total Pb / Dissolved Pb

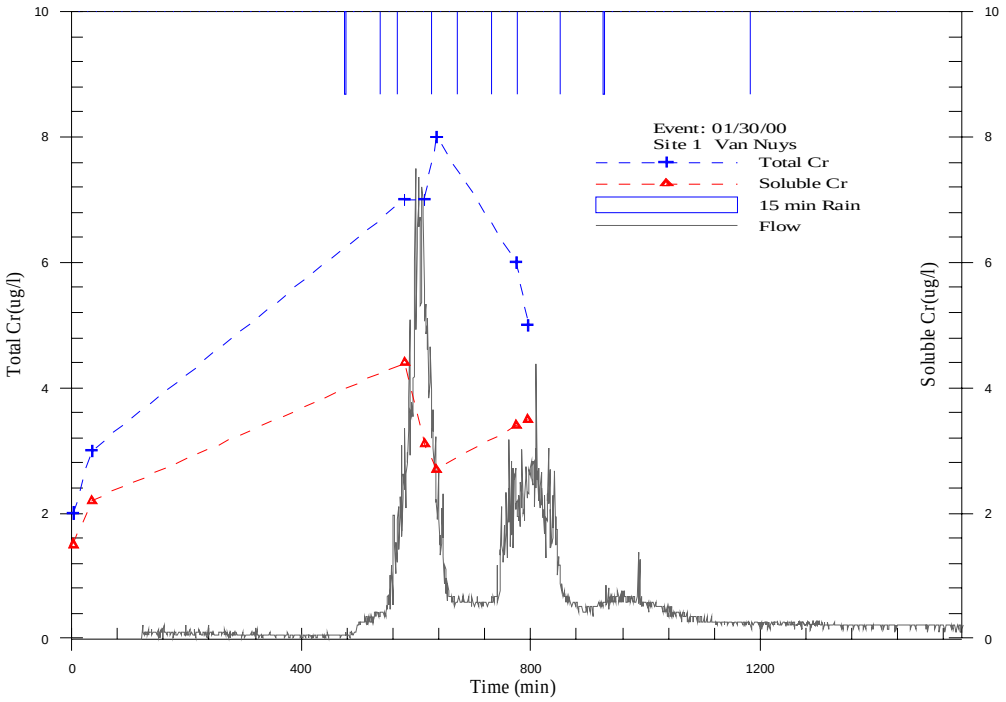


Figure I.1.1.2i (Y1-UCLA1-E3-9.) Polluto-graph for Total Cr / Dissolved Cr

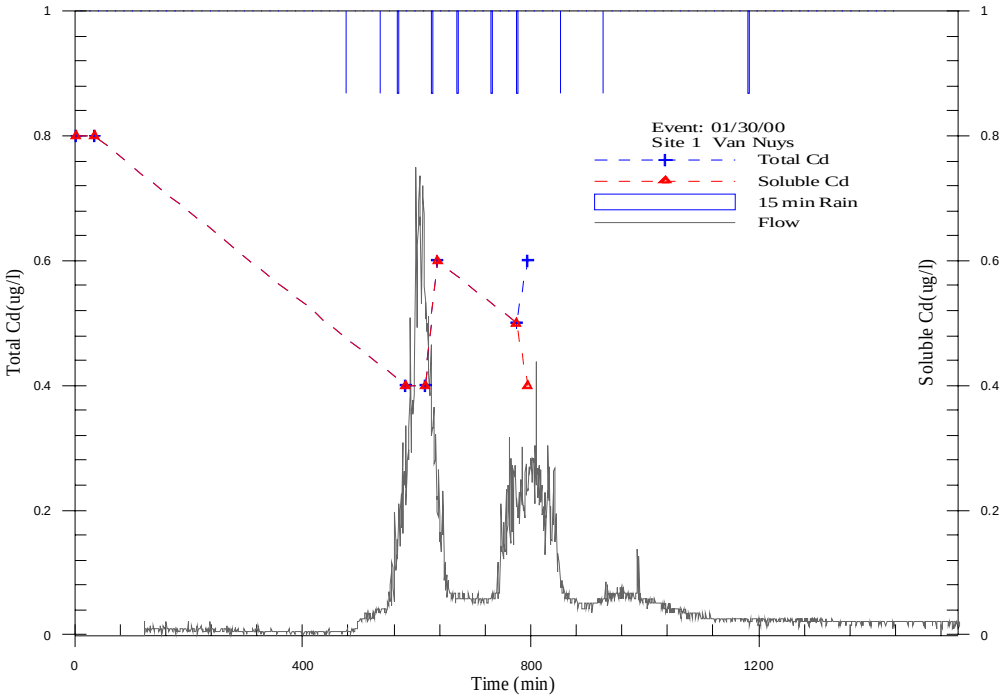


Figure I.1.1.2j (Y1-UCLA1-E3-10.) Polluto-graph for Total Cd / Dissolved Cd

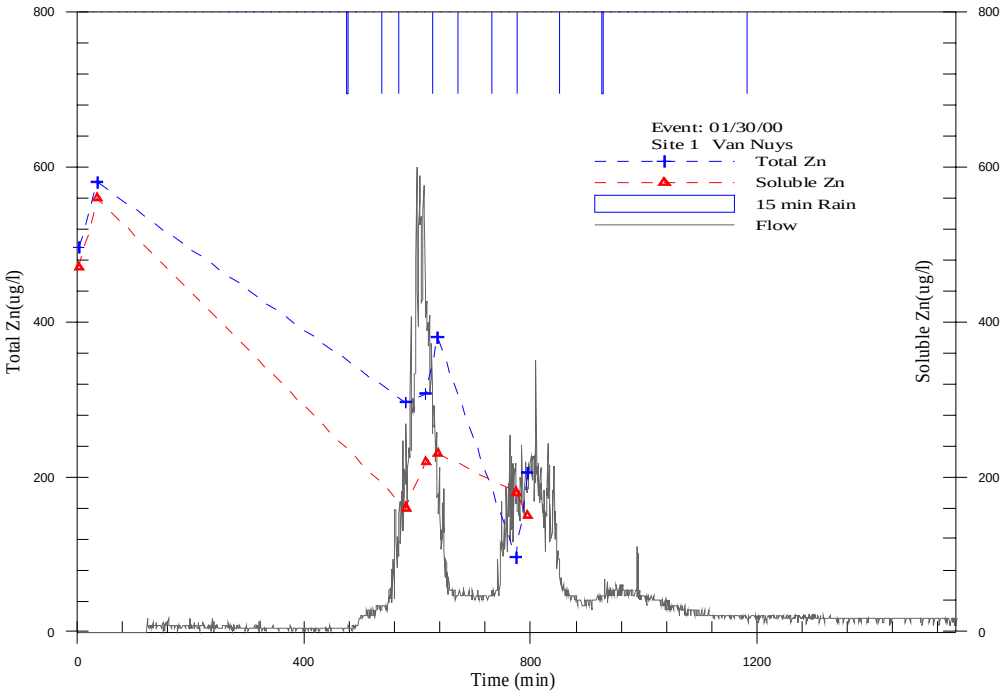


Figure I.1.1.2k (Y1-UCLA1-E3-11.) Polluto-graph for Total Zn / Dissolved Zn

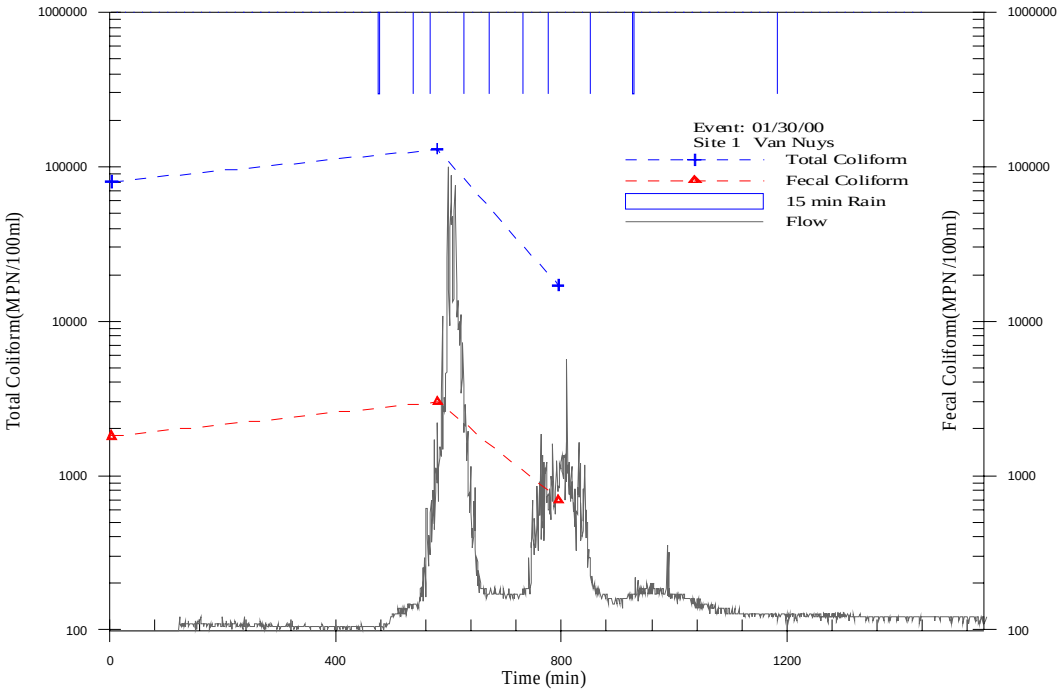


Figure I.1.1.2l (Y1-UCLA1-E3-12.) Polluto-graph for Total Coliform / Fecal Coliform

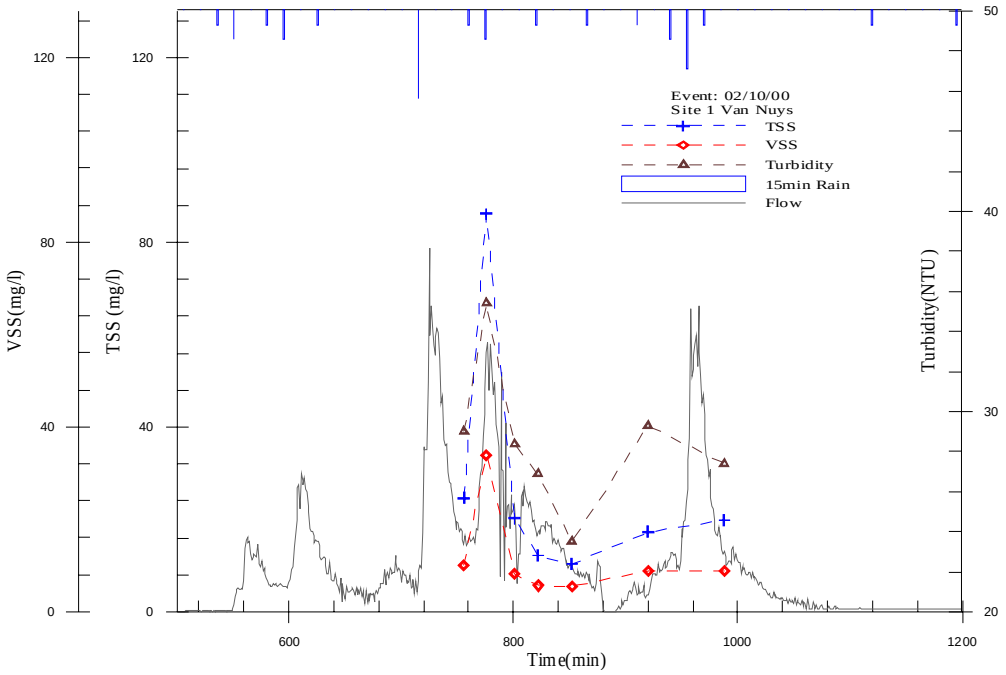


Figure I.1.1.3a (Y1-UCLA1-E4-1.) Polluto-graph for TSS, VSS and Turbidity

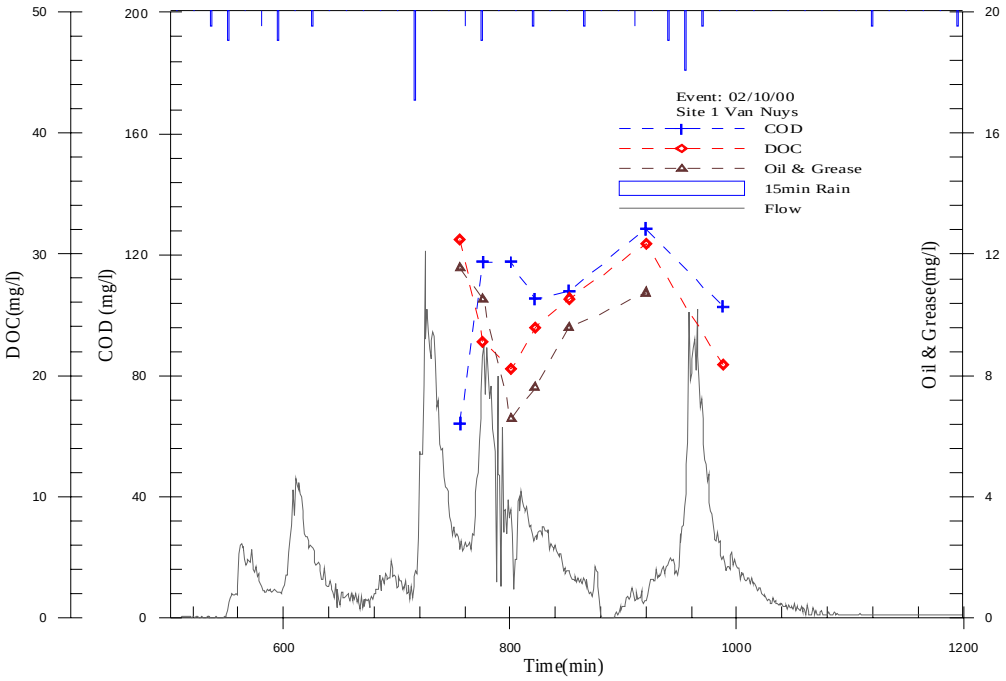


Figure I.1.1.3b (Y1-UCLA1-E4-2.) Polluto-graph for DOC, COD and Oil & Grease

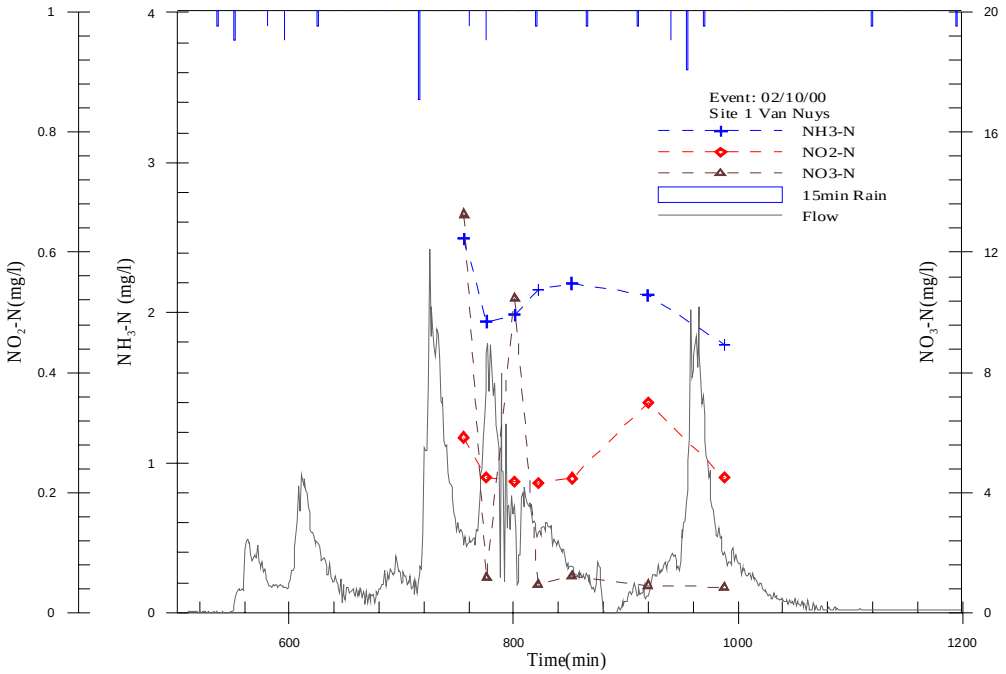


Figure I.1.1.3c (Y1-UCLA1-E4-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

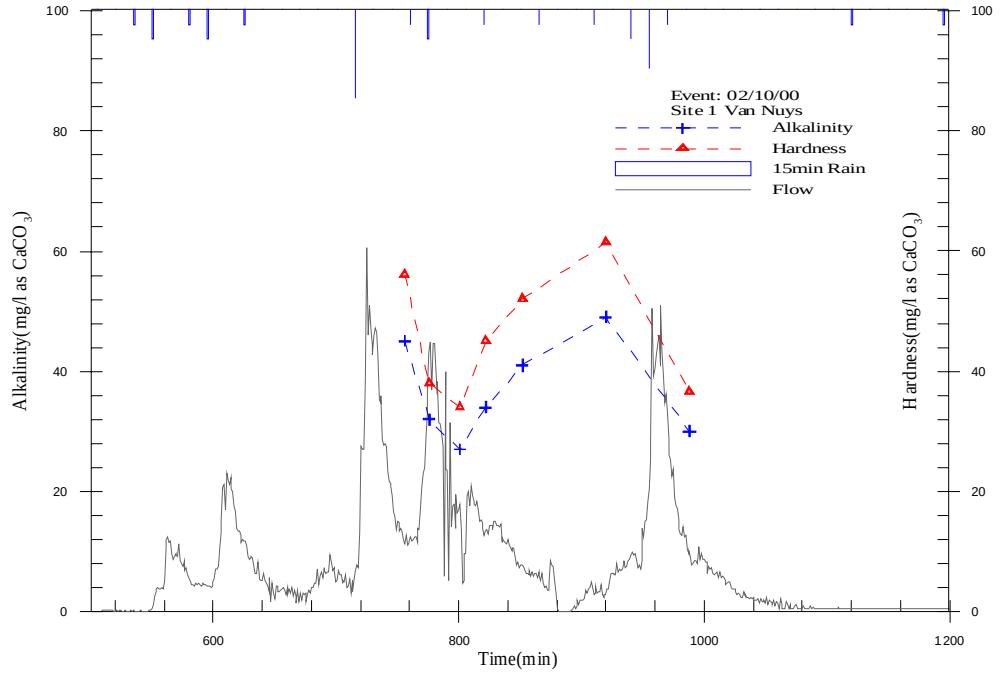


Figure I.1.1.3d (Y1-UCLA1-E4-4.) Polluto-graph for Alkalinity and Hardness

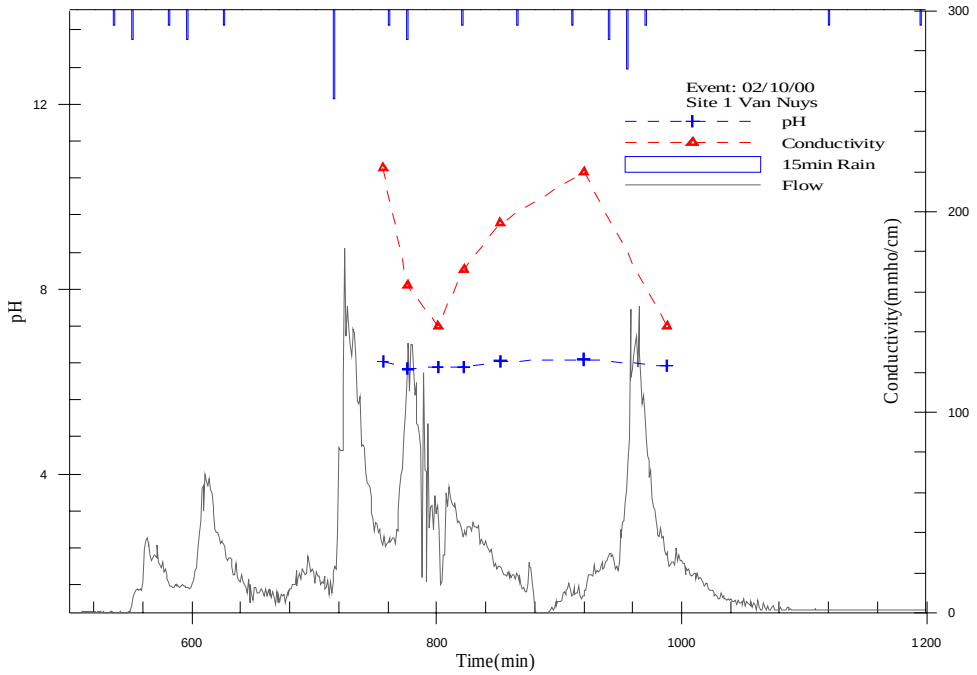


Figure I.1.1.3e (Y1-UCLA1-E4-5.) Polluto-graph for pH and Conductivity

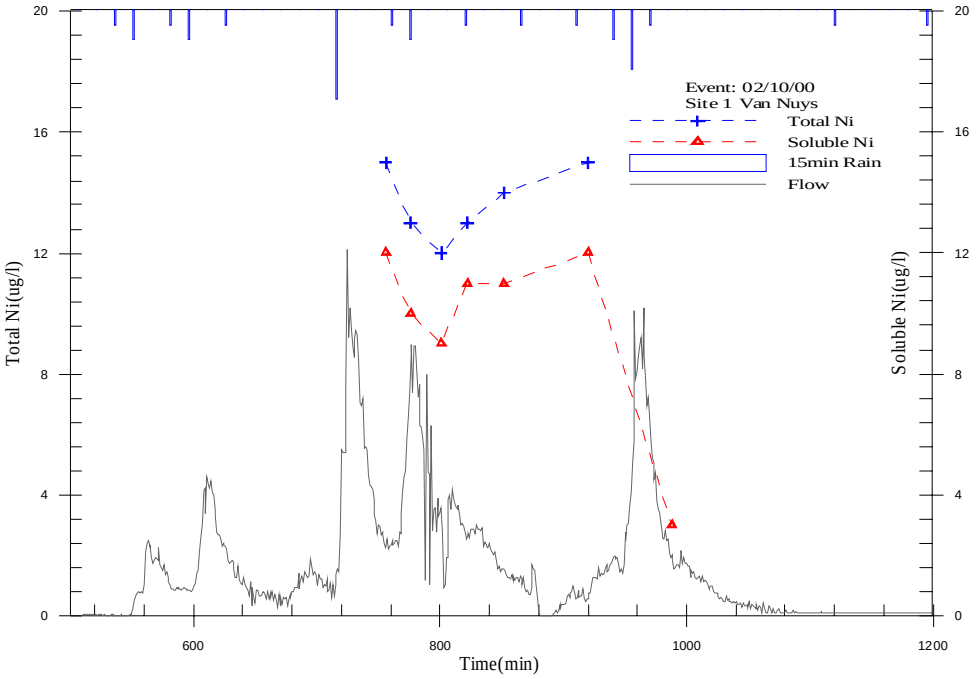


Figure I.1.1.3f (Y1-UCLA1-E4-6.) Polluto-graph for Total Ni / Dissolved Ni

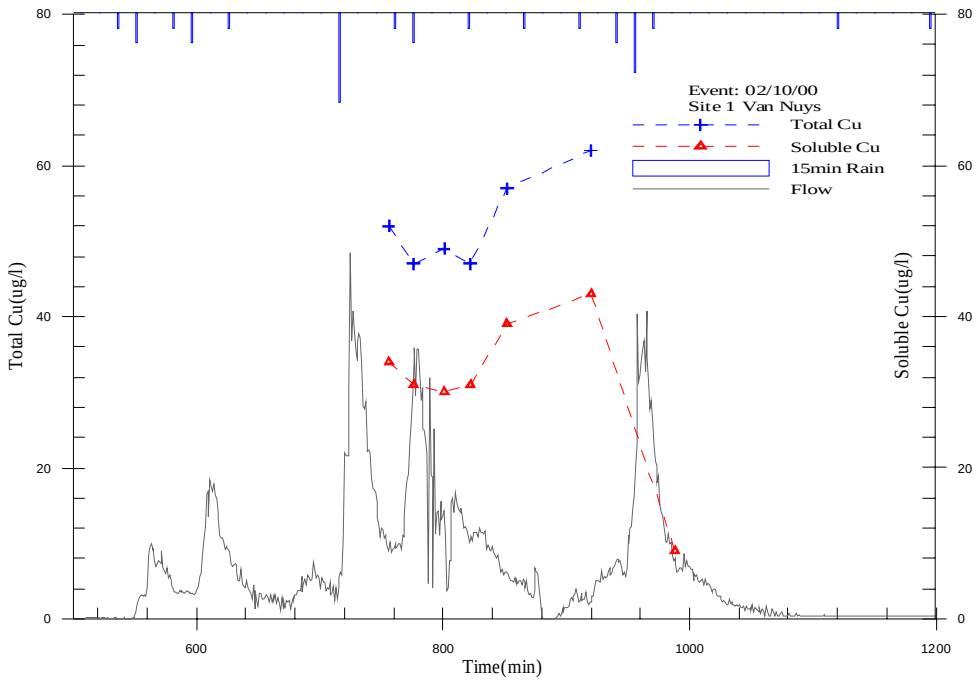


Figure I.1.1.3g (Y1-UCLA1-E4-7.) Polluto-graph for Total Cu / Dissolved Cu

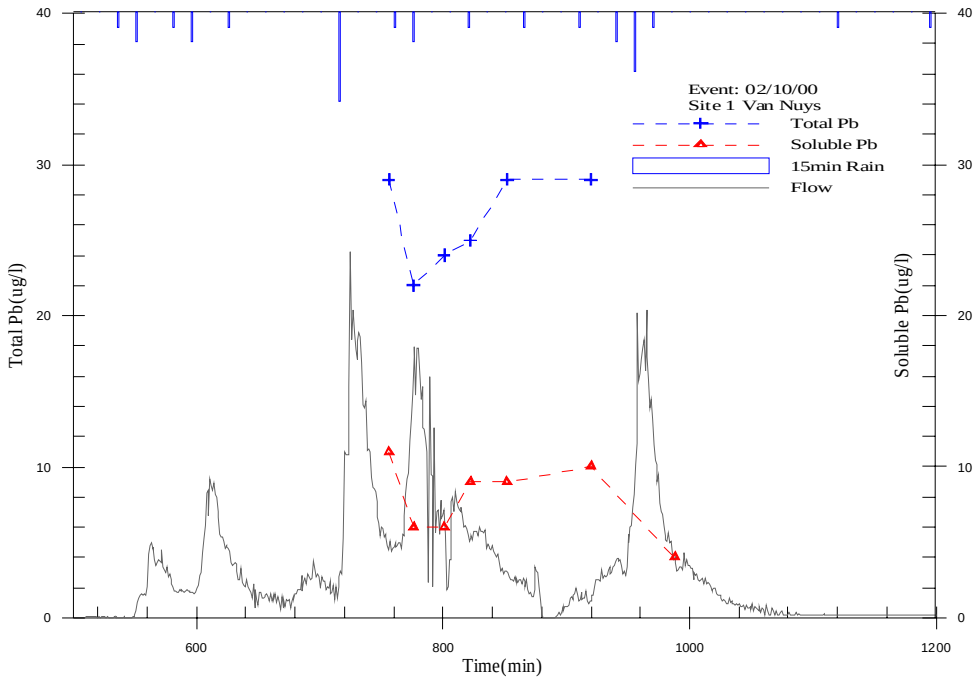


Figure I.1.1.3h (Y1-UCLA1-E4-8.) Polluto-graph for Total Pb / Dissolved Pb

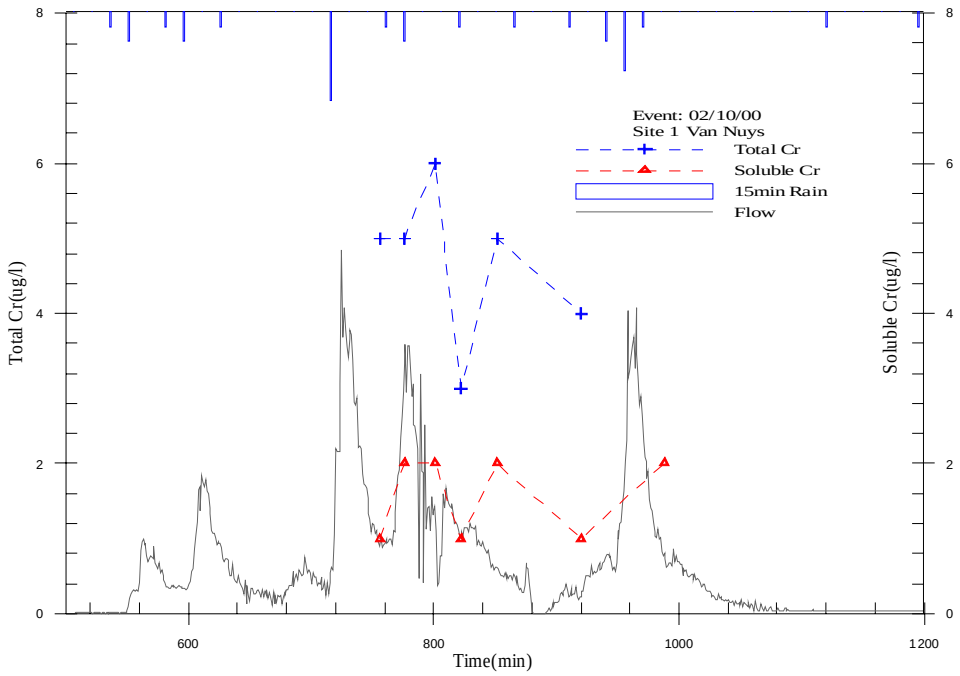


Figure I.1.1.3i (Y1-UCLA1-E4-9.) Polluto-graph for Total Cr / Dissolved Cr

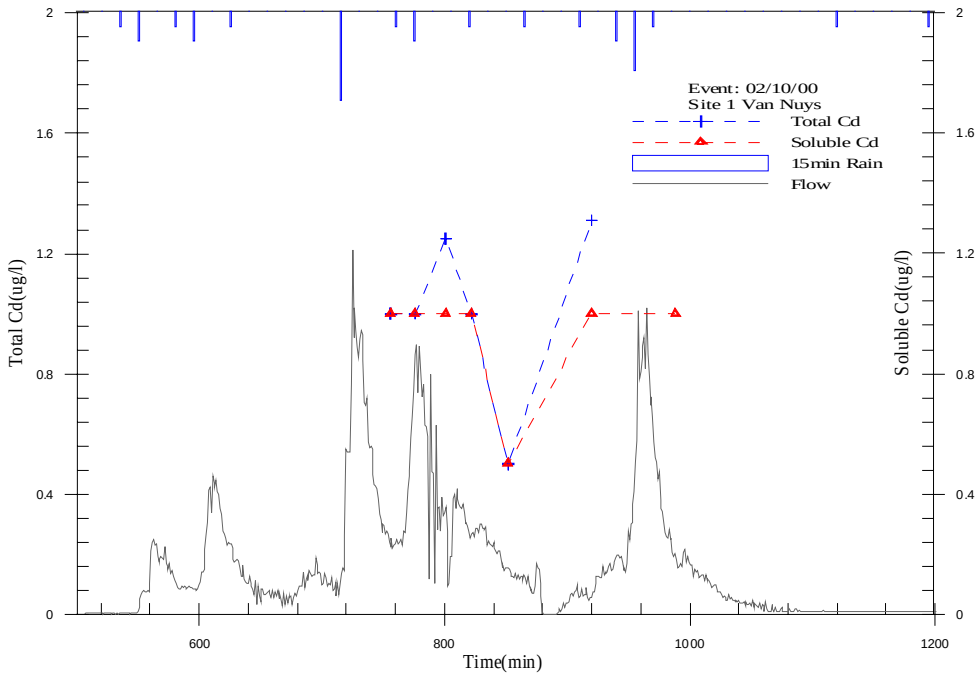


Figure I.1.1.3j (Y1-UCLA1-E4-10.) Polluto-graph for Total Cd / Dissolved Cd

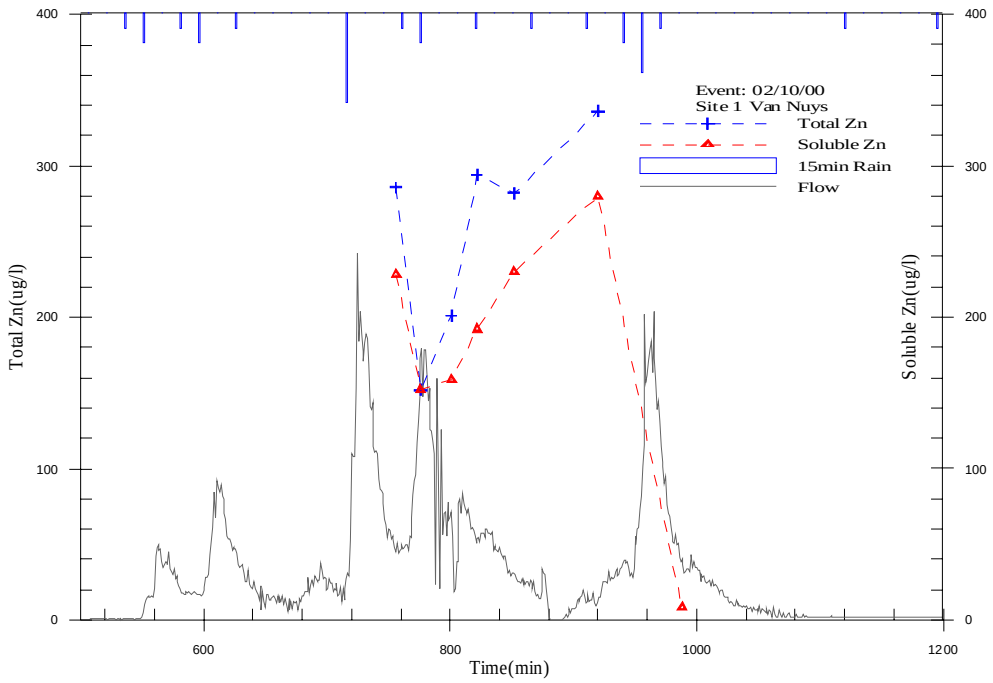


Figure I.1.1.3k (Y1-UCLA1-E4-11.) Polluto-graph for Total Zn / Dissolved Zn

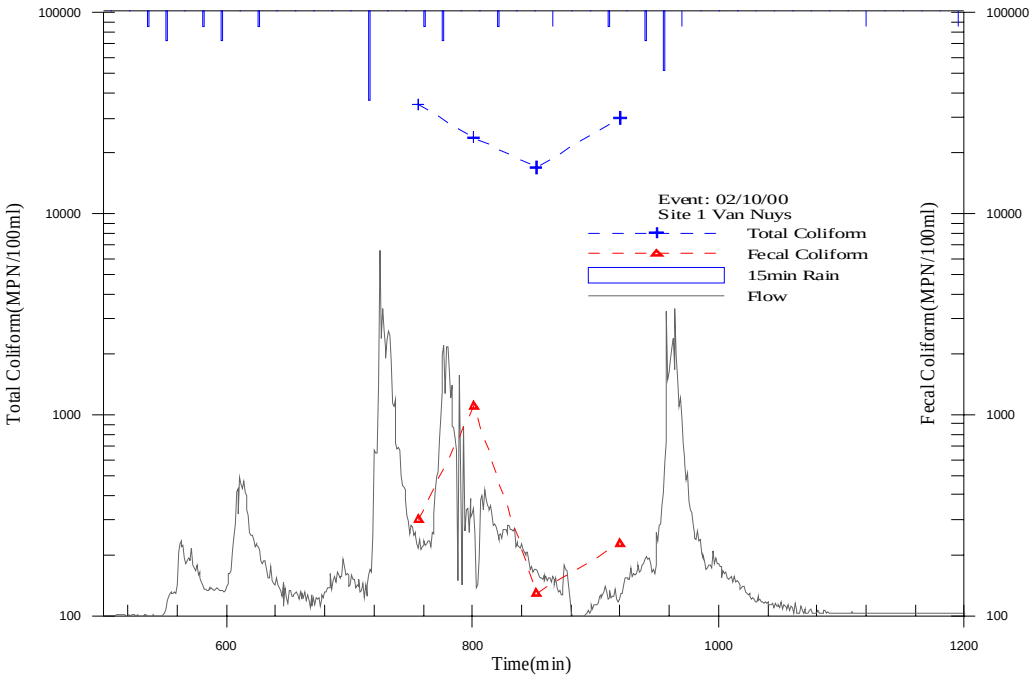


Figure I.1.1.3l (Y1-UCLA1-E4-12.) Polluto-graph for Total Coliform / Fecal Coliform

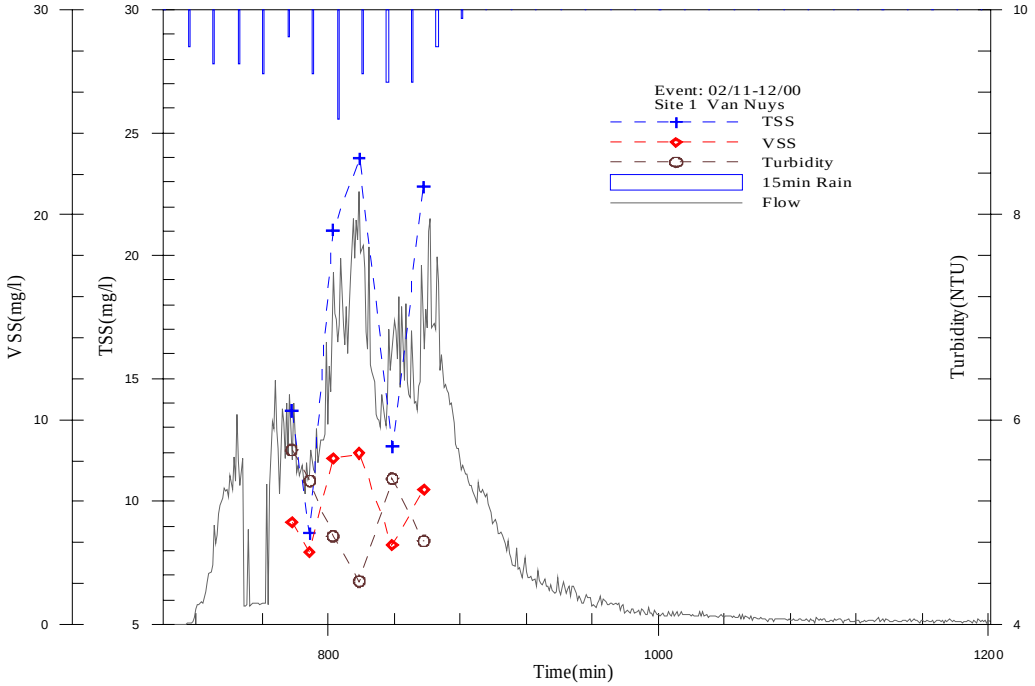


Figure I.1.1.4a (Y1-UCLA1-E5-1.) Polluto-graph for TSS, VSS and Turbidity

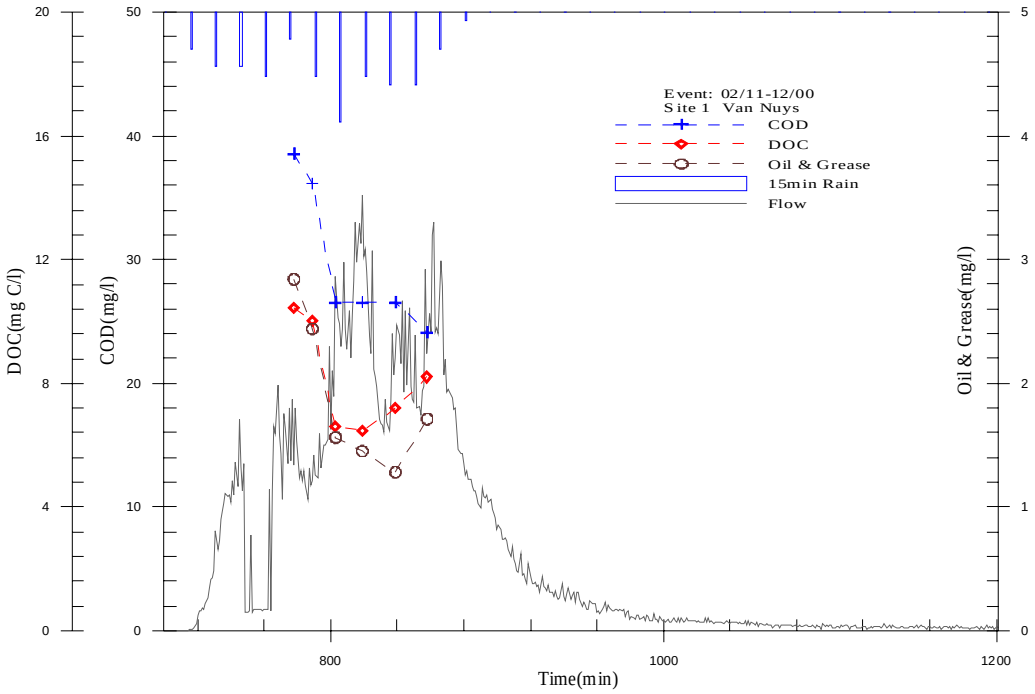


Figure I.1.1.4b (Y1-UCLA1-E5-2.) Polluto-graph for DOC, COD and Oil & Grease

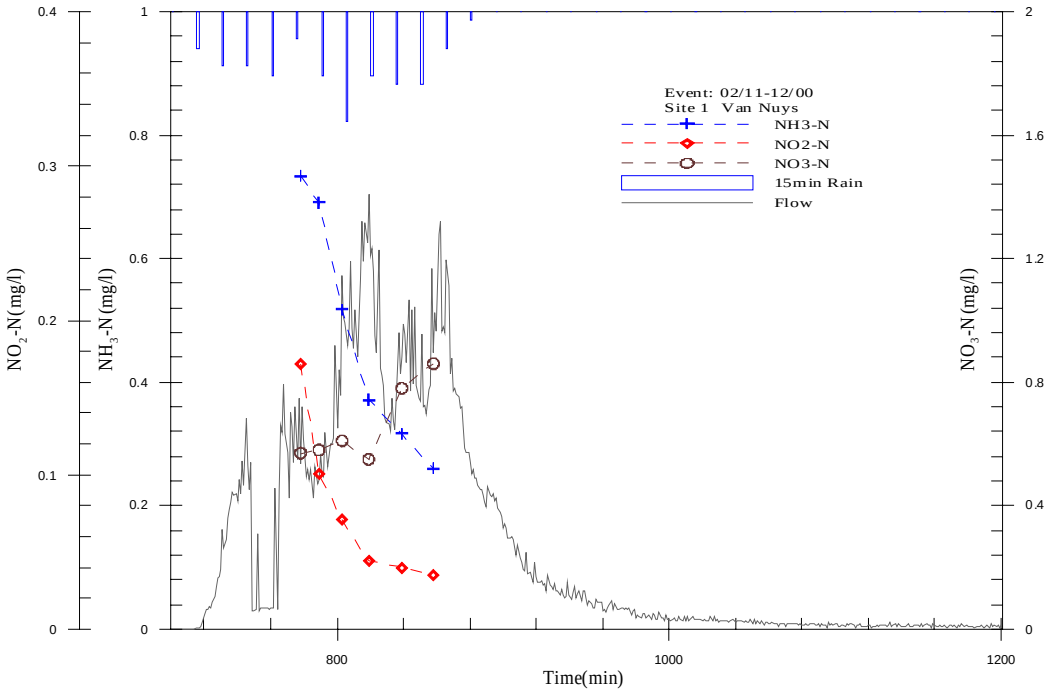


Figure I.1.1.4c (Y1-UCLA1-E5-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

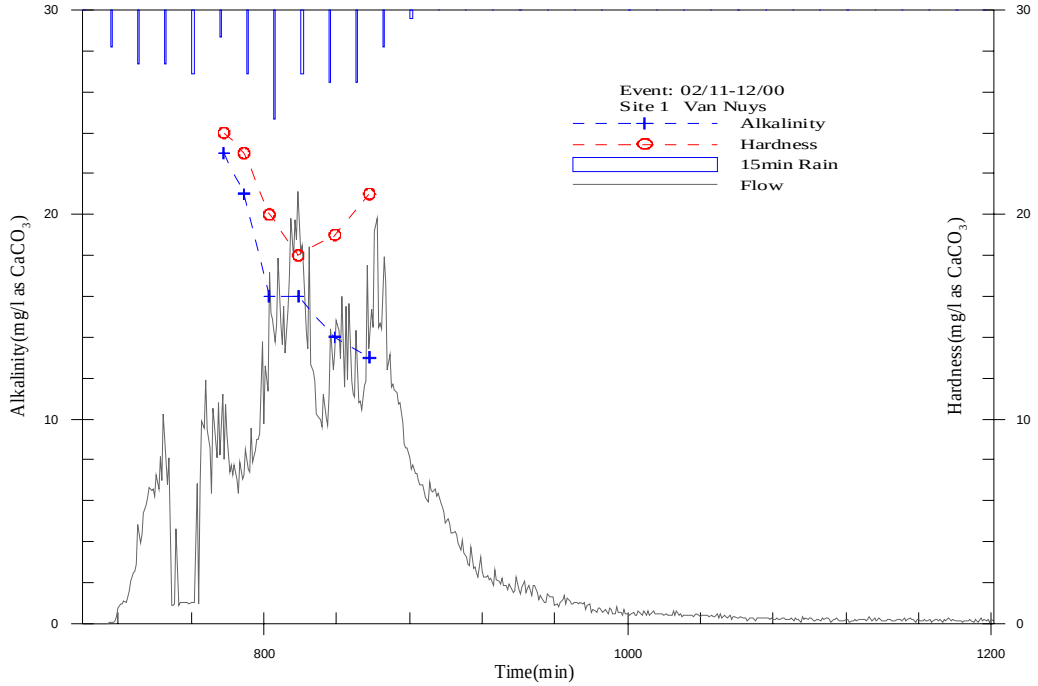


Figure I.1.1.4d (Y1-UCLA1-E5-4.) Polluto-graph for Alkalinity and Hardness

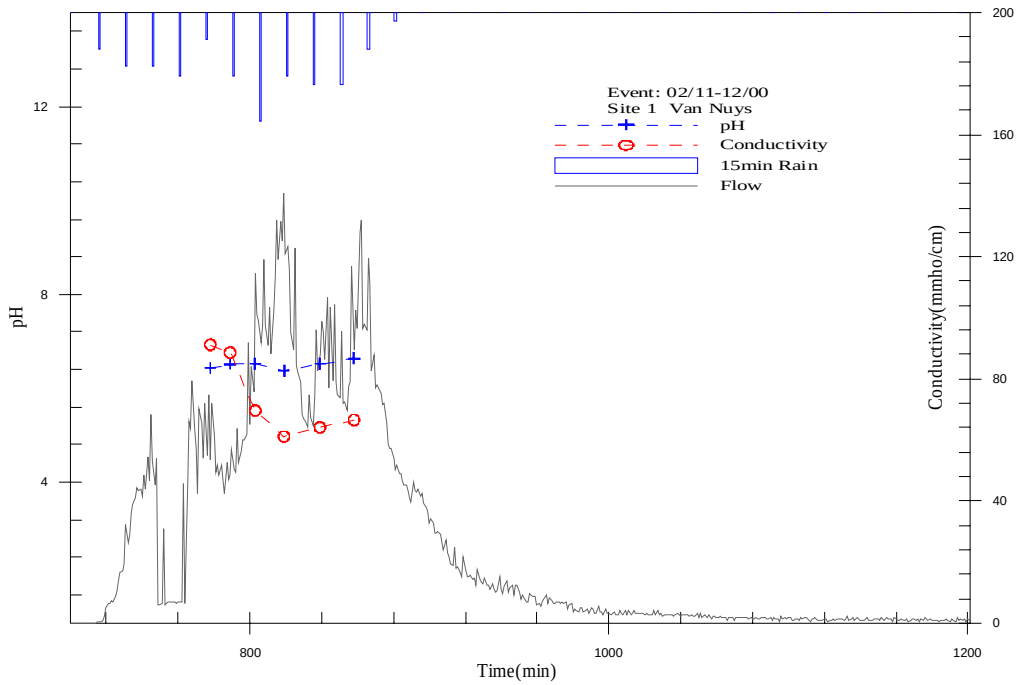


Figure I.1.1.4e (Y1-UCLA1-E5-5.) Polluto-graph for pH and Conductivity

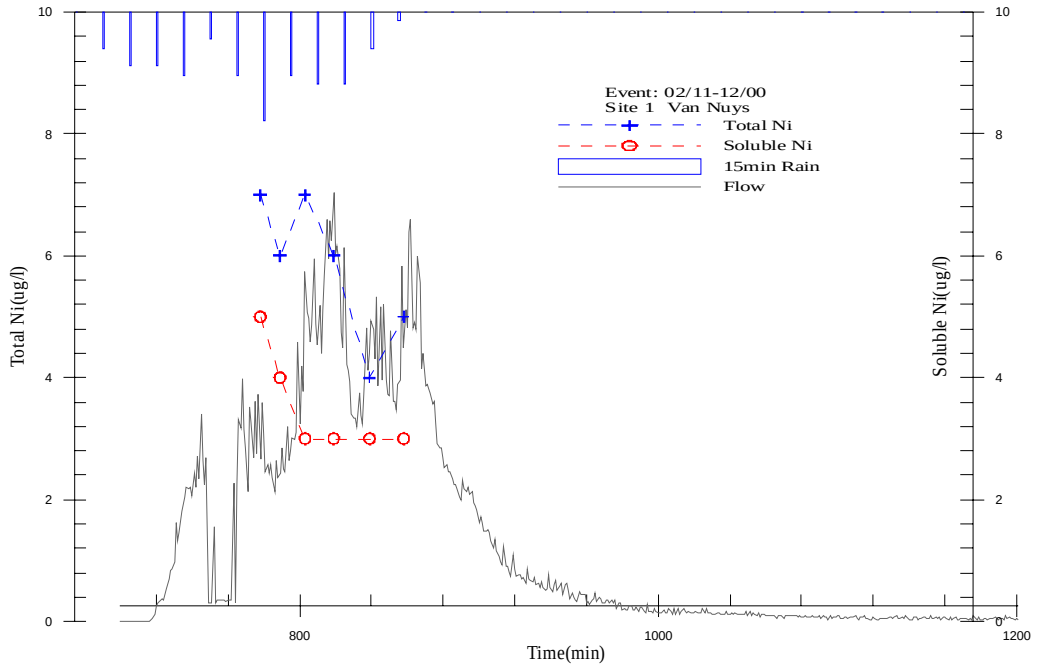


Figure I.1.1.4f (Y1-UCLA1-E5-6.) Polluto-graph for Total Ni / Dissolved Ni

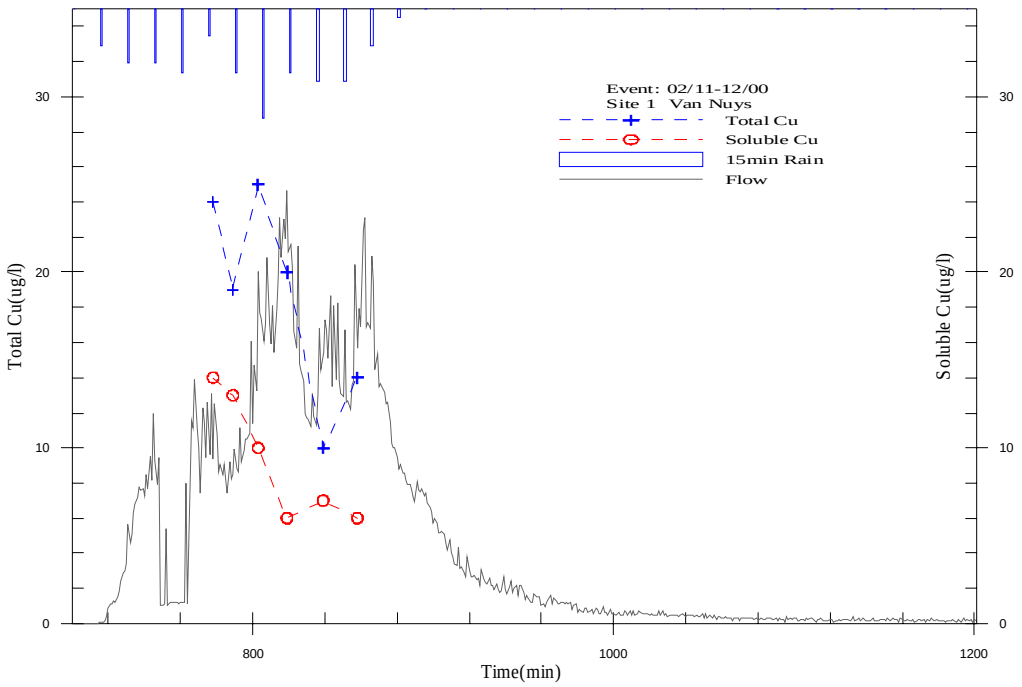


Figure I.1.1.4g (Y1-UCLA1-E5-7.) Polluto-graph for Total Cu / Dissolved Cu

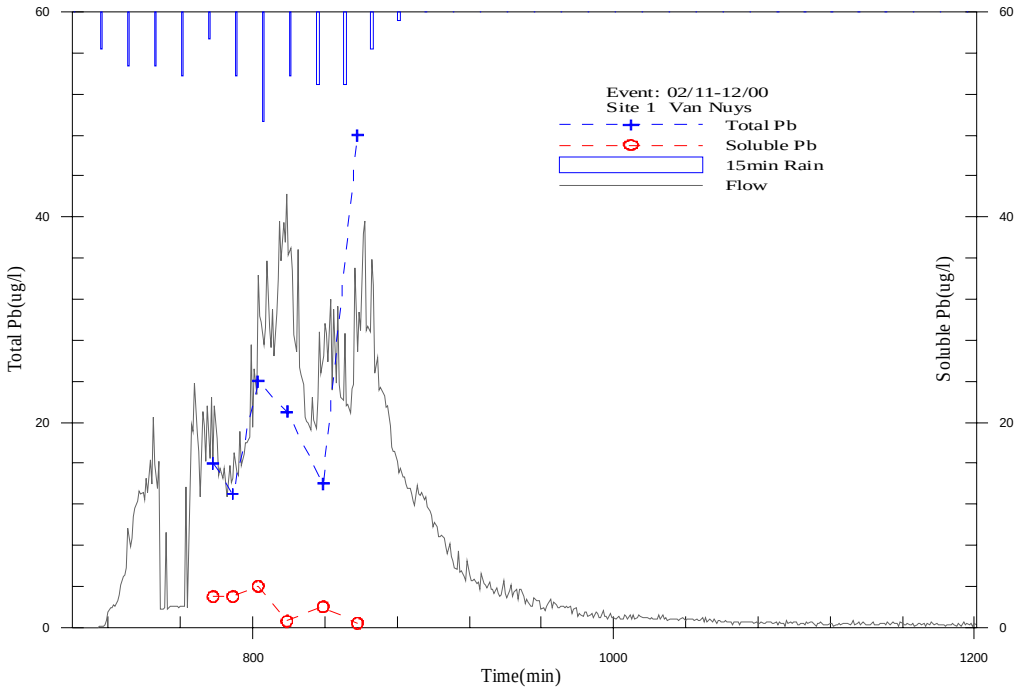


Figure I.1.1.4h (Y1-UCLA1-E5-8.) Polluto-graph for Total Pb / Dissolved Pb

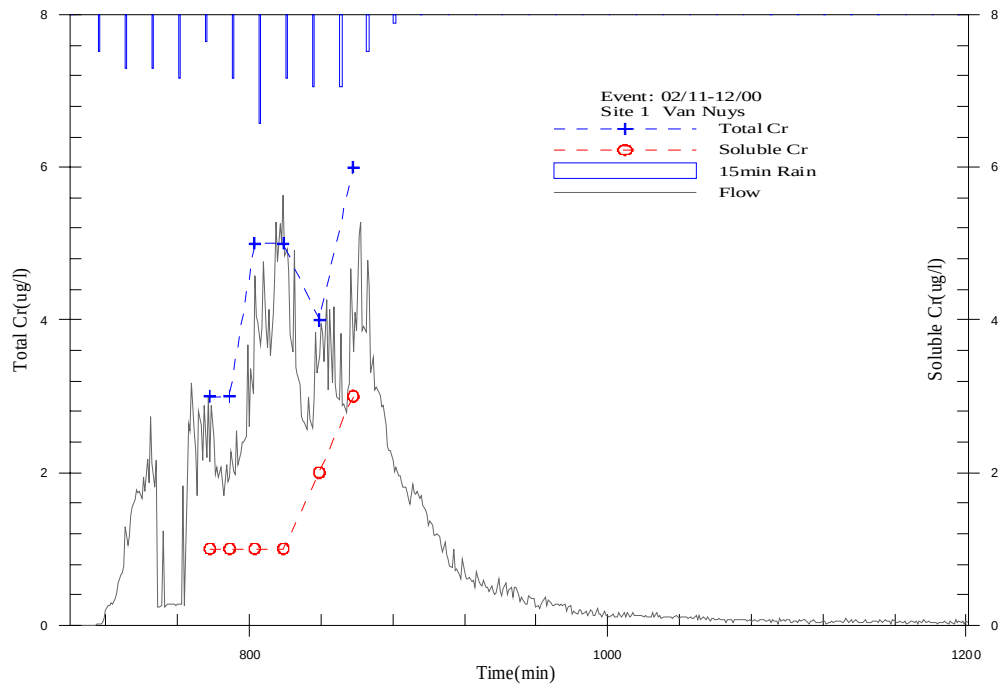


Figure I.1.1.4i (Y1-UCLA1-E5-9.) Polluto-graph for Total Cr / Dissolved Cr

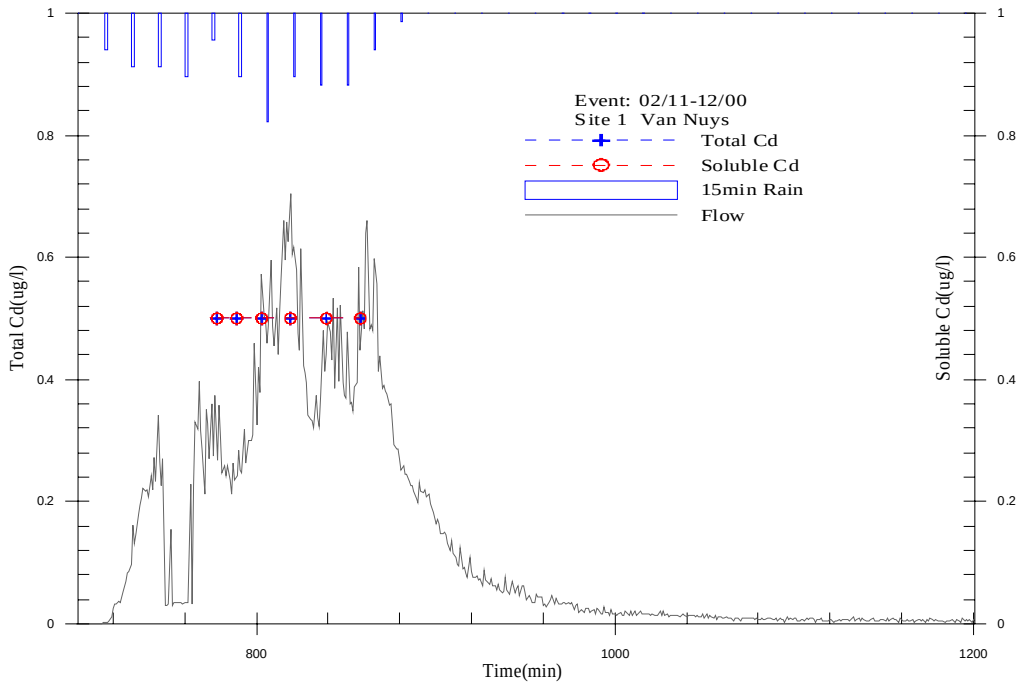


Figure I.1.1.4j (Y1-UCLA1-E5-10.) Polluto-graph for Total Cd / Dissolved Cd

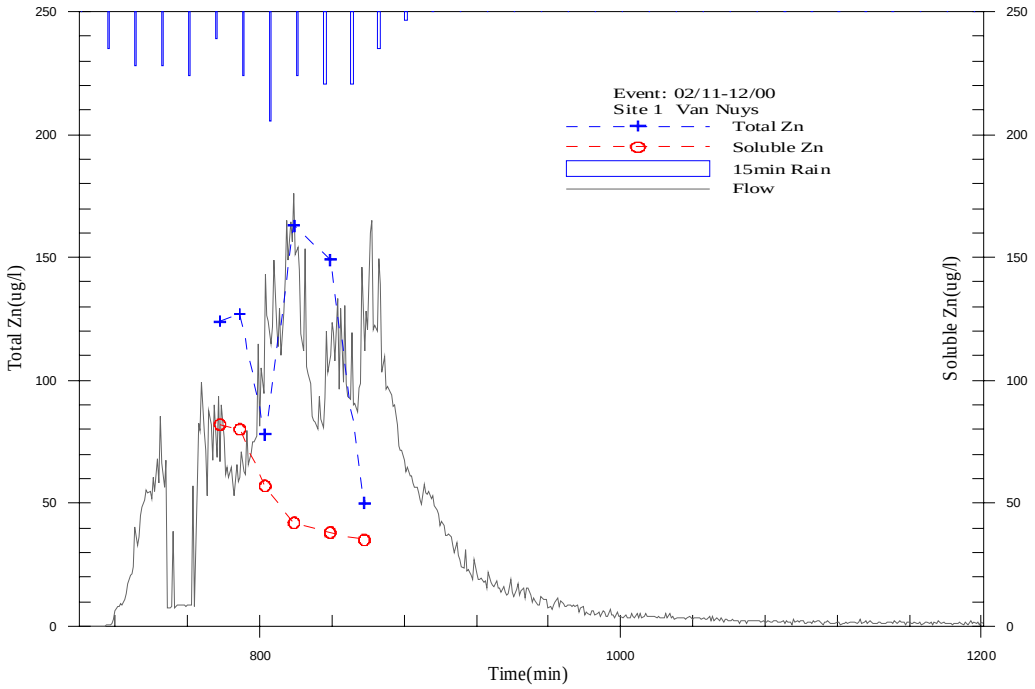


Figure I.1.1.4k (Y1-UCLA1-E5-11.) Polluto-graph for Total Zn / Dissolved Zn

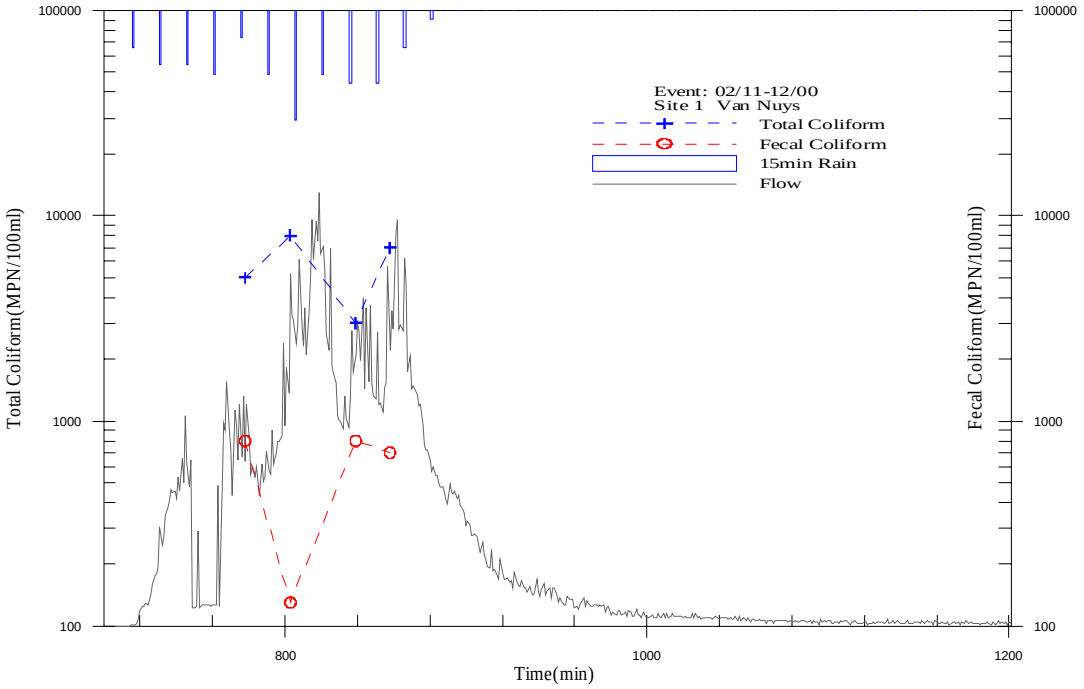


Figure I.1.1.4l (Y1-UCLA1-E5-12.) Polluto-graph for Total Coliform / Fecal Coliform

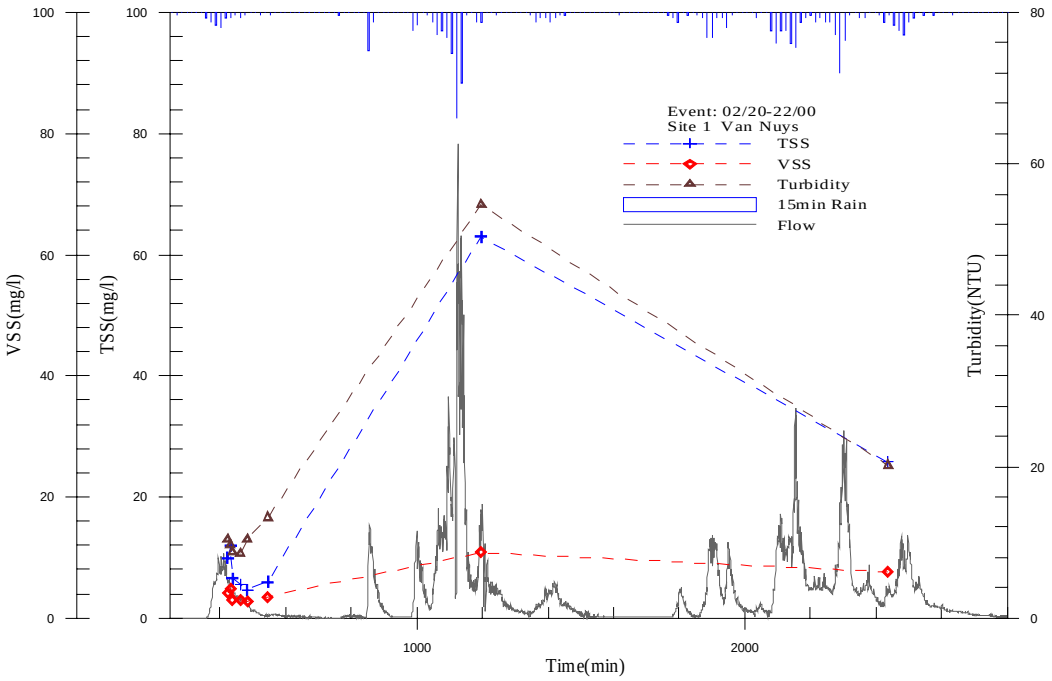


Figure I.1.1.5a (Y1-UCLA1-E6-1.) Polluto-graph for TSS, VSS and Turbidity

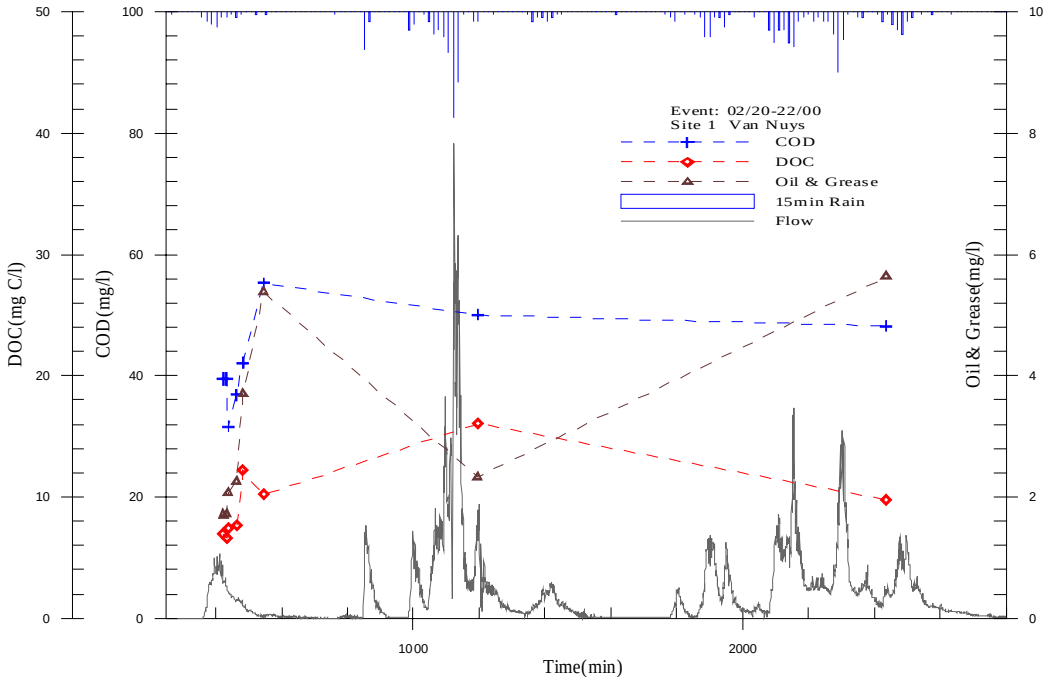


Figure I.1.1.5b (Y1-UCLA1-E6-2.) Polluto-graph for DOC, COD and Oil & Grease

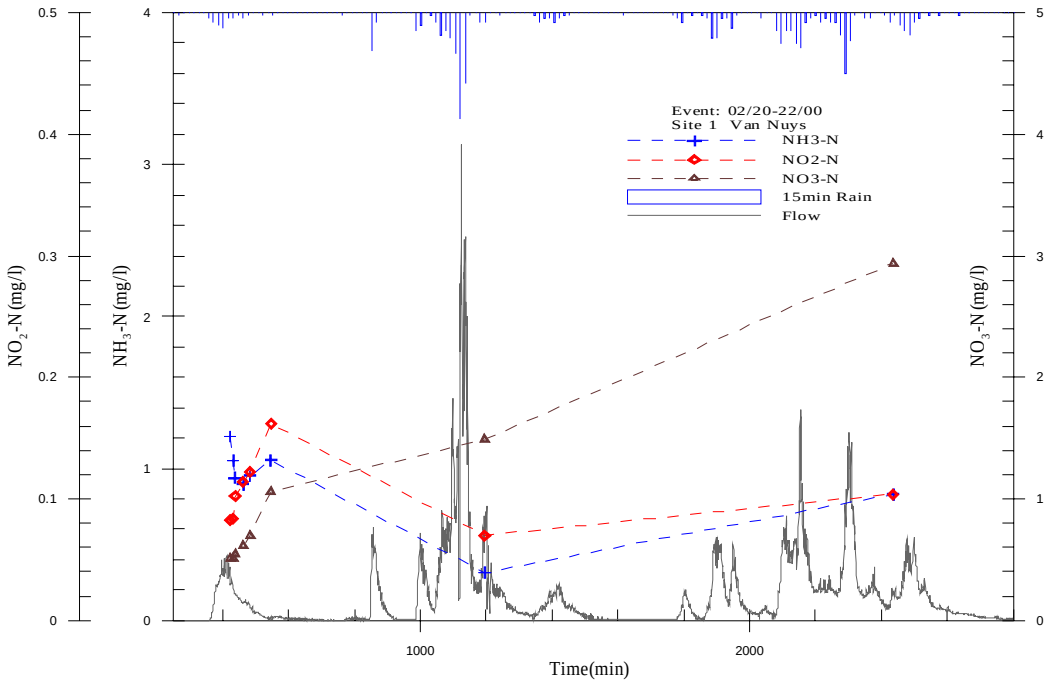


Figure I.1.1.5c (Y1-UCLA1-E6-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

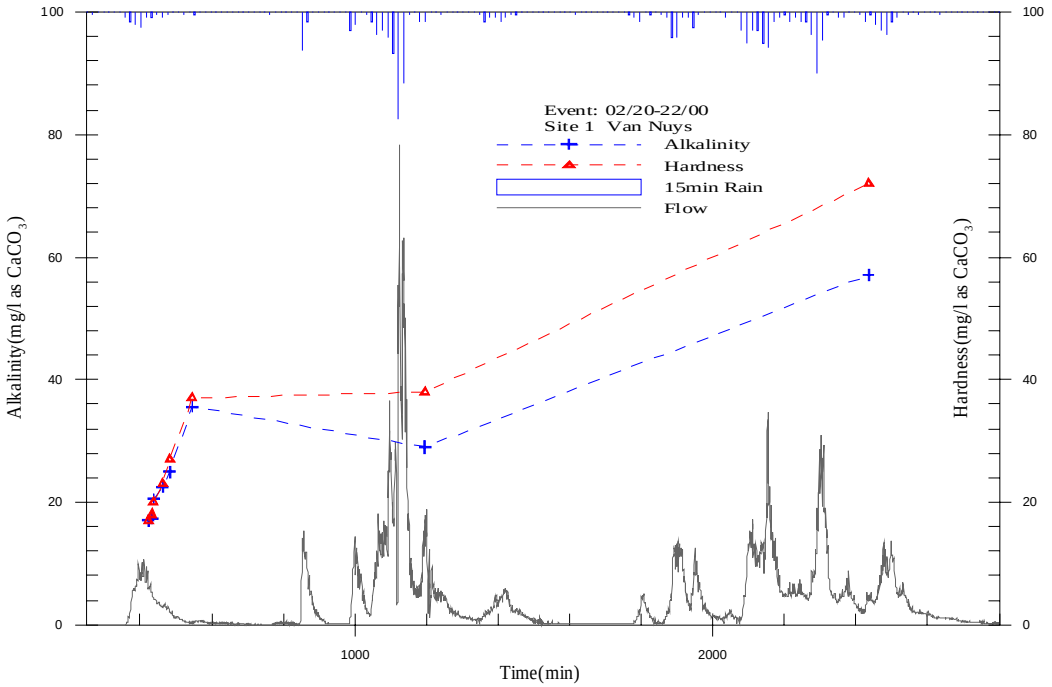


Figure I.1.1.5d (Y1-UCLA1-E6-4.) Polluto-graph for Alkalinity and Hardness

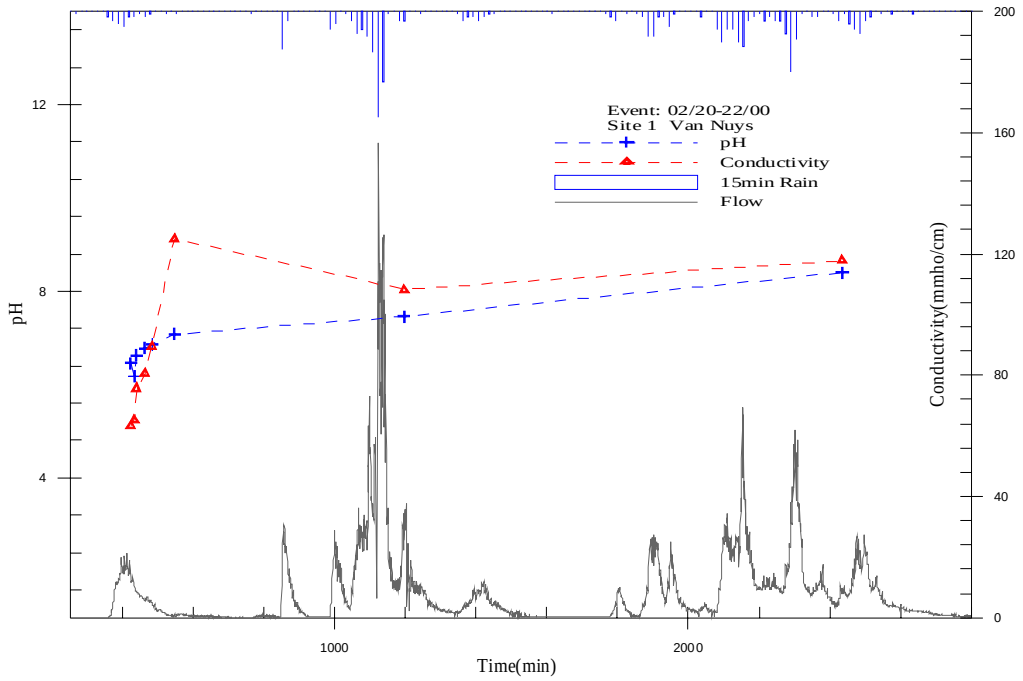


Figure I.1.1.5e (Y1-UCLA1-E6-5.) Polluto-graph for pH and Conductivity

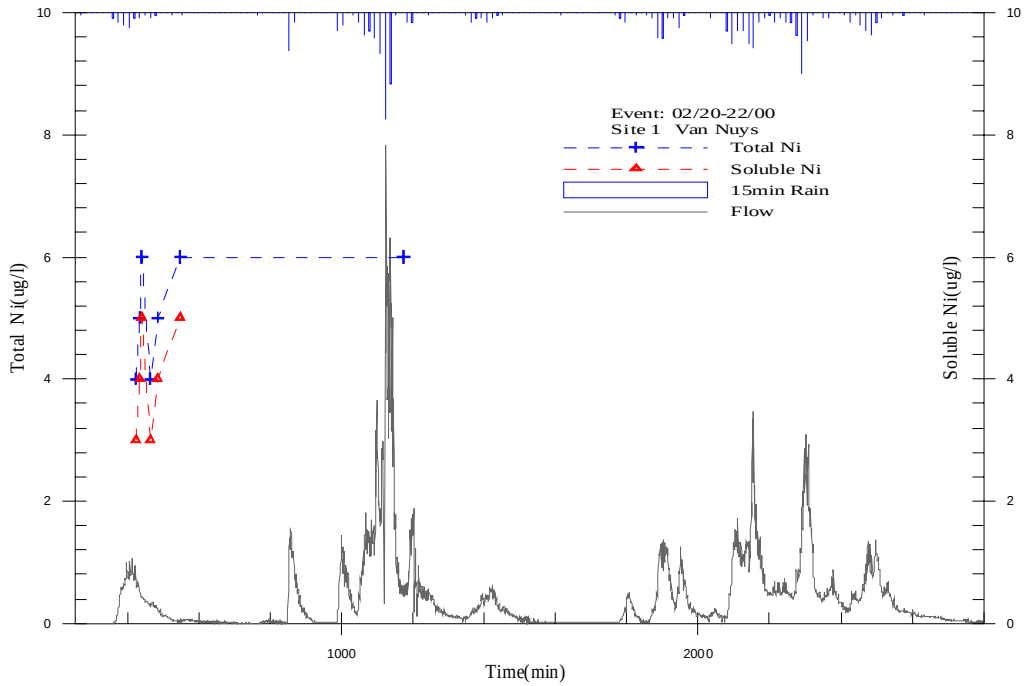


Figure I.1.1.5f (Y1-UCLA1-E6-6.) Polluto-graph for Total Ni / Dissolved Ni

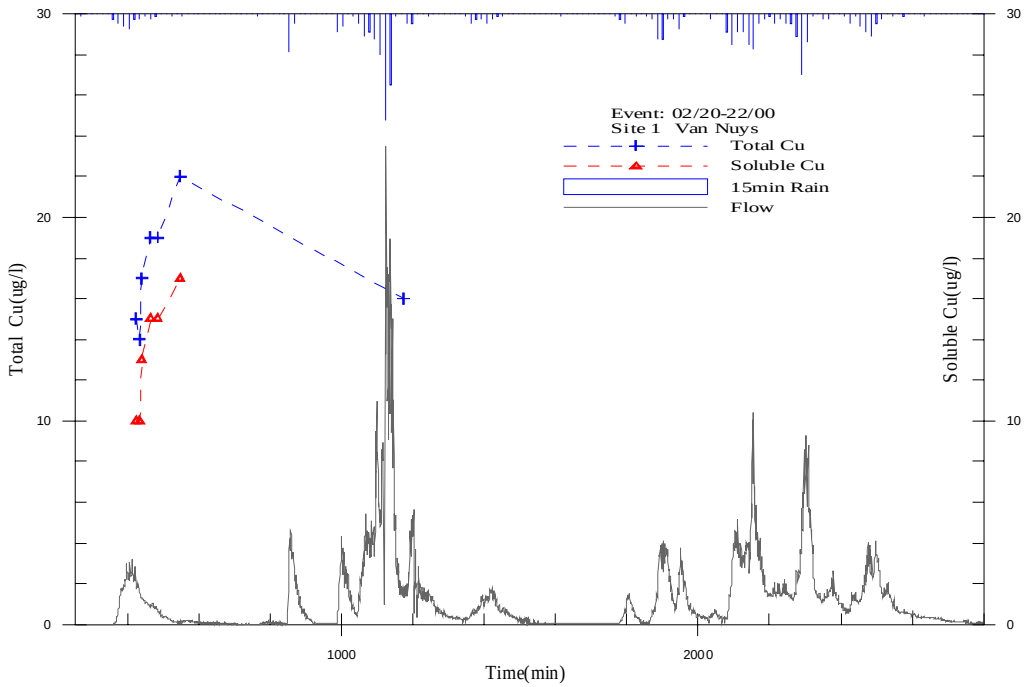


Figure I.1.1.5g (Y1-UCLA1-E6-7.) Polluto-graph for Total Cu / Dissolved Cu

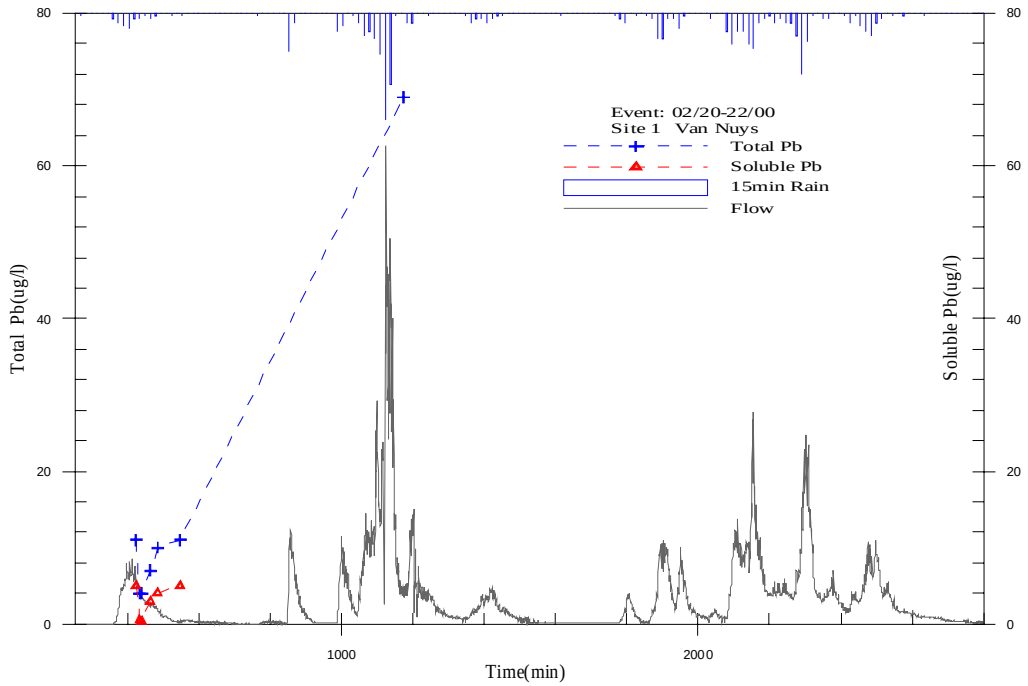


Figure I.1.1.5h (Y1-UCLA1-E6-8.) Polluto-graph for Total Pb / Dissolved Pb

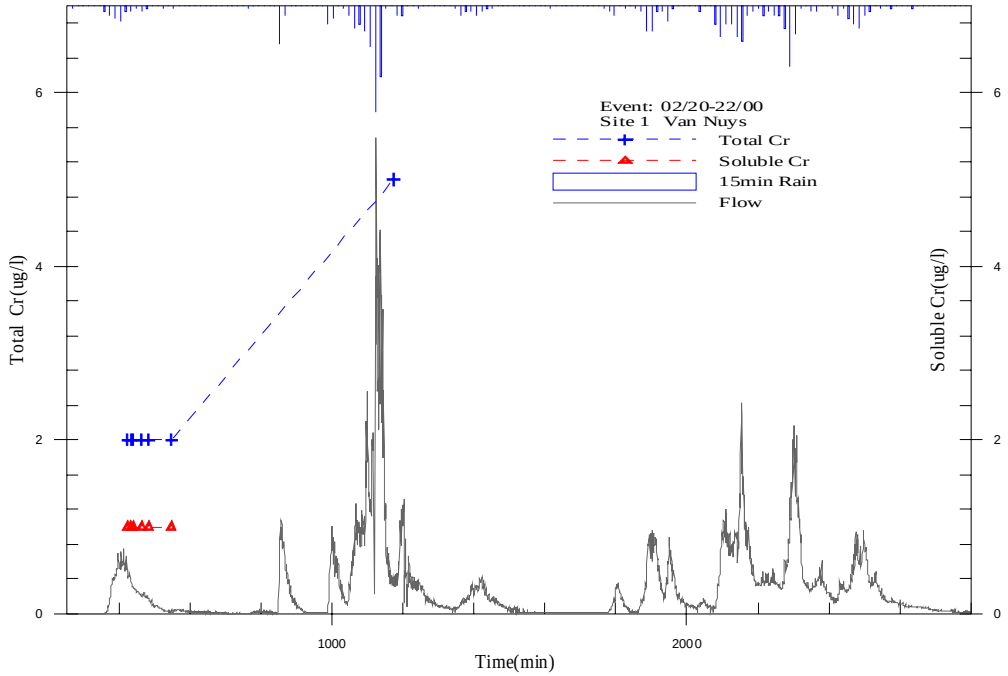


Figure I.1.1.5i (Y1-UCLA1-E6-9.) Polluto-graph for Total Cr / Dissolved Cr

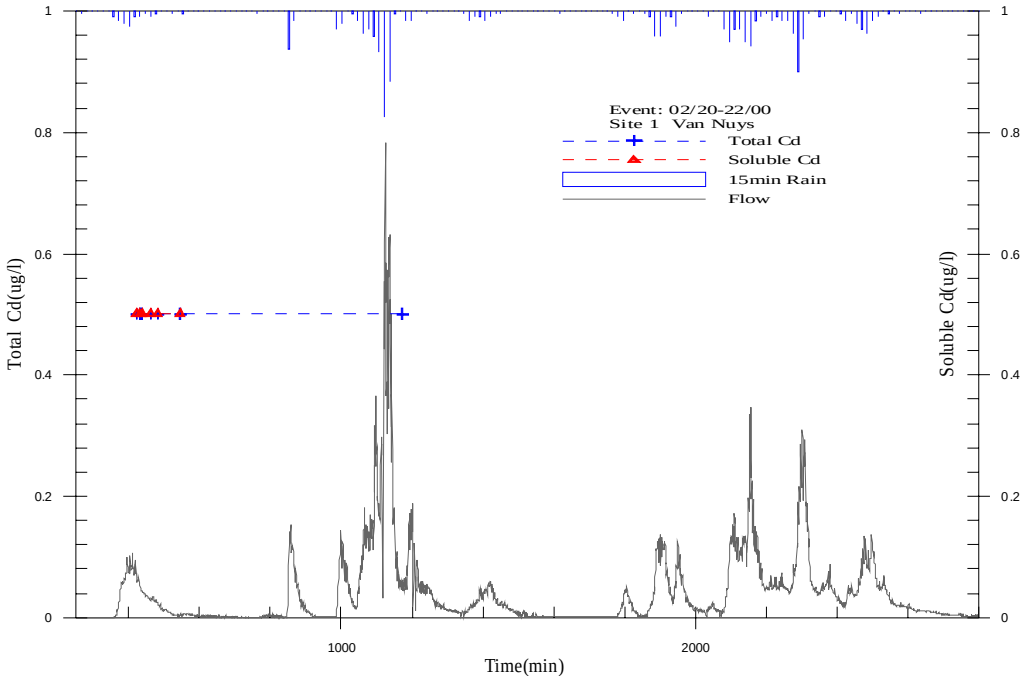


Figure I.1.1.5j (Y1-UCLA1-E6-10.) Polluto-graph for Total Cd / Dissolved Cd

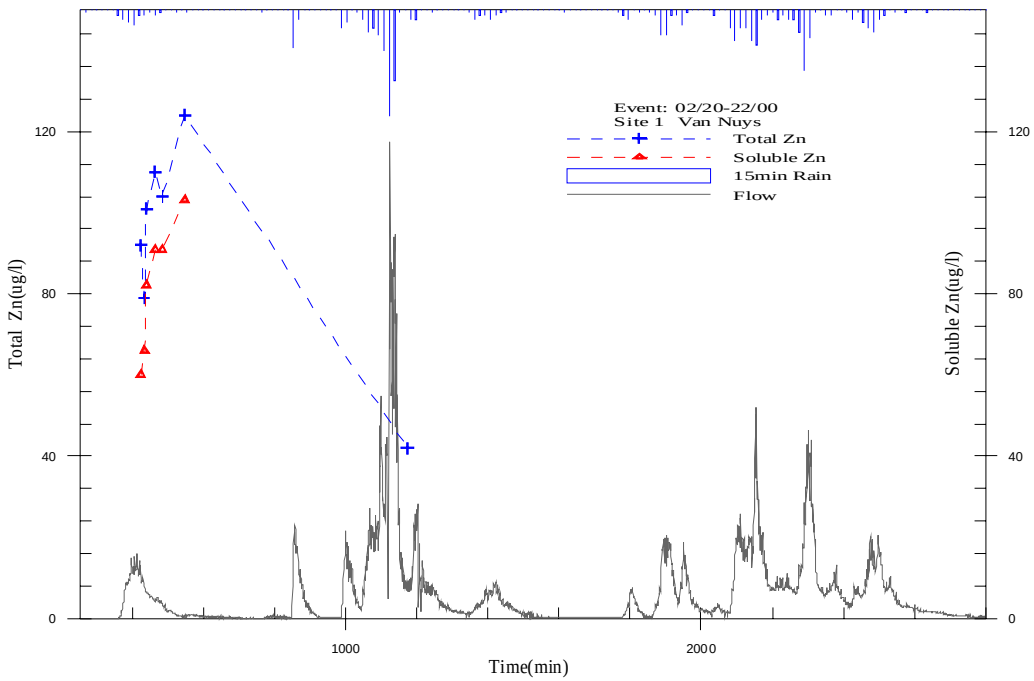


Figure I.1.1.5k (Y1-UCLA1-E6-11.) Polluto-graph for Total Zn / Dissolved Zn

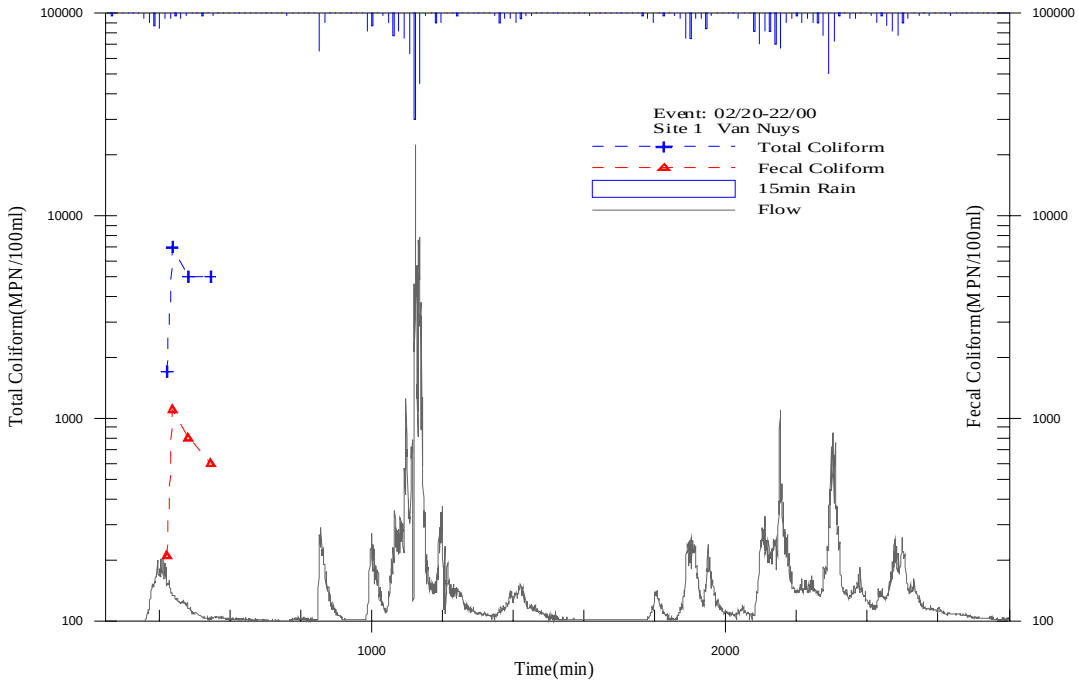


Figure I.1.1.5l (Y1-UCLA1-E6-12.) Polluto-graph for Total Coliform / Fecal Coliform

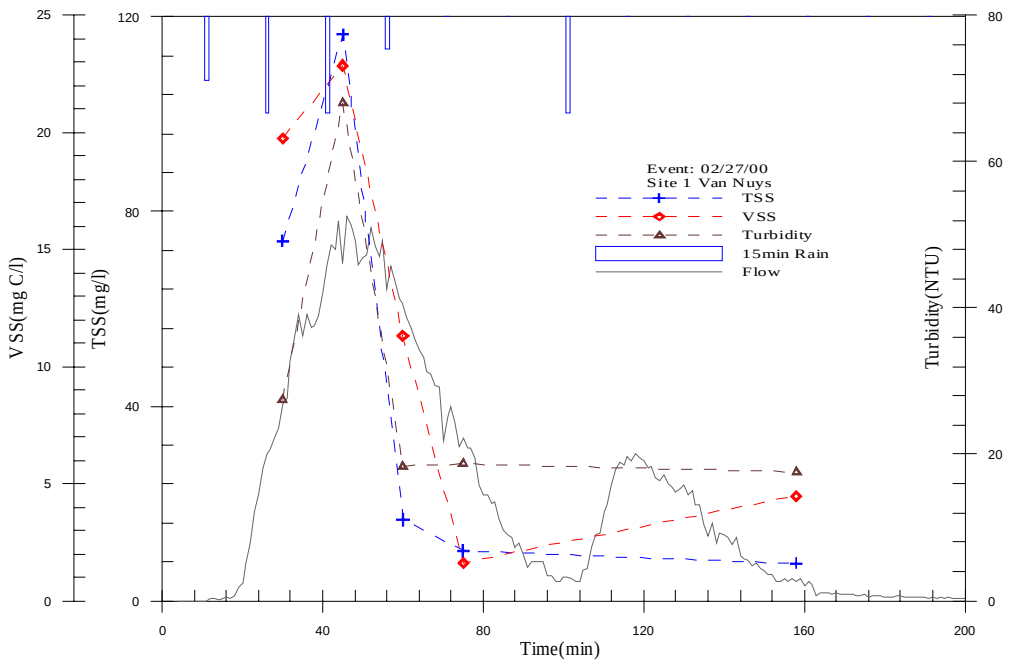


Figure I.1.1.6a (Y1-UCLA1-E7-1.) Polluto-graph for TSS, VSS and Turbidity

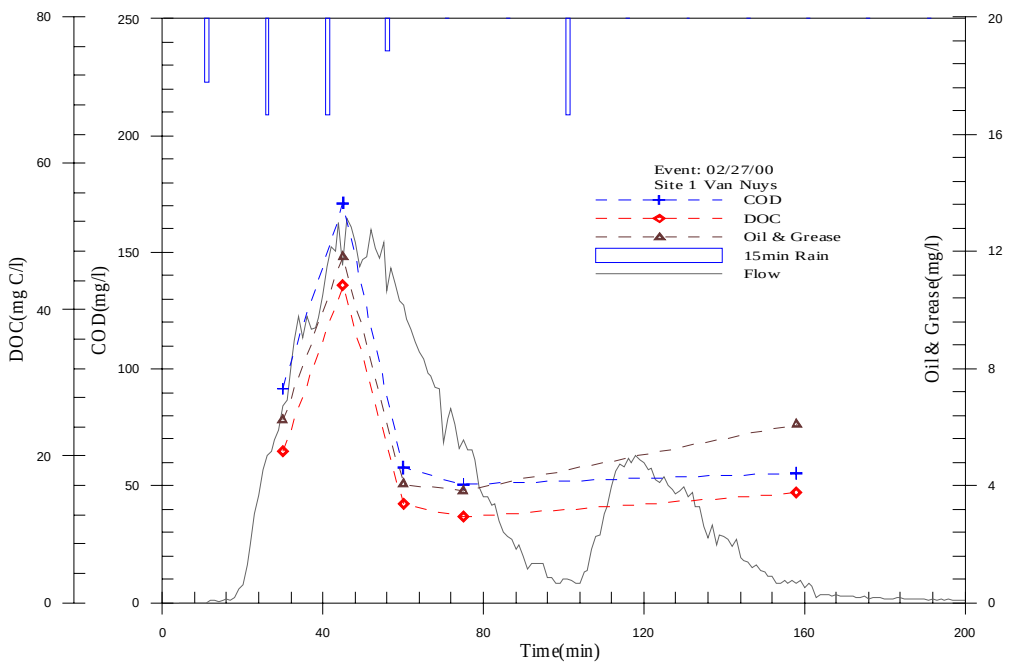


Figure I.1.1.6b (Y1-UCLA1-E7-2.) Polluto-graph for DOC, COD and Oil & Grease

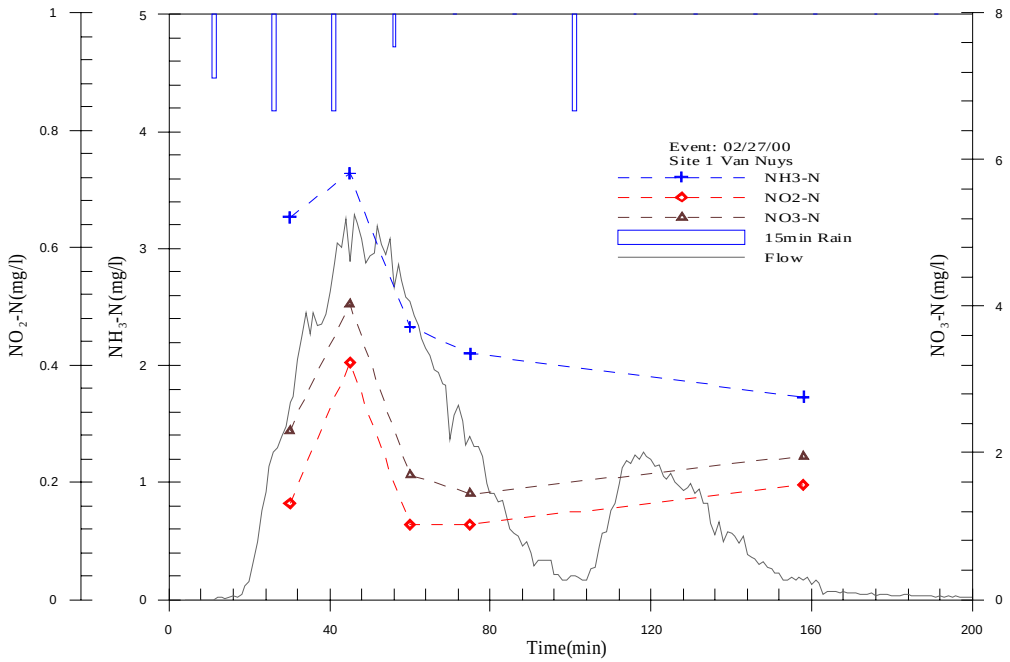


Figure I.1.1.6c (Y1-UCLA1-E7-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

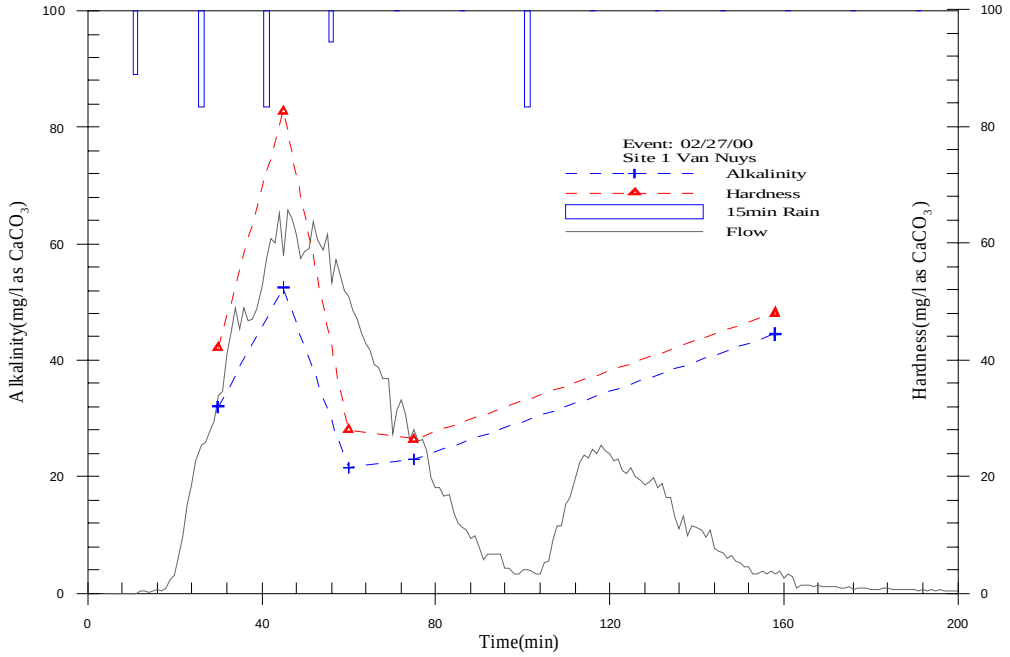


Figure I.1.1.6d (Y1-UCLA1-E7-4.) Polluto-graph for Alkalinity and Hardness

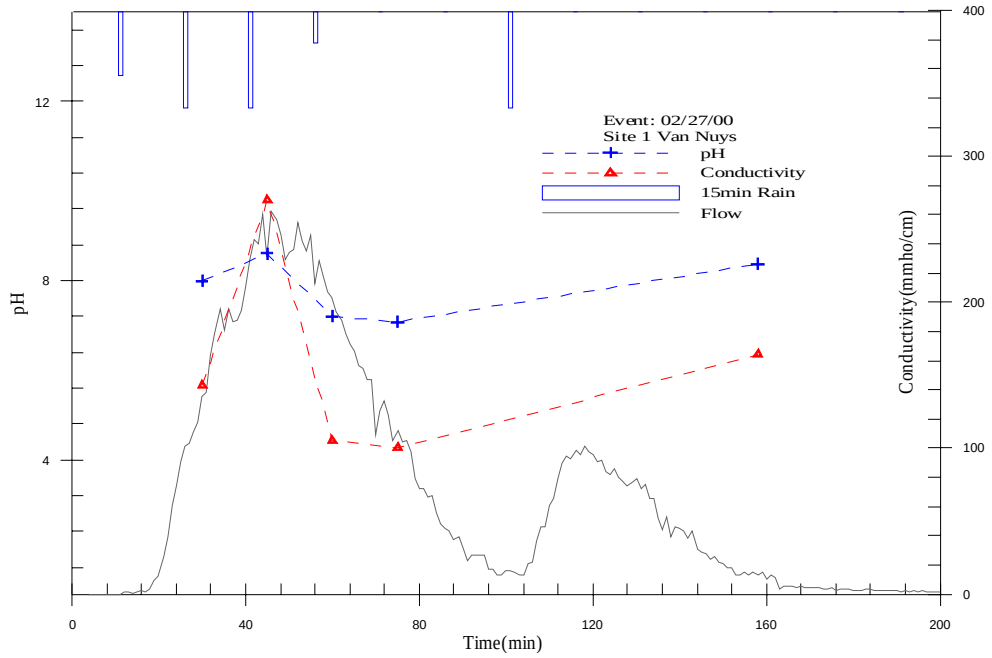


Figure I.1.1.6e (Y1-UCLA1-E7-5.) Polluto-graph for pH and Conductivity

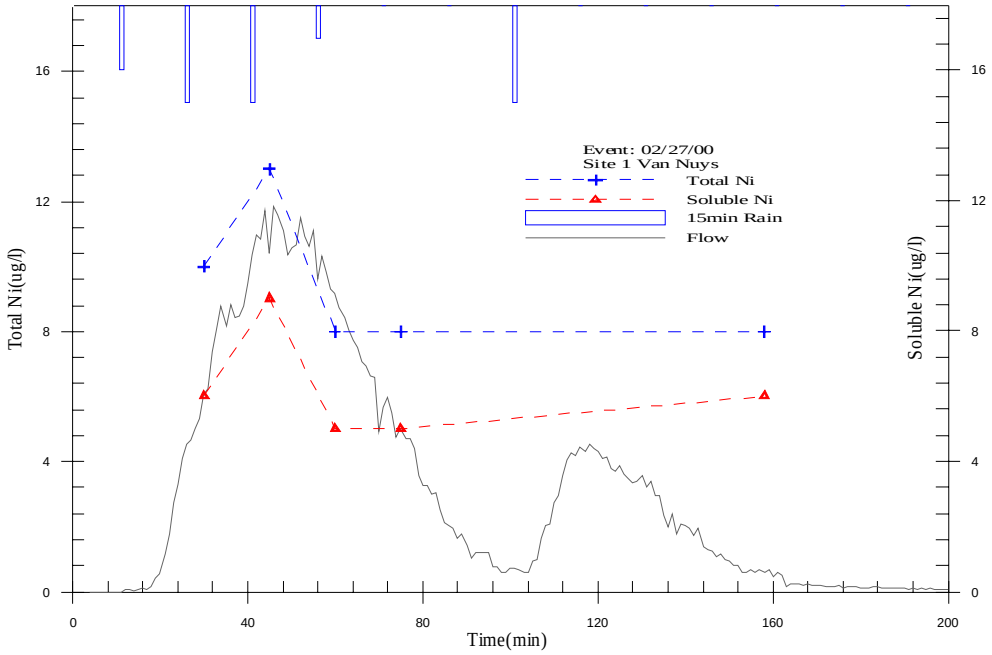


Figure I.1.1.6f (Y1-UCLA1-E7-6.) Polluto-graph for Total Ni / Dissolved Ni

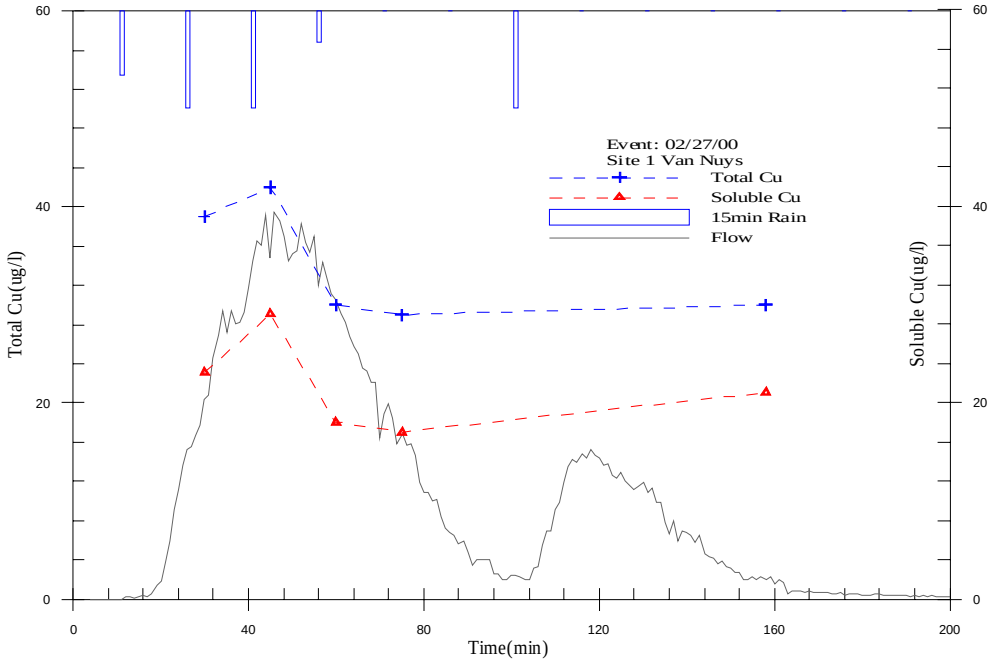


Figure I.1.1.6g (Y1-UCLA1-E7-7.) Polluto-graph for Total Cu / Dissolved Cu

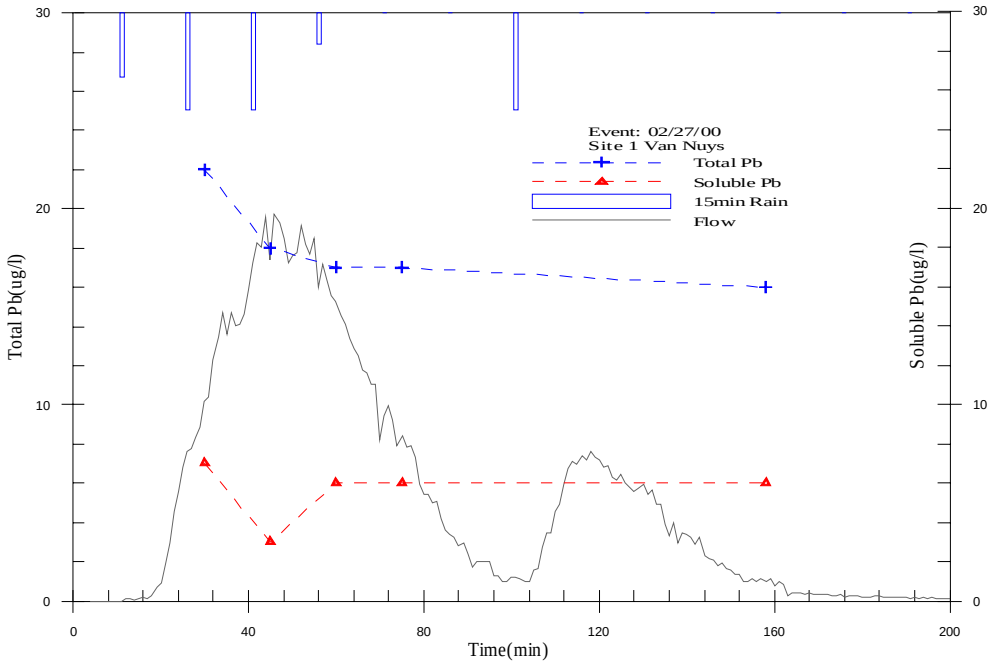


Figure I.1.1.6h (Y1-UCLA1-E7-8.) Polluto-graph for Total Pb / Dissolved Pb

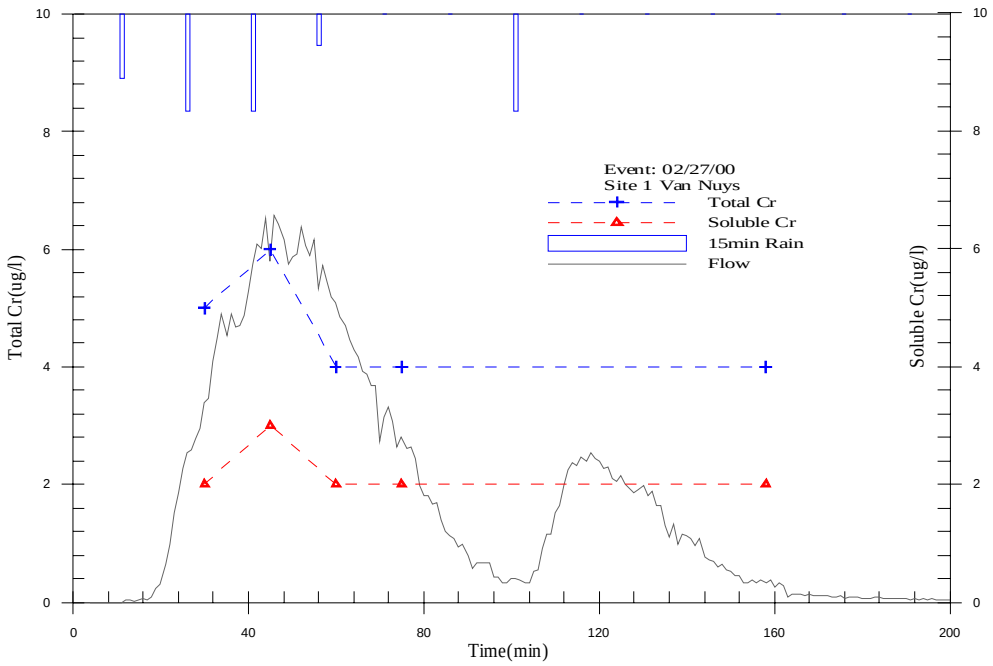


Figure I.1.1.6i (Y1-UCLA1-E7-9.) Polluto-graph for Total Cr / Dissolved Cr

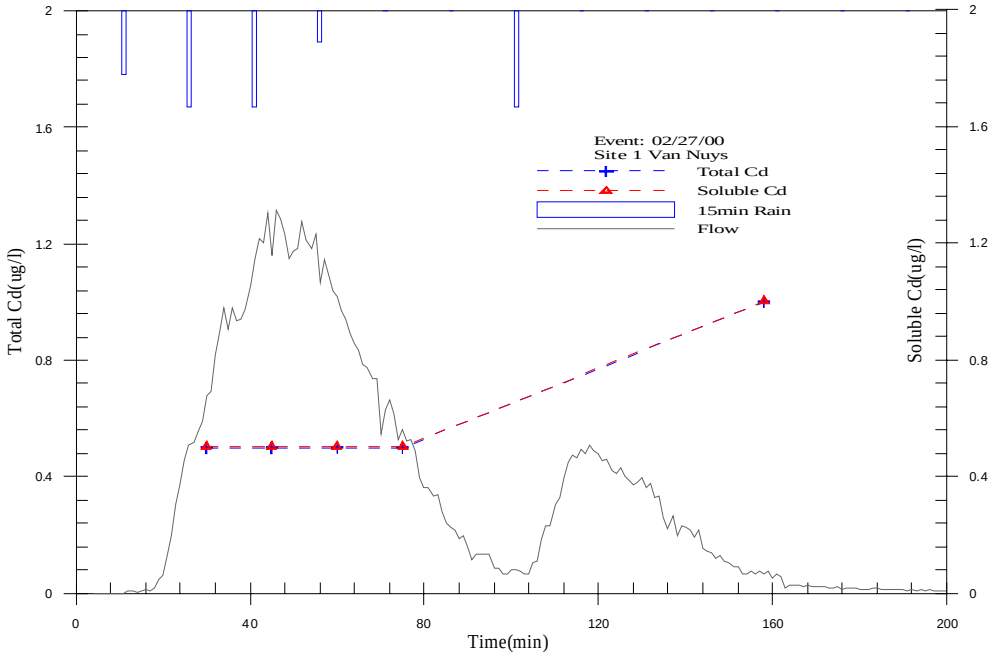


Figure I.1.1.6j (Y1-UCLA1-E7-10.) Polluto-graph for Total Cd / Dissolved Cd

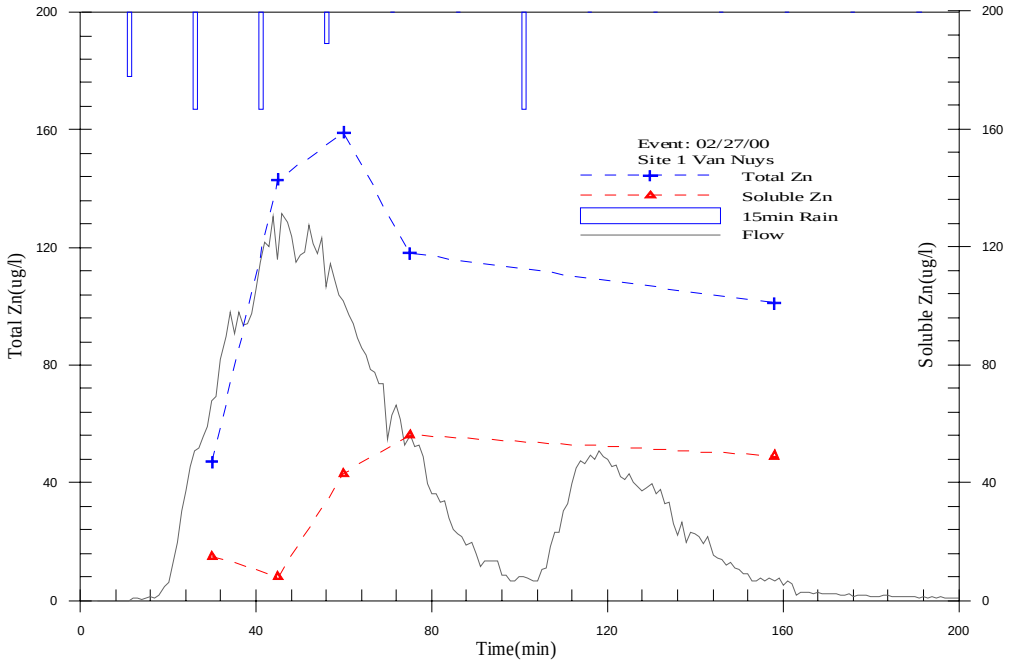


Figure I.1.1.6k (Y1-UCLA1-E7-11.) Polluto-graph for Total Zn / Dissolved Zn

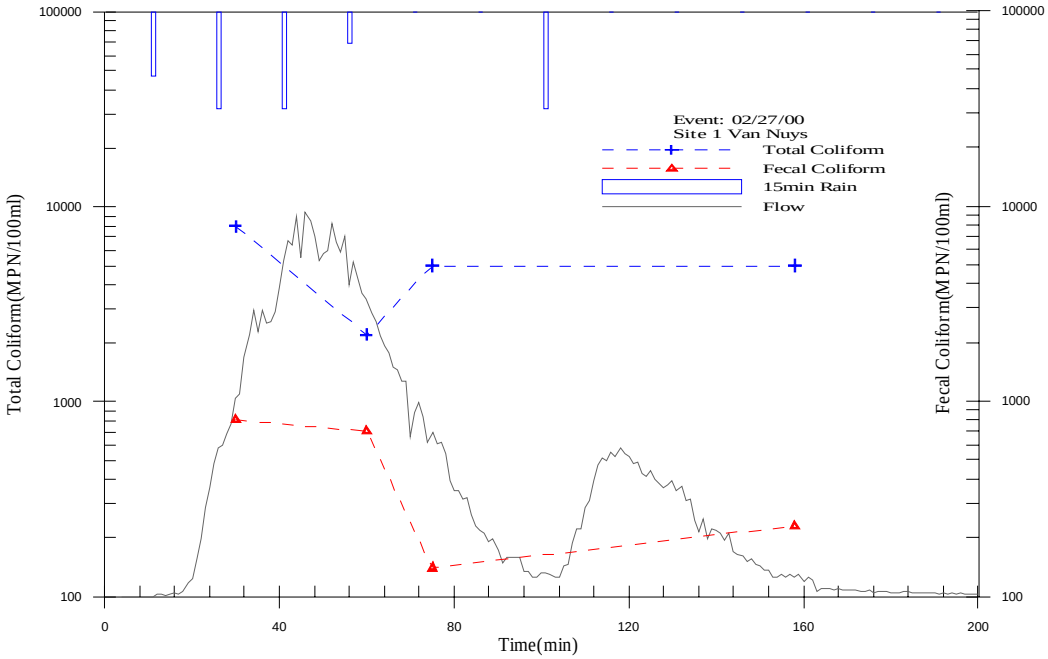


Figure I.1.1.6l (Y1-UCLA1-E7-12.) Polluto-graph for Total Coliform / Fecal Coliform

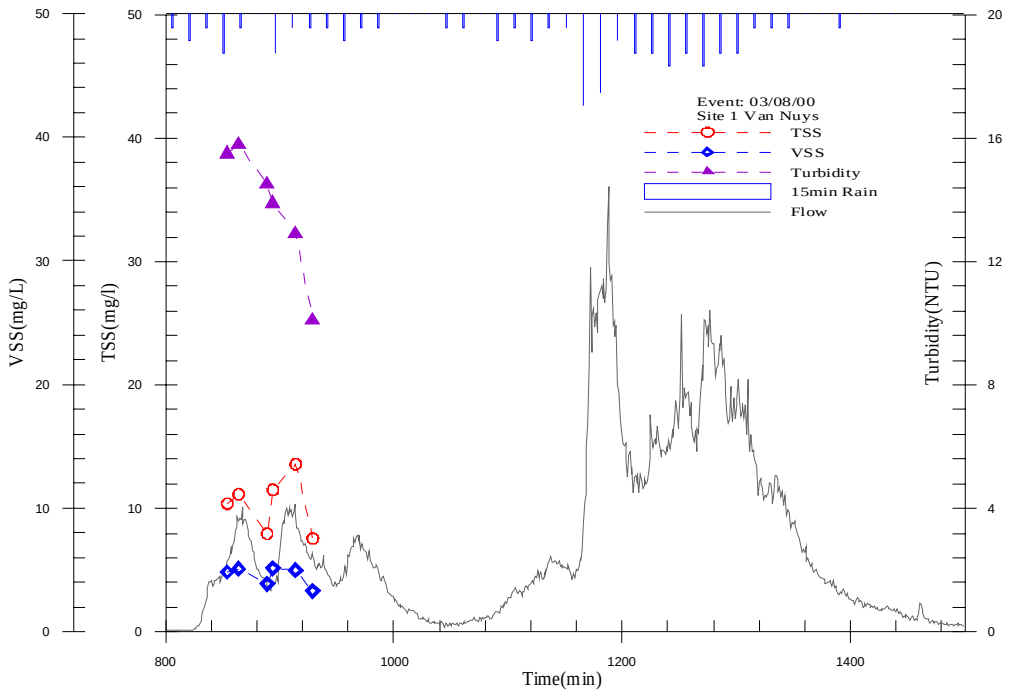


Figure I.1.1.7a (Y1-UCLA1-E9-1.) Polluto-graph for TSS, VSS and Turbidity

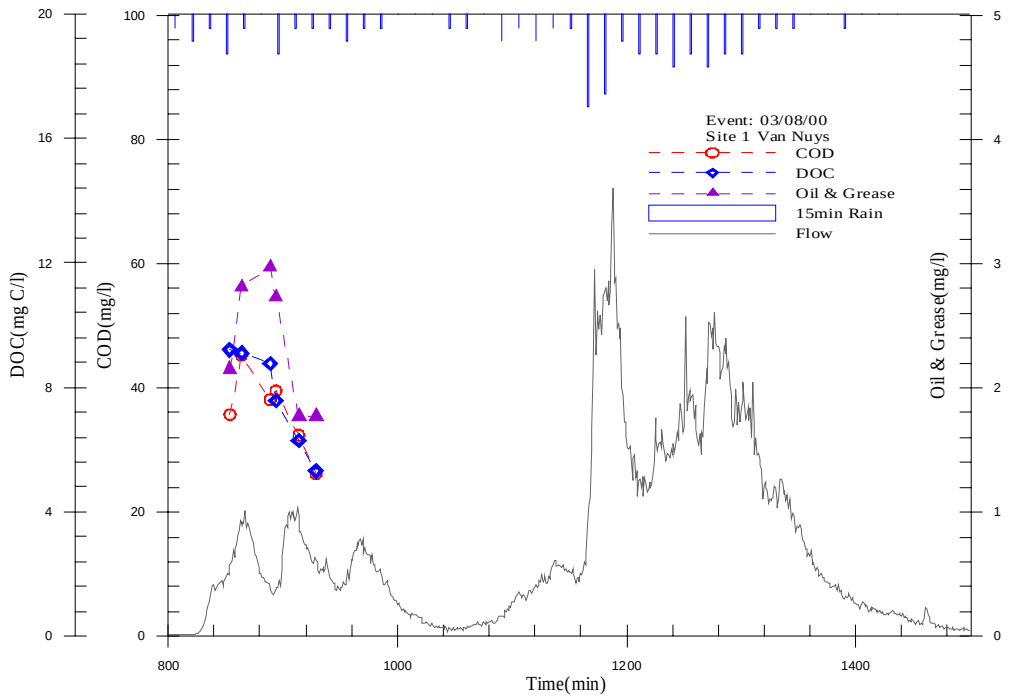


Figure I.1.1.7b (Y1-UCLA1-E9-2) Polluto-graph for DOC, COD and Oil & Grease

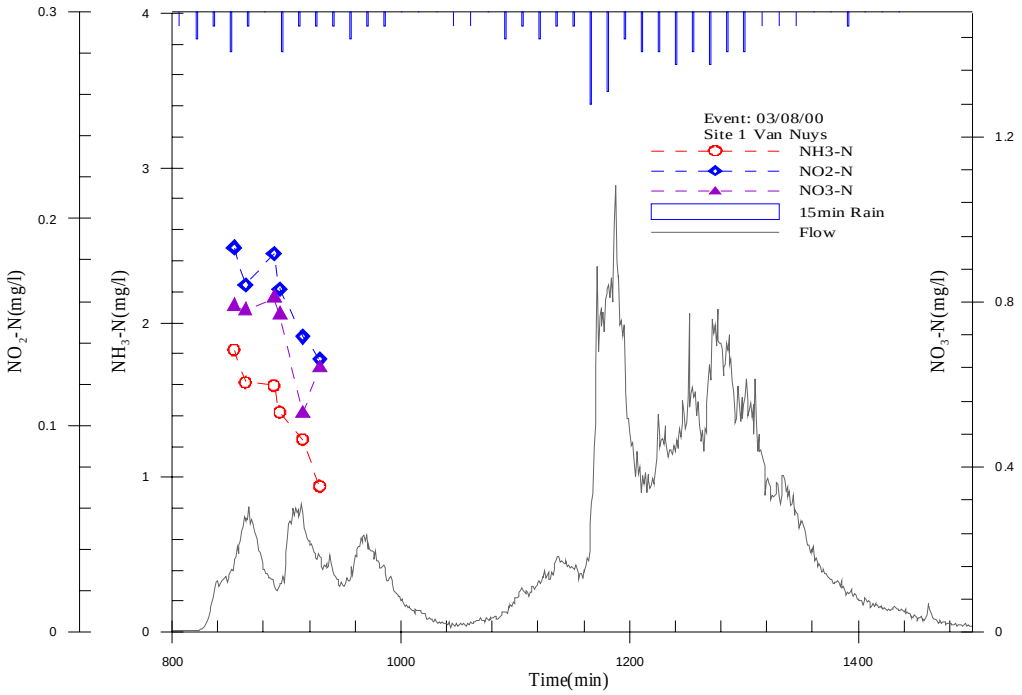


Figure I.1.1.7c (Y1-UCLA1-E9-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

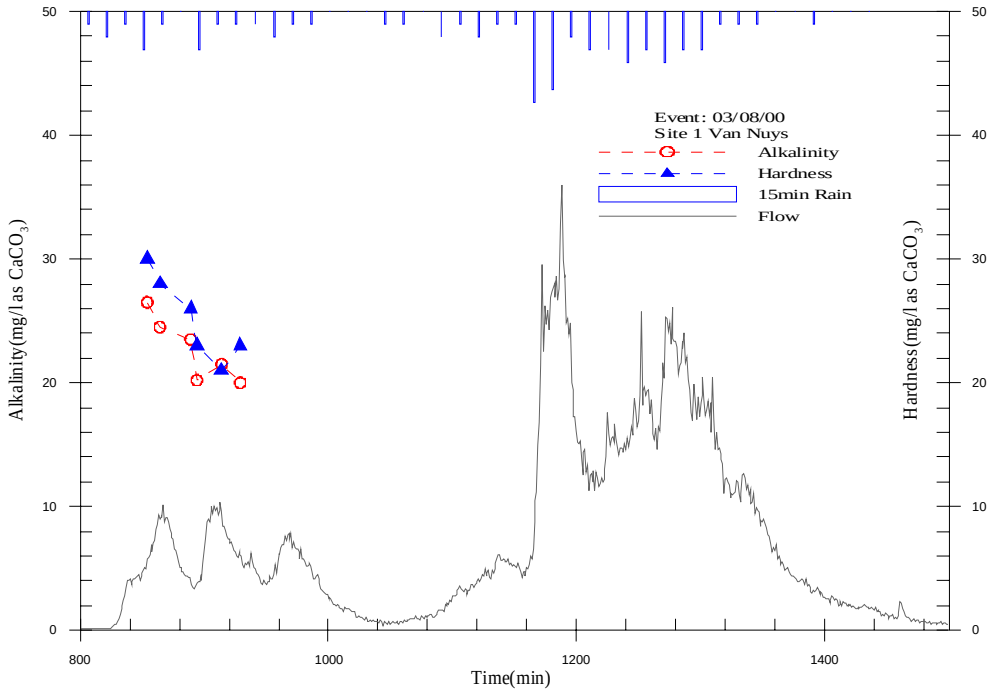


Figure I.1.1.7d (Y1-UCLA1-E9-4.) Polluto-graph for Alkalinity and Hardness

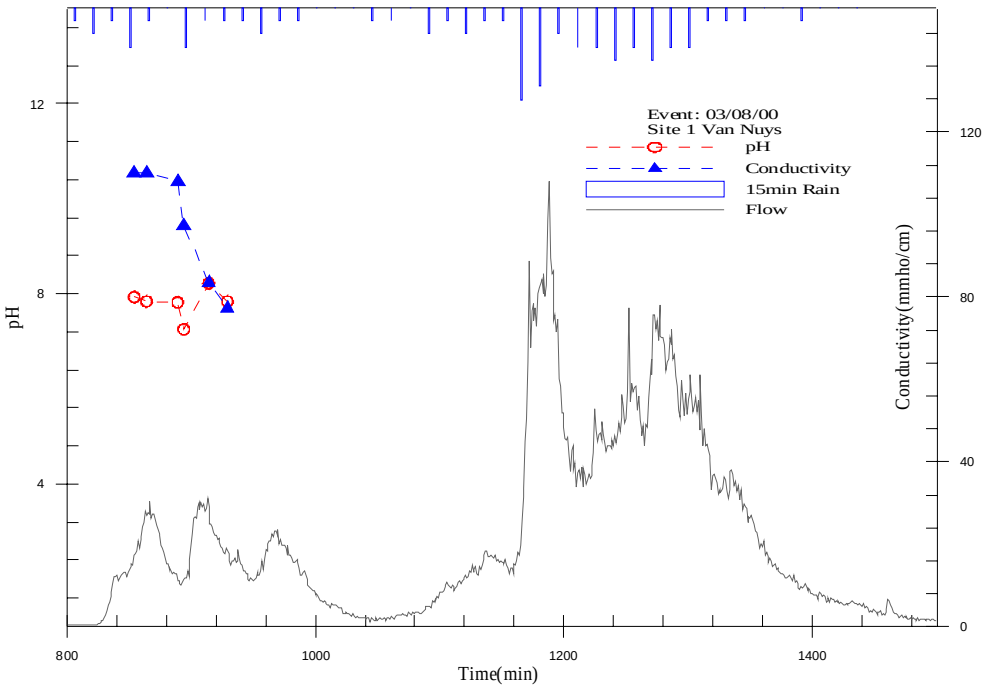


Figure I.1.1.7e (Y1-UCLA1-E9-5.) Polluto-graph for pH and Conductivity

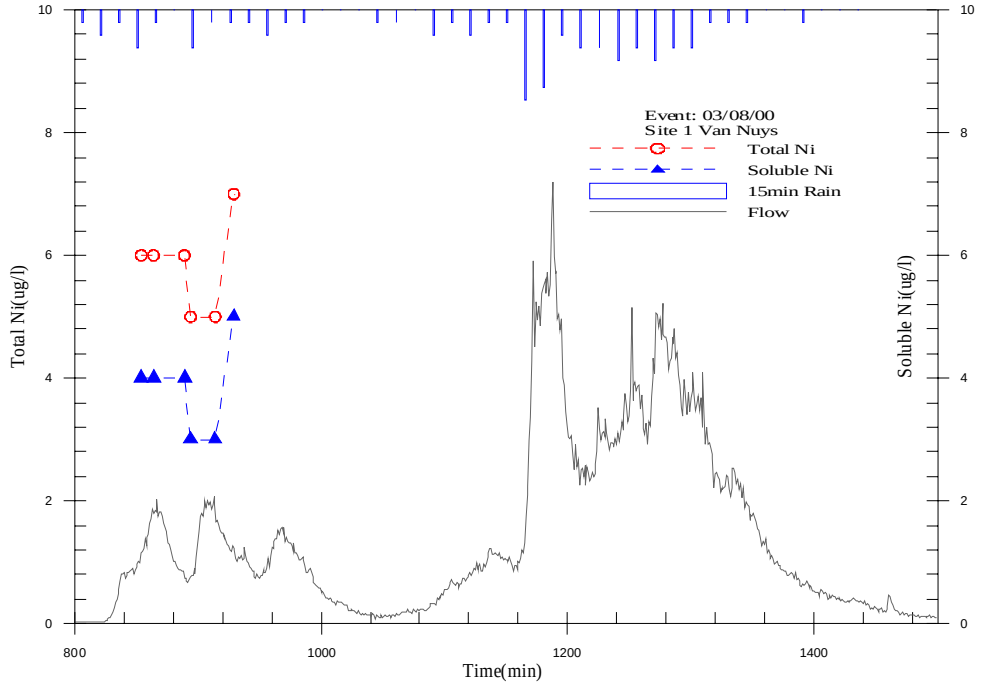


Figure I.1.1.7f (Y1-UCLA1-E9-6.) Polluto-graph for Total Ni / Dissolved Ni

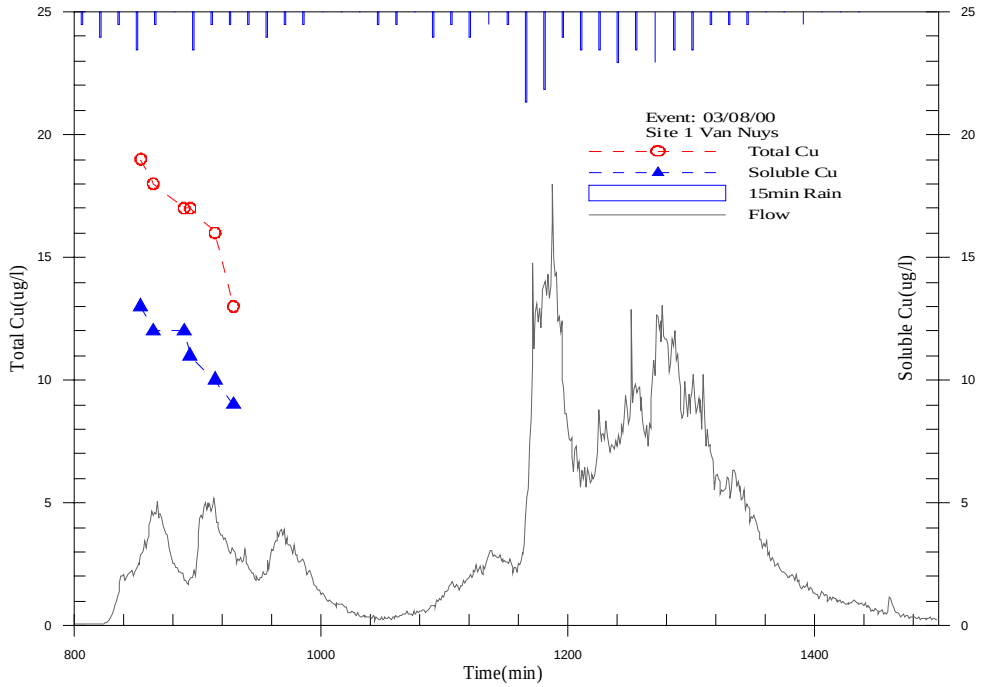


Figure I.1.1.7g (Y1-UCLA1-E9-7.) Polluto-graph for Total Cu / Dissolved Cu

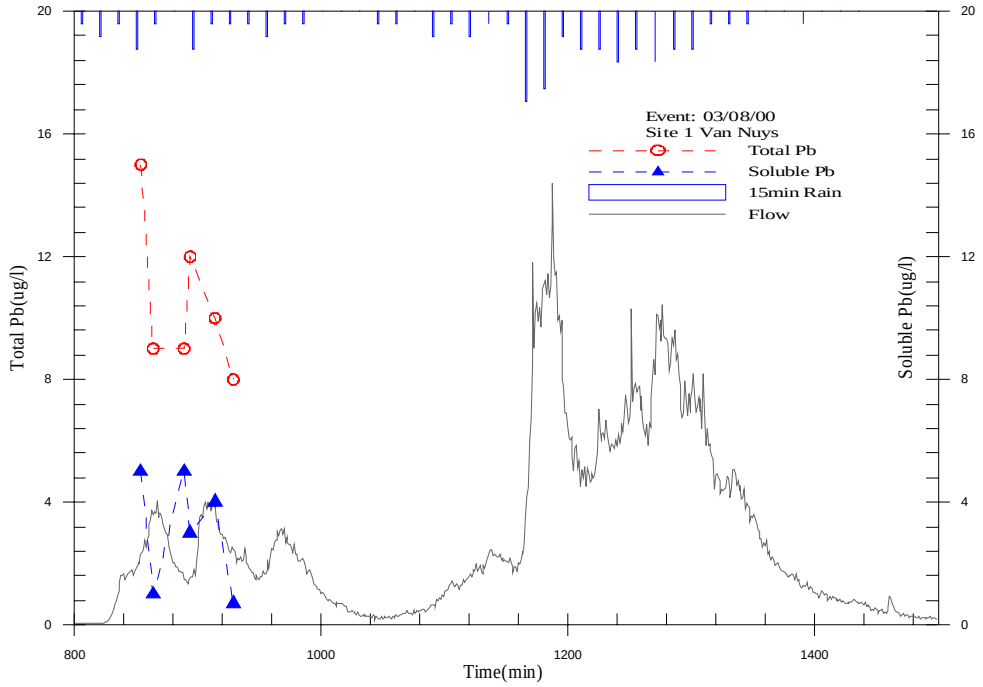


Figure I.1.1.7h (Y1-UCLA1-E9-8.) Polluto-graph for Total Pb / Dissolved Pb

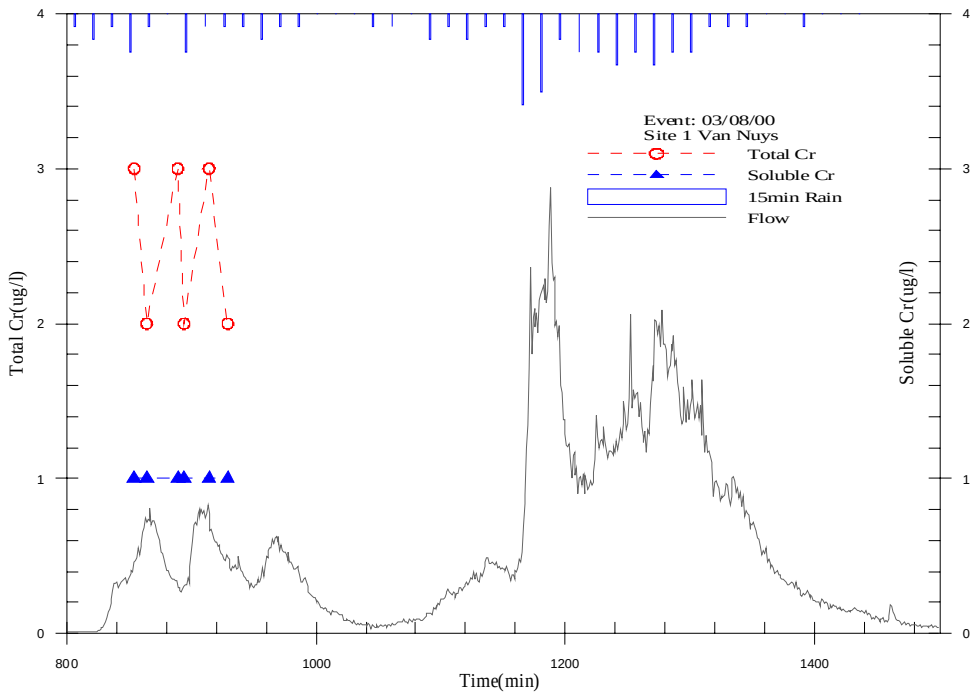


Figure I.1.1.7i (Y1-UCLA1-E9-9.) Polluto-graph for Total Cr / Dissolved Cr

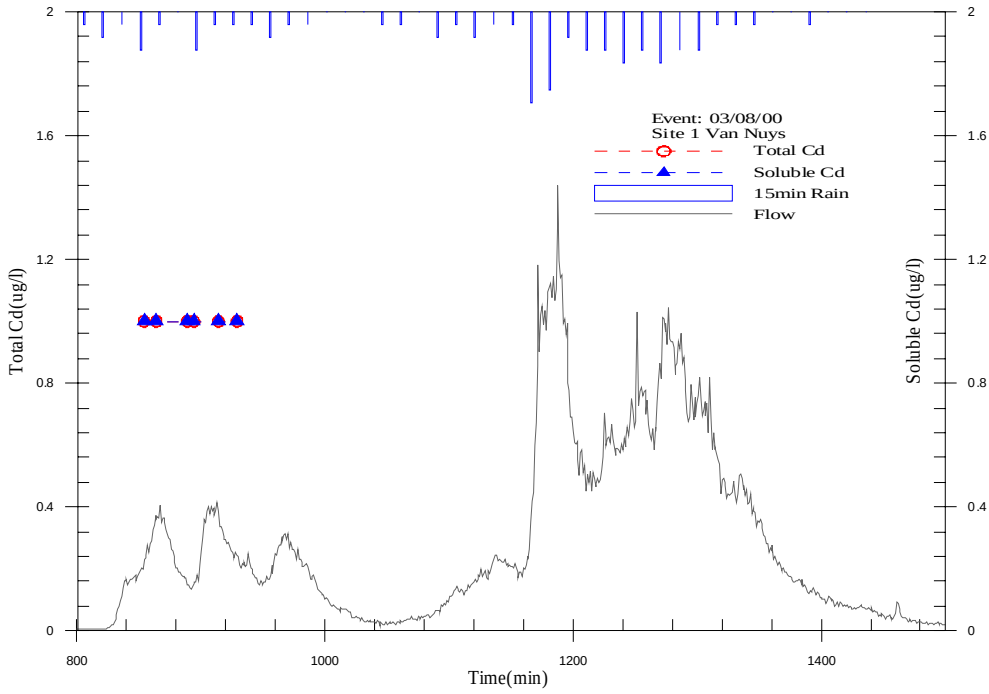


Figure I.1.1.7j (Y1-UCLA1-E9-10.) Polluto-graph for Total Cd / Dissolved Cd

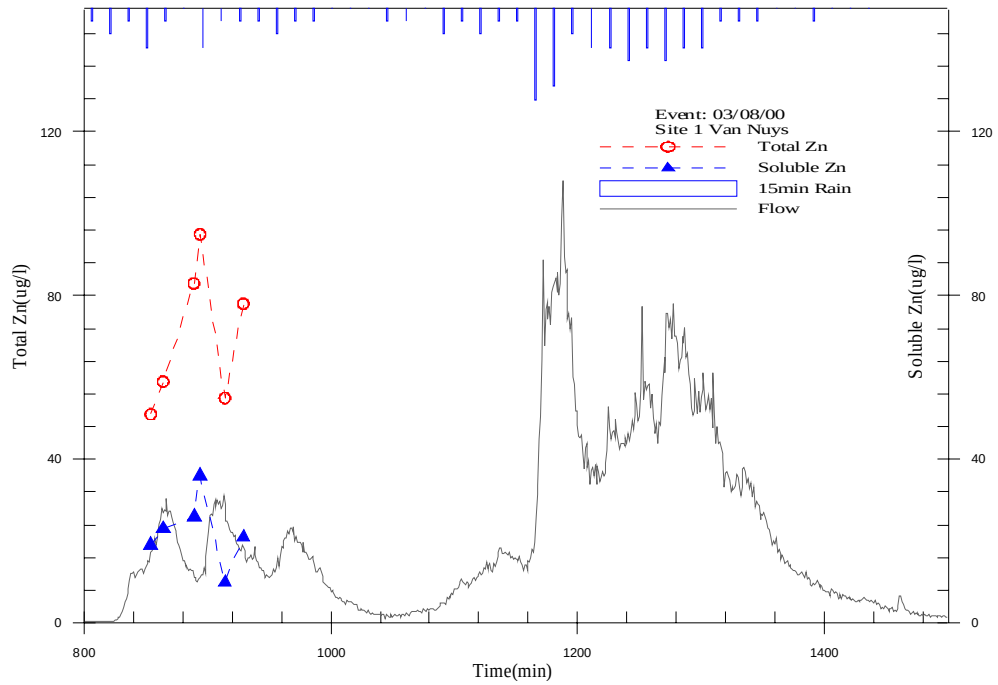


Figure I.1.1.7k (Y1-UCLA1-E9-11.) Polluto-graph for Total Zn / Dissolved Zn

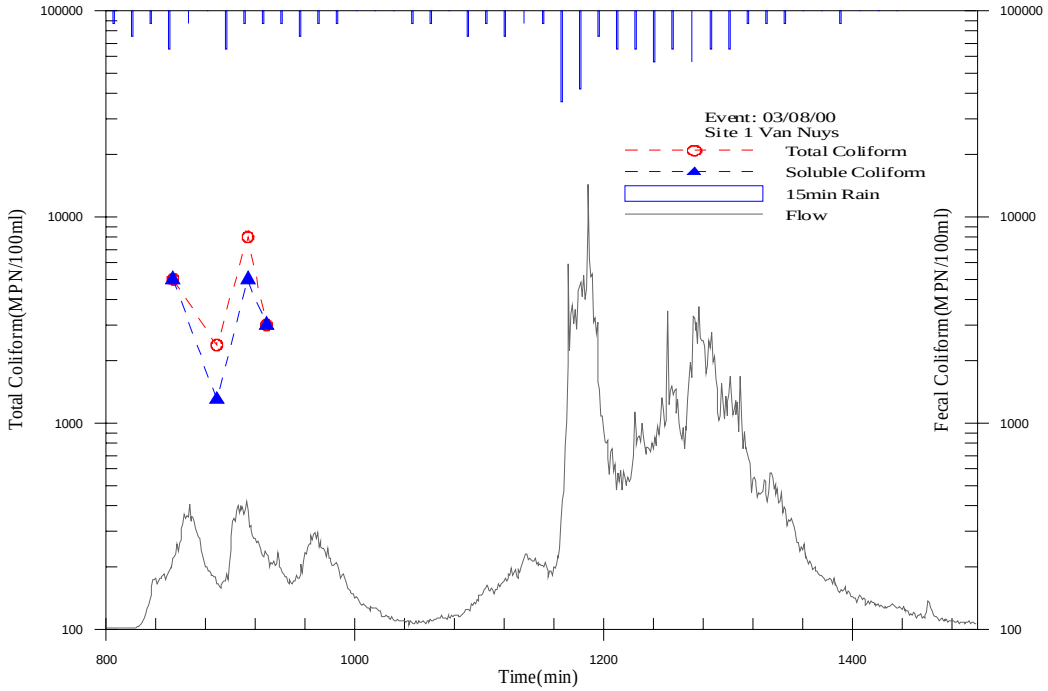


Figure I.1.1.7l (Y1-UCLA1-E9-12.) Polluto-graph for Total Coliform / Fecal Coliform

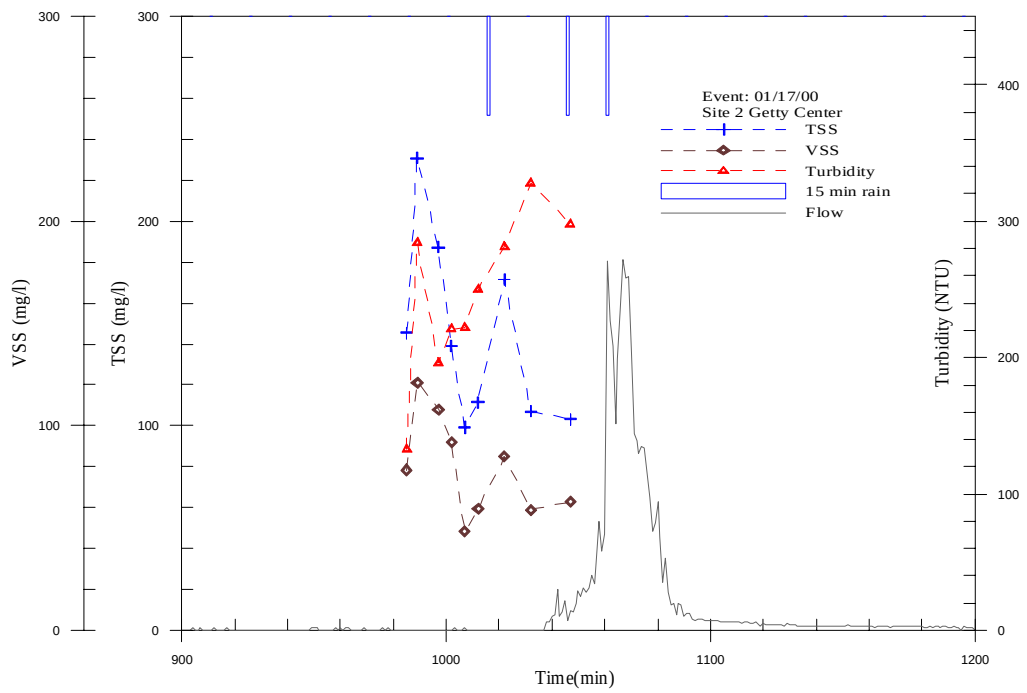


Figure I.1.2.1a (Y1-UCLA2-E2-1.) Polluto-graph for TSS, VSS and Turbidity

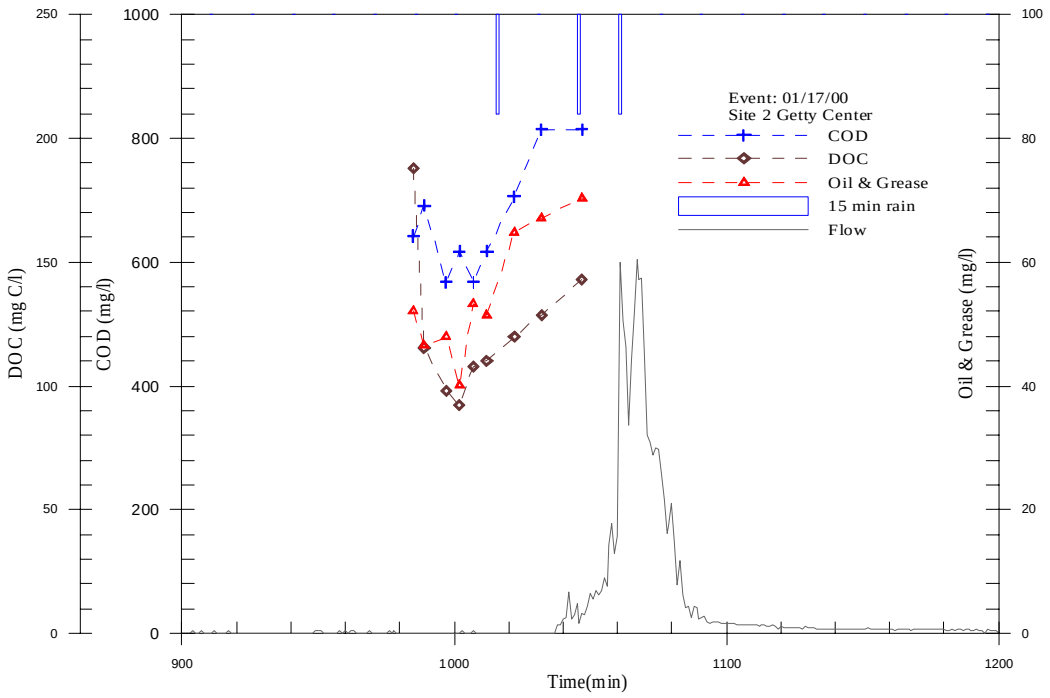


Figure I.1.2.1b (Y1-UCLA2-E2-2.) Polluto-graph for DOC, COD and Oil & Grease

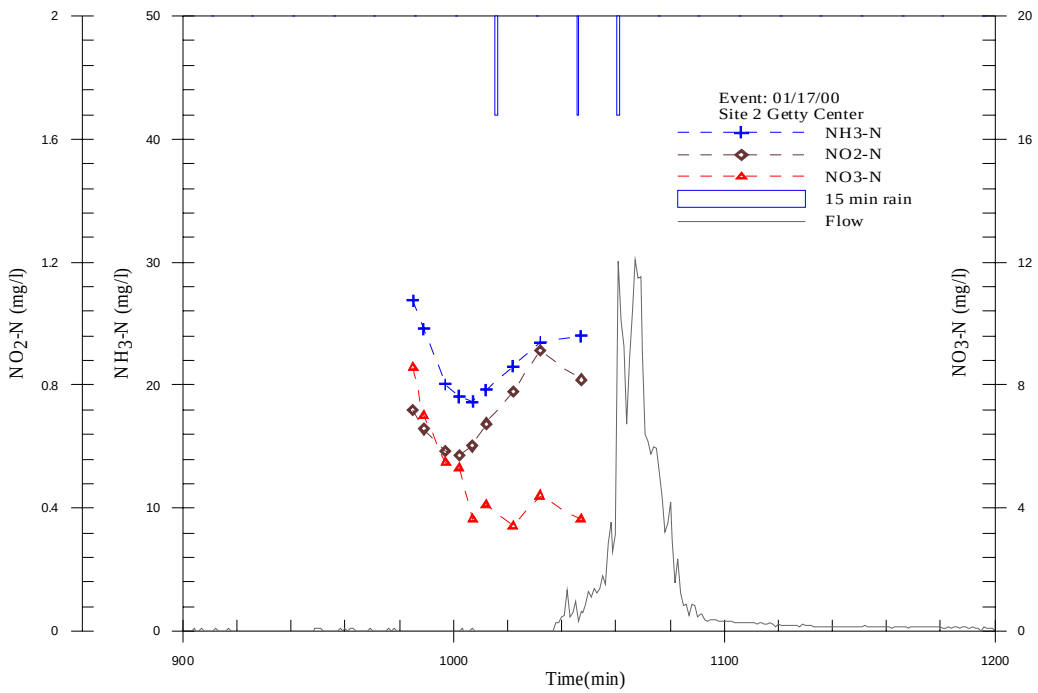


Figure I.1.2.1c (Y1-UCLA2-E2-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

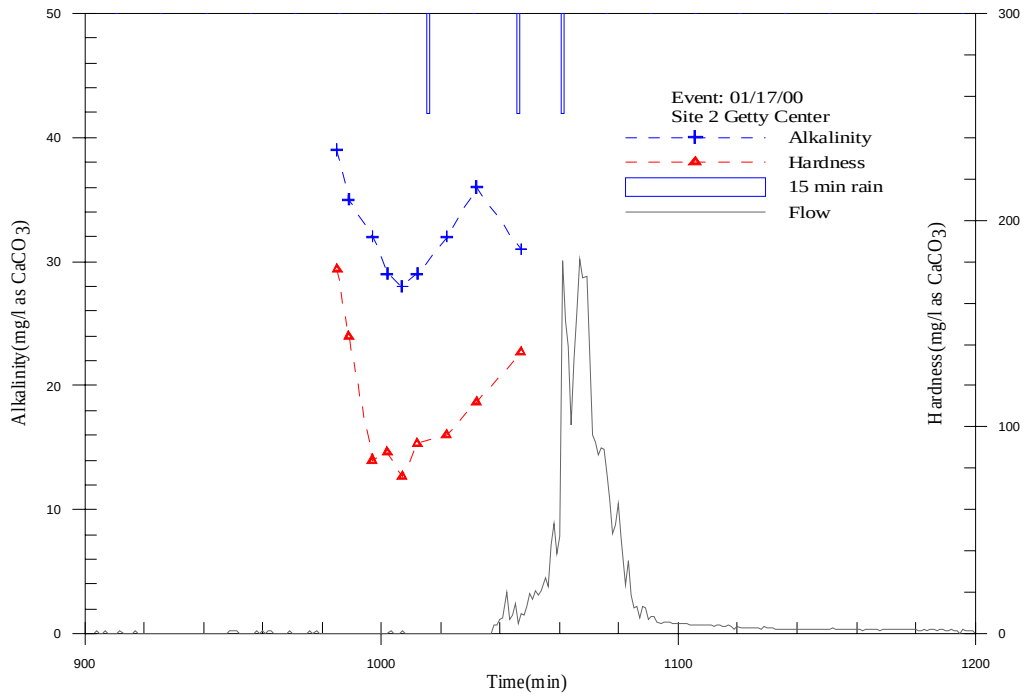


Figure I.1.2.1d (Y1-UCLA2-E2-4.) Polluto-graph for Alkalinity and Hardness

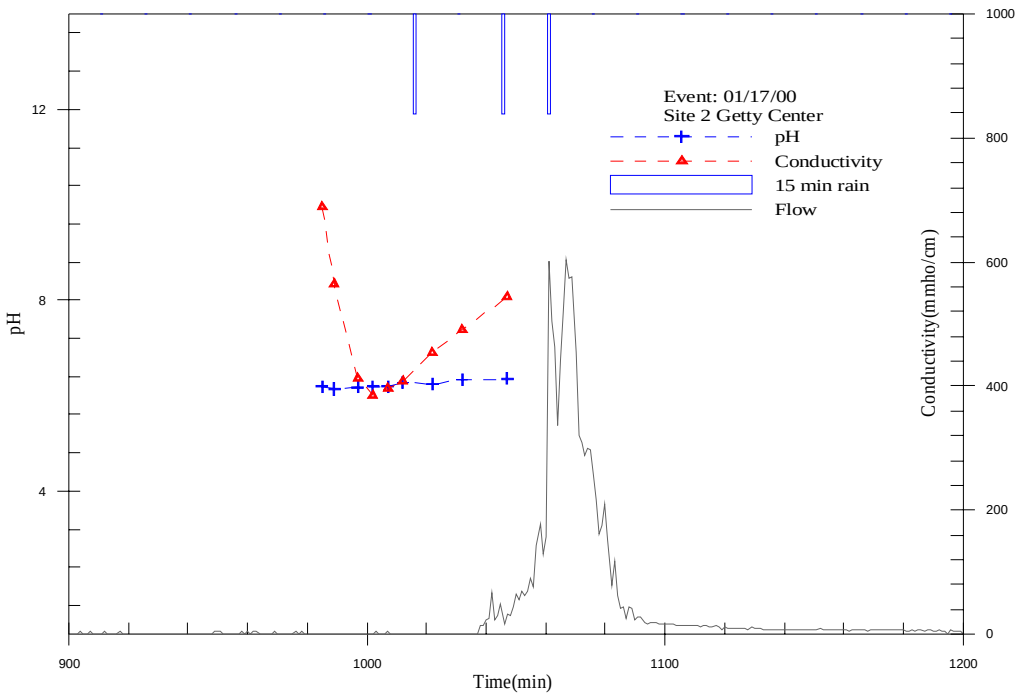


Figure I.1.2.1e (Y1-UCLA2-E2-5.) Polluto-graph for pH and Conductivity

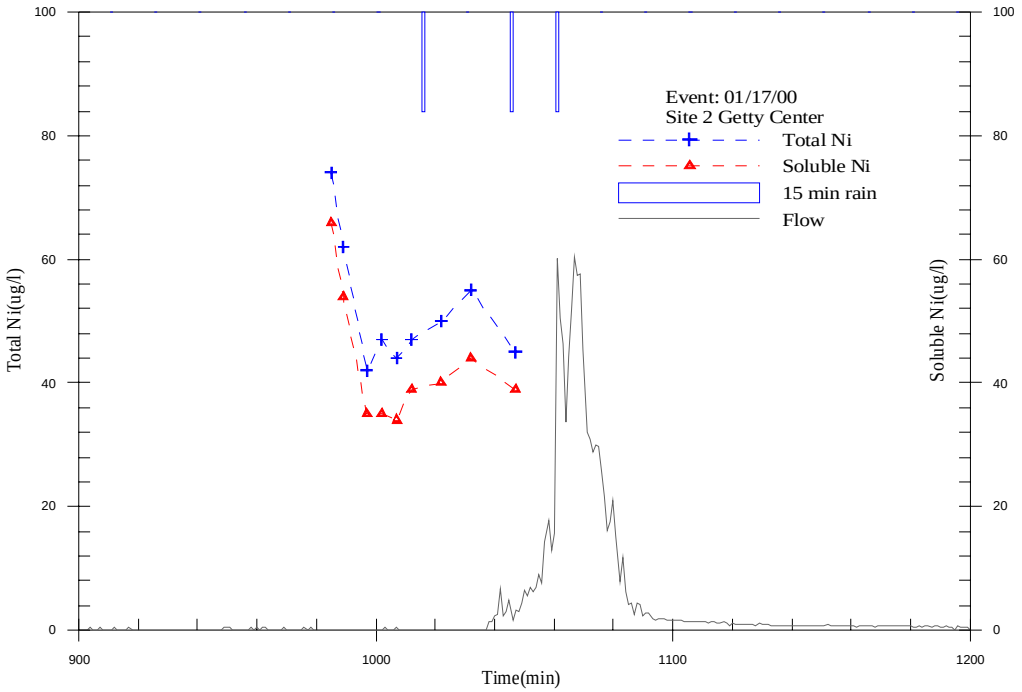


Figure I.1.2.1f (Y1-UCLA2-E2-6.) Polluto-graph for Total Ni / Dissolved Ni

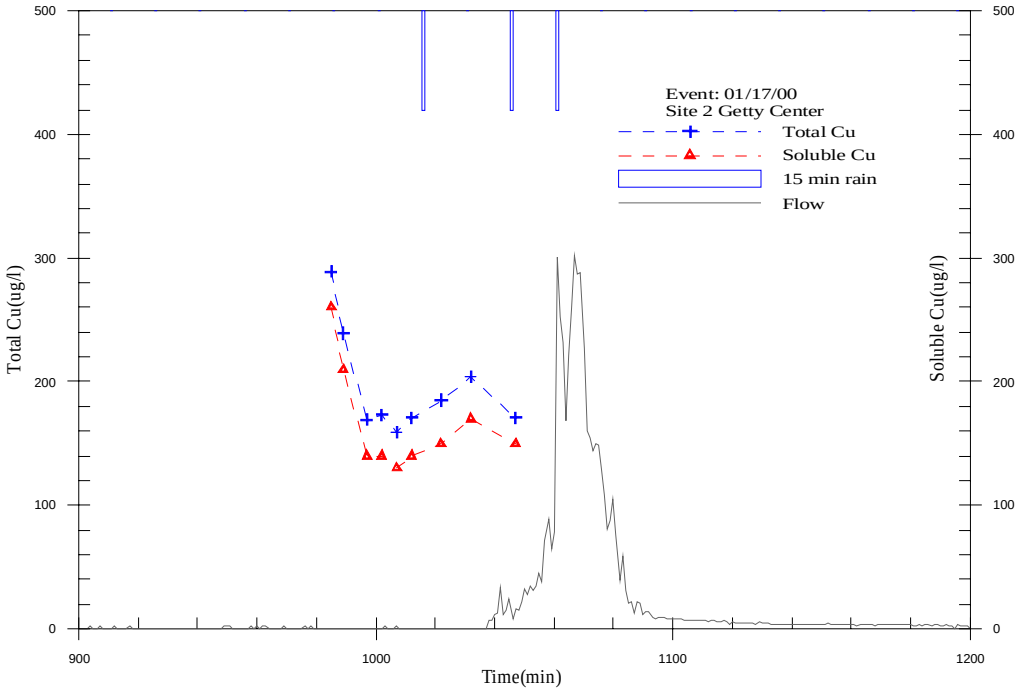


Figure I.1.2.1g (Y1-UCLA2-E2-7.) Polluto-graph for Total Cu / Dissolved Cu

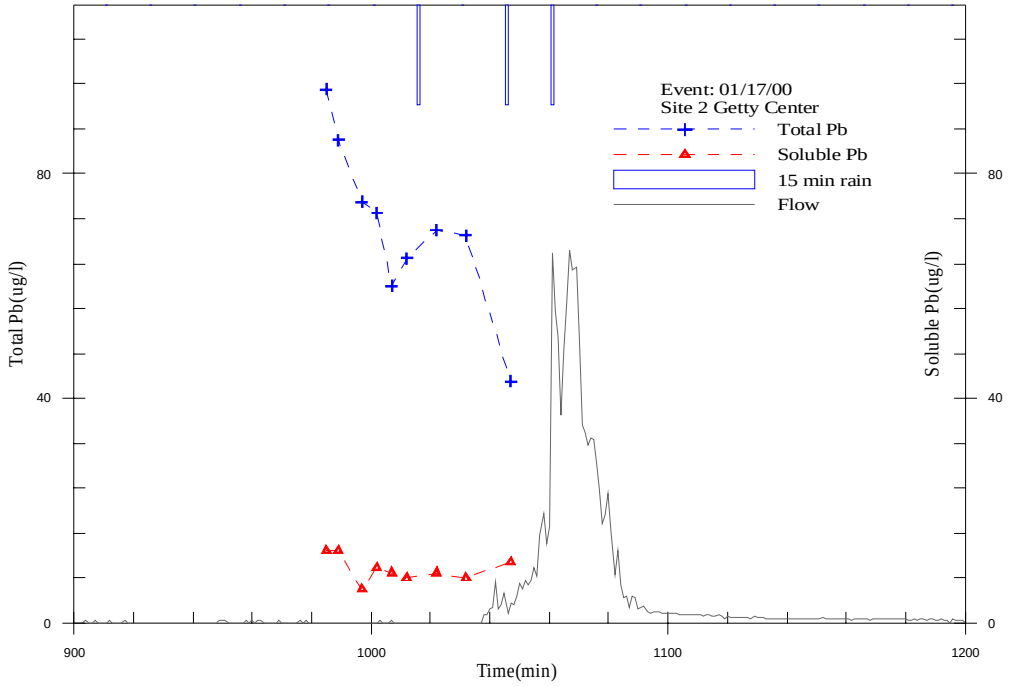


Figure I.1.2.1h (Y1-UCLA2-E2-8.) Polluto-graph for Total Pb / Dissolved Pb

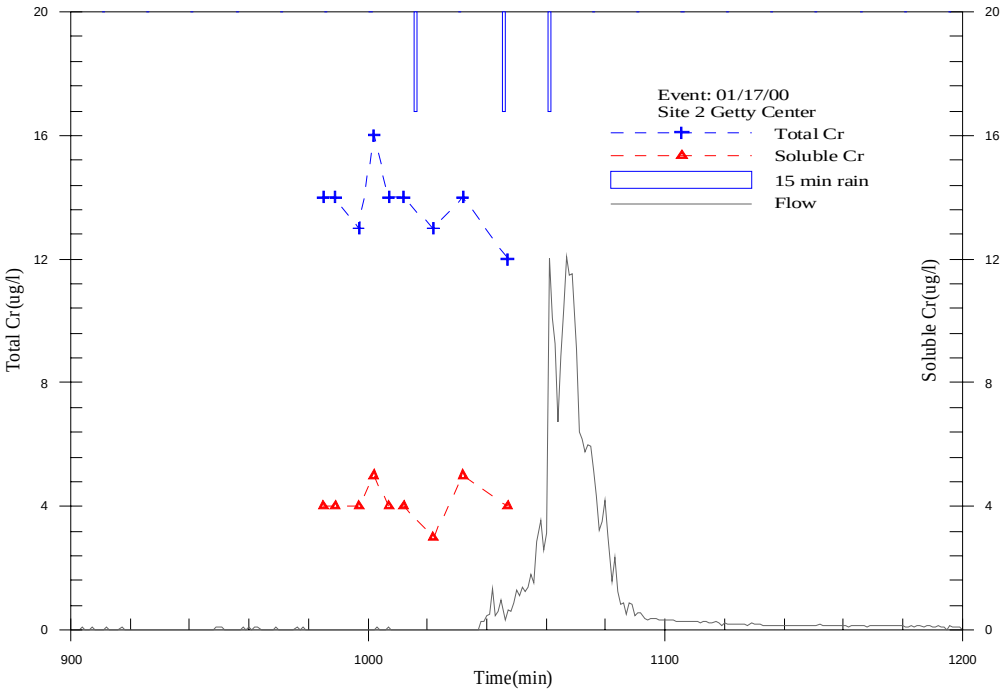


Figure I.1.2.1i (Y1-UCLA2-E2-9.) Polluto-graph for Total Cr / Dissolved Cr

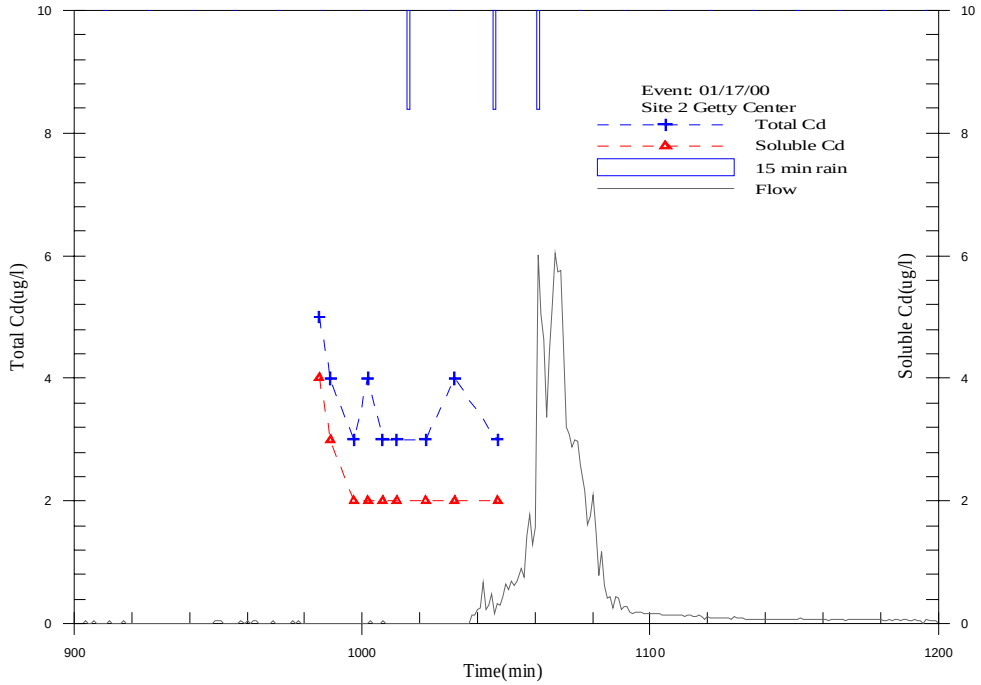


Figure I.1.2.1j (Y1-UCLA2-E2-10.) Polluto-graph for Total Cd / Dissolved Cd

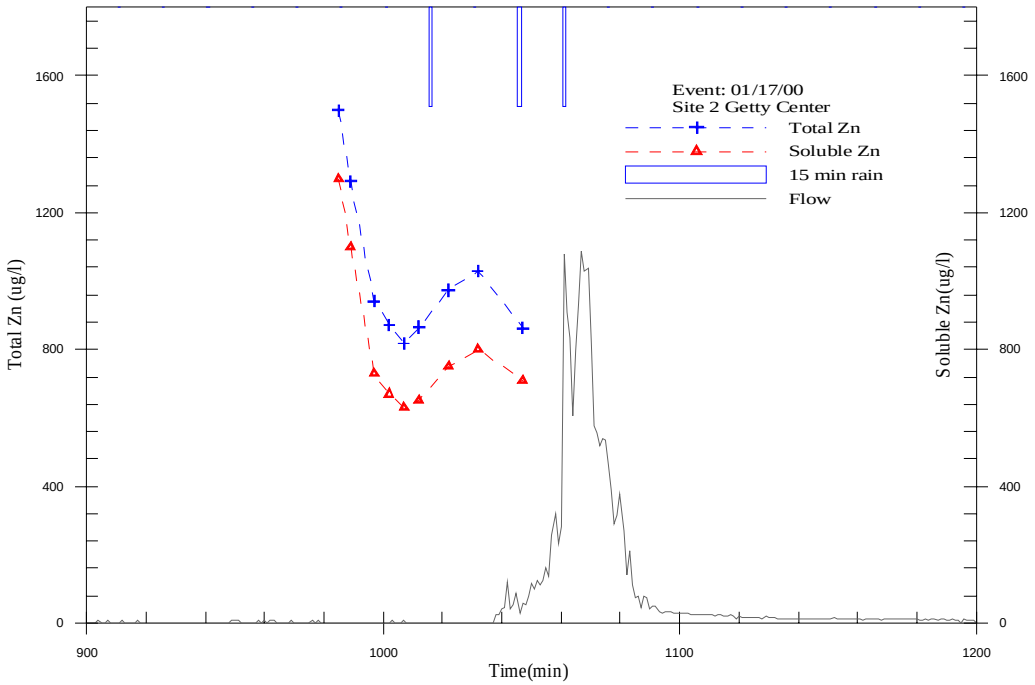


Figure I.1.2.1k (Y1-UCLA2-E2-11.) Polluto-graph for Total Zn / Dissolved Zn

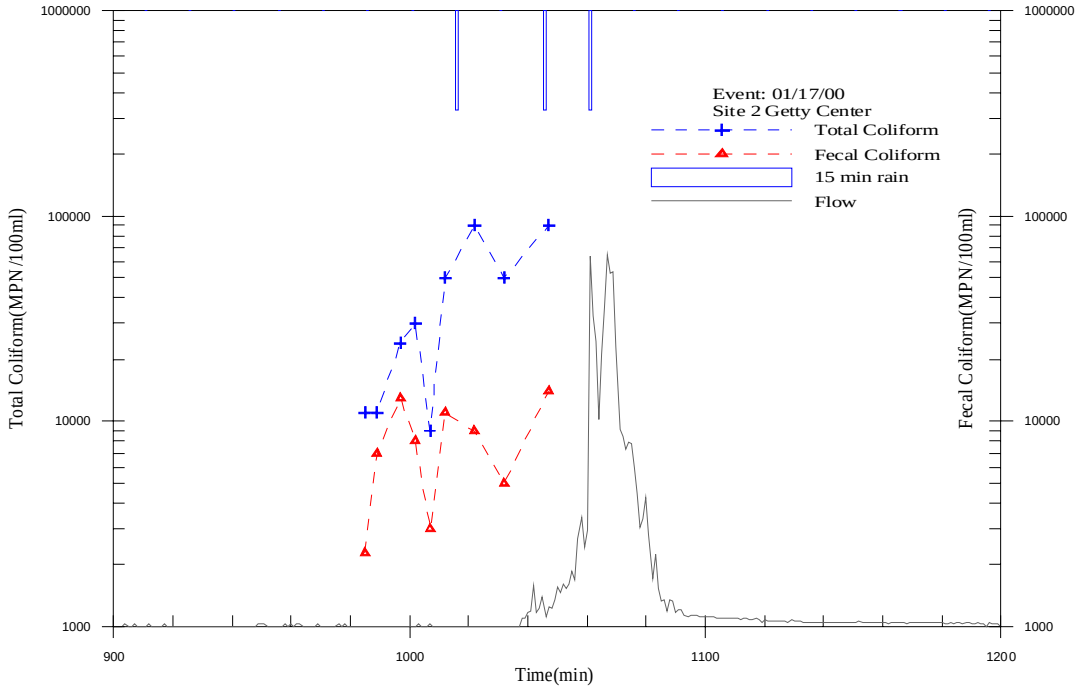


Figure I.1.2.1l (Y1-UCLA2-E2-12.) Polluto-graph for Total Coliform / Fecal Coliform

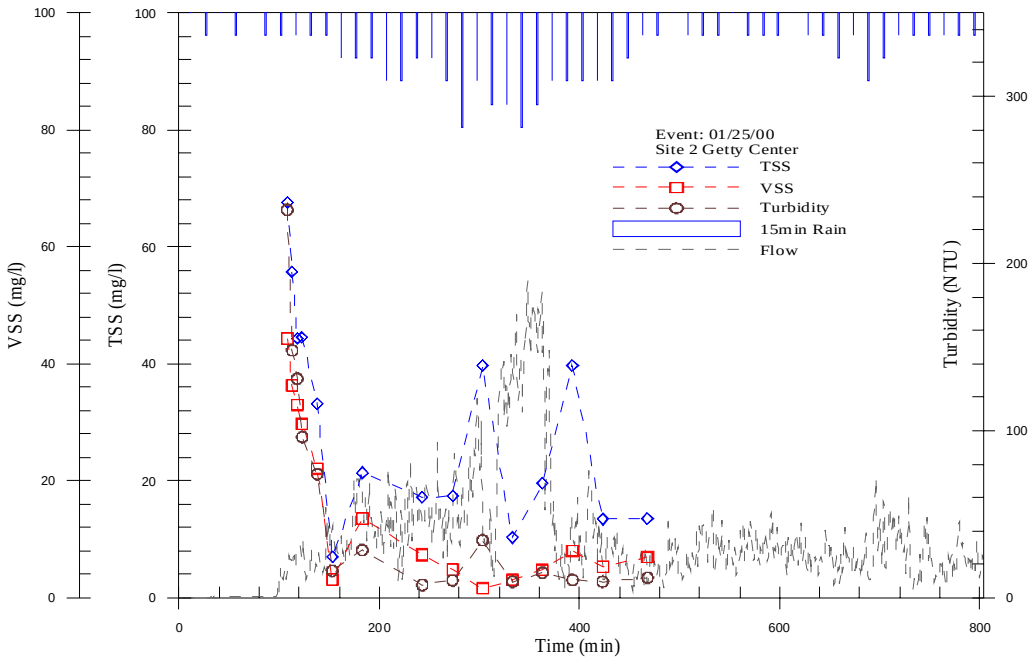


Figure I.1.2.2a (Y1-UCLA2-E3-1.) Polluto-graph for TSS, VSS and Turbidity

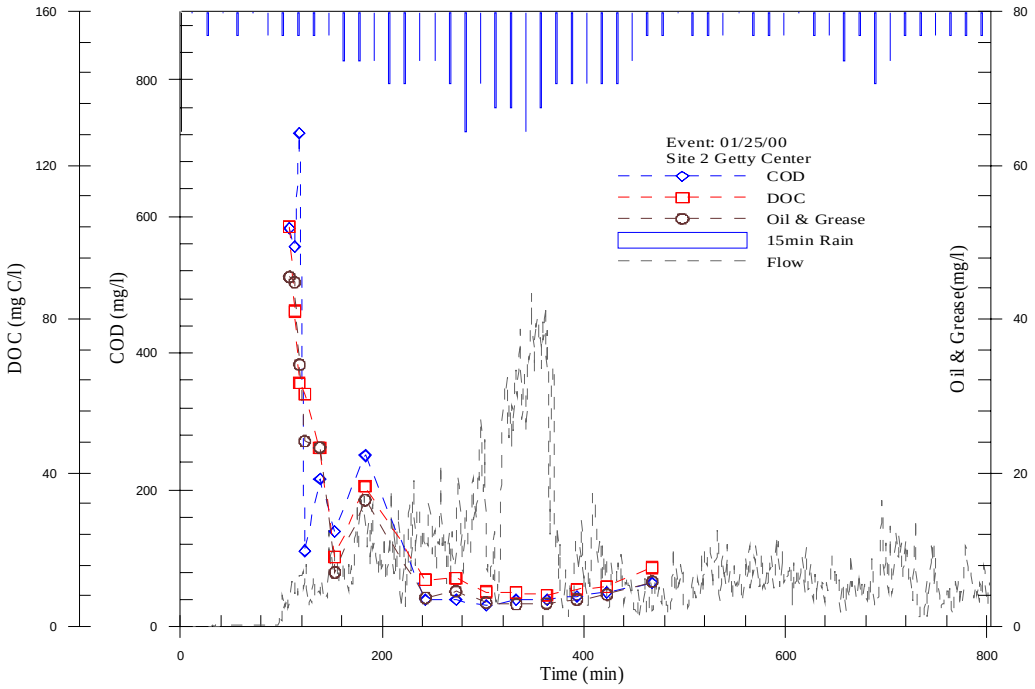


Figure I.1.2.2b (Y1-UCLA2-E3-2.) Polluto-graph for DOC, COD and Oil & Grease

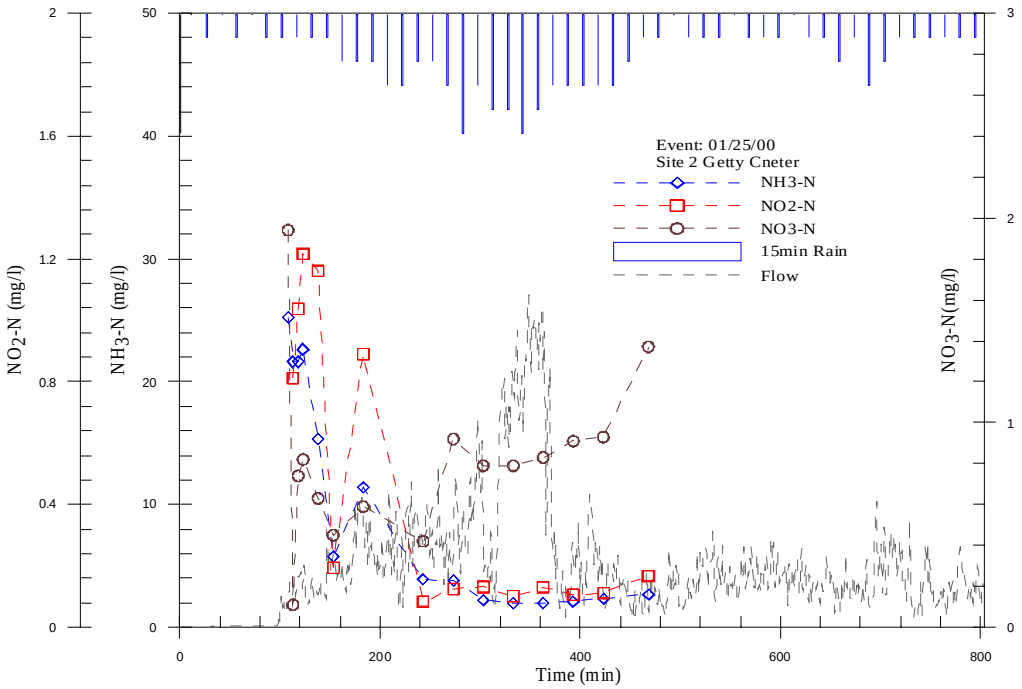


Figure I.1.2.2c (Y1-UCLA2-E3-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

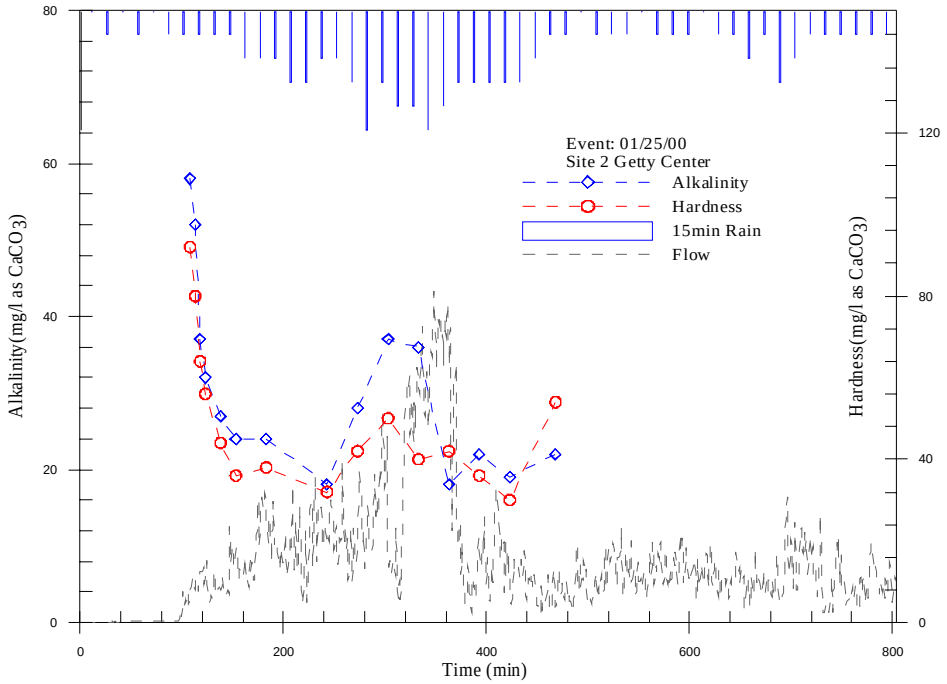


Figure I.1.2.2d (Y1-UCLA2-E3-4.) Polluto-graph for Alkalinity and Hardness

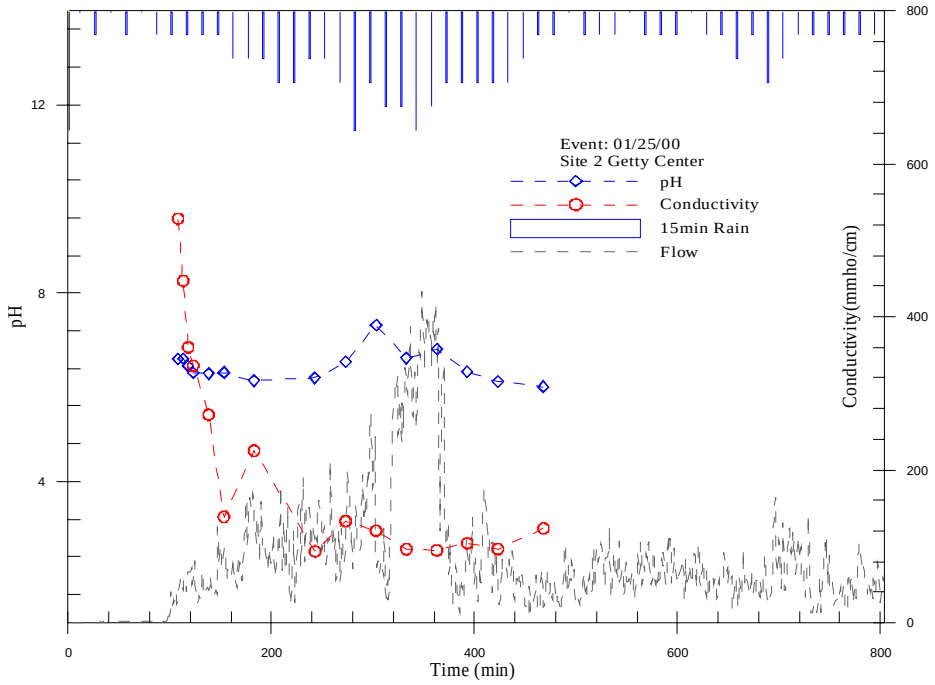


Figure I.1.2.2e (Y1-UCLA2-E3-5.) Polluto-graph for pH and Conductivity

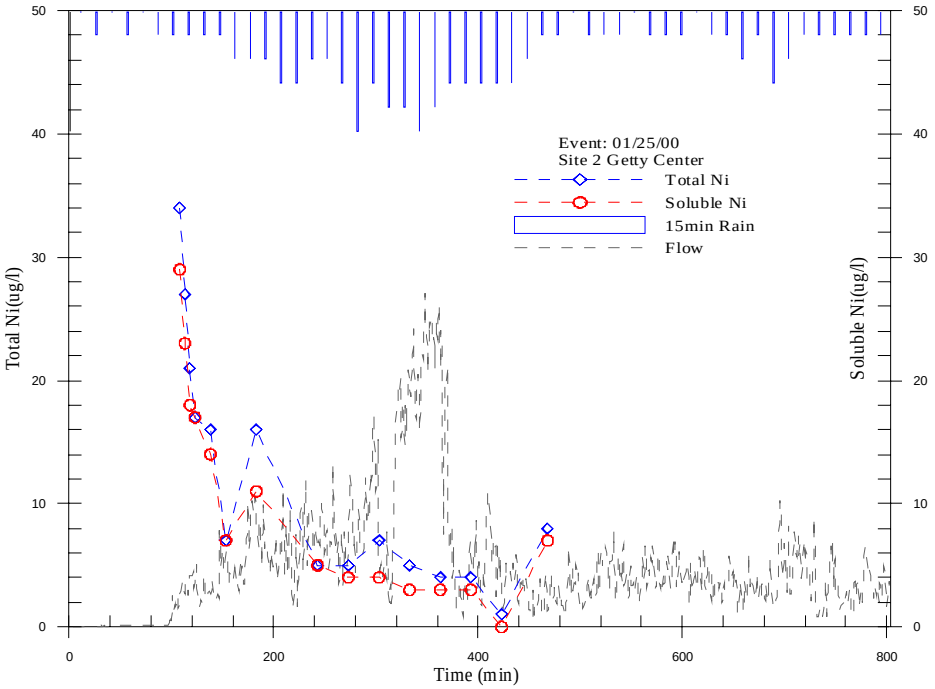


Figure I.1.2.2f (Y1-UCLA2-E3-6.) Polluto-graph for Total Ni / Dissolved Ni

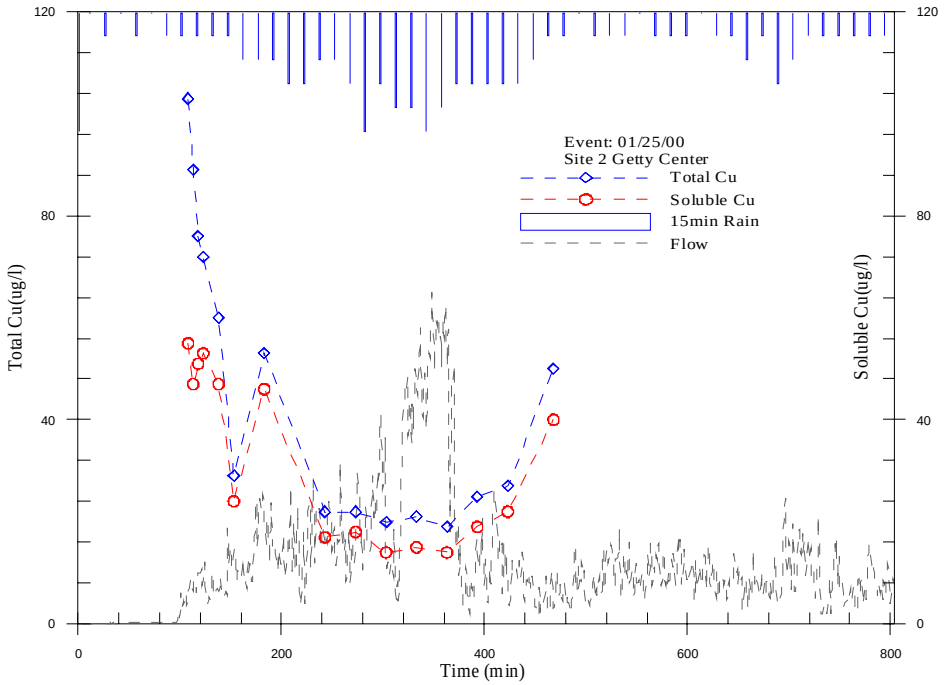


Figure I.1.2.2g (Y1-UCLA2-E3-7.) Polluto-graph for Total Cu / Dissolved Cu

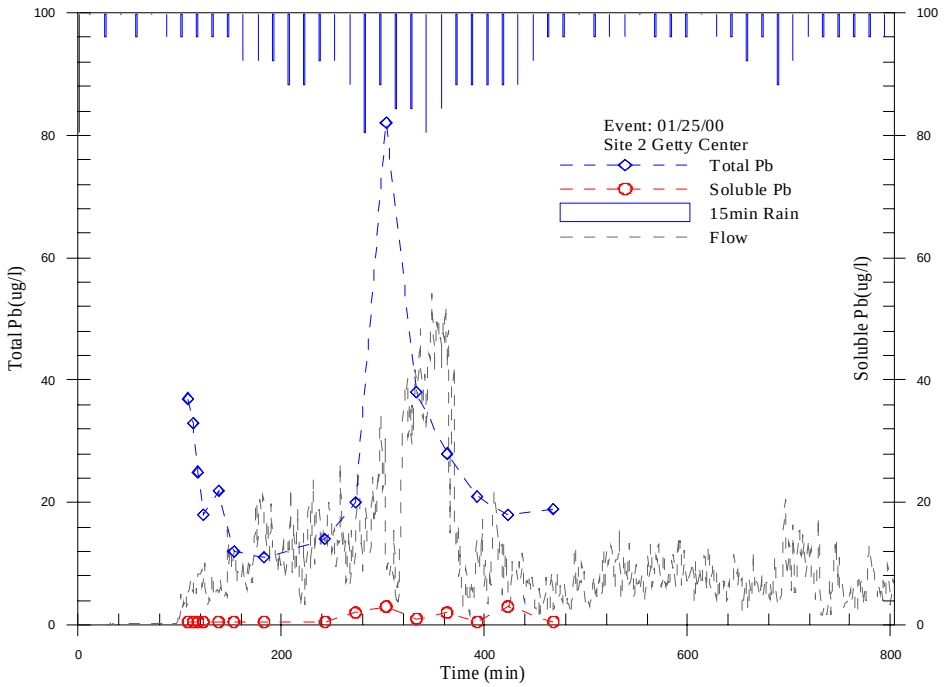


Figure I.1.2.2h (Y1-UCLA2-E3-8.) Polluto-graph for Total Pb / Dissolved Pb

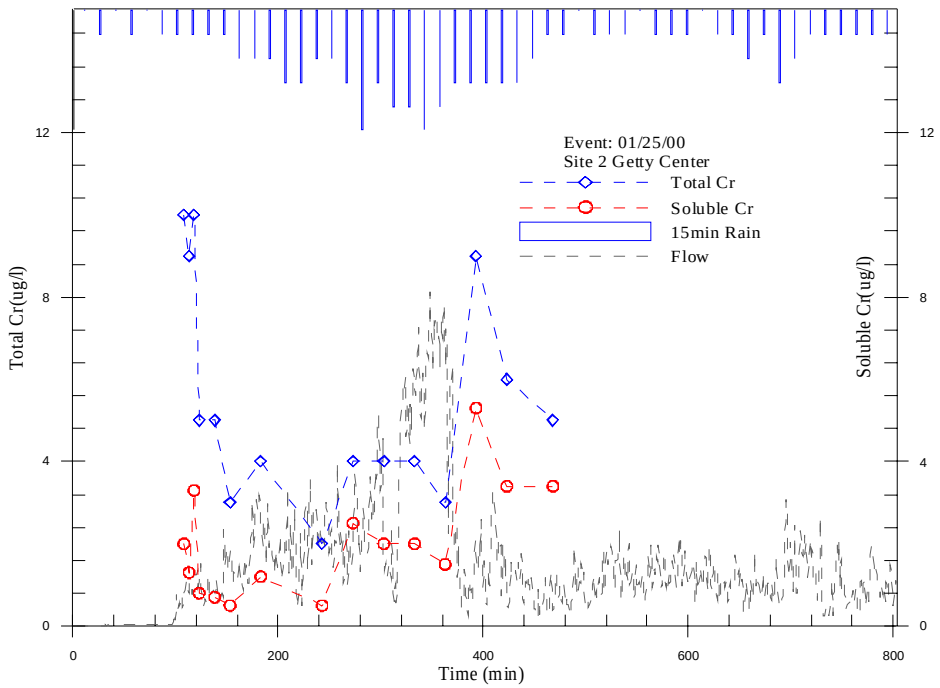


Figure I.1.2.2i (Y1-UCLA2-E3-9.) Polluto-graph for Total Cr / Dissolved Cr

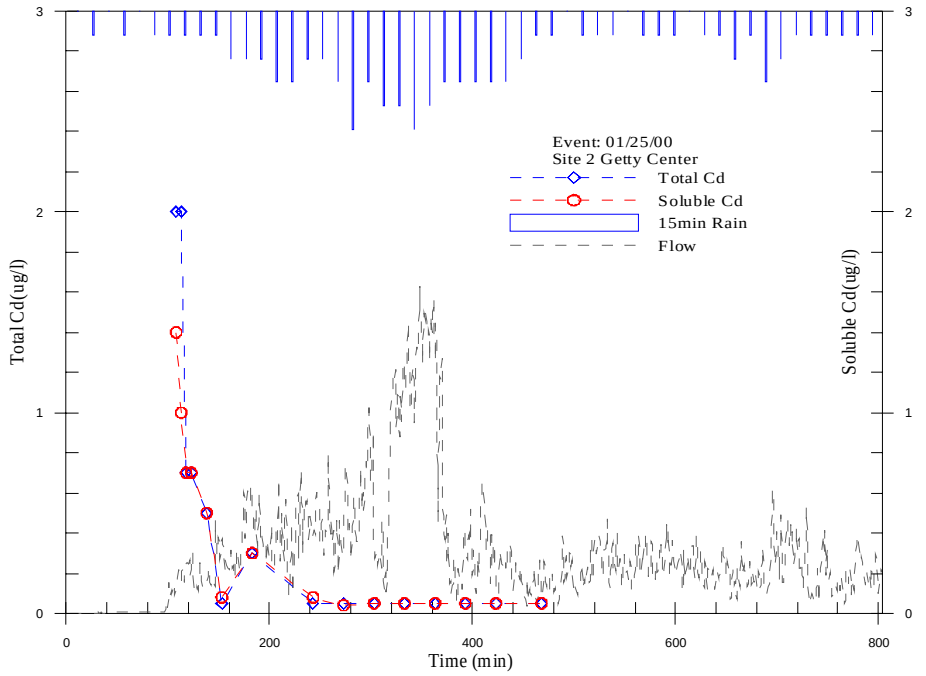


Figure I.1.2.2j (Y1-UCLA2-E3-10.) Polluto-graph for Total Cd / Dissolved Cd

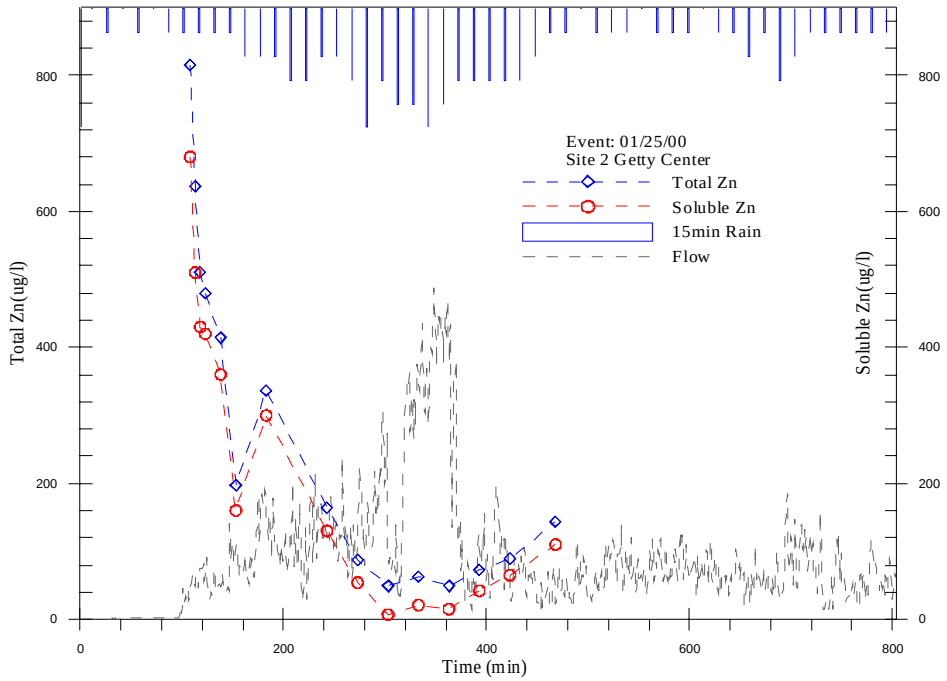


Figure I.1.2.2k (Y1-UCLA2-E3-11.) Polluto-graph for Total Zn / Dissolved Zn

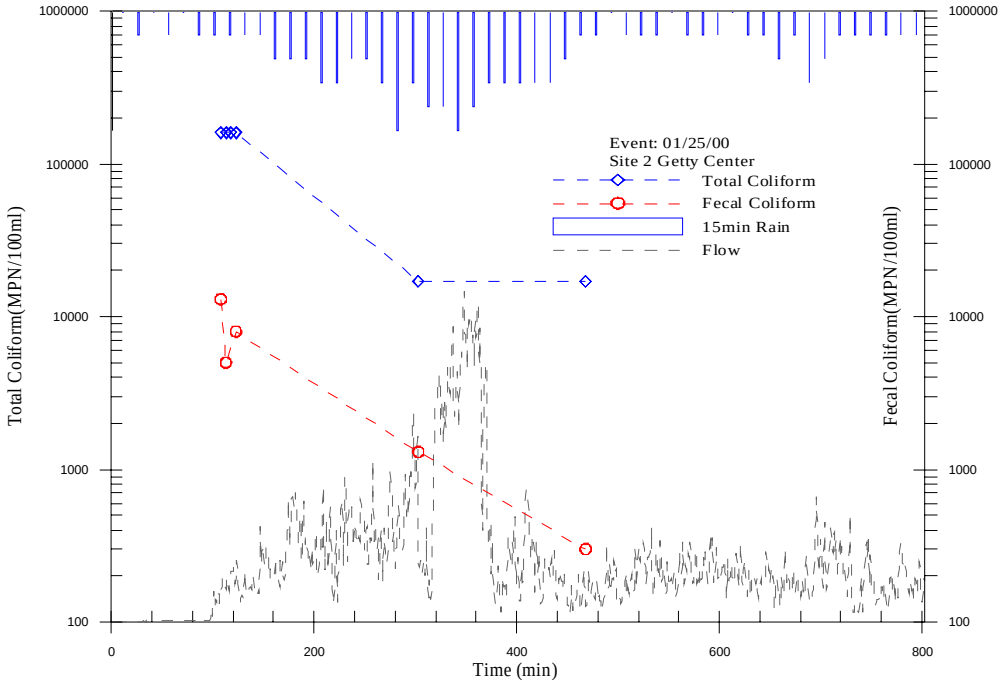


Figure I.1.2.2l (Y1-UCLA2-E3-12.) Polluto-graph for Total Coliform / Fecal Coliform

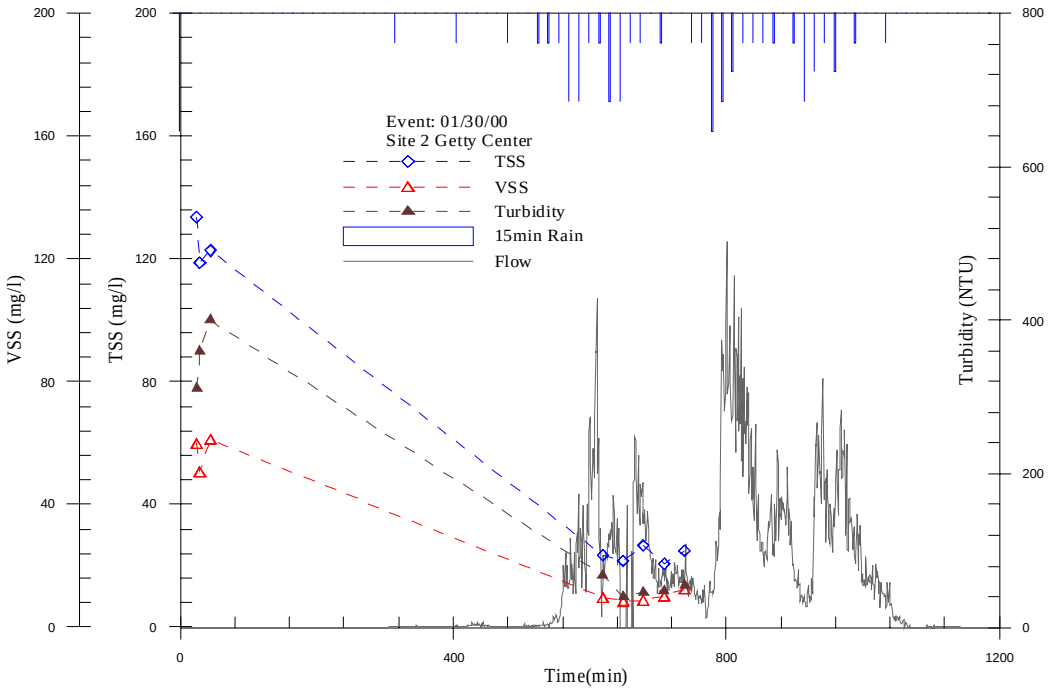


Figure I.1.2.3a (Y1-UCLA2-E4-1.) Polluto-graph for TSS, VSS and Turbidity

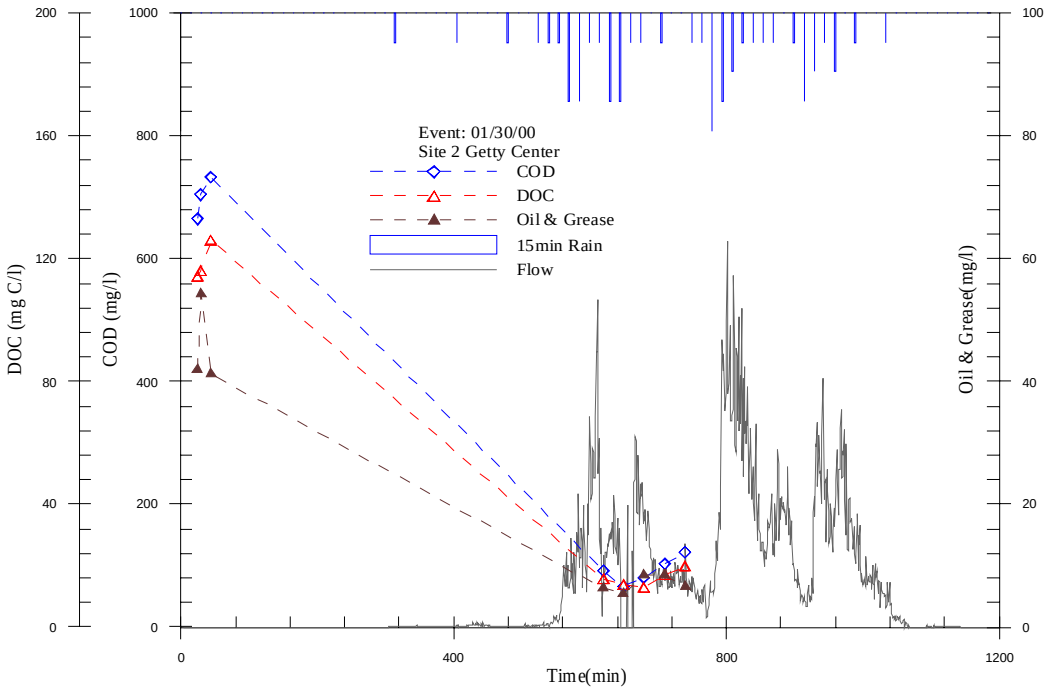


Figure I.1.2.3b (Y1-UCLA2-E4-2.) Polluto-graph for DOC, COD and Oil & Grease

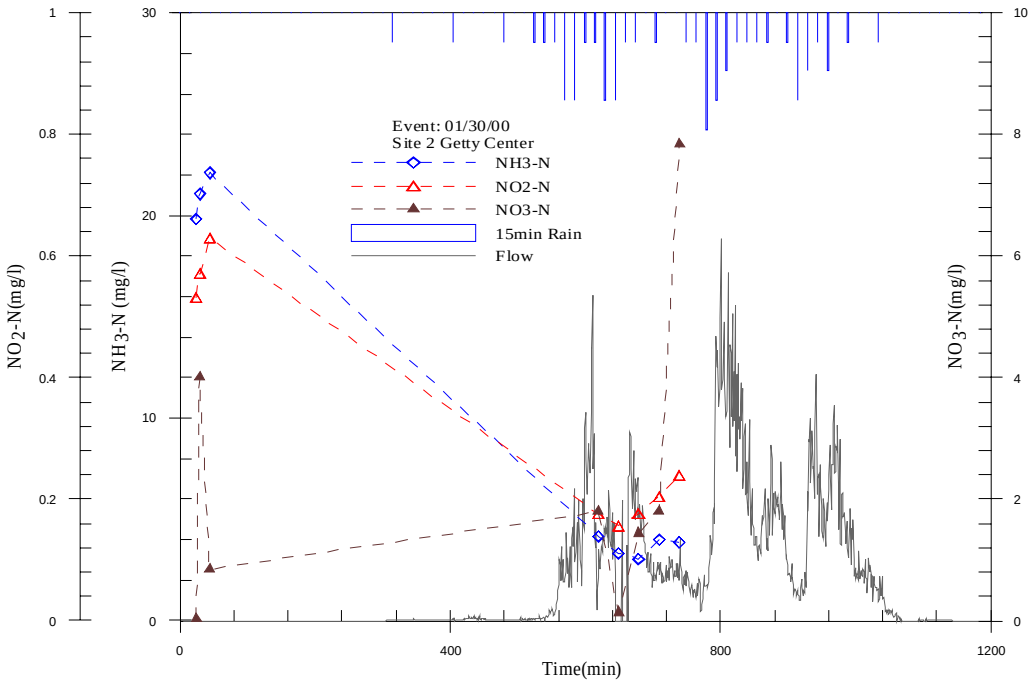


Figure I.1.2.3c (Y1-UCLA2-E4-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

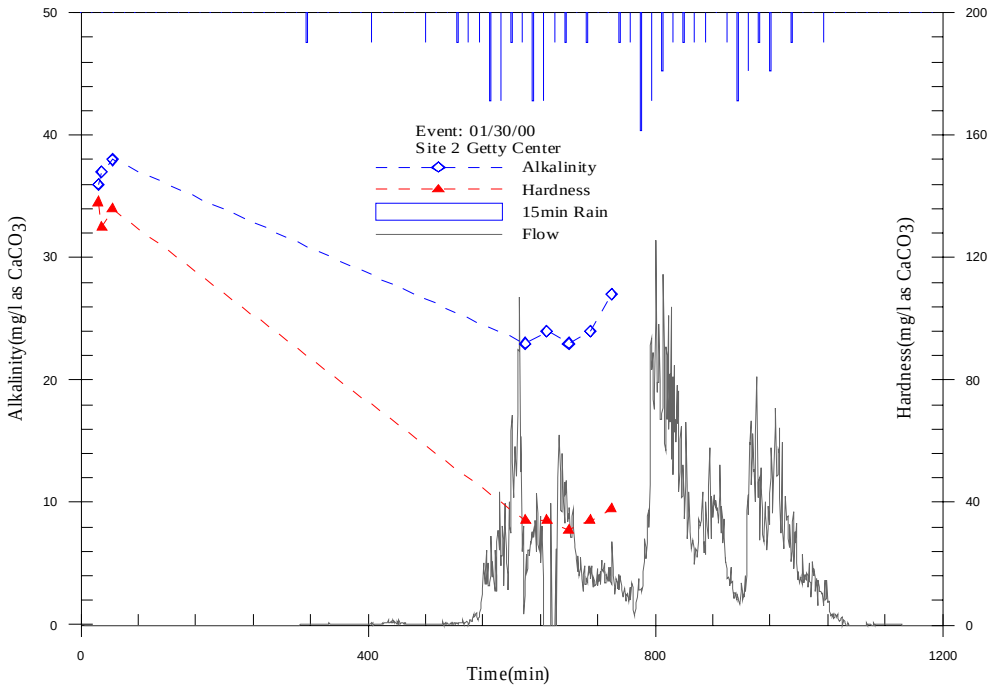


Figure I.1.2.3d (Y1-UCLA2-E4-4.) Polluto-graph for Alkalinity and Hardness

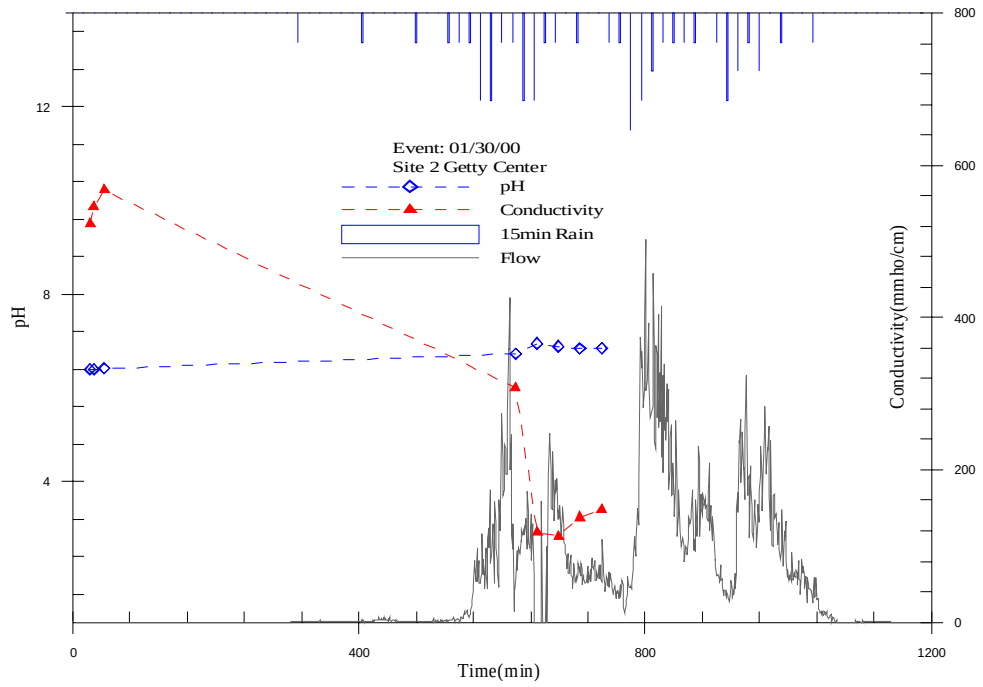


Figure I.1.2.3e (Y1-UCLA2-E4-5.) Polluto-graph for pH and Conductivity

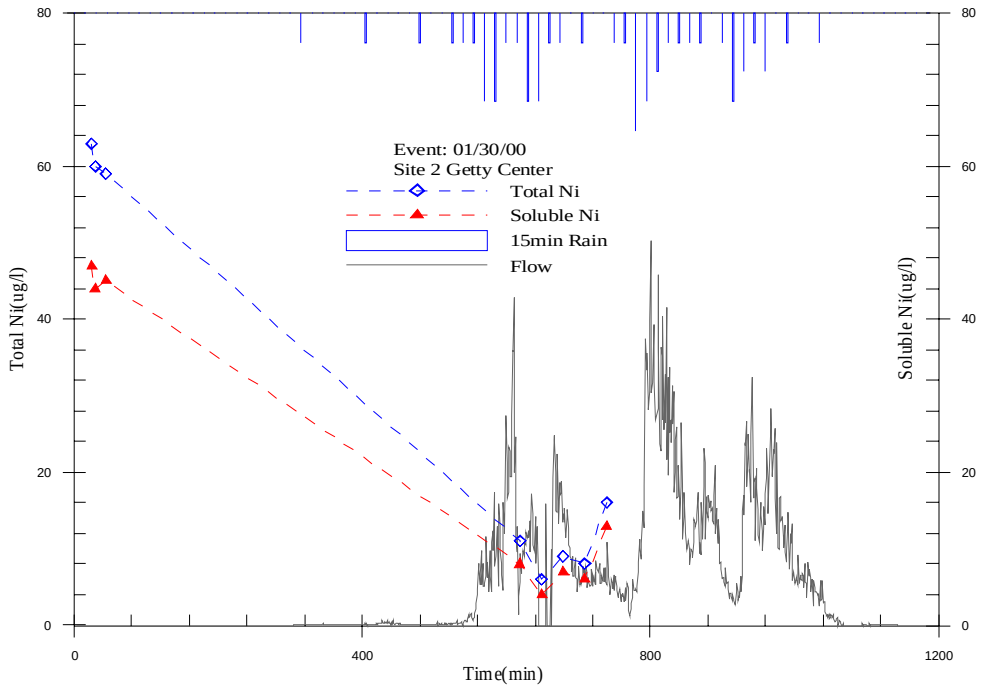


Figure I.1.2.3f (Y1-UCLA2-E4-6.) Polluto-graph for Total Ni / Dissolved Ni

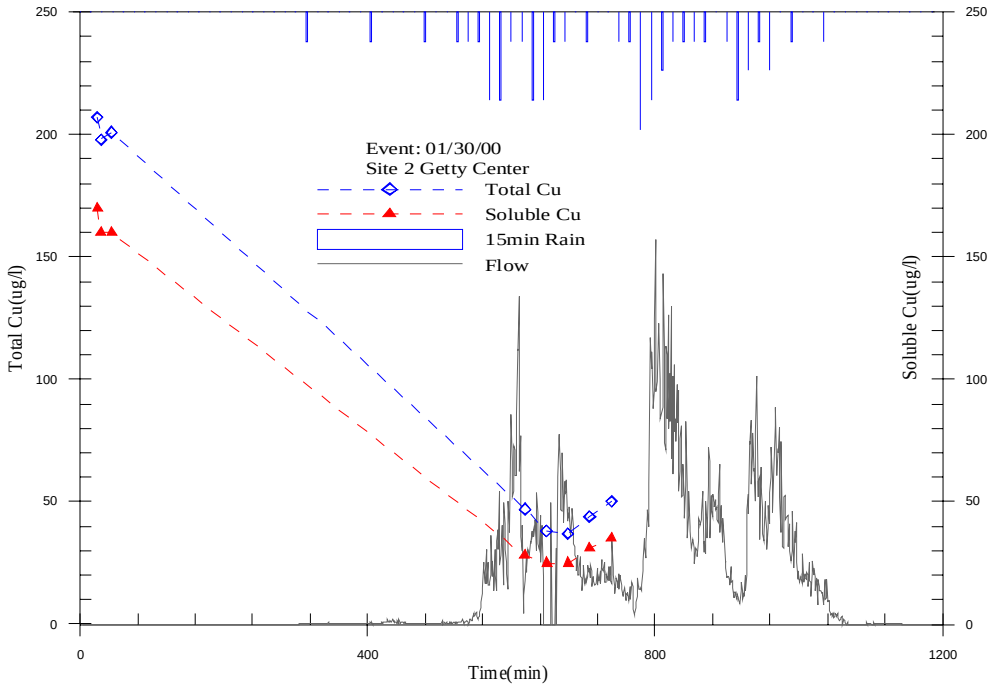


Figure I.1.2.3g (Y1-UCLA2-E4-7.) Polluto-graph for Total Cu / Dissolved Cu

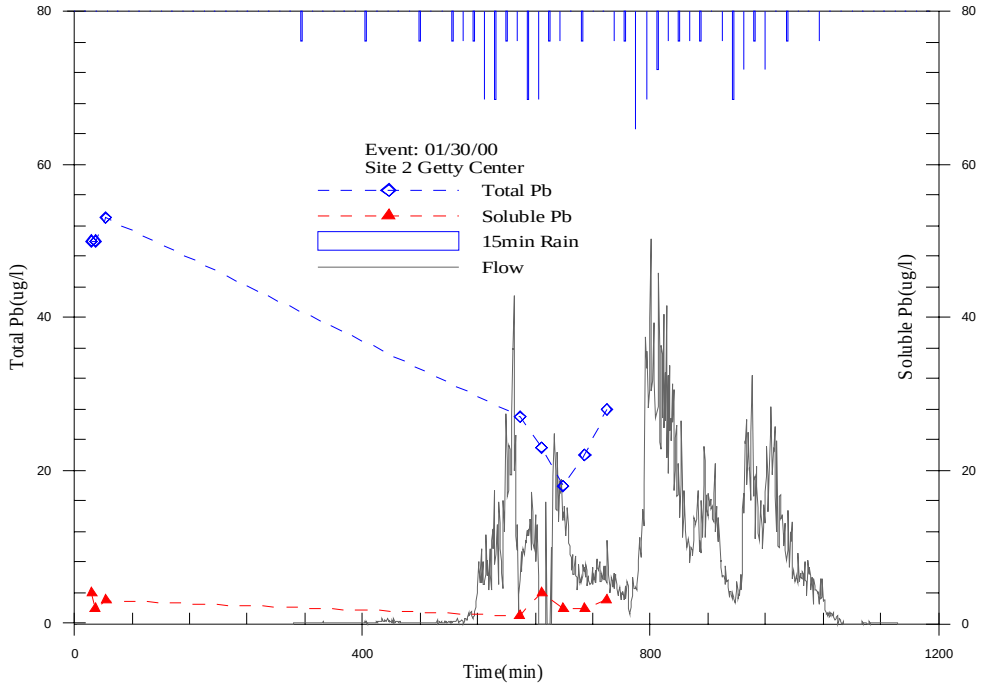


Figure I.1.2.3h (Y1-UCLA2-E4-8.) Polluto-graph for Total Pb / Dissolved Pb

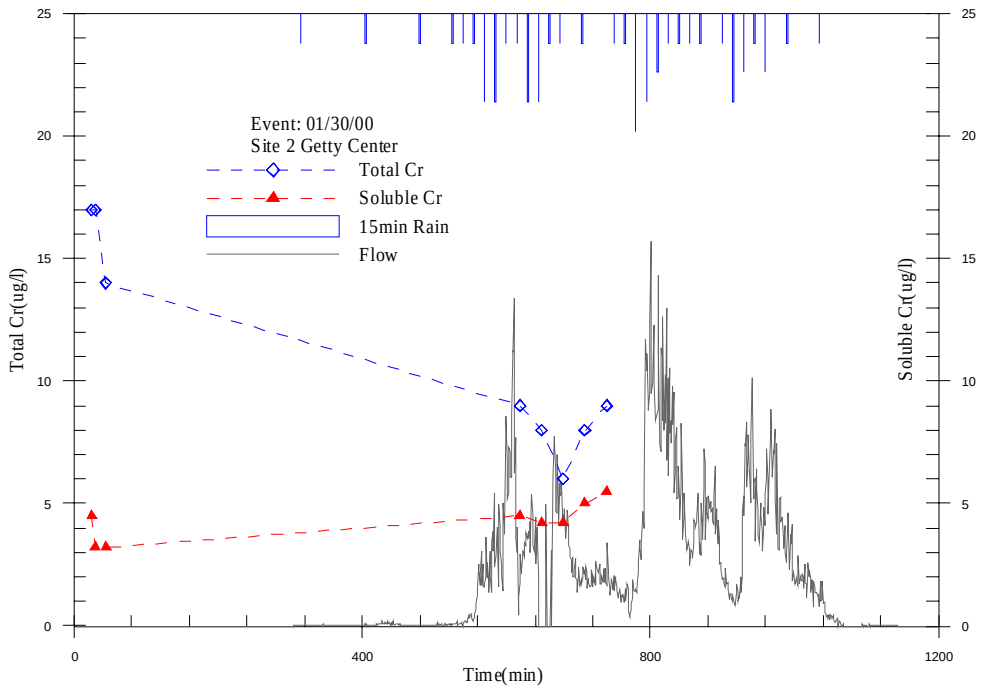


Figure I.1.2.3i (Y1-UCLA2-E4-9.) Polluto-graph for Total Cr / Dissolved Cr

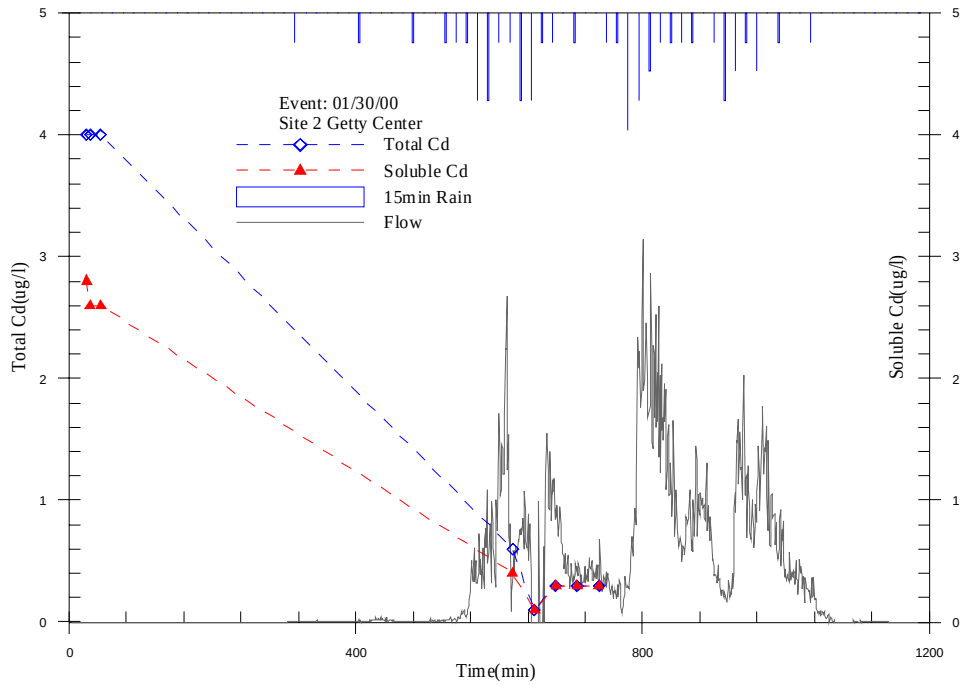


Figure I.1.2.3j (Y1-UCLA2-E4-10.) Polluto-graph for Total Cd / Dissolved Cd

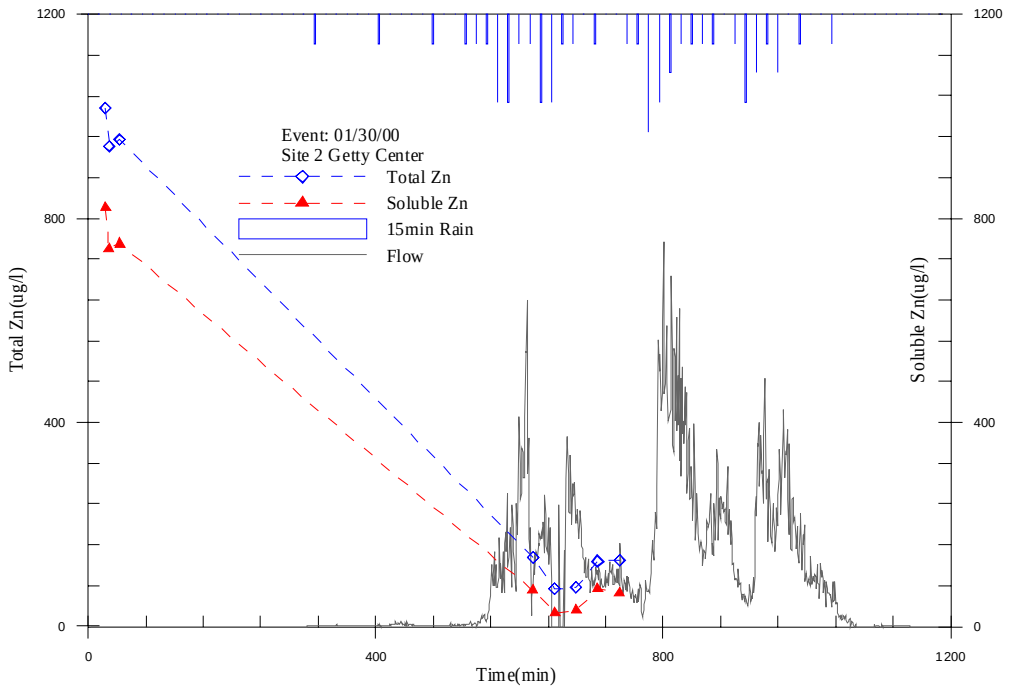


Figure I.1.2.3k (Y1-UCLA2-E4-11.) Polluto-graph for Total Zn / Dissolved Zn

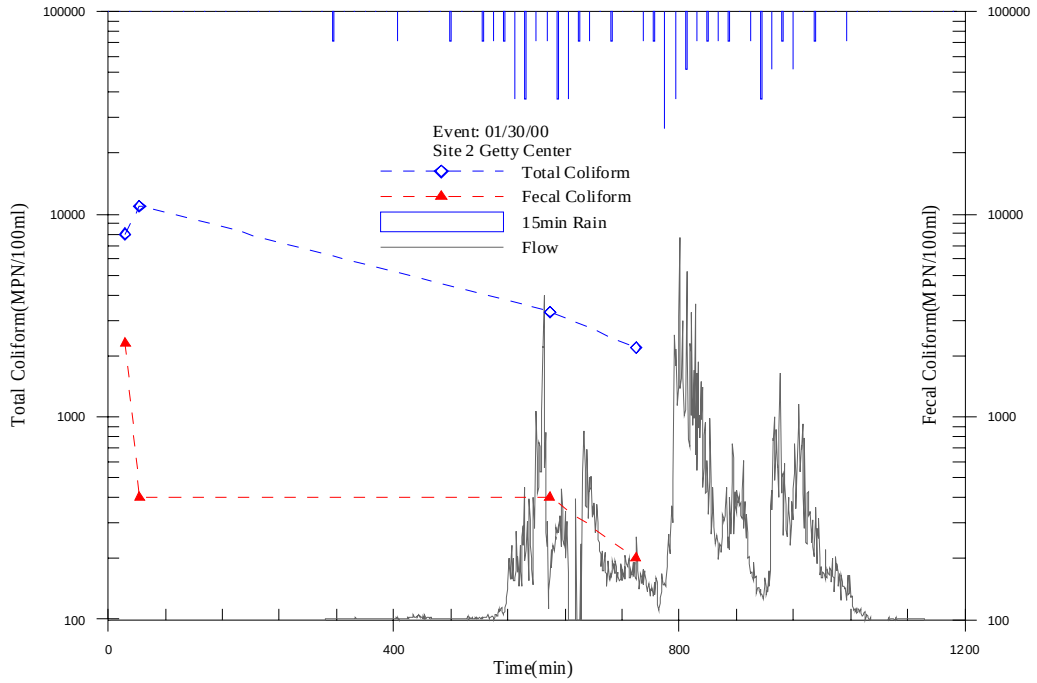


Figure I.1.2.3l (Y1-UCLA2-E4-12.) Polluto-graph for Total Coliform / Fecal Coliform

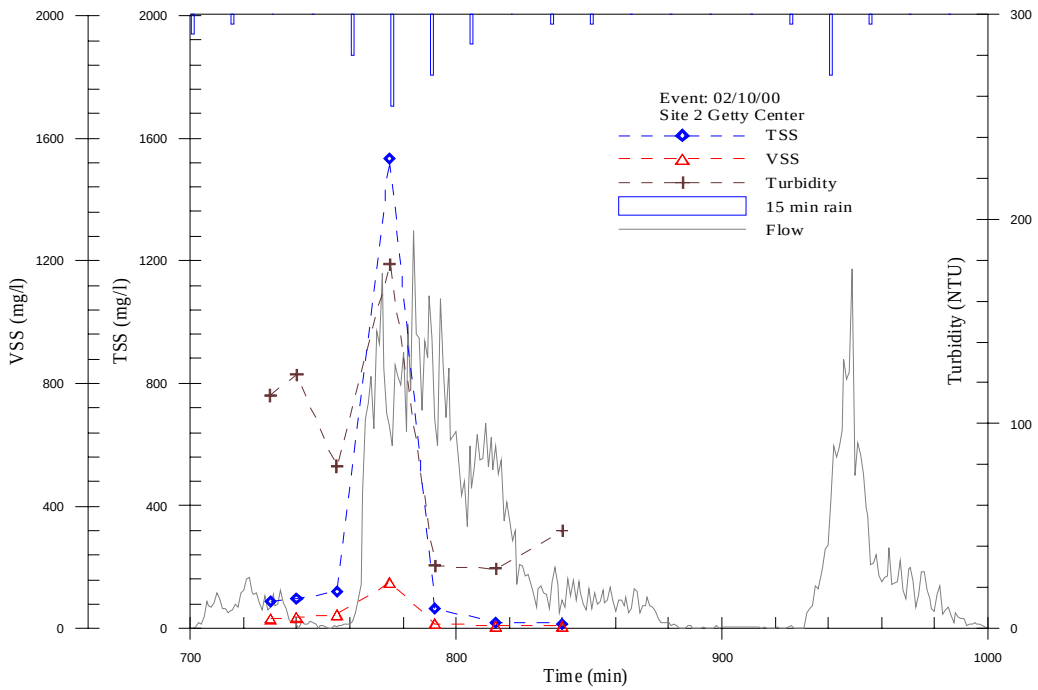


Figure I.1.2.4a (Y1-UCLA2-E5-1.) Polluto-graph for TSS, VSS and Turbidity

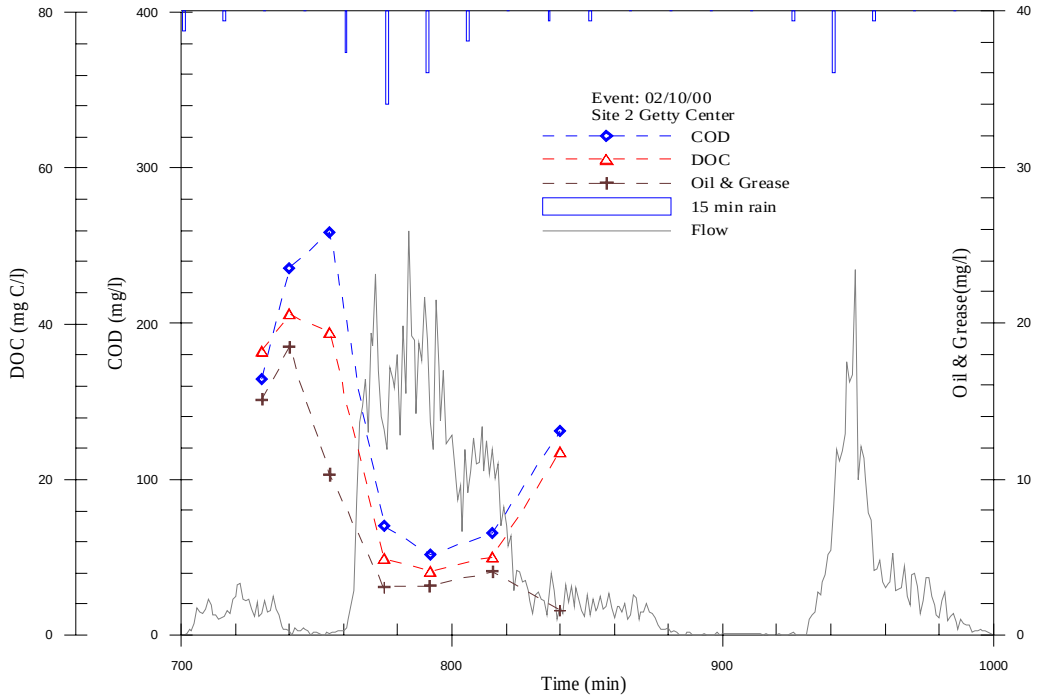


Figure I.1.2.4b (Y1-UCLA2-E5-2.) Polluto-graph for DOC, COD and Oil & Grease

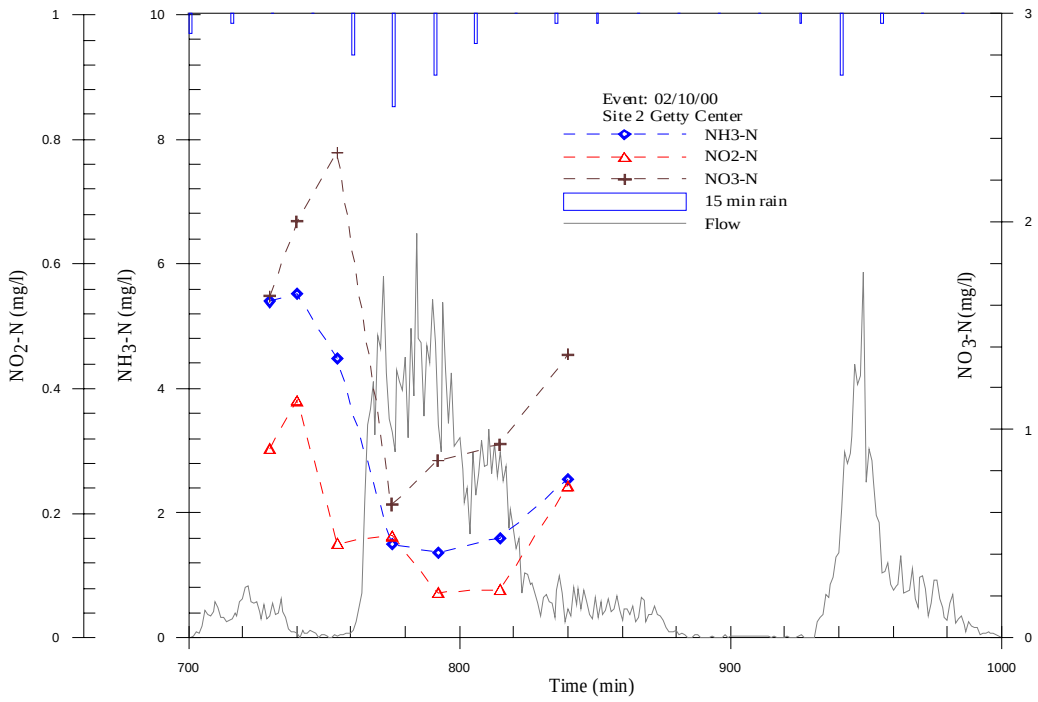


Figure I.1.2.4c (Y1-UCLA2-E5-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

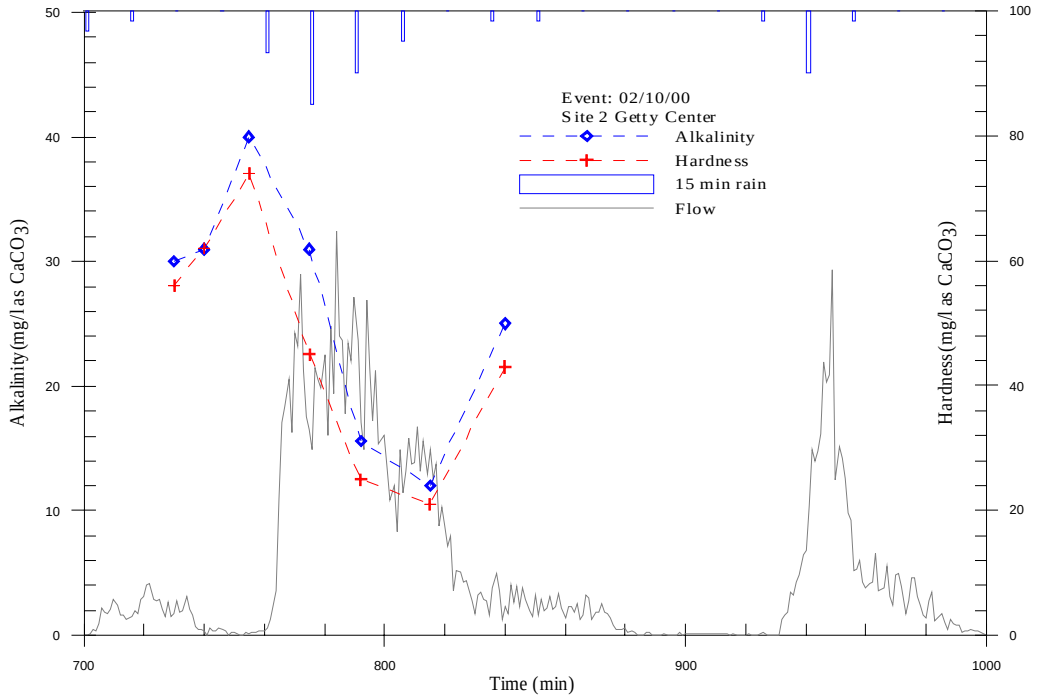


Figure I.1.2.4d (Y1-UCLA2-E5-4.) Polluto-graph for Alkalinity and Hardness

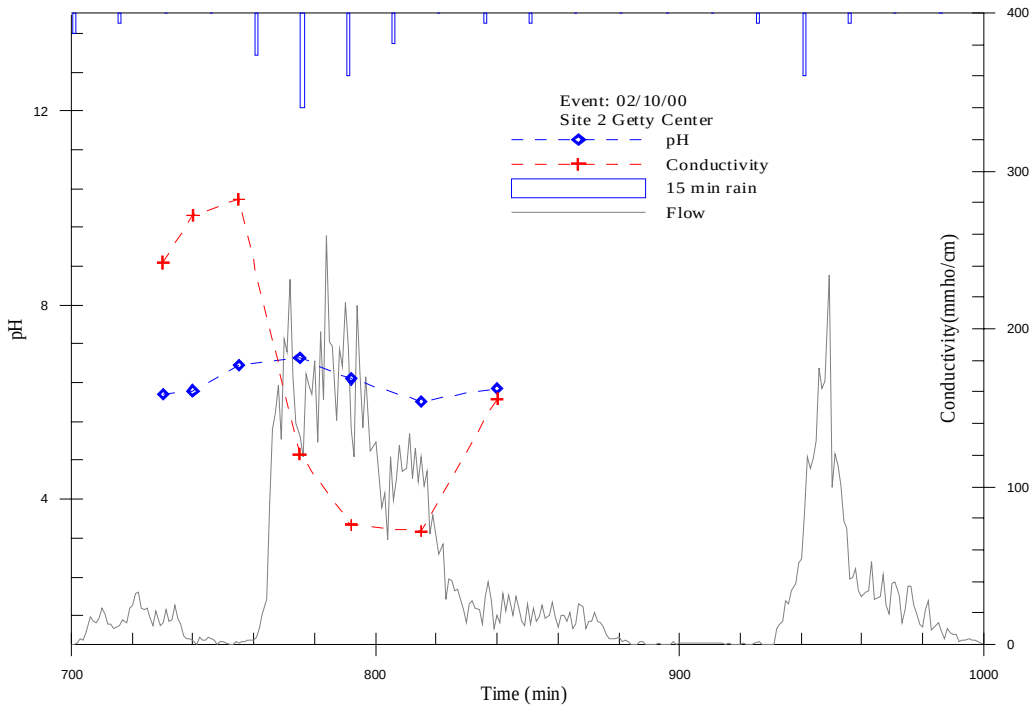


Figure I.1.2.4e (Y1-UCLA2-E5-5.) Polluto-graph for pH and Conductivity

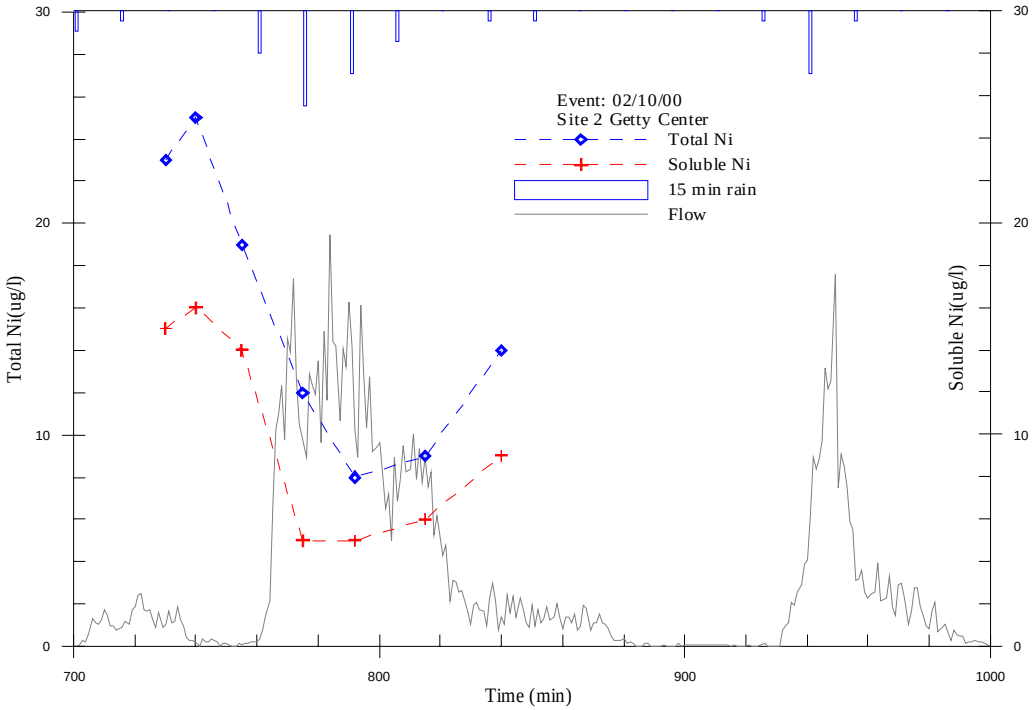


Figure I.1.2.4f (Y1-UCLA2-E5-6.) Polluto-graph for Total Ni / Dissolved Ni

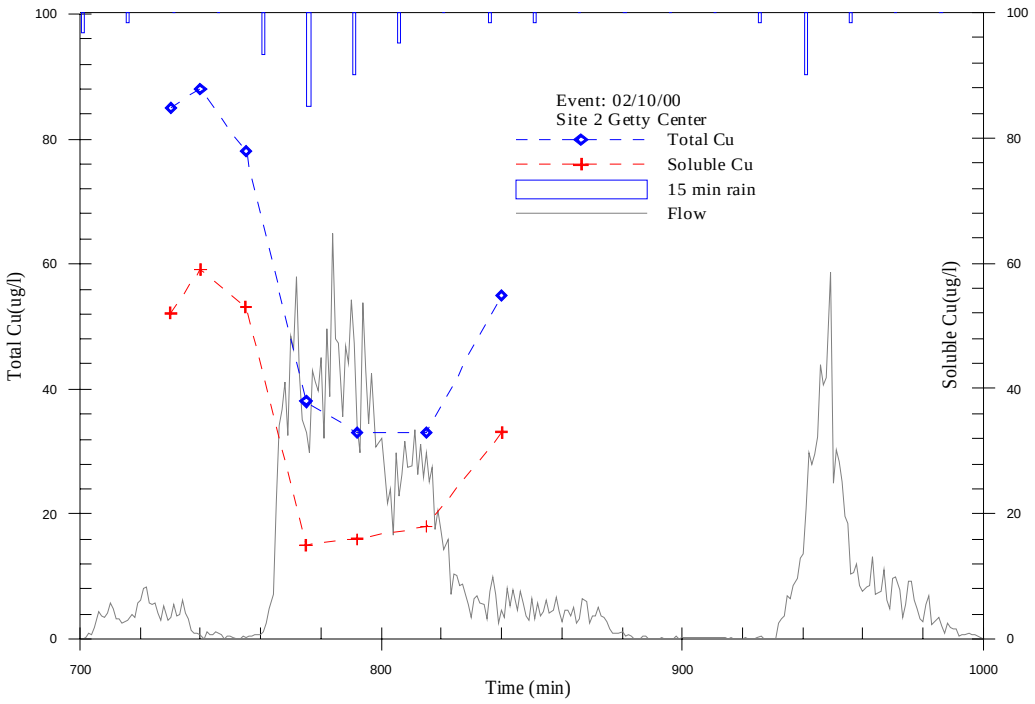


Figure I.1.2.4g (Y1-UCLA2-E5-7.) Polluto-graph for Total Cu / Dissolved Cu

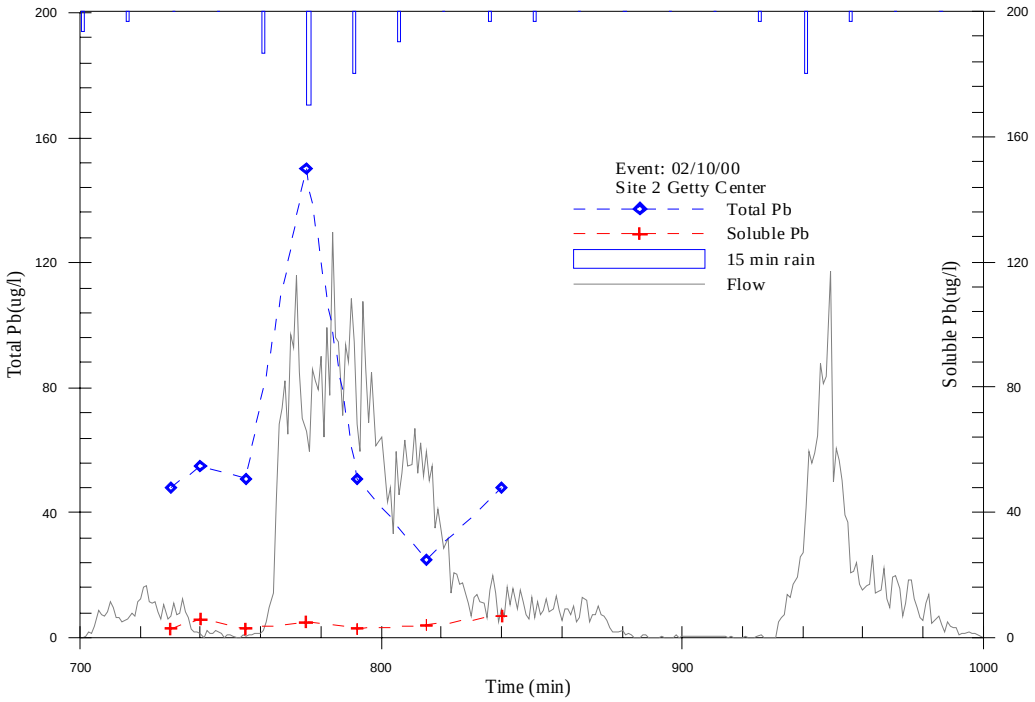


Figure I.1.2.4h (Y1-UCLA2-E5-8.) Polluto-graph for Total Pb / Dissolved Pb

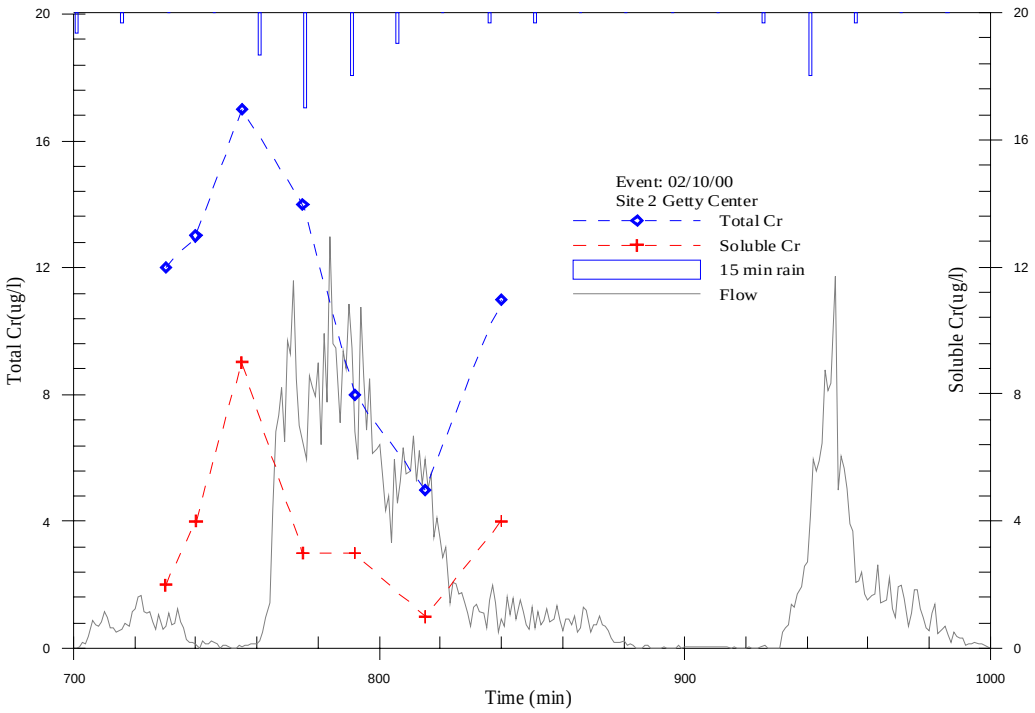


Figure I.1.2.4i (Y1-UCLA2-E5-9.) Polluto-graph for Total Cr / Dissolved Cr

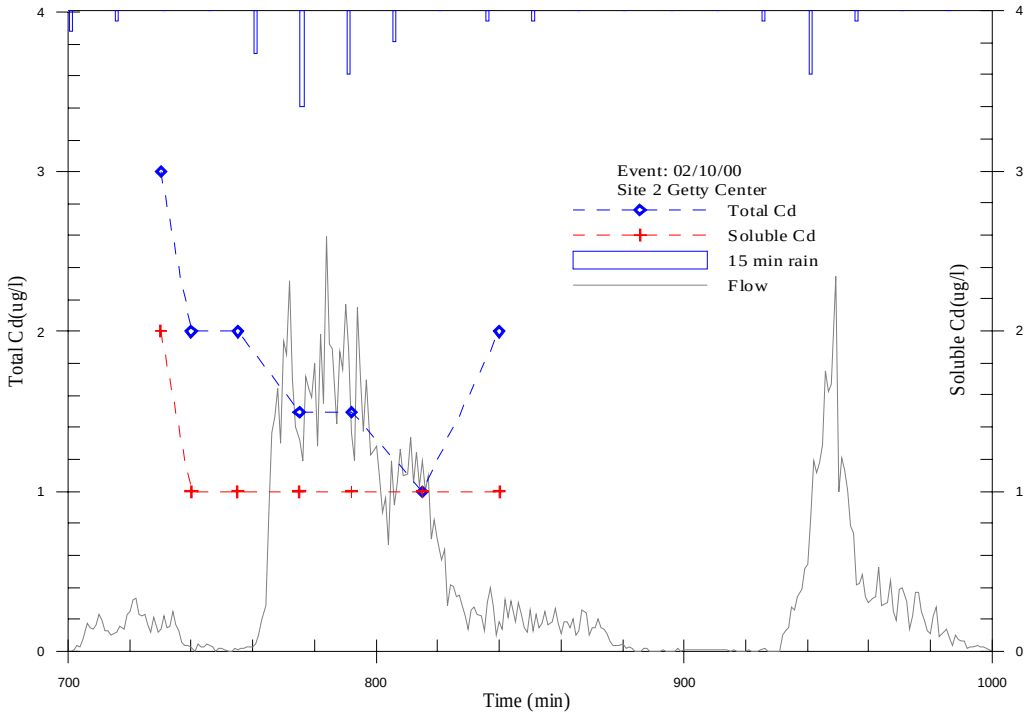


Figure I.1.2.4j (Y1-UCLA2-E5-10.) Polluto-graph for Total Cd / Dissolved Cd

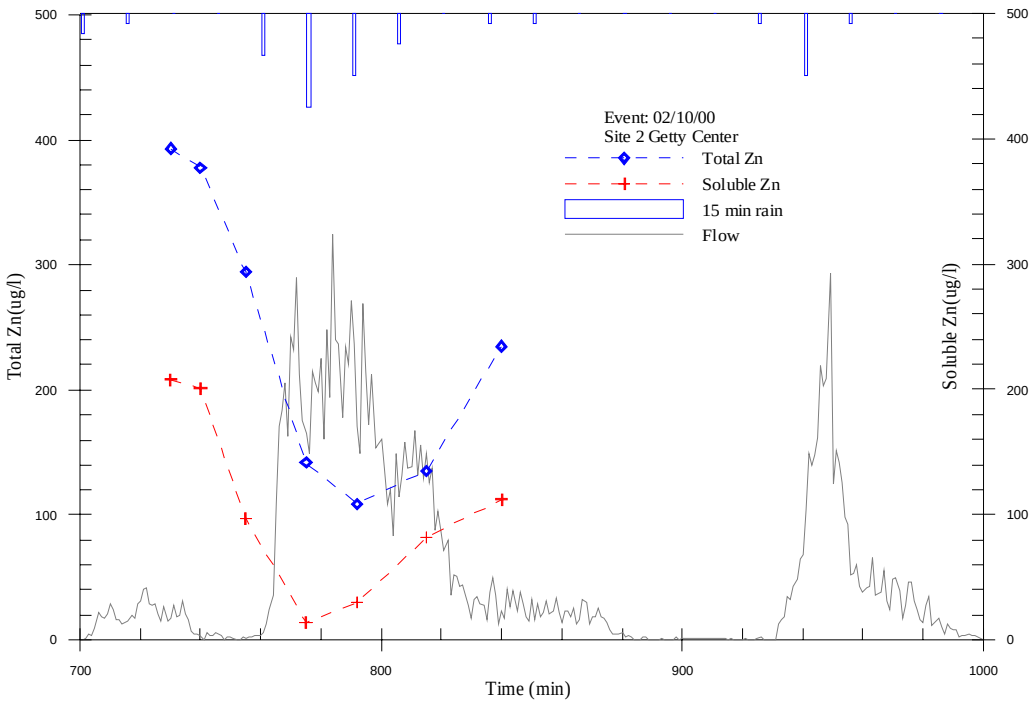


Figure I.1.2.4k (Y1-UCLA2-E5-11.) Polluto-graph for Total Zn / Dissolved Zn

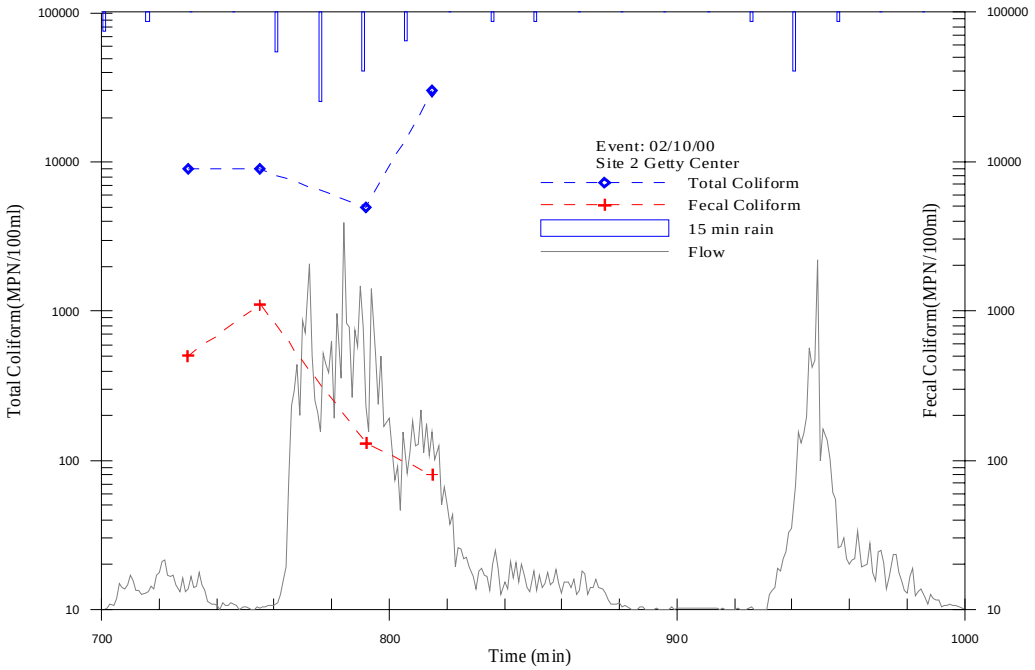


Figure I.1.2.4l (Y1-UCLA2-E5-12.) Polluto-graph for Total Coliform / Fecal Coliform

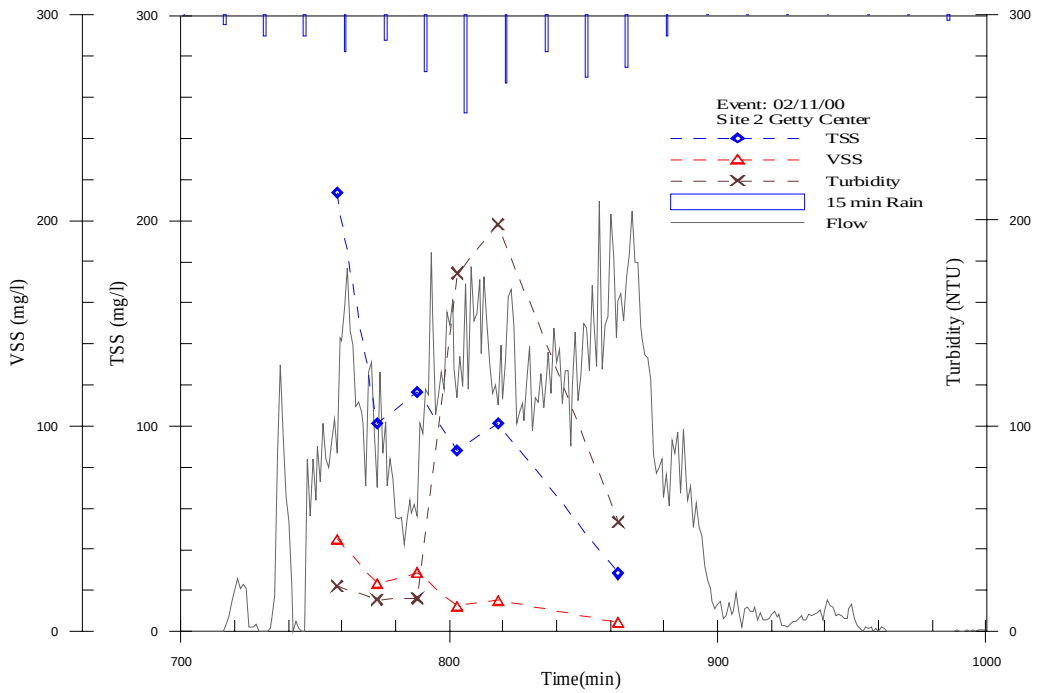


Figure I.1.2.5a (Y1-UCLA2-E6-1.) Polluto-graph for TSS, VSS and Turbidity

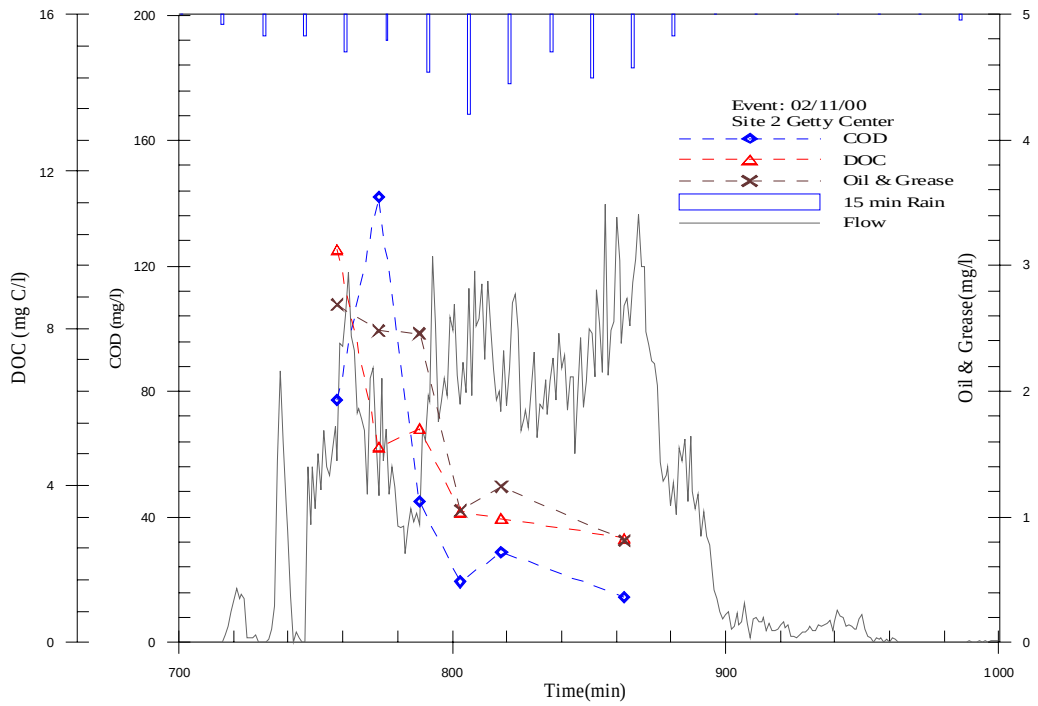


Figure I.1.2.5b (Y1-UCLA2-E6-2.) Polluto-graph for DOC, COD and Oil & Grease

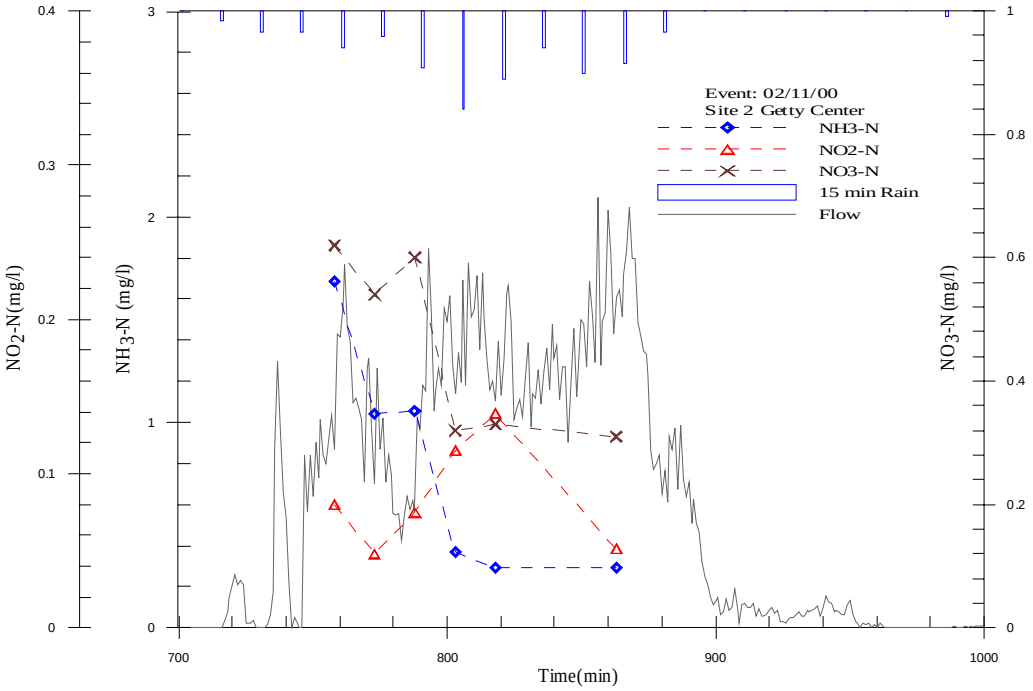


Figure I.1.2.5c (Y1-UCLA2-E6-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

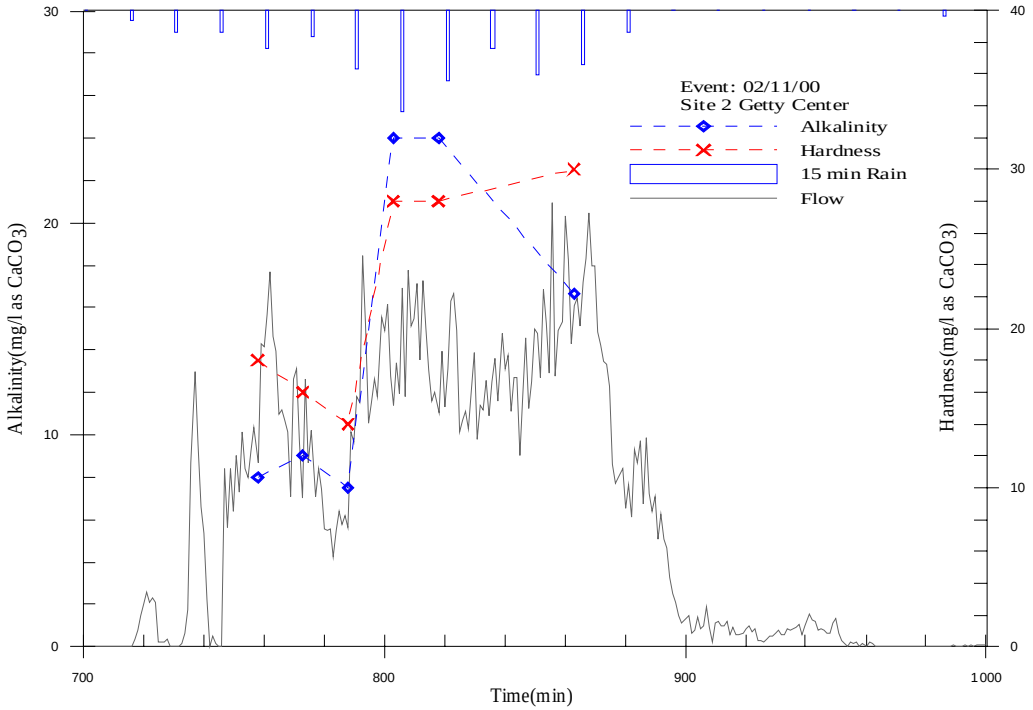


Figure I.1.2.5d (Y1-UCLA2-E6-4.) Polluto-graph for Alkalinity and Hardness

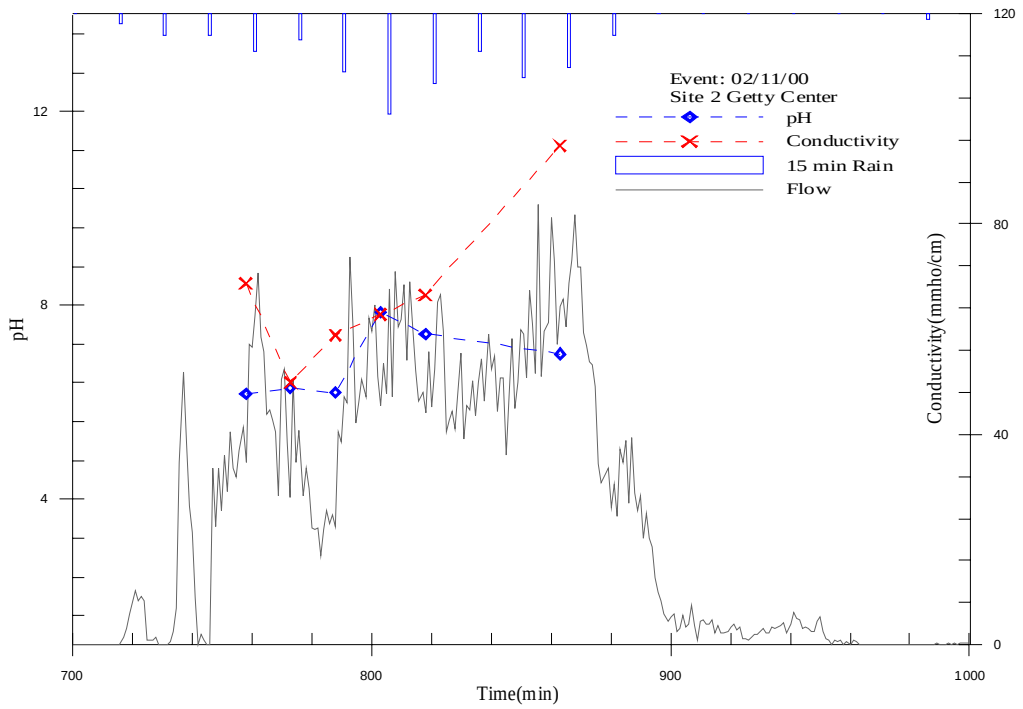


Figure I.1.2.5e (Y1-UCLA2-E6-5.) Polluto-graph for pH and Conductivity

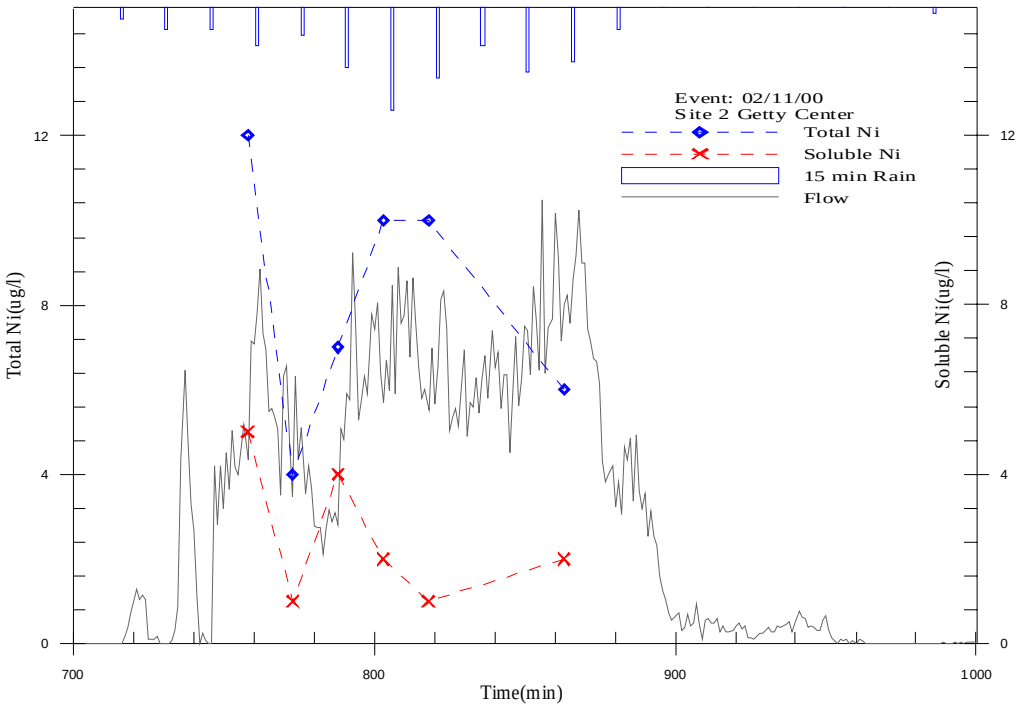


Figure I.1.2.5f (Y1-UCLA2-E6-6.) Polluto-graph for Total Ni / Dissolved Ni

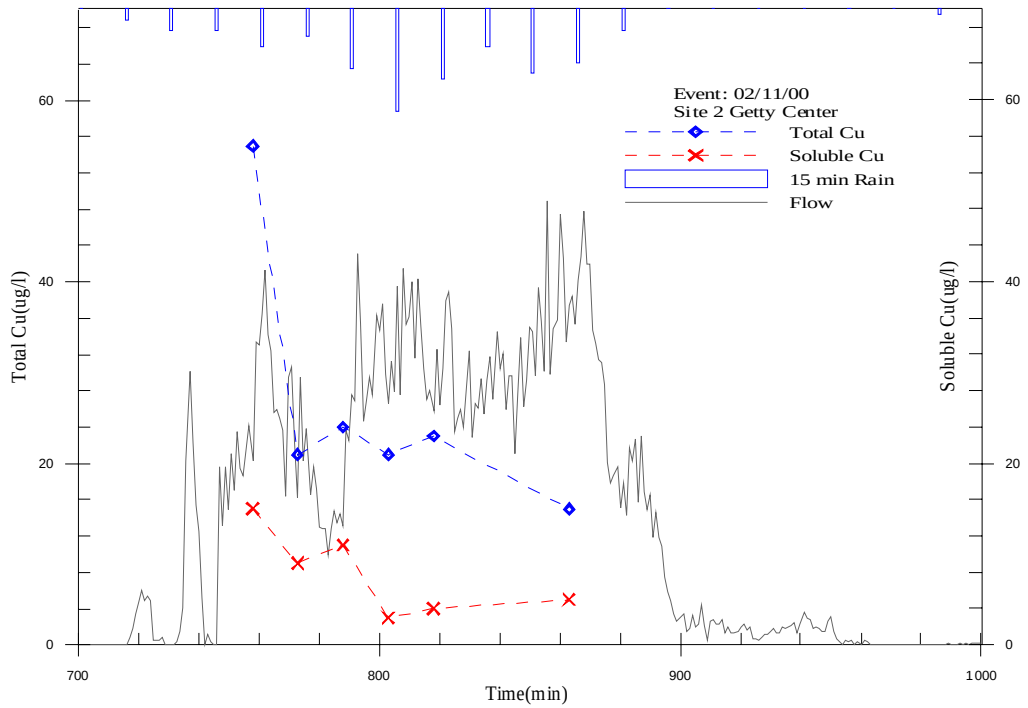


Figure I.1.2.5g (Y1-UCLA2-E6-7.) Polluto-graph for Total Cu / Dissolved Cu

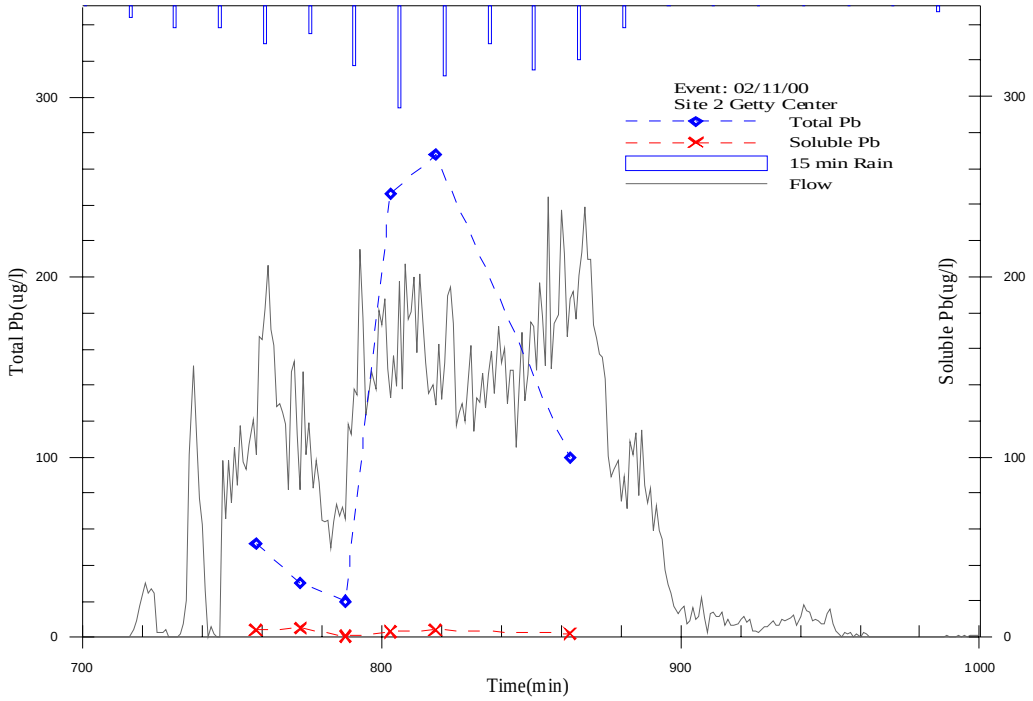


Figure I.1.2.5h (Y1-UCLA2-E6-8.) Polluto-graph for Total Pb / Dissolved Pb

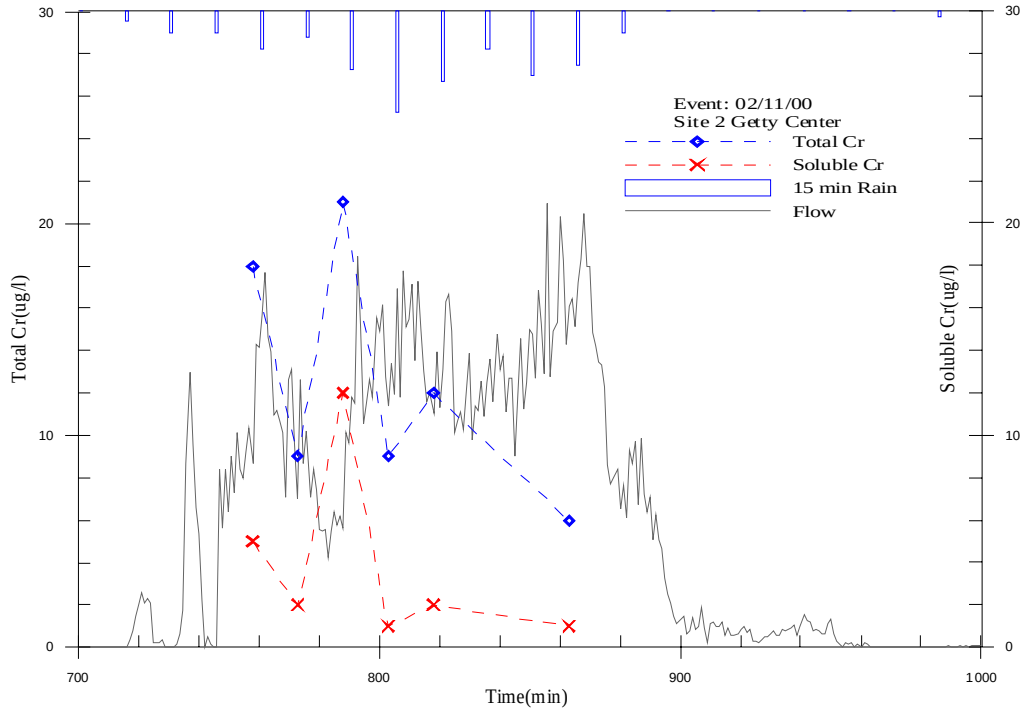


Figure I.1.2.5i (Y1-UCLA2-E6-9.) Polluto-graph for Total Cr / Dissolved Cr

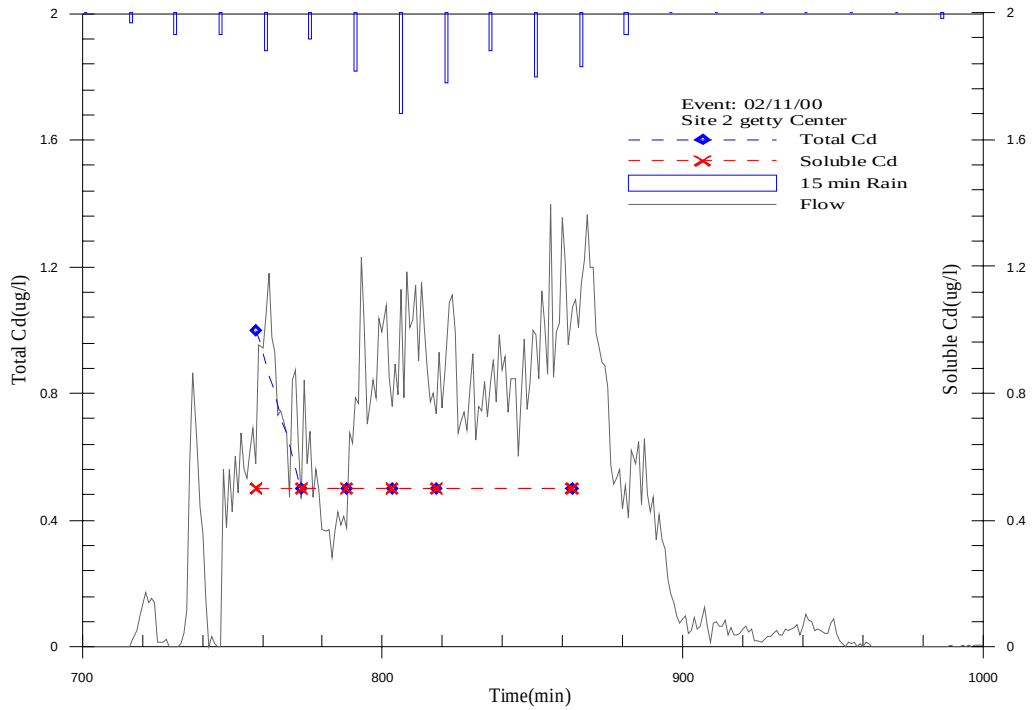


Figure I.1.2.5j (Y1-UCLA2-E6-10.) Polluto-graph for Total Cd / Dissolved Cd

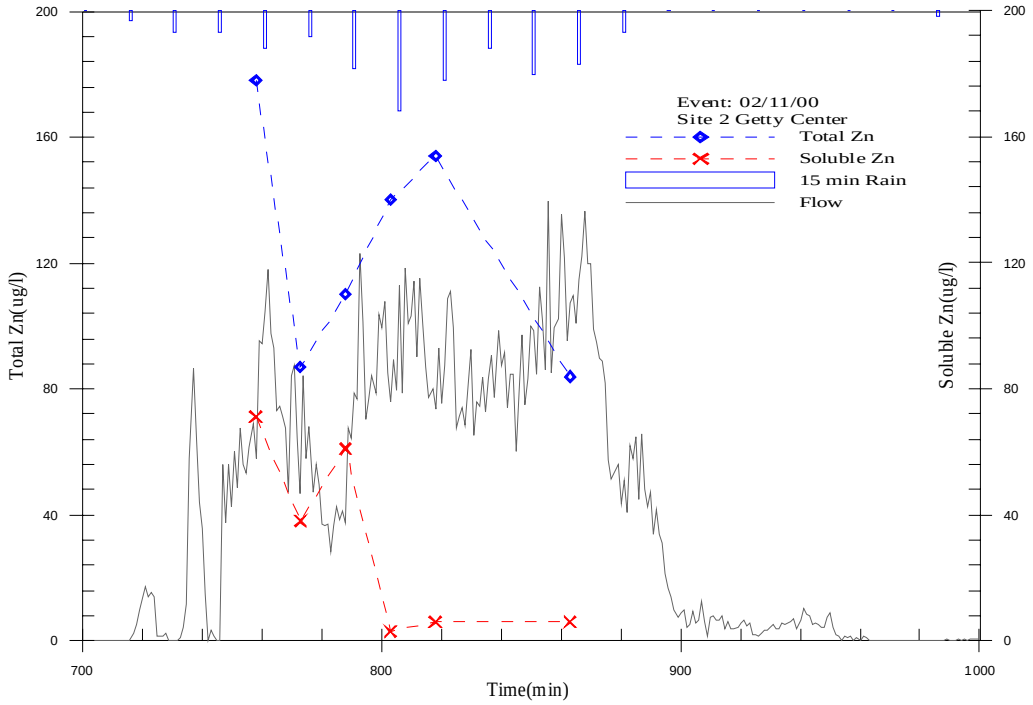


Figure I.1.2.5k (Y1-UCLA2-E6-11.) Polluto-graph for Total Zn / Dissolved Zn

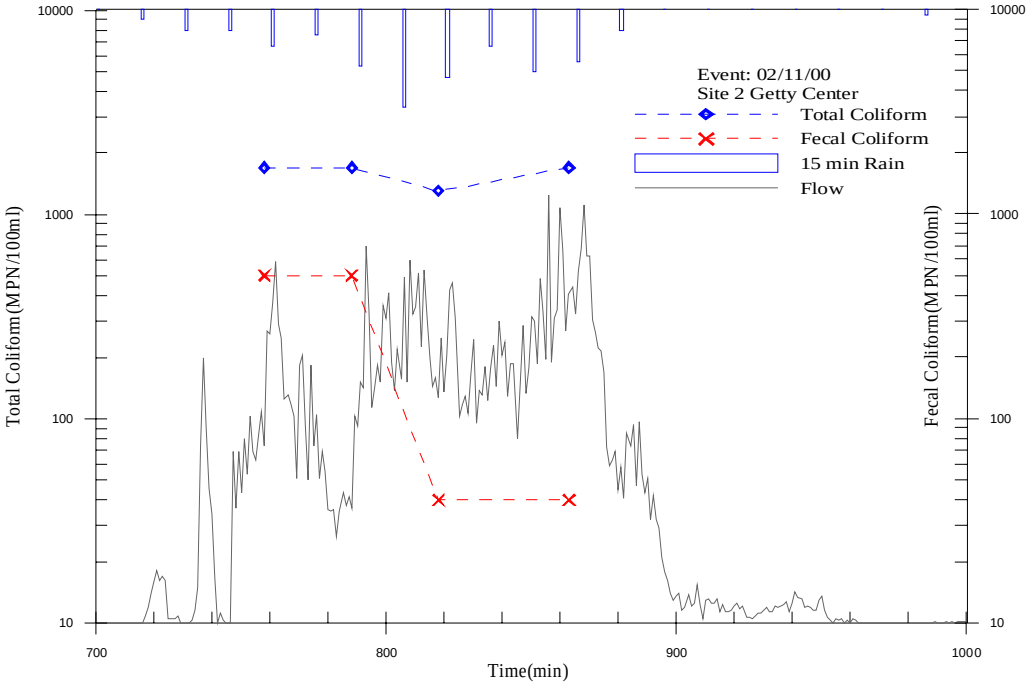


Figure I.1.2.5l (Y1-UCLA2-E6-12.) Polluto-graph for Total Coliform / Fecal Coliform

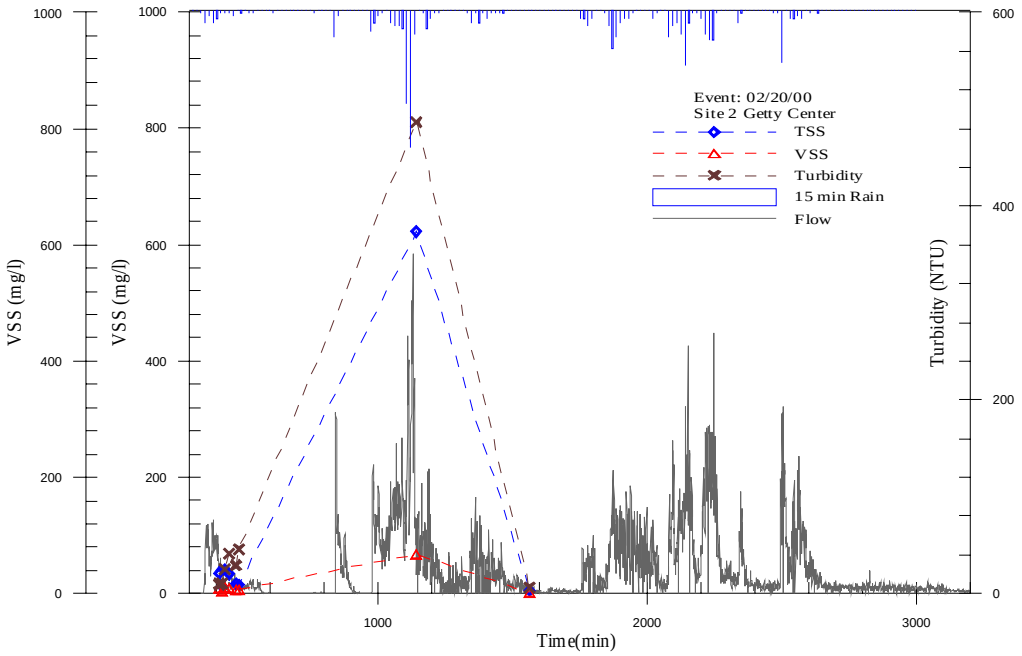


Figure I.1.2.6a (Y1-UCLA2-E7-1.) Polluto-graph for TSS, VSS and Turbidity

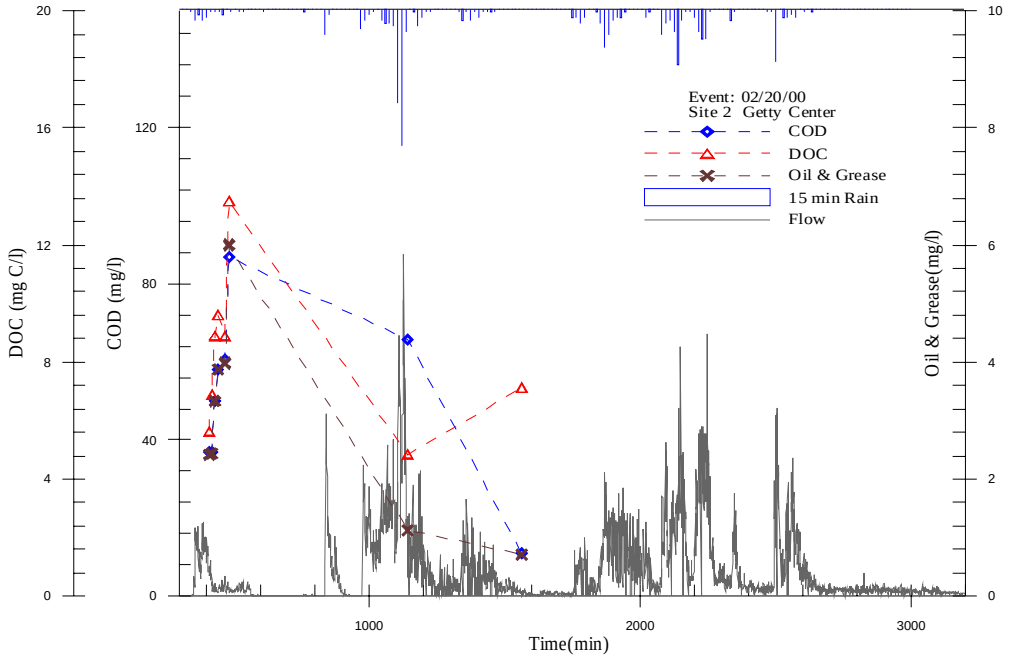


Figure I.1.2.6b (Y1-UCLA2-E7-2.) Polluto-graph for DOC, COD and Oil & Grease

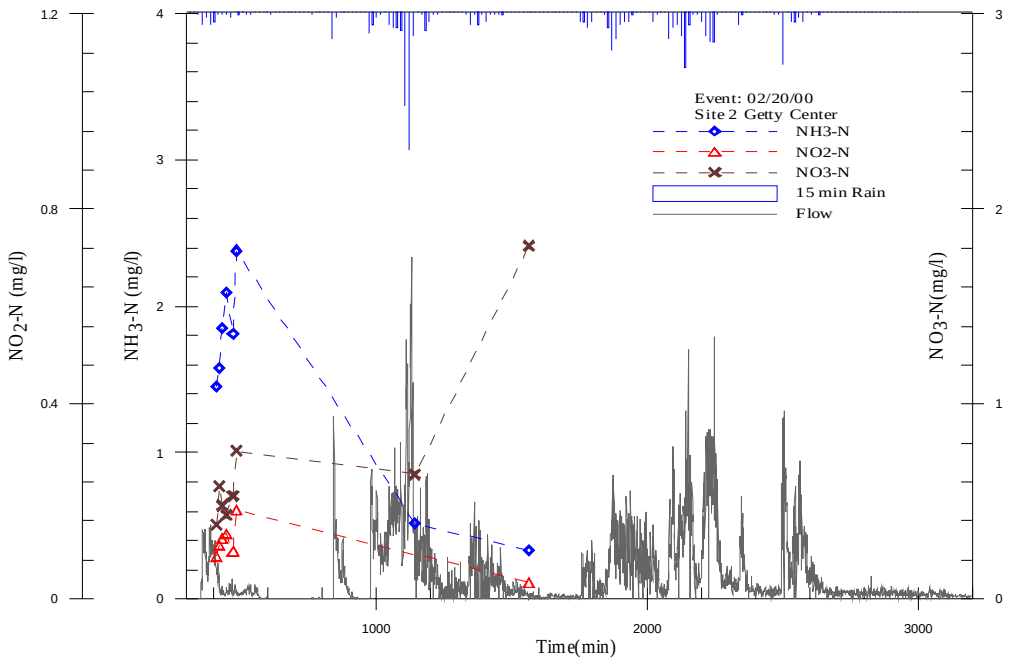


Figure I.1.2.6c (Y1-UCLA2-E7-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

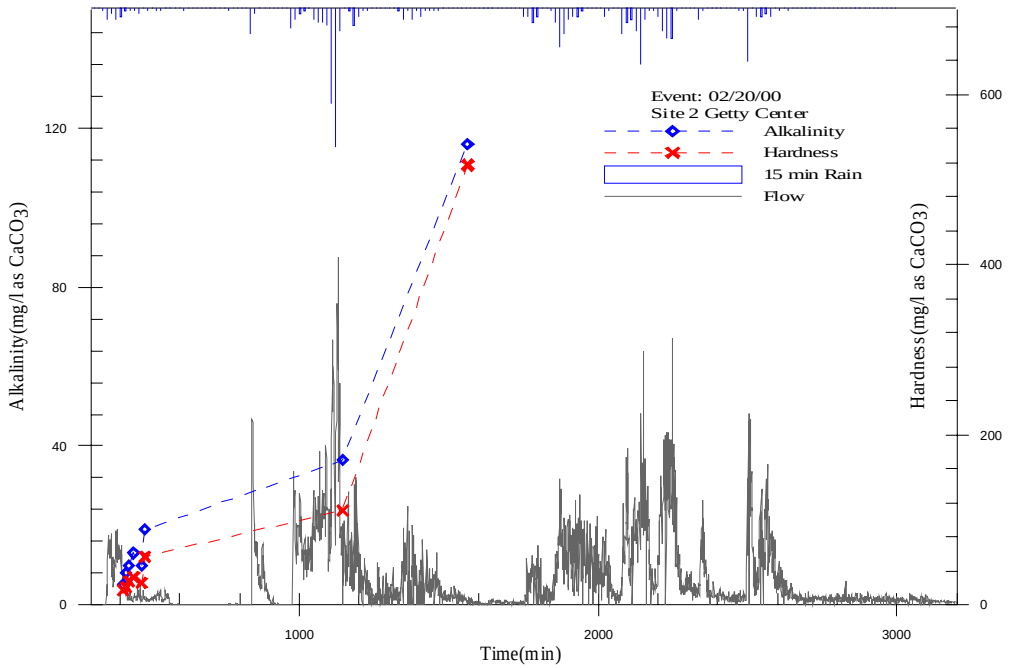


Figure I.1.2.6d (Y1-UCLA2-E7-4.) Polluto-graph for Alkalinity and Hardness

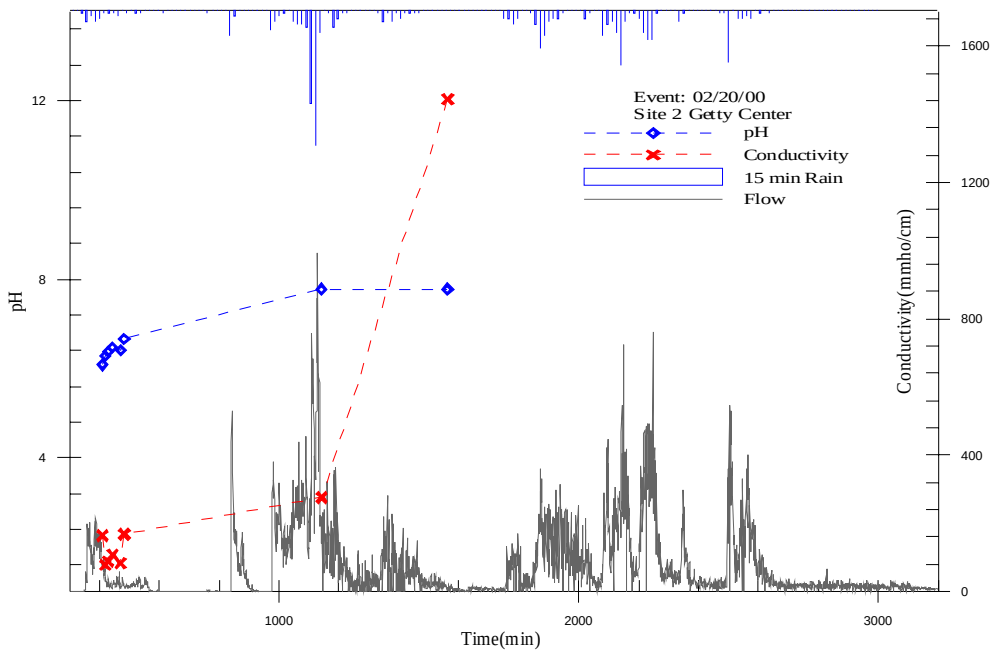


Figure I.1.2.6e (Y1-UCLA2-E7-5.) Polluto-graph for pH and Conductivity

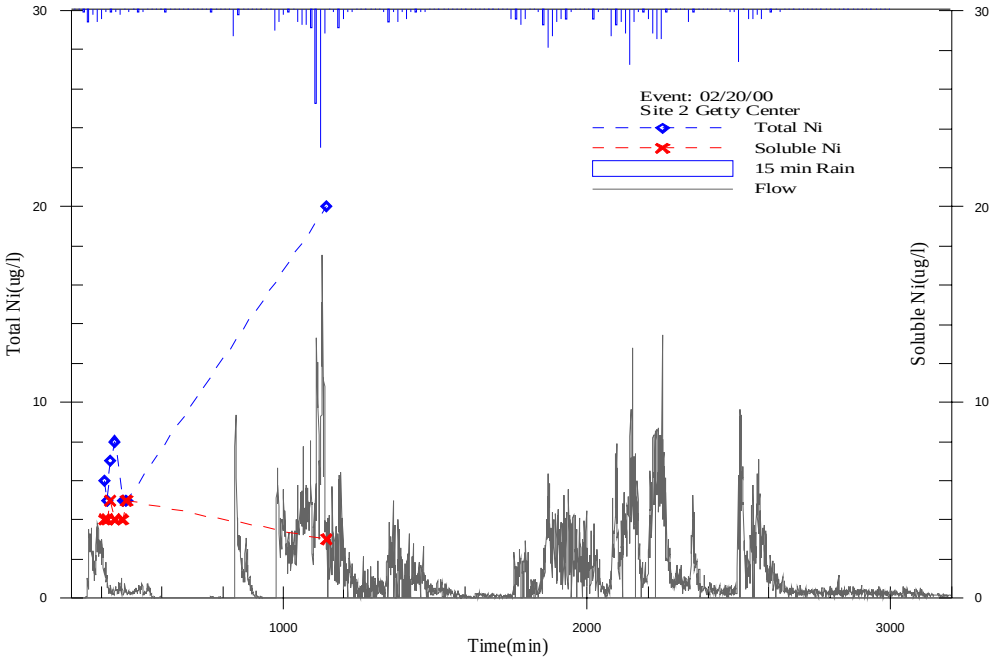


Figure I.1.2.6f (Y1-UCLA2-E7-6.) Polluto-graph for Total Ni / Dissolved Ni

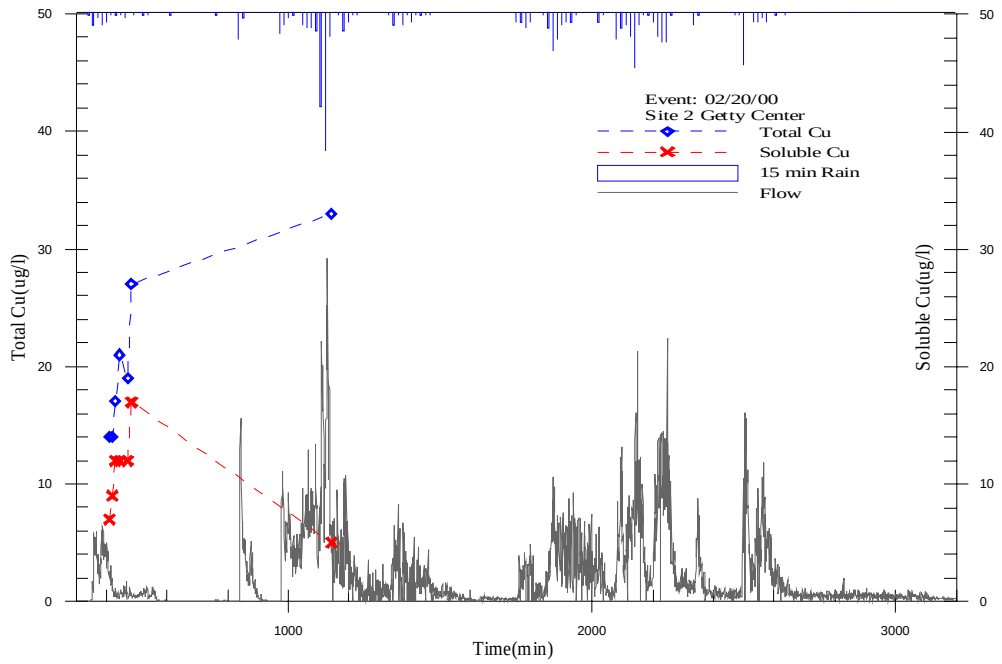


Figure I.1.2.6g (Y1-UCLA2-E7-7.) Polluto-graph for Total Cu / Dissolved Cu

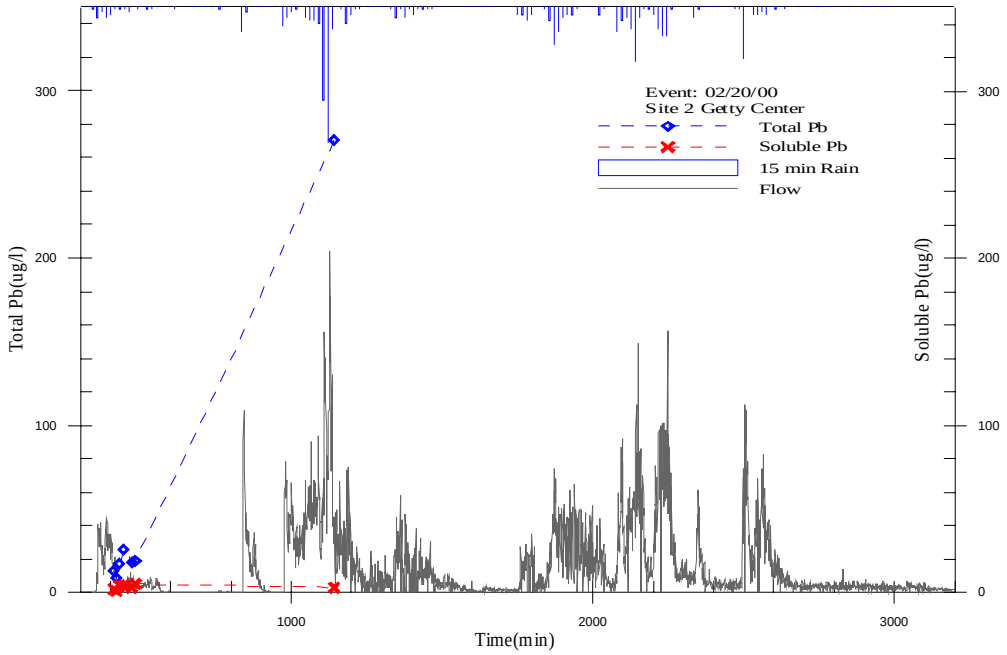


Figure I.1.2.6h (Y1-UCLA2-E7-8.) Polluto-graph for Total Pb / Dissolved Pb

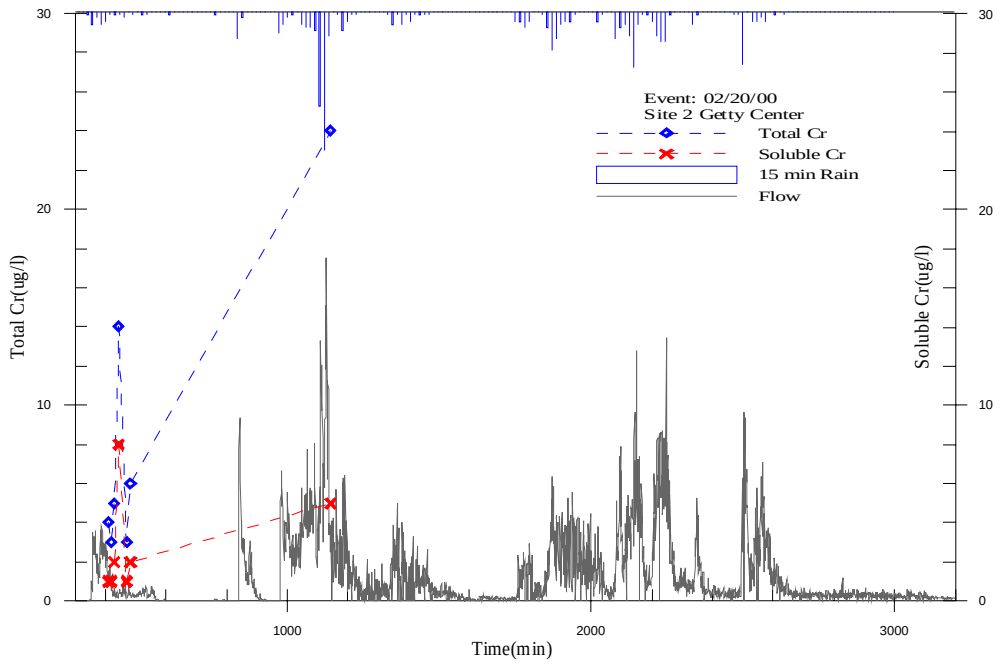


Figure I.1.2.6i (Y1-UCLA2-E7-9.) Polluto-graph for Total Cr / Dissolved Cr

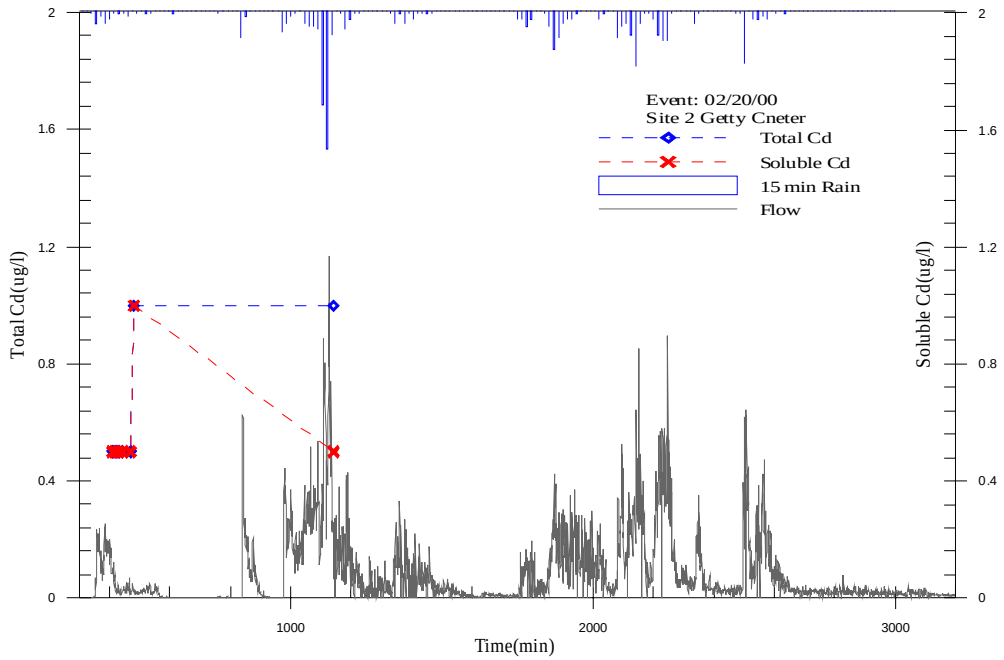


Figure I.1.2.6j (Y1-UCLA2-E7-10.) Polluto-graph for Total Cd / Dissolved Cd

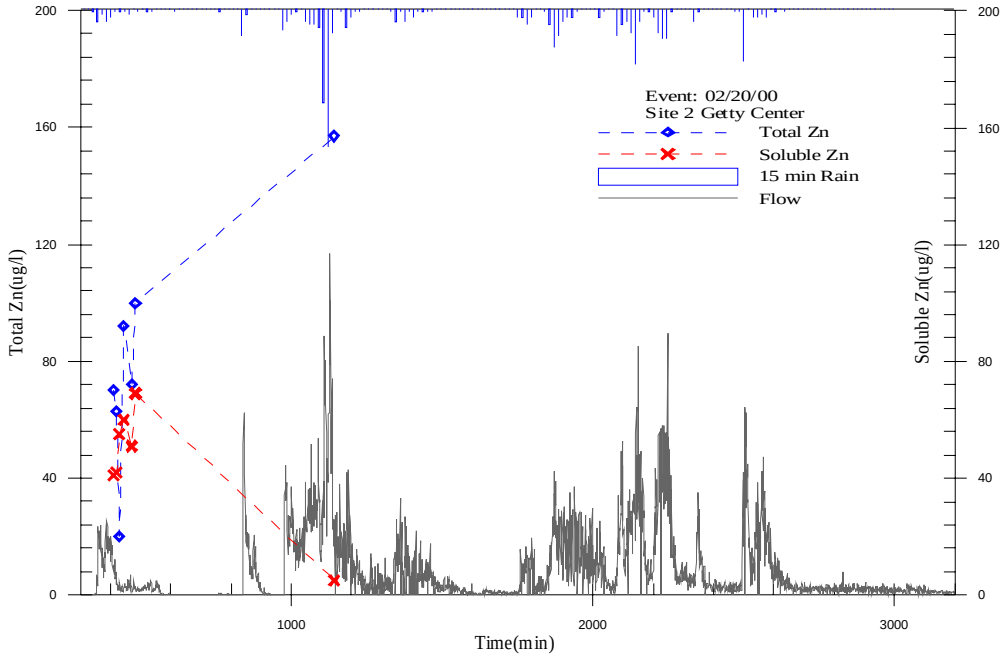


Figure I.1.2.6k (Y1-UCLA2-E7-11.) Polluto-graph for Total Zn / Dissolved Zn

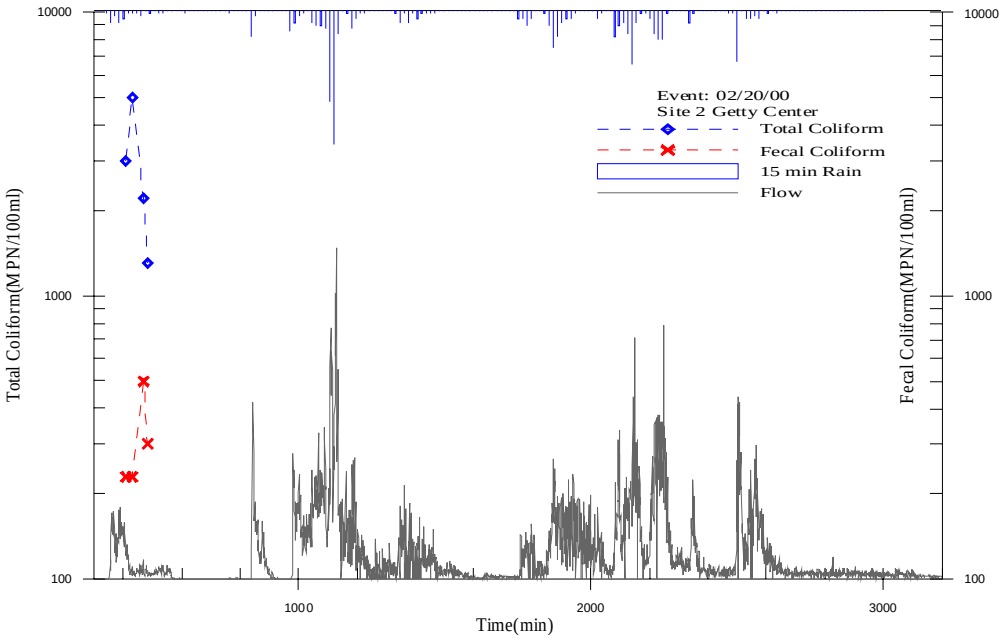


Figure I.1.2.6l (Y1-UCLA2-E7-12.) Polluto-graph for Total Coliform / Fecal Coliform

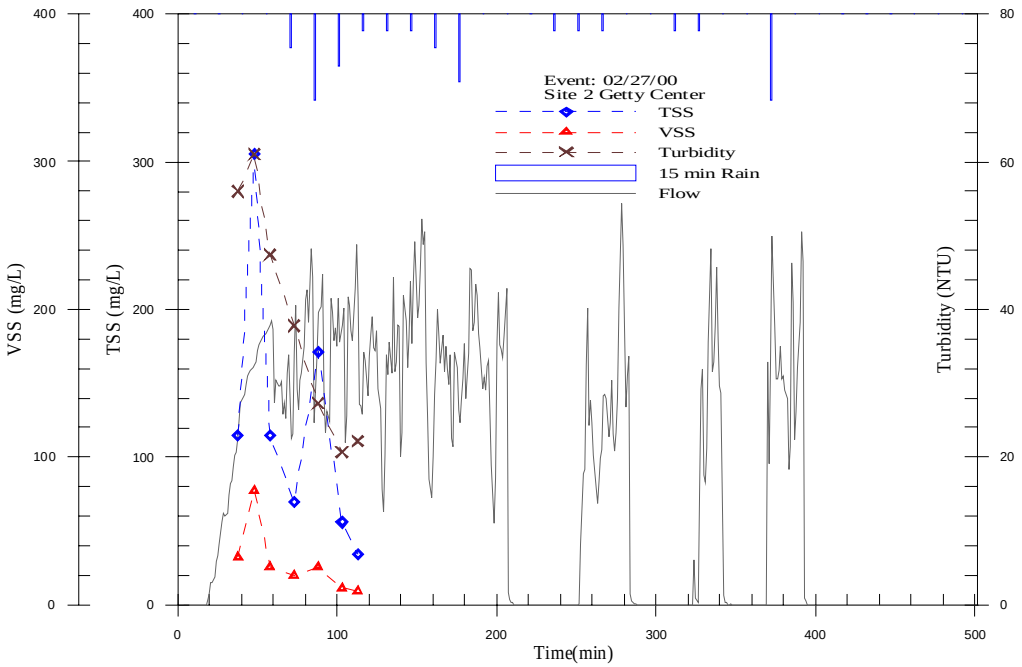


Figure I.1.2.7a (Y1-UCLA2-E8-1.) Polluto-graph for TSS, VSS and Turbidity

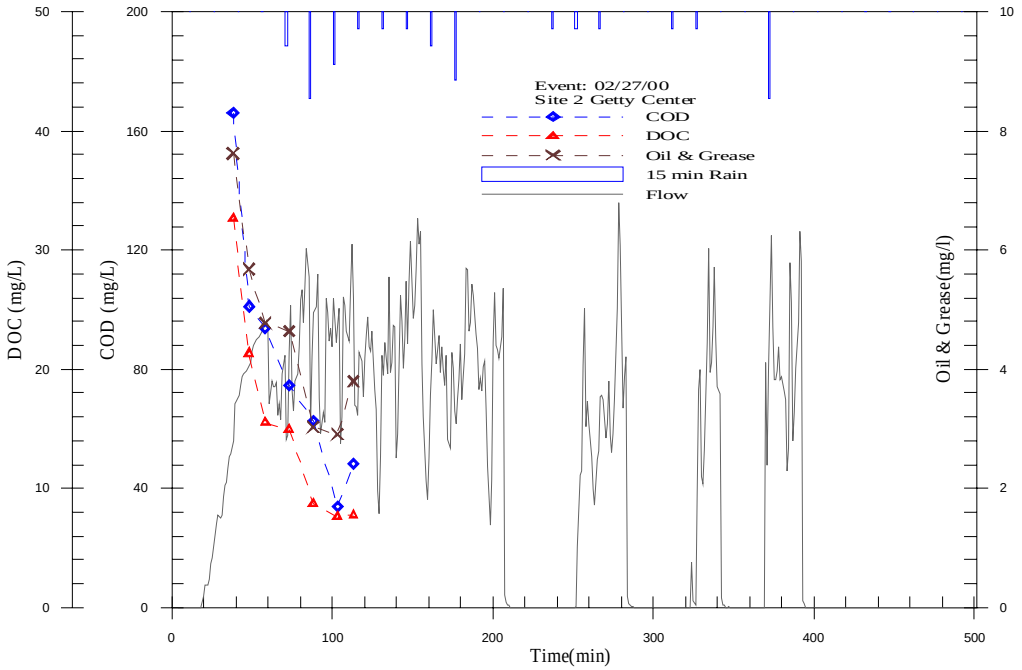


Figure I.1.2.7b (Y1-UCLA2-E8-2.) Polluto-graph for DOC, COD and Oil & Grease

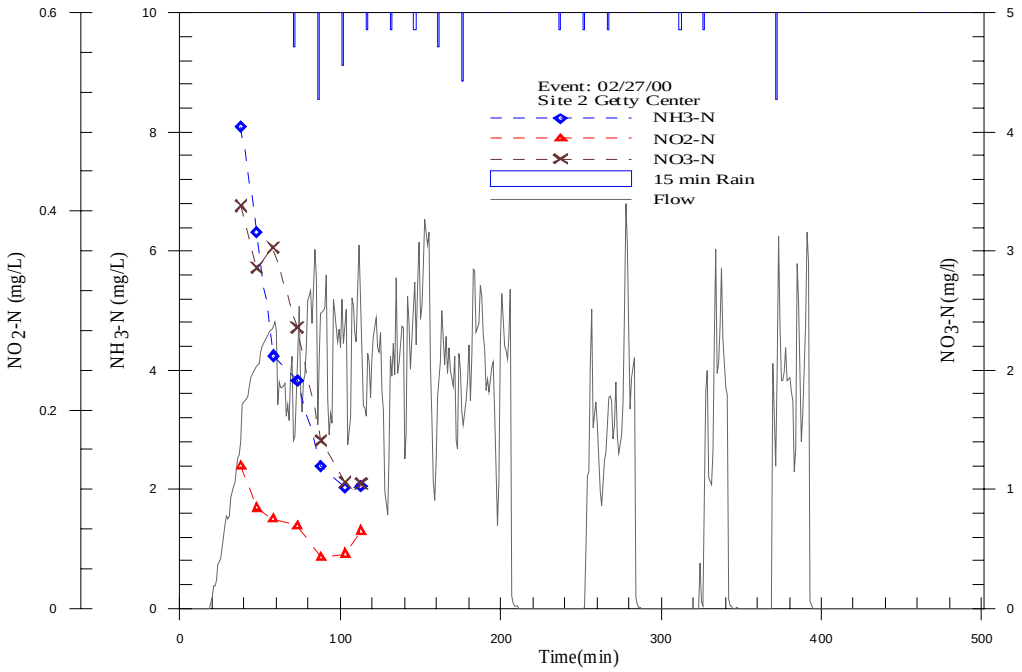


Figure I.1.2.7c (Y1-UCLA2-E8-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

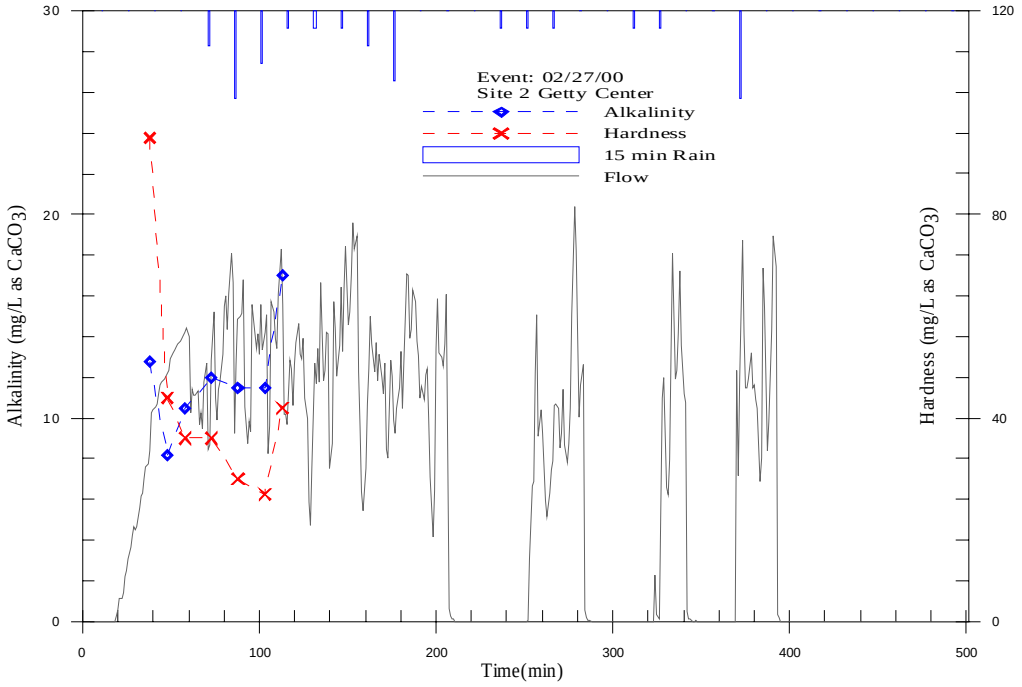


Figure I.1.2.7d (Y1-UCLA2-E8-4.) Polluto-graph for Alkalinity and Hardness

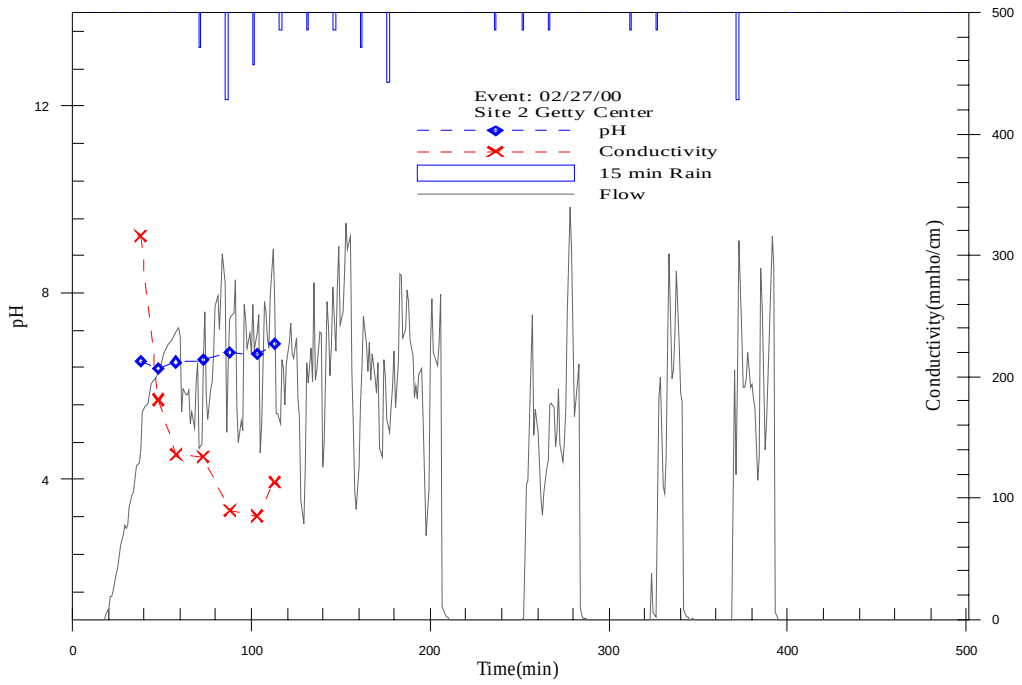


Figure I.1.2.7e (Y1-UCLA2-E8-5.) Polluto-graph for pH and Conductivity

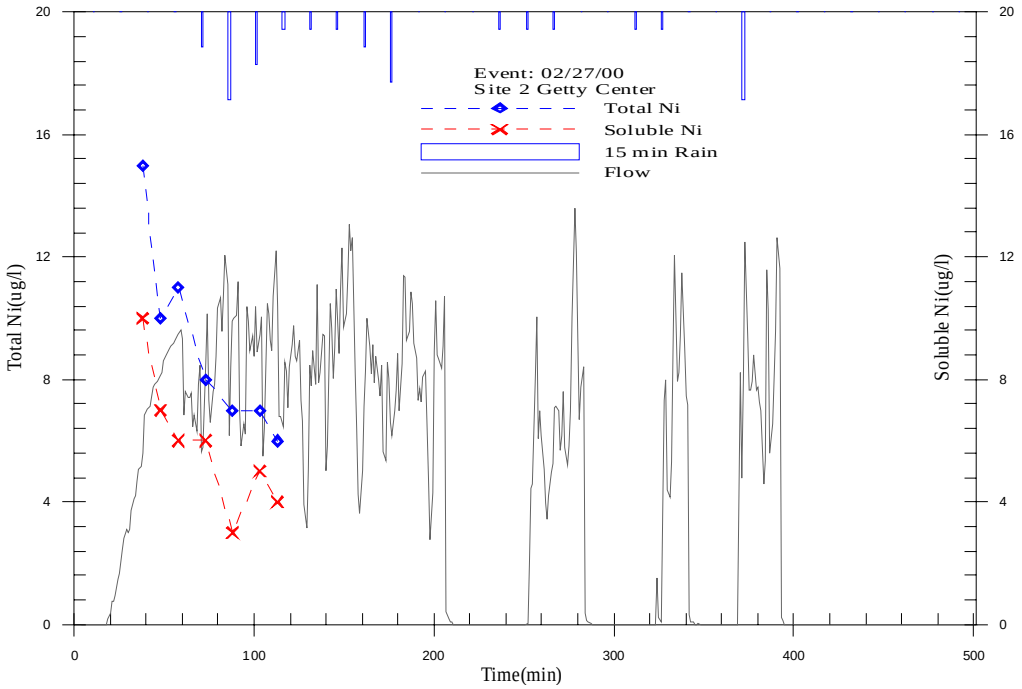


Figure I.1.2.7f (Y1-UCLA2-E8-6.) Polluto-graph for Total Ni / Dissolved Ni

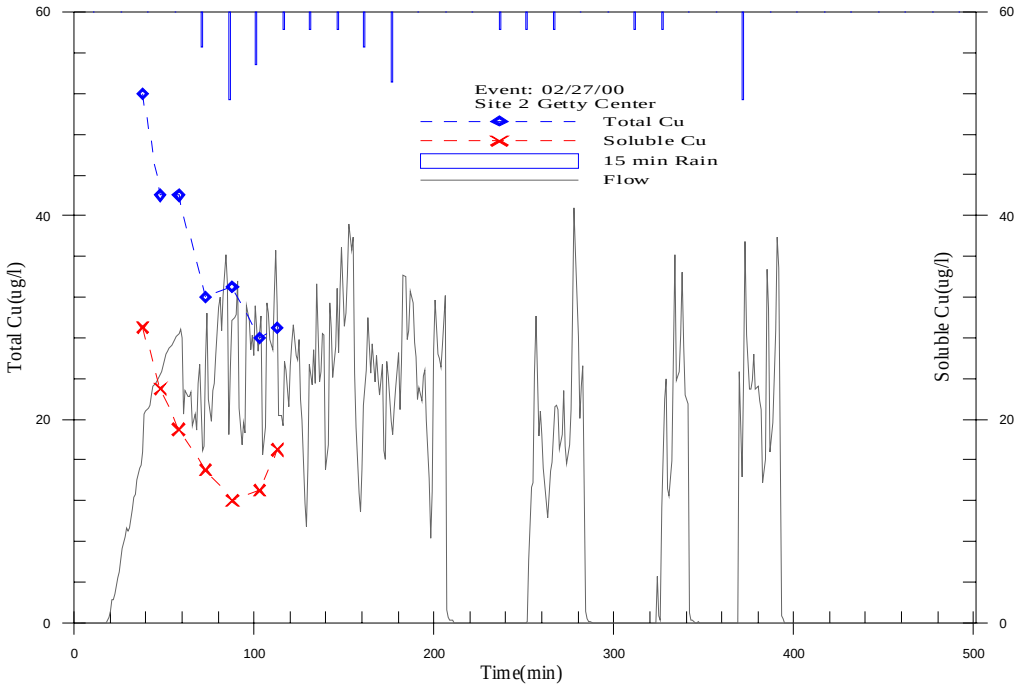


Figure I.1.2.7g (Y1-UCLA2-E8-7.) Polluto-graph for Total Cu / Dissolved Cu

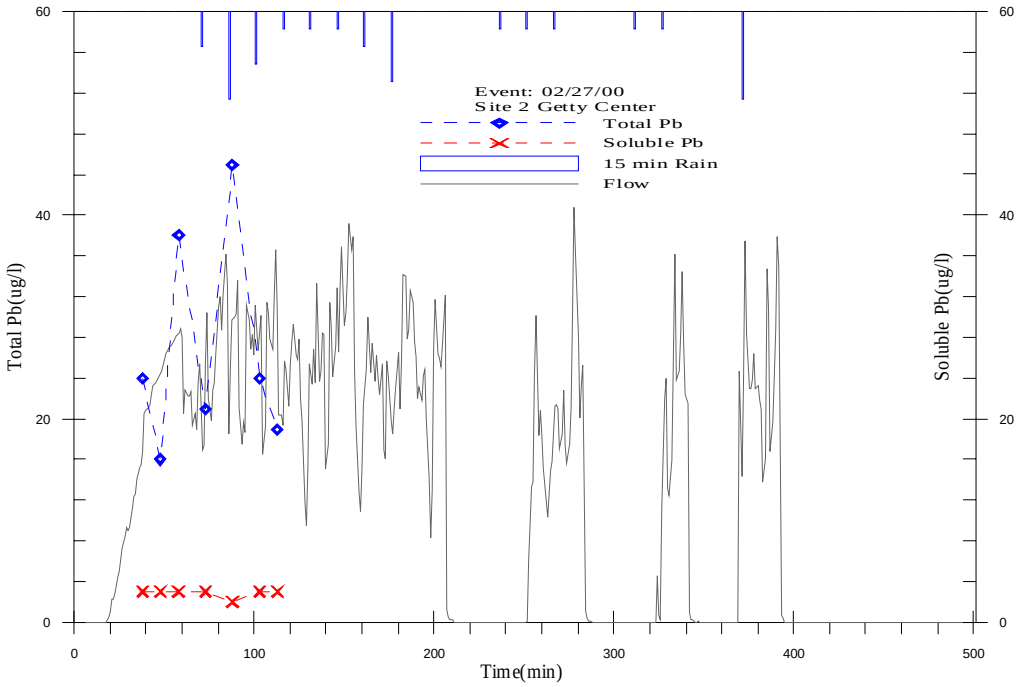


Figure I.1.2.7h (Y1-UCLA2-E8-8.) Polluto-graph for Total Pb / Dissolved Pb

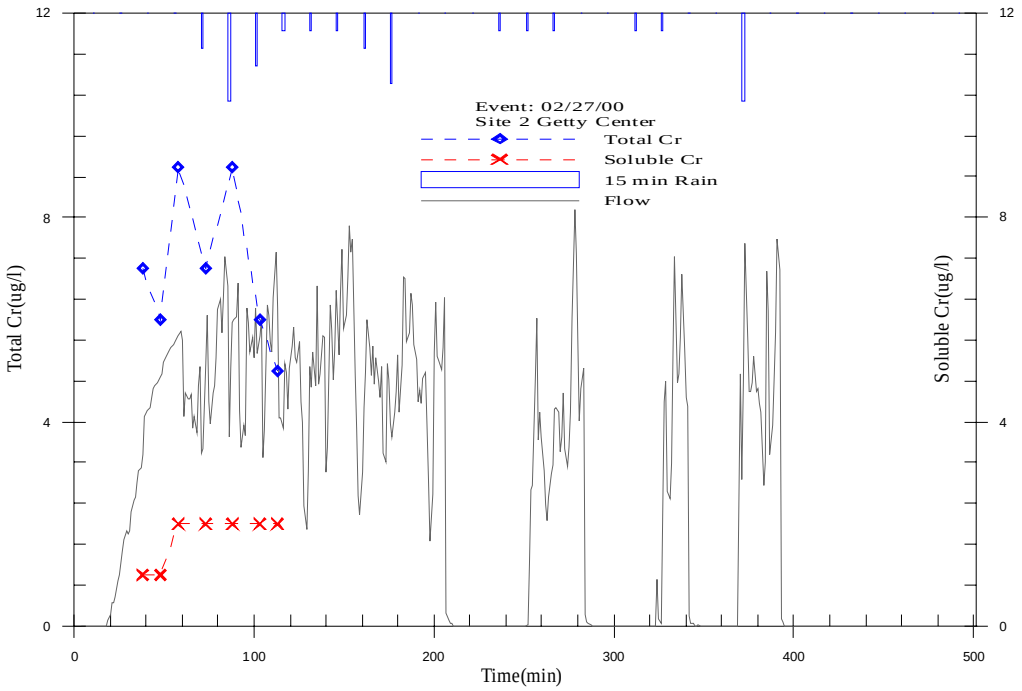


Figure I.1.2.7i (Y1-UCLA2-E8-9.) Polluto-graph for Total Cr / Dissolved Cr

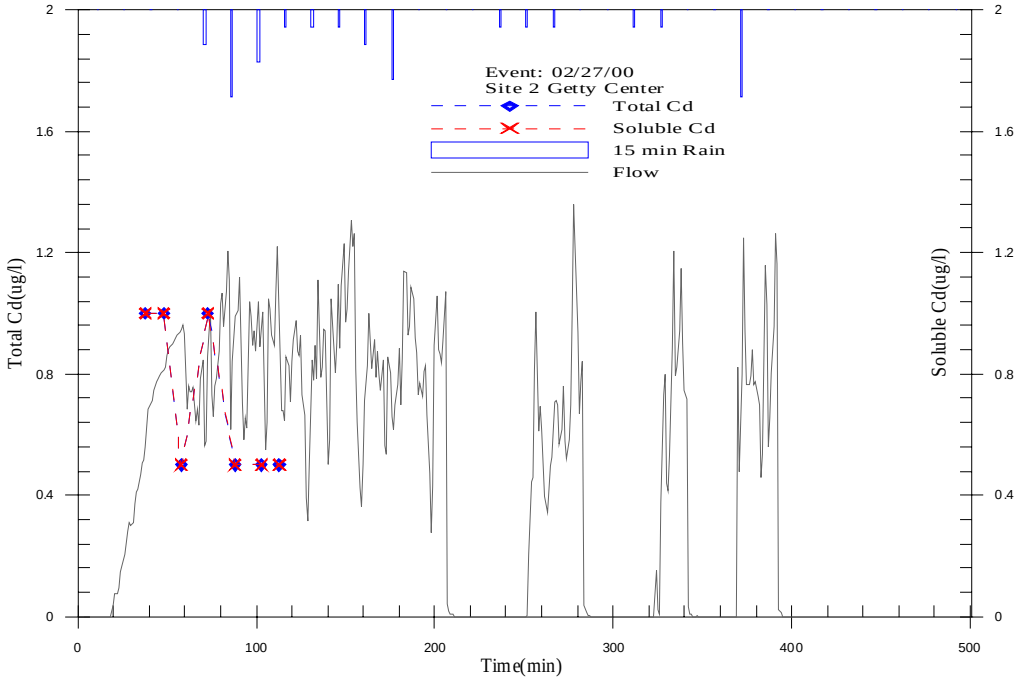


Figure I.1.2.7j (Y1-UCLA2-E8-10.) Polluto-graph for Total Cd / Dissolved Cd

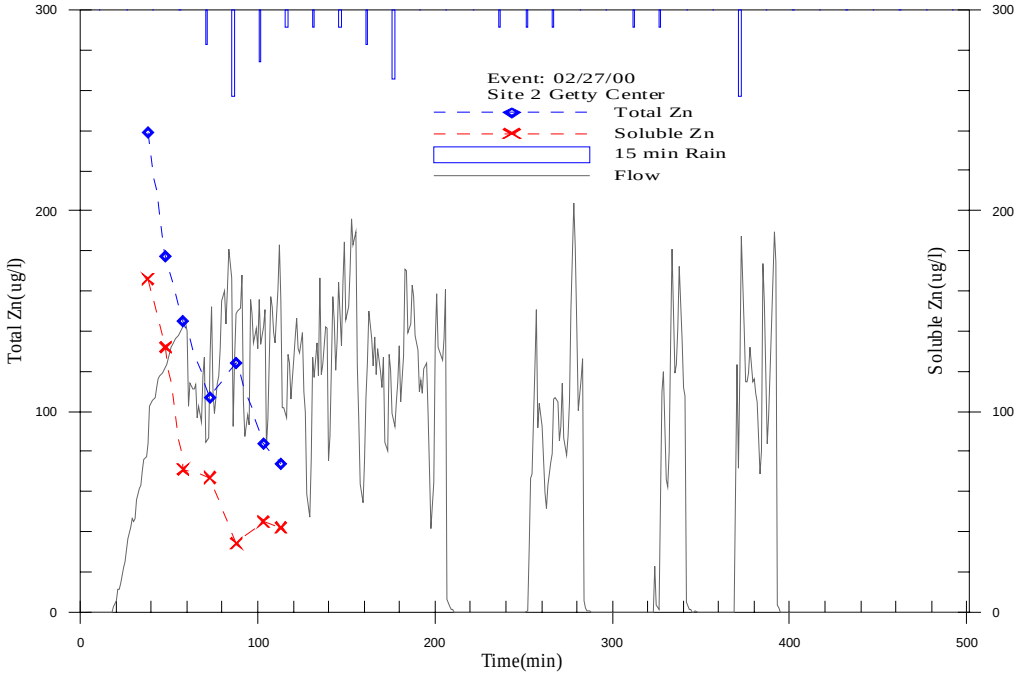


Figure I.1.2.7k (Y1-UCLA2-E8-11.) Polluto-graph for Total Zn / Dissolved Zn

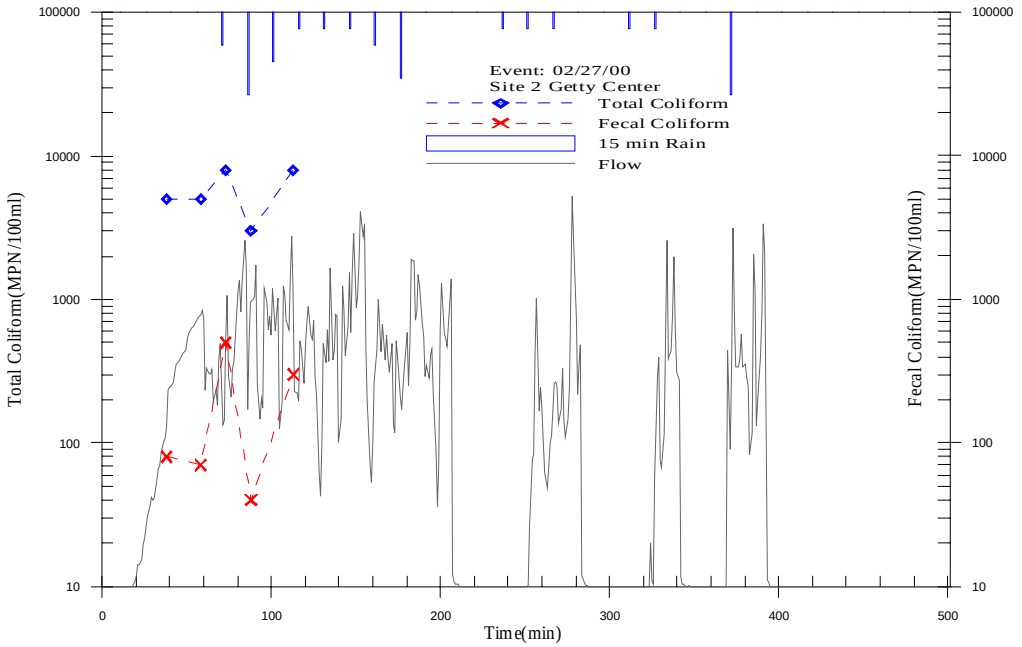


Figure I.1.2.7l (Y1-UCLA2-E8-12.) Polluto-graph for Total Coliform / Fecal Coliform

