First Flush Study
1999-2000 Report

June 2000

CTSW-RT-00-016

Contents

Appendices

List of Tables

List of Figures

Executive Summary

Introduction

To identify changes in the water quality of runoff throughout the season and during individual events, Caltrans conducted a comprehensive monitoring study during the 1999-2000 wet-weather season entitled, the Caltrans First Flush Study. The overall objective of this study is to collect data that can be used to identify the changes that occur in the quality of storm water runoff for the following bases:

- Wet season (e.g., how does the runoff quality of the first rain events compare to the quality of subsequent events); and
- Individual storm events (e.g., how does the runoff quality during the first portion of the runoff event compare to the quality during the later portions of an individual runoff event).

Specifically, the data collected under the monitoring program are designed to help assess the water quality of storm water at various times during rainfall and runoff events.

Monitoring Locations and Equipment

For the First Flush Study, water quality monitoring was performed at the discharge point of each of two catchments located in Los Angeles County. Station 1 was located at the Citrus Avenue on-ramp to the eastbound 210 freeway. Station 14 was located near the intersection of the westbound 91 freeway and the northbound 605 freeway. Both selected catchment areas consisted of a series of drain inlets that were connected through a network of storm drainpipes that drain to a single discharge point and that were representative of typical highway catchments. Monitoring stations, equipped with automated flow meters and rainfall gages, were installed at both outfalls.

Procedures

The required water quality data were obtained by collecting a series of discrete samples throughout the entire runoff event for monitored storm events. The discrete samples were collected using manual grab sampling techniques. Samples were collected on a time-paced basis. However, additional sampling was conducted to ensure all flow regimes were represented, especially during periods of peak flow and rainfall rates. Laboratory analysis of each discrete sample provided the chemical concentrations at the time of collection.

A total of eight storm events were monitored during the 1999-2000 season, the number targeted in the Sampling and Analysis Plan (CTSW-RT-99-074). On average 11 to 12 discrete water quality samples were collected during each monitoring event. The number of discrete samples per event ranged from five to 18.

For each monitored storm event, water quality, rainfall, and flow data were obtained. These data were used to generate water quality pollutographs (concentrations versus times), rainfall hyetographs (rain volumes versus time), and flow hydrographs (flow rates versus time). Changes in pollutant concentrations over the duration of the runoff event were noted. The time when peak concentrations occur were defined. The impacts of peak rainfall intensity and peak flow rates on pollutant concentrations were also investigated.

Field Data and Analytical Results

Precipitation

Rainfall amounts were continuously monitored at Stations 1 and 14. Rainfall volumes for the individual storm events when sampling occurred ranged from 0.16 inches to 1.69 inches with the average volume of 0.89 inches per storm event.

The majority of the rain fell within a six-week period. As a result, the monitored storm events only included two antecedent dry periods, greater than 20 days and four days or less.

The historical mean volume for rainfall for the "winter season" (December – February) at seven local NWS gages was examined. Rainfall totals during 1999-2000 season were below average at all seven NWS gages with the volumes ranging between 42 to 78 percent of the mean volume on record.

Runoff

The two catchments included in the First Flush Study represented typical highway stormwater drainage areas: small, highly impervious, rapidly responding catchments. Due to the highly impervious catchment areas, the response time between rainfall occurrence and runoff occurrence is very short during a storm event, between five to fifteen minutes.

Runoff coefficients for the two catchments were comparable despite the significant difference in areas. The runoff coefficient for Station 1 with an approximate area of 11.9 acres was 0.79. Station 14 with an approximate area of 0.6 acres had a runoff coefficient of 0.88. The relatively high value for the runoff coefficients for both sites is indicative of catchments dominated by impervious surfaces.

Analysis and Monitoring Results

A critical component of the First Flush Study was to utilize the collected data to assess and determine the changes that occur in the quality of storm water runoff throughout storm events. A series of data analyses was conducted as part of the evaluation to define trends in the water quality. These analyses included variability in constituent concentrations, time-series graphs, and correlation to rainfall and runoff.

Variability of Monitored Constituent Levels

All the water quality constituents demonstrated some level of variation over the course of the monitoring season and within individual runoff events. However, the level of variability was different for each constituent.

A review of the data reveals the constituents with the highest level of variability (i.e. highest values for the coefficient of variation and relative percent difference) during individual storm events are total and fecal coliform bacteria, total suspended solids (SS), oil and grease, dissolved nickel, total lead, and total phosphorus. The constituents with the lowest level of variability (i.e. lowest values for coefficient of variation and relative percent difference) include cadmium (total and dissolved), pH, and water temperature.

This high degree of variability in coliform bacteria levels that was observed over the course of individual storm events demonstrates the weakness of using single grab samples to accurately characterize levels. Multiple samples are required to ensure the levels are accurately represented. This protocol will require field crews to be present at the monitoring station throughout each event.

Factors Influencing in Water Quality

The antecedent dry condition was the only factor that appeared to influence the water quality of the runoff. The water quality concentrations of runoff preceded by extended dry periods (greater than 20 days) tended to be higher than the runoff preceded by short dry periods (less than four days). Additional monitoring should be performed in order to expand the range of antecedent dry periods included in the study.

First Flush Trends

The so-called "first flush" phenomenon is assumed to be demonstrated if the highest concentrations of a constituent occur during the first portion of a runoff event. A review of the data was performed to identify this trend was observed among any of the water quality constituents and storm events.

A portion of the constituents monitored at Site 1 demonstrated first flush trends (within individual storms) for five out of the eight monitored events. The concentrations of nitrate and total organic carbon were consistently higher at the beginning of Events 1, 4, 5, 7, and 8. Levels of coliform bacteria, pH, oil and grease, and water temperature did not demonstrate first flush trends during any of the eight monitored events. The concentrations of the remaining constituents were inconsistent in demonstrating first flush trends.

First flush trends were not as prevalent at Site 14. Only the concentrations for nitrate and total organic carbon were consistently higher at the beginning of the runoff events.

Section 1
Introduction

1.1 Background

The storm drainage system used for California highways is designed to maximize safety to the motoring public by avoiding flooding, and to minimize maintenance activities that require lane closures and increase traffic congestion. By virtue of the linear nature of highways, the catchment area served by each drainage system is relatively small, and typically ranges from 1 to 10 acres. The catchment area is defined as the section of highway and associated right-of-way that contributes storm water runoff to a single discharge point. Each drainage network typically consists of a series of drain inlets that collect sheet flow or gutter flow from the upstream catchment area. The inlets are connected through a series of laterals that collect the flows from each inlet and direct the flows by gravity to the outfall pipe, prior to discharging to either a municipal drainage system or receiving water.

During storm events, the runoff can carry suspended sediments and chemical constituents that derive from various sources, including vehicular emissions and residuals, and sediment from erosion of slopes. There is a concern that these sediments and associated chemical constituents may adversely affect the beneficial uses of the receiving waters.

In response to these concerns, Caltrans is conducting a series of field monitoring studies to investigate storm water runoff from its facilities. These studies include characterizing concentration levels of constituents; identification of factors that affect quality and loads in the runoff; identification of the mechanisms that affect the transport, mobilization, and transformation of constituents; and evaluation of various storm water management practices.

1.2 Overview of the First Flush Study

To identify changes in the water quality of runoff throughout the season and during individual events, Caltrans conducted a comprehensive monitoring study during the 1999-2000 wet-weather season entitled, the Caltrans First Flush Study, which is documented in this report.

1.2.1 Program Objective

The overall objective of the First Flush Study is to collect data that can be used to identify the changes that occur in the quality of storm water runoff for the following bases:

- Wet season (e.g., how does the runoff quality of the first rain events compare to the quality of subsequent events); and

- Individual storm events (e.g., how does the runoff quality during the first portion of the runoff event compare to the quality during the later portions of an individual runoff event).

Specifically, the data collected under the monitoring program are designed to help assess the water quality of storm water at various times during rainfall and runoff events. Ultimately, the results of this study will be used by Caltrans to further develop management strategies that target storm water quality related issues and improve existing best management practices.

1.2.2 Study Design

The study approach involved selecting two catchment areas within District 7 that were representative of typical highway catchments. Catchment areas were defined as the sections of highway, associated right-of-way, and offsite area (if any) that drain to a single discharge point. For the First Flush Study, each selected catchment area consisted of a series of drain inlets that were connected through a network of storm drainpipes.

To characterize the storm water discharging from the upstream drain inlets, water quality monitoring was performed at the discharge point of each of the two catchments. Monitoring stations, equipped with automated flow meters and rainfall gages, were installed at both outfalls.

The required water quality data were obtained by collecting a series of discrete samples throughout the entire runoff event for monitored storm events. The discrete samples were collected using manual grab sampling techniques. Samples were collected on a time-paced basis. However, additional sampling was conducted to ensure all flow regimes were represented, especially during periods of peak flow and rainfall rates. Laboratory analysis of each discrete sample provided the chemical concentrations at the time of collection.

For each monitored storm event, water quality, rainfall, and flow data were obtained. These data were used to generate water quality pollutographs (concentrations versus times), rainfall hyetographs (rain volumes versus time), and flow hydrographs (flow rates versus time). Changes in pollutant concentrations over the duration of the runoff event were noted. The time when peak concentrations occur were defined. The impacts of peak rainfall intensity and peak flow rates on pollutant concentrations were also investigated.

1.3 Report Organization

This report is organized as follows:

- Section 2 describes the monitoring locations and the monitoring equipment used in this study.

- Section 3 summarizes the sampling and monitoring methods used in this study.
- Section 4 presents the results of the field data collected during this study, including monitoring station network performance and data for precipitation, flow, and water quality.
- Section 5 summarizes the results of the analysis of the precipitation, flow, and water quality data.
- Section 6 presents conclusions based on the information contained herein.
- Section 7 lists the references cited within the text.

Appendices A through D contain additional detailed information regarding the study, including:

- Appendix A includes stacked time-series plots of flow, rainfall, and water quality for each station-storm event
- Appendix B includes analytical data from each station and monitored storm events, along with basic statistics
- Appendix C provides a discussion of data quality assurance / quality control (QA/QC) results
- Appendix D includes plots to determine if a correlation exists between water quality and rainfall intensity or runoff flow rate

Section 2
Monitoring Locations and Equipment

2.1 Monitoring Locations

The two monitoring sites for the First Flush Study were selected from a group of active stations currently being used for other Caltrans studies for assessing storm water runoff from the highway system. The monitoring sites for the First Flush Study required the same physical attributes and monitoring equipment as found at these other stations. Therefore, the First Flush Study was conducted at two of these same sites.

Selection criteria included:

1. **Personnel Safety.** This was the number one criterion in selecting a monitoring station. The selected site had to offer safe conditions for personnel to work during sampling events. Sites were eliminated if they: required lane closures to ensure safe conditions and or were located along large open channels and falling could result in physical injury and or being swept downstream.

2. **Inlet Cleaning.** The potential impact of cleaning drain inlets on storm water quality was not considered acceptable for the First Flush Study. Only test sites not included in any of the Caltrans inlet cleaning programs were considered for the First Flush Study.

3. **Access to Flow Stream.** Only test sites where the flow stream could be easily accessed for manual sampling were included in the selection process. Sites were eliminated from consideration if they required confined space entry or involved a long reach (greater than four feet) to collect a water quality sample.

Both monitoring sites were located in Los Angeles County. The location and spatial distribution of these sites is shown in Figure 2-1. Photographs of each site and their monitoring stations are presented in Figures 2-2 and 2-3.

Table 2-1 presents characteristics of each catchment. For each catchment, the table identifies the monitoring station number, location, type of highway within the catchment area, average daily traffic volume, number of drain inlets, catchment area, and percent impervious.

Table 2-1
Catchment Characteristics

	Station 1	**Station 14**
Location	**Eastbound 210 Freeway at Citrus Ave., on-ramp**	**91 Freeway and 605 Freeway Interchange**
Freeway/Post Mile	210 / 40.8	91 / 17.06
Type of Freeway (Cut/Fill)	Cut	Fill
Avg. Daily Traffic Volume	176,000	220,000
Total No. of Drain Inlets	24	2
Catchment Area (acres)	11.9	0.57
Approx. Percent Impervious (%)	58	100

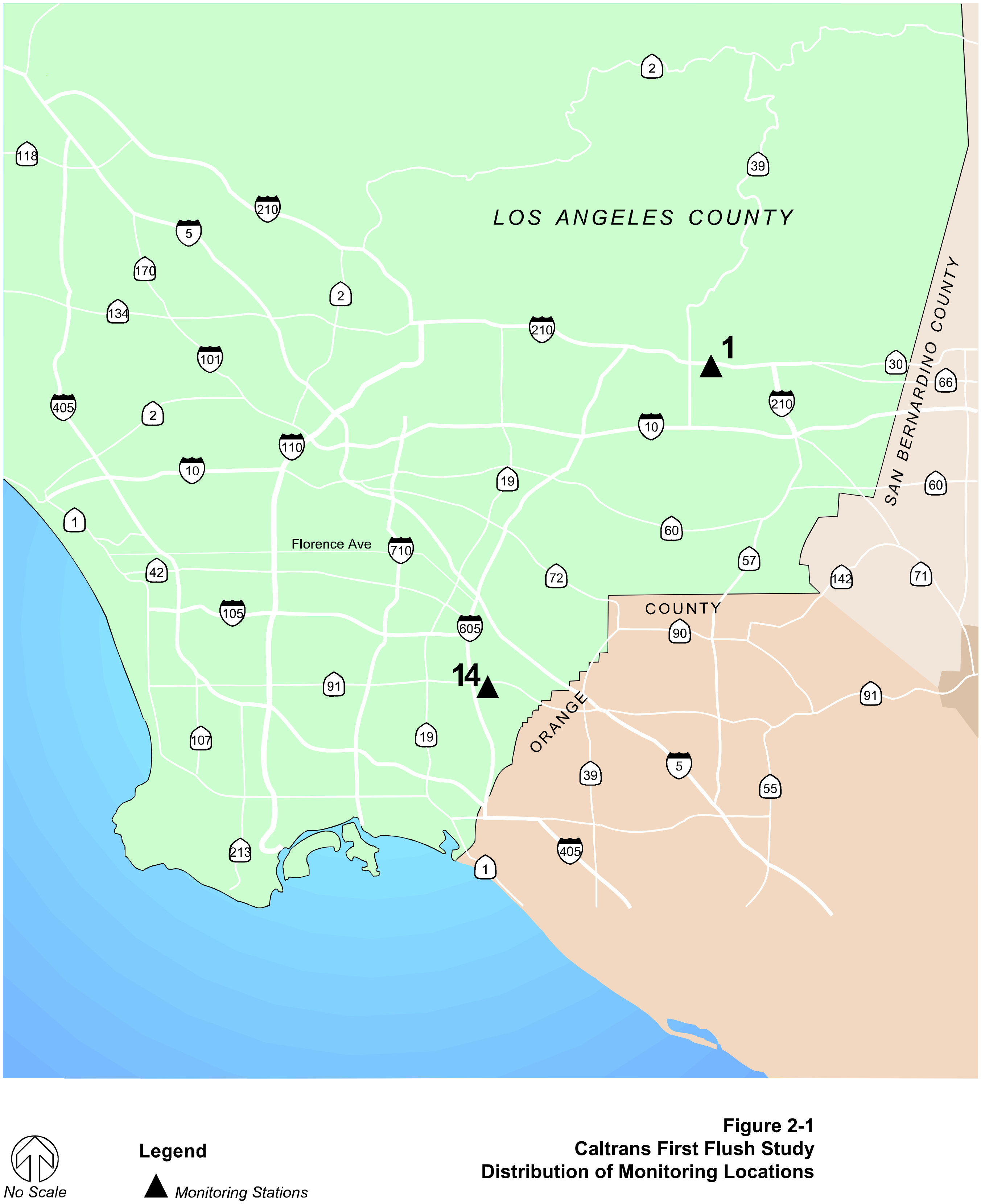


Figure 2-1
Caltrans First Flush Study
Distribution of Monitoring Locations

Photo No. 1 – Sampling Point at Site 01

Figure 2-2
Photos Depicting First Flush Monitoring Site 01 and Equipment

Photo No. 2 – Section of E/B 210 Freeway at Site 01

Photo No. 3 – Sigma Flowmeter, Mobile Phone and Encroachment Permit at Site 01

Figure 2-2
Photos Depicting First Flush Monitoring Site 01 and Equipment

Photo No. 1 – Sampling Point at Site 14

Photo No. 2 – Section of W/B 91 Freeway at Site 14

Figure 2-3
Photos Depicting First Flush Monitoring Site 14 and Equipment

2.2 Monitoring Equipment

The monitoring equipment installed at each station was selected to achieve the water quality monitoring objectives as described in detail in the Caltrans First Flush Study Sampling and Analysis Plan (CDM, 1999). All sites were equipped with a continuously recording flow meter and rain gage, power source, and telemetry. Equipment installations varied from site to site. At both sites, the flow rate was measured to the nearest 0.1 cubic feet per second and the rainfall volume to the nearest 0.01 inches. Both instantaneous flow rate and total rainfall volume were measured every five minutes on a continuous basis.

Site 1 was equipped with a flow meter outfitted with ultra-sonic probe for measuring depth of flow and a Doppler radar-based probe for measuring velocity. Flow was measured within the 36-inch reinforced concrete drainpipe. A rain gage was not installed at Site 1 due to overhead obstructions. A second station was established approximately one half mile from Site 1 for the tipping bucket rain gage. External DC batteries powered the equipment at both sites.

Site 14 was equipped with a bubbler flow meter that measures only depth of flow. The flow rate was measured using a cutthroat flume. Discharge from the storm drain outfall was directed through the flume where a relationship between depth of flow and flow rate was known. A tipping bucket rain gage was installed at the site. The equipment at the site was powered by 110 V A/C.

Each time a grab sample was taken, an extra sample was taken in a clean bottle and measurements were taken for pH, temperature and conductivity. An Extech Oyster pH, conductivity and temperature meter was used to take the measurements. The meters were calibrated prior to each monitoring event. Conductivity readings were accurate to ±10 :S/cm and pH readings accurate to 0.01 pH. Temperature was accurate to 0.1 °C, but measurements were taken with thermometers accurate to 1°F or ~1.8°C.

Section 3
Sample Handling, Analytical Methods, and Procedures

3.1 Storm Water Sampling

The storm water sampling method used for the First Flush Study was designed to provide a set of discrete concentrations for the parameters of interest that are presented in Section 3.3. The results were to represent concentrations of a given parameter for different times and flow regimes over a single runoff event. A graphical representation of this discrete sampling method is provided in Figure 3-1. The figure shows a flow hydrograph (flow rate versus time) and a rainfall hyetograph (rainfall volume versus time). The discrete storm water samples collected during the runoff event (indicated by S1 through S13) are shown on the hydrograph.

Sample collection was primarily paced by time. Samples were collected every 20-30 minutes for the first three hours from the start of the runoff and then on an hourly basis thereafter if the runoff lasted longer than three hours. However, field crews were instructed to collect samples at any time during the runoff event in order to ensure all flow conditions that occurred were represented. Crews monitored flow rates and levels, and collected samples during periods of peak flows.

Field measurements for pH, temperature and specific conductivity were also collected during each sample collection. Any observed color, turbidity, odor, and floating debris were noted. Field crews were to document any conditions that could explain anomalies in the data.

3.2 Wet Weather Response

An effort was made to collect storm water samples during all wet weather events. However, sampling was initiated only when weather forecasts predicted significant runoff-producing storm events. Generally, the following storm event criteria were used to select storm events to be monitored:

- At least 0.10 inches of rainfall
- First storm event of the season
- Probability of occurrence was greater than 50%
- Rainfall was preceded by at least 24 hours of dry weather

Implementation of the First Flush water quality monitoring program involved activities to prepare for and respond to storm events; routine equipment servicing; and data collection and handling. Details of these activities are presented in the document, Caltrans First Flush Study Sampling and Analysis Plan (CDM, 1999).

Section 4
Field Data and Analytical Results

4.1 Precipitation

4.1.1 Background

Both First Flush Study Monitoring Stations were equipped with rain gages and rainfall was continuously monitored during the periods when the stations were operational, December 1999 to April 2000. Precipitation data collected at several gages maintained by the National Weather Service (NWS) within District 7 were also compiled for the same period for comparison to the data collected at the First Flush Study monitoring stations. Finally, long-term historical rainfall conditions were compiled from the NWS stations as a means of qualifying the representativeness of the 1999-2000 wet-weather seasons.

4.1.2 Data Summary

Rainfall amounts were recorded at Station 14 from October 1999 to April 2000. The rainfall amounts at Station 01 were recorded from December 20, 1999 to April 2000.

Precipitation data generated during monitored storm events over the 1999-2000 monitoring season are summarized in Table 4-1. The majority of the rain occurred during the period of January 25 to March 8, 2000. Water quality sampling was performed for a total of eight storm events. The individual event totals recorded at the monitoring stations are presented in the upper portion of the table. The lower portion of Table 4-1 presents the total precipitation of all the sampled storms at each station. (e.g., the summation of each individual amount listed in the columns above).

Table 4-1
1999-2000 Monitoring Season Precipitation Summary

Storm Event Monitored	***Event Date***	***Monitoring Stations***	
		1	**14**
1	25-Jan-00	0.60	0.55
2	12-Feb-00	0.91	0.76
3	20-Feb-00	1.05	0.81
4	23-Feb-00	1.67	0.98
5	27-Feb-00	0.43	0.16
6	5-Mar-00	0.78	0.62
7	8-Mar-00	1.08	0.83
8	17-Apr-00	1.69	1.26
Station Summary Statistics			
Total Precipitation for Sampled Station Storms		8.21	5.97
Maximum Event Precipitation		1.69	1.26
Minimum Event Precipitation		0.43	0.16

Note: The rainfall total for Site 14 - Storm 1 was obtained from another rainfall gage in the area.

Rainfall volumes for the individual storm events when sampling occurred ranged from 0.16 inches to 1.69 inches. The total precipitation for the eight, sampled storm events was 8.21 inches at Station 01 and 5.97 inches at Station 14. Differences between stations were primarily due to orographic effects. Station 01 was located near the foothills of the San Gabriel Mountains. Station 14, which had lower rainfall totals, was located at a lower elevation, away from any significant mountain ranges.

4.1.3 Comparison with NWS Data

The First Flush Study rainfall data were compared to rainfall data collected at NWS Stations located within District 7. This comparison was performed to evaluate the accuracy of the First Flush Study rain gages and to further qualify the distribution characteristics within the study area.

For the 1990-2000 season, data from seven NWS rain gages were compiled for the period of October 1999 to February 2000. The locations of the NWS rain gages relative to the two First Flush rain gages are shown in Figure 4-1. Table 4-2 lists the monthly rainfall total recorded at both the NWS and First Flush Study rain gaging stations for the period of November 1999 through February 2000. Total rainfall recorded at the NWS stations for this period ranged from 3.69 inches to 10.96 inches, whereas the total rainfall at the First Flush Study stations was 8.62 inches and 6.68 inches. All the active NWS gages are located in the valley away from the orographic effects of the mountains. The rainfall totals for the NWS gages were comparable to the totals at the First Flush Study gages.

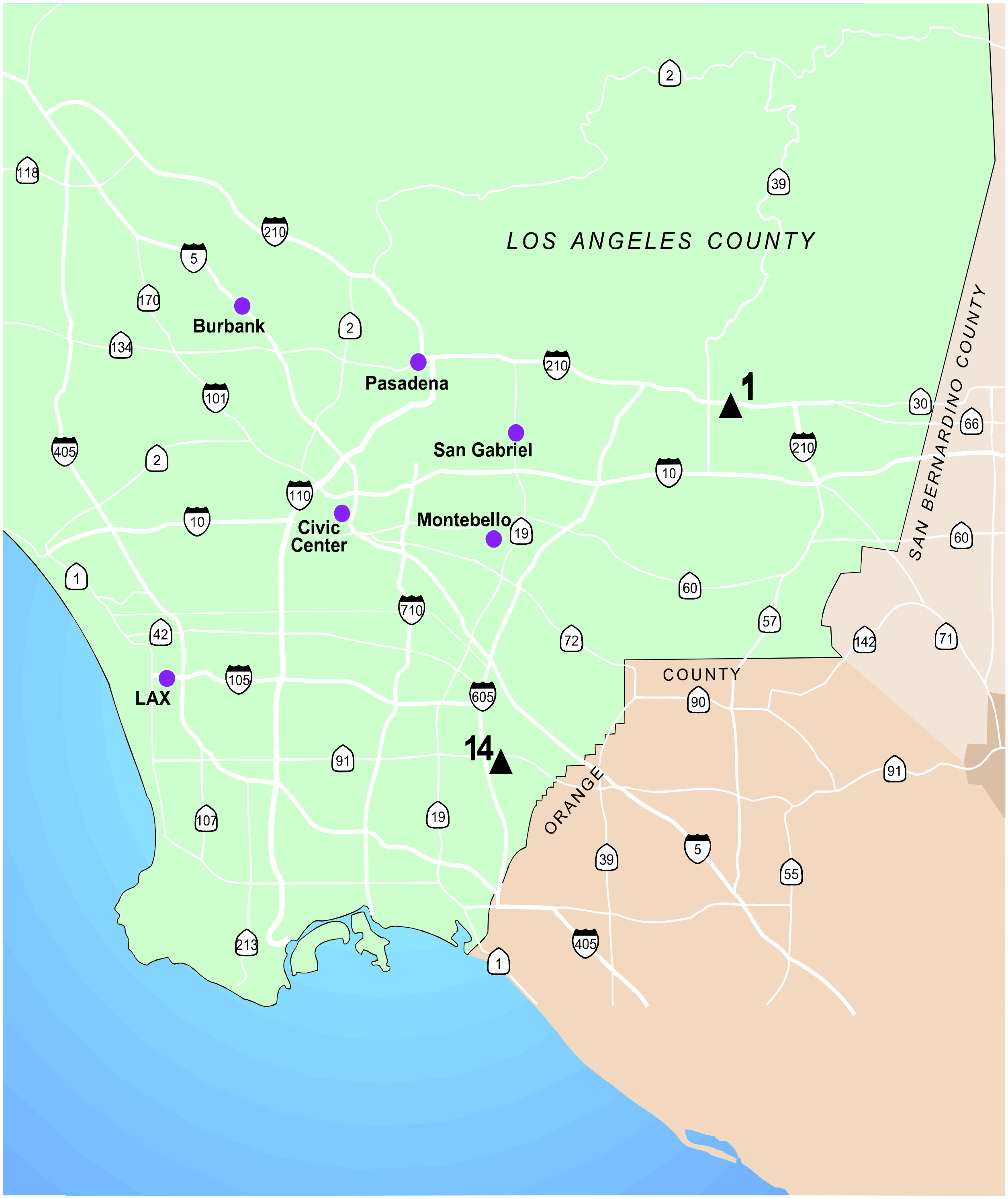
Table 4-2
1999-2000 Wet Season Precipitation Summary

		Month				
		Nov-99	Dec-99	Jan-00	Feb-00	**Total**
National Weather Service Rain Gages[1]	**Long Beach**	0.17	0.11	0.51	2.90	3.69
	LAX	0.28	0.00	0.86	4.06	5.20
	Civic Center	0.44	0.40	0.96	5.74	7.54
	Montebello	0.25	0.41	0.06	4.51	5.23
	Pasadena	0.43	0.35	1.03	9.15	10.96
	San Gabriel	0.16	0.22	0.78	6.06	7.22
	Burbank	0.22	0.00	0.78	6.34	7.34
Monitoring Stations	**1 [2]**	0.00	0.25	1.10	7.27	8.62
	14	0.12	0.52	0.74	5.30	6.68

Notes:

1 March and April data are unavailable until July 1, 2000.

2 The rain gage at Site 1 was not installed until 12/20/1999



No Scale

Legend

Monitoring Stations

NWS Rainfall Gauge Stations

Figure 4-1
Caltrans First Flush Study
Distribution of Monitoring Locations
And NWS Stations

A comparison of the monthly rainfall totals recorded at the NWS gages to the monthly rainfall totals recorded at the First Flush stations in Table 4-2 shows similar amounts and patterns. The month of February produced the highest rainfall volume at both sets of gages.

4.1.4 Comparison with NWS Historical Data

A comparison was made between long-term historical rainfall totals from the seven NWS stations and the rainfall that fell during the 1999-2000 season. The period of record at the NWS gages ranged from 71 years to 19 years with the average being 48 years.

Table 4-3 compares the 1999-2000 rainfall totals at the seven NWS gages with historical data for the "winter season" (December – February). The total rainfall amount for this three-month period during 1999-2000 is presented first. These data are followed by the mean volume for the period of record (POR), the highest single season volume, and the lowest single season volume.

A comparison between 1999-2000 record and the POR indicates the precipitation total during the 1999-2000 was less than typical conditions. Rainfall totals during 1999-2000 season were below average at all seven NWS gages with the volumes ranging between 42 to 78 percent of the mean volume on record.

Table 4-3
Historical Precipitation Summary for October - February

		Statistics*	1999-2000	POR Mean	High	Low
NWS Rain Gauging Station	Long Beach	Vol.	3.69	8.89	27.67	3.00
		Year			1978	1989
	LAX	Vol.	5.20	8.89	29.46	2.95
		Year			1983	1947
	LA Civic Center	Vol.	7.54	10.60	34.04	3.85
		Year			1983	1953
	Montebello	Vol.	5.23	11.93	37.90	4.23
		Year			1998	1989
	Pasadena	Vol.	10.96	14.14	48.47	5.37
		Year			1983	1947
	San Gabriel	Vol.	7.22	12.29	43.85	5.47
		Year			1983	1953
	Burbank	Vol.	7.34	11.45	39.77	3.52
		Year			1983	1947

Notes:

All rainfall volumes are expressed in inches.

* Source of this information is from the Western Regional Climate Center.

4.2 Runoff Data

4.2.1 Runoff Characteristics

A primary mechanism for mobilizing and transporting pollutants from highway drainage areas to receiving waters is storm water runoff. Storm water runoff is the volume of precipitation that eventually runs off a surface or drainage area as overland flow. The amount of storm water runoff is largely a function of specific catchment and storm event characteristics including (1) drainage area; (2) precipitation volume, intensity, and duration; (3) antecedent moisture condition; (4) topography; (5) impervious area; and (6) ground cover type.

Empirically, storm water runoff volume can be expressed as:

Storm Water Runoff Volume = Precipitation (in) Drainage Area (acres) * Runoff Coefficient*

The runoff coefficient is dimensionless and can be defined as the ratio of runoff to rainfall, which is a function of the specific catchment and storm event characteristics described above.

Figure 3-1 shows a typical runoff response to a rainfall event. The runoff hydrograph is shown along the bottom axis and the rainfall hyetograph along the top. The figure shows that storm water runoff is generated shortly after precipitation begins and continues until precipitation ceases. The sharp peaks along the flow hydrograph reflect the rapid flow response to changes in precipitation and precipitation intensity.

The two catchments included in the First Flush Study represented typical highway stormwater drainage areas: small, highly impervious, rapidly responding catchments. Due to the highly impervious catchment areas, the response time between rainfall occurrence and runoff occurrence is very short during a storm event.

4.2.2 Data Collection

Runoff data were collected at both of the First Flush Study Catchments. The two technologies employed to measure and record the flow rates for this study were: (1) the American Sigma 960 Area Velocity flow meter and (2) the American Sigma 950 Bubbler flow meter.

This equipment continuously monitored the velocity and/or depth of flow. From these two measurements, flow rates were calculated. The velocity and depth measurements, along with the flow calculations, were recorded at five-minute intervals.

4.2.3 Data Summary

Runoff and rainfall data for each station and storm event are presented in a graphical format in Appendix A. The top plot of each figure provides the flow hydrograph and rainfall hydrograph.

Table 4-4 presents runoff data for the 1999-2000 season. The table presents, by station, the drainage area, total volume of precipitation measured for sampled storm events, and the total volume of runoff expressed in both cubic-feet and an equivalent depth in inches over the catchment drainage area. The runoff/rainfall ratio is used to calculate the average runoff coefficient for each station.

The relatively high value for the runoff coefficients for both sites is indicative of catchments dominated by impervious surfaces. High values of runoff coefficients are common for highway facilities.

Table 4-4
1999-2000 Summary of Total Rainfall, Total Runoff Volume, and Estimated Runoff Coefficient for Sampled Station Storms

Station ID Number	*Drainage Area (ac)*	*Total Precipitation For Sampled Station Storms (inches)*	*Total Runoff For Sampled Station Storms*		*Estimated Runoff Coefficient*
			Volume (cubic feet)	*Depth* (inches)	
1	11.9	8.21	280,489	6.49	0.79
14	0.6	5.97	10,873	0.57	0.88

4.3 Monitoring Network Performance

A total of eight storm events were monitored during the 1999-2000 season, the number targeted in the Sampling and Analysis Plan (CTSW-RT-99-074). However, the first storm event of the wet season was missed at both locations. A storm event occurred on December 31, 1999. A total of 0.25 inches of rain was recorded at Station 1 and 0.52 inches of rain were recorded at a rain gauge located across the freeway from Station 14 for this event.

On average 11 to 12 discrete water quality samples were collected during each monitoring event. The number of discrete samples per event ranged from five to 18. The sample times are shown on the hydrographs presented in Appendix D for each station-storm event.

4.4 Water Quality Results

4.4.1 Background

Storm water runoff quality and rain water quality were evaluated using the suite of parameters listed in Table 3-1. Samples of both storm water and rain water were collected and sent to a laboratory for analysis of these parameters. The results of these analyses provided the data required to characterize the quality of both runoff and rain.

4.4.2 Quality Assurance/Quality Control (QA/QC)

QA/QC procedures were implemented for the sample collection and analysis portions of the First Flush study to ensure the water quality data were of known quality and met the project objectives. Procedures were established for both field and laboratory work. A detailed discussion of the procedures and findings of the QA/QC review process are included in Appendix C.

QA/QC procedures applied in the field were associated with the sample collection. They included standard operating procedures for collection methods and sample handling, thorough documentation for labeling bottles and completing chain-of-custody forms, and the collection of equipment blank and duplicate samples.

QA/QC procedures applied in the laboratory were associated with analysis of the water quality samples. They included standard operating procedures established for the specified analytical methods, purity of standards, solvents and reagents used in the analytical processes, certification of equipment calibration, and the routine analysis of method blanks, equipment blanks, laboratory control samples, and matrix spike samples. Refer to Appendix C for a more detailed description of the laboratory QA/QC procedures.

The results were reported by the laboratory in a standardized format. Upon receipt of each report, the data were completely reviewed and evaluated to determine if the data met the quality objectives established for the First Flush study. Initially, each laboratory report was screened for completeness. Following the screening, a more complete review process was performed which focused on laboratory performance. Based on this evaluation, each data point was flagged with an indicator of its quality. Data were furthered evaluated in terms of the accuracy of the compositing procedures and its representativeness of the storm event. Data from a specific station and storm event were removed from the dataset if either evaluation found a significant deficiency. Refer to Appendix C for a more detailed description of this data quality evaluation and results.

4.4.3 Storm Water Analytical Data Summary

All the storm water runoff analytical data generated during 1999-2000 monitoring season are provided in tabular format in Appendix B. The data are listed by station number and storm event for each parameter.

Table 4-5 summarizes the data generated by the 1990-2000 storm water monitoring program. The table includes both analytical parameters and in situ water quality parameters. The data summaries are presented in terms of a number of samples, maximum and minimum values, and mean, median and standard deviation of all data. Only the data meeting the quality objectives of the project were used to generate this summary. The mean values in Table 4-5 represent the arithmetic mean of all the discrete values from the given runoff event, not the flow-weighted mean that is often used to represent the event-mean concentration of the event. To show the variances at each site and storm event, these same statistics are presented for each station-storm event included in Appendix B.

Dissolved cadmium was the only parameter with the majority of the results below the laboratory's reporting limits. All other parameters were present at levels above the reporting limits.

The final column in Table 4-5 presents mean concentrations for storm water data collected at Caltrans facilities during the period of 1997 to 1999. This information is presented as a means of qualifying the representativeness of the runoff data from the First Flush study.

A comparison of the concentrations from the First Flush study to the means of the Caltrans 1997-99 data set indicates the First Flush data are representative of typical runoff quality from Caltrans facilities. There were several exceptions. Concentrations of nitrate from the First Flush study tended to be higher than levels typically found in runoff from Caltrans facilities and the concentrations of coliform bacteria, and oil and grease from the First Flush study were lower.

Table 4-5
Constituents Statistics

Constituent			N (1)	Minimum	Maximum	Median	Mean	Std Dev	Caltrans Data (2)
Flow		(cfs)	167	0.00	10.66	0.04	0.47	0.92	
Precipitation		(in)	2080	0.00	0.12	0.00	0.01	0.01	
Cadmium	Dissolved	(ug/L)	177	0.25	1.40	0.25	0.29	0.15	0.45
	Total		177	0.25	8.20	1.00	1.31	1.22	1.25
Chromium	Dissolved	(ug/L)	177	0.50	7.00	2.00	2.06	1.02	3.01
	Total		177	1.00	70.00	7.00	8.63	8.45	12.1
Copper	Dissolved	(ug/L)	177	2	118	9	15	17	16
	Total		177	10	306	36	49	41	50
Nickel	Dissolved	(ug/L)	177	1	59	2	4	7	5
	Total		177	2	90	8	10	11	15
Lead	Dissolved	(ug/L)	177	1	197	7	9	15	7
	Total		177	10	1420	126	168	180	121
Zinc	Dissolved	(ug/L)	177	7	496	39	64	79	89
	Total		177	50	1960	196	272	247	231
Phosphorus	Dissolved	(mg/L)	177	0.05	8.10	0.15	0.29	0.64	0
	Total		176	0.11	17.00	0.30	0.59	1.57	0.29
Hardness	(as CaCO3)	(mg/L)	177	16	328	42	58	50	59
Nitrate	(as N)	(mg/L)	177	0.15	9.40	0.65	1.01	1.23	0.22
SS		(mg/L)	177	2.00	1,600	81	145	197	161
TOC		(mg/L)	176	3.60	171	10	18	23	
Oil & Grease		(mg/L)	176	0.50	38	3	4	5	14
Coliform	Total	(MPN/100 ml)	177	10.00	30,000	800	2,225	3,623	30,570
	Fecal		177	10.00	58,000	130	936	4,493	8,200
pH		(pH units)	177	6.56	11.52	7.77	7.88	0.88	
Conductivity		(umhos/cm)	165	20	800	100	152.55	166.74	
Temperature		(°C)	152	10	17.5	12.64	12.99	2.10	

Notes:

(1) Number of data points

(2) Comilation of stormwater runoff data from Caltrans facilities during 1997-1999.

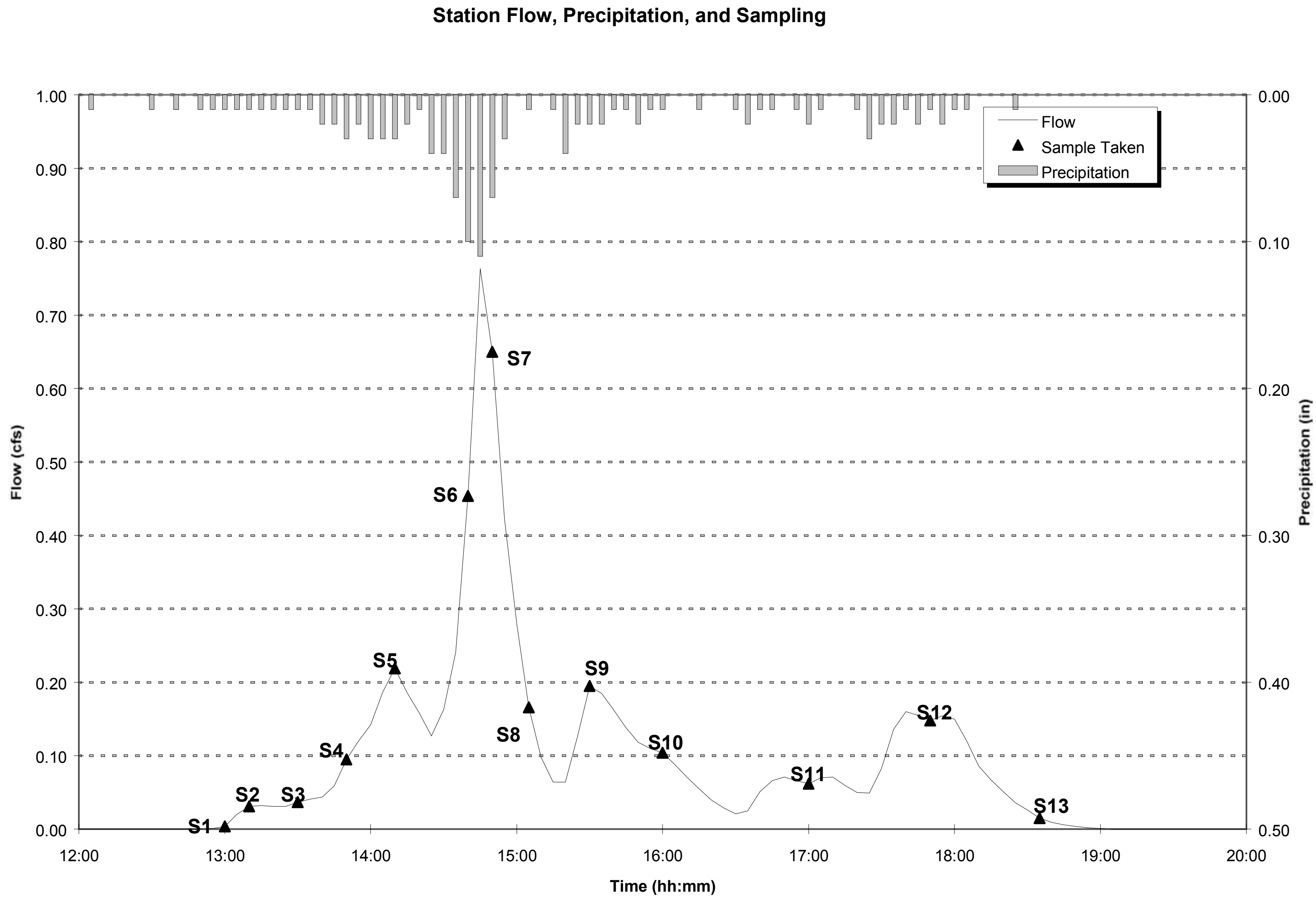


Figure 3-1
Typical Rainfall Hyetograph and Flow Hydrograph

3.3 Key Water Quality Constituents

The selection of the key water quality constituents for the First Flush Study was initially based on the constituents currently included in the Caltrans Drain Inlet Cleaning Efficacy (DICE) Study Water Quality Monitoring Program. The original criteria applied to the selection of the key constituents in the DICE Study included:

1. Constituents that are likely to be found in detectable concentrations in highway runoff;

2. Constituents that are likely to be associated with particulates; and

3. Constituents that have been identified as parameters of concern in the Santa Monica Bay (MBC Applied Environmental Sciences, 1994).

A total of 24 constituents were selected for the First Flush Study taking into account the above criteria, as well as budgetary considerations. Selection of constituents included the addition of indicators for bacteria and petroleum-based products. All of the storm water analytical parameters applied to the First Flush Study are summarized in Table 3-1. The table also lists the sampling method, EPA method used in the analytical analysis of the samples, unit, and the laboratory reporting limit for each of the constituents.

Table 3-1
Summary of Analytical Methods, Caltrans First Flush Study

Parameter	***Units***	***Sampling Method***	***EPA Analytical Method Number***	***Reporting Limit***
Metals (Total and Dissolved)				
Cadmium	ug/L	Manual Grab	200.8	1
Chromium	ug/L	Manual Grab	200.8	1
Copper	ug/L	Manual Grab	200.8	1
Lead	ug/L	Manual Grab	200.8	1
Nickel	ug/L	Manual Grab	200.8	1
Zinc	ug/L	Manual Grab	200.8	1
Nutrients				
Total Phosphorus	mg/L	Manual Grab	365.3	0.10
Dissolved Phosphorus	mg/L	Manual Grab	365.3	0.10
Nitrate-N	mg/L	Manual Grab	300.0	0.10
General				
Total Suspended Solids	mg/L	Manual Grab	160.2	4
Oil & Grease w/ TRPH	mg/L	Manual Grab	1664	5
TOC	mg/L	Manual Grab	415.1	0.5
Hardness	mg/L	Manual Grab	130.2	2
Total Coliform	MPN/100 mL	Manual Grab	SM9221B	2
Fecal Coliform	MPN/100 mL	Manual Grab	SM9221E	2
pH	pH	In situ	Field meter	0.01
Temperature	°C	In situ	Field meter	0.1
Specific conductivity	µmho/cm	In situ	Field meter	4.0 µmho/cm

[a] All metal analyses may be conducted using the indicated required volume.
mg/L=milligrams per liter
ml=milliliter
[*] No preservation at time of collection, preservation at lab within 48 hours of collection.

Section 5
Analysis of Monitoring Results

5.1 Overview of Analysis

A critical component of the First Flush Study was to utilize the collected data to assess and determine the changes that occur in the quality of storm water runoff throughout storm events. Results of these analyses were used to answer the following questions:

- Do the highest concentrations typically occur during the first portion of the runoff event?
- How do the concentrations react to higher rainfall intensities or higher runoff rates?
- Do the trends of individual pollutant react differently or the same as the other pollutants?

This section provides the results of the data analyses that were performed to evaluate the collected data.

5.2 Analysis Methodology

A series of data analyses was conducted as part of the evaluation to define trends in the water quality. These analyses included variability in constituent concentrations, time-series graphs, and correlation to rainfall and runoff.

Variability of Water Quality. The relative variation in the water quality concentrations over the course of individual runoff events and the monitoring season was evaluated from the values of the standard deviation, percent coefficient of variance (CV), and the relative percent difference (RPD).

Time-Series Graphs. For each storm event with sampling results, a series of time-series graphs have been generated using the collected data. These graphs plot rainfall, flow rate, and pollutant concentrations. The graphs of rainfall volumes versus time are known as hyetographs. The graphs of instantaneous flow rates versus time are known as hydrographs. The graphs of pollutant concentrations from the discrete samples versus time are known as pollutographs. The graphs representing the same storm event were generated for the same period of time to facilitate a comparison between the different parameters. Comparison of the various pollutographs to the hydrographs and hydrographs were used to define the impact timing, rainfall intensity, and flow rate has on runoff quality. These graphs are presented in Appendix A.

Correlation to Rainfall and Runoff. To identify the impact rainfall intensity and flow rate has on runoff quality, X-Y graphs were developed that compared the concentrations of the individual water quality constituents to:

- Rainfall volume (total volume of rainfall that fell within the 15 minutes preceding the sampling time)

- Flow rate (instantaneous flow rate at the time the samples were collected)

Total volume of rainfall for the 15 minutes preceding the sampling time was applied to compensate for the time of concentration at both catchments.

A linear regression analysis was performed to calculate the correlation coefficient (r^2) for each comparison. The value of r^2 identified the level of correlation of the water quality concentrations with rainfall intensity and flow rate.

5.3 Results

5.3.1 Variability in Water Quality

All the water quality constituents demonstrated some level of variation over the course of the monitoring season and within individual runoff events. However, the level of variability was different for each constituent.

To demonstrate the changes in water quality on a seasonal basis, Table 5-1 presents the mean concentration of each constituent for each individual runoff event that was monitored. This mean represents the arithmetic mean of all the discrete values from the given runoff event, not the flow-weighted mean that is often used to represent the event-mean concentration of the event. Flow-weighted means are included in the statistics presented in Appendix B for each station-storm

At Site 1, the highest concentrations for the season for most constituents occurred during the first monitored storm event (Storm 1). For the majority of the constituents, the concentrations during this event were two to eight times higher than the concentrations of the seven subsequent events. At Site 14, the highest concentrations for the season occurred during the first and eighth monitored storm events (Storms 1 and 8) for a majority of the constituents.

The reason for the higher concentrations during Storms 1 and 8 may be the length of the antecedent dry period that preceded both events. The antecedent periods for Storms 1 and 8 were 25 days and 39 days, respectively. Compare these periods to the antecedent dry periods of the remaining six storm events that only ranged from one to four days as shown on Table 5-1.

The volume of rainfall does not appear to be an influence on runoff quality because rainfall volumes were very different between Storms 1 and 8. The totals for Storm 8 were over twice the amount recorded during Storm 1 as shown on Table 5-1. The intensity of the rainfall was also different between Storm Events 1 and 8. The intensity during Event 1 was low and steady, averaging 0.01 inches per five-minute interval. The intensity during Event 8 ranged between 0.01 and 0.09 inches per five-minute interval.

Table 5-1
Station-Storm Mean Concentrations

Storm	Site	Rain (in.)	Antecedent Dry Conditions (days)	Cadmium Dissolved (ug/L)	Cadmium Total (ug/L)	Chromium Dissolved (ug/L)	Chromium Total (ug/L)	Copper Dissolved (ug/L)	Copper Total (ug/L)	Nickel Dissolved (ug/L)	Nickel Total (ug/L)	Lead Dissolved (ug/L)	Lead Total (ug/L)
1	1	0.60	25	0.25	2.39	2.9	20.1	25.7	93.6	5.2	23.7	5.1	715.9
2	1	0.91	2	0.36	1.06	1.8	11.0	14.3	46.5	2.9	11.5	58.0	320.3
3	1	1.05	3	0.25	0.37	2.6	4.1	5.9	17.0	1.3	3.9	12.1	90.7
4	1	1.67	2	0.25	0.95	2.0	8.4	7.4	36.7	1.3	8.1	14.0	223.0
5	1	0.43	4	0.25	0.69	1.9	14.6	8.7	30.3	2.0	6.1	8.4	114.4
6	1	0.62	1	0.25	0.25	1.2	2.0	4.0	12.7	0.6	2.3	4.9	47.6
7	1	1.08	1	0.25	0.85	2.1	6.3	10.8	29.9	1.2	6.8	13.1	180.7
8	1	1.69	39	0.25	1.15	2.4	9.0	13.4	48.0	3.2	10.4	12.5	227.6
1	14	N/A	N/A	0.58	2.39	2.6	12.9	55.8	119.8	13.8	22.6	4.6	228.4
2	14	0.76	2	0.27	1.21	0.7	8.9	11.0	48.9	2.4	9.1	3.6	95.1
3	14	0.81	4	0.25	2.22	2.2	6.4	10.3	41.3	2.7	7.5	4.3	76.7
4	14	0.98	2	0.25	1.59	2.2	9.6	14.8	61.4	3.6	10.6	10.5	145.9
5	14	0.16	4	0.25	0.80	2.3	5.0	21.3	42.2	5.3	8.5	4.8	46.3
6	14	0.78	1	0.25	0.44	0.8	2.8	6.8	19.7	1.4	3.6	2.2	29.4
7	14	0.83	3	0.25	1.23	1.9	6.7	11.3	47.2	2.9	7.9	8.0	113.5
8	14	1.26	39	0.49	3.30	3.1	19.2	38.9	126.3	16.2	32.3	10.2	233.2

Table 5-1
Station-Storm Mean Concentrations

Zinc Dissolved (ug/L)	Zinc Total (ug/L)	Phosphorus Dissolved (mg/L)	Phosphorus Total (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrate (as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Oil & Grease (mg/L)	Coliform Total (MPN/100 ml)	Coliform Fecal (MPN/100 ml)	pH (pH units)	Conductivity (umhos/cm)	Temperature (°C)
38.9	420.6	0.75	0.94	183	2.99	460	45	4.00	4178	421	8.46	147	15.5
50.5	220.5	0.46	0.58	70	1.11	251	17	0.88	2380	65	7.96	62	12.8
18.6	85.9	0.11	0.27	36	0.66	143	8	1.61	745	517	7.82	99	N/A
19.6	184.4	0.16	0.35	49	0.60	137	10	1.92	1658	341	7.36	N/A	11.8
32.7	159.0	0.16	0.37	41	1.33	130	11	2.14	569	73	7.98	80	13.1
19.9	70.5	0.13	0.20	26	0.45	23	4	1.19	99	13	6.81	48	10.5
17.6	169.2	0.11	0.26	47	0.56	120	8	2.92	538	162	7.65	75	10.4
37.3	227.2	0.24	0.59	76	1.49	196	14	5.25	2198	885	9.73	154	N/A
261.4	639.3	0.70	0.83	107	2.80	136	68	16.13	5250	1968	7.77	264	15.3
64.7	296.3	1.50	2.81	38	0.41	156	16	0.93	2319	206	9.51	73	13.1
57.5	265.5	0.14	0.23	36	0.46	89	11	3.73	257	87	7.32	79	14.6
65.6	324.9	0.17	0.27	50	0.70	77	15	4.76	4865	1875	8.57	120	12.9
163.7	248.0	0.22	0.28	49	0.90	39	18	6.83	1027	67	8.31	1154	15.4
49.2	139.6	0.09	0.15	27	0.35	26	6	2.58	103	23	6.87	658	10.9
60.5	266.3	0.14	0.29	45	0.54	96	12	4.03	5227	1405	8.02	99	12.1
168.5	750.5	0.48	2.28	110	2.43	398	50	13.25	3797	957	6.99	185	16.5

No explanation can be given for the higher concentrations at Site 14 during Storm 8, but not at Site 1 as well (Although the concentrations at Site 1 for Storm 8 were relatively high, they were more comparable to the concentration of Storms 2-7 than Storm 1). The reason may be site specific factors that have not been characterized or the impact of a larger drainage area. The catchment area at Site 1 is 12 acres, compared to 0.6 acres that drain to Site 14.

A review of the pollutographs in Appendix A demonstrates how the water quality varies during each of the monitored runoff events. The variability is also demonstrated by analyzing the basic statistical distribution (mean, median, standard deviation, minimum value, and maximum value) of each water quality constituent. These distributions are presented for each constituent and monitored event at the bottom of the tables found in Appendix B. The distribution for the combined set of data (e.g., both sites and all events) is presented in Table 4-5.

A review of the tables in Appendix B and Table 4-5 reveals the constituents with the highest level of variability (i.e. highest values for the standard deviation) during individual storm events are total and fecal coliform bacteria, total suspended solids (SS), zinc (total and dissolved), total lead, total copper, and hardness. The constituents with the lowest level of variability (i.e. lowest values for the standard deviation) include cadmium (total and dissolved), dissolved chromium, phosphorus (total and dissolved), nitrate, pH, and water temperature.

The values for the coefficient of variation (CV) were calculated for each constituent for each station-storm. The results are included at the bottom of each table in Appendix B. A summary of this information is presented in Table 5-2. The information presented in Table 5-2 was calculated from a combined data set of all the individual CV values from Sites 1 and 14. From this combined data set, the mean of all CV values was calculated, along with the standard deviation, maximum value and minimum value. These statistics are presented in Table 5-2 and can be used to assist in identifying the individual constituents with the highest and lowest level of variability.

A review of Table 5-2 reveals the mean CV values were all greater than zero, indicating some level of variability for all constituents. The majority of constituents had mean CV values that ranged between 35% and 55%. The mean CV values for total and fecal coliform bacteria were 102% and 116%, respectively. These represented the highest mean values of all constituents. Other constituents with relatively high mean CV values included total suspended solids (79%) and total phosphorus (61%). The constituents with the lowest mean CV values included dissolved cadmium (13%), pH (3%), and water temperature (5%).

The relative percent difference (RPD) is another value that can be used to identify the variability in the constituents. The value of the RPD was calculated for each constituent for each station-storm. The results are included at the bottom of each

Table 5-2

Summary of CV and RPD Values

Constituents		Percent Coefficient of Variance (CV)				Relative Percent Difference (RDP)			
		Mean	**Minimum**	**Maximum**	**Std Dev**	**Mean**	**Minimum**	**Maximum**	**Std Dev**
Cadmium	Dissolved	13%	0%	91%	27%	26%	0%	139%	46%
	Total	48%	0%	89%	25%	114%	0%	188%	50%
Chromium	Dissolved	37%	20%	95%	19%	93%	40%	164%	43%
	Total	53%	15%	168%	36%	119%	55%	181%	40%
Copper	Dissolved	51%	20%	166%	38%	114%	51%	178%	42%
	Total	36%	11%	71%	18%	95%	35%	159%	39%
Nickel	Dissolved	54%	23%	118%	27%	127%	55%	187%	43%
	Total	43%	12%	86%	20%	108%	33%	162%	41%
Lead	Dissolved	44%	16%	160%	34%	113%	40%	188%	40%
	Total	49%	19%	84%	19%	122%	68%	171%	31%
Zinc	Dissolved	50%	17%	129%	30%	114%	51%	181%	36%
	Total	43%	10%	88%	23%	107%	33%	167%	39%
Phosphorus	Dissolved	44%	15%	194%	44%	97%	38%	186%	42%
	Total	61%	18%	223%	51%	122%	51%	200%	45%
Hardness(as CaCO3)		35%	14%	87%	20%	90%	51%	170%	33%
Nitrate (as N)		51%	25%	131%	27%	116%	65%	185%	32%
SS		79%	24%	172%	42%	151%	59%	198%	41%
TOC		48%	14%	113%	27%	112%	45%	200%	44%
Oil &	Grease	50%	20%	86%	18%	129%	67%	200%	35%
Coliform	Total	102%	36%	221%	48%	172%	91%	197%	25%
	Fecal	116%	65%	203%	36%	178%	120%	200%	25%
pH		3%	1%	10%	3%	10%	4%	33%	8%
Conductivity		41%	16%	100%	26%	101%	55%	173%	40%
Temperature		5%	2%	12%	3%	15%	4%	38%	9%

table in Appendix B. A summary of all the RPD values from both Sites 1 and 14 is presented in Table 5-2.

A review of Table 5-2 reveals the majority of constituents had mean RDP values that ranged between 90% and 120%. None of the constituents had values less than 10%. The mean RPD values for total and fecal coliform bacteria were 172% and 178%, respectively. These represented the highest mean values of all constituents. Other constituents with relatively high mean RPD values included total suspended solids (151%), oil and grease (129%), dissolved nickel (127%), total lead (122%), and total phosphorus (122%). The constituents with the lowest mean RPD values included dissolved cadmium (263%), pH (10%), and water temperature (15%).

5.3.2 Observance of First Flush Impacts

The so-called "first flush" phenomenon is assumed to be demonstrated if the highest concentrations of a constituent occur during the first portion of a runoff event. A review of the pollutographs in Appendix A was performed to identify this trend was observed among any of the water quality constituents and storm events.

Water quality data collected at Site 1 shows higher concentrations during the early portion of the runoff event when compared to concentrations later on in the event. This first flush trend is most evident in the data from Storms 1, 4, 5, 7, and 8. The constituents with the most prevalent First Flush trend are nitrate and total organic carbon (TOC). Conversely, the first flush trend was not always as evident in the concentrations for the bacteria, total suspended solids, and total phosphorus.

Water quality data from Site 14 showed very little impact from the first flush effects. The first flush trend was only prevalent in the nitrate, total organic carbon (TOC), and hardness data (refer to all storm events in Appendix A).

The first flush trend appears to be more pronounced during storm events with low rainfall totals, such as Storms 1 and 5, or storms that start out slow with lower rainfall intensities as in Storms 4, 7, and 8. Why only two constituents (nitrate and TOC) out of 24 demonstrated first flush effects at Station 14 cannot be explained. Again, site specific factors such as the small catchment area may contribute to this observance.

5.3.3 Correlation to Rainfall and Runoff

To identify if any correlation exists between concentrations of the constituents in the runoff and flow rate or rainfall intensity, a graphical and mathematical correlation analysis was performed. A series of X-Y graphs were generated that plot concentration versus both flow rate and rainfall intensity. These graphs are presented in Appendix D.

A linear regression analysis was also performed to calculate the correlation coefficient (r^2) between rainfall or flow rate and the concentrations. The value of r^2 is shown in each plot.

None of the individual r^2 values for any of the constituents were greater than 0.2 (based on value of 1.0 representing perfect correlation) and the average of all r^2 values was less than 0.05. These low values in the correlation coefficient demonstrate very little correlation between observed constituent concentrations and either rainfall intensity or runoff.

A visual inspection of all the X-Y plots in Appendix D shows most plots with scattered patterns, which is also indicative of weak correlation. Two patterns that do emerge are:

1. Almost all the high concentrations are associated with low flows and or low rainfall intensities; not high flow or high rainfall intensities; and

2. Almost all the high flow rates and or high rainfall intensities are associated with low concentrations.

However, the converses of these two patterns are definitely not true (i.e., low concentrations are not associated with just high flow rates and high rainfall intensities; and low flow rates and low rainfall intensities do not only have high concentration.

Section 6
Conclusions

Based on the information contained herein, certain conclusions have been drawn. These conclusions are presented in the following sections.

6.1 Variability of Monitored Constituent Levels

- All the water quality constituents demonstrated some level of variation within individual runoff events based on the values of the standard deviation, coefficient of variation (CV) and relative percent difference (RPD).

- The level of variability was different for each constituent.

- Total and fecal coliform bacteria levels demonstrated the greatest variation of all the constituents. The values for the standard deviation, CV, and RPD for both types of coliform bacteria were the highest of all constitiuents.

- This high degree of variability in coliform bacteria levels that was observed over the course of individual storm events demonstrates the weakness of using single grab samples to accurately characterize levels. Multiple samples are required to ensure the levels are accurately represented. This protocol will require field crews to be present at the monitoring station throughout each event.

6.2 Factors Influencing in Water Quality

- The antecedent dry condition was the only factor that appeared to influence the water quality of the runoff. The water quality concentrations of runoff preceded by extended dry periods (greater than 20 days) tended to be higher than the runoff preceded by short dry periods (less than four days). Additional monitoring should be performed in order to expand the range of antecedent dry periods included in the study.

- No correlation was demonstrated between the concentrations of the water quality constituents and the instantaneous flow rate at the time the discrete samples were collected.

- No correlation was demonstrated between the concentrations of the water quality constituents and the volume of rainfall that occurred within the 15 minutes preceding the time the discrete samples were collected. A review of the hydrologic data (rainfall and flow) indicated that a change in the 15-minute period to either a longer or shorter time period would not impact the results of the correlation analysis. This is likely due to the short time of concentration at both sites and the low variability in the rainfall.

6.3 First Flush Trends

- A portion of the constituents monitored at Site 1 demonstrated first flush trends (within individual storms) for five out of the eight monitored events (Events 1, 4, 5, 7, and 8). The concentrations of nitrate and total organic carbon were consistently higher at the beginning of Events 1, 4, 5, 7, and 8. Levels of coliform bacteria, pH, oil and grease, and water temperature did not demonstrate first flush trends during any of the eight monitored events. The concentrations of the remaining constituents were inconsistent in demonstrating first flush trends.

- First flush trends were not as prevalent at Site 14. Only the concentrations for nitrate and total organic carbon were consistently higher at the beginning of the runoff events.

- Additional monitoring should be performed at other locations in order to expand the range of drainage area conditions included in the study to identify the factors that may influence the first flush phenomenon.

6.4 Hydrology

- The 1999-2000 wet-weather season was a drier year for rainfall when compared to the historical long-term average for the period of October to February.

- The majority of the rain fell within a six-week period. As a result, the monitored storm events only included two antecedent dry periods, greater than 20 days and four days or less.

- The relatively high value for the runoff coefficients for both sites (0.8 and Site 1 and 0.9 at Site 14) is indicative of catchments dominated by impervious surfaces.

6.5 Water Quality

- All the water quality constituents except for dissolved cadmium were typically present in the runoff at both Sites 1 and 14 at levels above the reporting limits established for the First Flush Study.

- The water quality of the runoff from the First Flush Study was comparable to the water quality of runoff from other Caltrans facilities.

Section 7
References

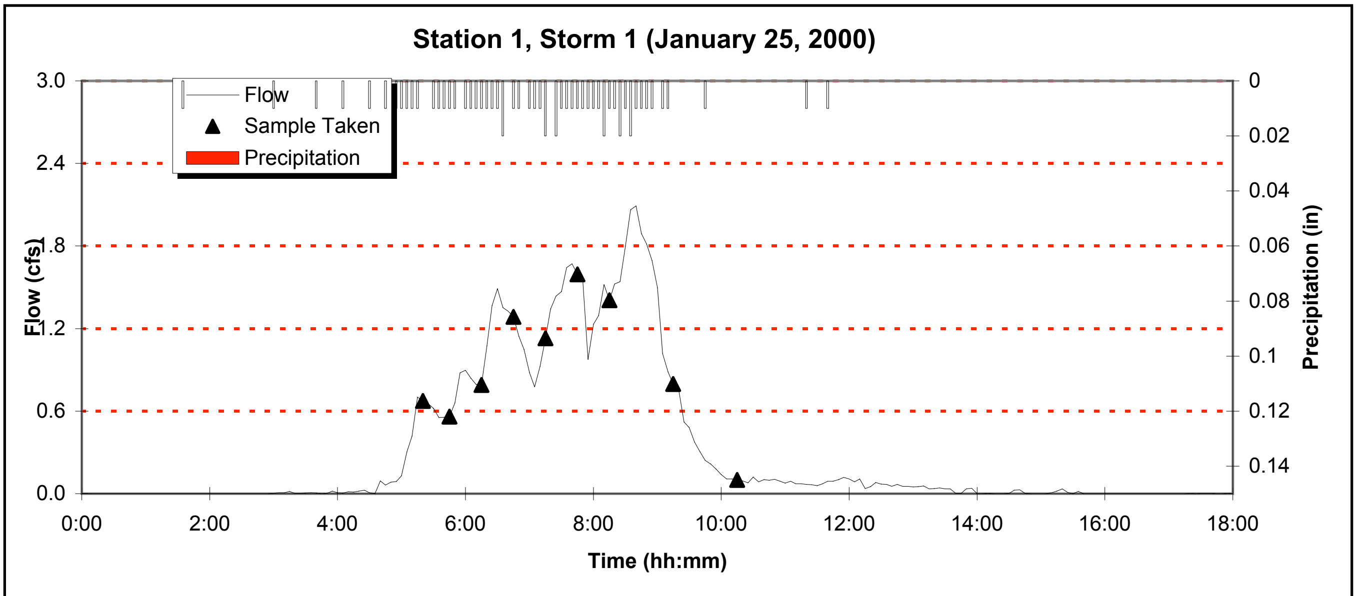
Camp Dresser & McKee Inc. 1999. *Caltrans First Flush Study Sampling and Analysis Plan* (CTSW-RT-99-074). Prepared for California Department of Transportation, Office of Environmental Engineering, Sacramento, California, November 1999.

Camp Dresser & McKee Inc. 1994. Watershed Management Model (WMM) Version 3.30 User's Manual.

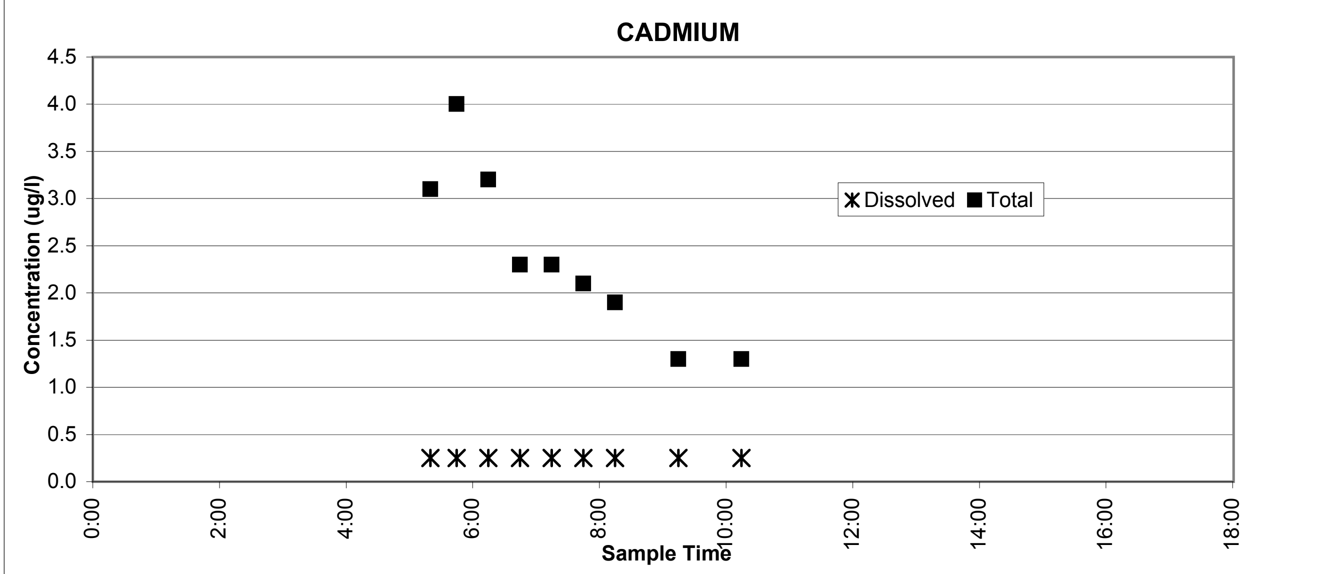
MBC Applied Environmental Sciences. 1994. Characterization Study of the Santa Monica Bay Restoration Plan, State of the Bay 1993. January.

Appendix A
Summary of Runoff Data

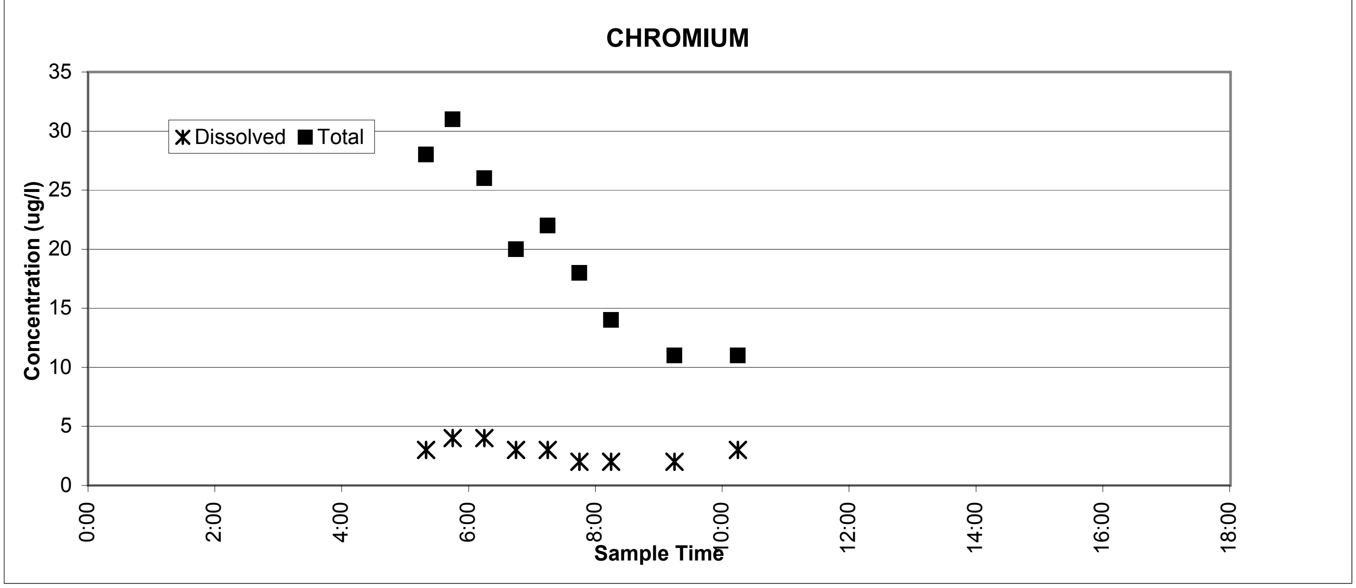
Appendix A-1
Runoff Data from Station No. 1



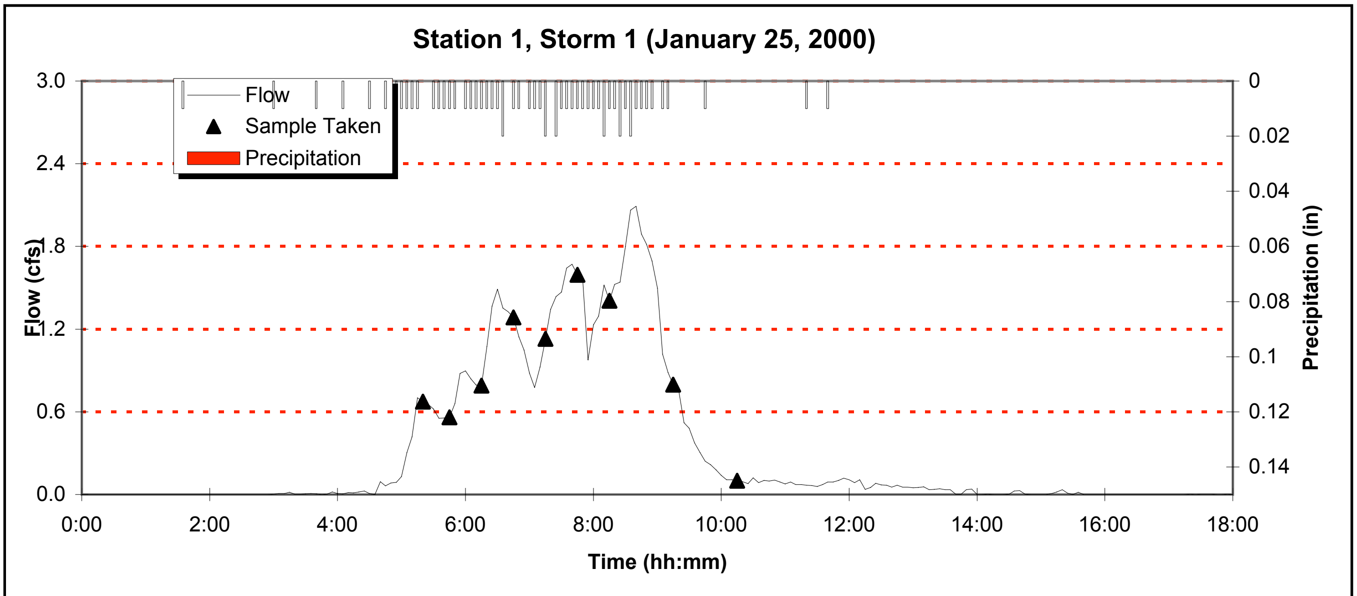
Station 1, Storm 1 (January 25, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

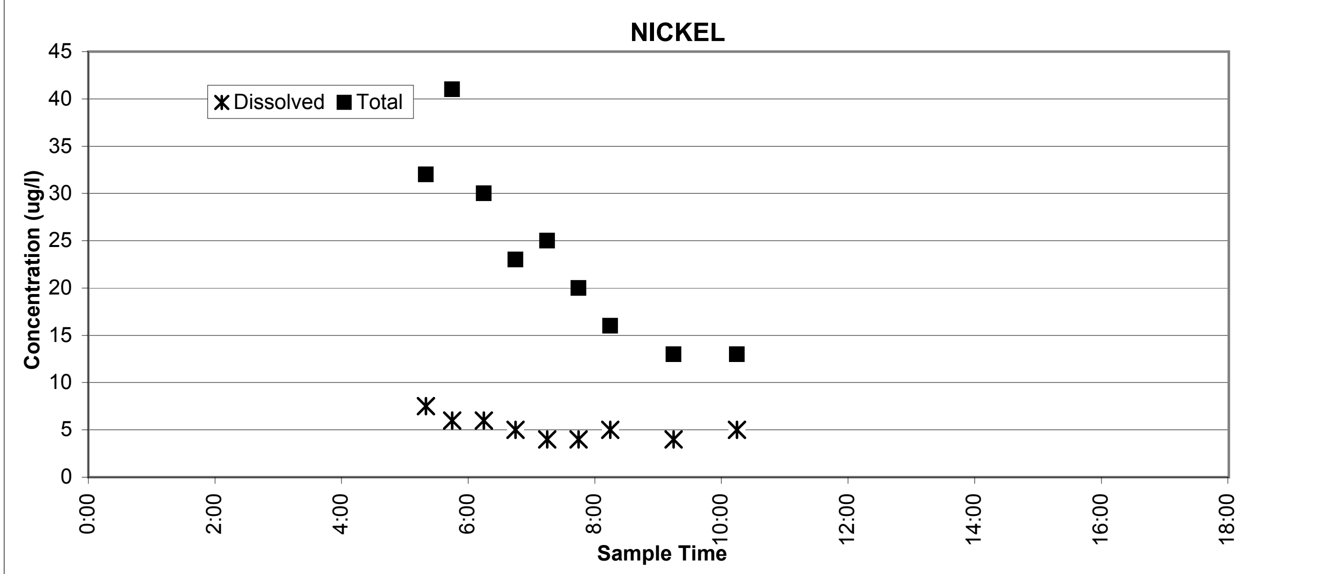


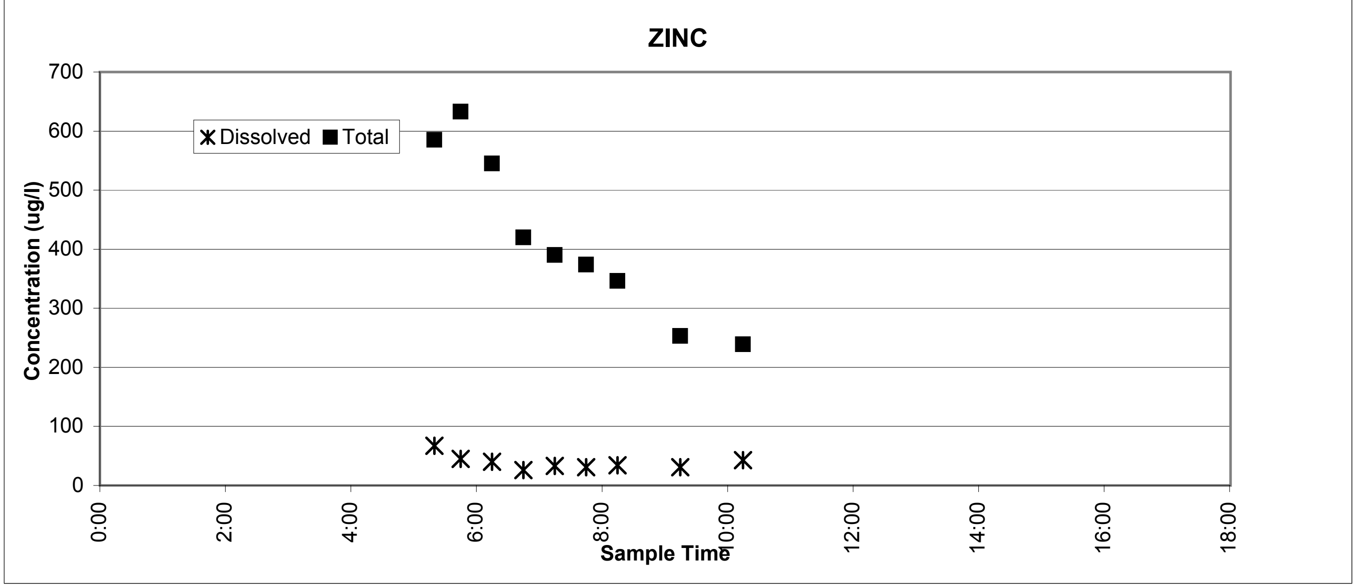
CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time

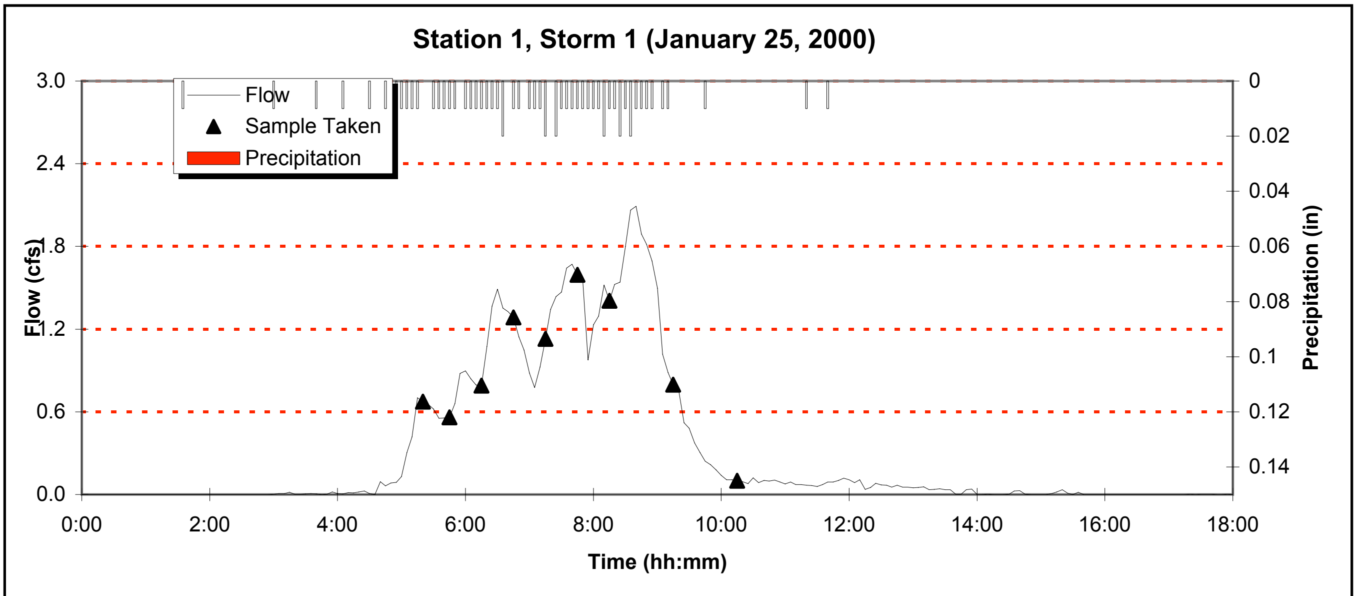


CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time

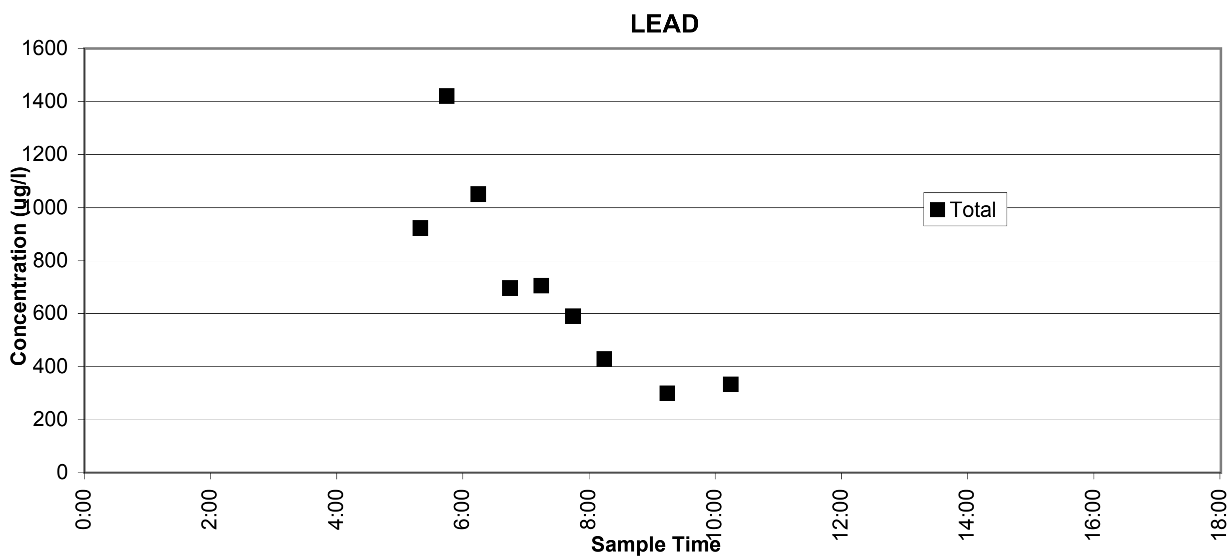

Station 1, Storm 1 (January 25, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time

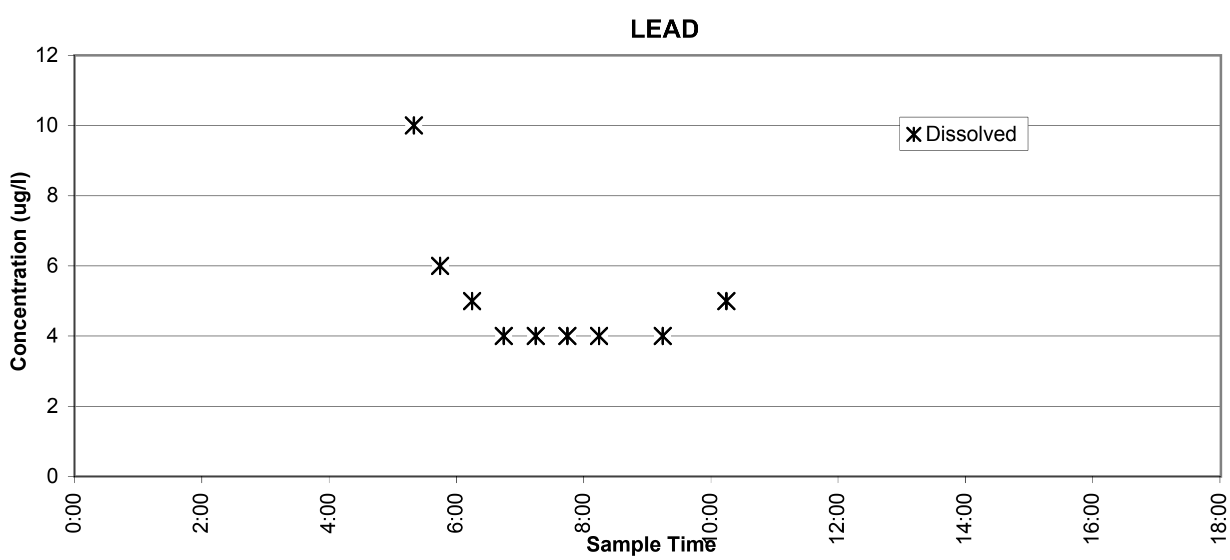

ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time



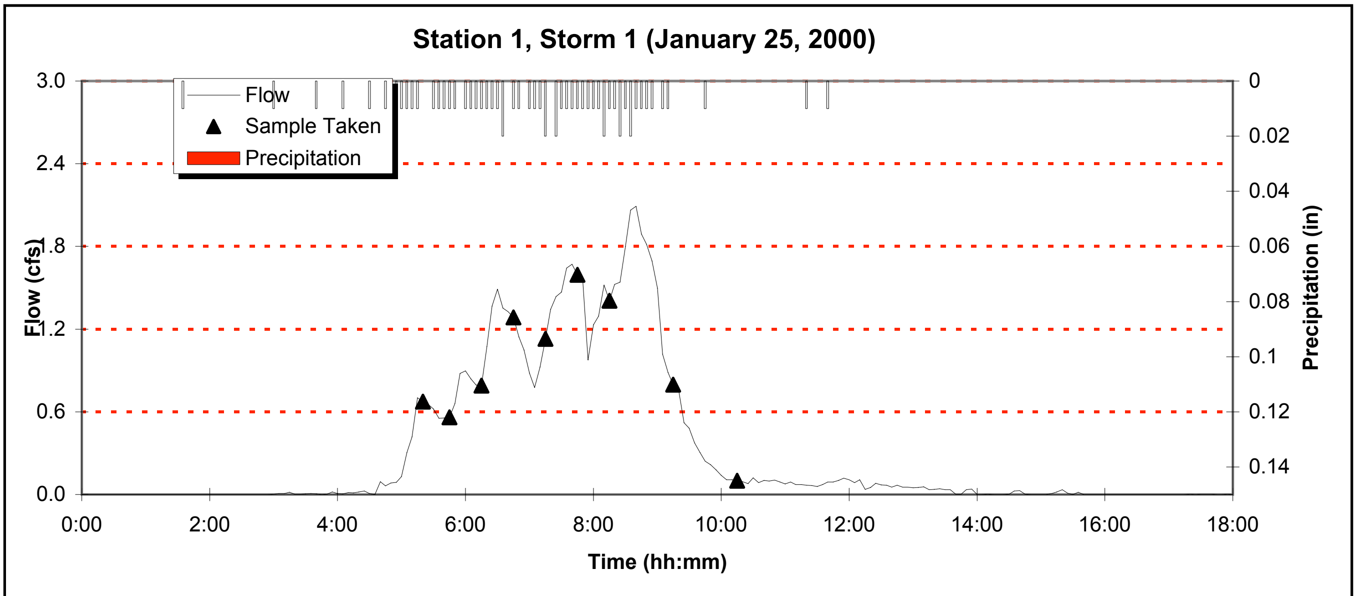
Station 1, Storm 1 (January 25, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