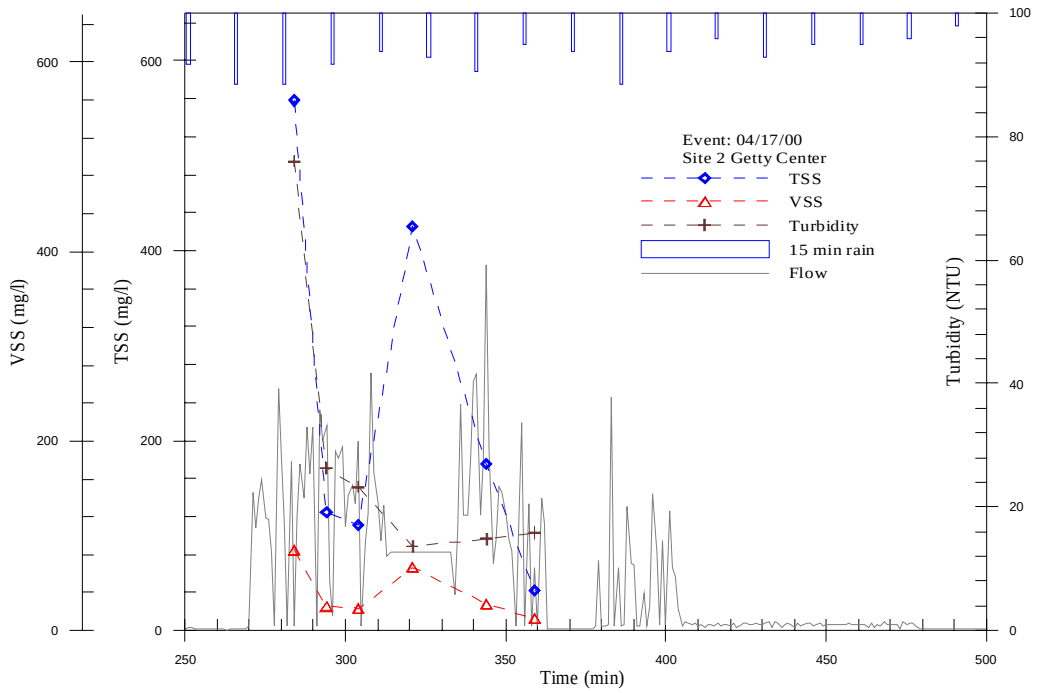


Figure I.1.2.8a (Y1-UCLA2-E11-1.) Polluto-graph for TSS, VSS and Turbidity

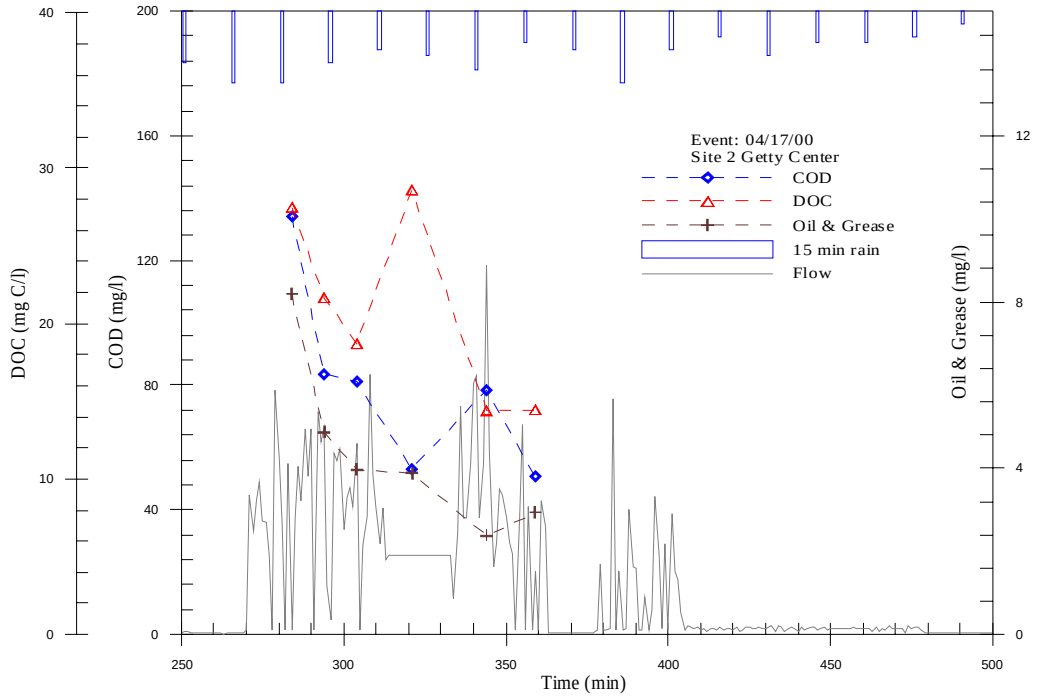


Figure I.1.2.8b (Y1-UCLA2-E11-2.) Polluto-graph for DOC, COD and Oil & Grease

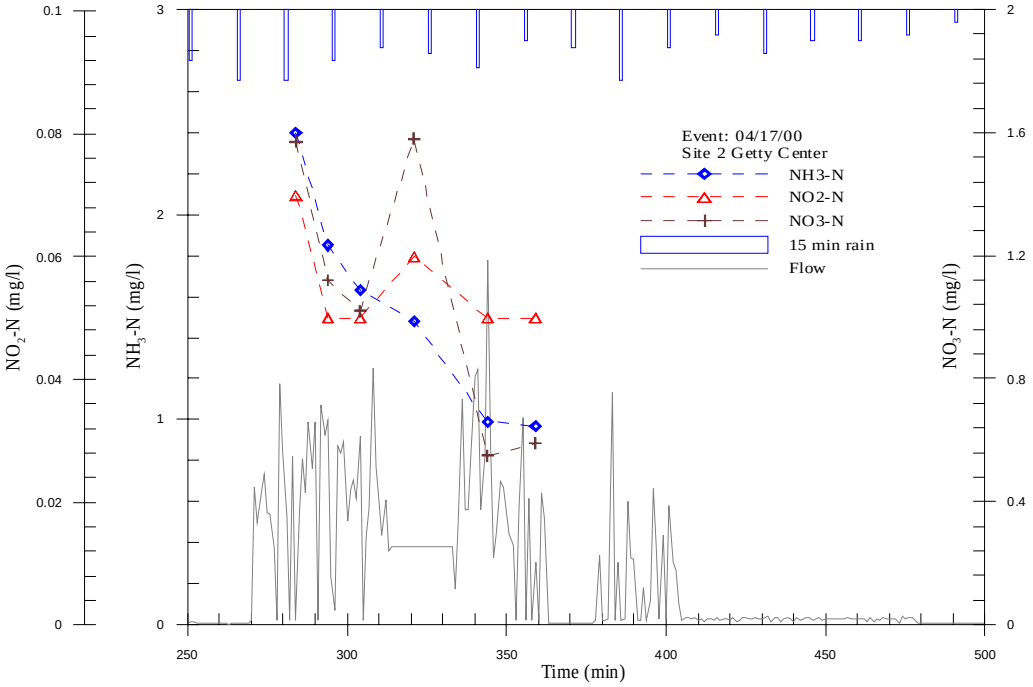


Figure I.1.2.8c (Y1-UCLA2-E11-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

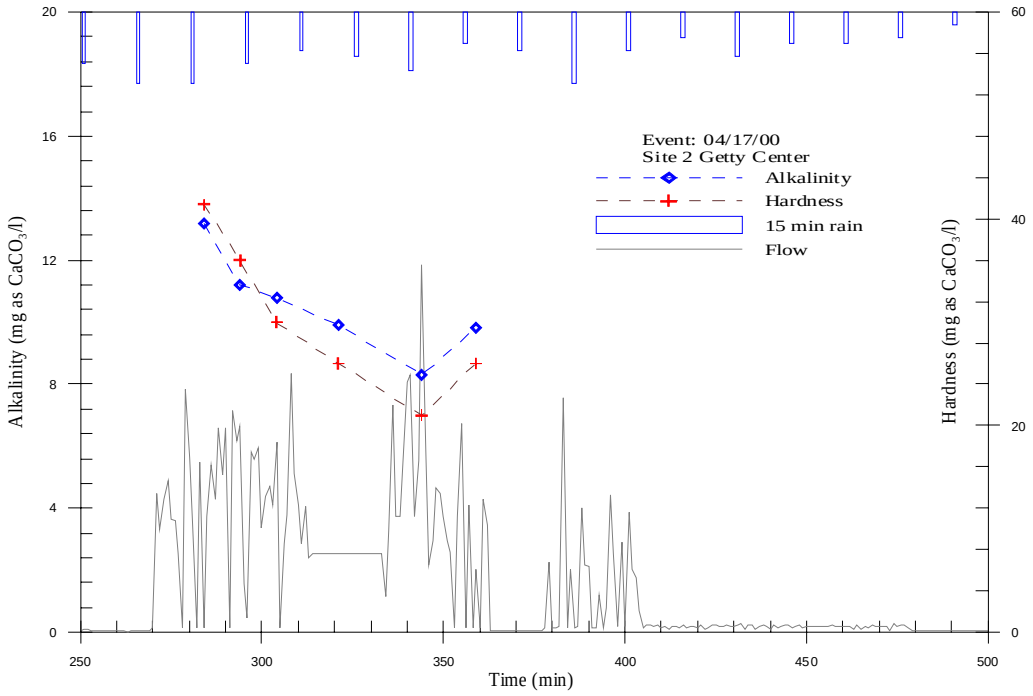


Figure I.1.2.8d (Y1-UCLA2-E11-4.) Polluto-graph for Alkalinity and Hardness

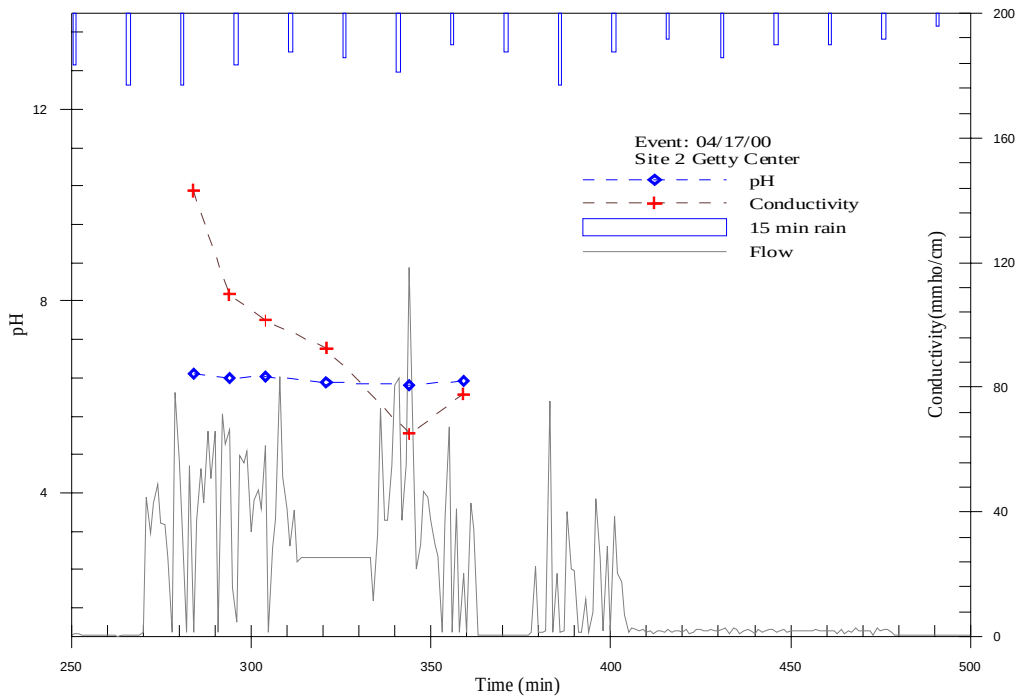


Figure I.1.2.8e (Y1-UCLA2-E11-5.) Polluto-graph for pH and Conductivity

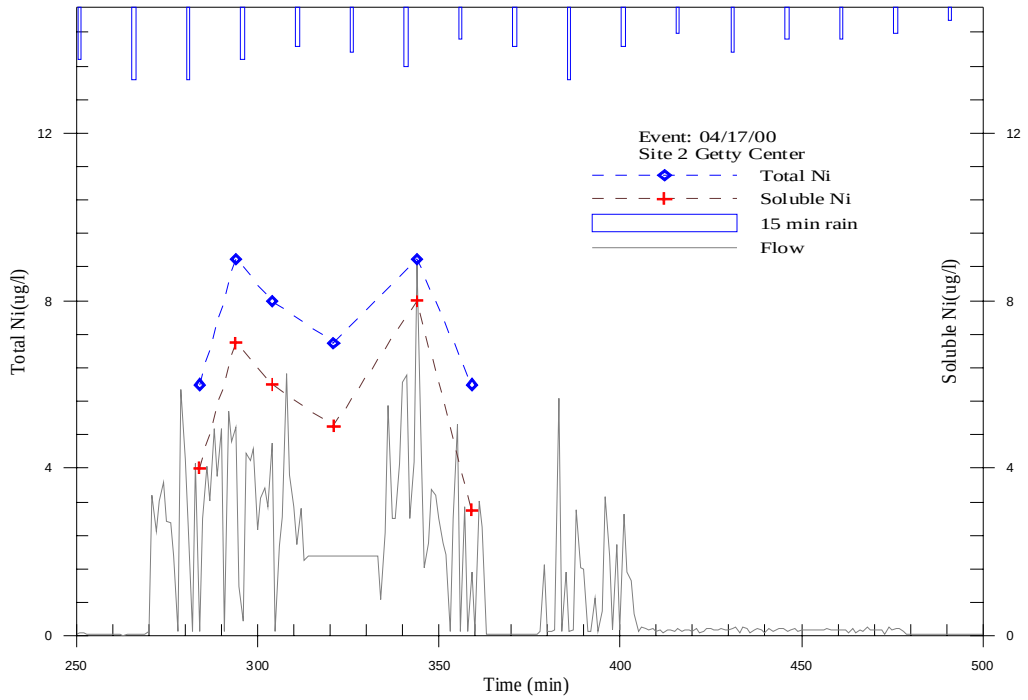


Figure I.1.2.8f (Y1-UCLA2-E11-6.) Polluto-graph for Total Ni / Dissolved Ni

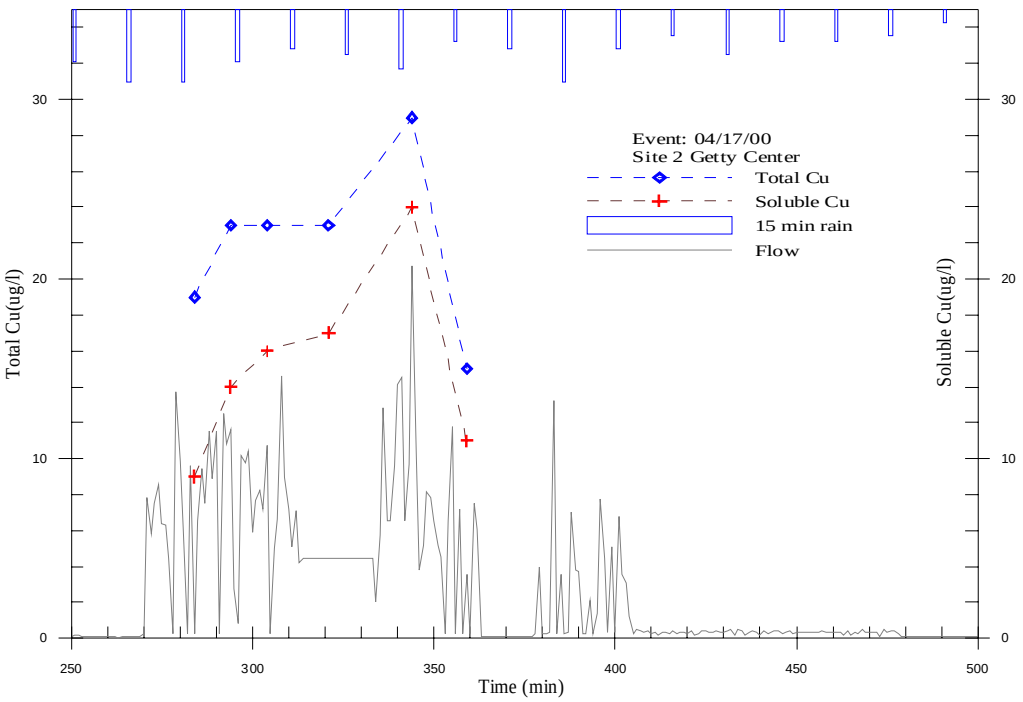


Figure I.1.2.8g (Y1-UCLA2-E11-7.) Polluto-graph for Total Cu / Dissolved Cu

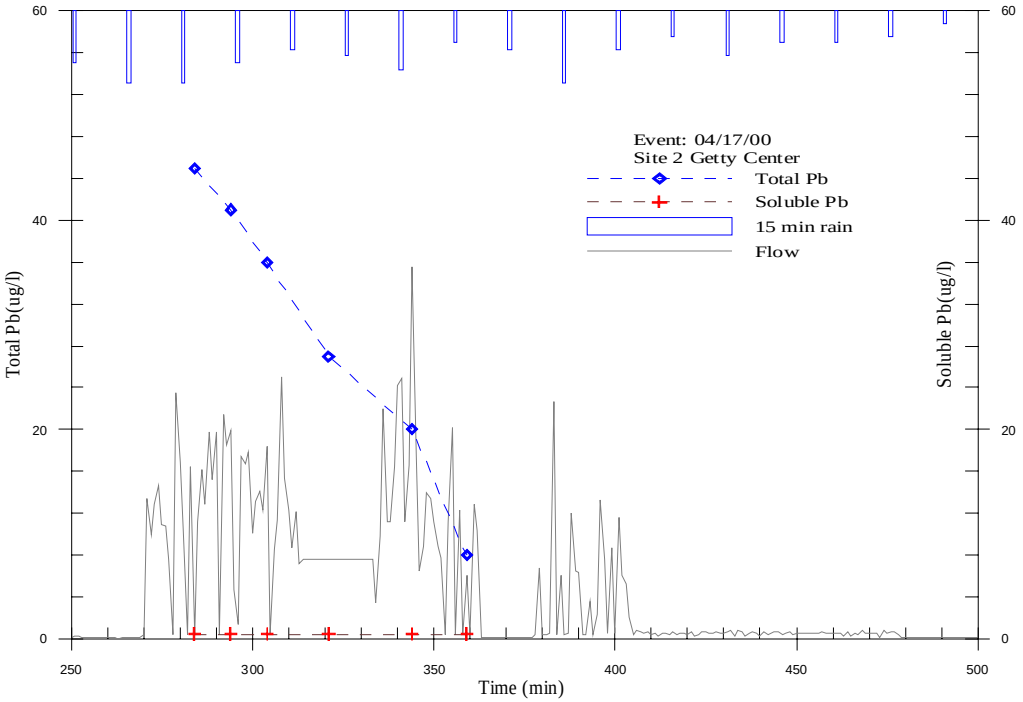


Figure I.1.2.8h (Y1-UCLA2-E11-8.) Polluto-graph for Total Pb / Dissolved Pb

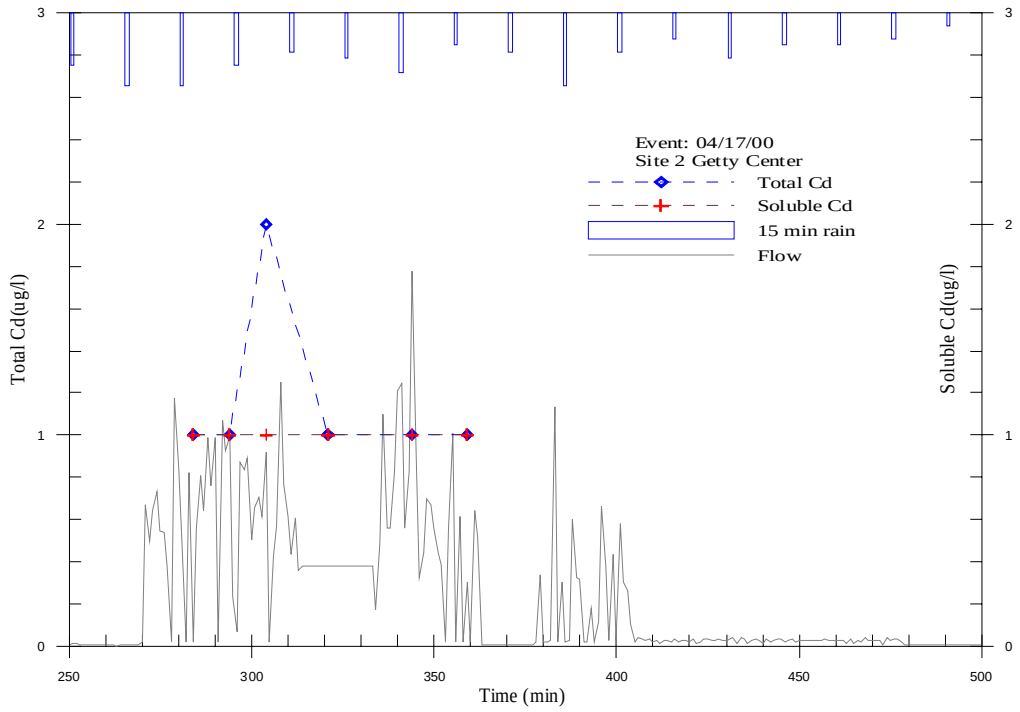


Figure I.1.2.8i (Y1-UCLA2-E11-9.) Polluto-graph for Total Cr / Dissolved Cr

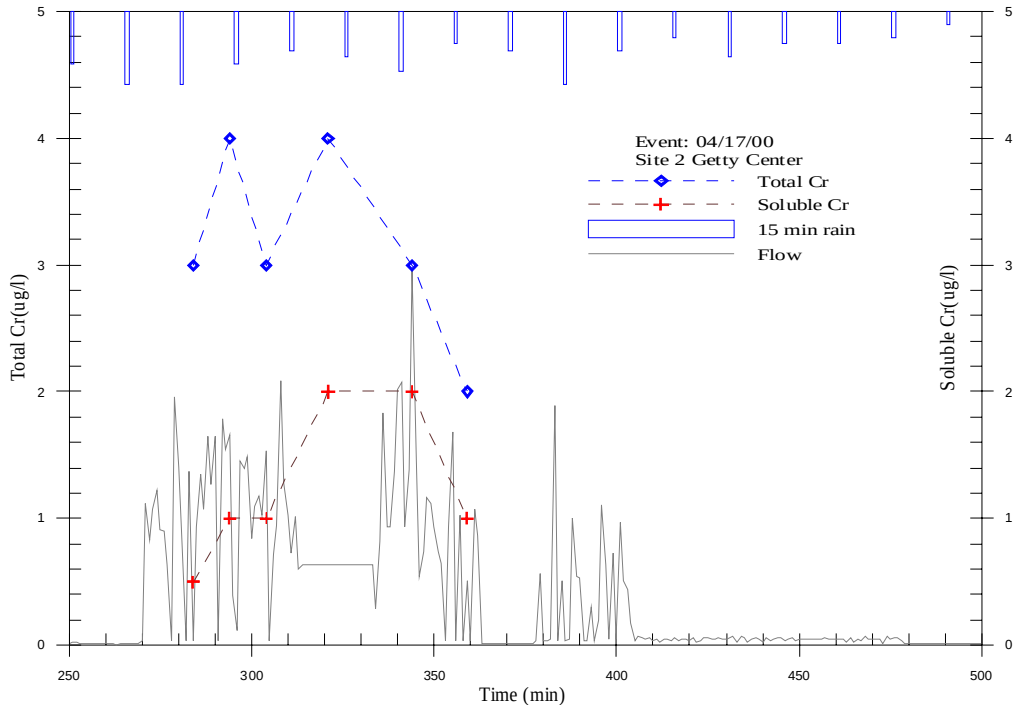


Figure I.1.2.8j (Y1-UCLA2-E11-10.)Polluto-graph for Total Cd / Dissolved Cd

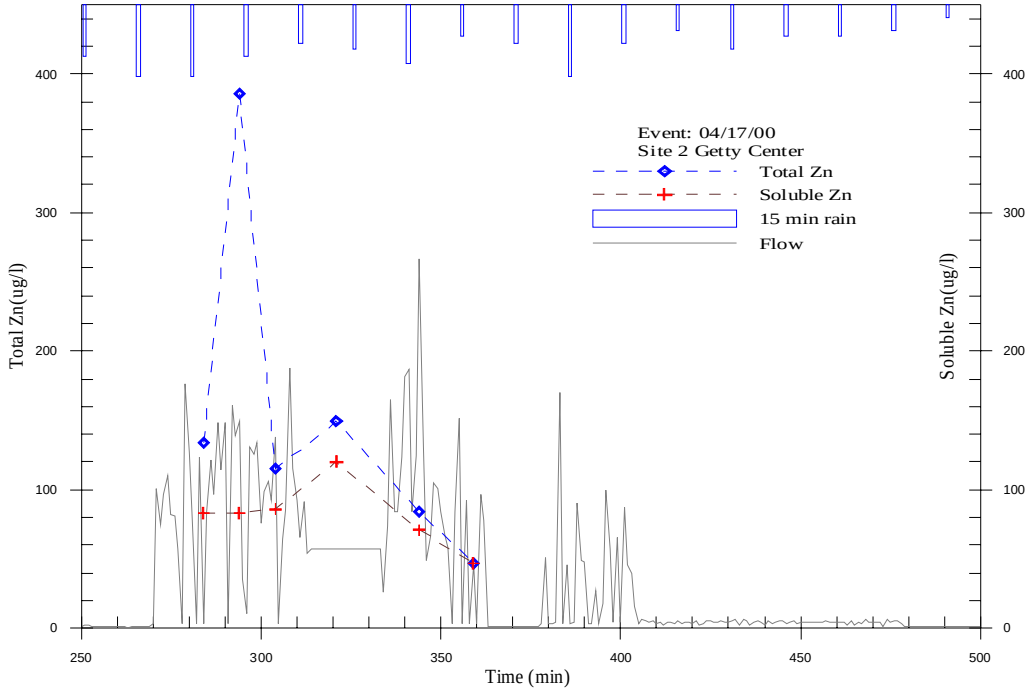


Figure I.1.2.8k (Y1-UCLA2-E11-11.) Polluto-graph for Total Zn / Dissolved Zn

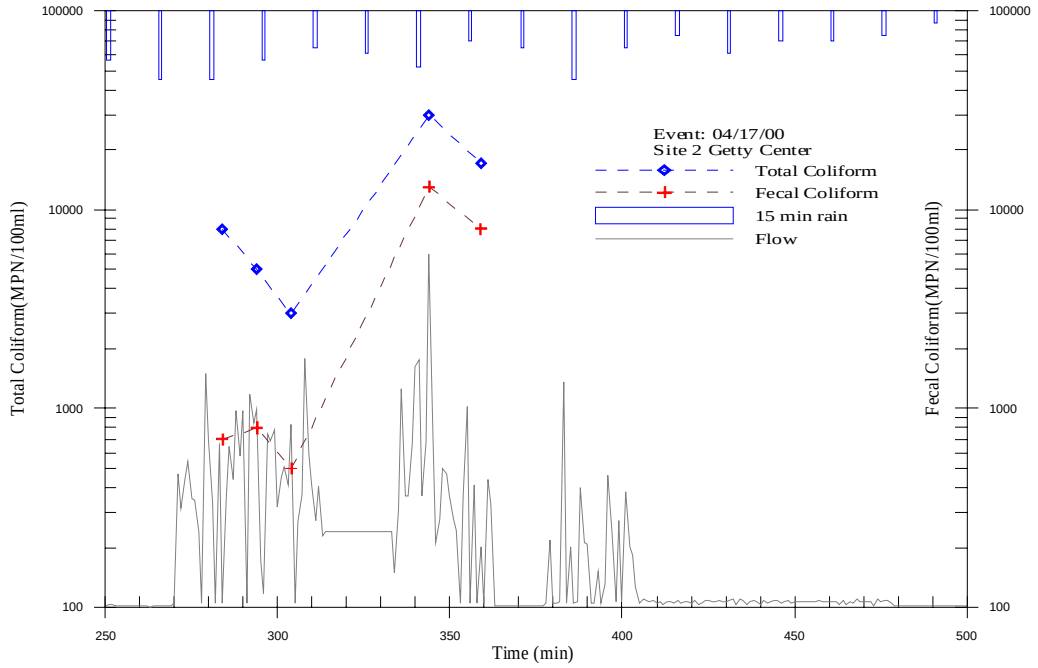


Figure I.1.2.8l (Y1-UCLA2-E11-12.) Polluto-graph for Total Coliform / Fecal Coliform

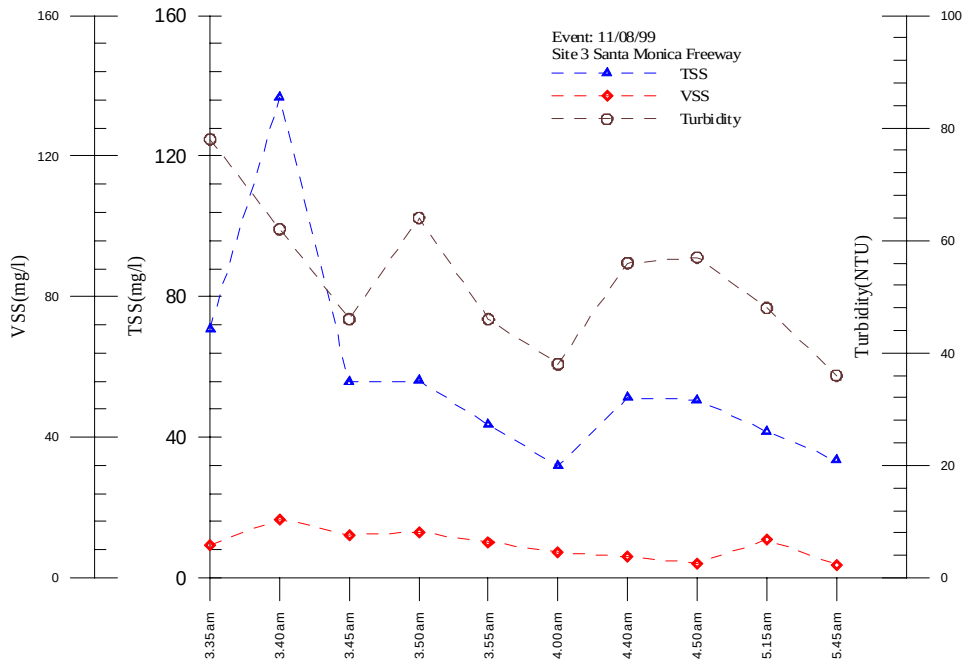


Figure I.1.3.1a (Y1-UCLA3-E1-1.) Polluto-graph for TSS, VSS and Turbidity

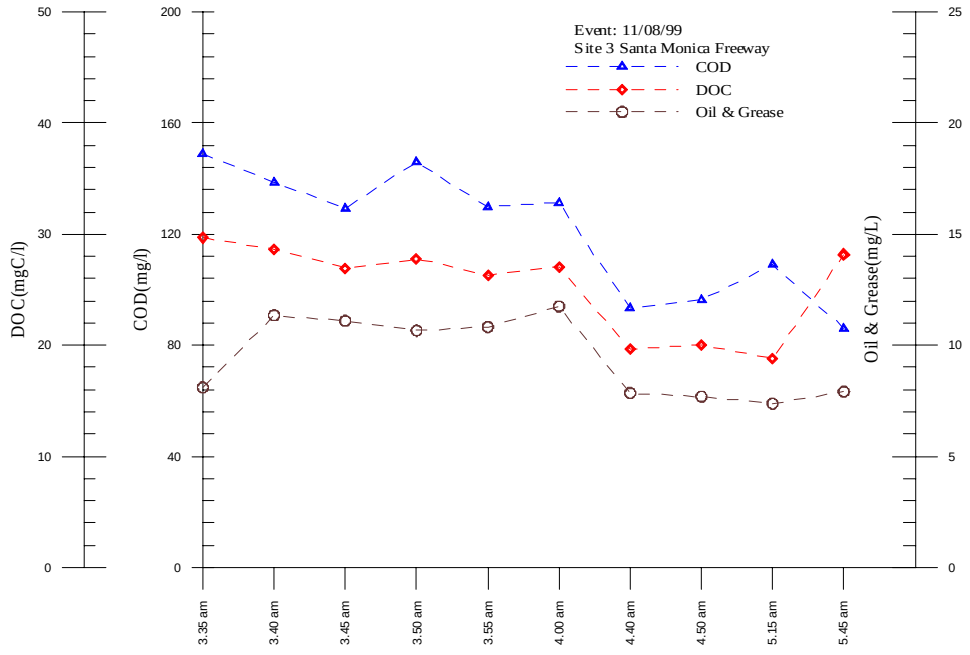


Figure I.1.3.1b (Y1-UCLA3-E1-2.) Polluto-graph for DOC, COD and Oil & Grease

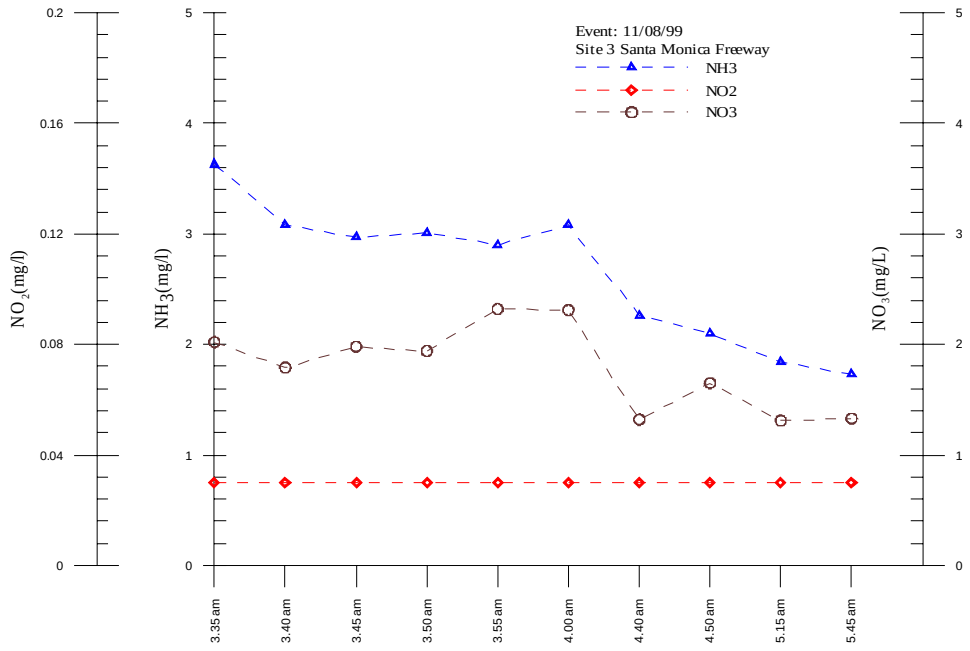


Figure I.1.3.1c (Y1-UCLA3-E1-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

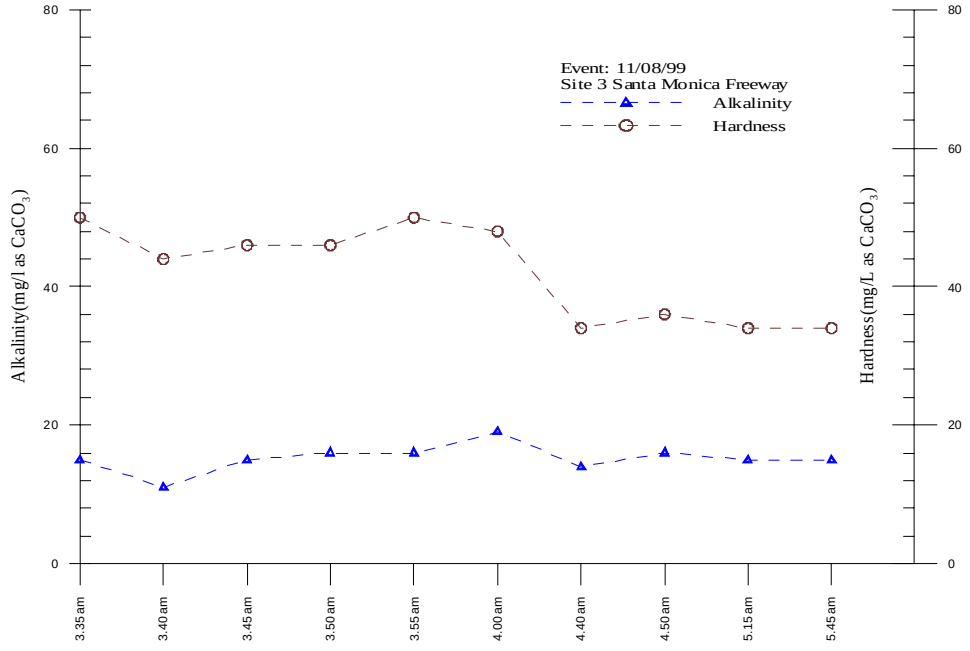


Figure I.1.3.1d (Y1-UCLA3-E1-4.) Polluto-graph for Alkalinity and Hardness

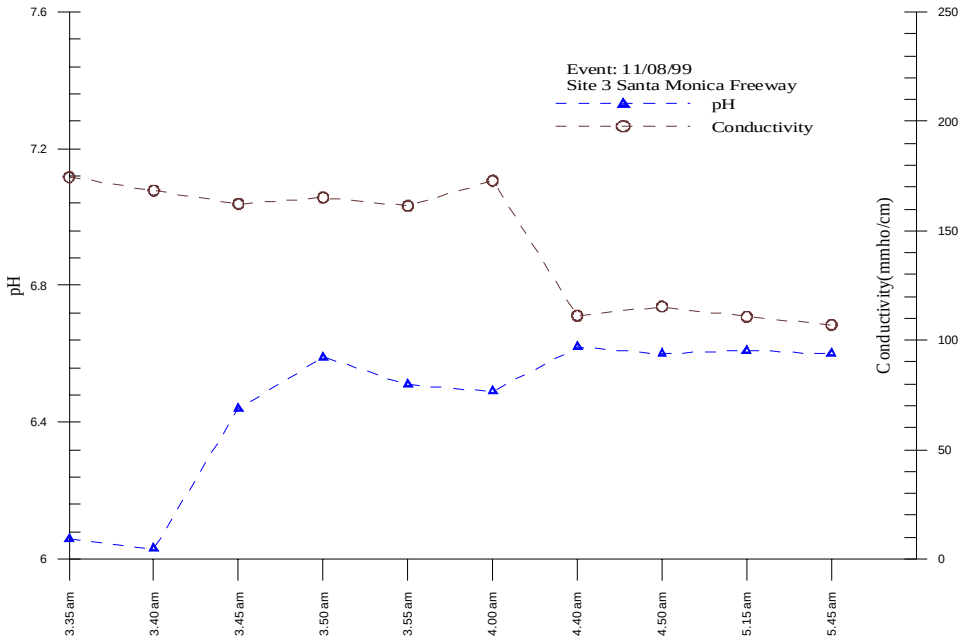


Figure I.1.3.1e (Y1-UCLA3-E1-5.) Polluto-graph for pH and Conductivity

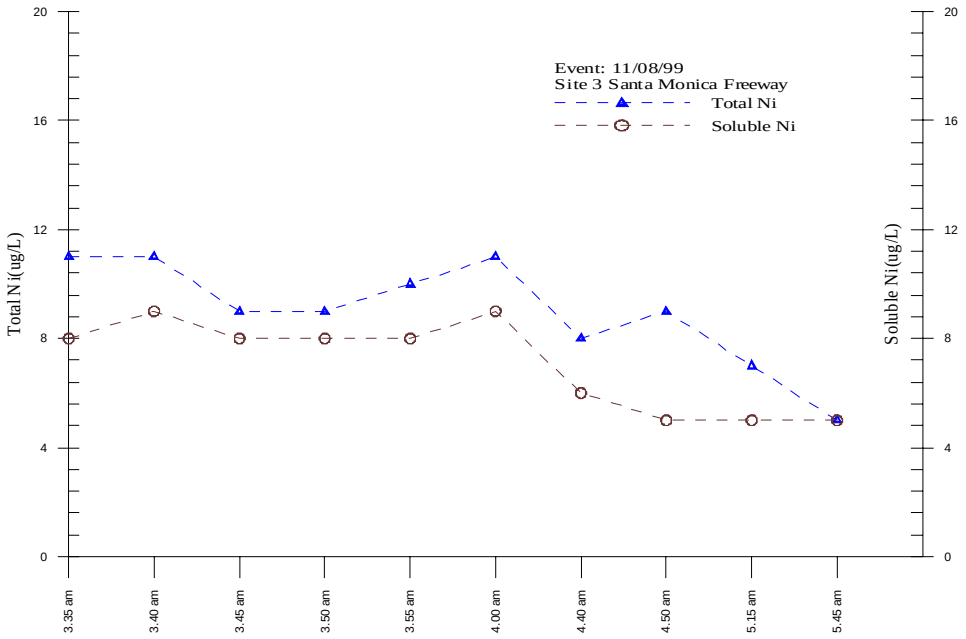


Figure I.1.3.1f (Y1-UCLA3-E1-6.) Polluto-graph for Total Ni / Dissolved Ni

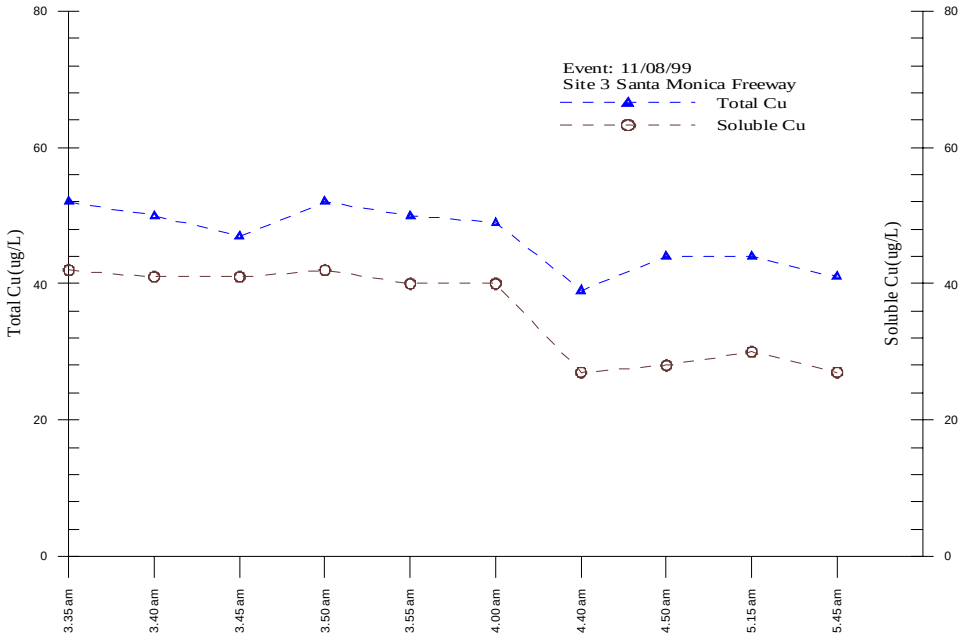


Figure I.1.3.1g (Y1-UCLA3-E1-7.) Polluto-graph for Total Cu / Dissolved Cu

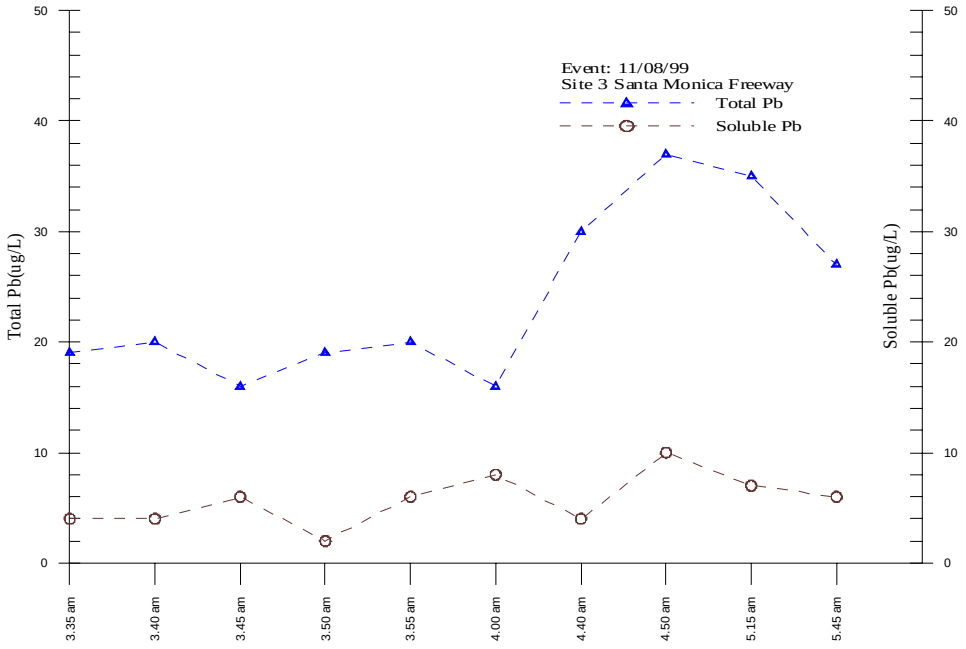


Figure I.1.3.1h (Y1-UCLA3-E1-8.) Polluto-graph for Total Pb / Dissolved Pb

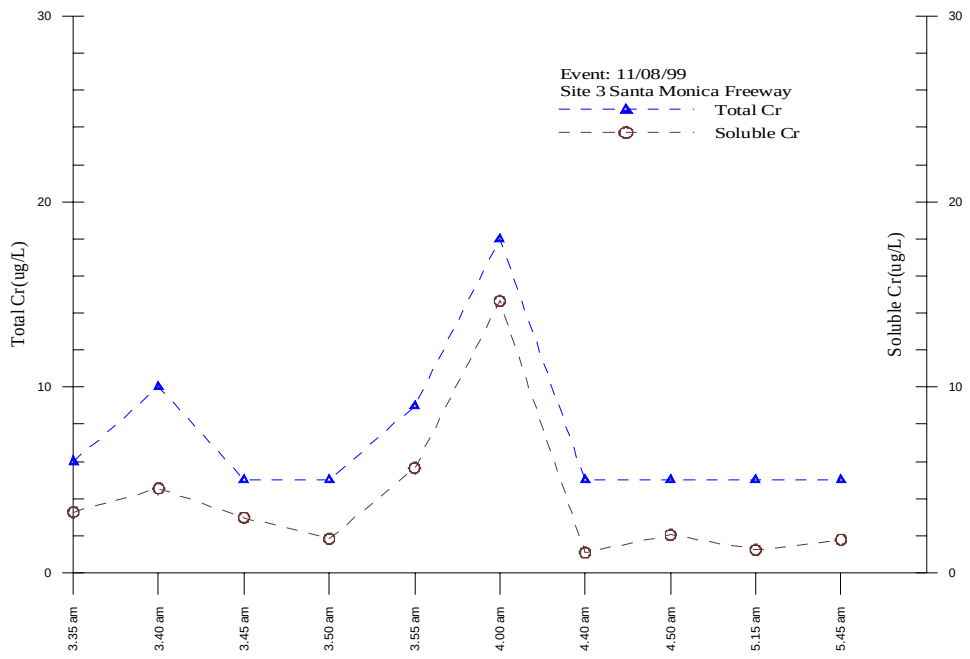


Figure I.1.3.1i (Y1-UCLA3-E1-9.) Polluto-graph for Total Cr / Dissolved Cr

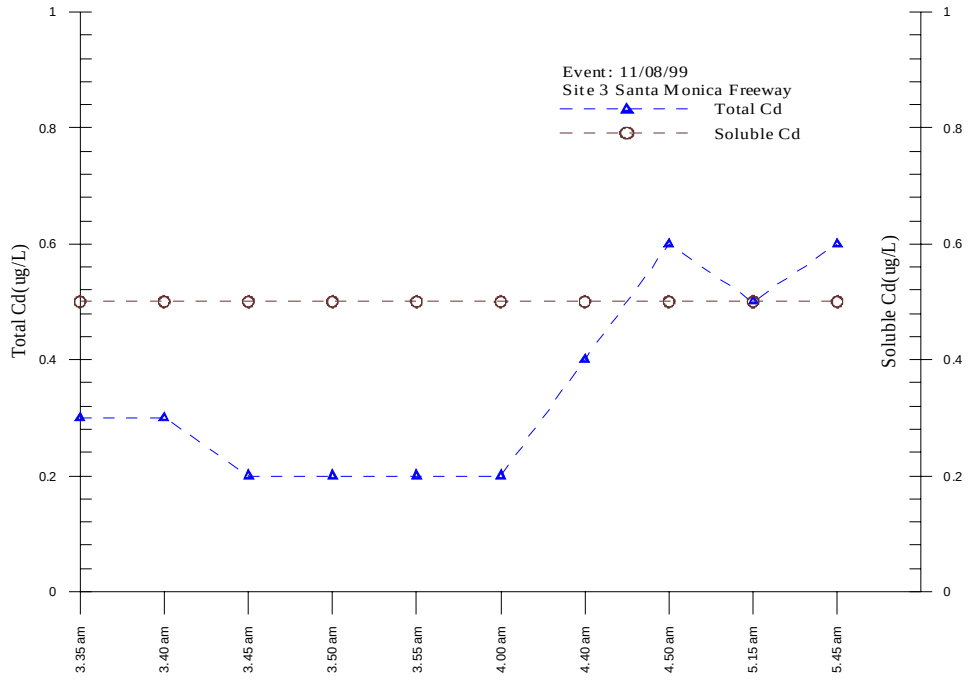


Figure I.1.3.1j (Y1-UCLA3-E1-10.) Polluto-graph for Total Cd / Dissolved Cd

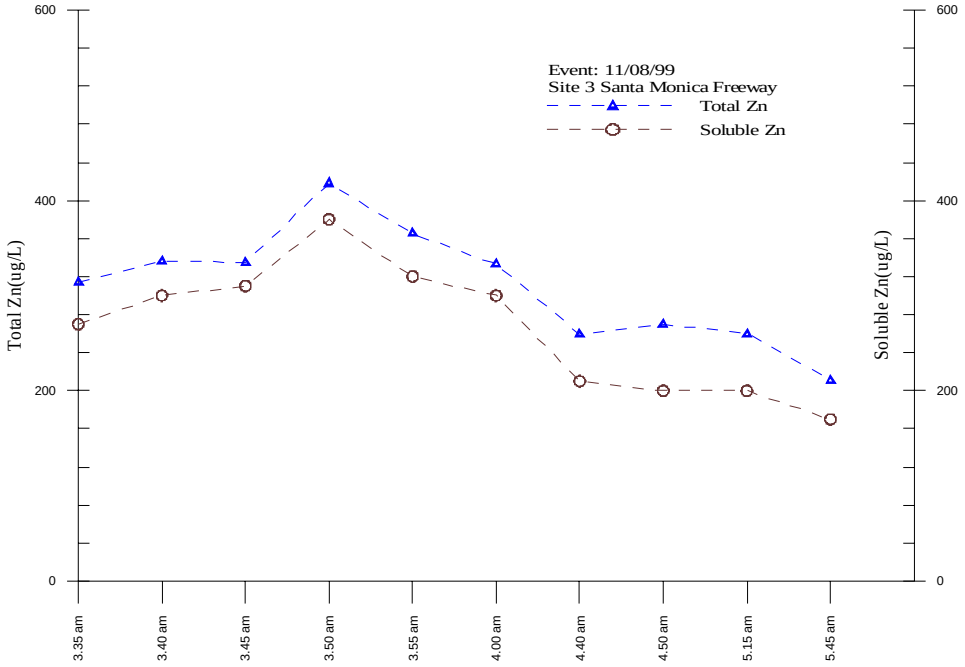


Figure I.1.3.1k (Y1-UCLA3-E1-11.) Polluto-graph for Total Zn / Dissolved Zn

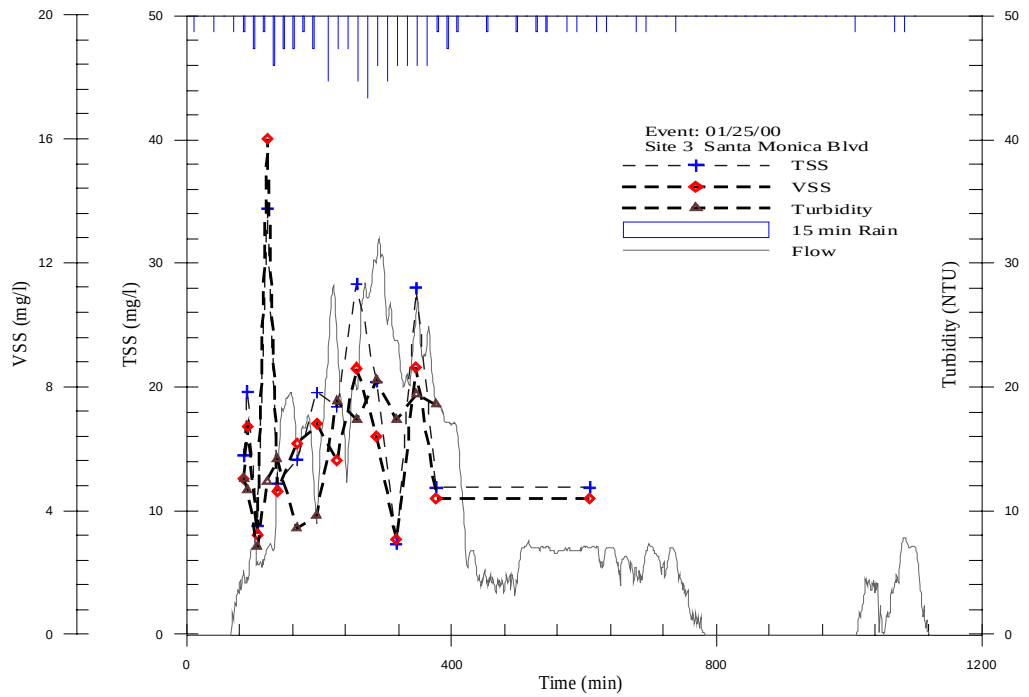


Figure I.1.3.2a (Y1-UCLA3-E4-1.) Polluto-graph for TSS, VSS and Turbidity

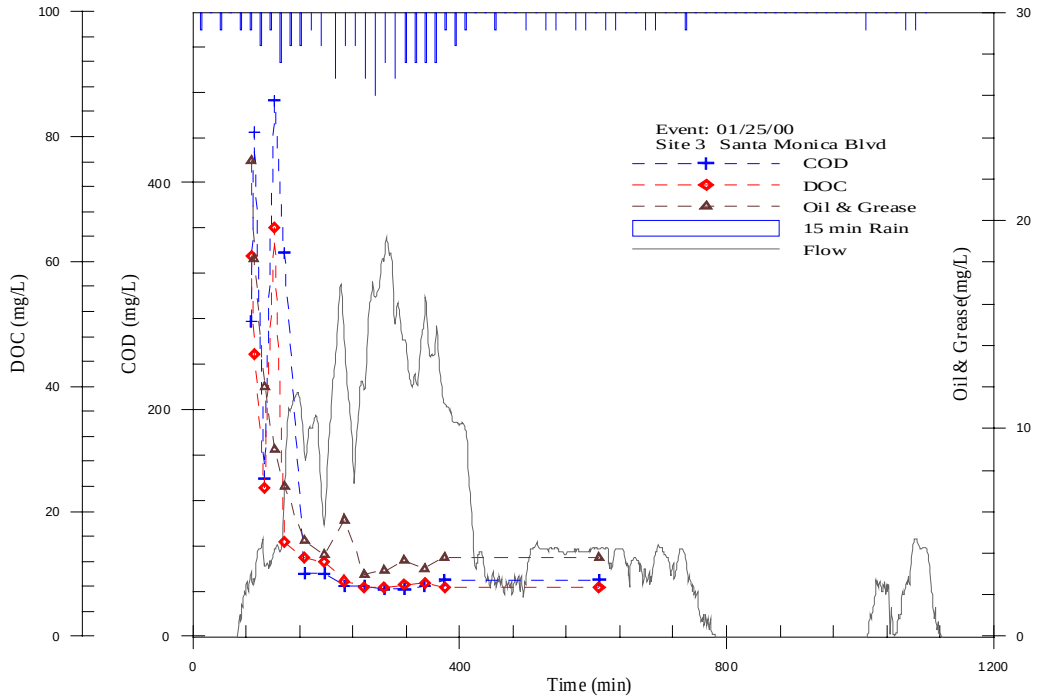


Figure I.1.3.2b (Y1-UCLA3-E4-2.) Polluto-graph for DOC, COD and Oil & Grease

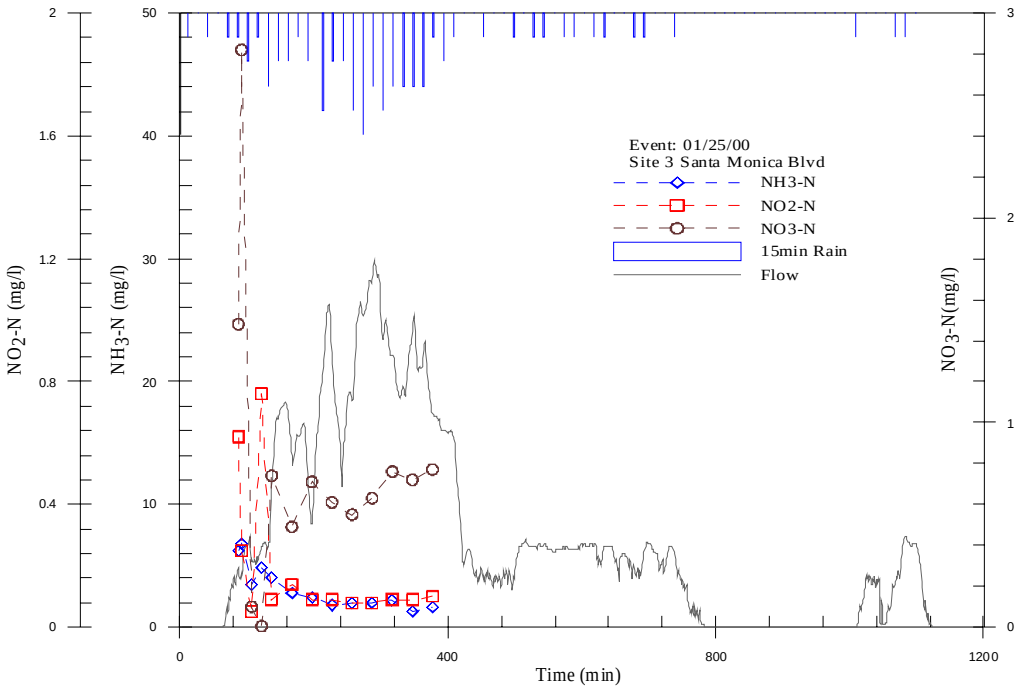


Figure I.1.3.2c (Y1-UCLA3-E4-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

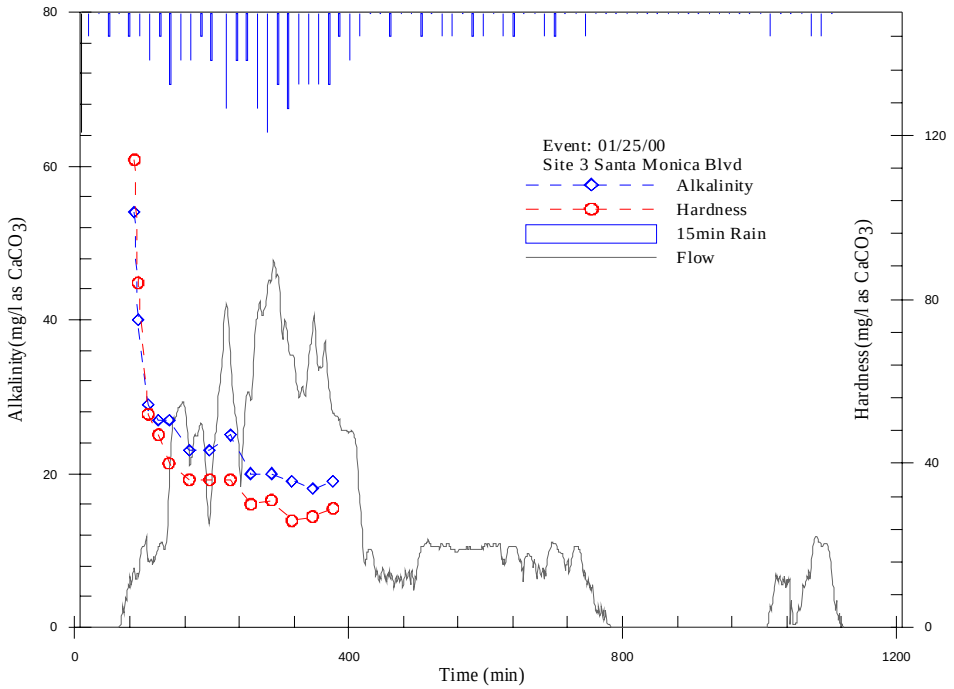


Figure I.1.3.2d (Y1-UCLA3-E4-4.) Polluto-graph for Alkalinity and Hardness

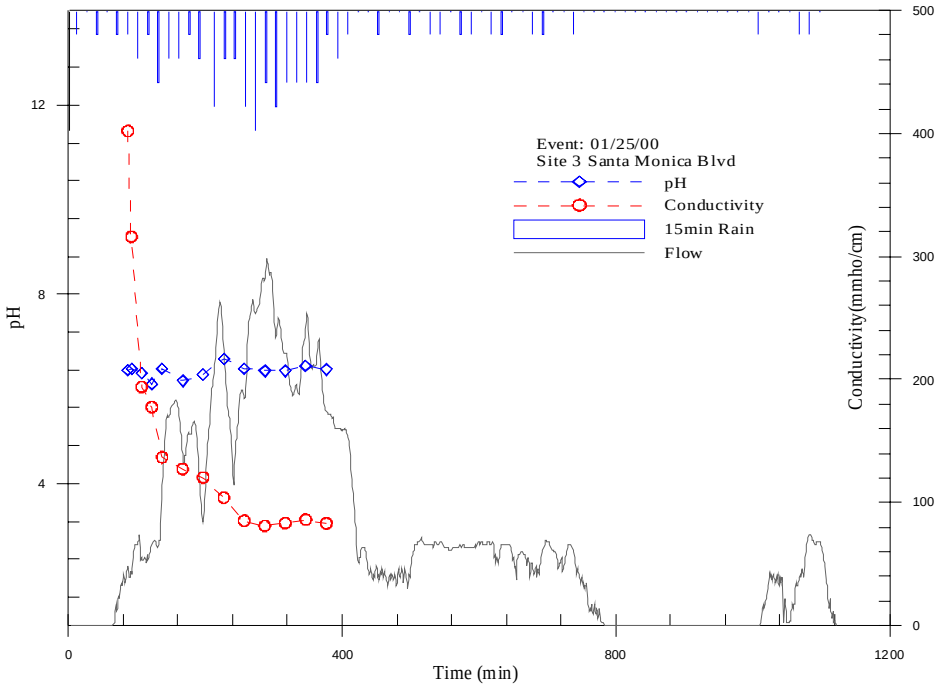


Figure I.1.3.2e (Y1-UCLA3-E4-5.) Polluto-graph for pH and Conductivity

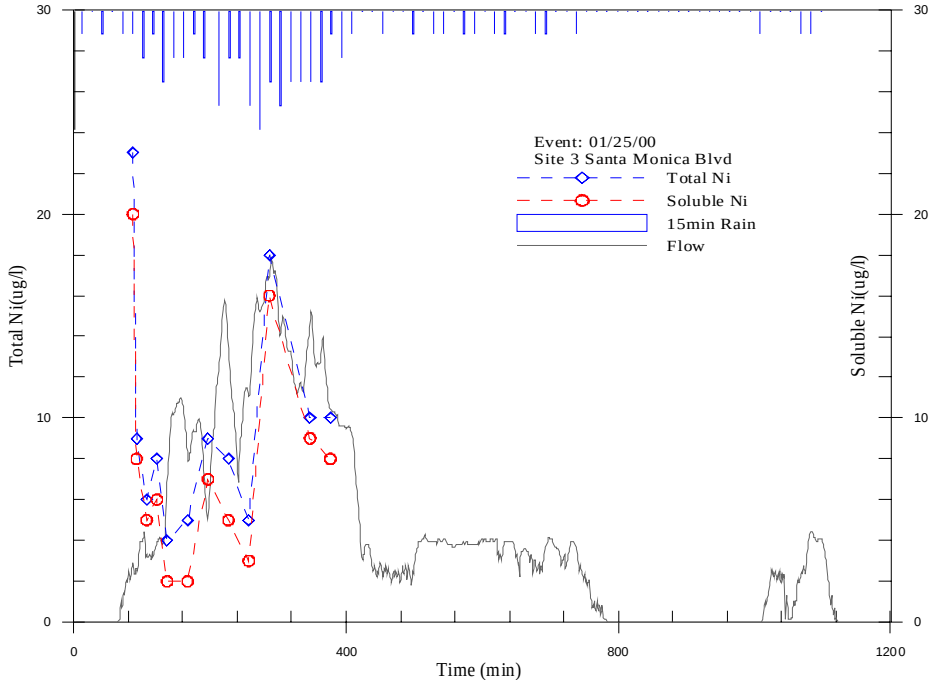


Figure I.1.3.2f (Y1-UCLA3-E4-6.) Polluto-graph for Total Ni / Dissolved Ni

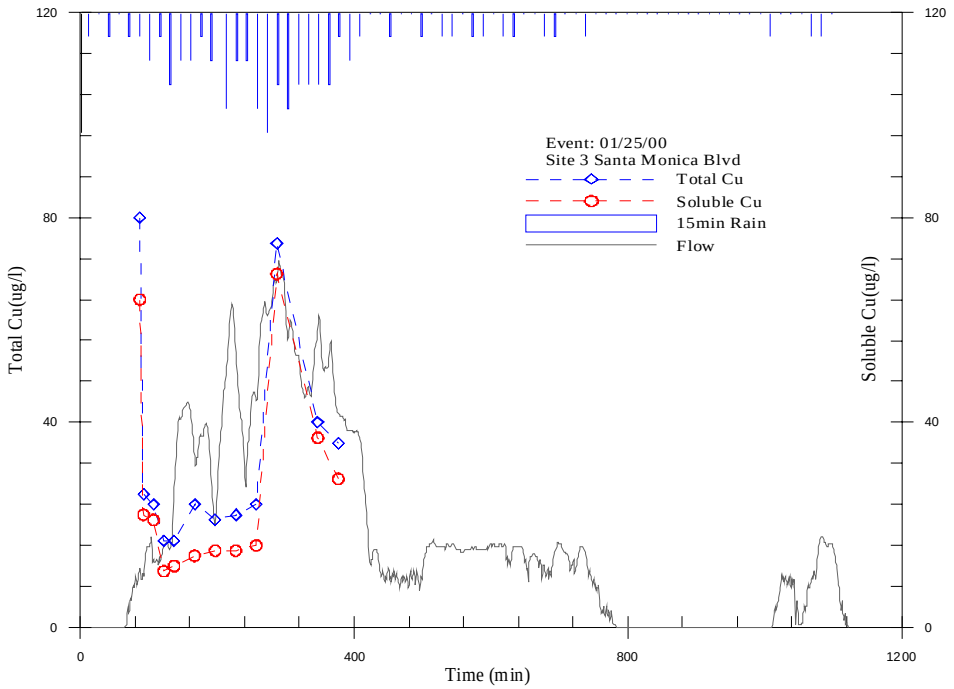


Figure I.1.3.2g (Y1-UCLA3-E4-7.) Polluto-graph for Total Cu / Dissolved Cu

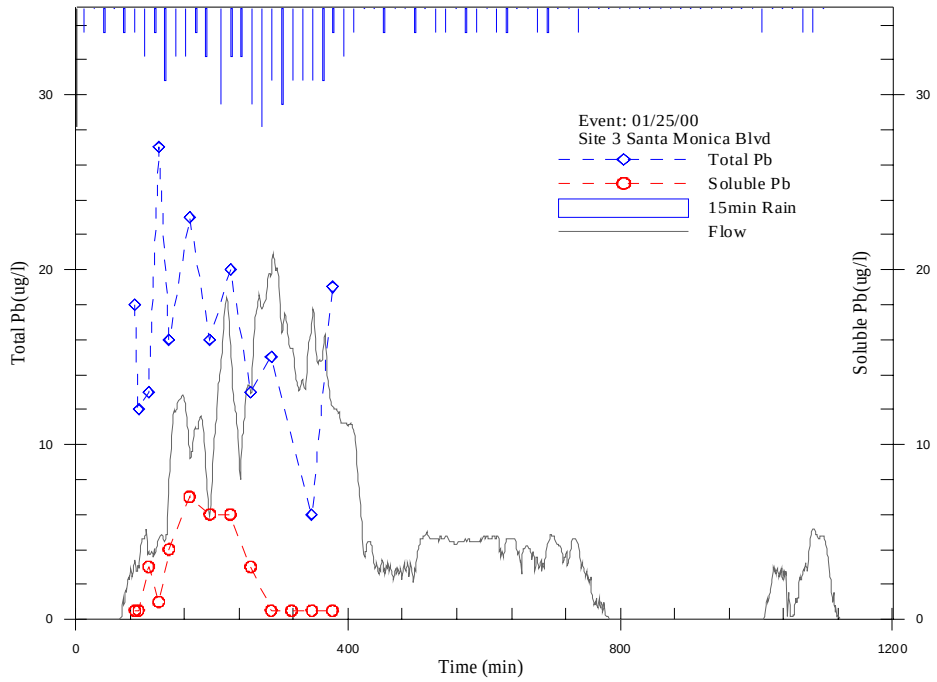


Figure I.1.3.2h (Y1-UCLA3-E4-8.) Polluto-graph for Total Pb / Dissolved Pb

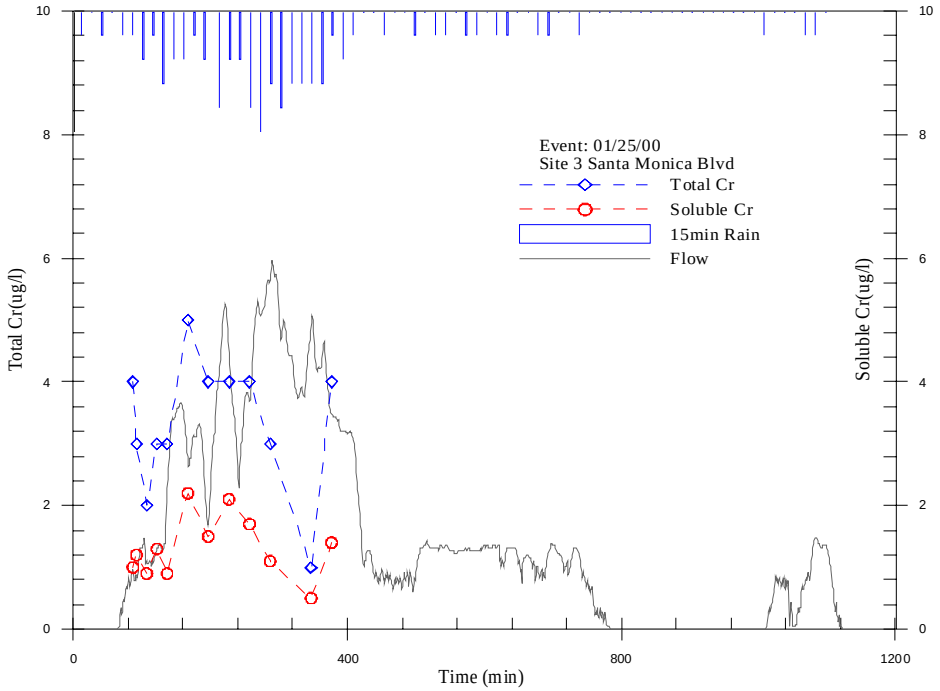


Figure I.1.3.2i (Y1-UCLA3-E4-9.) Polluto-graph for Total Cr / Dissolved Cr

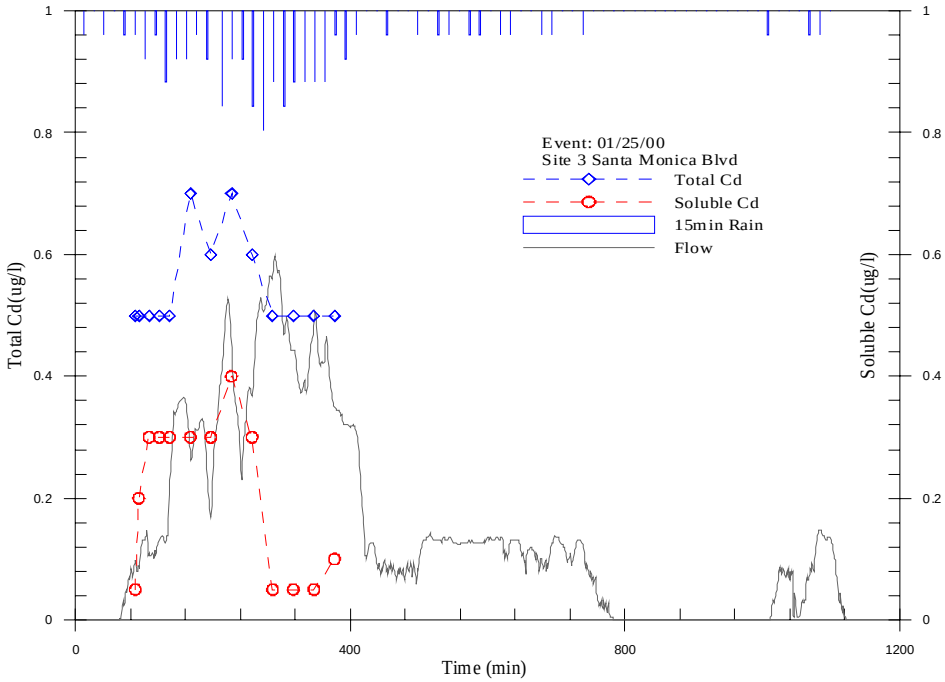


Figure I.1.3.2j (Y1-UCLA3-E4-10.) Polluto-graph for Total Cd / Dissolved Cd

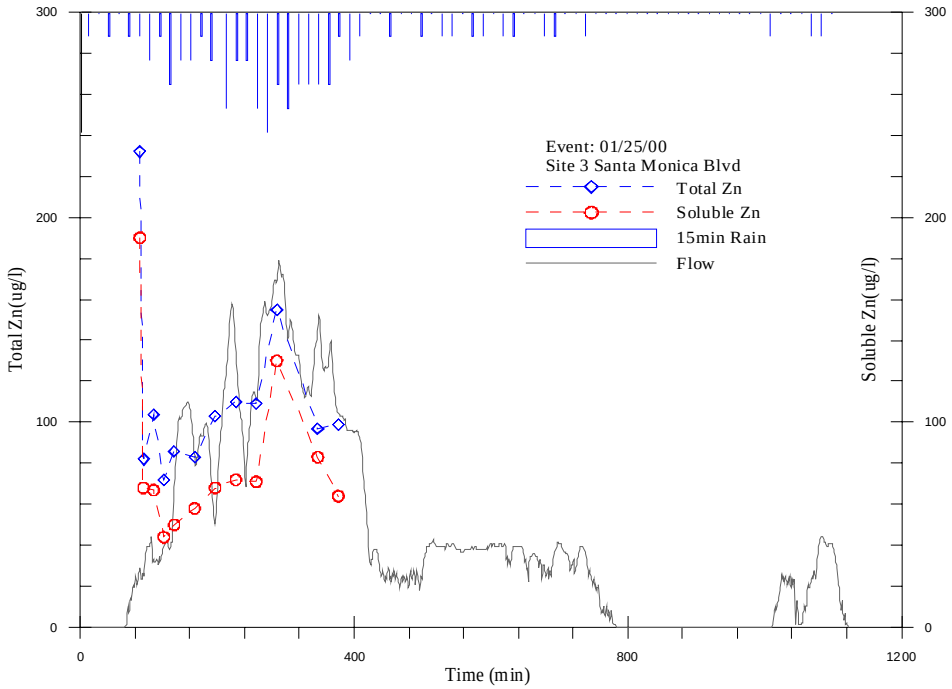


Figure I.1.3.2k (Y1-UCLA3-E4-11.) Polluto-graph for Total Zn / Dissolved Zn

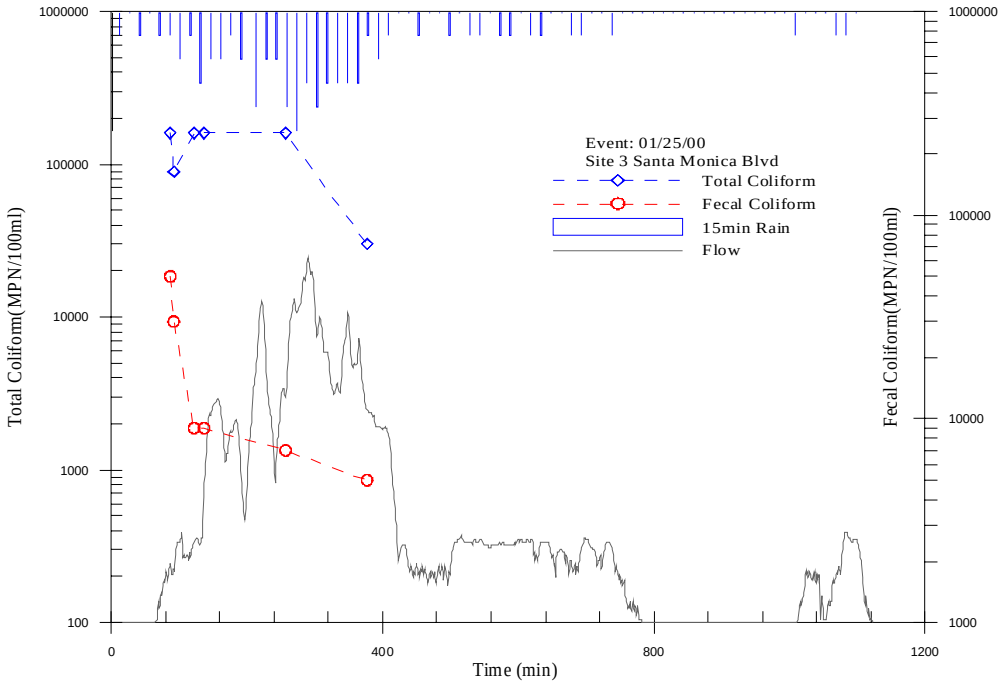


Figure I.1.3.2l (Y1-UCLA3-E4-12.) Polluto-graph for Total Coliform / Fecal Coliform

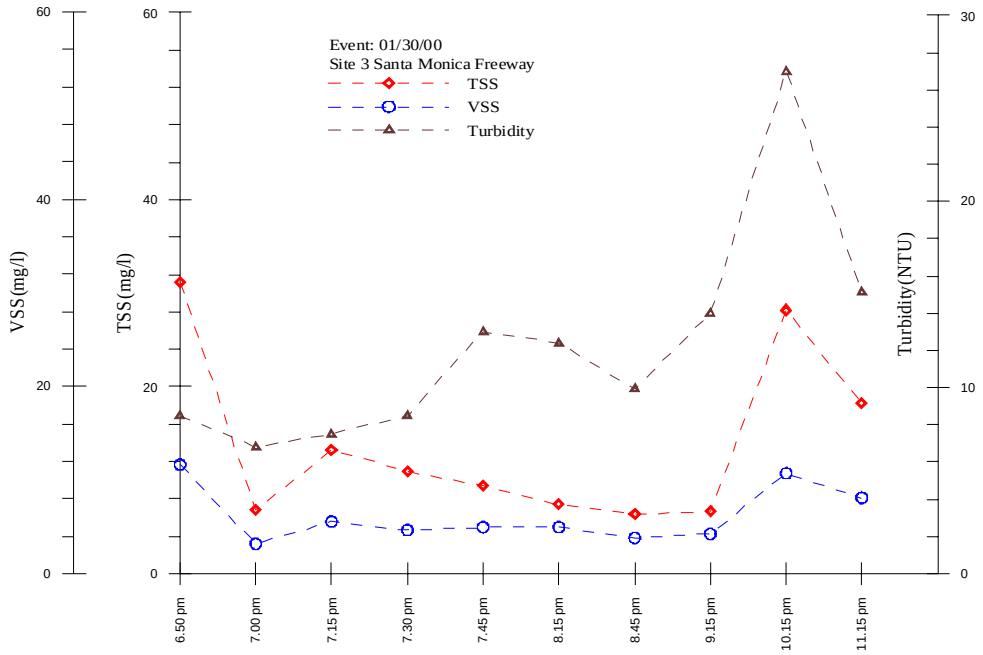


Figure I.1.3.3a (Y1-UCLA3-E5-1.) Polluto-graph for TSS, VSS and Turbidity

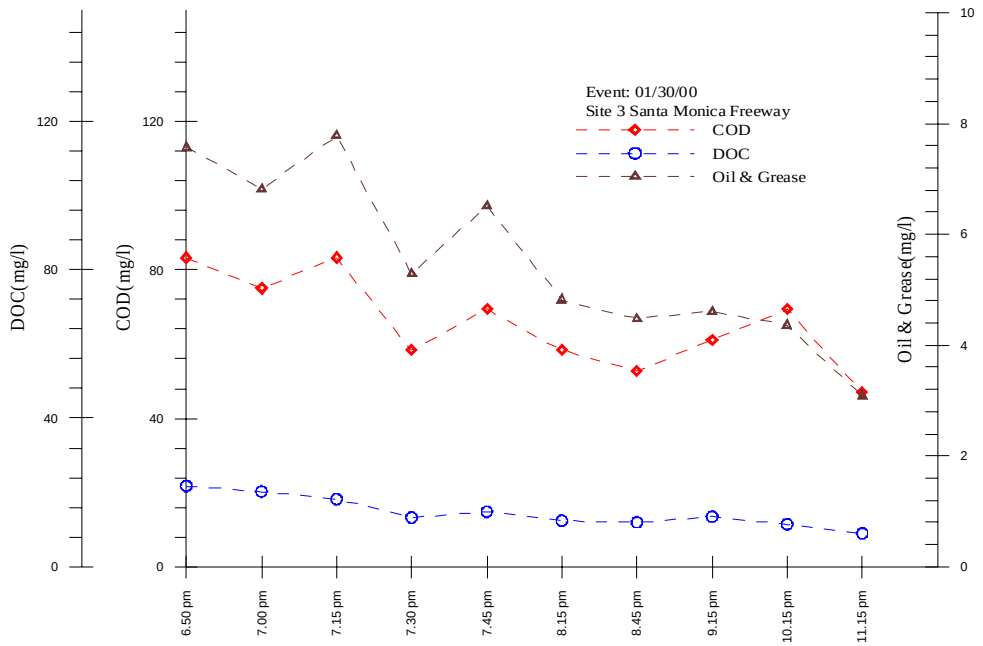


Figure I.1.3.3b (Y1-UCLA3-E5-2.) Polluto-graph for DOC, COD and Oil & Grease

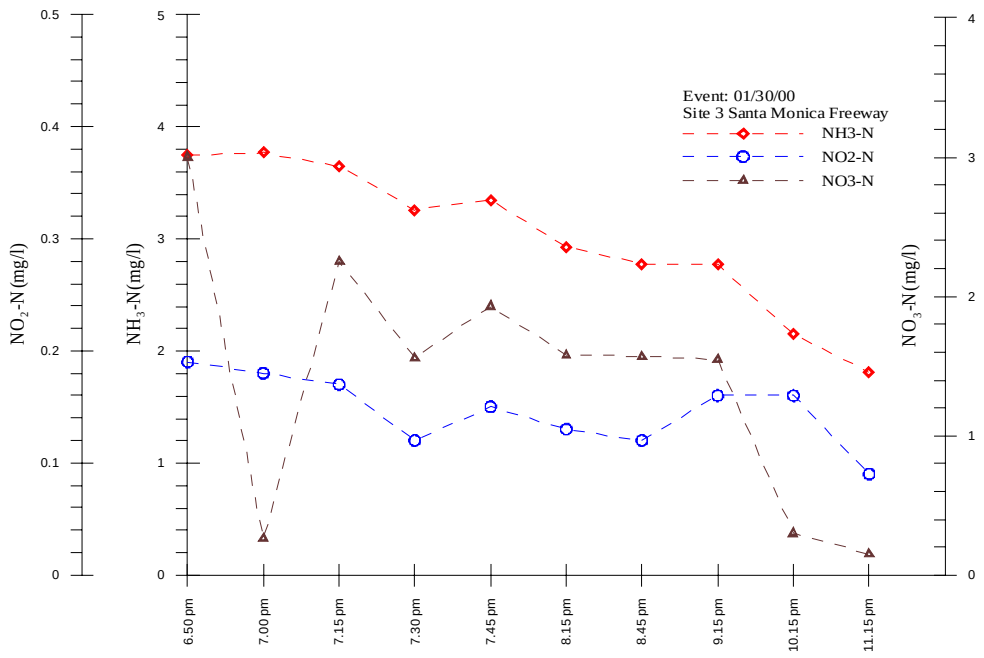


Figure I.1.3.3c (Y1-UCLA3-E5-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

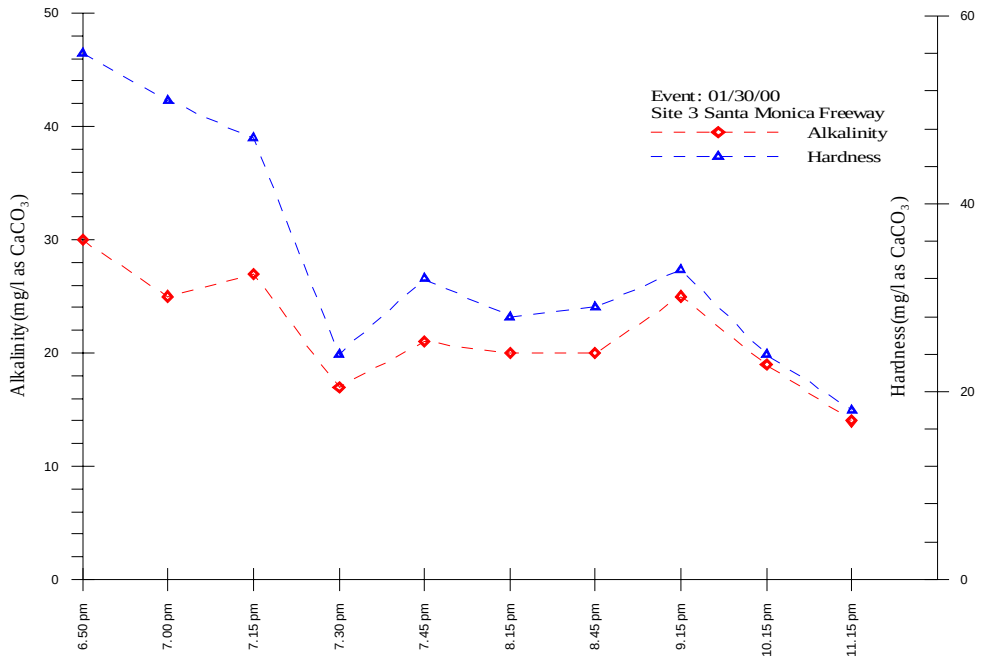


Figure I.1.3.3d (Y1-UCLA3-E5-4.) Polluto-graph for Alkalinity and Hardness

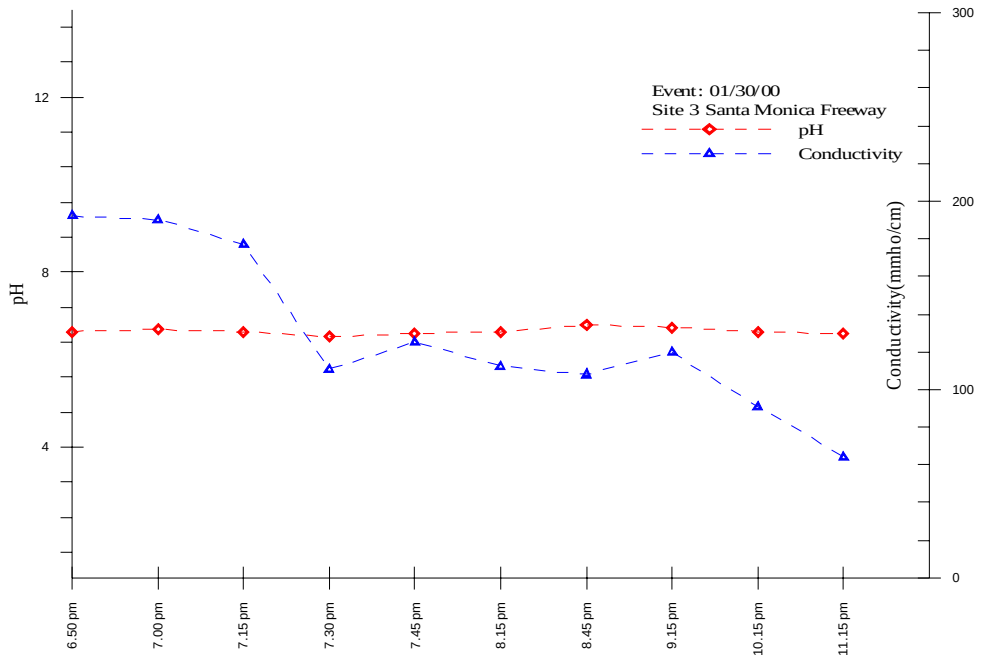


Figure I.1.3.3e (Y1-UCLA3-E5-5.) Polluto-graph for pH and Conductivity

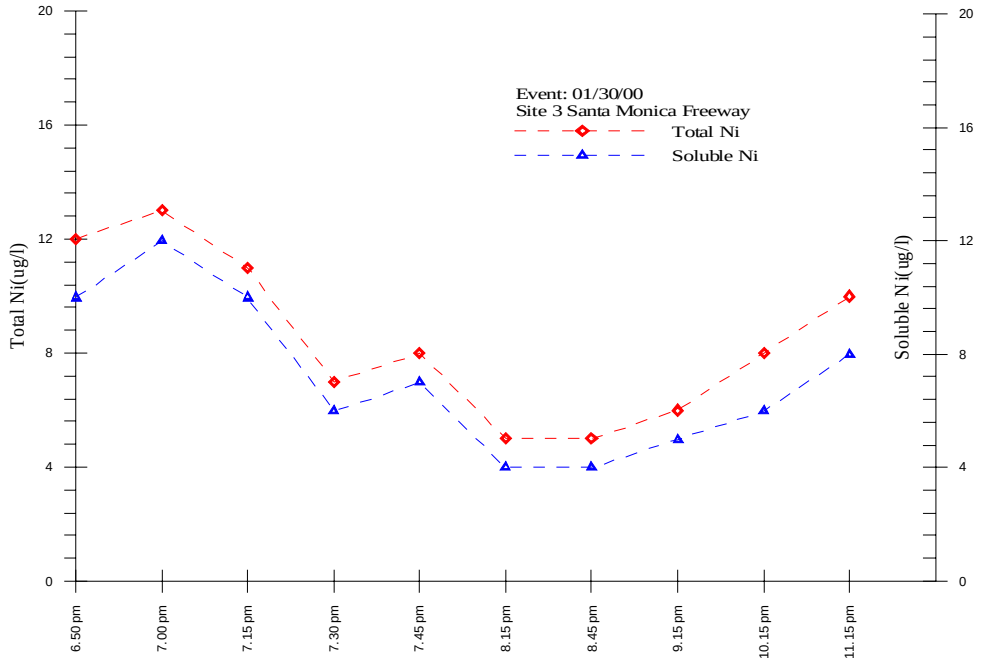


Figure I.1.3.3f (Y1-UCLA3-E5-6.) Polluto-graph for Total Ni / Dissolved Ni

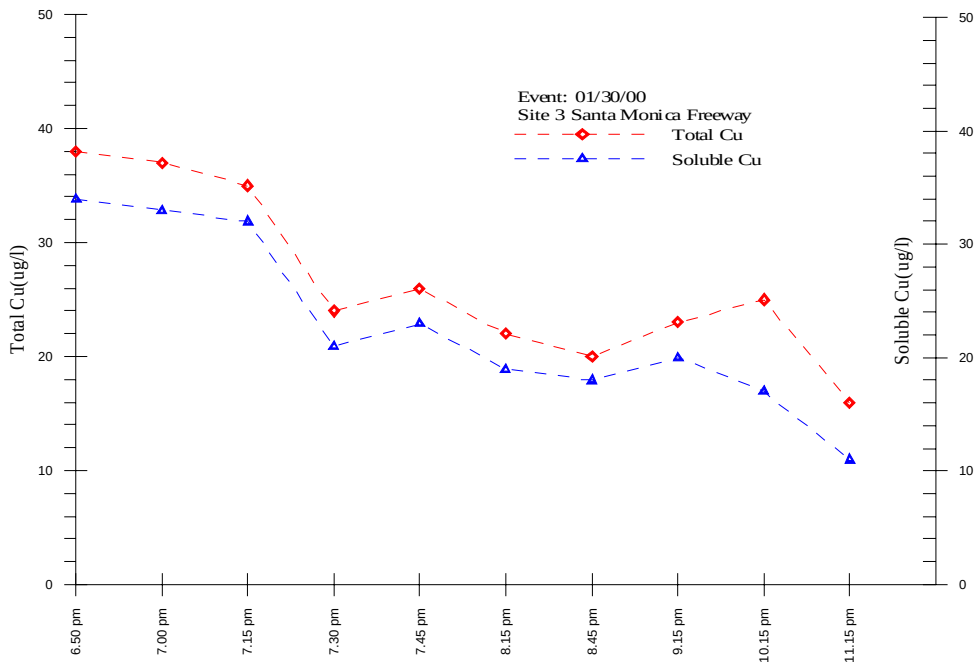


Figure I.1.3.3g (Y1-UCLA3-E5-7.) Polluto-graph for Total Cu / Dissolved Cu

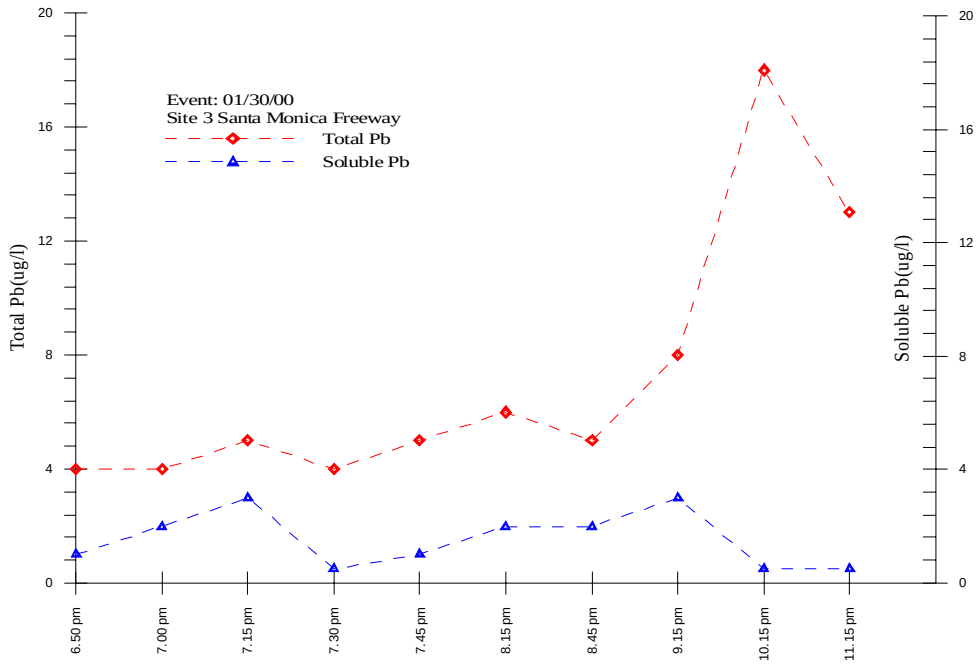


Figure I.1.3.3h (Y1-UCLA3-E5-8.) Polluto-graph for Total Pb / Dissolved Pb

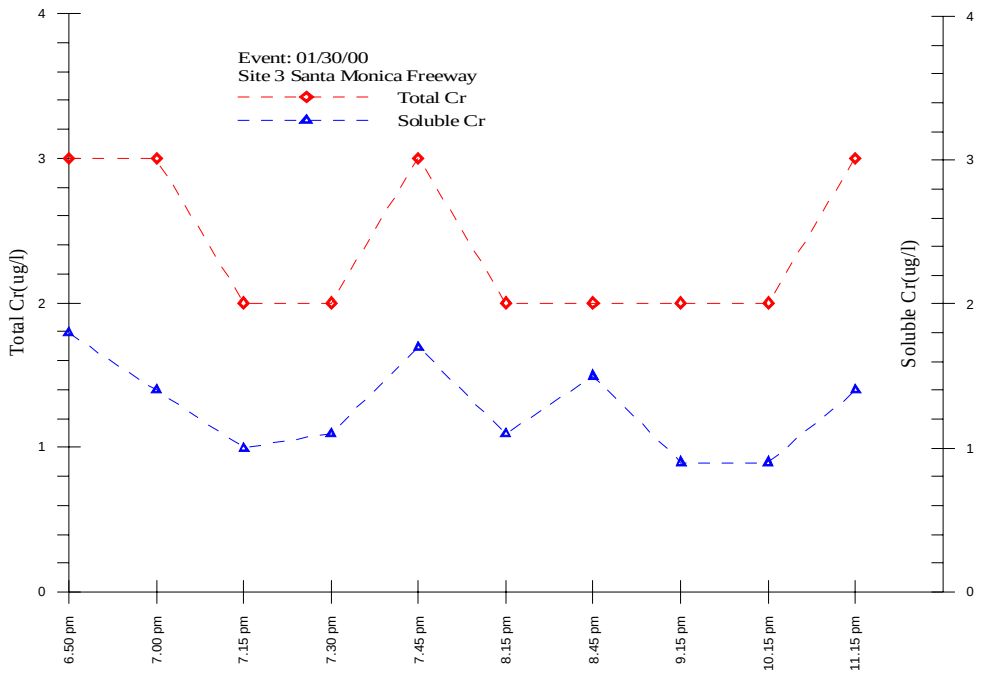


Figure I.1.3.3i (Y1-UCLA3-E5-9.) Polluto-graph for Total Cr / Dissolved Cr

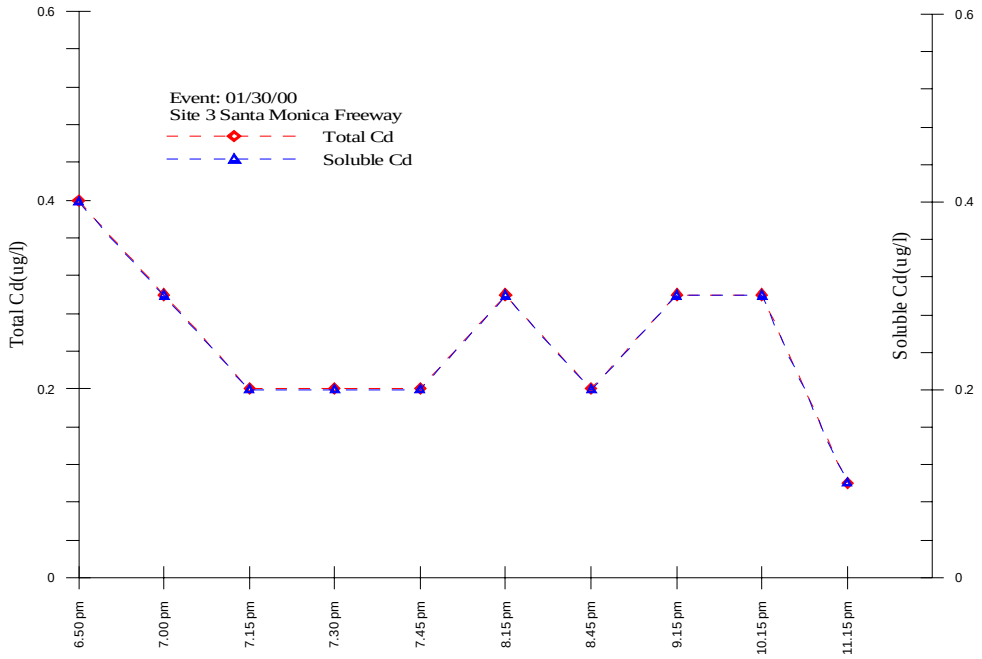


Figure I.1.3.3j (Y1-UCLA3-E5-10.) Polluto-graph for Total Cd / Dissolved Cd

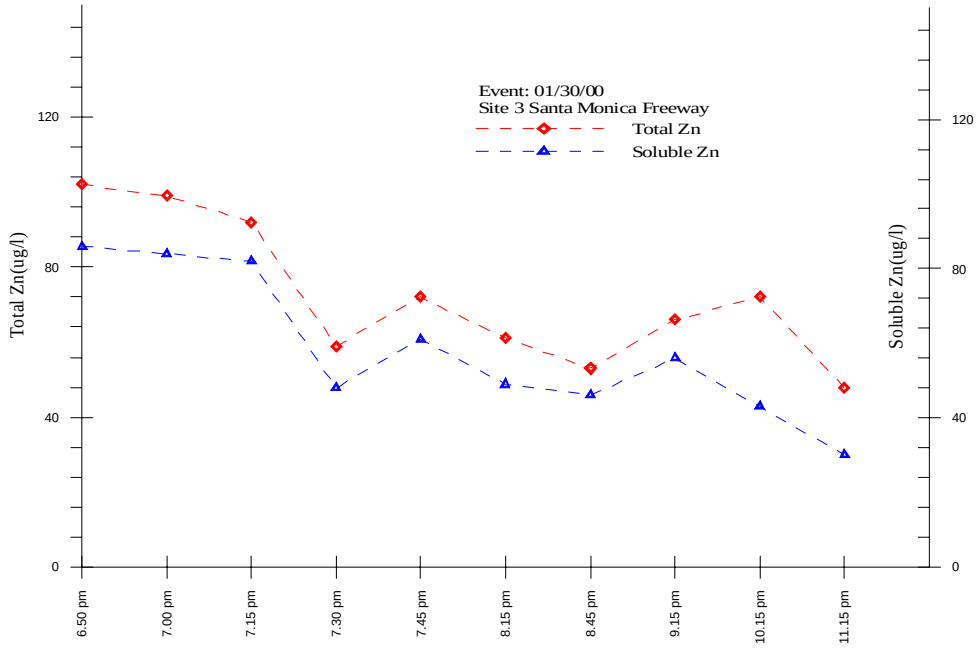


Figure I.1.3.3k (Y1-UCLA3-E5-11.) Polluto-graph for Total Zn / Dissolved Zn

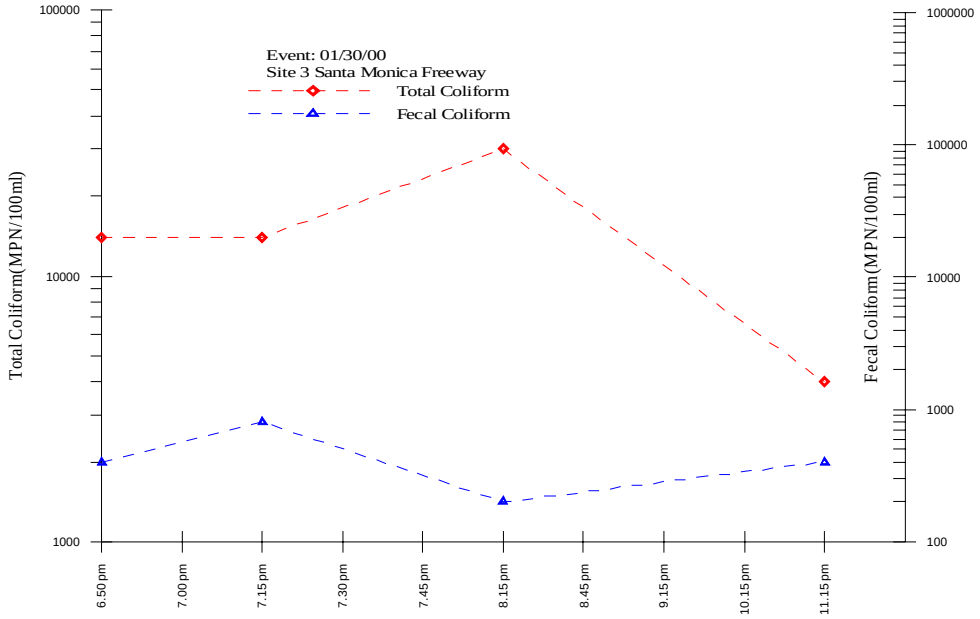


Figure I.1.3.3l (Y1-UCLA3-E5-12.) Polluto-graph for Total Coliform / Fecal Coliform

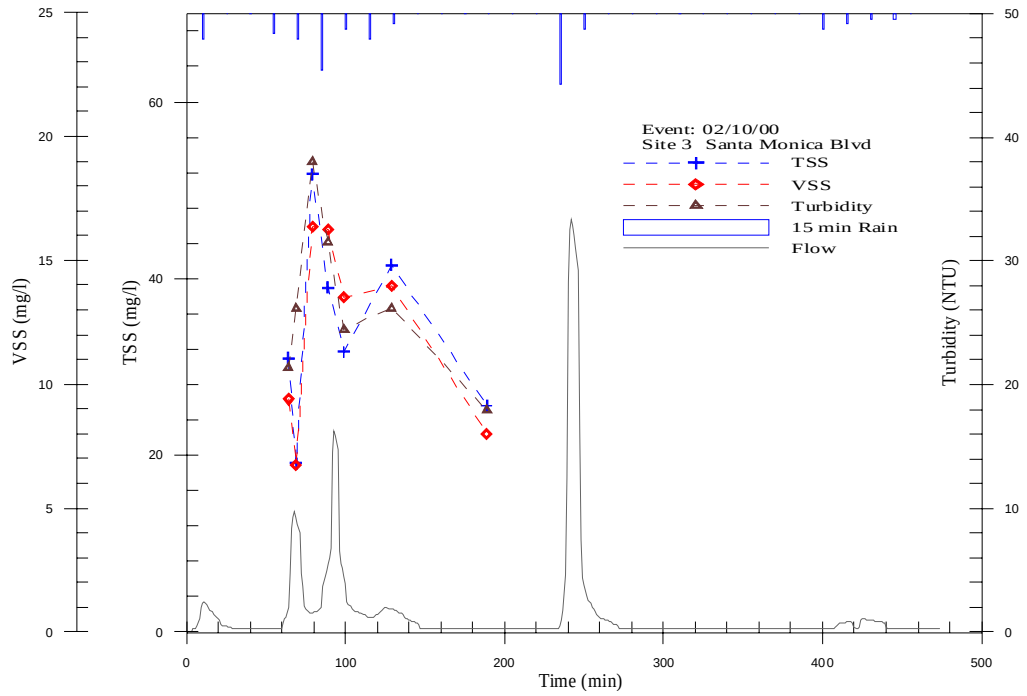


Figure I.1.3.4a (Y1-UCLA3-E6-1.) Polluto-graph for TSS, VSS and Turbidity

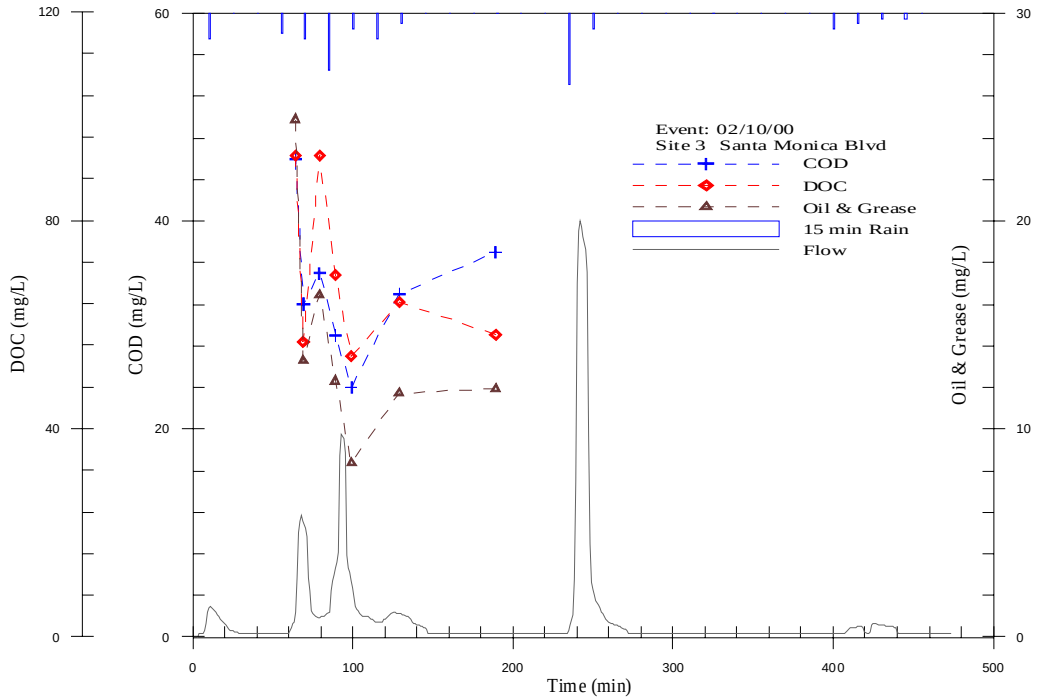


Figure I.1.3.4b (Y1-UCLA3-E6-2.) Polluto-graph for DOC, COD and Oil & Grease

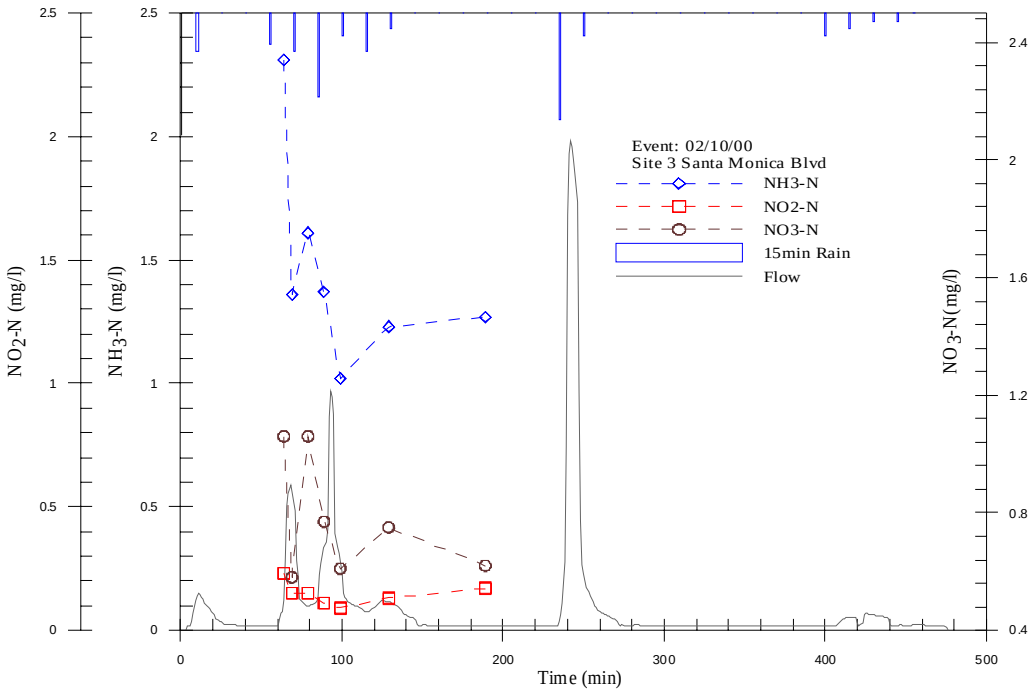


Figure I.1.3.4c (Y1-UCLA3-E6-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

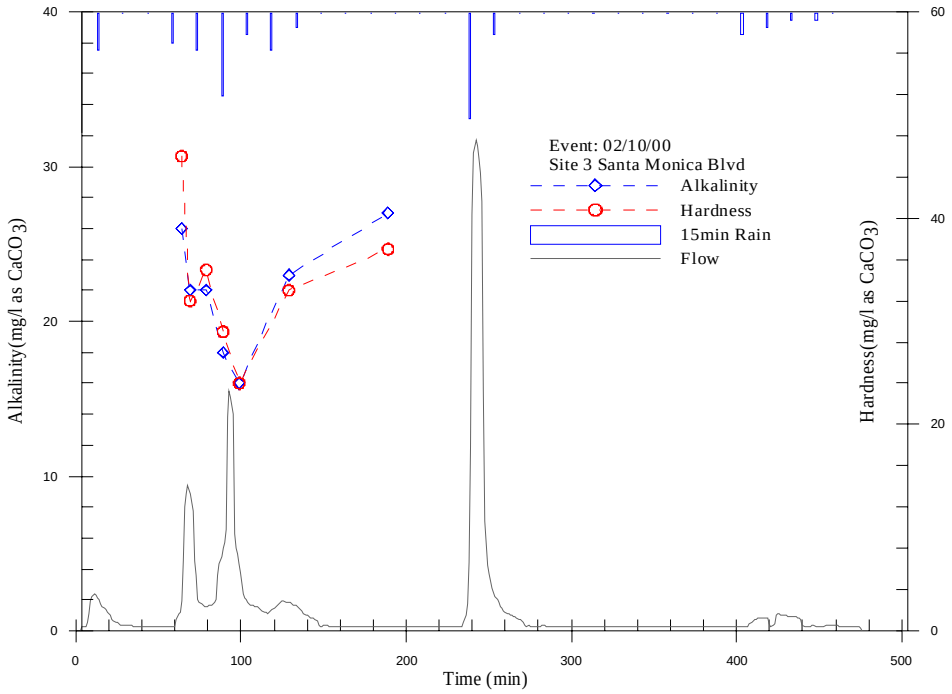


Figure I.1.3.4d (Y1-UCLA3-E6-4.) Polluto-graph for Alkalinity and Hardness

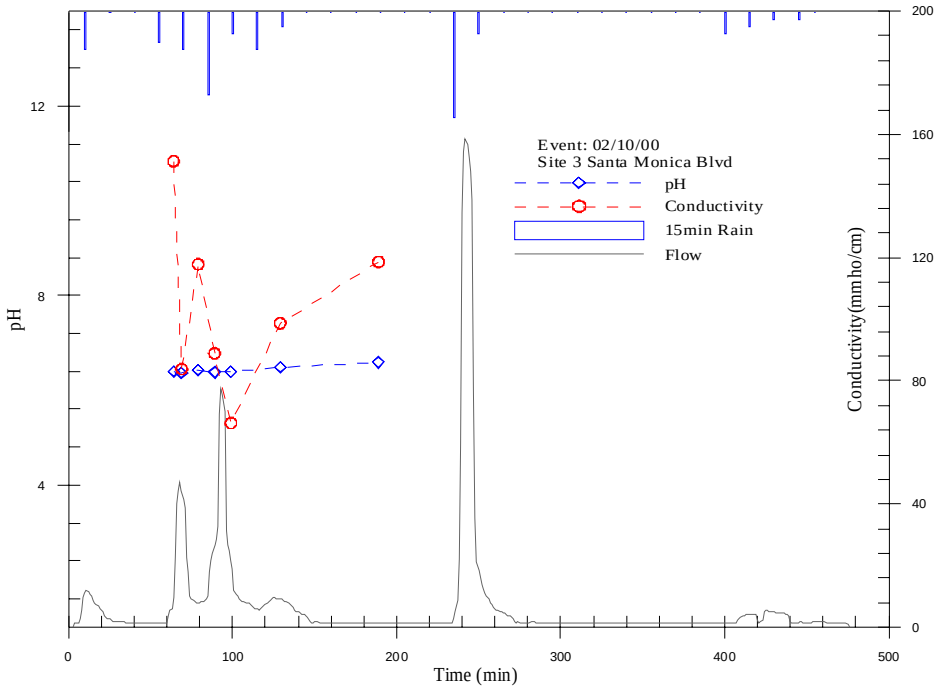


Figure I.1.3.4e (Y1-UCLA3-E6-5.) Polluto-graph for pH and Conductivity

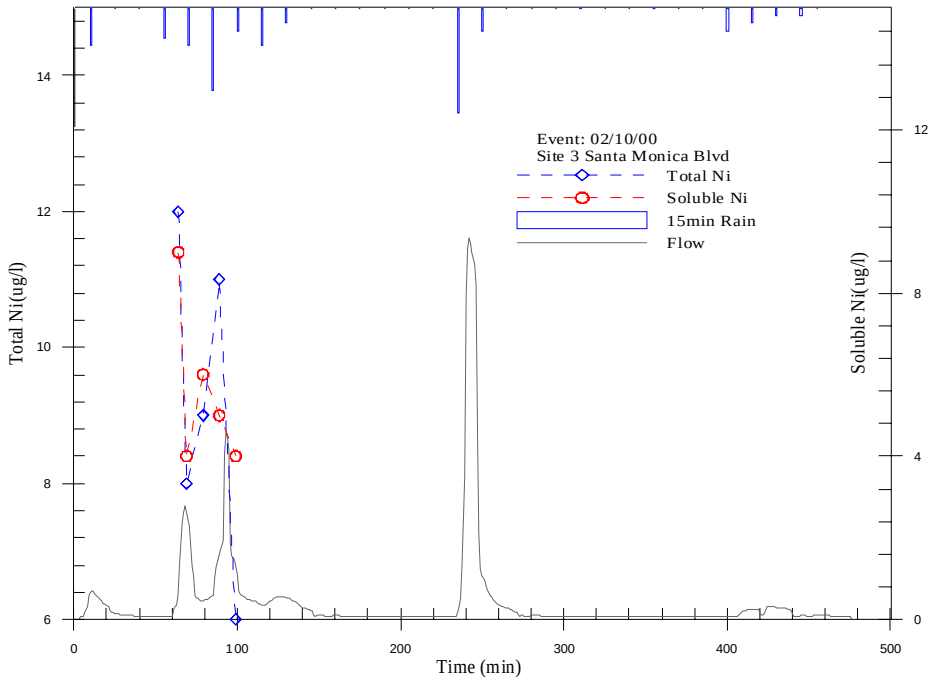


Figure I.1.3.4f (Y1-UCLA3-E6-6.) Polluto-graph for Total Ni / Dissolved Ni

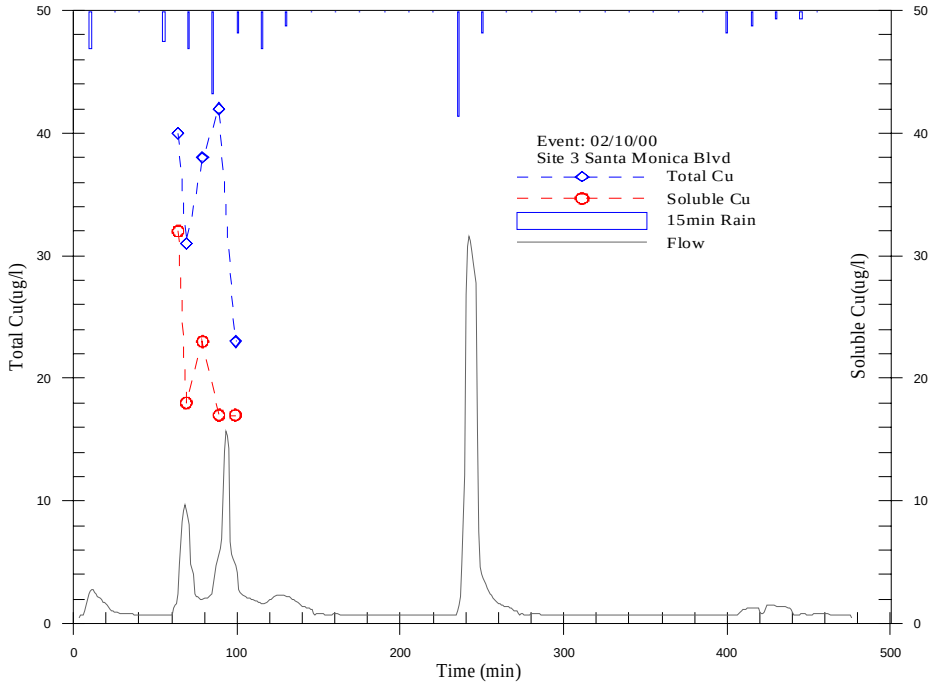


Figure I.1.3.4g (Y1-UCLA3-E6-7.) Polluto-graph for Total Cu / Dissolved Cu

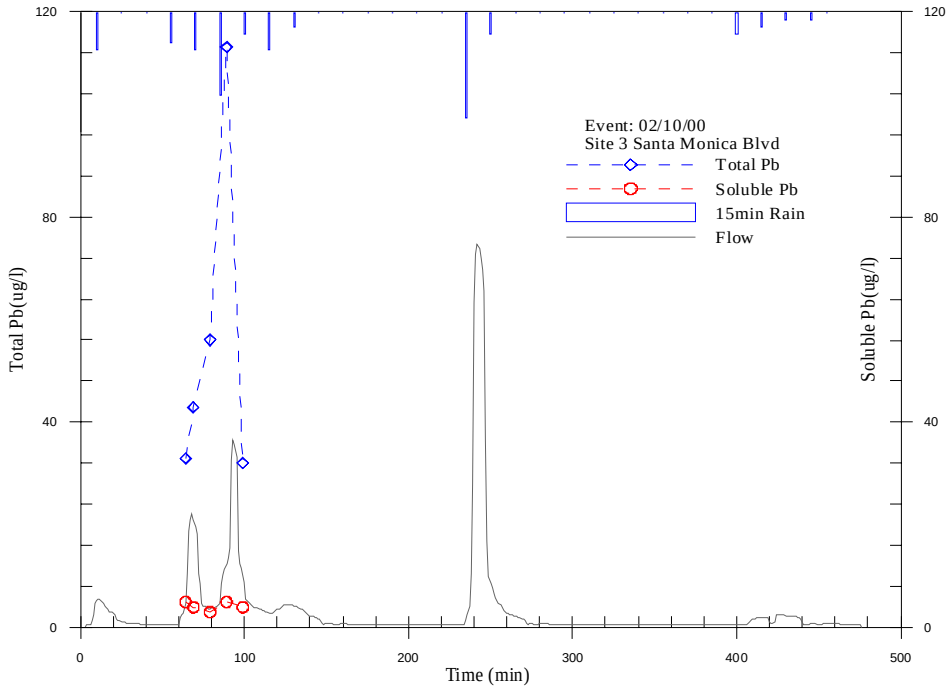


Figure I.1.3.4h (Y1-UCLA3-E6-8.) Polluto-graph for Total Pb / Dissolved Pb

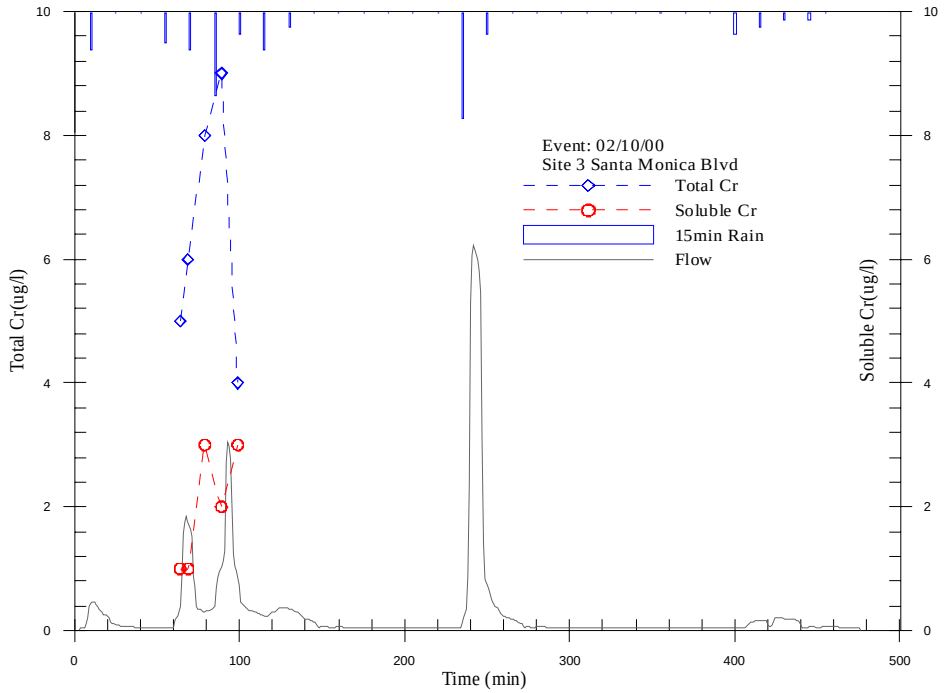


Figure I.1.3.4i (Y1-UCLA3-E6-9.) Polluto-graph for Total Cr / Dissolved Cr

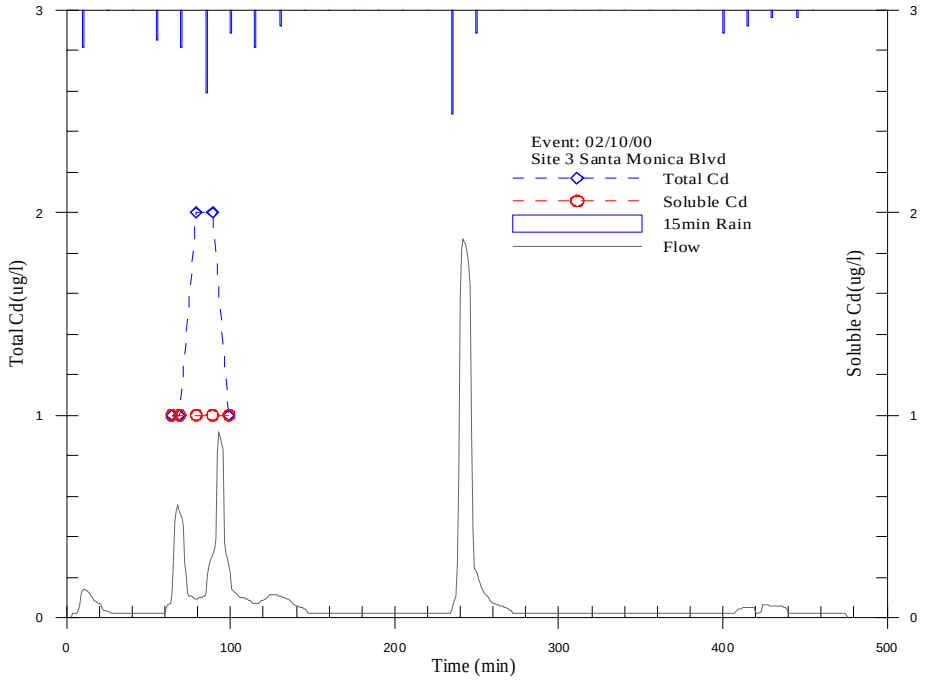


Figure I.1.3.4j (Y1-UCLA3-E6-10.) Polluto-graph for Total Cd / Dissolved Cd

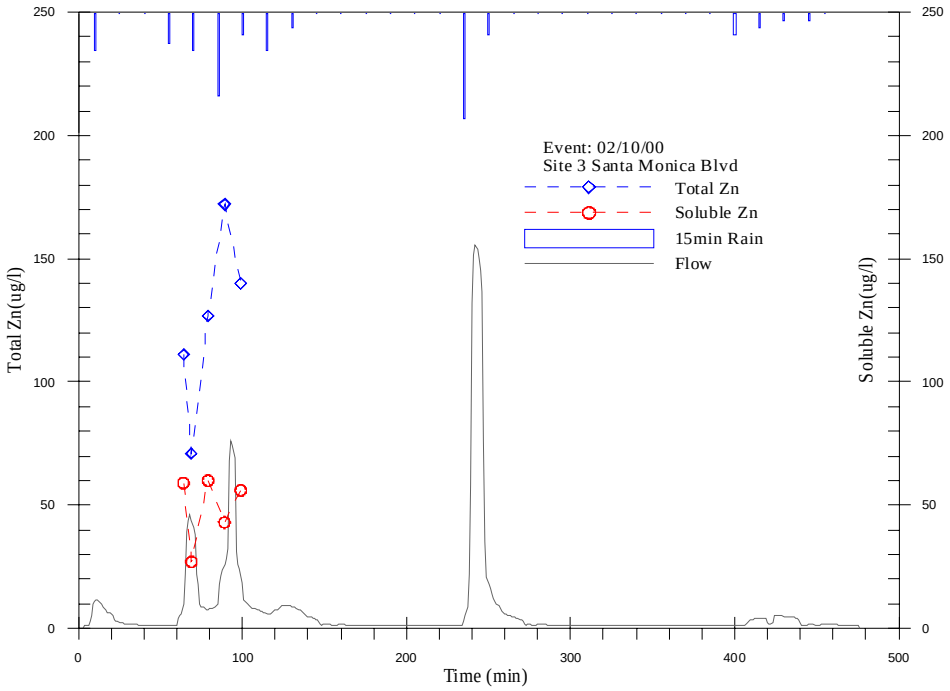


Figure I.1.3.4k (Y1-UCLA3-E6-11.) Polluto-graph for Total Zn / Dissolved Zn

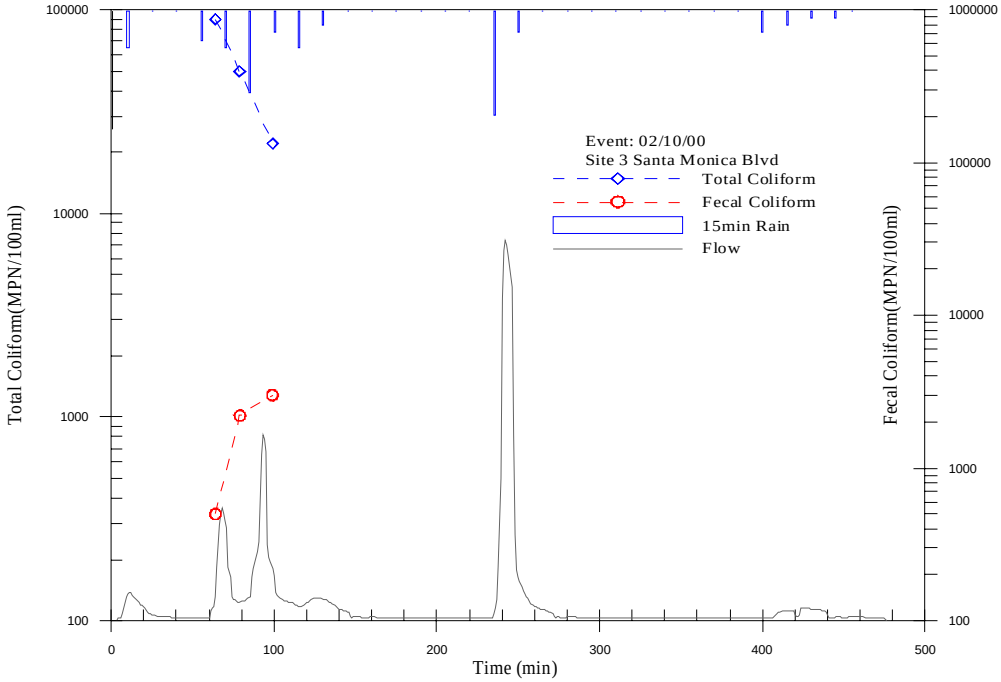


Figure I.1.3.4l (Y1-UCLA3-E6-12.) Polluto-graph for Total Coliform / Fecal Coliform

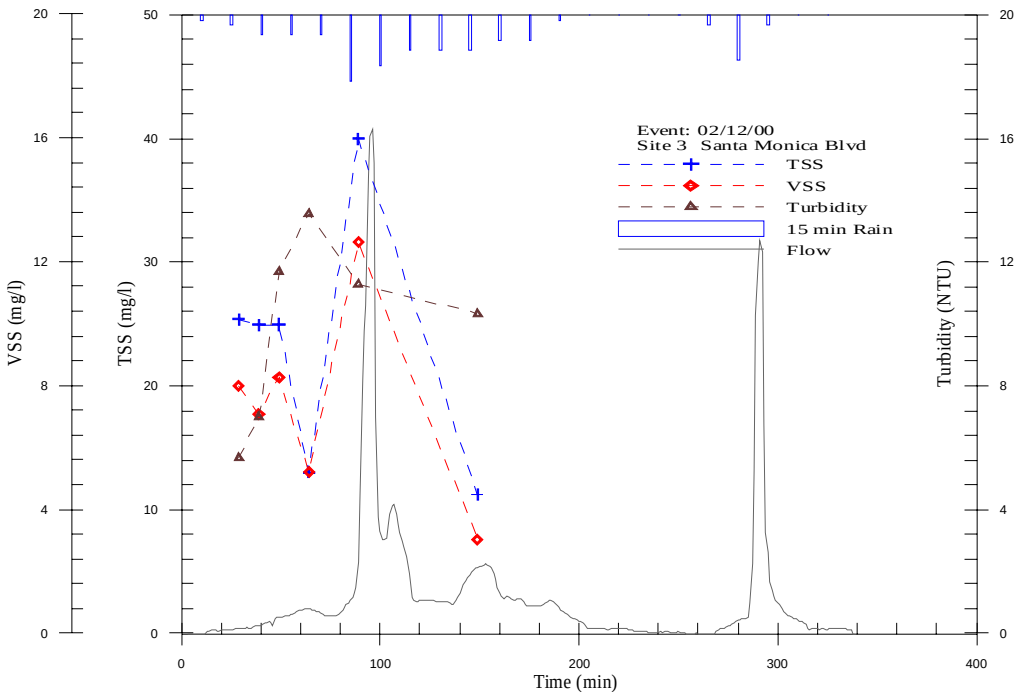


Figure I.1.3.5a (Y1-UCLA3-E7-1.) Polluto-graph for TSS, VSS and Turbidity

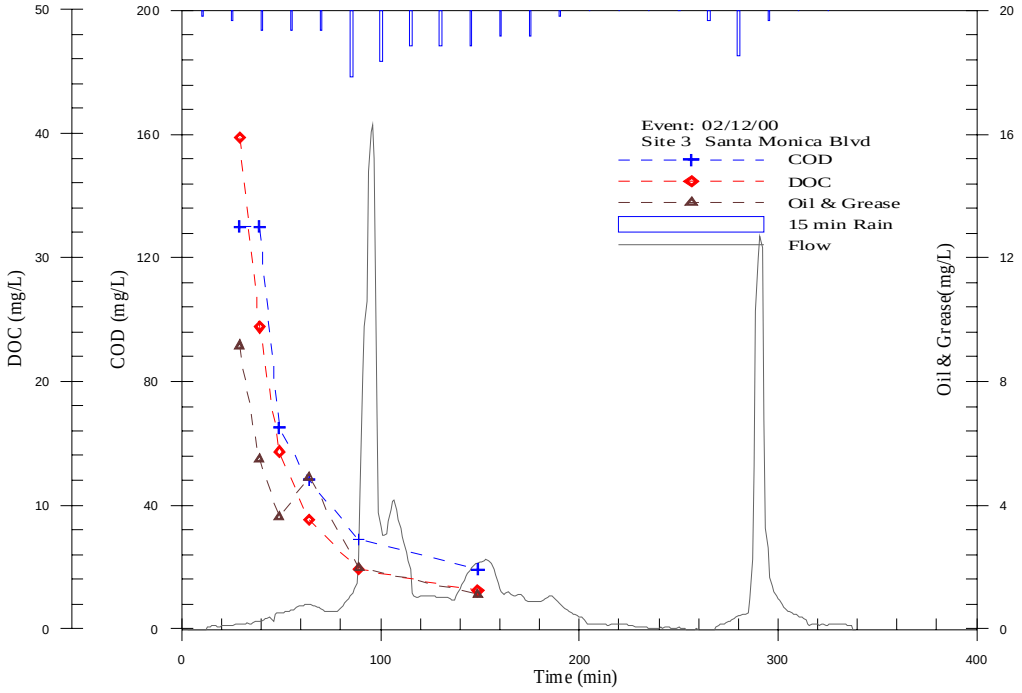


Figure I.1.3.5b (Y1-UCLA3-E7-2.) Polluto-graph for DOC, COD and Oil & Grease

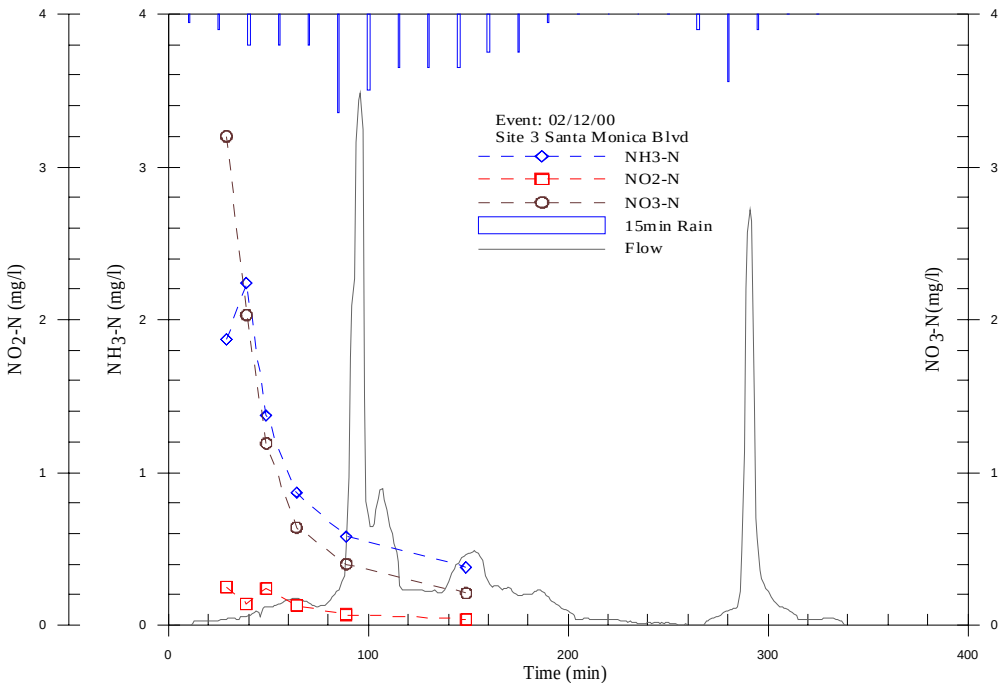


Figure I.1.3.5c (Y1-UCLA3-E7-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

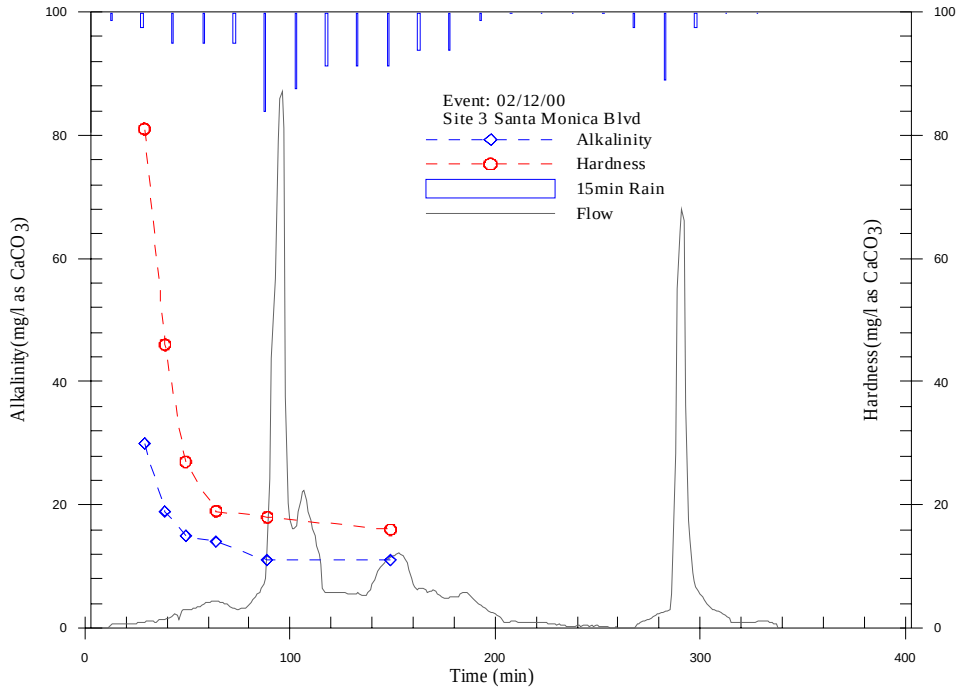


Figure I.1.3.5d (Y1-UCLA3-E7-4.) Polluto-graph for Alkalinity and Hardness

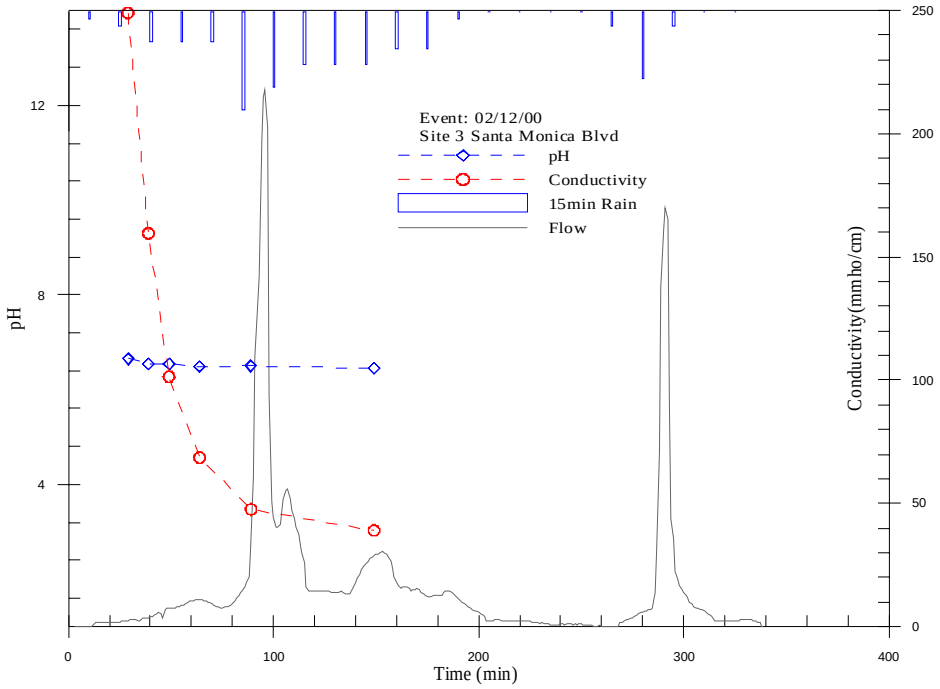


Figure I.1.3.5e (Y1-UCLA3-E7-5.) Polluto-graph for pH and Conductivity

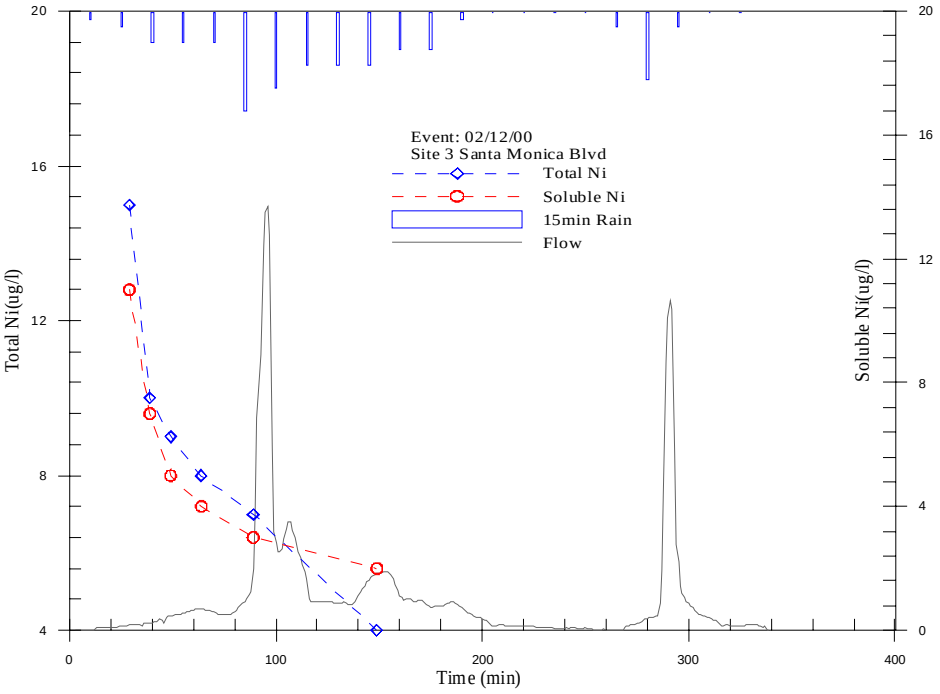


Figure I.1.3.5f (Y1-UCLA3-E7-6.) Polluto-graph for Total Ni / Dissolved Ni

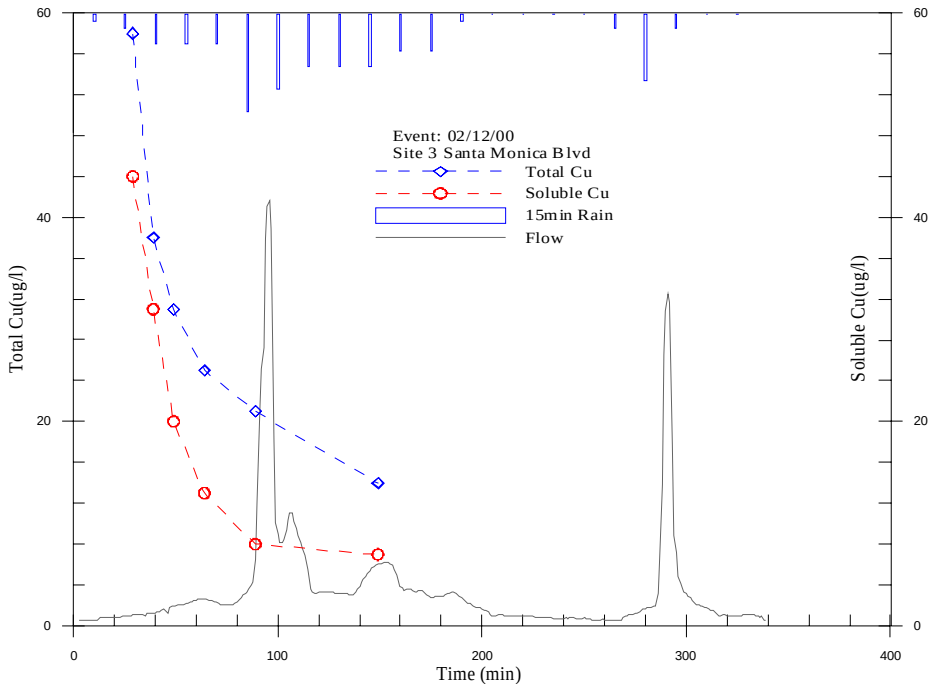


Figure I.1.3.5g (Y1-UCLA3-E7-7.) Polluto-graph for Total Cu / Dissolved Cu

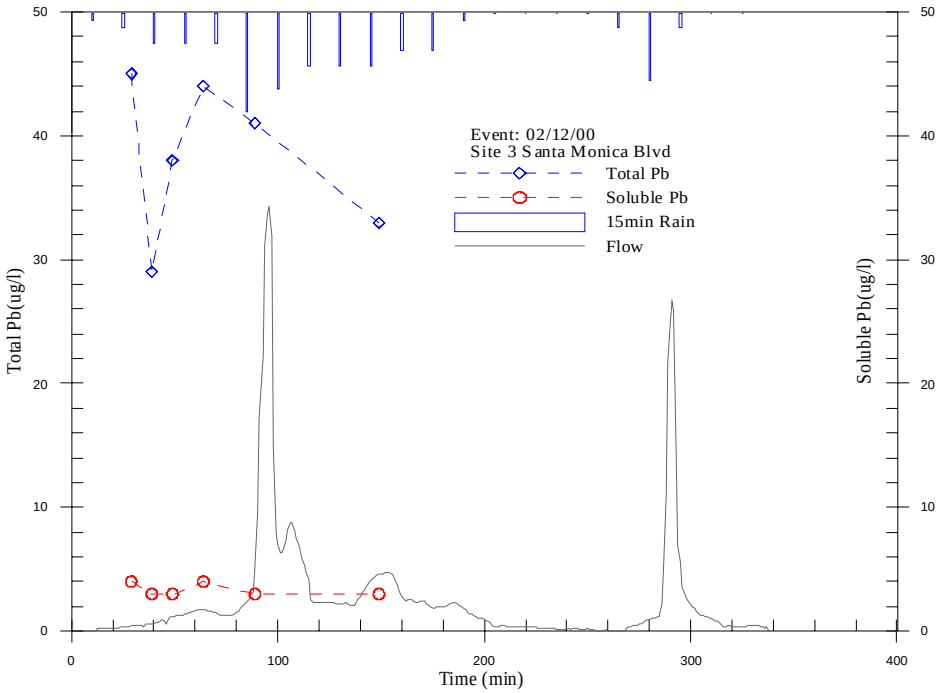


Figure I.1.3.5h (Y1-UCLA3-E7-8.) Polluto-graph for Total Pb / Dissolved Pb

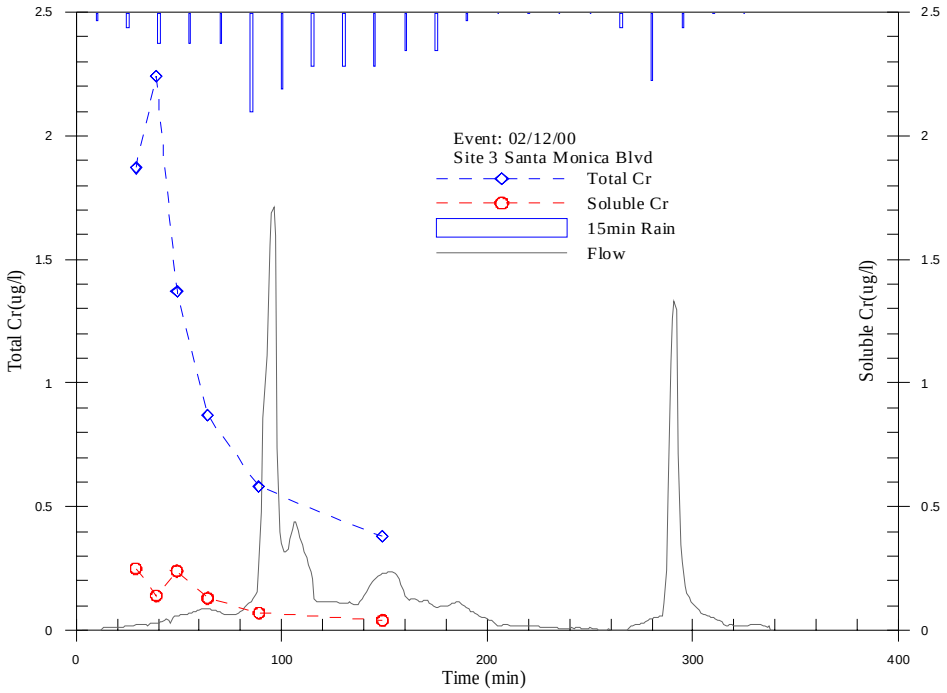


Figure I.1.3.5i (Y1-UCLA3-E7-9.) Polluto-graph for Total Cr / Dissolved Cr

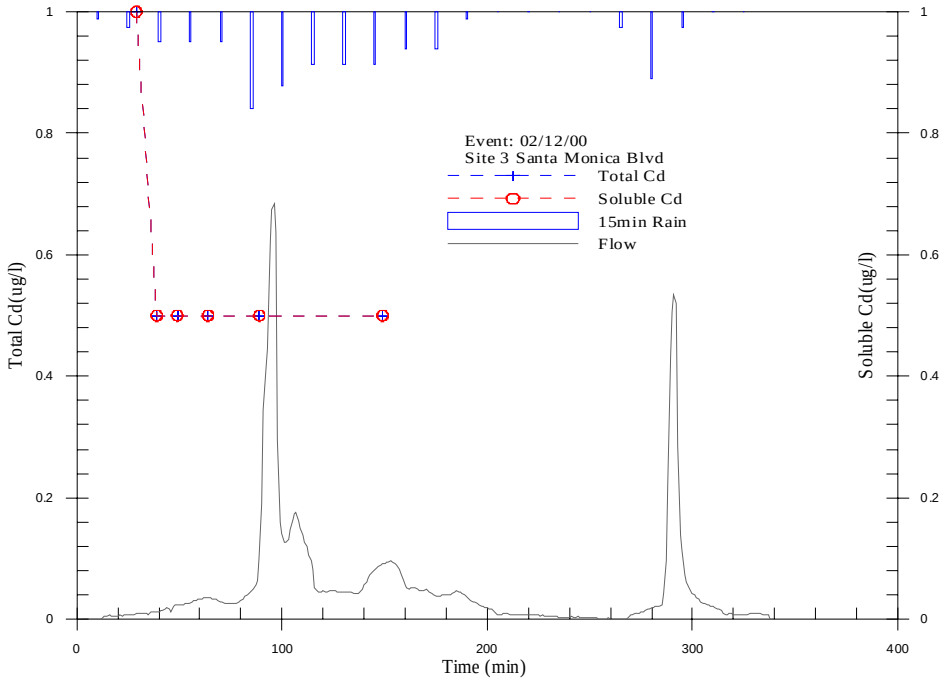


Figure I.1.3.5j (Y1-UCLA3-E7-10.) Polluto-graph for Total Cd / Dissolved Cd

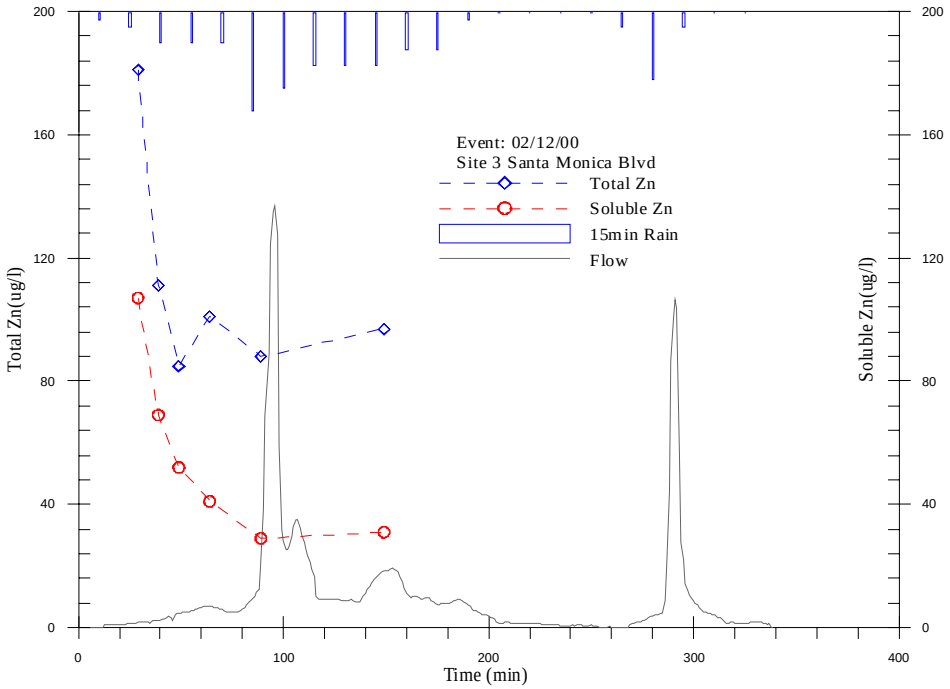


Figure I.1.3.5k (Y1-UCLA3-E7-11.) Polluto-graph for Total Zn / Dissolved Zn

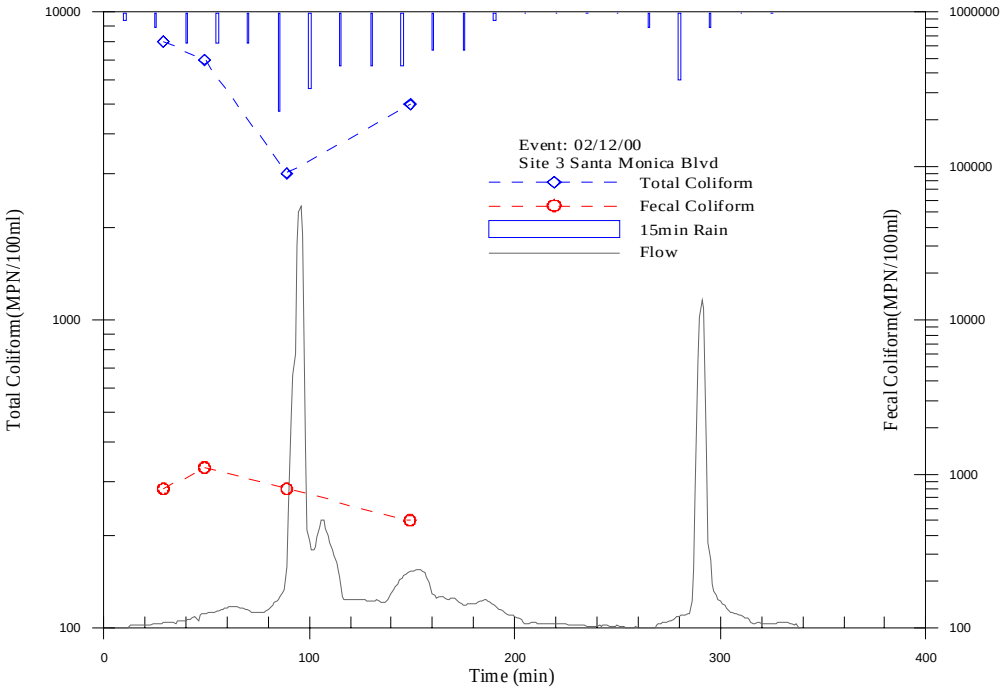


Figure I.1.3.5l (Y1-UCLA3-E7-12.) Polluto-graph for Total Coliform / Fecal Coliform

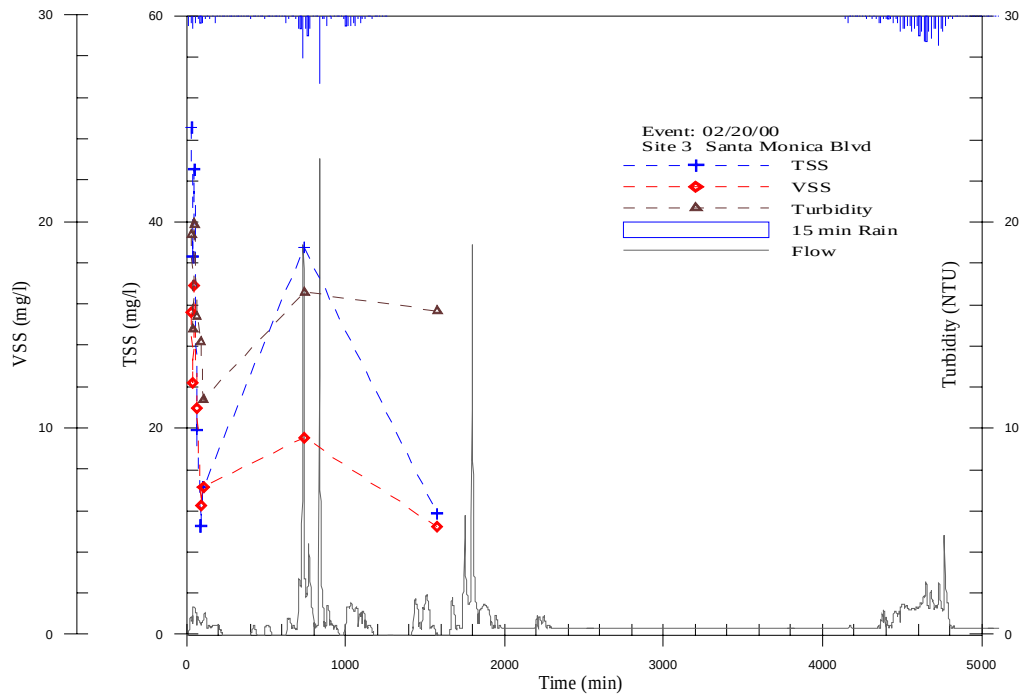


Figure I.1.3.6a (Y1-UCLA3-E8-1.) Polluto-graph for TSS, VSS and Turbidity

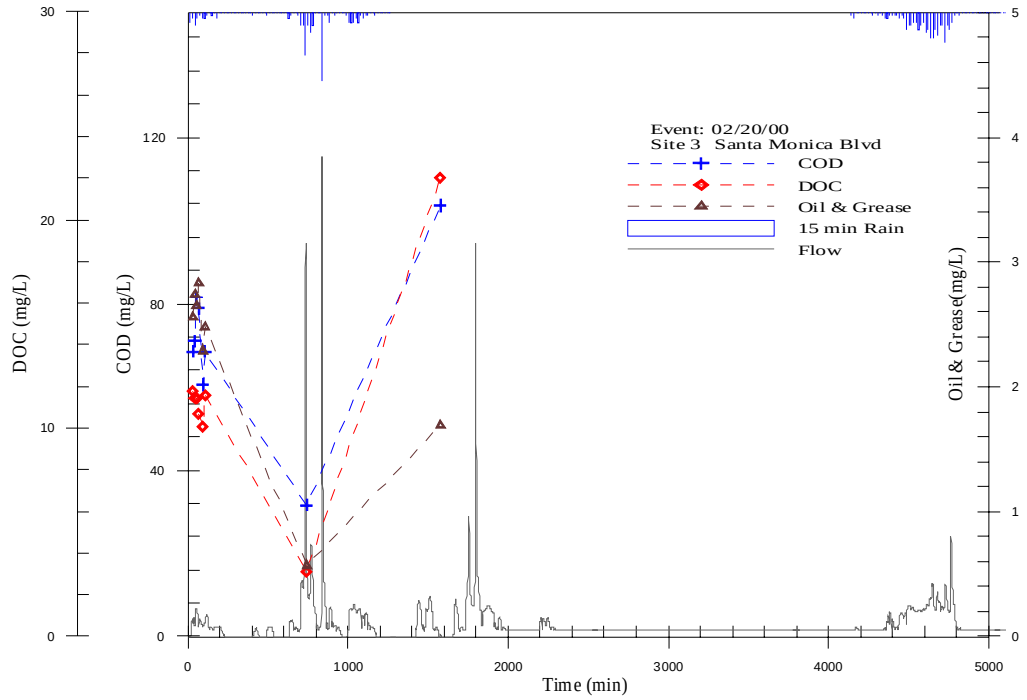


Figure I.1.3.6b (Y1-UCLA3-E8-2.) Polluto-graph for DOC, COD and Oil & Grease

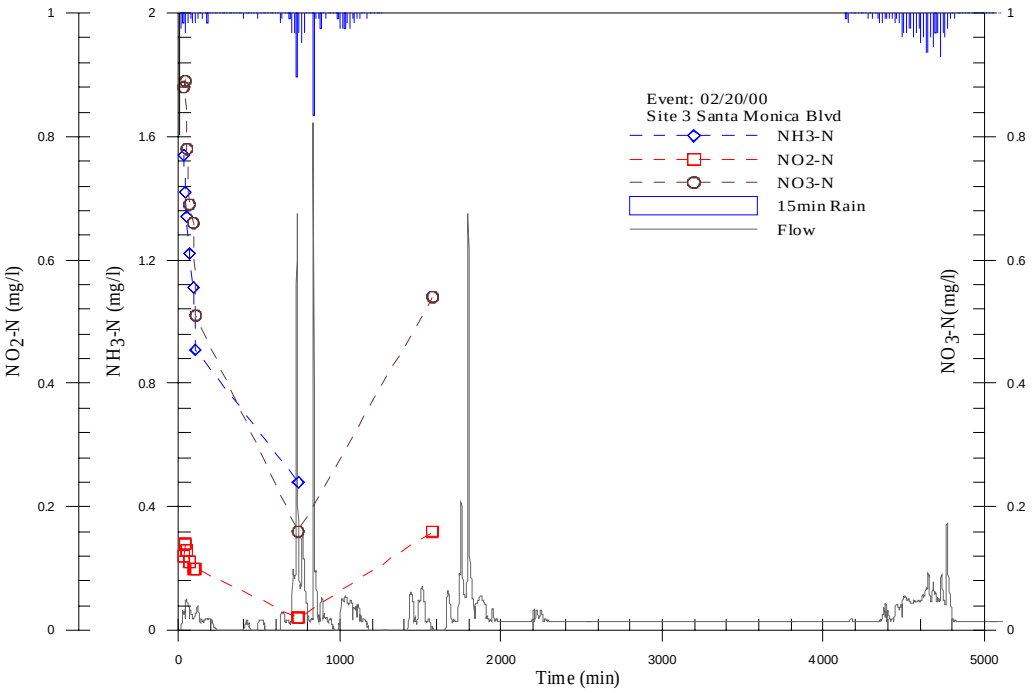


Figure I.1.3.6c (Y1-UCLA3-E8-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

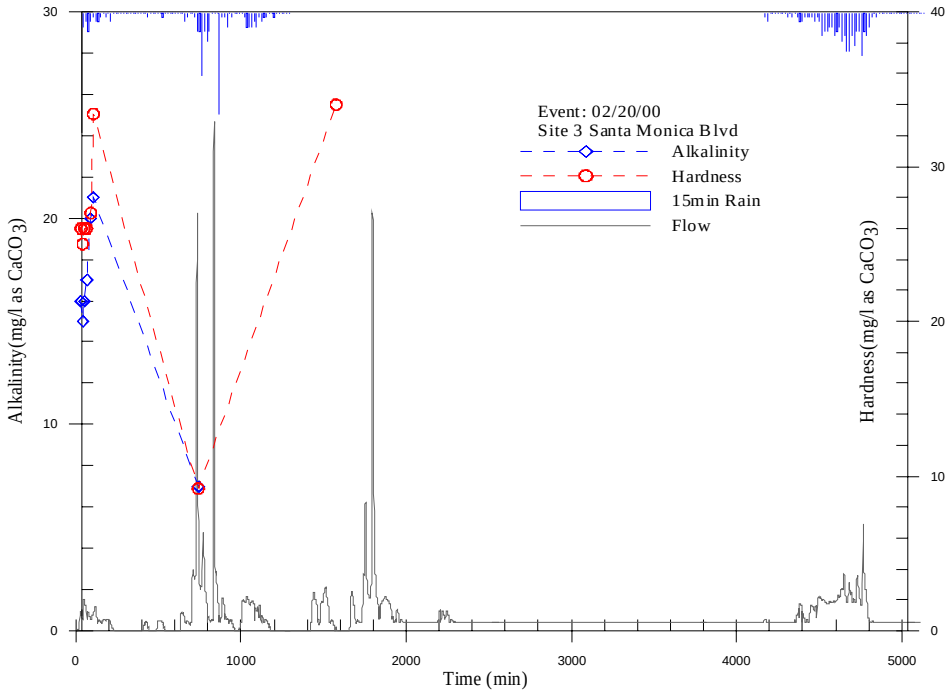


Figure I.1.3.6d (Y1-UCLA3-E8-4.) Polluto-graph for Alkalinity and Hardness

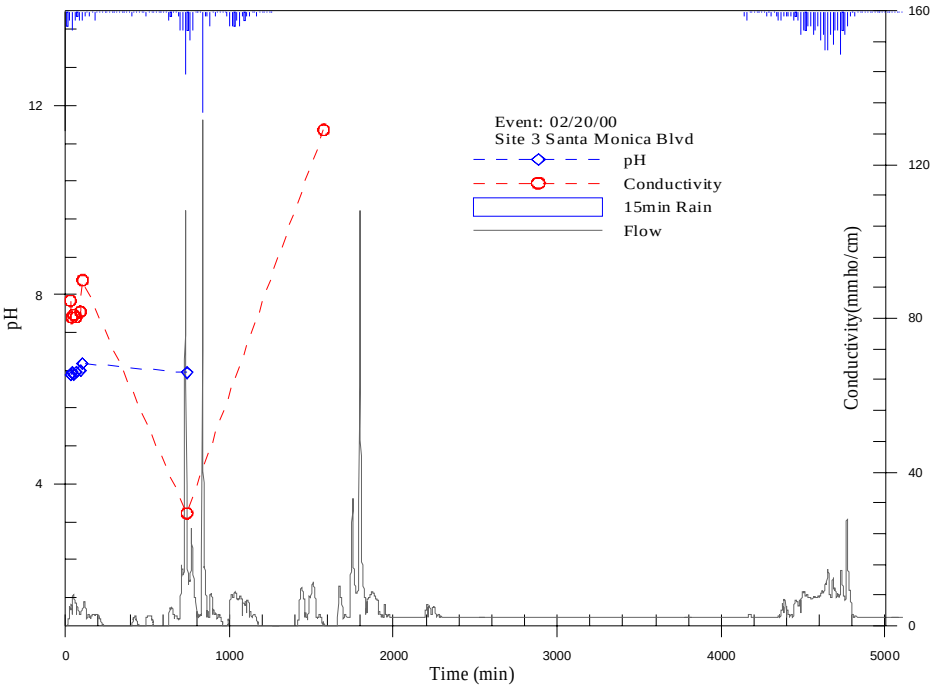


Figure I.1.3.6e (Y1-UCLA3-E8-5.) Polluto-graph for pH and Conductivity

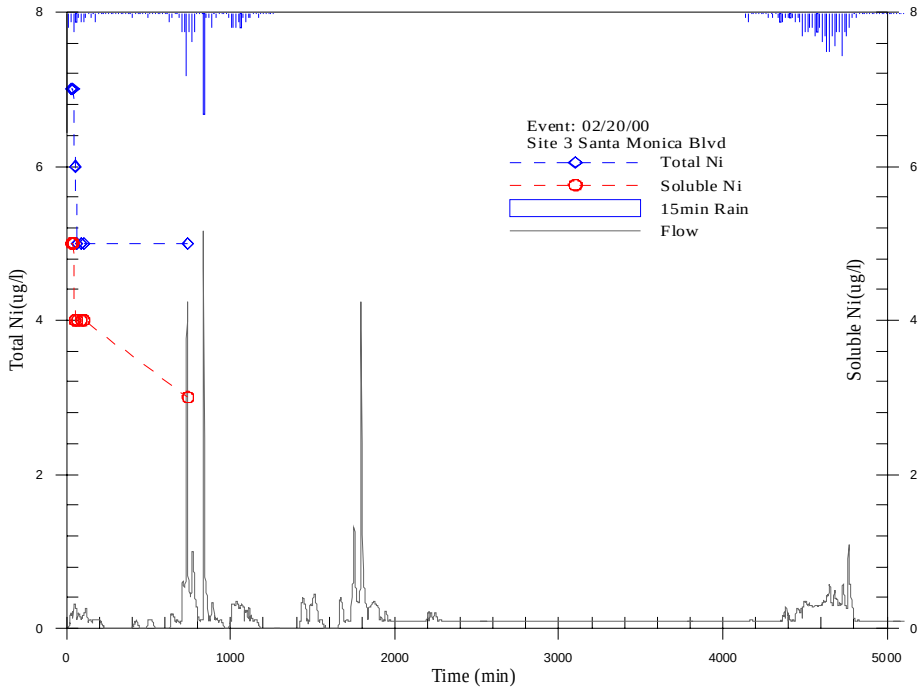


Figure I.1.3.6f (Y1-UCLA3-E8-6.) Polluto-graph for Total Ni / Dissolved Ni

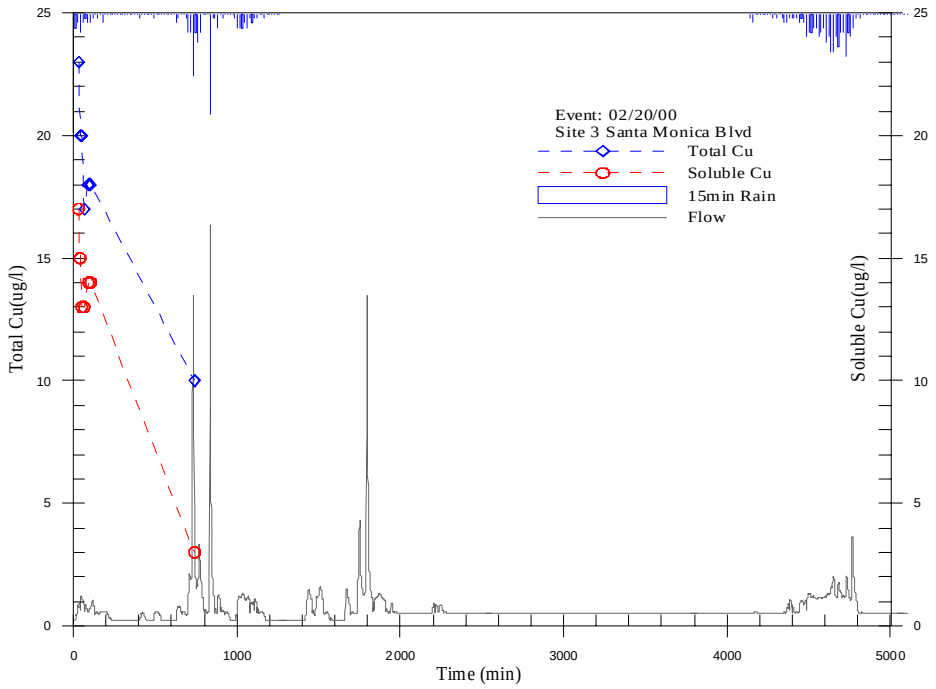


Figure I.1.3.6g (Y1-UCLA3-E8-7.) Polluto-graph for Total Cu / Dissolved Cu

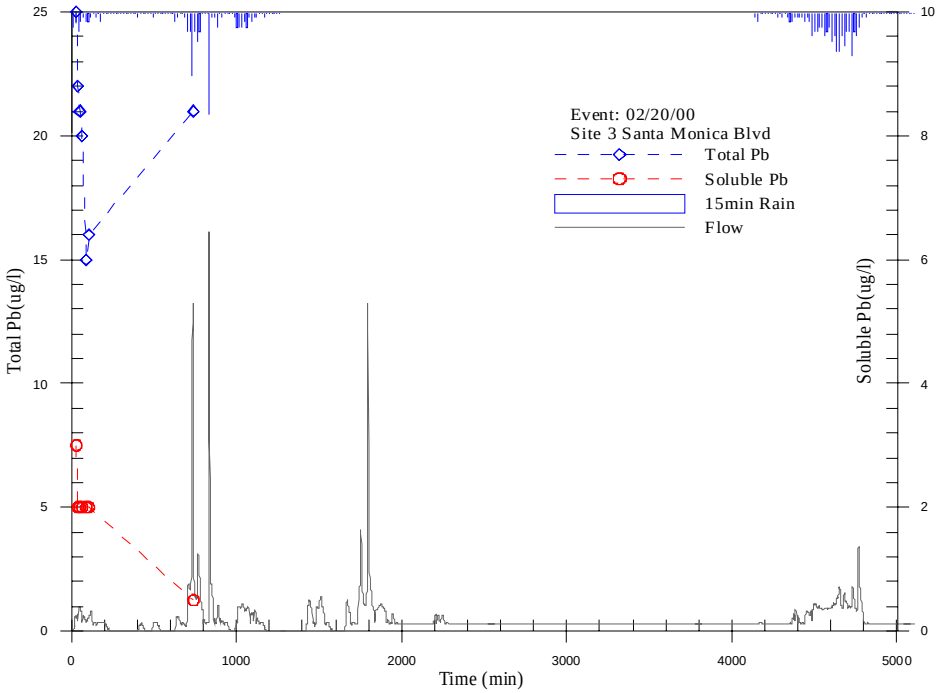


Figure I.1.3.6h (Y1-UCLA3-E8-8.) Polluto-graph for Total Pb / Dissolved Pb

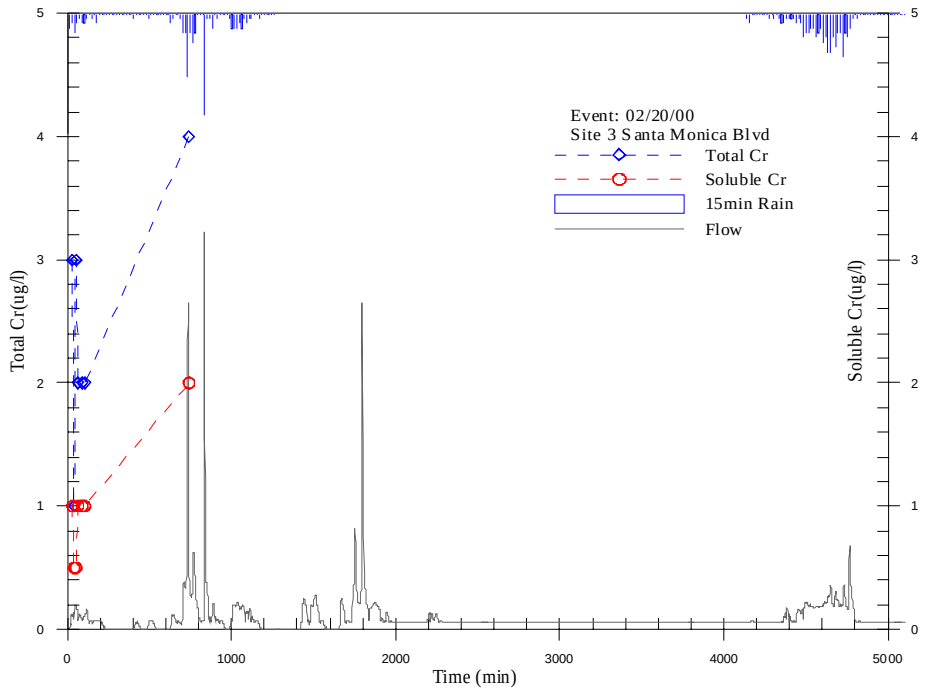


Figure I.1.3.6i (Y1-UCLA3-E8-9.) Polluto-graph for Total Cr / Dissolved Cr

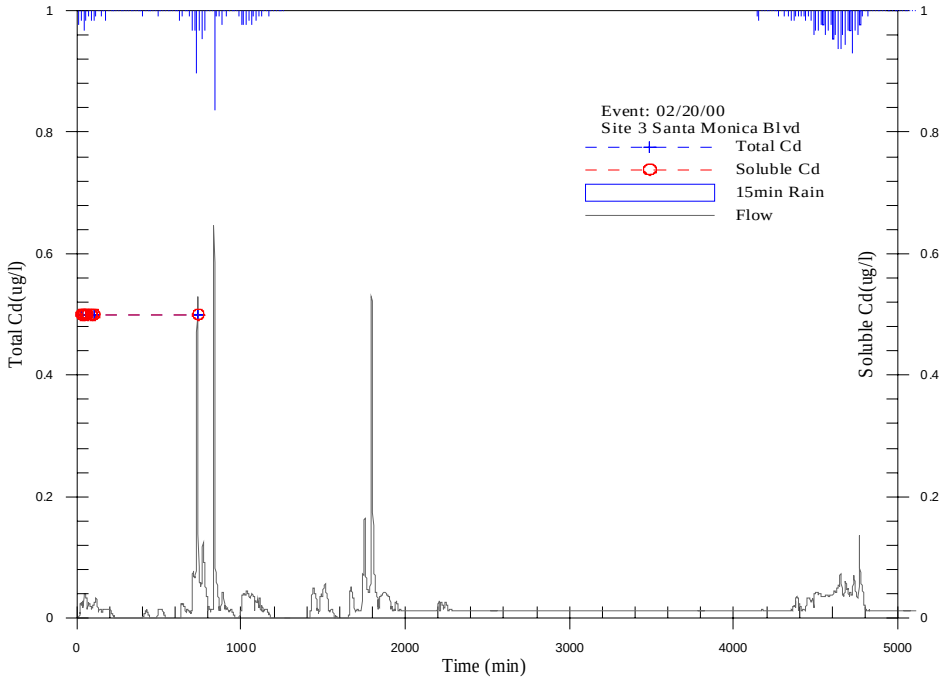


Figure I.1.3.6j (Y1-UCLA3-E8-10.) Polluto-graph for Total Cd / Dissolved Cd

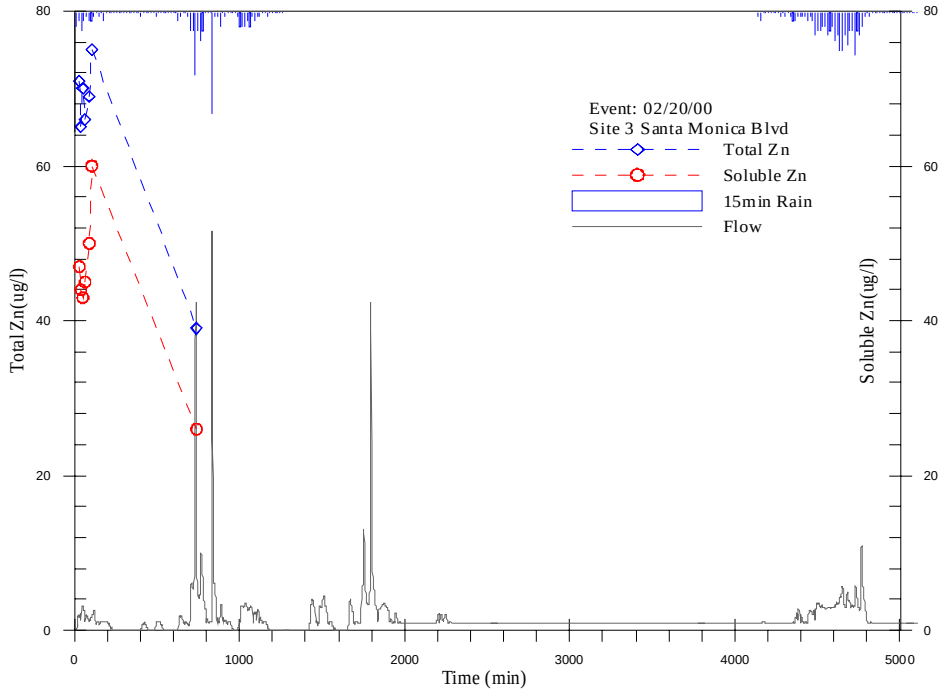


Figure I.1.3.6k (Y1-UCLA3-E8-11.) Polluto-graph for Total Zn / Dissolved Zn

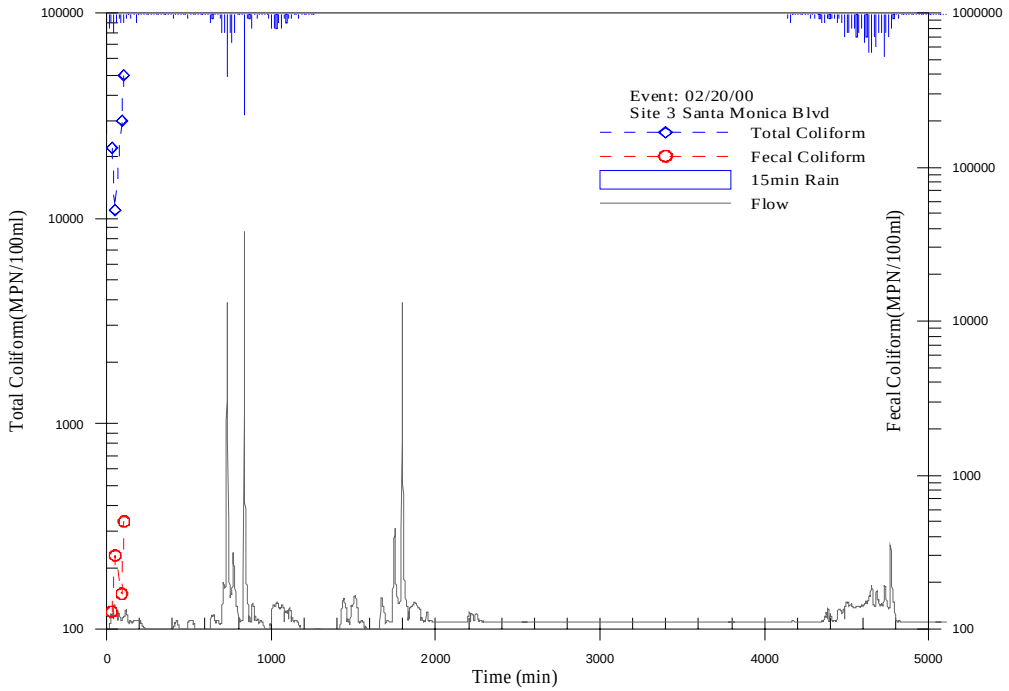


Figure I.1.3.6l (Y1-UCLA3-E8-12.) Polluto-graph for Total Coliform / Fecal Coliform

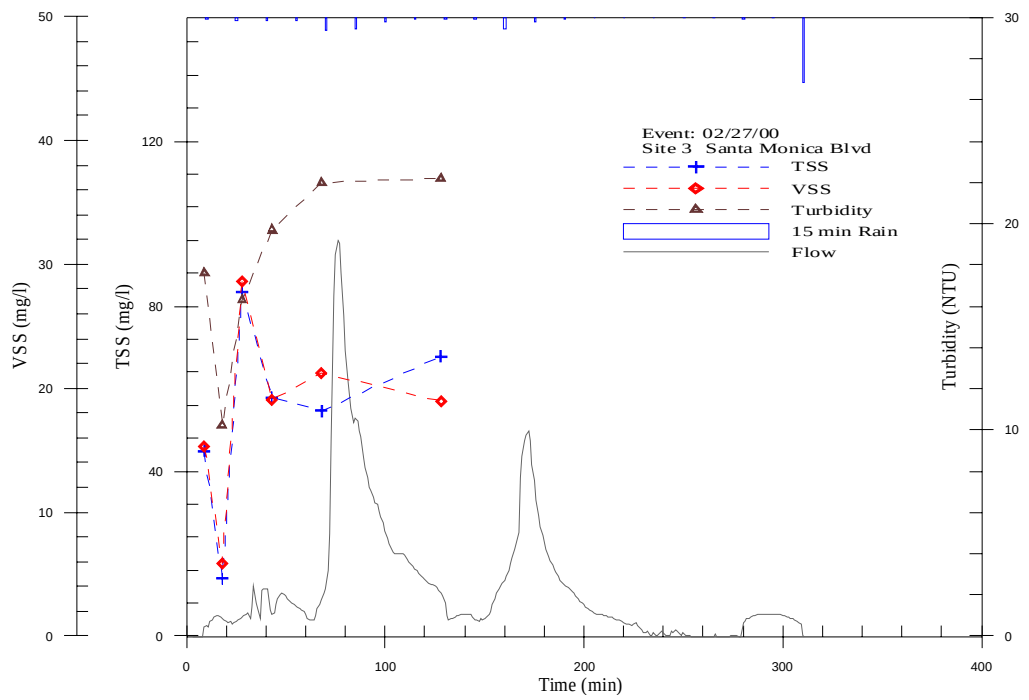


Figure I.1.3.7a (Y1-UCLA3-E9-1.) Polluto-graph for TSS, VSS and Turbidity

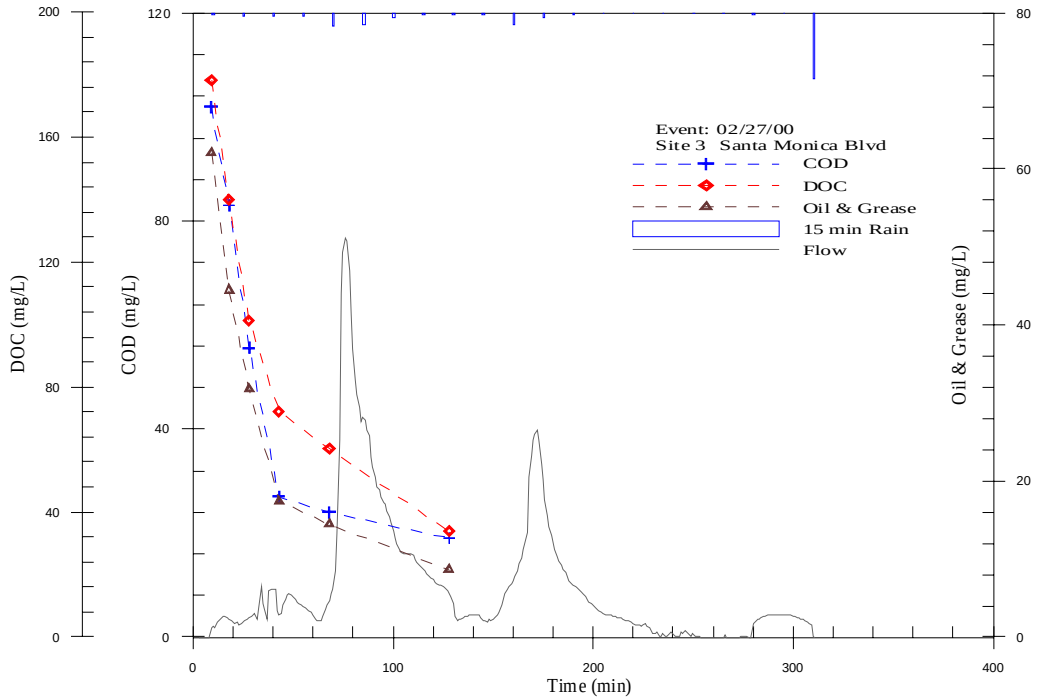


Figure I.1.3.7b (Y1-UCLA3-E9-2.) Polluto-graph for DOC, COD and Oil & Grease

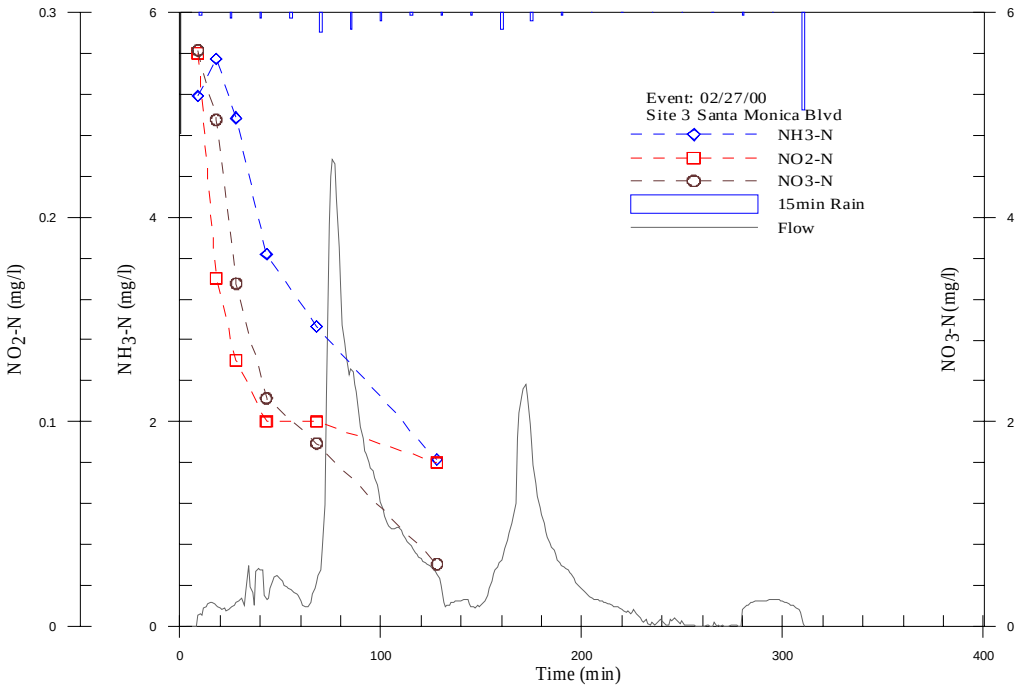


Figure I.1.3.7c (Y1-UCLA3-E9-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

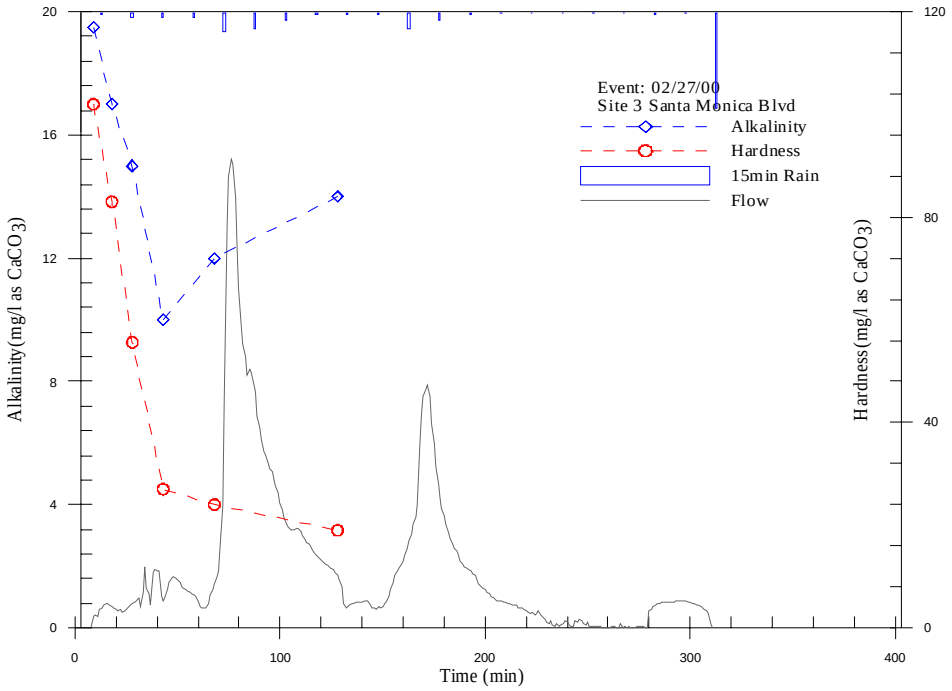


Figure I.1.3.7d (Y1-UCLA3-E9-4.) Polluto-graph for Alkalinity and Hardness

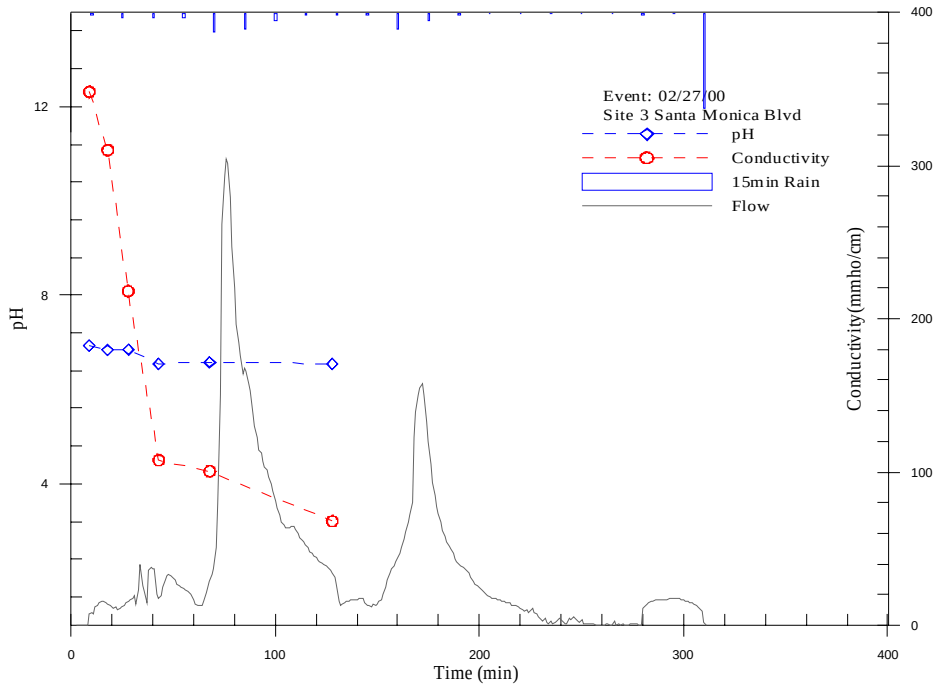


Figure I.1.3.7e (Y1-UCLA3-E9-5.) Polluto-graph for pH and Conductivity

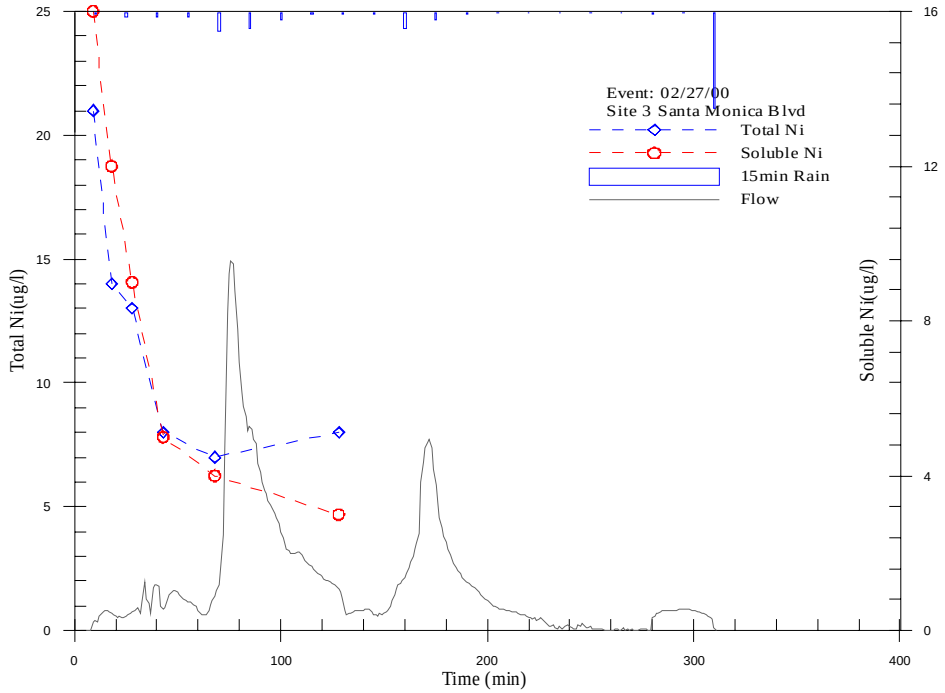


Figure I.1.3.7f (Y1-UCLA3-E9-6.) Polluto-graph for Total Ni / Dissolved Ni

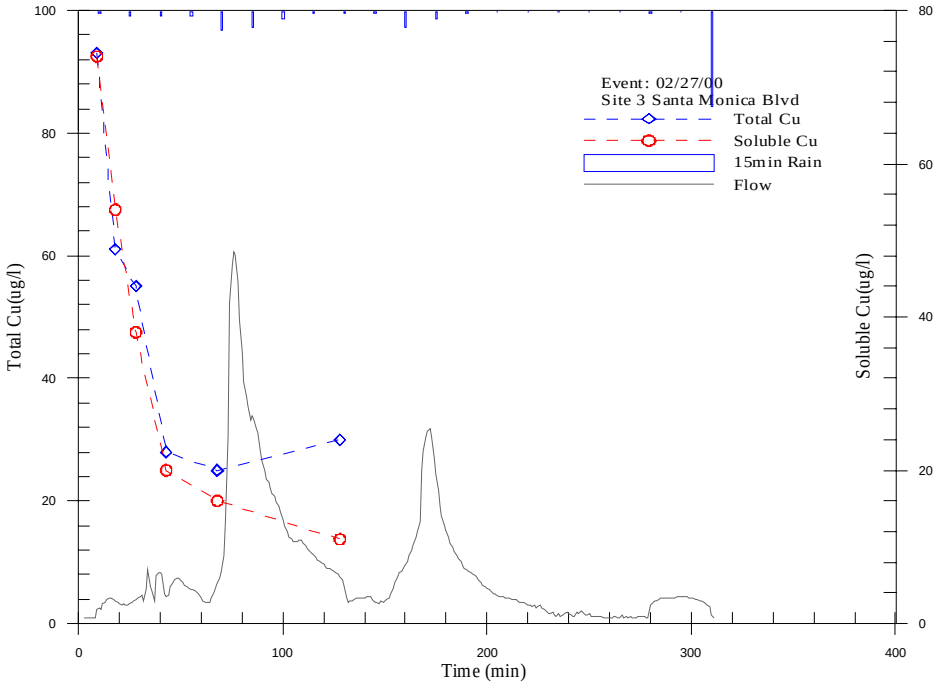


Figure I.1.3.7g (Y1-UCLA3-E9-7.) Polluto-graph for Total Cu / Dissolved Cu

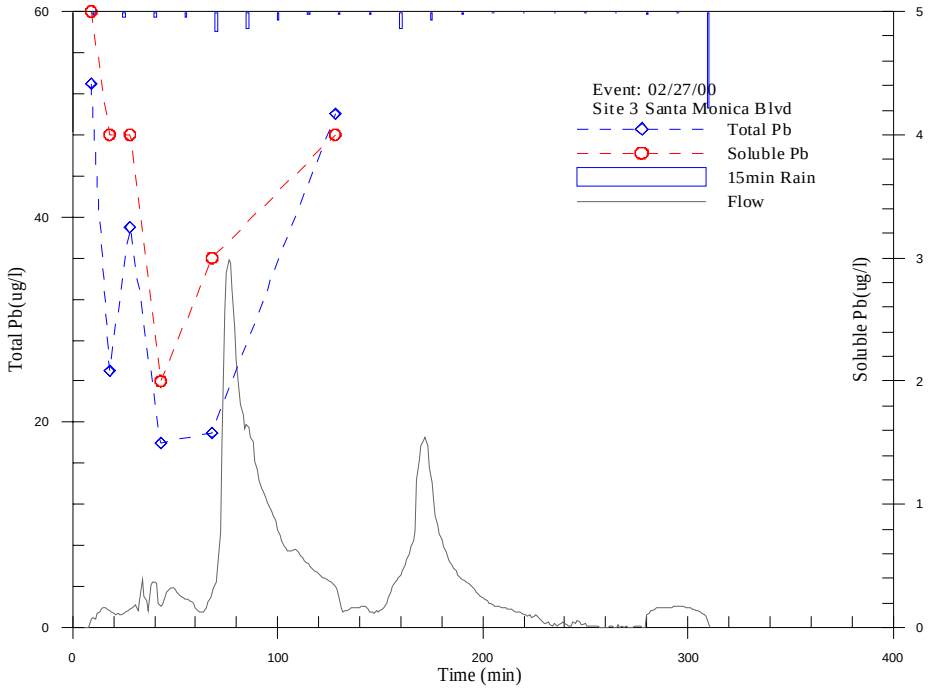


Figure I.1.3.7h (Y1-UCLA3-E9-8.) Polluto-graph for Total Pb / Dissolved Pb

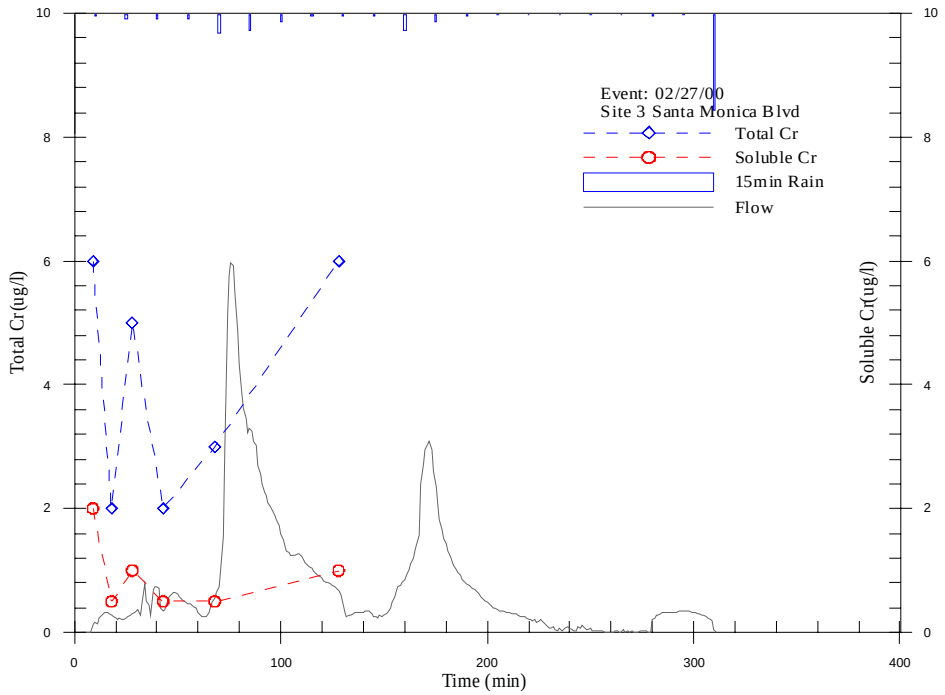


Figure I.1.3.7i (Y1-UCLA3-E9-9.) Polluto-graph for Total Cr / Dissolved Cr

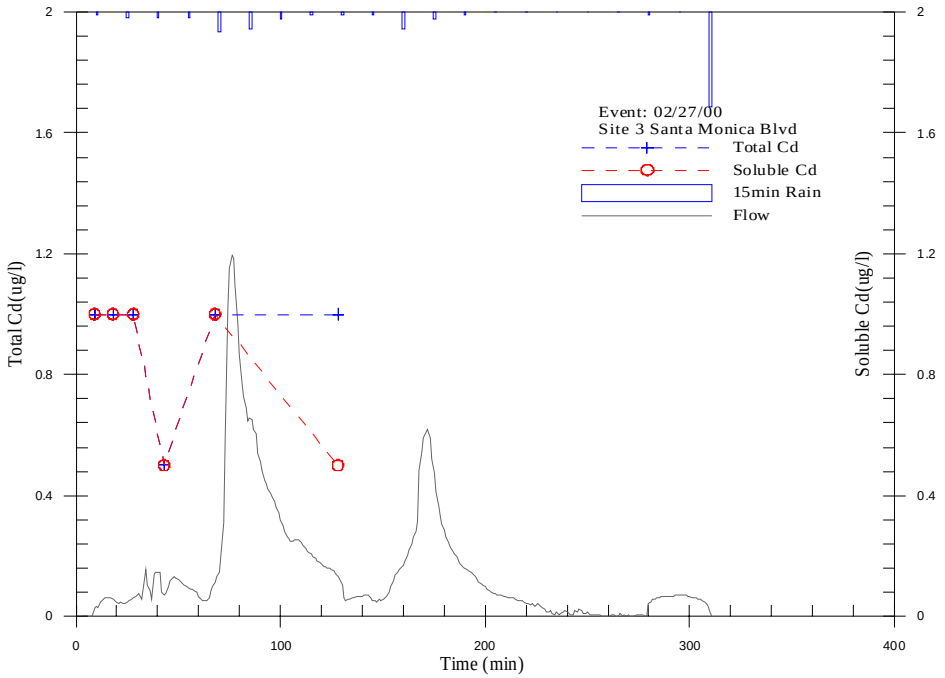


Figure I.1.3.7j (Y1-UCLA3-E9-10.) Polluto-graph for Total Cd / Dissolved Cd

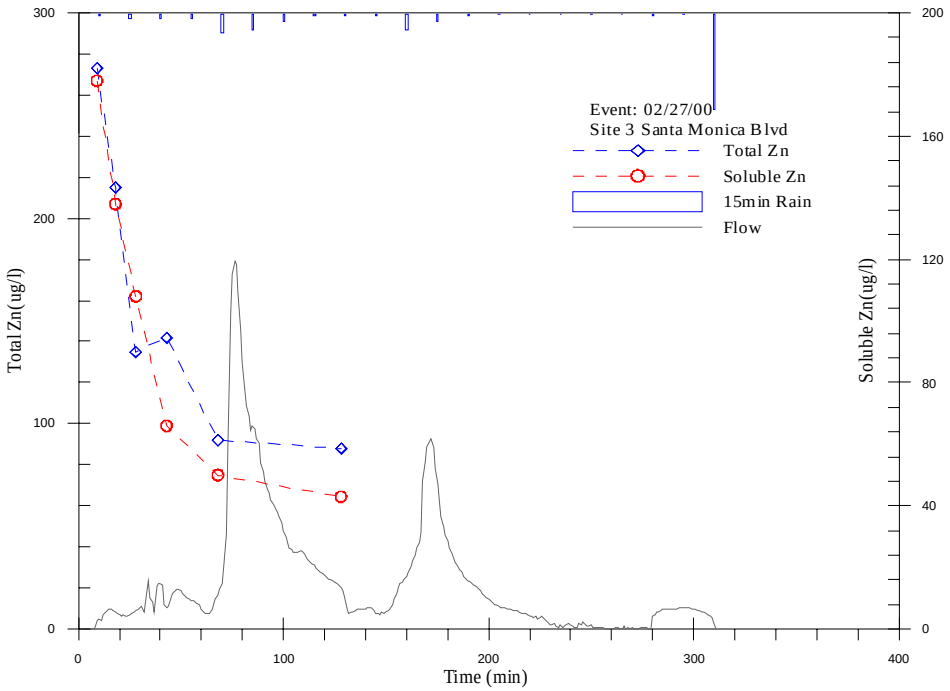


Figure I.1.3.7k (Y1-UCLA3-E9-11.) Polluto-graph for Total Zn / Dissolved Zn

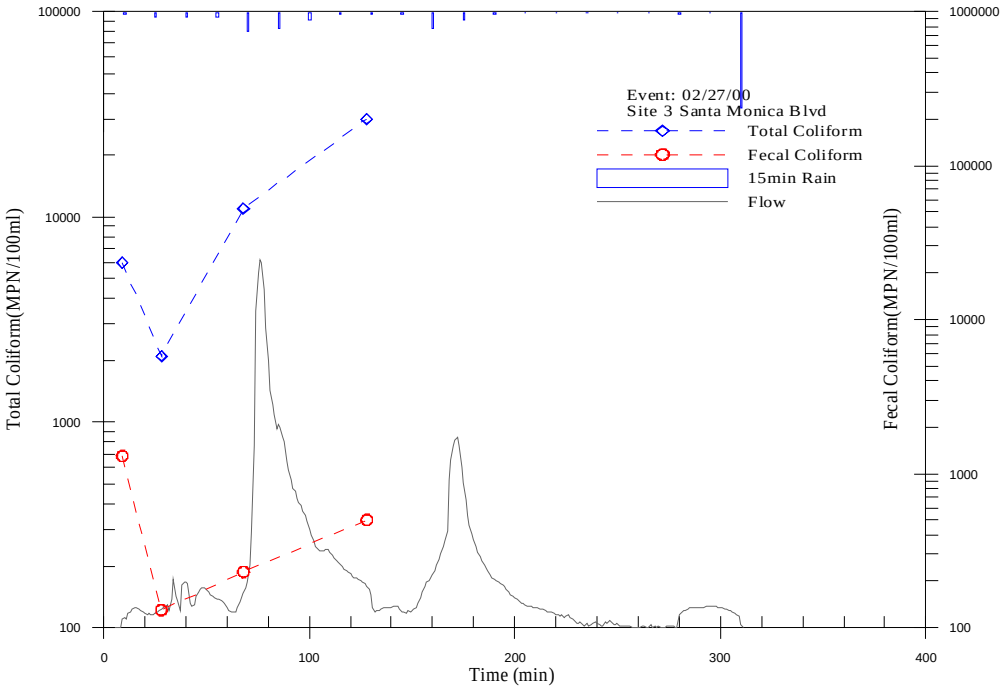


Figure I.1.3.7l (Y1-UCLA3-E9-12.) Polluto-graph for Total Coliform / Fecal Coliform

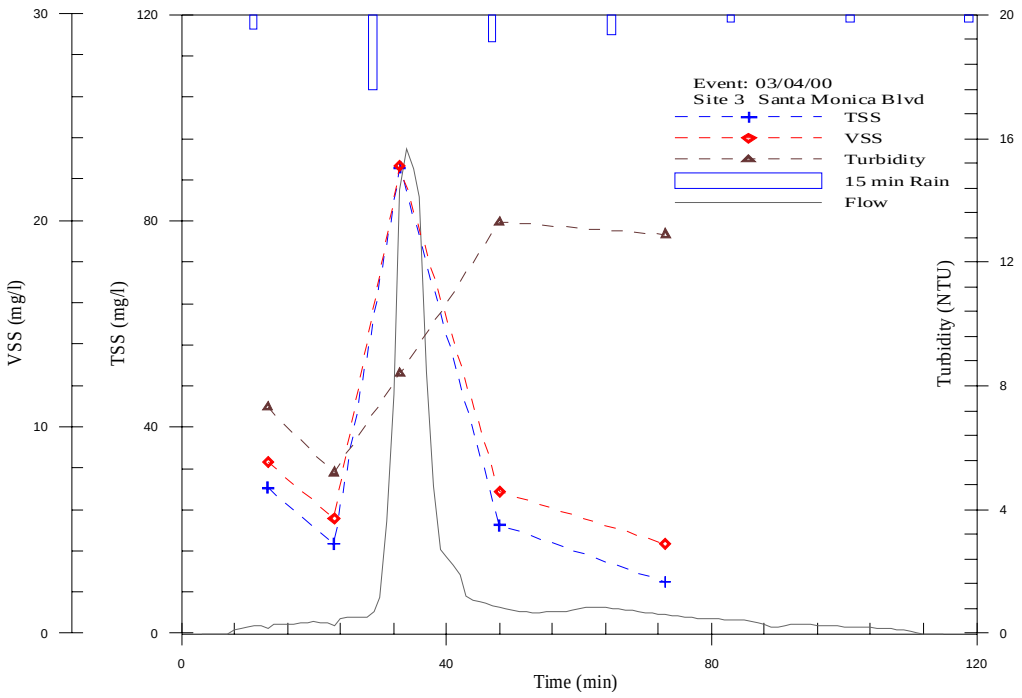


Figure I.1.3.8a (Y1-UCLA3-E10-1.) Polluto-graph for TSS, VSS and Turbidity

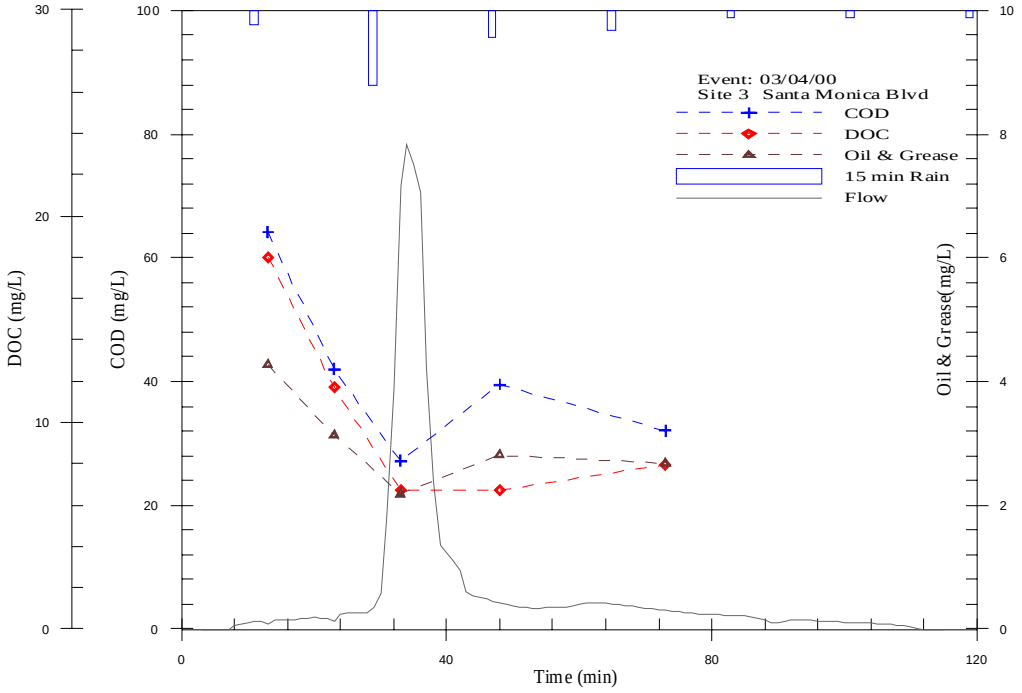


Figure I.1.3.8b (Y1-UCLA3-E10-2.) Polluto-graph for DOC, COD and Oil & Grease

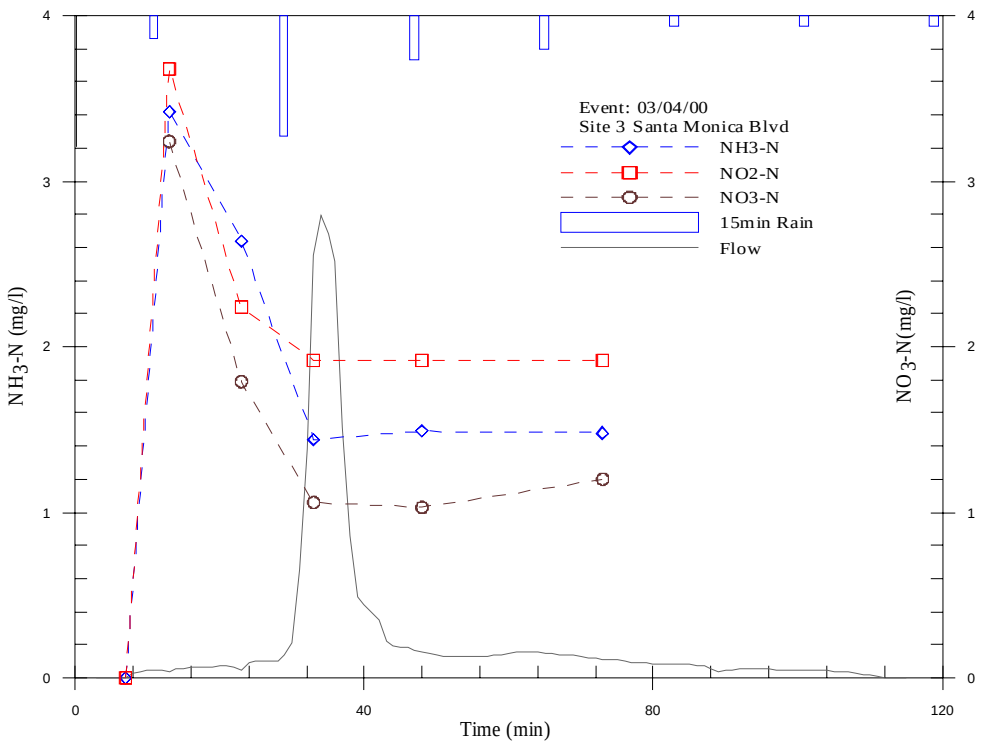


Figure I.1.3.8c (Y1-UCLA3-E10-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

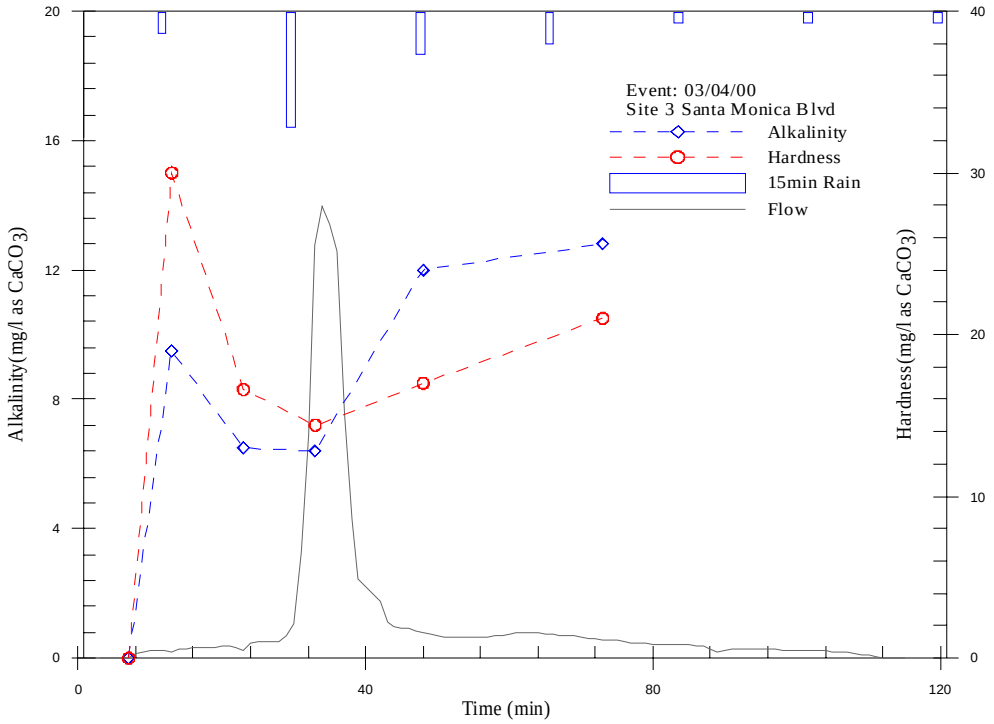


Figure I.1.3.8d (Y1-UCLA3-E10-4.) Polluto-graph for Alkalinity and Hardness

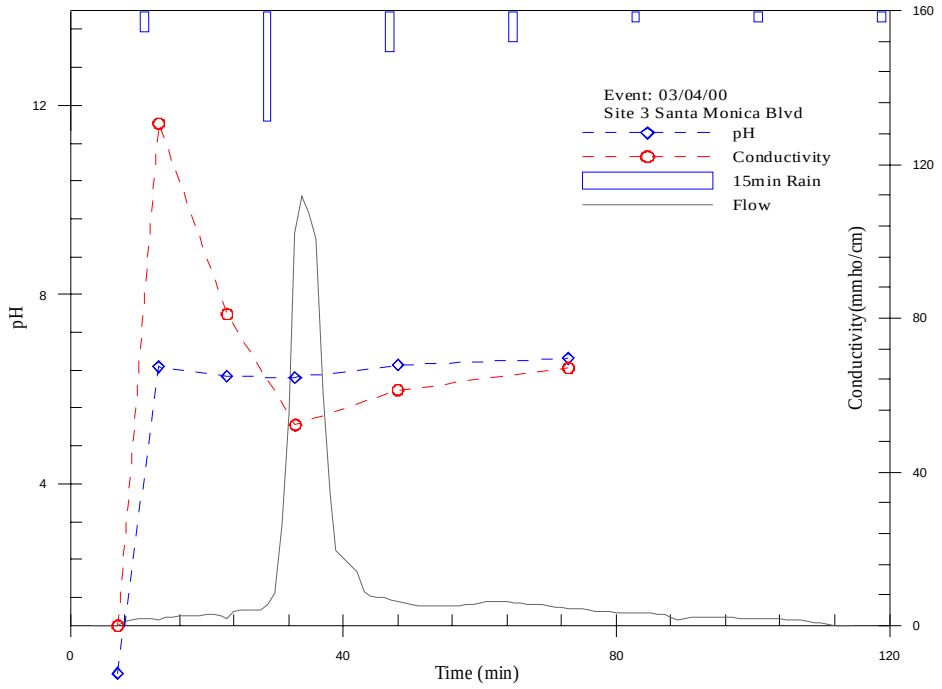


Figure I.1.3.8e (Y1-UCLA3-E10-5.) Polluto-graph for pH and Conductivity

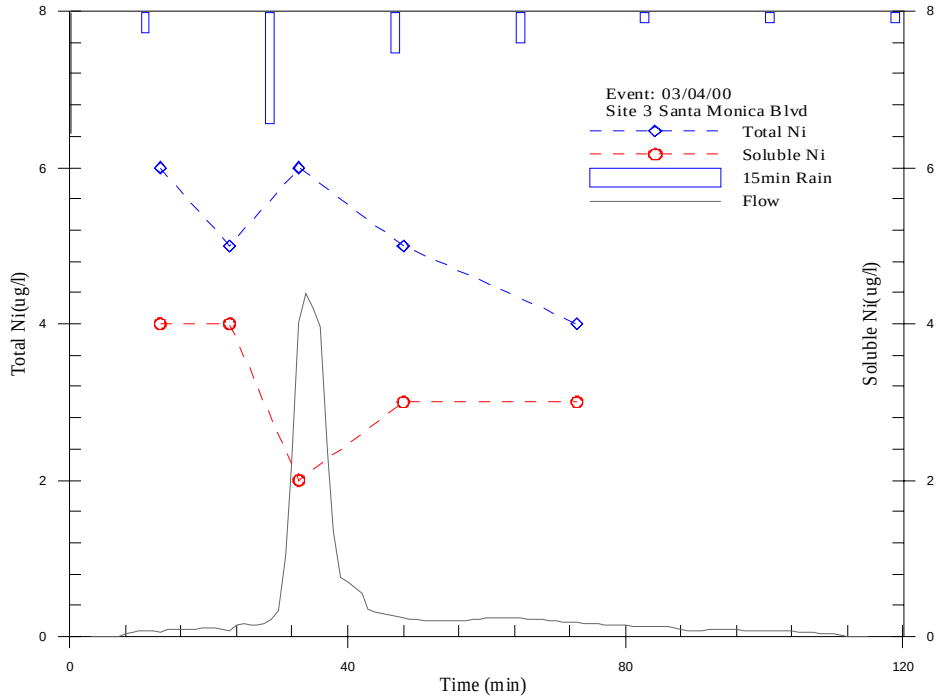


Figure I.1.3.8f (Y1-UCLA3-E10-6.) Polluto-graph for Total Ni / Dissolved Ni

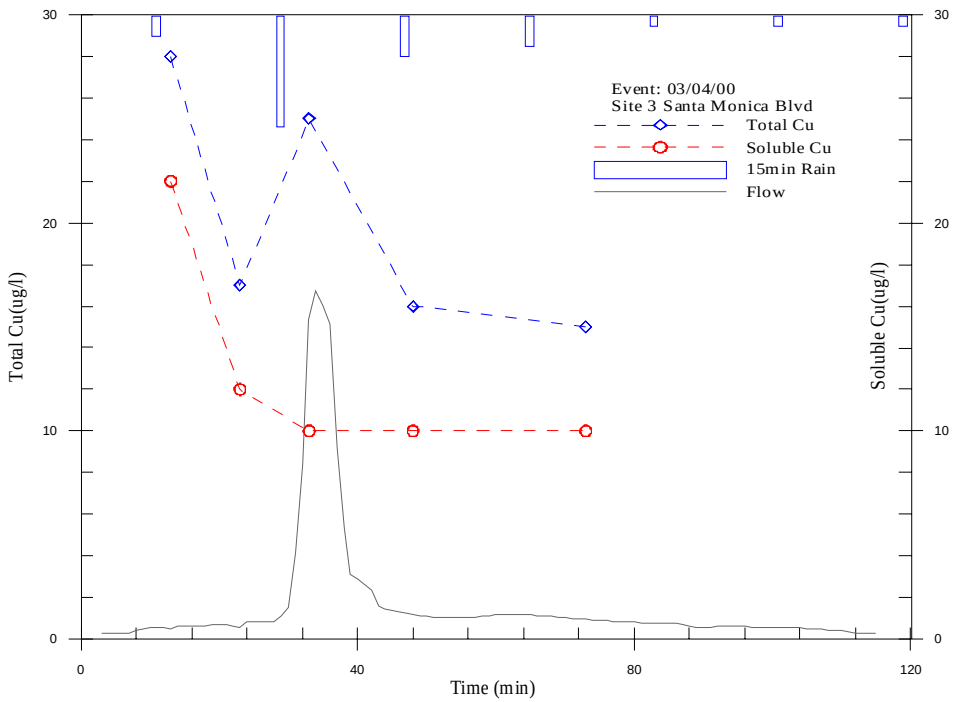


Figure I.1.3.8g (Y1-UCLA3-E10-7.) Polluto-graph for Total Cu / Dissolved Cu

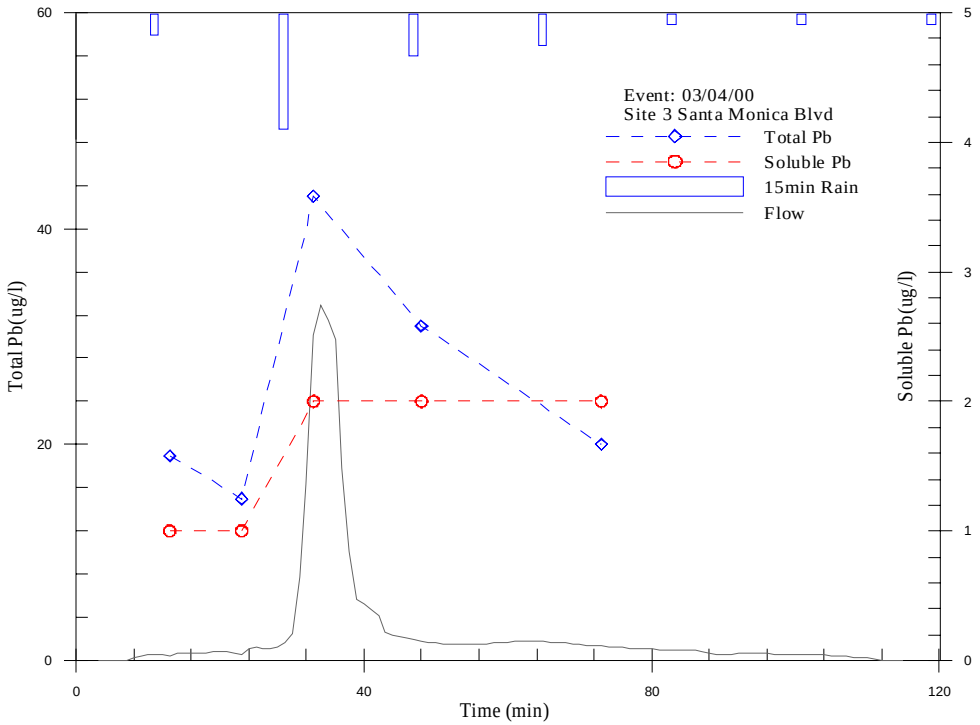


Figure I.1.3.8h (Y1-UCLA3-E10-8.) Polluto-graph for Total Pb / Dissolved Pb

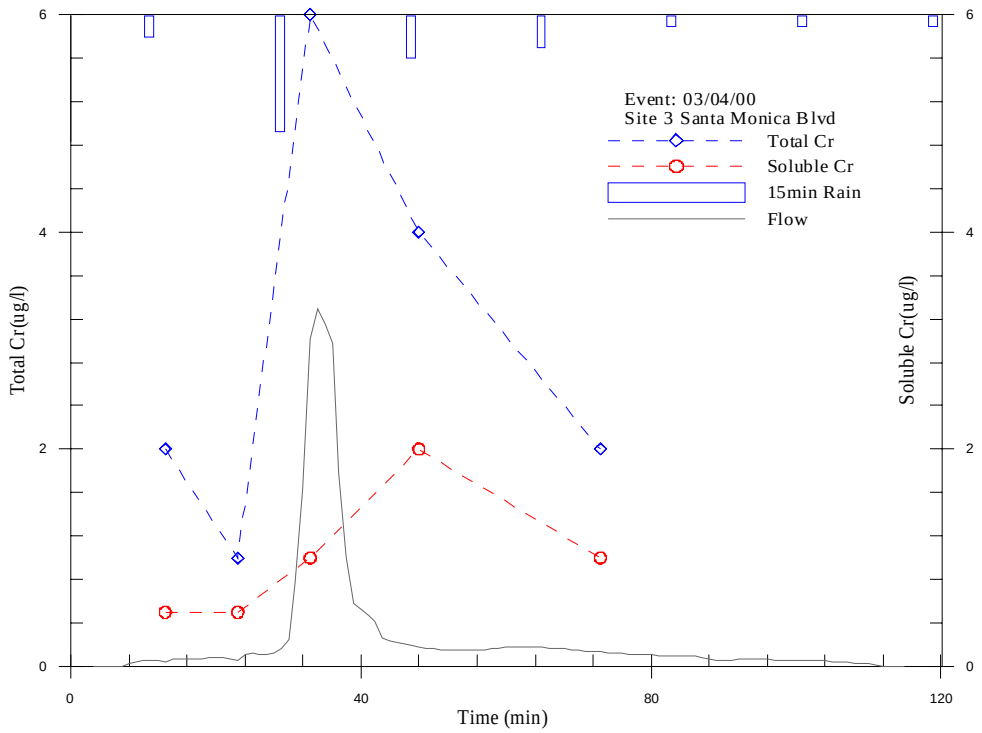


Figure I.1.3.8i (Y1-UCLA3-E10-9.) Polluto-graph for Total Cr / Dissolved Cr

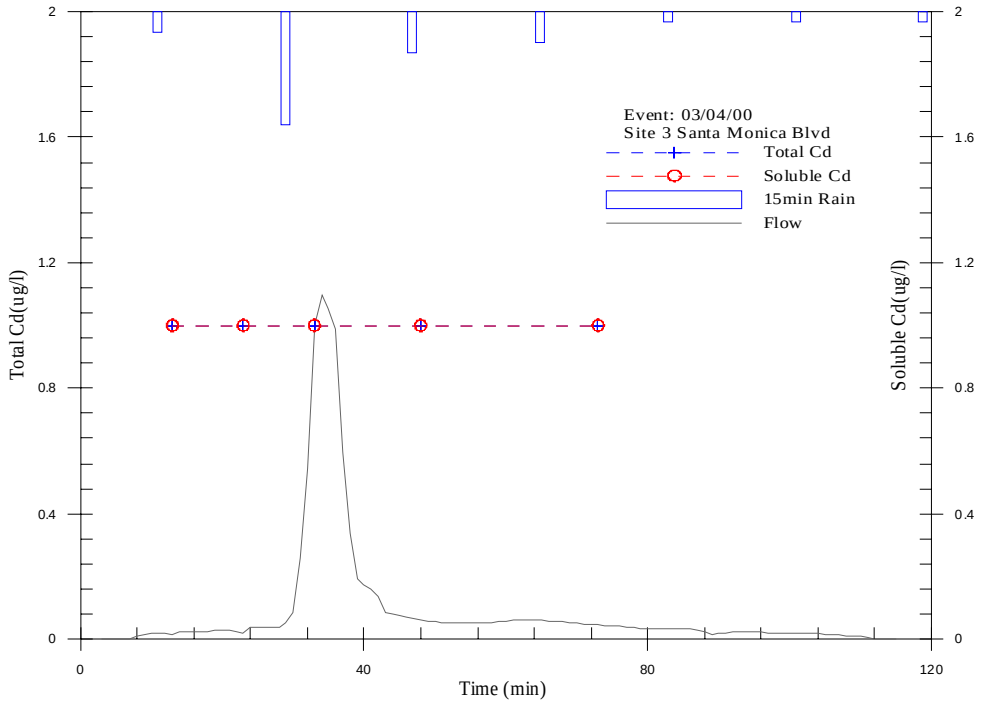


Figure I.1.3.8j (Y1-UCLA3-E10-10.) Polluto-graph for Total Cd / Dissolved Cd

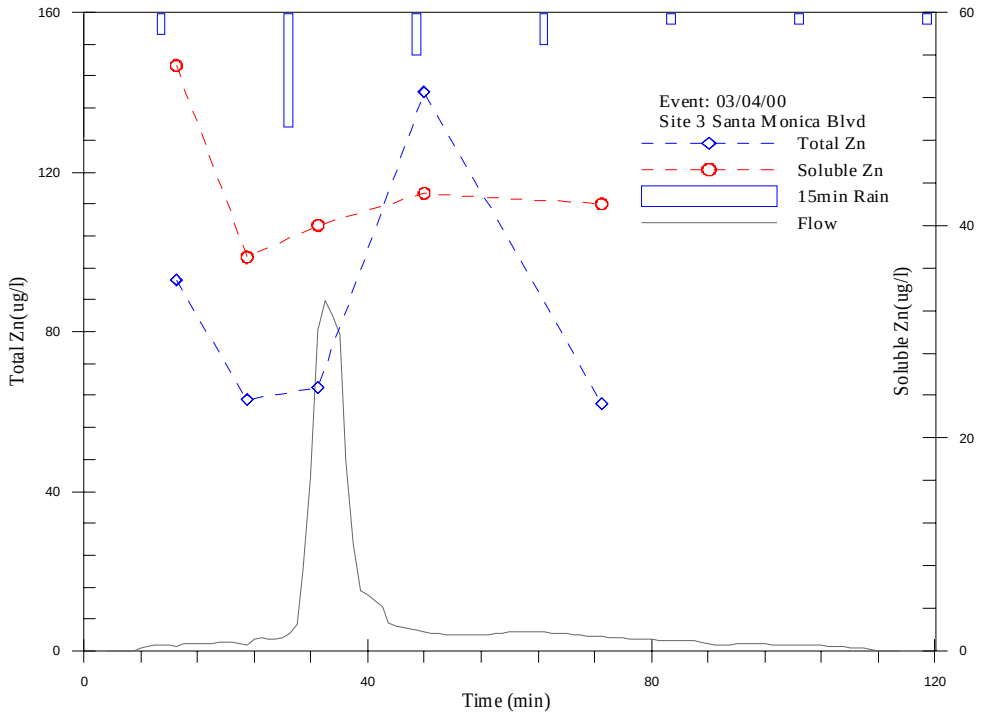


Figure I.1.3.8k (Y1-UCLA3-E10-11.) Polluto-graph for Total Zn / Dissolved Zn

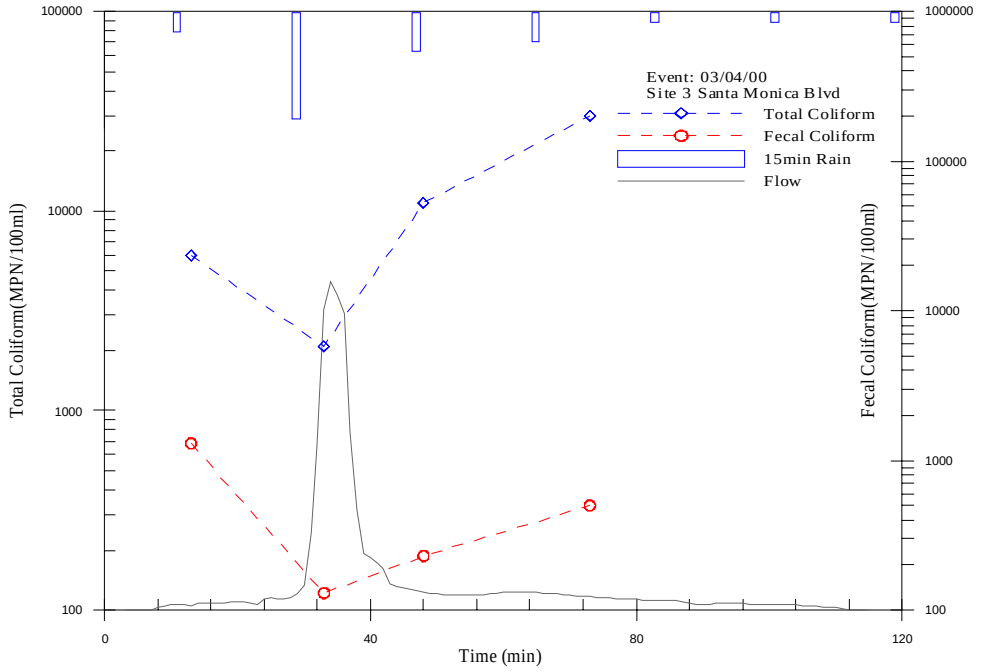


Figure I.1.3.8l (Y1-UCLA3-E10-12.) Polluto-graph for Total Coliform / Fecal Coliform

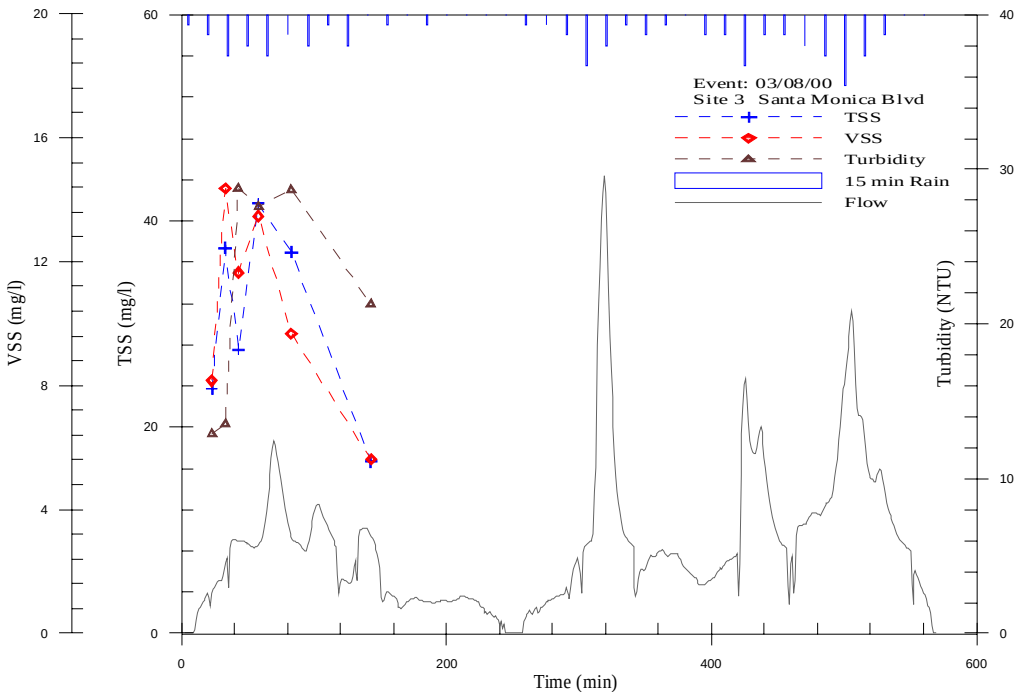


Figure I.1.3.9a (Y1-UCLA3-E11-1.) Polluto-graph for TSS, VSS and Turbidity

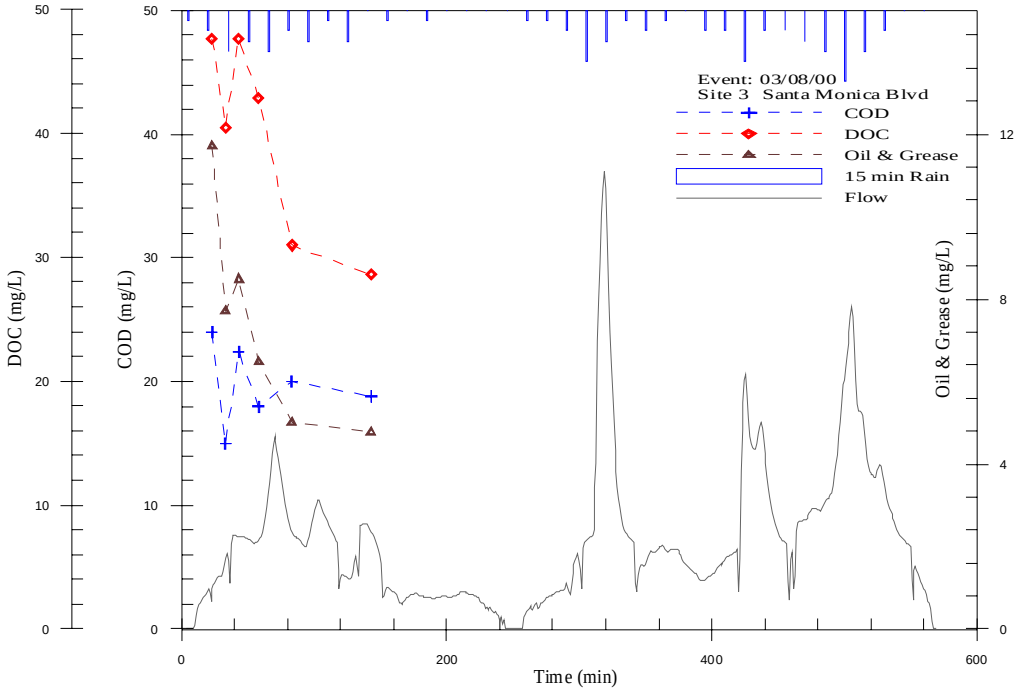


Figure I.1.3.9b (Y1-UCLA3-E11-2.) Polluto-graph for DOC, COD and Oil & Grease

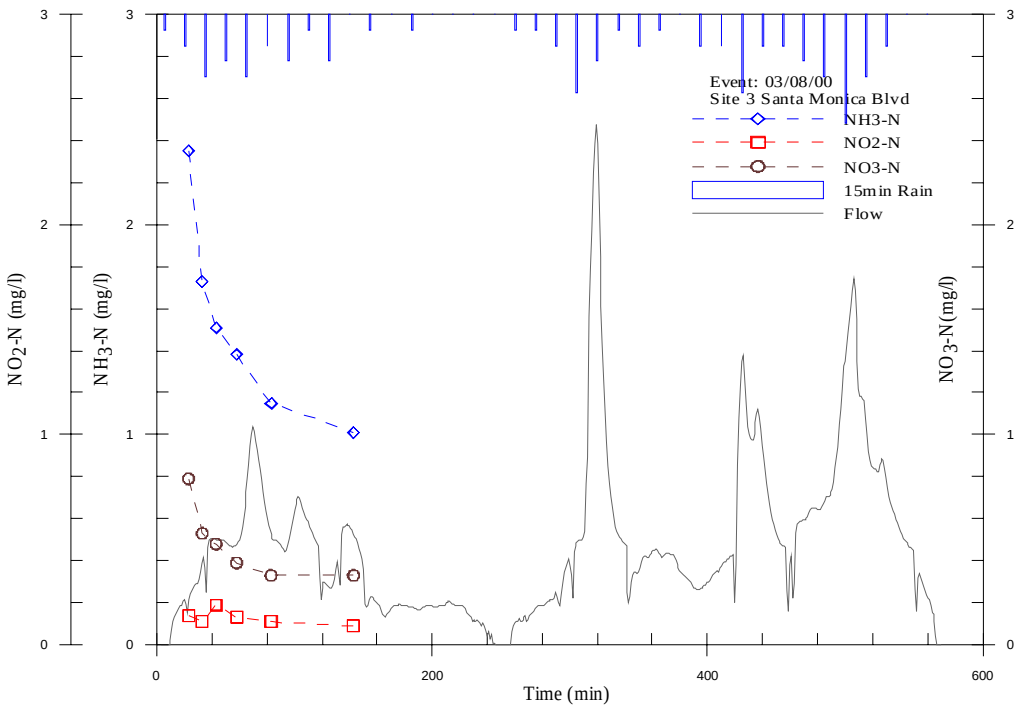


Figure I.1.3.9c (Y1-UCLA3-E11-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

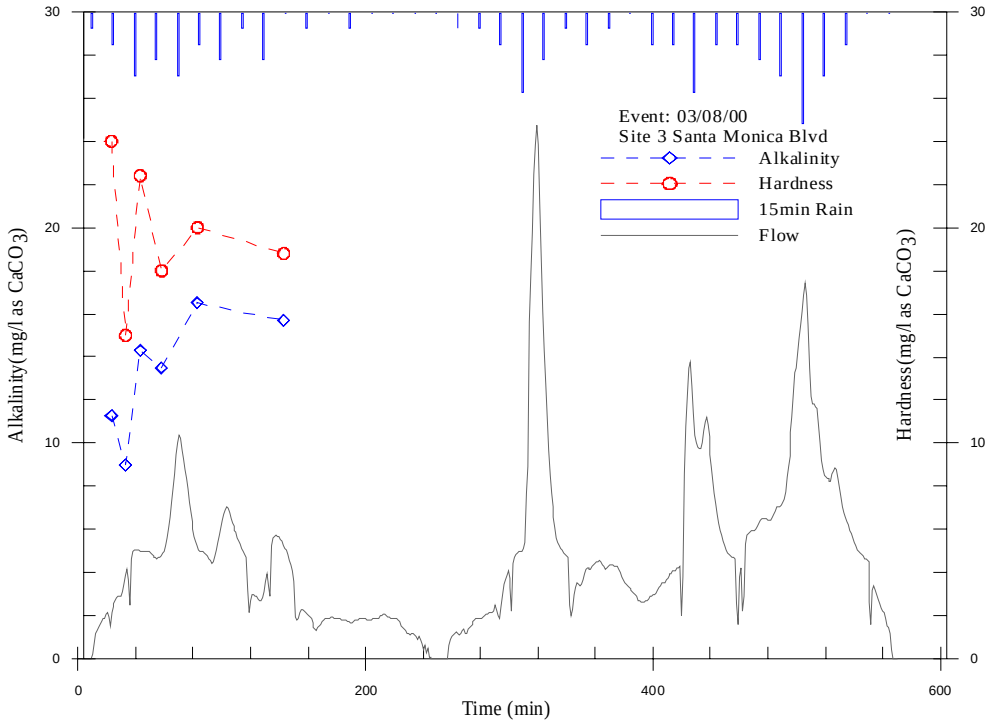


Figure I.1.3.9d (Y1-UCLA3-E11-4.) Polluto-graph for Alkalinity and Hardness

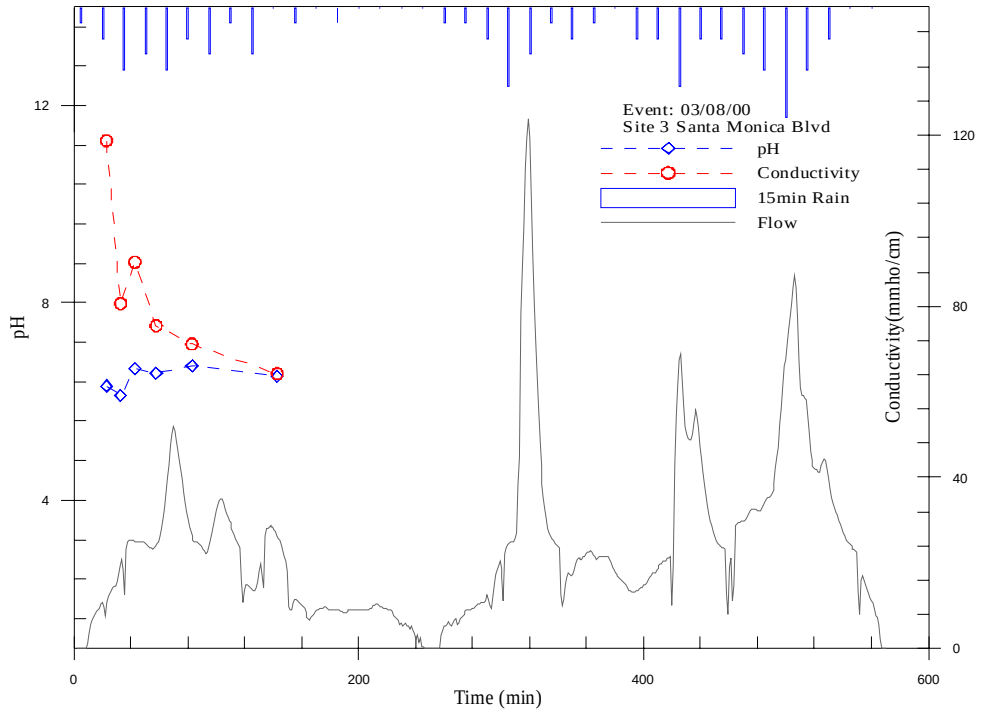


Figure I.1.3.9e (Y1-UCLA3-E11-5.) Polluto-graph for pH and Conductivity

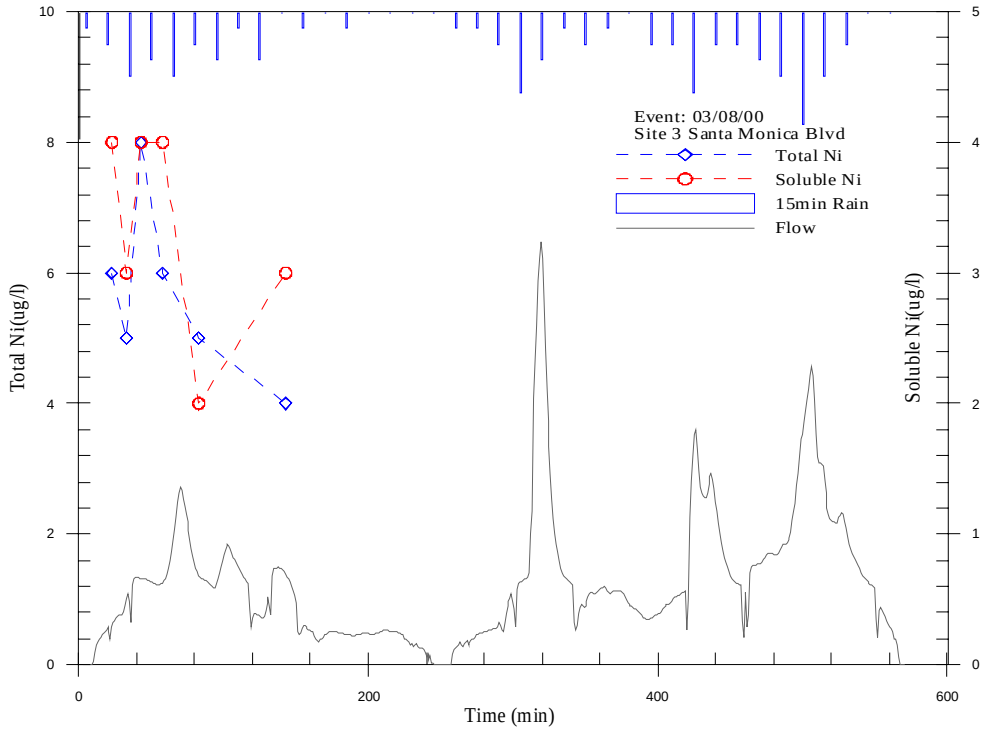


Figure I.1.3.9f (Y1-UCLA3-E11-6.) Polluto-graph for Total Ni / Dissolved Ni

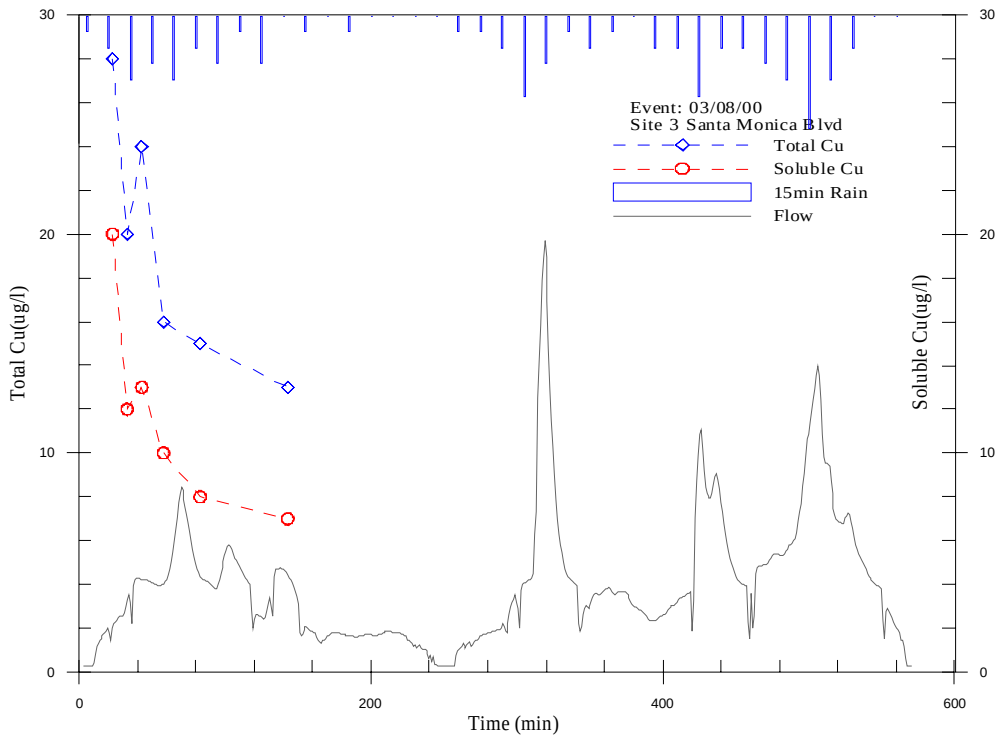


Figure I.1.3.9g (Y1-UCLA3-E11-7.) Polluto-graph for Total Cu / Dissolved Cu

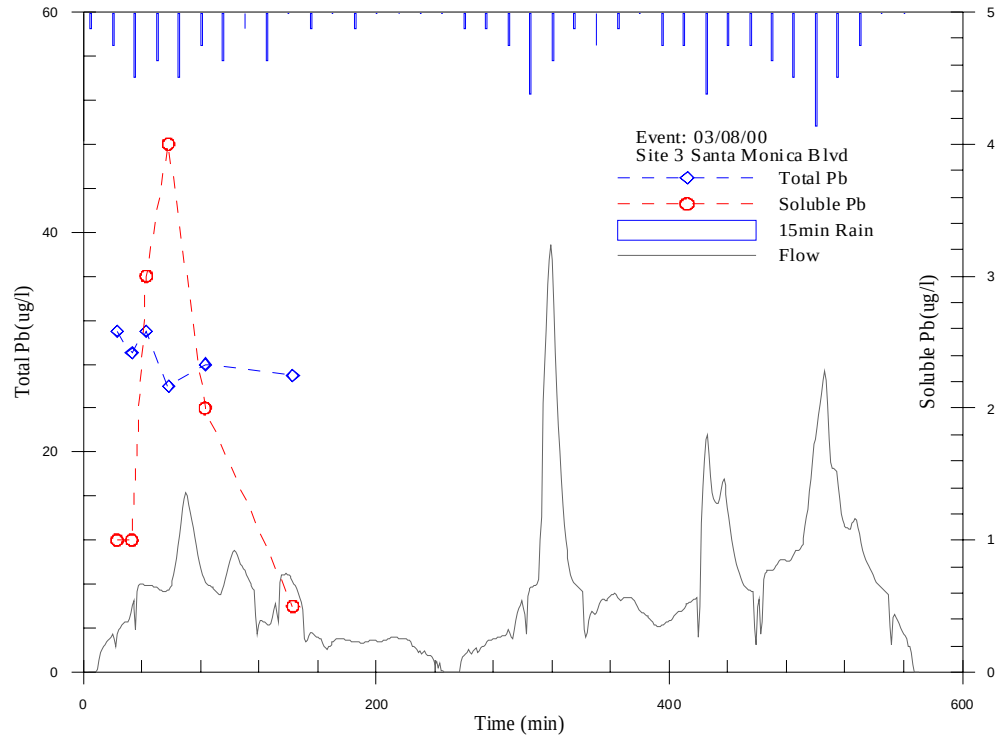


Figure I.1.3.9h (Y1-UCLA3-E11-8.) Polluto-graph for Total Pb / Dissolved Pb

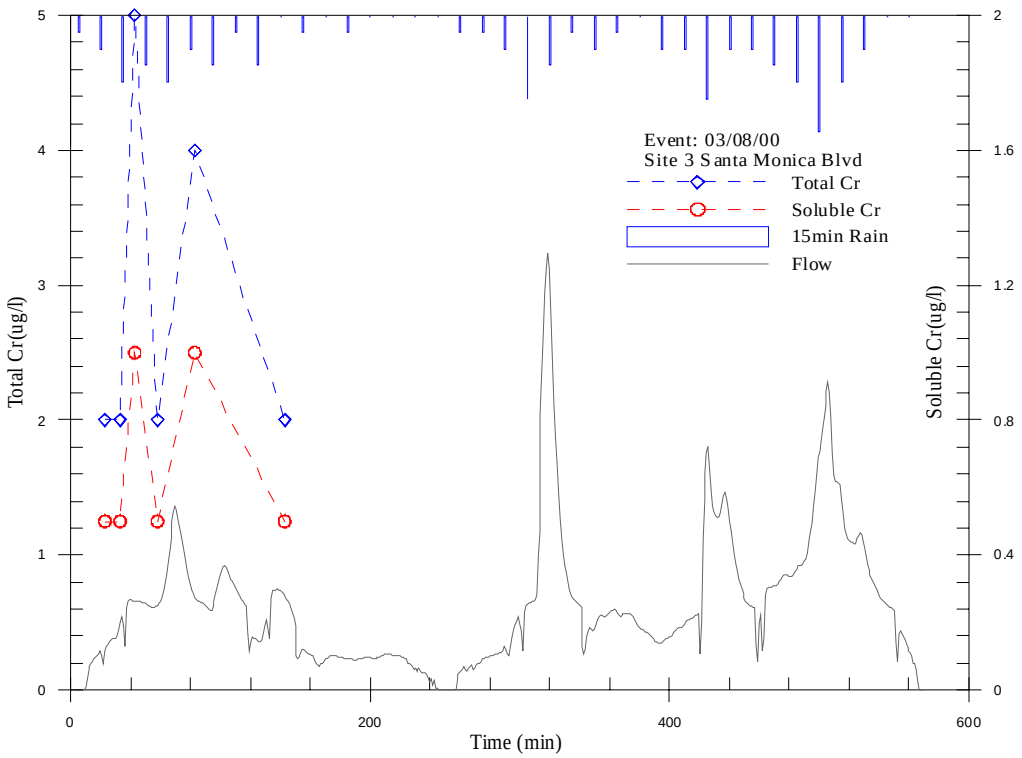


Figure I.1.3.9i (Y1-UCLA3-E11-9.) Polluto-graph for Total Cr / Dissolved Cr

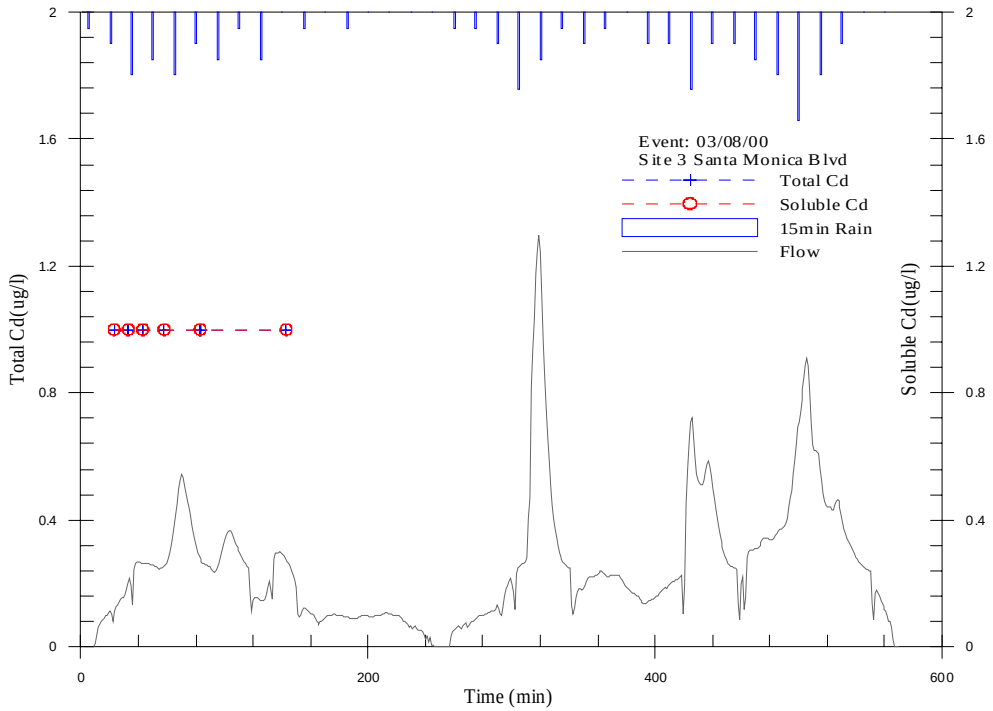


Figure I.1.3.9j (Y1-UCLA3-E11-10.) Polluto-graph for Total Cd / Dissolved Cd

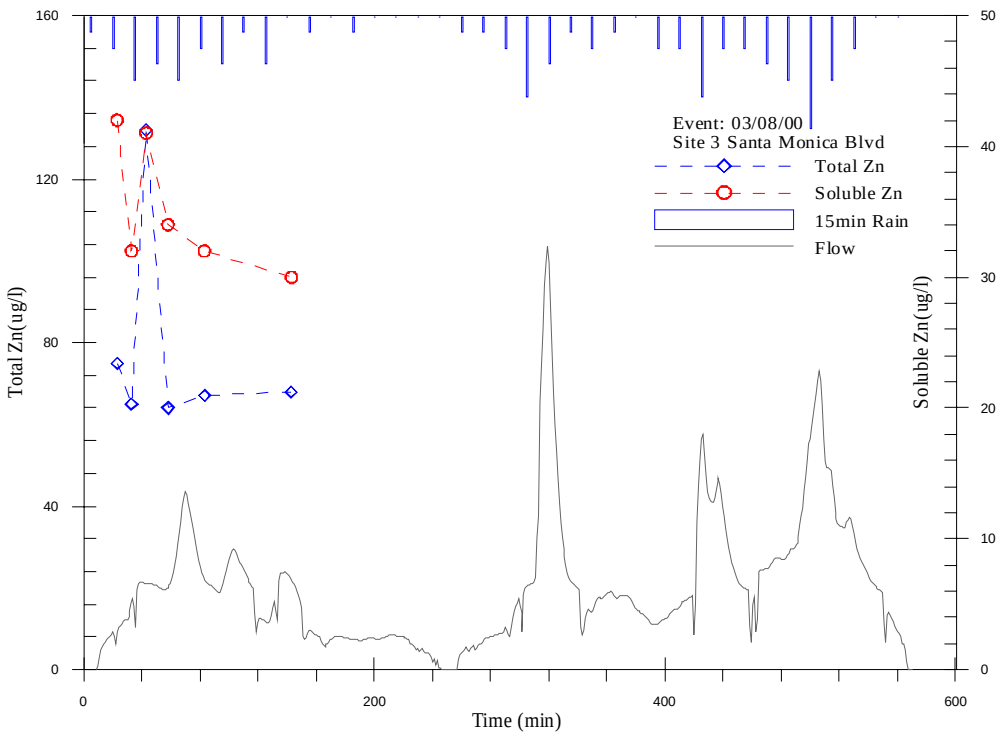


Figure I.1.3.9k (Y1-UCLA3-E11-11.) Polluto-graph for Total Zn / Dissolved Zn

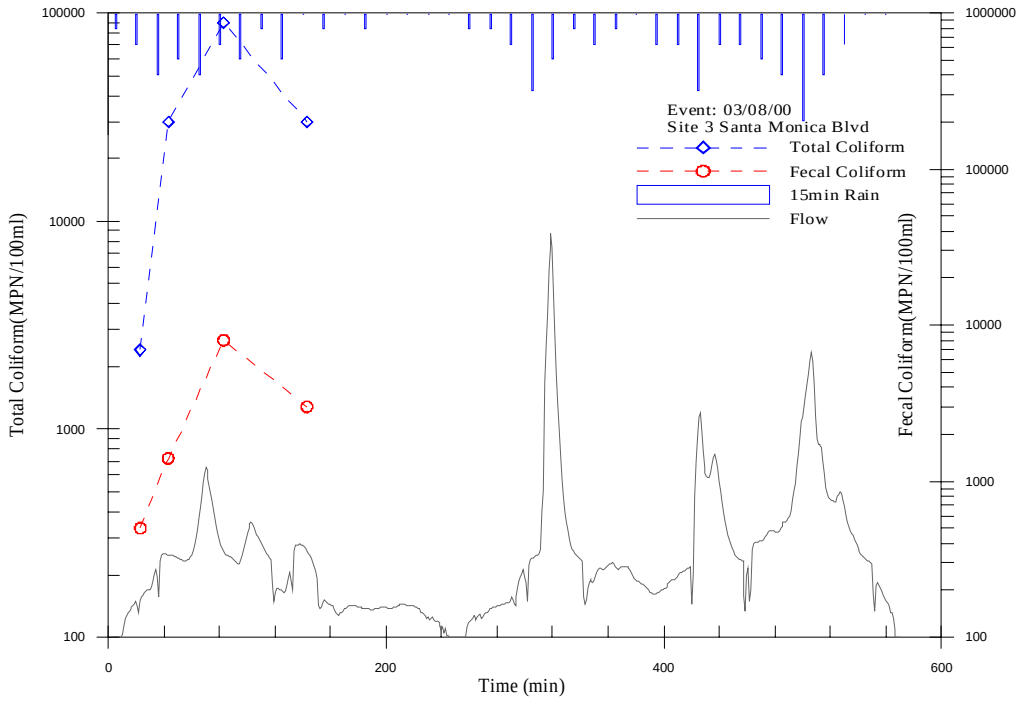


Figure I.1.3.9l (Y1-UCLA3-E11-12.) Polluto-graph for Total Coliform / Fecal Coliform

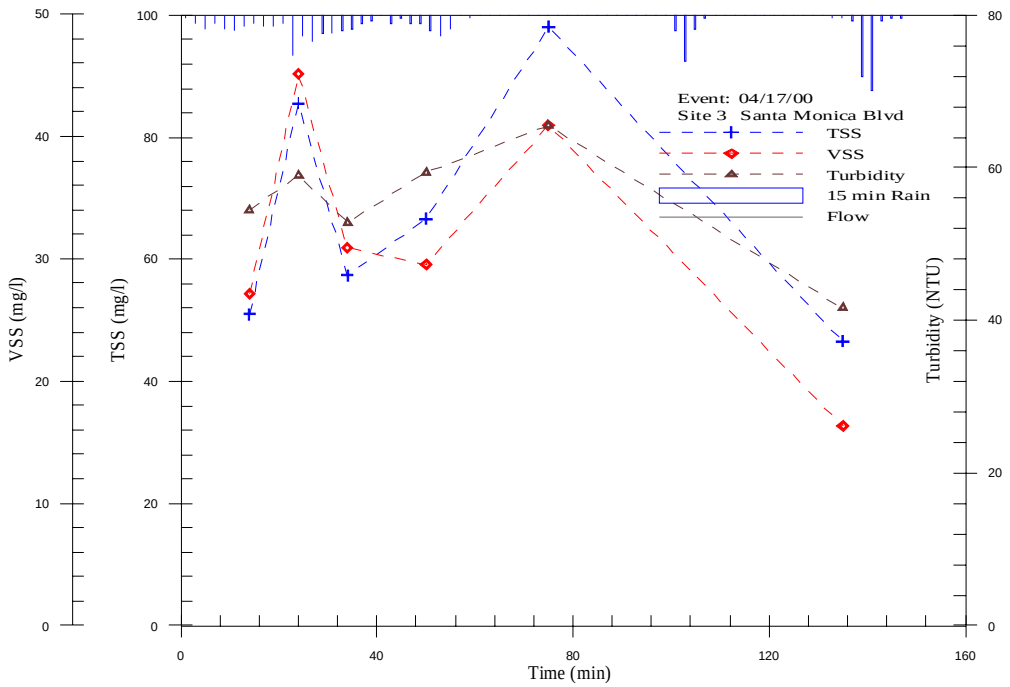


Figure I.1.3.10a (Y1-UCLA3-E12-1.) Polluto-graph for TSS, VSS and Turbidity

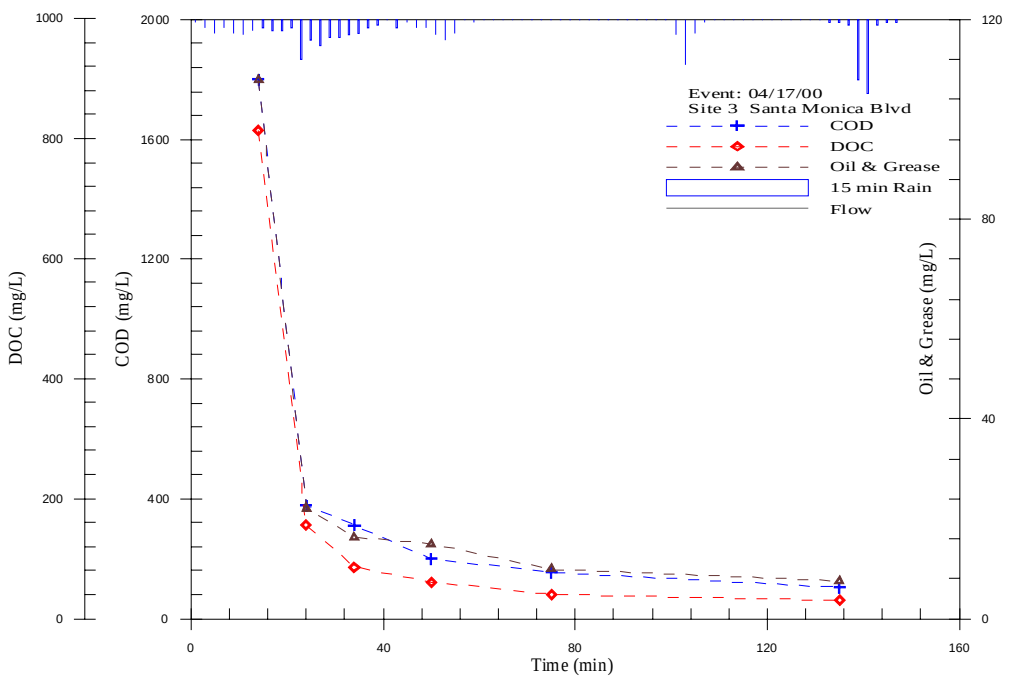


Figure I.1.3.10b (Y1-UCLA3-E12-2.) Polluto-graph for DOC, COD and Oil & Grease

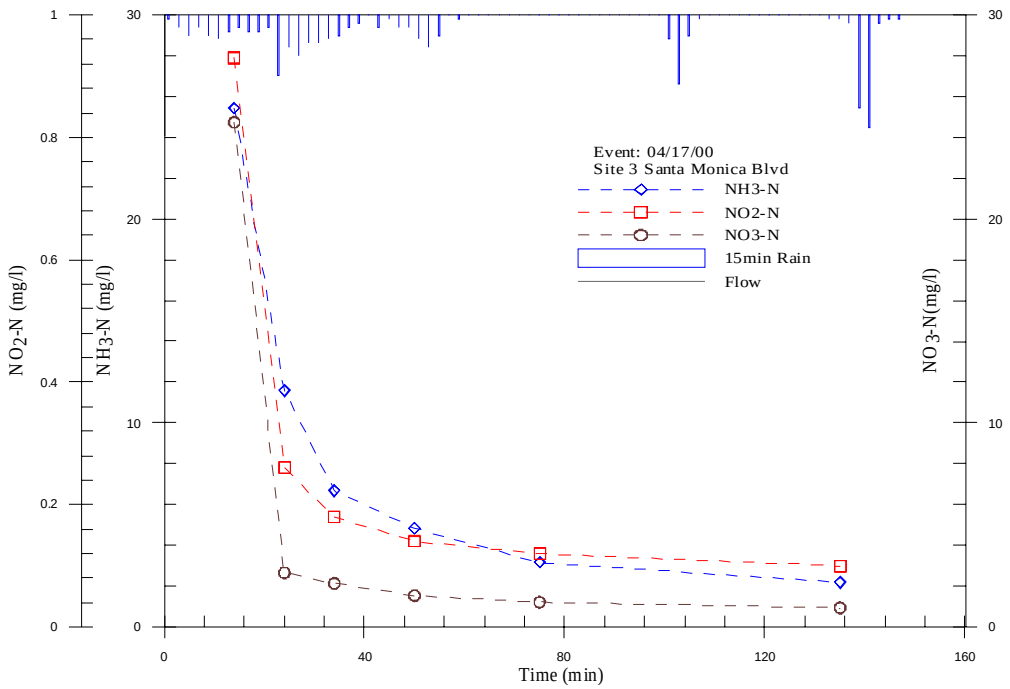


Figure I.1.3.10c (Y1-UCLA3-E12-3.) Polluto-graph for NH_3-N, NO_2-N and NO_3-N

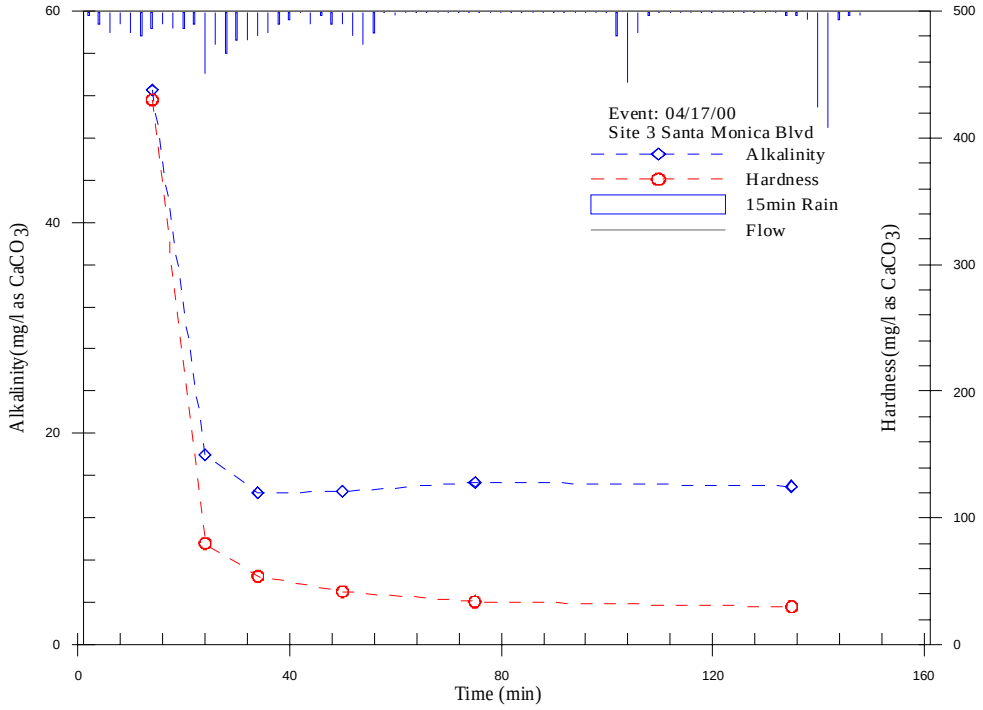


Figure I.1.3.10d (Y1-UCLA3-E12-4.) Polluto-graph for Alkalinity and Hardness

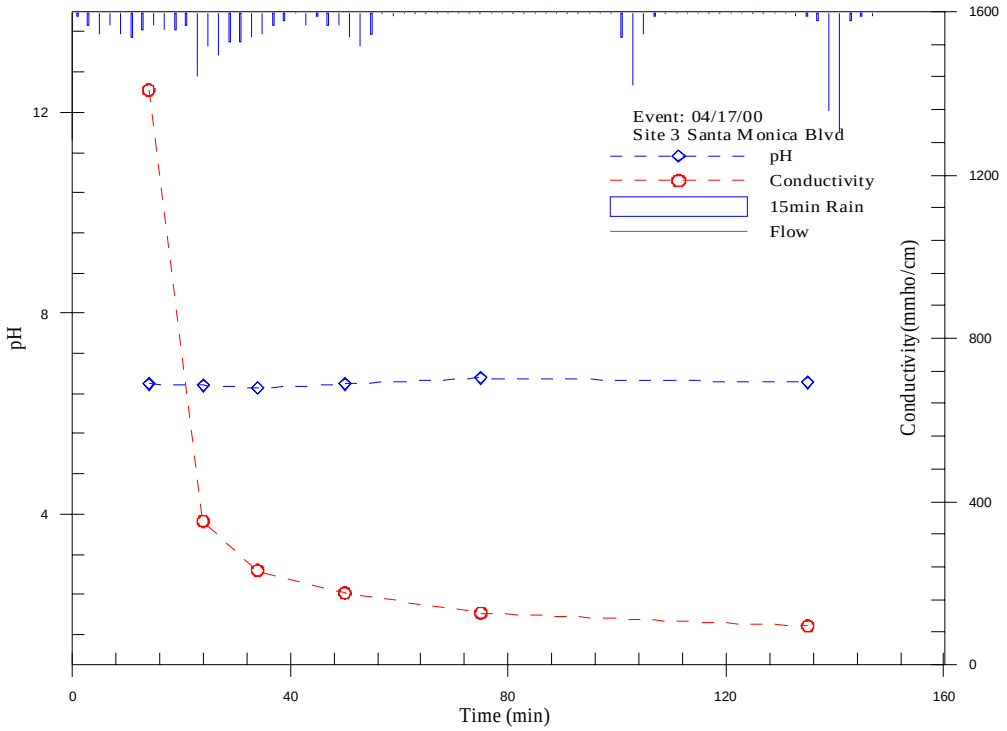


Figure I.1.3.10e (Y1-UCLA3-E12-5.) Polluto-graph for pH and Conductivity

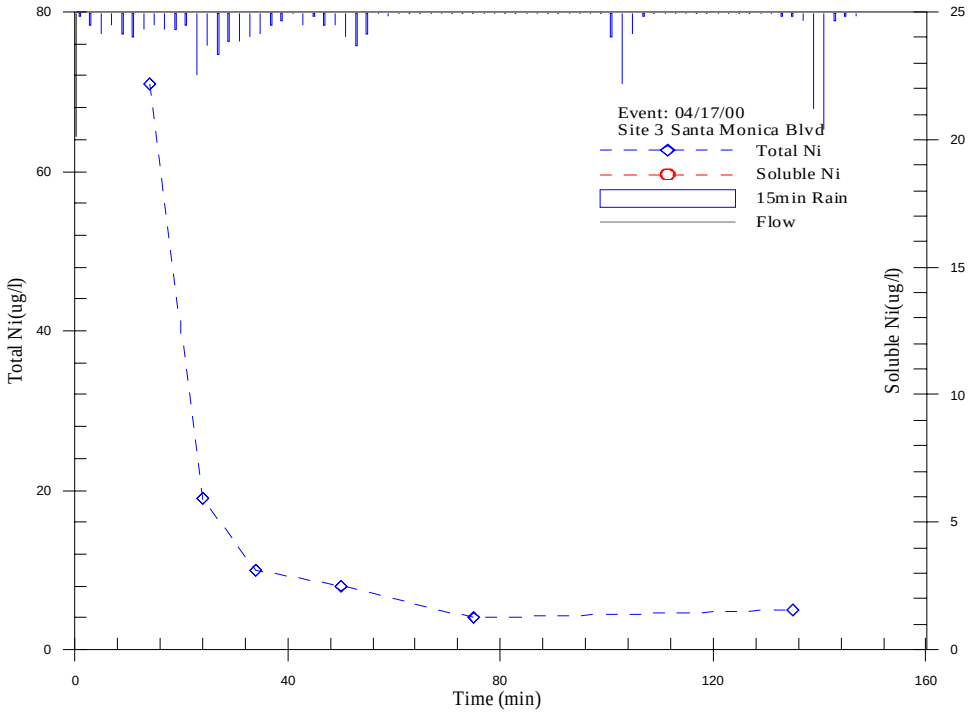


Figure I.1.3.10f (Y1-UCLA3-E12-6.) Polluto-graph for Total Ni / Dissolved Ni

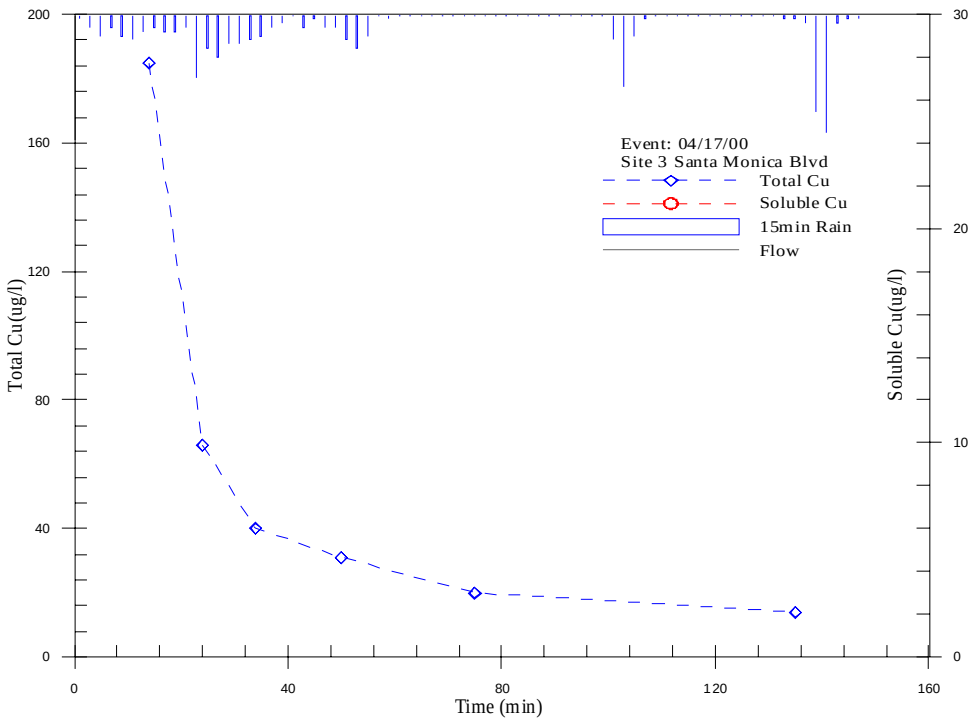


Figure I.1.3.10g (Y1-UCLA3-E12-7.) Polluto-graph for Total Cu / Dissolved Cu

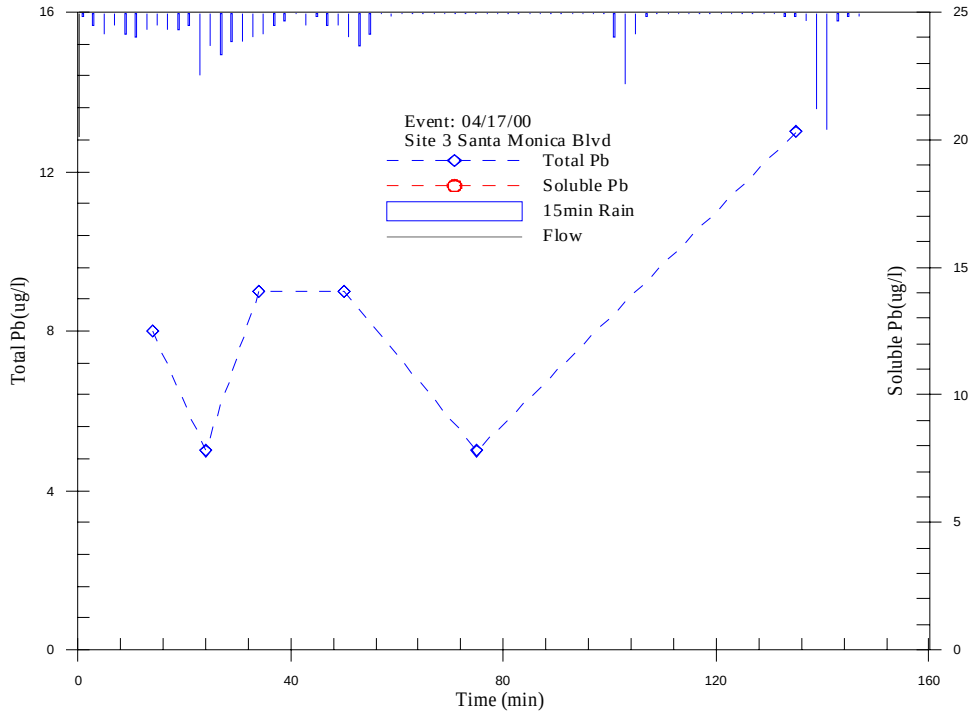


Figure I.1.3.10h (Y1-UCLA3-E12-8.) Polluto-graph for Total Pb / Dissolved Pb

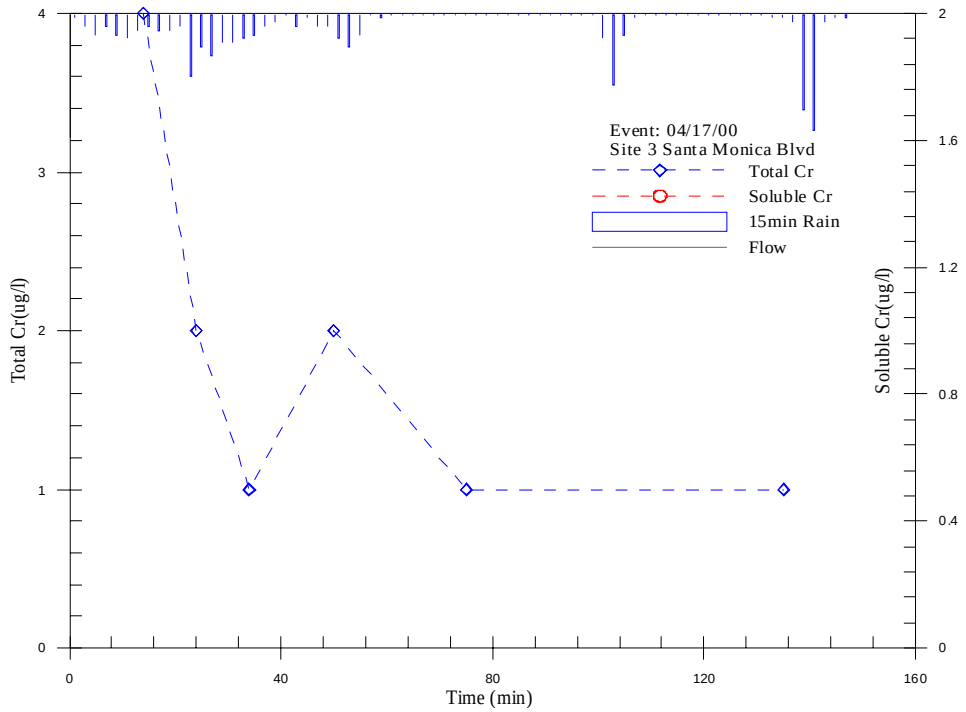


Figure I.1.3.10i (Y1-UCLA3-E12-9.) Polluto-graph for Total Cr / Dissolved Cr

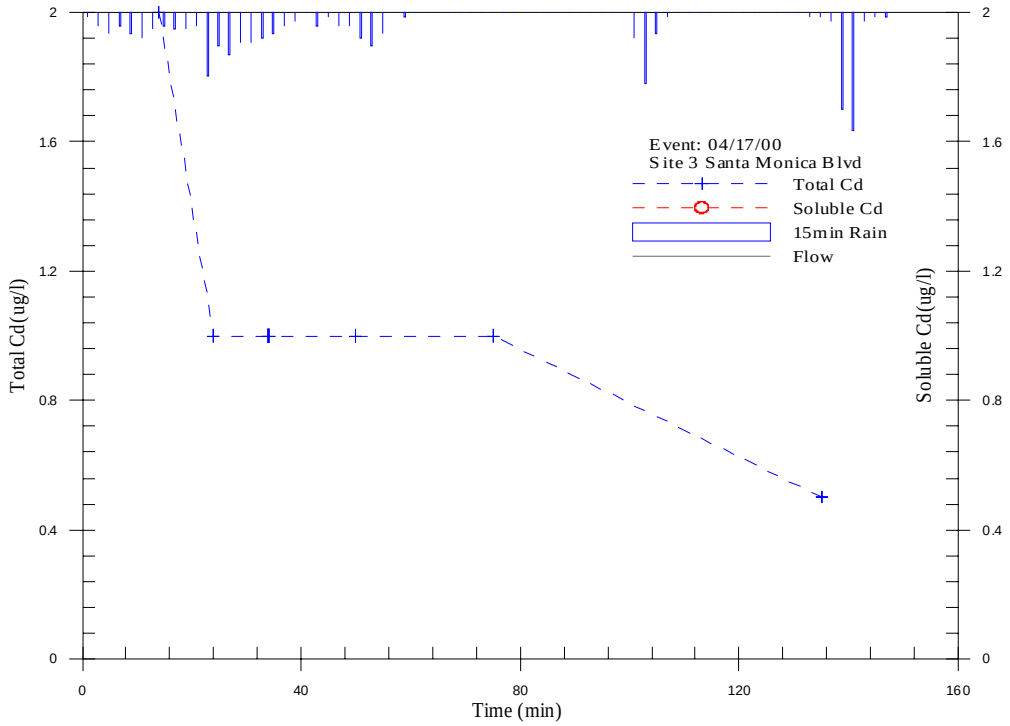


Figure I.1.3.10j (Y1-UCLA3-E12-10.) Polluto-graph for Total Cd / Dissolved Cd

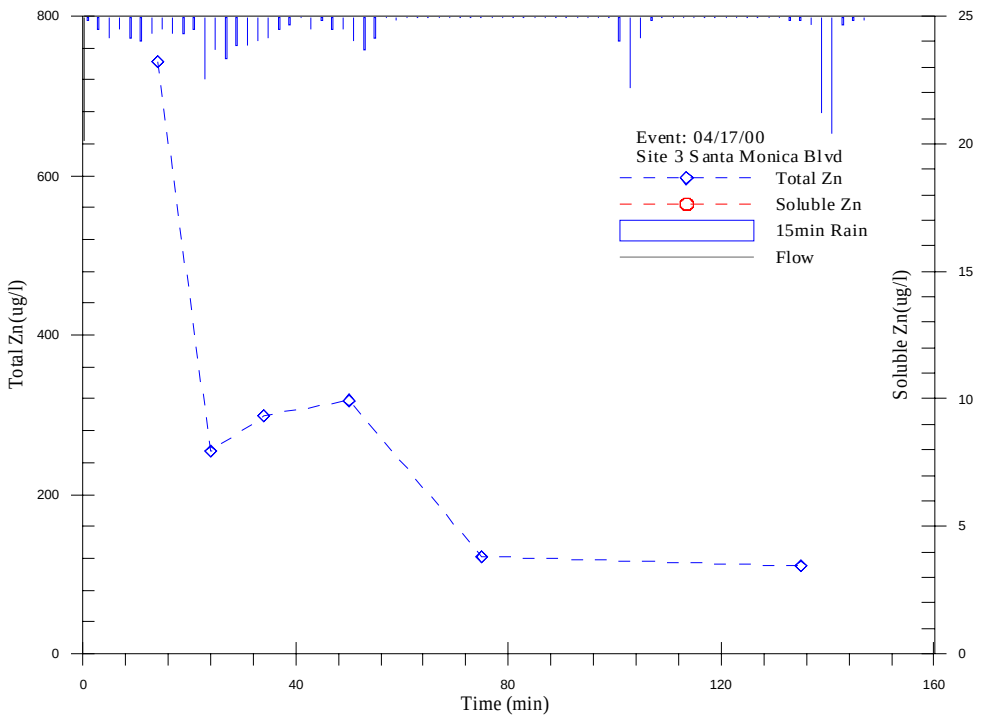


Figure I.1.3.10k (Y1-UCLA3-E12-11.) Polluto-graph for Total Zn / Dissolved Zn

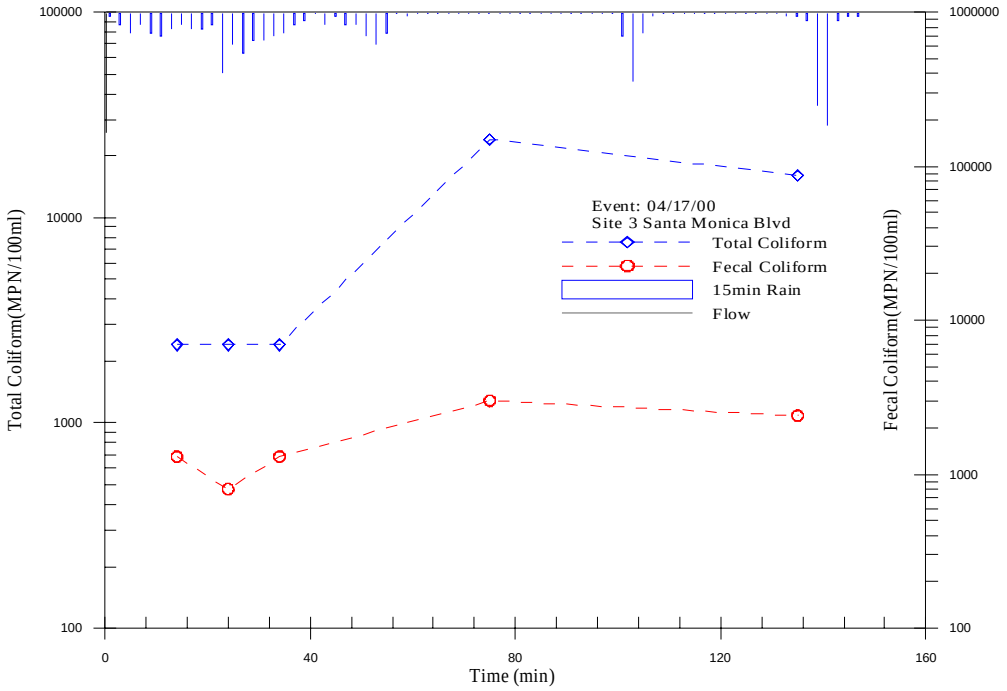


Figure I.1.3.10l (Y1-UCLA3-E12-12.) Polluto-graph for Total Coliform / Fecal Coliform

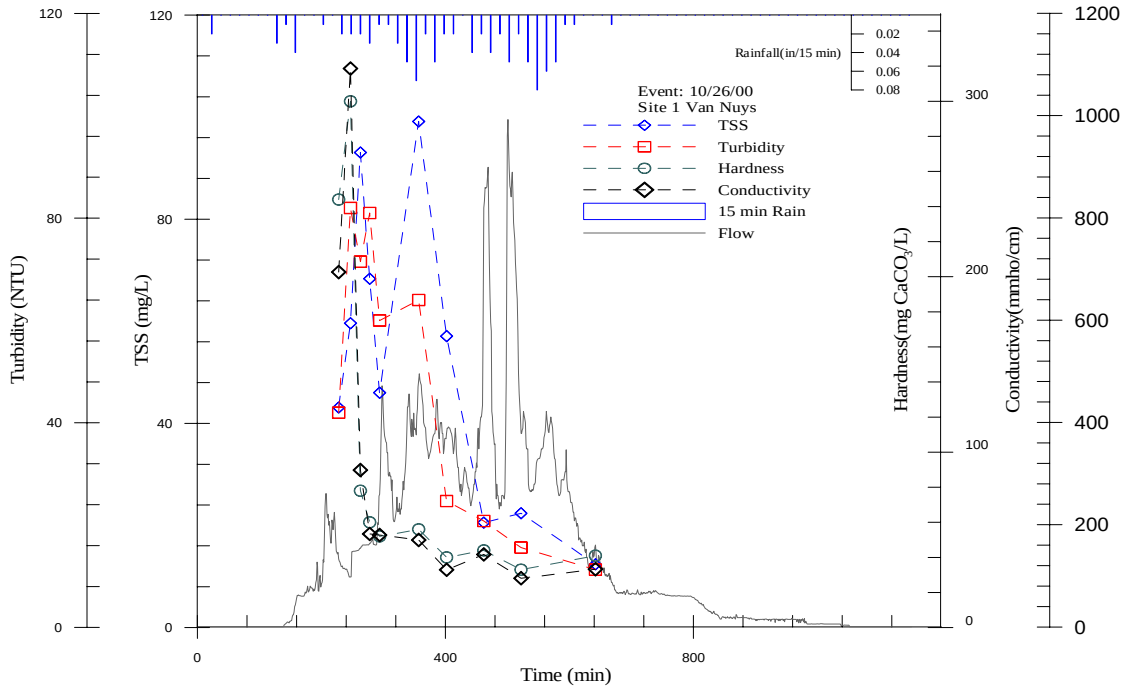


Figure I.2.1.1a (Y2-UCLA1-E1-1) Polluto-graphs for TSS, Turbidity, Hardness and Conductivity

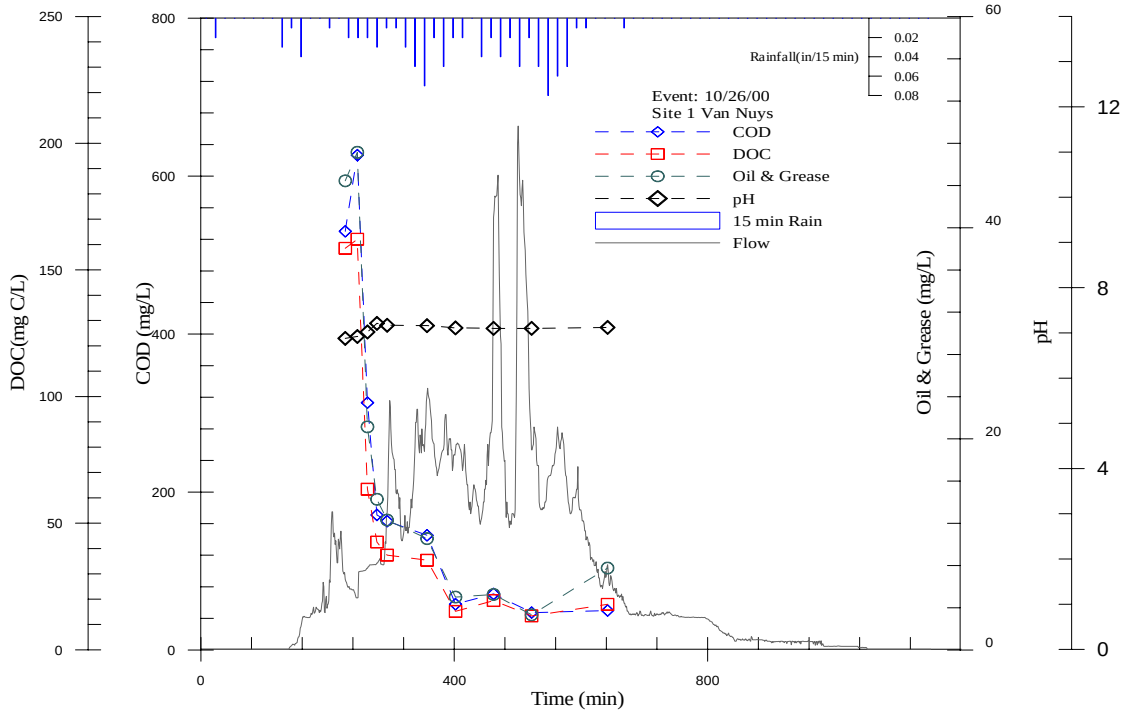


Figure I.2.1.1b (Y2-UCLA1-E1-2) Polluto-graph for COD, DOC, Oil & Grease and pH

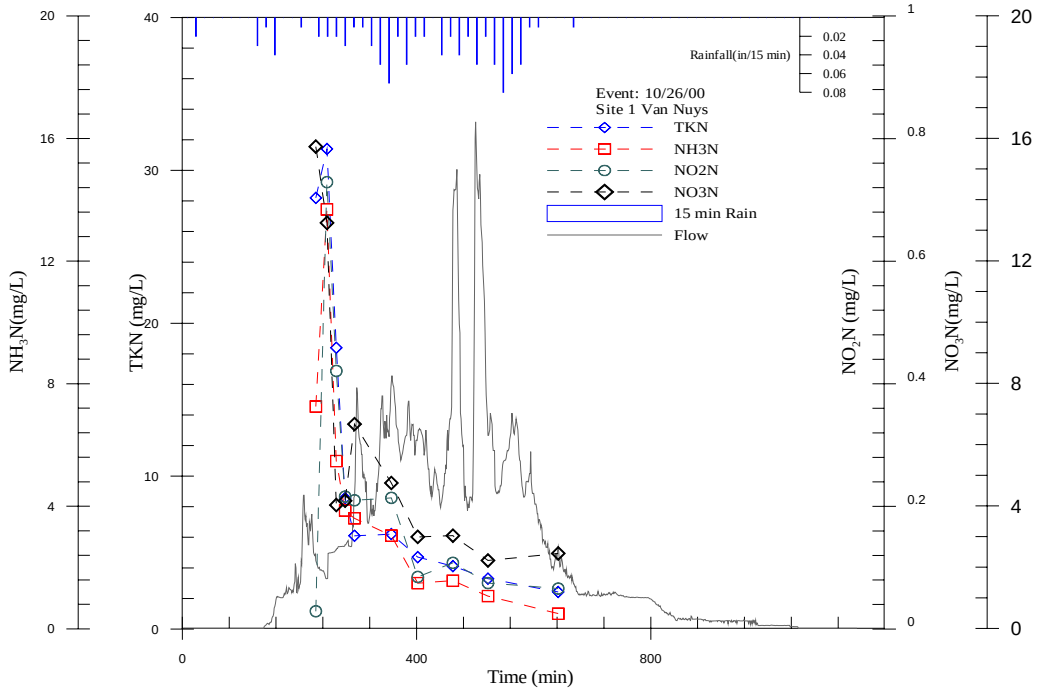


Figure I.2.1.1c (Y2-UCLA1-E1-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

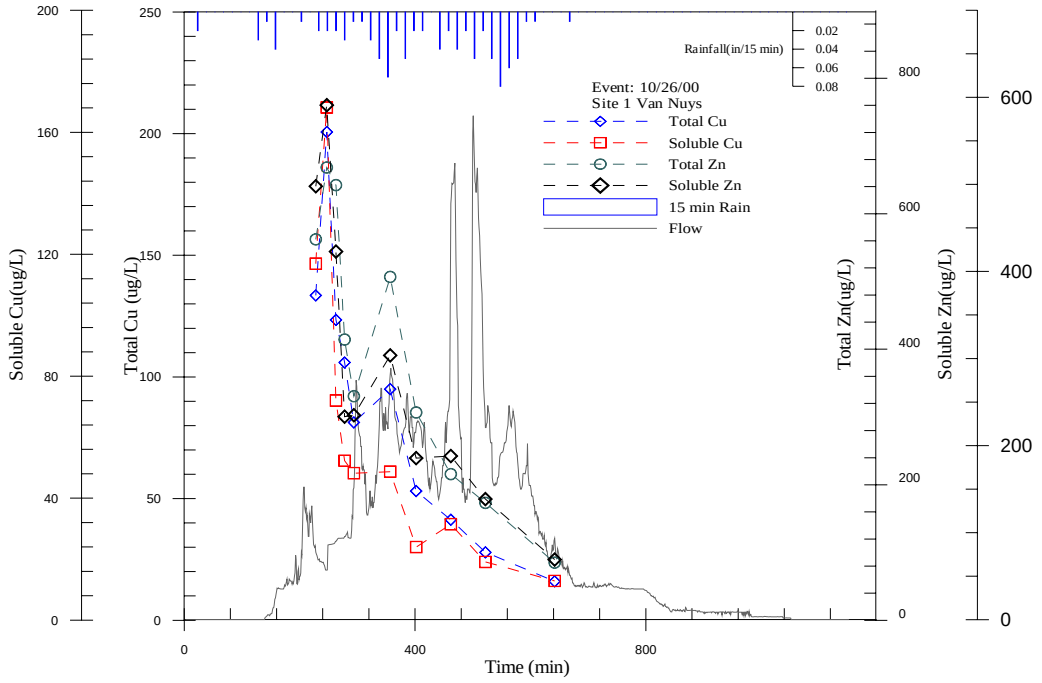


Figure I.2.1.1d (Y2-UCLA1-E1-4) Polluto-graph for Total/Soluble Cu and Zn

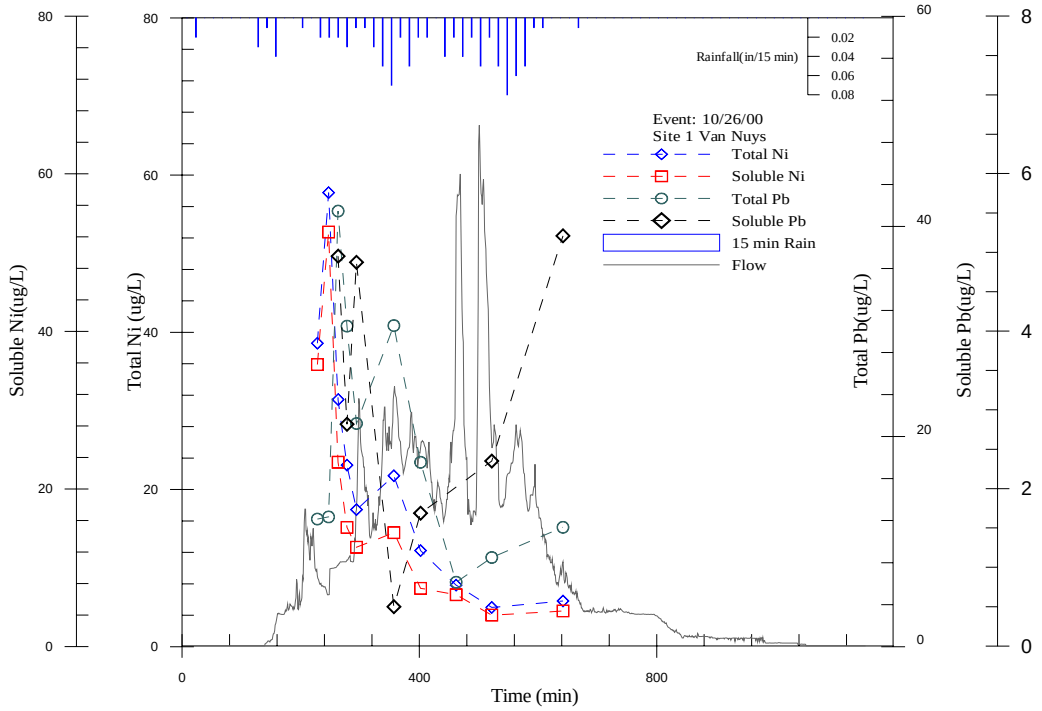


Figure I.2.1.1e (Y2-UCLA1-E1-5) Polluto-graph for Total/Soluble Ni and Pb

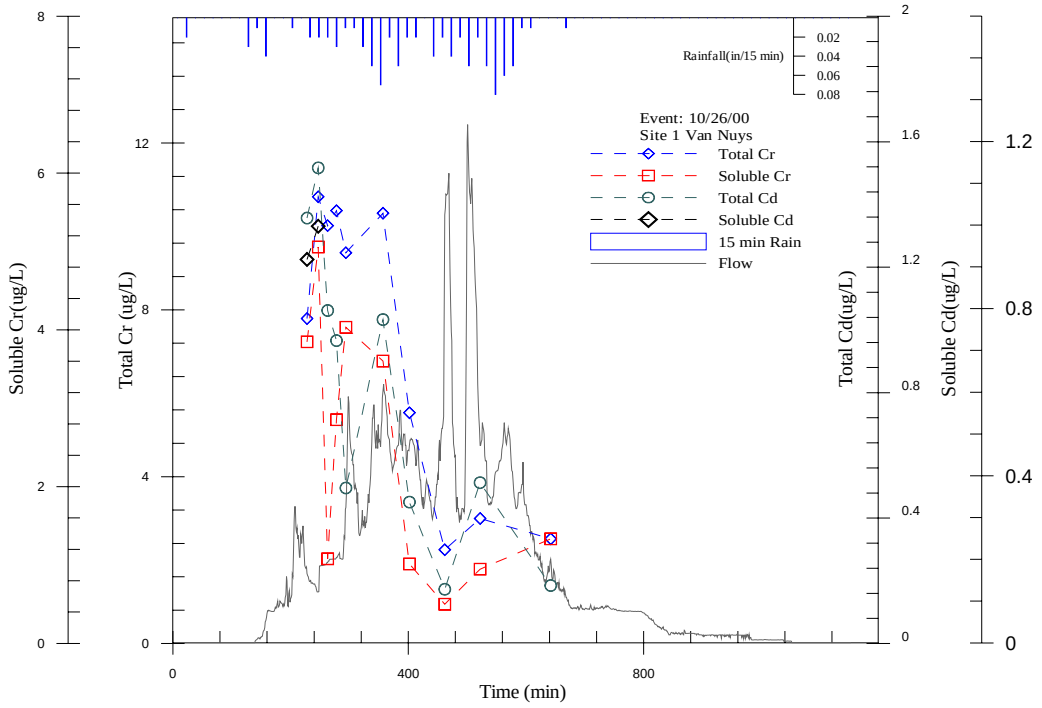


Figure I.2.1.1f (Y2-UCLA1-E1-6) Polluto-graph for Total/Soluble Cr and Cd

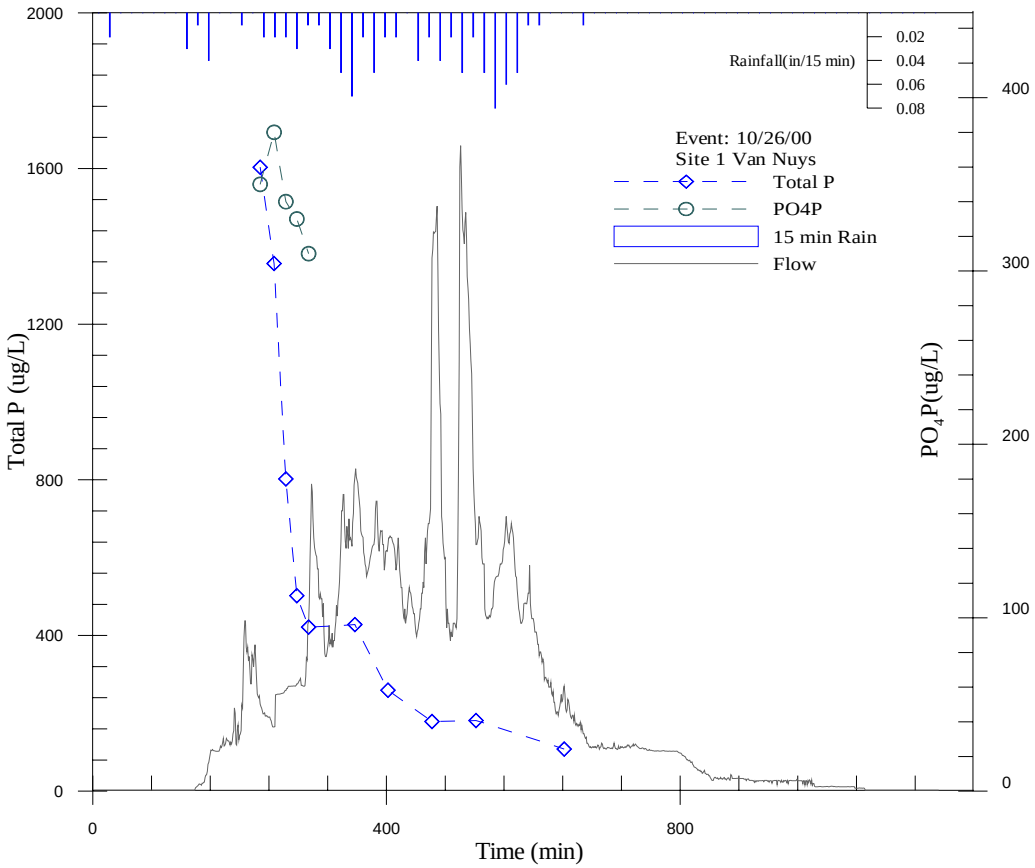


Figure I.2.1.1g (Y2-UCLA1-E1-7) Polluto-graph for Total -P and PO_4-P

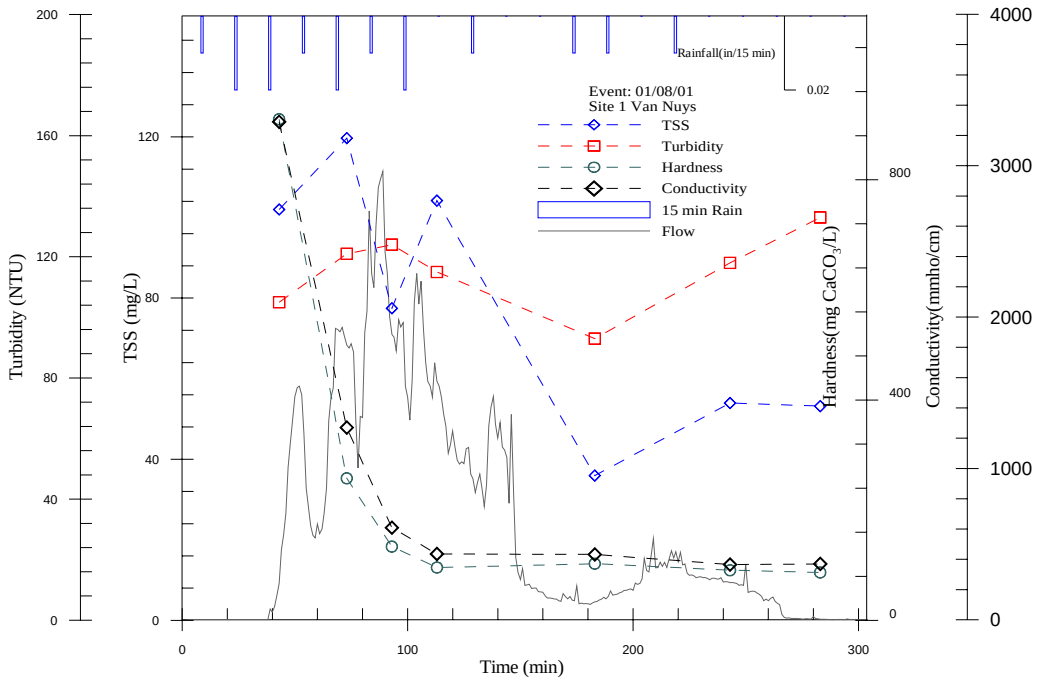


Figure I.2.1.2a (Y2-UCLA1-E2-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

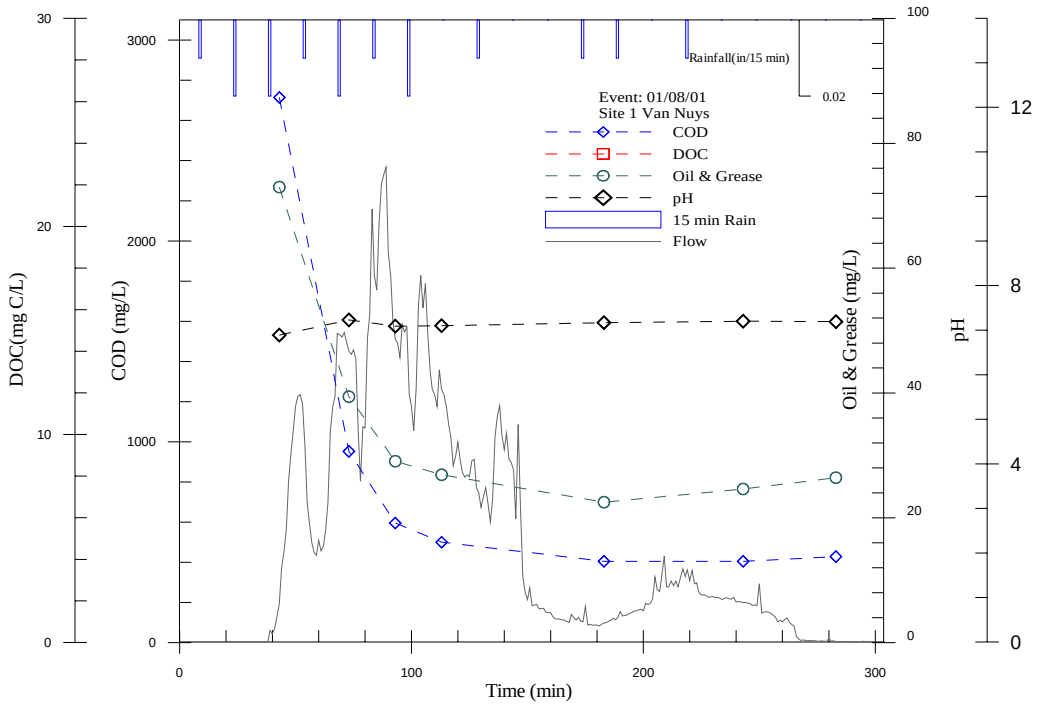


Figure I.2.1.2b (Y2-UCLA1-E2-2) Polluto-graph for COD, DOC, Oil & Grease and pH

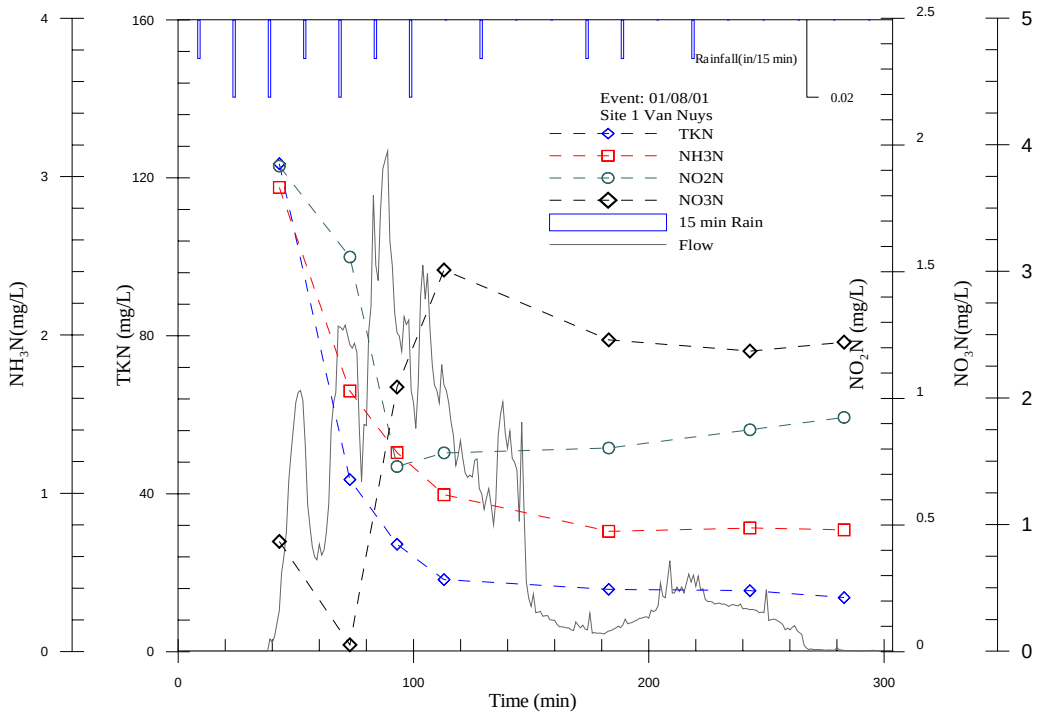


Figure I.2.1.2c (Y2-UCLA1-E2-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

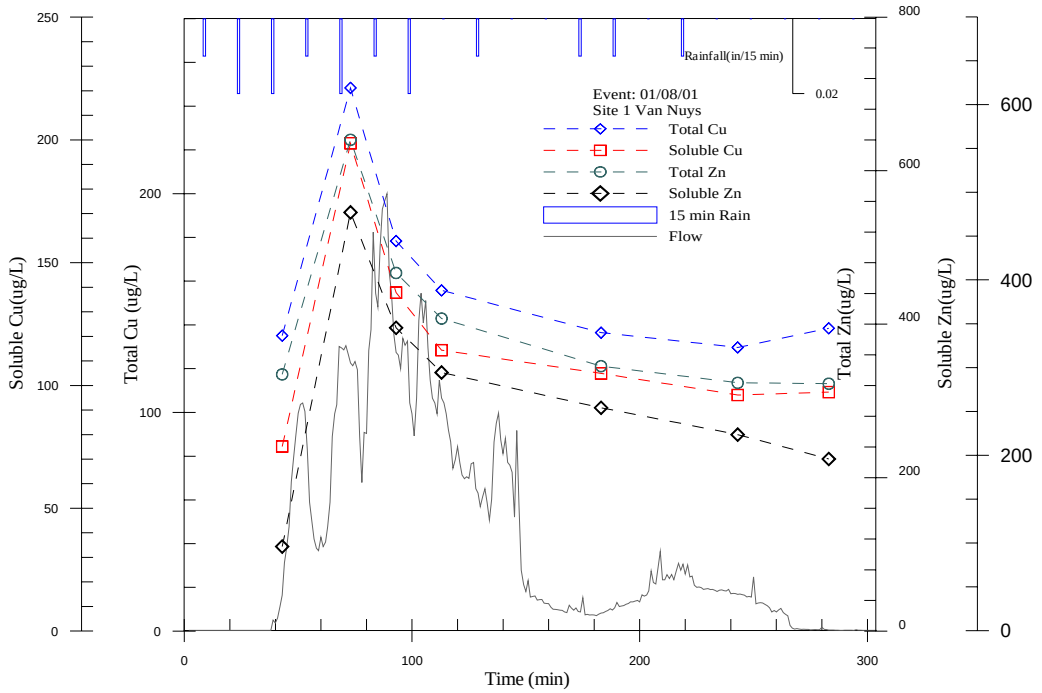


Figure I.2.1.2d (Y2-UCLA1-E2-4) Polluto-graph for Total/Soluble Cu and Zn

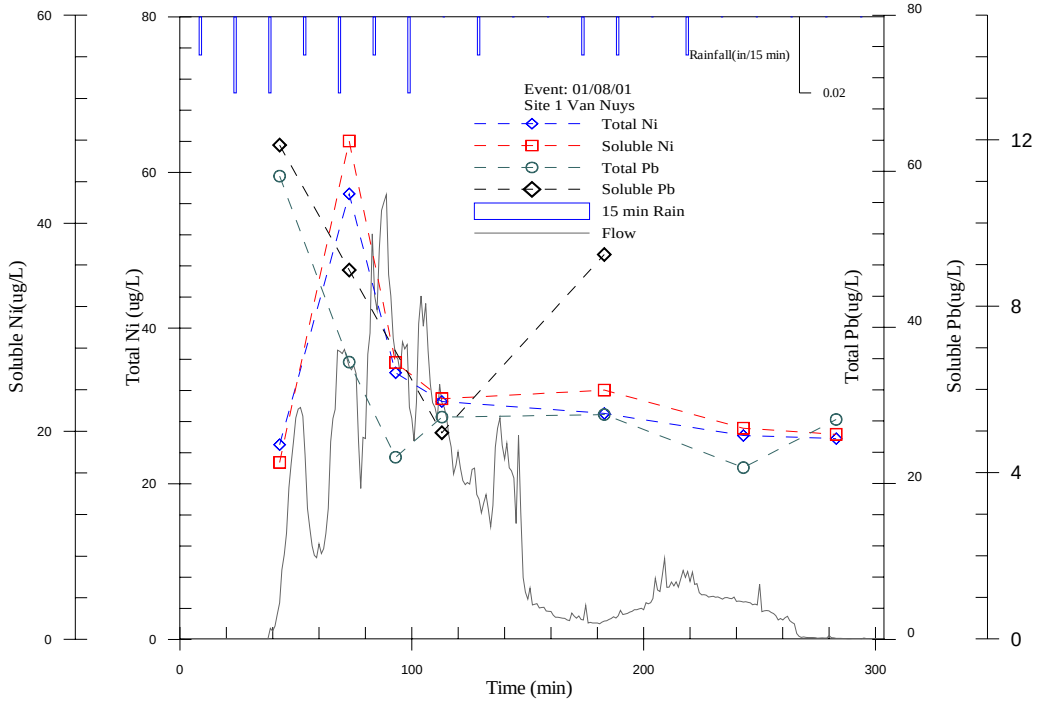


Figure I.2.1.2e (Y2-UCLA1-E2-5) Polluto-graph for Total/Soluble Ni and Pb

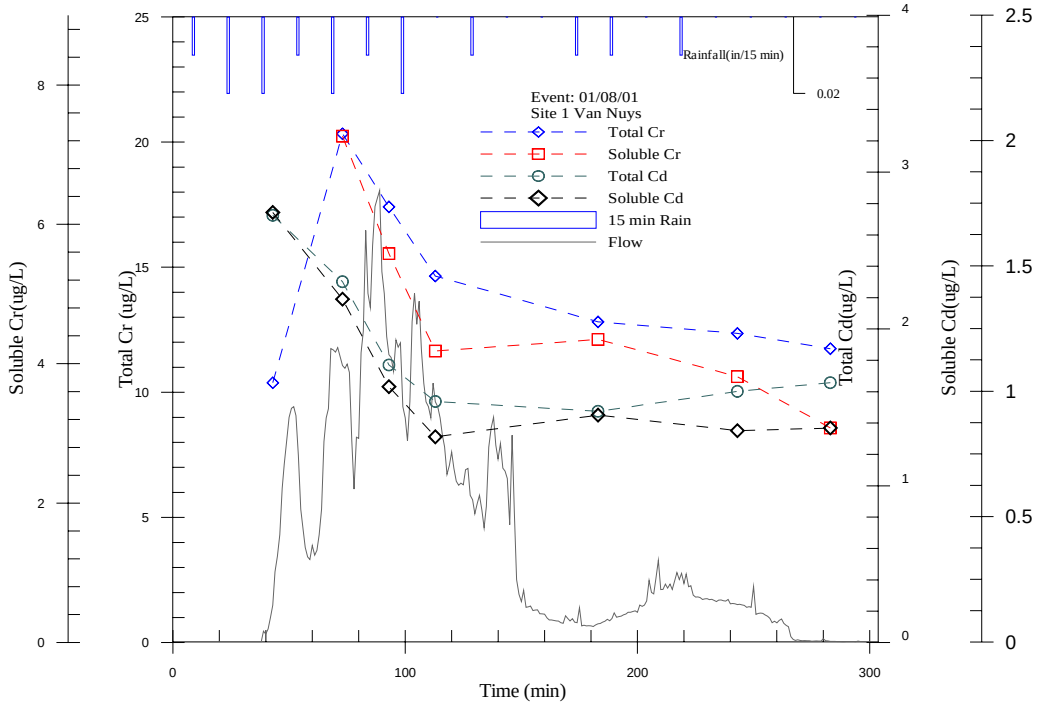


Figure I.2.1.2f (Y2-UCLA1-E2-6) Polluto-graph for Total/Soluble Cr and Cd

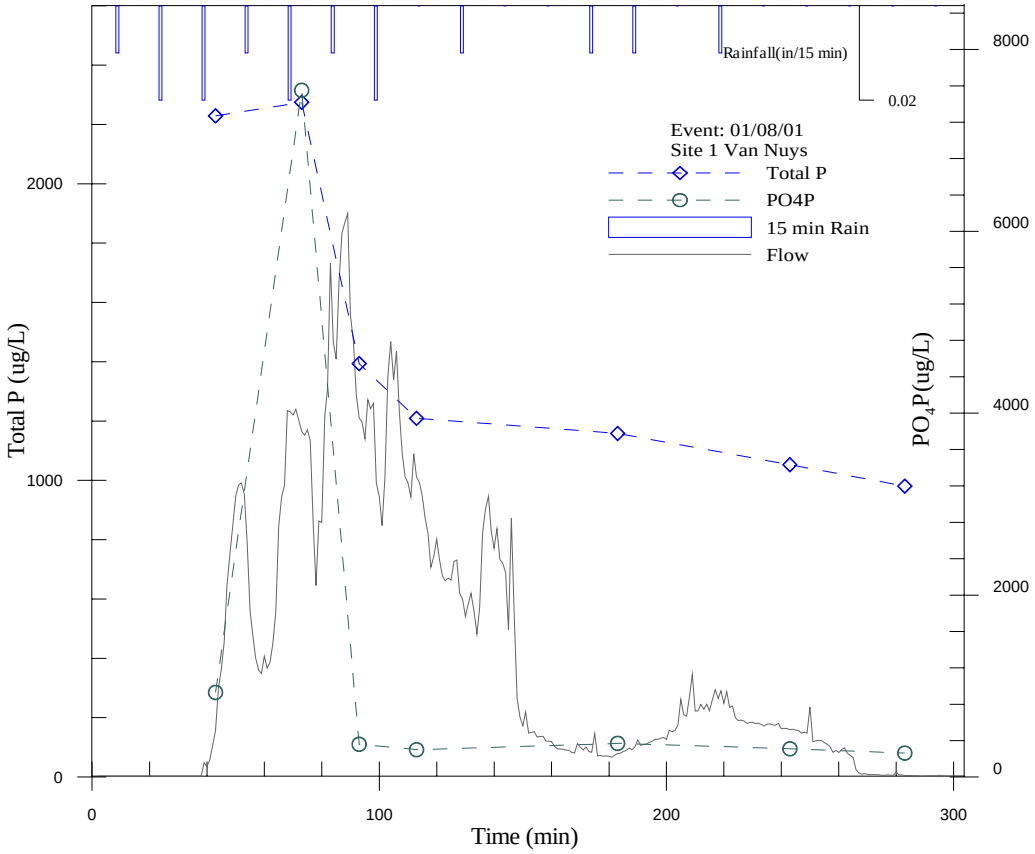


Figure I.2.1.2g (Y2-UCLA1-E2-7) Polluto-graph for Total-P and PO_4-P

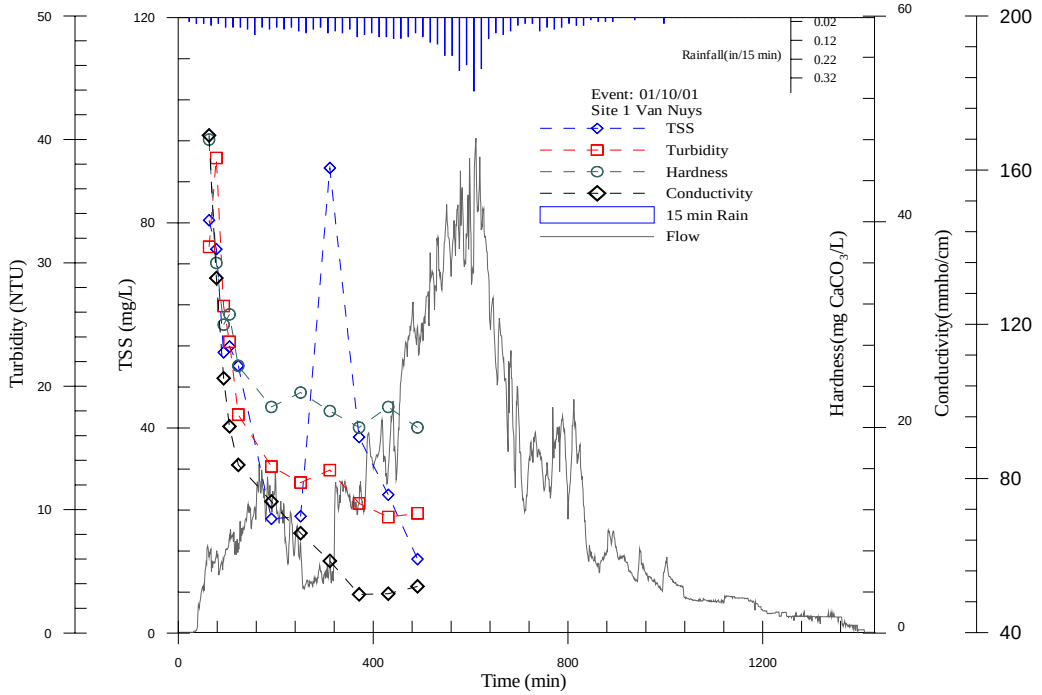


Figure I.2.1.3a (Y2-UCLA1-E3-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

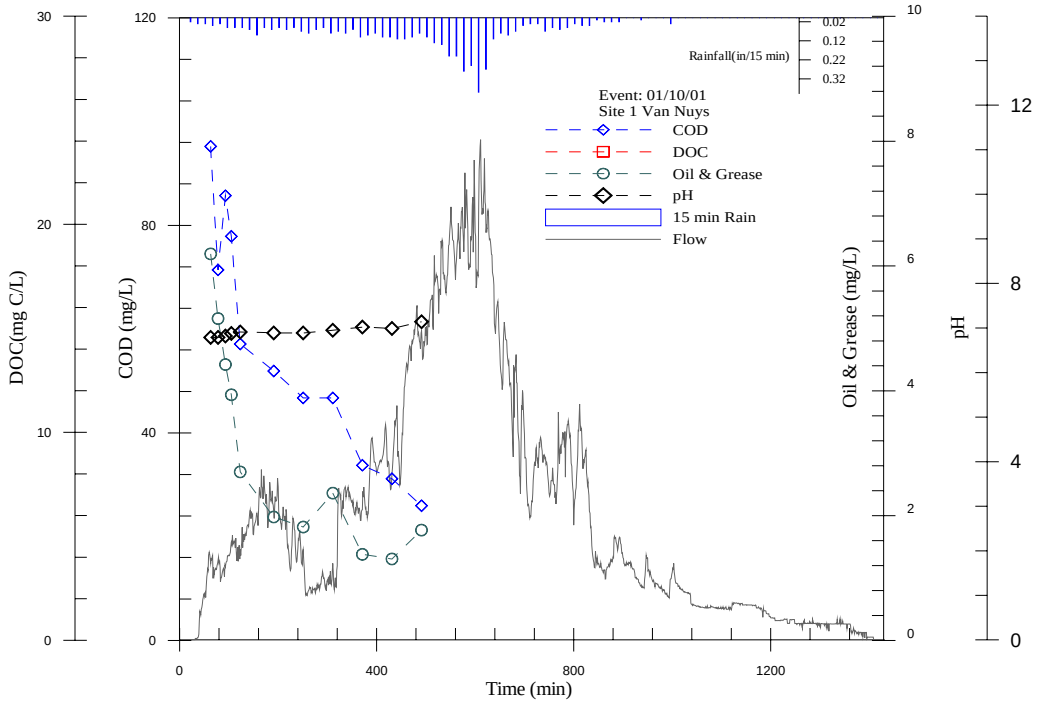


Figure I.2.1.3b (Y2-UCLA1-E3-2) Polluto-graph for COD, DOC, Oil & Grease and pH

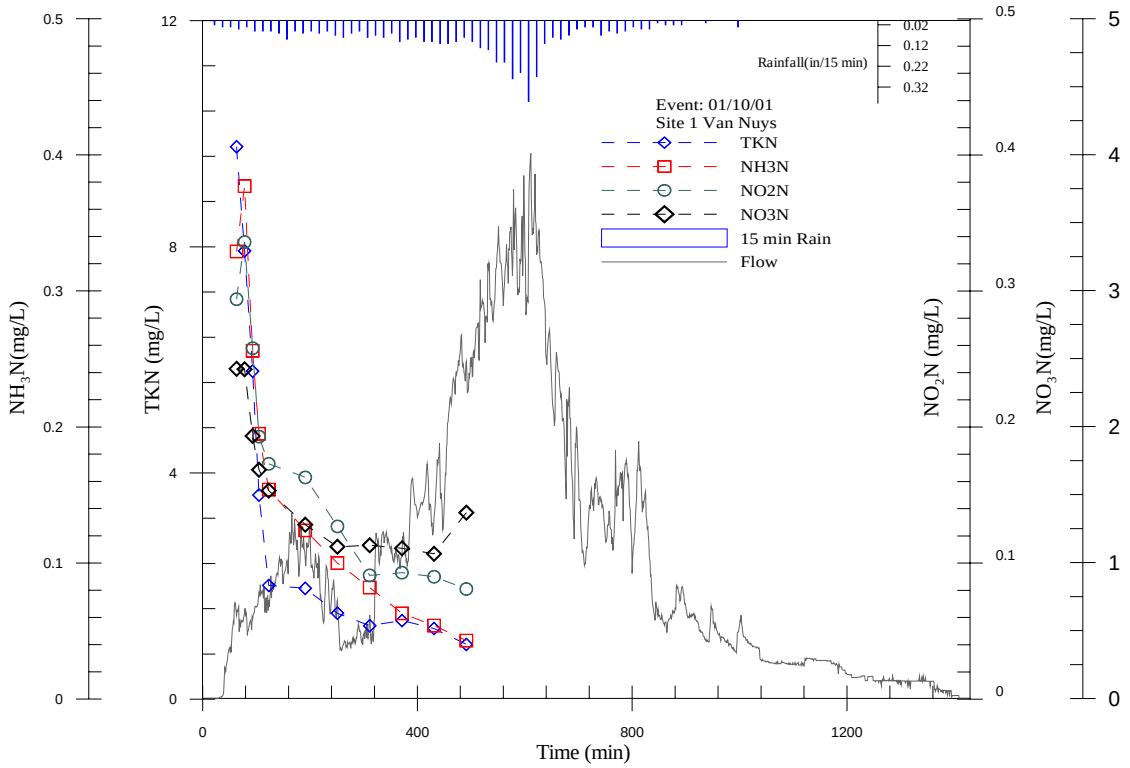


Figure I.2.1.3c (Y2-UCLA1-E3-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

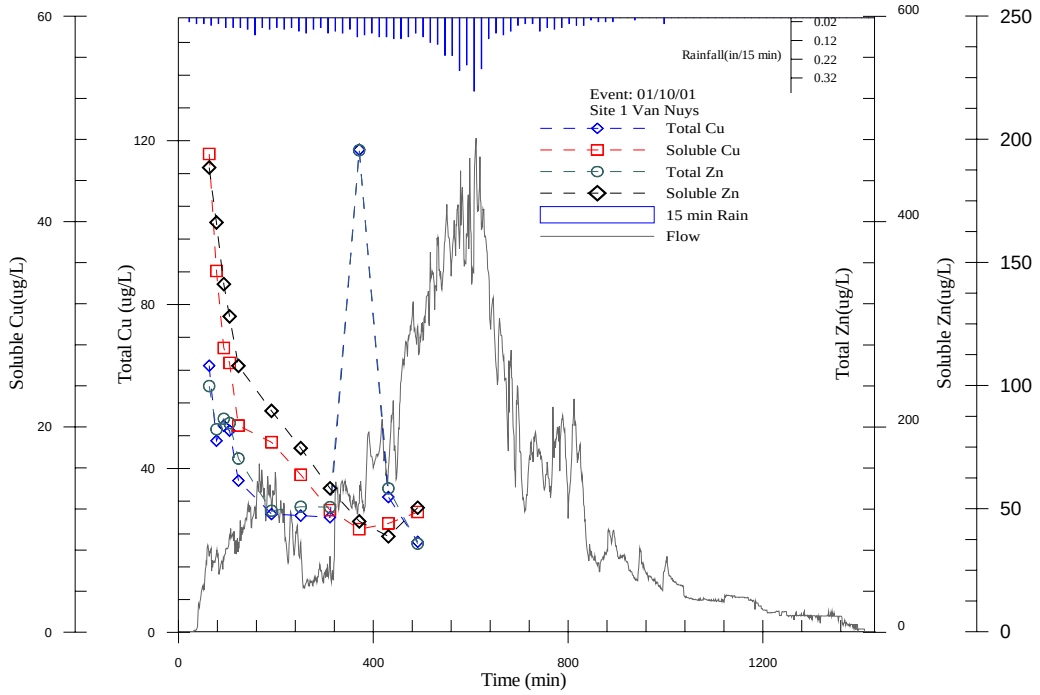


Figure I.2.1.3d (Y2-UCLA1-E3-4) Polluto-graph for Total/Soluble Cu and Zn

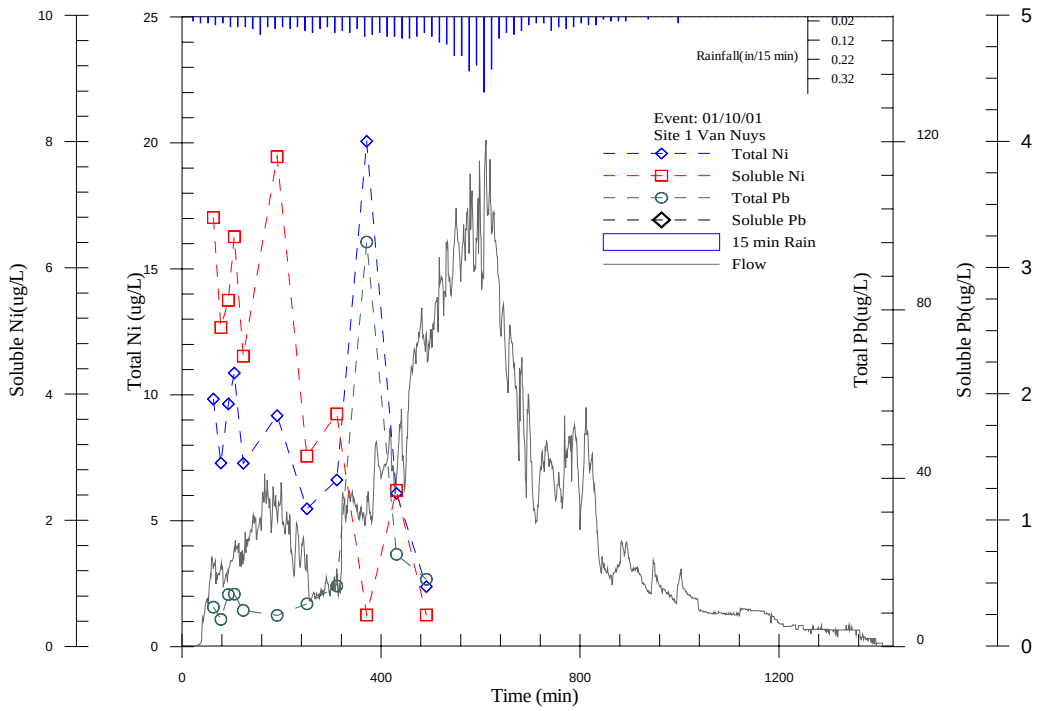


Figure I.2.1.3e (Y2-UCLA1-E3-5) Polluto-graph for Total/Soluble Ni and Pb

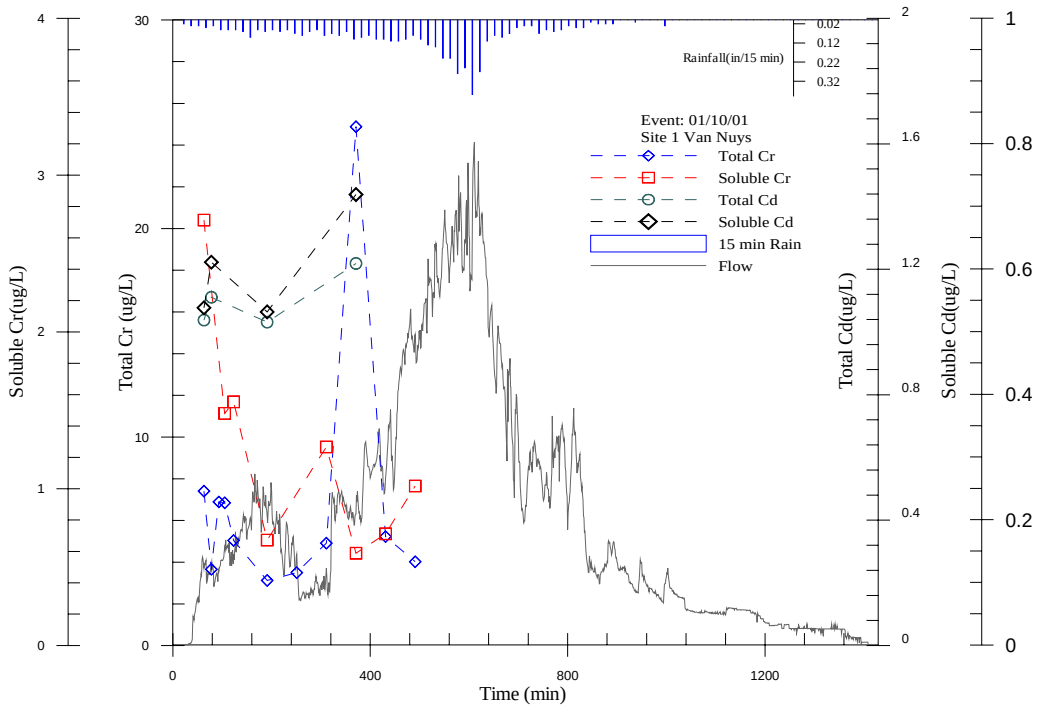


Figure I.2.1.3f (Y2-UCLA1-E3-6) Polluto-graph for Total/Soluble Cr and Cd

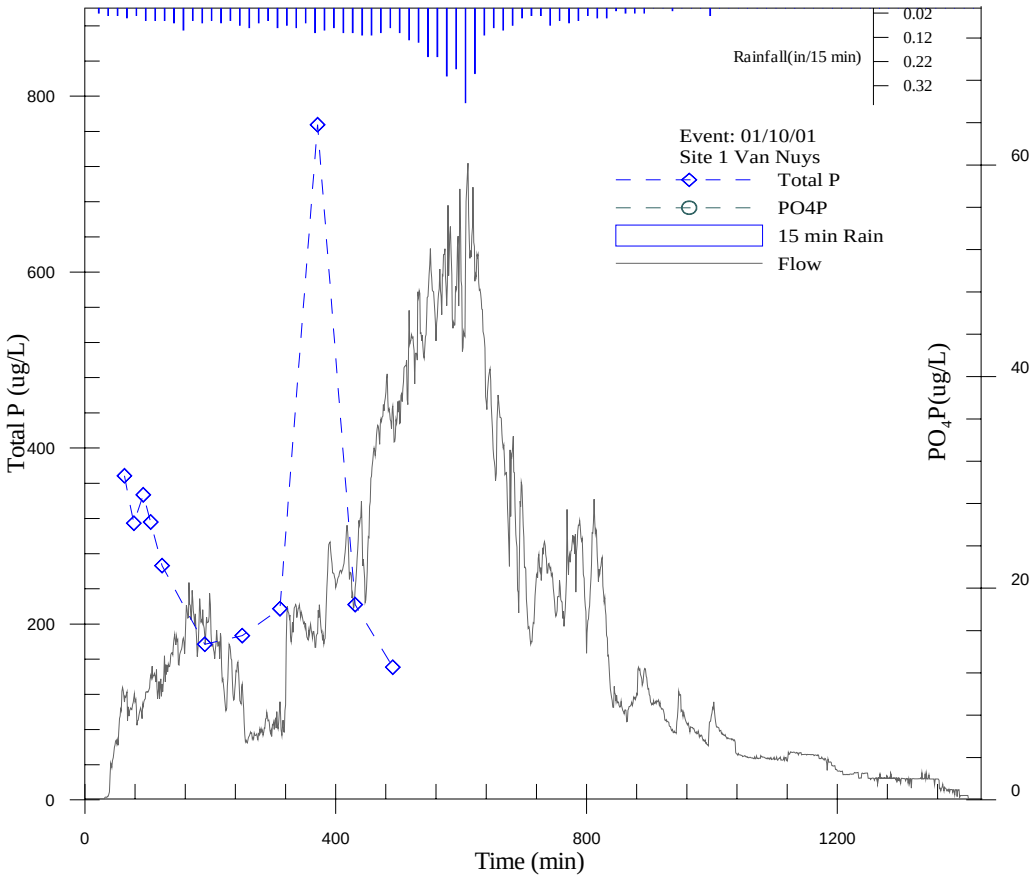


Figure I.2.1.3g (Y2-UCLA1-E3-7) Polluto-graph for Total -P and PO_4-P

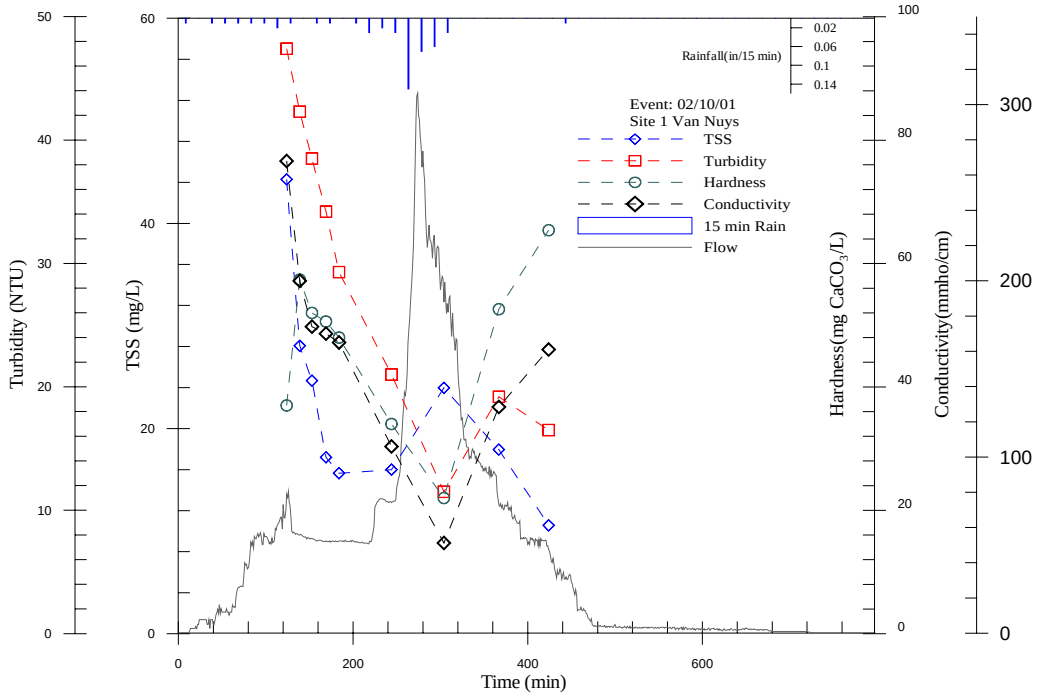


Figure I.2.1.4a (Y2-UCLA1-E4-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

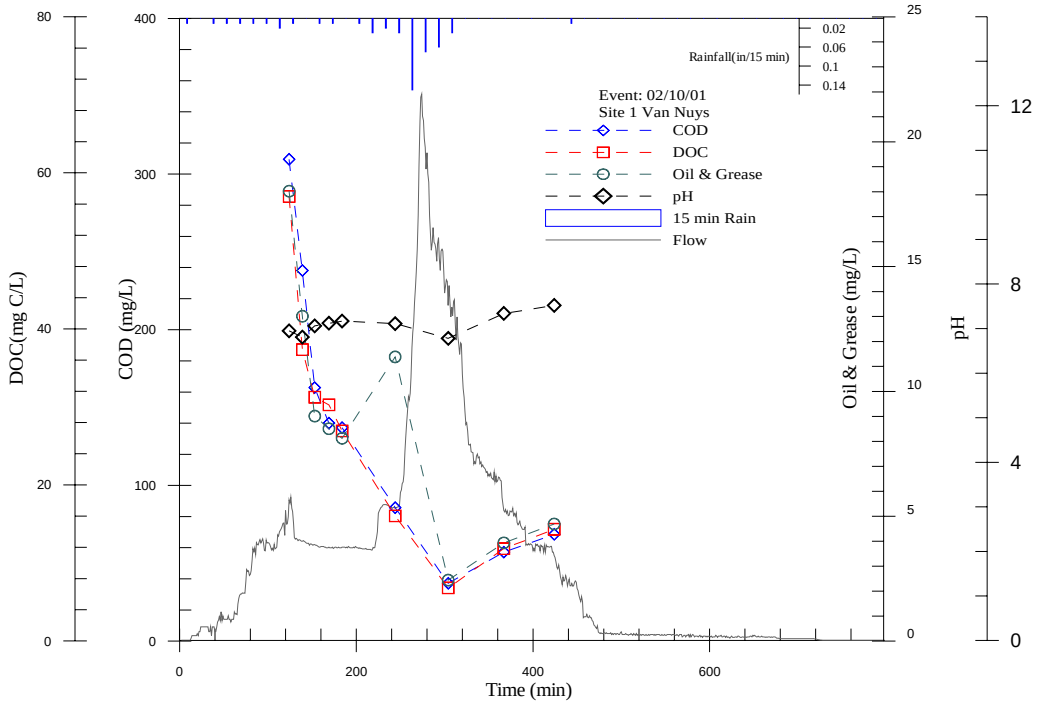


Figure I.2.1.4b (Y2-UCLA1-E4-2) Polluto-graph for COD, DOC, Oil & Grease and pH

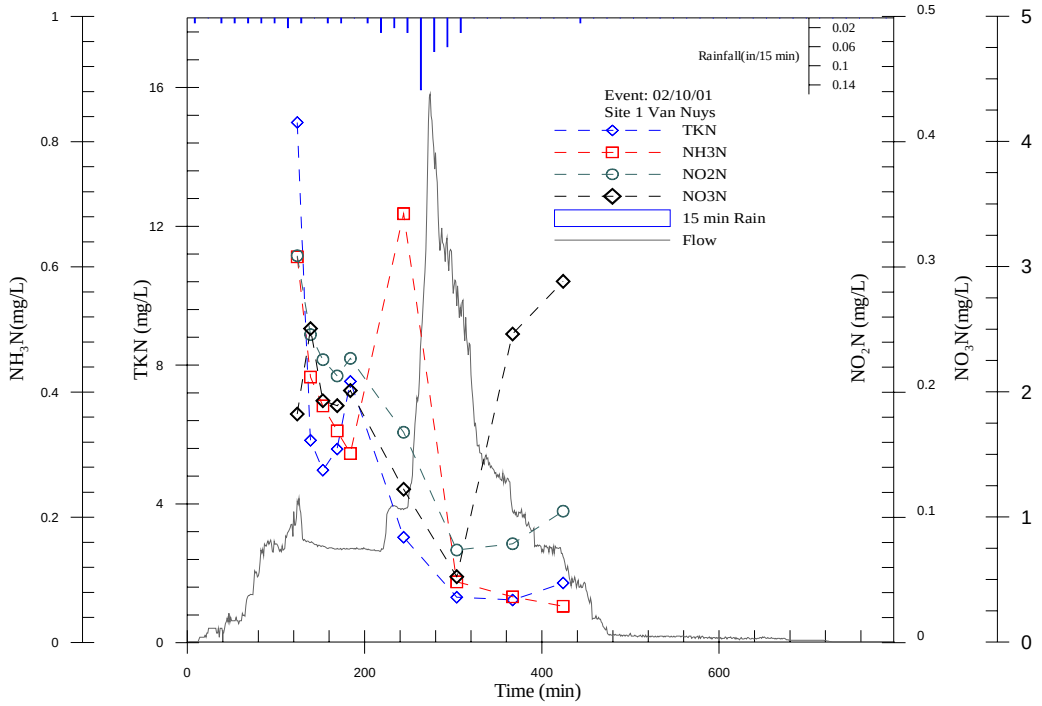


Figure I.2.1.4c (Y2-UCLA1-E4-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

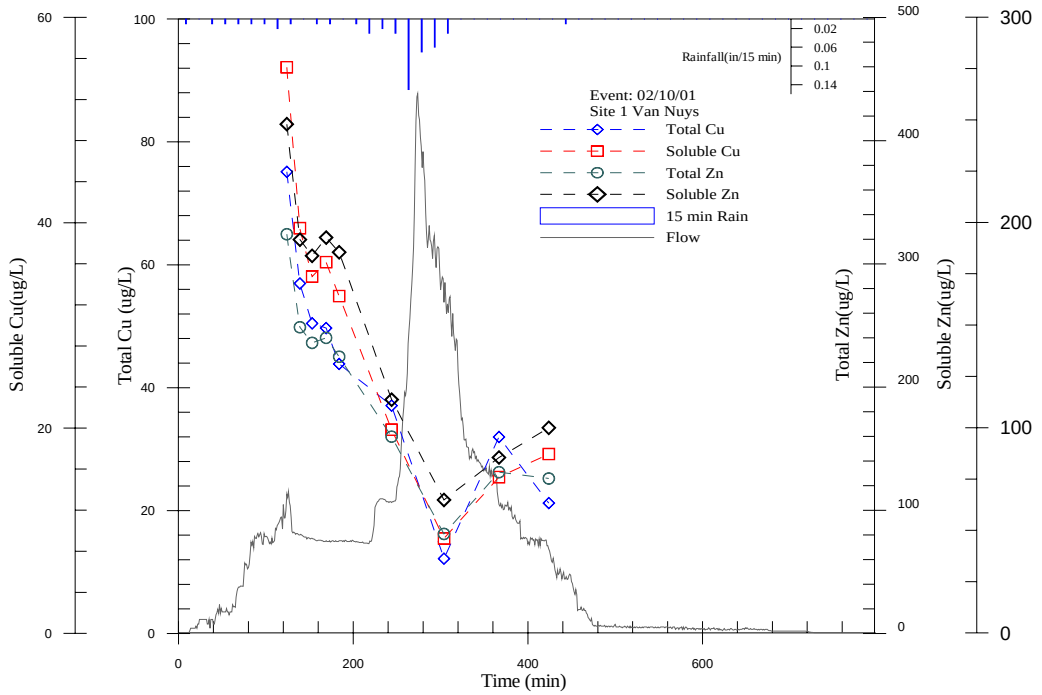


Figure I.2.1.4d (Y2-UCLA1-E4-4) Polluto-graph for Total/Solube Cu and Zn

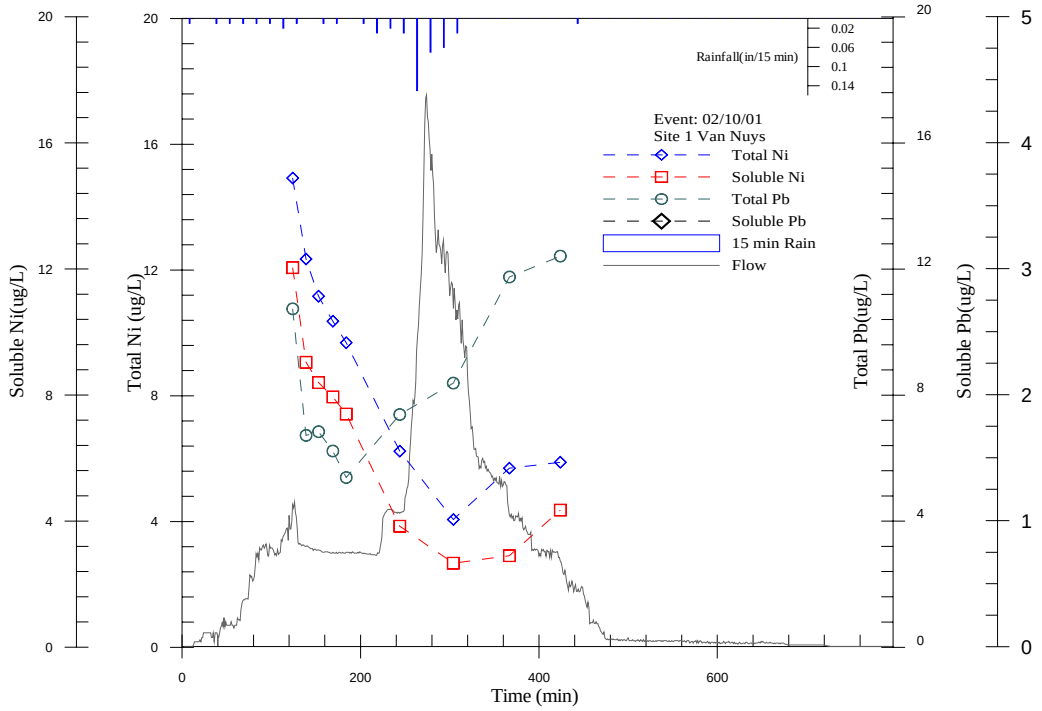


Figure I.2.1.4e (Y2-UCLA1-E4-5) Polluto-graph for Total/Soluble Ni and Pb

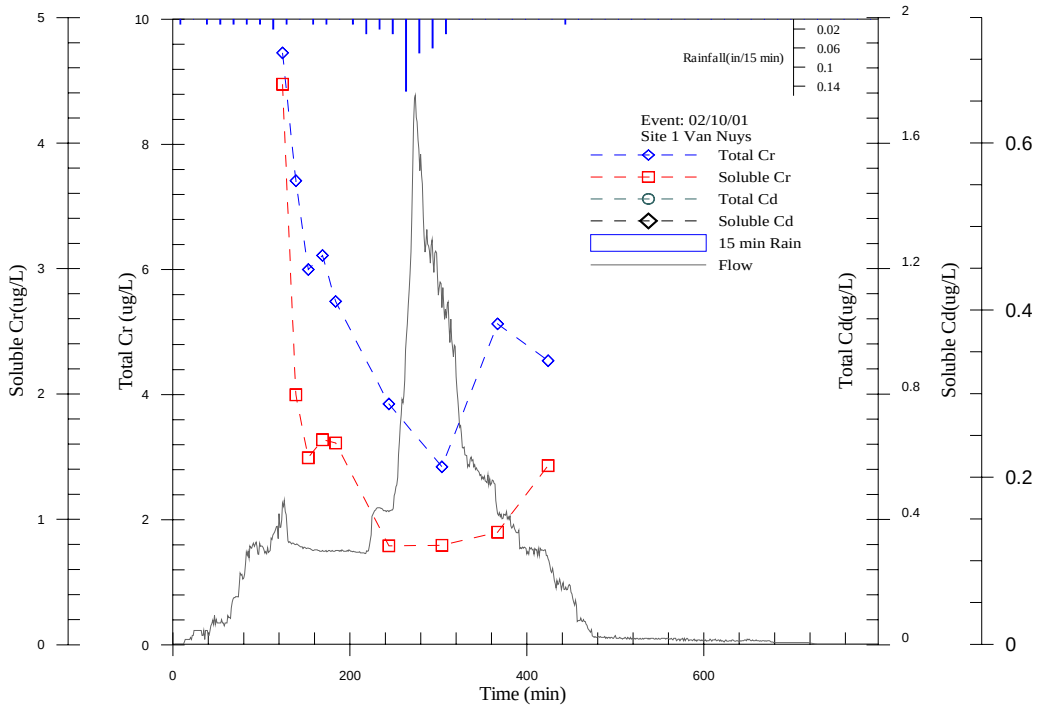


Figure I.2.1.4f (Y2-UCLA1-E4-6) Polluto-graph for Total/Soluble Cr and Cd

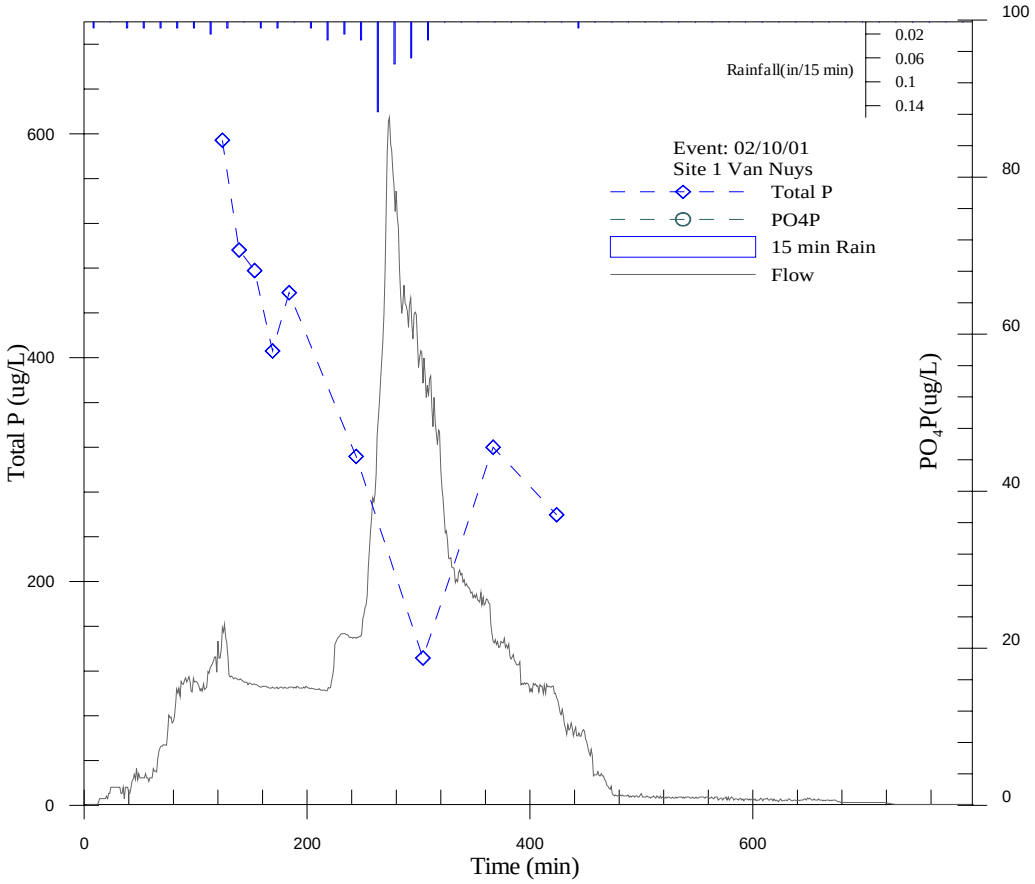


Figure I.2.1.4g (Y2-UCLA1-E4-7) Polluto-graph for Total-P and PO_4-P

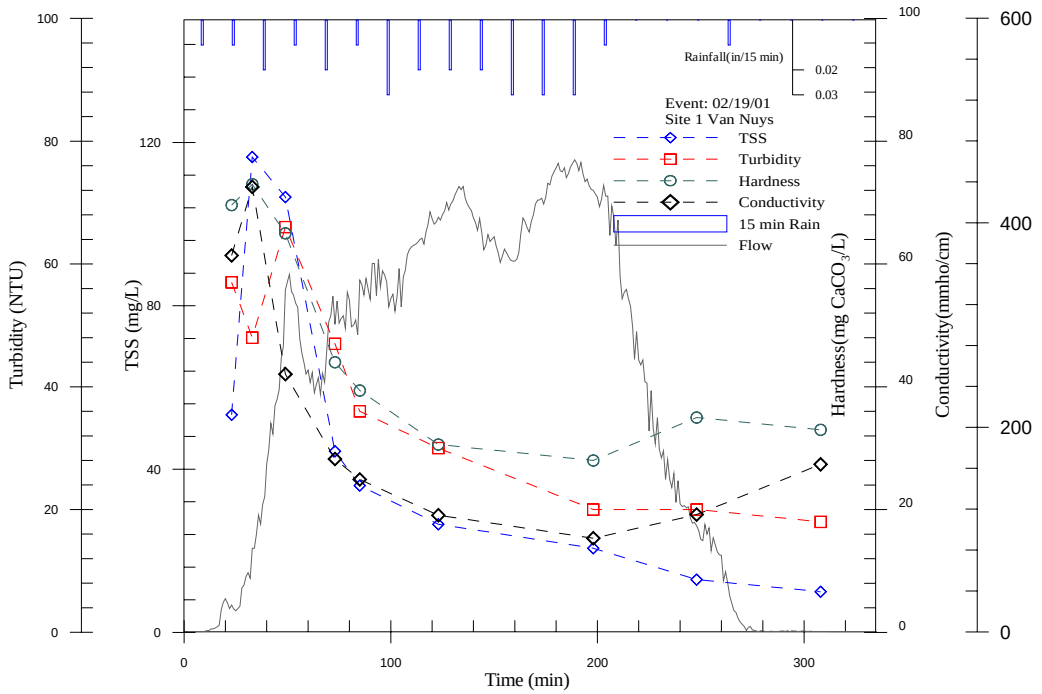


Figure I.2.1.5a (Y2-UCLA1-E5-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

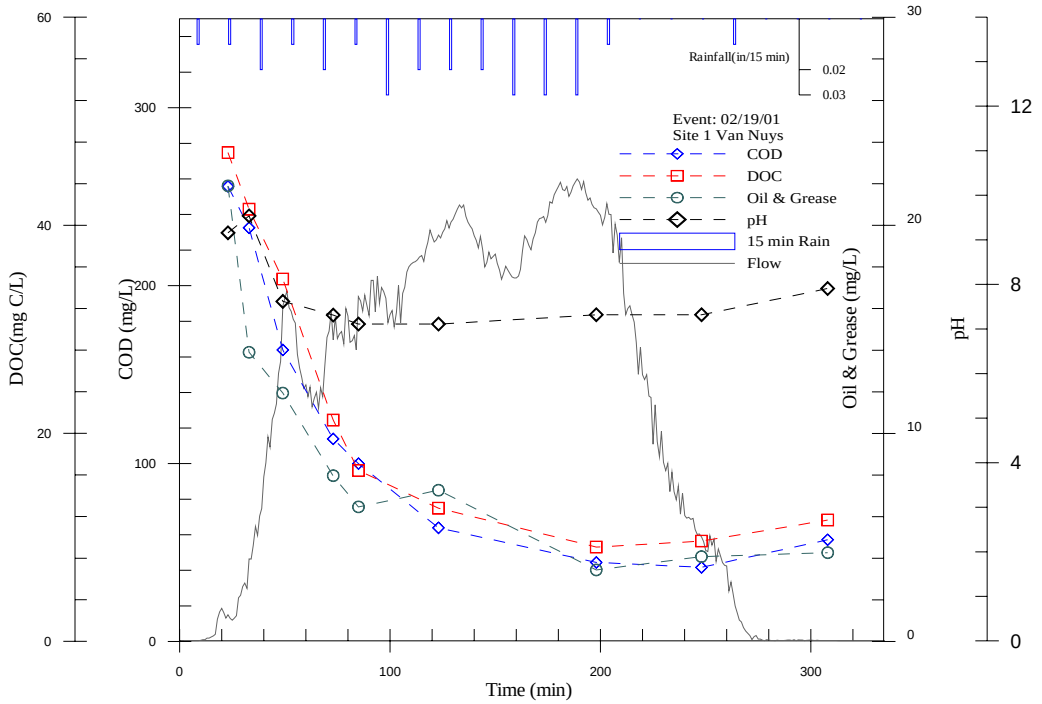


Figure I.2.1.5b (Y2-UCLA1-E5-2) Polluto-graph for COD, DOC, Oil & Grease and pH

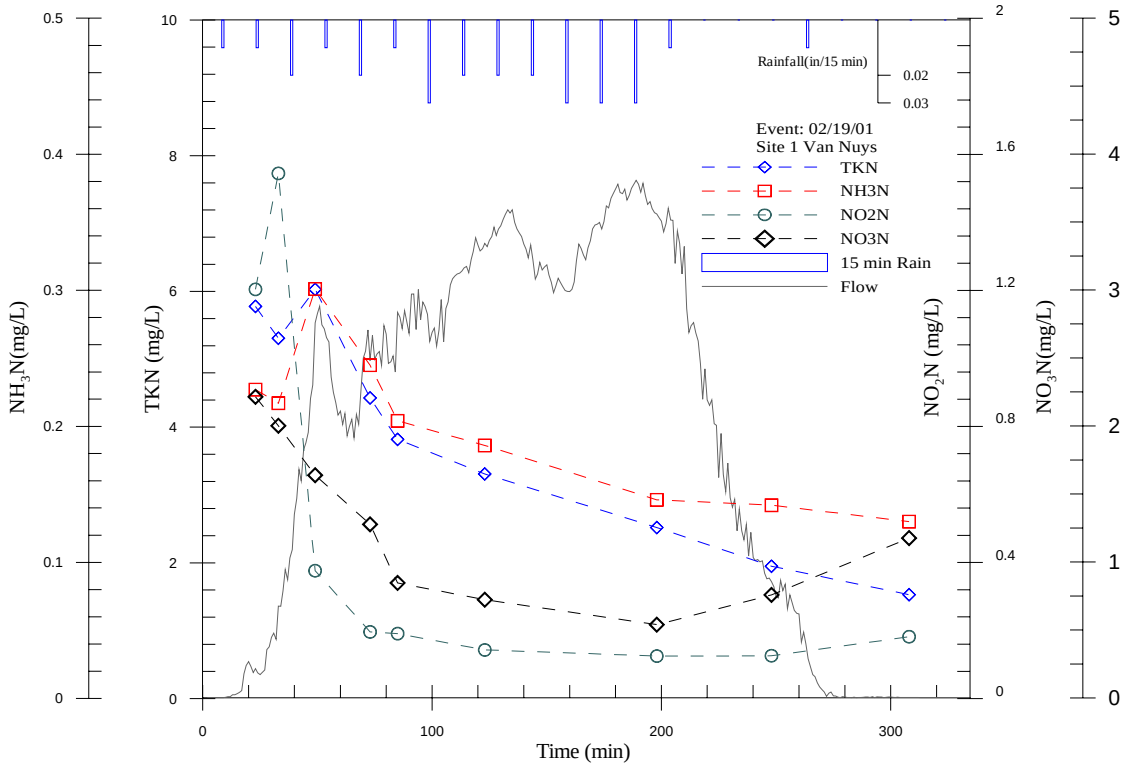


Figure I.2.1.5c (Y2-UCLA1-E5-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

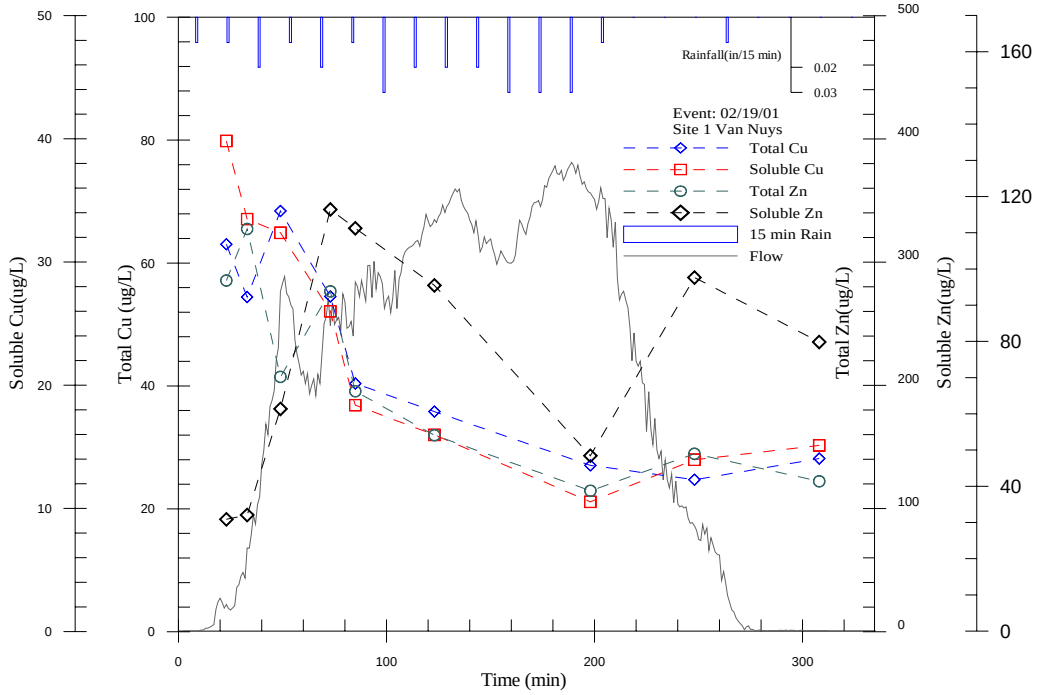


Figure I.2.1.5d (Y2-UCLA1-E5-4) Polluto-graph for Total/Soluble Cu and Zn

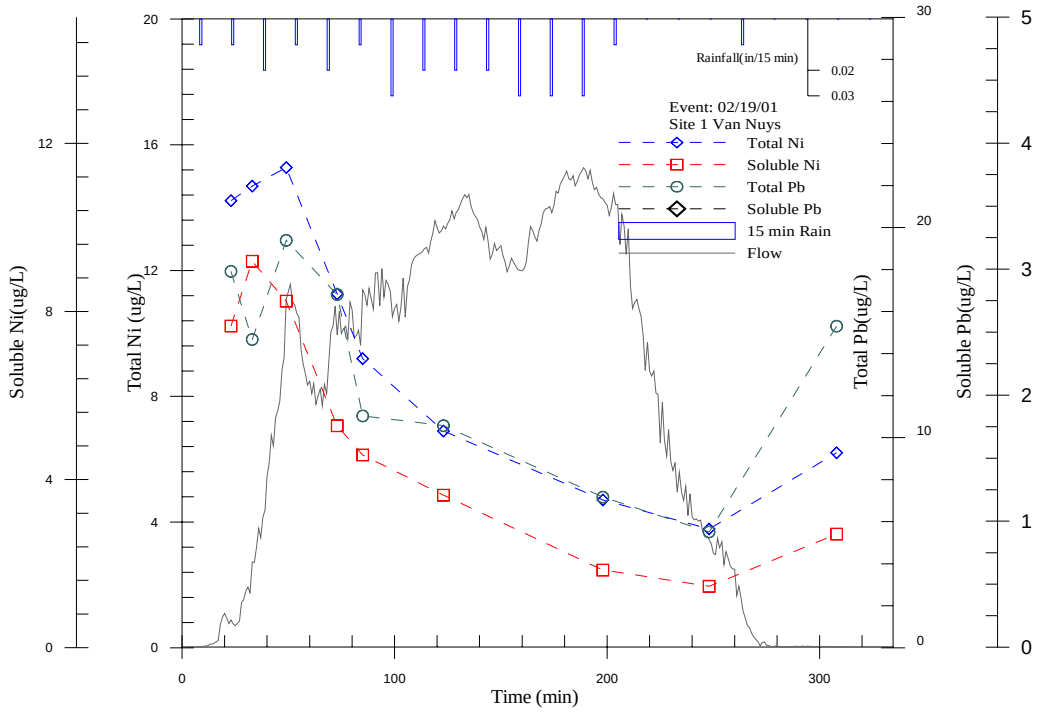


Figure I.2.1.5e (Y2-UCLA1-E5-5) Polluto-graph for Total/Soluble Ni and Pb

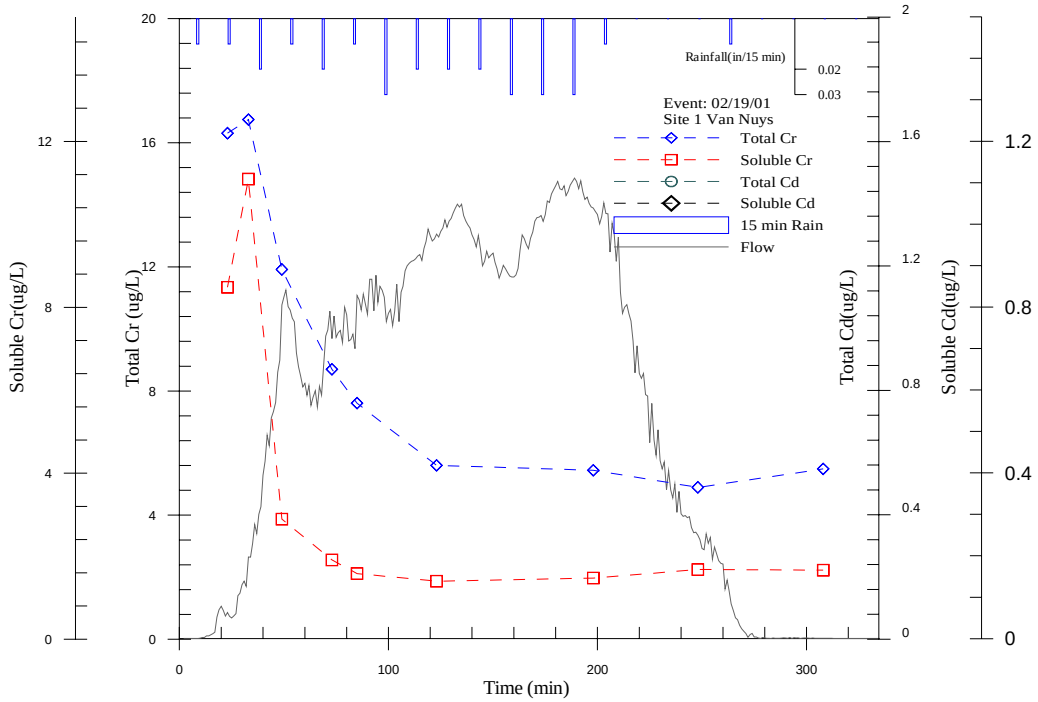


Figure I.2.1.5f (Y2-UCLA1-E5-6) Polluto-graph for Total/Soluble Cr and Cd

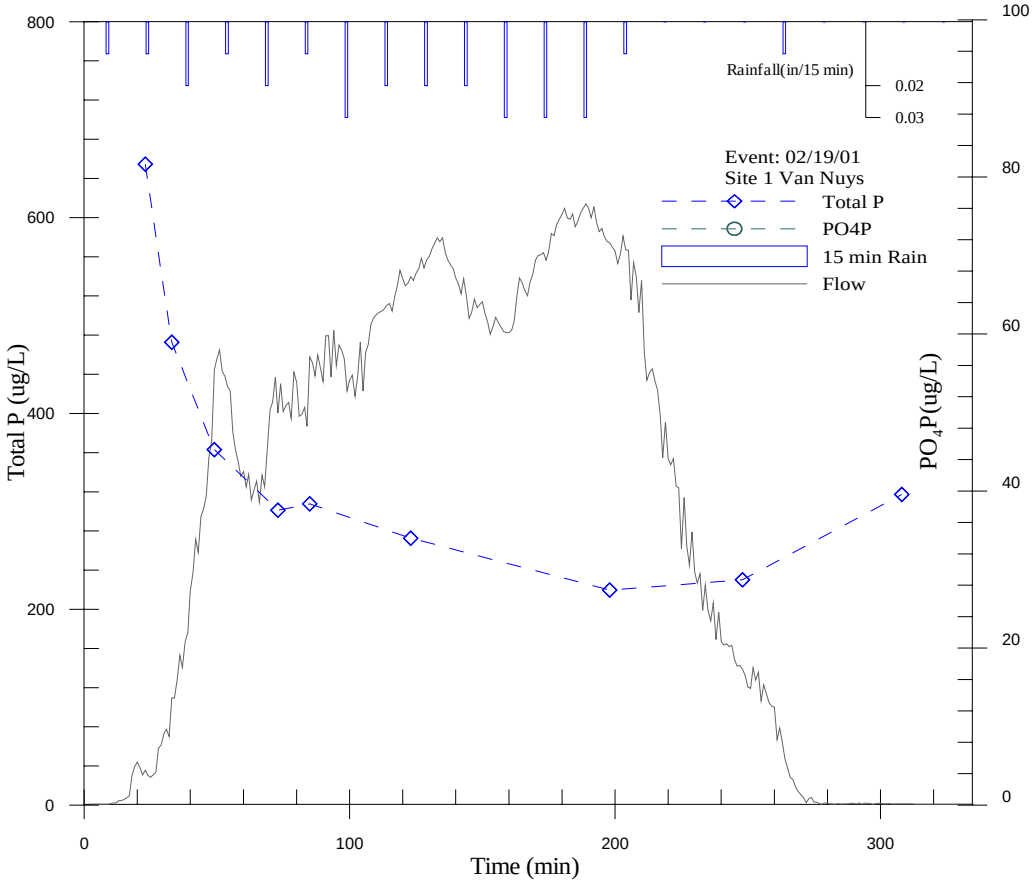


Figure I.2.1.5g (Y2-UCLA1-E5-7) Polluto-graph for Total -P and PO_4-P

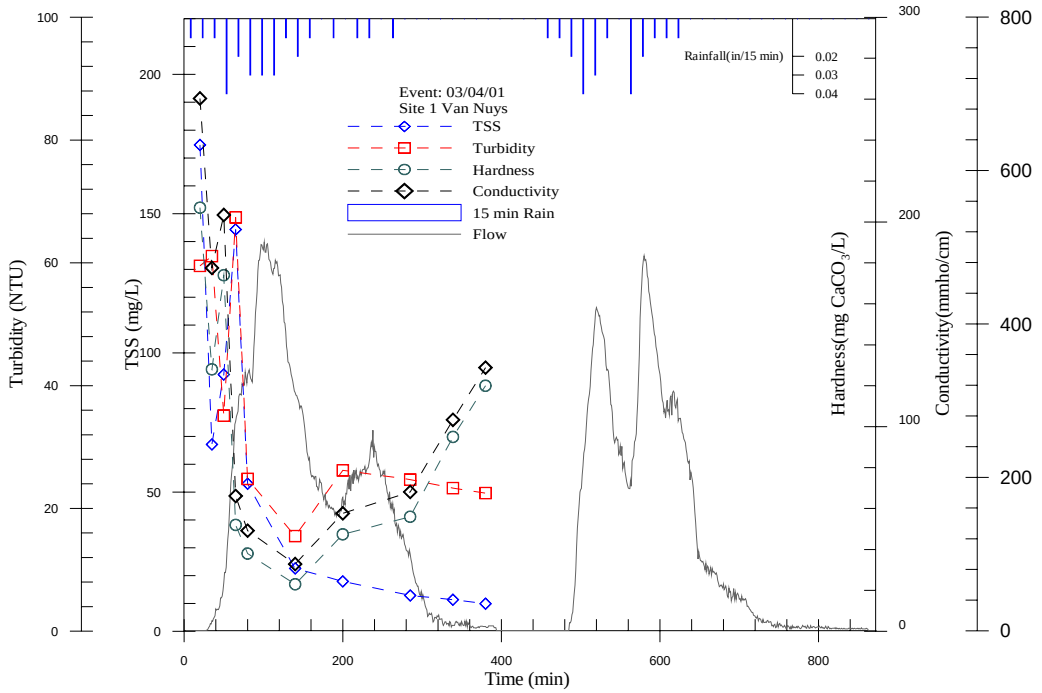


Figure I.2.1.6a (Y2-UCLA1-E7-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

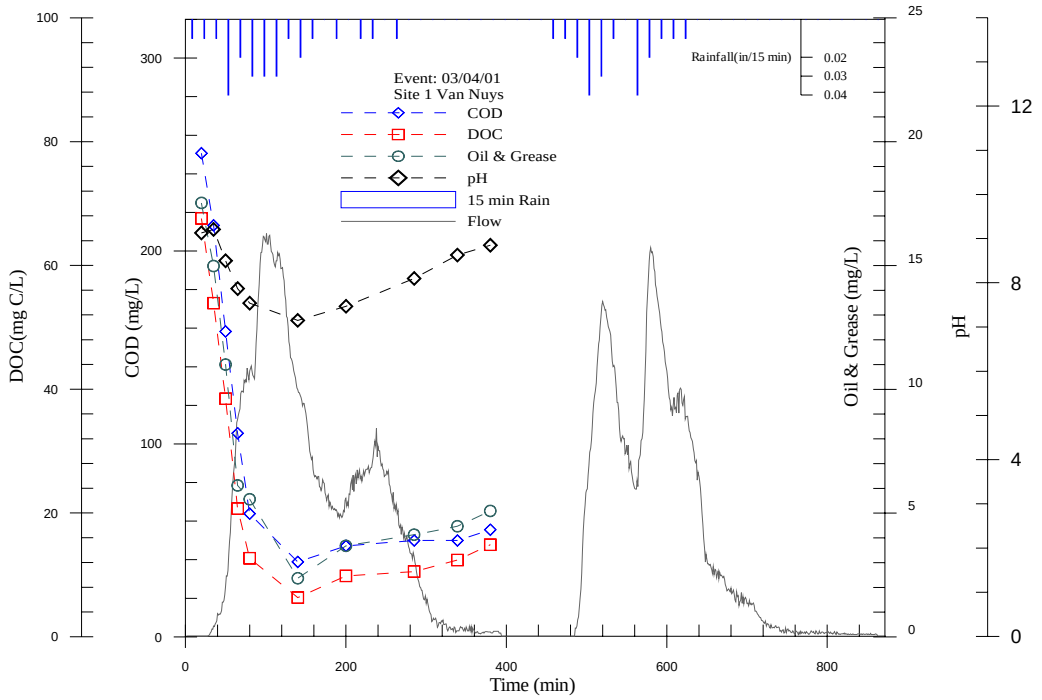


Figure I.2.1.6b (Y2-UCLA1-E7-2) Polluto-graph for COD, DOC, Oil & Grease and pH

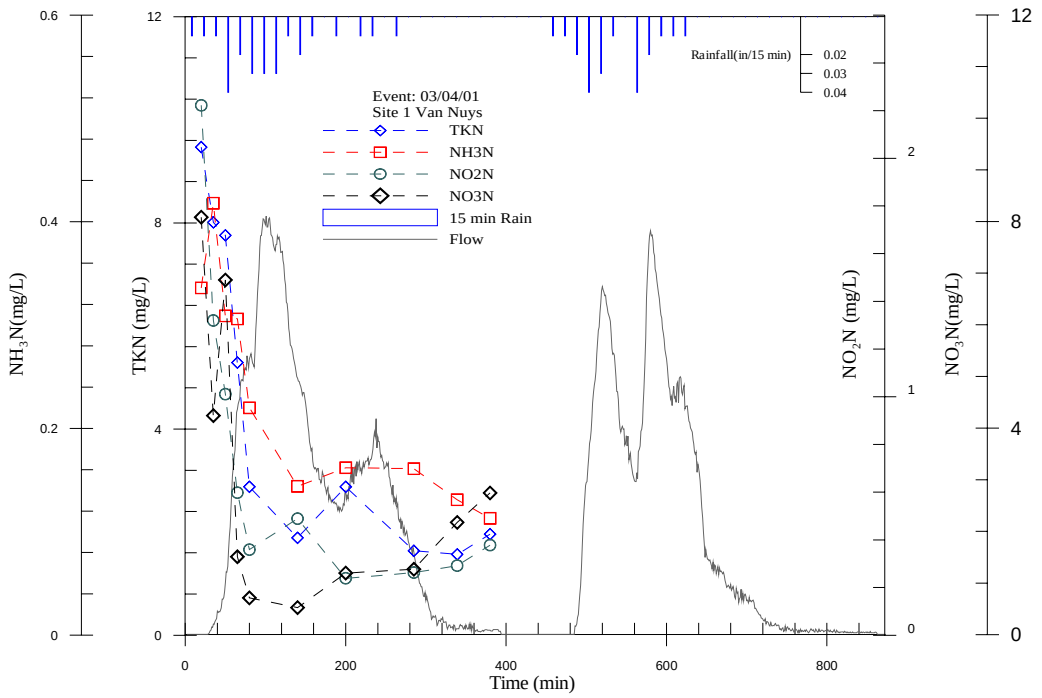


Figure I.2.1.6c (Y2-UCLA1-E7-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

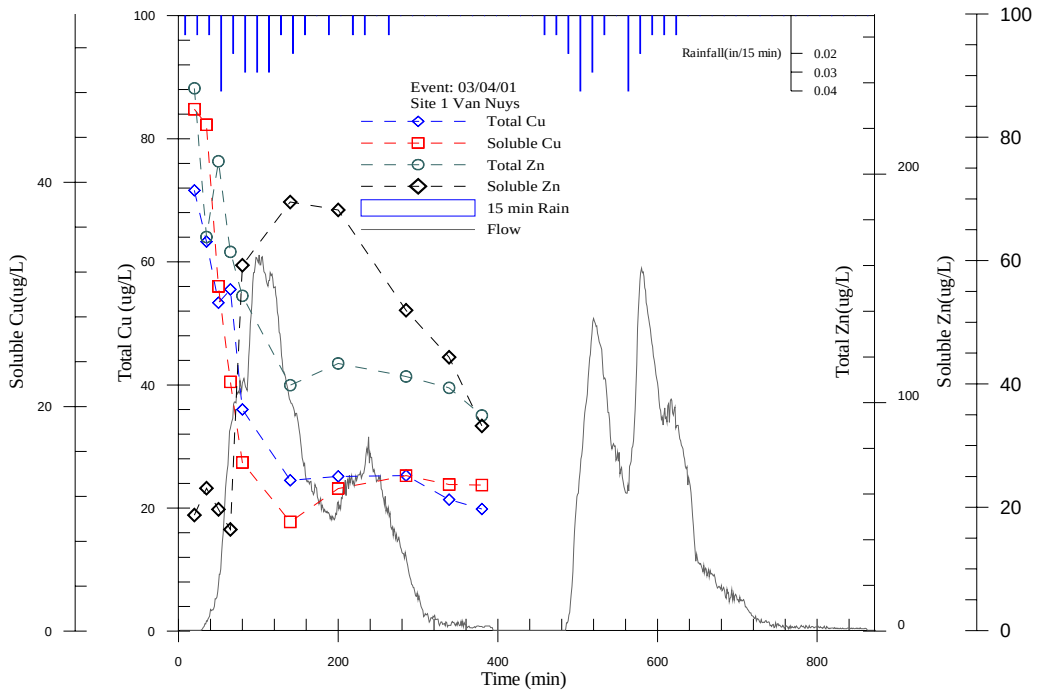


Figure I.2.1.6d (Y2-UCLA1-E7-4) Polluto-graph for Total/Soluble Cu and Zn

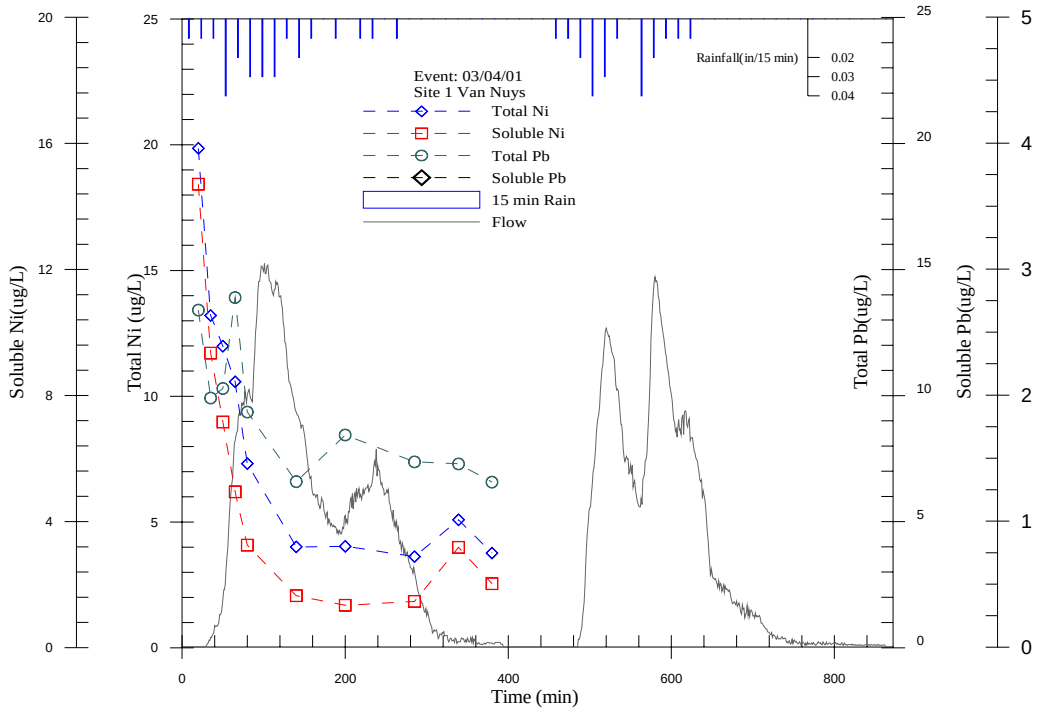


Figure I.2.1.6e (Y2-UCLA1-E7-5) Polluto-graph for Total/Soluble Ni and Pb

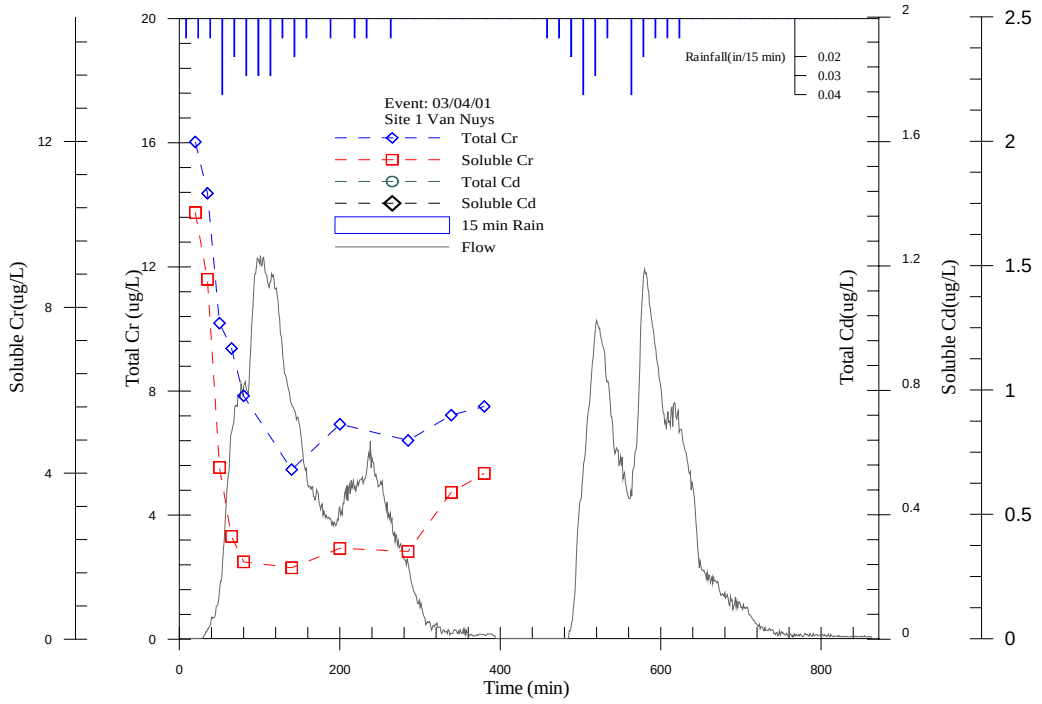


Figure I.2.1.6f (Y2-UCLA1-E7-6) Polluto-graph for Total/Soluble Cr and Cd

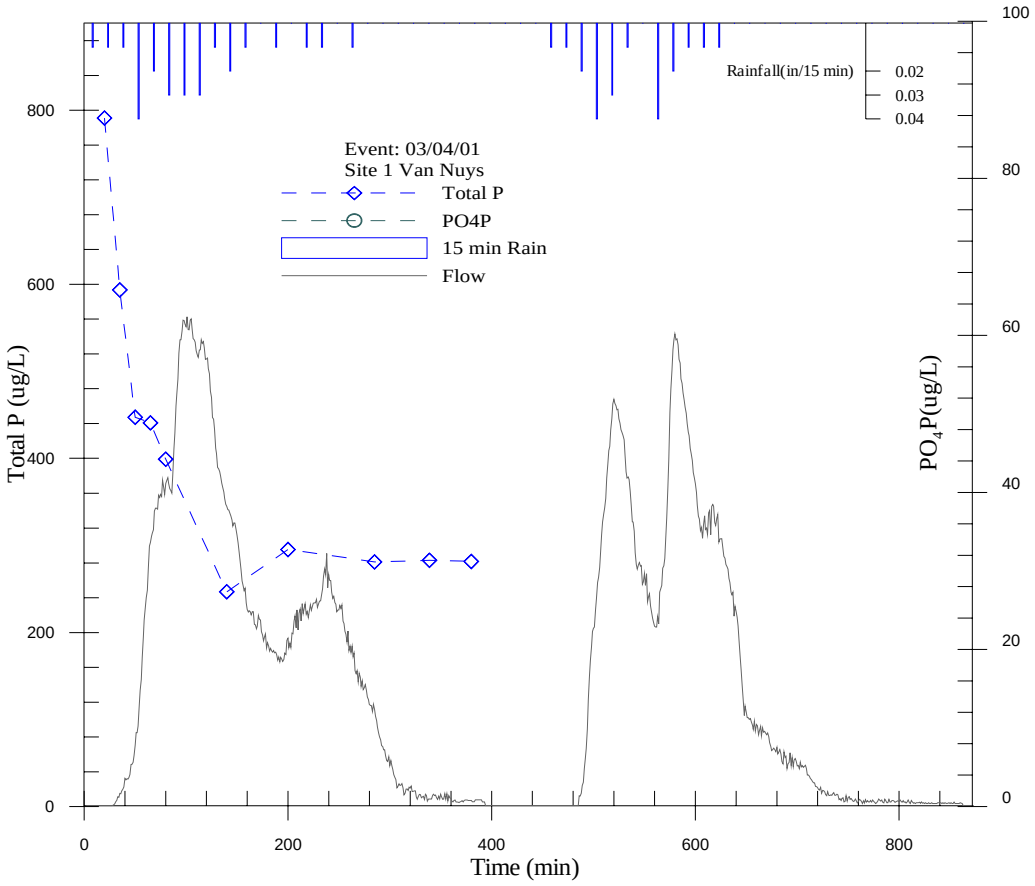


Figure I.2.1.6g (Y2-UCLA1-E7-7) Polluto-graph for Total-P and PO_4-P

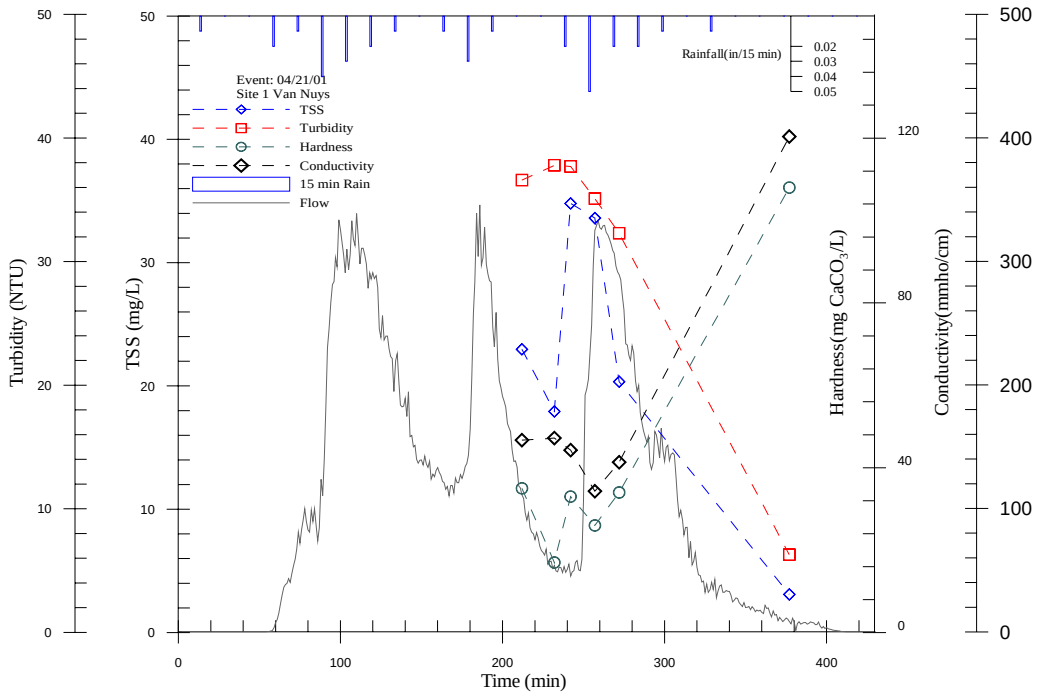


Figure I.2.1.7a (Y2-UCLA1-E9-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

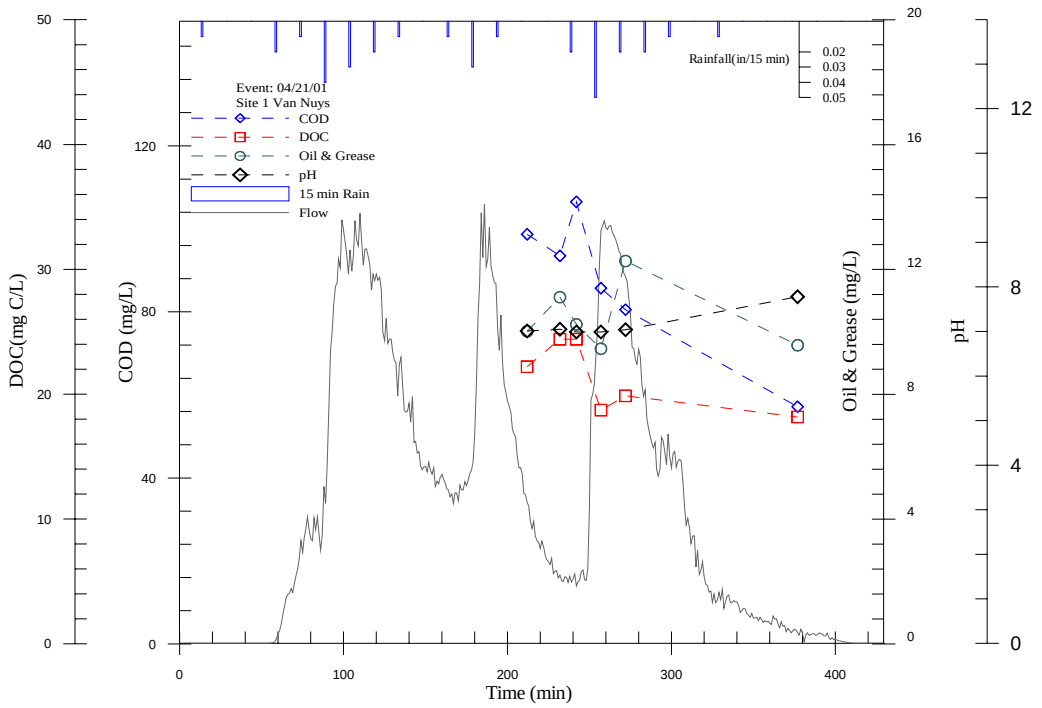


Figure I.2.1.7b (Y2-UCLA1-E9-2) Polluto-graph for COD, DOC, Oil & Grease and pH

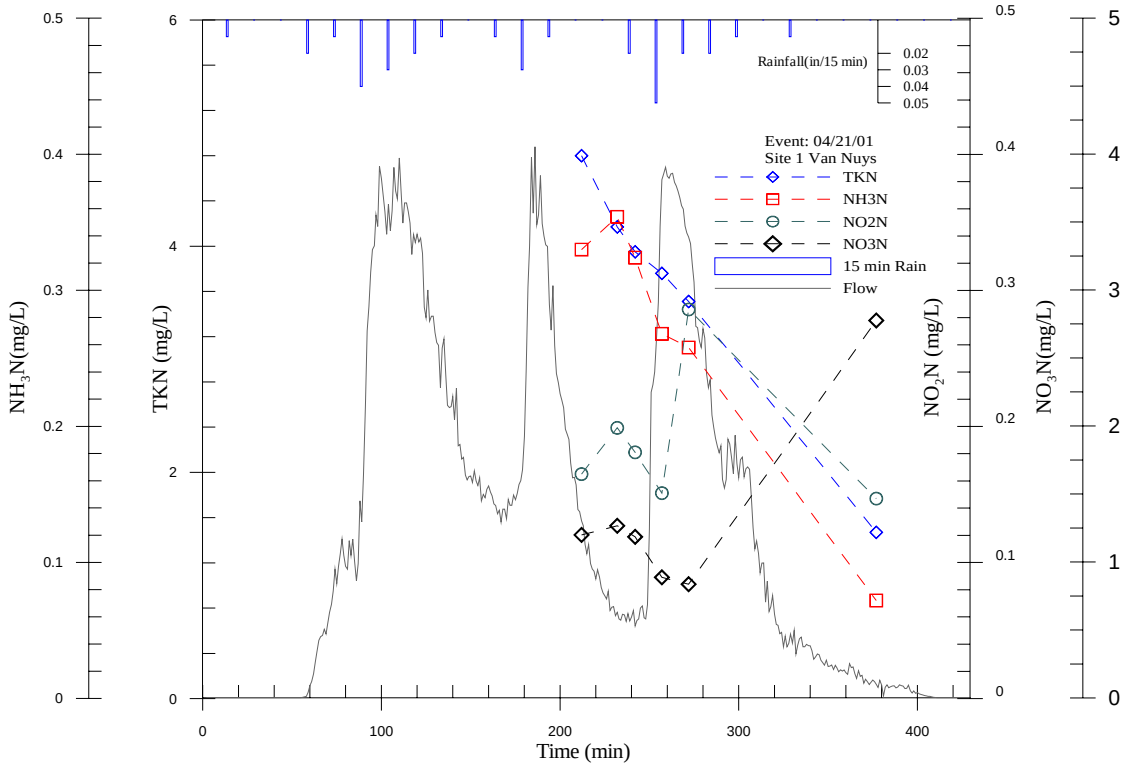


Figure I.2.1.7c (Y2-UCLA1-E9-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

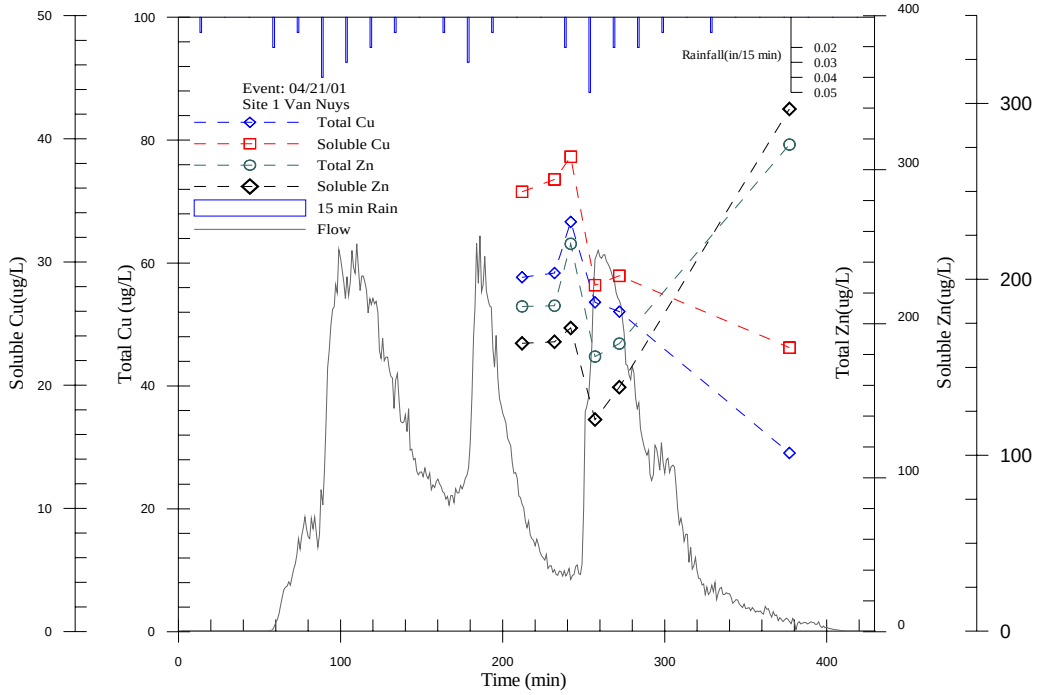


Figure I.2.1.7d (Y2-UCLA1-E9-4) Polluto-graph for Total/Soluble Cu and Zn

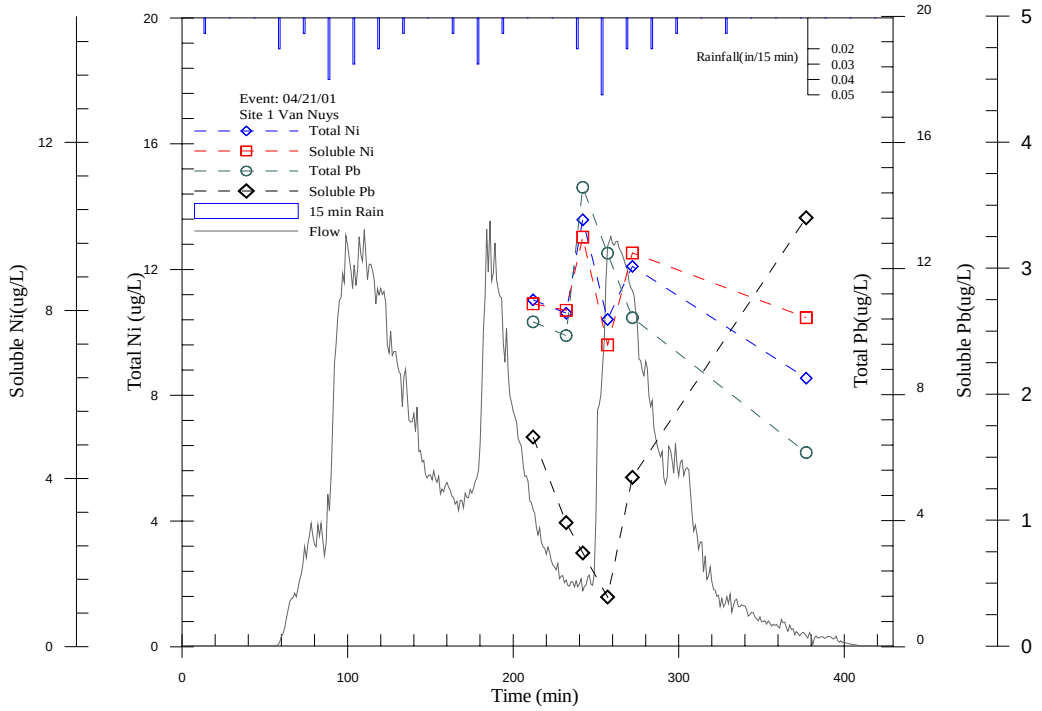


Figure I.2.1.7e (Y2-UCLA1-E9-5) Polluto-graph for Total/Soluble Ni and Pb

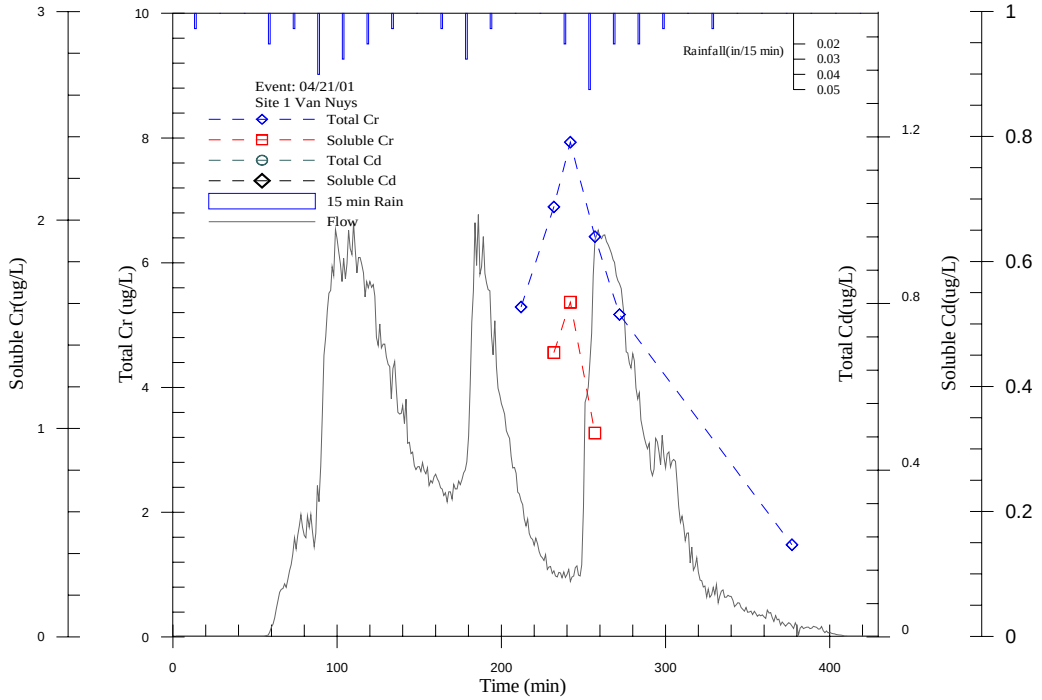


Figure I.2.1.7f (Y2-UCLA1-E9-6) Polluto-graph for Total/Soluble Cr and Cd

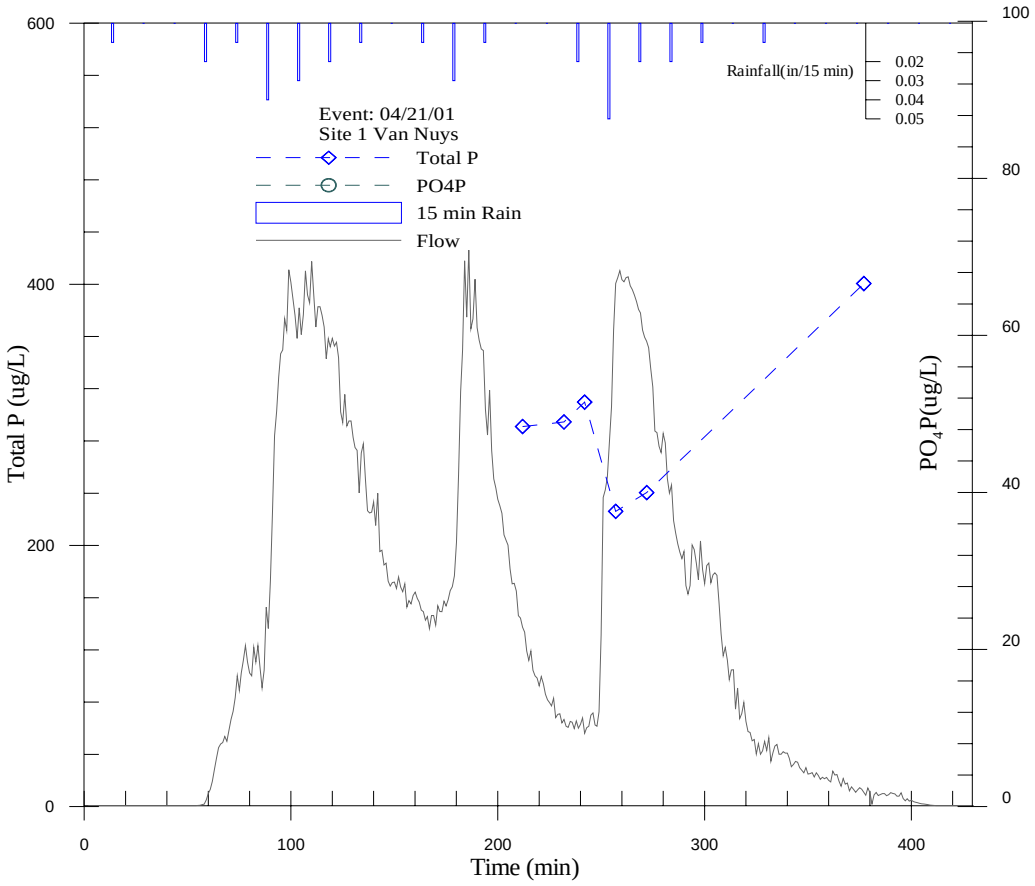


Figure I.2.1.7g (Y2-UCLA1-E9-7) Polluto-graph for Total-P and PO_4-P

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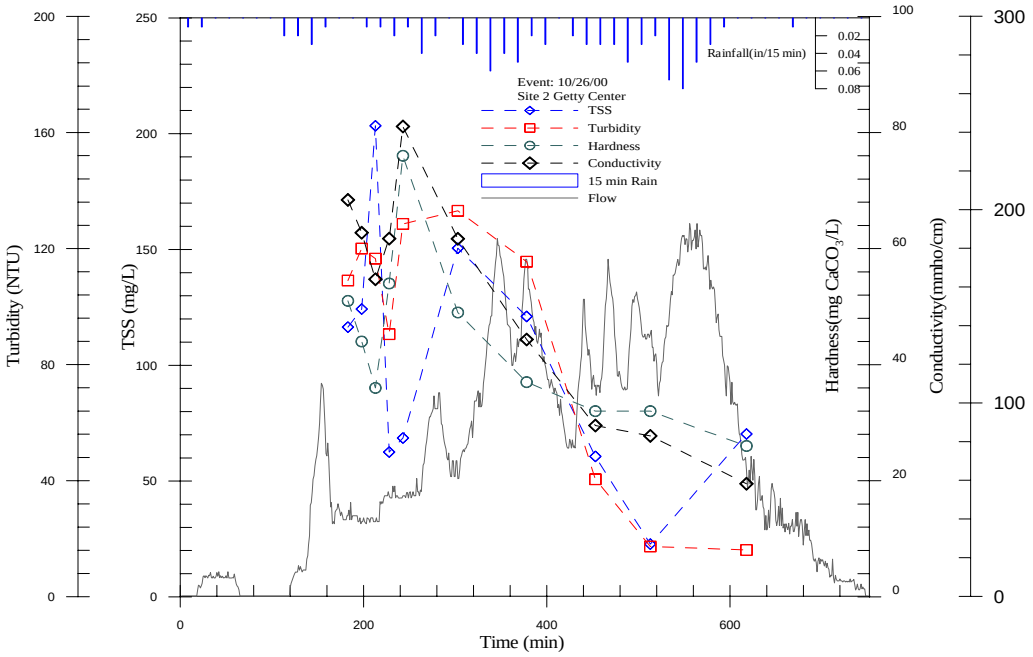

Figure I.2.2.1a (Y2-UCLA2-E1-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

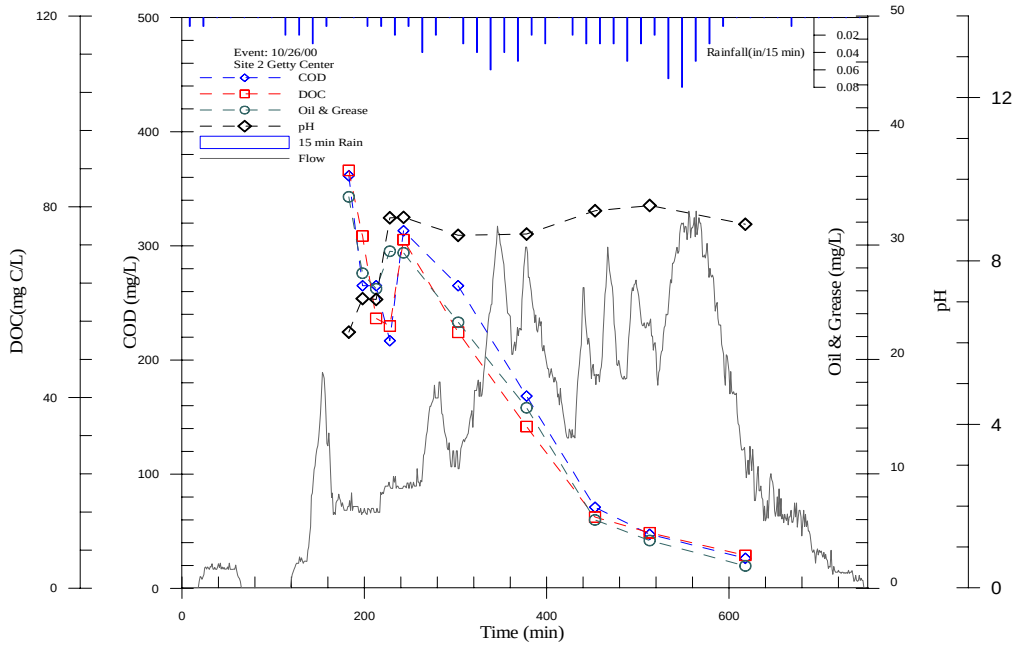

Figure I.2.2.1b (Y2-UCLA2-E1-2) Polluto-graph for COD, DOC, Oil & Grease and pH

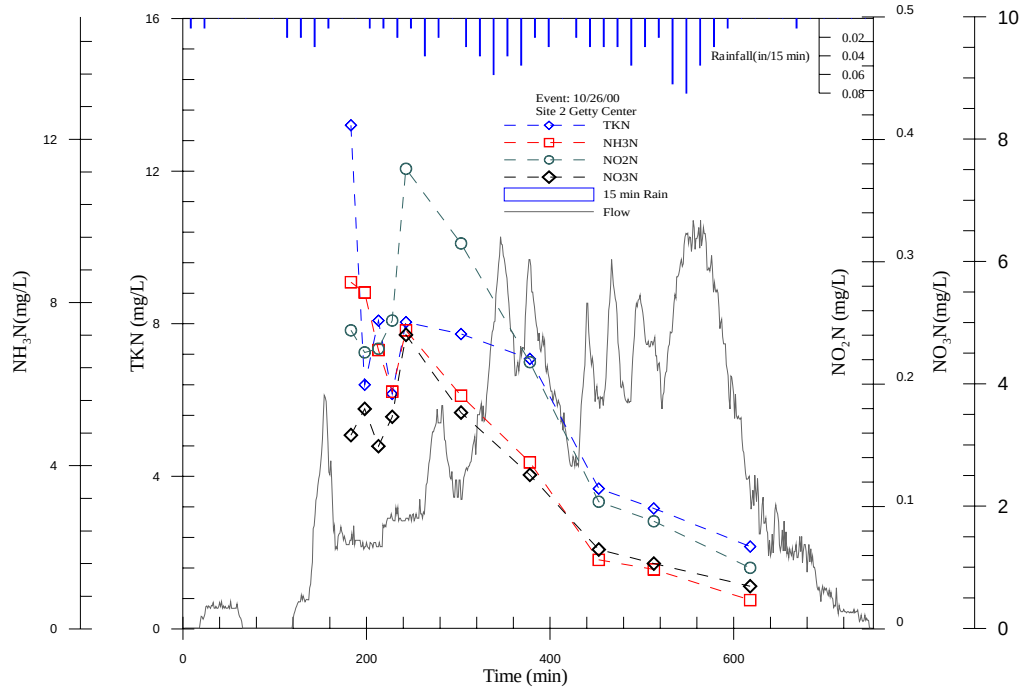

Figure I.2.2.1c (Y2-UCLA2-E1-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

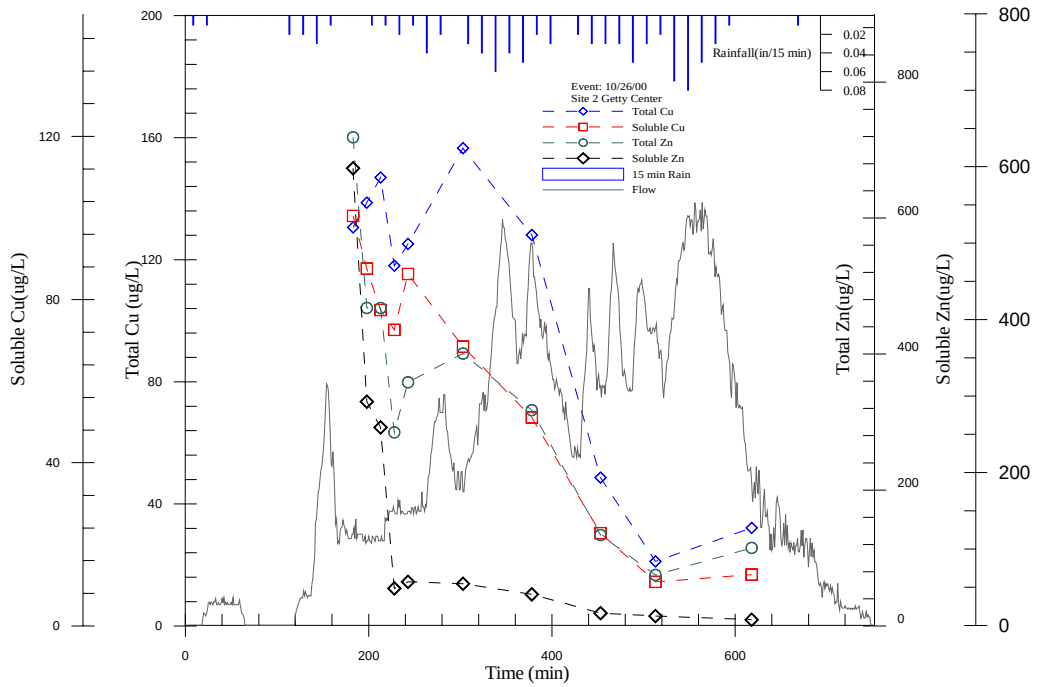

Figure I.2.2.1d (Y2-UCLA2-E1-4) Polluto-graph for Total/Soluble Cu and Zn

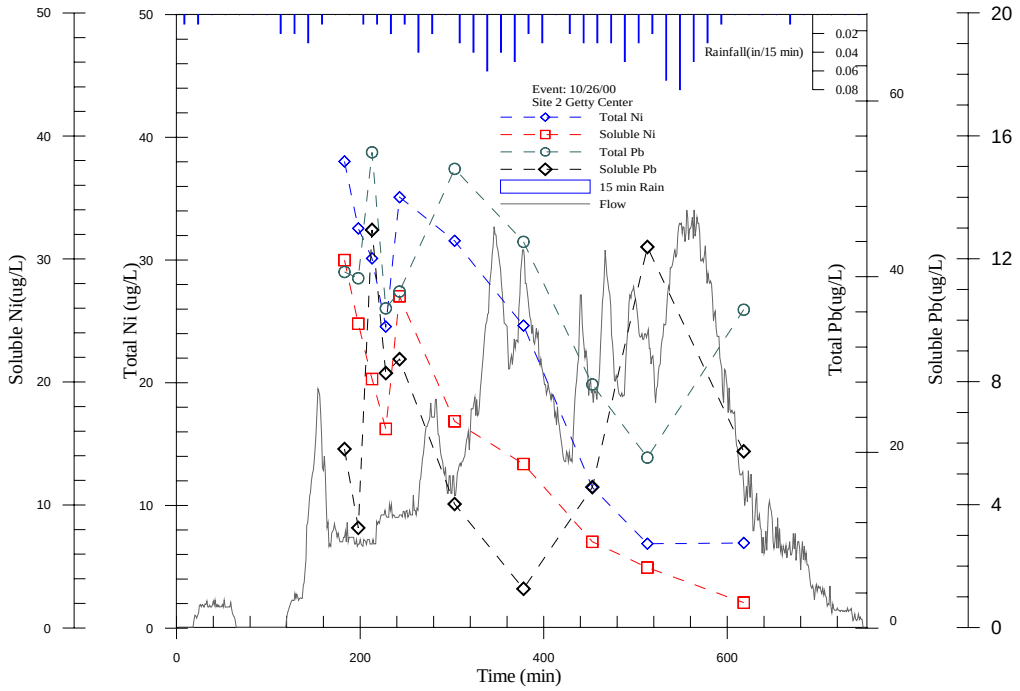

Figure I.2.2.1e (Y2-UCLA2-E1-5) Polluto-graph for Total/Soluble Ni and Pb

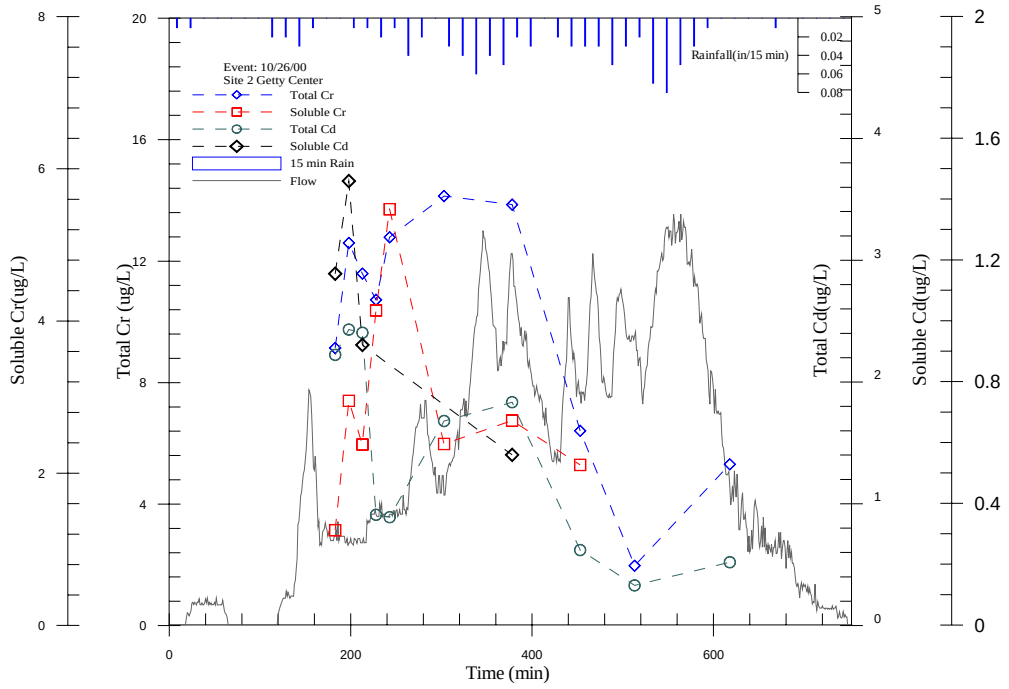

Figure I.2.2.1f (Y2-UCLA2-E1-6) Polluto-graph for Total/Soluble Cr and Cd

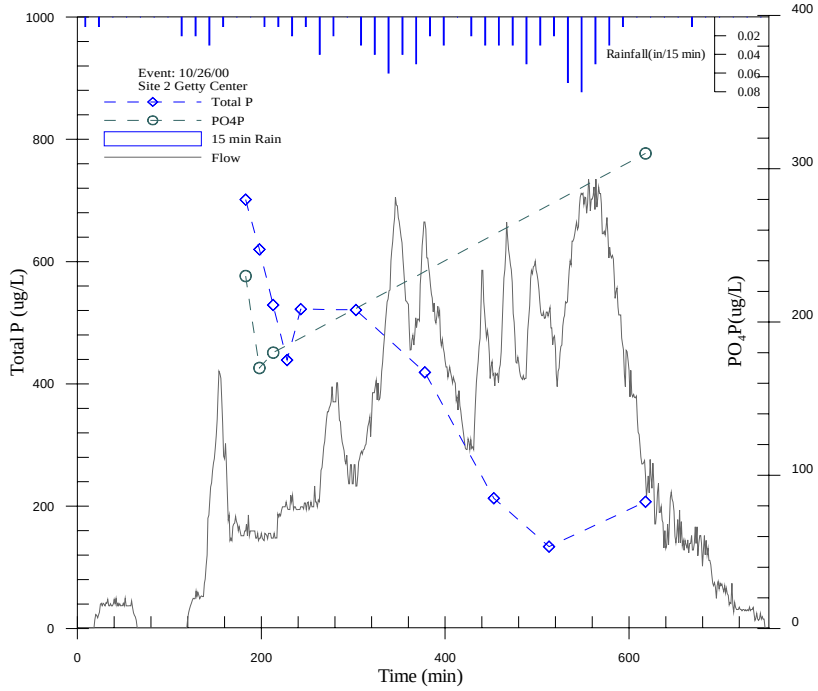

Figure I.2.2.1g (Y2-UCLA2-E1-7) Polluto-graph for Total-P and PO_4-P

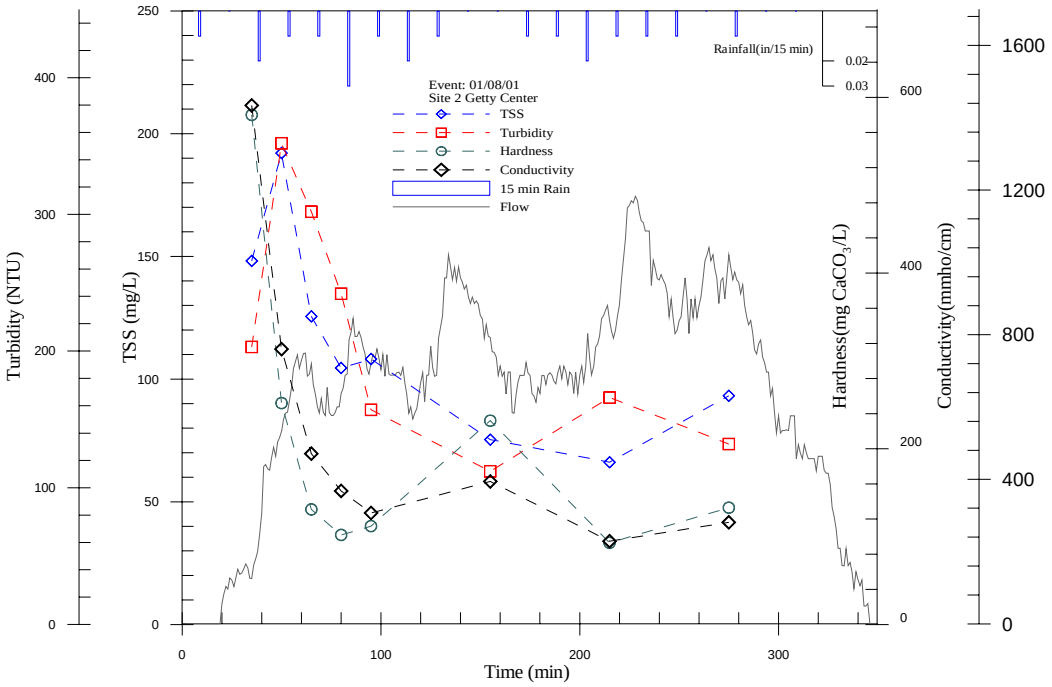

Figure I.2.2.2a (Y2-UCLA2-E2-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

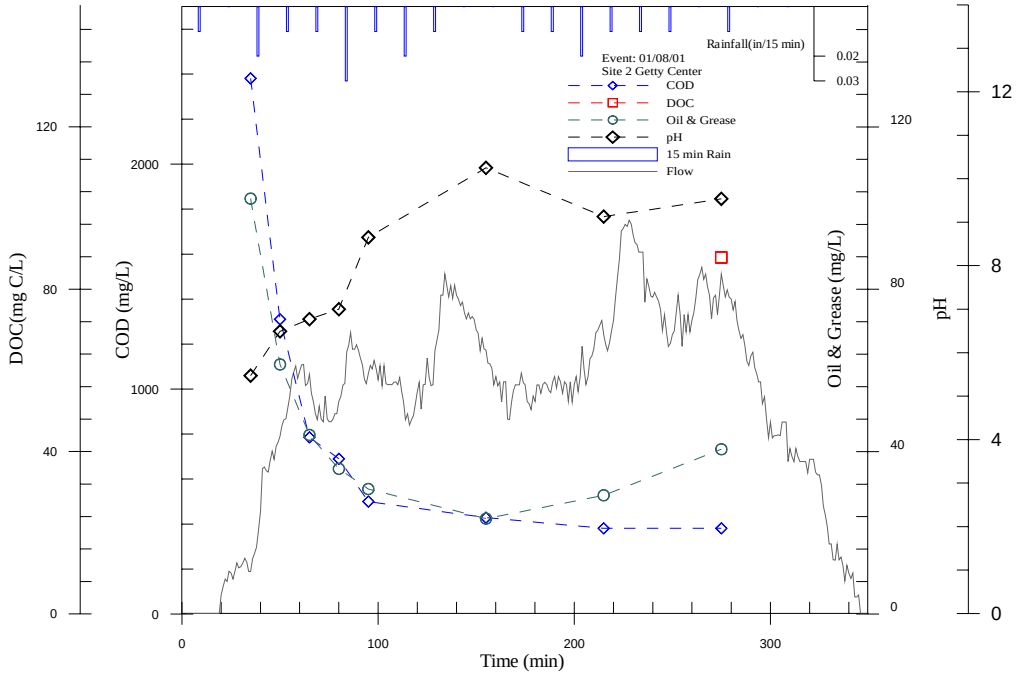

Figure I.2.2.2b (Y2-UCLA2-E2-2) Polluto-graph for COD, DOC, Oil & Grease and pH

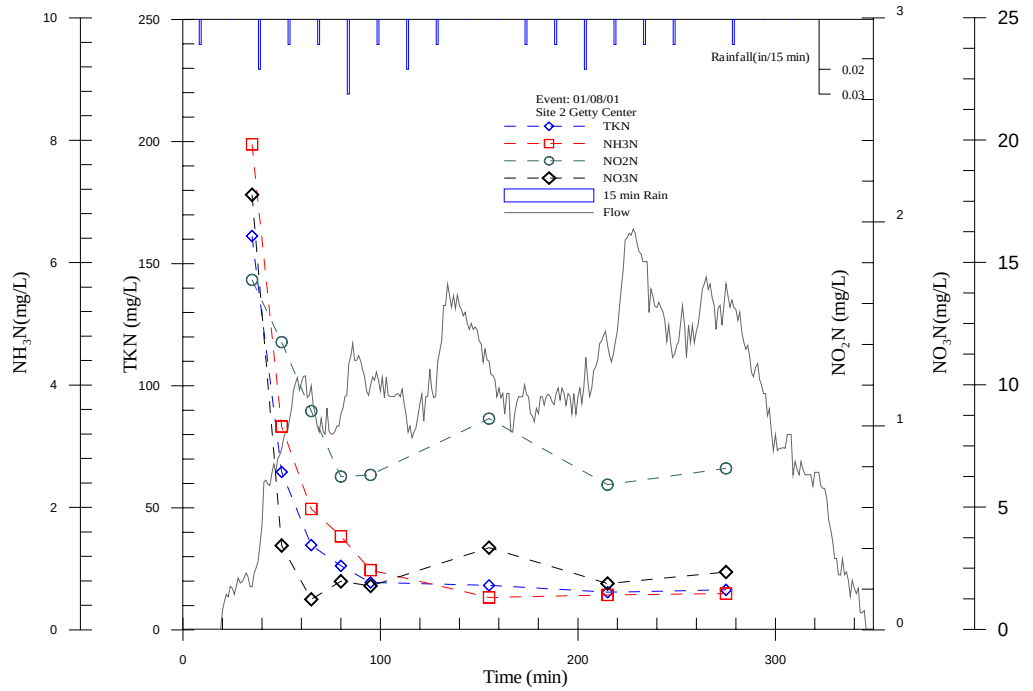

Figure I.2.2.2c (Y2-UCLA2-E2-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

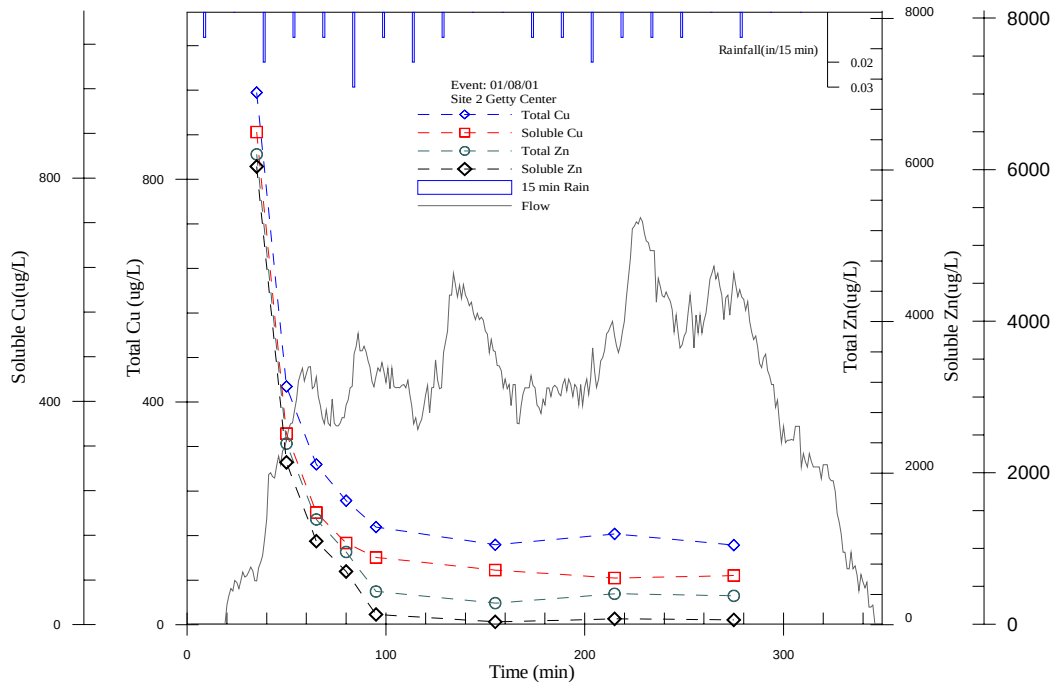

Figure I.2.2.2d (Y2-UCLA2-E2-4) Polluto-graph for Total/Soluble Cu and Zn

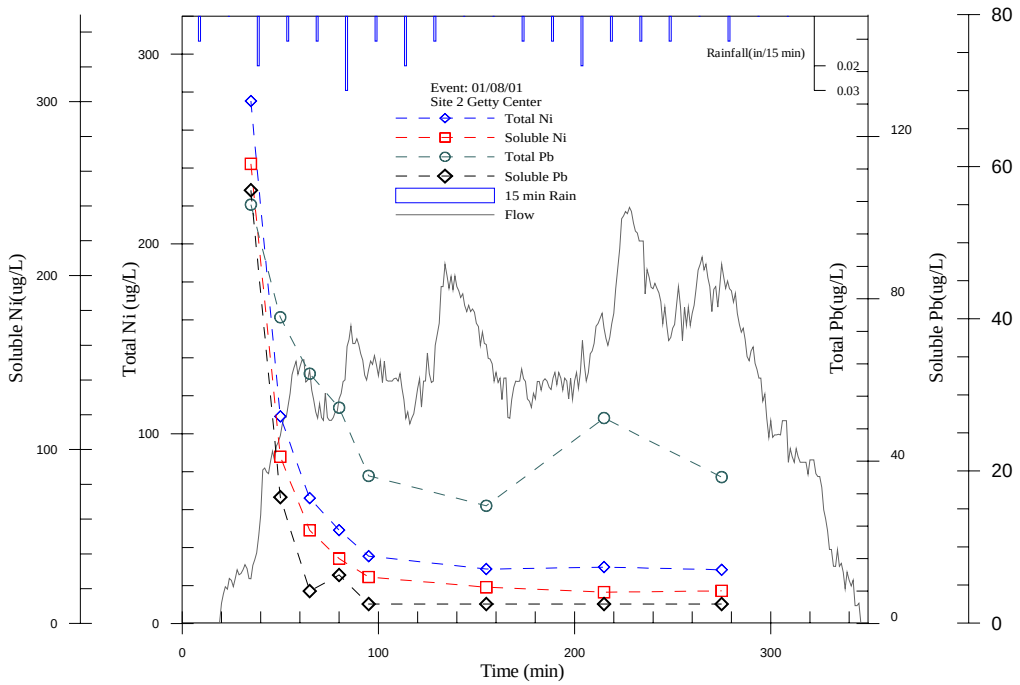

Figure I.2.2.2e (Y2-UCLA2-E2-5) Polluto-graph for Total/Soluble Ni and Pb

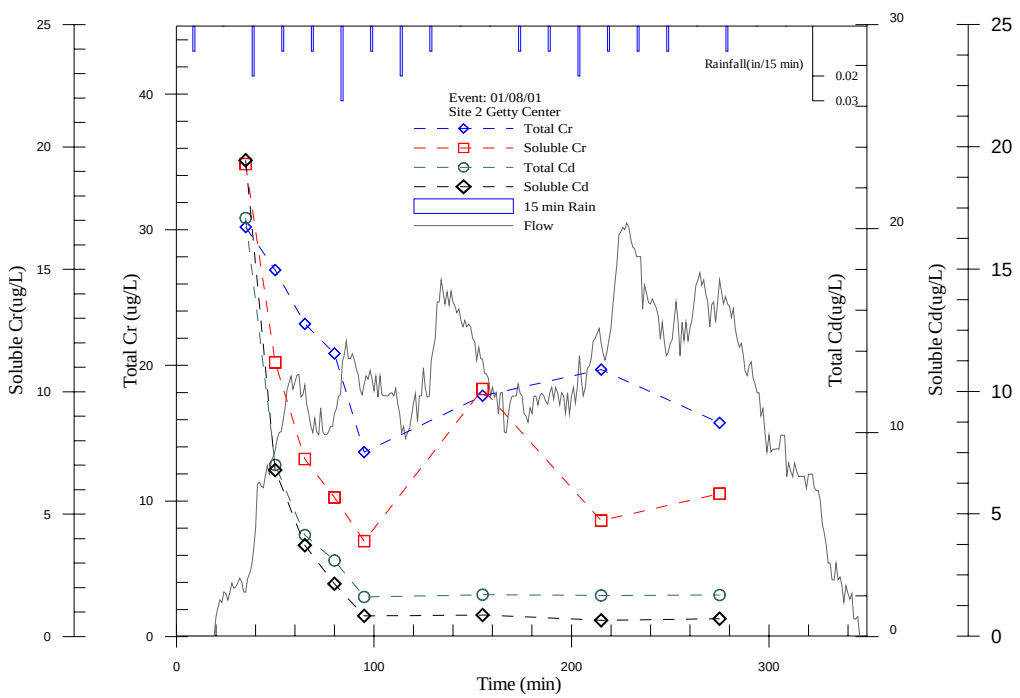

Figure I.2.2.2f (Y2-UCLA2-E2-6) Polluto-graph for Total/Soluble Cr and Cd

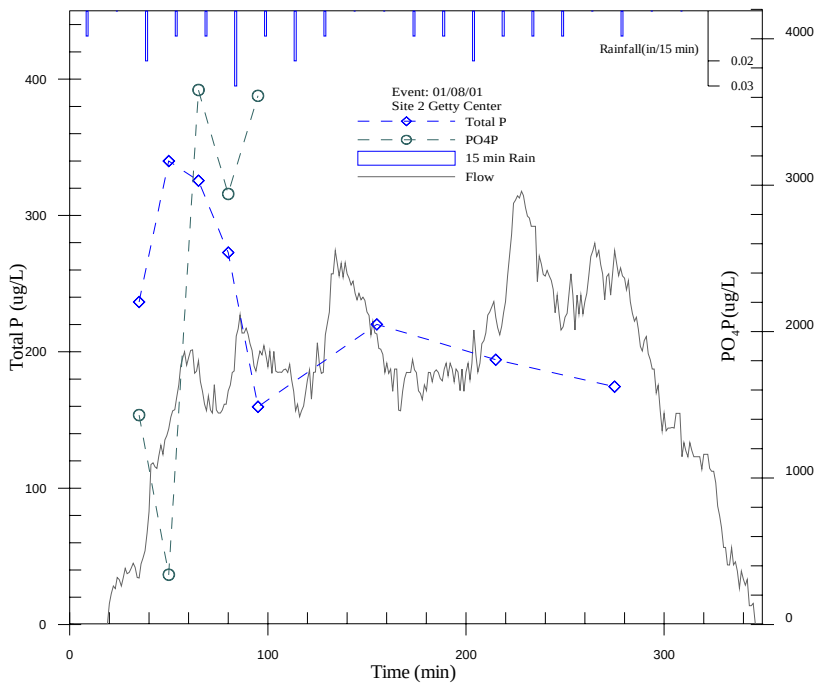

Figure I.2.2.2g (Y2-UCLA2-E2-7) Polluto-graph for Total-P and PO_4-P

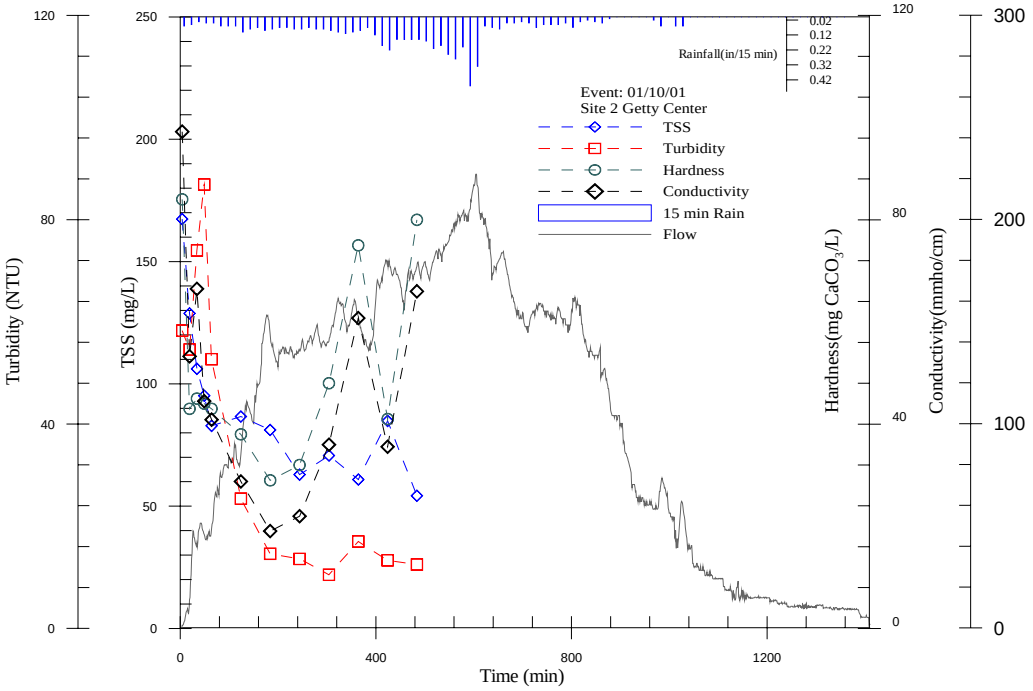

Figure I.2.2.3a (Y2-UCLA2-E3-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

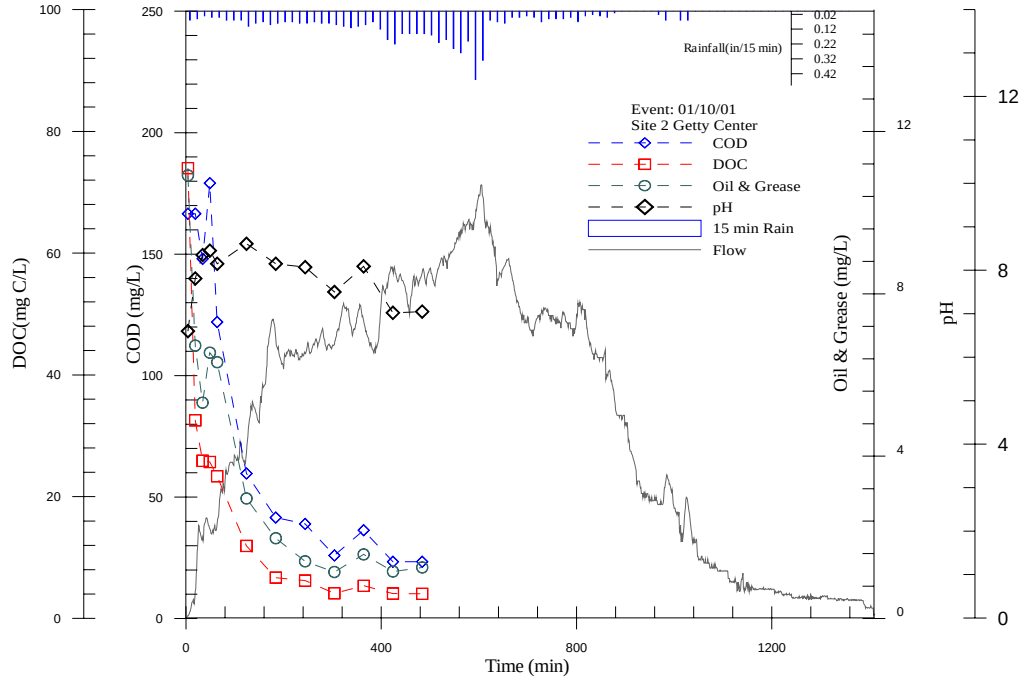

Figure I.2.2.3b (Y2-UCLA2-E3-2) Polluto-graph for COD, DOC, Oil & Grease and pH

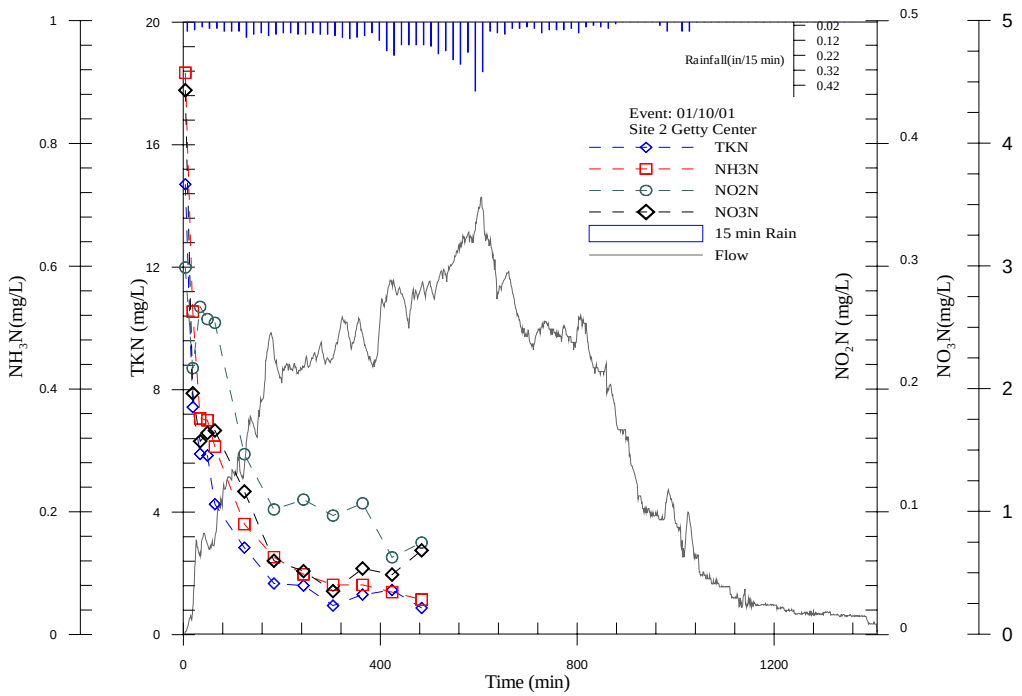

Figure I.2.2.3c (Y2-UCLA2-E3-3) Polluto-graph TKN, NH_3-N, NO_2-N and NO_3-N

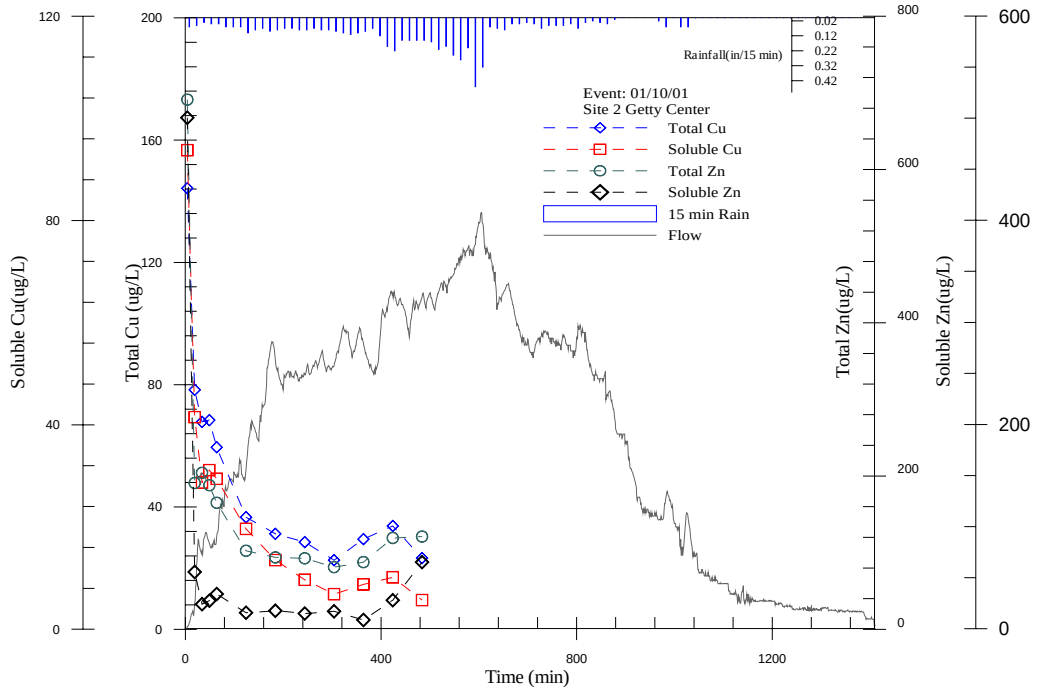

Figure I.2.2.3d (Y2-UCLA2-E3-4) Polluto-graph Total/Soluble Cu and Zn

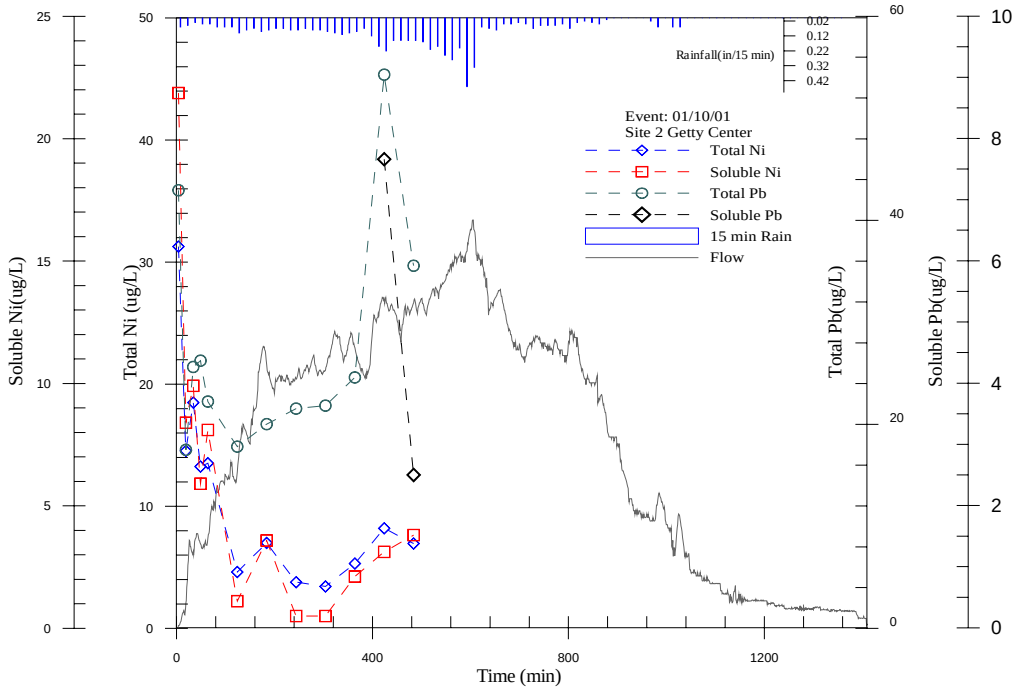

Figure I.2.2.3e (Y2-UCLA2-E3-5) Polluto-graph Total/Soluble Ni and Pb

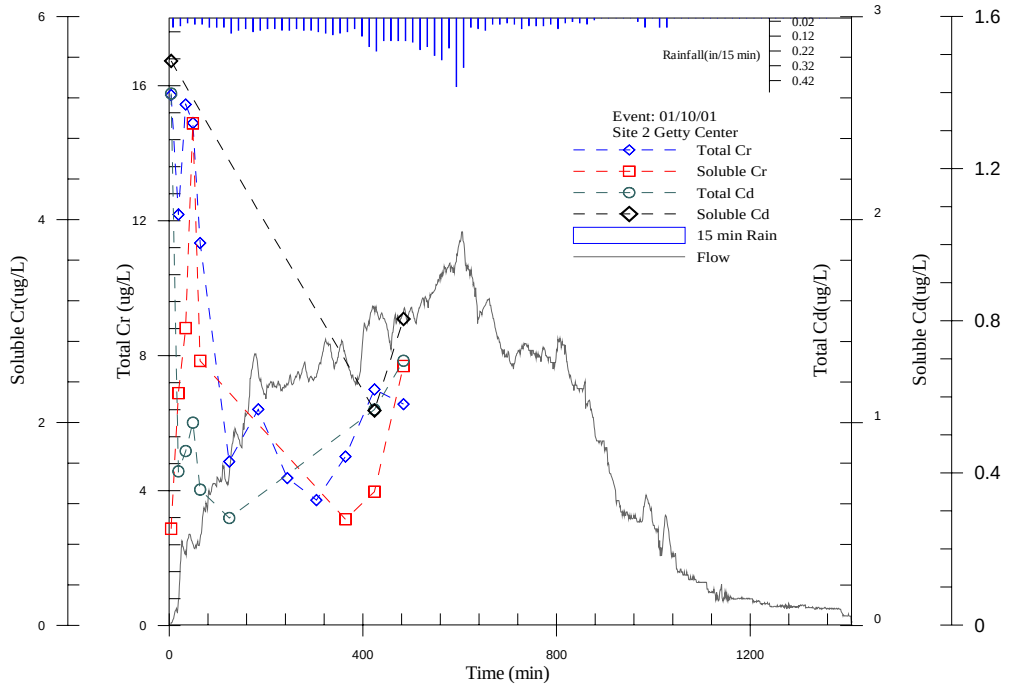

Figure I.2.2.3f (Y2-UCLA2-E3-6) Polluto-graph Total/Soluble Cr and Cd

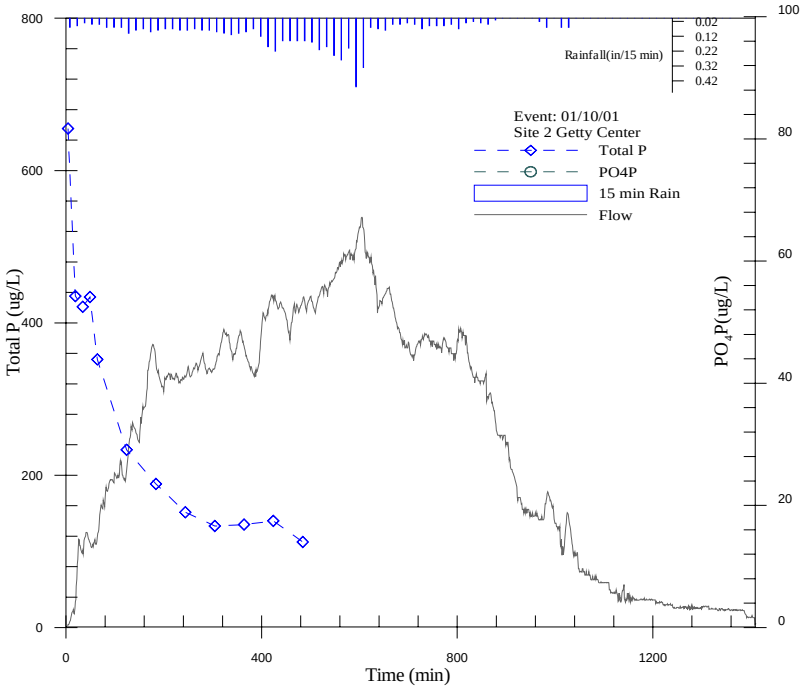

Figure I.2.2.3g (Y2-UCLA2-E3-7) Polluto-graph Total-P and PO_4-P

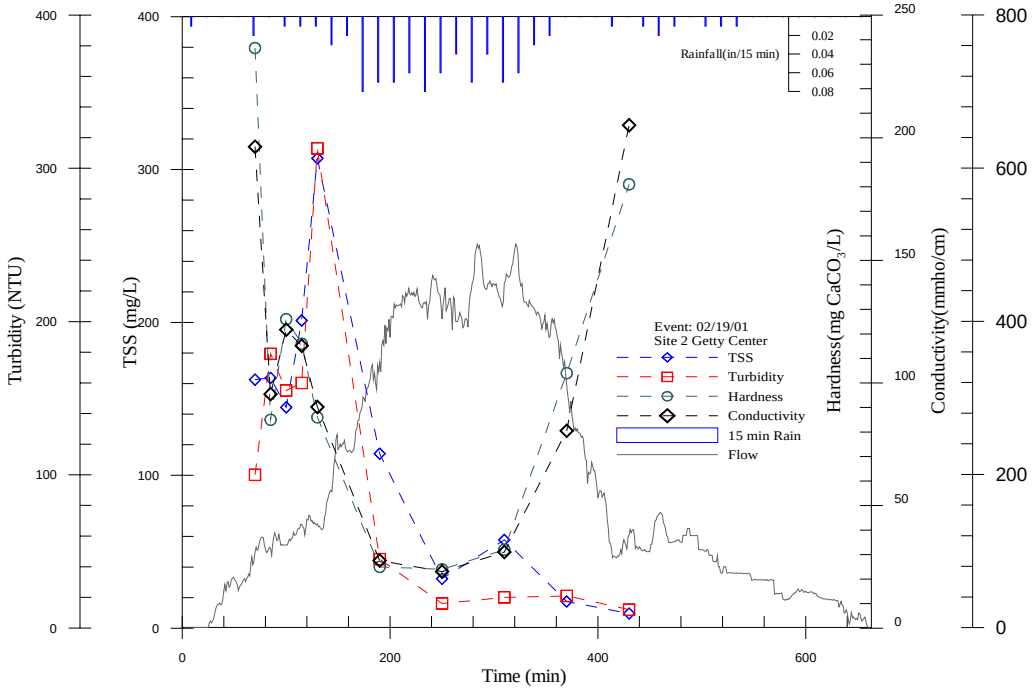

Figure I.2.2.4a (Y2-UCLA2-E5-1) Polluto-graph TSS, Turbidity, Hardness and Conductivity

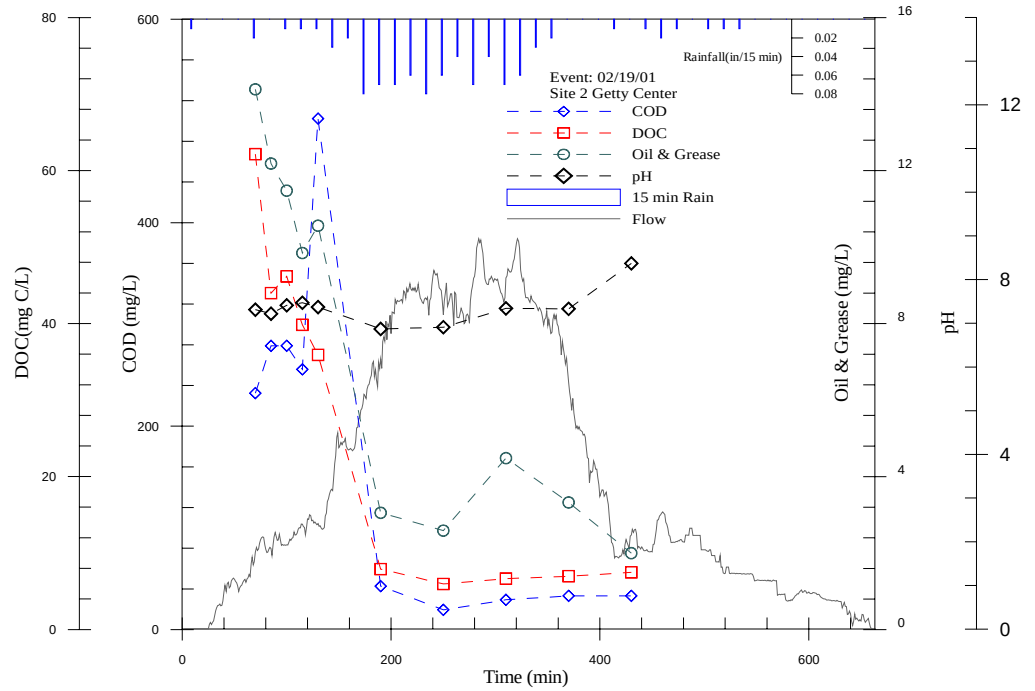

Figure I.2.2.4b (Y2-UCLA2-E5-2) Polluto-graph COD, DOC, Oil & Grease and pH

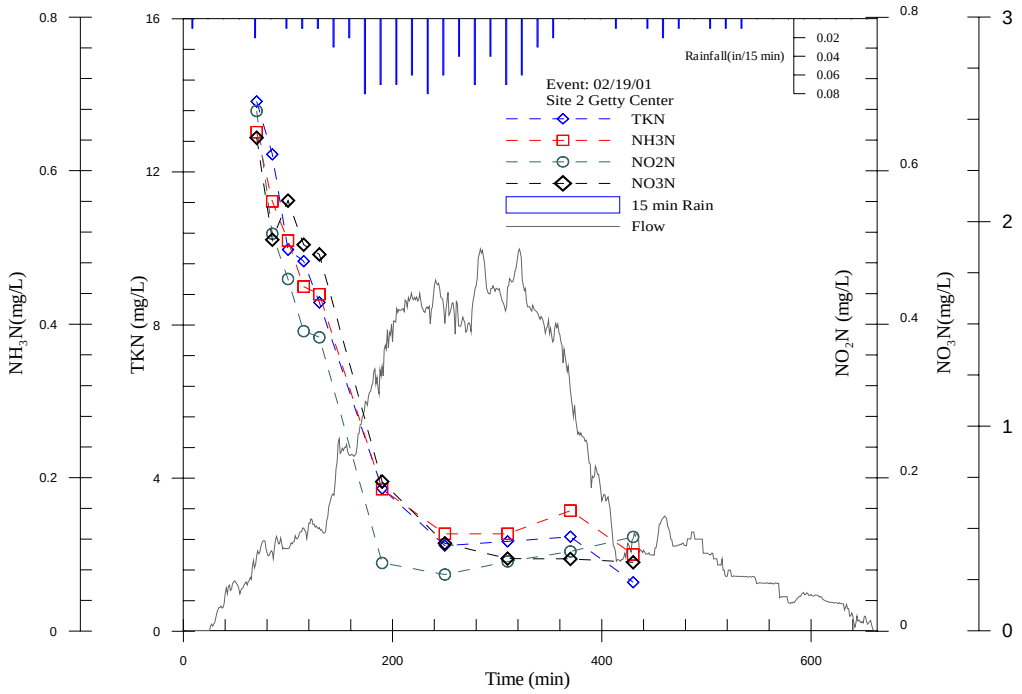

Figure I.2.2.4c (Y2-UCLA2-E5-3) Polluto-graph TKN, NH_3-N, NO_2-N and NO_3-N

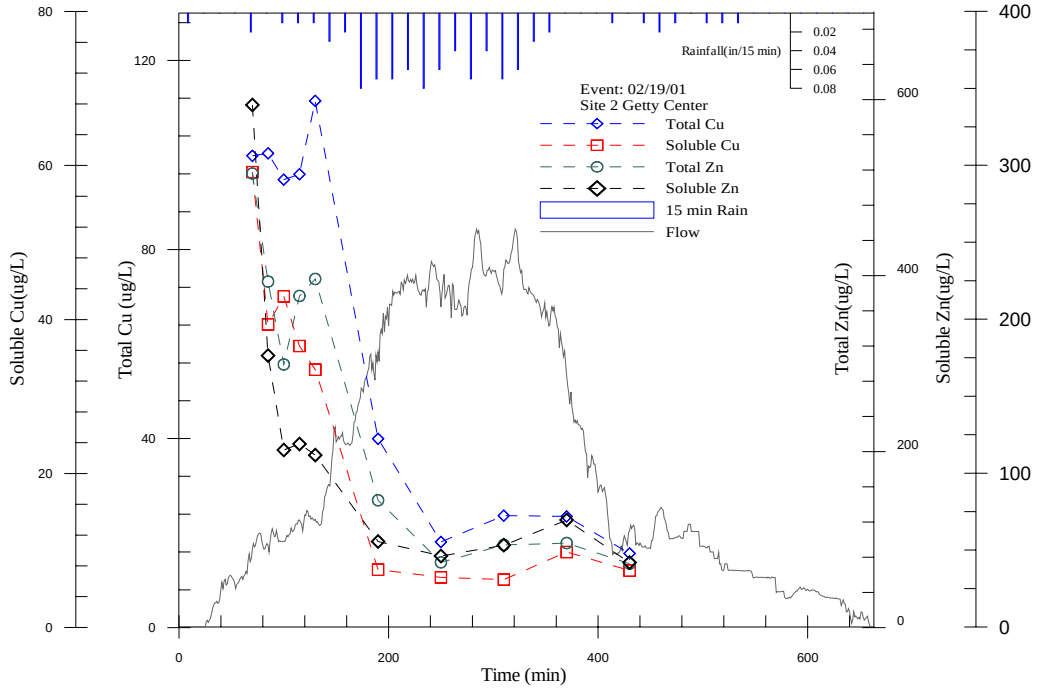

Figure I.2.2.4d (Y2-UCLA2-E5-4) Polluto-graph Total/Soluble Cu and Zn

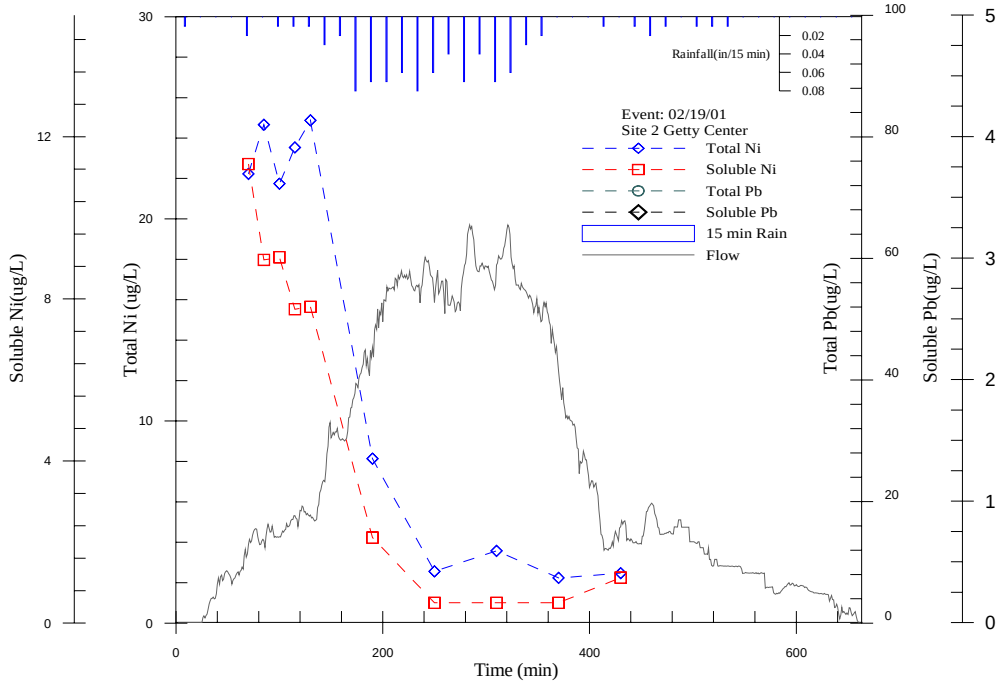

Figure I.2.2.4e (Y2-UCLA2-E5-5) Polluto-graph Total/Soluble Ni and Pb

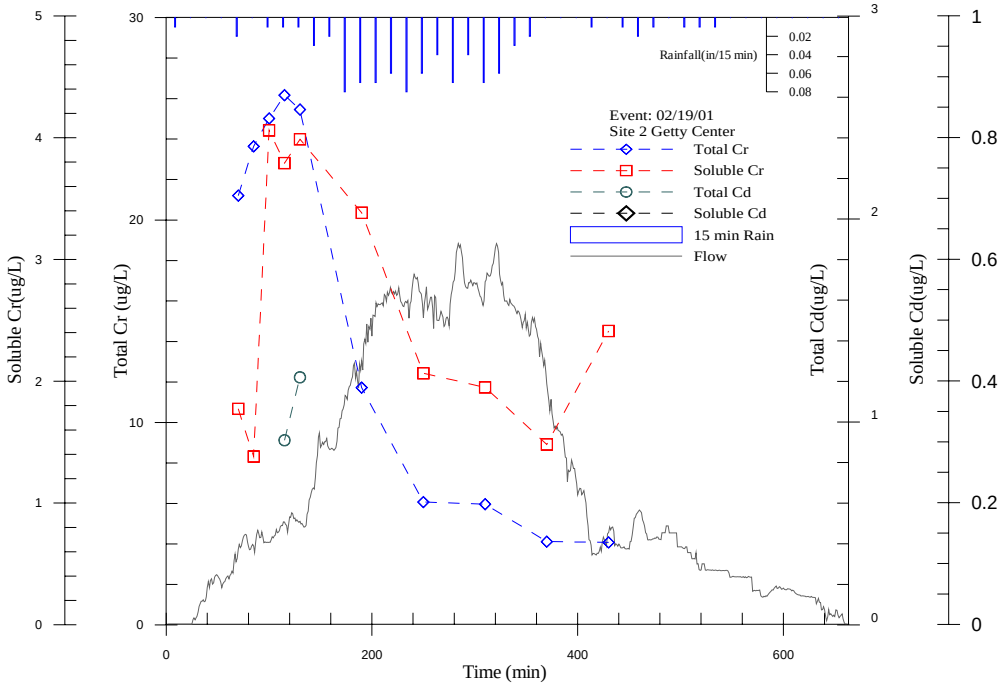

Figure I.2.2.4f (Y2-UCLA2-E5-6) Polluto-graph Total/Soluble Cr and Cd

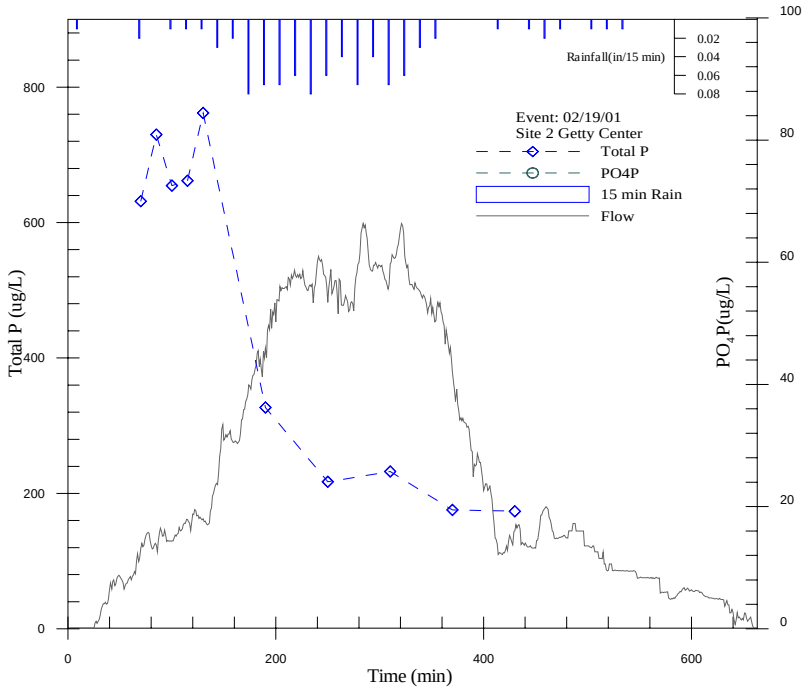

Figure I.2.2.4g (Y2-UCLA2-E5-7) Polluto-graph Total-P and PO_4-P

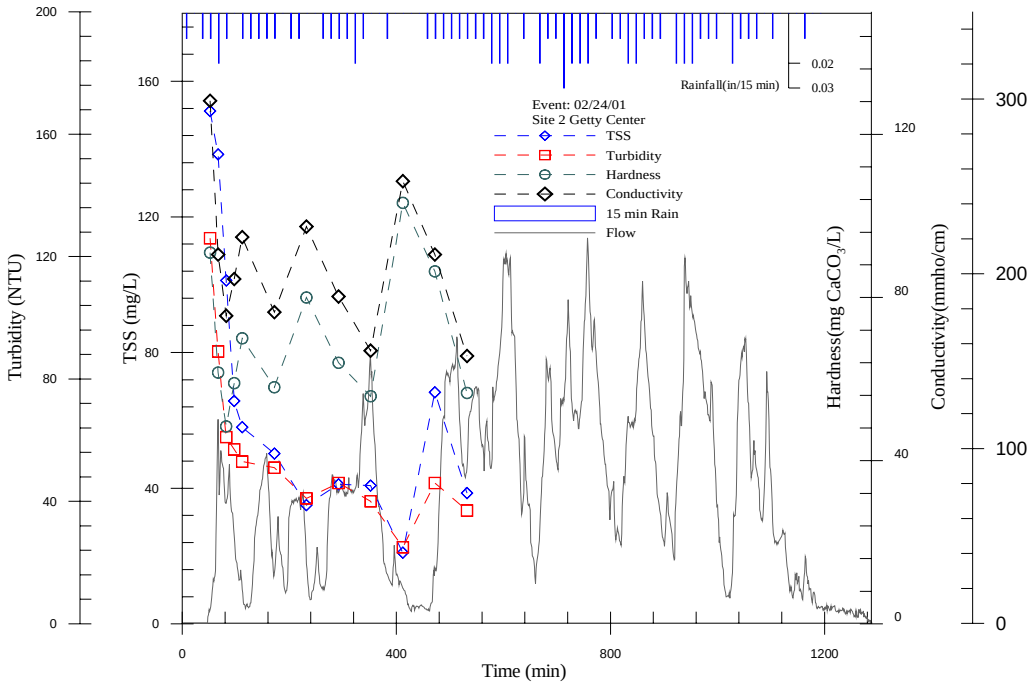

Figure I.2.2.5a (Y2-UCLA2-E6-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

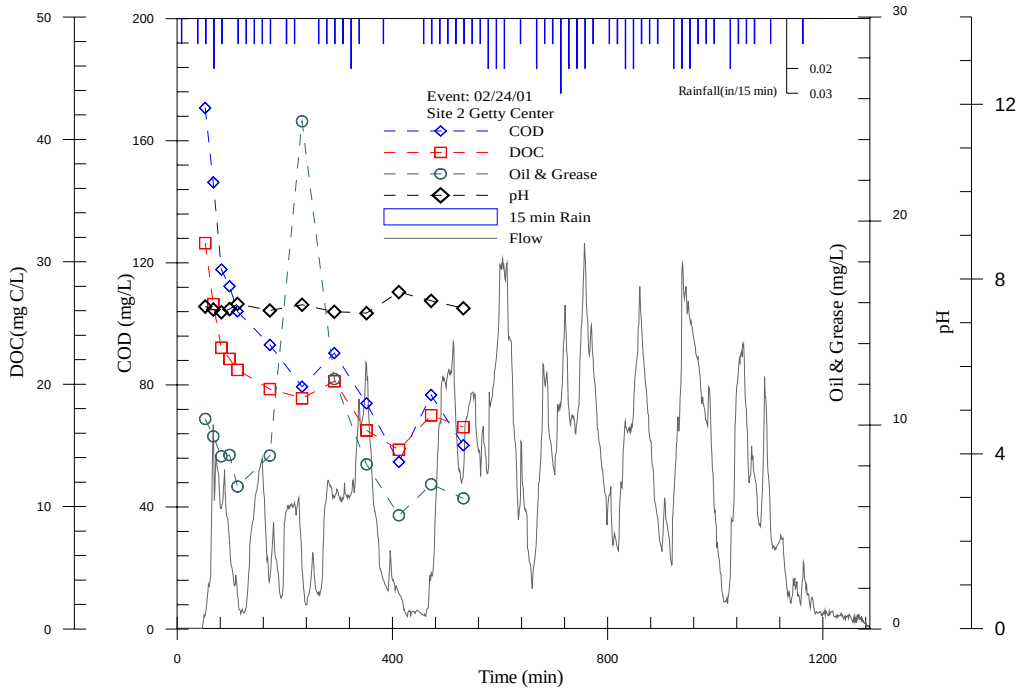

Figure I.2.2.5b (Y2-UCLA2-E6-2) Polluto-graph for COD, DOC, Oil & Grease and pH

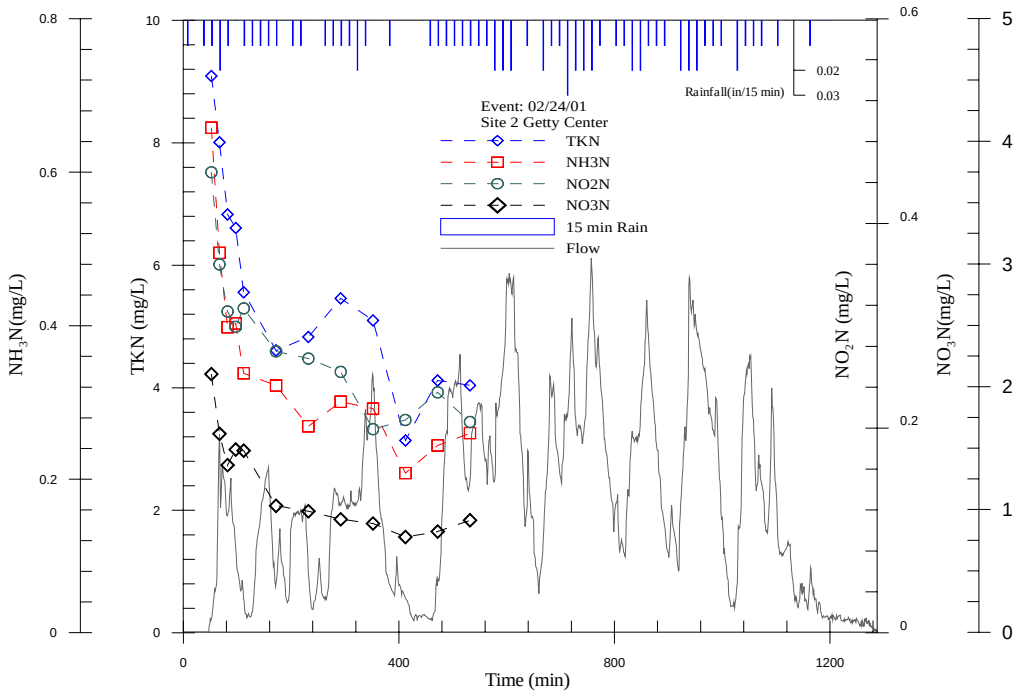

Figure I.2.2.5c (Y2-UCLA2-E6-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

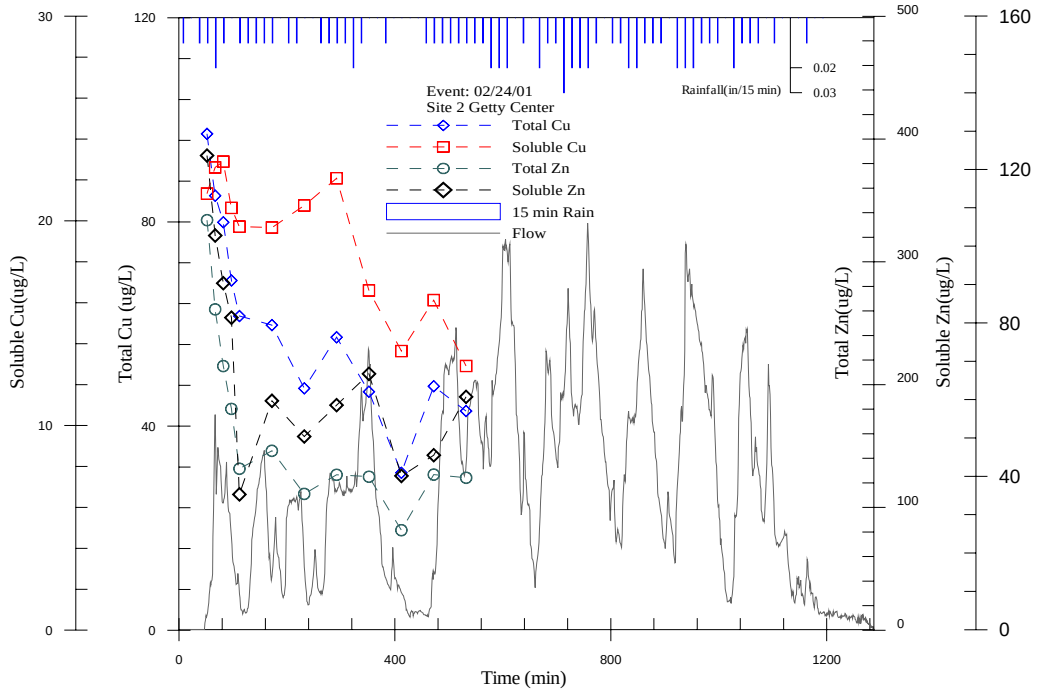

Figure I.2.2.5d (Y2-UCLA2-E6-4) Polluto-graph for Total/Soluble Cu and Zn

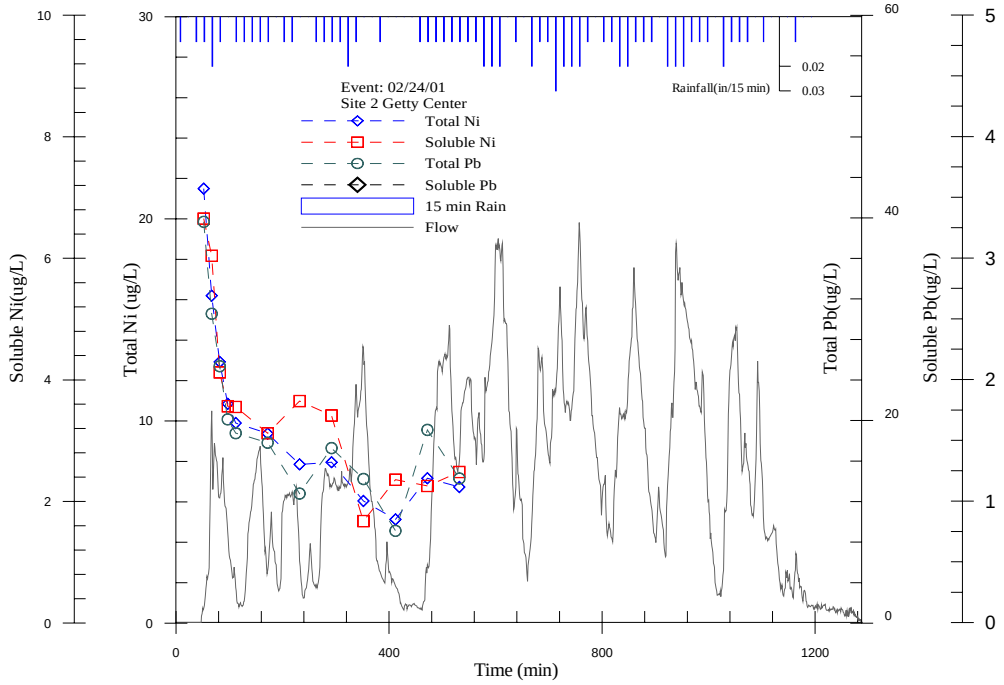

Figure I.2.2.5e (Y2-UCLA2-E6-5) Polluto-graph for Total/Soluble Ni and Pb

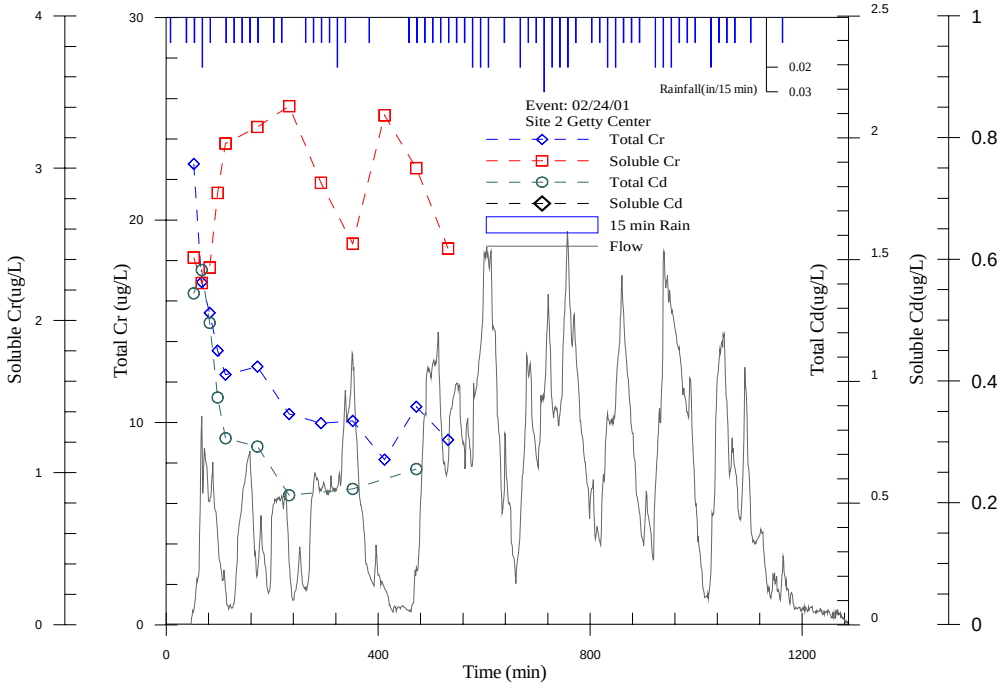

Figure I.2.2.5f (Y2-UCLA2-E6-6) Polluto-graph for Total/Soluble Cr and Cd

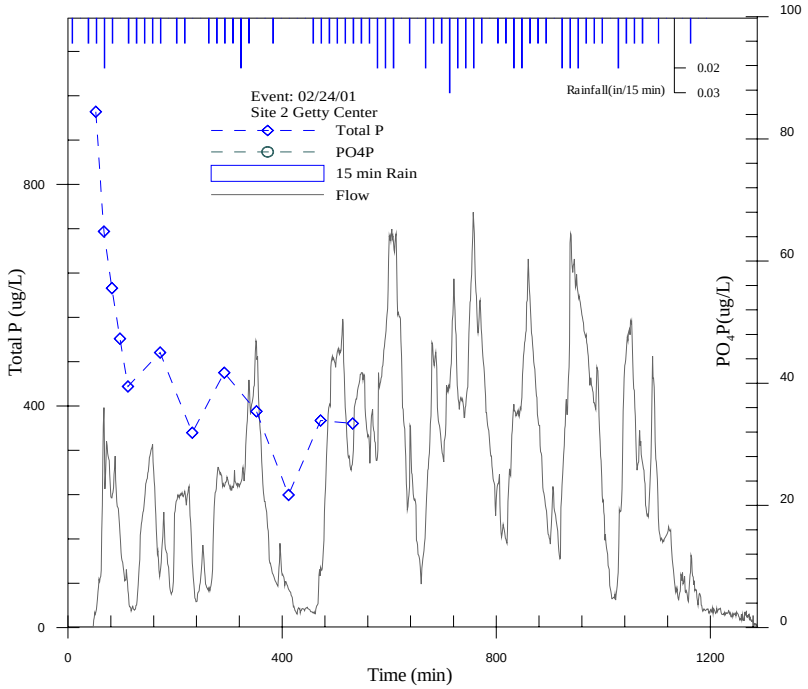

Figure I.2.2.5g (Y2-UCLA2-E6-7) Polluto-graph for Total-P and PO_4-P

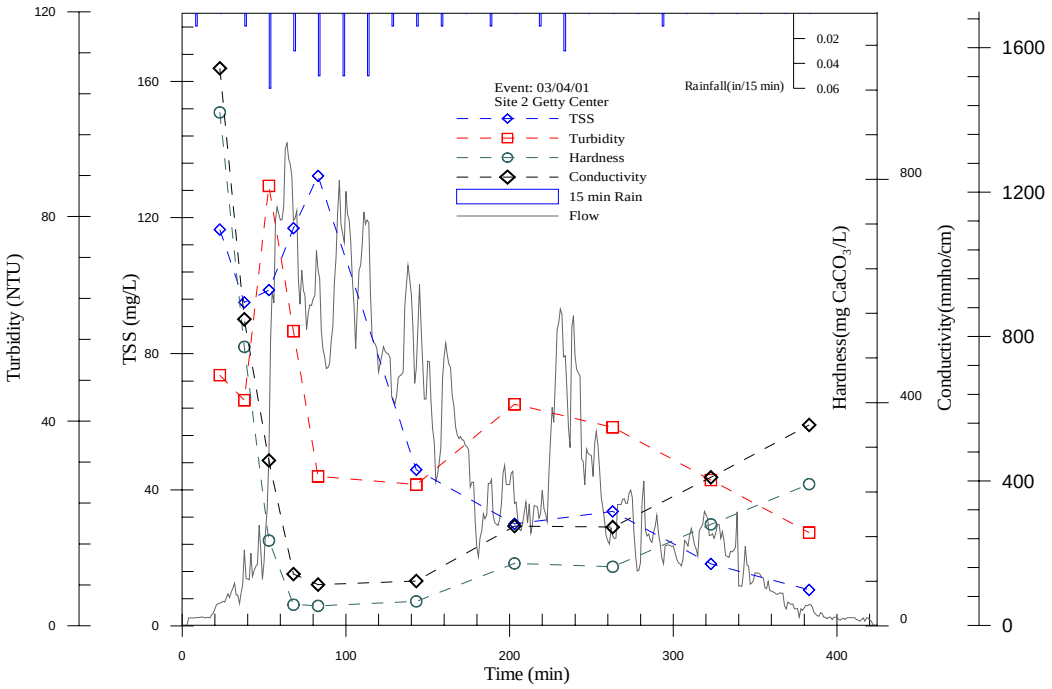

Figure I.2.2.6a (Y2-UCLA2-E7-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

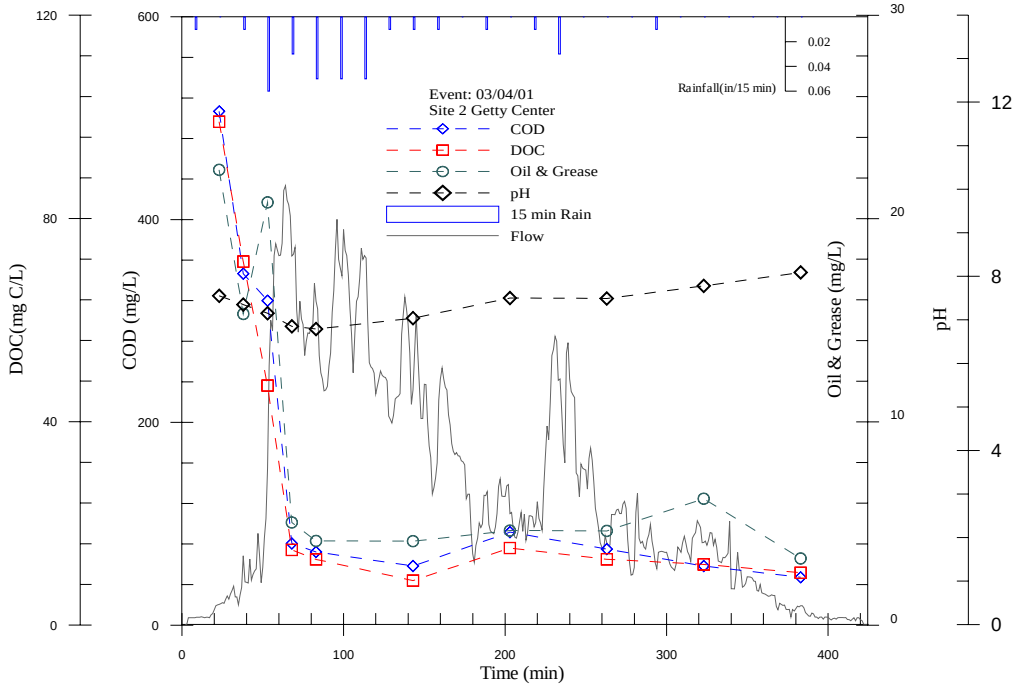

Figure I.2.2.6b (Y2-UCLA2-E7-2) Polluto-graph for COD, DOC, Oil & Grease and pH

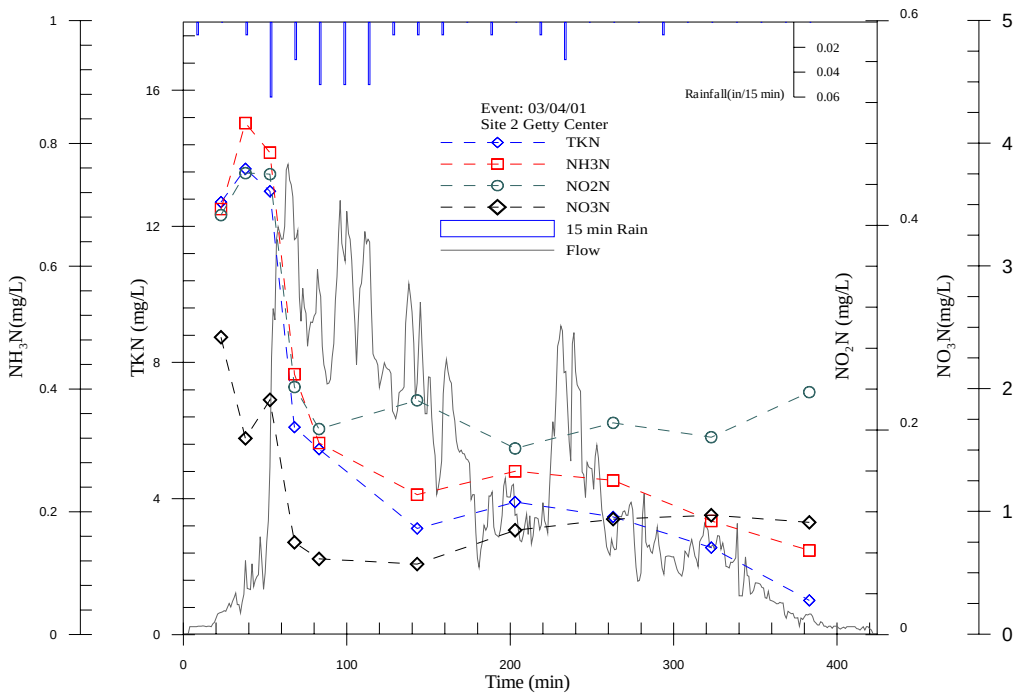

Figure I.2.2.6c (Y2-UCLA2-E7-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

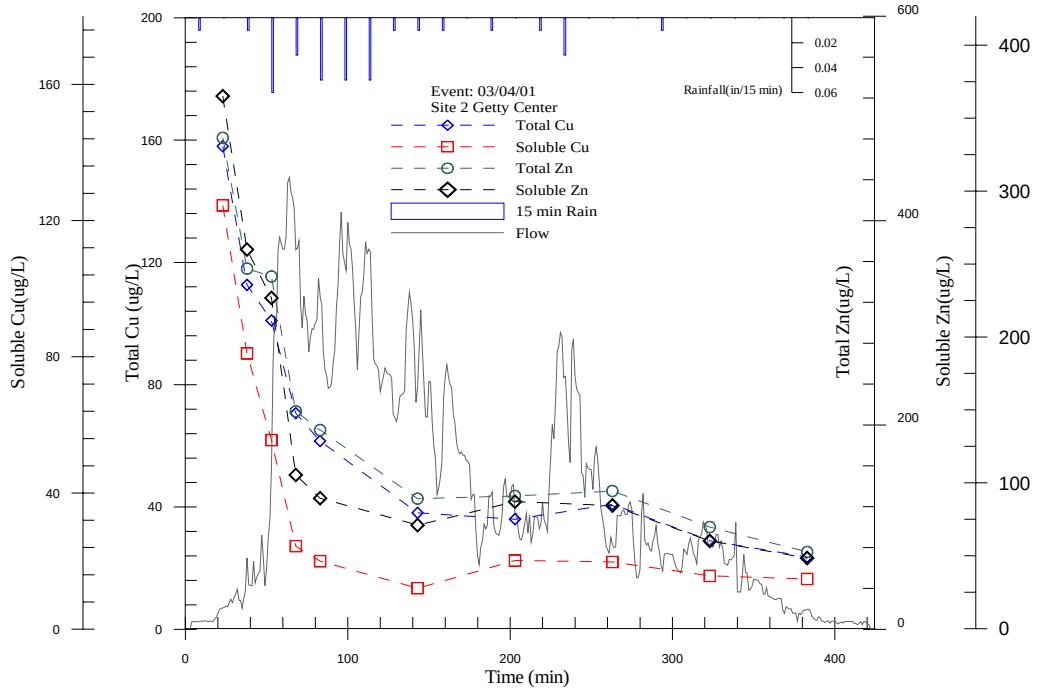

Figure I.2.2.6d (Y2-UCLA2-E7-4) Polluto-graph for Total/Soluble Cu and Zn

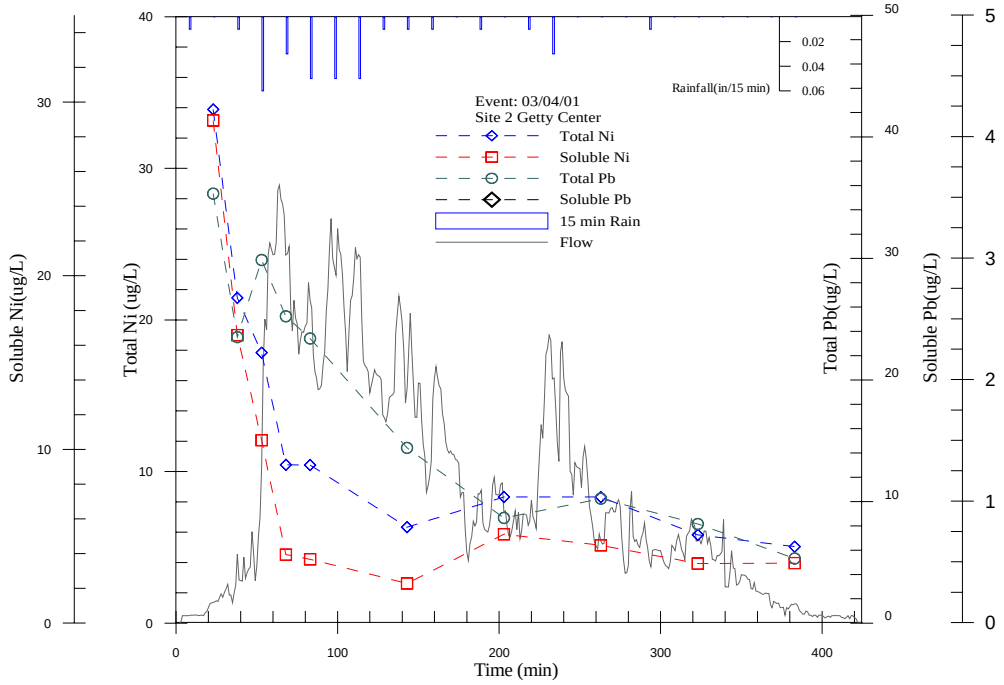

Figure I.2.2.6e (Y2-UCLA2-E7-5) Polluto-graph for Total/Soluble Ni and Pb

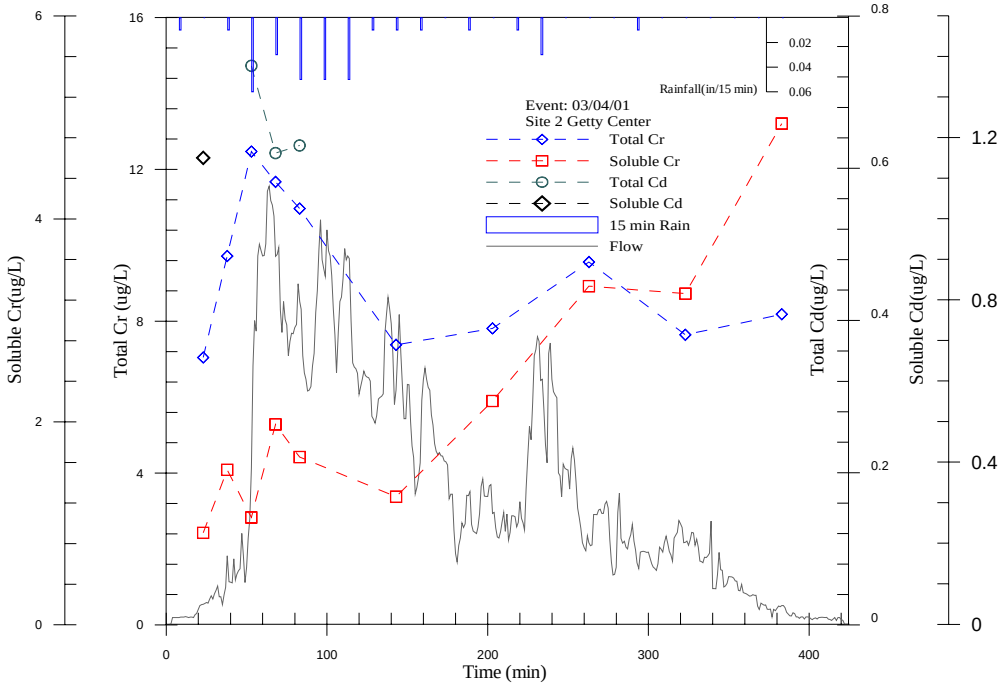

Figure I.2.2.6f (Y2-UCLA2-E7-6) Polluto-graph for Total/Soluble Cr and Cd

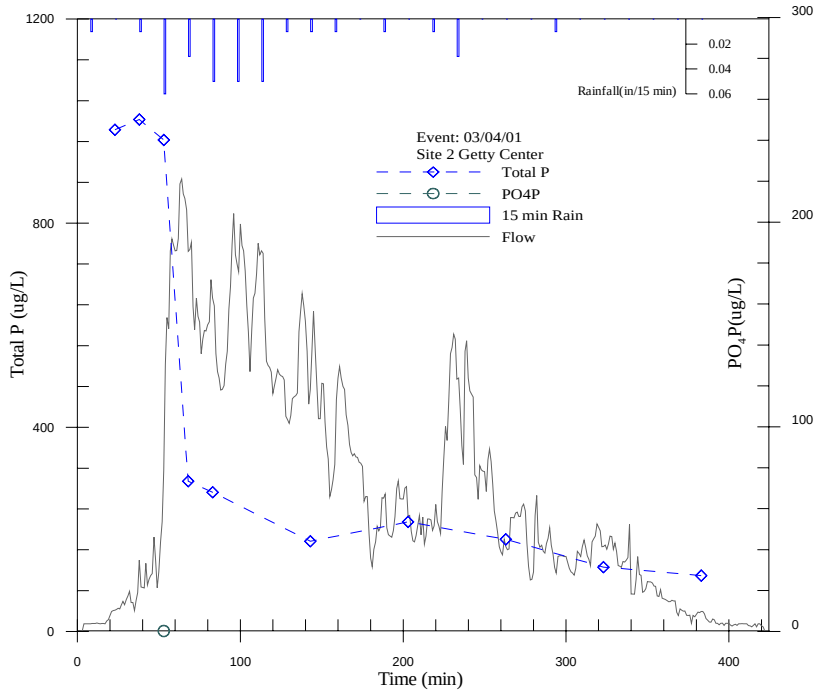

Figure I.2.2.6g (Y2-UCLA2-E7-7) Polluto-graph for Total-P and PO_4-P

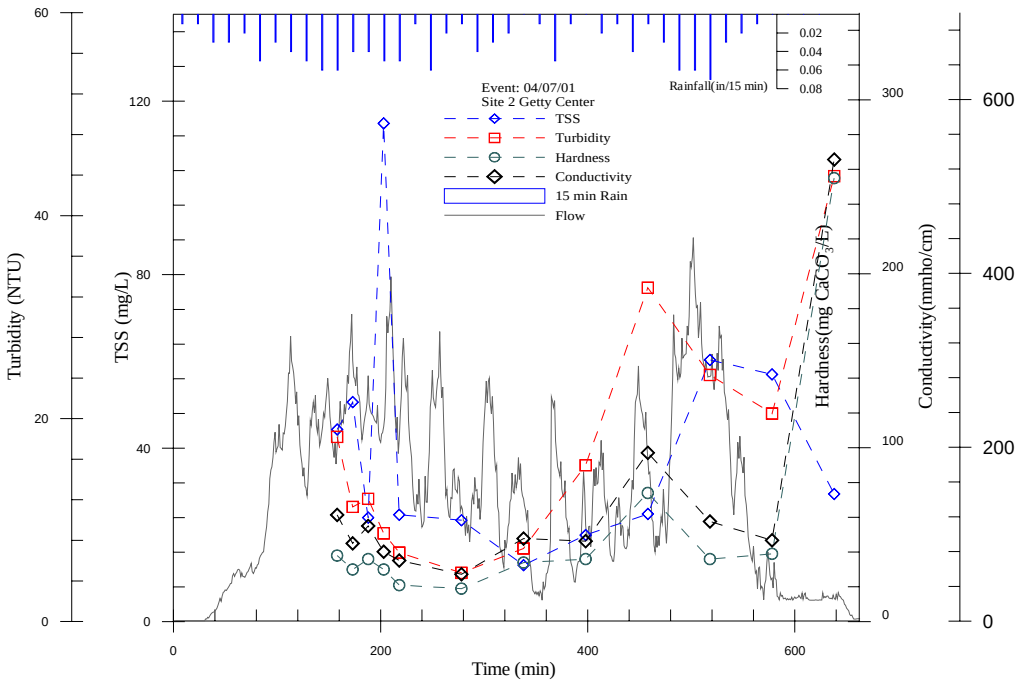

Figure I.2.2.7a (Y2-UCLA2-E8-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

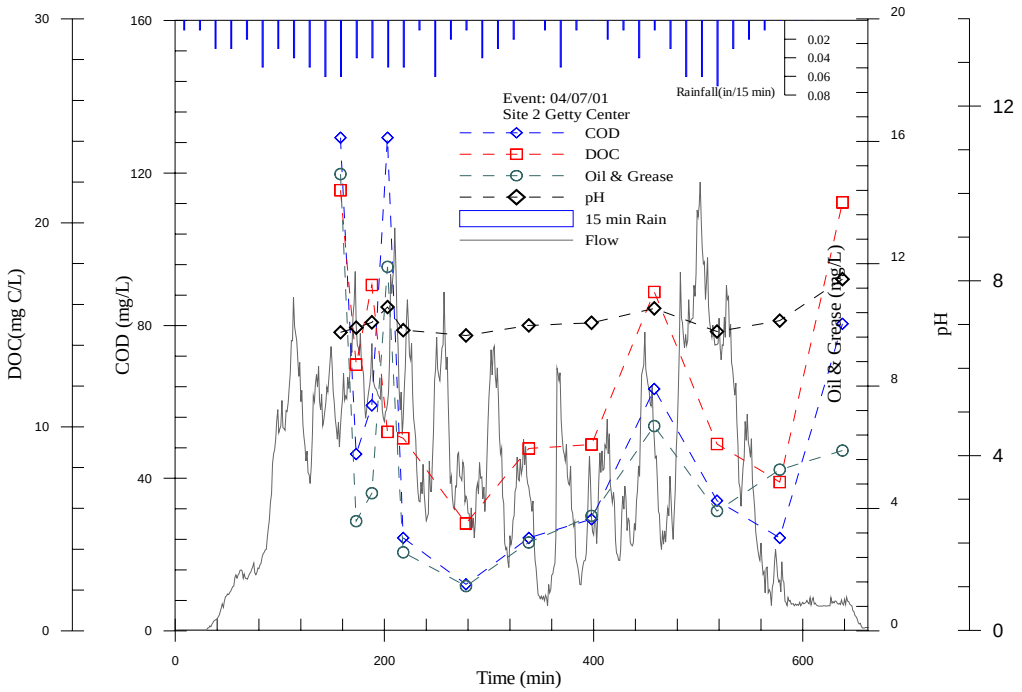

Figure I.2.2.7b (Y2-UCLA2-E8-2) Polluto-graph for COD, DOC, Oil & Grease and pH

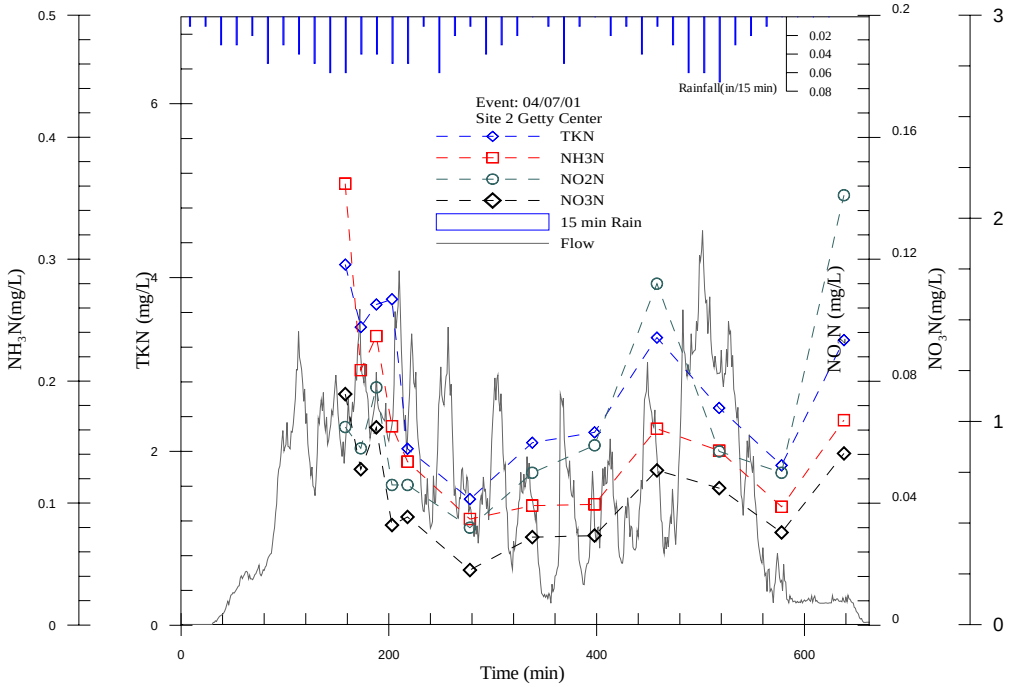

Figure I.2.2.7c (Y2-UCLA2-E8-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

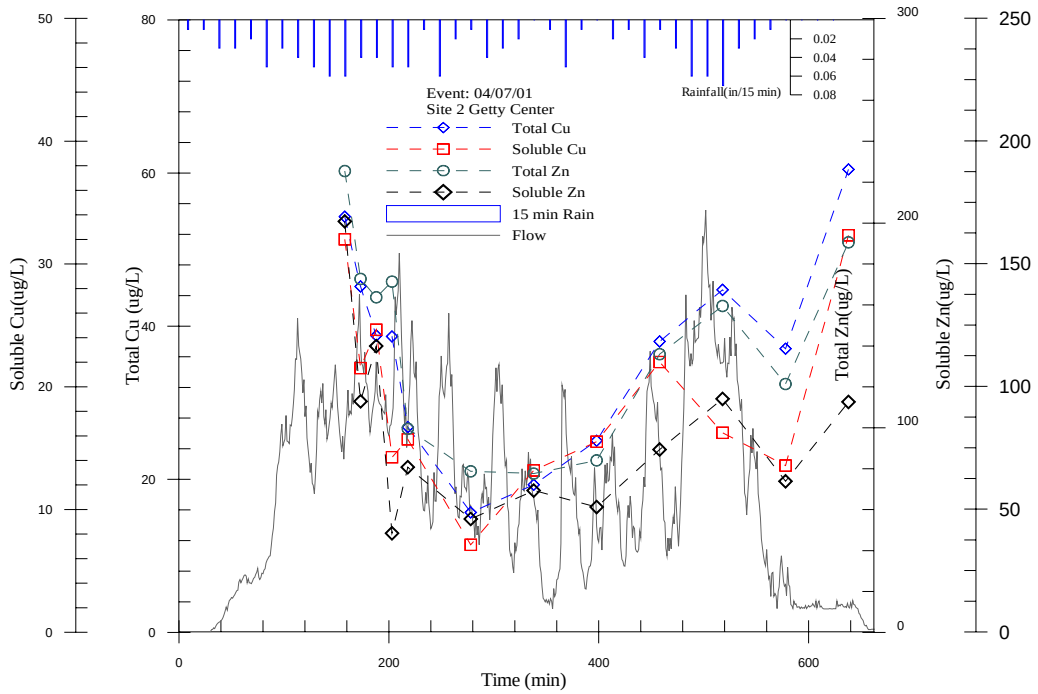

Figure I.2.2.7d (Y2-UCLA2-E8-4) Polluto-graph for Total/Soluble Cu and Zn

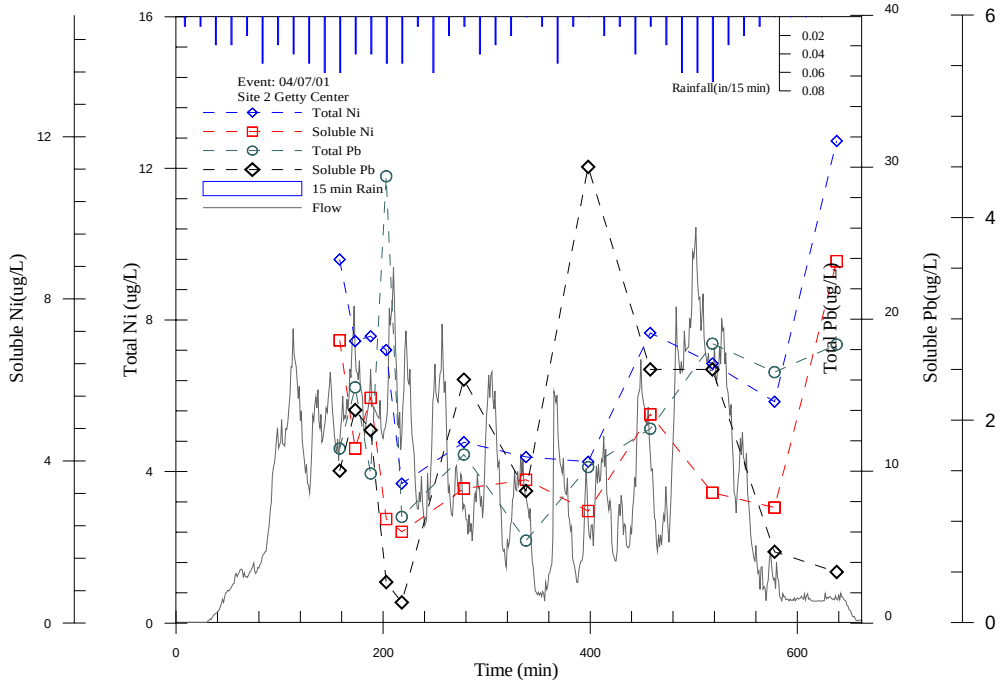

Figure I.2.2.7e (Y2-UCLA2-E8-5) Polluto-graph for Total/Soluble Ni and Pb

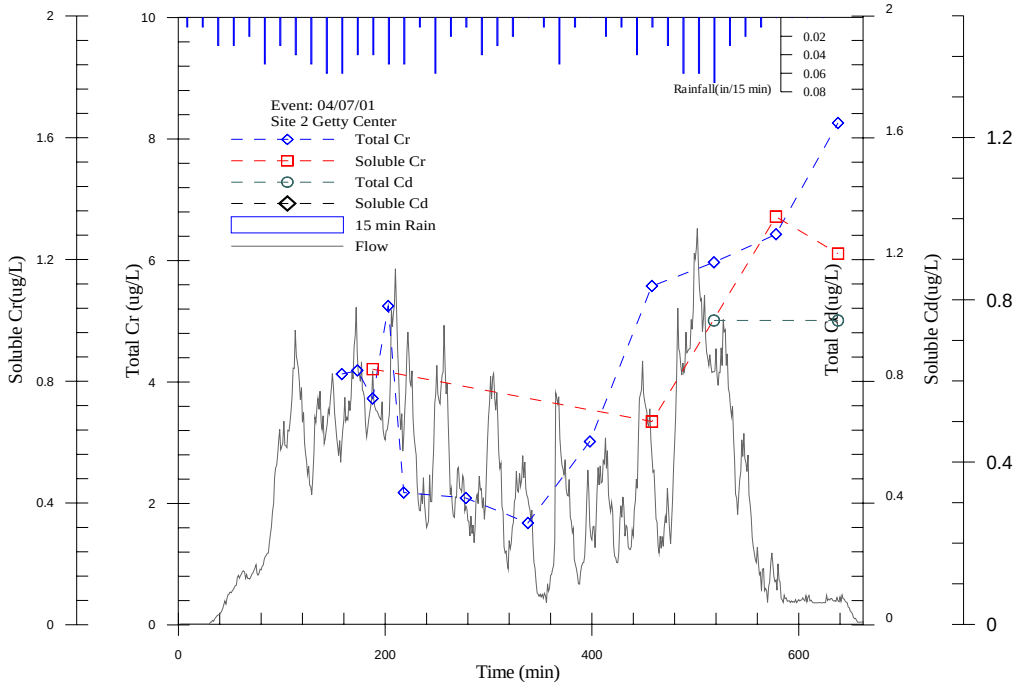

Figure I.2.2.7f (Y2-UCLA2-E8-6) Polluto-graph for Total/Soluble Cr and Cd

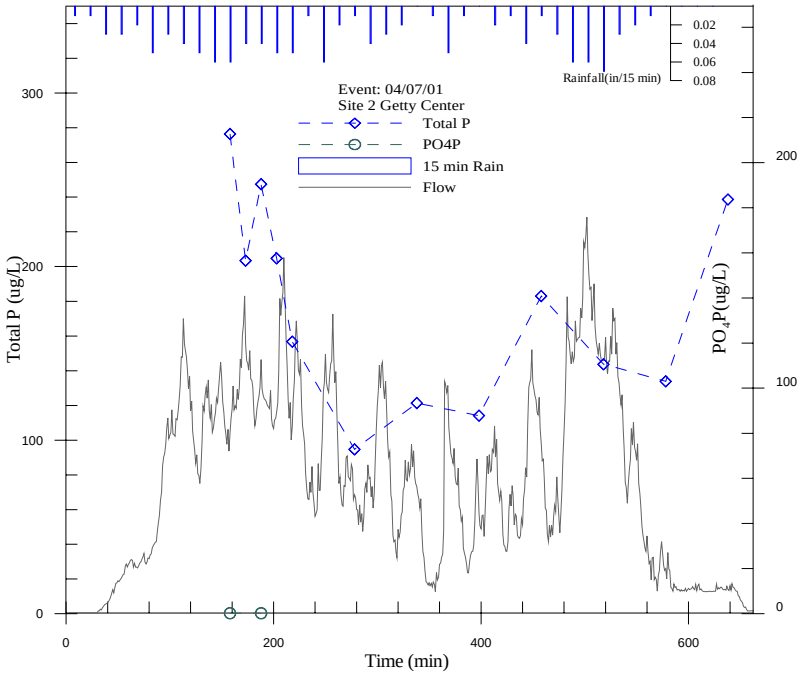

Figure I.2.2.7g (Y2-UCLA2-E8-7) Polluto-graph for Total-P and PO_4-P

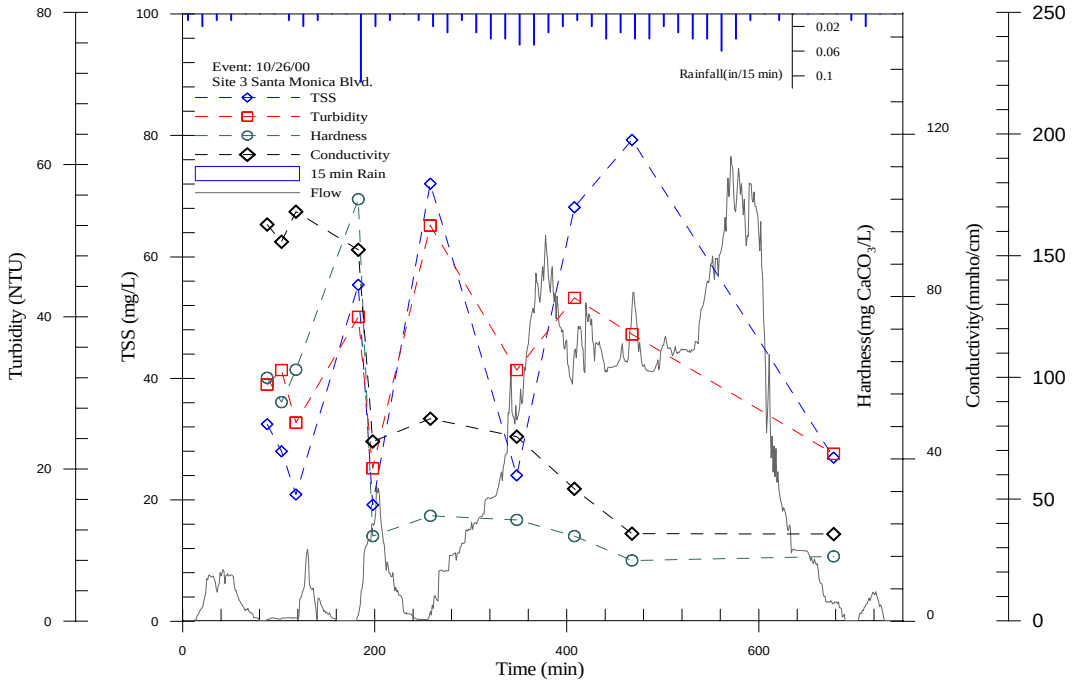

Figure I.2.3.1a (Y2-UCLA3-E1-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

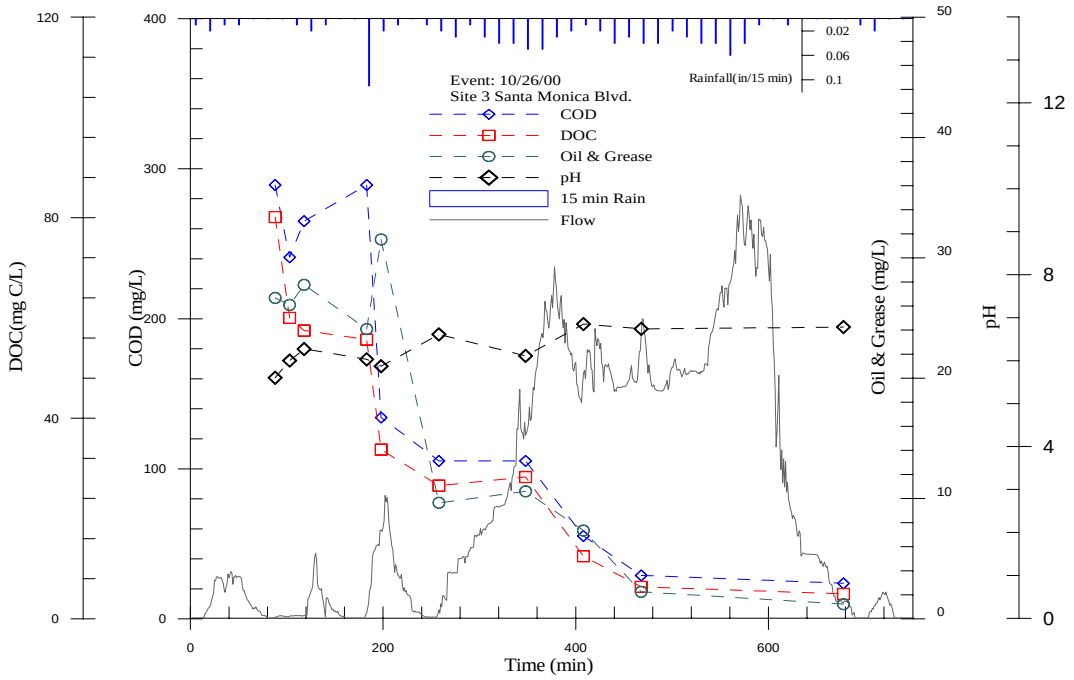

Figure I.2.3.1b (Y2-UCLA3-E1-2) Polluto-graph for COD, DOC, Oil & Grease and pH

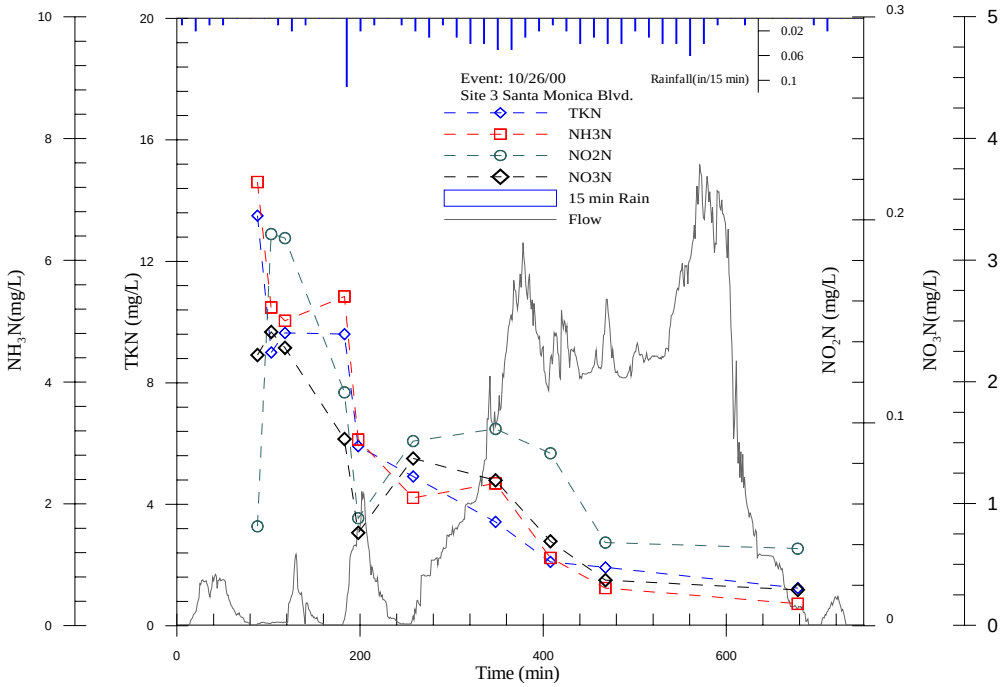

Figure I.2.3.1c (Y2-UCLA3-E1-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

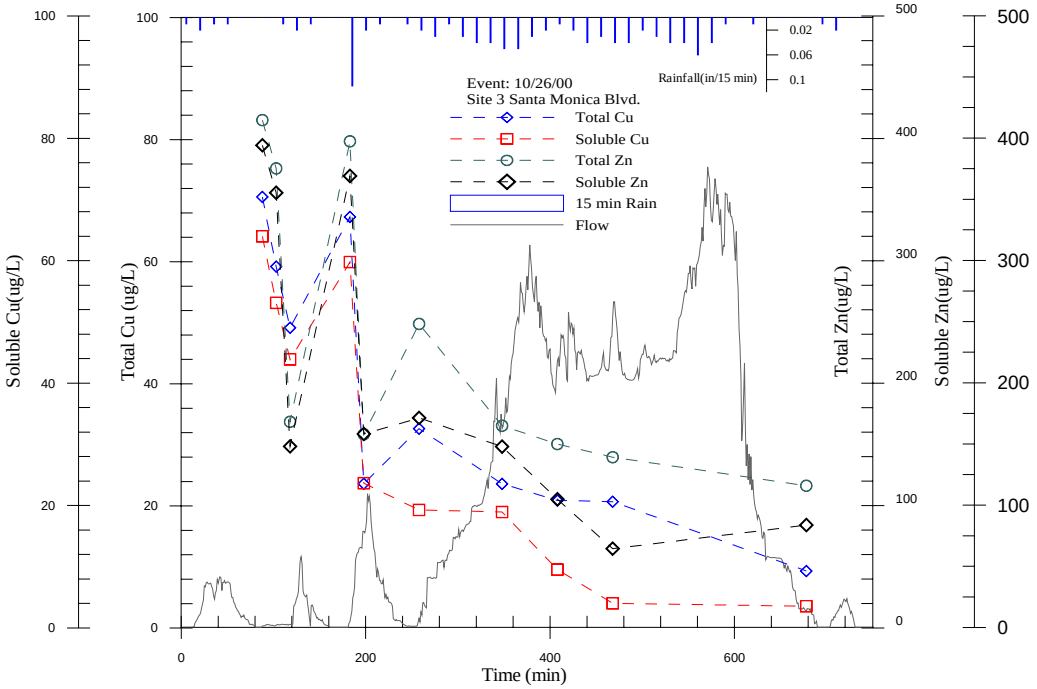

Figure I.2.3.1d (Y2-UCLA3-E1-4) Polluto-graph for Total/Soluble Cu and Zn

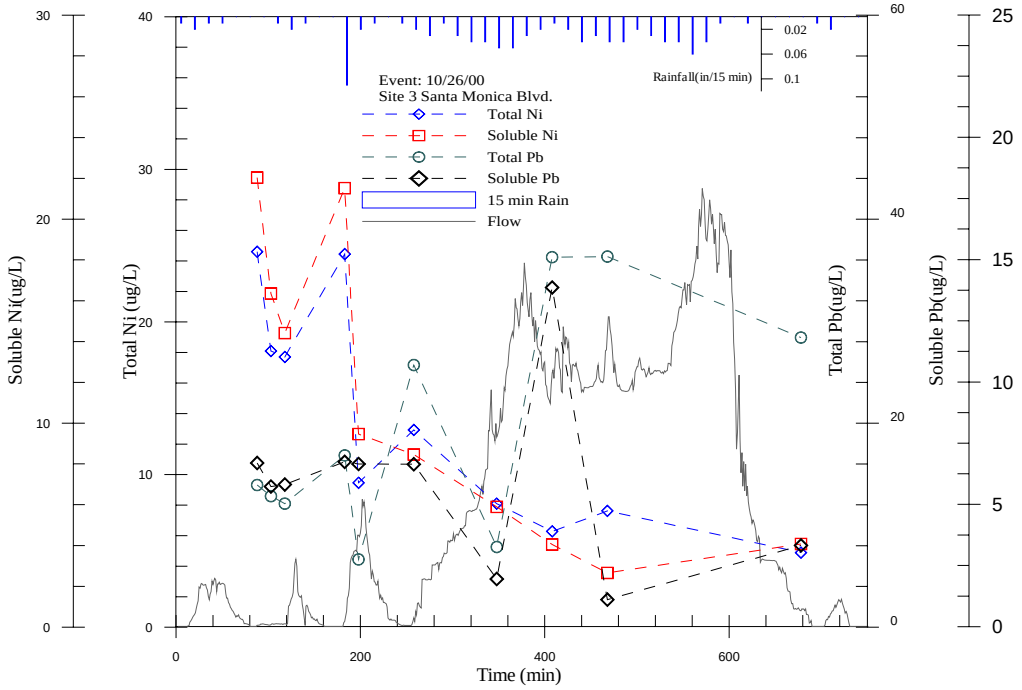

Figure I.2.3.1e (Y2-UCLA3-E1-5) Polluto-graph for Total/Soluble Ni and Pb

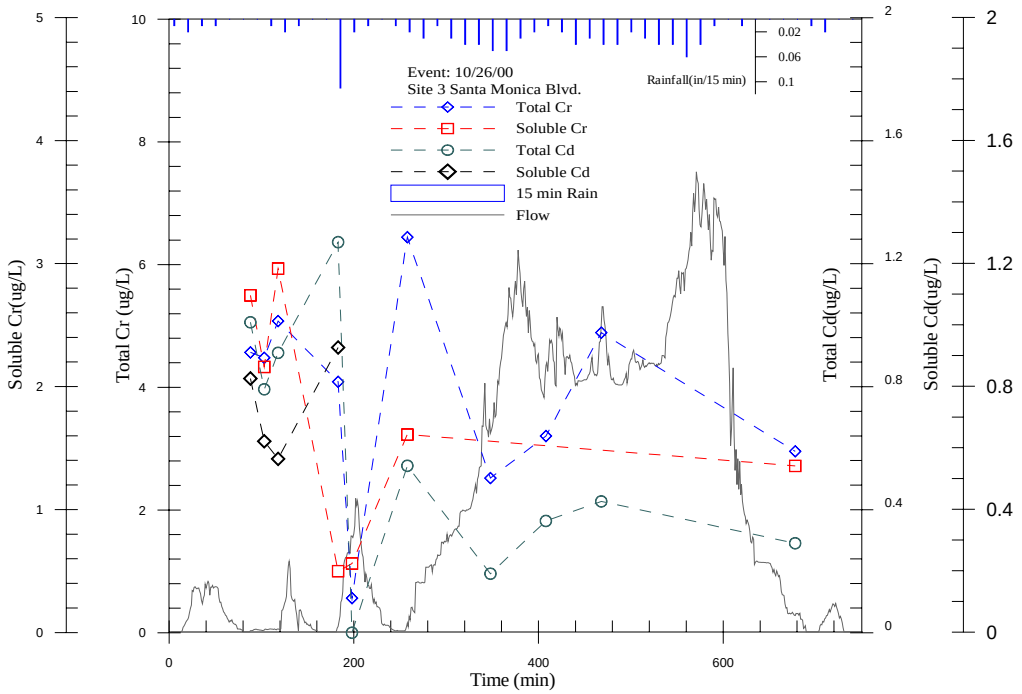

Figure I.2.3.1f (Y2-UCLA3-E1-6) Polluto-graph for Total/Soluble Cr and Cd

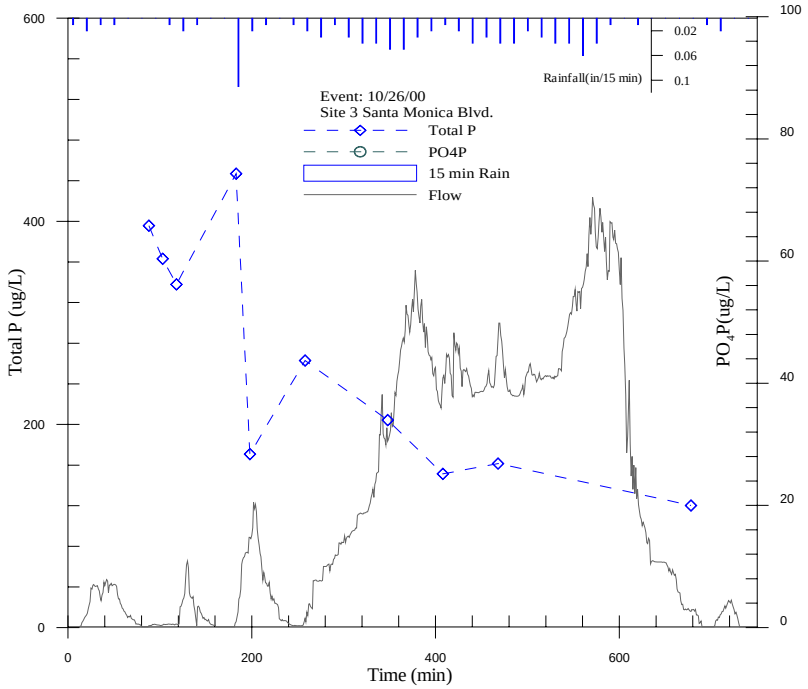

Figure I.2.3.1g (Y2-UCLA3-E1-7) Polluto-graph for Total-P and PO_4-P

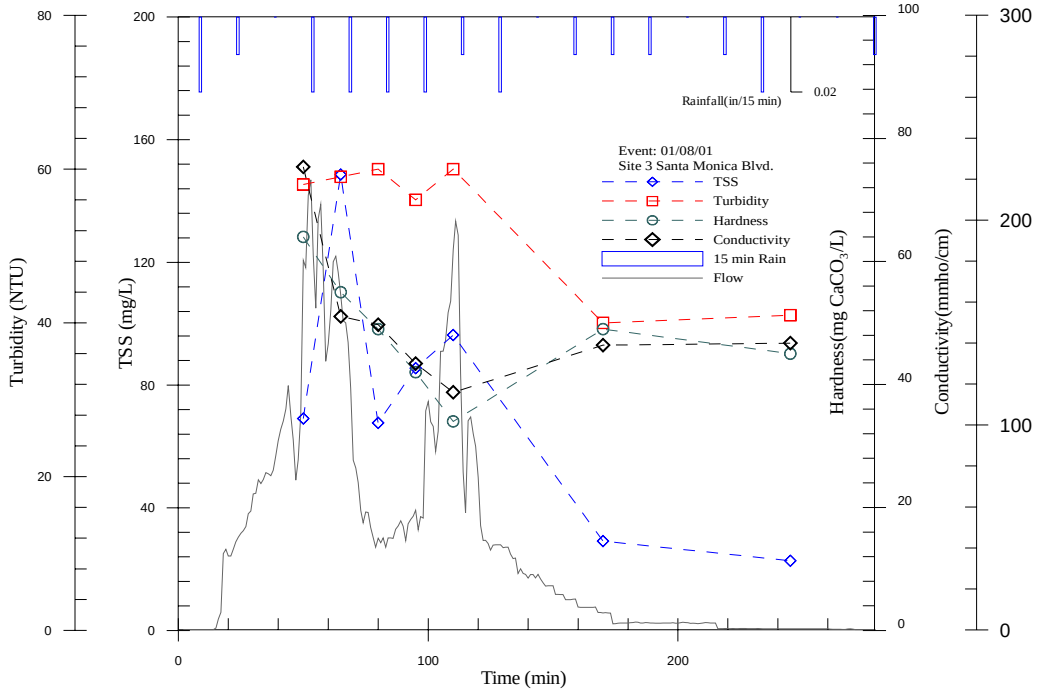

Figure I.2.3.2a (Y2-UCLA3-E2-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

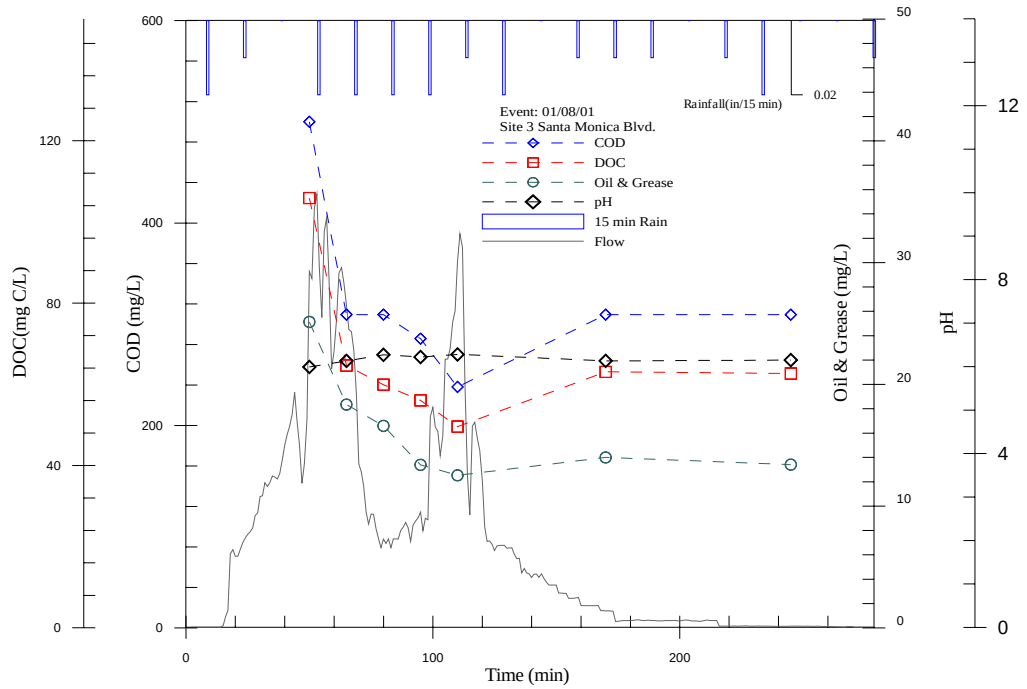

Figure I.2.3.2b (Y2-UCLA3-E2-2) Polluto-graph for COD, DOC, Oil & Grease and pH

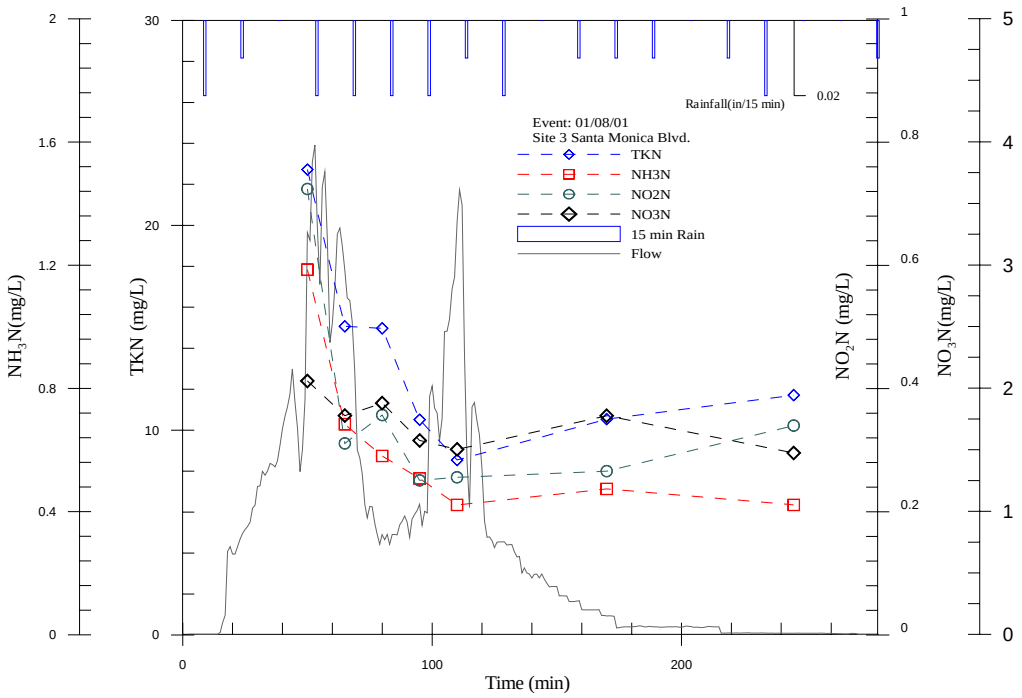

Figure I.2.3.2c (Y2-UCLA3-E2-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

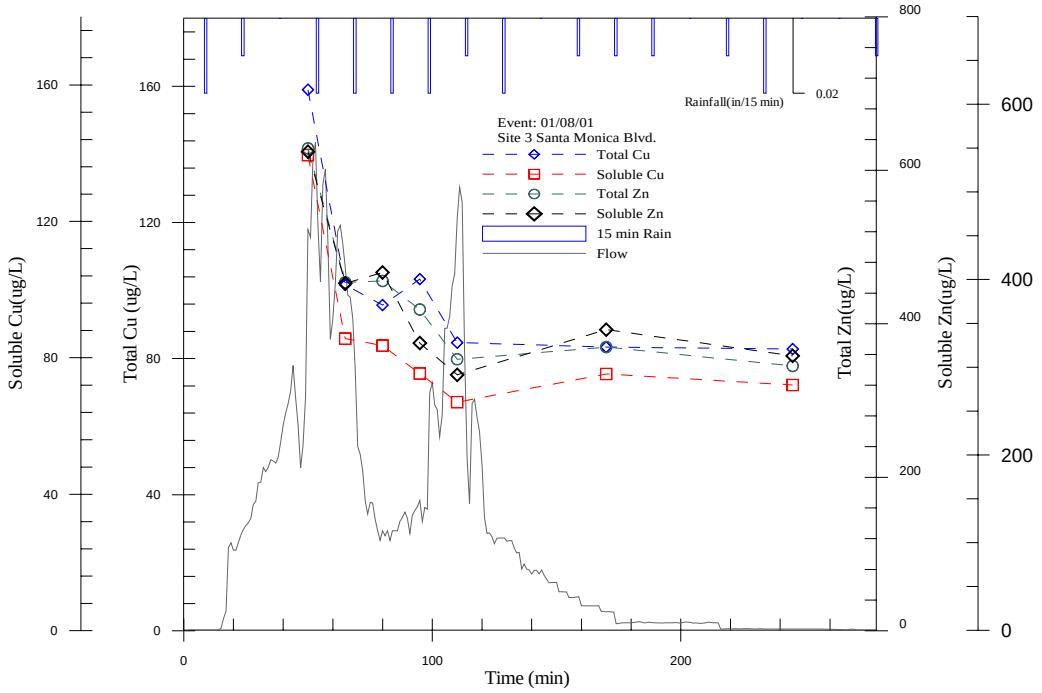

Figure I.2.3.2d (Y2-UCLA3-E2-4) Polluto-graph for Total/Soluble Cu and Zn

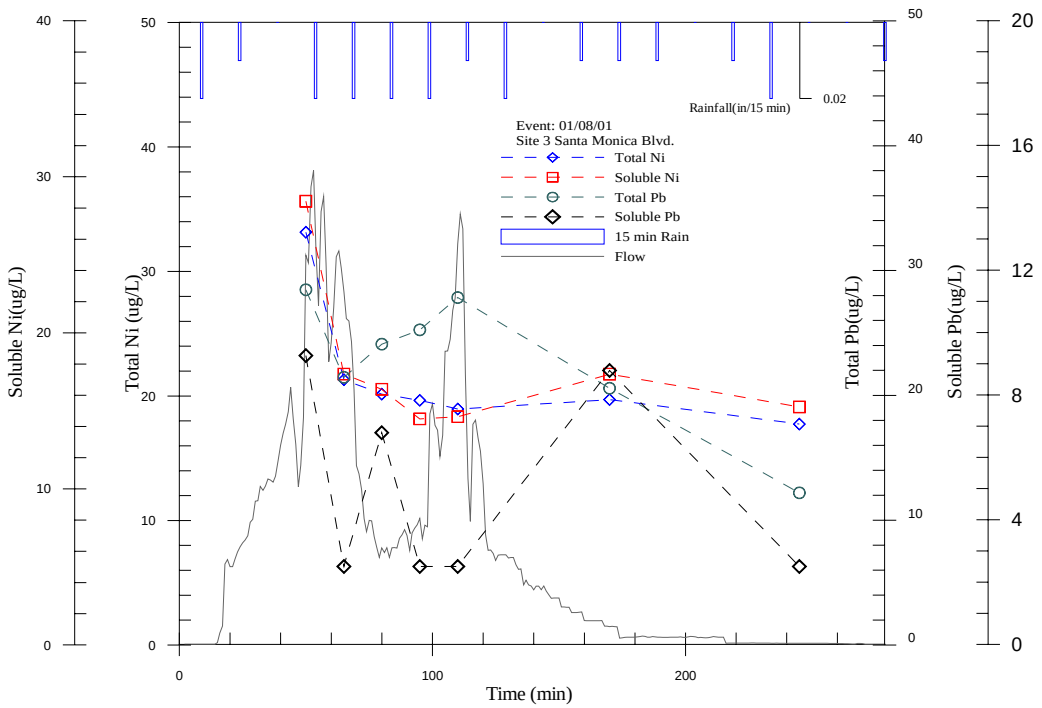

Figure I.2.3.2e (Y2-UCLA3-E2-5) Polluto-graph for Total/Soluble Ni and Pb

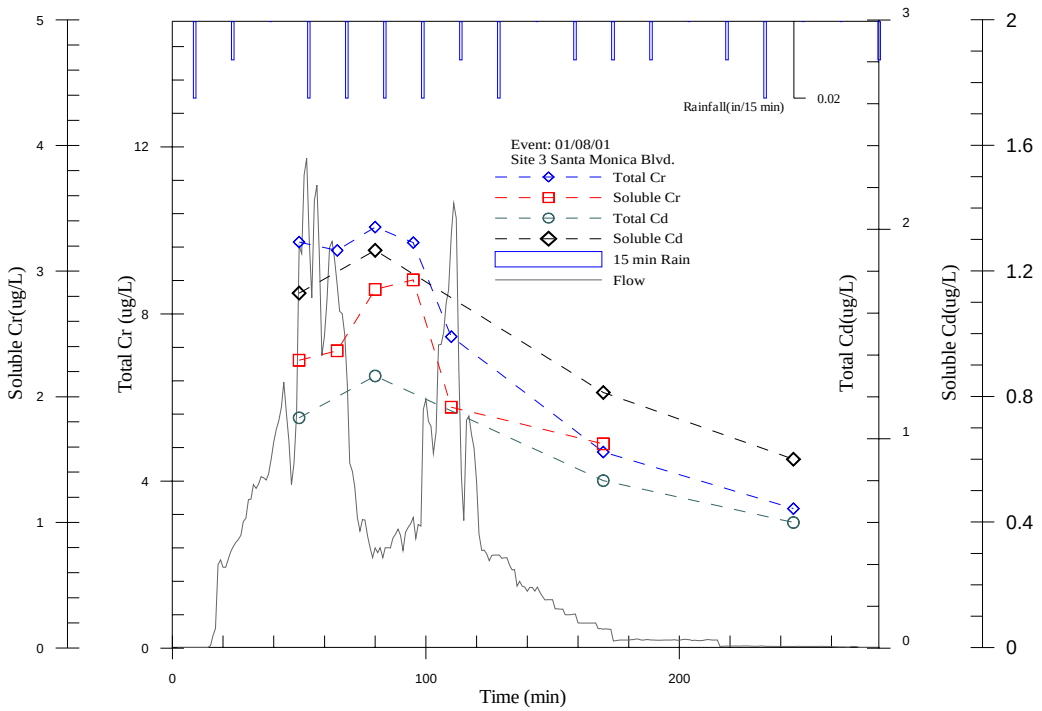

Figure I.2.3.2f (Y2-UCLA3-E2-6) Polluto-graph for Total/Soluble Cr and Cd

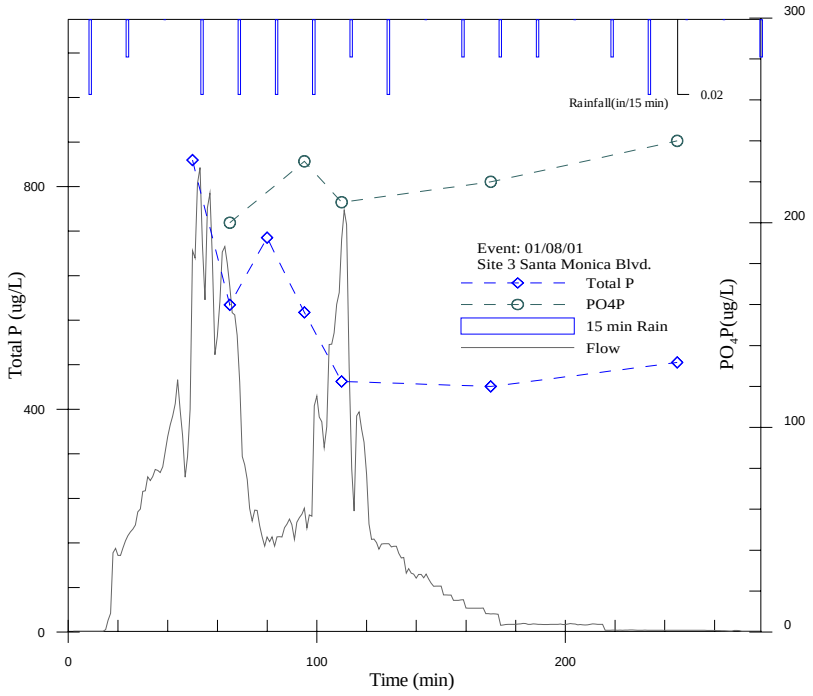

Figure I.2.3.2g (Y2-UCLA3-E2-7) Polluto-graph for Total-P and PO_4-P

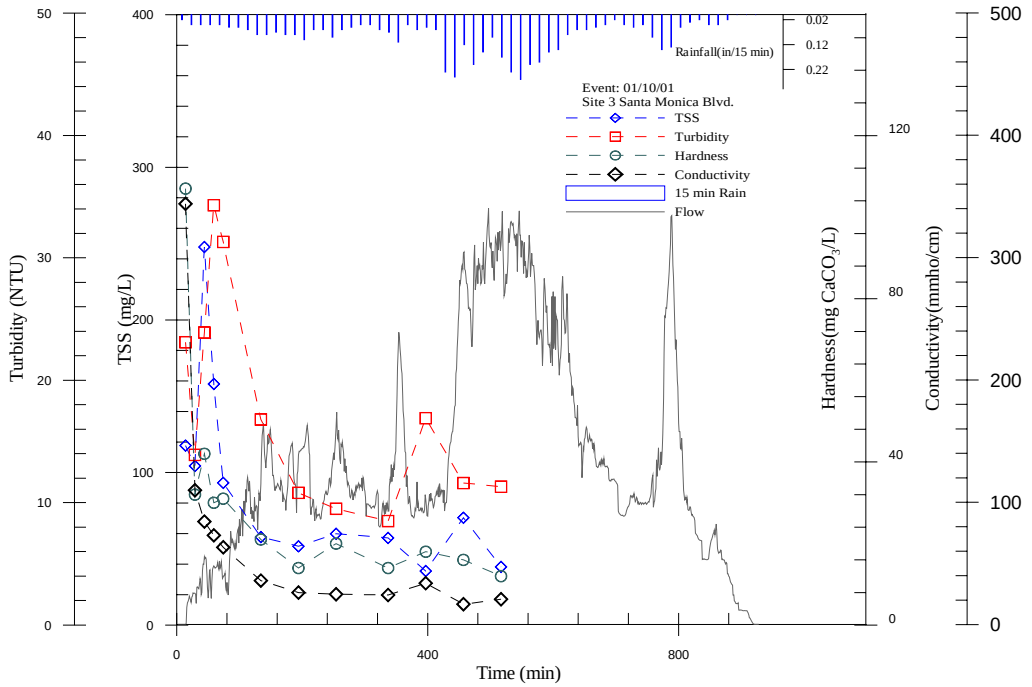

Figure I.2.3.3a (Y2-UCLA3-E3-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

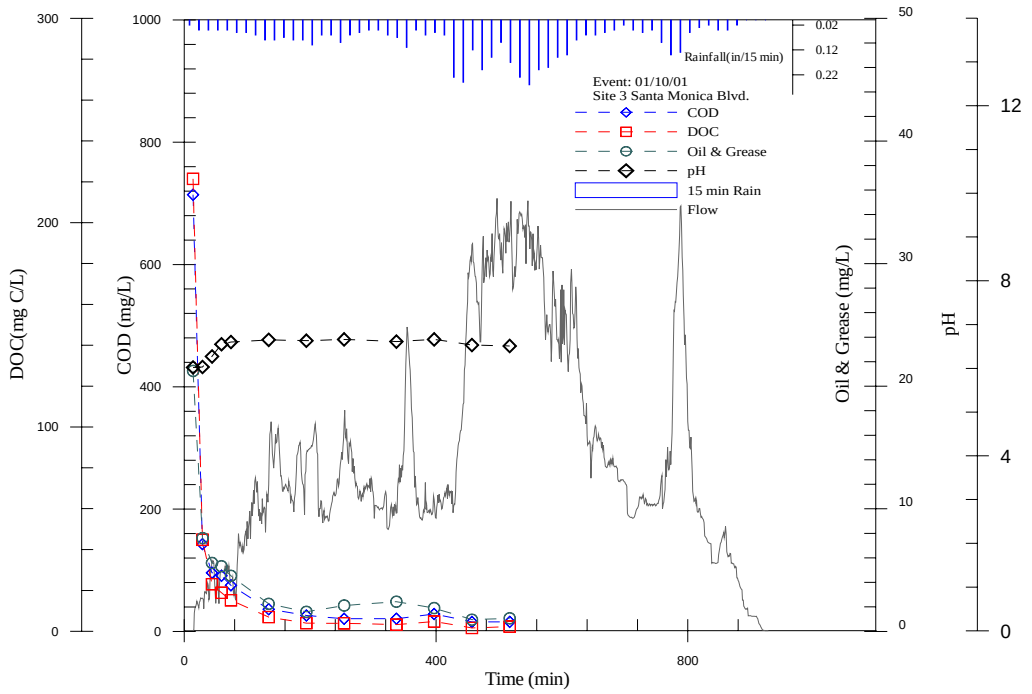

Figure I.2.3.3b (Y2-UCLA3-E3-2) Polluto-graph for COD, DOC, Oil & Grease and pH

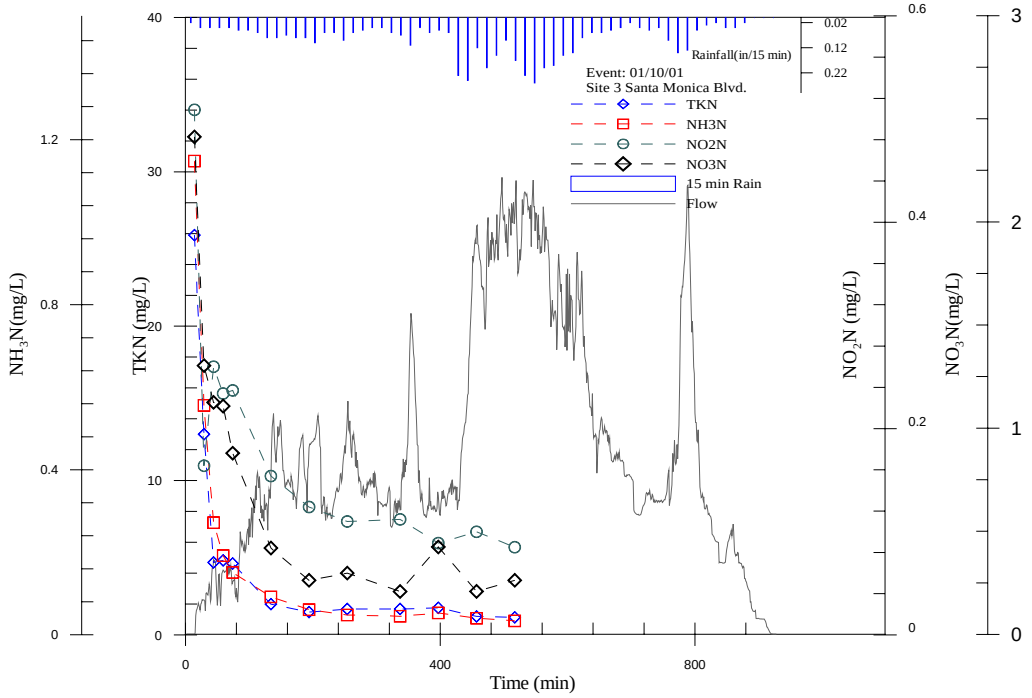

Figure I.2.3.3c (Y2-UCLA3-E3-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

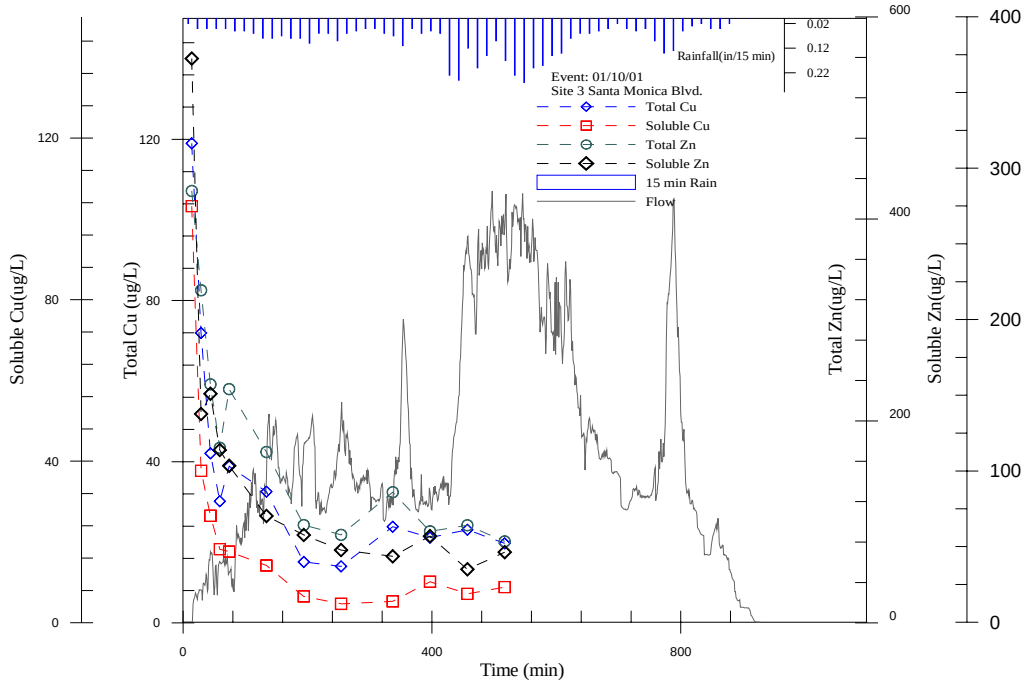

Figure I.2.3.3d (Y2-UCLA3-E3-4) Polluto-graph for Total/Soluble Cu and Zn

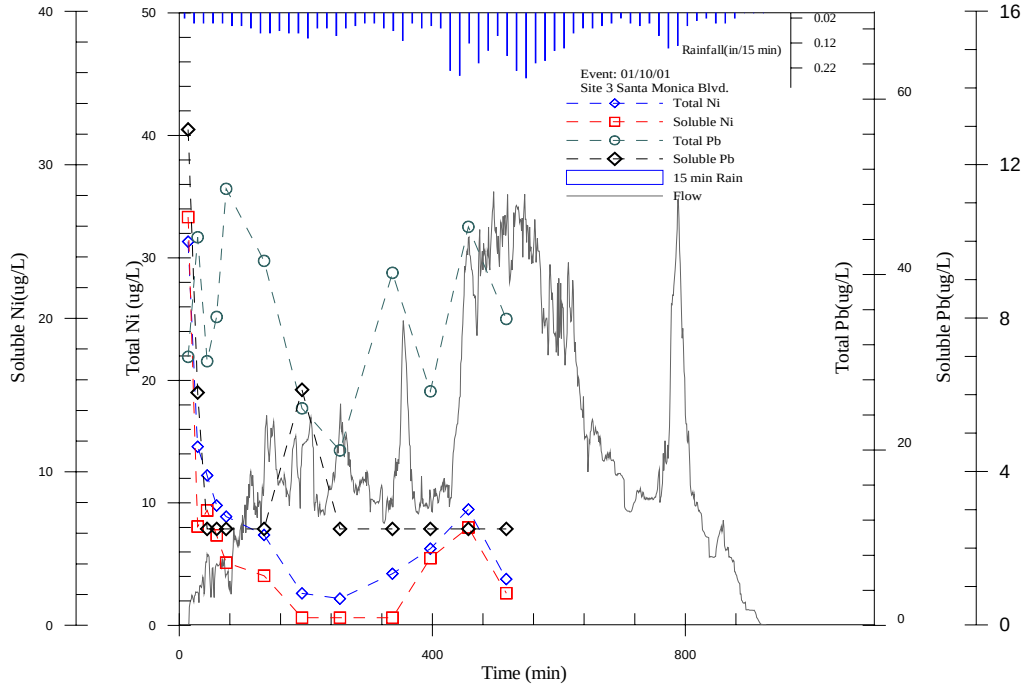

Figure I.2.3.3e (Y2-UCLA3-E3-5) Polluto-graph for Total/Soluble Ni and Pb

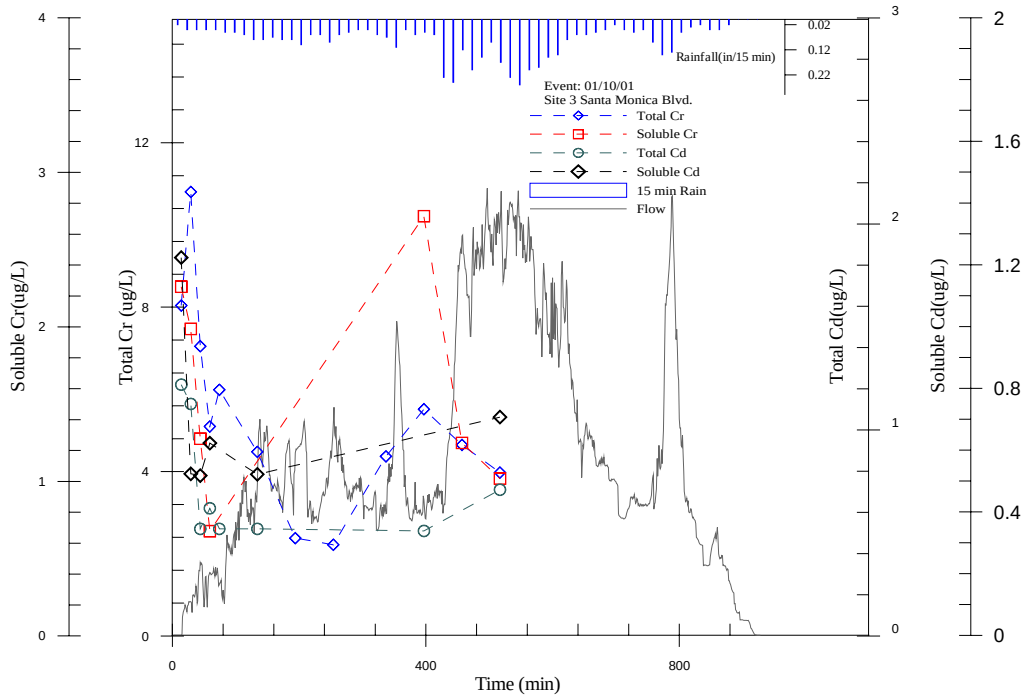

Figure I.2.3.3f (Y2-UCLA3-E3-6) Polluto-graph for Total/Soluble Cr and Cd

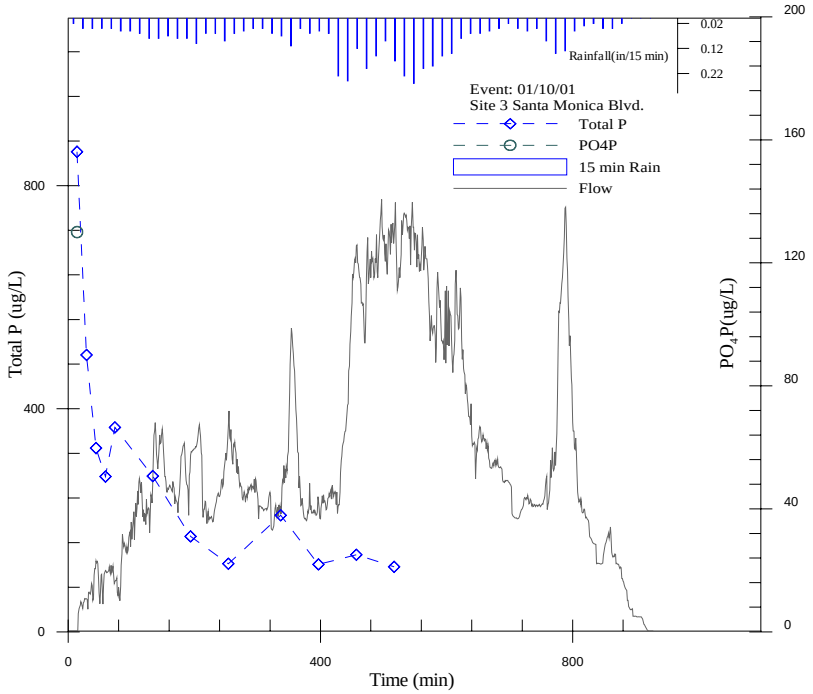

Figure I.2.3.3g (Y2-UCLA3-E3-7) Polluto-graph for Total-P and PO_4-P

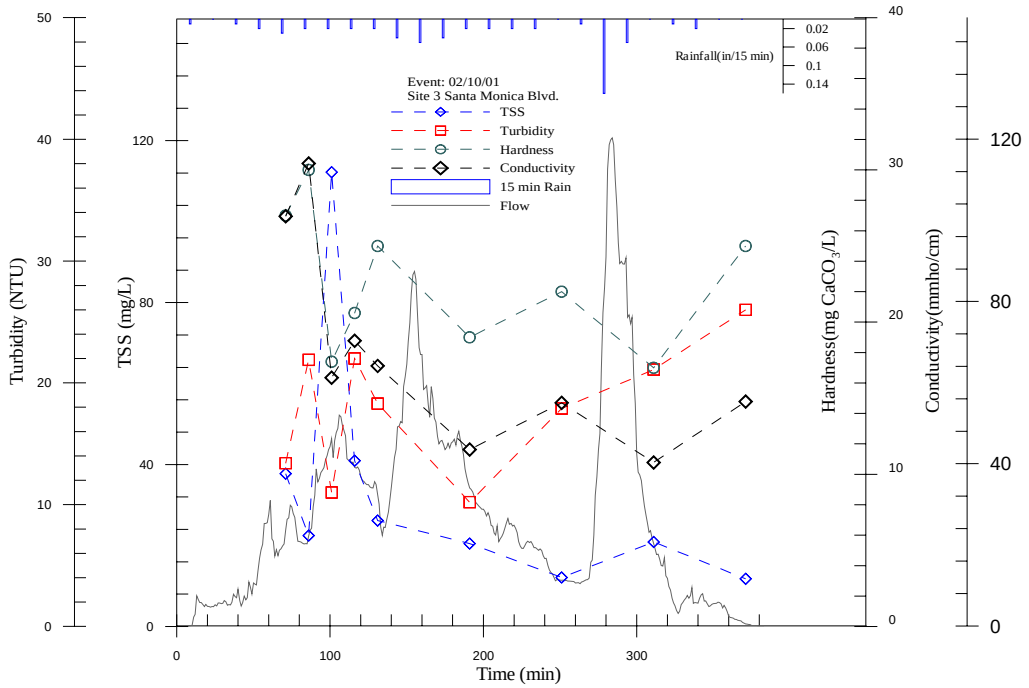

Figure I.2.3.4a (Y2-UCLA3-E4-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

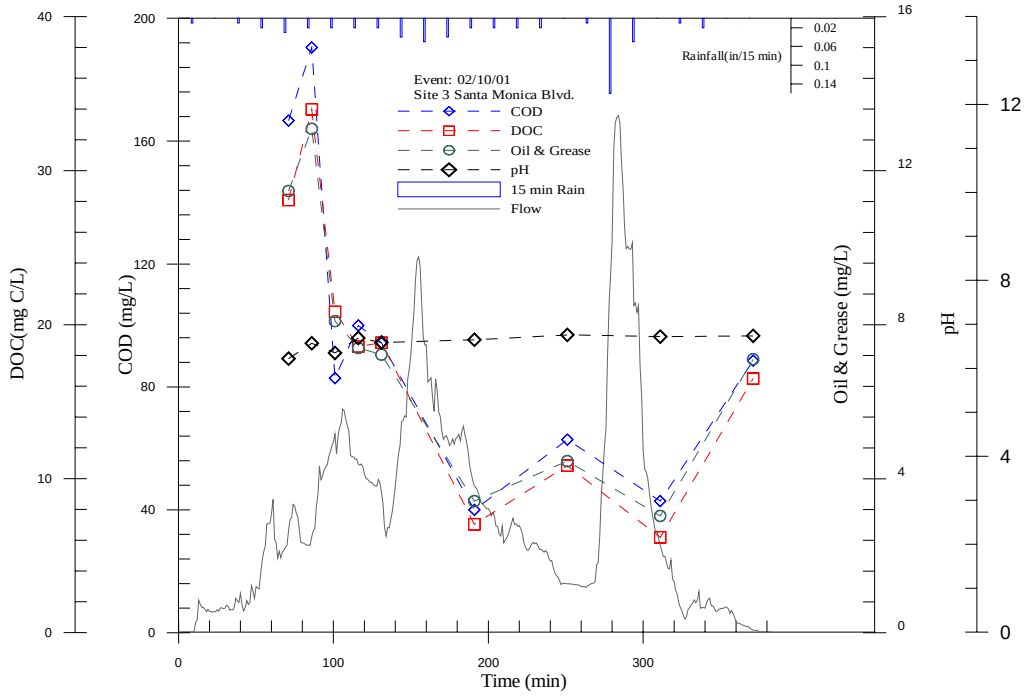

Figure I.2.3.4b (Y2-UCLA3-E4-2) Polluto-graph for COD, DOC, Oil & Grease and pH

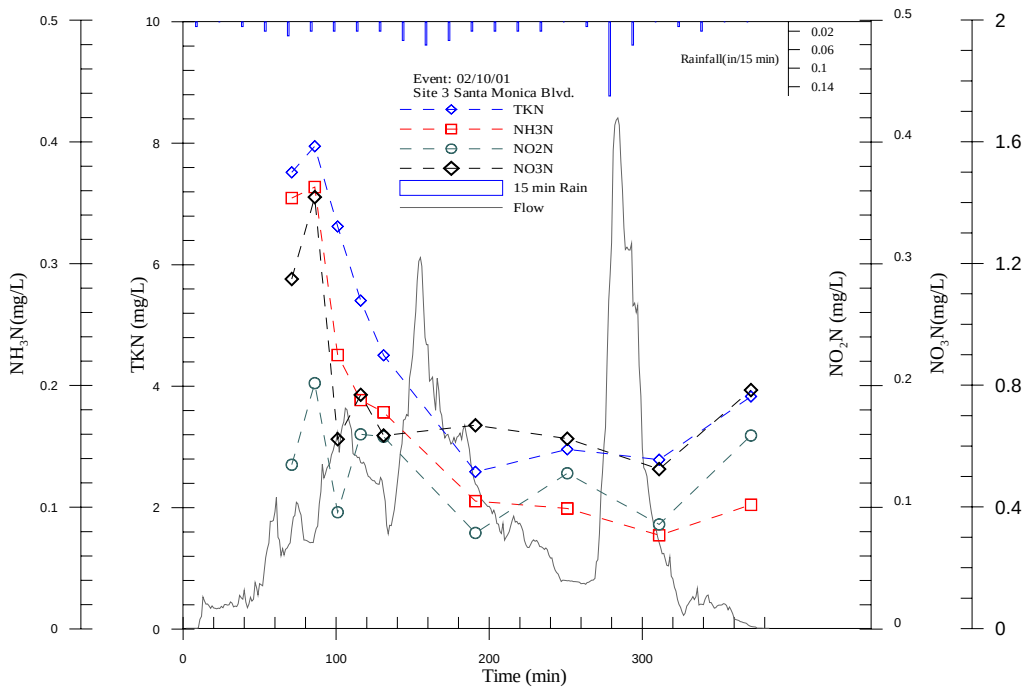

Figure I.2.3.4c (Y2-UCLA3-E4-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

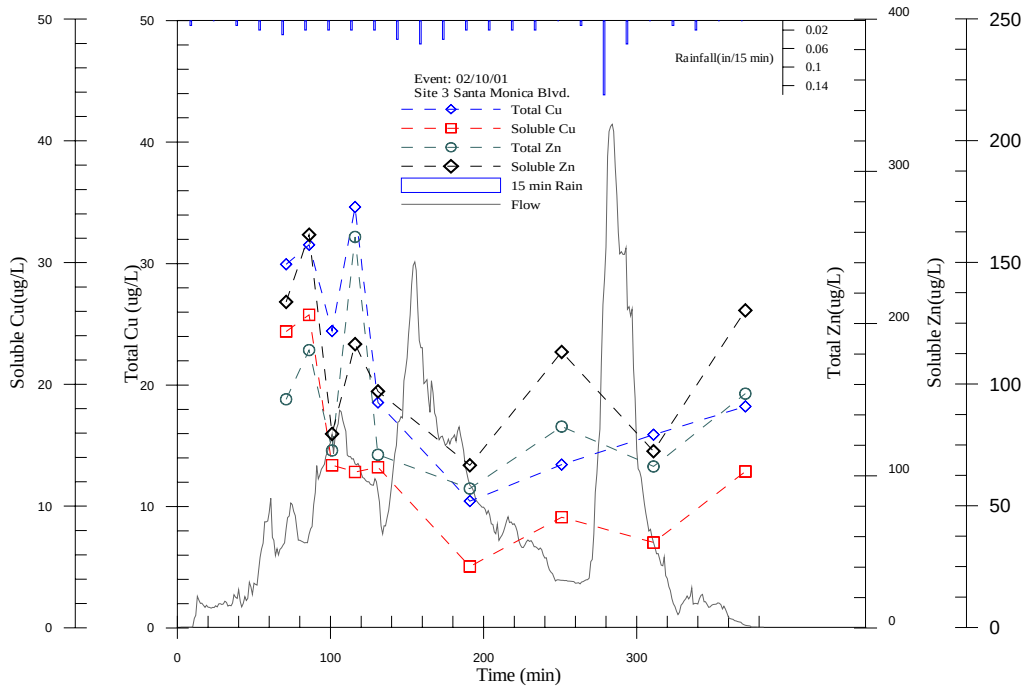

Figure I.2.3.4d (Y2-UCLA3-E4-4) Polluto-graph for Total/Soluble Cu and Zn

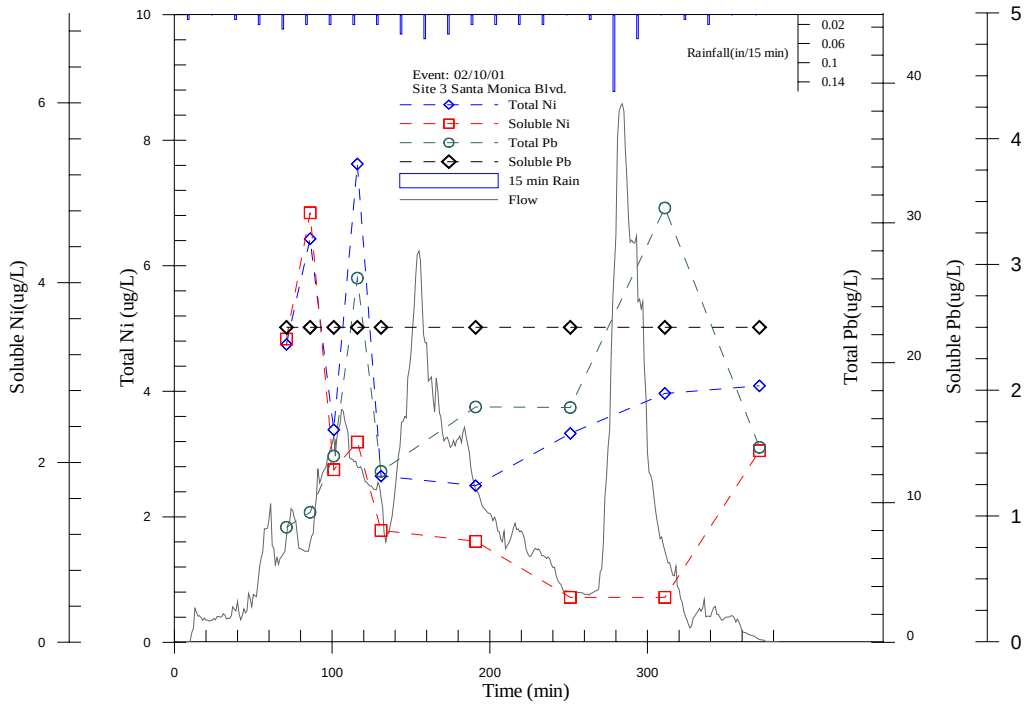

Figure I.2.3.4e (Y2-UCLA3-E4-5) Polluto-graph for Total/Soluble Ni and Pb

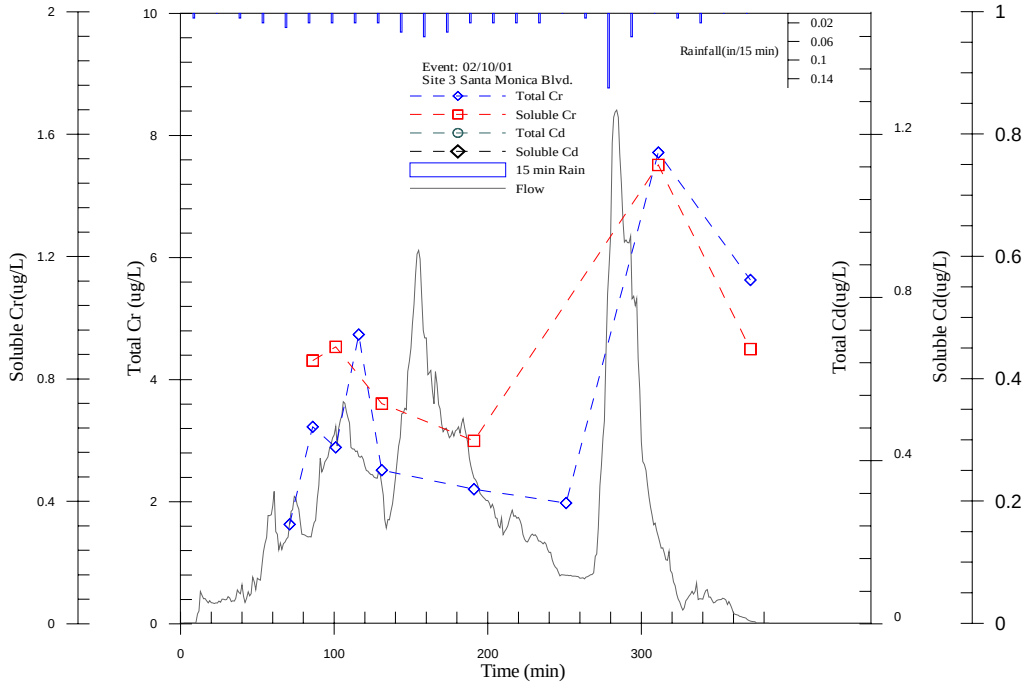

Figure I.2.3.4f (Y2-UCLA3-E4-6) Polluto-graph for Total/Soluble Cr and Cd

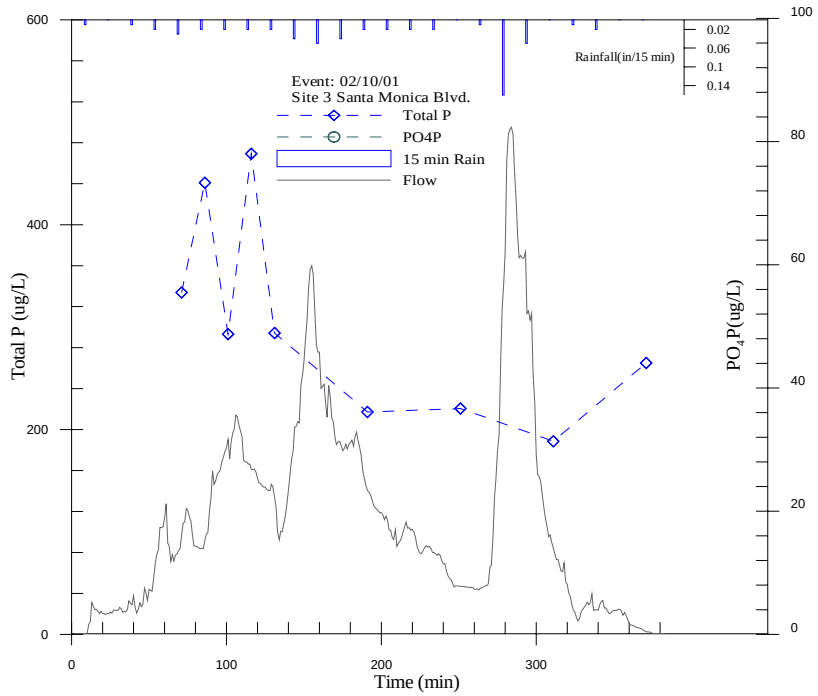

Figure I.2.3.4g (Y2-UCLA3-E4-7) Polluto-graph for Total-P and PO_4-P

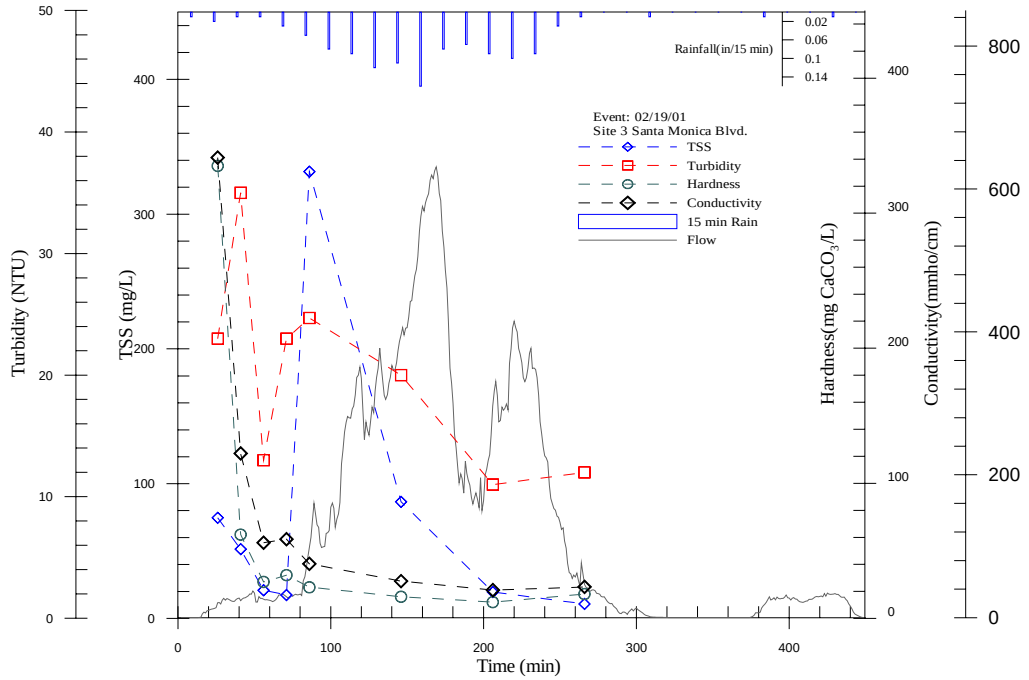

Figure I.2.3.5a (Y2-UCLA3-E5-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

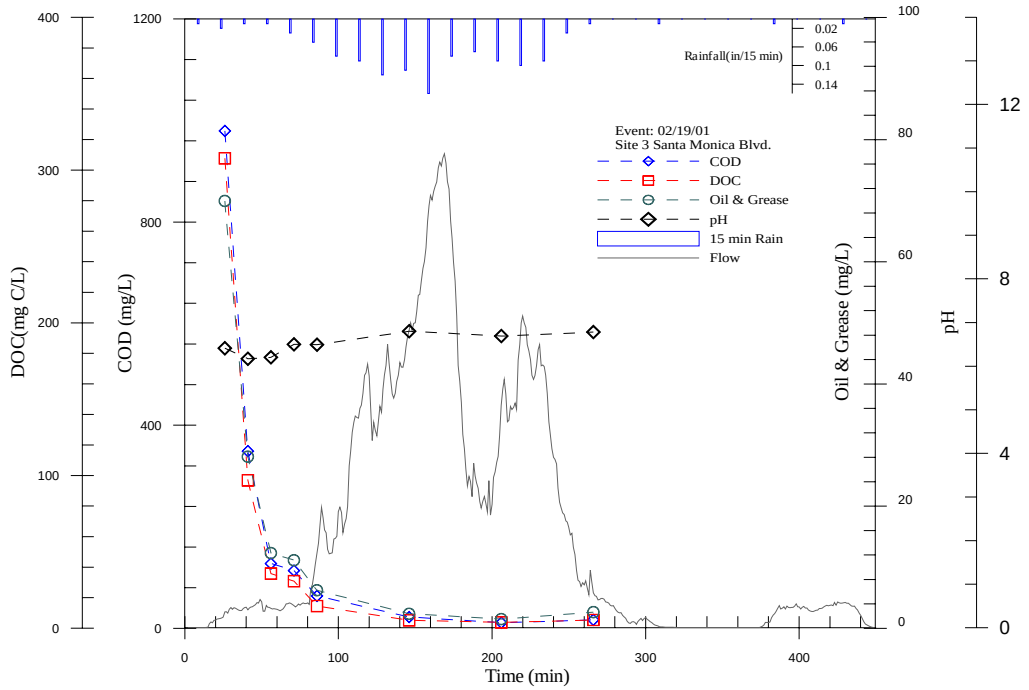

Figure I.2.3.5b (Y2-UCLA3-E5-2) Polluto-graph for COD, DOC, Oil & Grease and pH

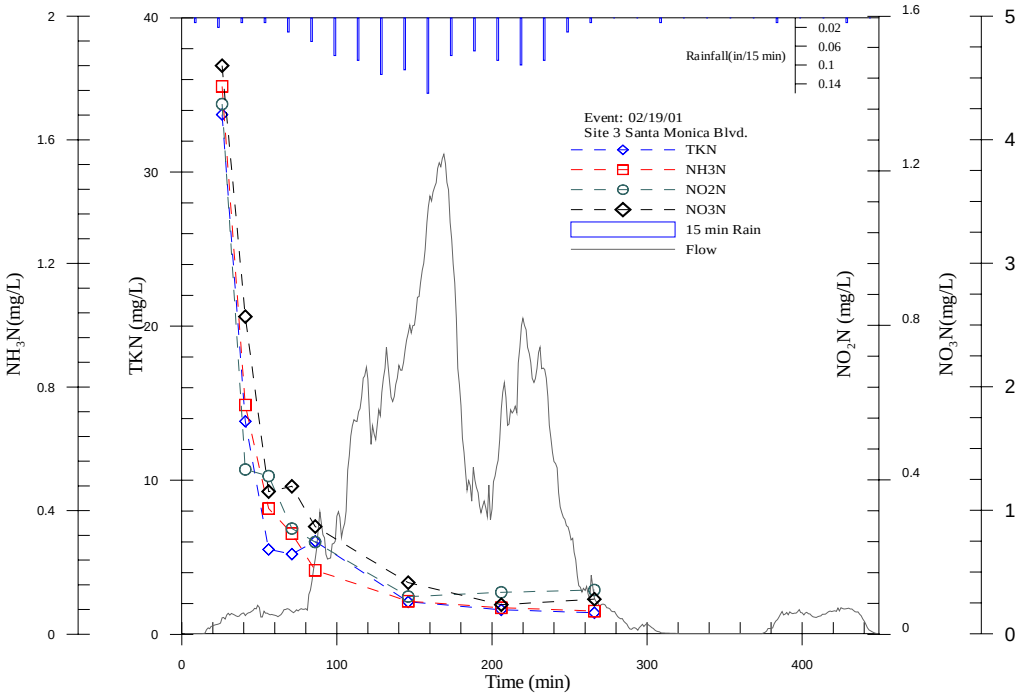

Figure I.2.3.5c (Y2-UCLA3-E5-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

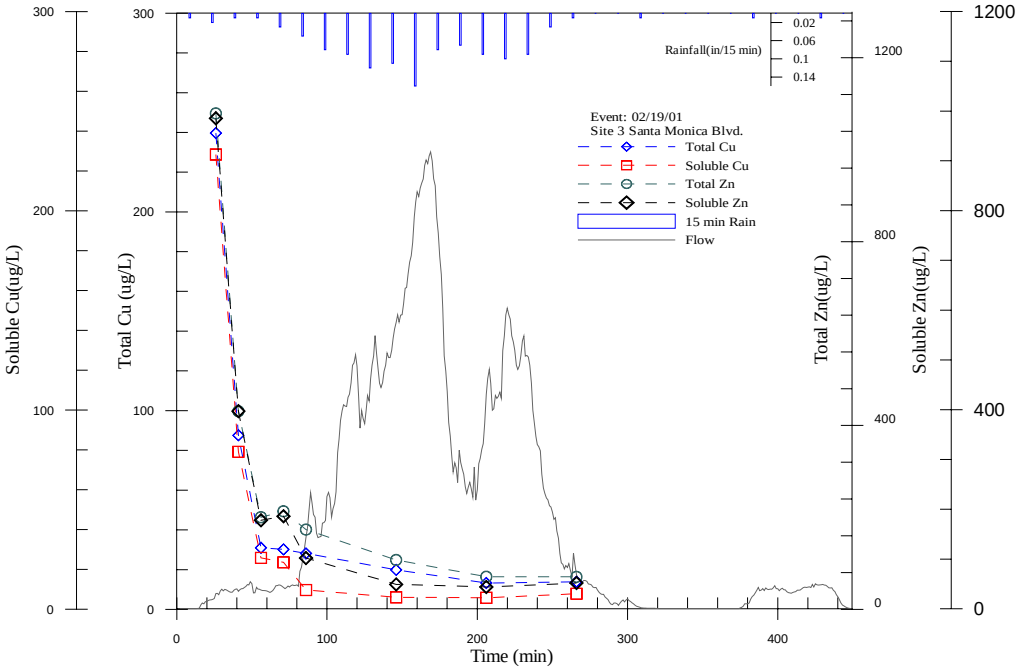

Figure I.2.3.5d (Y2-UCLA3-E5-4) Polluto-graph for Total/Soluble Cu and Zn

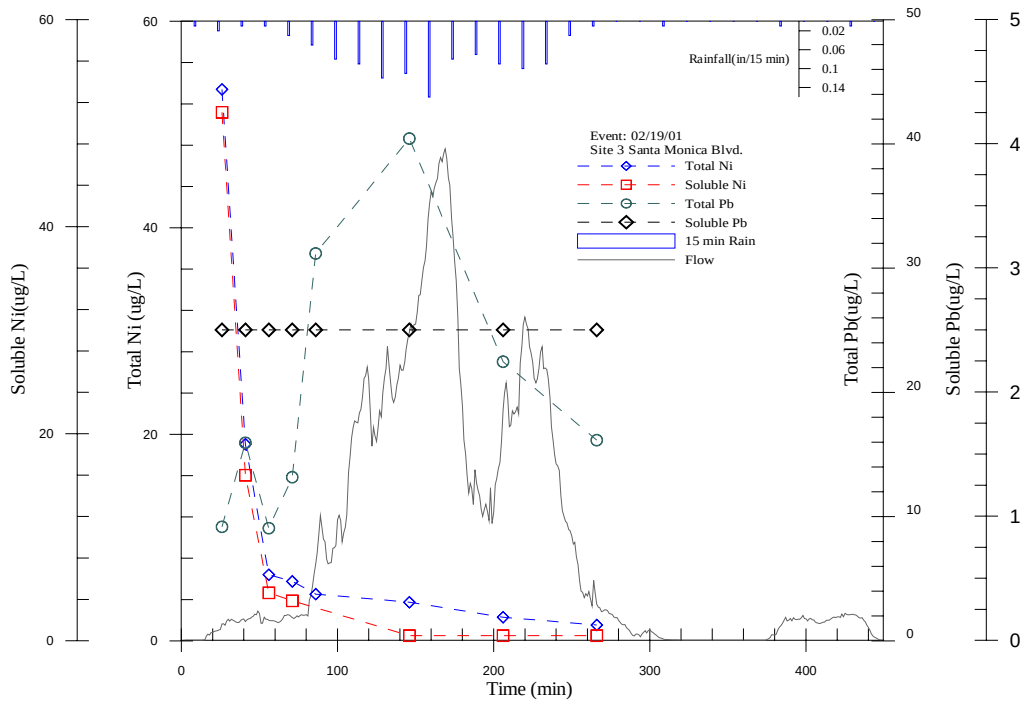

Figure I.2.3.5e (Y2-UCLA3-E5-5) Polluto-graph for Total/Soluble Ni and Pb

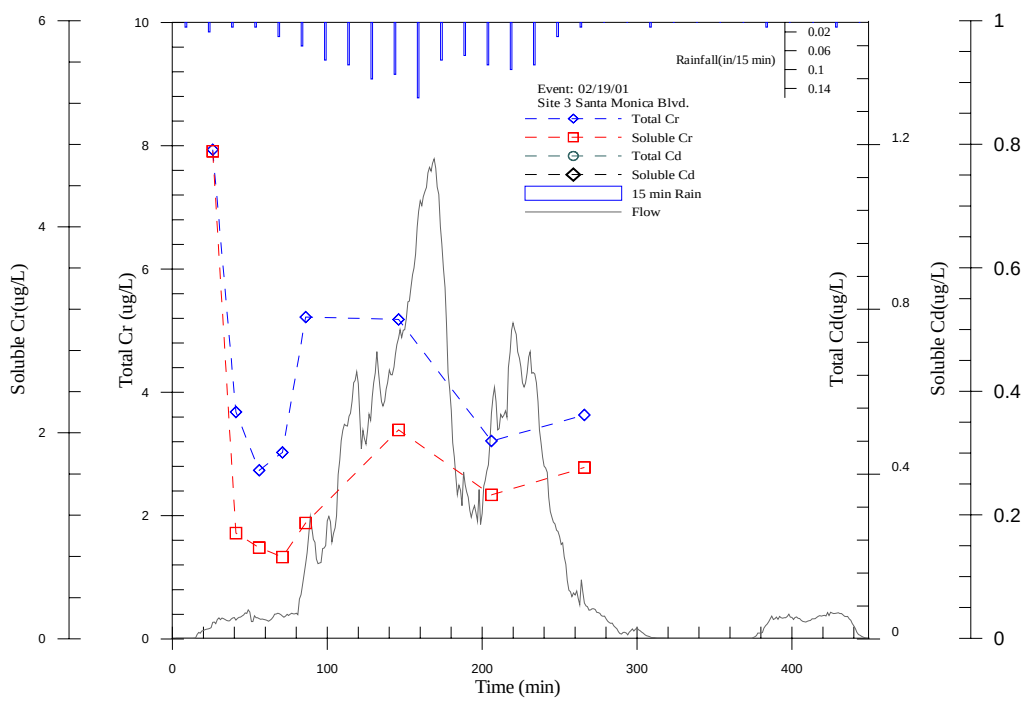

Figure I.2.3.5f (Y2-UCLA3-E5-6) Polluto-graph for Total/Soluble Cr and Cd

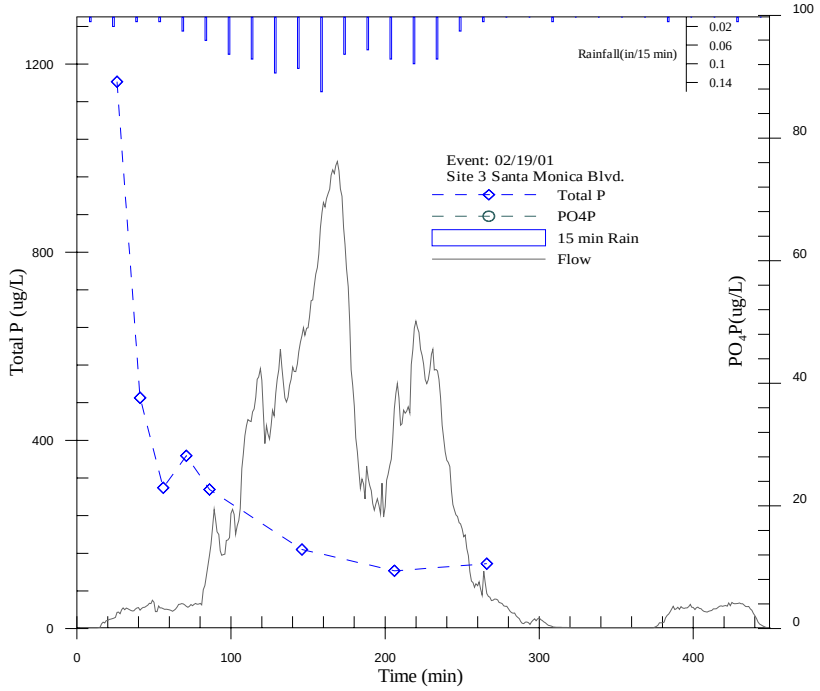

Figure I.2.3.5g (Y2-UCLA3-E5-7) Polluto-graph for Total-P and PO_4-P

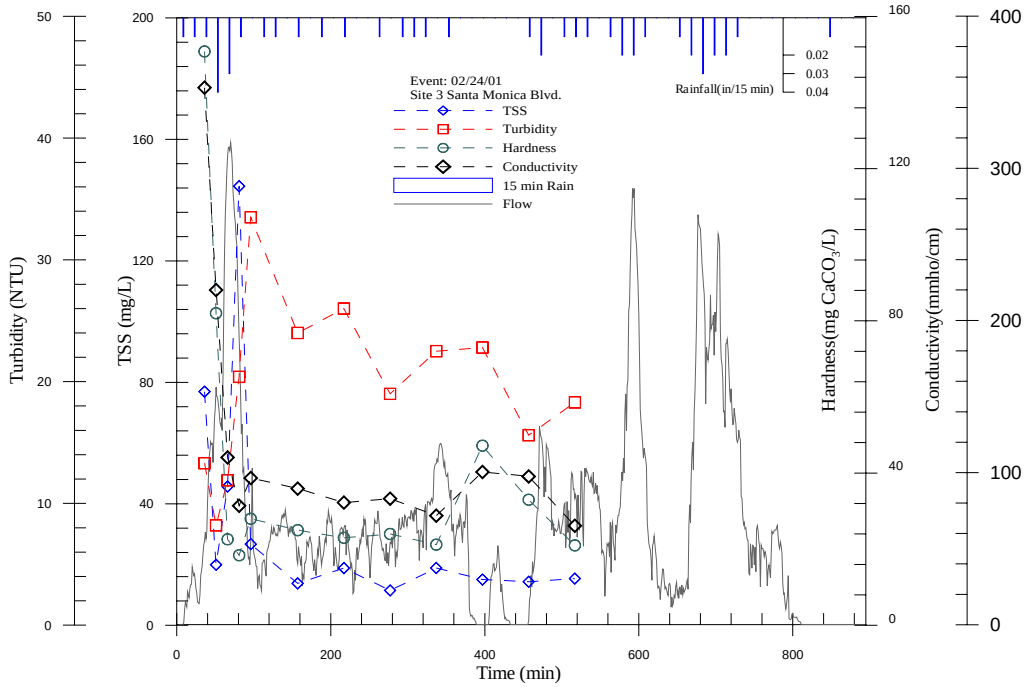

Figure I.2.3.6a (Y2-UCLA3-E6-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

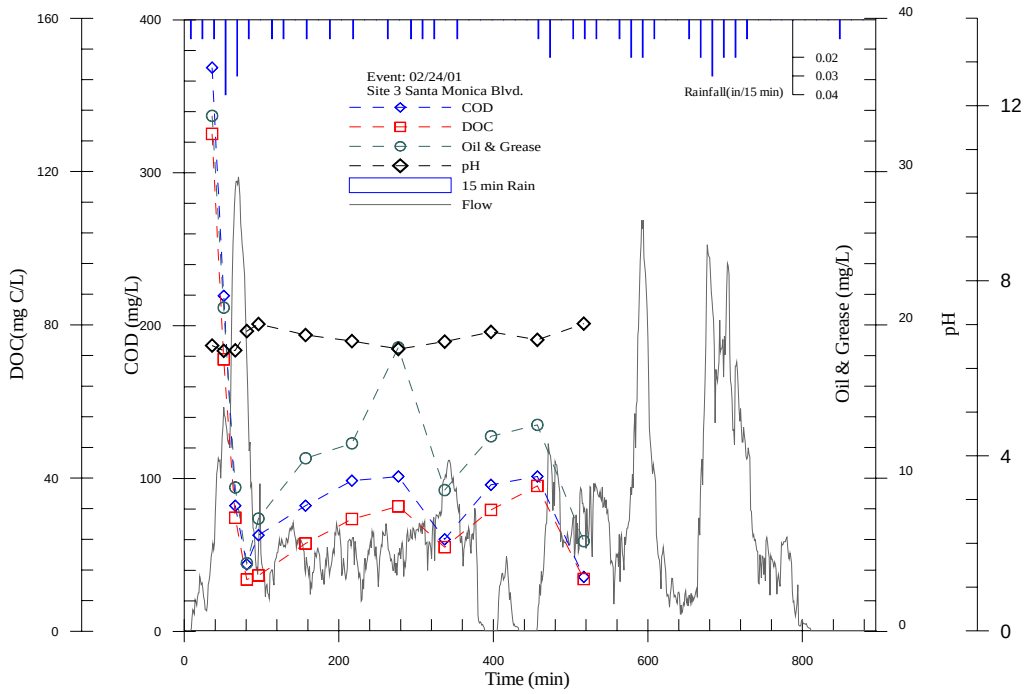

Figure I.2.3.6b (Y2-UCLA3-E6-2) Polluto-graph for COD, DOC, Oil & Grease and pH

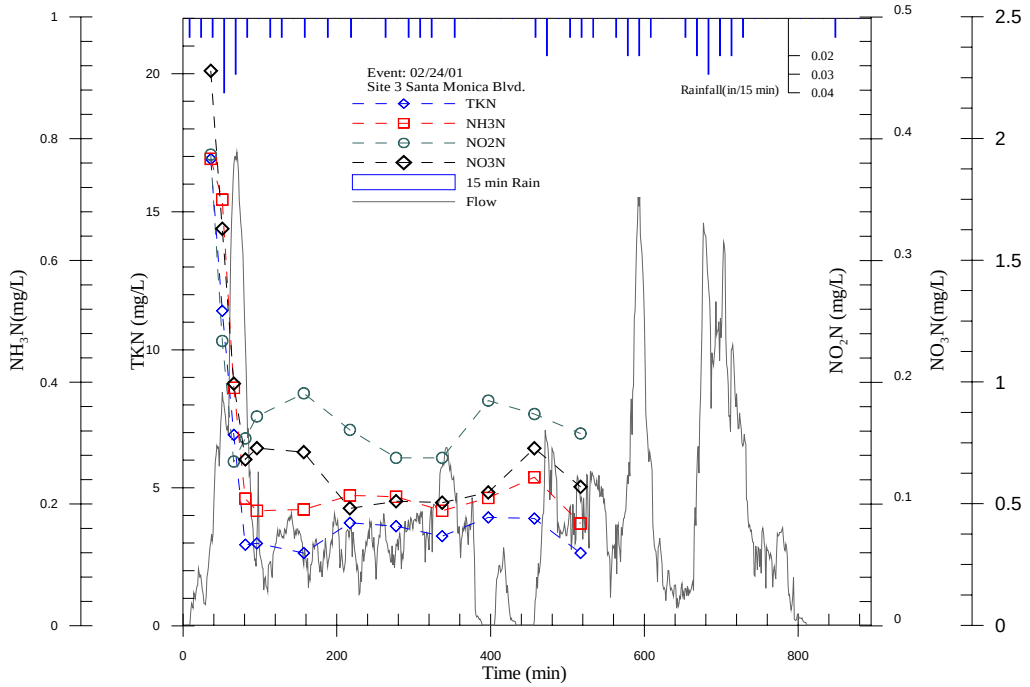

Figure I.2.3.6c (Y2-UCLA3-E6-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

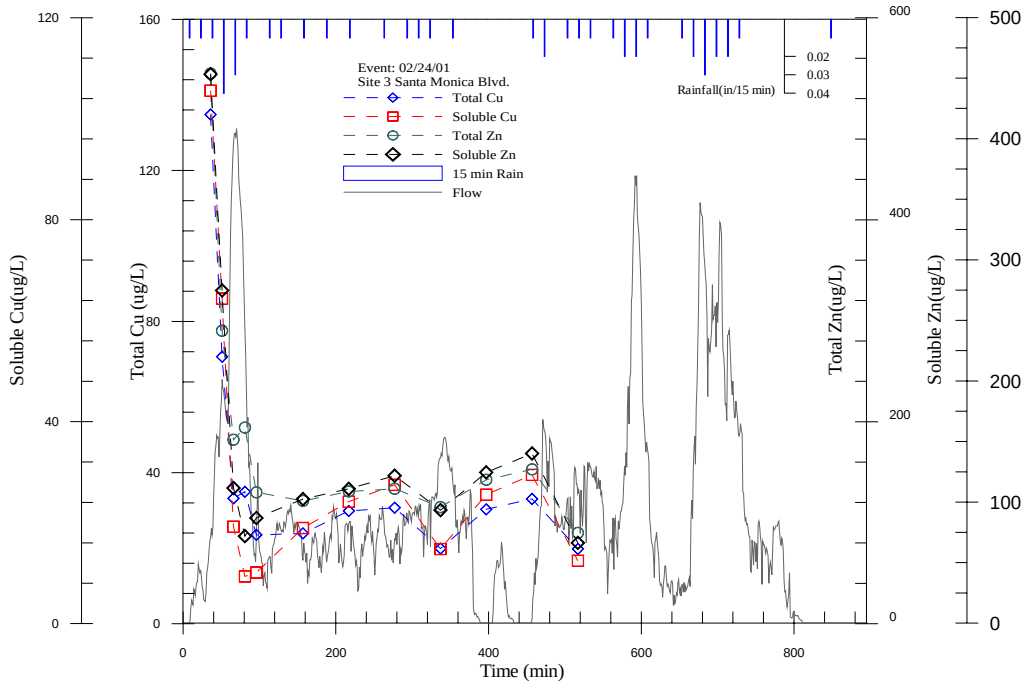

Figure I.2.3.6d (Y2-UCLA3-E6-4) Polluto-graph for Total/Soluble Cu and Zn

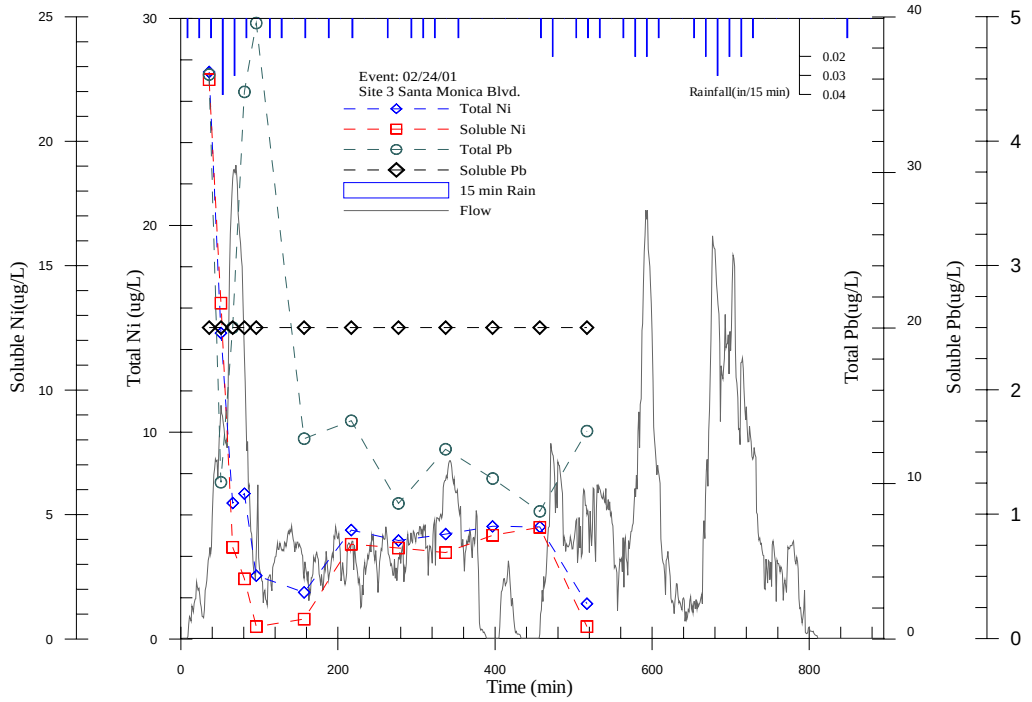

Figure I.2.3.6e (Y2-UCLA3-E6-5) Polluto-graph for Total/Soluble Ni and Pb

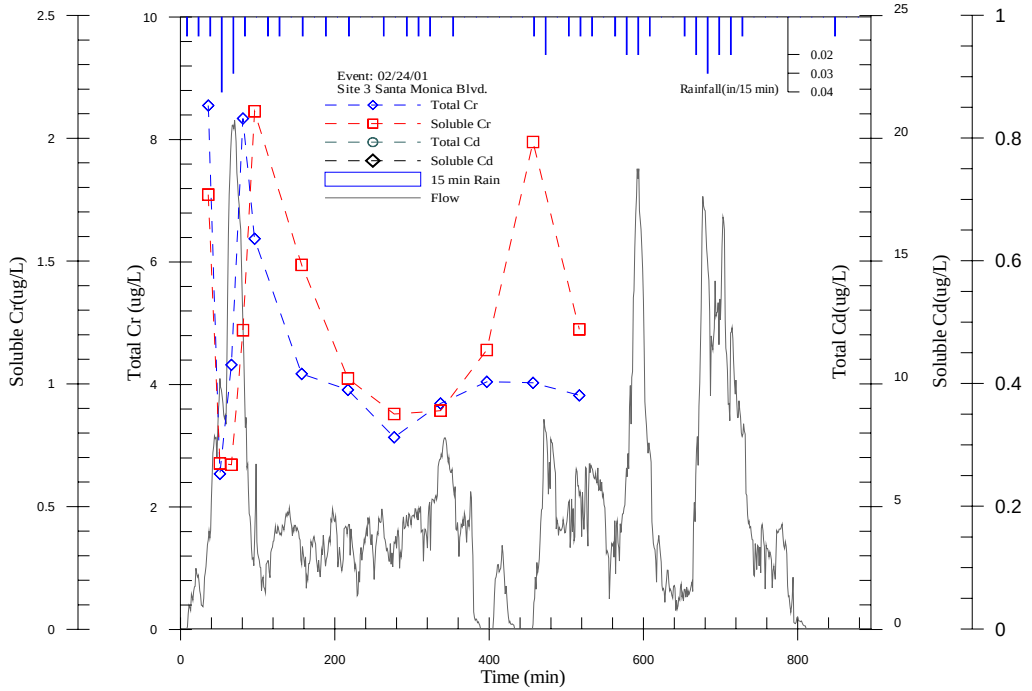

Figure I.2.3.6f (Y2-UCLA3-E6-6) Polluto-graph for Total/Soluble Cr and Cd

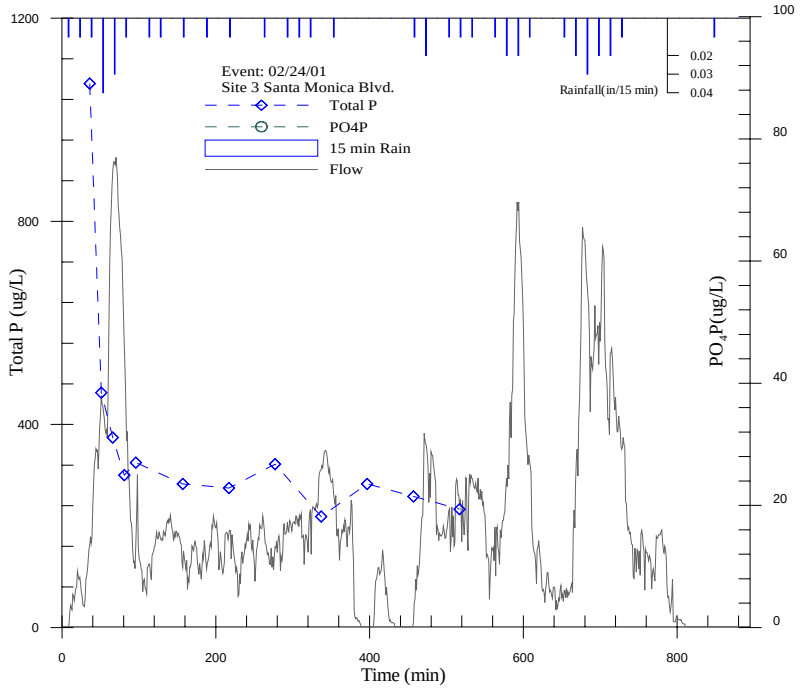

Figure I.2.3.6g (Y2-UCLA3-E6-7) Polluto-graph for Total-P and PO_4-P

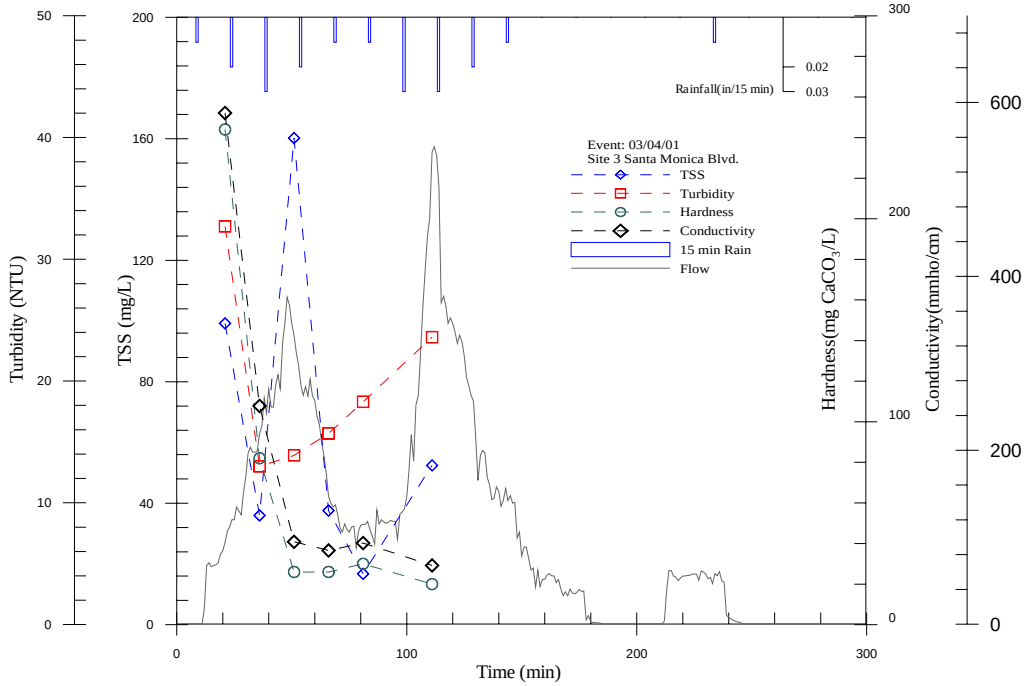

Figure I.2.3.7a (Y2-UCLA3-E7-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

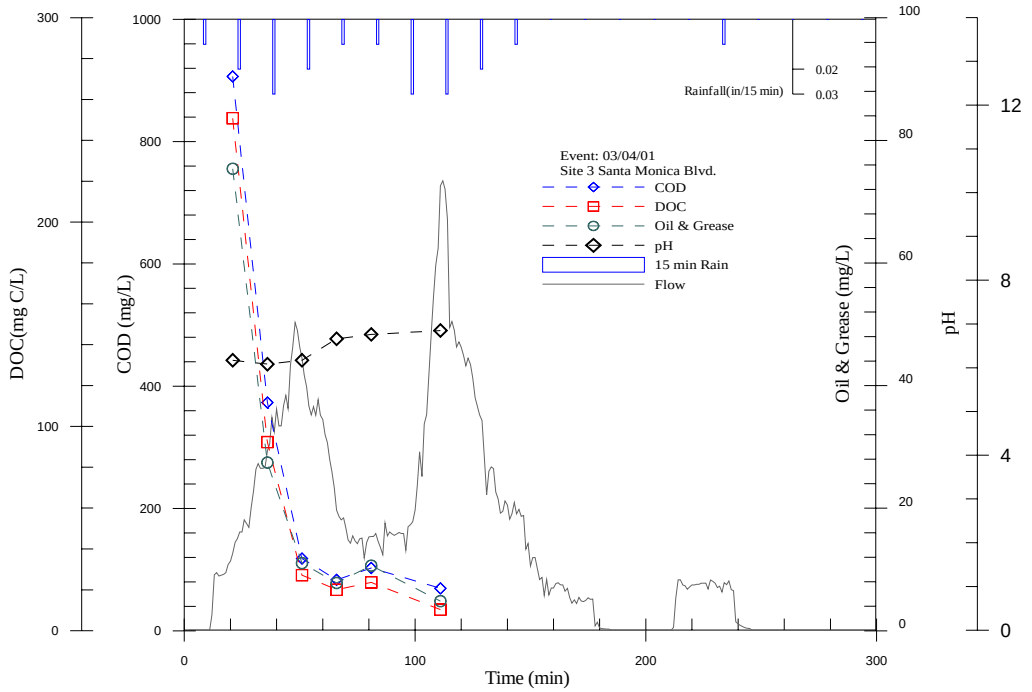

Figure I.2.3.7b (Y2-UCLA3-E7-2) Polluto-graph for COD, DOC, Oil & Grease and pH

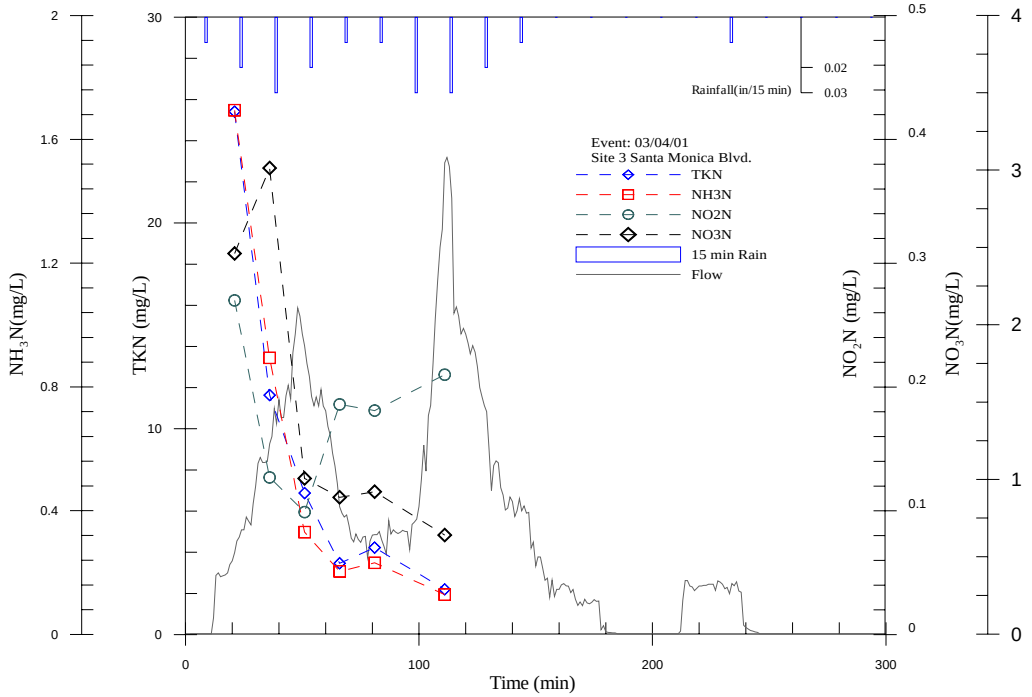

Figure I.2.3.7c (Y2-UCLA3-E7-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

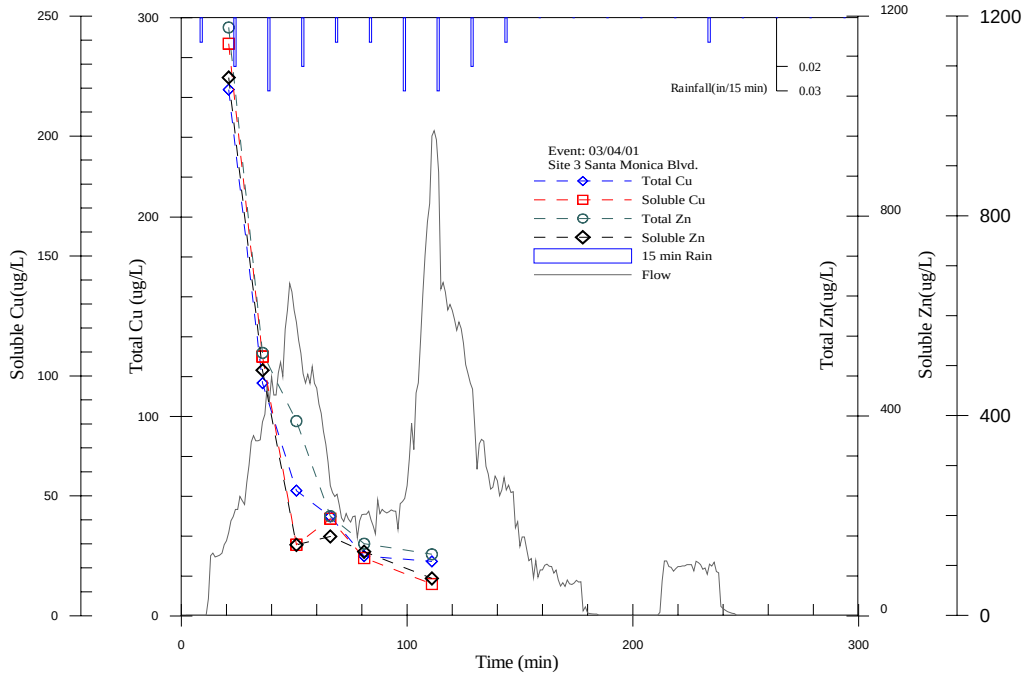

Figure I.2.3.7d (Y2-UCLA3-E7-4) Polluto-graph for Total/Soluble Cu and Zn

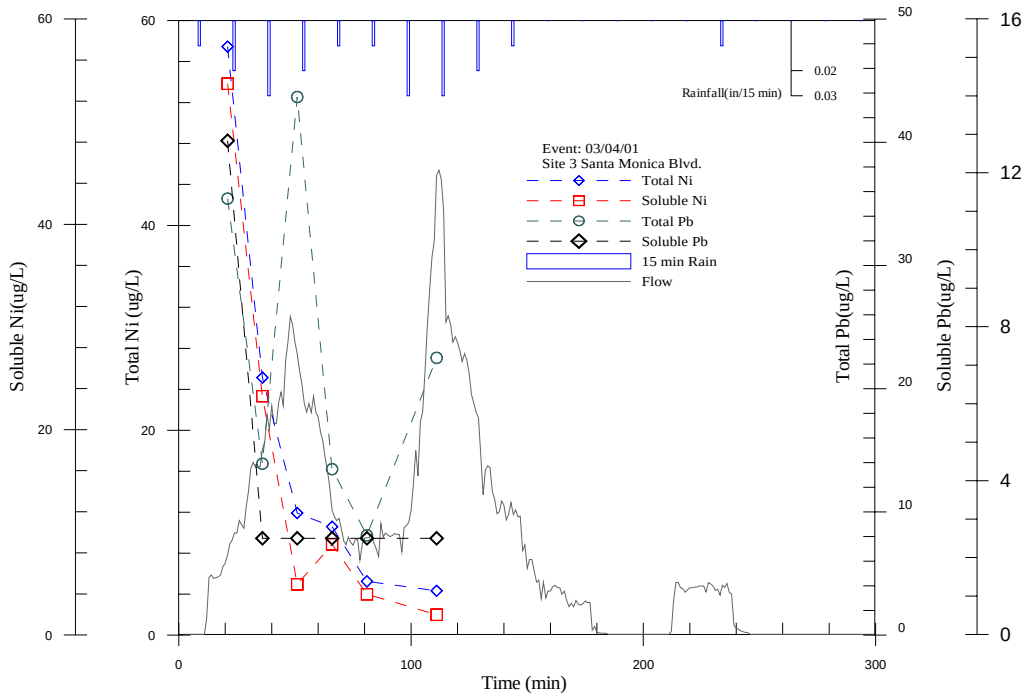

Figure I.2.3.7e (Y2-UCLA3-E7-5) Polluto-graph for Total/Soluble Ni and Pb

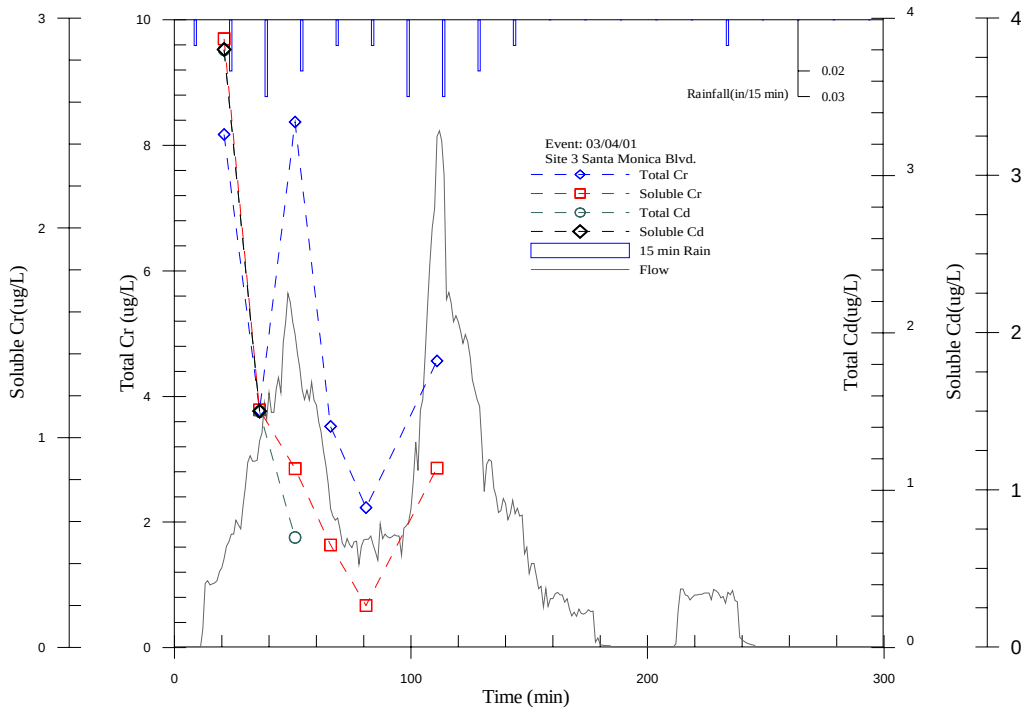

Figure I.2.3.7f (Y2-UCLA3-E7-6) Polluto-graph for Total/Soluble Cr and Cd

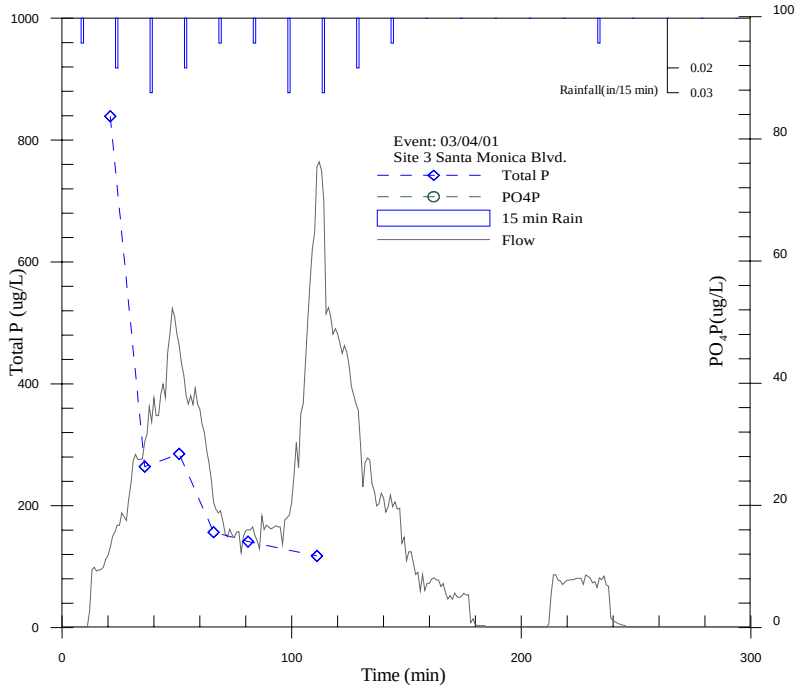

Figure I.2.3.7g (Y2-UCLA3-E7-7) Polluto-graph for Total-P and PO_4-P

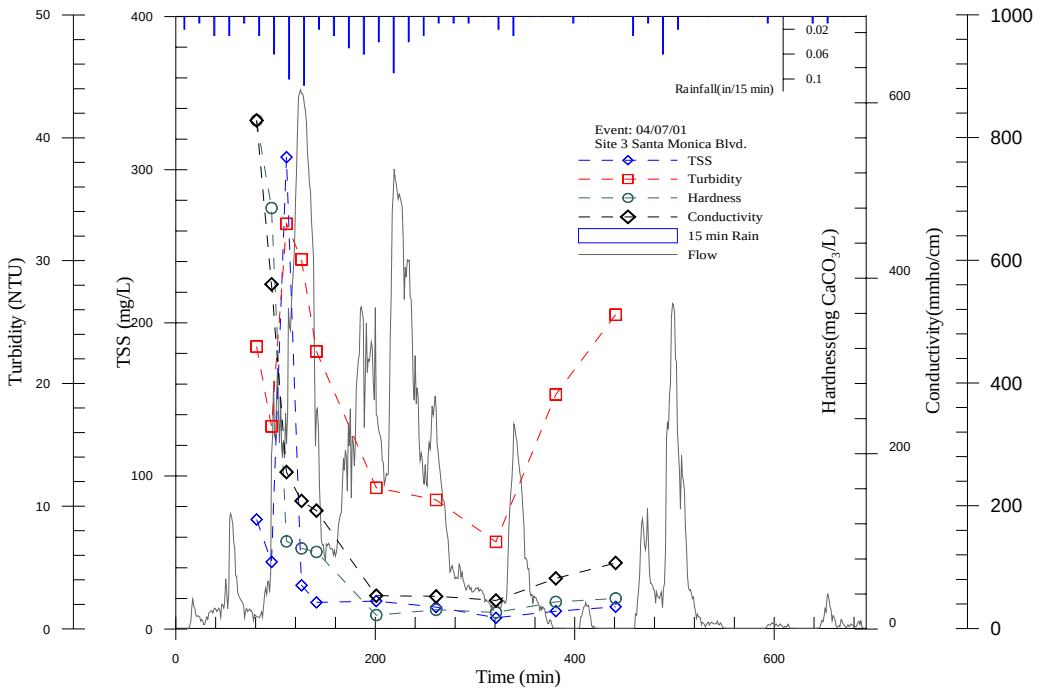

Figure I.2.3.8a (Y2-UCLA3-E8-1) Polluto-graph for TSS, Turbidity, Hardness and Conductivity

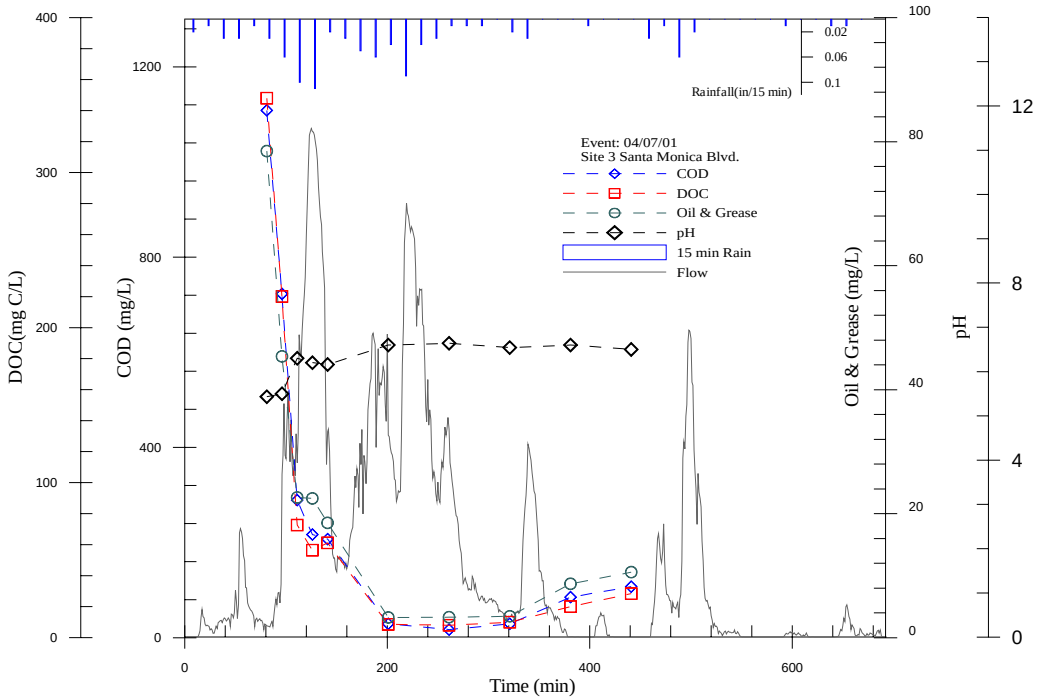

Figure I.2.3.8b (Y2-UCLA3-E8-2) Polluto-graph for COD, DOC, Oil & Grease and pH

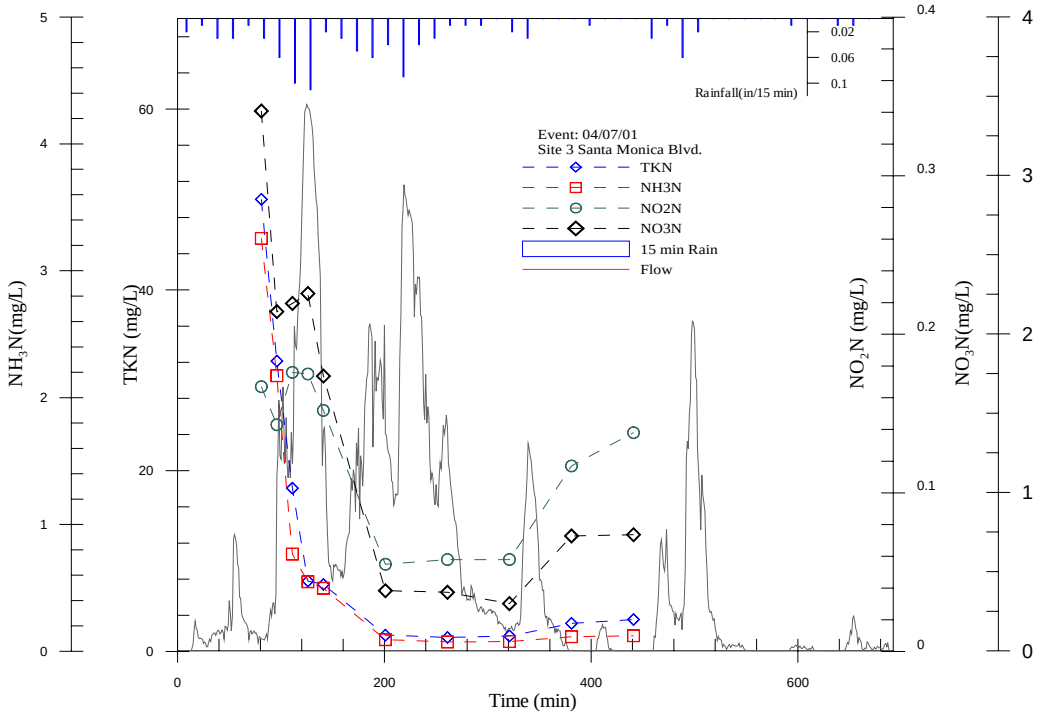

Figure I.2.3.8c (Y2-UCLA3-E8-3) Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

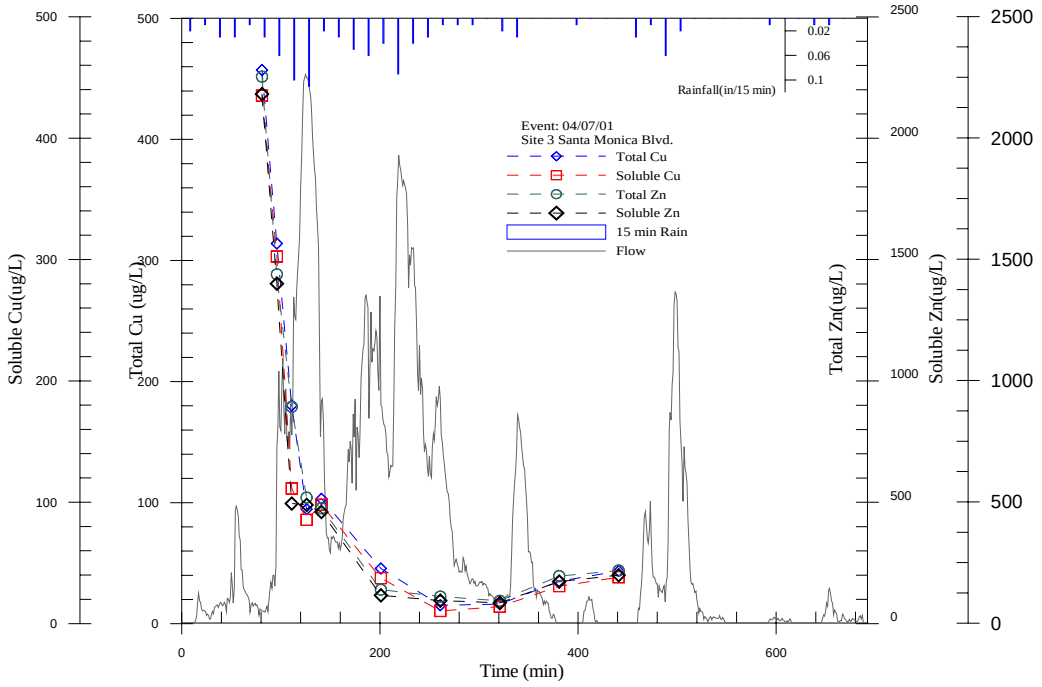

Figure I.2.3.8d (Y2-UCLA3-E8-4) Polluto-graph for Total/Soluble Cu and Zn

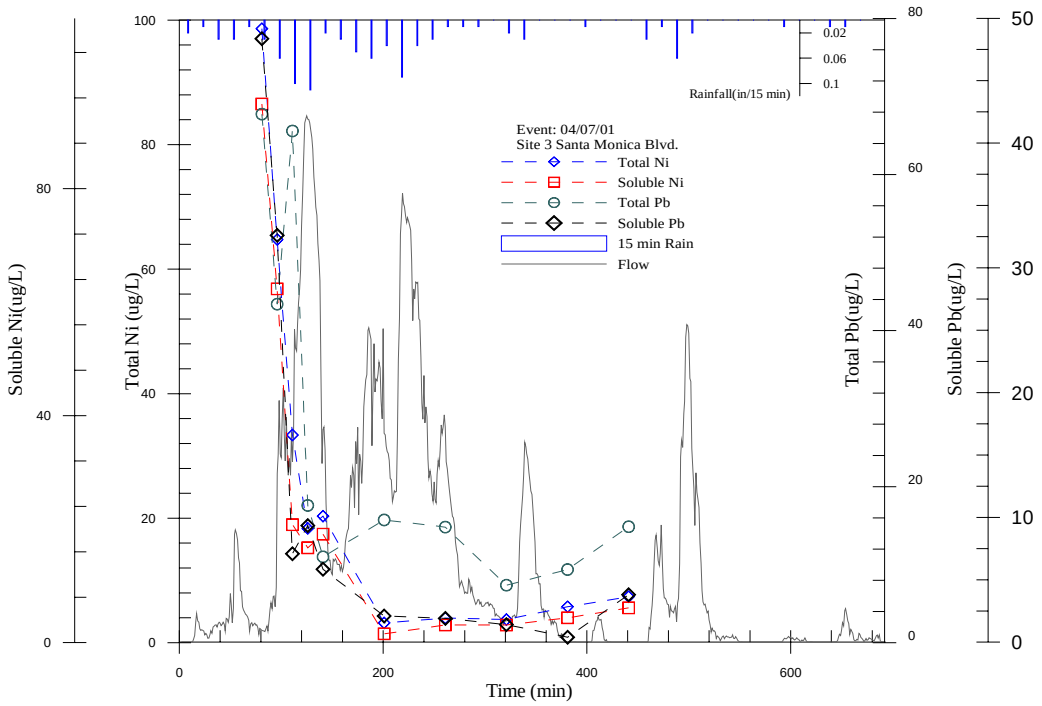

Figure I.2.3.8e (Y2-UCLA3-E8-5) Polluto-graph for Total/Soluble Ni and Pb

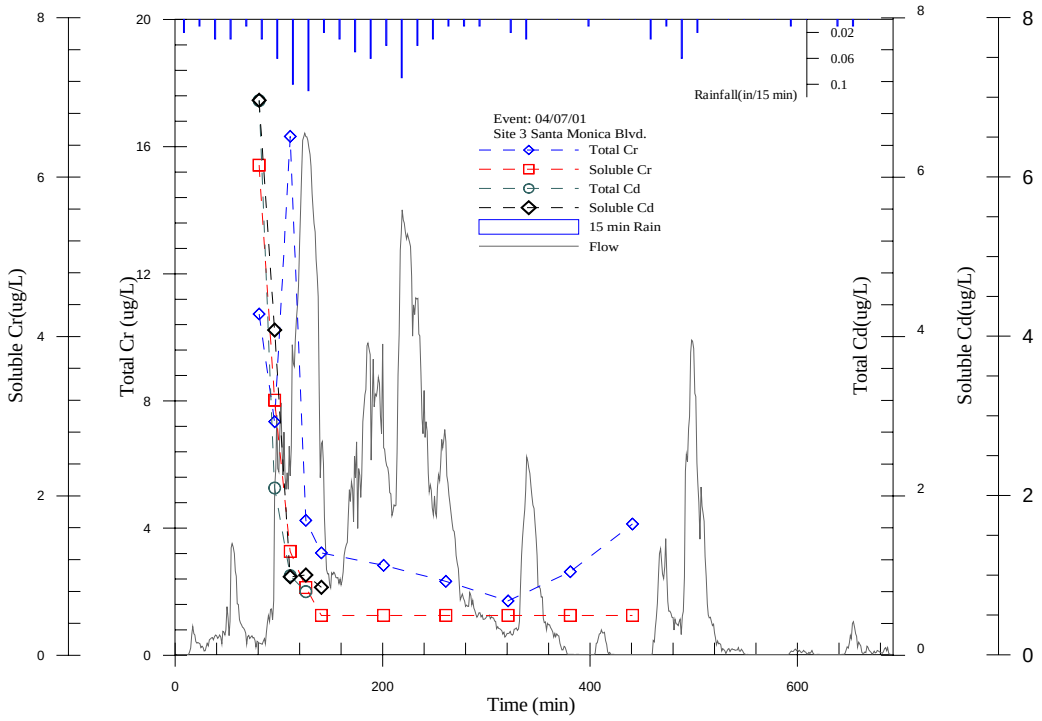

Figure I.2.3.8f (Y2-UCLA3-E8-6) Polluto-graph for Total/Soluble Cr and Cd

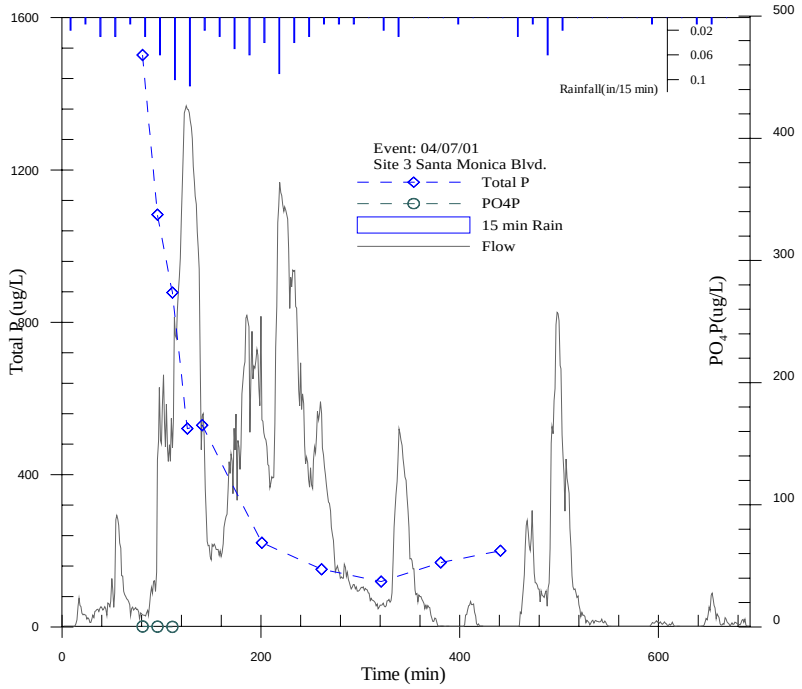

Figure I.2.3.8g (Y2-UCLA3-E8-7) Polluto-graph for Total-P and PO_4-P

1. UCLA1, 11/12/01

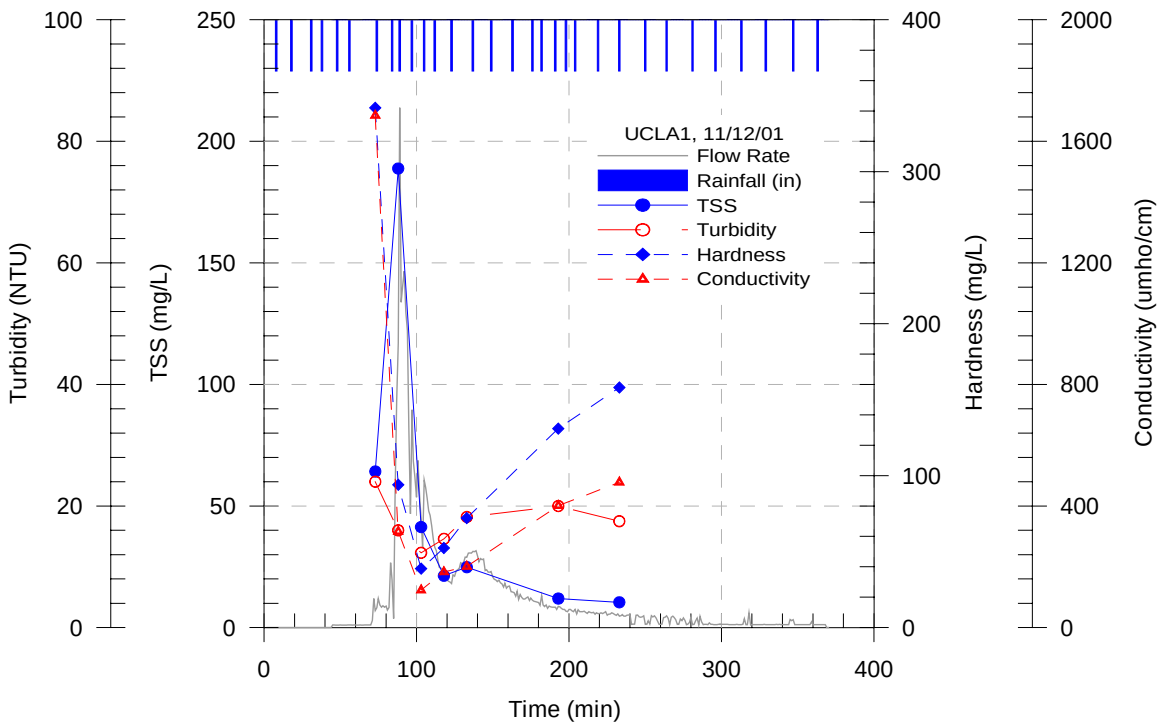

Figure I.3.1.1a[1] (Y3-UCLA1-E2-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

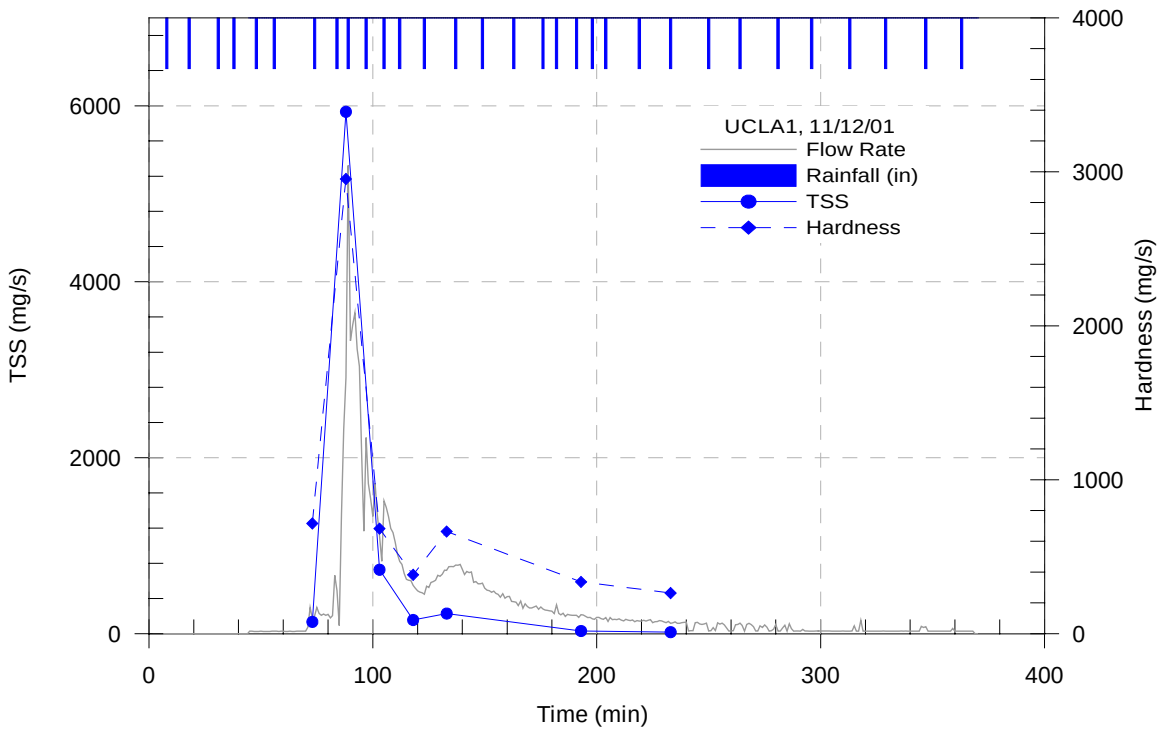

Figure I.3.1.1a[2] (Y3-UCLA1-E2-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

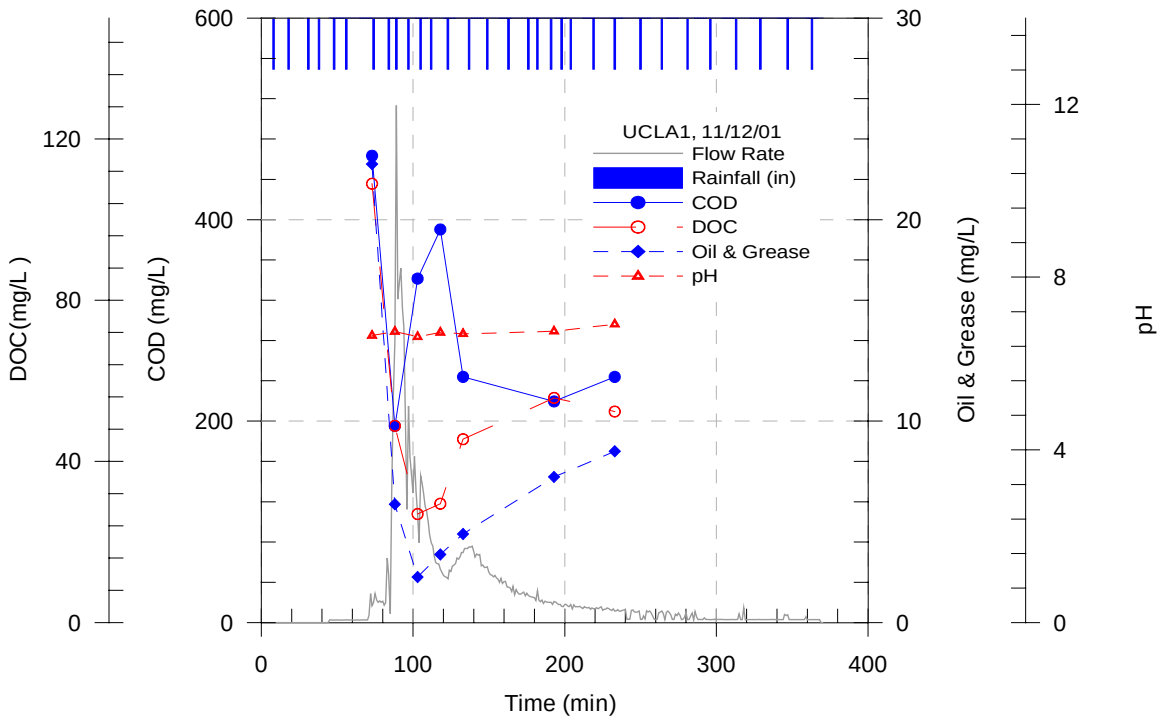

Figure I.3.1.2b[1] (Y3-UCLA1-E2-2). Polluto-graph for COD, DOC, Oil & Grease and pH

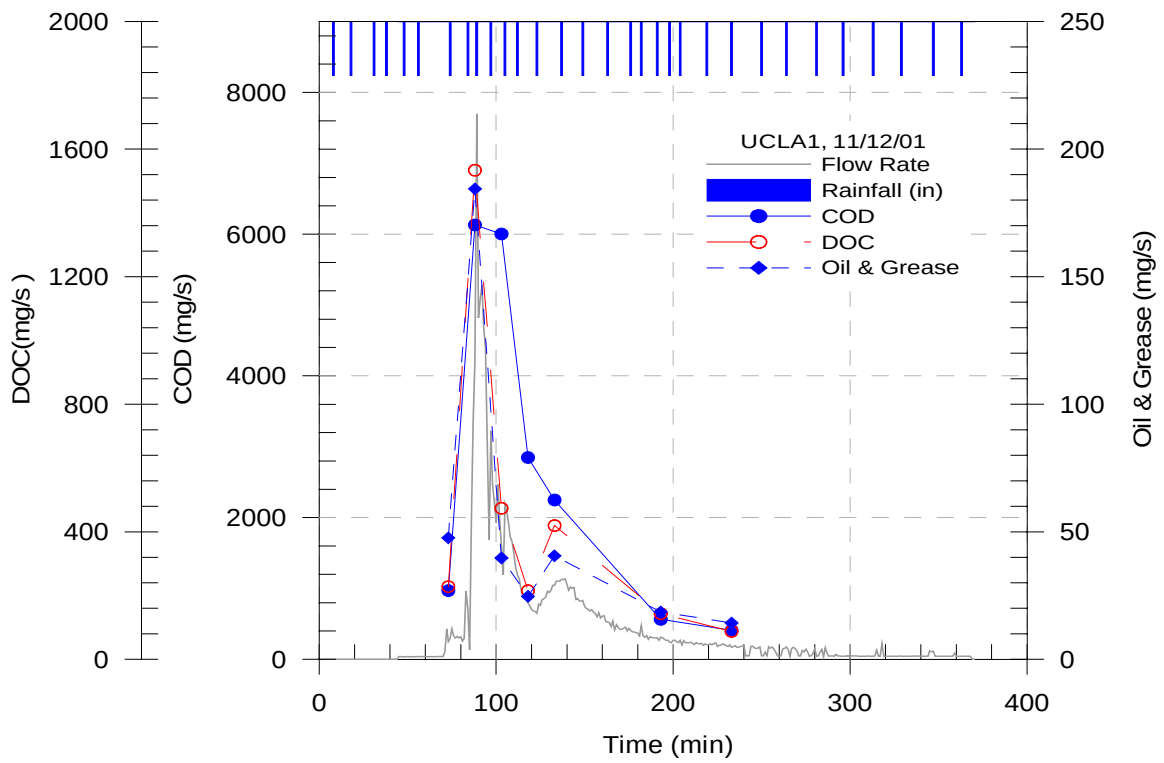

Figure I.3.1.2b[2] (Y3-UCLA1-E2-2). Load-graph for COD, DOC, Oil & Grease and pH

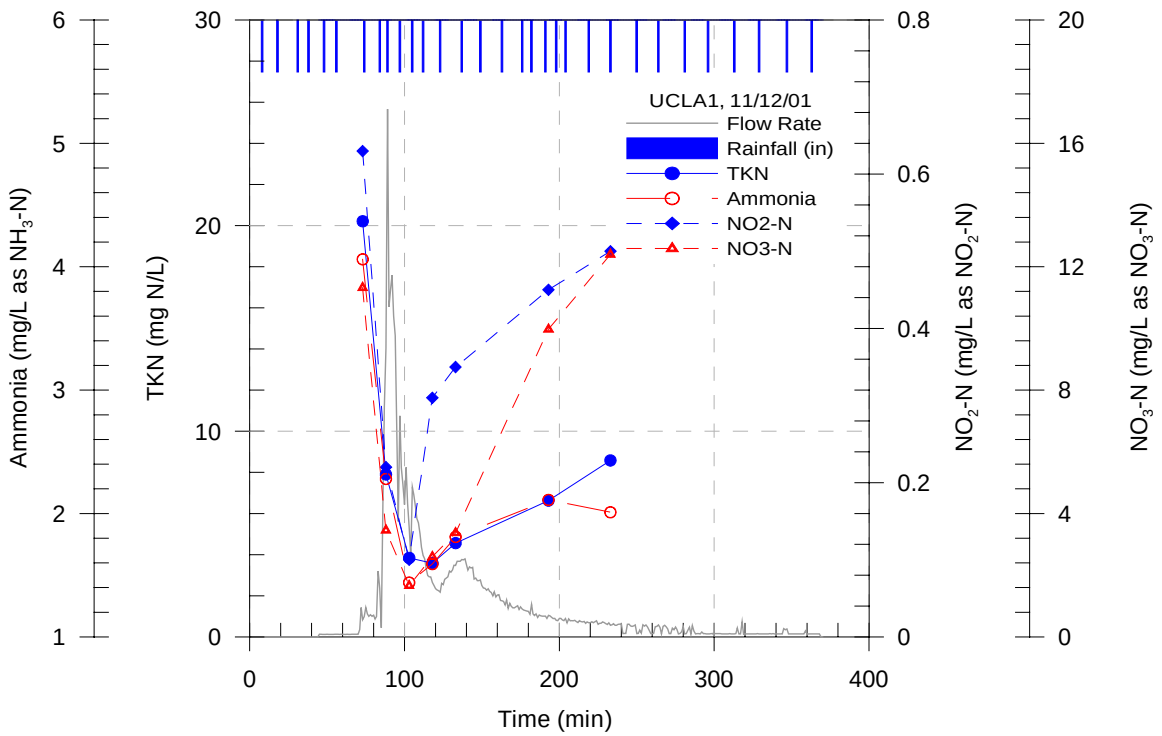

Figure I.3.1.3c[1] (Y3-UCLA1-E2-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

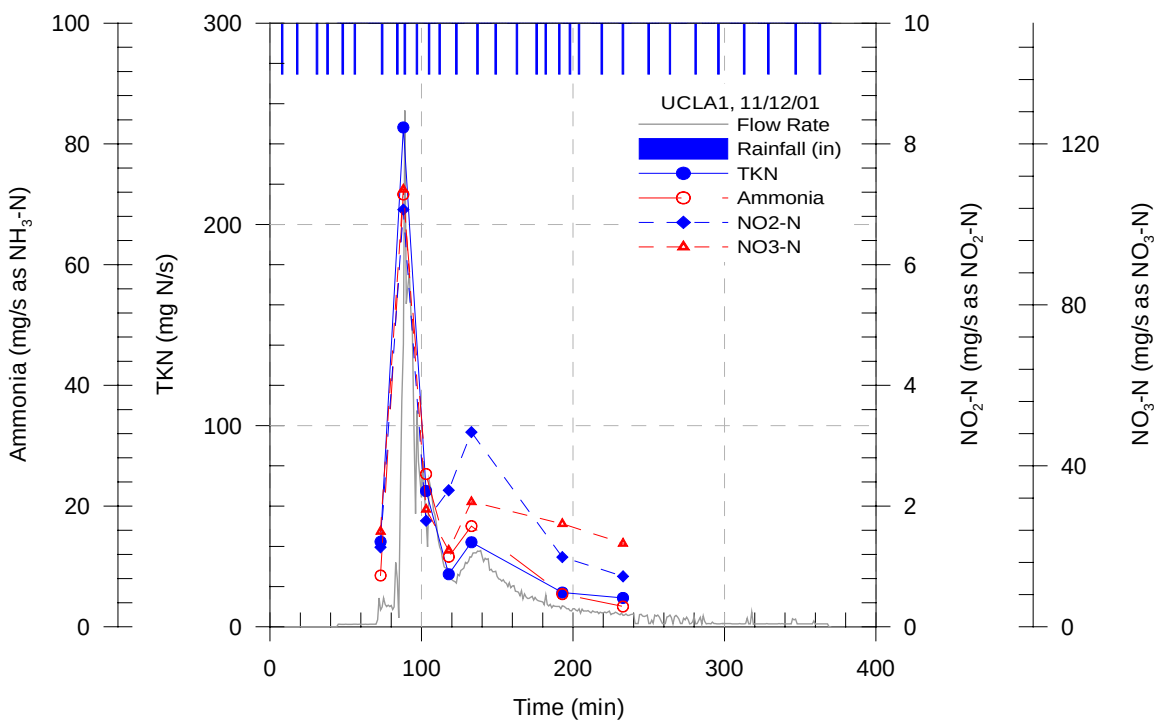

Figure I.3.1.3c[2] (Y3-UCLA1-E2-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

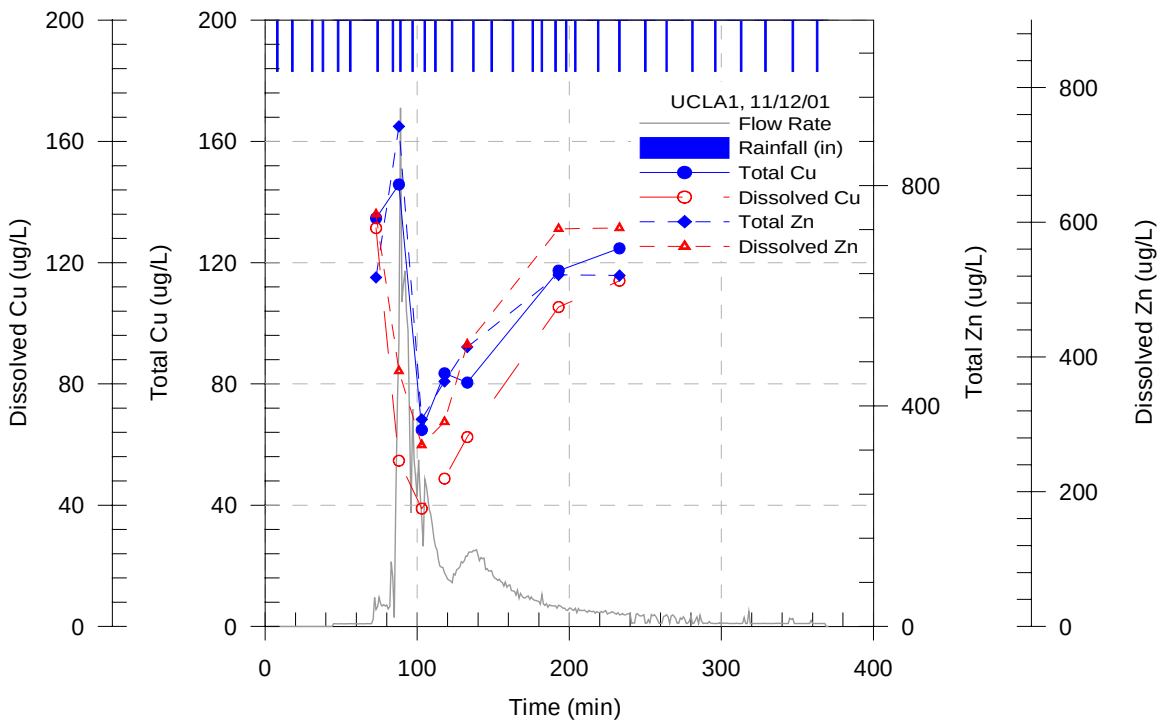

Figure I.3.1.4d[1] (Y3-UCLA1-E2-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

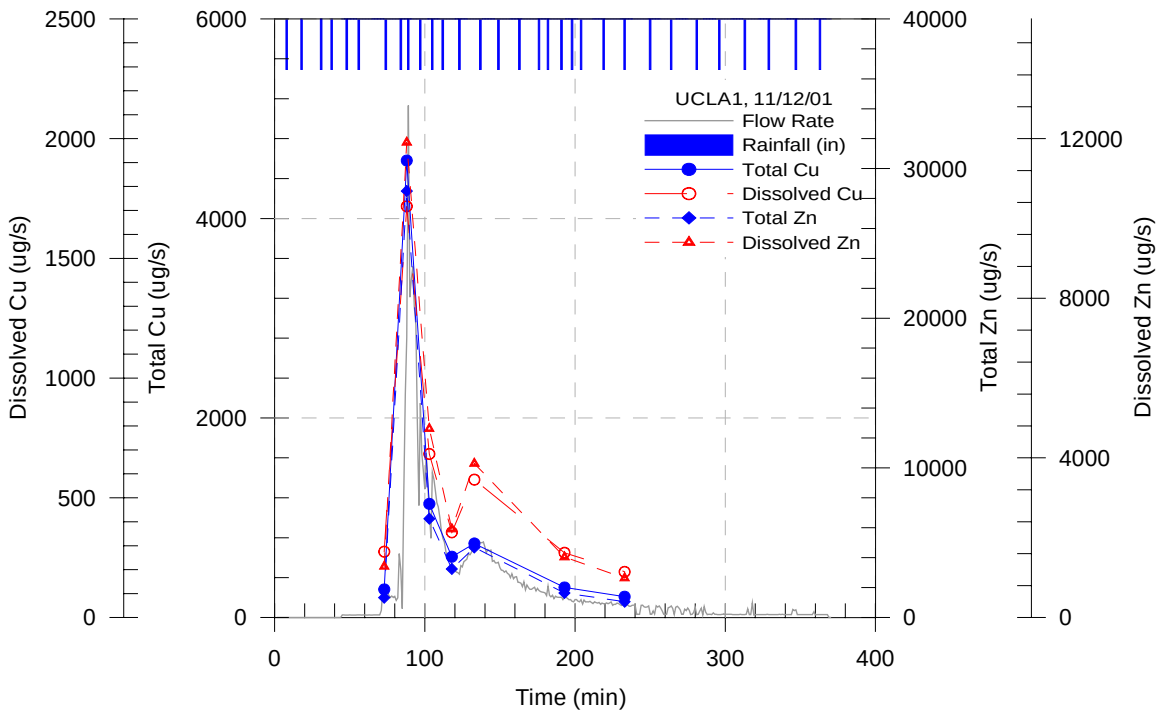

Figure I.3.1.4d[2] (Y3-UCLA1-E2-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