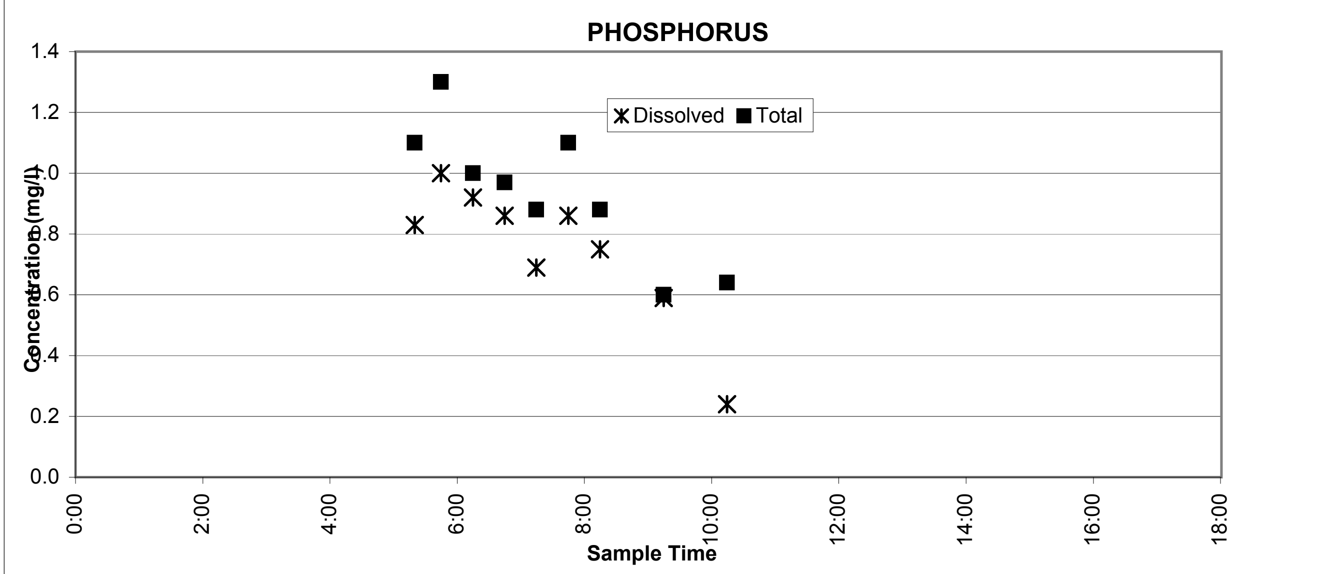
LEAD
Total
Concentration (ug/l)
Sample Time



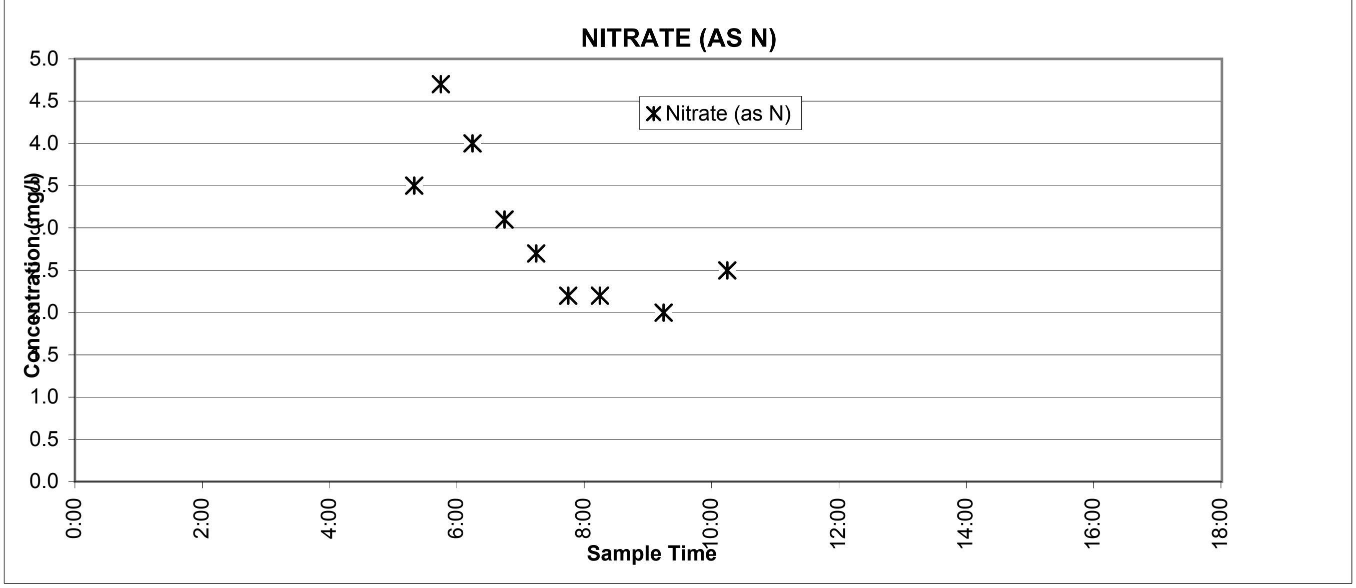
LEAD
Dissolved
Concentration (ug/l)
Sample Time



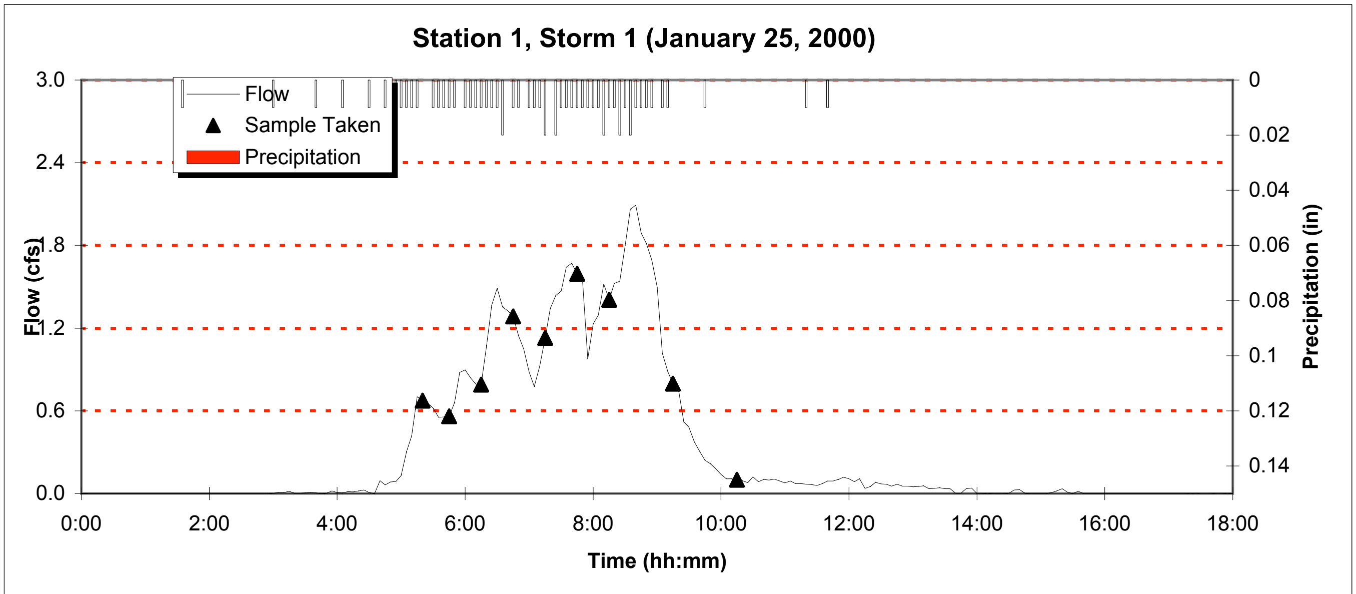
Station 1, Storm 1 (January 25, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



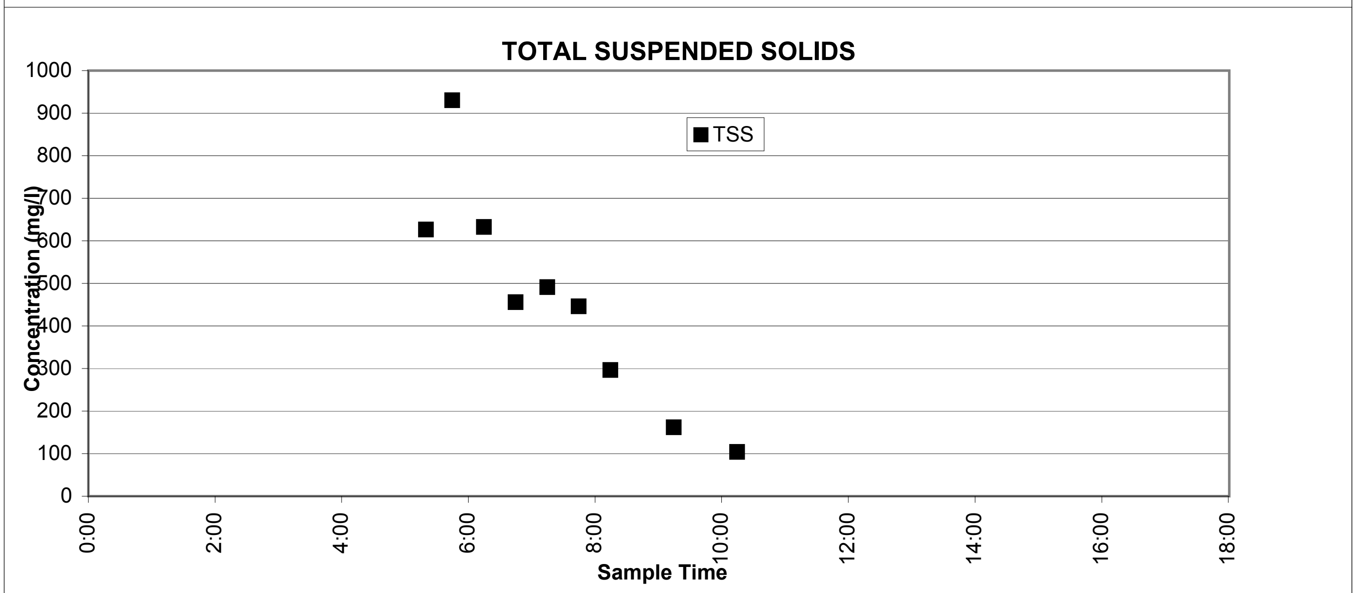
PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time



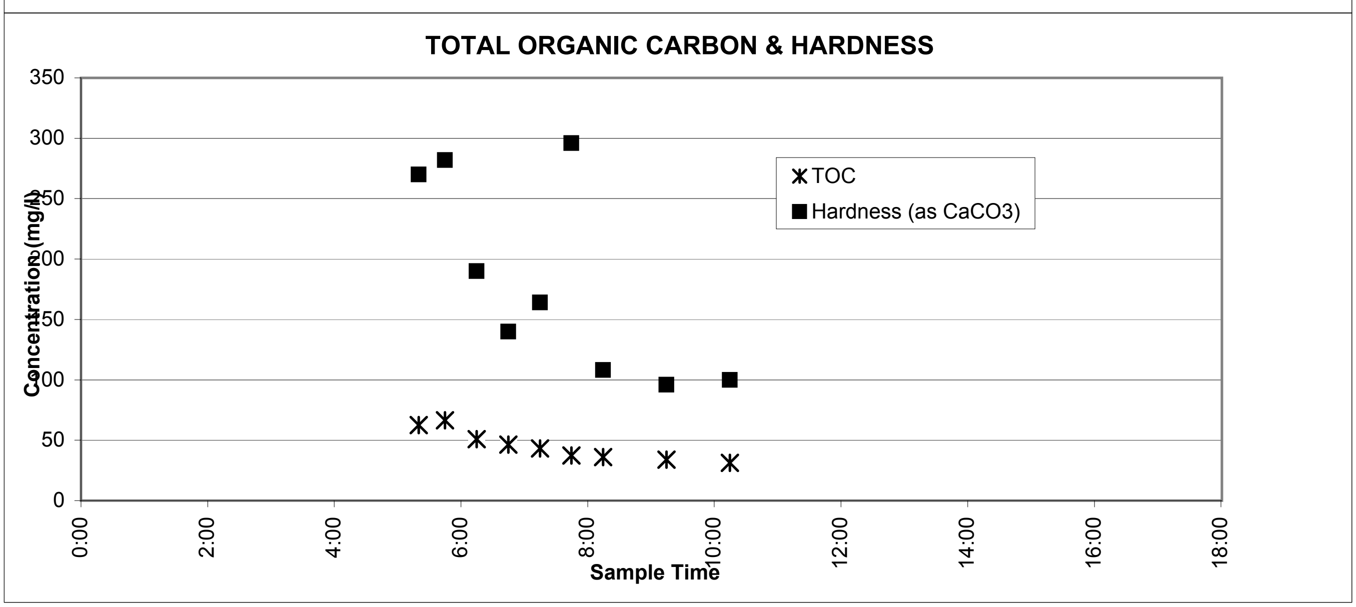
NITRATE (AS N)
Nitrate (as N)
Concentration (mg/l)
Sample Time



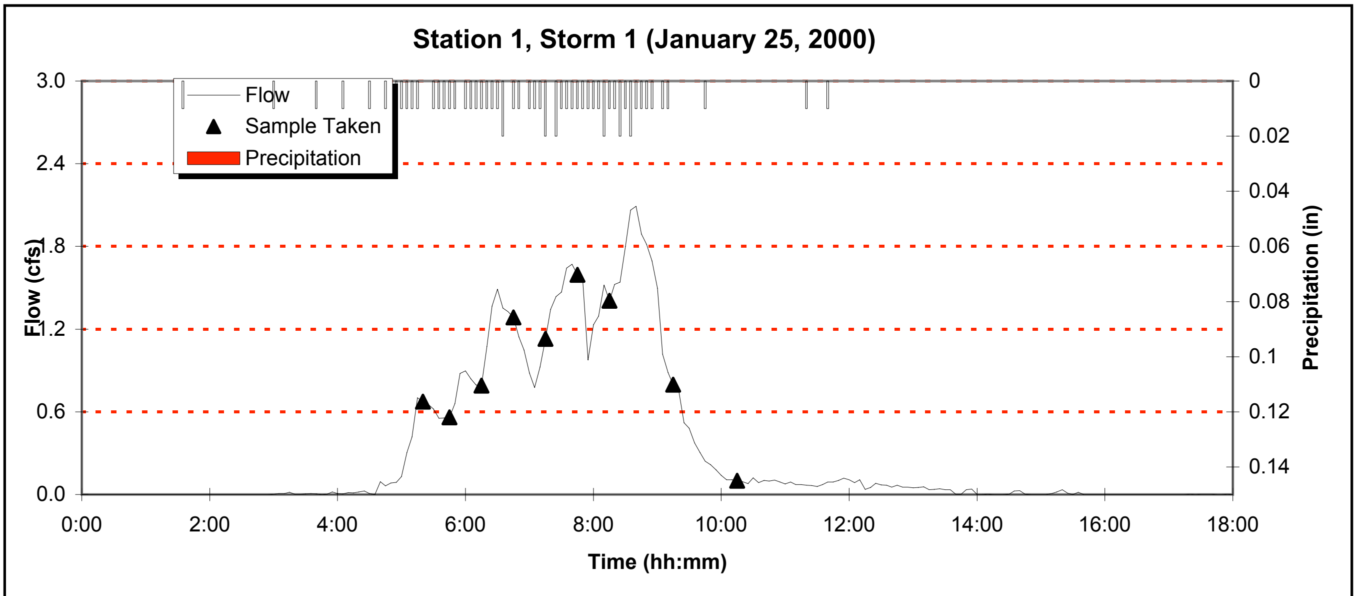
Station 1, Storm 1 (January 25, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



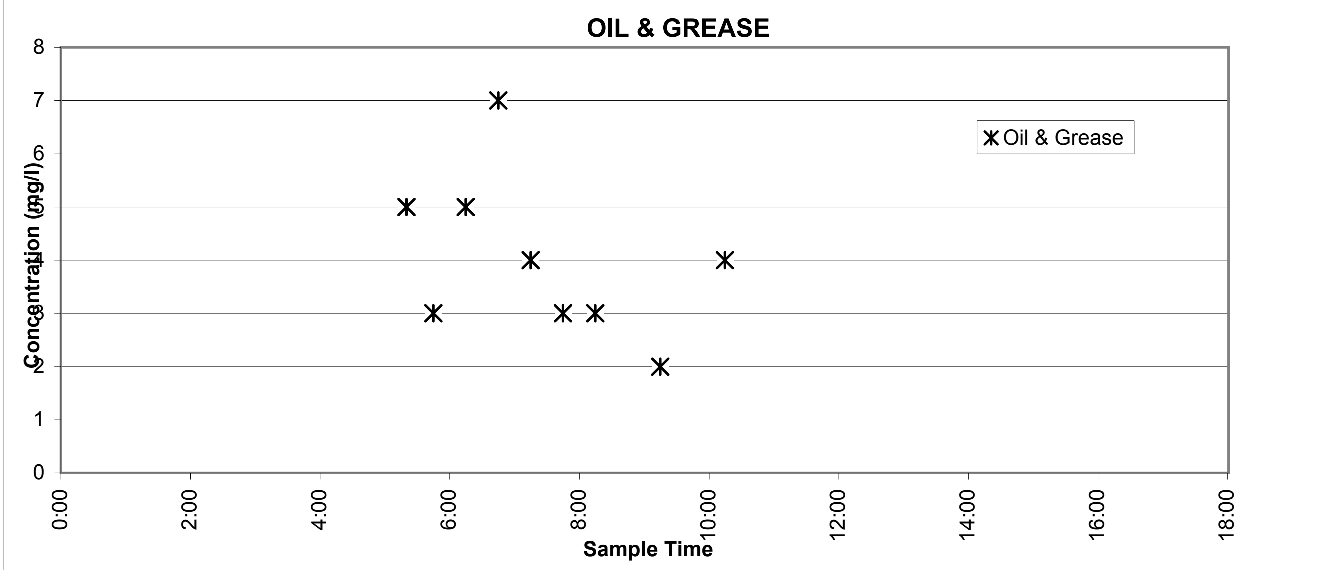
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time



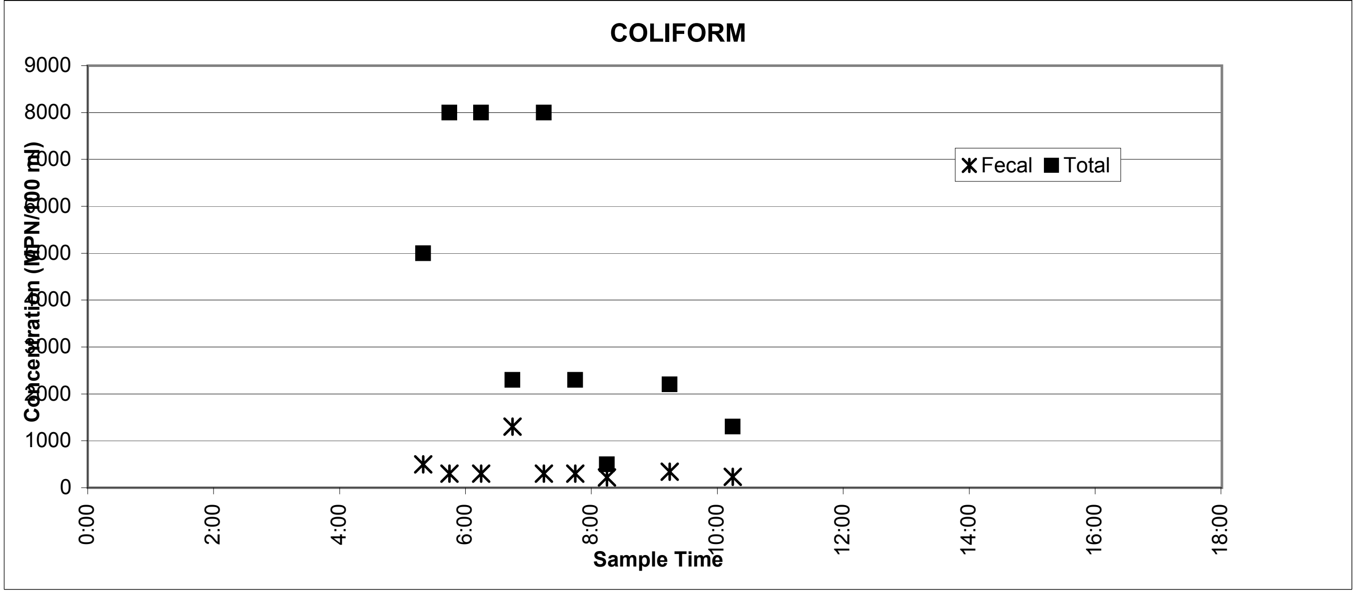
TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time



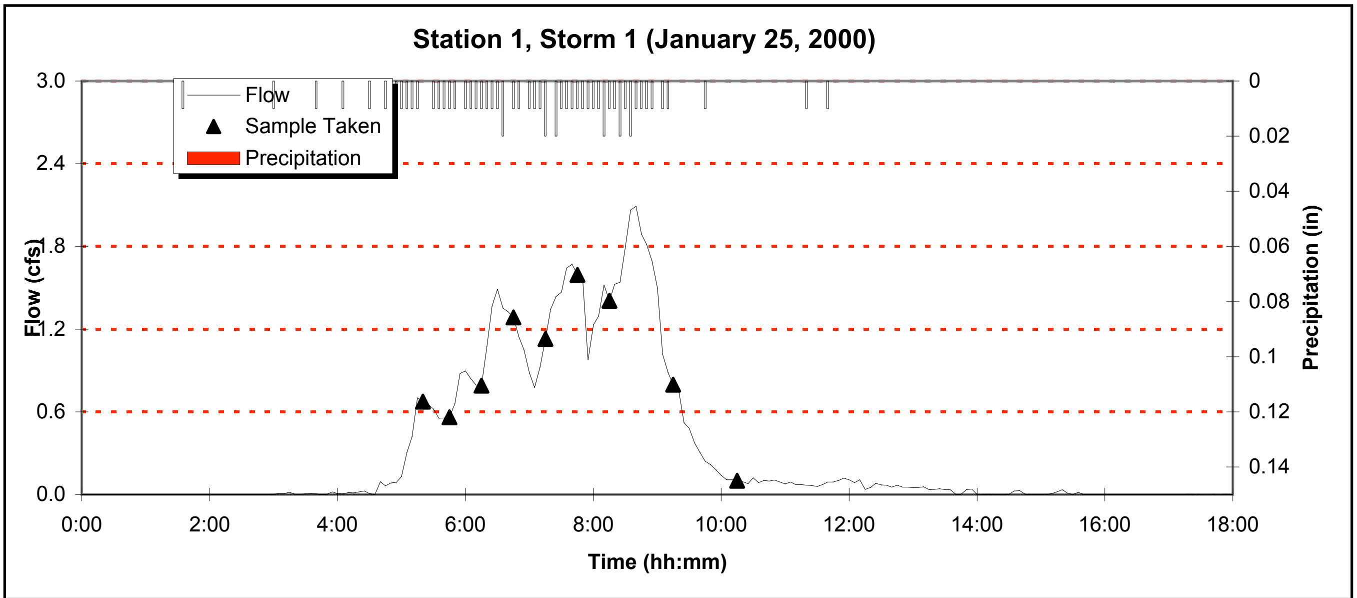
Station 1, Storm 1 (January 25, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
3.0
2.4
1.8
1.2
0.6
0.0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00



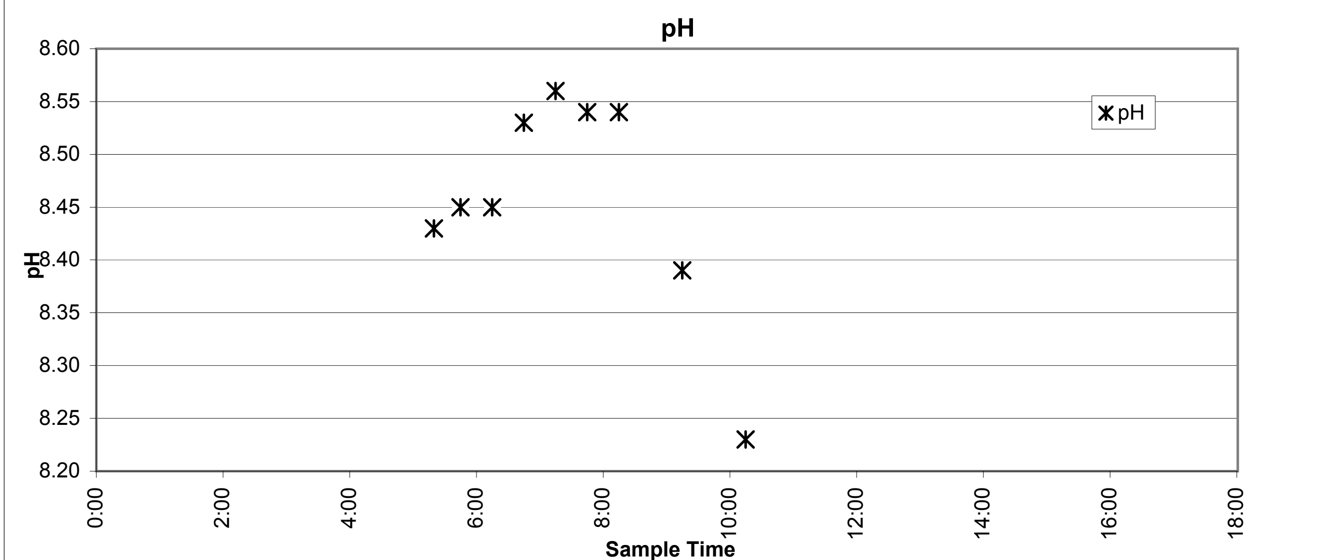
OIL & GREASE
Oil & Grease
Concentration (mg/l)
Sample Time
8
7
6
5
4
3
2
1
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00



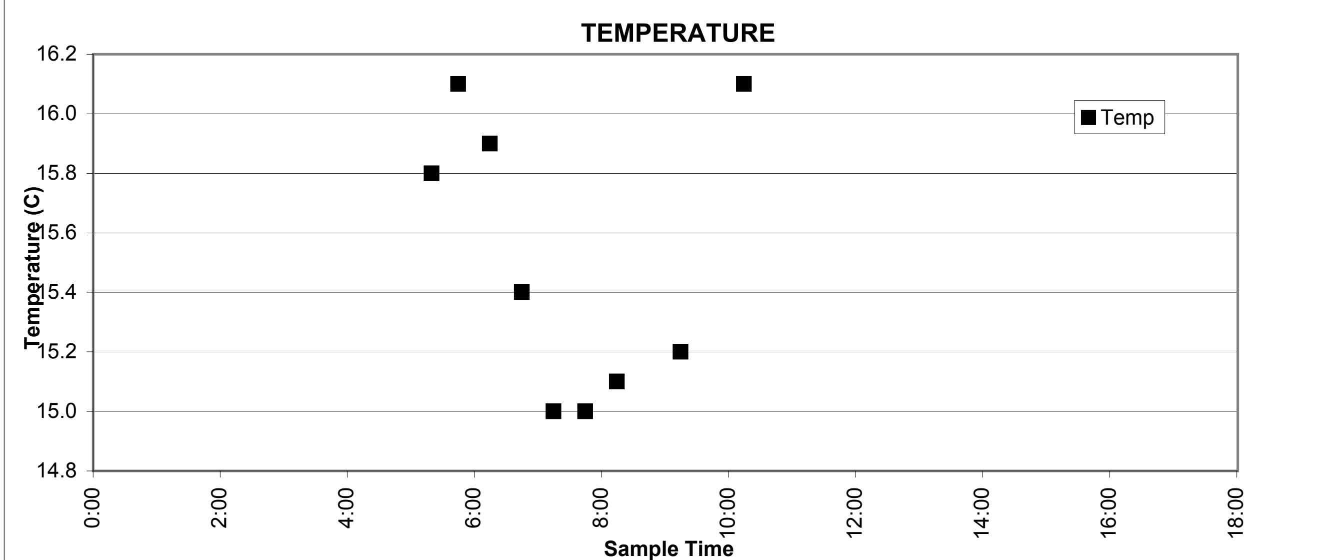
COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
Sample Time
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00



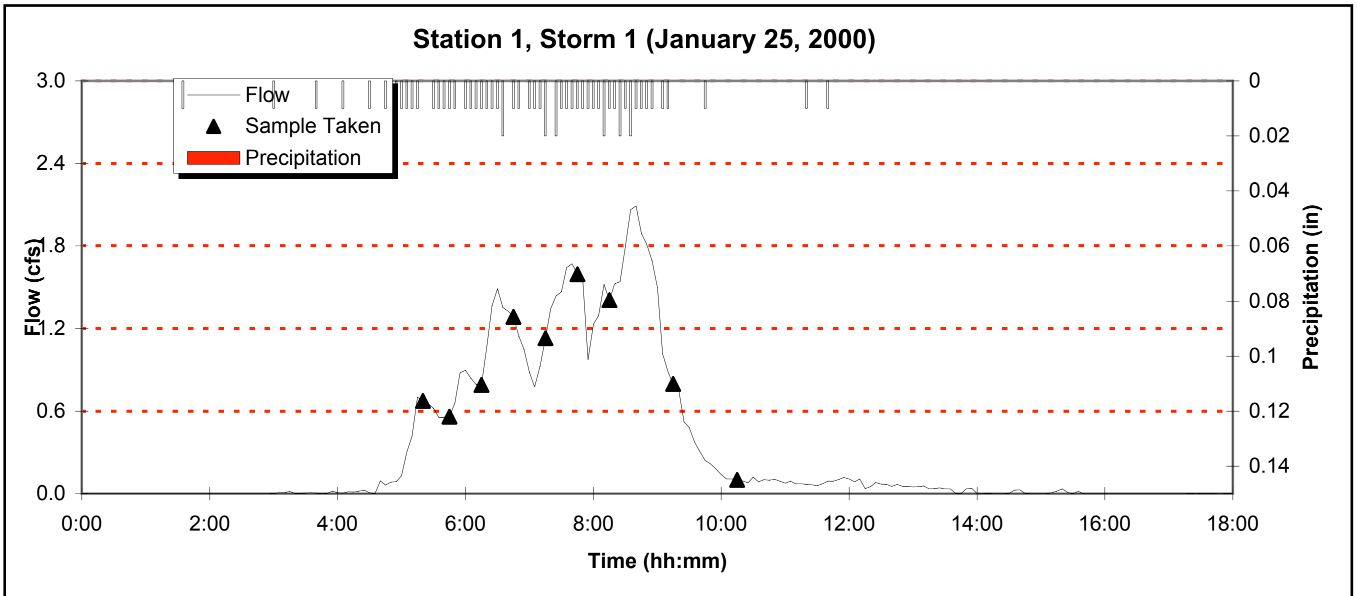
Station 1, Storm 1 (January 25, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



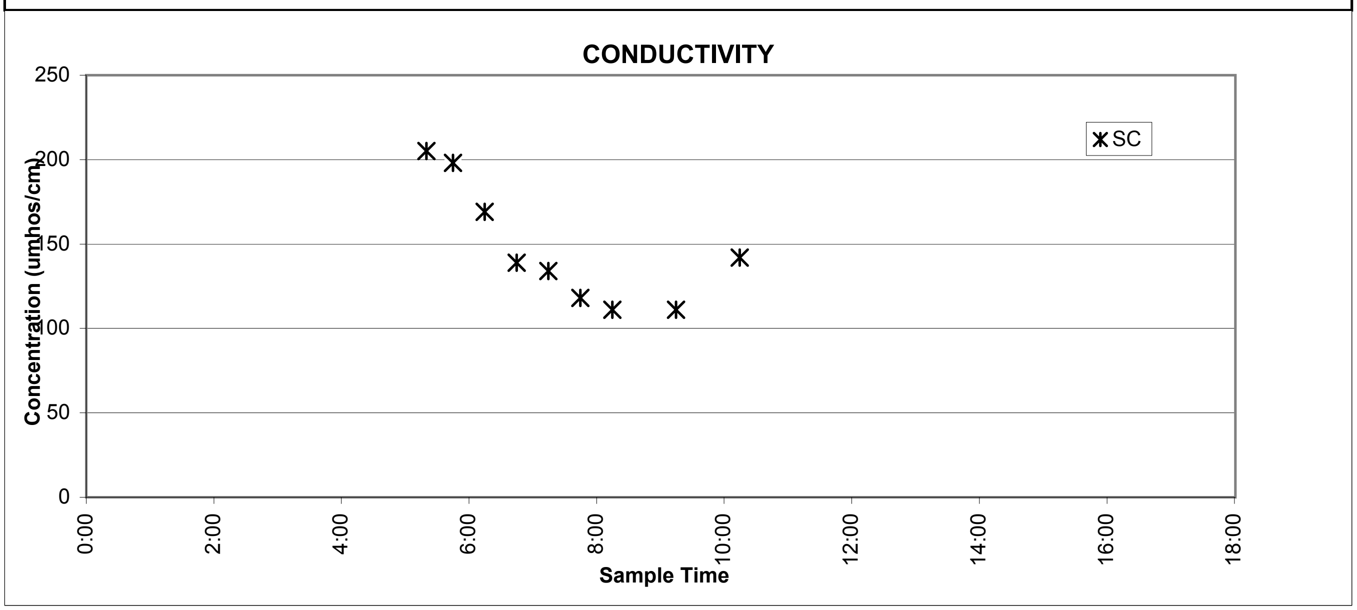
pH
pH
pH
Sample Time



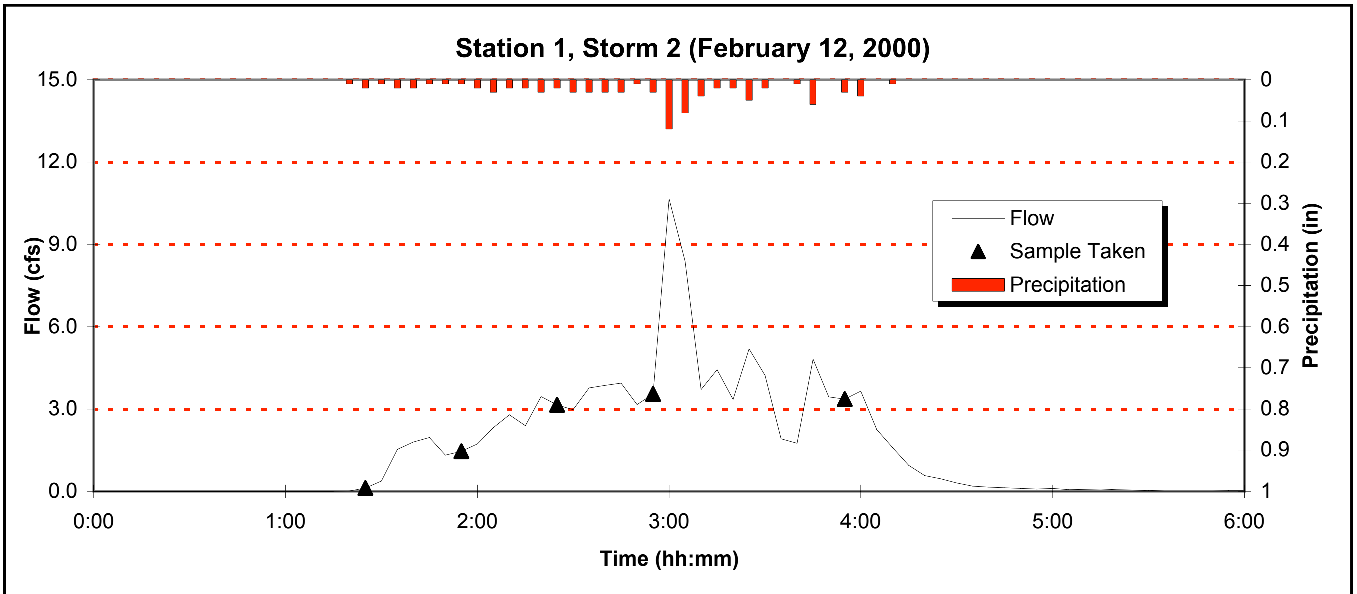
TEMPERATURE
Temp
Temperature (C)
Sample Time



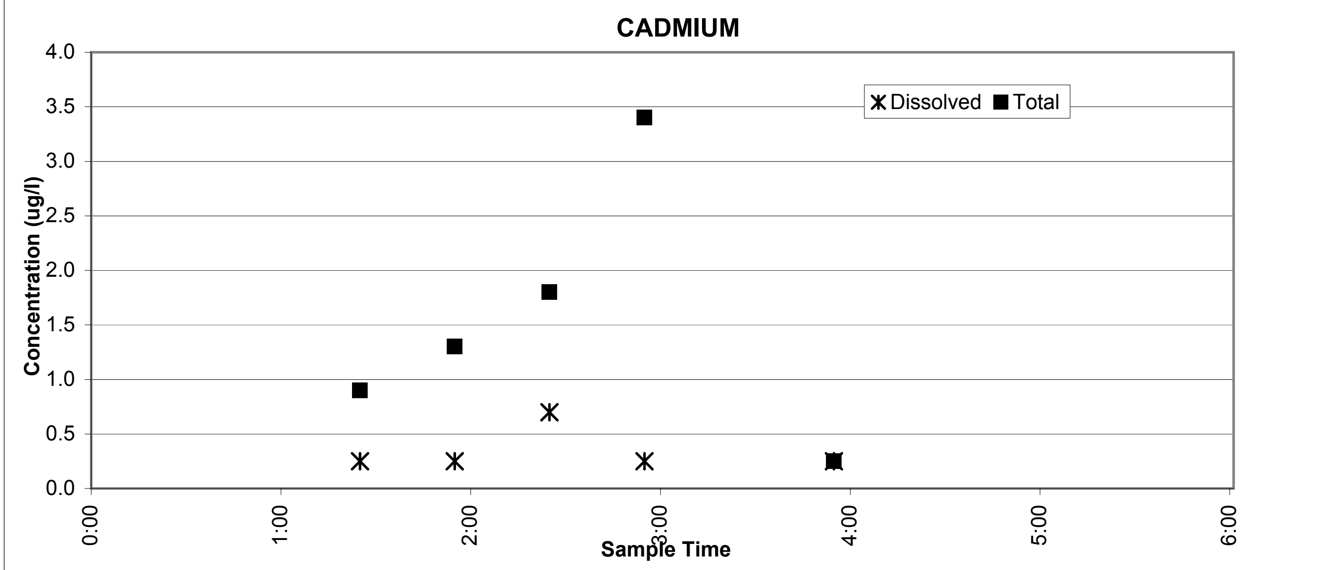
Station 1, Storm 1 (January 25, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
3.0
2.4
1.8
1.2
0.6
0.0
Precipitation (in)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
Time (hh:mm)



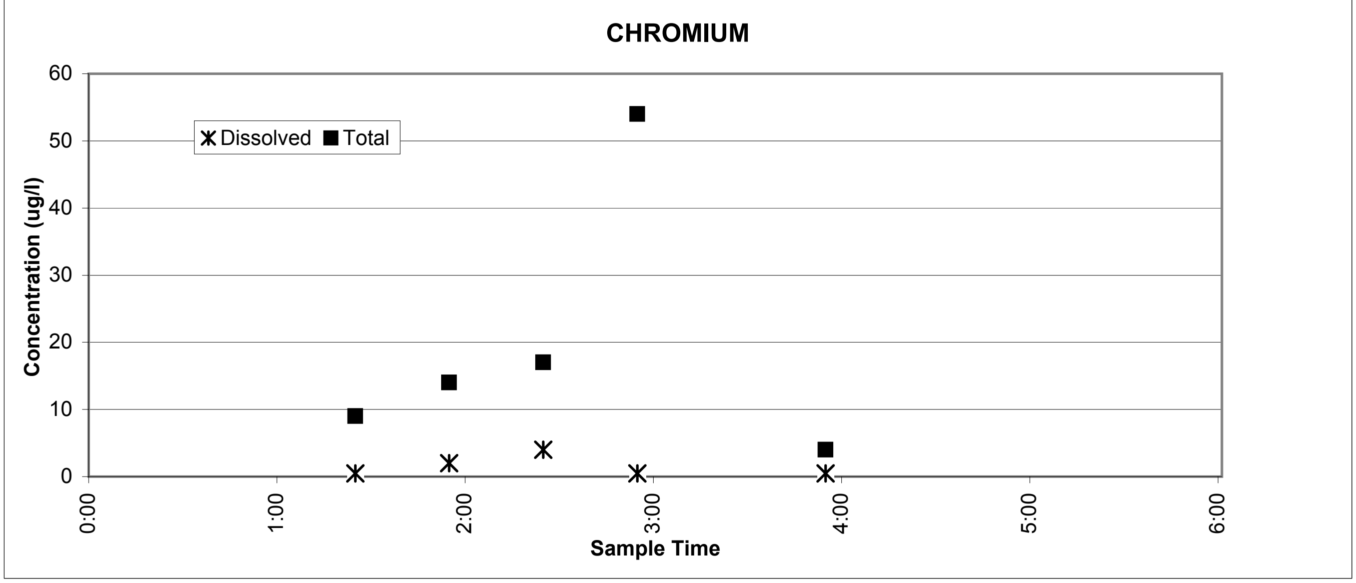
CONDUCTIVITY
SC
Concentration (umhos/cm)
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
Sample Time



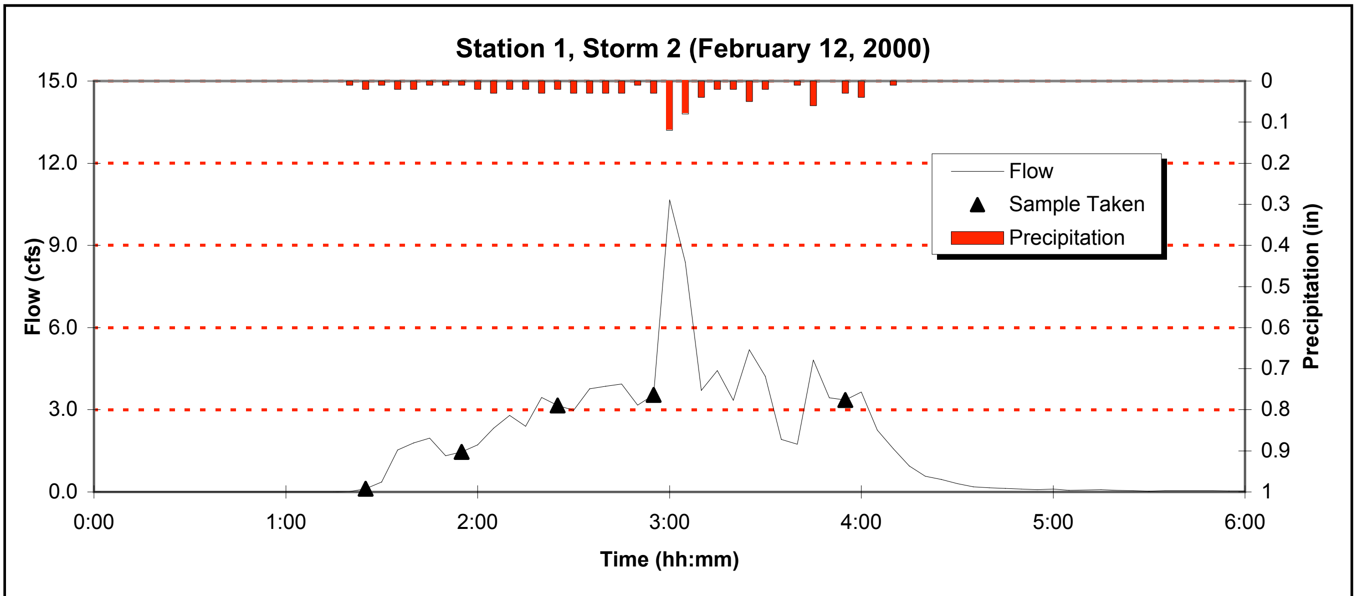
Station 1, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

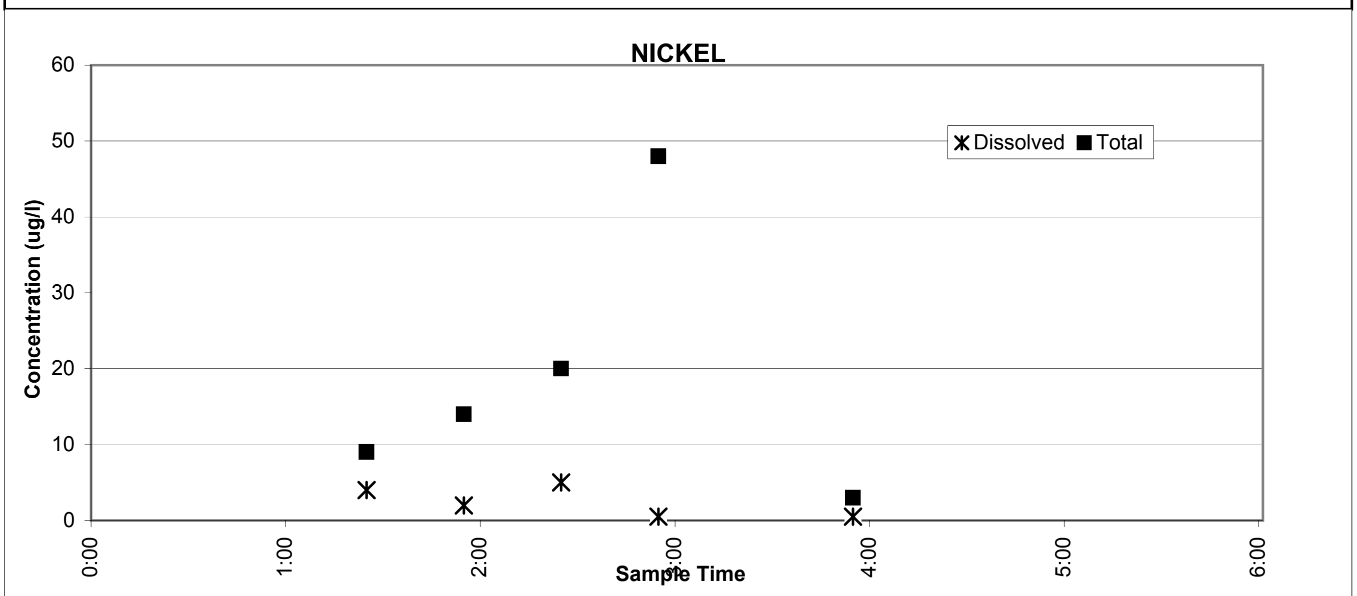


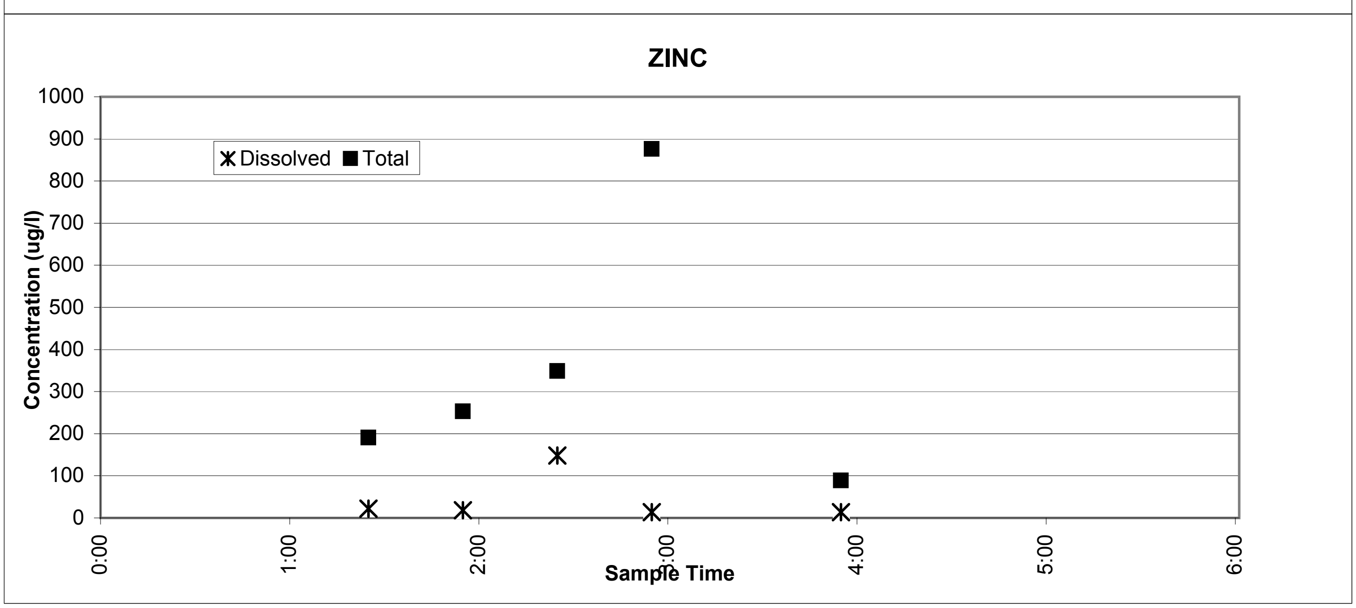
CADMIUM
Concentration (ug/l)
Sample Time
Dissolved
Total

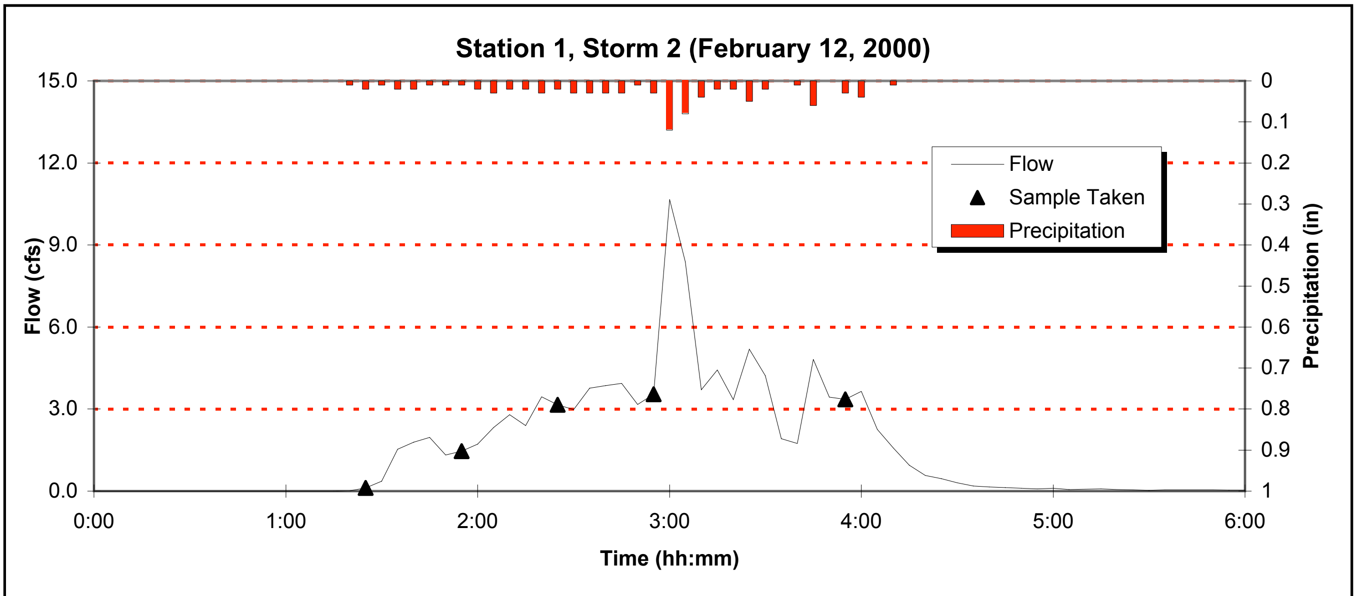


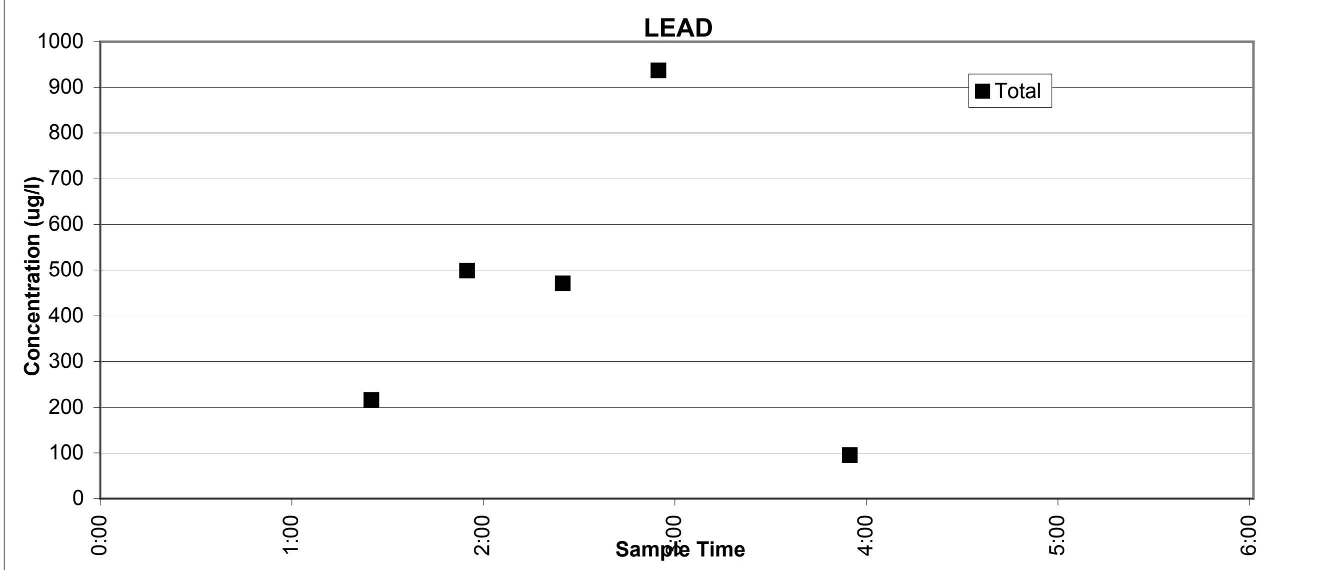
CHROMIUM
Concentration (ug/l)
Sample Time
Dissolved
Total

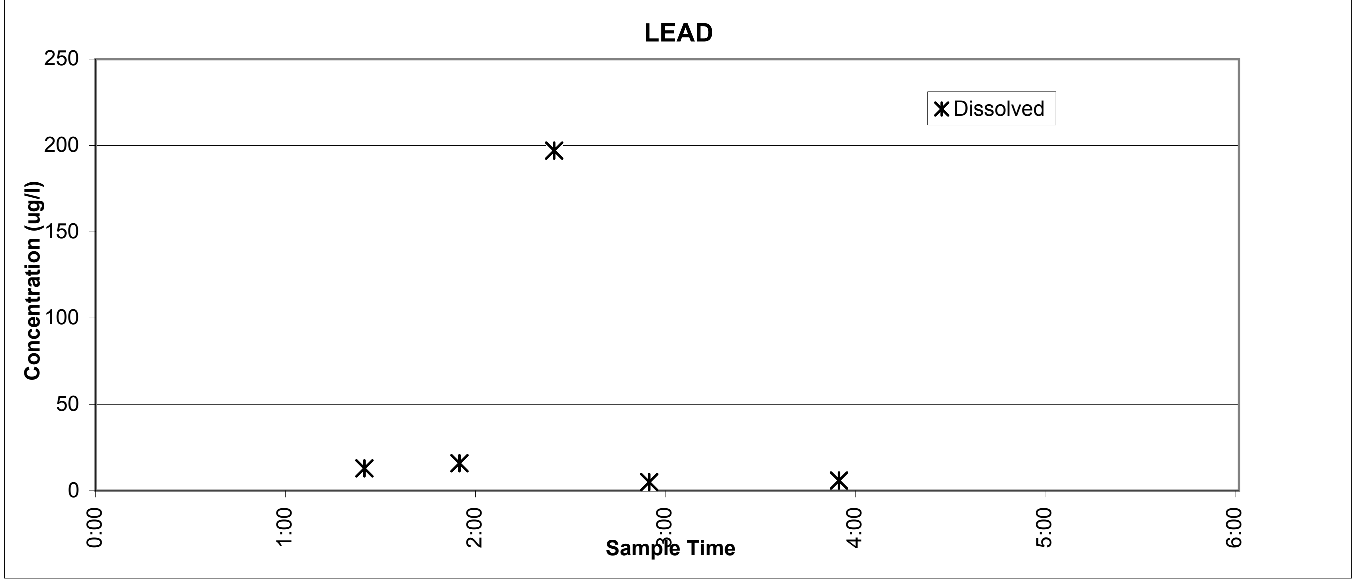

Station 1, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
15.0
12.0
9.0
6.0
3.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0:00
1:00
2:00
3:00
4:00
5:00
6:00

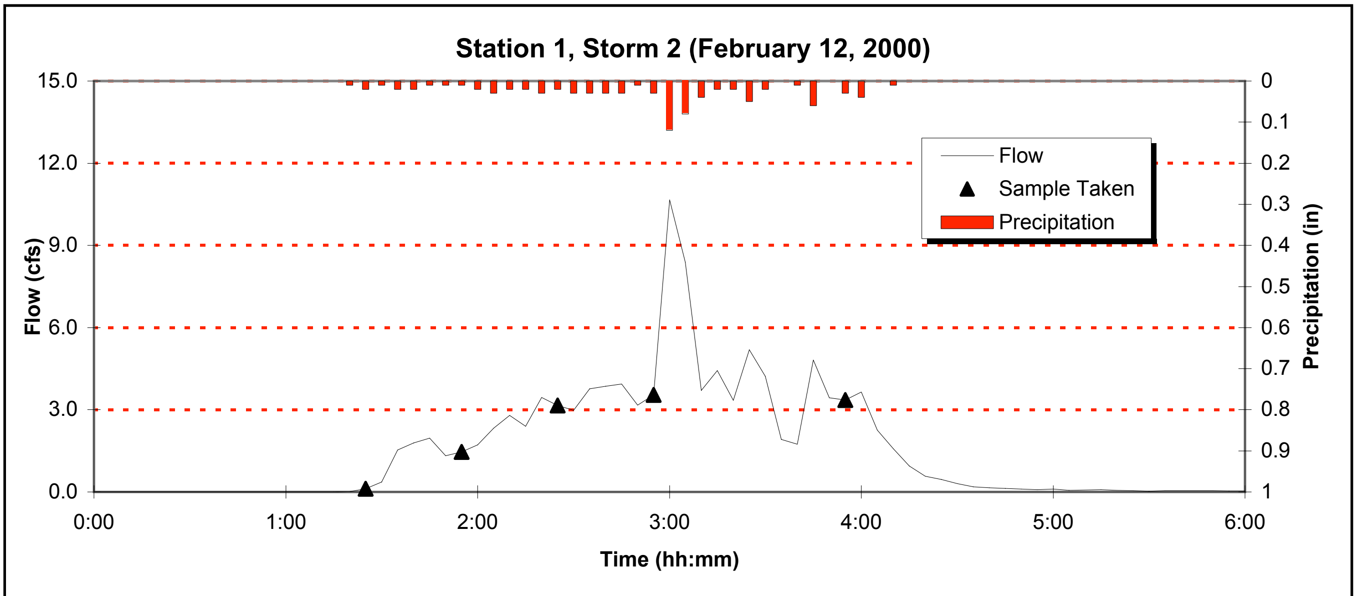

NICKEL
Concentration (ug/l)
Sample Time
Dissolved
Total
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00


ZINC
Concentration (ug/l)
Sample Time
Dissolved
Total
1000
900
800
700
600
500
400
300
200
100
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

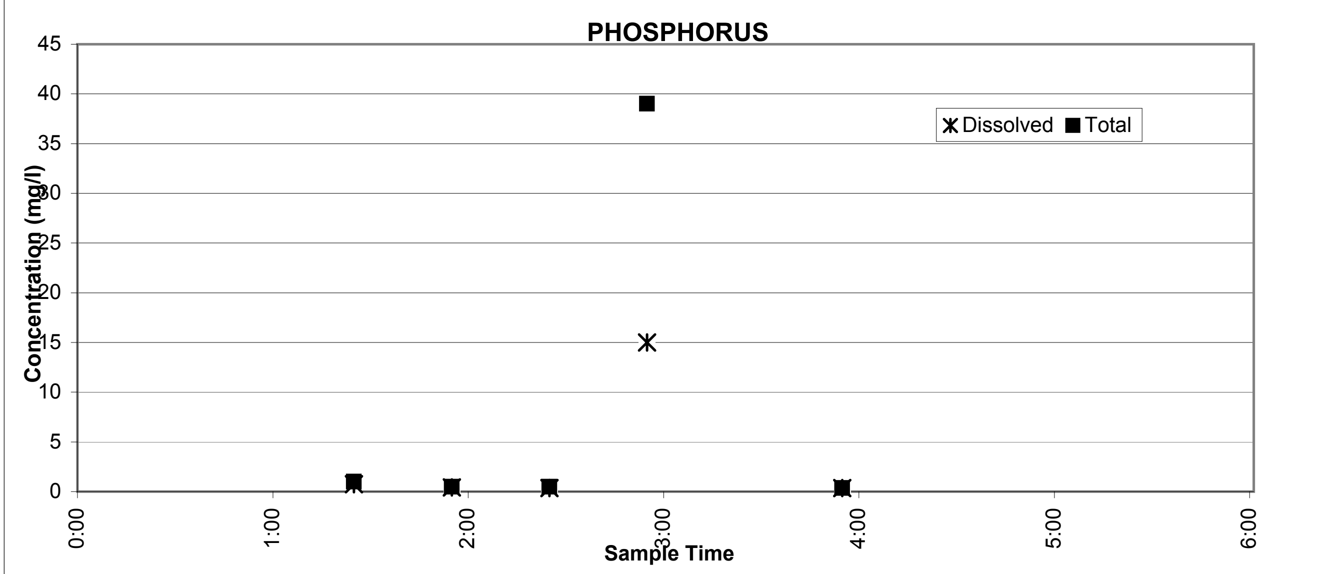

Station 1, Storm 2 (February 12, 2000)
Flow (cfs)
15.0
12.0
9.0
6.0
3.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Precipitation (in)
Flow
Sample Taken
Precipitation
0:00
1:00
2:00
3:00
4:00
5:00
6:00
Time (hh:mm)


LEAD
Concentration (ug/l)
1000
900
800
700
600
500
400
300
200
100
0
Total
0:00
1:00
2:00
3:00
4:00
5:00
6:00
Sample Time

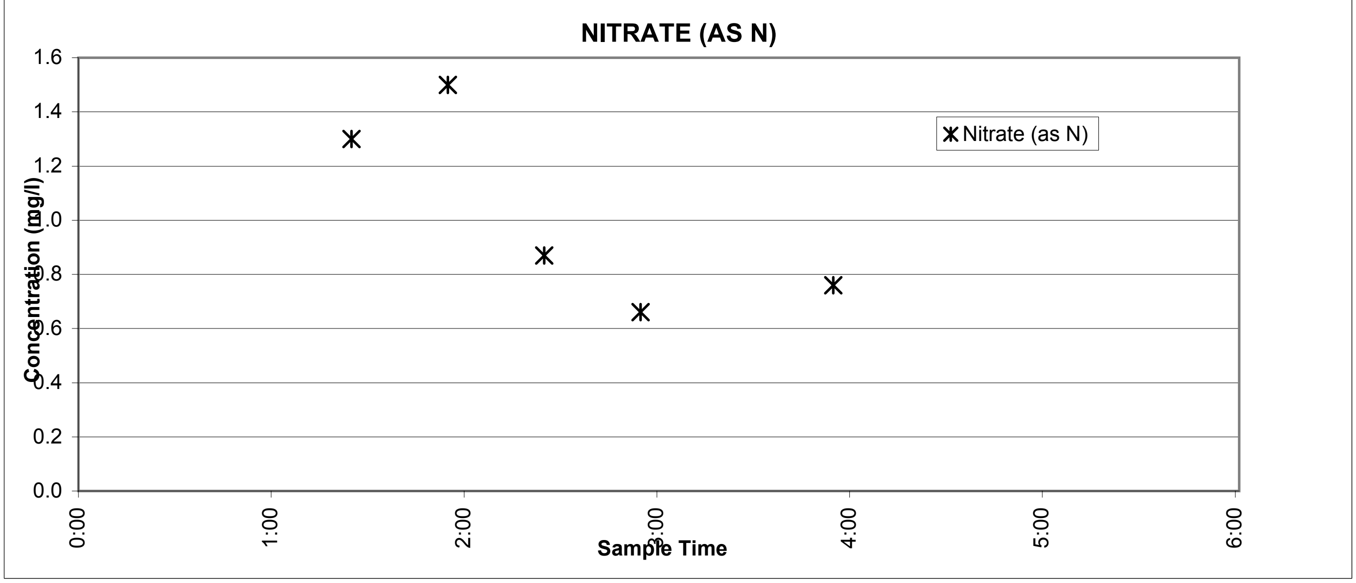

LEAD
Concentration (ug/l)
250
200
150
100
50
0
Dissolved
0:00
1:00
2:00
3:00
4:00
5:00
6:00
Sample Time



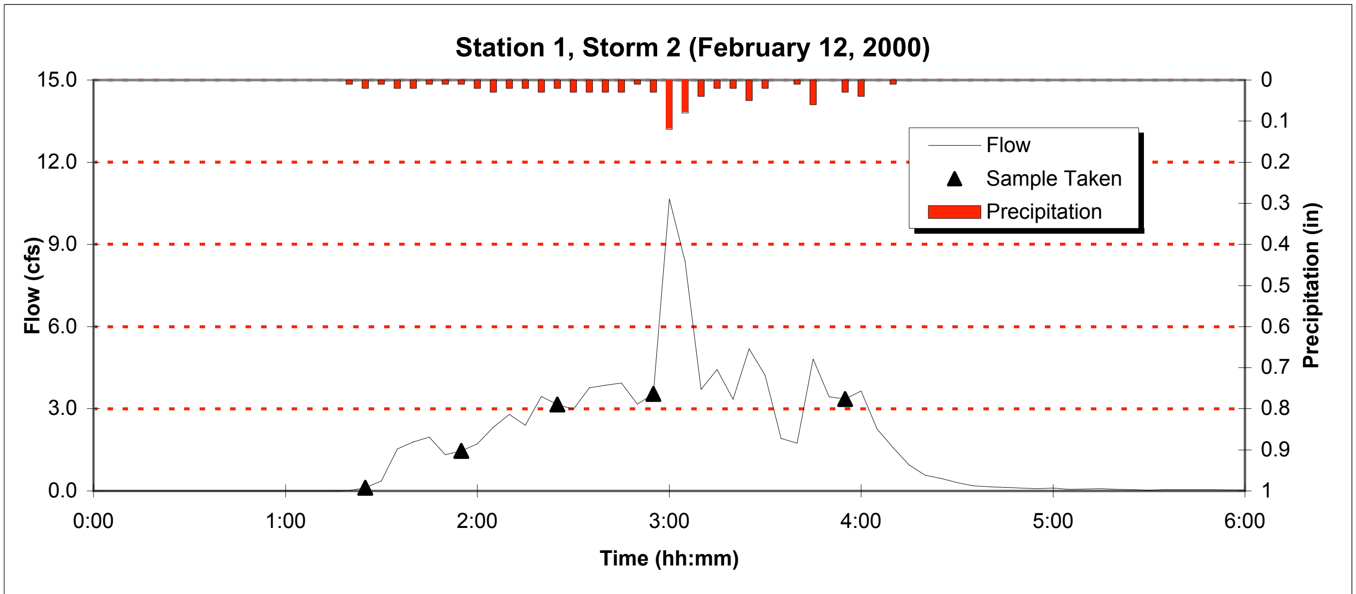
Station 1, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
15.0
12.0
9.0
6.0
3.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0:00
1:00
2:00
3:00
4:00
5:00
6:00

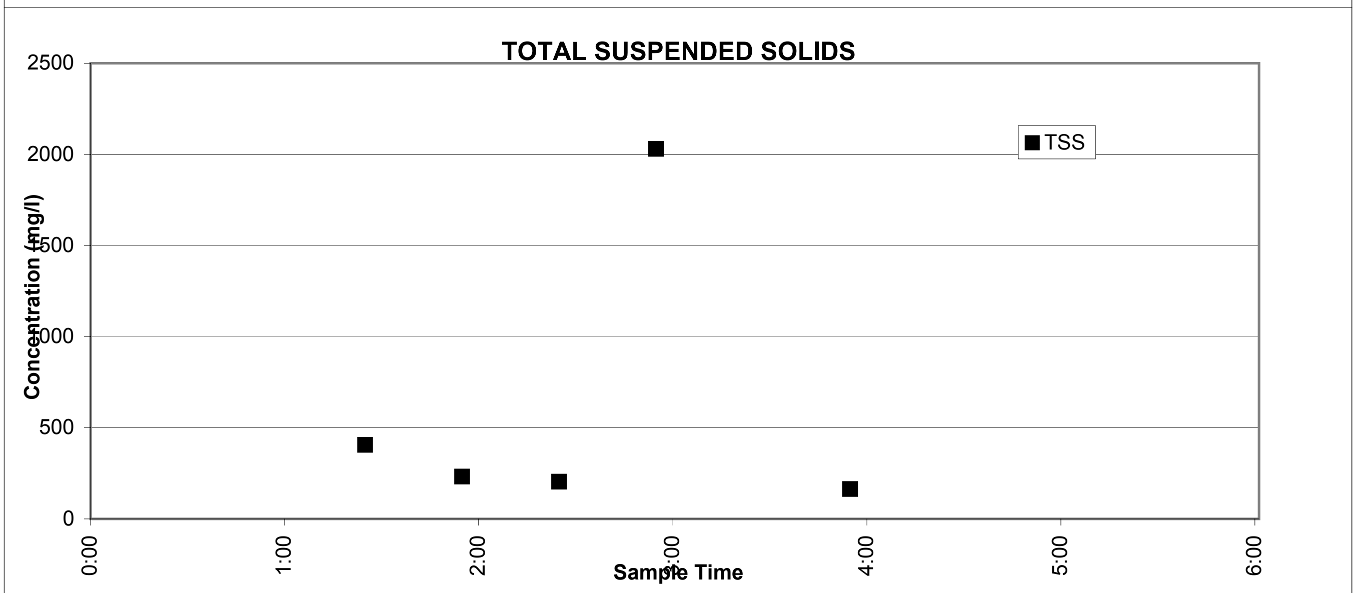


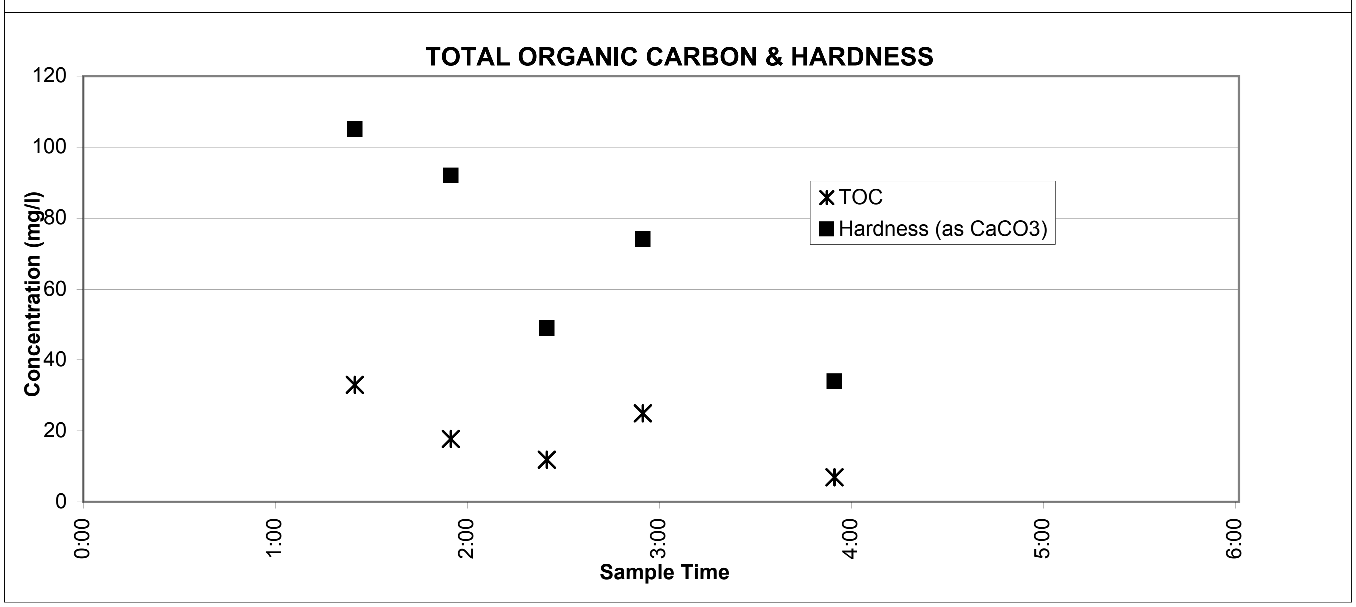
PHOSPHORUS
Concentration (mg/l)
Sample Time
Dissolved
Total
45
40
35
30
25
20
15
10
5
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

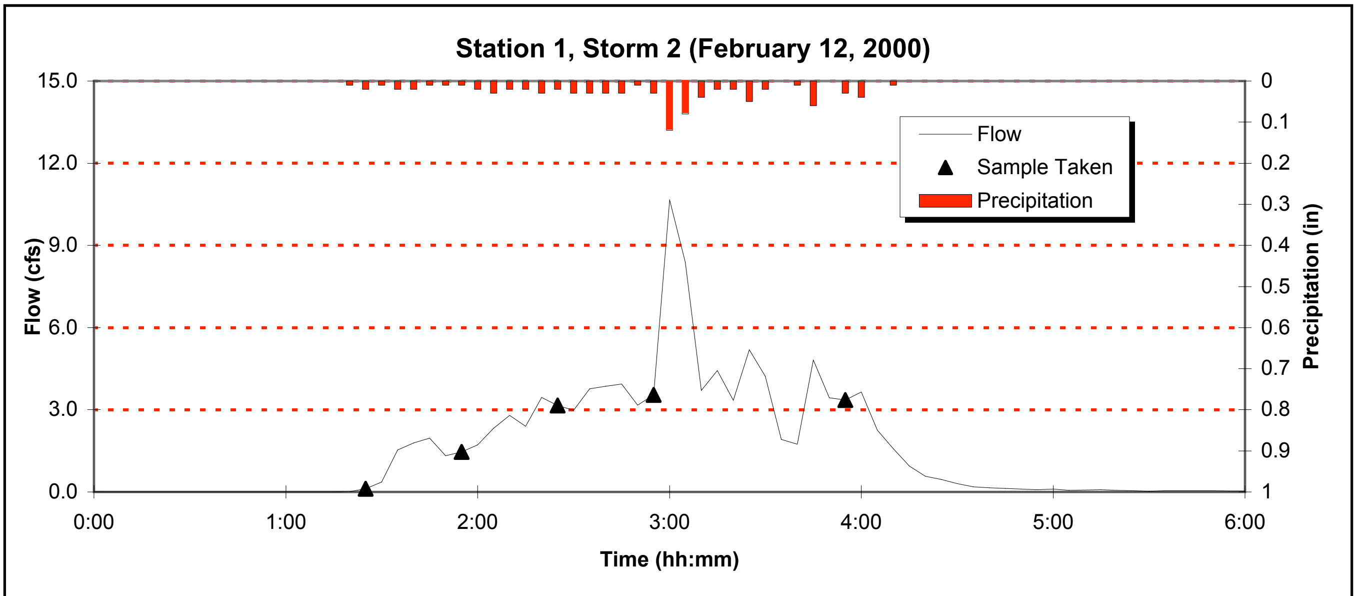


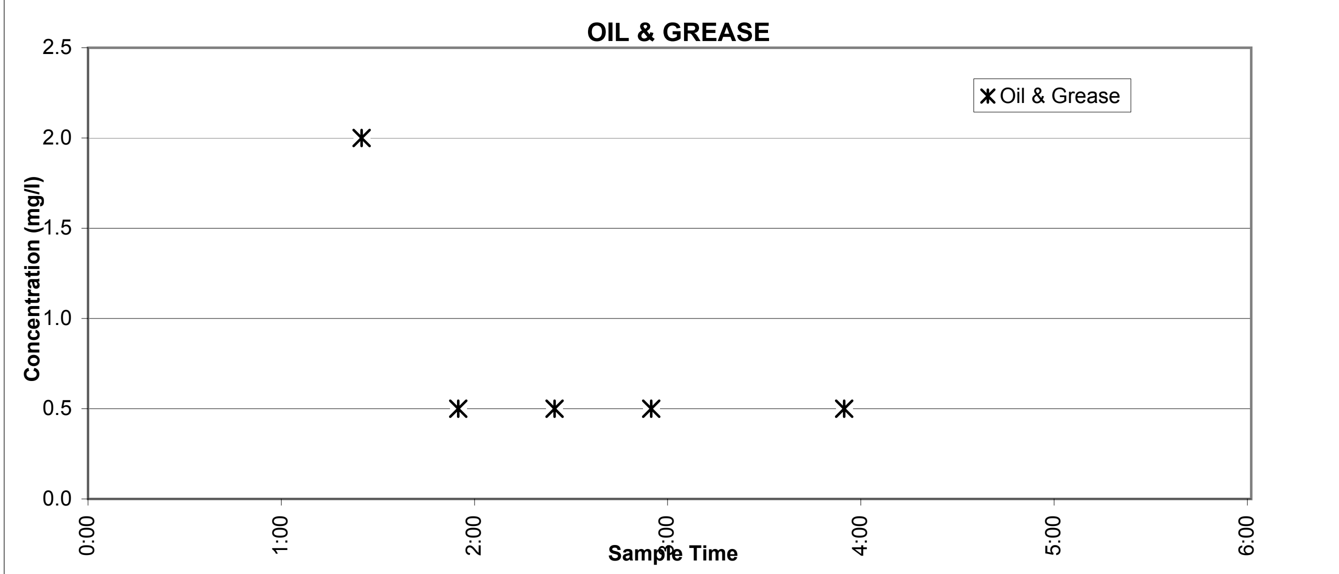
NITRATE (AS N)
Concentration (mg/l)
Sample Time
Nitrate (as N)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

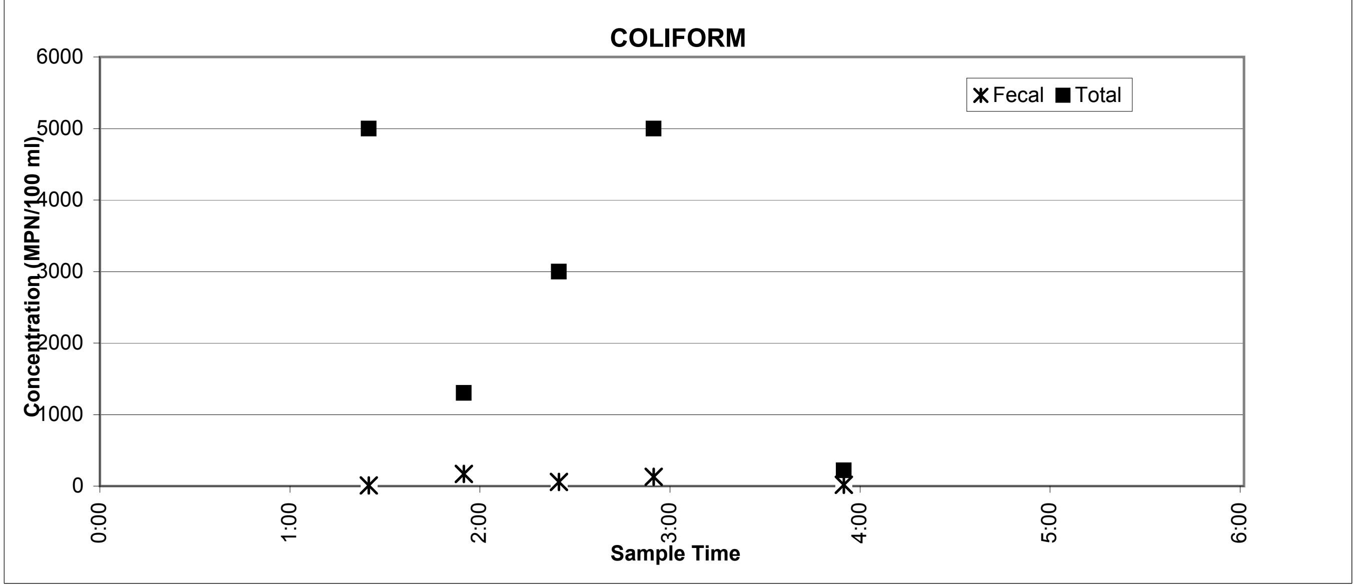

Station 1, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
15.0
12.0
9.0
6.0
3.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0:00
1:00
2:00
3:00
4:00
5:00
6:00

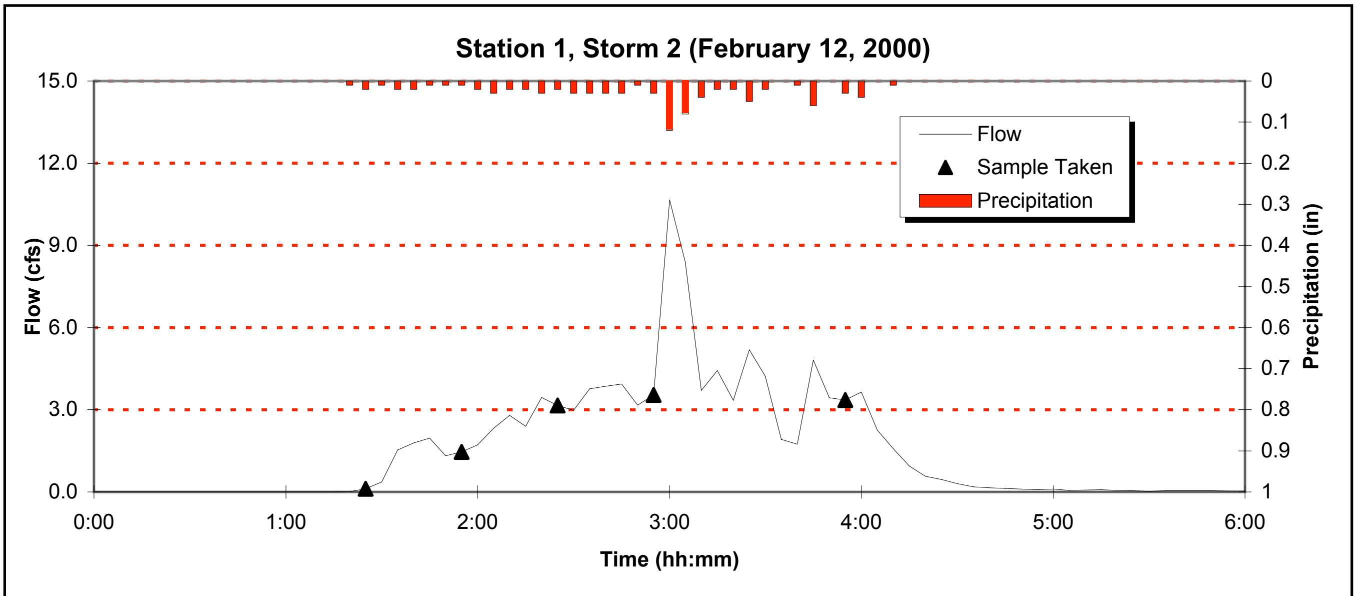

TOTAL SUSPENDED SOLIDS
Concentration (mg/l)
Sample Time
TSS
2500
2000
1500
1000
500
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

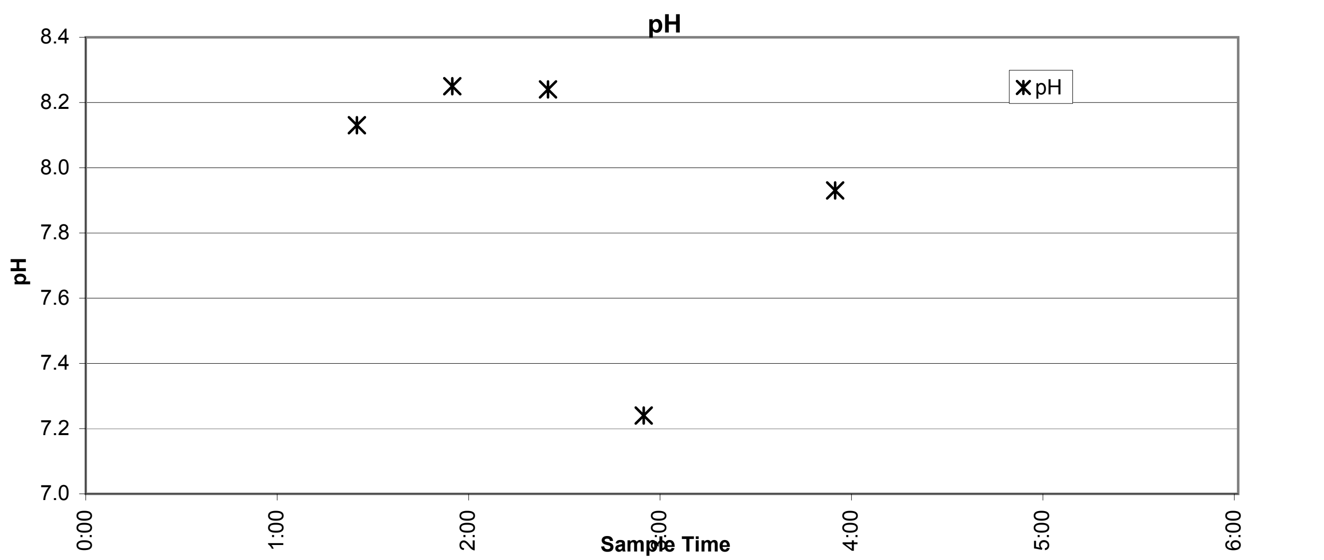

TOTAL ORGANIC CARBON & HARDNESS
Concentration (mg/l)
Sample Time
TOC
Hardness (as CaCO3)
120
100
80
60
40
20
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