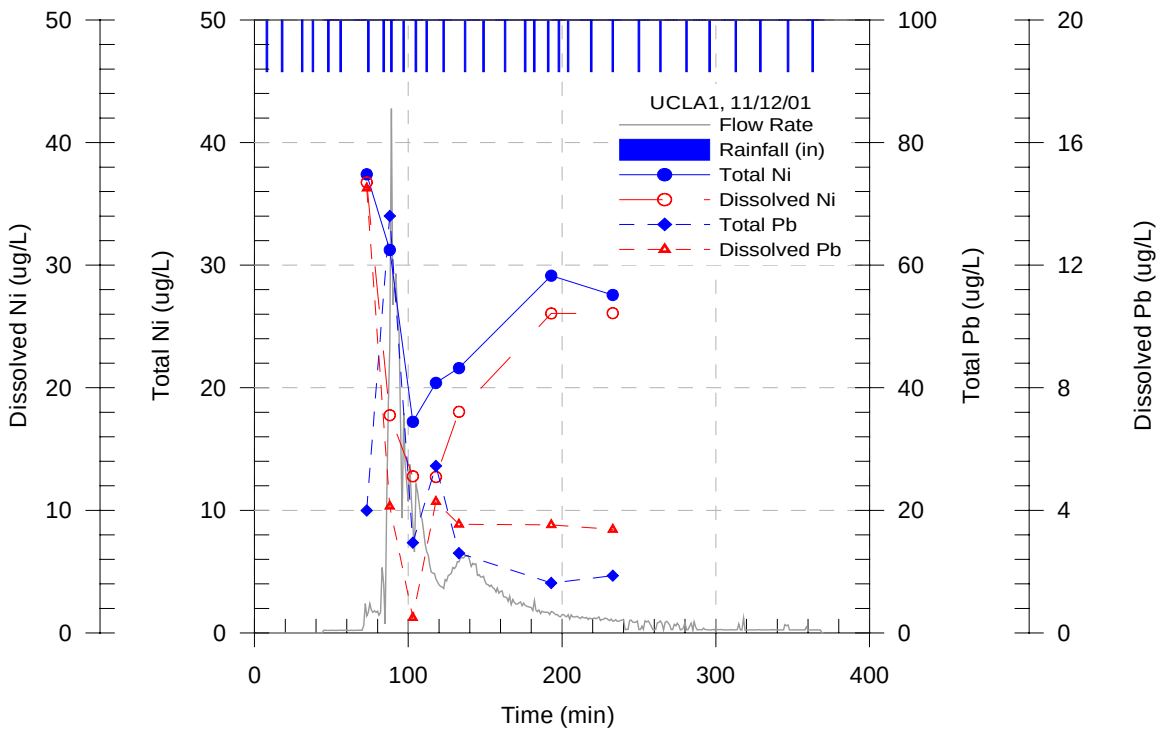

Figure I.3.1.5e[1] (Y3-UCLA1-E2-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

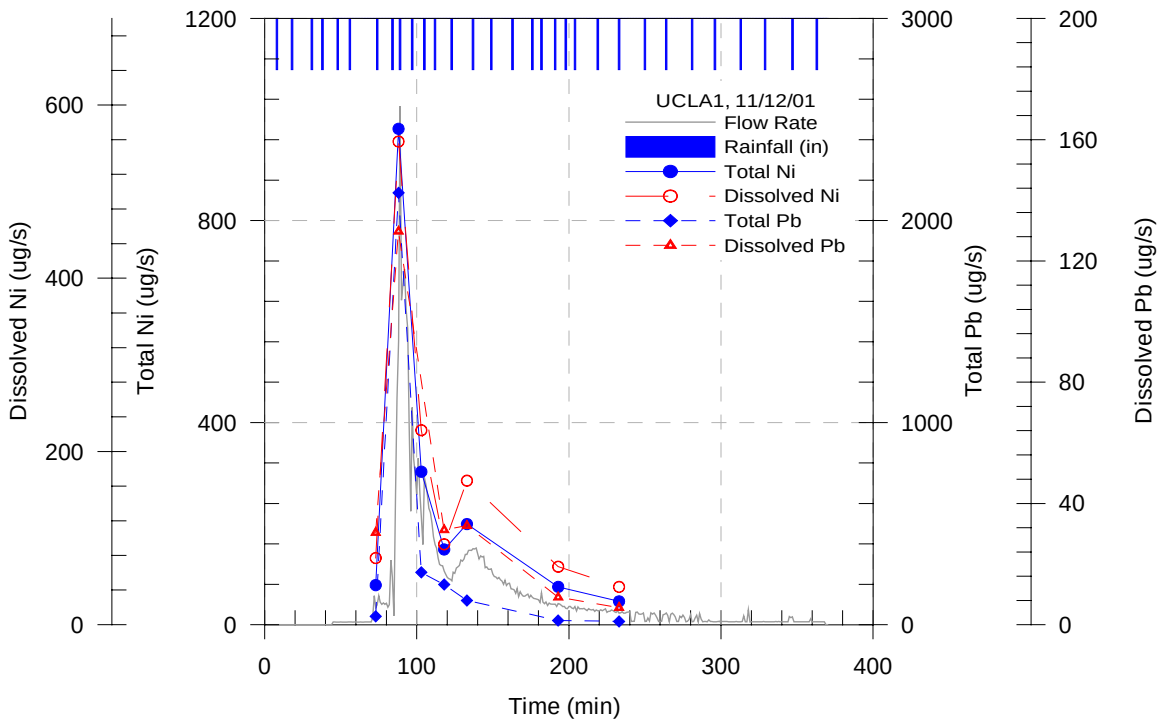

Figure I.3.1.5e[2] (Y3-UCLA1-E2-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

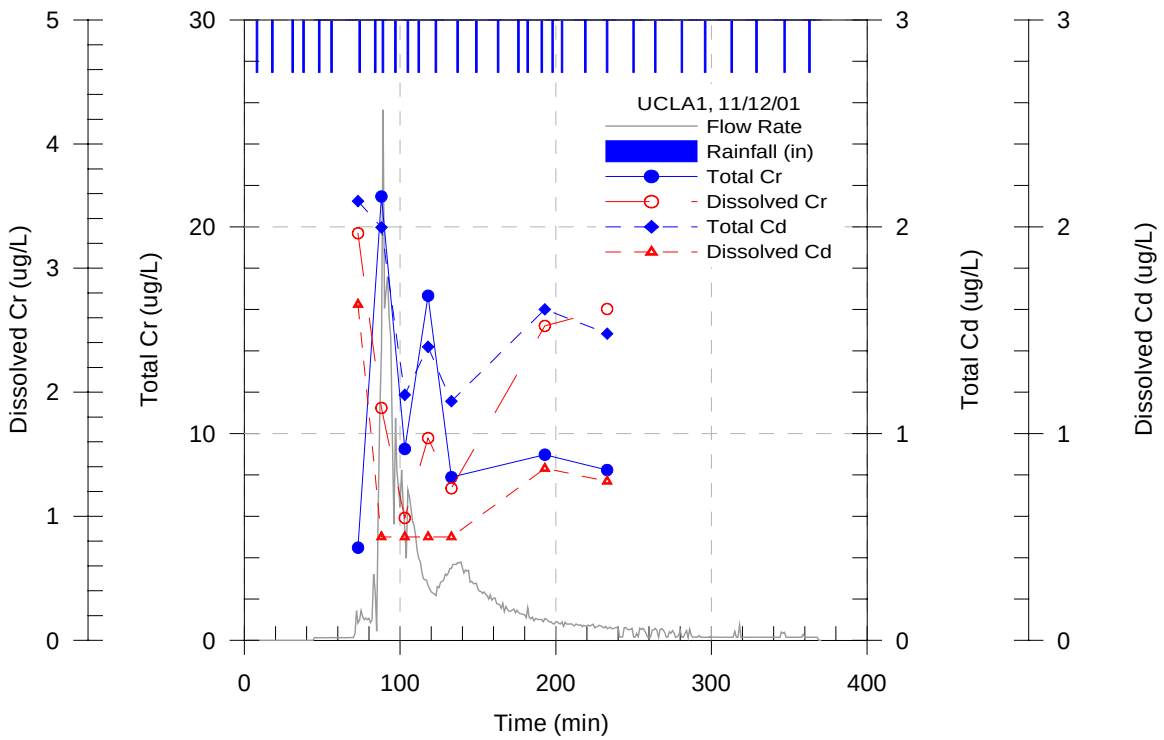

Figure I.3.1.6f[1] (Y3-UCLA1-E2-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

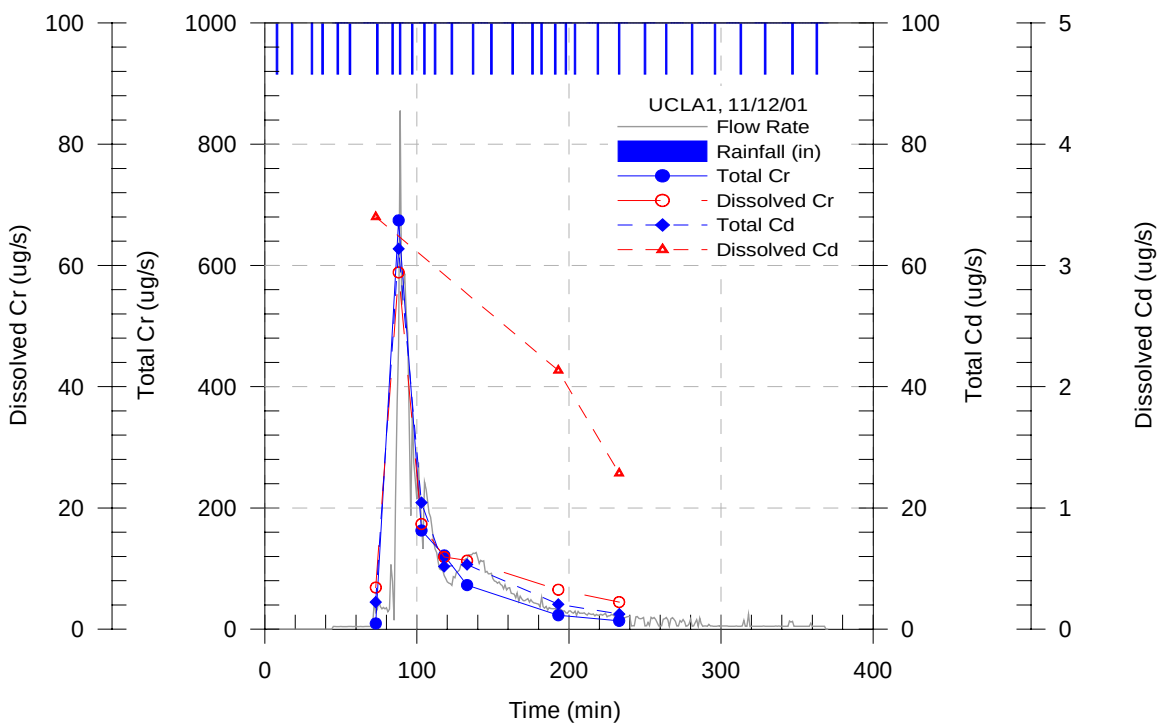

Figure I.3.1.6f[2] (Y3-UCLA1-E2-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

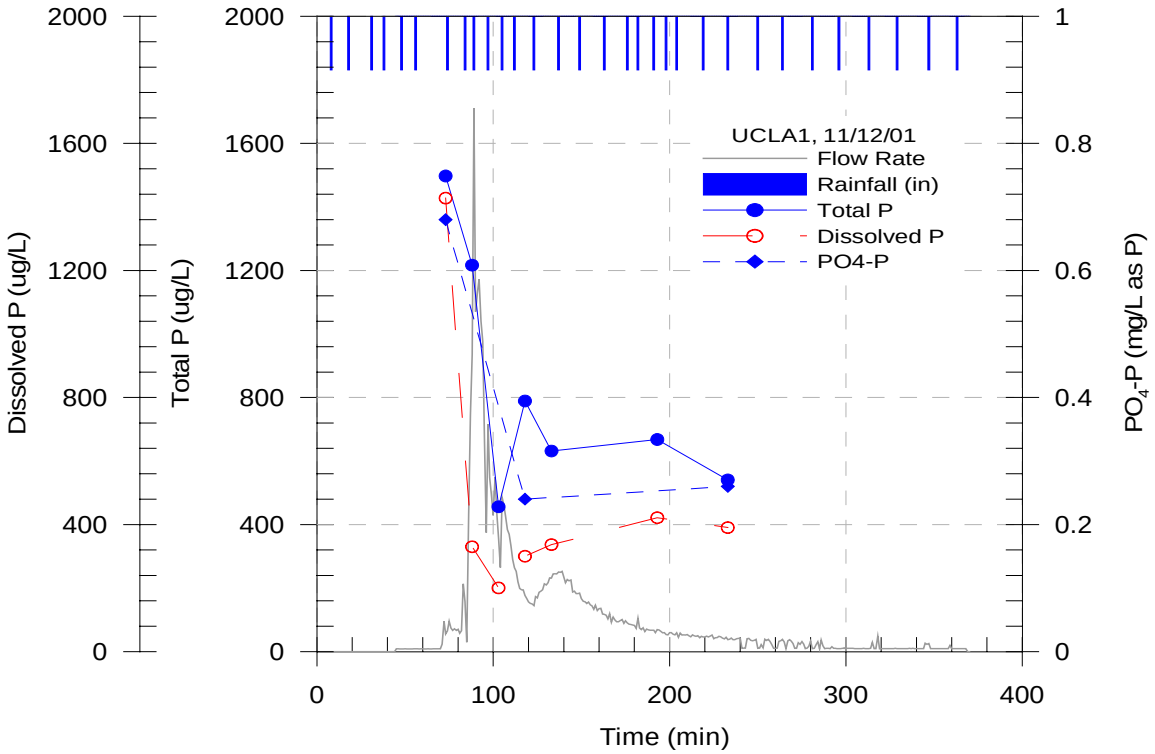

Figure I.3.1.7g[1] (Y3-UCLA1-E2-7). Polluto-graph for Total P / PO_4^{3-}-P

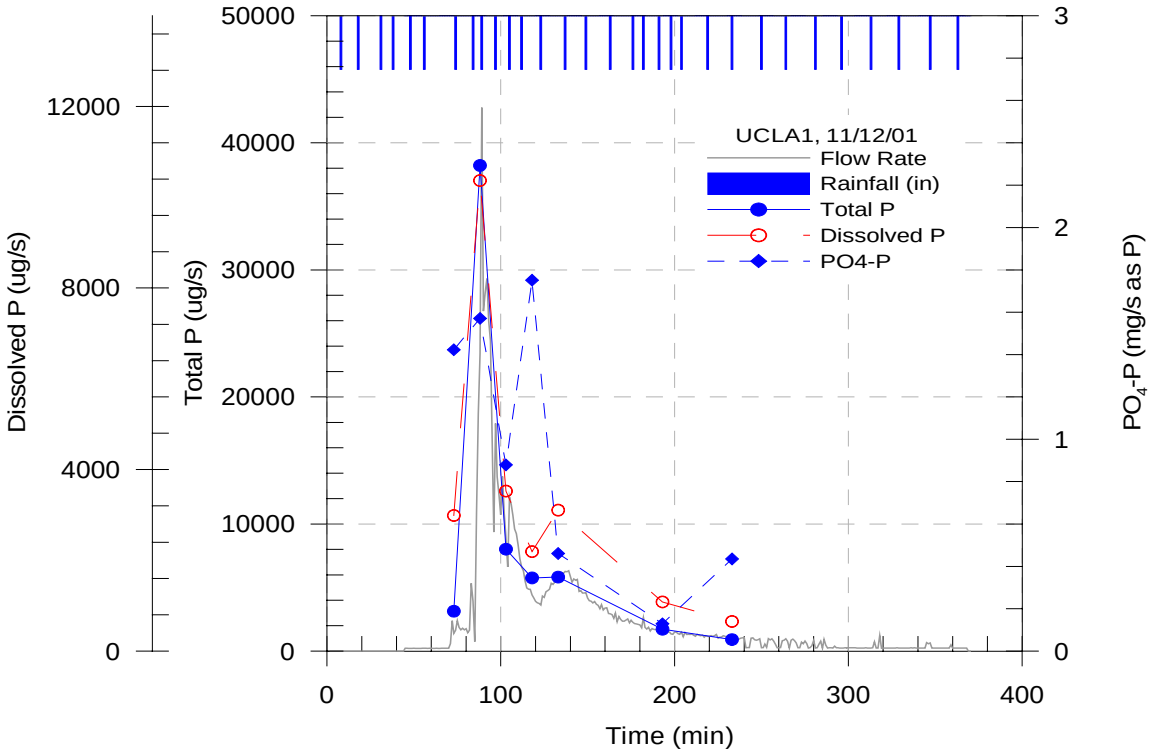

Figure I.3.1.7g[2] (Y3-UCLA1-E2-7). Load -graph for Total P / PO_4^{3-}P

2. UCLA1, 11/24/01

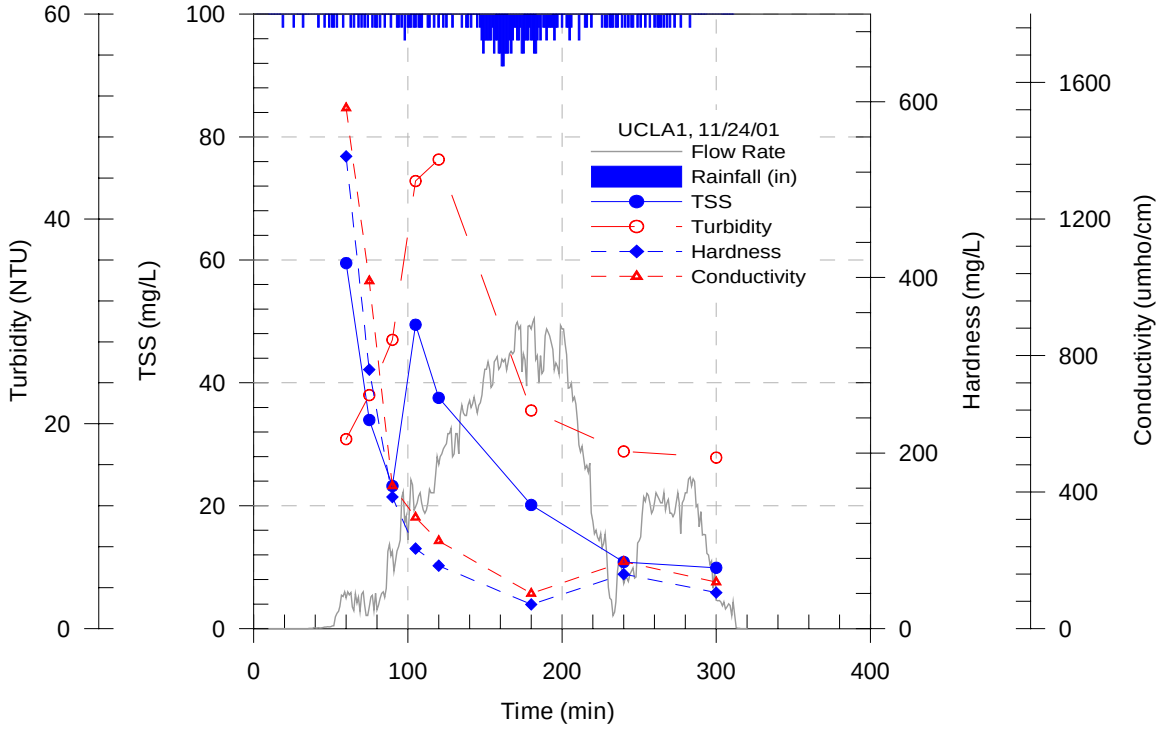

Figure I.3.1.2a[1] (Y3-UCLA1-E3-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

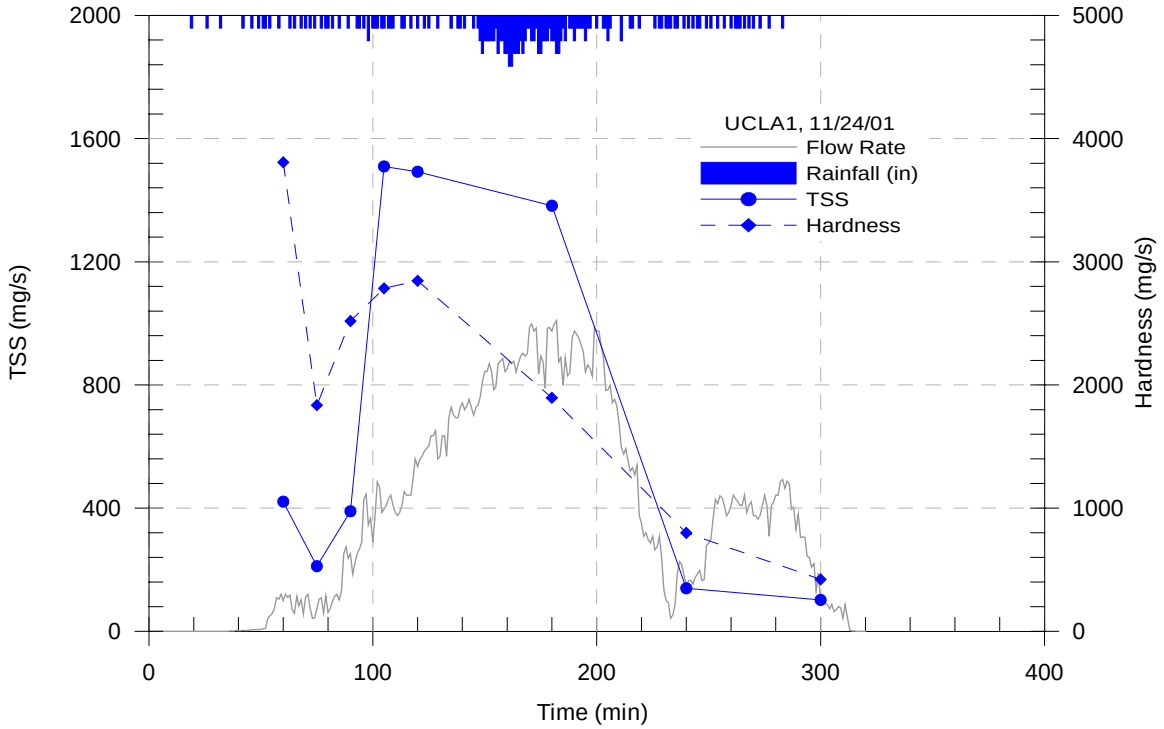

Figure I.3.1.2a[2] (Y3-UCLA1-E3-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

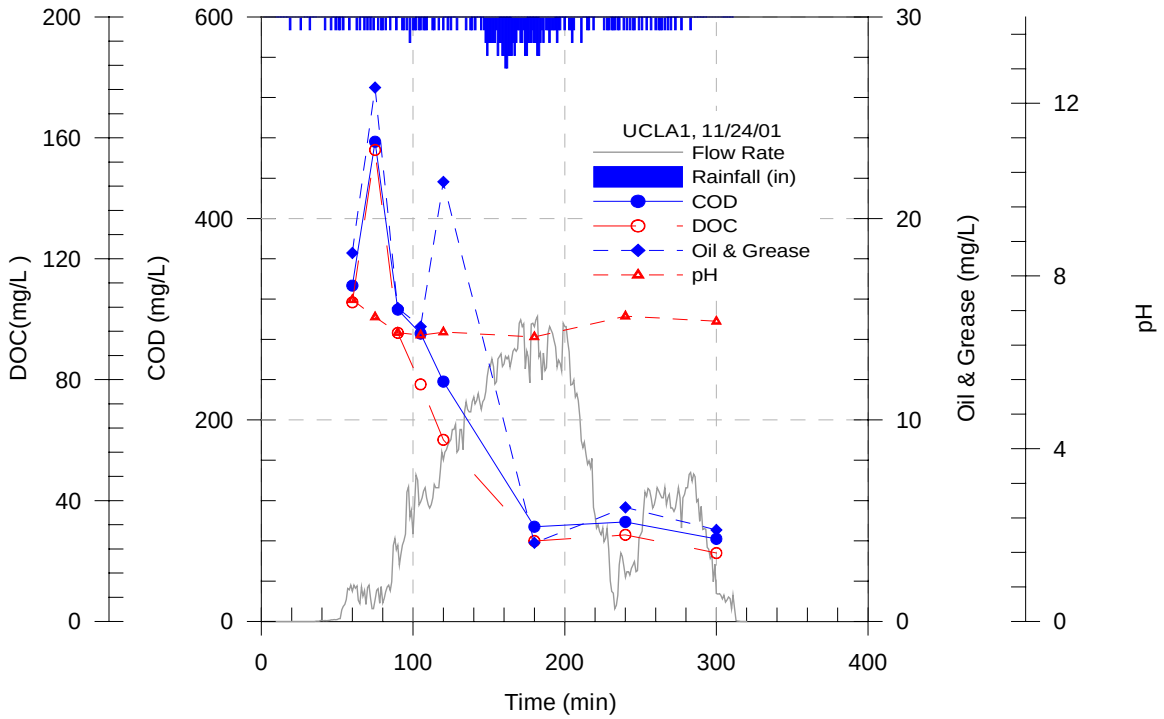

Figure I.3.1.2b[1] (Y3-UCLA1-E3-2). Polluto-graph for COD, DOC, Oil & Grease and pH

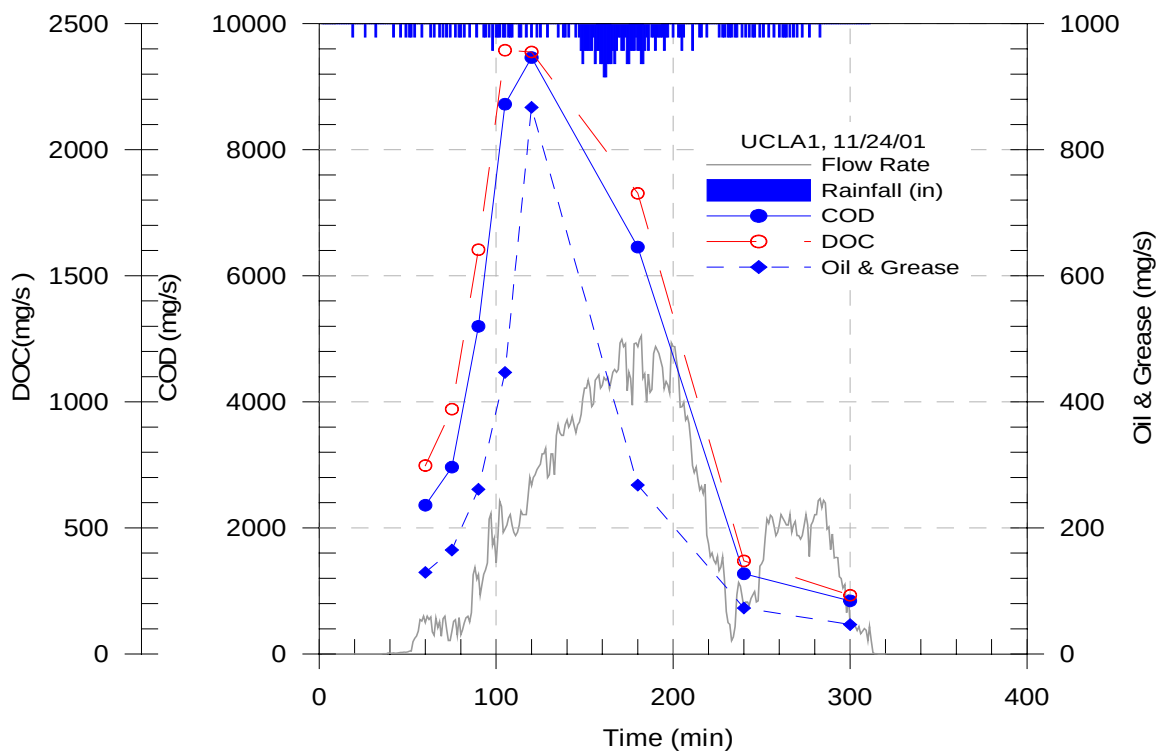

Figure I.3.1.2b[2] (Y3-UCLA1-E3-2). Load-graph for COD, DOC, Oil & Grease and pH

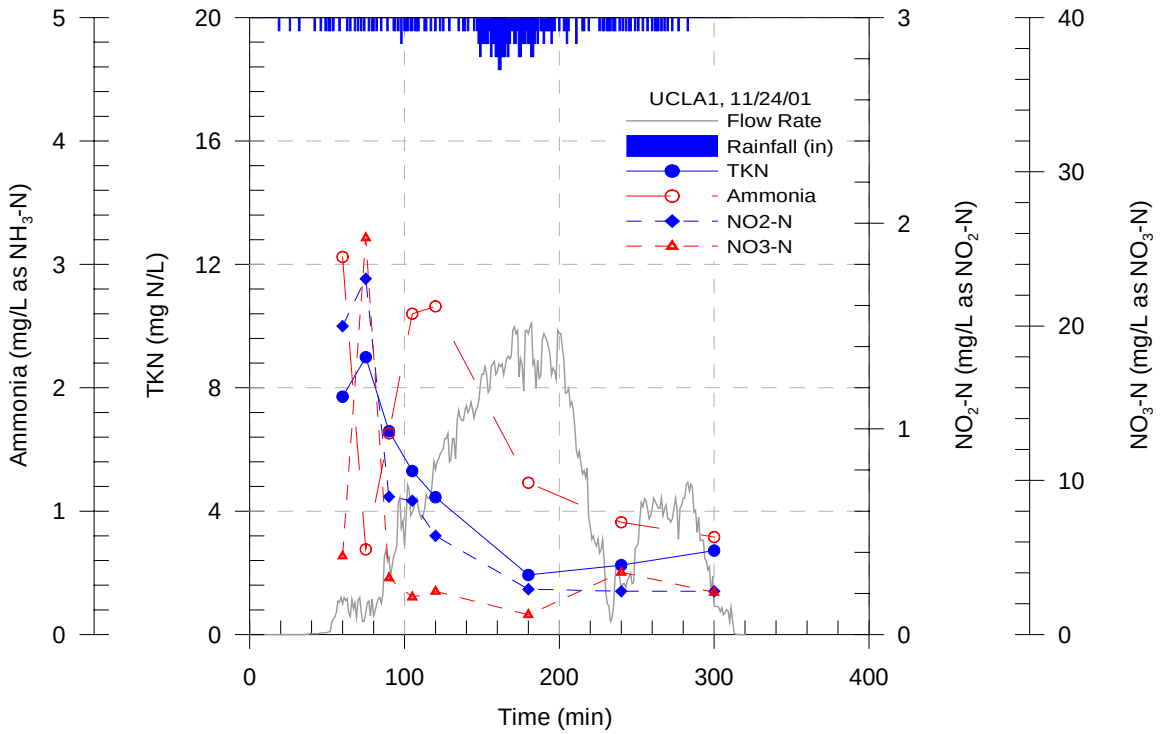

Figure I.3.1.2c[1] (Y3-UCLA1-E3-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

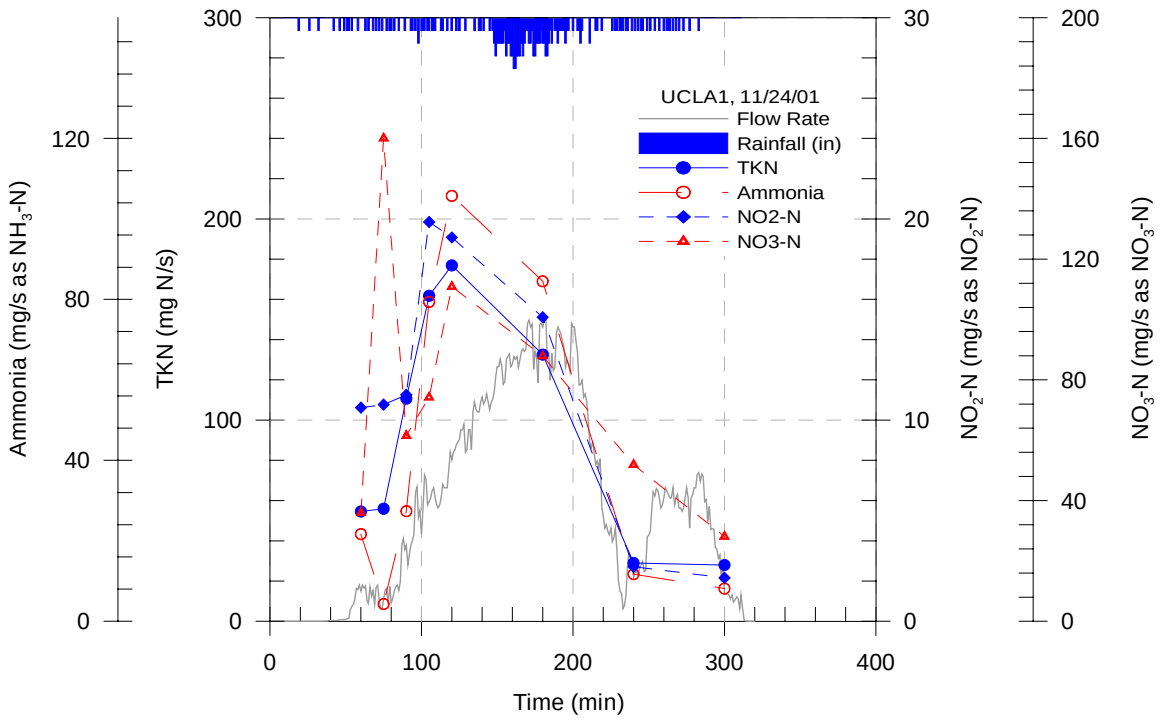

Figure I.3.1.2c[2] (Y3-UCLA1-E3-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

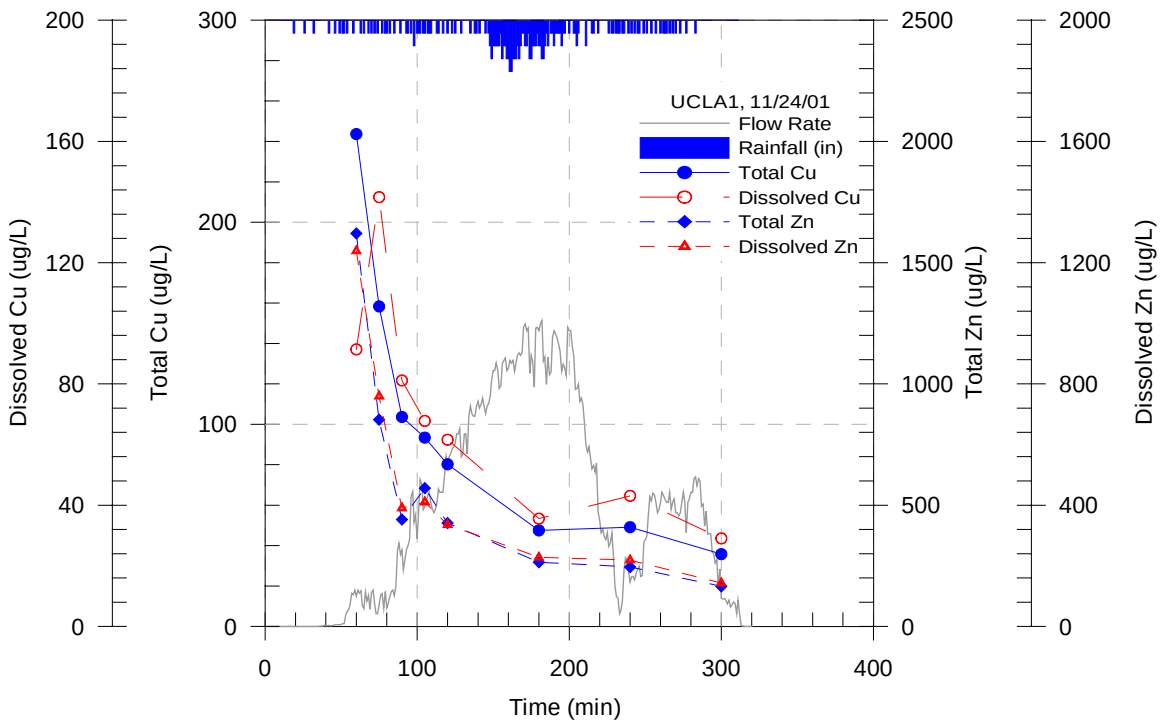

Figure I.3.1.2d[1] (Y3-UCLA1-E3-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

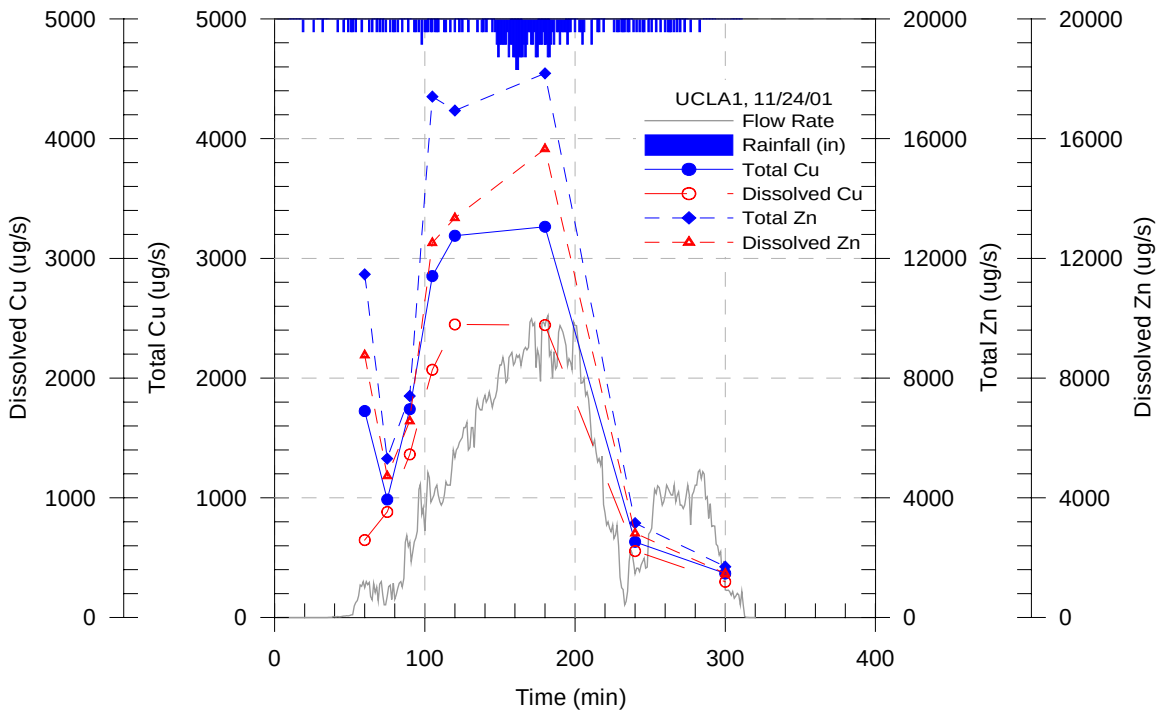

Figure I.3.1.2d[2] (Y3-UCLA1-E3-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

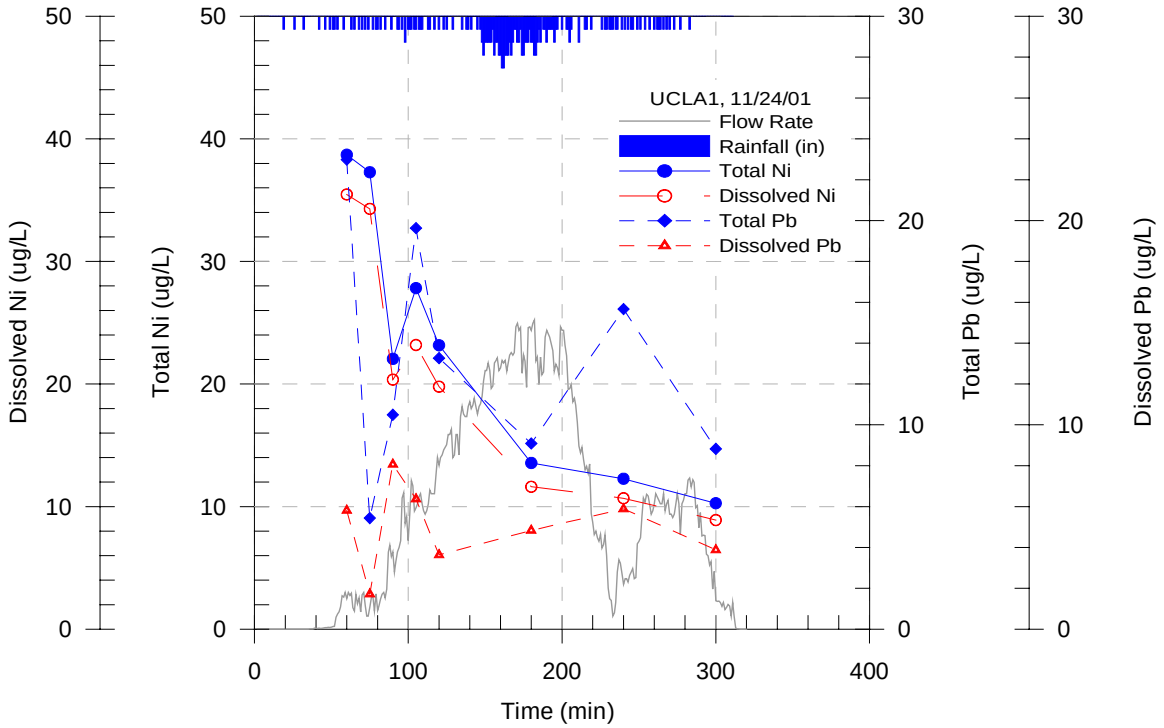

Figure I.3.1.2e[1] (Y3-UCLA1-E3-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

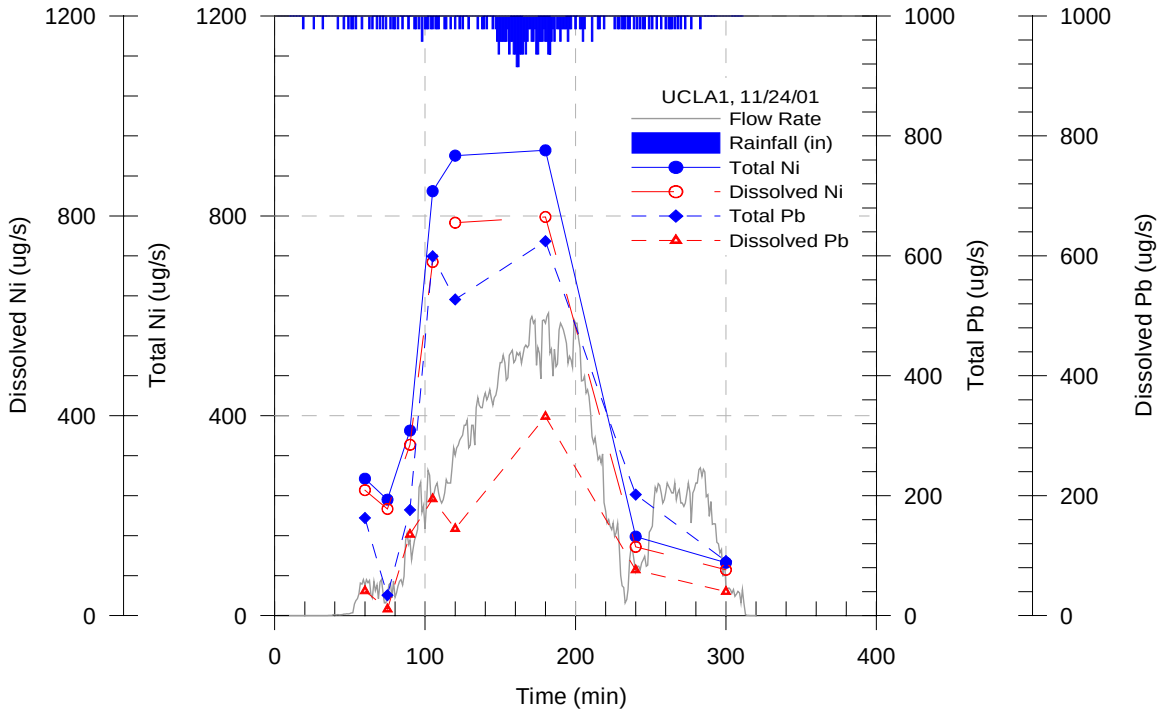

Figure I.3.1.2e[2] (Y3-UCLA1-E3-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

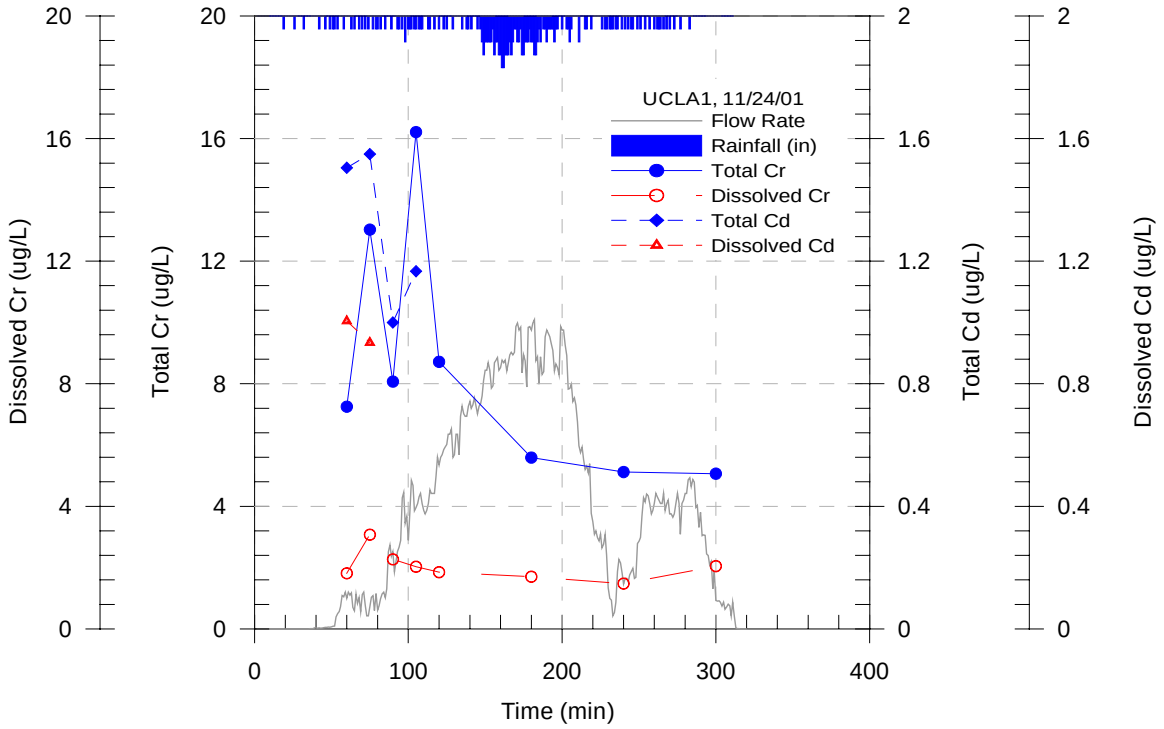

Figure I.3.1.2f[1] (Y3-UCLA1-E3-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

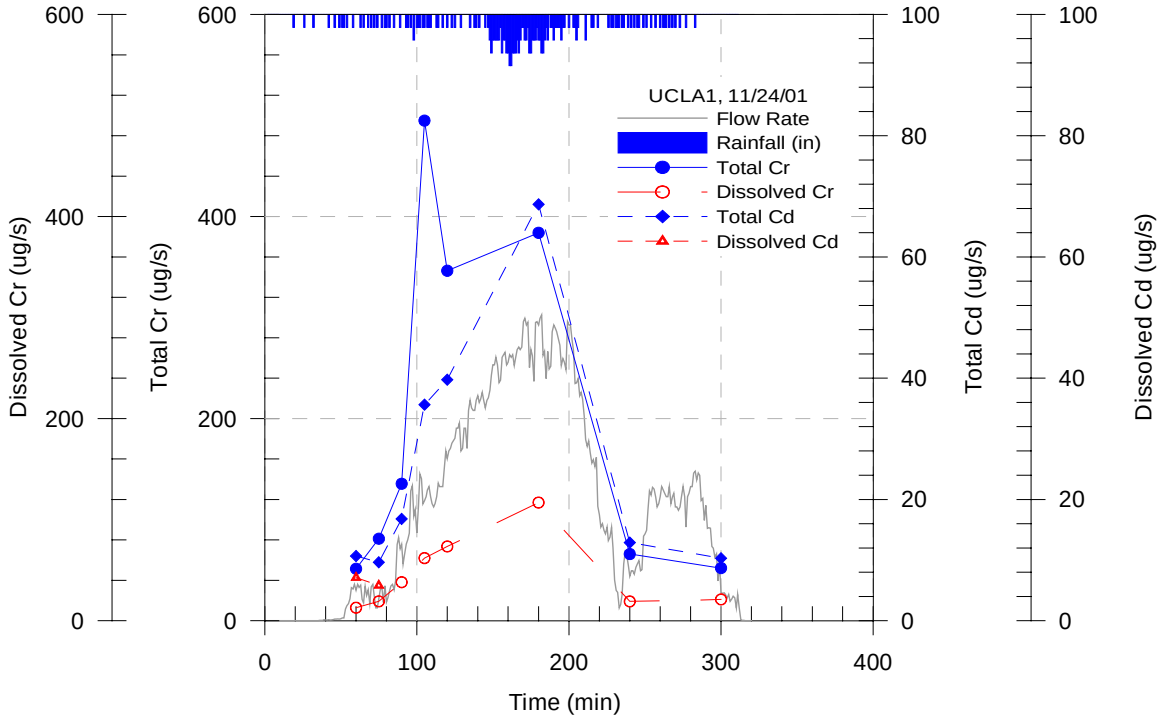

Figure I.3.1.2f[2] (Y3-UCLA1-E3-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

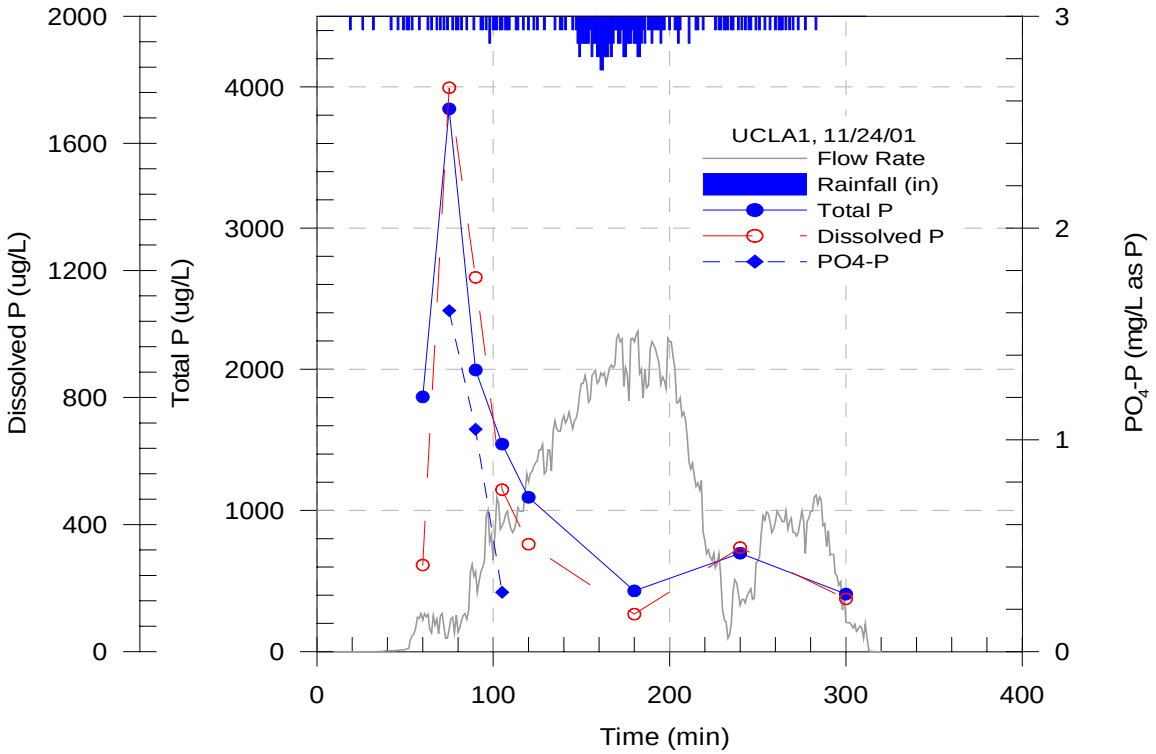

Figure I.3.1.2g[1] (Y3-UCLA1-E3-7). Polluto-graph for Total P / PO_4^{3-}-P

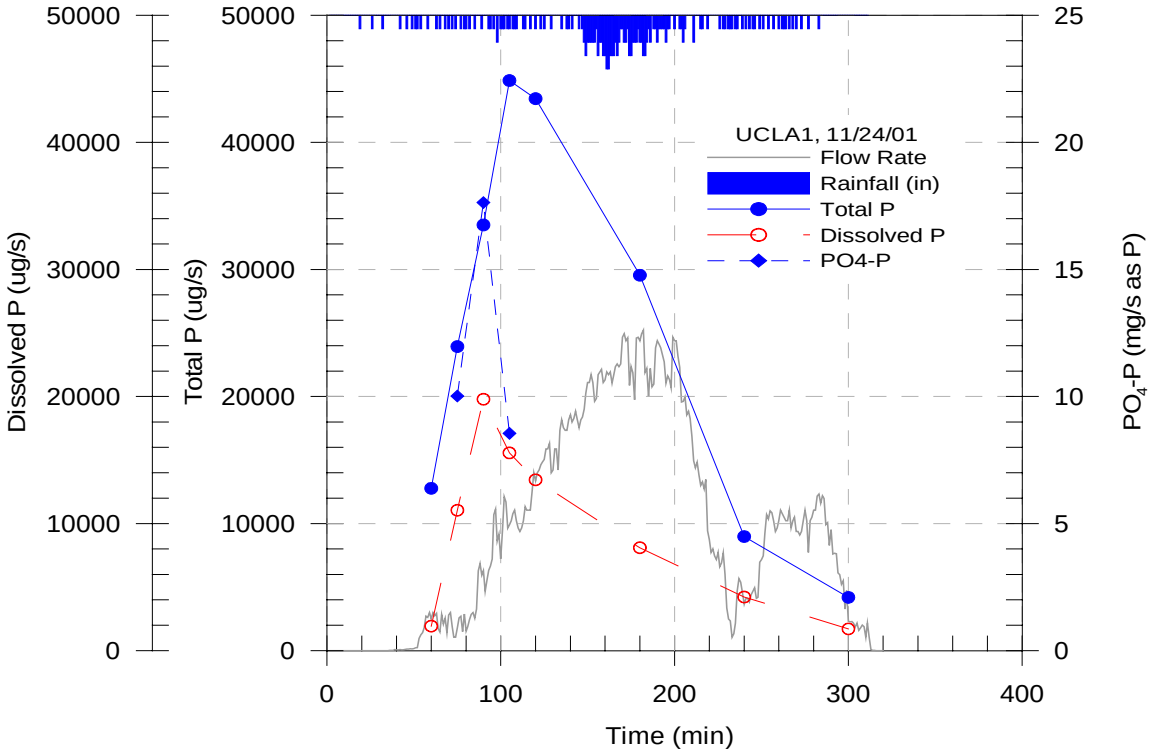

Figure I.3.1.2g[2] (Y3-UCLA1-E3-7). Load -graph for Total P / PO_4^{3-}-P

3. UCLA1, 12/20/01

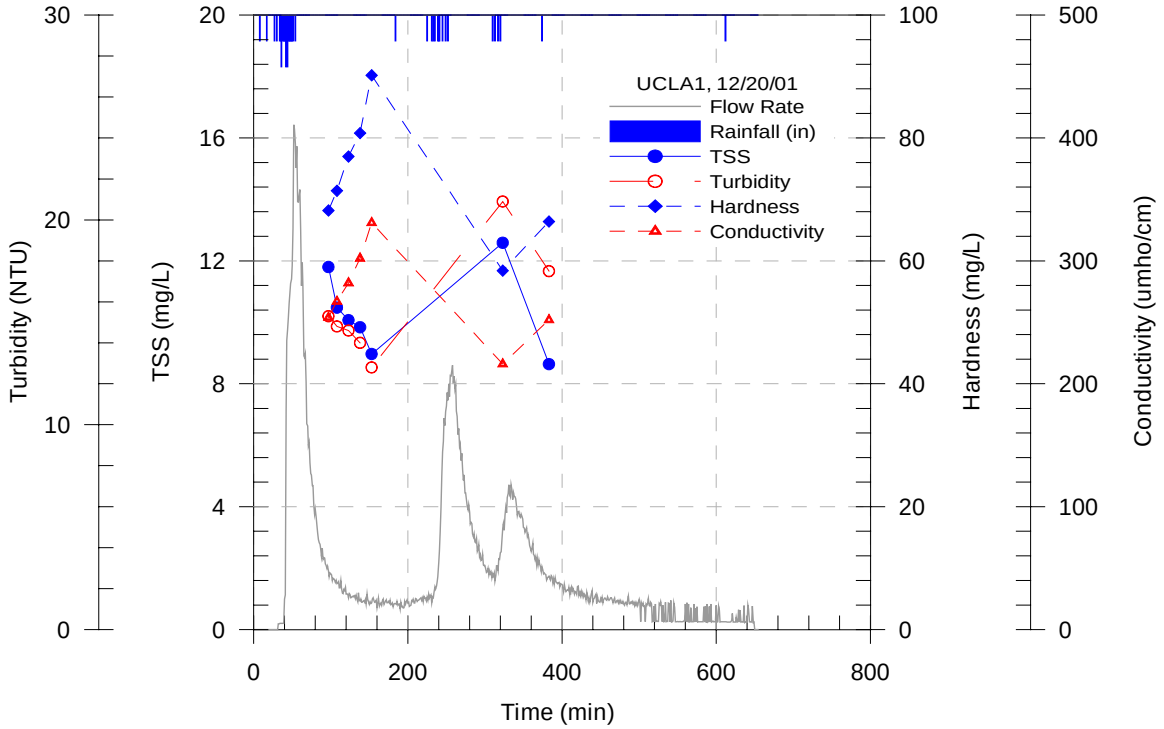

Figure I.3.1.3a[1] (Y3-UCLA1-E5-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

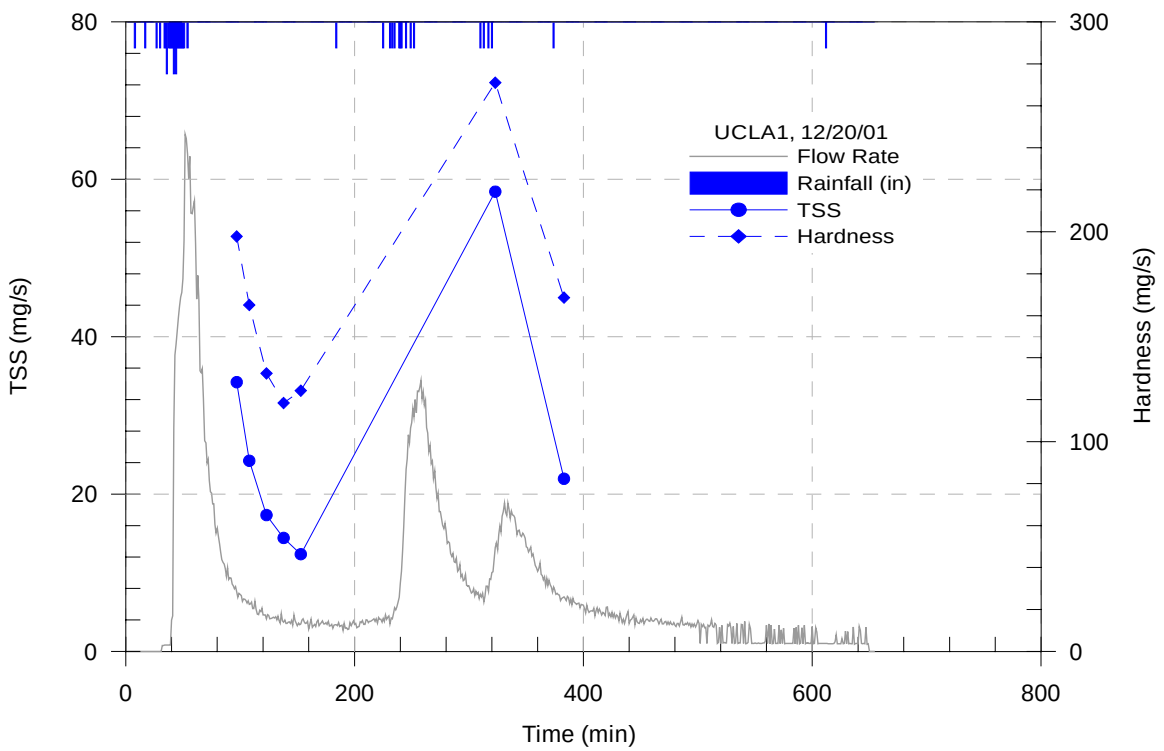

Figure I.3.1.3a[2] (Y3-UCLA1-E5-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

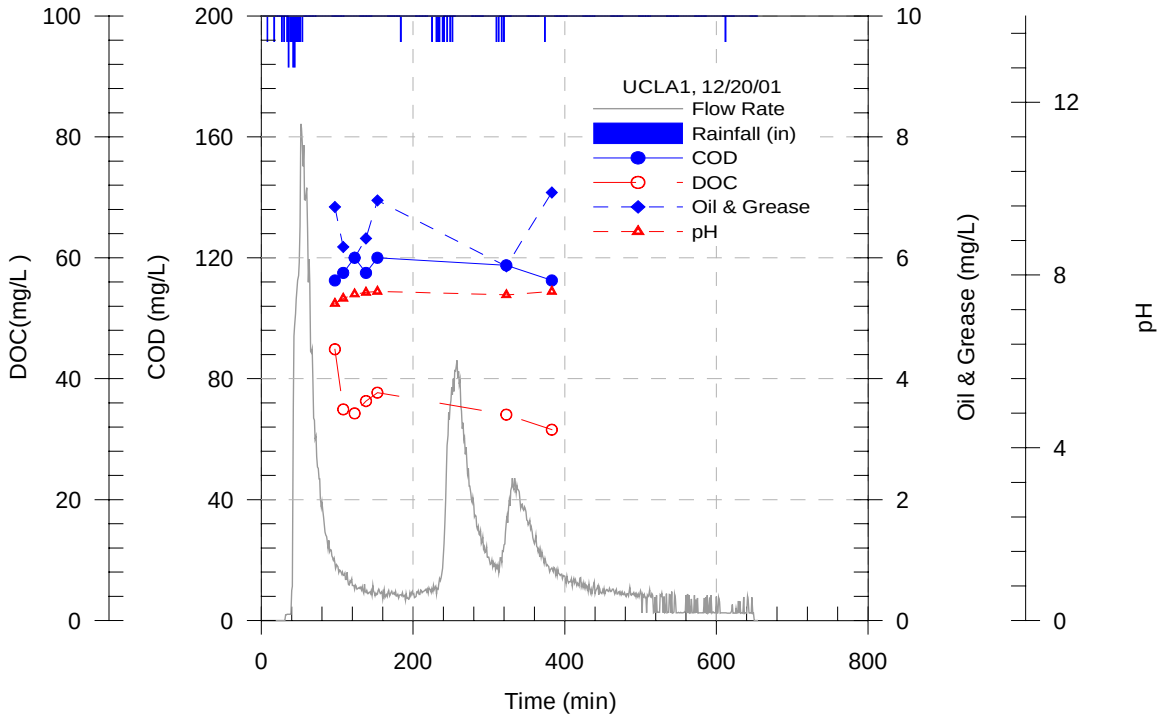

Figure I.3.1.3b[1] (Y3-UCLA1-E5-2). Polluto-graph for COD, DOC, Oil & Grease and pH

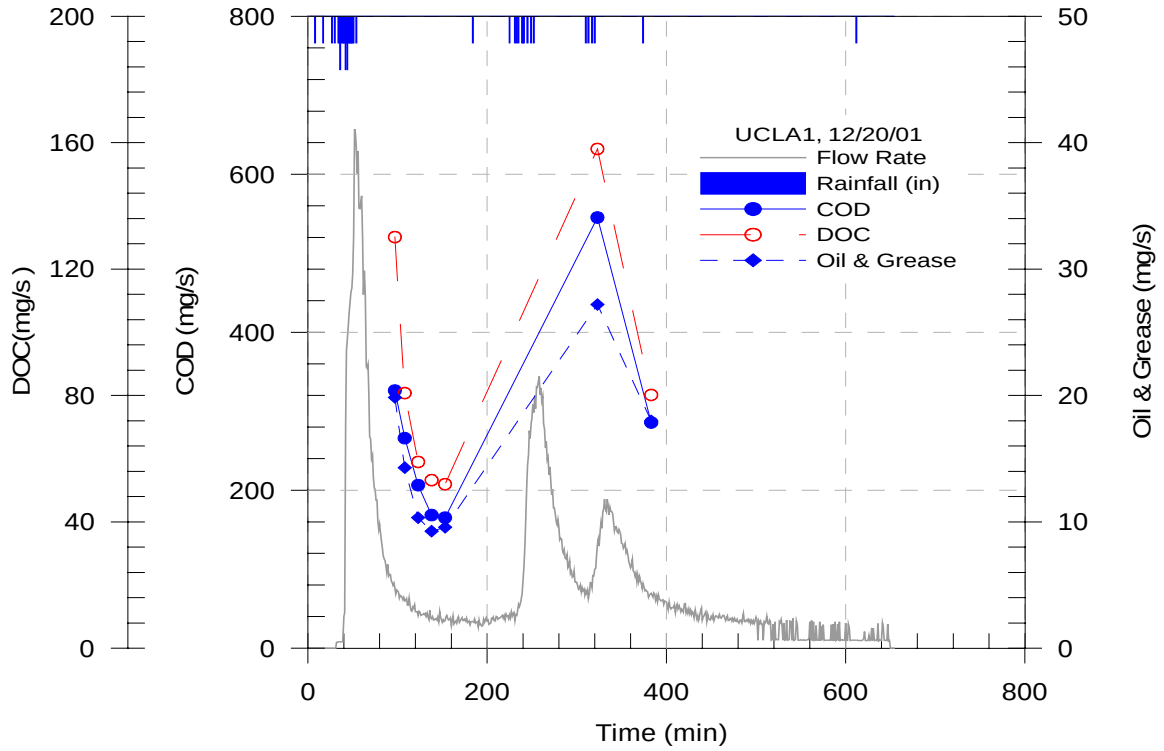

Figure I.3.1.3b[2] (Y3-UCLA1-E5-2). Load-graph for COD, DOC, Oil & Grease and pH

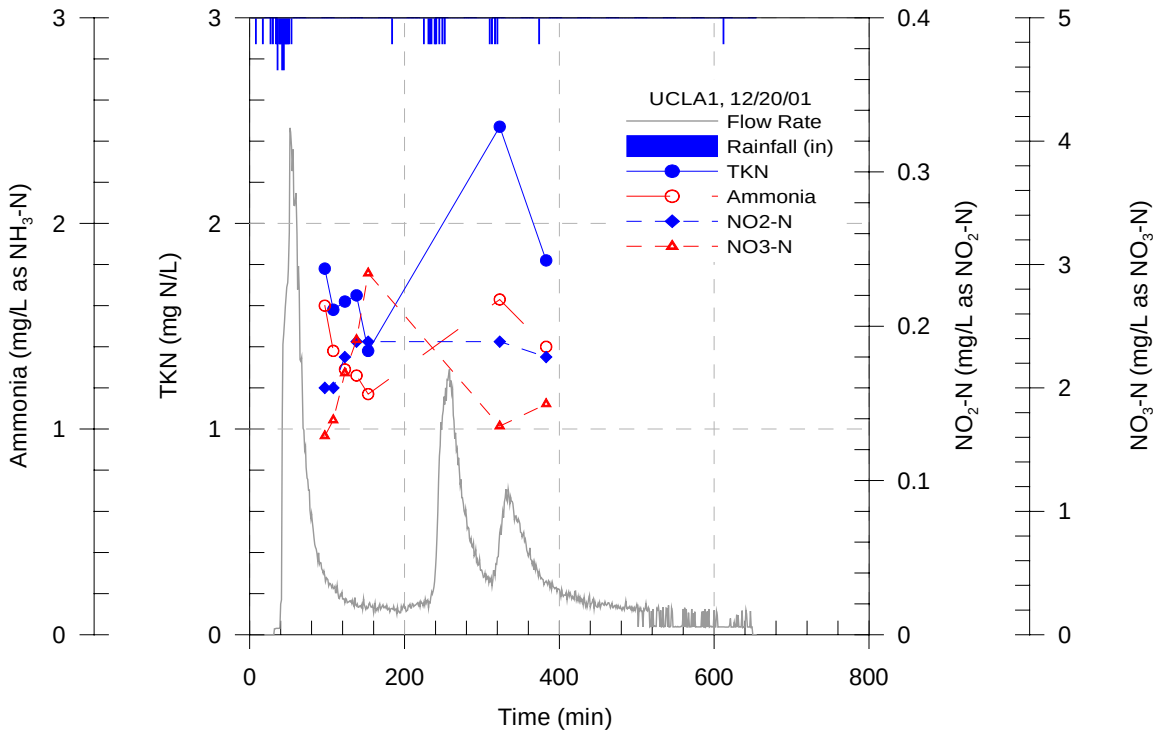

Figure I.3.1.3c[1] (Y3-UCLA1-E5-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

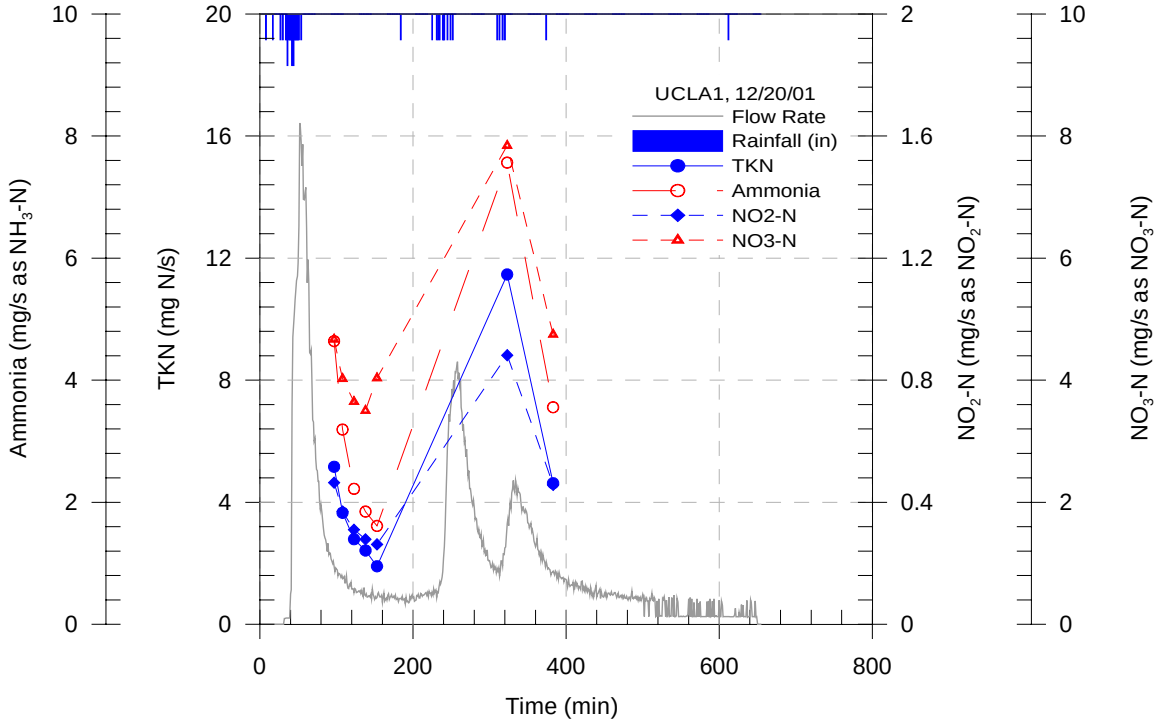

Figure I.3.1.3c[2] (Y3-UCLA1-E5-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

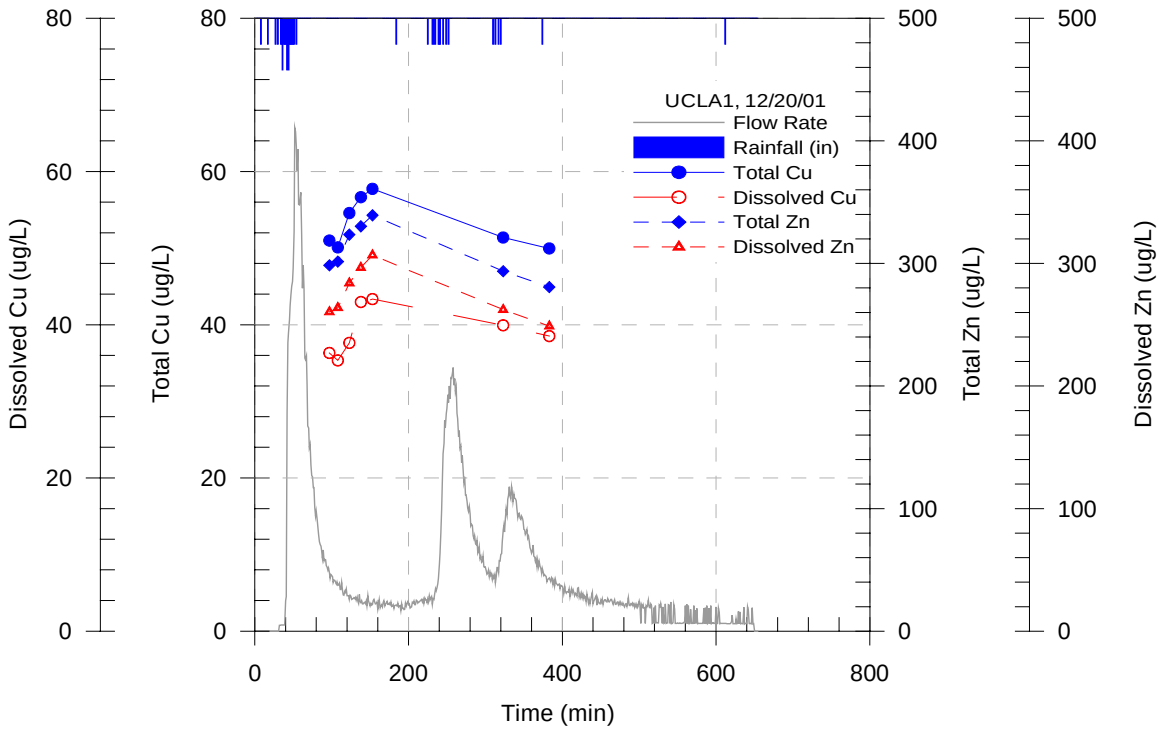

Figure I.3.1.3d[1] (Y3-UCLA1-E5-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

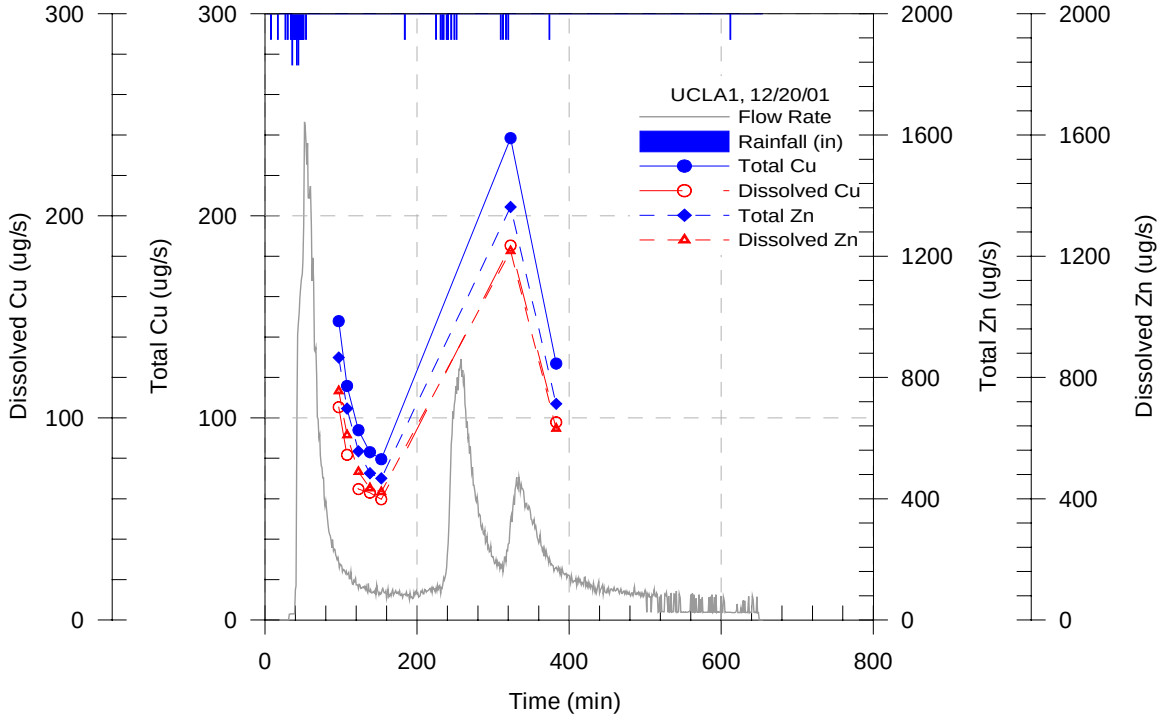

Figure I.3.1.3d[2] (Y3-UCLA1-E5-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

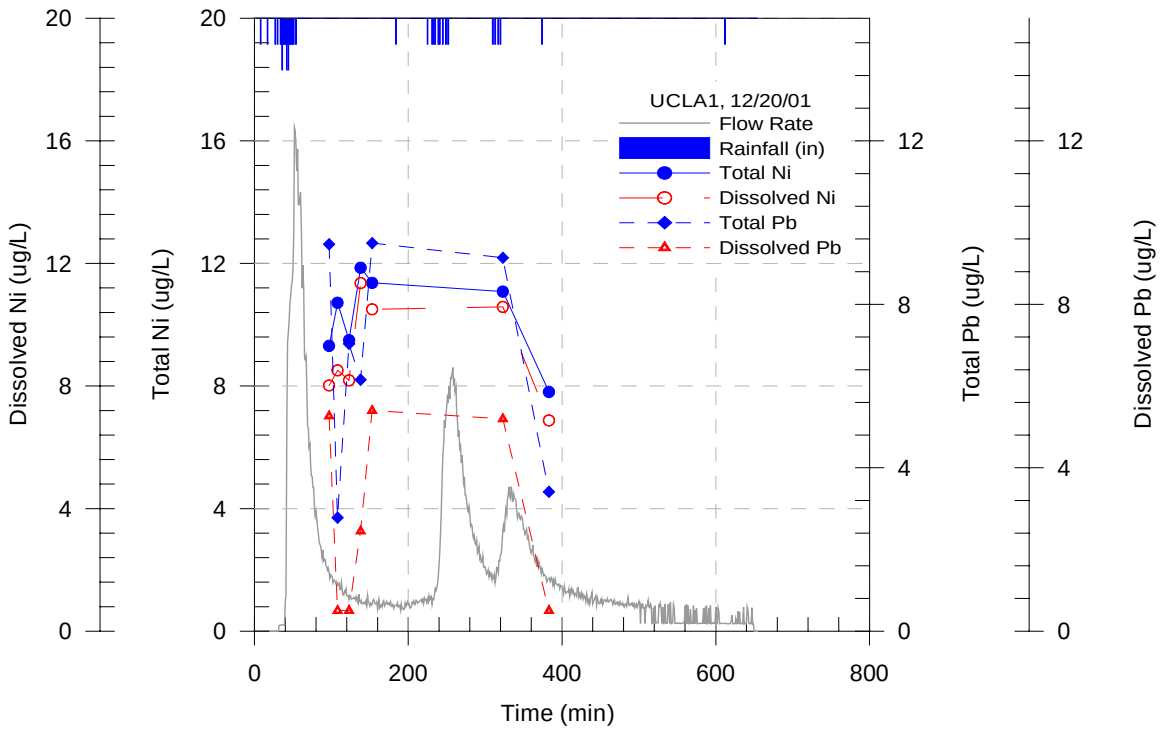

Figure I.3.1.3e[1] (Y3-UCLA1-E5-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

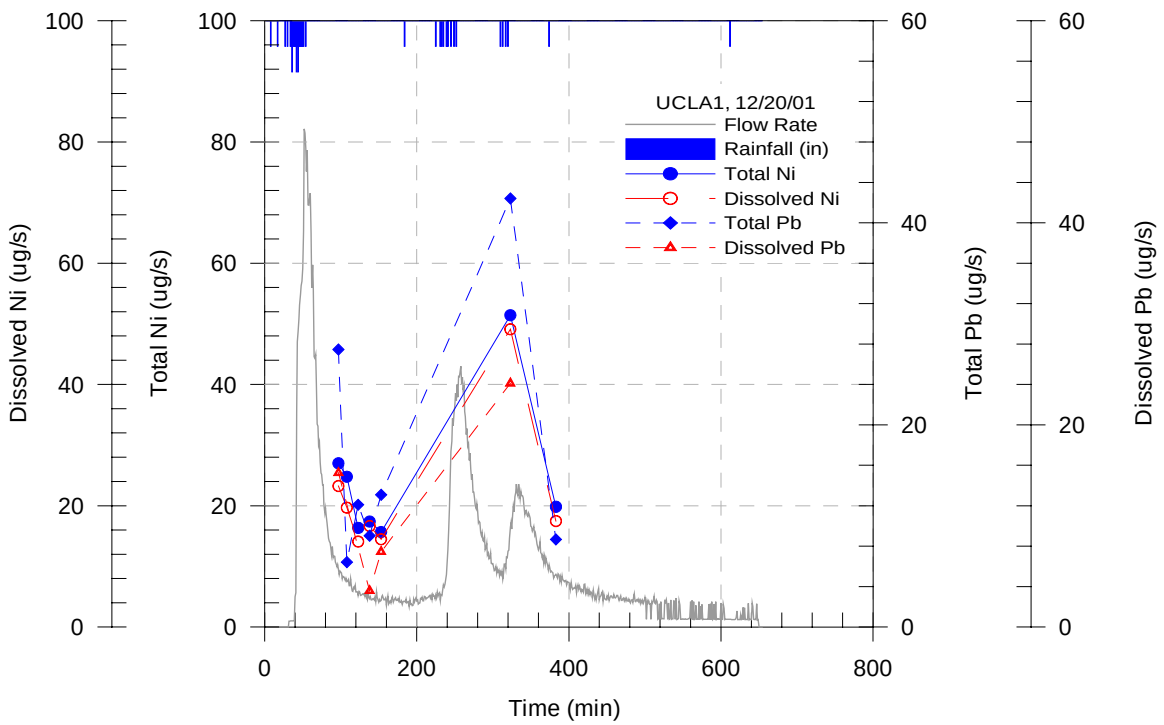

Figure I.3.1.3e[2] (Y3-UCLA1-E5-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

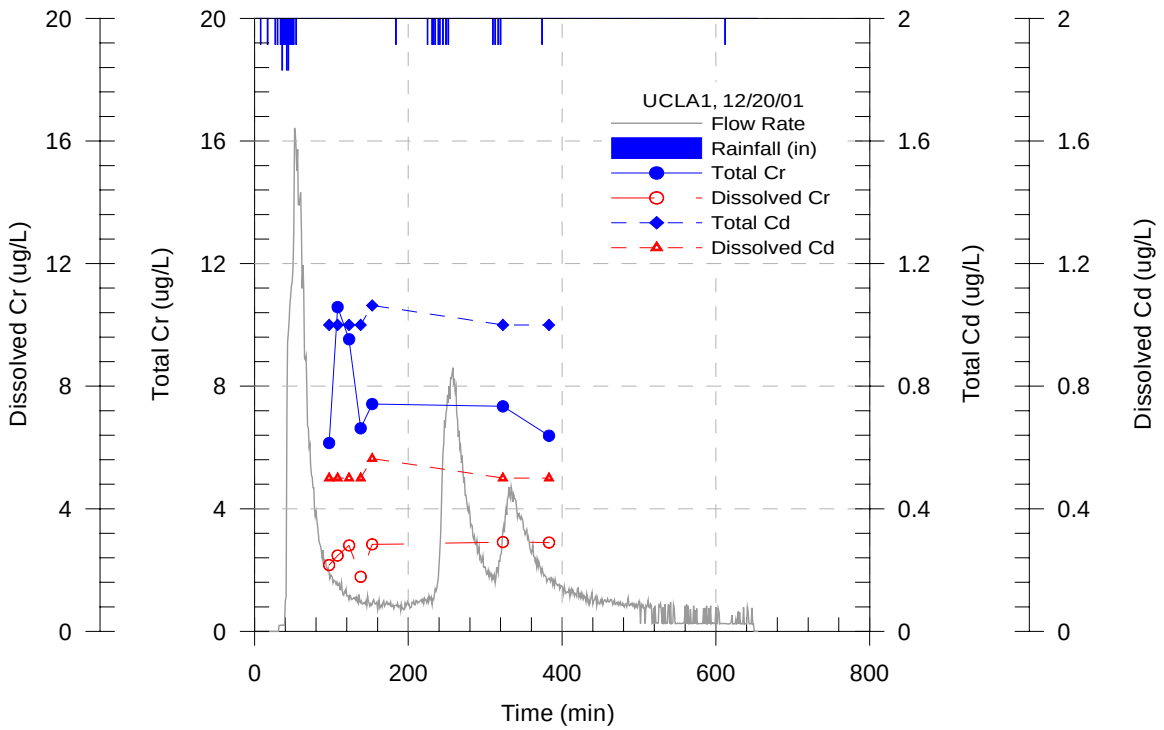

Figure I.3.1.3f[1] (Y3-UCLA1-E5-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

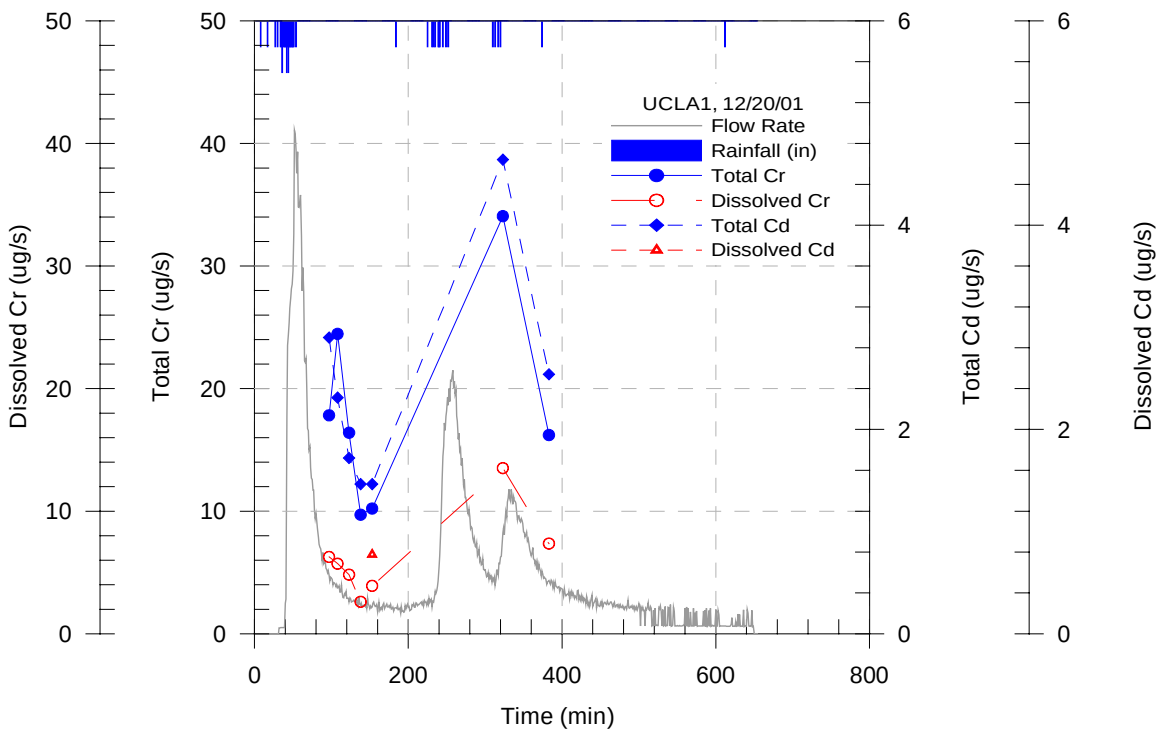

Figure I.3.1.3f[2] (Y3-UCLA1-E5-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

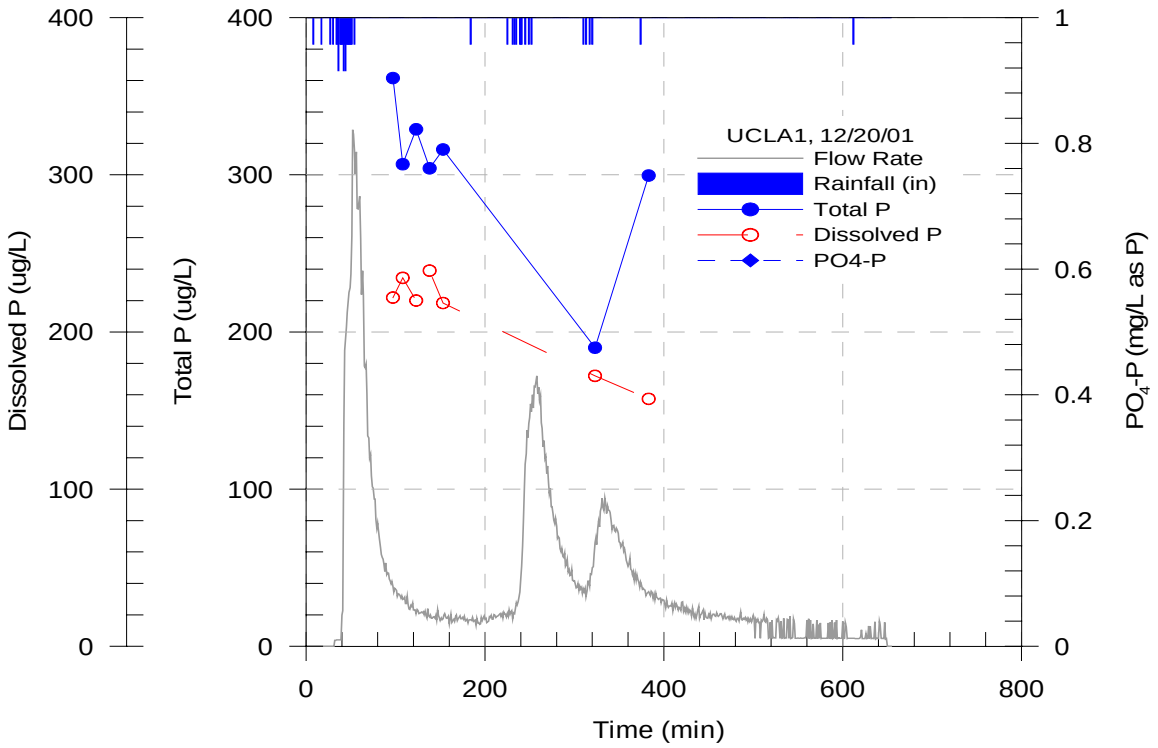

Figure I.3.1.3g[1] (Y3-UCLA1-E5-7). Polluto-graph for Total P / PO_4^{3-}-P

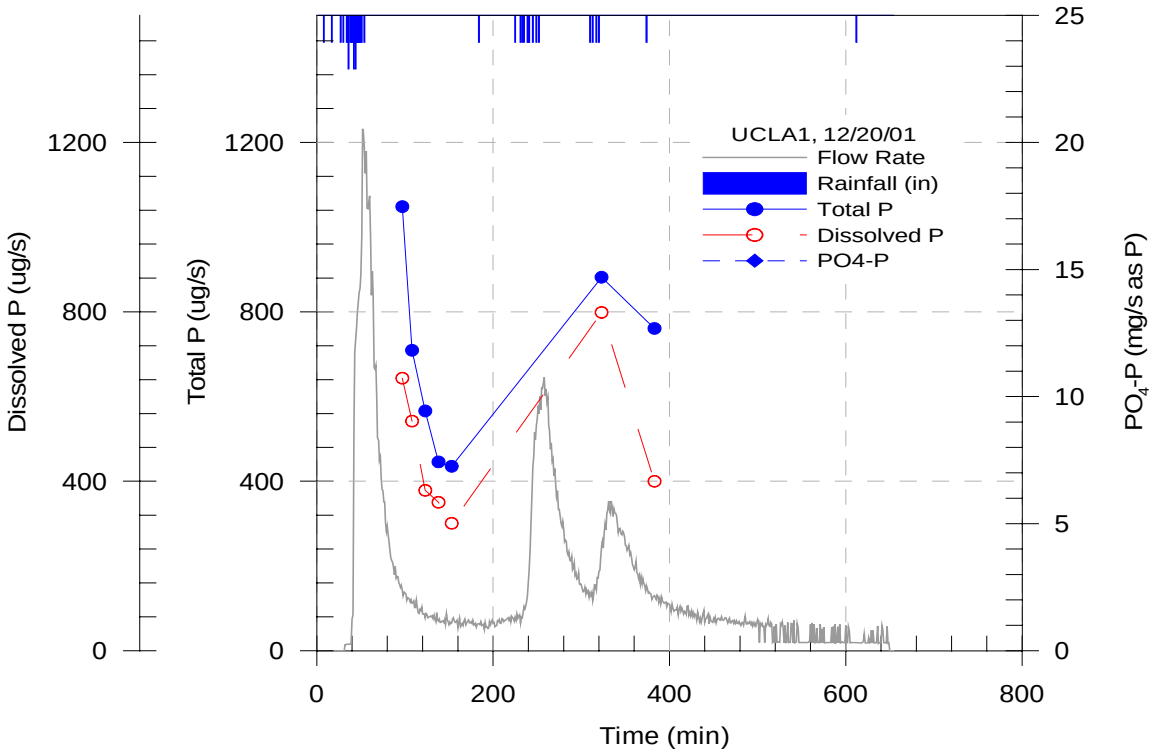

Figure I.3.1.3g[2] (Y3-UCLA1-E5-7). Load -graph for Total P / PO_4^{3-}-P

4. UCLA1, 01/27/02

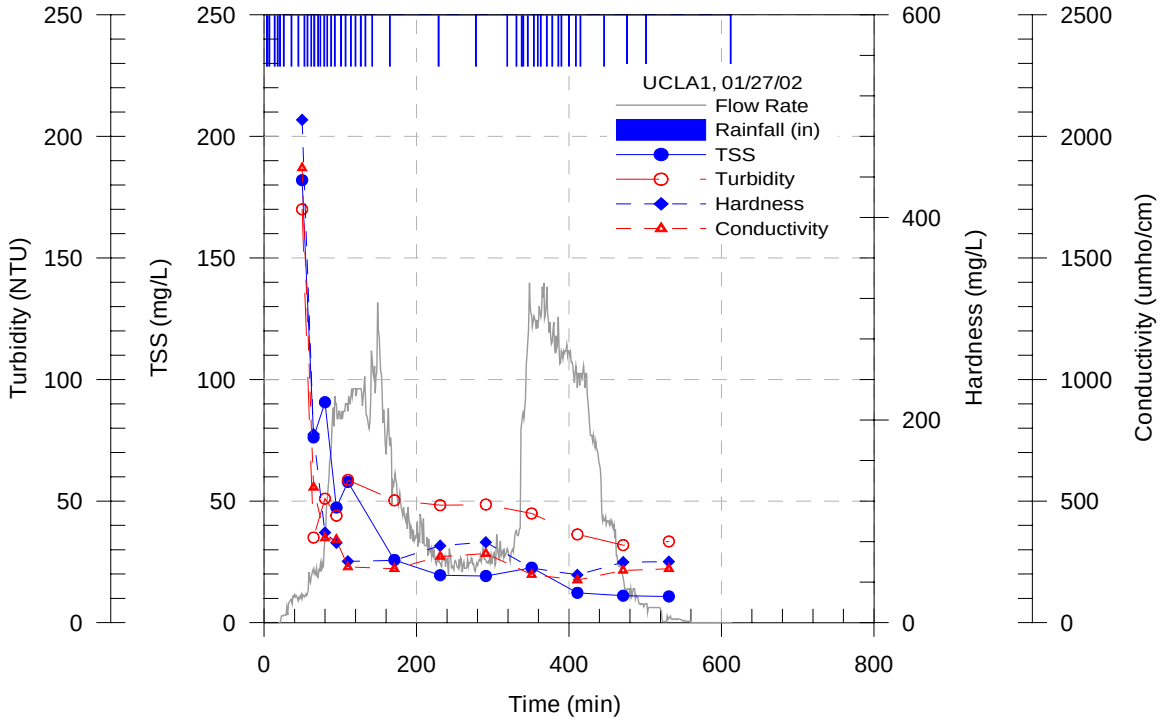

Figure I.3.1.4a[1] (Y3-UCLA1-E6-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

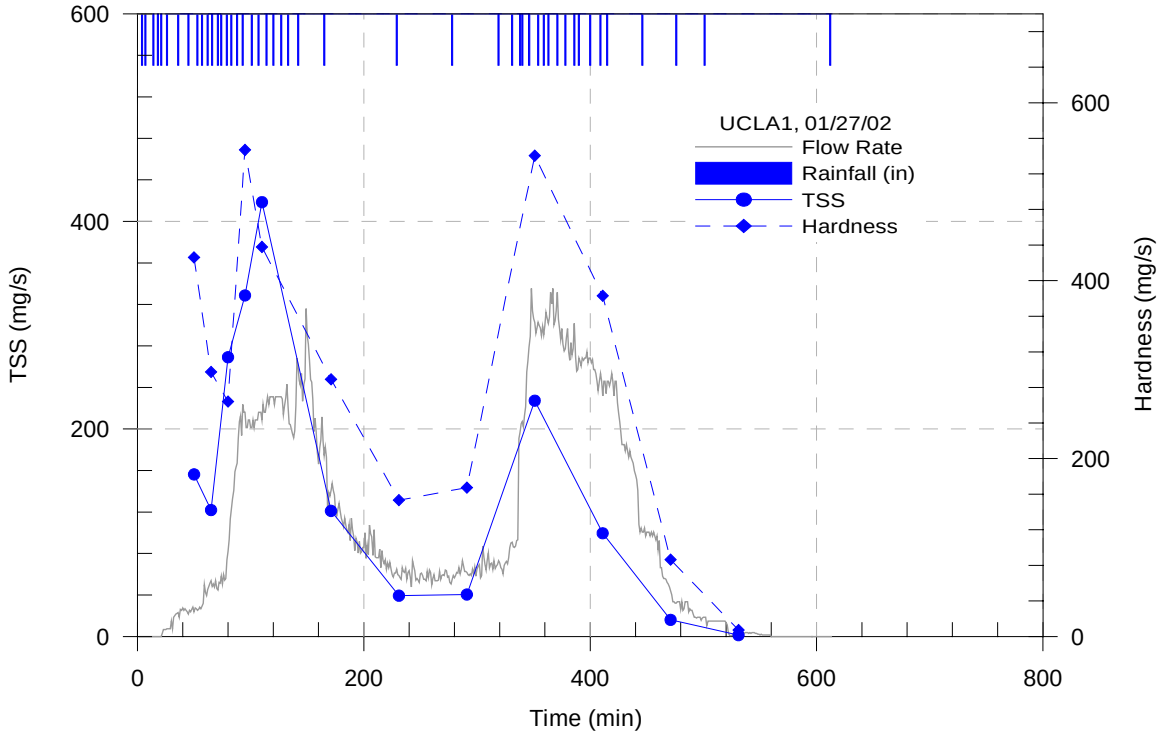

Figure I.3.1.4a[2] (Y3-UCLA1-E6-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

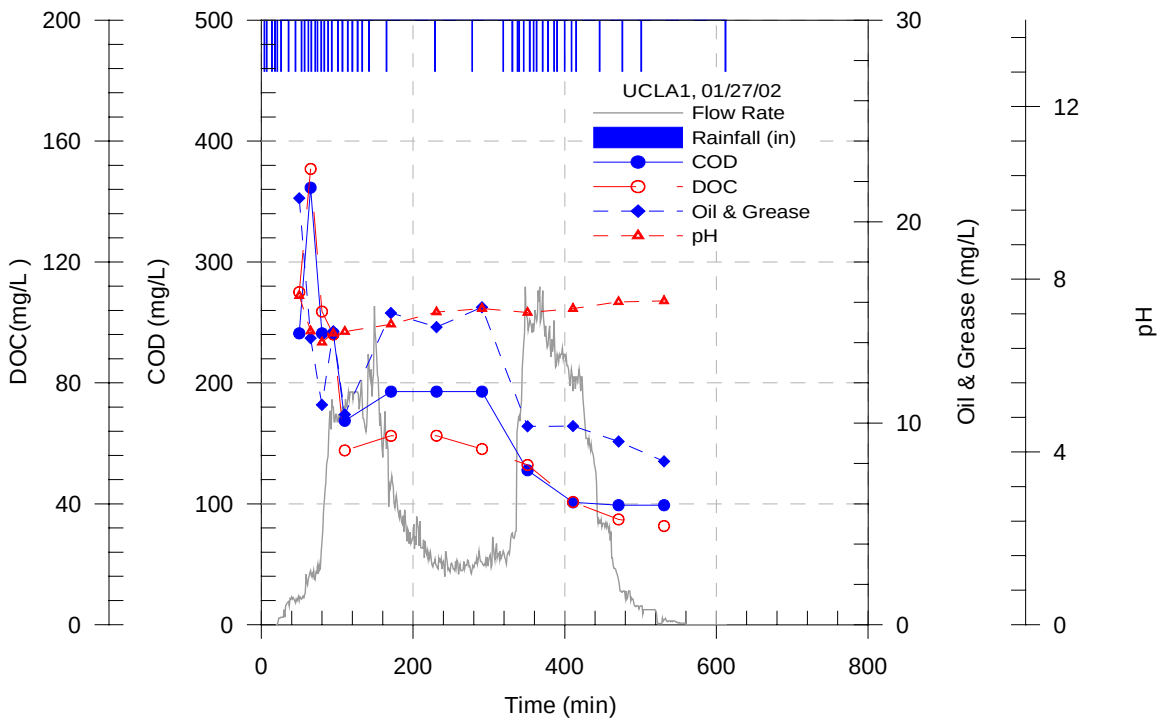

Figure I.3.1.4b[1] (Y3-UCLA1-E6-2). Polluto-graph for COD, DOC, Oil & Grease and pH

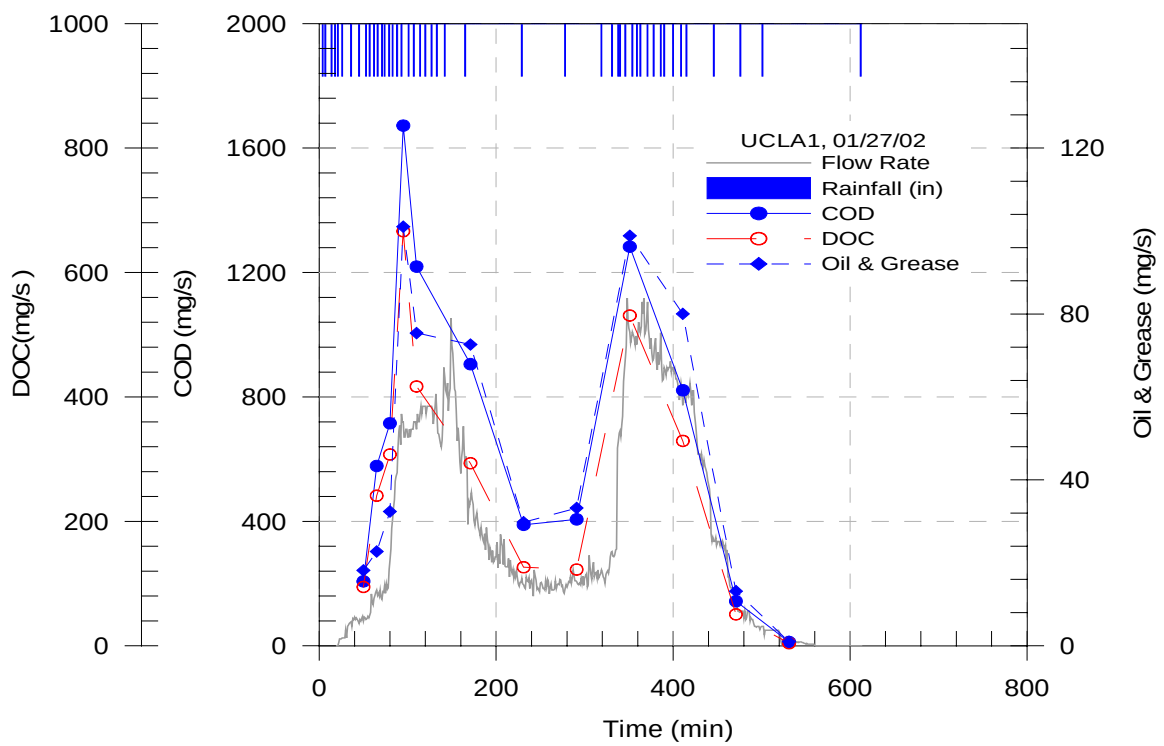

Figure I.3.1.4b[2] (Y3-UCLA1-E6-2). Load-graph for COD, DOC, Oil & Grease and pH

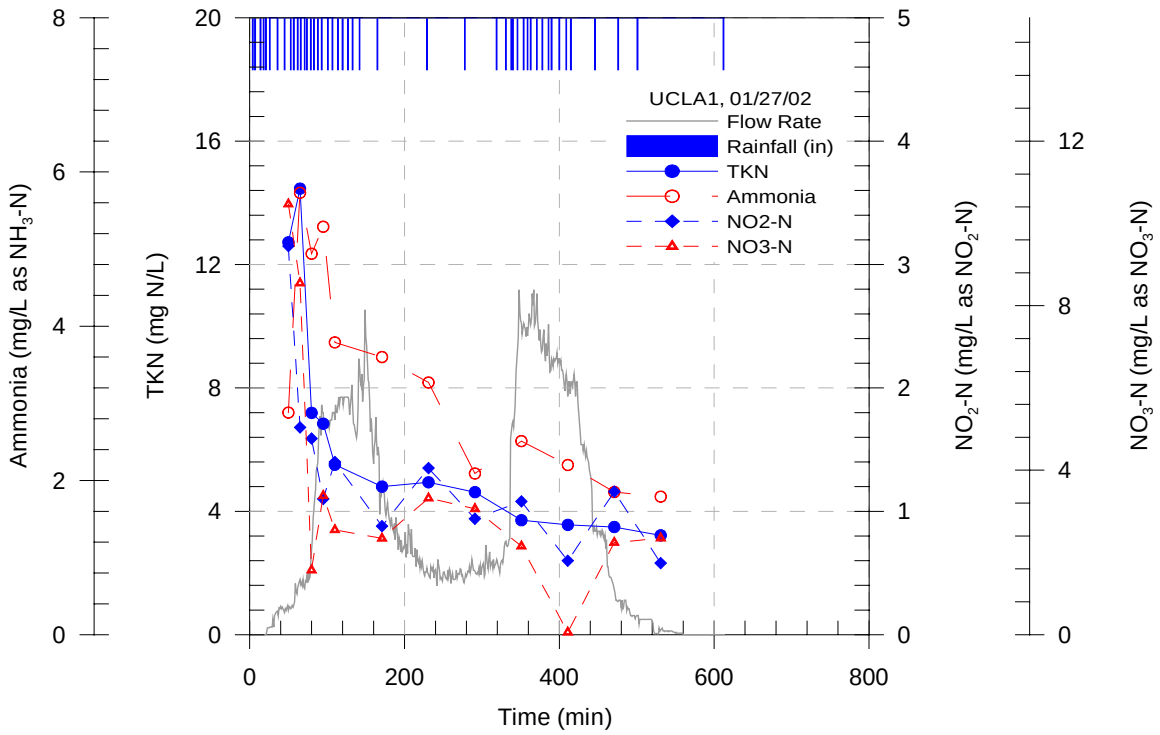

Figure I.3.1.4c[1] (Y3-UCLA1-E6-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

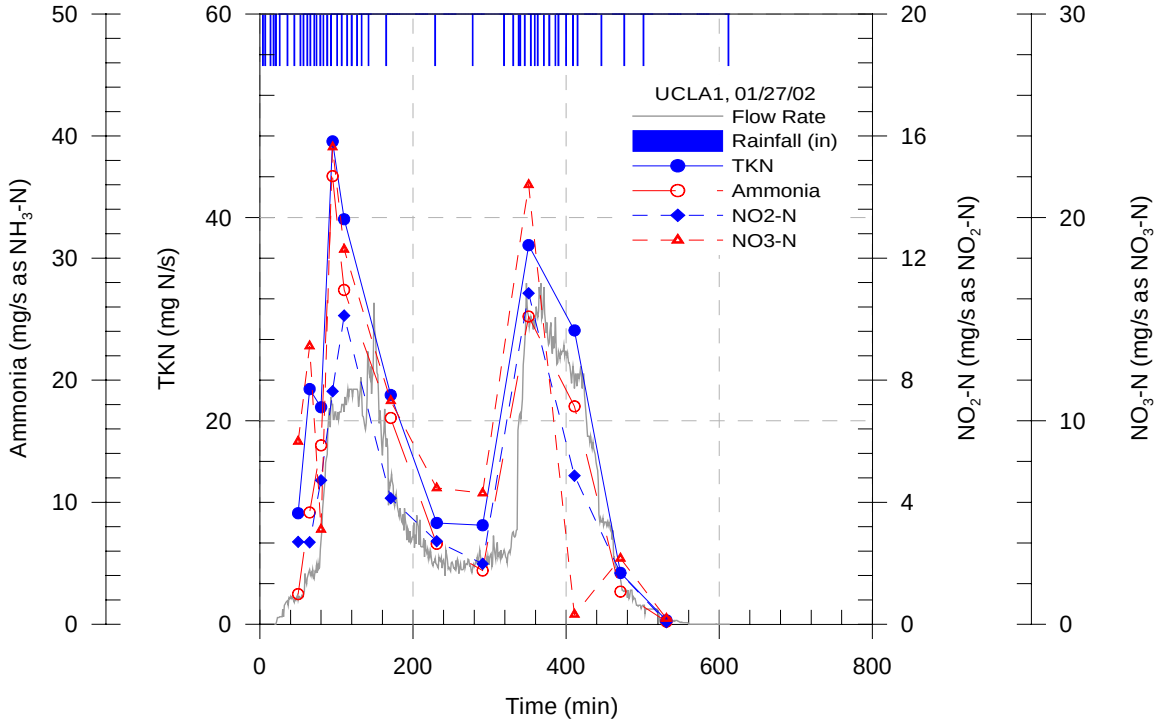

Figure I.3.1.4c[2] (Y3-UCLA1-E6-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

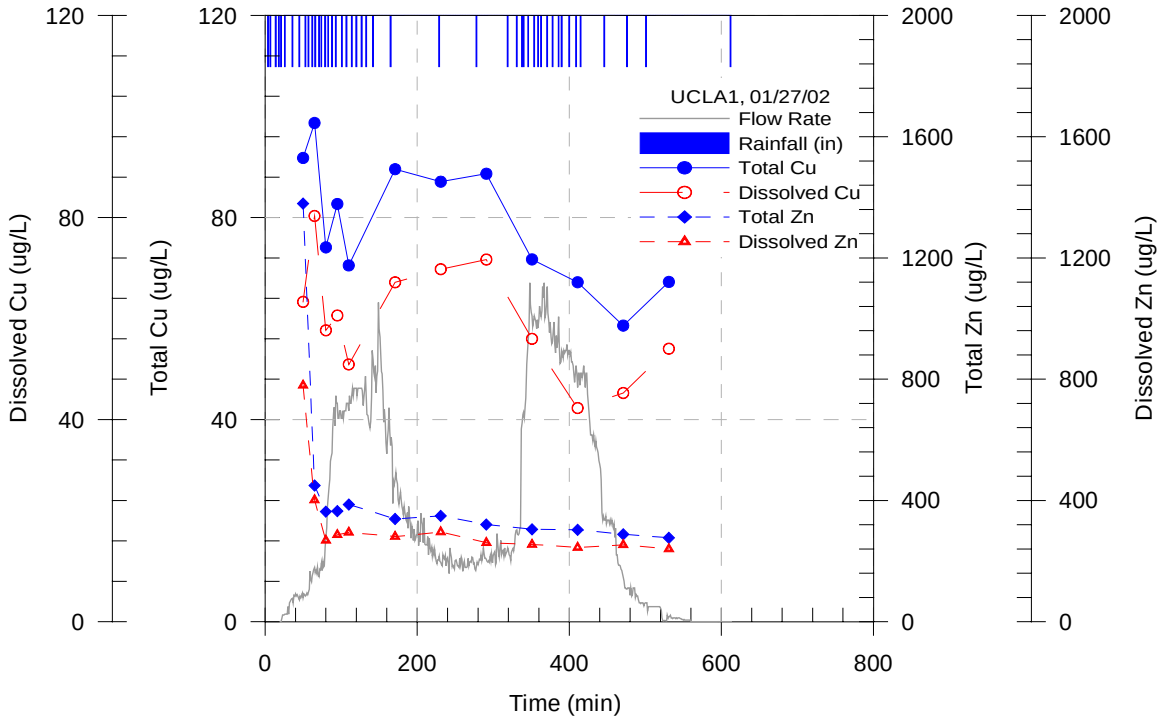

Figure I.3.1.4d[1] (Y3-UCLA1-E6-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

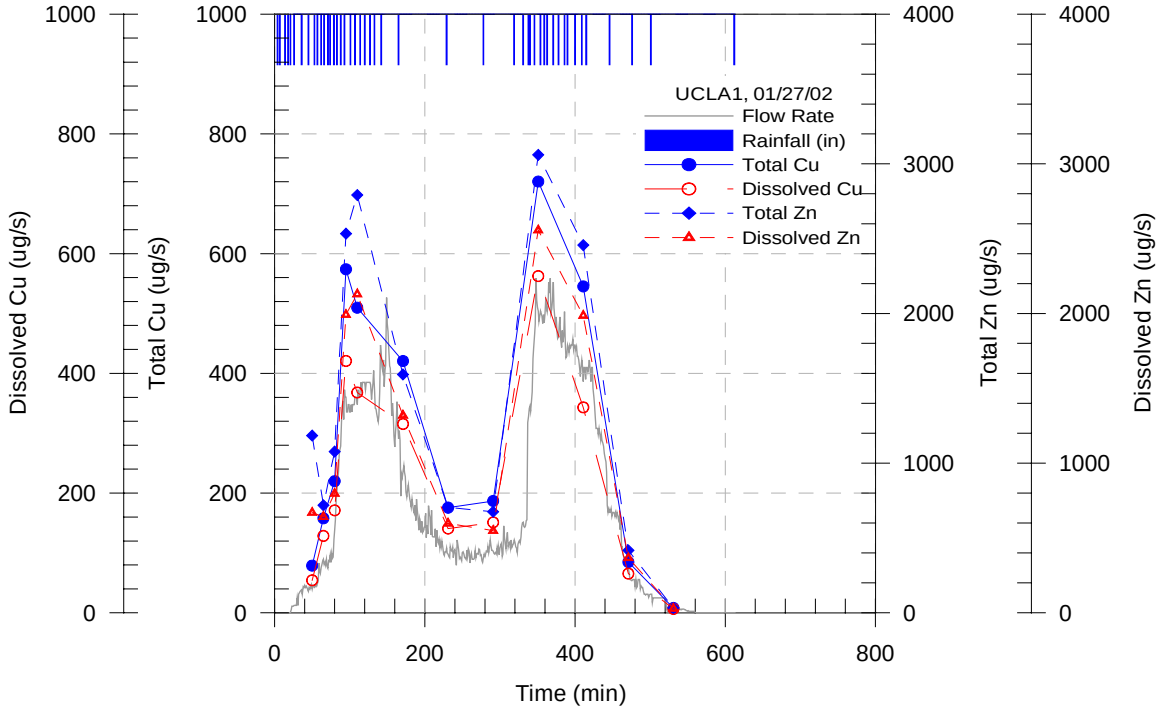

Figure I.3.1.4d[2] (Y3-UCLA1-E6-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

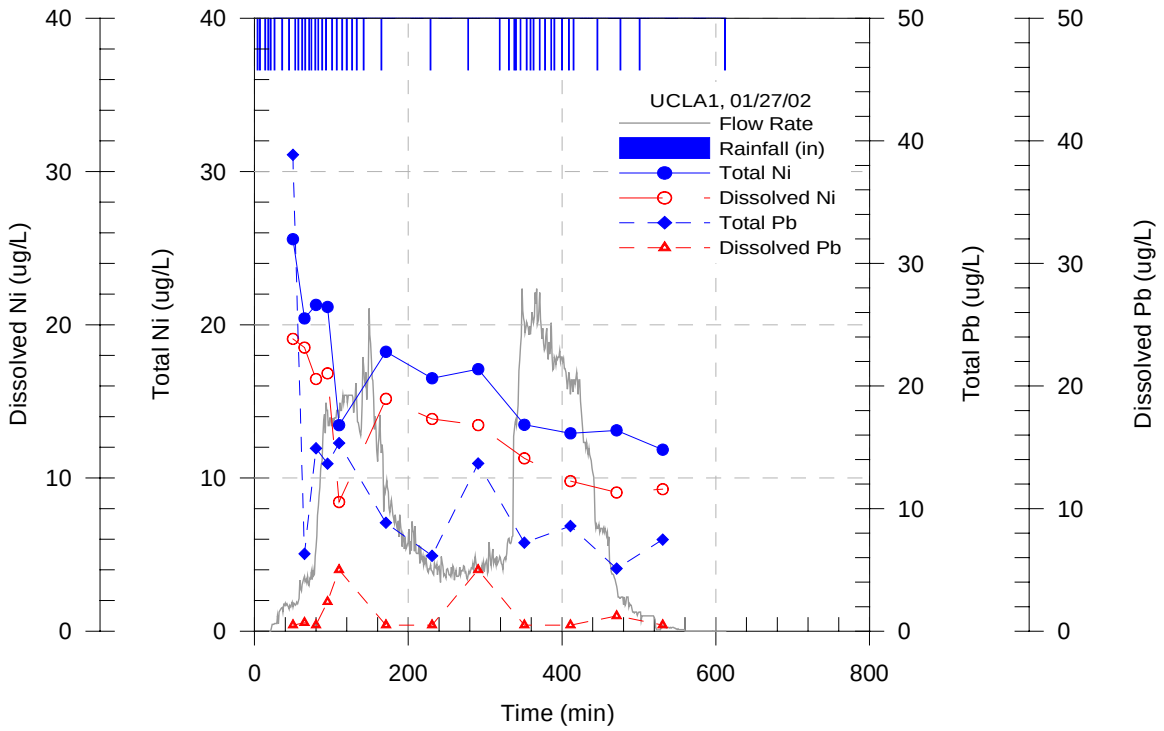

Figure I.3.1.4e[1] (Y3-UCLA1-E6-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

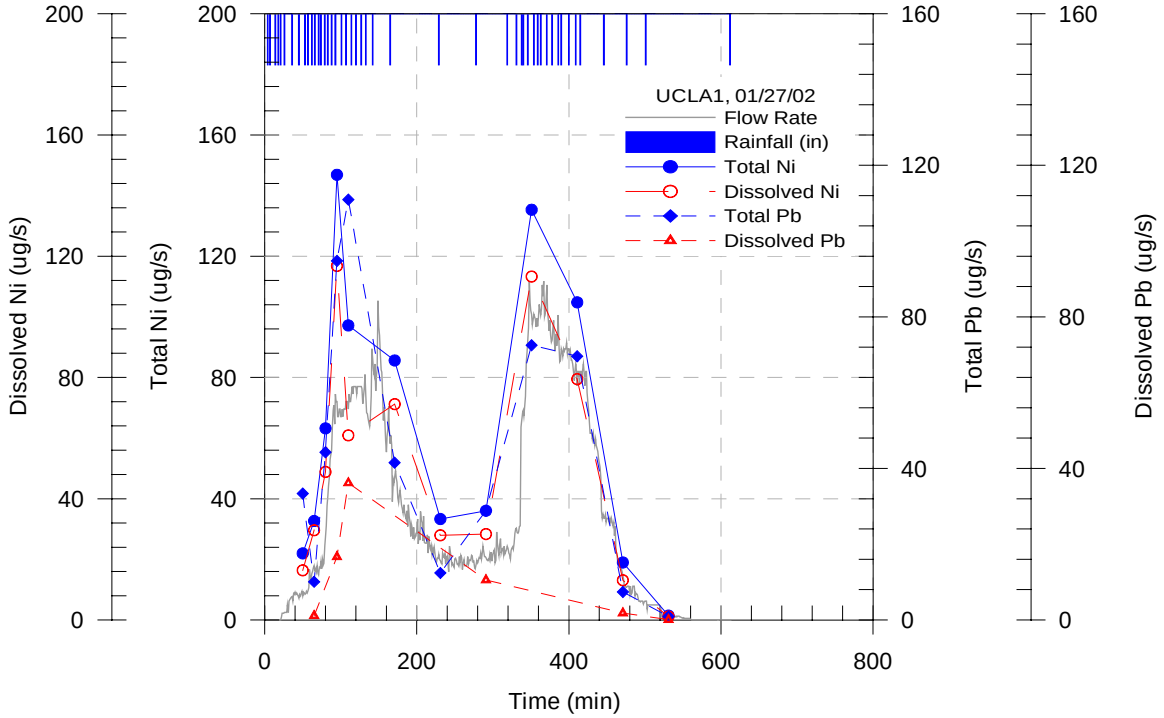

Figure I.3.1.4e[2] (Y3-UCLA1-E6-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

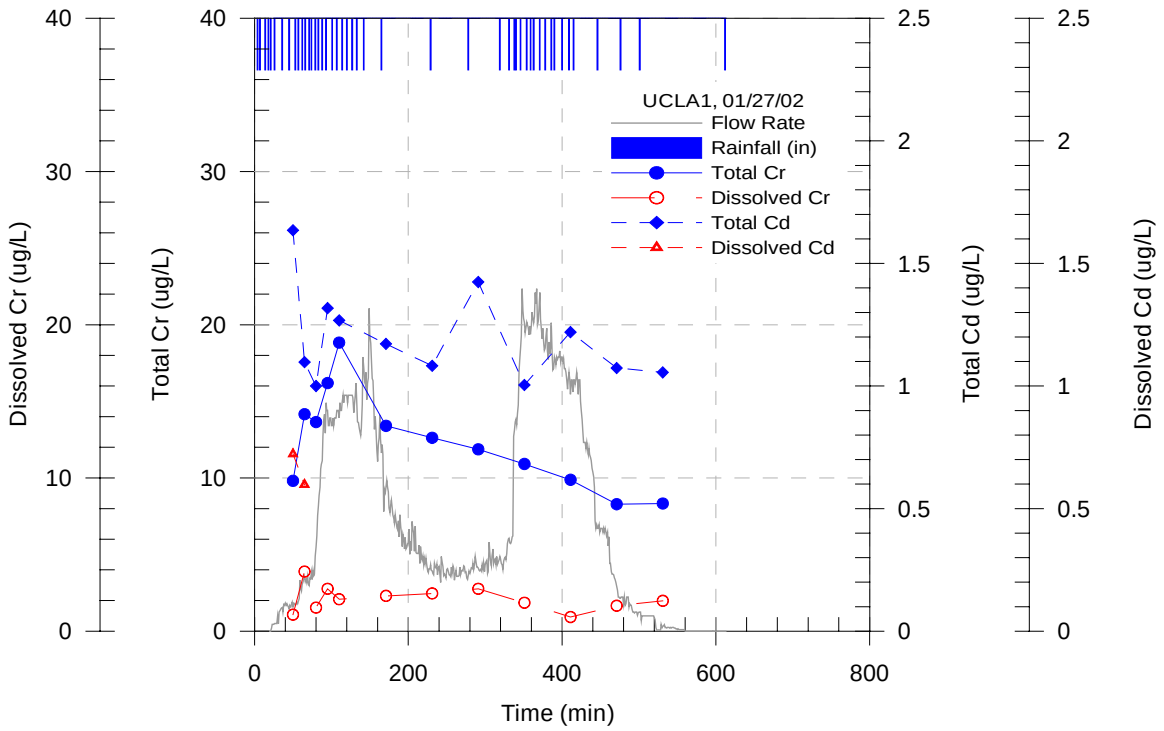

Figure I.3.1.4f[1] (Y3-UCLA1-E6-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

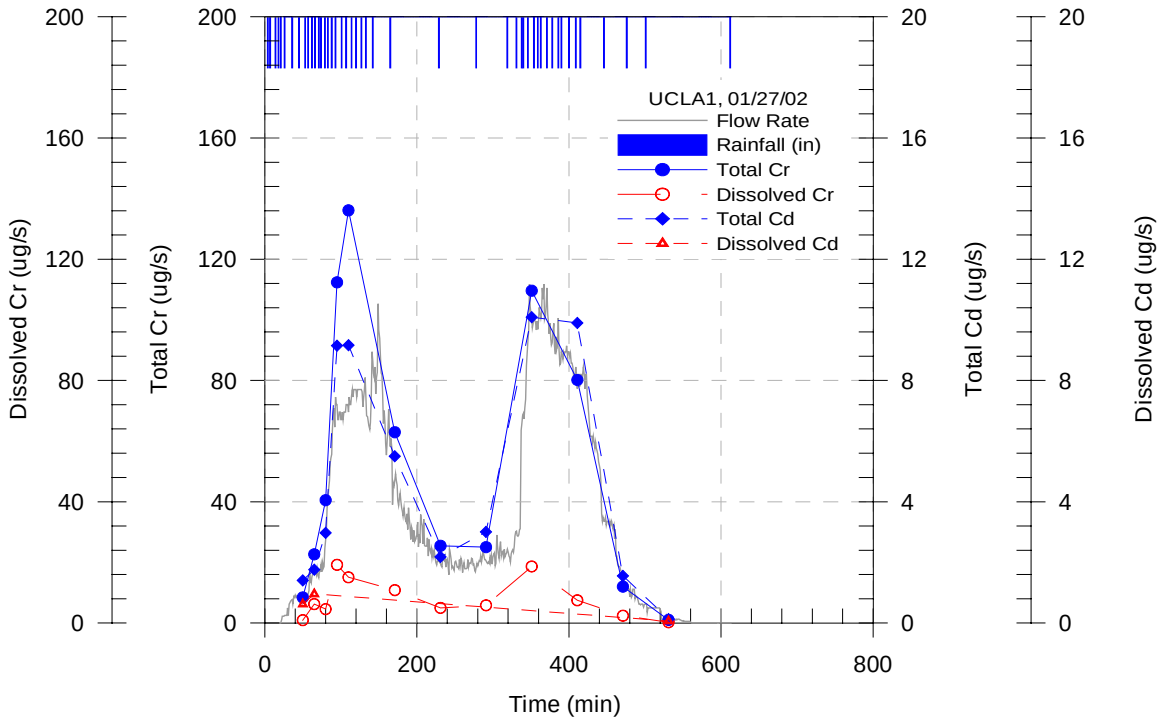

Figure I.3.1.4f[2] (Y3-UCLA1-E6-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

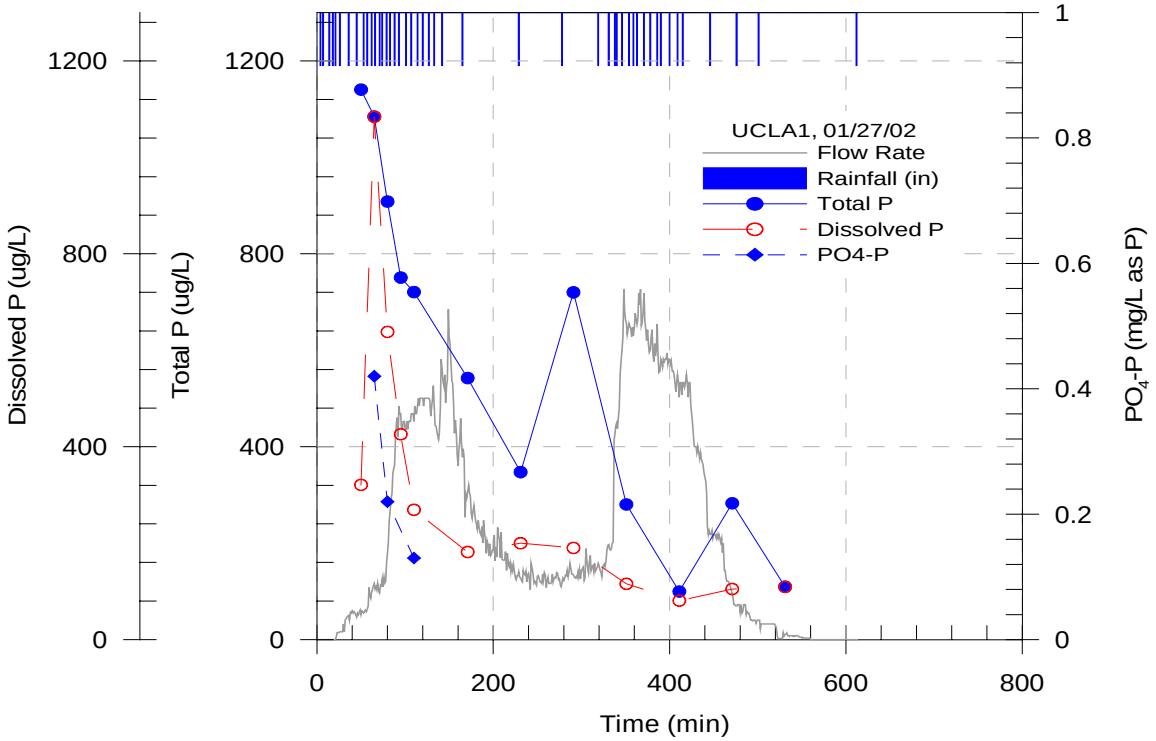

Figure I.3.1.4g[1] (Y3-UCLA1-E6-7). Polluto-graph for Total P / PO_4^{3-}-P

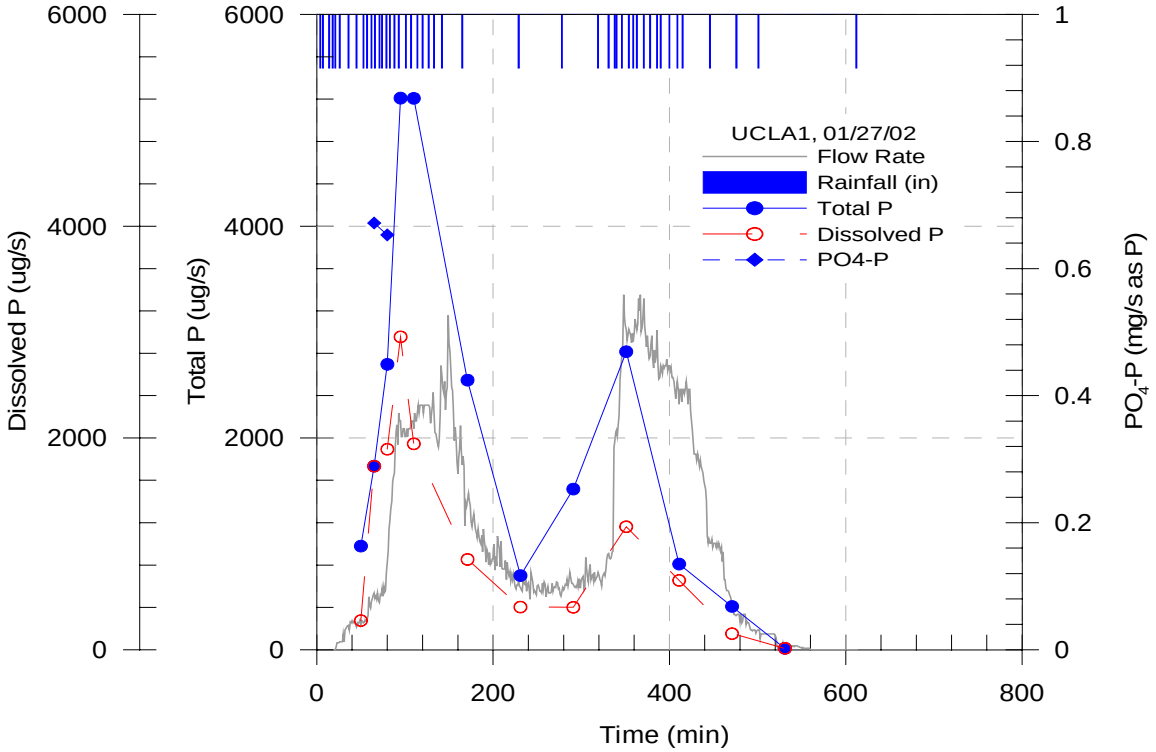

Figure I.3.1.4g[2] (Y3-UCLA1-E6-7). Load -graph for Total P / PO_4^{3-}-P

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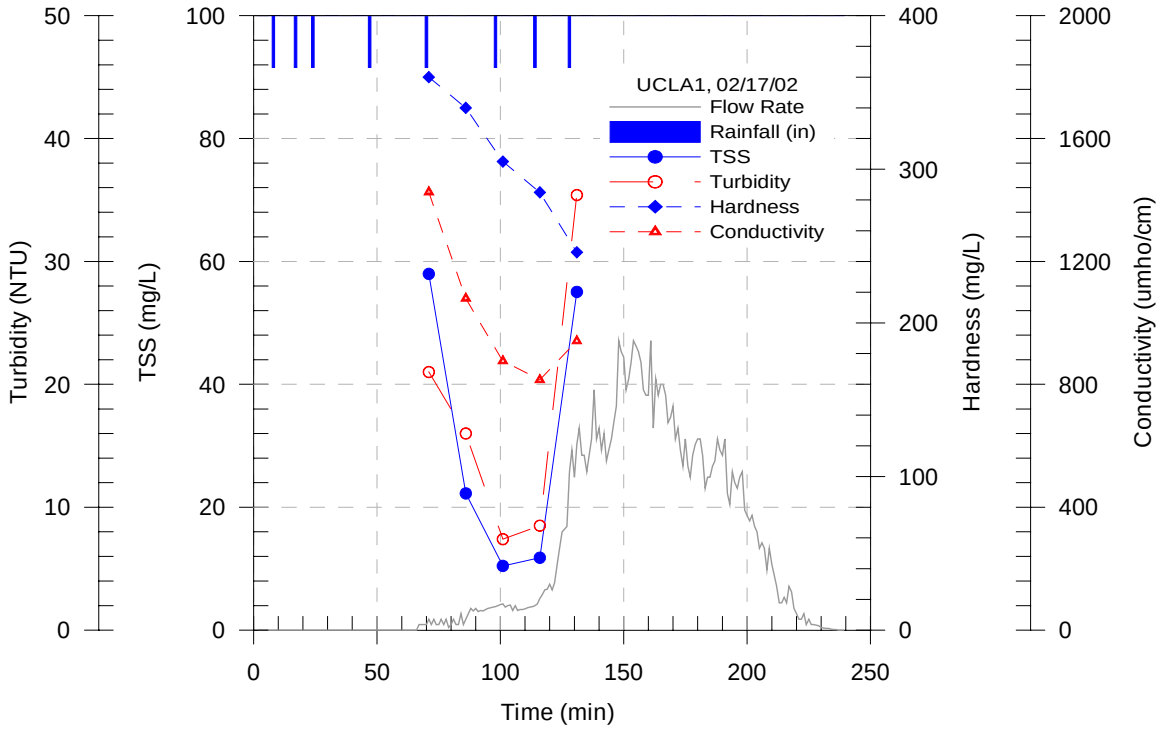

Figure I.3.1.5a[1] (Y3-UCLA1-E6-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

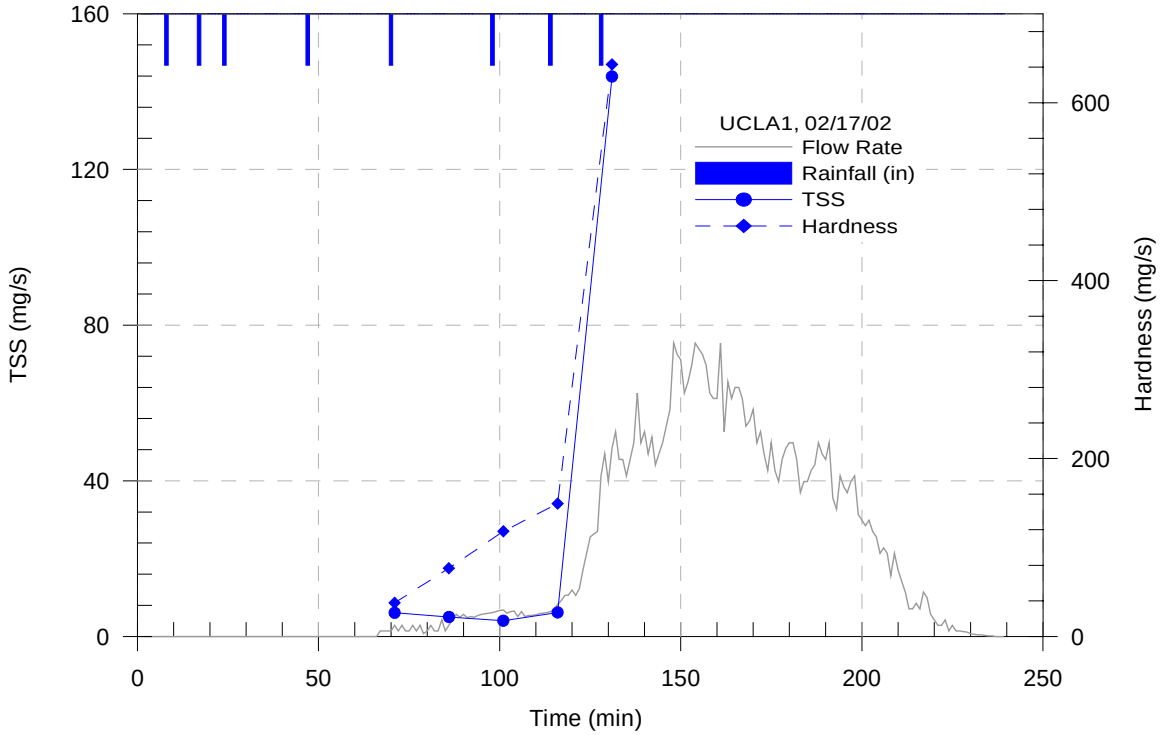

Figure I.3.1.5a[2] (Y3-UCLA1-E6-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

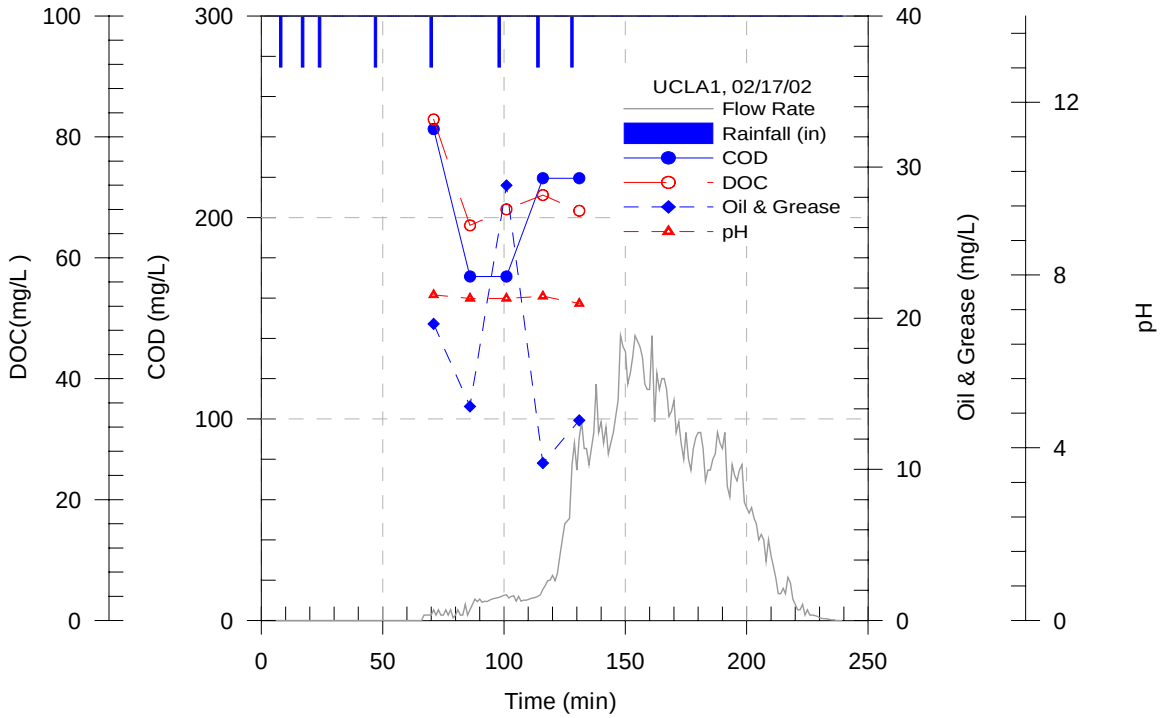

Figure I.3.1.5b[1] (Y3-UCLA1-E6-2). Polluto-graph for COD, DOC, Oil & Grease and pH

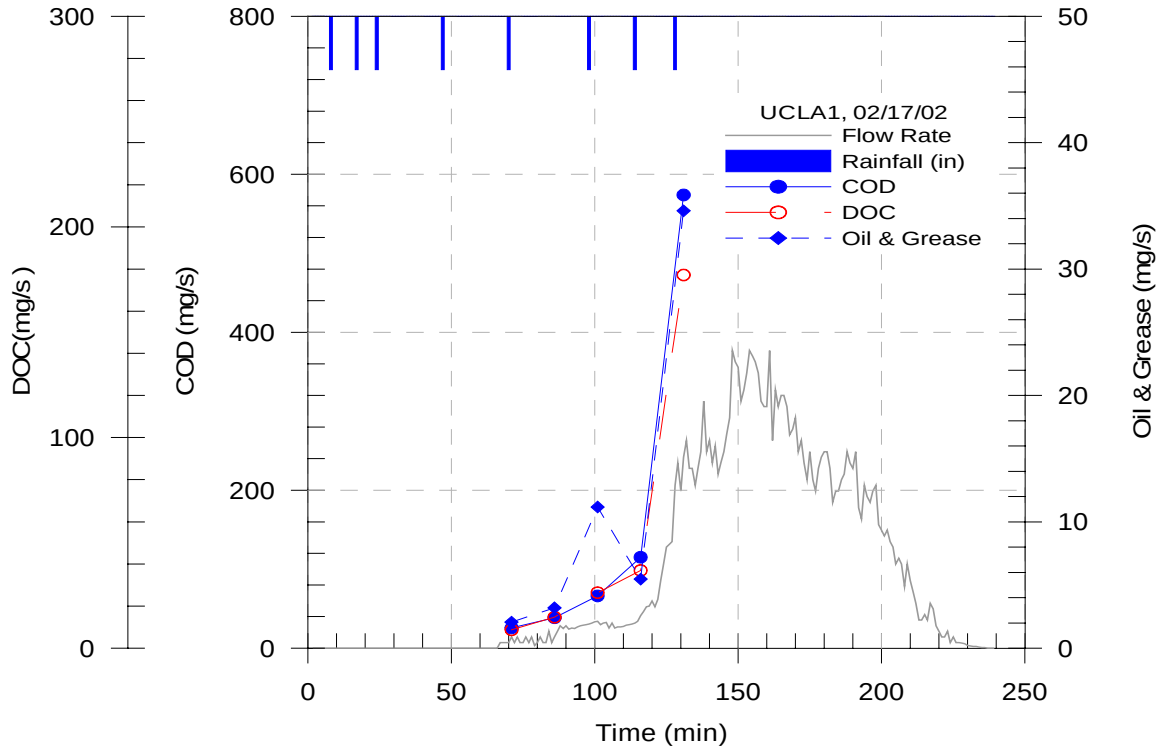

Figure I.3.1.5b[2] (Y3-UCLA1-E6-2). Load-graph for COD, DOC, Oil & Grease and pH

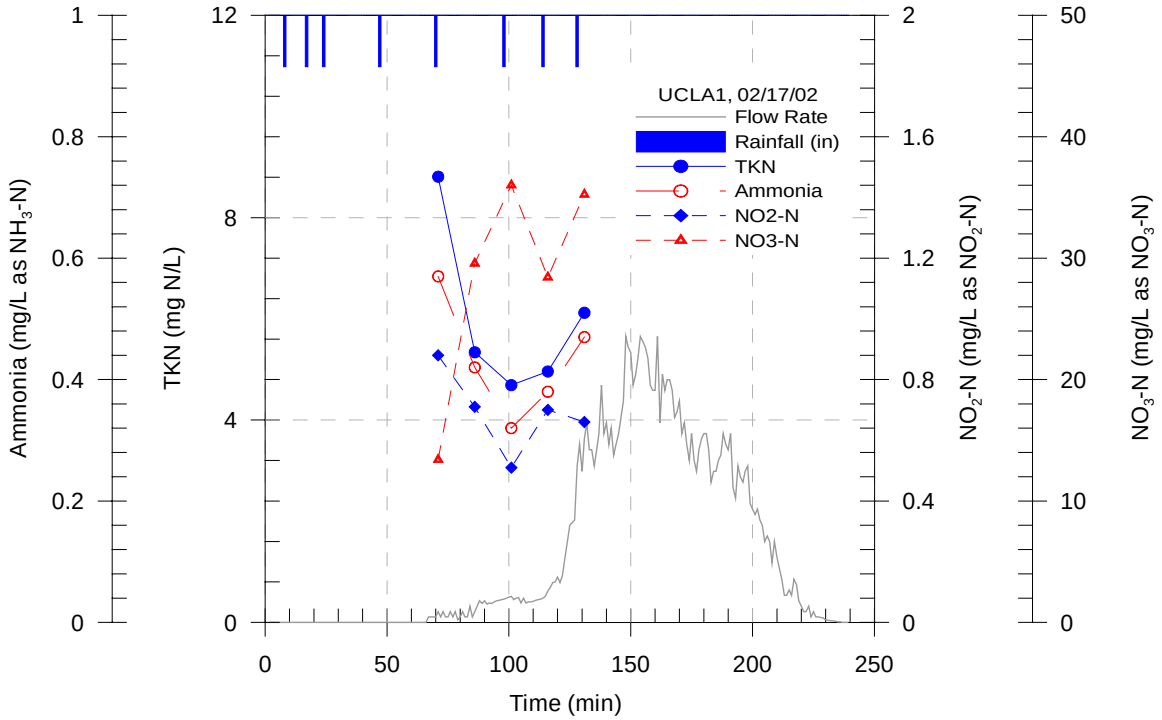

Figure I.3.1.5c[1] (Y3-UCLA1-E6-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

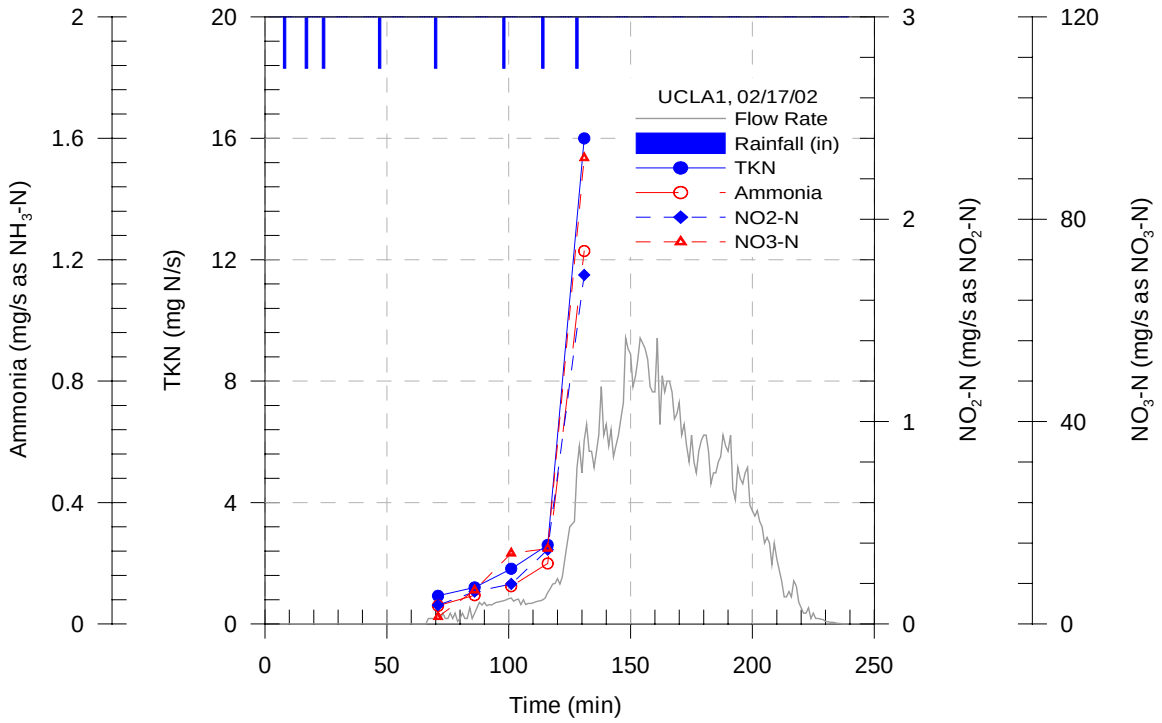

Figure I.3.1.5c[2] (Y3-UCLA1-E6-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

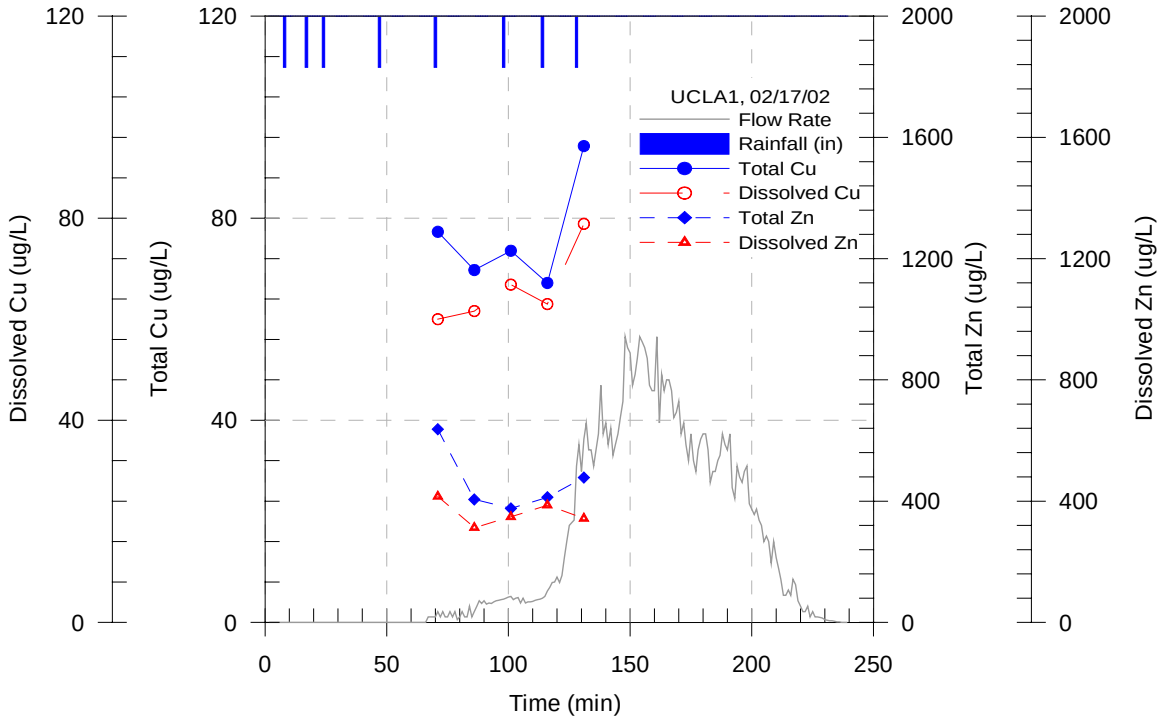

Figure I.3.1.5d[1] (Y3-UCLA1-E6-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

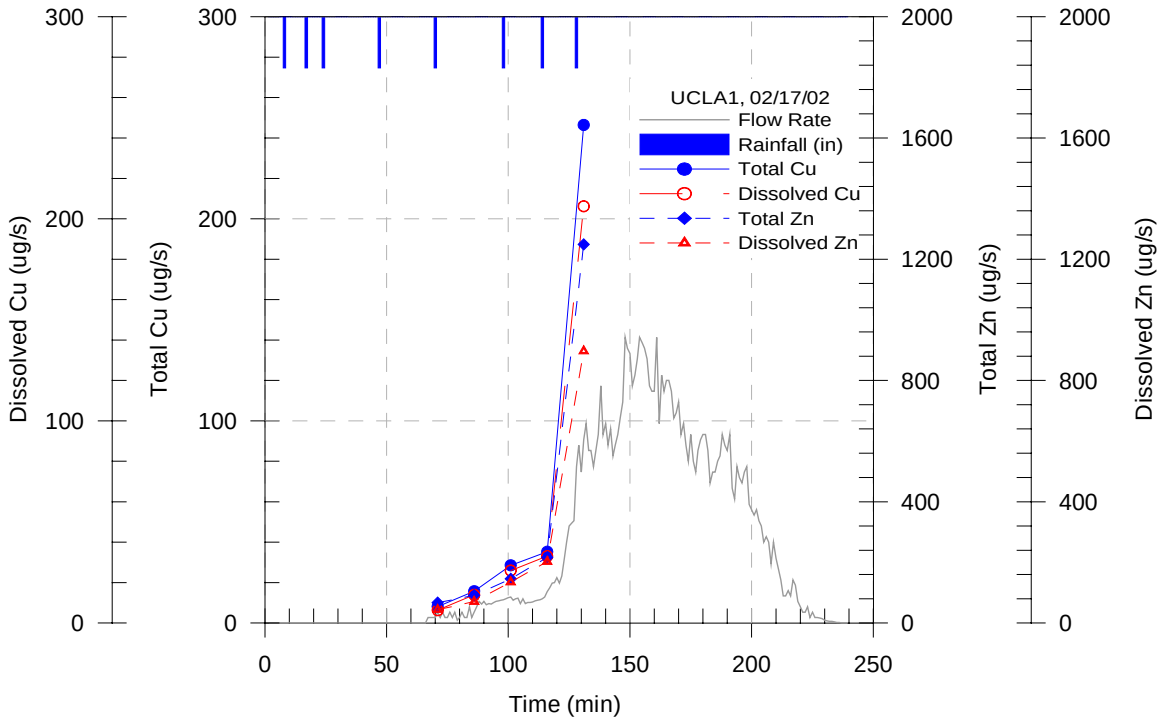

Figure I.3.1.5d[2] (Y3-UCLA1-E6-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

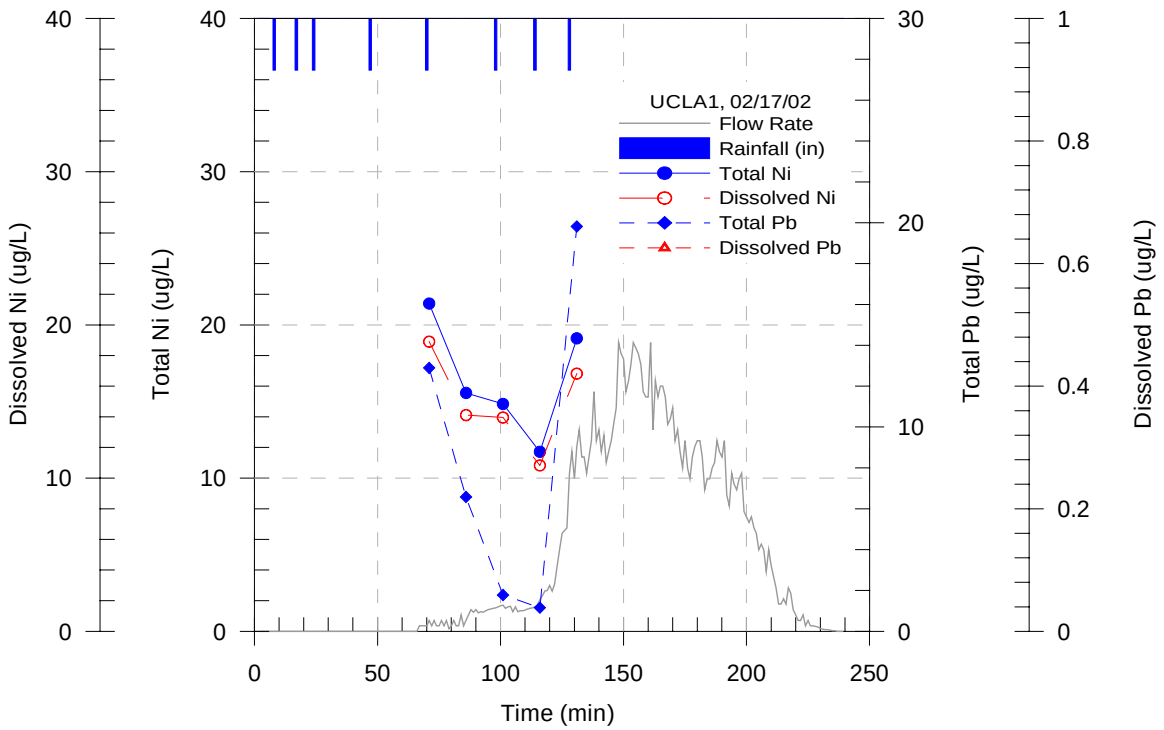

Figure I.3.1.5e[1] (Y3-UCLA1-E6-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

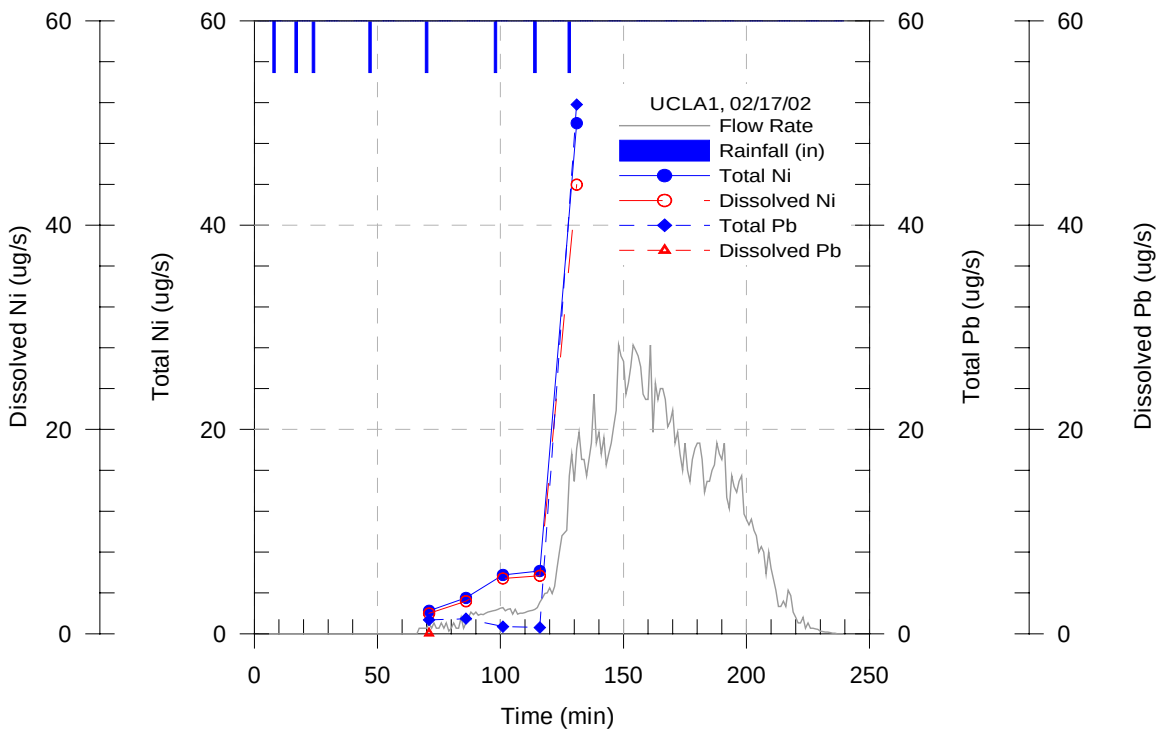

Figure I.3.1.5e[2] (Y3-UCLA1-E6-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

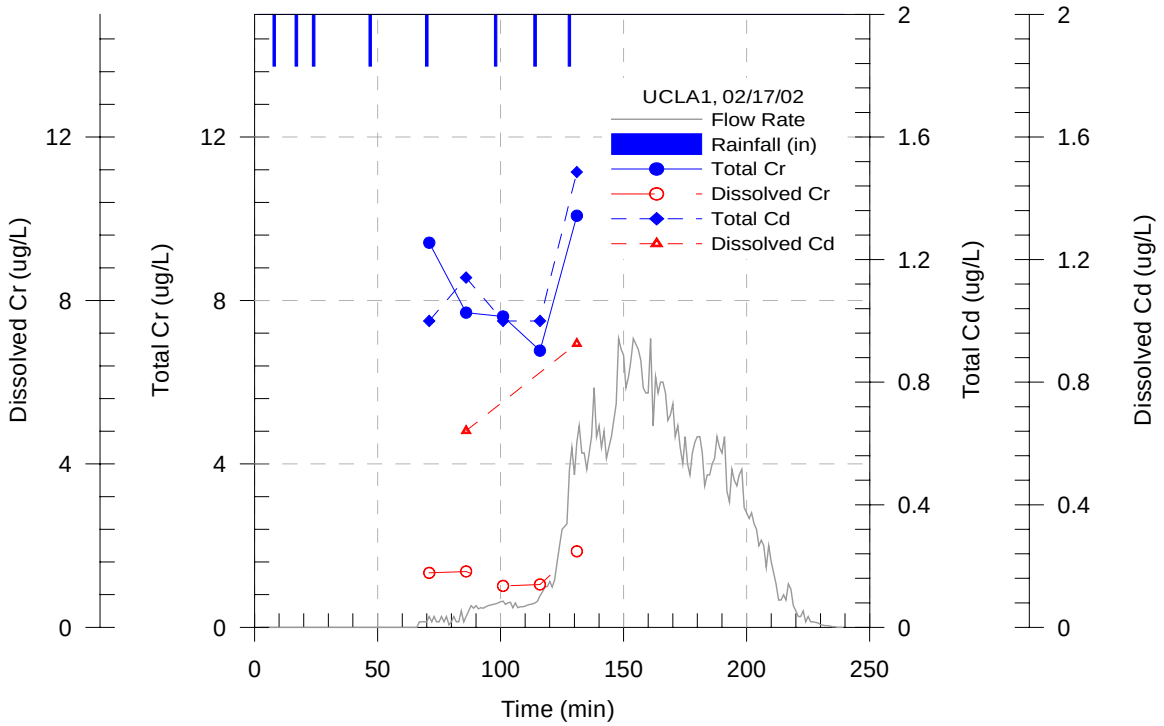

Figure I.3.1.5f[1] (Y3-UCLA1-E6-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

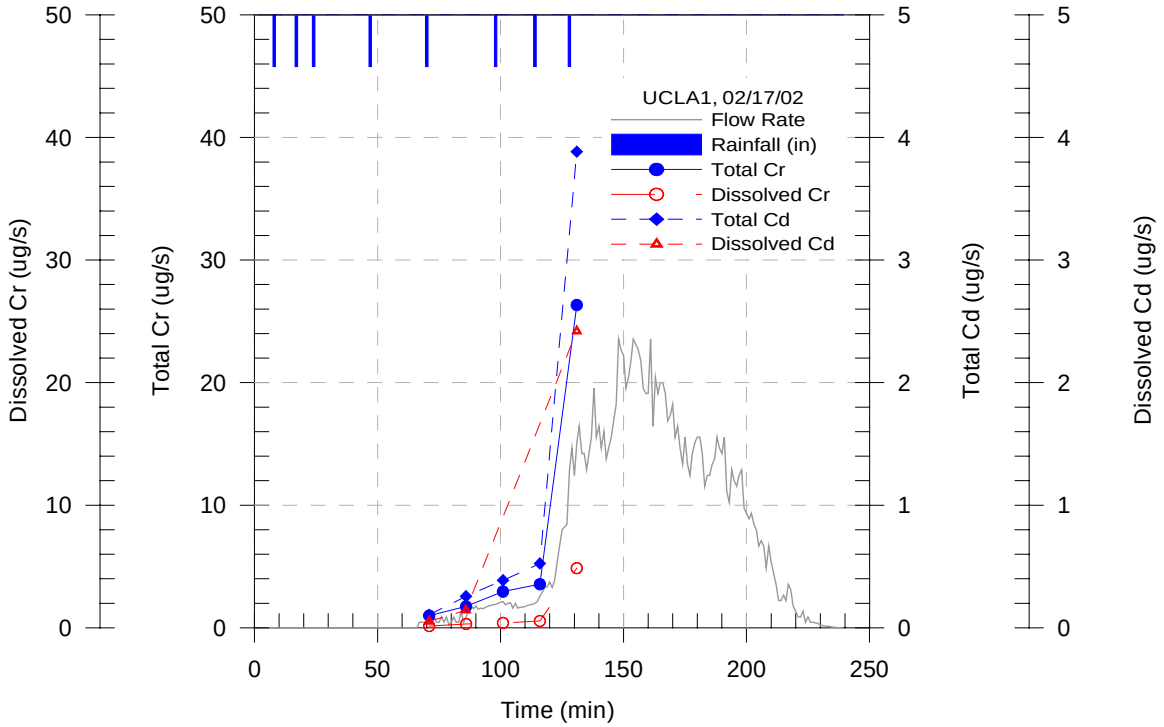

Figure I.3.1.5f[2] (Y3-UCLA1-E6-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

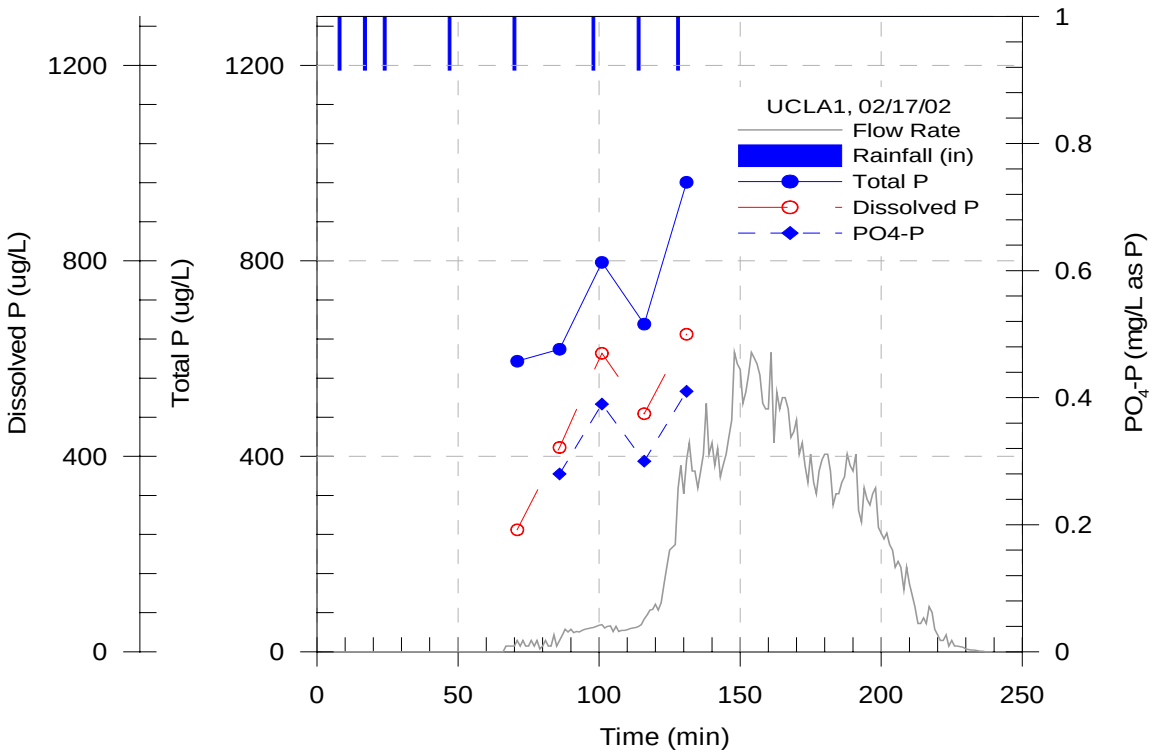

Figure I.3.1.5g[1] (Y3-UCLA1-E6-7). Polluto-graph for Total P / PO_4^{3-}-P

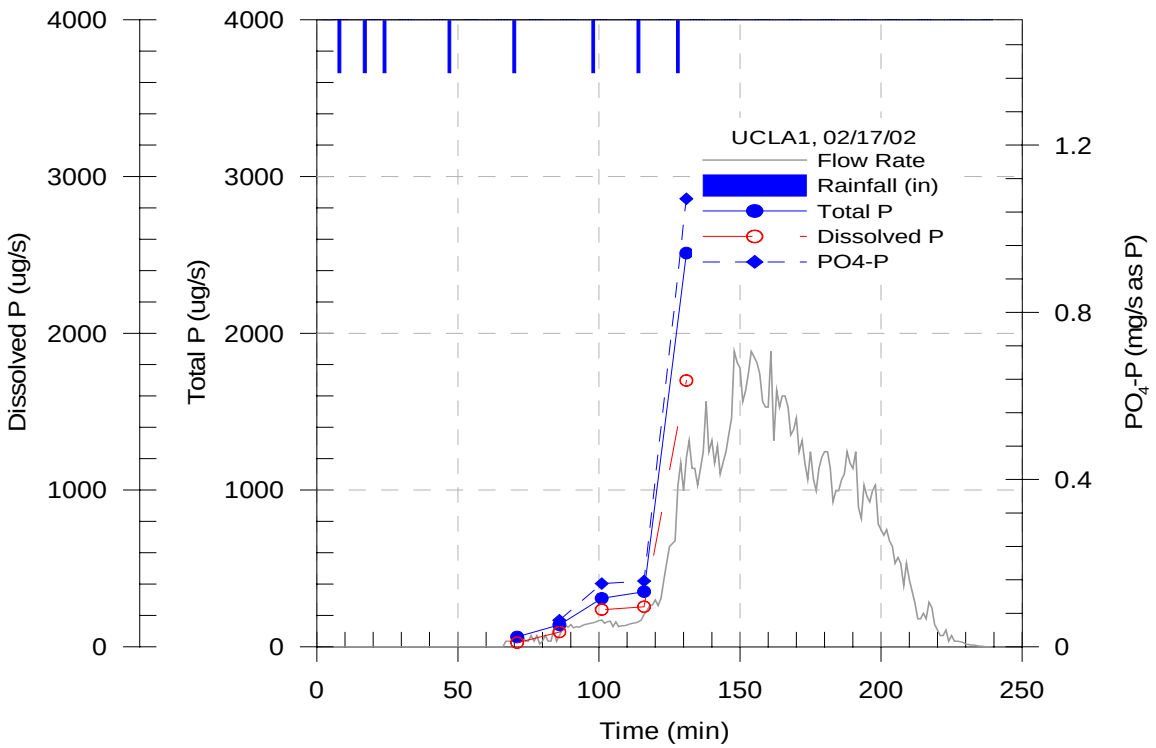

Figure I.3.1.5g[2] (Y3-UCLA1-E6-7). Load -graph for Total P / PO_4^{3-}-P

1. UCLA2, 10/30/01

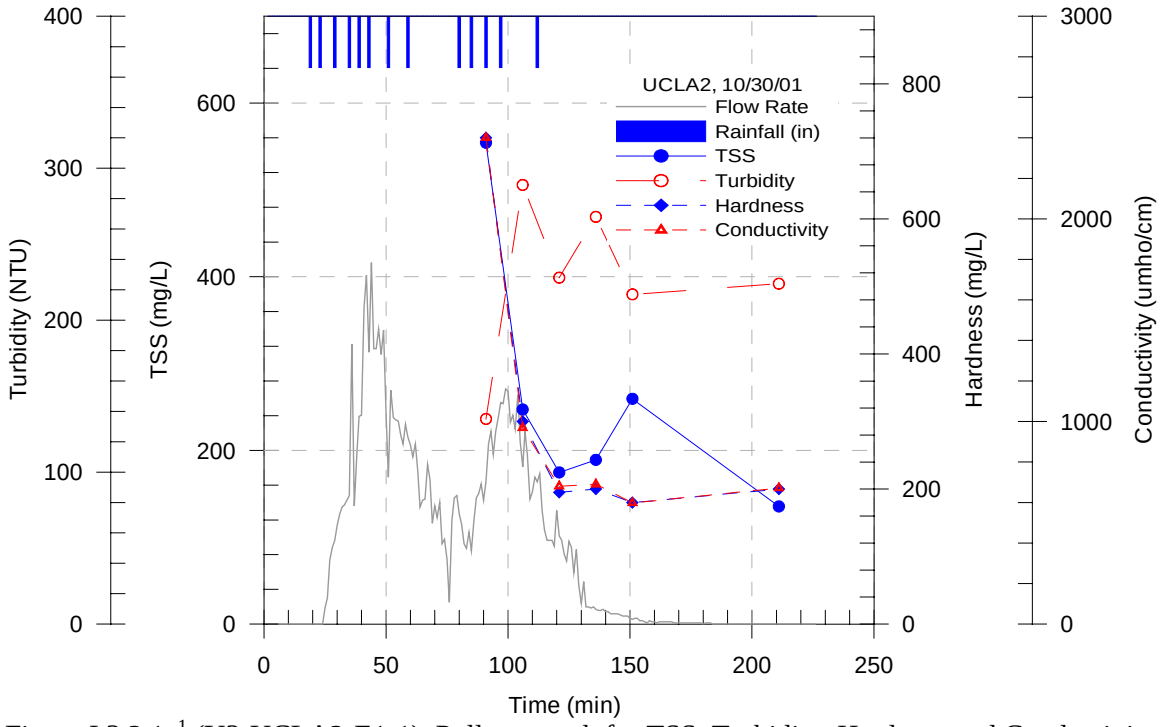

Figure I.3.2.1a[1] (Y3-UCLA2-E1-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

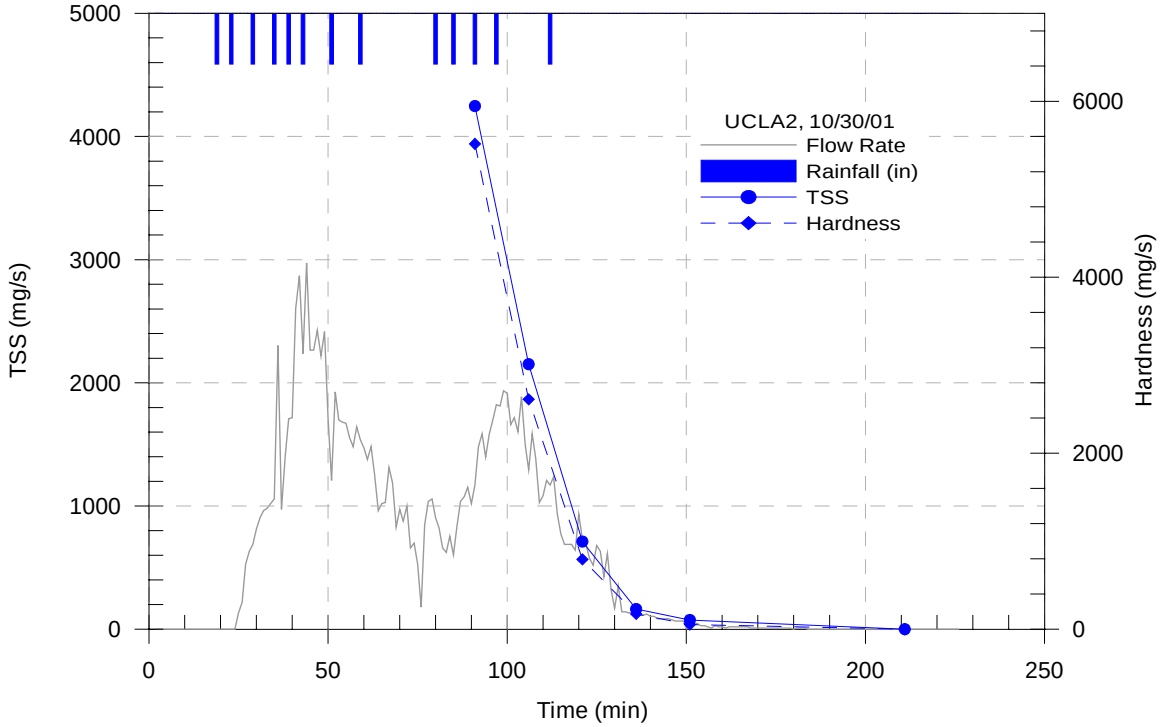

Figure I.3.2.1a[2] (Y3-UCLA2-E1-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

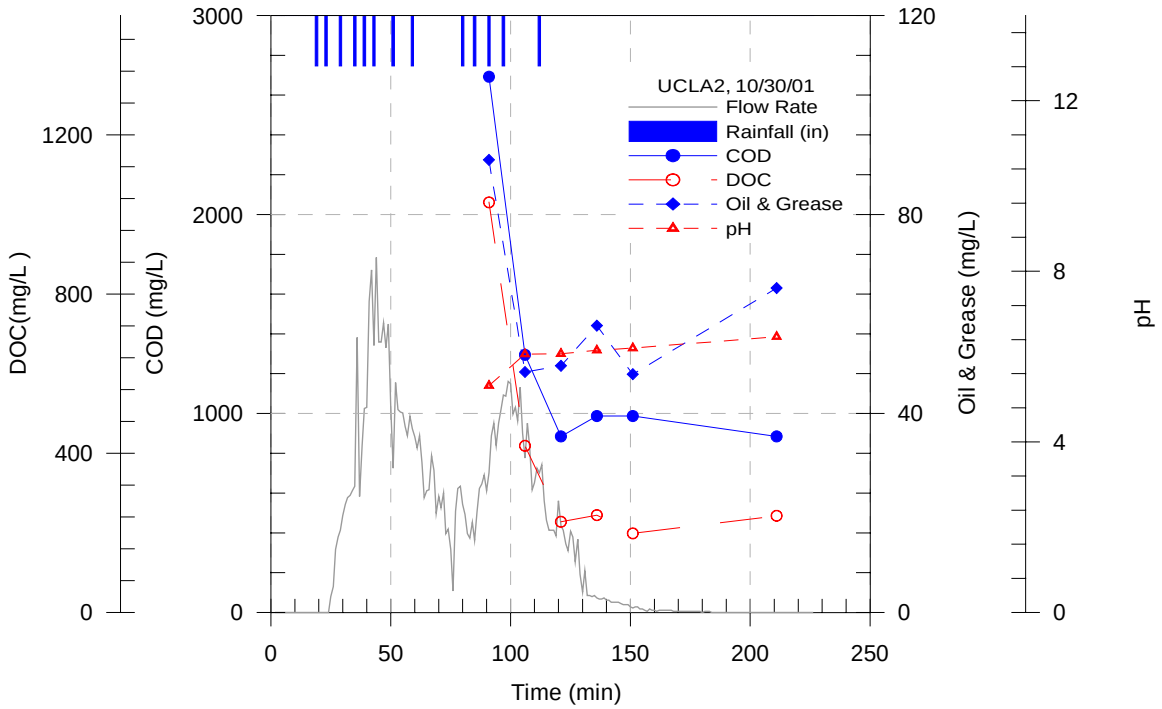

Figure I.3.2.1b[1] (Y3-UCLA2-E1-2). Polluto-graph for COD, DOC, Oil & Grease and pH

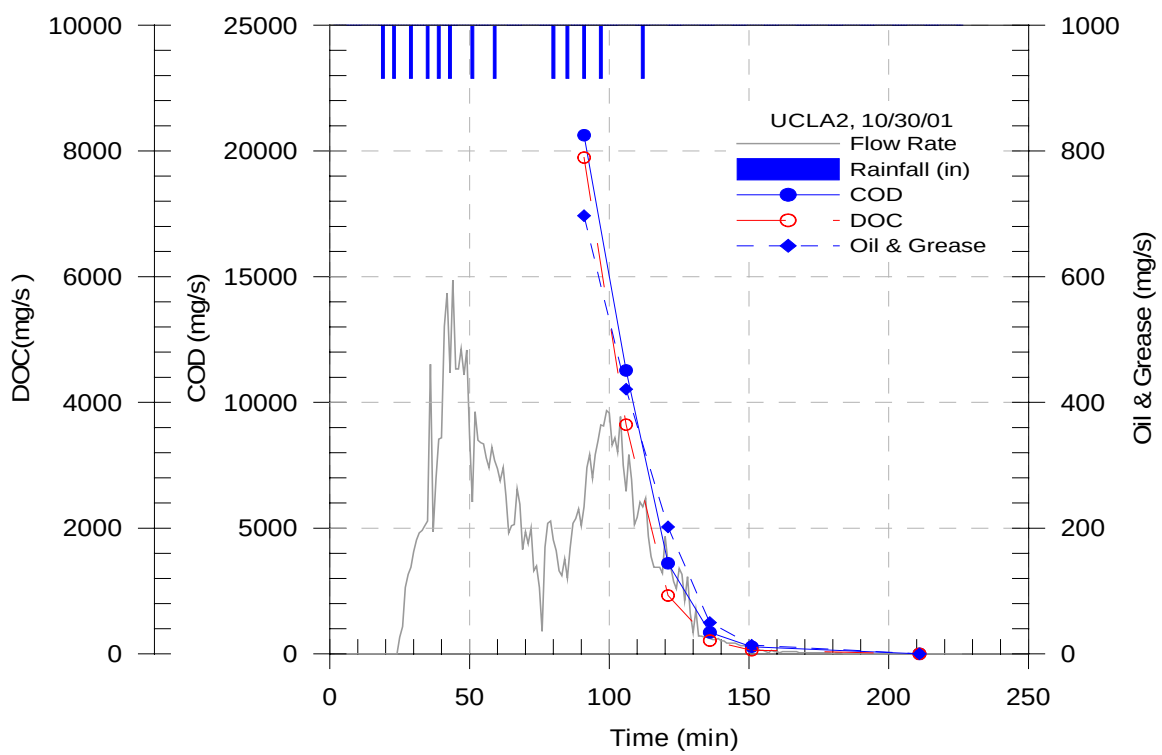

Figure I.3.2.1b[2] (Y3-UCLA2-E1-2). Load-graph for COD, DOC, Oil & Grease and pH

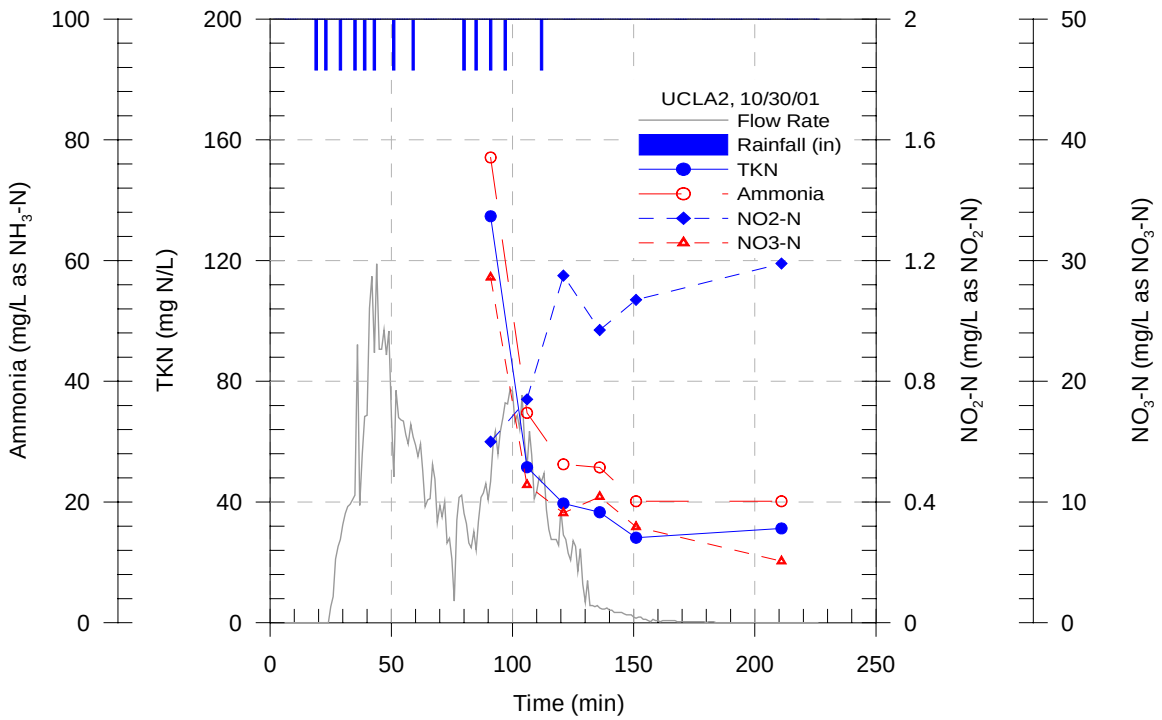

Figure I.3.2.1c[1] (Y3-UCLA2-E1-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

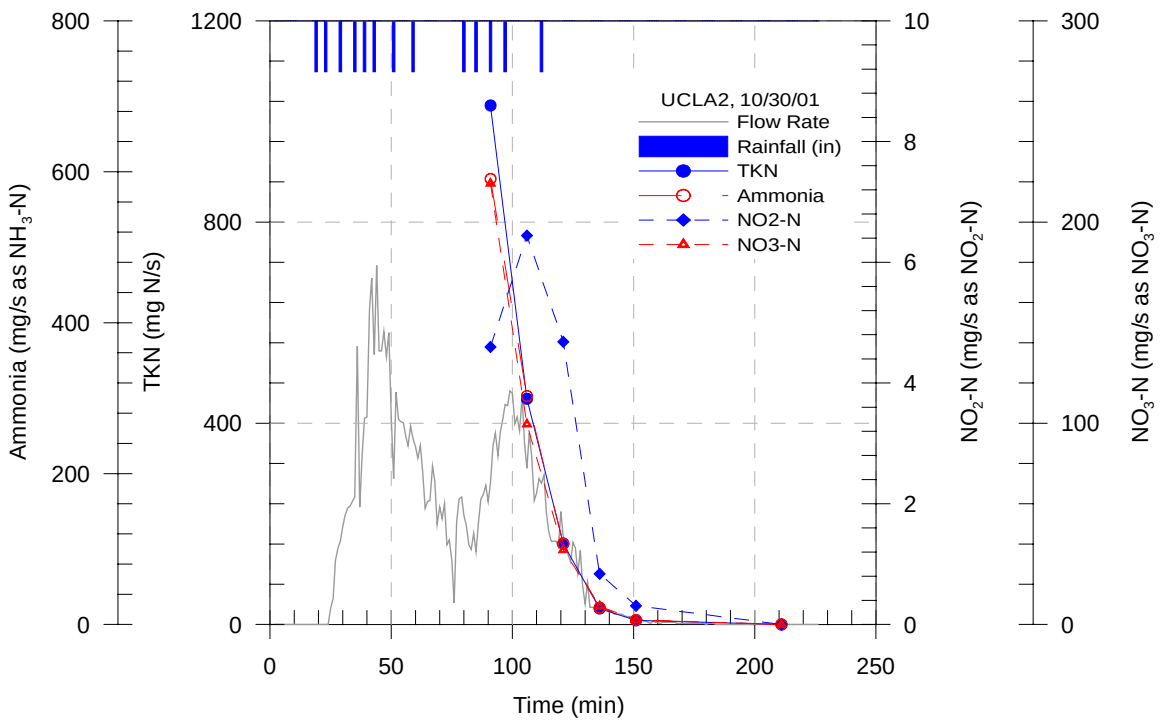

Figure I.3.2.1c[2] (Y3-UCLA2-E1-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

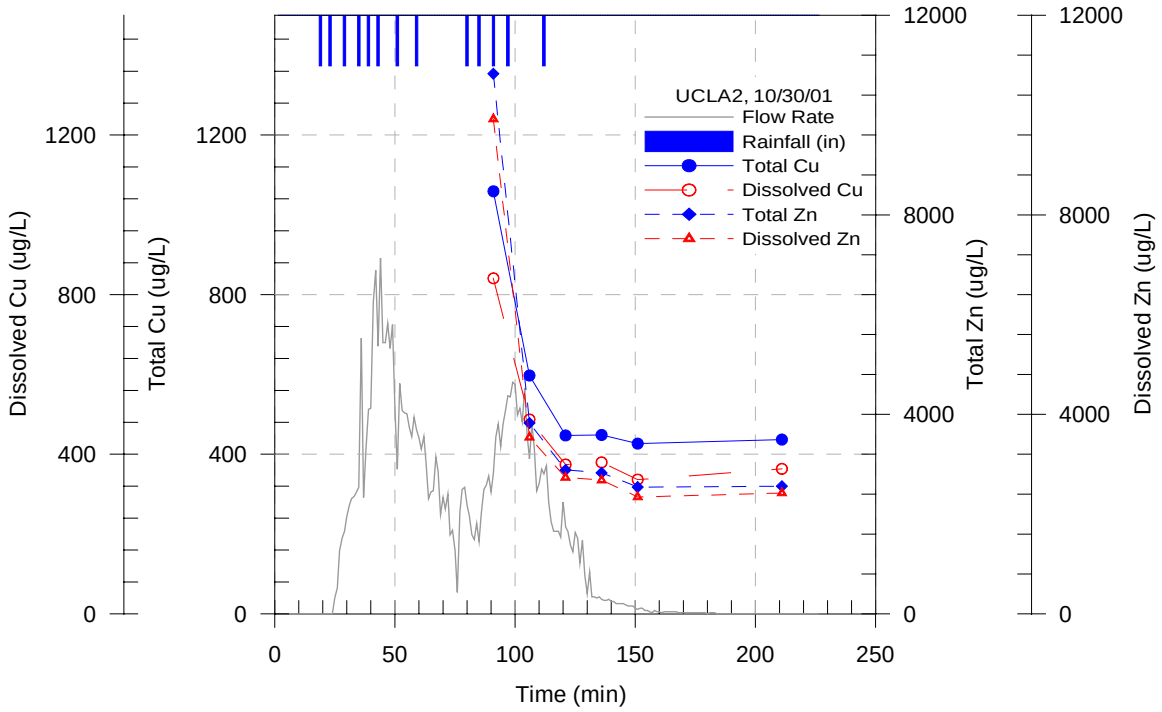

Figure I.3.2.1d[1] (Y3-UCLA2-E1-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

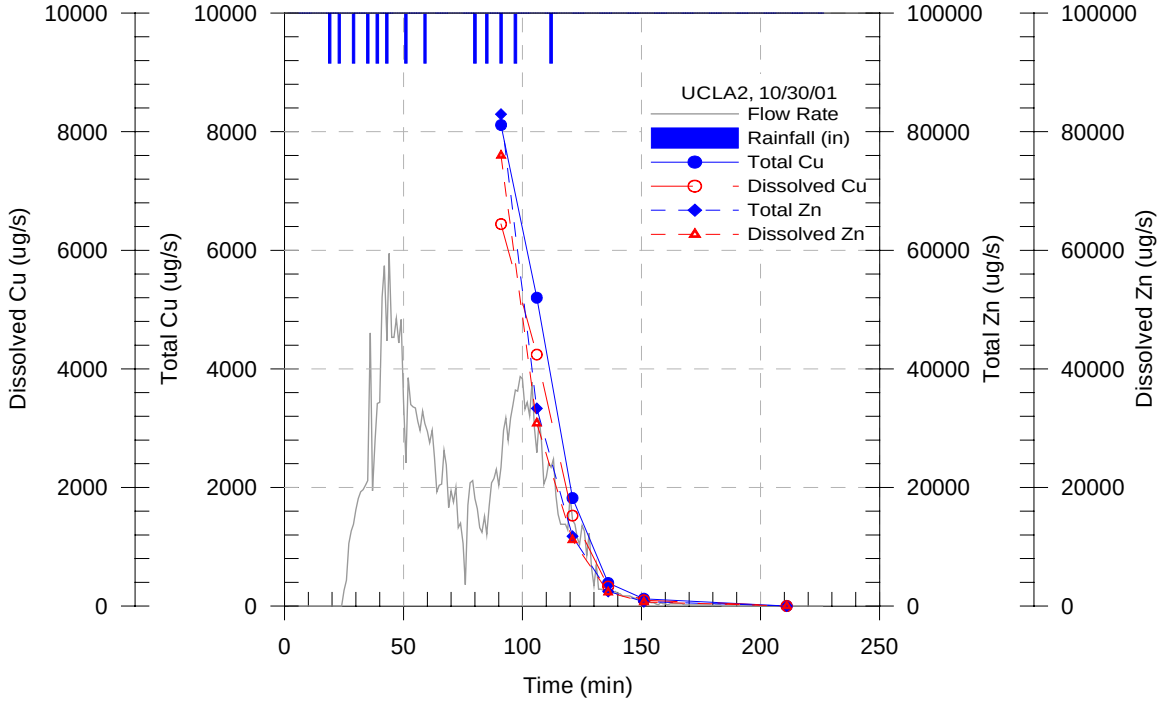

Figure I.3.2.1d[2] (Y3-UCLA2-E1-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

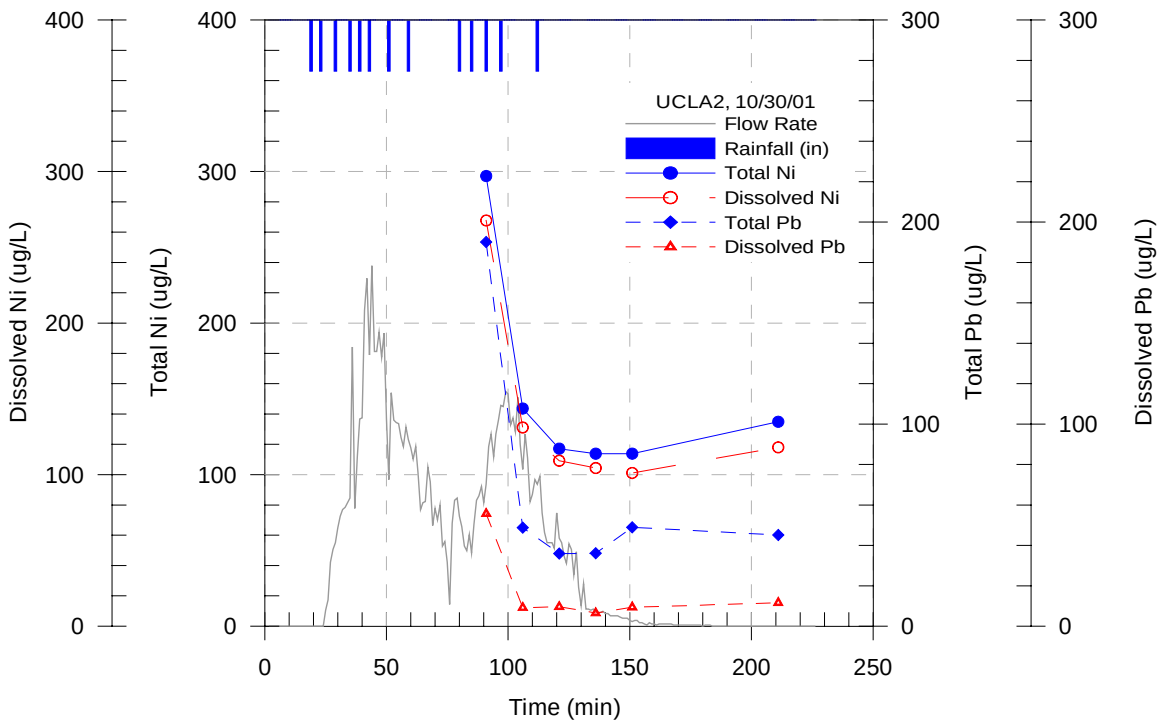

Figure I.3.2.1e[1] (Y3-UCLA2-E1-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

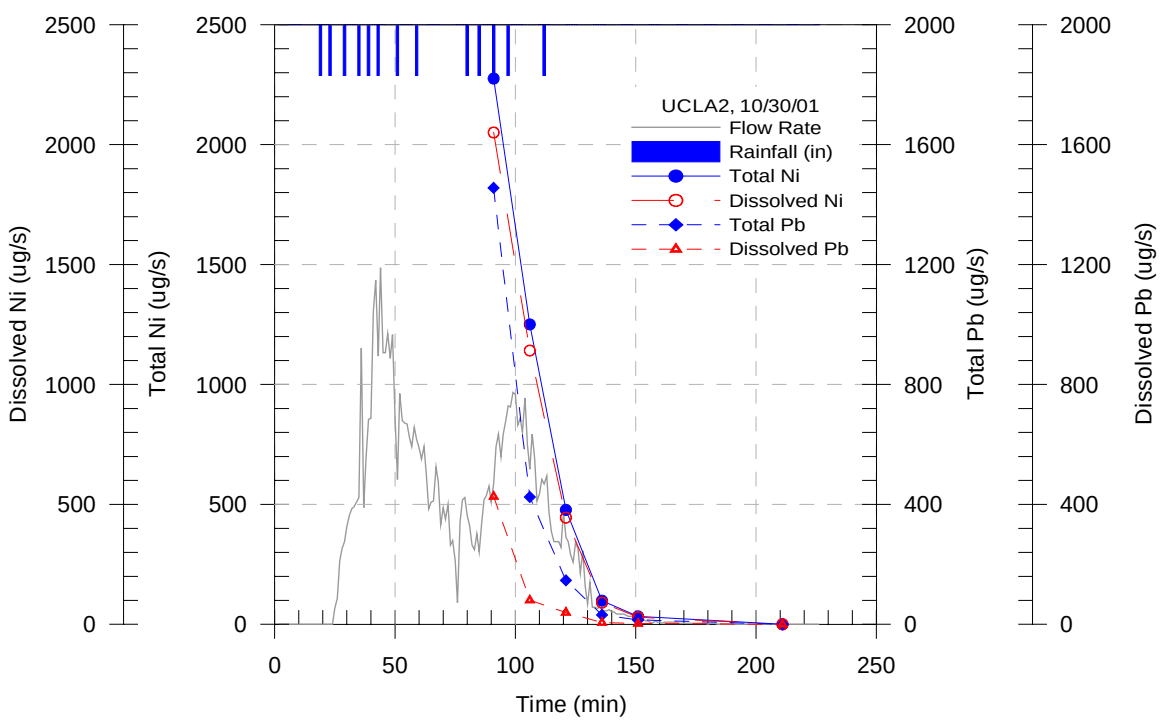

Figure I.3.2.1e[2] (Y3-UCLA2-E1-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

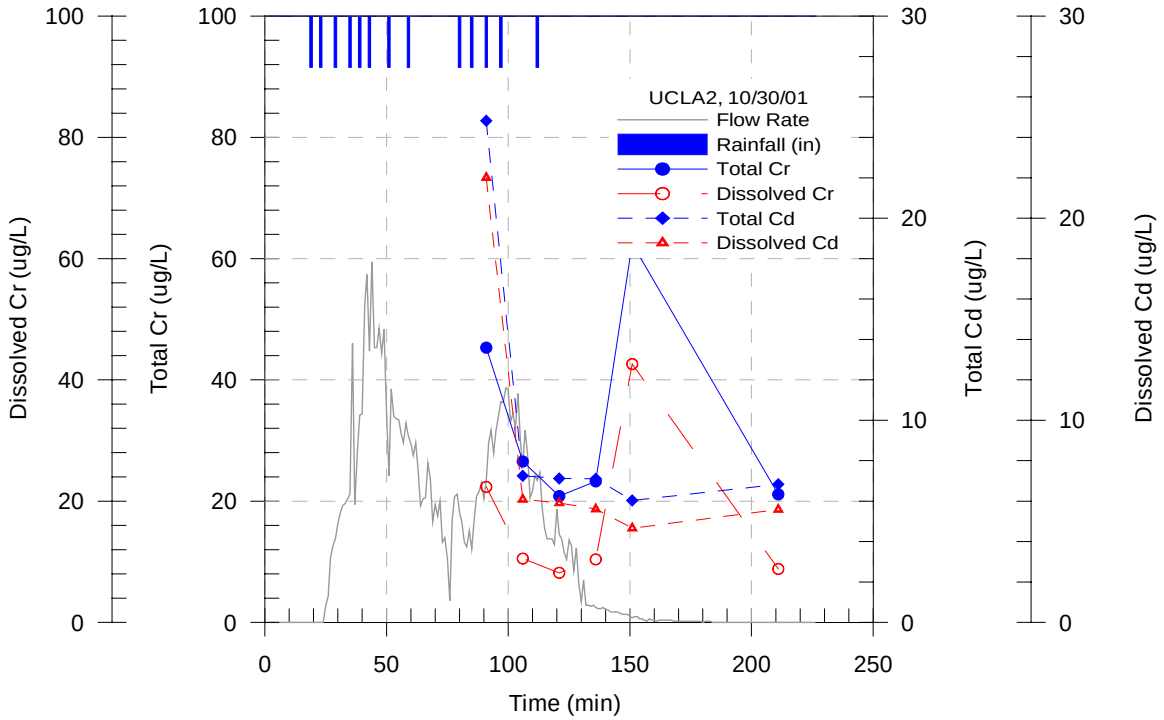

Figure I.3.2.1f[1] (Y3-UCLA2-E1-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

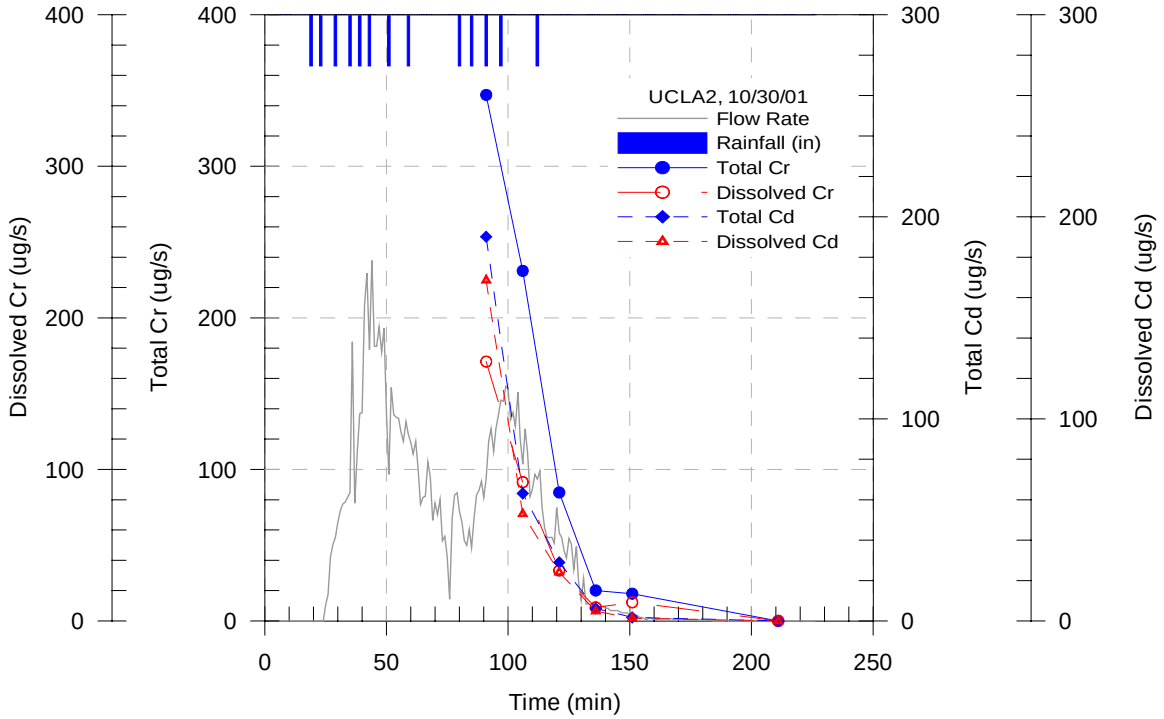

Figure I.3.2.1f[2] (Y3-UCLA2-E1-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

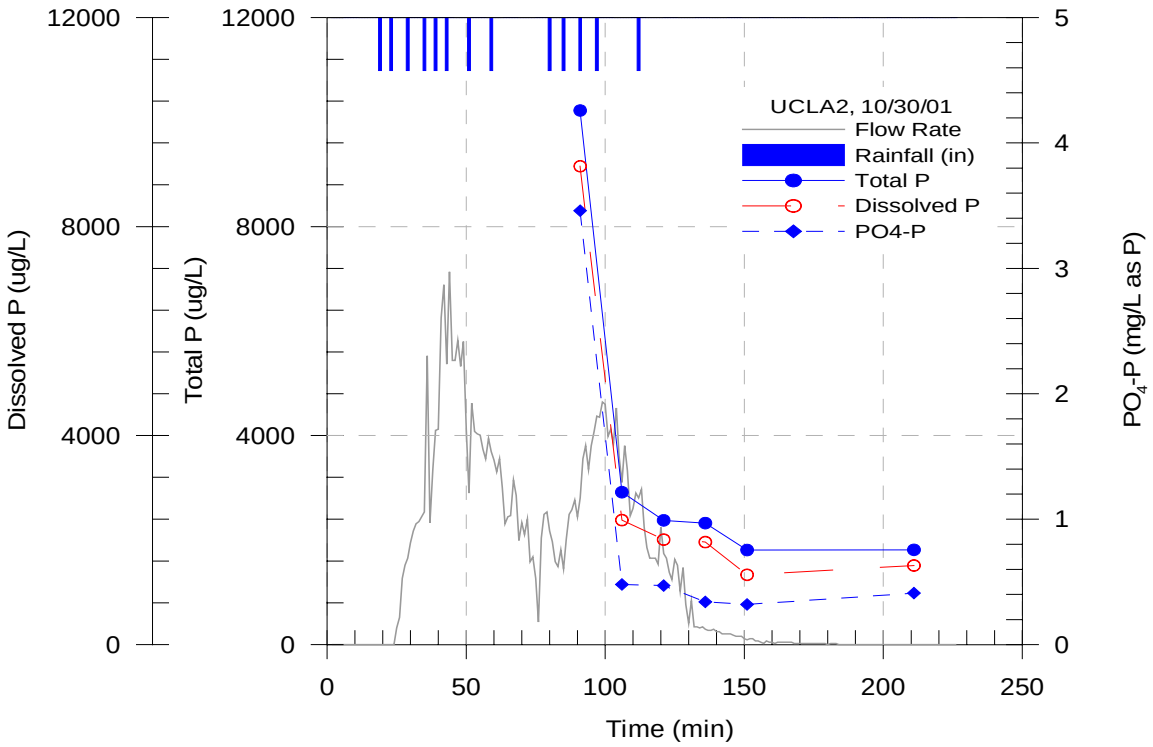

Figure I.3.2.1g[1] (Y3-UCLA2-E1-7). Polluto-graph for Total P / PO_4^{3-}-P

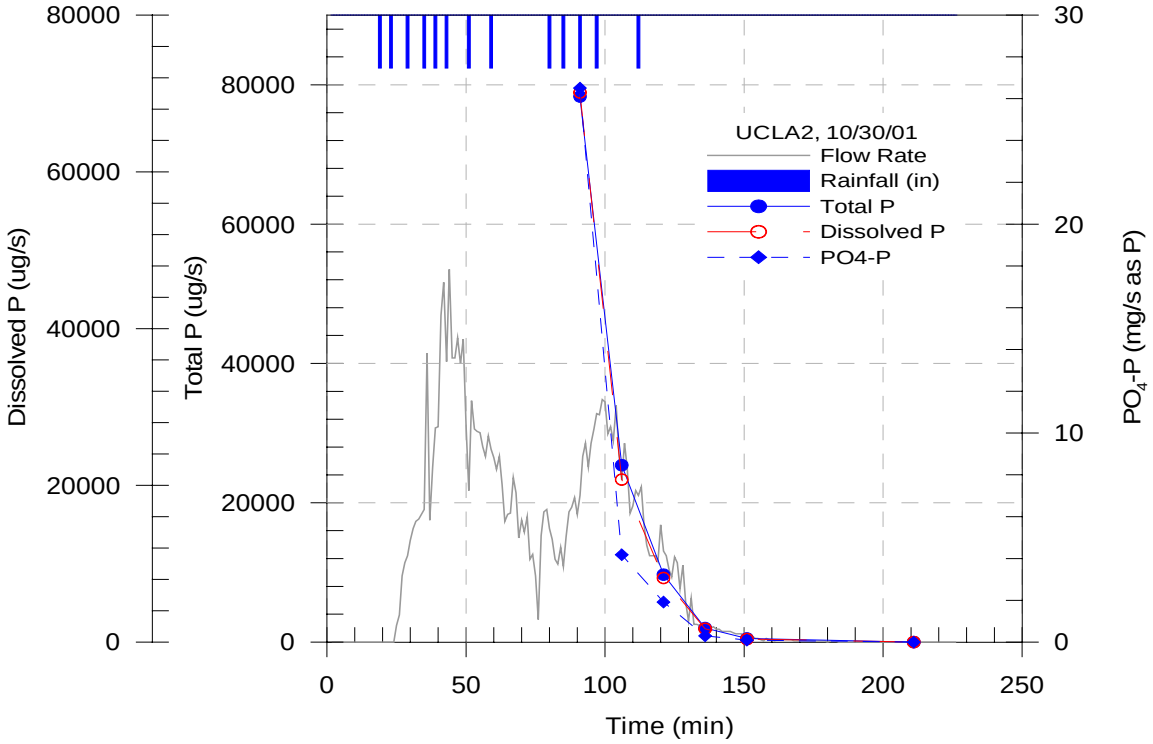

Figure I.3.2.1g[2] (Y3-UCLA2-E1-7). Load -graph for Total P / PO_4^{3-}P

2. UCLA2, 11/12/01

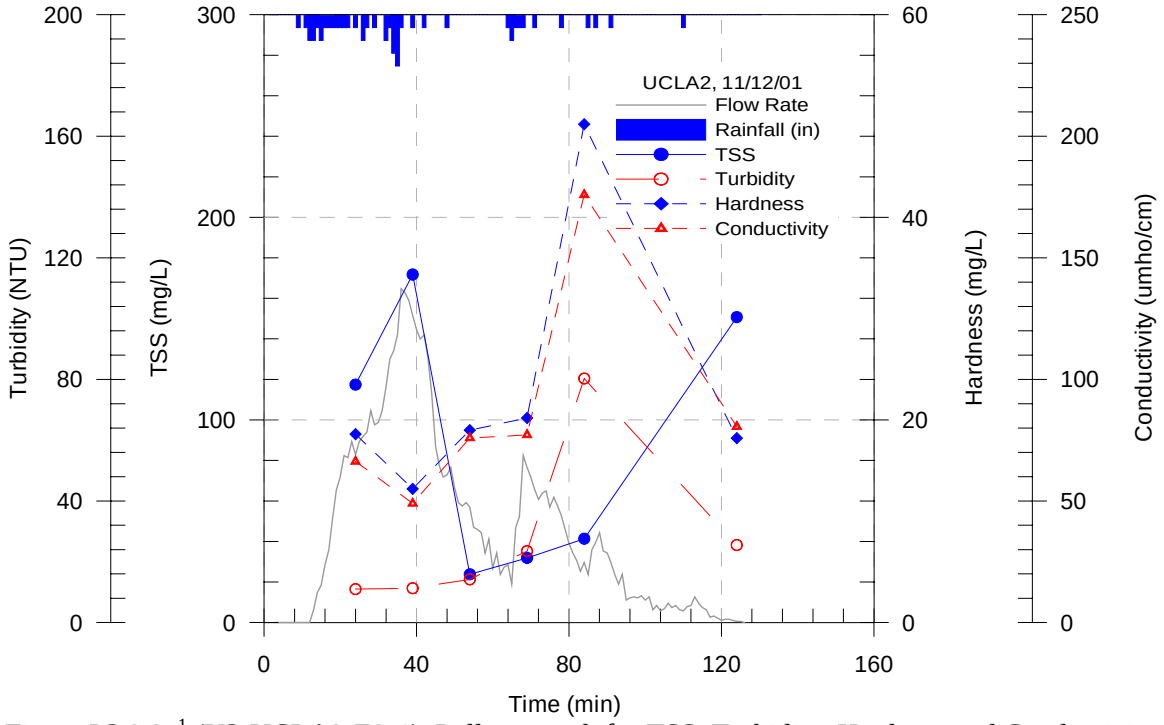

Figure I.3.2.2a[1] (Y3-UCLA2-E2-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

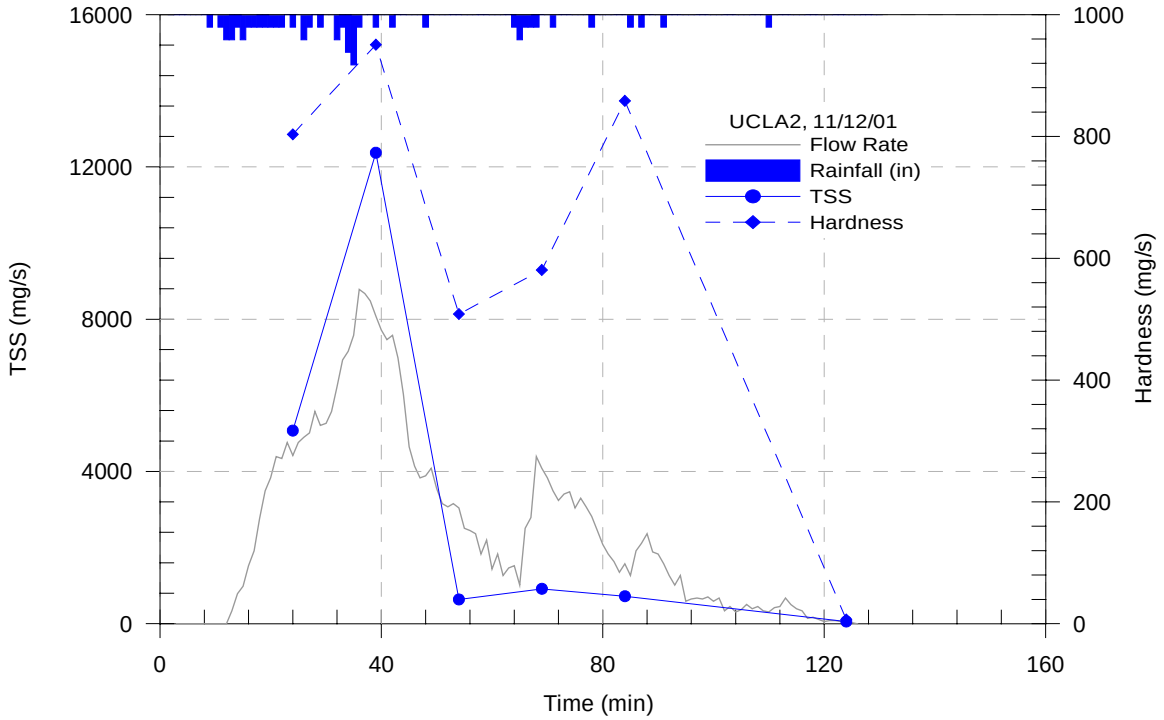

Figure I.3.2.2a[2] (Y3-UCLA2-E2-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

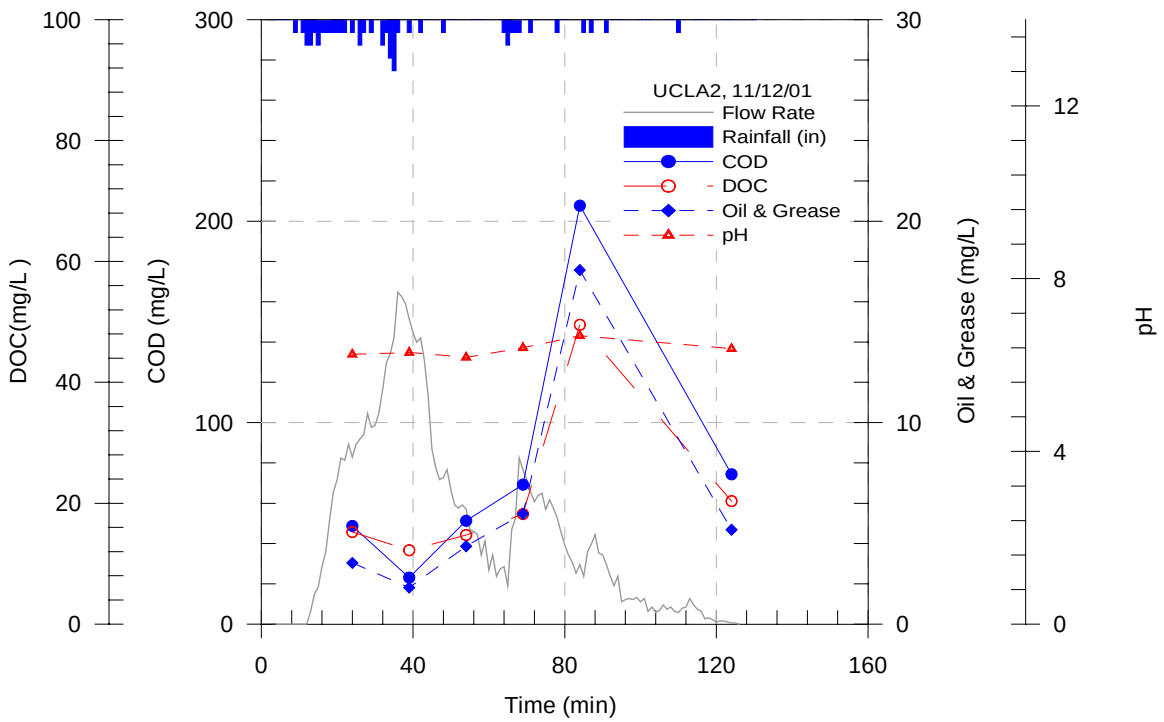

Figure I.3.2.2b[1] (Y3-UCLA2-E2-2). Polluto-graph for COD, DOC, Oil & Grease and pH

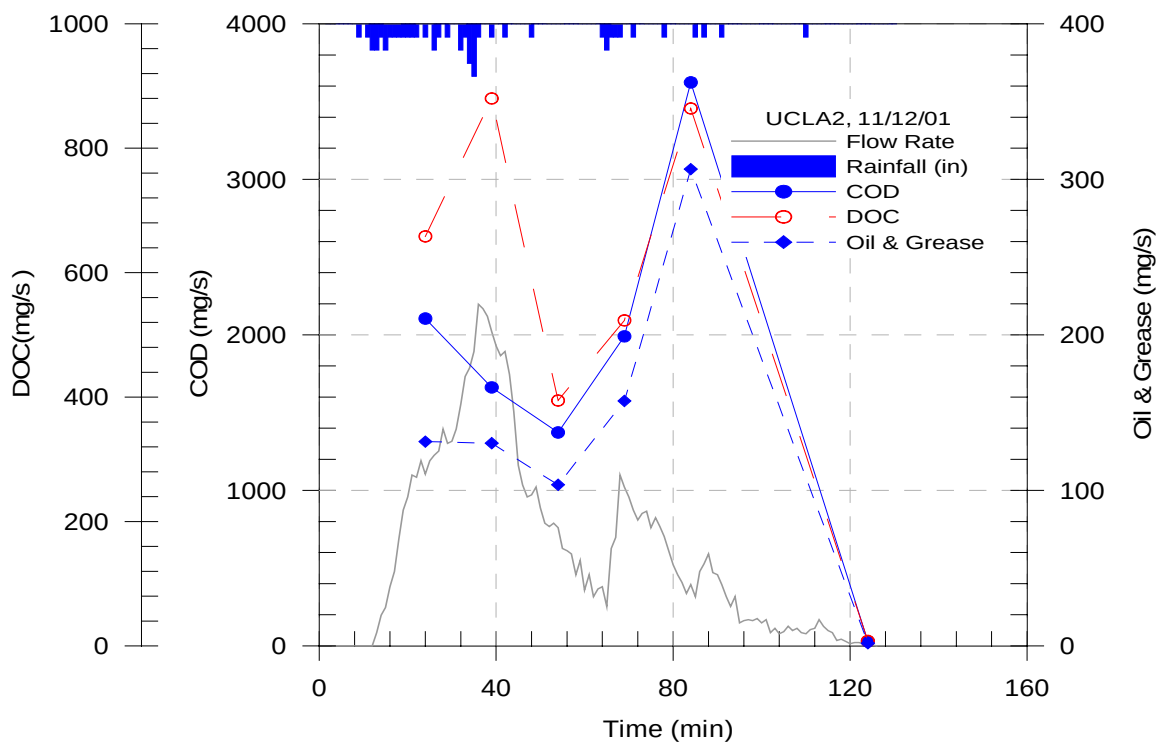

Figure I.3.2.2b[2] (Y3-UCLA2-E2-2). Load-graph for COD, DOC, Oil & Grease and pH

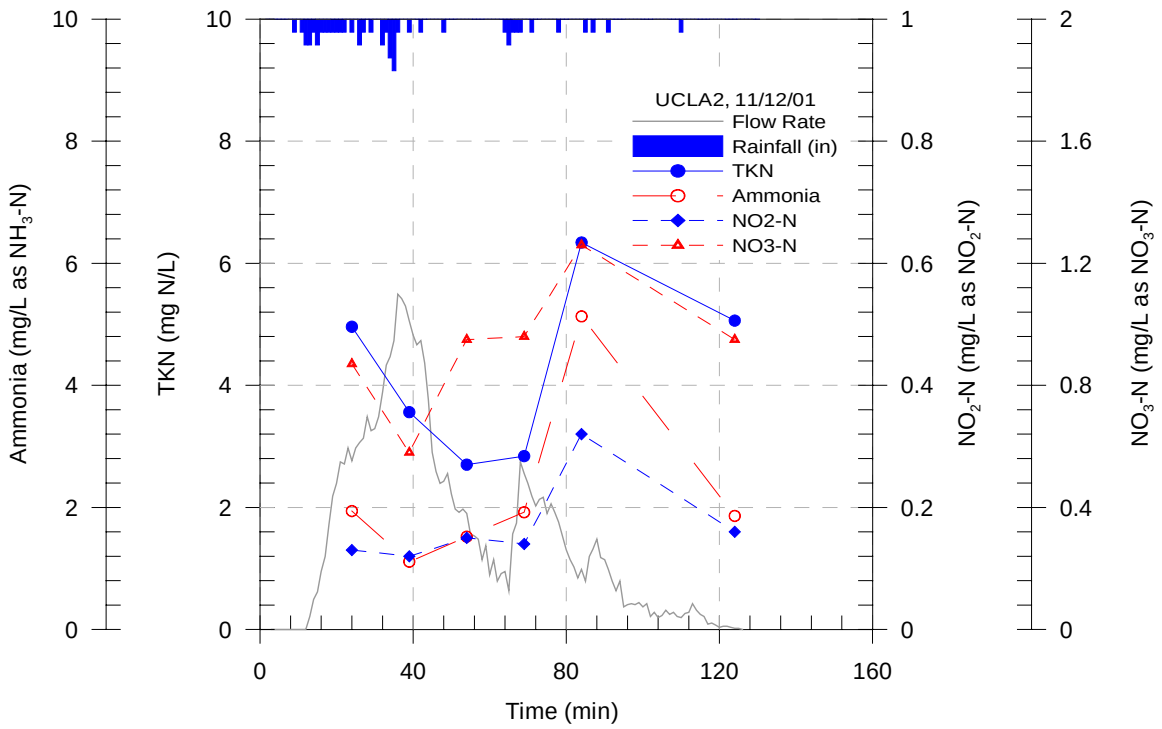

Figure I.3.2.2c[1] (Y3-UCLA2-E2-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

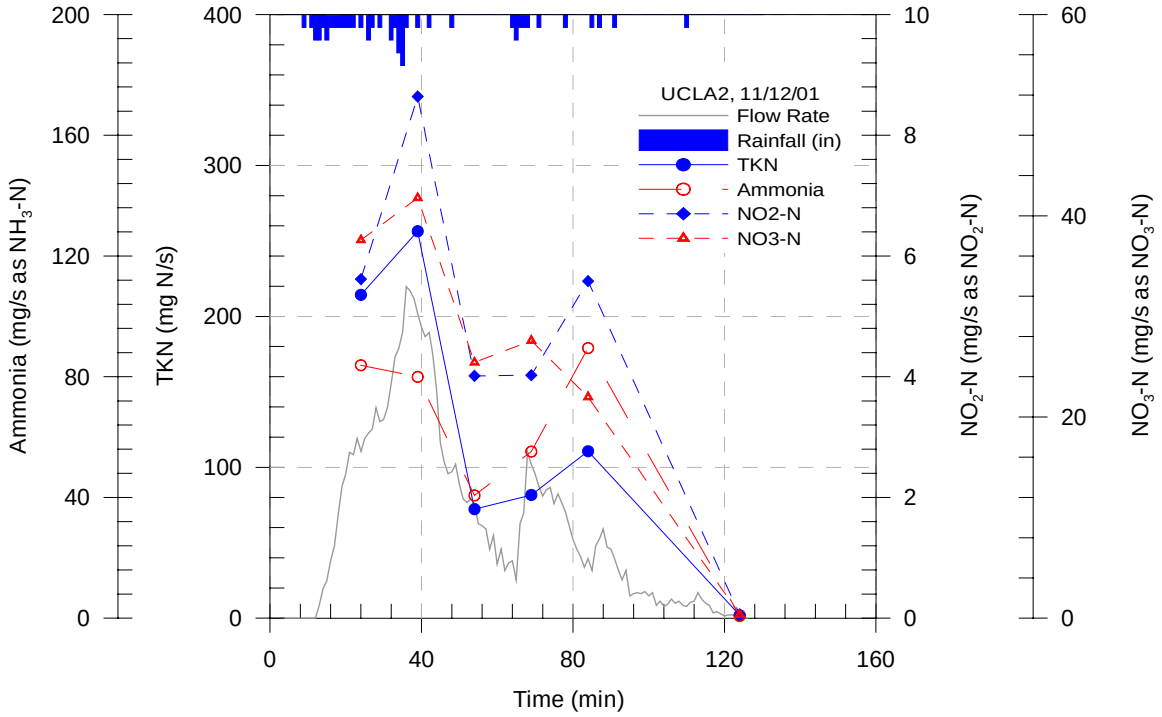

Figure I.3.2.2c[2] (Y3-UCLA2-E2-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

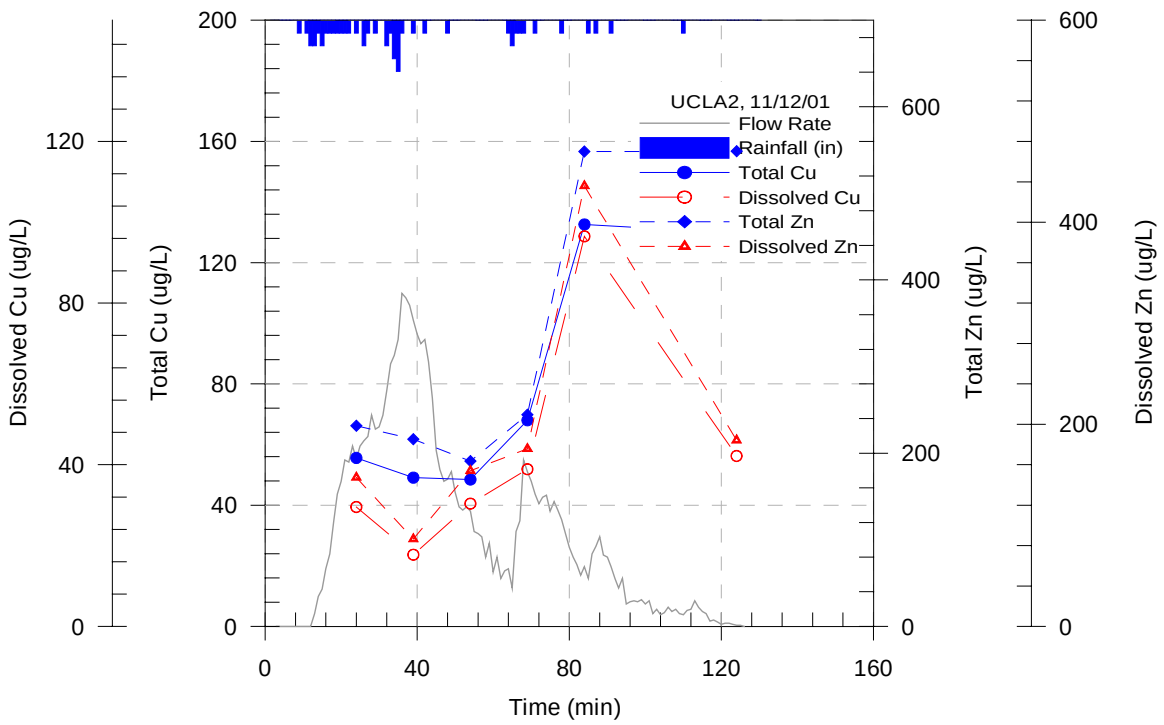

Figure I.3.2.2d[1] (Y3-UCLA2-E2-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

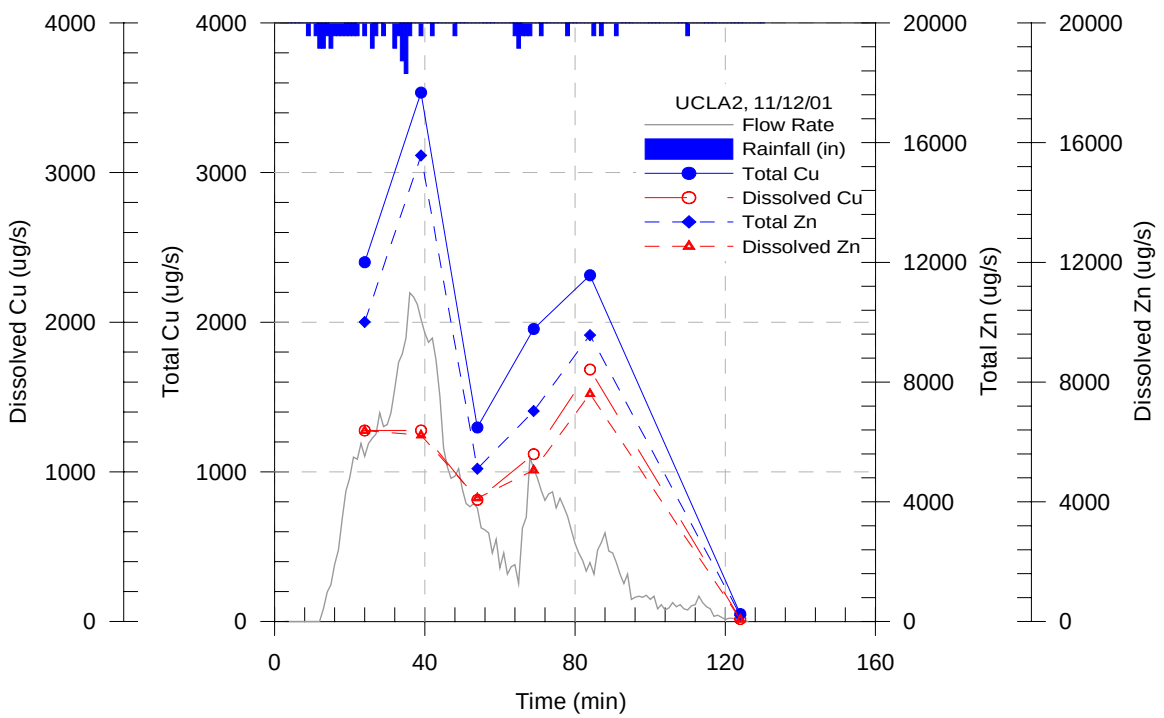

Figure I.3.2.2d[2] (Y3-UCLA2-E2-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

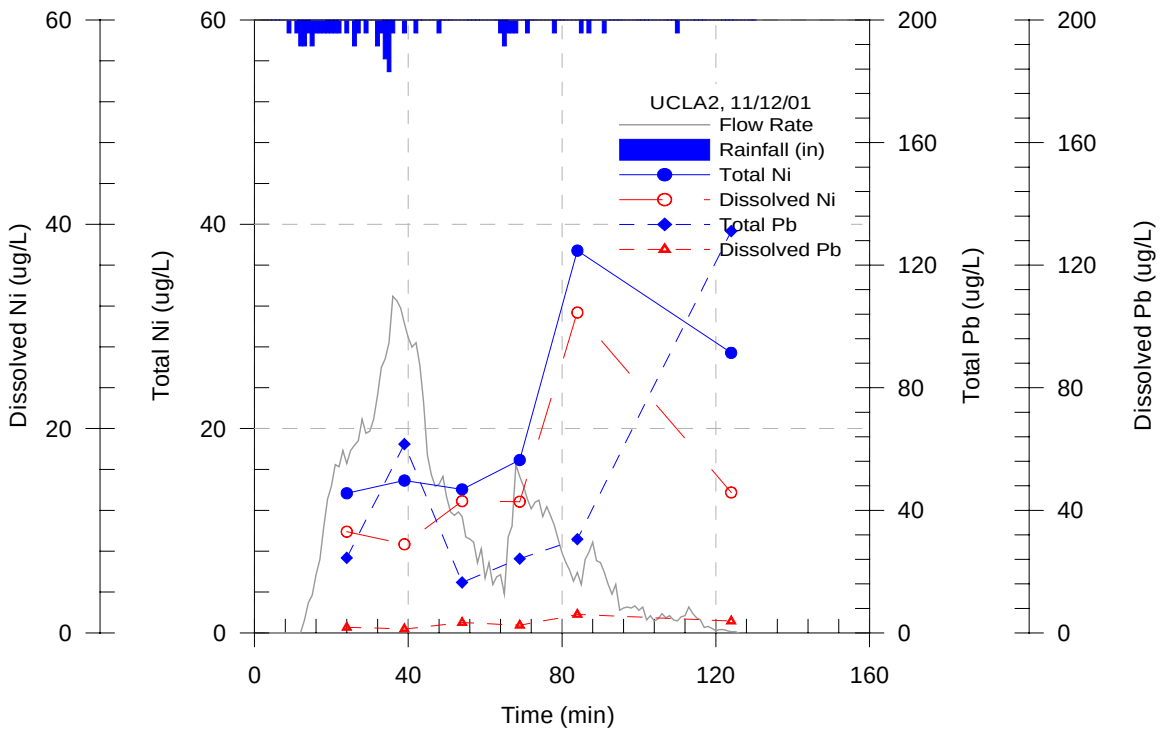

Figure I.3.2.2e[1] (Y3-UCLA2-E2-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

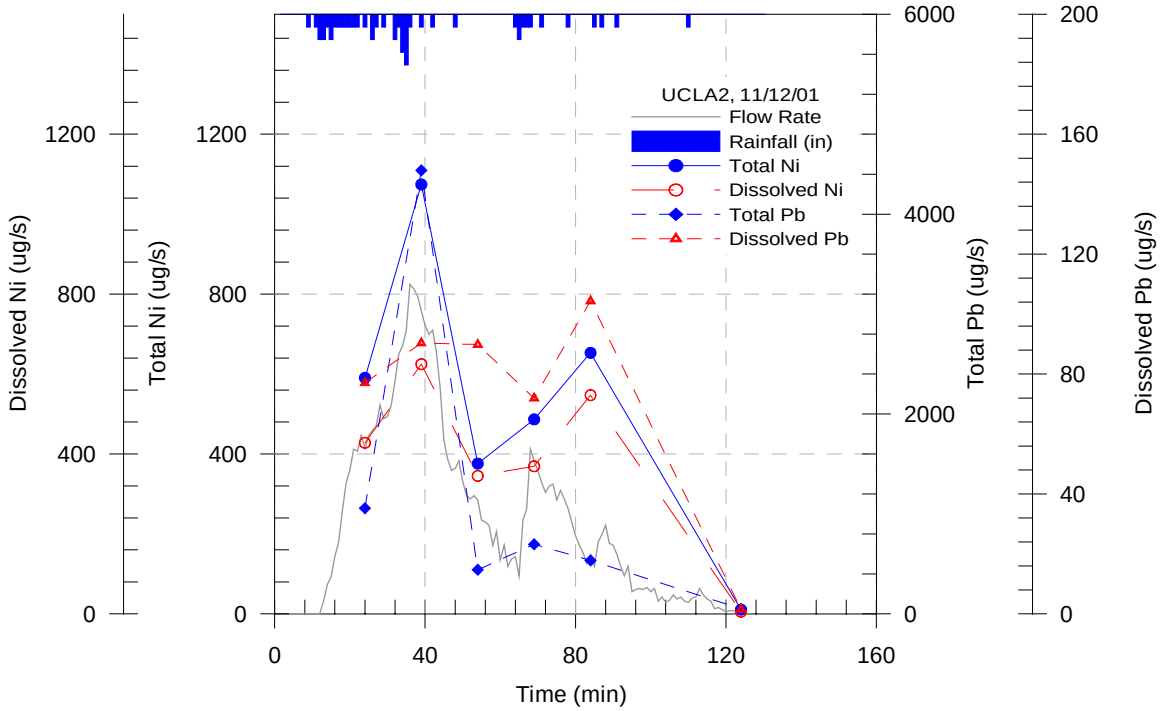

Figure I.3.2.2e[2] (Y3-UCLA2-E2-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

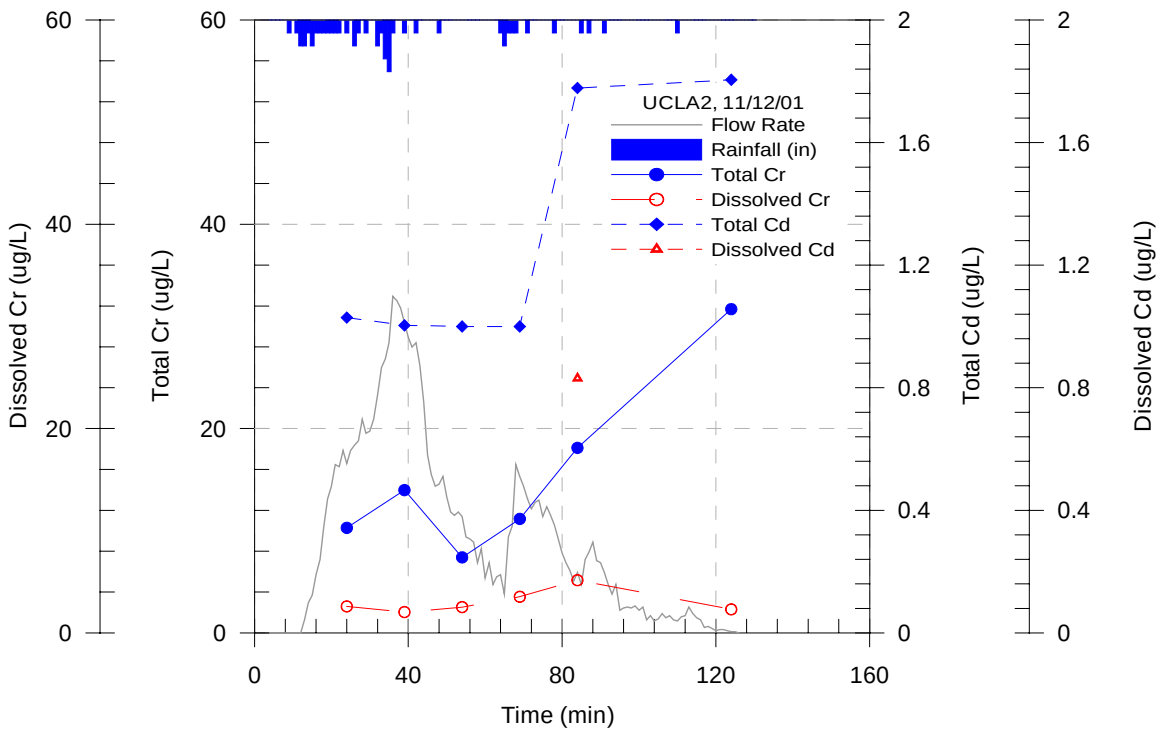

Figure I.3.2.2f[1] (Y3-UCLA2-E2-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

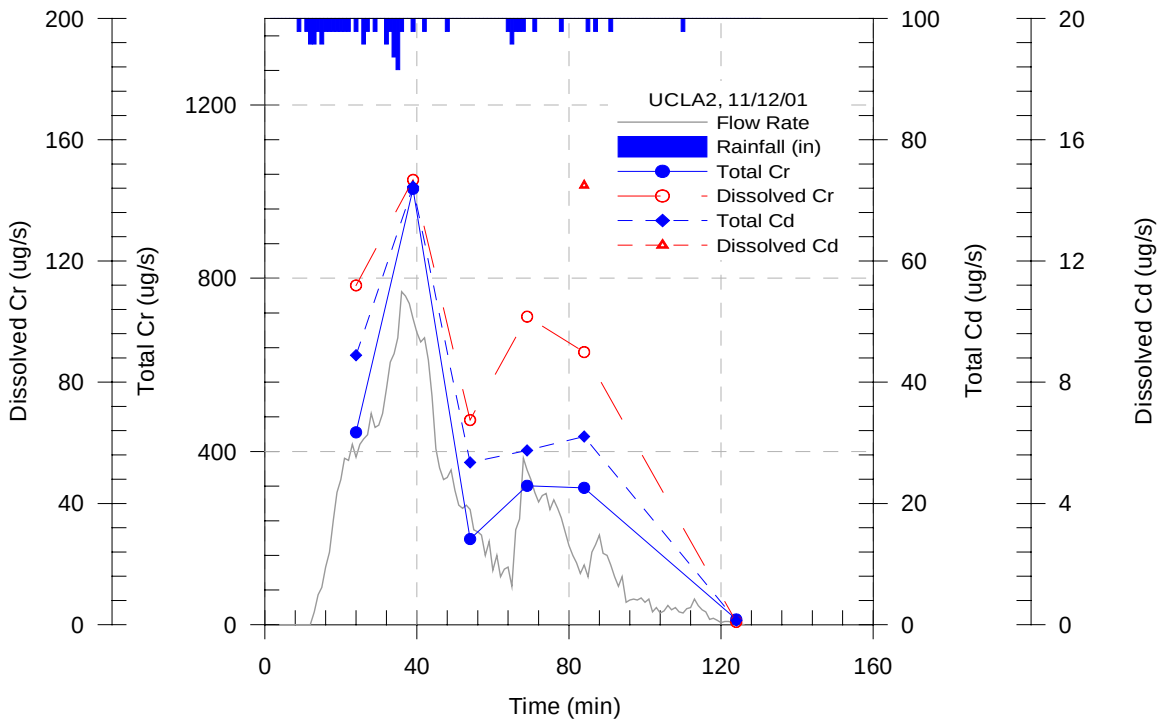

Figure I.3.2.2f[2] (Y3-UCLA2-E2-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

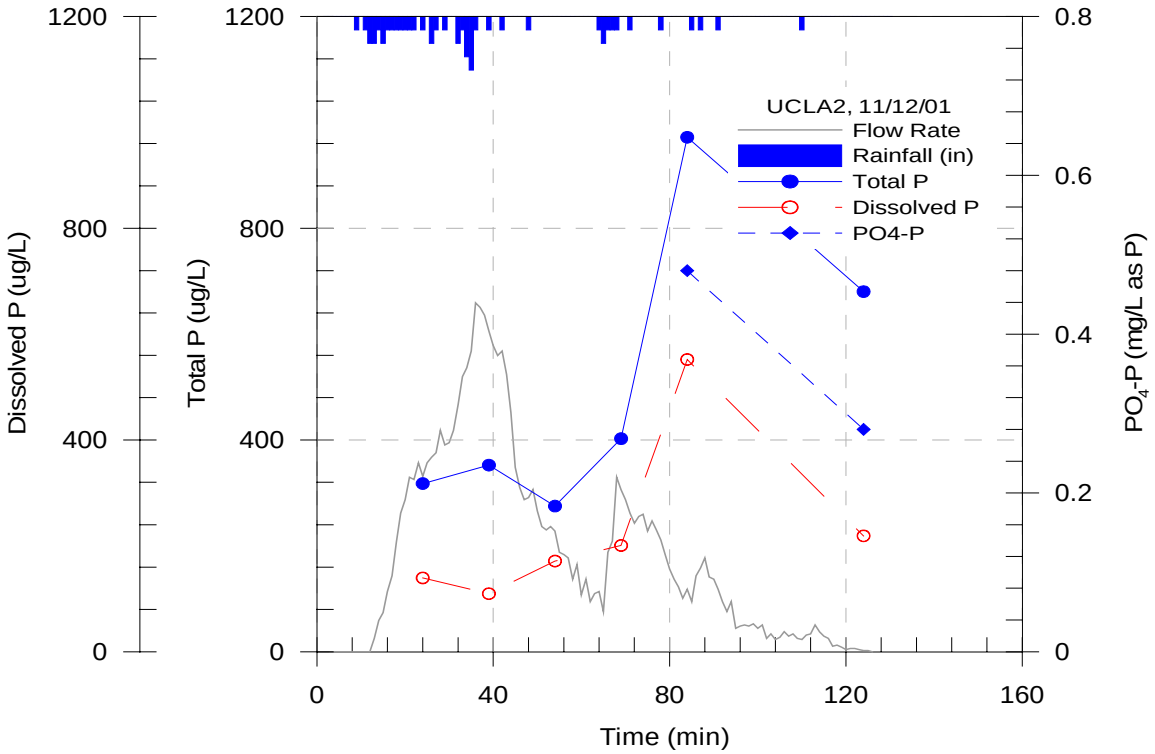

Figure I.3.2.2g[1] (Y3-UCLA2-E2-7). Polluto-graph for Total P / PO_4^{3-}-P

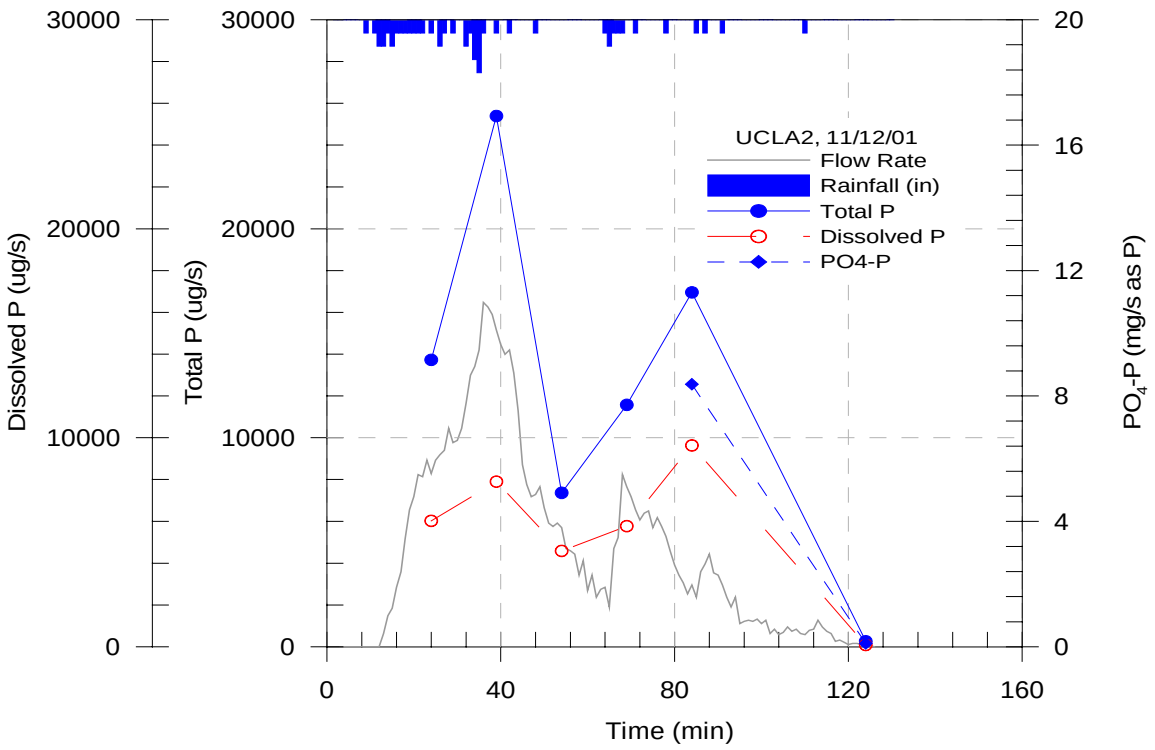

Figure I.3.2.2g[2] (Y3-UCLA2-E2-7). Load -graph for Total P / PO_4^{3-}P

3. UCLA2, 11/24/01

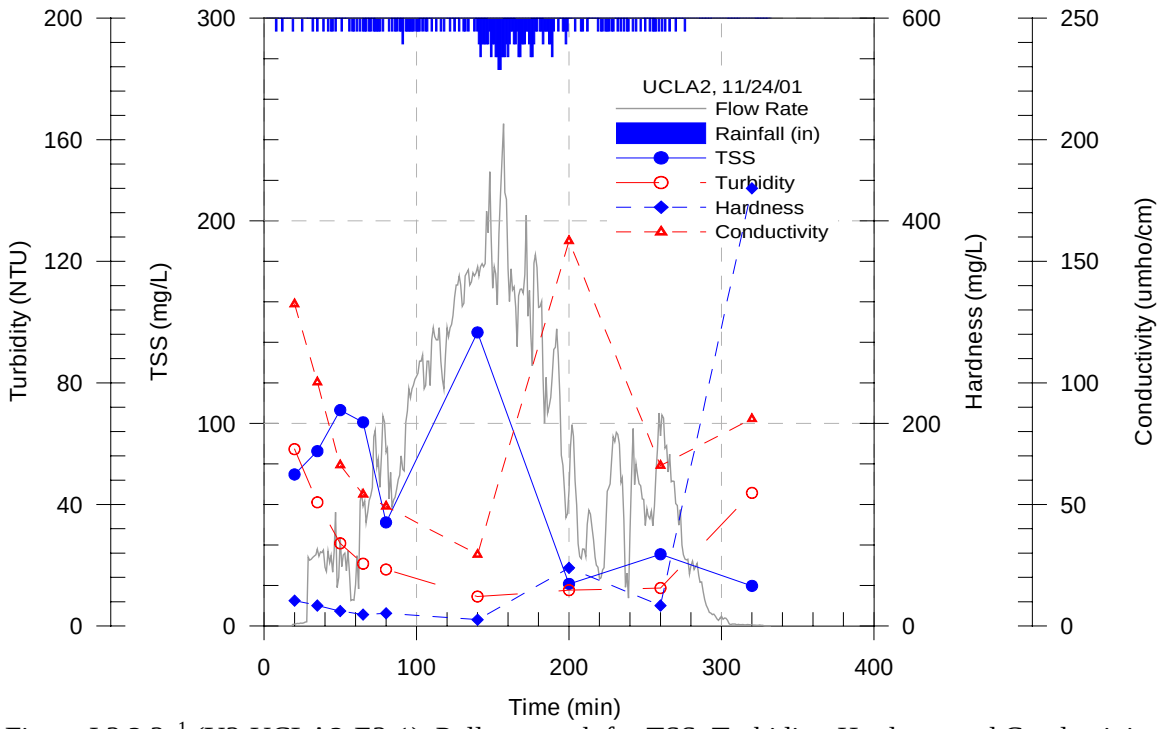

Figure I.3.2.3a[1] (Y3-UCLA2-E3-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

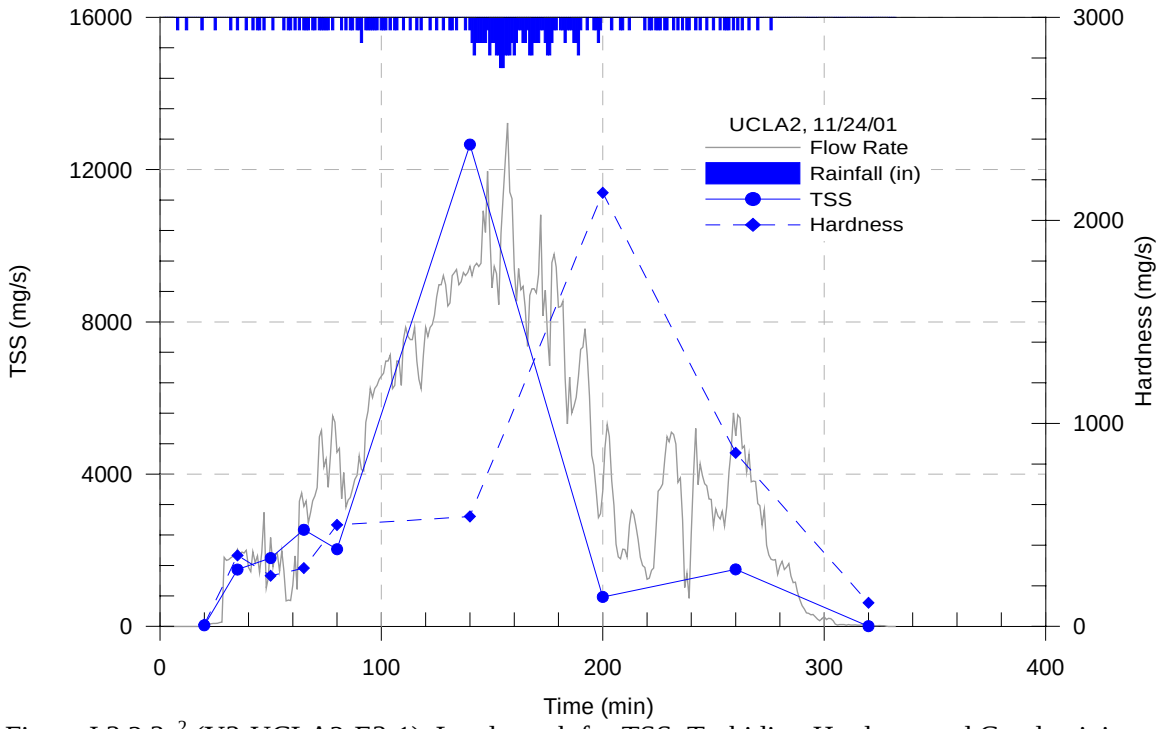

Figure I.3.2.3a[2] (Y3-UCLA2-E3-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

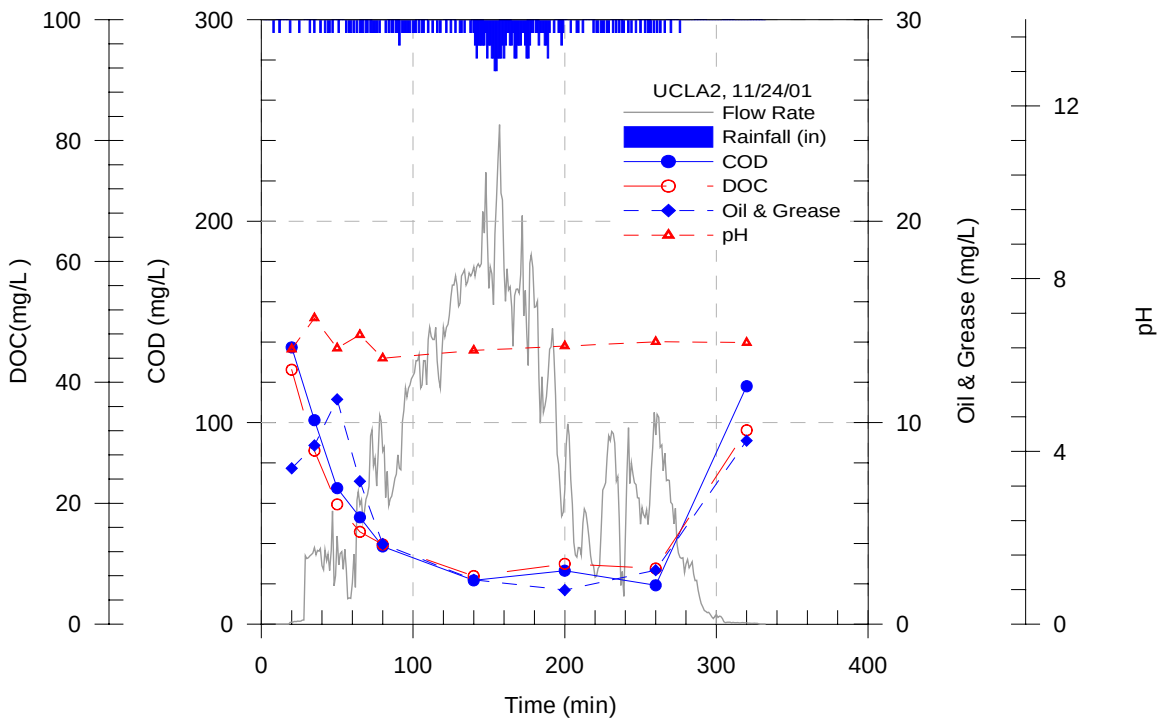

Figure I.3.2.3b[1] (Y3-UCLA2-E3-2). Polluto-graph for COD, DOC, Oil & Grease and pH

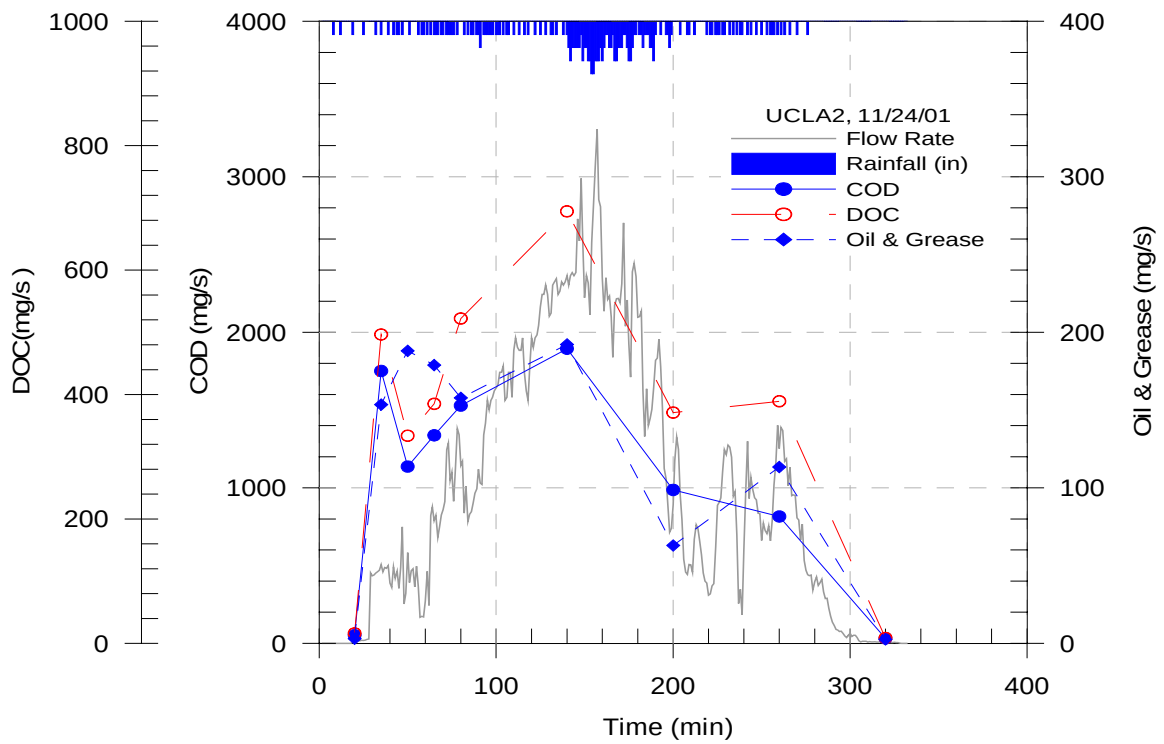

Figure I.3.2.3b[2] (Y3-UCLA2-E3-2). Load-graph for COD, DOC, Oil & Grease and pH

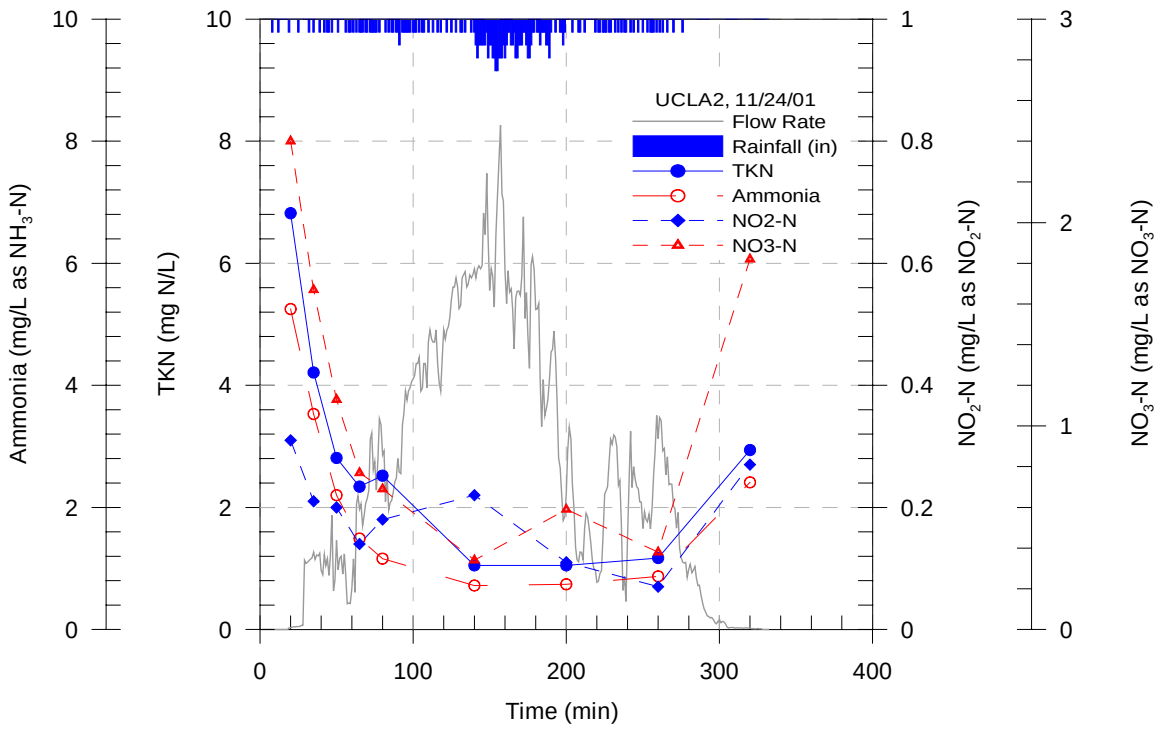

Figure I.3.2.3c[1] (Y3-UCLA2-E3-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

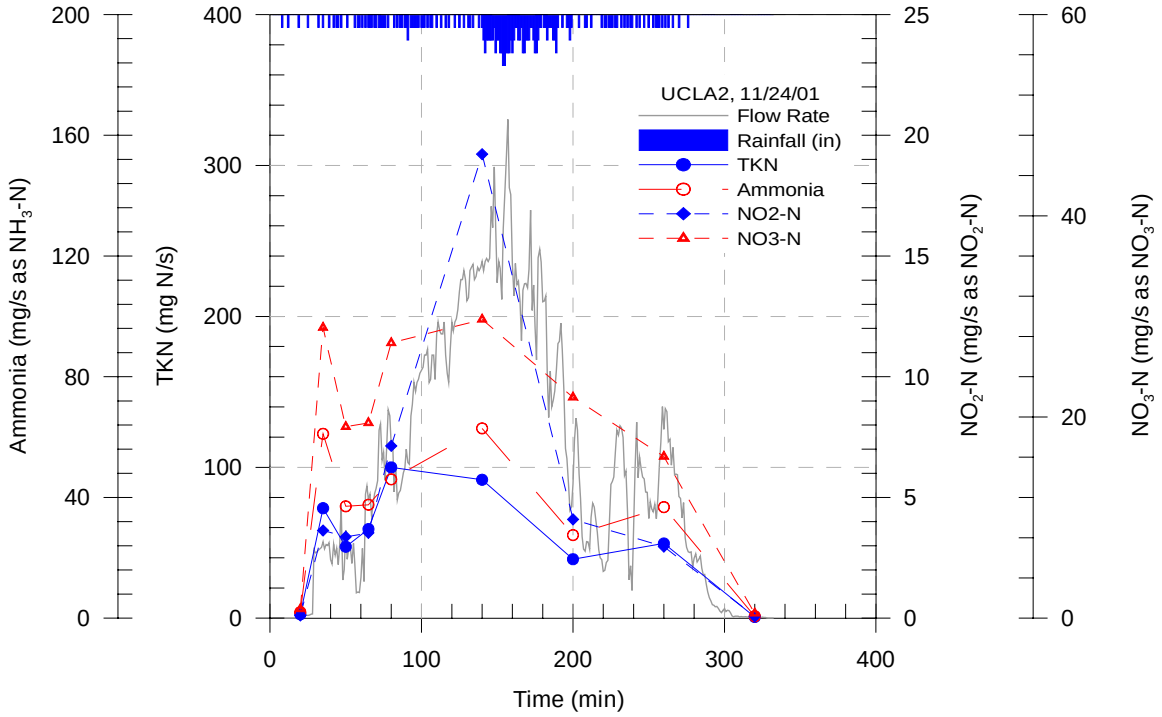

Figure I.3.2.3c[2] (Y3-UCLA2-E3-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

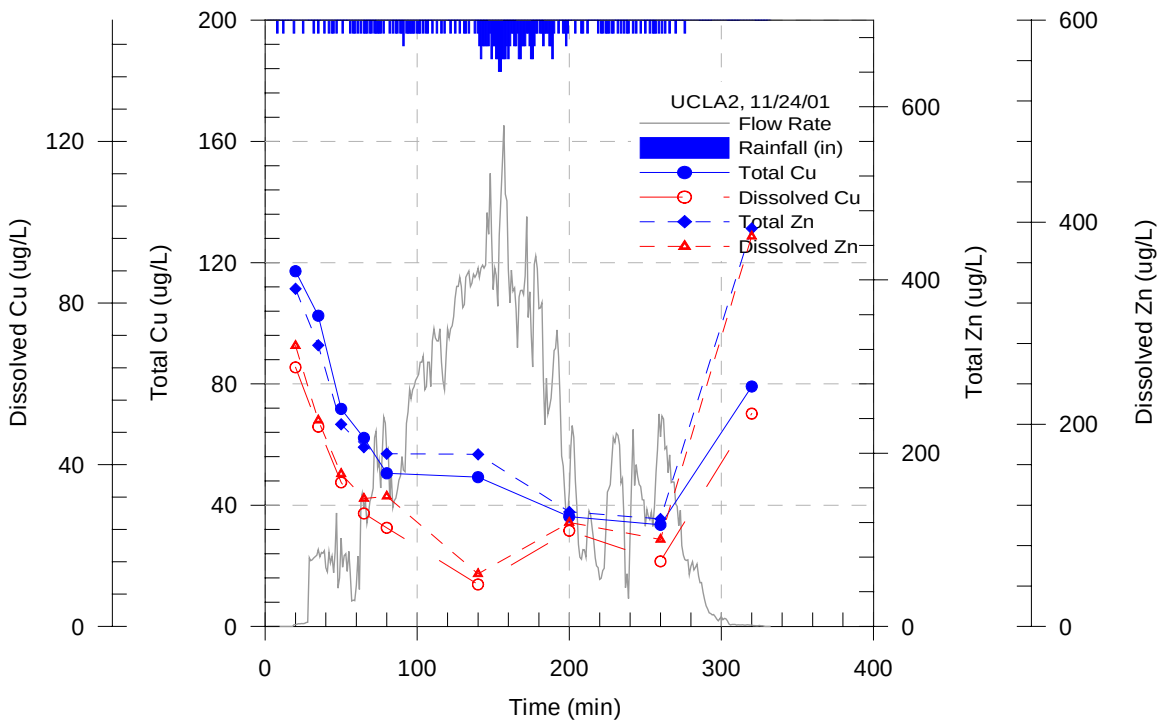

Figure I.3.2.3d[1] (Y3-UCLA2-E3-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

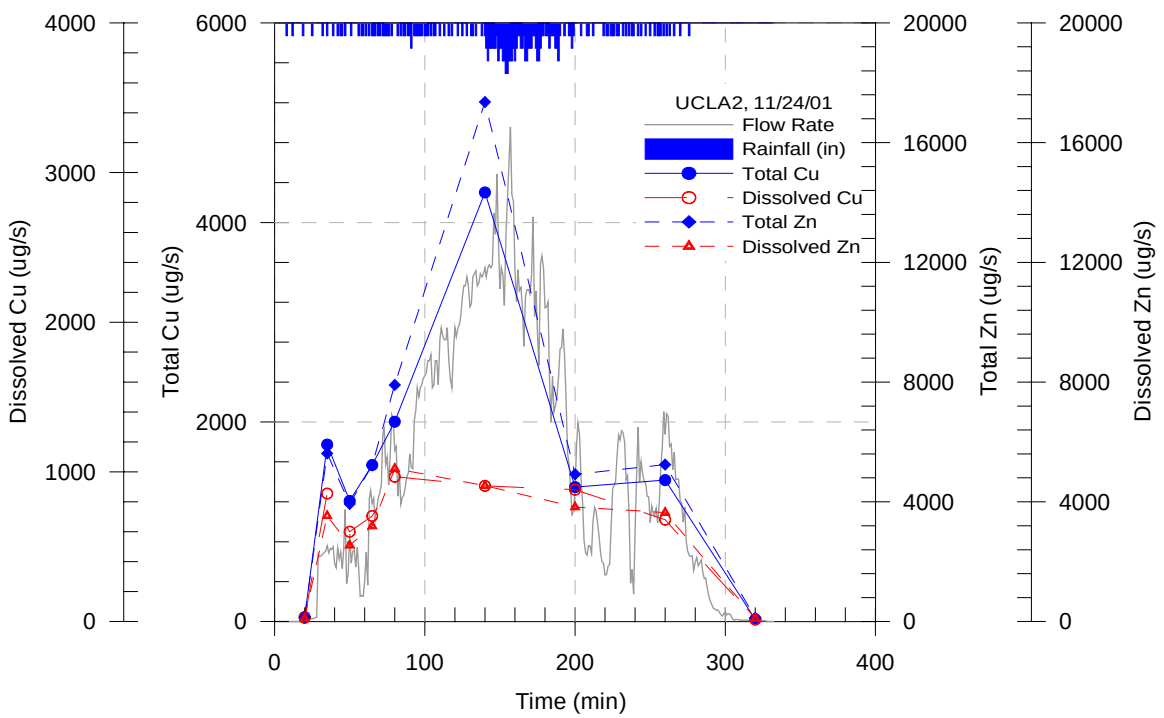

Figure I.3.2.3d[2] (Y3-UCLA2-E3-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

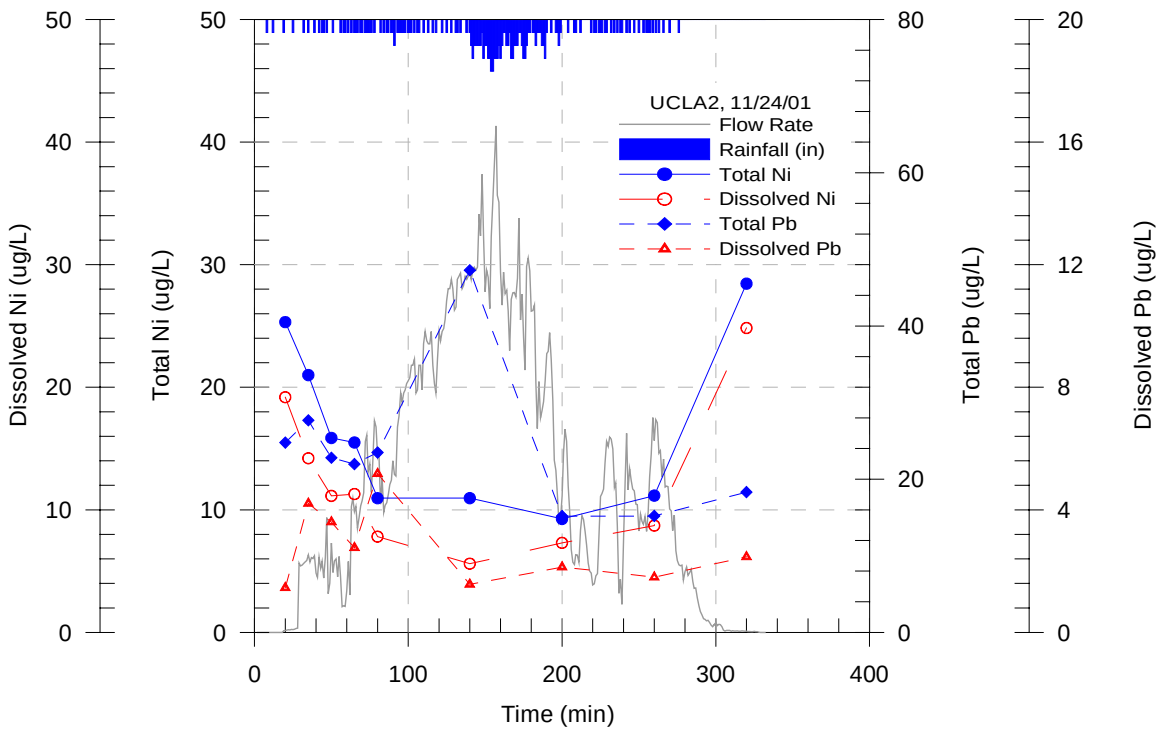

Figure I.3.2.3e[1] (Y3-UCLA2-E3-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

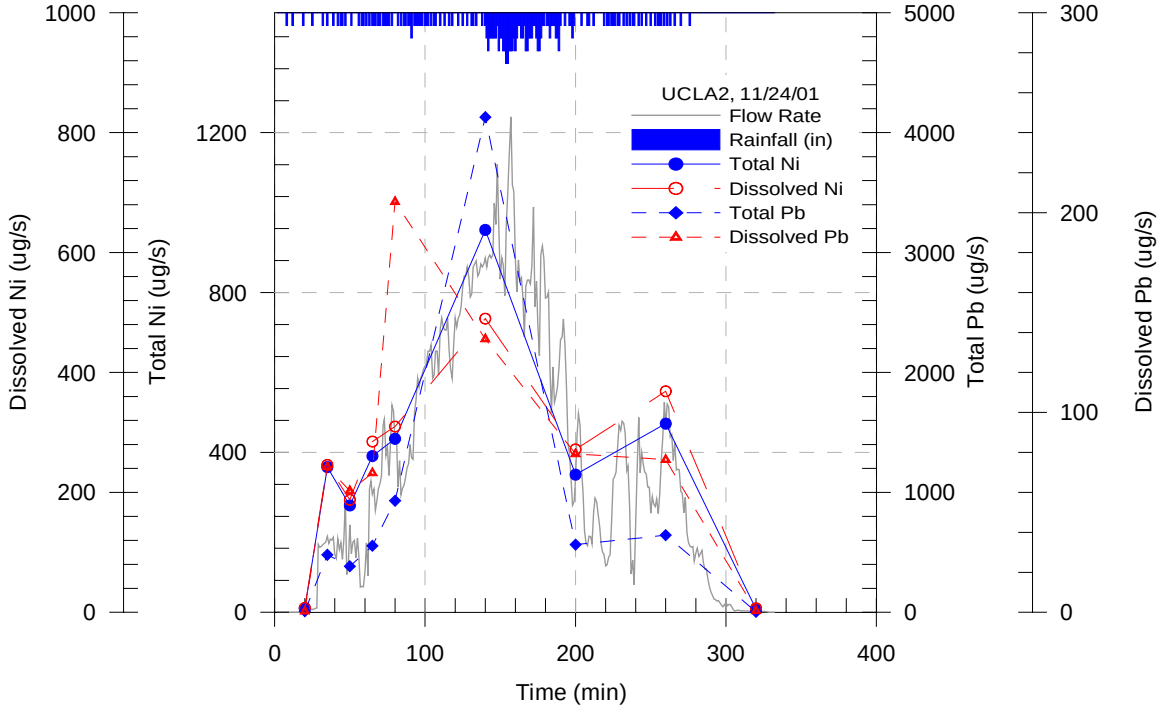

Figure I.3.2.3e[2] (Y3-UCLA2-E3-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

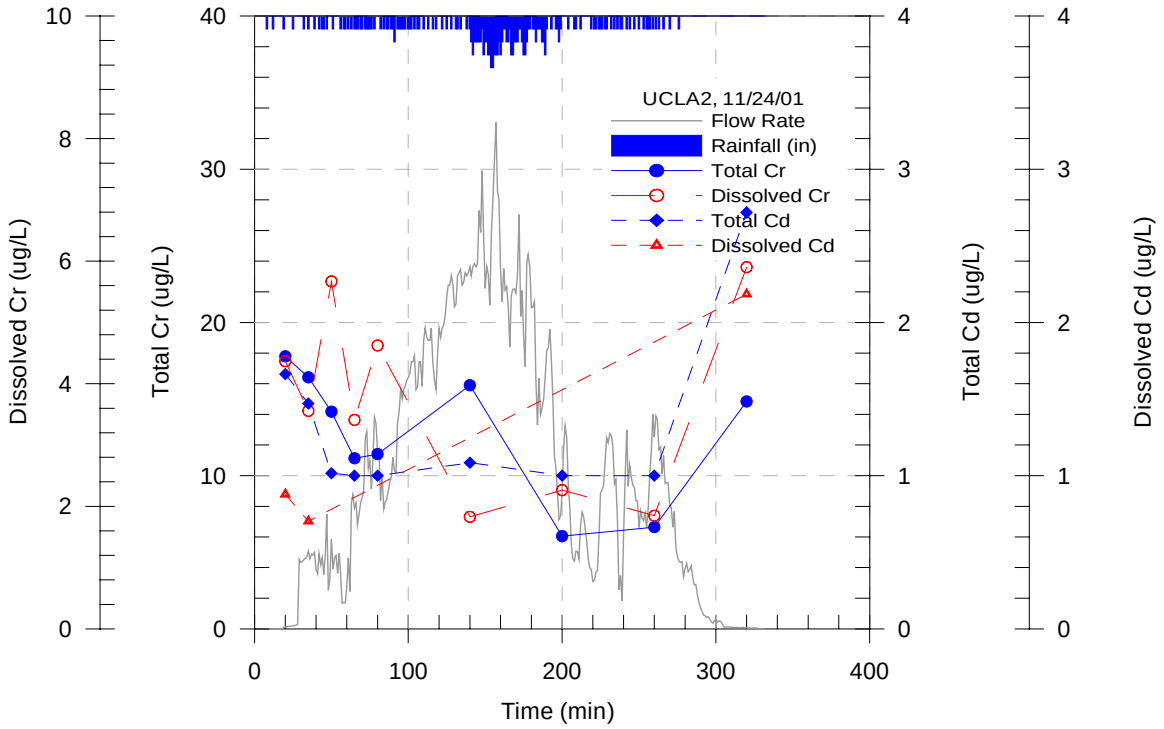

Figure I.3.2.3f[1] (Y3-UCLA2-E3-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

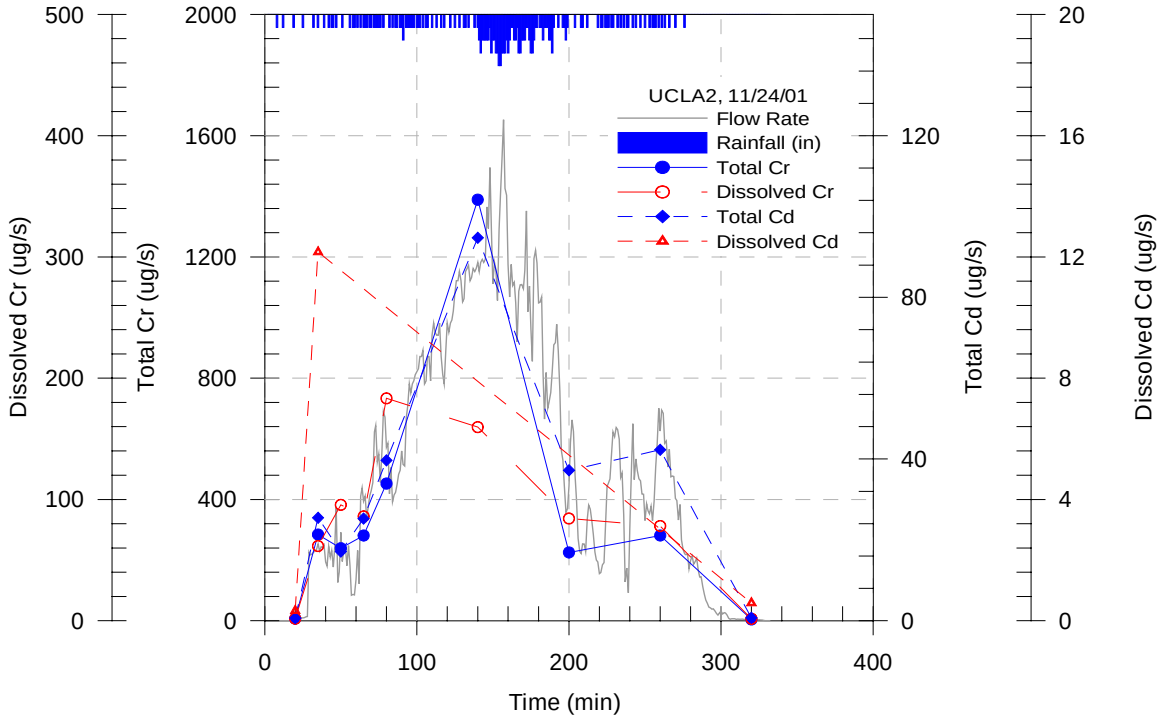

Figure I.3.2.3f[2] (Y3-UCLA2-E3-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

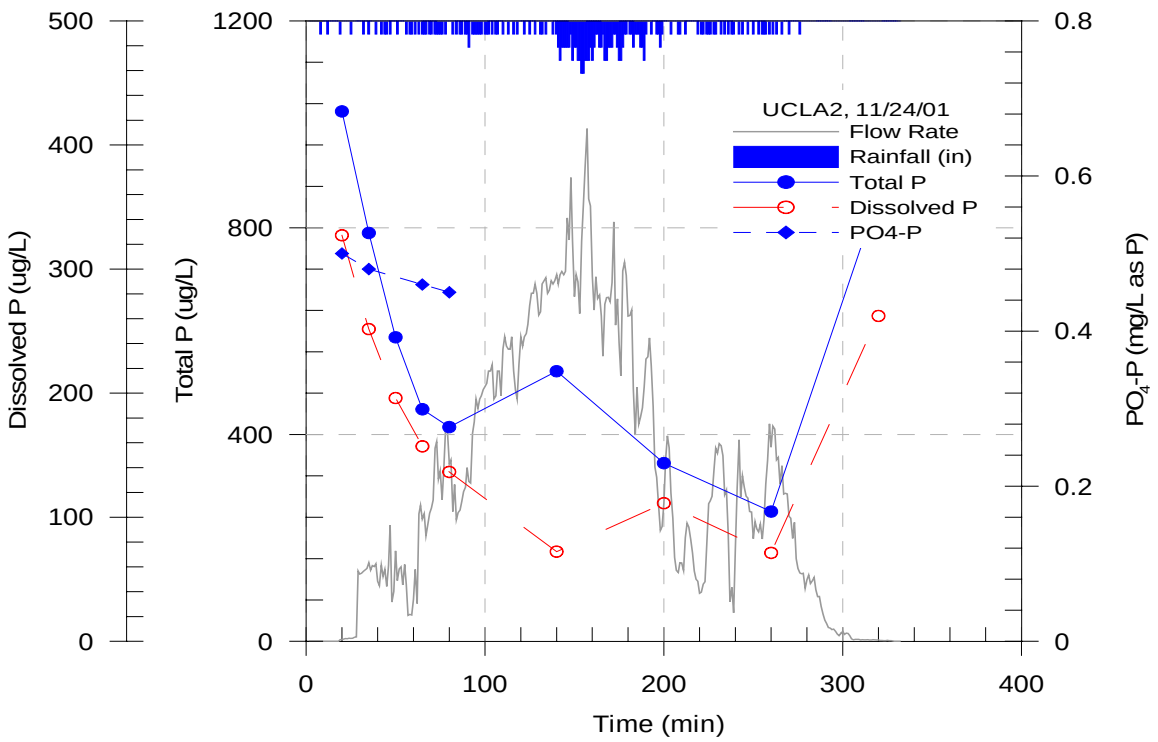

Figure I.3.2.3g[1] (Y3-UCLA2-E3-7). Polluto-graph for Total P / PO_4^{3-}-P

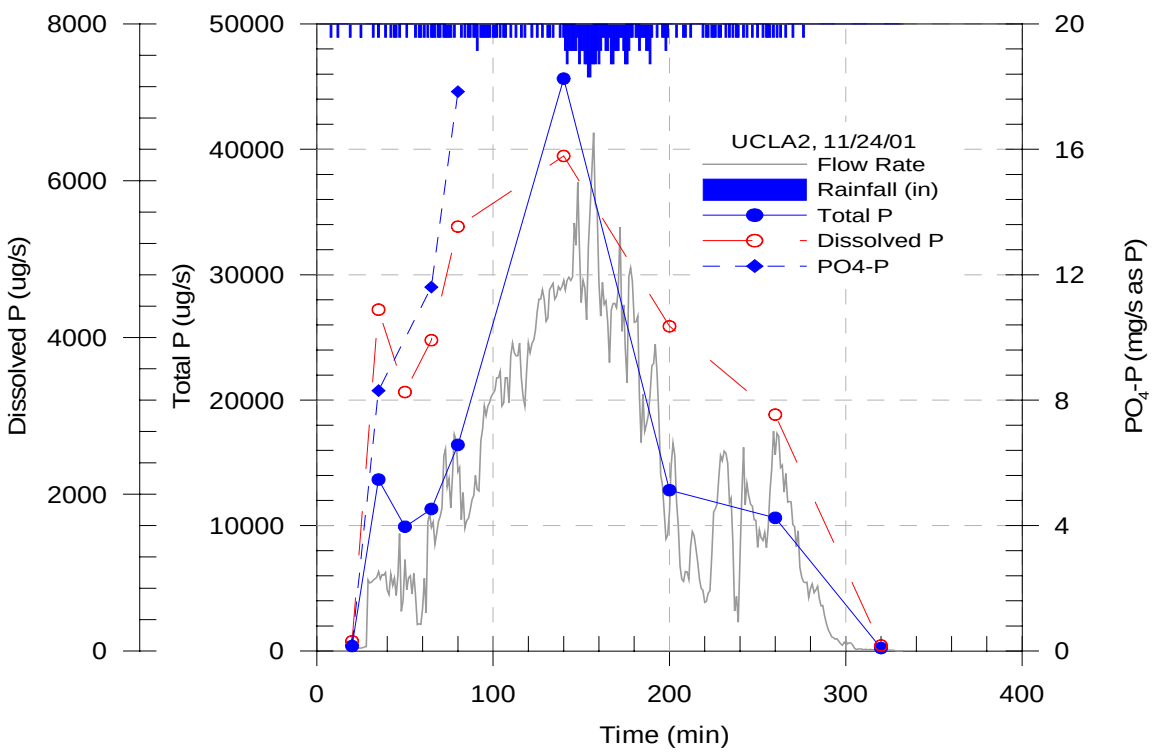

Figure I.3.2.3g[2] (Y3-UCLA2-E3-7). Load -graph for Total P / PO_4^{3-}P

4. UCLA2, 12/14/01

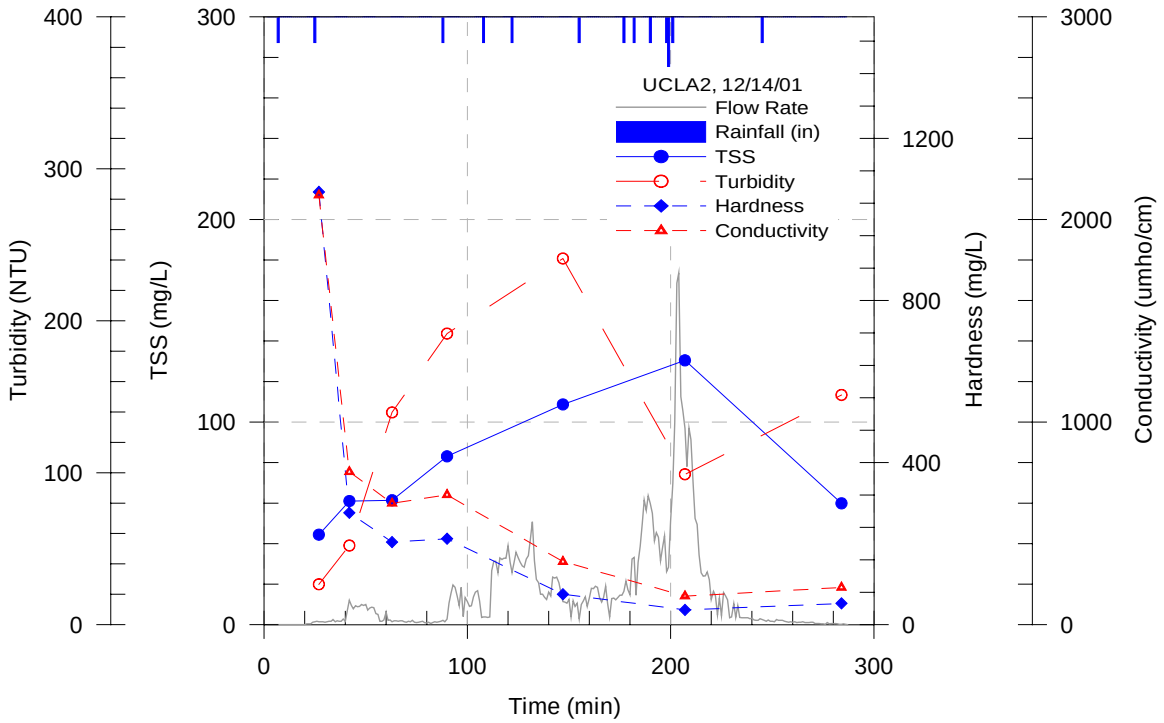

Figure I.3.2.4a[1] (Y3-UCLA2-E4-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

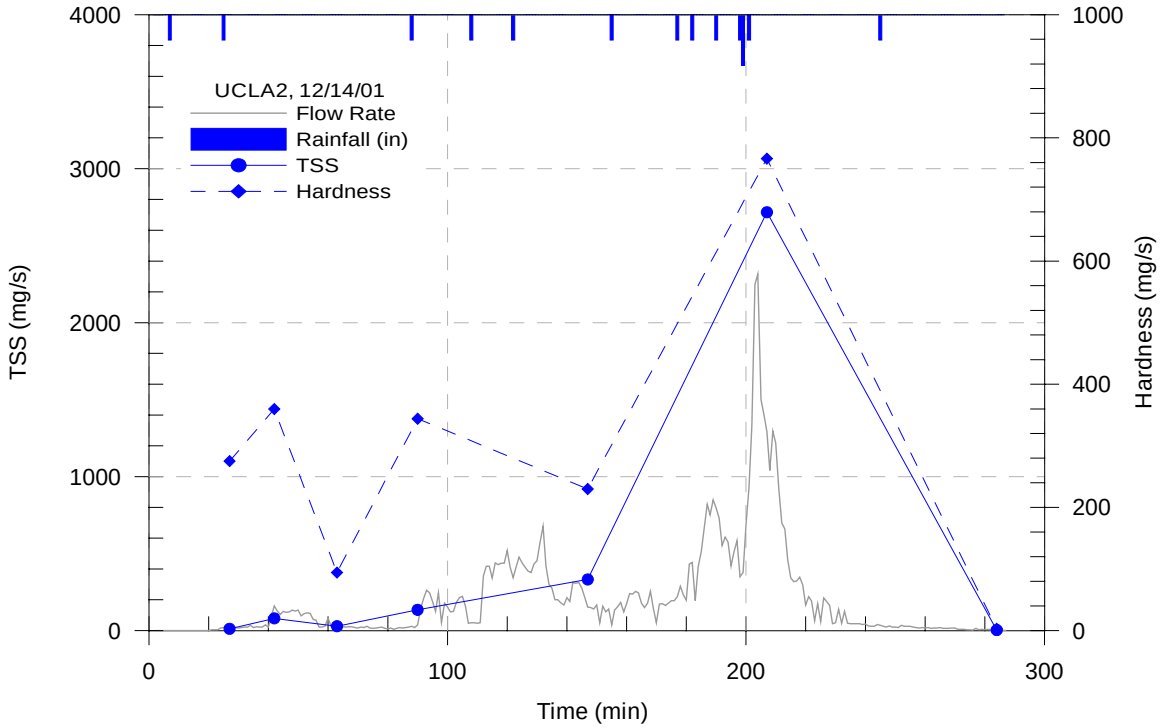

Figure I.3.2.4a[2] (Y3-UCLA2-E4-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

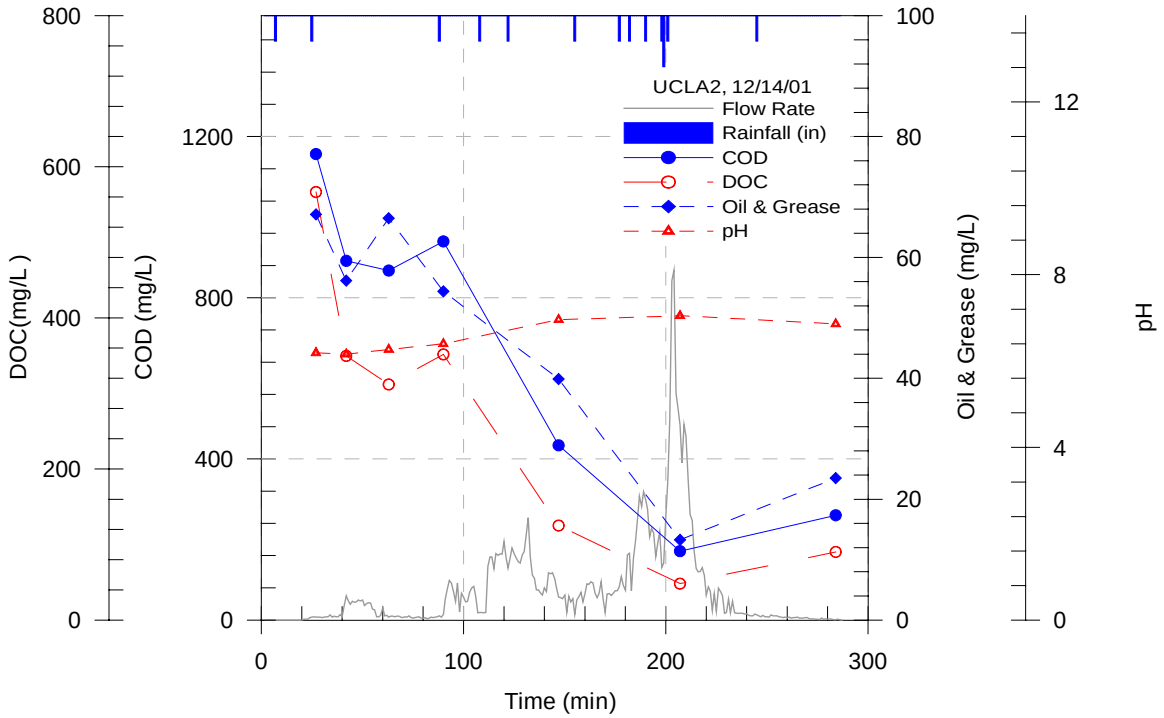

Figure I.3.2.4b[1] (Y3-UCLA2-E4-2). Polluto-graph for COD, DOC, Oil & Grease and pH

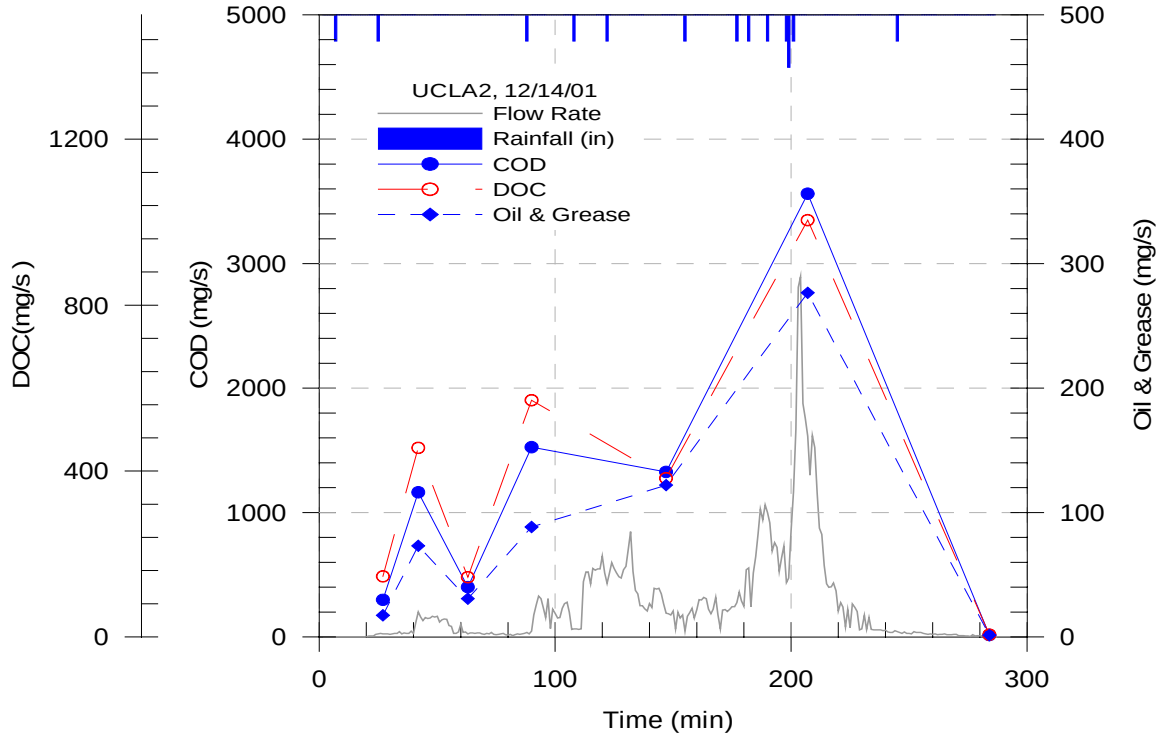

Figure I.3.2.4b[2] (Y3-UCLA2-E4-2). Load-graph for COD, DOC, Oil & Grease and pH

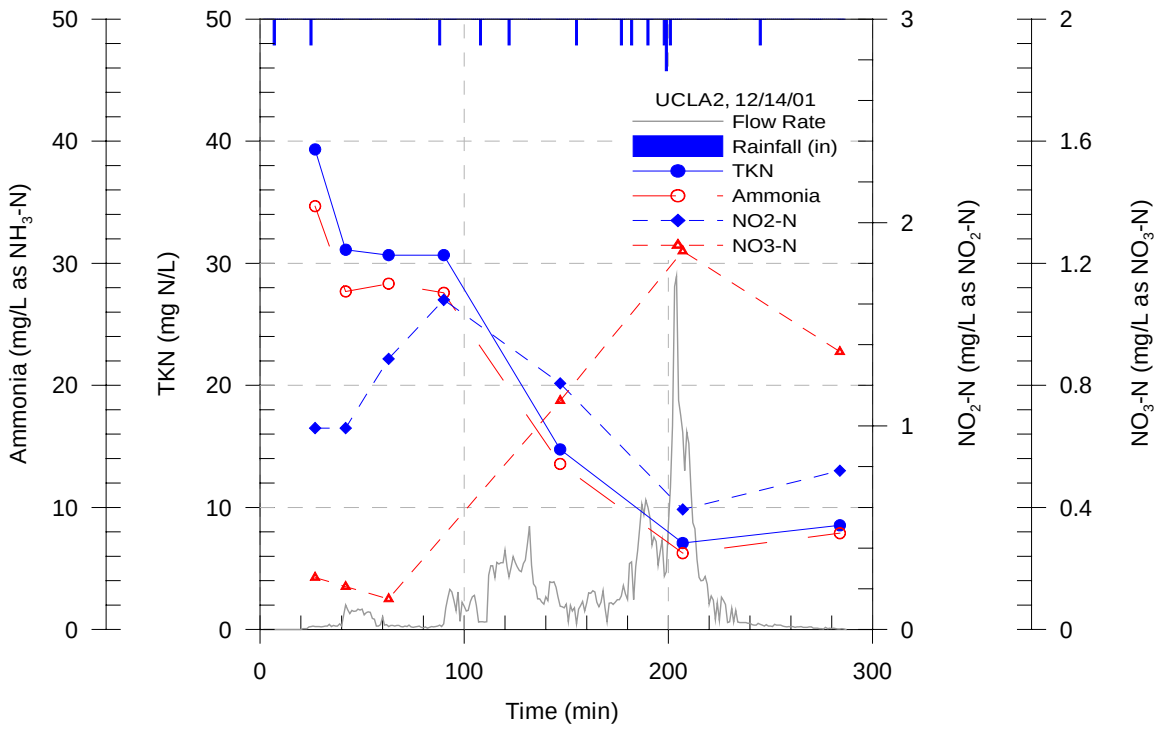

Figure I.3.2.4c[1] (Y3-UCLA2-E4-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

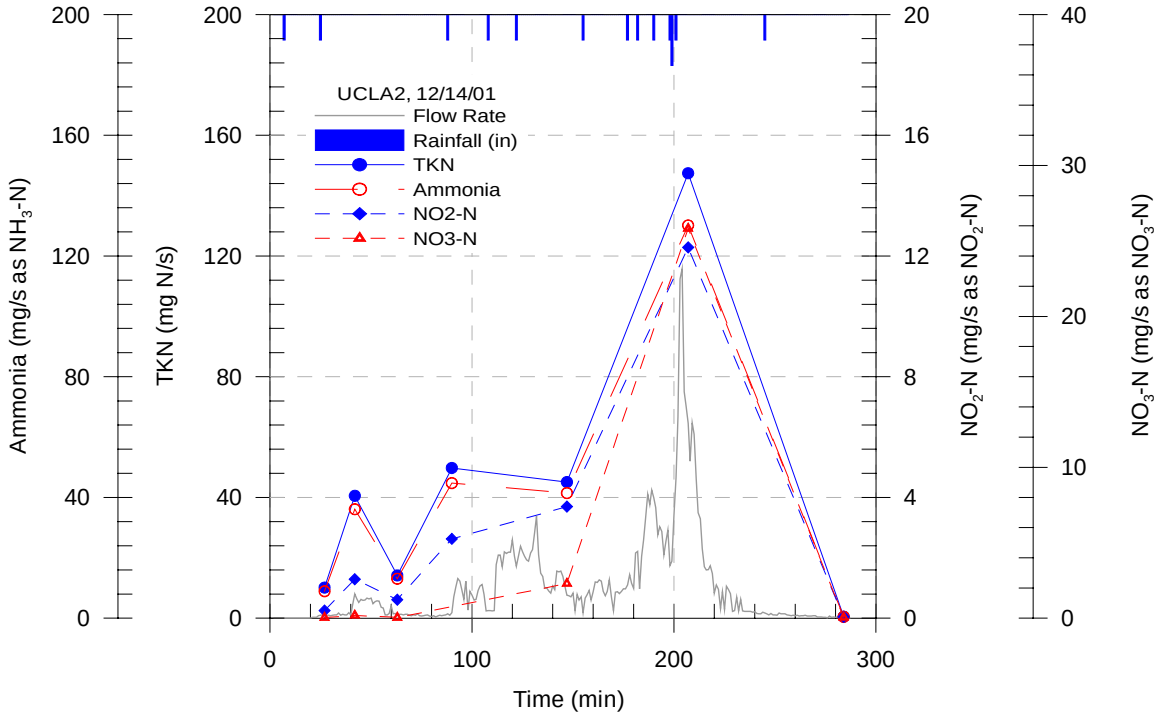

Figure I.3.2.4c[2] (Y3-UCLA2-E4-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

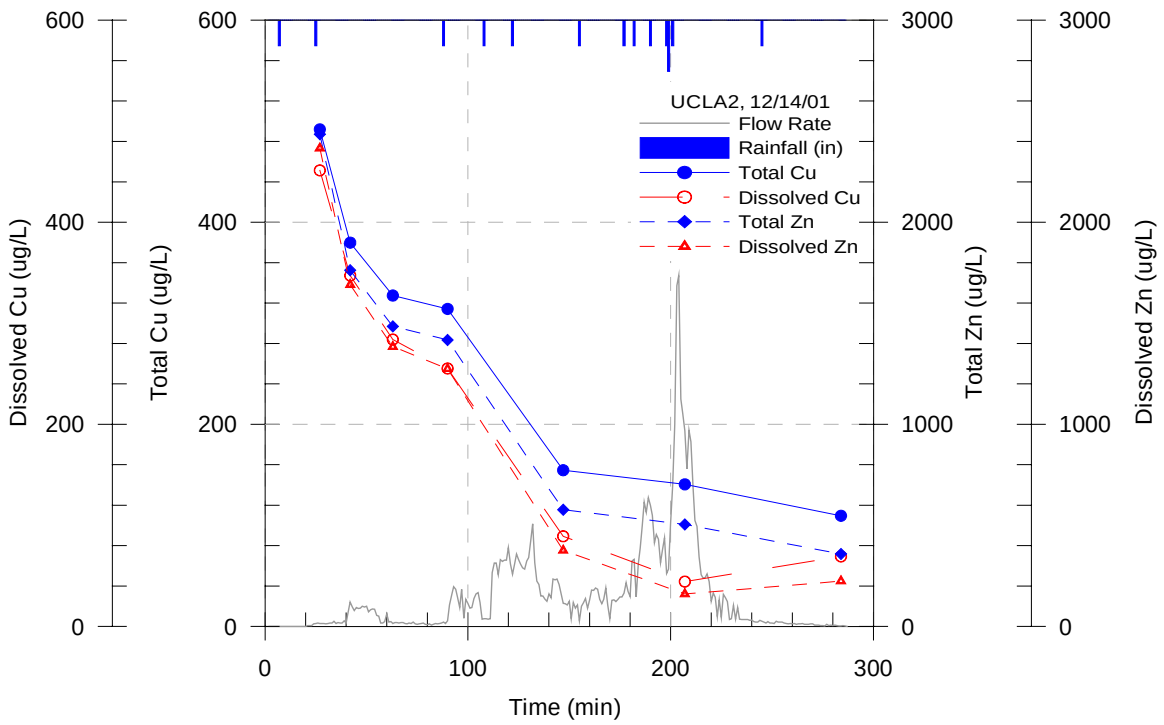

Figure I.3.2.4d[1] (Y3-UCLA2-E4-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

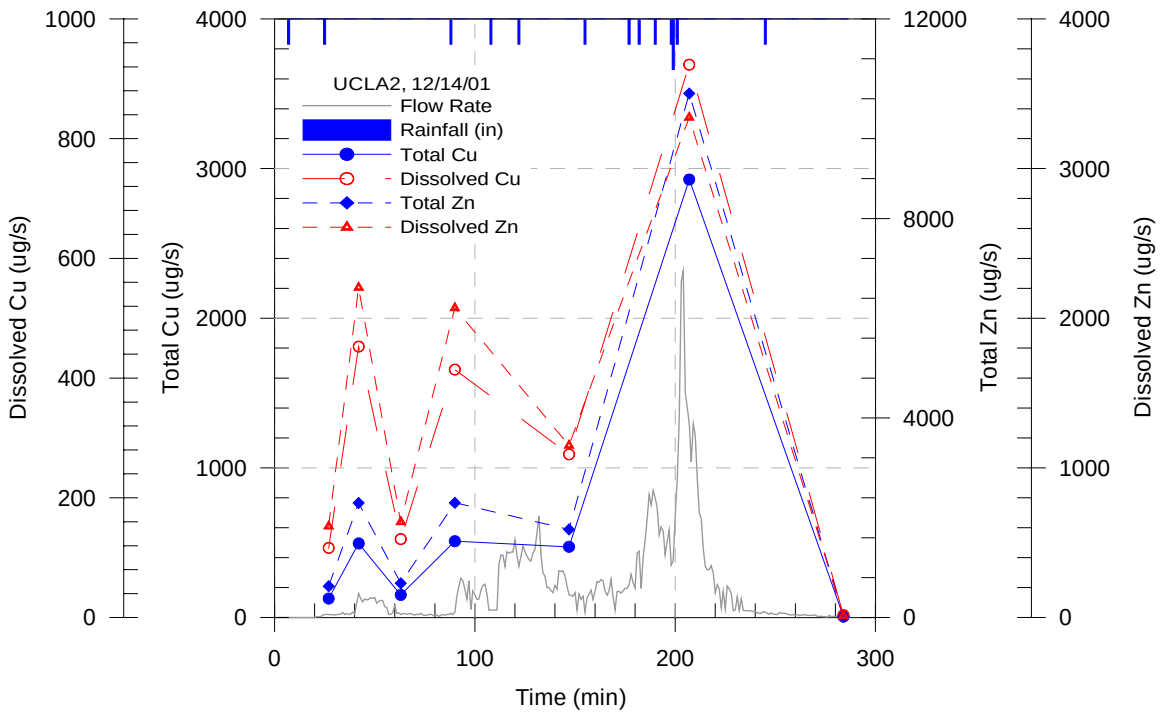

Figure I.3.2.4d[2] (Y3-UCLA2-E4-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

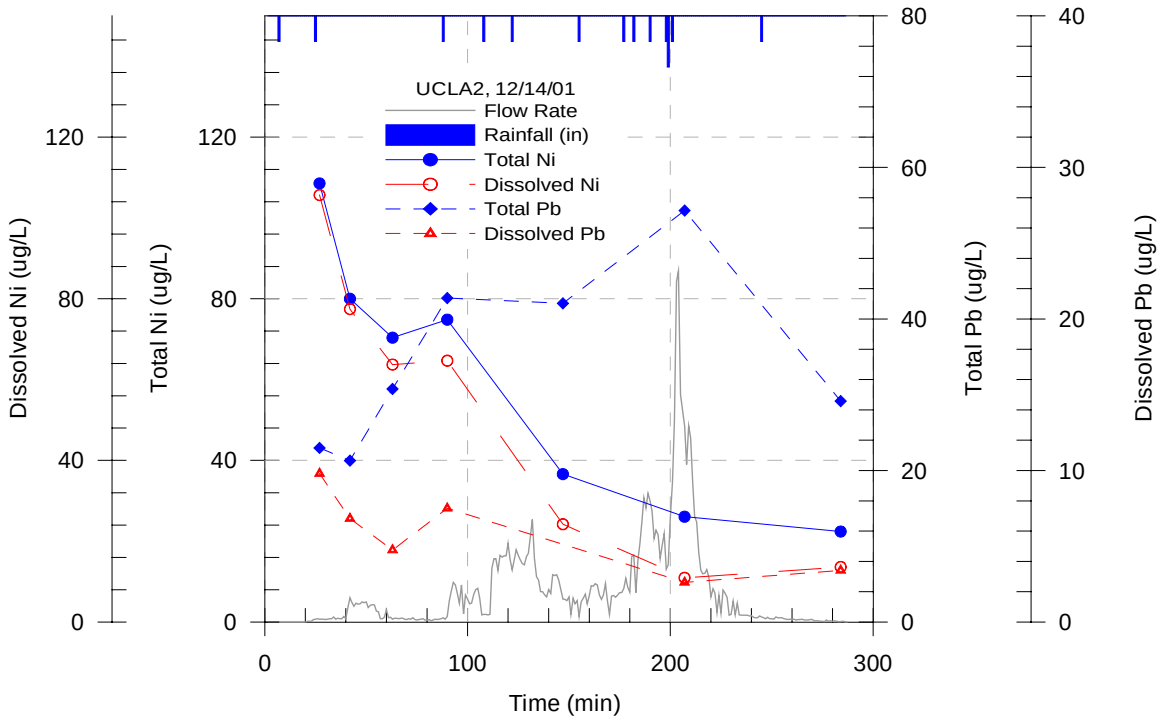

Figure I.3.2.4e[1] (Y3-UCLA2-E4-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

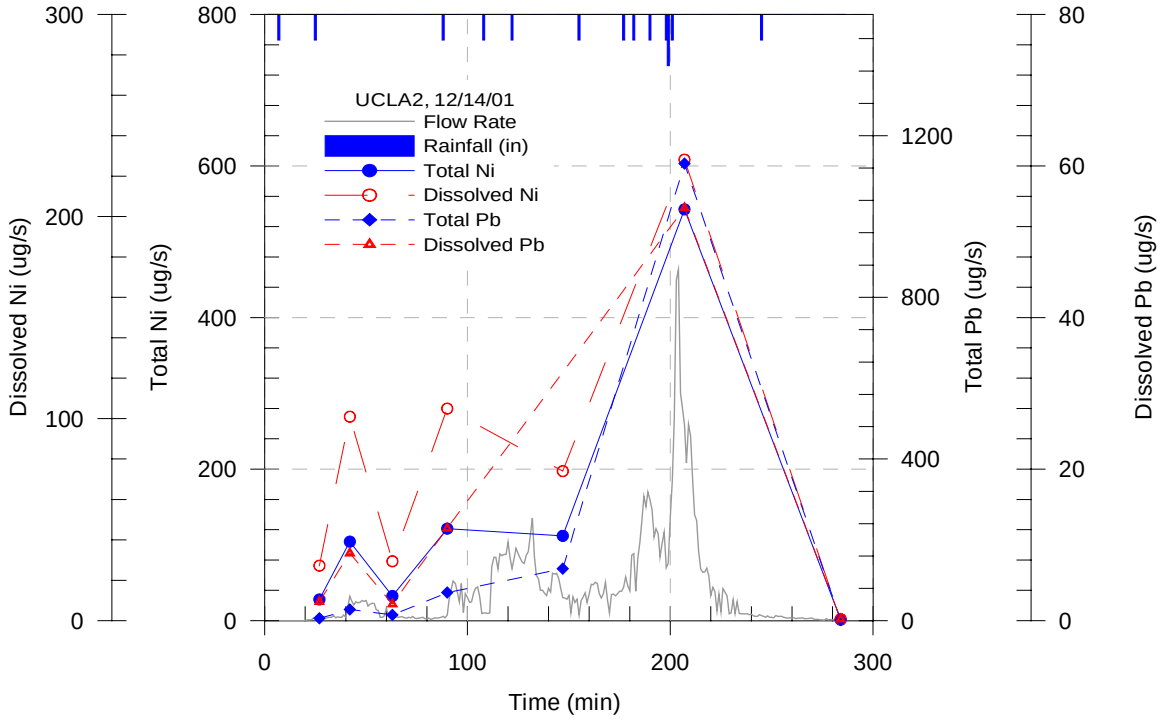

Figure I.3.2.4e[2] (Y3-UCLA2-E4-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

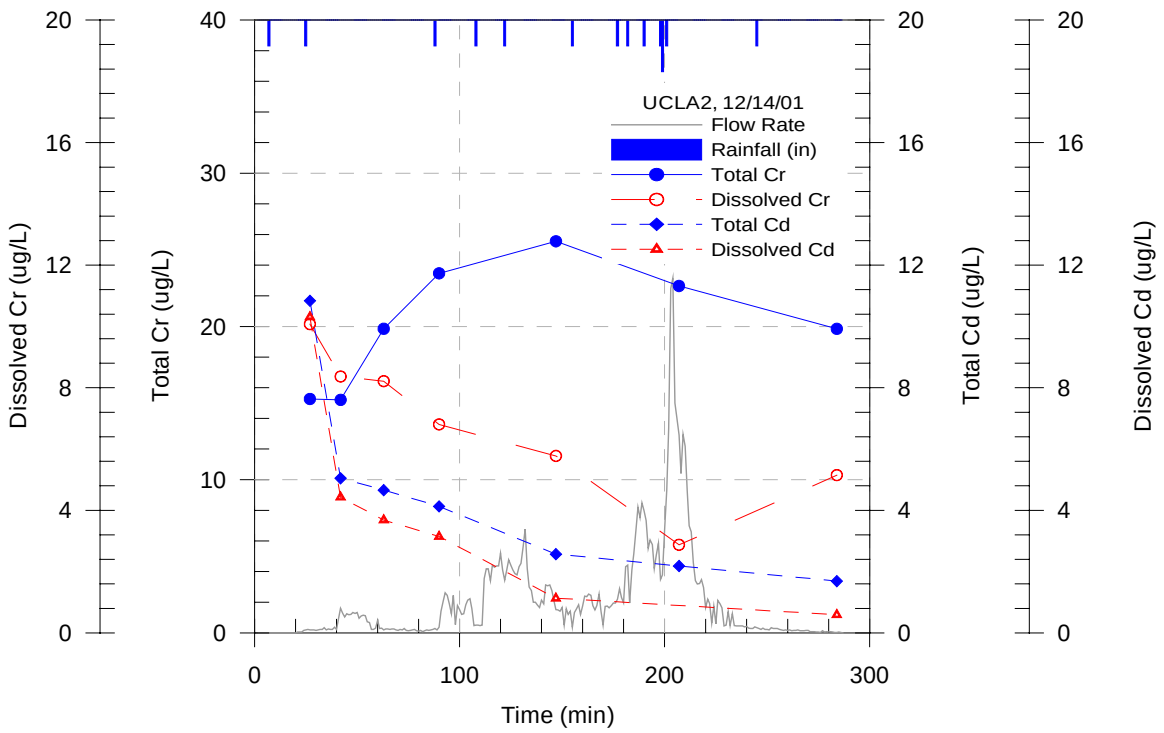

Figure I.3.2.4f[1] (Y3-UCLA2-E4-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

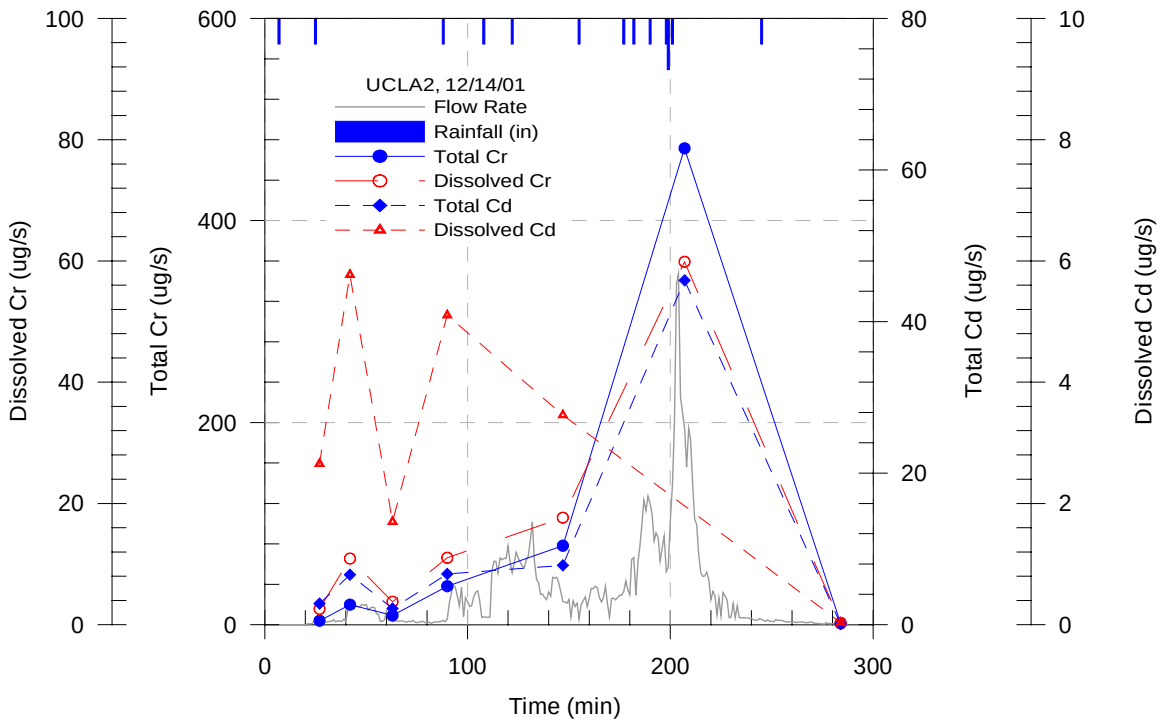

Figure I.3.2.4f[2] (Y3-UCLA2-E4-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

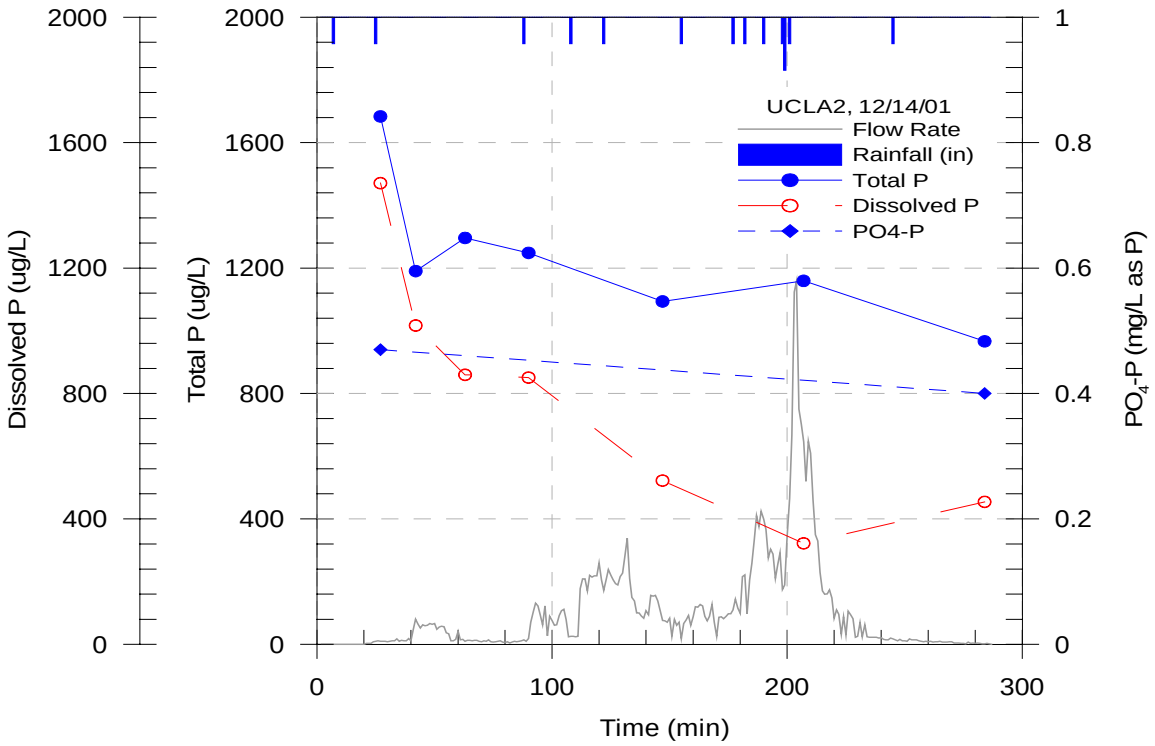

Figure I.3.2.4g[1] (Y3-UCLA2-E4-7). Polluto-graph for Total P / PO_4^{3-}-P

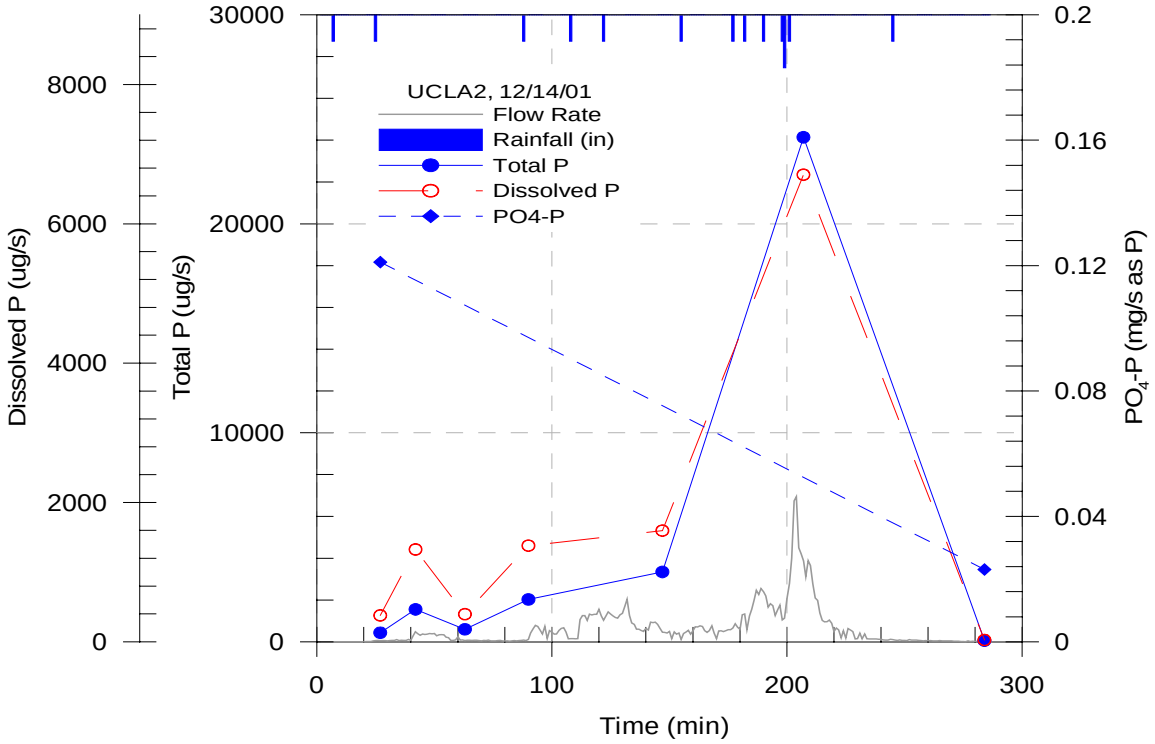

Figure I.3.2.4g[2] (Y3-UCLA2-E4-7). Load -graph for Total P / PO_4^{3-}P

5. UCLA2, 01/27/02

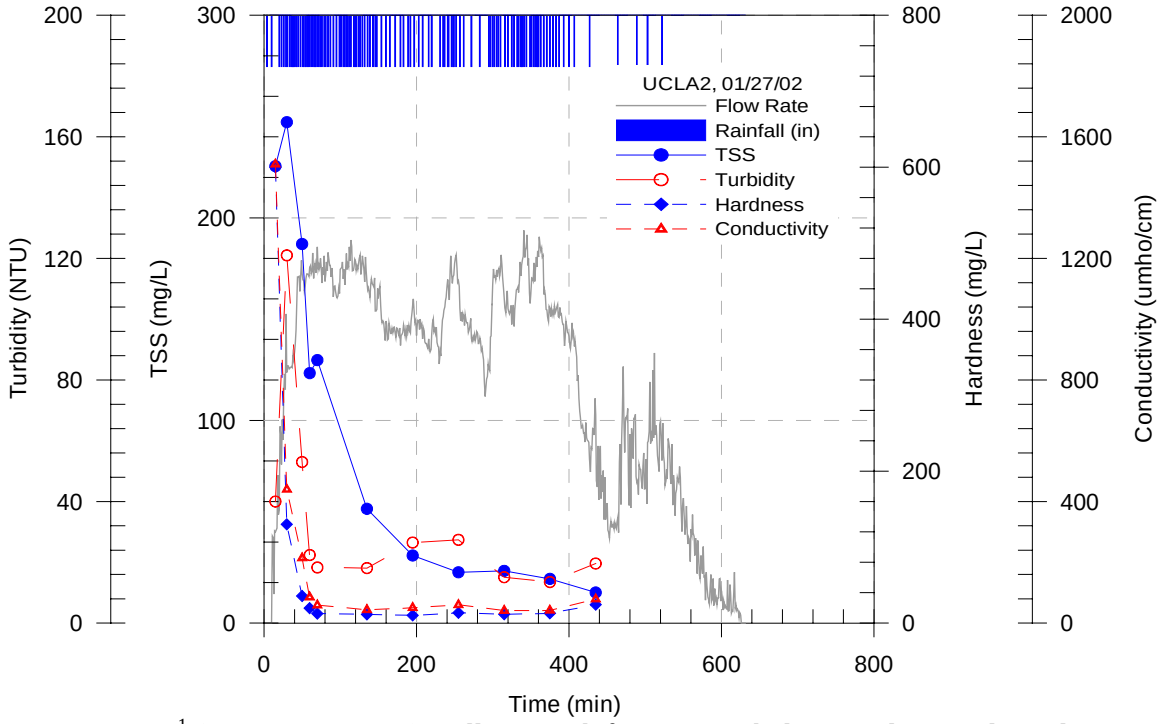

Figure I.3.2.5a[1] (Y3-UCLA2-E6-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

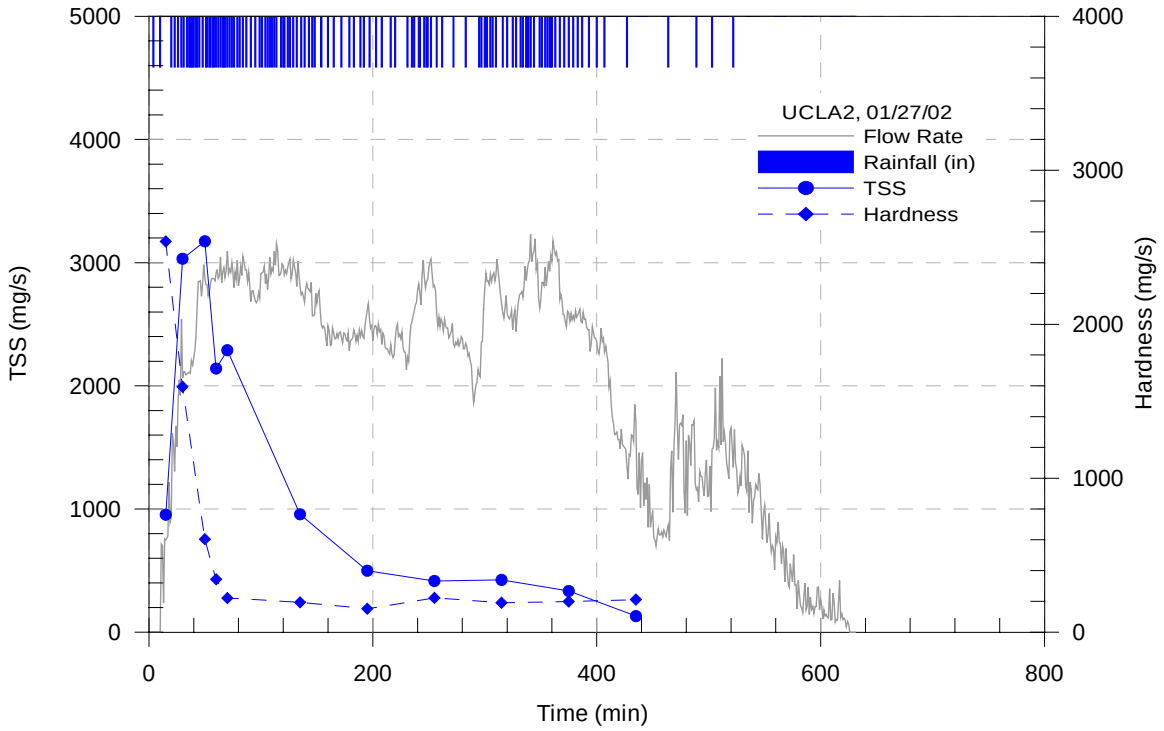

Figure I.3.2.5a[2] (Y3-UCLA2-E6-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

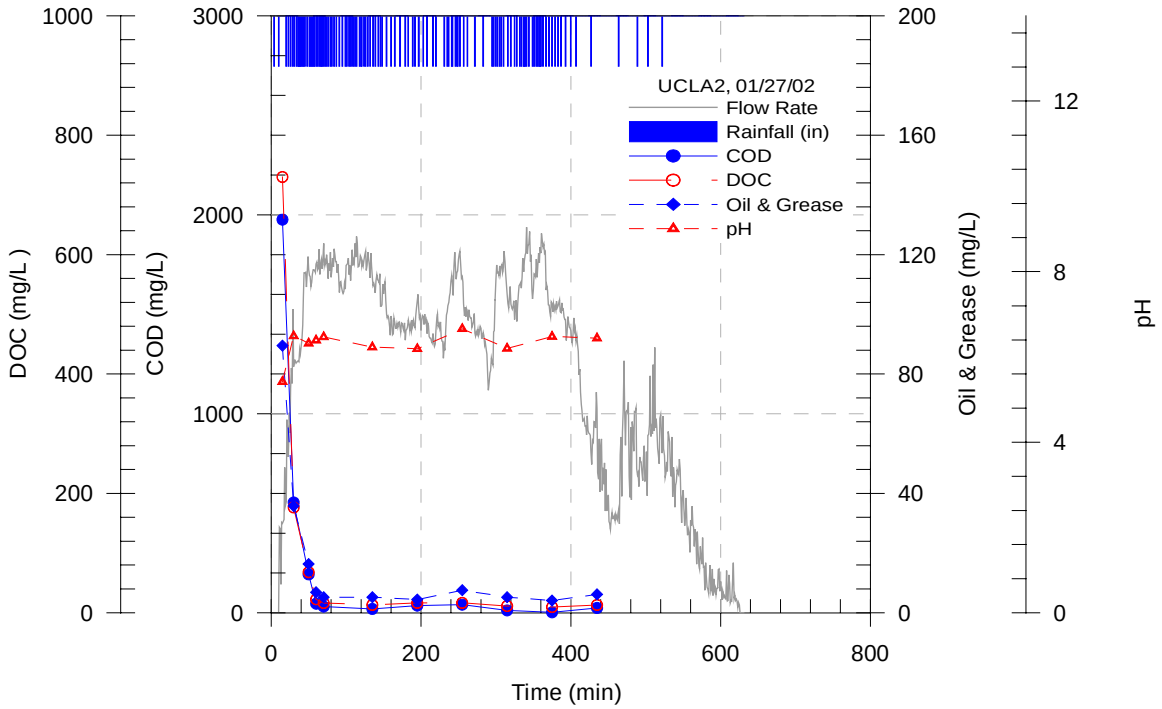

Figure I.3.2.5b[1] (Y3-UCLA2-E6-2). Polluto-graph for COD, DOC, Oil & Grease and pH

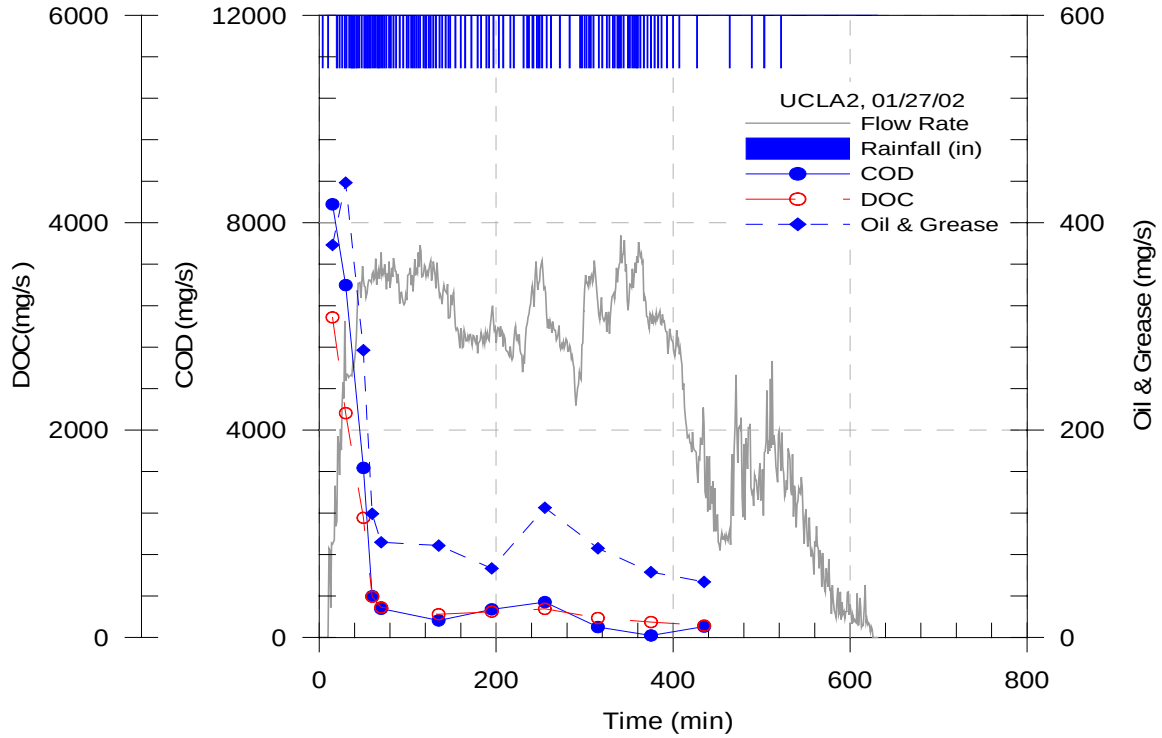

Figure I.3.2.5b[2] (Y3-UCLA2-E6-2). Load-graph for COD, DOC, Oil & Grease and pH

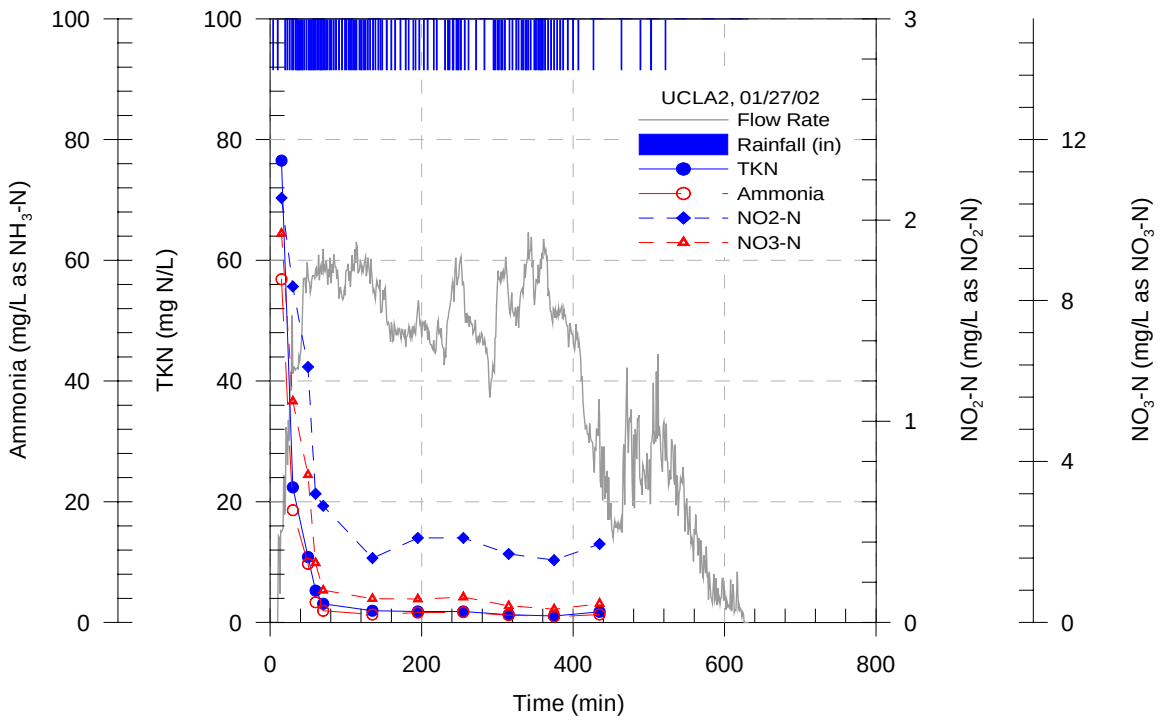

Figure I.3.2.5c[1] (Y3-UCLA2-E6-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