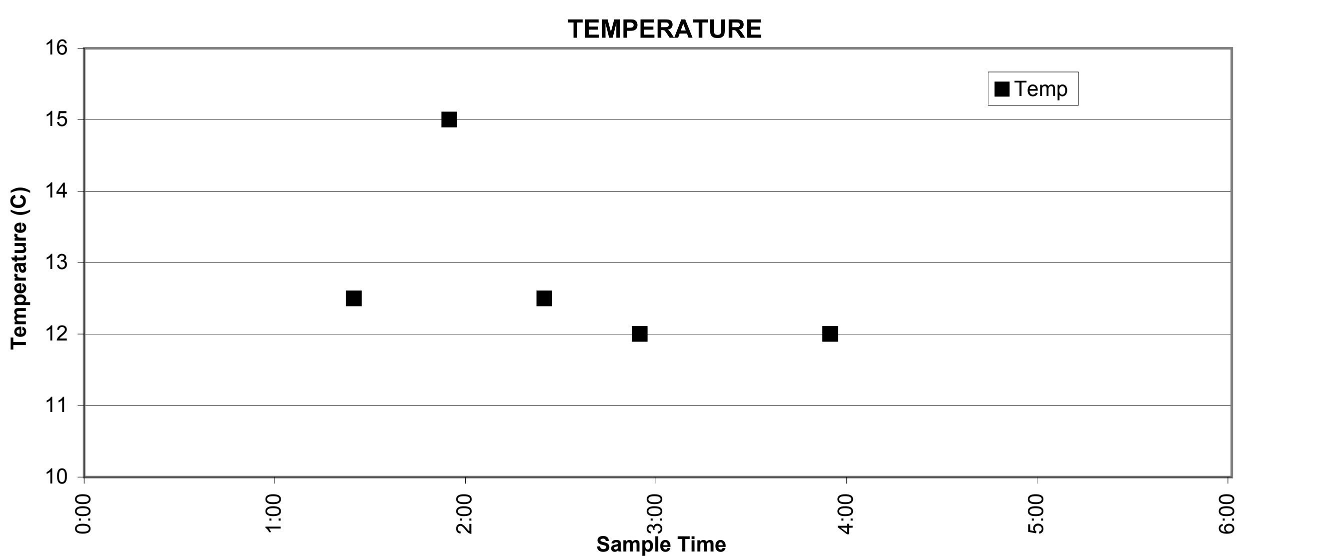

Station 1, Storm 2 (February 12, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
15.0
12.0
9.0
6.0
3.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0:00
1:00
2:00
3:00
4:00
5:00
6:00

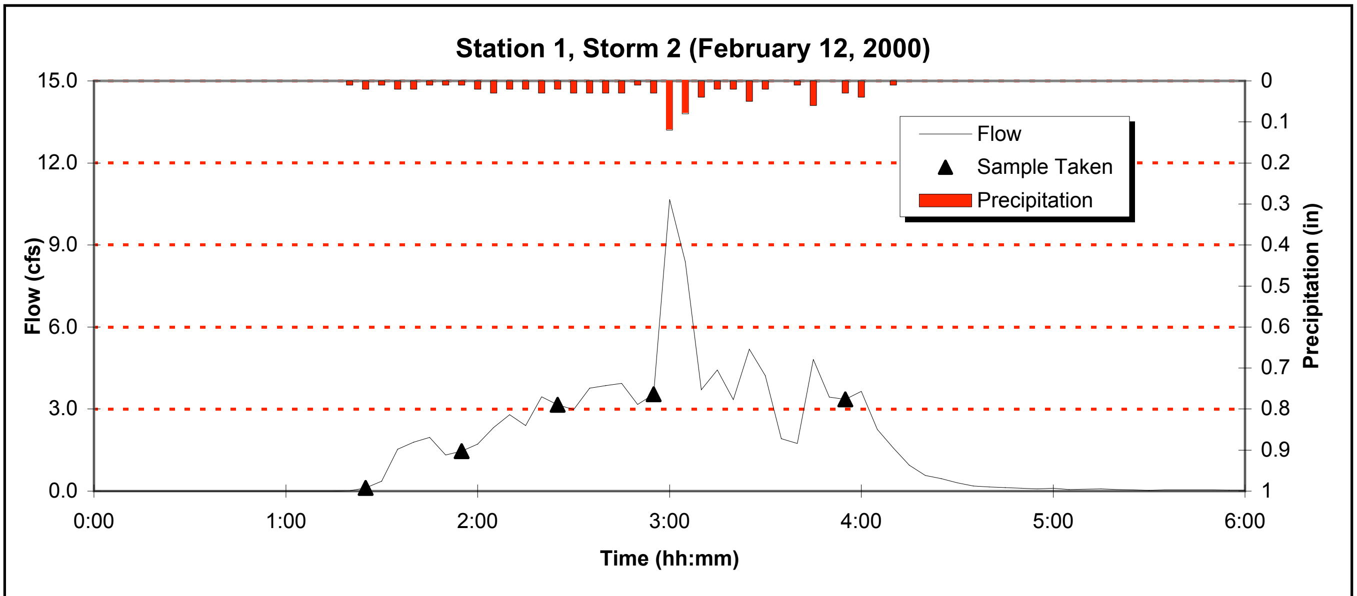

OIL & GREASE
Oil & Grease
Concentration (mg/l)
Sample Time
2.5
2.0
1.5
1.0
0.5
0.0
0:00
1:00
2:00
3:00
4:00
5:00
6:00


COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
Sample Time
6000
5000
4000
3000
2000
1000
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

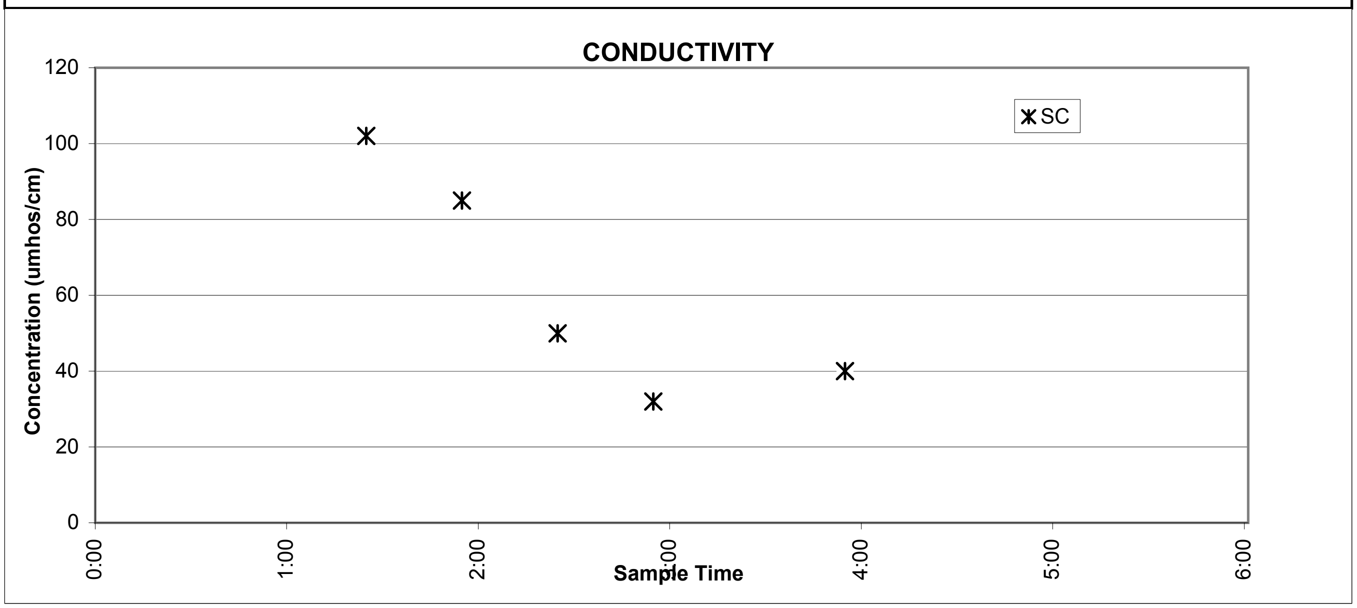

Station 1, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
15.0
12.0
9.0
6.0
3.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0:00
1:00
2:00
3:00
4:00
5:00
6:00


pH
pH
Sample Time
8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

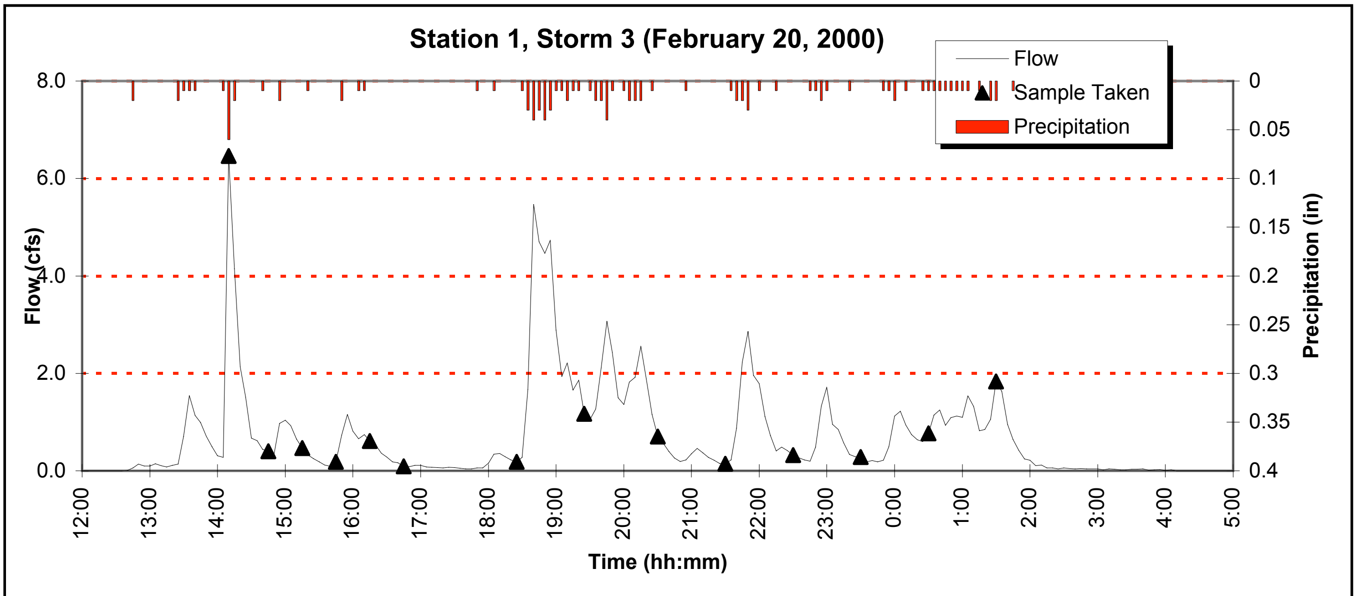

TEMPERATURE
Temp
Temperature (C)
Sample Time
16
15
14
13
12
11
10
0:00
1:00
2:00
3:00
4:00
5:00
6:00

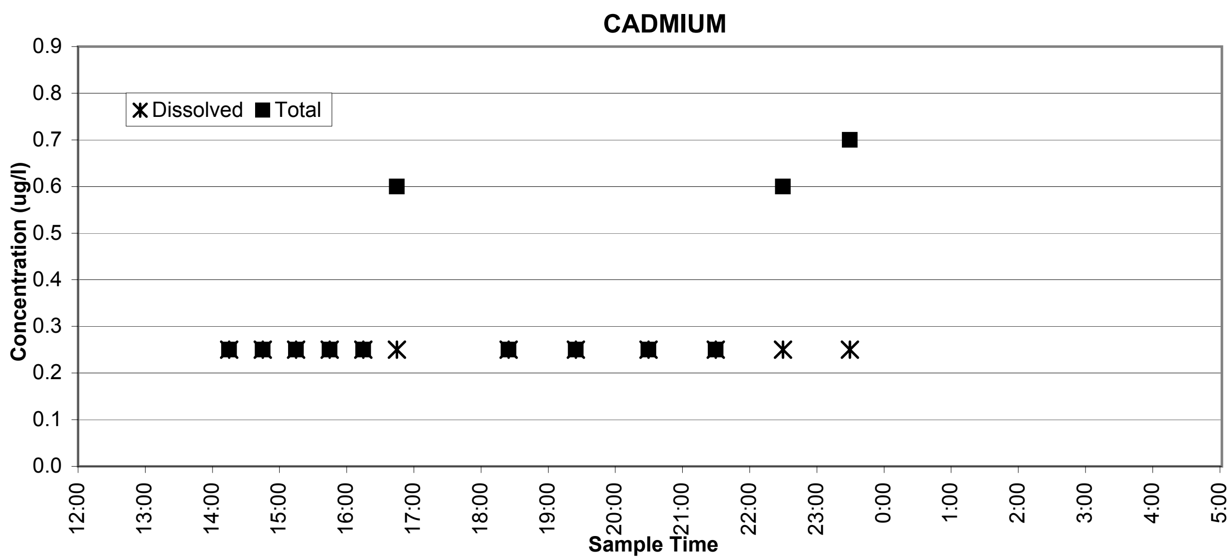


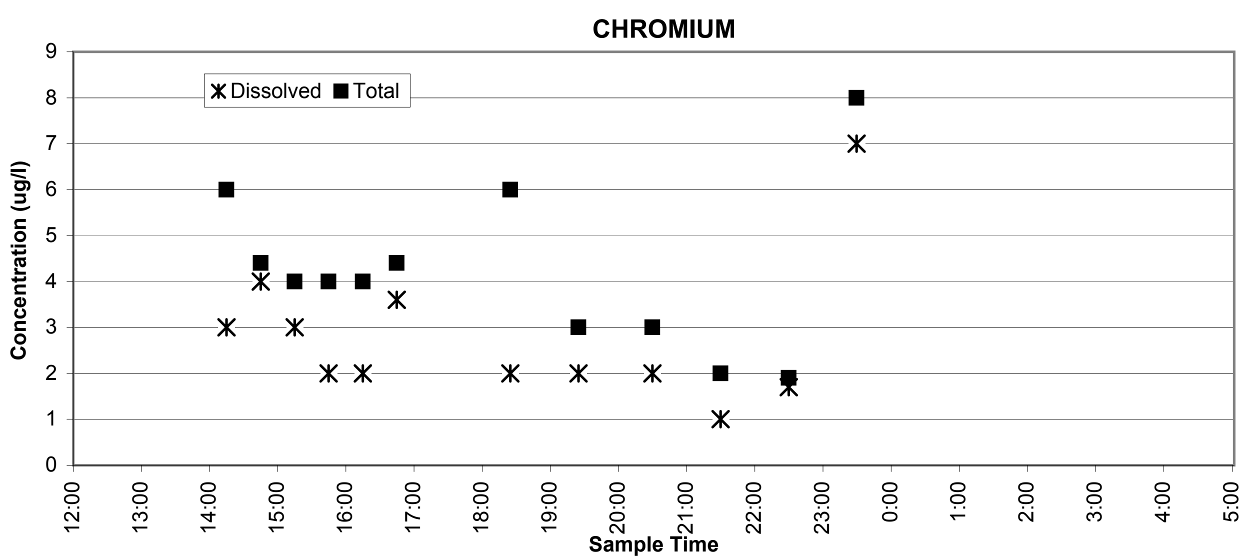
Station 1, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
15.0
12.0
9.0
6.0
3.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0:00
1:00
2:00
3:00
4:00
5:00
6:00

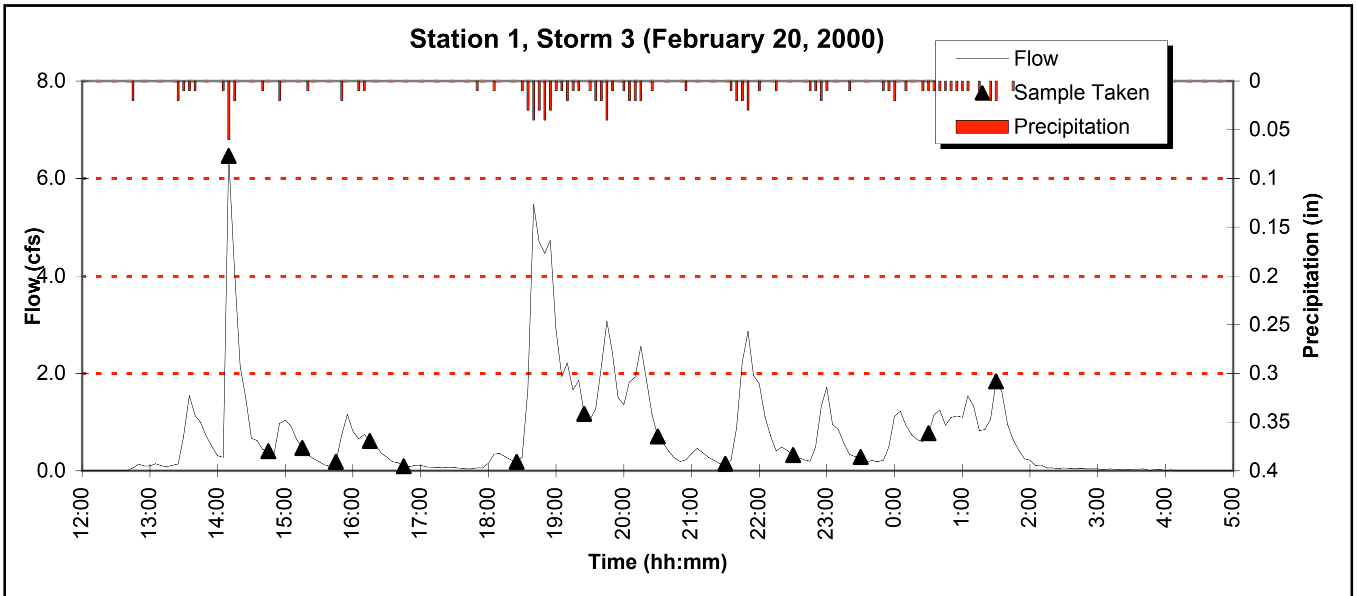


CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
SC
120
100
80
60
40
20
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

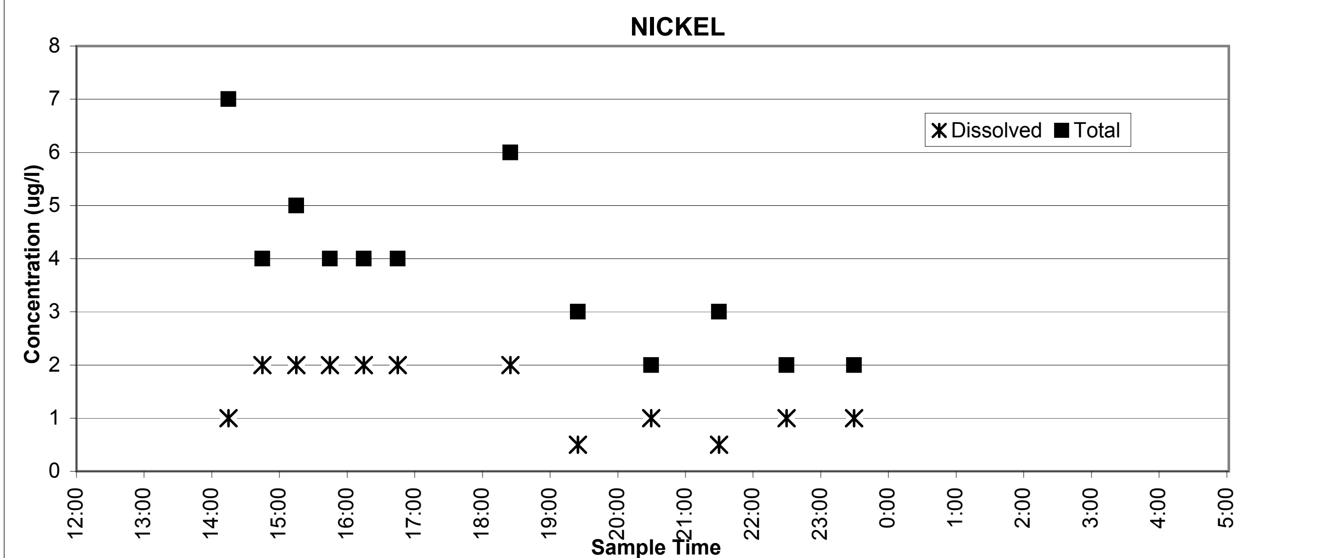

Station 1, Storm 3 (February 20, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time

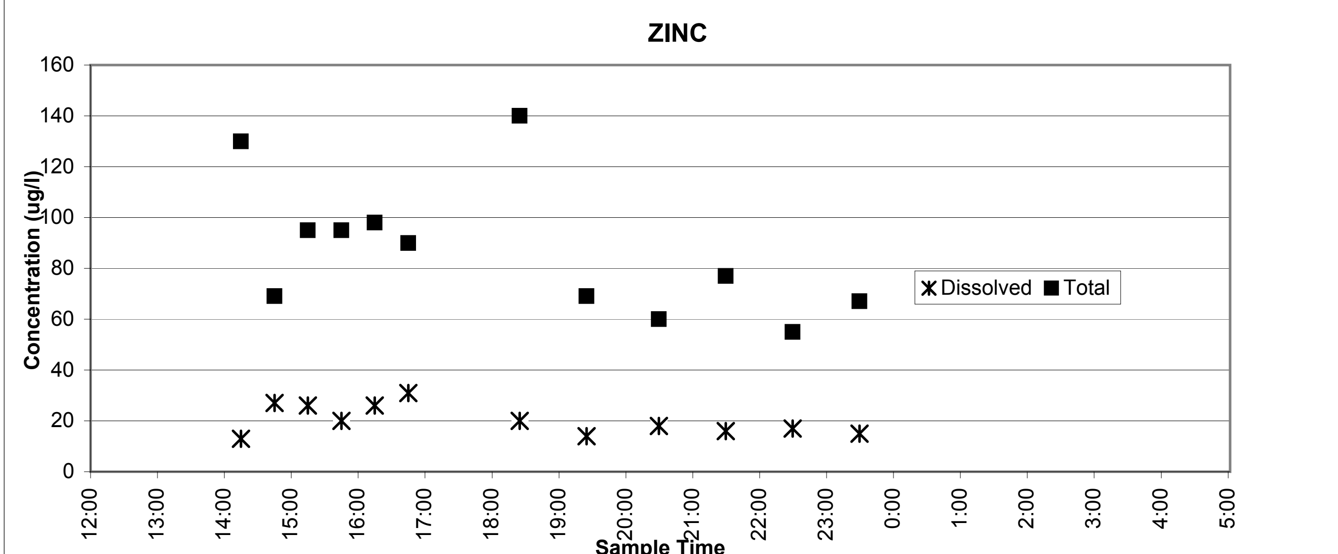

CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time



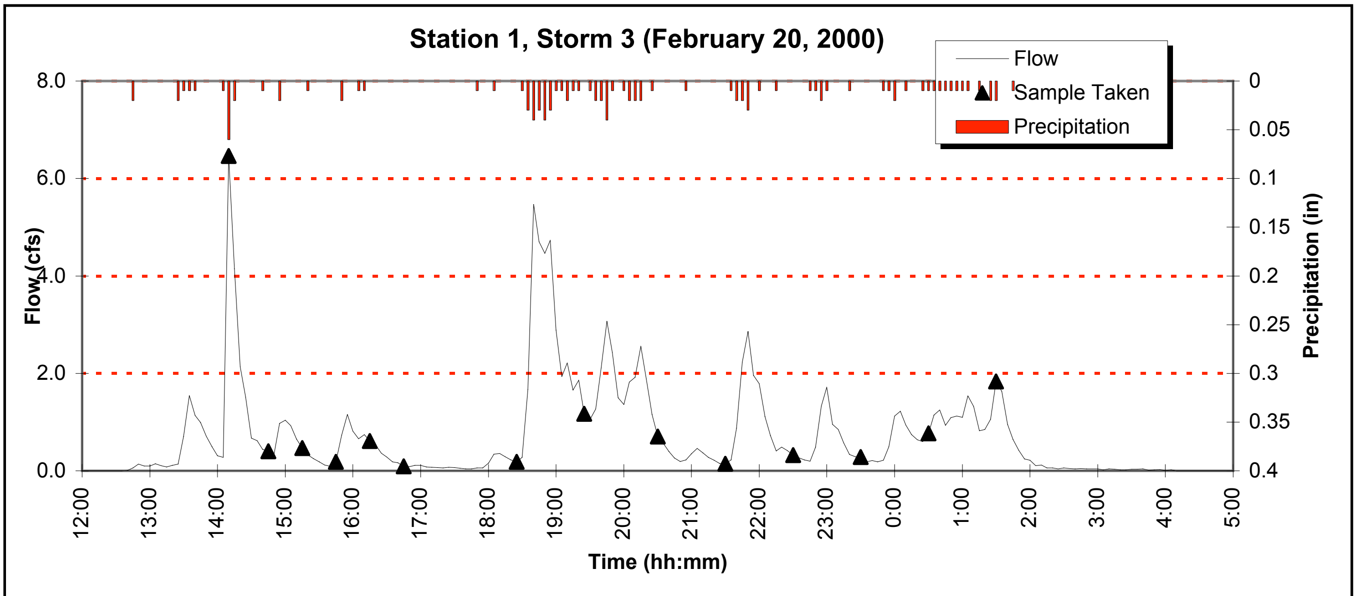
Station 1, Storm 3 (February 20, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



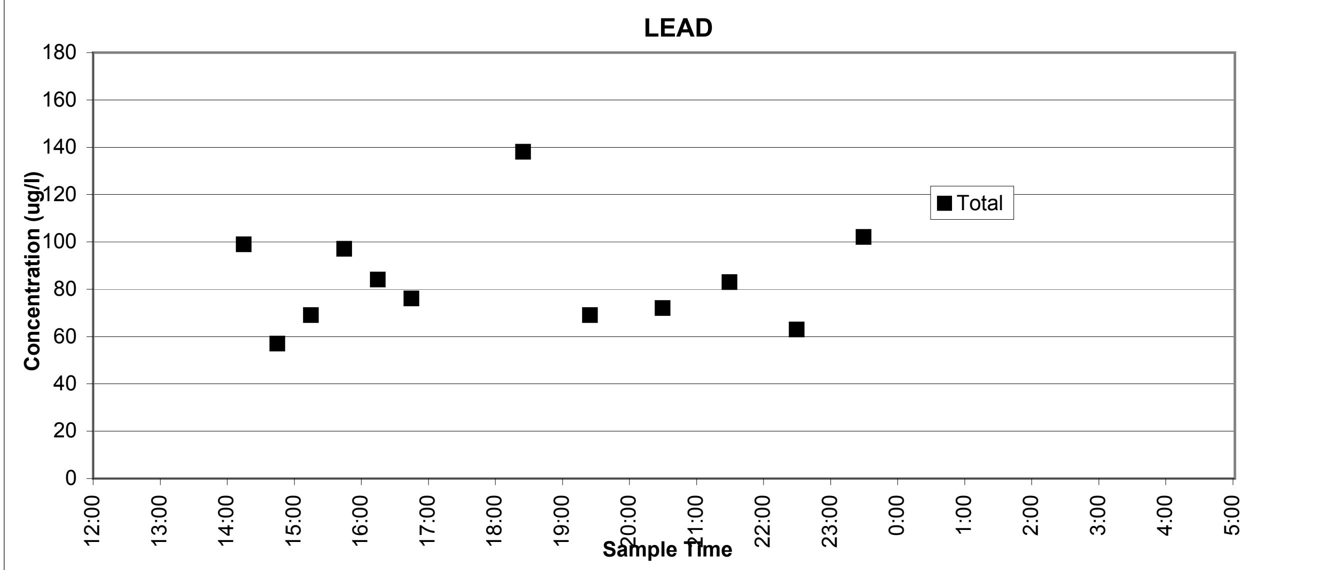
NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time



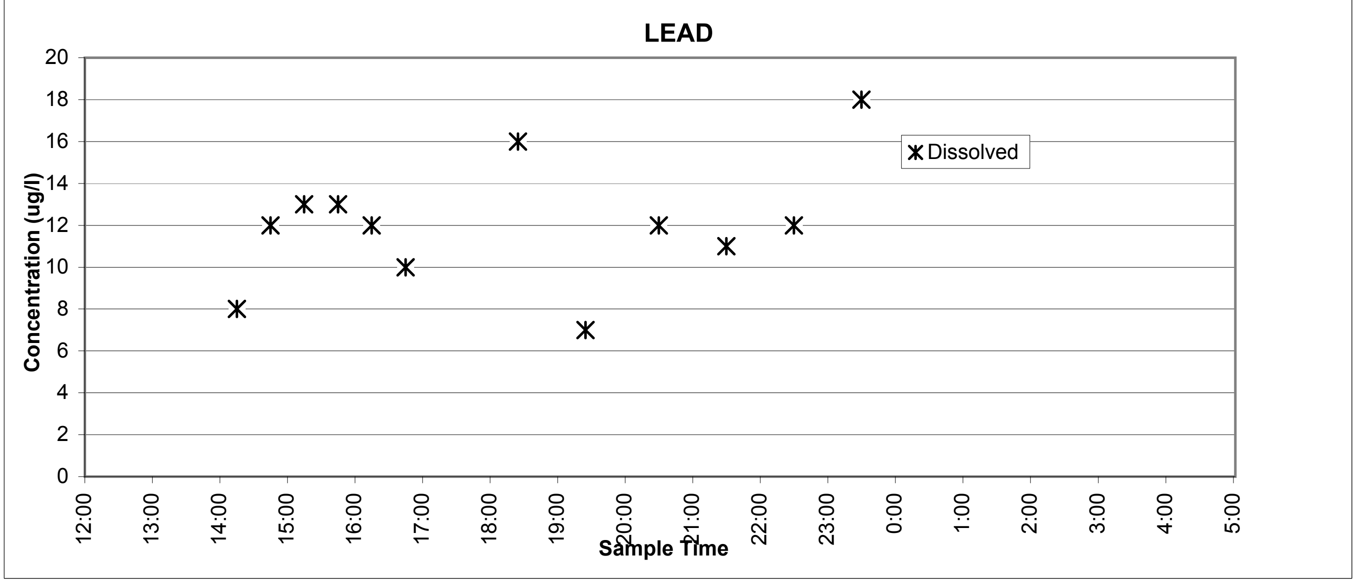
ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time



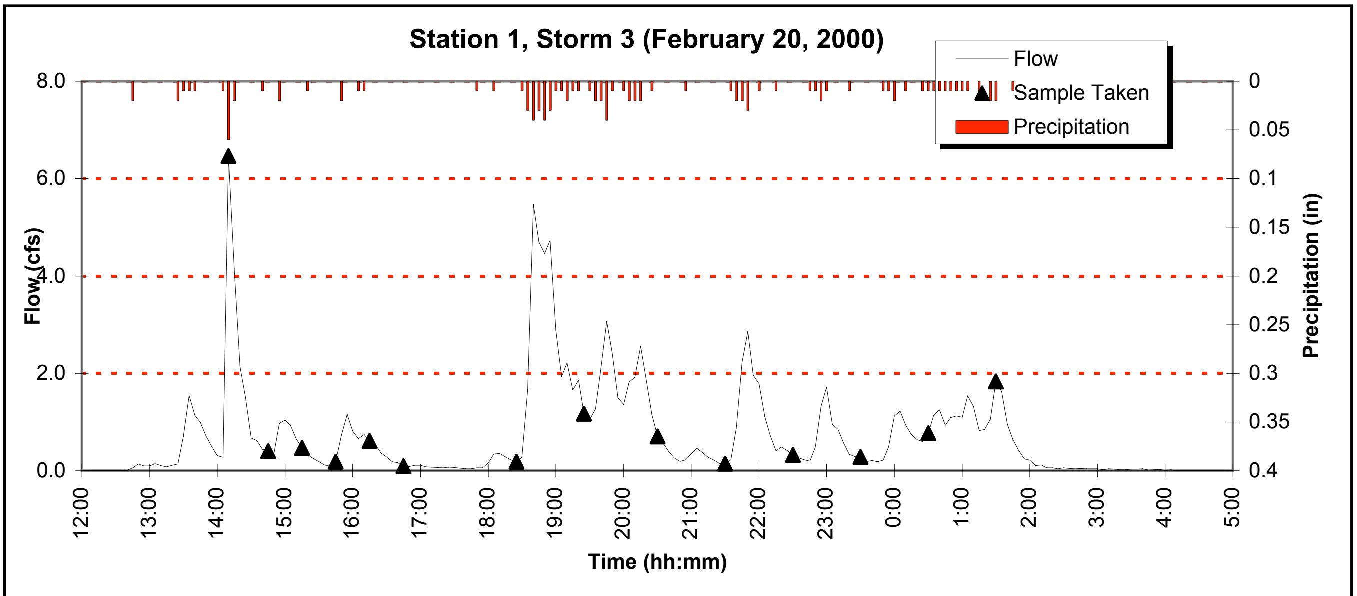
Station 1, Storm 3 (February 20, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
8.0
6.0
4.0
2.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

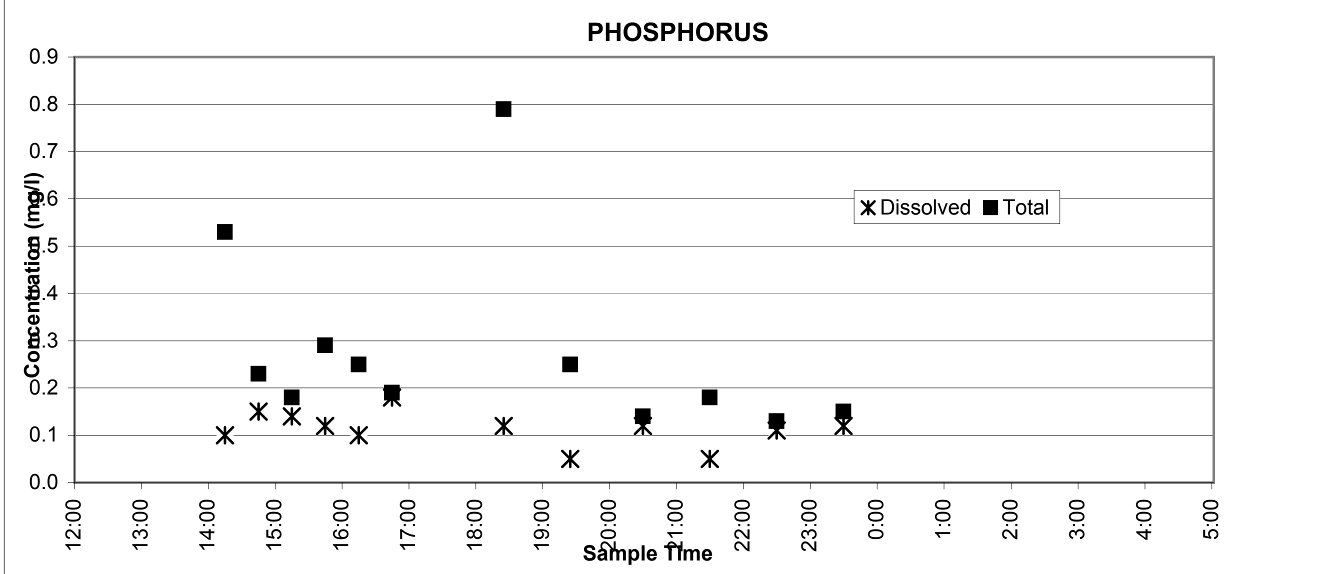


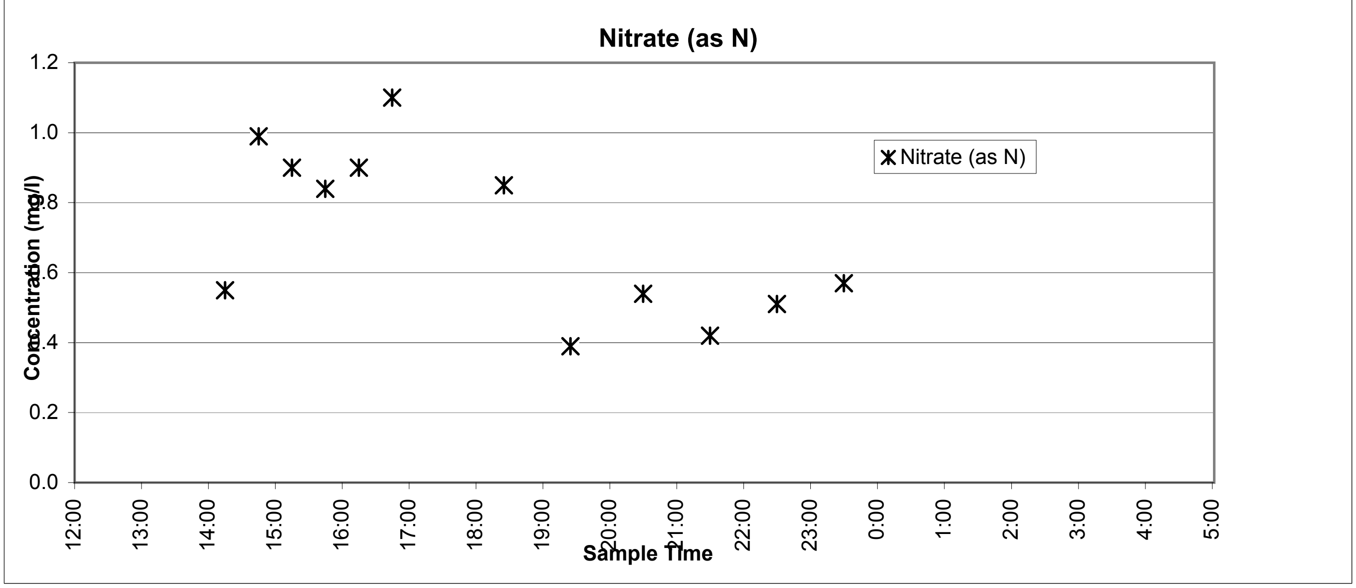
LEAD
Total
Concentration (ug/l)
Sample Time
180
160
140
120
100
80
60
40
20
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

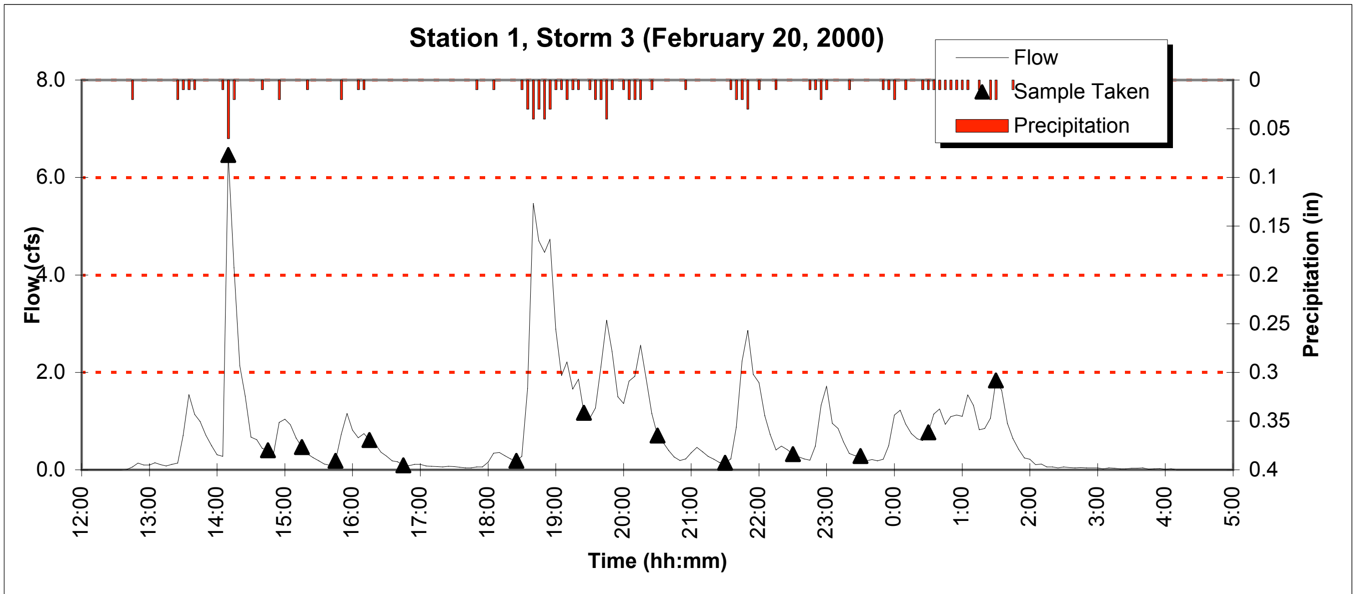


LEAD
Dissolved
Concentration (ug/l)
Sample Time
20
18
16
14
12
10
8
6
4
2
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

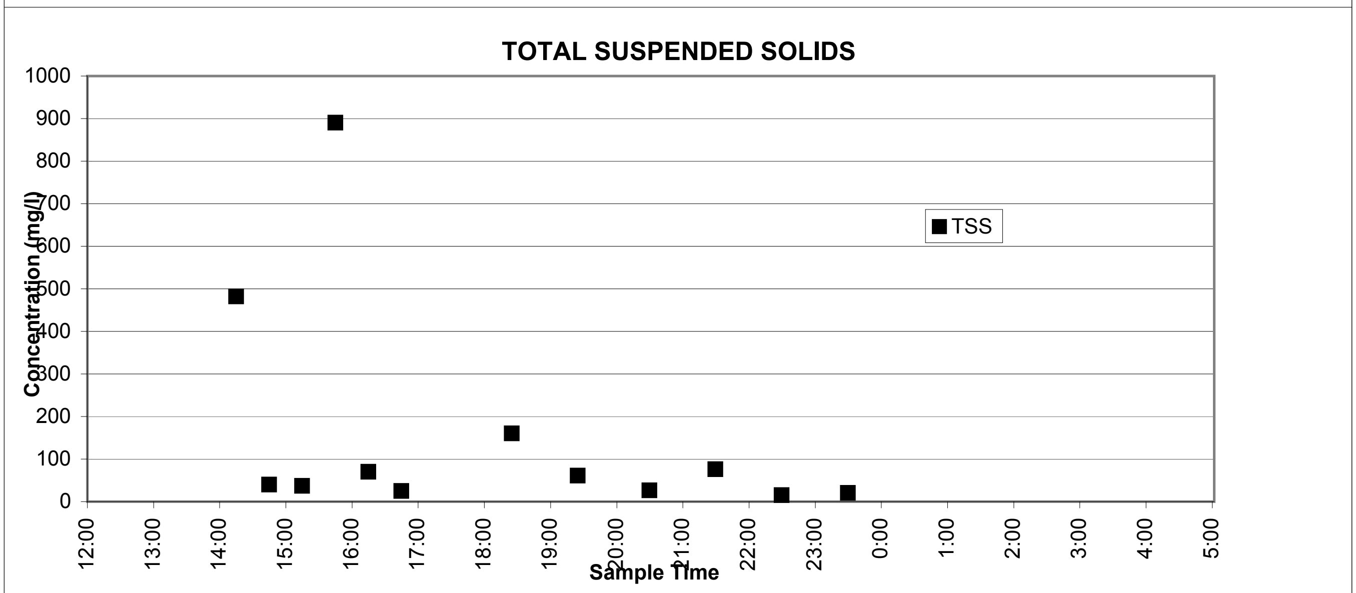

Station 1, Storm 3 (February 20, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time

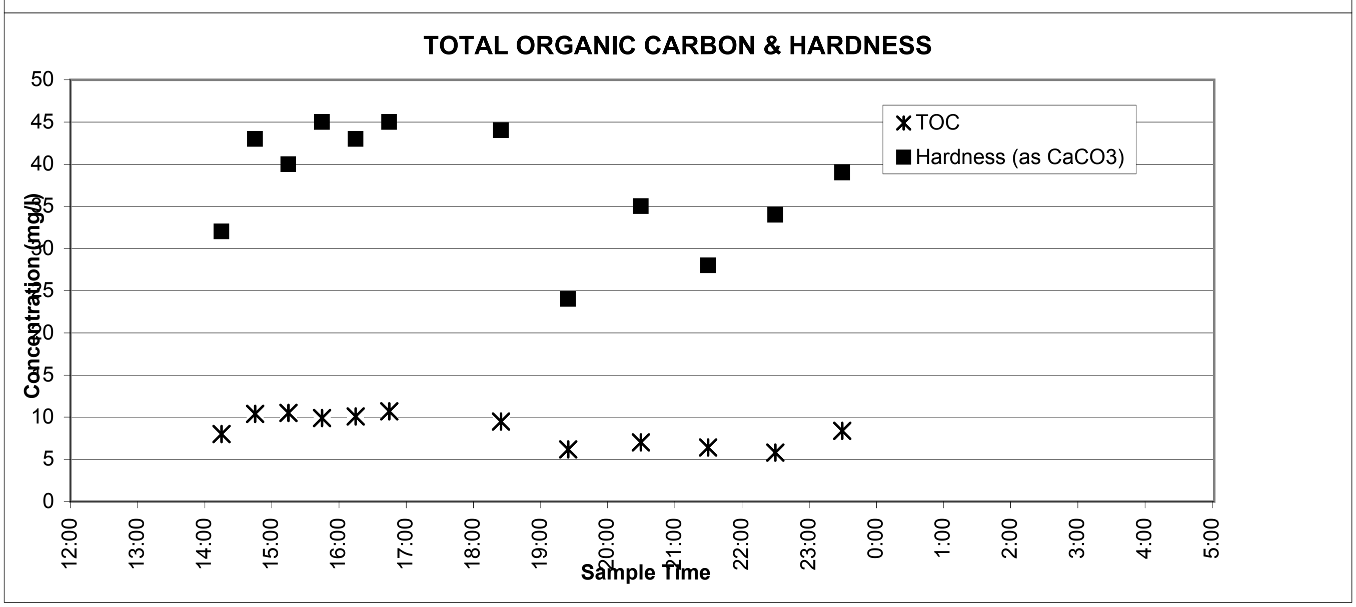

Nitrate (as N)
Nitrate (as N)
Concentration (mg/l)
Sample Time



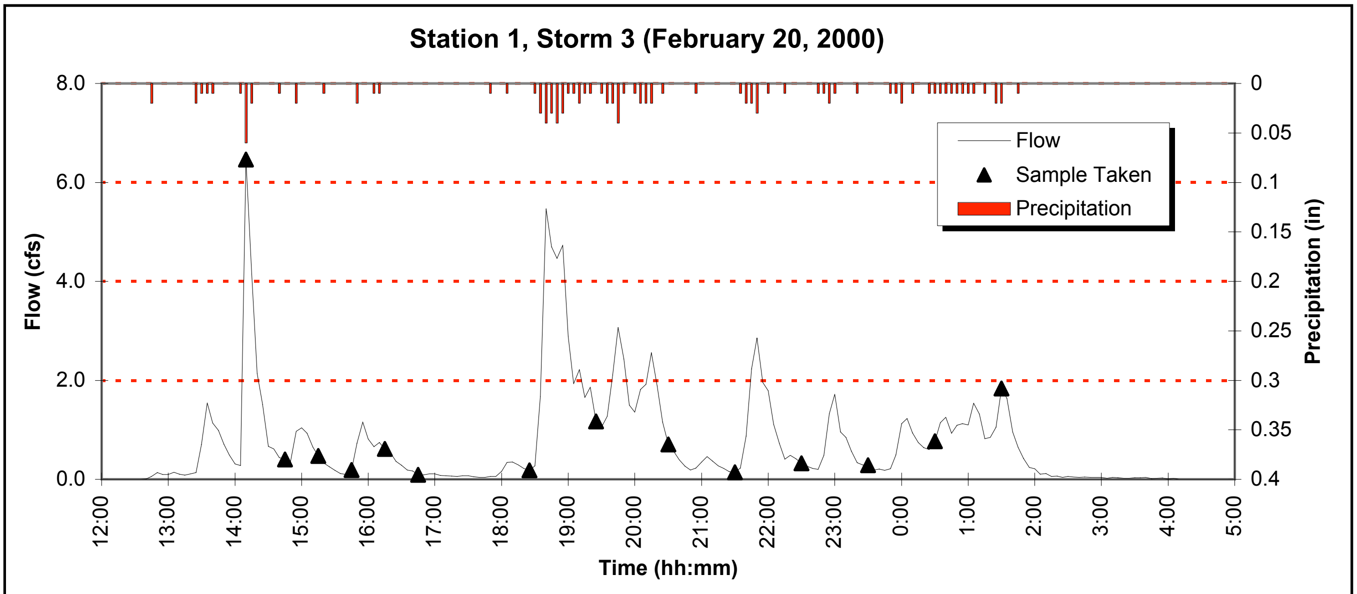
Station 1, Storm 3 (February 20, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
8.0
6.0
4.0
2.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

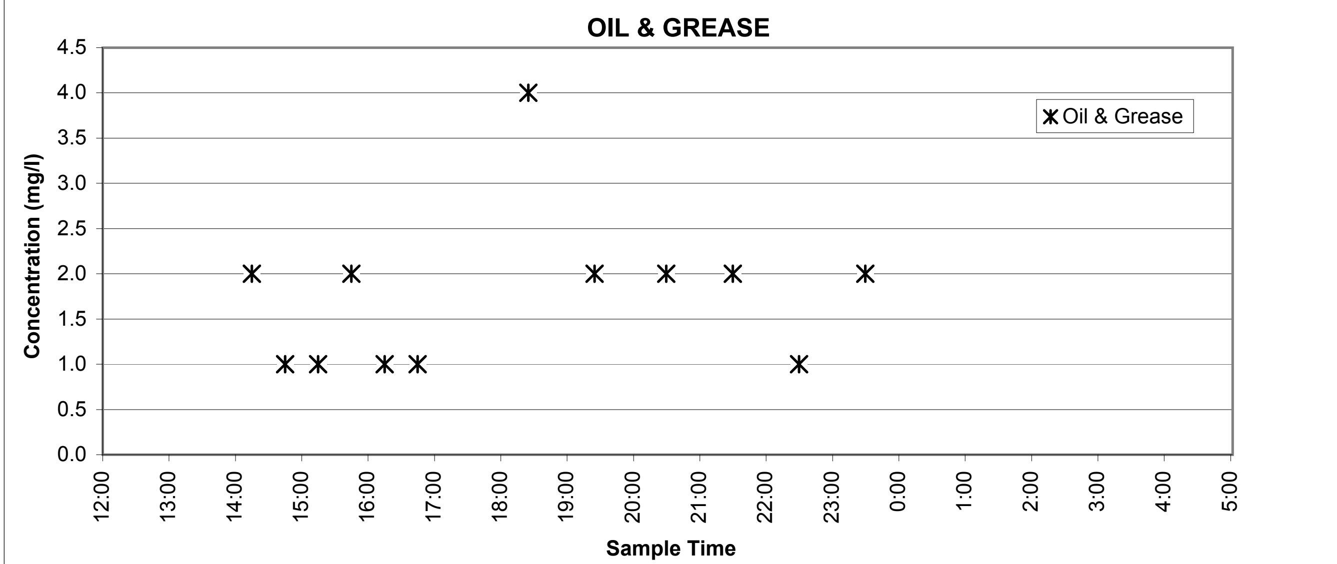


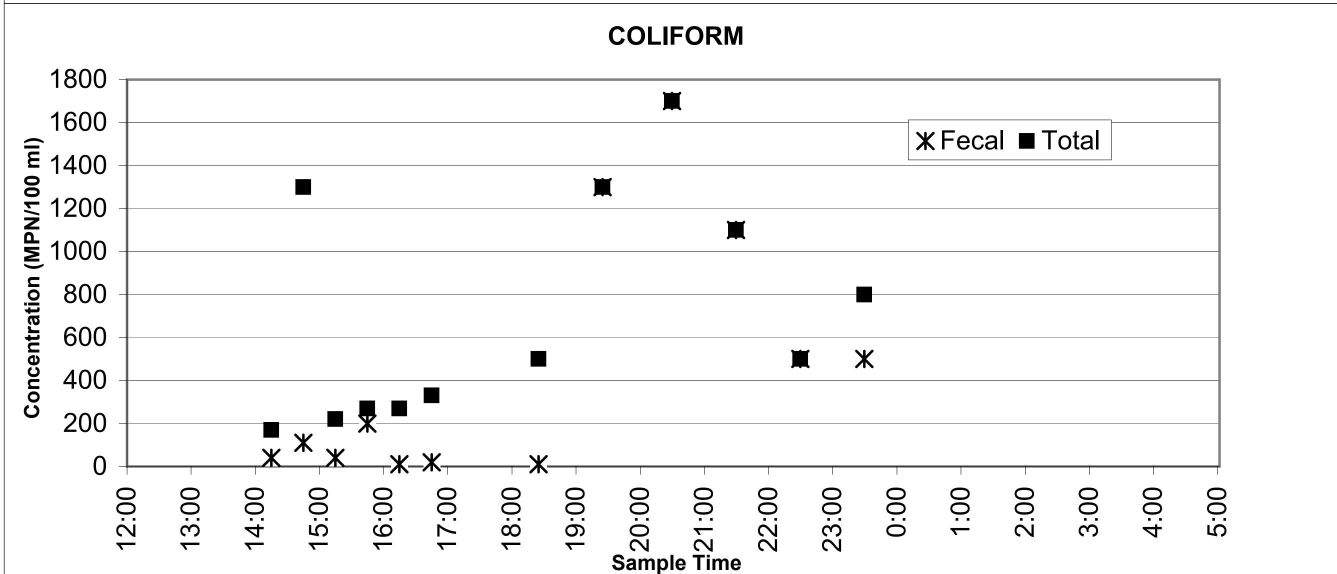
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time
1000
900
800
700
600
500
400
300
200
100
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

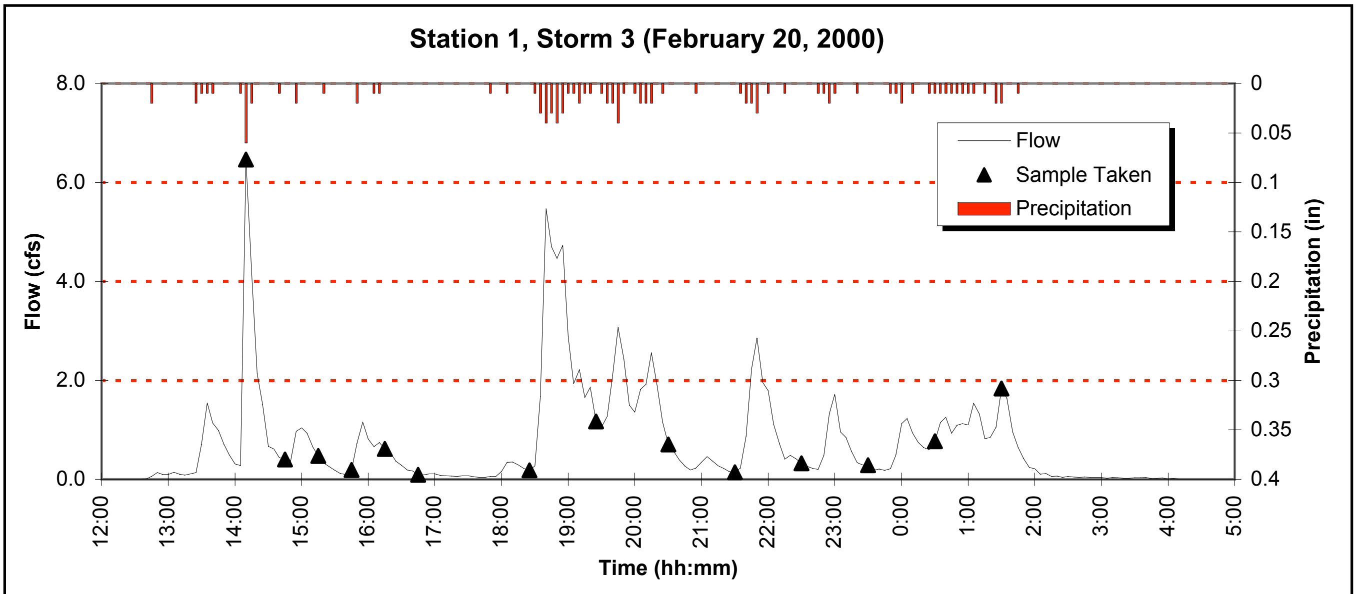


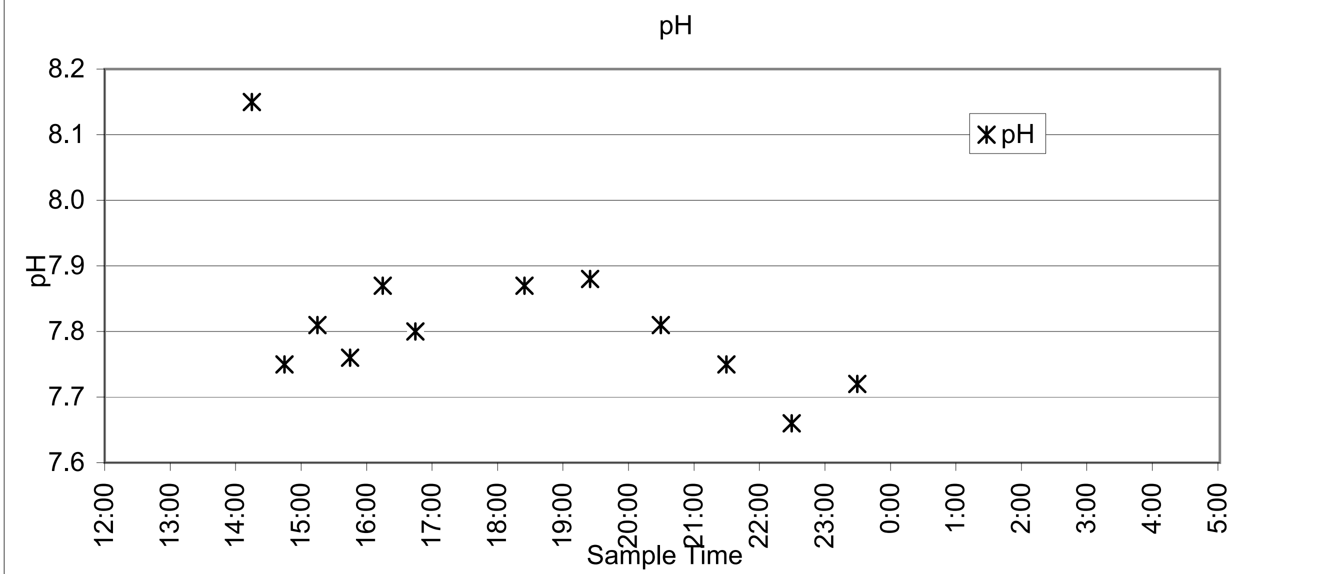
TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time
50
45
40
35
30
25
20
15
10
5
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

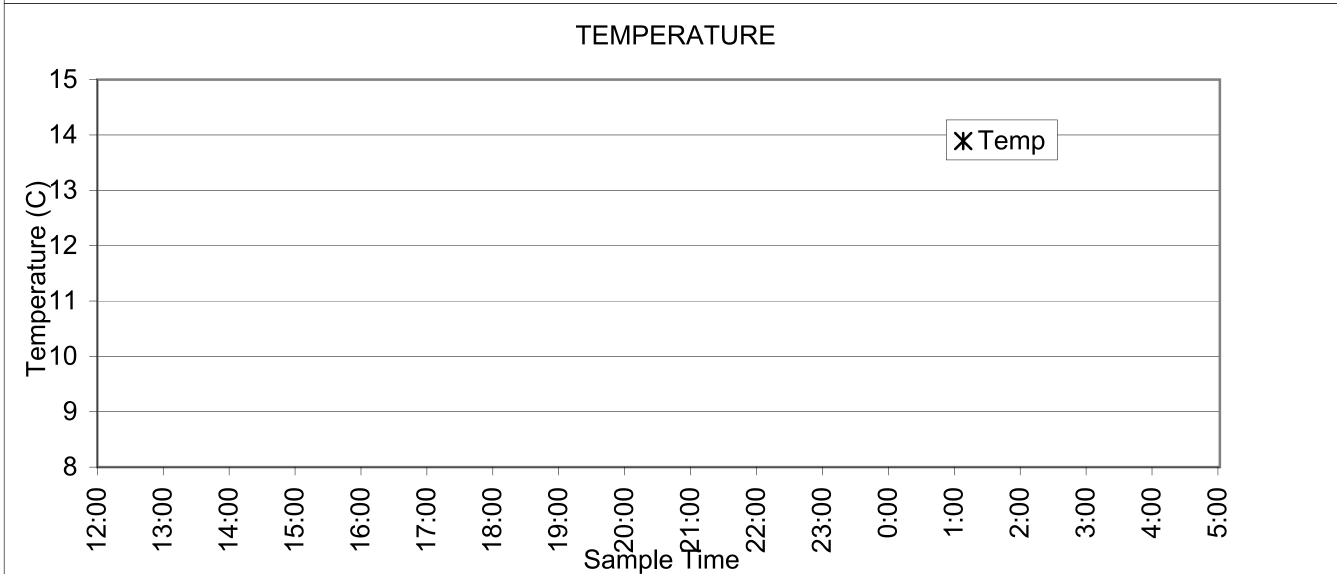

Station 1, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

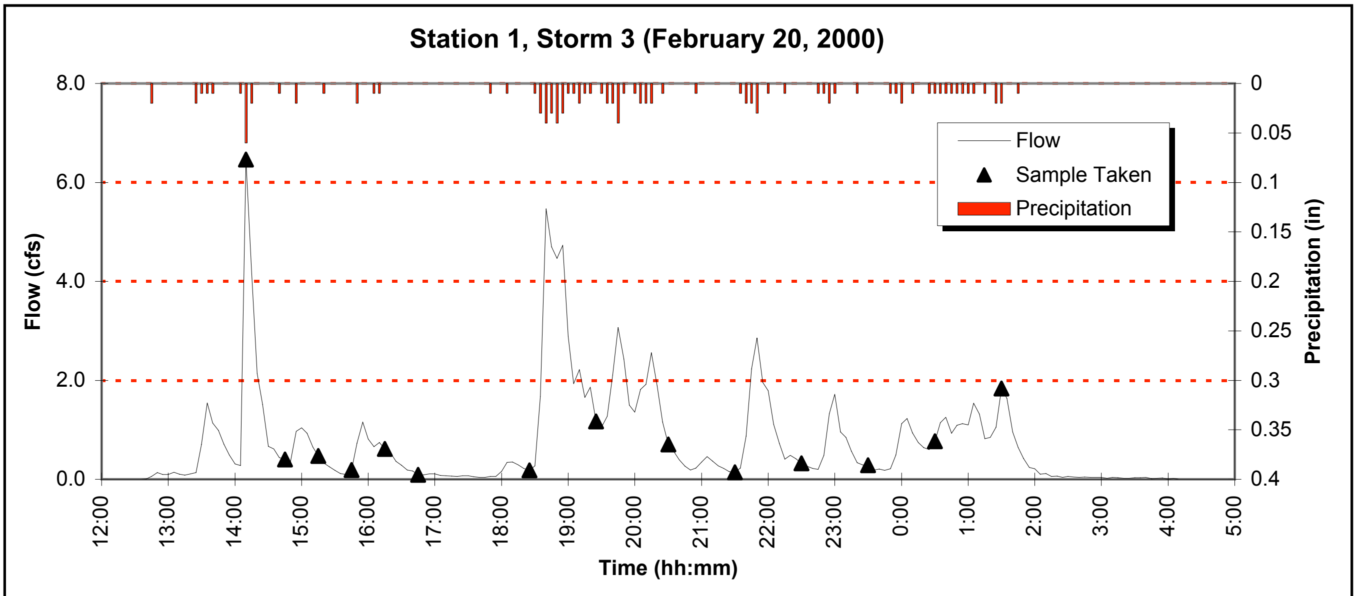

OIL & GREASE
Concentration (mg/l)
Sample Time
Oil & Grease


COLIFORM
Concentration (MPN/100 ml)
Sample Time
Fecal
Total

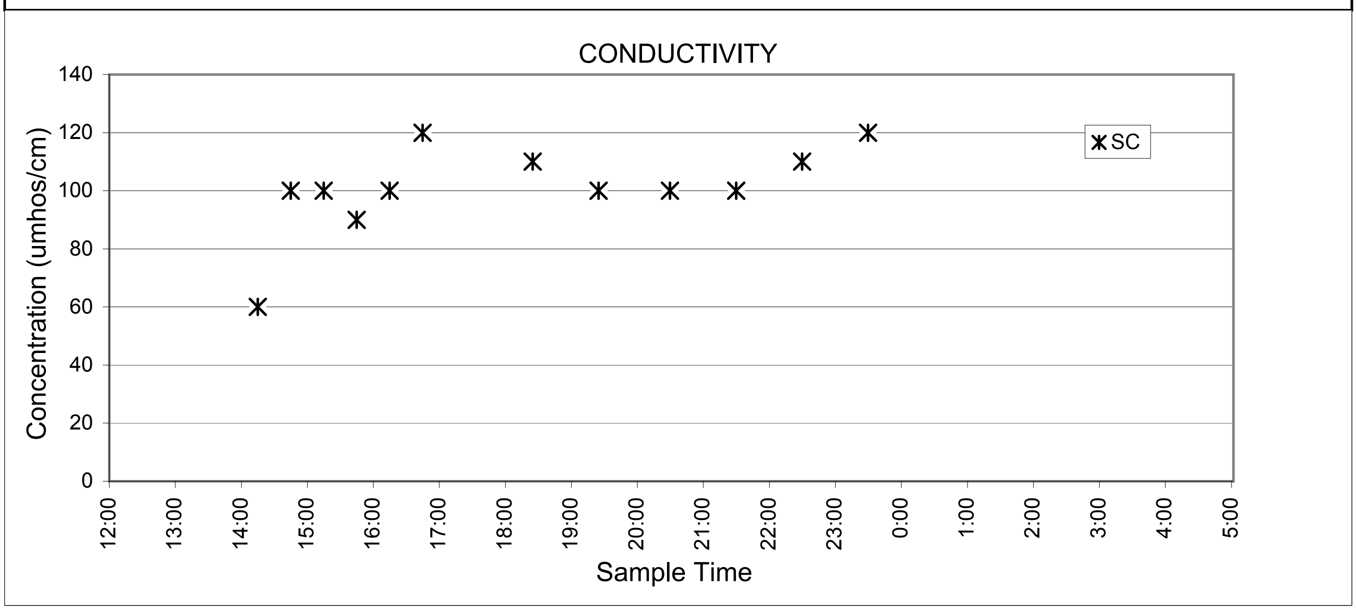

Station 1, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation


pH
pH
Sample Time

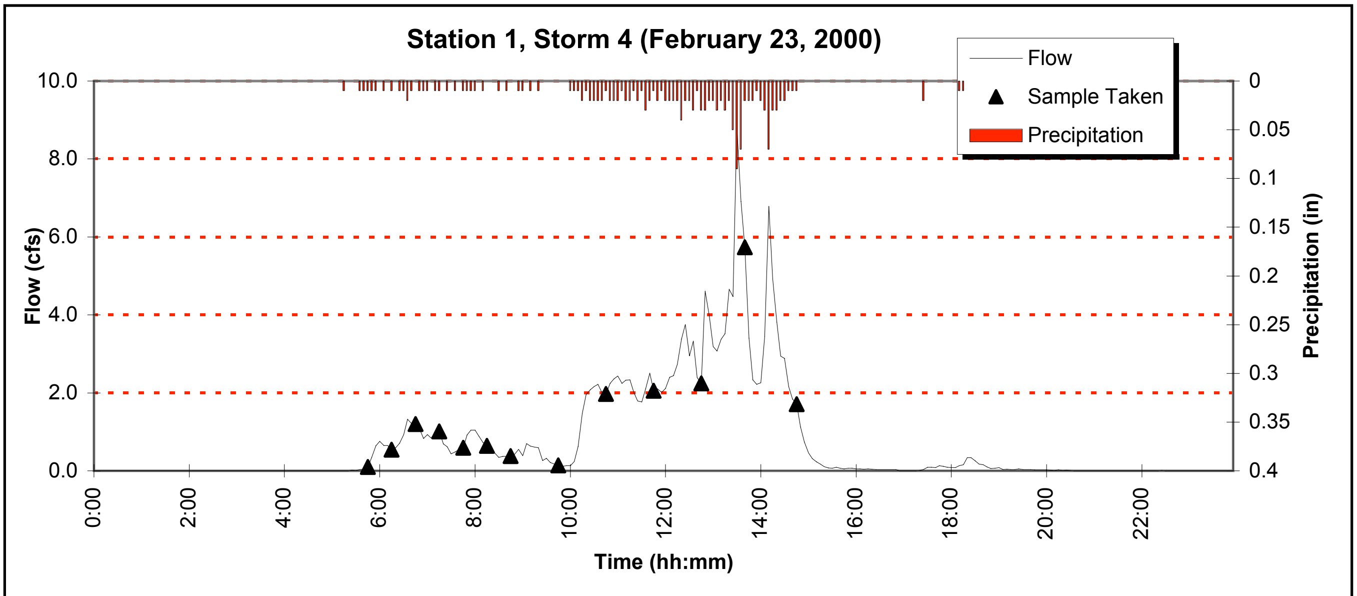

TEMPERATURE
Temperature (C)
Temp
Sample Time

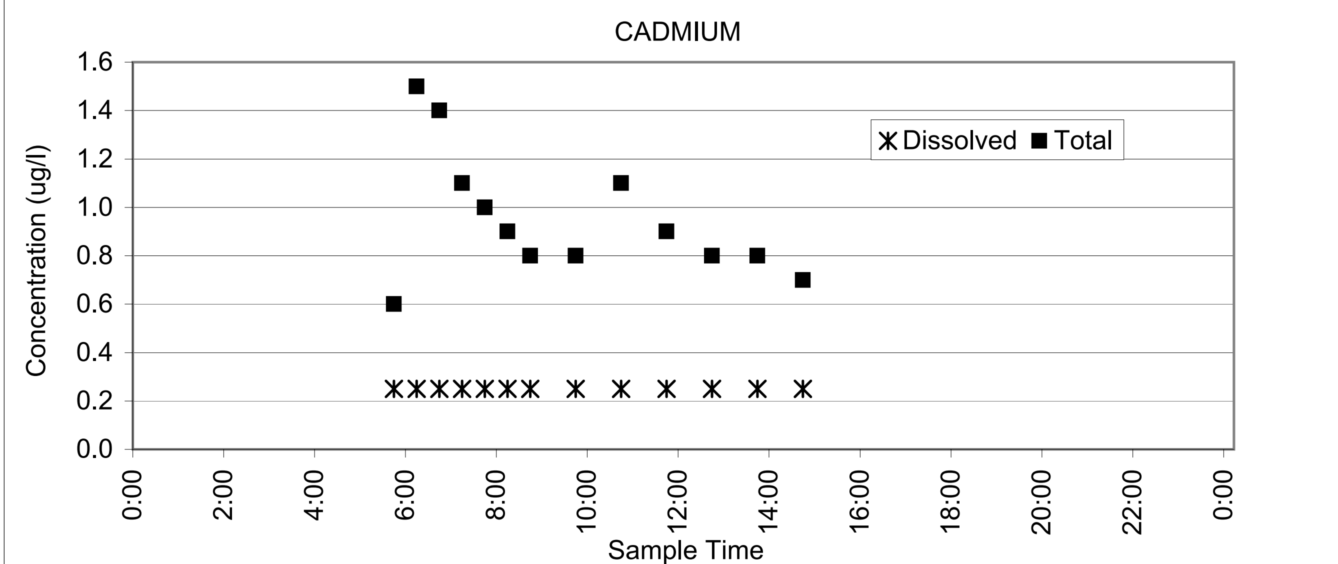


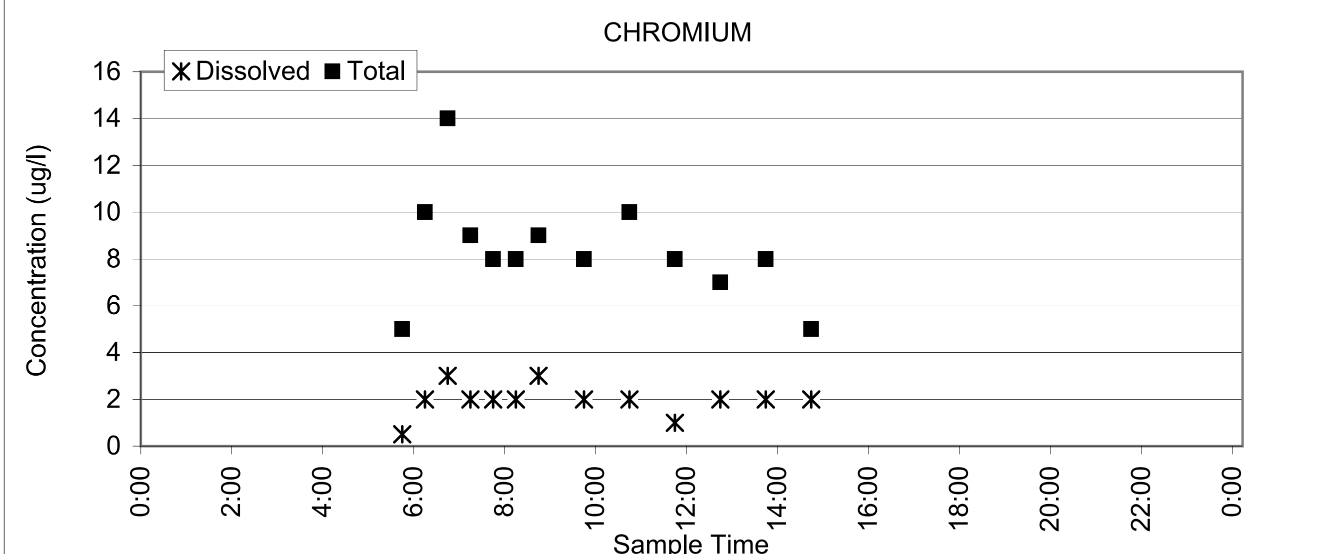
Station 1, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
8.0
6.0
4.0
2.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

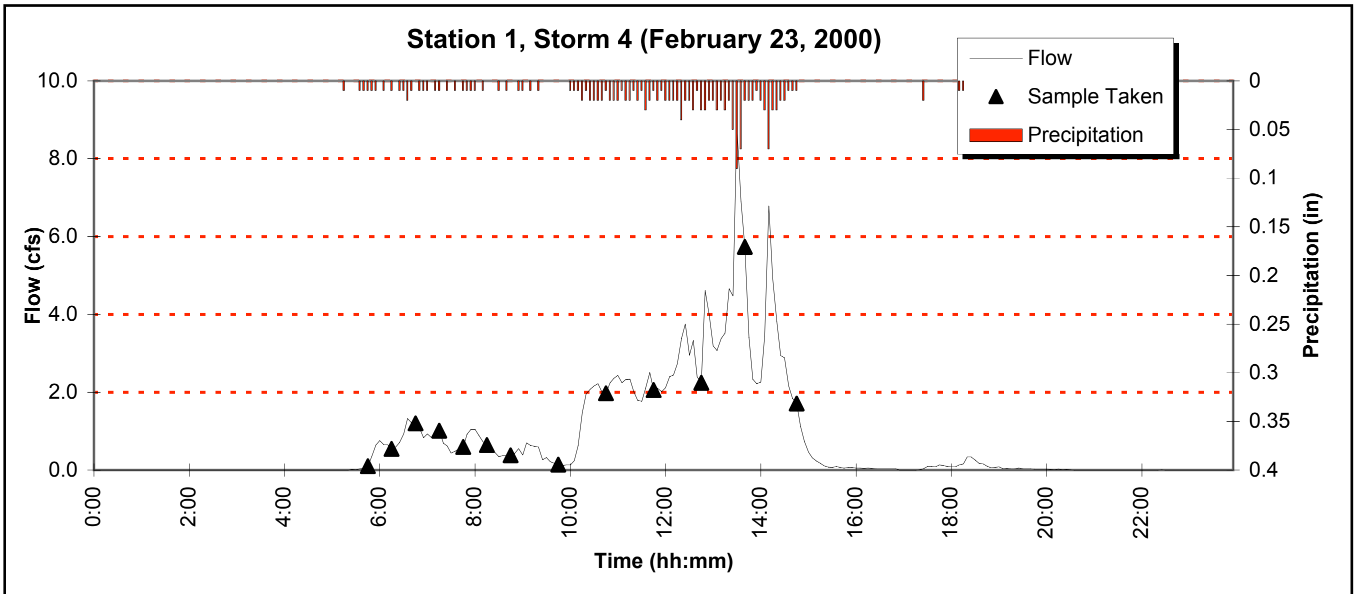


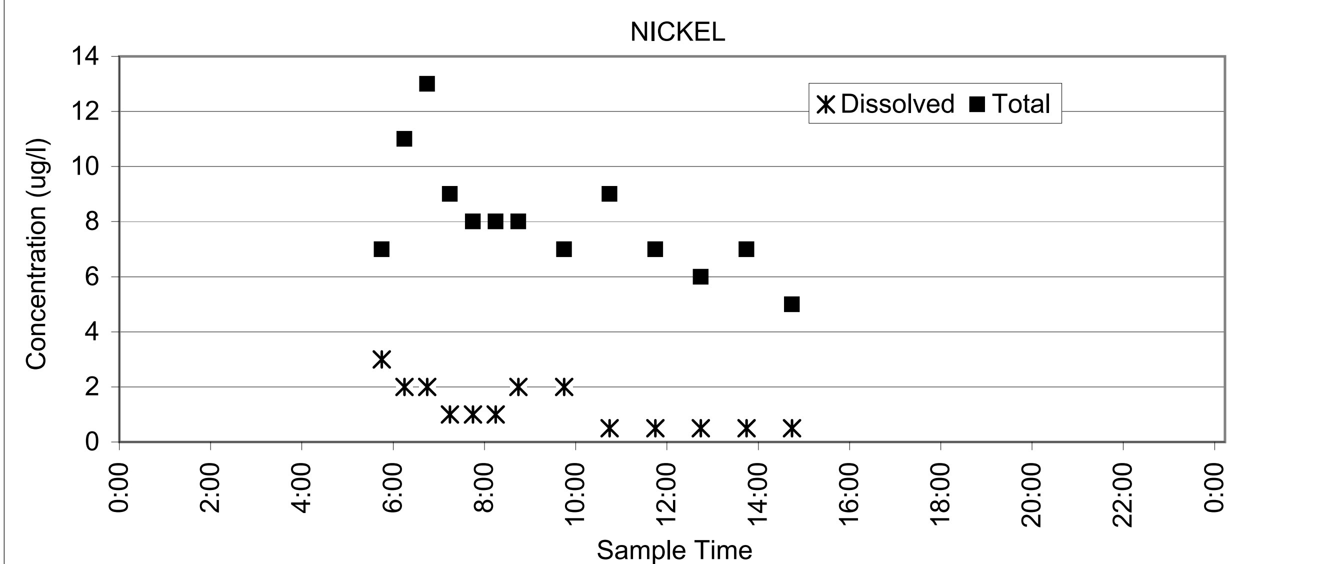
CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
SC
140
120
100
80
60
40
20
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

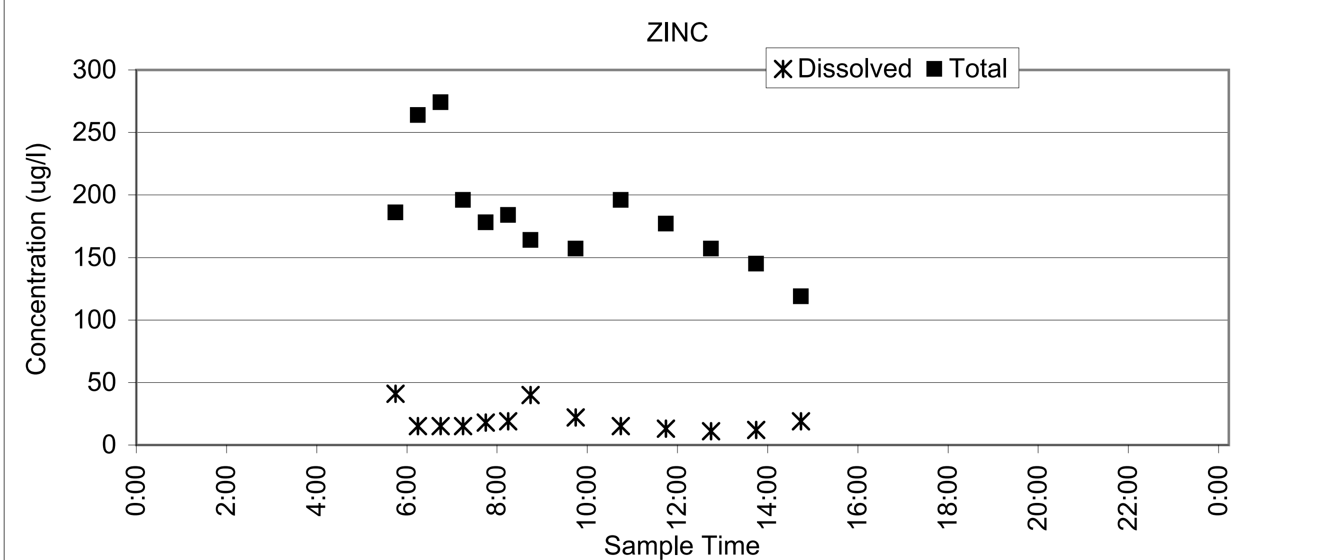

Station 1, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

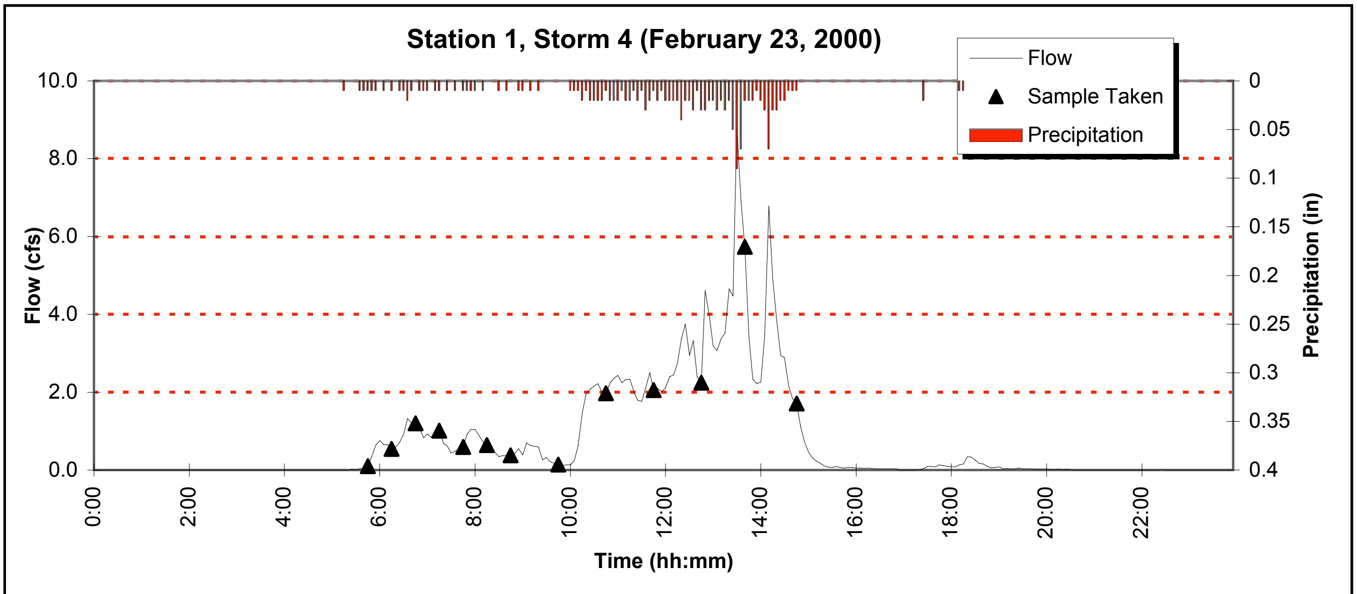

CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time

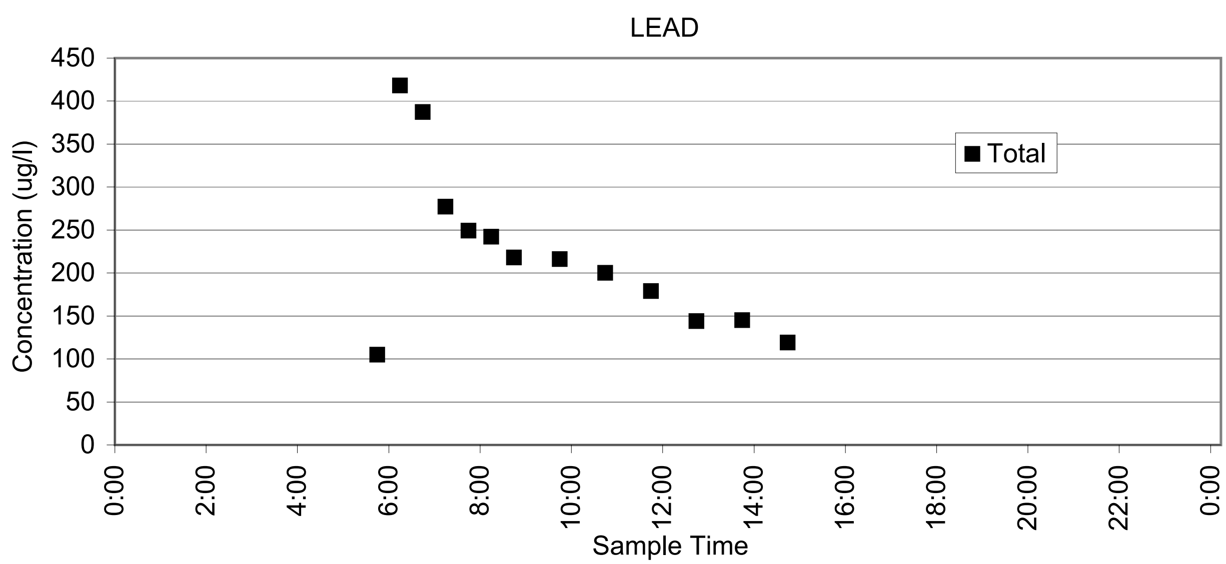

CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time

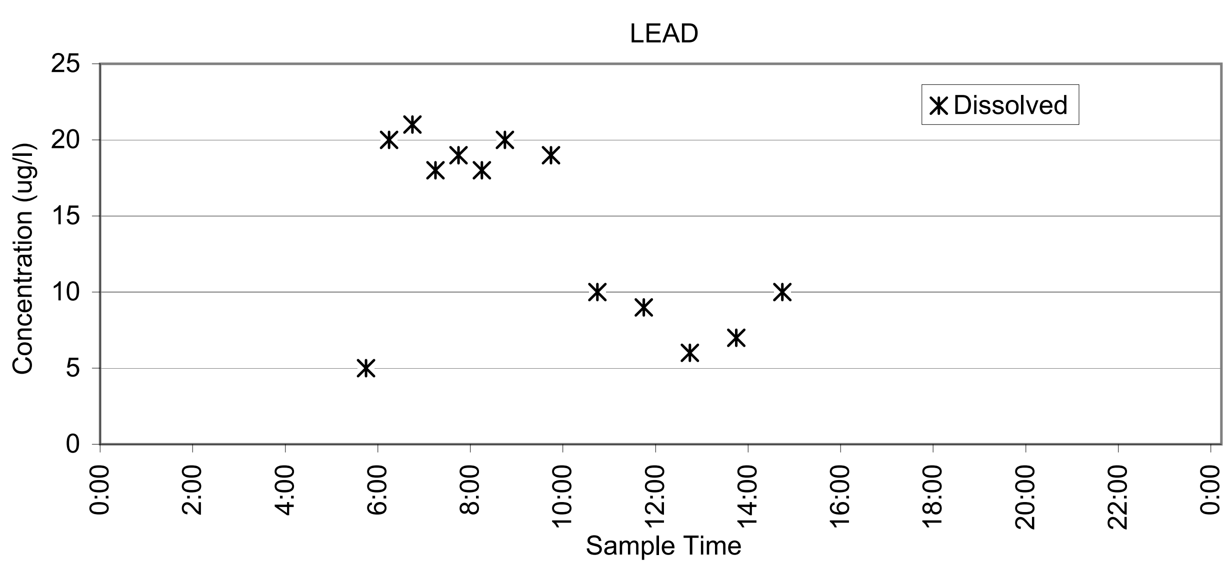

Station 1, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
10.0
8.0
6.0
4.0
2.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00