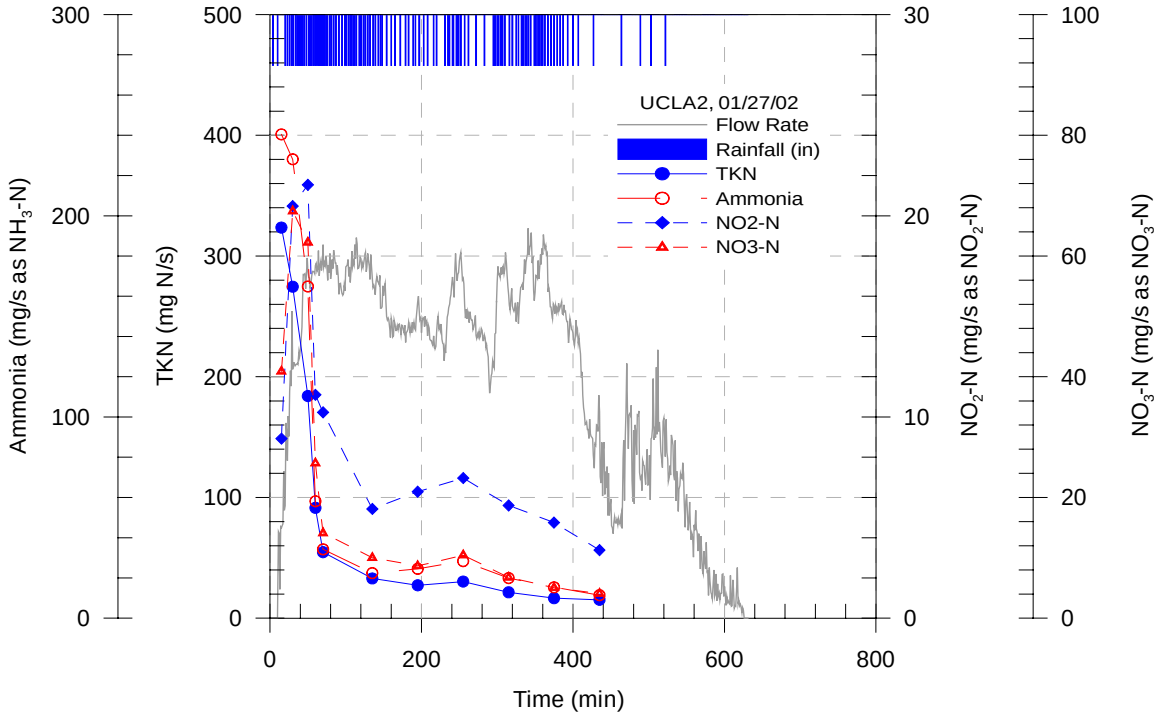

Figure I.3.2.5c[2] (Y3-UCLA2-E6-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

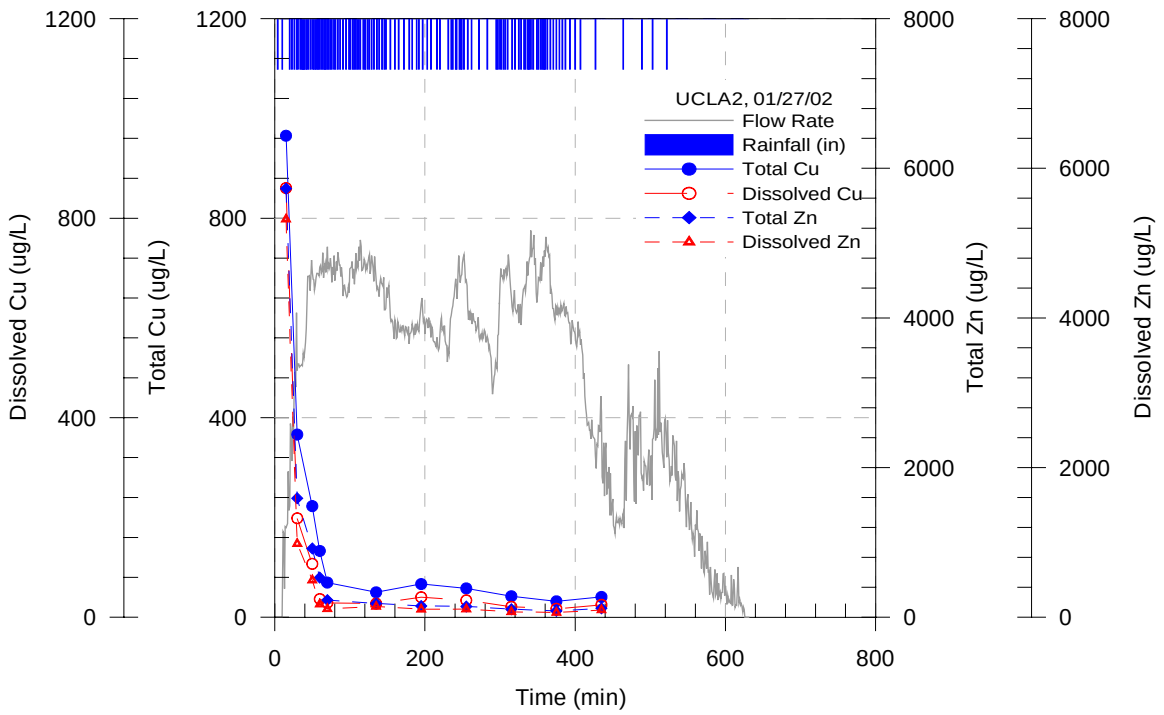

Figure I.3.2.5d[1] (Y3-UCLA2-E6-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

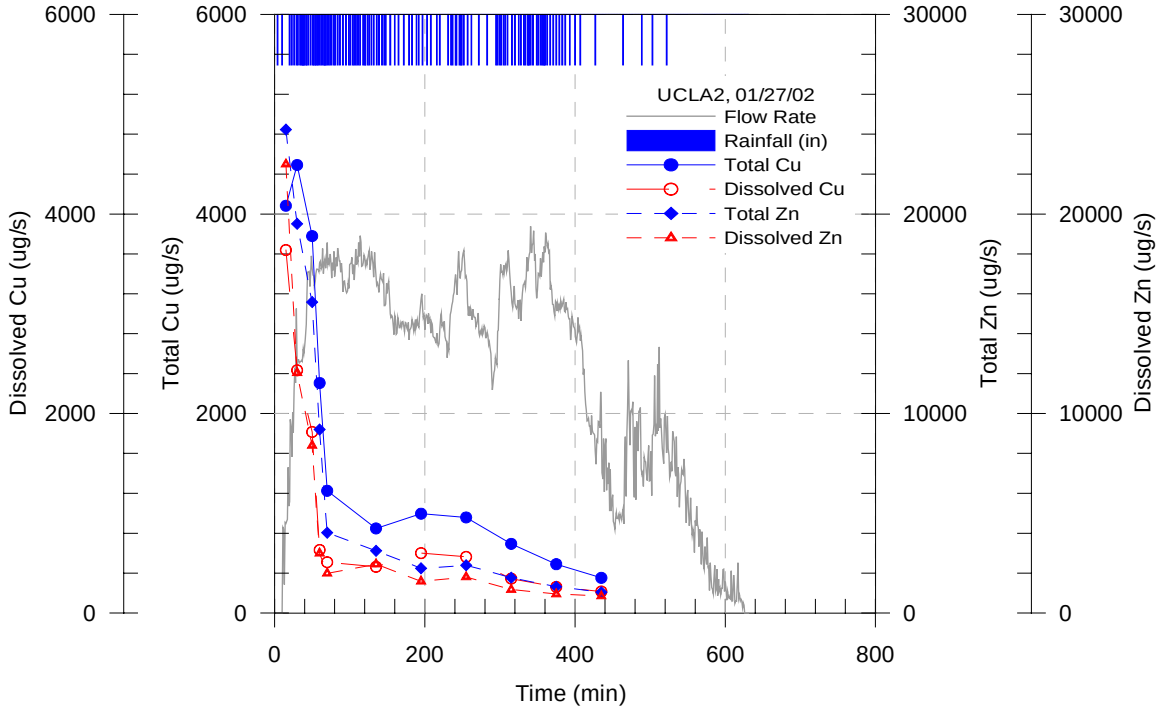

Figure I.3.2.5d[2] (Y3-UCLA2-E6-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

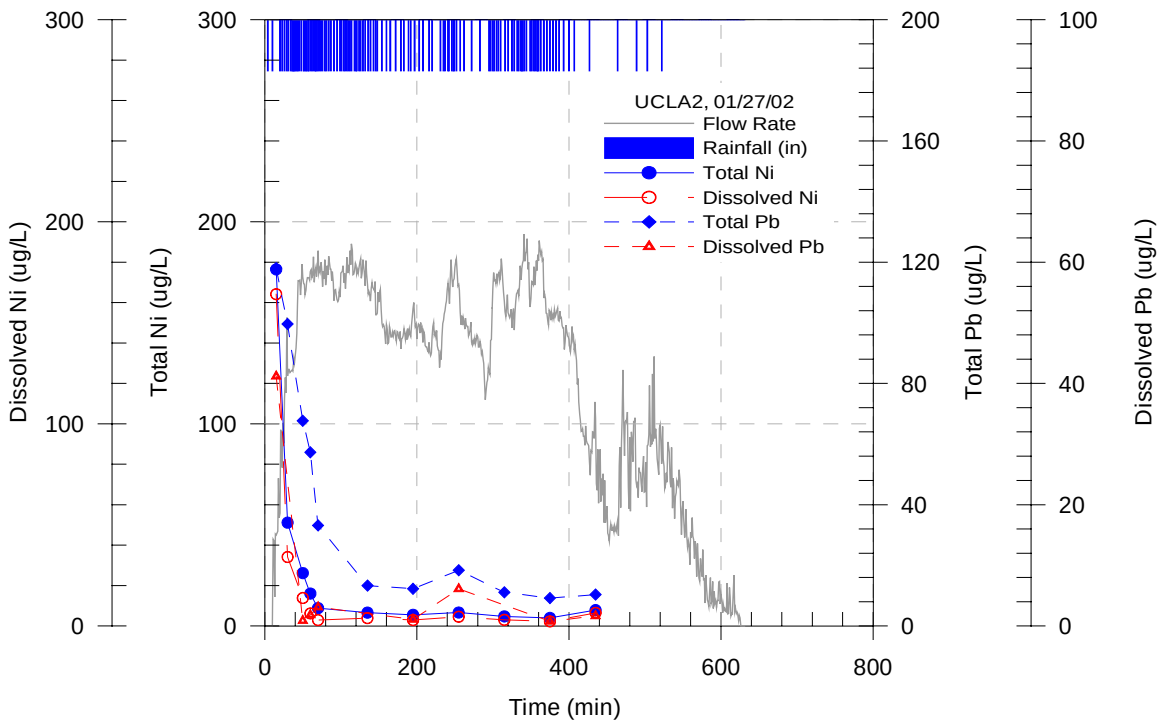

Figure I.3.2.5e[1] (Y3-UCLA2-E6-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

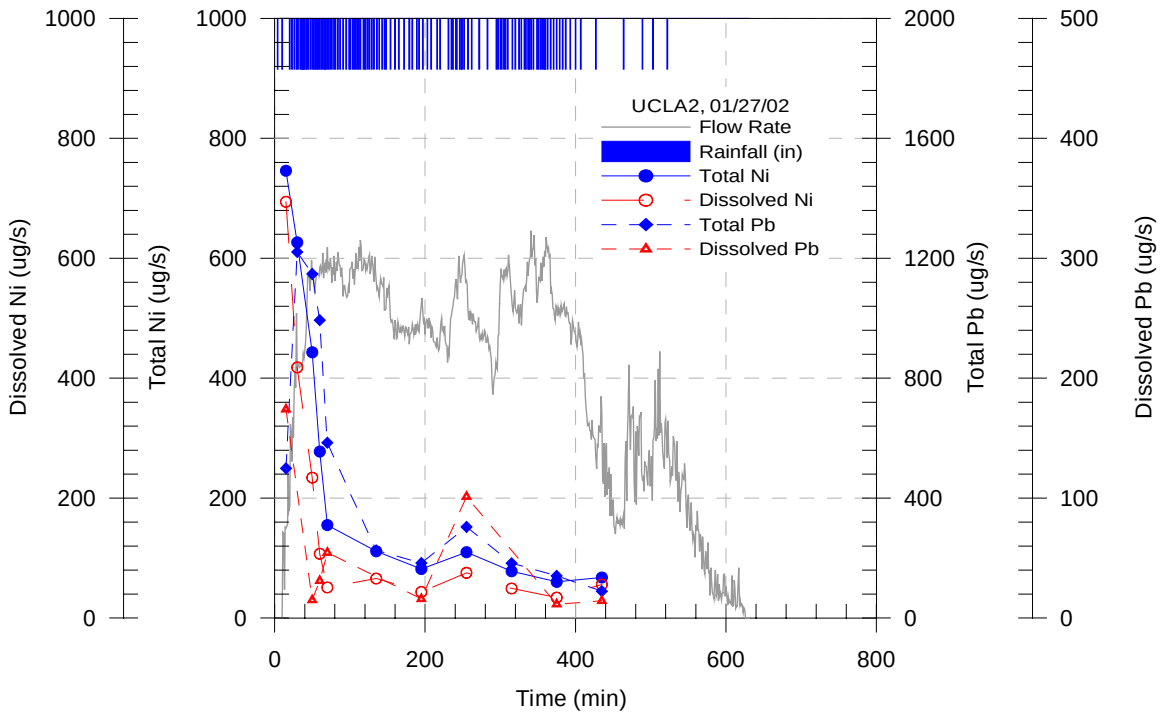

Figure I.3.2.5e[2] (Y3-UCLA2-E6-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

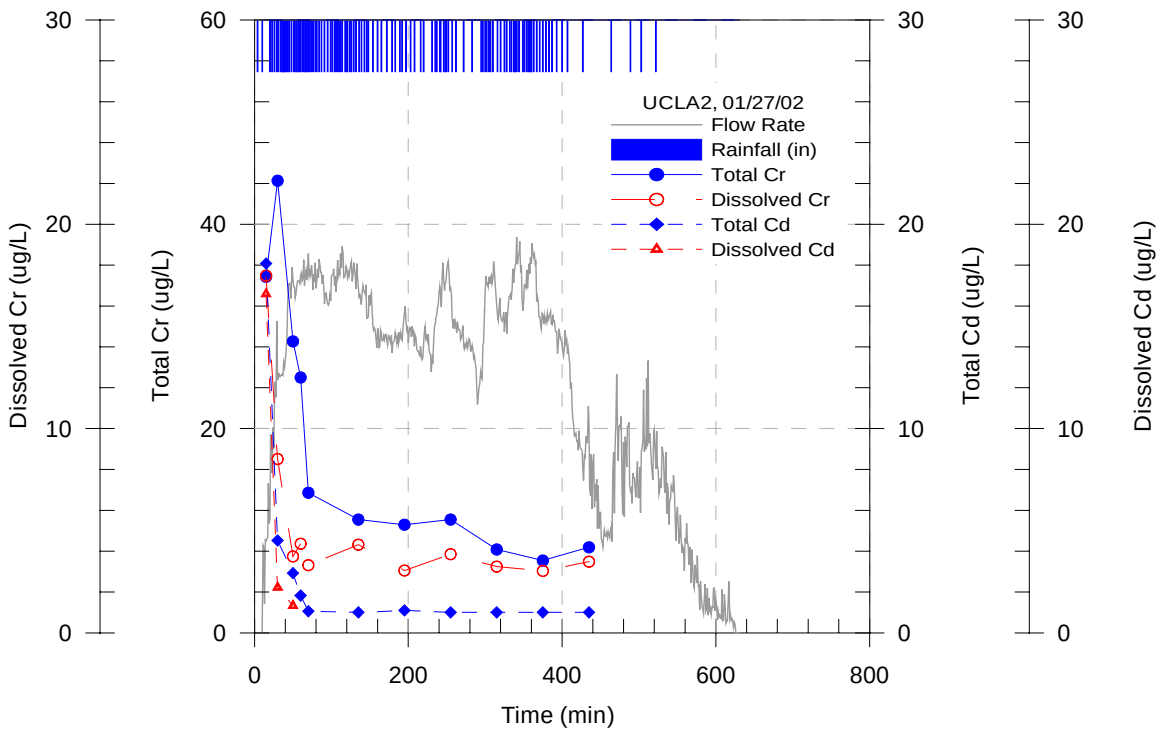

Figure I.3.2.5f[1] (Y3-UCLA2-E6-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

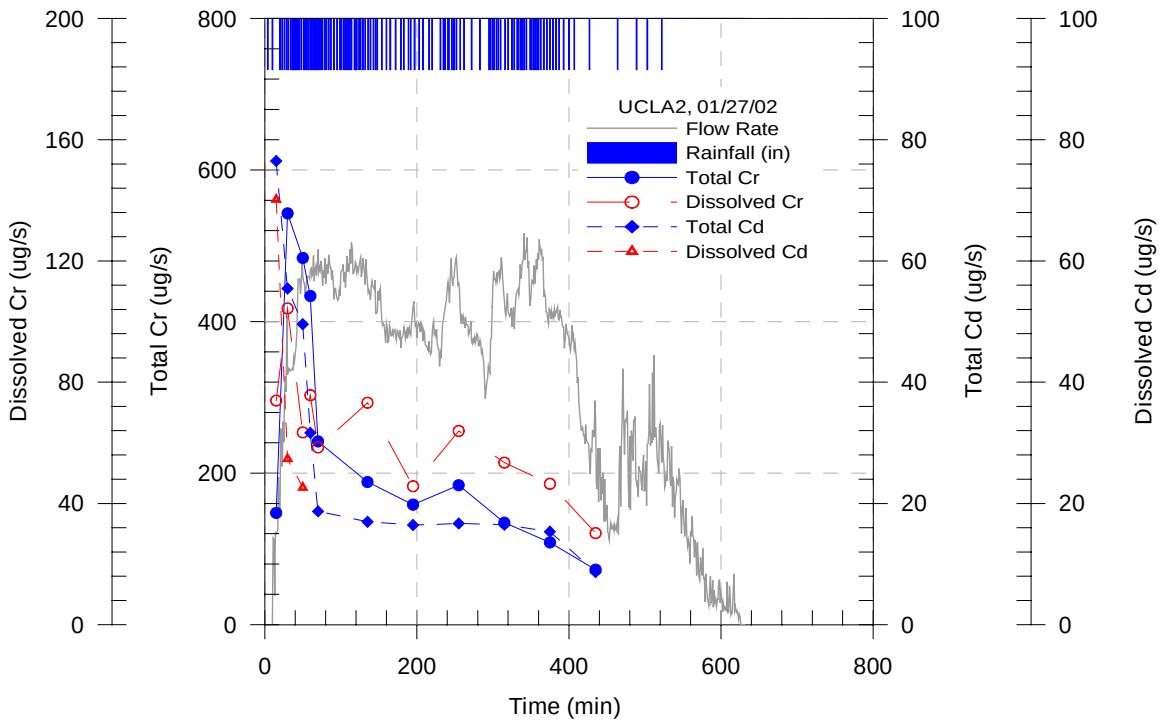

Figure I.3.2.5f[2] (Y3-UCLA2-E6-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

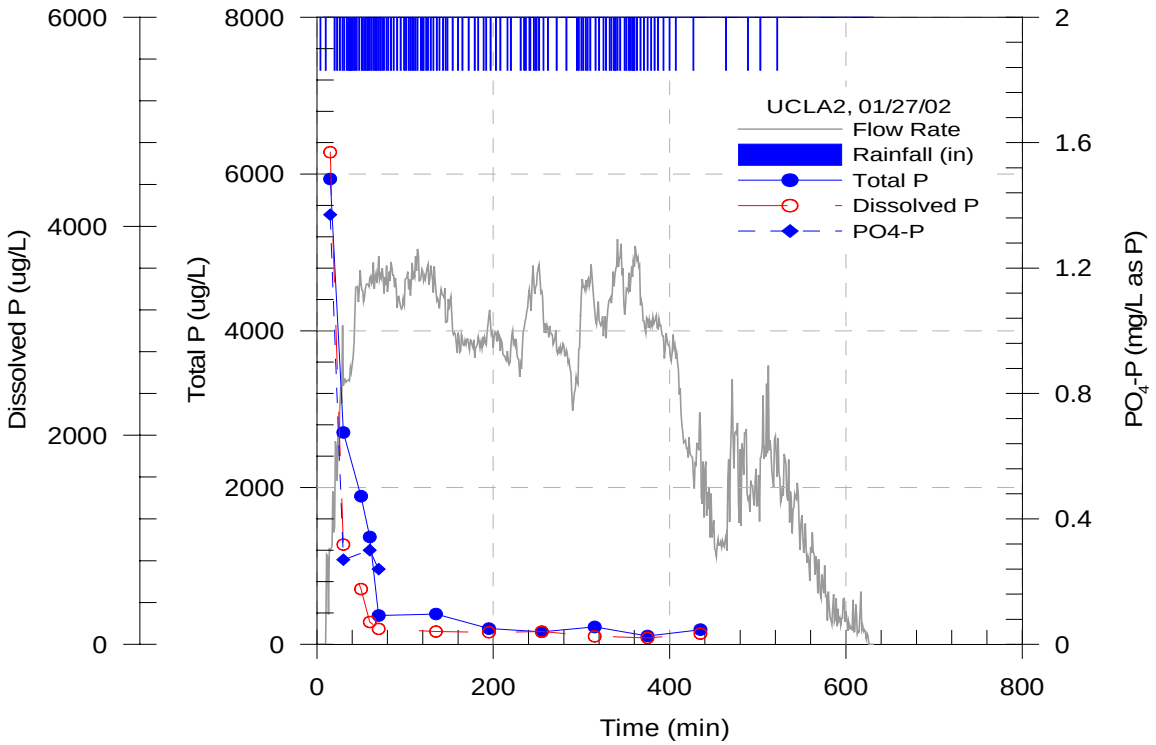

Figure I.3.2.5g[1] (Y3-UCLA2-E6-7). Polluto-graph for Total P / PO_4^{3-}-P

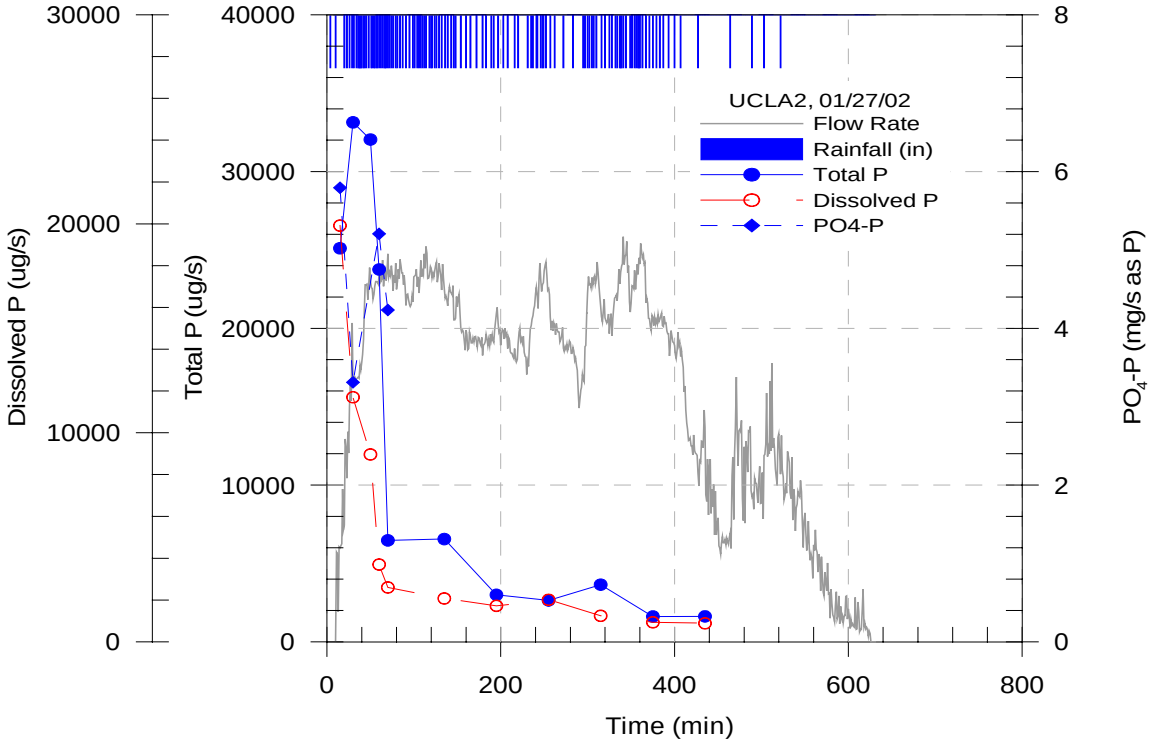

Figure I.3.2.5g[2] (Y3-UCLA2-E6-7). Load -graph for Total P / PO_4^{3-}P

6. UCLA2, 02/17/02

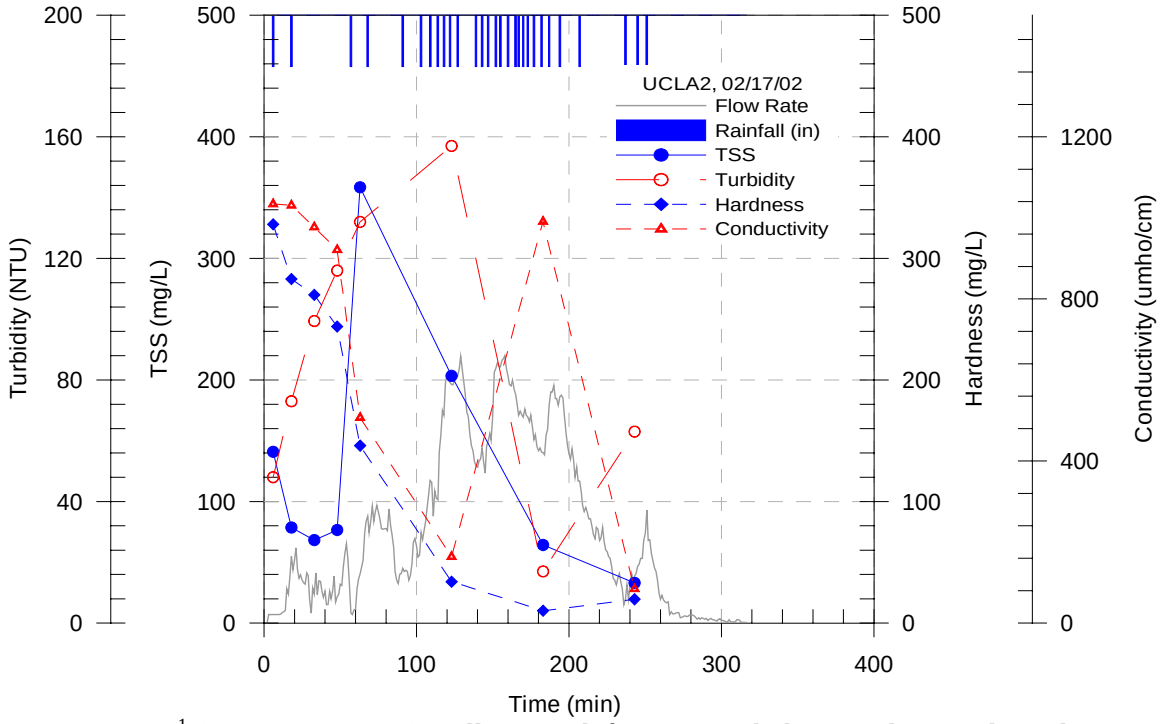

Figure I.3.2.6a[1] (Y3-UCLA2-E7-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

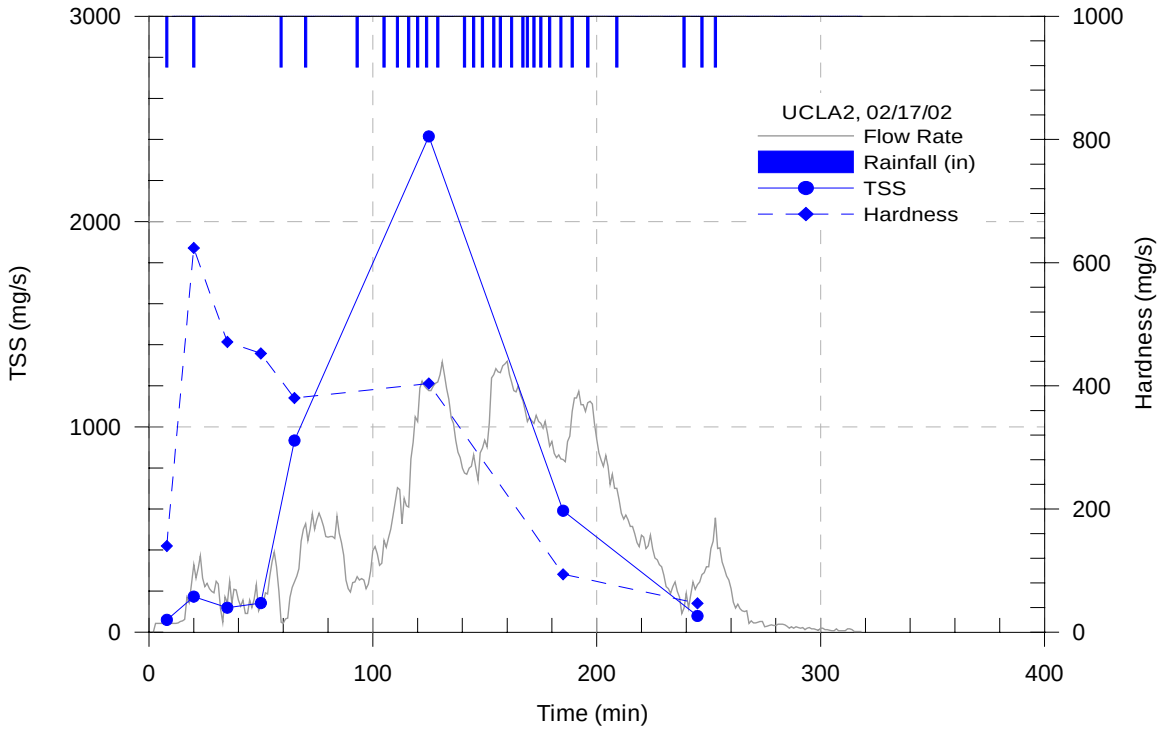

Figure I.3.2.6a[2] (Y3-UCLA2-E7-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

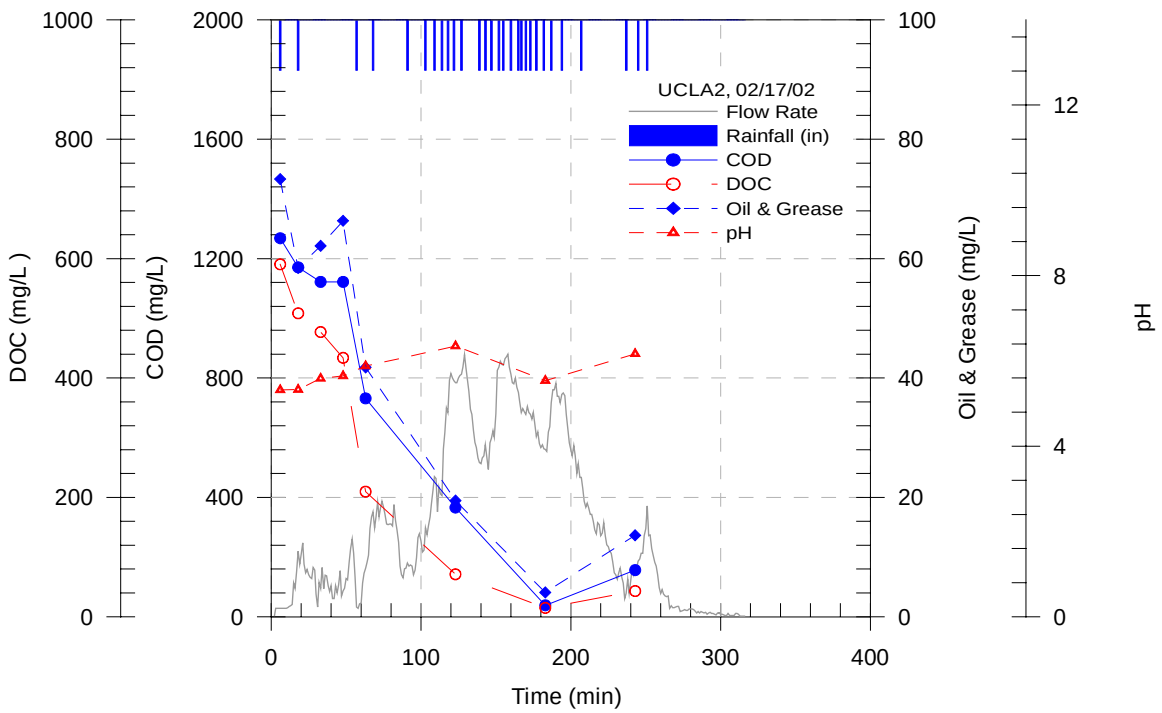

Figure I.3.2.6b[1] (Y3-UCLA2-E7-2). Polluto-graph for COD, DOC, Oil & Grease and pH

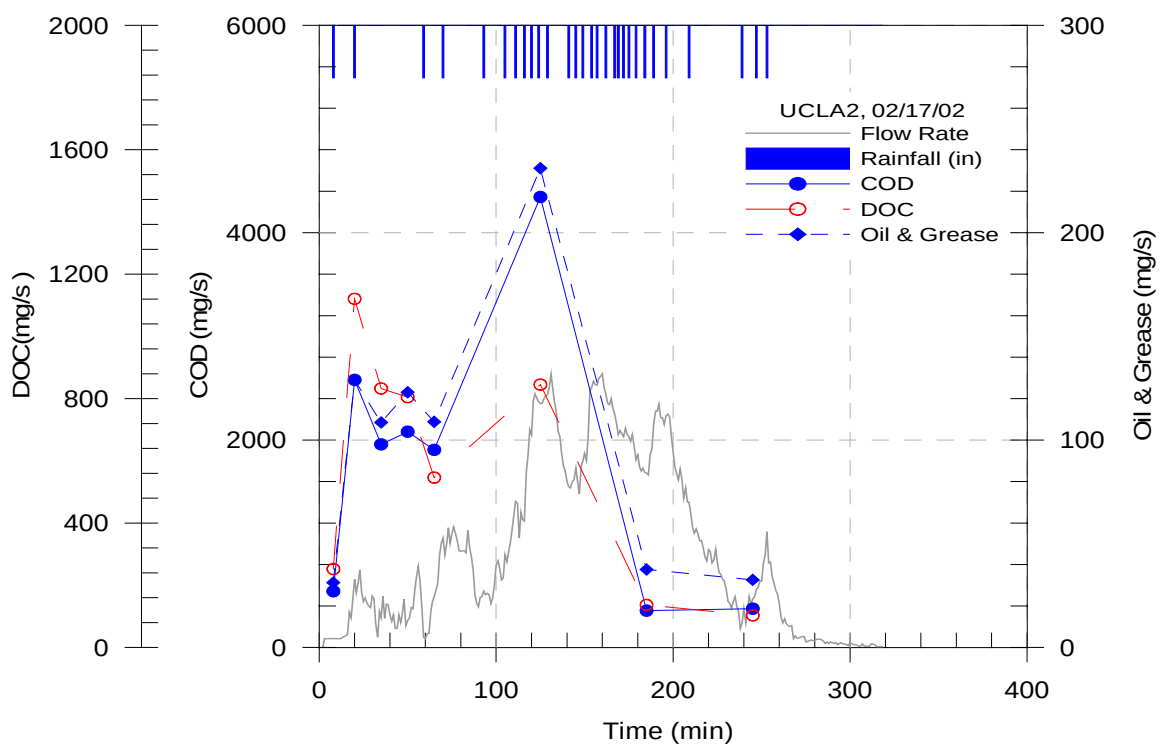

Figure I.3.2.6b[2] (Y3-UCLA2-E7-2). Load-graph for COD, DOC, Oil & Grease and pH

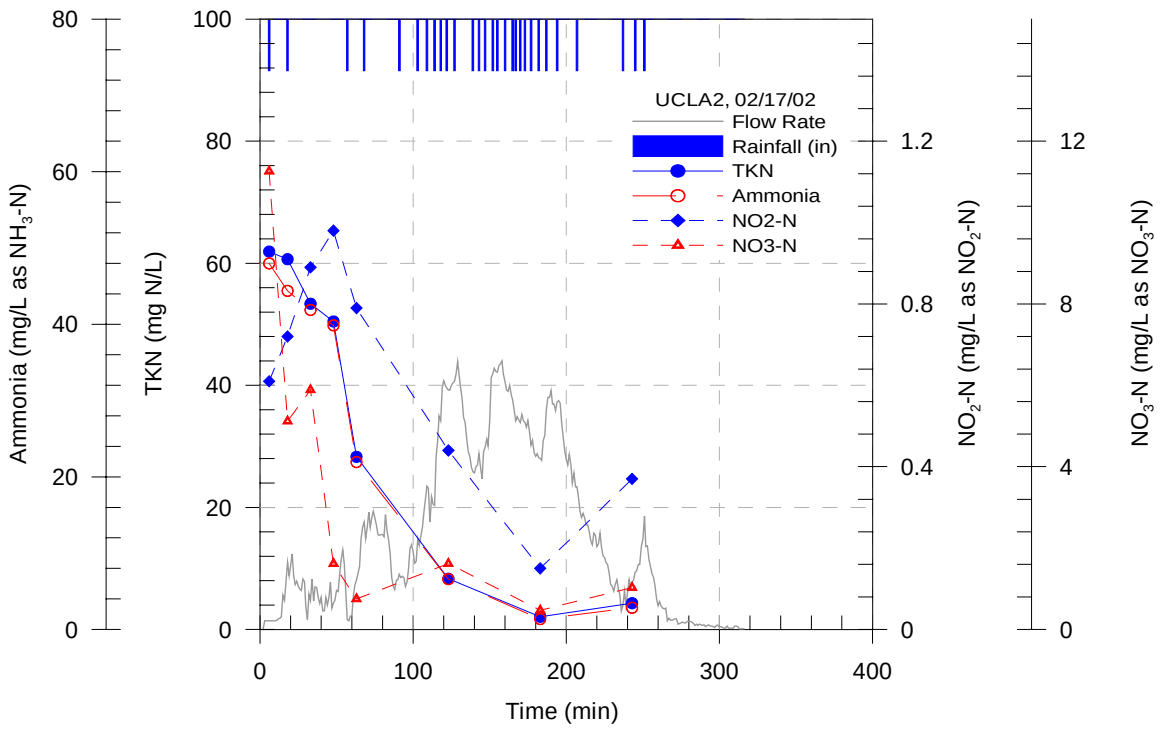

Figure I.3.2.6c[1] (Y3-UCLA2-E7-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

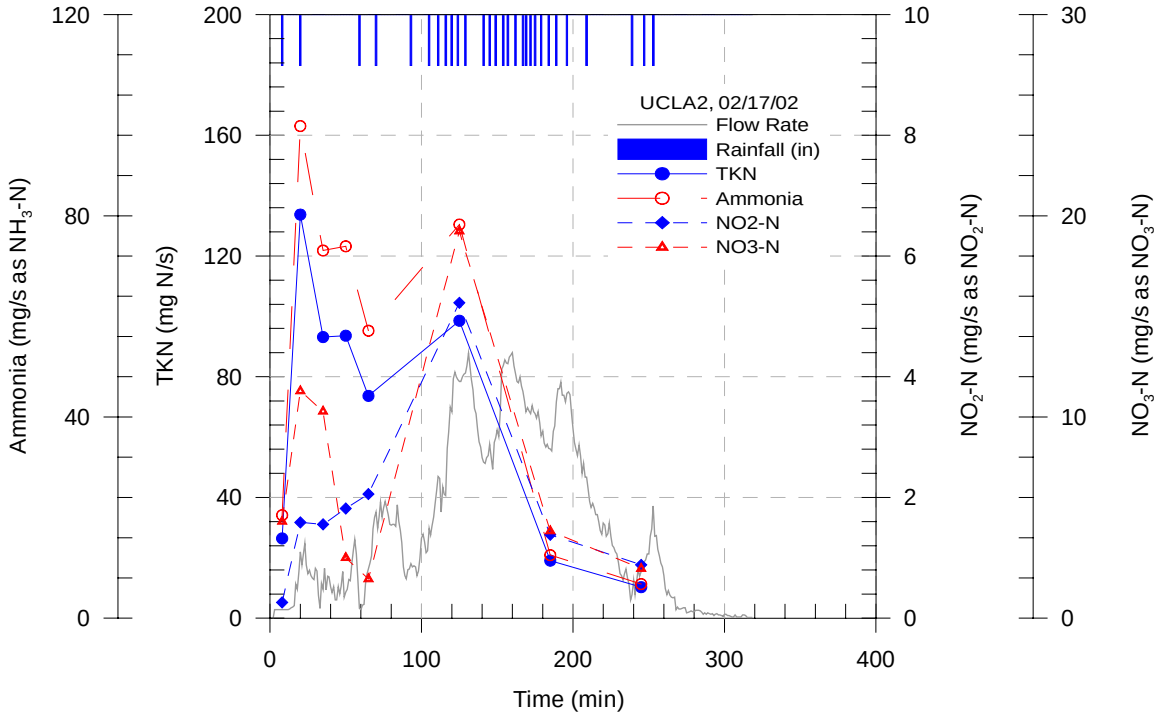

Figure I.3.2.6c[2] (Y3-UCLA2-E7-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

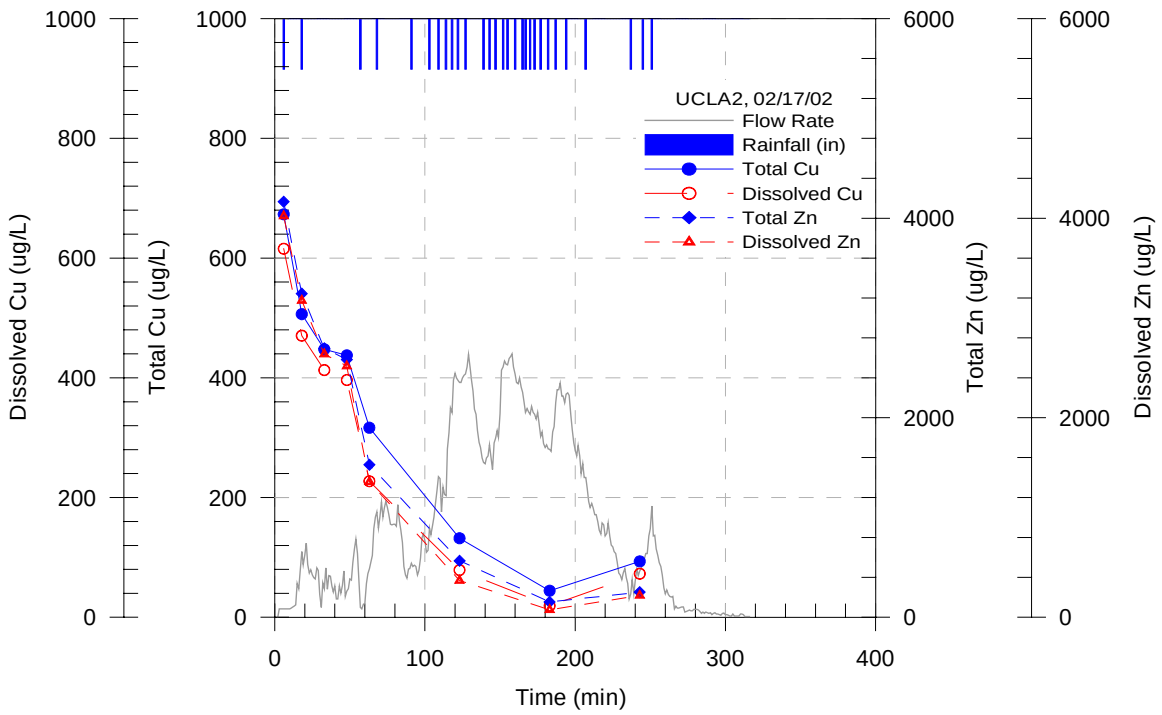

Figure I.3.2.6d[1] (Y3-UCLA2-E7-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

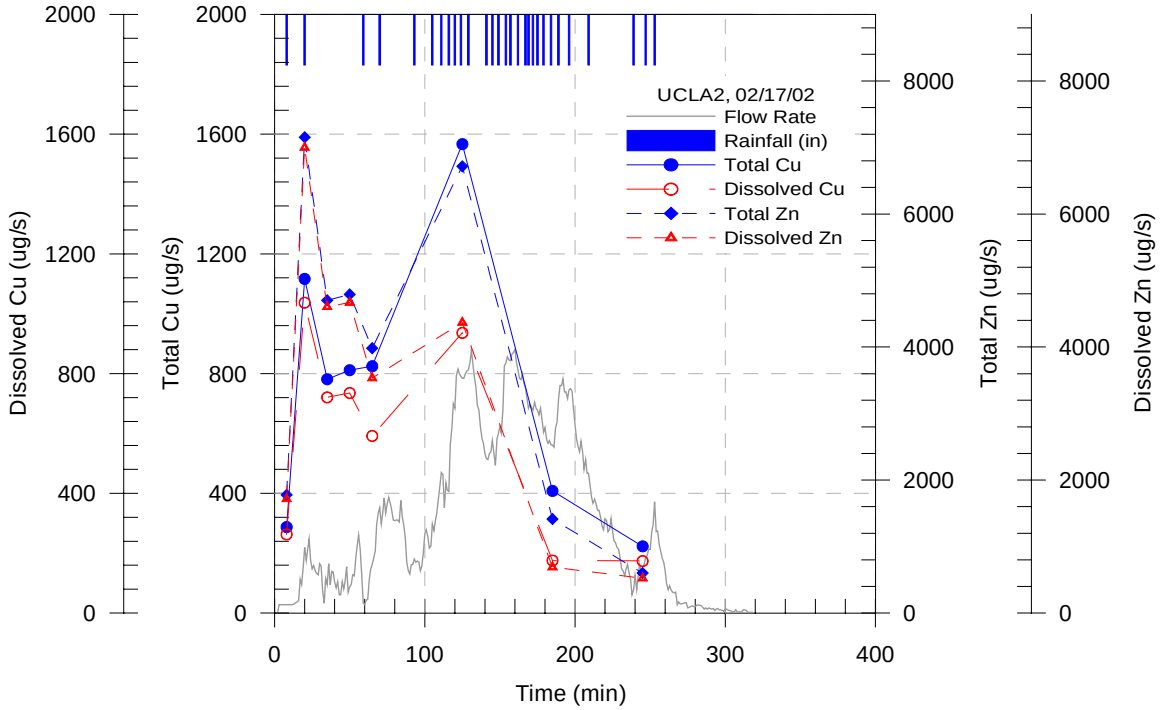

Figure I.3.2.6d[2] (Y3-UCLA2-E7-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

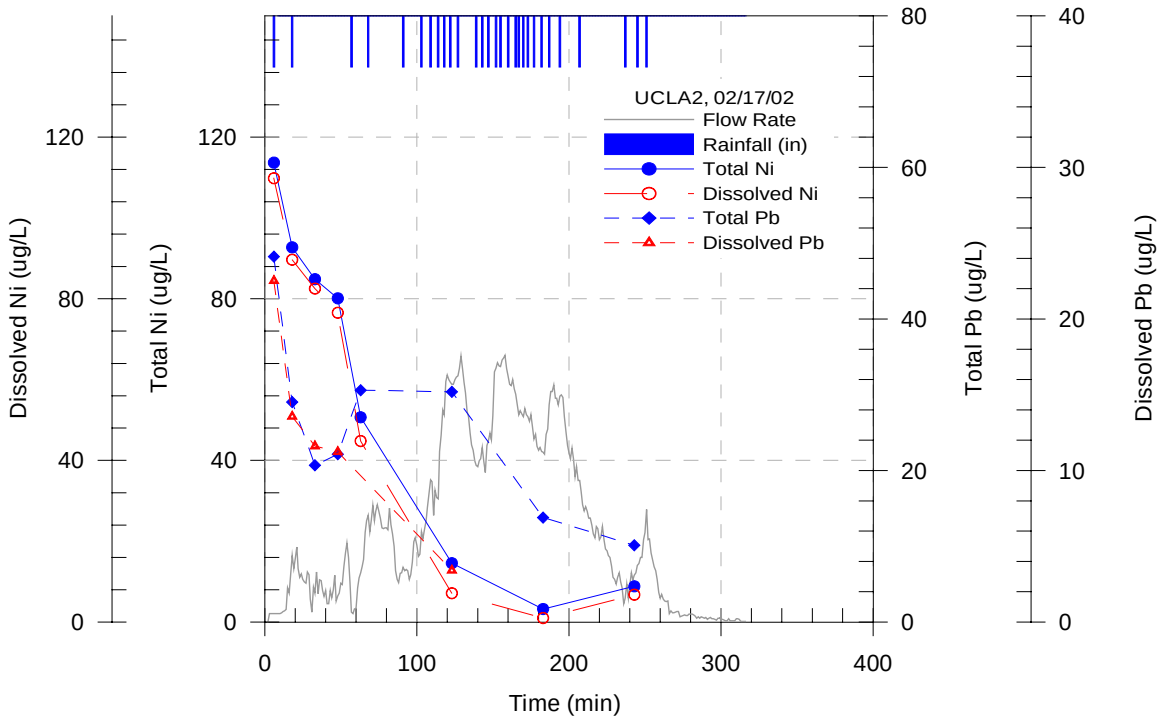

Figure I.3.2.6e[1] (Y3-UCLA2-E7-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

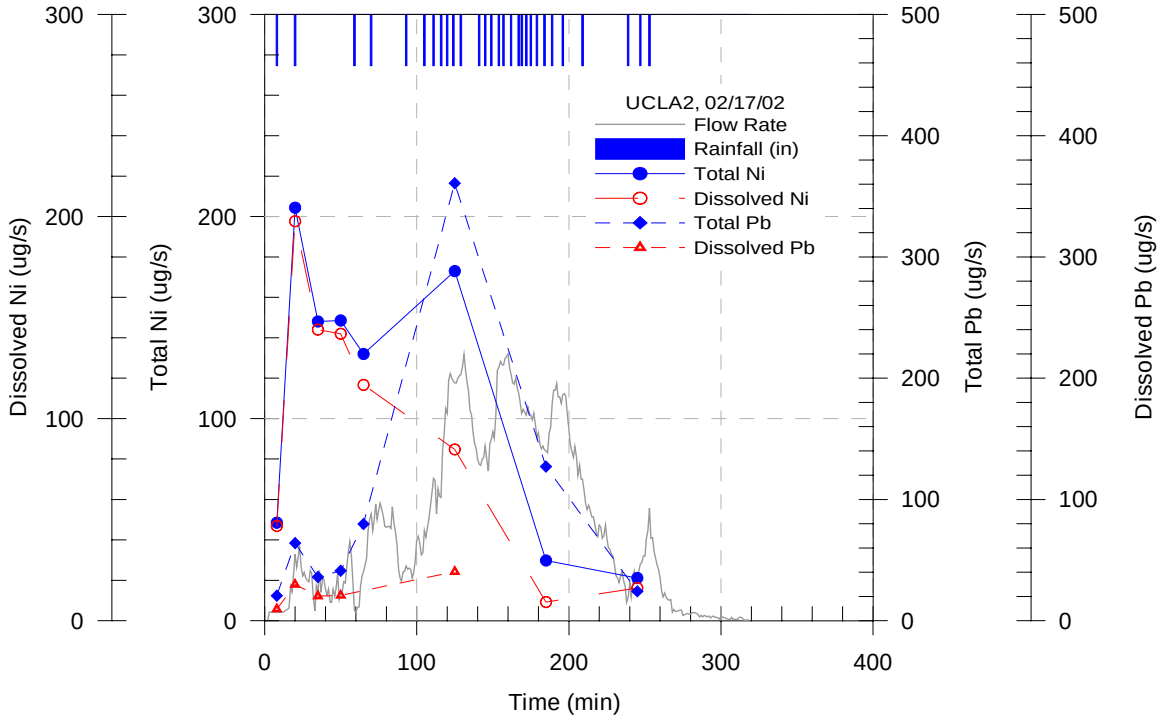

Figure I.3.2.6e[2] (Y3-UCLA2-E7-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

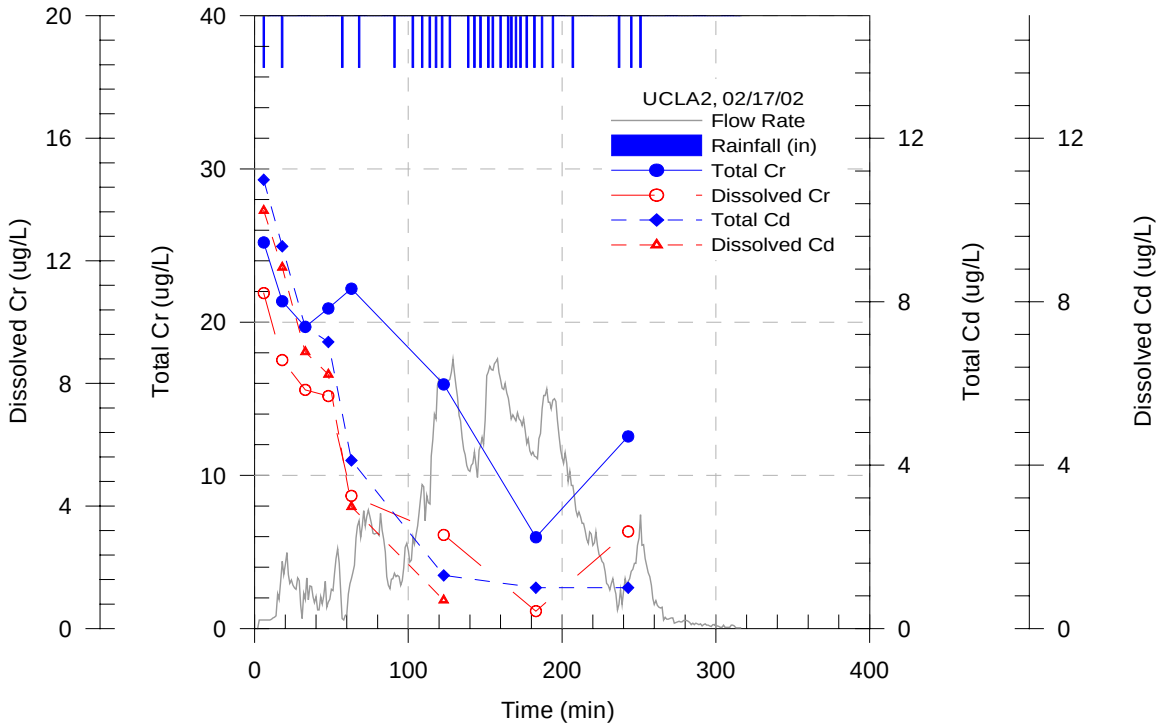

Figure I.3.2.6f[1] (Y3-UCLA2-E7-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

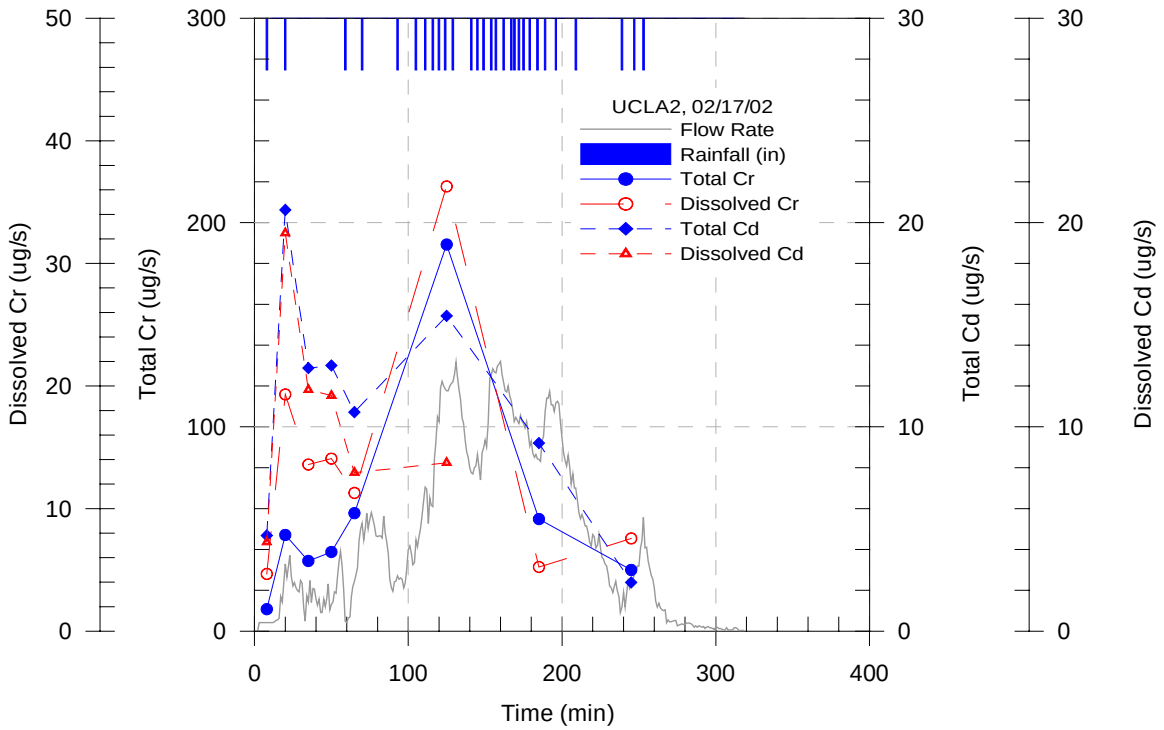

Figure I.3.2.6f[2] (Y3-UCLA2-E7-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

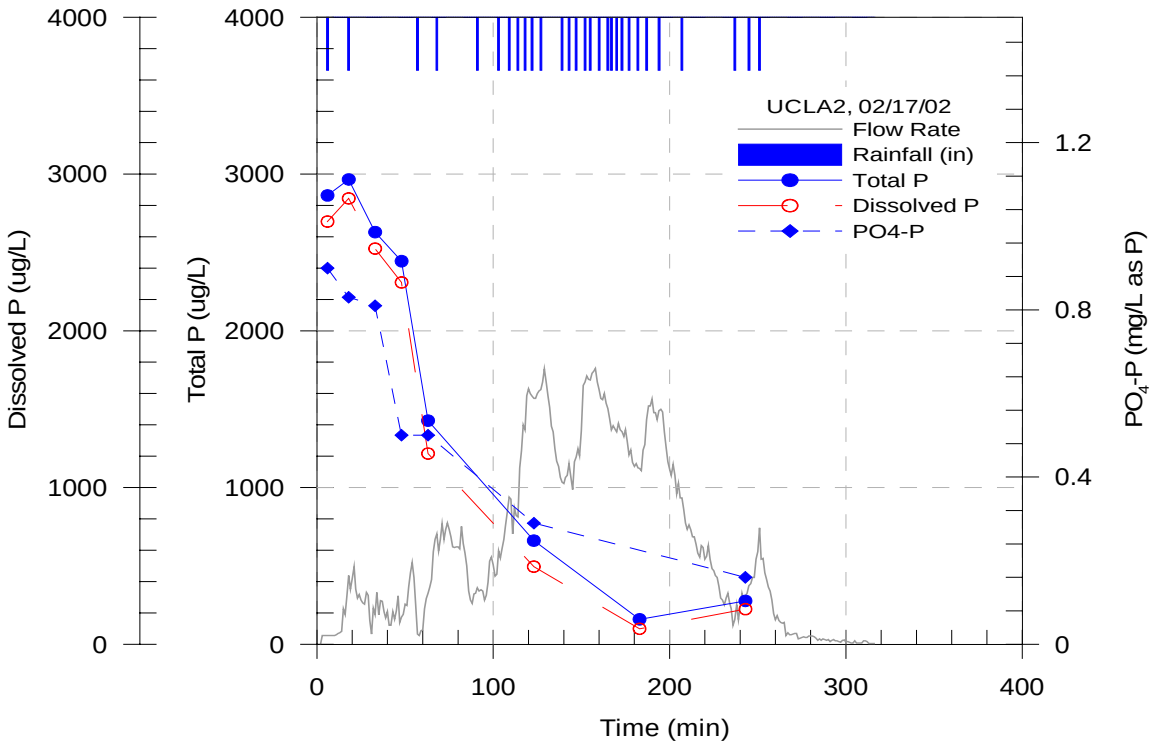

Figure I.3.2.6g[1] (Y3-UCLA2-E7-7). Polluto-graph for Total P / PO_4^{3-}-P

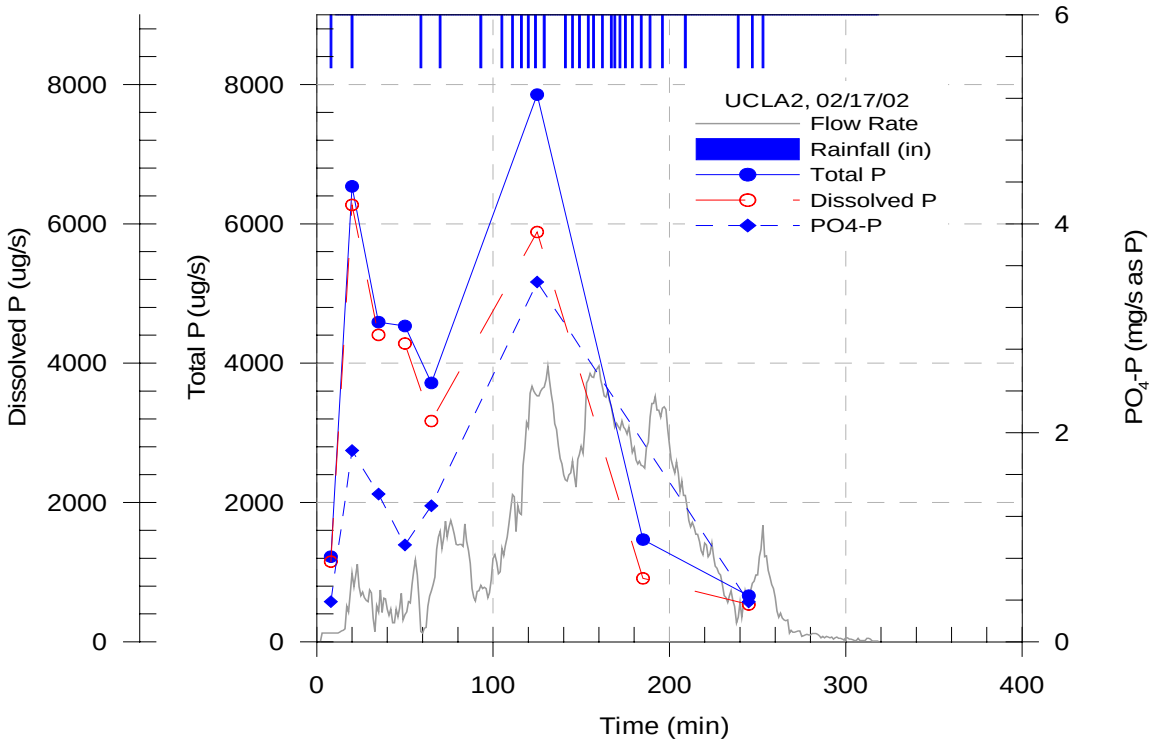

Figure I.3.2.6g[2] (Y3-UCLA2-E7-7). Load -graph for Total P / PO_4^{3-}P

7. UCLA2, 03/06/02

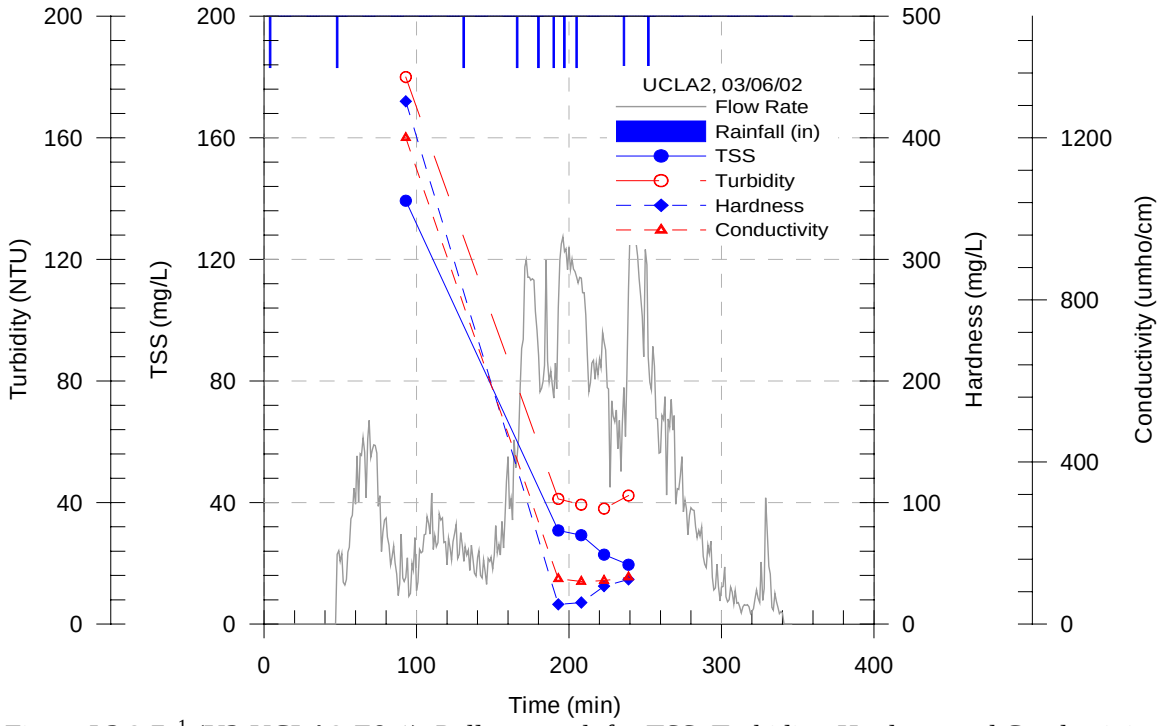

Figure I.3.2.7a[1] (Y3-UCLA2-E8-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

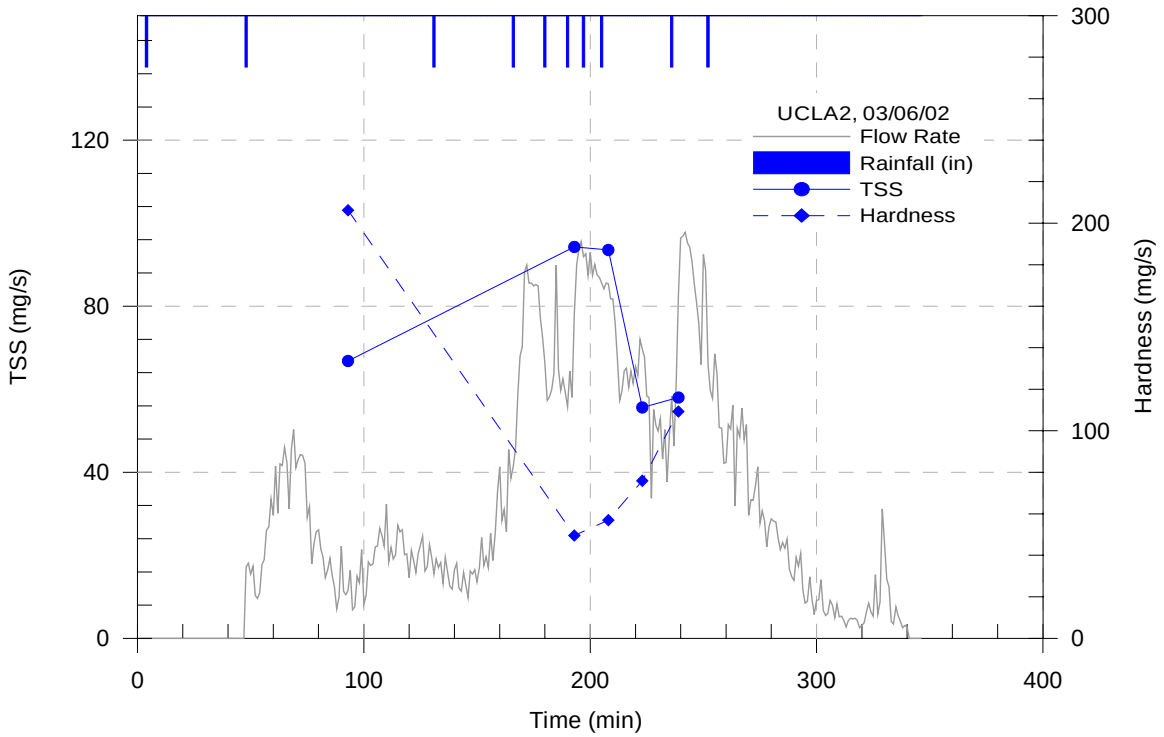

Figure I.3.2.7a[2] (Y3-UCLA2-E8-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

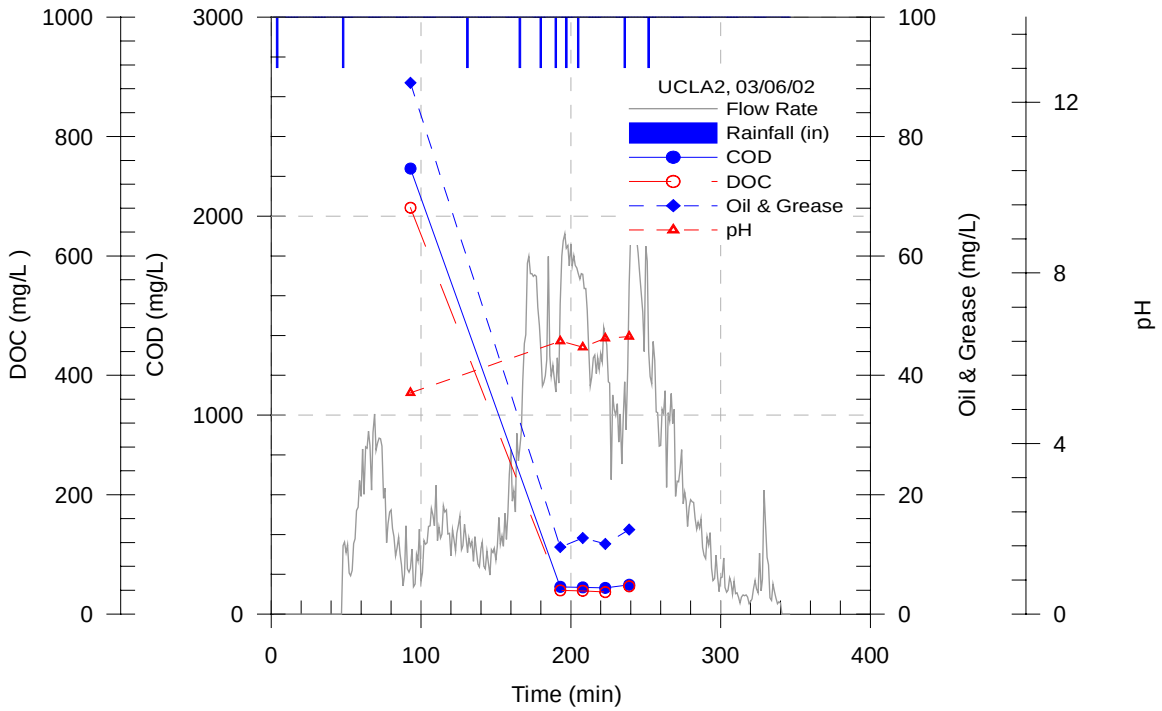

Figure I.3.2.7b[1] (Y3-UCLA2-E8-2). Polluto-graph for COD, DOC, Oil & Grease and pH

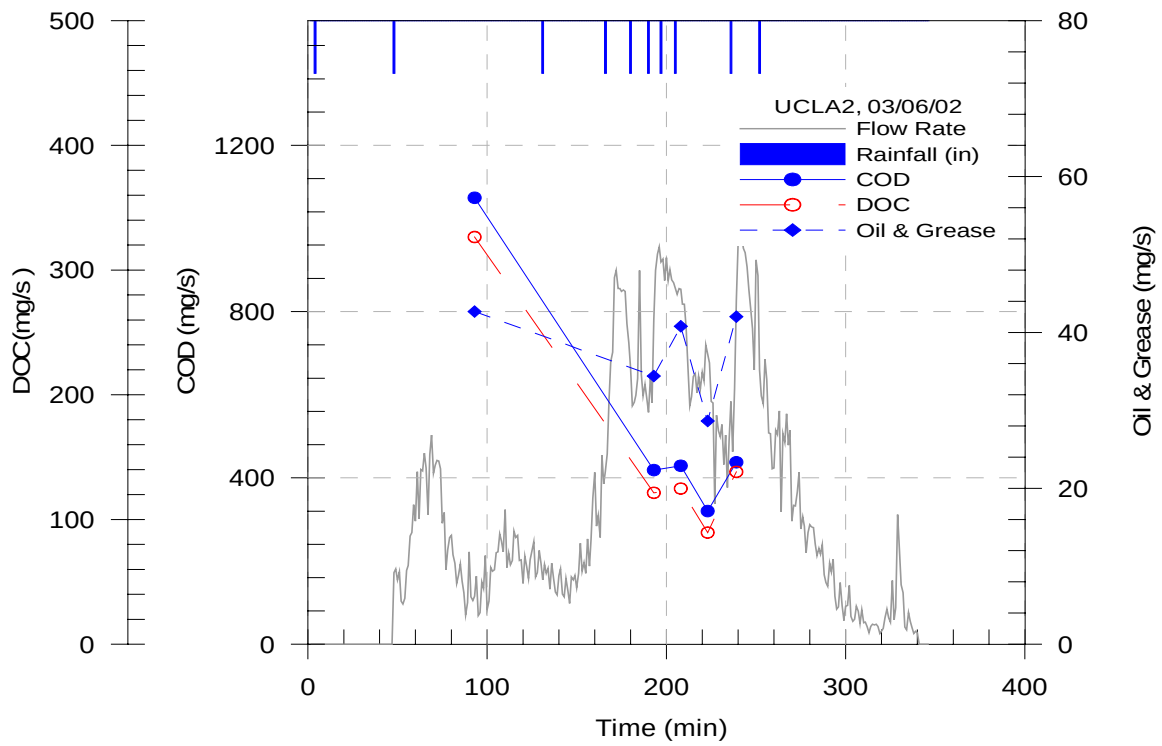

Figure I.3.2.7b[2] (Y3-UCLA2-E8-2). Load-graph for COD, DOC, Oil & Grease and pH

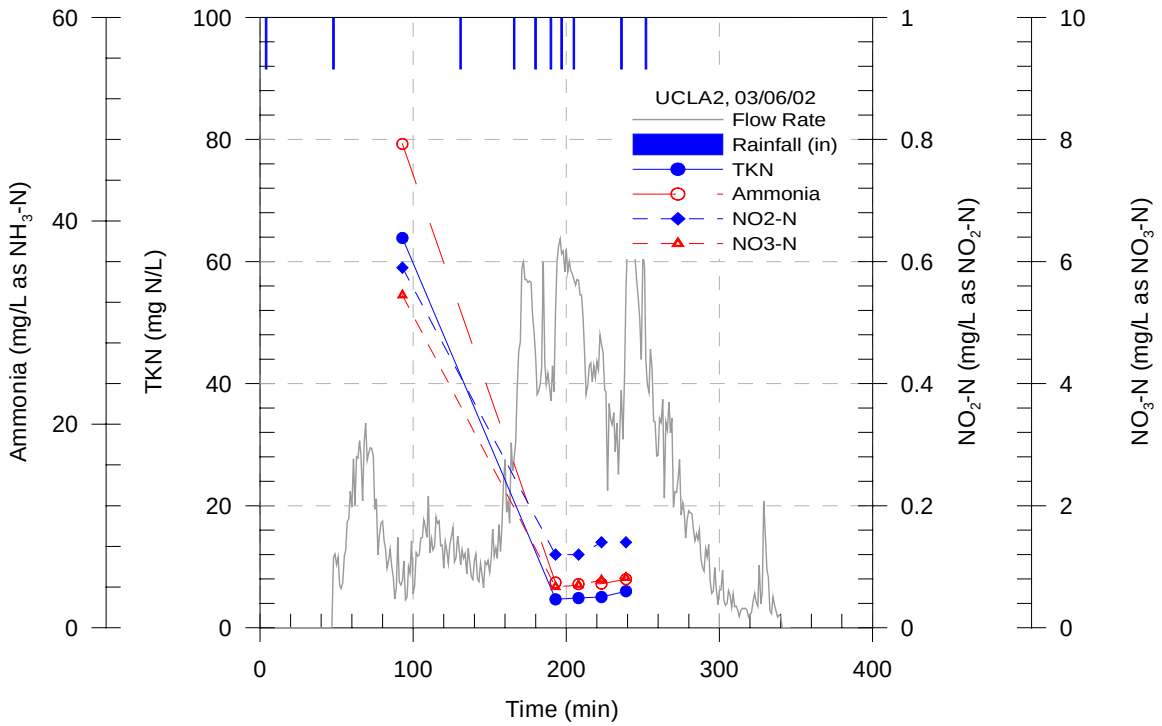

Figure I.3.2.7c[1] (Y3-UCLA2-E8-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

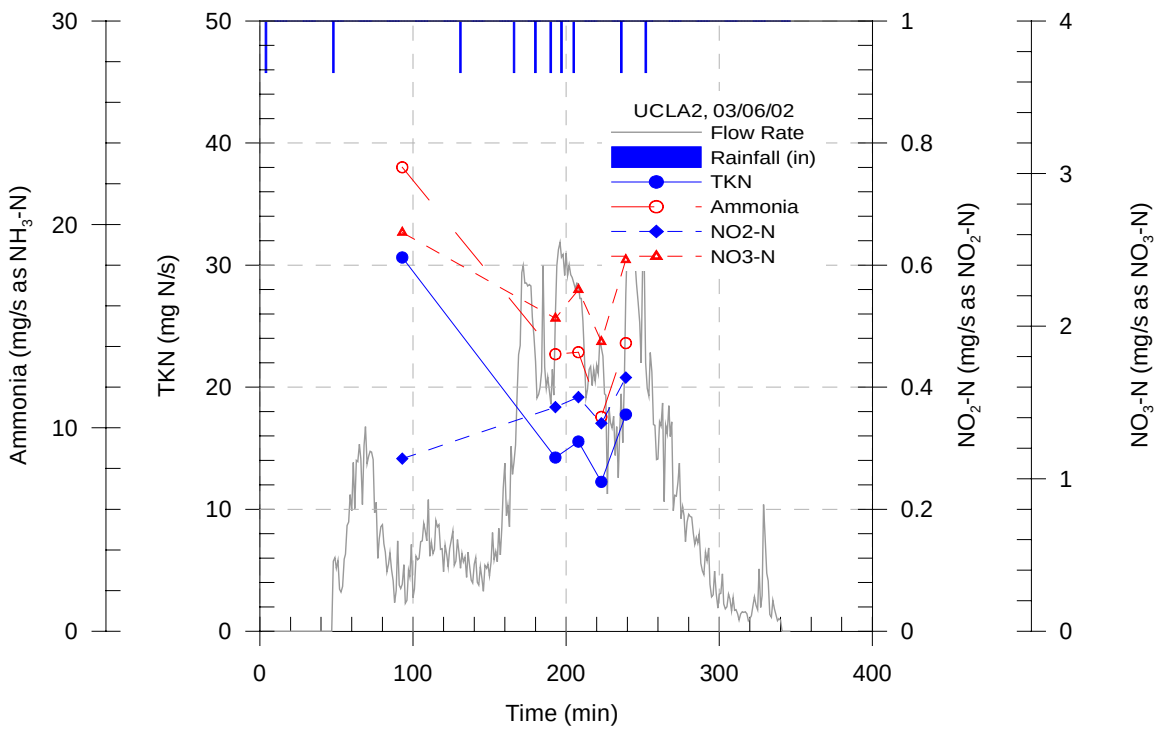

Figure I.3.2.7c[2] (Y3-UCLA2-E8-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

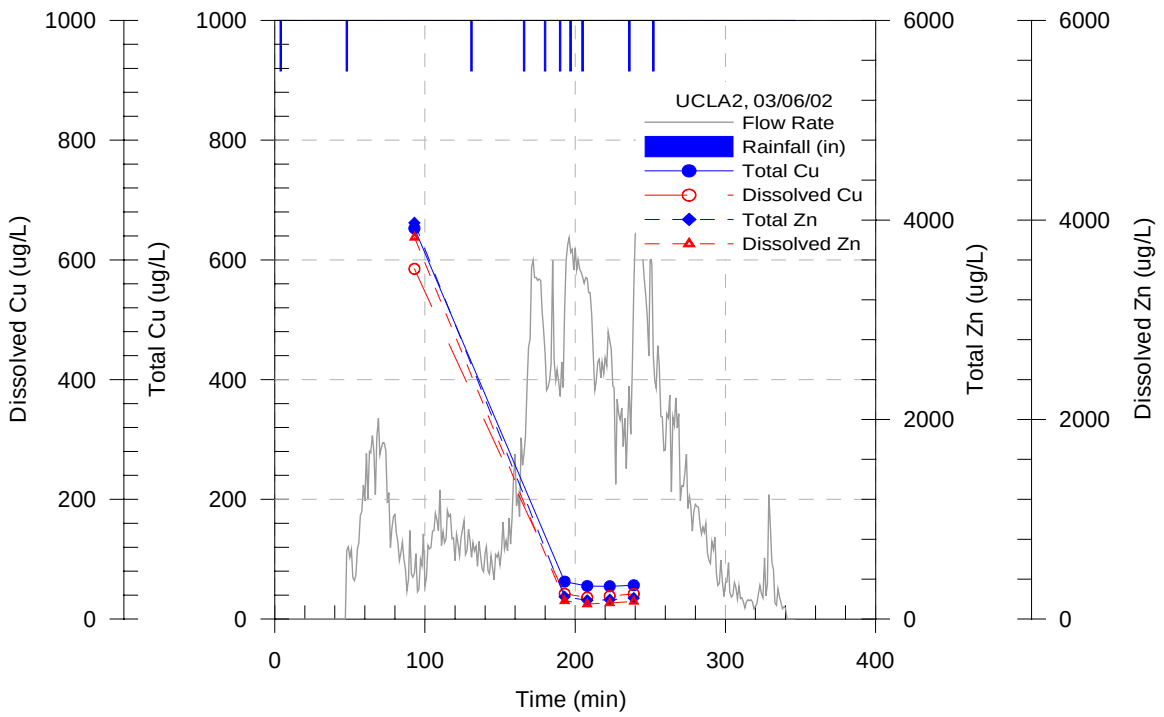

Figure I.3.2.7d[1] (Y3-UCLA2-E8-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

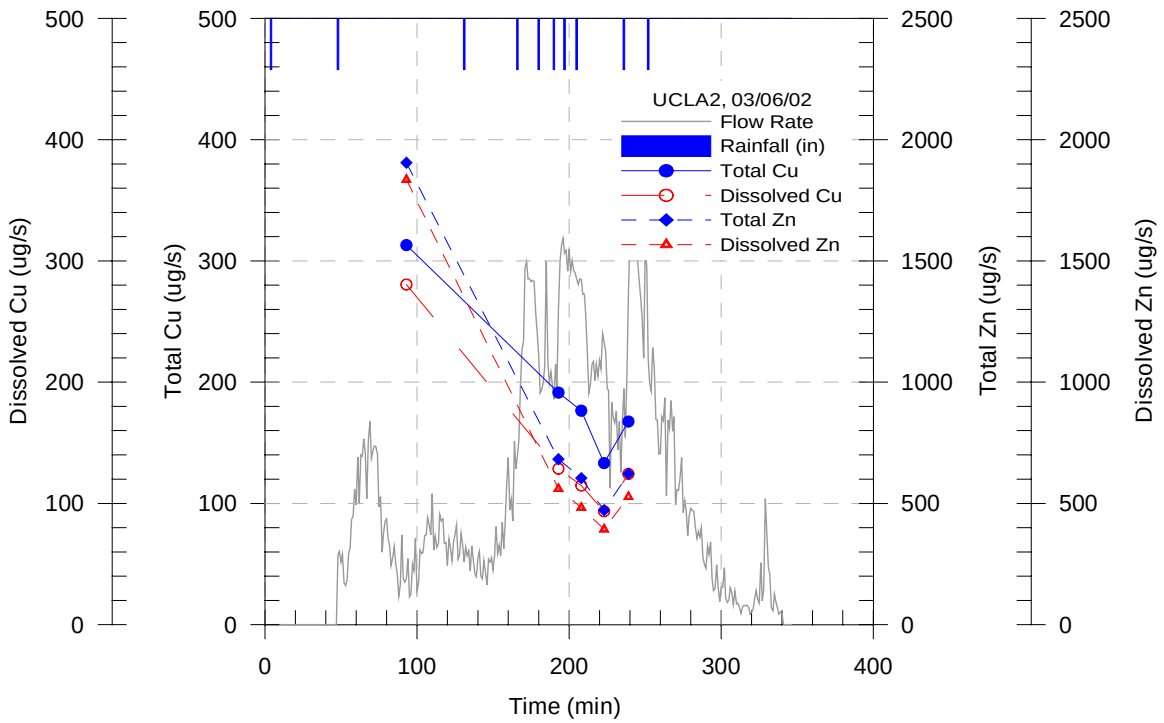

Figure I.3.2.7d[2] (Y3-UCLA2-E8-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

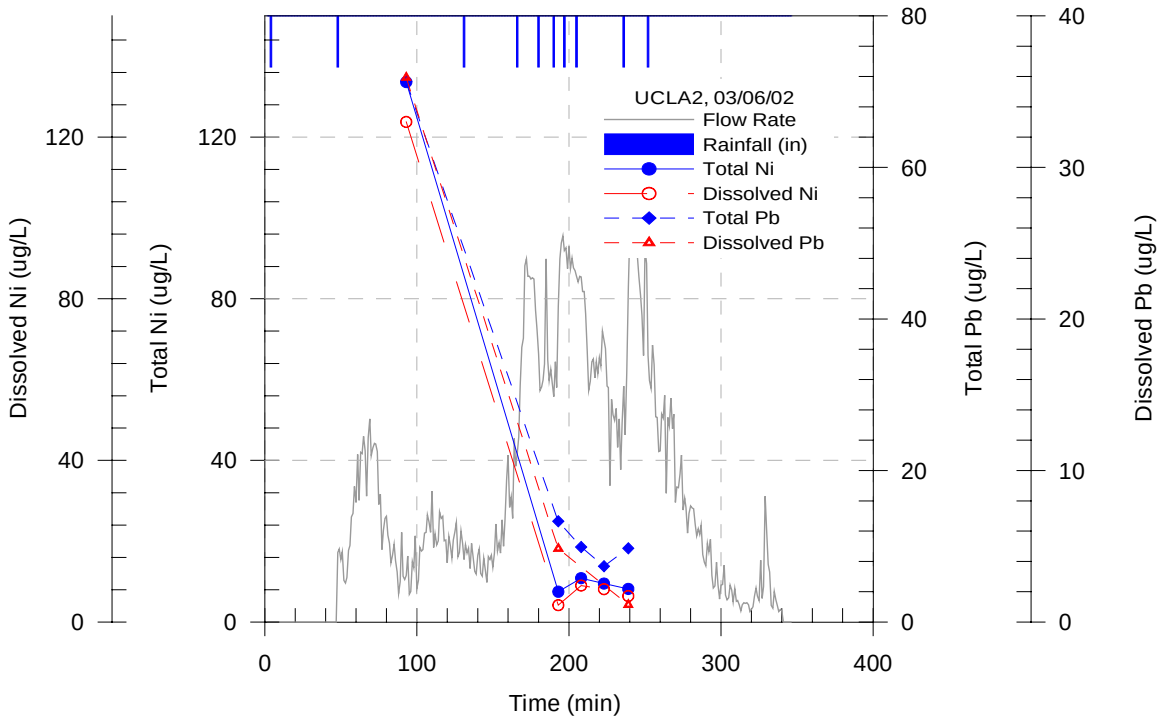

Figure I.3.2.7e[1] (Y3-UCLA2-E8-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

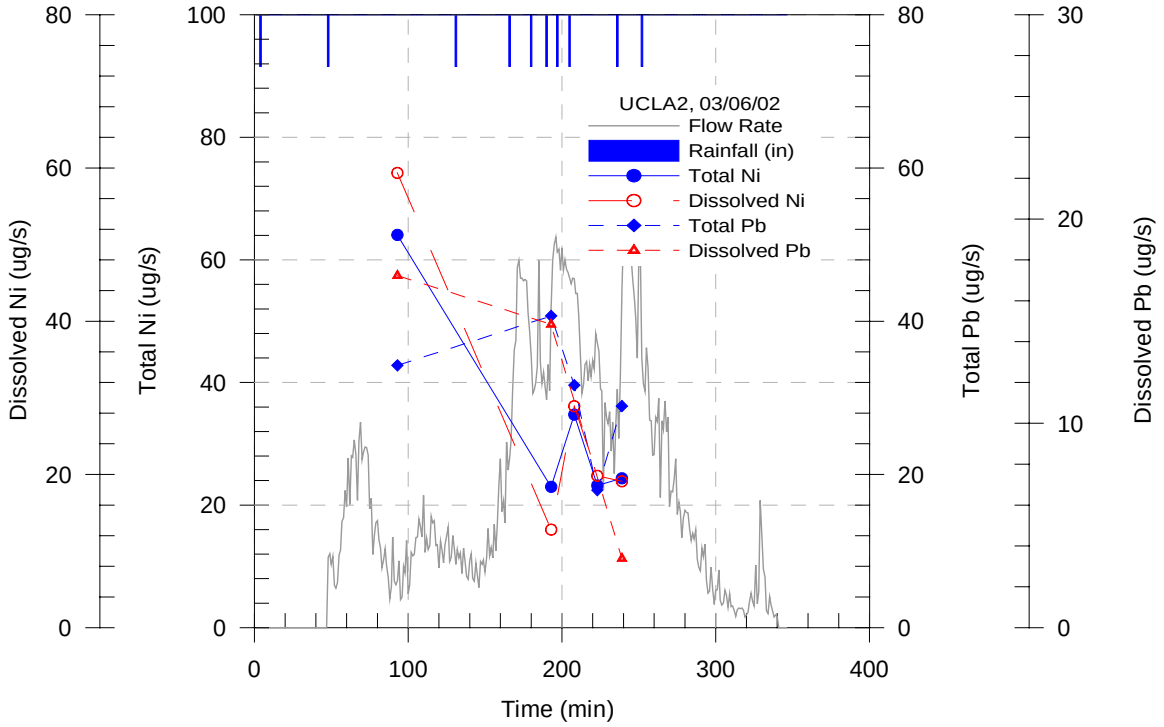

Figure I.3.2.7e[2] (Y3-UCLA2-E8-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

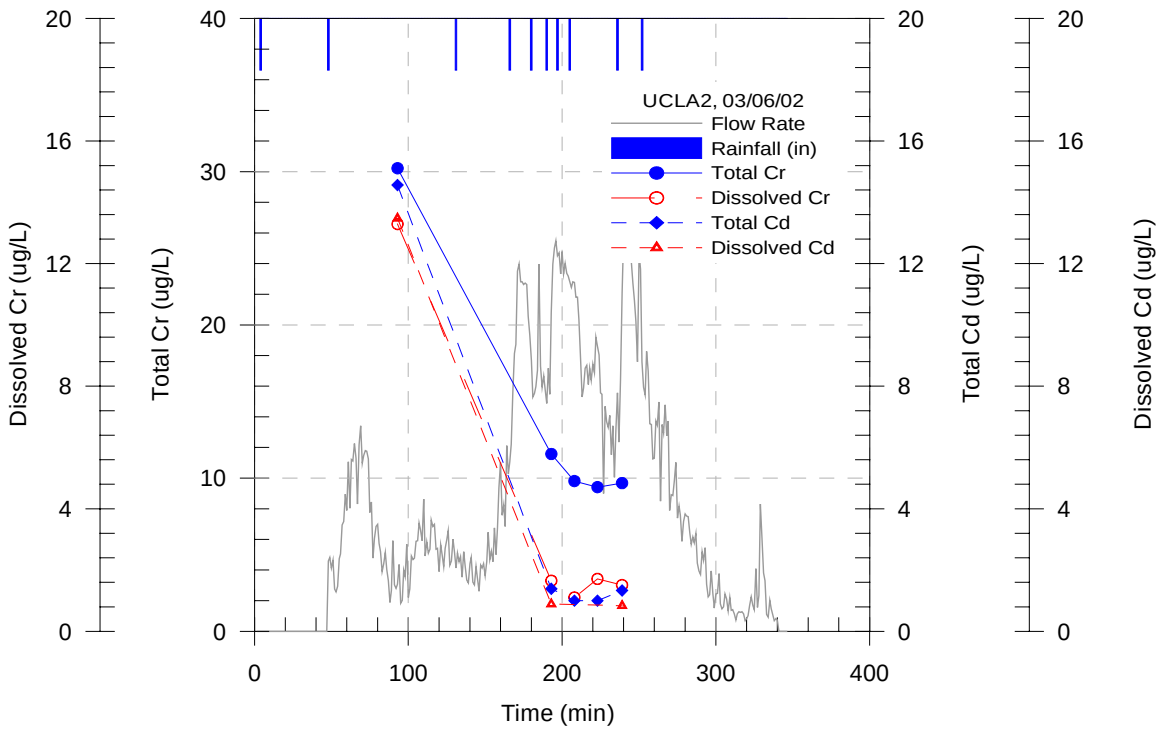

Figure I.3.2.7f[1] (Y3-UCLA2-E8-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

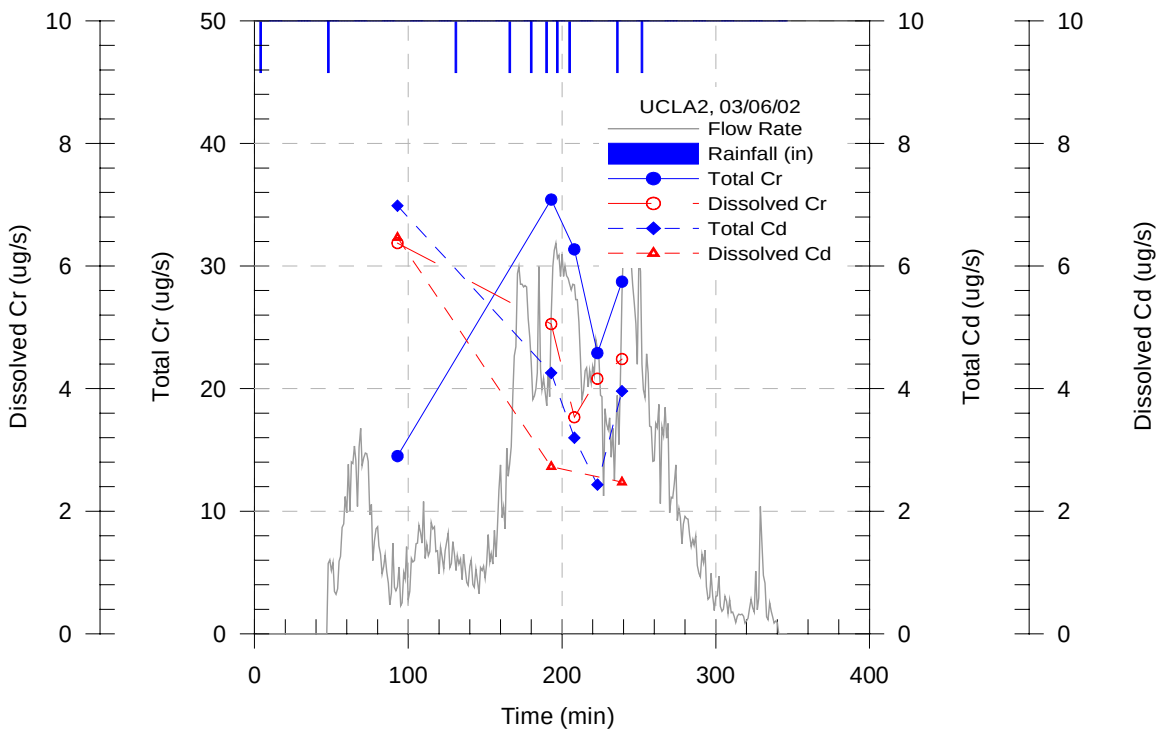

Figure I.3.2.7f[2] (Y3-UCLA2-E8-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

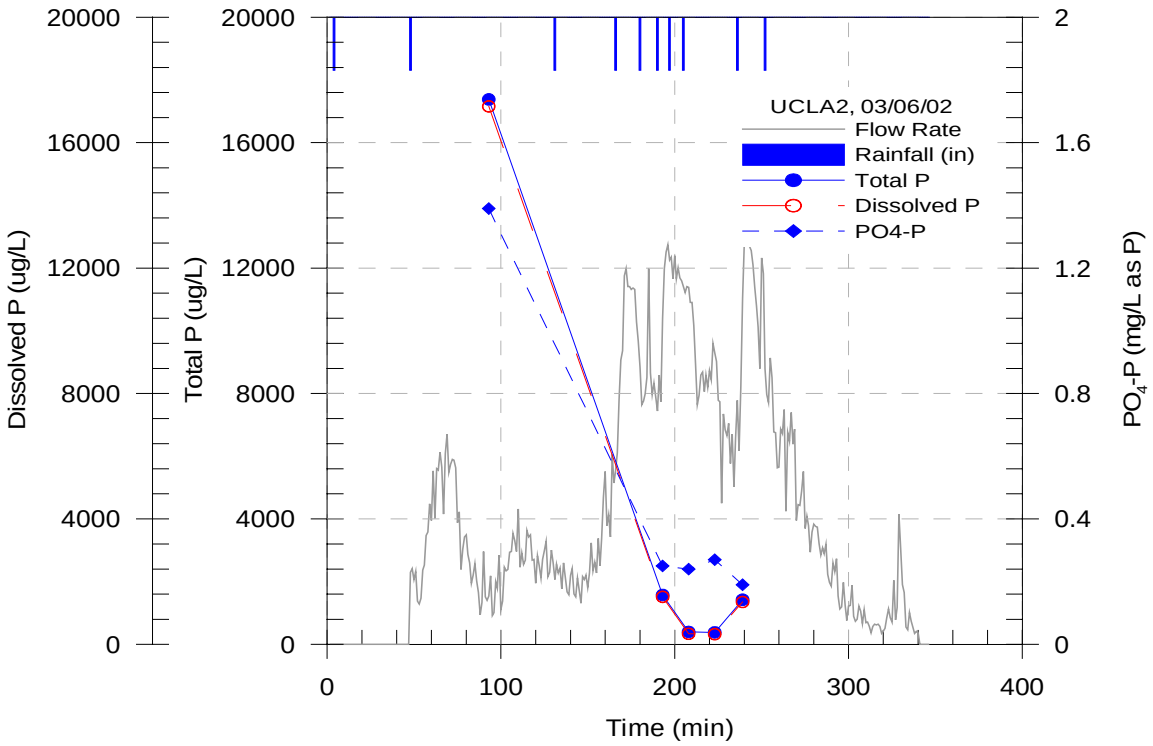

Figure I.3.2.7g[1] (Y3-UCLA2-E8-7). Polluto-graph for Total P / PO_4^{3-}-P

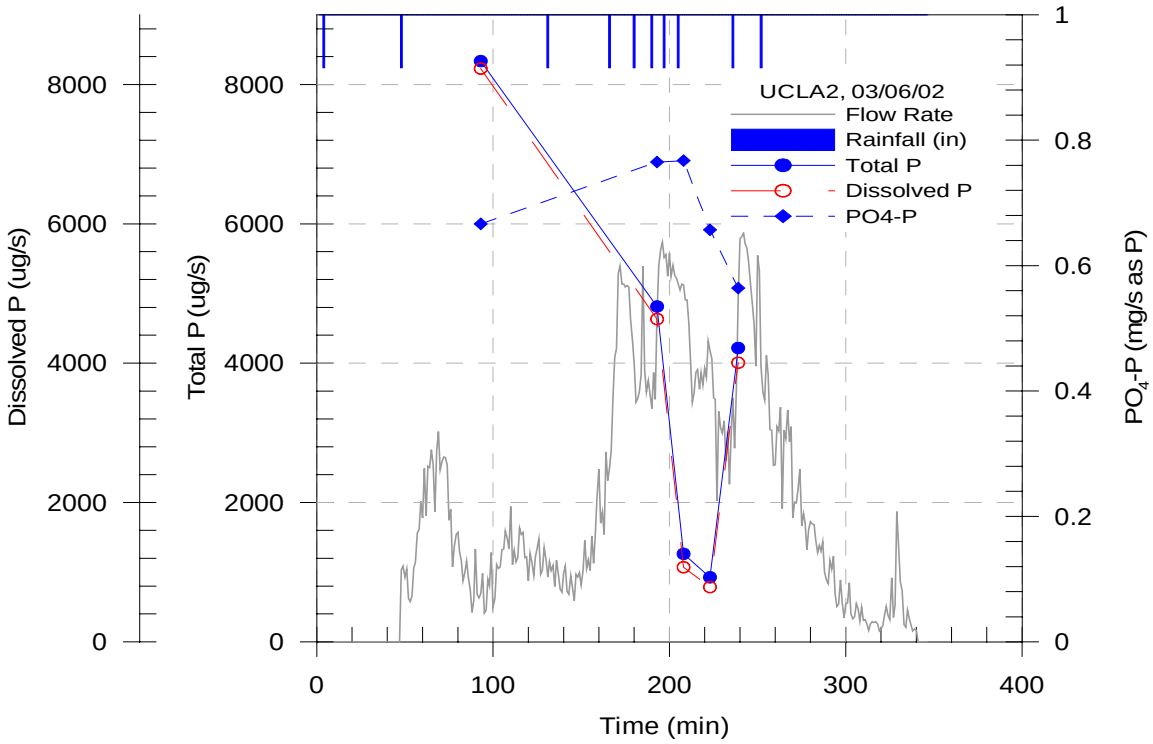

Figure I.3.2.7g[2] (Y3-UCLA2-E8-7). Load -graph for Total P / PO_4^{3-}P

8. UCLA2, 03/17/02

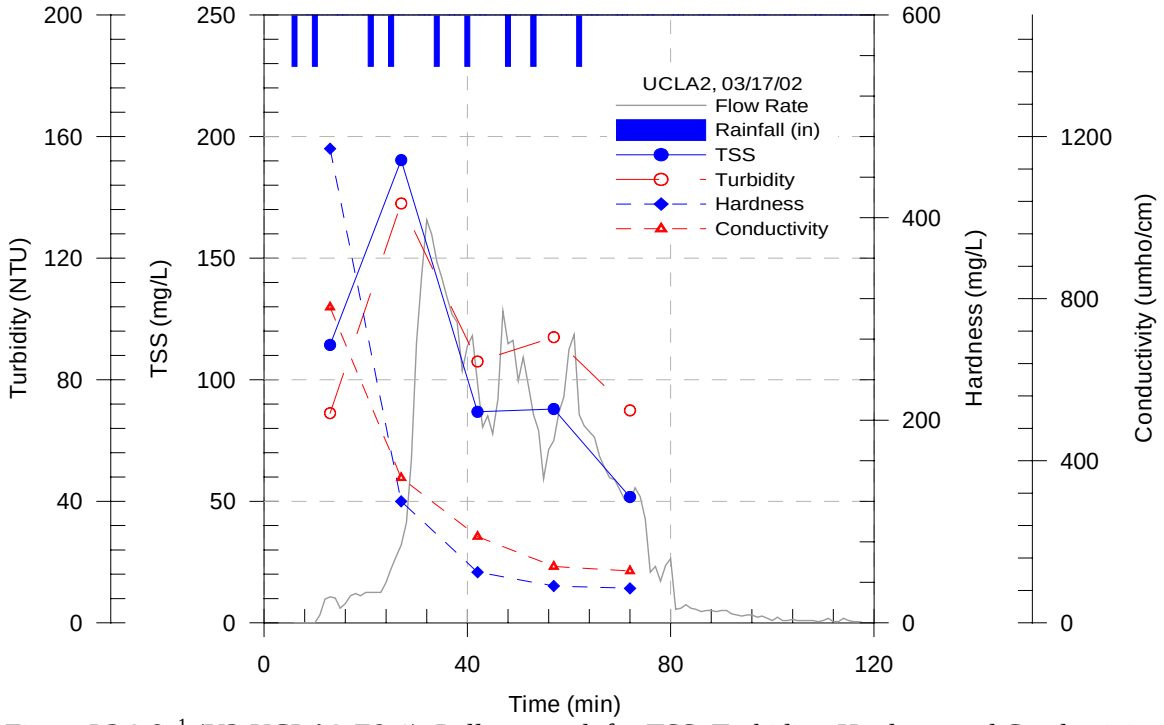

Figure I.3.2.8a[1] (Y3-UCLA2-E9-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

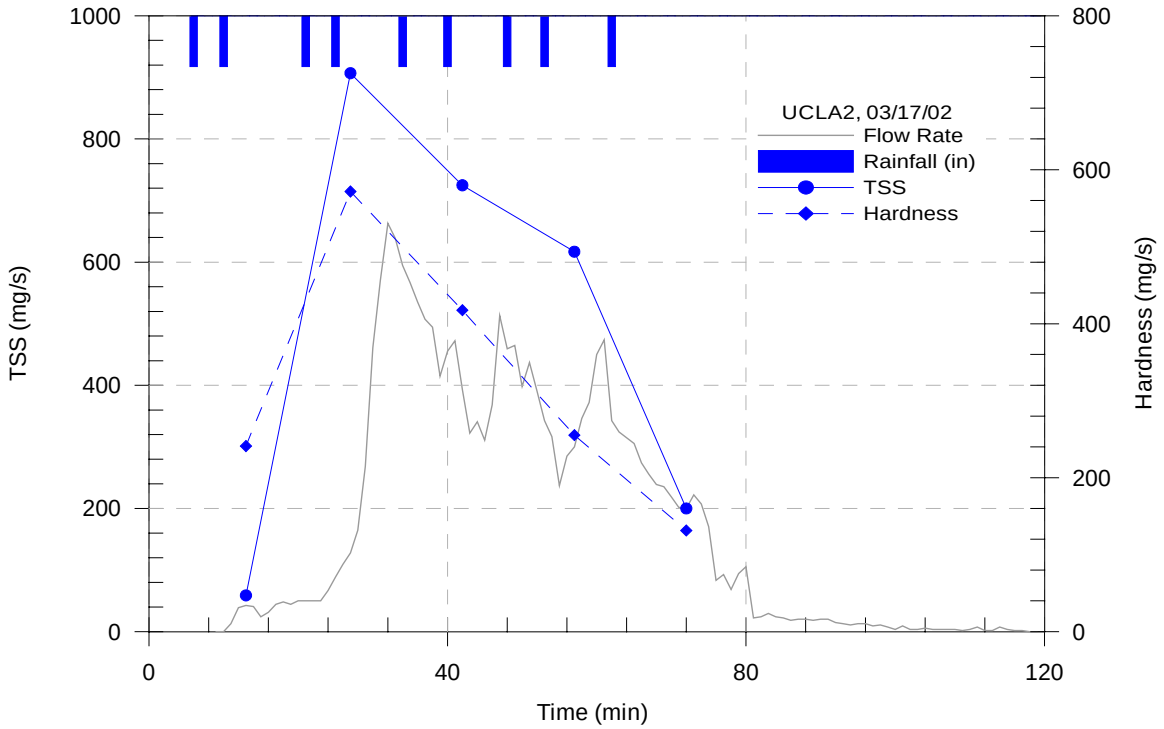

Figure I.3.2.8a[2] (Y3-UCLA2-E9-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

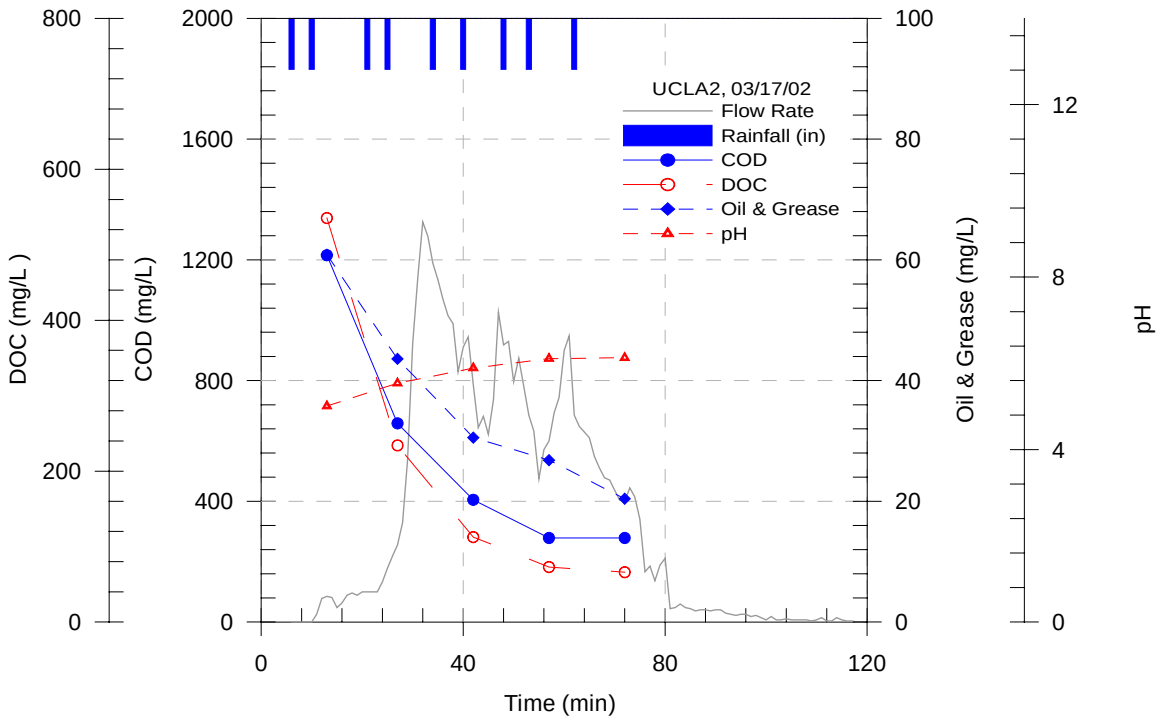

Figure I.3.2.8b[1] (Y3-UCLA2-E9-2). Polluto-graph for COD, DOC, Oil & Grease and pH

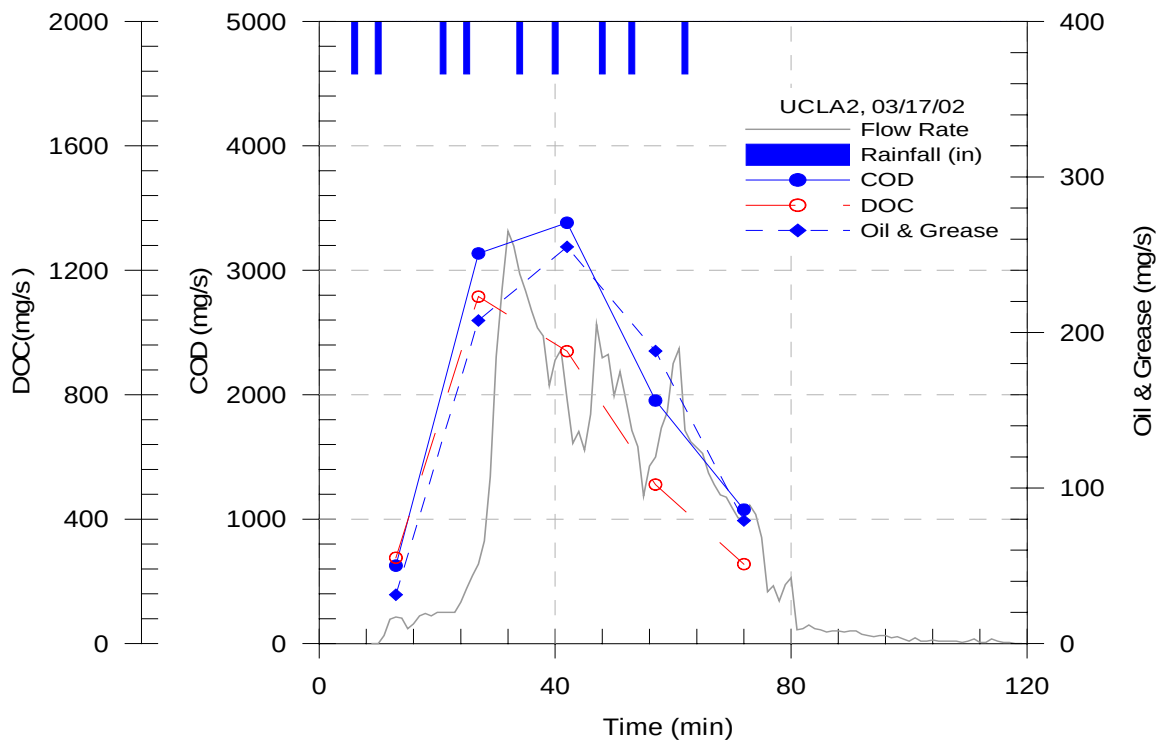

Figure I.3.2.8b[2] (Y3-UCLA2-E9-2). Load-graph for COD, DOC, Oil & Grease and pH

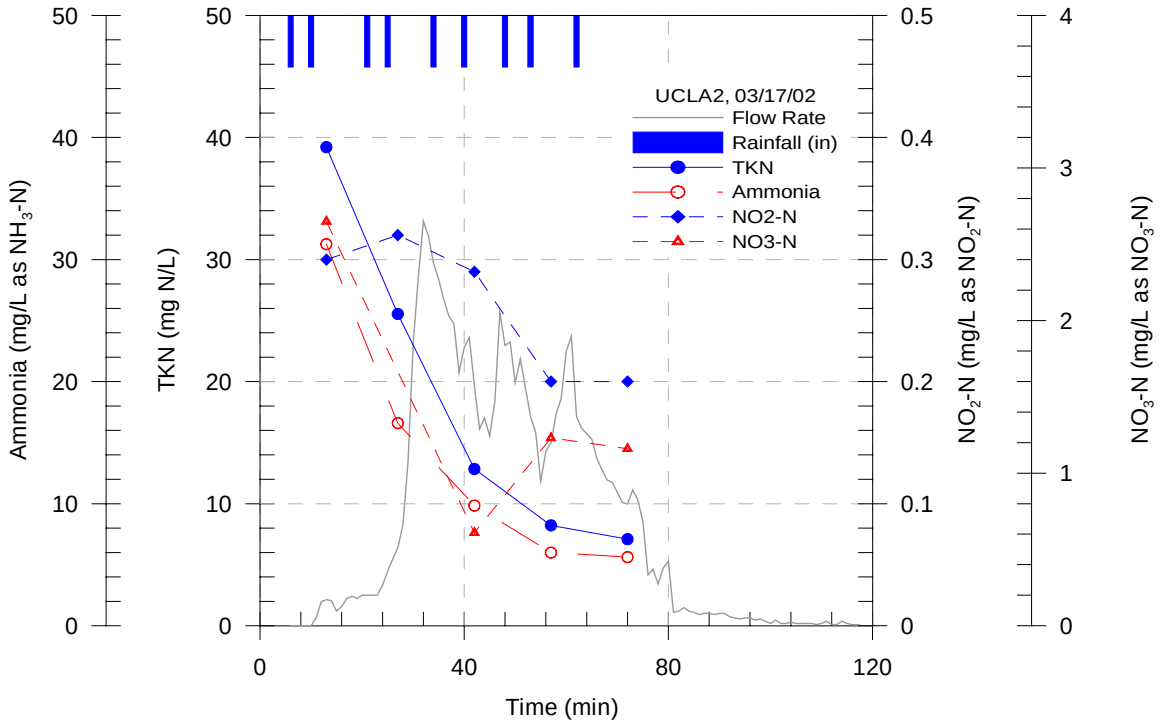

Figure I.3.2.8c[1] (Y3-UCLA2-E9-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

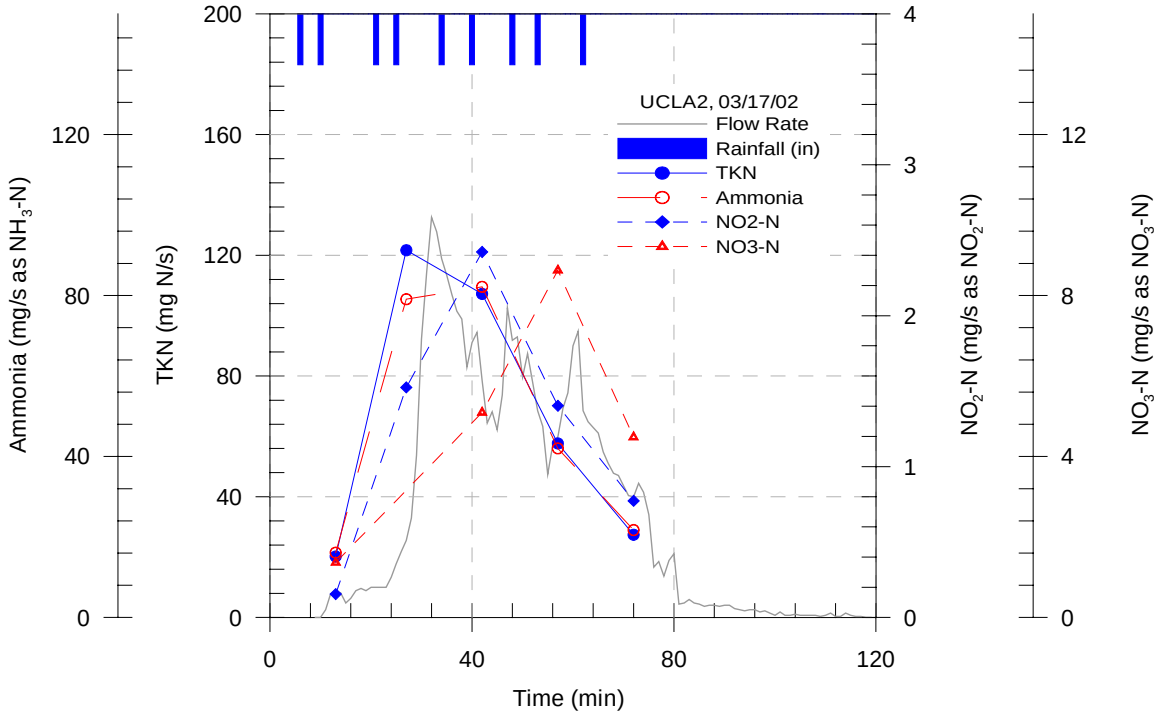

Figure I.3.2.8c[2] (Y3-UCLA2-E9-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

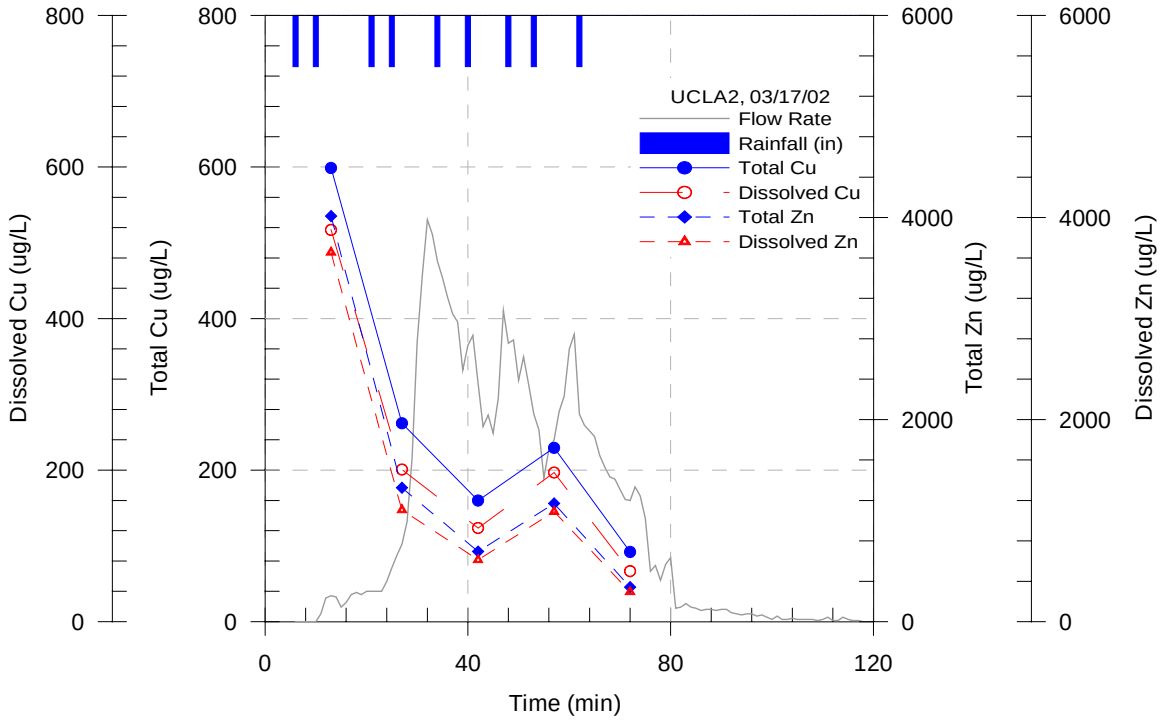

Figure I.3.2.8d[1] (Y3-UCLA2-E9-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

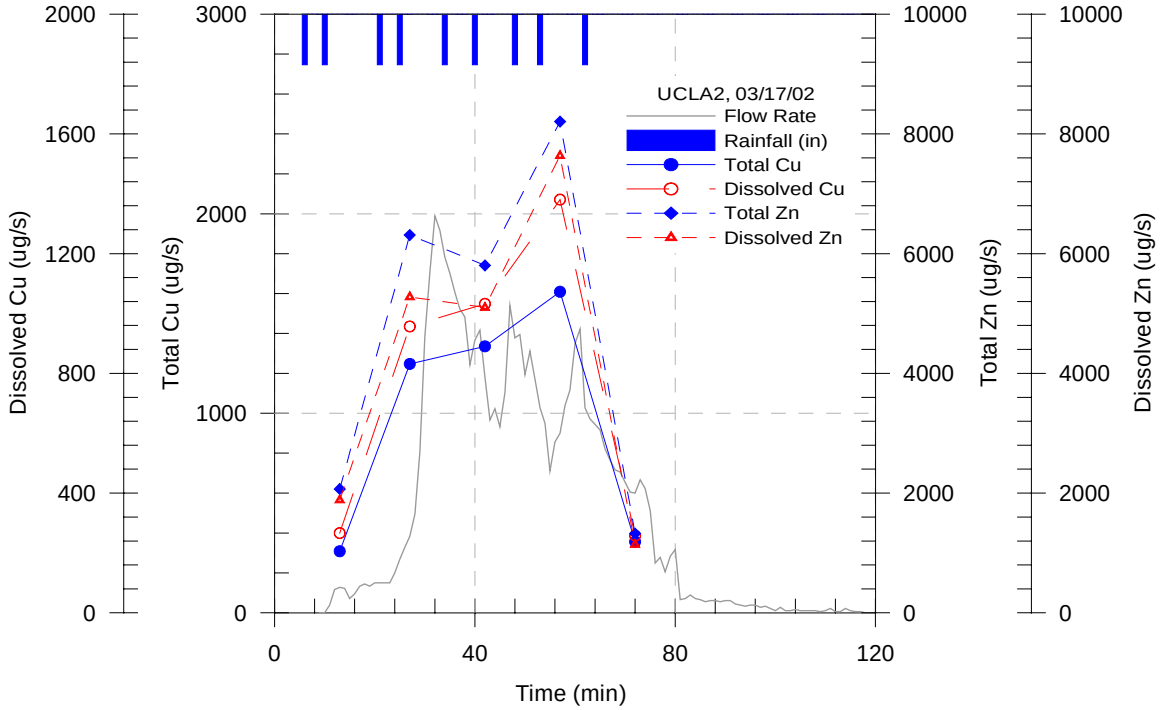

Figure I.3.2.8d[2] (Y3-UCLA2-E9-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

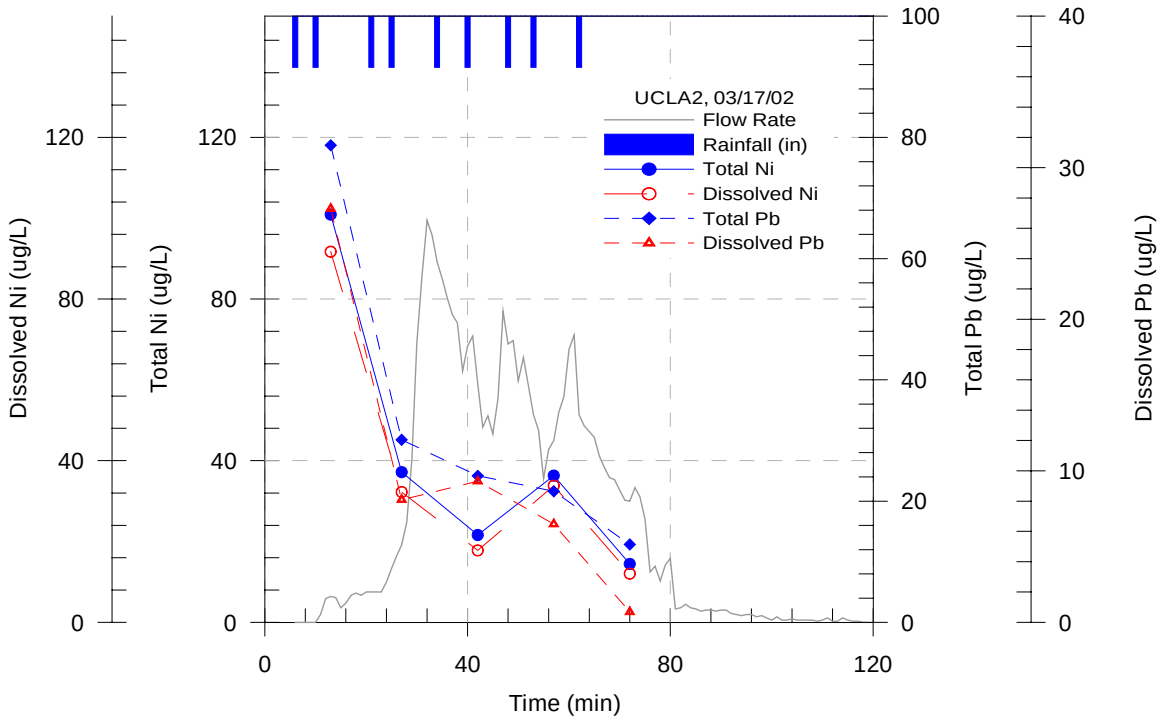

Figure I.3.2.8e[1] (Y3-UCLA2-E9-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

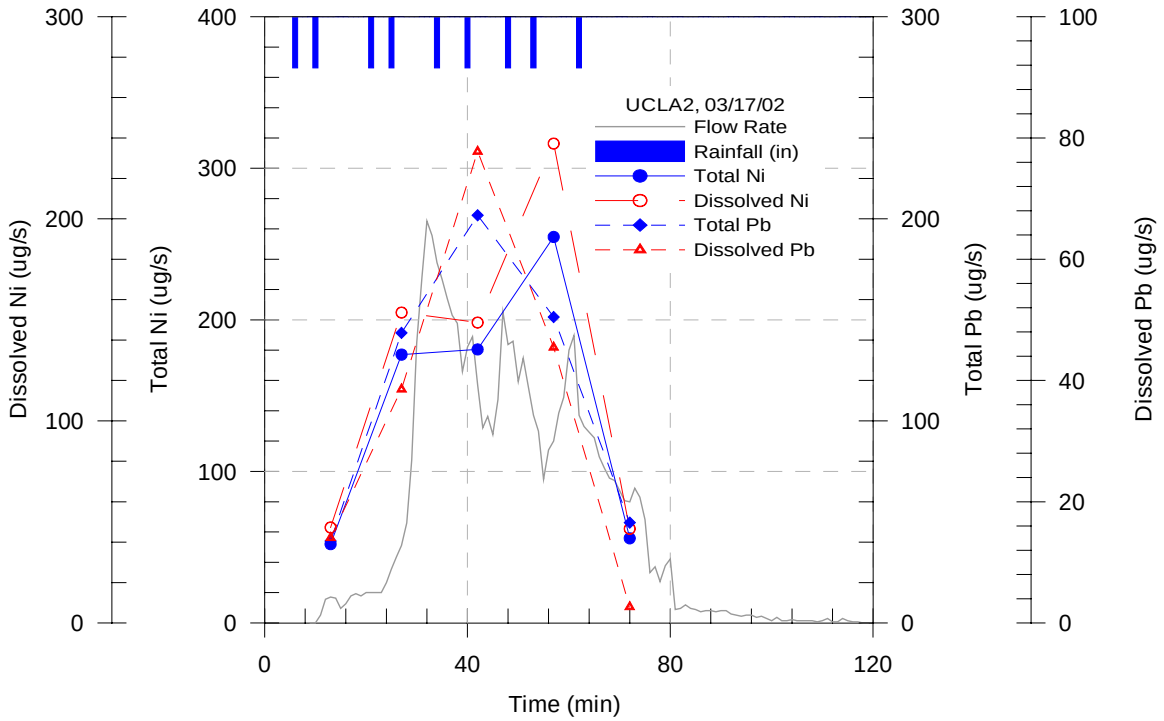

Figure I.3.2.8e[2] (Y3-UCLA2-E9-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

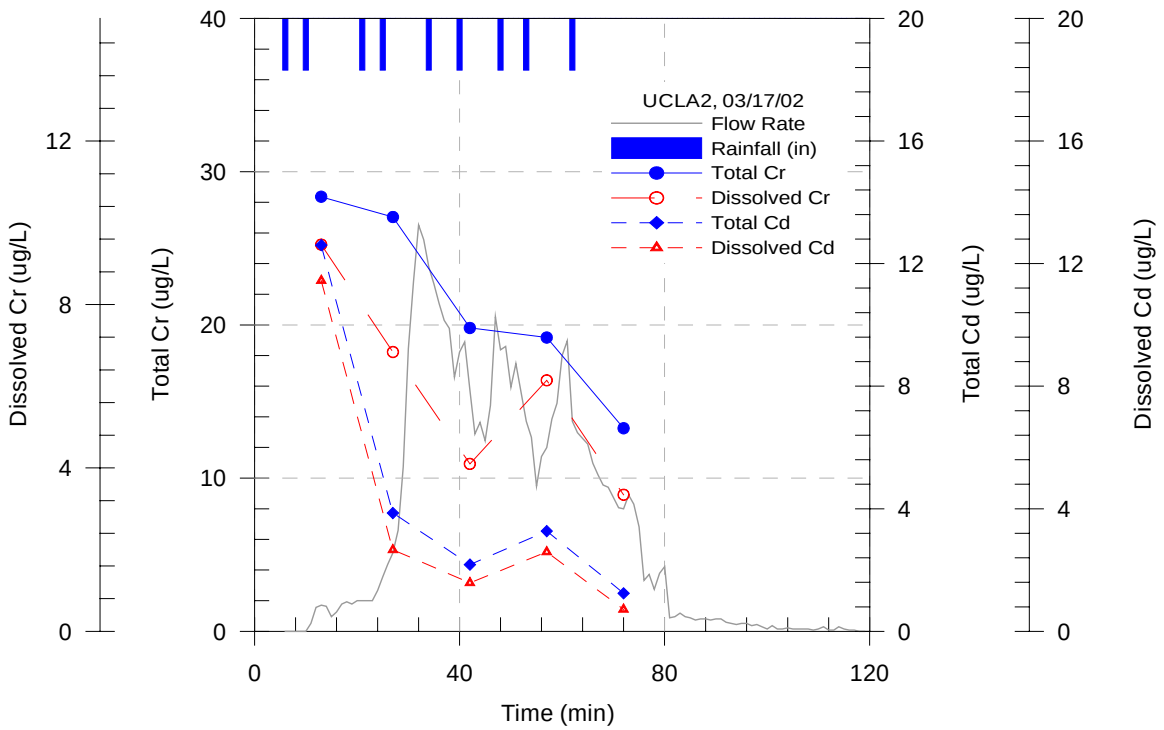

Figure I.3.2.8f[1] (Y3-UCLA2-E9-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

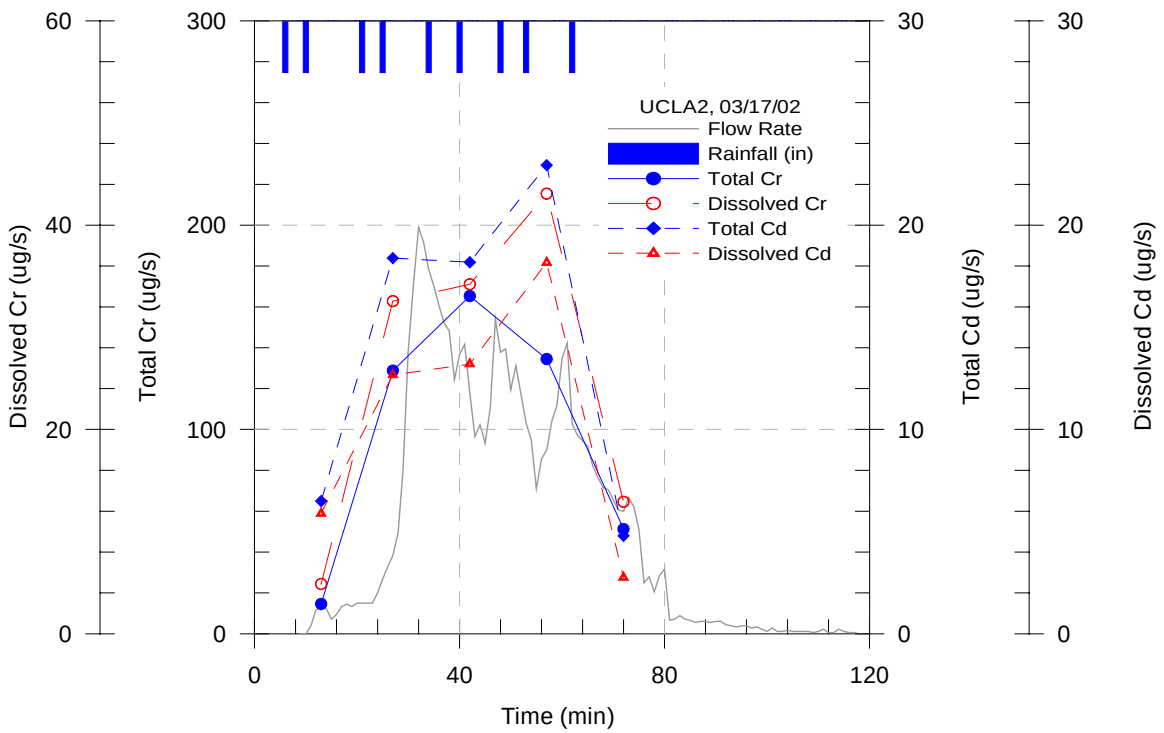

Figure I.3.2.8f[2] (Y3-UCLA2-E9-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

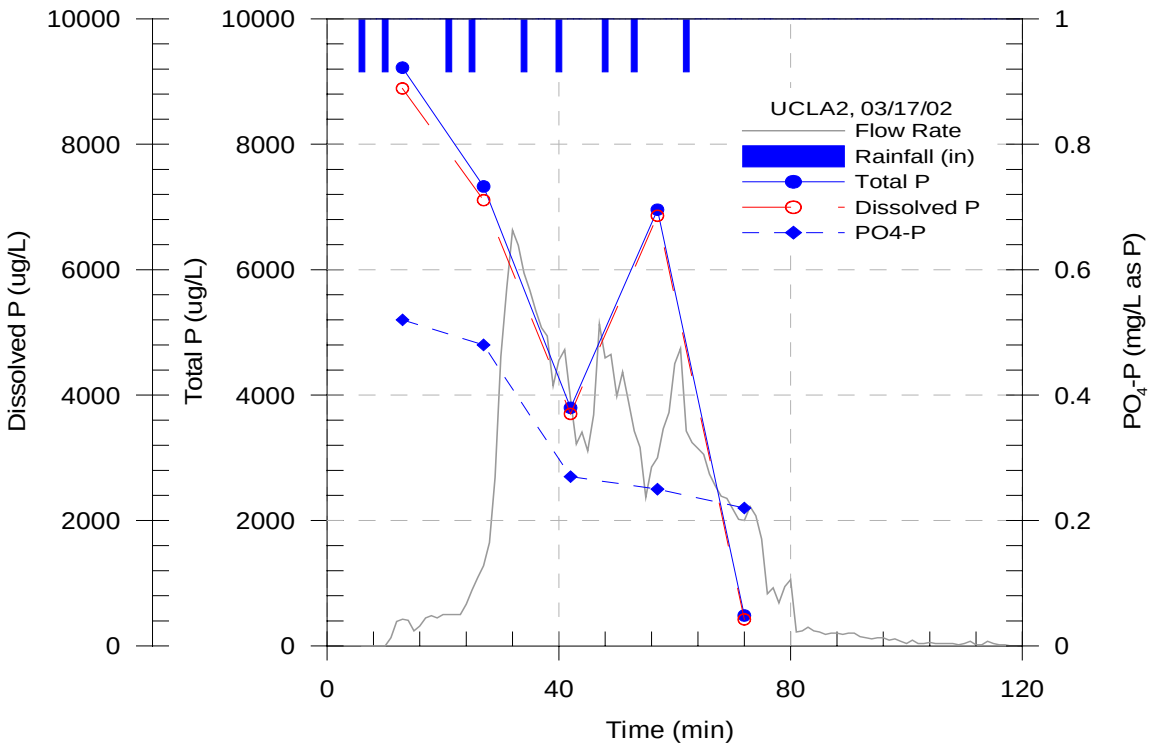

Figure I.3.2.8g[1] (Y3-UCLA2-E9-7). Polluto-graph for Total P / PO_4^{3-}-P

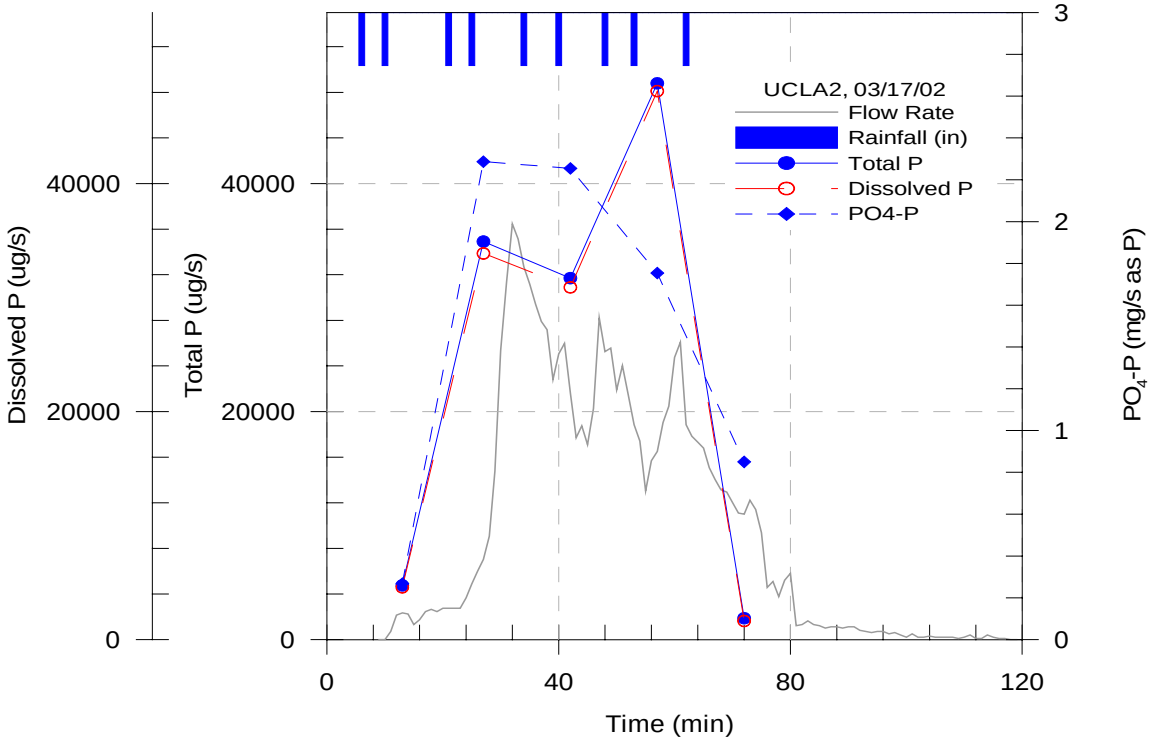

Figure I.3.2.8g[2] (Y3-UCLA2-E9-7). Load -graph for Total P / PO_4^{3-}P

1. UCLA3, 10/30/01

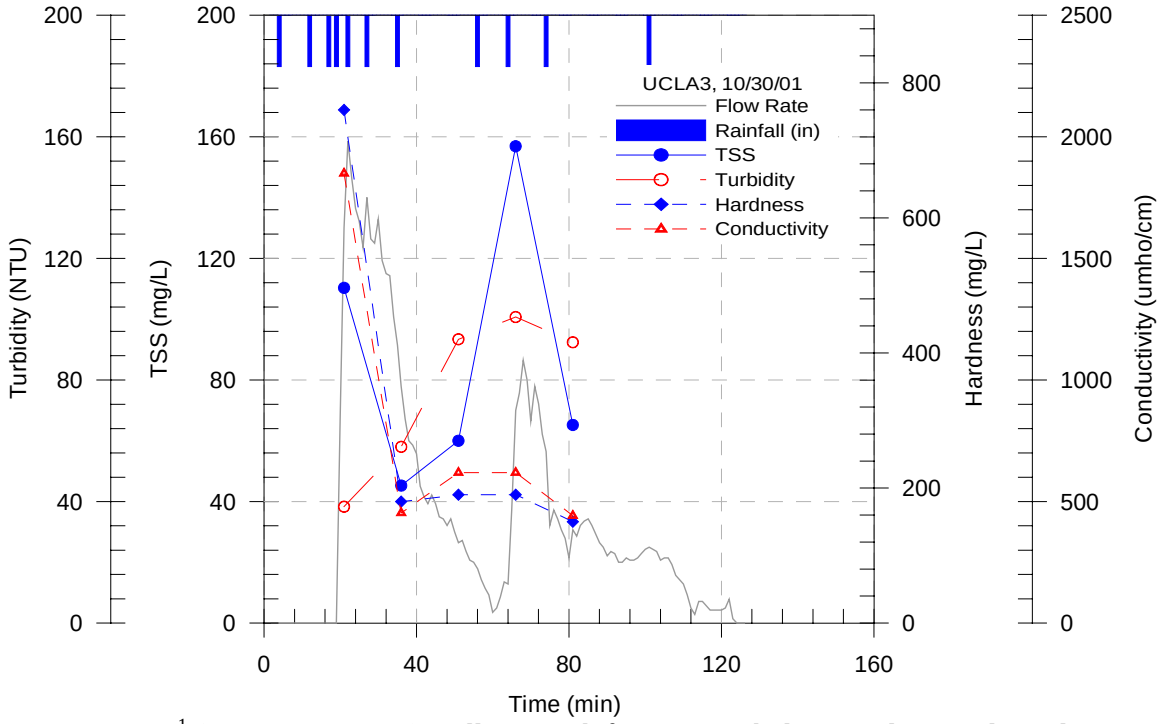

Figure I.3.3.1a[1] (Y3-UCLA3-E1-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

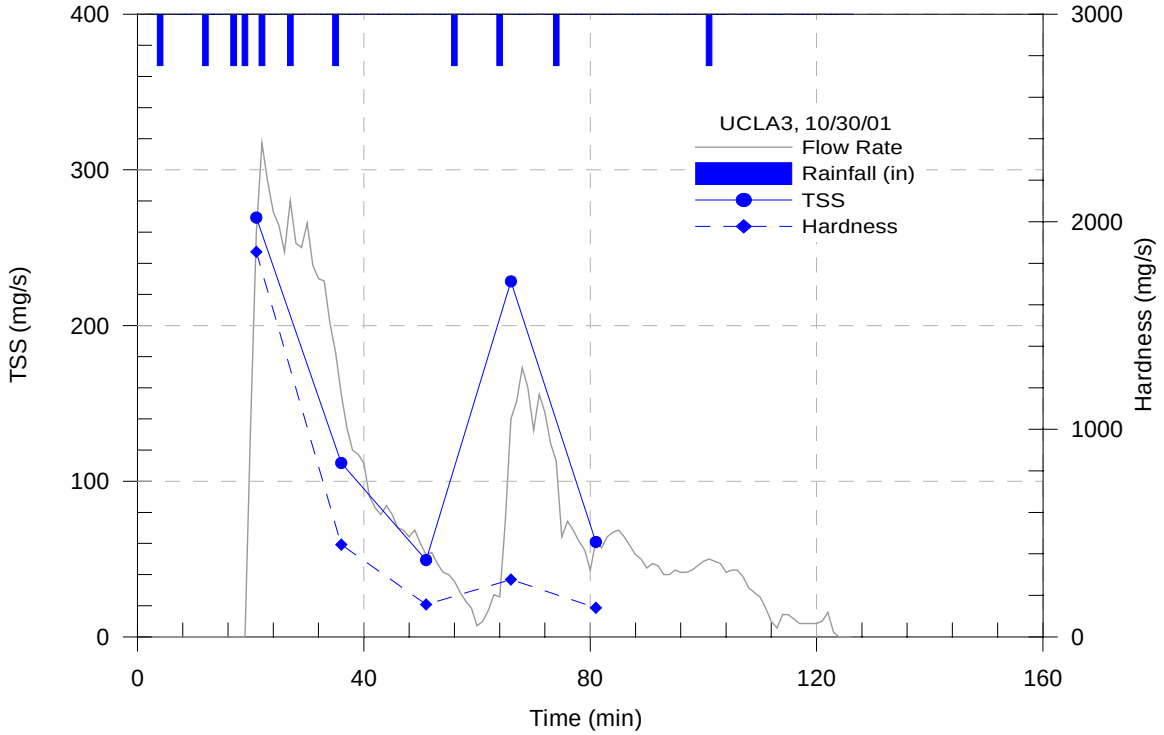

Figure I.3.3.1a[2] (Y3-UCLA3-E1-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

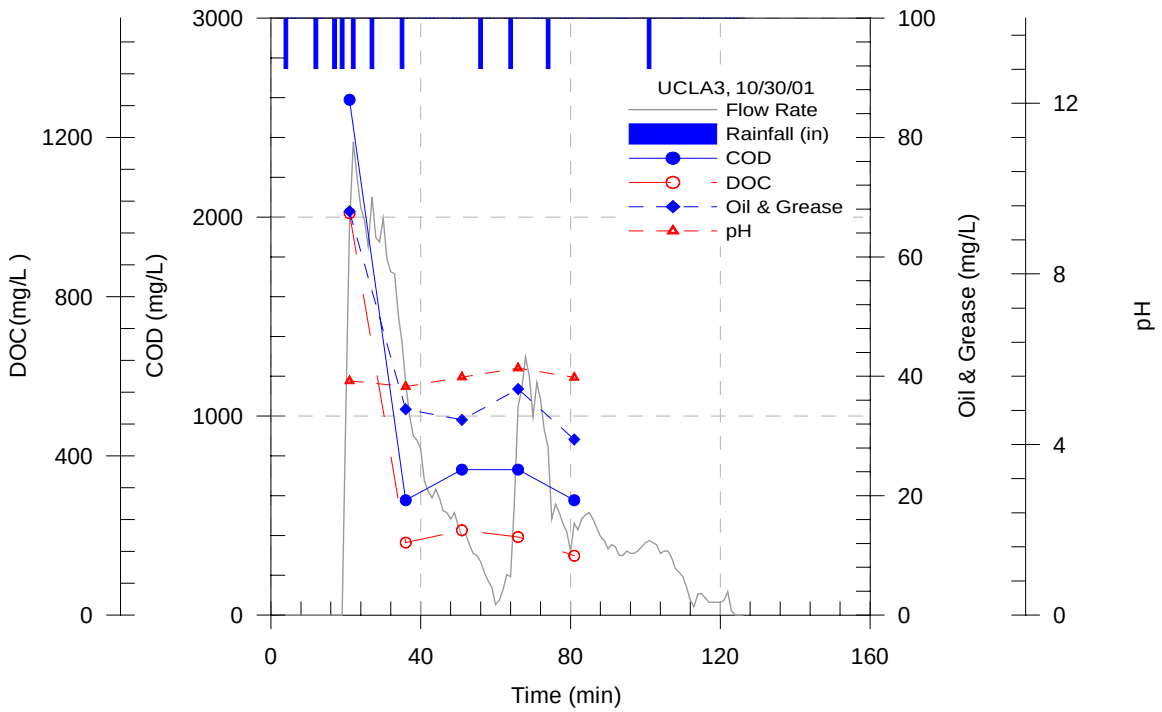

Figure I.3.3.1b[1] (Y3-UCLA3-E1-2). Polluto-graph for COD, DOC, Oil & Grease and pH

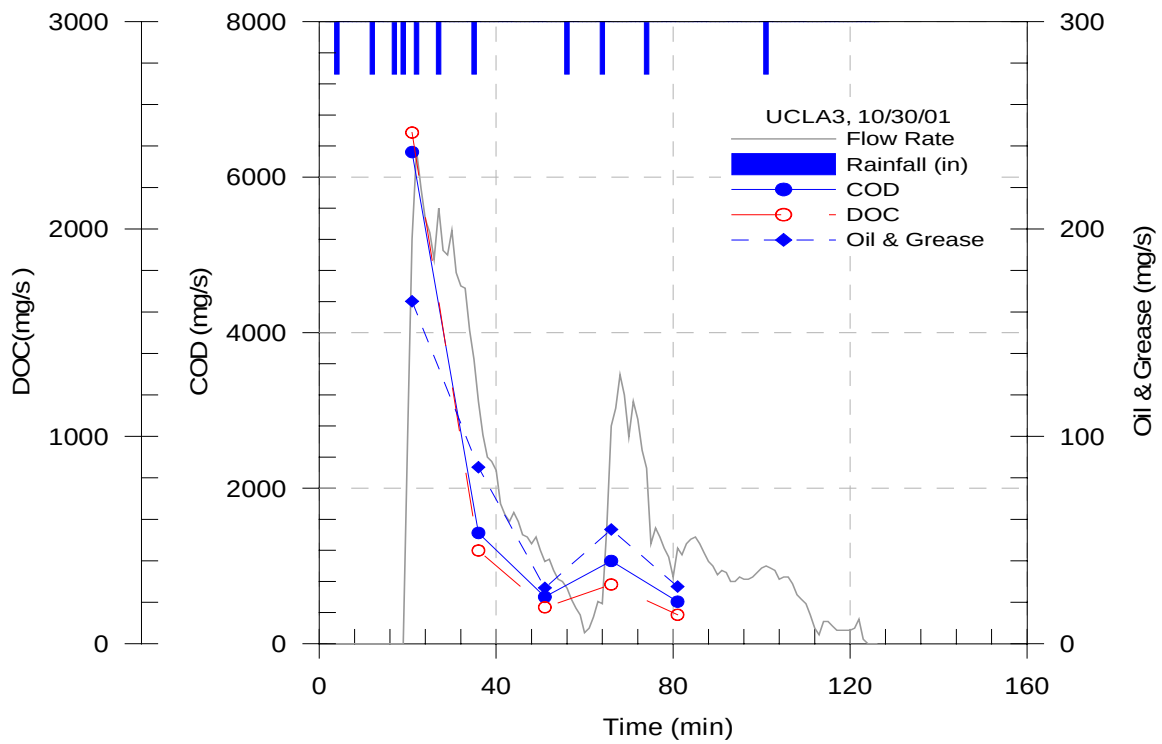

Figure I.3.3.1b[2] (Y3-UCLA3-E1-2). Load-graph for COD, DOC, Oil & Grease and pH

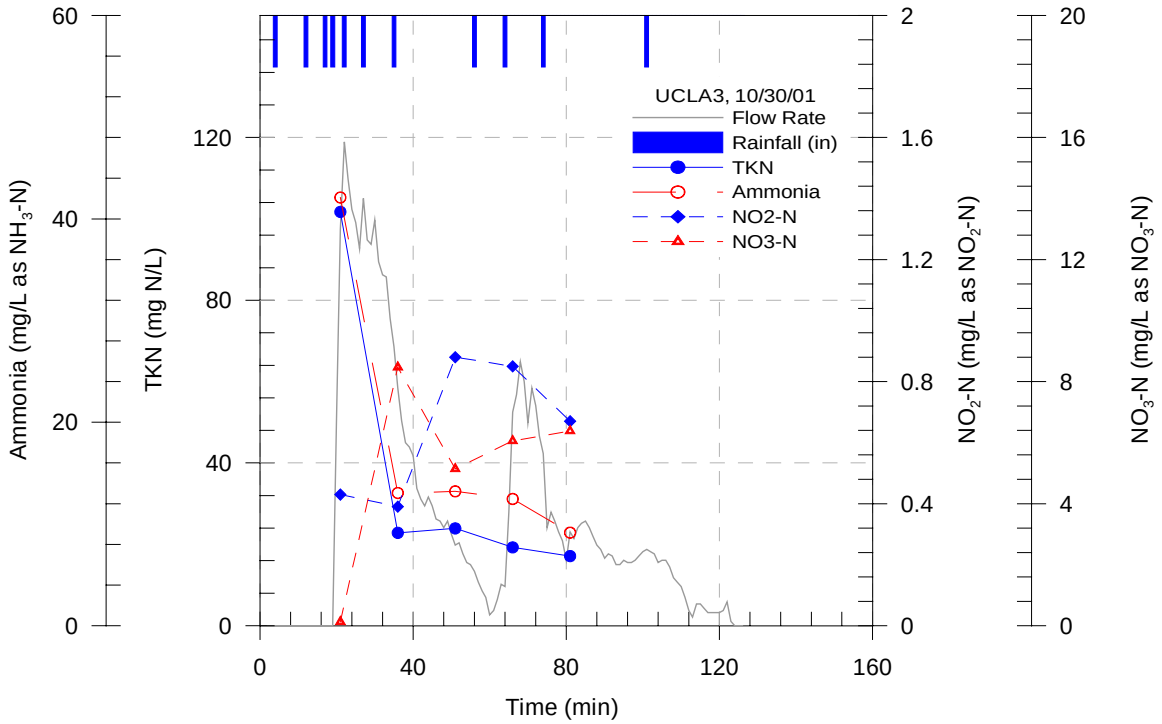

Figure I.3.3.1c[1] (Y3-UCLA3-E1-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

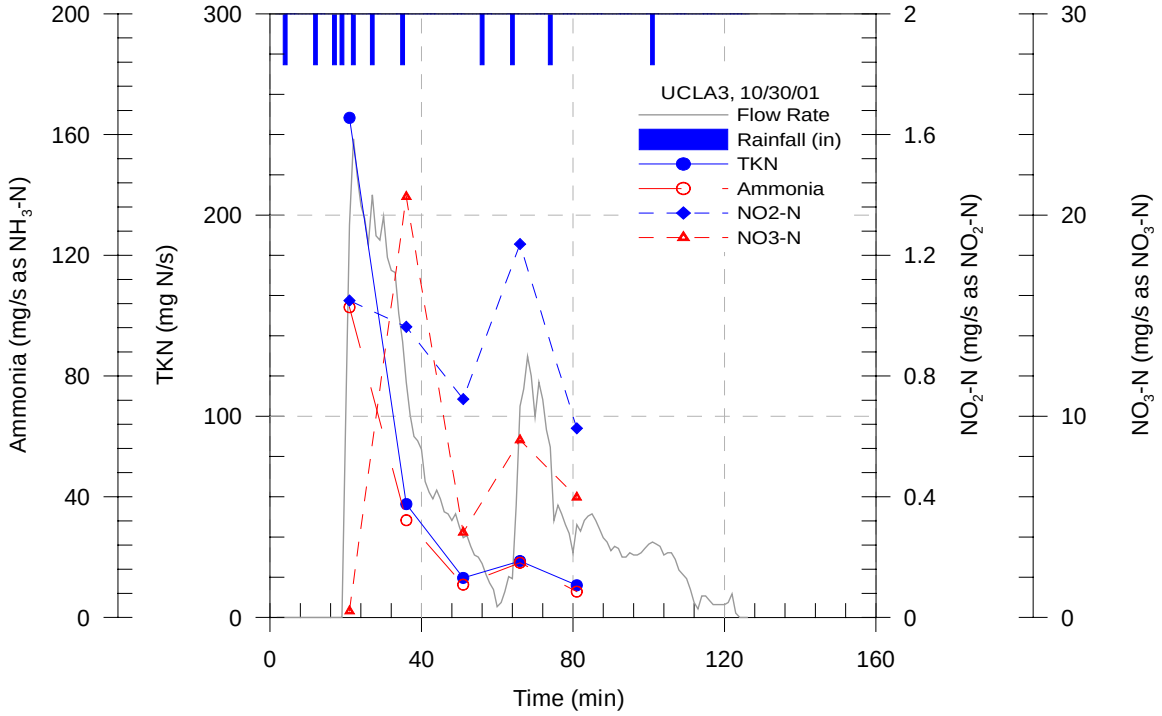

Figure I.3.3.1c[2] (Y3-UCLA3-E1-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

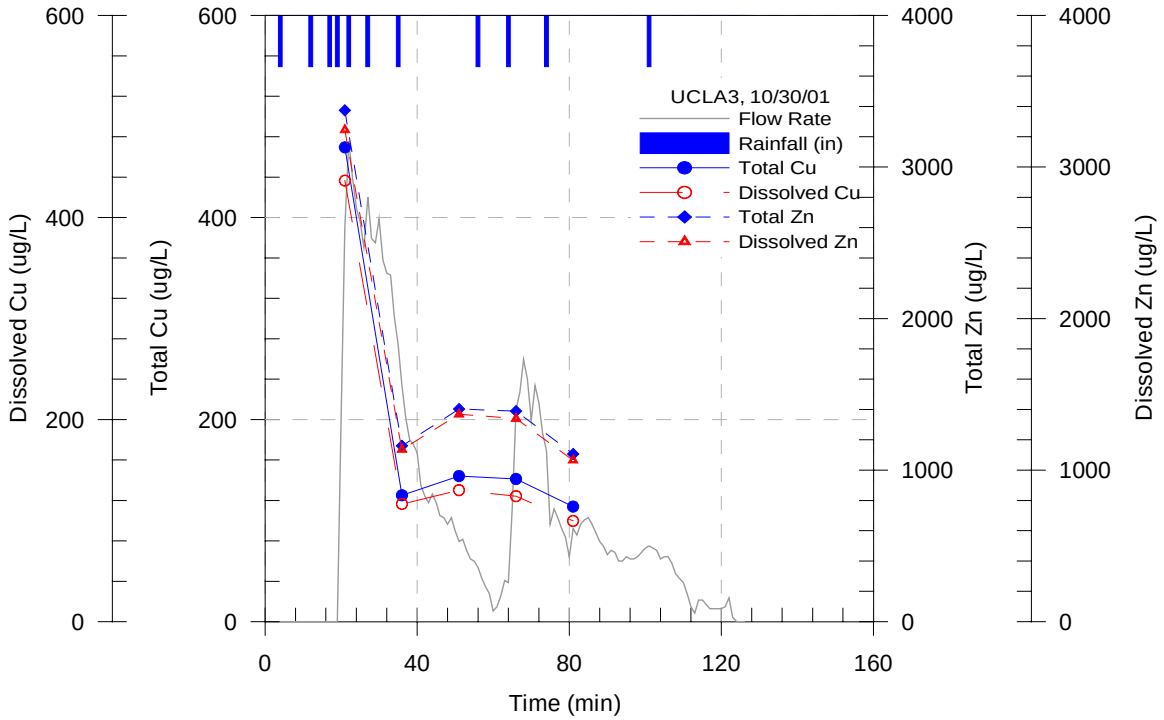

Figure I.3.3.1d[1] (Y3-UCLA3-E1-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

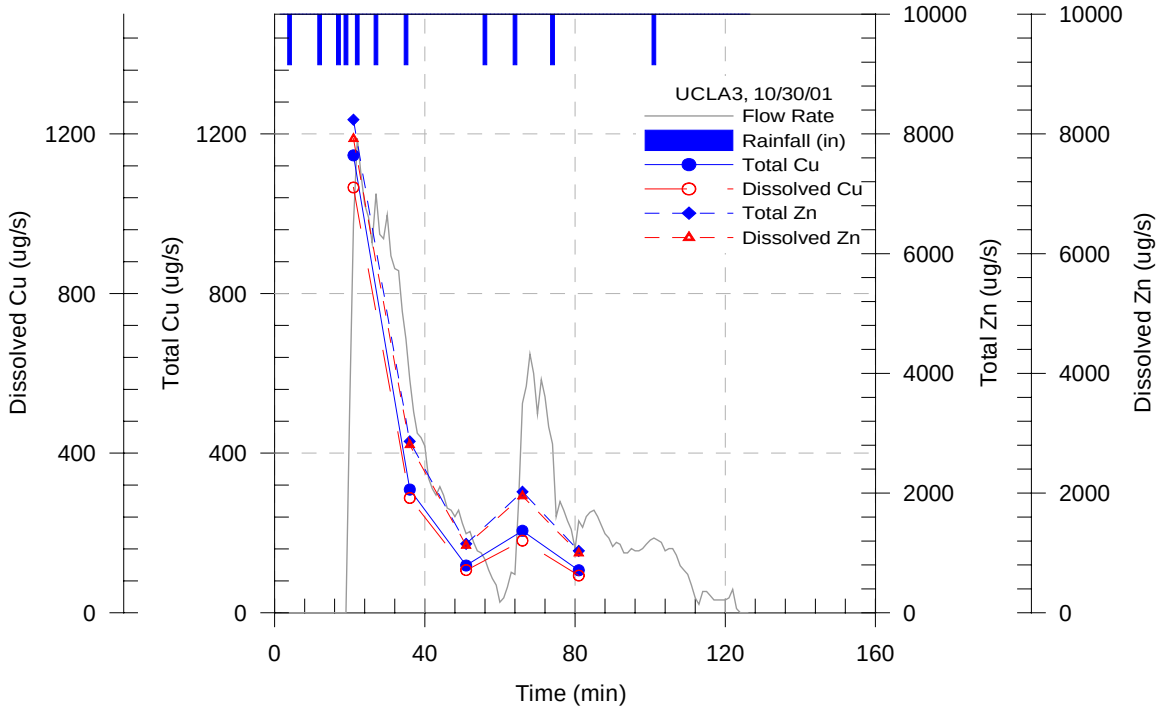

Figure I.3.3.1d[2] (Y3-UCLA3-E1-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

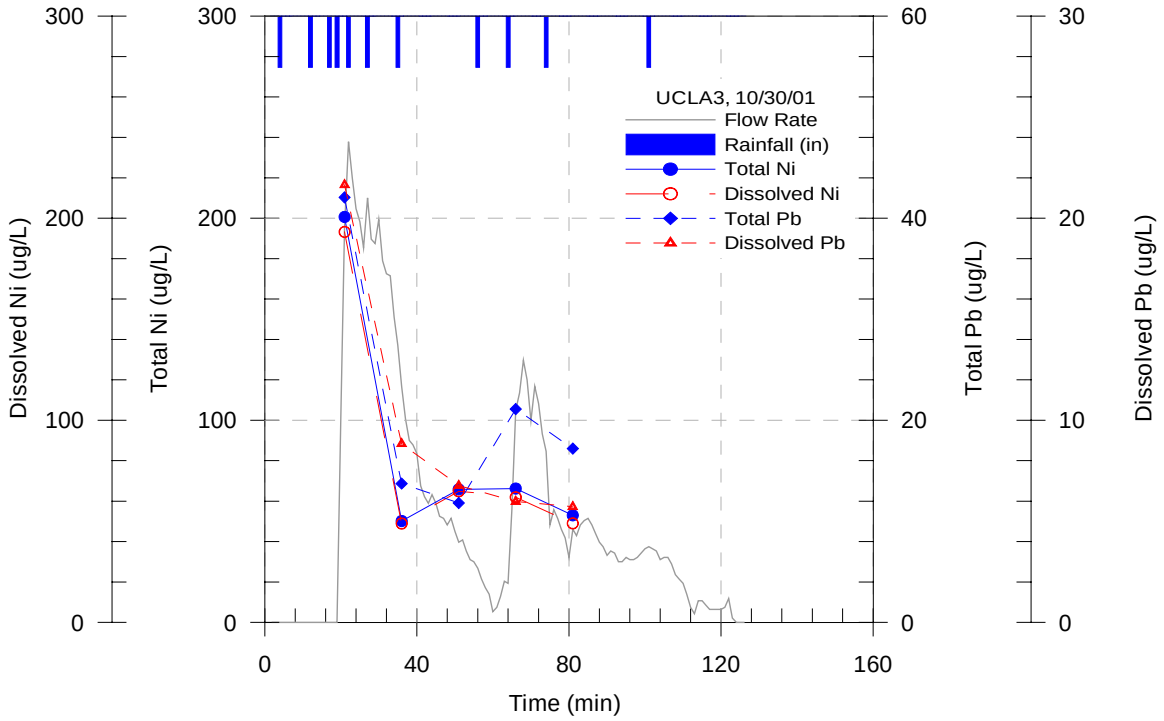

Figure I.3.3.1e[1] (Y3-UCLA3-E1-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

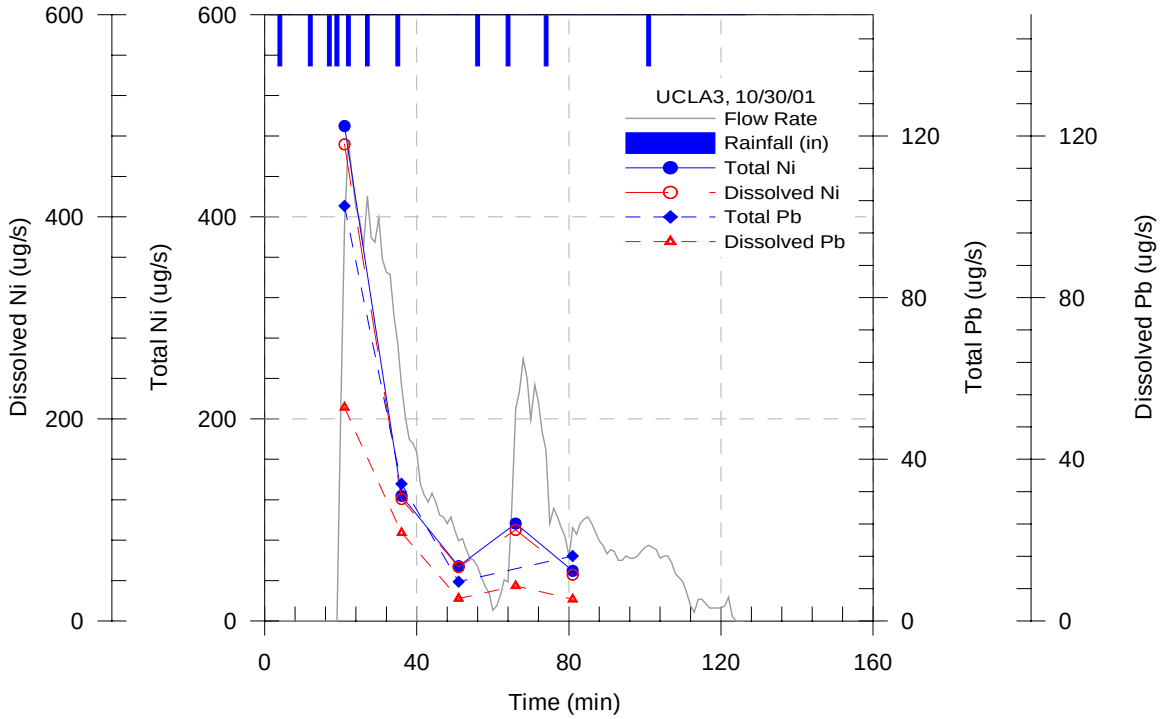

Figure I.3.3.1e[2] (Y3-UCLA3-E1-5(b). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

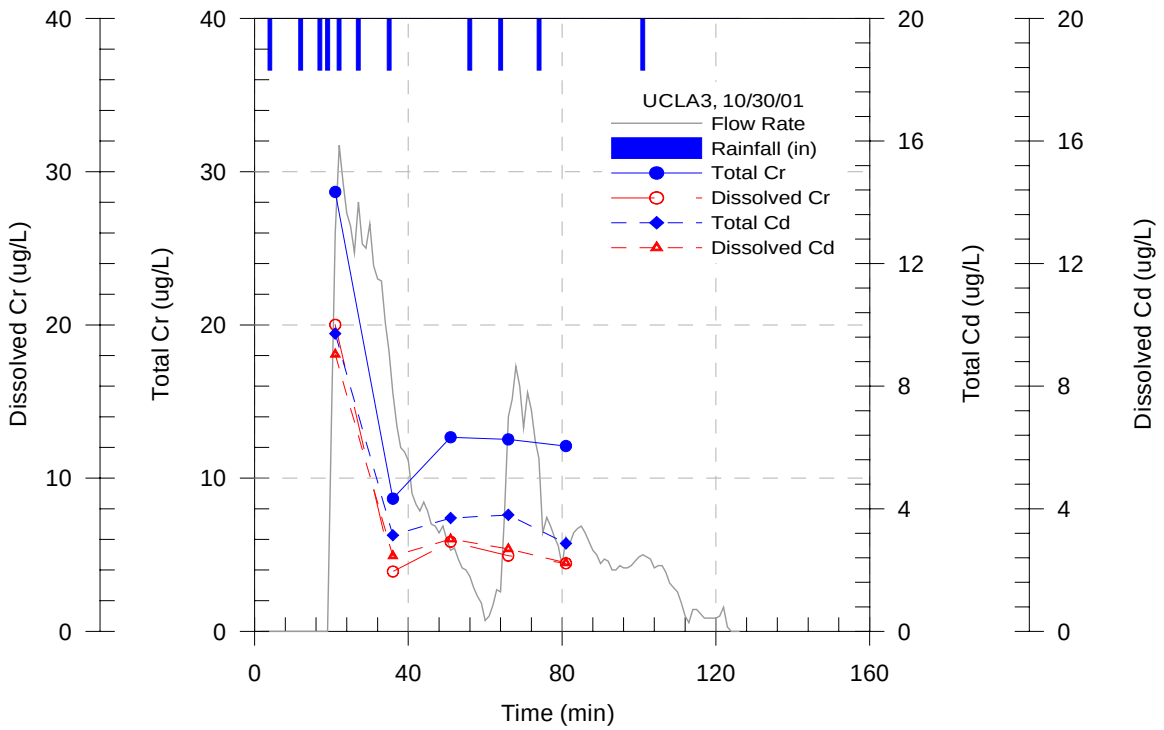

Figure I.3.3.1f[1] (Y3-UCLA3-E1-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

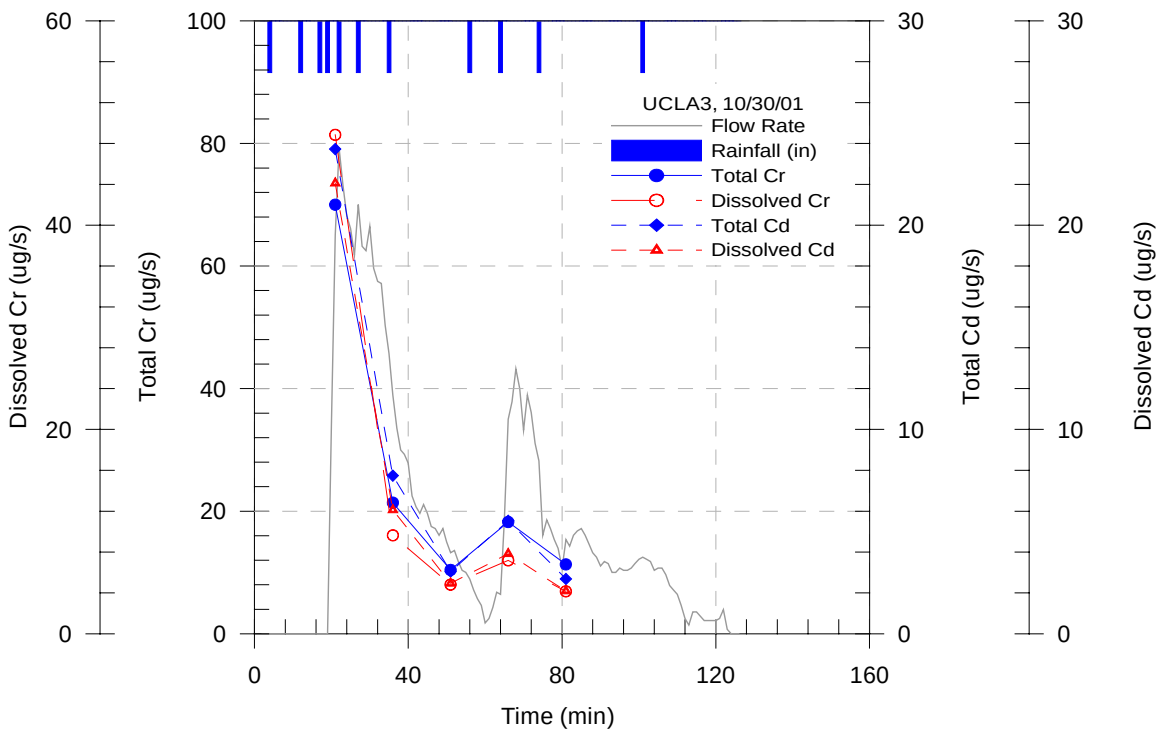

Figure I.3.3.1f[2] (Y3-UCLA3-E1-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

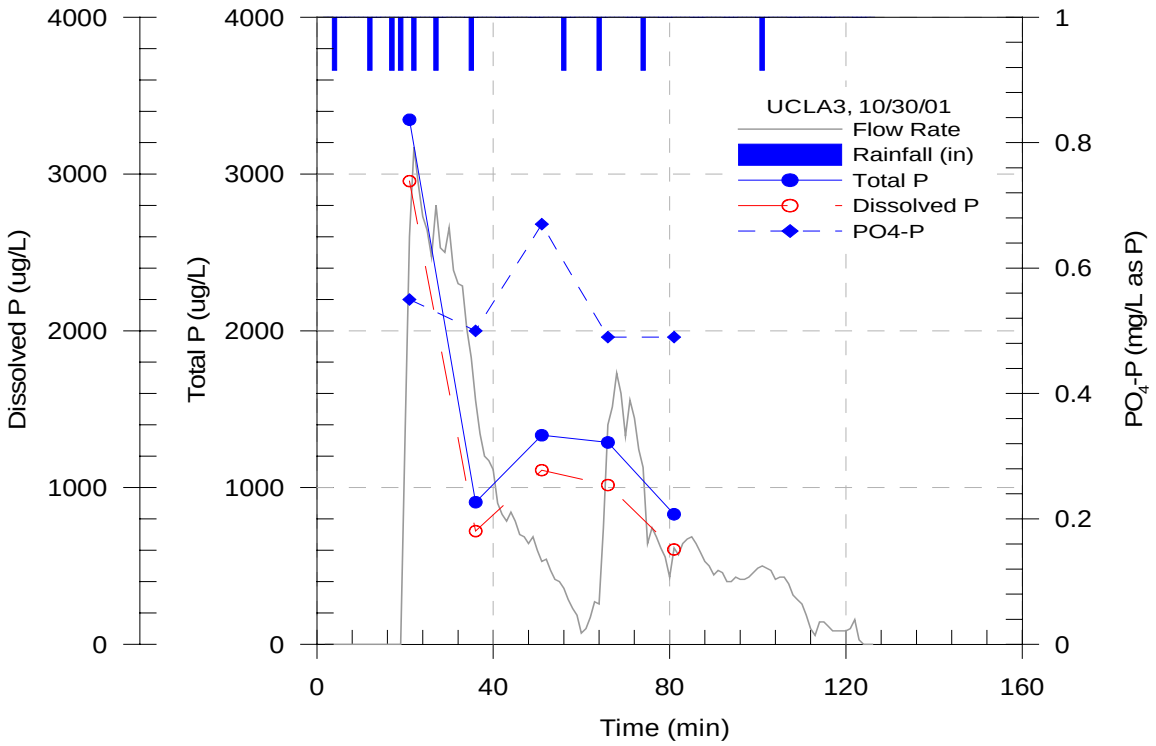

Figure I.3.3.1g[1] (Y3-UCLA3-E1-7). Polluto-graph for Total P / PO_4^{3-}-P

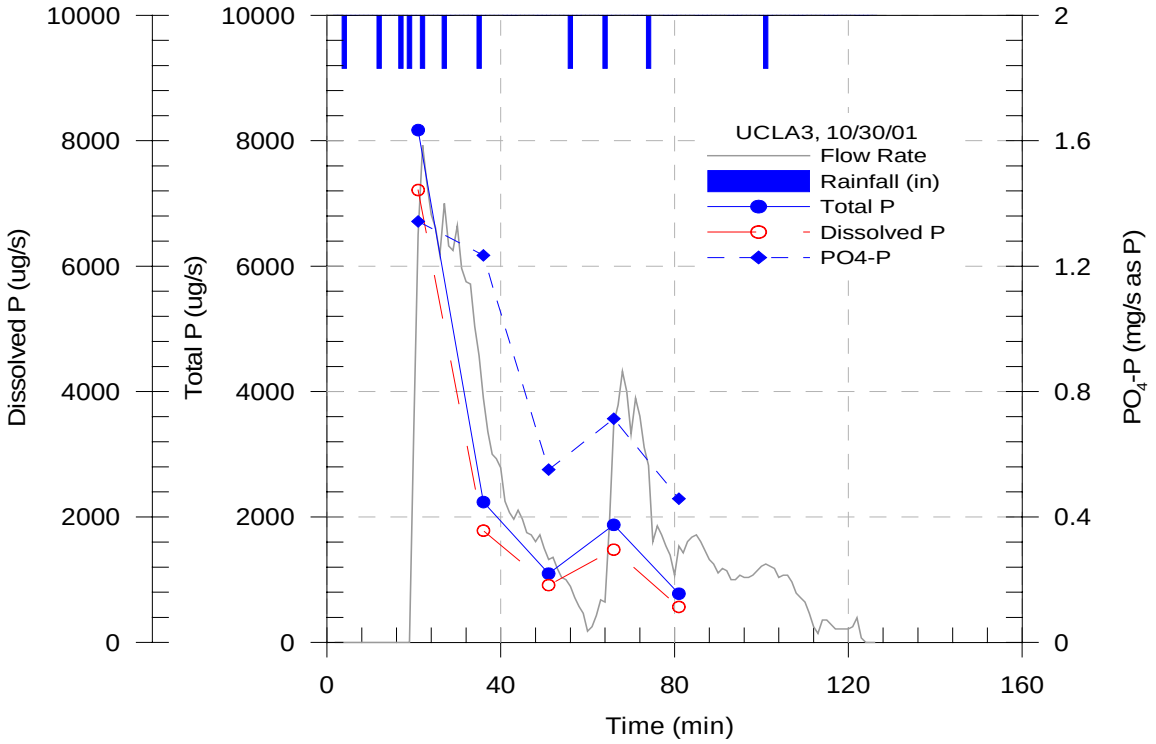

Figure I.3.3.1g[2] (Y3-UCLA3-E1-7). Load -graph for Total P / PO_4^{3-}P

2. UCLA3, 11/12/01

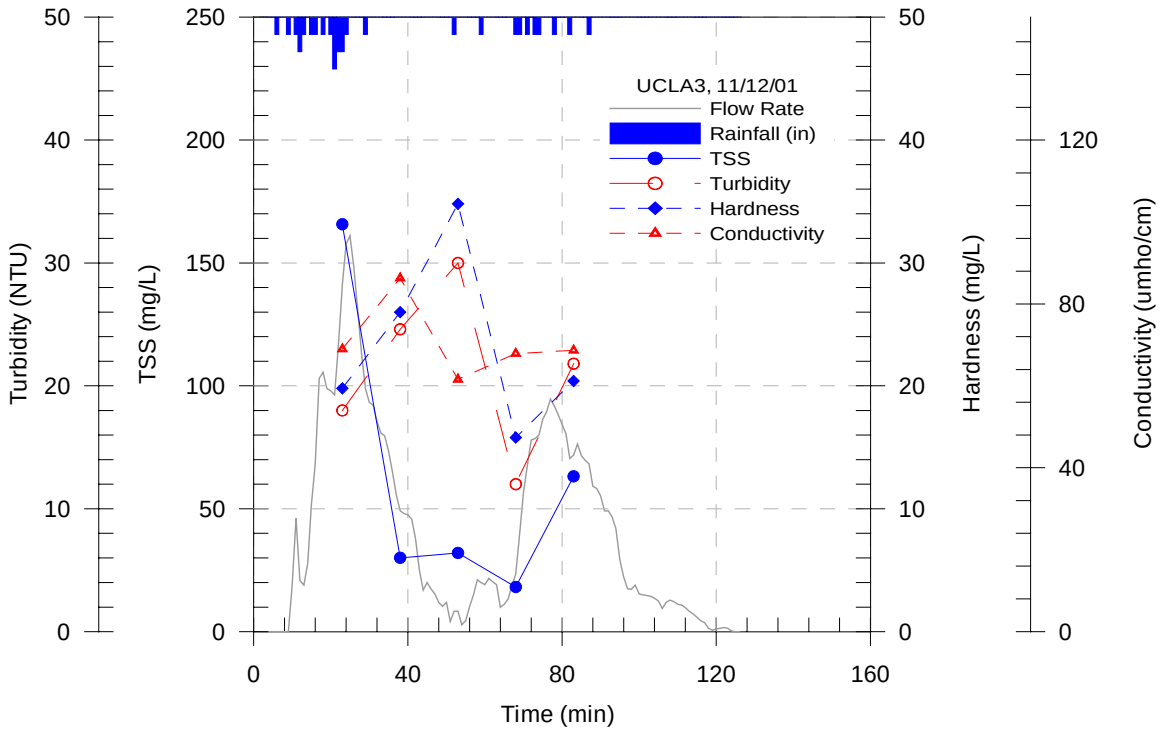

Figure I.3.3.2a[1] (Y3-UCLA3-E2-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

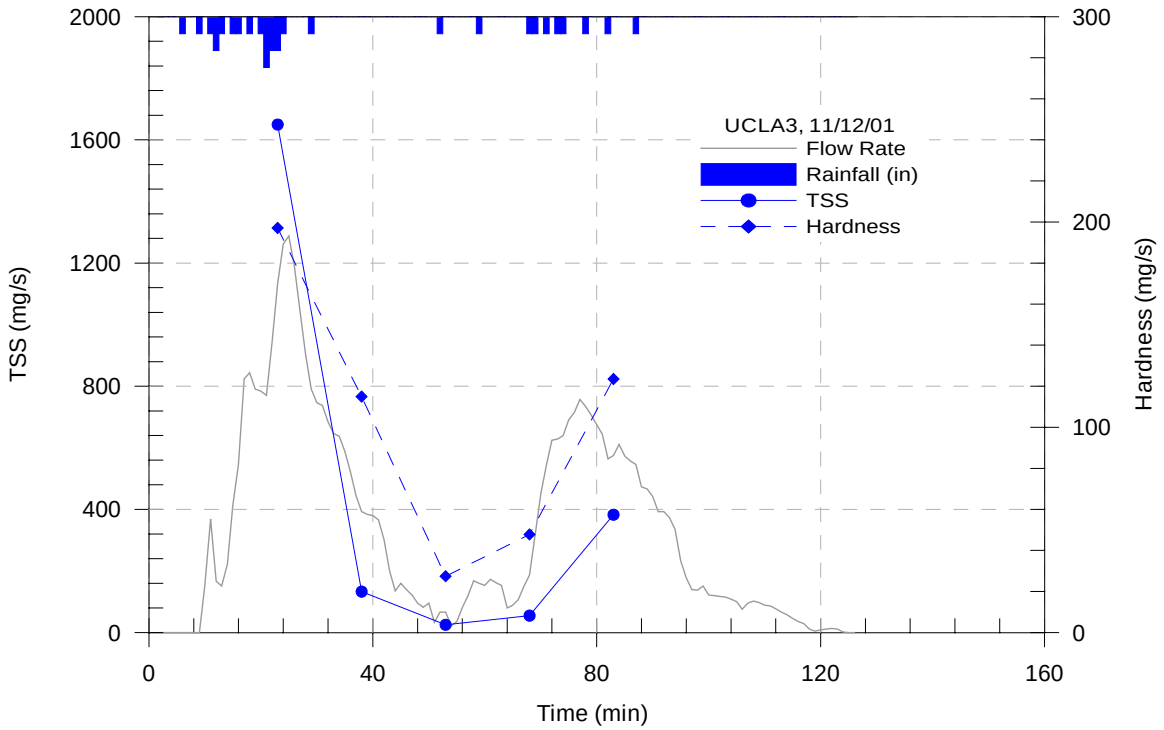

Figure I.3.3.2a[2] (Y3-UCLA3-E2-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

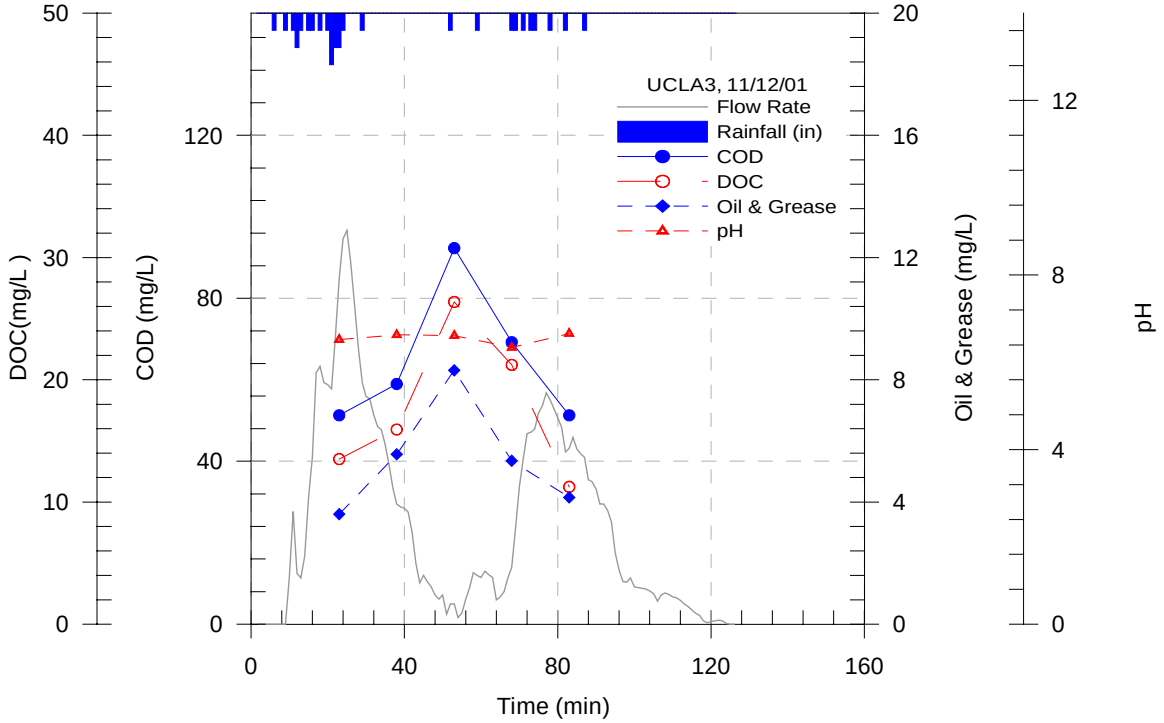

Figure I.3.3.2b[1] (Y3-UCLA3-E2-2). Polluto-graph for COD, DOC, Oil & Grease and pH

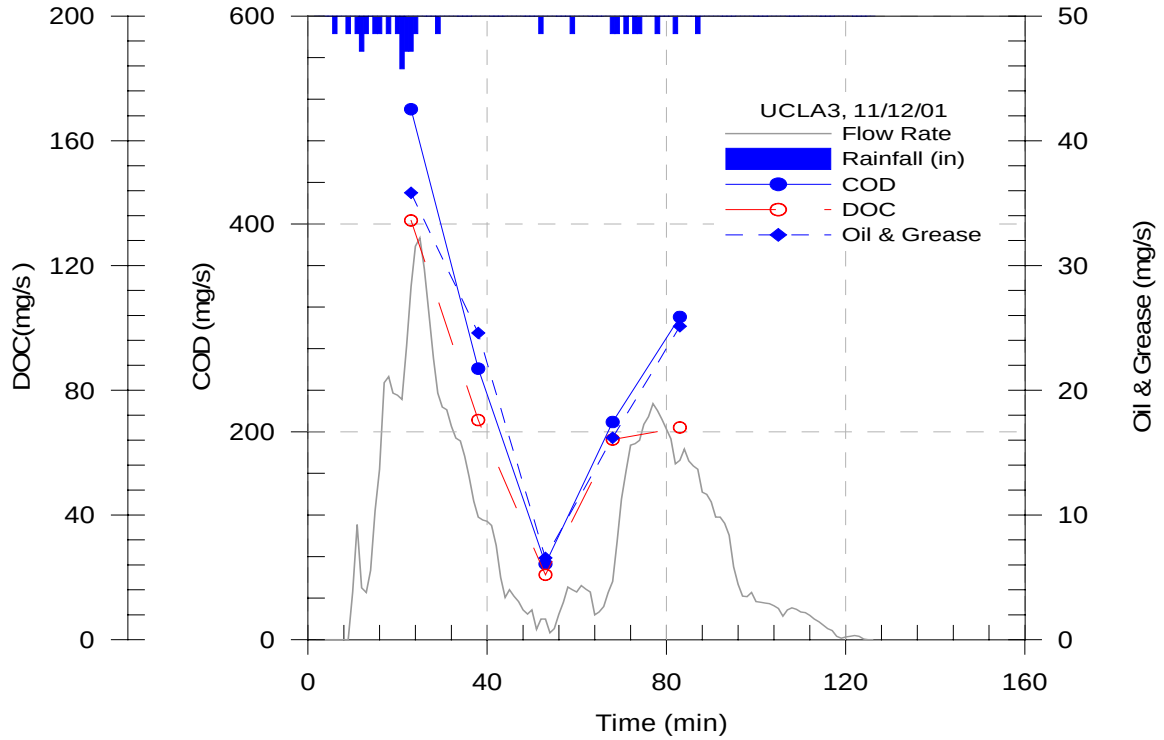

Figure I.3.3.2b[2] (Y3-UCLA3-E2-2). Load-graph for COD, DOC, Oil & Grease and pH

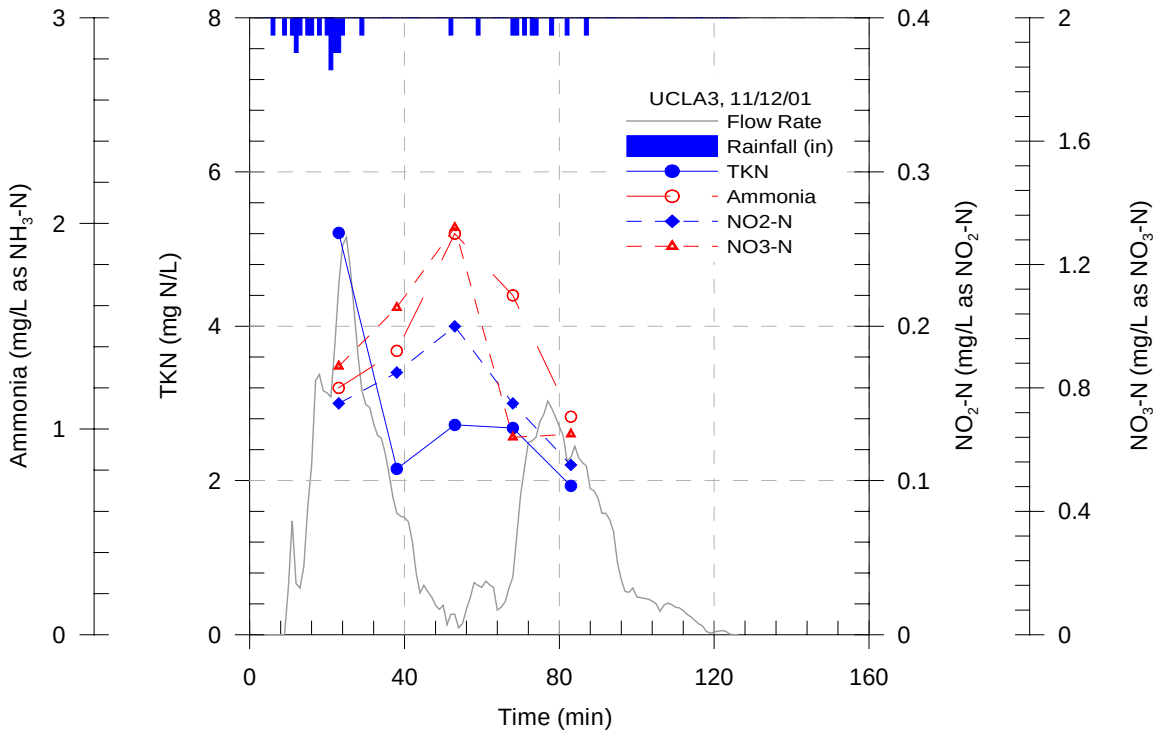

Figure I.3.3.2c[1] (Y3-UCLA3-E2-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

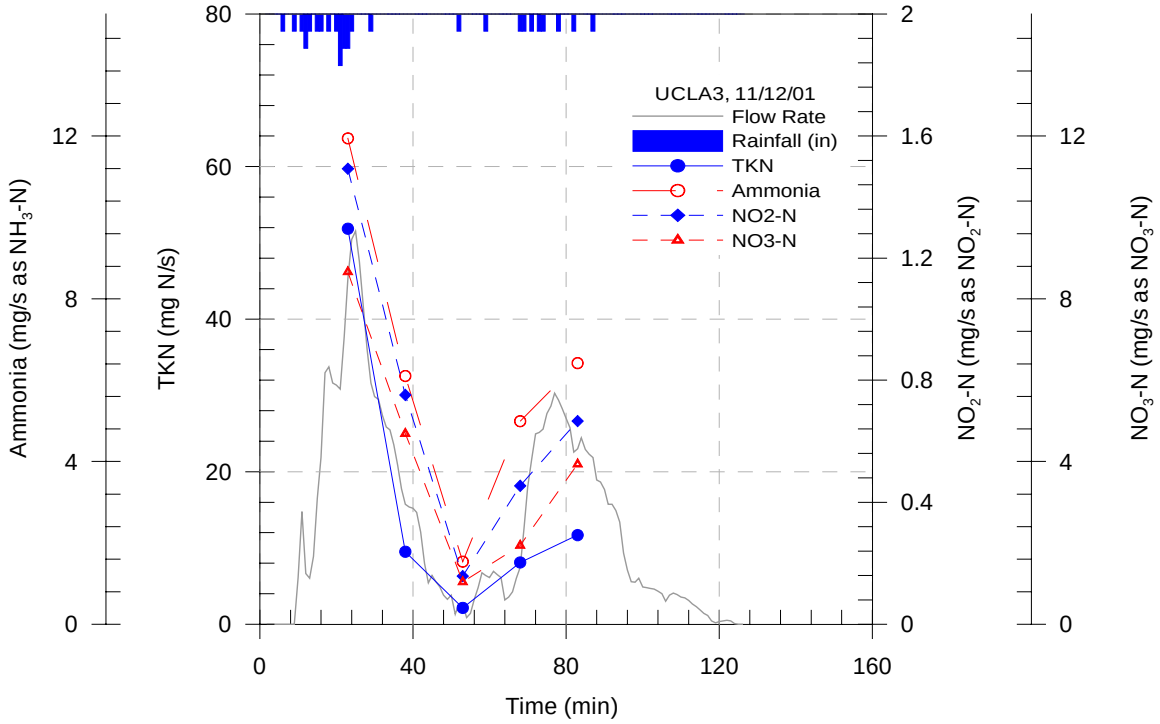

Figure I.3.3.2c[2] (Y3-UCLA3-E2-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

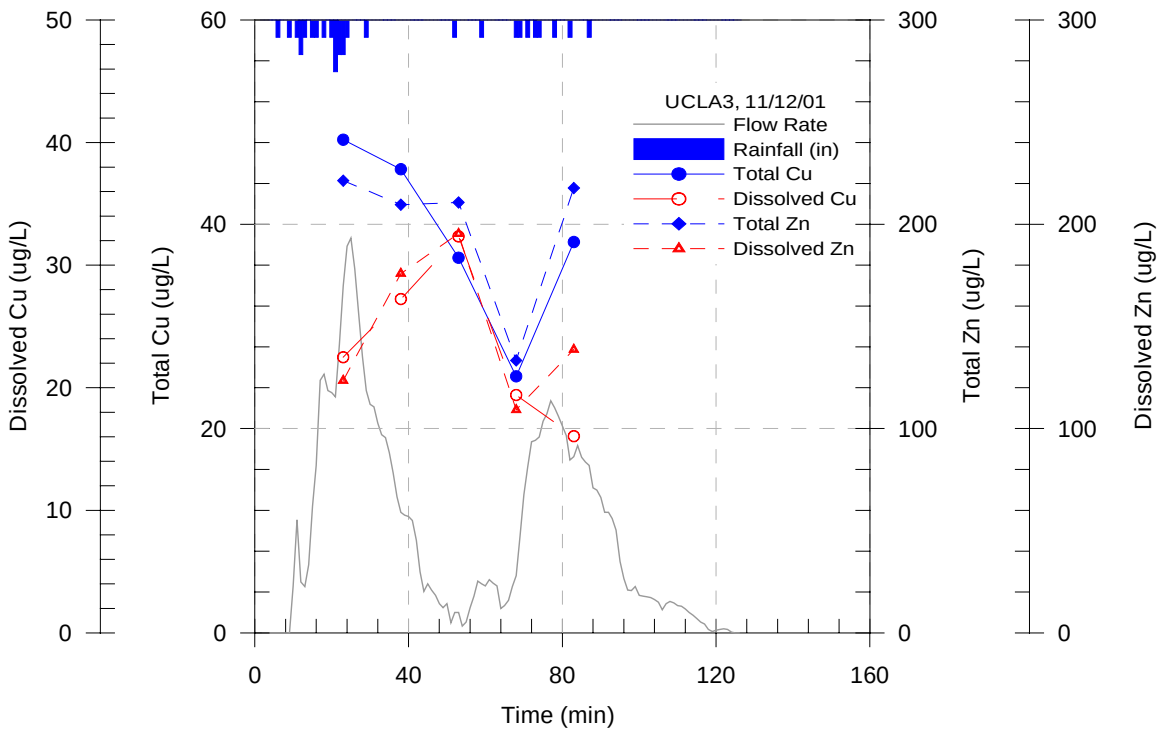

Figure I.3.3.2d[1] (Y3-UCLA3-E2-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

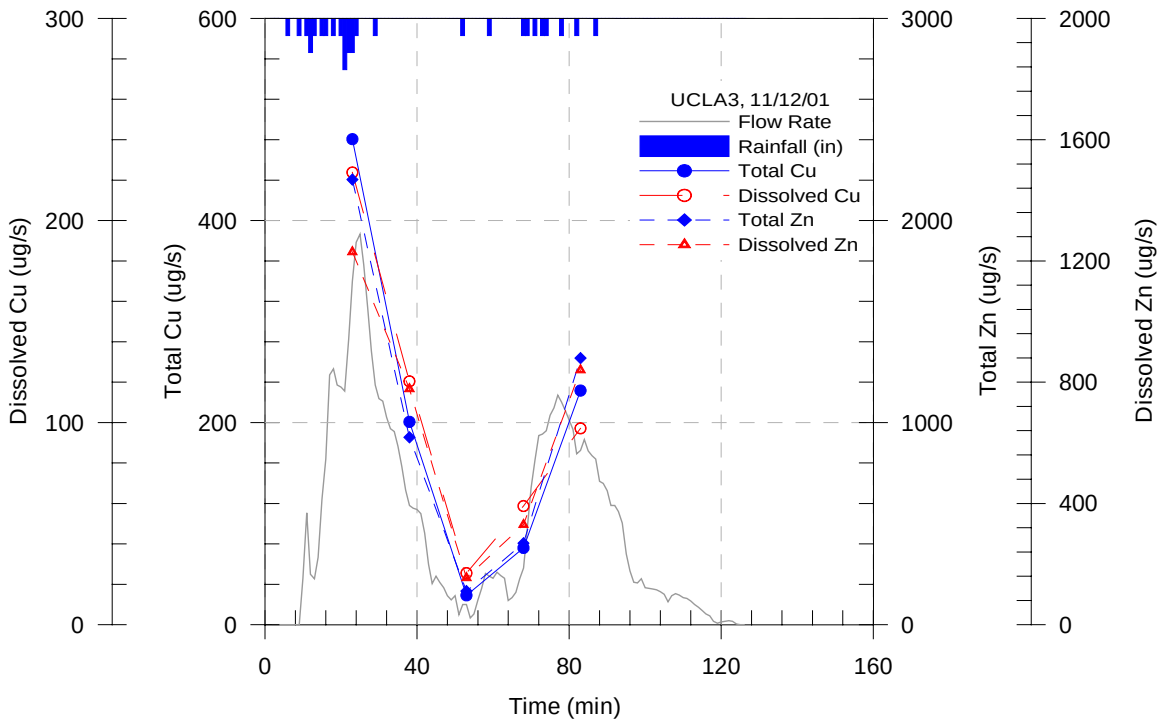

Figure I.3.3.2d[2] (Y3-UCLA3-E2-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

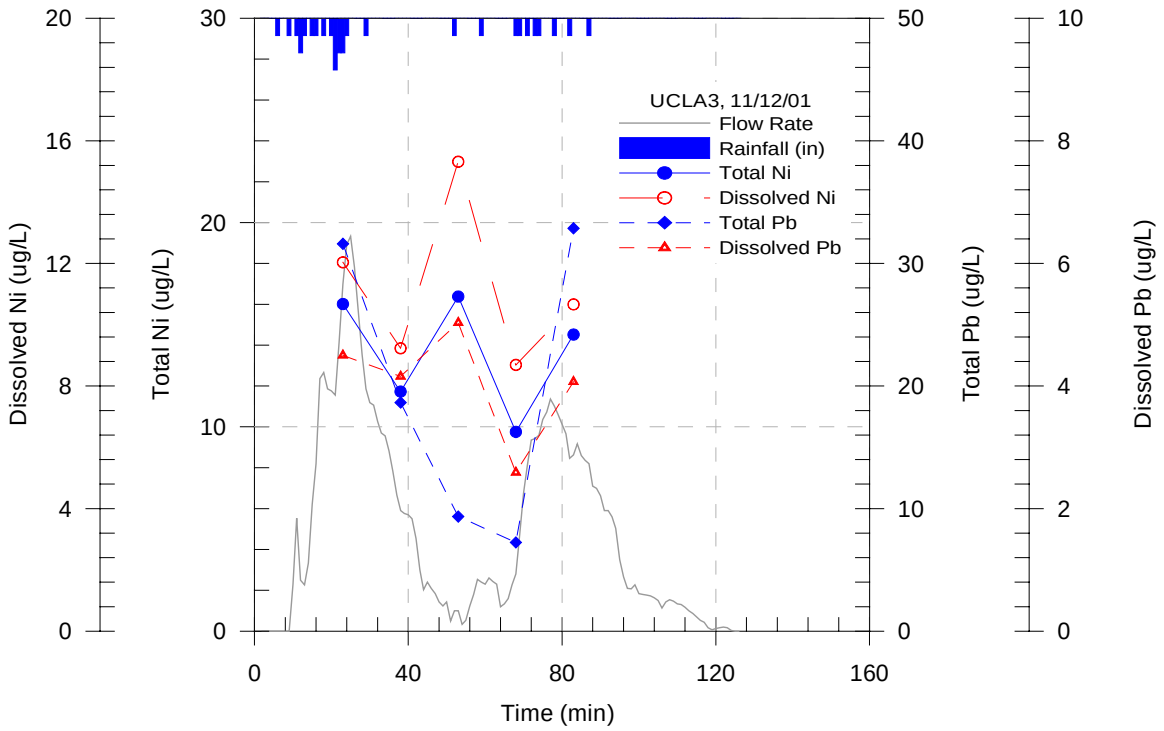

Figure I.3.3.2e[1] (Y3-UCLA3-E2-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

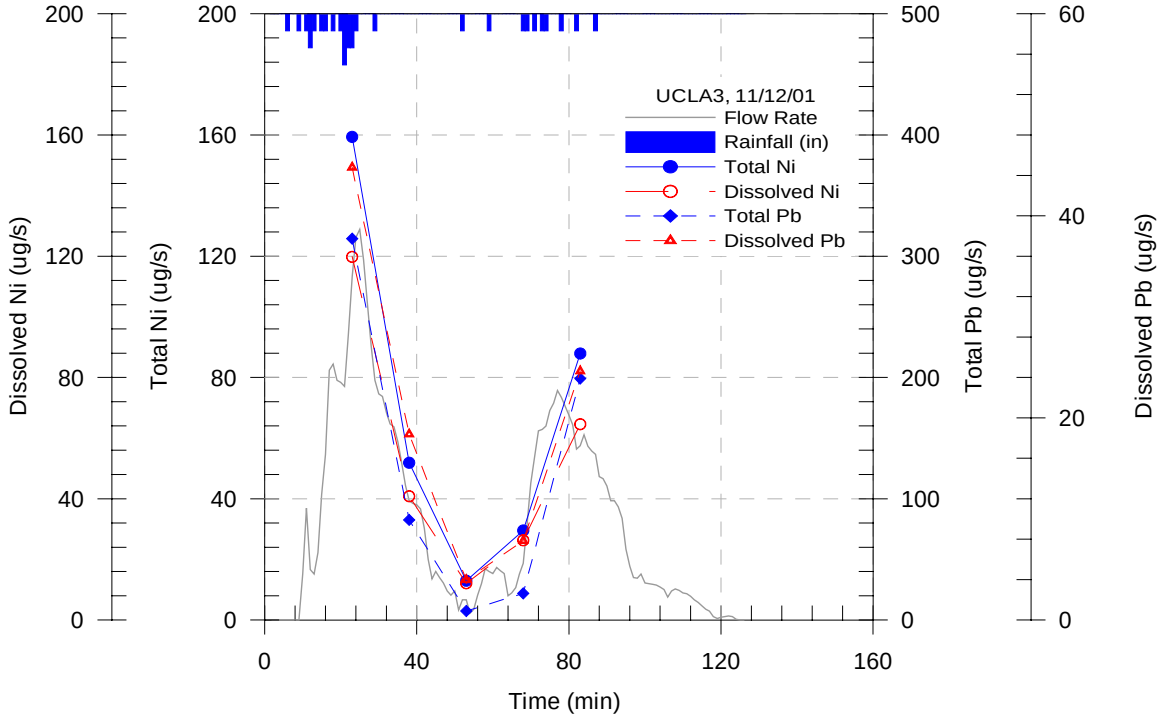

Figure I.3.3.2e[2] (Y3-UCLA3-E2-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

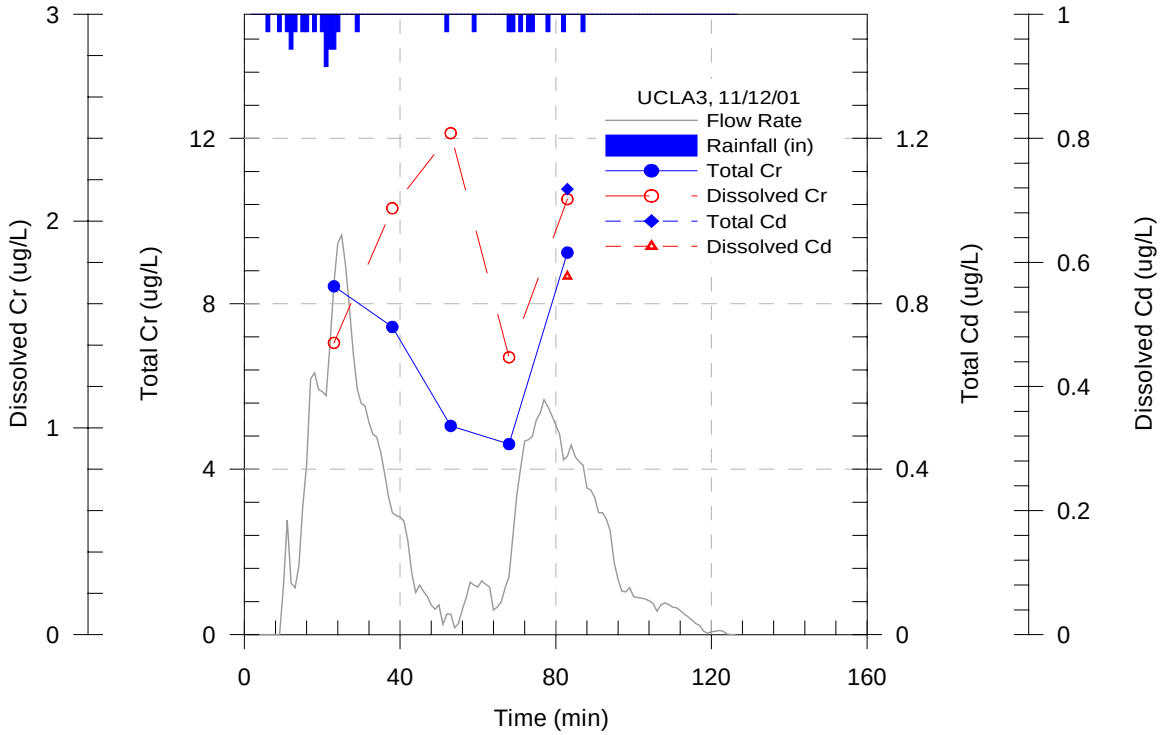

Figure I.3.3.2f[1] (Y3-UCLA3-E2-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

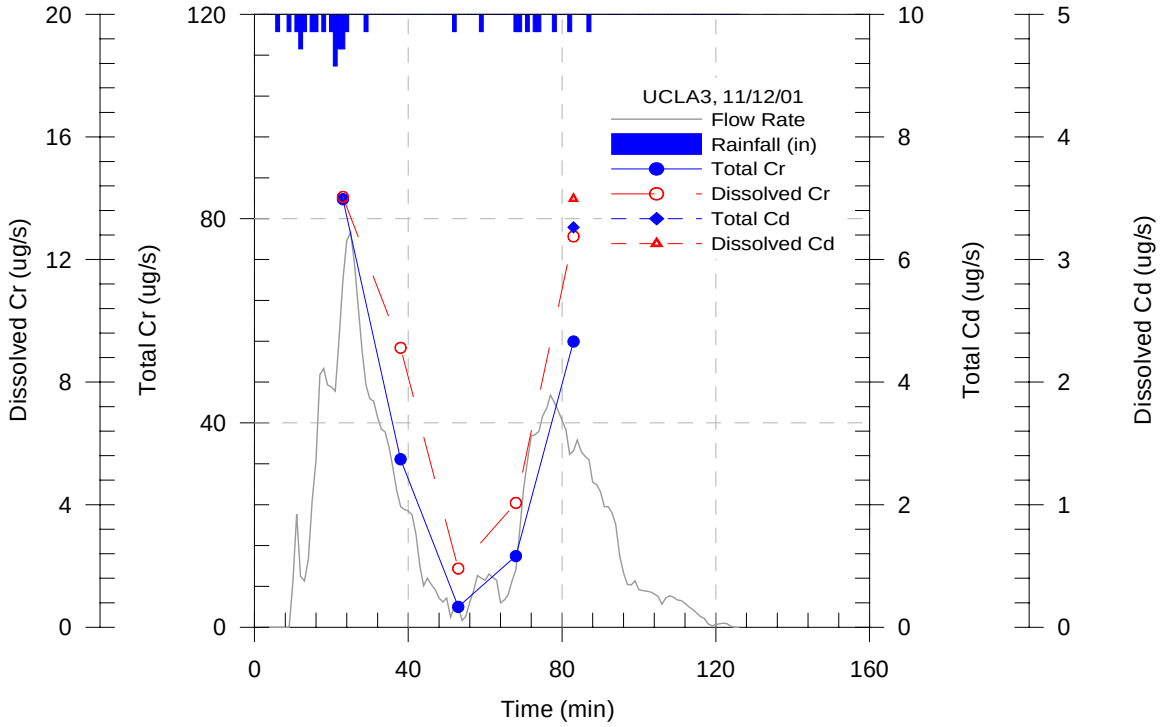

Figure I.3.3.2f[2] (Y3-UCLA3-E2-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

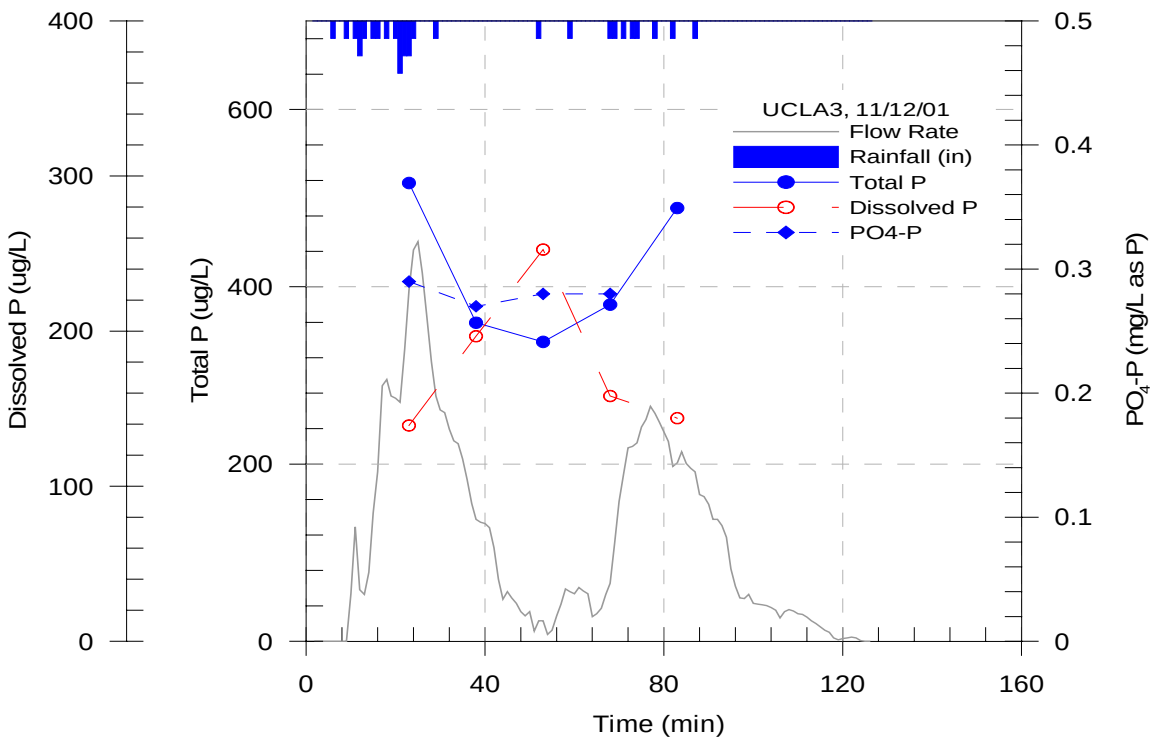

Figure I.3.3.2g[1] (Y3-UCLA3-E2-7). Polluto-graph for Total P / PO_4^{3-}-P

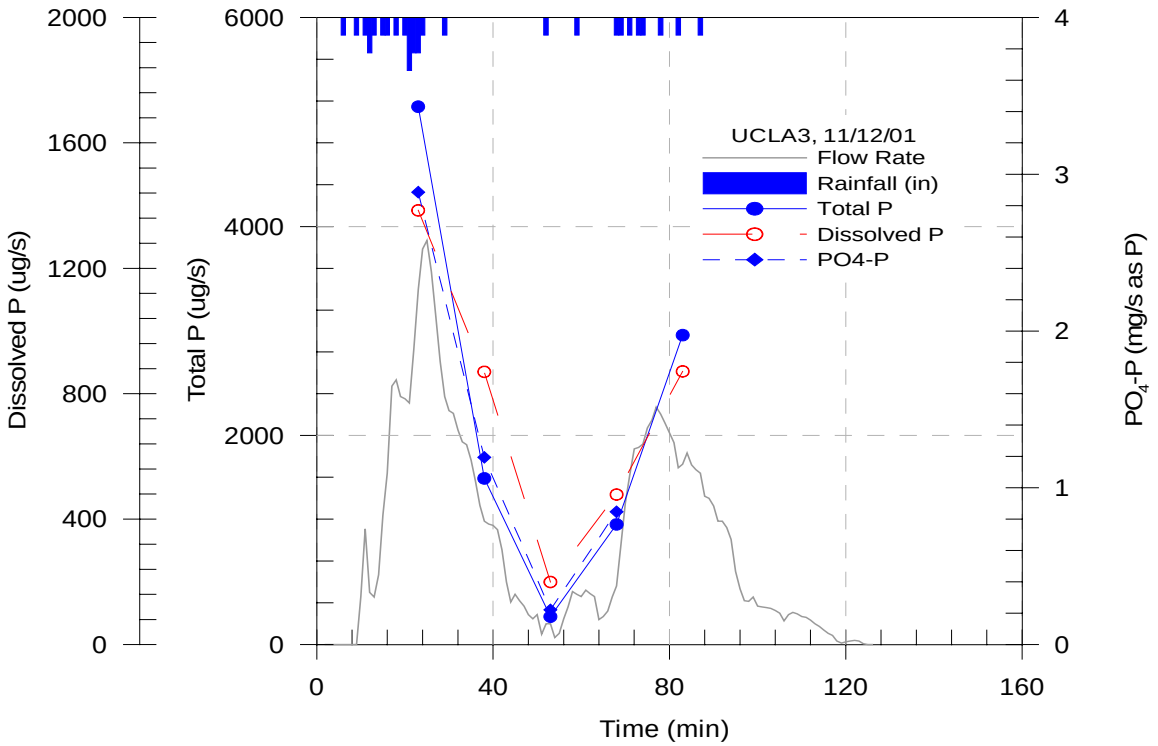

Figure I.3.3.2g[2] (Y3-UCLA3-E2-7). Load -graph for Total P / PO_4^{3-}P

3. UCLA3, 11/24/01

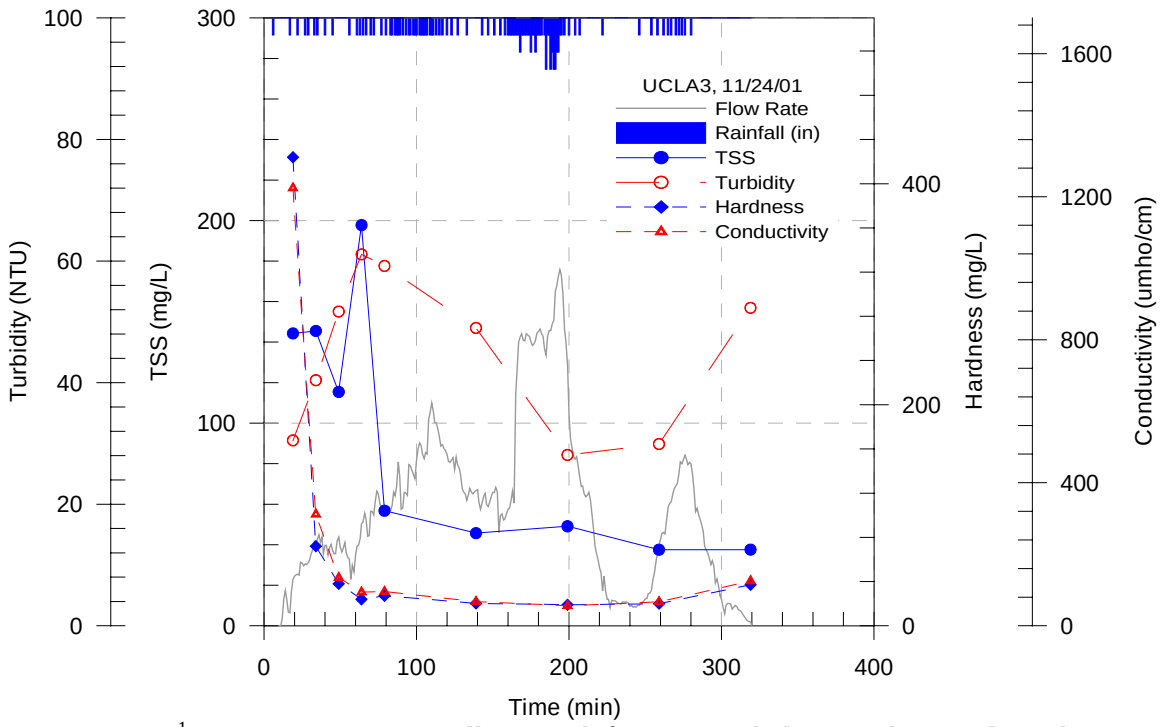

Figure I.3.3.3a[1] (Y3-UCLA3-E3-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

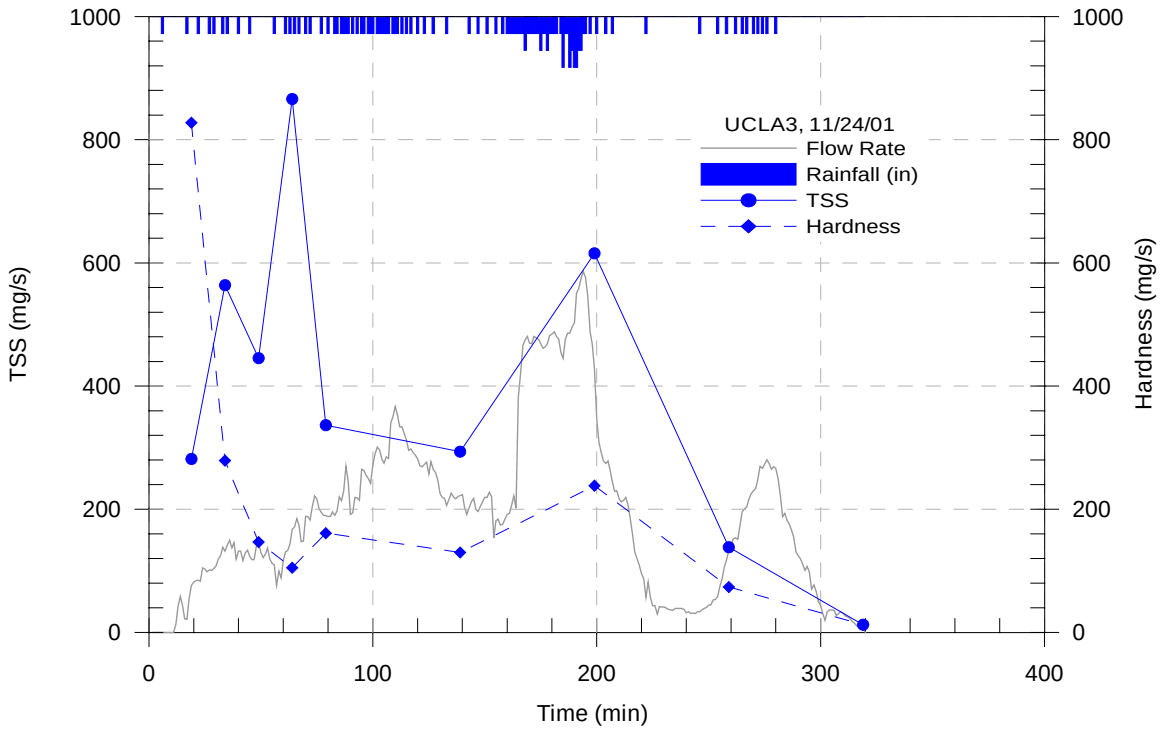

Figure I.3.3.3a[2] (Y3-UCLA3-E3-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

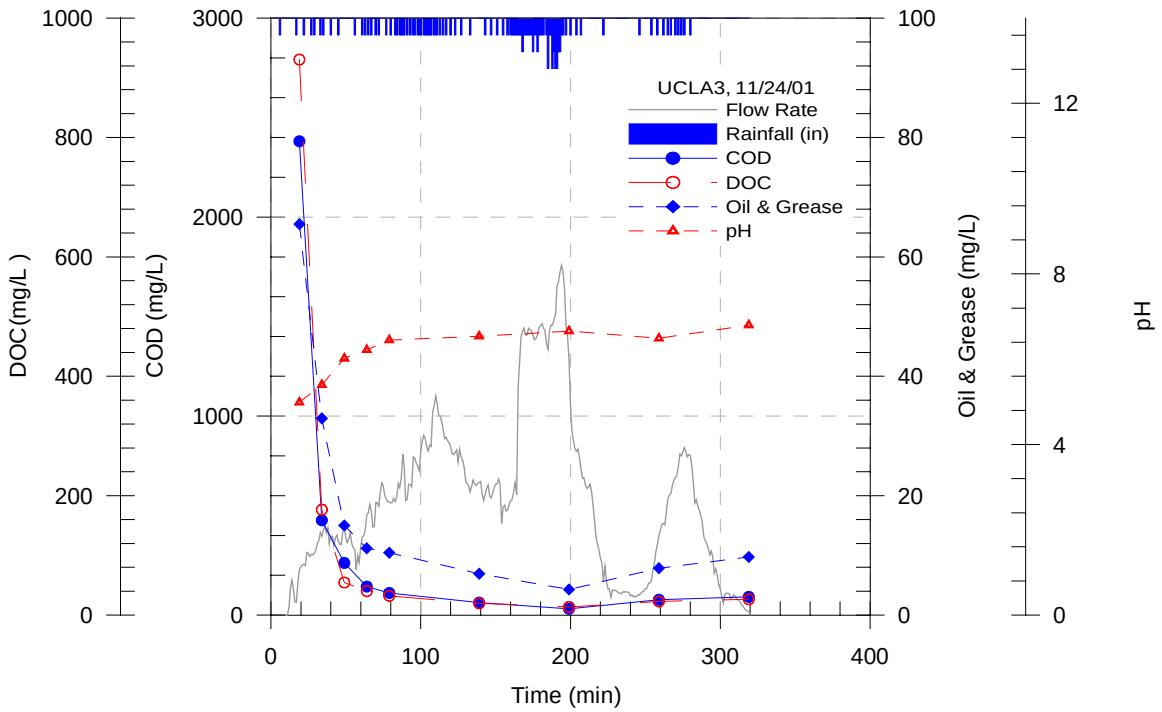

Figure I.3.3.3b[1] (Y3-UCLA3-E3-2). Polluto-graph for COD, DOC, Oil & Grease and pH

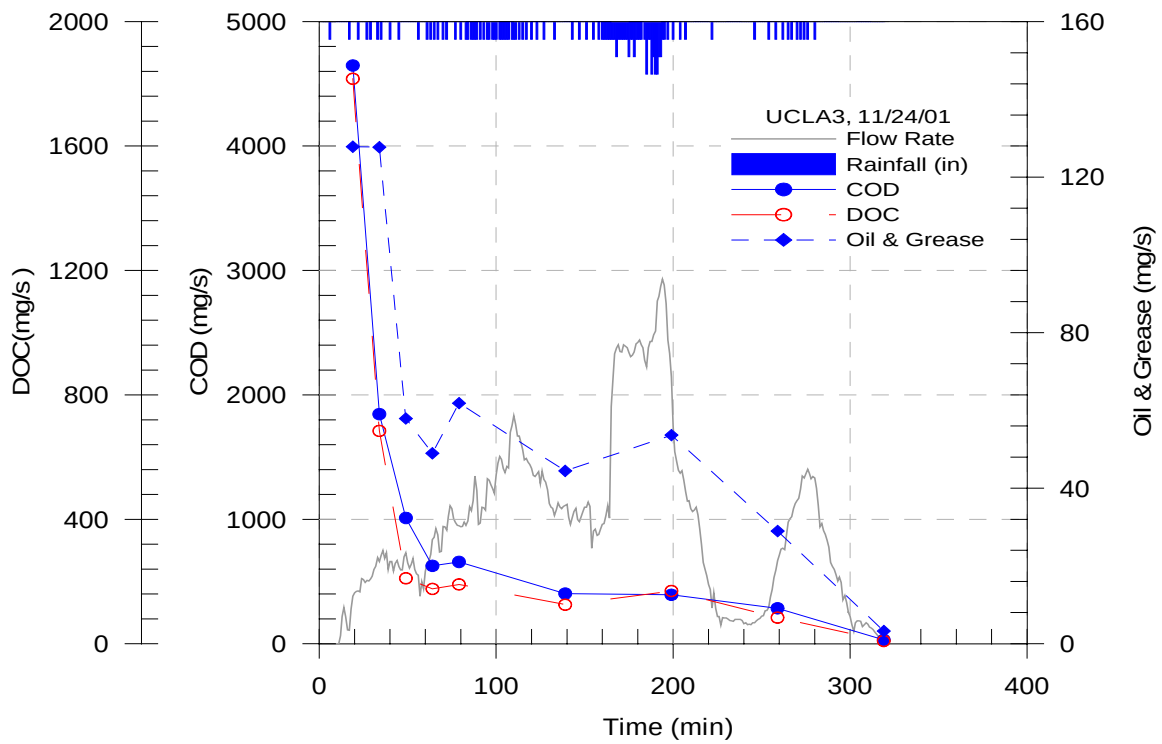

Figure I.3.3.3b[2] (Y3-UCLA3-E3-2). Load-graph for COD, DOC, Oil & Grease and pH

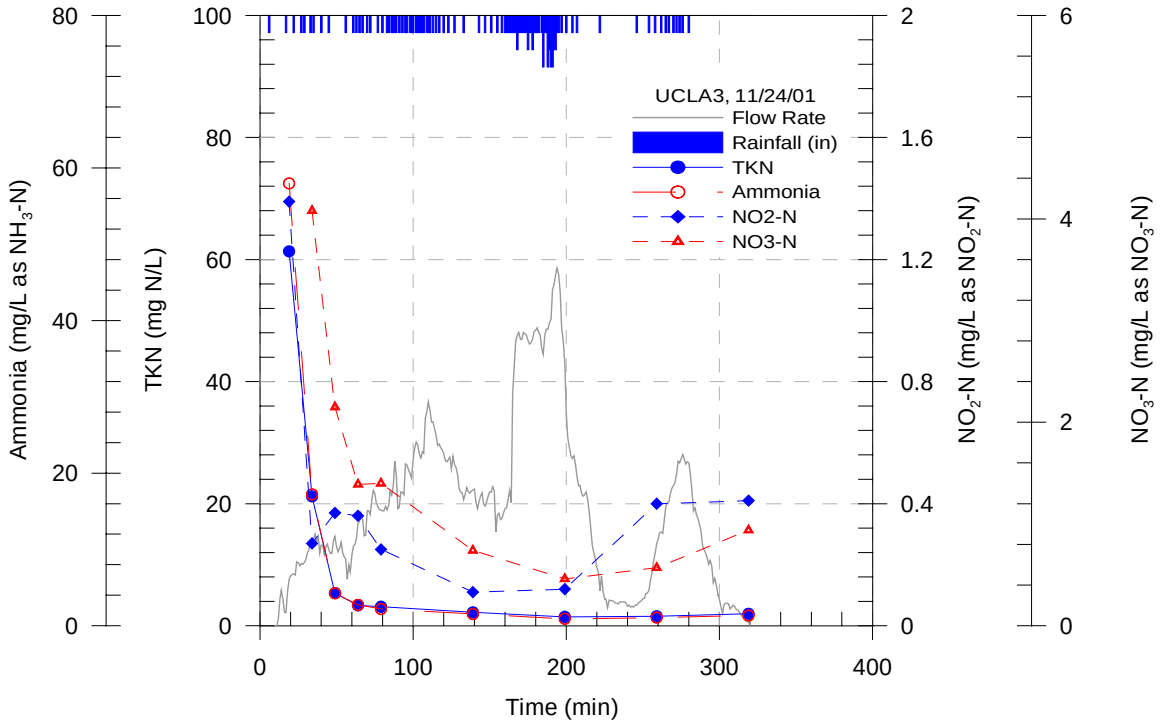

Figure I.3.3.3c[1] (Y3-UCLA3-E3-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

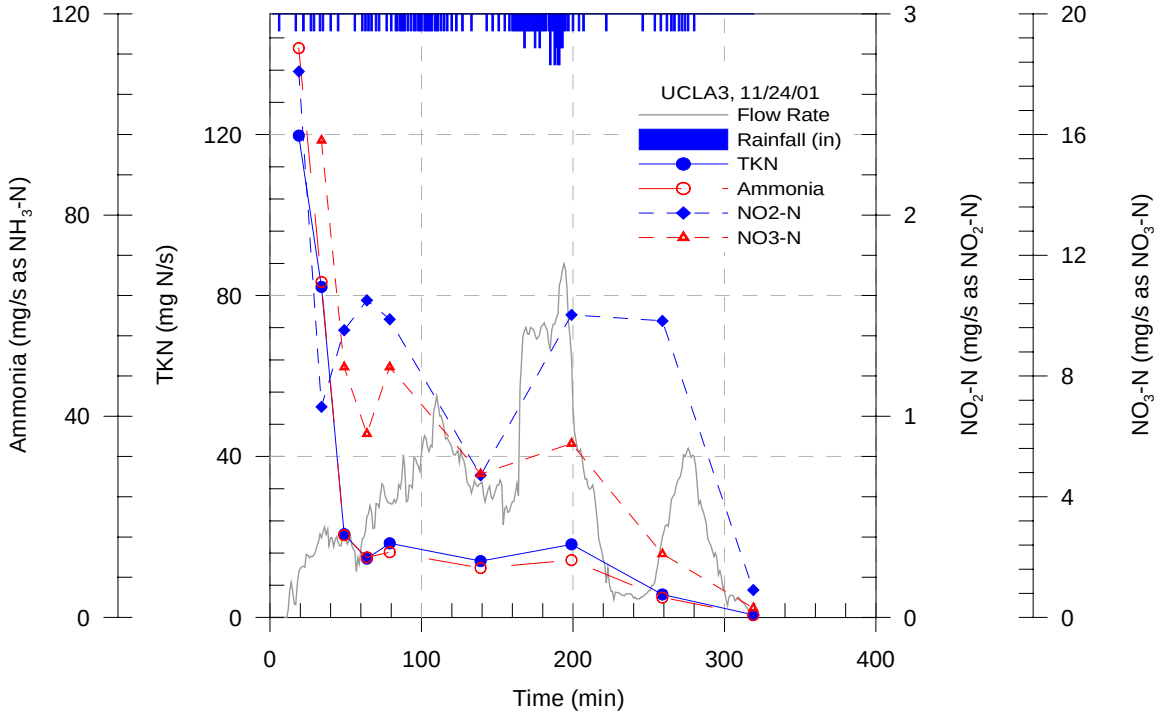

Figure I.3.3.3c[2] (Y3-UCLA3-E3-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

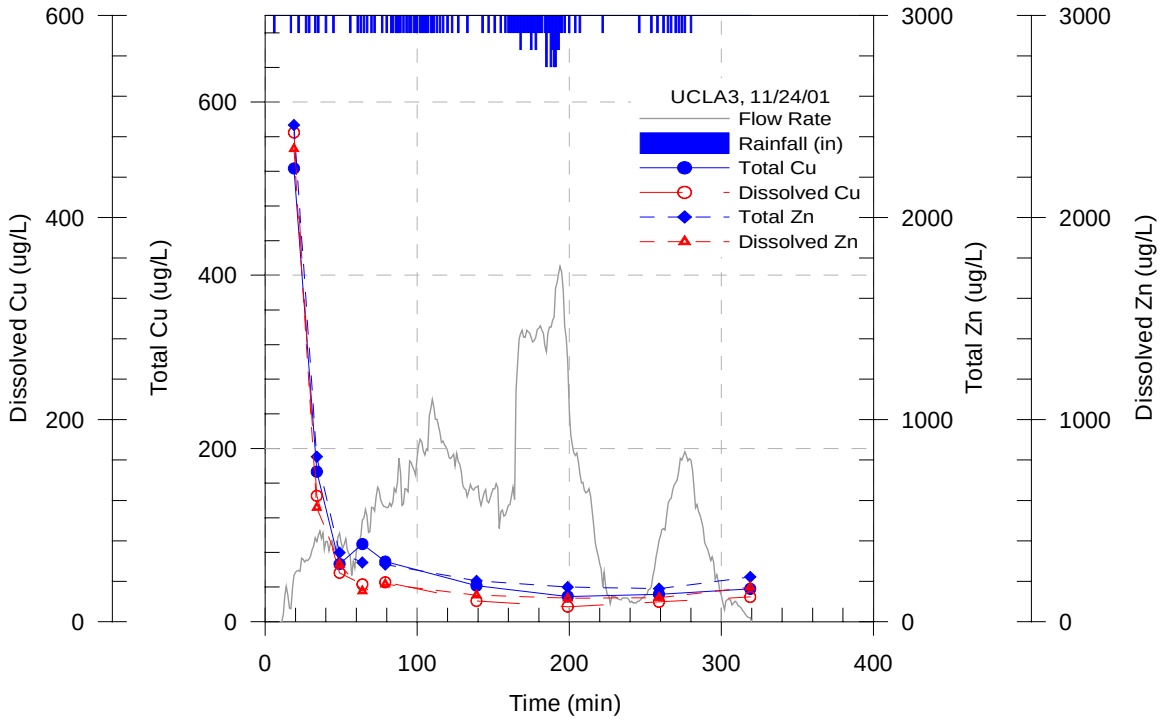

Figure I.3.3.3d[1] (Y3-UCLA3-E3-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

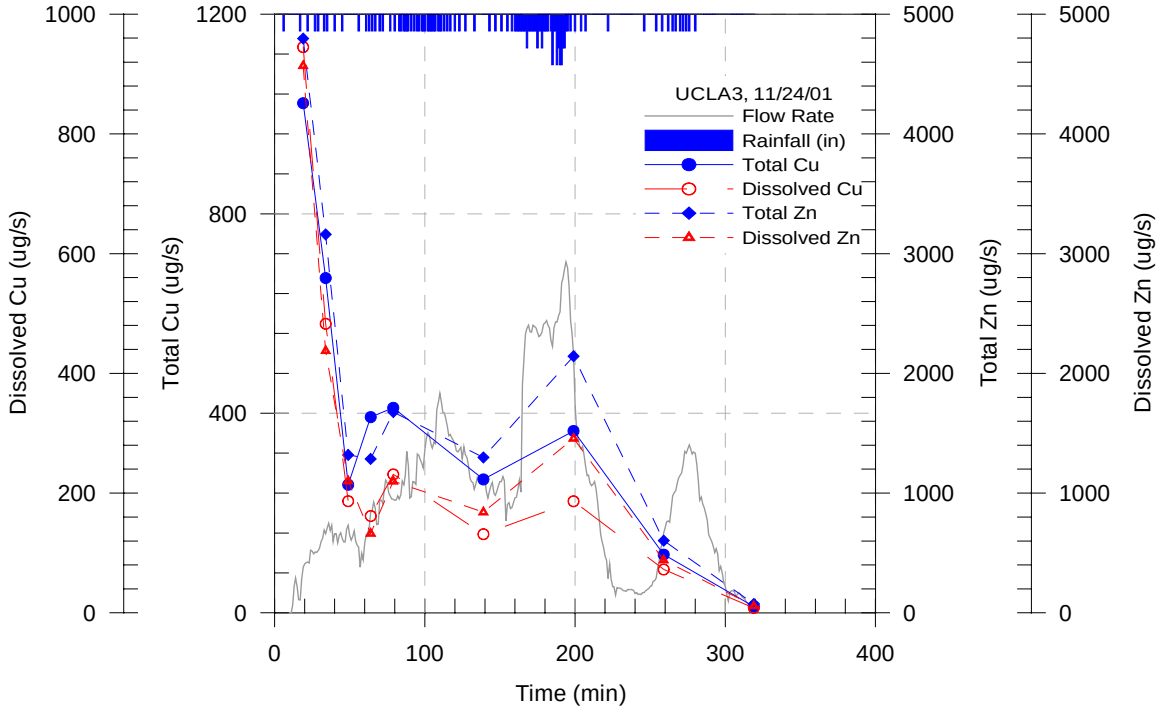

Figure I.3.3.3d[2] (Y3-UCLA3-E3-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

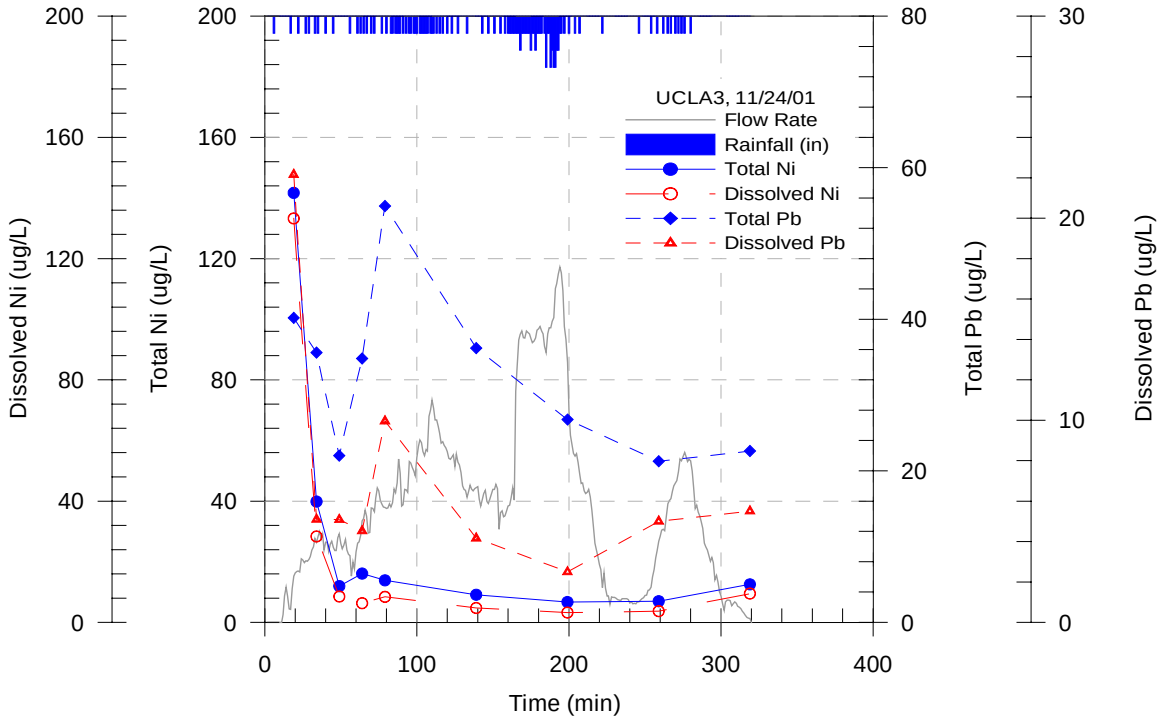

Figure I.3.3.3e[1] (Y3-UCLA3-E3-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

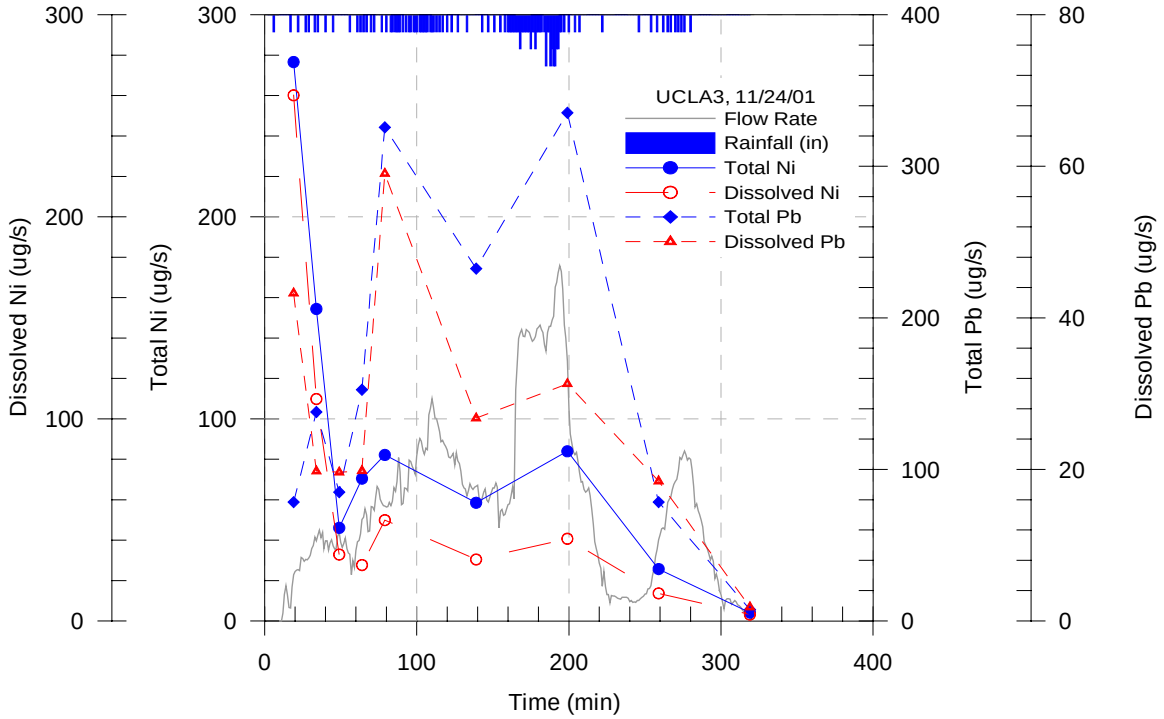

Figure I.3.3.3e[2] (Y3-UCLA3-E3-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

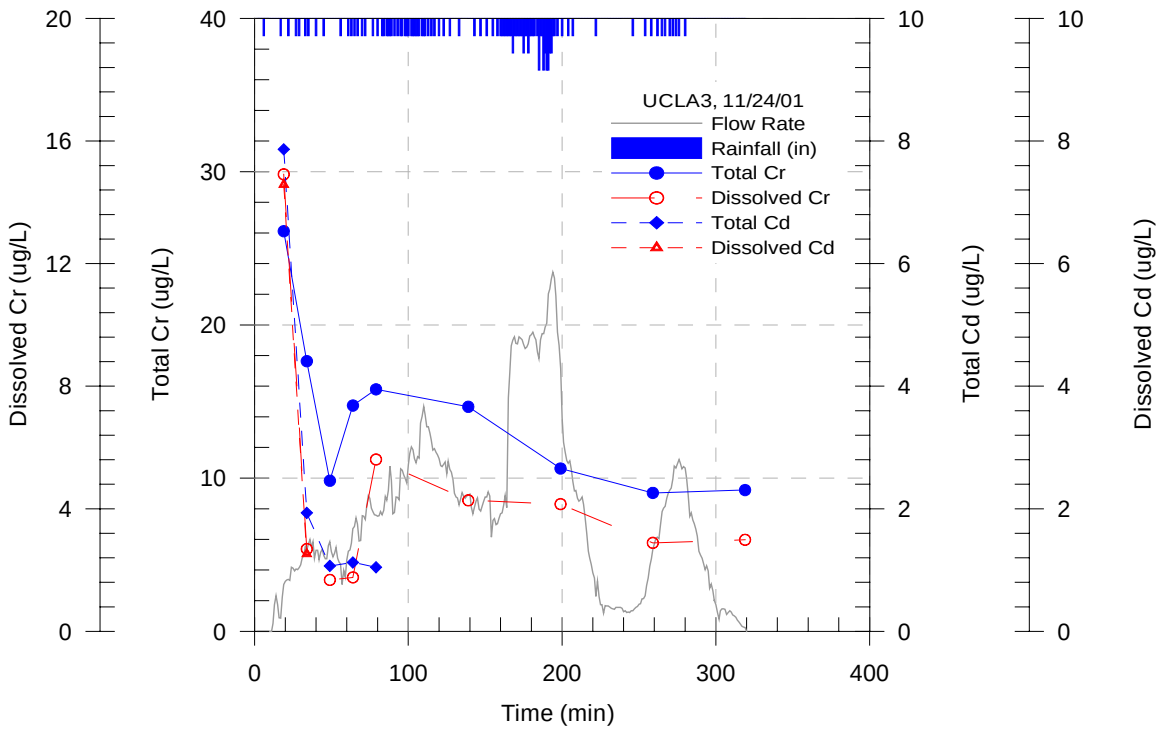

Figure I.3.3.3f[1] (Y3-UCLA3-E3-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

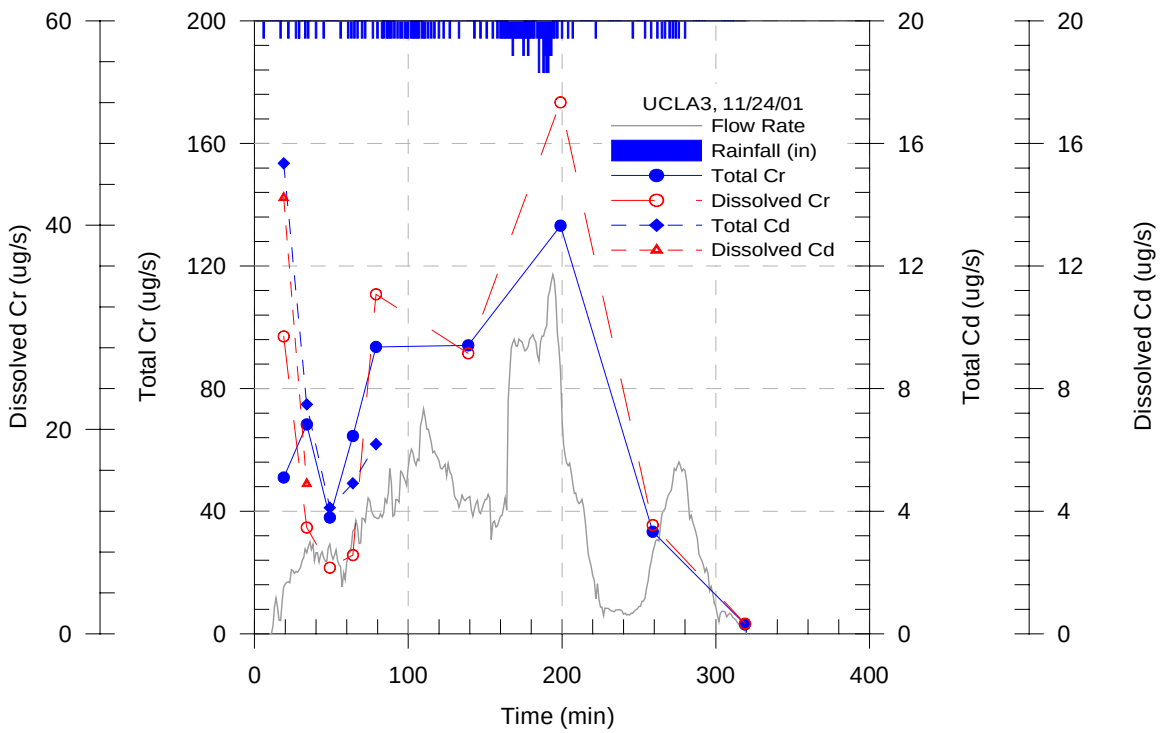

Figure I.3.3.3f[2] (Y3-UCLA3-E3-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

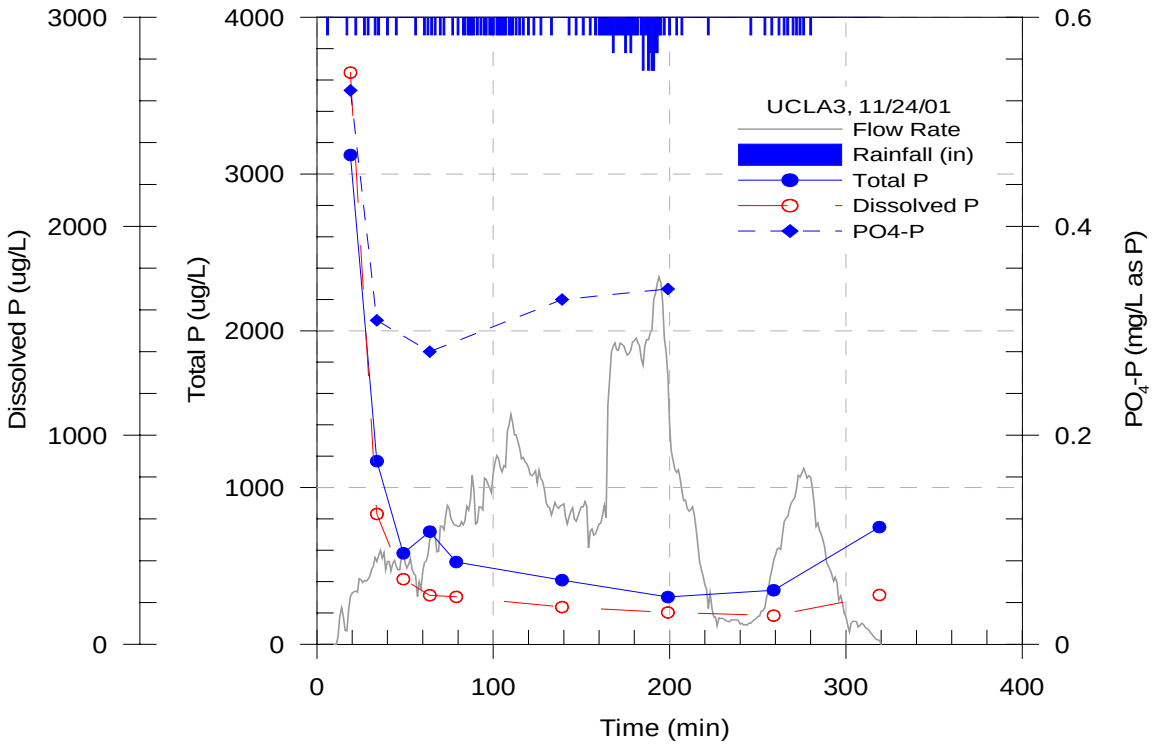

Figure I.3.3.3g[1] (Y3-UCLA3-E3-7). Polluto-graph for Total P / PO_4^{3-}-P

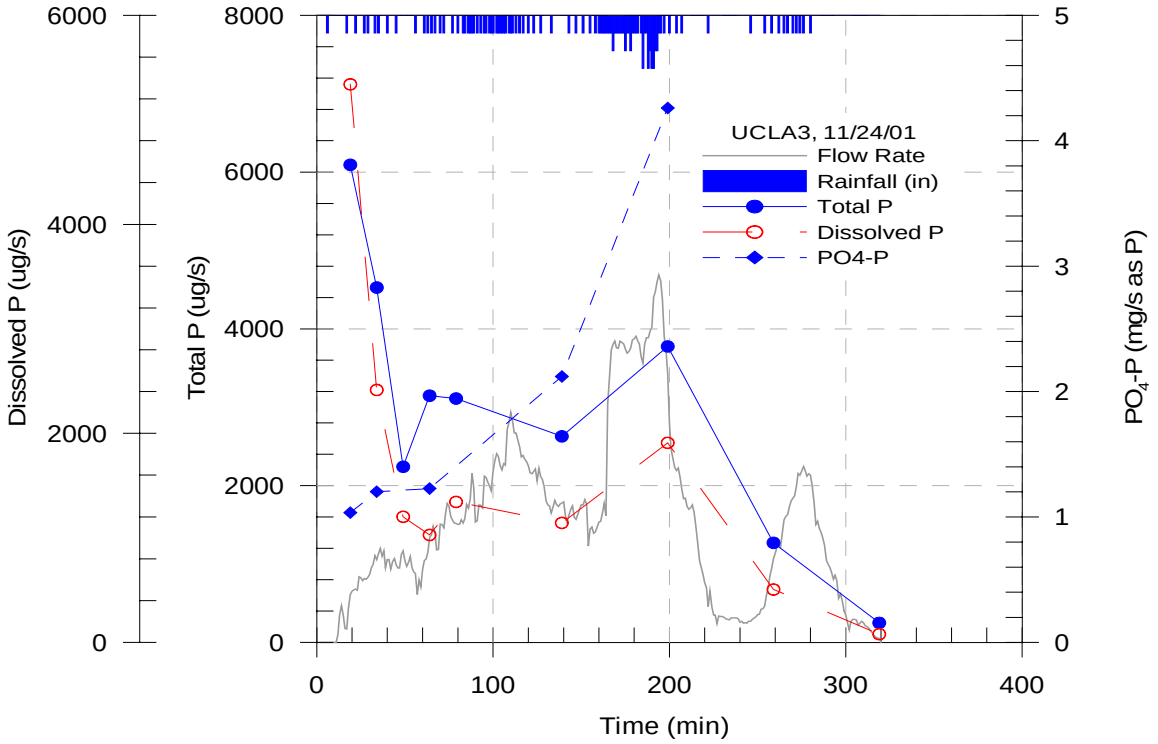

Figure I.3.3.3g[2] (Y3-UCLA3-E3-7). Load -graph for Total P / PO_4^{3-}-P

4. UCLA3, 12/20/01

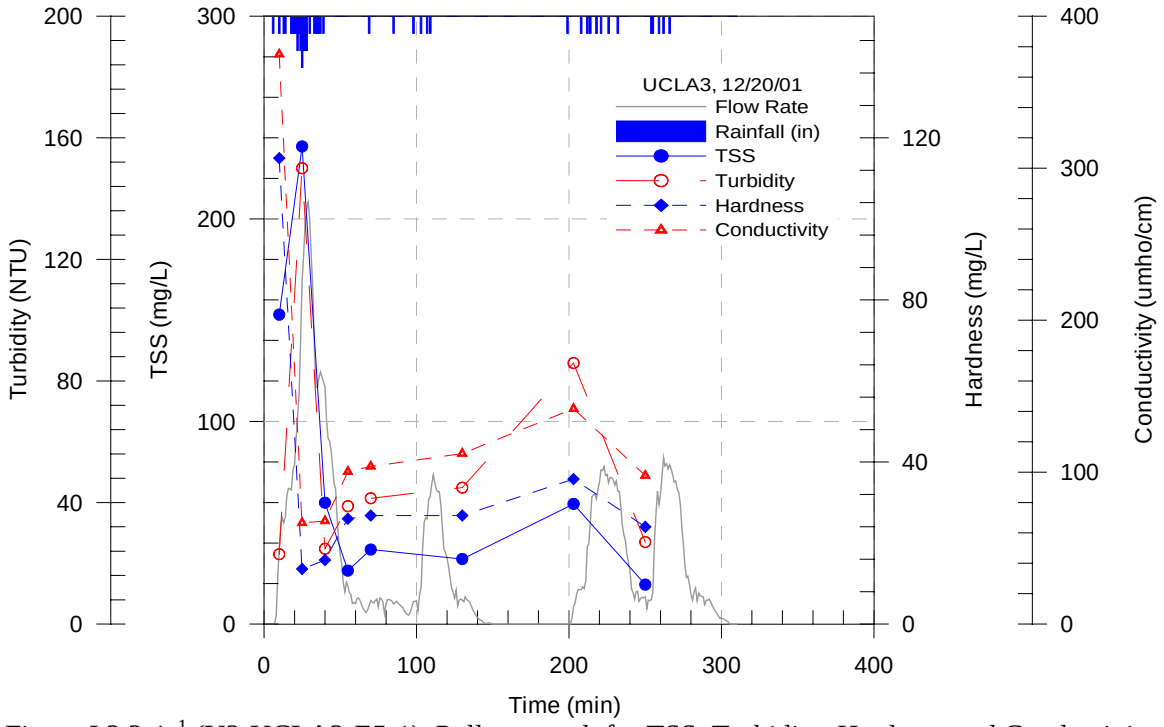

Figure I.3.3.4a[1] (Y3-UCLA3-E5-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

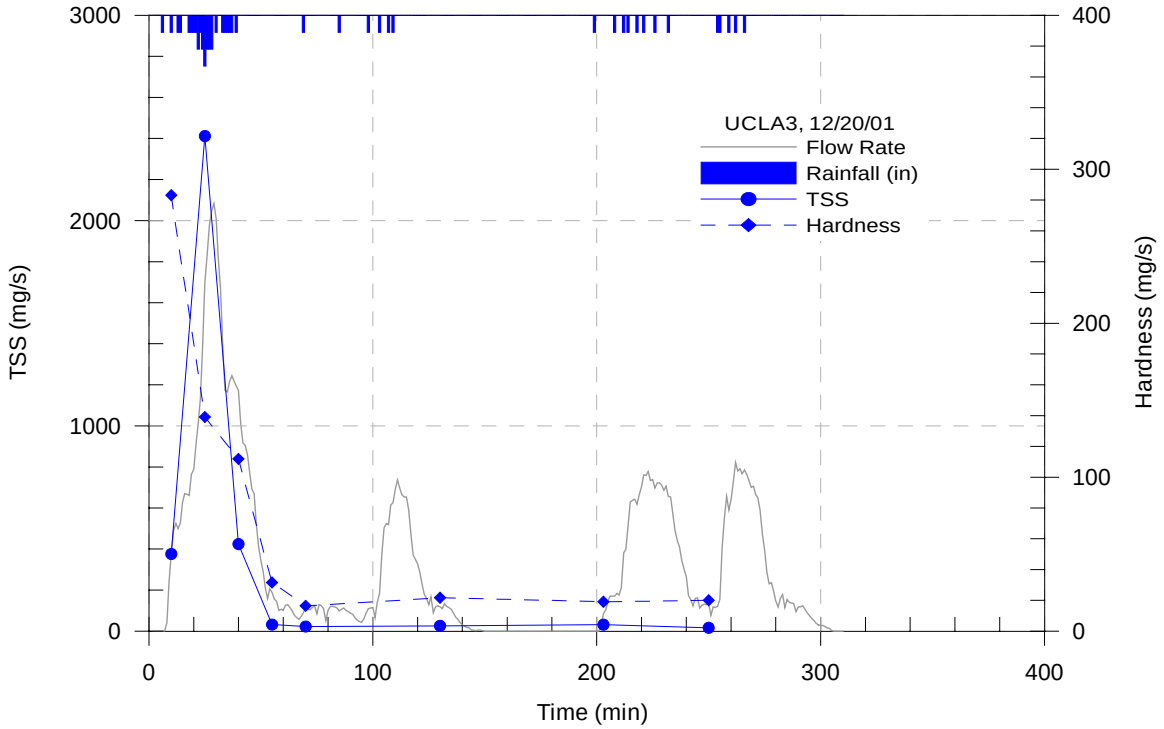

Figure I.3.3.4a[2] (Y3-UCLA3-E5-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

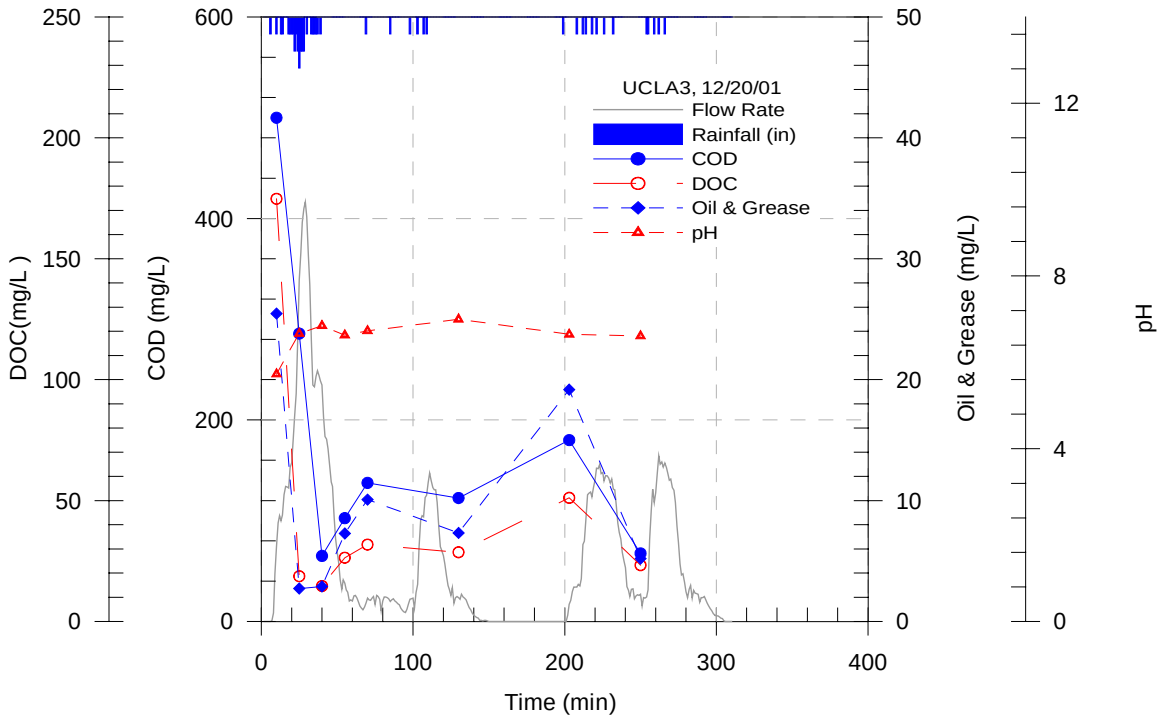

Figure I.3.3.4b[1] (Y3-UCLA3-E5-2). Polluto-graph for COD, DOC, Oil & Grease and pH

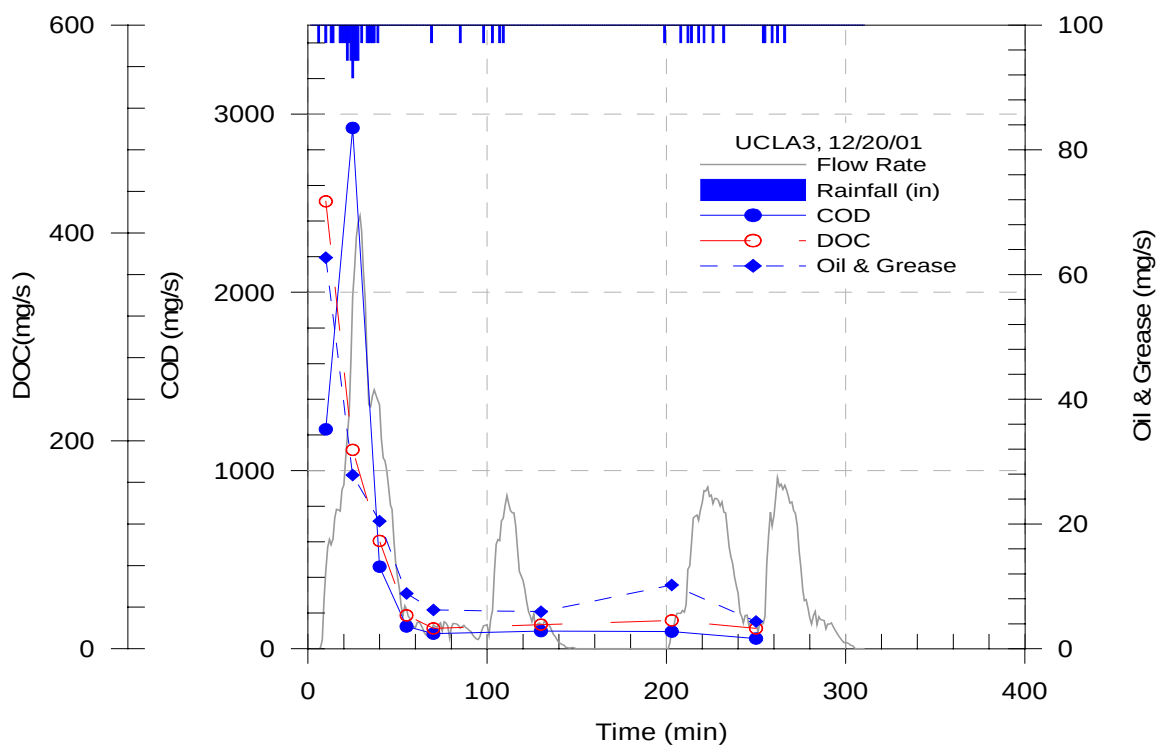

Figure I.3.3.4b[2] (Y3-UCLA3-E5-2). Load-graph for COD, DOC, Oil & Grease and pH

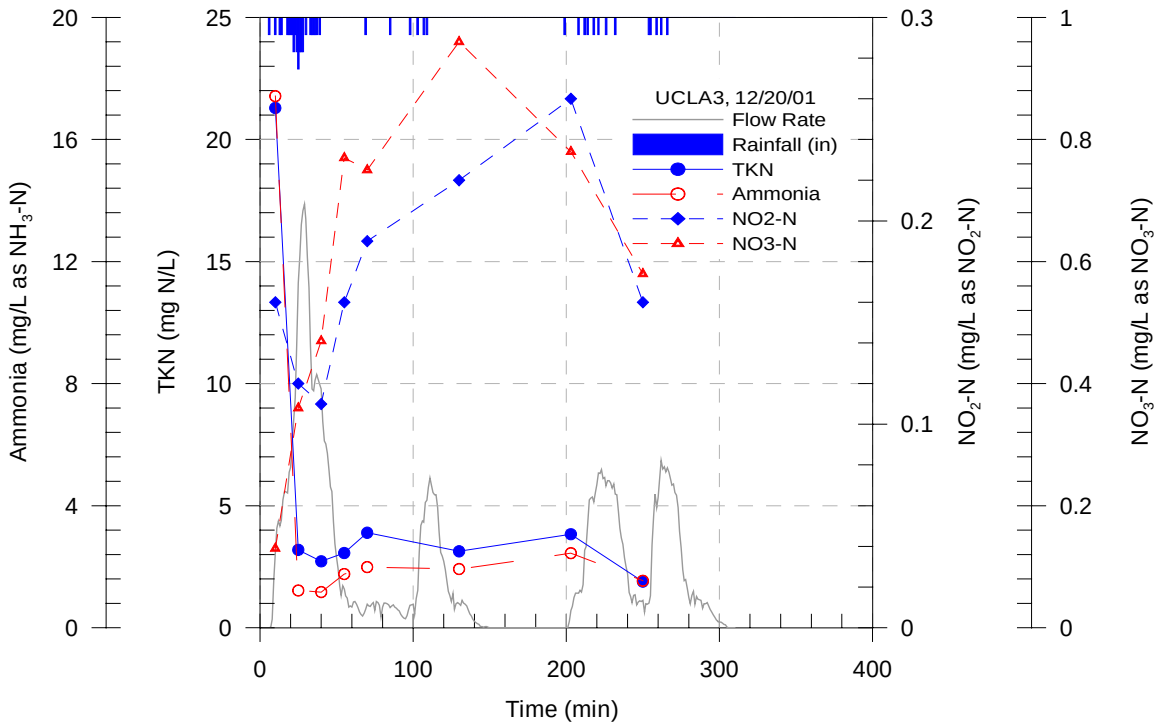

Figure I.3.3.4c[1] (Y3-UCLA3-E5-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

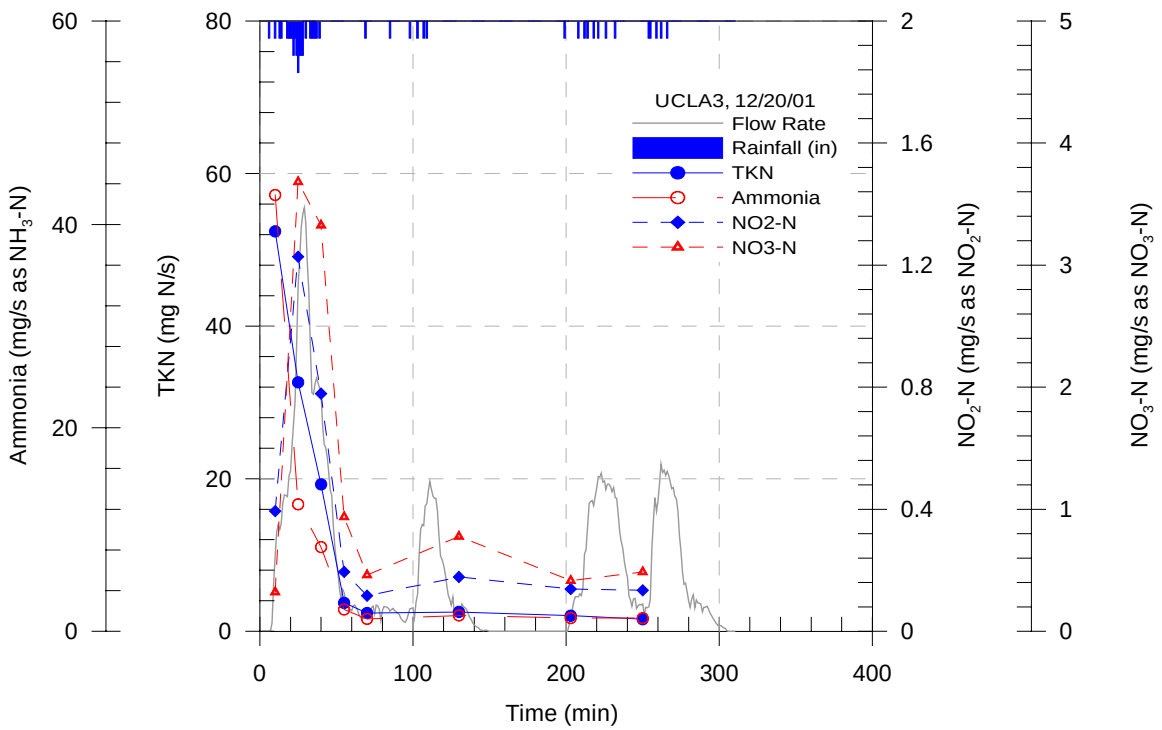

Figure I.3.3.4c[2] (Y3-UCLA3-E5-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

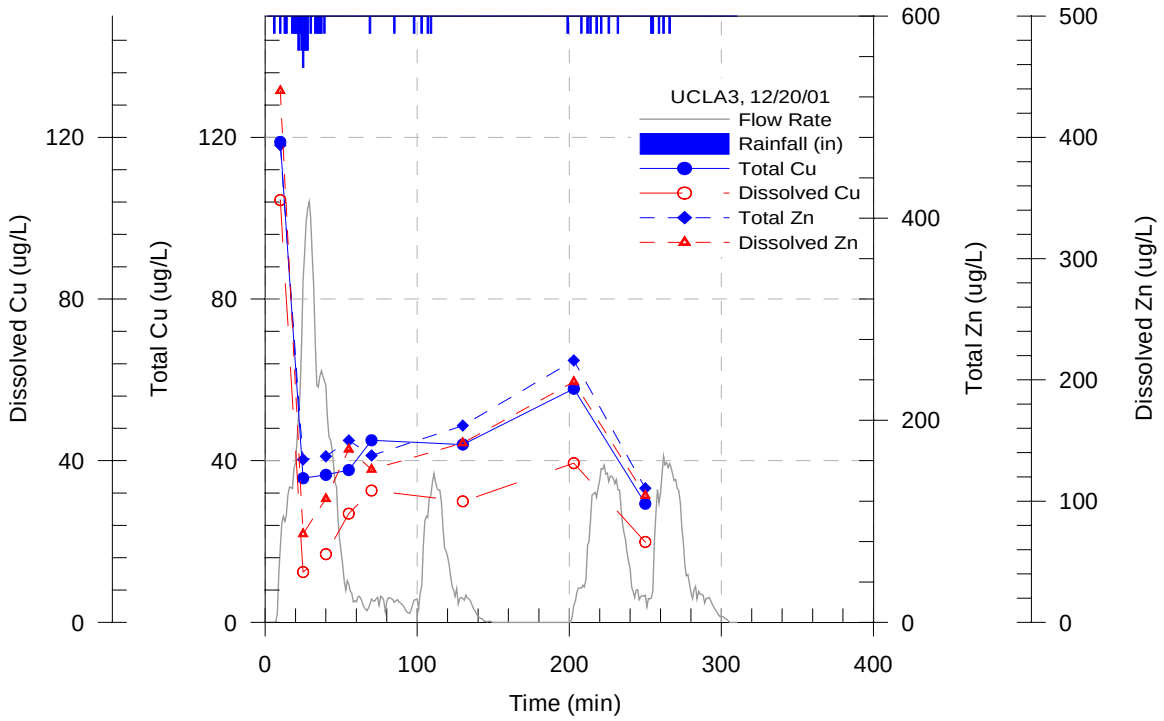

Figure I.3.3.4d[1] (Y3-UCLA3-E5-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

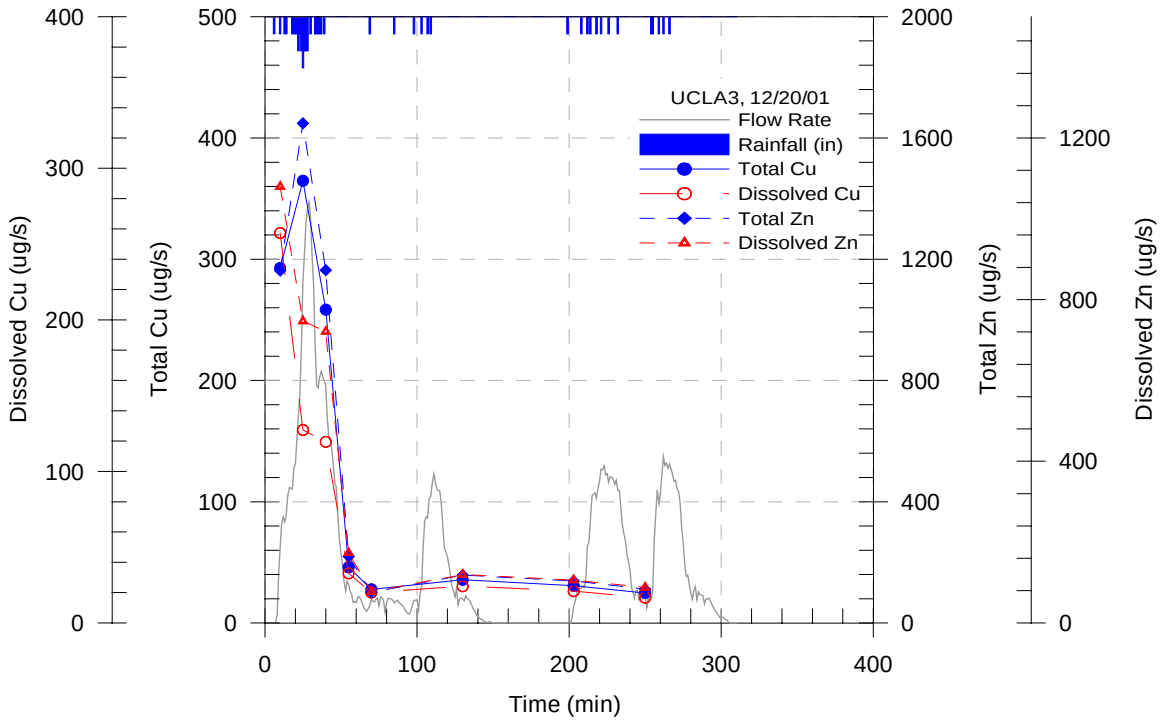

Figure I.3.3.4d[2] (Y3-UCLA3-E5-4(b). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

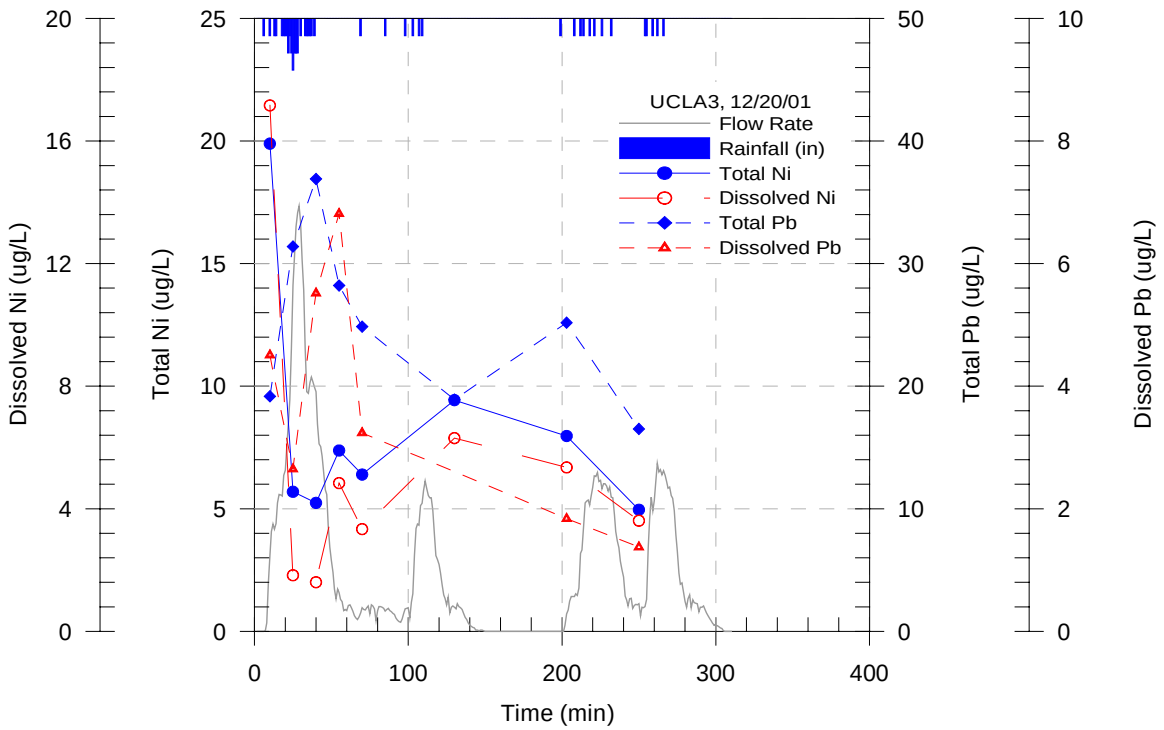

Figure I.3.3.4e[1] (Y3-UCLA3-E5-5(a). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

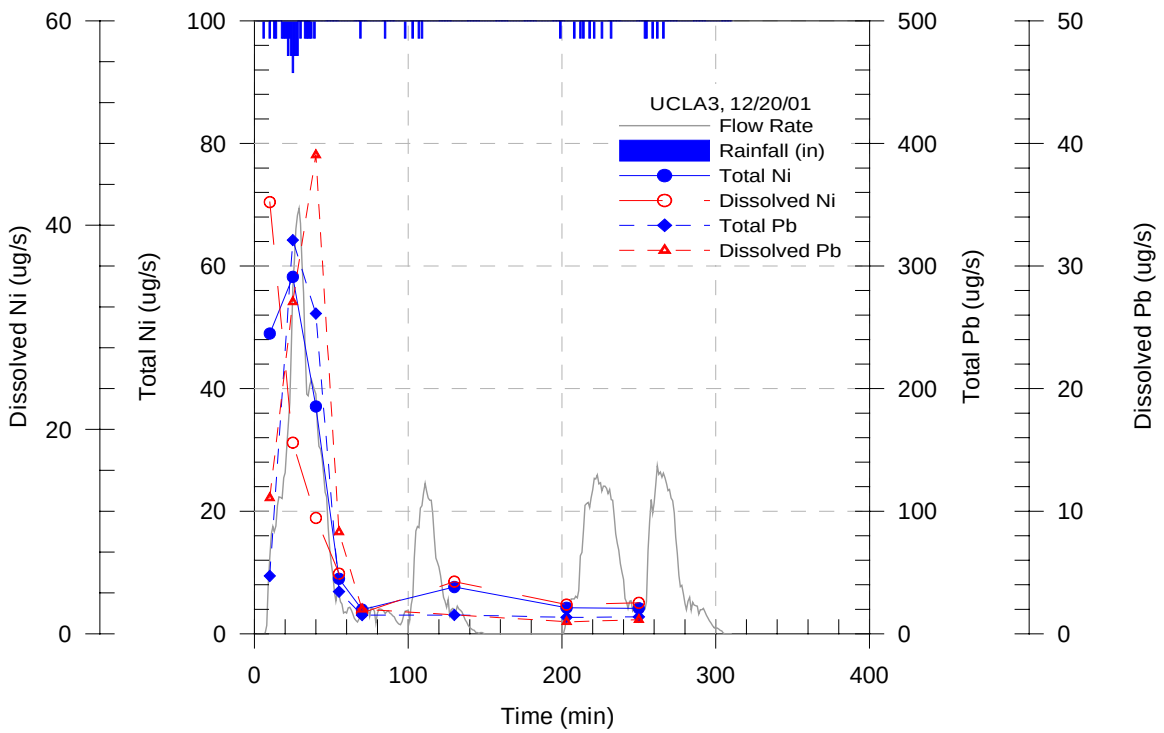

Figure I.3.3.4e[2] (Y3-UCLA3-E5-5(b). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

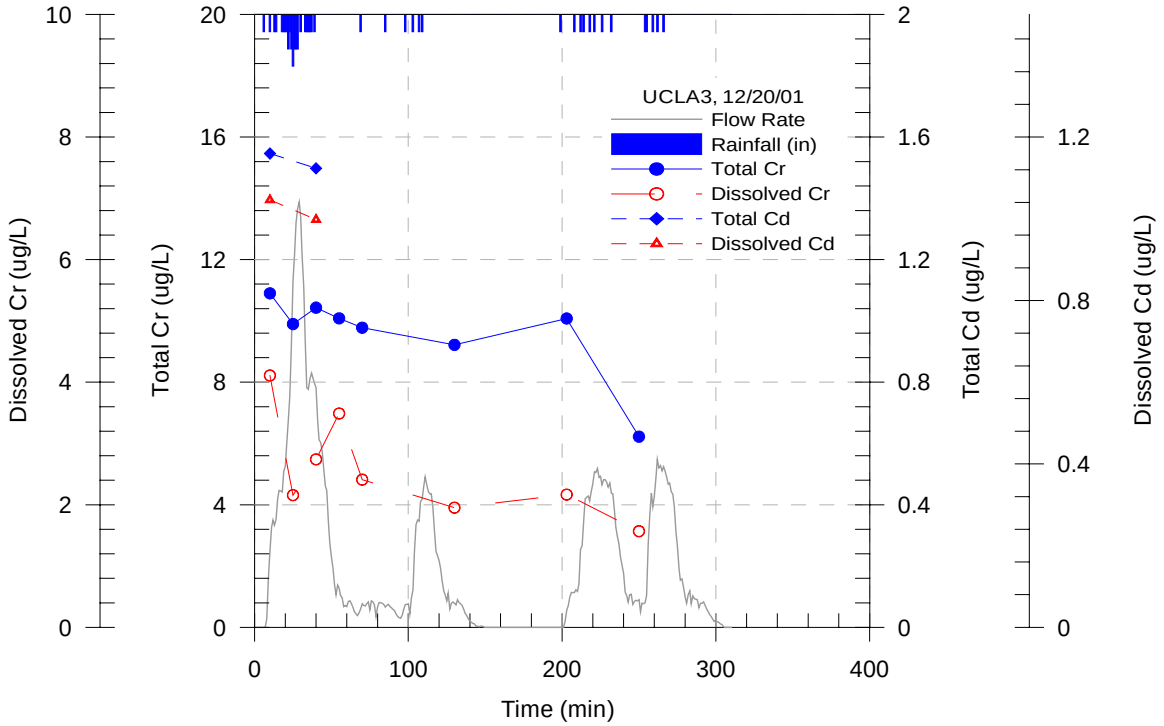

Figure I.3.3.4f[1] (Y3-UCLA3-E5-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

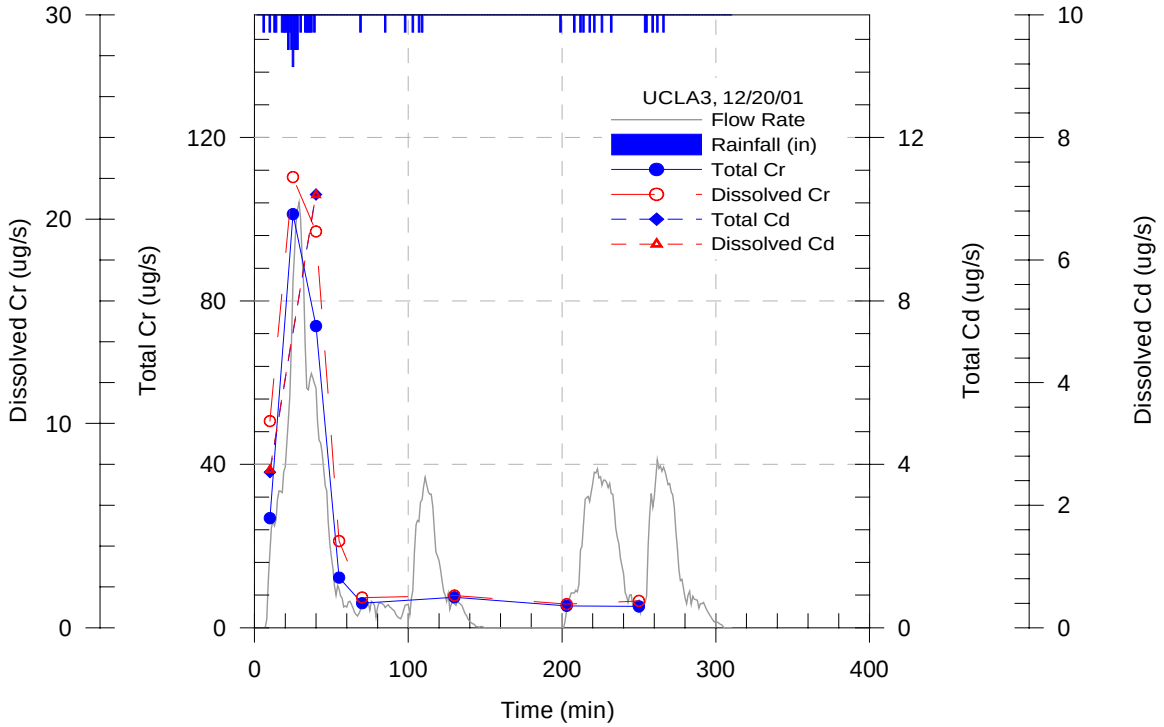

Figure I.3.3.4f[2] (Y3-UCLA3-E5-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

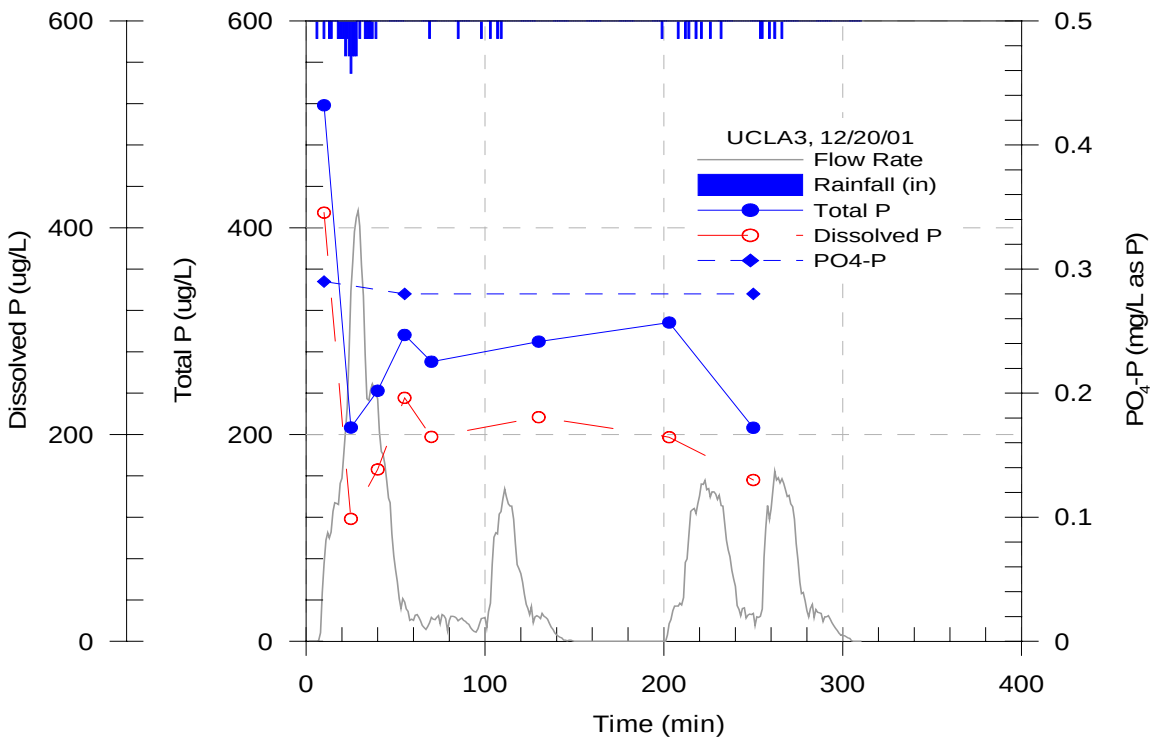

Figure I.3.3.4g[1] (Y3-UCLA3-E5-7). Polluto-graph for Total P / PO_4^{3-}-P

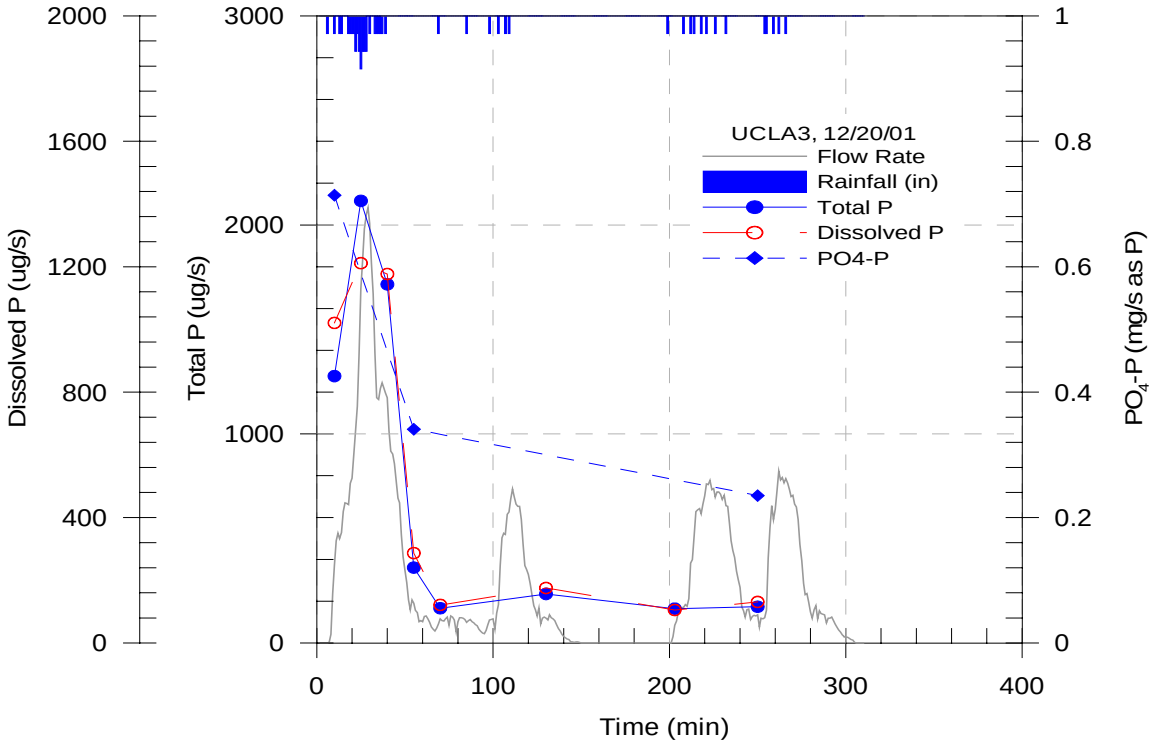

Figure I.3.3.4g[2] (Y3-UCLA3-E5-7). Load -graph for Total P / PO_4^{3-}-P

5. UCLA3, 01/27/02

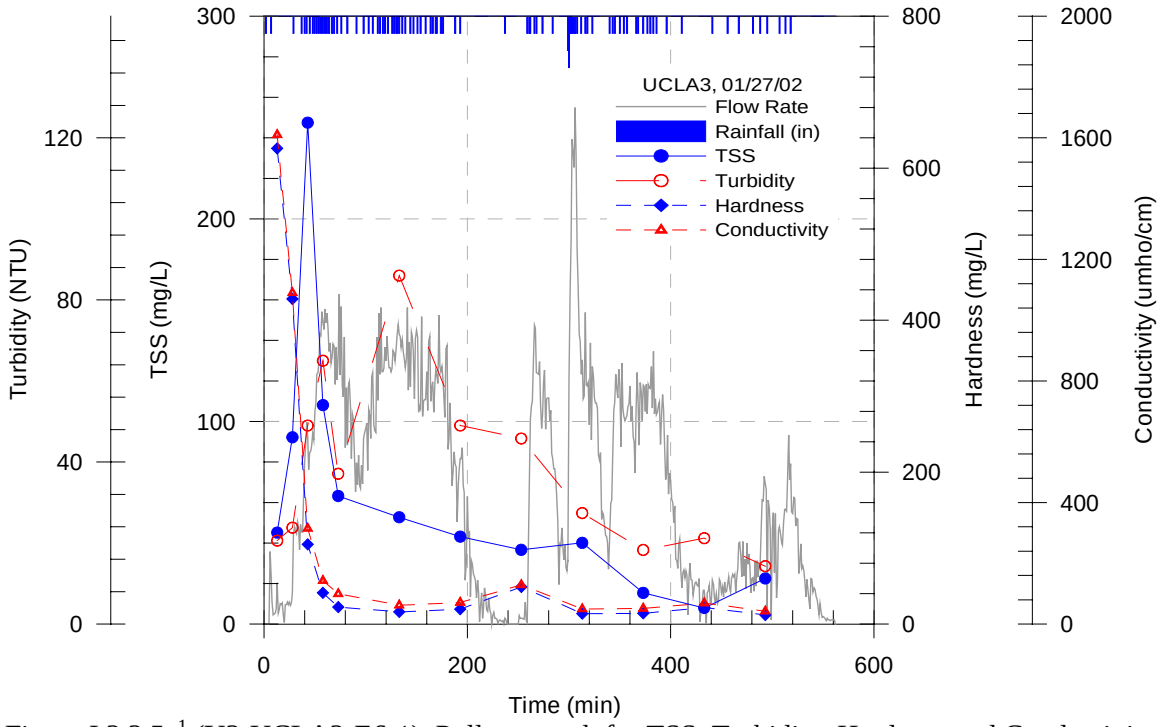

Figure I.3.3.5a[1] (Y3-UCLA3-E6-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

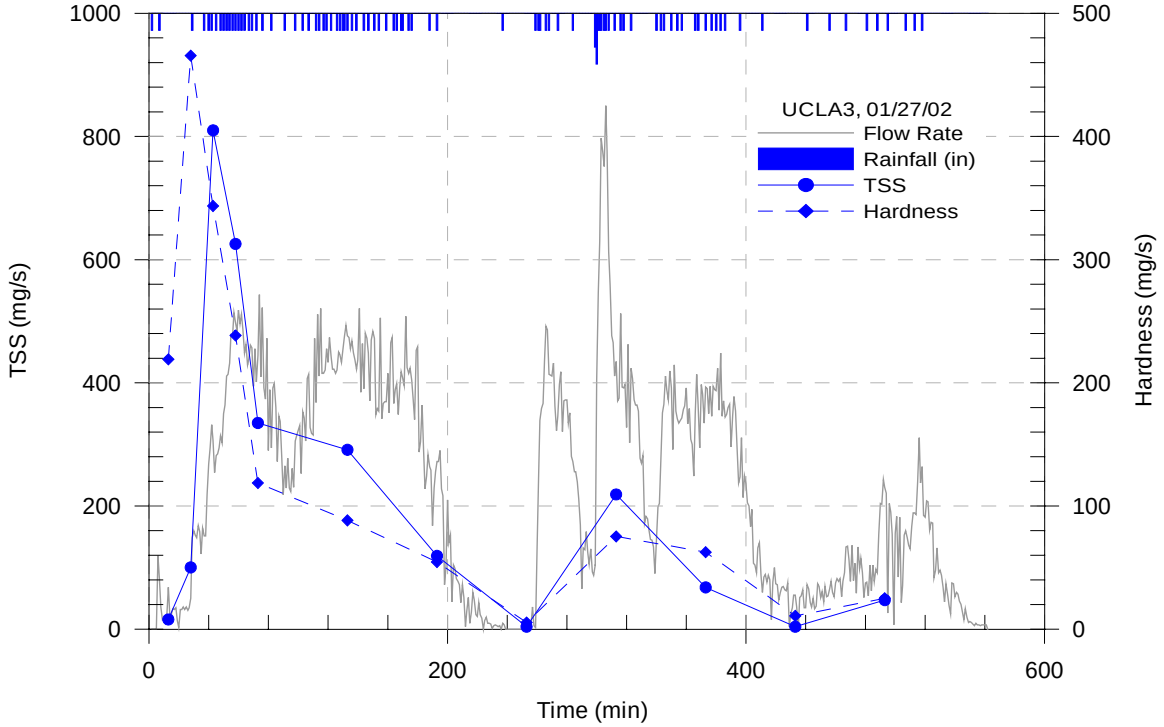

Figure I.3.3.5a[2] (Y3-UCLA3-E6-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

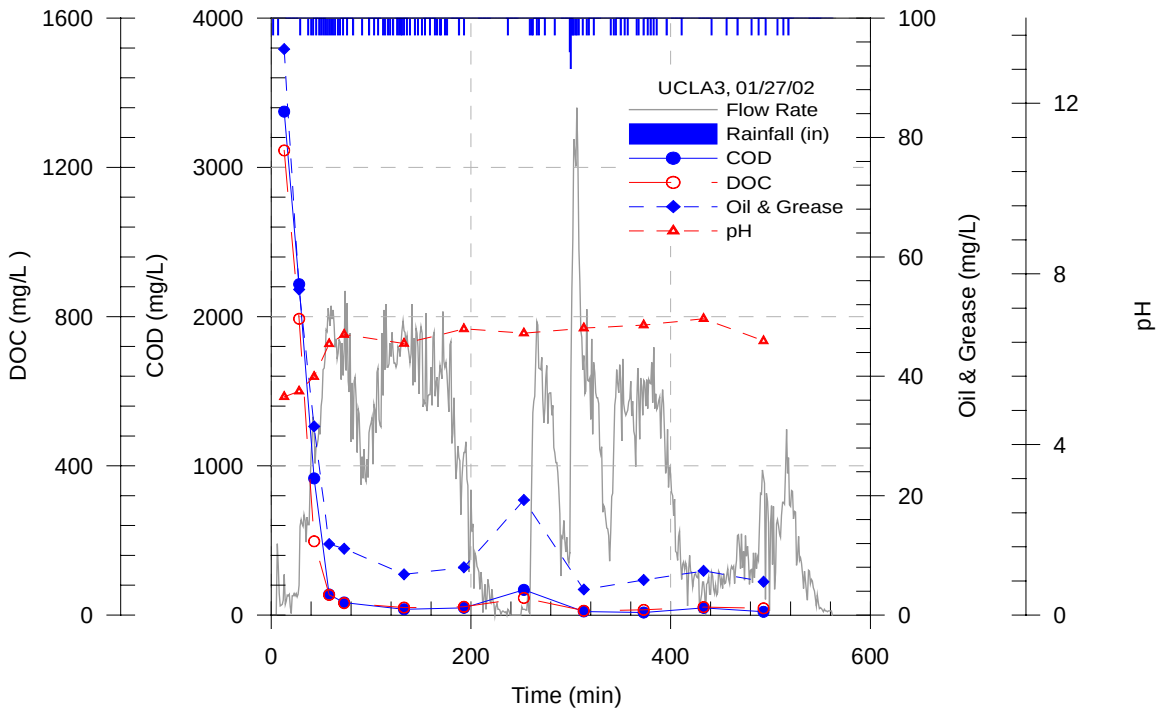

Figure I.3.3.5b[1] (Y3-UCLA3-E6-2). Polluto-graph for COD, DOC, Oil & Grease and pH

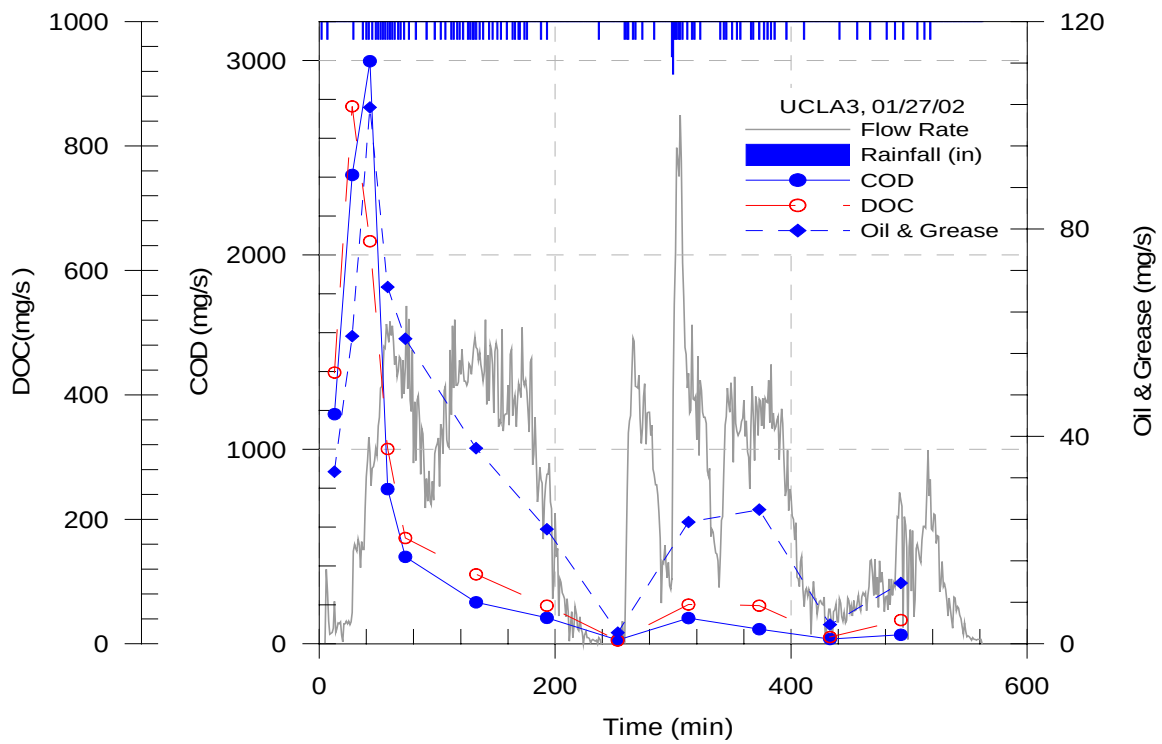

Figure I.3.3.5b[2] (Y3-UCLA3-E6-2). Load-graph for COD, DOC, Oil & Grease and pH

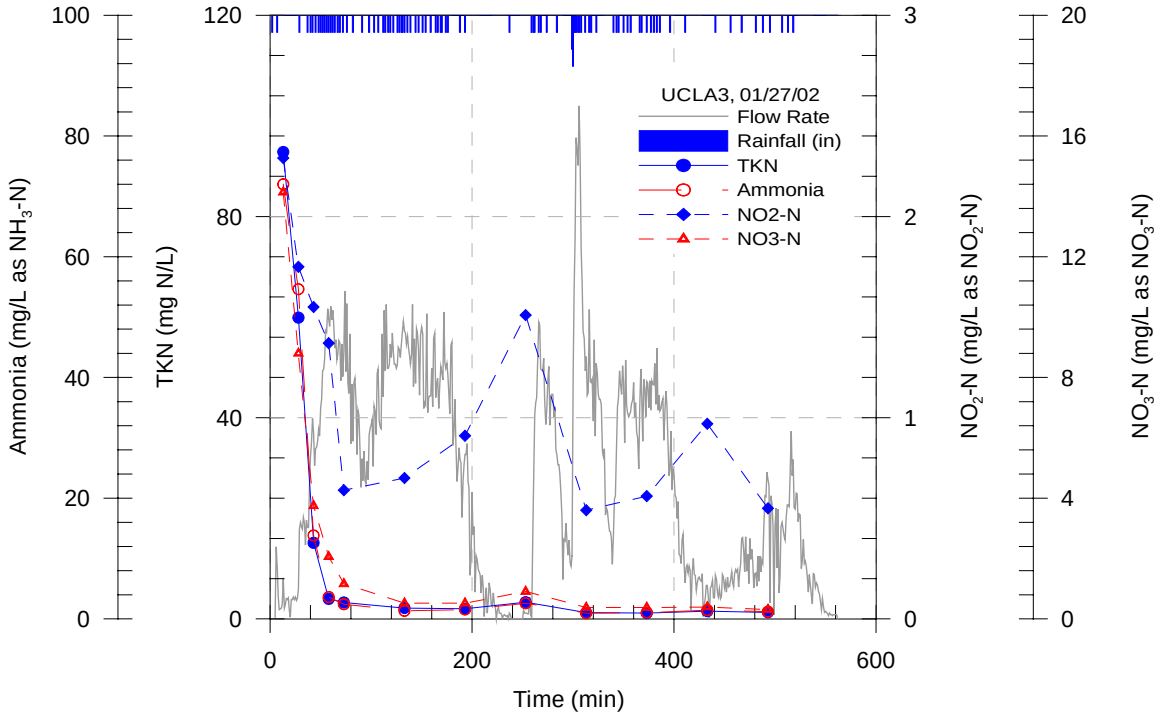

Figure I.3.3.5c[1] (Y3-UCLA3-E6-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

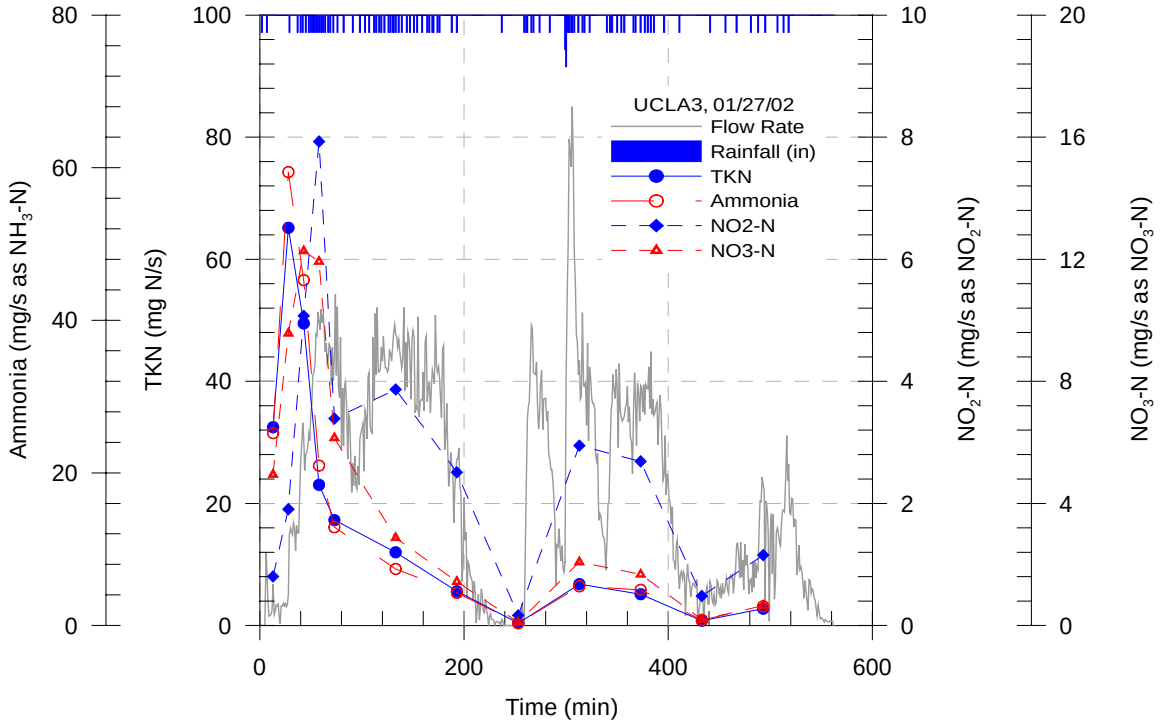

Figure I.3.3.5c[2] (Y3-UCLA3-E6-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

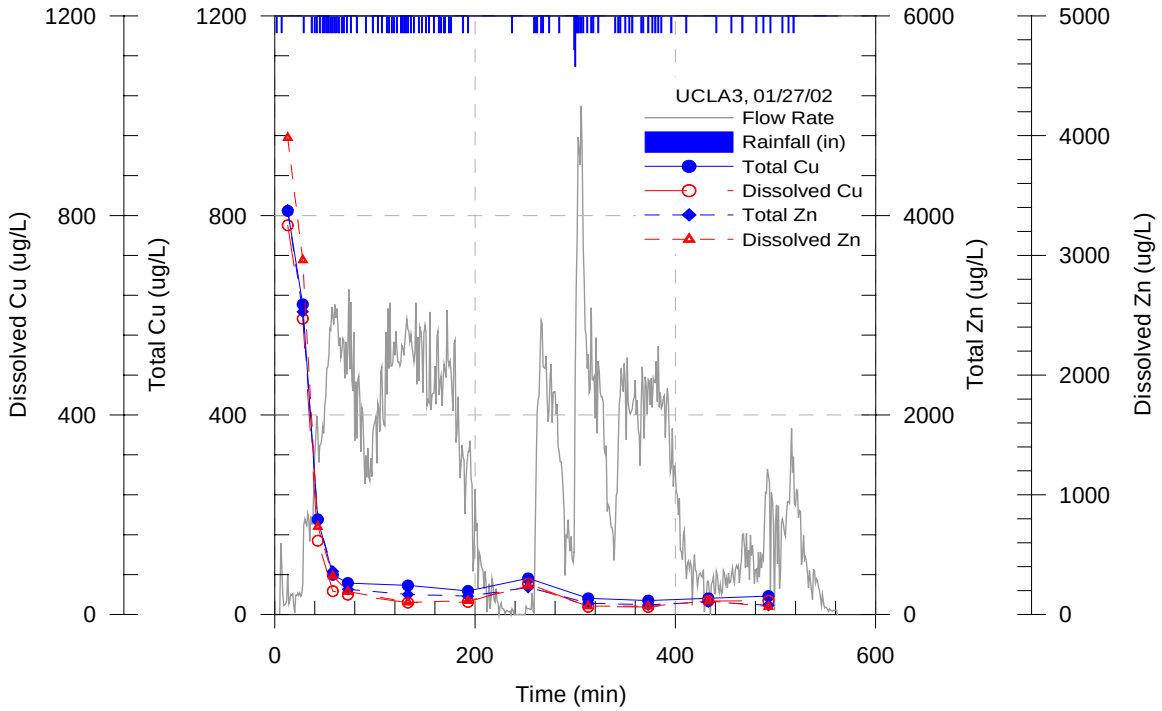

Figure I.3.3.5d[1] (Y3-UCLA3-E6-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

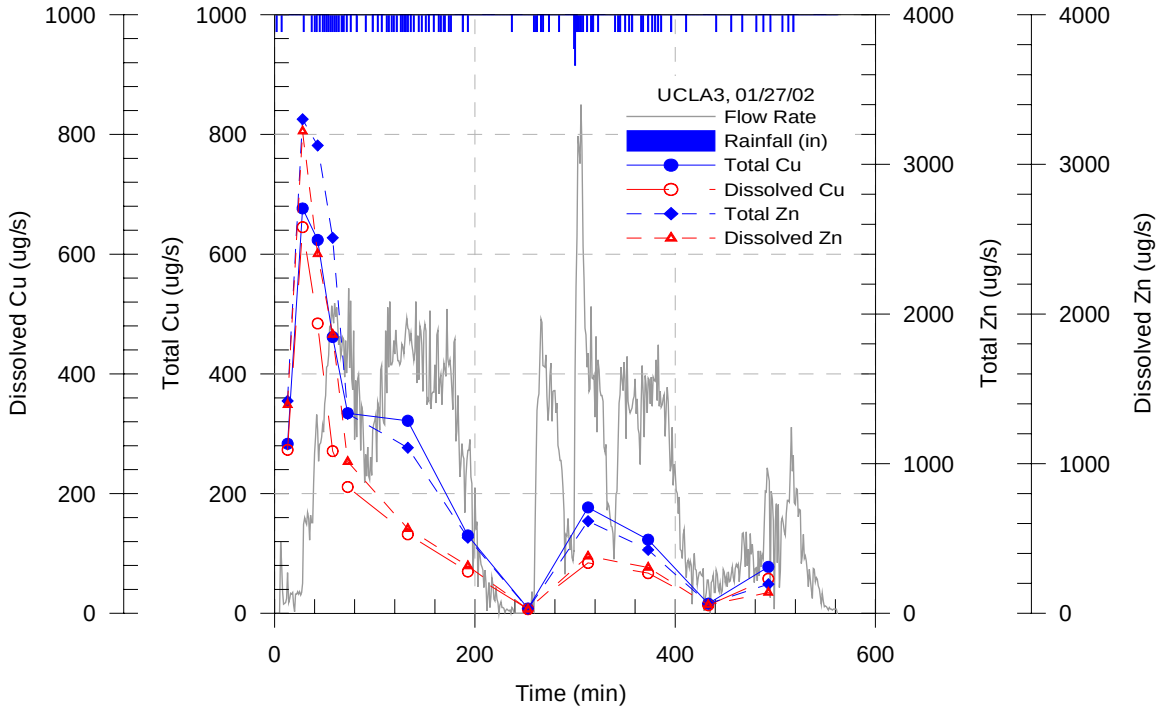

Figure I.3.3.5d[2] (Y3-UCLA3-E6-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

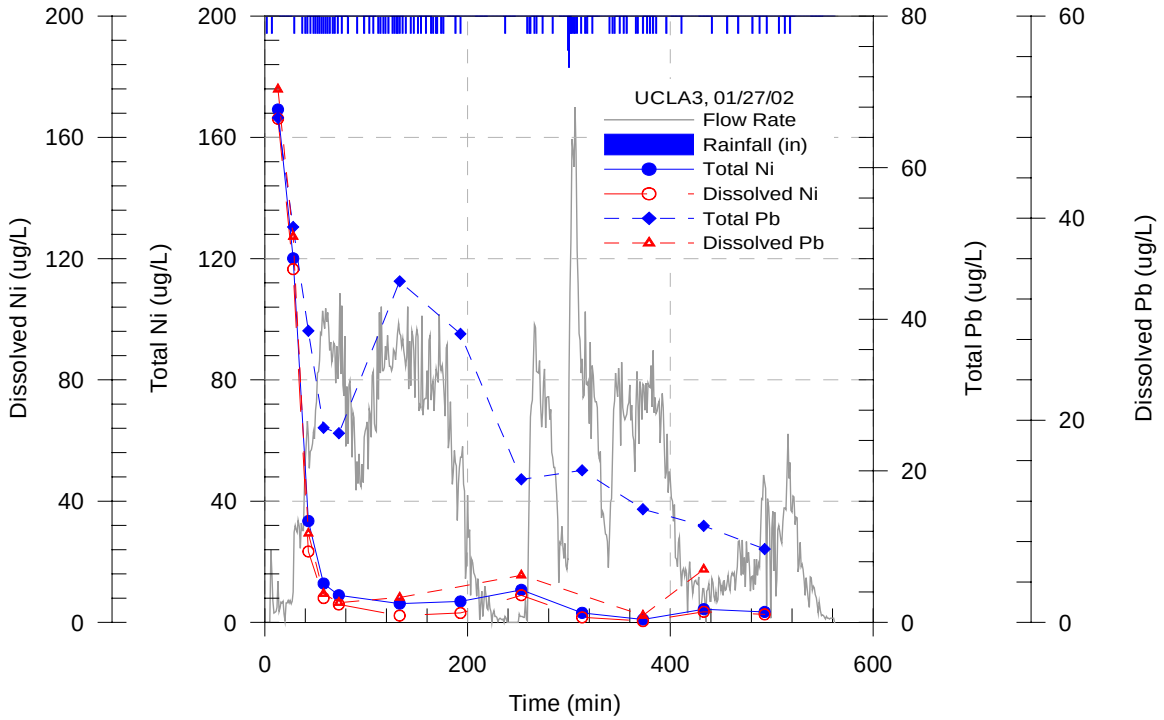

Figure I.3.3.5e[1] (Y3-UCLA3-E6-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

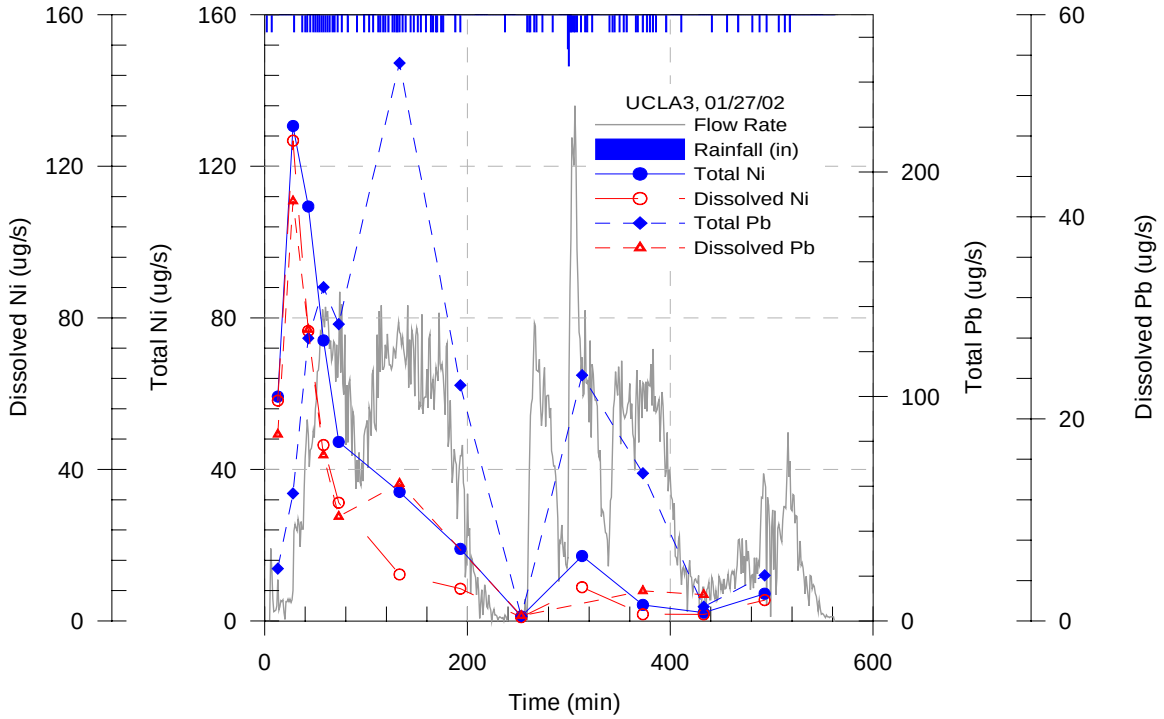

Figure I.3.3.5e[2] (Y3-UCLA3-E6-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

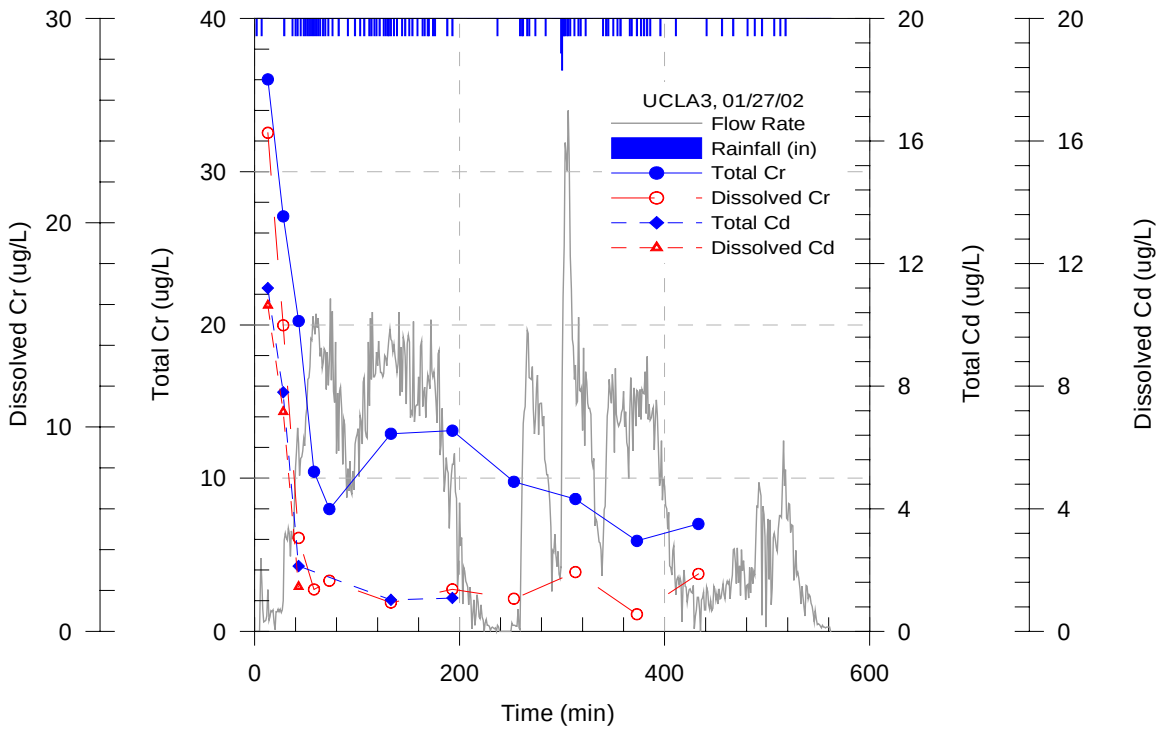

Figure I.3.3.5f[1] (Y3-UCLA3-E6-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

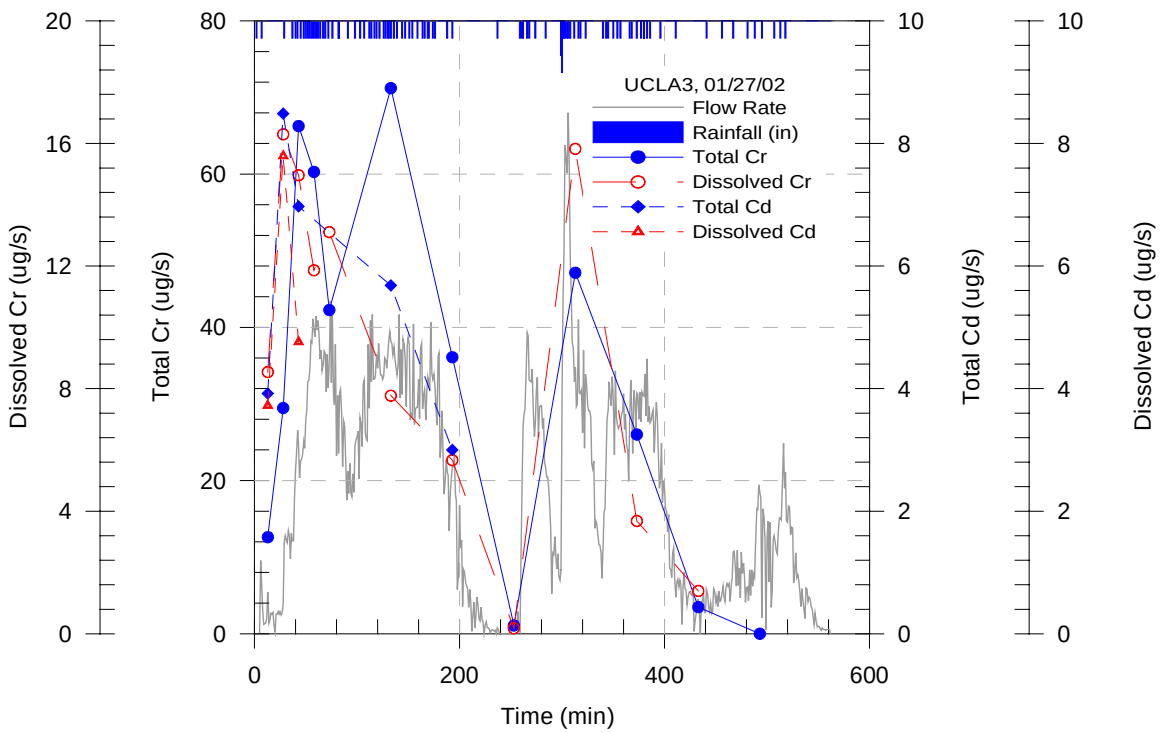

Figure I.3.3.5f[2] (Y3-UCLA3-E6-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

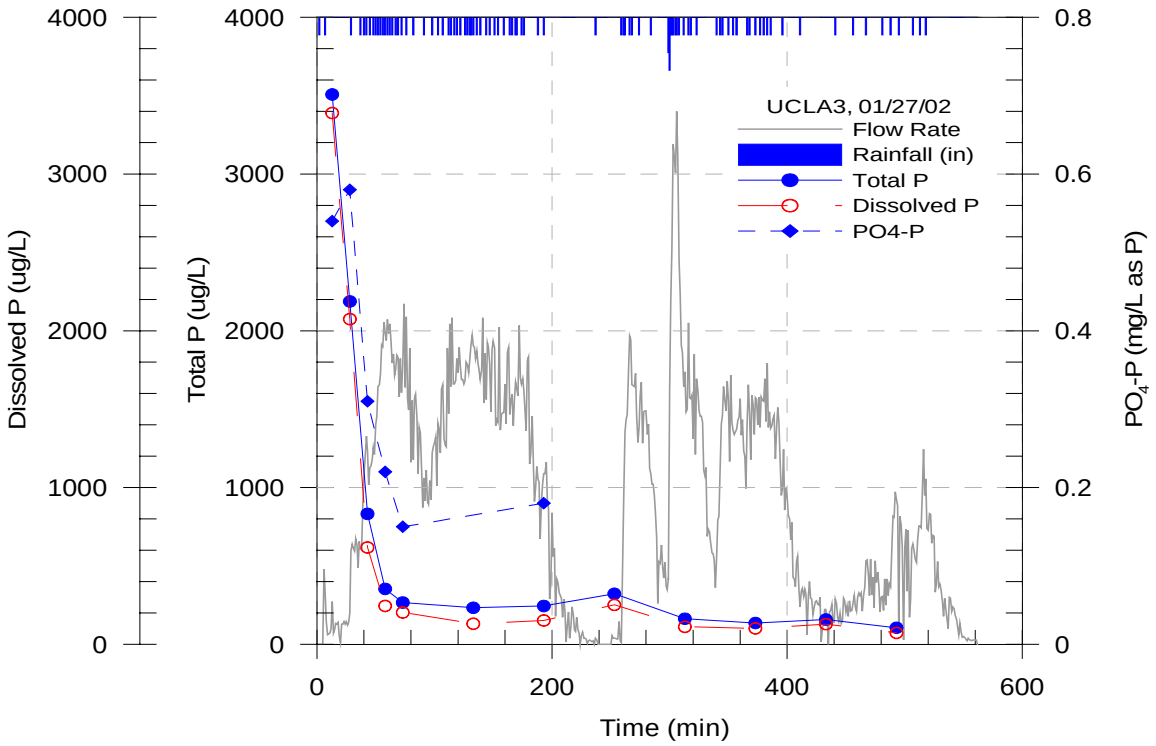

Figure I.3.3.5g[1] (Y3-UCLA3-E6-7). Polluto-graph for Total P / PO_4^{3-}-P

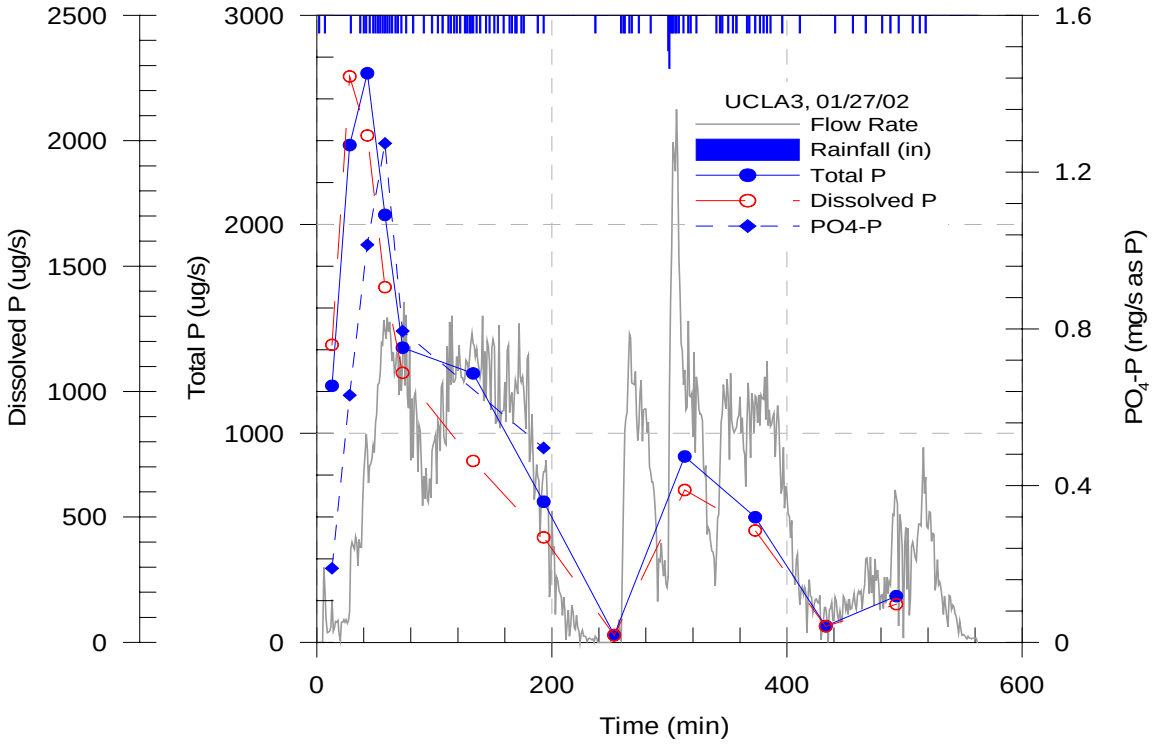

Figure I.3.3.5g[2] (Y3-UCLA3-E6-7). Load -graph for Total P / PO_4^{3-}P

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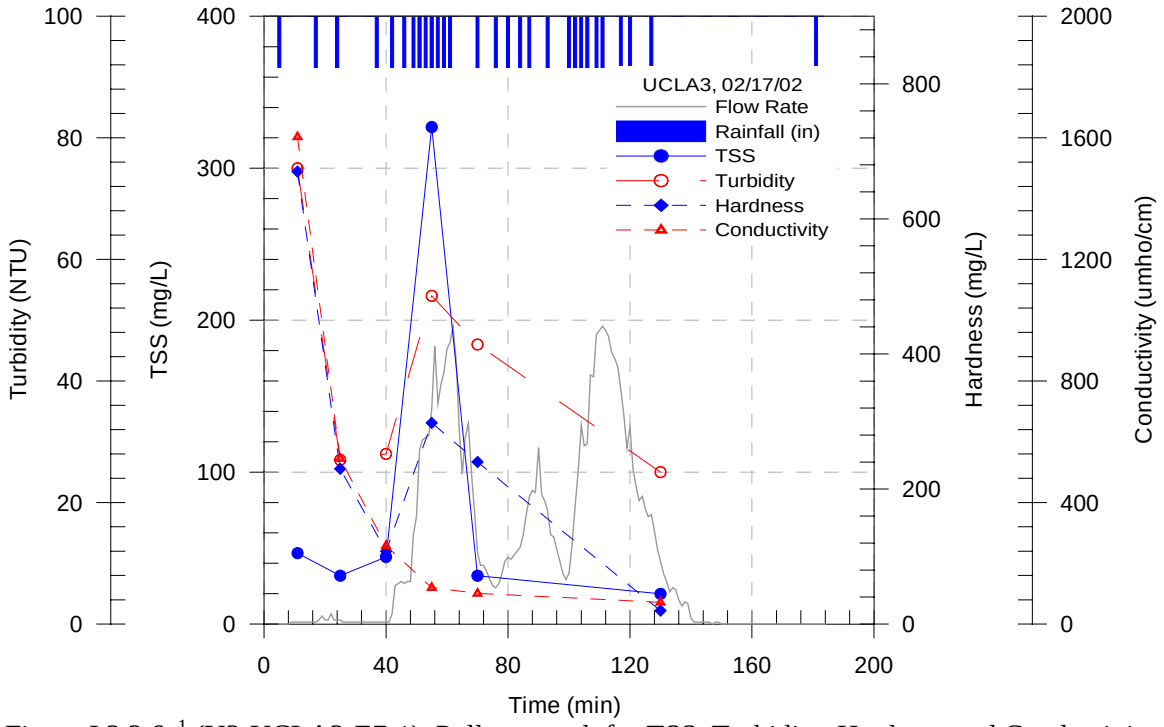

Figure I.3.3.6a[1] (Y3-UCLA3-E7-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

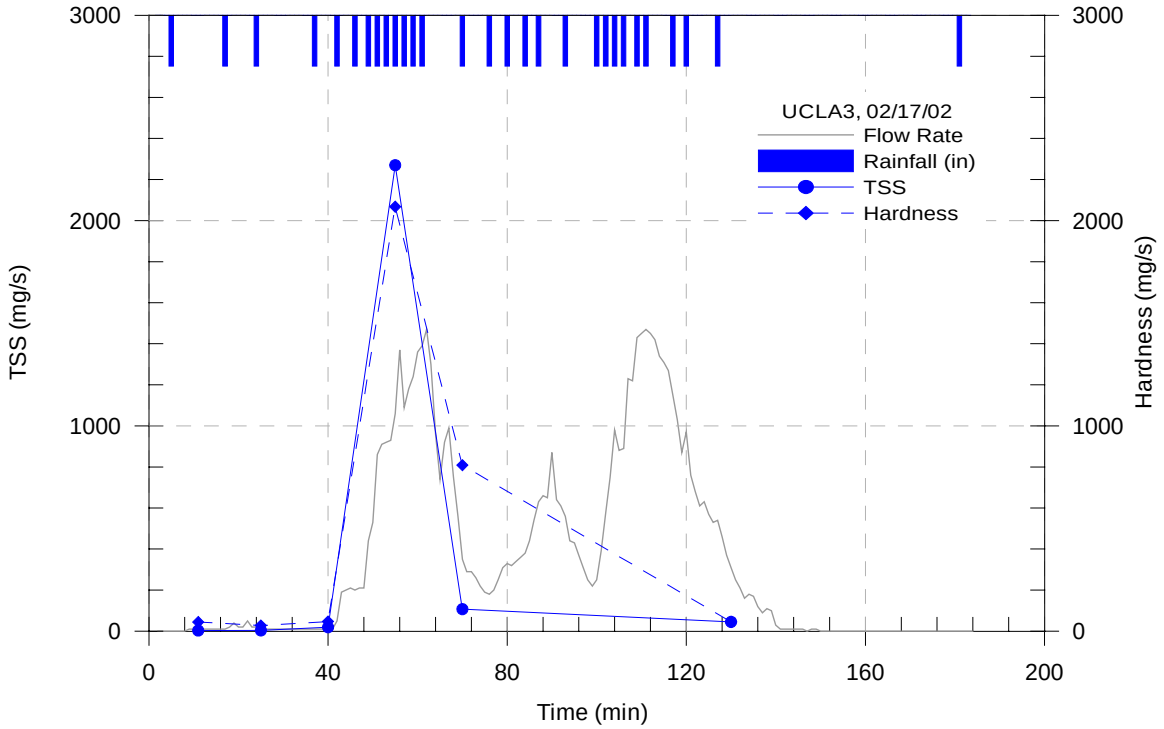

Figure I.3.3.6a[2] (Y3-UCLA3-E7-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

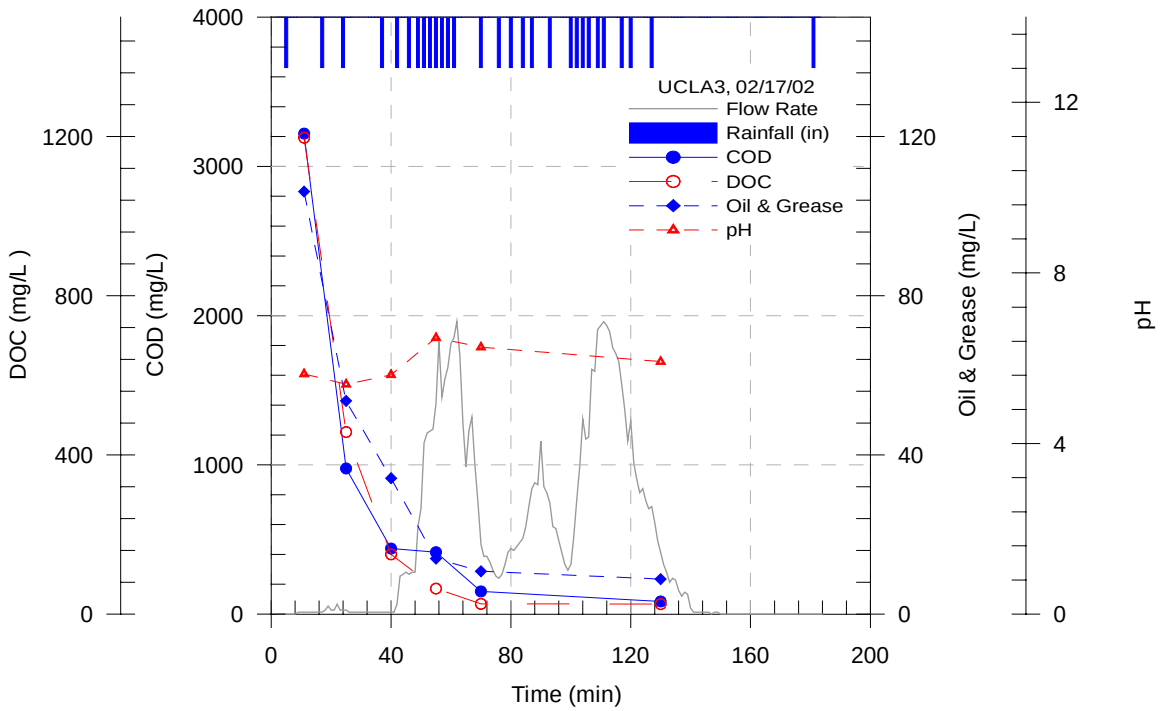

Figure I.3.3.6b[1] (Y3-UCLA3-E7-2). Polluto-graph for COD, DOC, Oil & Grease and pH

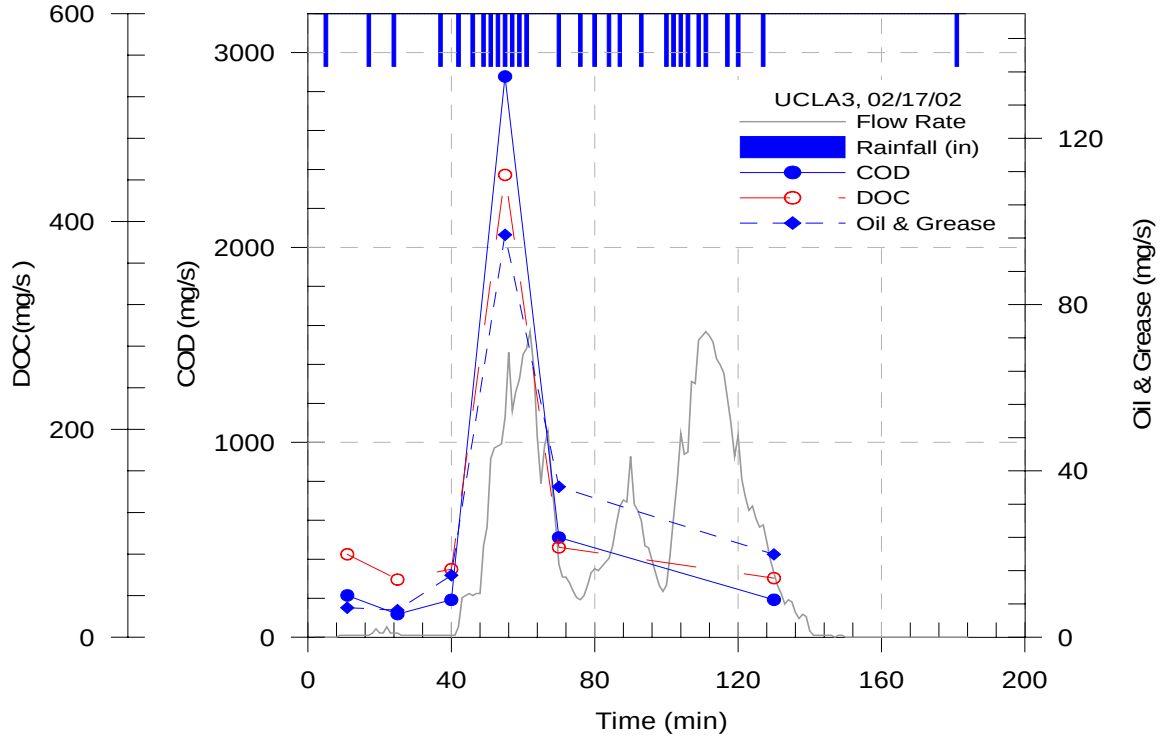

Figure I.3.3.6b[2] (Y3-UCLA3-E7-2). Load-graph for COD, DOC, Oil & Grease and pH

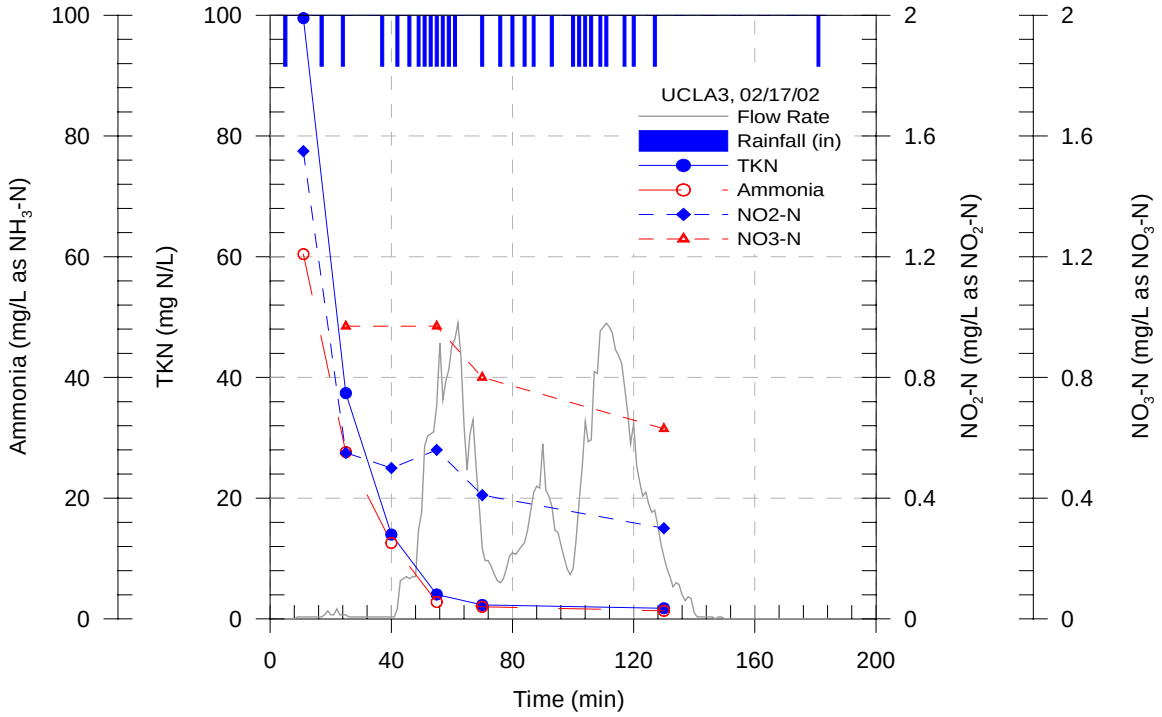

Figure I.3.3.6c[1] (Y3-UCLA3-E7-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

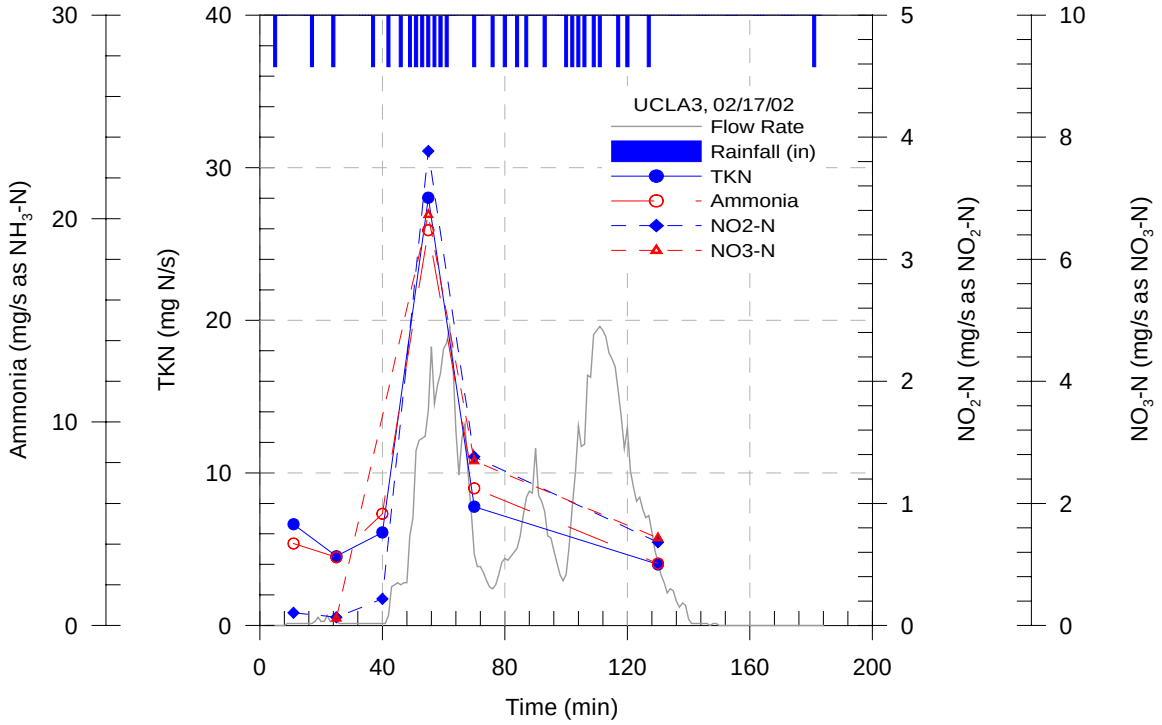

Figure I.3.3.6c[2] (Y3-UCLA3-E7-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

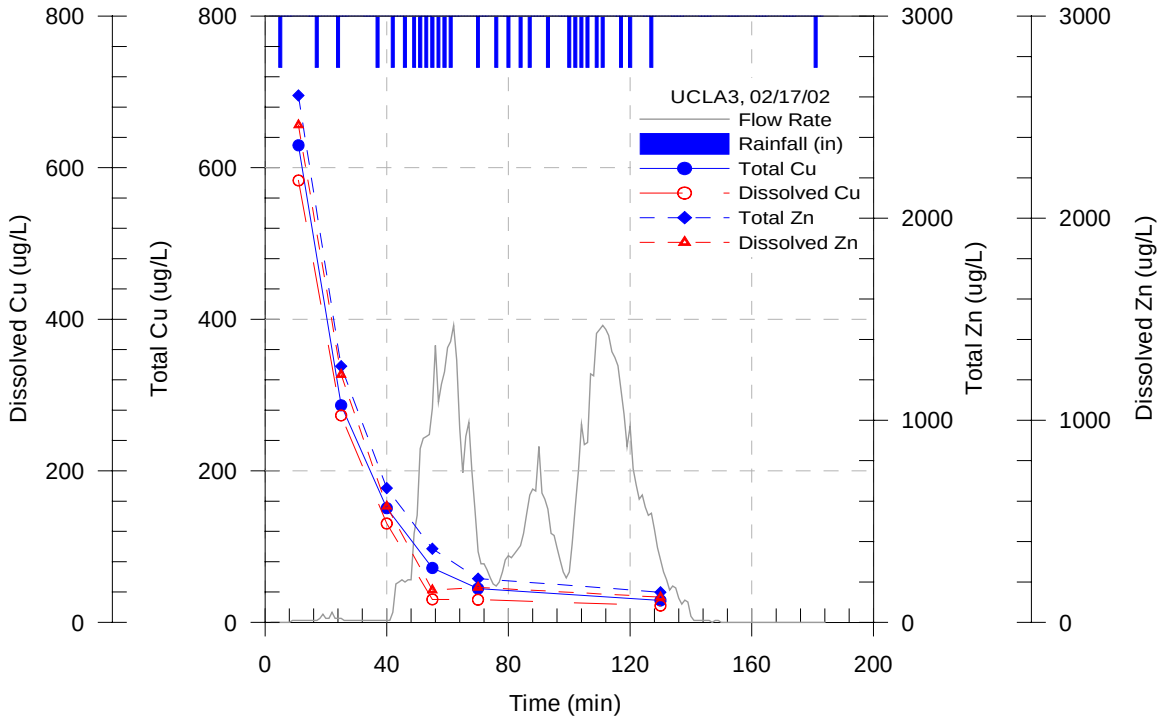

Figure I.3.3.6d[1] (Y3-UCLA3-E7-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

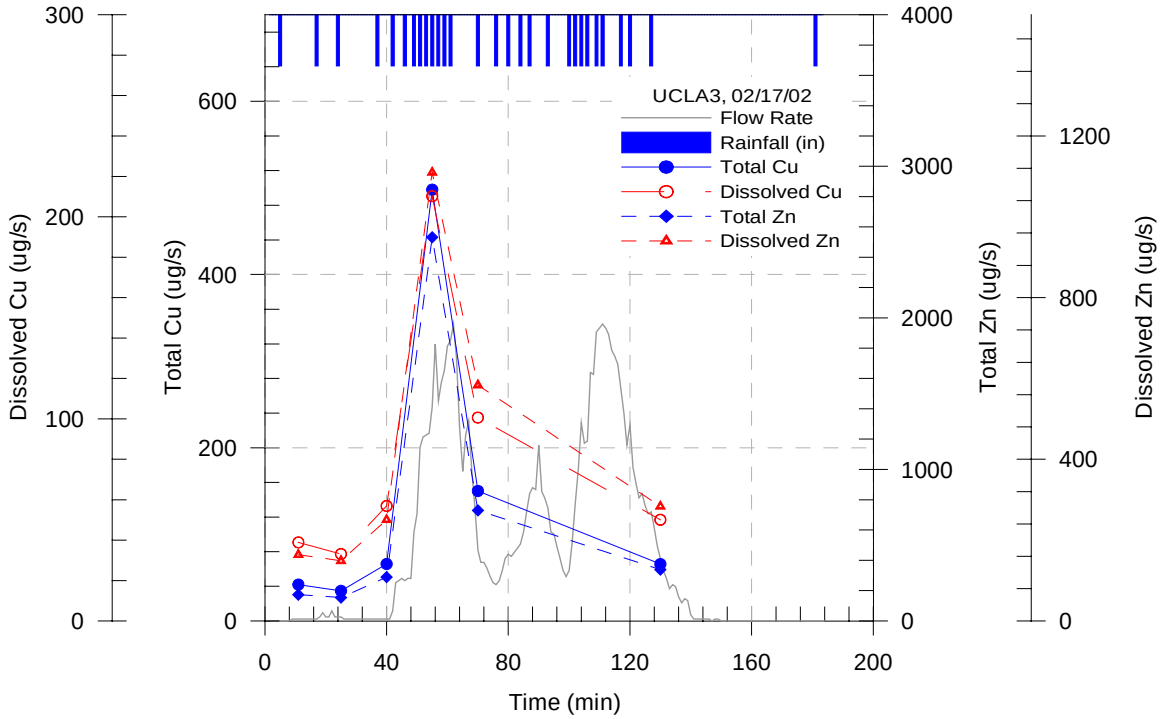

Figure I.3.3.6d[2] (Y3-UCLA3-E7-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

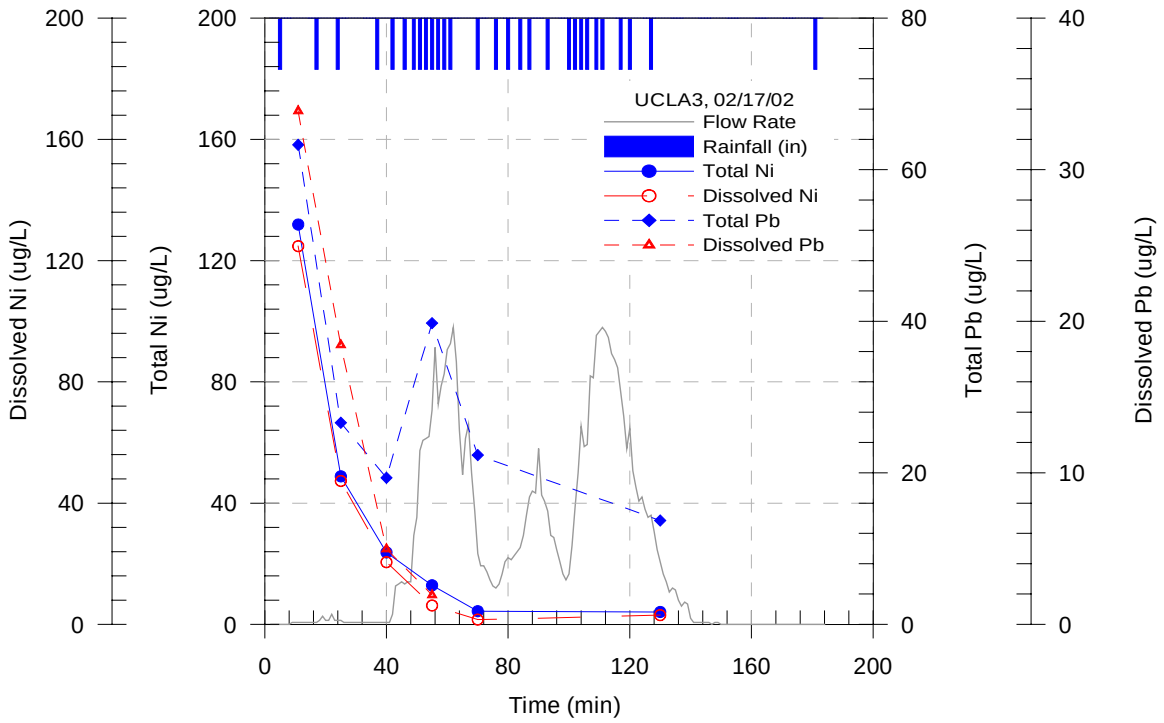

Figure I.3.3.6e[1] (Y3-UCLA3-E7-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

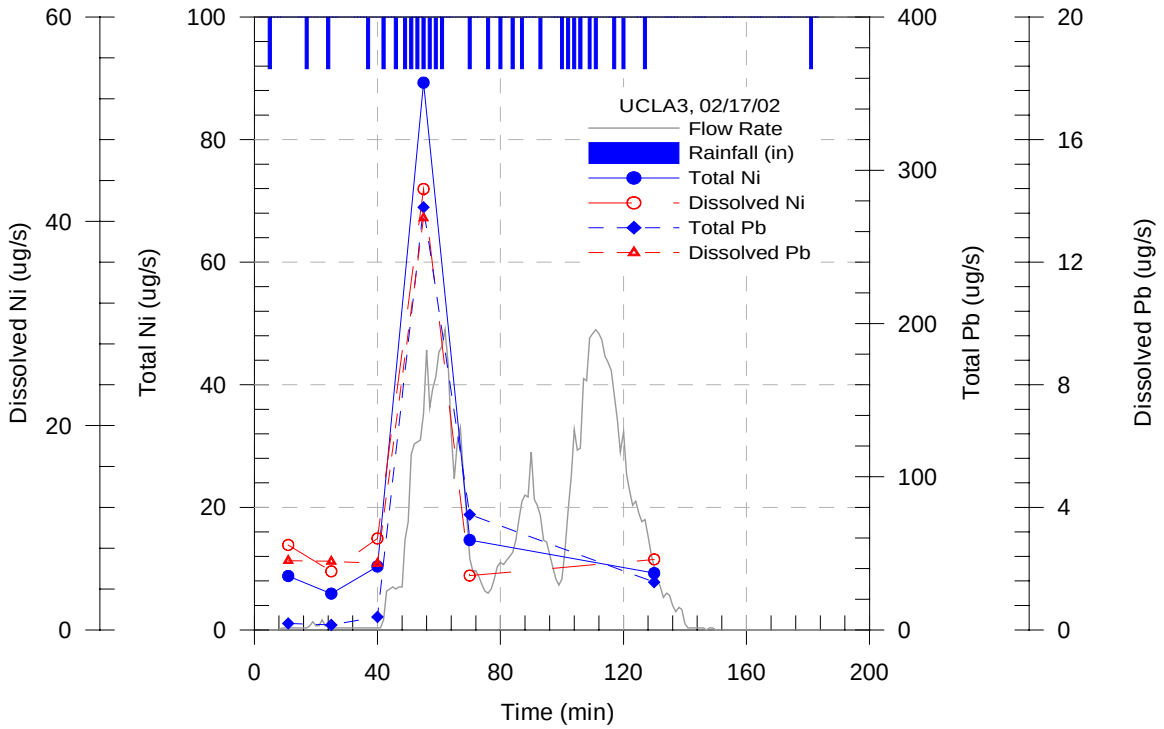

Figure I.3.3.6e[2] (Y3-UCLA3-E7-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

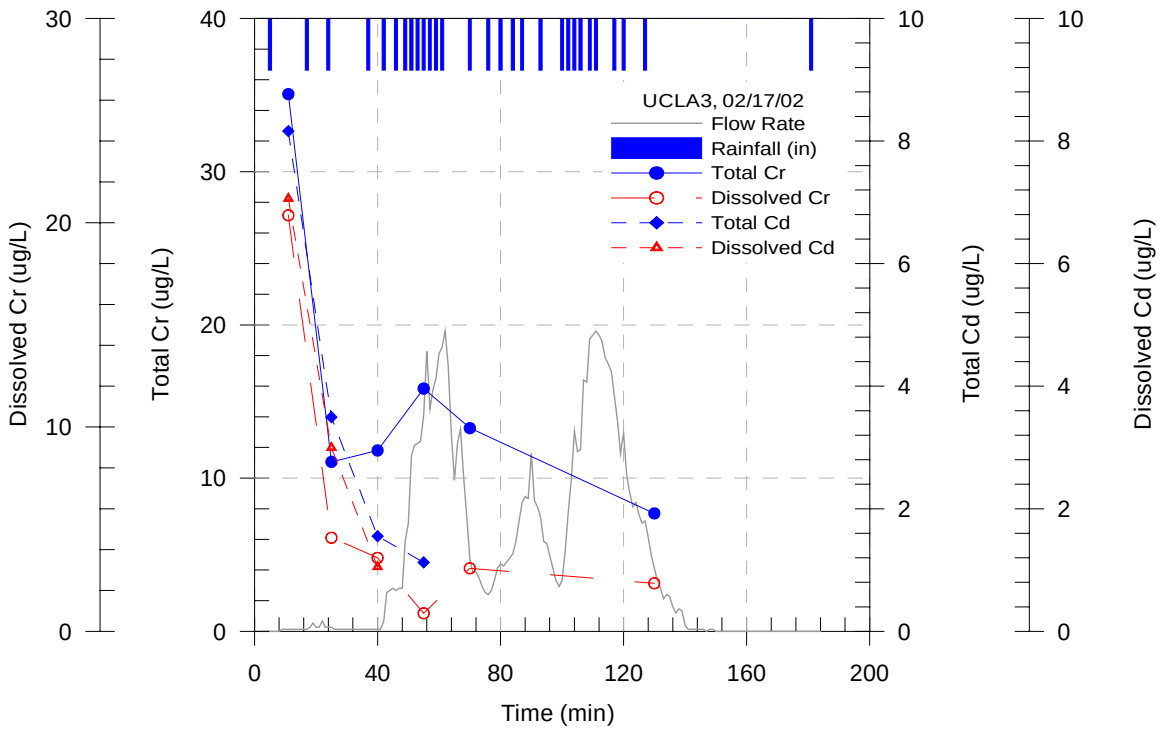

Figure I.3.3.6f[1] (Y3-UCLA3-E7-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

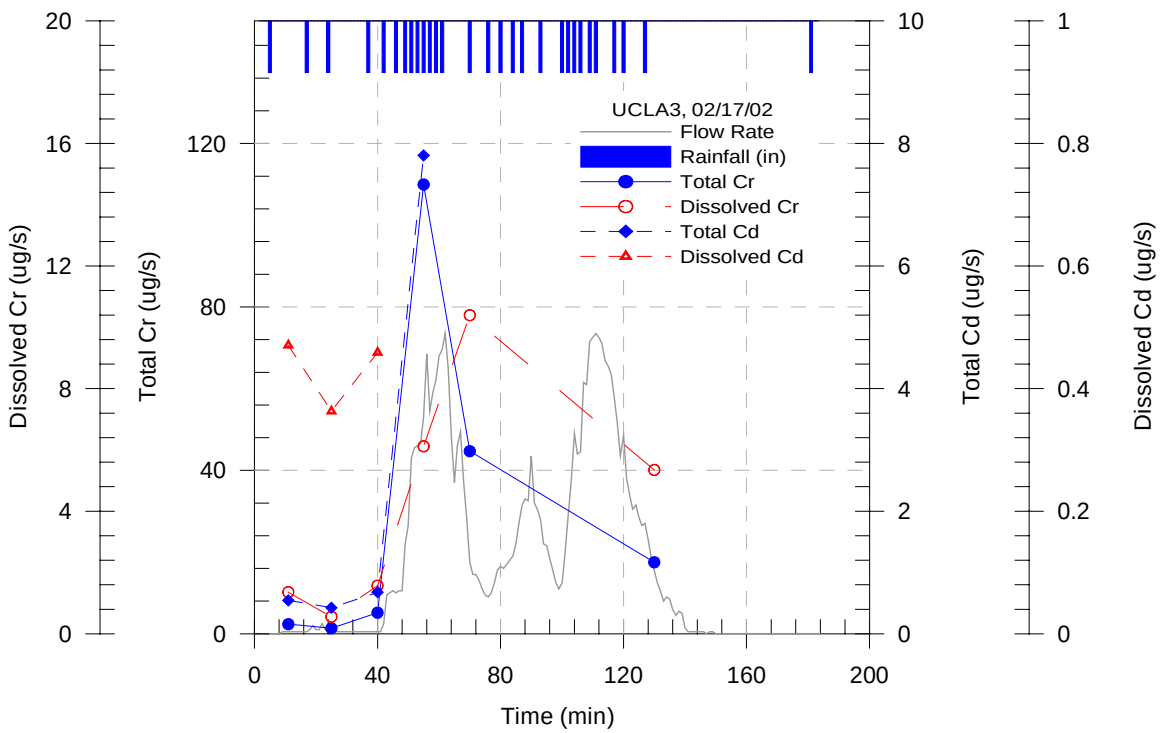

Figure I.3.3.6f[2] (Y3-UCLA3-E7-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

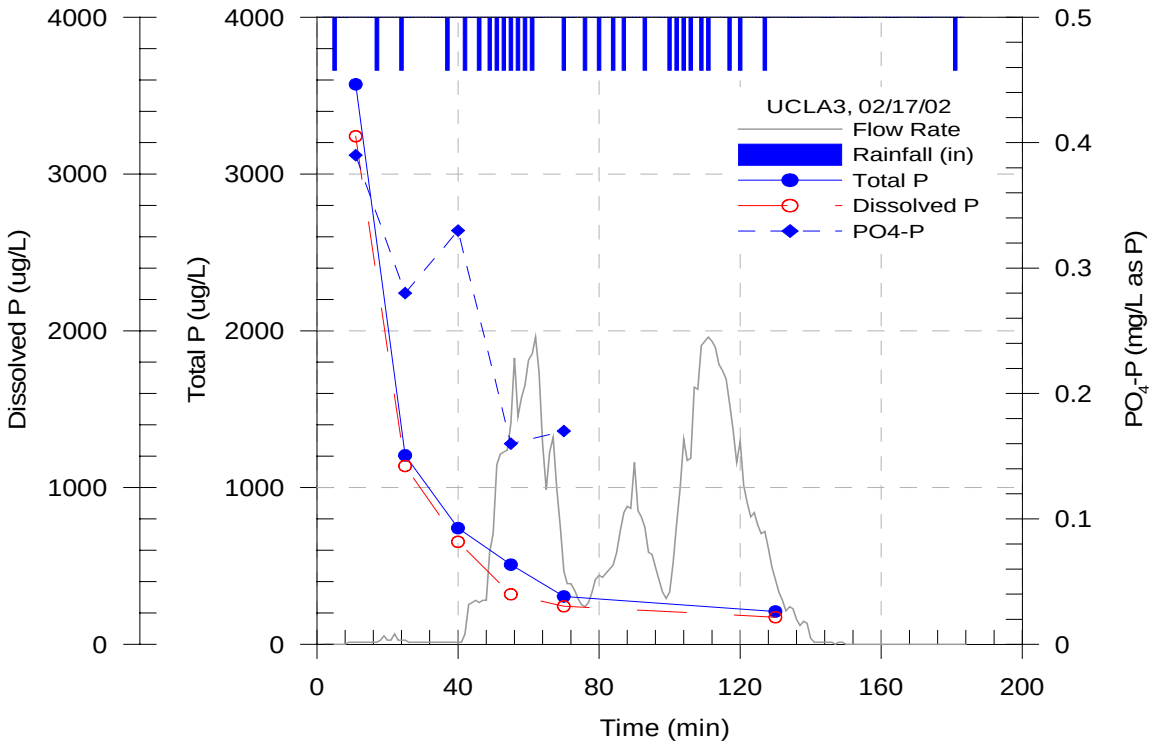

Figure I.3.3.6g[1] (Y3-UCLA3-E7-7). Polluto-graph for Total P / PO_4^{3-}-P

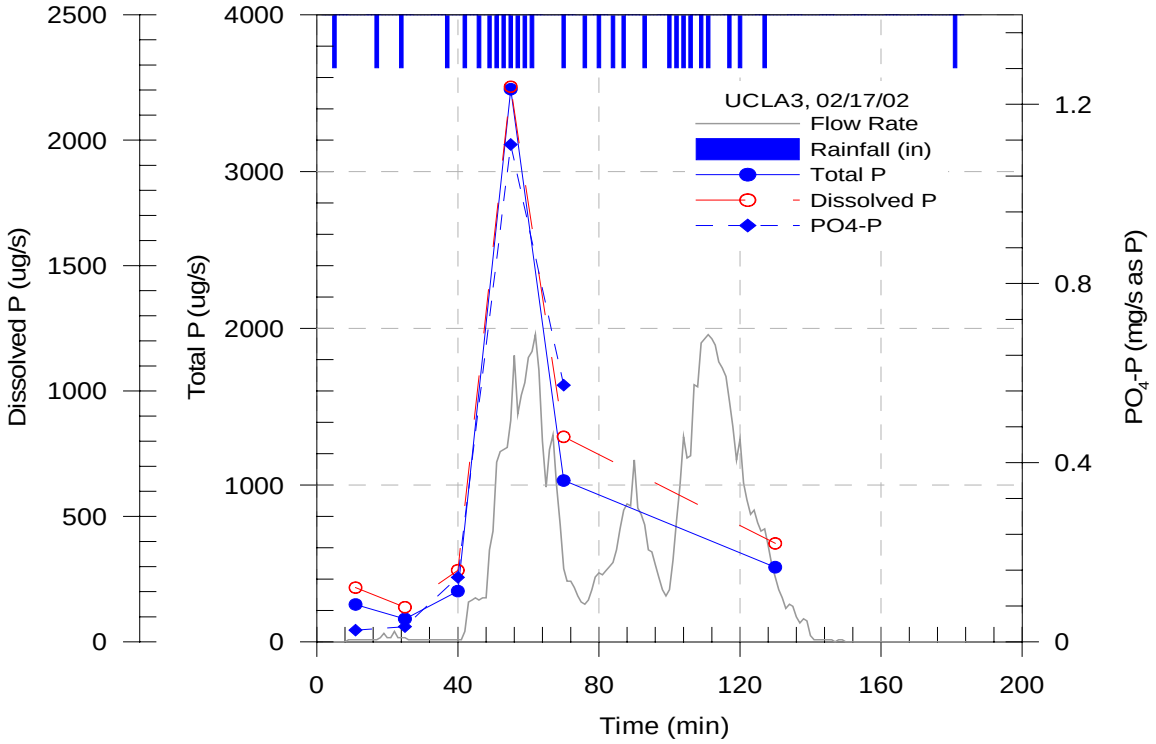

Figure I.3.3.6g[2] (Y3-UCLA3-E7-7). Load -graph for Total P / PO_4^{3-}P

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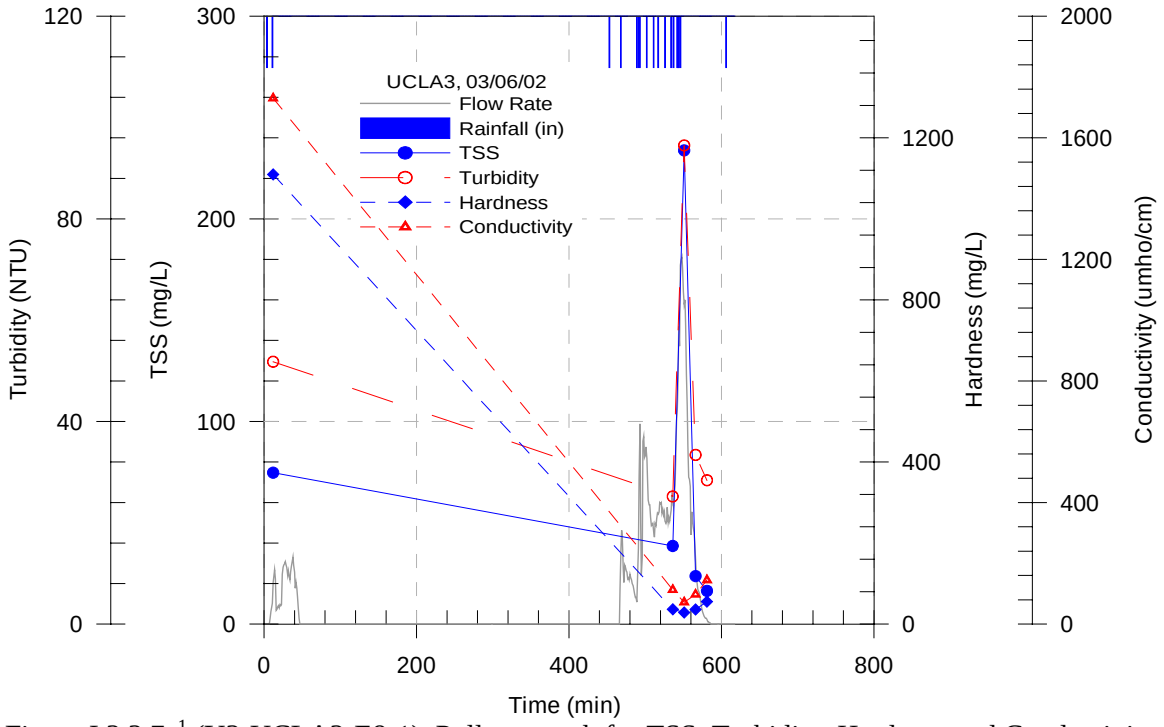

Figure I.3.3.7a[1] (Y3-UCLA3-E8-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

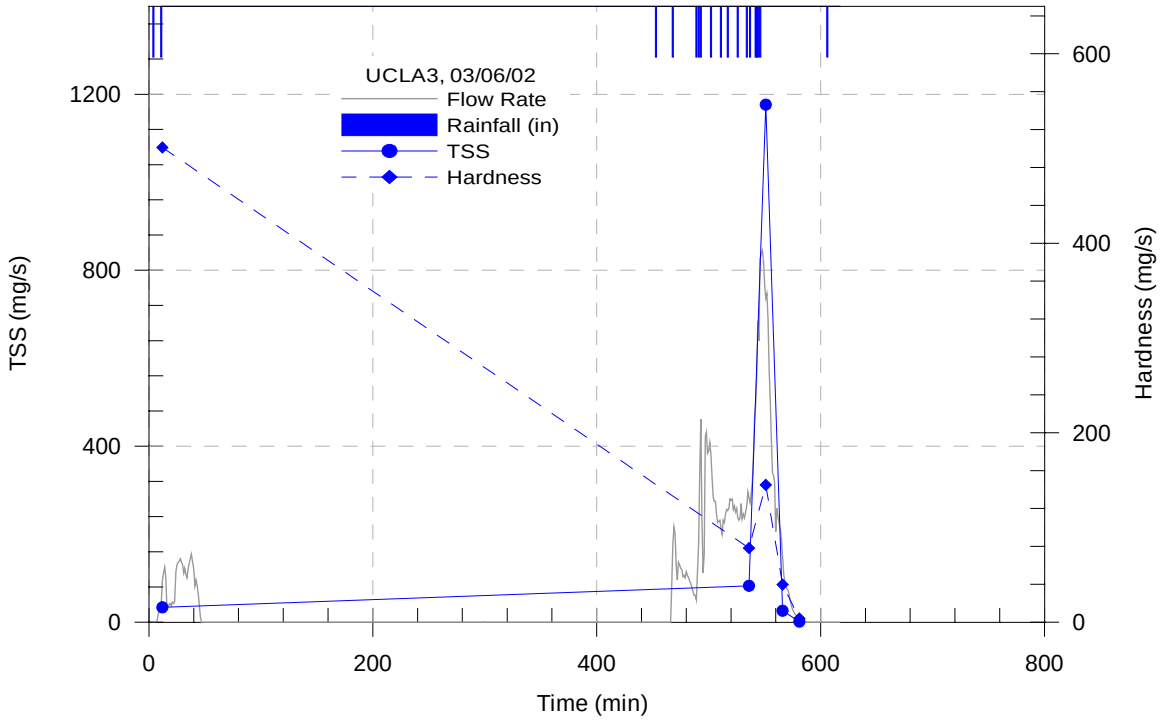

Figure I.3.3.7a[2] (Y3-UCLA3-E8-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

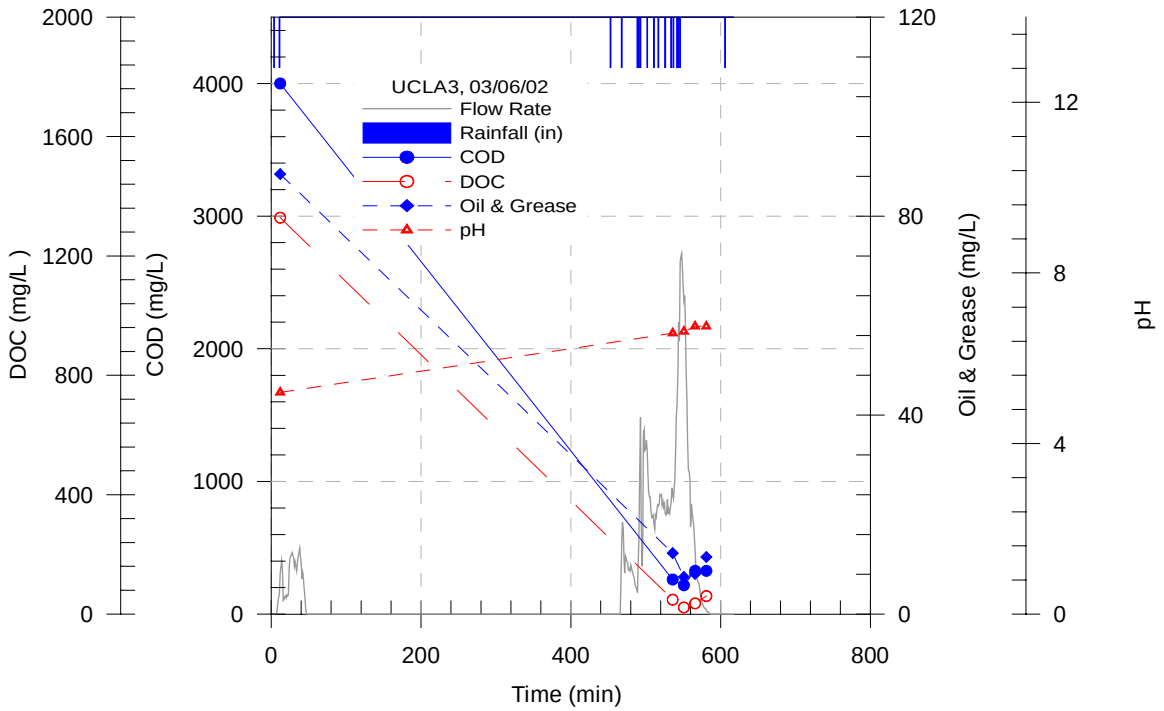

Figure I.3.3.7b[1] (Y3-UCLA3-E8-2). Polluto-graph for COD, DOC, Oil & Grease and pH

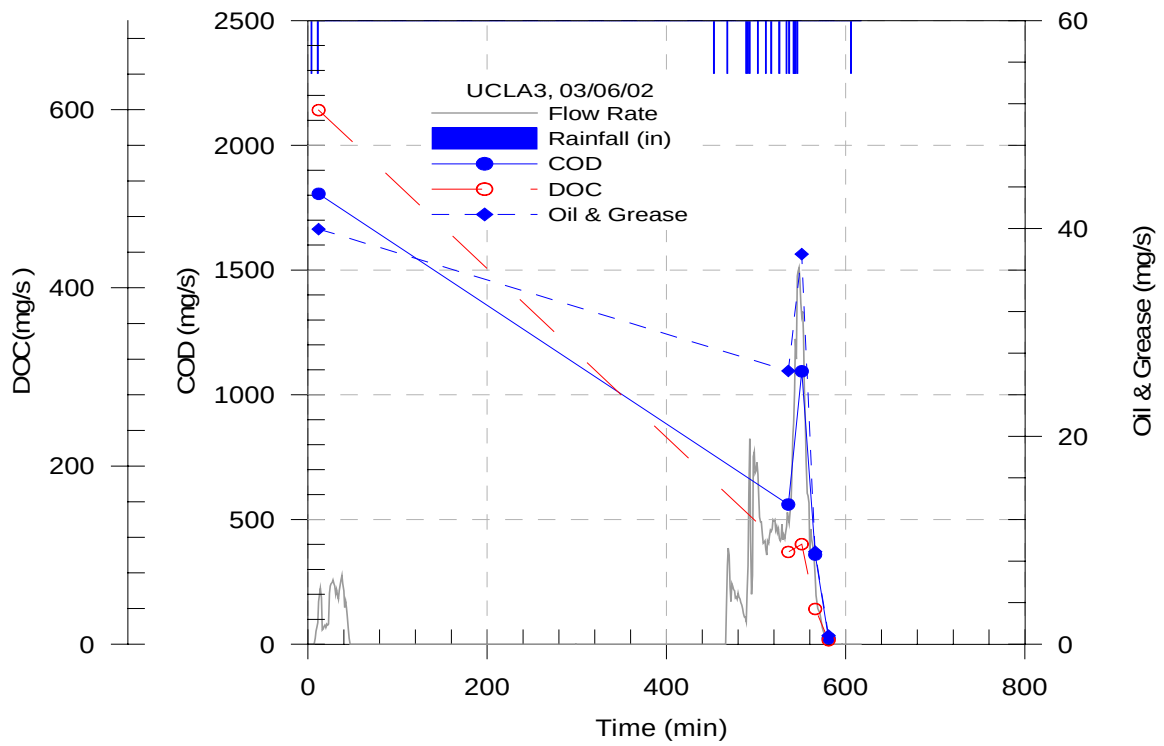

Figure I.3.3.7b[2] (Y3-UCLA3-E8-2). Load-graph for COD, DOC, Oil & Grease and pH

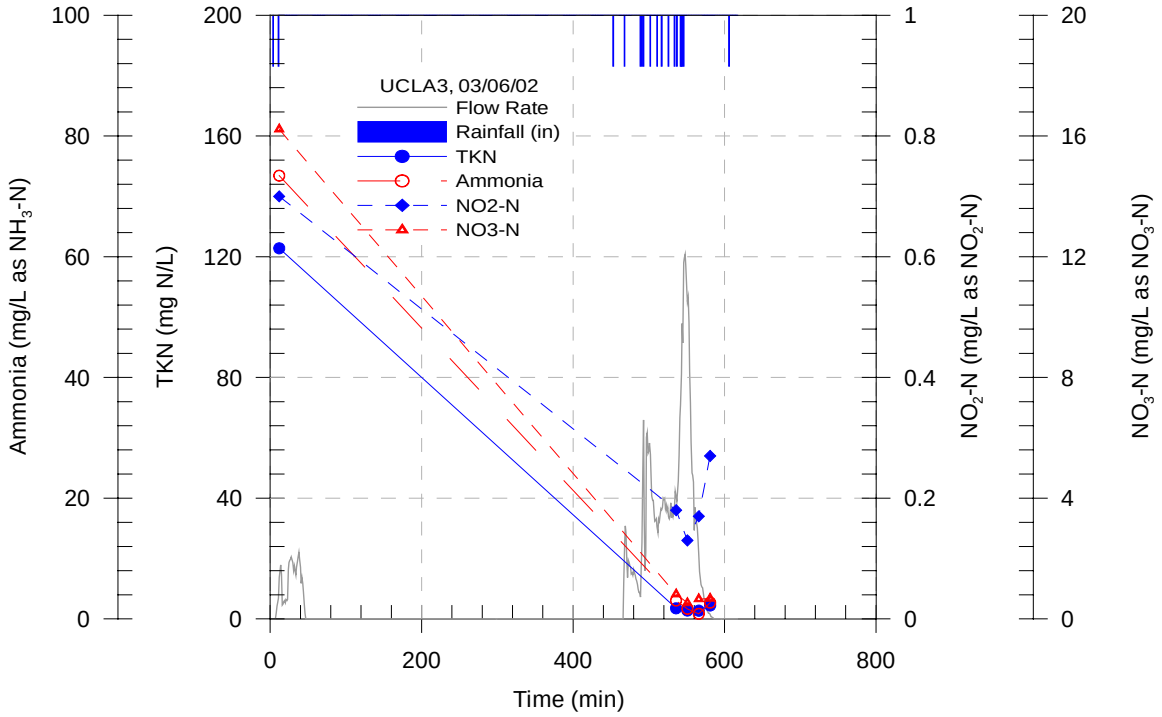

Figure I.3.3.7c[1] (Y3-UCLA3-E8-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

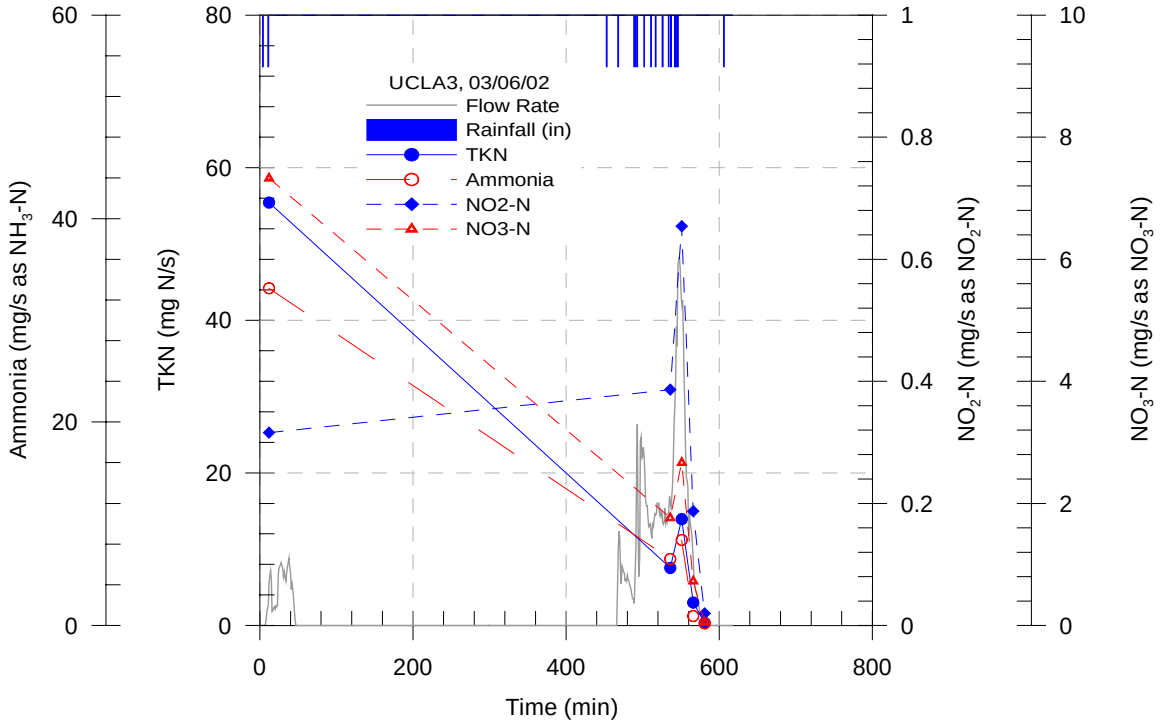

Figure I.3.3.7c[2] (Y3-UCLA3-E8-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

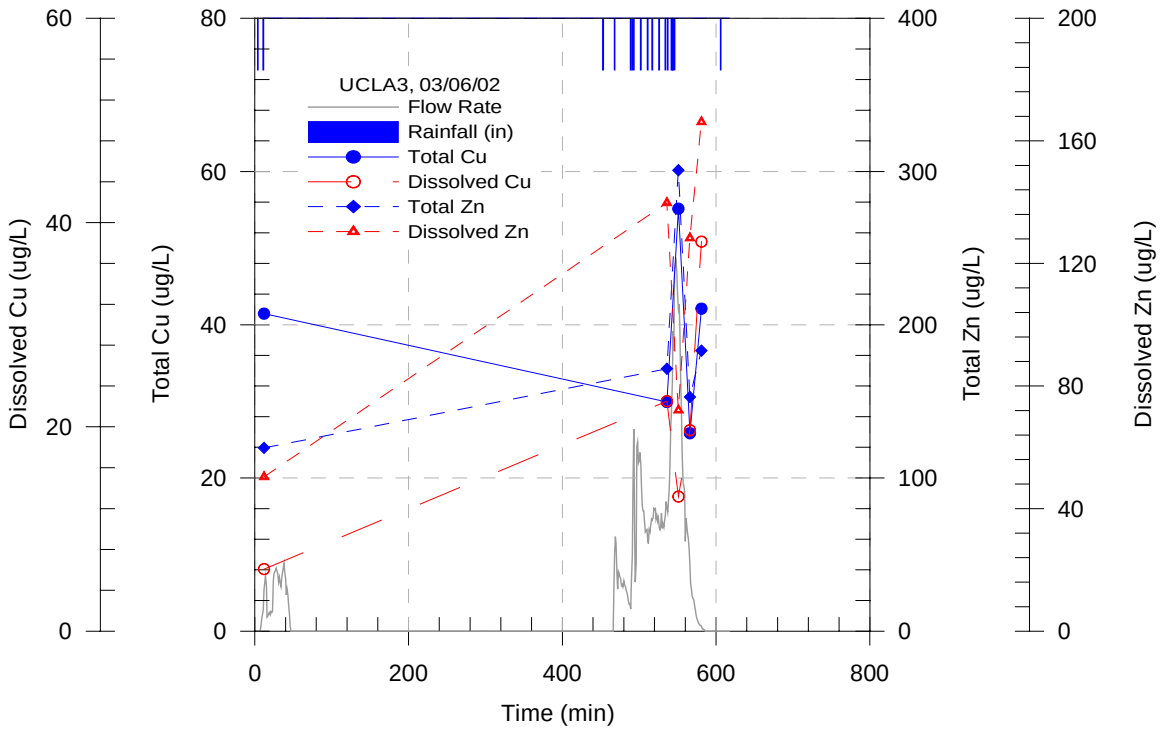

Figure I.3.3.7d[1] (Y3-UCLA3-E8-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

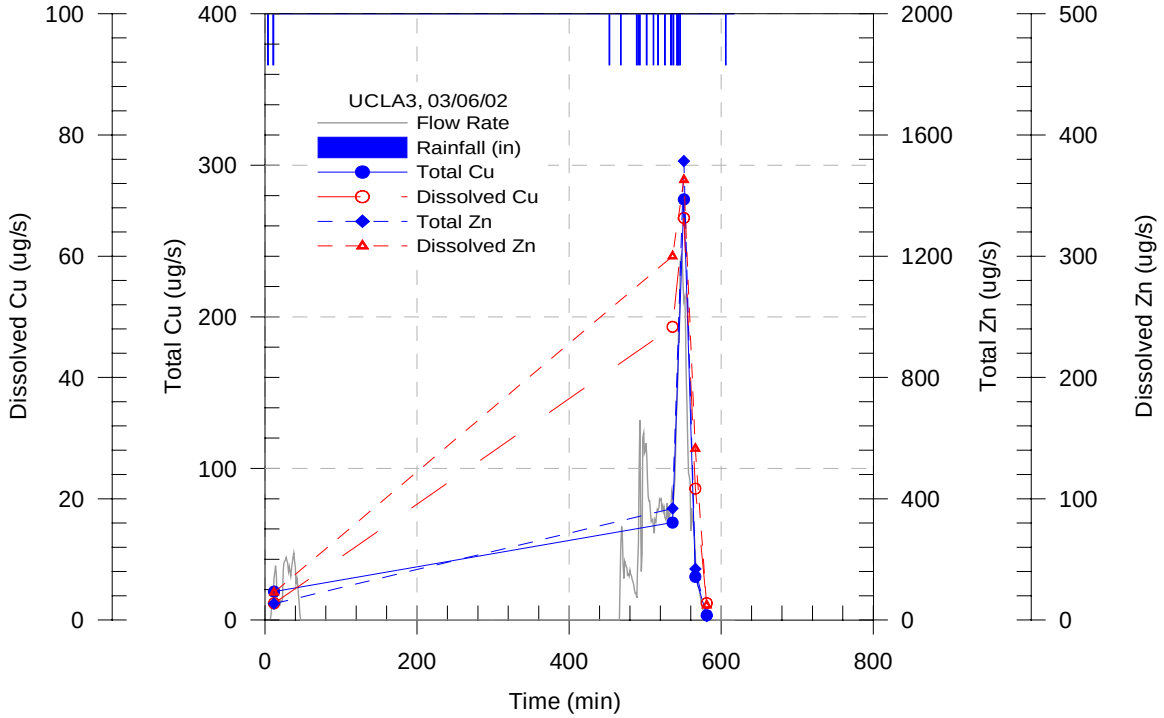

Figure I.3.3.7d[2] (Y3-UCLA3-E8-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

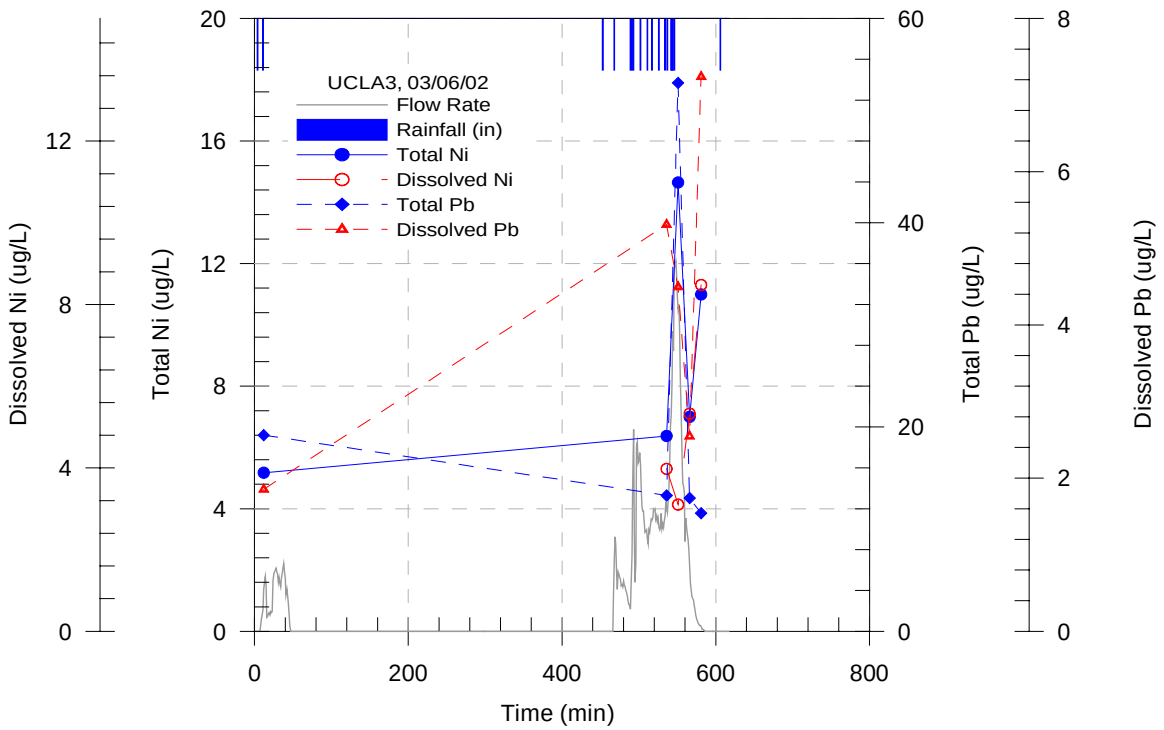

Figure I.3.3.7e[1] (Y3-UCLA3-E8-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

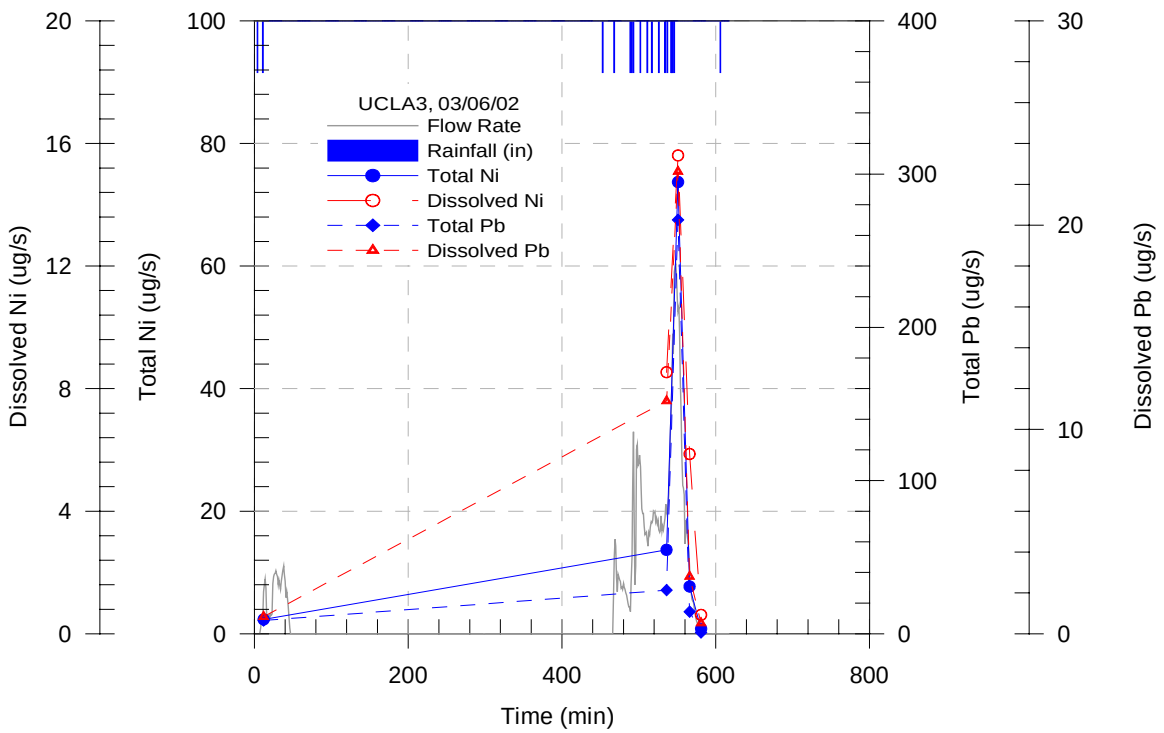

Figure I.3.3.7e[2] (Y3-UCLA3-E8-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

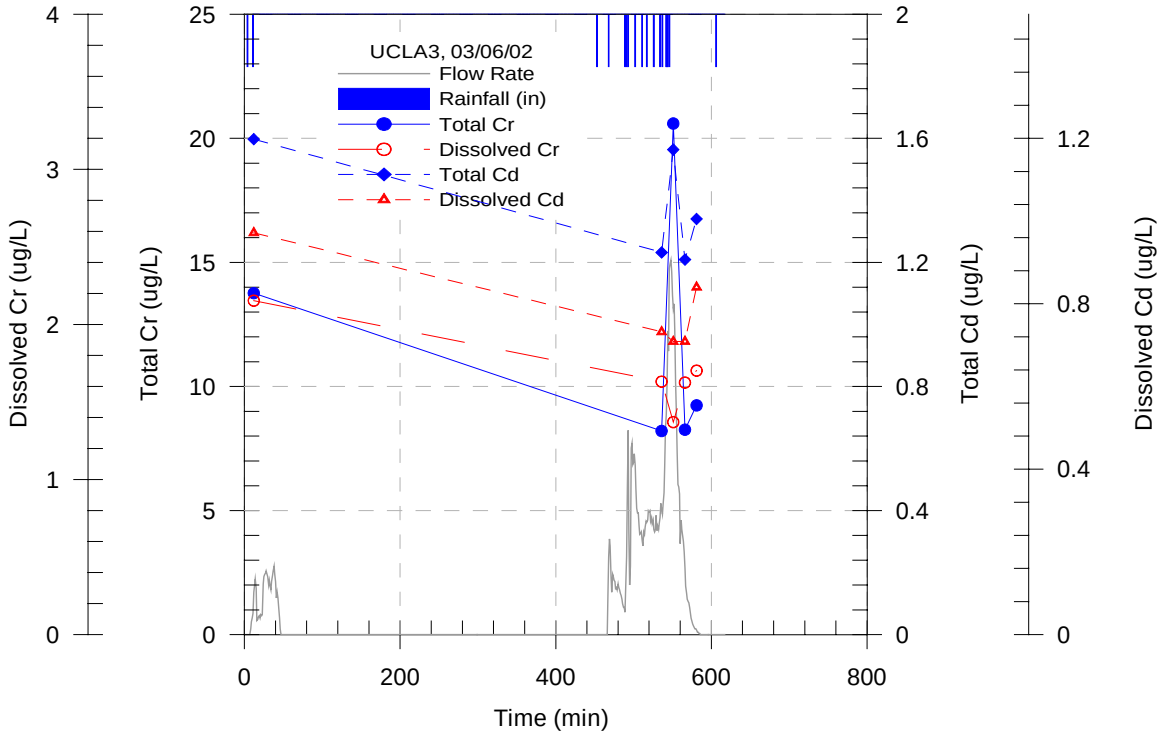

Figure I.3.3.7f[1] (Y3-UCLA3-E8-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

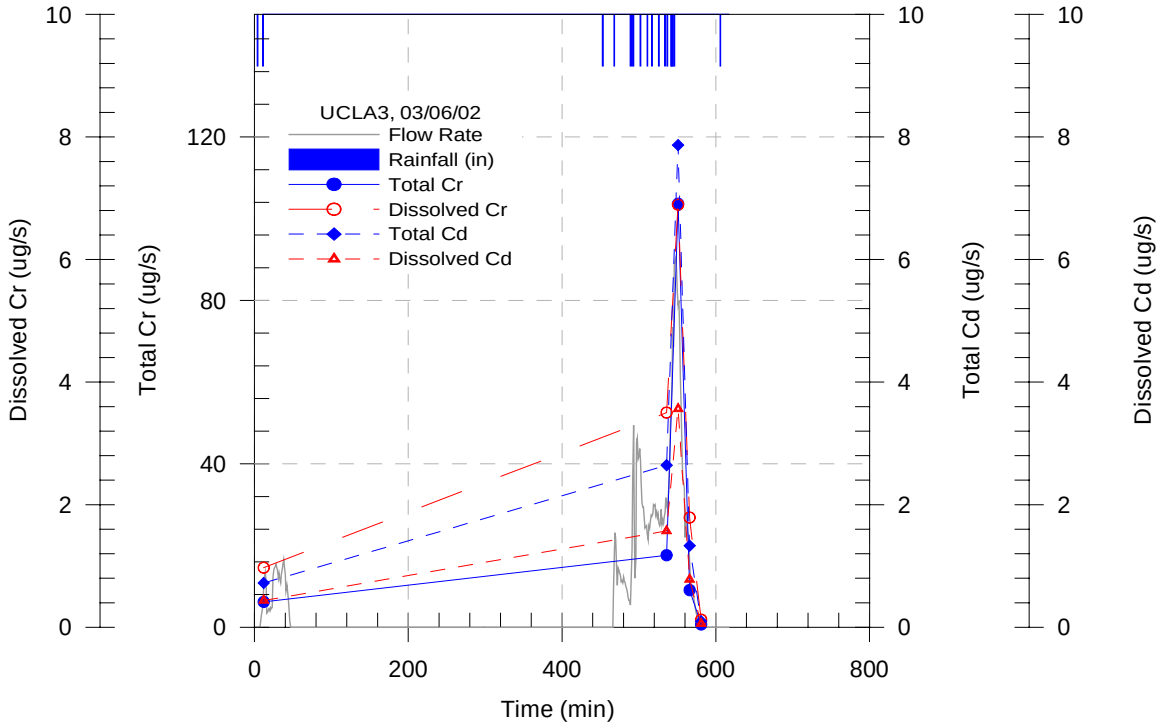

Figure I.3.3.7f[2] (Y3-UCLA3-E8-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

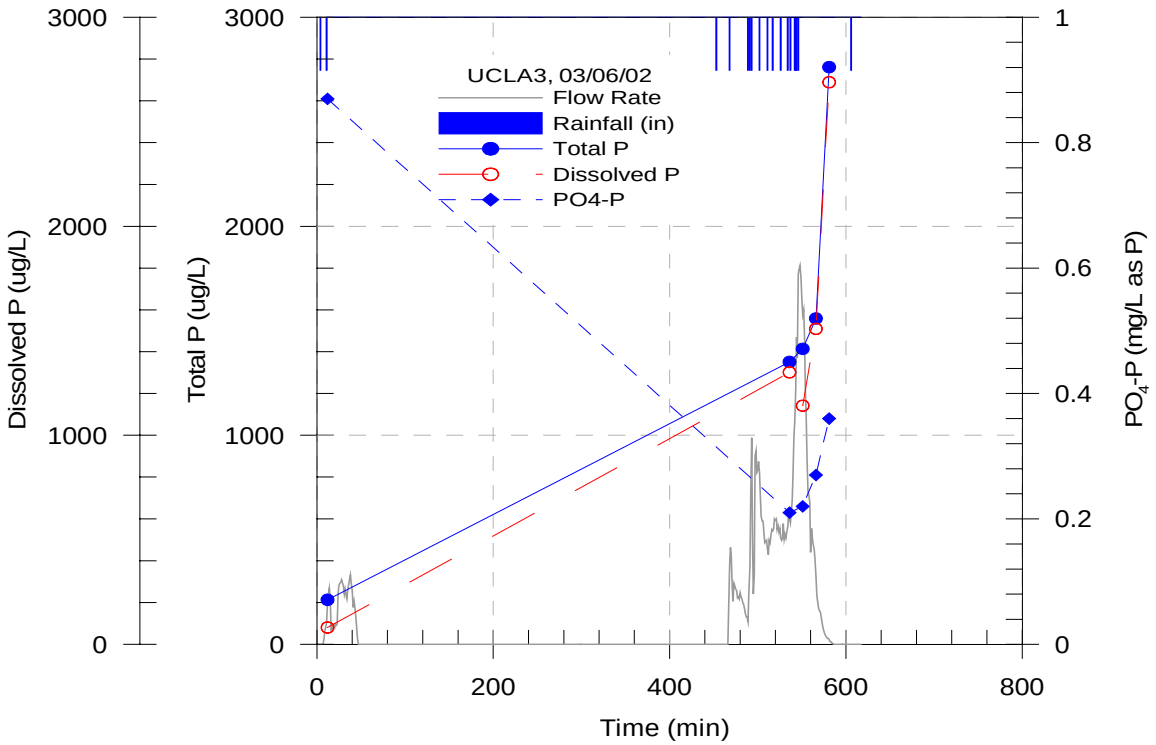

Figure I.3.3.7g[1] (Y3-UCLA3-E8-7). Polluto-graph for Total P / PO_4^{3-}-P

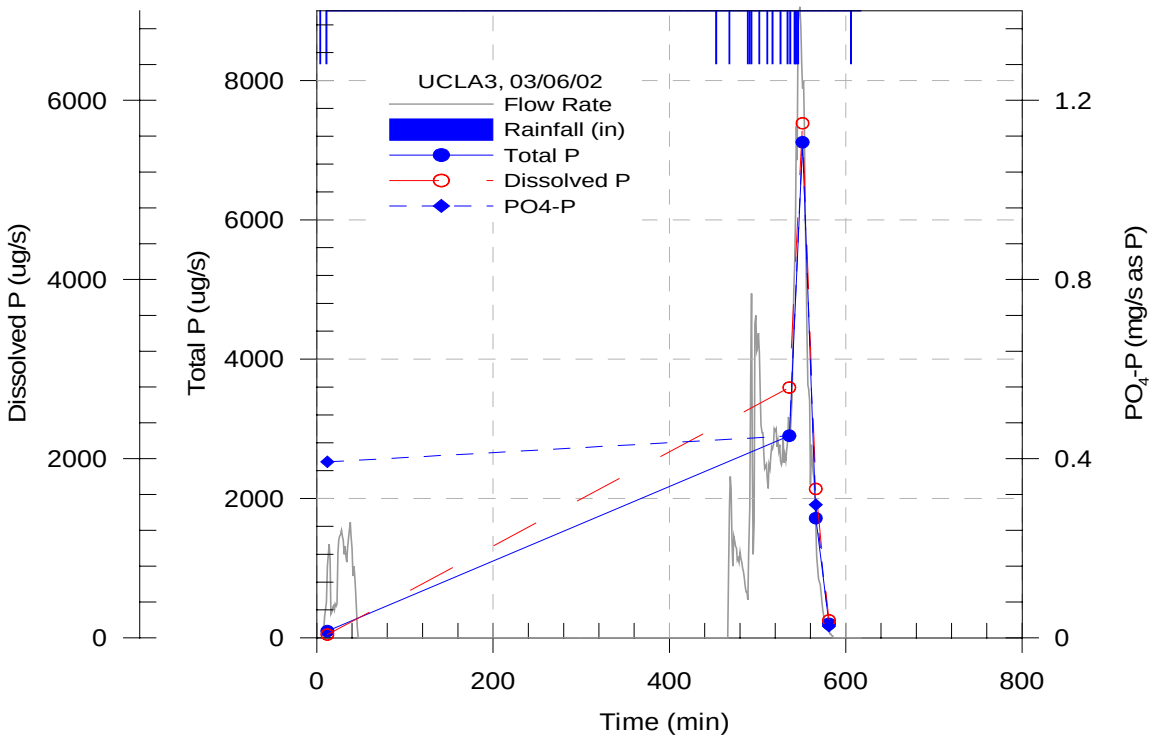

Figure I.3.3.7g[2] (Y3-UCLA3-E8-7). Load -graph for Total P / PO_4^{3-}P

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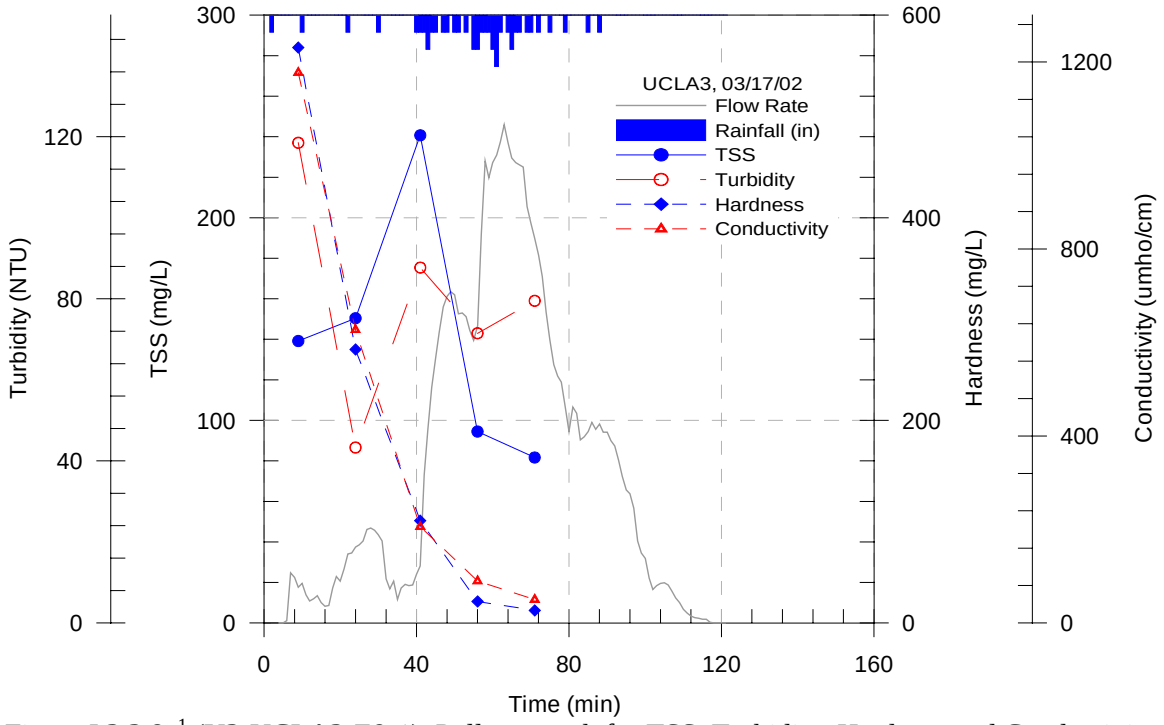

Figure I.3.3.8a[1] (Y3-UCLA3-E9-1). Polluto-graph for TSS, Turbidity, Hardness and Conductivity

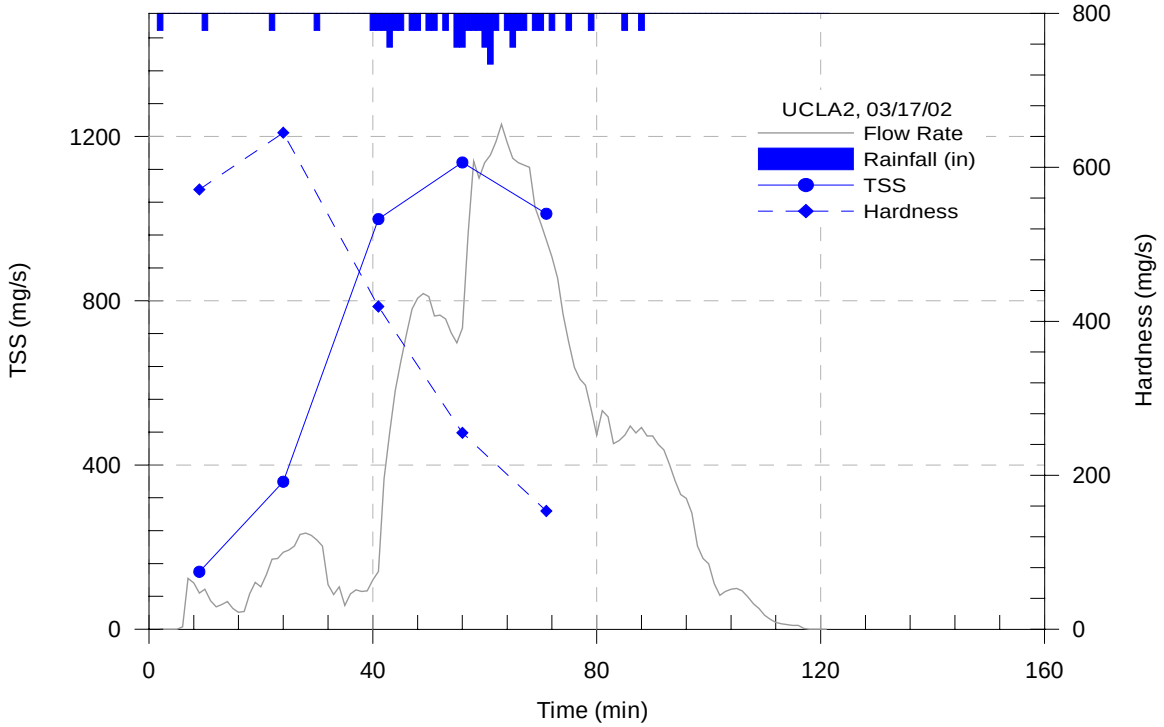

Figure I.3.3.8a[2] (Y3-UCLA3-E9-1). Load-graph for TSS, Turbidity, Hardness and Conductivity

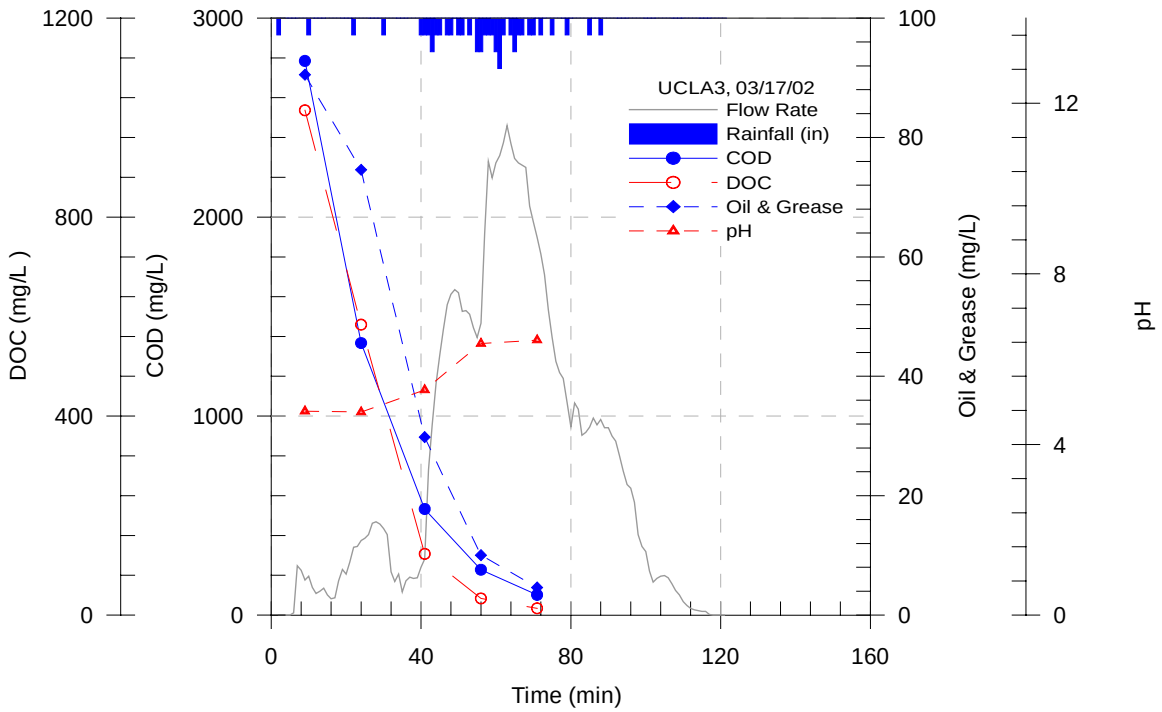

Figure I.3.3.8b[1] (Y3-UCLA3-E9-2). Polluto-graph for COD, DOC, Oil & Grease and pH

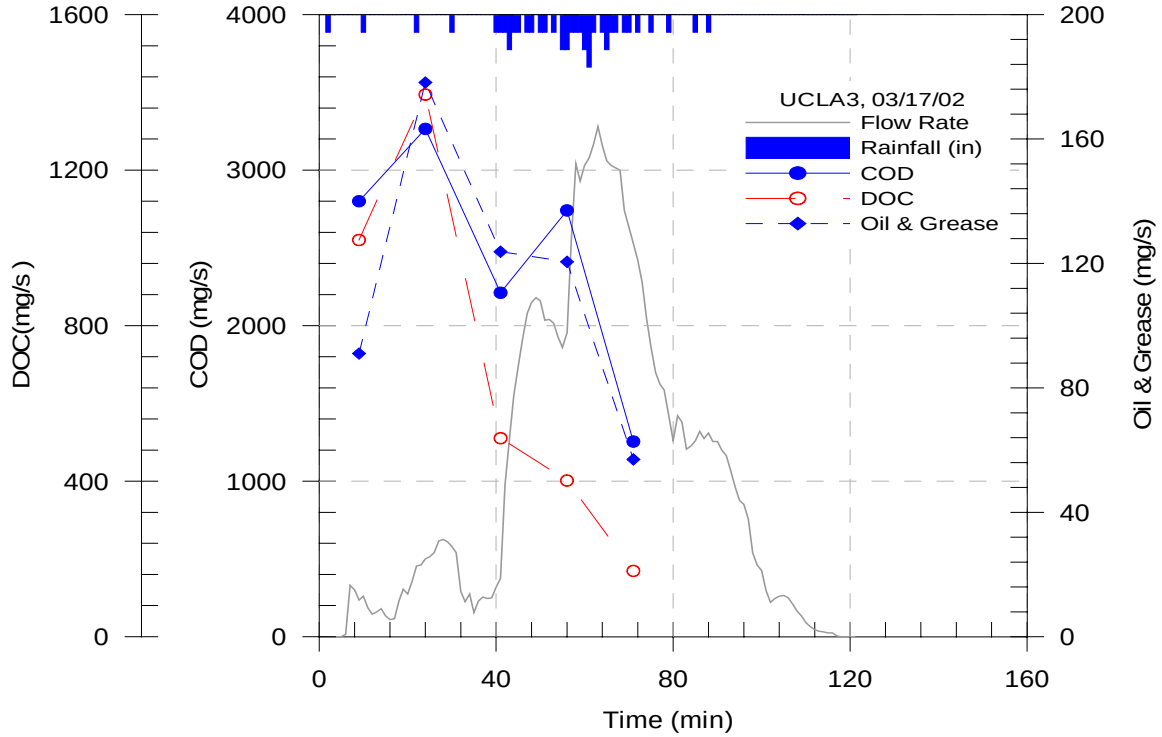

Figure I.3.3.8b[2] (Y3-UCLA3-E9-2). Load-graph for COD, DOC, Oil & Grease and pH

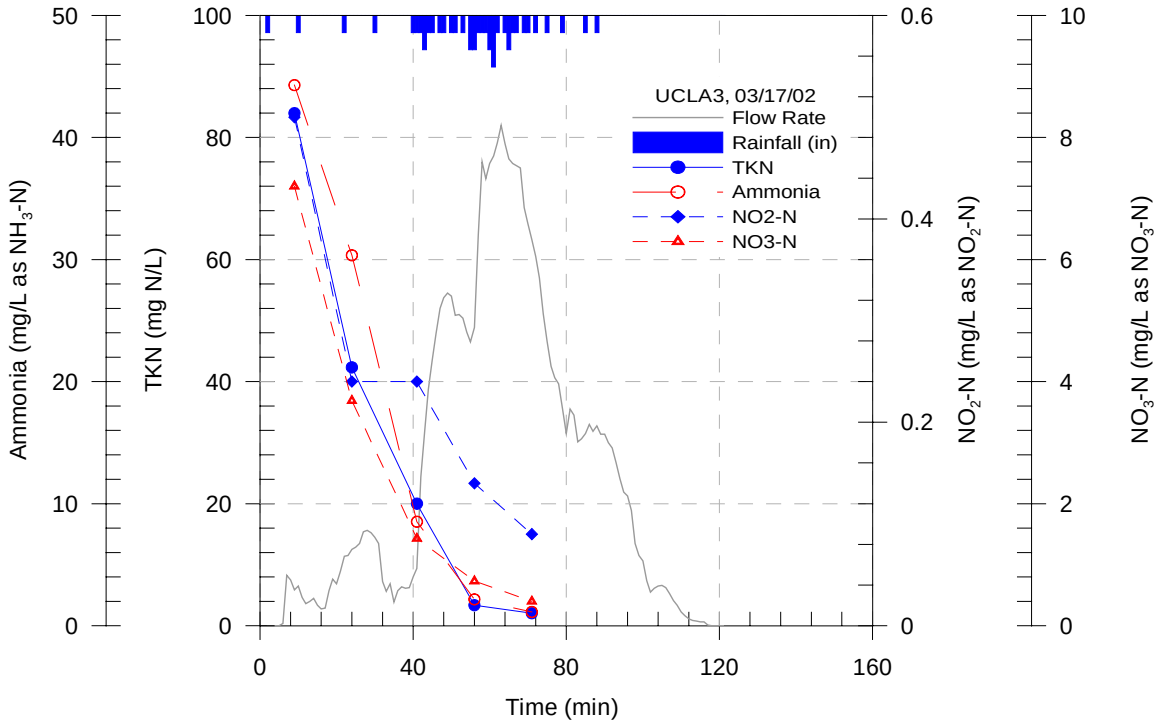

Figure I.3.3.8c[1] (Y3-UCLA3-E9-3). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

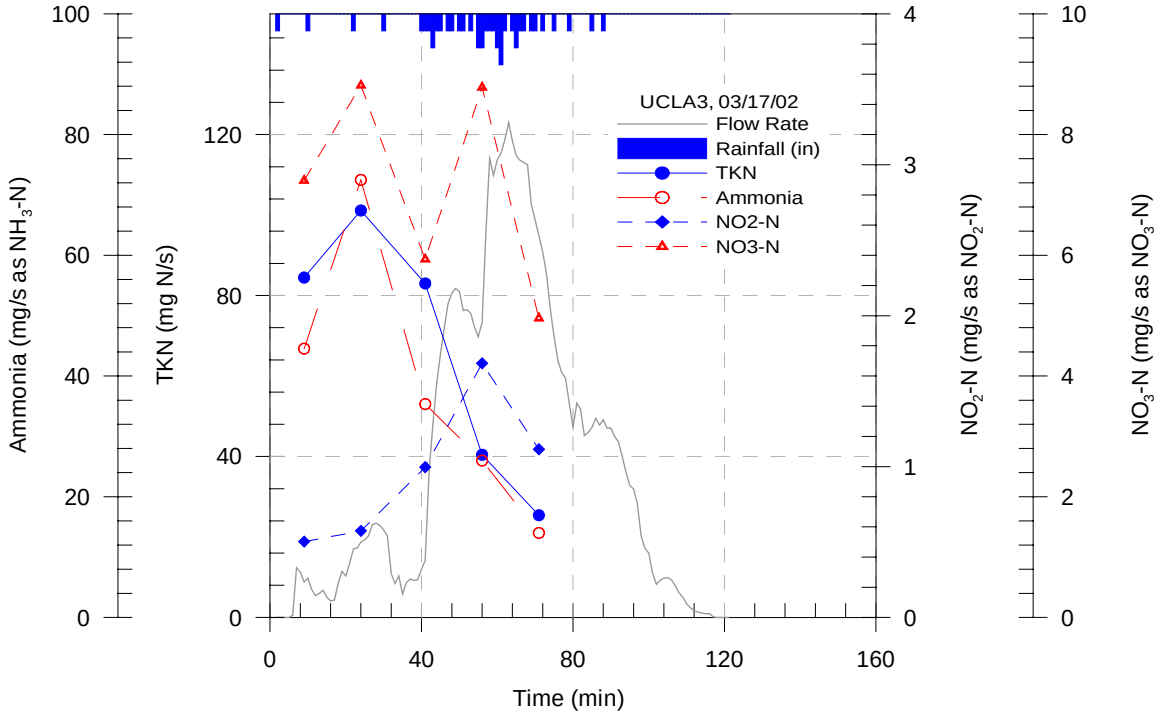

Figure I.3.3.8c[2] (Y3-UCLA3-E9-3). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

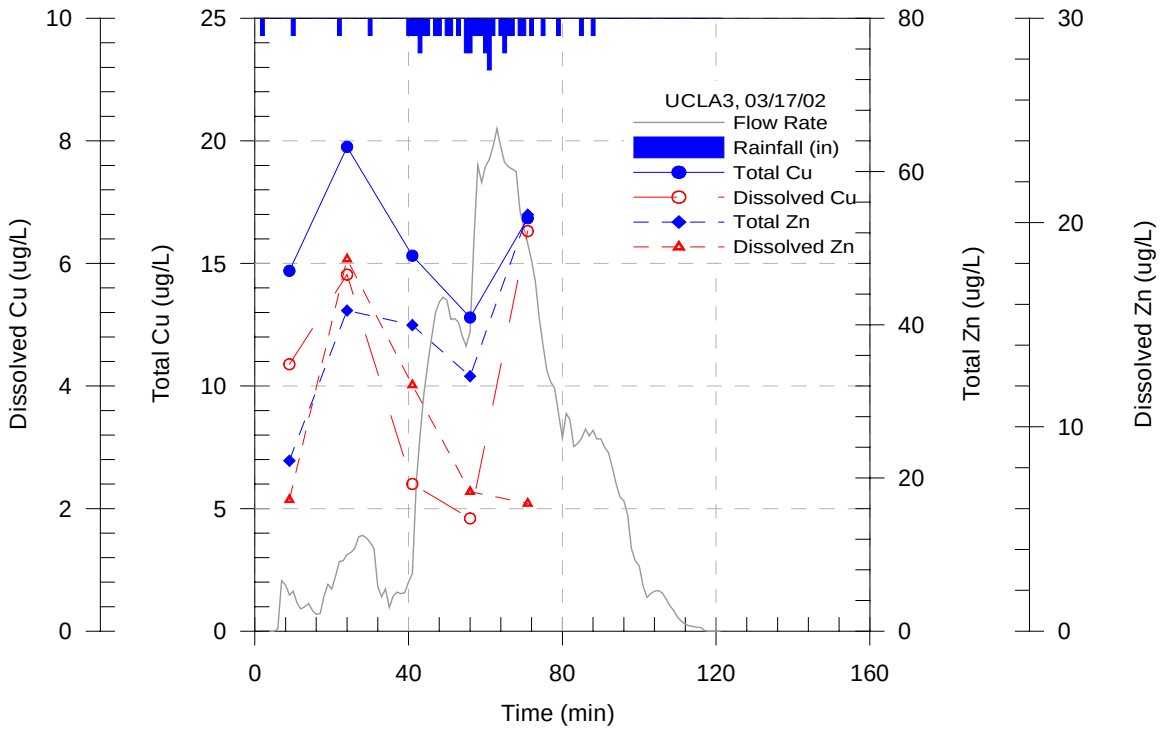

Figure I.3.3.8d[1] (Y3-UCLA3-E9-4). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

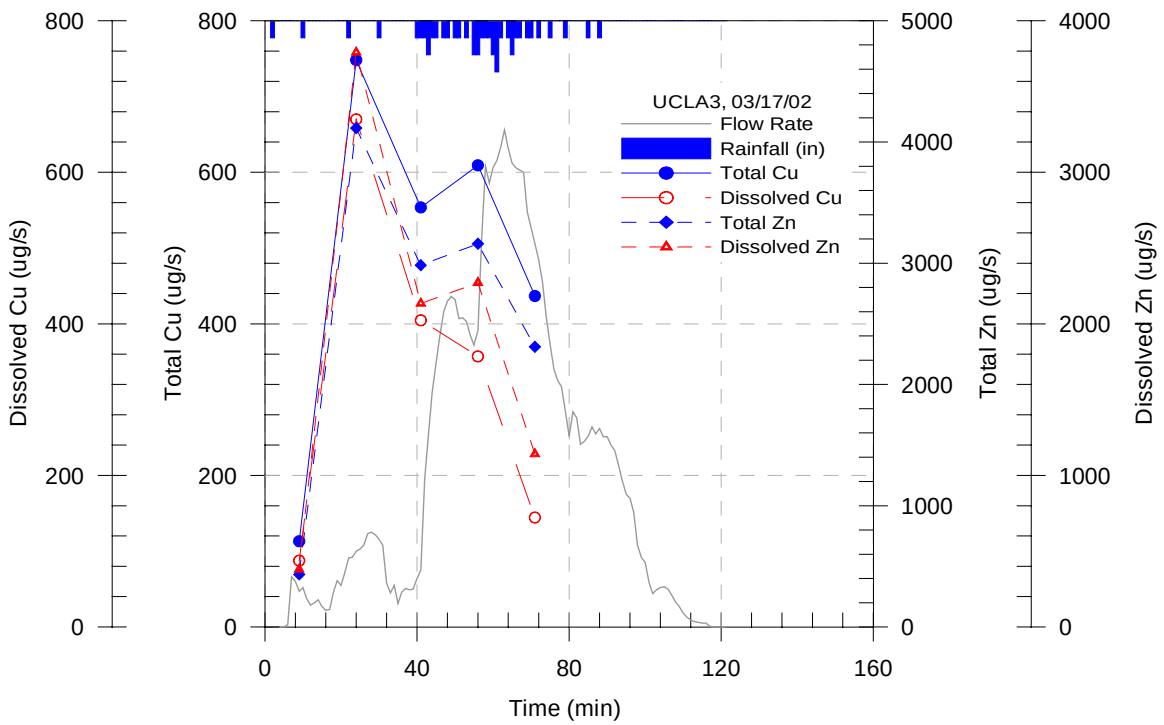

Figure I.3.3.8d[2] (Y3-UCLA3-E9-4). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

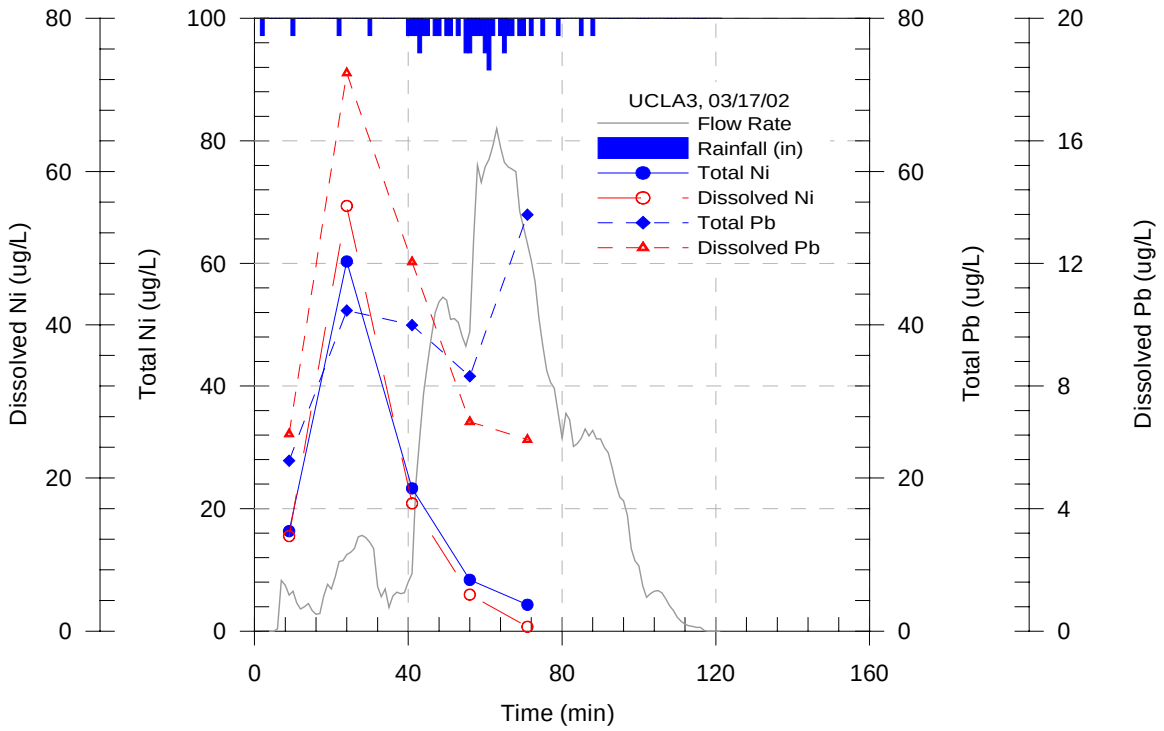

Figure I.3.3.8e[1] (Y3-UCLA3-E9-5). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

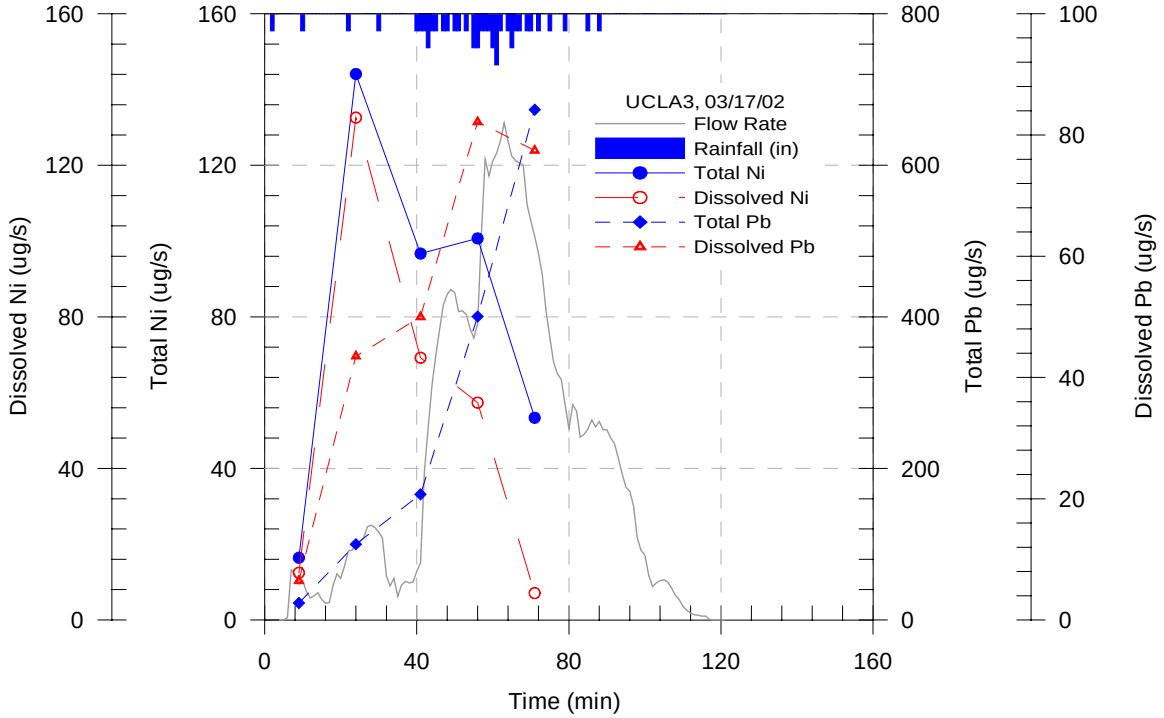

Figure I.3.3.8e[2] (Y3-UCLA3-E9-5). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

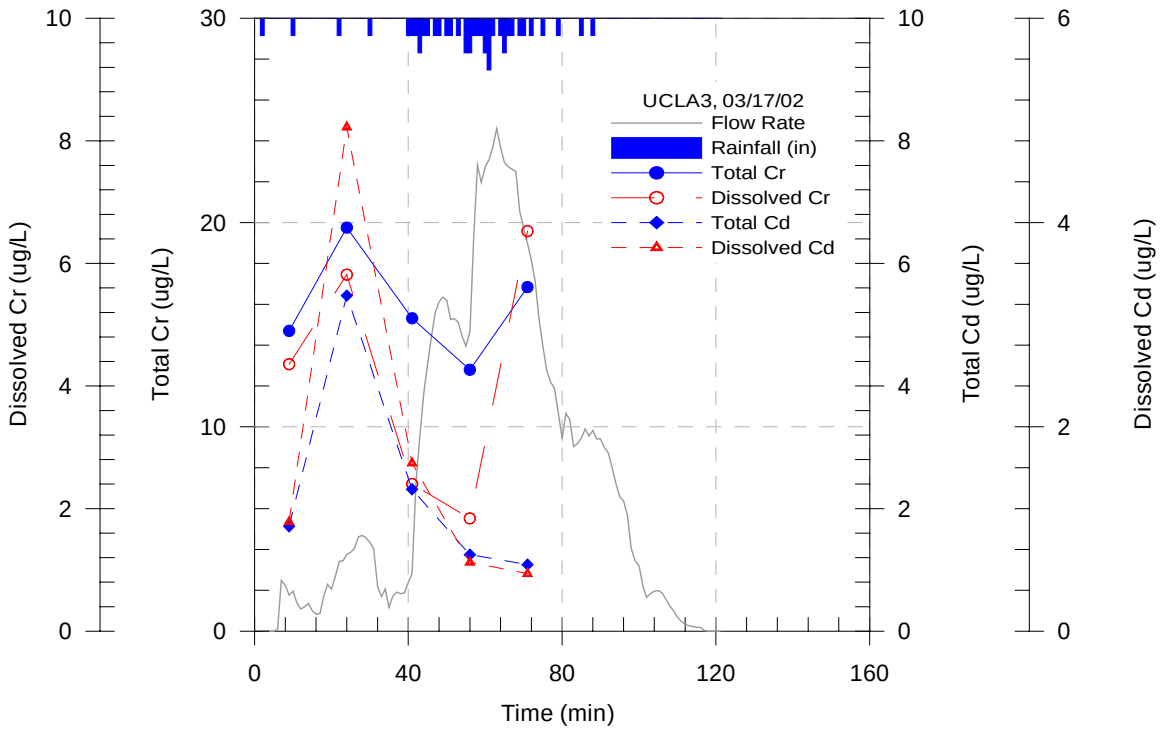

Figure I.3.3.8f[1] (Y3-UCLA3-E9-6). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

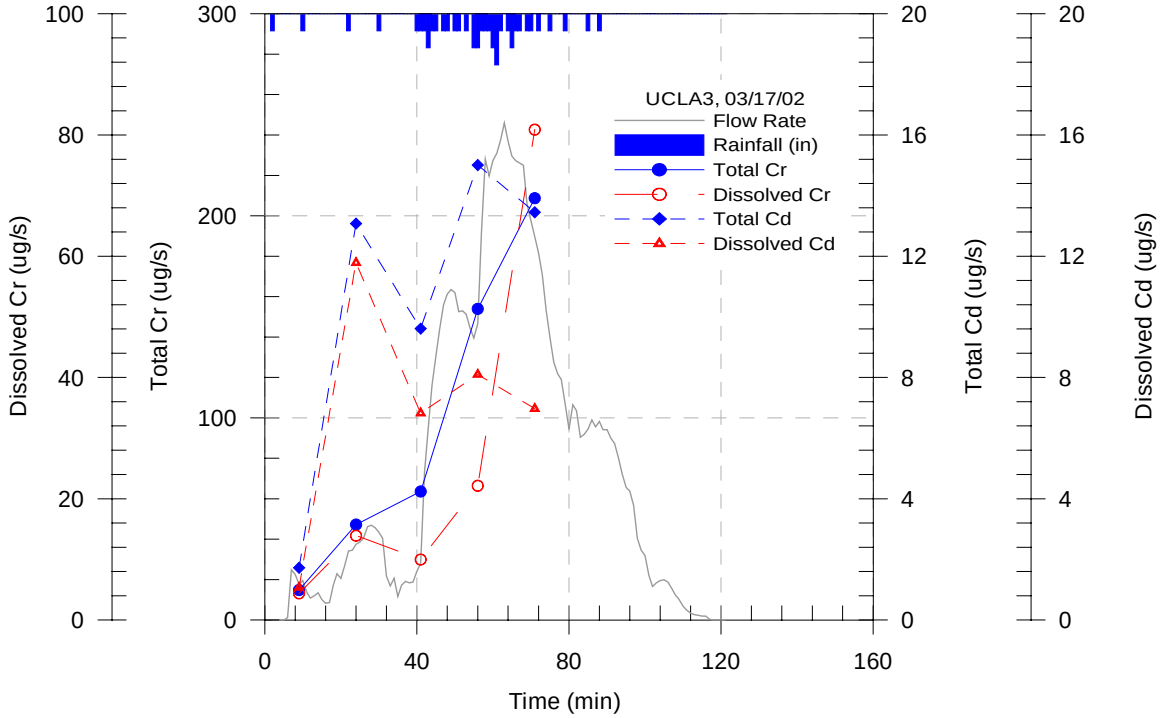

Figure I.3.3.8f[2] (Y3-UCLA3-E9-6). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

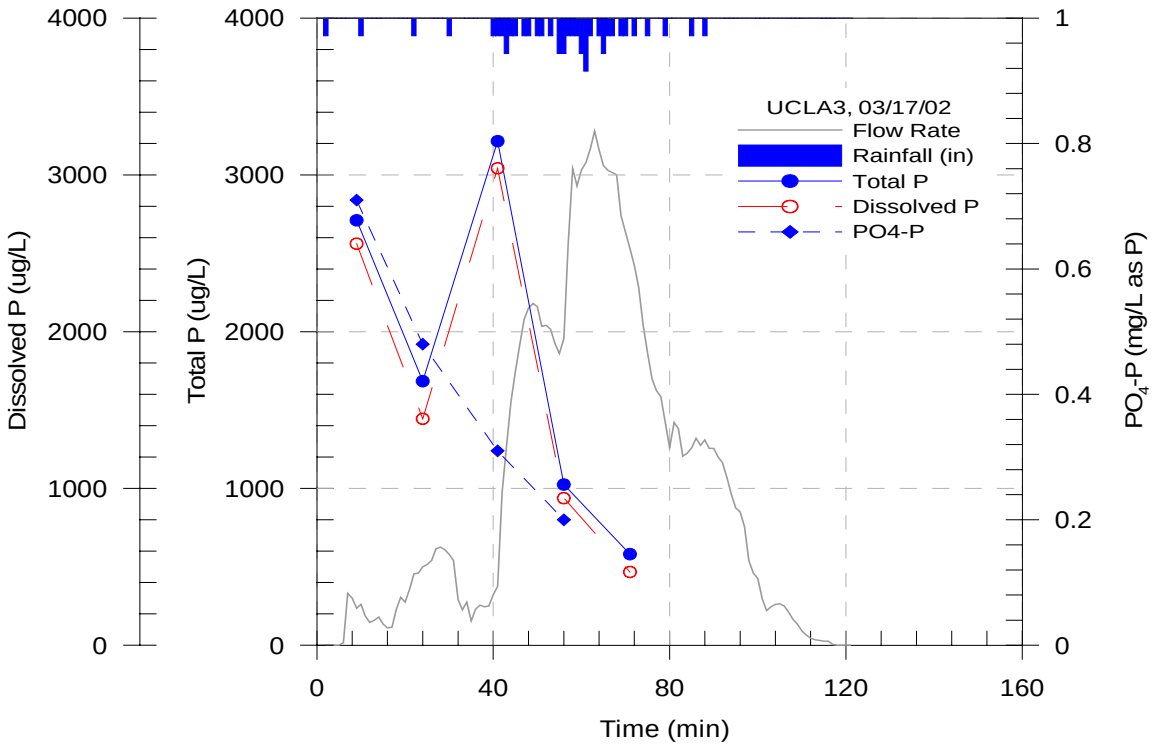

Figure I.3.3.8g[1] (Y3-UCLA3-E9-7). Polluto-graph for Total P / PO_4^{3-}-P

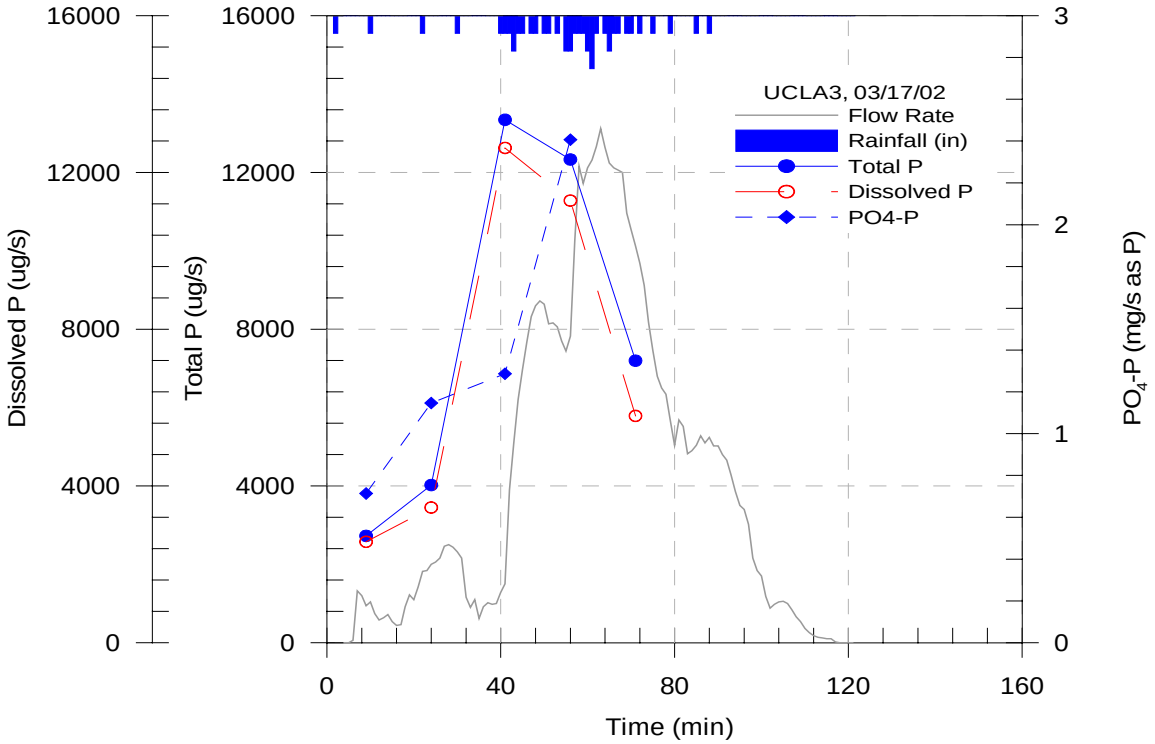

Figure I.3.3.8g[2] (Y3-UCLA3-E9-7). Load -graph for Total P / PO_4^{3-}P

1. UCLA1, 11/07/02

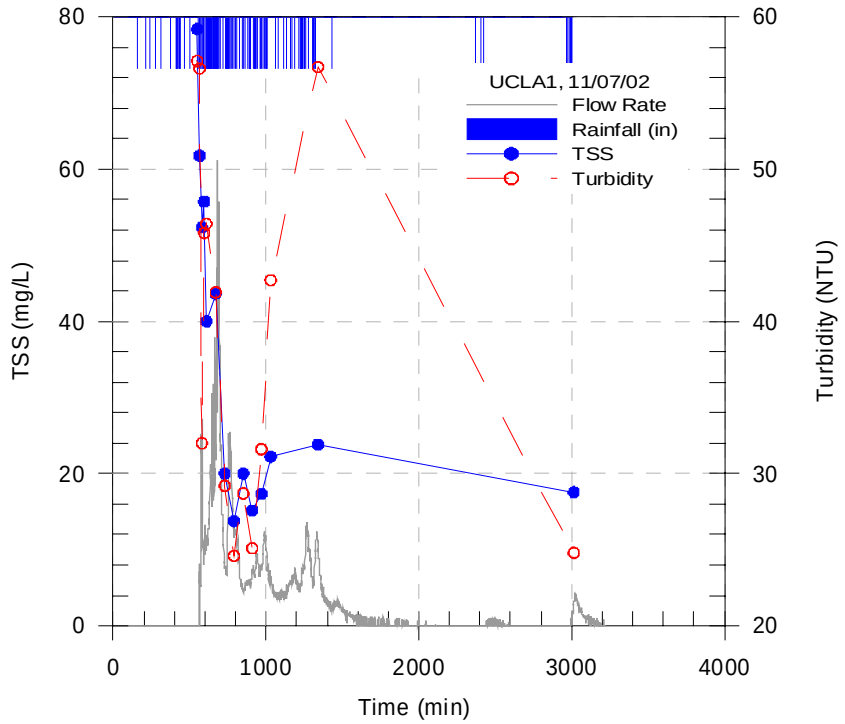

Figure I.4.1.1a[1] (Y4-UCLA1-E1-1). Polluto-graph for TSS and Turbidity

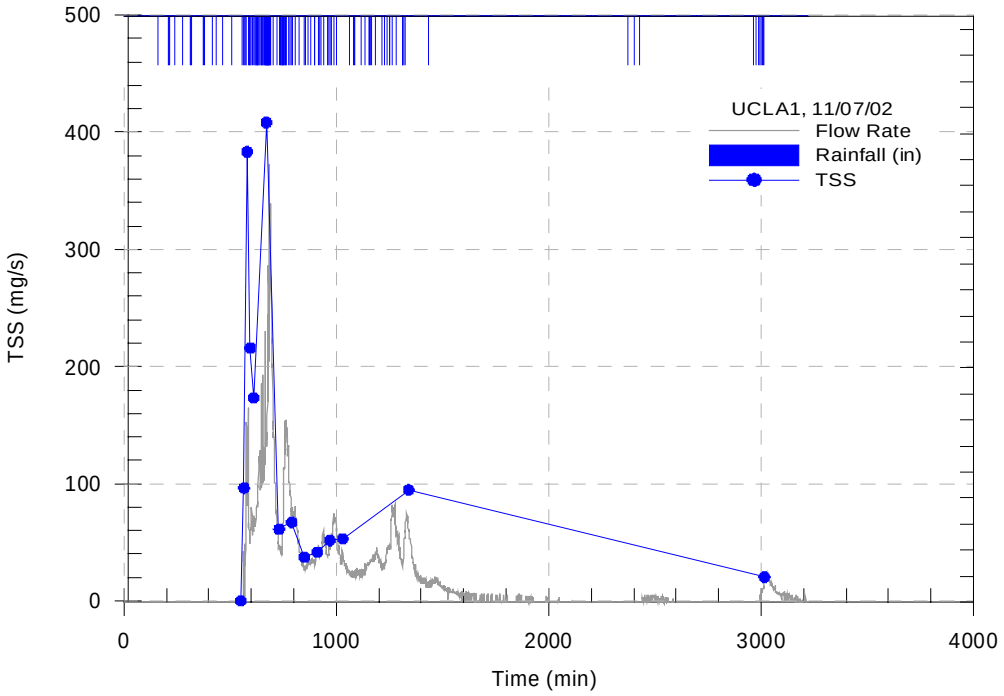

Figure I.4.1.1a[2] (Y4-UCLA1-E1-1). Load-graph for TSS

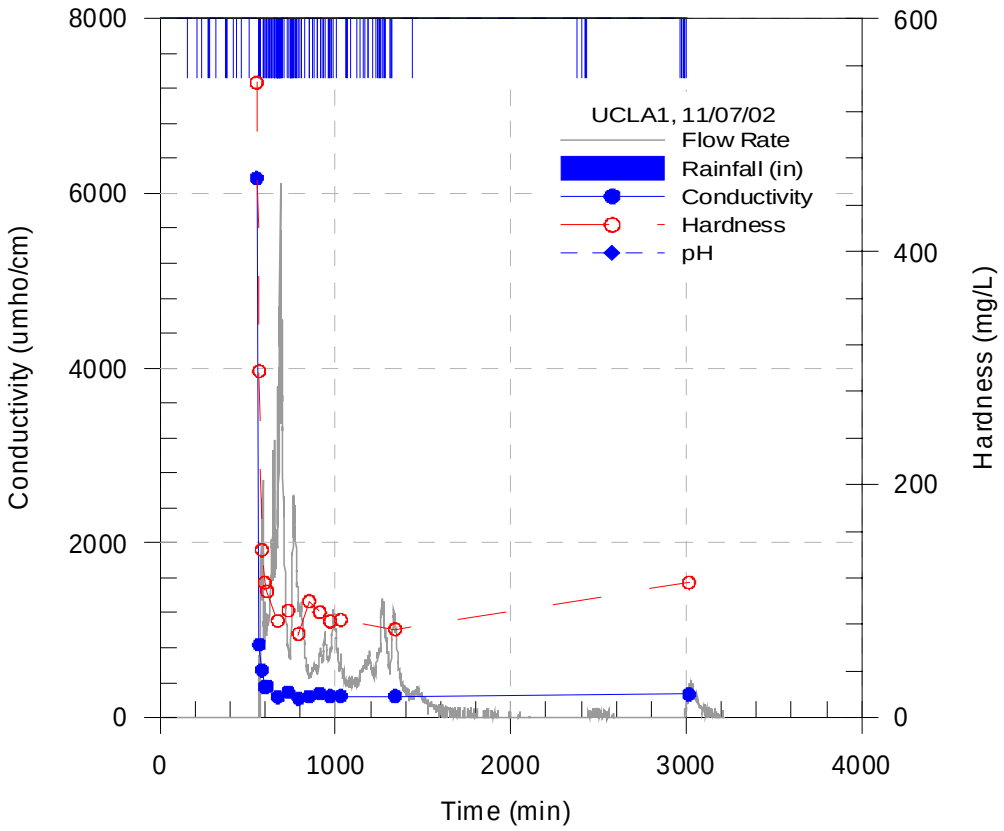

Figure I.4.1.1b[1] (Y4-UCLA1-E1-2). Polluto-graph for Conductivity, Hardness and pH

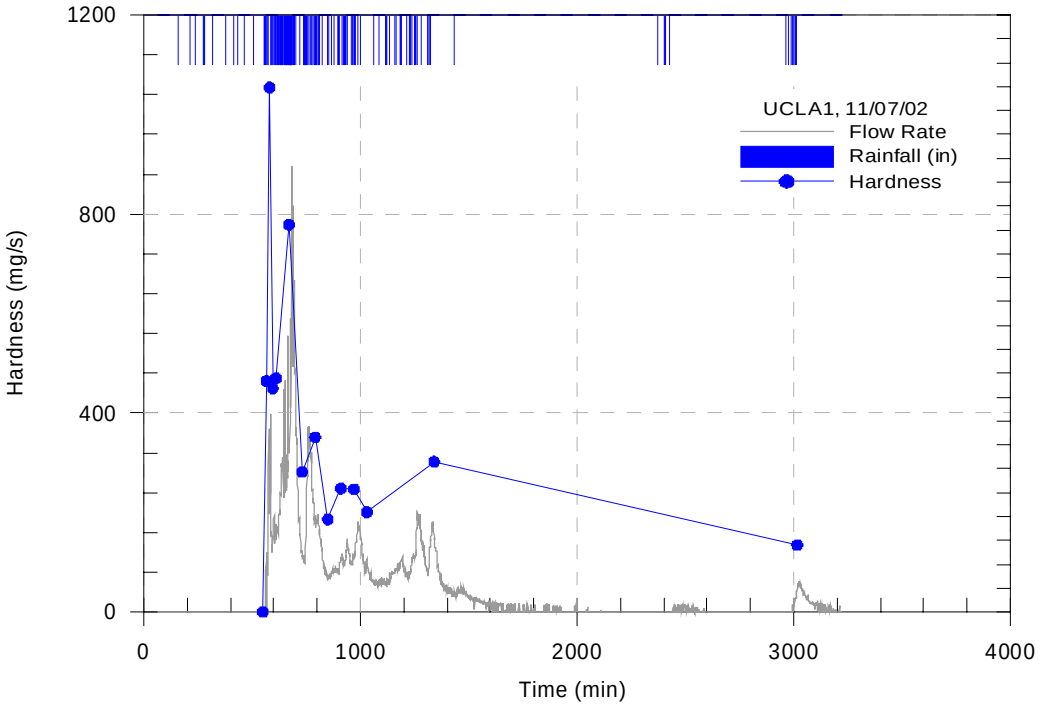

Figure I.4.1.1b[2] (Y4-UCLA1-E1-2). Load-graph for Hardness

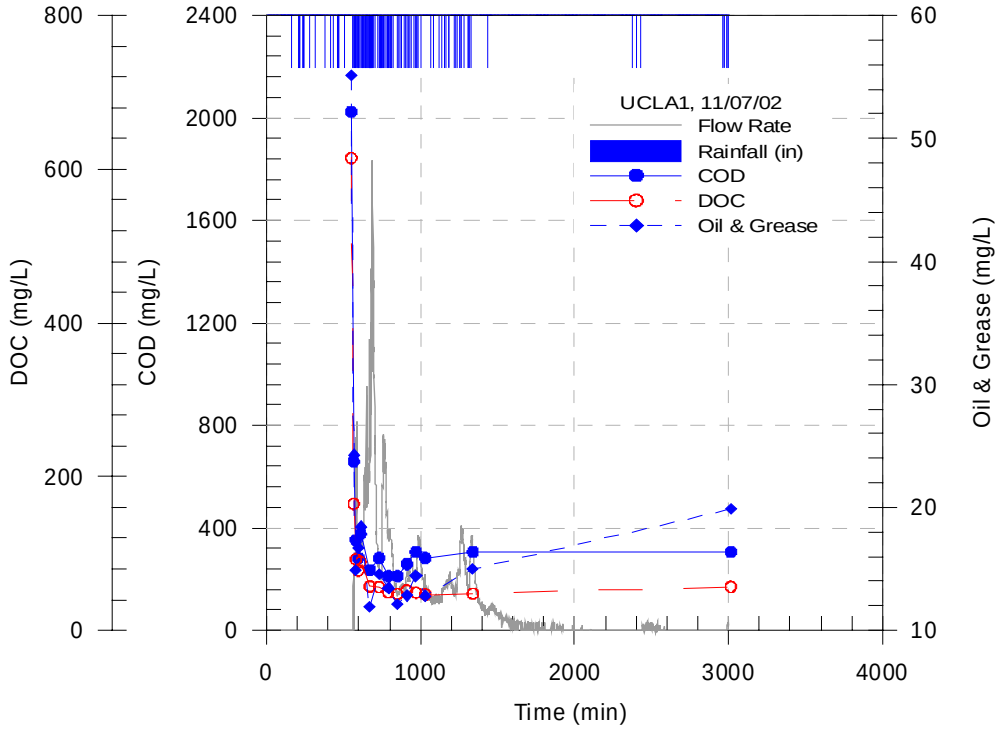

Figure I.4.1.1c[1] (Y4-UCLA1-E1-3). Polluto-graph for COD, DOC and Oil & Grease

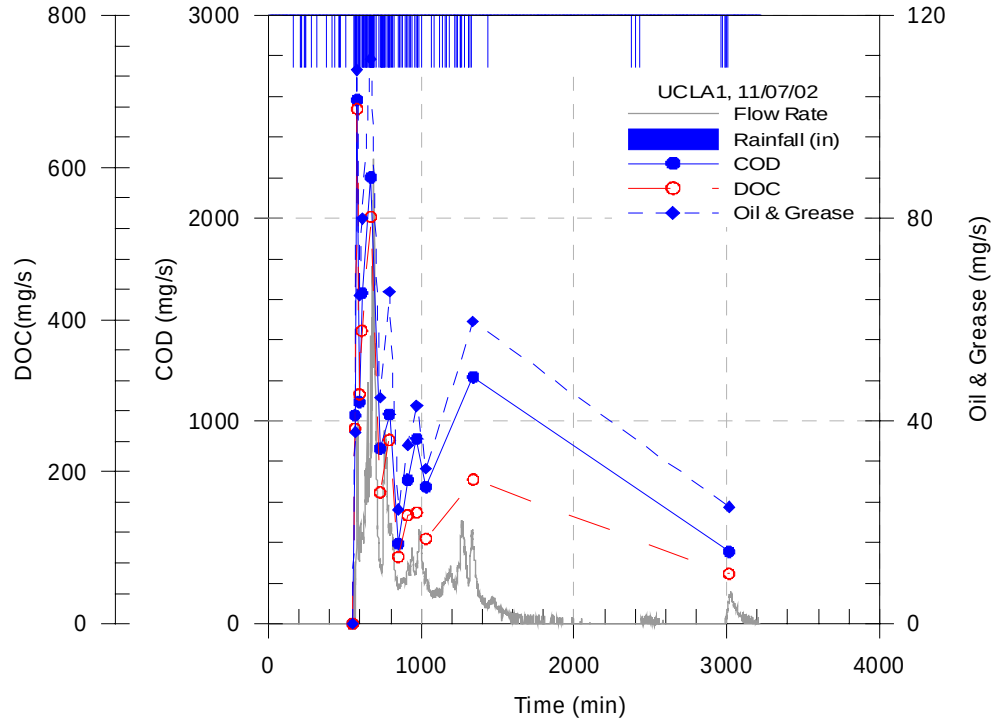

Figure I.4.1.1c[2] (Y4-UCLA1-E1-3). Load-graph for COD, DOC and Oil & Grease

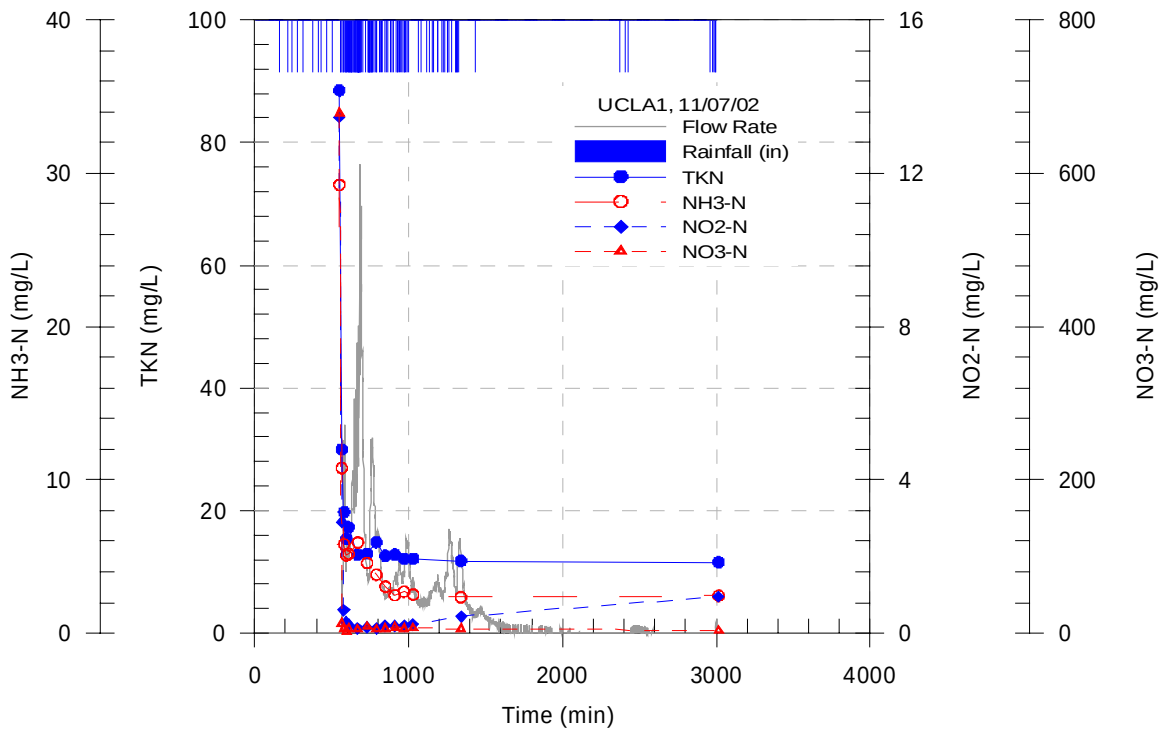

Figure I.4.1.1d[1] (Y4-UCLA1-E1-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

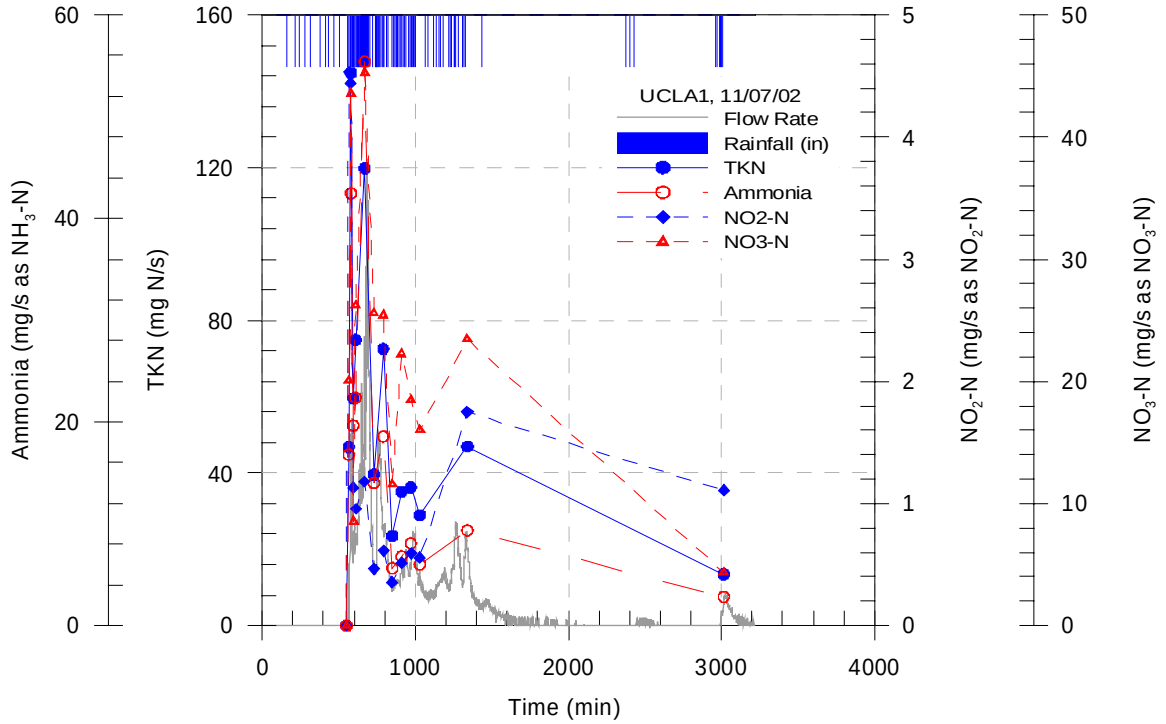

Figure I.4.1.1d[2] (Y4-UCLA1-E1-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

2. UCLA1, 12/16/02

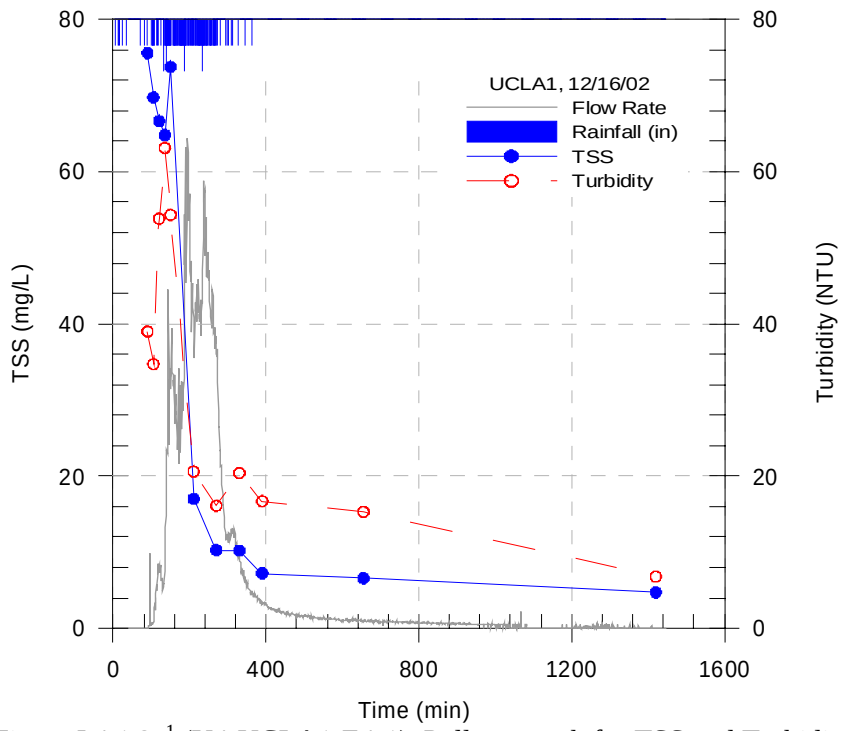

Figure I.4.1.2a[1] (Y4-UCLA1-E4-1). Polluto-graph for TSS and Turbidity

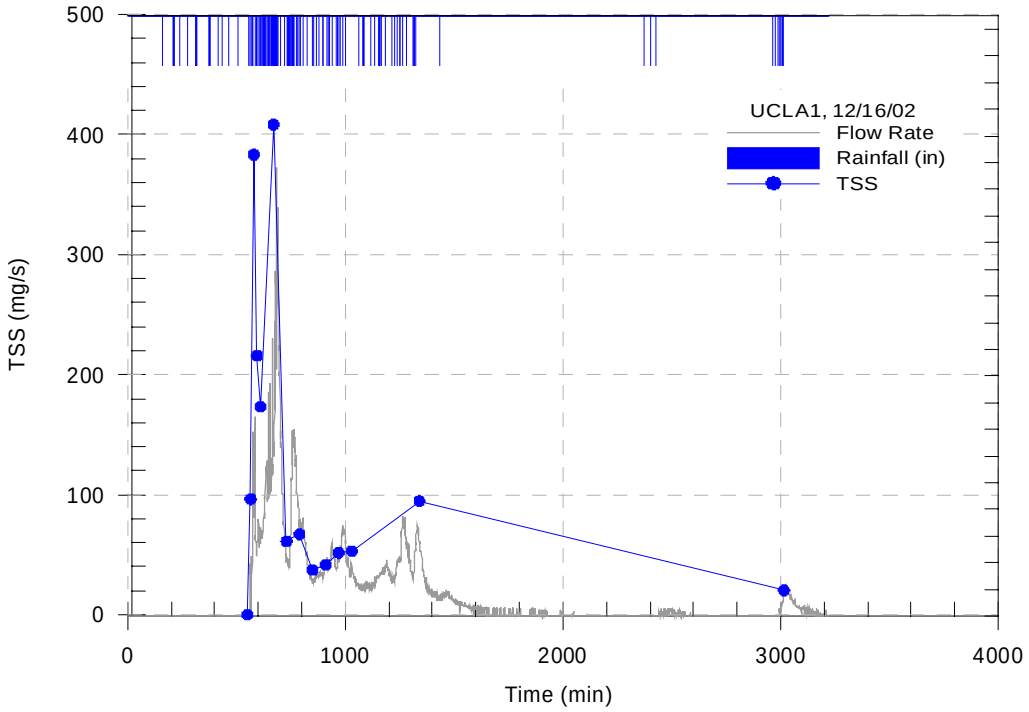

Figure I.4.1.2a[2] (Y4-UCLA1-E4-1). Load-graph for TSS

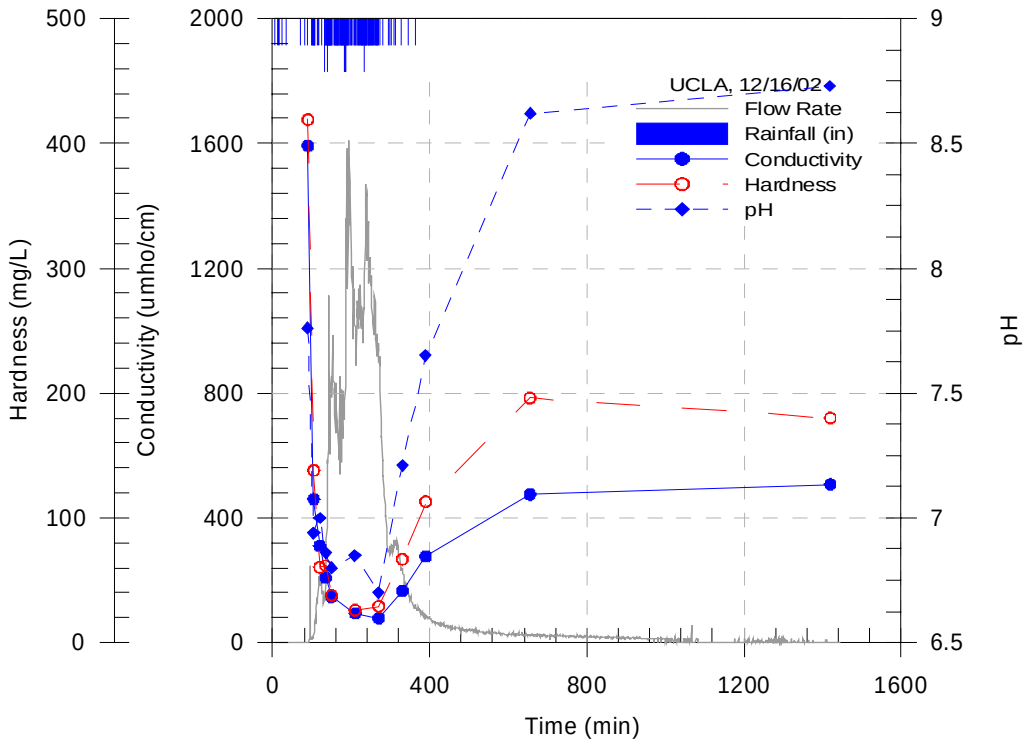

Figure I.4.1.2b[1] (Y4-UCLA1-E4-2). Polluto-graph for Conductivity, Hardness and pH

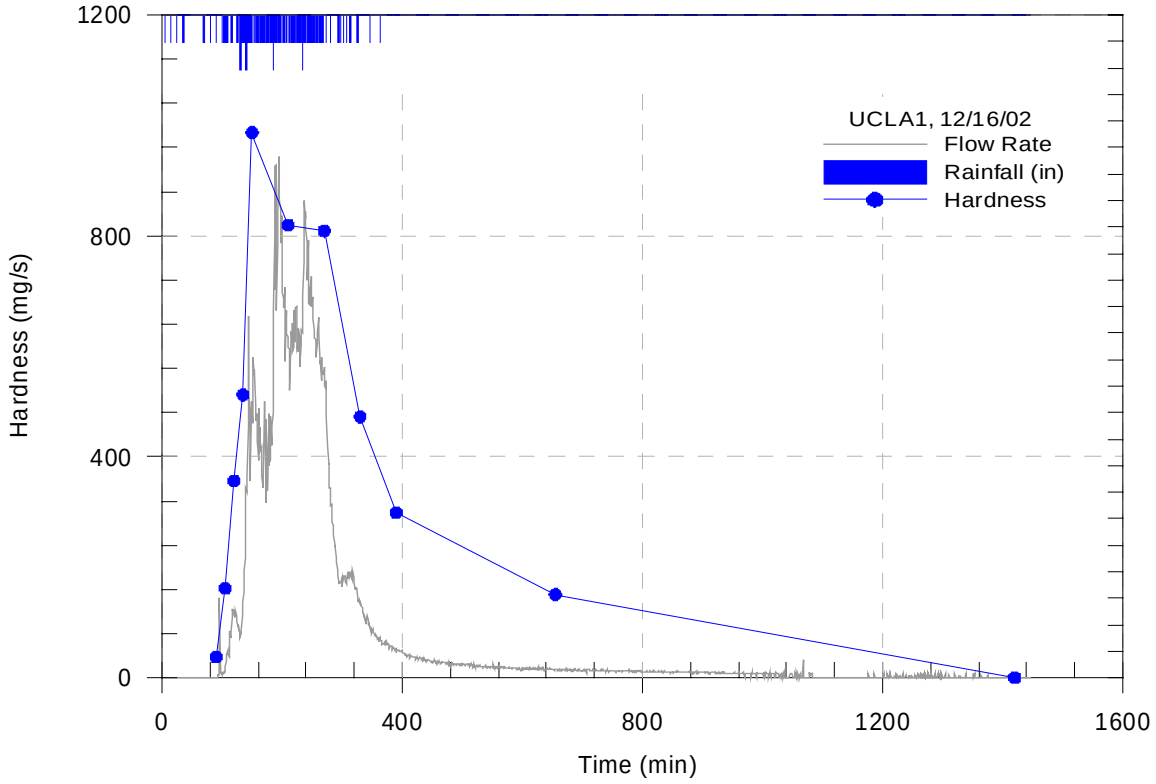

Figure I.4.1.2b[2] (Y4-UCLA1-E4-2). Load-graph for Hardness

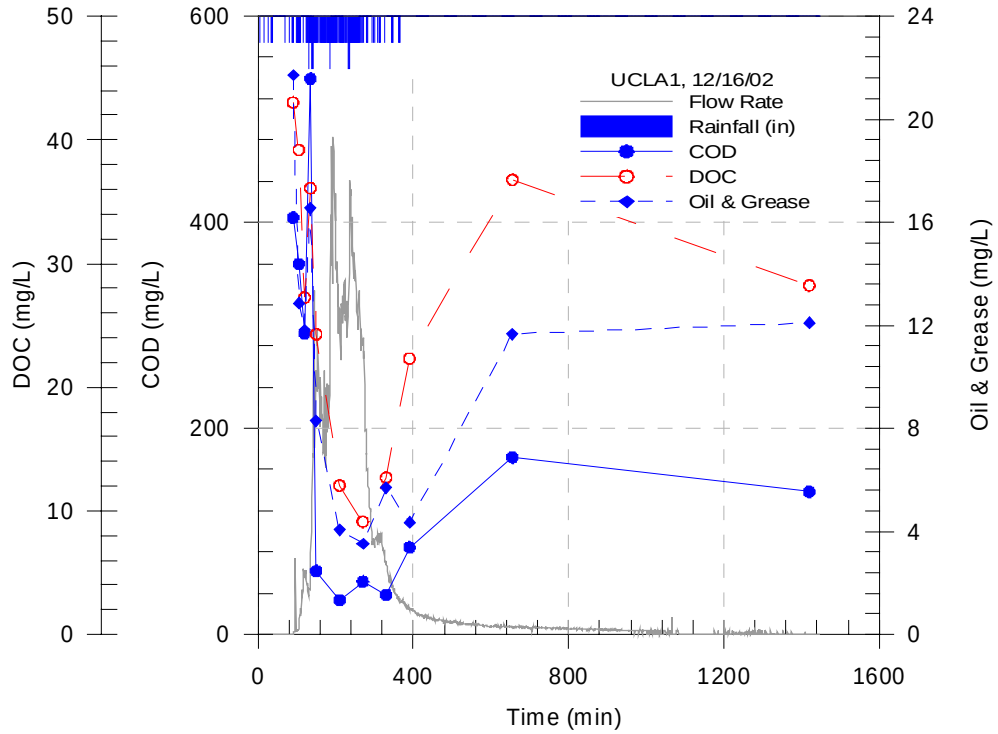

Figure I.4.1.2c[1] (Y4-UCLA1-E4-3). Polluto-graph for COD, DOC and Oil & Grease

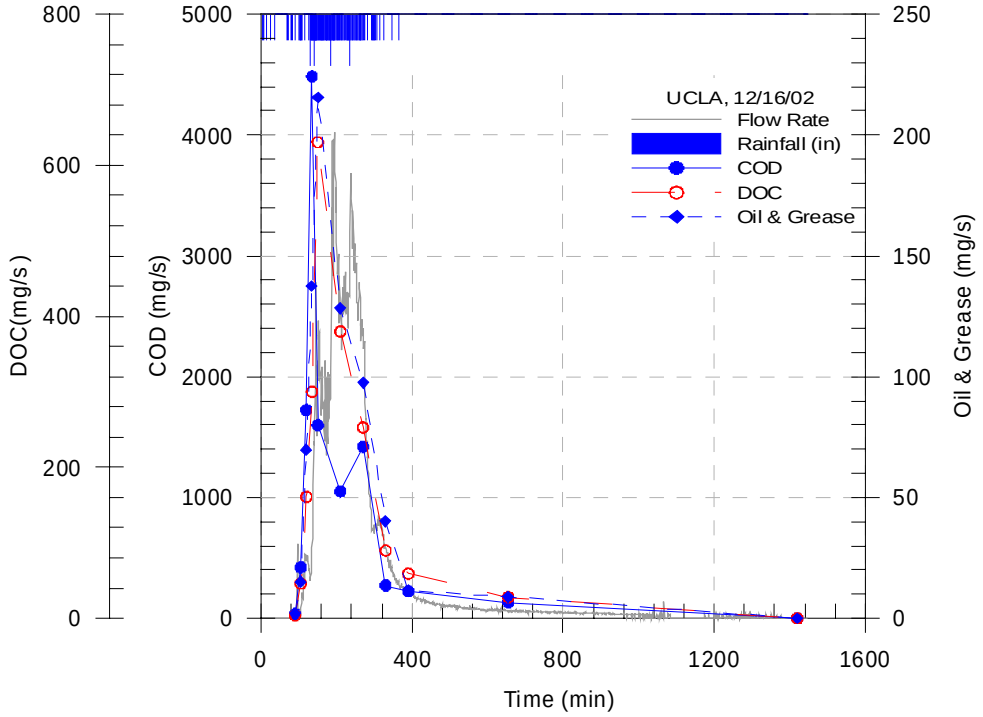

Figure I.4.1.2c[2] (Y4-UCLA1-E4-3). Load-graph for COD, DOC and Oil & Grease

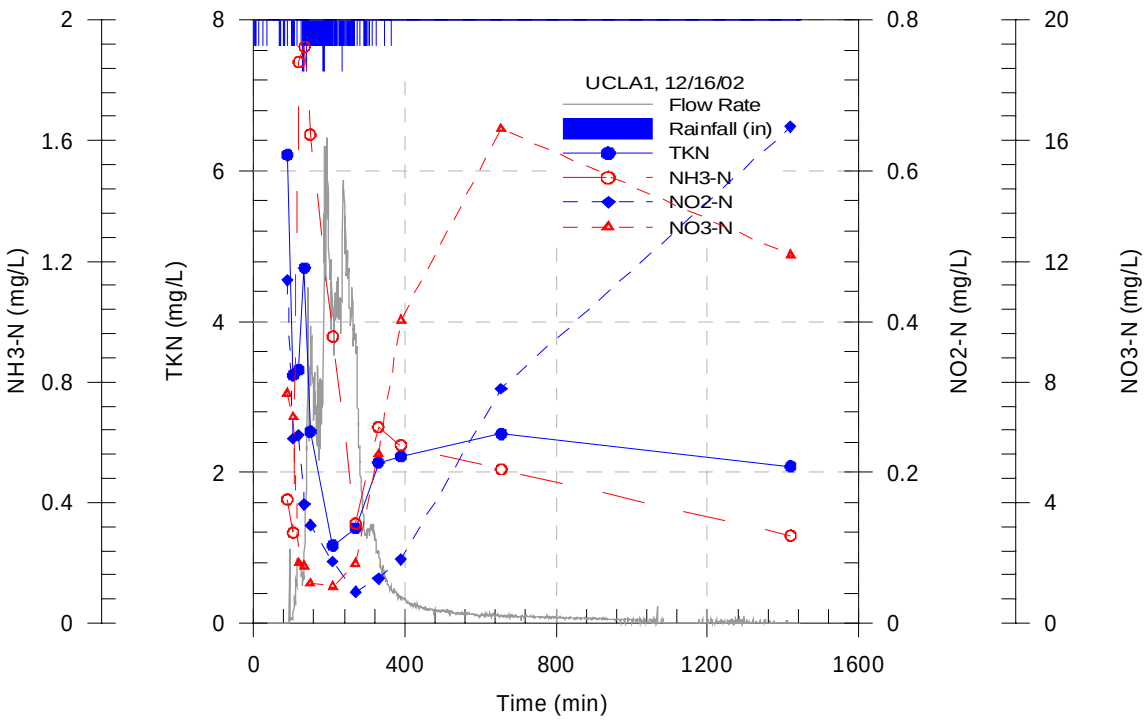

Figure I.4.1.2d[1] (Y4-UCLA1-E4-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

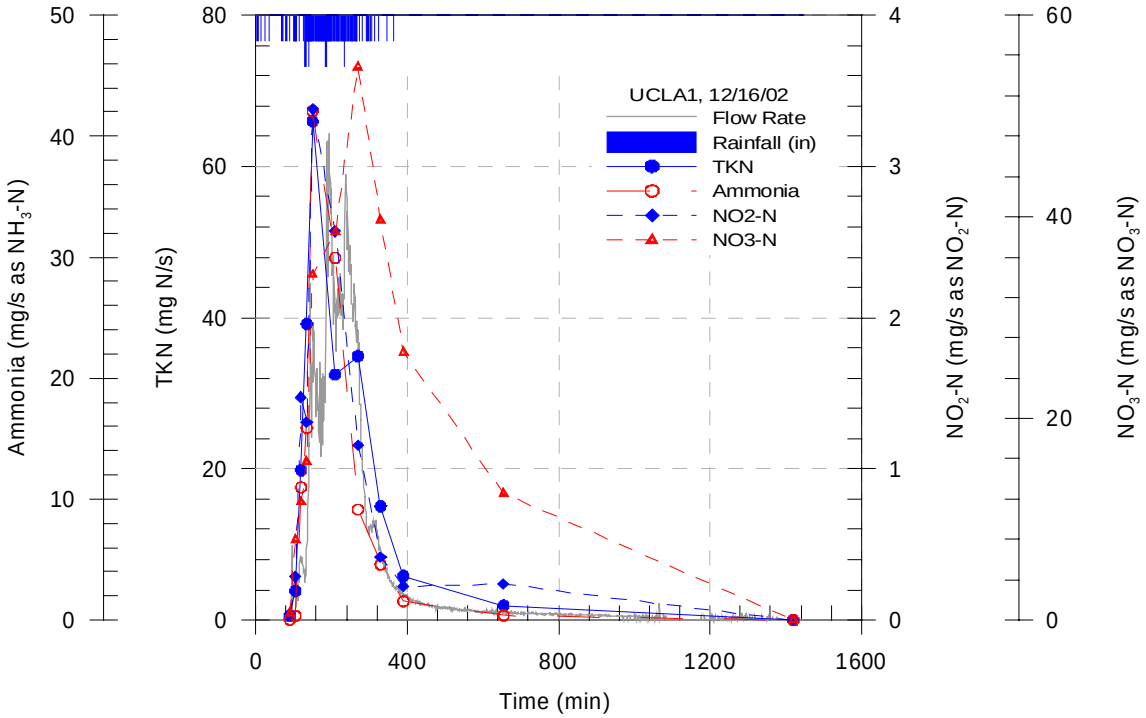

Figure I.4.1.2d[2] (Y4-UCLA1-E4-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

3. UCLA1, 12/19/02

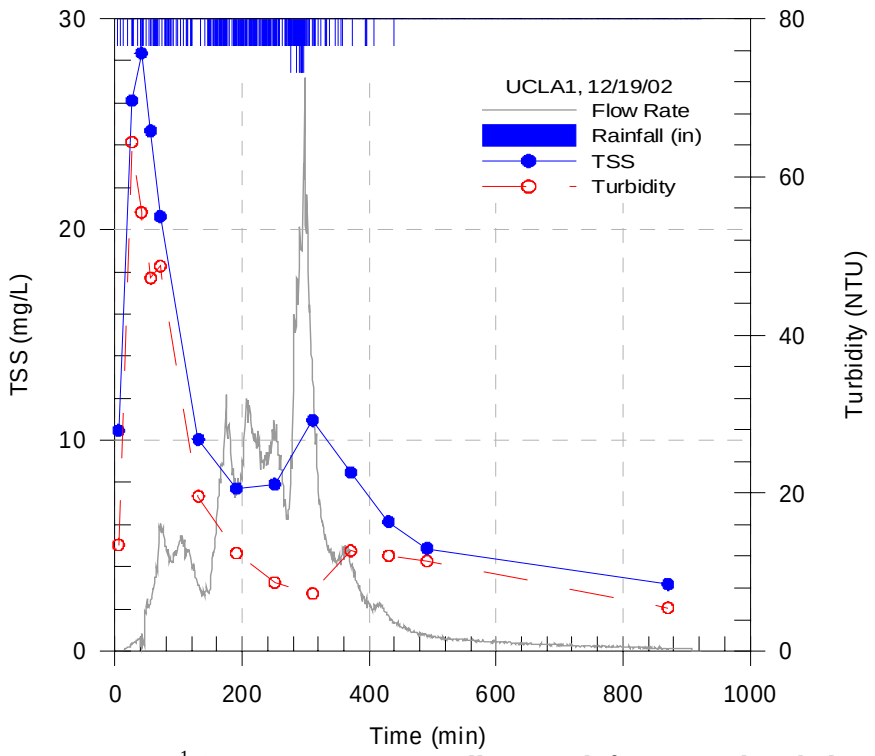

Figure I.4.1.3a[1] (Y4-UCLA1-E5-1). Polluto-graph for TSS and Turbidity

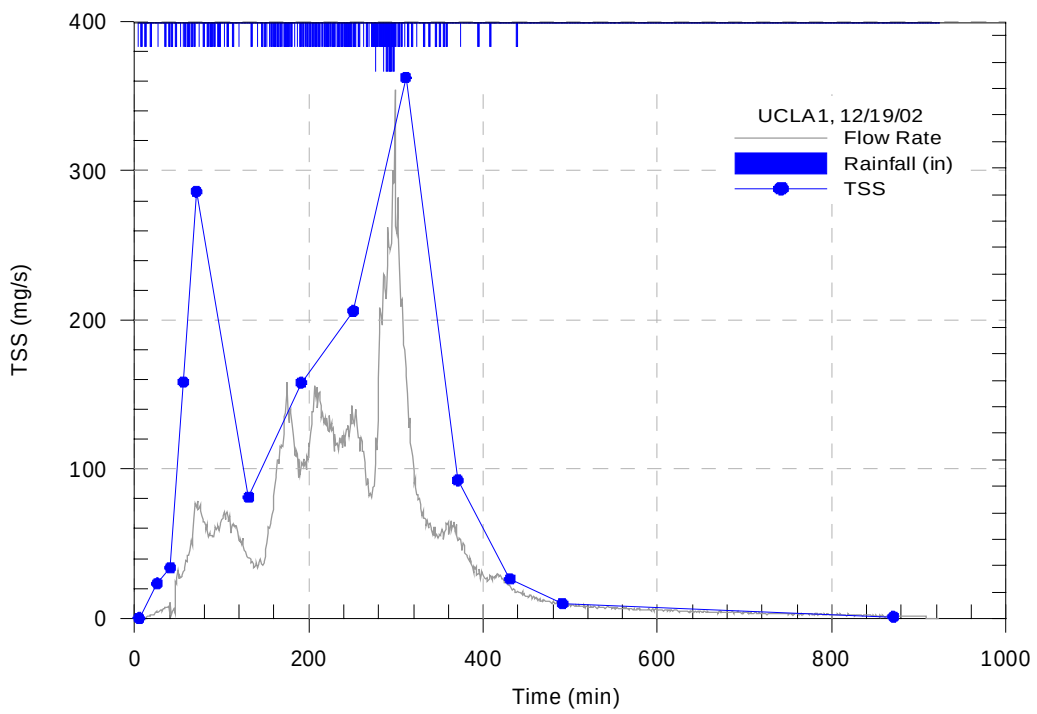

Figure I.4.1.3a[2] (Y4-UCLA1-E5-1). Load-graph for TSS

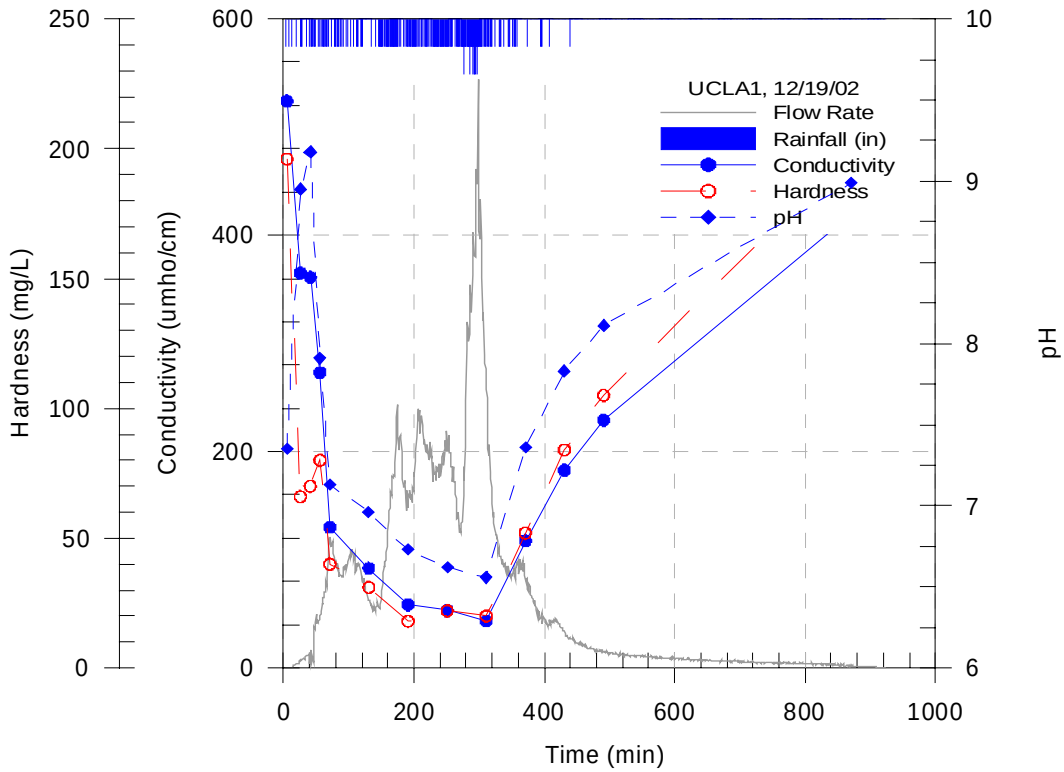

Figure I.4.1.3b[1] (Y4-UCLA1-E5-2). Polluto-graph for Conductivity, Hardness and pH

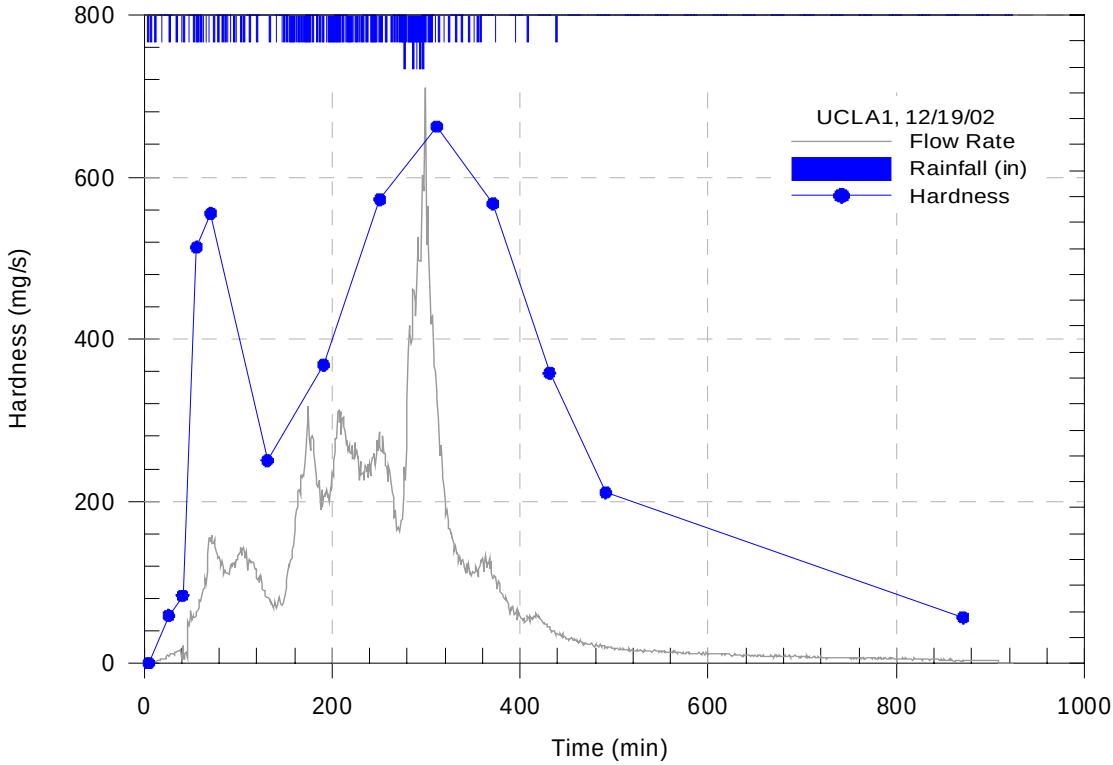

Figure I.4.1.3b[2] (Y4-UCLA1-E5-2). Load-graph for Hardness

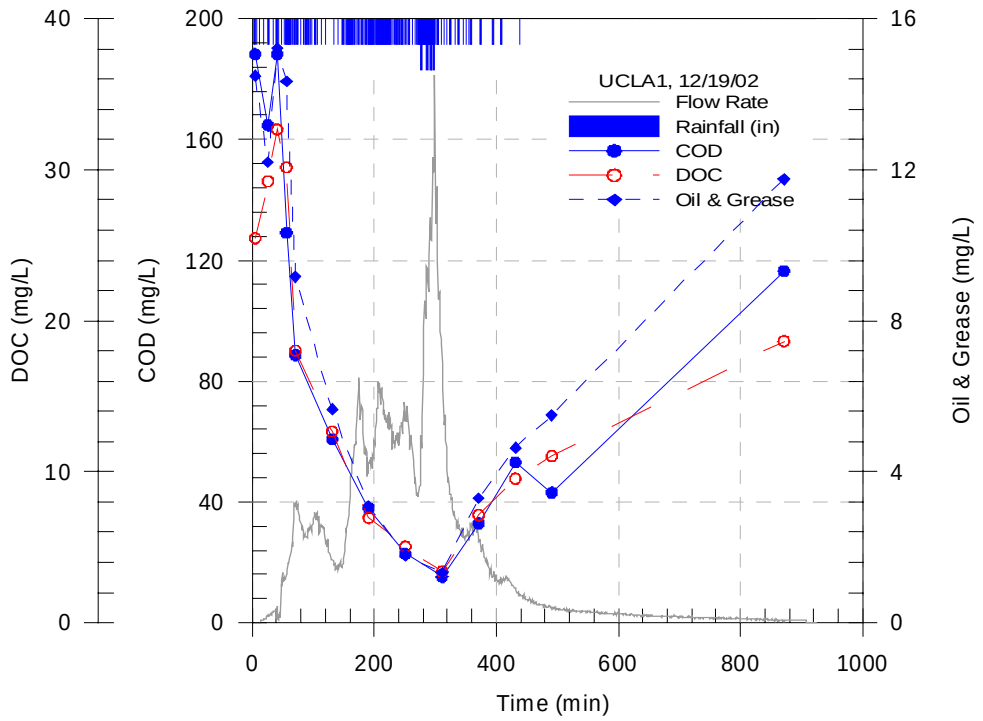

Figure I.4.1.3c[1] (Y4-UCLA1-E5-3). Polluto-graph for COD, DOC and Oil & Grease

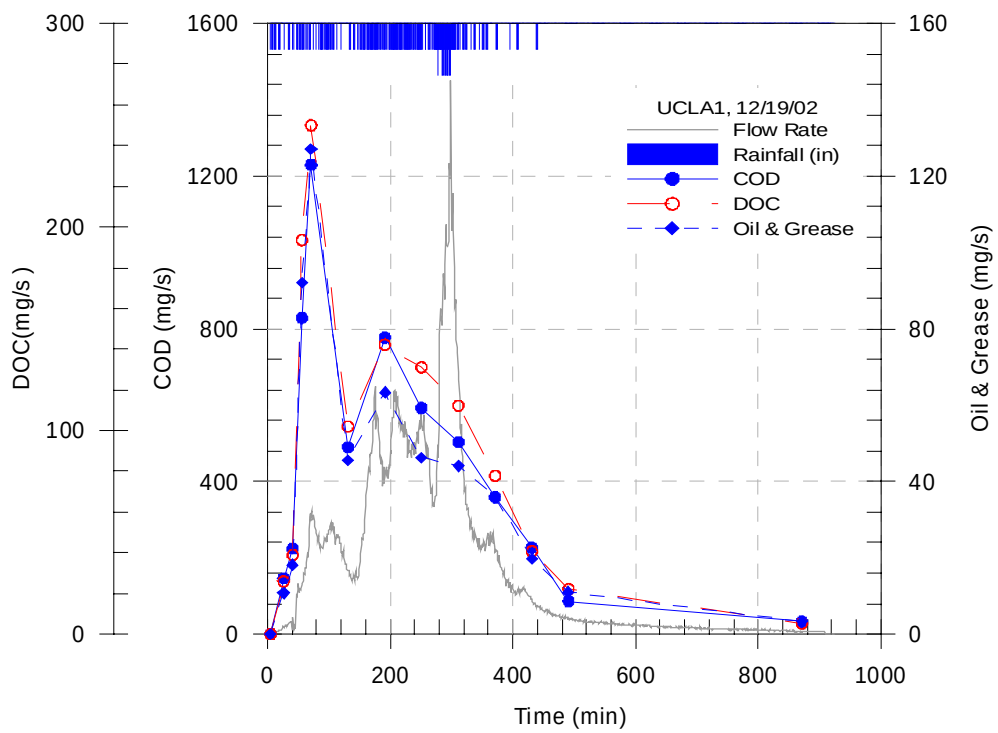

Figure I.4.1.3c[2] (Y4-UCLA1-E5-3). Load-graph for COD, DOC and Oil & Grease

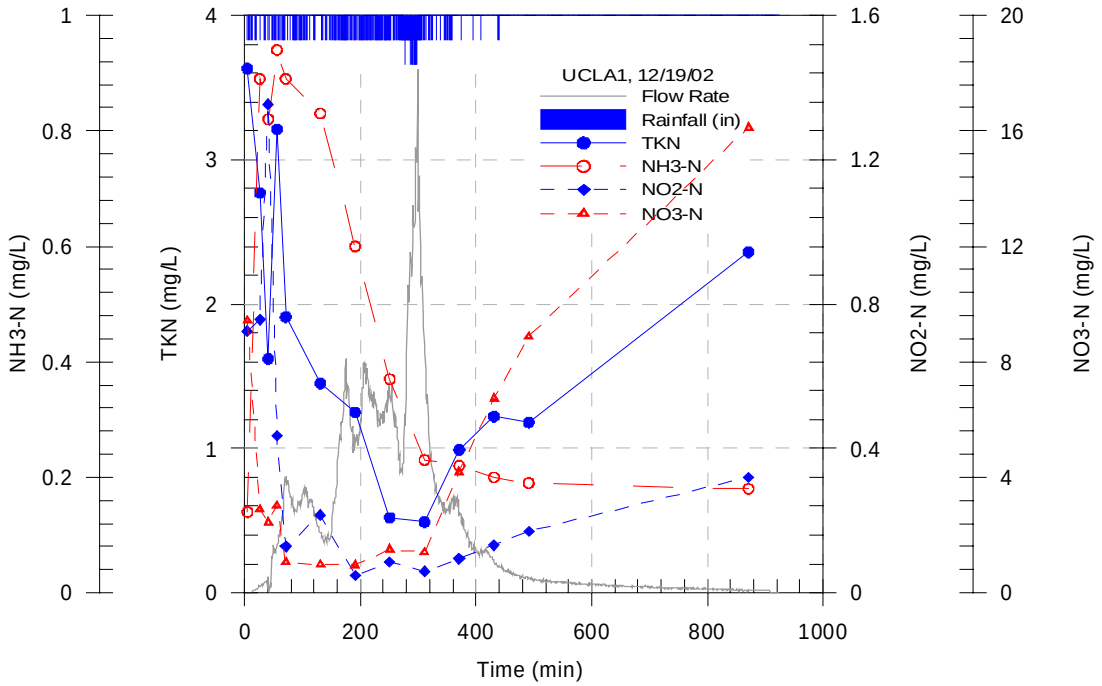

Figure I.4.1.3d[1] (Y4-UCLA1-E5-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

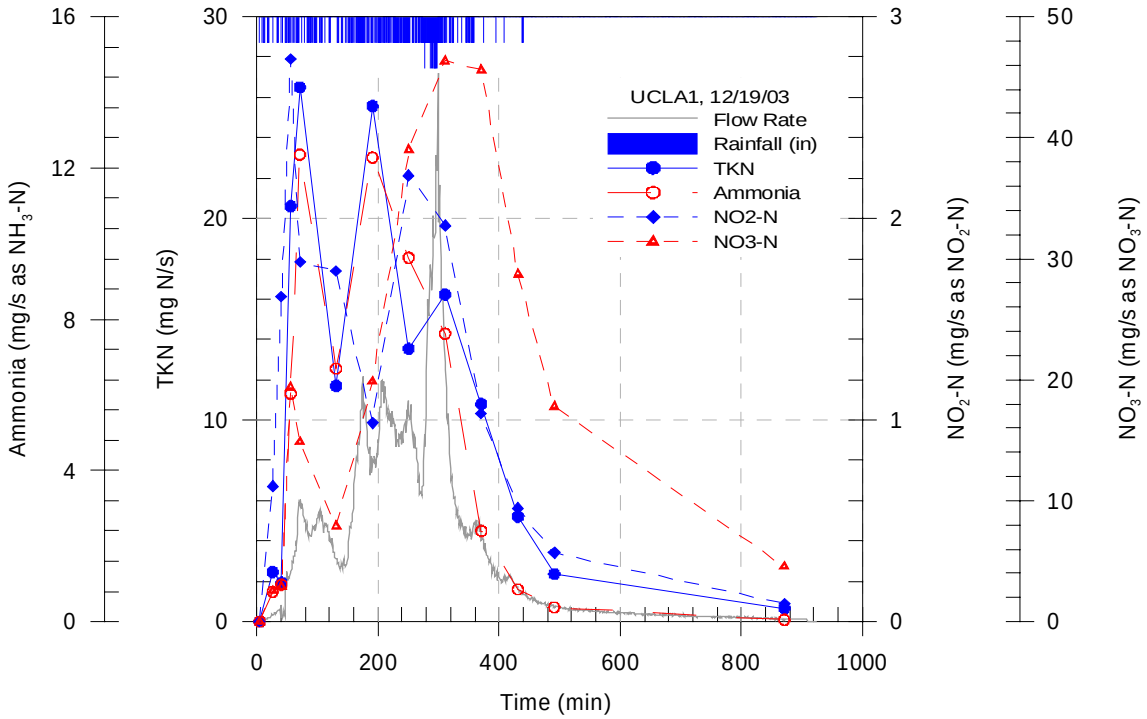

Figure I.4.1.3d[2] (Y4-UCLA1-E5-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

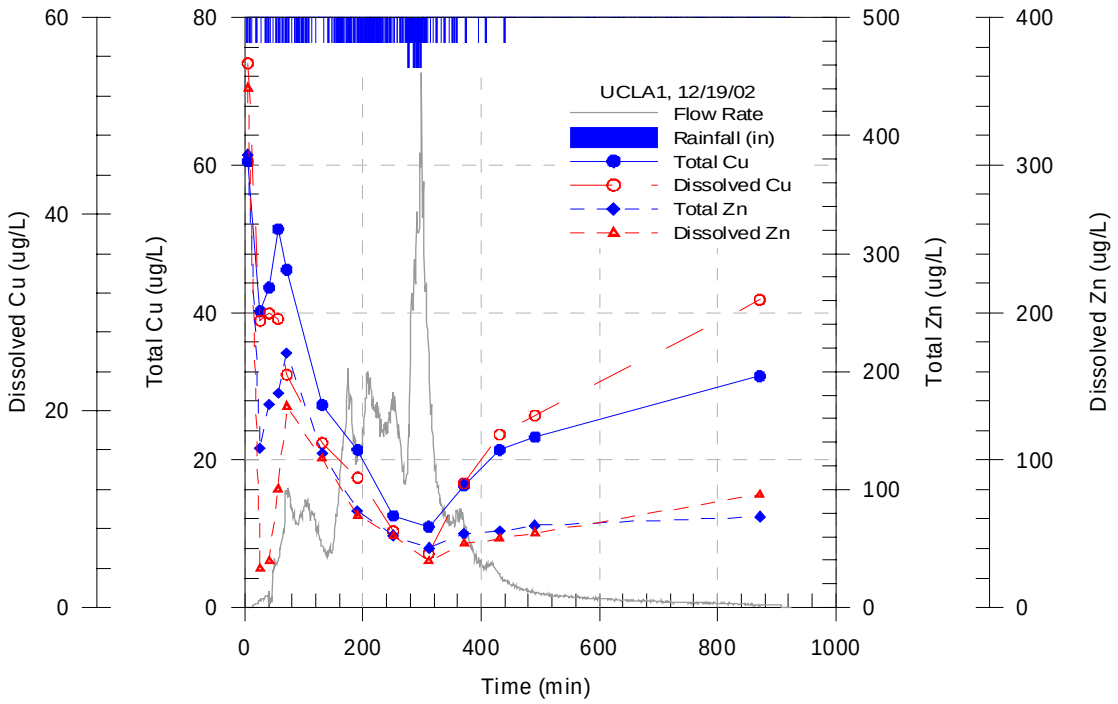

Figure I.4.1.3e[1] (Y4-UCLA1-E5-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

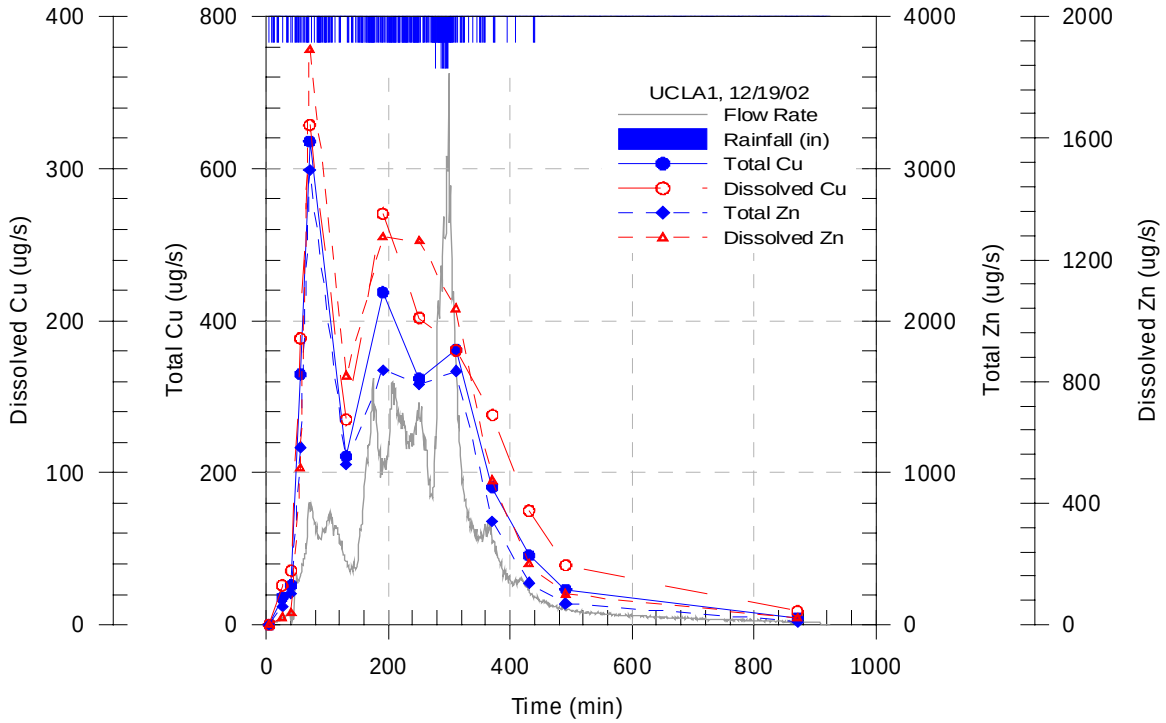

Figure I.4.1.3e[2] (Y4-UCLA1-E5-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

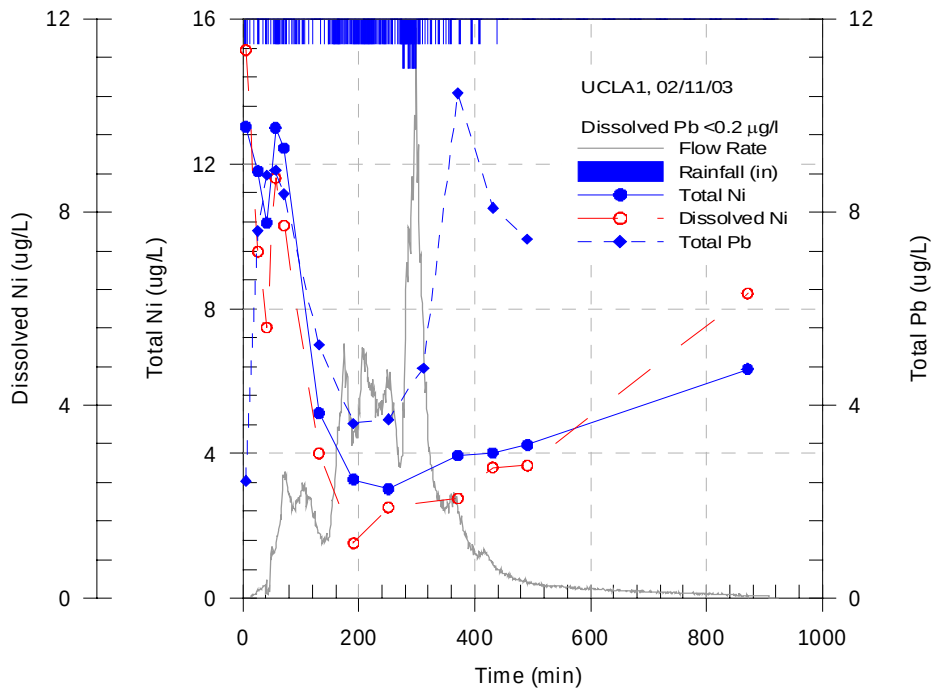

Figure I.4.1.3f[1] (Y4-UCLA1-E5-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

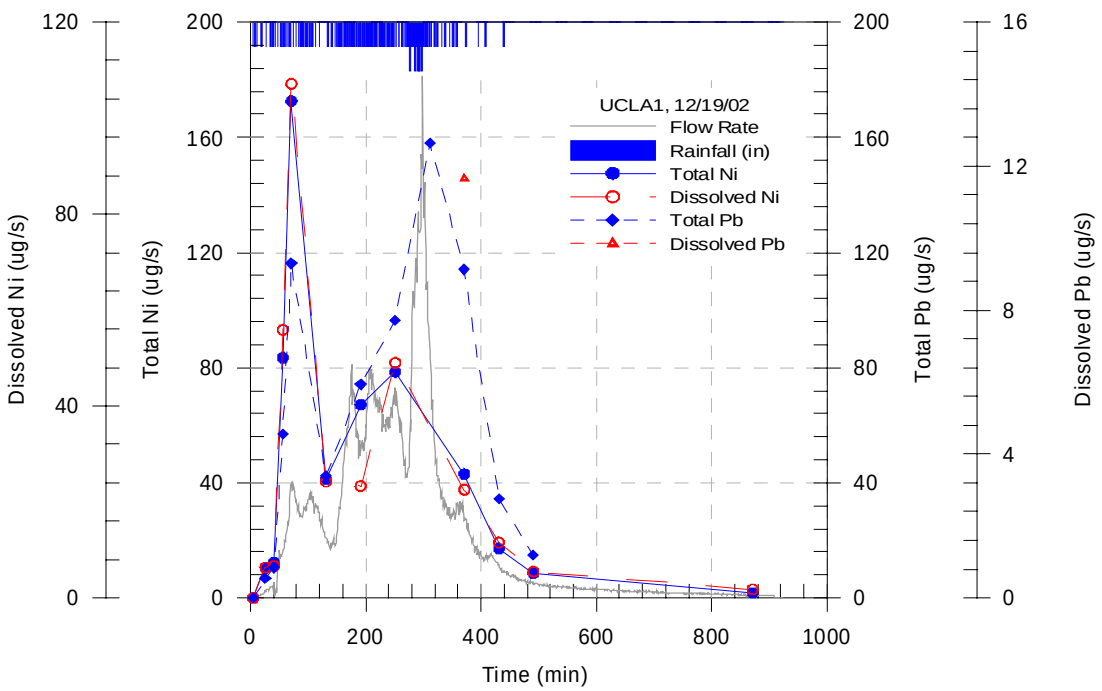

Figure I.4.1.3f[2] (Y4-UCLA1-E5-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

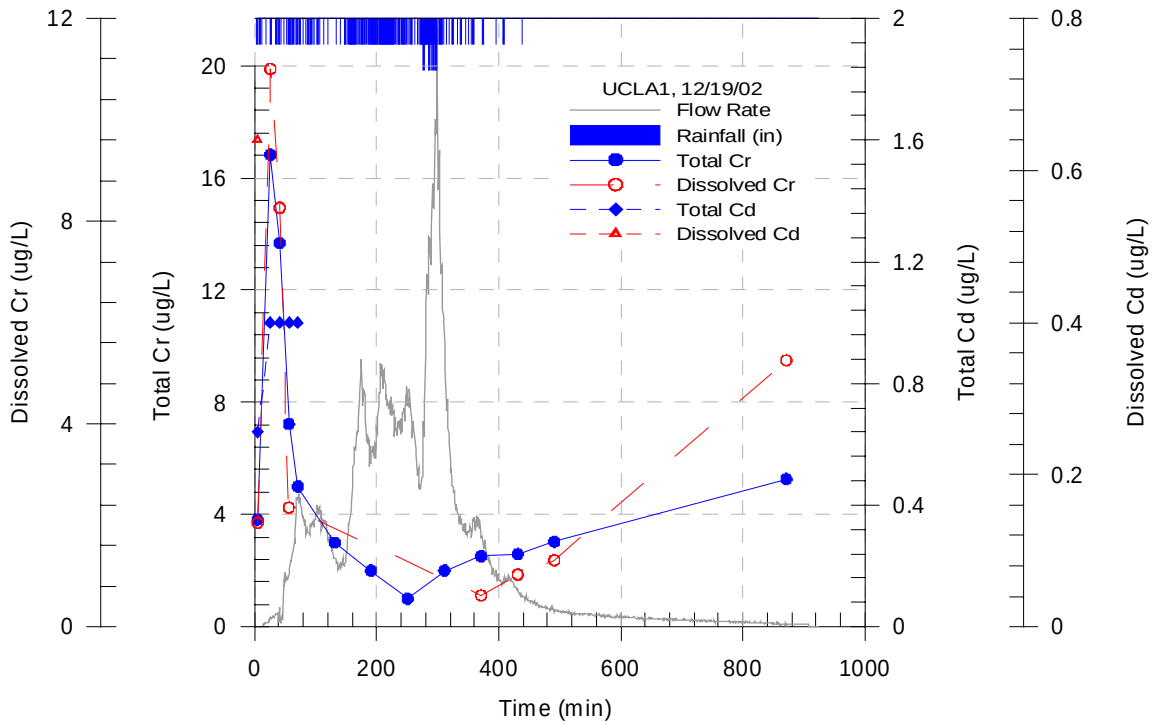

Figure I.4.1.3g[1] (Y4-UCLA1-E5-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

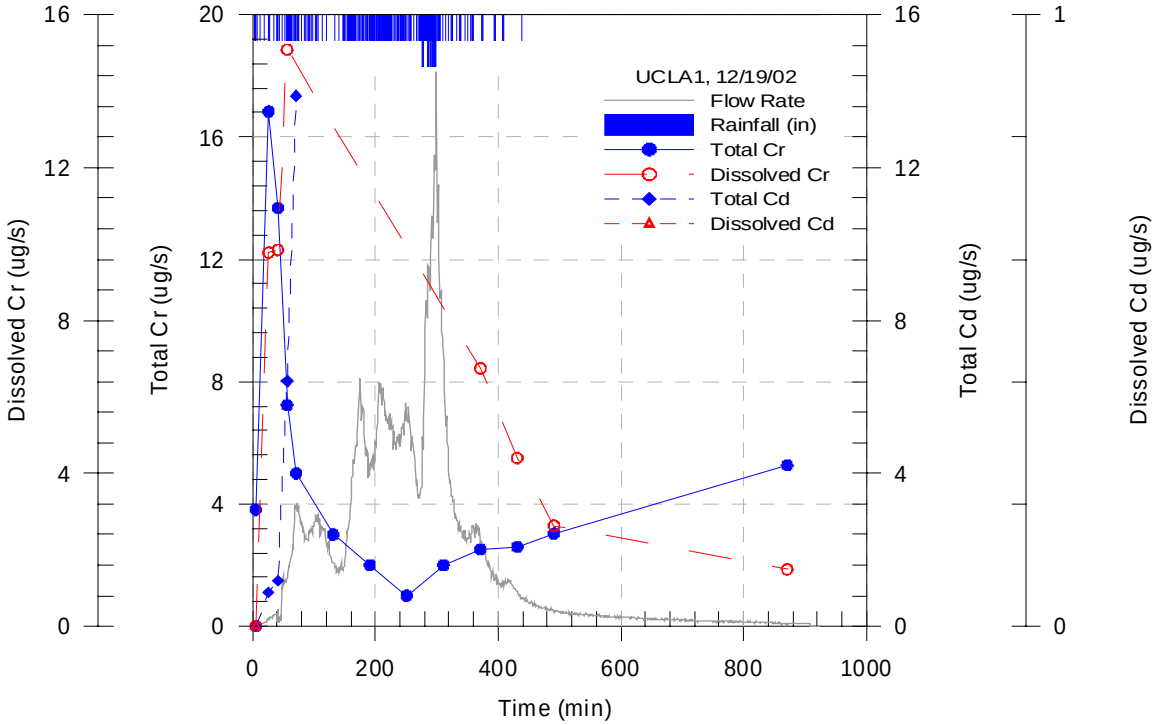

Figure I.4.1.3g[2] (Y4-UCLA1-E5-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

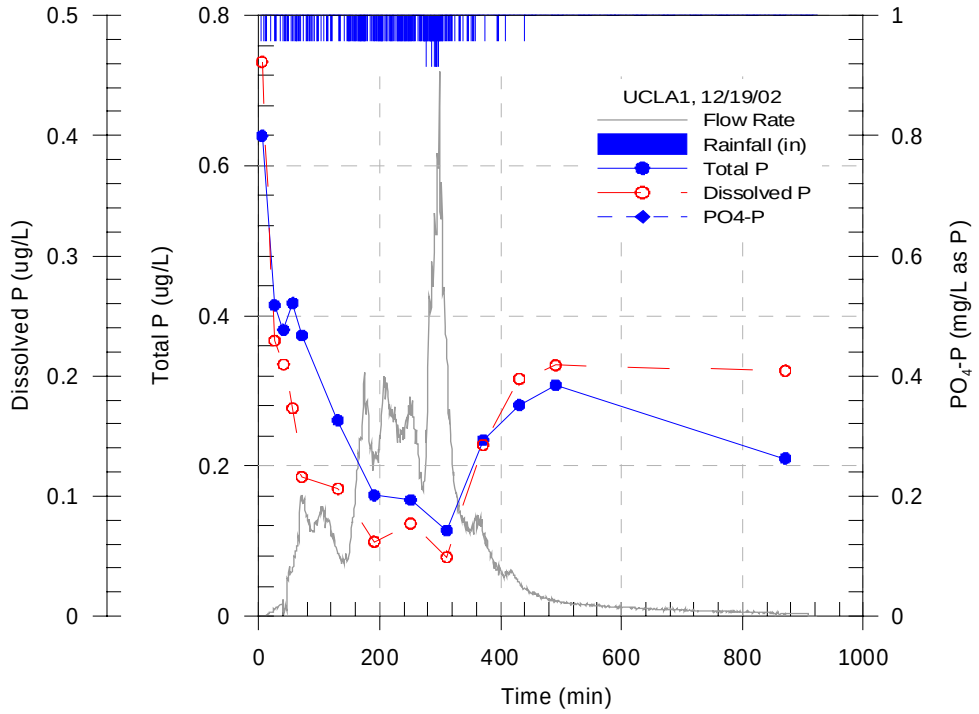

Figure I.4.1.3h[1] (Y4-UCLA1-E5-8). Polluto-graph for Total P / PO_4^{3-}-P

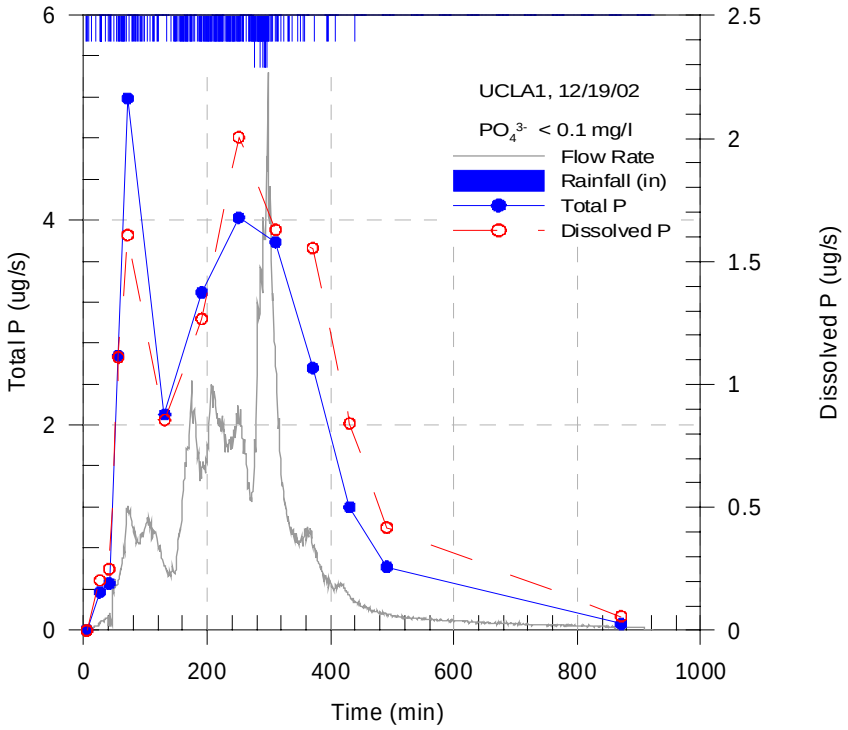

Figure I.4.1.3h[2] (Y4-UCLA1-E5-8). Load -graph for Total P / PO_4^{3-}P

4. UCLA1, 2/11/03

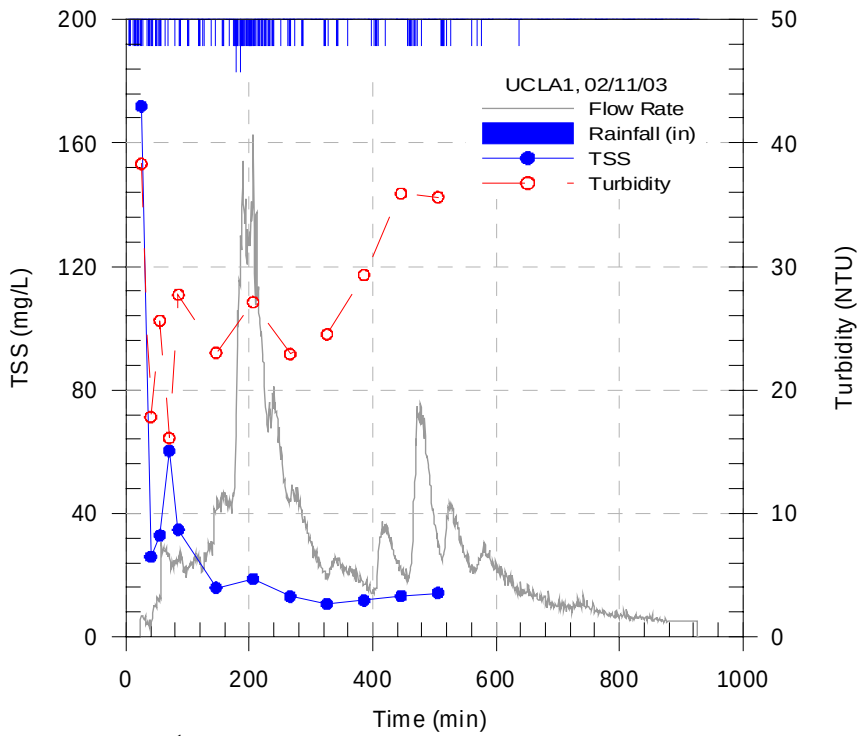

Figure I.4.1.4a[1] (Y4-UCLA1-E6-1). Polluto-graph for TSS and Turbidity

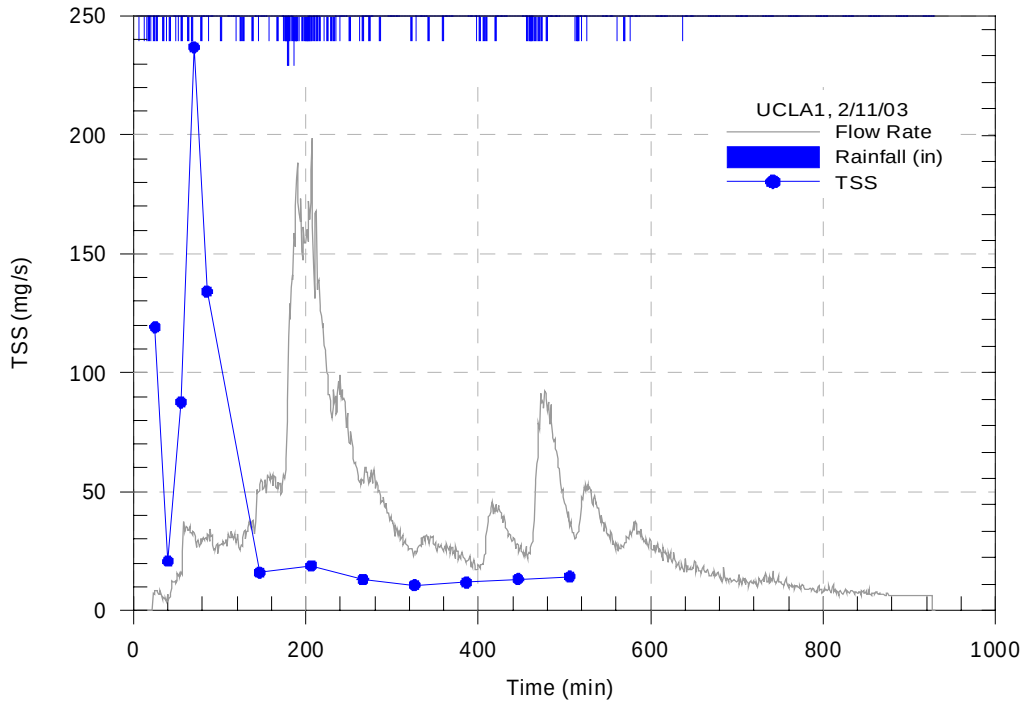

Figure I.4.1.4a[2] (Y4-UCLA1-E6-1). Load-graph for TSS

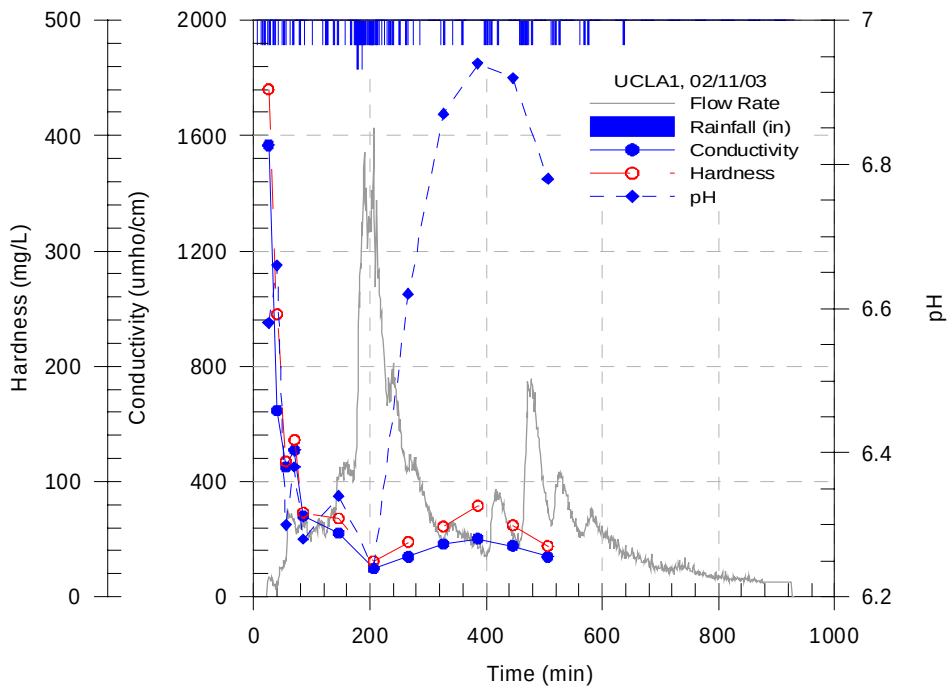

Figure I.4.1.4b[1] (Y4-UCLA1-E6-2). Polluto-graph for Conductivity Hardness and pH

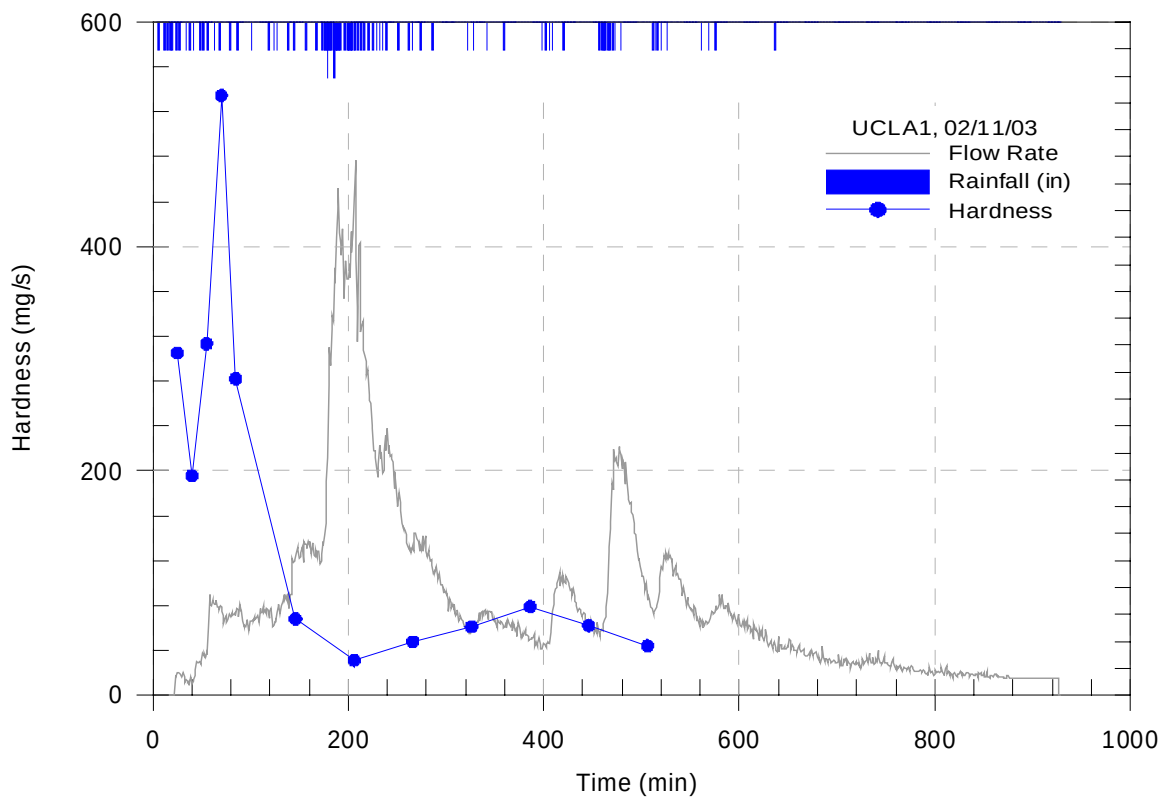

Figure I.4.1.4b[2] (Y4-UCLA1-E6-2). Load-graph for Hardness

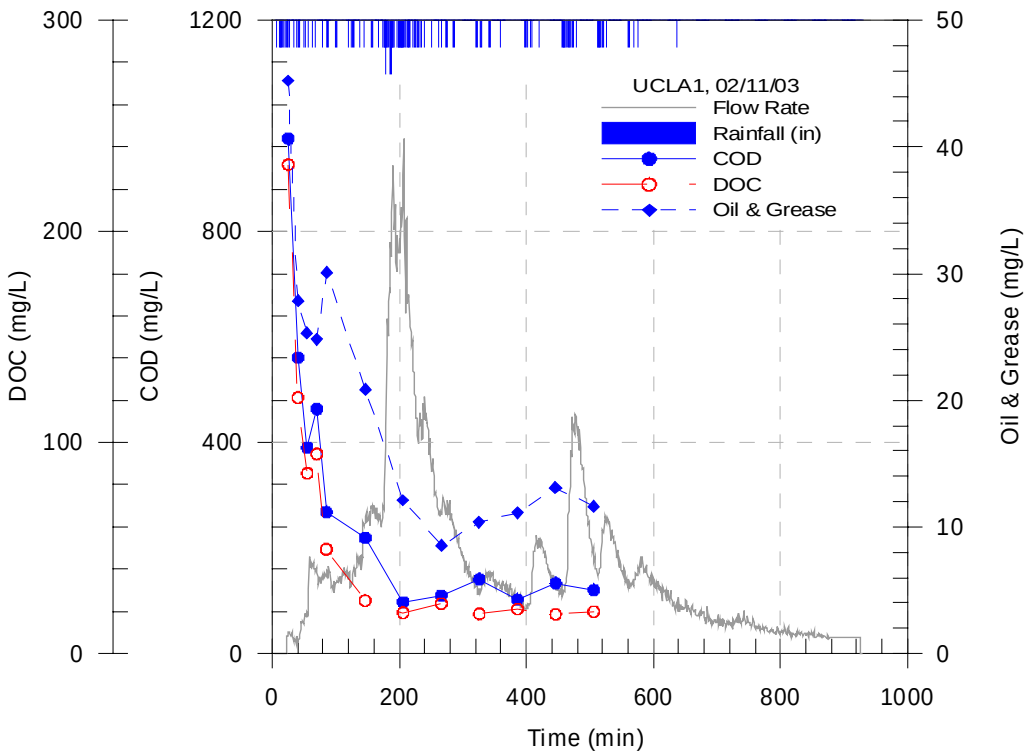

Figure I.4.1.4c[1] (Y4-UCLA1-E6-3). Polluto-graph for COD, DOC and Oil & Grease

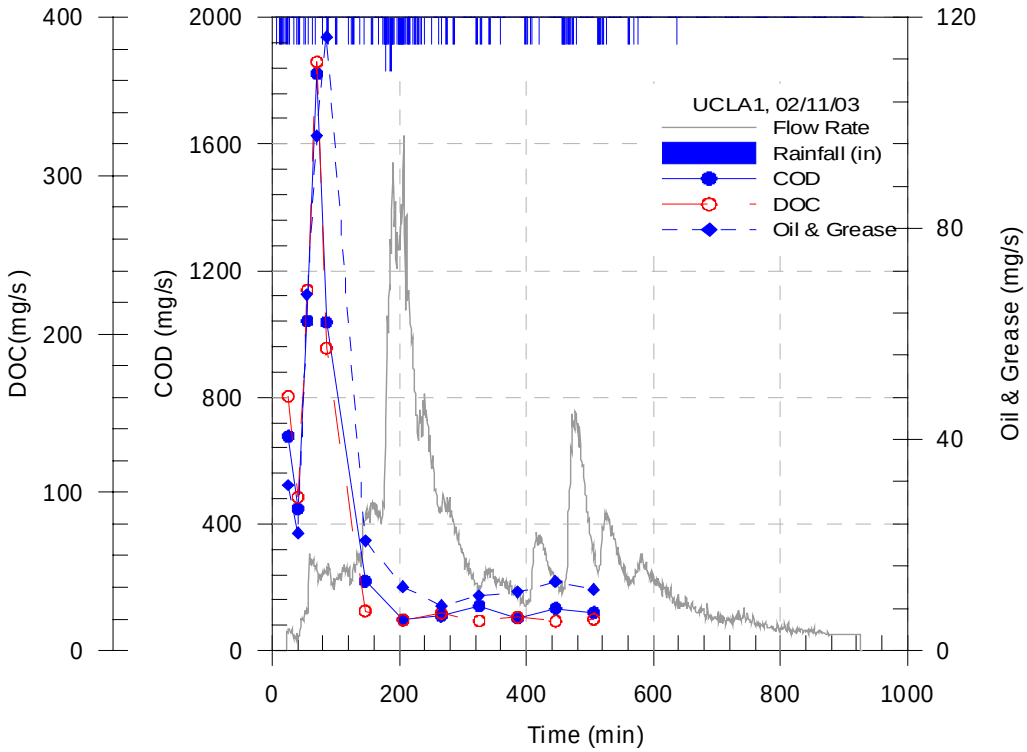

Figure I.4.1.4c[2] (Y4-UCLA1-E6-3). Load-graph for COD, DOC and Oil & Grease

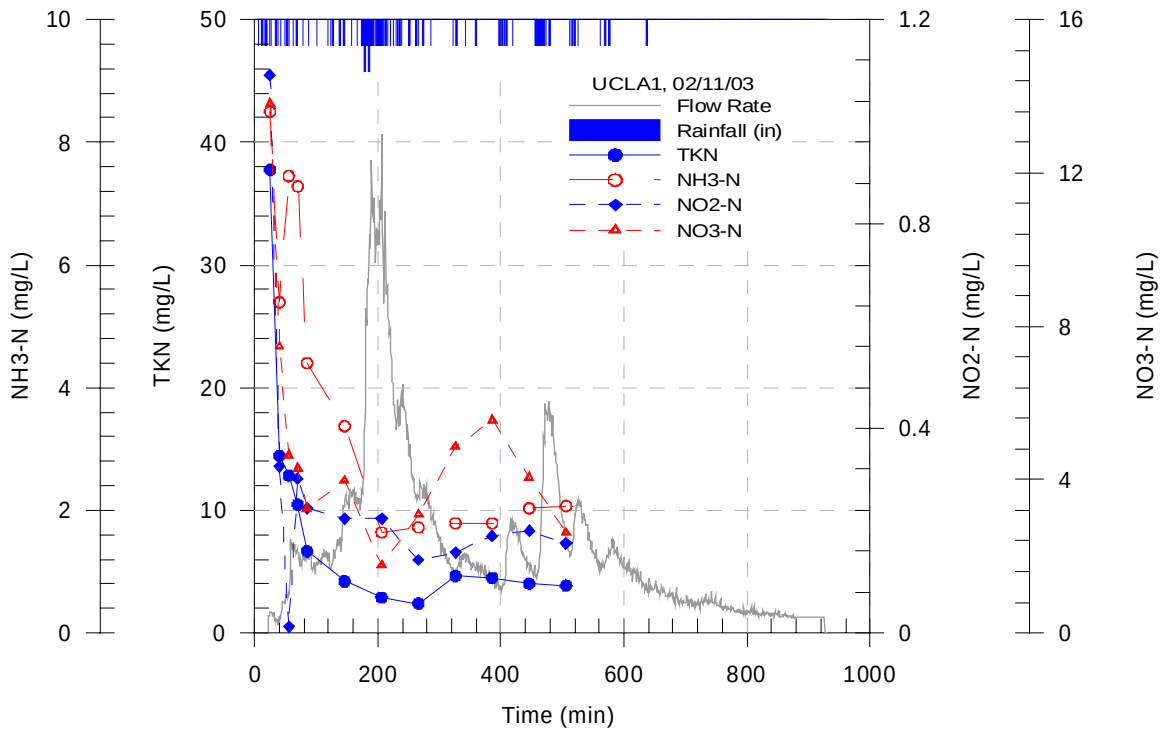

Figure I.4.1.4d[1] (Y4-UCLA1-E6-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

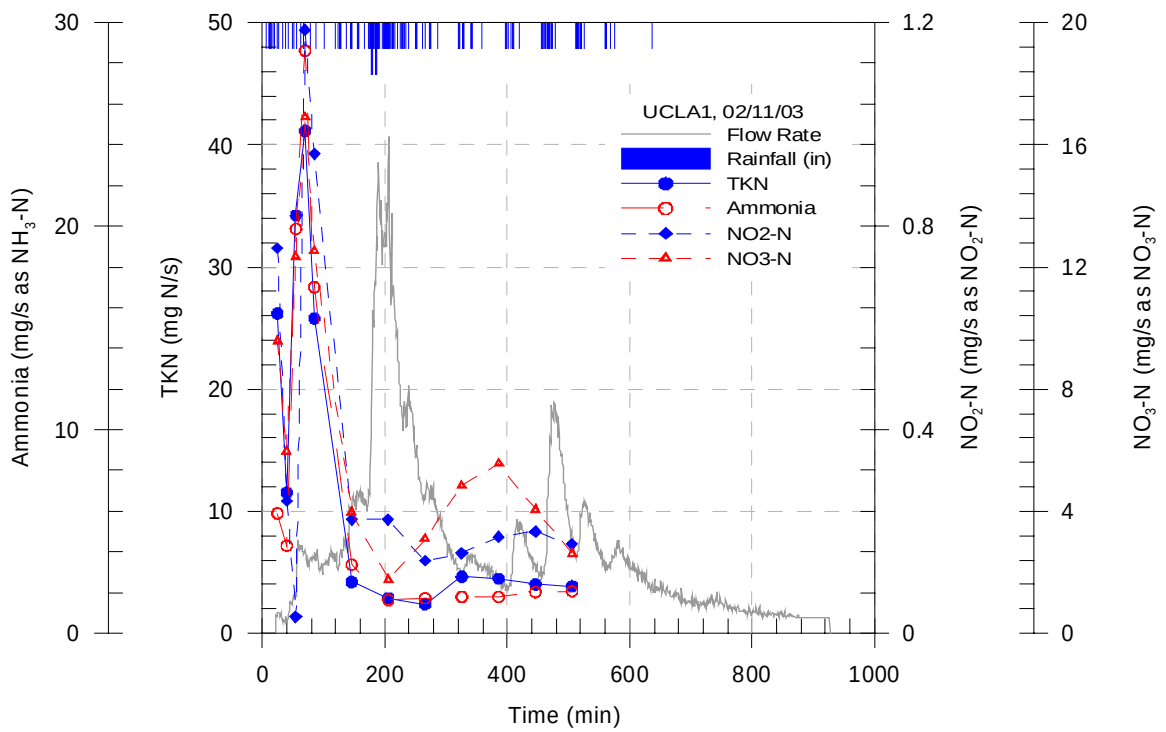

Figure I.4.1.4d[2] (Y4-UCLA1-E6-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

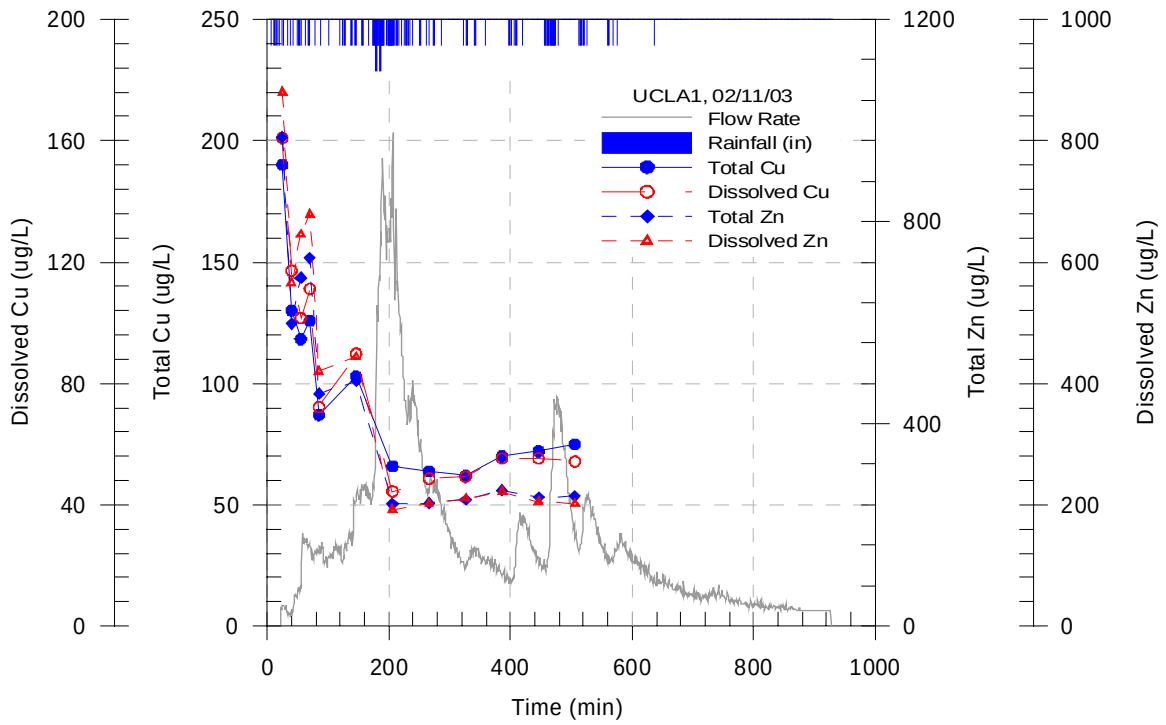

Figure I.4.1.4e[1] (Y4-UCLA1-E6-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

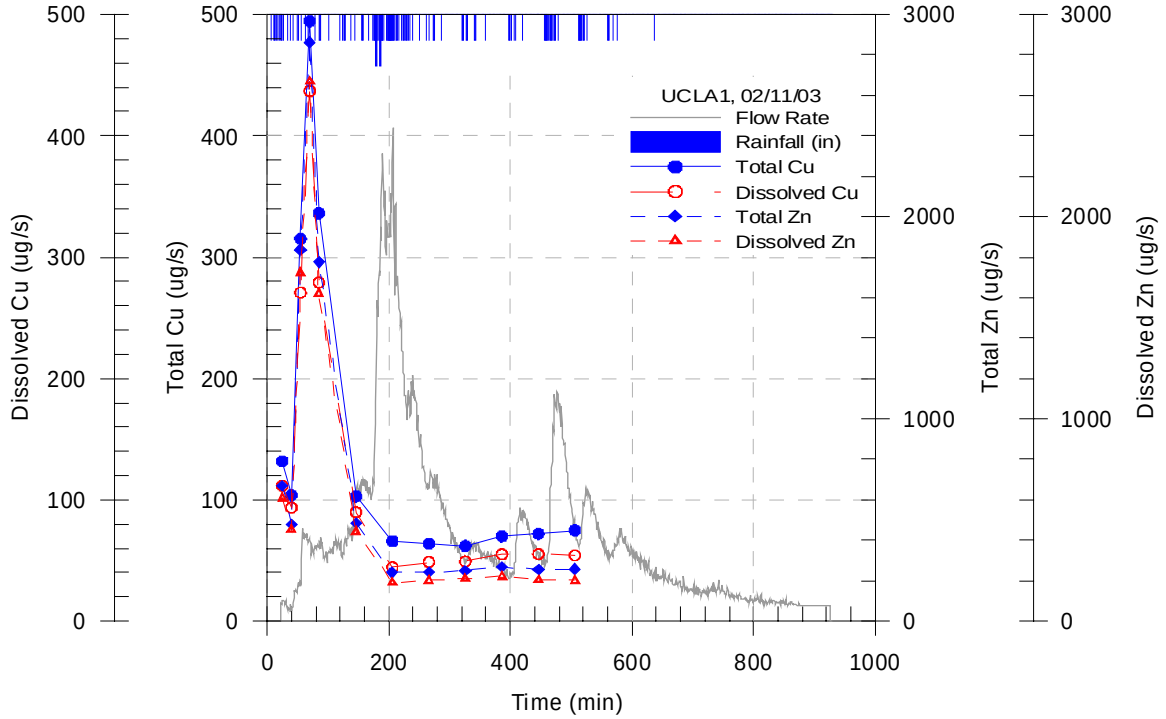

Figure I.4.1.4e[2] (Y4-UCLA1-E6-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

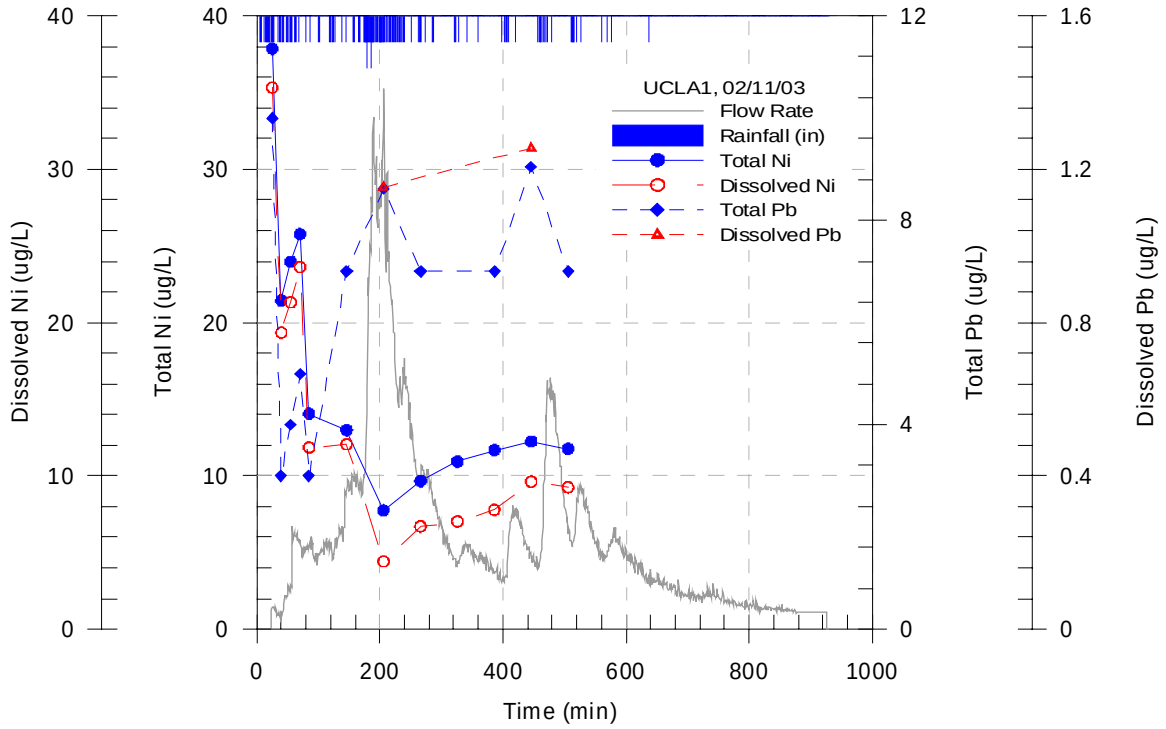

Figure I.4.1.4f[1] (Y4-UCLA1-E6-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

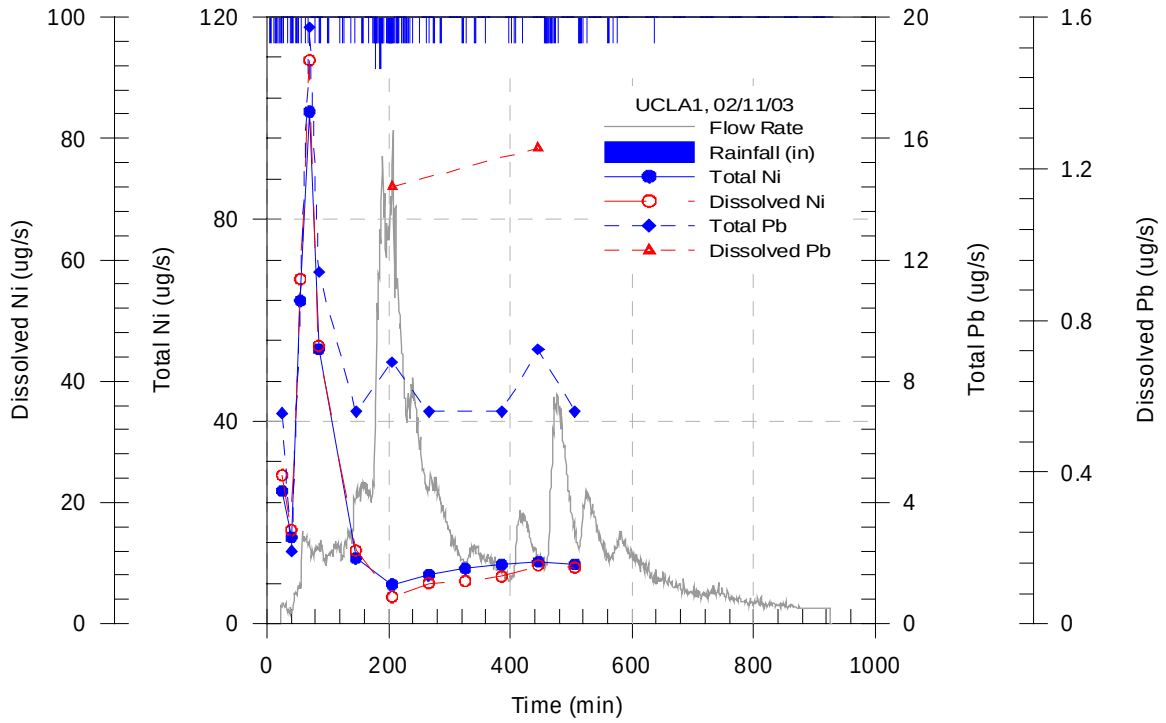

Figure I.4.1.4f[2] (Y4-UCLA1-E6-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

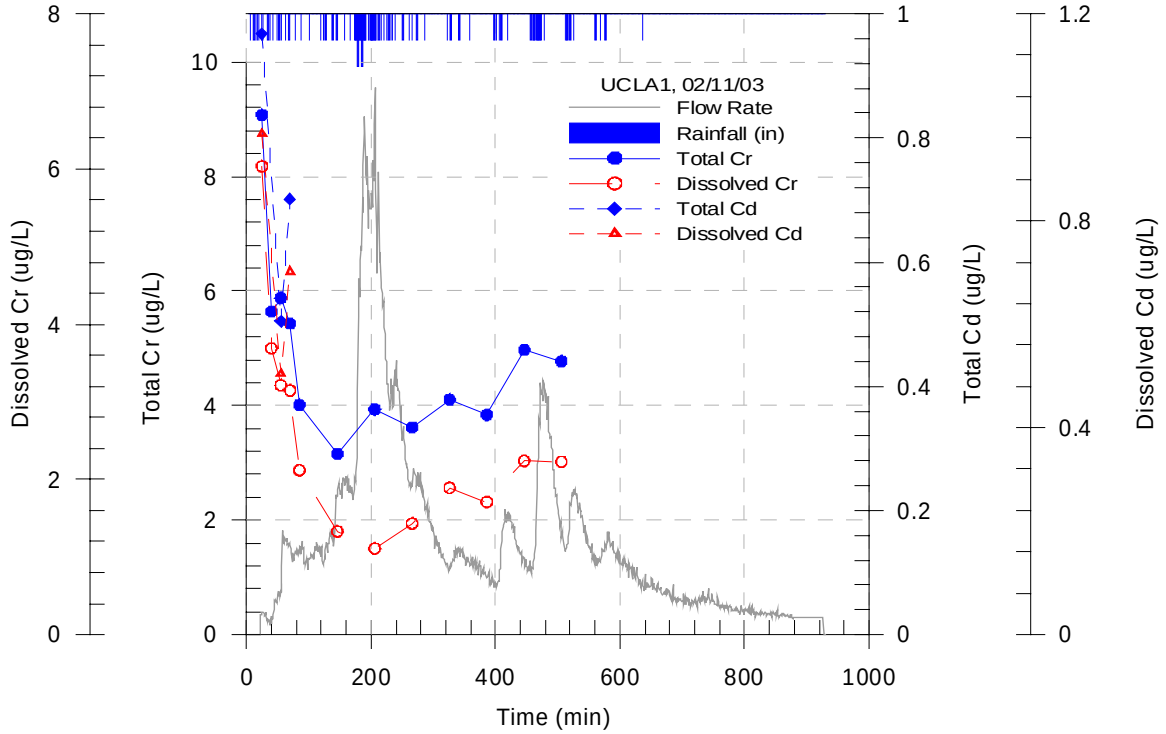

Figure I.4.1.4g[1] (Y4-UCLA1-E6-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

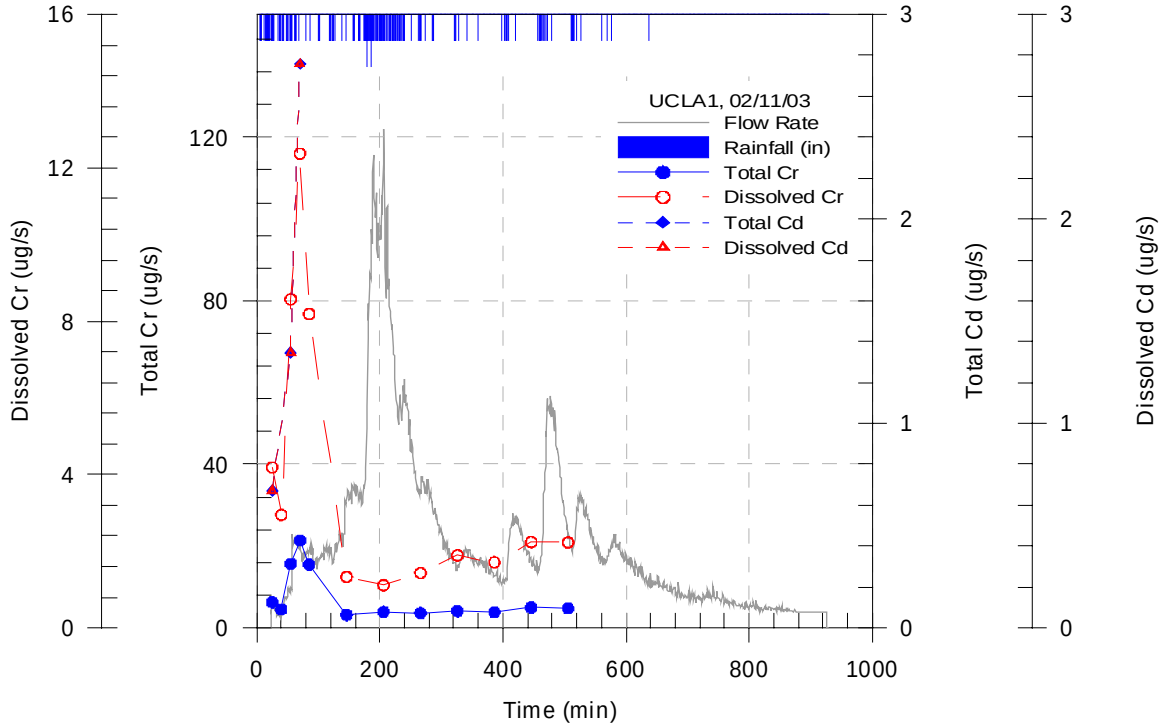

Figure I.4.1.4g[2] (Y4-UCLA1-E6-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

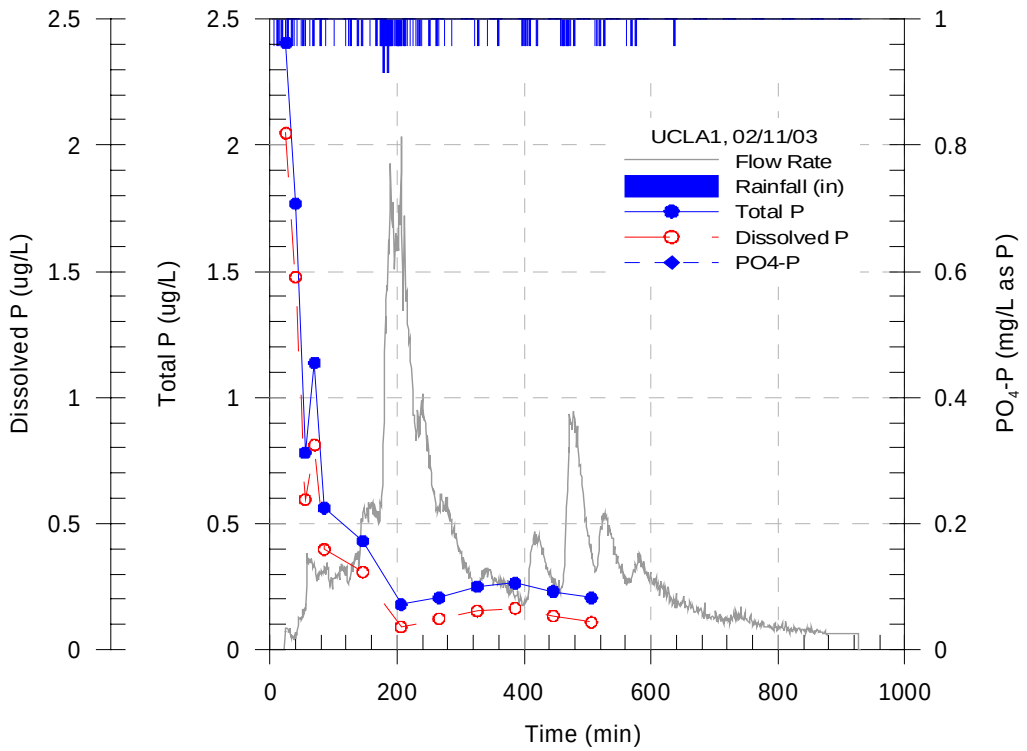

Figure I.4.1.4h[1] (Y4-UCLA1-E6-8). Polluto-graph for Total P / PO_4^{3-}-P

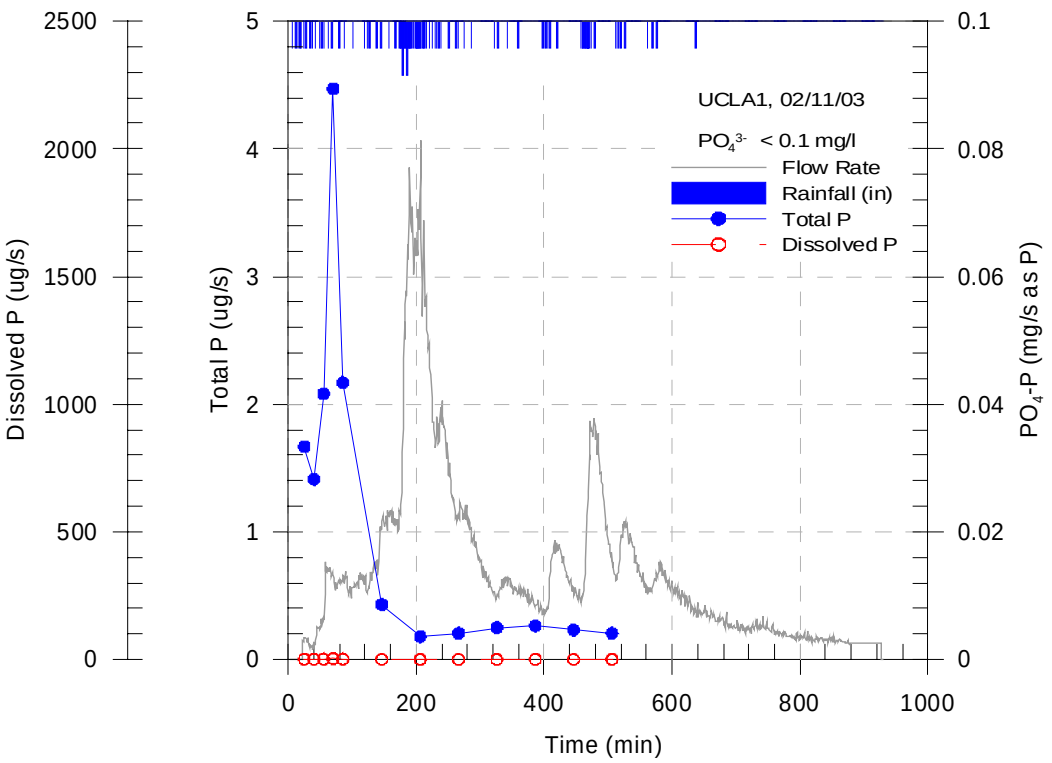

Figure I.4.1.4h[2] (Y4-UCLA1-E6-8). Load -graph for Total P / PO_4^{3-}-P

5. UCLA1, 3/15/03

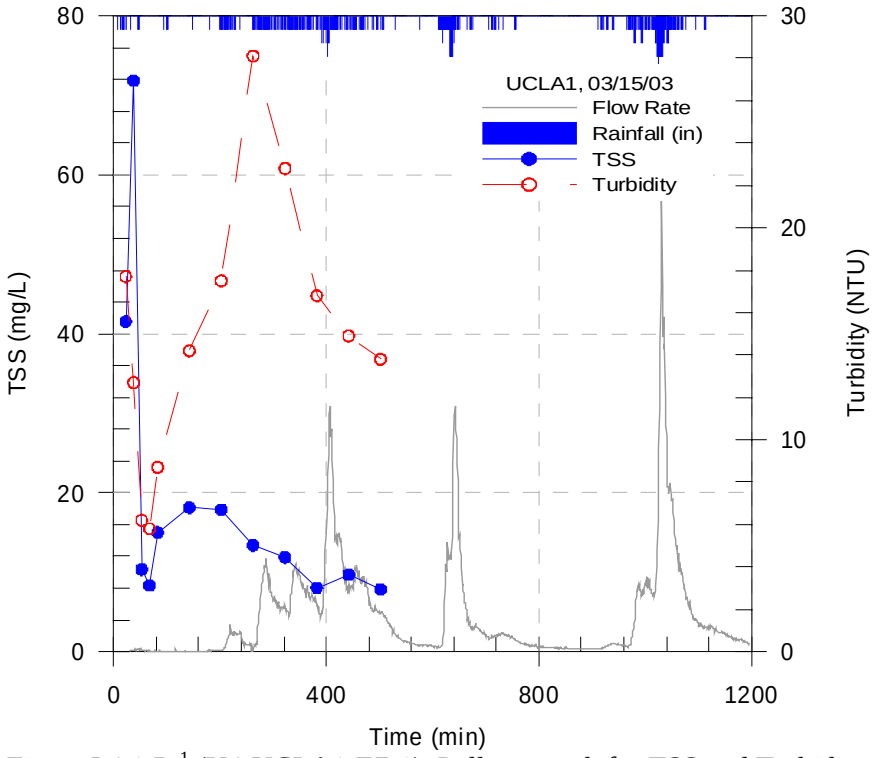

Figure I.4.1.5a[1] (Y4-UCLA1-E7-1). Polluto-graph for TSS and Turbidity

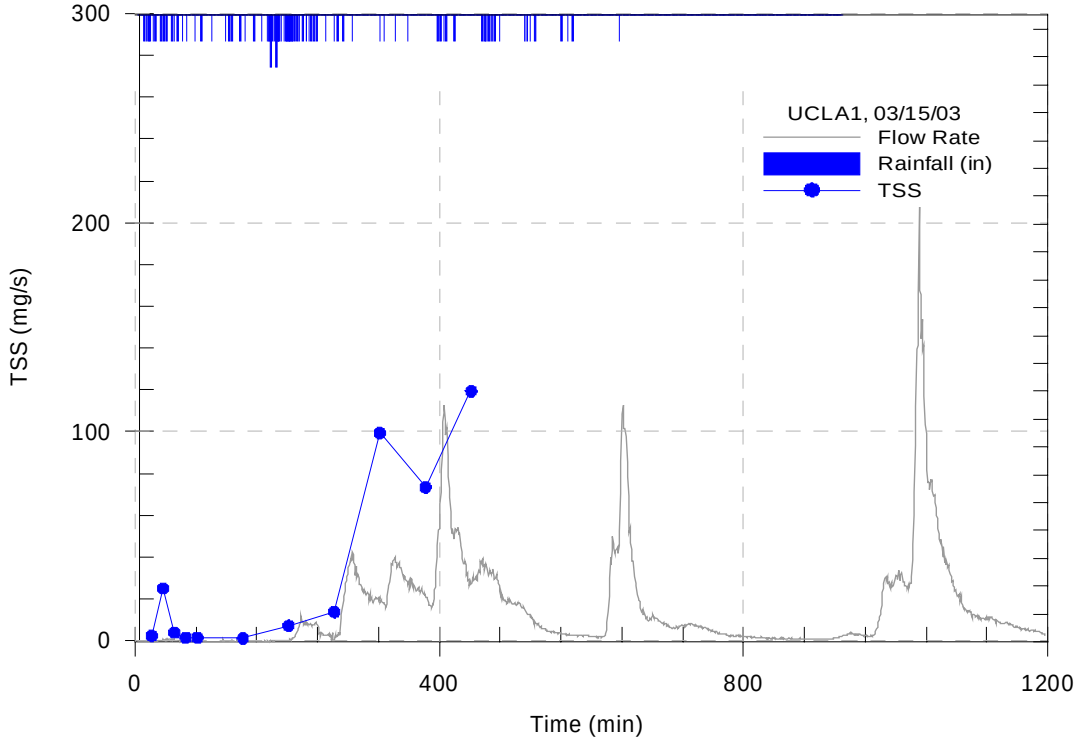

Figure I.4.1.5a[2] (Y4-UCLA1-E7-1). Load-graph for TSS

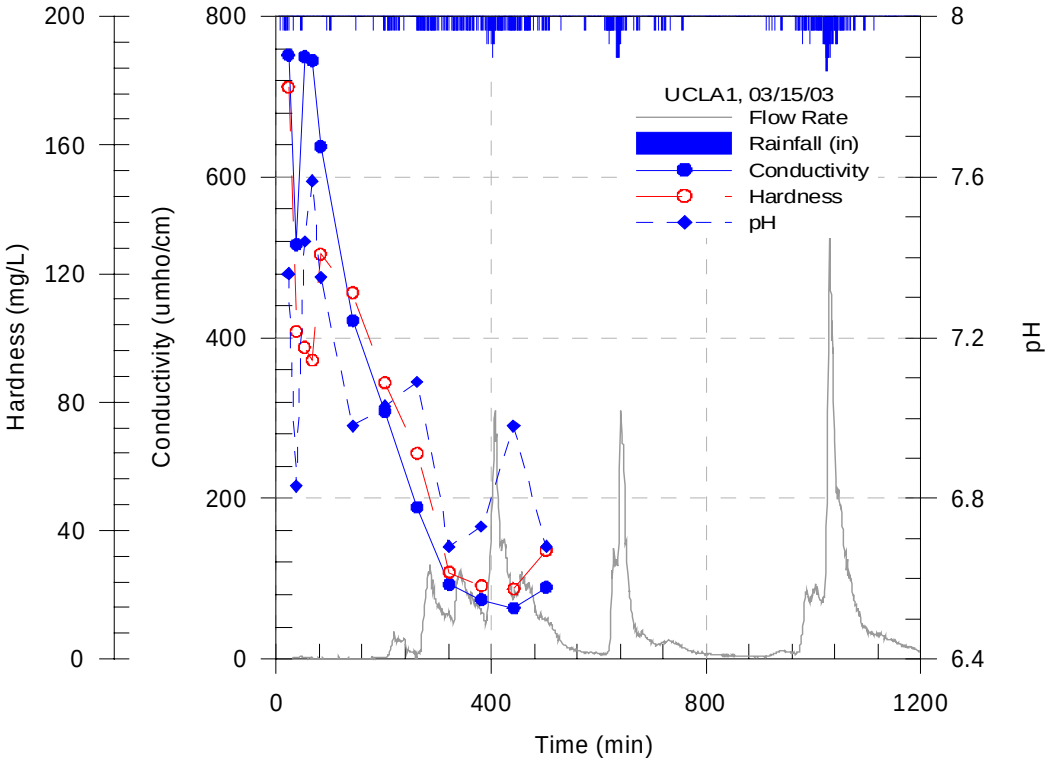

Figure I.4.1.5b[1] (Y4-UCLA1-E7-2). Polluto-graph for Conductivity, Hardness and pH

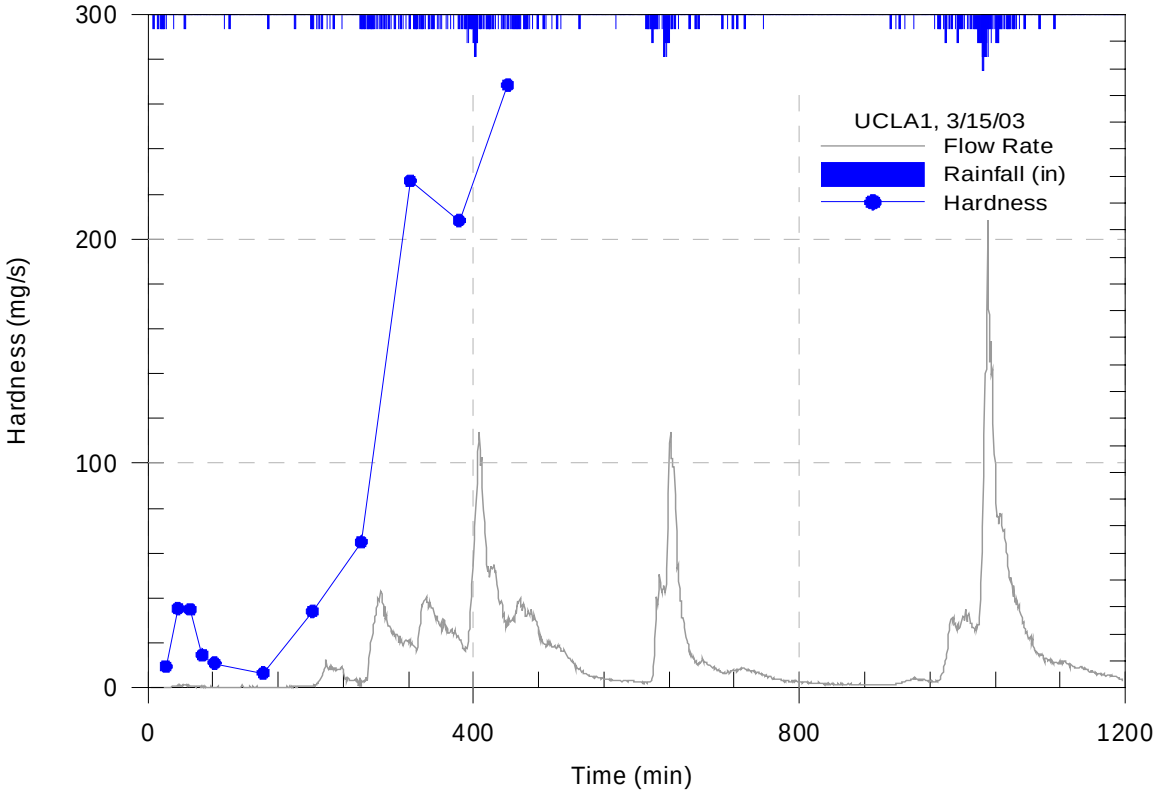

Figure I.4.1.5b[2] (Y4-UCLA1-E7-2). Load-graph for Hardness

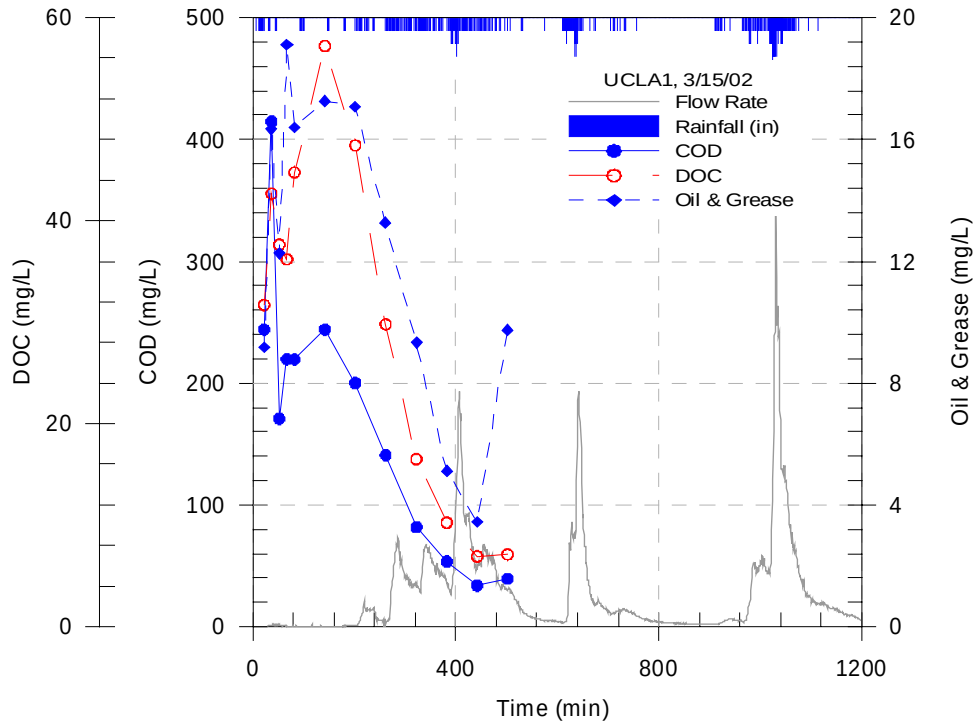

Figure I.4.1.5c[1] (Y4-UCLA1-E7-3). Polluto-graph for COD, DOC and Oil & Grease

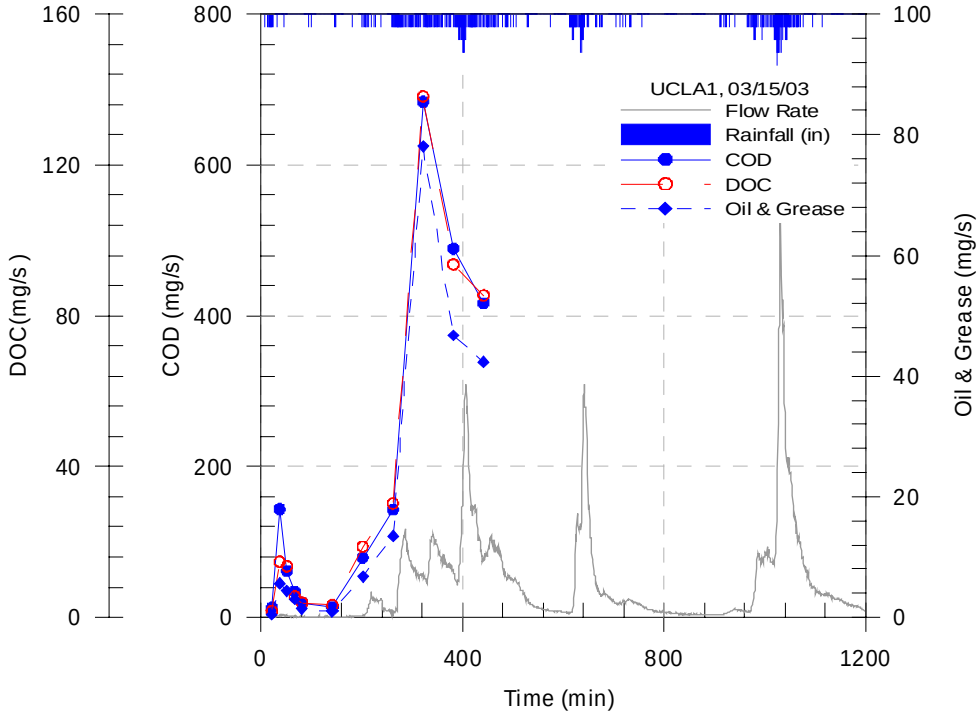

Figure I.4.1.5c[2] (Y4-UCLA1-E7-3). Load-graph for COD, DOC and Oil & Grease

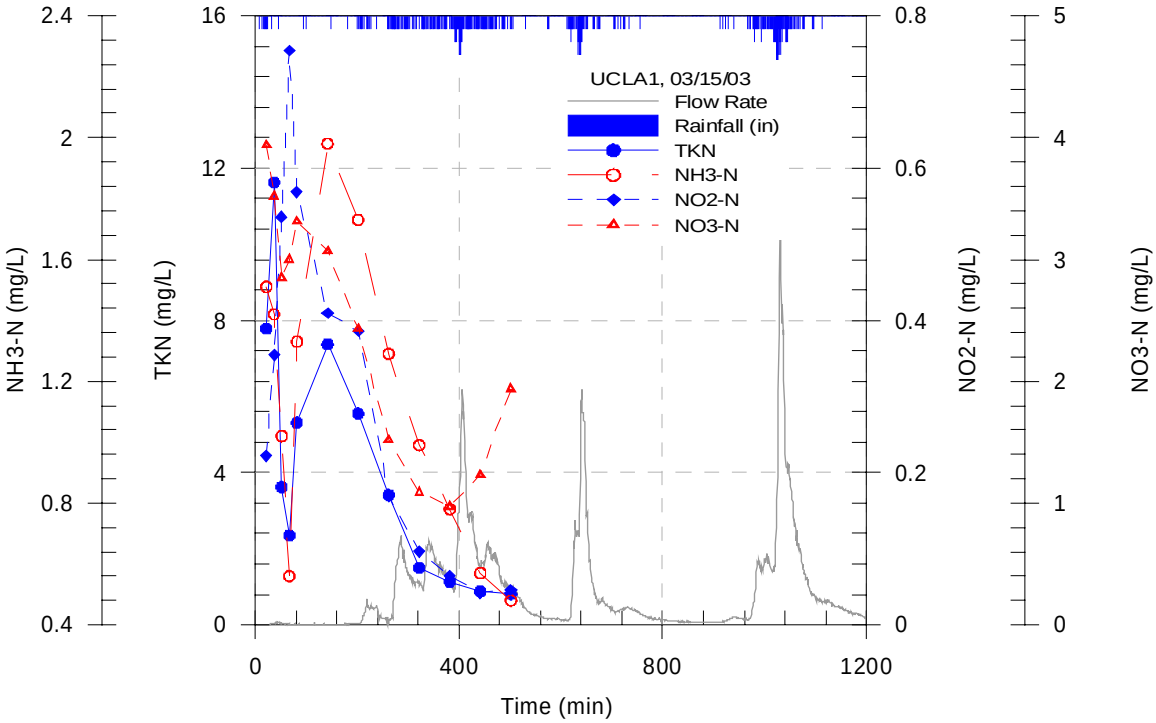

Figure I.4.1.5d[1] (Y4-UCLA1-E7-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

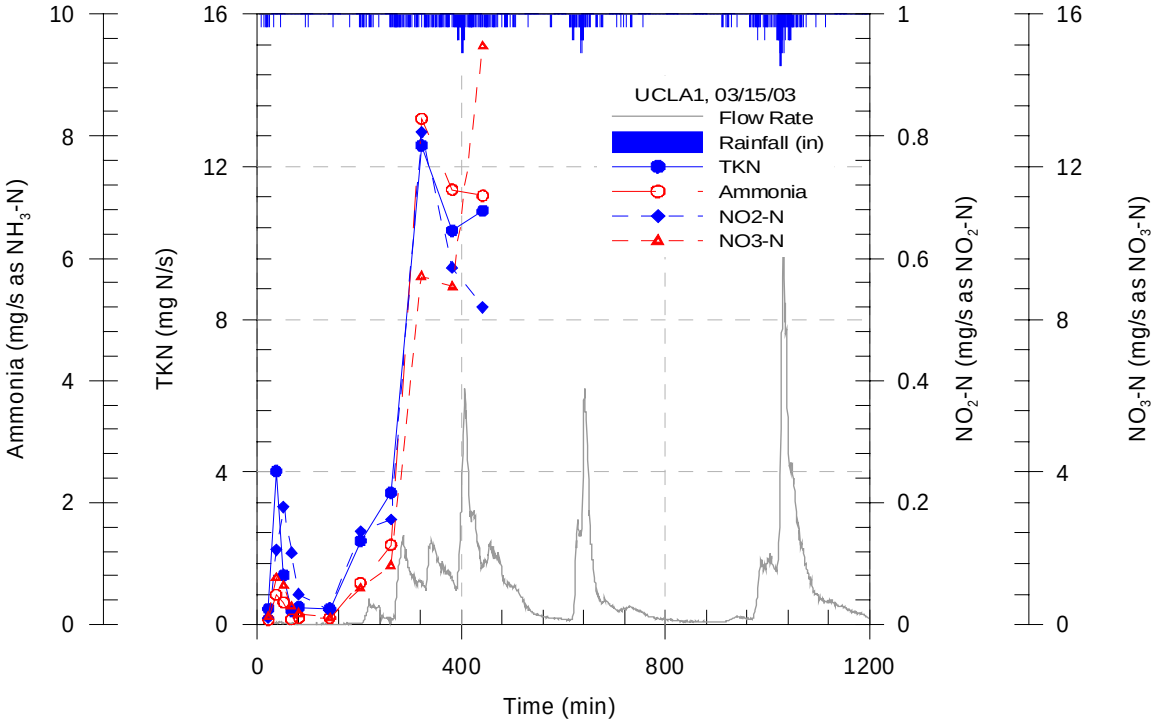

Figure I.4.1.5d[2] (Y4-UCLA1-E7-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

6. UCLA1, 05/03/03

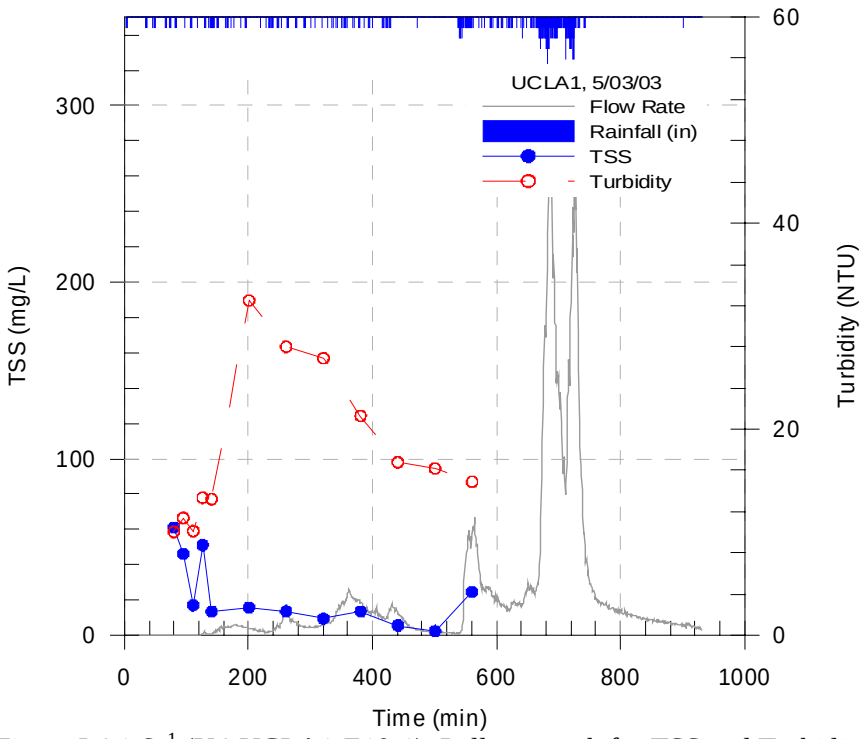

Figure I.4.1.6a[1] (Y4-UCLA1-E10-1). Polluto-graph for TSS and Turbidity

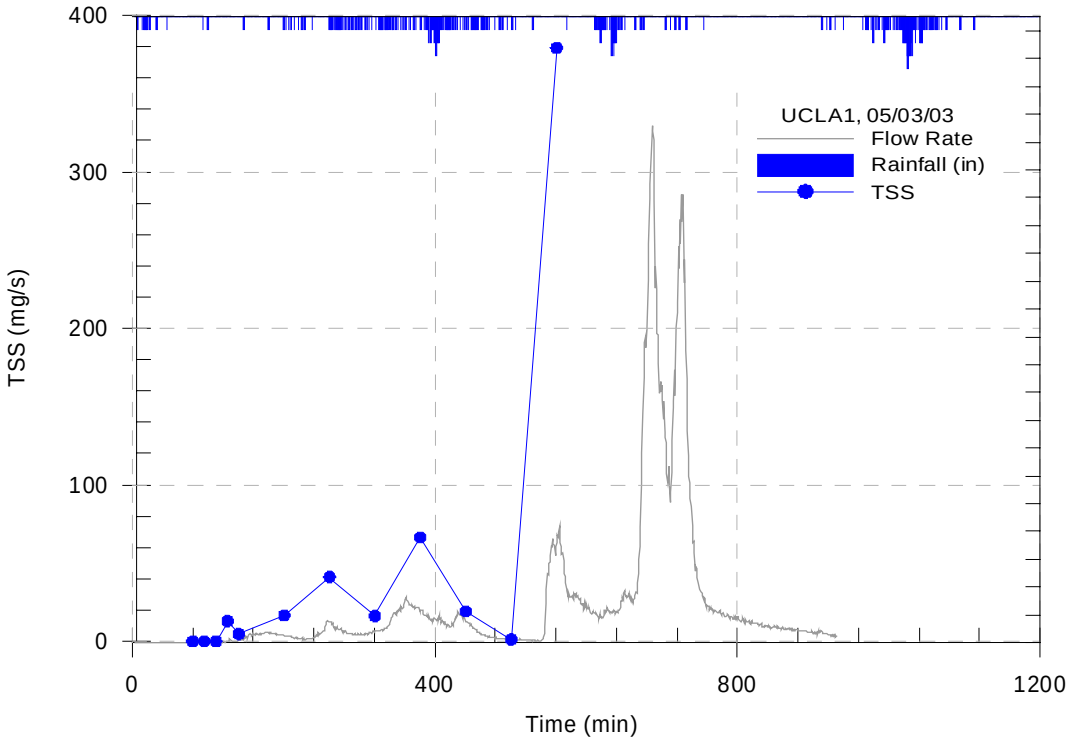

Figure I.4.1.6a[2] (Y4-UCLA1-E10-1). Load-graph for TSS

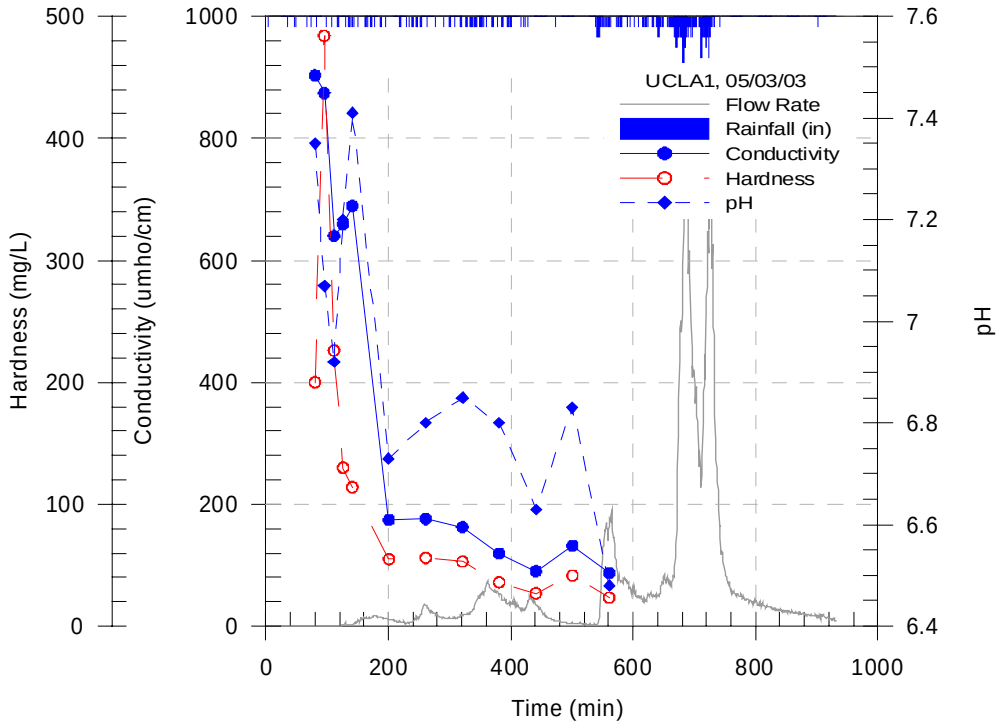

Figure I.4.1.6b[1] (Y4-UCLA1-E10-2). Polluto-graph for Conductivity, Hardness and pH

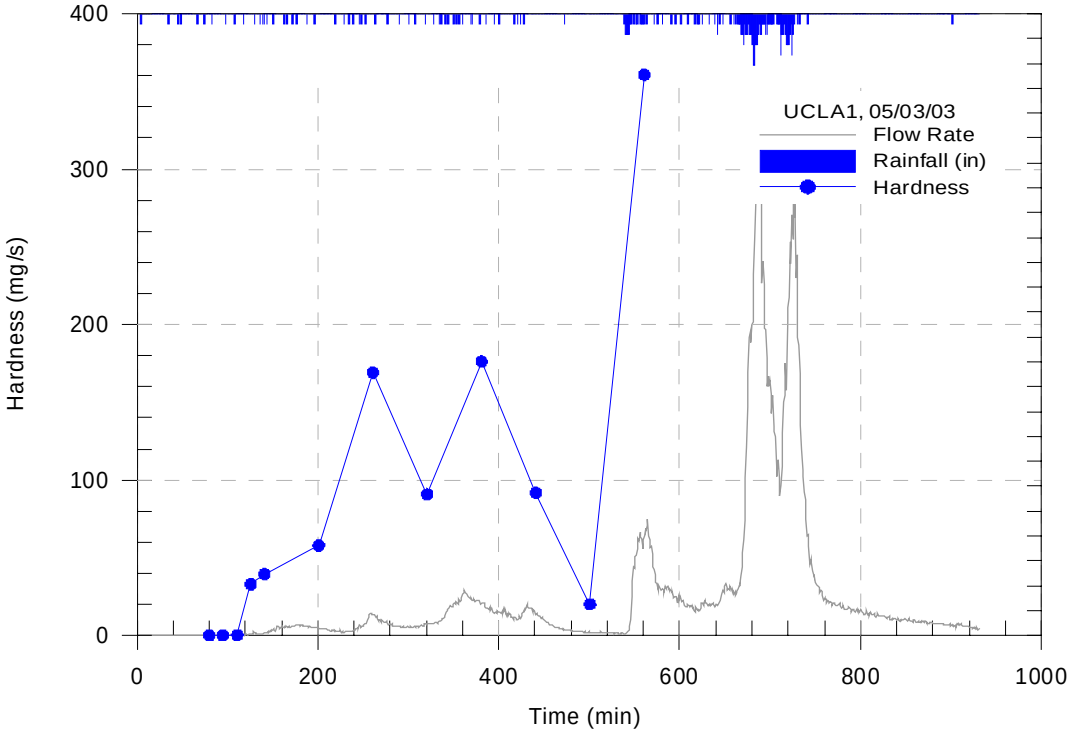

Figure I.4.1.6b[2] (Y4-UCLA1-E10-2). Load-graph for Hardness

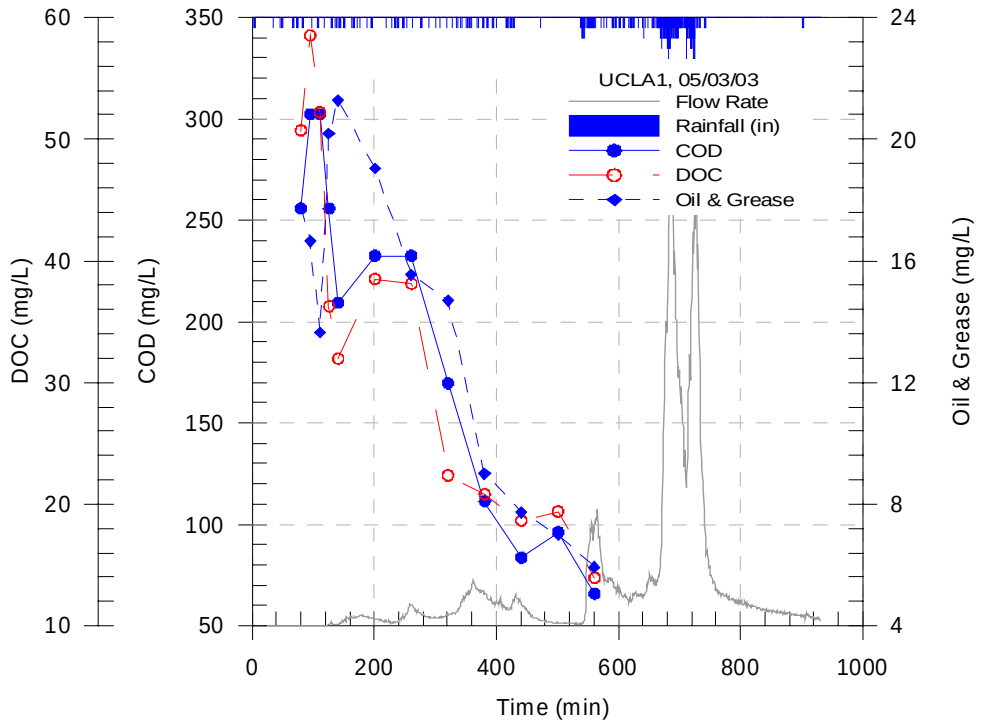

Figure I.4.1.6c[1] (Y4-UCLA1-E10-3). Polluto-graph for COD, DOC and Oil & Grease

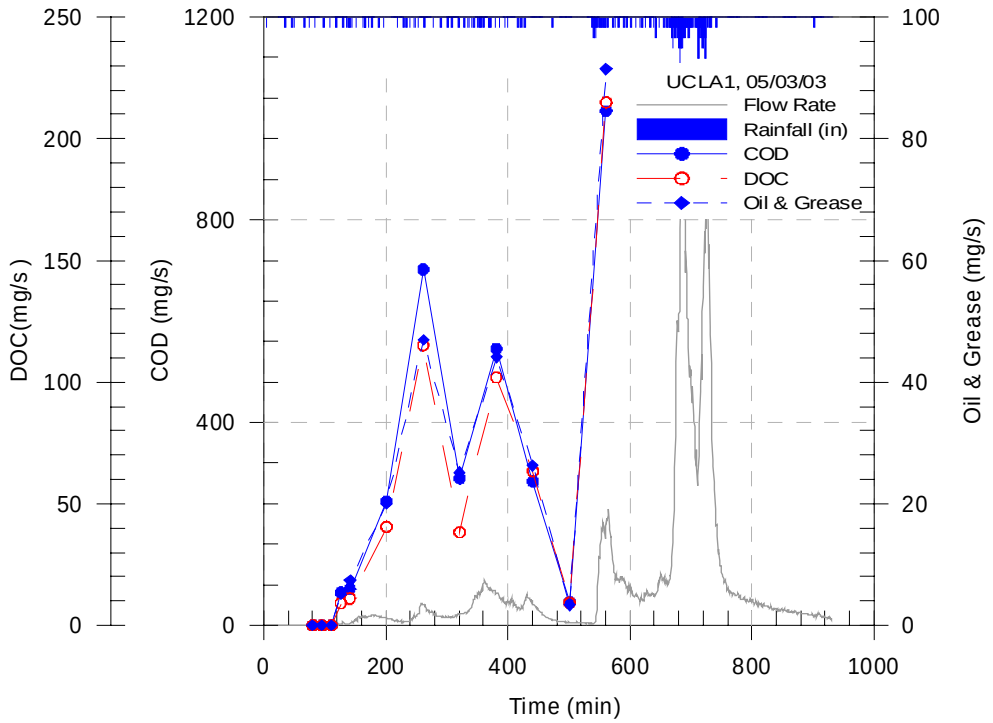

Figure I.4.1.6c[2] (Y4-UCLA1-E10-3). Load-graph for COD, DOC and Oil & Grease

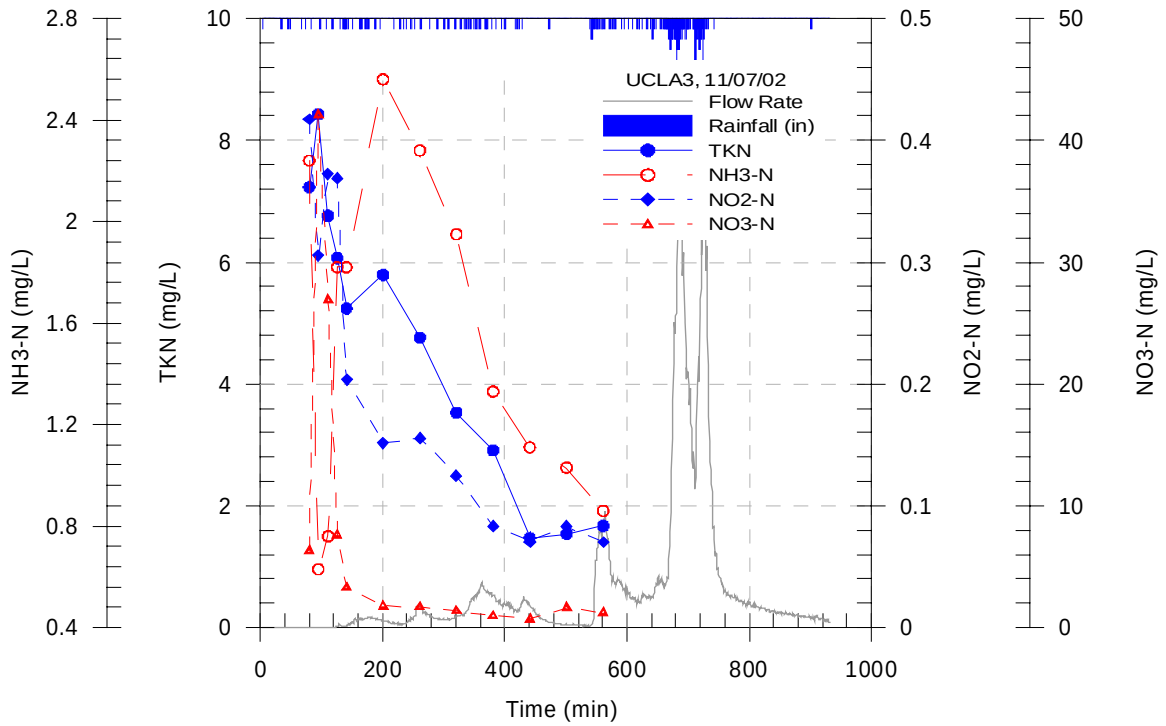

Figure I.4.1.6d[1] (Y4-UCLA1-E10-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

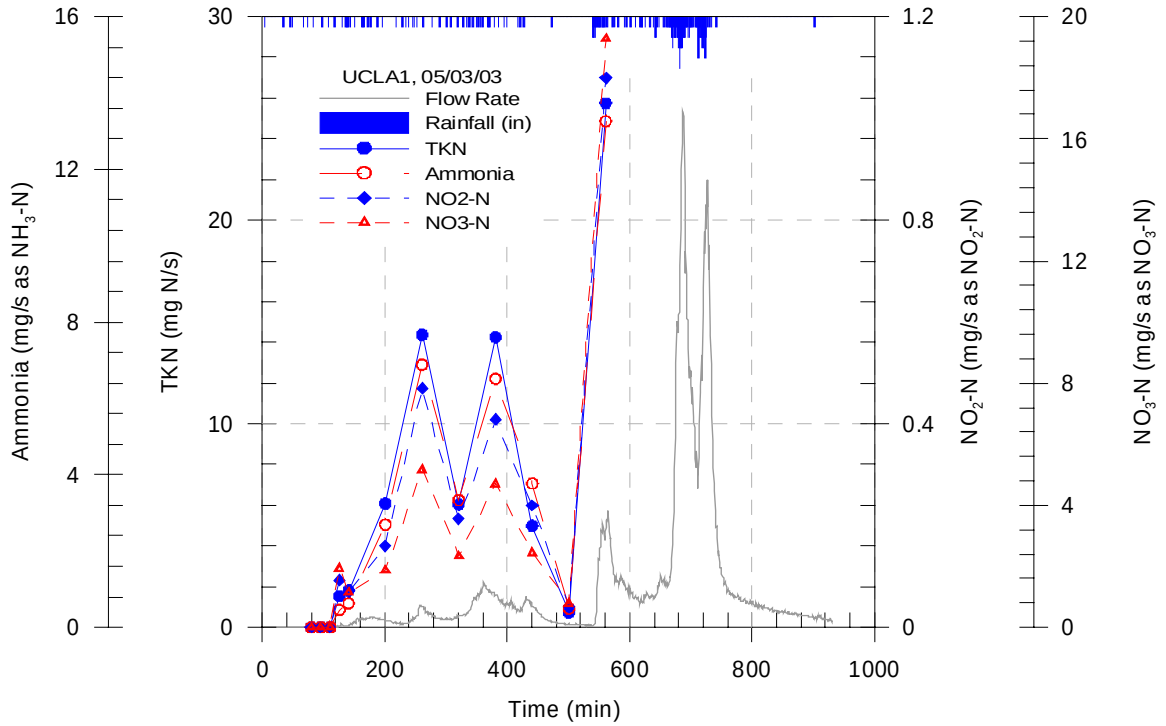

Figure I.4.1.6d[2] (Y4-UCLA1-E10-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

1. UCLA2, 11/07/02

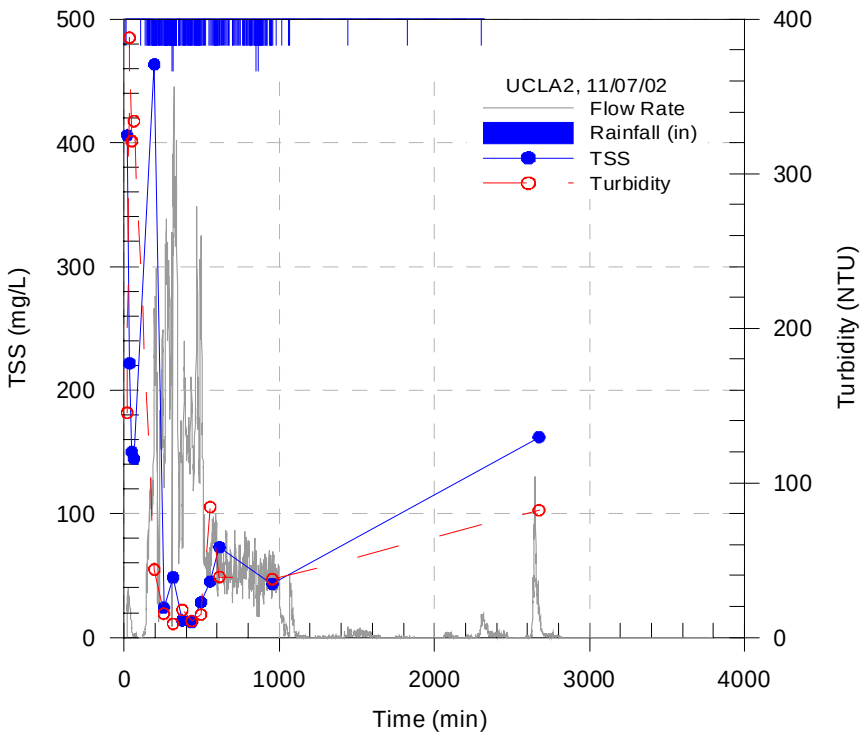

Figure I.4.2.1a[1] (Y4-UCLA2-E1-1). Polluto-graph for TSS and Turbidity

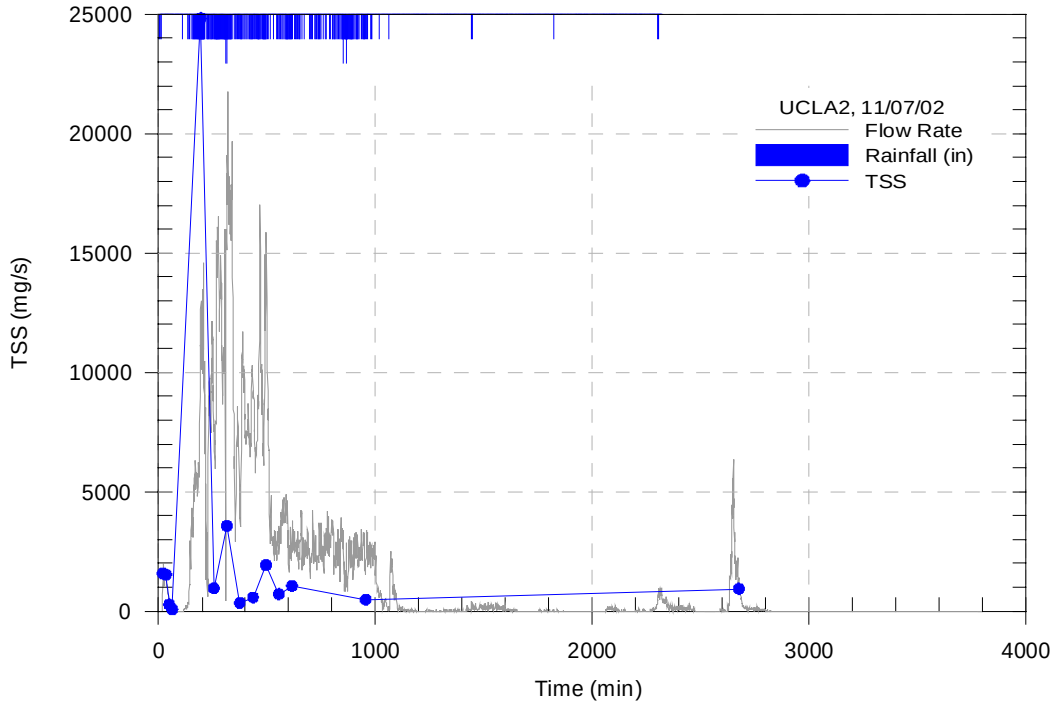

Figure I.4.2.1a[2] (Y4-UCLA2-E1-1). Load-graph for TSS

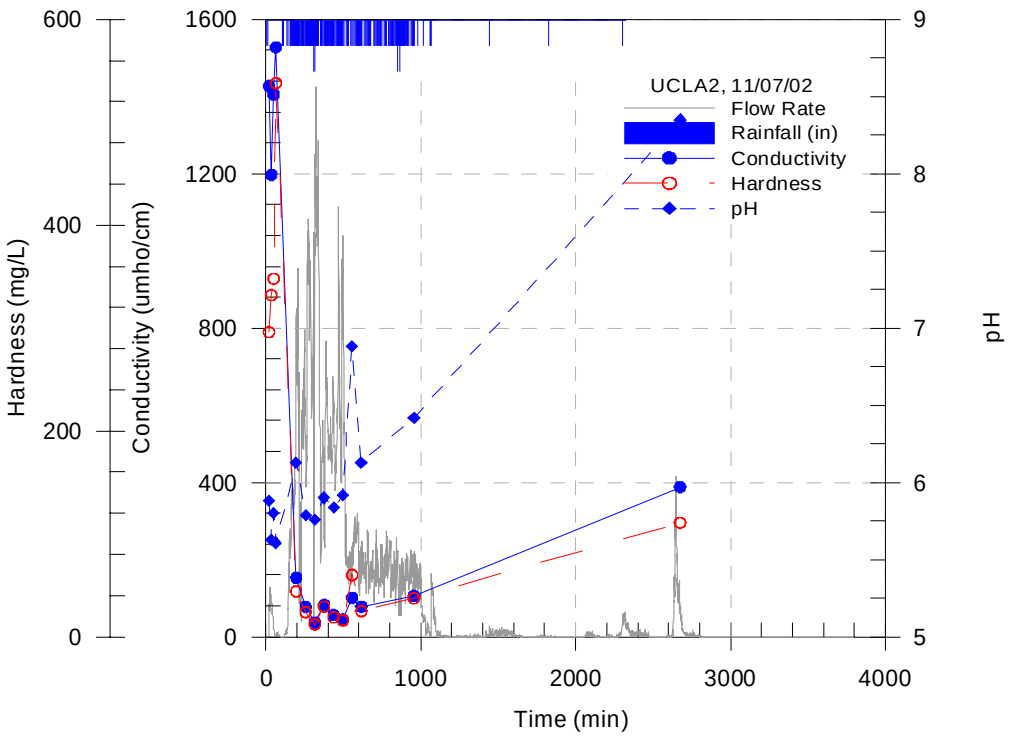

Figure I.4.2.1b[1] (Y4-UCLA2-E1-2). Polluto-graph for Conductivity, Hardness and pH

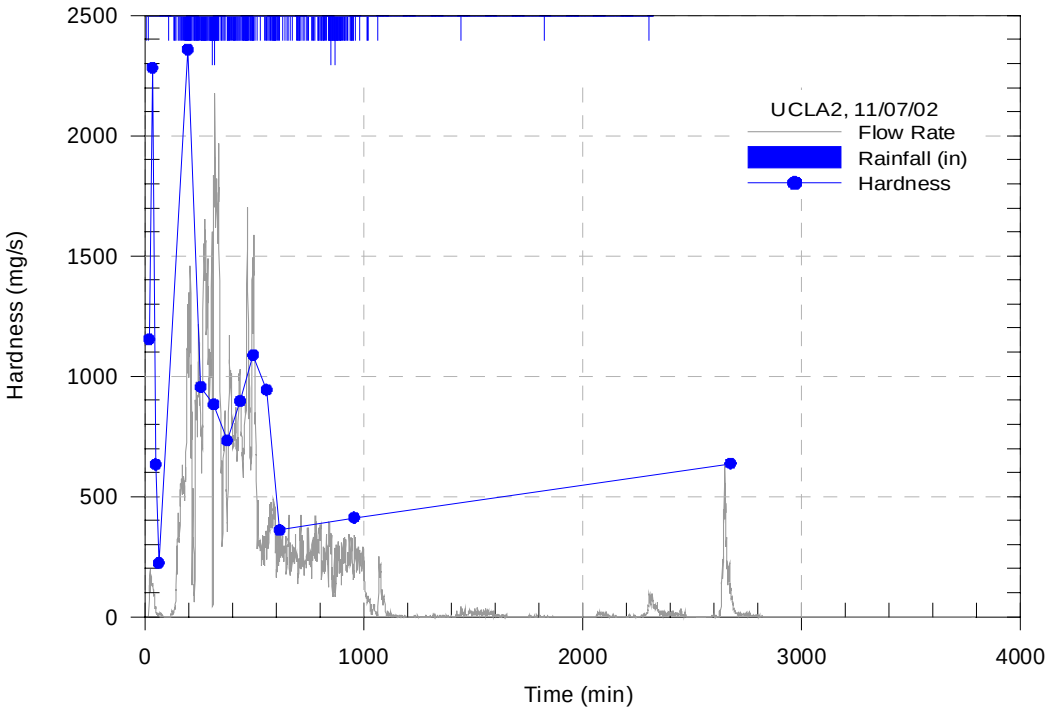

Figure I.4.2.1b[2] (Y4-UCLA2-E1-2). Load-graph for Hardness

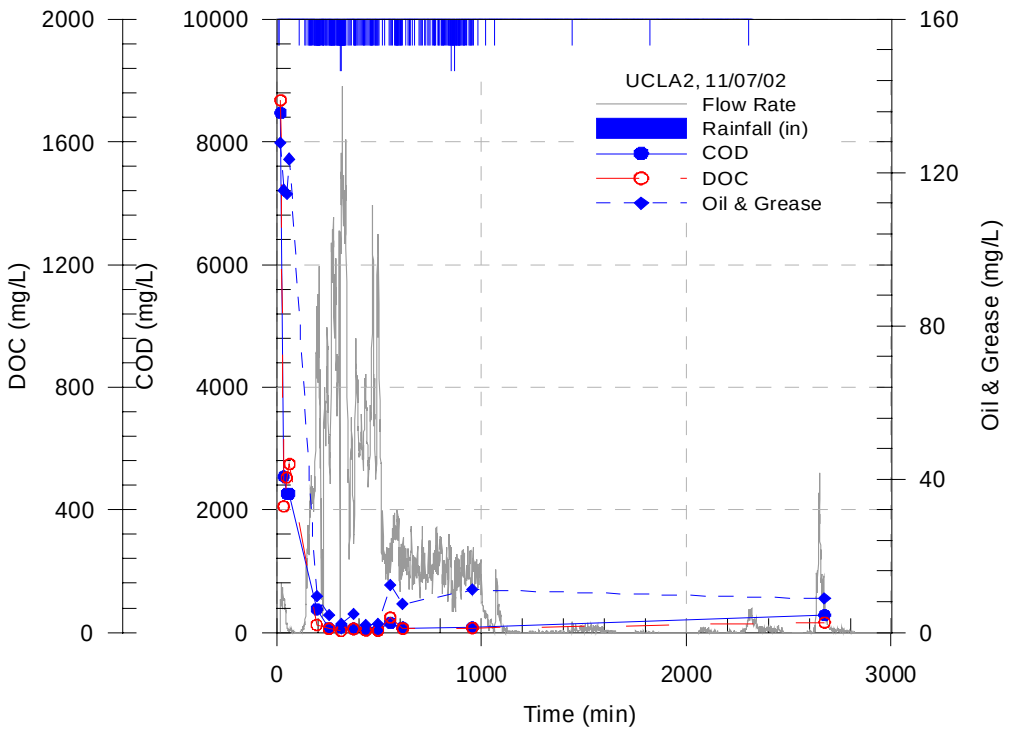

Figure I.4.2.1c[1] (Y4-UCLA2-E1-3). Polluto-graph for COD, DOC and Oil & Grease

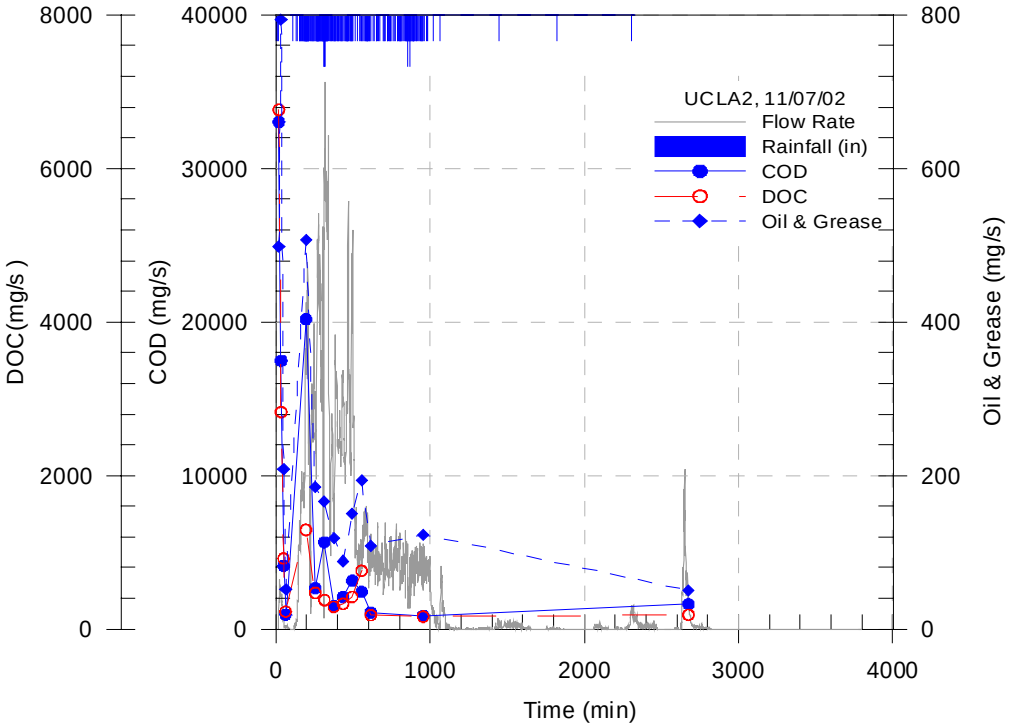

Figure I.4.2.1c[2] (Y4-UCLA2-E1-3). Load-graph for COD, DOC and Oil & Grease

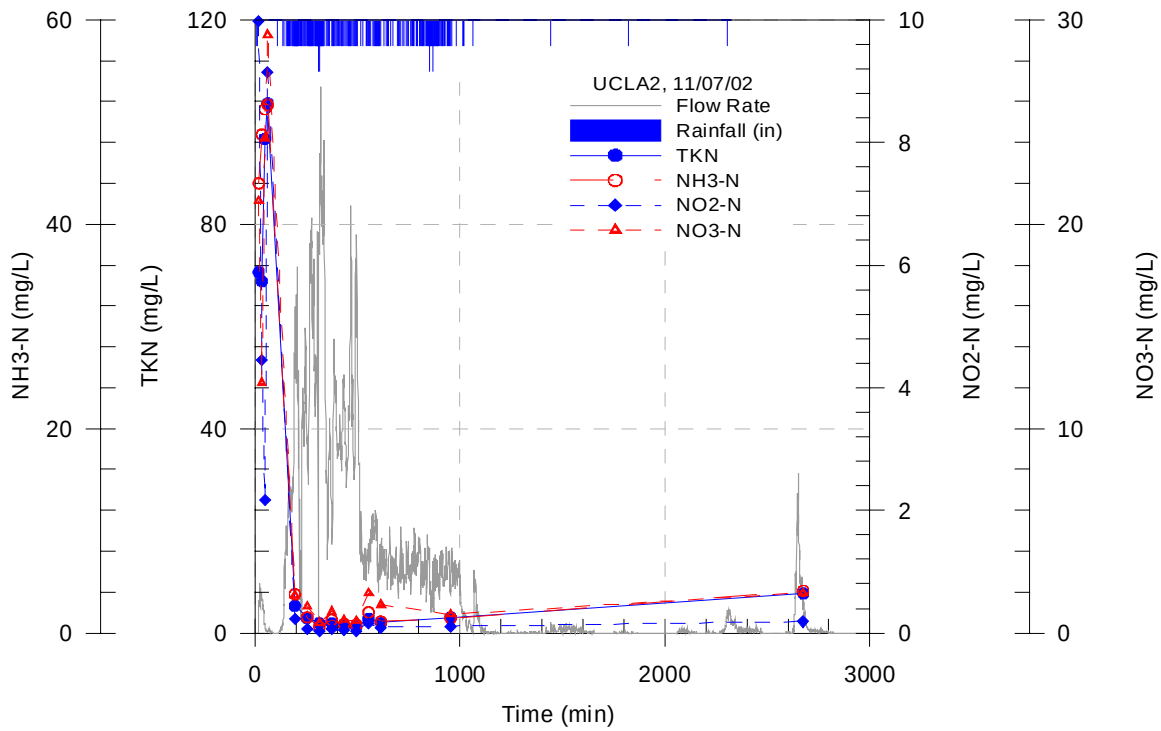

Figure I.4.2.1d[1] (Y4-UCLA2-E1-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

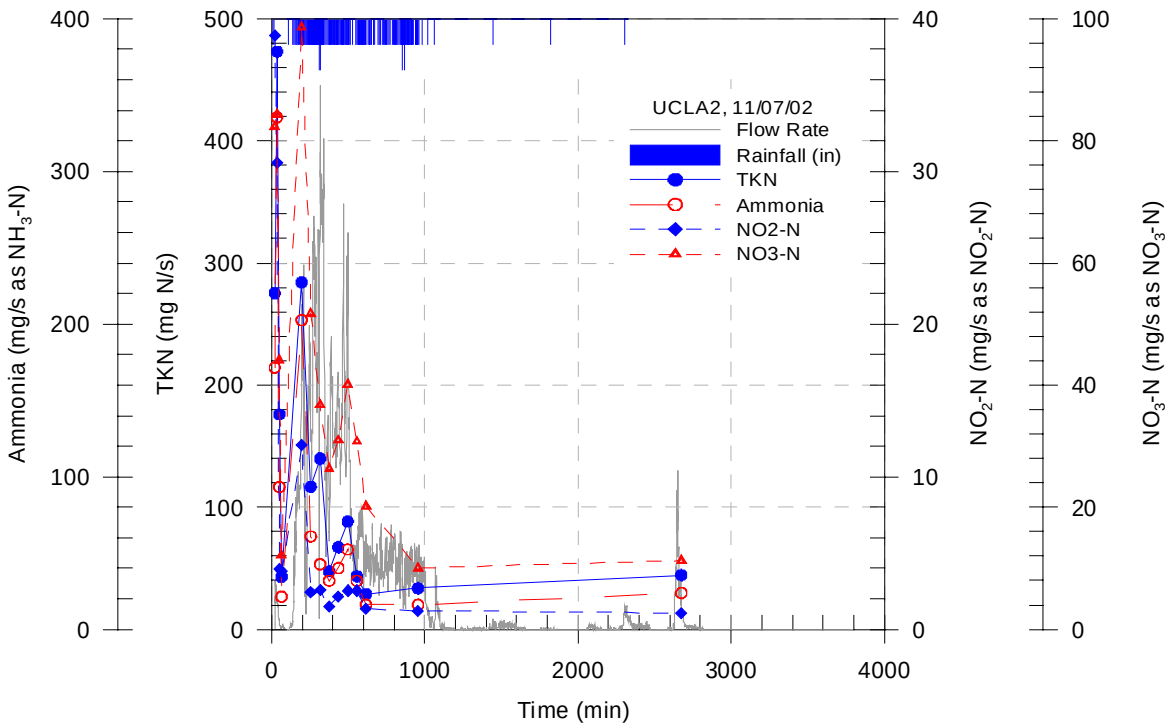

Figure I.4.2.1d[2] (Y4-UCLA2-E1-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

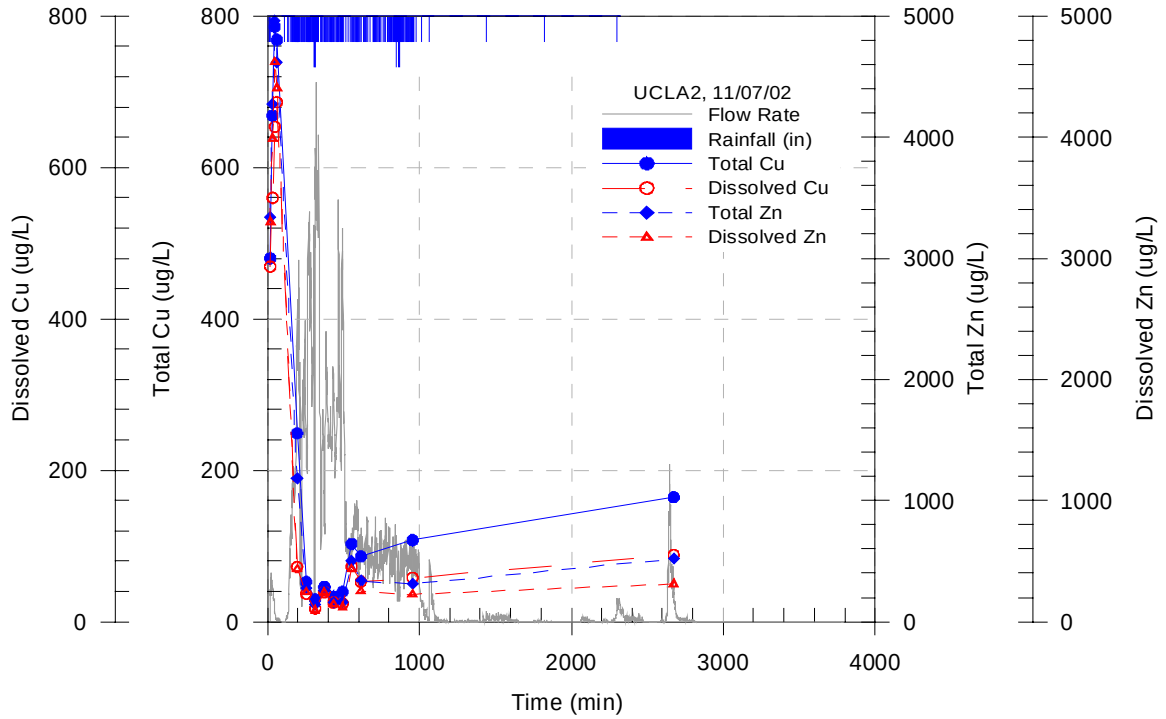

Figure I.4.2.1e[1] (Y4-UCLA2-E1-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

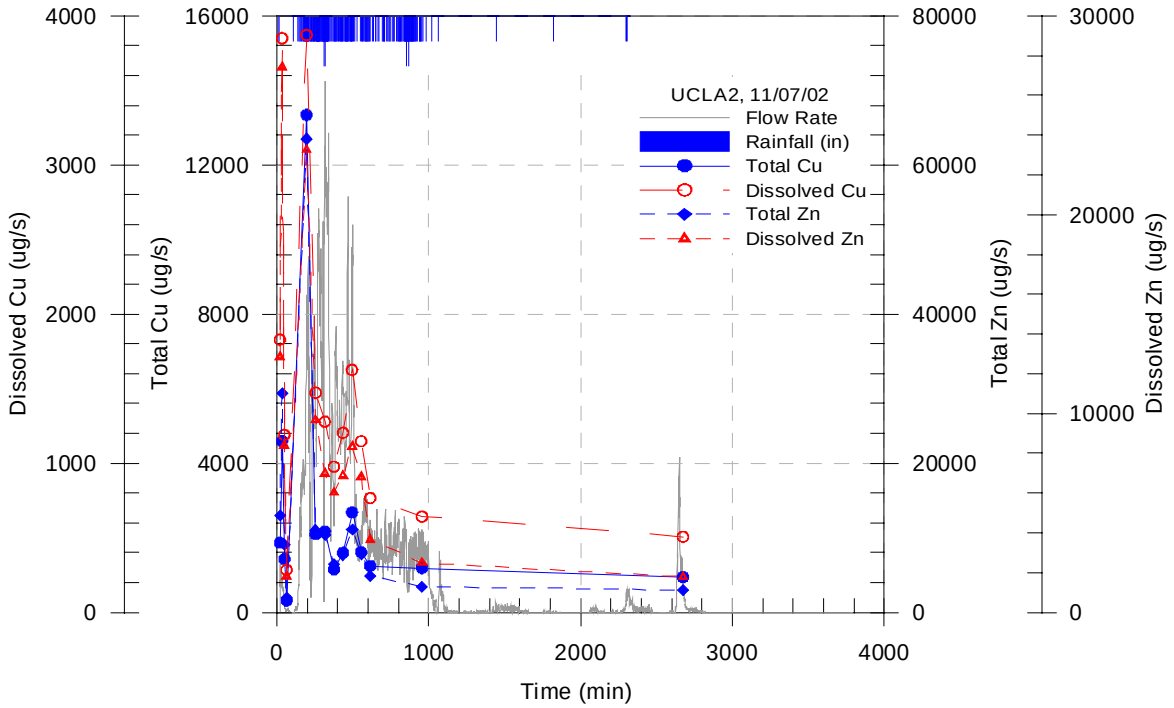

Figure I.4.2.1e[2] (Y4-UCLA2-E1-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

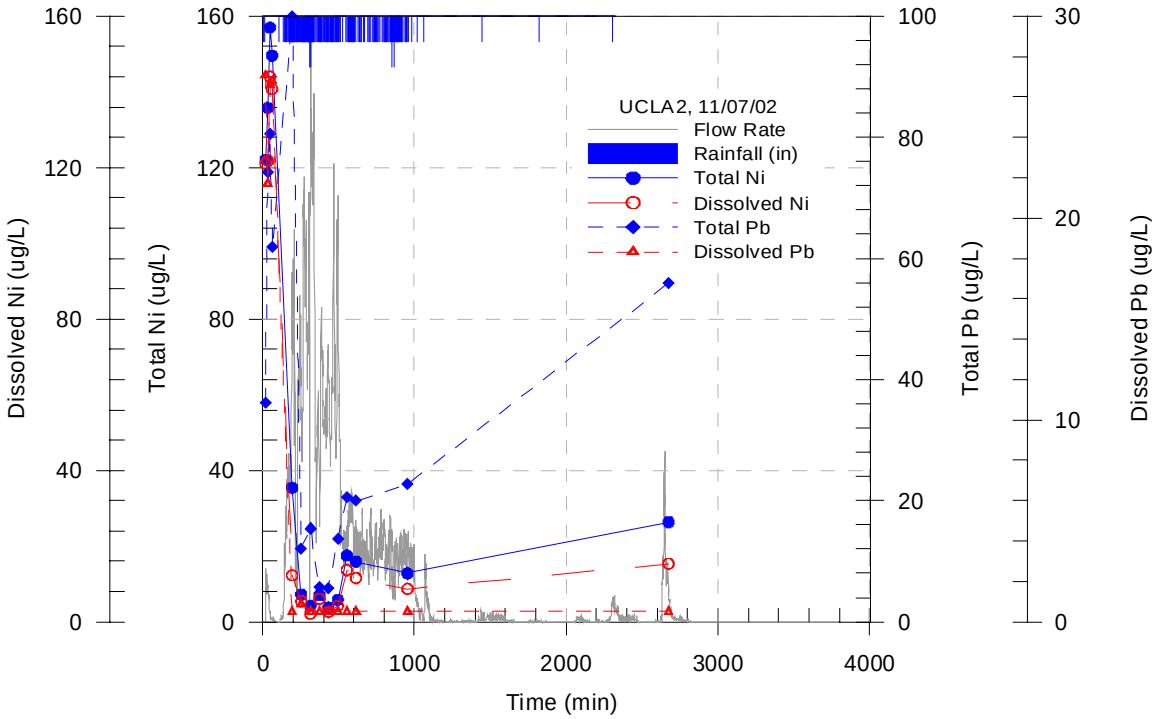

Figure I.4.2.1f[1] (Y4-UCLA2-E1-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

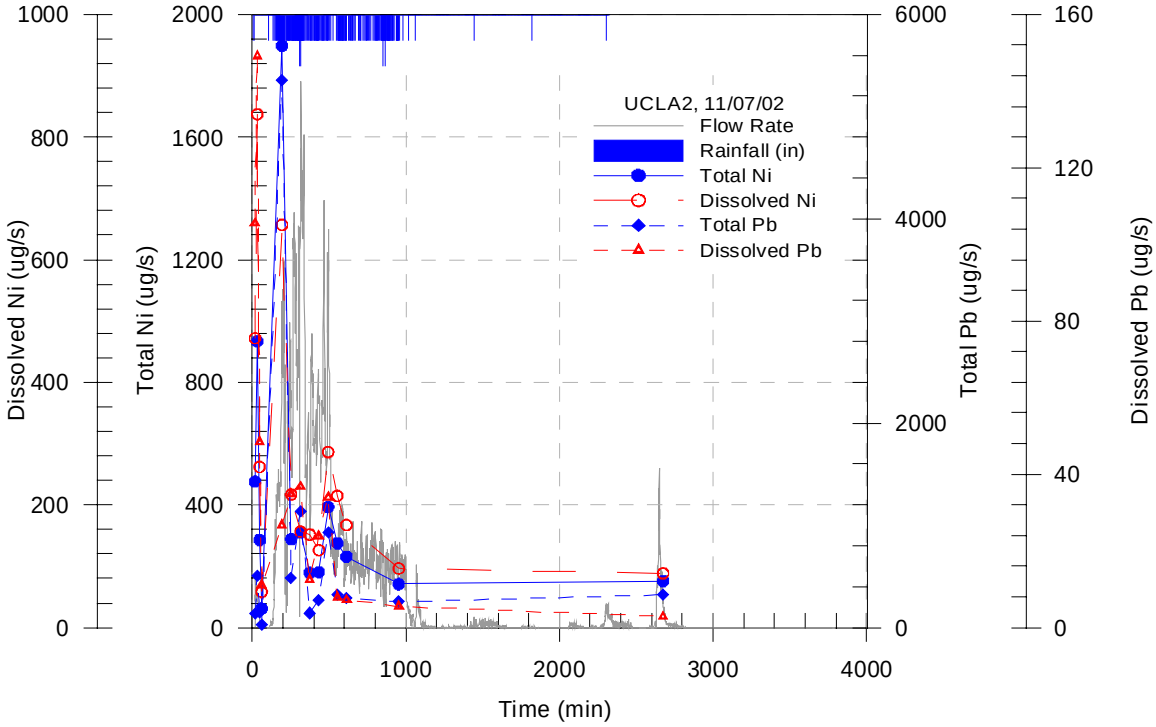

Figure I.4.2.1f[2] (Y4-UCLA2-E1-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

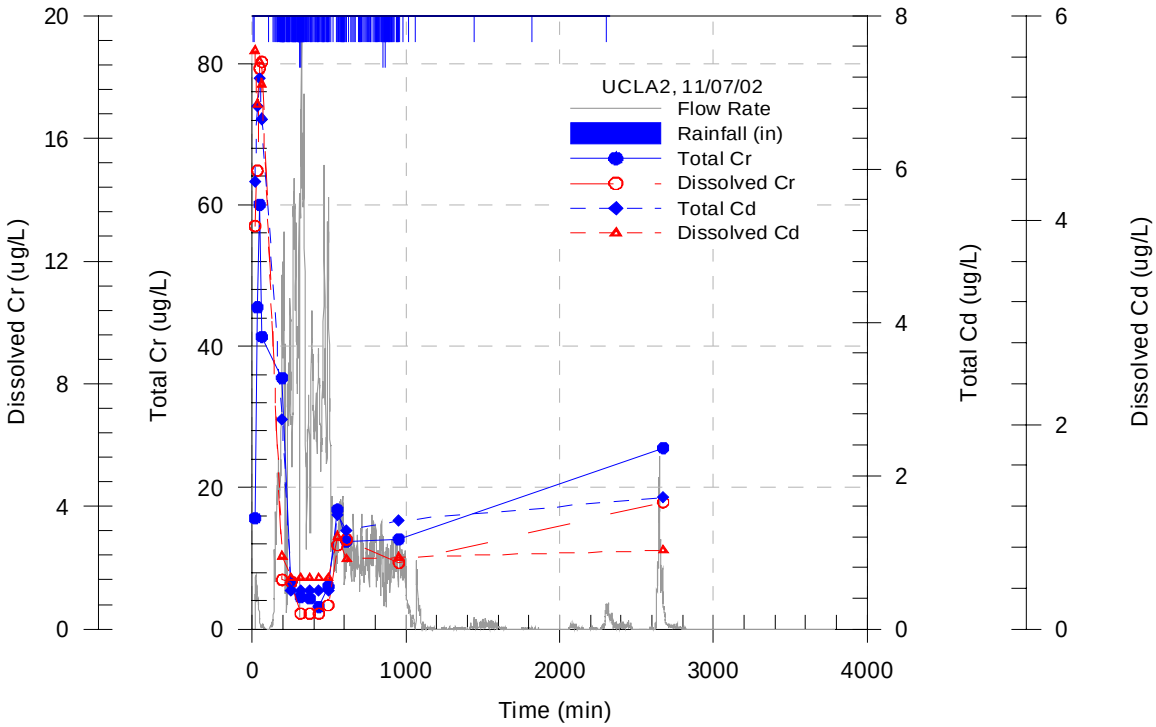

Figure I.4.2.1g[1] (Y4-UCLA2-E1-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

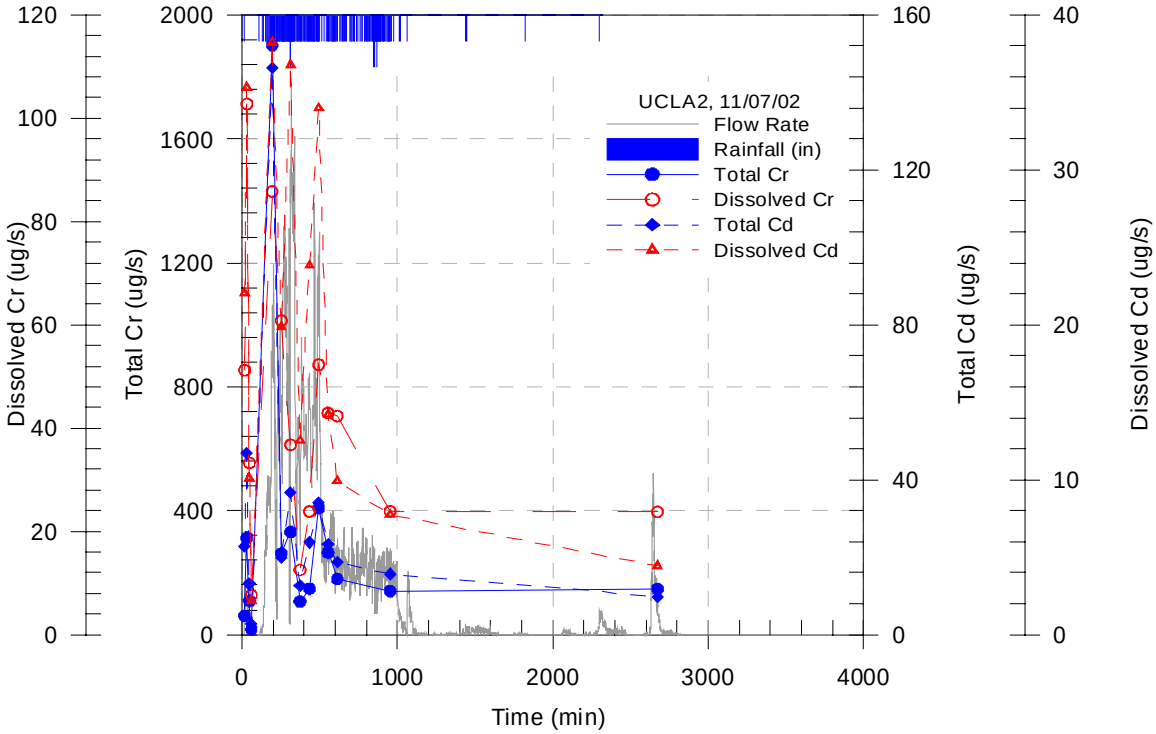

Figure I.4.2.1g[2] (Y4-UCLA2-E1-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

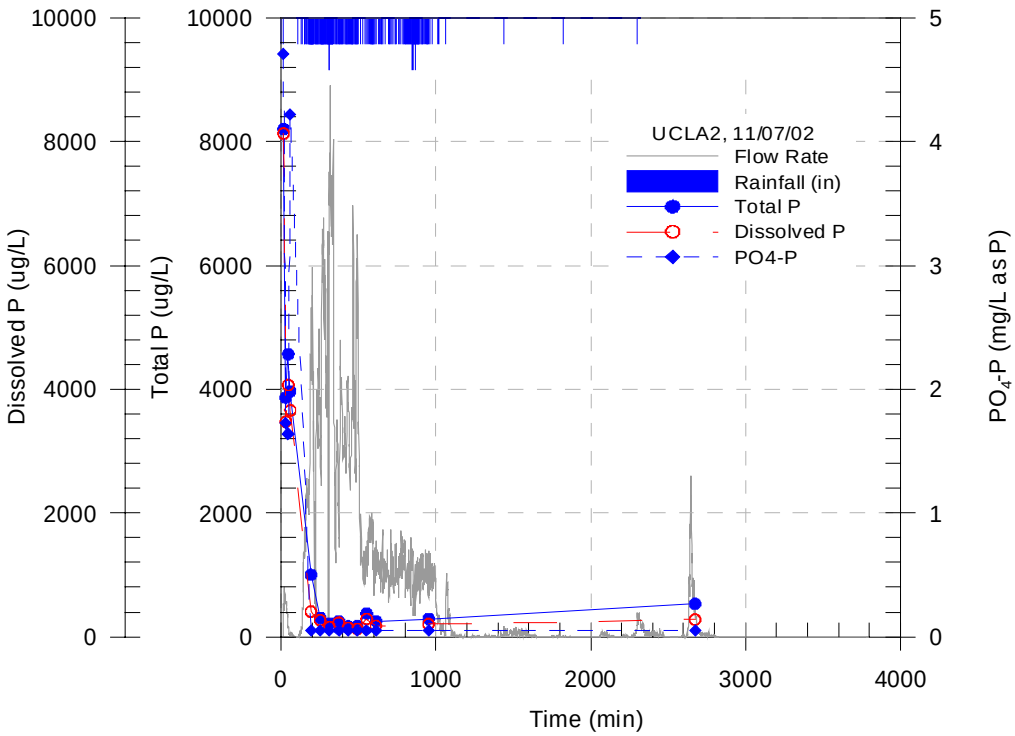

Figure I.4.2.1h[1] (Y4-UCLA2-E1-8). Polluto-graph for Total P / PO_4^{3-}-P

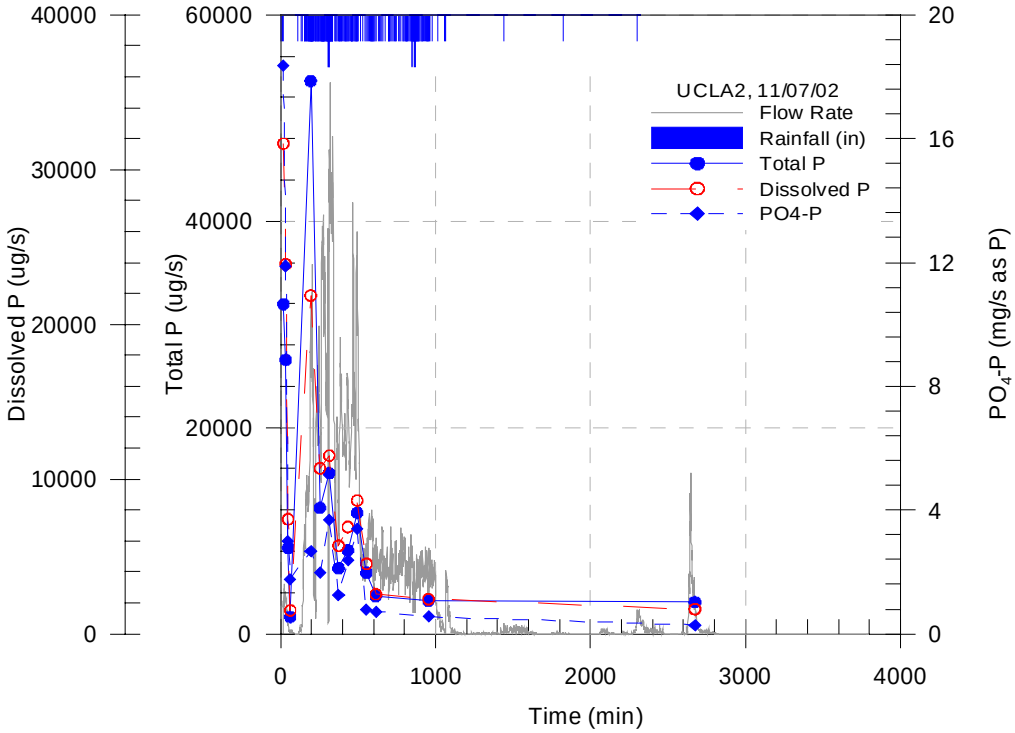

Figure I.4.2.1h[2] (Y4-UCLA2-E1-8). Load -graph for Total P / PO_4^{3-}-P

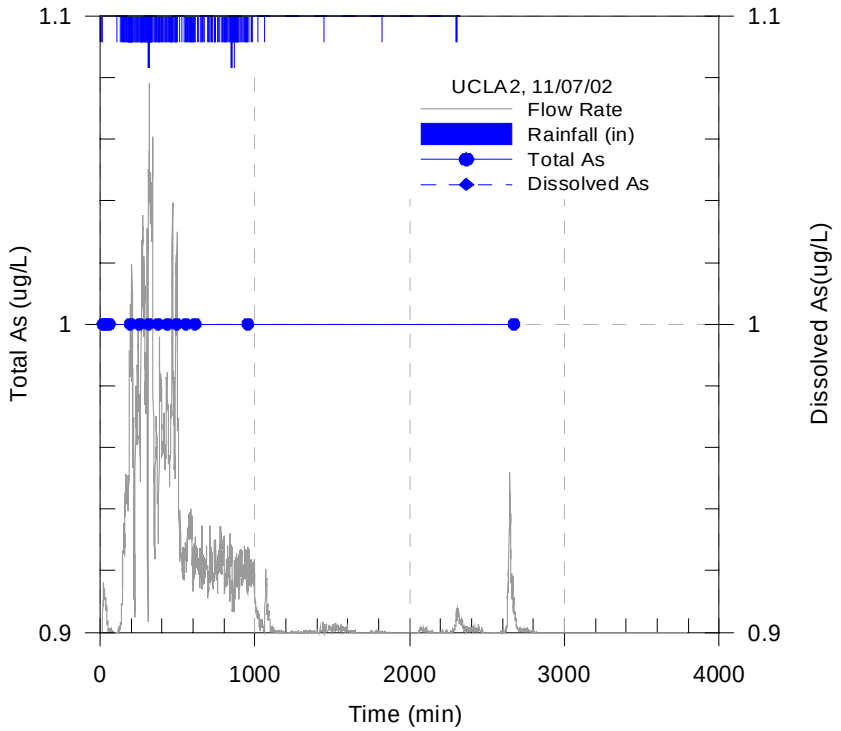

Figure I.4.2.1i[1] (Y4-UCLA2-E1-9). Polluto-graph for Total As / Dissolved As

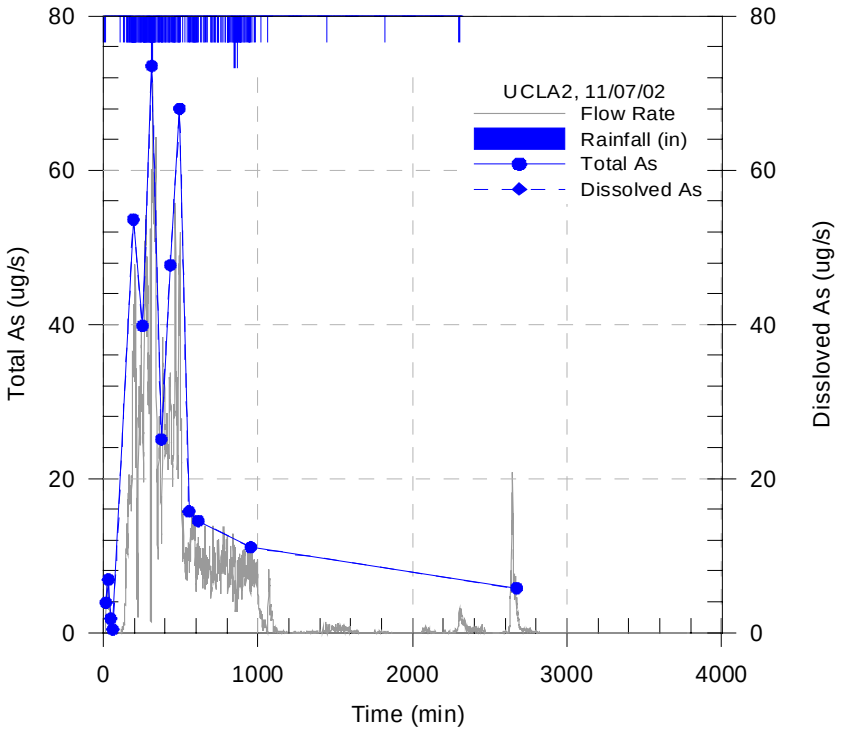

Figure I.4.2.1i[2] (Y4-UCLA2-E1-9). Load -graph for Total As / Dissolved As

2. UCLA2, 11/29/02

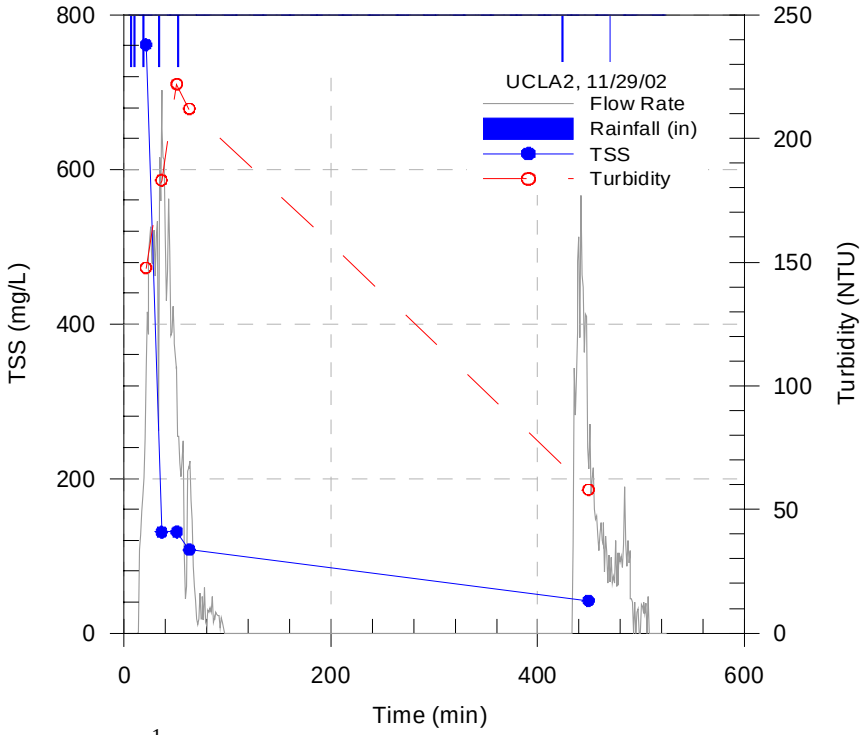

Figure I.4.2.2a[1] (Y4-UCLA2-E2-1). Polluto-graph for TSS and Turbidity

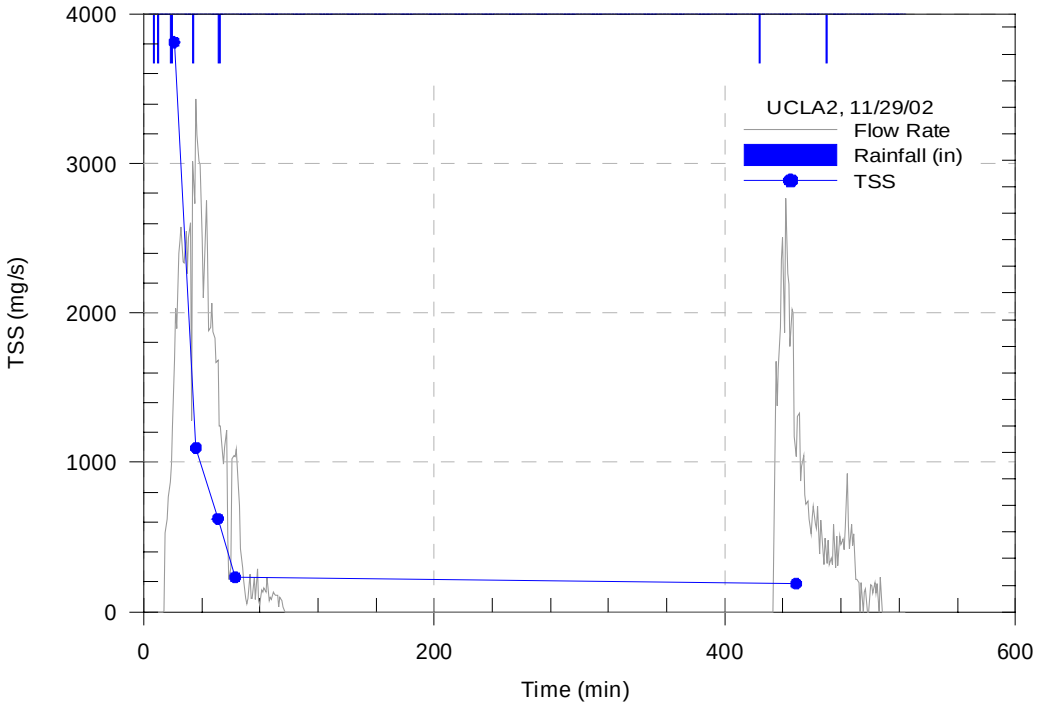

Figure I.4.2.2a[2] (Y4-UCLA2-E2-1). Load-graph for TSS

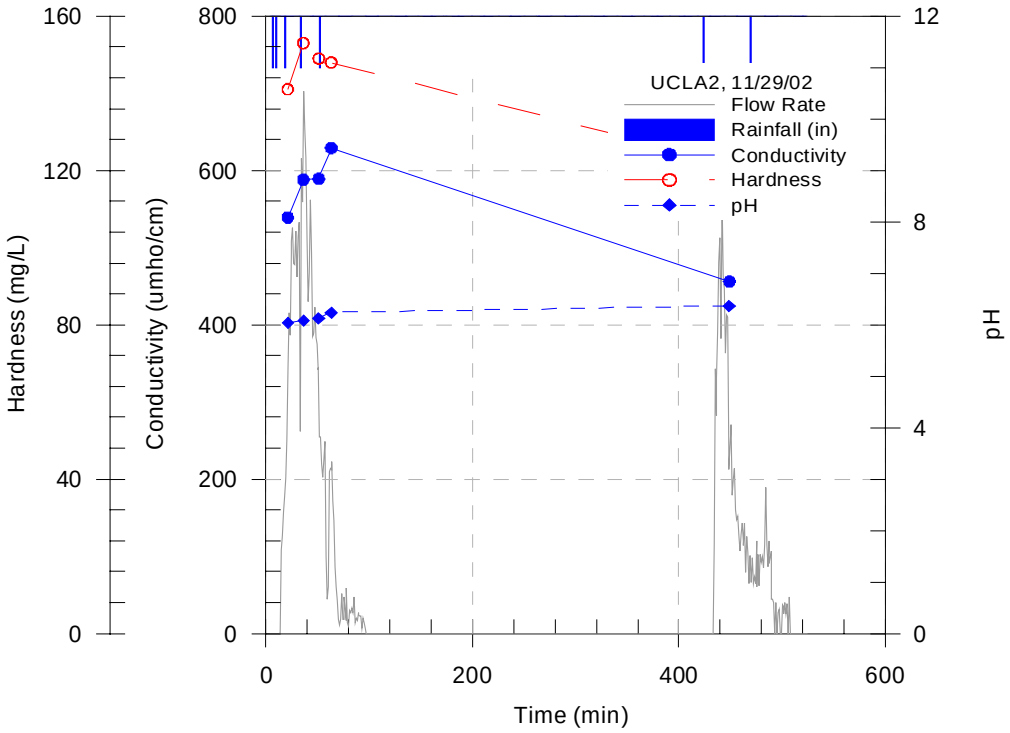

Figure I.4.2.2b[1] (Y4-UCLA2-E2-2). Polluto-graph for Conductivity, Hardness and pH

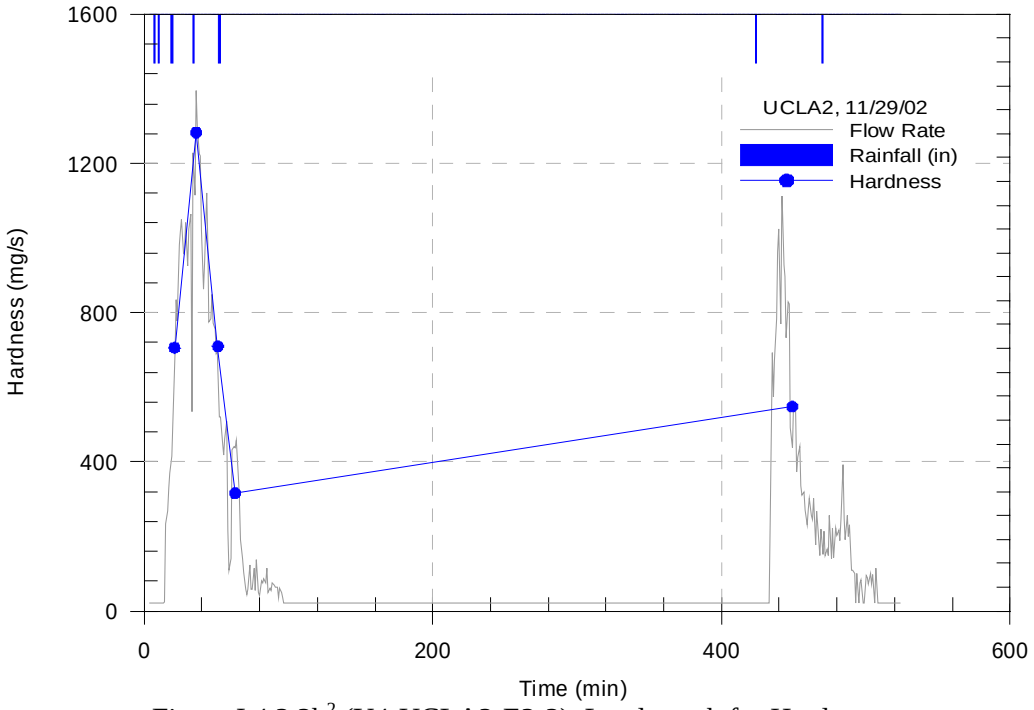

Figure I.4.2.2b[2] (Y4-UCLA2-E2-2). Load-graph for Hardness

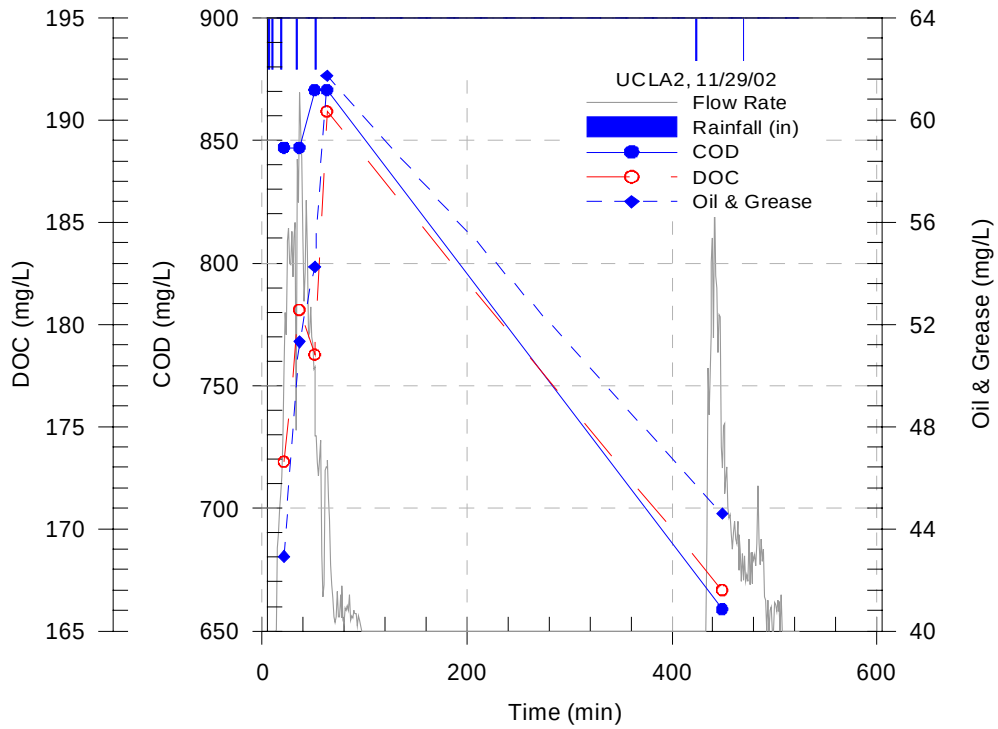

Figure I.4.2.2c[1] (Y4-UCLA2-E2-3). Polluto-graph for COD, DOC and Oil & Grease

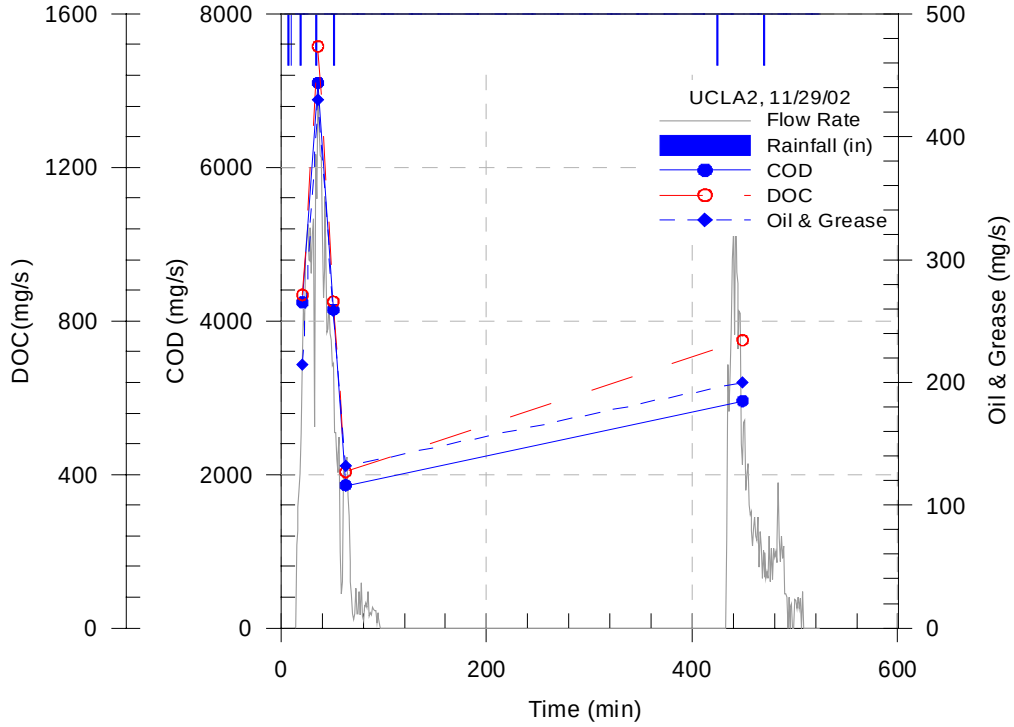

Figure I.4.2.2c[2] (Y4-UCLA2-E2-3). Load-graph for COD, DOC and Oil & Grease

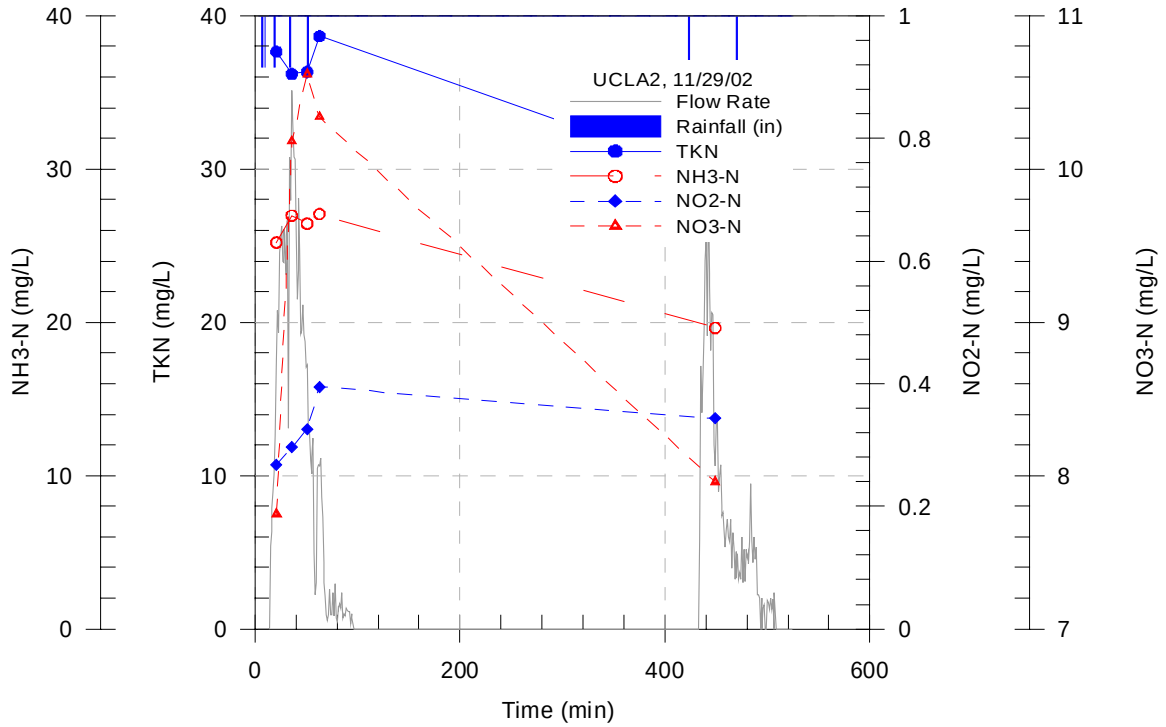

Figure I.4.2.2d[1] (Y4-UCLA2-E2-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

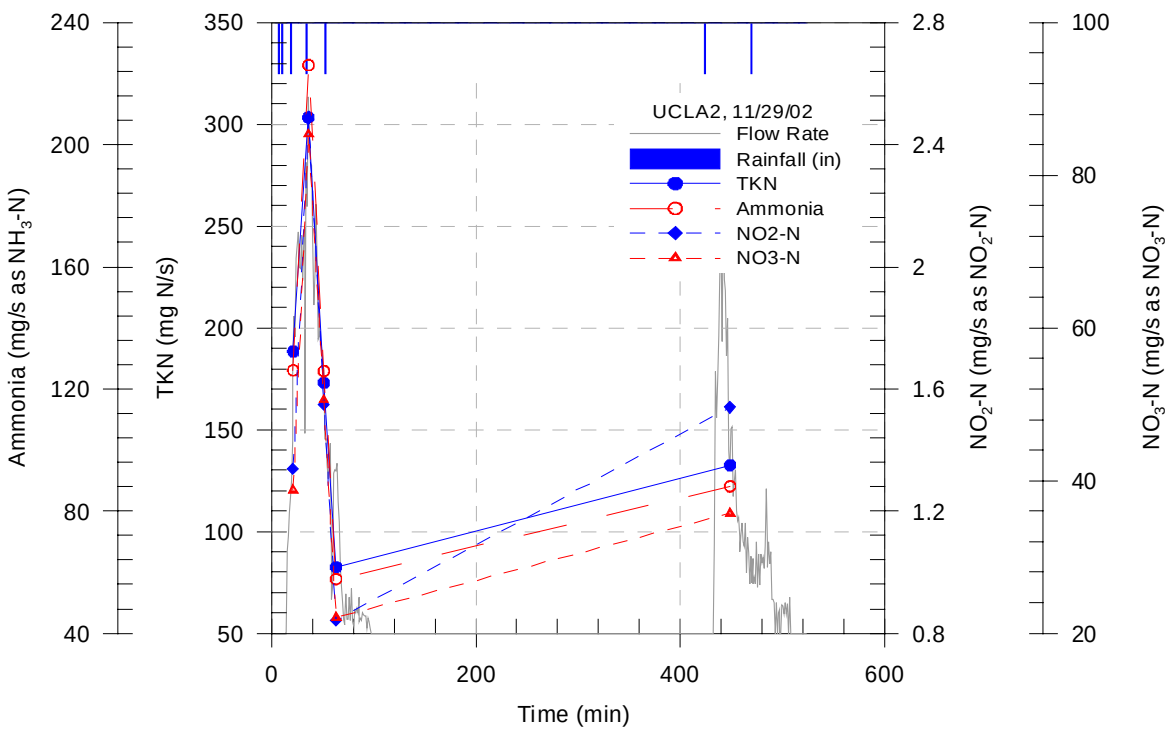

Figure I.4.2.2d[2] (Y4-UCLA2-E2-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

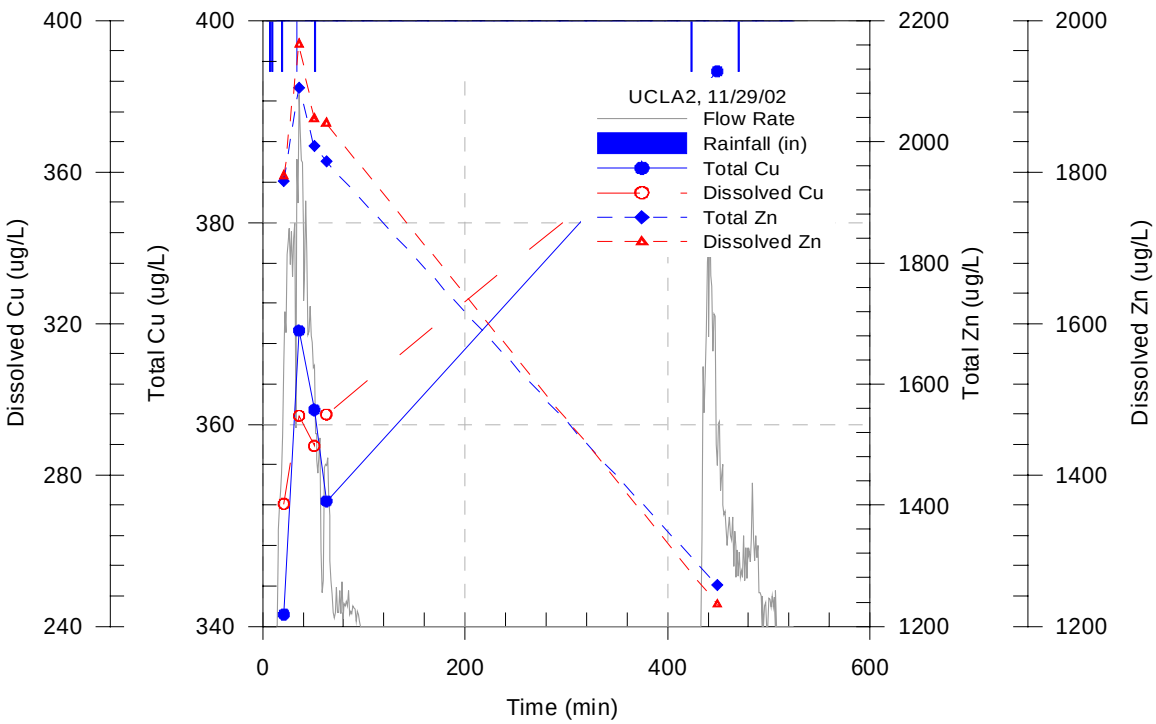

Figure I.4.2.2e[1] (Y4-UCLA2-E2-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

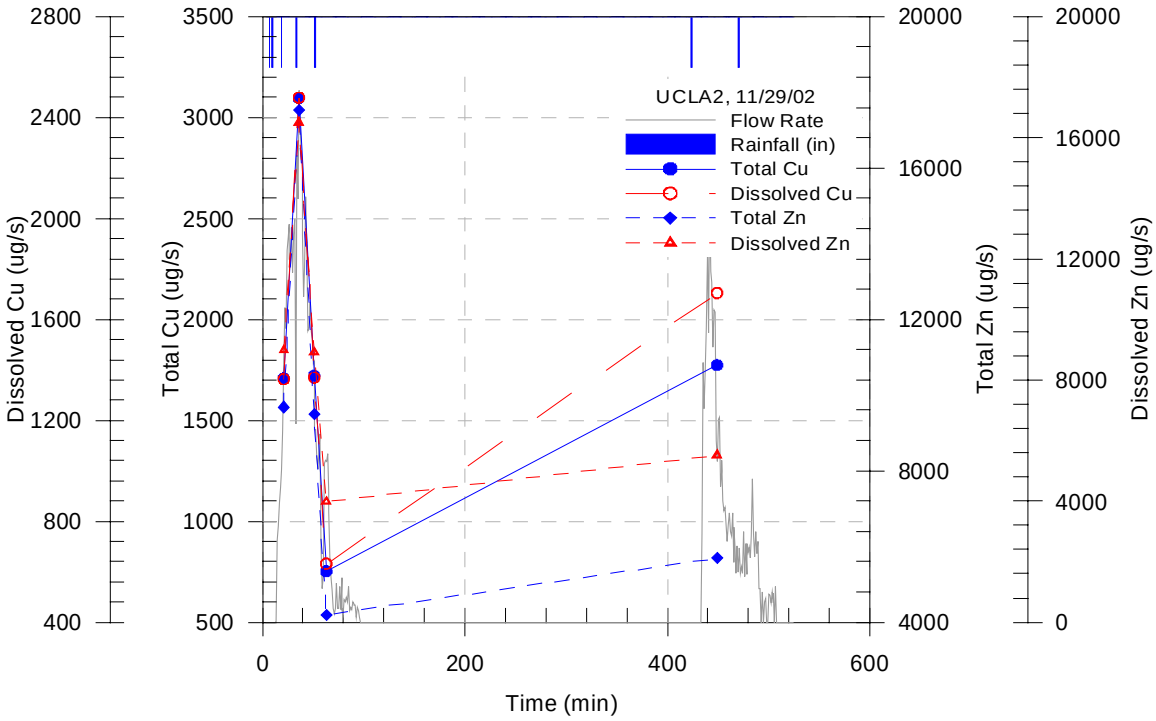

Figure I.4.2.2e[2] (Y4-UCLA2-E2-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