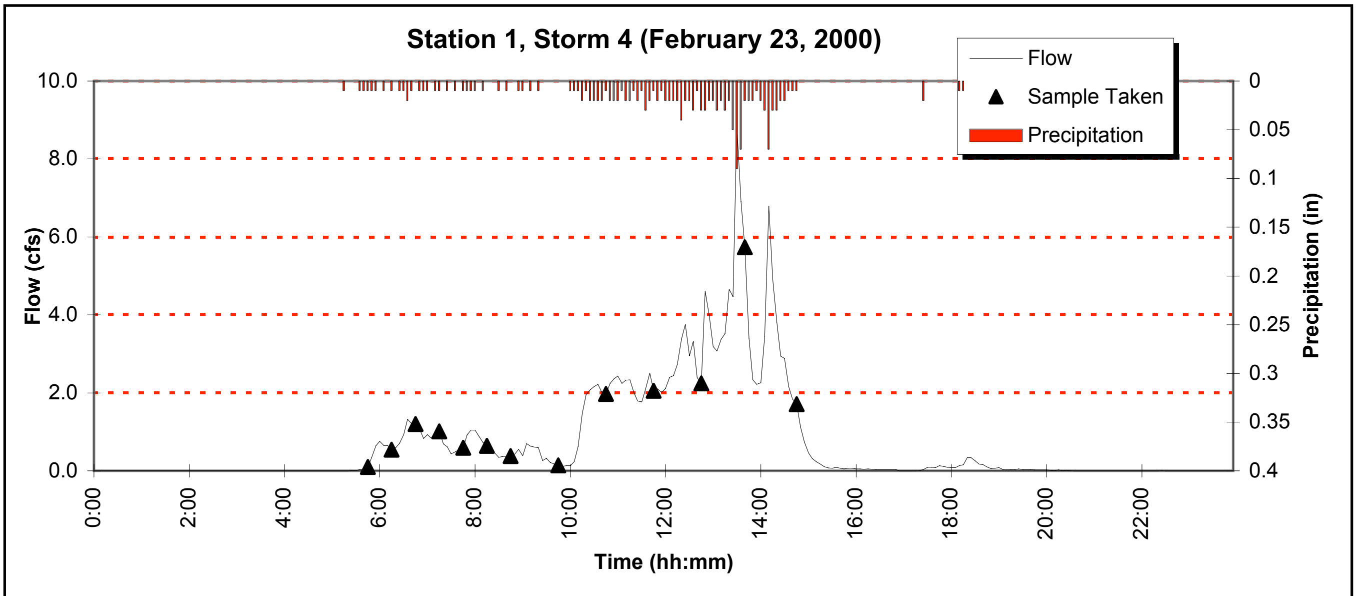

NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time
14
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

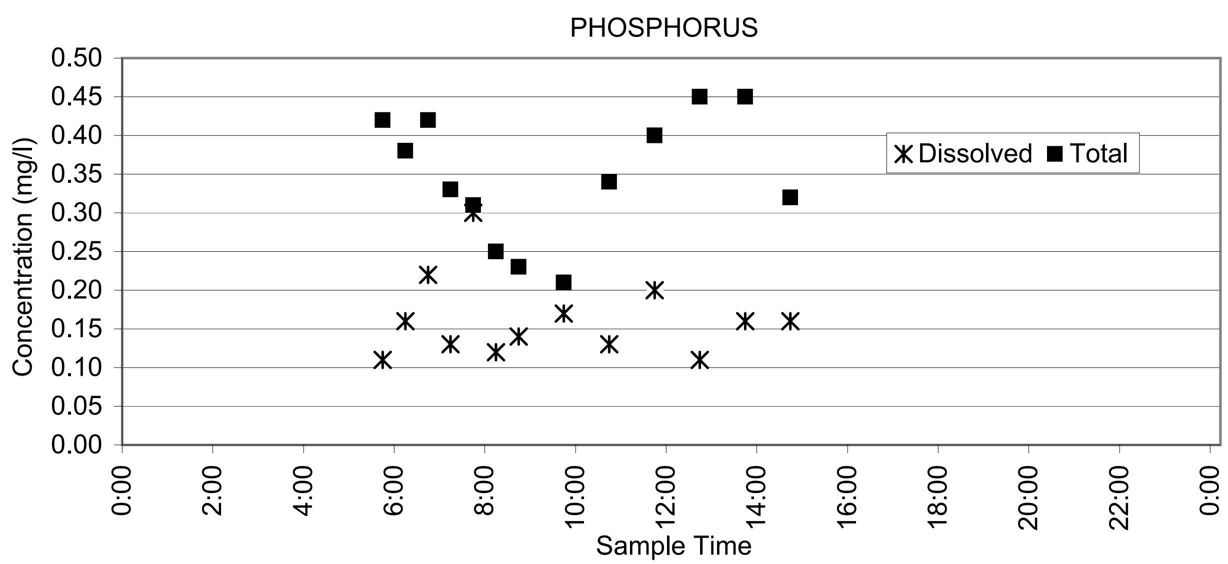

ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

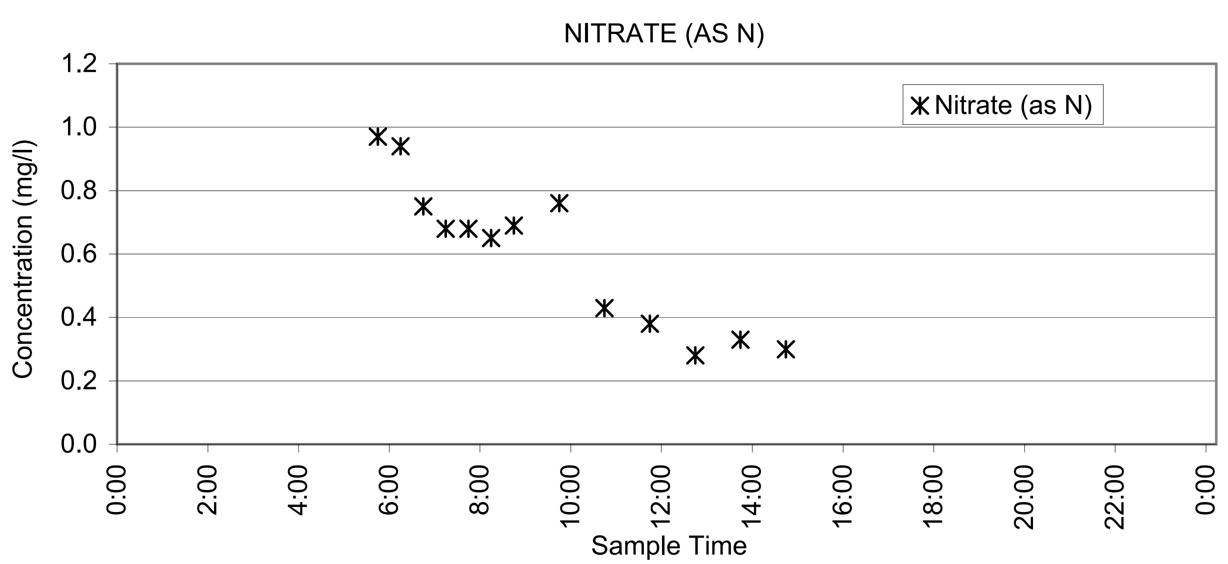

Station 1, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

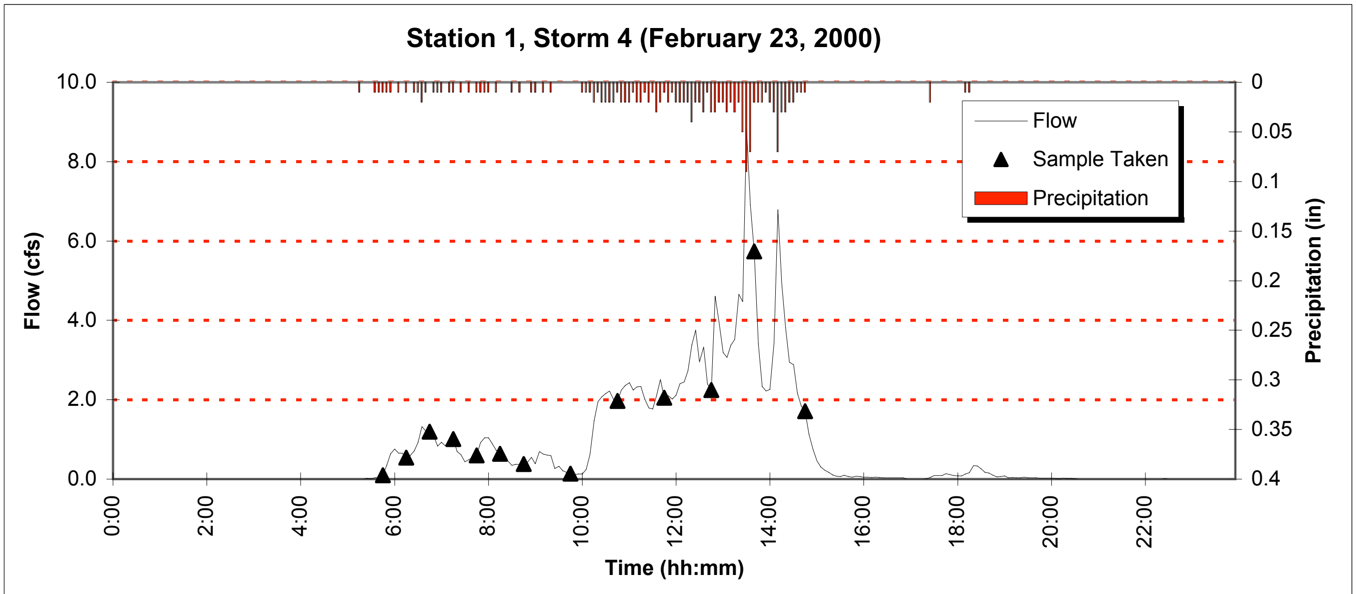

LEAD
Total
Concentration (ug/l)
Sample Time


LEAD
Dissolved
Concentration (ug/l)
Sample Time

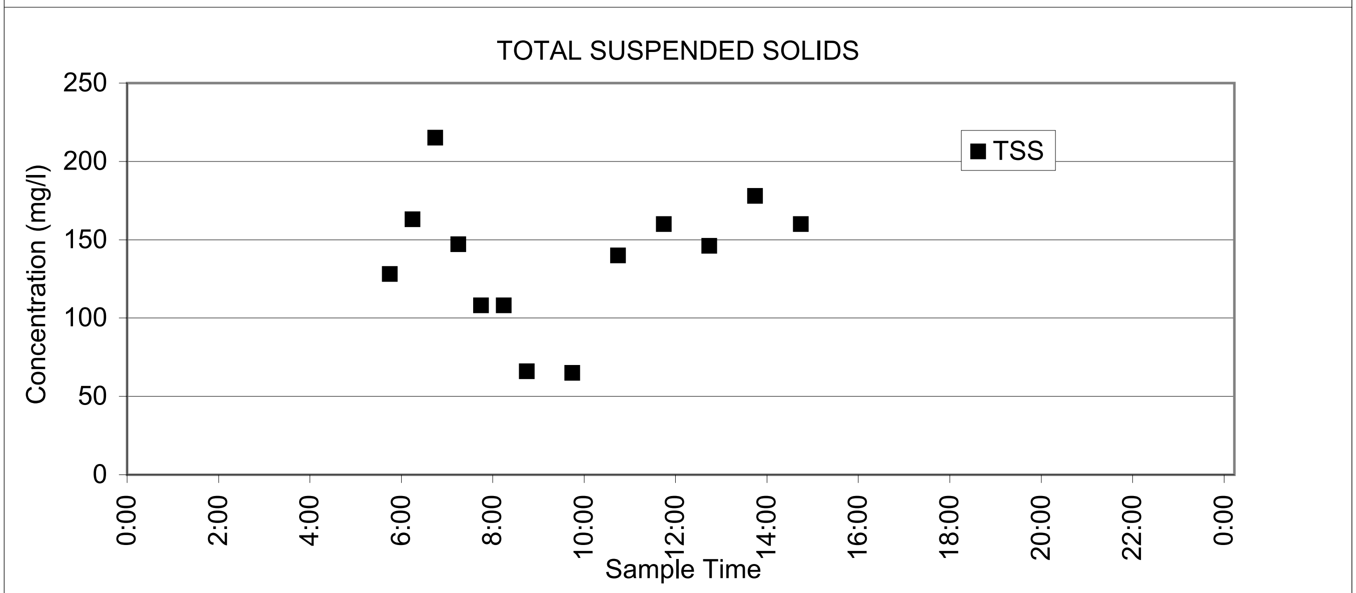

Station 1, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time

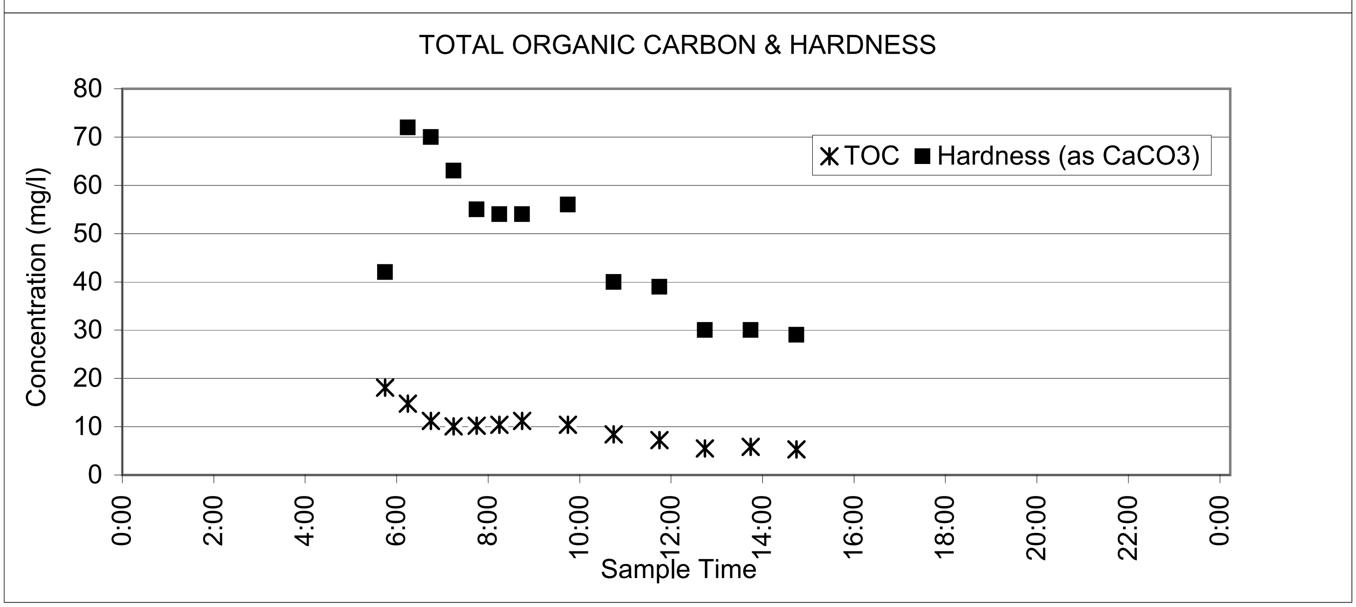

NITRATE (AS N)
Nitrate (as N)
Concentration (mg/l)
Sample Time



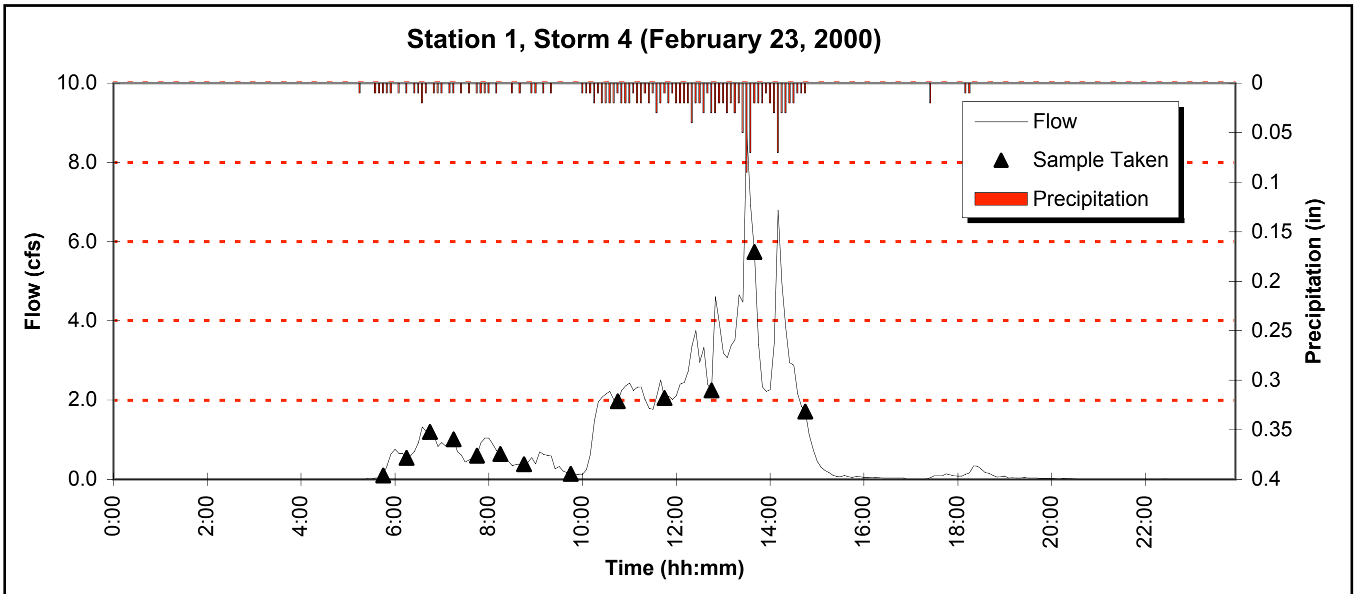
Station 1, Storm 4 (February 23, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation



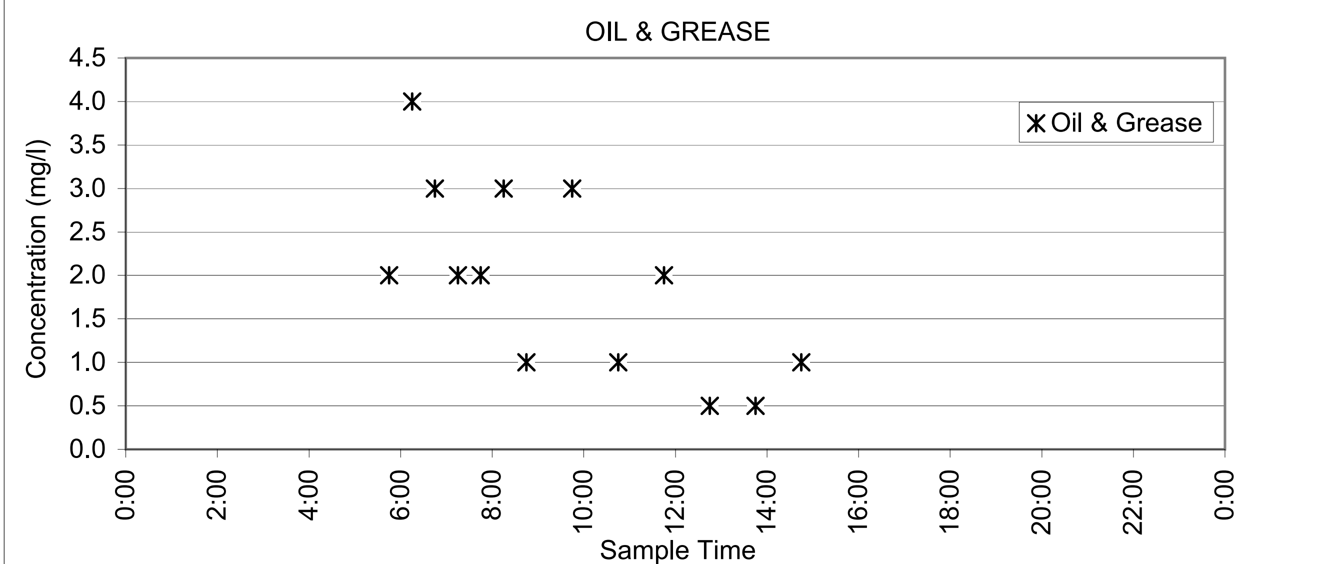
TOTAL SUSPENDED SOLIDS
Concentration (mg/l)
Sample Time
TSS



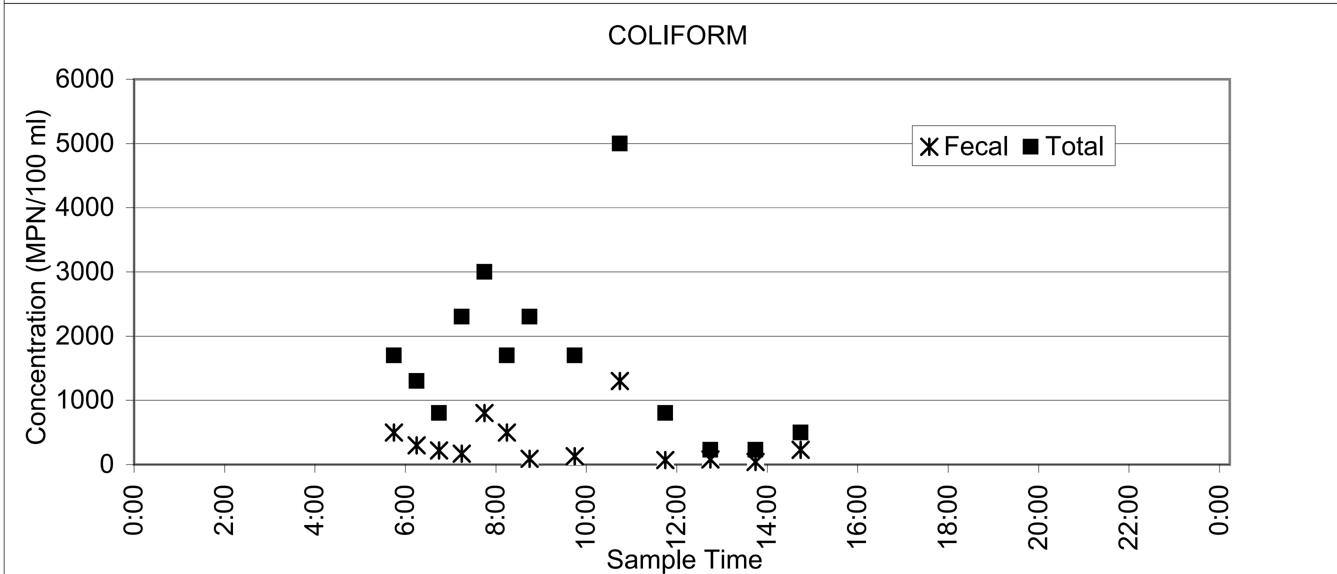
TOTAL ORGANIC CARBON & HARDNESS
Concentration (mg/l)
Sample Time
TOC
Hardness (as CaCO3)



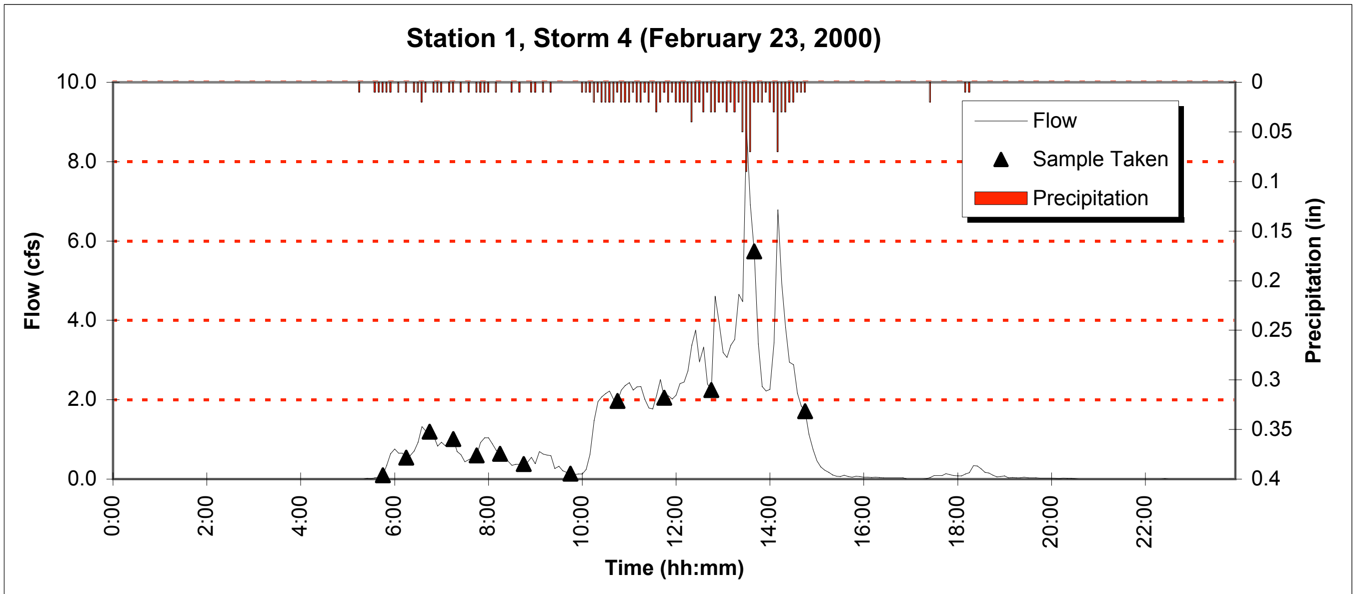
Station 1, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

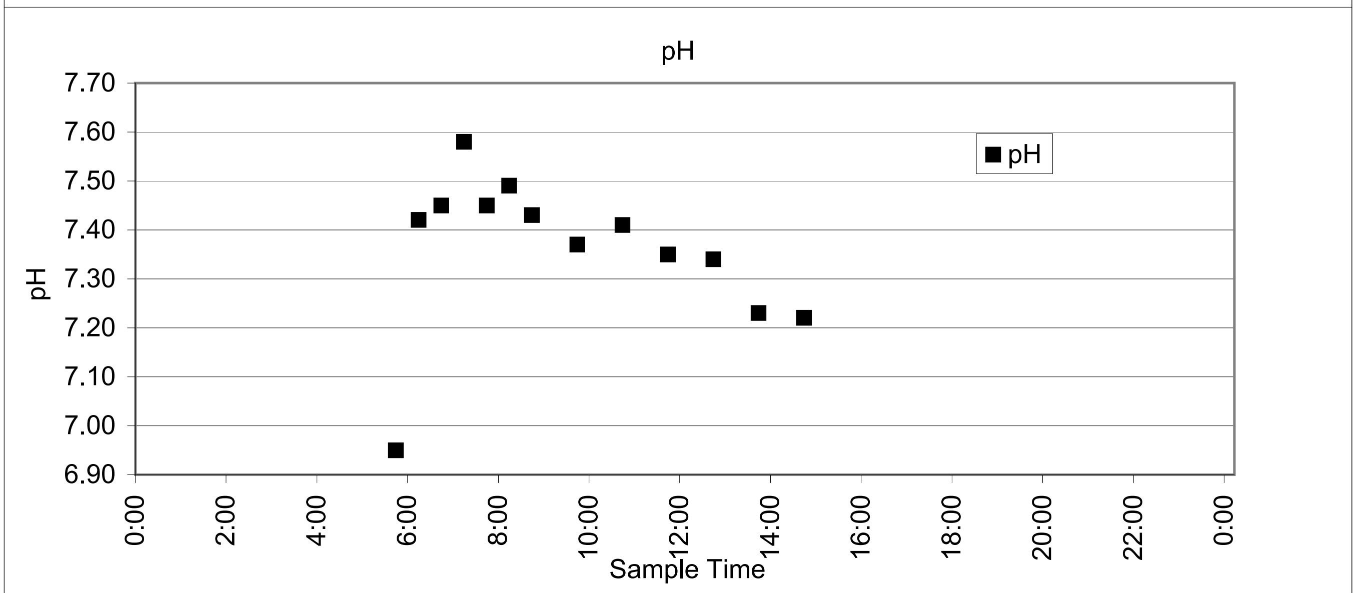


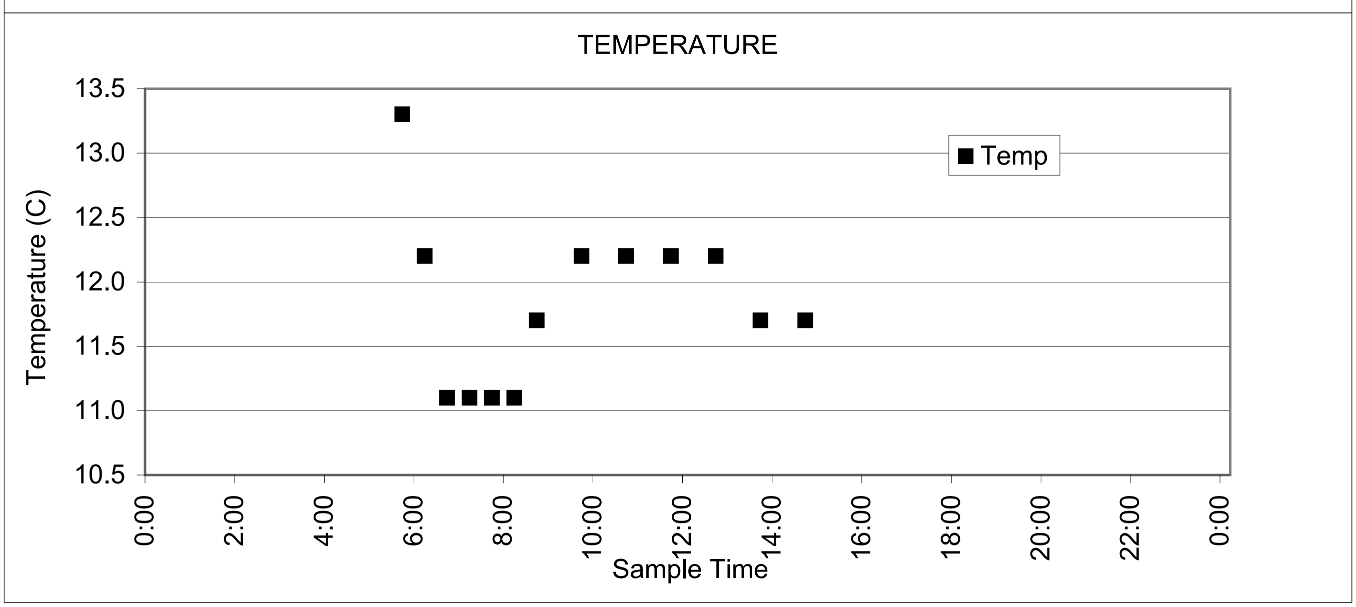
OIL & GREASE
Oil & Grease
Concentration (mg/l)
Sample Time

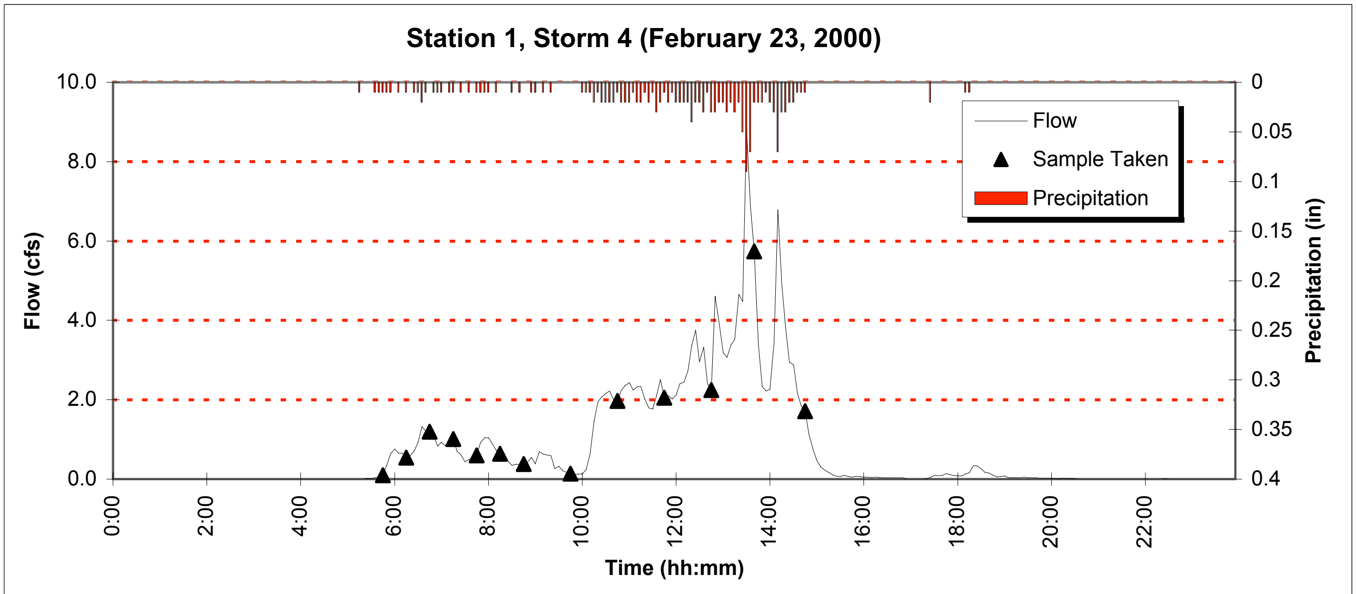


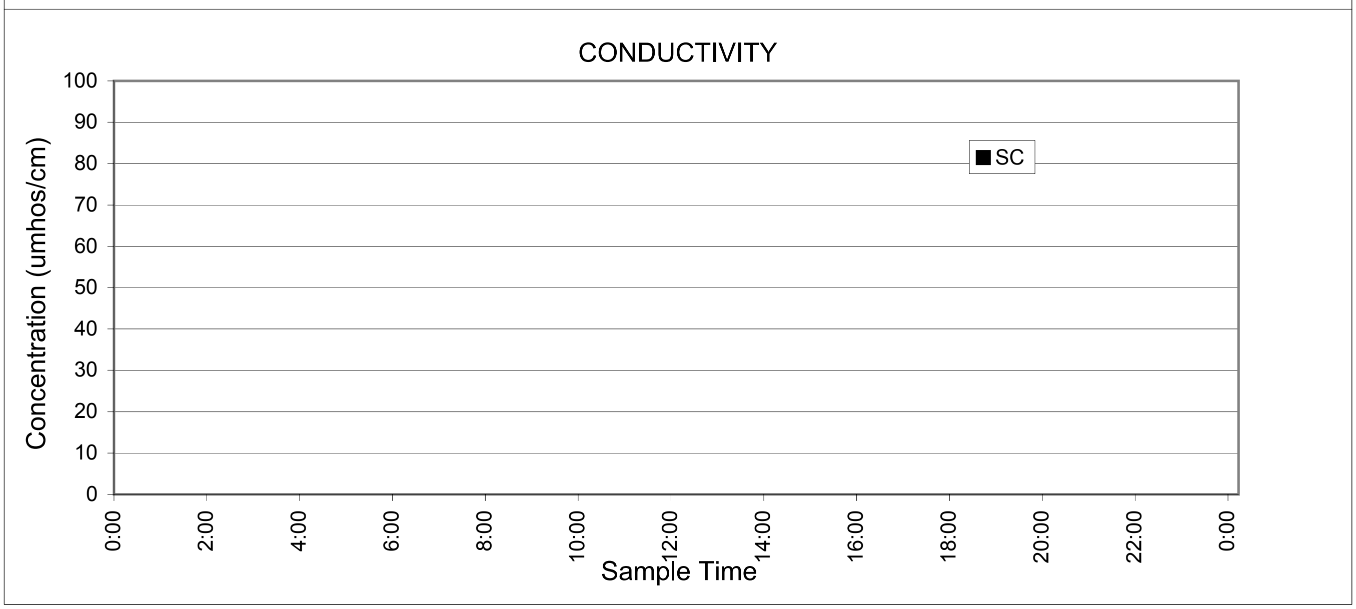
COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
Sample Time

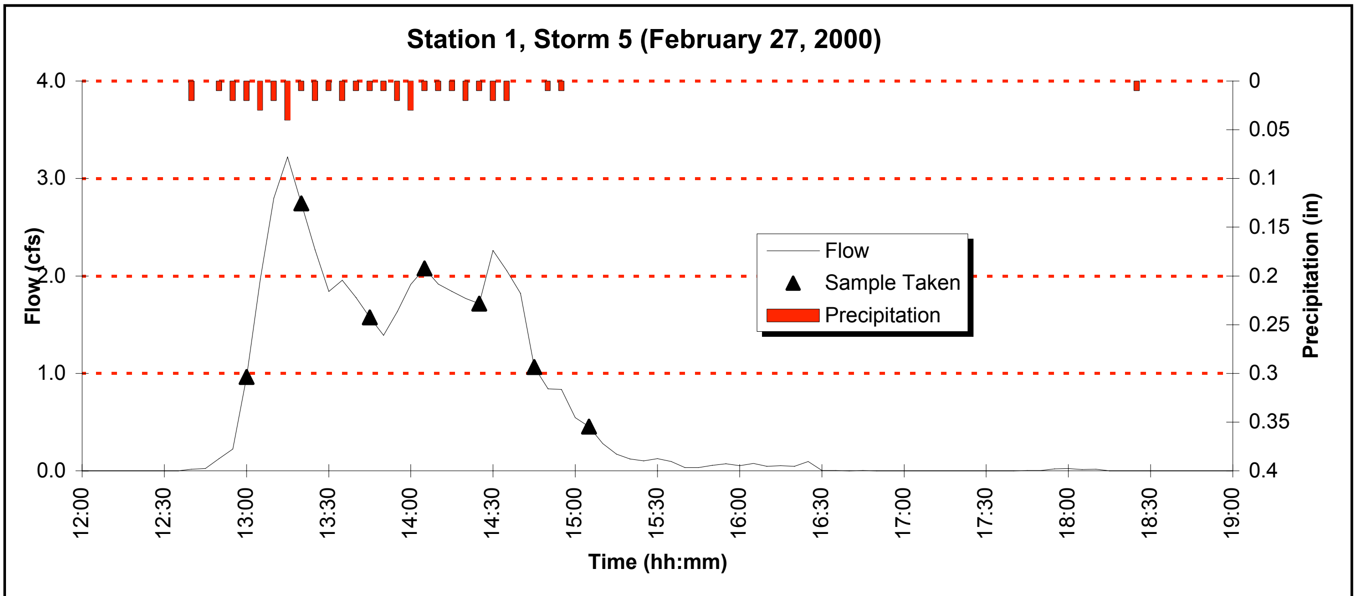

Station 1, Storm 4 (February 23, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
10.0
8.0
6.0
4.0
2.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00

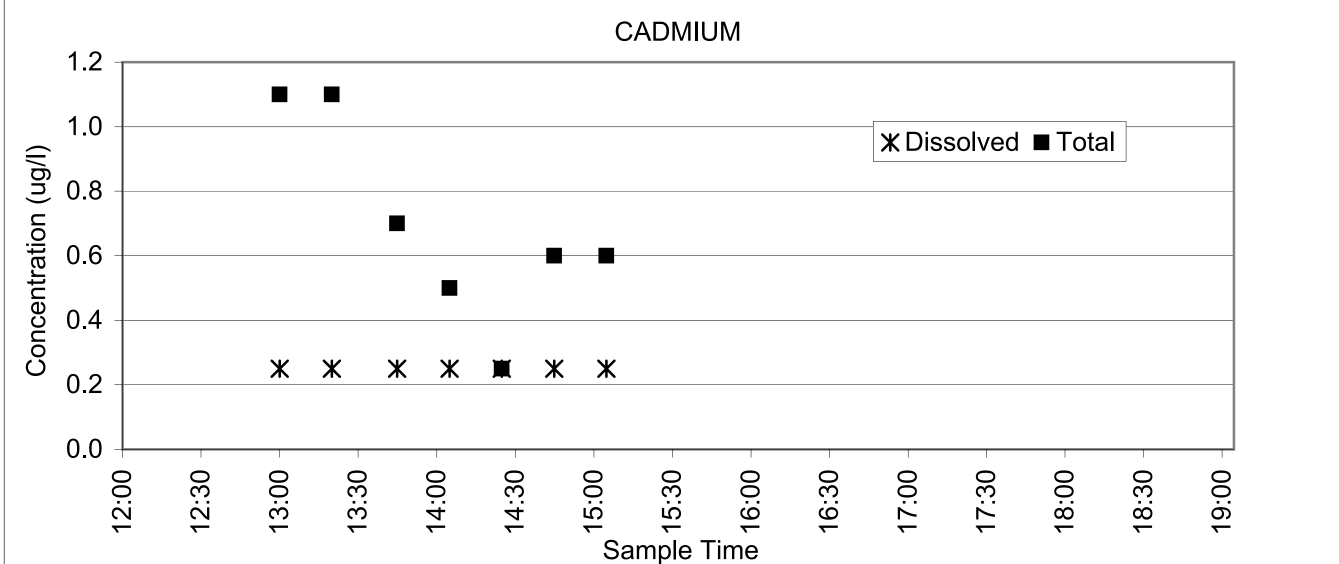

pH
pH
Sample Time
7.70
7.60
7.50
7.40
7.30
7.20
7.10
7.00
6.90
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

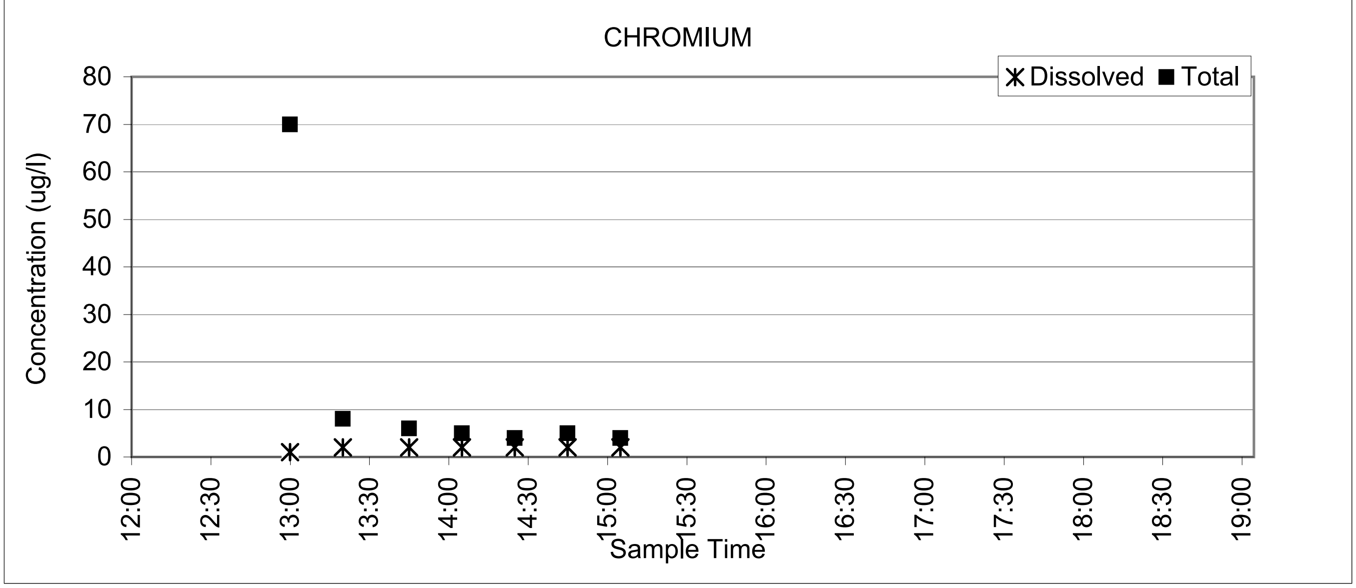

TEMPERATURE
Temp
Temperature (C)
Sample Time
13.5
13.0
12.5
12.0
11.5
11.0
10.5
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

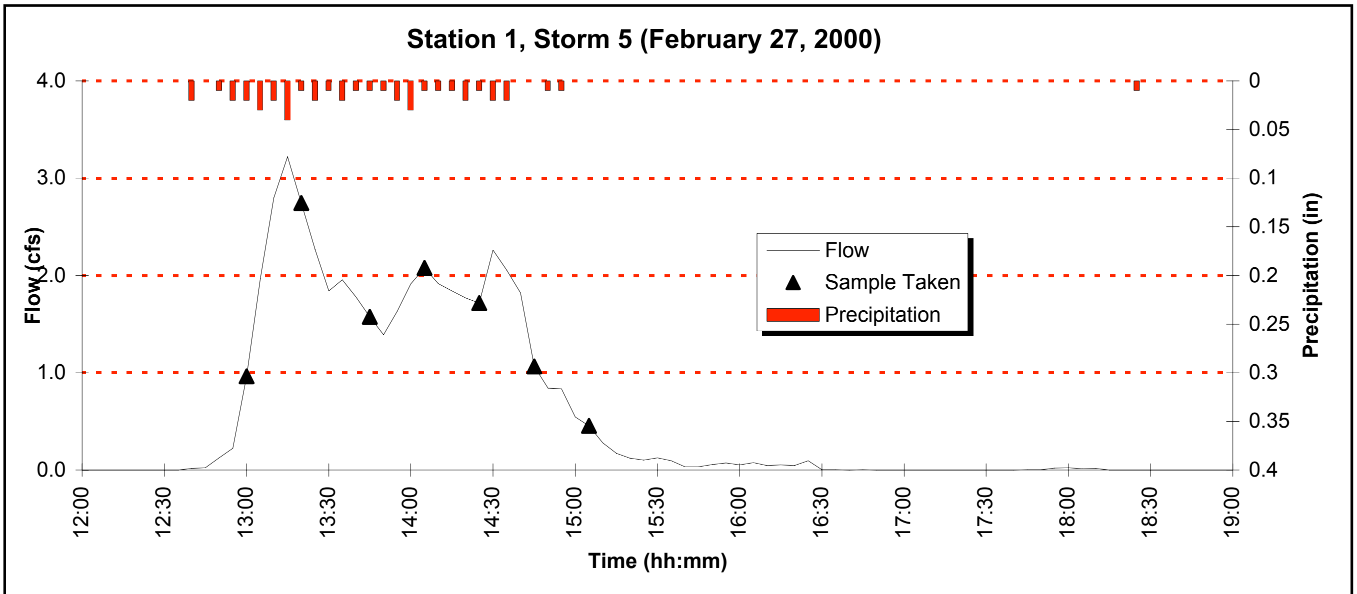

Station 1, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
10.0
8.0
6.0
4.0
2.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00

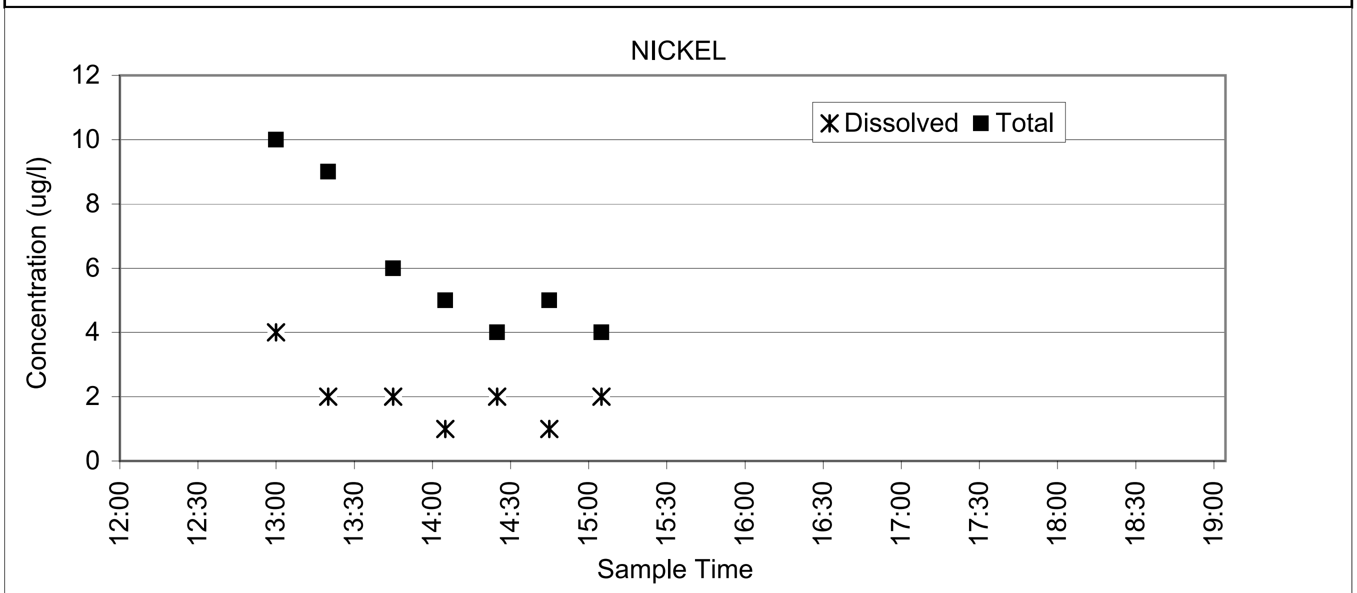

CONDUCTIVITY
SC
Concentration (umhos/cm)
Sample Time
100
90
80
70
60
50
40
30
20
10
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

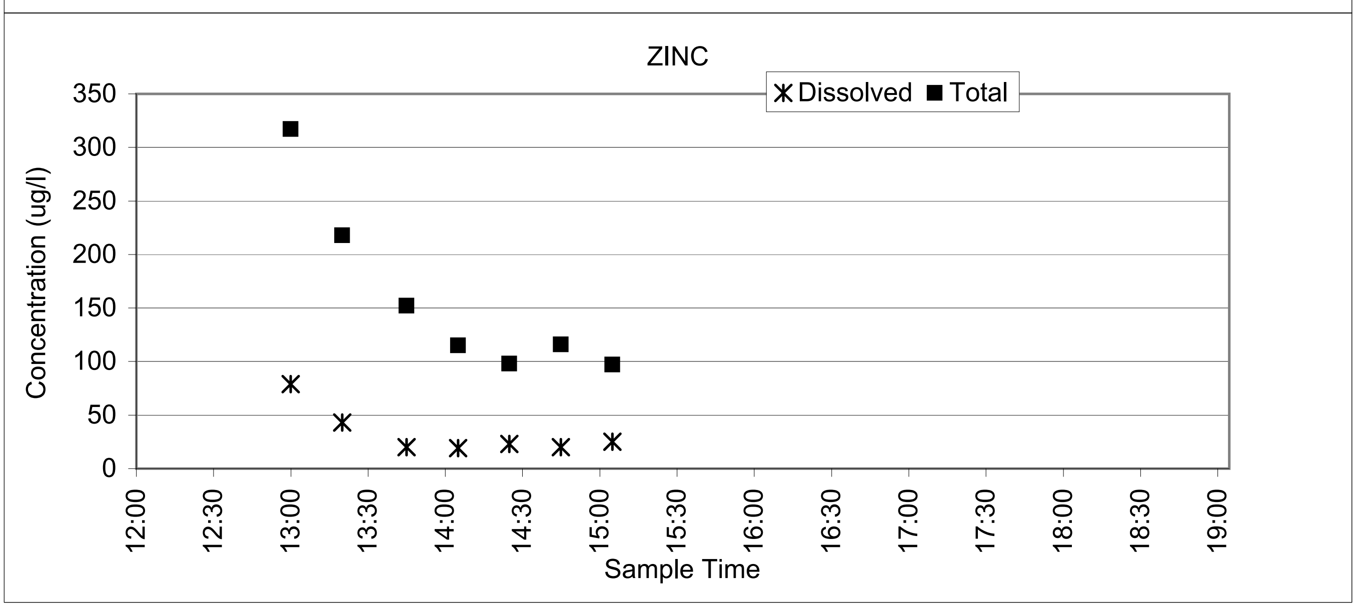

Station 1, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Flow
Sample Taken
Precipitation
Time (hh:mm)

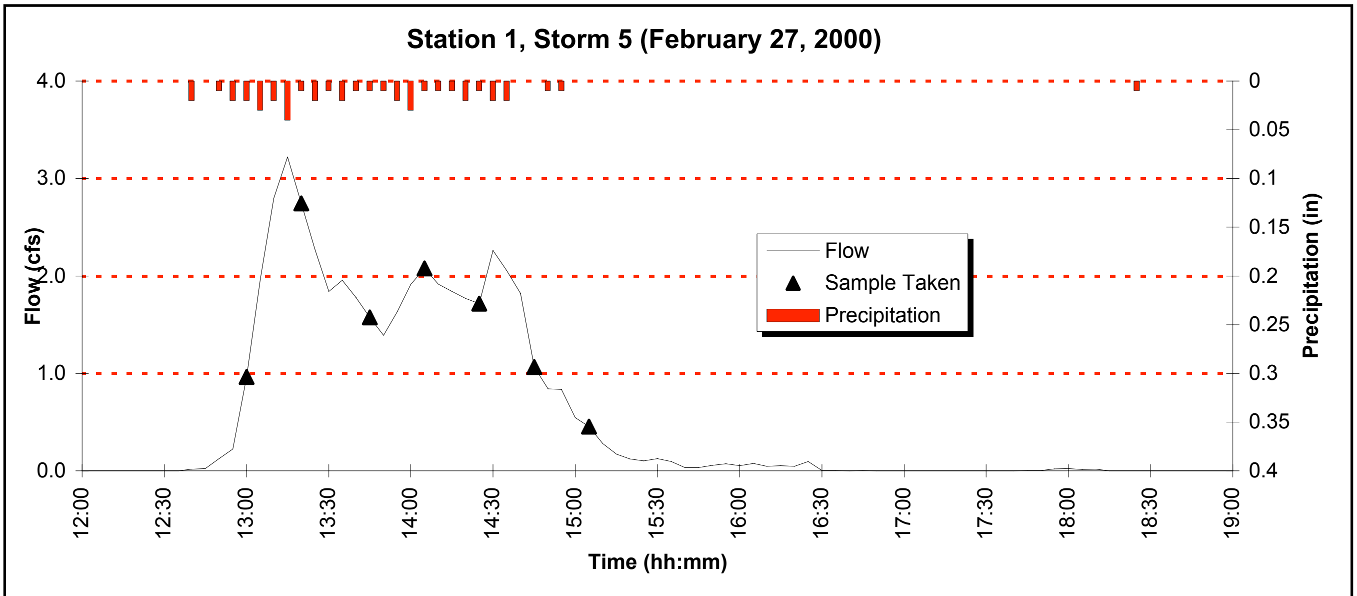

CADMIUM
Concentration (ug/l)
Dissolved
Total
Sample Time


CHROMIUM
Concentration (ug/l)
Dissolved
Total
Sample Time

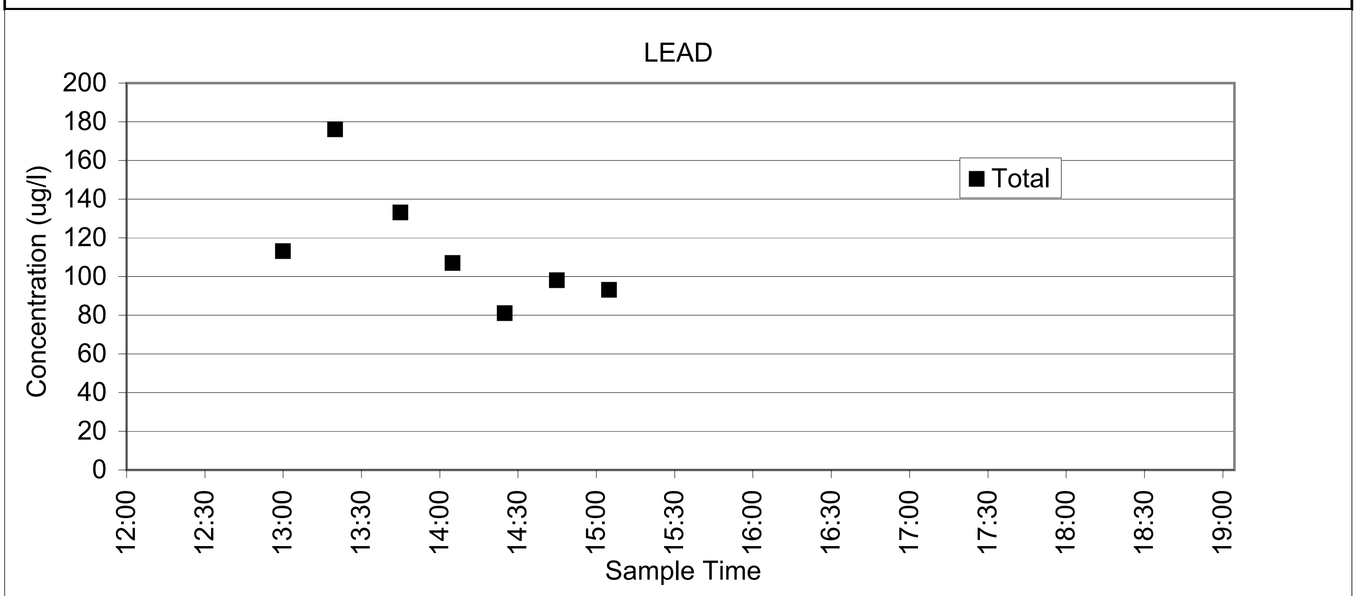

Station 1, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
4.0
3.0
2.0
1.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00


NICKEL
Concentration (ug/l)
Sample Time
Dissolved
Total
12
10
8
6
4
2
0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00

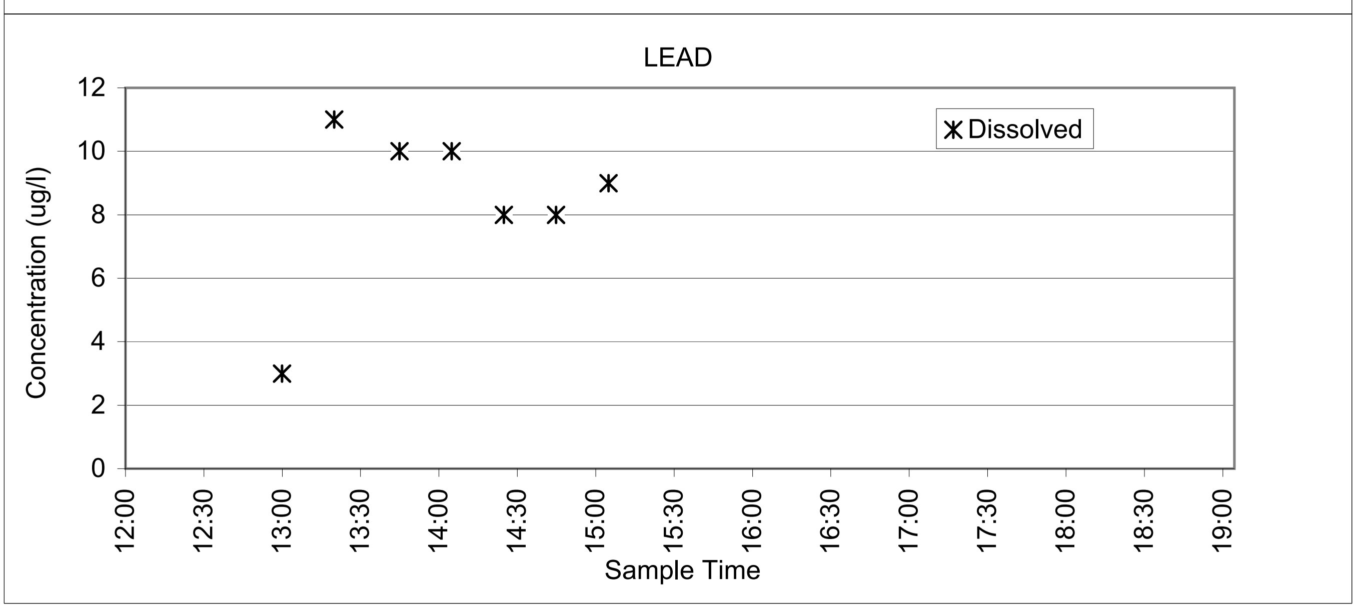

ZINC
Concentration (ug/l)
Sample Time
Dissolved
Total
350
300
250
200
150
100
50
0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



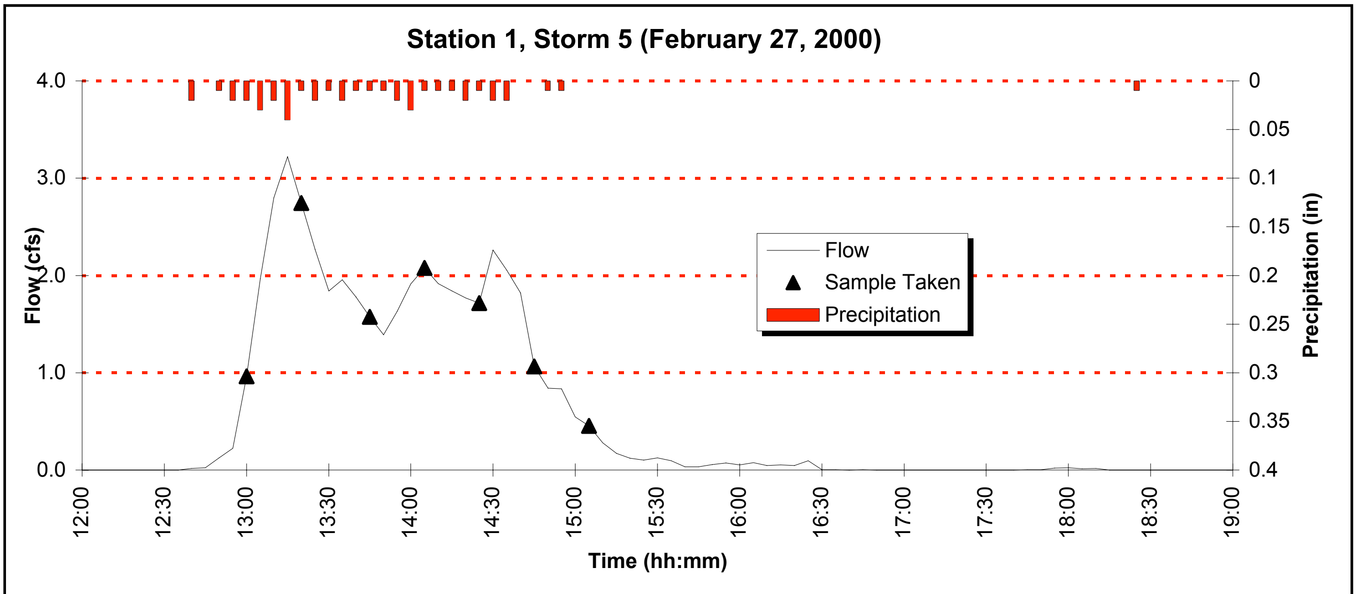
Station 1, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
4.0
3.0
2.0
1.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00

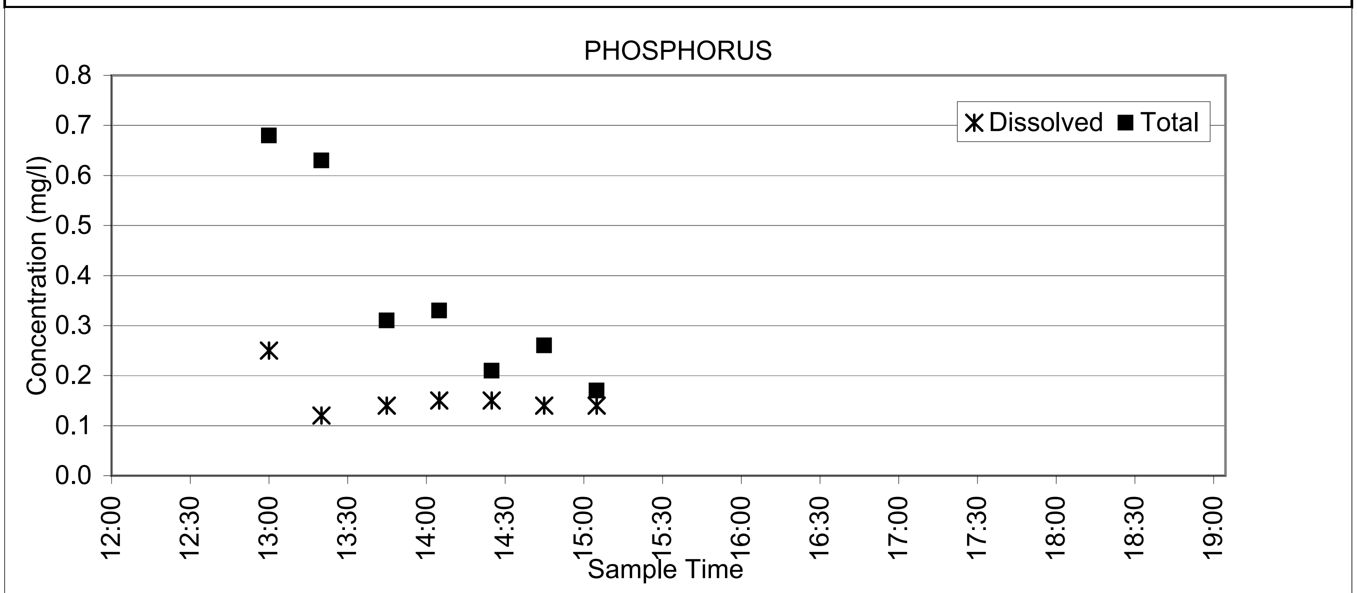


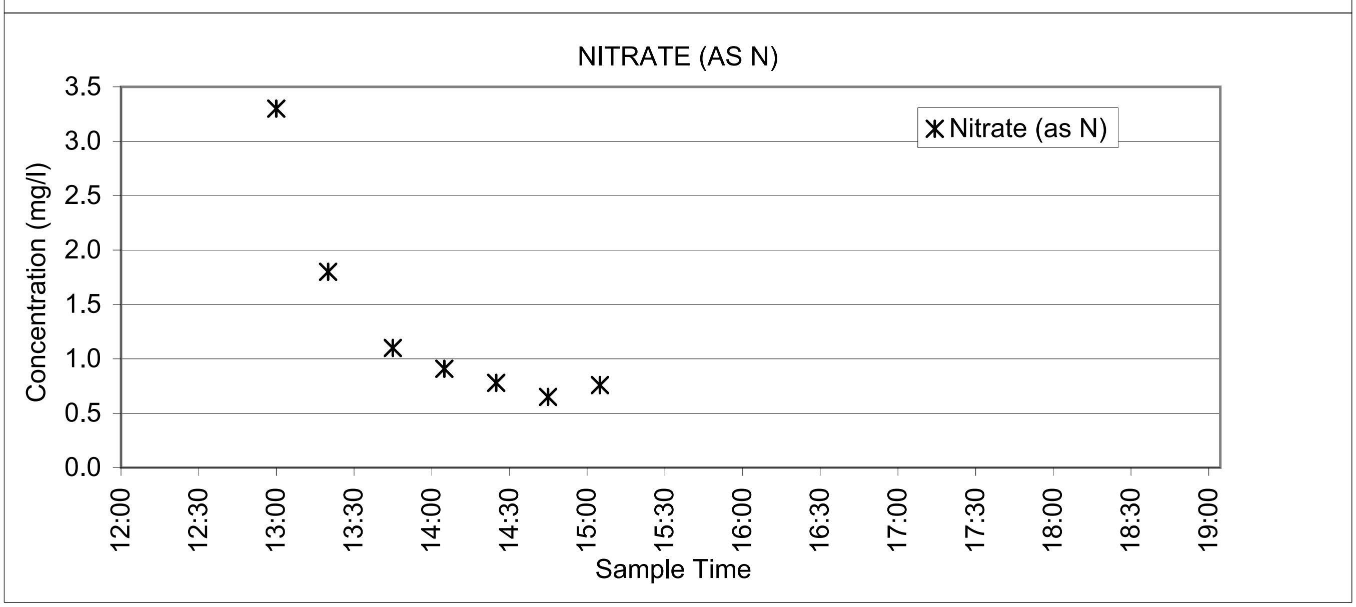
LEAD
Concentration (ug/l)
Sample Time
Total
200
180
160
140
120
100
80
60
40
20
0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00

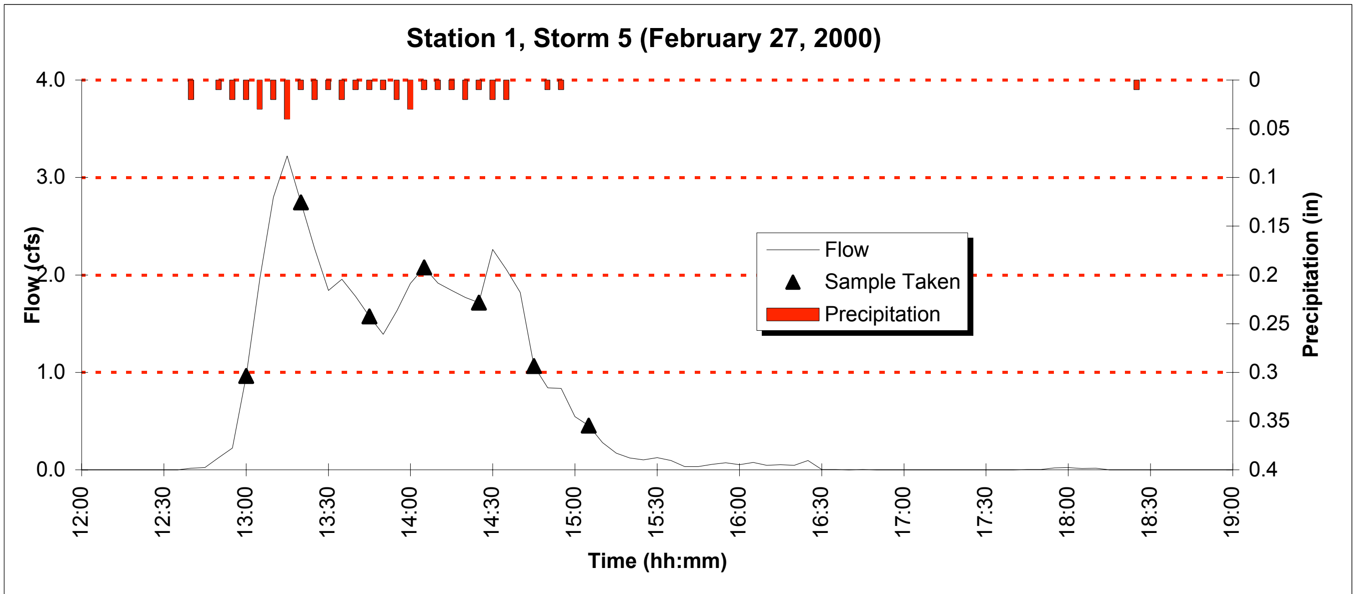


LEAD
Concentration (ug/l)
Sample Time
Dissolved
12
10
8
6
4
2
0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00

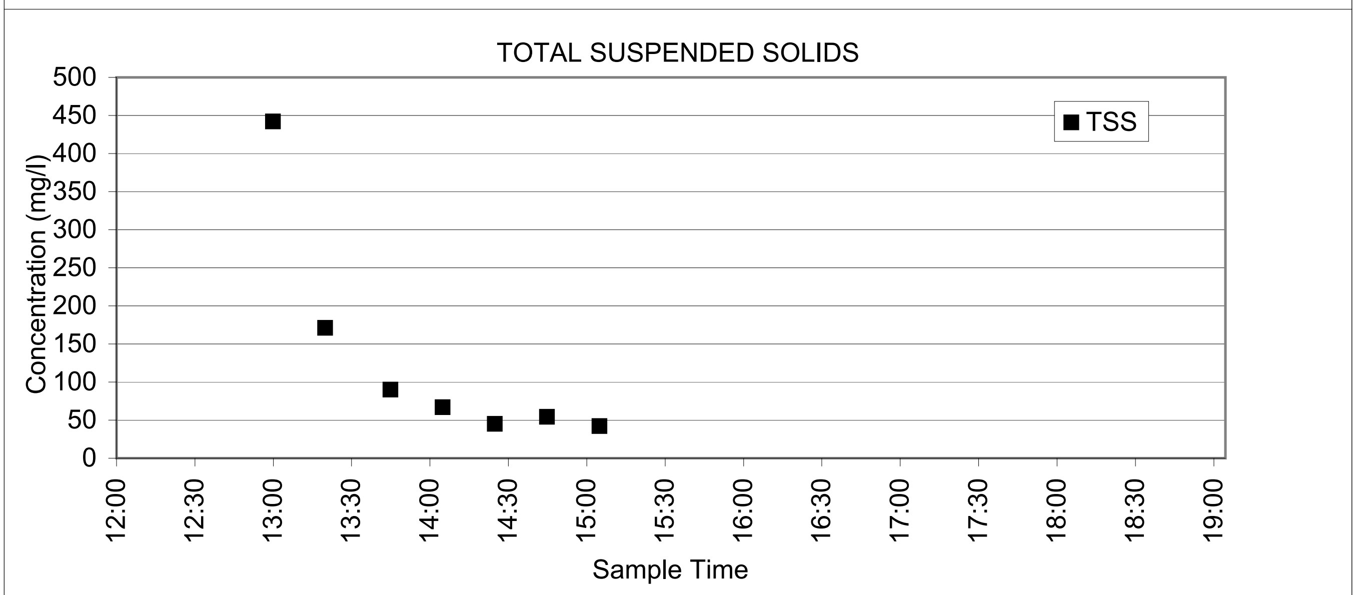

Station 1, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
4.0
3.0
2.0
1.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00


PHOSPHORUS
Concentration (mg/l)
Sample Time
Dissolved
Total
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00

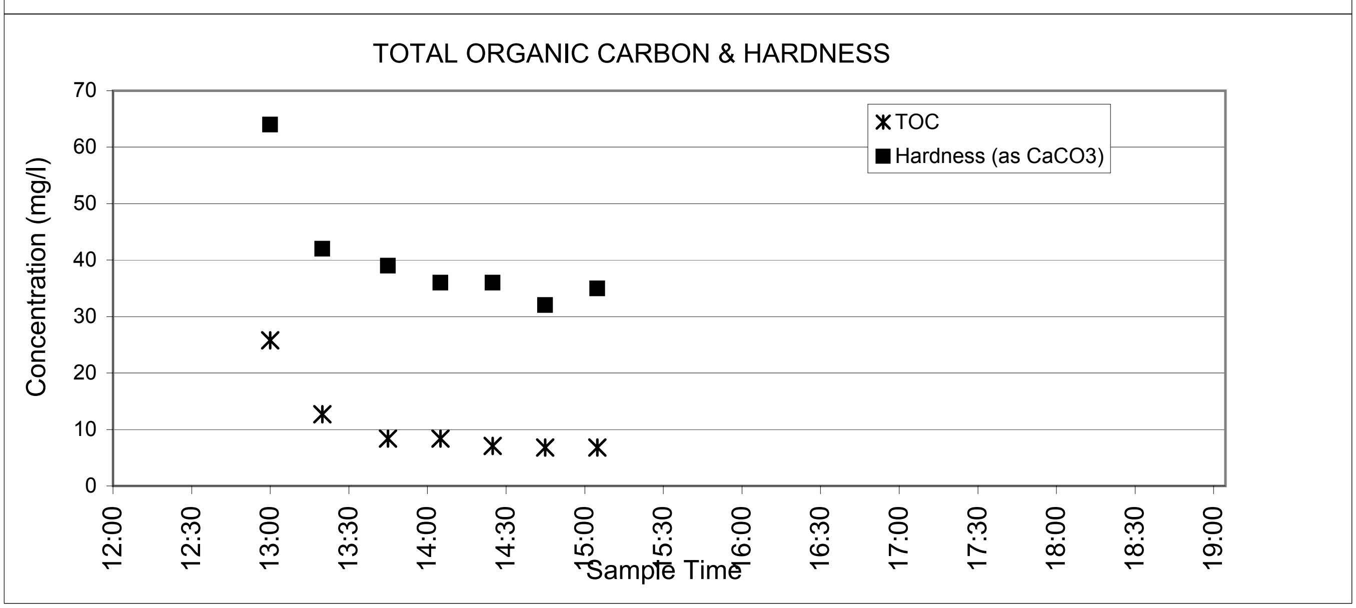

NITRATE (AS N)
Concentration (mg/l)
Sample Time
Nitrate (as N)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



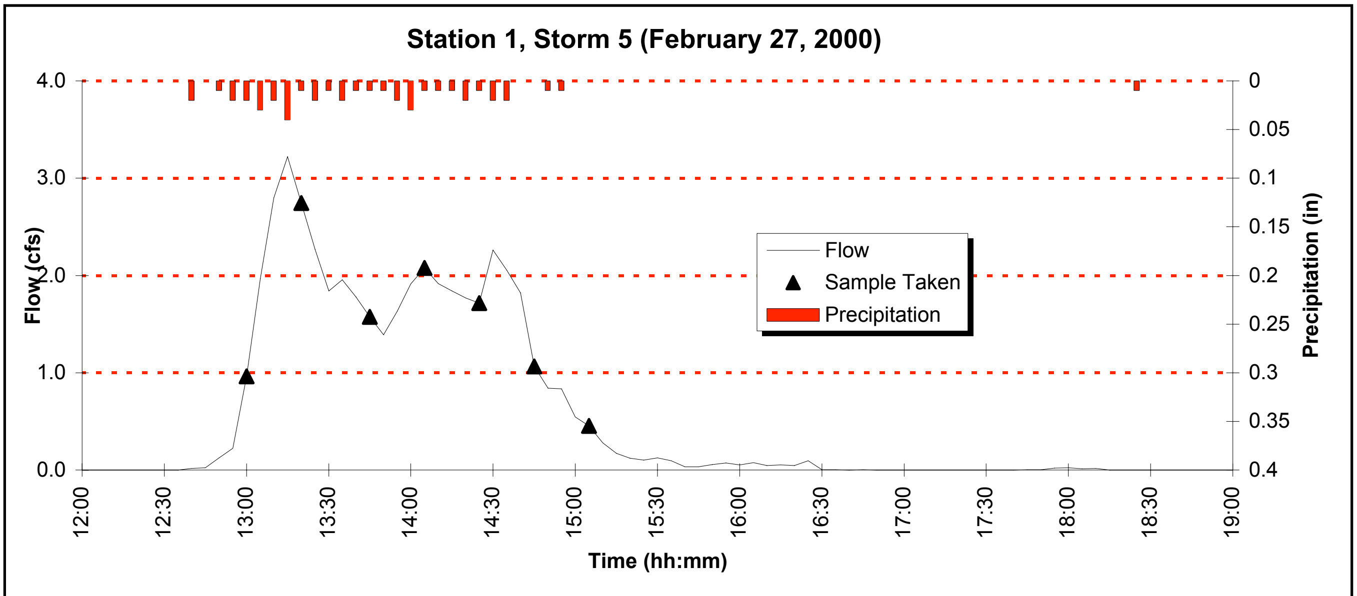
Station 1, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
4.0
3.0
2.0
1.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



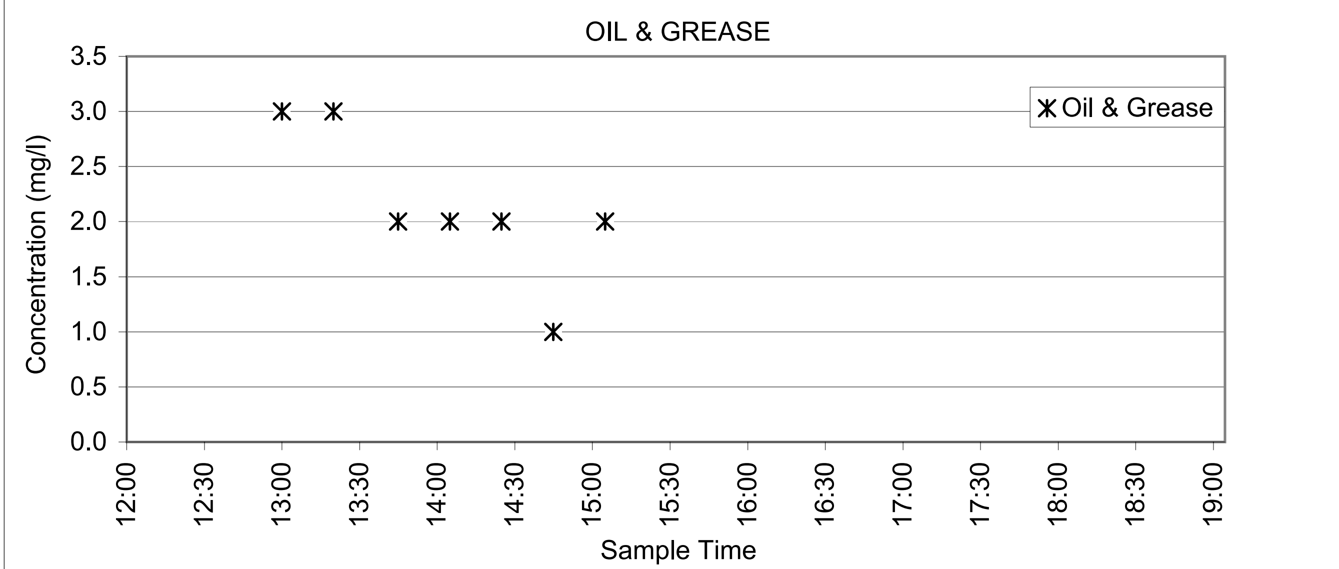
TOTAL SUSPENDED SOLIDS
Concentration (mg/l)
Sample Time
TSS
500
450
400
350
300
250
200
150
100
50
0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



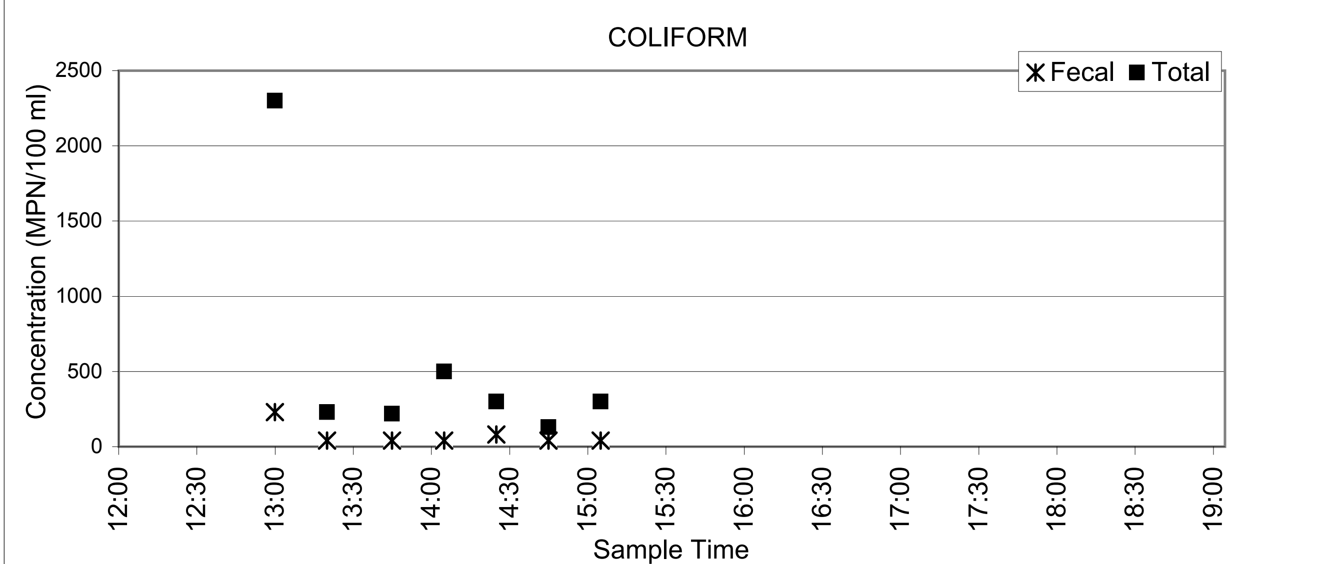
TOTAL ORGANIC CARBON & HARDNESS
Concentration (mg/l)
Sample Time
TOC
Hardness (as CaCO3)
70
60
50
40
30
20
10
0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



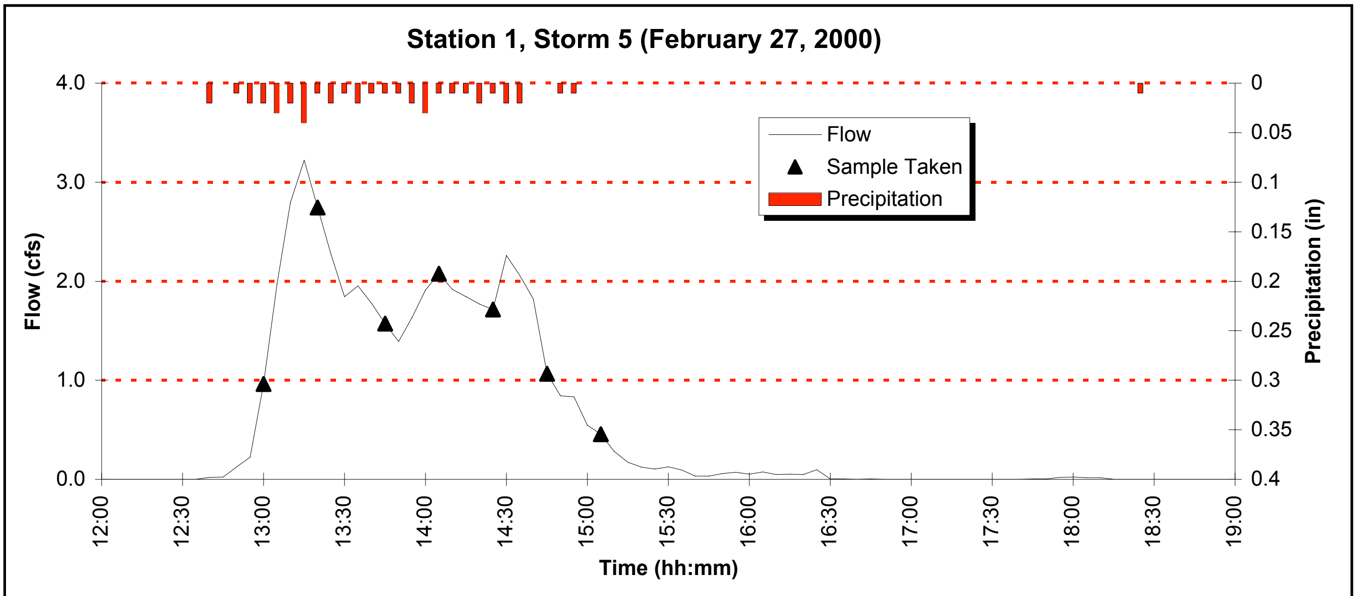
Station 1, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation



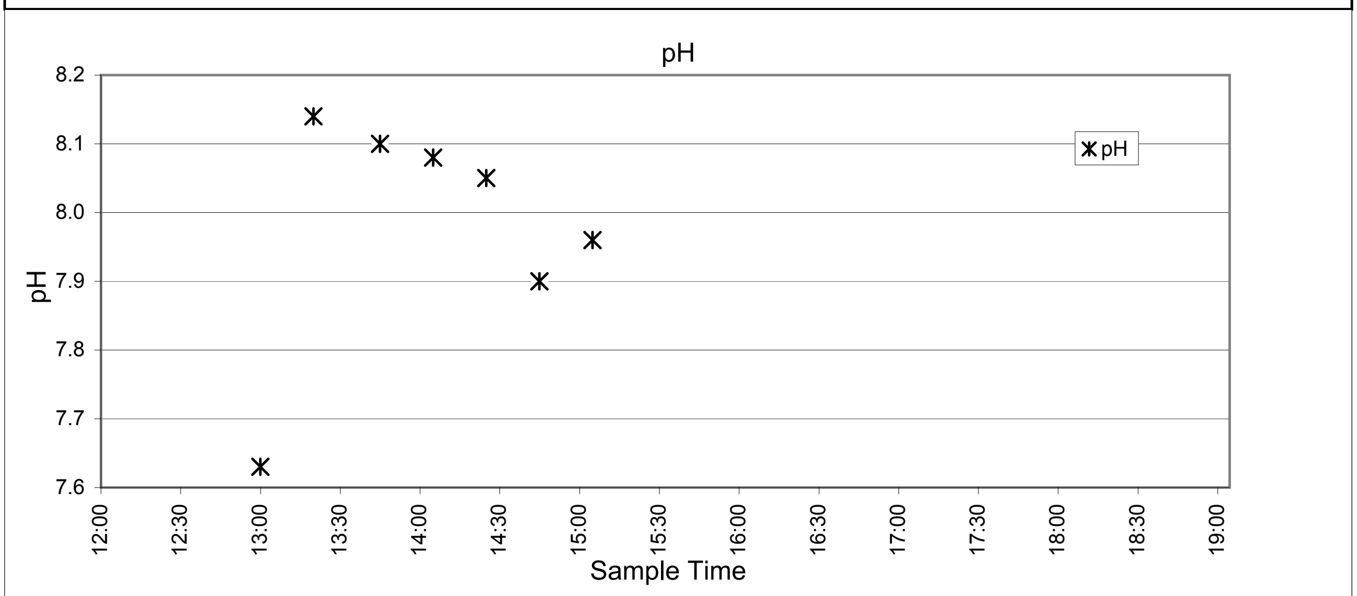
OIL & GREASE
Concentration (mg/l)
Sample Time
Oil & Grease



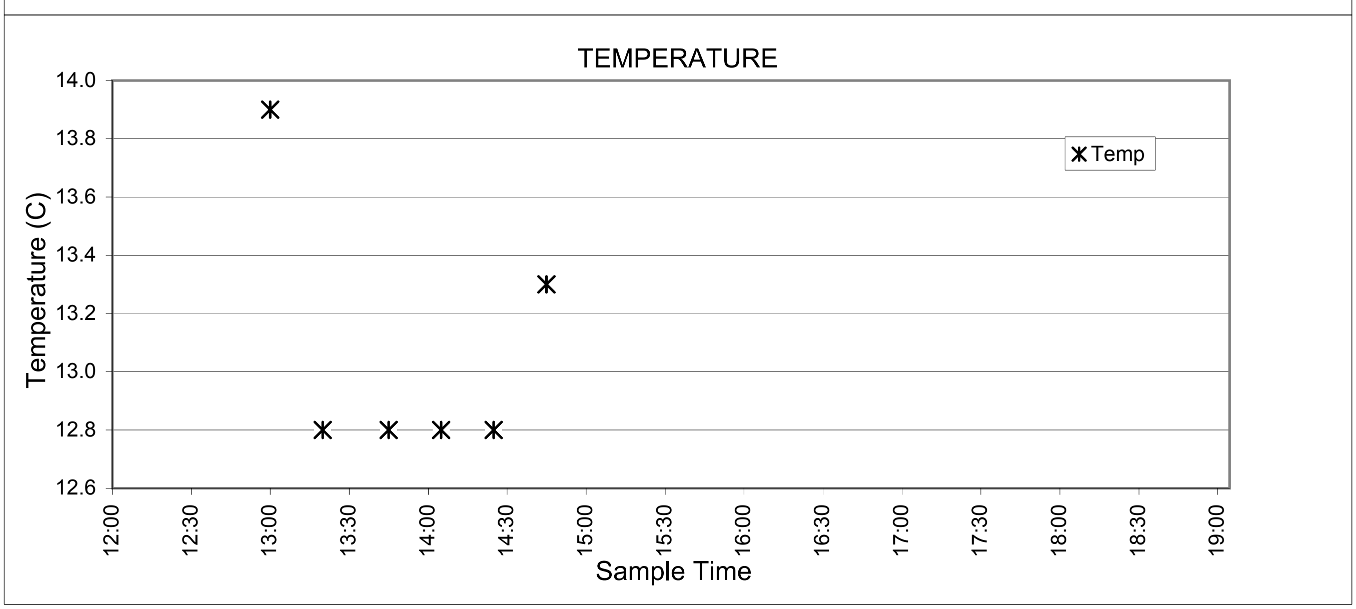
COLIFORM
Concentration (MPN/100 ml)
Sample Time
Fecal
Total



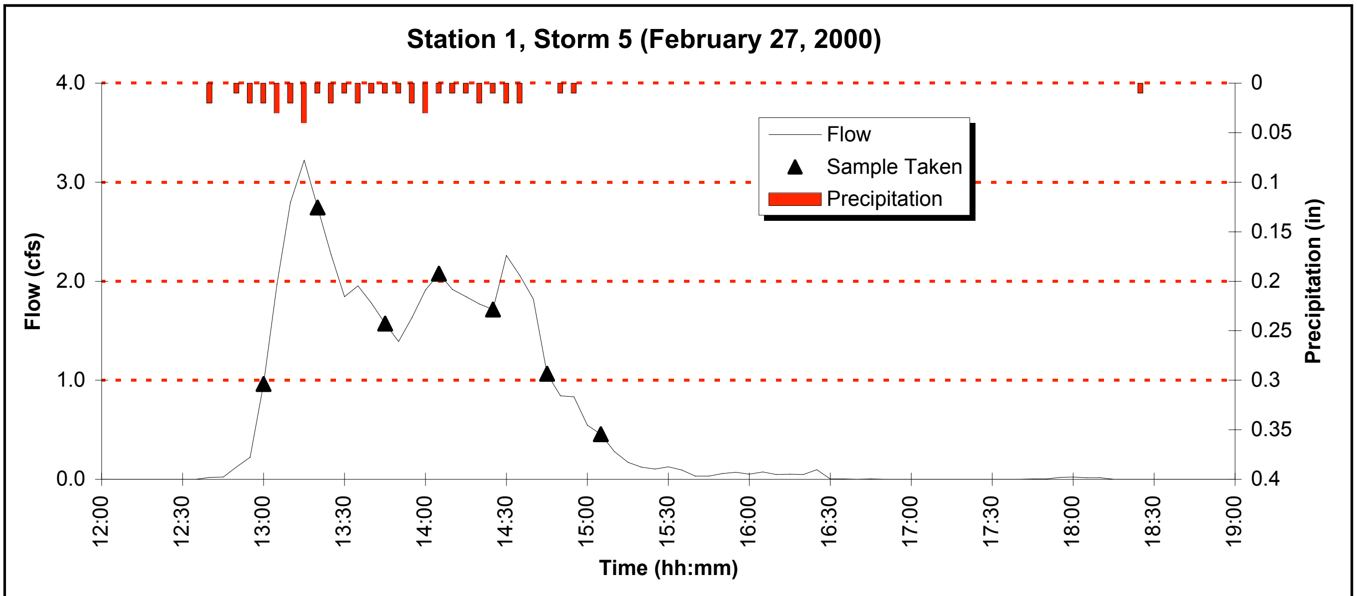
Station 1, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
4.0
3.0
2.0
1.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



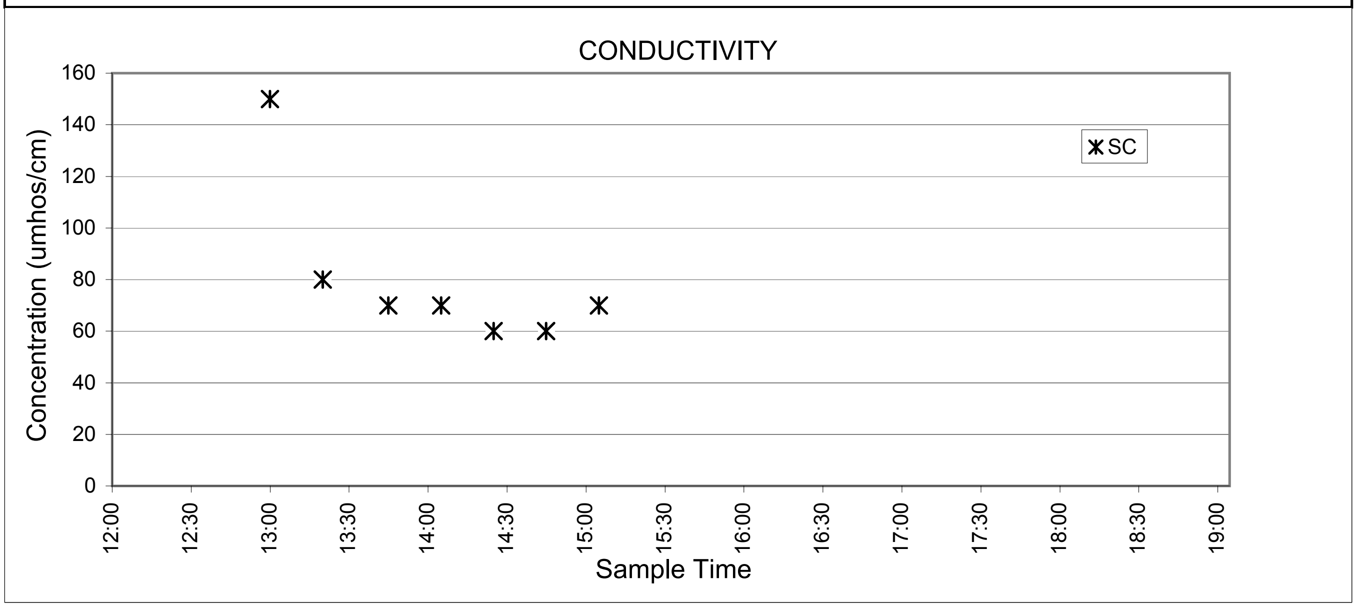
pH
pH
Sample Time
8.2
8.1
8.0
7.9
7.8
7.7
7.6
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



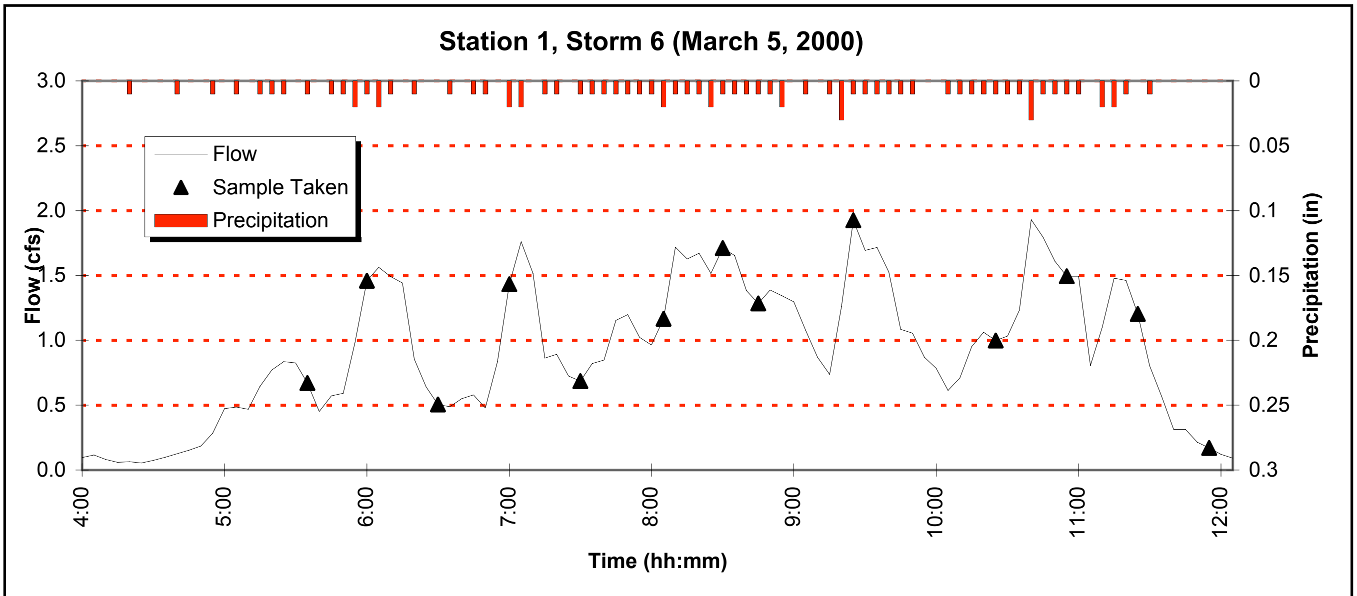
TEMPERATURE
Temp
Temperature (C)
Sample Time
14.0
13.8
13.6
13.4
13.2
13.0
12.8
12.6
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



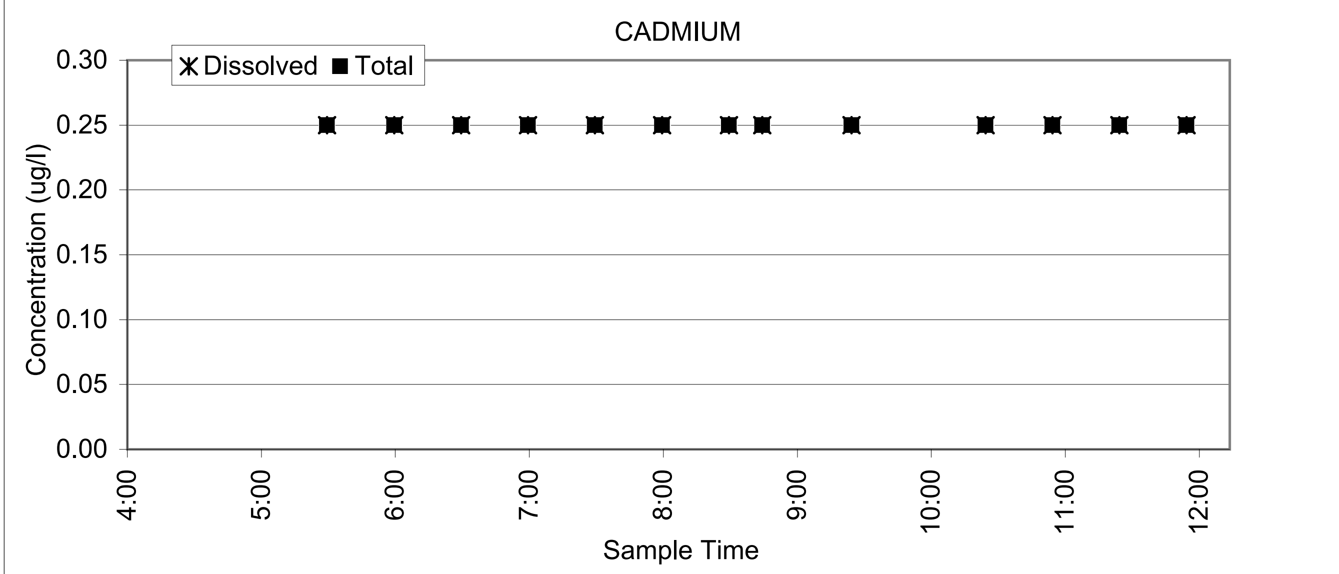
Station 1, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
4.0
3.0
2.0
1.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



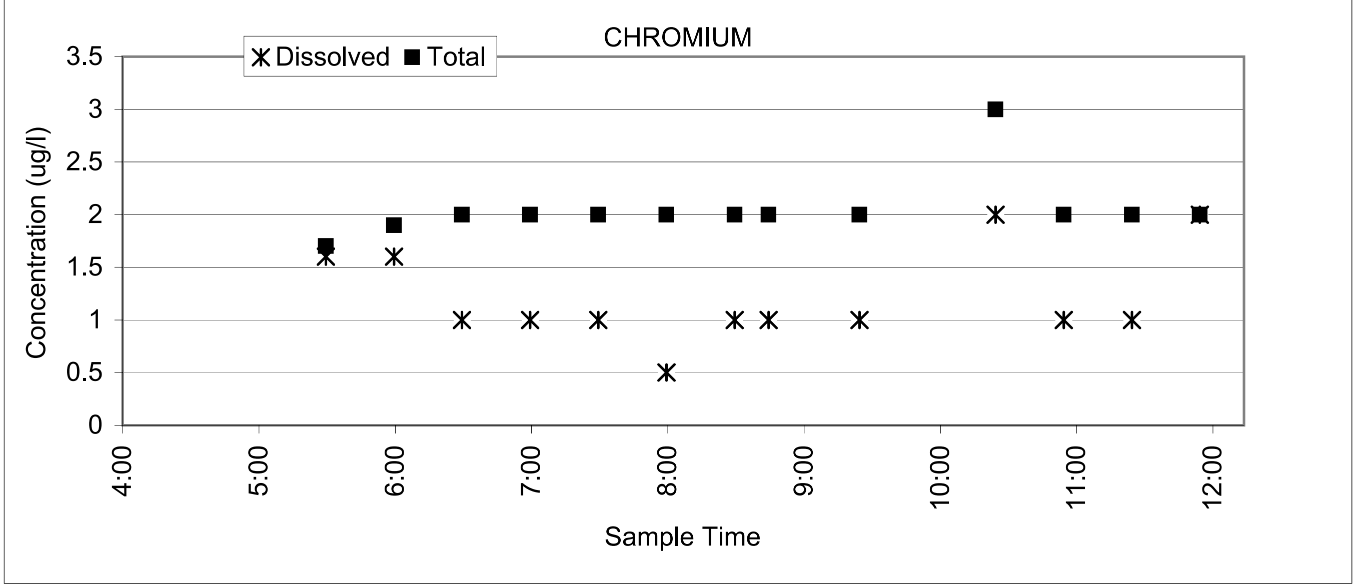
CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
SC
160
140
120
100
80
60
40
20
0
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00



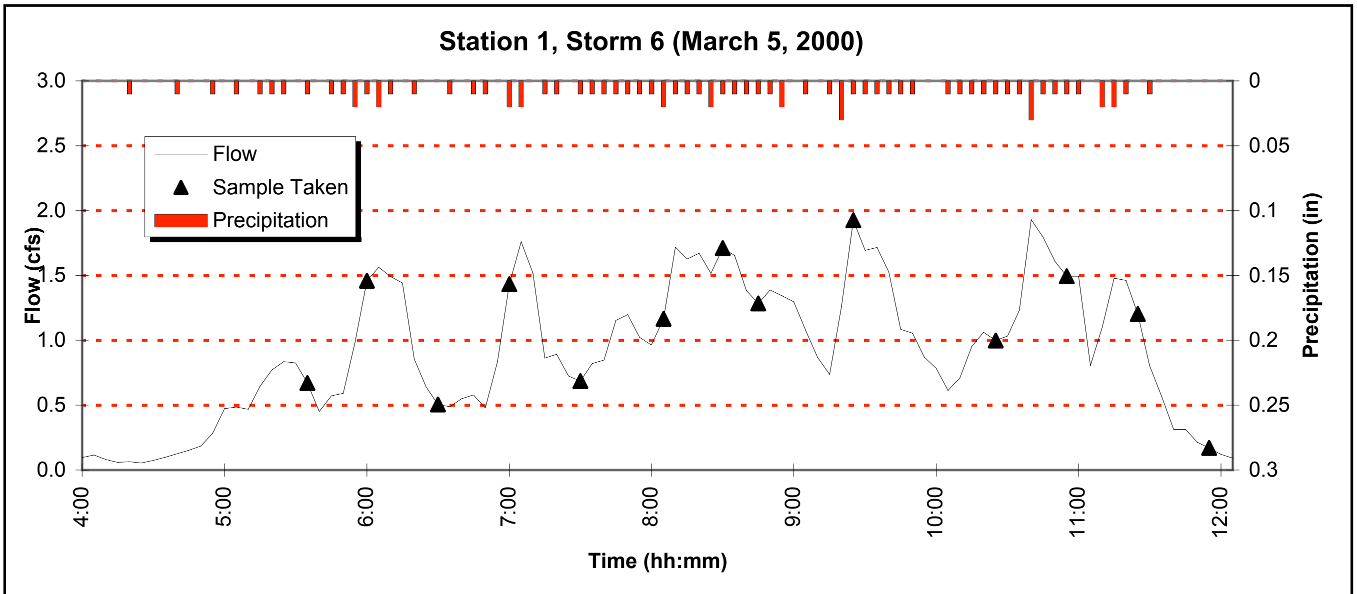
Station 1, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

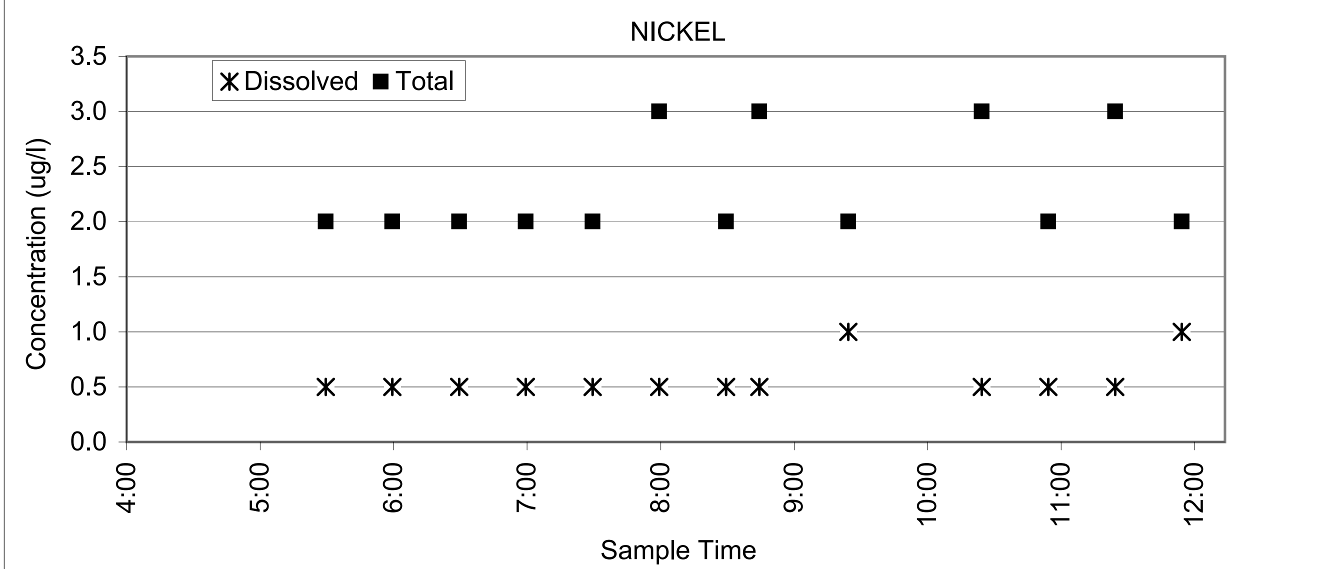


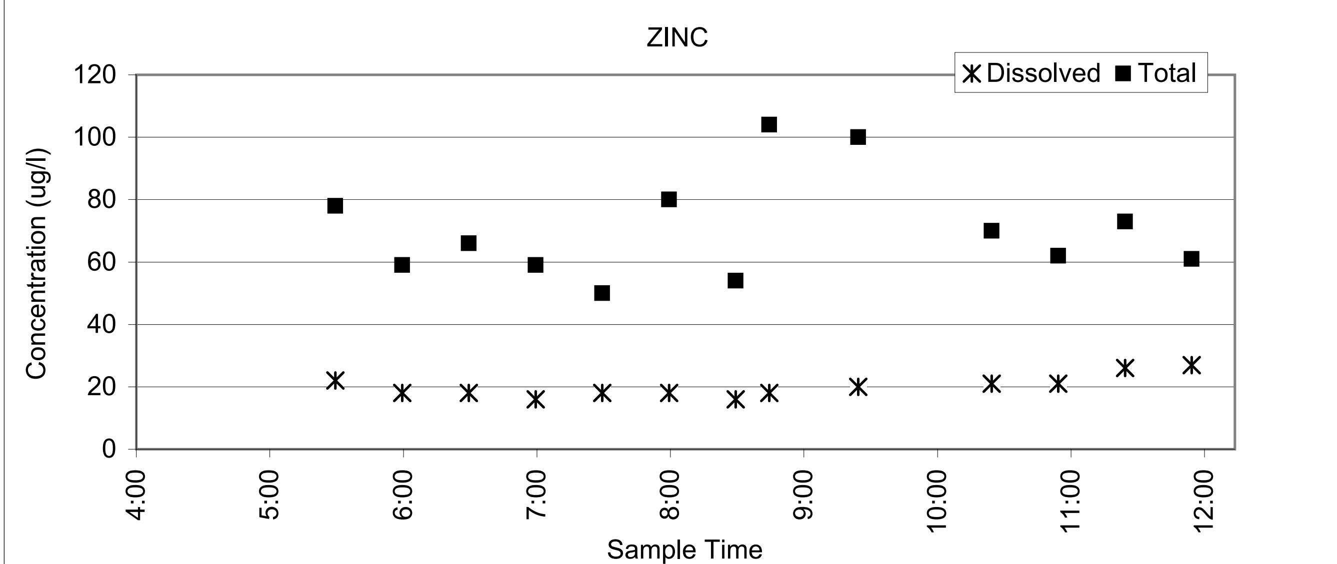
CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time

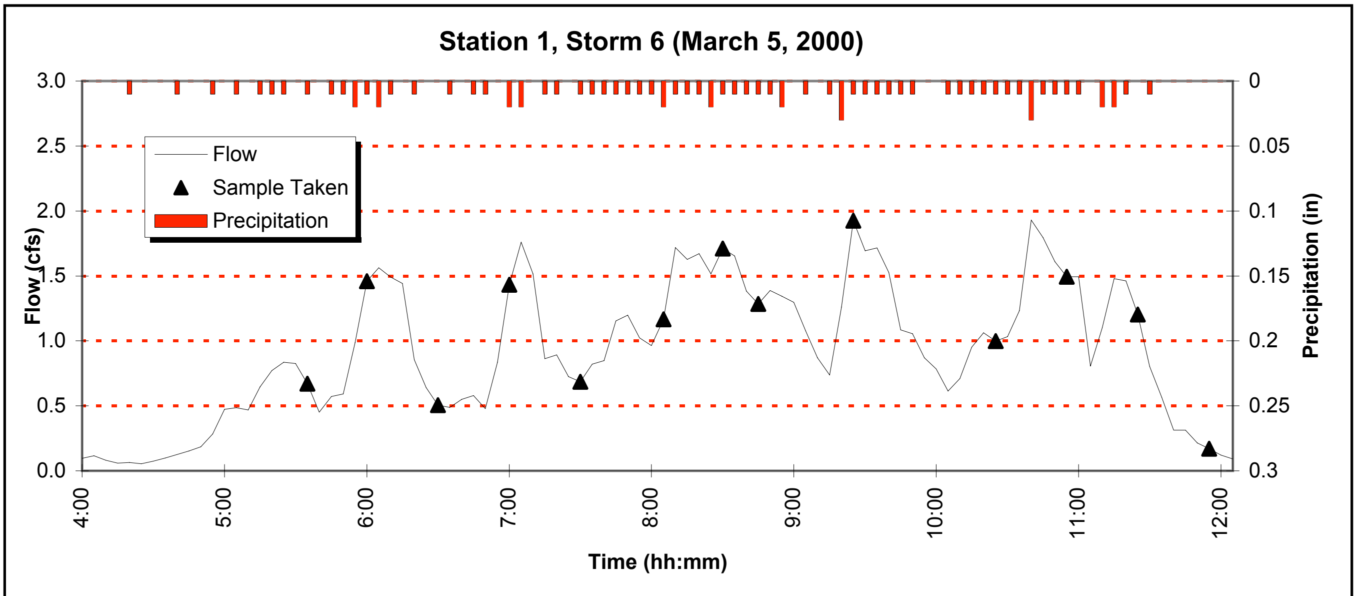


CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time

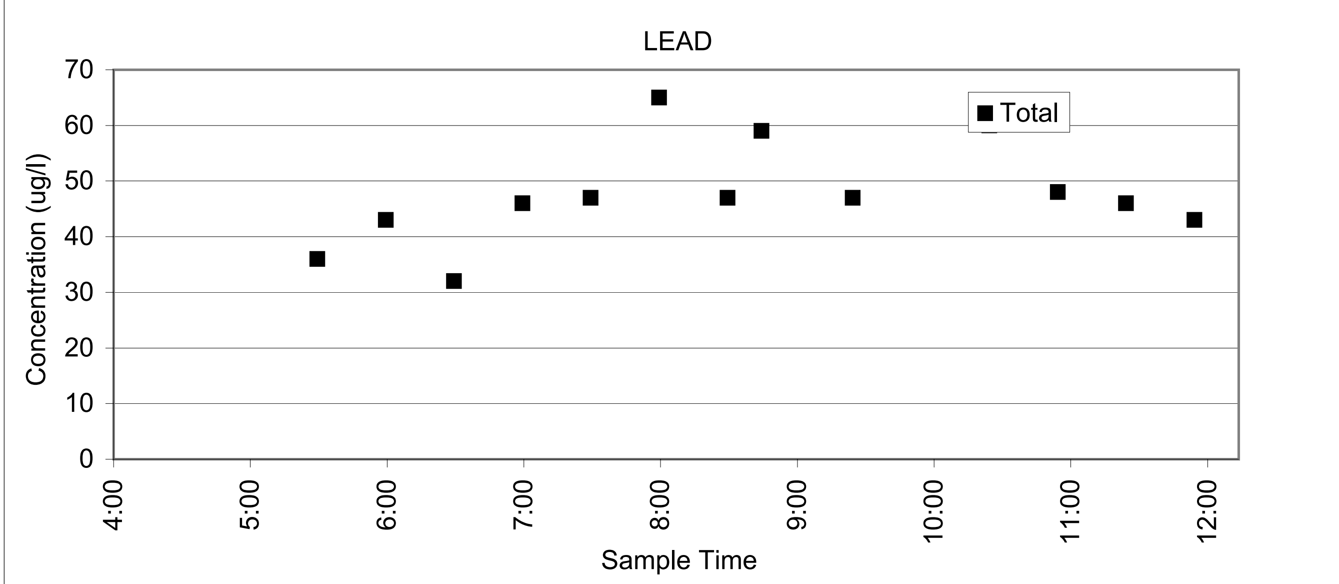

Station 1, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00


NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00

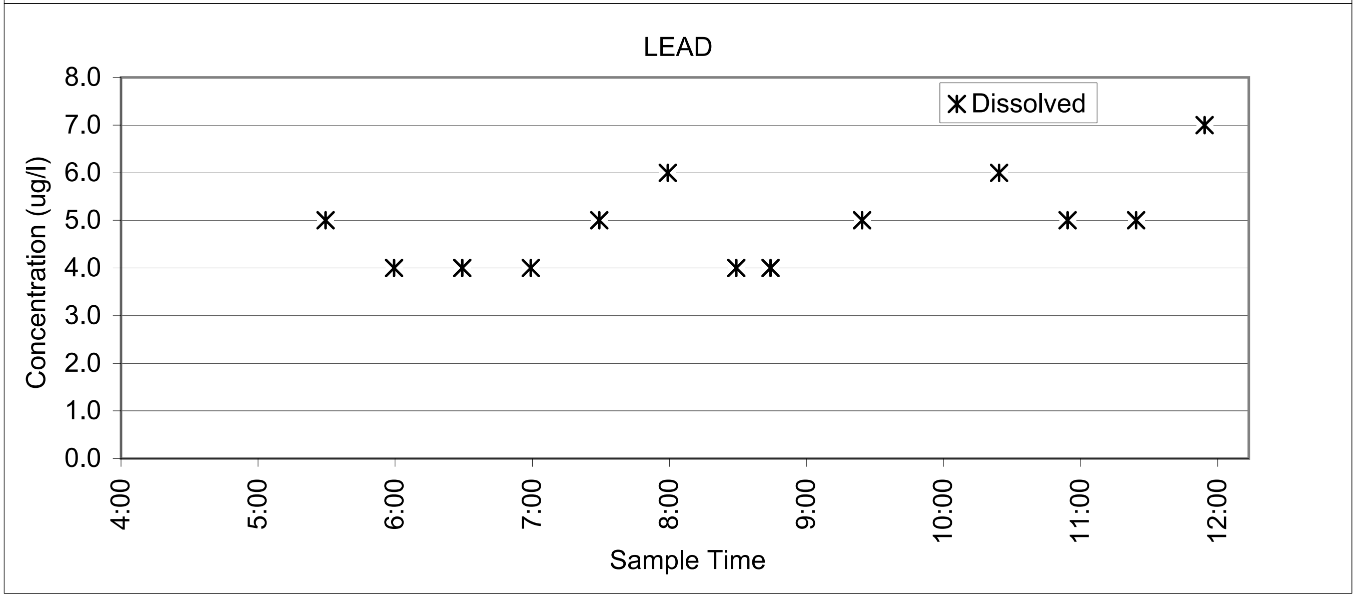

ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time
120
100
80
60
40
20
0
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00



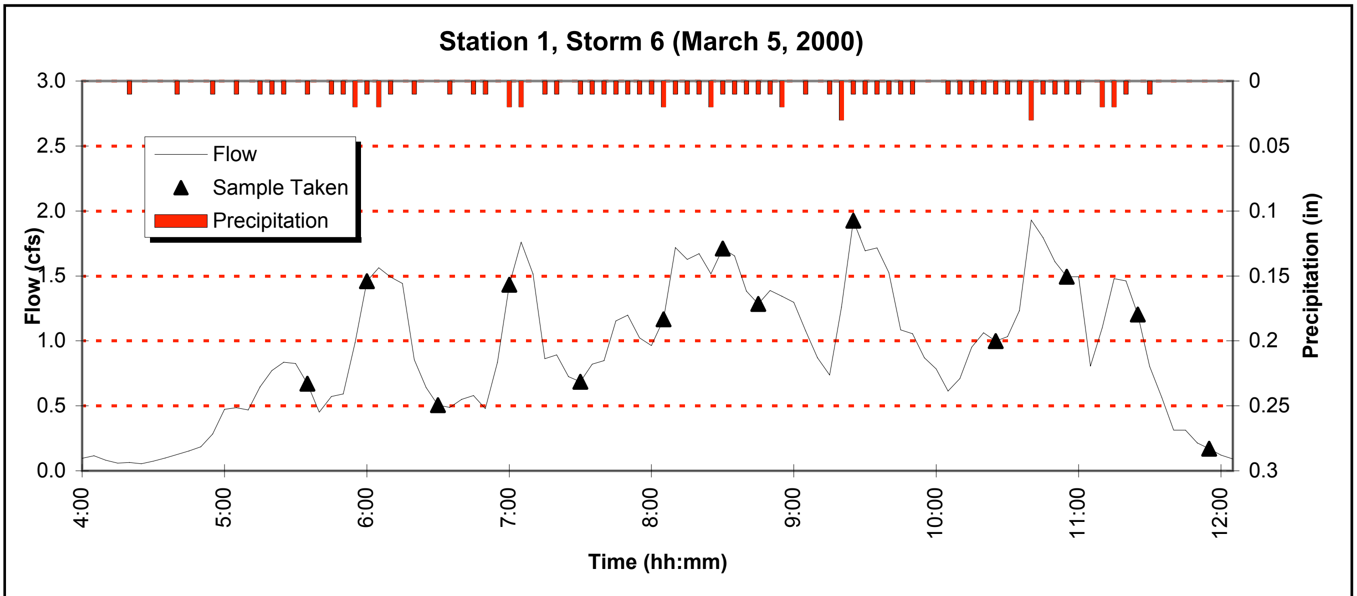
Station 1, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



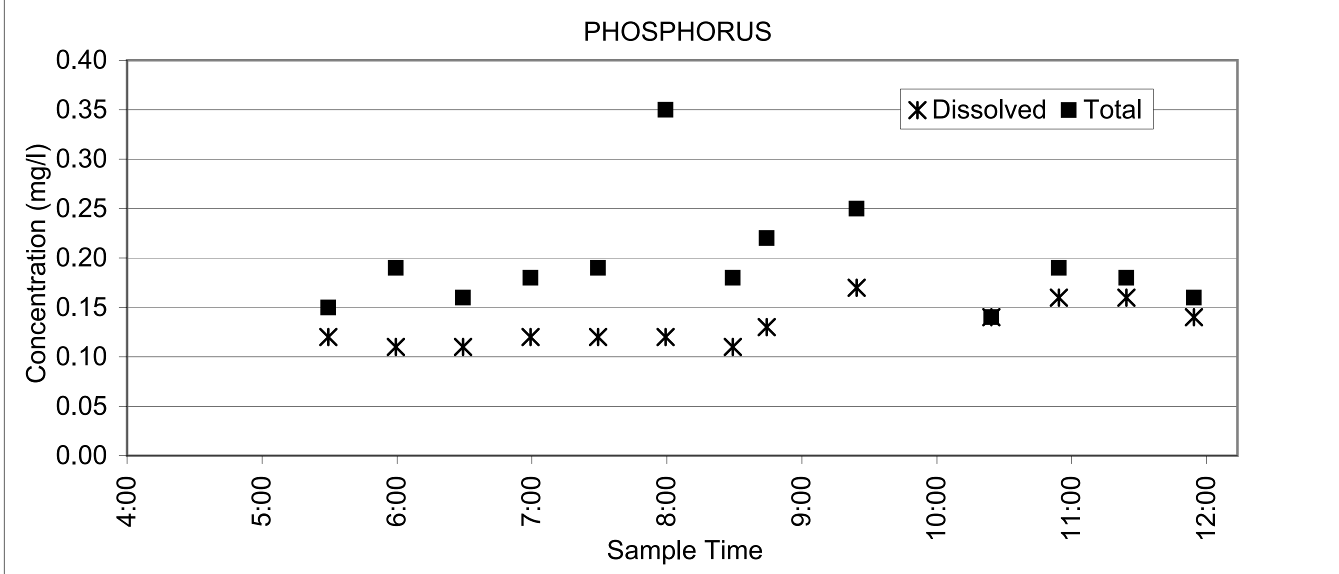
LEAD
Total
Concentration (ug/l)
Sample Time



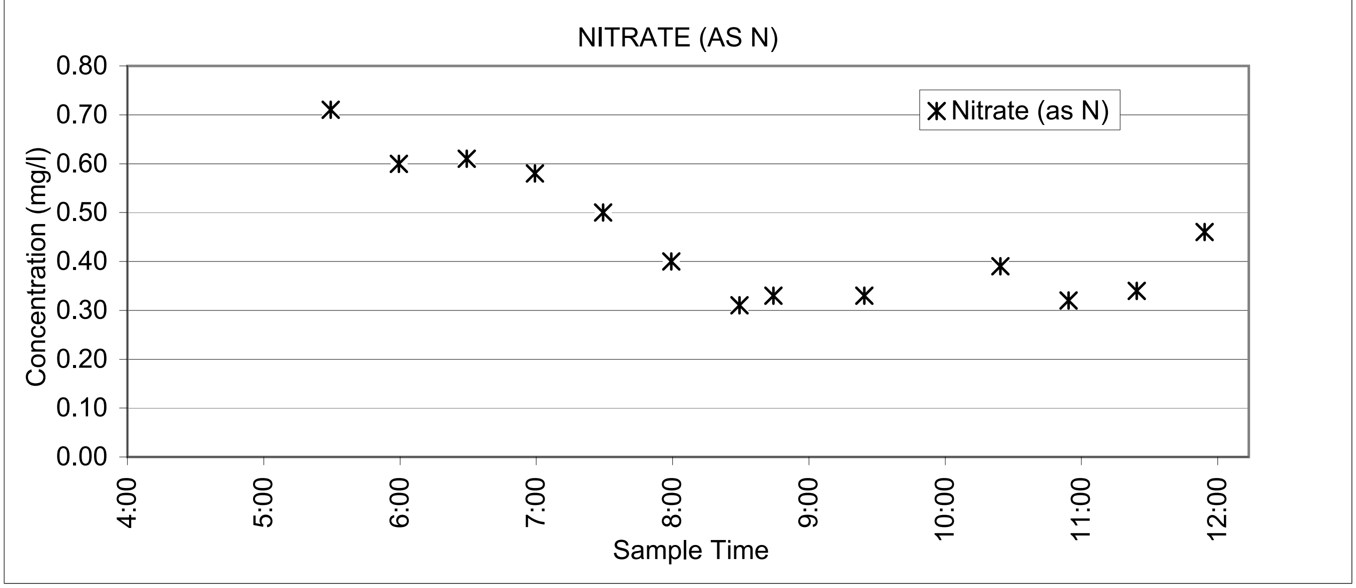
LEAD
Dissolved
Concentration (ug/l)
Sample Time



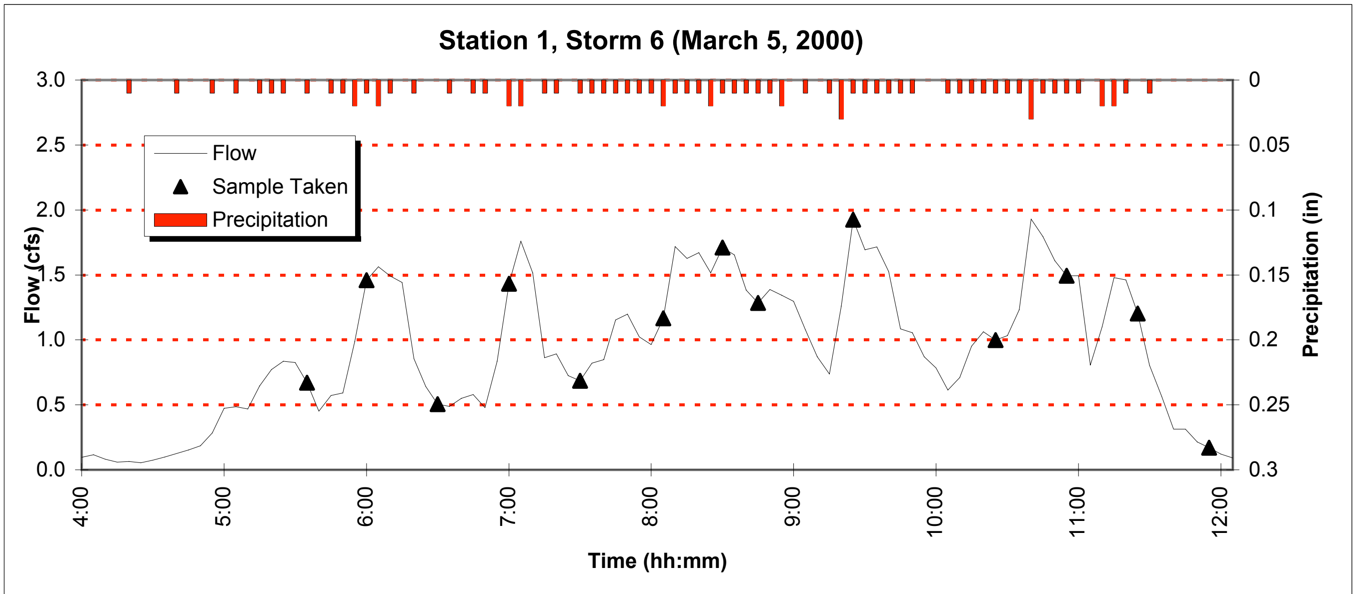
Station 1, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



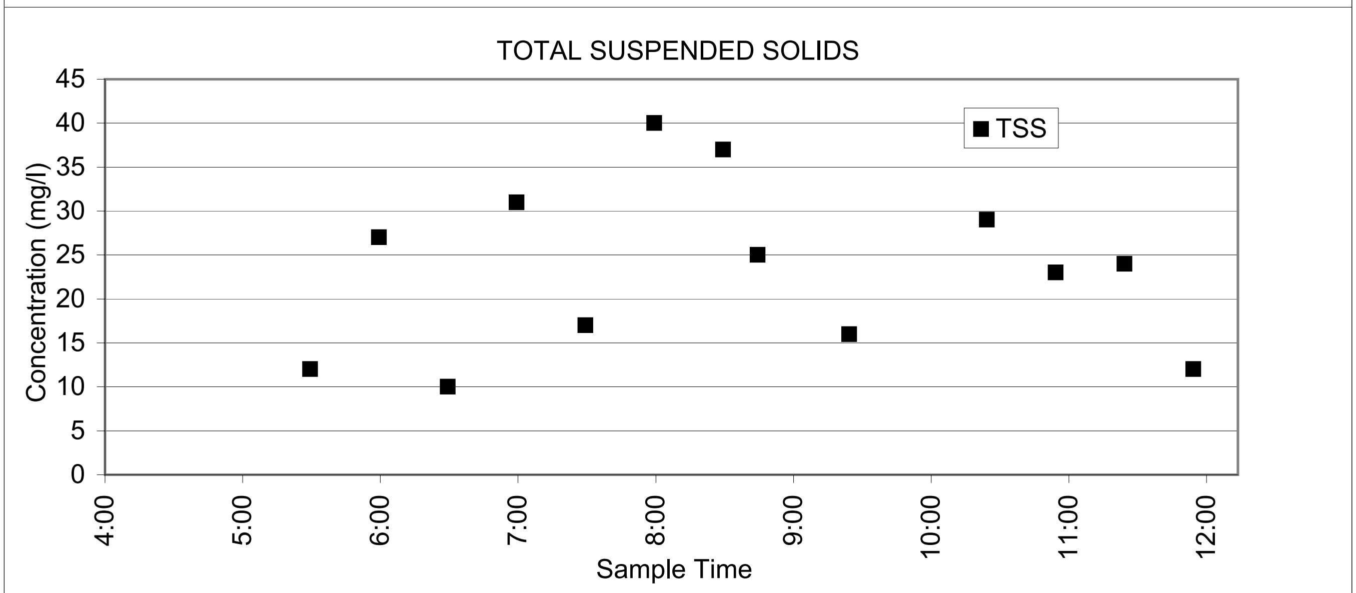
PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time



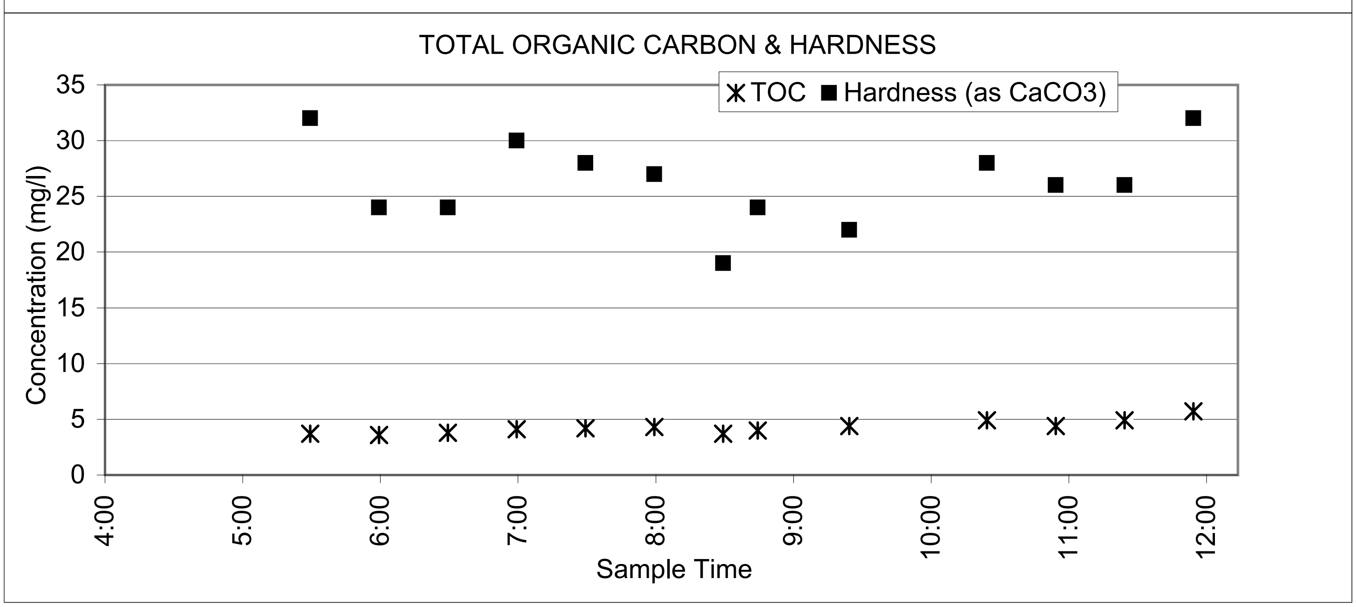
NITRATE (AS N)
Nitrate (as N)
Concentration (mg/l)
Sample Time



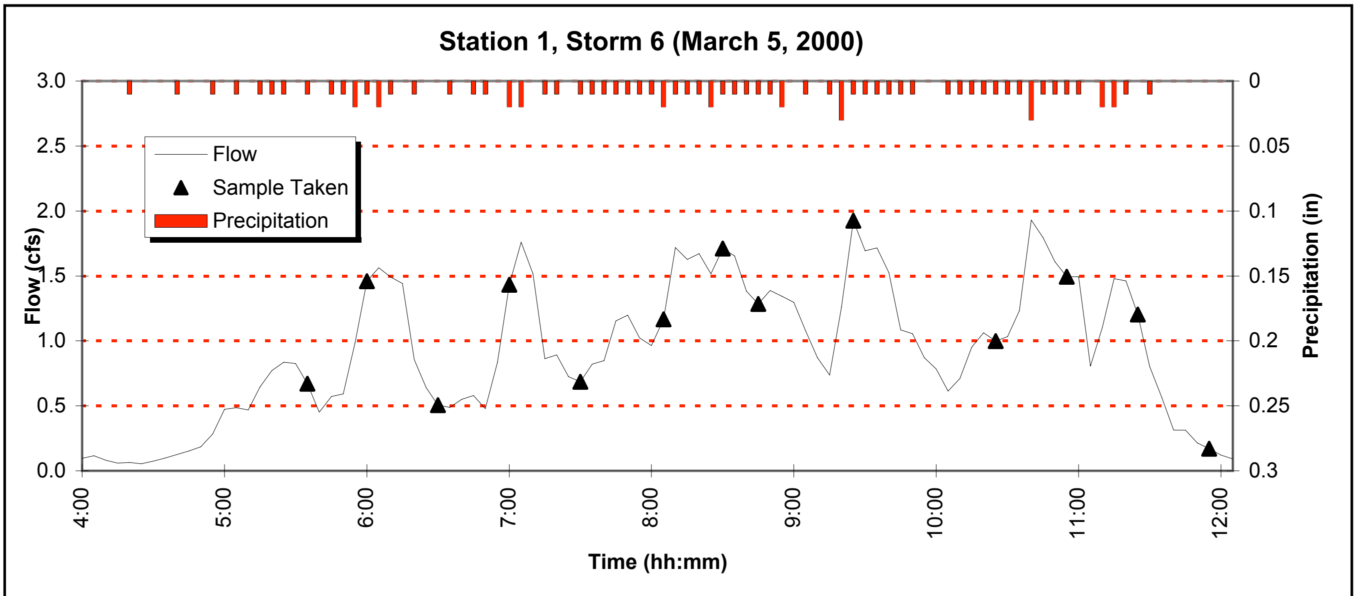
Station 1, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

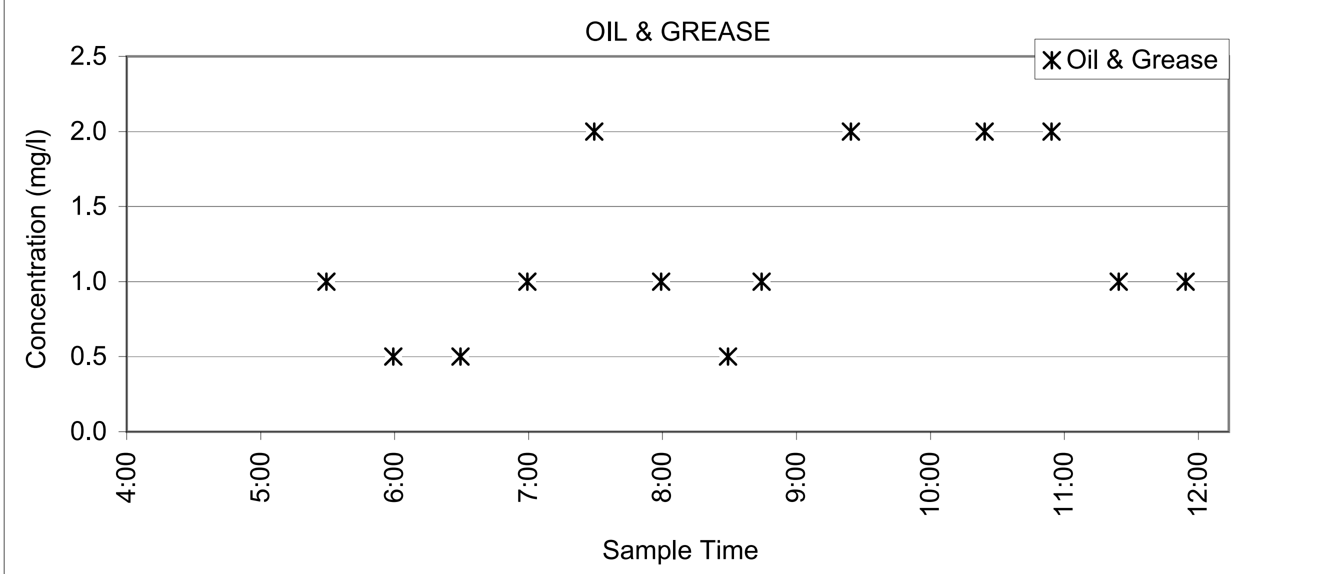


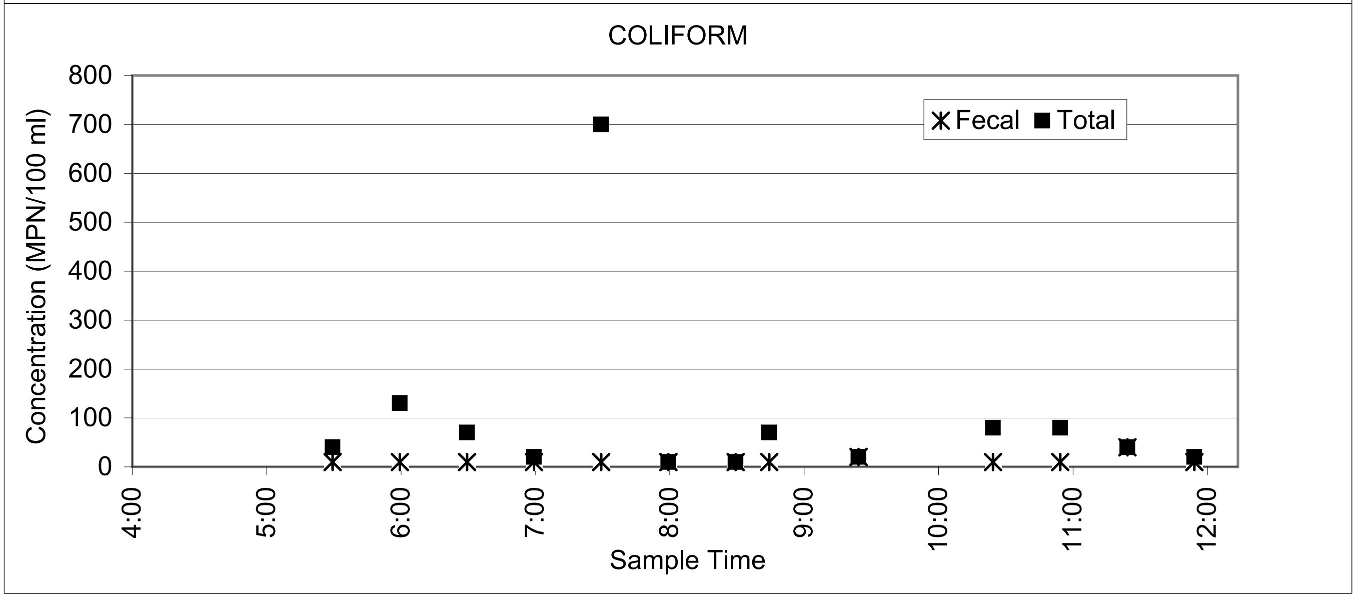
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time

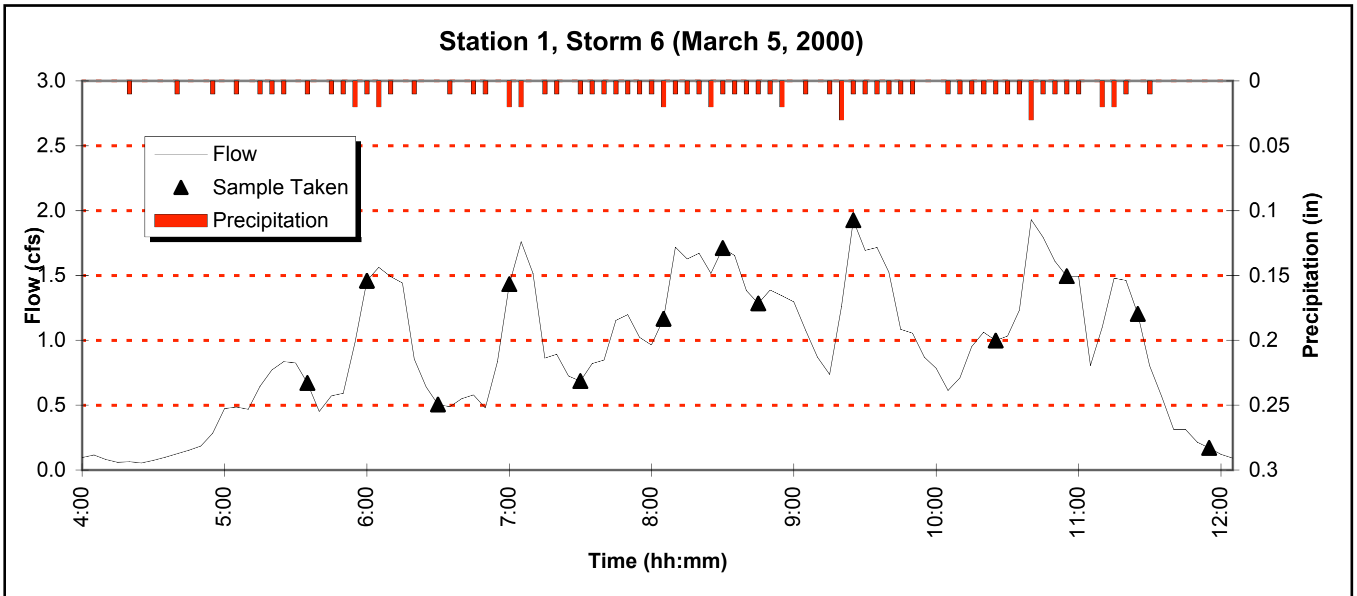


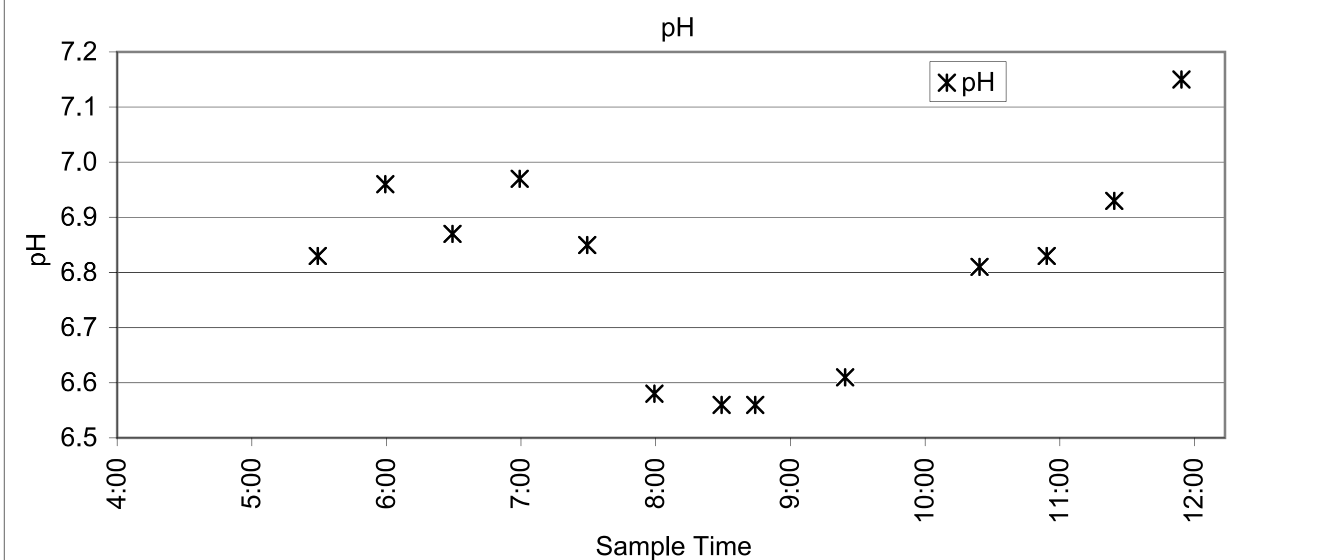
TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time

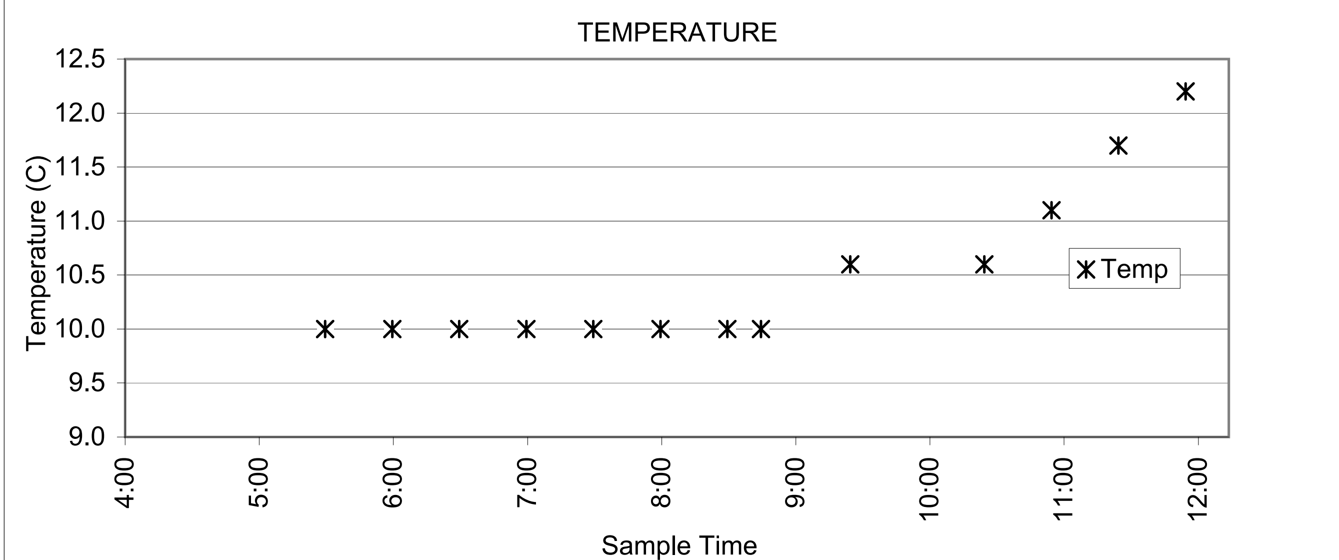

Station 1, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Time (hh:mm)

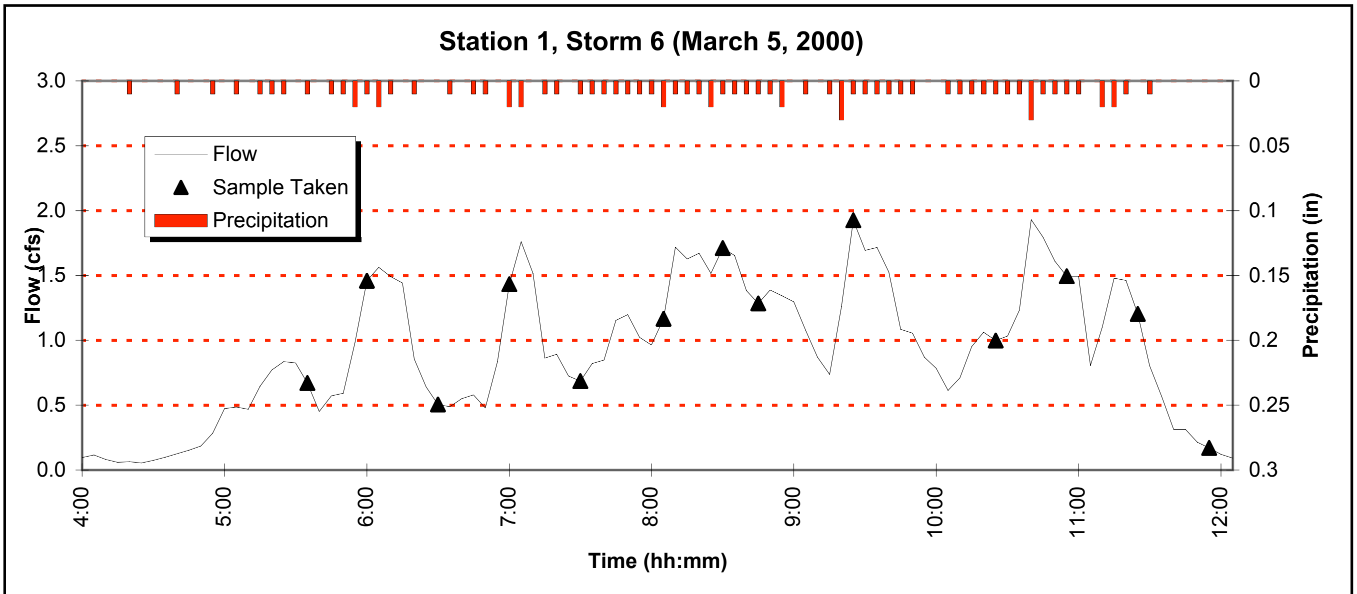

OIL & GREASE
Oil & Grease
Concentration (mg/l)
2.5
2.0
1.5
1.0
0.5
0.0
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Sample Time

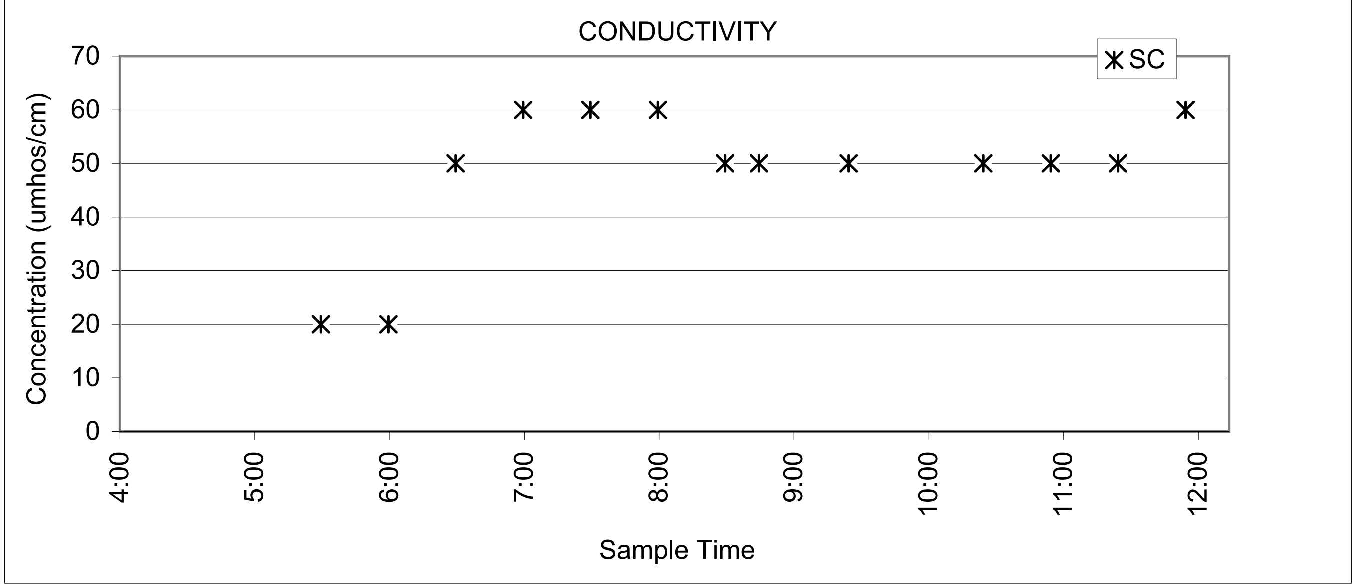

COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
800
700
600
500
400
300
200
100
0
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Sample Time

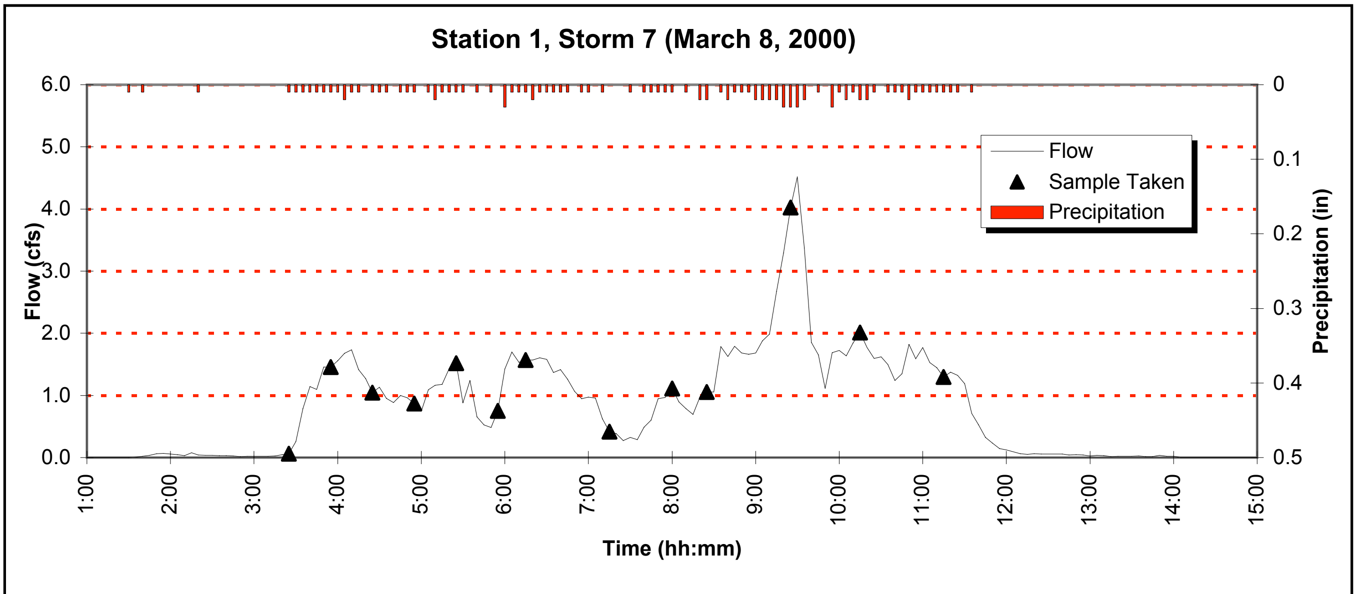

Station 1, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


pH
pH
Sample Time

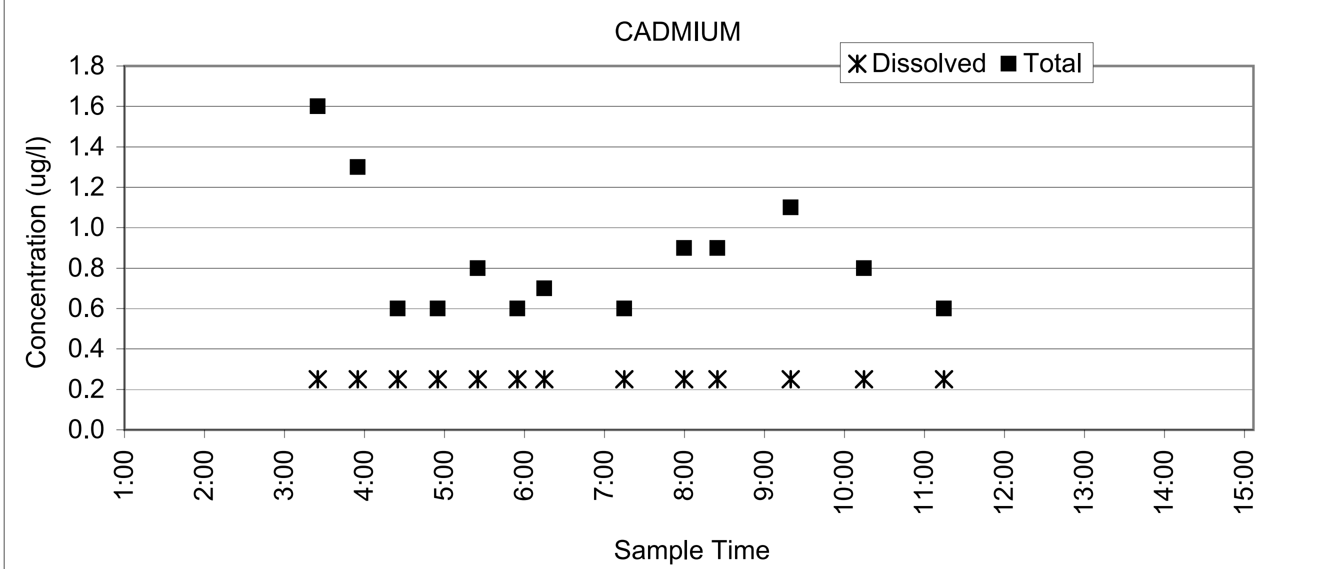

TEMPERATURE
Temperature (C)
Temp
Sample Time


Station 1, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00

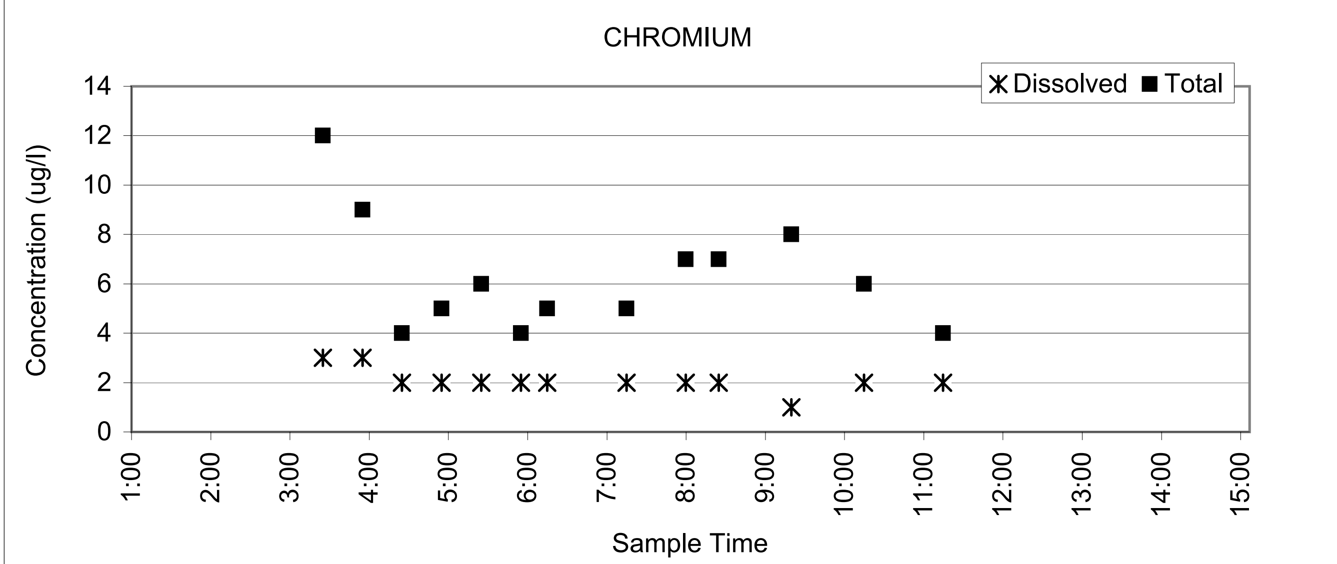

CONDUCTIVITY
SC
Concentration (umhos/cm)
Sample Time
70
60
50
40
30
20
10
0
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00



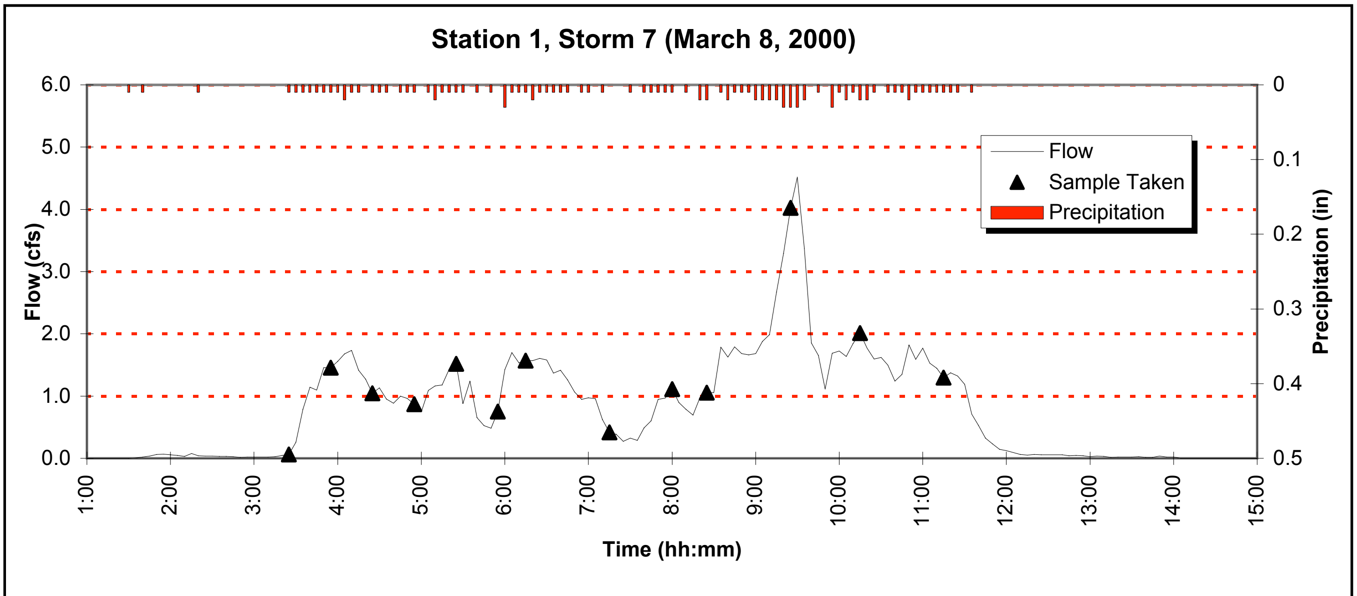
Station 1, Storm 7 (March 8, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation



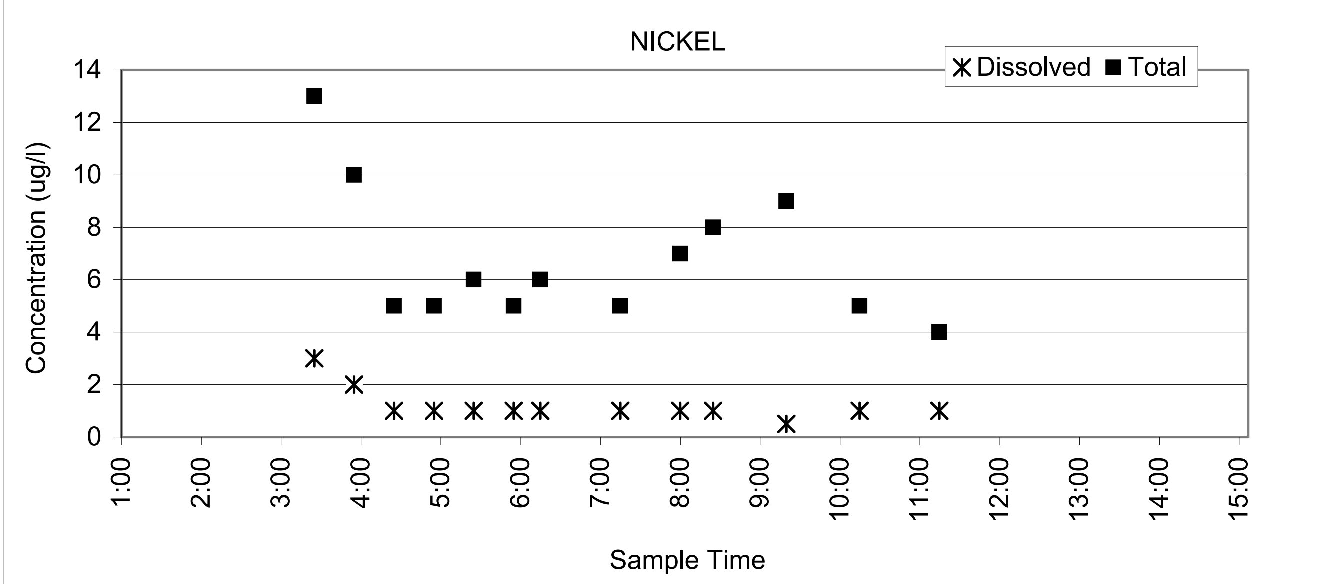
CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time



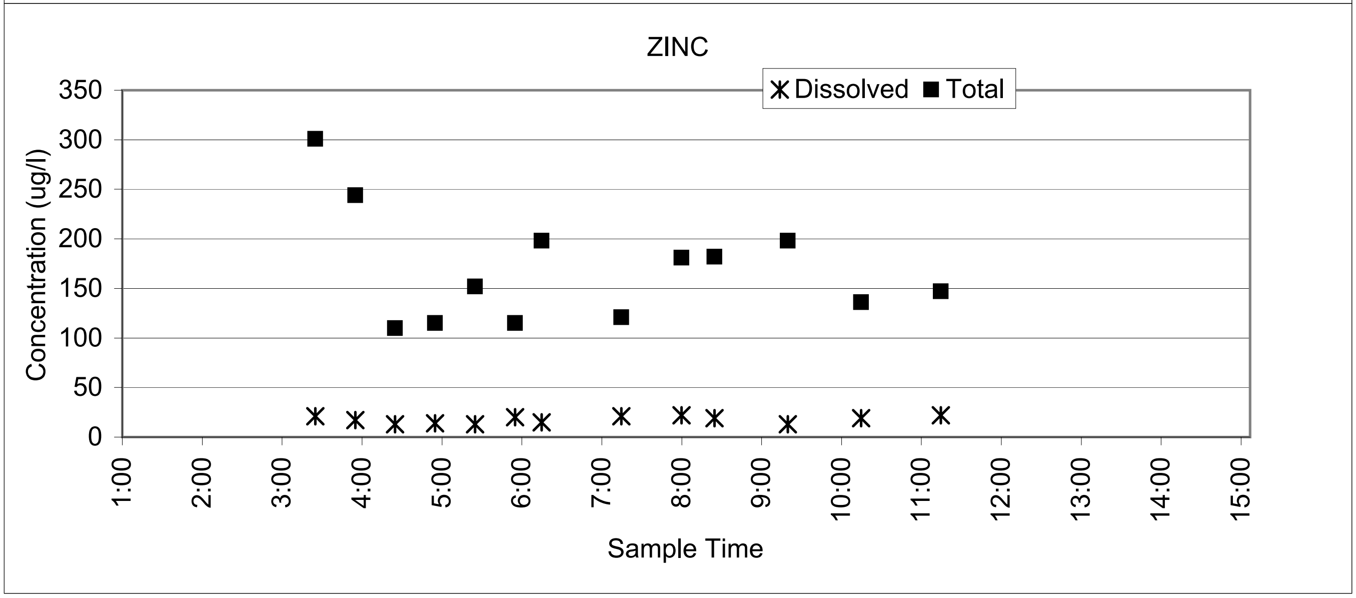
CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time



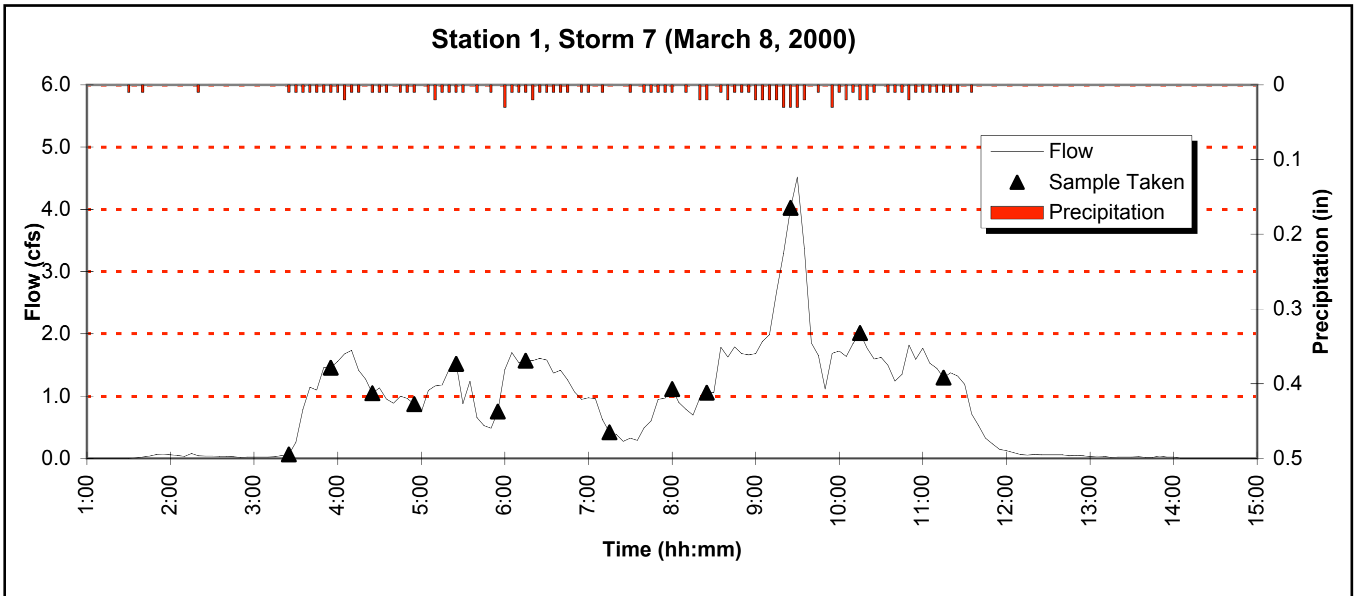
Station 1, Storm 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



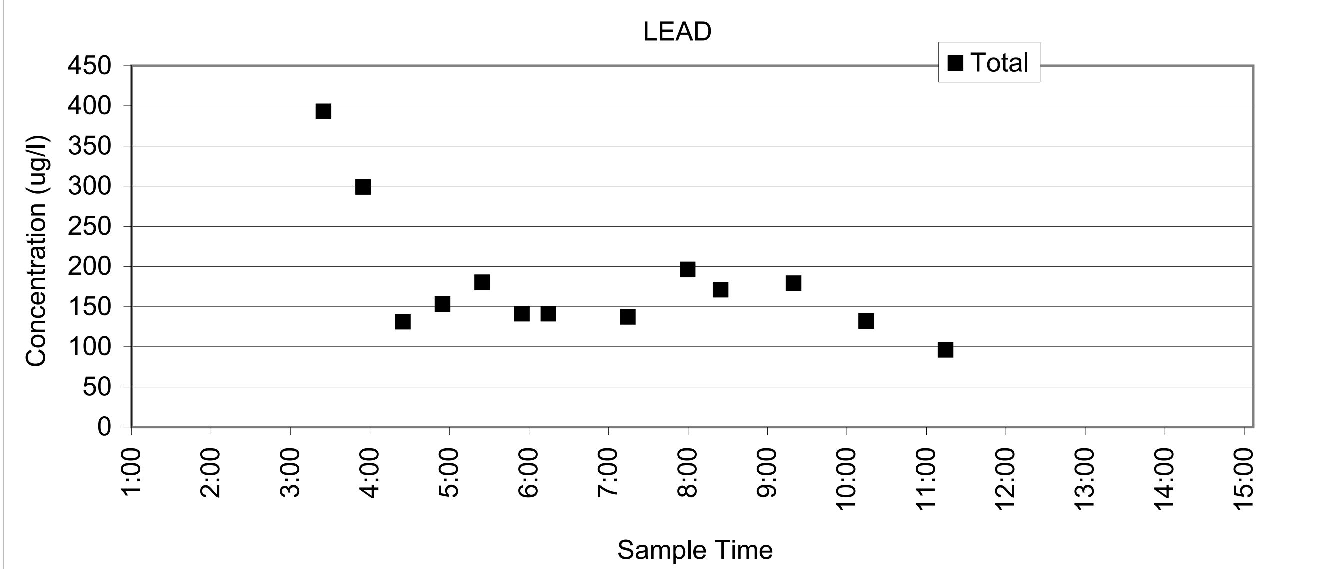
NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time