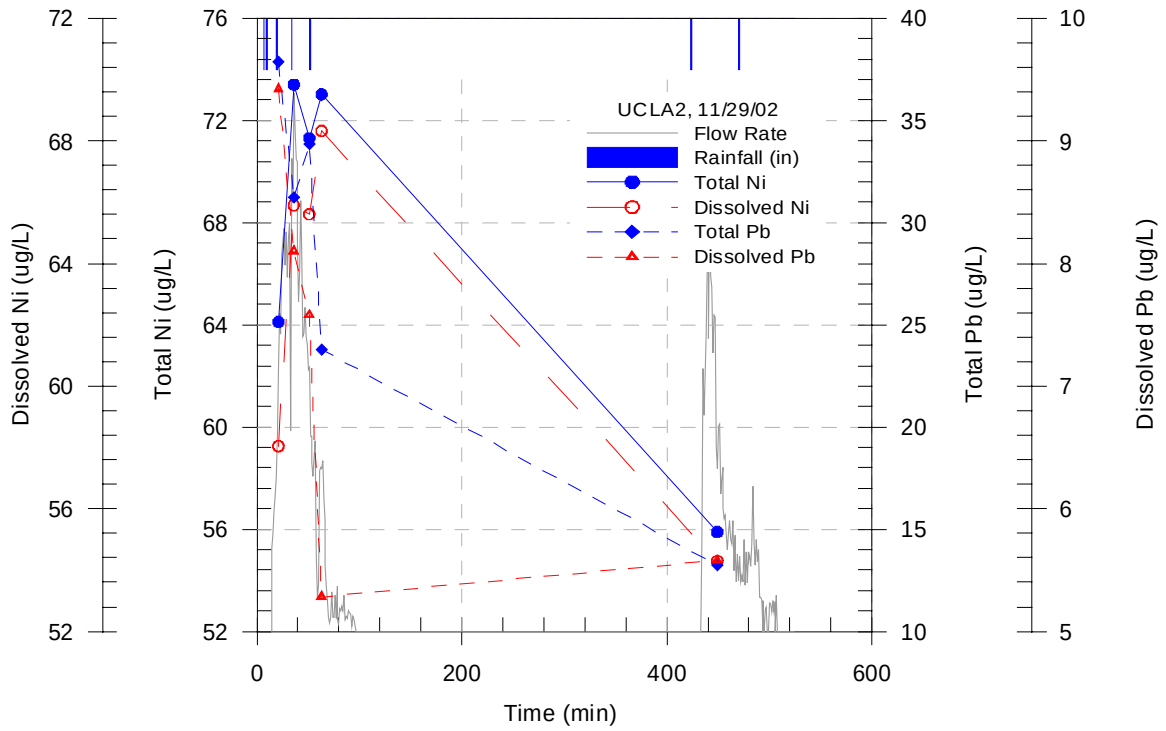

Figure I.4.2.2f[1] (Y4-UCLA2-E2-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

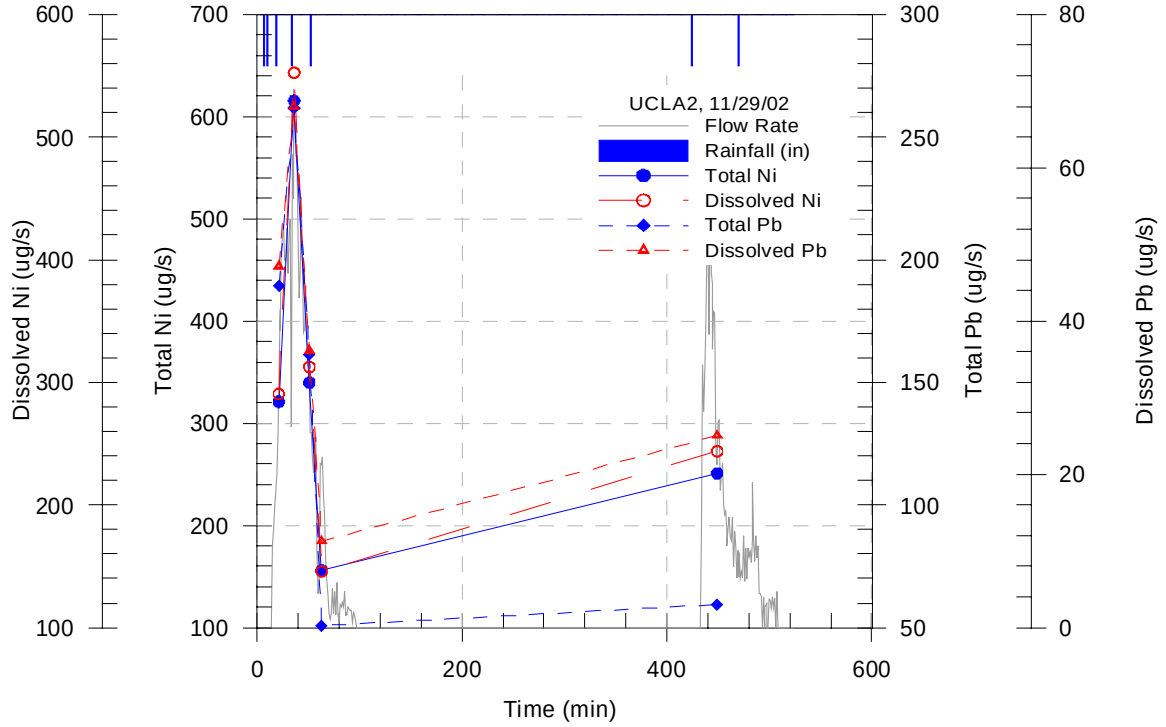

Figure I.4.2.2f[2] (Y4-UCLA2-E2-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

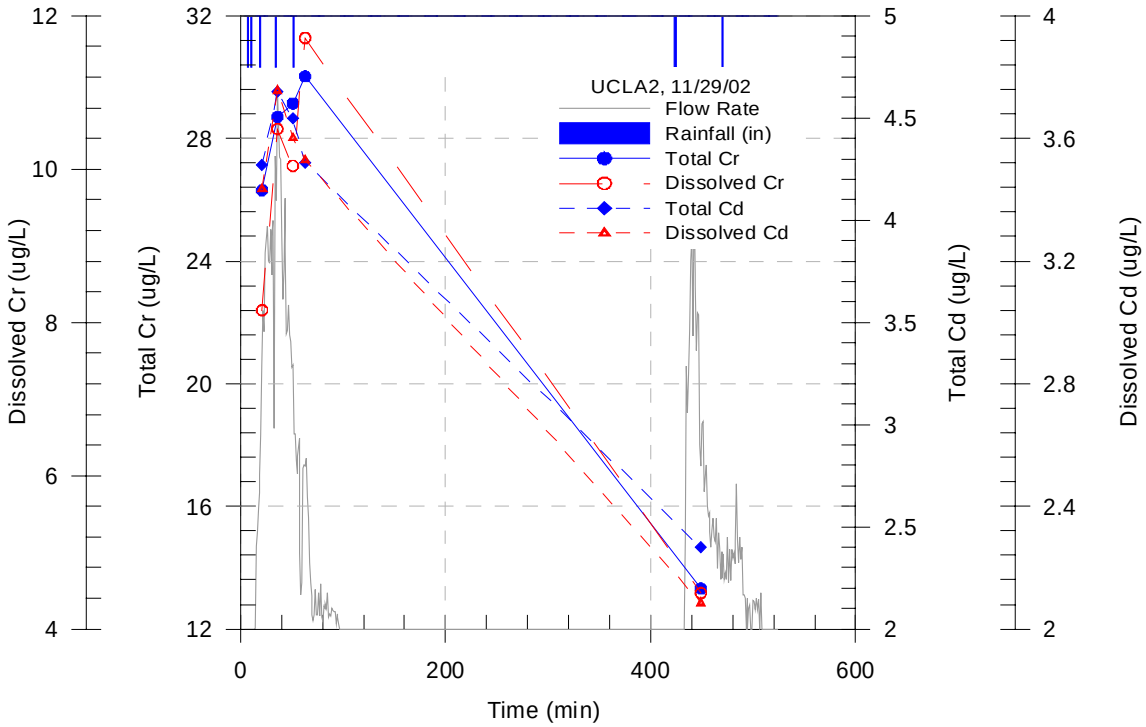

Figure I.4.2.2g[1] (Y4-UCLA2-E2-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

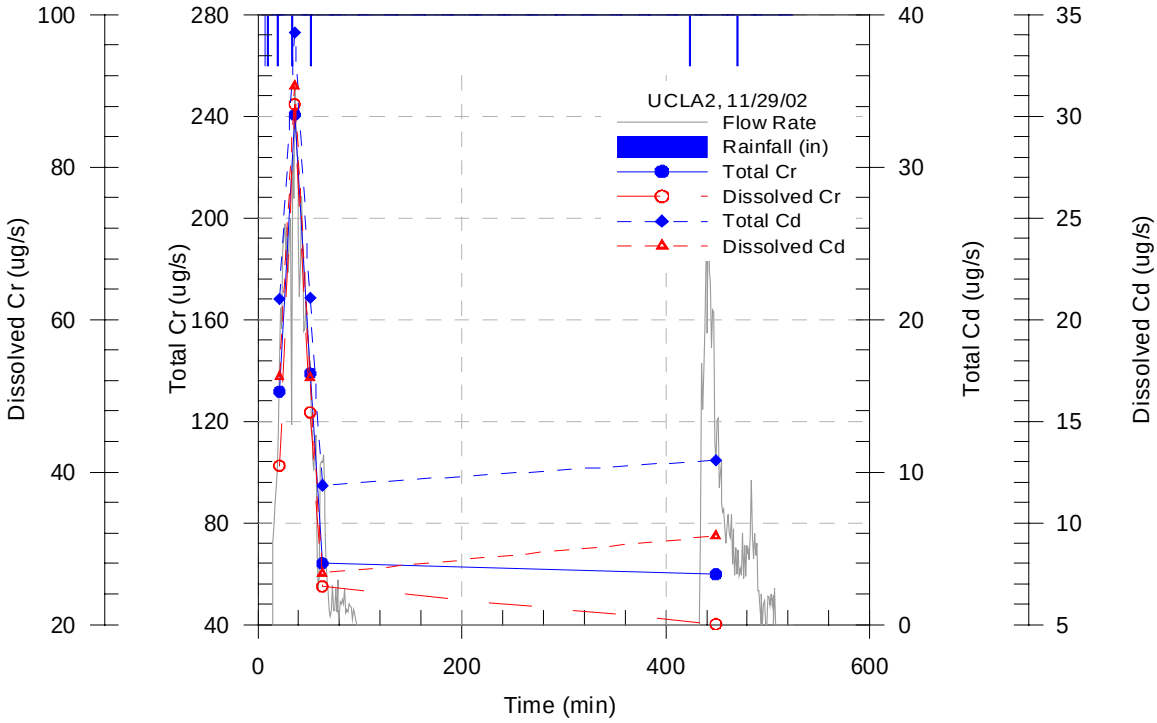

Figure I.4.2.2g[2] (Y4-UCLA2-E2-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

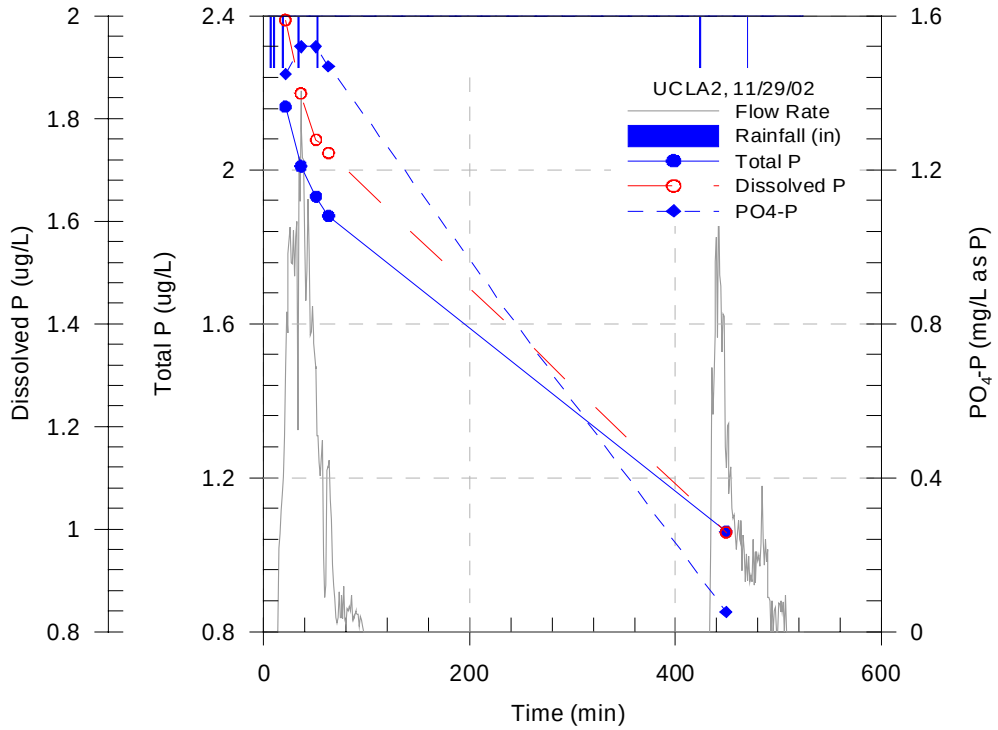

Figure I.4.2.2h[1] (Y4-UCLA2-E2-8). Polluto-graph for Total P / PO_4^{3-}-P

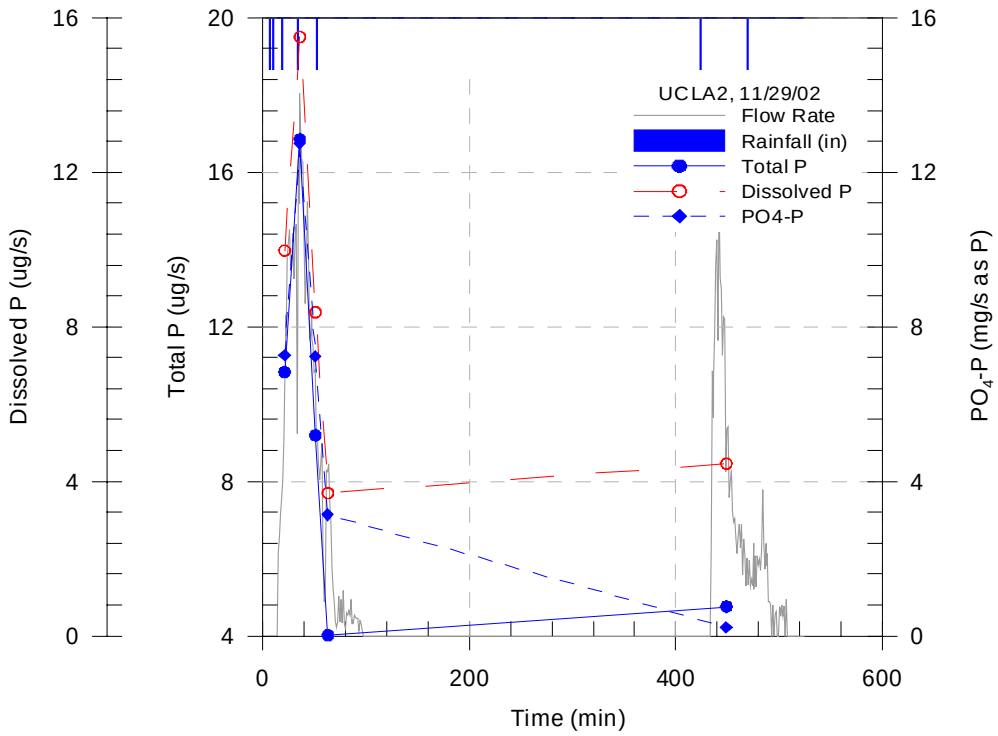

Figure I.4.2.2h[2] (Y4-UCLA2-E3-8). Load -graph for Total P / PO_4^{3-}-P

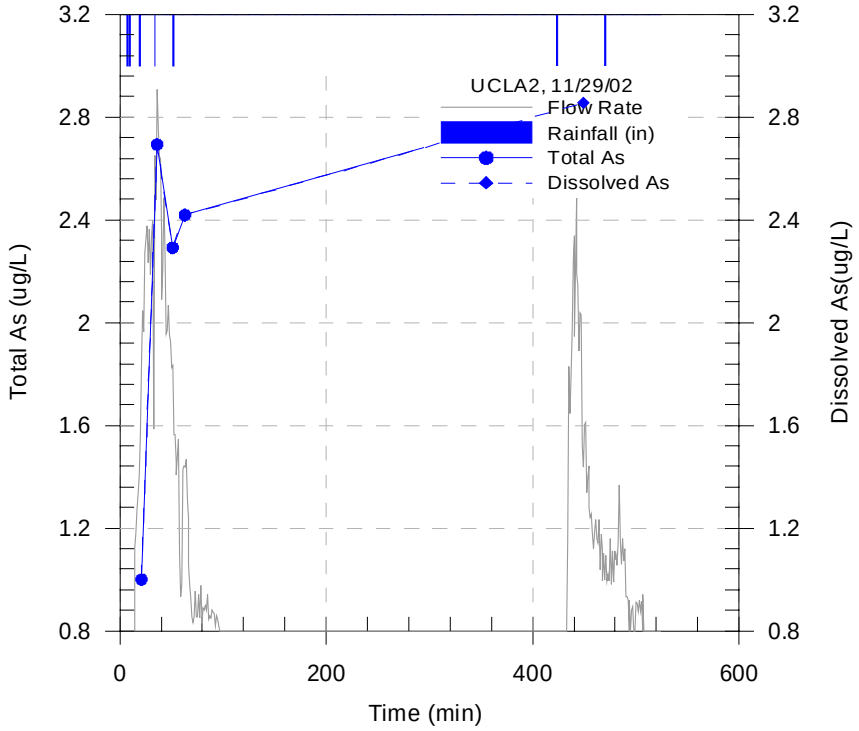

Figure I.4.2.2i[1] (Y4-UCLA2-E2-9). Polluto-graph for Total As / Dissolved As

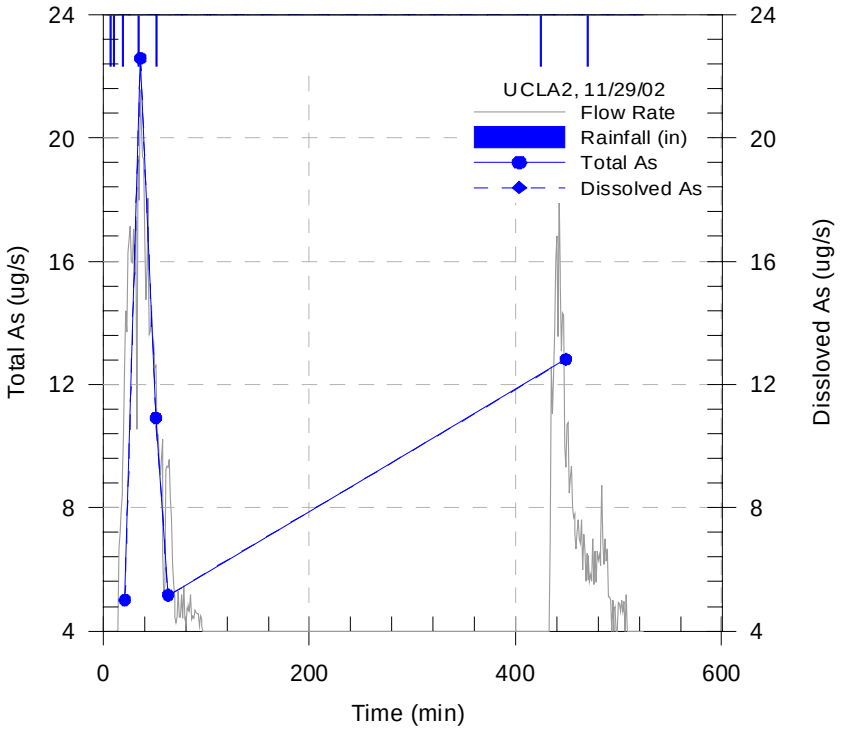

Figure I.4.2.2i[2] (Y4-UCLA2-E2-9). Load -graph for Total As / Dissolved As

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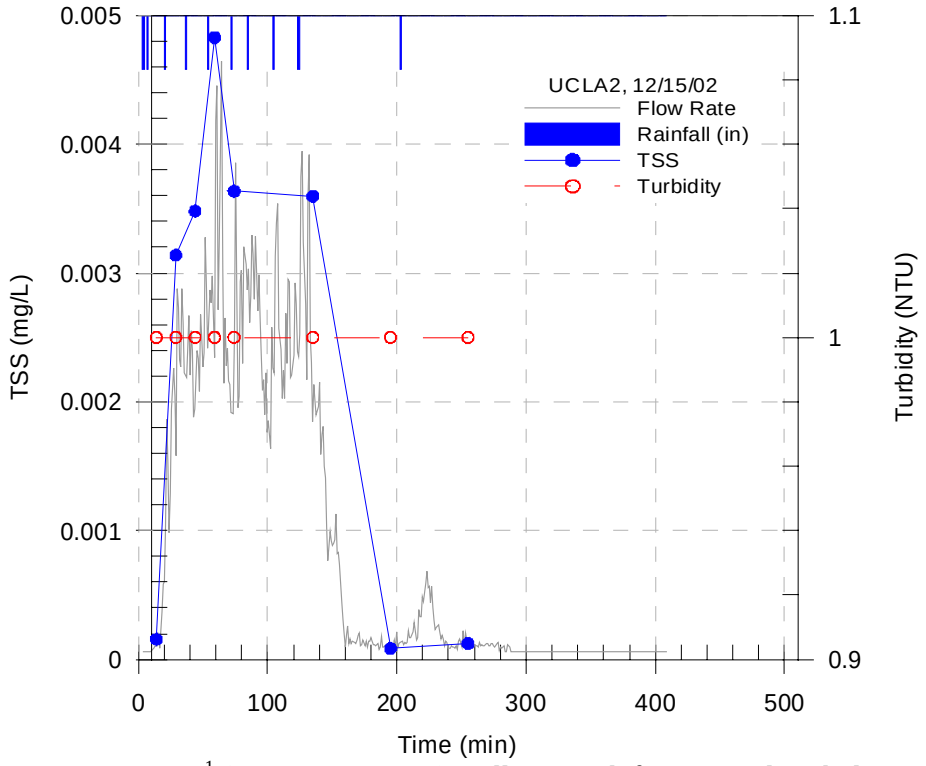

Figure I.4.2.3a[1] (Y4-UCLA2-E3-1). Polluto-graph for TSS and Turbidity

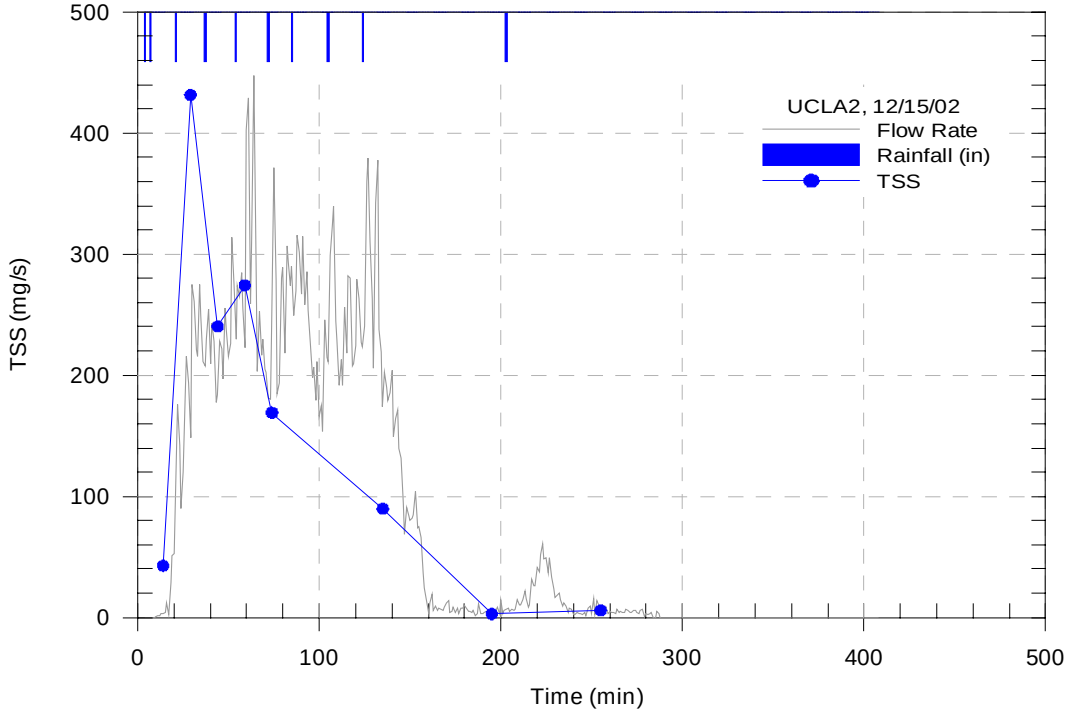

Figure I.4.2.3a[2] (Y4-UCLA2-E3-1). Load-graph for TSS

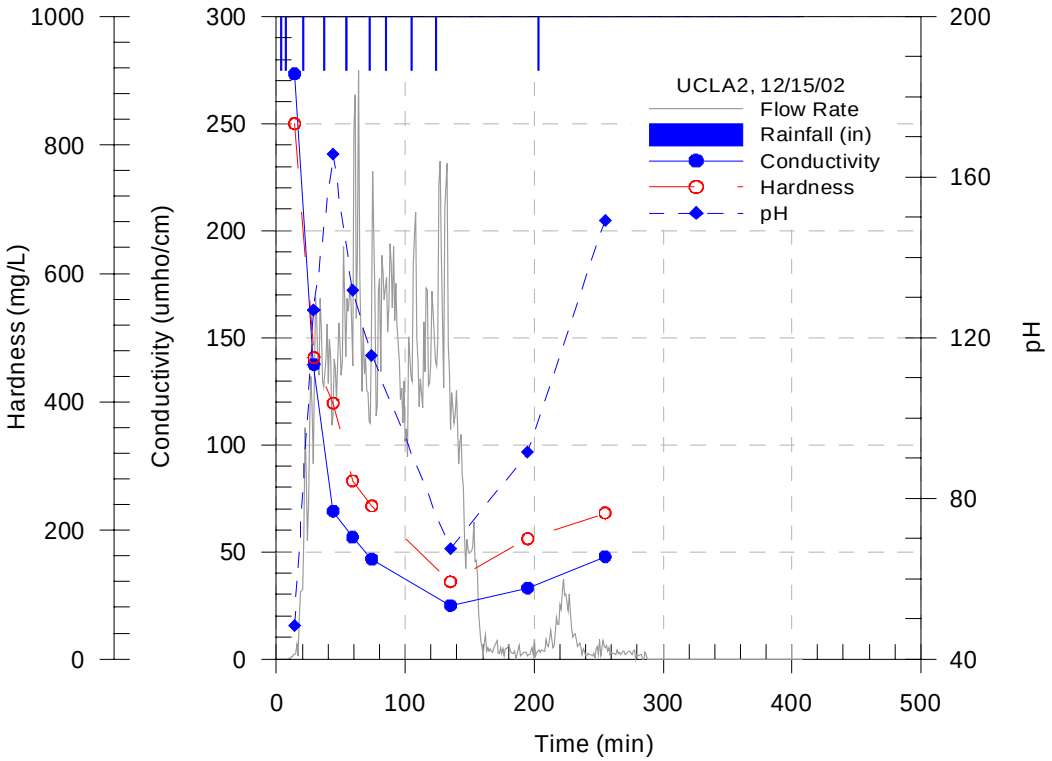

Figure I.4.2.3b[1] (Y4-UCLA2-E3-2). Polluto-graph for Conductivity, Hardness and pH

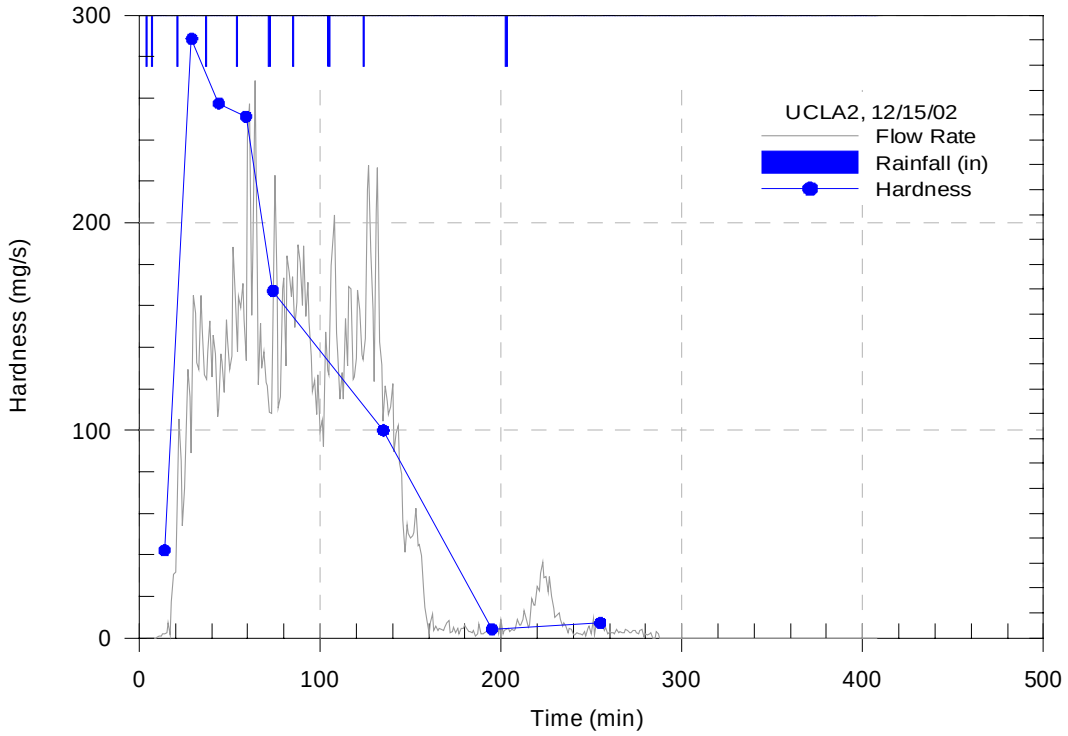

Figure I.4.2.3b[2] (Y4-UCLA2-E3-2). Load-graph for Hardness

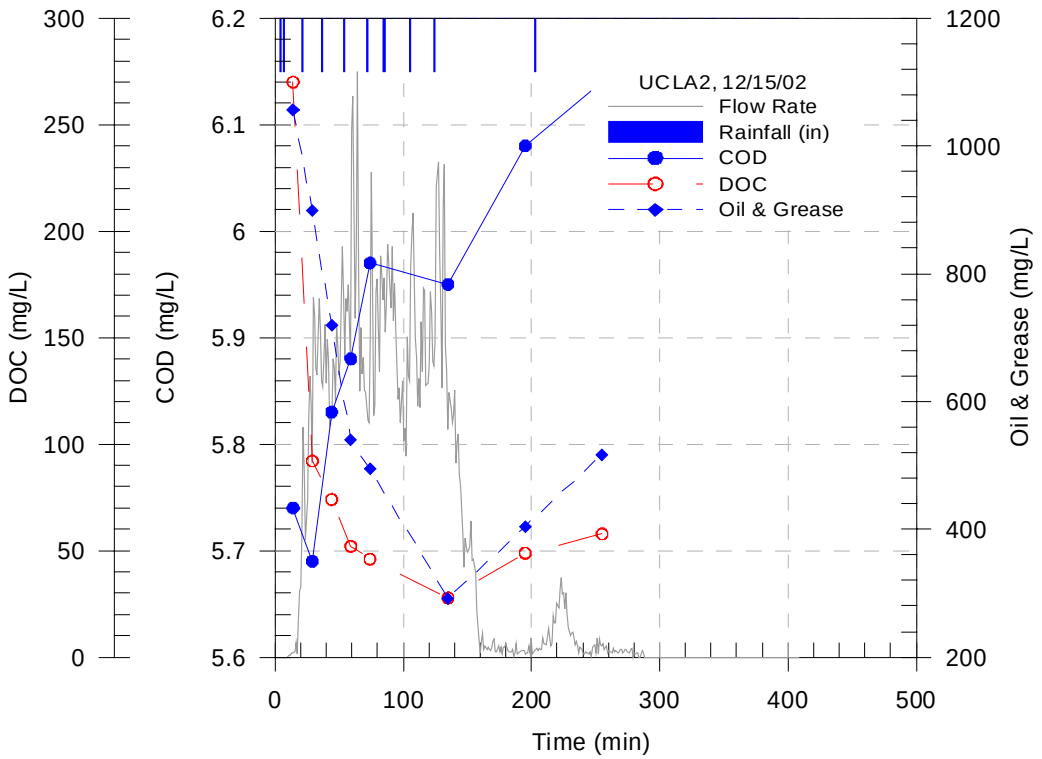

Figure I.4.2.3c[1] (Y4-UCLA2-E3-3). Polluto-graph for COD, DOC and Oil & Grease

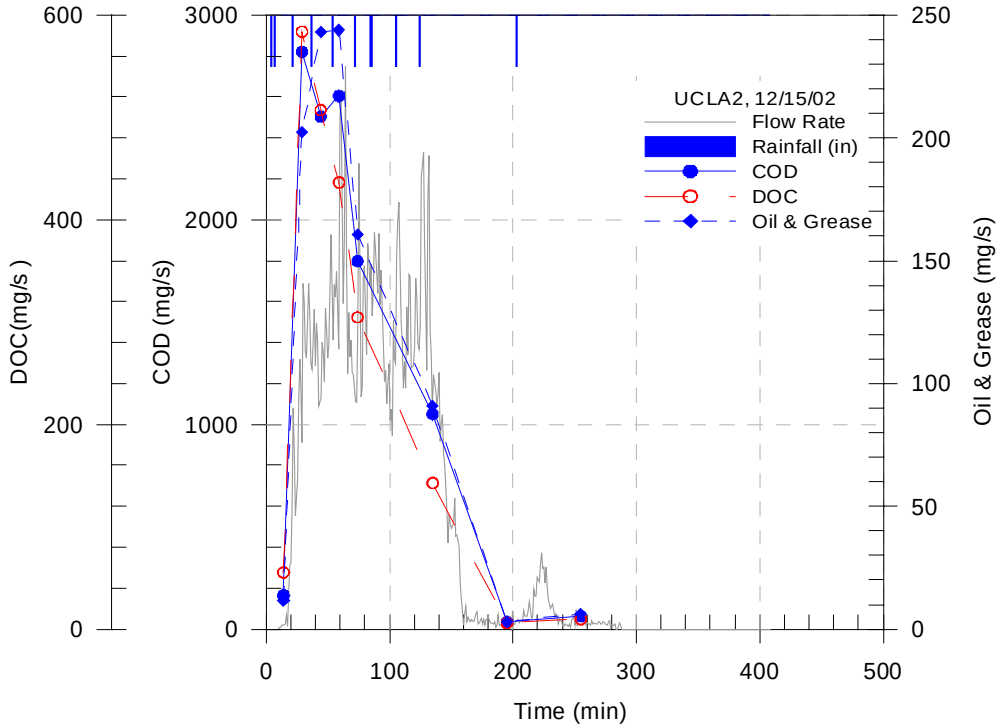

Figure I.4.2.3c[2] (Y4-UCLA2-E3-3). Load-graph for COD, DOC and Oil & Grease

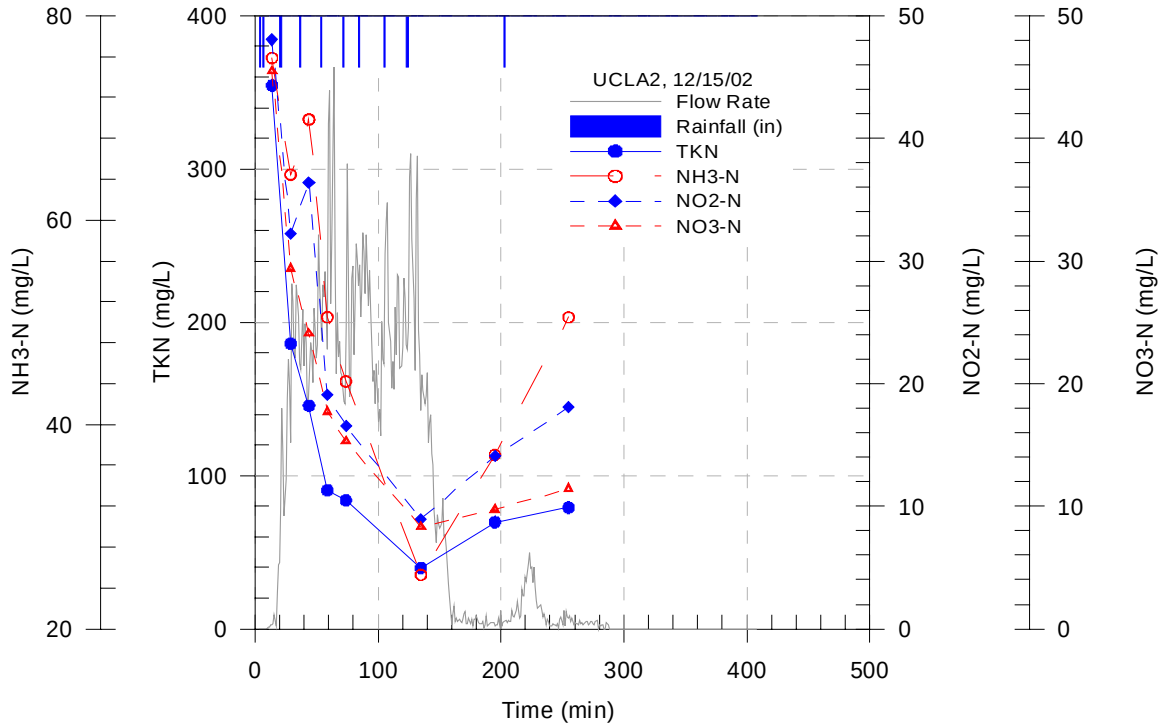

Figure I.4.2.3d[1] (Y4-UCLA2-E3-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

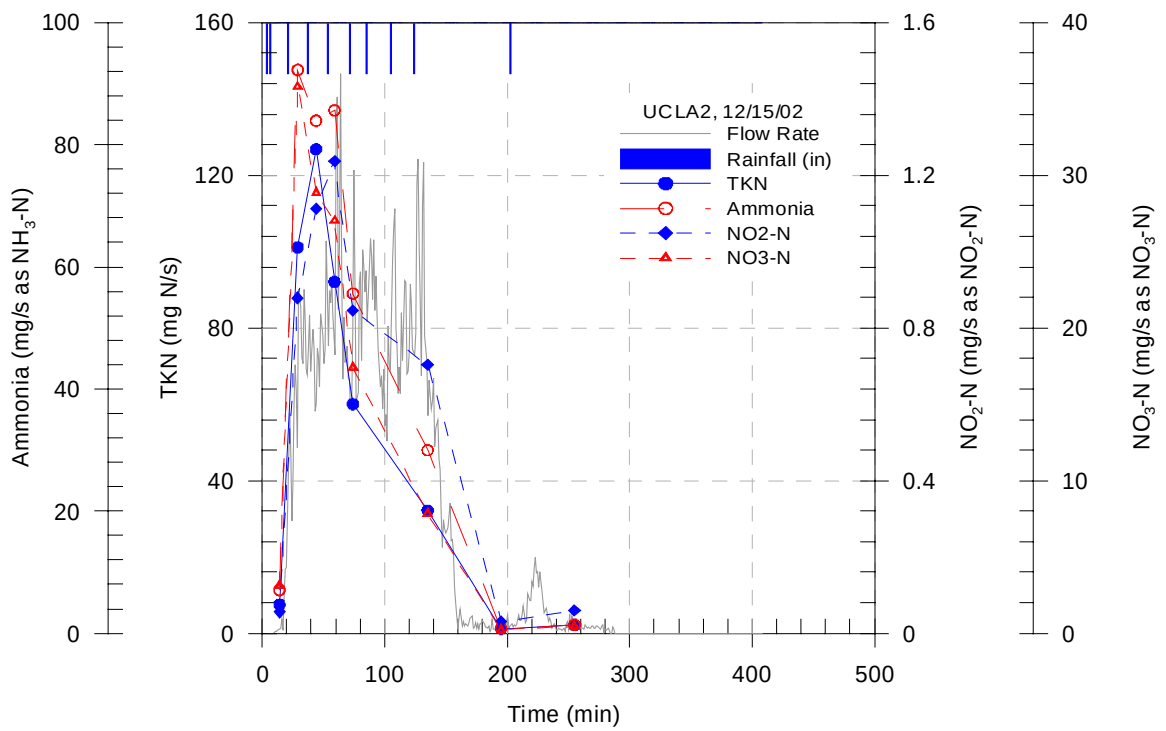

Figure I.4.2.3d[2] (Y4-UCLA2-E3-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

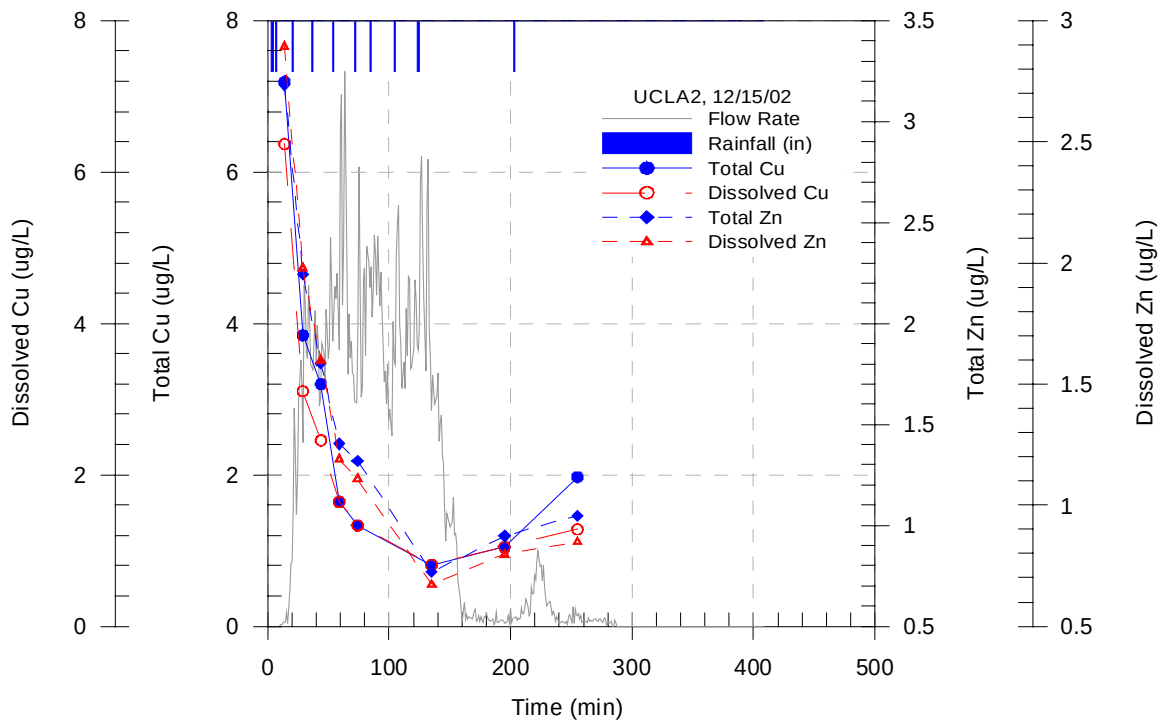

Figure I.4.2.3e[1] (Y4-UCLA2-E3-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

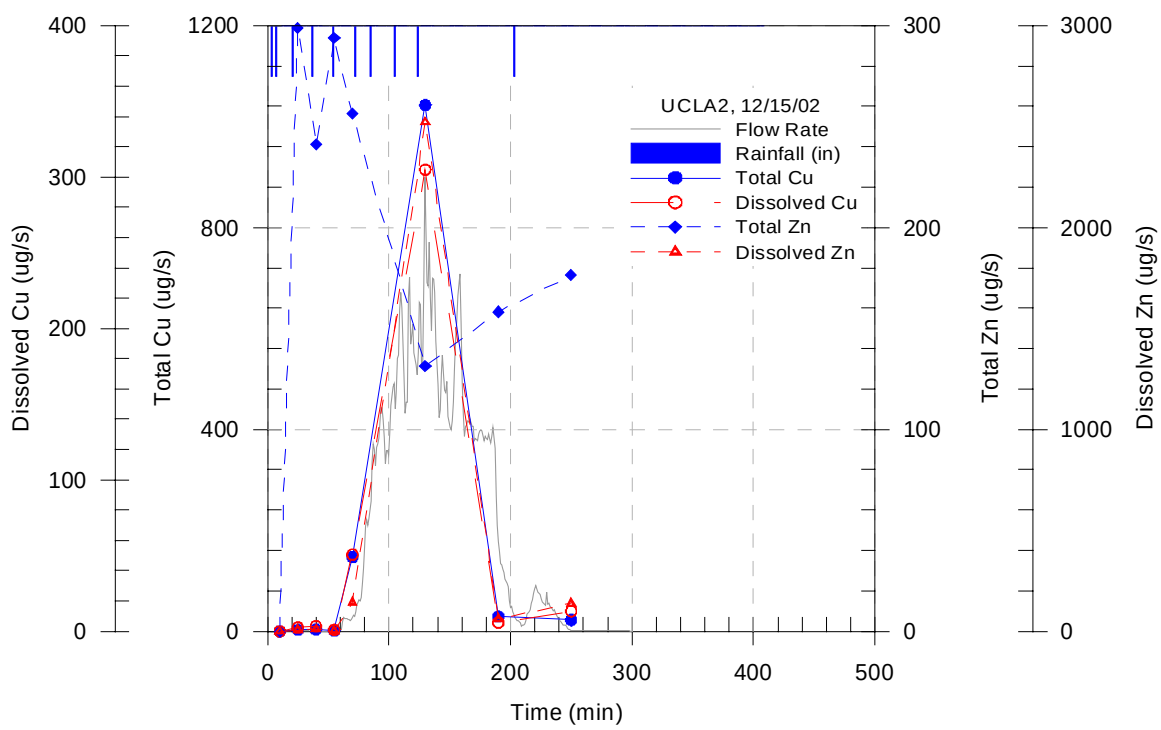

Figure I.4.2.3e[2] (Y4-UCLA2-E3-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

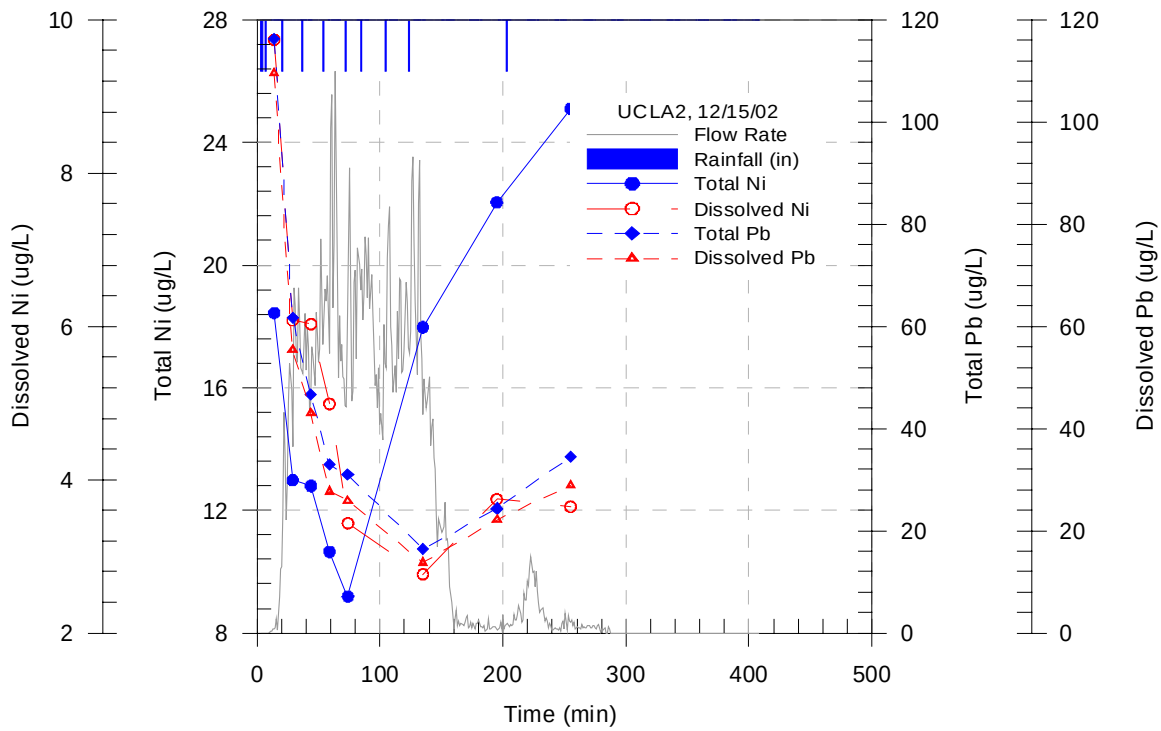

Figure I.4.2.3f[1] (Y4-UCLA2-E3-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

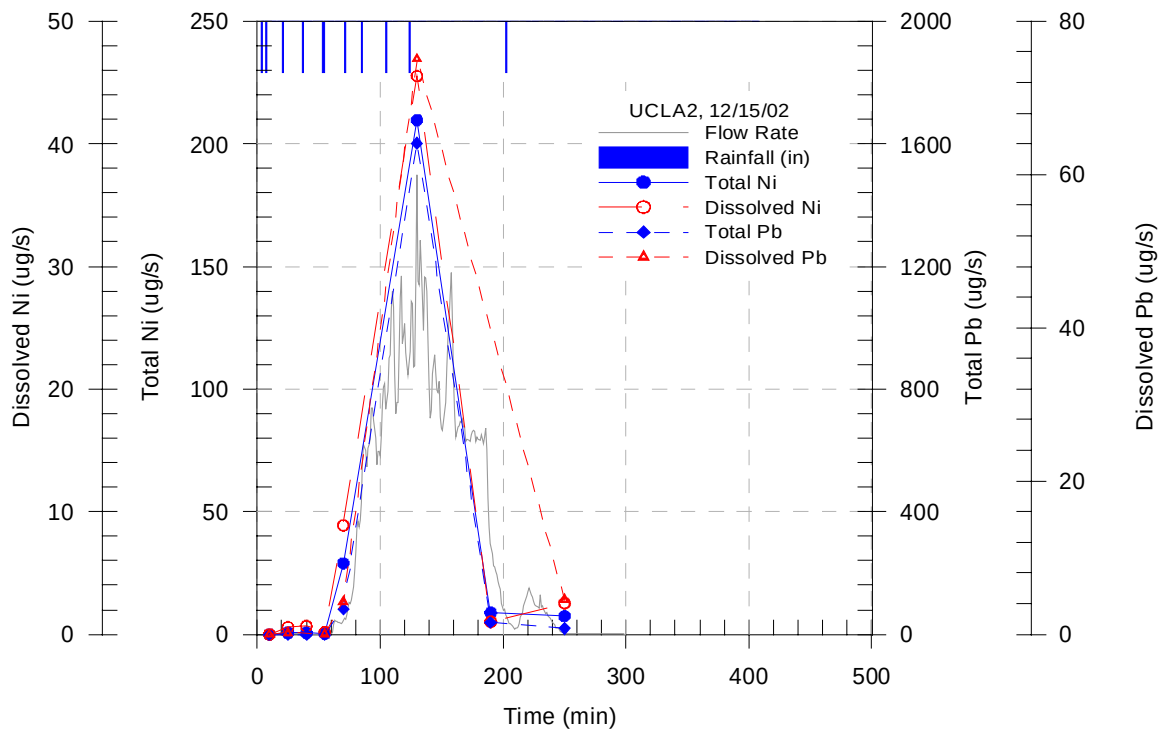

Figure I.4.2.3f[2] (Y4-UCLA2-E3-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

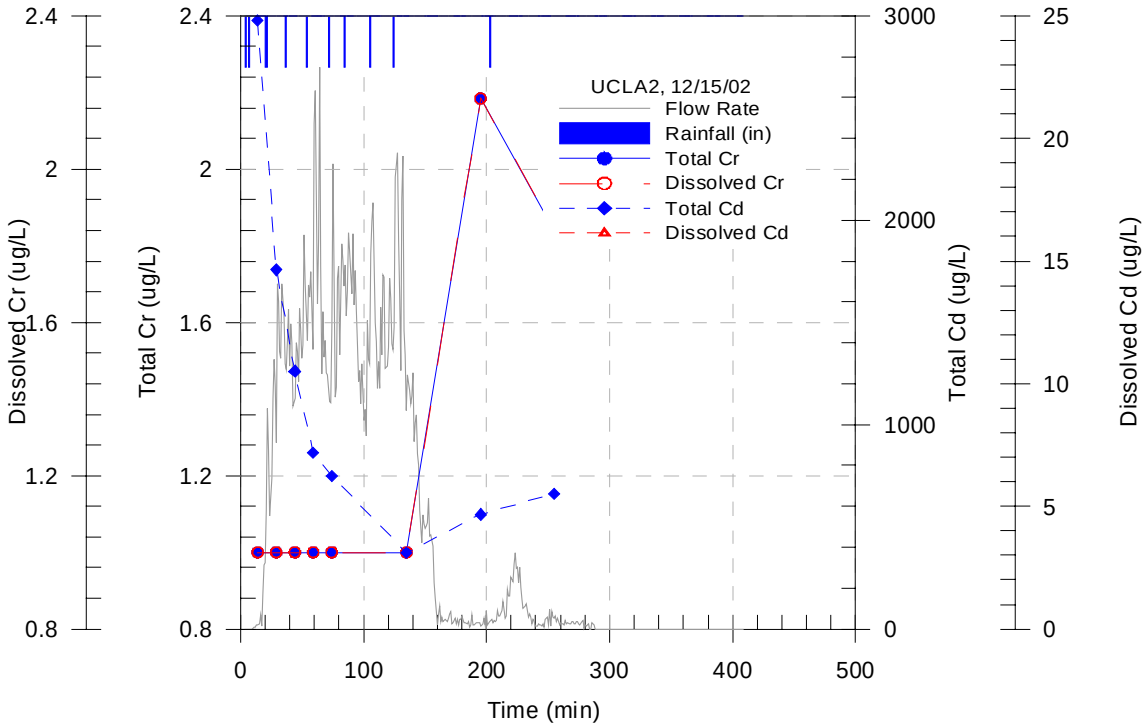

Figure I.4.2.3g[1] (Y4-UCLA2-E3-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

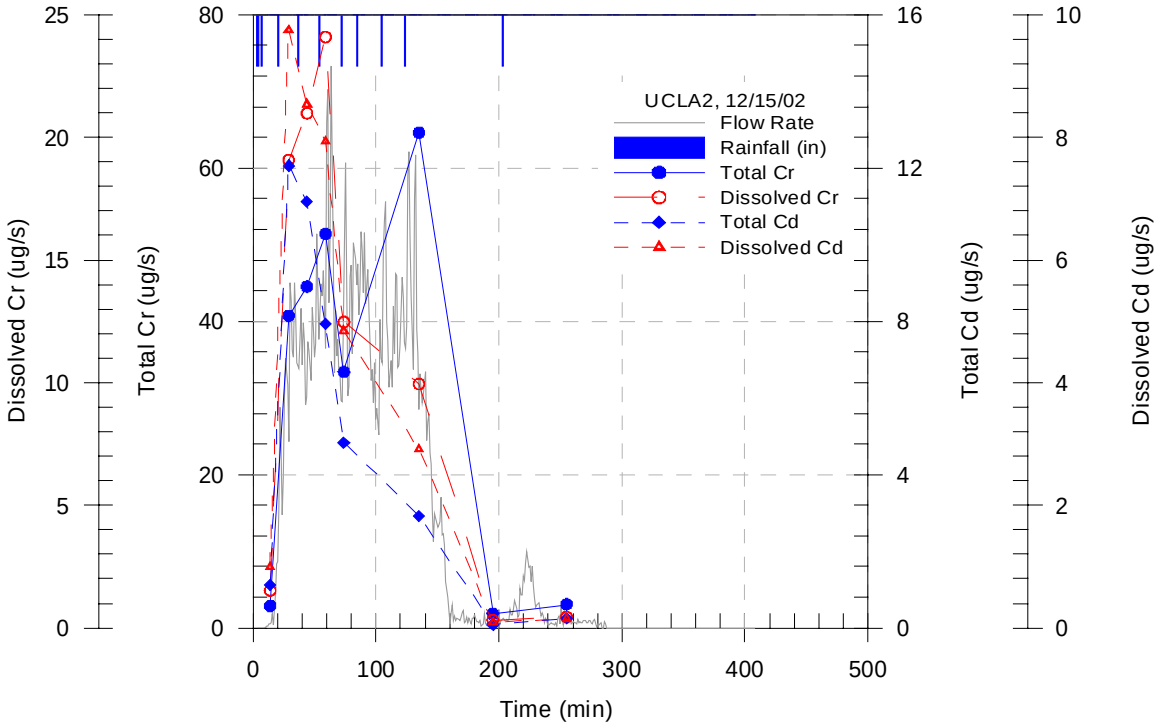

Figure I.4.2.3g[2] (Y4-UCLA2-E3-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

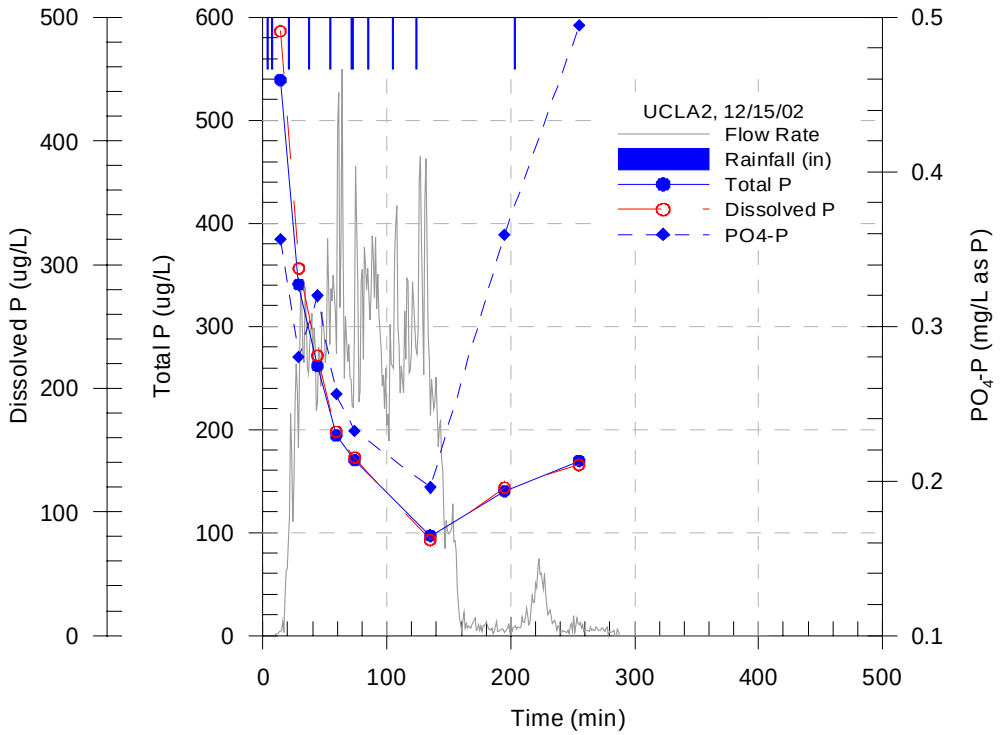

Figure I.4.2.3h[1] (Y4-UCLA2-E3-8). Polluto-graph for Total P / PO_4^{3-}-P

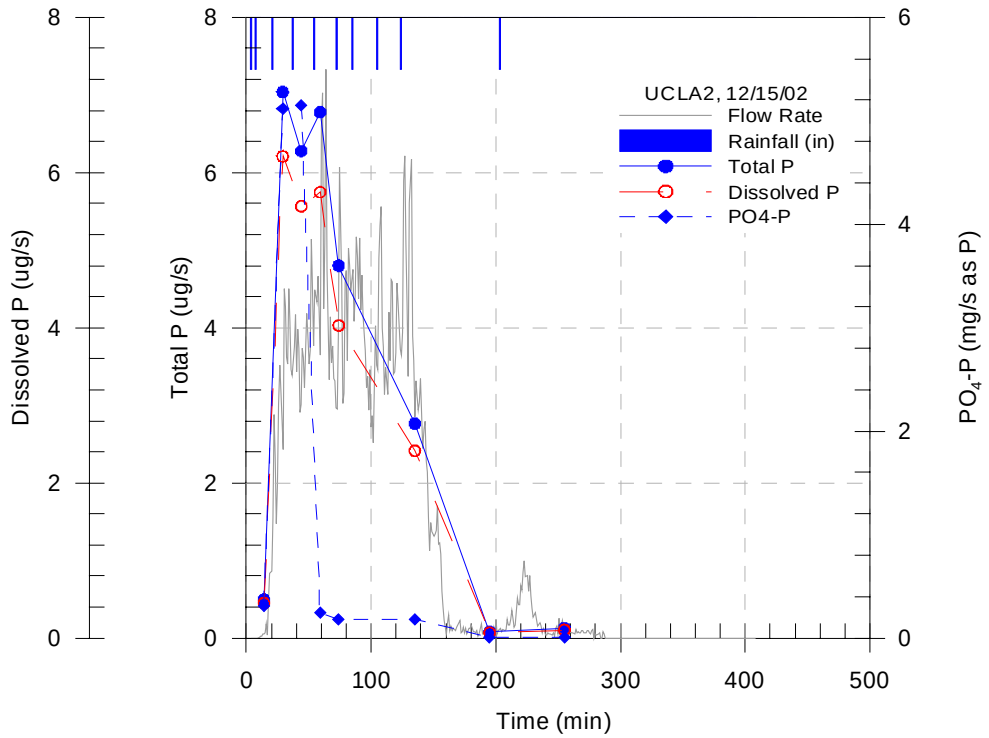

Figure I.4.2.3h[2] (Y4-UCLA2-E3-8). Load -graph for Total P / PO_4^{3-}P

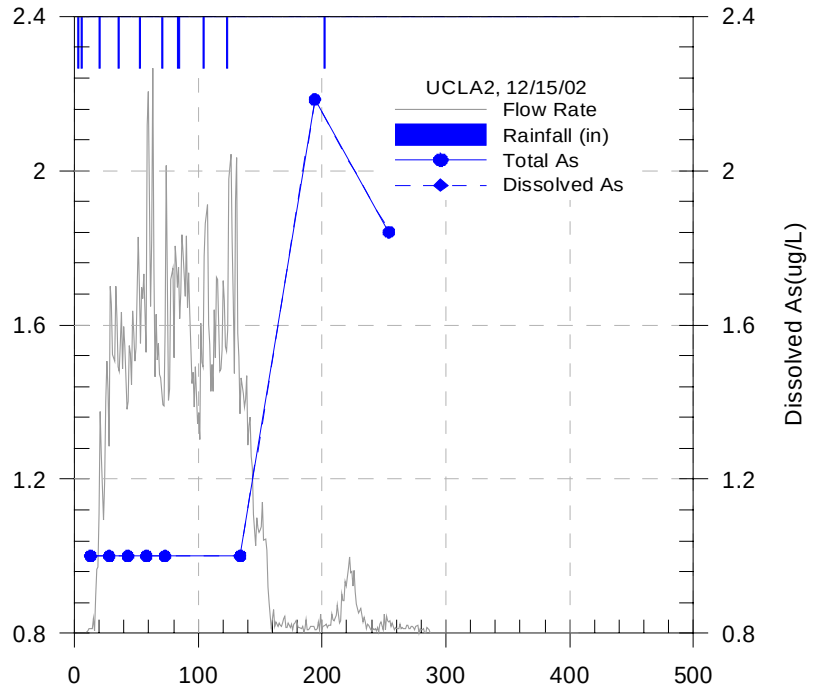

Figure I.4.2.3i[1] (Y4-UCLA2-E3-9). Polluto-graph for Total As / Dissolved As

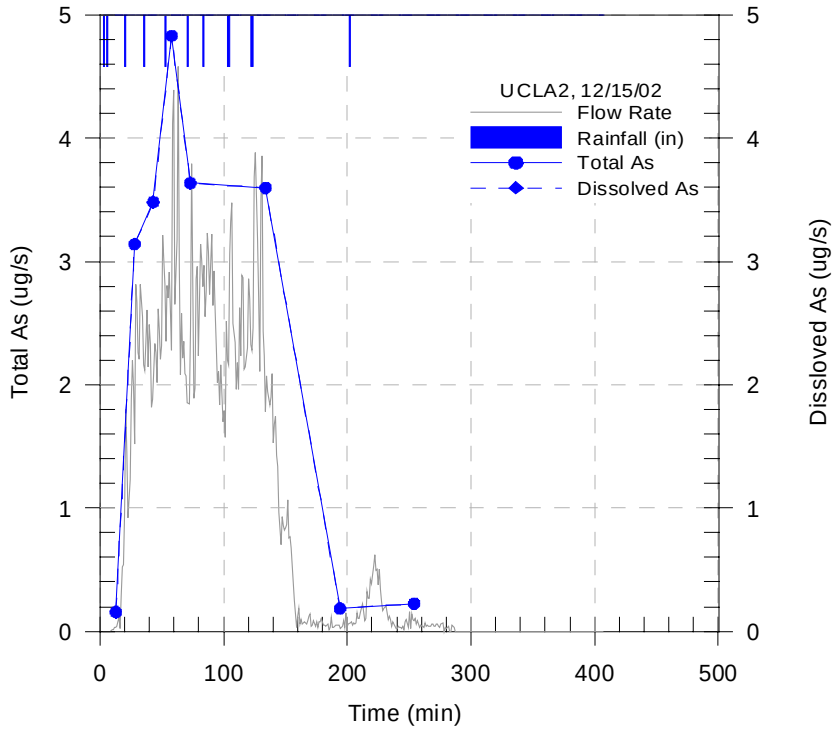

Figure I.4.2.3i[2] (Y4-UCLA2-E3-9). Load -graph for Total As / Dissolved As

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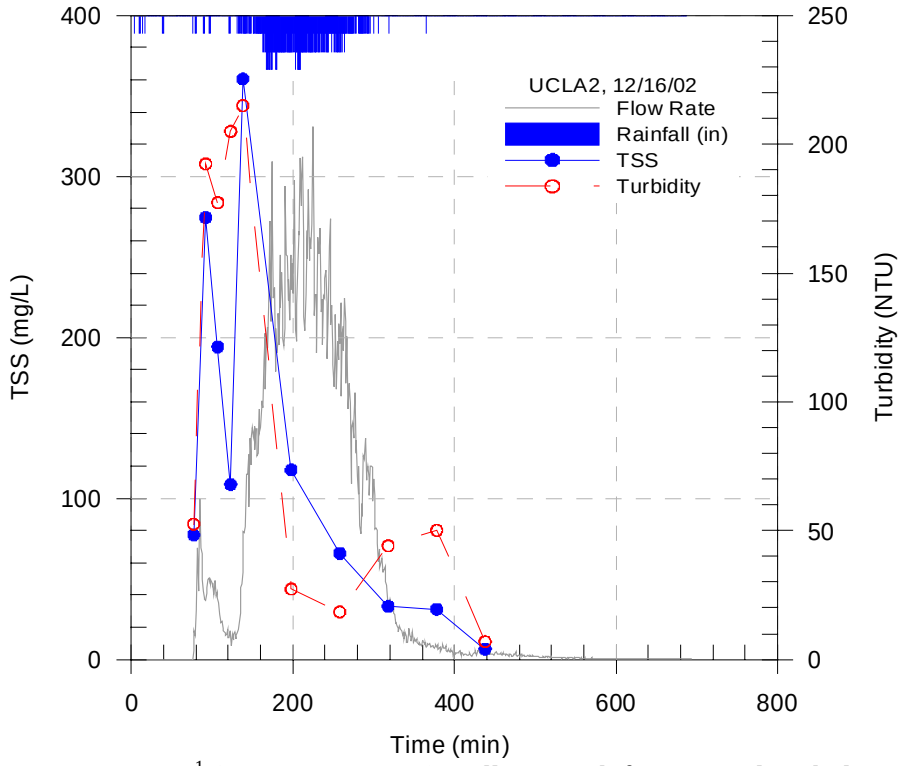
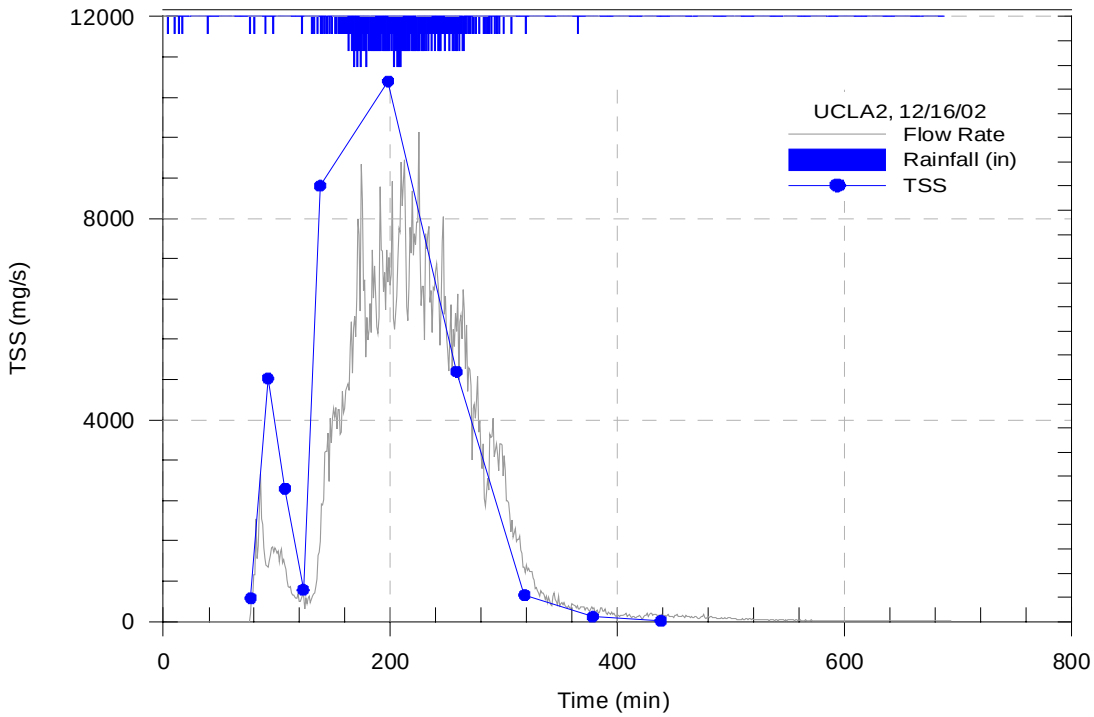


Figure I.4.2.4a[1] (Y4-UCLA2-E4-1). Polluto-graph for TSS and Turbidity



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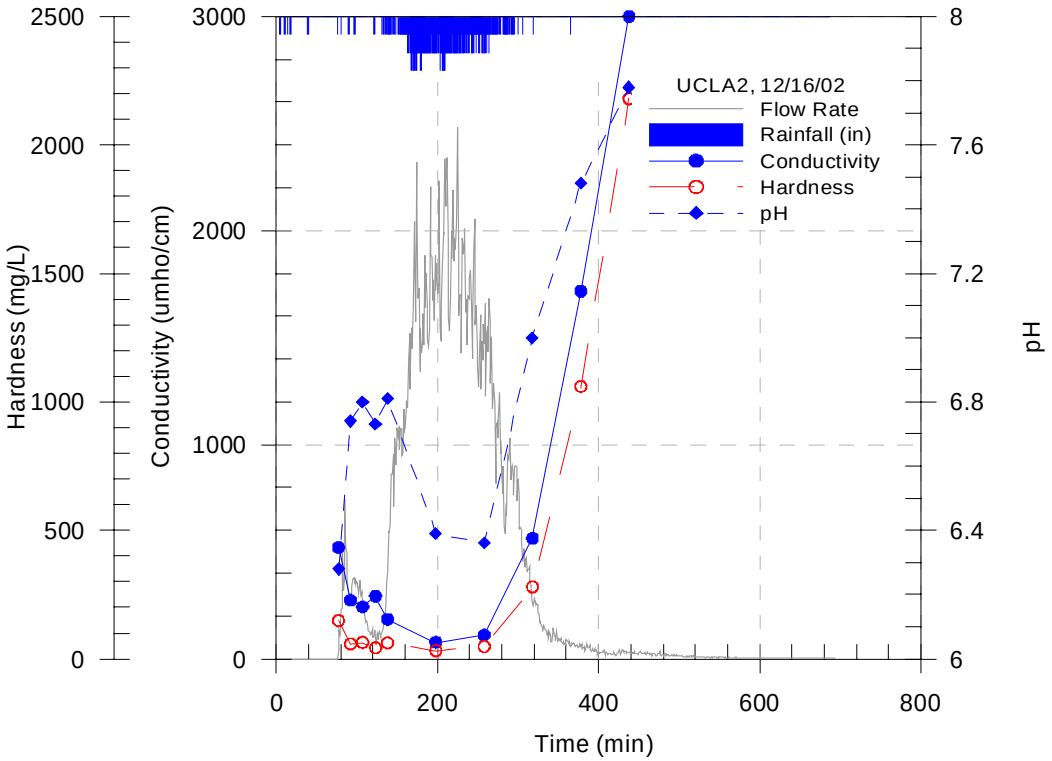

Figure I.4.2.4b[1] (Y4-UCLA2-E4-2). Polluto-graph for Conductivity, Hardness and pH

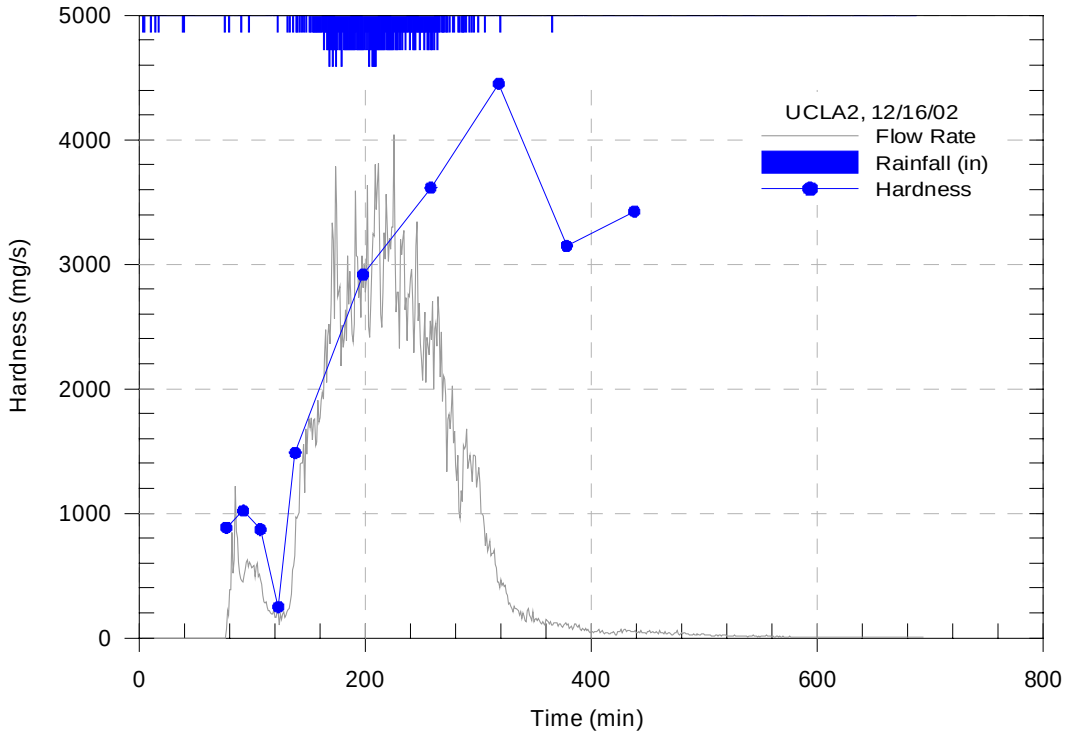

Figure I.4.2.4b[2] (Y4-UCLA2-E4-2). Load-graph for Hardness

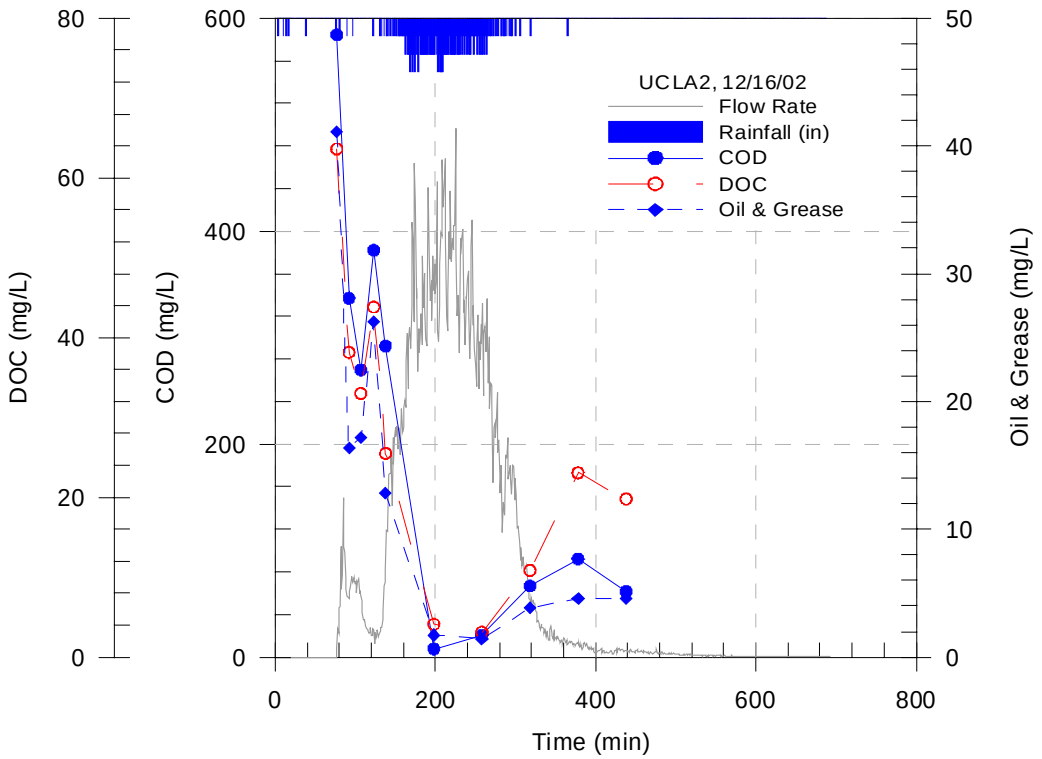

Figure I.4.2.4c[1] (Y4-UCLA2-E4-3). Polluto-graph for COD, DOC and Oil & Grease

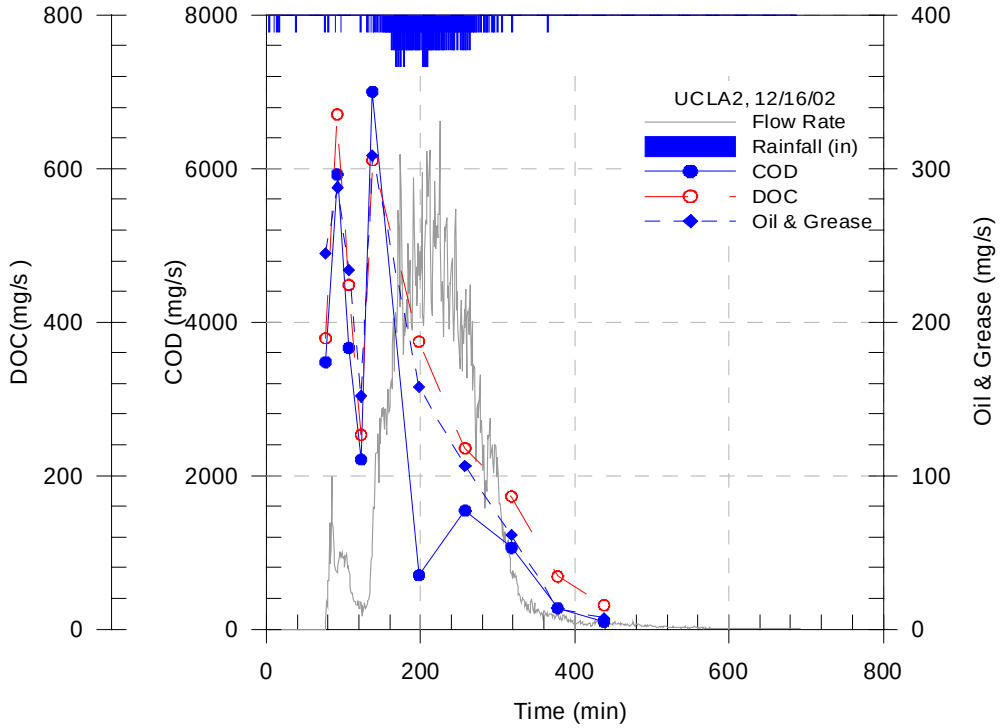

Figure I.4.2.4c[2] (Y4-UCLA2-E4-3). Load-graph for COD, DOC and Oil & Grease

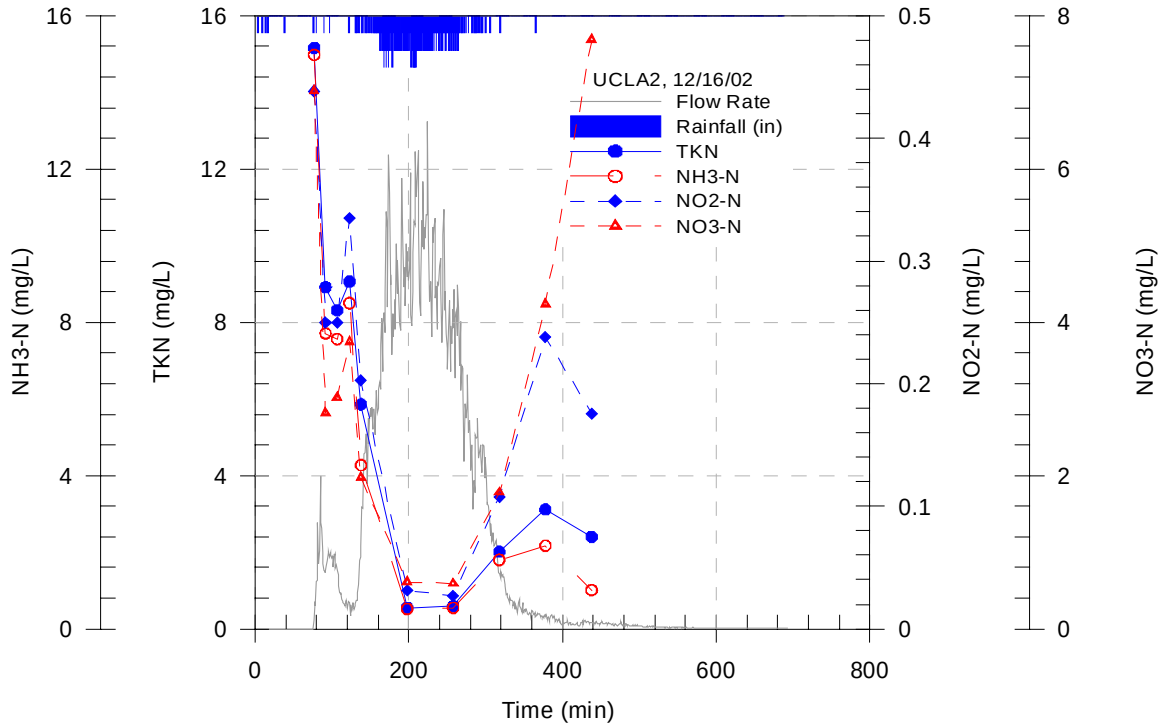

Figure I.4.2.4d[1] (Y4-UCLA2-E4-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

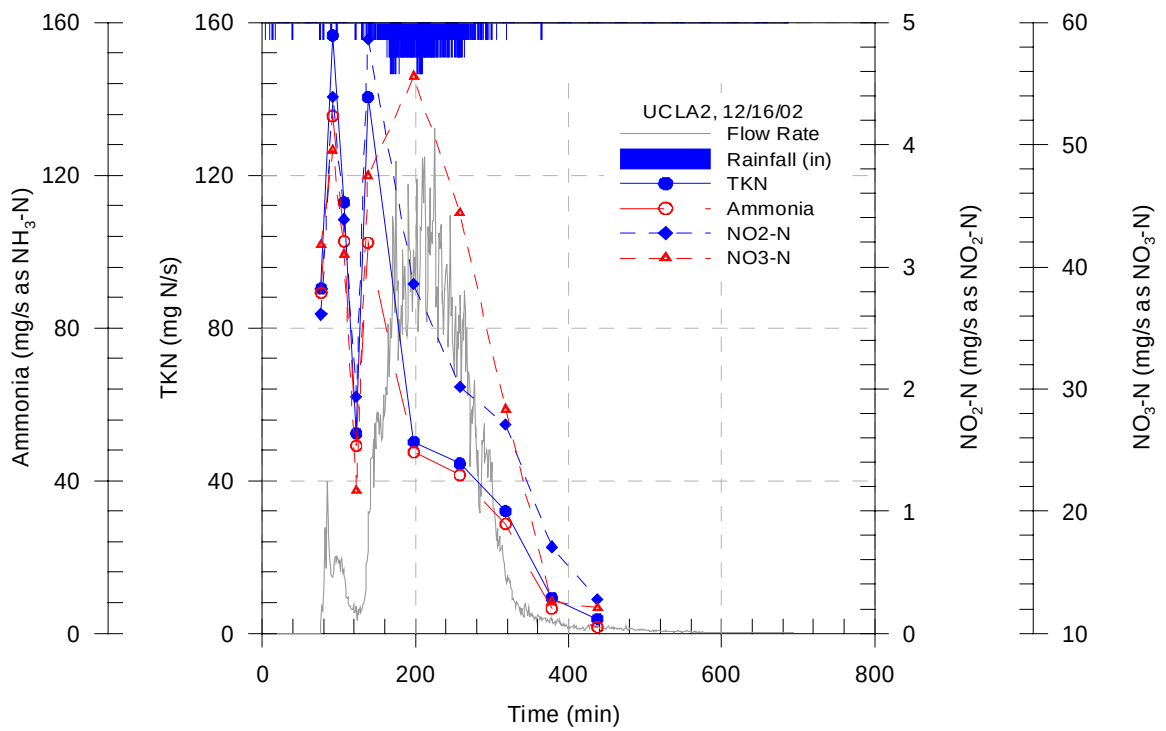

Figure I.4.2.4d[2] (Y4-UCLA2-E4-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

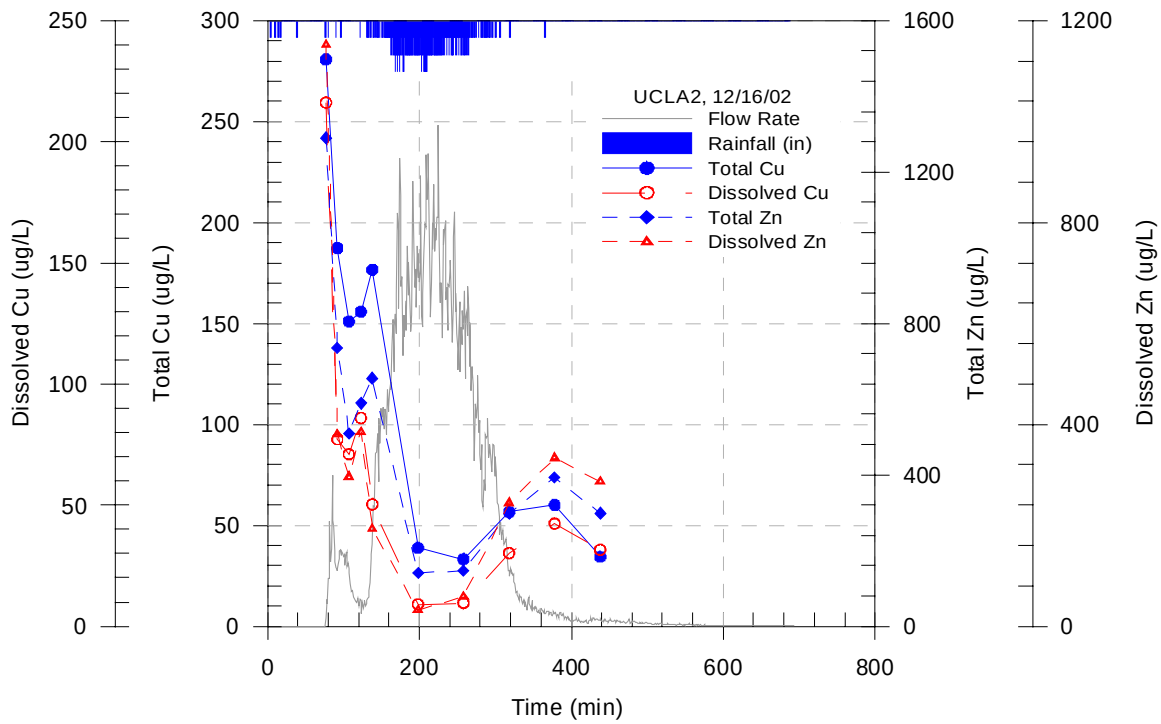

Figure I.4.2.4e[1] (Y4-UCLA2-E4-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

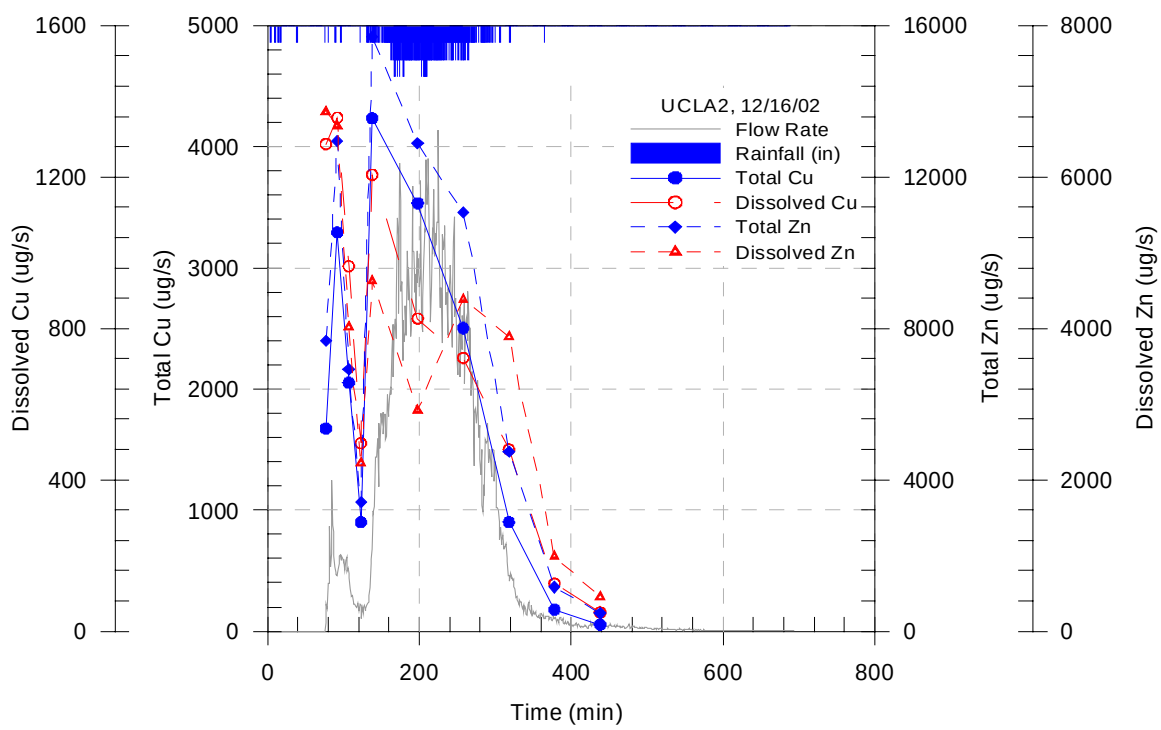

Figure I.4.2.4e[2] (Y4-UCLA2-E4-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

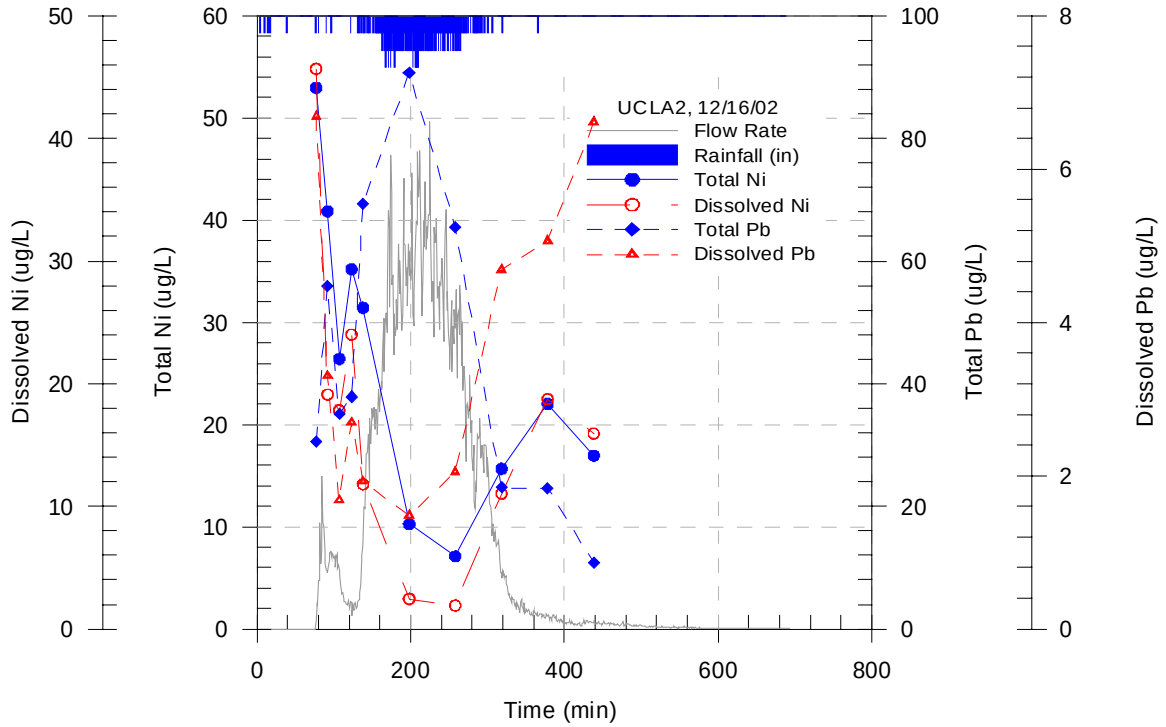

Figure I.4.2.4f[1] (Y4-UCLA2-E4-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

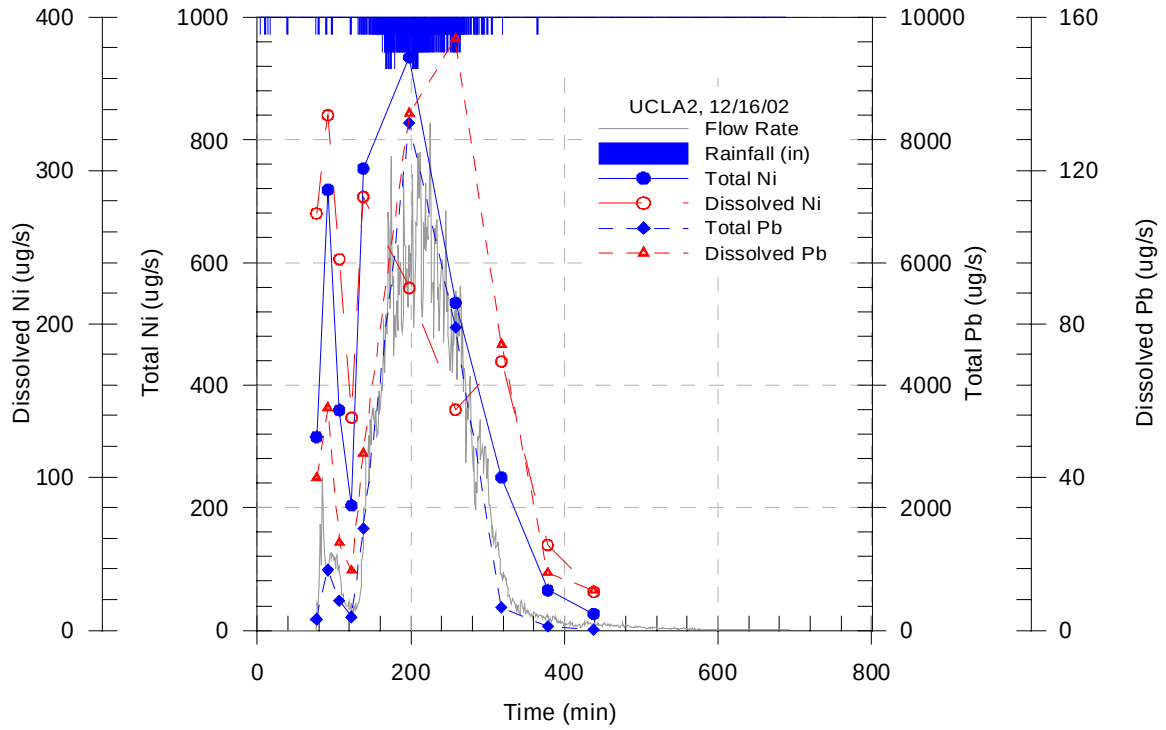

Figure I.4.2.4f[2] (Y4-UCLA2-E4-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

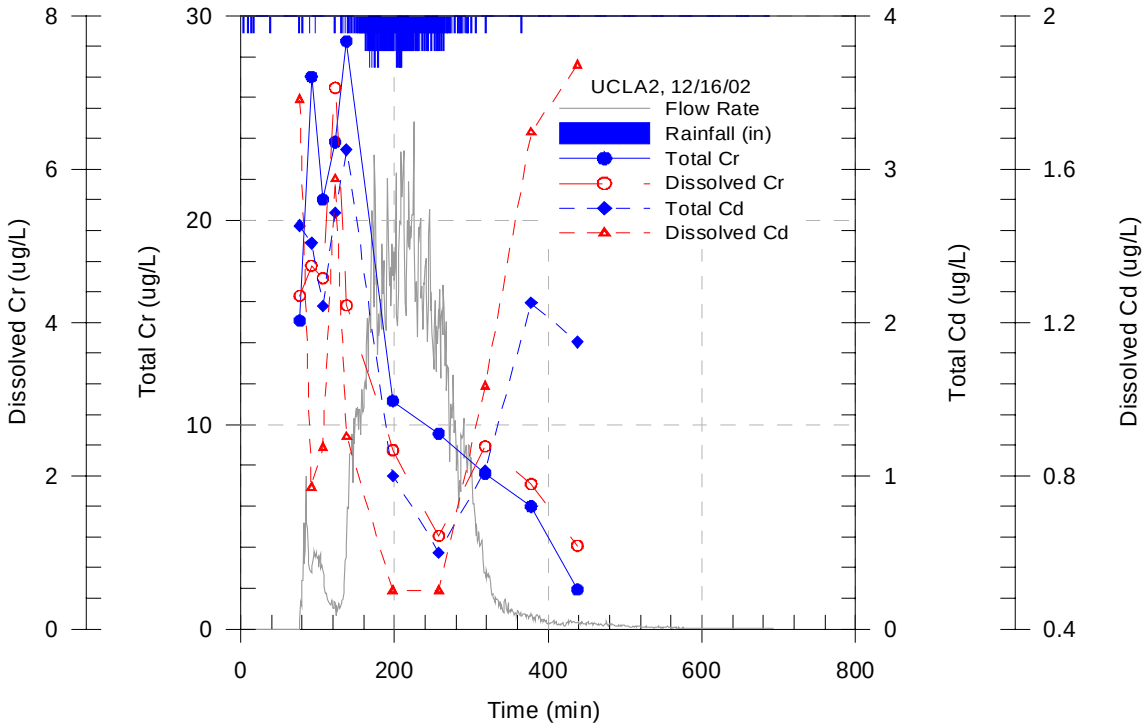

Figure I.4.2.4g[1] (Y4-UCLA2-E4-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

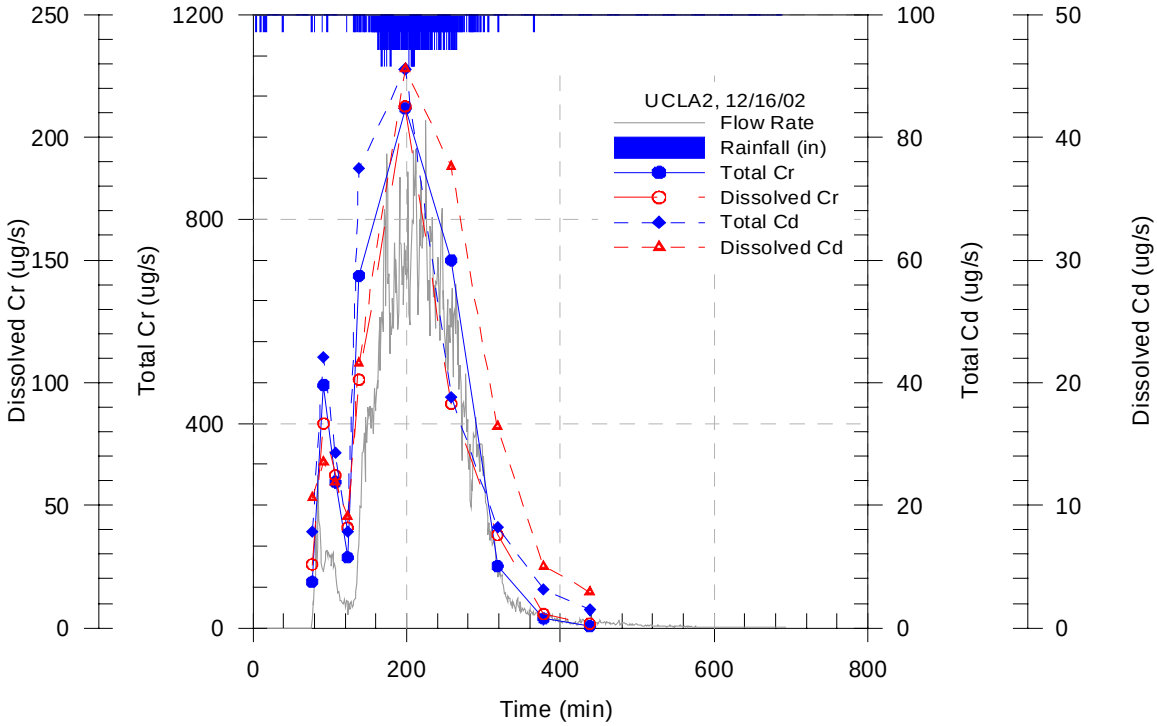

Figure I.4.2.4g[2] (Y4-UCLA2-E4-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

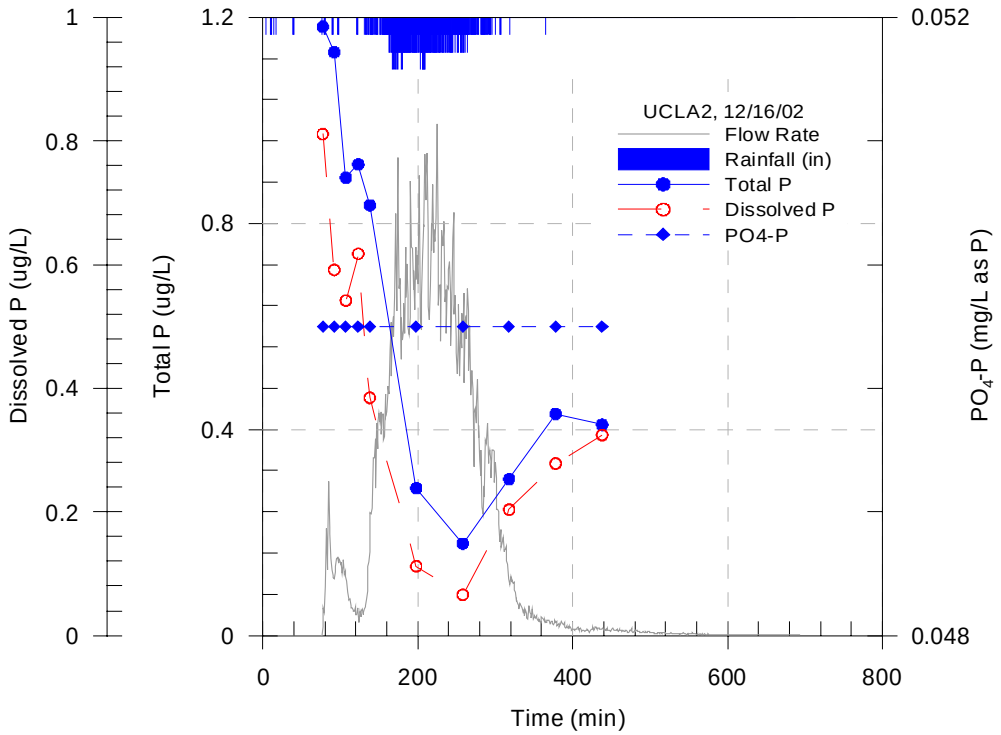

Figure I.4.2.4h[1] (Y4-UCLA2-E4-8). Polluto-graph for Total P / PO_4^{3-}-P

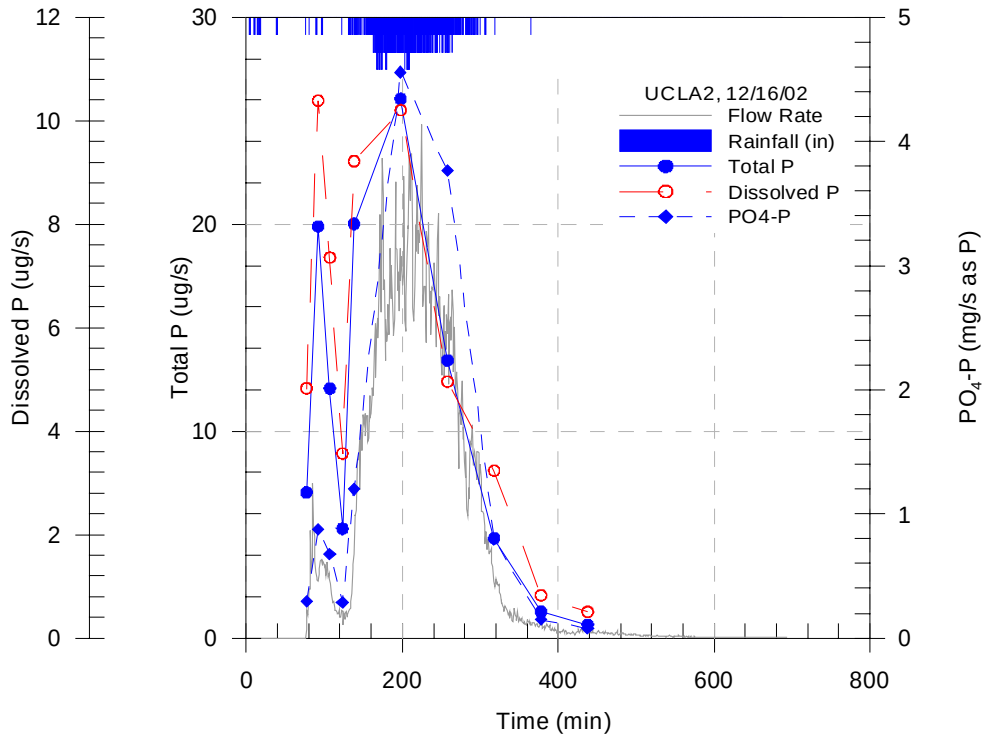

Figure I.4.2.4h[2] (Y4-UCLA2-E4-8). Load -graph for Total P / PO_4^{3-}-P

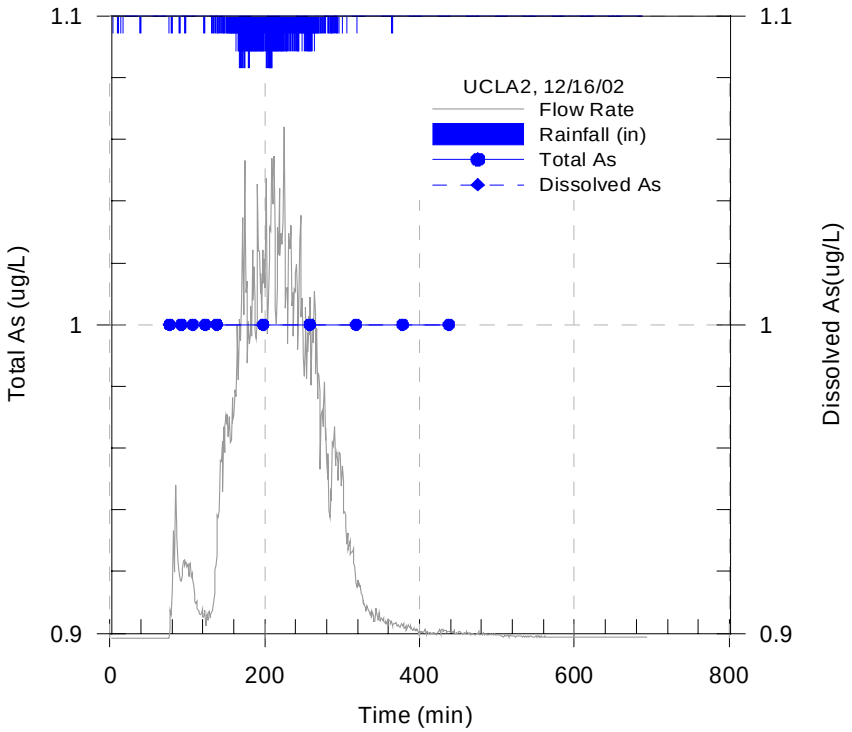

Figure I.4.2.4i[1] (Y4-UCLA2-E4-9). Polluto-graph for Total As / Dissolved As

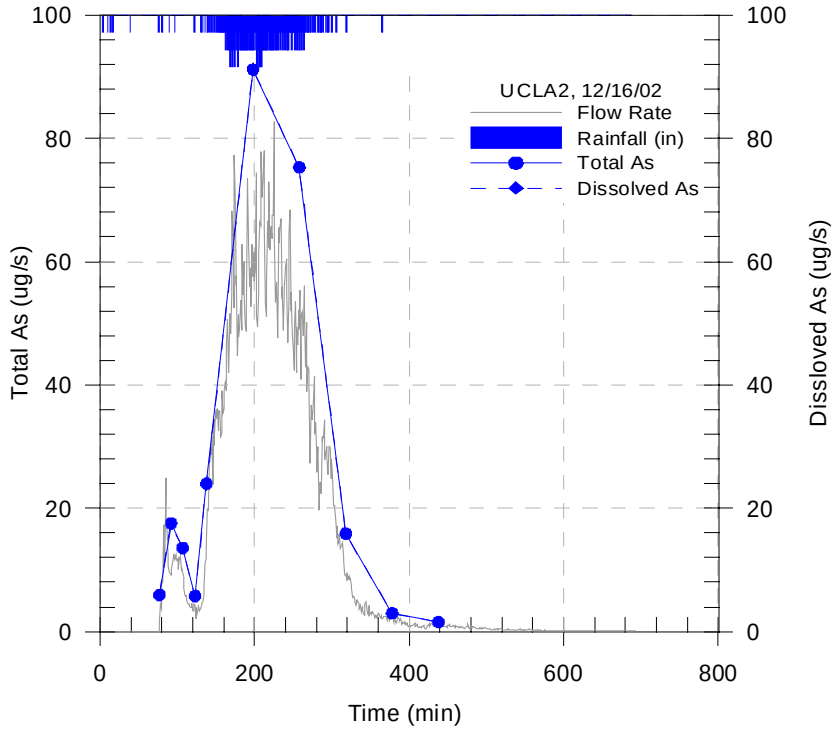

Figure I.4.2.4i[2] (Y4-UCLA2-E4-9). Load -graph for Total As / Dissolved As

6. UCLA2, 2/11/03

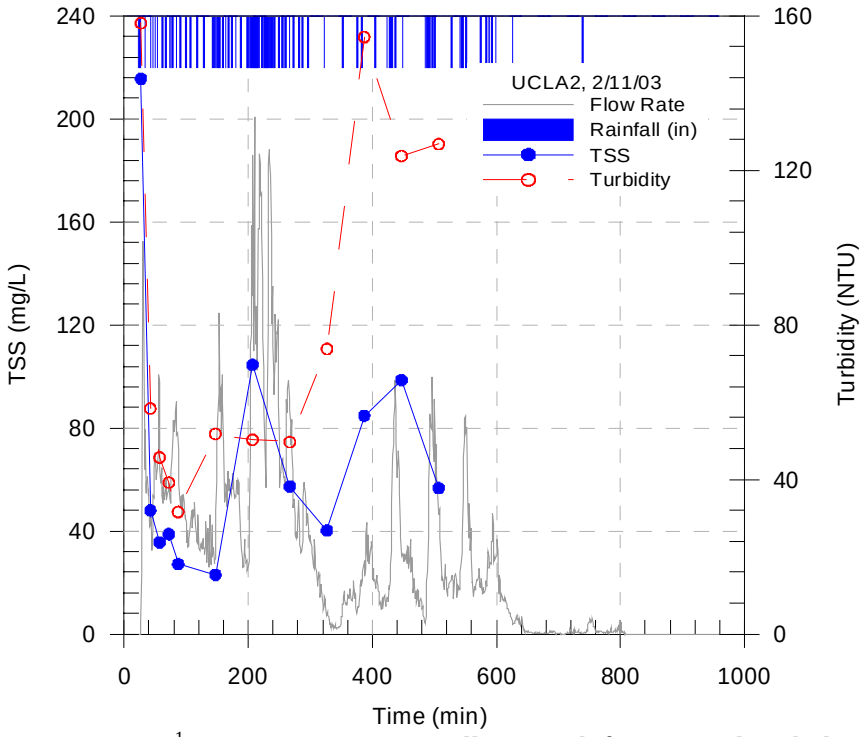

Figure I.4.2.5a[1] (Y4-UCLA2-E6-1). Polluto-graph for TSS and Turbidity

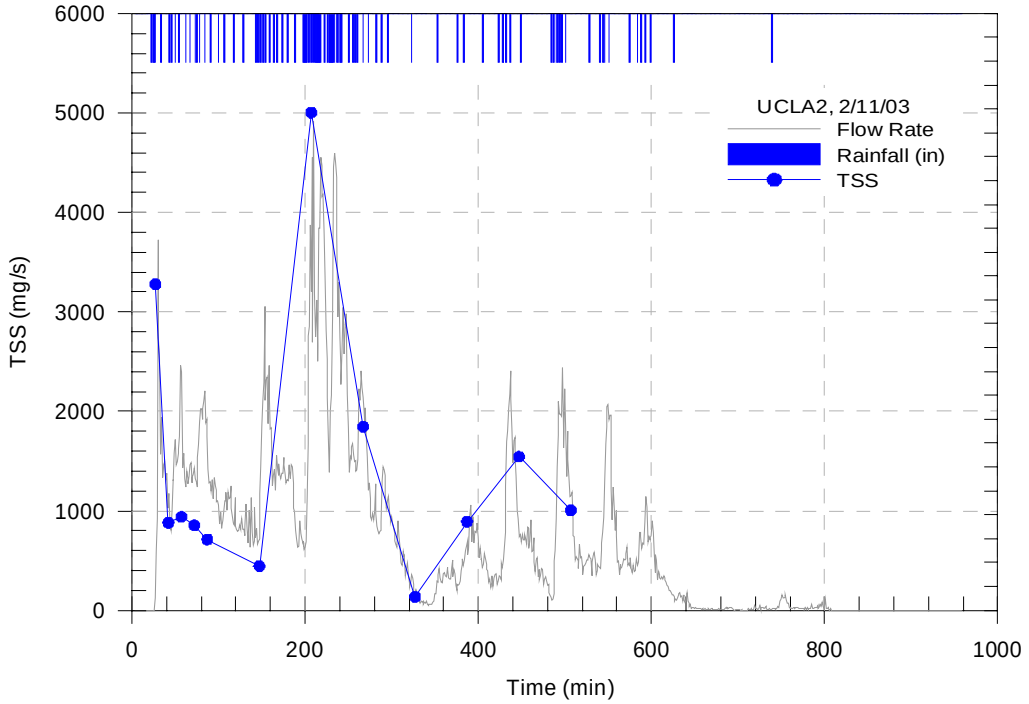

Figure I.4.2.5a[2] (Y4-UCLA2-E6-1). Load-graph for TSS

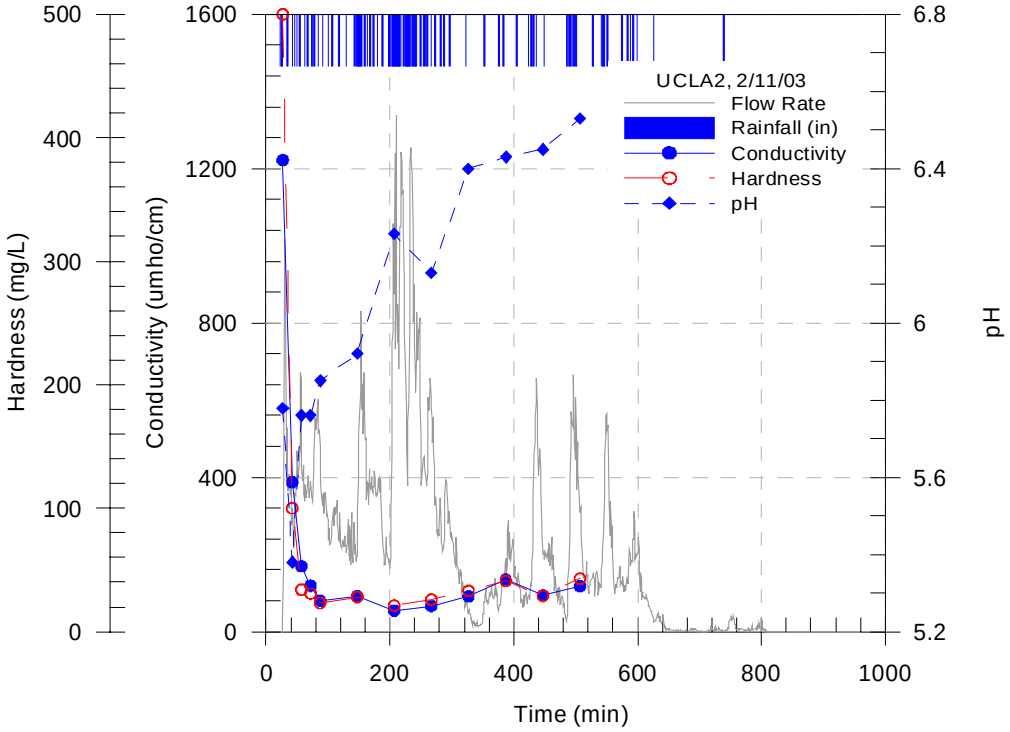

Figure I.4.2.5b[1] (Y4-UCLA2-E6-2). Polluto-graph for Conductivity Hardness and pH

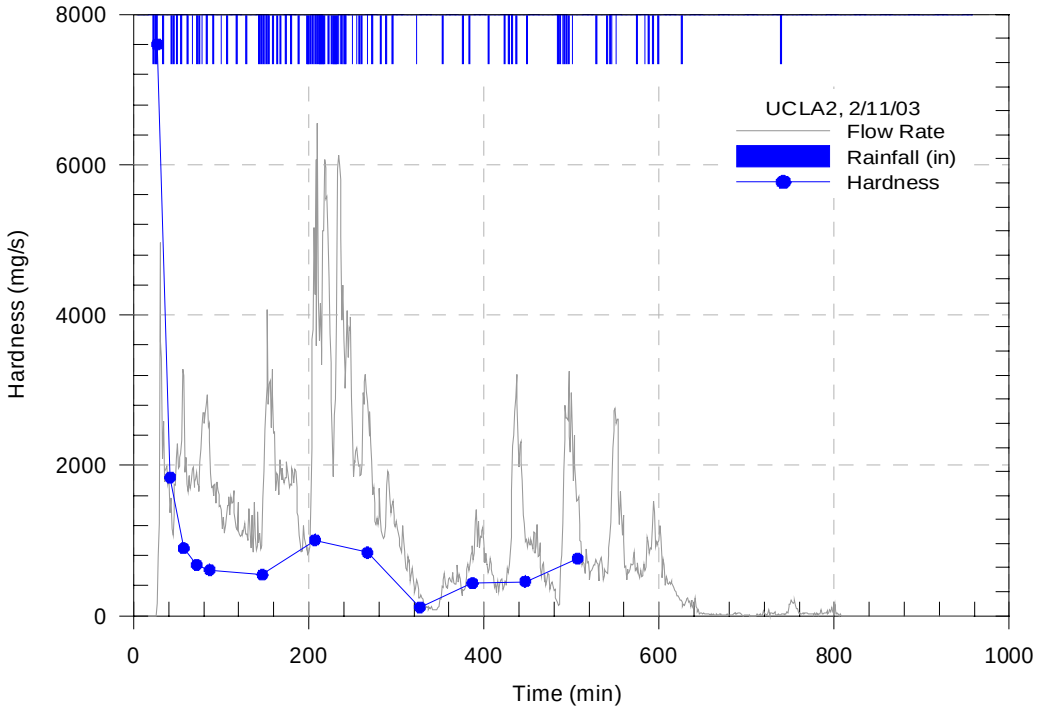

Figure I.4.2.5b[2] (Y4-UCLA2-E6-2). Load-graph for Hardness

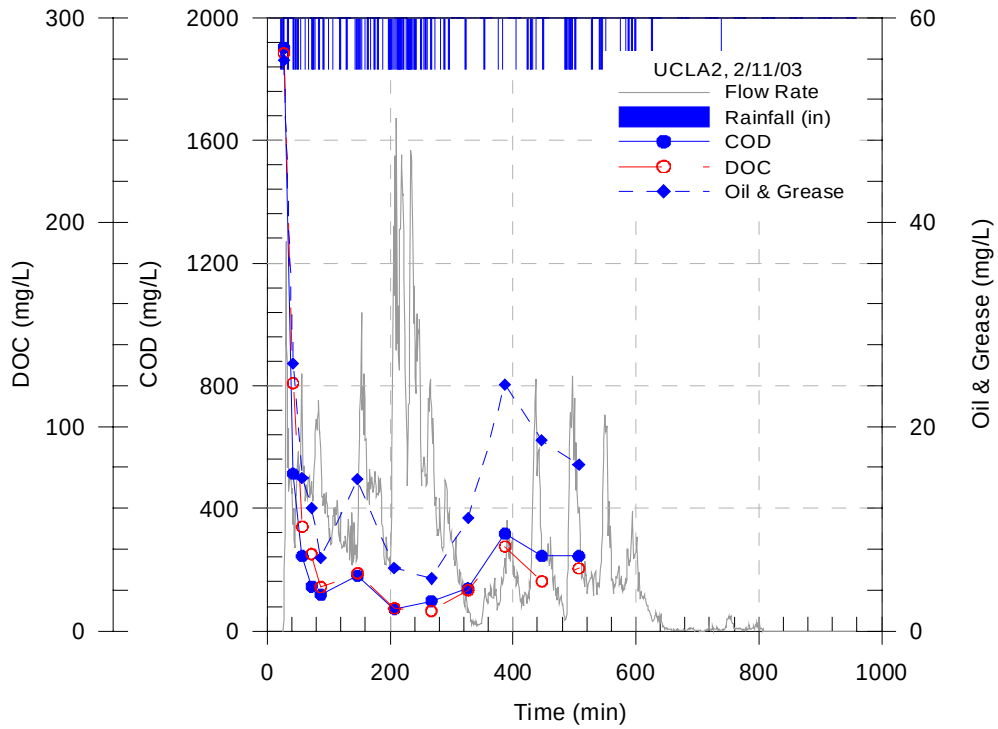

Figure I.4.2.5c[1] (Y4-UCLA2-E6-3). Polluto-graph for COD, DOC and Oil & Grease

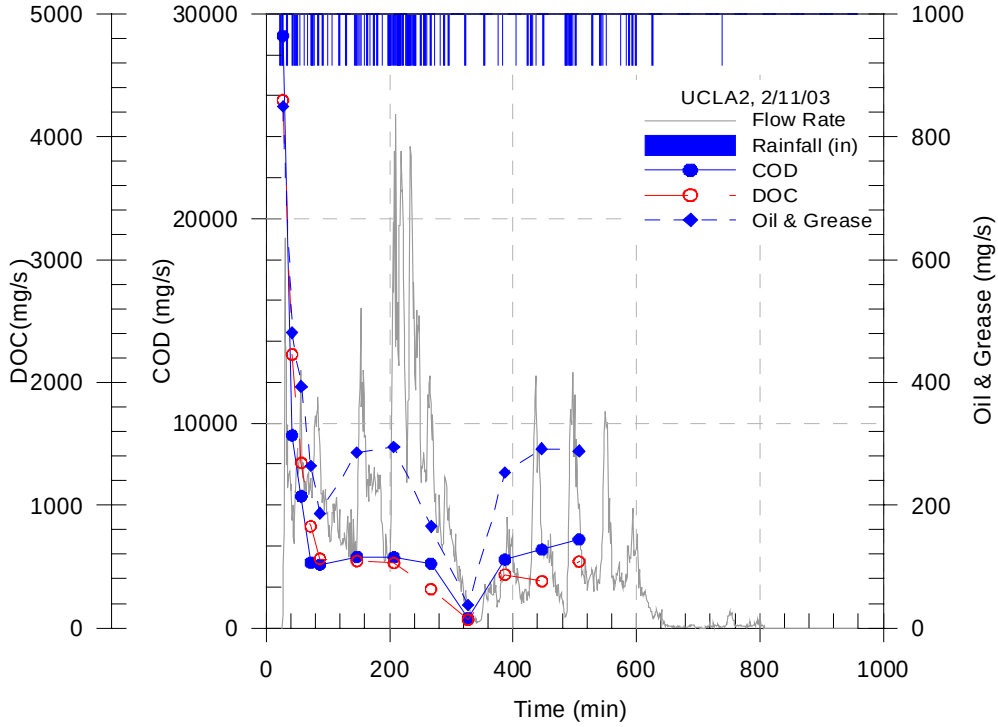

Figure I.4.2.5c[2] (Y4-UCLA2-E6-3). Load-graph for COD, DOC and Oil & Grease

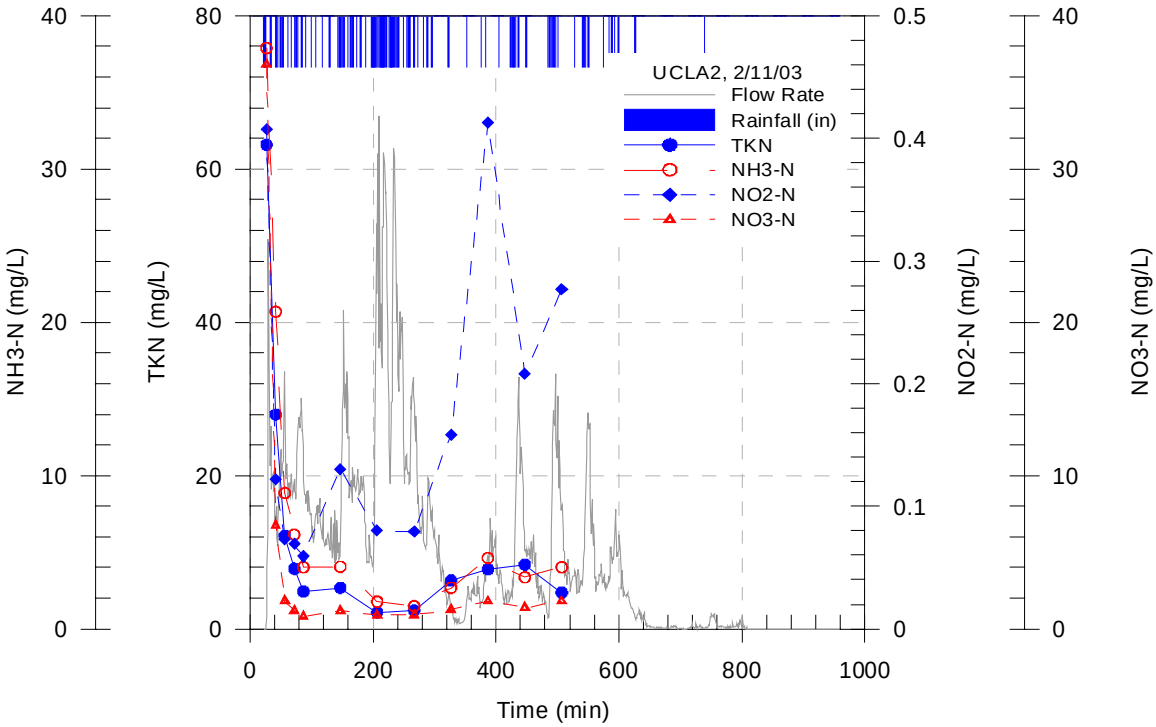

Figure I.4.2.5d[1] (Y4-UCLA2-E6-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

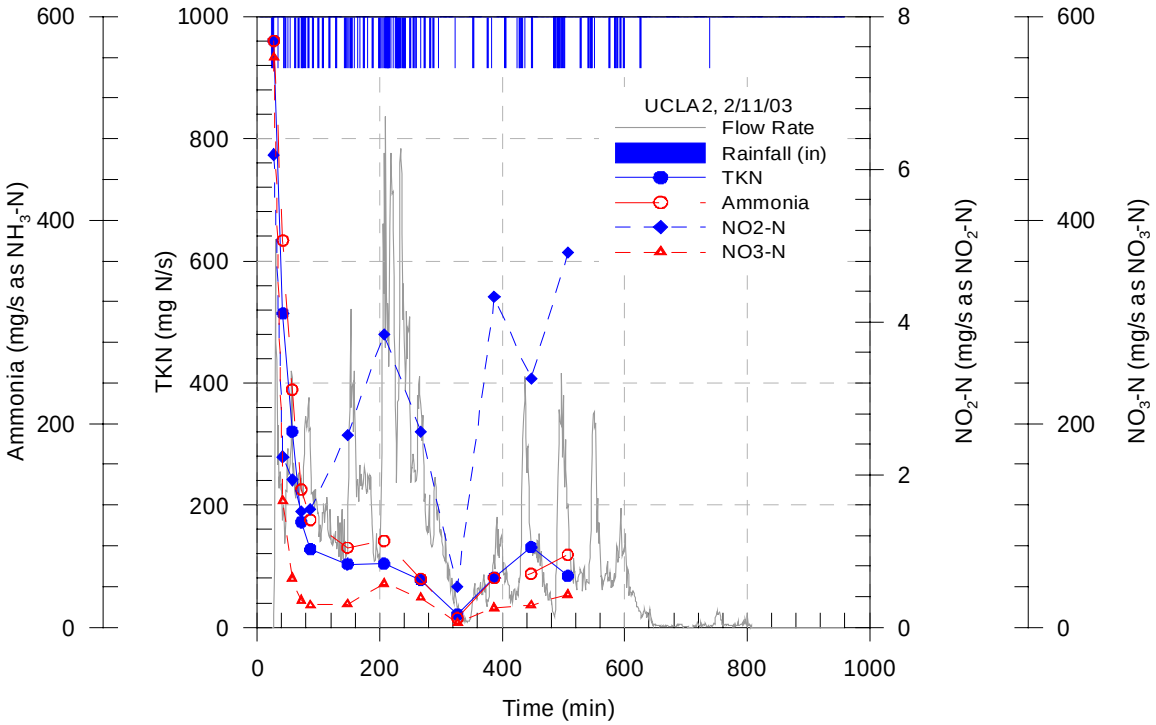

Figure I.4.2.5d[2] (Y4-UCLA2-E6-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

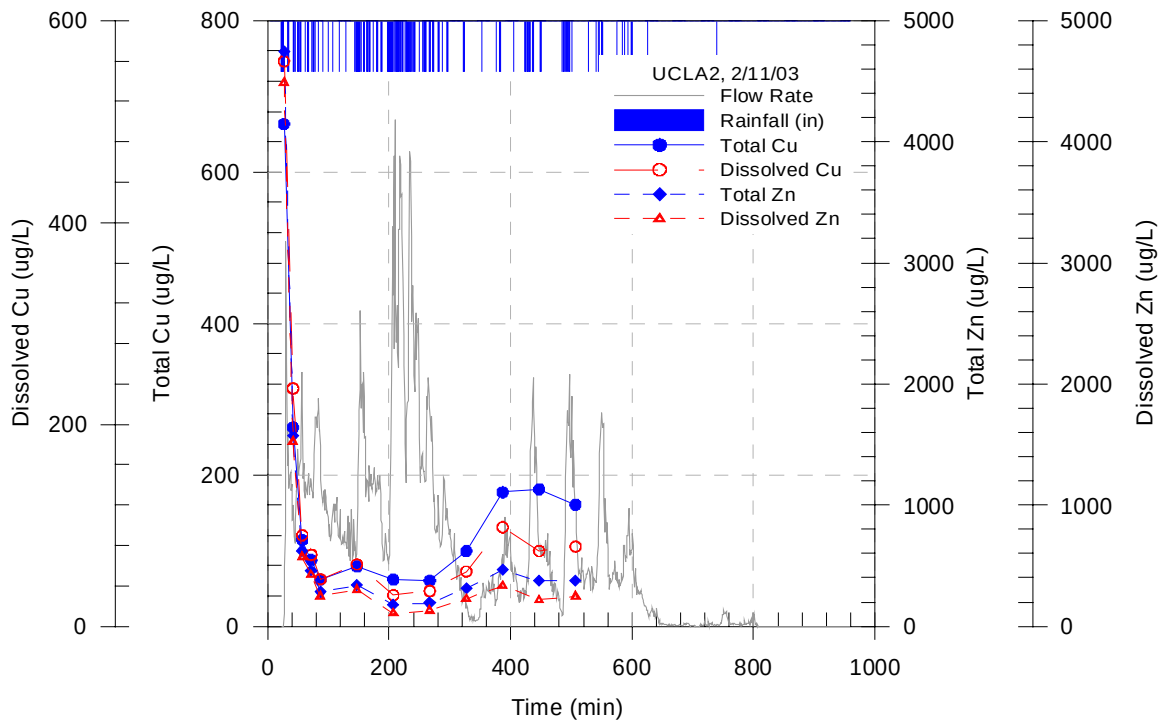

Figure I.4.2.5e[1] (Y4-UCLA2-E6-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

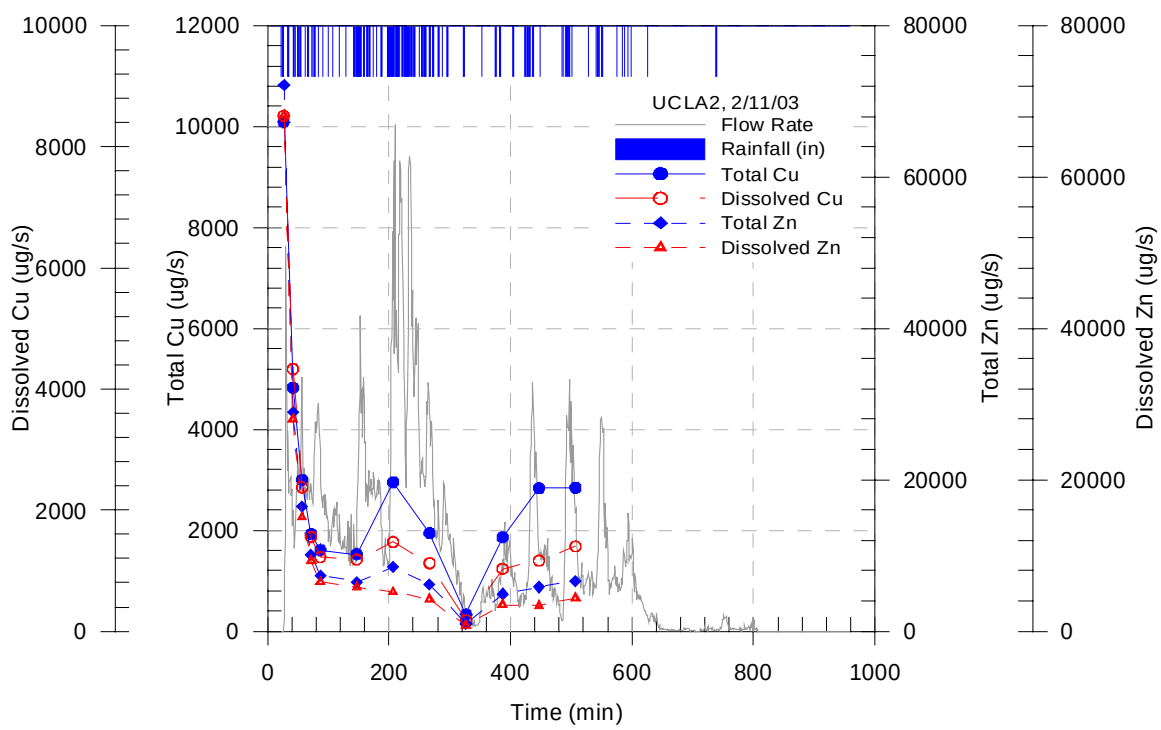

Figure I.4.2.5e[2] (Y4-UCLA2-E6-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

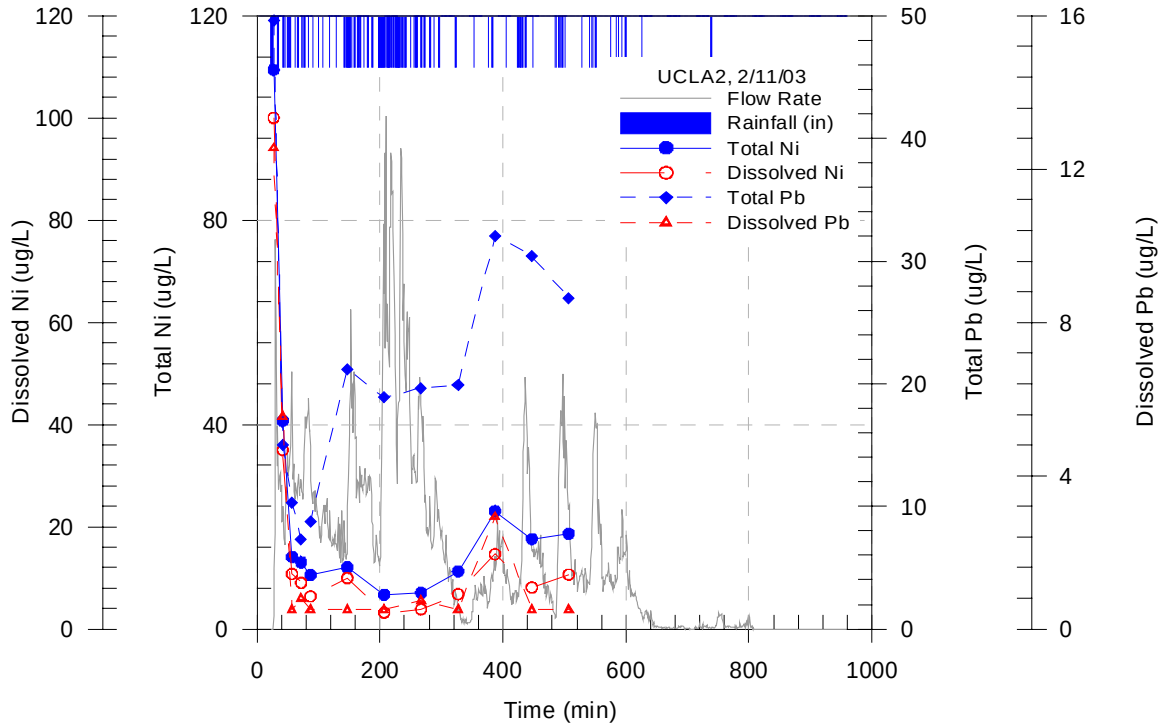

Figure I.4.2.5f[1] (Y4-UCLA2-E6-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

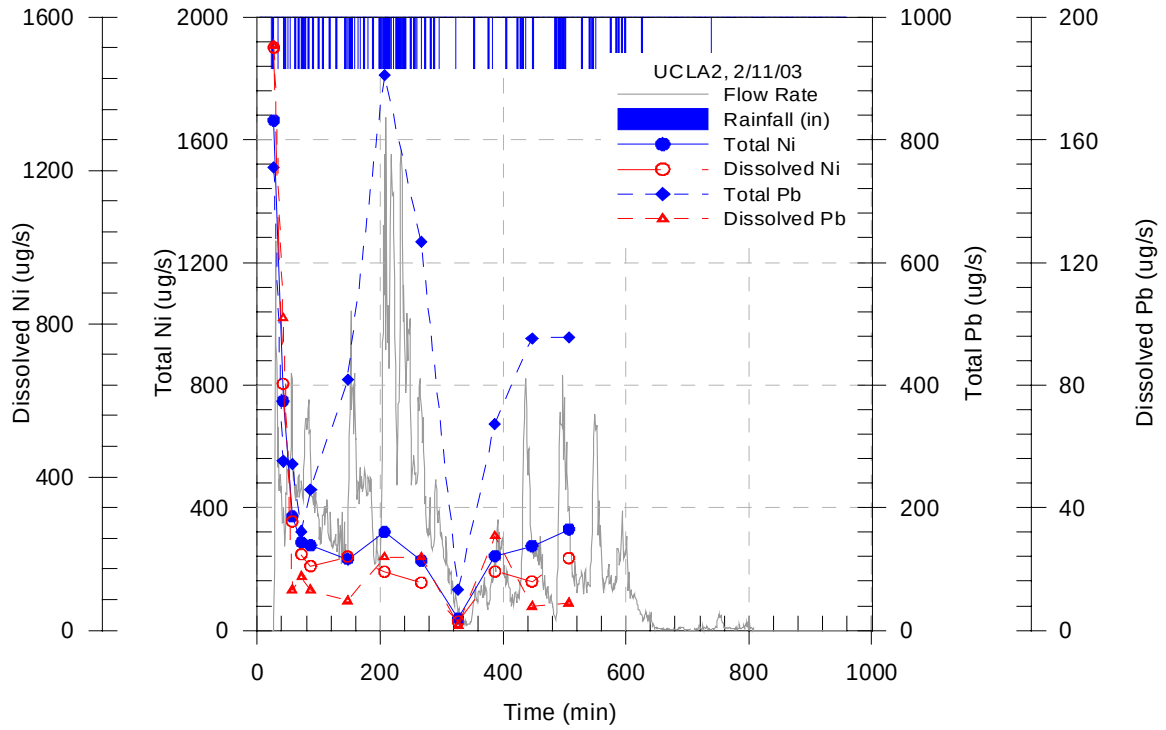

Figure I.4.2.5f[2] (Y4-UCLA2-E6-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

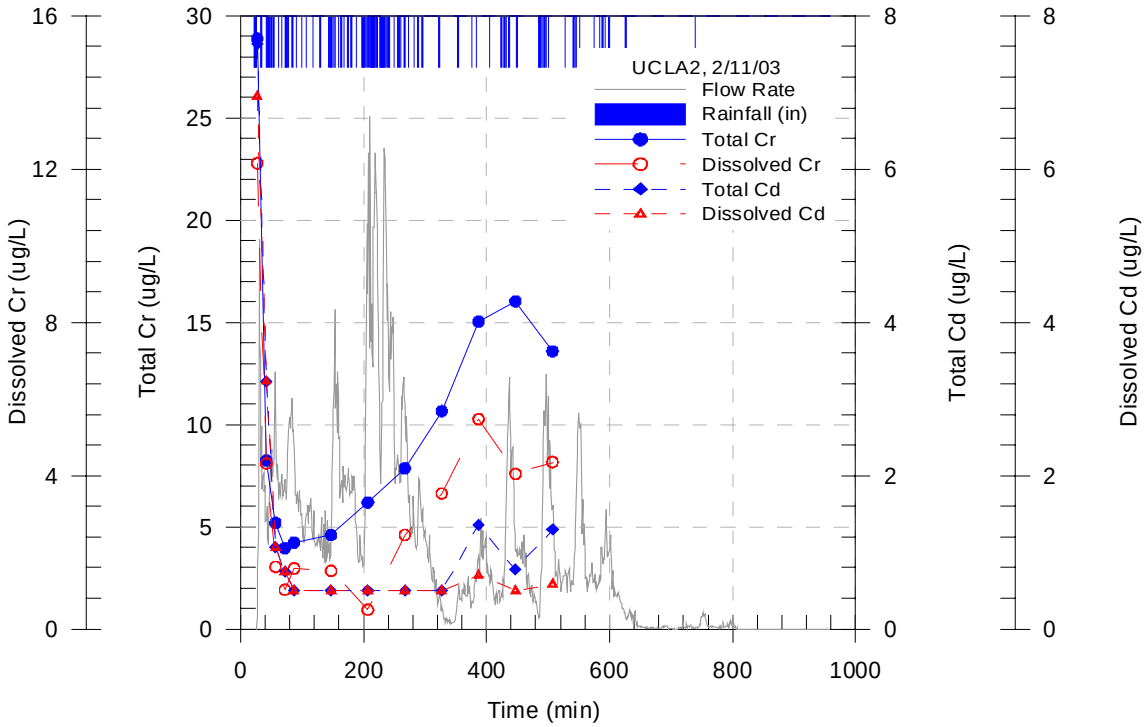

Figure I.4.2.5g[1] (Y4-UCLA2-E6-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

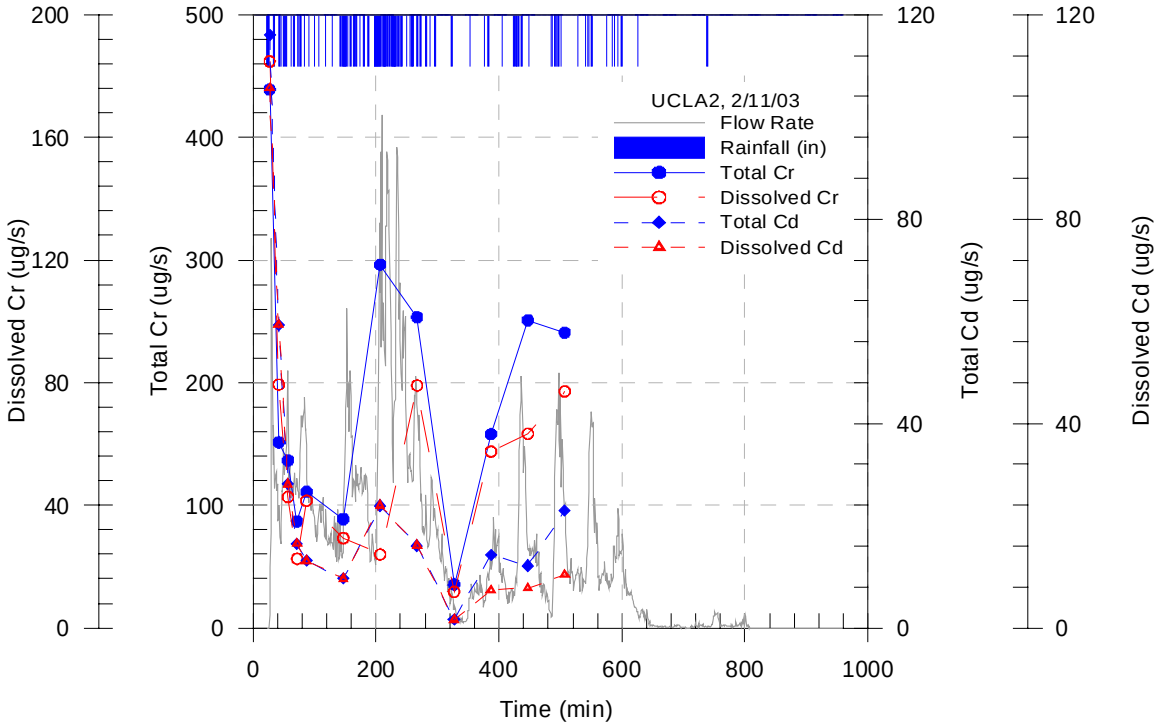

Figure I.4.2.5g[2] (Y4-UCLA2-E6-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

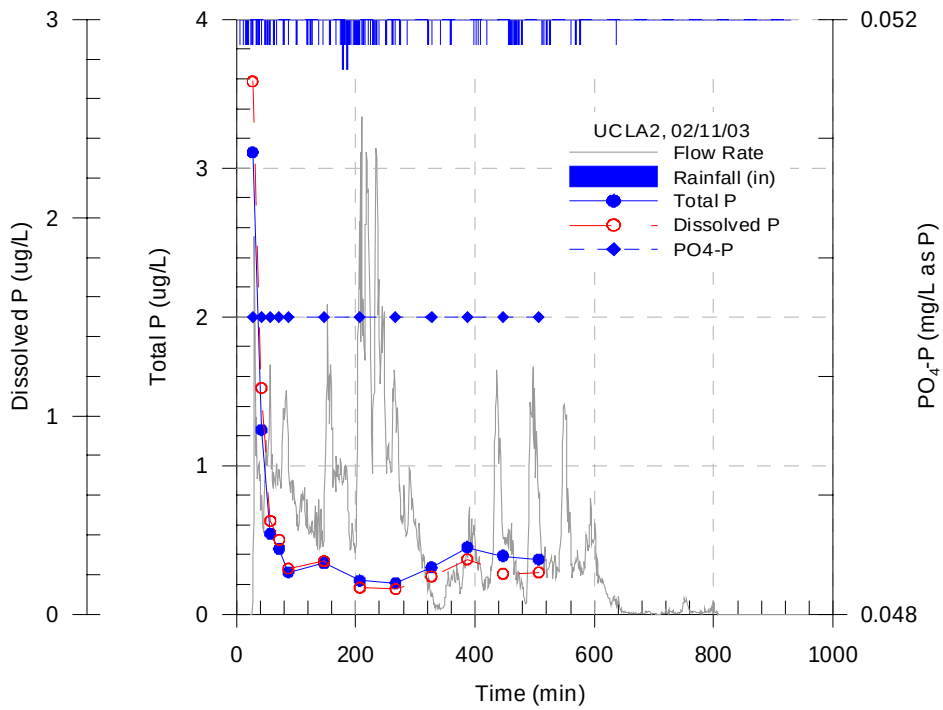

Figure I.4.2.5h[1] (Y4-UCLA2-E6-8). Polluto-graph for Total P / PO_4^{3-}-P

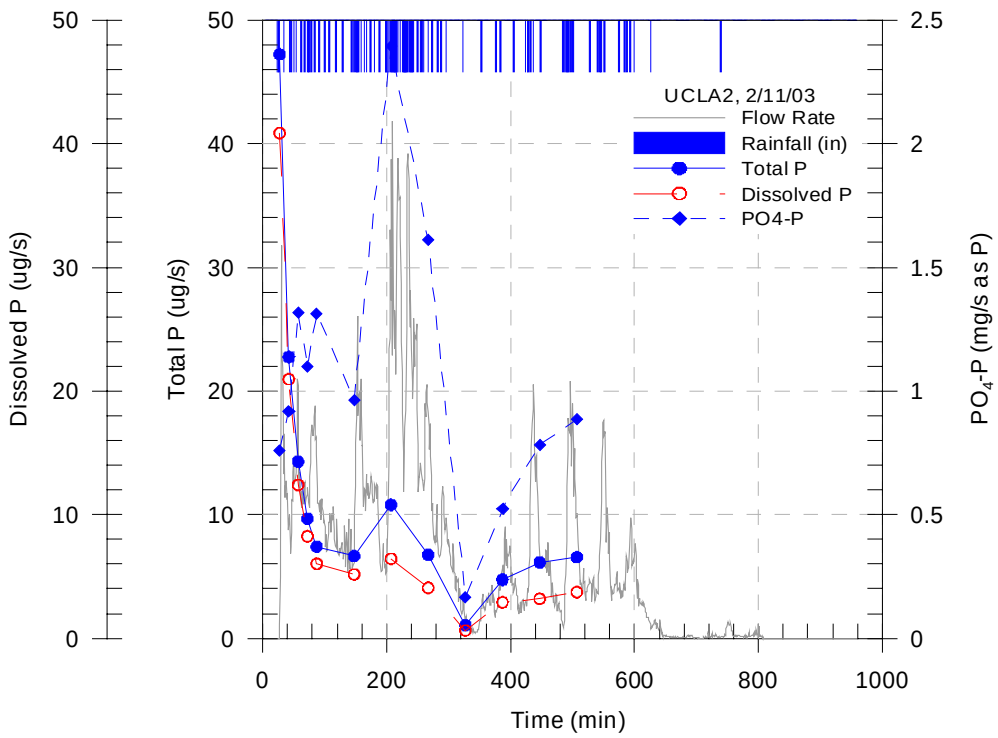

Figure I.4.2.5h[2] (Y4-UCLA2-E6-8). Load -graph for Total P / PO_4^{3-}P

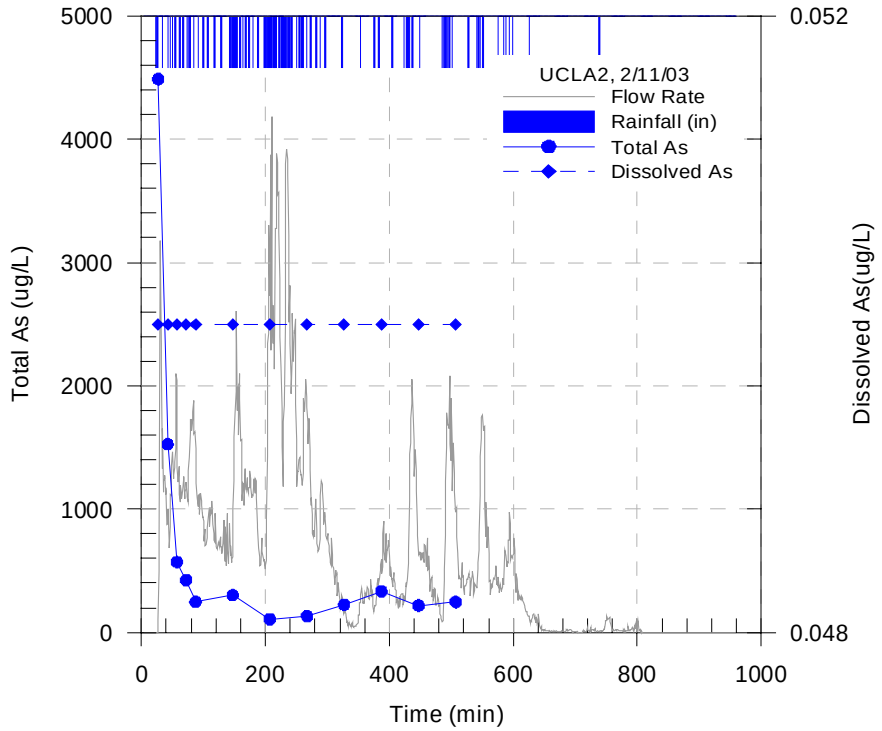

Figure I.4.2.5i[1] (Y4-UCLA2-E6-9). Polluto-graph for Total As / Dissolved As

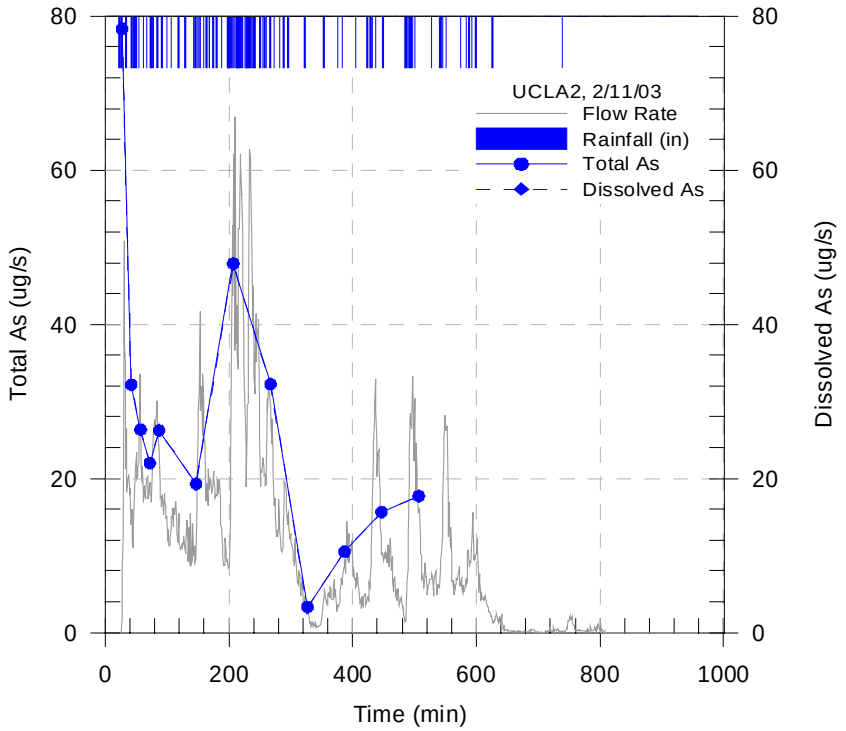

Figure I.4.2.5i[2] (Y4-UCLA2-E6-9). Load -graph for Total As / Dissolved As

9. UCLA2, 4/14/03

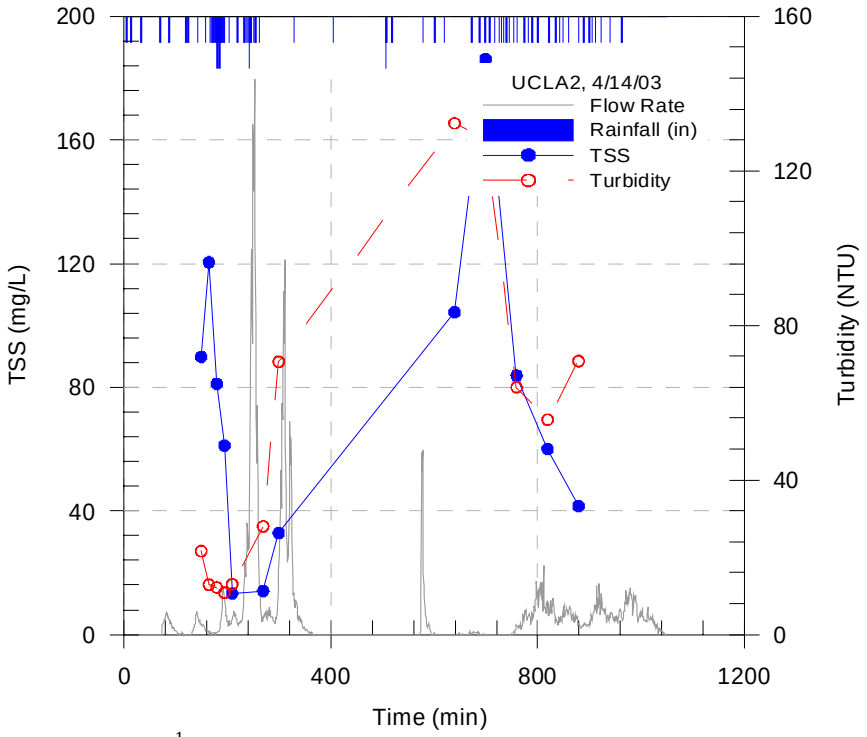

Figure I.4.2.6a[1] (Y4-UCLA2-E9-1). Polluto-graph for TSS and Turbidity

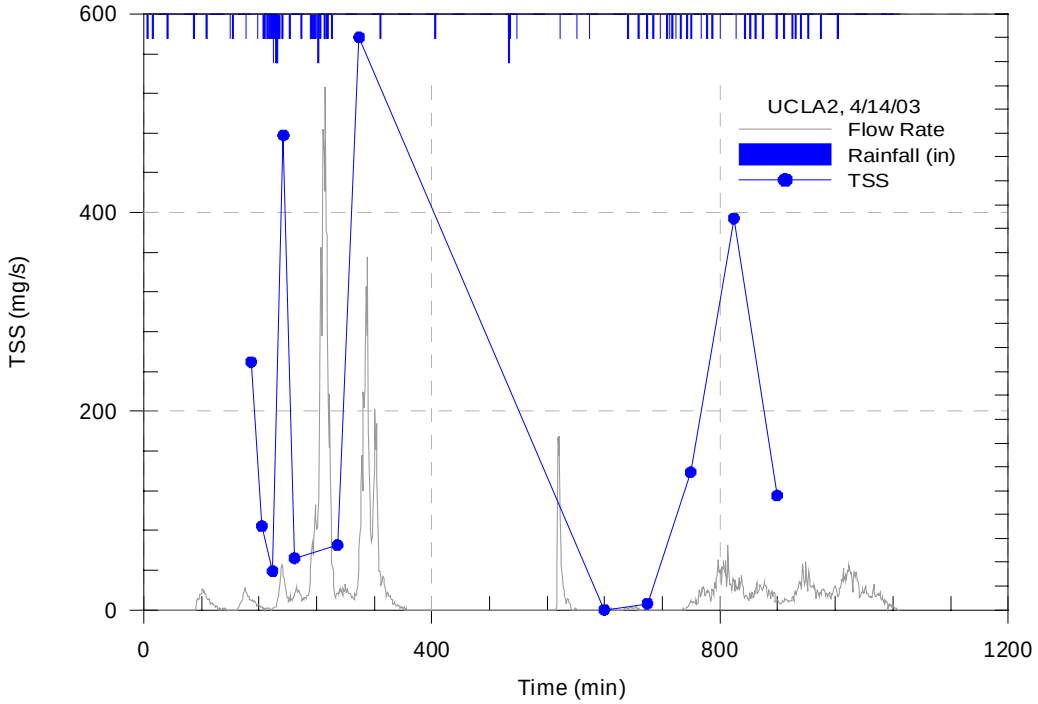

Figure I.4.2.6a[2] (Y4-UCLA2-E9-1). Load-graph for TSS

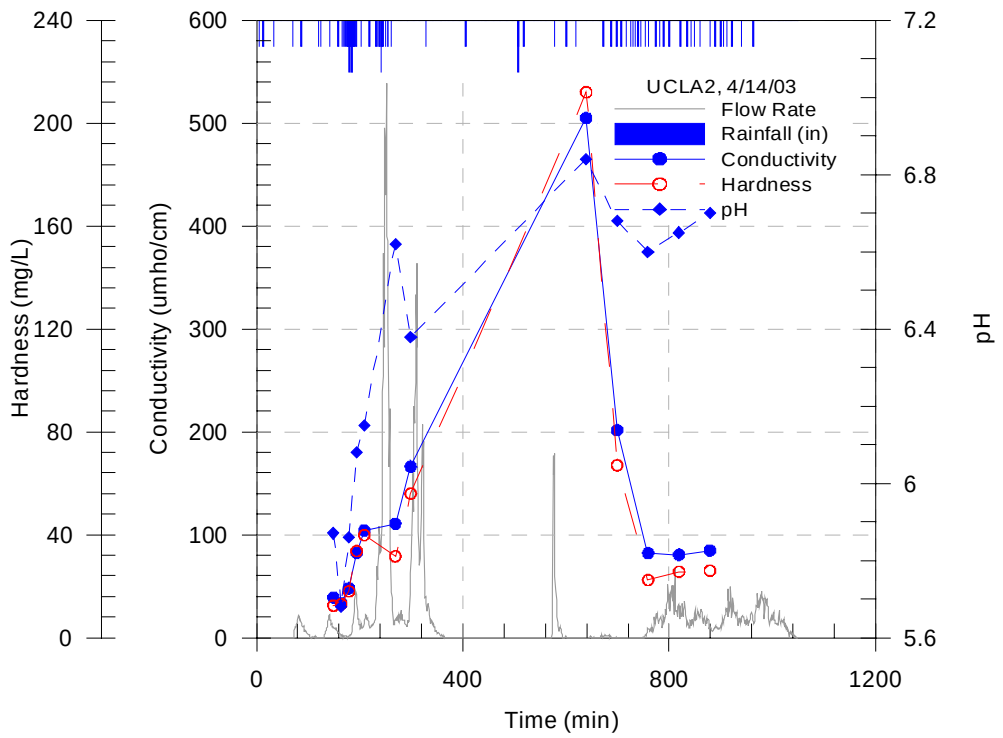

Figure I.4.2.6b[1] (Y4-UCLA2-E9-2). Polluto-graph for Conductivity, Hardness and pH

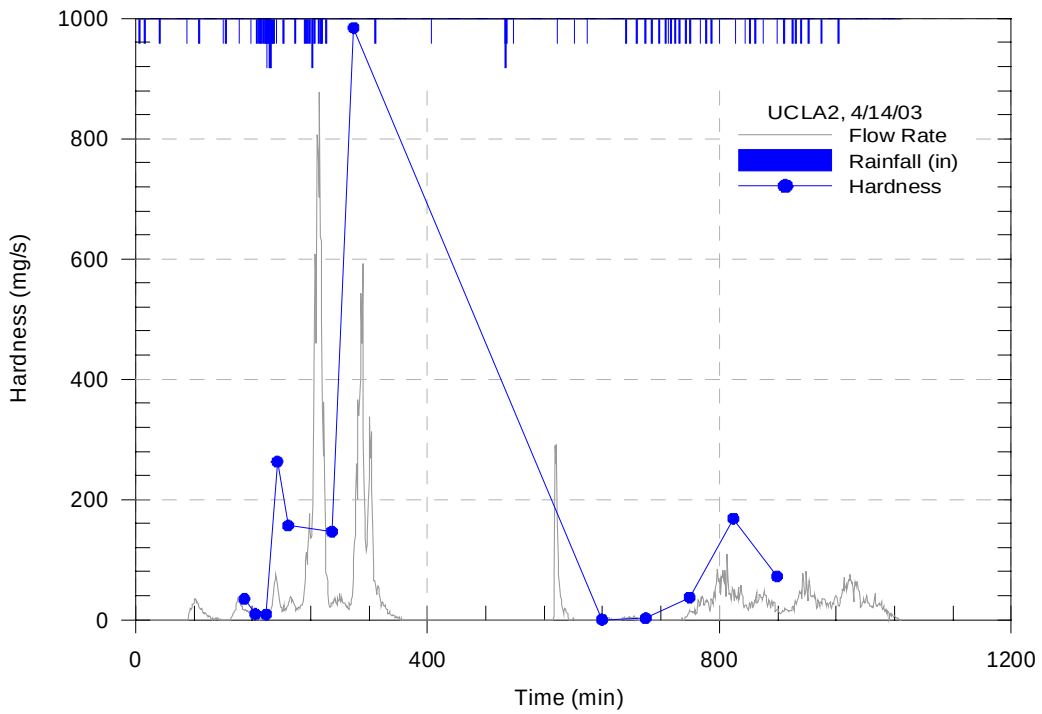

Figure I.4.2.6b[2] (Y4-UCLA2-E9-2). Load-graph for Hardness

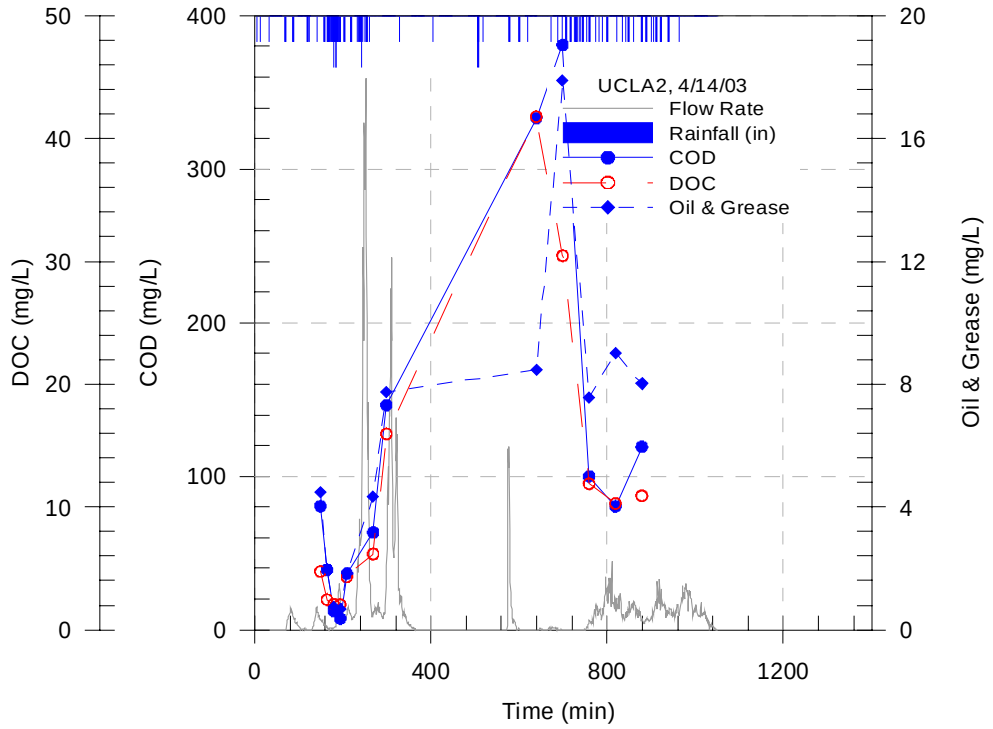

Figure I.4.2.6c[1] (Y4-UCLA2-E9-3). Polluto-graph for COD, DOC and Oil & Grease

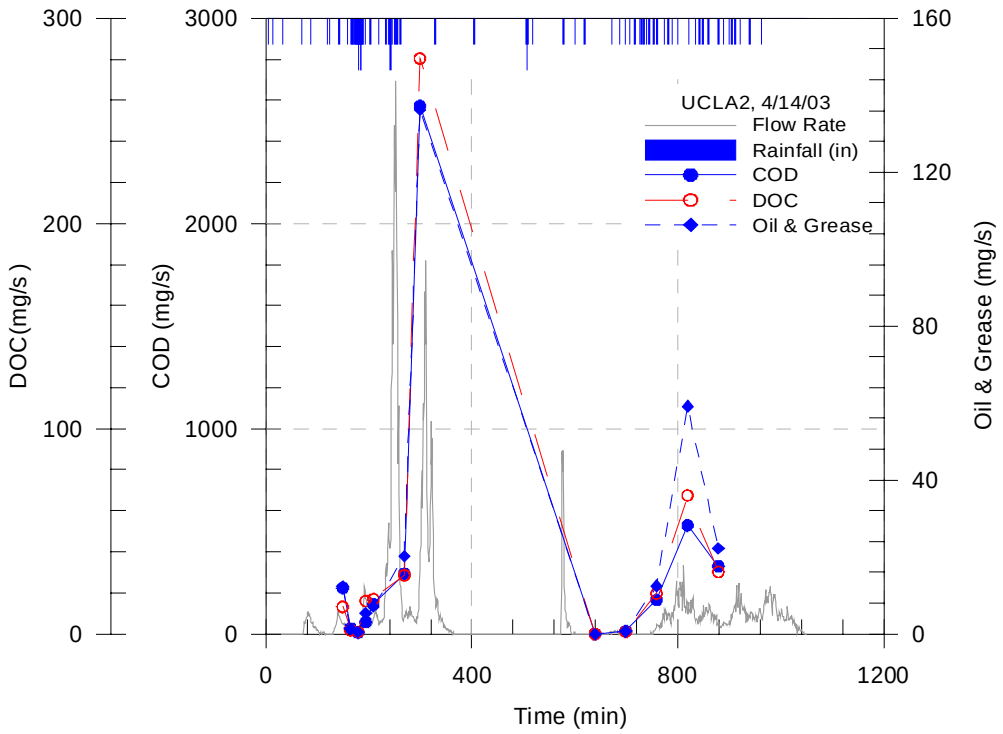

Figure I.4.2.6c[2] (Y4-UCLA2-E9-3). Load-graph for COD, DOC and Oil & Grease

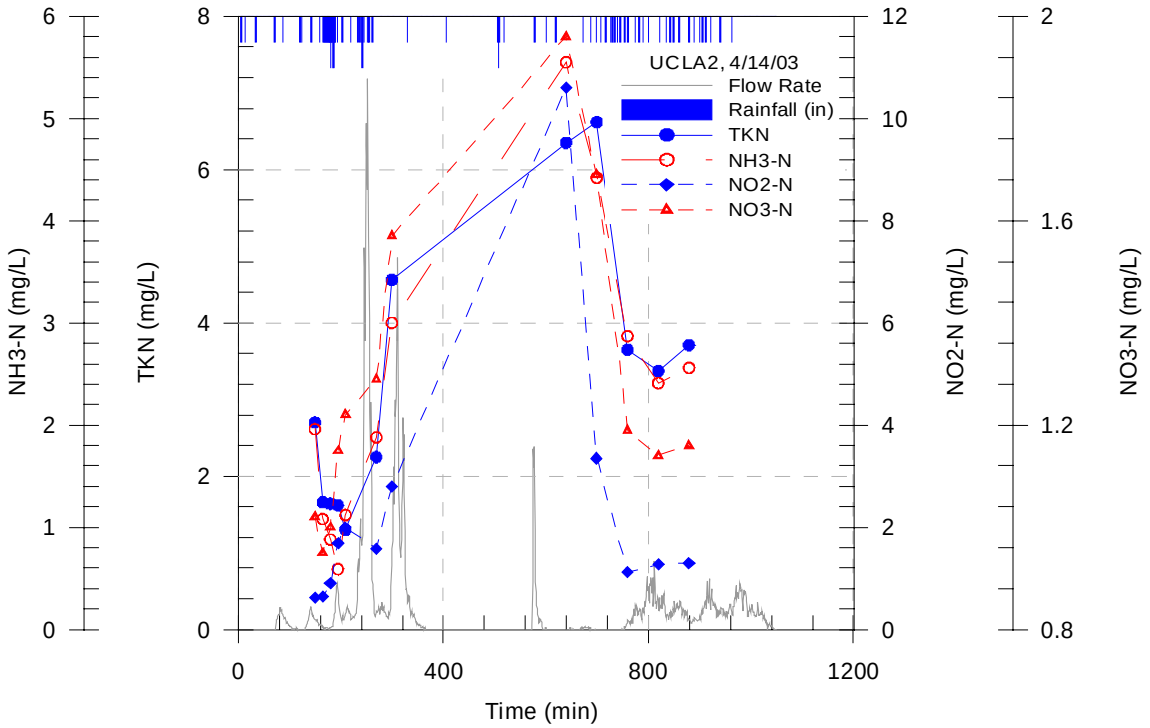

Figure I.4.2.6d[1] (Y4-UCLA2-E9-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

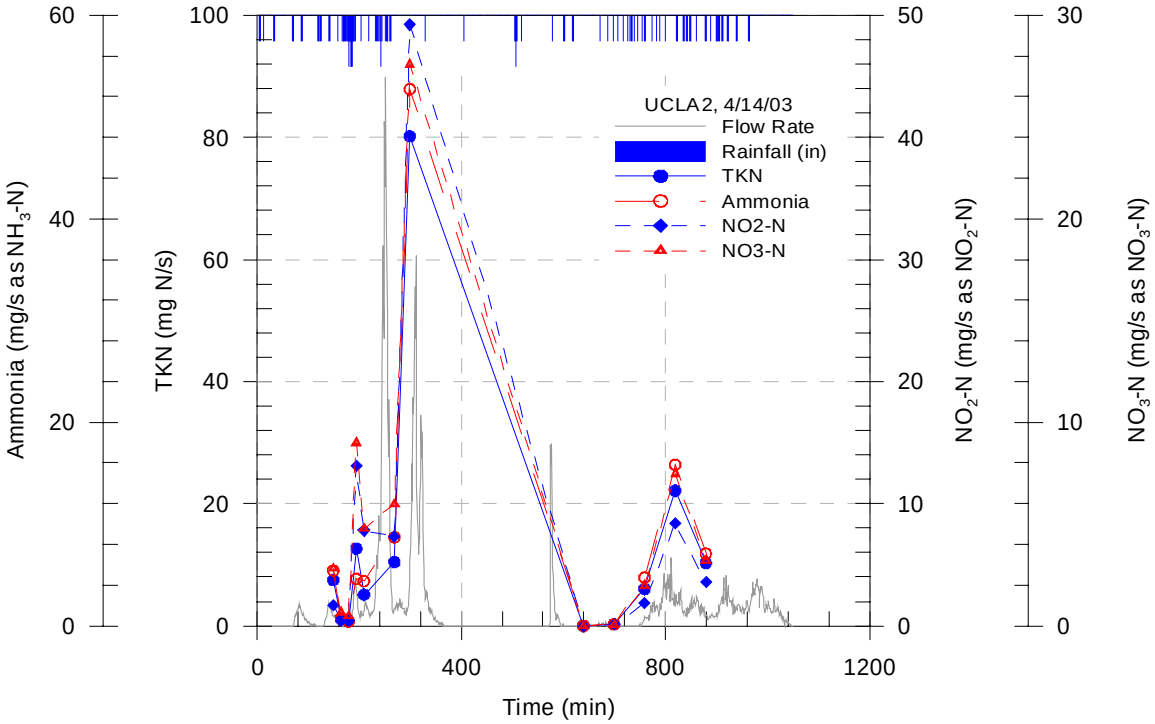

Figure I.4.2.6d[2] (Y4-UCLA2-E9-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

1. UCLA3, 11/07/02

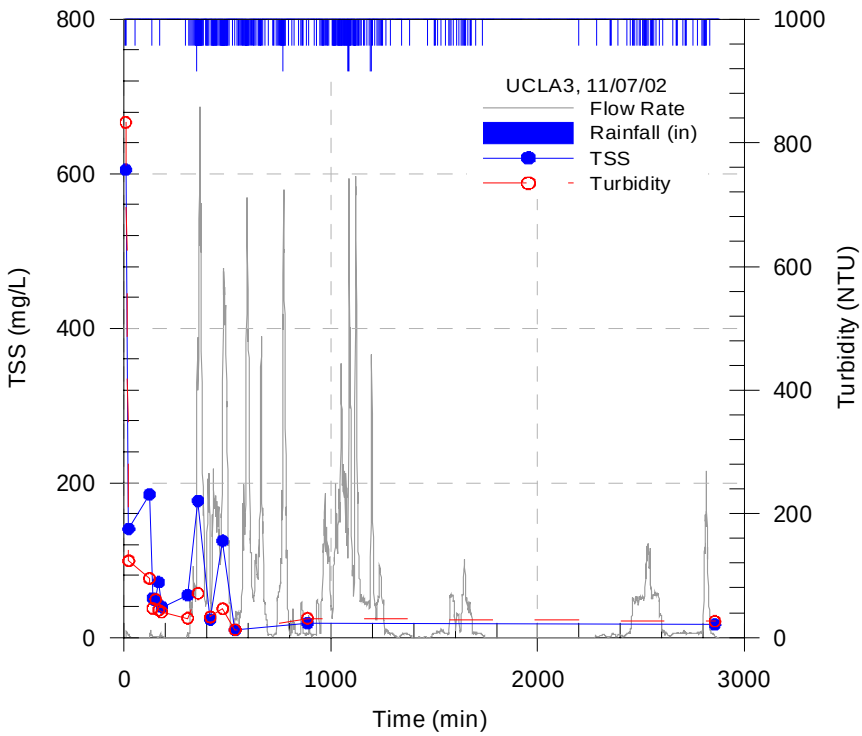

Figure I.4.3.1a[1] (Y4-UCLA3-E1-1). Polluto-graph for TSS and Turbidity

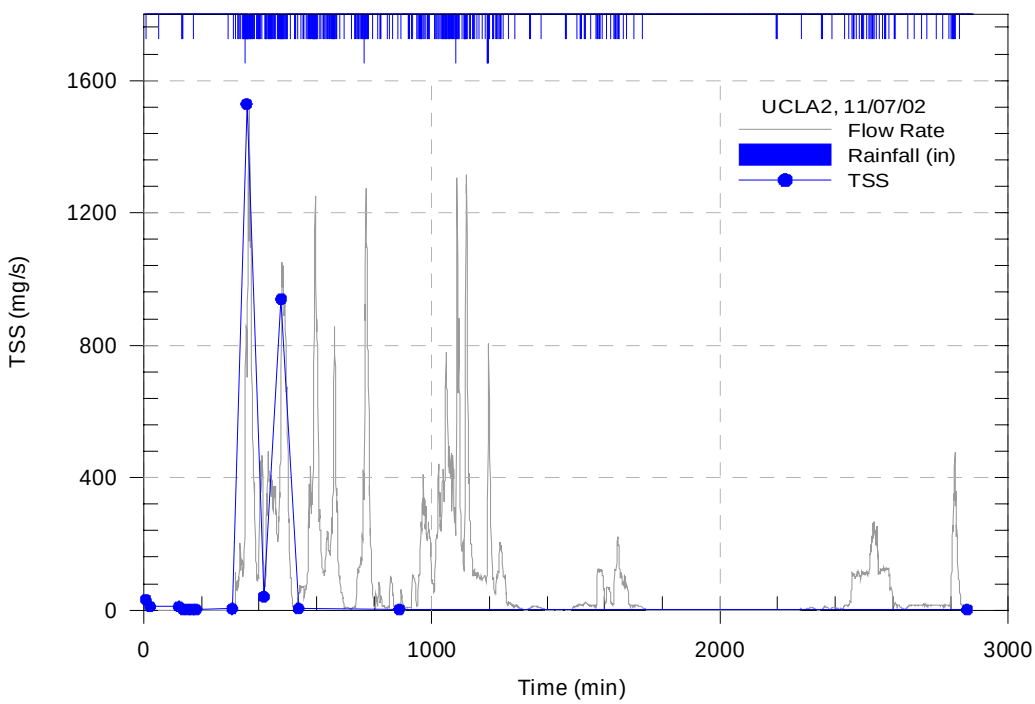

Figure I.4.3.1a[2] (Y4-UCLA3-E1-1). Load-graph for TSS

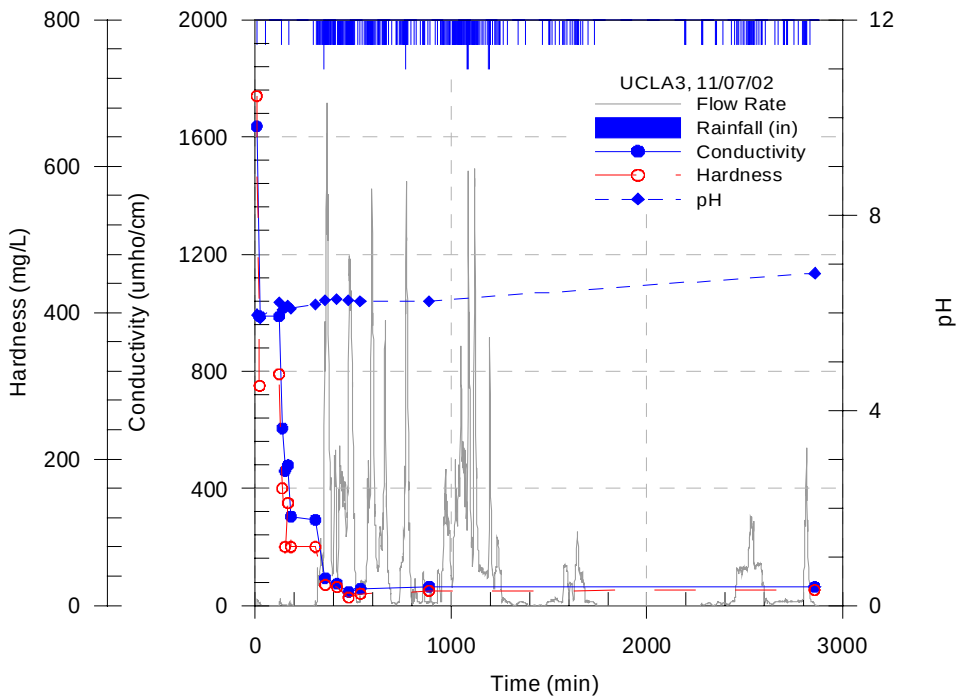

Figure I.4.3.1b[1] (Y4-UCLA3-E1-2). Polluto-graph for Conductivity, Hardness and pH

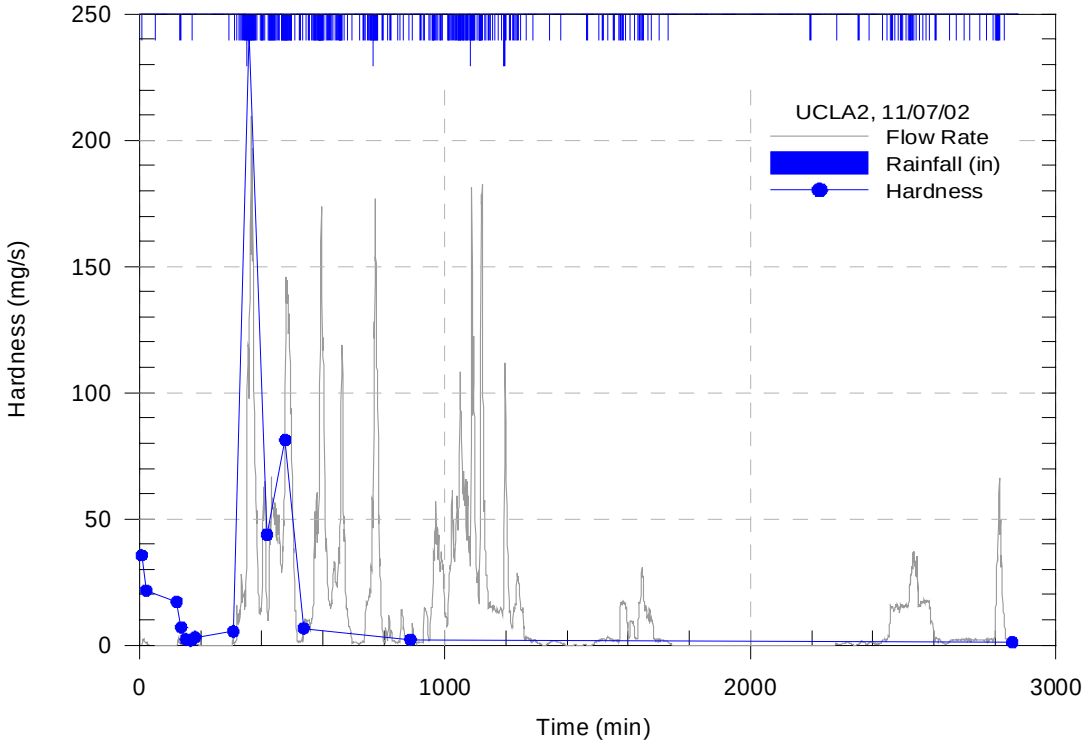

Figure I.4.3.1b[2] (Y4-UCLA3-E1-2). Load-graph for Hardness

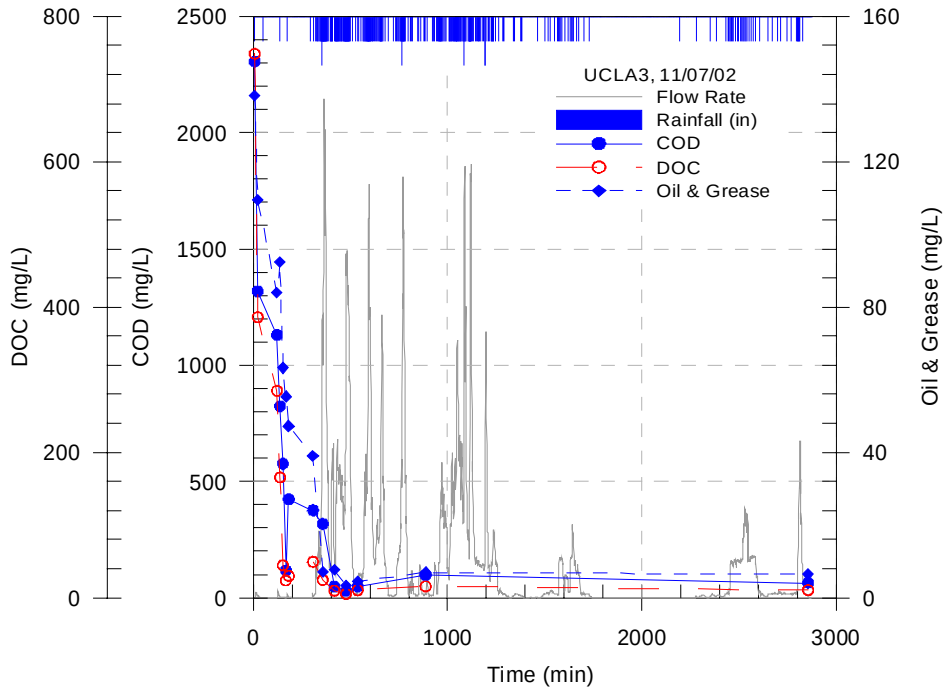

Figure I.4.3.1c[1] (Y4-UCLA3-E1-3). Polluto-graph for COD, DOC and Oil & Grease

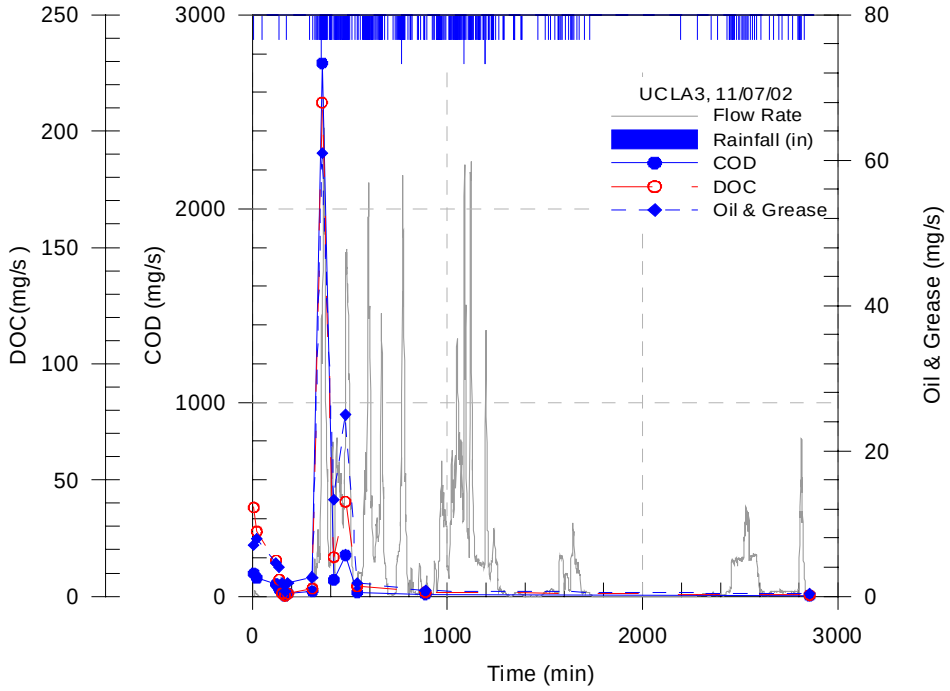

Figure I.4.3.1c[2] (Y4-UCLA3-E1-3). Load-graph for COD, DOC and Oil & Grease

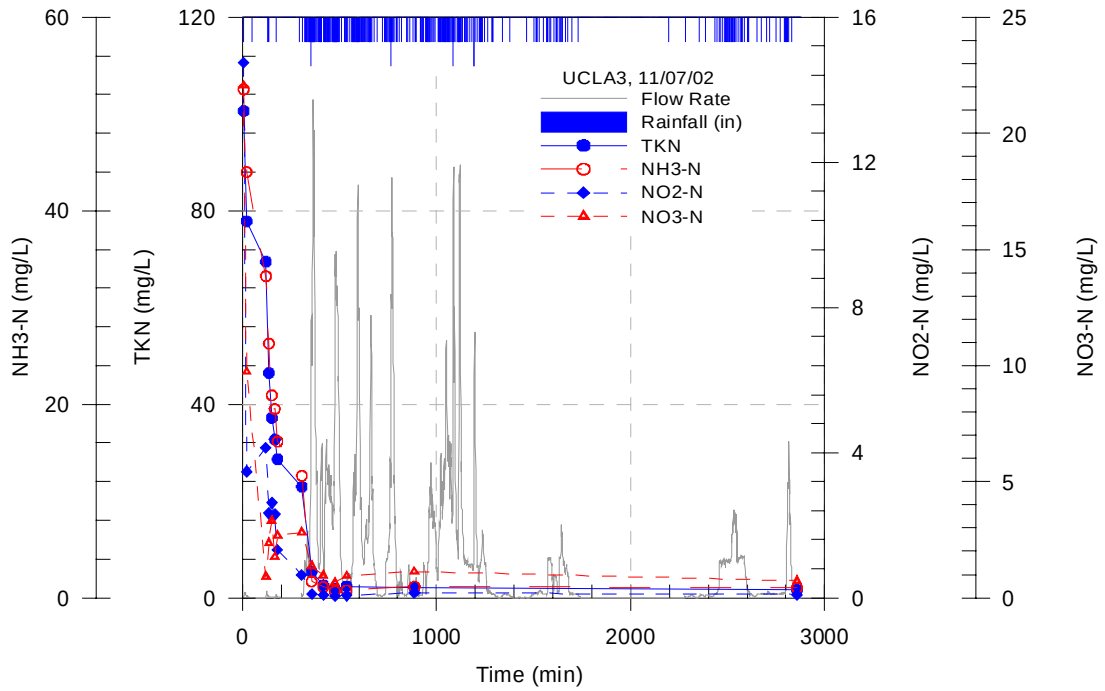

Figure I.4.3.1d[1] (Y4-UCLA3-E1-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

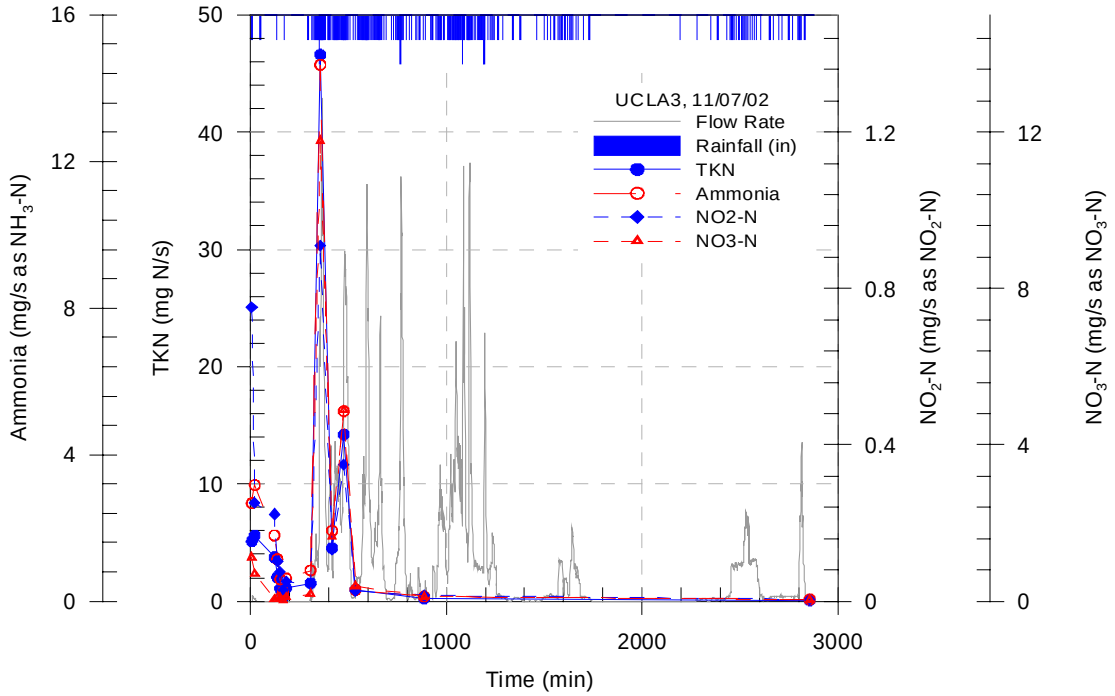

Figure I.4.3.1d[2] (Y4-UCLA3-E1-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

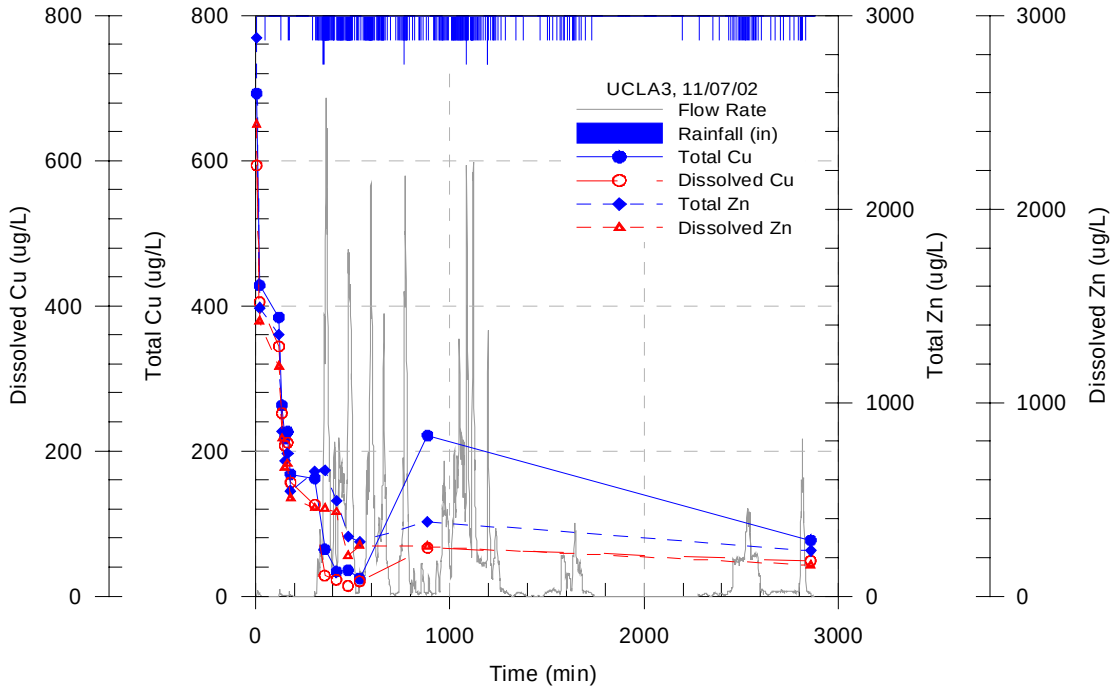

Figure I.4.3.1e[1] (Y4-UCLA3-E1-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

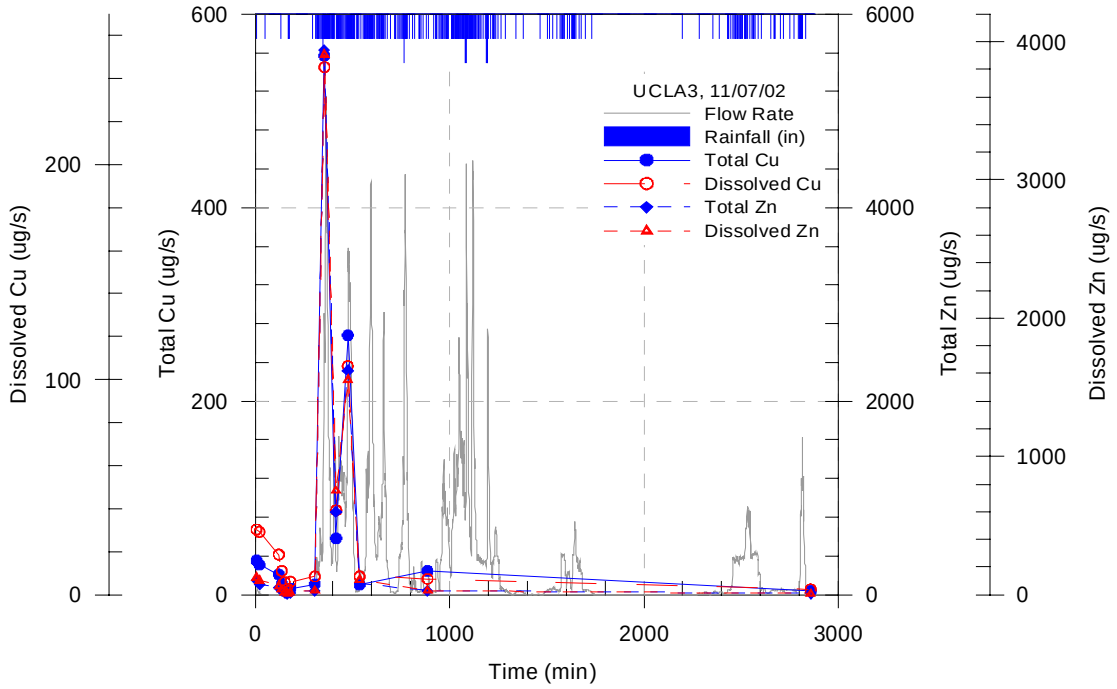

Figure I.4.3.1e[2] (Y4-UCLA3-E1-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

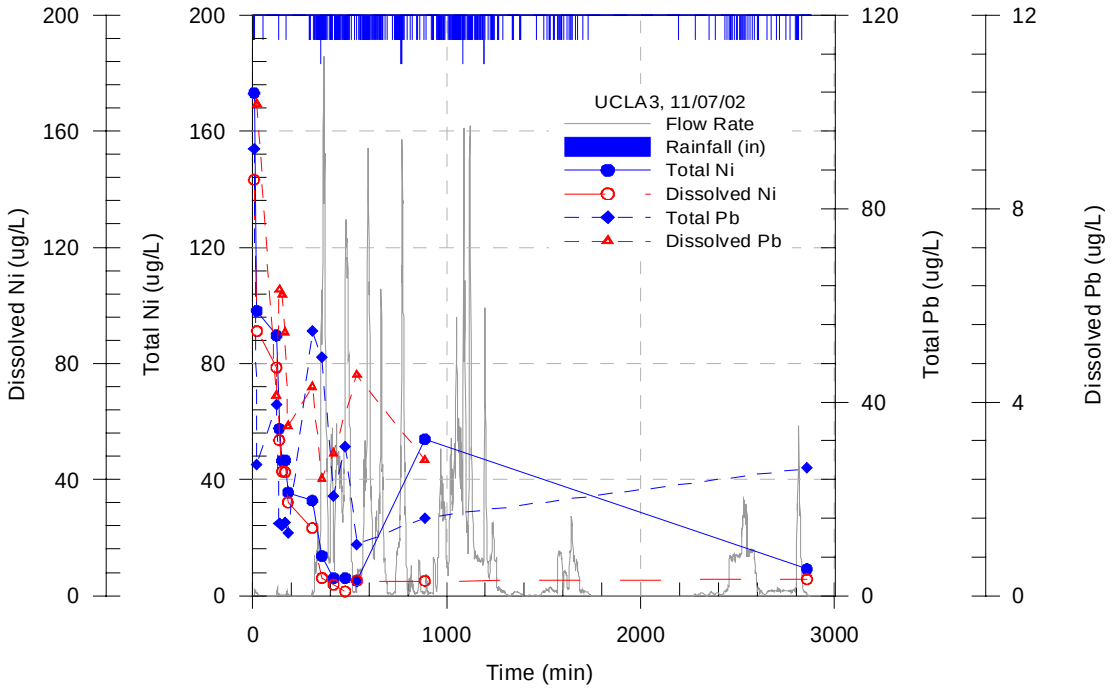

Figure I.4.3.1f[1] (Y4-UCLA3-E1-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

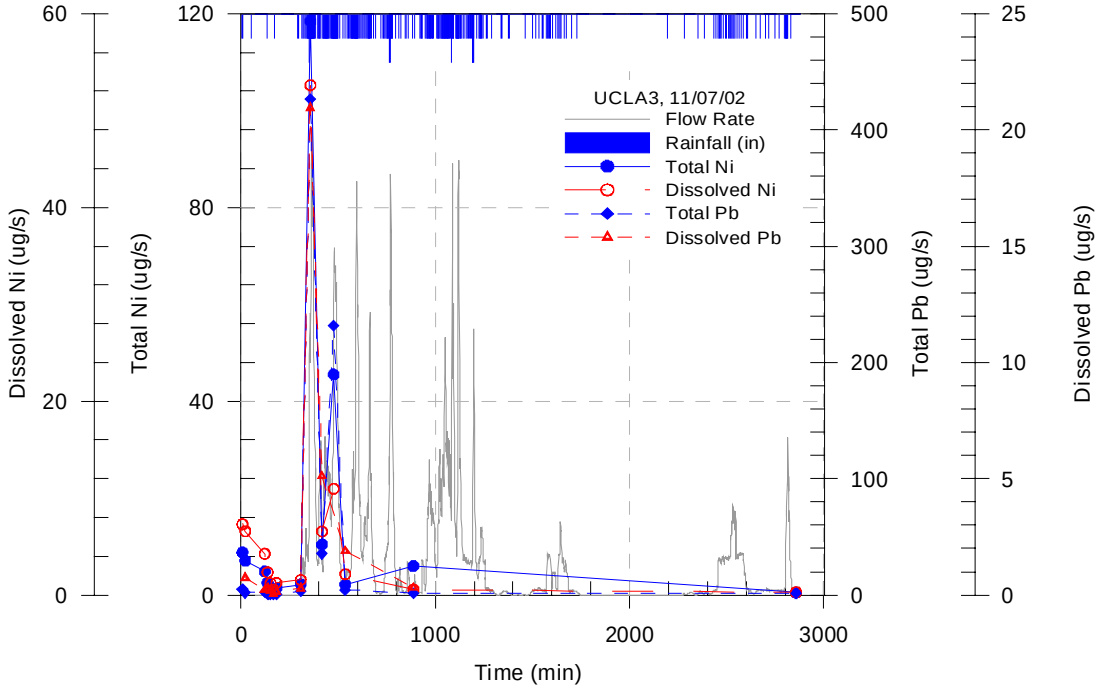

Figure I.4.3.1f[2] (Y4-UCLA3-E1-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

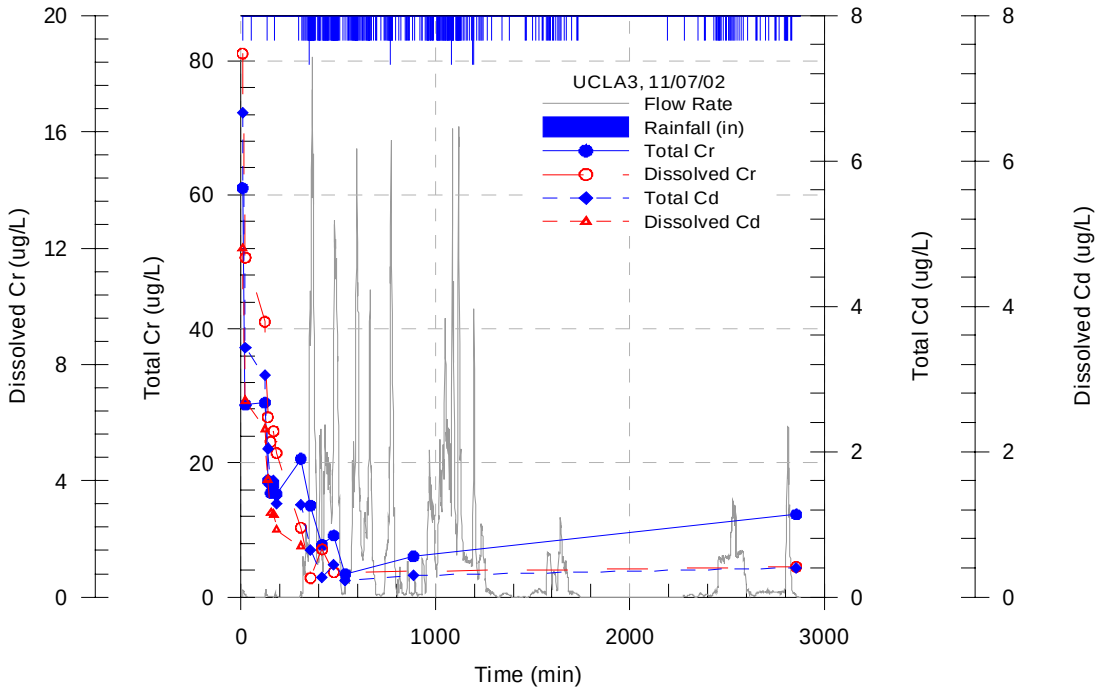

Figure I.4.3.1g[1] (Y4-UCLA3-E1-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

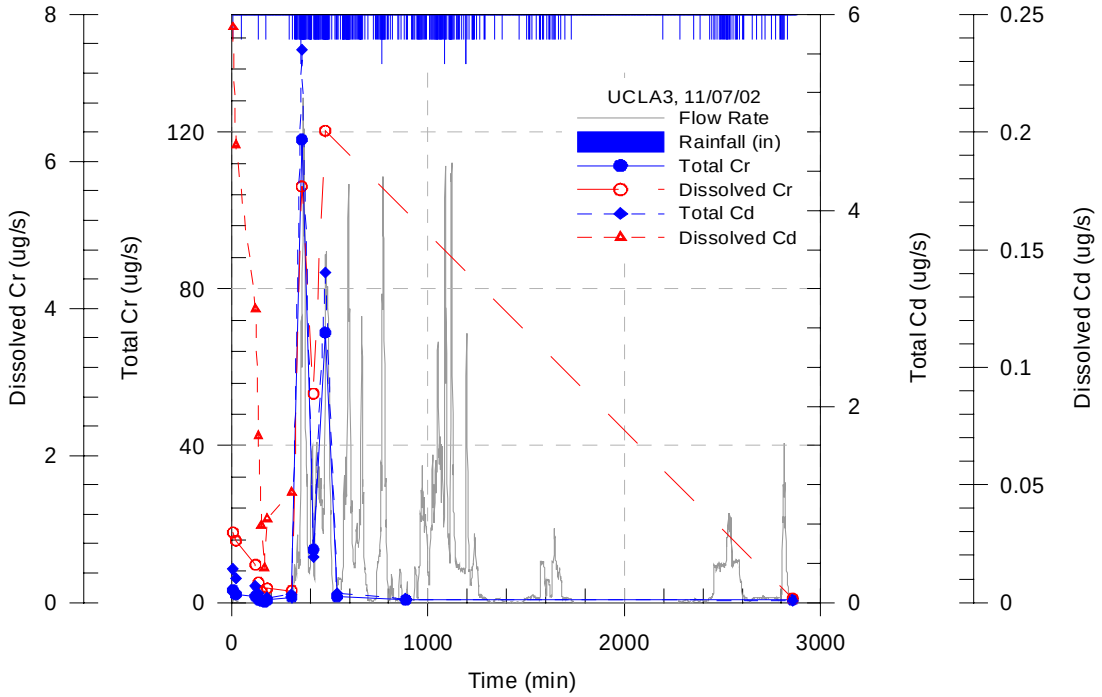

Figure I.4.3.1g[2] (Y4-UCLA3-E1-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

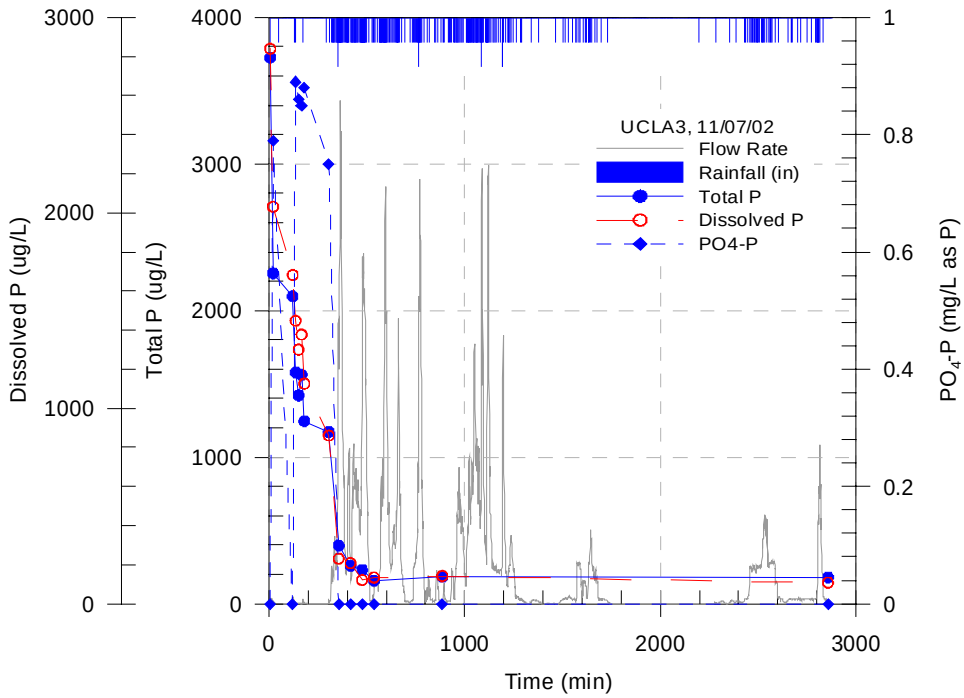

Figure I.4.3.1h[1] (Y4-UCLA3-E1-8). Polluto-graph for Total P / PO_4^{3-}-P

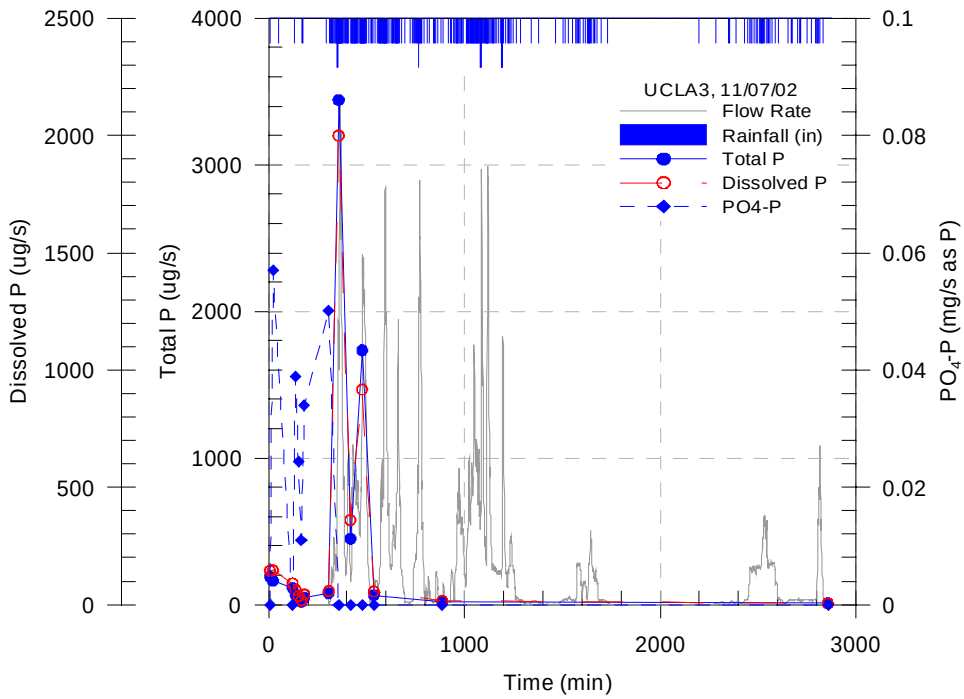

Figure I.4.3.1h[2] (Y4-UCLA3-E1-8). Load -graph for Total P / PO_4^{3-}P

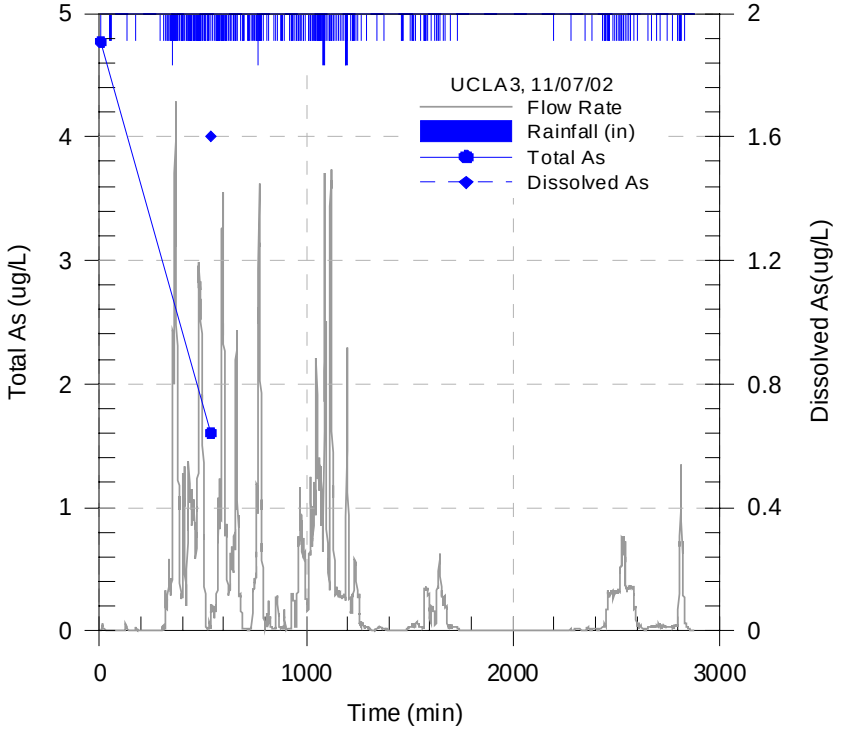

Figure I.4.3.1i[1] (Y4-UCLA3-E1-9). Polluto-graph for Total As / Dissolved As

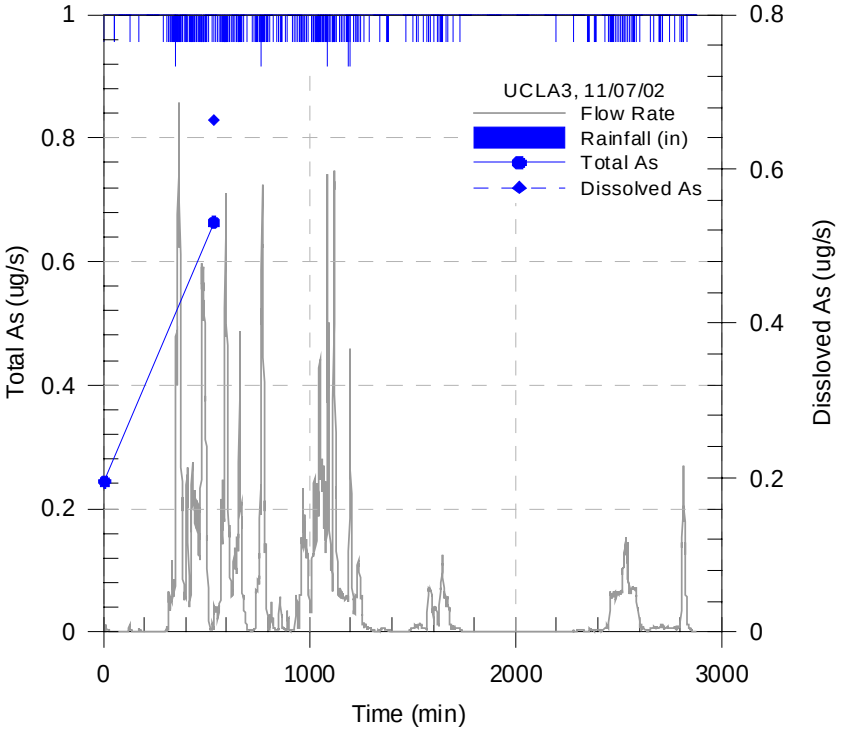

Figure I.4.3.1i[2] (Y4-UCLA3-E1-9). Load -graph for Total As / Dissolved As

2. UCLA3, 11/29/02

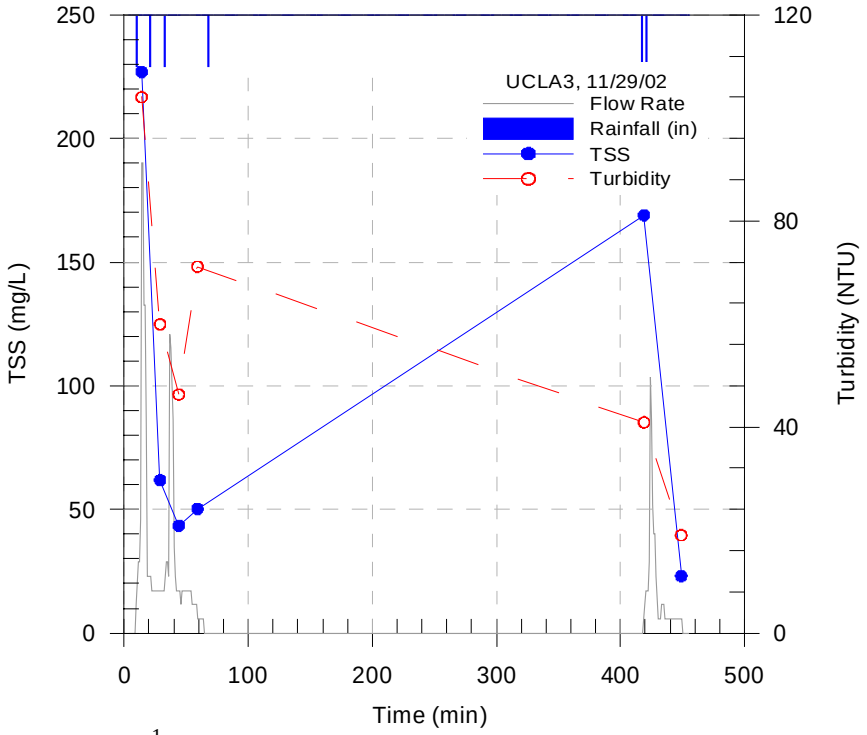

Figure I.4.3.2a[1] (Y4-UCLA3-E1-1). Polluto-graph for TSS and Turbidity

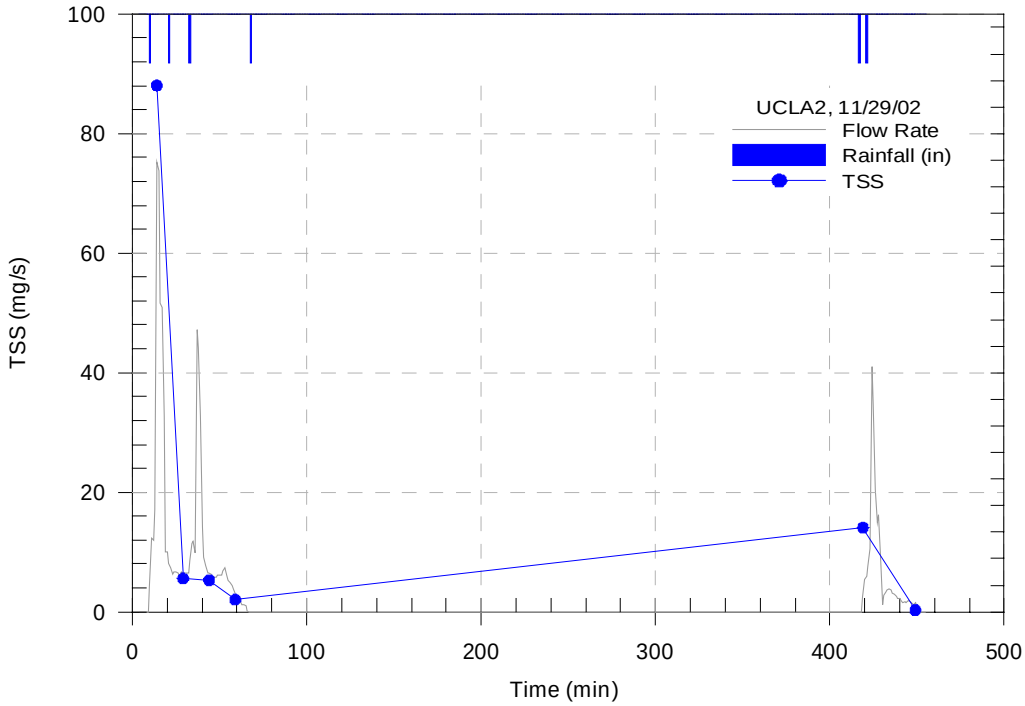

Figure I.4.3.2a[2] (Y4-UCLA3-E1-1). Load-graph for TSS

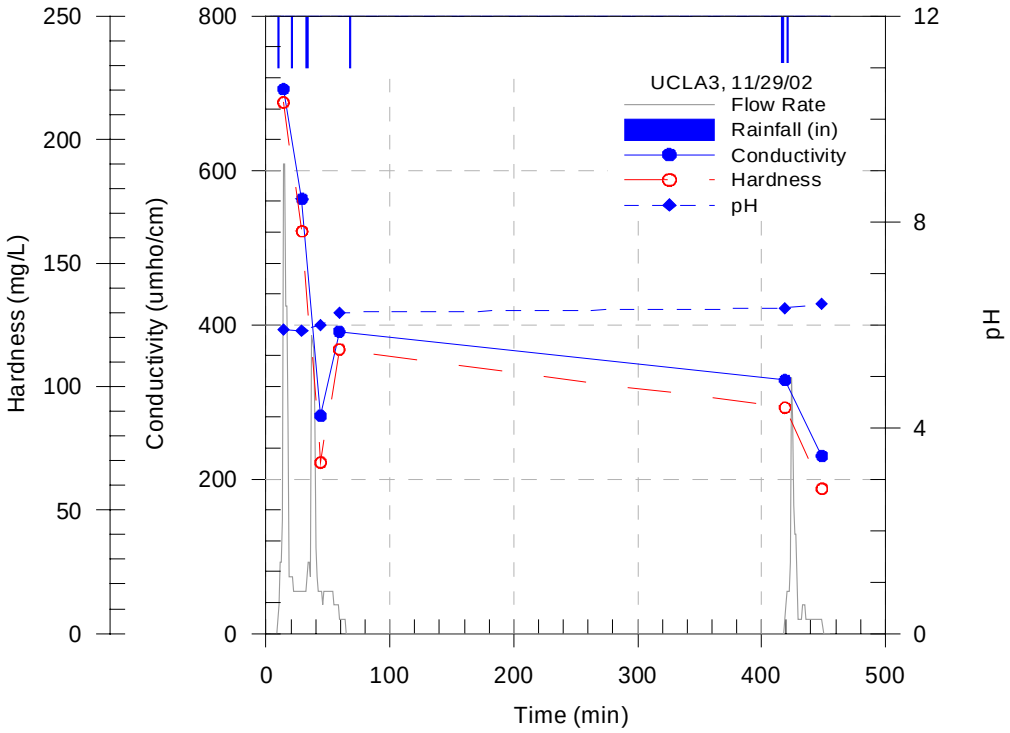

Figure I.4.3.2b[1] (Y4-UCLA3-E1-2). Polluto-graph for Conductivity, Hardness and pH

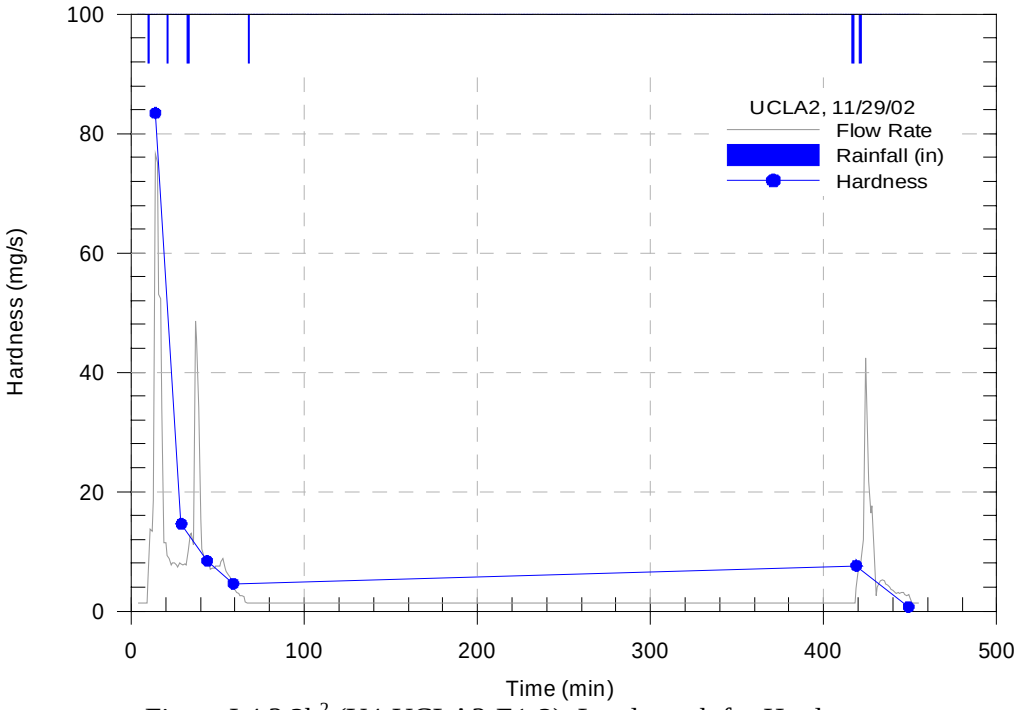

Figure I.4.3.2b[2] (Y4-UCLA3-E1-2). Load-graph for Hardness

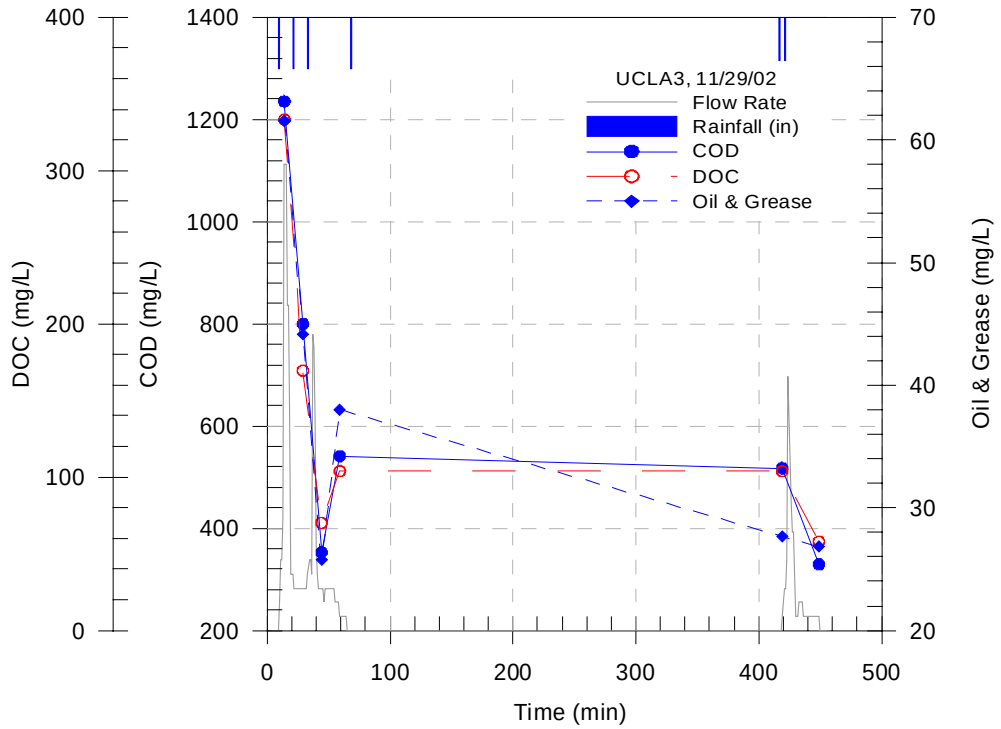

Figure I.4.3.2c[1] (Y4-UCLA3-E2-3). Polluto-graph for COD, DOC and Oil & Grease

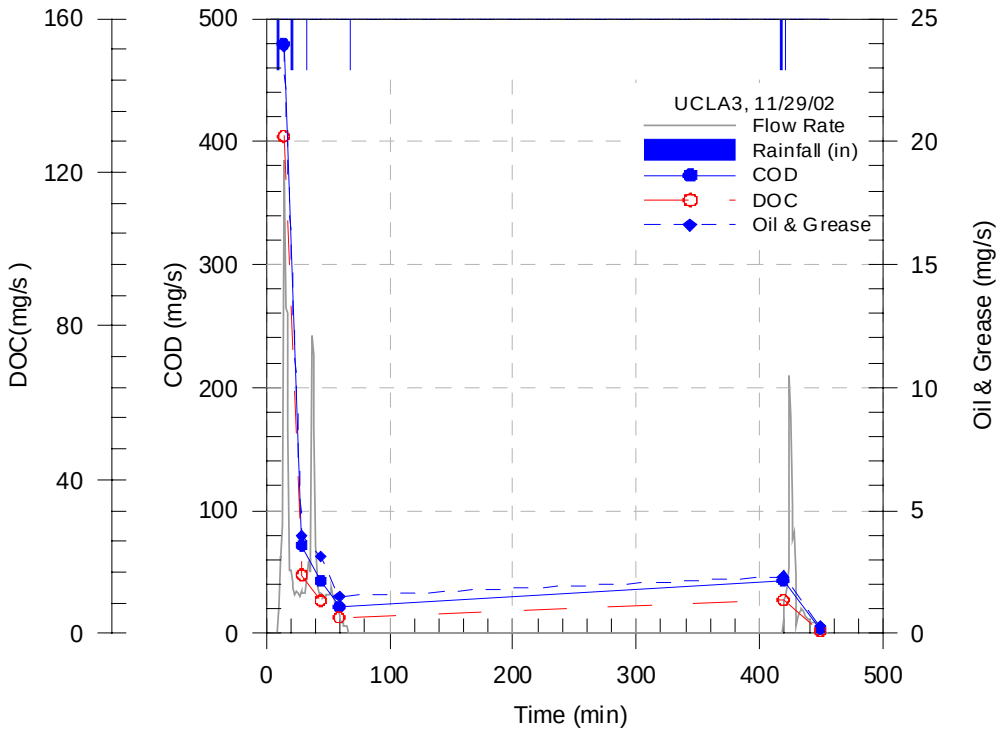

Figure I.4.3.2c[2] (Y4-UCLA3-E2-3). Load-graph for COD, DOC and Oil & Grease

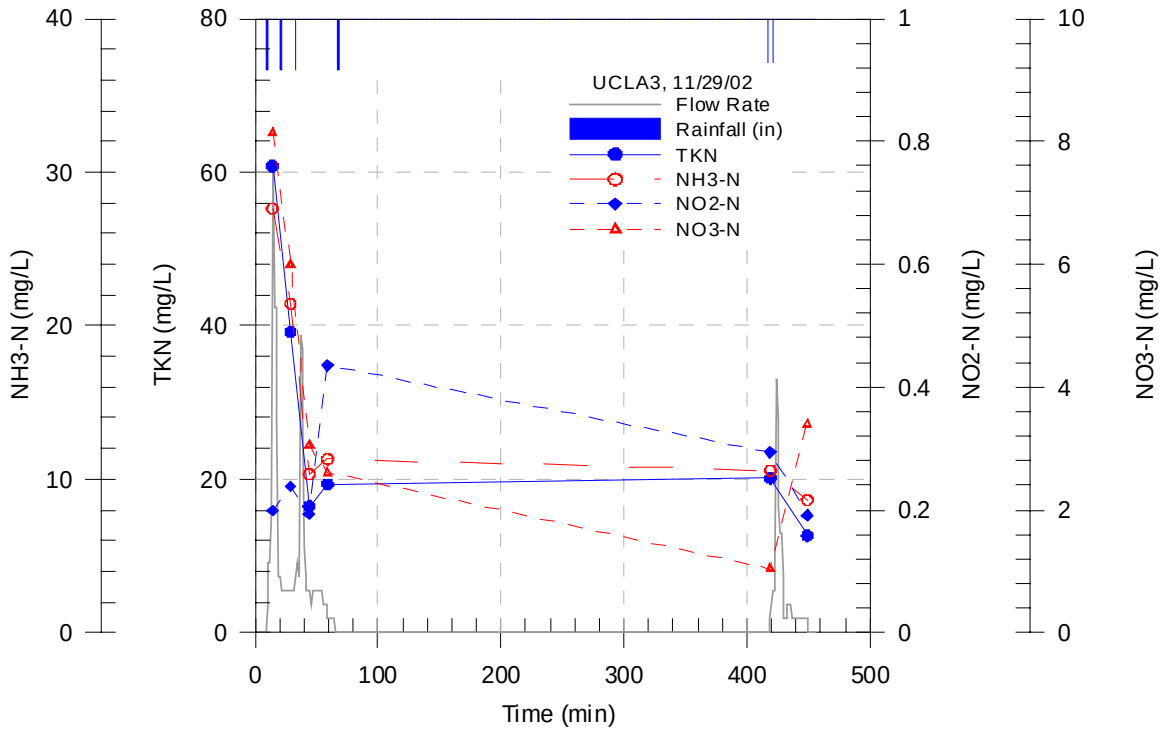

Figure I.4.3.2d[1] (Y4-UCLA3-E2-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

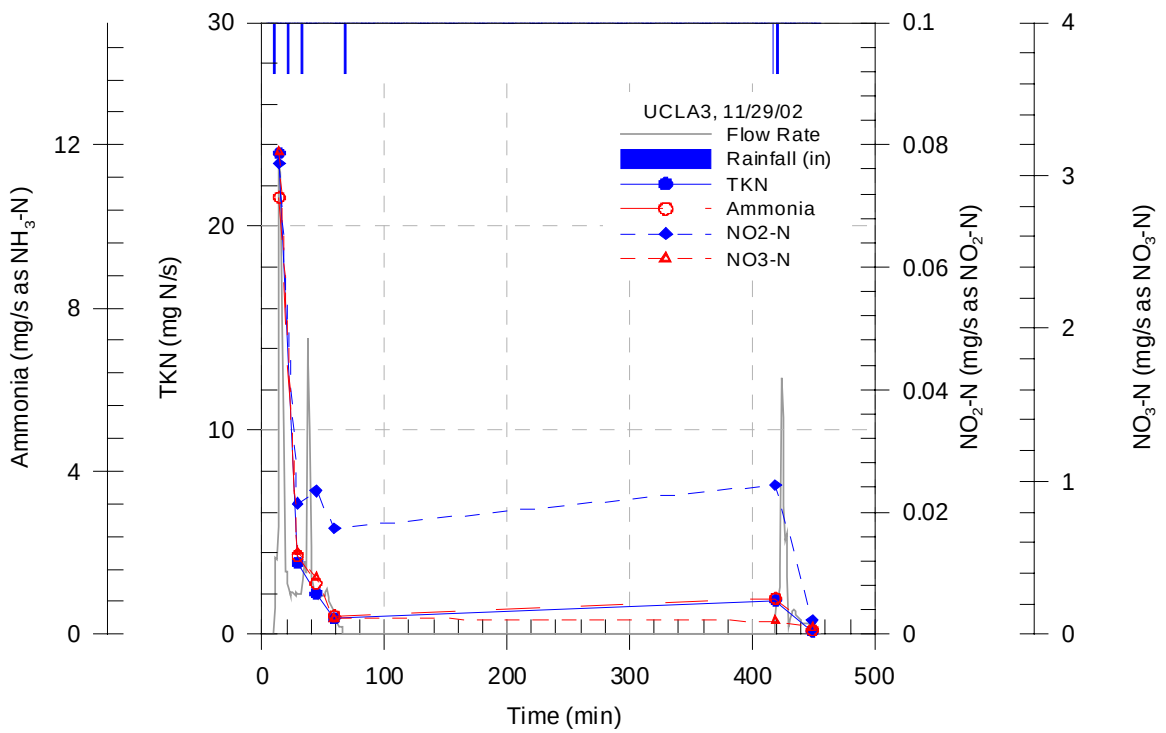

Figure I.4.3.2d[2] (Y4-UCLA3-E2-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

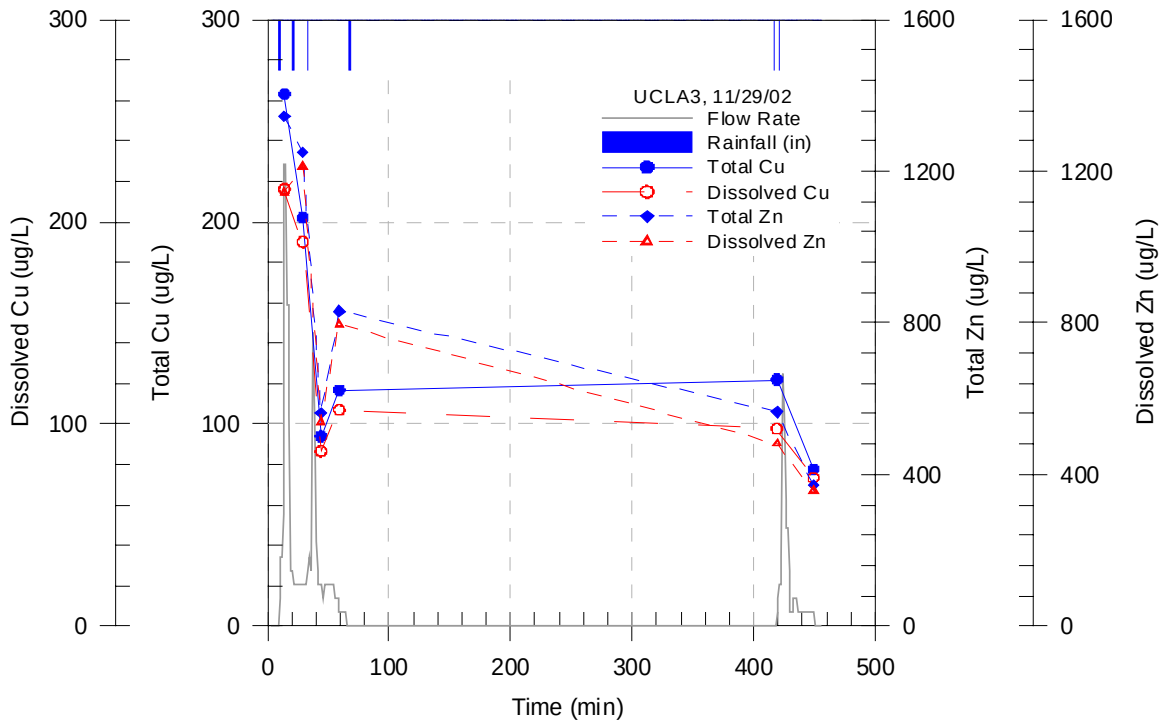

Figure I.4.3.2e[1] (Y4-UCLA3-E2-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

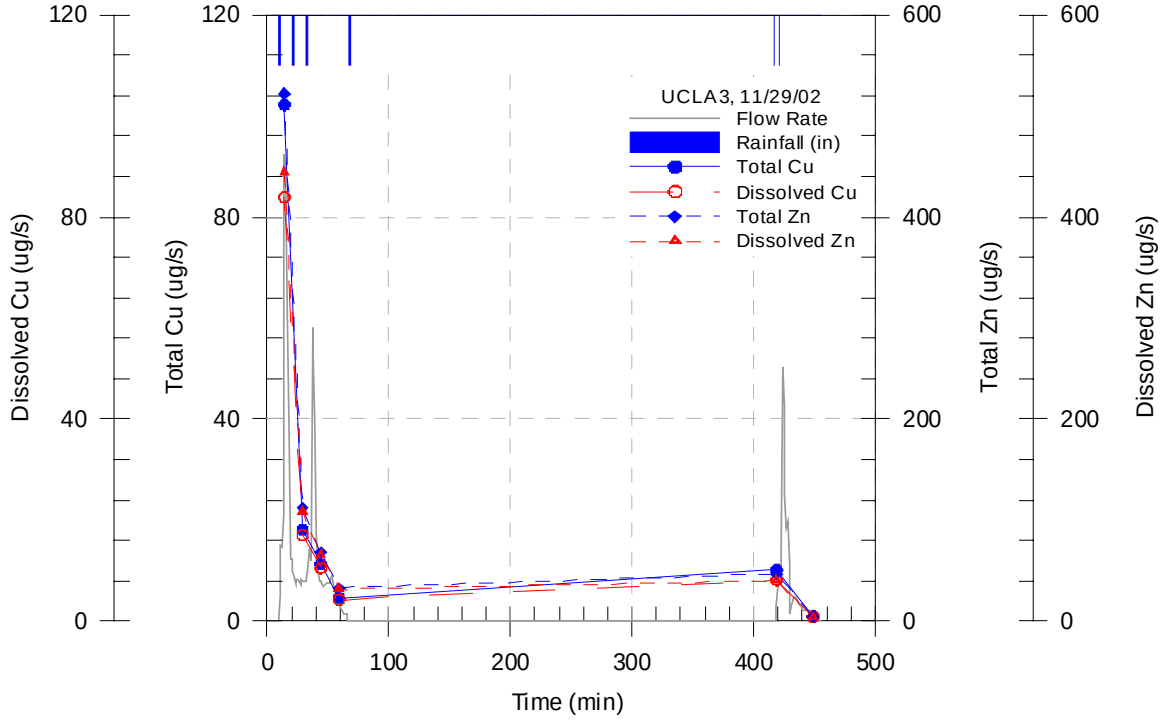

Figure I.4.3.2e[2] (Y4-UCLA3-E2-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

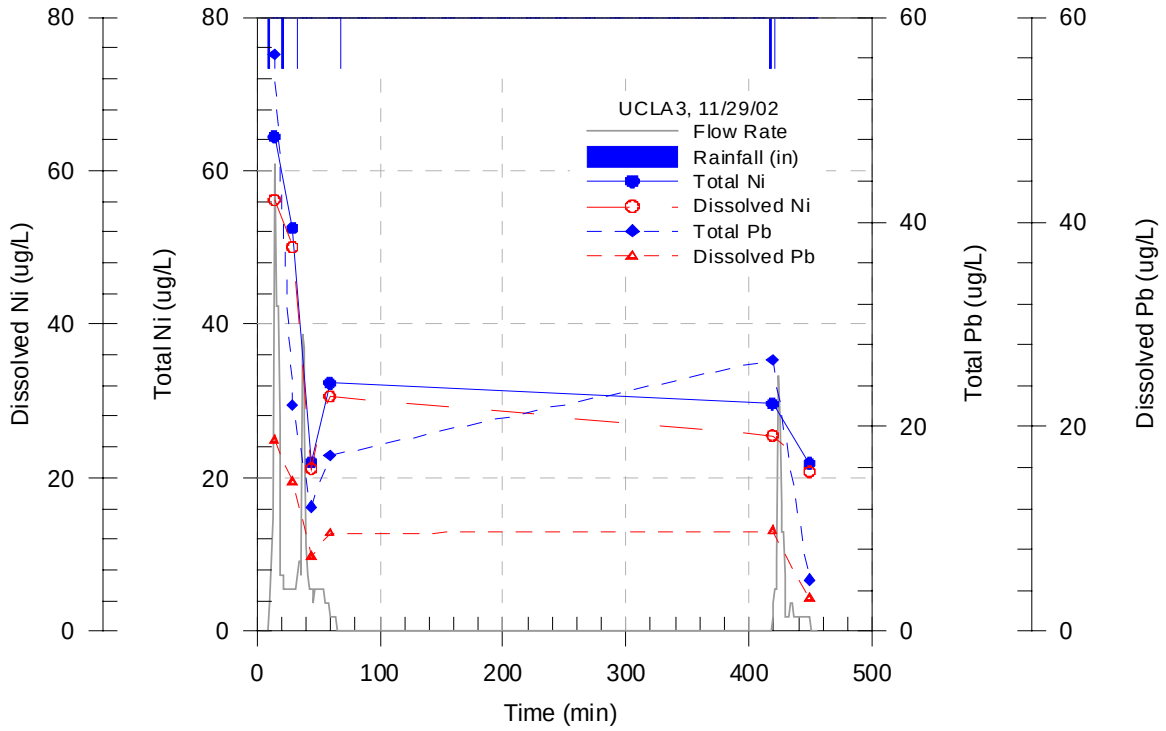

Figure I.4.3.2f[1] (Y4-UCLA3-E2-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

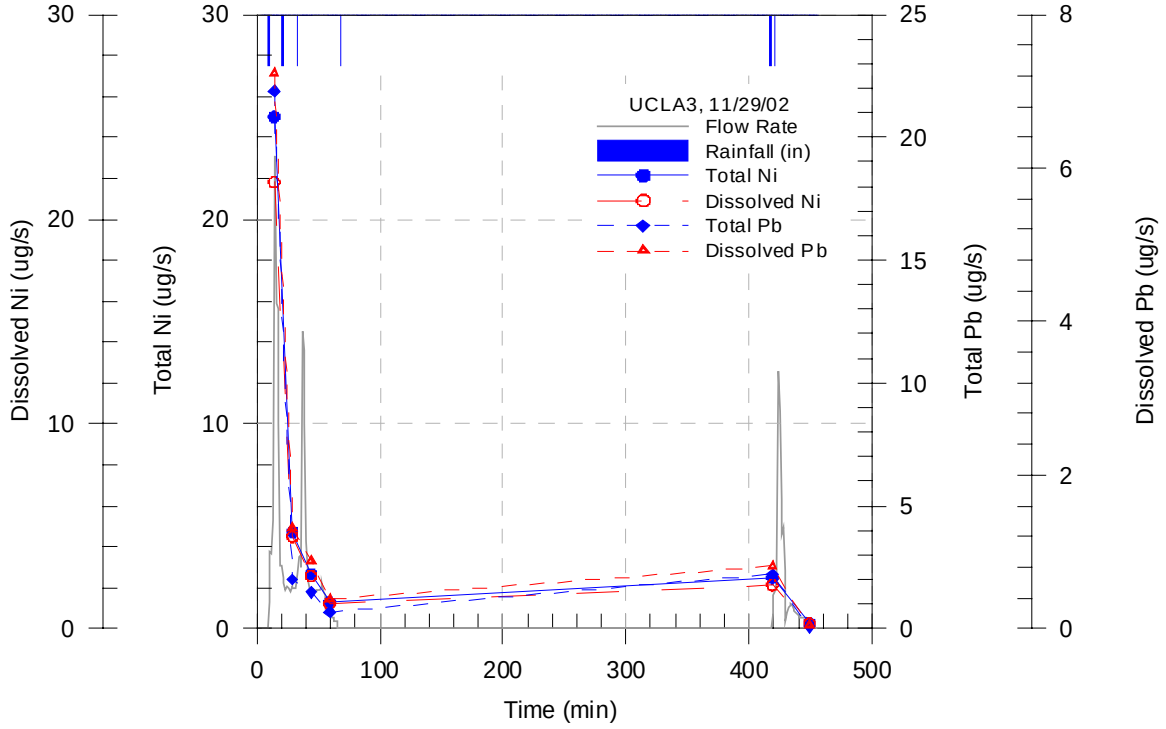

Figure I.4.3.2f[2] (Y4-UCLA3-E2-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

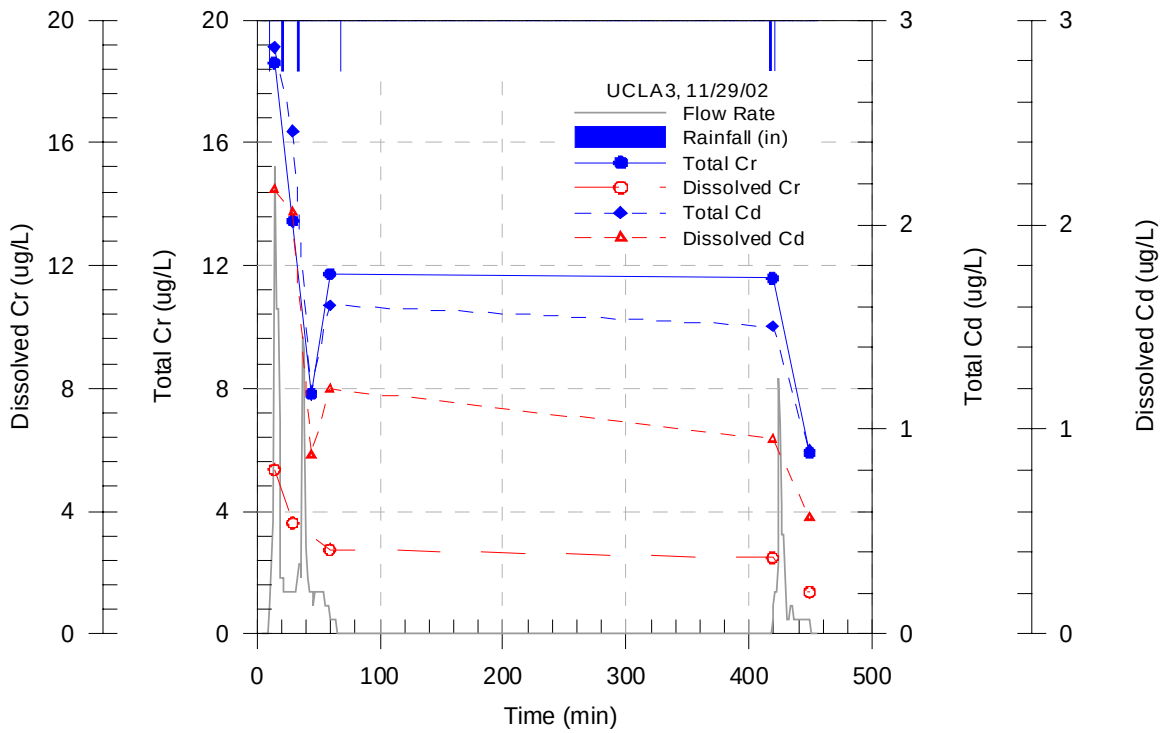

Figure I.4.3.2g[1] (Y4-UCLA3-E2-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

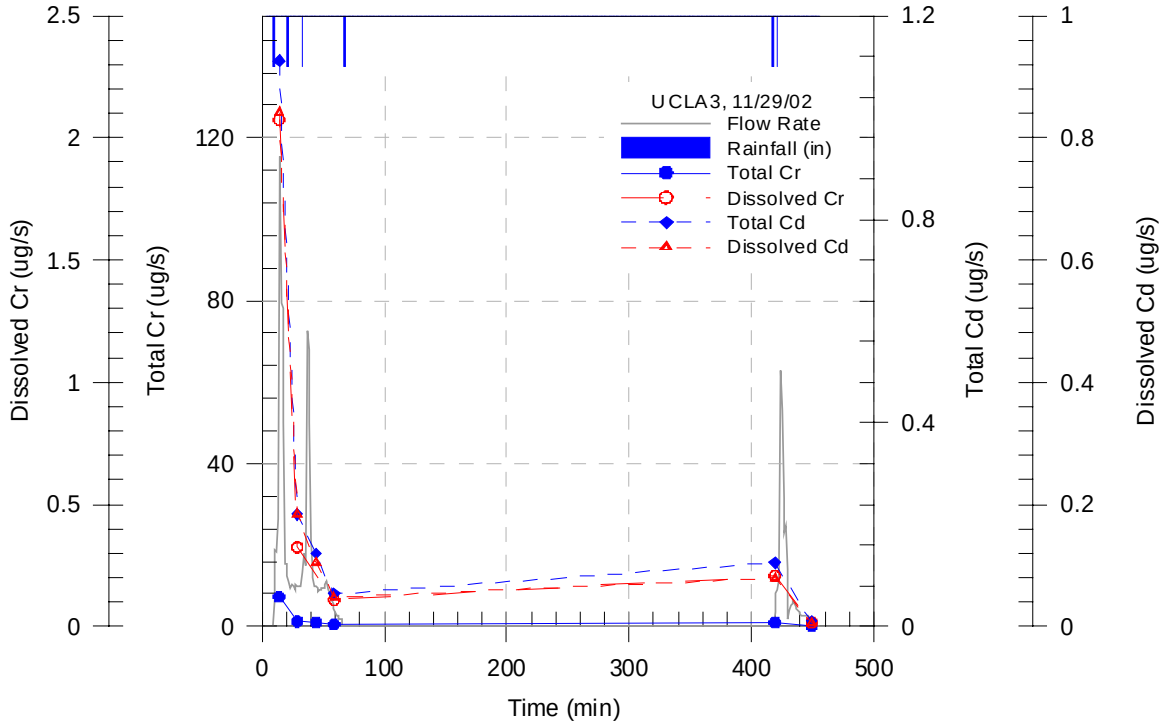

Figure I.4.3.2g[2] (Y4-UCLA3-E2-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

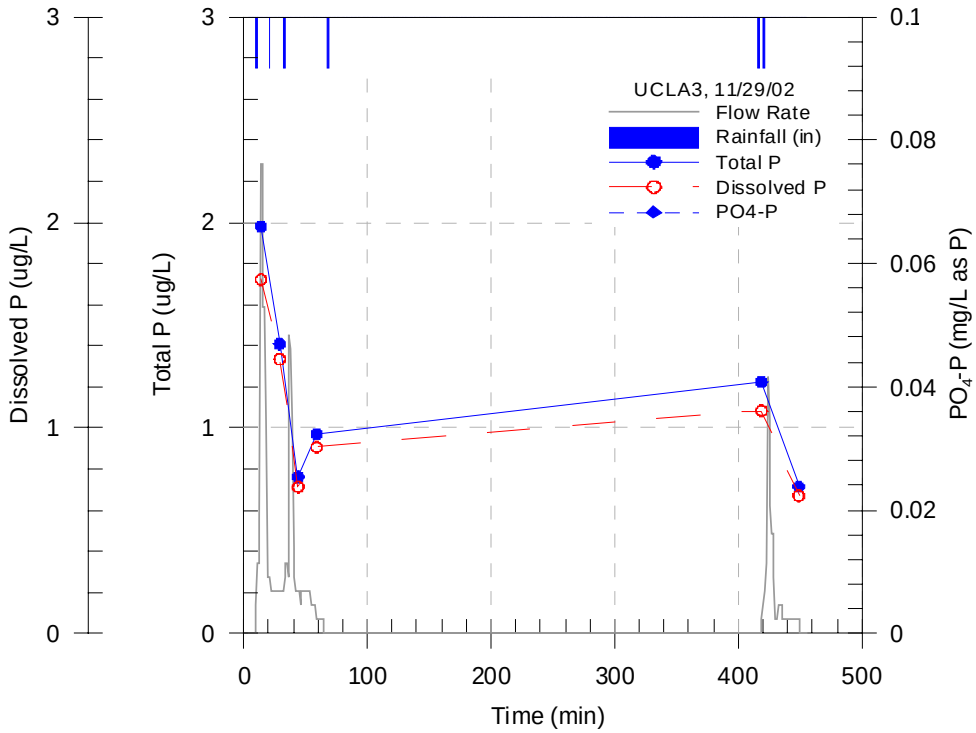

Figure I.4.3.2h[1] (Y4-UCLA3-E2-8). Polluto-graph for Total P / PO_4^{3-}-P

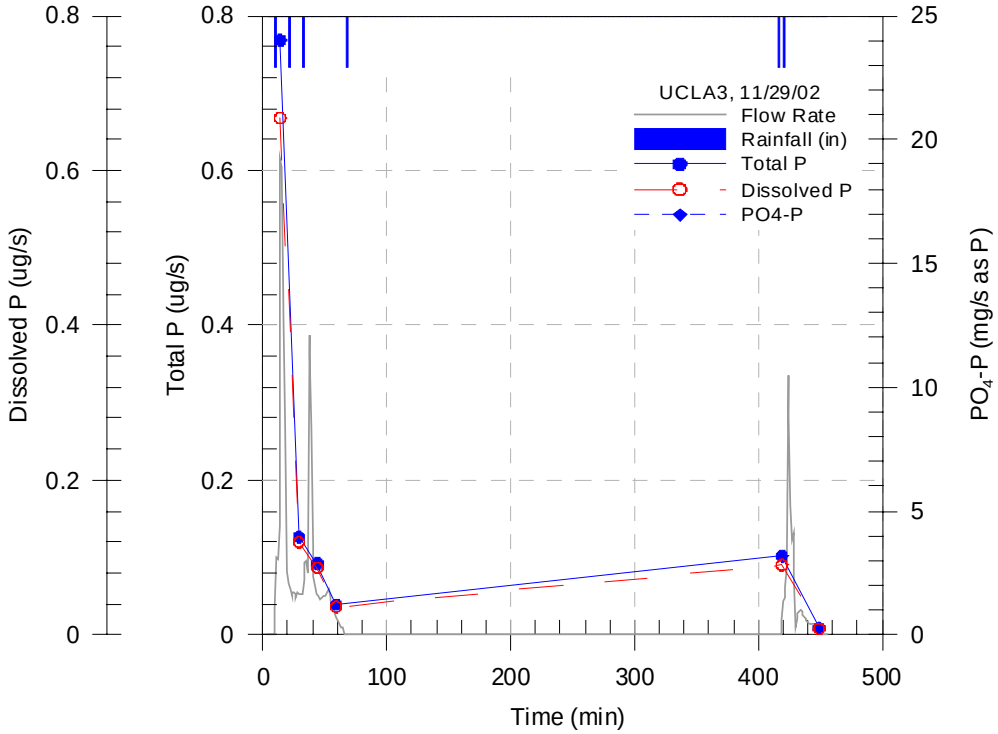

Figure I.4.3.2h[2] (Y4-UCLA3-E3-8). Load -graph for Total P / PO_4^{3-}P

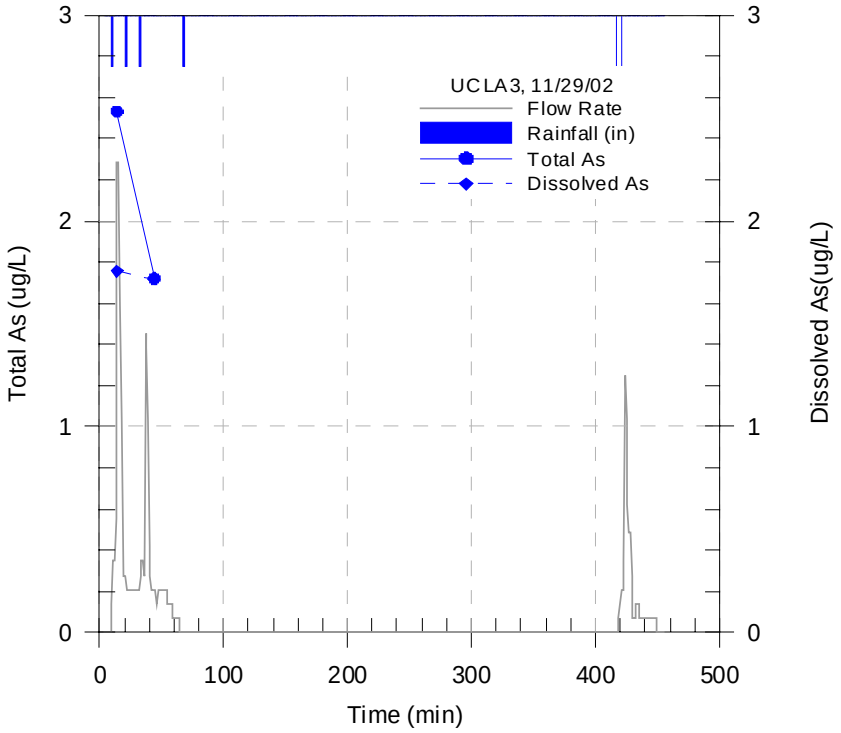

Figure I.4.3.2i[1] (Y4-UCLA3-E2-9). Polluto-graph for Total As / Dissolved As

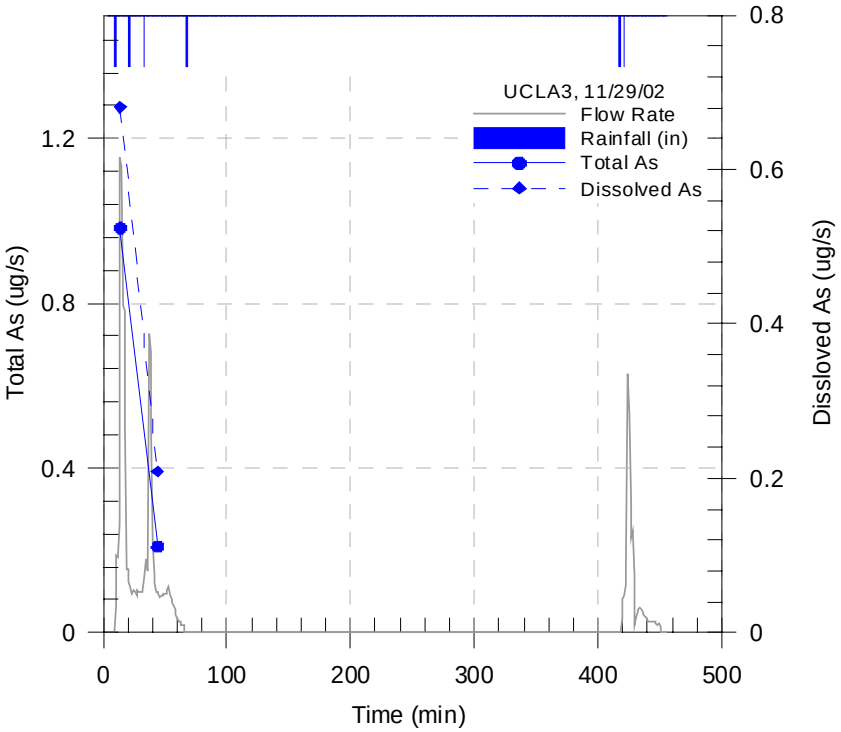

Figure I.4.3.2i[2] (Y4-UCLA3-E2-9). Load -graph for Total As / Dissolved As

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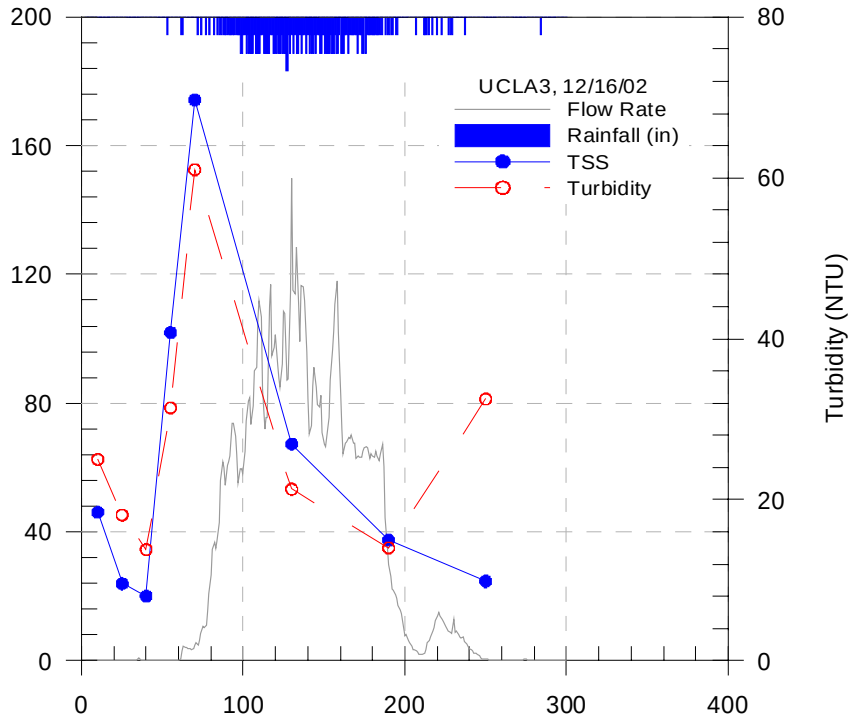
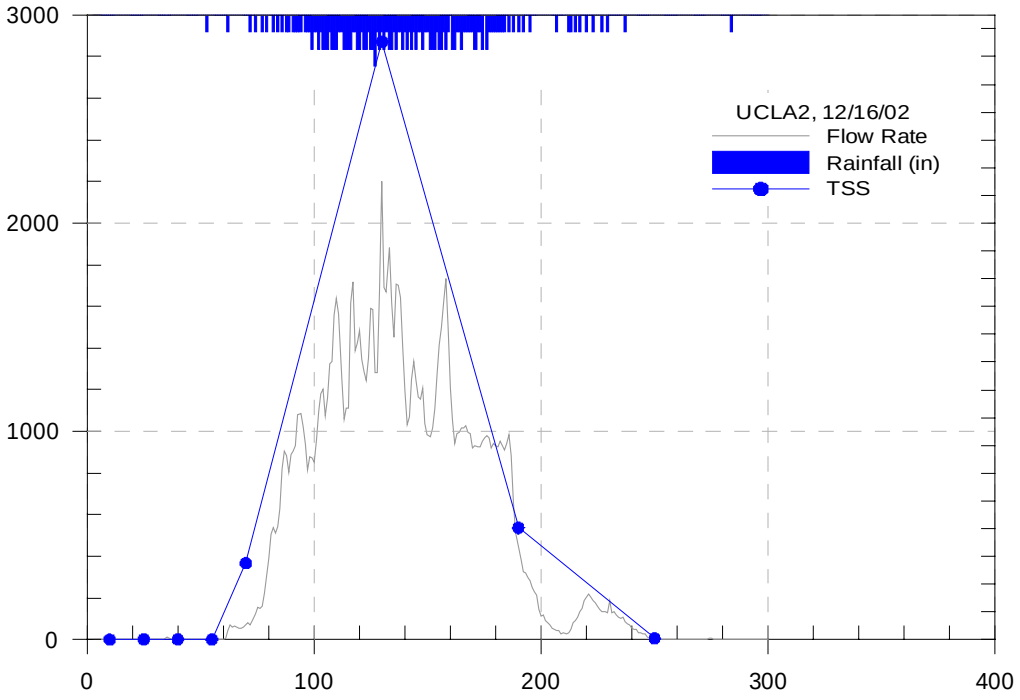


Figure I.4.3.3a[1] (Y4-UCLA3-E4-1). Polluto-graph for TSS and Turbidity



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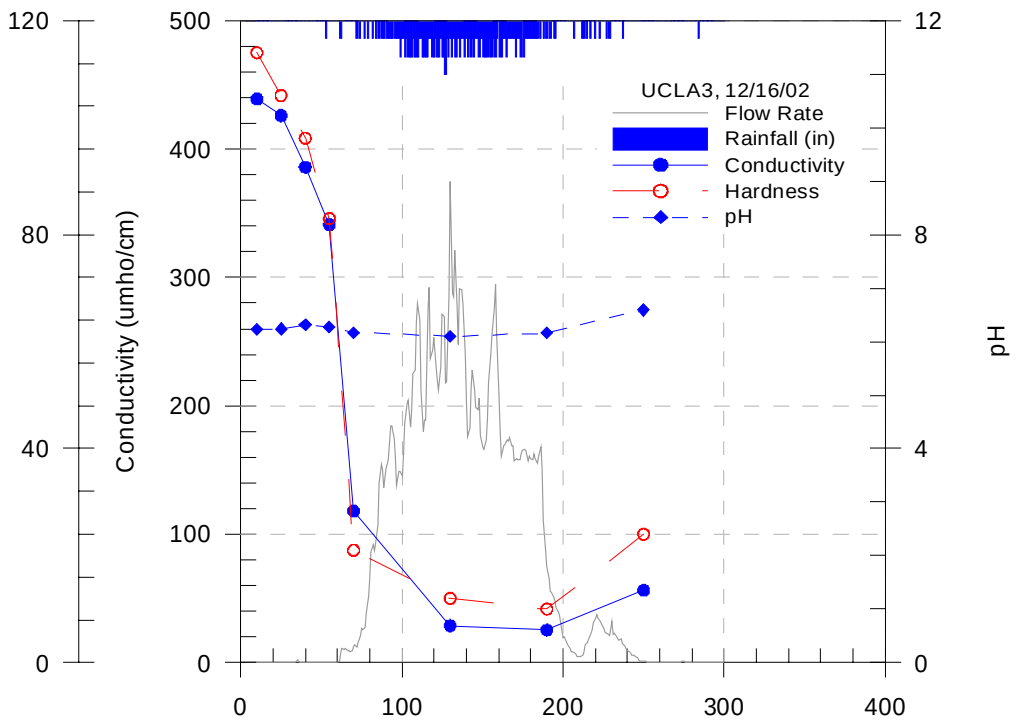
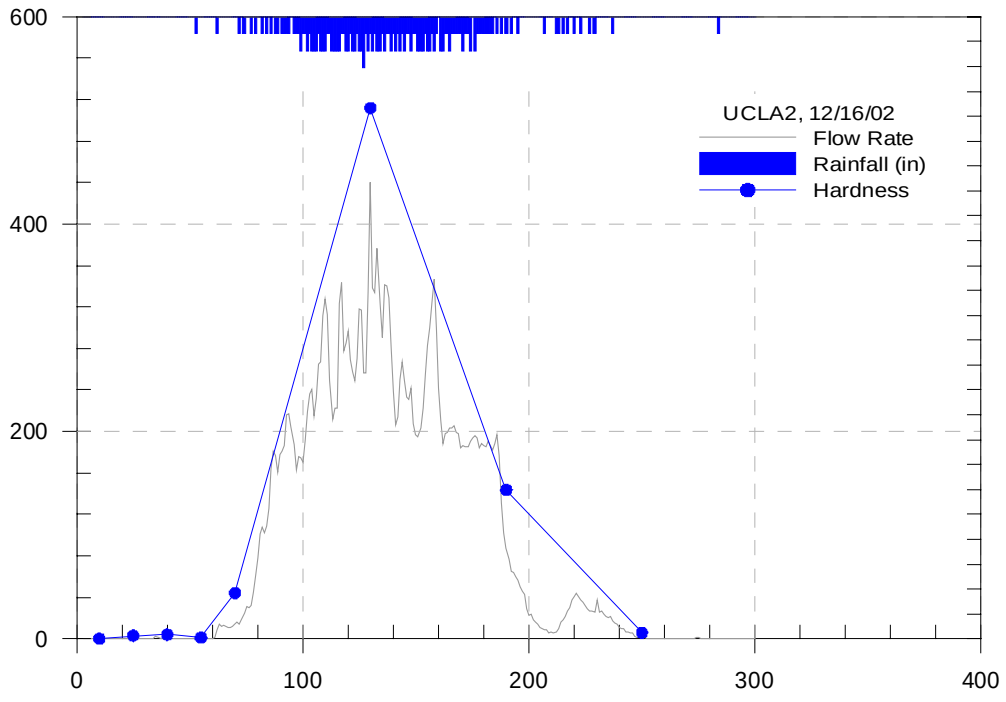


Figure I.4.3.3b[1] (Y4-UCLA3-E4-2). Polluto-graph for Conductivity, Hardness and pH



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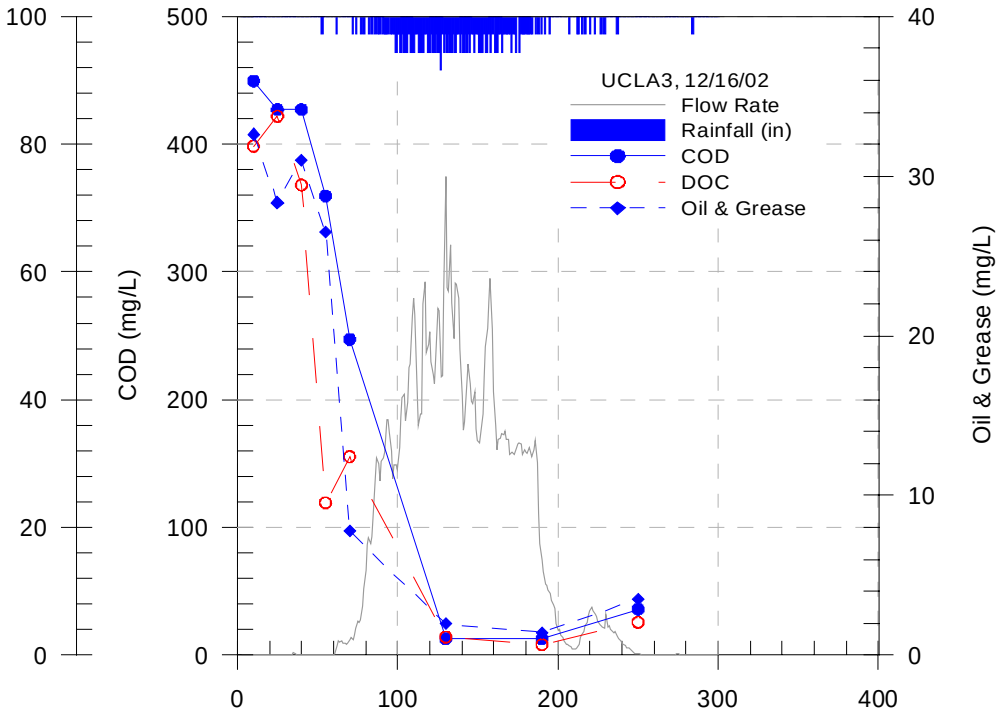
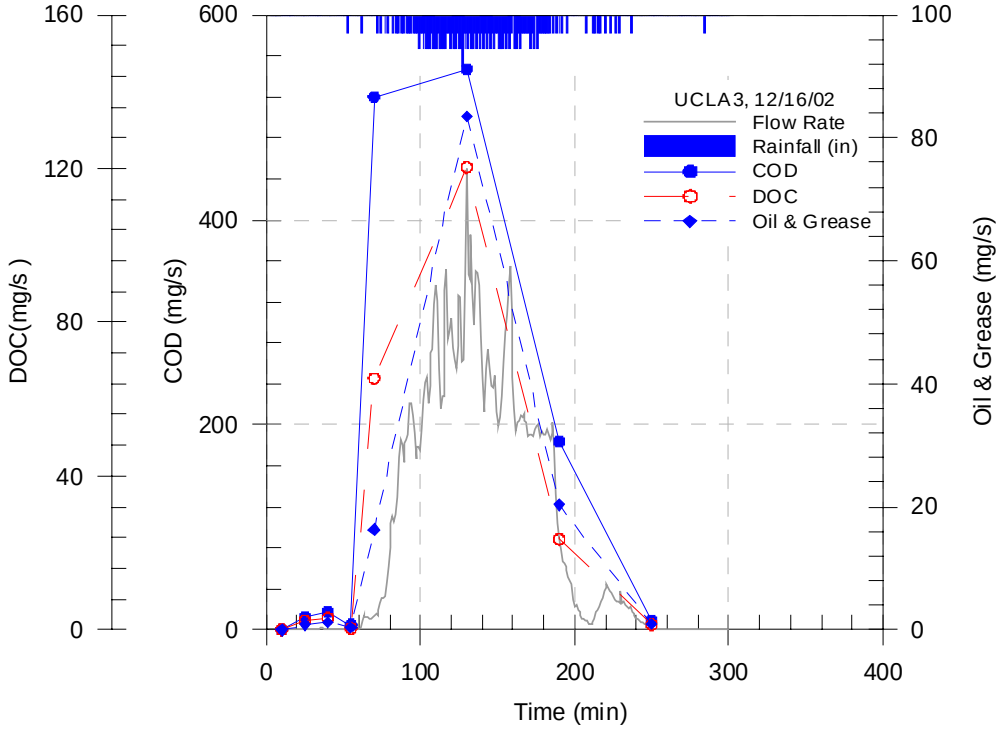


Figure I.4.3.3c[1] (Y4-UCLA3-E4-3). Polluto-graph for COD, DOC and Oil & Grease



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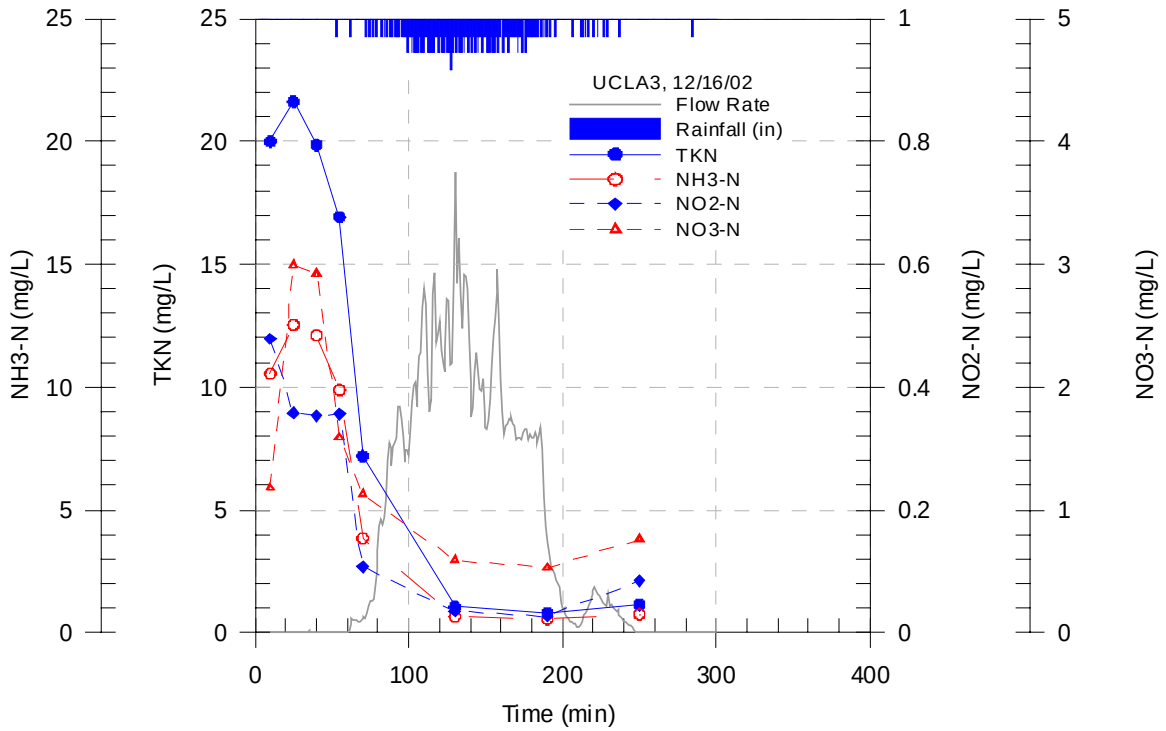

Figure I.4.3.3d[1] (Y4-UCLA3-E4-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

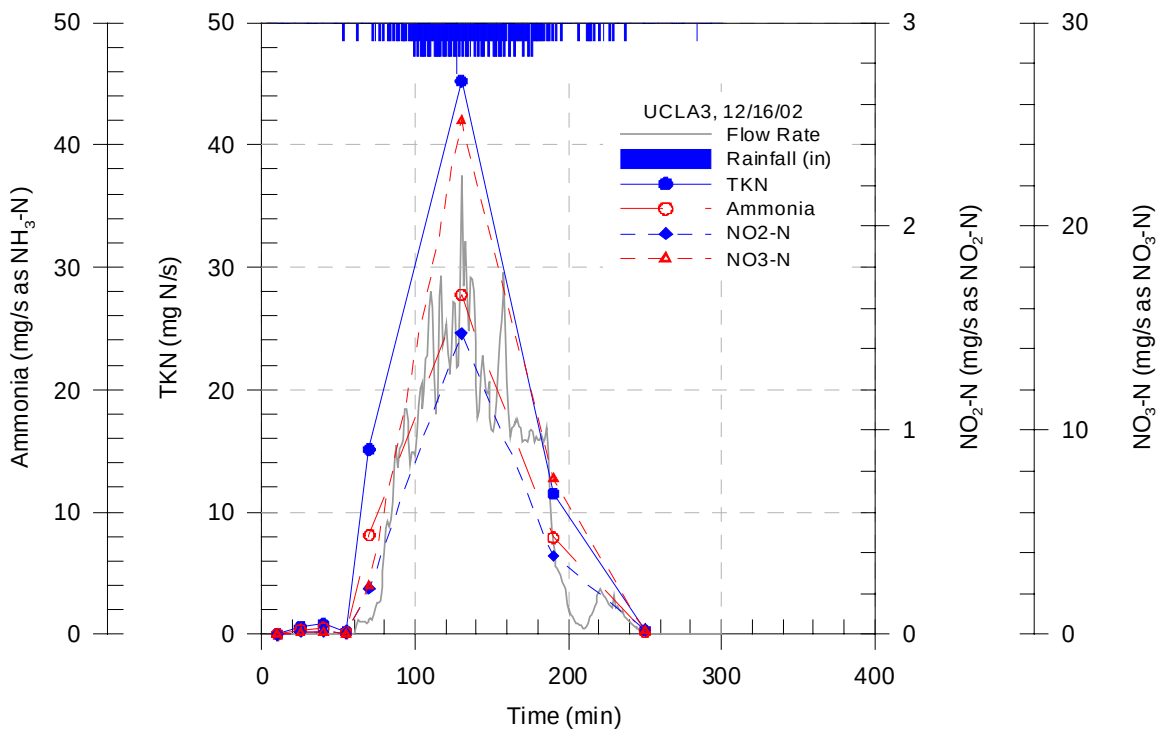

Figure I.4.3.3d[2] (Y4-UCLA3-E4-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

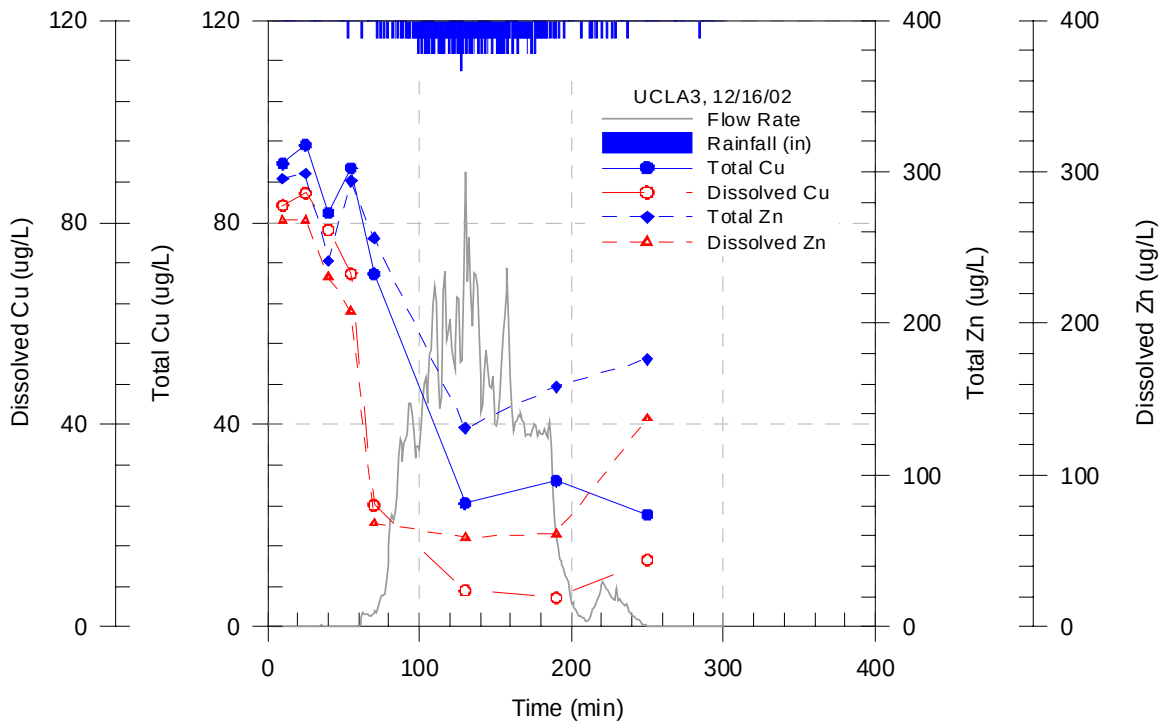

Figure I.4.3.3e[1] (Y4-UCLA3-E4-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

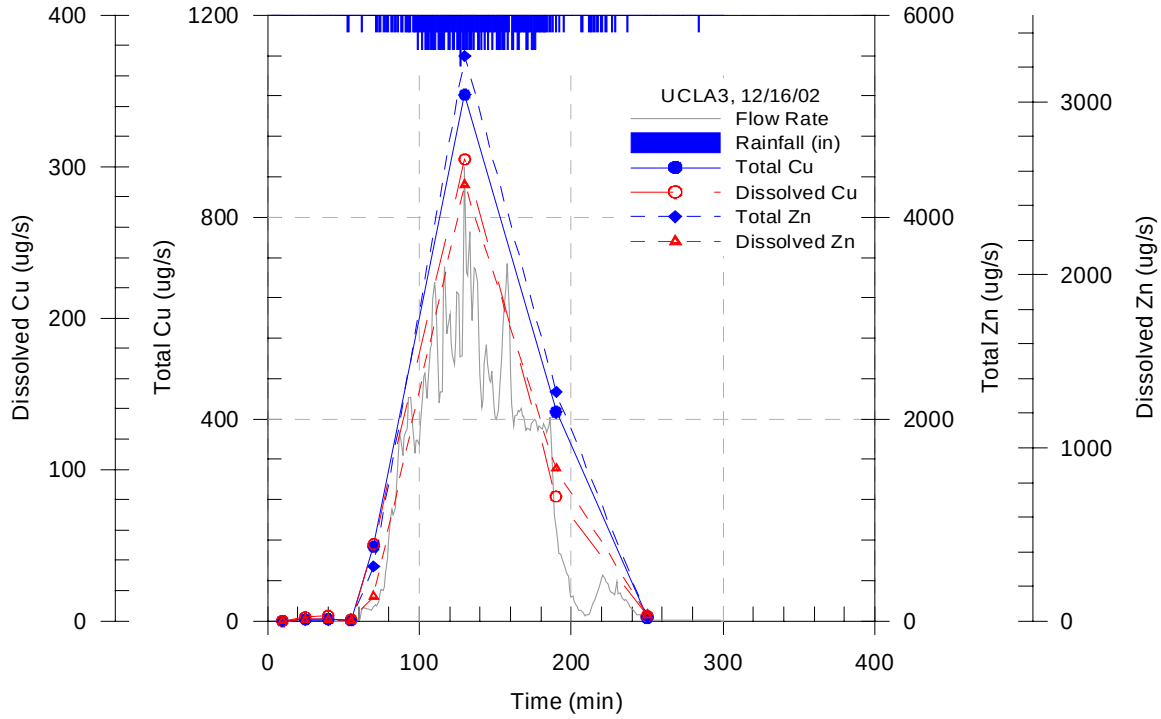

Figure I.4.3.3e[2] (Y4-UCLA3-E4-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

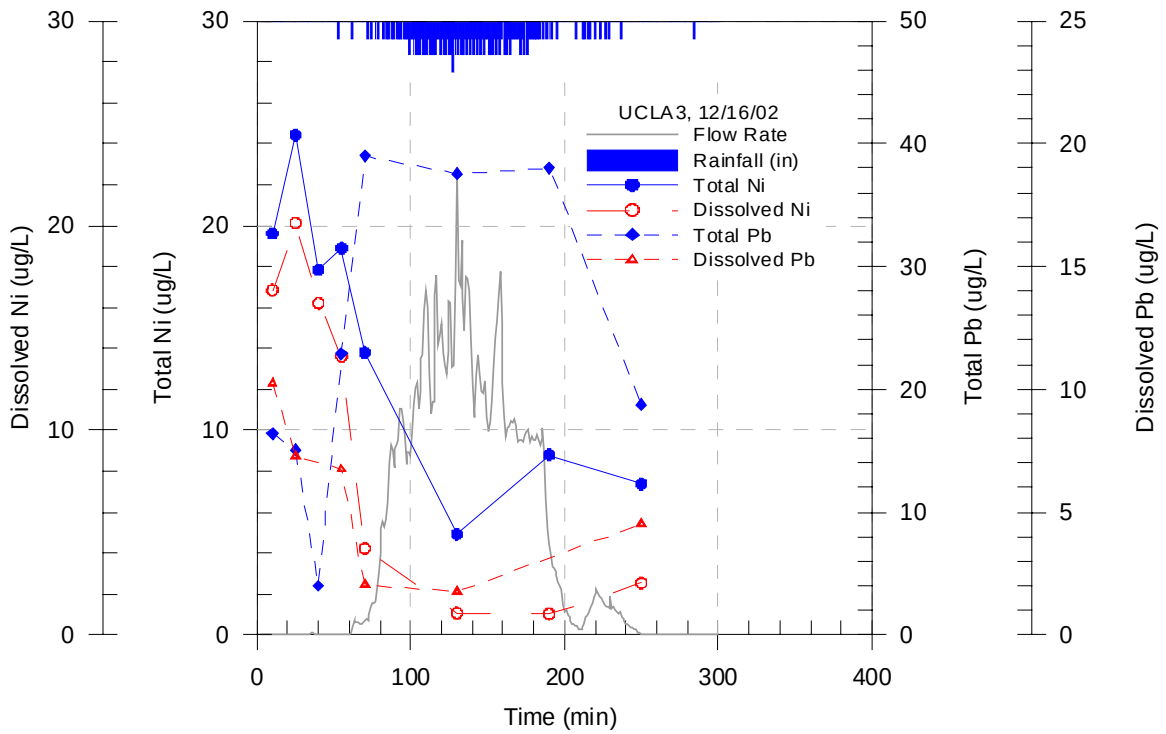

Figure I.4.3.3f[1] (Y4-UCLA3-E4-6). Polluto-graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

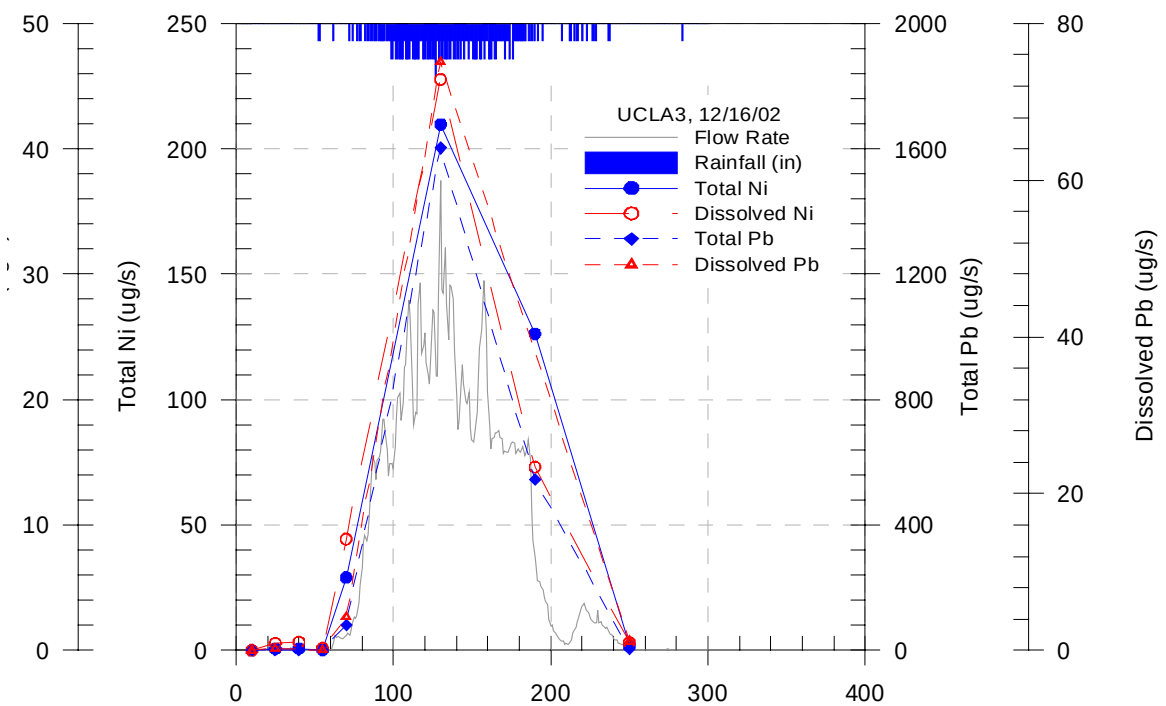

Figure I.4.3.3f[2] (Y4-UCLA3-E4-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb

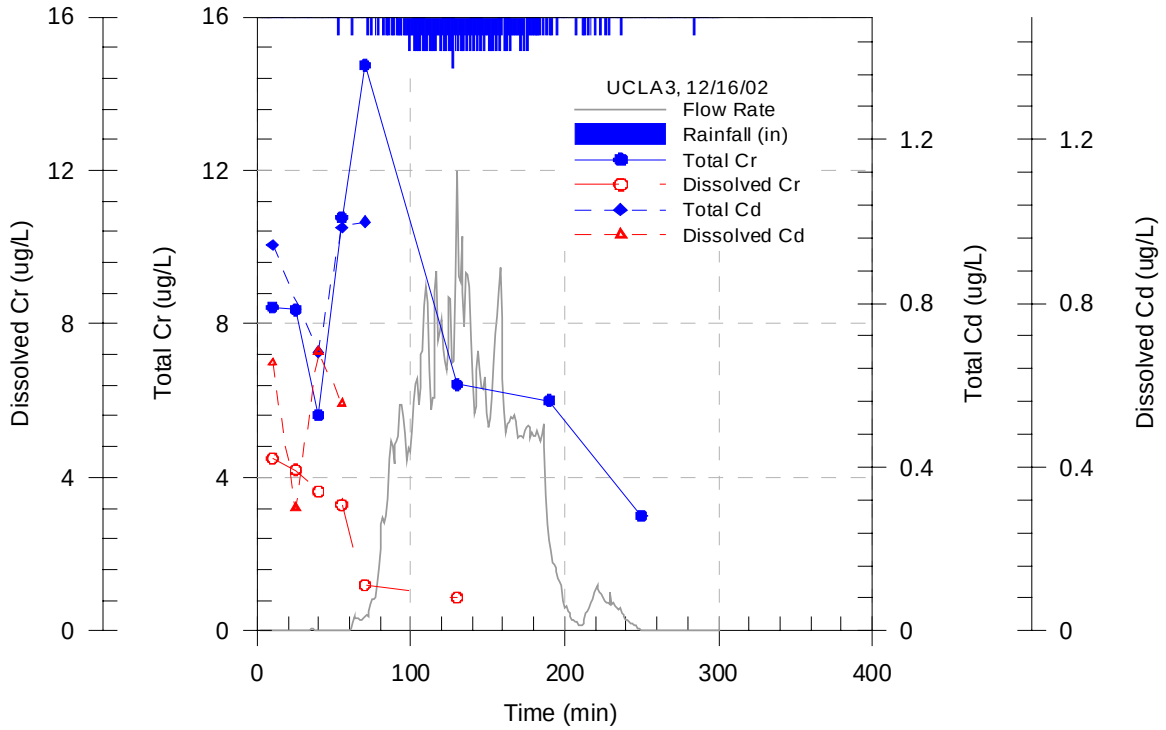

Figure I.4.3.3g[1] (Y4-UCLA3-E4-7). Polluto-graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

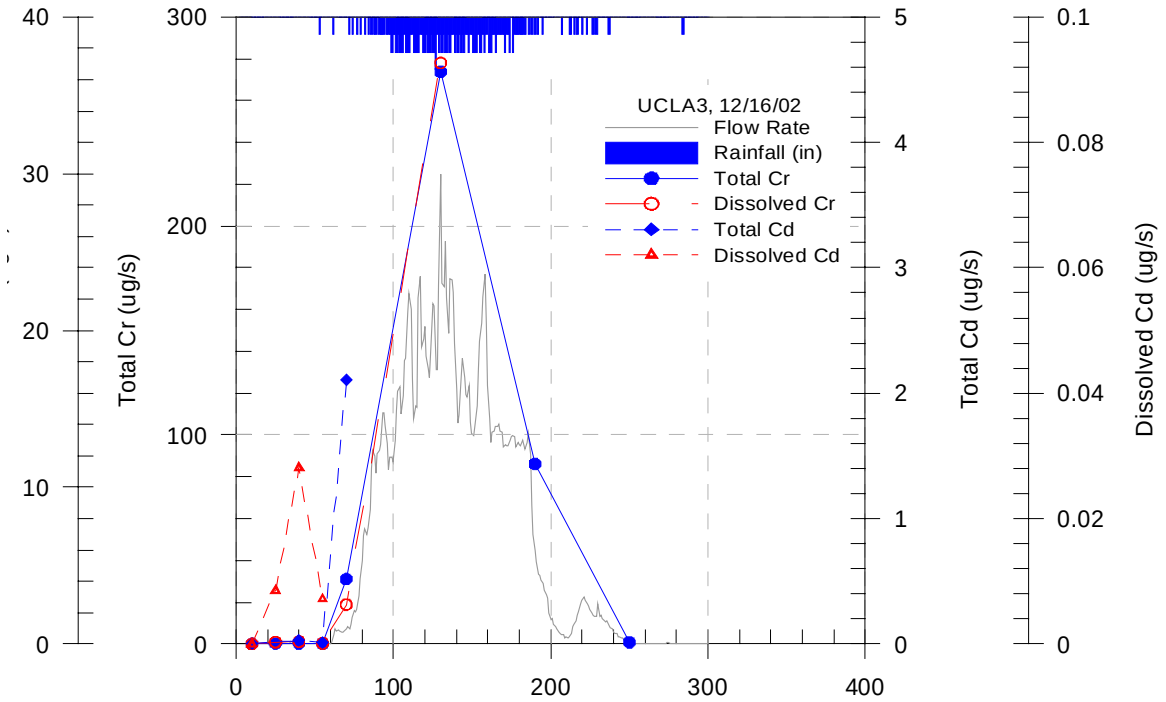

Figure I.4.3.3g[2] (Y4-UCLA3-E4-7). Load -graph for Total Cr / Dissolved Cr and Total Cd / Dissolved Cd

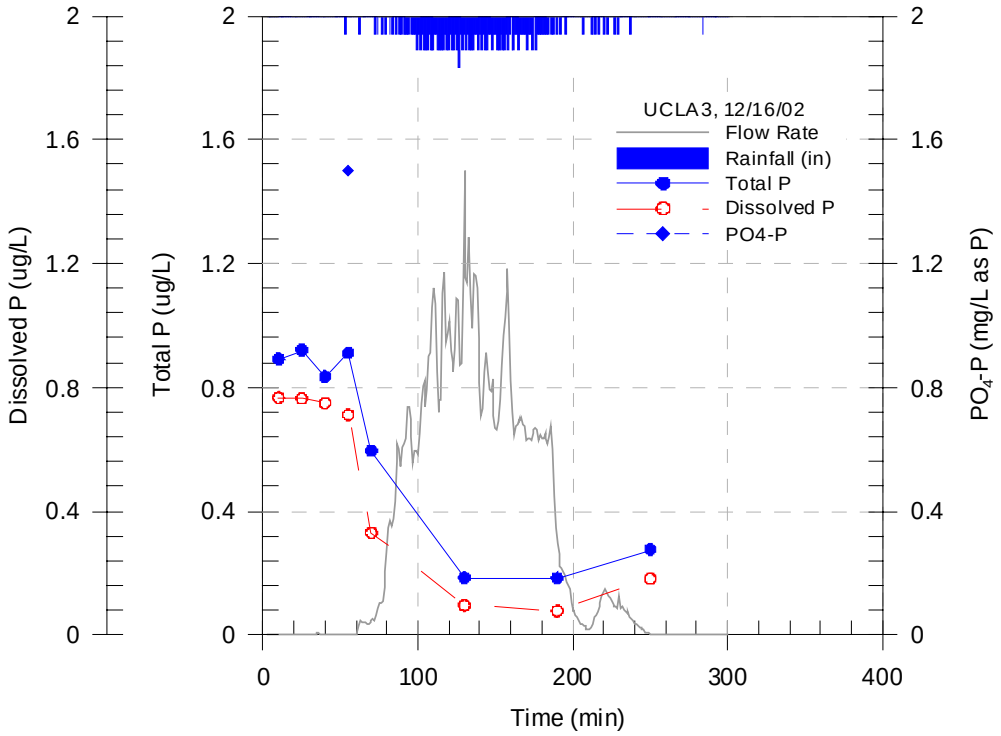

Figure I.4.3.3h[1] (Y4-UCLA3-E4-8). Polluto-graph for Total P / PO_4^{3-}-P

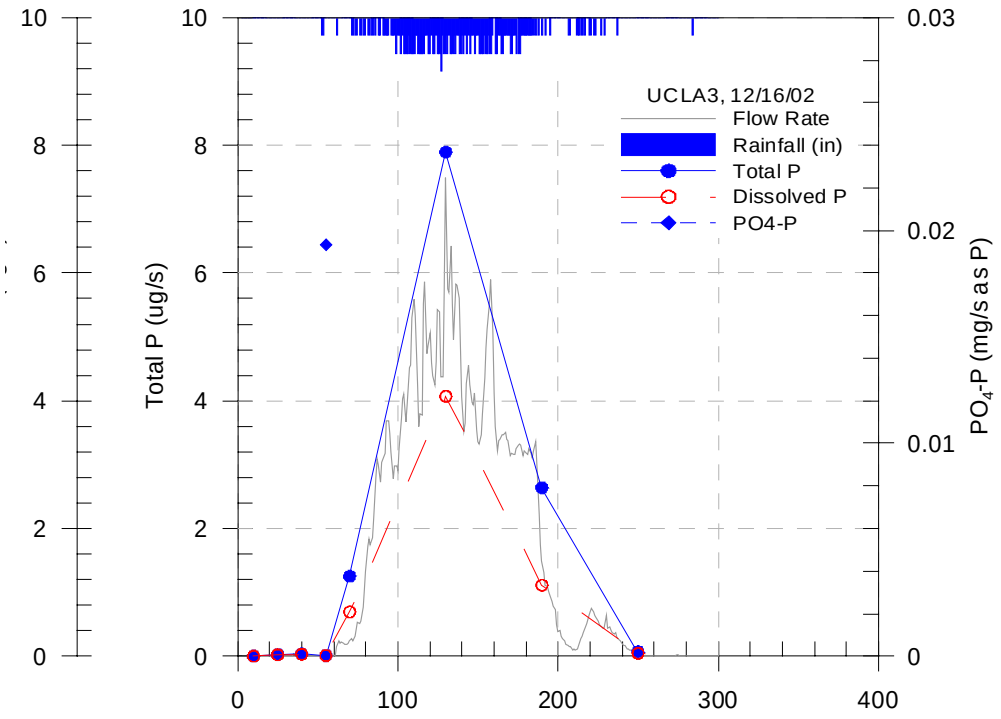

Figure I.4.3.3h[2] (Y4-UCLA3-E4-8). Load -graph for Total P / PO_4^{3-}-P

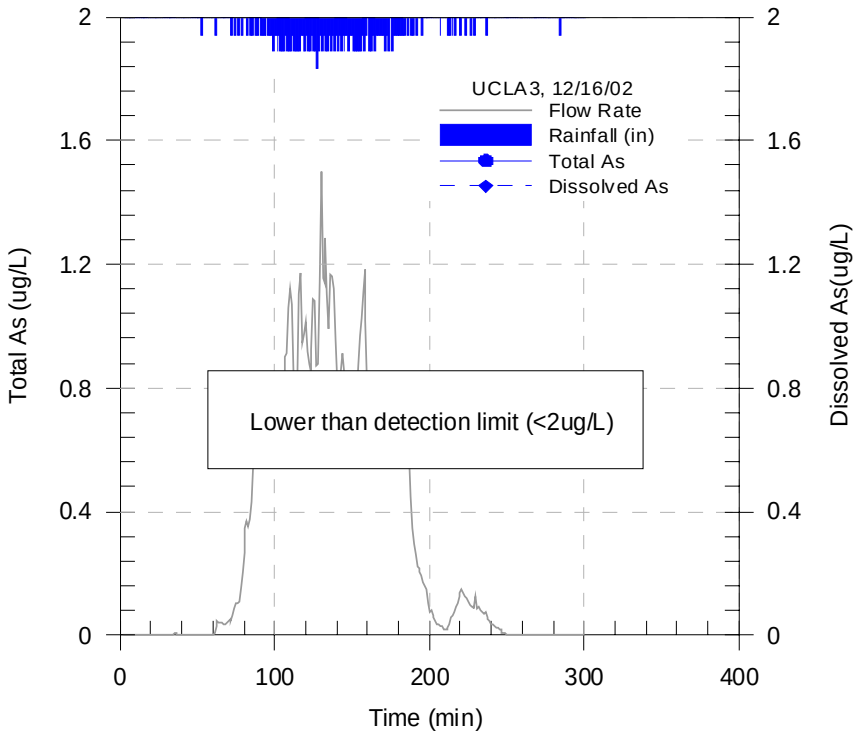

Figure I.4.3.3i[1] (Y4-UCLA3-E4-9). Polluto-graph for Total As / Dissolved As

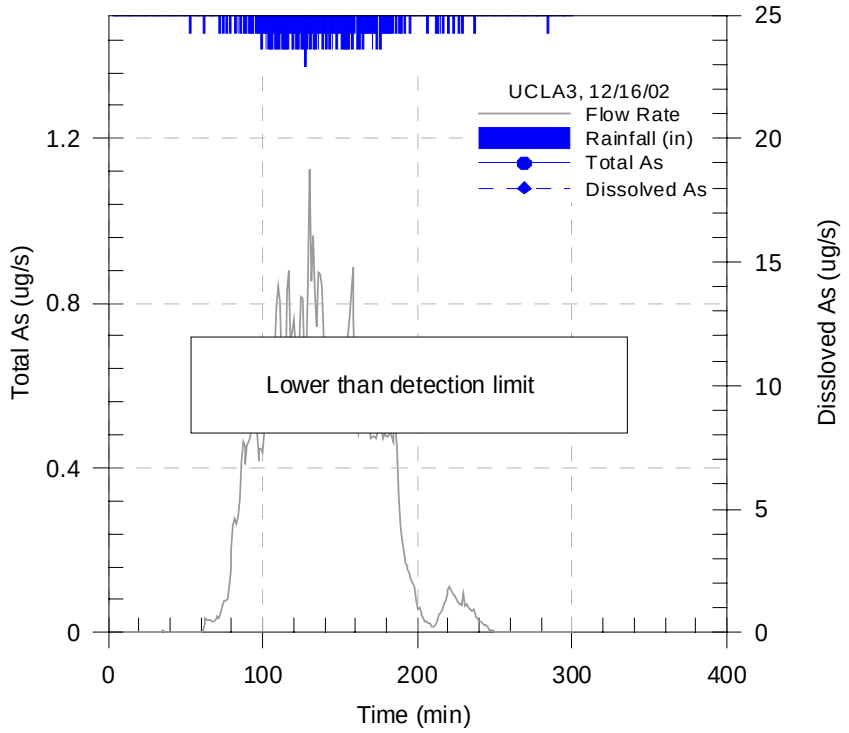

Figure I.4.3.3i[2] (Y4-UCLA3-E4-9). Load -graph for Total As / Dissolved As

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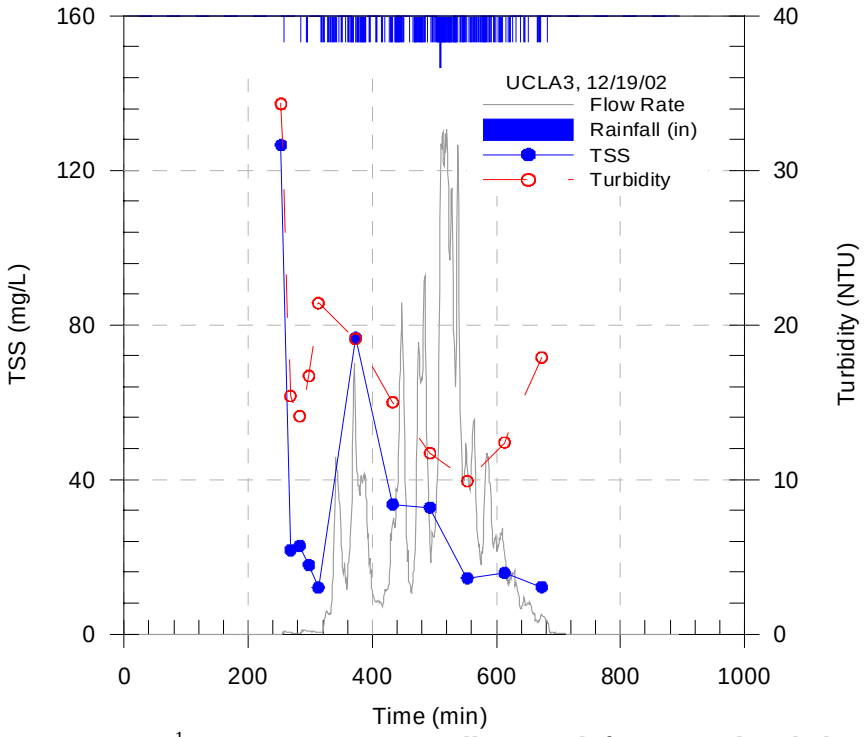

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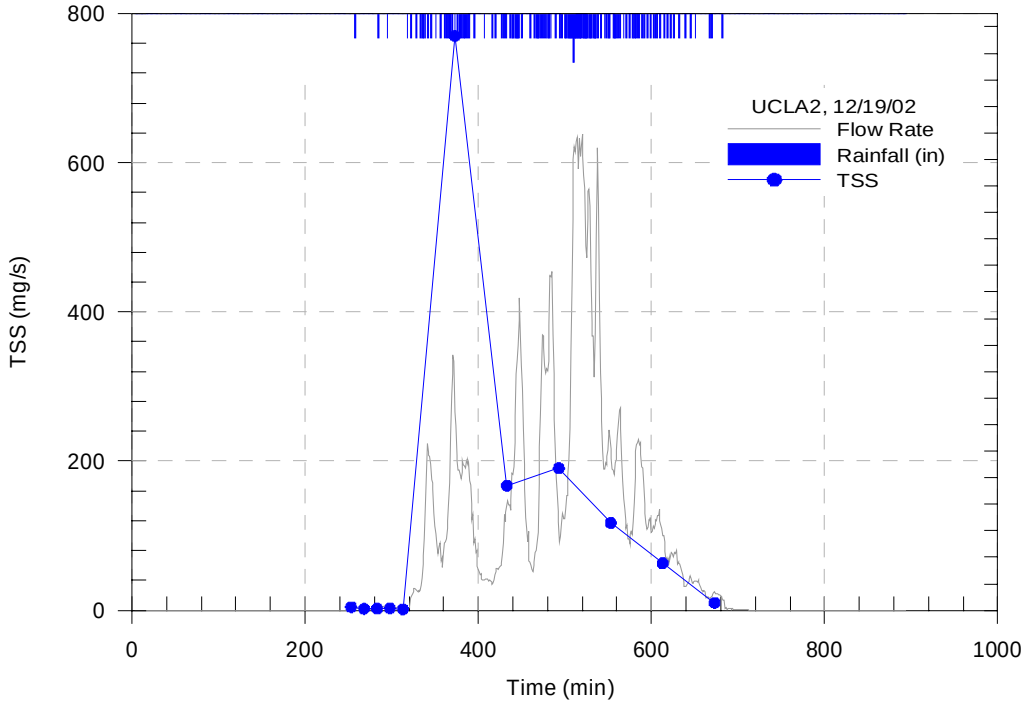


Figure I.4.3.4a[2] (Y4-UCLA3-E5-1). Load-graph for TSS

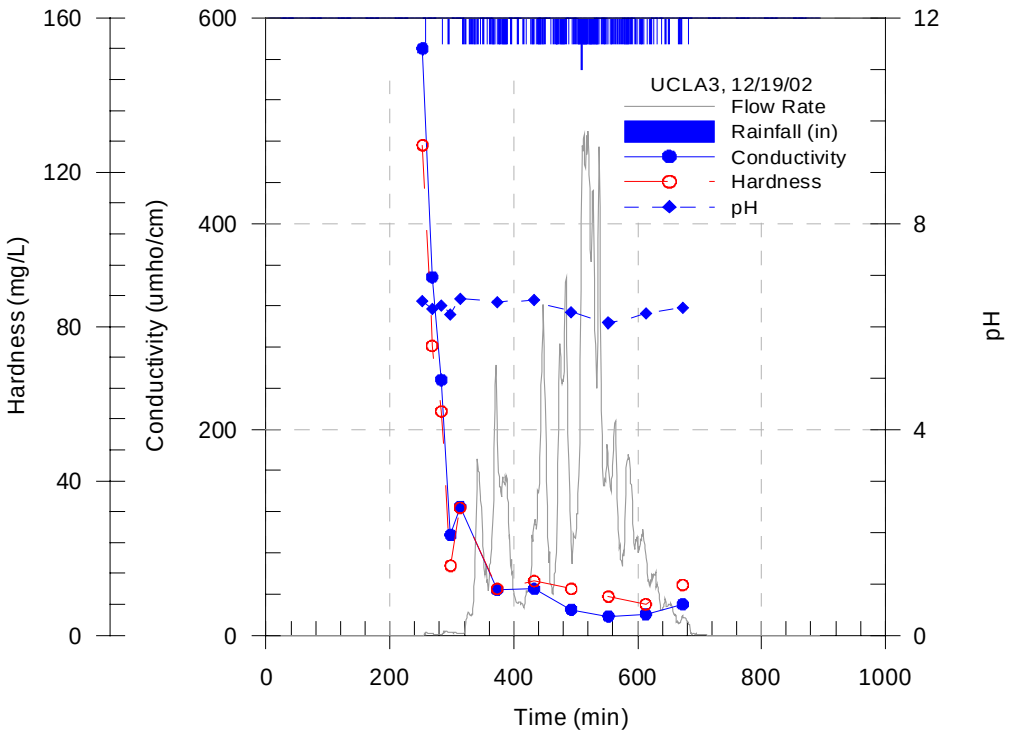


Figure I.4.3.4b[1] (Y4-UCLA3-E5-2). Polluto-graph for Conductivity, Hardness and pH

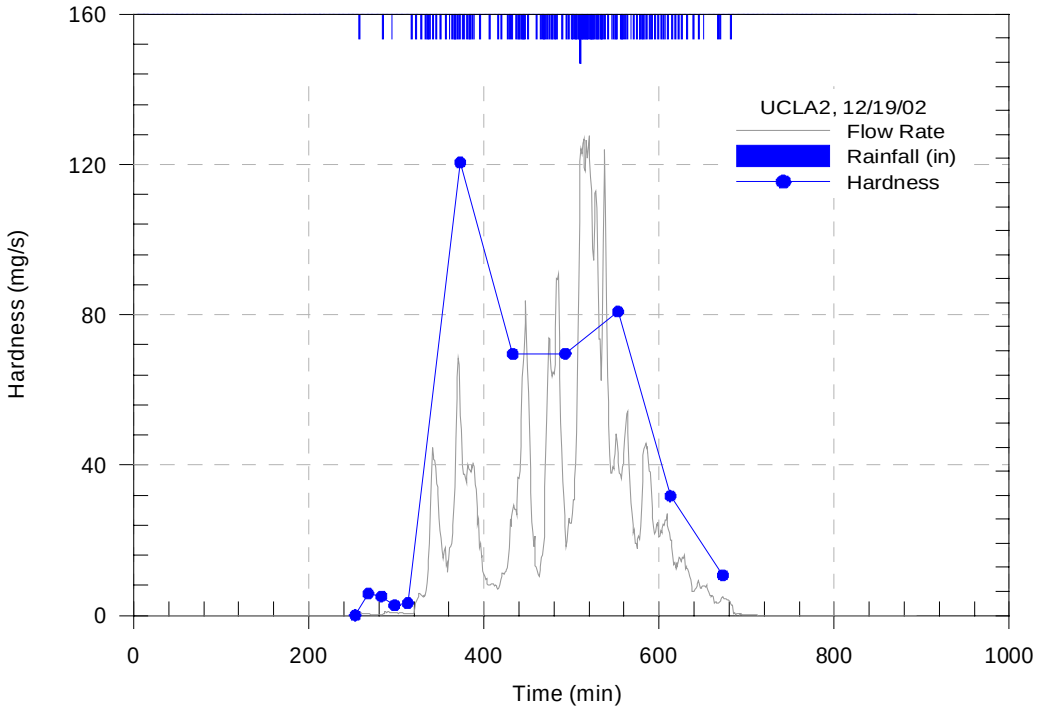


Figure I.4.3.4b[2] (Y4-UCLA3-E5-2). Load-graph for Hardness

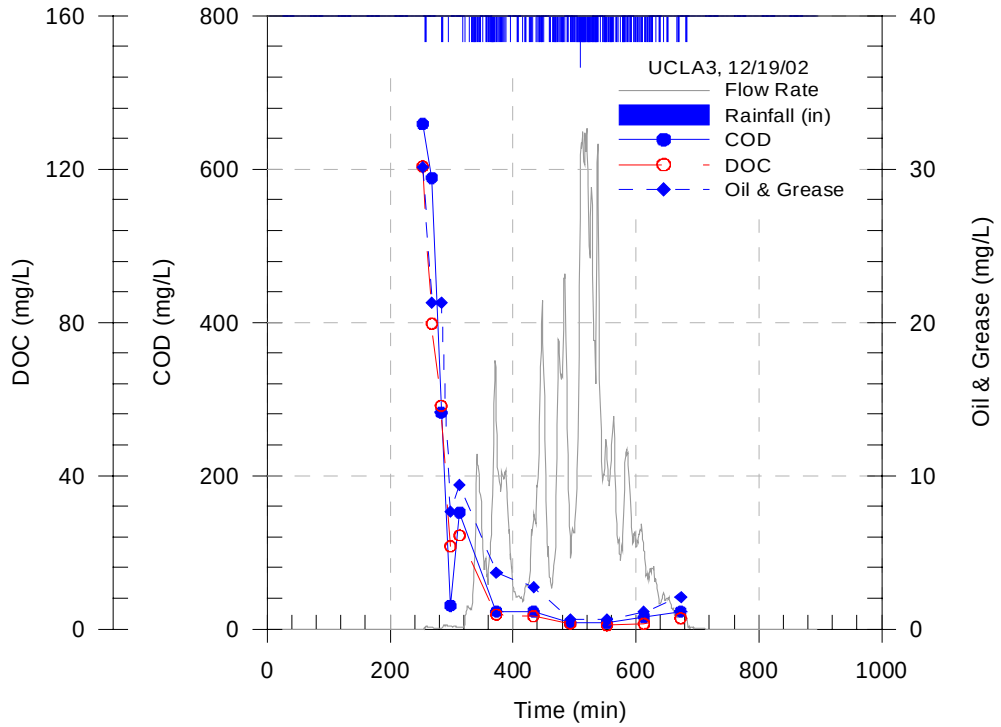


Figure I.4.3.4c[1] (Y4-UCLA3-E5-3). Polluto-graph for COD, DOC and Oil & Grease

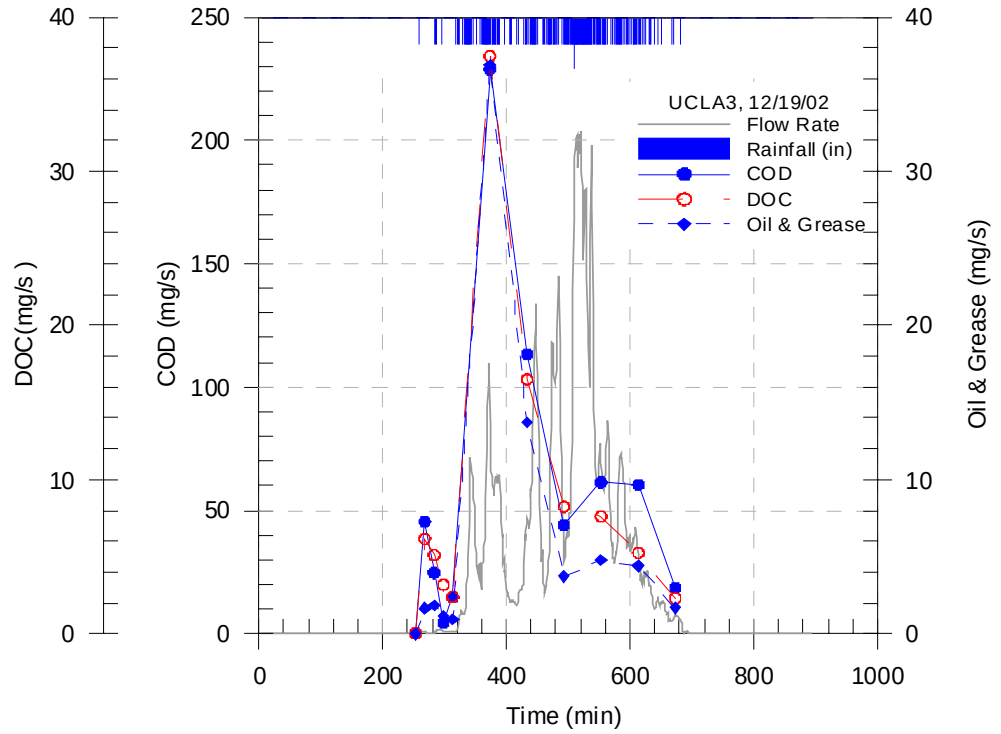


Figure I.4.3.4c[2] (Y4-UCLA3-E5-3). Load-graph for COD, DOC and Oil & Grease

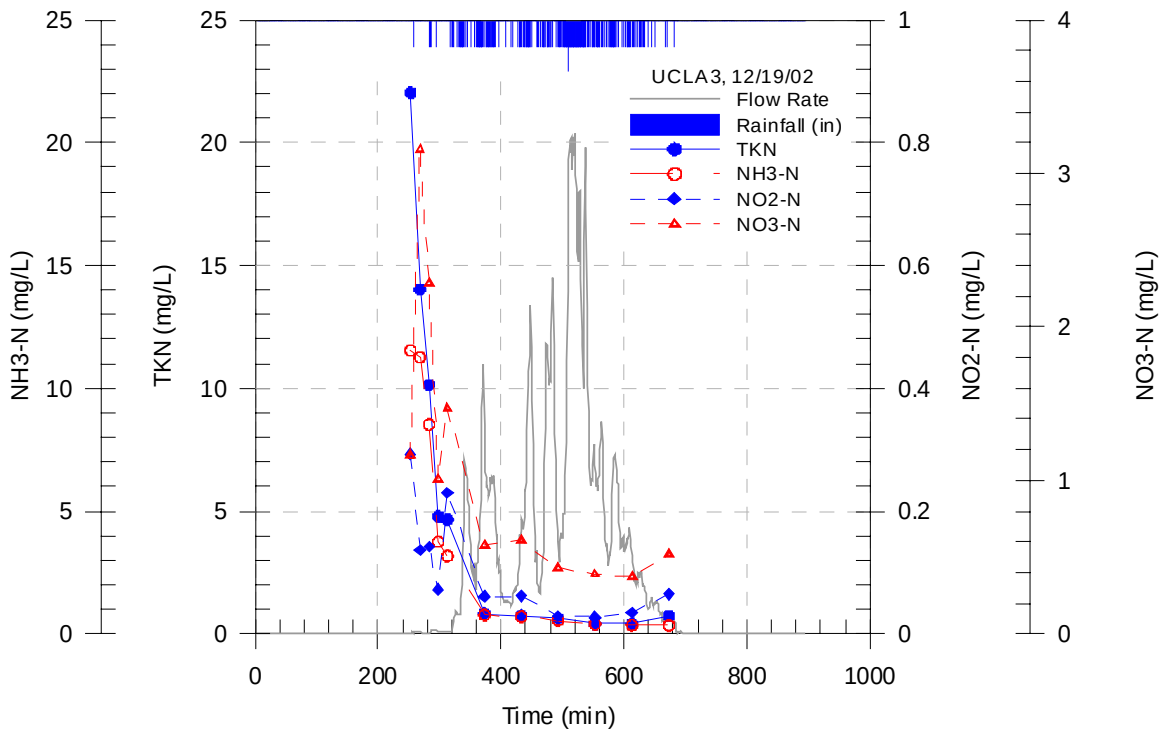


Figure I.4.3.4d[1] (Y4-UCLA3-E5-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

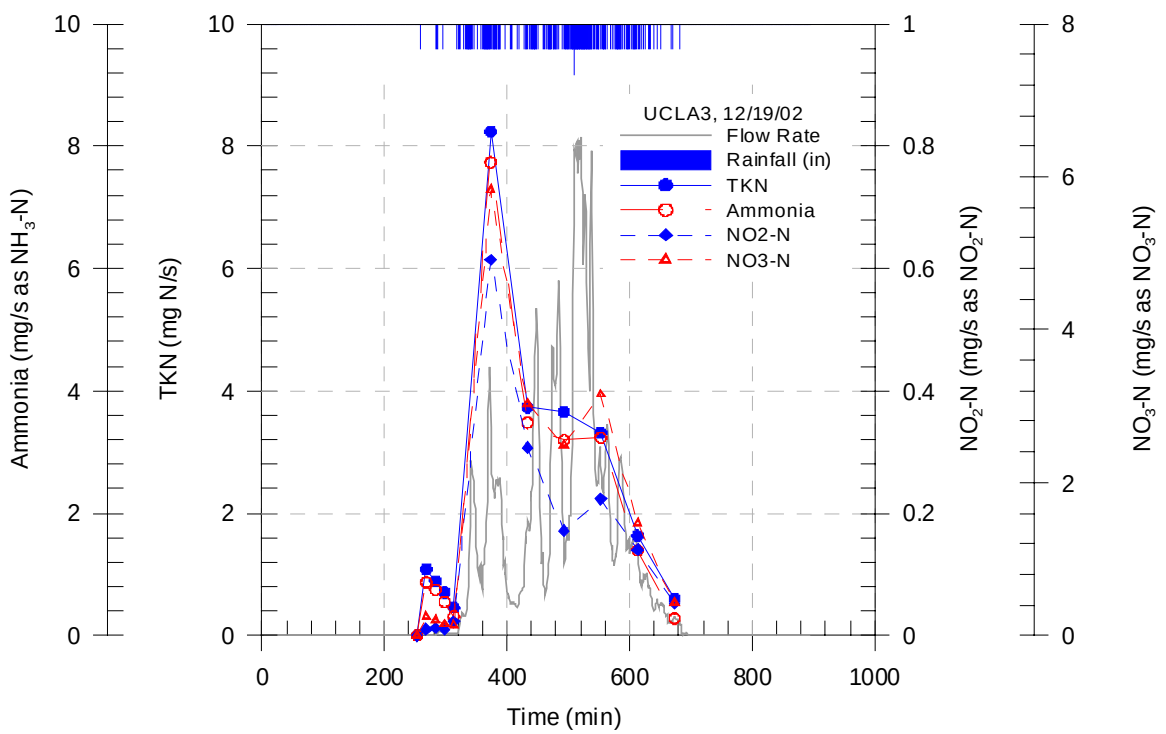


Figure I.4.3.4d[2] (Y4-UCLA3-E5-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

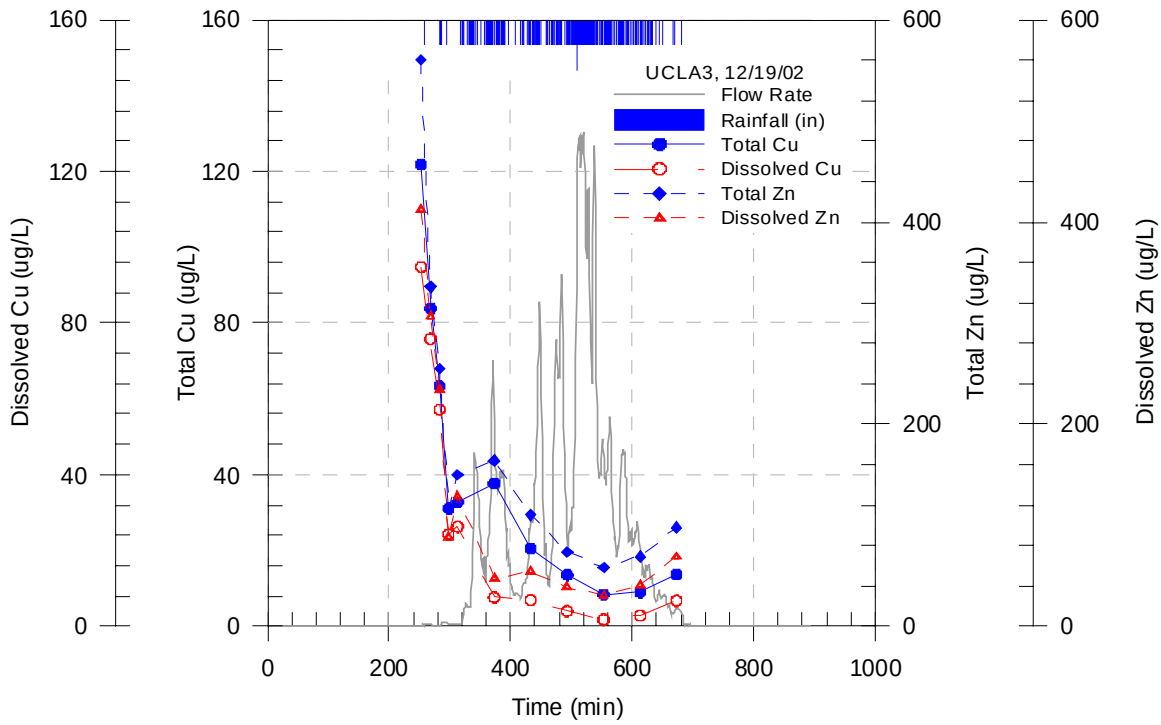


Figure I.4.3.4e[1] (Y4-UCLA3-E5-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn

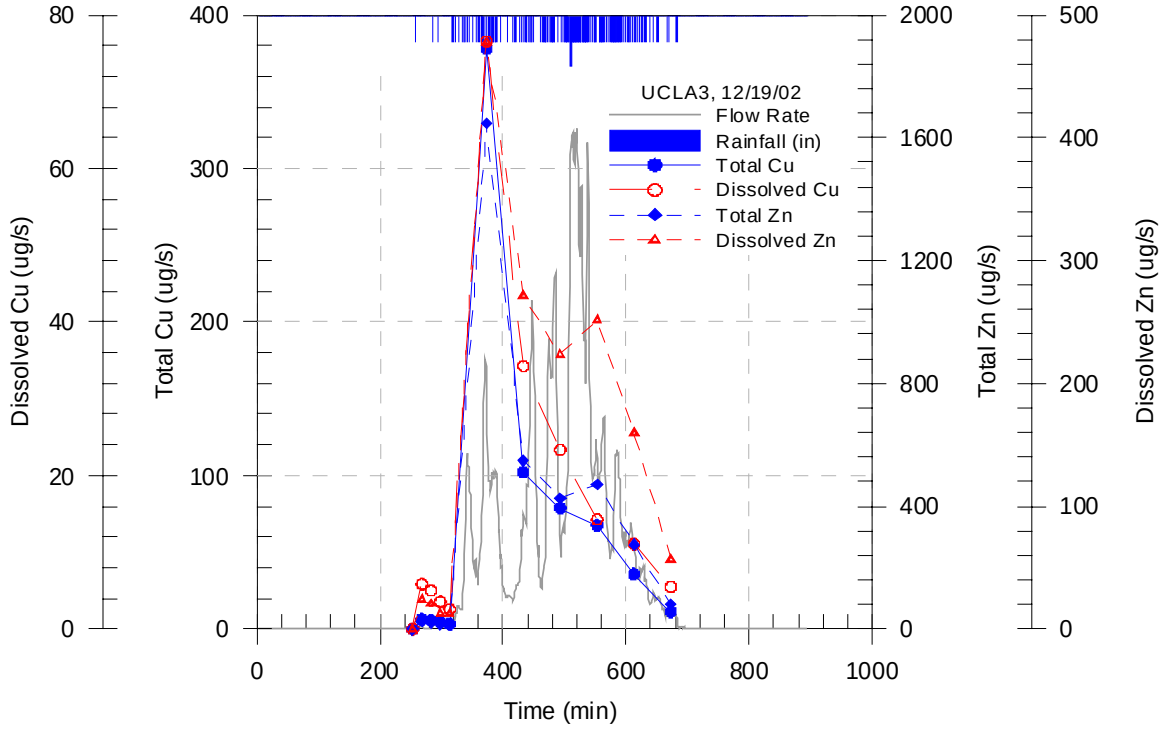
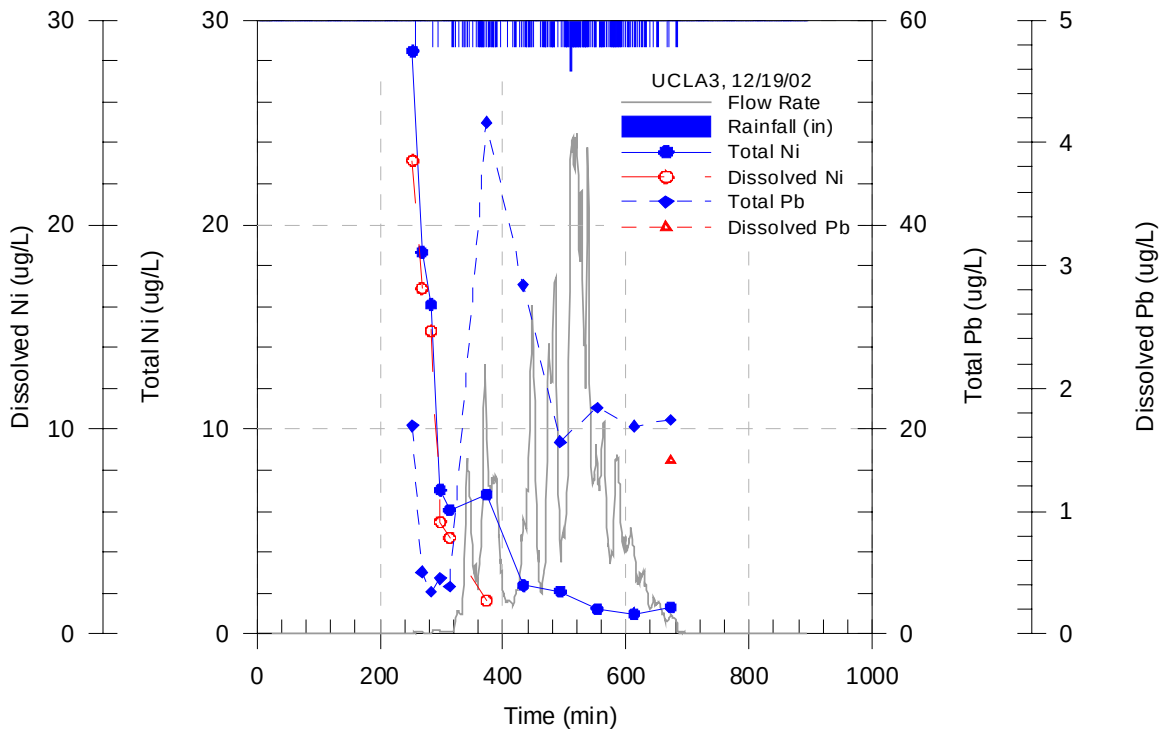


Figure I.4.3.4e[2] (Y4-UCLA3-E5-5). Load -graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn