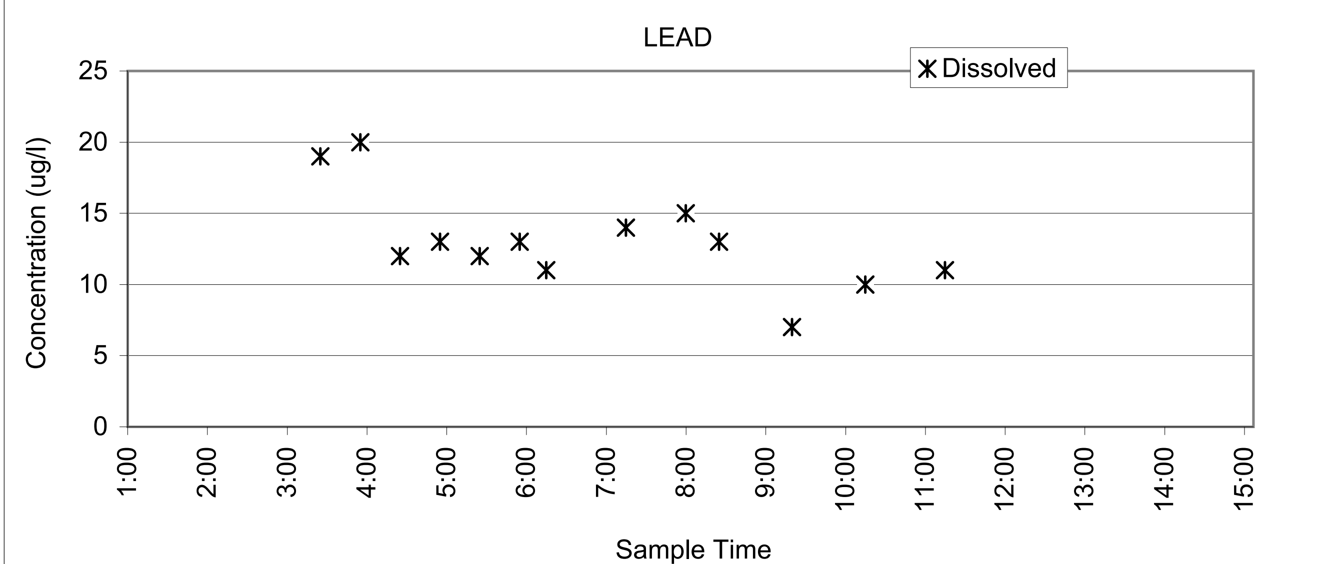
ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time



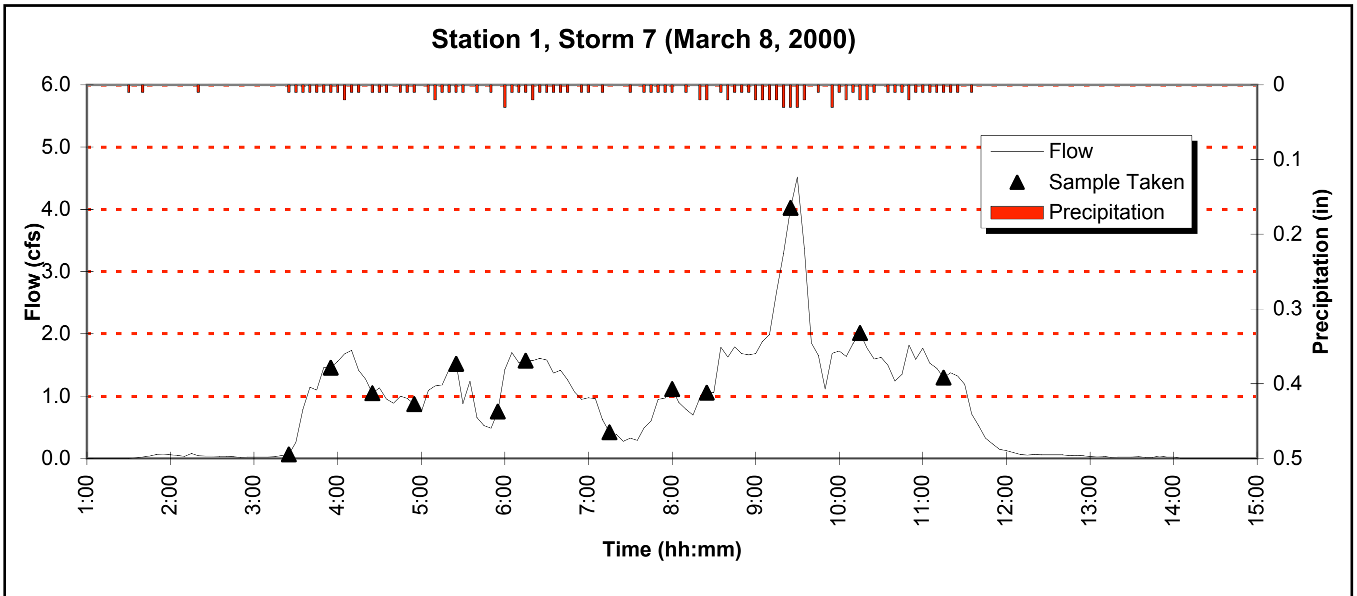
Station 1, Storm 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



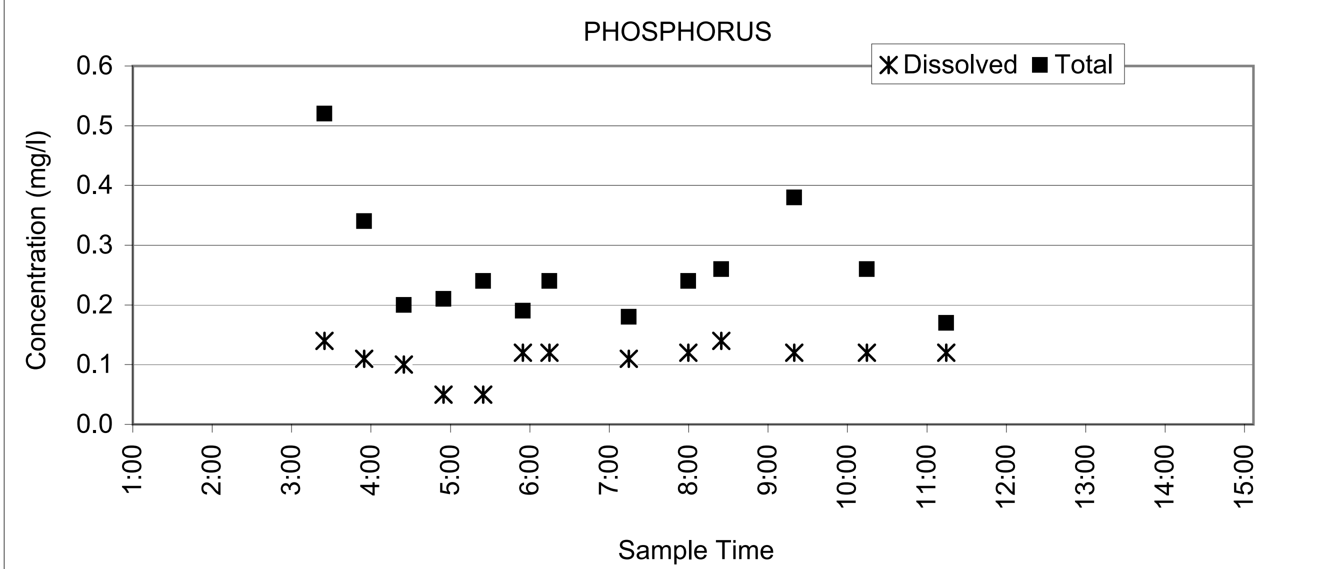
LEAD
Total
Concentration (ug/l)
Sample Time



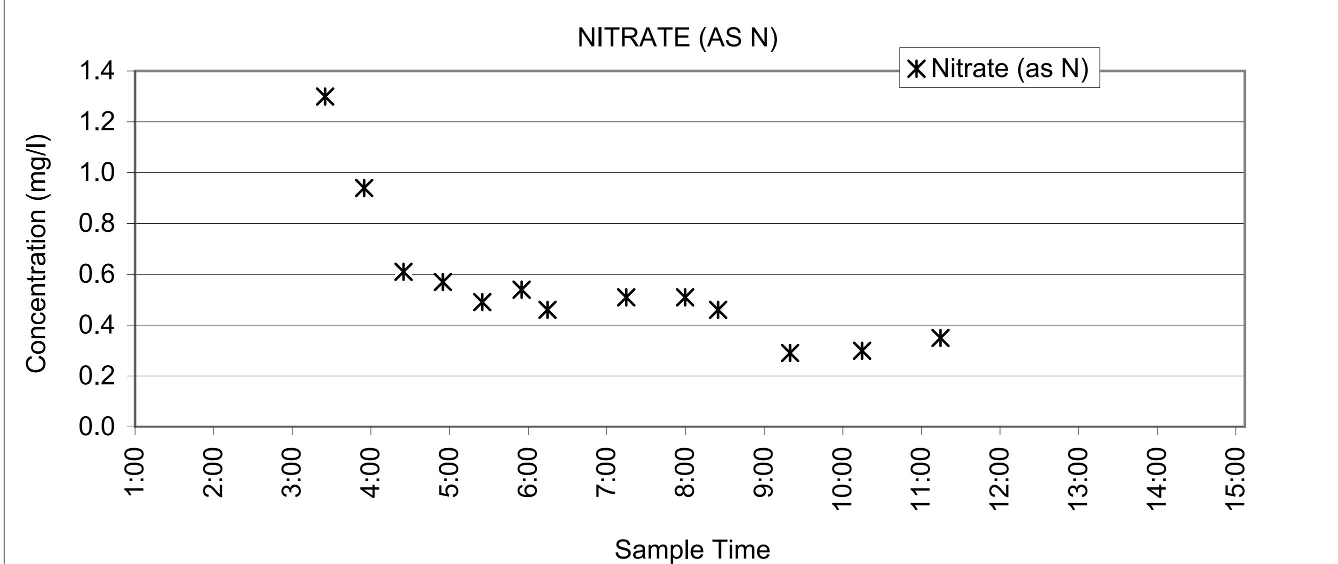
LEAD
Dissolved
Concentration (ug/l)
Sample Time



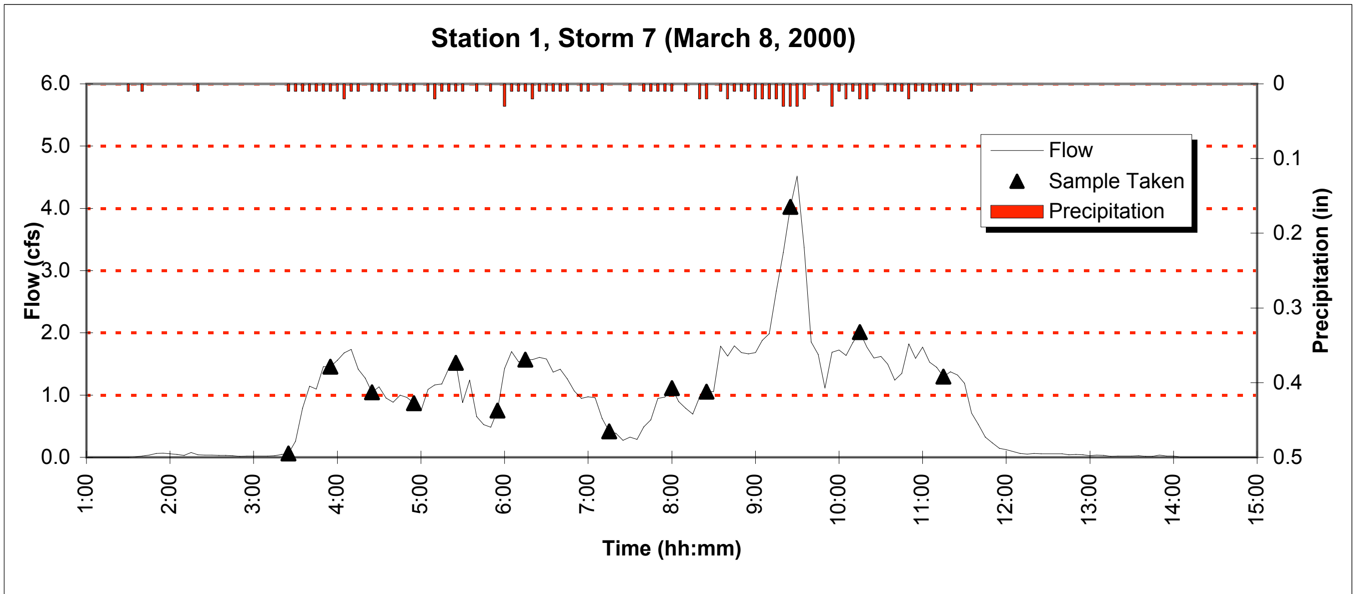
Station 1, Storm 7 (March 8, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation



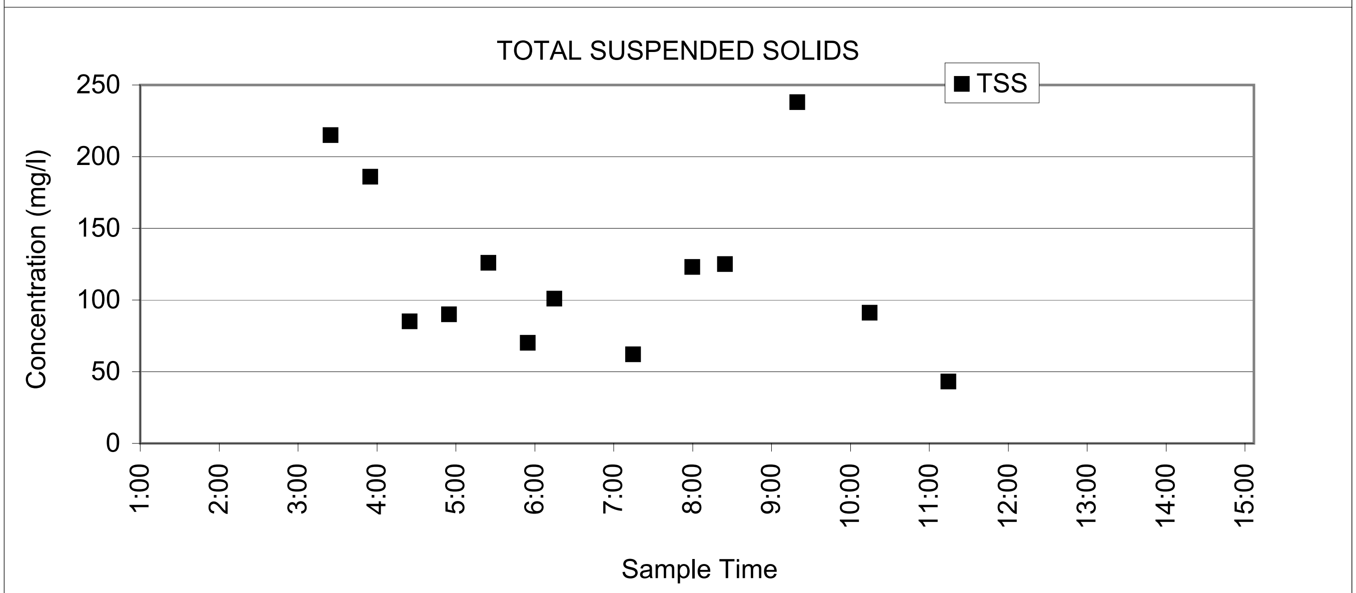
PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time



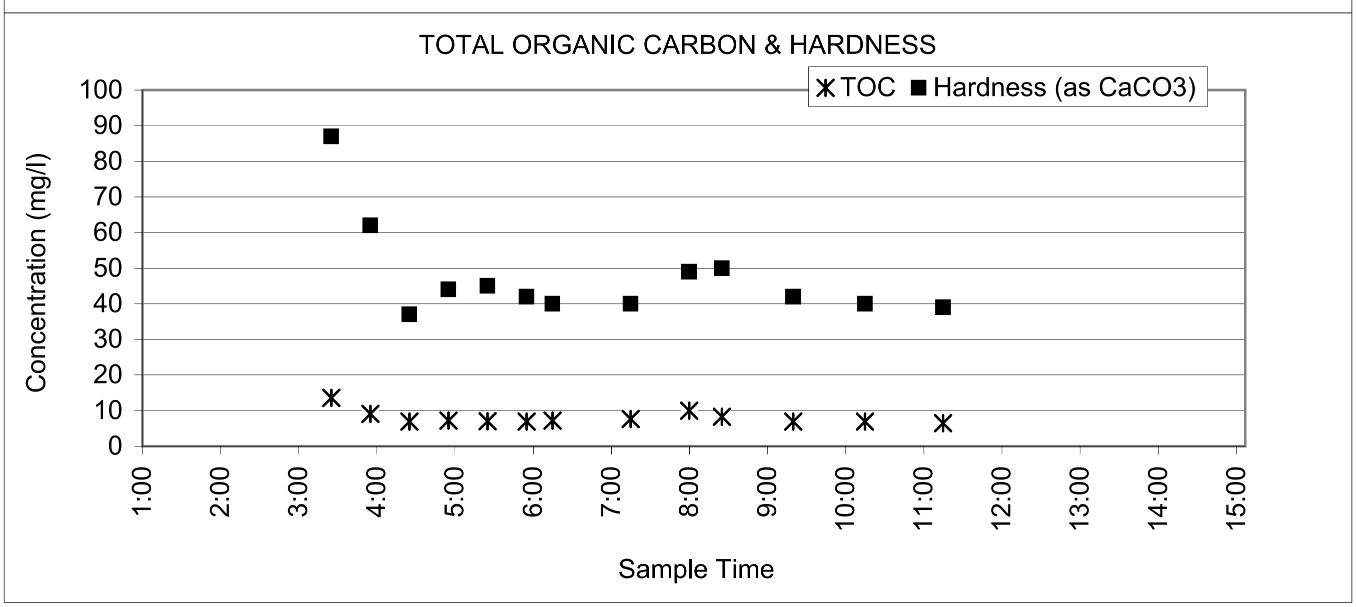
NITRATE (AS N)
Nitrate (as N)
Concentration (mg/l)
Sample Time



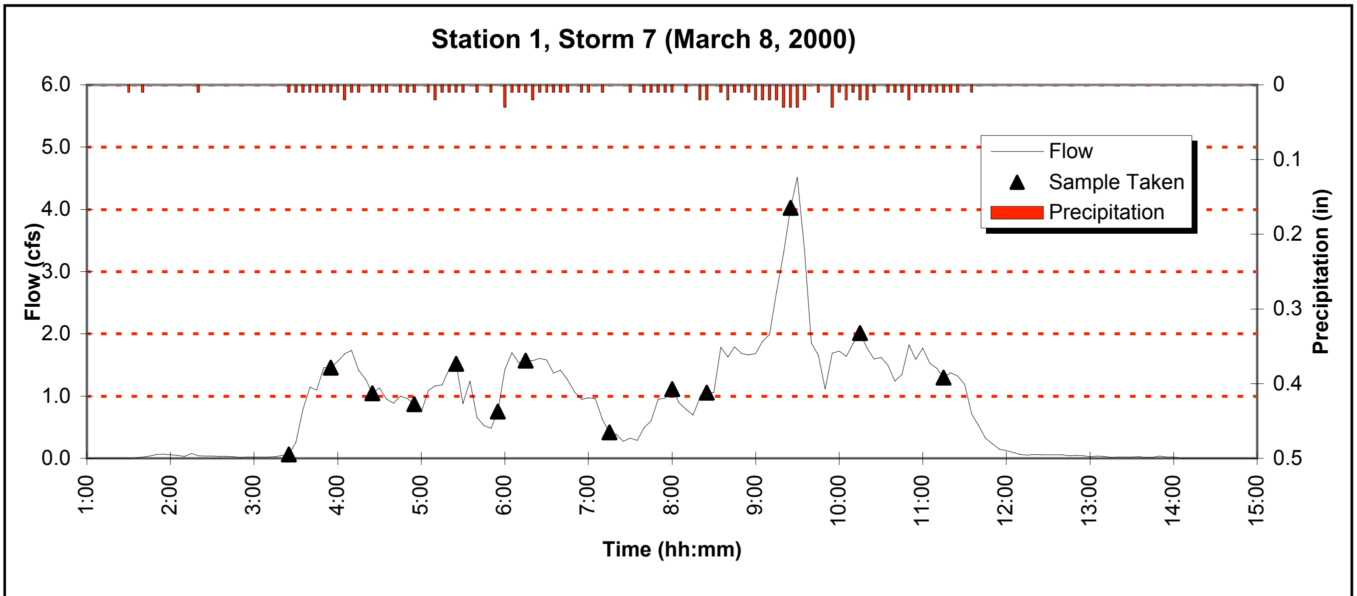
Station 1, Storm 7 (March 8, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

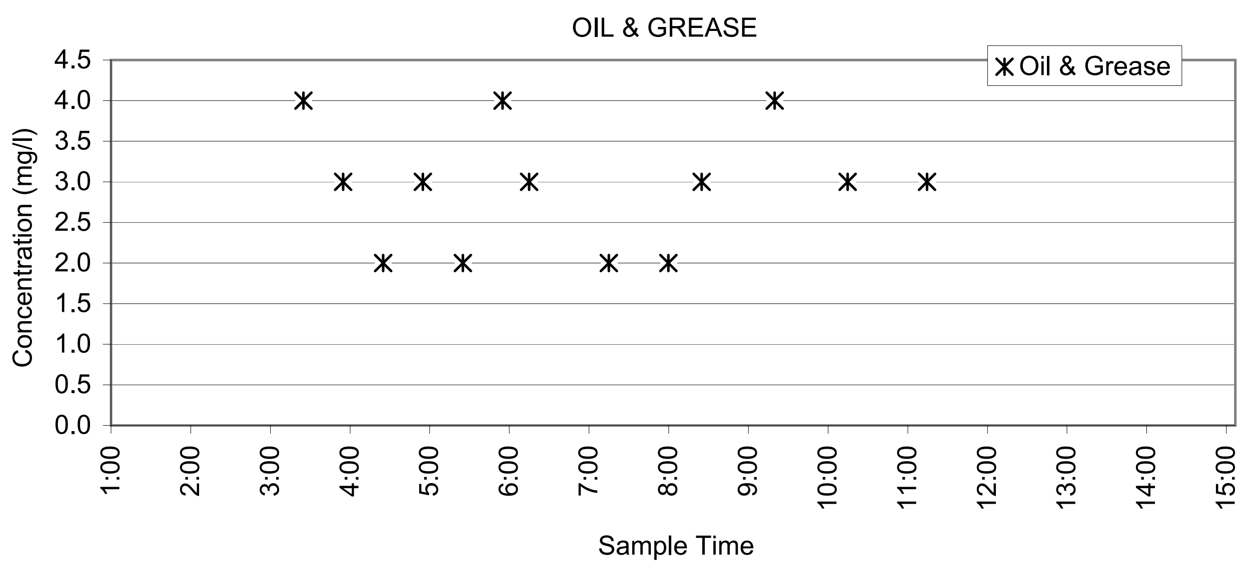


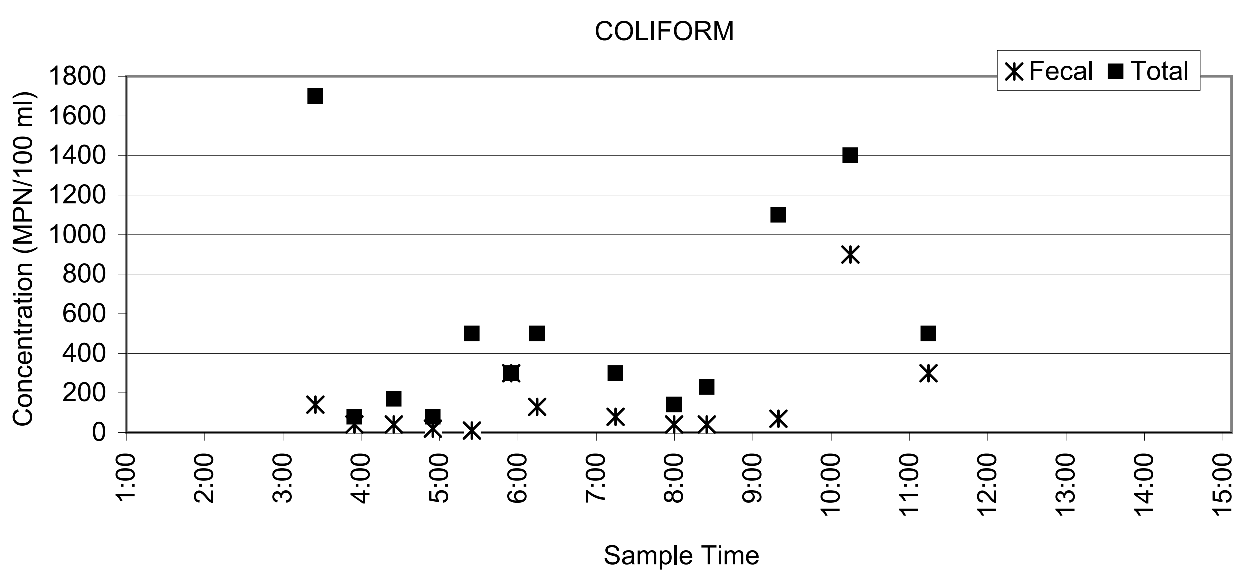
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time

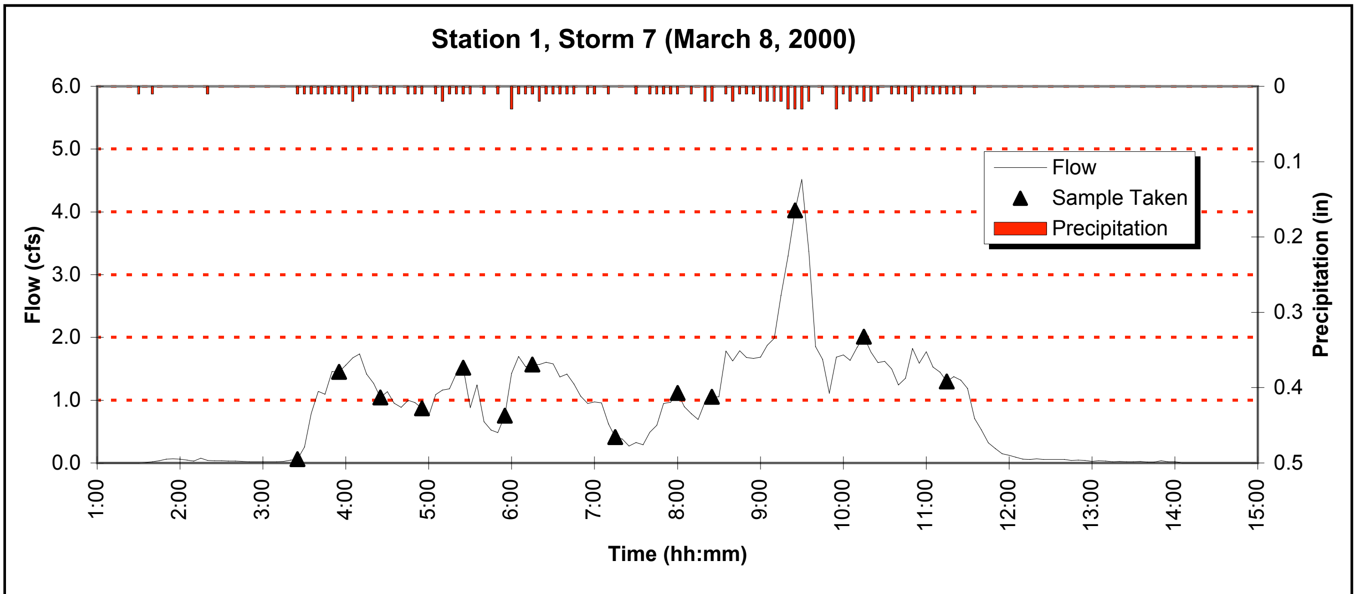


TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time

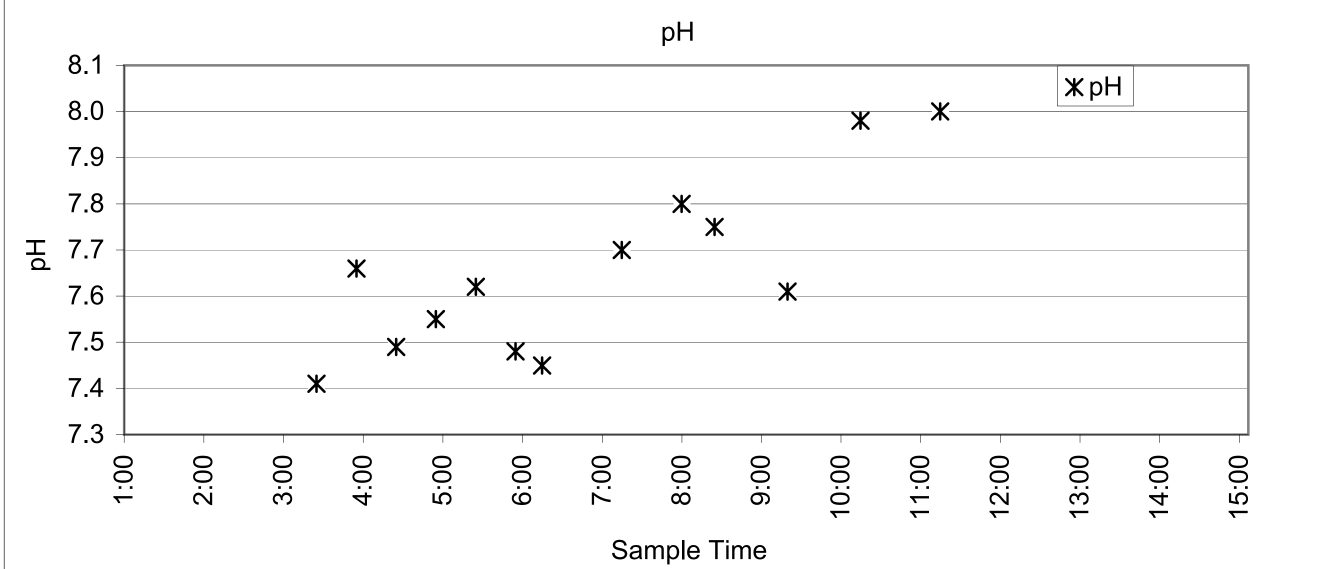

Station 1, Storm 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


OIL & GREASE
Oil & Grease
Concentration (mg/l)
Sample Time

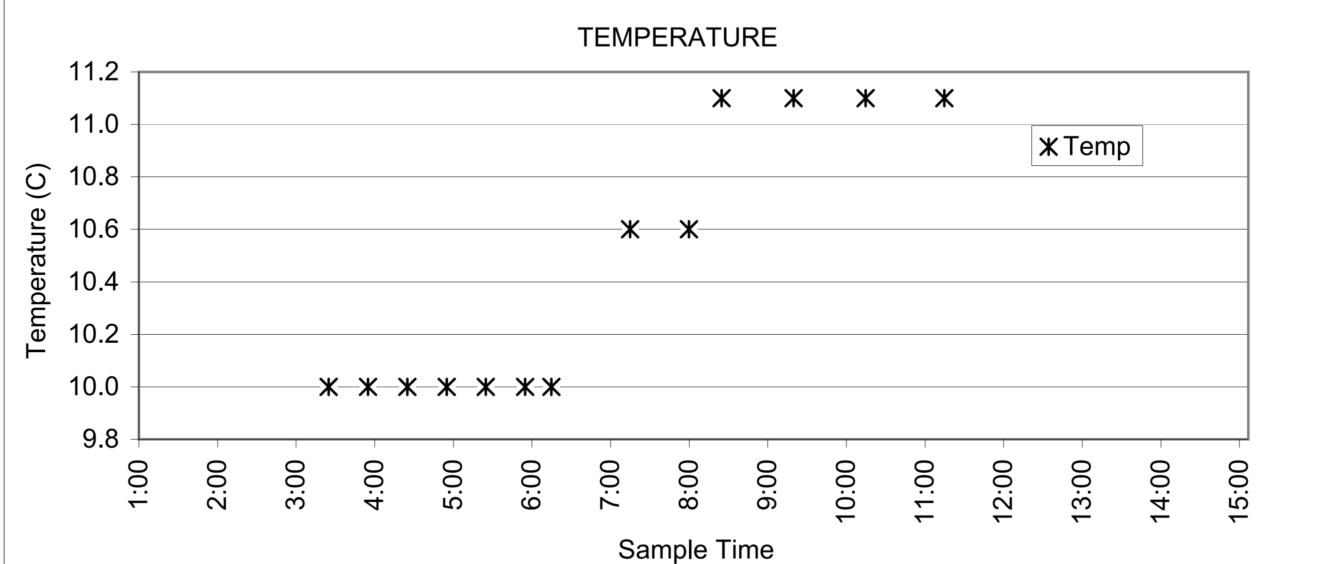

COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
Sample Time



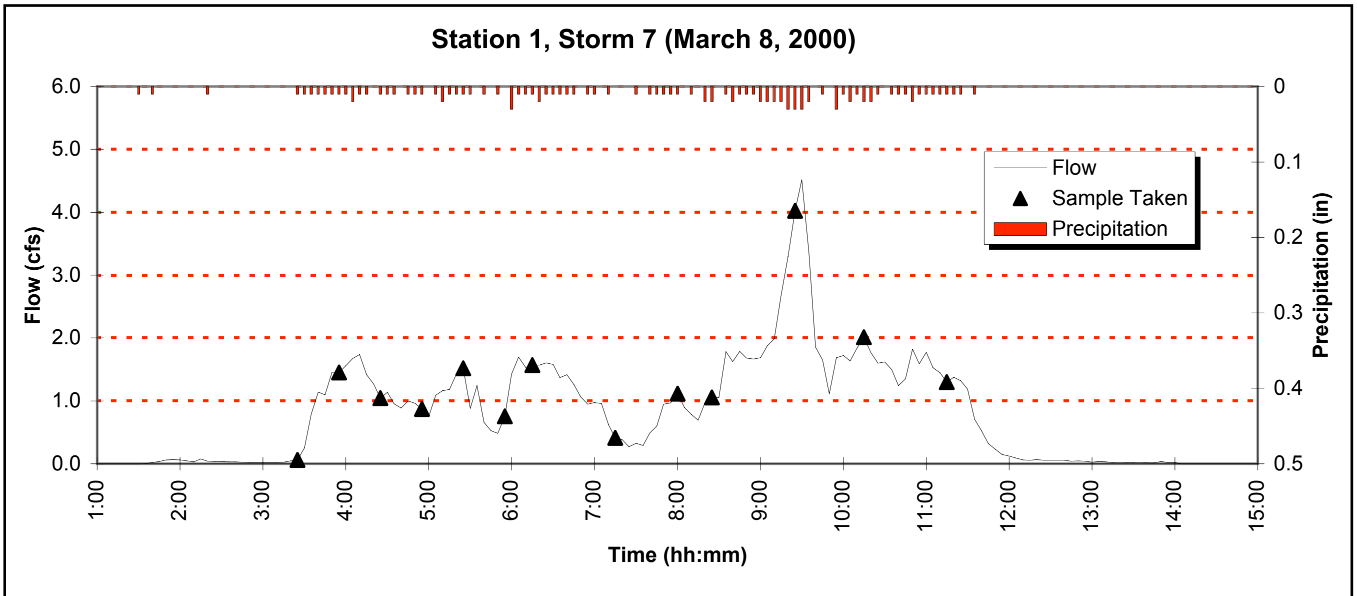
Station 1, Storm 7 (March 8, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation



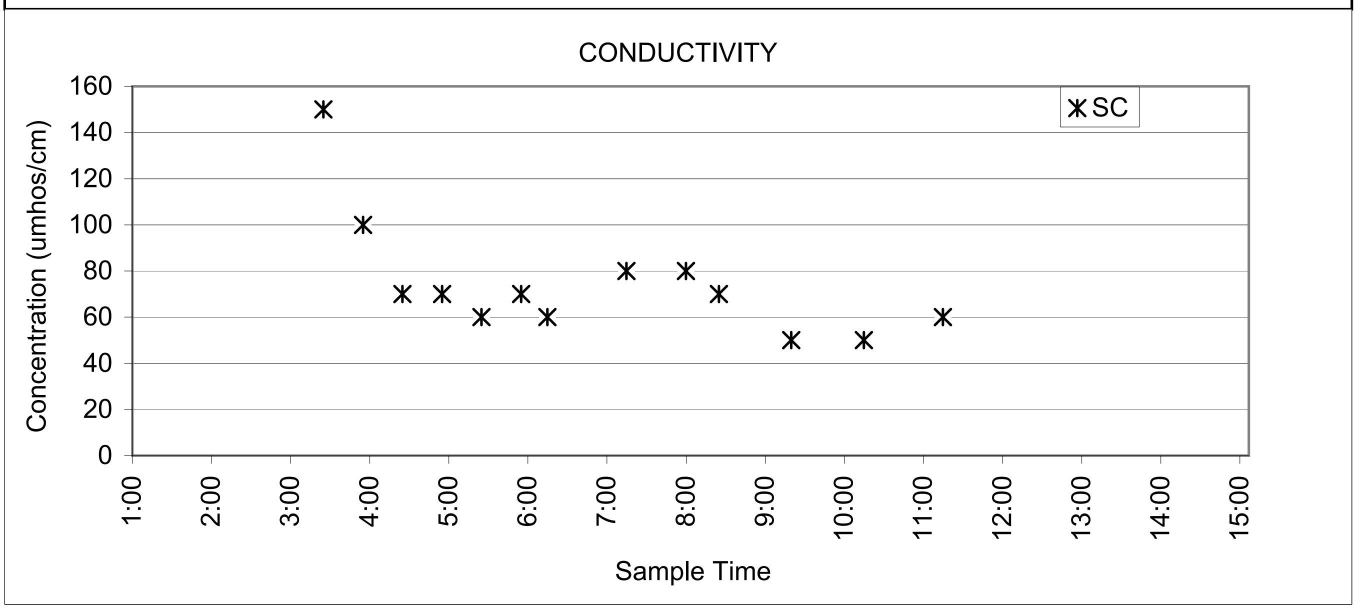
pH
pH
Sample Time



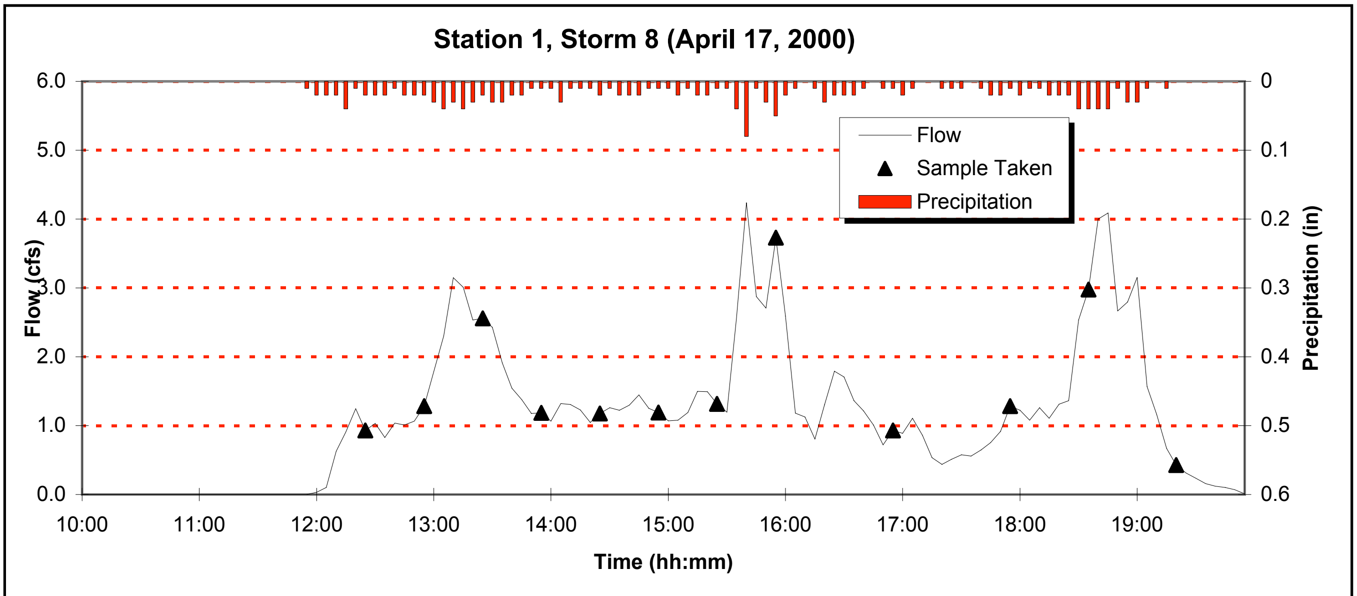
TEMPERATURE
Temperature (C)
Temp
Sample Time



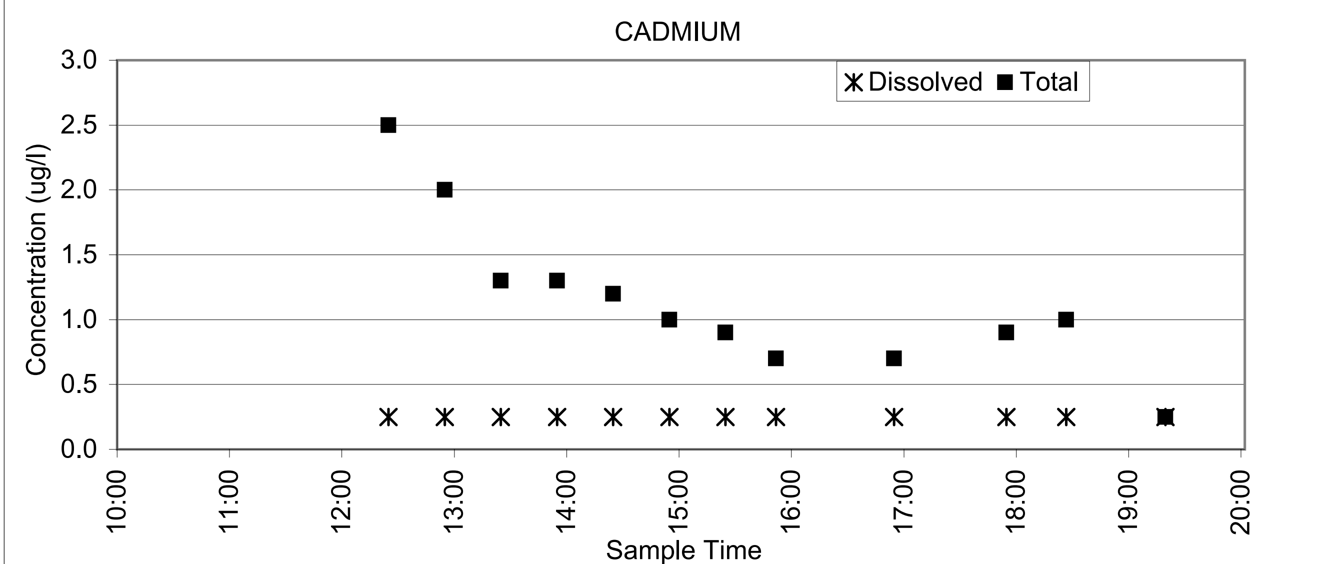
Station 1, Storm 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.1
0.2
0.3
0.4
0.5
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00



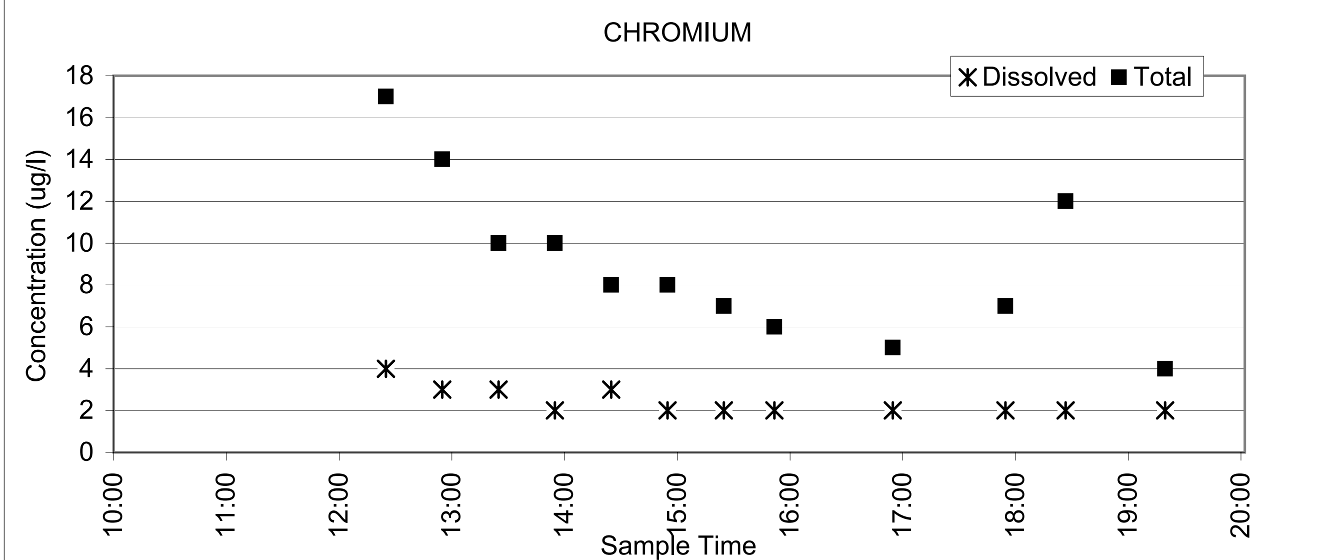
CONDUCTIVITY
SC
Concentration (umhos/cm)
Sample Time
160
140
120
100
80
60
40
20
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00



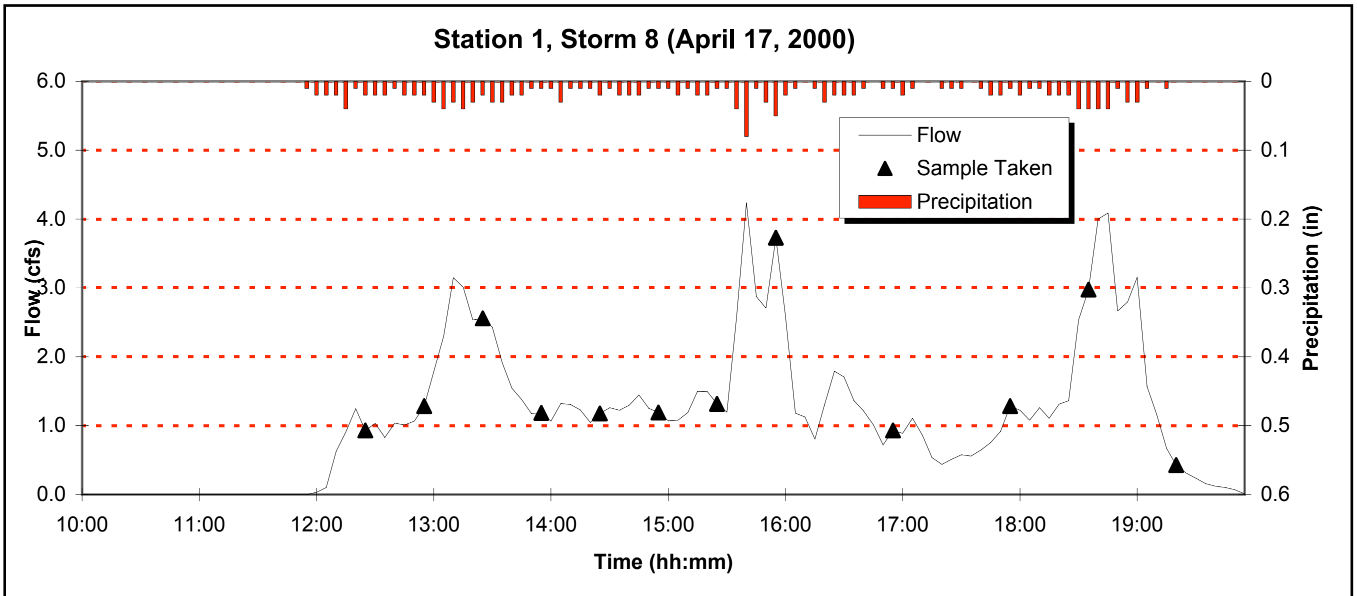
Station 1, Storm 8 (April 17, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00



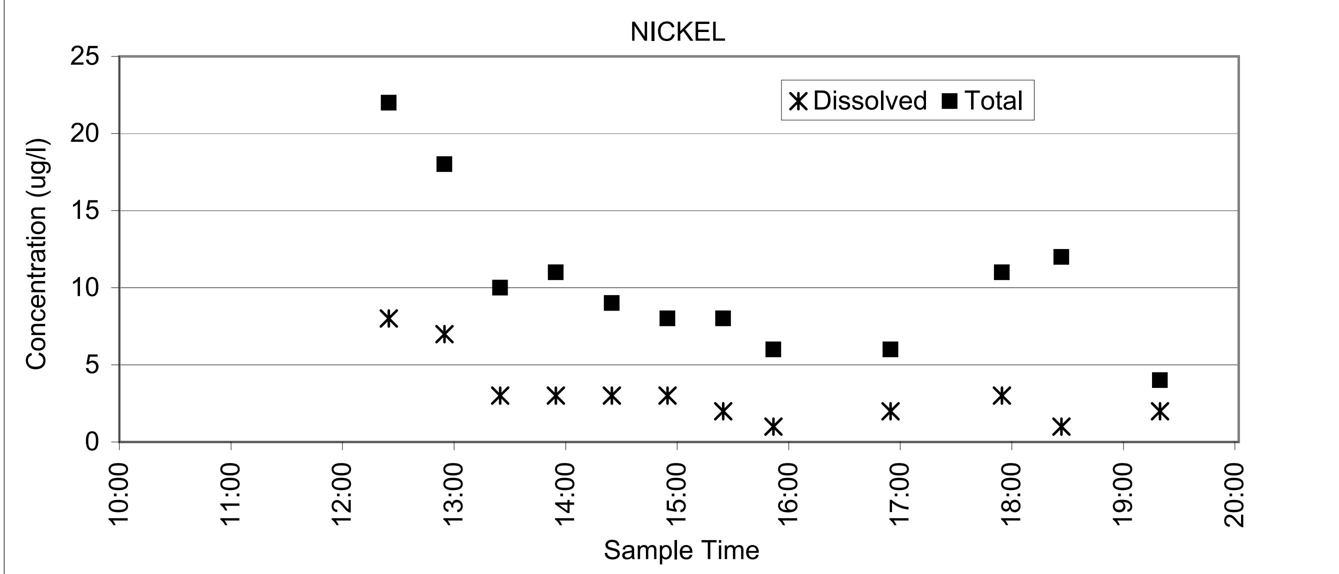
CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00



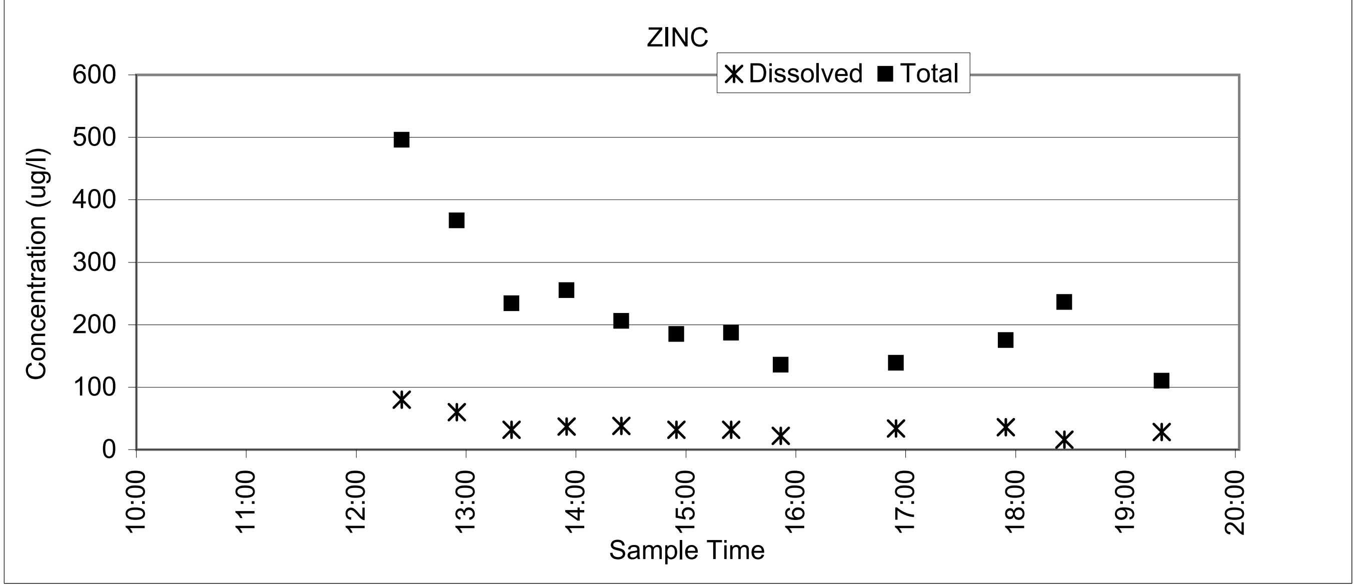
CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time
18
16
14
12
10
8
6
4
2
0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00



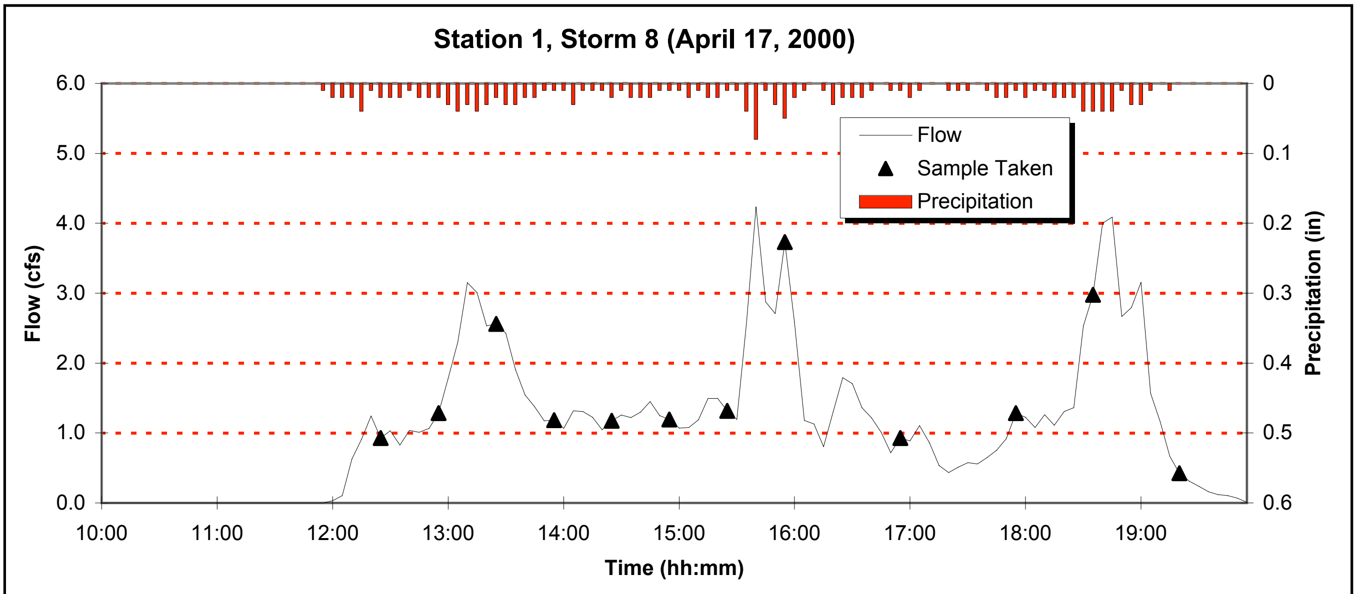
Station 1, Storm 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

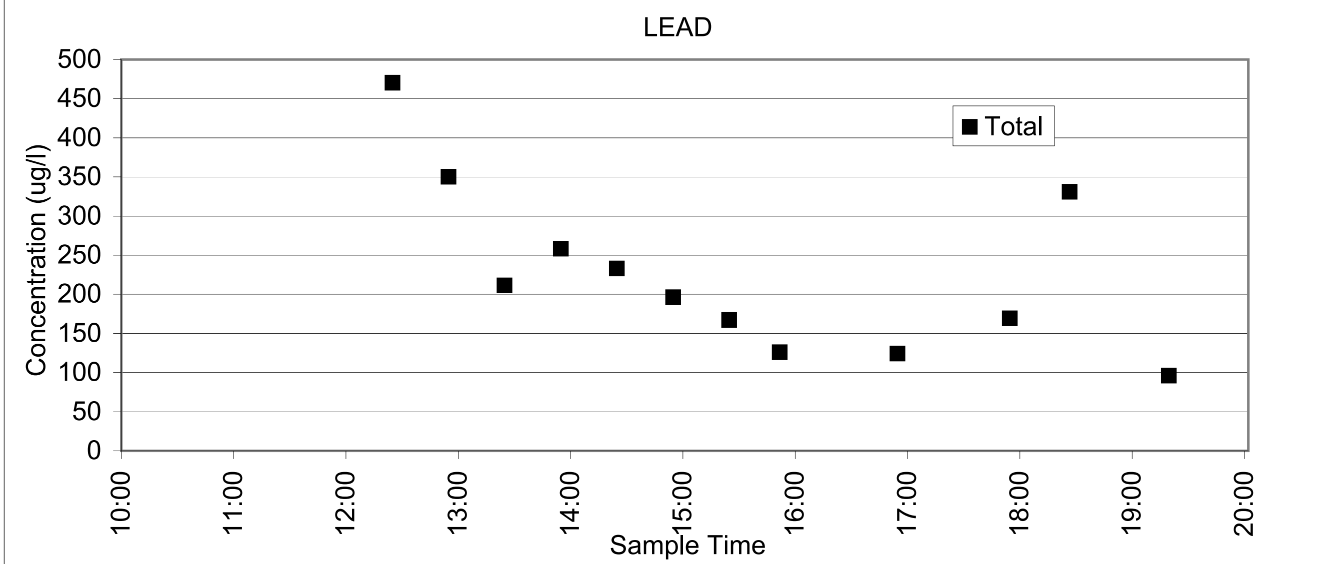


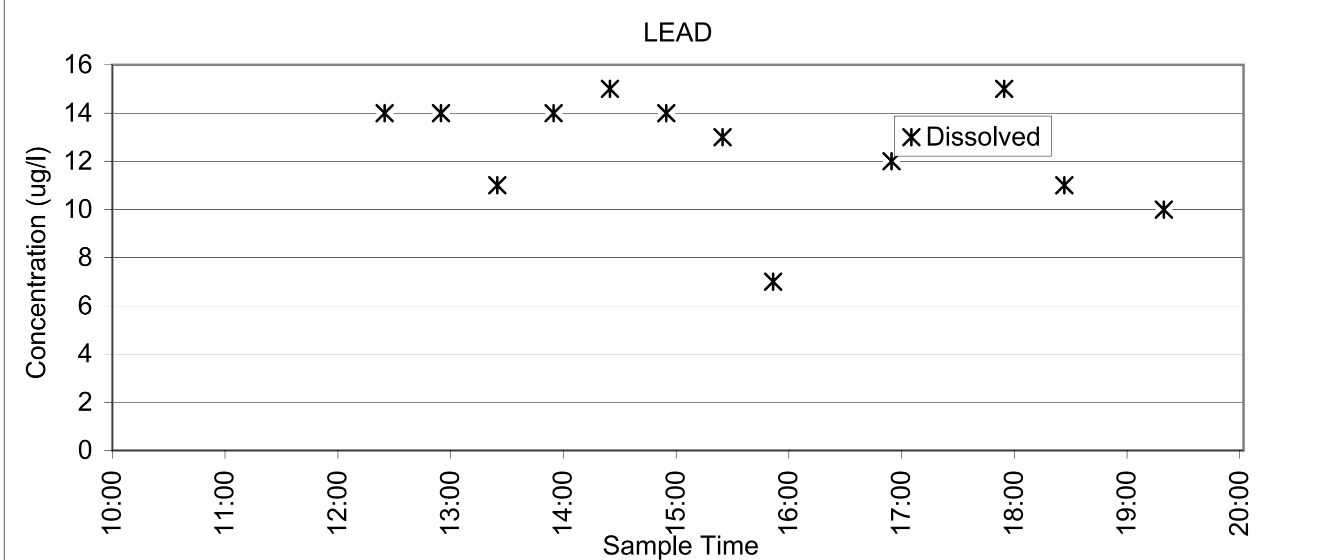
NICKEL
Concentration (ug/l)
Sample Time
Dissolved
Total

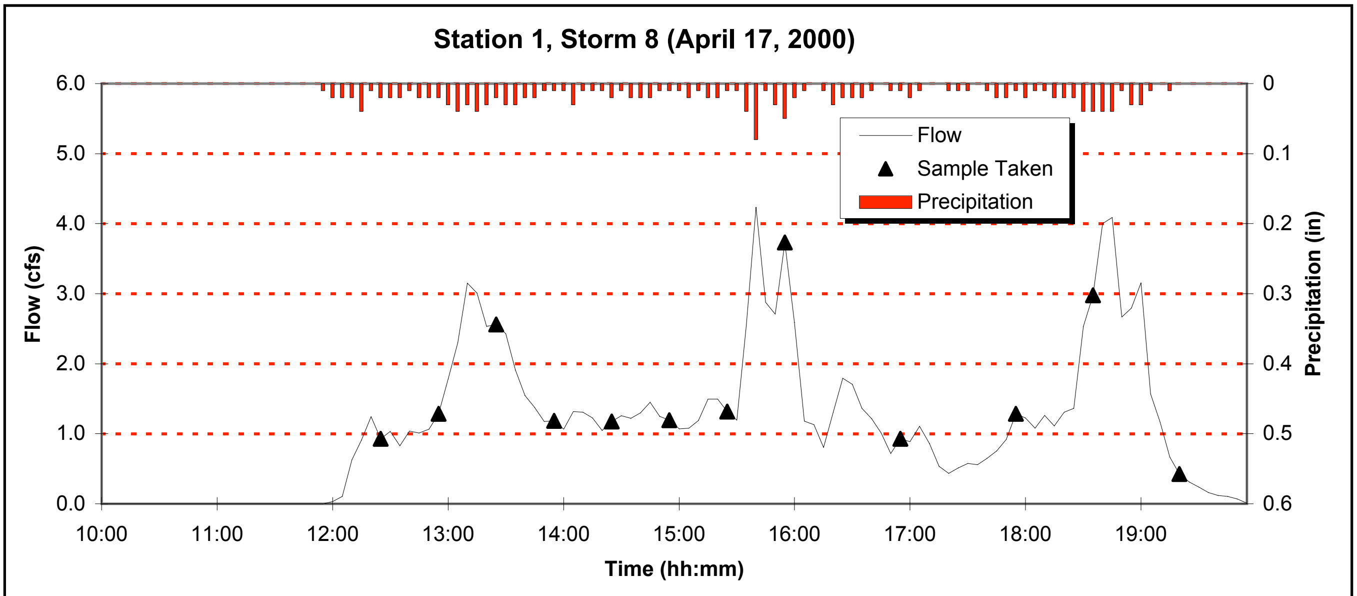


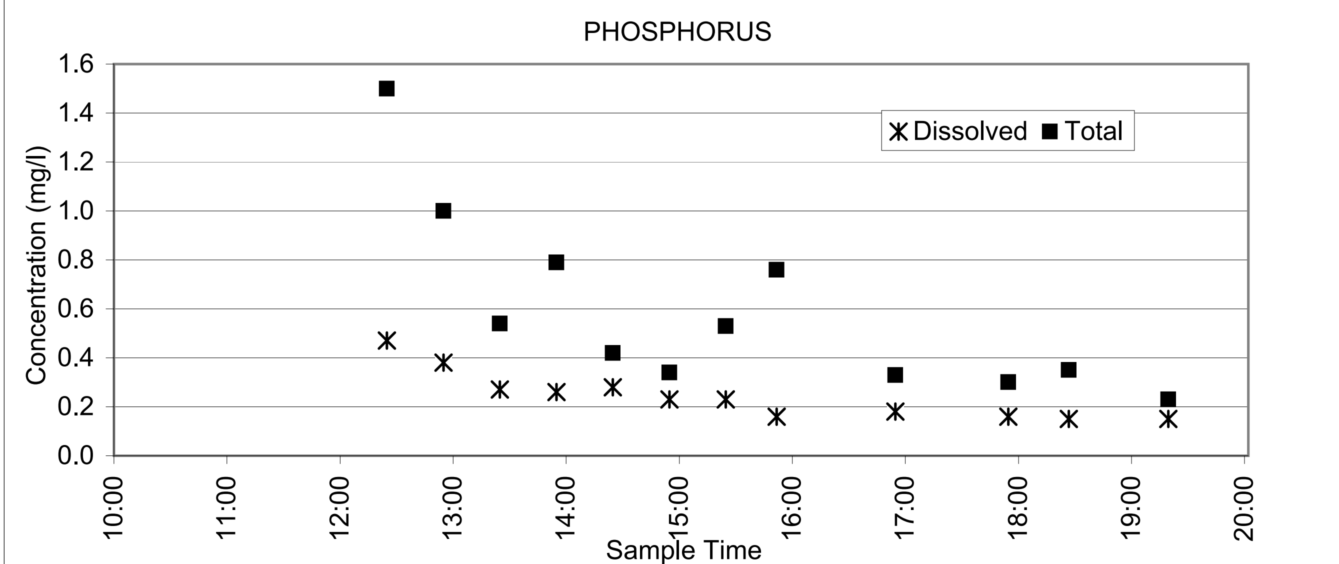
ZINC
Concentration (ug/l)
Sample Time
Dissolved
Total

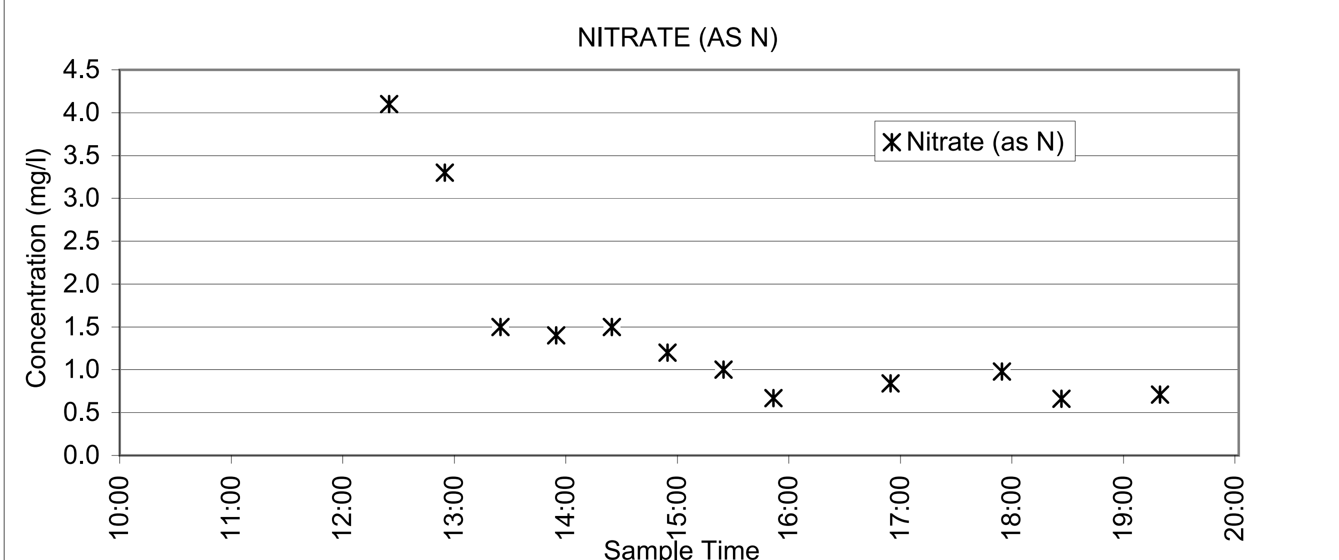

Station 1, Storm 8 (April 17, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00

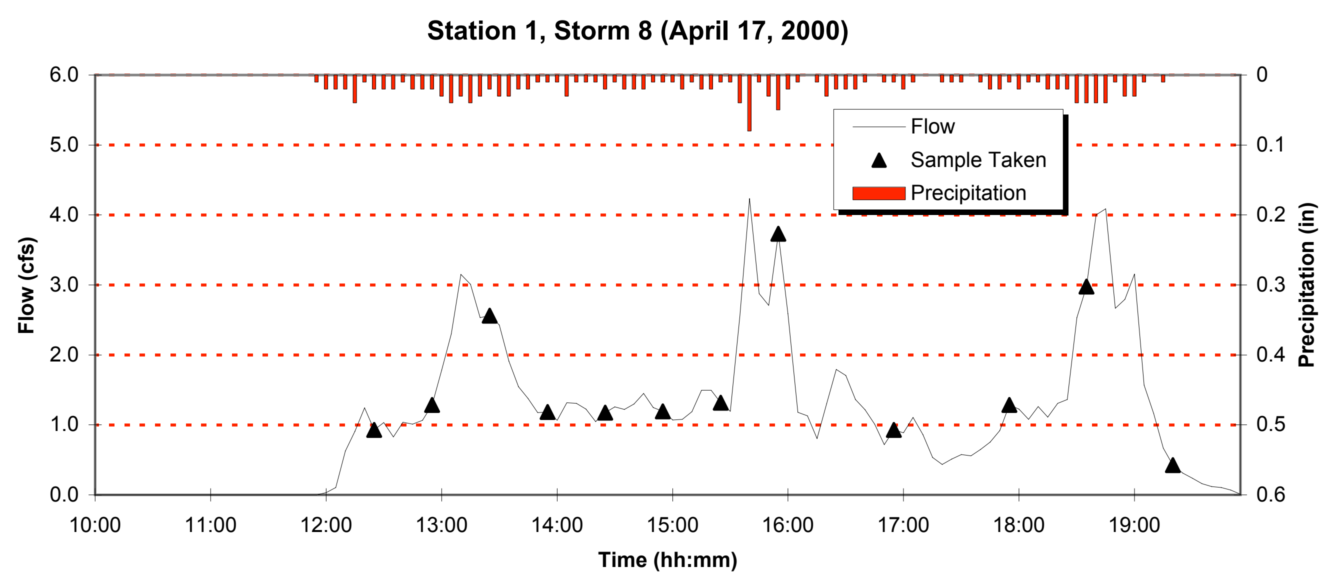

LEAD
Total
Concentration (ug/l)
Sample Time
500
450
400
350
300
250
200
150
100
50
0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00


LEAD
Dissolved
Concentration (ug/l)
Sample Time
16
14
12
10
8
6
4
2
0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

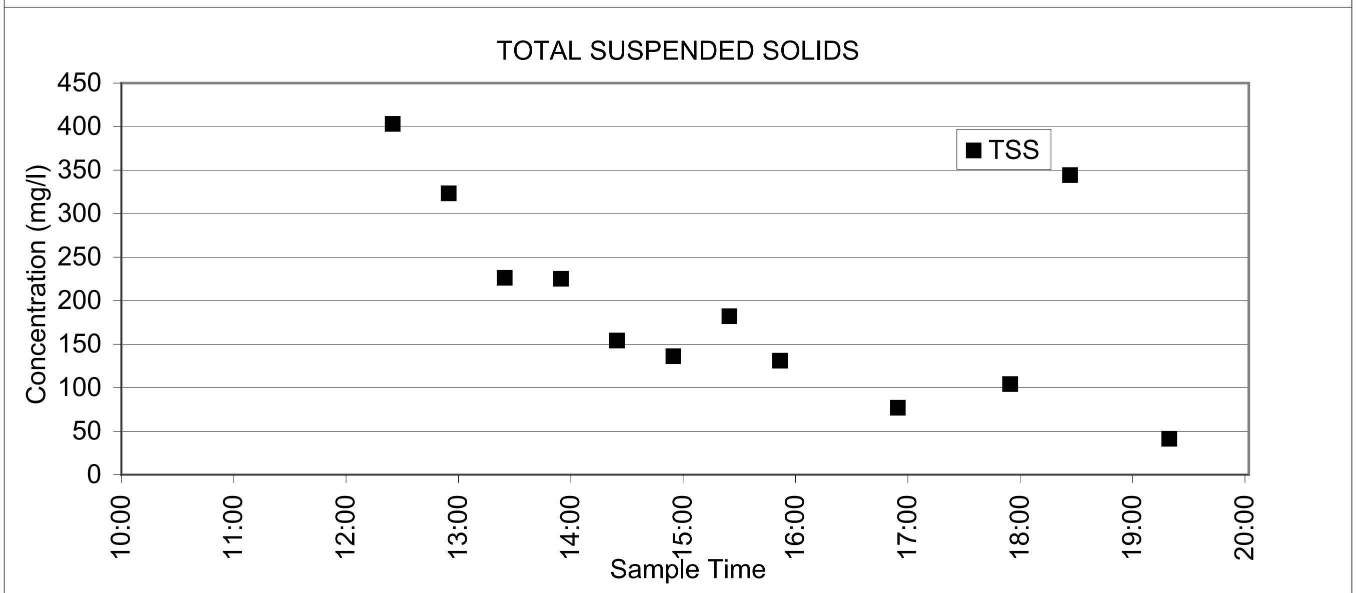

Station 1, Storm 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00


PHOSPHORUS
Concentration (mg/l)
Sample Time
Dissolved
Total
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

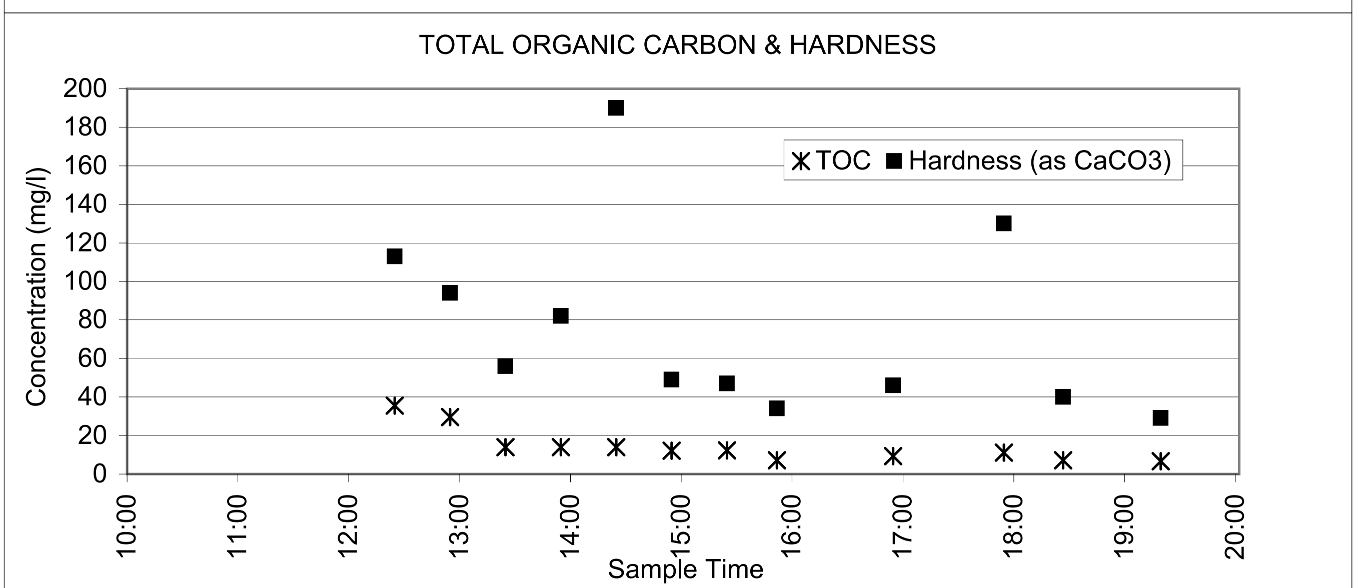

NITRATE (AS N)
Concentration (mg/l)
Sample Time
Nitrate (as N)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00



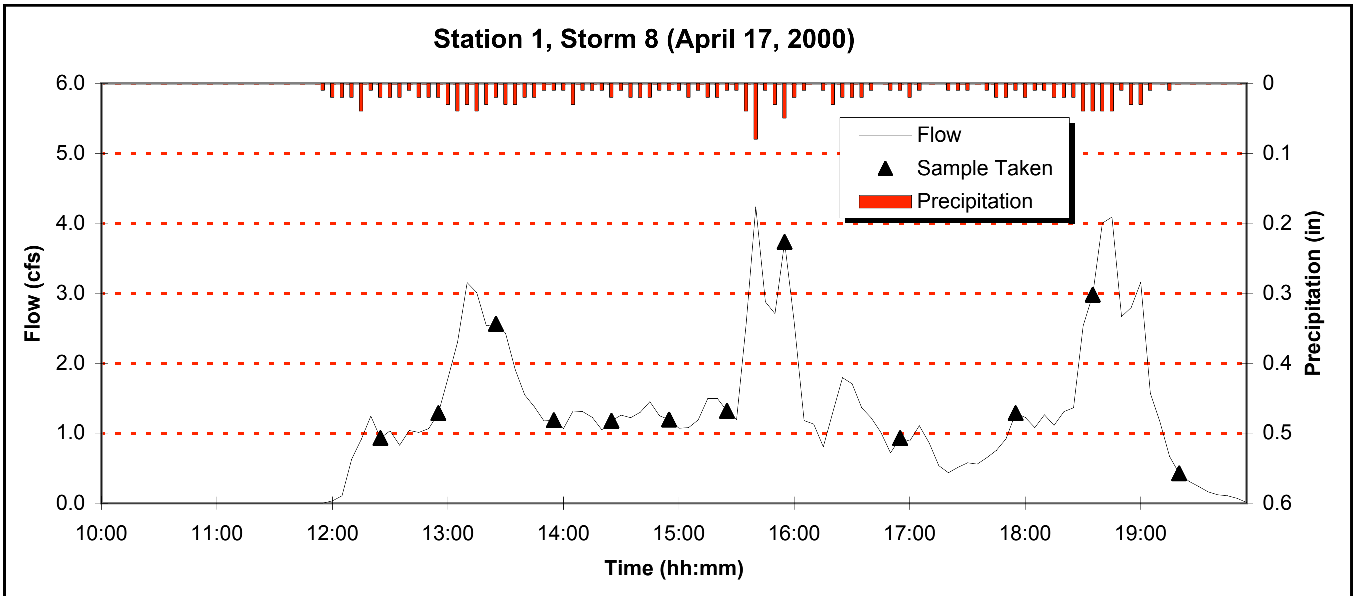
Station 1, Storm 8 (April 17, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00



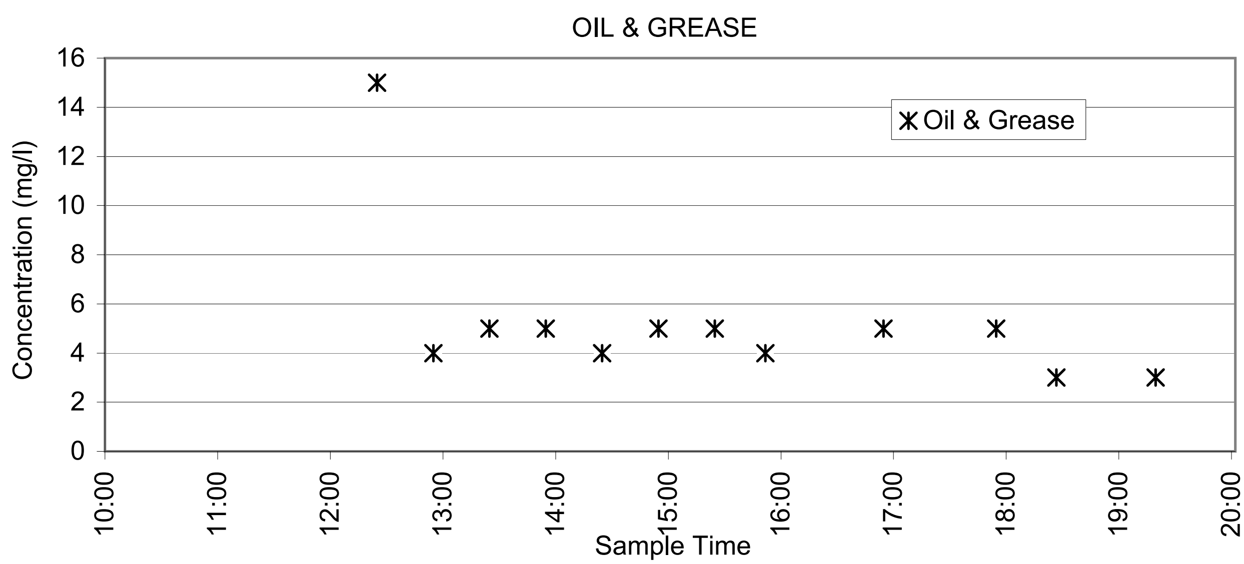
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time
450
400
350
300
250
200
150
100
50
0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00



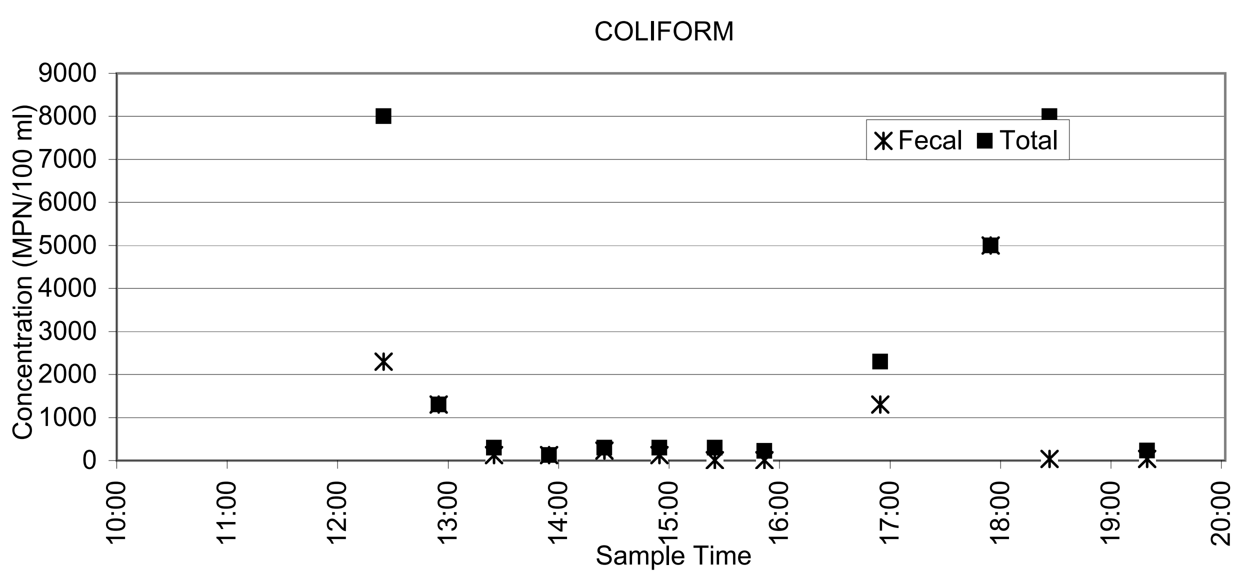
TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time
200
180
160
140
120
100
80
60
40
20
0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00



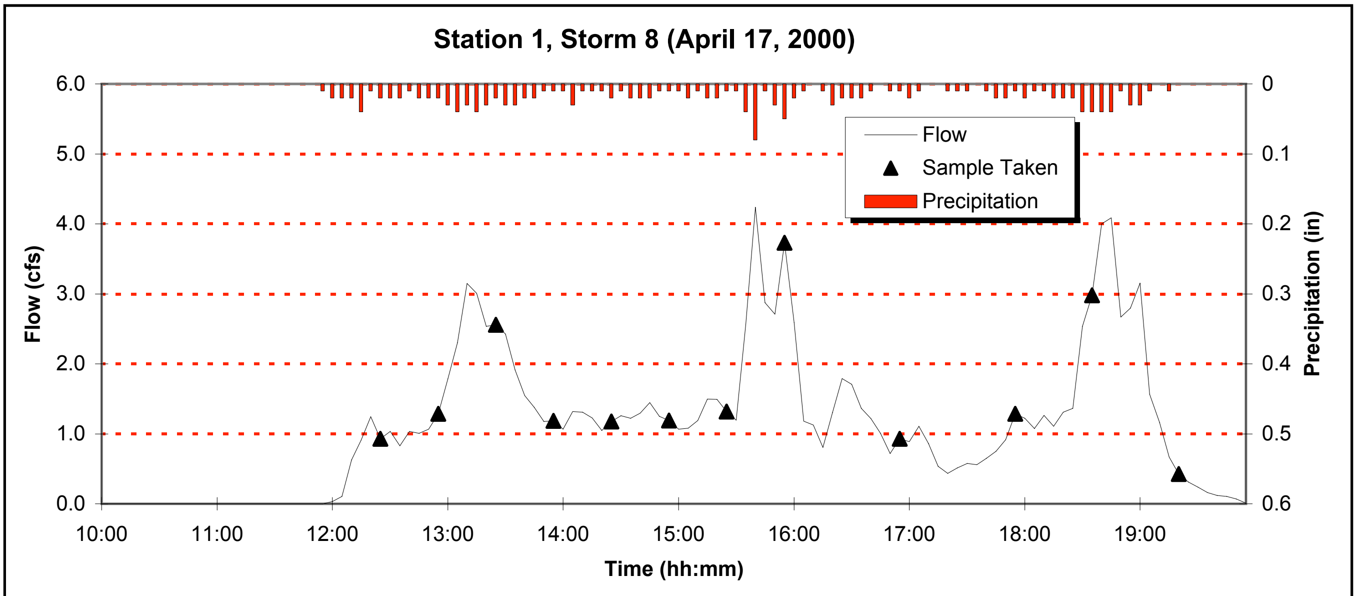
Station 1, Storm 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

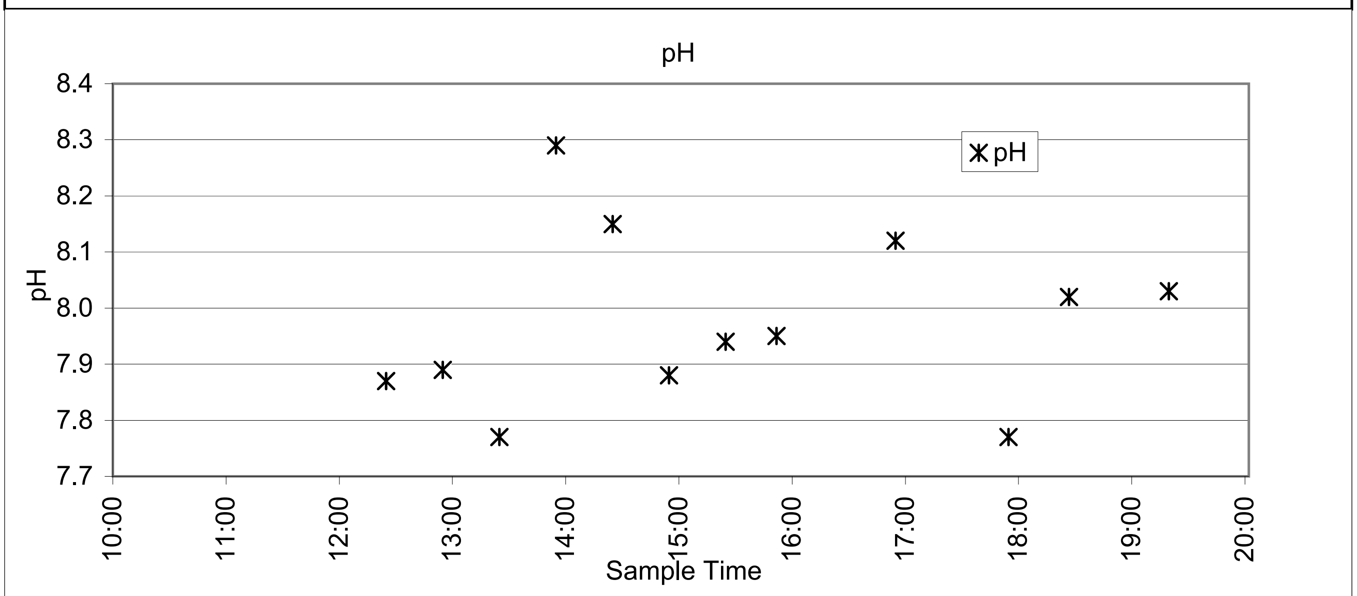


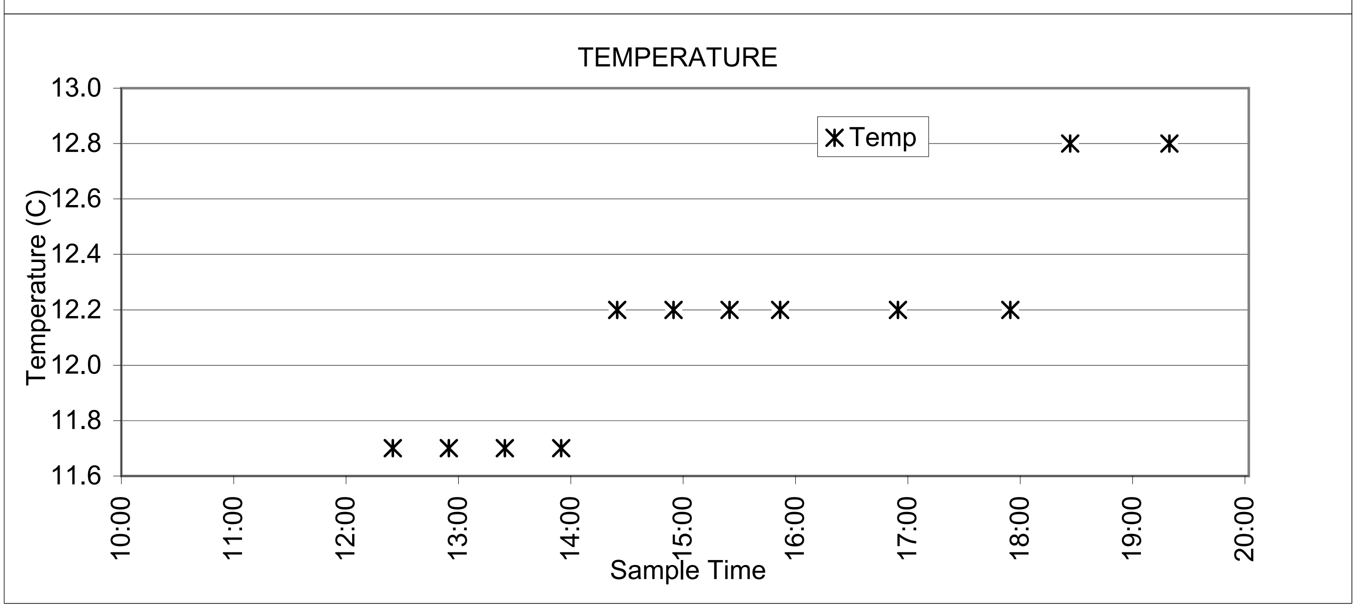
OIL & GREASE
Concentration (mg/l)
Sample Time
Oil & Grease

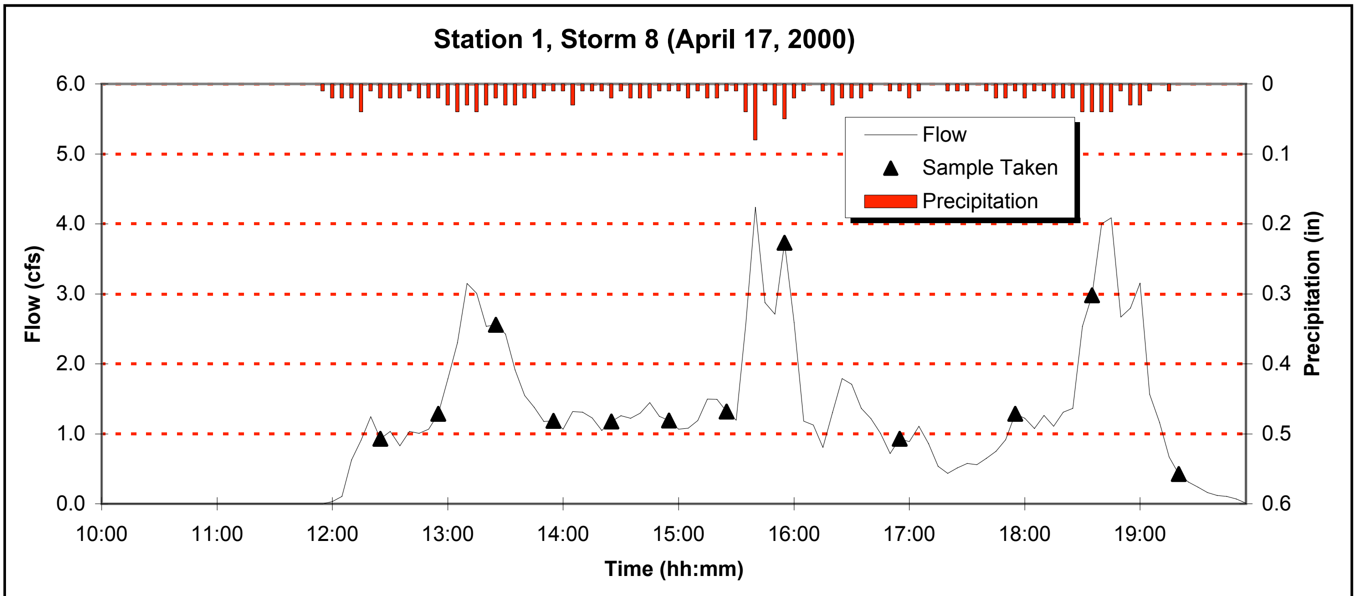


COLIFORM
Concentration (MPN/100 ml)
Sample Time
Fecal
Total

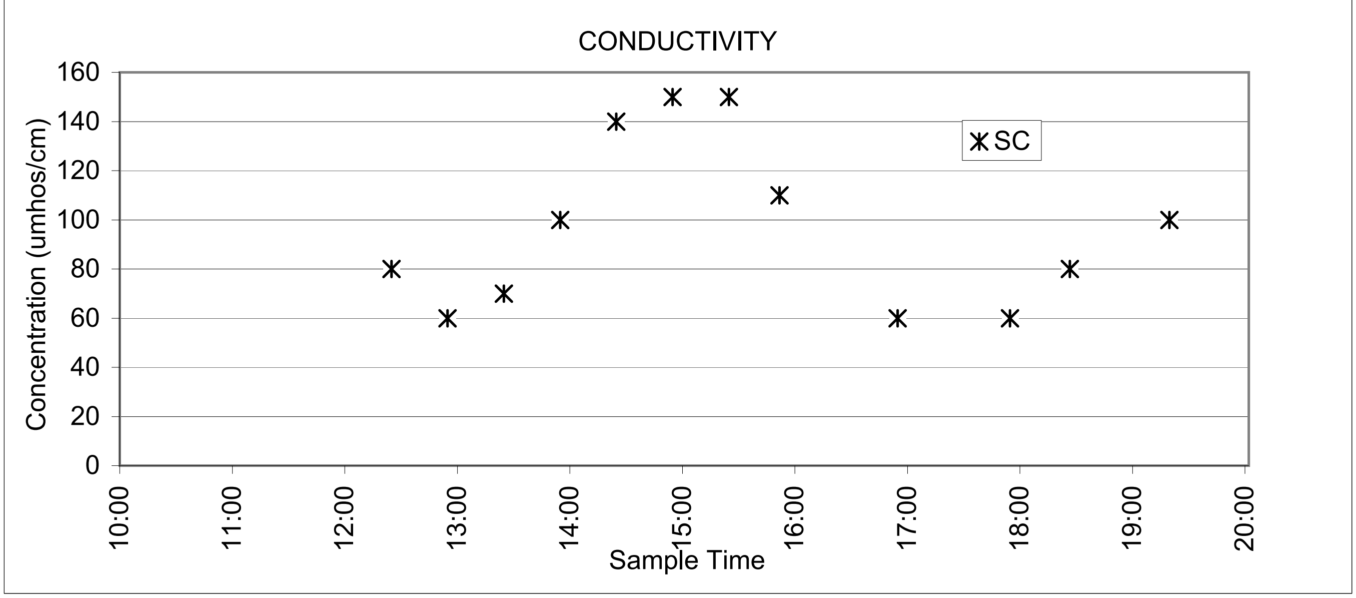

Station 1, Storm 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00


pH
pH
Sample Time
8.4
8.3
8.2
8.1
8.0
7.9
7.8
7.7
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00


TEMPERATURE
Temperature (C)
Sample Time
Temp
13.0
12.8
12.6
12.4
12.2
12.0
11.8
11.6
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

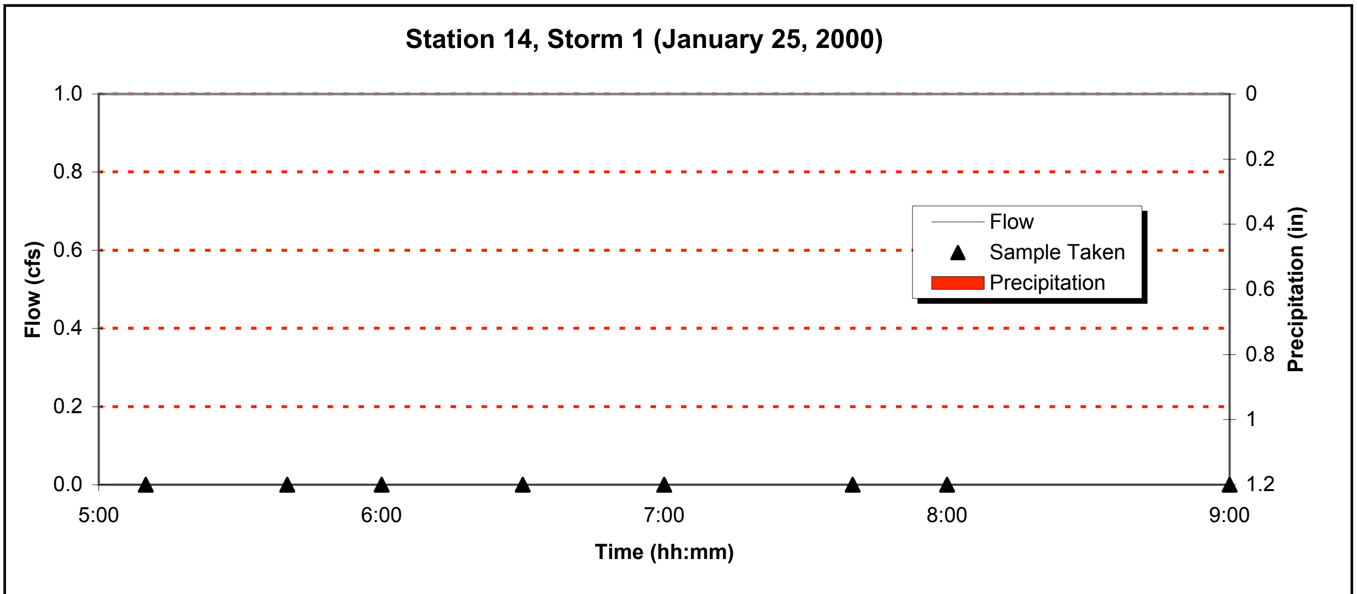


Station 1, Storm 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.1
0.2
0.3
0.4
0.5
0.6
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00

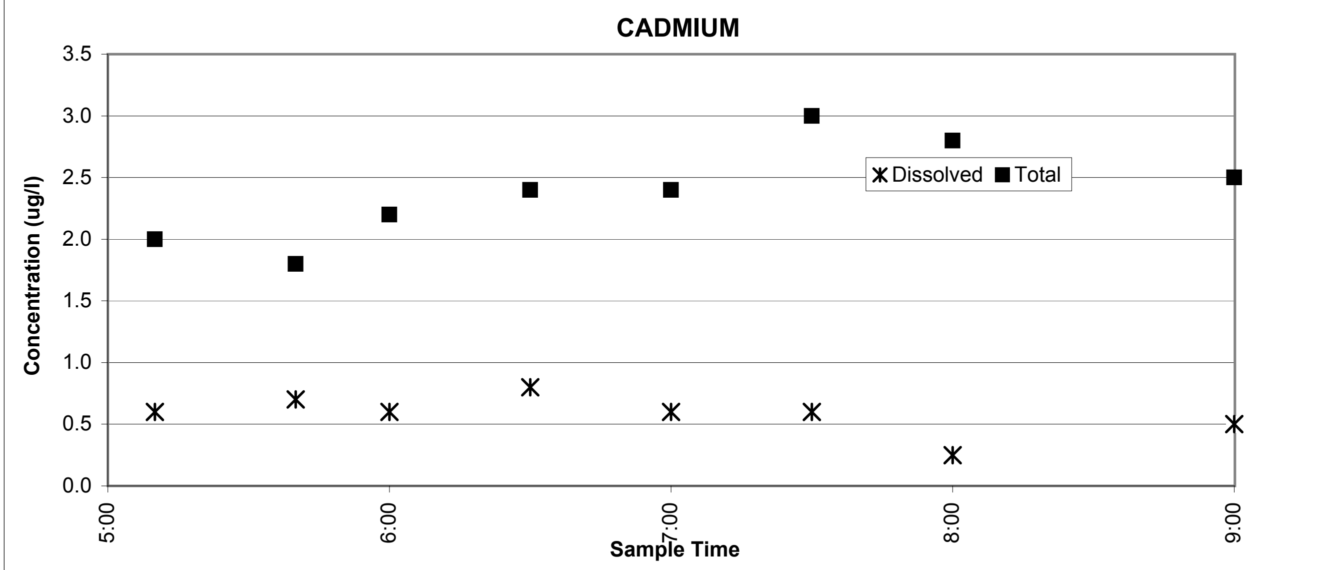


CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
SC
160
140
120
100
80
60
40
20
0
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

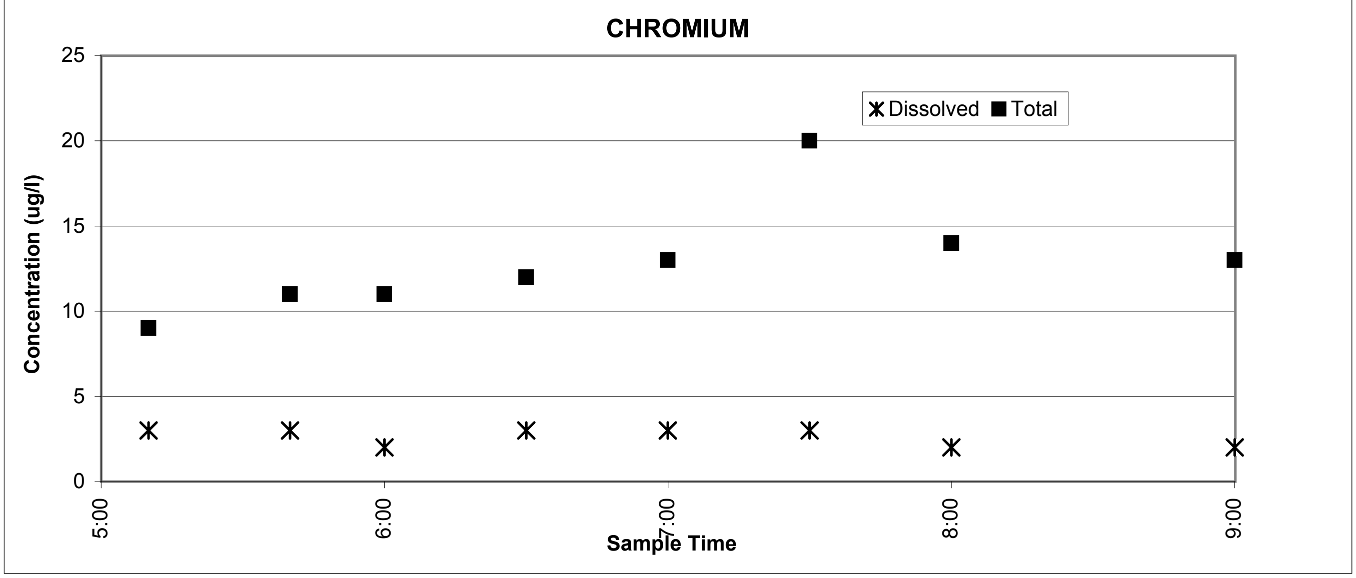
Appendix A-2
Runoff Data from Station No. 14



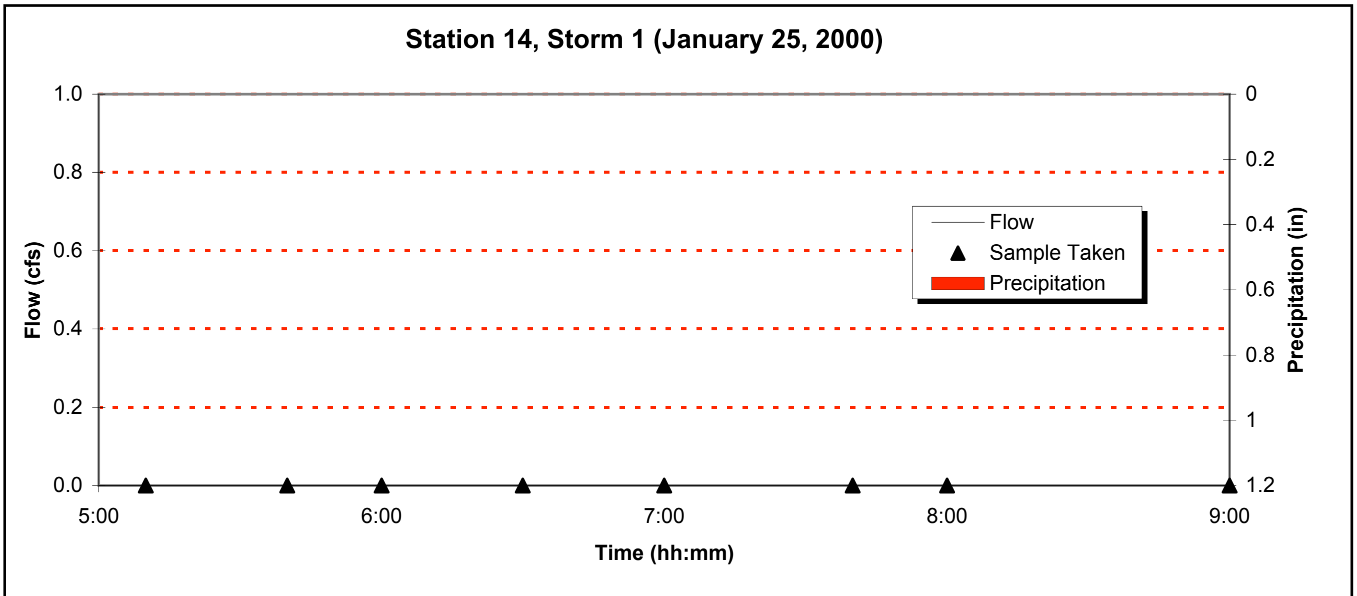
Station 14, Storm 1 (January 25, 2000)
Flow (cfs)
Precipitation (in)
Flow
Sample Taken
Precipitation
Time (hh:mm)
1.0
0.8
0.6
0.4
0.2
0.0
0
0.2
0.4
0.6
0.8
1
1.2
5:00
6:00
7:00
8:00
9:00

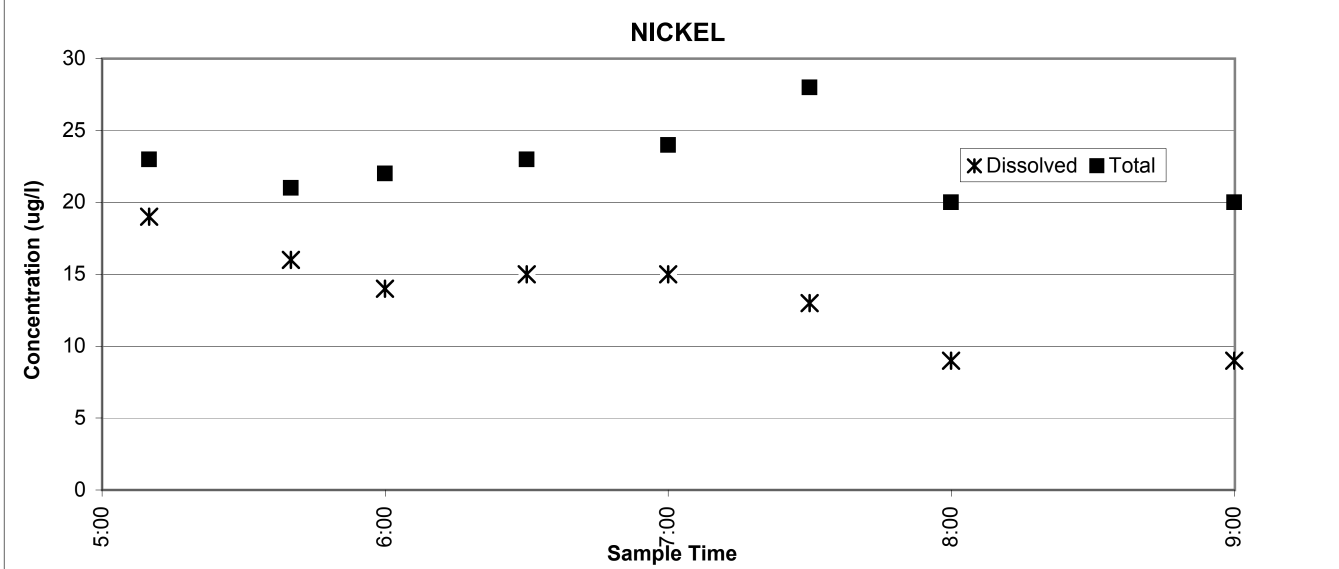


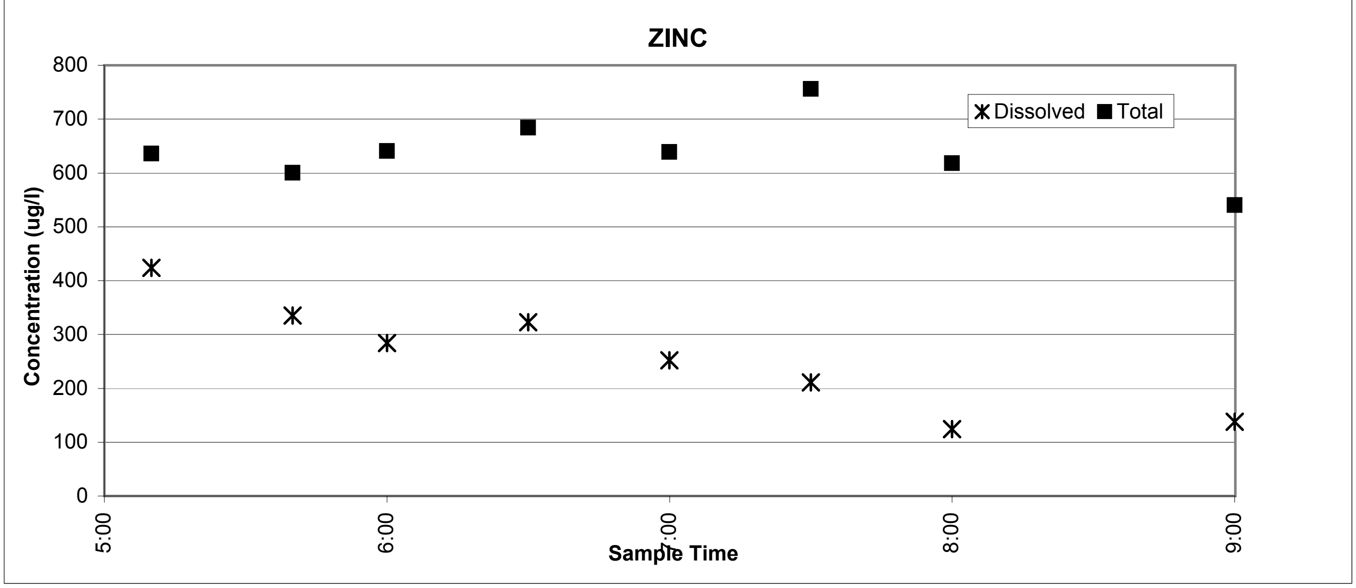
CADMIUM
Concentration (ug/l)
Dissolved
Total
Sample Time
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
5:00
6:00
7:00
8:00
9:00

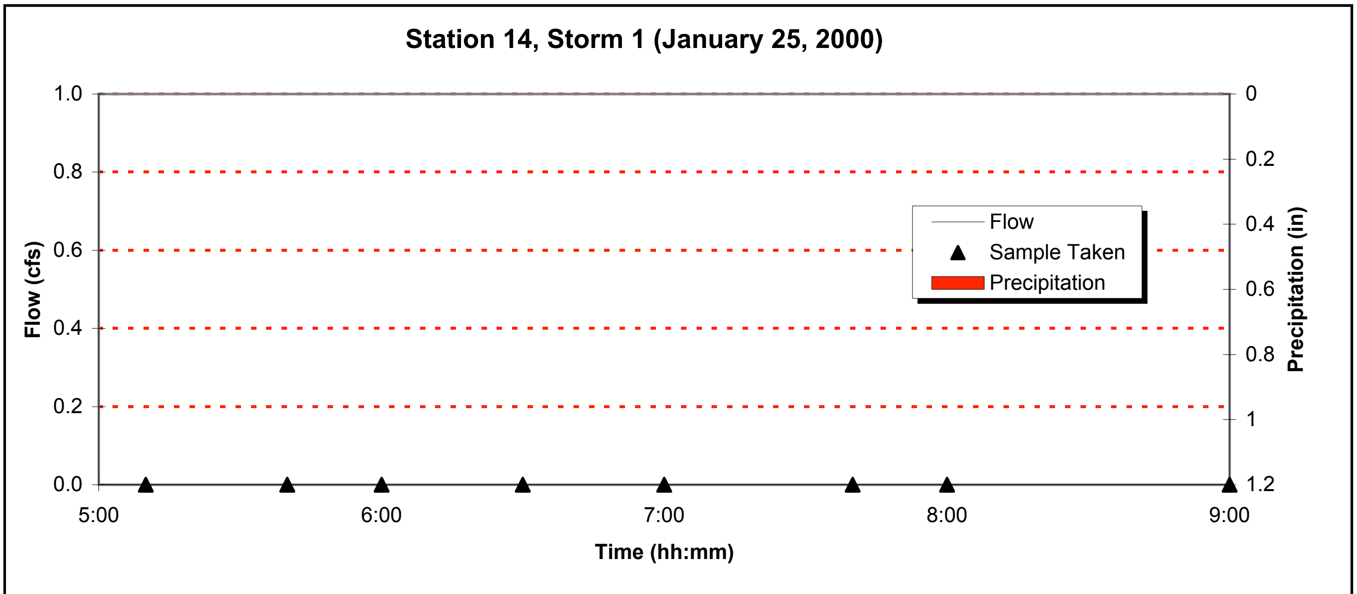


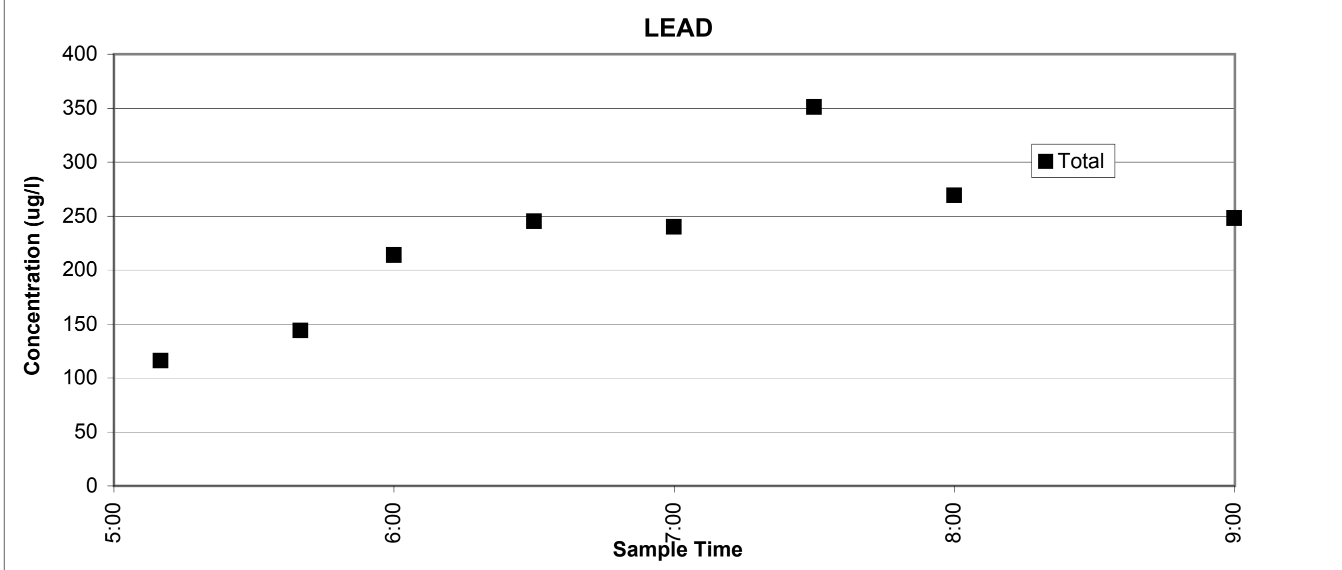
CHROMIUM
Concentration (ug/l)
Dissolved
Total
Sample Time
25
20
15
10
5
0
5:00
6:00
7:00
8:00
9:00

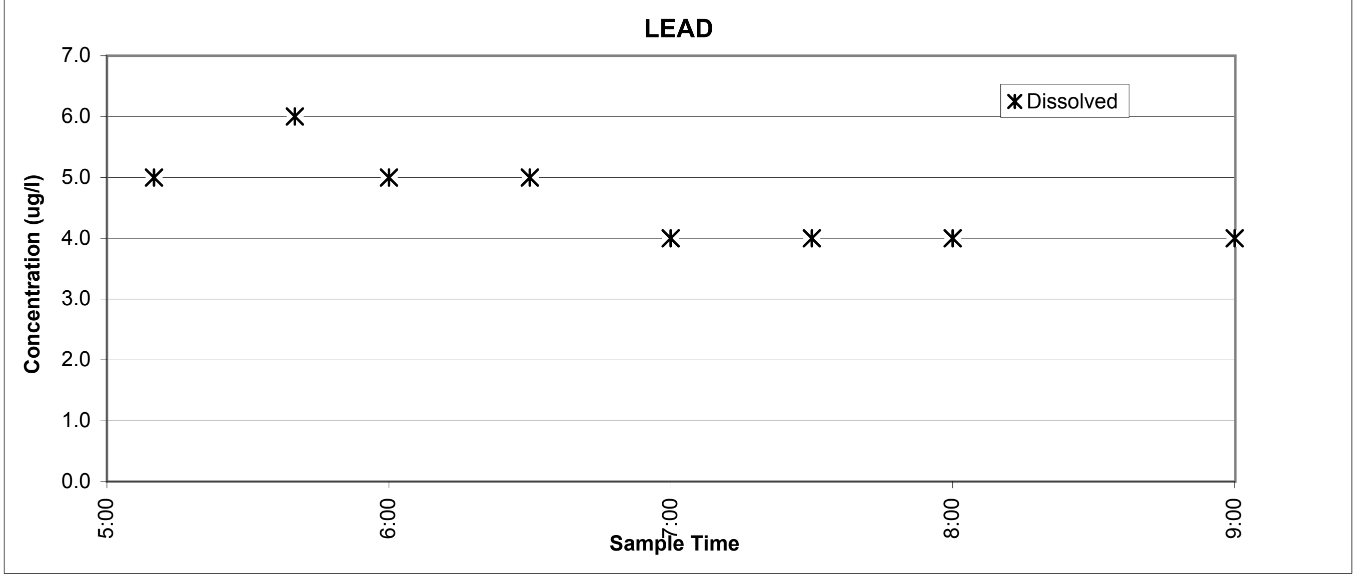

Station 14, Storm 1 (January 25, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.0
0.8
0.6
0.4
0.2
0.0
0
0.2
0.4
0.6
0.8
1
1.2
5:00
6:00
7:00
8:00
9:00

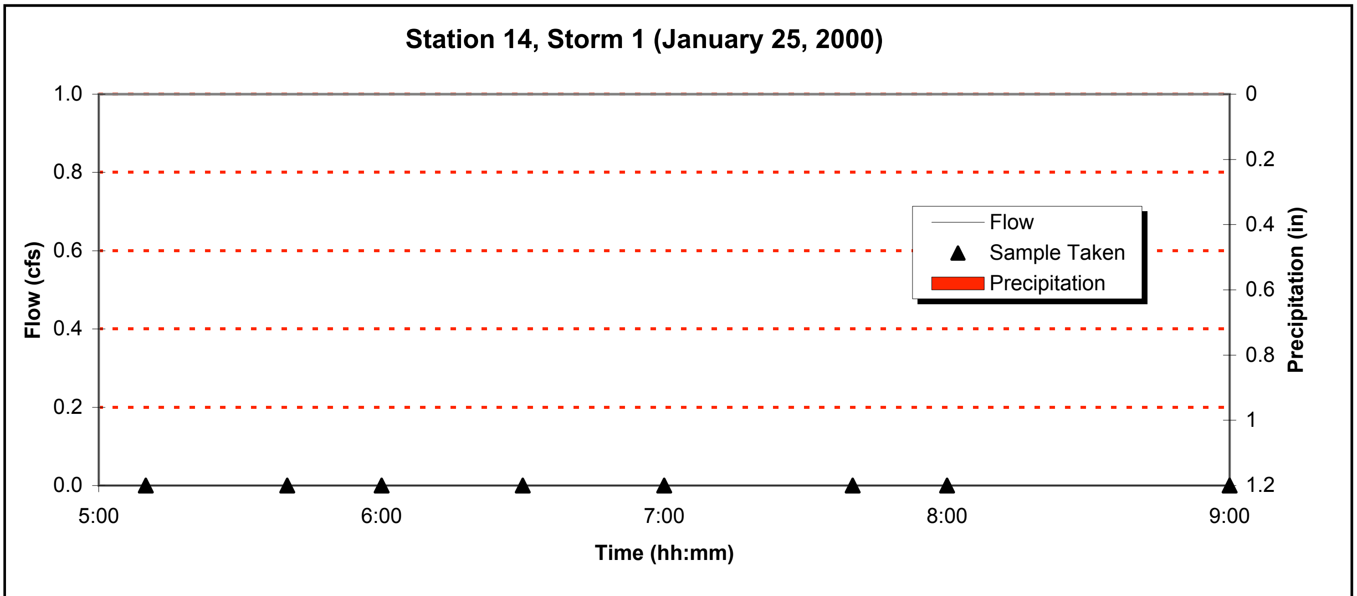

NICKEL
Concentration (ug/l)
Sample Time
Dissolved
Total
30
25
20
15
10
5
0
5:00
6:00
7:00
8:00
9:00

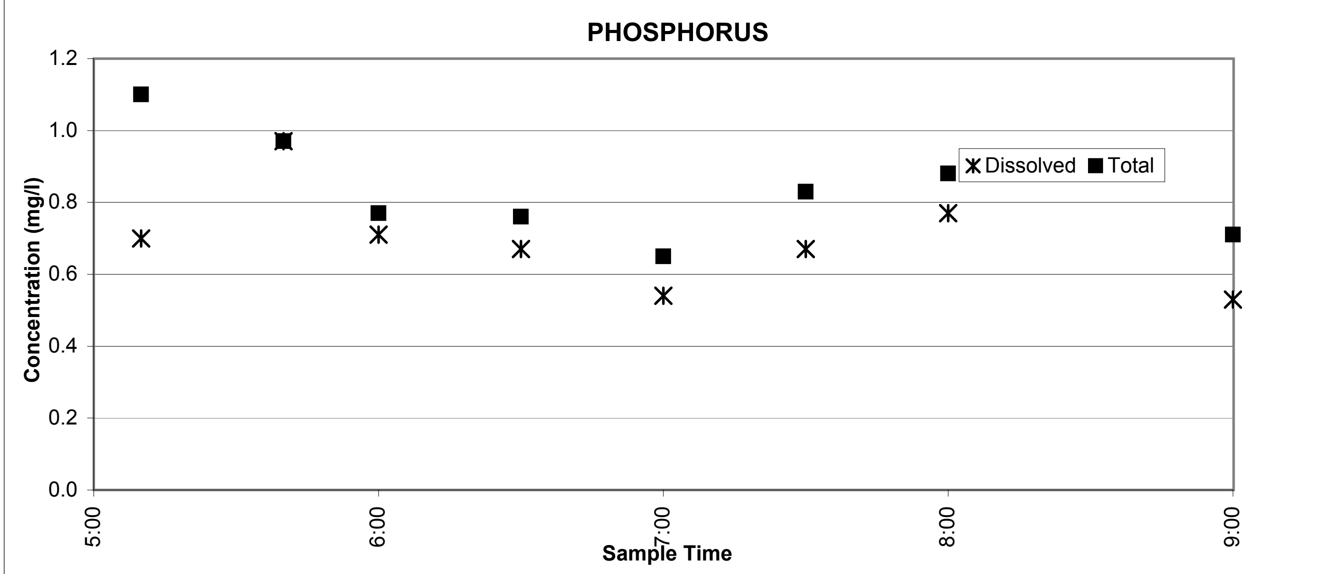

ZINC
Concentration (ug/l)
Sample Time
Dissolved
Total
800
700
600
500
400
300
200
100
0
5:00
6:00
7:00
8:00
9:00

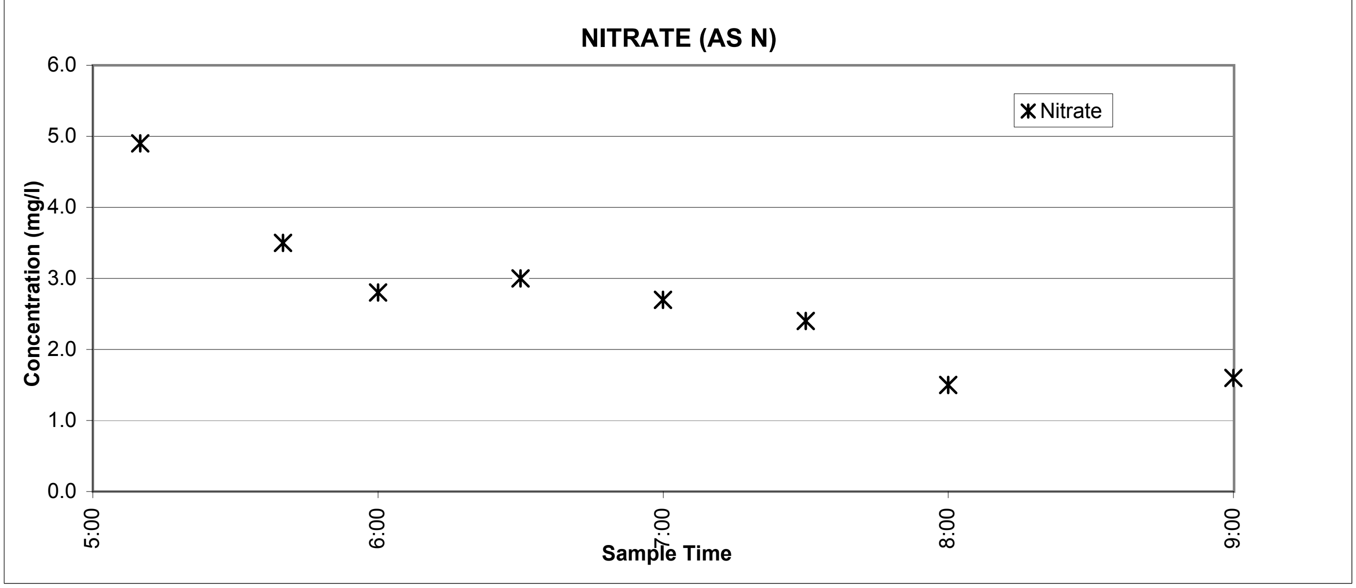

Station 14, Storm 1 (January 25, 2000)
Flow (cfs)
1.0
0.8
0.6
0.4
0.2
0.0
0
0.2
0.4
0.6
0.8
1
1.2
Precipitation (in)
Flow
Sample Taken
Precipitation
5:00
6:00
7:00
8:00
9:00
Time (hh:mm)

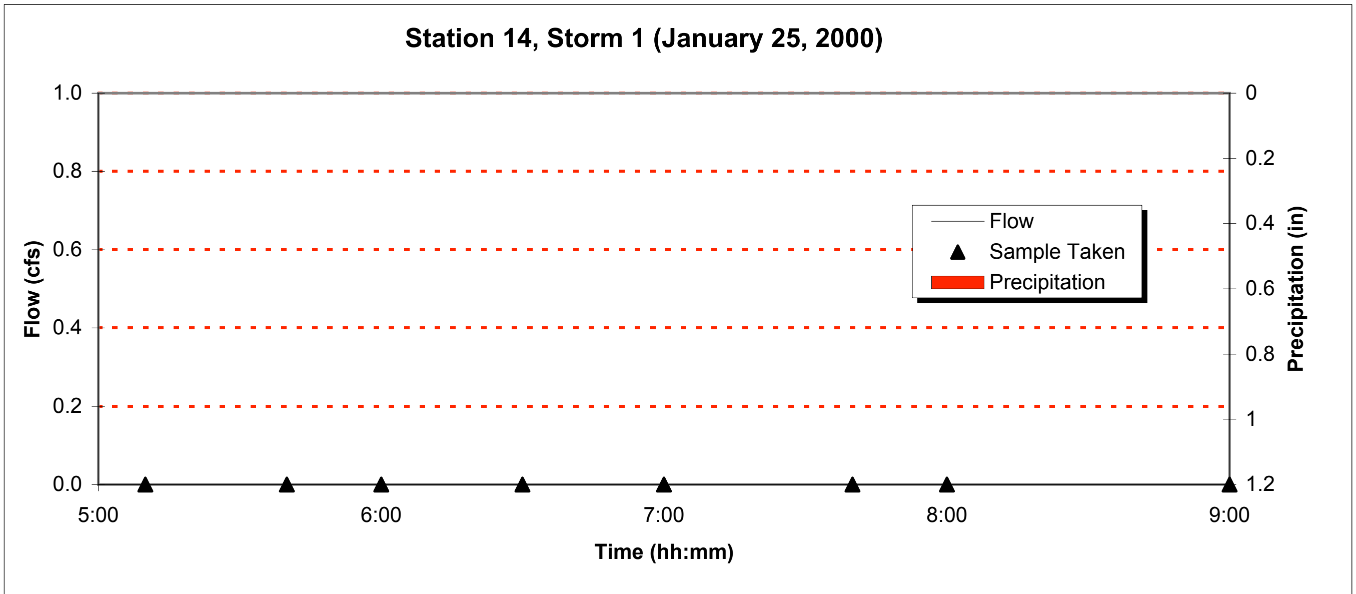

LEAD
Concentration (ug/l)
400
350
300
250
200
150
100
50
0
Total
5:00
6:00
7:00
8:00
9:00
Sample Time

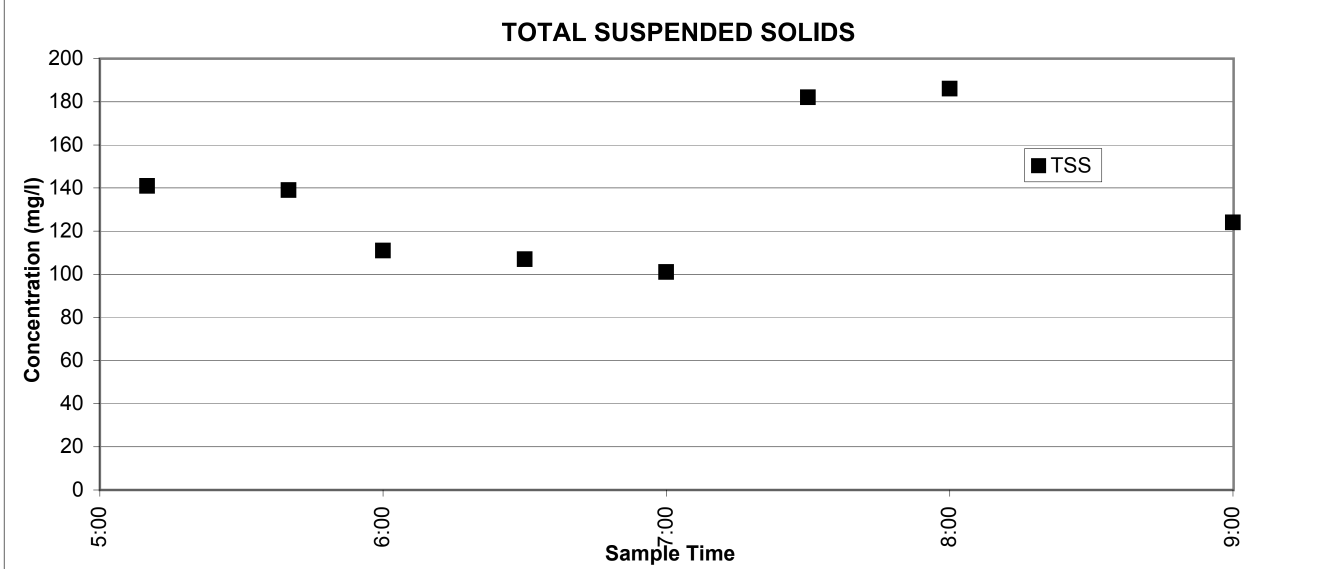

LEAD
Concentration (ug/l)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dissolved
5:00
6:00
7:00
8:00
9:00
Sample Time

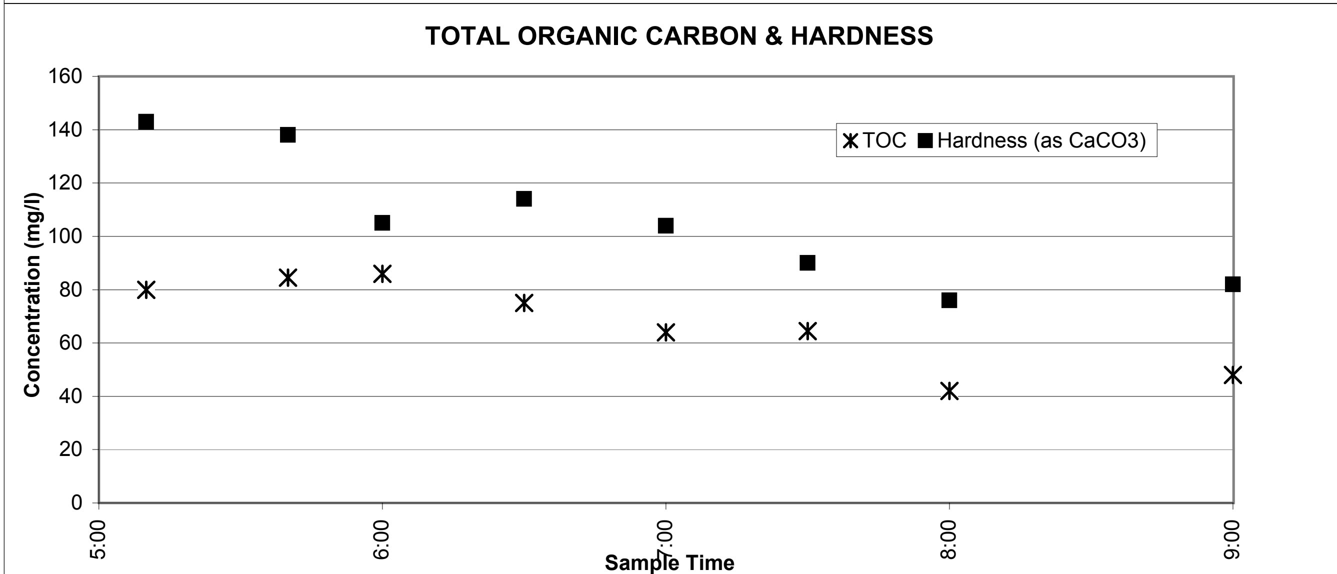

Station 14, Storm 1 (January 25, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.0
0.8
0.6
0.4
0.2
0.0
0
0.2
0.4
0.6
0.8
1
1.2
5:00
6:00
7:00
8:00
9:00

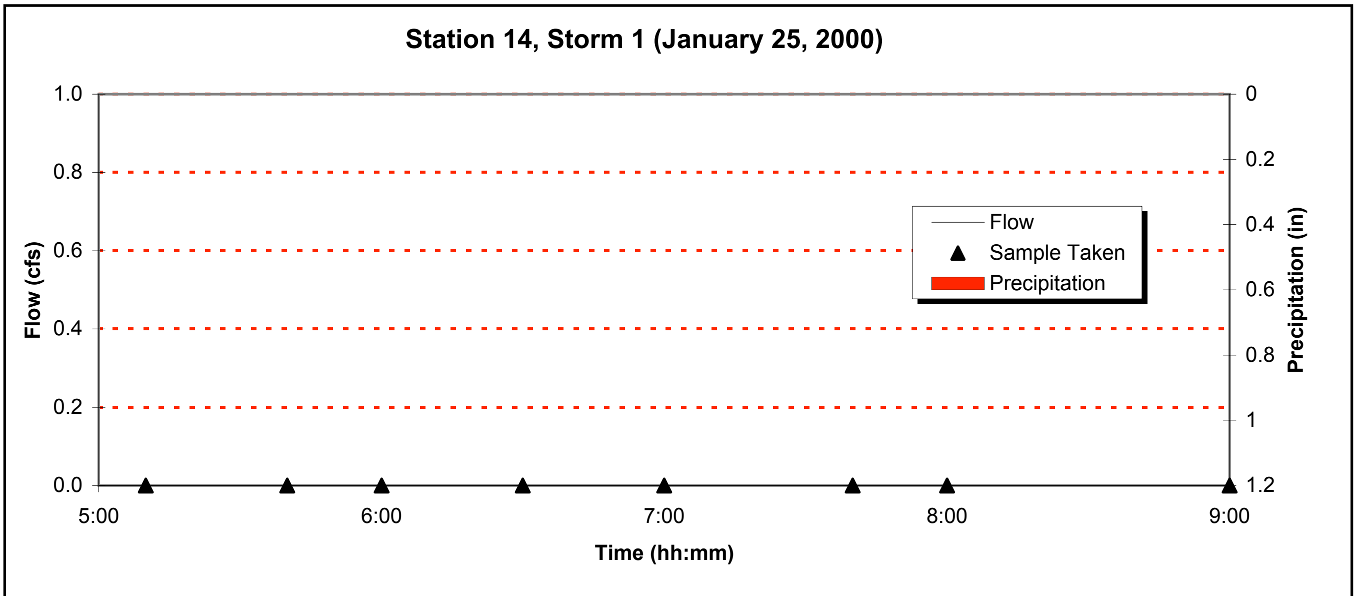

PHOSPHORUS
Concentration (mg/l)
Sample Time
Dissolved
Total
1.2
1.0
0.8
0.6
0.4
0.2
0.0
5:00
6:00
7:00
8:00
9:00

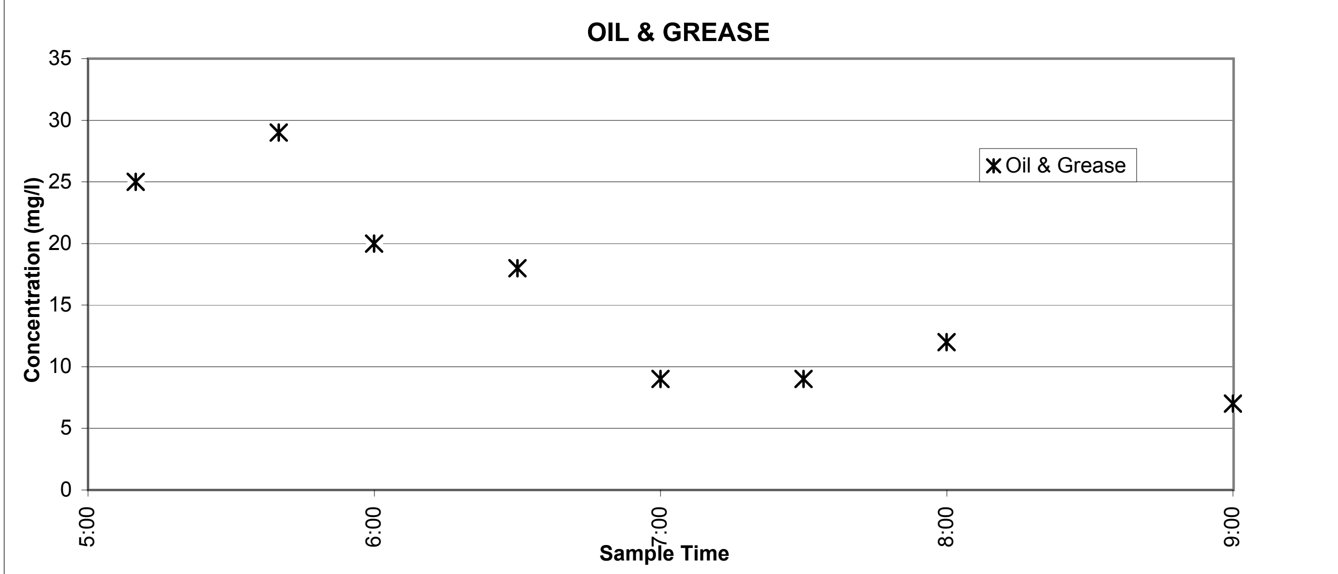

NITRATE (AS N)
Concentration (mg/l)
Sample Time
Nitrate
6.0
5.0
4.0
3.0
2.0
1.0
0.0
5:00
6:00
7:00
8:00
9:00

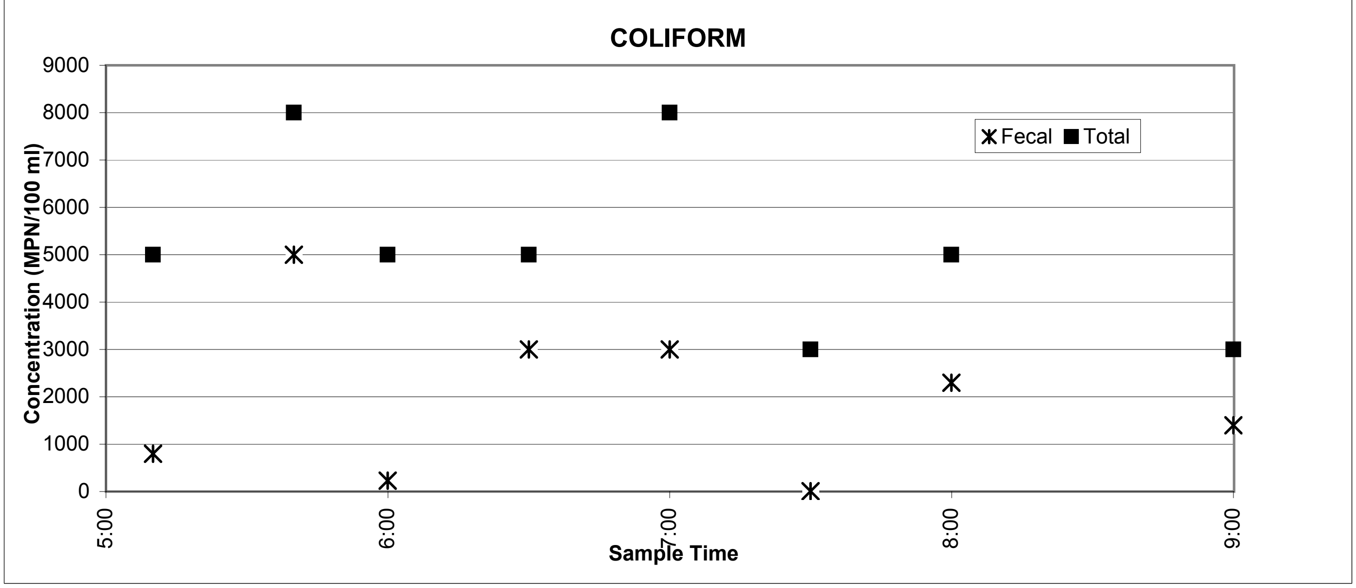

Station 14, Storm 1 (January 25, 2000)
Flow (cfs)
Precipitation (in)
Flow
Sample Taken
Precipitation
Time (hh:mm)
5:00
6:00
7:00
8:00
9:00

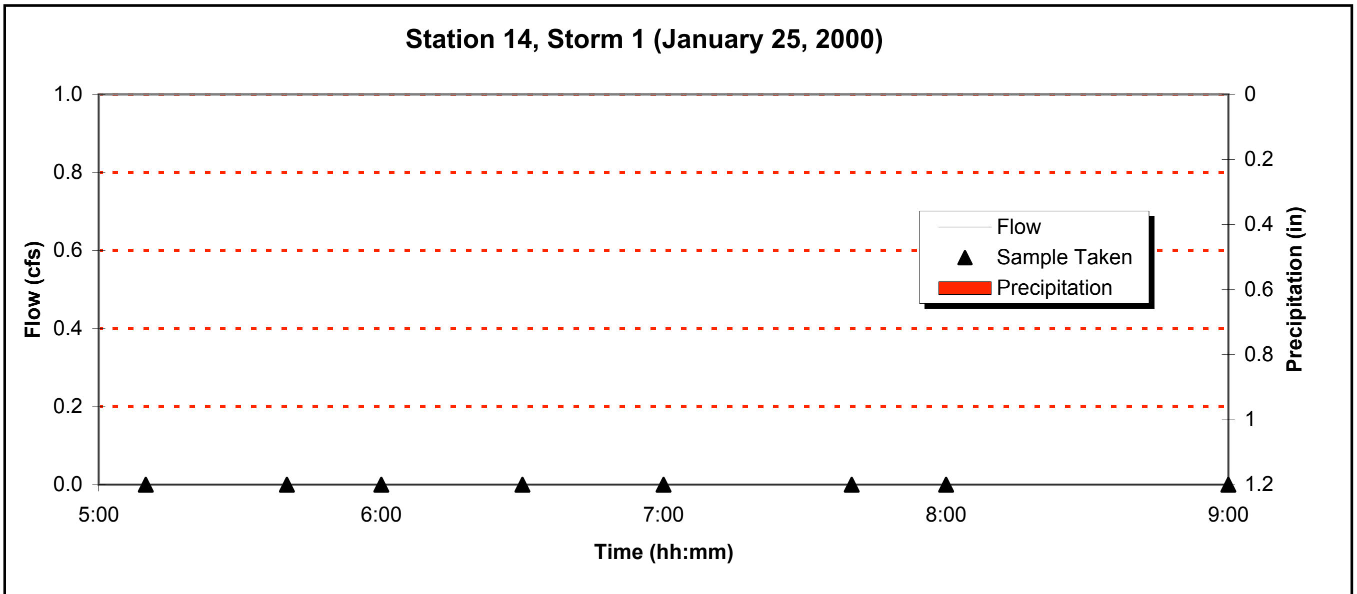

TOTAL SUSPENDED SOLIDS
Concentration (mg/l)
TSS
Sample Time

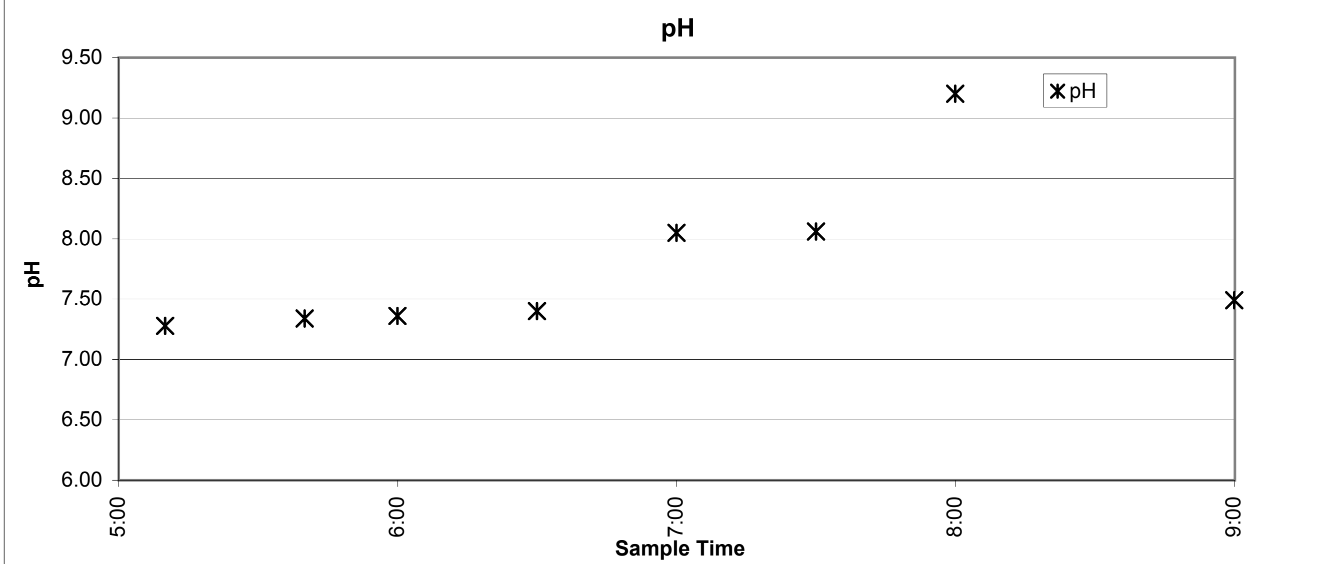

TOTAL ORGANIC CARBON & HARDNESS
Concentration (mg/l)
TOC
Hardness (as CaCO3)
Sample Time

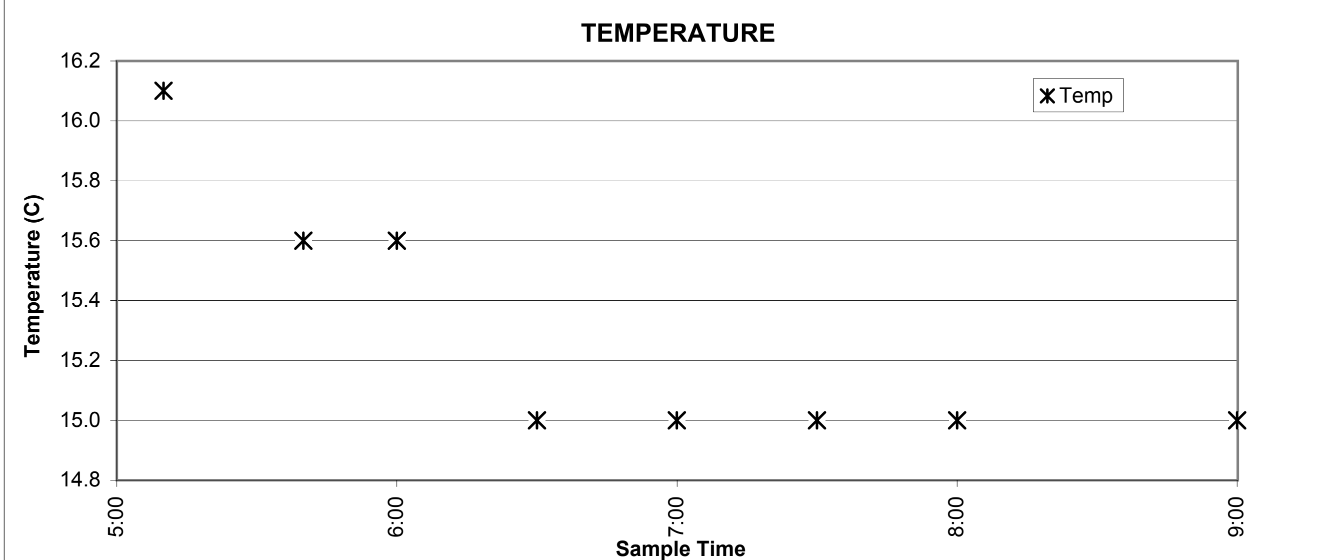

Station 14, Storm 1 (January 25, 2000)
Flow (cfs)
1.0
0.8
0.6
0.4
0.2
0.0
Precipitation (in)
0
0.2
0.4
0.6
0.8
1
1.2
Flow
Sample Taken
Precipitation
5:00
6:00
7:00
8:00
9:00
Time (hh:mm)

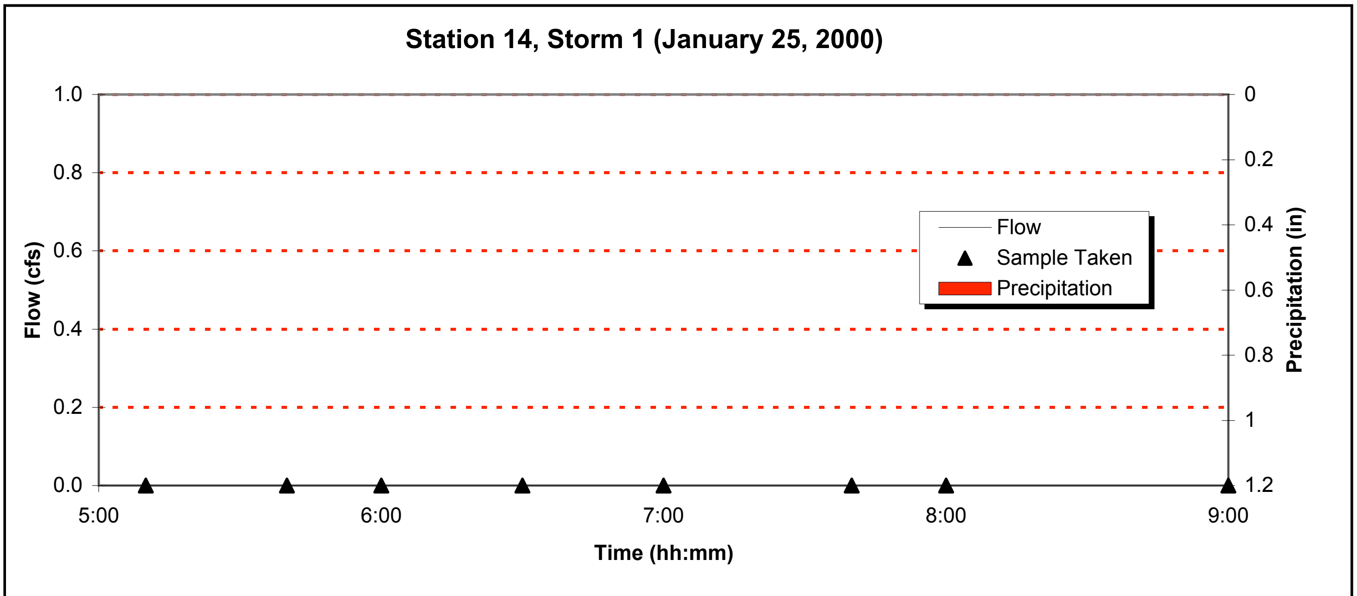

OIL & GREASE
Concentration (mg/l)
35
30
25
20
15
10
5
0
Oil & Grease
5:00
6:00
7:00
8:00
9:00
Sample Time

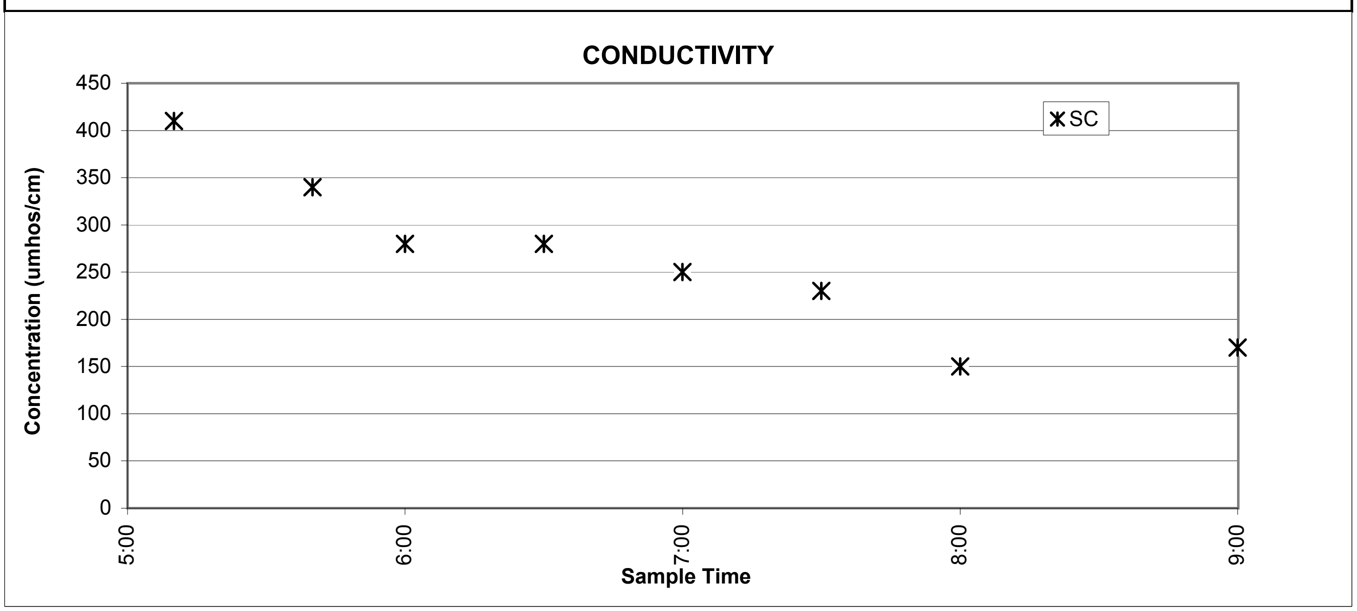

COLIFORM
Concentration (MPN/100 ml)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Fecal
Total
5:00
6:00
7:00
8:00
9:00
Sample Time

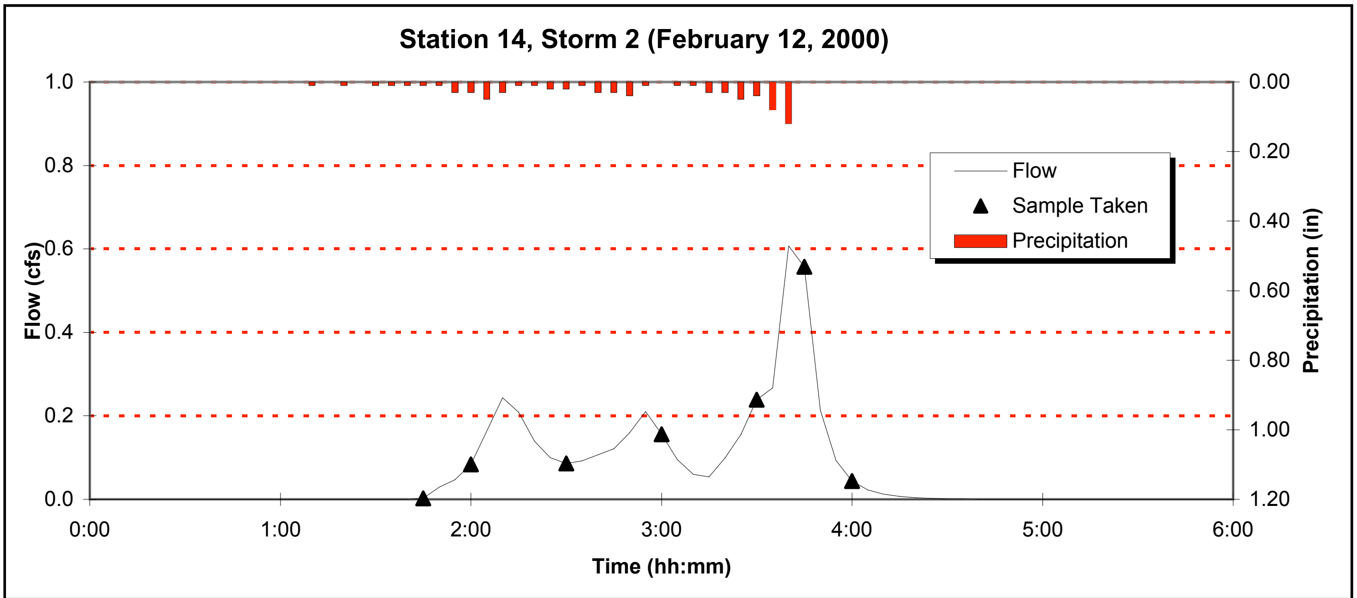

Station 14, Storm 1 (January 25, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.0
0.8
0.6
0.4
0.2
0.0
0
0.2
0.4
0.6
0.8
1
1.2
5:00
6:00
7:00
8:00
9:00

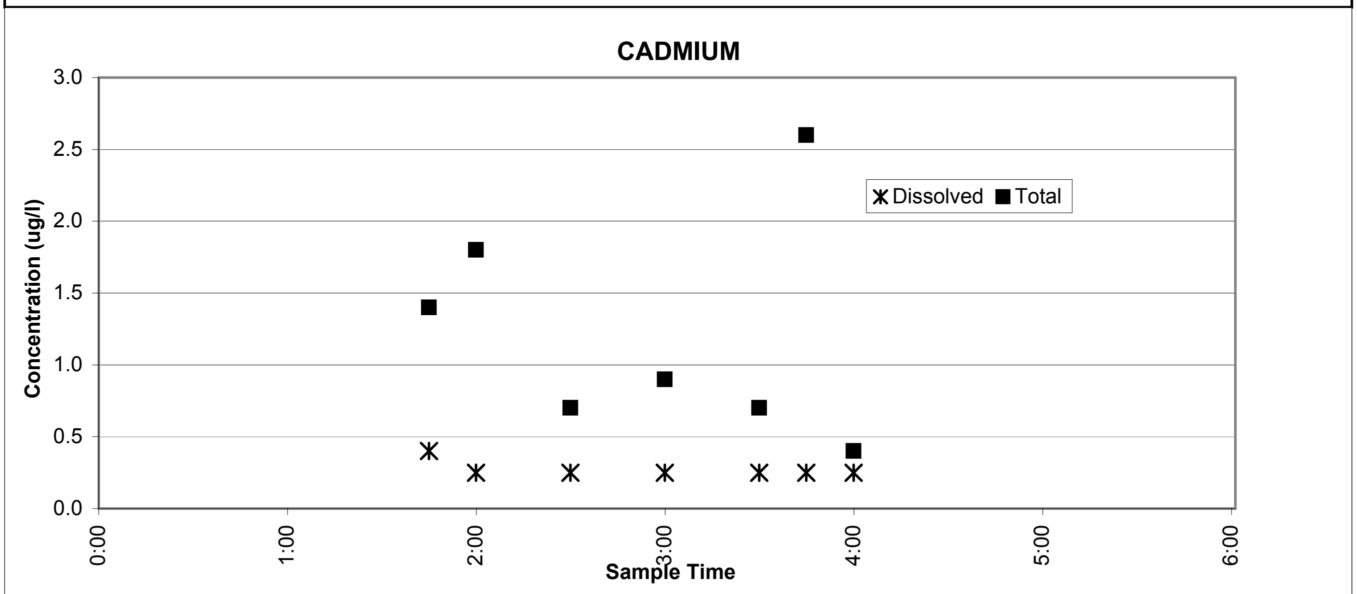

pH
pH
Sample Time
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5:00
6:00
7:00
8:00
9:00

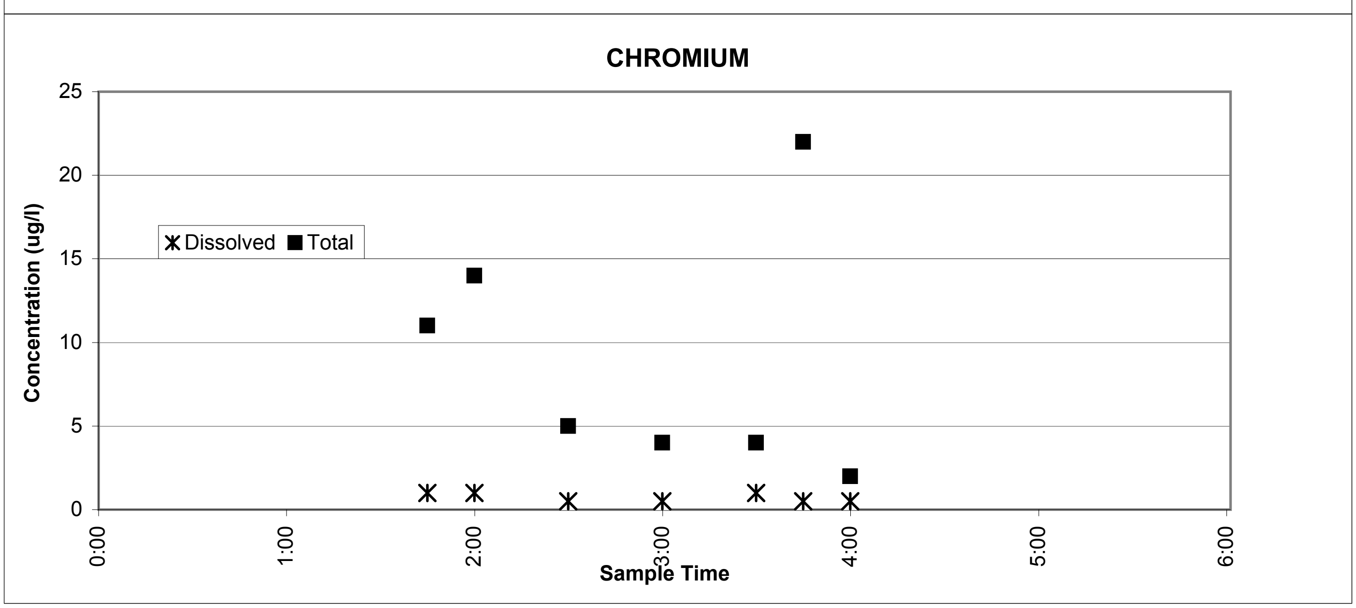

TEMPERATURE
Temp
Temperature (C)
Sample Time
16.2
16.0
15.8
15.6
15.4
15.2
15.0
14.8
5:00
6:00
7:00
8:00
9:00

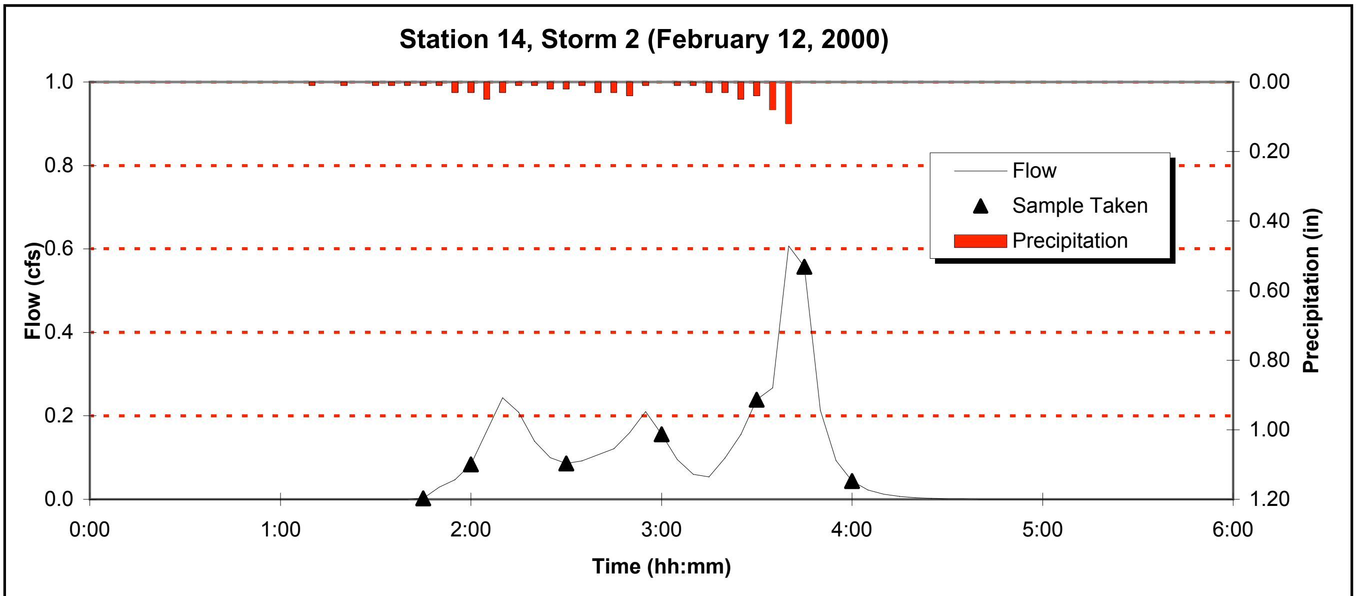

Station 14, Storm 1 (January 25, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.0
0.8
0.6
0.4
0.2
0.0
0
0.2
0.4
0.6
0.8
1
1.2
5:00
6:00
7:00
8:00
9:00

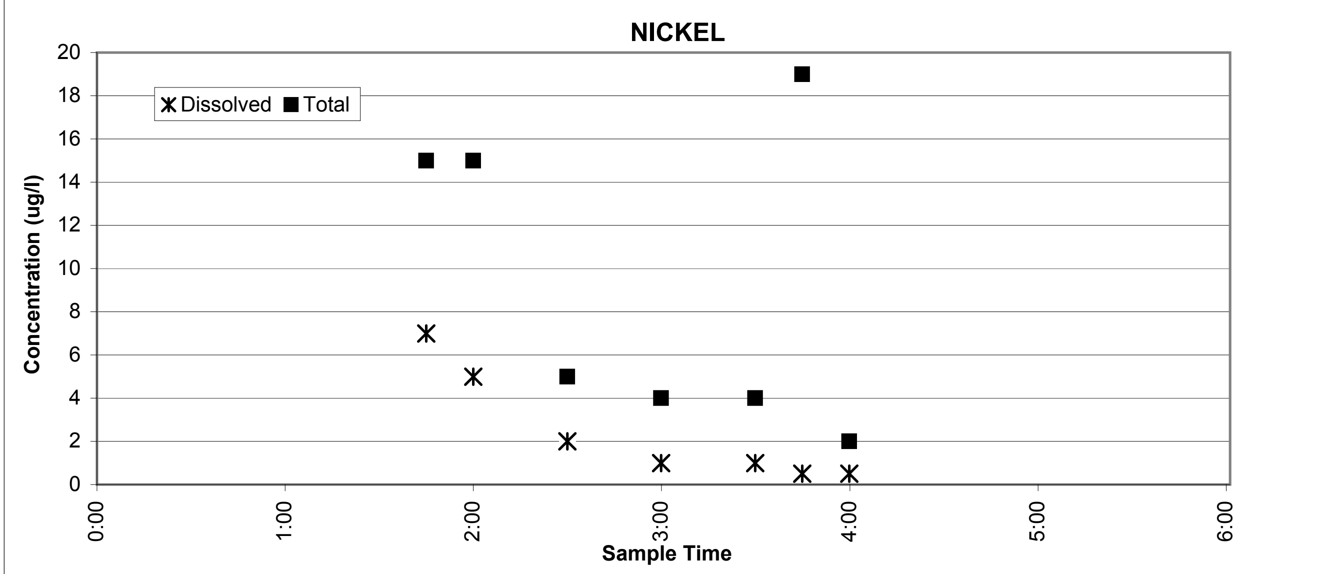

CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
SC
450
400
350
300
250
200
150
100
50
0
5:00
6:00
7:00
8:00
9:00

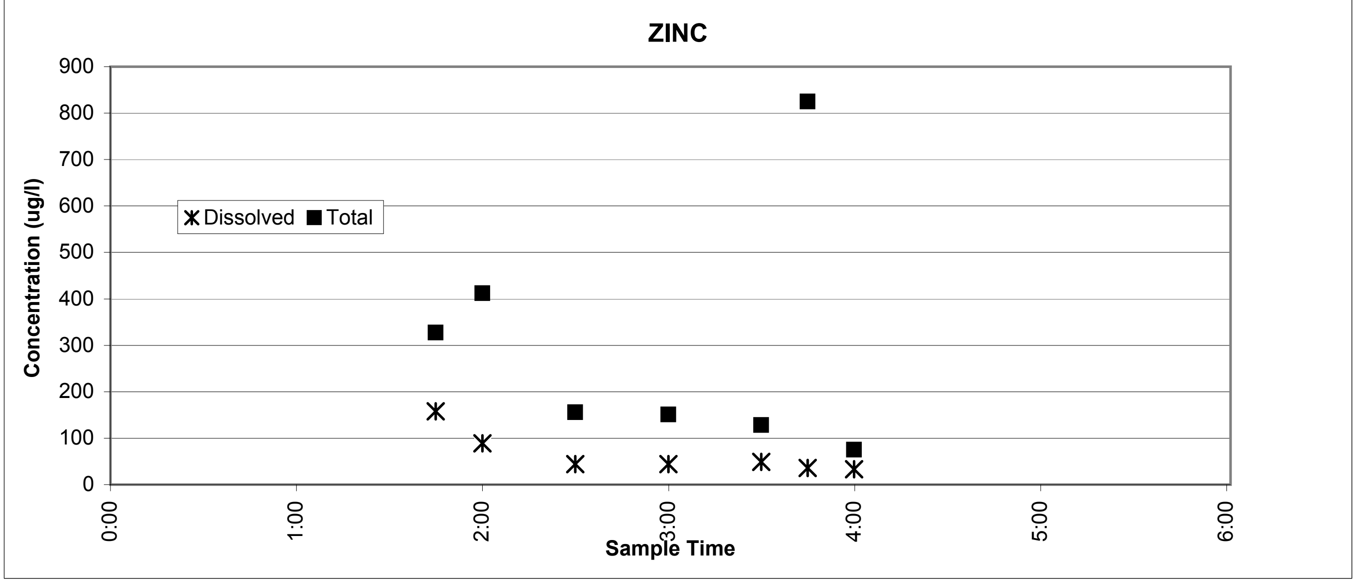

Station 14, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
0.0
0.2
0.4
0.6
0.8
1.0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
0:00
1:00
2:00
3:00
4:00
5:00
6:00