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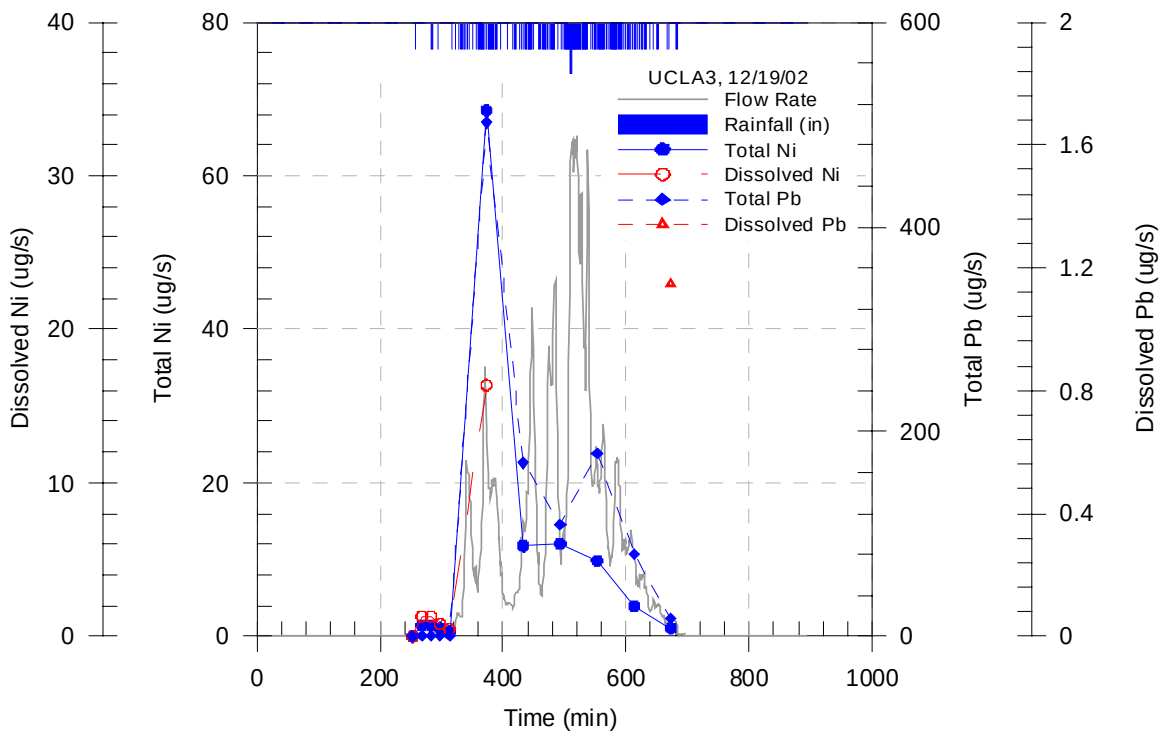
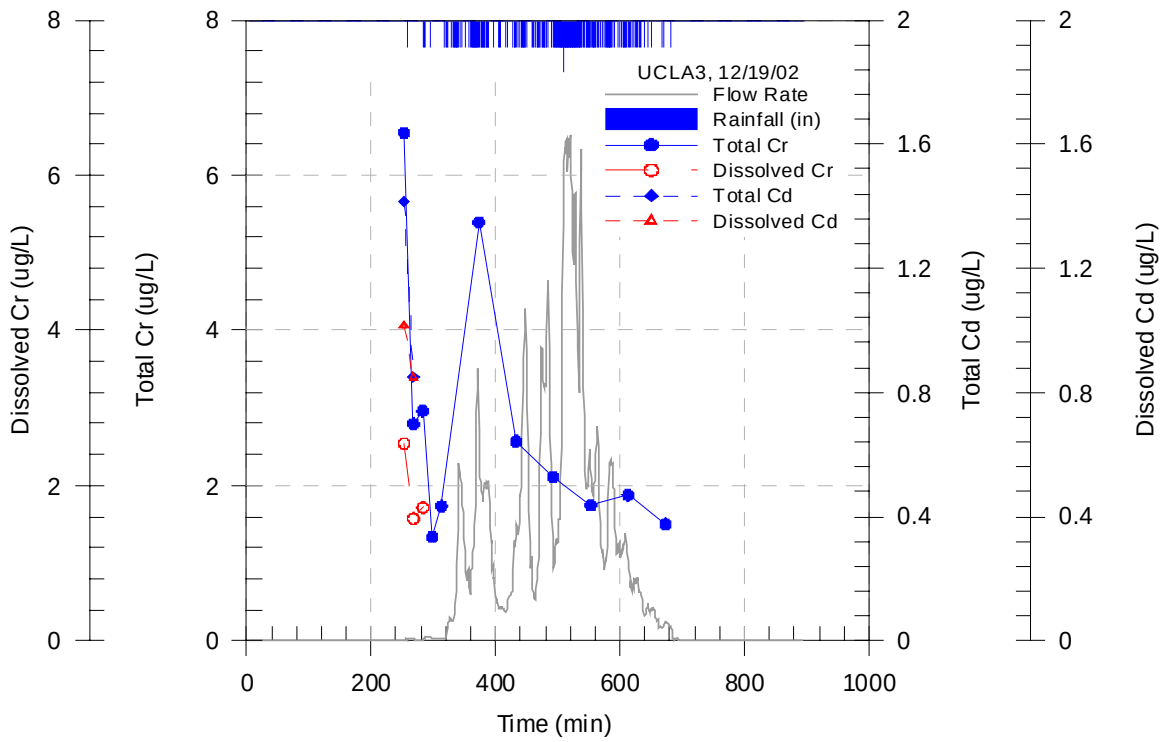


Figure I.4.3.4f[2] (Y4-UCLA3-E5-6). Load -graph for. Total Ni / Dissolved Ni and Total Pb / Dissolved Pb



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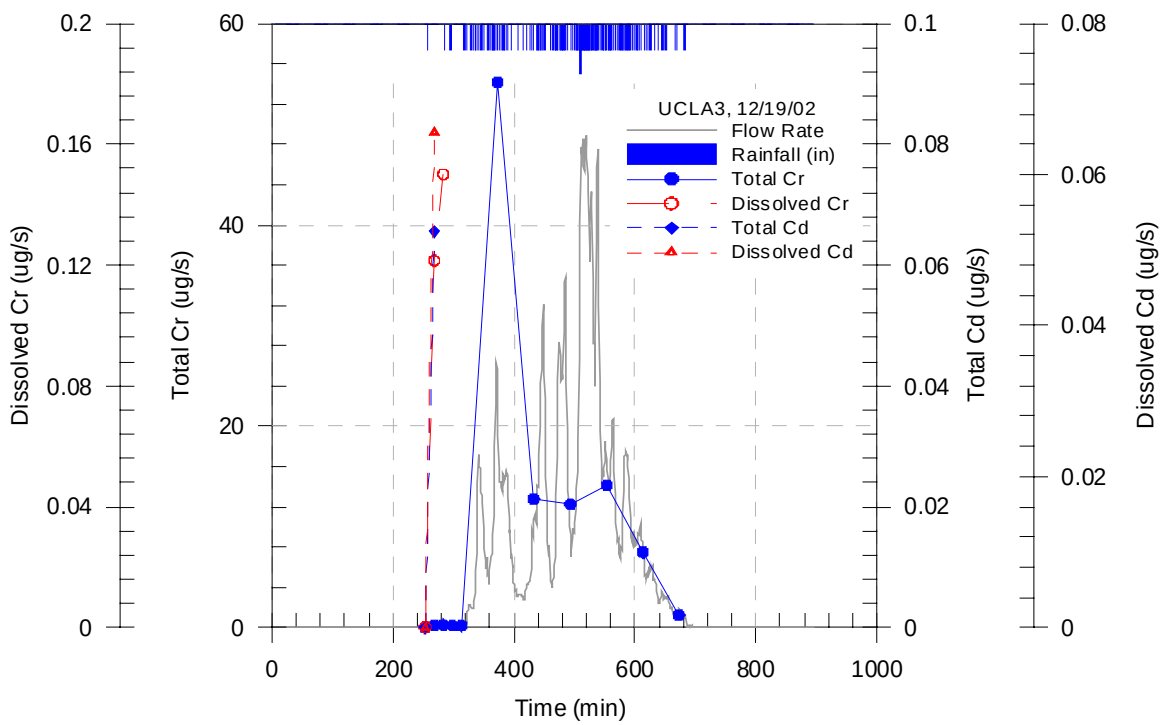

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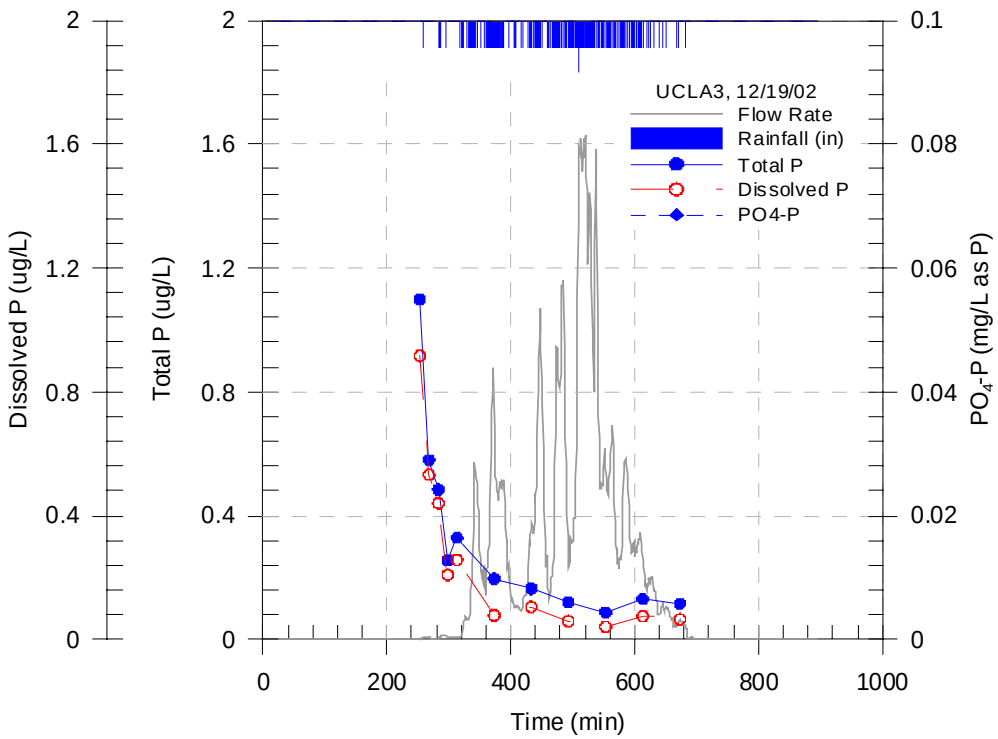

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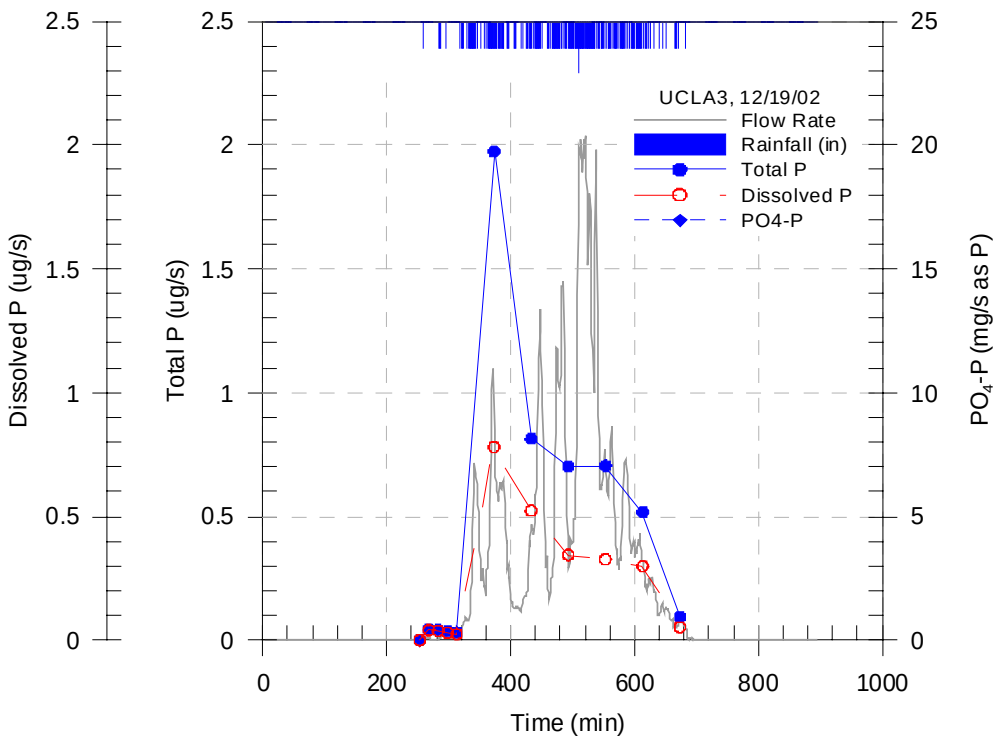

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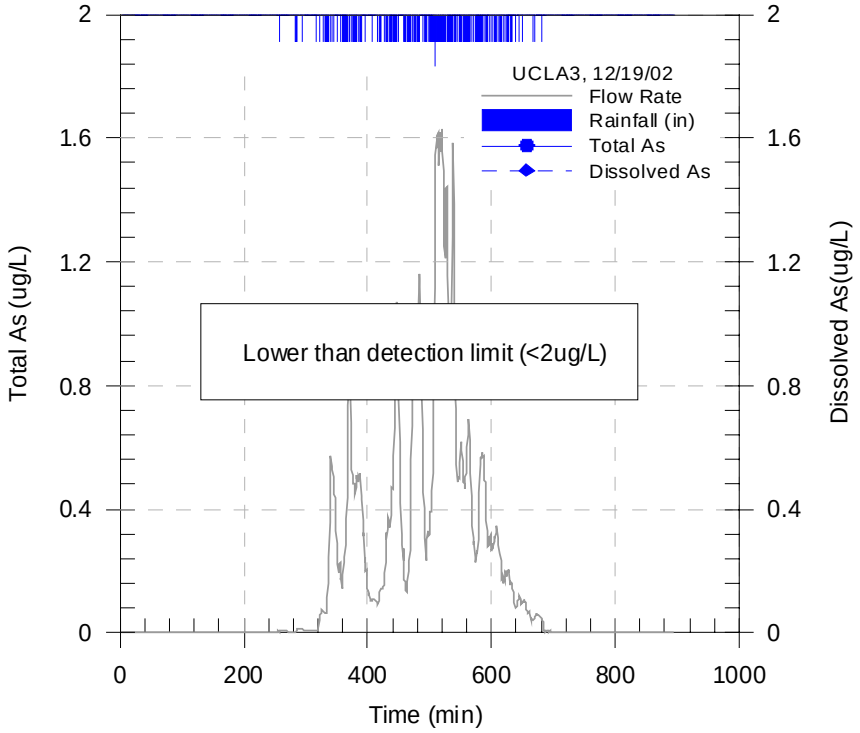
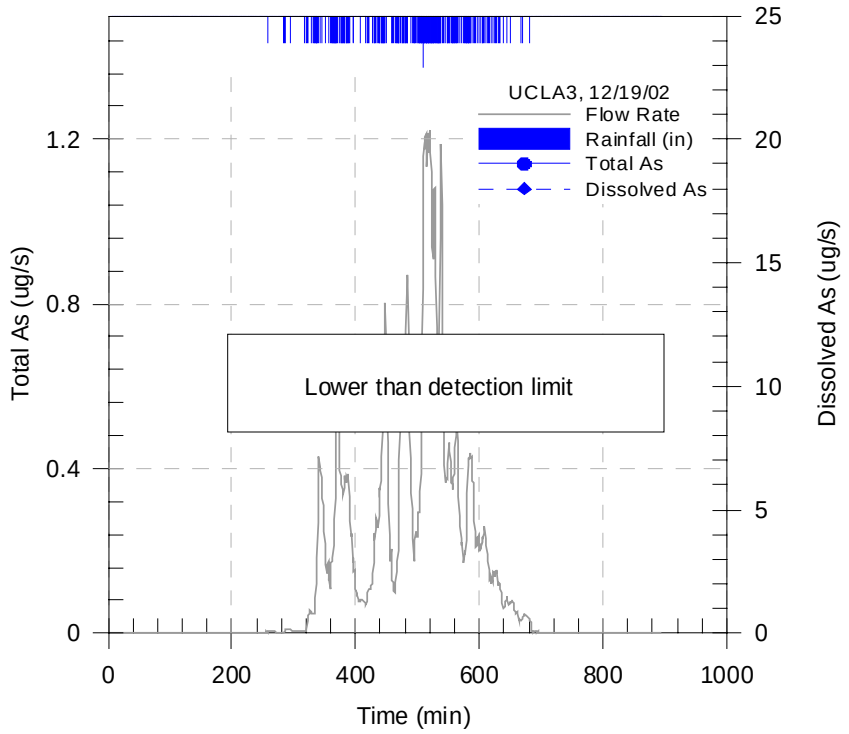


Figure I.4.3.4i[1] (Y4-UCLA3-E5-9). Polluto-graph for Total As / Dissolved As



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5. UCLA3, 2/11/03

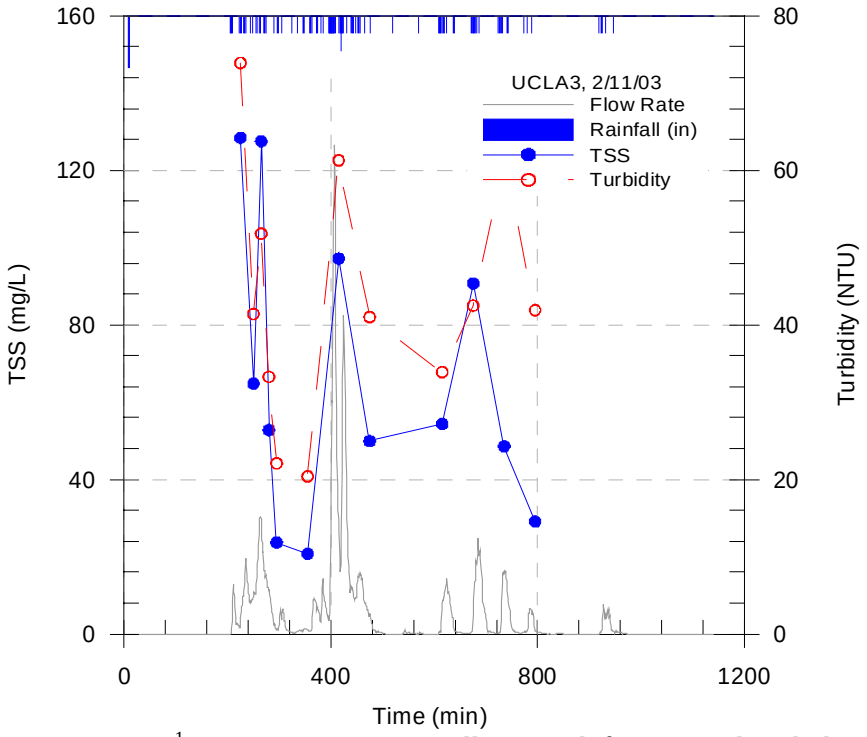
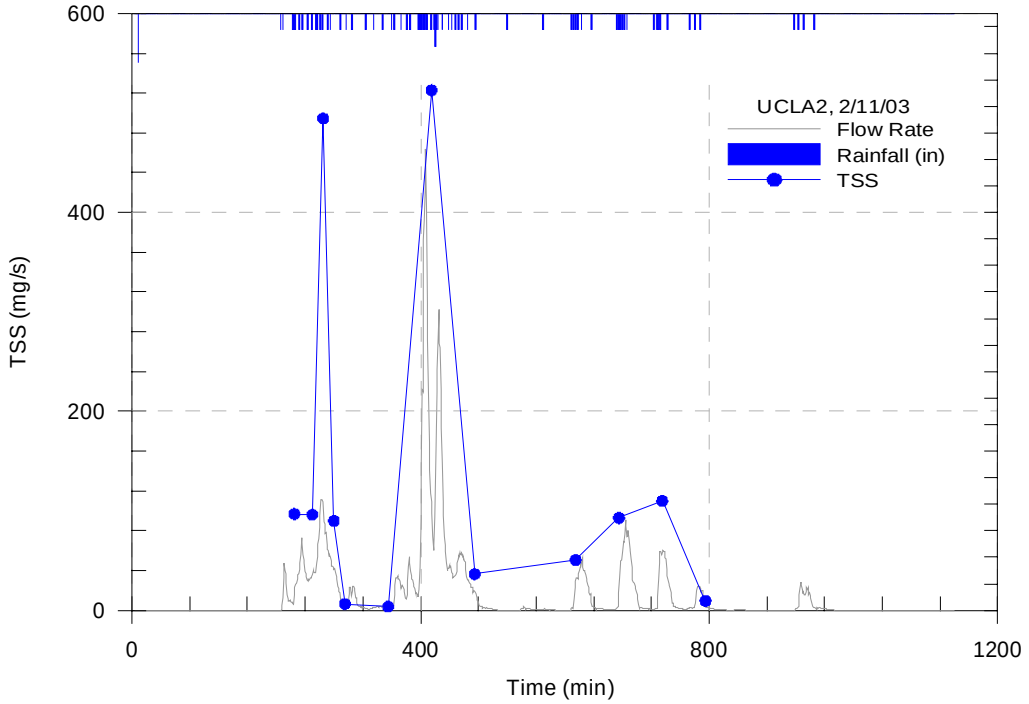


Figure I.4.3.5a[1] (Y4-UCLA3-E6-1). Polluto-graph for TSS and Turbidity



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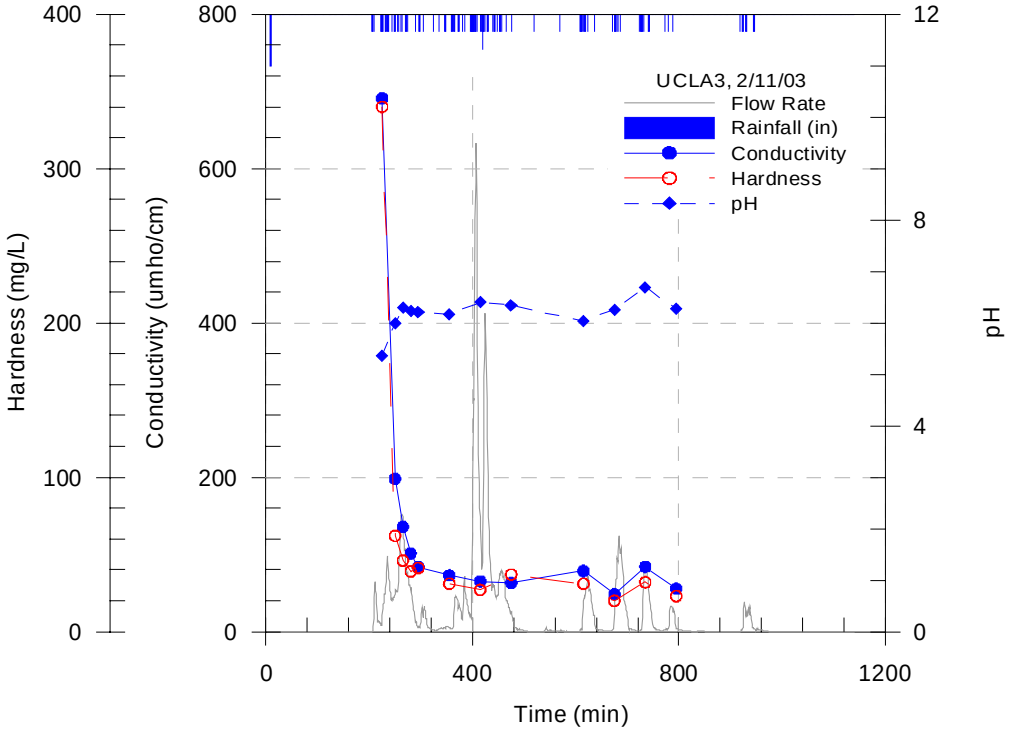

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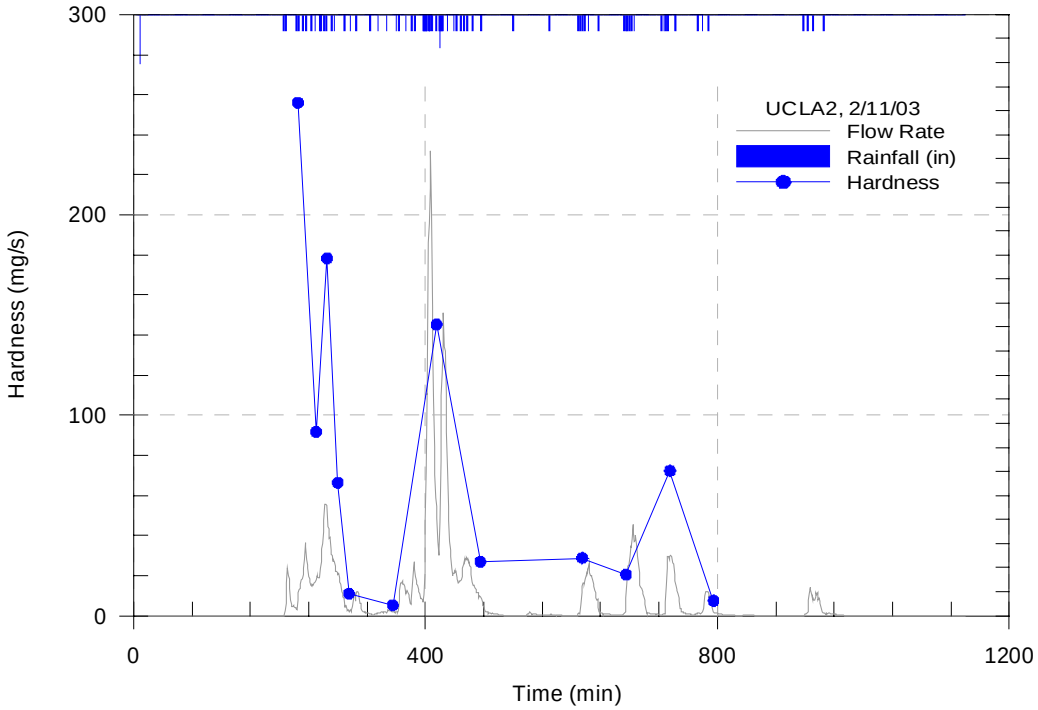

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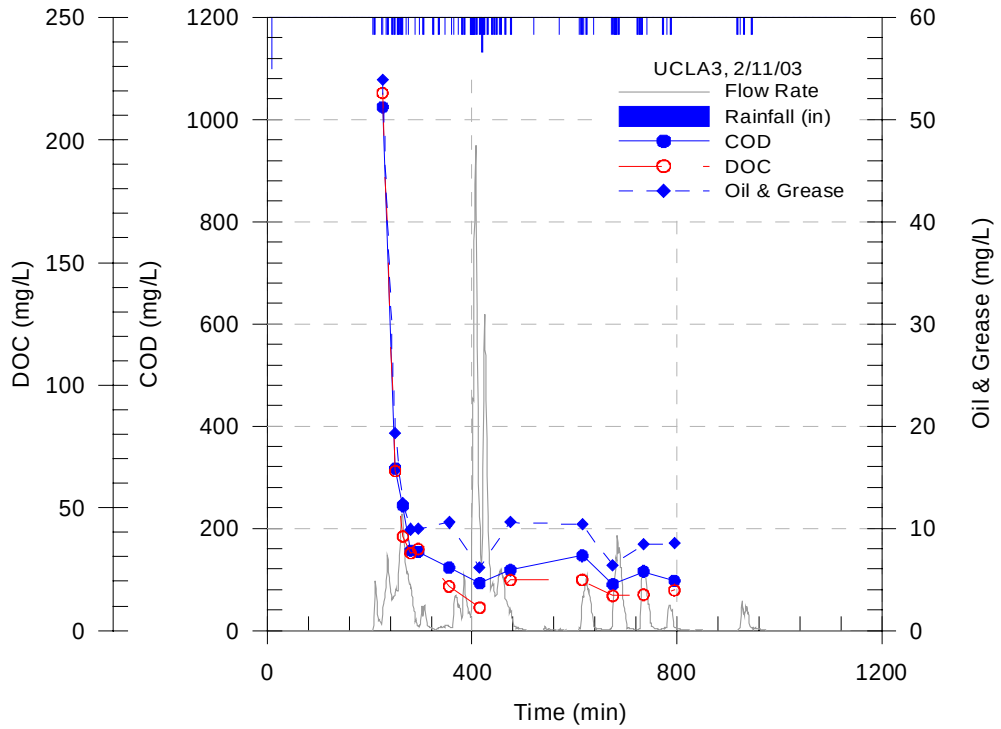
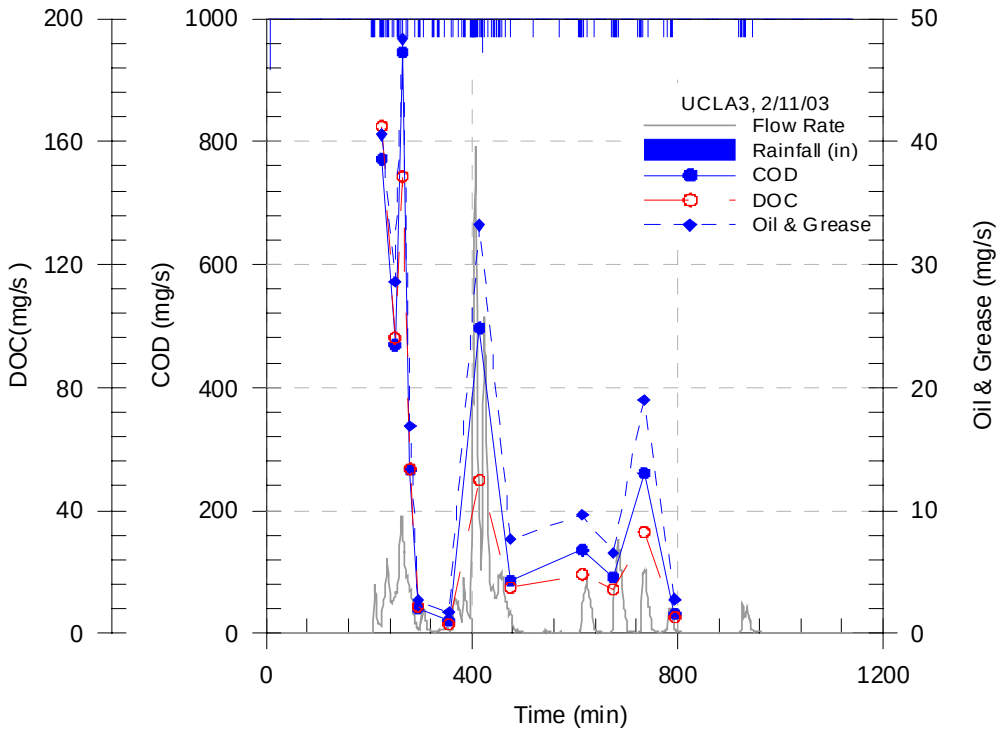


Figure I.4.3.5c[1] (Y4-UCLA3-E6-3). Polluto-graph for COD, DOC and Oil & Grease



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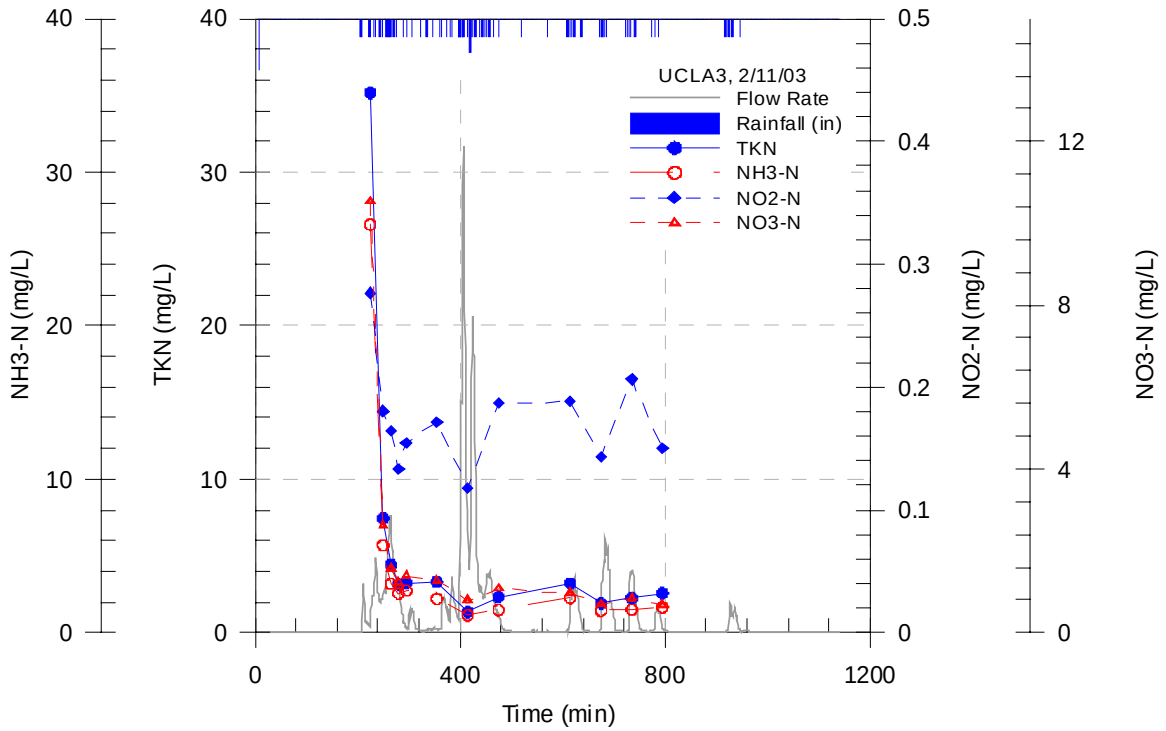


Figure I.4.3.5d[1] (Y4-UCLA3-E6-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

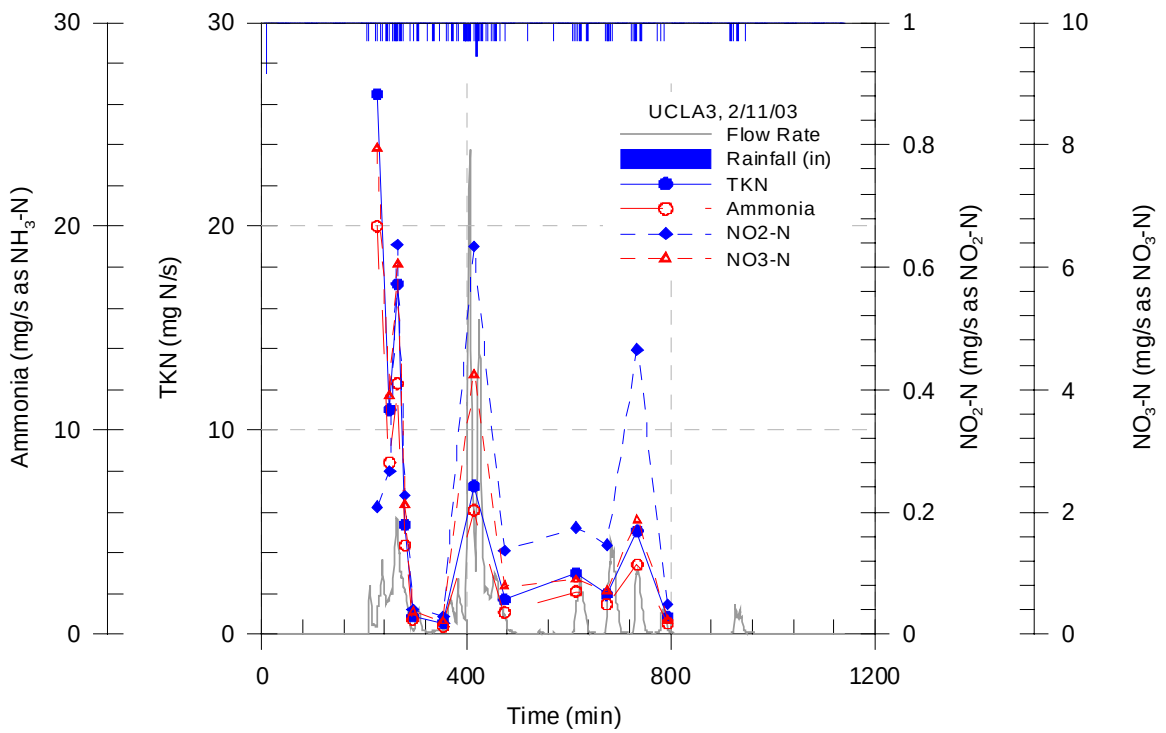


Figure I.4.3.5d[2] (Y4-UCLA3-E6-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

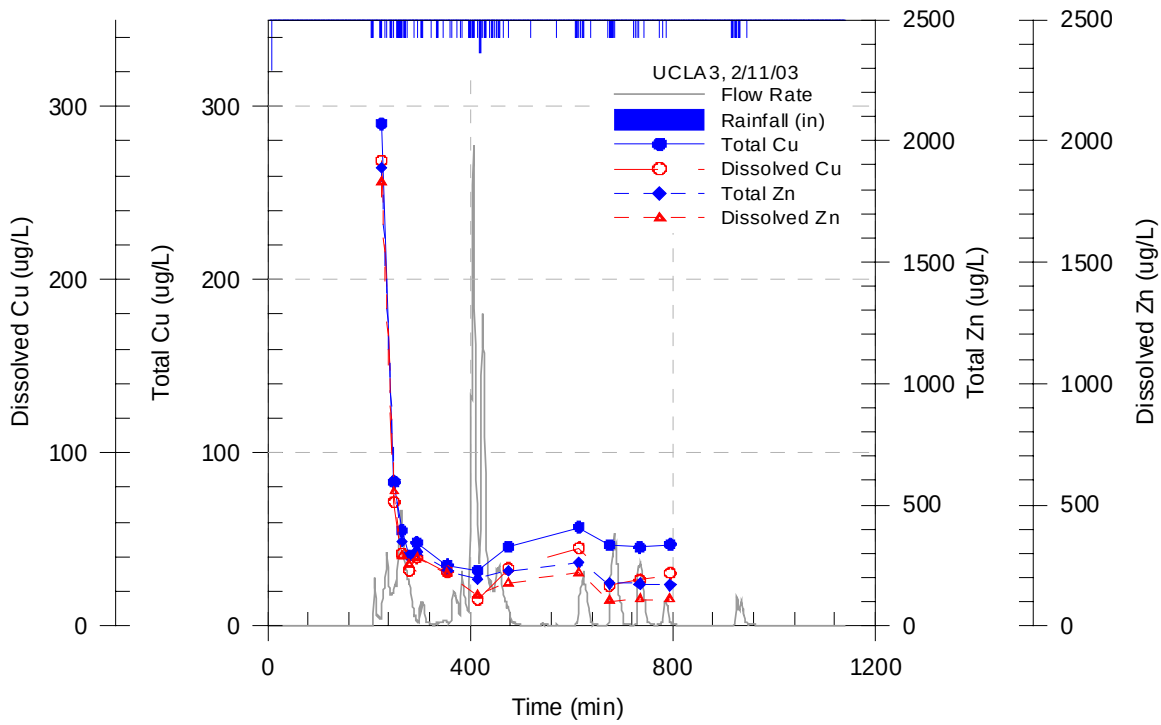
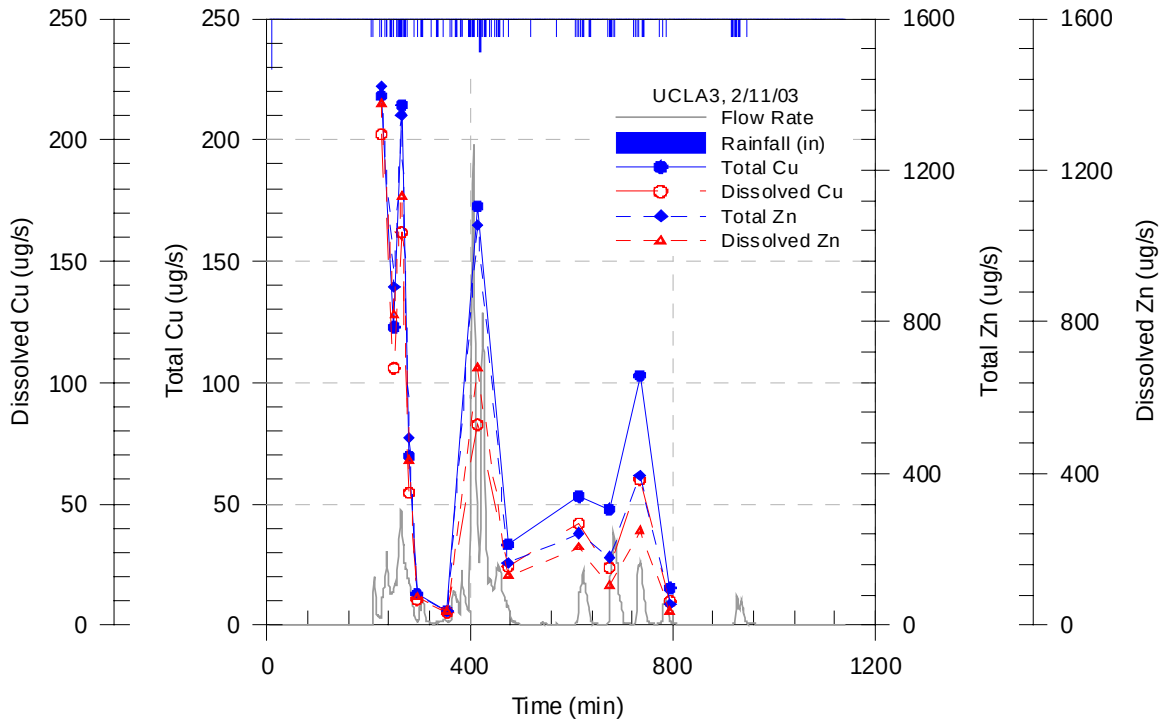


Figure I.4.3.5e[1] (Y4-UCLA3-E6-5). Polluto-graph for Total Cu / Dissolved Cu and Total Zn / Dissolved Zn



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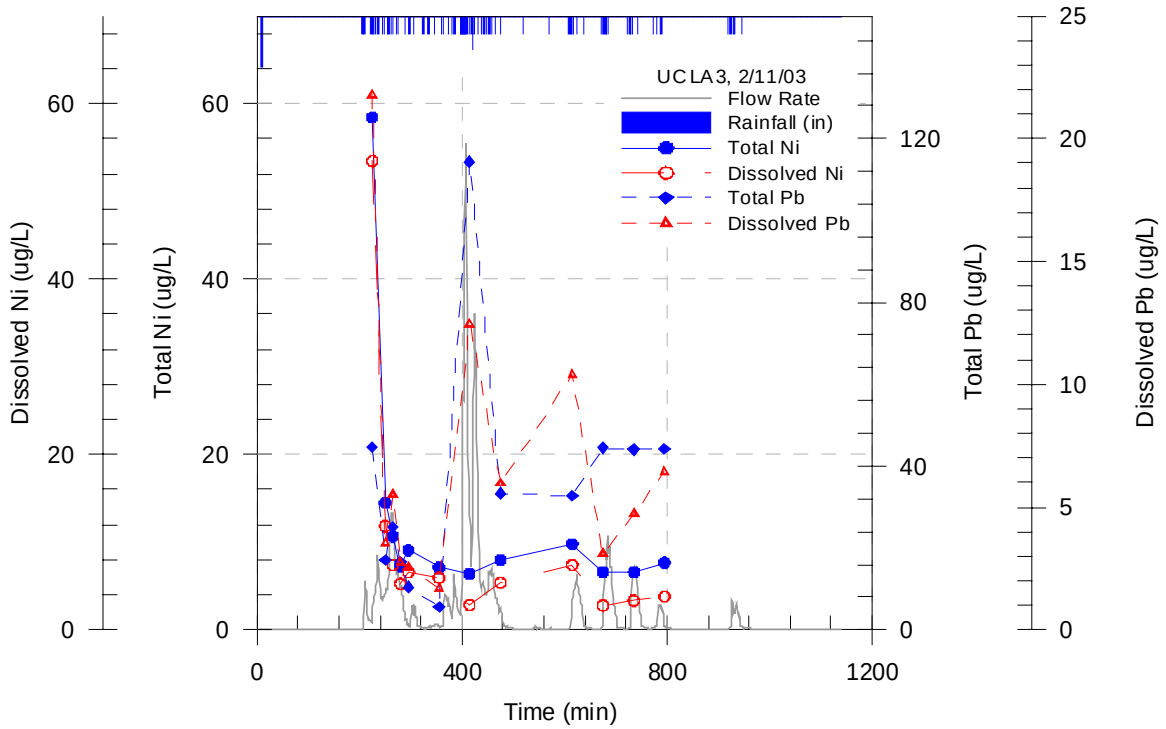

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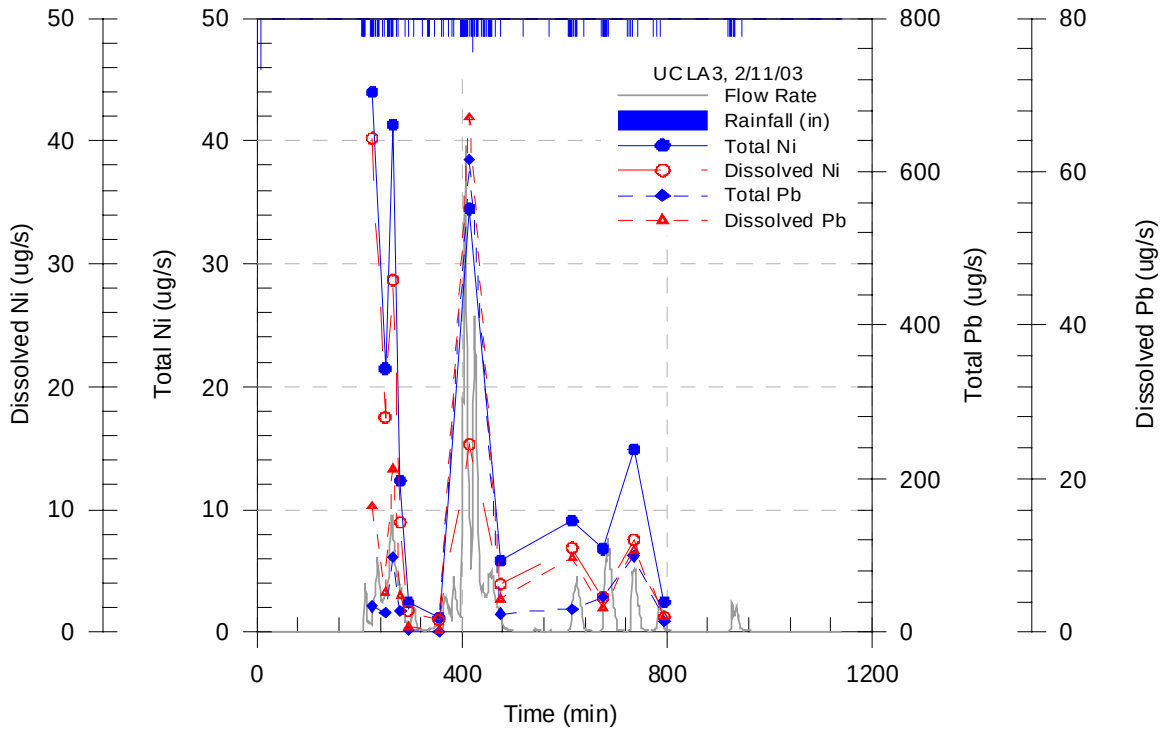

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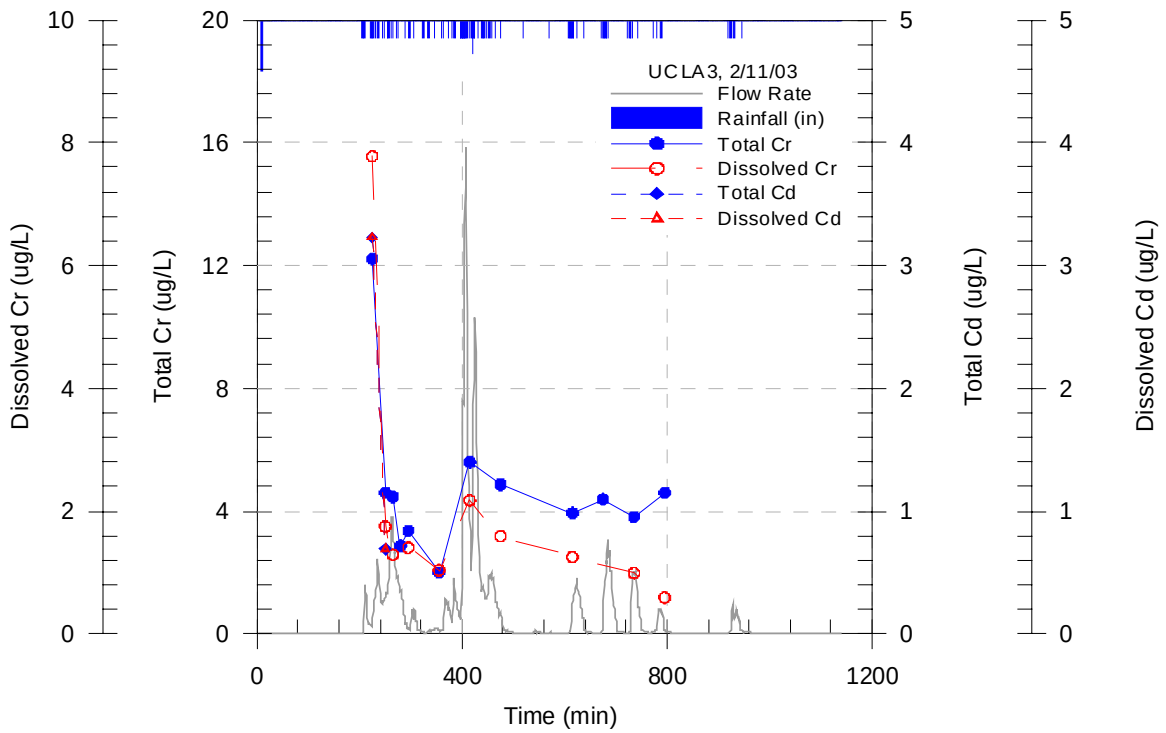

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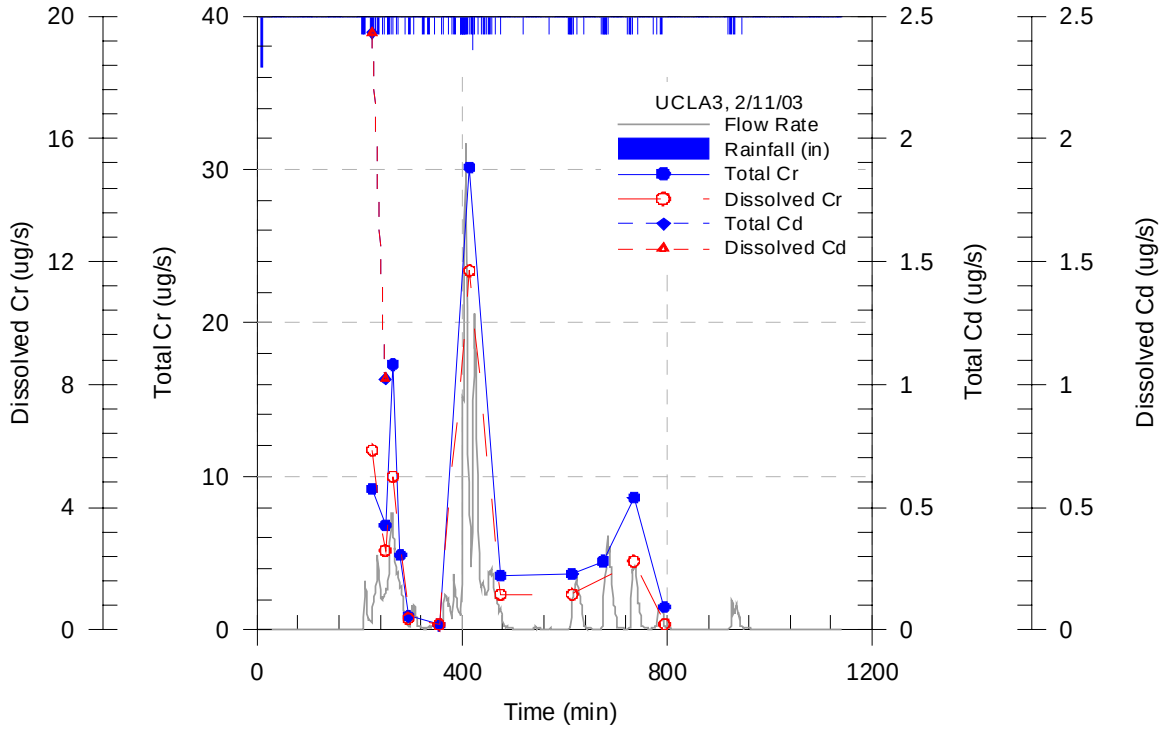

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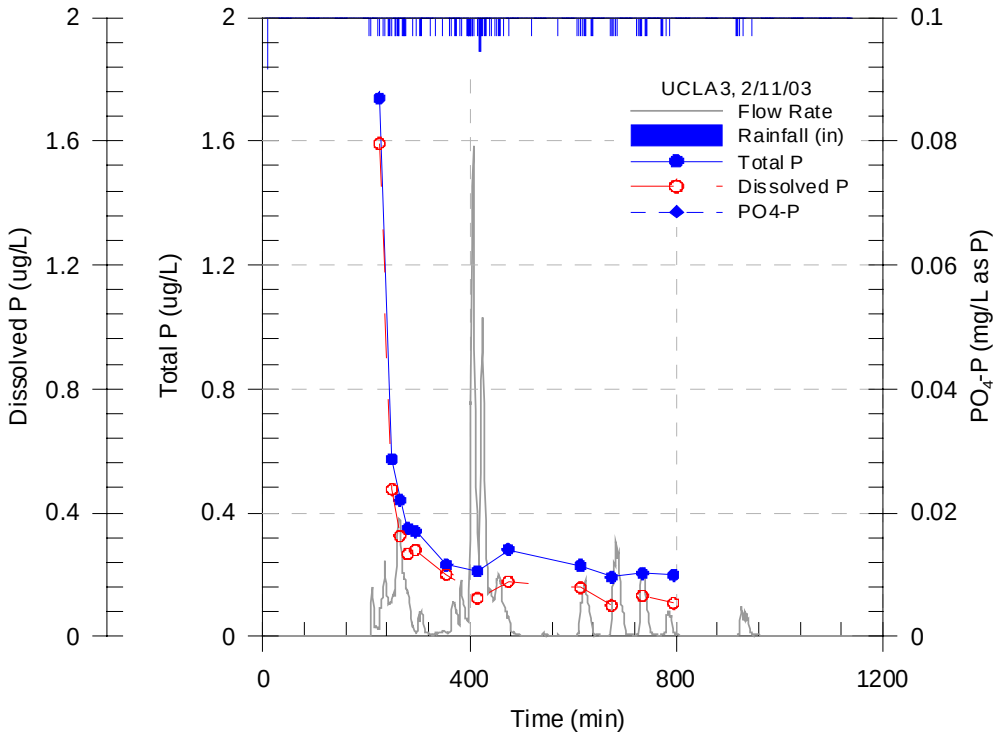

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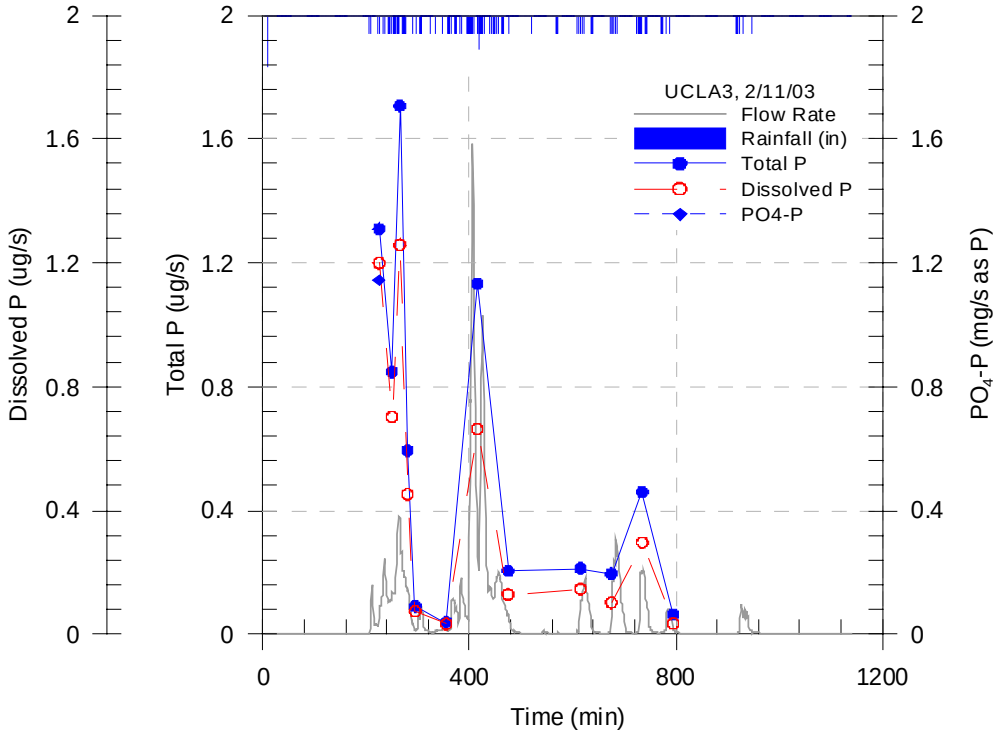

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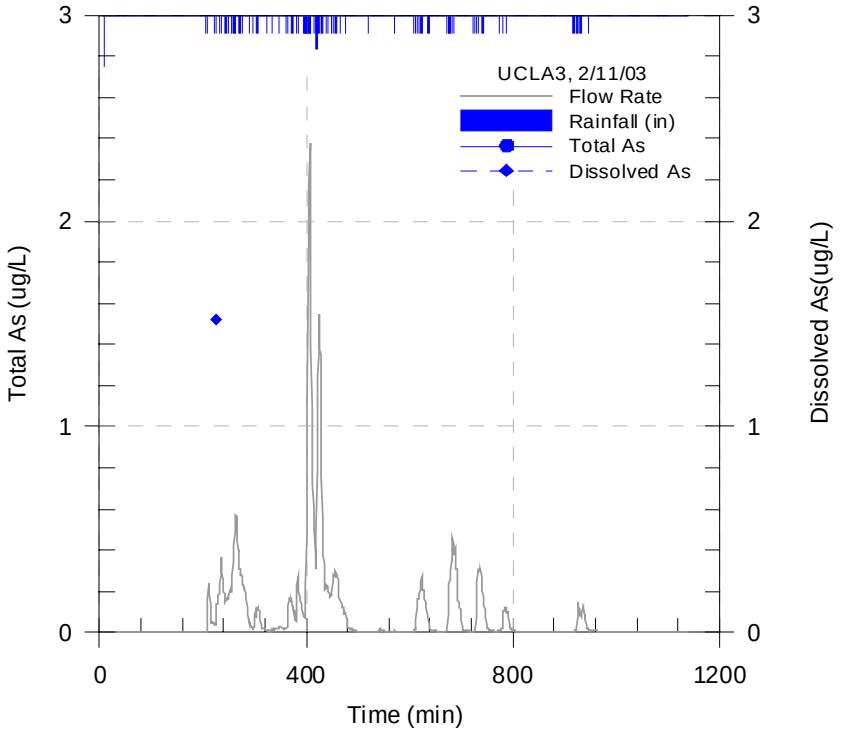
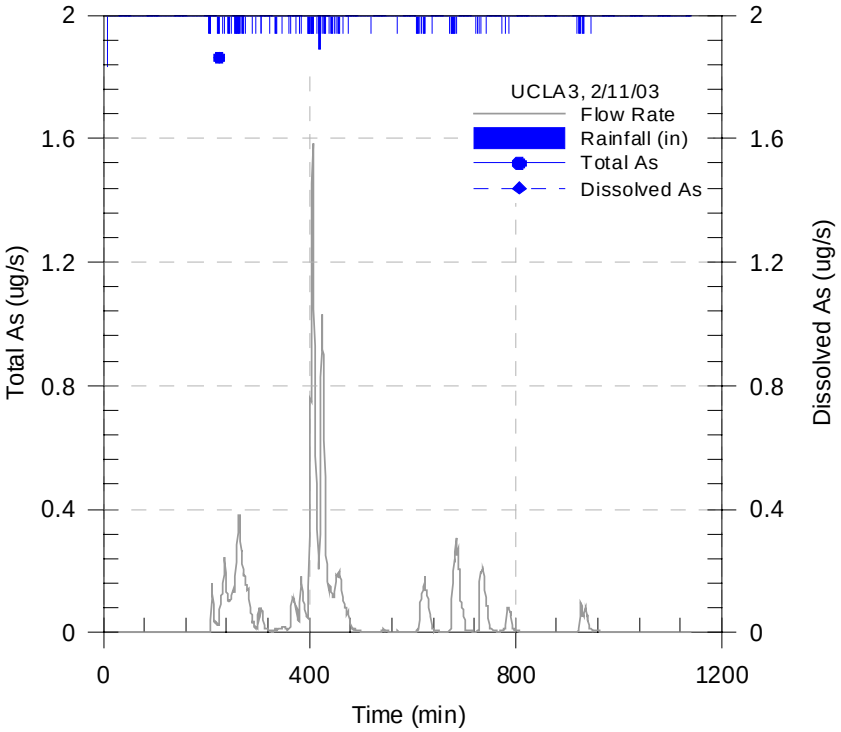


Figure I.4.3.5i[1] (Y4-UCLA3-E6-9). Polluto-graph for Total As / Dissolved As



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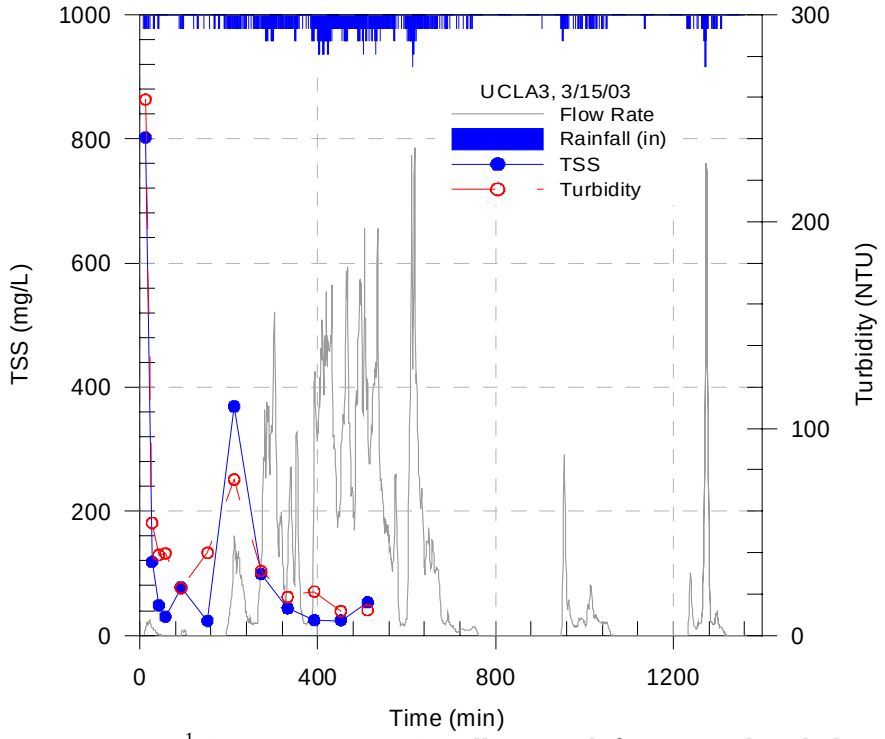
6. UCLA3, 3/15/03



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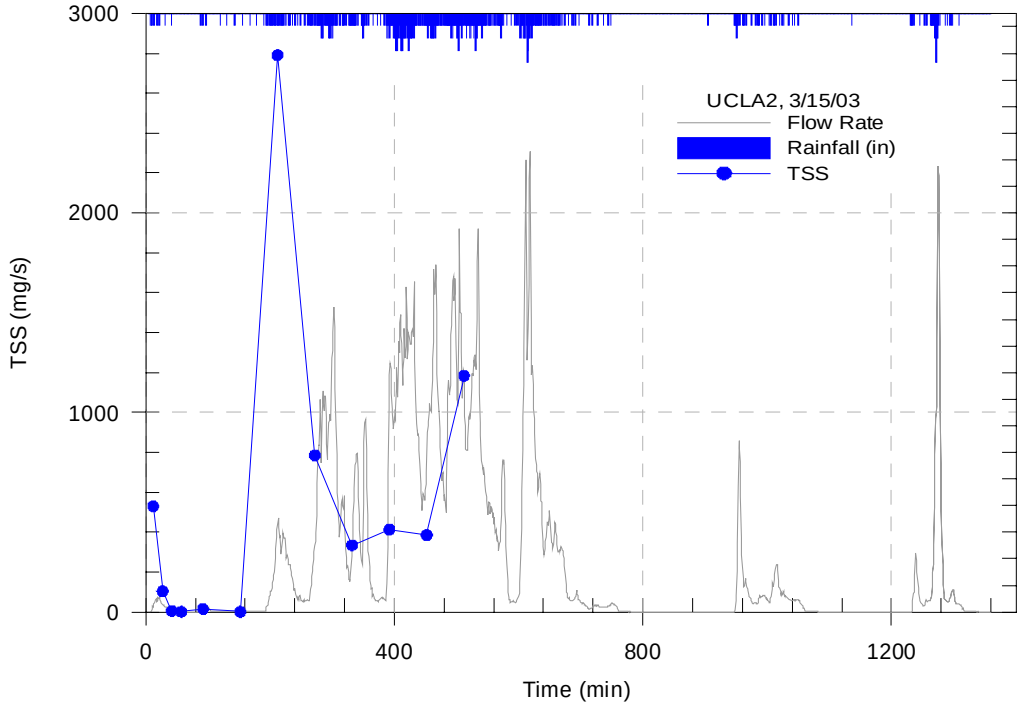

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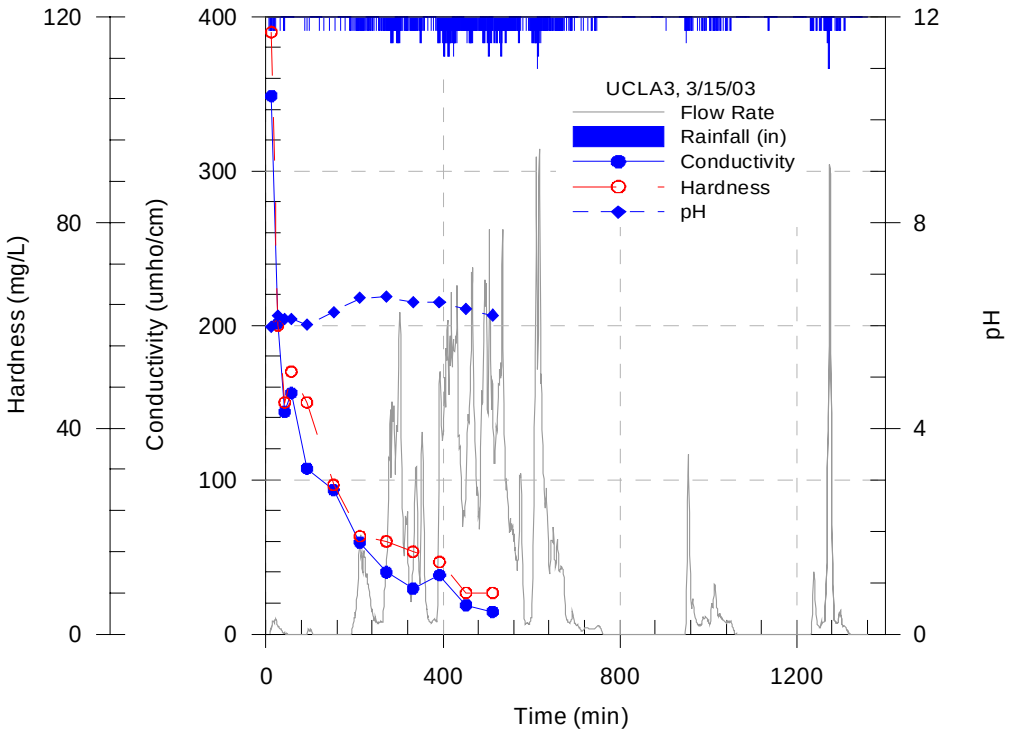

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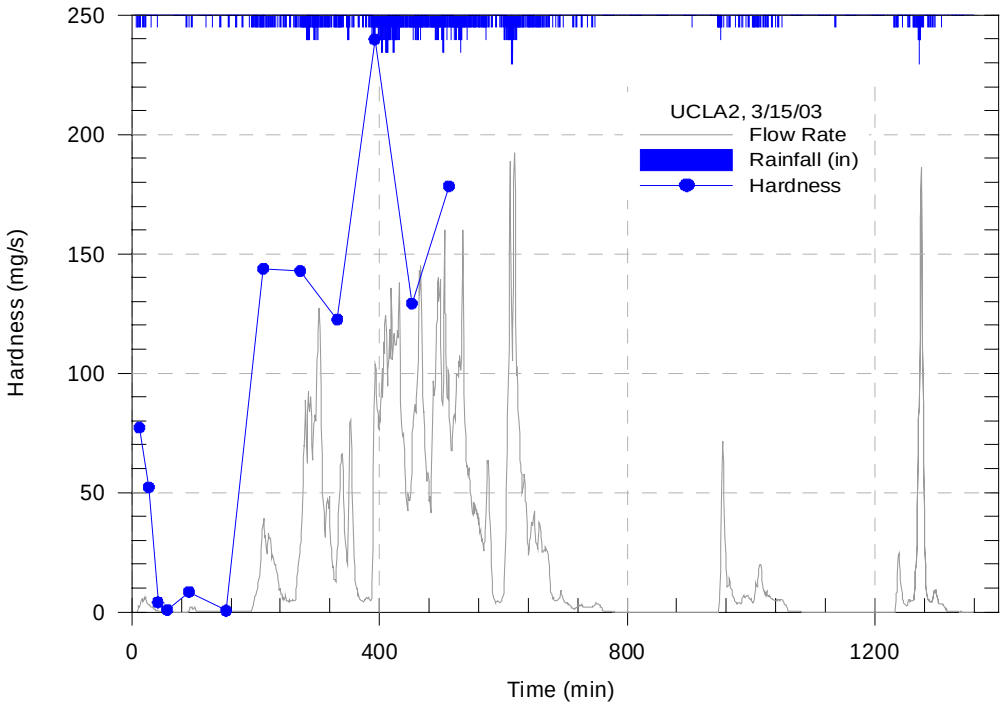

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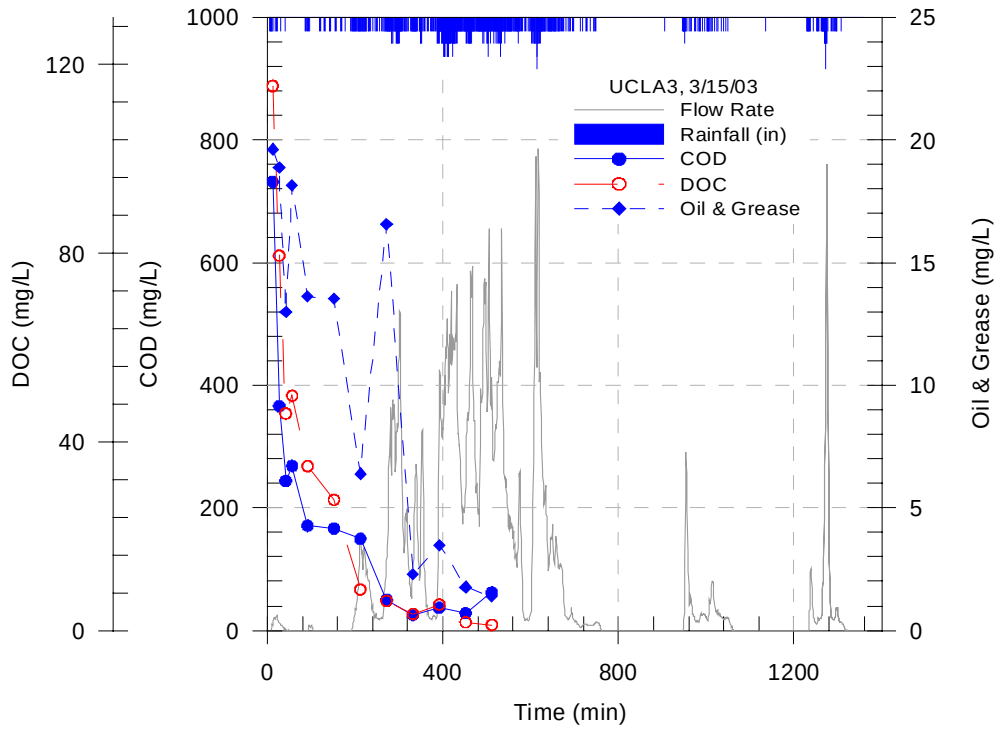
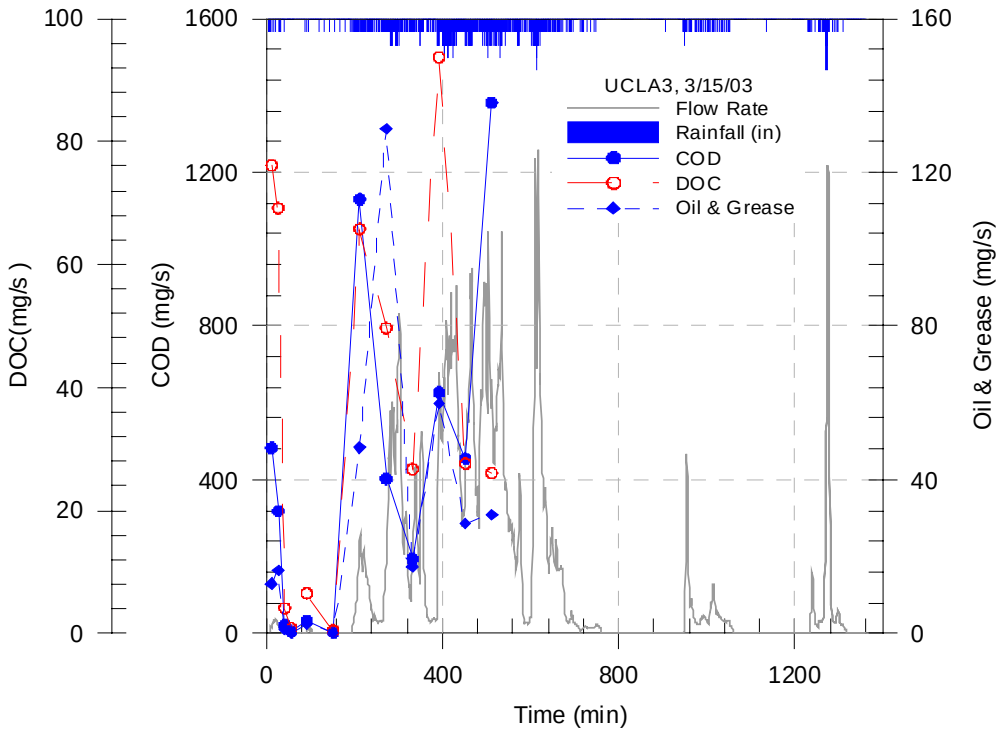


Figure I.4.3.6c[1] (Y4-UCLA3-E7-3). Polluto-graph for COD, DOC and Oil & Grease



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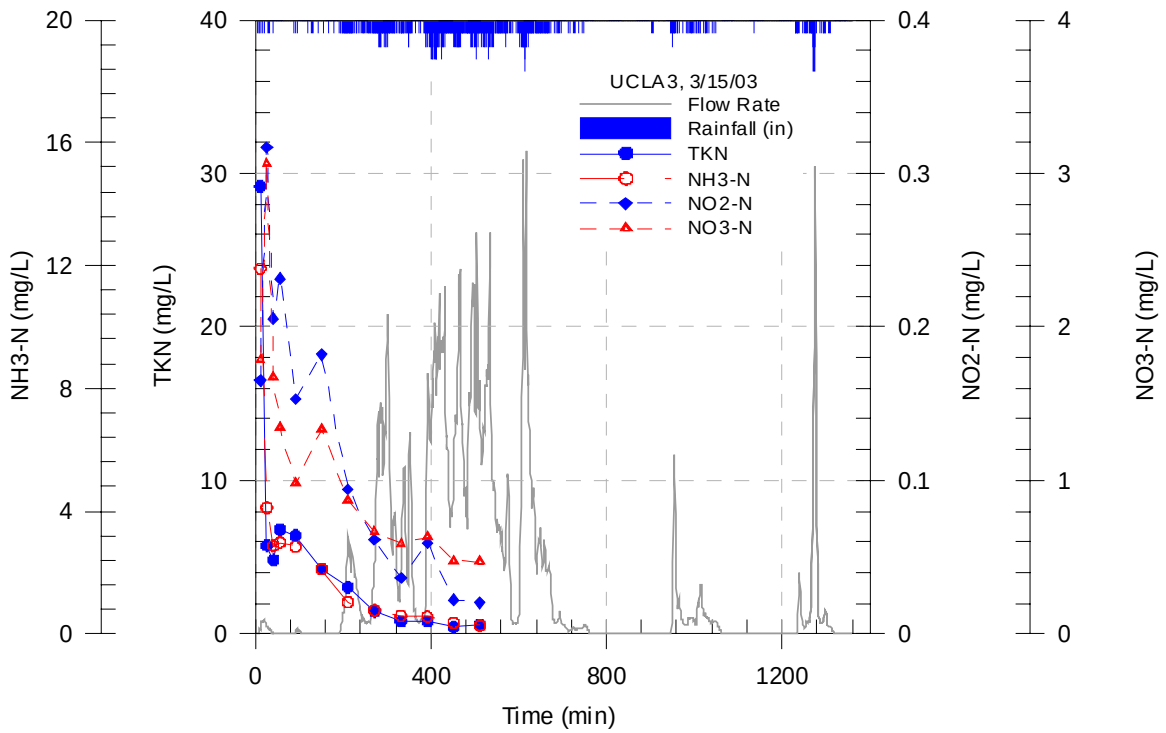

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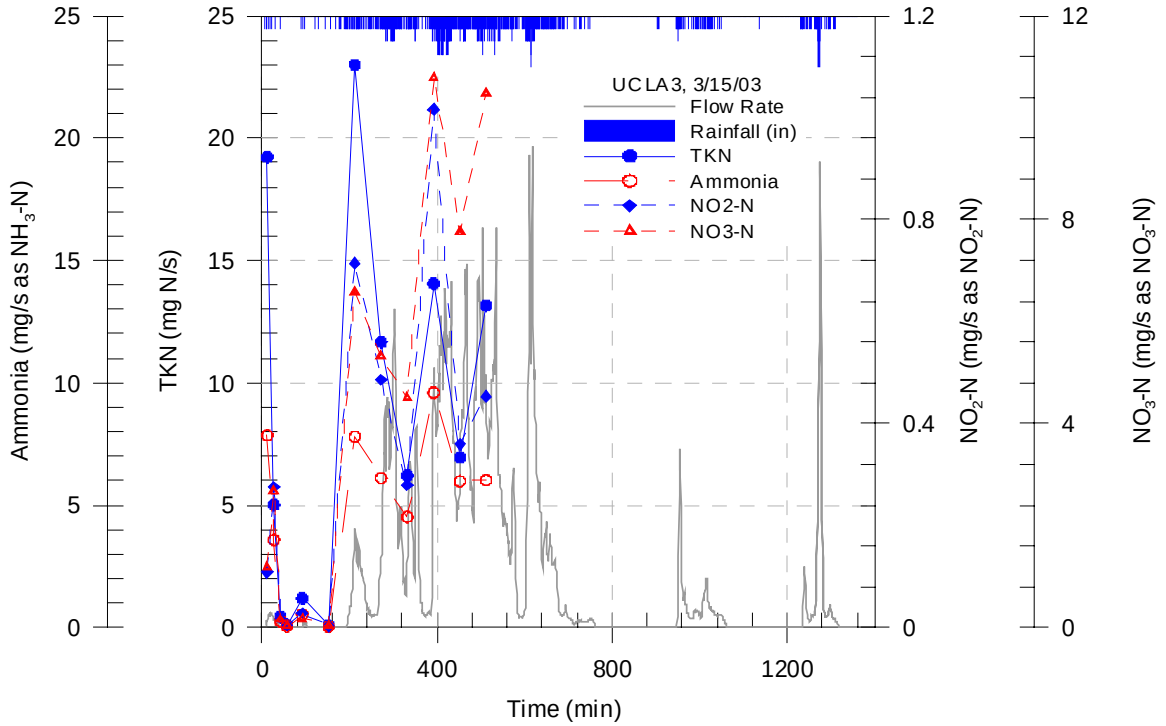


Figure I.4.3.6d[2] (Y4-UCLA3-E7-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

7. UCLA3, 4/14/03

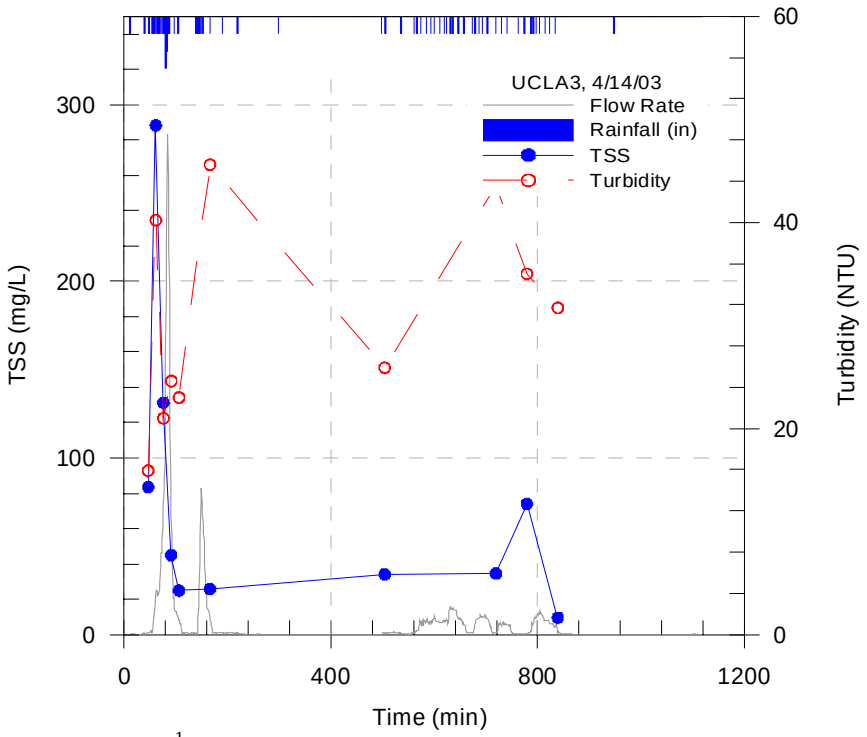
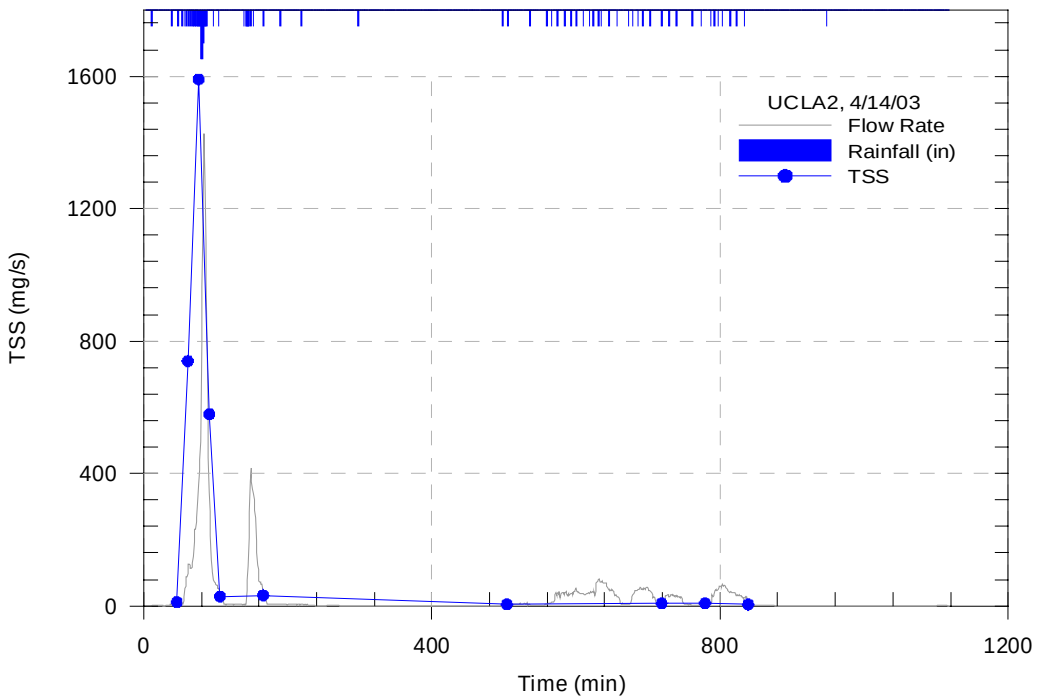


Figure I.4.3.7a[1] (Y4-UCLA3-E9-1). Polluto-graph for TSS and Turbidity



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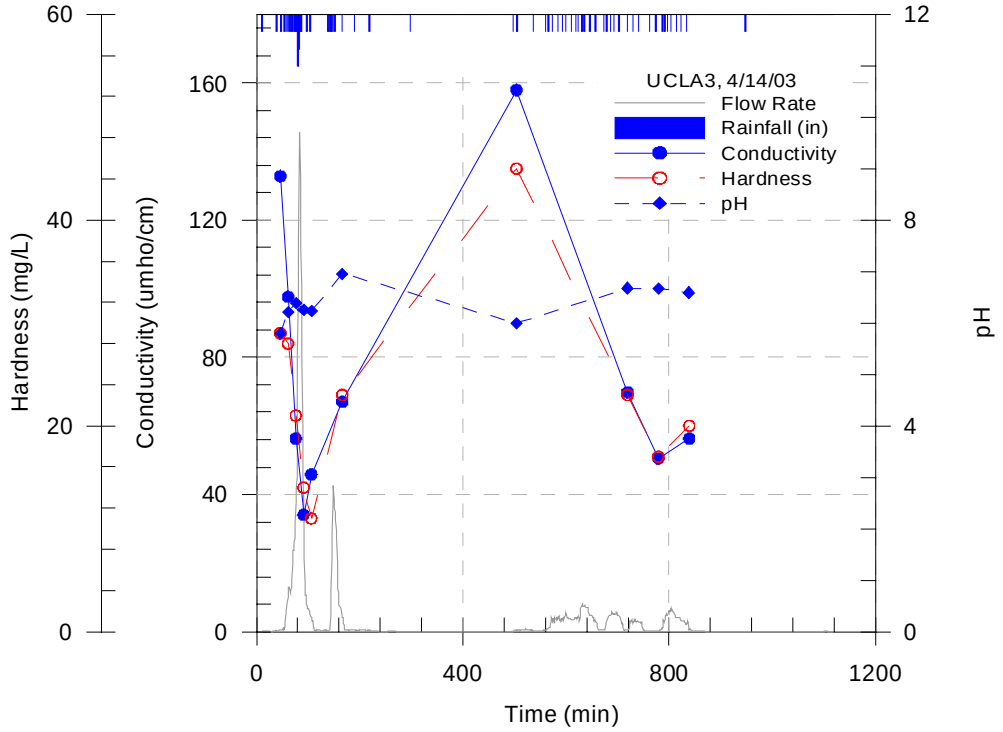


Figure I.4.3.7b[1] (Y4-UCLA3-E9-2). Polluto-graph for Conductivity, Hardness and pH

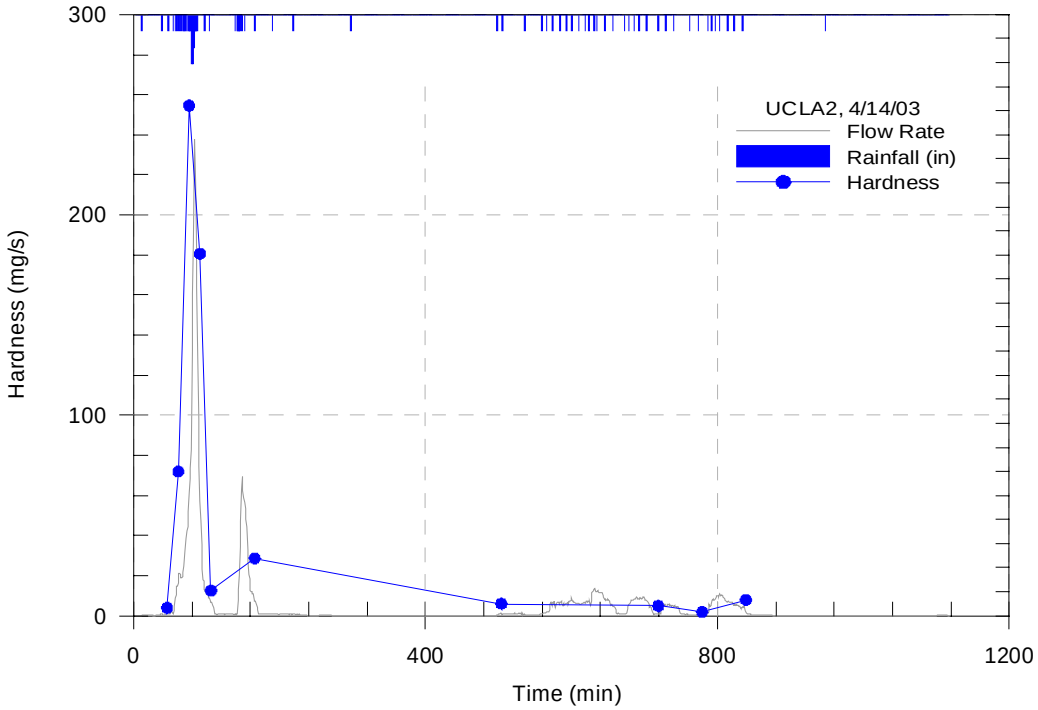


Figure I.4.3.7b[2] (Y4-UCLA3-E9-2). Load-graph for Hardness

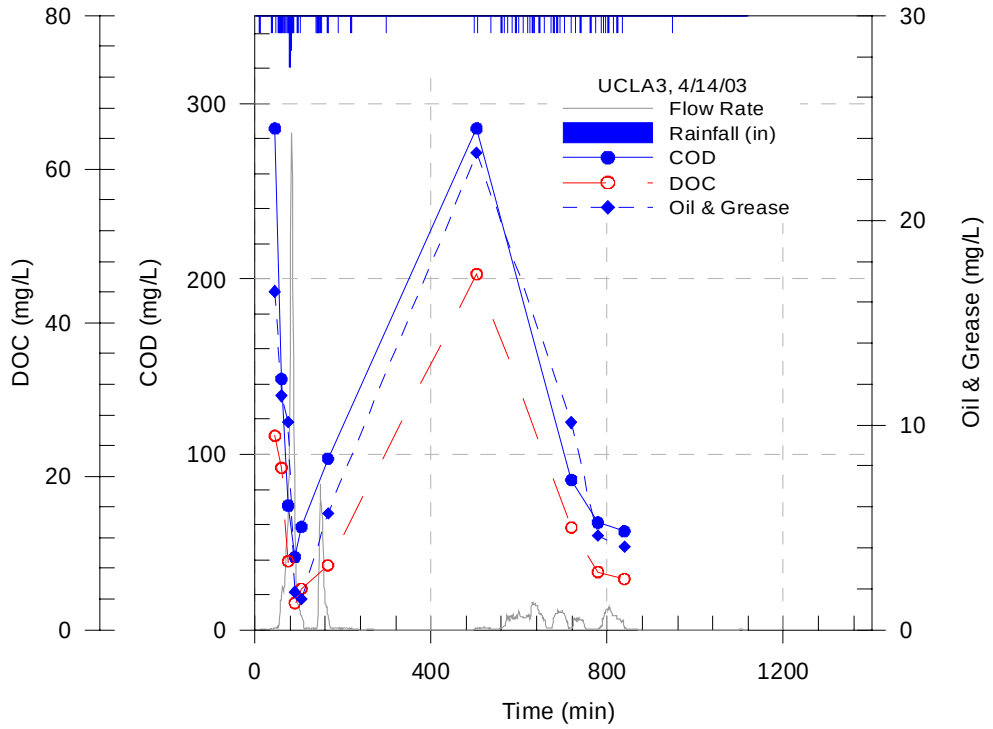
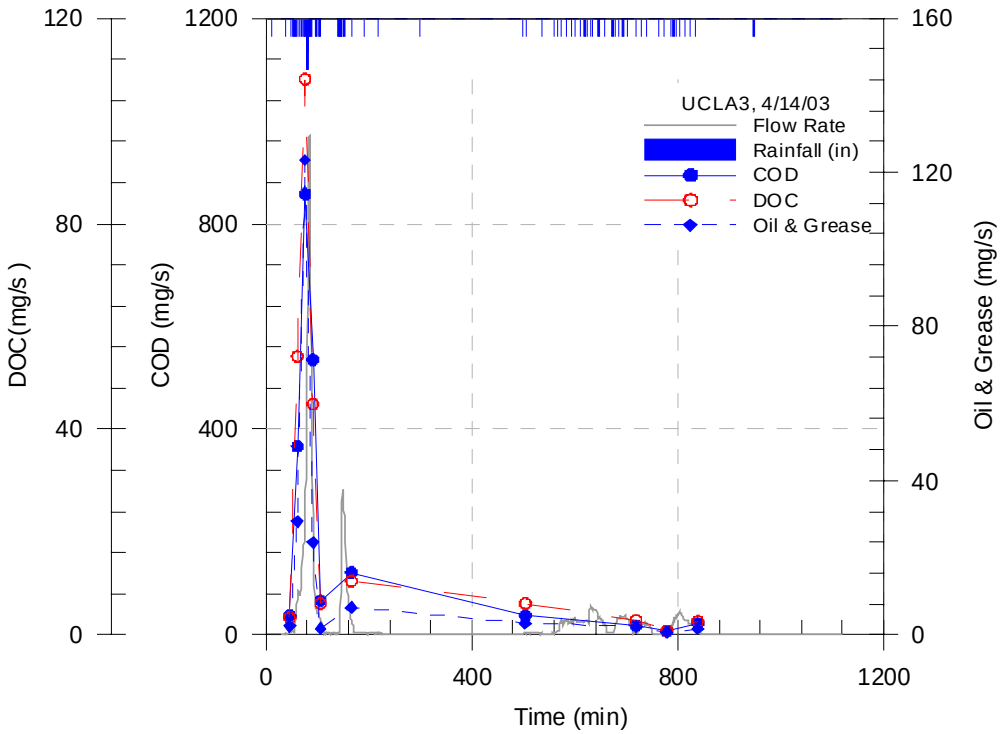


Figure I.4.3.7c[1] (Y4-UCLA3-E9-3). Polluto-graph for COD, DOC and Oil & Grease



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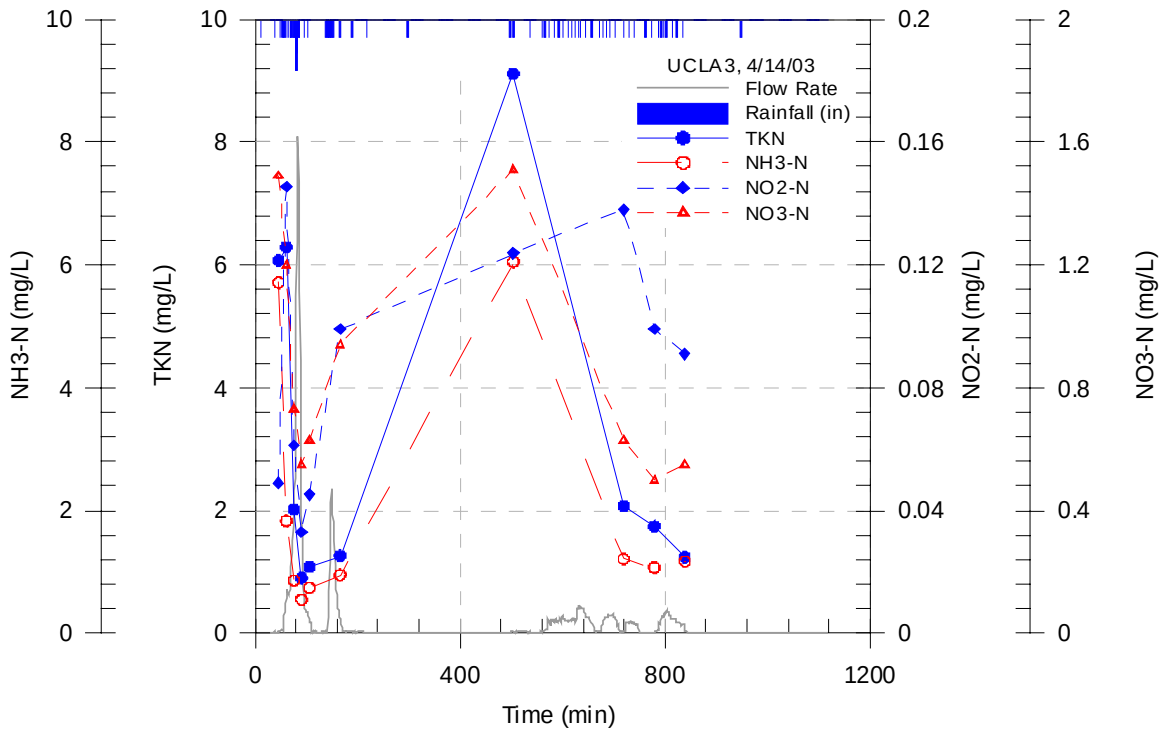

Figure I.4.3.7d[1] (Y4-UCLA3-E9-4). Polluto-graph for TKN, NH_3-N, NO_2-N and NO_3-N

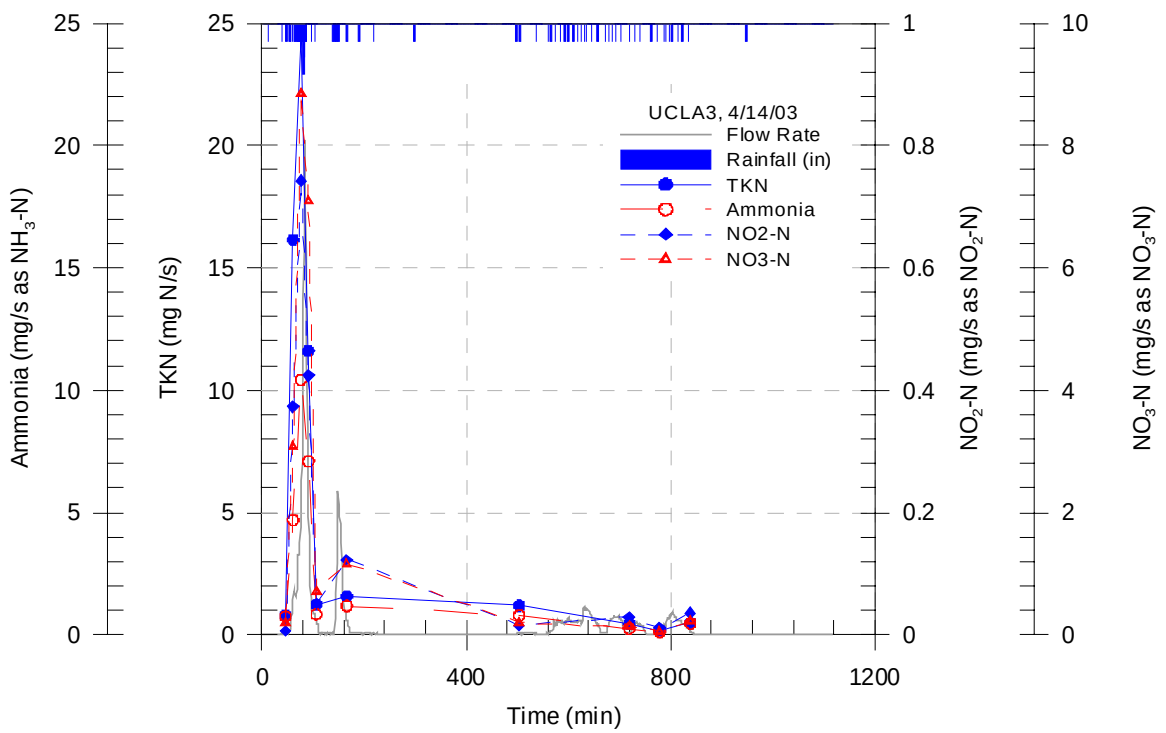

Figure I.4.3.7d[2] (Y4-UCLA3-E9-4). Load-graph for TKN, NH_3-N, NO_2-N and NO_3-N

APPENDIX J
SITE MAPS AND AERIAL PHOTOGRAPHS

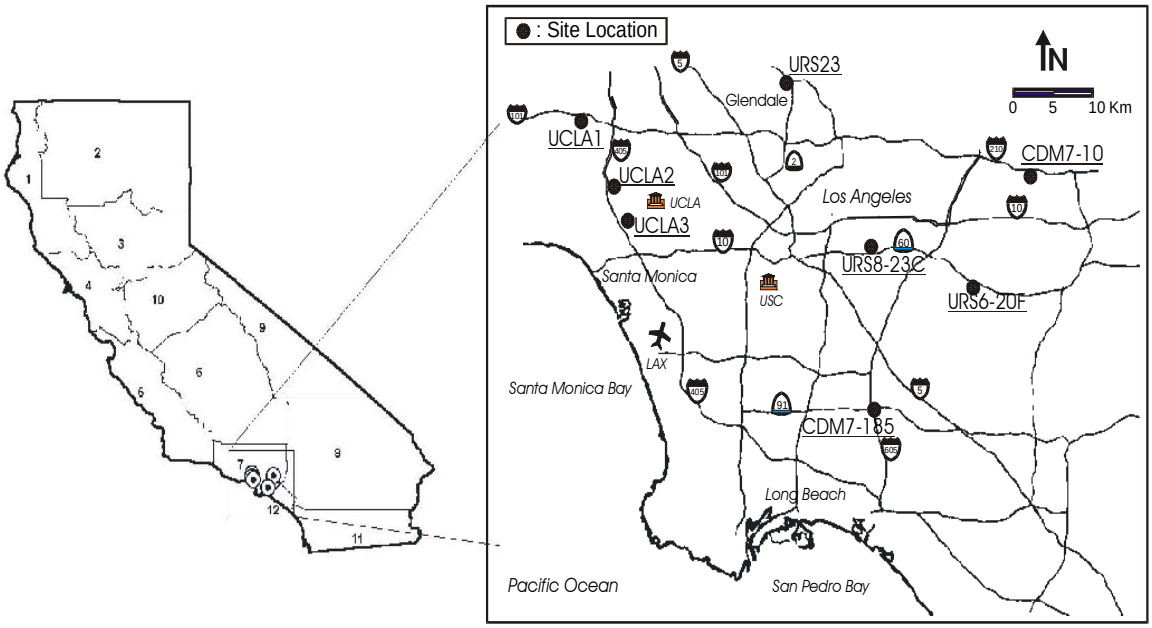

Figure J.1.1 Maps for the Stormwater Monitoring Sites

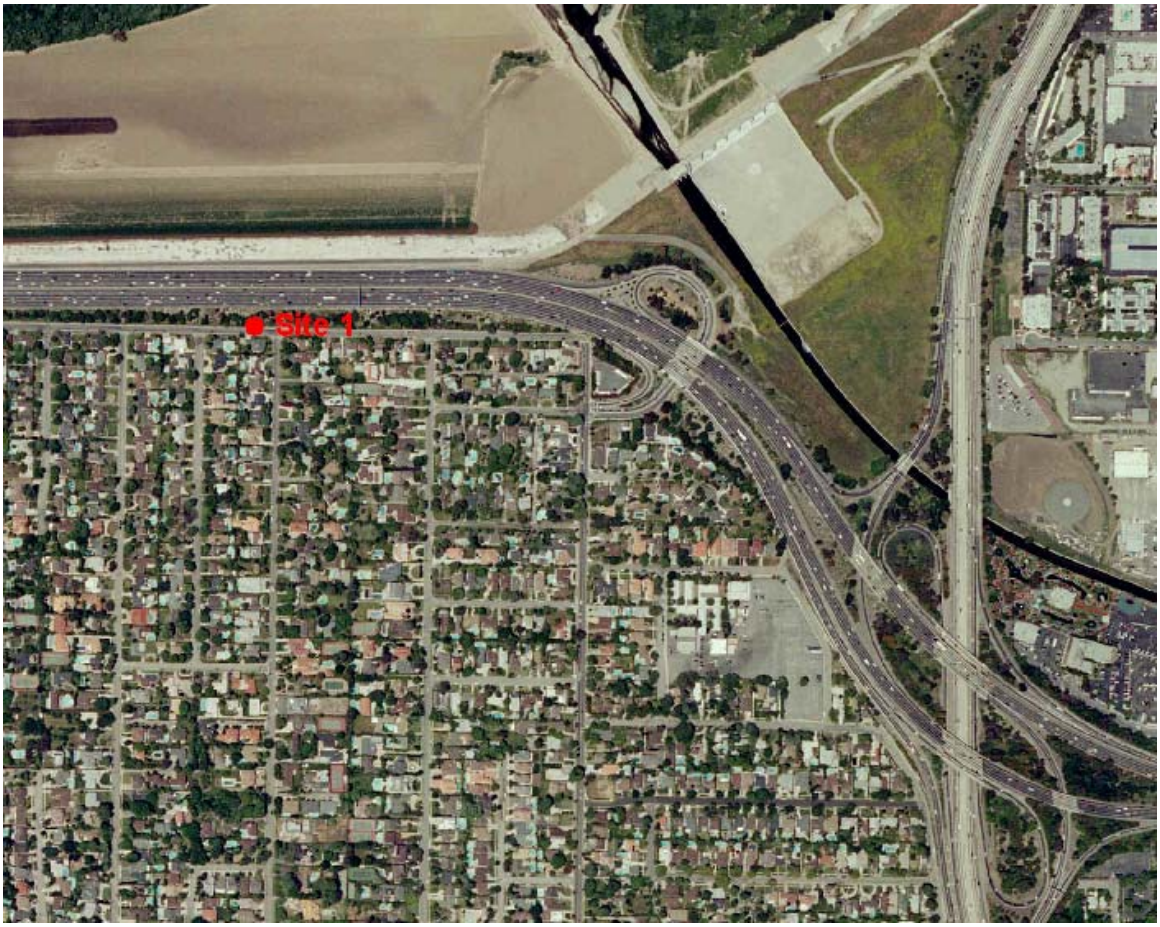

Figure J.2.1 Aerial Photograph for UCLA 1

Figure J.2.2 Aerial Photograph for UCLA 2

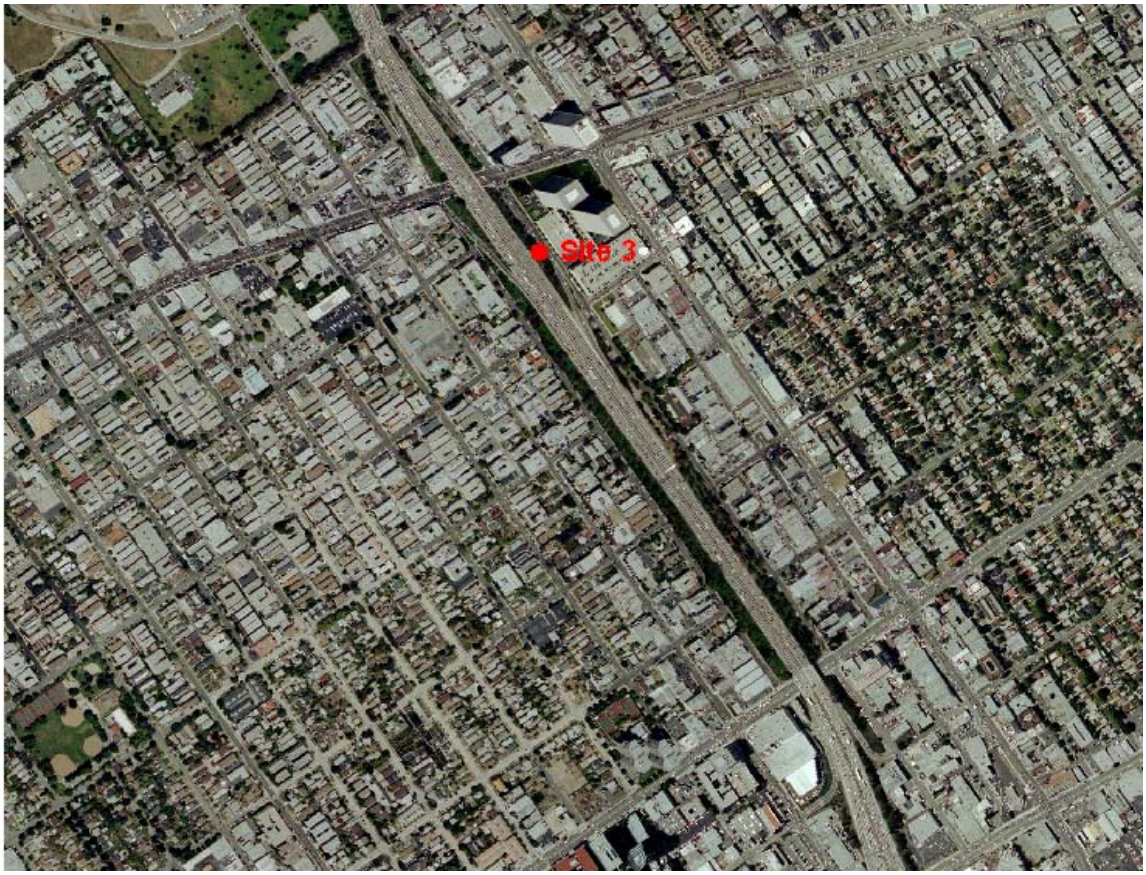

Figure J.2.3 Aerial Photograph for UCLA 3

APPENDIX K
TECHNICAL MEMORANDUMS

TECHNICAL MEMORANDUM (Part V)

Seasonal First Flush Phenomenon

Prepared for

California Department of Transportation
Division of Environmental Analysis
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Summary

California's climate, typified by winter and spring precipitation and summer drought, is often called a Mediterranean climate, and creates a long period for pollutant build-up. The initial storms of the winter season usually have higher pollutant concentrations, which is called a seasonal first flush. To investigate the existence of a seasonal first flush, we analyzed four major data sets including our first flush highway runoff study and Caltrans' statewide highway runoff monitoring datasets, collected over the 1999-2000 to 2002 –2003 wet seasons. Trends in seasonal loads were quantified by plotting pollutant concentrations or cumulative pollutant load versus cumulative rainfall or cumulative runoff volume. Pollutant concentrations in the first part of the wet season were ranged from 1.2 to 20 times higher than concentrations near the end of the season, and mass emission rates were similarly higher at the beginning of the season. A seasonal first flush existed for most cases and was strongest for organics, minerals and heavy metals except lead. This result suggests that applying treatment BMPs early in the season could remove several times more pollutant mass than randomly-timed or uniformly-applied BMPs.

1. Introduction

Urban stormwater discharge during wet weather flow is major contributor to the pollution of many receiving waters (Saget et al., 1996; Appel and Hudak, 2001; Brezonik and Stadelmann, 2002; Buffleben et al., 2002). Climatic conditions such as the existence of long dry or wet periods may greatly impact pollutant emissions from urban stormwater discharges. California has a Mediterranean climate, typified by winter and spring precipitation and summer drought. Most of western parts of California including Los Angeles are dry from May through September. Figure 1A shows the monthly average rainfall throughout the northern, central and southern California during 1971- 2000 (http://www.ncdc.noaa.gov/oa/ climate/online/ccd/nrmlprcp.html). This rainfall pattern creates a long period for pollutant build-up, and therefore the initial storm of the season may higher pollutant concentrations than in later events. This phenomenon is called a seasonal first flush. Figure 1B shows the monthly average rainfall throughout United States during 1971- 2000, and is useful to compare California's rainfall pattern with the other cities in United States.

The presence of a seasonal first flush of urban stormwater discharge as well as existence of the first flush of a storm event is important for selecting efficient source and treatment Best Management Practices (BMPs). Many researchers investigated the first flush phenomenon to understand the characteristics of stormwater runoff discharge (Bertrand-Krajewski et al., 1998; Deletic, 1998; Larsen et al., 1998; Barbosa and Hvitved-Jacobsen, 1999), but only a few have determined the effect of the antecedent dry period (Saget et al., 1996; Deletic and Maksimovic,

1998; Lee et al., 2002). The antecedent dry period is an important factor and creates the seasonal first flush. However, the antecedent dry periods in the previous studies are

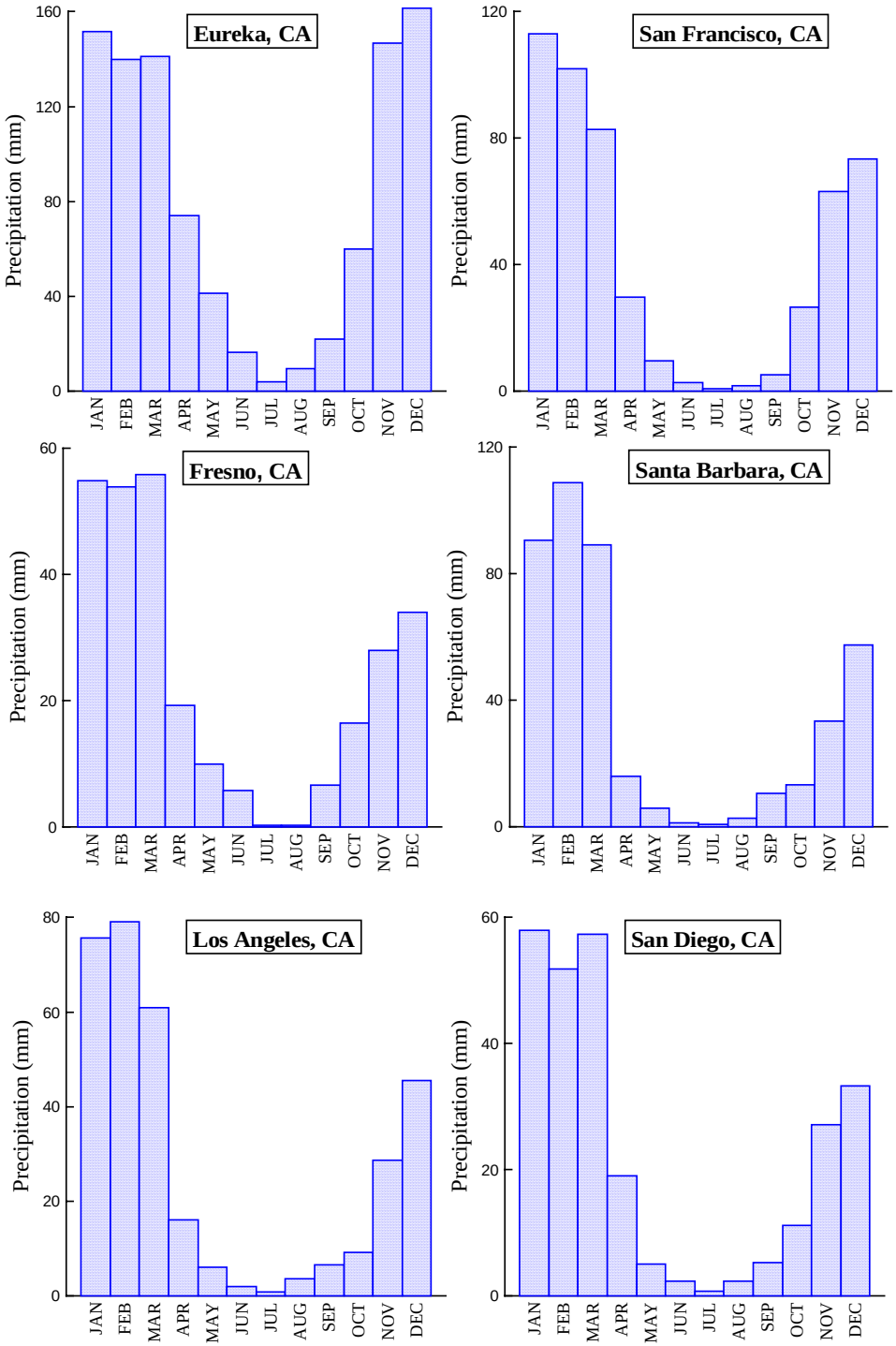

Fig. 1A. Distribution of monthly average rainfall in California during 1971-2000

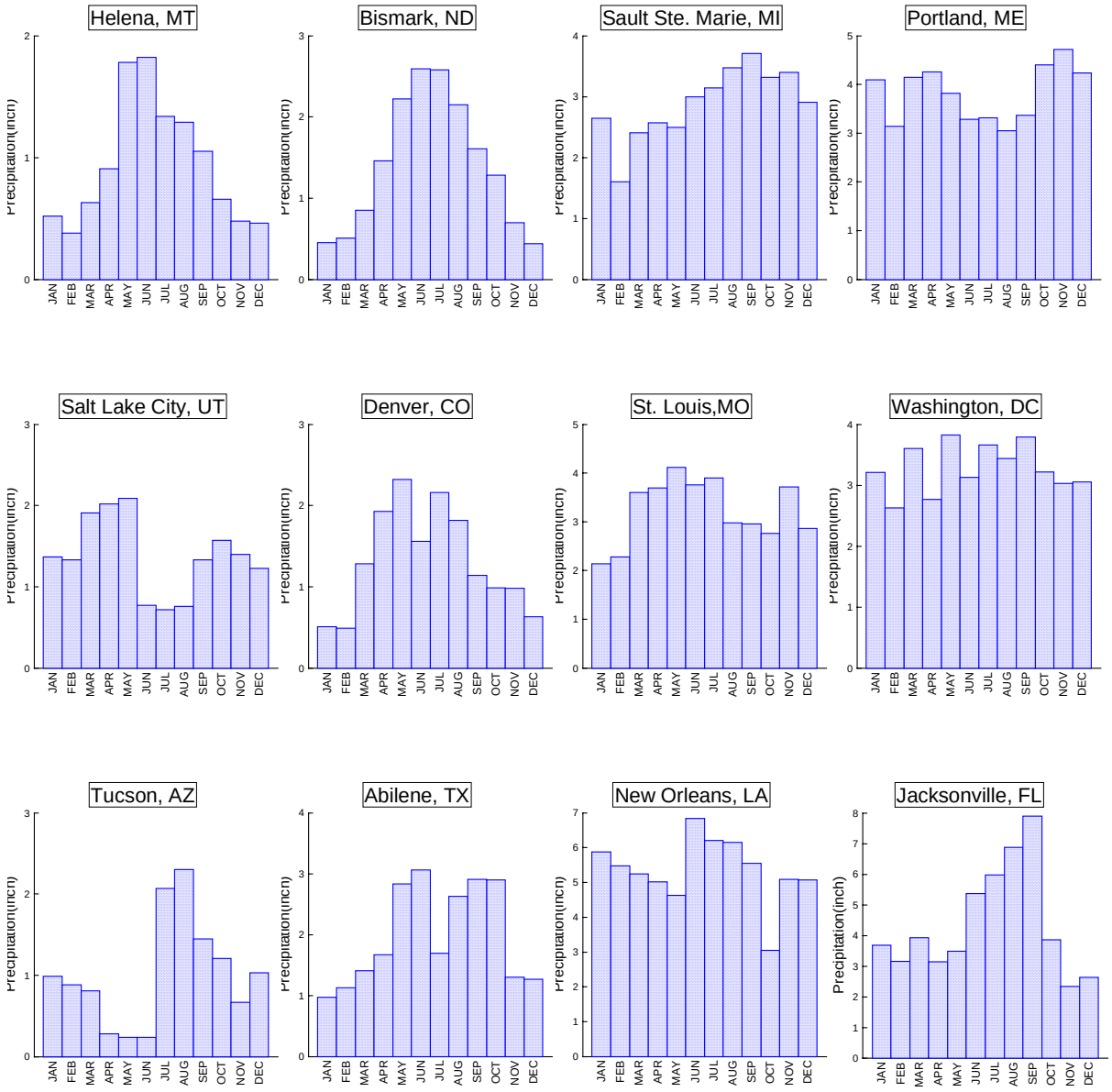

Fig. 1B. Distribution of monthly average rainfall in United States during 1971-2000

quite short, and range from one to 30 days. In California, there is no precipitation in the summer months in most areas. The existence and magnitude of a seasonal first flush of urban stormwater discharge have been rarely investigated.

Our primary objective of this study is to identify a seasonal first flush and quantify the its mass loading in order to use the information in BMPs evaluation strategies. To do this we analyzed four major stormwater runoff monitoring programs in California. They include the Los Angeles Industrial Activities General Permit monitoring data, the landuse monitoring data from the Los Angeles County Department of Public Works, the California Department of Transportation (Caltrans) first flush highway runoff study data and the Caltrans state-wide highway runoff monitoring data.

We hope this study will assist in selecting the most effective BMPs to control stormwater runoff pollution in areas with prolonged rainy and dry seasons such as California.

2. Methodology

Table 1 summaries the data sets used in this study. The monitoring data, with the exception of our first flush highway runoff data, were collected by others. The data sets were examined to identify a seasonal first flush using the relationship between the cumulative runoff volume and the cumulative pollutant load. Pollutant concentrations were used for the two data sets that had missing or inadequate runoff flowrate data, and cumulative rainfall, which is available from publicly monitored rain gages, was used in lieu of runoff volume. Data from wet seasons over the past four years 1999-2000 to 2002 –2003 wet seasons when available, were analyzed. Wet season or rainy season for California generally means October to April. Basic water quality parameters such as chemical oxygen demand (COD), specific conductance (SC), total organic carbon (TOC), and total suspended solids (TSS) were used. Additionally, when available, metals such as aluminum (Al), copper (Cu), lead (Pb), nickel (Ni) and zinc (Zn) were analyzed in both soluble and particulate phases. Additional water quality parameters exist in the data sets, and will be analyzed at a future date. For clarity, each data set is described in separate sections, with the specific information for each data set and the results of the analysis presented together. Section 4 discusses the benefit associated with preferentially treating stormwater early in the season, and the implications of metal partitioning on first flush and BMP selection.

Table 1. Summary of monitoring data sets

Name of Monitoring Program	Sponsoring or Managing Agency	Monitoring year	Monitoring Area	Drainage Area (hectares)	Primary Land Use	Number of observations in this study
Industrial Activities General Permit	Los Angeles Regional Water Quality Control Board, (LARWQCB)	from 1992 to present	County of Los Angeles	0.0000464 - 14771	Industrial	~ 6500 events from many sites over 2 years
Land Use Monitoring	Los Angeles County Department of Public Works (LACDPW)	from 1996 to 2001	near LAX	365	Transportation [c]	24 events from 1 site over 2 years
First Flush Highway Runoff Characterization [a]	California Department of Transportation (Caltrans)	from 1999 to present	405 and 101 freeway near UCLA (3 sites)	0.39, 1.28, 1.69	Transportation (Highway)	71 events from 3 sites over 3 years
Statewide Highway Runoff Monitoring [b]	California Department of Transportation (Caltrans)	from 1997 to present	California (statewide)	0.04 - 5.94	Transportation (Highway)	237 events from 25 sites over 3 years

[a] Performed by the Civil & Environmental Engineering, University of California, Los Angeles.
[b] Part of Caltrans state-wide stormwater runoff monitoring program.
[C] Transportation includes surface roads, while highway includes only freeways.

3. Seasonal first flush results

3.1 Industrial Activities General Permit monitoring

On November 19, 1991, the California State Water Resource Control Board issued the statewide General Permit for discharges of storm water associated with industrial activities excluding construction activities (the General Permit). The General Permit requires monitoring by facilities that discharge storm water associated with the industrial activities. Currently, there are approximately 3,000 permittees within the Los Angeles County that are covered under the General Permit. Under the monitoring requirements, permittees must collect water quality samples from two storms per year and analyzed for four basic parameters: pH, specific conductance, total suspended solids, and oil and grease. Total organic carbon can be substituted for oil and grease. Certain facilities must analyze for specific additional pollutants such as metals (Cu, Fe, Pb, Ni, and Zn), and permittees must analyze for pollutants that they believe are pervasive in their storm water. Industries are categorized by Standard Industrial Codes (SIC codes). For the General Permit, only grab samples, which are discrete samples taken within a short period time, were required. Runoff flow rate was not required. Records of water quality data were obtained from the Regional Water Quality Control Board, Los Angeles.

To determine seasonal first flush, SC, TOC, TSS, and Zn were analyzed for 1999-2000 and 2000-2001 wet seasons. Among the metals only zinc was selected for analysis because of its prevalence in observations (cases). The General Permit requests that the first storm and one later storm to be sampled; no other guidance for selecting storm events is provided. In some cases the permittee missed the first sample, either because they were not prepared, or because the rainfall

was small. The desire to sample large storm events means that some events have more cases than other events. We selected several events with large numbers of cases. Approximately 70 percent of the total cases, or 6500 cases were analyzed. Median pollutant concentrations were used to represent for the selected large events. The daily precipitation records from Los Angles Civic Center station (http://www.nwsla.noaa.gov/climate/climate.html) were used to calculate cumulative rainfall and antecedent dry days. Although, rainfall is site specific, the record from Civic Center was used as representative of the general pattern of rainfall for Los Angeles area.

Figure 2 shows the concentrations according to the normalized cumulative precipitation during 1999-2000 (top) and 2000-2001 (bottom) wet season. Concentrations of SC, TOC, and Zn were highest in the first storm event and decreased continuously during the 1999 -2000 season, until the last event. In the last event, the concentrations for all parameter increased, which was probably due to the long dry period preceding the event (antecedent dry days, ADD). For the 2000-2001 season, the concentrations of all parameters were highest in the first few events and decreased as the season progressed. The first few rainfall events of this season were small (less than 41 mm or 8.29 % of the total rainfall), closely spaced, and should be considered as a single event. There are several large storm events, but the concentrations of all parameters are much lower than in the first few storm events of the season.

The results show that concentrations are more influenced by antecedent dry period than the amount of rainfall. TOC, SC, Zn and TSS concentrations in the first part of the season were approximately 5.5, 4, 2.5, 1.5 times higher respectively than concentrations at the end of the

season. A substantial concentration peak in the initial of storm event suggests the presence of a seasonal first flush in stormwater discharges associated with industrial activities.

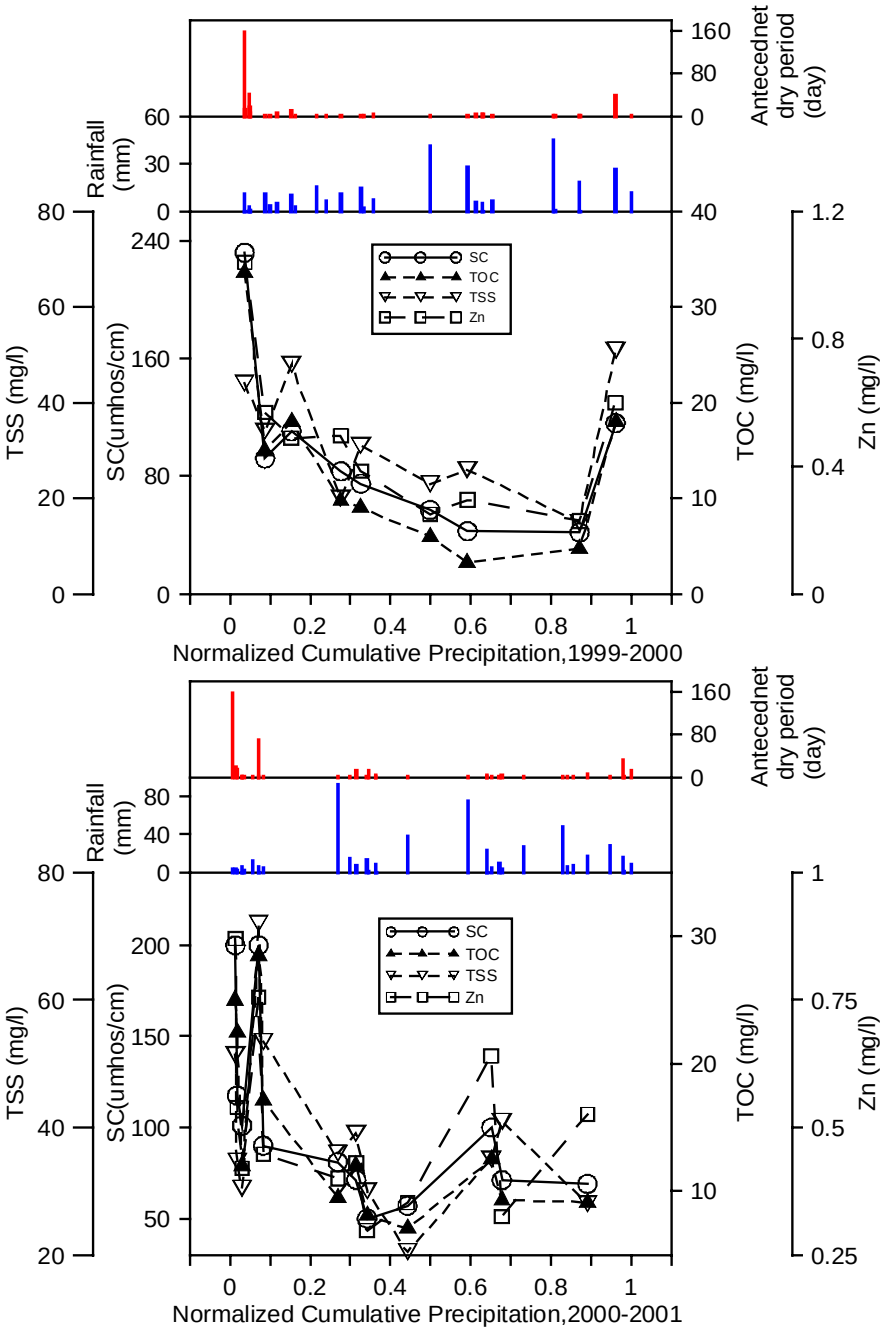

Fig. 2. Concentrations versus normalized cumulative precipitation during 1999-2000(top) and 2000-2001(bottom) wet season for industrial activities General Permit monitoring.

3.2 Landuse monitoring

The Los Angeles County Department of Public Works (LACDPW) has been monitoring stormwater under the 1990 and 1996 NPDES Municipal Permits. The 1996 Municipal Permit also requires samples from various landuses. Flow-weighted composite samples were analyzed for many water quality variables including indicator bacteria, general minerals, nutrients, metals, semi-volatile organic compounds, oil and grease and pesticides. Results of the flow-weighted composite sample can be considered as an event mean concentrations (EMCs). Records of the stormwater quality data in various types of landuse were obtained online (http://www.ladpw.org/wmd/NPDES/report_directory.cfm) for the 1999-2000 and 2000-2001 wet seasons. For the purpose of this study, we selected the Dominguez Channel station whose primary landuse is transportation. The landuse is 75.2 % transportation, 17 % light industrial, 0.6 % high density residential, 0.1 % retail/commercial, and 7.1 % other or unknown.

Basic water quality parameters such as COD, SC, TOC, and TSS and metals such as Al, Cu, Ni and Zn were analyzed to identify seasonal first flush. A total of 24 events were analyzed for the two wet seasons. LACDPW provided precipitation and runoff volume for every monitored event. Unfortunately, in some cases the first storm was missed or runoff volume was not provided, which makes it impossible to calculate the cumulative runoff volume and pollutant load. Therefore normalized cumulative rainfall was analyzed in lieu of runoff volume.

Figure 3A and Figure 3B shows the concentrations as a function of the normalized cumulative precipitation during 1999-2000 and 2000-2001 wet season respectively.

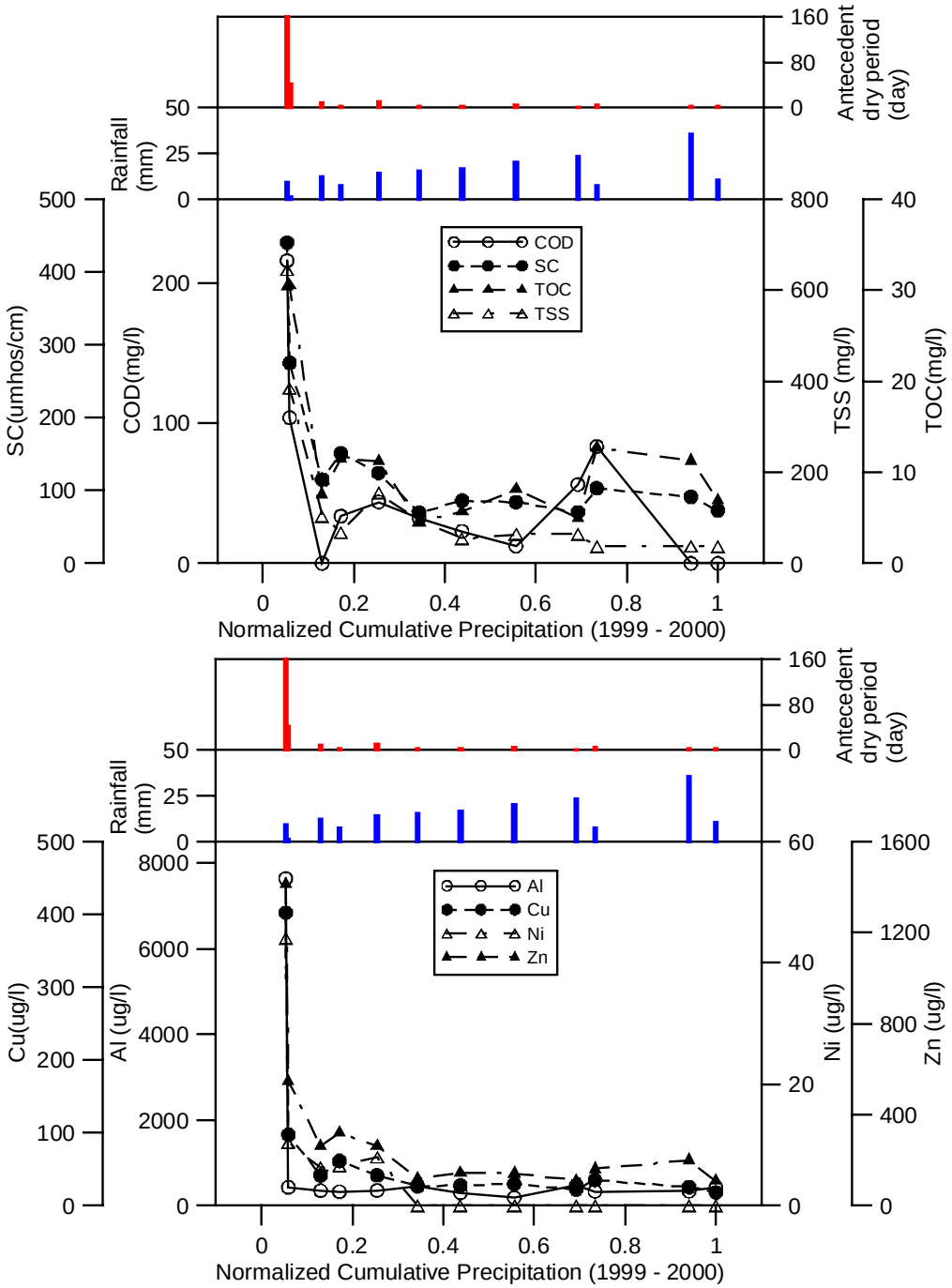

Fig. 3A Concentrations versus normalized cumulative precipitation during 1999-2000 wet season for basic parameters (top) and metals (bottom) for transportation landuse monitoring by LACDPW.

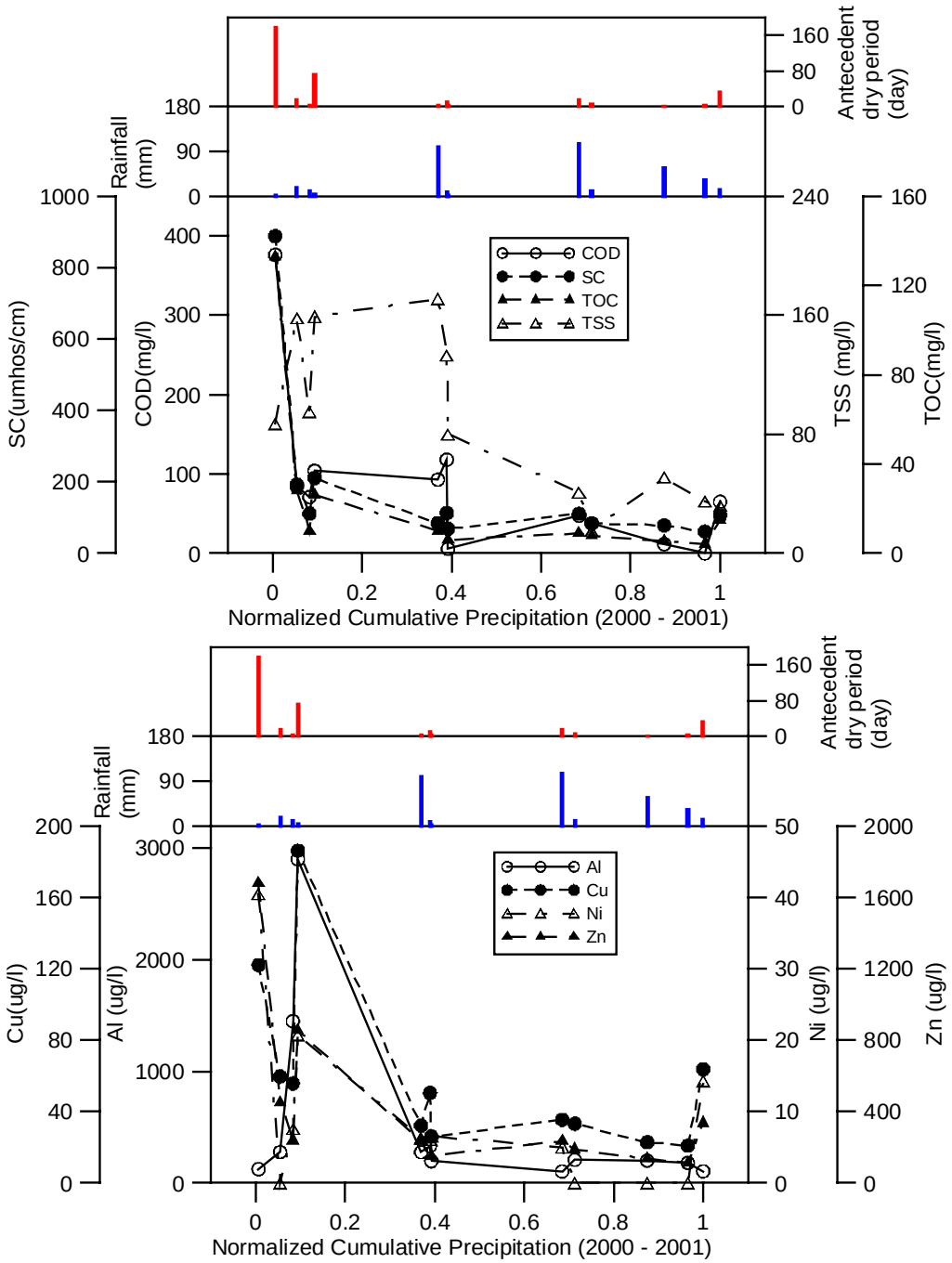

Fig. 3B Concentrations versus normalized cumulative precipitation during 2000-2001 wet season for basic parameters (top) and metals (bottom) for transportation landuse monitoring by LACDPW.

Concentrations for all parameters were highest in the first event, dropping dramatically for the next event and generally decreasing to the last event for 1999-2000 wet season. The seasonal first flush was greater for metals than basic water quality parameters. Cu, Al, and Zn concentrations in the first part of the wet season were approximately 22, 18, and 13 times higher, respectively, than concentrations at the end of the season. The concentration ratios of the basic water quality parameters for COD, SC, TOC and TSS ranged from 4 to 17. The 2000-2001 season showed similar trends for COD, SC, TOC, Ni and Zn concentrations. The first storms were quite small, comprising less than 10% of the total cumulative rainfall, closely spaced, and should be considered as a single event. The concentrations of all parameters, except TSS show dramatic declines as the season progressed. The ratios of the concentrations at the start of season to end of season ranged from 1.2 to 11.2, depending on the pollutant and the method of comparison. The average ratio of the 8 pollutants in the first storm to the last storm was 4.6. The average ratio of the 8 pollutants for the first four storms to the last storm was 3.7. In general, there is a strong seasonal first flush in the stormwater discharges from the transportation landuse.

3.3 First flush highway runoff monitoring

The Department of Civil and Environmental Engineering at UCLA has characterized runoff from three highway sites since 1999(Stenstrom et al., 2000, 2001, 2002). This study was conducted to assess runoff water quality and quantity from California freeways with particular emphasis on characterizing first flush. During the first hour of the storm, grab samples were collected every 15 minutes. After the first hour, additional grab samples were collected each hour up to 8 hours. An automatic composite sampler was also used in the second and third years to collect flow-

weighted composite samples. We measured a large suite of constituents including indicator bacteria, general minerals, nutrients, oil and grease, organics and metals.

Event mean concentrations (EMCs) were calculated from grab samples results and measured flow rate. The definition of EMCs is described by Sansalone and Buchberger (1997) and Lee et al. (2002). The calculated EMCs can be interpreted as a flow-weighted average of pollutant concentrations of a storm event. Figure 4A through Figure 4E show the EMCs as a function of the normalized cumulative precipitation for 2000-2001 and 2001-2002 from site 2 located on 405 Freeway with average daily traffic of 260,000. Site 2 was selected as illustrative of all three sites.

For 2000-2001, the concentrations of all parameters were highest in the first two events, which had 30 and 69 antecedent dry days (ADD). The first two rainfall events were small, (less than 54 mm or 9.96 % of the total rainfall), and should also be considered as a single event. The ADD for the first storm event would normally be 100 days or more. The reason for the shorter ADD is that the very first storm of the season was too small to produce sufficient runoff for sampling. The concentrations in the 2001-2002 wet season show the clearest seasonal first flush trend for all parameters except total P and NO_2 - N. Table 2 shows the ratio of the concentration at the start of season to end of season. For dissolved and total metals, nickel and zinc have the highest value for the ratio during 2000-2001 and 2001-2002 season respectively. For nutrients, TKN concentration in the start event of season was approximately 8 times higher than concentrations at the end of season for the two wet seasons.

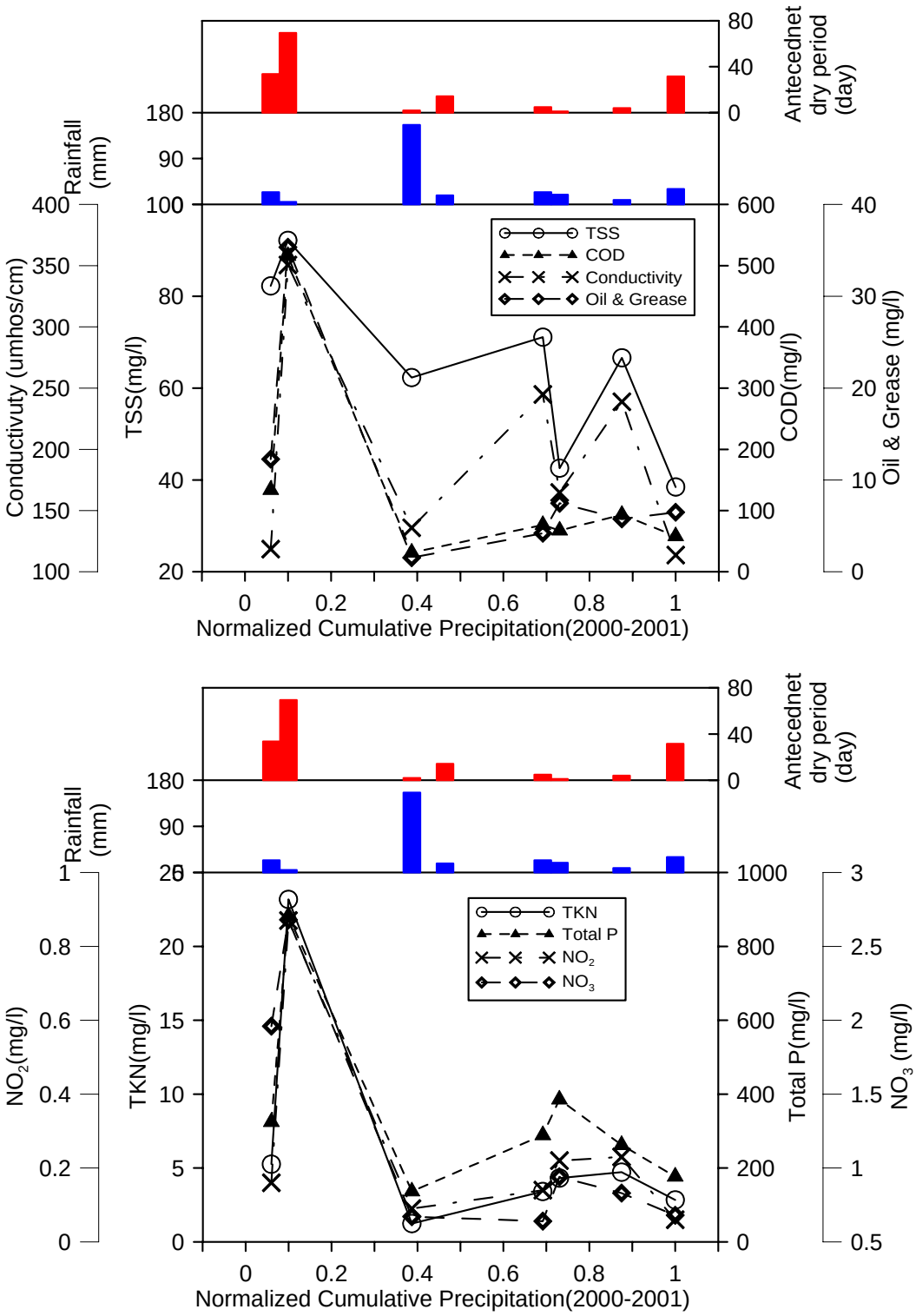

Fig. 4A. Concentrations versus normalized cumulative precipitation during 2000 – 2001 wet season for basic parameters (top) and nutrients (bottom) for first flush highway runoff characterization study at UCLA site 2.

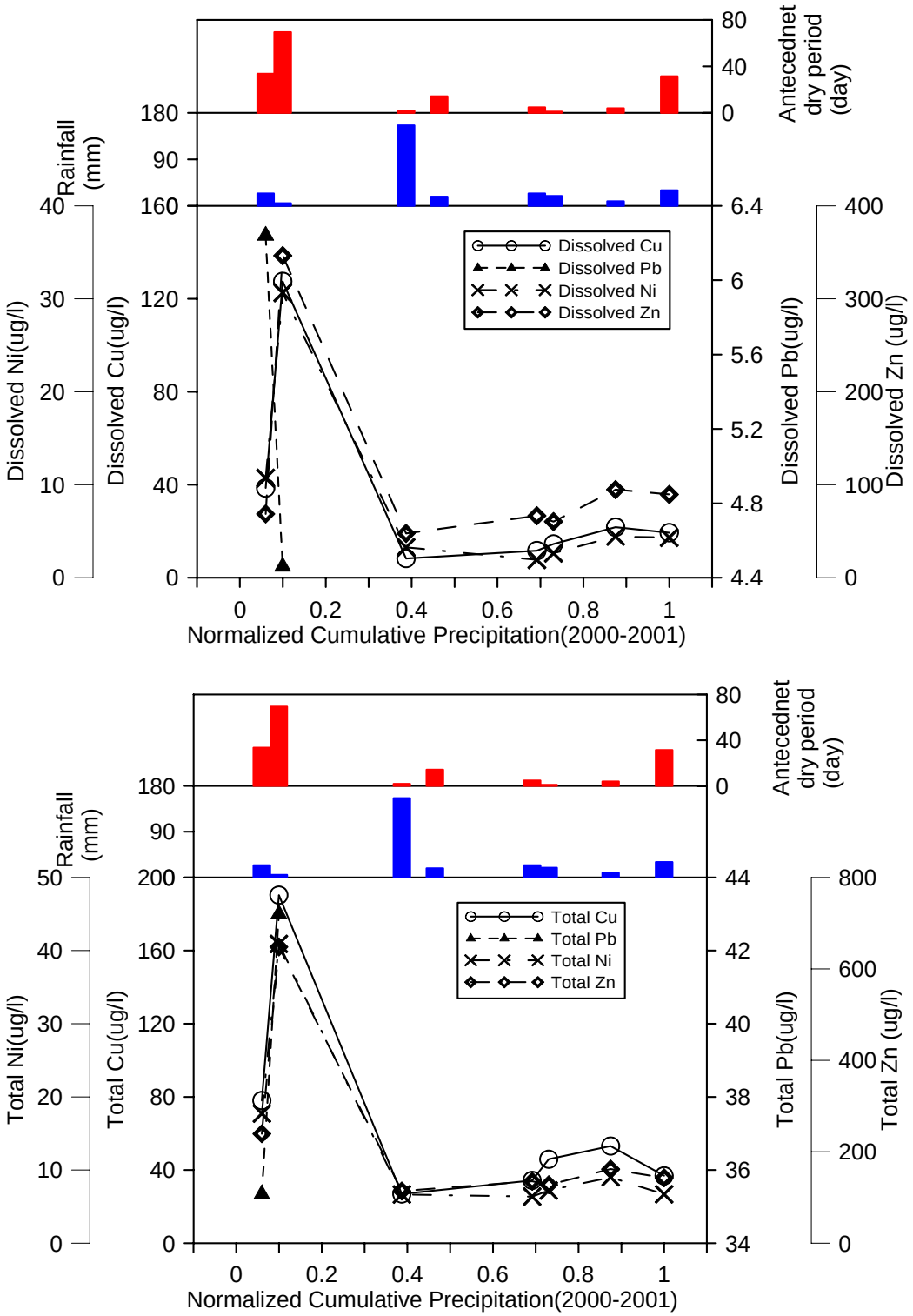

Fig. 4B. Concentrations versus normalized cumulative precipitation during 2000 – 2001 wet season for dissolved metals (top) and total metals (bottom) for first flush highway runoff characterization study at UCLA site 2.

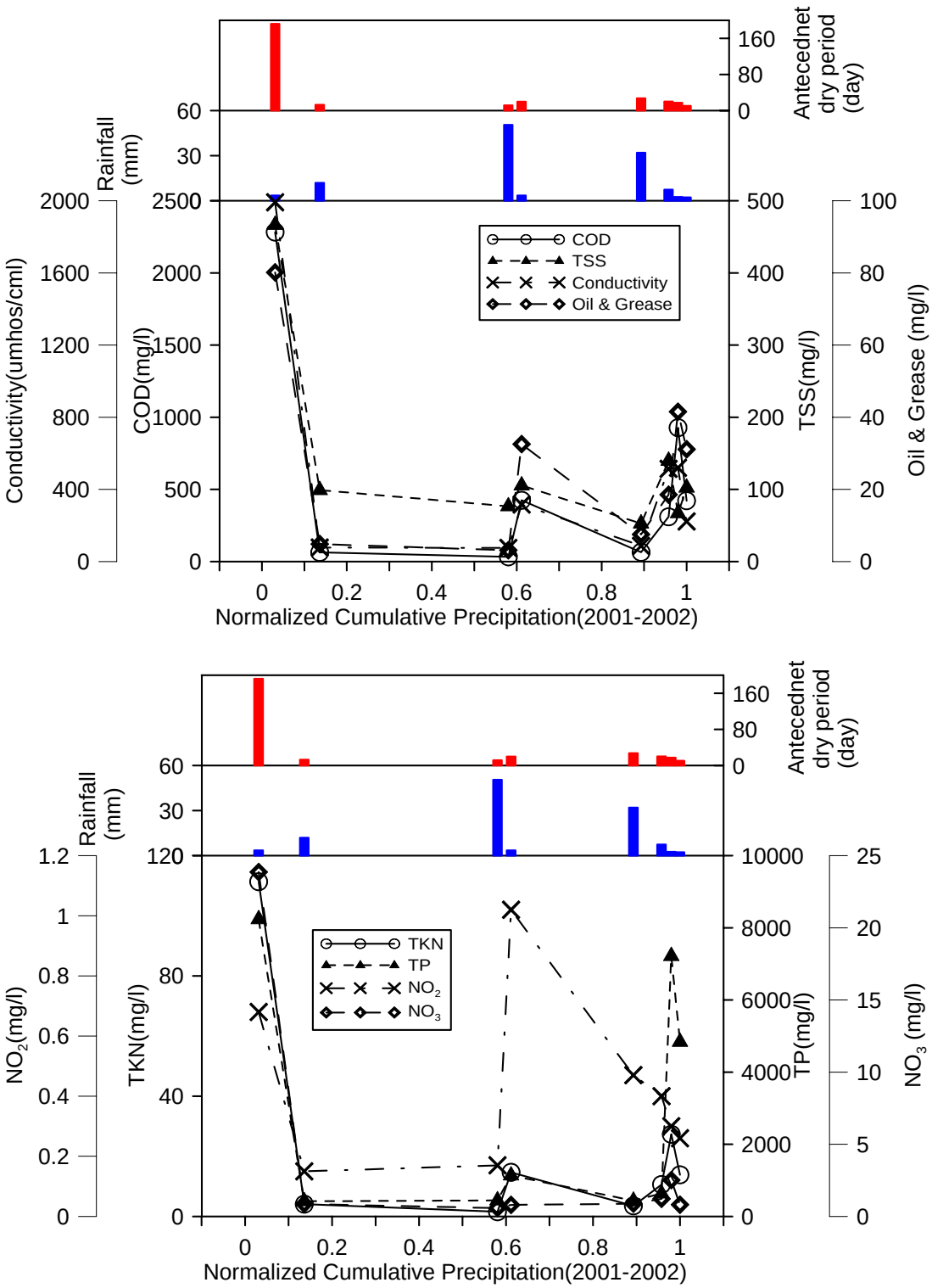

Fig. 4C. Concentrations versus normalized cumulative precipitation during 2001 – 2002 wet season for basic parameters (top) and nutrients (bottom) for first flush highway runoff characterization study at UCLA site 2.

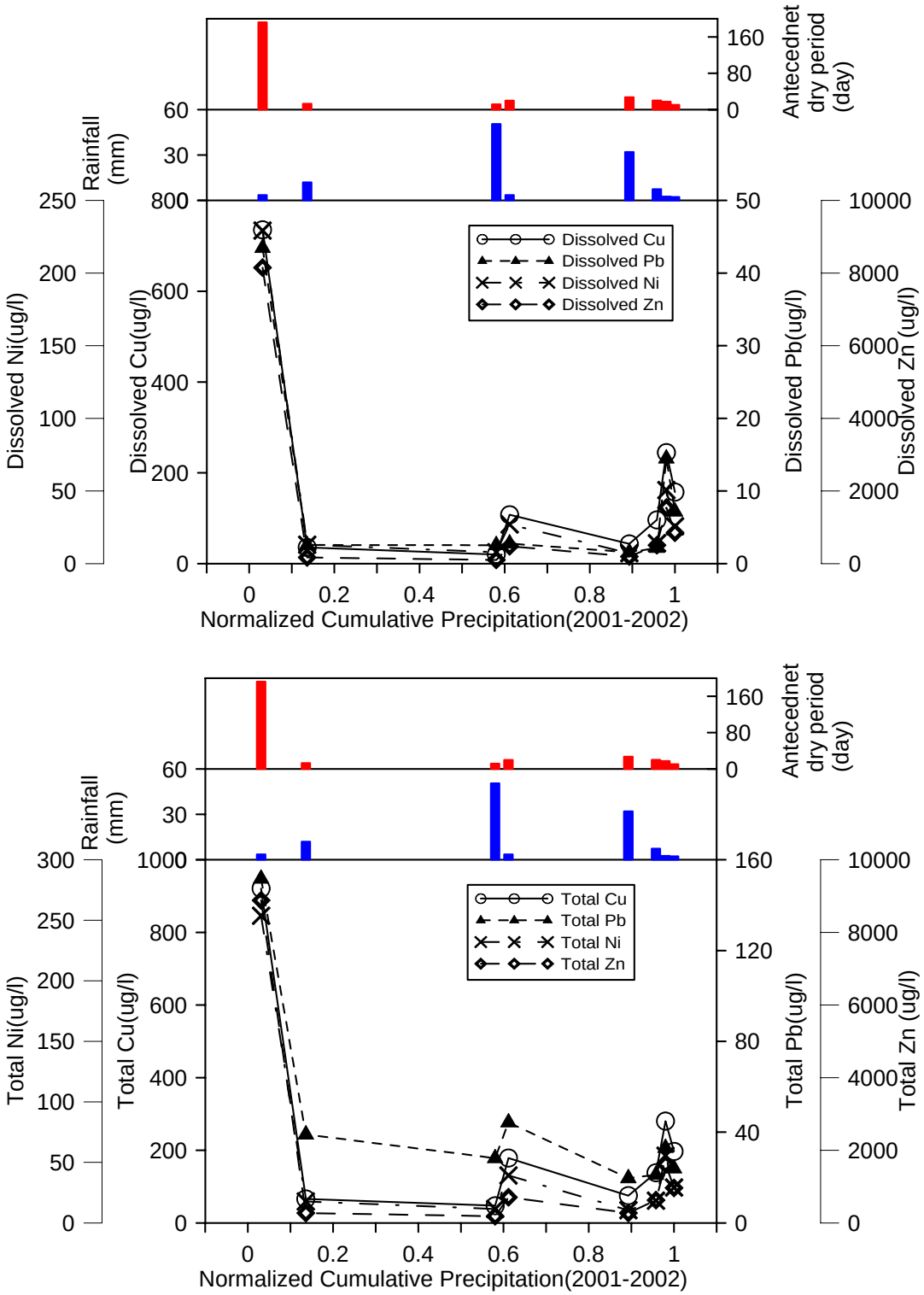

Fig. 4D. Concentrations versus normalized cumulative precipitation during 2001 – 2002 wet season for dissolved metals (top) and total metals (bottom) for first flush highway runoff characterization study at UCLA site 2.

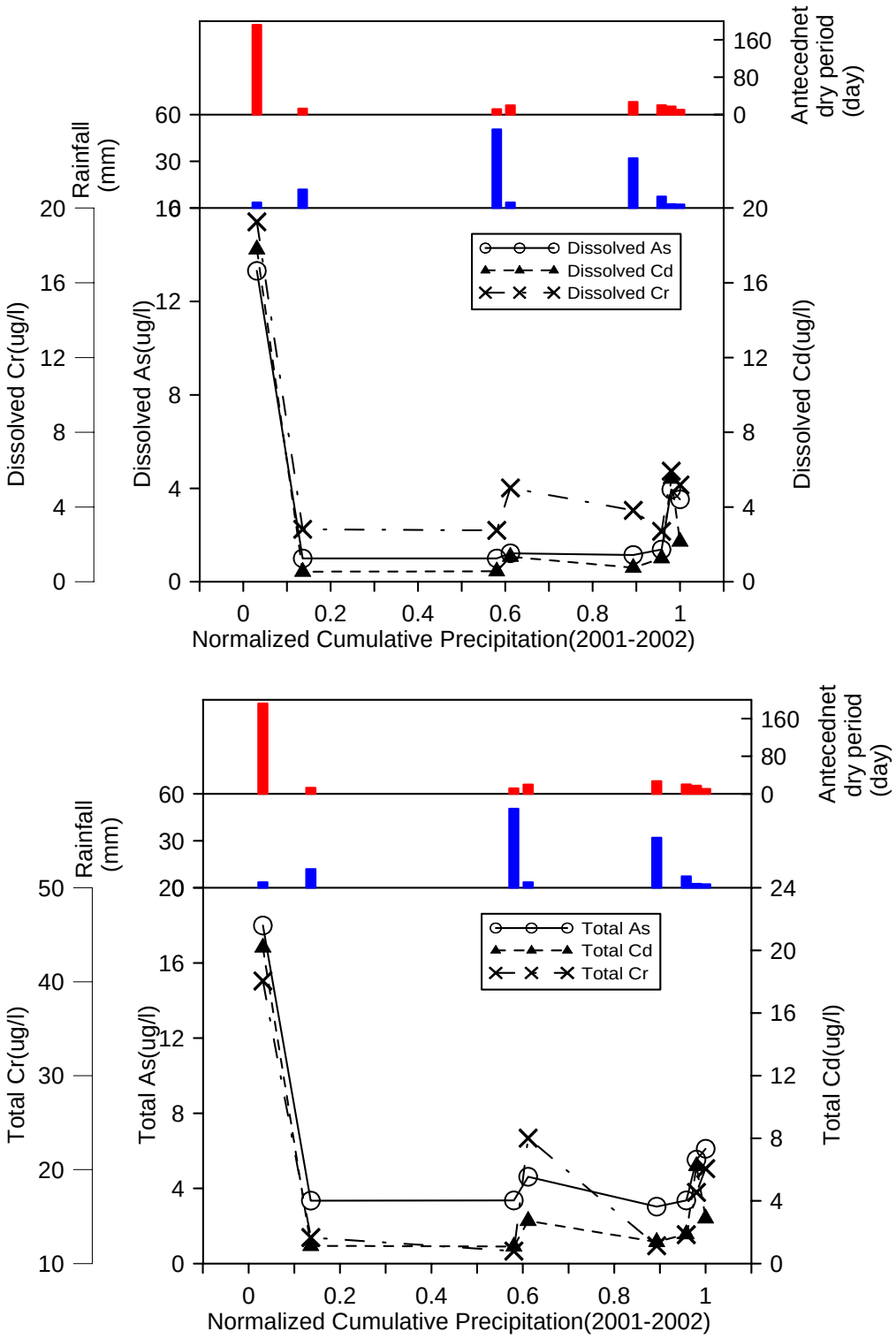

Fig. 4E. Concentrations versus normalized cumulative precipitation during 2001 – 2002 wet season for dissolved metals, As, Cd, and Cr, (top) and total metals (bottom) for first flush highway runoff characterization study at UCLA site 2.

Table 2. Ratios of the concentrations at the start of season to end of season at UCLA site2

	Parameter	Ratios of the concentrations at the start of season to end of season	
		2000-2001[a]	2001-2002
Basic	TSS	2.4	4.6
	COD	8.9	5.4
	Conductivity	3.1	9.0
	Oil & Grease	5.5	2.6
Nutrients	TKN	8.2	8.0
	TP	5.0	1.7
	NO_2-N	14.5	2.6
	NO_3-N	3.9	29.5
Dissolved metals	As		3.8
	Cd		8.3
	Cr		3.7
	Cu	6.6	4.7
	Pb		6.1
	Ni	7.1	8.9
	Zn	3.9	9.5
Total metals	As		2.9
	Cd		7.0
	Cr		2.0
	Cu	5.2	4.7
	Pb		6.3
	Ni	6.1	8.7
	Zn	4.5	9.2

[a.] The ratio of the concentration at second event of season to end of season was used for 2000-2001 season

This monitoring project collected both flow rates and pollutant concentrations, which allows mass loadings to be computed. The normalized mass loading of a pollutant for a storm event is obtained by multiplying the calculated EMCs by the total runoff volume for the event, and dividing by the total mass emission for the season. A loading graph is created by plotting normalized cumulative pollutant load versus normalized cumulative runoff volume (see Fig.5).

The diagonal line on Figure 5 represents the loading of a hypothetical pollutant with constant concentration. The normalized loadings for COD, TSS, Cu, Ni, Pb, and Zn are plotted on Figure 5 for sites 1 and 2 (1999-2000 season) and site 2 and 3 (2001-2002 season). These two years were selected because they have at least seven events. Data points above the diagonal line represent a higher loading that would be expected for pollutants exhibiting a seasonal first flush. Most of the storm events show a season first flush. For events in the first 10% of the normalized runoff volume, 16 of 18 events showed a seasonal first flush. In the first 20% and 30%, 40 of 56 and 48 of 66 events showed a seasonal first flush. The points below the diagonal line were Pb and TSS, except for two that were Ni, which means Pb and TSS did not exhibit a seasonal first flush.

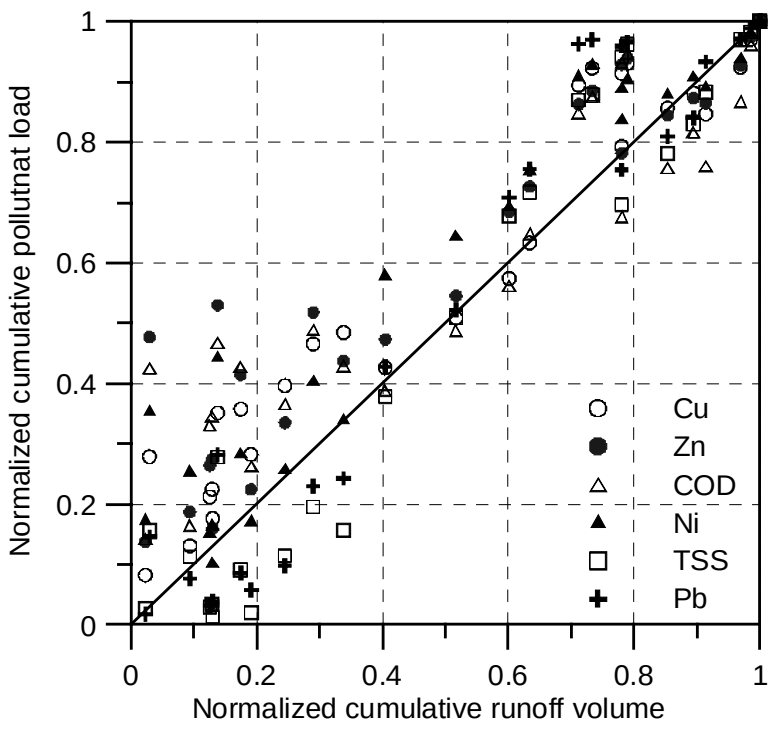

Fig. 5. Normalized cumulative pollutant load and runoff volume for UCLA sites1, 2, and 3.

3.4 State-wide highway runoff monitoring

The California Department of Transportation (Caltrans) has had a large monitoring program since 1997 to characterize the water quality impacts of highway runoff. A large suite of water quality constituents, such as conventional nutrients and metals, have been sampled using automatic sampler by collecting flow-weighted composite samples. Precipitation and runoff volume were also measured.

Highway stormwater runoff water quality has been collected at 135 sites in California. Among them, 31 cases from 25 sites were deemed to be suitable for seasonal first flush analysis. Each case is for a single site with a minimum of five events for one wet season. In all, 237 events were analyzed. Cases with no observations from October to December were not analyzed, since the absence of observations during this period indicates that the initial rainfall events were not sampled. Cases that had initial events with ADD of less than 30 days were also not considered for this analysis. The imperviousness of the selected sites was over 90 percent. Based on the all the selection criteria, only the events in the last three years, 2000-2001 to 2002-2003 wet seasons, were selected for further analysis. TOC, TSS, Cu, Ni, Pb, and Zn were chosen for the existence of seasonal first flush analysis. These parameters were selected because they are likely to be more strongly regulated.

The total mass loading of a pollutant for a storm event is obtained by multiplying the concentration obtained from the flow-weighted composite sample (EMC) by the total runoff volume for the event. Figure 6 shows the normalized cumulative pollutant load versus

normalized cumulative runoff volume for the selected parameters. Most data points within the initial 30 percent of normalized runoff volume are above the diagonal line, indicating a seasonal first flush. The normalized cumulative pollutant load is also plotted using box plots at ten intervals over the normalized cumulative runoff volume (see Figure 7). The shade area indicates a seasonal first flush.

Table 3 shows average normalized cumulative pollutant load at several ranges of normalized cumulative volume. In the 20 to 30% range of normalized runoff volume, the mean values ranged from 0.29 to 0.39, with maximums as large as 0.63. If no seasonal first flush existed, the mean values should be 0.25. Seasonal first flush was greatest for TOC, whose mean mass to volume ratio in the range of 20 to 30% of the normalized runoff, is 0.39, and only one observation fell below the diagonal line. It is weakest for Cu with a mean ratio of 0.29.

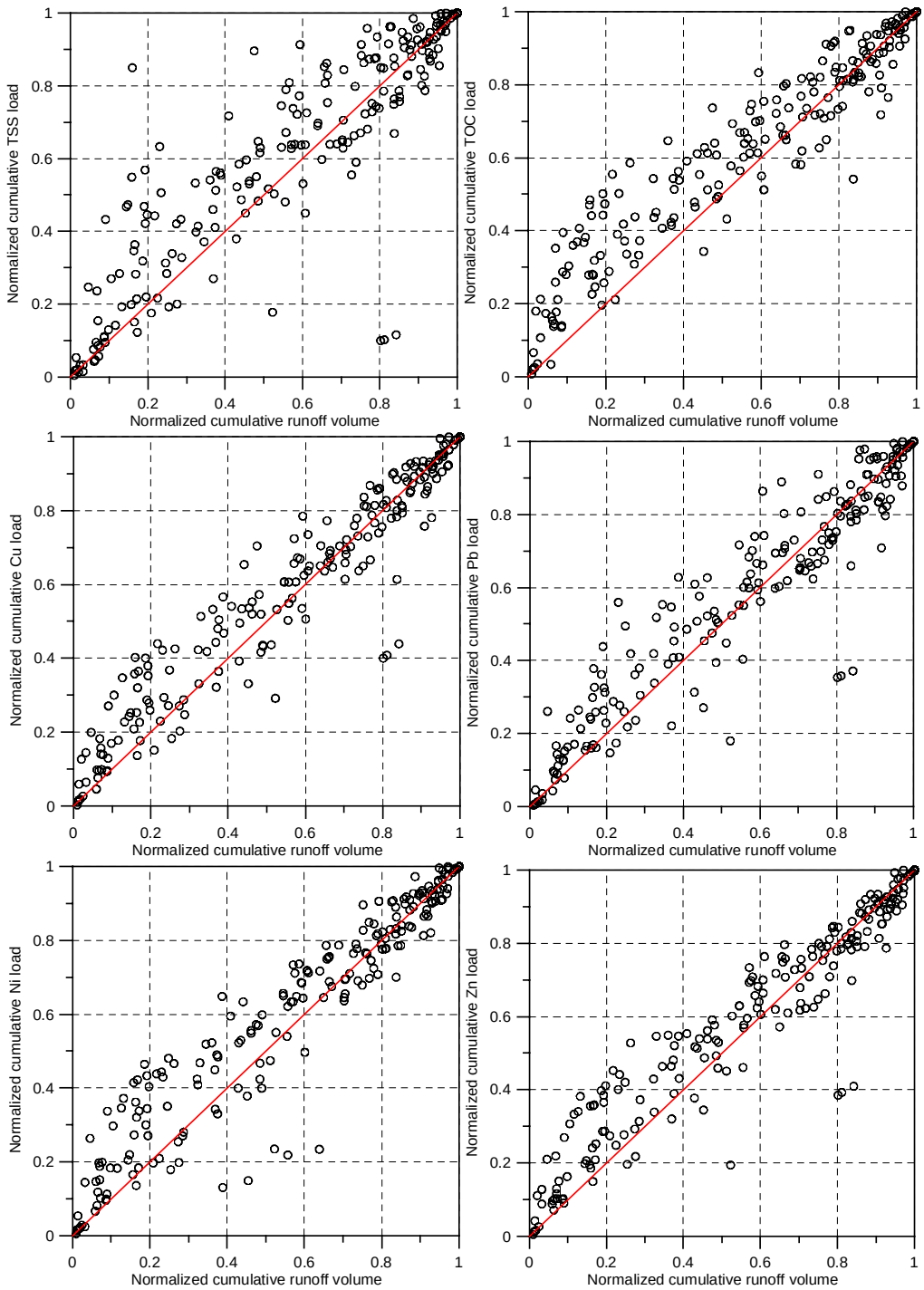

Fig. 6. Normalized cumulative pollutant load and runoff volume for 2000–2003 for the Caltrans state-wide highway runoff monitoring study.

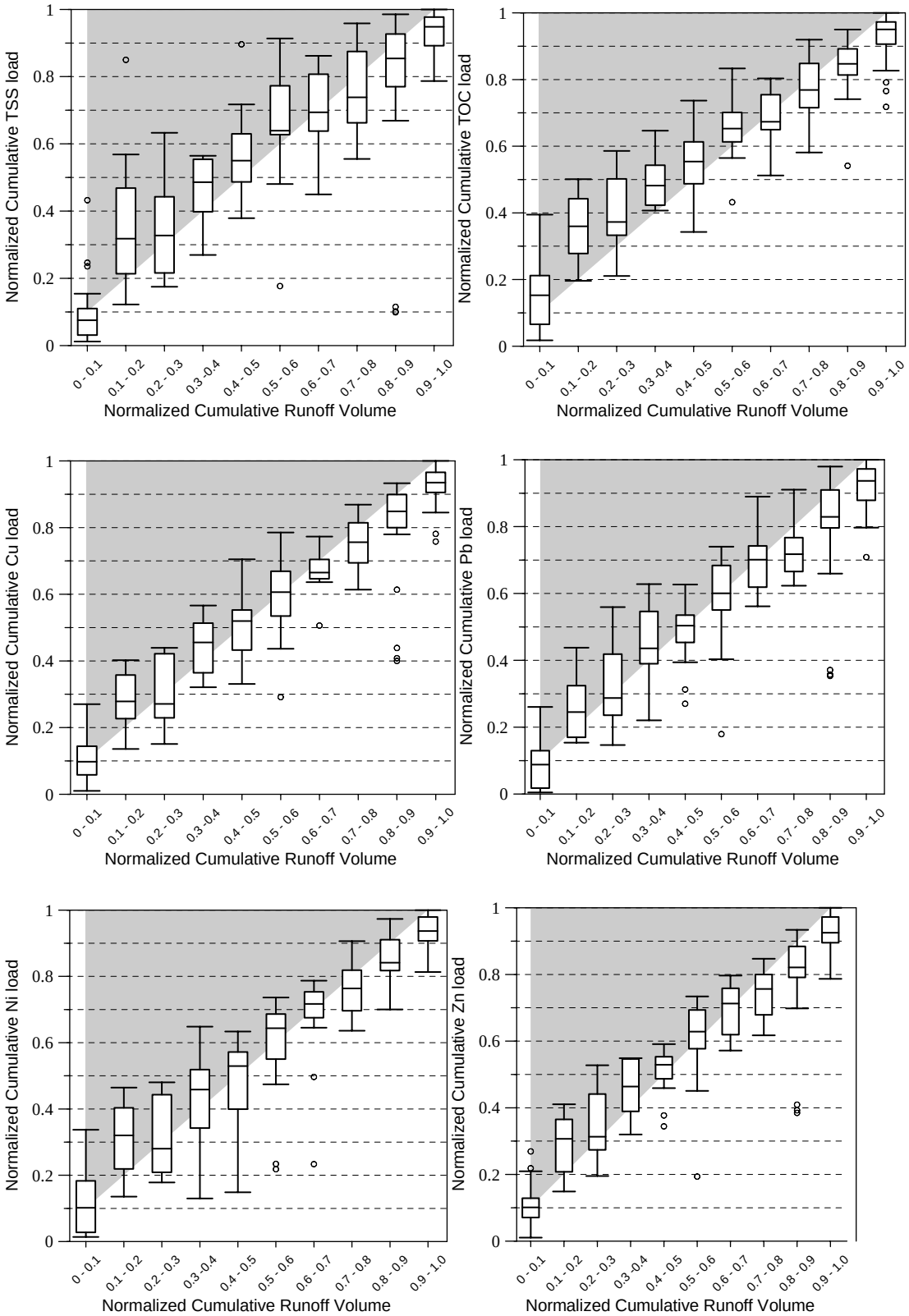

Fig. 7. Box plot for the normalized cumulative pollutant load and runoff volume for 2000 – 2003 for the Caltrans state-wide highway runoff monitoring study.

Table 3 Normalized cumulative load at several range of normalized cumulative volume

Constituent	range of normalized cumulative volume	Normalized cumulative load			
		0.1-0.2	0.2-0.3	0.3-0.4	0.4-0.5
TOC	min.	0.20	0.21	0.41	0.34
	max.	0.50	0.59	0.65	0.74
	mean	0.35	0.39	0.49	0.55
TSS	min.	0.12	0.18	0.27	0.38
	max.	0.85	0.63	0.57	0.90
	mean	0.35	0.35	0.47	0.58
Pb	min.	0.15	0.15	0.22	0.27
	max.	0.44	0.56	0.63	0.63
	mean	0.26	0.32	0.45	0.49
Ni	min.	0.14	0.18	0.13	0.15
	max.	0.46	0.48	0.65	0.63
	mean	0.31	0.32	0.44	0.49
Cu	min.	0.14	0.15	0.32	0.33
	max.	0.40	0.44	0.57	0.71
	mean	0.28	0.29	0.45	0.51
Zn	min.	0.15	0.20	0.32	0.34
	max.	0.41	0.53	0.55	0.59
	mean	0.30	0.34	0.46	0.51

4. Discussion

The practical implications of the seasonal first flush results presented in this study are important for selecting BMPs. Runoff from storms early in the season is more contaminated that runoff from later storms. A method for estimating the relative value of treating early runoff compared to later runoff is discussed in the next section.

4.1 BMP selection criteria

In order to estimate the potential benefits of treating early runoff as compared to runoff later in the season, we defined an effectiveness factor as a function of cumulative runoff volume. In the expected situation of having limited funding for BMP construction, applying BMPs to runoff with higher pollutant concentrations will generally be more beneficial. Also there is growing evidence that suggests that BMPs removal efficiencies are higher in runoff with higher concentrations (Strecker et al., 2001; Lau and Stenstrom, 2002).

The effectiveness factor at a specific cumulative runoff volume is calculated as follows :

$$E(V) = \frac{(Mv / v)}{(1 - Mv)/(1 - v)} \qquad (1)$$

where *E(V)* is the effectiveness factor at a specific cumulative runoff volume *V*, and *Mv* is the normalized cumulative mass at a specific normalized cumulative runoff volume, *v*. Figure 8A shows an example of the effectiveness factor at 20 percent of runoff volume. An example is illustrated at 20 percent of runoff volume, which is 2.67. The means that treating the first 20%

of the stormwater will remove 2.67 times the mass of pollutants removed if an equal volume were treated later in the storm.

Figure 8B shows the effectiveness factor at ten intervals of runoff volume. The dashed line at 1.0 would be the relative effectiveness if the pollutants concentrations were constant throughout the wet season (i.e.., no seasonal first flush). The relative effectiveness was the highest in 10-20 percent rage of runoff volume for all parameters. The effectiveness was greatest for TOC and weakest for Pb, with many outliers. The range for TSS was also very large. The median effectiveness for TOC at 10 to 20 percent of runoff volume was approximately 3.5 which means treatment of the initial 10 to 20 percent of runoff volume could remove the TOC load 3.5 times as much pollutant mass as treating an equal volume later in the storm. This result suggests that applying treatment BMPs early in the season could remove several times more pollutant mass than randomly-timed BMPs.

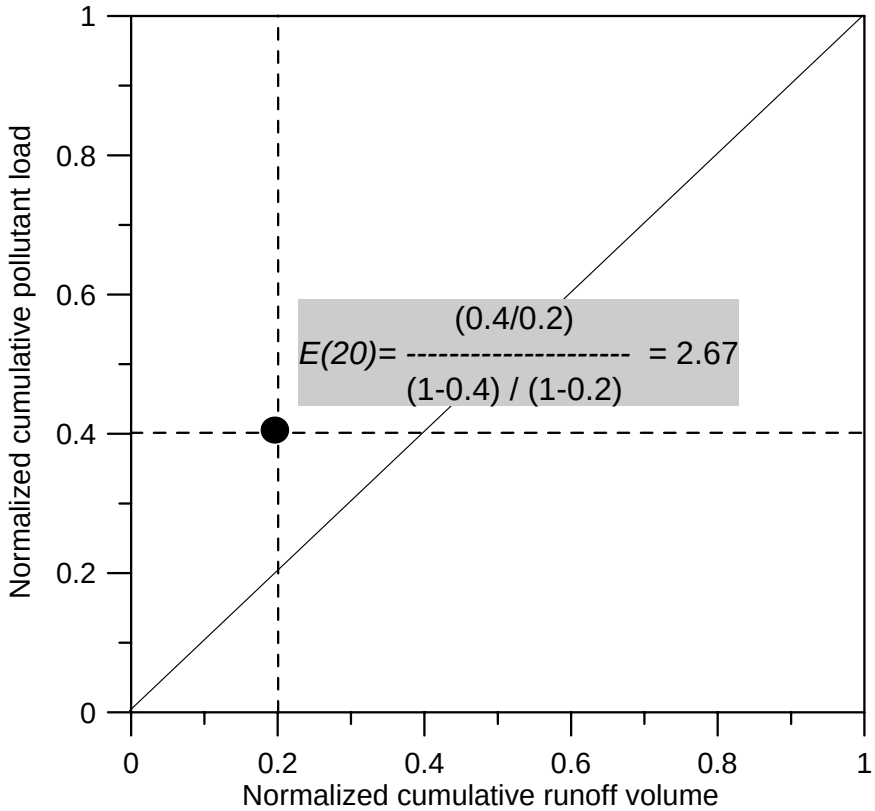

Fig. 8A. An example of the effectiveness factor, *E(v)*, at 20 percent of runoff volume.

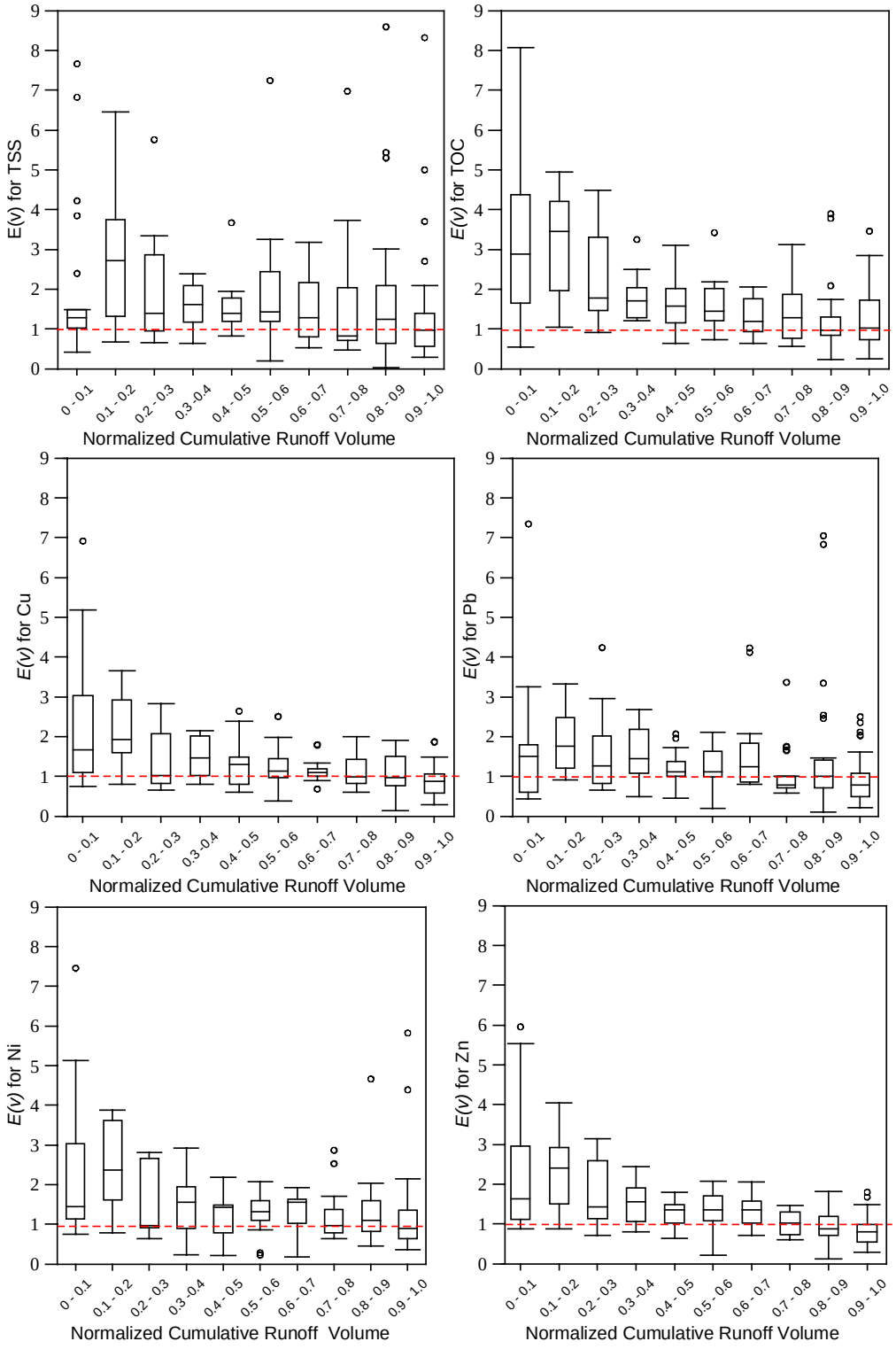

Fig. 8B. Effectiveness factor, *E(V)*, for the Caltrans state-wide highway runoff monitoring study.

4.2 Suspended and soluble pollutants

Suspended solids have often been used as a surrogate for other pollutants in stormwater runoff. This has interesting interactions for first flush, because the particle dynamics may have major impacts on emission rates of other pollutants. In the previous section we noted the existence of a seasonal first flush, and suspended solids generally showed less magnitude than other pollutants. This may be in part attributed by rainfall intensity effects on TSS emission rates.

An important question is the state of the metals: dissolved or adsorbed to suspended solids. Metals in the dissolved form may easily mobilized during storm event and exhibit a strong seasonal first flush. Metals adsorbed to solids will generally follow the trends of the suspended solids. Metals monitored in the highway characterization studies were analyzed in both soluble and particulate forms. Figure 9 shows the dissolved fraction, as a percent, for Pb, Ni, Cu, and Zn from the state-wide study (top) and the first flush study (bottom) highway runoff characterization studies. The state-wide study includes 237 flow-weighted composite samples for each metal for the 2000-2001, 2001-2002, and 2002-2003 wet seasons. The first flush study includes 526 grab samples per metal from three sites for 1999-2000, 2000-2001 and 2001-2002 wet seasons. The composite samples show approximately equal portions in the dissolved and particulate form, except for lead, which is less than 30% (median) in the dissolved form. The grab samples show greater dissolved fractions, except for lead, which is only 11 % (median) in the dissolved form. Therefore one should expect the Pb and TSS first flushes to be related, and the emissions of Ni, Cu and Zn to be more independent of TSS. The main reason of the frequent weak seasonal first flush for Pb is that it exists mainly particulate-bound in stormwater runoff (Sansalone Buchberger, 1997; Legret and Pagotto, 1999).

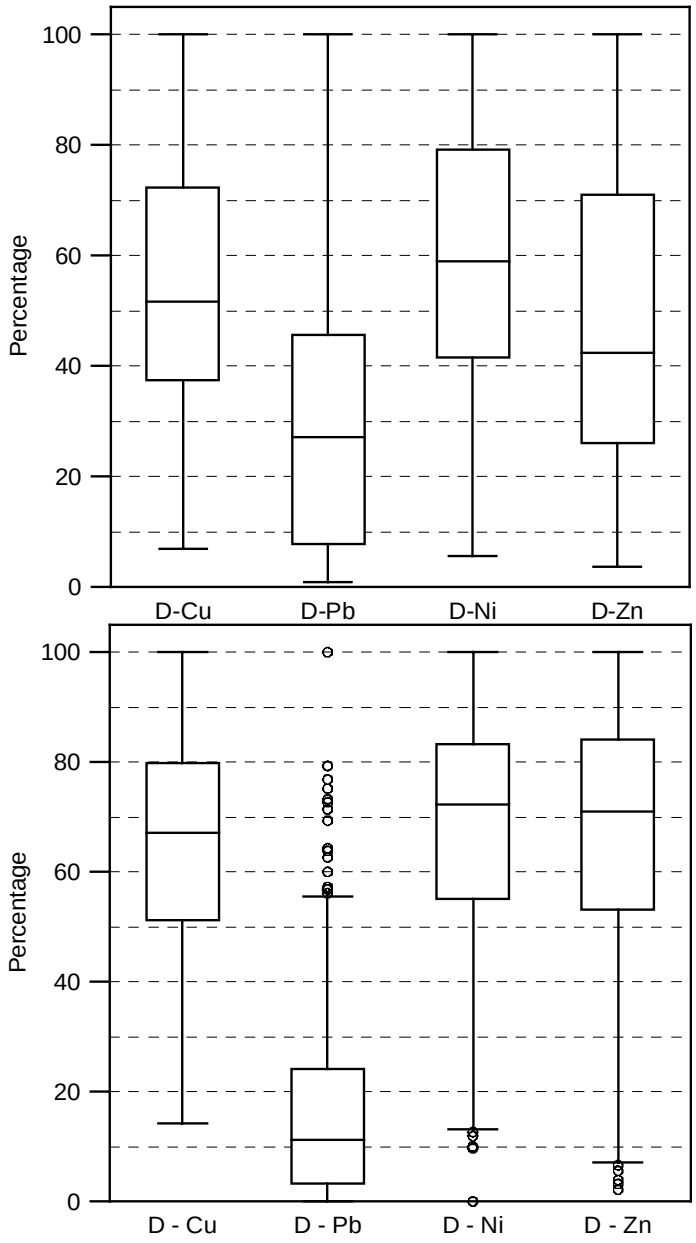

Fig. 9. Dissolved fraction (%) for Cu, Pb, Ni, and Zn for composite (top) and grab (bottom) samples.

Partitioning between dissolved and particulate phases is potentially important in understanding the results. The time between sampling and receipt of grab samples at UCLA laboratory was less than 4 hours, which means sample holding time is shorter than flow–weighted composite samples. The nature of the composite sample means that equilibrium processes can occur for at

least the length of the storm (e.g., 6 to 8 hrs) and the allowable holding time before filtration (< 24 hours). Sansalone and Buchberger (1997) showed modest increases in the particulate fraction over time (0 to 24 hours). The difference in soluble fractions between the two highway studies may be partially related to equilibrium processes that occur during sample collection or analysis. Metals partitioning will be an important consideration for BMP selection, since metal removal by BMPs is primarily due to suspended solids removal. The retention time for many BMPs, such as a sedimentation tank, is quite small compared to the time allowed for equilibrium in most monitoring programs. The time required for equilibrium merits further consideration and study.

5. Conclusions

Four major data sets, collected over the previous four years were examined to identify a seasonal first flush phenomenon, which occurs when the initial storm or storms of the wet season have higher pollutant concentration than storms near the end of the wet season. Trends in seasonal loads were quantified by plotting pollutant concentrations or cumulative pollutant load versus cumulative rainfall or cumulative runoff volume. A distinctive seasonal first flush existed in most cases. In general, the seasonal first flush was strong for total organic carbon (TOC), minerals as measured by specific conductivity (SC) and metals except for lead, which existed mainly particulate-bound phase.

We calculated an effectiveness factor as a function of cumulative runoff volume. The parameter is intended to show the benefits of treating runoff early in the season to treating runoff later in the season. The relative effectiveness was the highest in initial 10-20 percent of runoff volume for all parameters. The effectiveness was the greatest for TOC and weakest for Pb, with many outliers. The median effectiveness for TOC at 10 to 20 percent of runoff volume was approximately 3.5 which means treatment of the initial 10 to 20 percent of runoff volume could remove 3.5 times as much TOC mass as a BMP treating an equal volume later in the storm. This result suggests that applying treatment BMPs early in the season could remove several times more pollutant mass than randomly-timed BMPs.

The large number of samples provided an opportunity to observe the distribution between dissolved and particulate-bound metals. The distribution was approximately equal for composite samples and about 70% dissolved for grab samples, except for lead, which was only 30% dissolved in composites and 11% dissolved in grab samples. The data supports the hypothesis

that the phase of the metals is not at equilibrium at sample collection, which warrants further study to better understand BMP design or selection.

The information in this paper will be helpful in selecting better BMPs for controlling the quality of stormwater runoff in the areas with prolonged rainy and dry seasons, or Mediterranean climates. Additionally, there are other areas, with less pronounced seasonal rainfall, which may benefit from this research.

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Technical Memorandum:

EVENT MEAN CONCENTRATION AND LOADING OF LITTER FROM HIGHWAYS DURING STORMS

February 2004

Prepared for:

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SUMMARY

Total captured gross pollutants in stormwater runoff were monitored at six Southern California highway sites over two years. Gross pollutants were defined as larger than 0.5 cm and were classified into three categories. The gross pollutants were 90% vegetation and 10% litter. Approximately 50% of the litter was composed of biodegradable materials. Event mean concentrations and mass emission rates are presented. First flush was not consistently observed at all monitoring sites during the same storm event. However, litter polluto-graphs and load-graphs indicate that the first flush phenomenon was occasionally observed in all six sites during certain storm events. No statistically significant correlations of litter production were noted, although the event mean concentrations show an increasing trend with antecedent dry days and a decreasing trend with total runoff volume or total rainfall. The mass emission rates will be useful to estimate total litter production for developing total maximum daily loads.

1. INTRODUCTION

Since the passage of the Clean Water Act Amendments in 1972, great progress has been achieved in treating wastewaters from municipalities and industries. In the Los Angeles area, all treatment plants now have secondary treatment or better. In spite of this progress the aquatic environment is still impacted due to pollution from diffuse, or non-point sources. Currently non-point source pollution remains the Nation's largest source of water quality problems (Horan, 1990; Larsen et al., 1998; Parr et al., 1998).

To address the combined impacts of point and non-point sources, Section 303(d) of the Clean Water Act mandated the implementation of total maximum daily loads (TMDL). A TMDL is a calculation of the maximum amount of pollutant that can be discharged to receiving water and still meet water quality standards. The TMDL includes the allocation of loads to the various dischargers to meet the goal. The process requires the identification of the uses for each receiving water (e.g., drinking water supply, contact recreation, and aquatic life support) and the scientific criteria to support that use. A TMDL becomes the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the receiving water can be used for the designated purposes, and must also account for seasonal variation in water quality.

The California State Water Resources Control Board has identified in their 303(d) list at least 36 water bodies where trash or litter is considered a pollutant of concern (California State Water Resources Control Board, 1999). The first TMDL adopted by the Region 4 (Los Angeles area) of

the California State Water Quality Control Board was for trash in the Los Angeles River (California Regional Water Quality Control Board, 2001), and other litter TMDLs are being developed for other watersheds. Figure 1 shows the parameters that impact California waters and lists them by percentage of total area or linear miles impacted. Litter is included in "sedimentation" and "other" categories and can potentially affect approximately 60% of receiving waters.

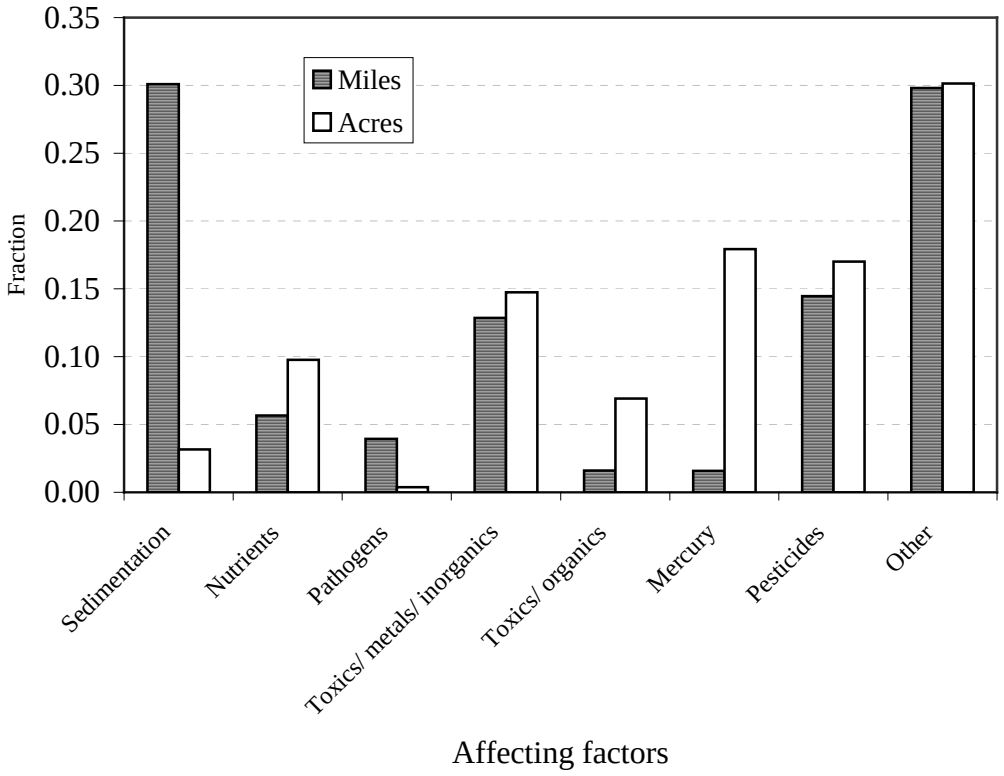

Figure 1
Percentage of 8 impacting parameters to waters in California.

The California Department of Transportation (Caltrans) is actively assessing the characteristics and potential impacts of litter generated from their highways (Caltrans, 2000a). Caltrans is also evaluating the practical application and performance of several litter capturing devices (Caltrans,

2001). Currently, litter characterization is an integrated part of the Caltrans First Flush Characterization Study (FFCS) where both water quality and litter characteristics during the first flush and the entire storm event are being evaluated. These data will provide a basis for Caltrans to develop potential treatment technologies and best management practices (BMPs) to control pollutants in runoff from Caltrans freeways. As part of this study, gross pollutants were captured and analyzed at 6 monitoring sites in the Los Angeles area for 17 storm events during the 2000-2002 rainy seasons. Gross pollutants (defined as being larger than 0.5 cm) were collected and divided into vegetation, biodegradable litter and non-biodegradable litter. This paper presents the results, including mass emission rates, event mean concentrations, and correlations to site-specific conditions.

2. METHODOLOGY

2.1. Study area

The first flush characteristic study (FFCS) was developed to obtain first flush water quality and litter data from representative stormwater runoff from standard highway drainage outfalls in the Los Angeles area. The locations of the FFCS monitoring sites are shown in Figure 2, and their characteristics are summarized in Table 1. Table 1 shows average daily traffic (ADT), catchment area and approximate site imperviousness. Each site was equipped with a rainfall gage, flow meter and flow-weighted composite sampler. Rainfall and flow data were recorded at one-minute intervals. Each site generally had a corrugated or reinforced concrete pipe that discharged stormwater from grated drain vaults located along the edge of the highway. The circular storm drain outfalls were modified using a metal collar extension to mount and secure litter collection bags with ½ -centimeter openings.

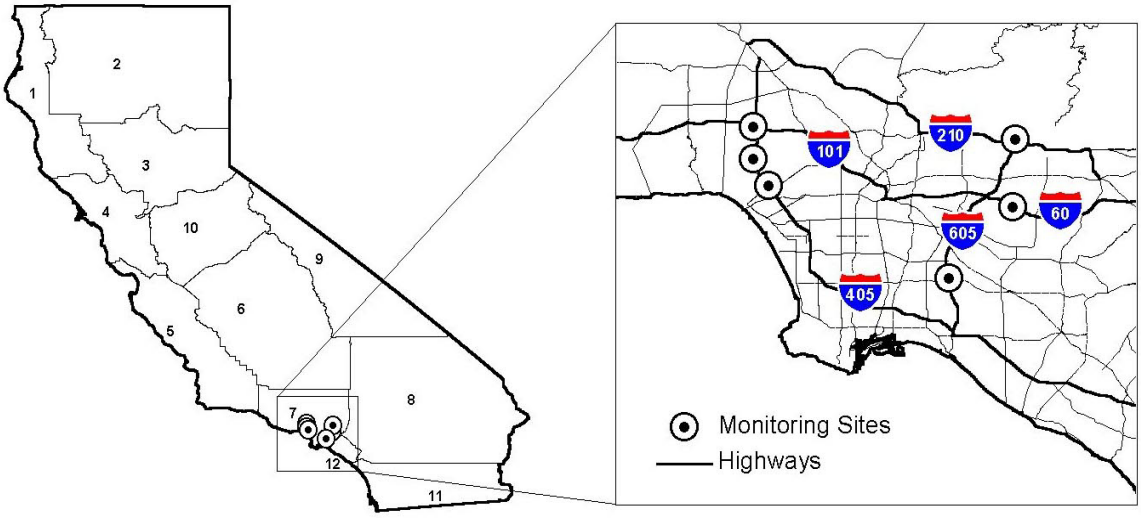

Figure 2
Monitoring sites in Southern California.

Table 1 Descriptions of monitoring sites

Site Name	Site Location	Post Kilometers	ADT (cars/day)	No. of Drain Inlets	Catchment Area (ha.)	Approx. Percent Impervious (%)
UCLA1	101 Freeway	29.2	328,000	1	1.3	100
UCLA2	405 Freeway	53.6	260,000	1	1.7	95
UCLA3	405 Freeway	49.7	322,000	1	0.4	100
URS6-20F	60 Freeway	8.2/25.1	216,600	1	0.2	100
URS8-23C	605 Freeway	9/9.6	229,000	1	0.3	100
URS23	210 Freeway	29.8	122,000	20	2.9	100

2.2. Litter collection procedure

Gross pollutant samples were collected in accordance with the procedures detailed in the FFCS Sampling and Analysis Plan (SAP) (Caltrans, 2000b). Gross pollutants refer to the combination of litter and vegetation that is initially collected in the bags. Samples were collected throughout each storm event, with particular emphasis on the first flush of storm water flow. Prior to the start of a storm event, a new collection bag was securely fastened to the outfall. During the event, up to four bags were used at each site. The bags were collected ½ hour, 1 hour and 2 hours after the beginning of runoff. The fourth and final bag was collected after the storm event. The

collection bags were removed at the appropriate times, secured inside a plastic trash bag with labels and delivered to the laboratory for analysis.

2.3. Gross Pollutant Analysis

The collected material was analyzed for gross pollutants, vegetation, wet litter, dry litter, biodegradable dry litter, and non-biodegradable dry litter according to the procedures specified in Caltrans Litter Monitoring Guidance Manual (Caltrans, 2000c). Litter was defined as non-vegetation larger than ½-cm. The weight and volume of the gross pollutants were initially measured. The gross pollutants were then emptied into a tray, where vegetation was separated. The wet weight and volume of litter and vegetation were measured and recorded. The wet litter fraction was then air dried for a minimum of 24 hours. After drying, the litter dry weight and volume were measured and recorded. The dry litter fraction was then sorted into non-biodegradable and biodegradable fractions and weighed. Non-biodegradable litter is defined as litter that does not naturally degrade in the environment, such as metals and plastics. Biodegradable litter consists primarily of paper products. Mass balances were used to for quality control. Twenty percent of the samples were remeasured, and the replicates were generally less than 15% different in volume and 5% different in weight.

2.4. Calculation of event mean concentrations and emission parameters for litter

The classical event mean concentration was used to characterize litter loading as shown in equation 1:

$$EMC_T\ (g/L) = \frac{Captured\ Litter\ Mass}{Discharged\ Runoff\ Volume} = \frac{\int_0^T M(t)dt}{\int_0^T Q_{TRu}(t)dt} \qquad (1)$$

where EMC is event mean concentration, M(t) is captured litter weight, $Q_{TRu}(t)$ is runoff volume during integration interval, and T is the period of the storm. The equation can also be applied to portions of the storm by applying the appropriate integration limits. EMCs are frequently used to characterize stormwater loadings and can be multiplied by the runoff volume to estimate the mass discharge (Corwin and Vaughan, 1997; Irish Jr. et al., 1998).

Pollutant concentrations often decline over time, and it is generally believed that the first runoff is the most polluted. The emission rate is generally greater at the beginning of rainfall. This phenomenon is often called a "first flush", and the existence of a first flush can influence the selection of best management practices (BMPs). The decline in concentration is sometimes off-set by an increasing runoff rate as a storm progresses. Mass emission based definitions of first flush have been proposed (Ma et al., 2002). In this paper, the first flush of litter refers to the mass collected during the first two hours of the event. This corresponds to the first three bags.

Site and event specific parameters were calculated in order to investigate the sources or nature of litter emissions. Factors such as average daily traffic (ADT), antecedent dry days (ADD), total rainfall and runoff volume were correlated with litter emission rates and first flush masses. Dividing by catchment area normalized litter emission.

3. RESULTS AND DISCUSSION

3.1 Hydrologic data

Table 2 shows storm event summaries for each monitored event and site, which includes event rainfall, maximum rainfall intensity, total runoff volume and antecedent dry days (ADD). The hydrologic data were used to prepare hydrographs and to calculate event mean litter concentrations. During the monitoring periods, antecedent dry days were observed from 1 day to

190 days and event rainfalls were monitored from 0.28 cm to 15.6 cm. The total runoff volume varied from 8 m^3 to 1420 m^3 among the sites. The 2000-2001 season was a normal rainfall year with total rainfall nearly equal the mean 43-year record; the 2001-2002 season was a dry year, with approximately 25% of mean rainfall.

Table 2
Event summary for all monitored events

Event Date(m/d/y)	UCLA Monitoring Sites														
	UCLA1					UCLA2					UCLA3				
	Event Rainfall (cm)	Storm Duration (hr)	Max Rainfall Intensity (mm/hr)	Total Flow (m^3)	ADD (days)	Event Rainfall (cm)	Storm Duration (hr)	Max Rainfall Intensity (mm/hr)	Total Flow (m^3)	ADD (days)	Event Rainfall (cm)	Storm Duration (hr)	Max Rainfall Intensity (mm/hr)	Total Flow (m^3)	ADD (days)
10/26/00	2.39	11.0	6.1	260.7	33.6	2.39	11.0	5.84	200.8	33.6	2.59	11.7	4.06	94.7	33.6
01/08/01	0.38	6.5	1.78	43.7	69.4	0.51	4.2	1.78	52.2	69.4	0.53	4.4	2.03	17.9	69.4
01/10/01	12.7	16.3	30.23	1327.4	1.9	15.6	17.2	32.26	1416.2	1.9	12.85	14.5	22.35	481.1	2
02/10/01	1.32	7.2	7.87	155.2	14.2						1.55	5.7	4.57	58.6	14.2
02/19/01	0.71	4.1	2.79	80.9	5.4	2.39	9.0	7.11	261.6	4.8	3.02	7.0	12.19	112.4	5.3
02/24/01	1.45	19.0	1.78	165.6	1	1.91	19.1	2.29	241.6	1	1.14	11.5	2.29	38.1	1
03/04/01	1.19	10.3	3.05	139.1	4	0.89	5.0	4.83	140.2	4	0.51	3.7	2.29	11.4	4
04/07/01						3.02	9.2	5.33	501.9	31.5	2.54	10.8	7.62	65.2	31.6
04/20/01	0.81	6.2	2.79	79	13.2										
10/30/01						0.33	4.3	2.03	47.5	192.2	0.28	4.3	2.29	8.1	192.3
11/12/01						1.19	1.7	9.91	172.3	12.98	0.74	1.4	5.33	24.8	12.99
11/24/01						5.03	4.4	26.67	737.8	11.69	2.97	4.4	14.48	108.7	11.6
12/14/01						0.36	4.0	2.03	52	19.73					
01/27/02						3.18	8.6	8.13	445.6	27.13	2.46	8.6	5.08	92.2	27.14
02/17/02											0.74	2.1	4.32	25.6	20.31
03/07/02											0.46	1.5	3.3	14.4	17.74
03/17/02						0.23	1.0	2.29	23.53	10.69	1.04	1.6	9.4	37	10.7
	URS Monitoring Sites[a]														
	URS6-20F					URS8-23C					URS23				
10/26/00	0.89	10.0	15.2	33.9	33		15.3	7.6	11.2		3.2	9.7			33
01/08/01	0.23	2.1	3	2	70.6	0.33	3.0			108	0.43	3.8			70.4
01/10/01	7.11	18.8	18.3	130.6	72.2	10.26	18.5	24.4	168	2	8.74	21.1	27.4	1673.5	2
01/26/01	0.71	7.3	6.1	10.7	1.7	1.45	6.2	6.1	14.6	1.7	1.19	7.8	21.3	156.1	1.7
02/10/01	0.71	6.6	6.1	4.3	14.5	1.25	6.4	12.2	7.3	2.9	0.79	9.2	9.1	152.7	14.6
02/19/01	0.46	5.7	6.1	7.9	5.6	0.94	6.5	1.5	12	5.5	1.04	6.4	6.1	117.6	5.7
02/24/01	9.04	9.7	9.1	80.8	1.1	6.43	9.1	9.1	118.3	0	9.55	10.5	12.2	1047.4	5.1
04/09/01	1.55	8.2	15.2	21.7	31.8		15.3	24.4	31.4	28.1	2.29	10.0	15.2	564.6	31.8

[a] *Due to low rainfall in 2001-02 rainy season, limiter litter data were available from the URS sites.*
** The missing data in UCLA sites are due to collection failure.*

3.2. Statistical summary

The results of a statistical analysis for normalized weight and volume by area are summarized in Table 3 for the 2000-2002 monitoring seasons. URS23, the largest site, had the highest total weight and volume of gross pollutants and litter collected over the storm season. The net volume of litter collected from URS23 was greater than observed at other sites, but less when normalized by area. Sites URS6-20F and URS8-23C had larger specific pollutant loadings compared to other sites. The mean mass loading for wet gross pollutant in URS6-20F was 18.63 kg/ha and volume loading was 73.46 L/ha. Comparatively UCLA3 and URS23 sites had smaller mean mass and volume loadings, which were 5.34 kg/ha and 12.81 L/ha for UCLA3 and 5.88 kg/ha and 17.65 L/ha for URS23.

Table 4 shows the cumulative litter parameters for the 2000-2001 season, normalized by site area. The site UCLA1 is missing due to collection failures. The normalized litter values vary for each site range from 2.69 to 17.35 kg/ha for dry litter weight, 0.40 – 8.99 kg/ha for dry biodegradable litter weight, and 0.85 – 6.61 kg/ha for non-biodegradable litter weight. The ratio of net weight of biodegradable to non-biodegradable litter at UCLA3, URS8-23C, and URS23, was very similar, approximately 1 to 1. A higher fraction of biodegradable litter (up to 2 times) was observed at URS6-20F and a higher fraction of non-biodegradable litter (up to 2 times) at UCLA2.

Table 3
Statistical summary of normalized litter for all data during the 2000-2002 monitoring seasons

Parameters	Monitoring Sites	Gross Pollutants		Litter				Biodegradable		Non-biodegradable		Vegetation	
		Wet		Wet		Dry		Dry		Dry		Wet	
		Weight (kg/ha)	Volume (L/ha)	Weight (kg/ha)	Volume (L/ha)	Weight (kg/ha)	Volume (L/ha)	Weight (kg/ha)	Volume (L/ha)	Weight (kg/ha)	Volume (L/ha)	Weight (kg/ha)	Volume (L/ha)
Minimum	UCLA2	0.302	0.412	0.020	0.088	0.010	0.082	0.005	0.000	0.005	0.000	0.280	0.323
	UCLA3	0.625	1.875	0.221	0.000	0.104	0.000	0.036	0.000	0.034	0.000	0.625	1.875
	URS6-20F	0.350	2.400	0.033	0.500	0.012	0.400	0.010	0.249	0.000	0.100	0.305	1.400
	URS8-23C	0.497	2.833	0.172	0.900	0.084	0.934	0.053	0.600	0.031	0.334	0.313	1.834
	URS23	0.407	1.793	0.066	0.345	0.030	0.145	0.008	0.072	0.007	0.072	0.335	1.448
Maximum	UCLA2	49.42	35.76	1.38	22.94	0.90	10.00	0.37	4.41	0.39	4.71	48.65	33.84
	UCLA3	11.45	32.50	0.88	5.75	0.40	7.00	0.35	5.00	0.21	4.75	10.75	31.00
	URS6-20F	80.00	292.00	6.80	52.00	4.17	39.30	2.60	19.70	1.15	12.80	72.50	234.00
	URS8-23C	43.33	82.33	7.70	27.73	6.07	26.37	2.30	11.33	3.31	12.37	35.00	53.00
	URS23	20.77	50.00	2.22	8.97	1.30	8.97	0.58	4.14	0.63	4.66	18.22	40.34
Median	UCLA2	3.78	4.44	0.27	1.07	0.16	0.86	0.05	0.16	0.04	0.15	3.30	3.29
	UCLA3	4.78	10.13	0.46	1.63	0.25	2.24	0.12	1.05	0.08	0.56	4.24	7.25
	URS6-20F	5.81	35.00	0.66	2.37	0.26	2.68	0.14	1.72	0.08	0.92	5.40	33.08
	URS8-23C	6.60	10.58	1.27	4.48	0.72	4.50	0.30	1.97	0.36	2.36	5.27	6.10
	URS23	2.25	8.79	0.26	1.55	0.14	1.67	0.05	0.33	0.02	0.24	2.11	5.69
Mean	UCLA2	9.28	10.76	0.46	3.69	0.30	2.75	0.09	0.57	0.13	0.60	8.78	7.06
	UCLA3	5.34	12.81	0.49	2.28	0.25	2.60	0.14	1.31	0.10	1.05	4.88	10.36
	URS6-20F	18.63	73.46	1.58	10.03	0.85	8.38	0.54	4.86	0.24	2.62	16.59	60.94
	URS8-23C	13.97	23.78	2.31	8.66	1.62	7.90	0.67	3.45	0.85	3.93	11.51	14.83
	URS23	5.88	17.65	0.59	2.63	0.33	2.69	0.14	1.09	0.13	1.25	5.21	11.59
Standard Deviation	UCLA2	14.00	13.12	0.44	6.56	0.30	3.53	0.12	1.23	0.16	1.33	13.76	9.56
	UCLA3	3.02	8.82	0.22	1.88	0.10	2.22	0.08	1.37	0.06	1.25	2.95	8.33
	URS6-20F	26.70	93.71	2.29	17.63	1.41	13.29	0.88	6.94	0.39	4.24	24.13	73.93
	URS8-23C	17.22	30.85	2.88	10.43	2.30	9.67	0.88	4.09	1.26	4.59	14.18	19.89
	URS23	7.45	17.54	0.77	3.07	0.45	3.12	0.21	1.57	0.23	1.70	6.58	14.20

* Litter collection of some events at UCLA1 failed.

Table 4
Normalized litter as function of catchment area during 2000-2001 monitoring season

Parameter				Cumulative Pollutant				
Monitoring Sites				UCLA2	UCLA3	URS6-20F	URS8-23C	URS23
Gross pollutants	Wet	Weight	(kg/ha.)	64.8	36.4	329	121	48
		Volume	(L/ha.)	56.1	78.6	1,440.00	178	138
Litter	Wet	Weight	(kg/ha.)	1.8	4	25.3	19.1	4.87
		Volume	(L/ha.)	6.25	18.1	165	69.3	22.1
	Dry	Weight	(kg/ha.)	5.8	17.35	14.1	13.3	2.69
		Volume	(L/ha.)	1.3	1.8	149	63.7	22.3
Biodegradable	Dry	Weight	(kg/ha.)	0.4	0.8	8.99	6.01	1.1
		Volume	(L/ha.)	2.8	9.5	82.3	28.3	8.28
Non-biodegradable	Dry	Weight	(kg/ha.)	0.85	0.85	4.4	6.61	1.01
		Volume	(L/ha.)	3	7.8	58.3	31.7	9.55

3.3. Litter fraction

The fractions of each parameter are shown in Figure 3.

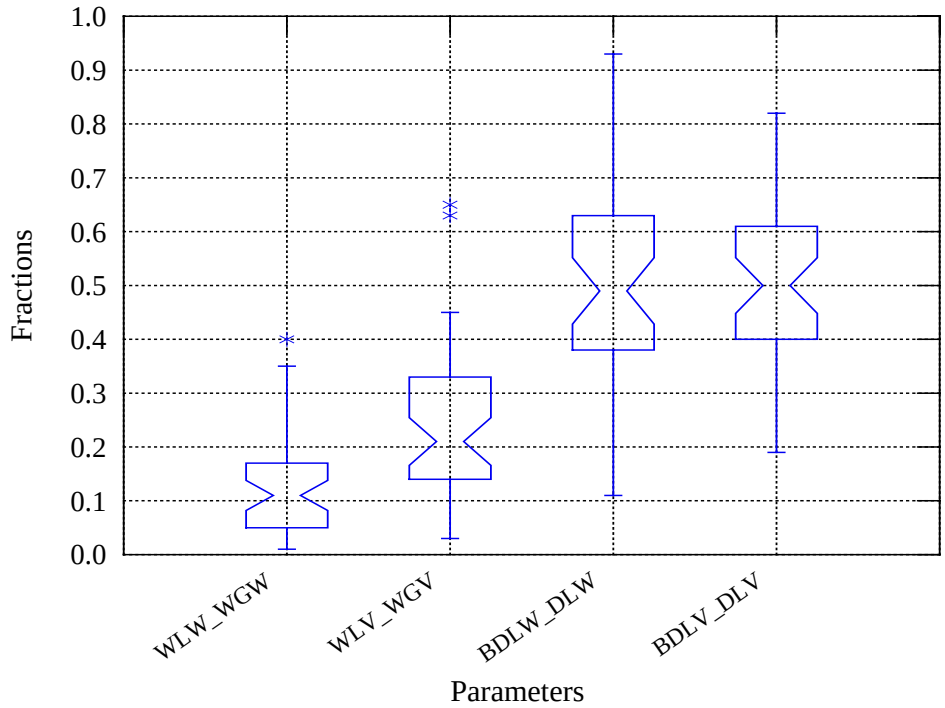

Figure 3
Fractions of litter for all monitoring data (WLW_WGW = wet litter weight/wet gross weight, WLV_WGV = wet litter volume/wet gross volume, BDLW_DLW = biodegradable dry litter weight/dry litter weight, BDLV_DLV = biodegradable dry litter volume/dry litter volume).

The notched box plots show the median value and inter-quartile range with flared sides that terminate at the 95% confidence limit. The data used for this comparison was the combined data from all sites and events. The mean fraction of wet litter weight was about 12% of the wet gross pollutant weight while the remainder was vegetation. Mean wet litter volume was 21% of the total gross pollutant volume, but varied widely, from 3 to 45%. The mean portions of biodegradable dry litter weight and volume were approximately 50% of the dry litter weight and volume; the fractions of biodegradable and non-biodegradable were nearly equal.

3.4. Litter polluto- and load-graphs

Gross pollutant and litter data were evaluated as polluto-graphs (concentration versus time) and load-graphs (mass loading rate versus time) for each event and site.

The litter concentrations were calculated as the dry litter mass divided by the total flow volume during the time of the litter sample collection. The litter mass loading rates were calculated as the dry litter mass divided by the elapsed time of litter collection, and normalized by the catchment area. These plots were compared to the respective hydrographs to determine the potential relationships to flow intensity and storm duration. The plots were also used to determine whether a first flush effect (i.e., relatively higher litter concentrations early in the event, followed by a decrease in concentration after a period of time) was present. Figure 4 shows an example of combined litter polluto-graph and load-graph for the first event of the season. The first event of the season at site UCLA1 shows very high dry litter concentration and load in first hour.

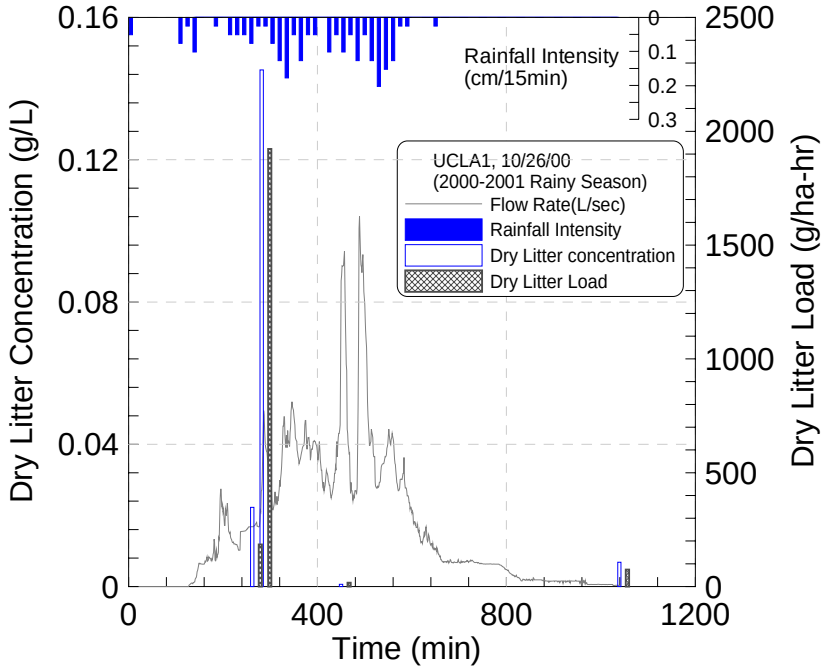

Figure 4
Litter polluto- and load-graphs for first storm event (with hydrograph shown in background).

3.5. First flush

Caltrans' first flush criteria for litter is defined as the litter mass fraction within the first two hours of the storm event. If more than 50% of the mass is emitted during the first two hours, it is called a first flush. The litter first flush observation based on the litter ratio is presented in Table 5 for selected events. The occurrence of a first flush was not consistently observed at all monitoring sites during the same storm event. Similarly, review of the litter polluto-graphs and load-graphs indicate that the first flush phenomenon was occasionally observed in all sites during certain storm events. Table 5 shows that site URS 6-20F most consistently exhibited a first flush. During the storm event of January 10, 2001, URS6-20F, URS8-23C and URS23 showed significant first flush effects, but there was none present for UCLA2 and UCLA3. This storm event also had the highest relative rainfall intensity of the season.

Table 5
Fraction of litter occurring in the first two hour of runoff [a]

Parameters		Gross Pollutant Wet Weight	Gross Pollutant Wet Volume	Litter Wet Weight	Litter Wet Volume	Litter Air Dry Weight	Litter Air Dry Volume	Biodegradable Dry Weight	Biodegradable Dry Volume
UCLA2	10/26/01	0.02	0.03	0.04	0.05	0.03	0.06	0.03	0.04
	1/8/01	0.98	0.95	0.98	0.97	0.96	0.97	0.97	0.98
	1/10/01	0.05	0.11	0.53	0.39	0.48	0.5	0.5	0.63
UCLA3	10/26/01	0.92	0.73	0.85	0.62	0.81	0.61	0.64	0.4
	1/8/01	0.94	0.9	0.98	0.96	0.98	0.96	0.98	0.95
	1/10/01	0.2	0.27	0.59	0.31	0.38	0.34	0.49	0.37
	2/10/01	0.25	0.26	0.15	0.13	0.12	0.1	0.15	0.1
	2/19/01	0.61	0.57	0.85	0.71	0.92	0.74	0.75	0.57
URS6-20F	10/26/00	0.23	0.29	0.33	0.35	0.29	0.34	0.24	0.31
	1/10/01	0.98	0.96	0.94	0.96	0.96	0.94	0.97	0.94
	1/26/01	0.87	0.88	0.94	0.96	0.96	0.96	1	0.93
	2/10/01	0.97	0.95	0.99	0.93	0.99	0.94	0.99	0.93
URS8-23C	10/26/00	0.19	0.2	0.14	0.12	0.12	0.12	0.16	0.14
	1/10/01	0.77	0.68	0.58	0.7	0.53	0.62	0.77	0.7
	2/24/01	0.22	0.32	0.37	0.43	0.37	0.33	0.46	0.33

[a] Due to low rainfall in 2001-02 monitoring season, limited litter data were available.

Evaluation of the litter load-graphs, however, presented no clear observations of a first flush phenomenon. In many instances, the litter mass loading rates were not highest during the first portion of a storm event; the highest litter mass loading rate was observed later in the storm event, after the peak flow had occurred.

Gross pollutant and litter data were also reviewed and compared on a multi-event basis to evaluate a potential effect of the first storm event of the season. It was hypothesized that the first storm event of the season would have the highest relative amount of litter mass, volume and mass loading compared to subsequent storm events. Table 5 shows that the first monitored storm event of the season did not produce a relatively greater amount of litter when compared to the subsequent storm events. The existence of a first flush and the mass of gross pollutants may be a

function of the total or maximum intensity of rainfall. Gross pollutants are retained on the surfaces and in catch basins and pipes, and a minimum flow may be required to mobilize them. If the first rainfall of the season is large but lengthy with low intensity, gross pollutants may not be mobilized. Conversely, a short, intense rainfall may mobilize more pollutants. The amount of runoff to mobilize gross pollutants is a question for future research, but may be important for designers, since it may be possible to change stormdrain designs to impact litter mobilization.

The ratio of biodegradable to non-biodegradable litter was calculated for each event and site. The values varied considerably during each storm event. Site URS6-20F, the site with the highest normalized litter mass loading, consistently had higher amounts of biodegradable litter. Site UCLA2 had more non-biodegradable litter. On average for all sites, a slightly greater percentage (approximately 60%) of biodegradable litter was measured in the first flush of the storm events. This was consistent with individual storm event observations where lighter biodegradable litter appeared to be washed out first, leaving the relatively heavier non-biodegradable litter to wash out with the remainder of the storm event during the peak flow periods.

Figure 5 shows the normalized wet gross, vegetation and litter rates for each event at UCLA3 site. The storm event, October 30, 2001, is the first storm at UCLA3 site. The mass rate is not higher compared to other events. The mass rates vary to event-to-event and influenced by several factors as discussed below.

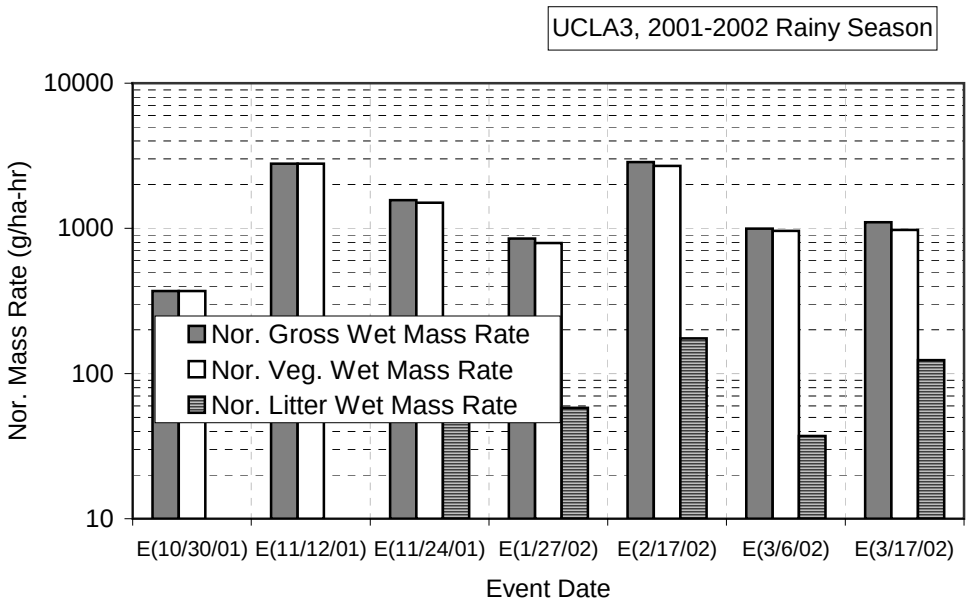

Figure 5
Normalized mass rates as function of catchment area and storm duration.

3.6. Factors affecting litter production

Each parameter normalized by area was compared with potential affecting factors such as total rainfall, maximum rainfall intensity and antecedent dry days to determine whether there are any potential relationships. The matrix of small figures represents mass loading relationship with affecting parameters. Table 6 shows the matrices of mass-based parameters and volume-based parameters. There are no obvious correlations with storm characteristics, such as ADD and total rainfall (TR). The relationship between wet gross pollutant mass or volume and wet vegetation mass or volume is striking. The wet gross pollutant mass is primarily vegetation. There are also significant relationships between wet and dry volumes, which is expected.

Table 6

Correlation matrix with impacting parameter for (a) mass loading and (b) volume loading (TR: total rainfall, MI: maximum rainfall intensity, ADD: antecedent dry days (WGV: wet gross volume, WVV: wet vegetation volume, WLV: wet litter volume, and DLV: dry litter volume)

	Pearson correlation matrix							
	Volume	TR	MI	ADD	WGV	WVV	WLV	DLV
Matrix of Bonferroni Probabilities	TR	1	0.76	-0.21	0.48	0.44	0.26	0.25
	MI	0.00	1	-0.18	0.59	0.64	0.42	0.43
	ADD	1.00	1.00	1	-0.08	-0.06	0.08	0.08
	WGV	0.09	0.01	1.00	1	0.93	0.86	0.87
	WVV	0.23	0.00	1.00	0.00	1	0.87	0.88
	WLV	1.00	0.30	1.00	0.00	0.00	1	0.99
	DLV	1.00	0.28	1.00	0.00	0.00	0.00	1

	Pearson correlation matrix							
	Mass	TR	MI	ADD	WGW	WVW	WLW	DLW
Matrix of Bonferroni Probabilities	TR	1	0.76	-0.21	0.608	0.60	0.32	0.38
	MI	0.00	1	-0.18	0.70	0.69	0.51	0.56
	ADD	1.00	1.00	1	-0.10	-0.10	0.04	0.06
	WGW	0.00	0.00	1.00	1	0.99	0.63	0.66
	WVW	0.00	0.00	1.00	0	1	0.57	0.61
	WLW	1.00	0.06	1.00	0.00	0.01	1	0.99
	DLW	0.58	0.02	1.00	0.00	0.00	0.00	1

Figure 6 shows the litter EMC as a function of ADD and event rainfall. The wet gross pollutant weight shows no trend with ADD or rainfall; however, the EMC shows a slight increasing trend with ADD for litter, suggesting accumulation during dry periods. The EMCs for litter show a small decreasing trend with total rainfall. This has been observed for other pollutants and suggests that the large rainfall has washed out sufficiently large masses of litter from the catchment so that the concentration decreases.

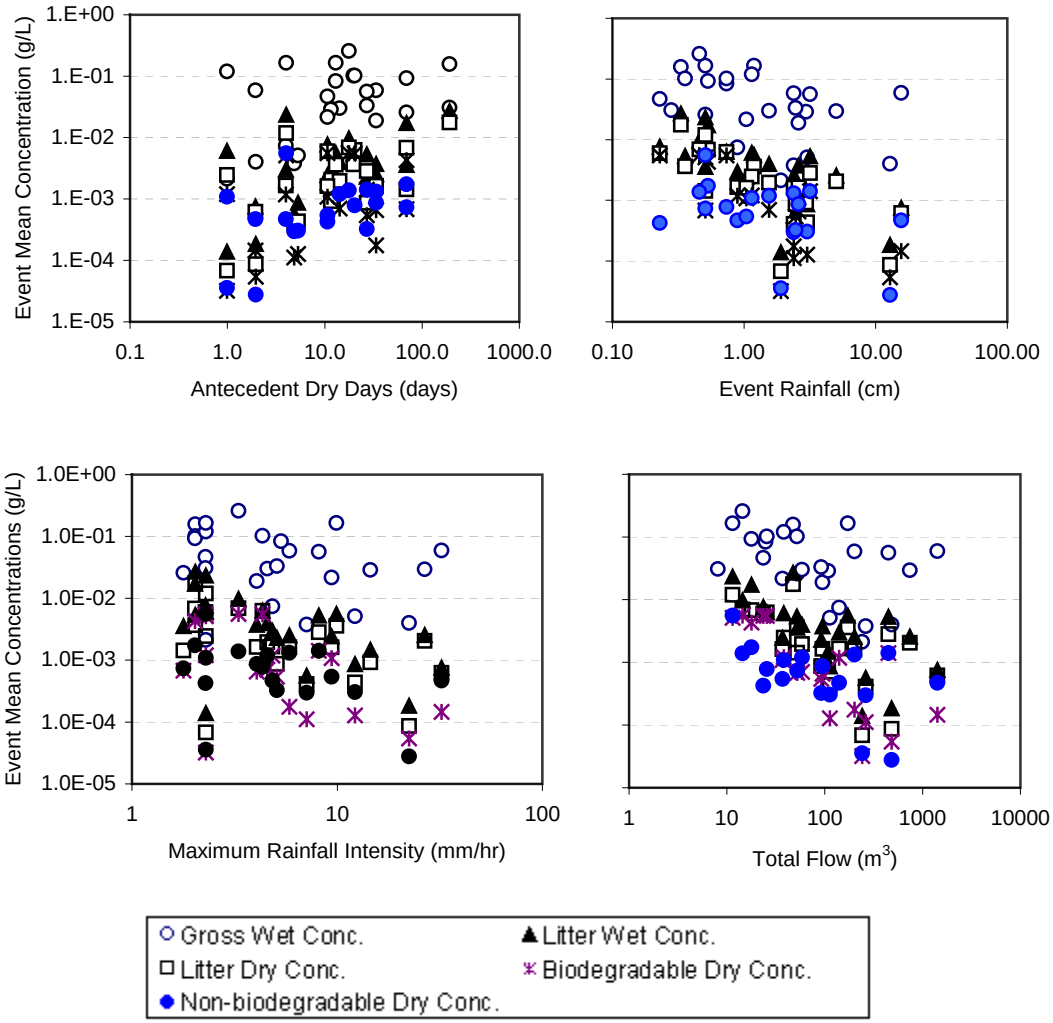

Figure 6
Correlation between event mean concentrations and impacting parameters (ADD, event rainfall, maximum rainfall intensity and total flow).

The figure also shows the litter EMC as a function of maximum rainfall intensity. There is no obvious trend; also the rainfall intensity is correlated with total rainfall (see Table 6) so that any trends may be due to total rainfall or maximum intensity. The figure also shows the total runoff volume and total rainfall are related by the runoff coefficient.

Figure 7 shows EMCs represented by notched box plot for the six previously defined litter parameters. The EMCs can be used to estimate litter production in planning models. The variability of litter emission is 2 orders of magnitude in some cases.

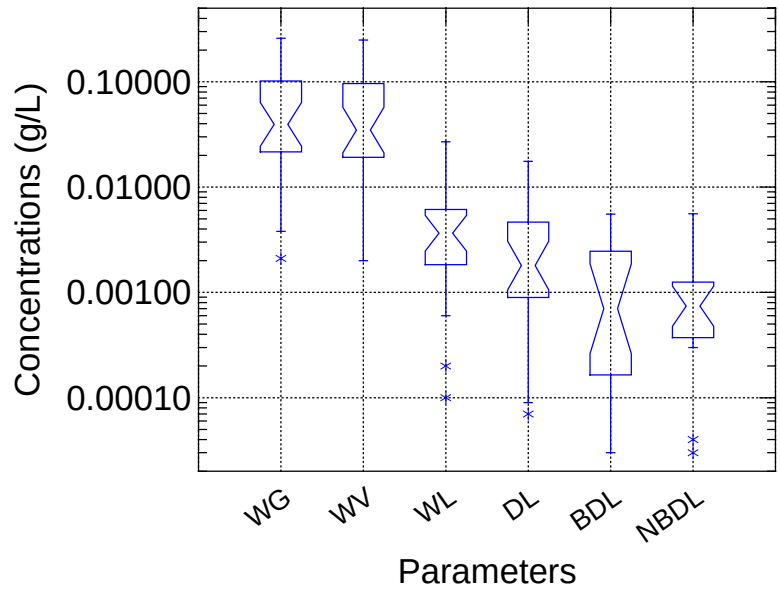

Figure 7
Notched box plot for event mean concentrations (WG: wet gross, WV: wet vegetation, WL: wet litter, DL: dry litter, BDL: biodegradable dry litter, NBDL: non- biodegradable dry litter).

3.7. Regression model for event mean concentrations of litter

In order to predict the litter EMC to measurable or predictable rainfall parameters and power regression was performed using the following equation:

$$EMC_{litter} = \varepsilon \left(ADD \right)^{a} \left(TR \right)^{b} \qquad (2)$$

where ADD is antecedent dry days (days) and TR is total rainfall (cm). ε, a and b are fitting parameters.

The regression in equation 2 explains approximately 40 to 80% of the variability as shown in Table 7. The fitting parameters are also shown. The value of fitting parameter, a, is positive, suggesting that EMC increases with increasing ADD. The parameter b is negative, suggesting that EMC decreases with total rainfall or runoff. These two model parameters match the results

presented earlier in the paper indicating that the litter will build up over dry days, and the high rainfall or runoff will washout litter from the catchment, reducing the concentration.

Table 7
Coefficient determination and statistical summaries

Parameters	ε	*a*	*b*	R^2	Durbin-Watson D
Wet gross pollutant	0.0239	0.206	-0.408	0.500	2.009
Wet vegetation	0.02056	0.215	-0.387	0.490	1.964
Wet litter	0.0016	0.360	-0.683	0.790	1.933
Dry litter	0.00095	0.354	-0.694	0.770	2.061
Dry biodegradable litter	0.00061	0.245	-1.034	0.570	1.676
Dry non-biodegradable	0.00032	0.336	-0.408	0.590	2.252

4. CONCLUSIONS

This technical memorandum presents the results of total gross pollutants and litter observations at 6 highway sites in Southern California over two years. Both pollutants have become important aspects of stormwater pollution prevention. Litter is observable by the public and has attracted increased interest. The first TMDL for Southern California was for litter. There is less information about litter since it has not been considered a traditional water pollutant. The conclusions that can be drawn from this study are summarized as follows.

1. Vegetation composed almost 90% of the total gross pollutants (> 0.5 cm) captured in litter traps. Litter composed the remaining 10%.
2. The normalized litter loadings vary from 2.69 to 17.35 kg/ha for dry litter, 0.40 to 8.99 kg/ha for dry biodegradable litter, and 0.85 to 6.61 kg/ha for non-biodegradable litter.
3. The event mean concentration for total gross pollutants ranged from 2.1 to 259 mg/L (wet basis). The concentrations of non-biodegradable (metals, plastics, etc.) and

biodegradable litter (paper, etc.) were nearly equal and ranged from 0.03 to 5.5 mg/L (dry basis).

4. The occurrence of a first flush was not consistently observed at all monitoring sites during the same storm event. Similarly, review of the litter polluto-graphs and load-graphs indicate that the first flush phenomenon was occasionally observed in all sites during certain storm events.

5. There were few meaningful correlations of litter parameters with storm parameters such as total rainfall, antecedent dry days, etc. A decreasing trend in litter EMC was observed with total rainfall or total runoff volume. An increasing trend of EMC was observed with antecedent dry days.

6. An empirical power series model was developed that can be used to estimate litter production. The trend observations and the model are considered developmental and need verification.

5. ACKNOWLEDGEMENTS

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Particle Size Distribution in Highway Runoff

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SUMMARY

Particles in highway runoff contain various adsorbed pollutants, and many best management practices (BMPs) are selected for particle removal efficiency. Particle removal efficiency is a function of particle size and density, which makes particle size distribution (PSD) a crucial BMP design parameter. PSD was quantified for three rainfall events during 2002-2003 rainy season at three highway sites in west Los Angeles. Rainfall, runoff flow rate, and a large suite of water quality parameters were also measured. An initial experimental protocol was developed, which defined sample handing procedures and showed that samples must be analyzed within six hours of collection to minimize changes in PSD. Preliminary results suggest that the concentration of small particles decreased with a corresponding increase in the concentration of larger particles in stored samples. This preliminary finding suggests a natural particle flocculation. The PSD changed throughout the storm, and the total number of particles decreased as the storm progressed. The number of large particles decreased more rapidly than the total number of particles. Particles between 2 μm and 1000 μm demonstrated a strong first flush. On average, 40% of the particles were discharged in the first 20% of the runoff. Additional research is needed to confirm the findings presented in this tech memo. Specific research needed to be investigated to fulfill the current knowledge and data gaps includes:

- Hydrographic measurement of particles
- Impact of storage/detention time on different size particle coagulation
- Improving particle fractionation and chemical analysis technique
- Developing and testing of suitable on-line particle size analysis system for stormwater

1. INTRODUCTION

A great proportion of pollutants in highway runoff such as heavy metals and polynuclear aromatic hydrocarbons (PAHs) are bound to particles (Oliver et al. 1974; Herrmann 1981; Ongley et al. 1981; Hoffman et al. 1985; Hewitt and Rahssed 1992; Legret and Pagotto 1999). Most of the particles are characterized as suspended solids (Uchimura et al. 1997). The large surface-to volume ratios of particles in highway runoff provide reactive locations for partitioning and transport of pollutants, and may serve as reservoirs of these pollutants in downstream locations (Oliver et al. 1974; Thomson et al. 1997; Cristina et al. 2002). In addition, pollutants adsorbed to particles generally have less mobility and bioavailability than in their dissolved form. Consequently, understanding characteristics of particles in highway runoff is crucial for future runoff management and BMP selection.

Particles in highway runoff arise from roadway maintenance operations, atmospheric deposition, and various kinds of traffic activities such as tire abrasion, vehicular wear, fluid leakage, and pavement degradation (Kobriger and Geinopolis 1984; Thomson 1997; Legret and Pagotto 1999; Grant et al. 2003). Tire and pavement wear produces numerous particles with diameters from several nanometers to several millimeters. Their properties range from quickly dissolving to insoluble.

Tire and pavement abrasion is the source of many of the particles (Muschack 1990; Sansalone and Tribouillard 1999). Kobriger and Geinopol (1984) reported the distribution of particles from vehicle-related deposition processes: 37% arise from pavement wear; 37% from tire wear, and

18.5% from abrasion of vehicle parts, such as brakes and engines. Deposition from settleable exhaust accounts for 7.5% of the total particulate mass.

The focus of this preliminary investigation was to characterize particles size distribution (PSD) of highway runoff with major emphasis on developing a protocol to insure proper particle analysis and reproducible results. In addition, runoff samples were collected throughout the storm and particles were analyzed to verify the existence of particle first flush.

2. REVIEW OF PARTICLE-SIZING TECHNIQUE

Several particle-sizing techniques have been utilized to characterize stormwater. Sieving techniques use screens for analyzing dry particles. Sedimentation methods have been used for particles in the water column (Gromaire-Mertz et al. 1999). A large variety of instruments have been developed for characterizing particles in the water column, and their advantages and disadvantages are shown in Table 1.

Sieving methods are used for larger, dry particles (generally larger than 45 μm). Ellis and Revitt (1982) used oven drying and sieve analysis for sediments from roadway runoff. Lau and Stenstrom (2001) reported PSD of samples collected during dry weather from roads; they used air drying and mechanical screens over a range of 43 to 2,200 μm. Sansalone et al. (1997) collected sediments from individual storm events and measured PSD by drying the sediments at 110° C and sieving with mechanical screens. The drying step required before sieving can alter particle size and character. In addition, due to potential aggregation among particles, PSD in sediments does not necessarily represent the PSD in runoff.

Robert et al. (1998) utilized a Coulter Counter to measure particle sizes and employed scanning electron microscopy to characterize the alteration of runoff-entrained pavement solids transported through a pipe sewer during rainfall runoff events. Sansalone et al. (1998) investigated PSD in highway runoff ranging from 2 μm to 300 μm using a HIAC/ROYCO light obscuration and electrical resistance instrument (AWWA 1992). Drapper et al. (2000) employed a Mastersizer laser particle size analyzer to determine the PSD of roadway runoff samples taken from sites at

southeast Queensland, Australia. The instrument uses light diffraction and is useful for particles 710 μm and smaller.

Hargesheimer et al. (1992) proposed an experimental particle-sizing protocol for enumerating the total number of particles in wastewater effluents, and described sample collection, handing and analysis and storage procedures. They found that glass bottles, cleaned by hand, dishwasher or super-cleaning procedures, were satisfactory sample containers when counting particles as small as 0.5 μm in diameter. Plastic and teflon bottles were unsuitable containers when counting particles less than 5 μm in diameter, regardless of cleaning methods. Carefully cleaned caps and freshly dispensed parafilm contaminated samples with small particles (most less than 1 μm in diameter). Gentle inversion, sonication, and inversion-sonication-inversion were satisfactory mixing techniques, producing similar particle counting results. Gentle inversion was preferred because of its simplicity. They found that the variability of particle counts increased with storage time and results were most reproducible immediately after sample collection. Although several researchers have measured PSD in highway runoff or stormwater (Characklis and Wiesner 1997; Sansalone et al. 1998; Legret and Pagotto 1999), no consistent experimental method has evolved. In addition, few researchers have systematically measured PSD over a wide range (2-1000 μm) and over entire storm events. Both of these topics are the focus of this paper.

Table 1. Particle Sizing Techniques Commonly Used in Stormwater Area (Grant et al. 2003)

Particle's (P's) Property Measured	Aspect Measured	4 Advantage	Limitation	Sample Instruments
Transport property: sedimentation	Gravity	Directly applicable results to sedimentation basin design.	Slow	MICROMERITICS Sedigraph
Electrical property: differential resistance	Voltage pulse (proportional to P's volume)	Change of particles in sub-size region has no effect elsewhere. Results are not affected by P's shape, nature, gravity, and refractive index.	Carrier fluid influence (e.g. coagulation); May disrupt fragile flocs.	COULTER Multisizer 2
Light obscuration (blockage)	Voltage pulse (proportional to P's maximum cross sectional area)	Change of particles in sub-size region has no effect elsewhere. Results are not affected by P's, nature, gravity, and refractive index. Optical analogue of resistive pulse technique but without electrolyte.	May disrupt fragile flocs.	NICOMP AccuSizer 780 PACIFIC SCIENTIFIC INSTRUMENTS Model 9703
Light diffraction property: light intensity	Light intensity	Do not require calibration step.	Concentration of solution has great influence on results.	SEQUOIA LISST-100 MASTERSIZER S Laser Particle Size Analyzer
Dynamic light scattering property: Time or spatial fluctuations in scattering intensity	Hydrodynamic effect – photopulse signal	Good for small particles till 1nm.	Need long time to get stable	NICOMP PSS 170

3. METHODOLOGY

3.1 Site Description

Three monitoring sites in west Los Angeles were selected with catchment areas ranging from 0.39 to 1.69 hectors and annual average daily traffic (AADT) of over 260, 000 cars per day. These three sites were chosen as typical small catchment area sites with heavy traffic load. All sites were equipped with American Sigma (Loveland, Colorado) Ultrasonic 950 Area-Velocity flow meters, tipping bucket rain gauges and composite auto samplers. Additional site descriptions are summarized in Table 2.

Table 2. Site Description Summary

Site ID	Location	AADT (cars/day)	Catchment Area (hect)	Number of Lanes (/direction)	Drainage Pipe Diameter (mm)	Approximate Impervious (%)
Site 1	Hwy 101, Van Nuys	328,000	1.28	6	508	100
Site 2	Hwy 405, Getty Center Exit	260,000	1.69	5	610	95
Site 3	Hwy 405, Santa Monica Blvd.	322,000	0.39	5	600	100

3.2 Sample Collection Procedure

Grab samples were taken with 4L narrow mouthed glass bottles at 15 minutes intervals during the first hour of runoff. After the first hour, samples were taken at one-hour intervals for the following 7 hours. For storms that lasting longer than 8 hours, one or two addition grab samples were collected. Samples were collected with a plastic bucket from a free waterfall as runoff exited a drainage pipe. Flow-weighted composite samples were collected using several 4L glass bottles. The grab samples collected within the first hour were delivered to the lab and analyzed immediately. The samples collected from the second hour until the end of the storm event were

periodically taken to the lab. All grab samples were analyzed for PDS within 6 hours of collection. Composite samples were also brought to the lab at the end of storm event and were analyzed within 6 hours. The logic behind the PSD analysis within 6 hours is discussed in following section.

3.3 Particle Size Analysis

A Nicomp (Santa Barbara, California) PSS AccuSizer 780 Optical Particle Sizer module equipped with an auto-dilution system and a LE1000-2SE Light Scattering/Extinction sensor was used for particle size analysis. This instrument was selected for its wide range (2 to 1000 μm), speed (< 2 minutes/sample) and auto dilution capability. Our review (2002) found no other instrument with these capabilities. A representative sample ranging in volume from 1 to 10 ml was removed from the 4L sample bottle using a wide-bore glass pipette, after gently inverting the 4L bottle 5 to 6 times, and then injected into the AccuSizer. Between samples, the system was flushed at least three times to ensure background particle concentrations were less than 3 particles per ml.

4. RESULTS AND DISCUSSION

4.1 PSD Protocol Development

As discussed in the previous section, no standard protocol exists for measuring PSD in stormwater. A series of experiments were performed to establish a standard protocol with defined accuracy and repeatable results. These experiments were performed to understand four key sampling concerns: reproducibility, sample contamination, sample representativeness, and sample storage time and temperature. These parameters were selected after three months of rigorous experimental evaluation using stored samples. Each experimental parameter is discussed in the following sections. The experiments and results presented below are considered preliminary. Additional experiments are needed to be performed to improve the protocol for standard roadway runoff PSD.

4.2 PSD Reproducibility

The reproducibility of the PSD obtained by AccuSizer was demonstrated by measuring duplicate stormwater samples. Fresh samples were randomly obtained from 3 storm events. The Difference between each duplicate pair was represented by a difference proportion (DP), calculated as follows:

$$\text{Difference proportion} = 100\ \frac{2\left|N_1 - N_2\right|}{(N_1 + N_2)} \qquad (1)$$

Where N_1 and N_2 are the number of particles in a specific size range for the first and second samples. The mean and variance of eleven duplicates are shown in Table 3. The reproducibility for duplicate samples was within 10% for particles less than 30 μm. The DP increased for larger particles, and was approximately 76% for particles in the range of 200 to 1000 μm. This resulted in part because there were only a few particles in this size range; the number of large particles

ranged from 0 to 57/ml, which means that even a small difference in particle number produces a large DP. For the 2 to 3 μm size range, the number of particles averaged 166,000/ml. To decrease the variability of the DP for large particles, larger sample volumes might be collected or the measuring range might be modified to include more particles. We did not develop a protocol for larger particles since the smaller particles were the focus of our study.

Table 3. DP Values of Duplicate Samples (11 duplicates)

	Particle Diameter Range (m)										Total
	2-3	**3-5**	**5-7**	**7-10**	**10-20**	**20-30**	**30-50**	**50-100**	**100-20Õ**	**200-1000**	**2-1000**
Mean	9.5	4.5	6.1	8.3	9.6	9.7	20.4	35.4	66.9	75.6	5.0
Variance	0.5	0.1	0.2	0.5	0.8	0.9	2.4	12.0	24.4	64.2	0.1

4.3 Sample Contamination

We investigated four possible sources of particle contamination. These four sources include: sampling device (e.g., scoop), sample bottle (4L glass bottle and cap), transfer pipette, and instrument (dilution chamber and stirrer). The sampling scoop was eliminated as a source of contamination by rinsing the scoop in fresh runoff prior to sample collection. The particle-sizing instrument was eliminated as a source by diluting and flushing the chamber through at least three cycles with deionized (DI) water filtered through a 0.2 μm membrane filter, which insured that particle counts were less than 3/ml. Contamination from sample bottles and glassware was evaluated by counting particles in cleaned bottles and beakers. Sample bottles were cleaned by soaking overnight in detergent, rinsing with hot water five to six times, rinsing with 10% nitric acid, rinsing with dichloro-methane, rinsing in DI water and oven drying. Four bottles (4L) and three 200-ml beakers were evaluated. The beakers were cleaned as before and rinsed with

nanopure, particle free water (NPPFW) obtained from a Barnstead Nanopure Infinity Water System with a 0.2 μm filter. All bottles and beakers were filled with NPPFW.

Each container was sampled with a 10 ml pipette and analyzed. The results are shown in Table 4. After cleaning, the instrument was essentially particle free, which was treated as background concentration. The beakers had very few particles, ranging from 38 to 49/ml. The bottles had particle concentrations ranging from 55 to 231 /ml. This procedure evaluated the combined contamination sources of cleaning, bottle, cap, and pipette.

Table 4. Particle Number Concentration Based on Contamination Experiment (cm^{-3})

Sample		Particle Diameter Range (m)										Total
		2-3	3-5	5-7	7-10	10-20	20-30	30-50	50-100	100-200	200-1000	2-1000
Instrument[a]	P1	2	0	0	0	0	0	0	0	0	0	2
	P2	1	0	0	0	0	0	0	0	0	0	1
Beaker	N1	12	10	6	5	6	2	3	1	2	2	49
	N2	12	8	6	3	3	1	2	1	1	1	38
	N3	13	8	3	3	3	2	4	1	1	1	39
4L Bottle	H1	14	10	9	5	8	3	4	0	1	1	55
	H2	45	33	16	8	5	2	2	0	0	1	112
	H3	81	75	34	20	12	2	1	1	3	2	231
	H4	27	29	16	13	11	4	3	0	0	1	104

[a]*Without sample injection*

Particle concentration decreased with increasing particle diameter. Instrument particle concentration was less than 3/ml, which was satisfactory. The washing procedures cleaned the bottles to less than 250/ml total particles in all size fractions. The cleaning method was adopted since runoff particle concentrations were usually in excess of 10,000 particles per ml.

4.4 Sample Representativeness

Sample representativeness is very important to characterize highway runoff PSD because particle-sizing instruments typically need only a small amount of sample injection. In addition, runoff from highways usually contains dense particles. Complete mixing of samples is therefore an essential step to assure a representative sample. Four procedures were used to mix the 4L sample bottles: (1) no mixing; (2) gentle inversion (five to six times); (3) gentle inversion-decanting-stirring, and (4) gentle inversion-decanting-blending. In each procedure, the end of pipette was inserted about 2 cm below the liquid surface to collect 1 to 10 ml sample immediately after the final mixing step, and injected into the particle sizing system for measurement. Figure 1 shows the PSD of the above four sampling techniques. With no mixing, the particle concentration measured was far less than measured with mixing, suggesting sedimentation in the bottle. Gentle inversion and gentle inversion-decanting-stirring produced similar PSD results. Blending destroyed many large particles, producing many additional small particles.

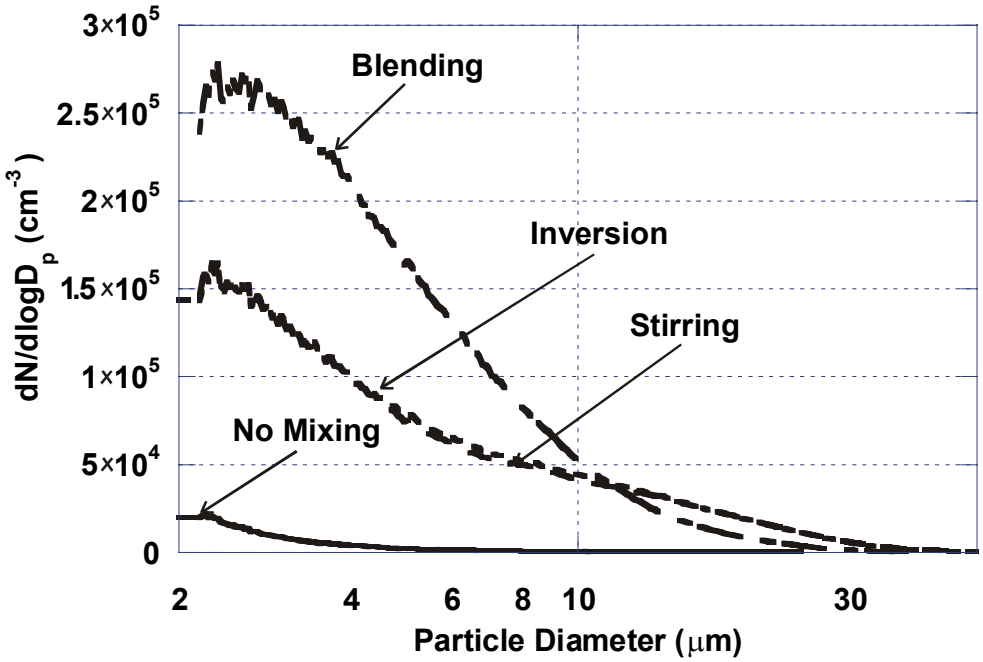

Figure 1
Comparison of different mixing methods.

To further evaluate gentle inversion and gentle inversion-decanting-stirring, PSDs of four samples were analyzed using both methods, and the results are shown in Table 5. Concentrations of particles with diameters between 2 and 1000 μm measured with the two methods produced DP values less than 3. The large DP values of particles with diameters greater than 100 μm are due in part to the sample volume, as described before in the reproducibility analysis. The inversion and stirring methods produced similar results, and gentle inversion was adopted.

Table 5. Concentration Difference Evaluation Using Inversion and Stirring Methods

Diameter Range (m)	Sample 1			Sample 2			Sample 3			Sample 4		
	Inversion	Stirring	DP	Inversion	Stirring	DP	Inversion	Stirring	DP	Inversion	Stirring	DP
2-1000	176601	181548	2.8	611184	603383	1.3	94741	95276	0.6	96090	95533	0.6
2-3	42294	44351	4.7	309057	307472	0.5	39423	39959	1.4	42813	41785	2.4
3-5	57797	60073	3.9	222907	220401	1.1	34558	34921	1.0	36709	36435	0.7
5-7	31622	32492	2.7	50004	48569	2.9	10865	10902	0.3	10518	10845	3.1
7-10	23712	24054	1.4	19234	17744	8.1	5557	5418	2.5	4167	4507	7.8
10-20	17698	17316	2.2	8461	7918	6.6	3497	3304	5.7	1749	1829	4.5
20-30	2407	2213	8.4	983	782	22.8	594	499	17.4	97	99	2.0
30-50	827	802	3.1	341	338	0.9	215	225	4.5	31	27	13.8
50-100	207	209	1.0	120	115	4.3	29	42	36.6	4	4	0.0
100-200	31	34	9.2	48	42	13.3	3	5	50.0	1	2	66.7
200-1000	6	4	40.0	29	2	174.2	0	1	200.0	1	0	200.0

4.5 Sample Storage Time and Temperature

PSD may change with storage time because of particle aggregation or dissolution. To quantify the changes in PSD with storage time, seven grab samples taken on November 7th and December

15th, 2002 were kept in a 4° C cooling room. At the same time, 200 mls of sample were poured into beakers from each of the seven grab samples after gentle inversion, and kept at room temperature (20° C), open to the atmosphere, but protected from dust fall or any other contamination. Figure 2 shows the PSD over time for one sample, stored at 4°C and 20°C. It can be seen that the particle size generally increased over time at both storage temperatures. The size of the particles in the sample stored at room temperature increased at a much higher rate. Particle size measurements were terminated after 60 hrs under room temperature due to particle breakup during analysis.

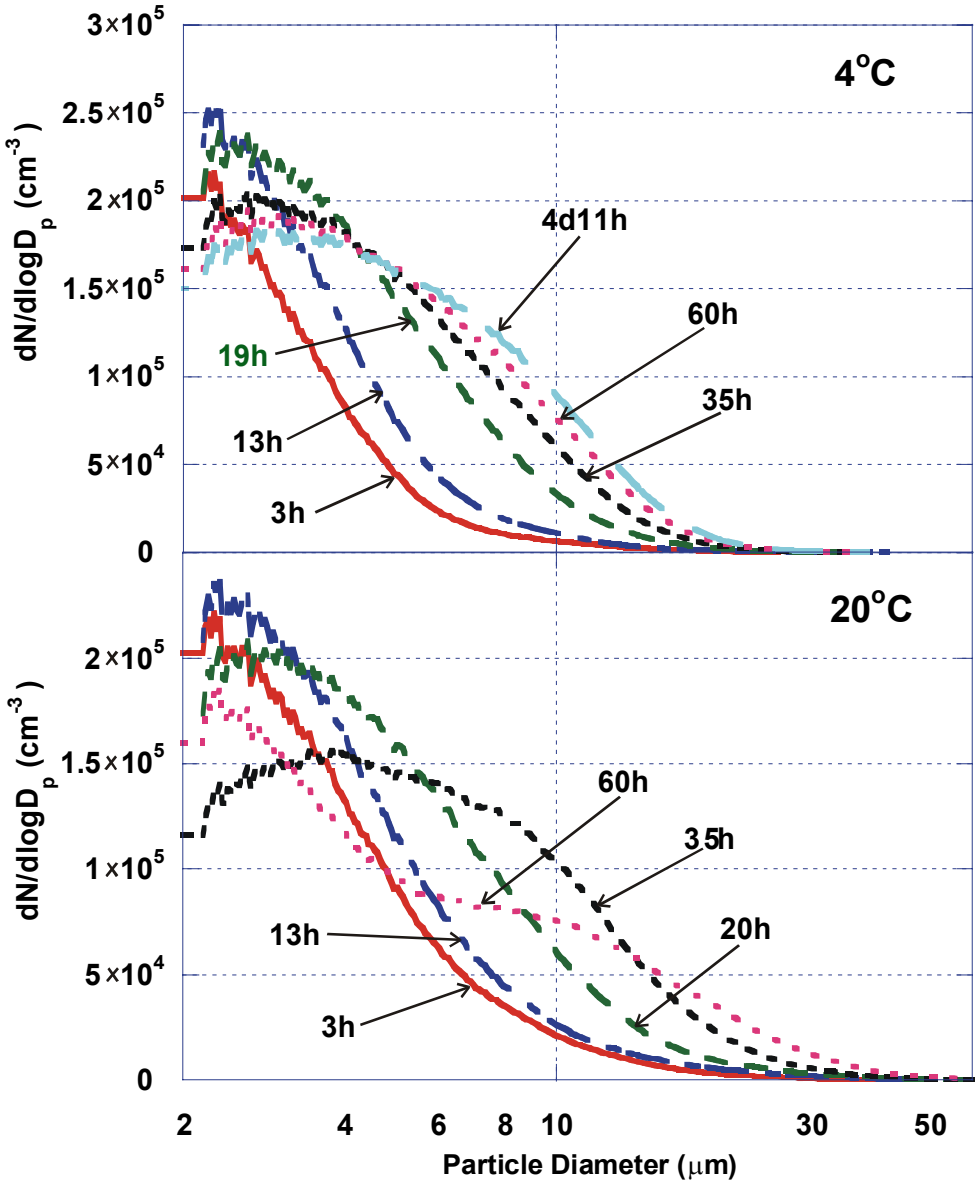

Figure 2
Sample storage time and temperature influence (Site 3, event 12/15/02, grab sample No. 2).

To illustrate the changes in particle sizes, the numbers of particles in specific size fractions at different times were normalized by dividing by the initial particle concentration. The normalized concentrations of all seven grab samples were averaged and plotted as ratios. Figure 3 shows the refrigerated samples. Concentrations of particles in the smallest fractions increased for the first 50 hours and then decreased. The particles stored at room temperature (Figure 4) showed the

same trend but at a much more rapid rate with larger increases in concentration. Particles larger than 7 μm at both temperatures showed a monotone increase in particle numbers through the period of observation.

The rapid growth in particle size suggests a naturally occurring coagulation/flocculation mechanism. The presence of naturally occurring flocculation and an increase in particle size will have profound impact on sample storage and hence on designing BMPs. Based on these results, all samples for PSD analysis were analyzed within six hours of collection. BMPs that hold the stormwater for appreciable amounts of time may have improved sedimentation rates due to particle growth.

The number of particles in the range of 2 to 7 μm increased in all samples. Particle numbers continued to increase for 13 to 50 hours, depending on sample. After this time, the numbers gradually decreased. This suggests that new particles were being formed from precipitation, or that particles too small to be counted were increasing in size and appearing in the smallest fraction. Future work should investigate this phenomena, since particles in this range will likely escape treatment by BMPs. Accelerating particle aggregation should help overall BMP effectiveness.

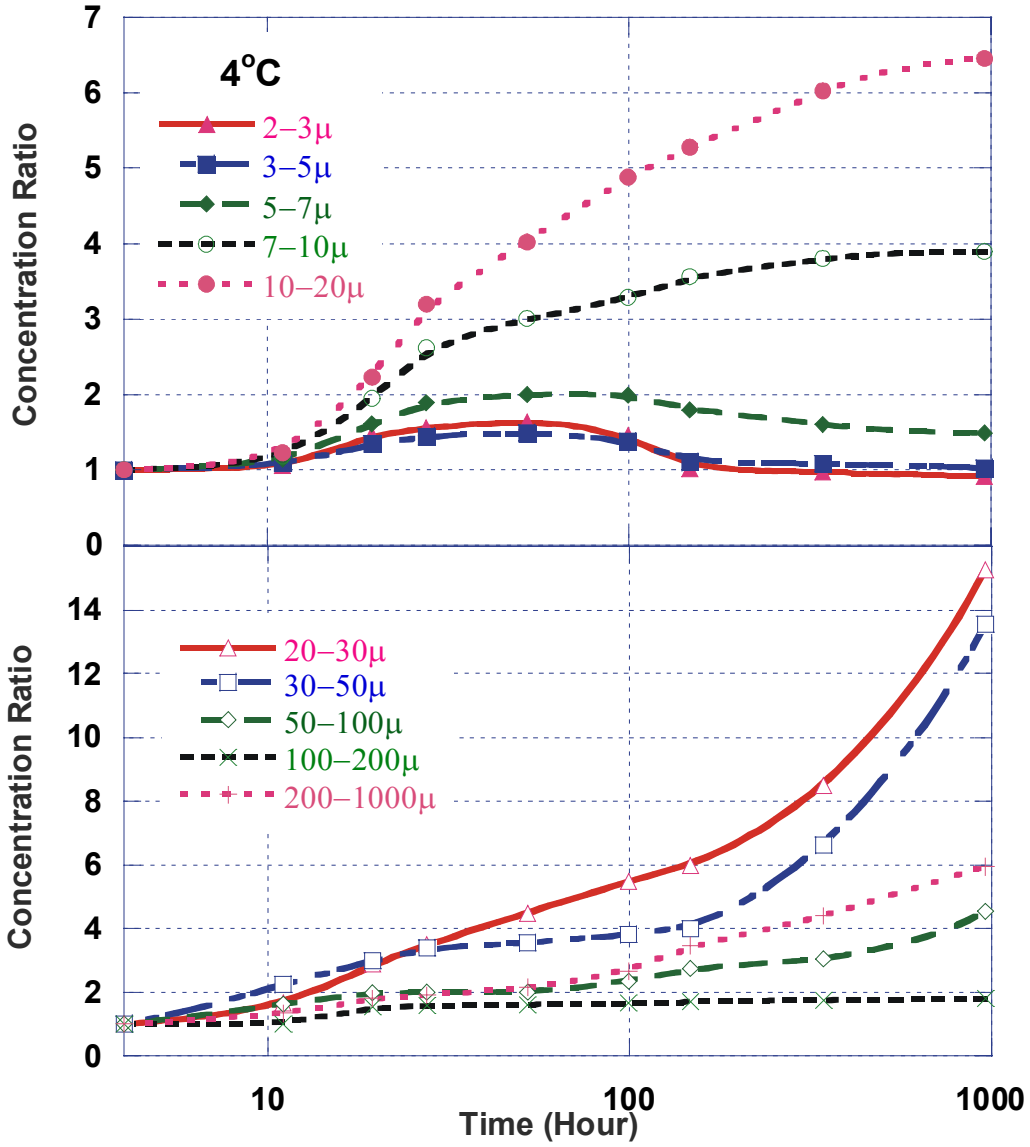

Figure 3
Average concentration ratio vs. time (4 °C).

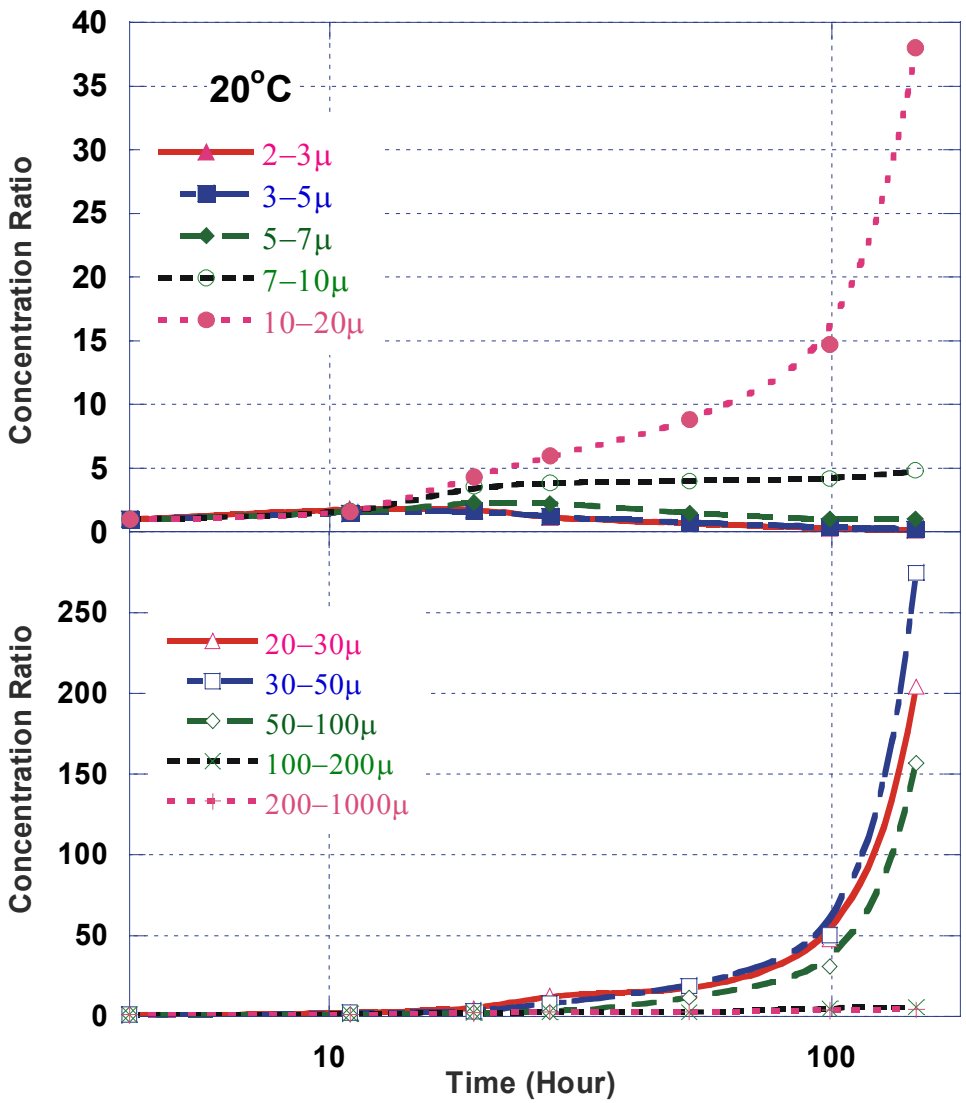

Figure 4
Average concentration ratio vs. time (20 °C).

4.6 PSD with Respect to Hydrograph and Partial Water Quality Parameters

Table 6 summarizes three events where PSD was monitored. Fourteen grab samples were collected at all three sites on November 7th. The other two storms were shorter and fewer samples were collected. Turbidity, conductivity and total suspended solids (TSS) were measured and are reported in this paper. A large suite of other parameters were measured and reported elsewhere (Ma et al., 2002).

Table 6. Event Summary

Monitoring Site	Event Date	Grab Sample Number	Antecedent Dry Day (days)	Event Rainfall (mm)	Runoff Volume (m^3)	Max Intensity (mm/hr)	Rainfall Duration (hr:min)	Runoff Duration (hr:min)
1	11/7/02	14	40.1	29.0	210.5	10.16	47:31	44:09
2	11/7/02	14	41.2	58.7	825.8	14.22	46:29	46:43
3	11/7/03	14	40.2	71.4	178.0	12.19	47:05	47:38
2	11/29/02	5	20.2	1.8	23.3	3.05	7:44	8:14
3	11/29/02	6	20.2	1.5	0.7	2.03	6:52	7:21
2	12/15/02	8	16.1	2.5	30.3	2.03	3:20	4:38

Figure 5 shows the PSD, rainfall, runoff, TSS, turbidity and conductivity for Site 1, event November 7, 2002 as a representative example of the three events. The concentration of particles (2 to 1000 μm) in 61 grab samples of all three events ranged between 50,000 and 3,742,000/cm^{-3} with a median value 204,000 /cm^{-3}. For all samples, the highest particle concentration always occurred within the first hour, and decreased rapidly thereafter.

The lower two graphs in Figure 5 show particle distribution for composite sample and various grab samples. The data are plotted on two axes for clarity. Each distribution has a time label that can be compared to the top of Figure 5. to show the point on the hydrograph when the

sample was taken. The trends shown are typical of most samples. The very first sample did not have the highest particle concentration, which probably resulted because runoff had not developed this early in the storm. Particle concentration increased to a maximum over the next 15 to 45 minutes, and generally decreased in later samples. The vast majority of the particles were less than 10μm, and after several hours particles larger than 10 μm were very reduced in concentration. The median particle size decreased as the storm progressed, which is due to a more rapid washout of larger particles.

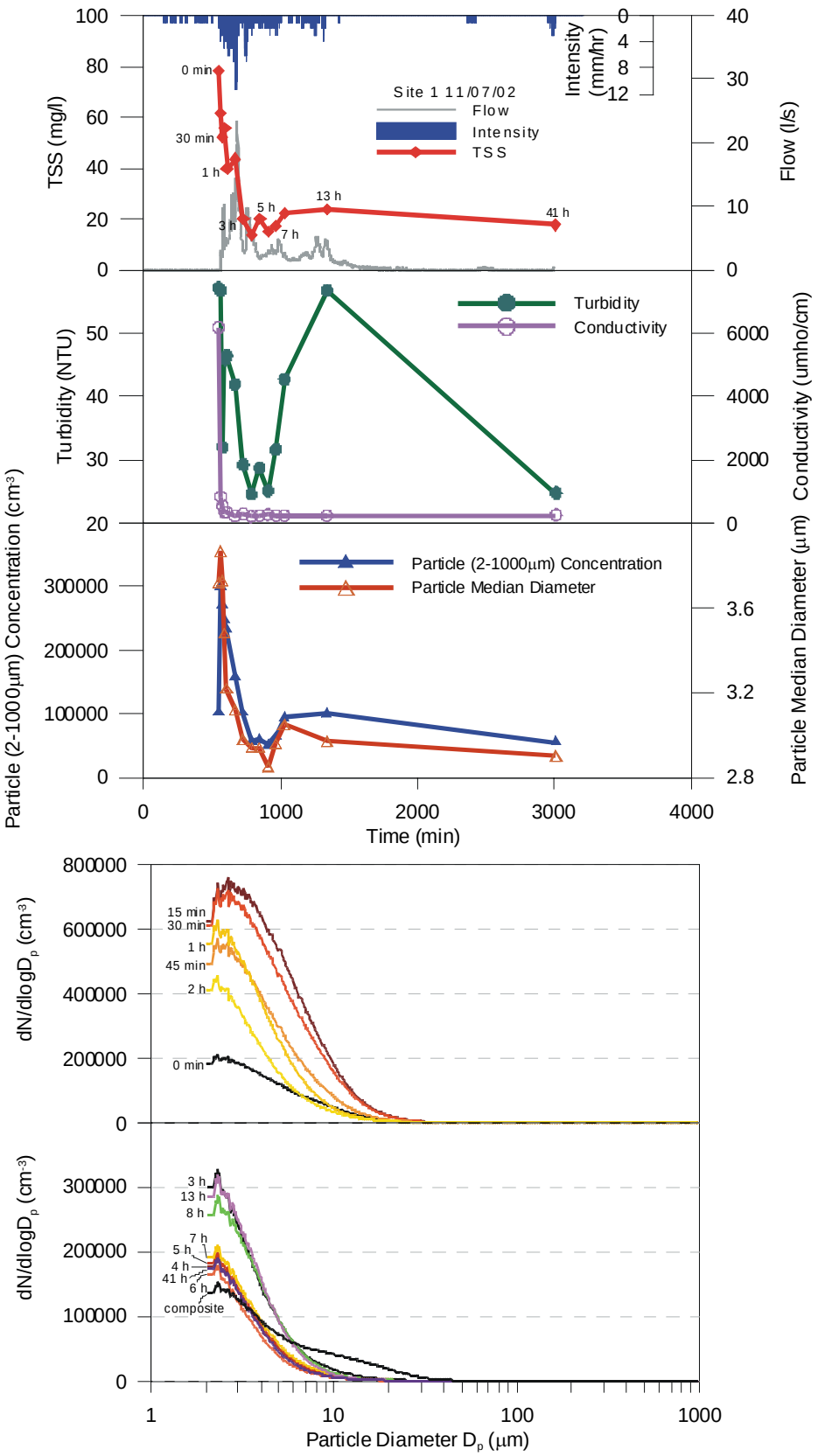

Figure 5
Hydrograph with TSS, turbidity, conductivity and PSD for site 1, event 11/07/02.

In many of our previously sampled storms, we observed increases in contaminant concentrations after rapid increases or “spikes” in runoff flow. At approximately 13 hours such a spike occurred for example (Figure 5), which increased particle concentration and turbidity. An examination of many data sets does not reveal a strong correlation between instantaneous runoff flow rate and pollutant concentrations, but there are many examples of spikes in flow rate followed by spikes in concentration, particularly suspended solids. We believe there is a cause and effect relationship between instantaneous runoff rate and contaminant concentration, but a quantitative relationship has not yet been found.

Conductivity decreased rapidly as the storm progress, and is typical of many of our observations; conductivity usually exhibits a significant first flush. The low conductivity rain water eventually dilutes out the salts being flushed from surfaces.

Figure 6 shows similar results for Site 2, event November 7, 2002. Early samples had the greatest particle concentration. Median particle diameter did not decline but increased slightly. The increase at the end of the storm is due to the brief, intense rainfall at 44 hours. The rainfall is responsible for increases in TSS, turbidity and particle concentration. Figure 7 shows the results from Site 3 on November 29, 2002. This was a shorter storm with reduced rainfall. It is easy to observe the washout of small particles as the storm progressed. There is a surge in TSS, particle concentration and median diameter at 6.75 hour, which corresponds to additional rainfall.

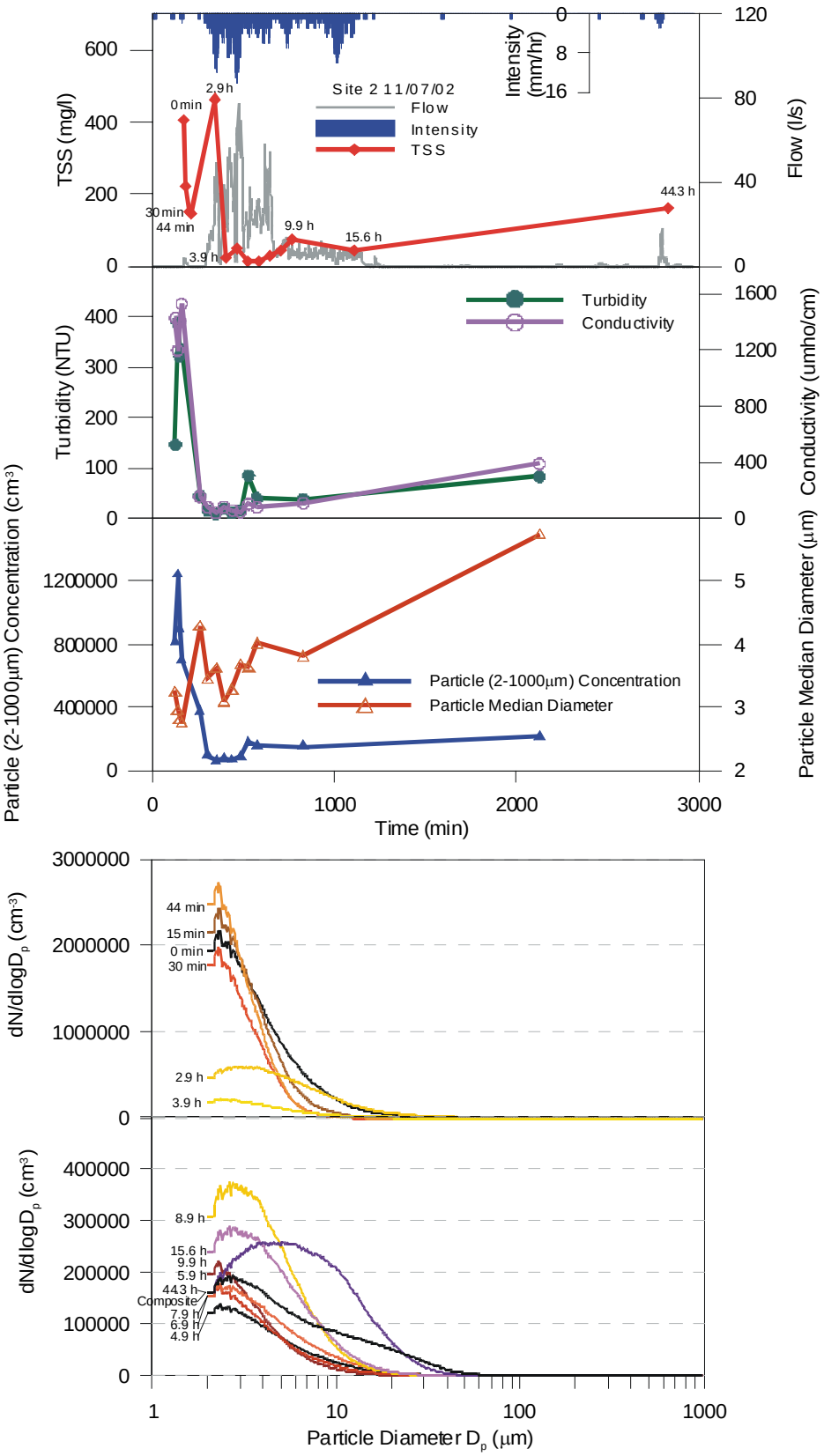

Figure 6
Hydrograph with TSS, turbidity, conductivity and PSD for site 2, event 11/07/02.

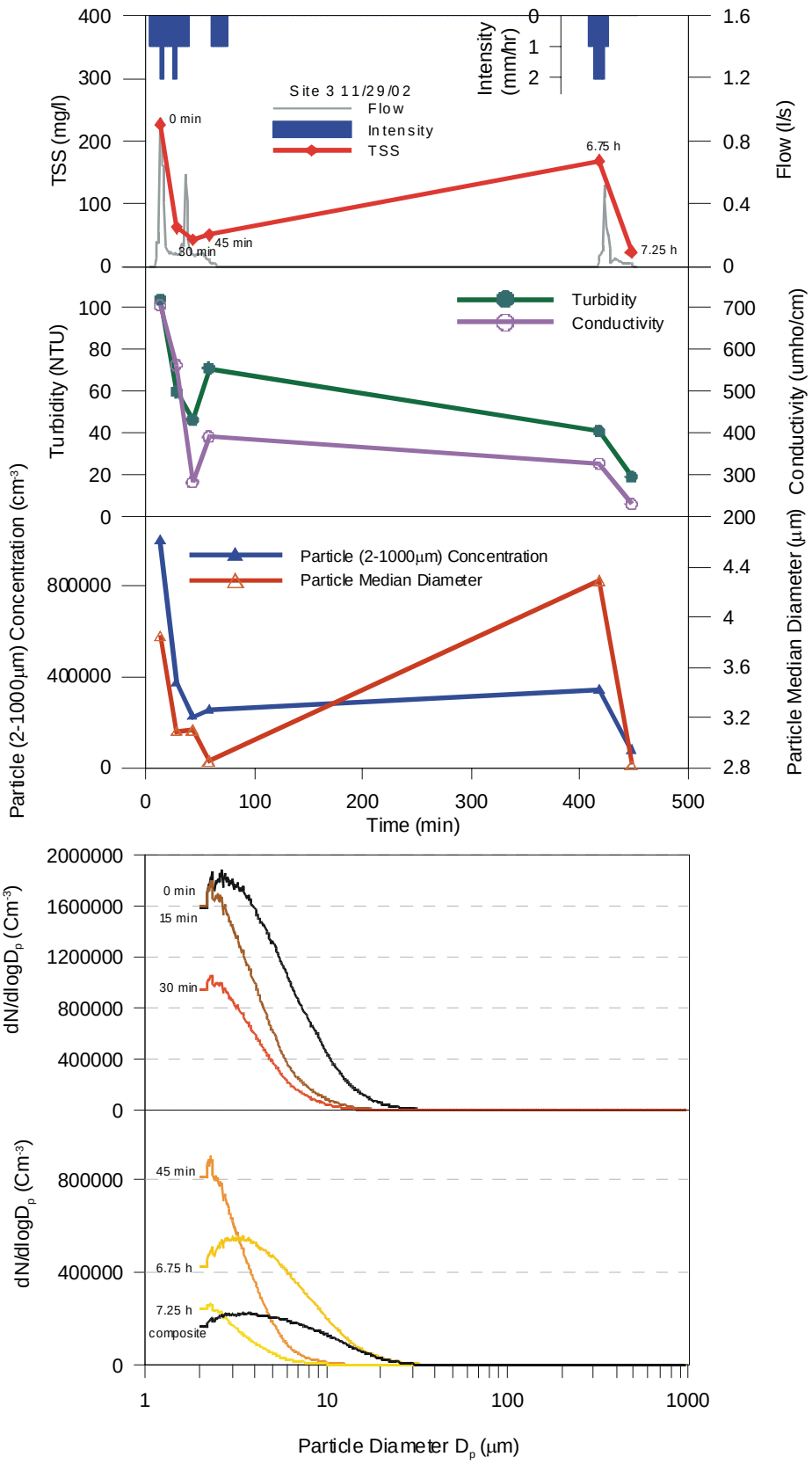

Figure 7
Hydrograph with TSS, turbidity, conductivity and PSD for site 3, event 11/29/02.

The particle concentrations in composite samples are also shown in the proceeding figures. They are lower than most grab samples, and should have a particle concentration between the lowest and highest. The composite sample concentrations were only between 34% and 94% of the corresponding flow-weighted averages of the grab samples. This large difference suggests that aggregation or some other phenomena is occurring. Figure 8 shows the particle size distribution for grab samples, composite sample, and the calculated composite using the flow weighted average. Composite samplers may not be appropriate collecting samples for particle size distribution.

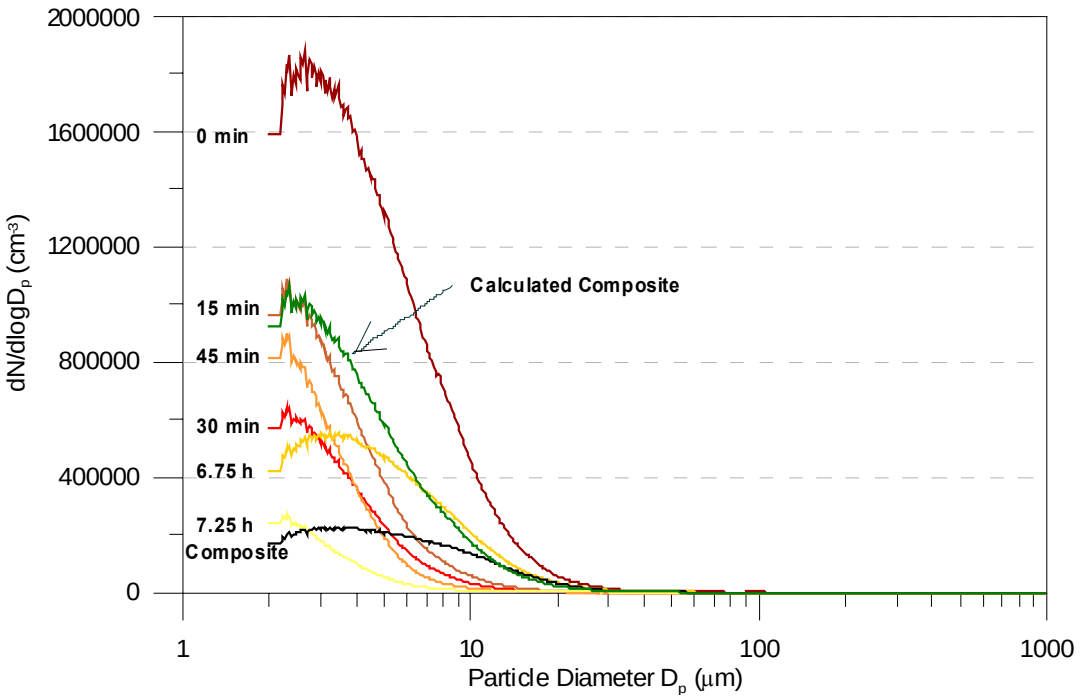

Figure 8
Particle size distribution for Site 3, event 11/29/02, showing the large difference between a calculated composite sample and a sample collected by an automatic flow-weighted composite sampler.

These results can be compared to other results if particle concentrations are converted to mass concentration by assuming spherical particles. Lau and Stenstrom (2001) recovered particles from dry pavement at 18 sites adjacent to various landuses in the City of Santa Monica. They used a vacuum cleaner and HEPA filter to recover the particles, and separated particles by sieving. They found that only 3% of the particle mass, assuming spherical particles, occurred in particles smaller than 50 μm. Sansalone and Tribouillard (1999) observed less than 10% of total particle mass in particles smaller than 50 μm. The observations in this research suggest that more than 30% of the particle mass (again assuming spherical particles) is found in particles smaller than 50 μm.

The removal of particles by BMPs will depend on the particle size, shape and density. It will also be important to know pollutant distribution among the various particle size fractions. The combination will allow BMPs to be selected to optimize pollutant removal as well as particle removal. This topic is currently under investigation in our laboratory.

4.7 First Flush of Particles

First flush phenomenon is a controversial topic in stormwater management (Characklis and Wiesner 1997; Deletic 1998). Certain researchers (Barrett et al. 1998; Saget et al., 1995) found that the overall first flush effect of highway stormwater runoff was small or negligible, while other researchers (Vorreiter and Hickey 1994; Gupta and Saul 1996; Sansalone and Buchberger 1997; Lau et al. 2002; Ma et al. 2002) observed moderate or strong first flush. Generally, smaller catchment areas exhibited stronger first flushes (Characklis and Wiesner 1997). In addition, no consensus definition exits for first flush (Bertrand-Krajewski et al. 1998) and different researchers have used different definitions (Ashley et al. 1992; Thornton and Saul 1987; US EPA 1993; FNDAE 1998; Saget 1995; Geiger 1984; Gupta and Saul 1996; Vorreiter and Hickey 1994; Sansalone and Buchberger 1997; Deletic 1998; Ma et al. 2002). In this discussion, we extend the mass first flush ratio (MFF) developed by Ma et al. (2002) to particle first flush, and present it as particle number first flush (PNFF).

The PNFF ratio is defined as the normalized number of particles divided by normalized volume fraction at any point of normalized runoff diagram. It is similar to the definition proposed by Bertrand-Krajewski et al. (1998).

Let x represents the x percent runoff volume at a certain time t_1. Then

$$x\,\% = \frac{\int_0^{t_1} Q(t)dt}{V} \qquad (2)$$

$$PNFF_x = \frac{\dfrac{\int_0^{t_1} C_p(t)Q(t)dt}{N}}{\dfrac{\int_0^{t_1} Q(t)dt}{V}} \qquad (3)$$

Where $C_p(t)$ = particle number concentration, V = total runoff volume and N = total particle number in an event.

The ratio can be calculated for any specific point in the storm, and approaches 1.0 by definition at the end of the storm. The ratio allows convenient characterization of first flush. For example, $PNFF_{20}$ = 2.5 means that 50% of particle count is contained in the first 20% of the runoff.

Figure 9 shows the number first flush ratios ($PNFF_{10}$, $PNFF_{20}$, $PNFF_{40}$) for particles in different size ranges. The top and bottom of the box mark the limits of ± 25 % of the variable population, and the horizontal line is the median. The whiskers represent the maximum and minimum observed values, unless there are outliers. Figure 9 illustrates median $PNFF_{10}$, $PNFF_{20}$, $PNFF_{40}$ values generally increase with increasing particle diameter. The PNFF ratio is generally about 25% larger than the analogous MFF ratio for other water quality parameters such as TSS and turbidity (Ma et al. 2002). This suggests that BMPs that can completely capture the early runoff will be more effective than BMPs that treat a portion of the runoff throughout the storm.

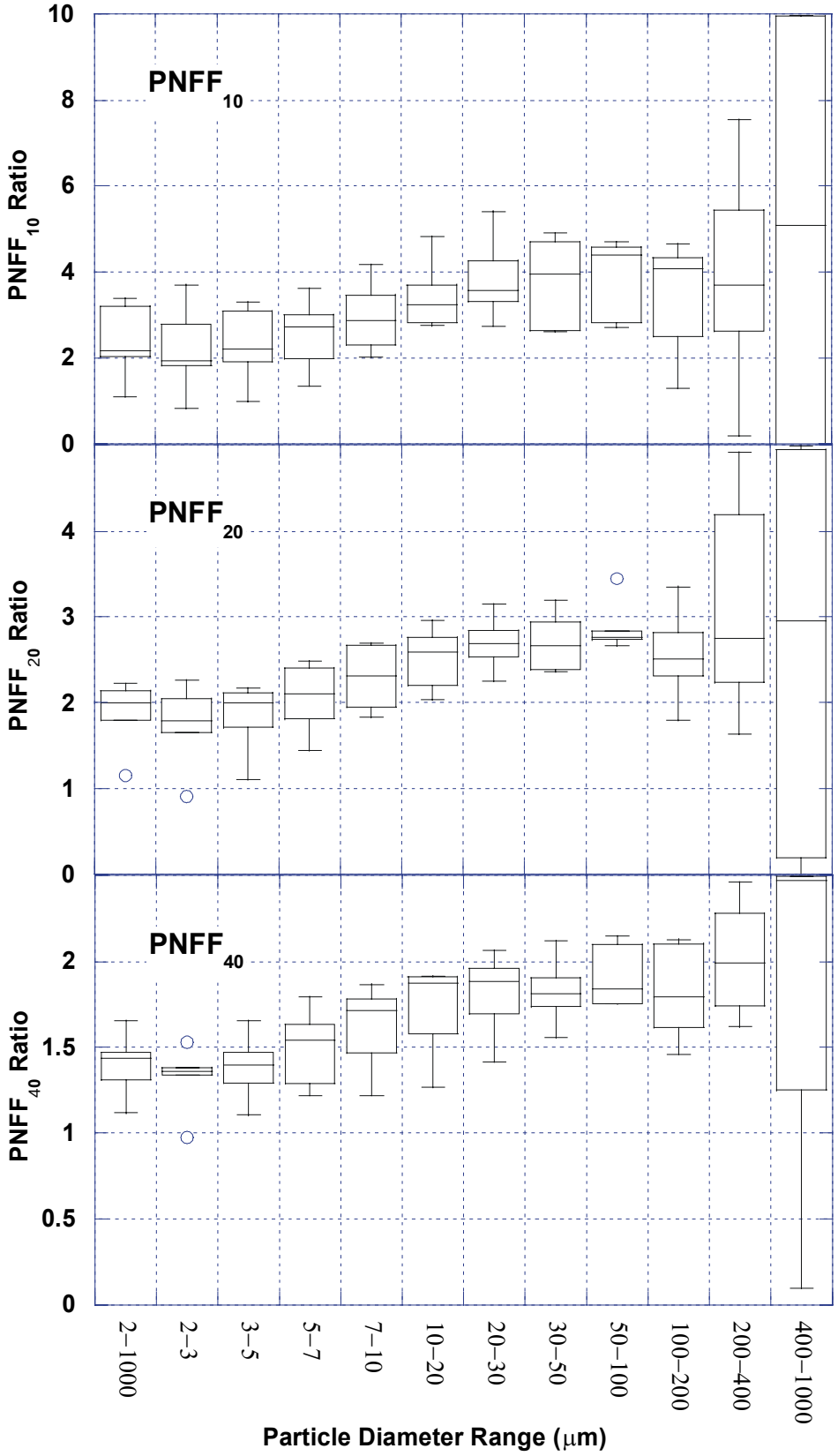

Figure 9
Boxplots for different PNFF.

5. CONCLUSIONS

Particle size distribution (PSD) was characterized in three storm events at three sites. It was necessary to develop an experimental protocol to insure representative samples. A hand washing procedure for glass bottles was a suitable method for preventing contamination of samples being analyzed for PSD; gentle inversion (five to six times) of the sampling bottle was an appropriate mixing method that prevented sedimentation or particle shearing. Particles showed a natural aggregation, which requires analysis as soon as possible but within 6 hours of sample collection. Particle concentrations in samples collected by flow-weighted composite samplers were quite different than a composite sample calculated from a series of grab samples and flow rates (see Figure 8). Our preliminary results suggest that composite samplers should not be used to collect samples for PSD analysis until further development is completed.

Results obtained to date revealed that:

- More than 97% of the particles were less than 30 μm.
- Particle concentration and size generally decreased rapidly as the storm progressed.
- Rapid increases in particle number occurred after rapid increases in rainfall or runoff, and were accompanied by increases in turbidity and total suspended solids concentration.
- Particles showed an obvious first flush, with median of $PNFF_{20}$ of approximately 2, indicating that 40 % of total particles were carried in the first 20 % of runoff volume.
- Larger particles showed stronger first flush than smaller particles.

More research is needed to confirm the above preliminary findings. Specific research topics to be investigated to fulfill the current knowledge and data gaps include:

- Hydrographic measurement of particles
- Impact of site specific and storm specific conditions such as temperature and rainfall intensity
- Impact of storage/detention time on different size particle coagulation
- Improving particle fractionation and chemical analysis technique
- Developing and testing of suitable on-line particle size analysis system for stormwater

Additional field investigation is needed to implement the study findings for BMP design and performance evaluation of pollutants removal using particles as surrogate parameter.

The most important result of this work is that it demonstrates that we can measure particle size distribution in stormwater runoff and that many things affect it. Additional work to determine the distribution of pollutants among various size particles will enable BMP designers to be scientific in their approach and should reduce the need for extensive pilot testing.

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TECHNICAL MEMORANDUM

Oil and Grease Measurement in Highway Runoff — Sampling Time and Event Mean Concentrations

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Summary

The constituent concentration measured from a flow-weighted composite sample is called event mean concentration (*EMC*), and is usually collected with an automatic, flow-weighted composite sampler. Automatic samplers are not recommended to collect oil and grease (O&G) samples due to interactions with tubing and pumps that may bias the measured concentrations. To measure the *EMC* without sampler interferences, a series of grab samples (often over 10 samples) must be collected along with the flow measurement to compute the *EMC*. This report examines 22 O&G pollutographs to determine when a single O&G grab sample most closely approximates a flow-weighted composite sample. The analysis performed in this study revealed that samples collected at the beginning of the storm event (within the first hour) can overestimate the O&G *EMC* by 20 mg/L or more. Samples collected toward the end of the storm event may underestimate the *EMC*. The best time to collect a single grab sample ranged from 1 to 6 hours after the beginning of runoff and was related to site or storm-specific factors.

Results obtained from this study also showed that strong correlations (R^2=0.9) exist between O&G and other organic constituents, such as chemical oxygen demand (COD) and dissolved organic carbon (DOC), that are normally collected using automatic samplers. Correlations also exist between O&G *EMC*, antecedent dry days, and total rainfall. Depending upon site and regulatory specific factors, correlating COD or DOC *EMCs* collected by automated samplers may be the best method for estimating O&G *EMC*.

1. Introduction

Highway stormwater runoff affects the quality of receiving water bodies by washing contaminants that have accumulated on roadway surfaces to receiving waters. Specifically, stormwater runoff includes suspended solids, nutrients, ionic species, metals, and organic constituents. Oil and grease (O&G), chemical oxygen demand (COD), and dissolved organic carbon (DOC) are frequently used to measure the concentration of organic constituents. Because free O&G can be easily observed as rainbow-colored sheens, it attracts public and regulatory interest. O&G that reaches receiving waters can cause problems, varying from toxicity to aquatic life, depressed dissolved oxygen concentration, odor, unsightly conditions and loss of use. O&G may contain a wide variety of hydrocarbon compounds, and some, such as polynuclear aromatic hydrocarbons (Eganhouse and Kaplan 1981), are known to be toxic to aquatic life even at very low concentrations.

Landuses that have large numbers of vehicles such as highways are known to discharge more O&G than other landuses such as residential property (Stenstrom et al. 1984). This concern requires transportation agencies and others to monitor O&G in their stormwater discharges from vehicular-intensive landuses. O&G emissions from vehicles, such as crankcase drippings and partially combusted fuels, are an important source of hydrocarbons. These emissions can be retained on highly impervious surfaces such as highways and are washed off during a runoff event. Hence, managing the discharge of O&G in stormwater runoff from vehicular-intensive landuses such as highways has potential to improve the water quality.

Monitoring for O&G presents special problems because automated samples are not recommended for O&G samples collection (American Public Health Association 1998). Most stormwater monitoring programs use automated samplers for collecting flow-weighted composite samples. These samplers generally work well, can be left unattended and can be triggered automatically to insure that the very beginning of runoff is sampled. The sampler is programmed to collect many small samples over the entire storm event to insure representativeness. Analysis of a flow-weighted composite sample provides Event Mean Concentration *(EMC).*

Composite samples are not recommended for analyzing certain constituents, such as O&G. The O&G in the sample can adsorb to the collection tubing and sample containers, which will cause the *EMC* to be underestimated. Subsequent samples can be contaminated by carry over from earlier samples. In the case of toxicity measurements associated with O&G measurement, artifactual toxicity can result from interaction with sampler materials. In some other cases, the sample can change during the elapsed time in the sample bottle. Therefore, a series of grab samples collected at discrete times are recommended to approximate the *EMC* of specific constituents such as O&G. Collecting grab samples can be more difficult and less practical during storm events for several reasons: (i) the sampling crew must standby, awaiting the beginning of rainfall, and may miss important parts of a storm event if it begins at an inconvenient time; (ii) the sampling team may need to travel a great distance in a short time to reach all sampling locations; (iii) the sampling team may not have safe access to sampling locations during rainfall, and (iv) the cost associated with manually collecting grab samples is high. As a

result, often only a single, randomly-timed, grab sample is collected, which may not be representative of the *EMC*. O&G often exhibits a first flush (Lau et al. 2002; Ma et al. 2002), which means samples collected early in storm will have higher concentrations than those collected later in the storm.

This study was undertaken with the following specific objectives:

1. To determine if there exists a "best time" to collect a single grab sample for O&G from highway landuse that most accurately represents the *EMC*.
2. To develop a mathematical relationship to determine the best time to collect a single O&G grab sample to be more representative of *EMC*, from site or storm-specific information.
3. To discover mathematical relationships that can be used to accurately correlate the O&G *EMC* ($EMC_{O\&G}$) from site and storm information and from organic constituents such as COD and DOC that are commonly collected by automatic samplers.

2. Background

Event mean concentrations are normally used to represent stormwater pollutant concentrations (Huber 1993). The *EMC* is the flow-weighted average concentration collected over the entire storm event, and is equal to the total mass emission, divided the total runoff volume. Eq. (1) shows the mathematical definition of *EMC* (mg/L):

$$EMC = \frac{M}{V} = \frac{\int_0^T c(t)q(t)dt}{\int_0^T q(t)dt} \tag{1}$$

where M=total mass of pollutant during the entire runoff (kg); V=total volume of runoff (m^3); $c(t)$=time varying pollutant concentration (mg/L); $q(t)$=time variable flow (L/min); and T=total duration of runoff (min).

In case of a series of grab samples, the flow-weighted *EMC* is defined using the following equation:

$$EMC = \frac{\sum_{i=1}^{n} C_i V_i}{\sum_{i=1}^{n} V_i} = \frac{C_1V_1 + C_2V_2 + ... + C_nV_n}{V_T} = W_1C_1 + W_2C_2 + ... + W_nC_n \tag{2}$$

where

$$W_i = \frac{V_i}{V_T} \tag{3}$$

$$W_1 + W_2 + ... + W_n = 1 \tag{4}$$

where C_i=fractional concentration assigned to the *i*-th grab sample (mg/L); W_i=weight for the *i*-th grab sample (dimensionless); V_i=fractional flow volume assigned to the *i*-th grab sample (L); V_T=total volume of runoff (L); and *n*=number of grab samples (dimensionless).

EMCs are useful because they can be multiplied by total runoff volume to calculate mass discharge, and avoid the high variability that is associated with grab samples (Ha and Stenstrom, 2003). They can be correlated to land use (Stenstrom et al. 1984; Sartor et al. 1974; Smullen et al. 1999). Unit loading rates (mass of pollutant per unit area per unit of rainfall) can be approximated from *EMCs* and the rational method, as shown in Eq. (5). Such procedures are useful in developing Total Maximum Daily Limits (TMDLs).

$$ULF = \frac{EMC \cdot V}{AREA \cdot T_RAIN} \cdot 10^{-6} \tag{5}$$

where *ULF*=unit loading rate (pollutant mass per unit area per unit rainfall, kg/ha/mm); *V*=total runoff volume (L); *AREA*=catchment area (ha), *T_RAIN*=total rainfall (mm), *V=AREA.T_RAIN.RC.k*, *RC*=rational runoff coefficient (dimensionless), and, *k*=unit conversion factor (10^4 L/ha/in).

3. Methodology

3.1 Site description

Table 1 shows the characteristics of the three sites. These sites were monitored as part of a larger project to determine the characteristics of highway stormwater runoff. The freeways are among the busiest in California, and the construction of the sites is typical of many freeways. The sites are highly impervious. Twenty-two events monitored at these sites during the rainy seasons (October to April) of 1999-00, 2000-01, and 2001-02 were used in this analysis. The sites were all close to the UCLA campus so that sampling teams could reach the sites prior to the initiation of runoff.

Table 1. Site Characteristics

Site	Location	Highway	No. of events[a]	*AREA* (ha)	*RC*	Type of surface	*ADT* (cars/day)
1	Van Nuys	US-101	6	1.28	0.94	Pavement	328000
2	Getty Center	I-405	6	1.69	0.71	Pavement	260000
3	Santa Monica Blvd	I-405	10	0.39	0.89	Pavement	322000

[a]The number of events is the storms used in the analysis.

3.2 Sample collection and analysis

Both grab and composite samples were collected as part of this study. Grab samples (4 liters each) were collected at 15-minute intervals during the first hour of runoff and at one-hour intervals over the next seven hours. For those few storms that lasted longer than 8 hours, additional grab samples were collected to capture the end of the storm. Grab samples were collected by bailing from a freefall of runoff exiting a discharge pipe. American Sigma (Loveland, Colorado), model 950 equipped with tilting bucket rain

gauge, and area/velocity flow meter was used for flow-weighted composite samples. The automated composite sampler was allowed to run until the end of runoff. A large suite of water quality constituents were monitored (Lau et al. 2002), but for the purposes of this study, only O&G, COD and DOC analyses are presented. O&G was measured using the procedure by Lau and Stenstrom (1997); COD was analyzed using US EPA 410.1 and DOC was analyzed using US EPA 415.1, with a Tekmar-Dohrman Model Apollo 9000 analyzer (Mason, Ohio).

3.3 Timing for grab sample collection

Many constituents exhibit a first flush, which means the concentration declines as the storm progresses (Ma et al 2002). Best time or time-to-*EMC* (*TEMC*) is defined as the time from the beginning of runoff to the point that corresponds to *EMC*. This assumes concentration is monotonically declining. A grab sample collected too early may overestimate the true *EMC* because of the first flush effect, and a grab sample collected too late may underestimate the actual *EMC* as a result of pollutant wash-off.

Several best time strategies were evaluated to collect a single grab sample. One strategy was to see if there exists a point in the runoff hydrograph that is routinely more accurate for estimating the *EMC*. A second strategy was to pick convenient but consistent times, such as 3, 4 or 5 hours after the beginning of runoff. Another strategy is to determine if rainfall or site characteristics have an impact on the best time, determine if the characteristics can be predicted from weather reports and then to use a predicted best time to collect a grab sample.

3.4 Statistical analysis

In order to simulate sampling at different points in a storm, it was assumed that the runoff concentrations were piece-wise linear functions. Under this assumption it is possible to interpolate between data points to simulate sampling at an arbitrary time. Sampling at a random time was simulated using a random number generator that was programmed to produce random times during the runoff period. O&G concentration was estimated at the random times by interpolating between the measured concentrations that span to random time. Sampling at specific times (1 to 6 hours) after the beginning of runoff was also simulated in this fashion. Analysis was performed using Systat 9 (Richmond, California).

The various events were classified into types based upon concentration and runoff profiles. Next a screening analysis was performed to confirm expected correlations of site and event specific parameters with $EMC_{O\&G}$. From these correlations, further analysis was performed as follows:

1. Strategies to collect a grab sample at timed points in a storm event (i.e., 1, 2, 3 etc. hours after the storm beginning);
2. Strategies to estimate the best time to sample from event and site variables, such as antecedent dry days (*ADD*), *T_RAIN* etc.;
3. Strategies to estimate the $EMC_{O\&G}$ directly from event and site variables, without collecting a grab sample;

4. Strategies to estimate $EMC_{O\&G}$ from COD and DOC *EMC* that are collected from automated composite samplers.

Some of the strategies require only parameters known in advance of the storm, such as *ADD*, average daily traffic (*ADT*), and *AREA*. Other strategies require parameters related to storm characteristics, and include *T_RAIN*, duration of runoff (*D_RUN*), total runoff (*T_RUN*), and the centroid (*CENTROID*, normalized distance from the beginning of runoff to the centroid of hydrograph), which must be estimated from weather predictions, which were simulated with three levels of accuracy.

4. Results and Discussion

4.1 Hydrograph and concentration characteristics

Table 2. Statistical summary of total number of monitored runoff events, runoff types, and pollutograph types

	Type	Site 1	Site 2	Site 3	All sites
No. of runoff events		6	6	10	22
No. of hydrographs	1	4	4	5	13
	2	0	2	3	5
	3	2	0	2	4
	4	0	0	0	0
No. of O&G pollutographs	1	2	2	5	9
	2	4	4	5	13
	3	0	0	0	0
No. of COD pollutographs	1	3	3	6	12
	2	3	3	4	10
	3	0	0	0	0
No. of DOC pollutographs	1	2	2	6	10
	2	4	3	4	11
	3	0	1	0	1

Table 2 summaries O&G, COD, and DOC the total number of monitored runoff events, runoff types, and pollutograph types for each site. The storm events were divided into 4 types, based upon the shape of each hydrograph, as follows:

- type 1 where runoff is continuous;
- type 2 where runoff is discontinuous but the discontinuity can be neglected in the analysis;
- type 3 where runoff is discontinuous and only the first part of the runoff is used in the analysis, and
- type 4 where runoff is discontinuous and only the last part of the storm is used in the analysis.

Runoff types are presented in Fig. 1, and most were type 1 (13 out of 22).

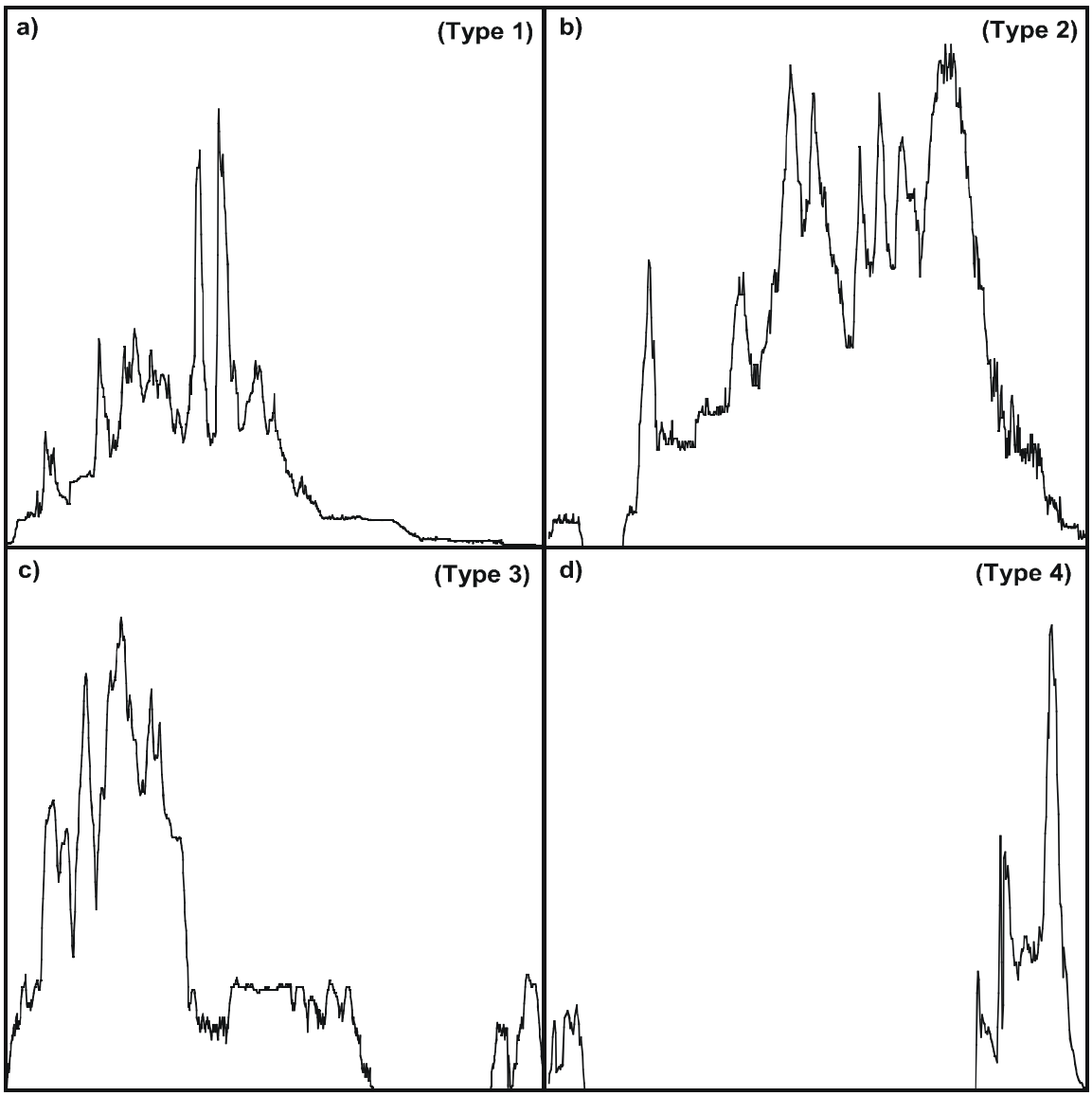

Fig. 1. General classification of storm events based on various typical hydrographs

The O&G concentration profile or pollutograph was divided into 3 types:

- type 1, where concentration decreases monotonically with time;
- type 2 where the concentration profile generally decreases with time, and
- type 3, where the concentration profile demonstrates abrupt changes or random patterns.

Pollutograph types are presented in Fig. 2. Most (13 out of 22) of the O&G pollutographs were type 2, with the remainder being type 1 (9). Type 3 pollutographs were found only for DOC.

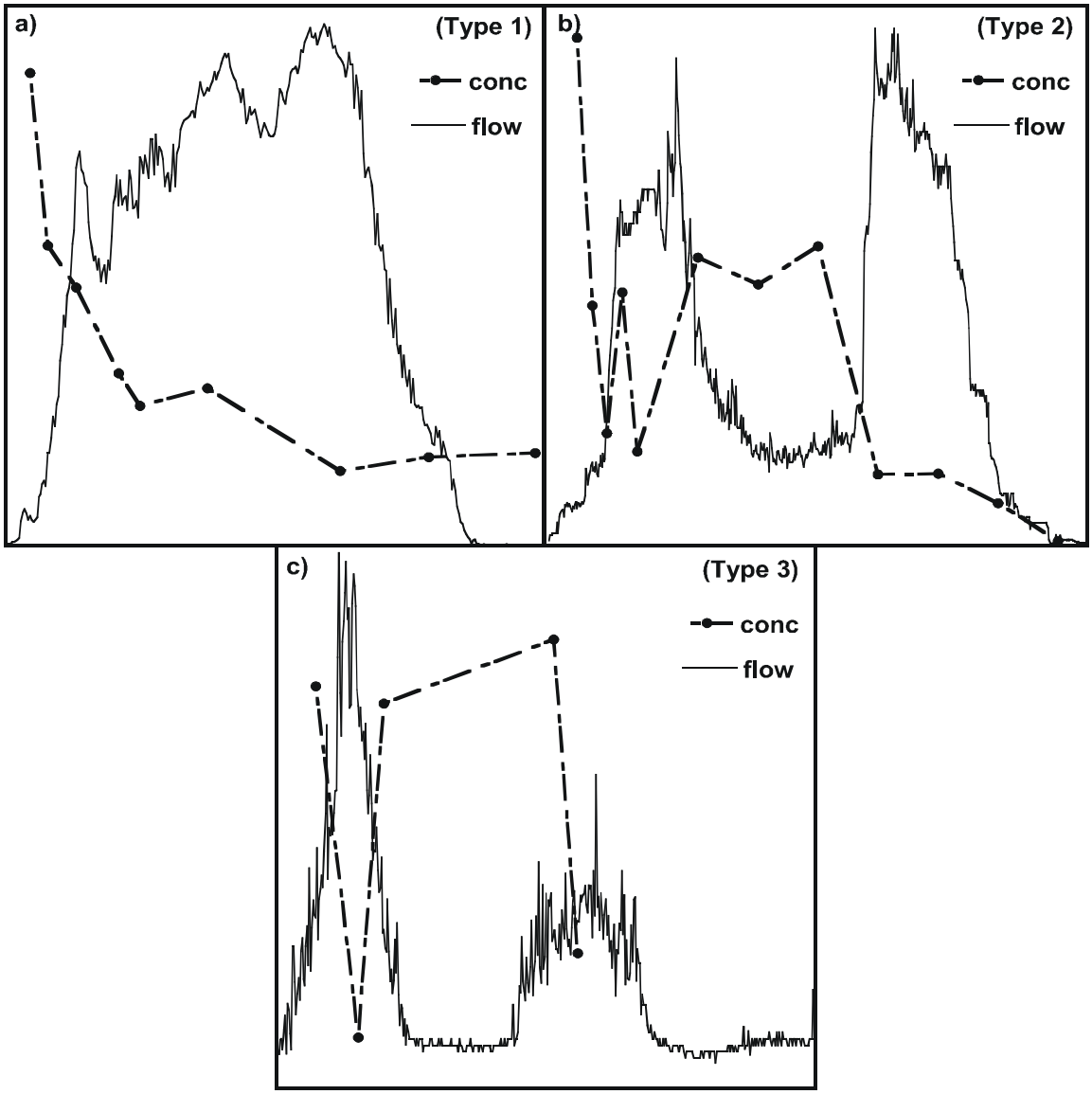

Fig. 2. General classification of pollutographs

The statistical summary of *EMCs* of relevant constituents are presented in Table 3. The mean *EMC* values of the contaminants were higher for site 1 than other sites. Site 3 had

the minimum standard deviation of *EMCs*. Reasons for differences among sites are not known at this time.

Table 3. Statistical summary of O&G, COD, and DOC *EMC* analysis

Constituent	Statistical summary, mg/L				
	Min	**Max**	**Median**	**Mean**	**SD**
O&G					
Site 1	1.84	33.85	6.77	8.95	7.43
Site 2	1.44	80.12	6.37	15.53	19.78
Site 3	1.52	41.63	5.54	8.83	8.63
All Sites	1.44	80.12	6.57	11.03	13.22
COD					
Site 1	18.19	257.96	113.12	115.05	73.21
Site 2	31.36	693.78	104.8	157.28	155.44
Site 3	13.76	418.24	66.83	102.93	110.7
All Sites	13.76	693.78	85.23	124.17	118.67
DOC					
Site 1	27.53	819.72	101.16	150.32	175.83
Site 2	31.31	2283	76.72	291.63	521.99
Site 3	22.01	1109.89	70.66	157.58	227.96
All Sites	22.01	2283	84.99	198.6	341.95

4.2 Correlation and regression results for best time and $EMC_{O\&G}$

Table 4 shows the results as a correlation matrix. As shown, the best time to sample for O&G ($TEMC_{O\&G}$) and $EMC_{O\&G}$ were correlated with the 8 independent event-specific and site-specific variables chosen. There exists a strong correlation between $EMC_{O\&G}$ and *ADD* (R=0.91), and no strong correlations with other parameters. The time-to-*EMC* is strongly correlated with, *D_RUN*, (R=0.77), *T_RUN* (R=0.82), *T_RAIN* (R=0.87). This was expected since the emission of O&G should occur over the length of runoff, which is related to the total rainfall and its duration. *D_RUN*, *T_RUN* and *T_RAIN* are highly correlated among themselves, as expected. There is almost no correlation with *TEMC* and *EMC* with other site parameters such as *RC*, *ADT*, and *AREA*. *CENTROID* was

poorly correlated with other parameters and the correlations are not reported. *ADT* would probably not show any correlation in our analysis, since it does not vary greatly among sites. More detailed information on the effects of *ADT* on water quality can be found in Kayhanian et al. (2003).

Table 4. Correlation matrix (R) for dependent and independent variables

	$EMC_{O\&G}$	$TEMC_{O\&G}$	*ADD*	*D_RUN*	*T_RUN*	*T_RAIN*	*ADT*	*RC*	*AREA*
$EMC_{O\&G}$	1.00								
$TEMC_{O\&G}$	-0.38	1.00							
ADD	0.91	-0.37	1.00						
D_RUN	-0.30	0.77	-0.22	1.00					
T_RUN	-0.26	0.82	-0.22	0.79	1.00				
T_RAIN	-0.29	0.87	-0.25	0.79	0.96	1.00			
ADT	0.03	-0.18	0.00	-0.33	-0.43	-0.33	1.00		
RC	-0.17	-0.21	-0.06	-0.12	-0.37	-0.36	0.61	1.00	
AREA	0.11	0.23	0.07	0.35	0.46	0.25	-0.70	-0.37	1.00

Table 5 shows the results of all four strategies for estimating $EMC_{O\&G}$. The results for all methods are placed in one large table to facilitate comparisons. They are divided by method: (i) timed samples; (ii) samples collected at a specific times determined by regressions of storm characteristics; (iii) regressions as a function of event and site characteristics, and (iv) regression of $EMC_{O\&G}$ with COD and DOC measured using autosamplers. They are discussed in the following sections.

Table 5. Summary of R^2, RMS error, and Bias values for different methods to predict $EMC_{O\&G}$

Sampling strategy or regression method	No. of Obs.	R^2	RMS Error (mg/L)	Bias (mg/L)
Random grab sampling time	22	0.54	9.40	1.15
Strategy 1: Timed sample strategies after beginning of runoff				
0.25 hr	22		32.4	23.8
1 hr	22		3.47	1.39
2 hr	22		3.91	-2.07
3 hr	18		3.92	-2.54
4 hr	15		3.59	-0.88
5 hr	14		3.13	-1.21
6 hr	9		2.19	-1.38
Storm end	22		3.52	-1.96
Strategy 2: Best sampling time from event and site variables				
Post storm measured parameters				
Total rainfall Eq. (6)	22	0.96	1.99	-0.27
Duration of runoff Eq. (7)	22	0.92	2.64	-0.22
Total rainfall and duration of runoff Eq. (8)	22	0.96	1.96	-0.26
Total rainfall, duration of runoff, and antecedent dry days Eq. (9)	22	0.97	2.72	0.73
Predicted parameters				
Total rainfall Eq. (6)	22	0.89	2.98	0.39
Duration of runoff Eq. (7)	22	0.95	2.22	-0.40
Total rainfall and duration of runoff Eq. (8)	22	0.88	3.19	0.37
Total rainfall, duration of runoff, and antecedent dry days Eq. (9)	22	0.92	3.46	1.18
Strategy 3: *EMC* of O&G from site and event variables				
Antecedent dry days Eq. (10)	22	0.82	3.84	-0.01
Antecedent dry days and total rainfall Eq. (11)	22	0.83	3.79	0.00
Logarithm of Antecedent dry days and total rainfall Eq. (12)	22	0.84	3.60	-0.42
Strategy 4: *EMC* of O&G from composite COD or DOC measurement				
COD Eq. (13)	22	0.90	2.90	0.07
DOC Eq. (14)	22	0.90	2.84	0.01

4.3 Best time for sample collection

A simulation was made to determine if specific times for grab sample collection might be a good strategy. Sample collection was simulated by using the pollutograph to determine O&G concentration at specific times, as described previously. Times from 0.25 hour to 6 hours and storm end were evaluated. The results are shown in Table 5. It is useful to compare these results to the results of collecting a randomly time sample. Root mean square (RMS) error, bias and number of storms are reported. The number of storms used for analysis decreases at longer sampling times, since not all storms lasted as long as the

sampling time. The error and bias are the differences between the *EMC* calculated from the series of grab samples and the value simulated by the various strategies.

For random timing, the error is 9.4 mg/L with a bias of 1.15 mg/L. Bias is average difference between the measured *EMCs* and the *EMCs* estimated by the various strategies. The RMS error is largest for sampling strategies that are early in the runoff, which is expected since O&G typically shows a first flush. The RMS error is roughly equal for samples collected after 1 hour, although the bias decreases to a negative value after 2 hours. Therefore sampling at specific times longer than one hour produces much less error than randomly timed samples, but slightly underestimates the $EMC_{O\&G}$. Sampling at the end of the storm is also a good strategy.

4.4 Best time from event and site variables

The $TEMC_{O\&G}$ is determined by finding the intersection of the O&G pollutograph with the *EMC* calculated from the grab samples and runoff flow rates. The time where this occurs is defined as $TEMC_{O\&G}$, and is shown in Fig. 3. For type 1 pollutographs, the O&G concentration equals the *EMC* value only at a single point. In the case of pollutographs of types 2 and 3, the O&G concentration might equal the *EMC* at more than one point, as shown in Figure 4. For these cases, the first value obtained in the time axis was used to compute the best time for this research. The best times illustrated in Figs. 3 and 4 are 133 and 54 minutes respectively. The first occurrence of the *EMC* was used, although other approaches are possible, such as smoothing the curve.

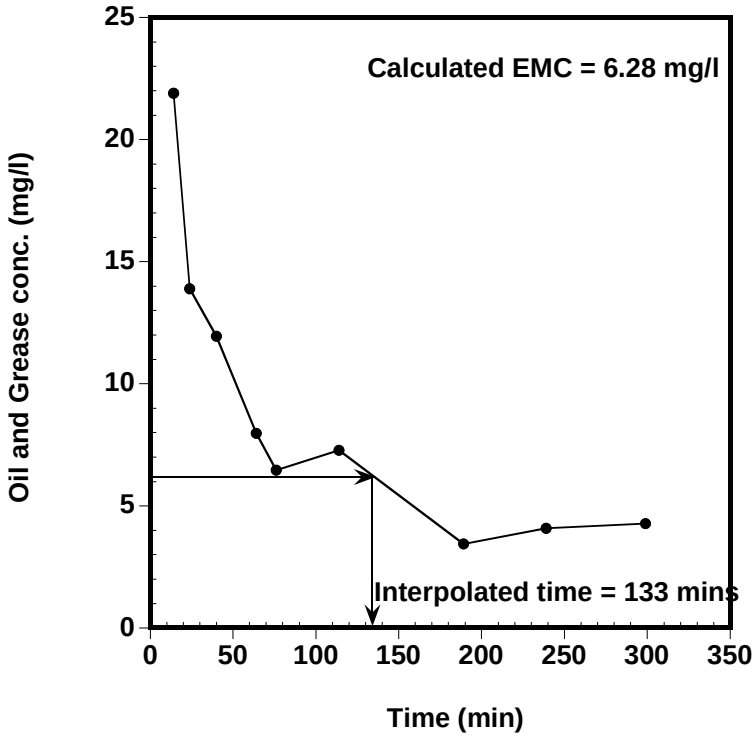

Fig. 3. Example of obtaining interpolated time based on calculated *EMC* value for pollutographs of type 1.

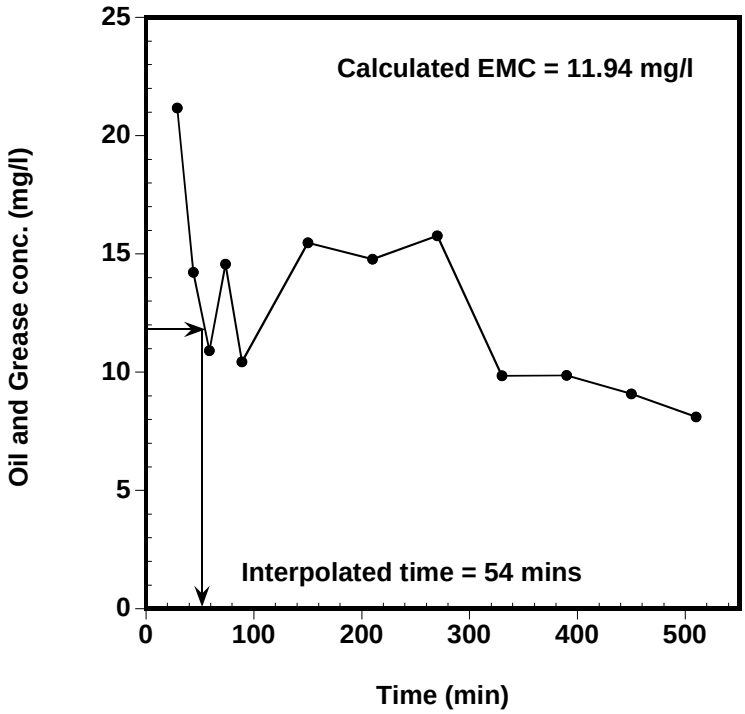

Fig. 4. Example of obtaining interpolated time based on calculated *EMC* value for pollutographs of type 2 and type 3.

$TEMC_{O\&G}$ was analyzed against the favorable factors (*ADD*, *D_RUN*, and *T_RAIN*). Five forms of equations, namely, linear, power, log, exponential, and inverse were considered for simple and multiple regressions. The linear regression results proved to be better than the nonlinear regressions. Only the four best results are presented, and are shown in Eqs. (6) to (9), with regression coefficients. Table 6 shows the significance.

Table 6. R^2 and p values for Eqs. (6) to (9)

	R^2	p value			
		Intercept	***T_RAIN***	***D_RUN***	***ADD***
Eq. (6)	0.76	0.00	0.00		
Eq. (7)	0.59	0.14		0.00	
Eq. (8)	0.78	0.00	0.00	0.23	
Eq. (9)	0.81	0.00	0.00	0.23	0.17

$$TEMC_{O\&G} = 55.71 + 1.50T_RAIN \qquad R^2 = 0.76 \qquad (6)$$

$$TEMC_{O\&G} = 22.29 + 9.12D_RUN \qquad R^2 = 0.59 \qquad (7)$$

$$TEMC_{O\&G} = 43.53 + 1.21T_RAIN + 2.55D_RUN \qquad R^2 = 0.78 \qquad (8)$$

$$TEMC_{O\&G} = 52.31 + 1.51T_RAIN + 2.47D_RUN - 0.39ADD \qquad R^2 = 0.81 \qquad (9)$$

The O&G concentrations associated with the different regressions were determined by finding the intersection of the best time and O&G concentration on the pollutograph. Table 5 shows values of R^2, RMS error and bias in *EMC* concentrations. The estimation is better than timed samples for both RMS error and bias. The RMS error is less than 2.8 mg/L with bias less than |0.75|. R^2 values are all above 0.9. Using only the total rainfall provides essentially the best estimate. Adding the *D_RUN* only marginally improves the estimate, and *ADD* is not useful for this case. The largest improvement over the timed

strategies is the reduced bias, which is essentially within the precision of O&G analysis for the best time strategies.

The problem with this strategy is that some parameters, such as *T_RAIN* are not known until after the storm, and can only be estimated by weather predictions. To simulate weather prediction, the estimated values of *T_RAIN* and *D_RUN* were provided by dividing the post rain data into three categories: low (6 mm and 5 hours), medium (13 mm and 7 hours) and high (25 mm and 12 hours). This assumes that the weather prediction could estimate *T_RAIN* and *D_RUN* within this accuracy. These values were substituted into Eqs (6)-(9). The results are shown in Table 5 under strategy 2, predicted parameters. If weather prediction is able to classify rainfall as small, medium or large, this best time strategy is superior to timed strategies. This strategy still requires sampling teams to mobilize and travel to the sampling sites at specific times, and this may not be possible for teams with many sites to sample.

The analysis shows that collecting the first flush at the beginning of the storm does not provide a good estimate of the *EMC*. This means that sampling teams do not need to standby awaiting the beginning of rainfall to insure collection of the first flush.

4.5 $EMC_{O\&G}$ from event and site variables

An analysis was performed to determine if $EMC_{O\&G}$ could be estimated directly from event or site characteristics. This strategy is completely predictive and does not require an O&G sample. Regressions were made between $EMC_{O\&G}$ and the 7 previously

described parameters using 5 different models. Simple and multiple regressions were used. Useful results were obtained only when using *ADD* and *T_RAIN*. Eq. (10) shows the result for *ADD*.

$$EMC_{\mathrm{O\&G}} = 2.64 + 0.38ADD \qquad R^2 = 0.82 \qquad (10)$$

The p values for the intercept and *ADD* were 0.03 and 0.00, respectively. This regression provides nearly the same accuracy as the previously described strategies, but its use is limited to type of rainfall events used in this analysis. No event less than 3.8 mm was analyzed; very low rainfall is usually associated with higher $EMC_{\mathrm{O\&G}}$.

Although Eq. (10) predicts $EMC_{\mathrm{O\&G}}$ reasonably well, it does not include any effects of rainfall or storm duration. There are two primary mechanisms that influence the *EMC*. The first relates to the build-up phase, which is correlated to *ADD* and the second is related to the wash-off. Eq. (10) considers only the build-up mechanism, which is impacted only by the variables *ADD* and *ADT*. The wash-off phase can be impacted by other variables: *D_RUN*, *T_RUN*, *T_RAIN*, and *RC*. A second regression was performed using *ADD* and *T_TRAIN*, and is shown as Eq. (11). Eq. (11) has slightly better fit (see Table 5) and includes both build-up and wash-off mechanisms. In this regression, the significance of the intercept (p=0.03) and ADD (p=0.00) coefficient remain high, but the significance of *T_RAIN* or wash-off is low (p=0.50); therefore, the effect of wash-off is either not important or is not estimated by the linear regression.

$$EMC_{\text{O\&G}} = 3.20 + 0.37\,ADD - 0.02\,T_RAIN \qquad R^2 = 0.83 \qquad (11)$$

Eq. (12) shows the same regression except using a log transformation of the data.

$$\log_{10}(EMC_{\text{O\&G}}) = 0.37 + 0.64\log_{10}(ADD) - 0.17\log_{10}(T_RAIN) \qquad R^2 = 0.86 \qquad (12)$$

The coefficients are significant with p values of 0.02, 0.00, and 0.09 for the intercept, *ADD*, and *T_RAIN*, respectively. Eq. (12) is a more realistic model with the possibility of including two separate effects.

4.6 $EMC_{\text{O\&G}}$ from composite COD and DOC measurement

Another method for estimating $EMC_{\text{O\&G}}$ is to correlate the *EMC* with other parameters measuring organics concentration, such as COD and DOC, or total suspended solids (TSS), which is often used as a surrogate for other water quality parameters in stormwater management. O&G is only a fraction of the compounds that compose COD or DOC and the fraction depends upon landuse (Stenstrom et al. 1986; Fam et al. 1987). Highway runoff is all the same landuse and we can expect the source of the hydrocarbons to be similar.

There exists a significant correlation between the $EMC_{\text{O\&G}}$, EMC_{COD}, and EMC_{DOC} (R=0.95). Eqs. (13) and (14) show the regressions between $EMC_{\text{O\&G}}$ and EMC_{COD} or EMC_{DOC}. The intercept is not significant for DOC and is not reported. In both cases the R^2 are 0.90 and the remaining regression parameters are significant ($p < 0.02$).

$$EMC_{\text{O\&G}} = 3.71 + 0.04 EMC_{\text{COD}} \qquad R^2 = 0.90 \qquad (13)$$

$$EMC_{\text{O\&G}} = 0.15 + 0.28 EMC_{\text{DOC}} \qquad R^2 = 0.90 \qquad (14)$$

TSS and $EMC_{\text{O\&G}}$ were not correlated (R=0.18). In this case, TSS is not a useful surrogate for O&G.

5. Practical Applications and Recommendations

Four alternative methods have been presented to estimate $EMC_{O\&G}$: timed samples; estimates of the best time to collect a grab sample, based upon various storm and site specific parameters; regression with storm and site specific parameters, and correlation with COD or DOC. All methods are superior to collecting a randomly-timed grab sample and produced RMS errors less than 4 mg/L and R^2 from 0.82 to 0.97. The RMS error associated with a randomly timed sample was 9.4 mg/L. Collecting a sample at the very beginning of a storm event was the worst strategy with RMS error of 32.4 mg/L. Small differences in the performance among the methods were noted. The selection of method should probably be based considerations in addition to accuracy.

The timed sampling strategies require a sampling team or sampling device to collect a sample at a specific time, which may be inconvenient for teams sampling many sites. Also it may not be possible to know the exact time the beginning of the storm without local rain gages or flow meters. The best time strategies have the same disadvantage in that a sample must be collected at a specific time, and are more complicated because the sample time must be calculate from a regression and weather prediction.

Regressions with site-specific parameters such as *ADD* were slightly less accurate than the timed methods, but have the advantage that no sample needs to be collected. Regulatory agencies may not support this strategy, unless the accuracy of the regression is demonstrated.

Correlation of $EMC_{O\&G}$ with EMC_{COD} or EMC_{DOC} is perhaps most promising. It is nearly as accurate as the best of all methods and has no bias. It has the advantage that the result is based upon an actual sample. The sampling team needs to do no extra work, and COD or DOC can be monitored with composite samplers. DOC may be preferable since it is not subject to interferences from inorganic reduced pollutants.

To demonstrate the practical application of methodologies presented in this report, the data collected as part of the California Department of Transportation (Caltrans) was used for comparison. This data set includes water quality measurements from 1997 to 2002 at 94 highway sites. O&G grab samples were collected for each storm even, as well as flow-weighted composite samples that were analyzed for DOC and COD. The timing for grab sample collection was not controlled, but grab samples were generally collected early in the storm, to insure than a sample was obtained. Additionally *T_RAIN* and *ADD* were recorded. The various correlations were applied to this data set to allow comparisons of the measured grab samples with the various strategies. Only samples above O&G detection limits were used. The comparison shows the potential impact of the alternate methods on the overall estimation of O&G concentrations.

Table 7 shows the comparison, which illustrates the potential impact of the methods on overall O&G concentration estimations. All methods had lower variability than the grab samples, as indicated by the standard deviations. Median values of O&G were lower by approximately 2 mg/L for all methods except correlation to COD [Eq. (13)], which was a

2.8 mg/L greater. Mean values for all methods were lower than grab sample mean. This is expected since grab samples were collected early in the storm.

This exercise shows suggest that O&G estimates from gab samples may slightly over estimate the actual concentrations. The new methods produced less variable results and can be performed without collecting grab samples, which should result in substantial cost savings.

Table 7. Basic statistics for different methods to predict $EMC_{O\&G}$ for highway runoff characterization[a]

Method	No. of cases	Min	Max	Median	Mean	Std. Dev.	C.V.[b]
Actual values reported	418	1.00	226.00	6.00	10.28	15.00	1.46
Regression with event and site characteristics							
Antecedent dry days Eq. (10)	391	2.72	112.84	4.16	8.85	11.94	1.35
Antecedent dry days and total rainfall Eq. (11)	391	0.56	110.37	4.46	8.73	11.66	1.34
Logarithm of Antecedent dry days and total rainfall Eq. (12)	391	0.29	64.74	3.90	7.05	8.09	1.15
Regression with measured constituents							
COD Eq. (13)	102	4.32	19.99	8.89	9.55	3.53	0.37
DOC Eq. (14)	228	1.03	88.53	4.02	5.42	8.49	1.57

[a] Source: Caltrans discharge characterization study report, CTSW-RT-03-065.51.42.
[b] C.V. = Coefficient of variation

6. Conclusions

This report addresses the question of when to collect a grab sample for oil and grease (O&G) to best approximate the event mean concentration (*EMC*) for an entire storm event. Twenty-two storm events using three sites during the rainy seasons (October to April) of 1999-2002 were used to determine if there exists a point in the pollutograph that best approximates the (O&G *EMC*) $EMC_{O\&G}$. Regression analysis were performed to determine if $EMC_{O\&G}$ and best sampling time could be related to storm-specific parameters such as total rainfall, or site-specific parameters, such as antecedent dry days (*ADD*). Finally, correlations were made between other organic parameters, such as chemical oxygen demand (COD) and dissolved organic carbon (DOC), to determine if using a correlation to estimate $EMC_{O\&G}$ is a viable strategy. The report provides quantitative relations that support the following conclusions:

1. Collecting a single grab sample at no specific time is a poor strategy for estimating $EMC_{O\&G}$.
2. If a single O&G grab sample is to be collected to characterize the storm event, it should be collected several hours into the storm. Samples collected at the beginning of the storm event (~15 minutes) can overestimate the $EMC_{O\&G}$ by 20 mg/L or more. Samples collected after 1 hour generally had root mean square errors under 4 mg/L, when compared to the *EMC*. Samples collected toward the end of the storm may underestimate the *EMC*, but only by 1 to 2 mg/L.
3. There exists a best time to sample for O&G which is related to storm characteristics such as total rainfall (*T_RAIN*). Greater *T_RAIN* or storm duration delays the best time to collect a sample.

4. The $EMCs_{O\&G}$ were well correlated to site-specific storm conditions such as antecedent dry days and *T_RAIN*.
5. There exists a strong correlation ($R^2 \sim 0.9$) between $EMC_{O\&G}$ and COD or DOC. Using the correlation with EMC_{COD} or EMC_{DOC} is a viable strategy for estimating $EMC_{O\&G}$ for highway runoff.
6. $EMC_{O\&G}$ was not well correlated to total suspended solids *EMC* ($R^2 \sim 0.2$).
7. A comparison of the methods presented here with a large California, state-wide stormwater monitoring program suggests that the new methods will have less variability and will, on average, produce O&G concentrations that are 2 mg/L less than those obtained with grab samples.
8. The approach used in this report might also be useful for other parameters that are difficult to sample with automated composite samplers.

7. Notation

The following symbols are used in this report:

EMC = event mean concentration [mg L^{-1}];

O&G = oil and grease;

COD = chemical oxygen demand;

RMS = root mean square;

DOC = dissolved organic carbon;

M = total mass of pollutant during the entire runoff [kg];

V = total volume of runoff [m^3];

$c(t)$ = time varying pollutant concentration [mg L^{-1}];

$q(t)$ = time variable flow [L min^{-1}];

T = total duration of runoff [min];

C_i = fractional concentration assigned to the i-th grab sample [mg L^{-1}];

W_i = weight for the i-th grab sample;

V_i = fractional flow volume assigned to the i-th grab sample [L];

V_T = total volume of runoff [L];

n = number of grab samples;

U = unit loading rate [kg ha^{-1} mm^{-1}];

AREA = catchment area [ha];

T_RAIN = total rainfall [mm];

RC = rational runoff coefficient;

TSS = total suspended solids [mg L^{-1}];

ADD = antecedent dry days [day];

ADT = average daily traffic;

D_RUN = duration of runoff total runoff [hr];

T_RUN = total runoff volume [L];

TEMC = best time to sample from the beginning of runoff [min];

R = correlation coefficient, and

p = probability value.

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