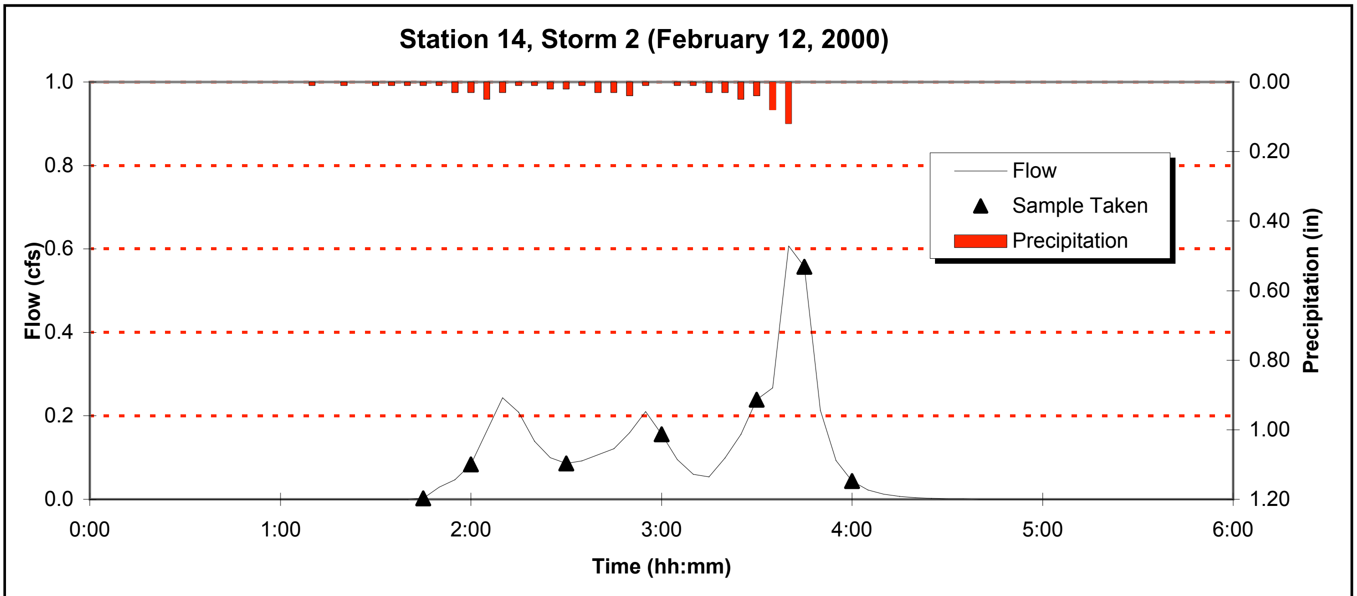

CADMIUM
Concentration (ug/l)
Sample Time
Dissolved
Total
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

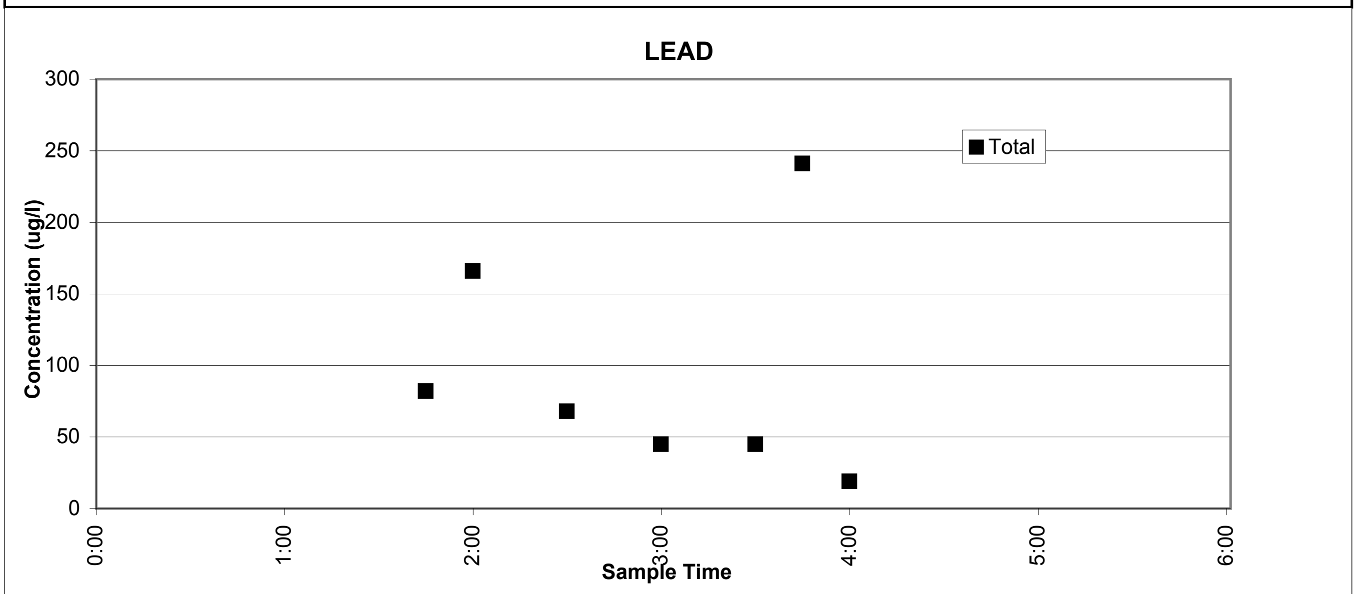

CHROMIUM
Concentration (ug/l)
Sample Time
Dissolved
Total
0
5
10
15
20
25
0:00
1:00
2:00
3:00
4:00
5:00
6:00

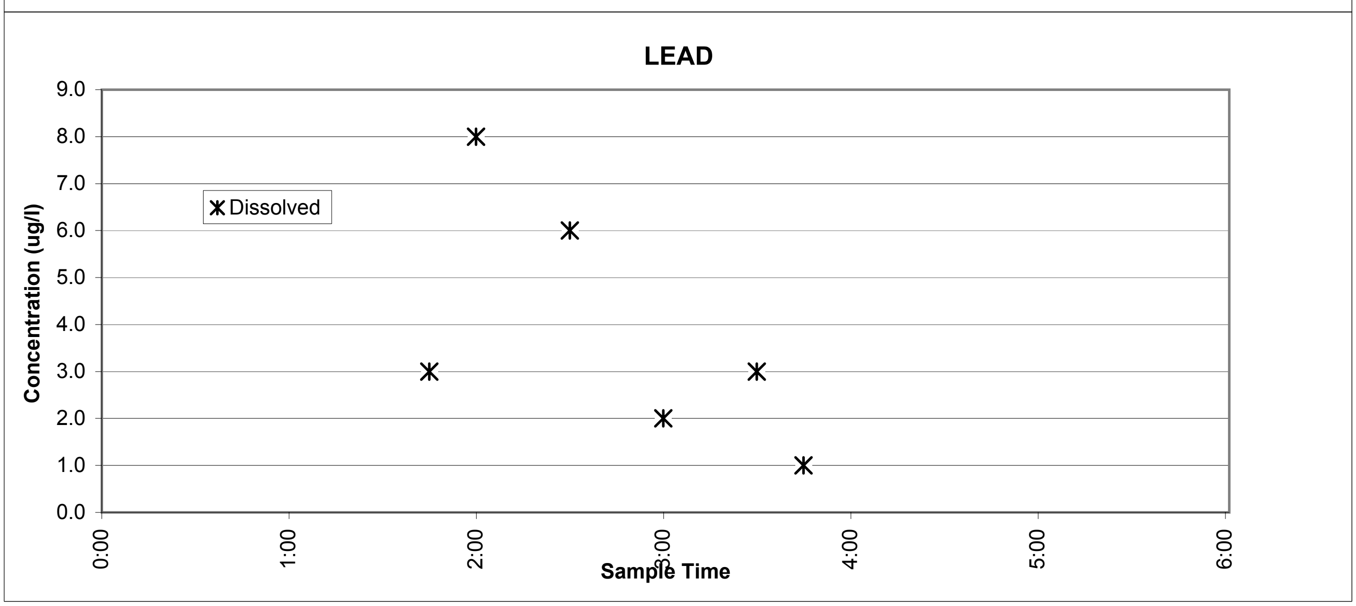

Station 14, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
0:00
1:00
2:00
3:00
4:00
5:00
6:00

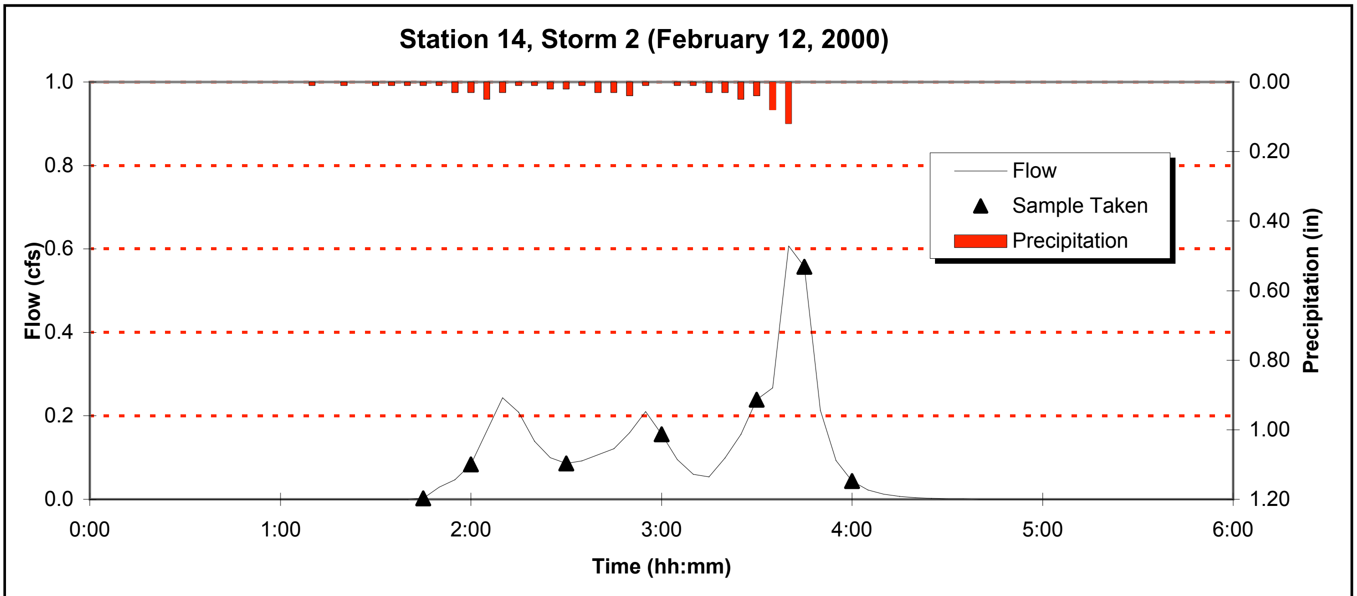

NICKEL
Concentration (ug/l)
Sample Time
Dissolved
Total
20
18
16
14
12
10
8
6
4
2
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00


ZINC
Concentration (ug/l)
Sample Time
Dissolved
Total
900
800
700
600
500
400
300
200
100
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

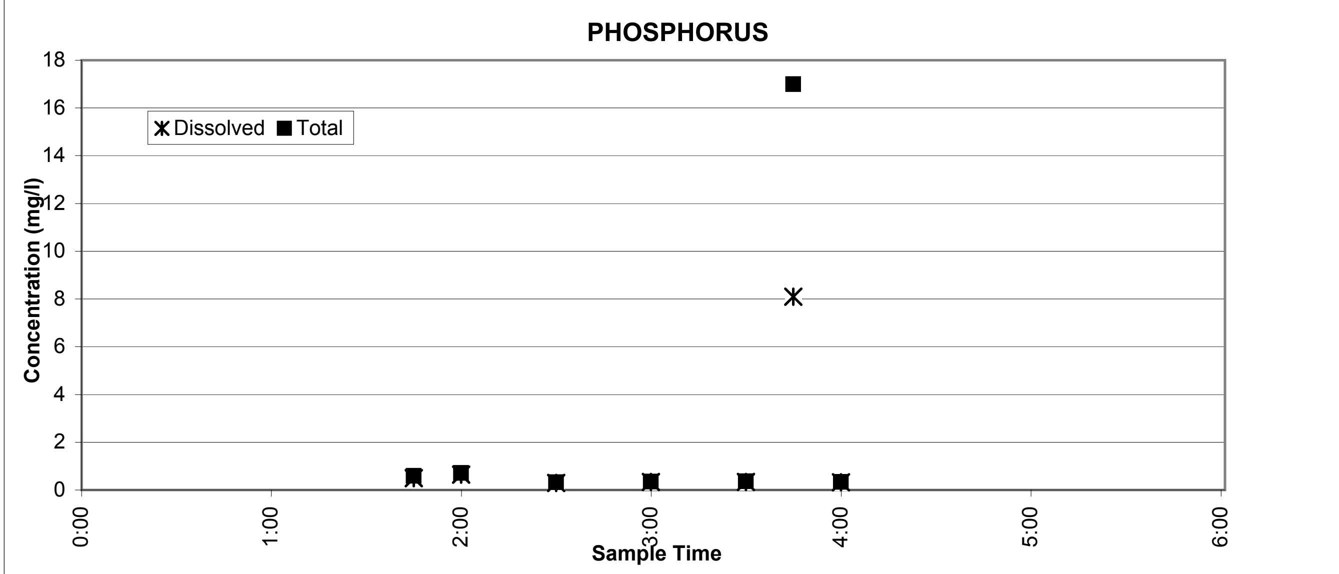

Station 14, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
0:00
1:00
2:00
3:00
4:00
5:00
6:00


LEAD
Concentration (ug/l)
Sample Time
Total
300
250
200
150
100
50
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

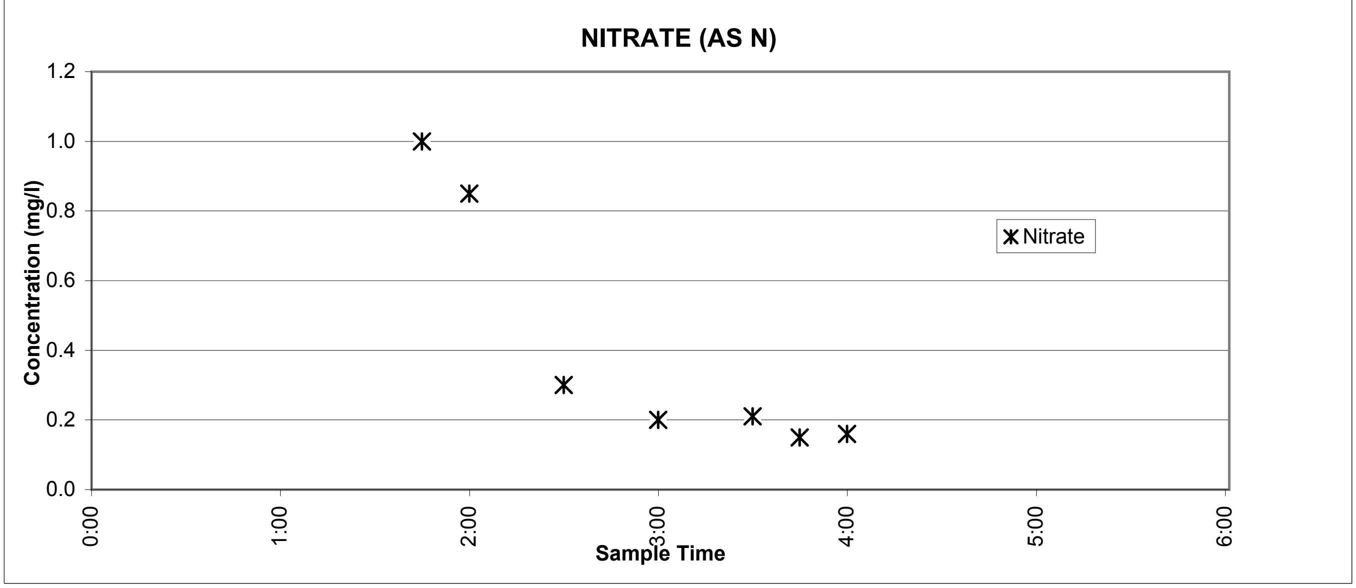

LEAD
Concentration (ug/l)
Sample Time
Dissolved
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0:00
1:00
2:00
3:00
4:00
5:00
6:00



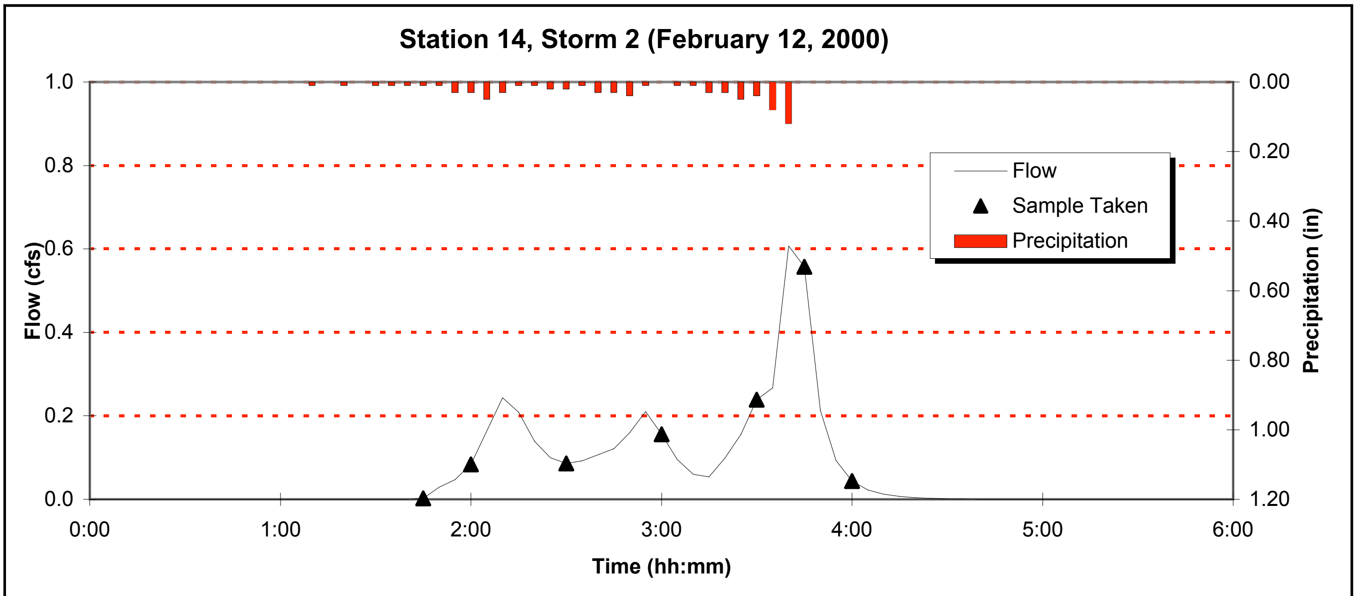
Station 14, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation



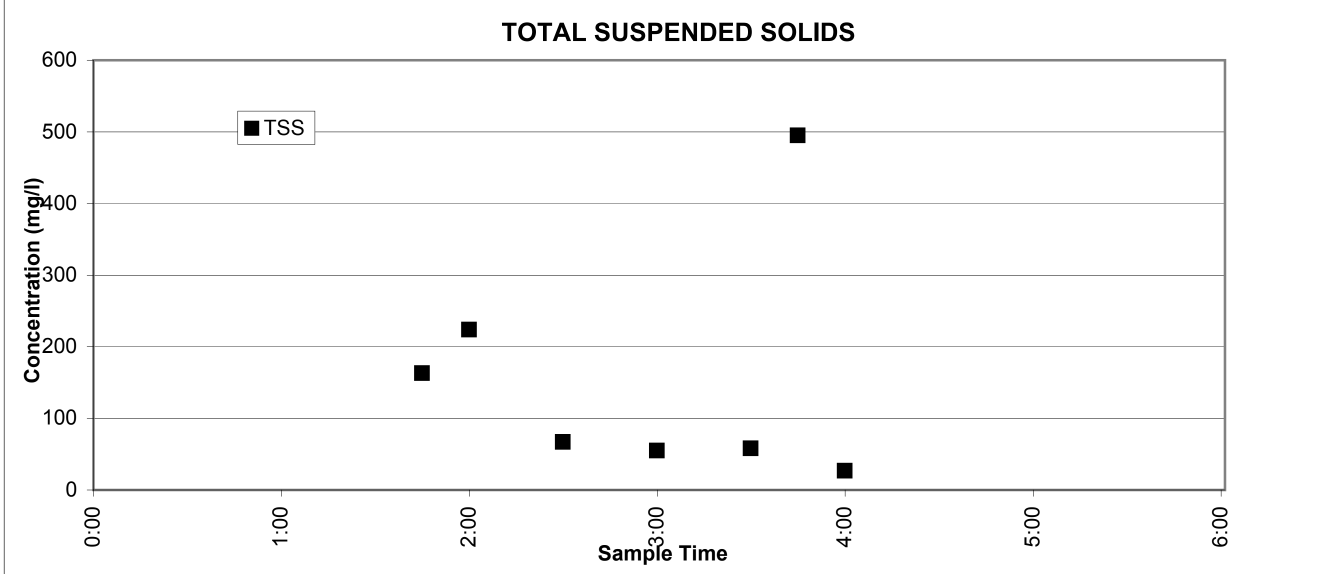
PHOSPHORUS
Concentration (mg/l)
Sample Time
Dissolved
Total



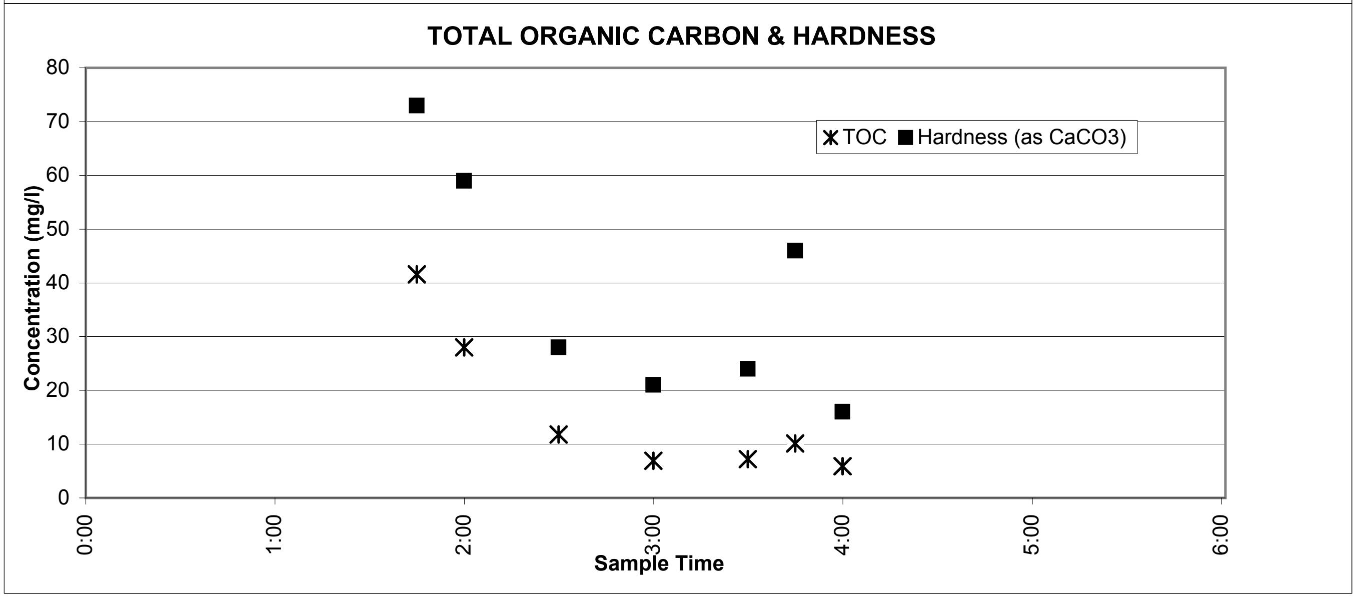
NITRATE (AS N)
Concentration (mg/l)
Sample Time
Nitrate



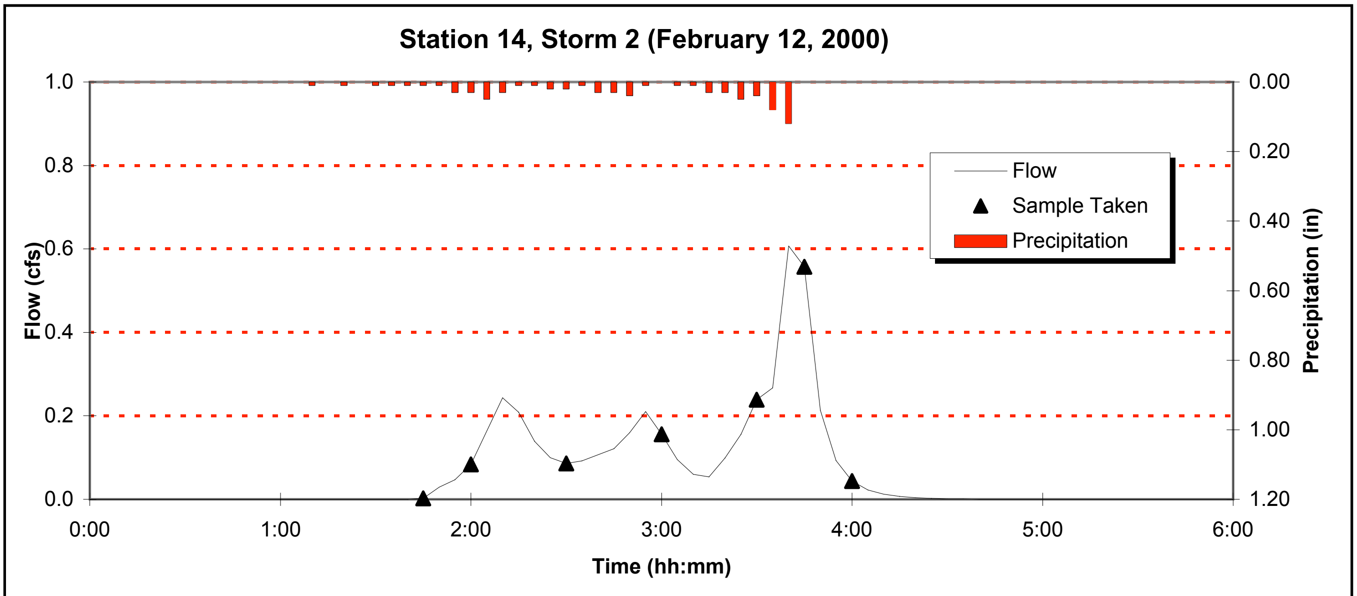
Station 14, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation



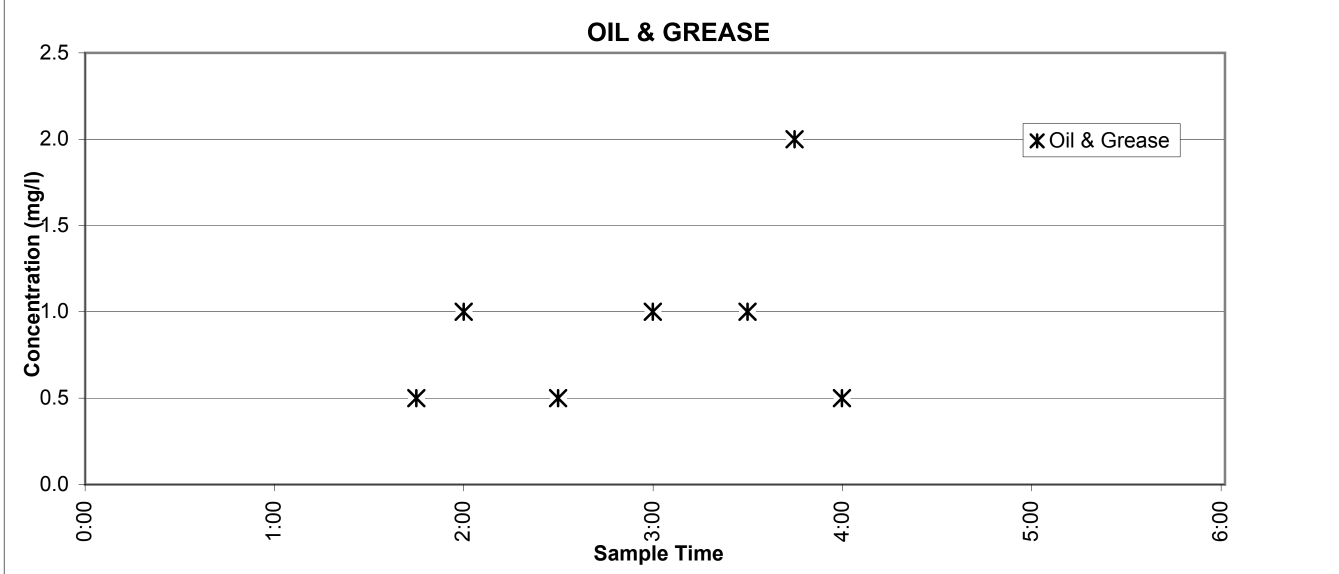
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time



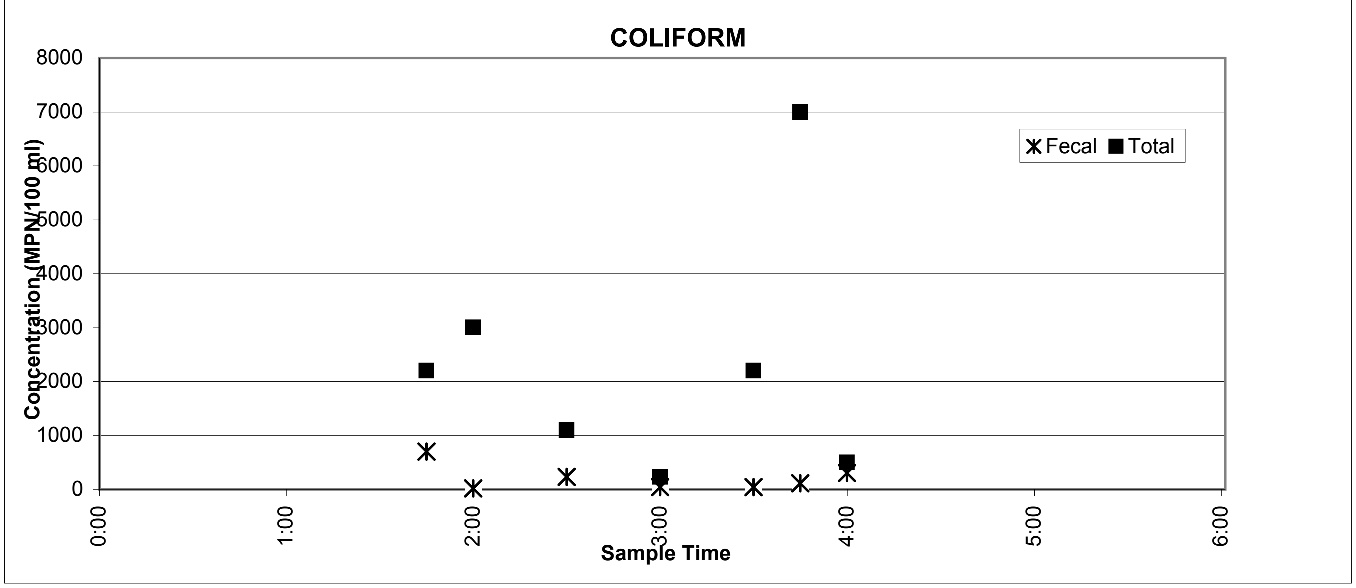
TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time



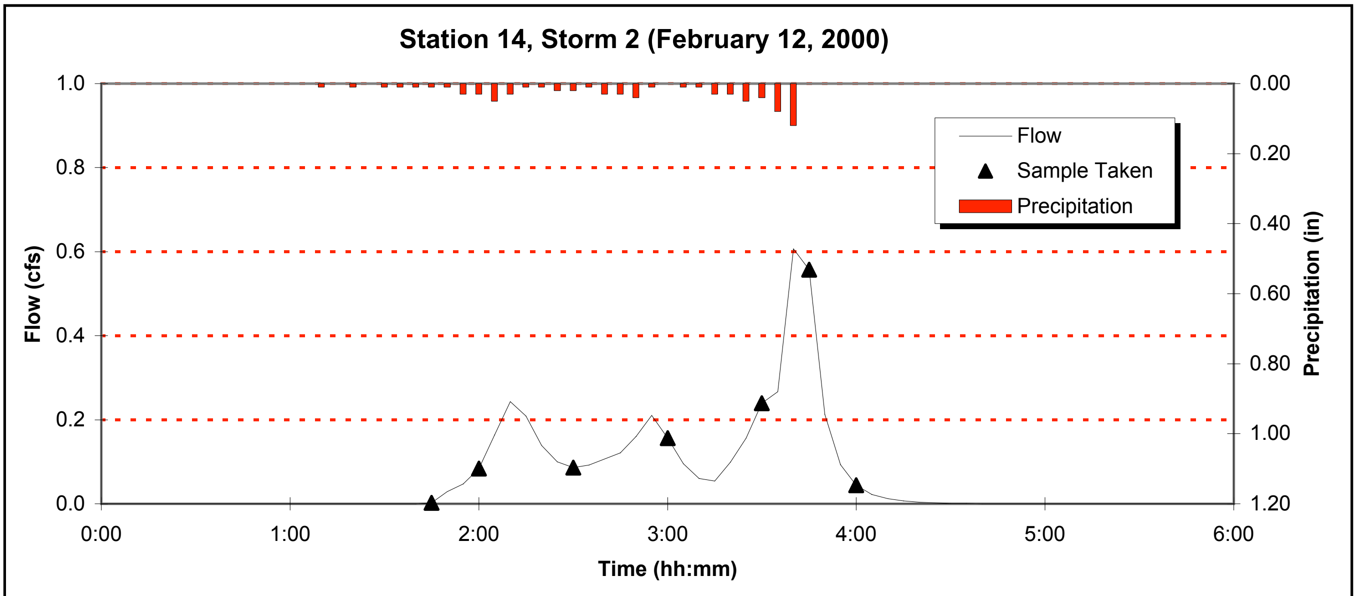
Station 14, Storm 2 (February 12, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
0:00
1:00
2:00
3:00
4:00
5:00
6:00

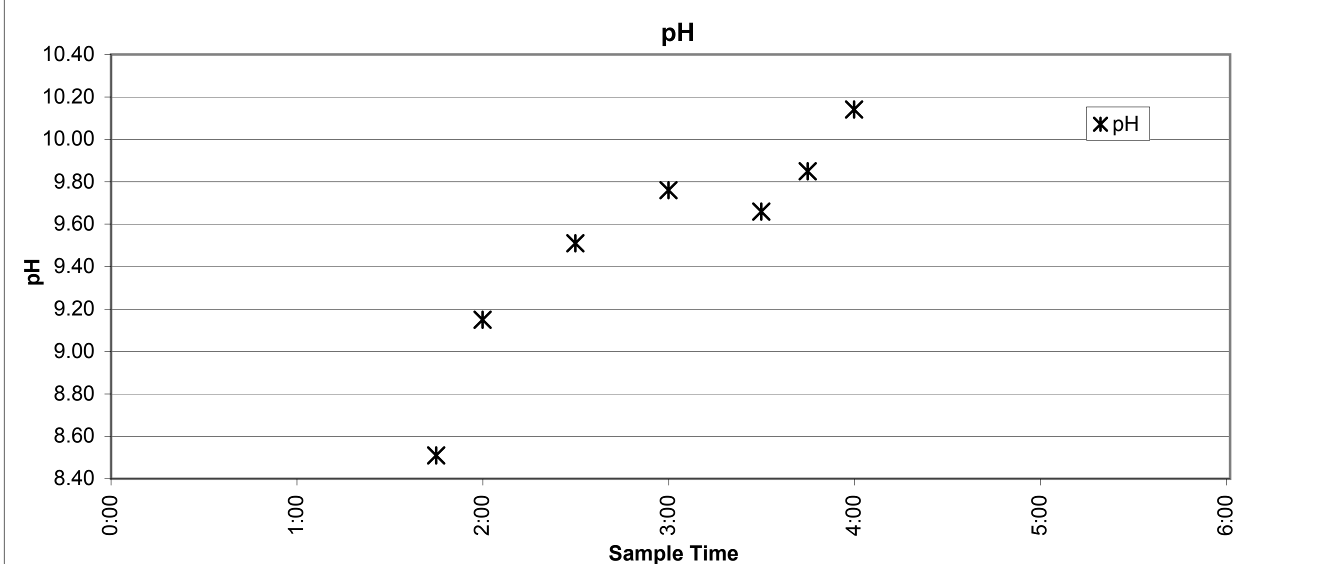


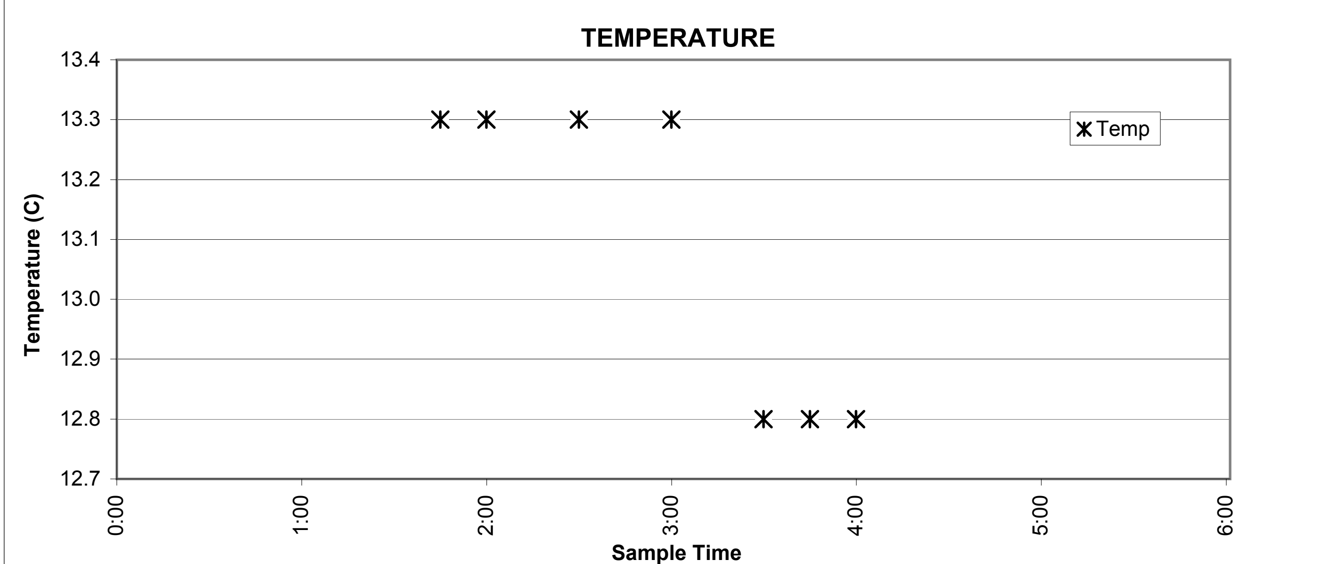
OIL & GREASE
Concentration (mg/l)
Sample Time
Oil & Grease
2.5
2.0
1.5
1.0
0.5
0.0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

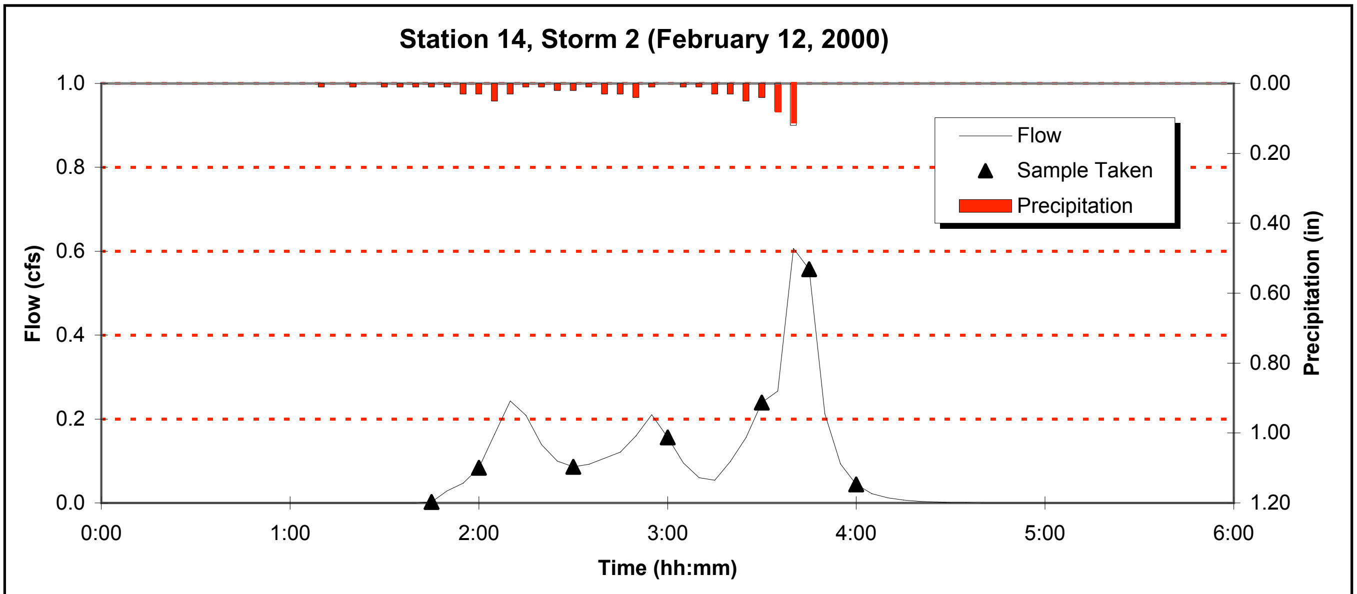


COLIFORM
Concentration (MPN/100 ml)
Sample Time
Fecal
Total
8000
7000
6000
5000
4000
3000
2000
1000
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00

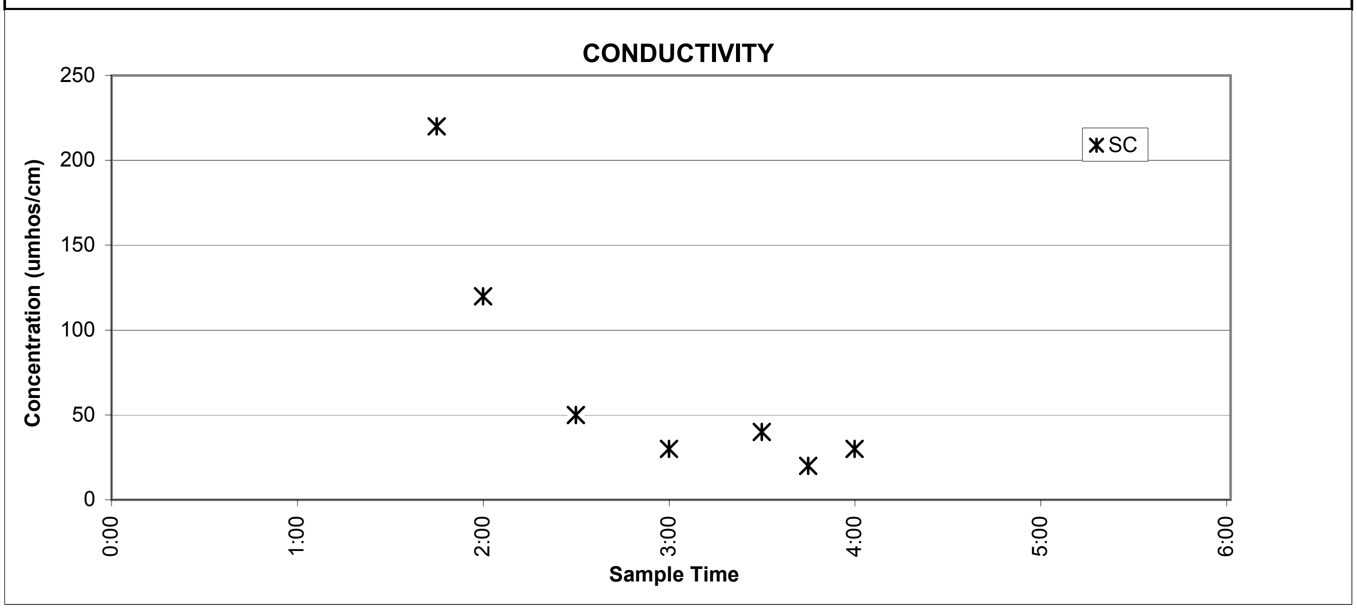

Station 14, Storm 2 (February 12, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
0:00
1:00
2:00
3:00
4:00
5:00
6:00


pH
pH
pH
Sample Time
10.40
10.20
10.00
9.80
9.60
9.40
9.20
9.00
8.80
8.60
8.40
0:00
1:00
2:00
3:00
4:00
5:00
6:00

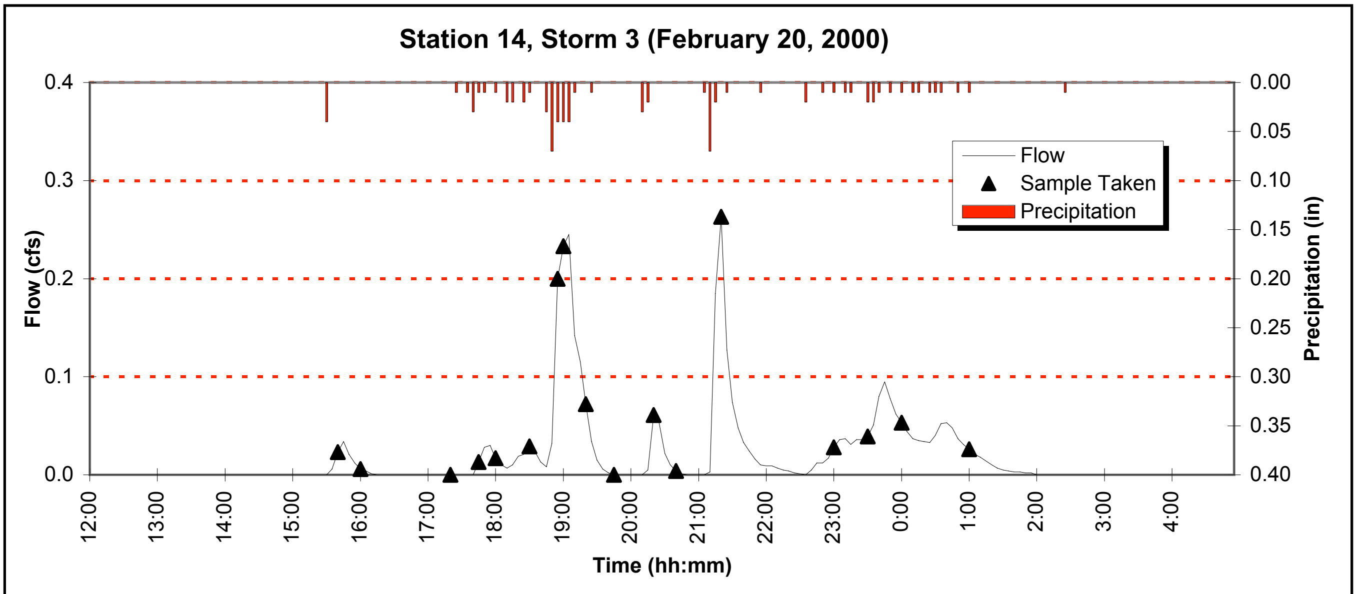

TEMPERATURE
Temp
Temperature (C)
Sample Time
13.4
13.3
13.2
13.1
13.0
12.9
12.8
12.7
0:00
1:00
2:00
3:00
4:00
5:00
6:00



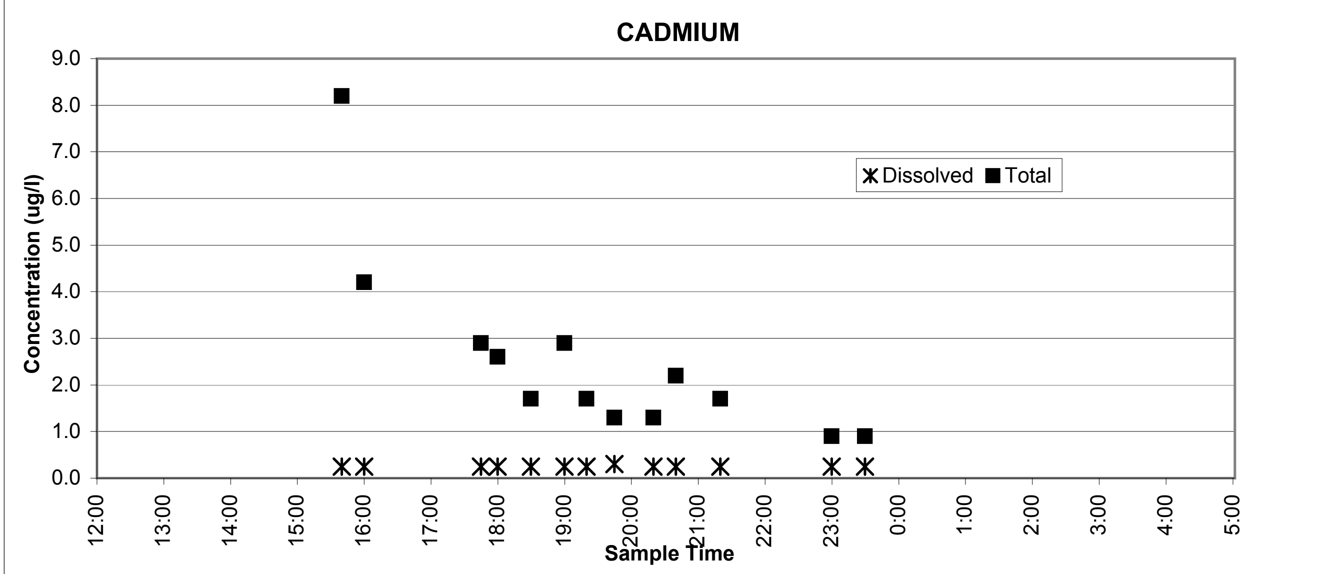
Station 14, Storm 2 (February 12, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



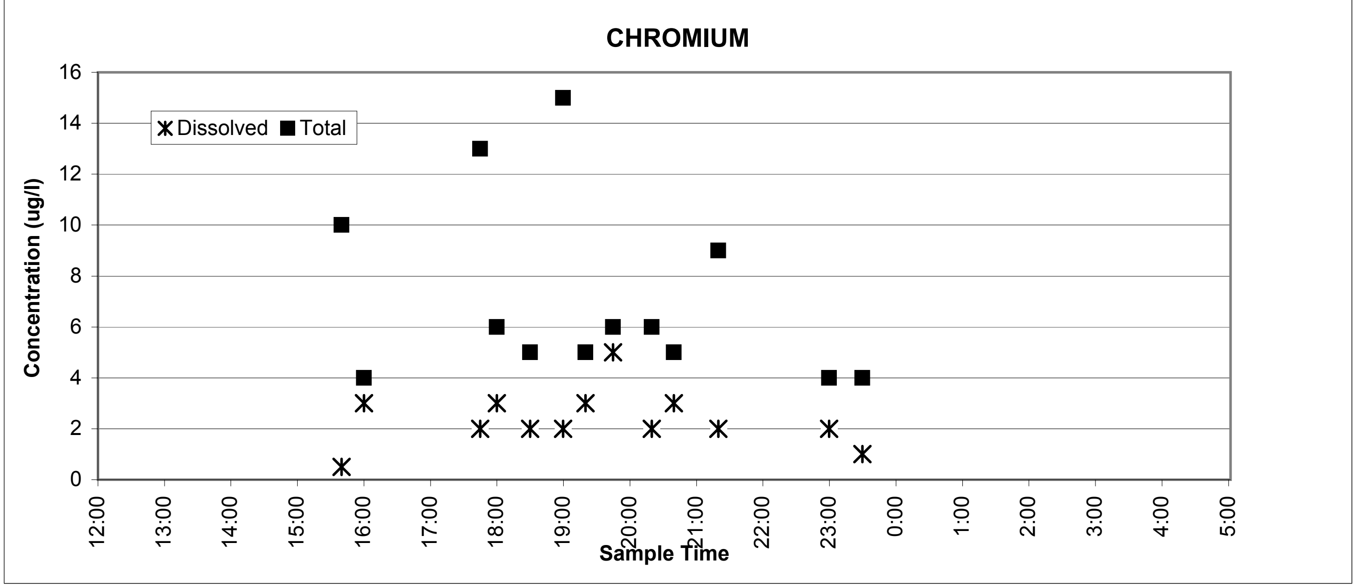
CONDUCTIVITY
SC
Concentration (umhos/cm)
Sample Time



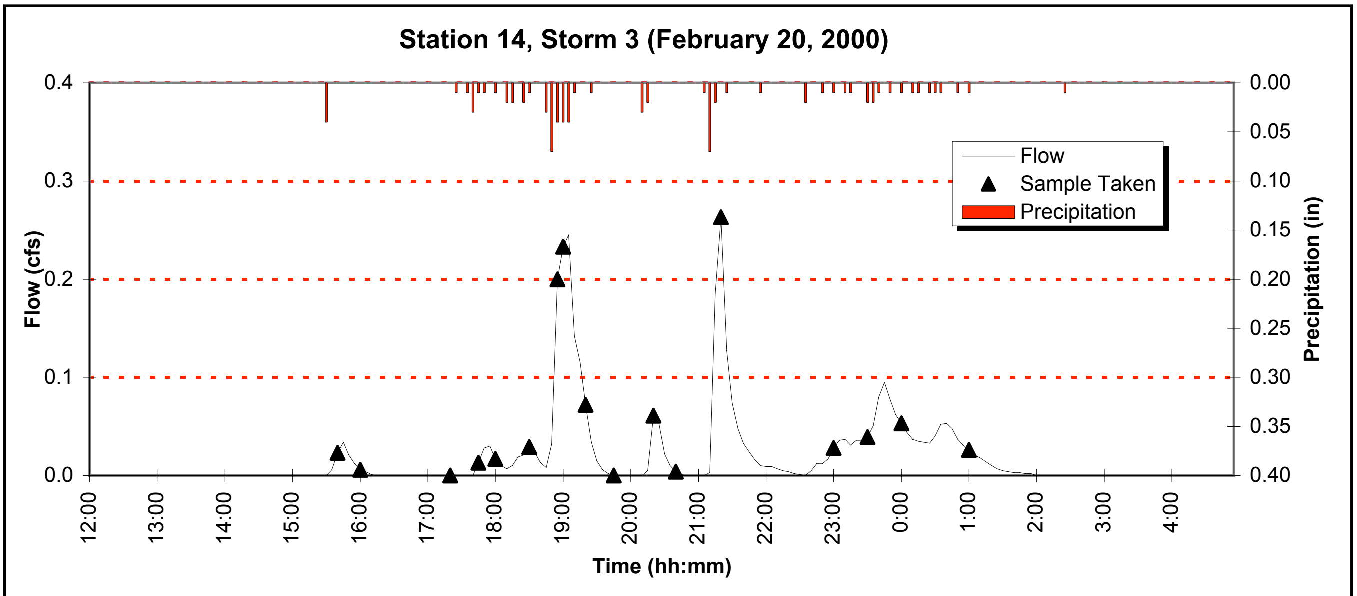
Station 14, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation



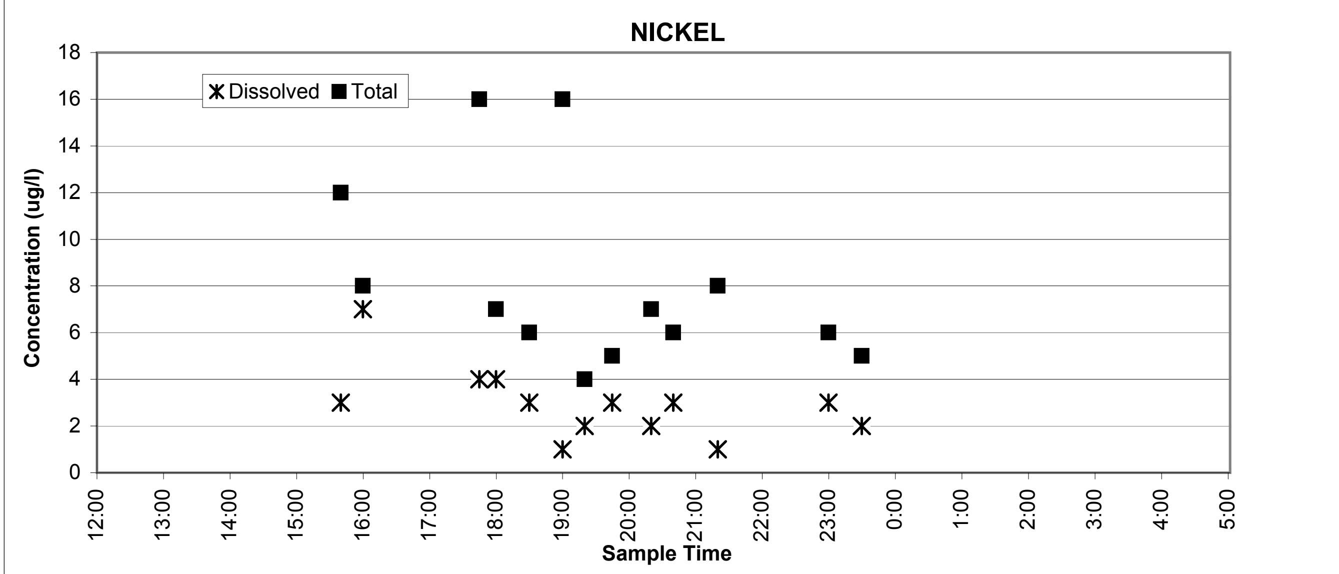
CADMIUM
Concentration (ug/l)
Sample Time
Dissolved
Total



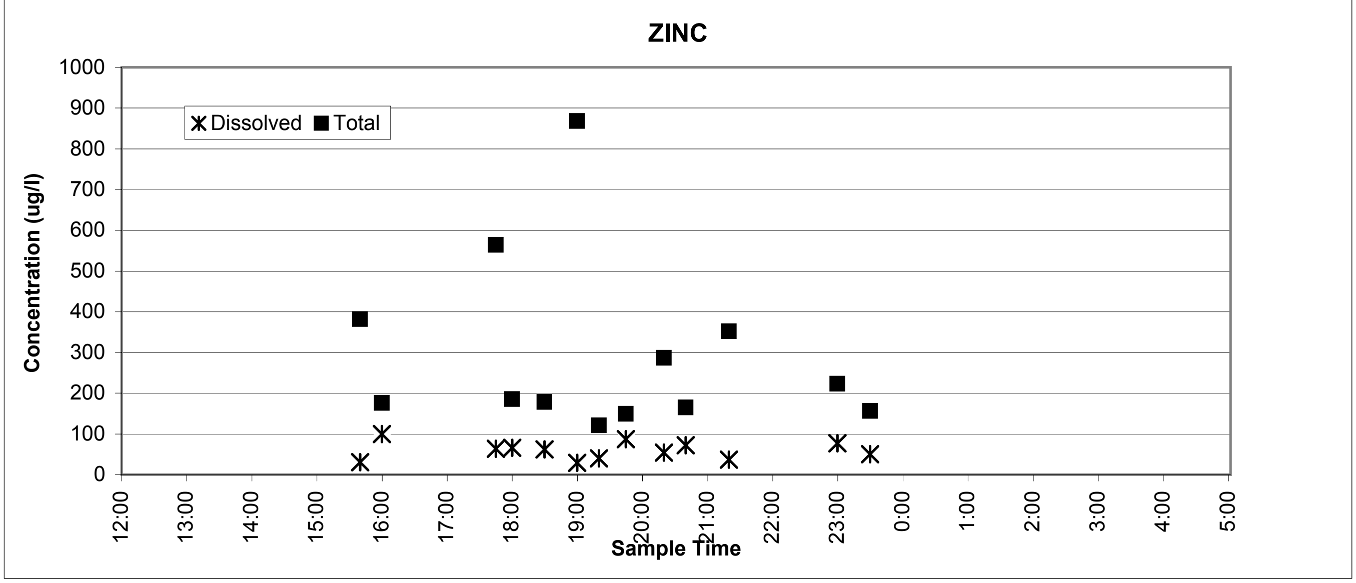
CHROMIUM
Concentration (ug/l)
Sample Time
Dissolved
Total



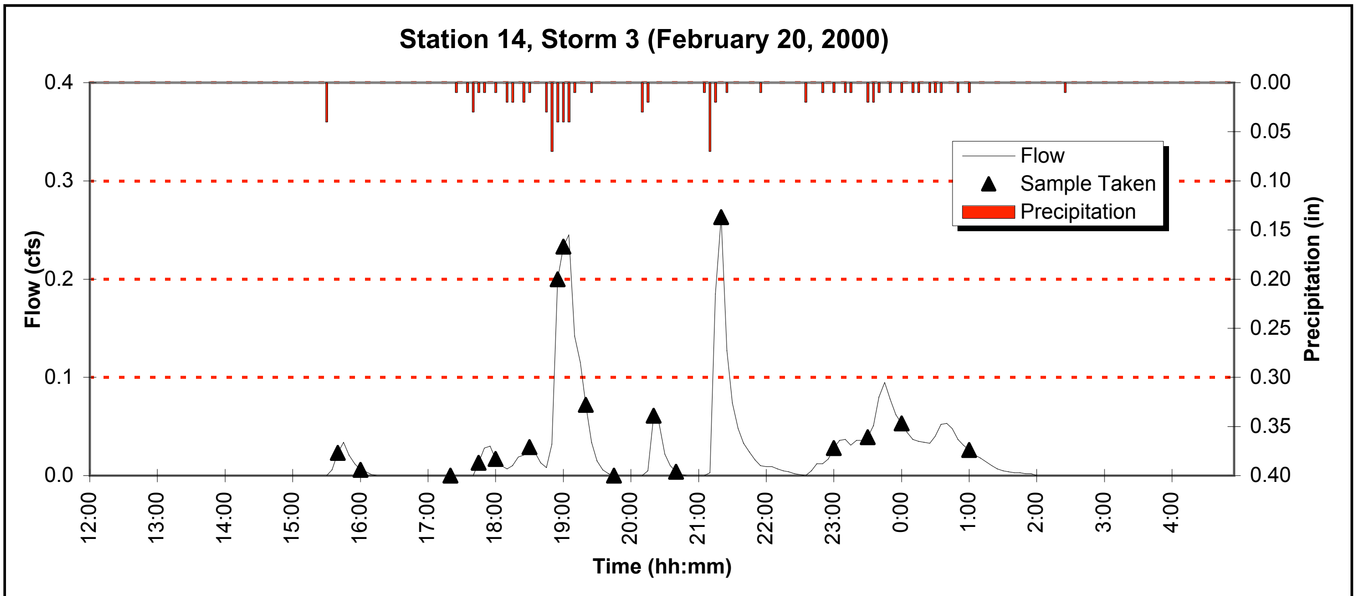
Station 14, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

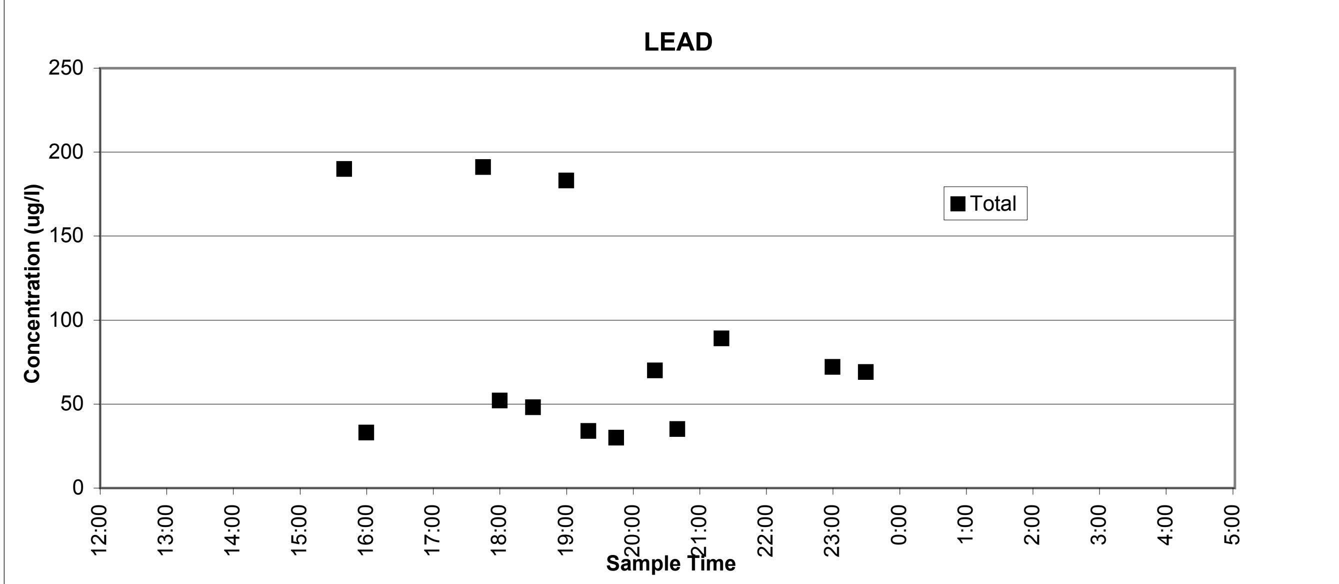


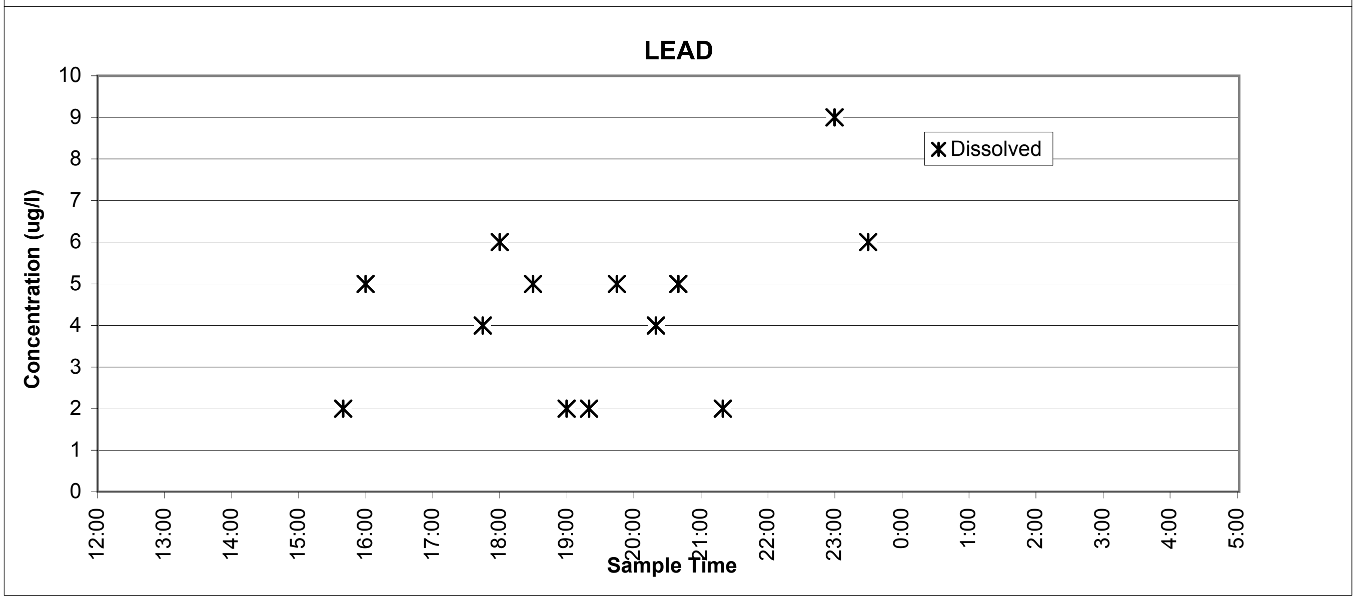
NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time

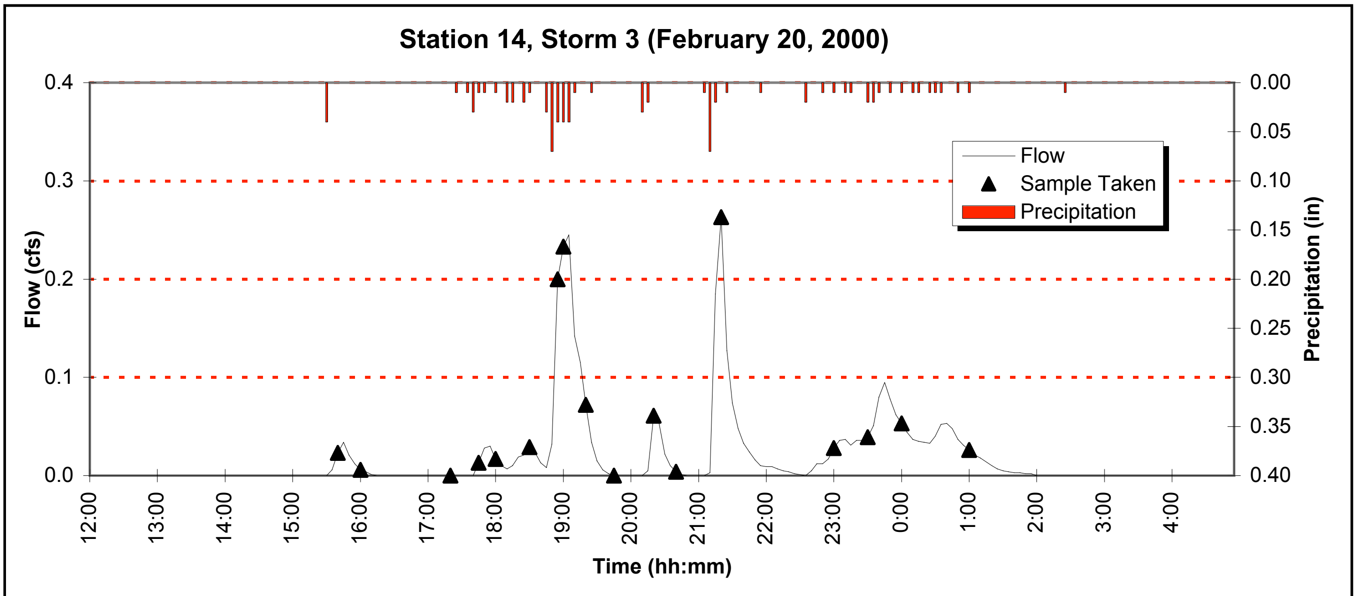


ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time

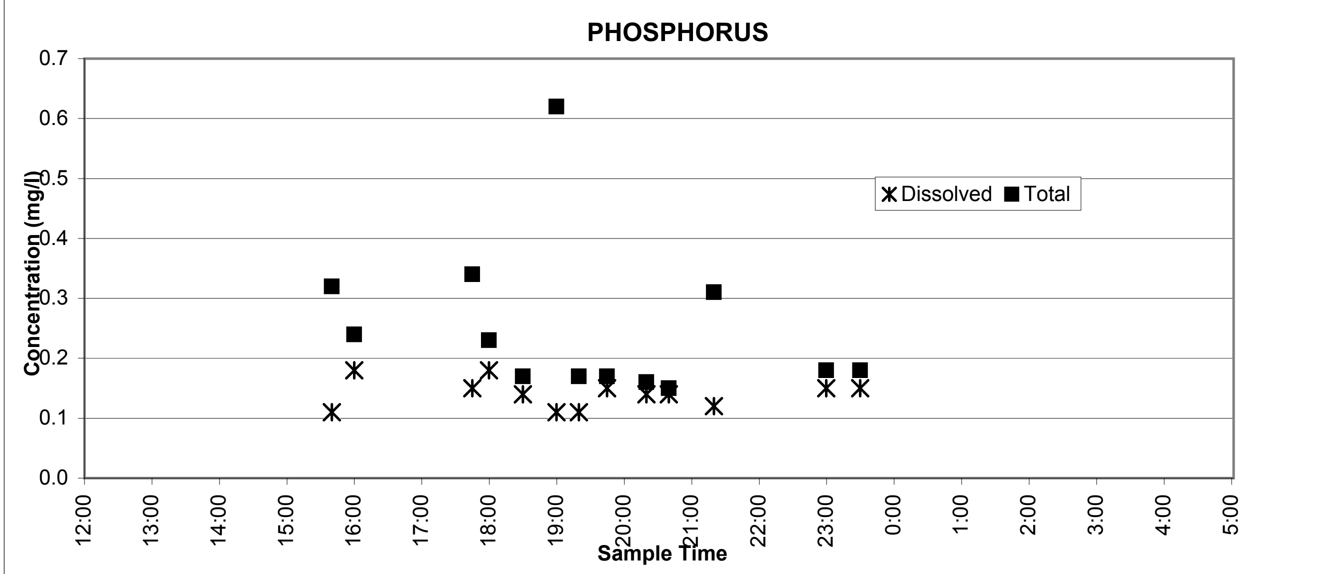

Station 14, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation


LEAD
Concentration (ug/l)
Sample Time
Total

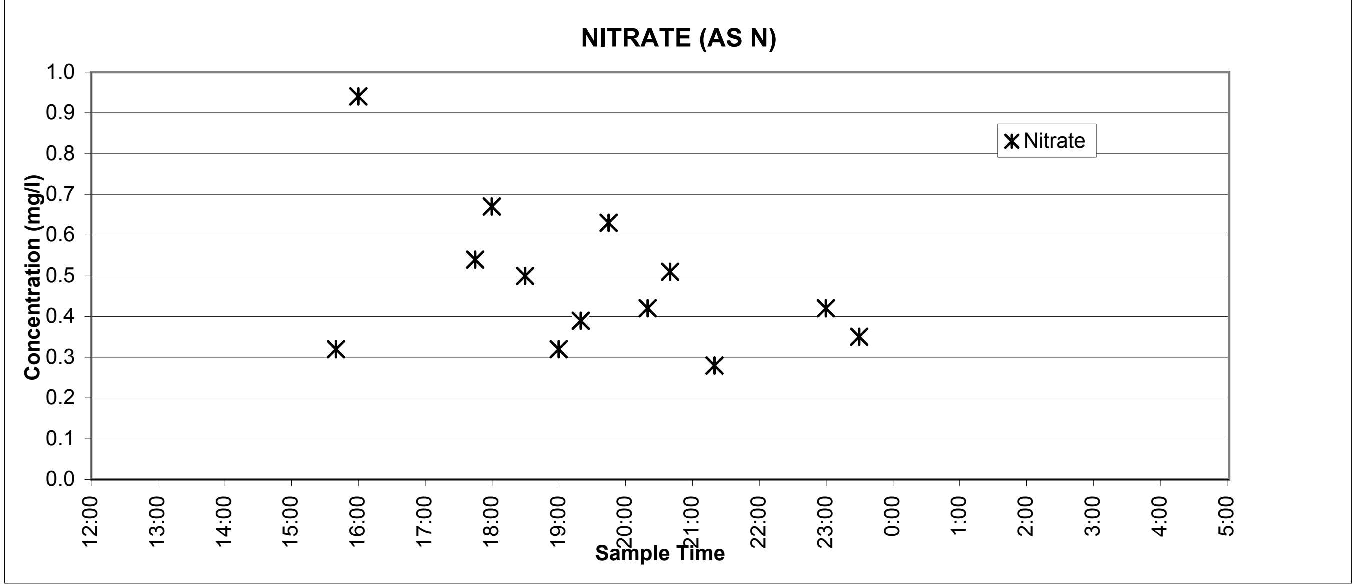

LEAD
Concentration (ug/l)
Sample Time
Dissolved



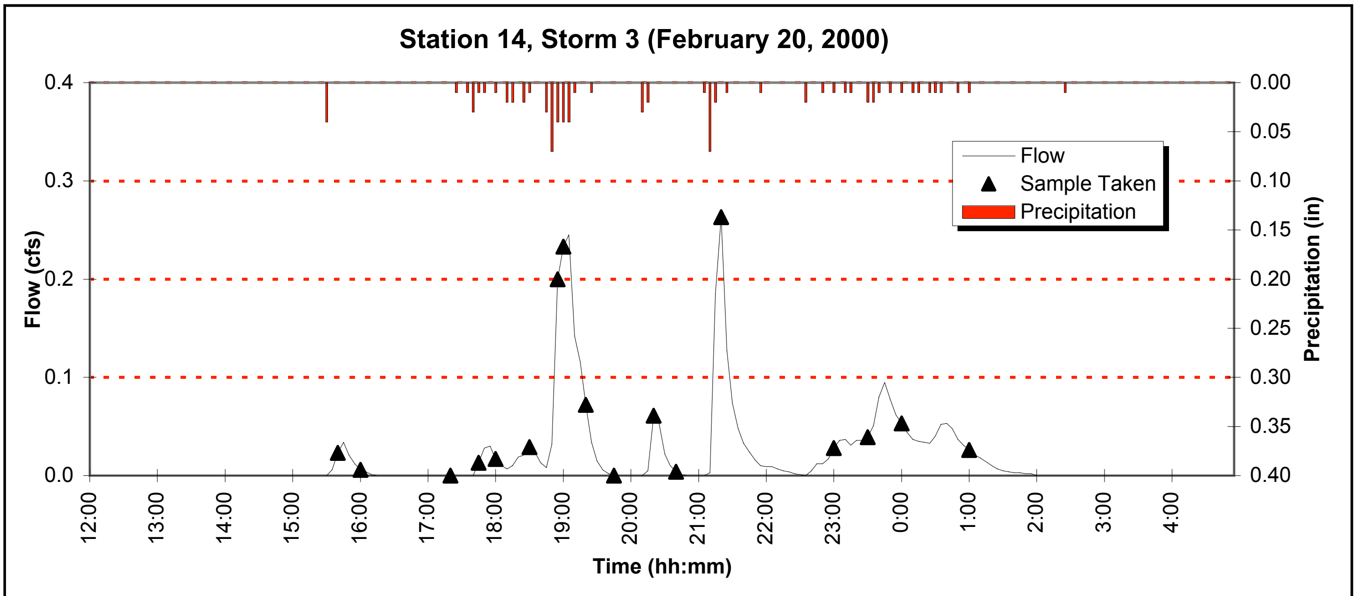
Station 14, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
0.4
0.3
0.2
0.1
0.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00

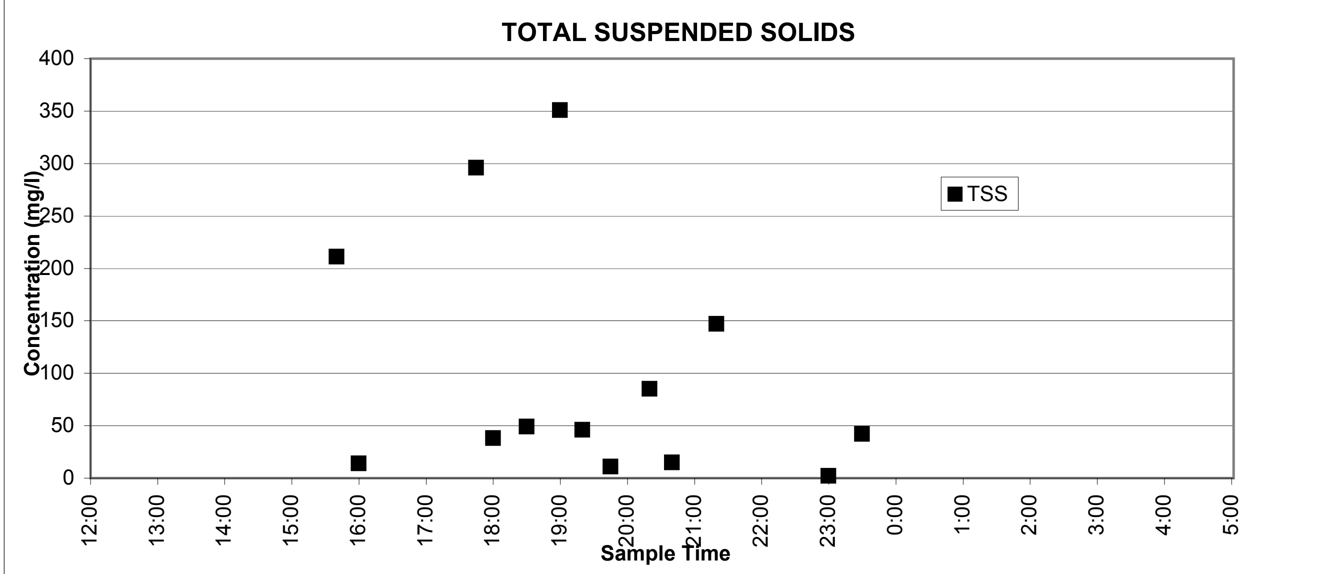


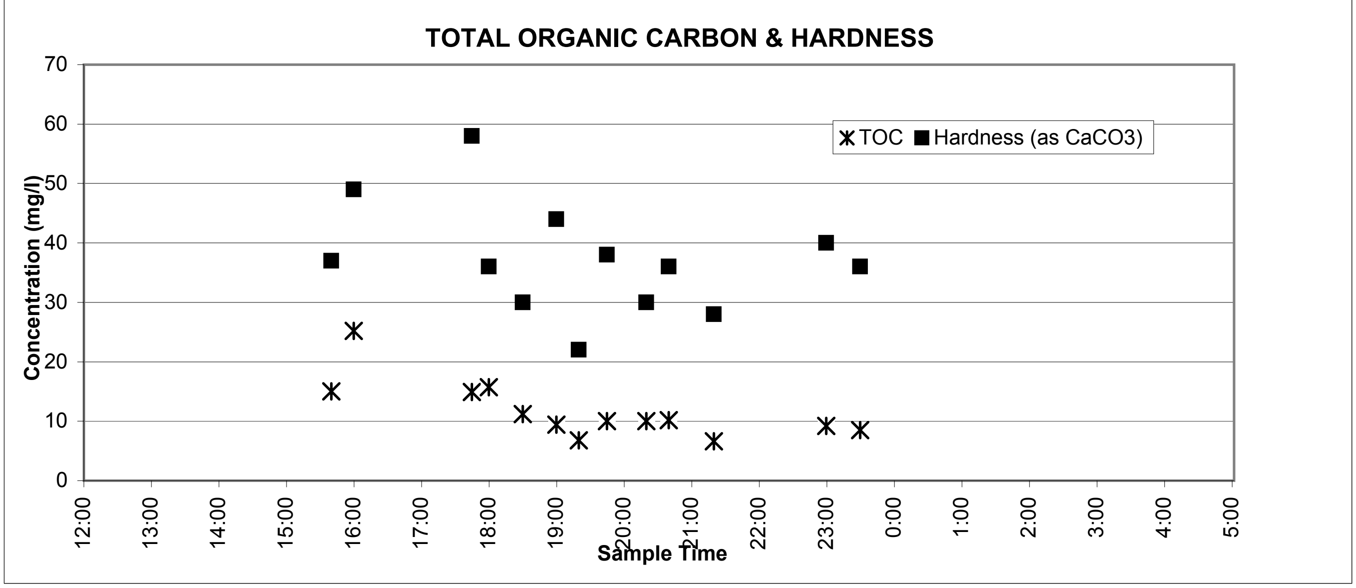
PHOSPHORUS
Concentration (mg/l)
Sample Time
Dissolved
Total
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

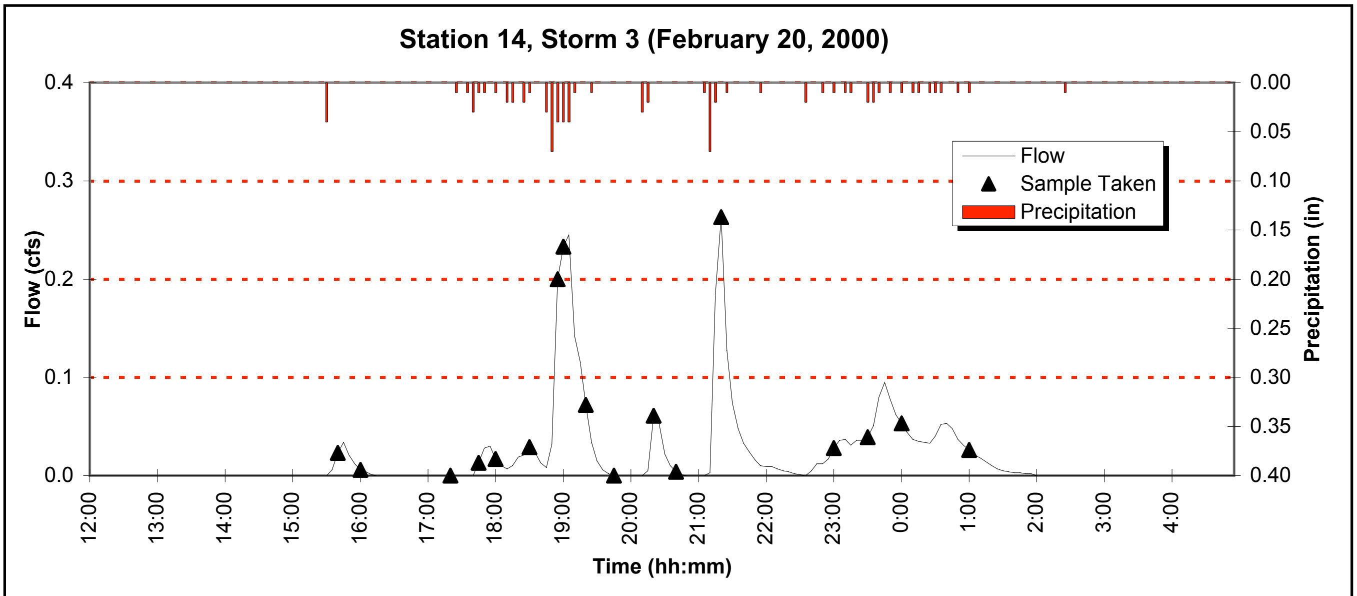


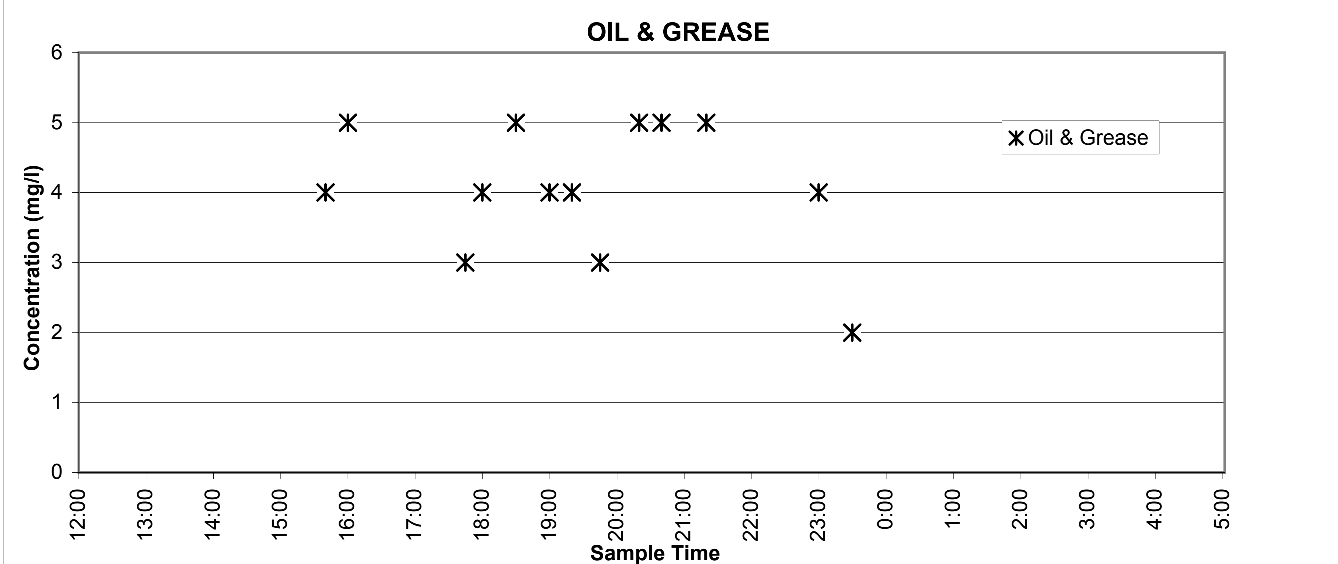
NITRATE (AS N)
Concentration (mg/l)
Sample Time
Nitrate
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

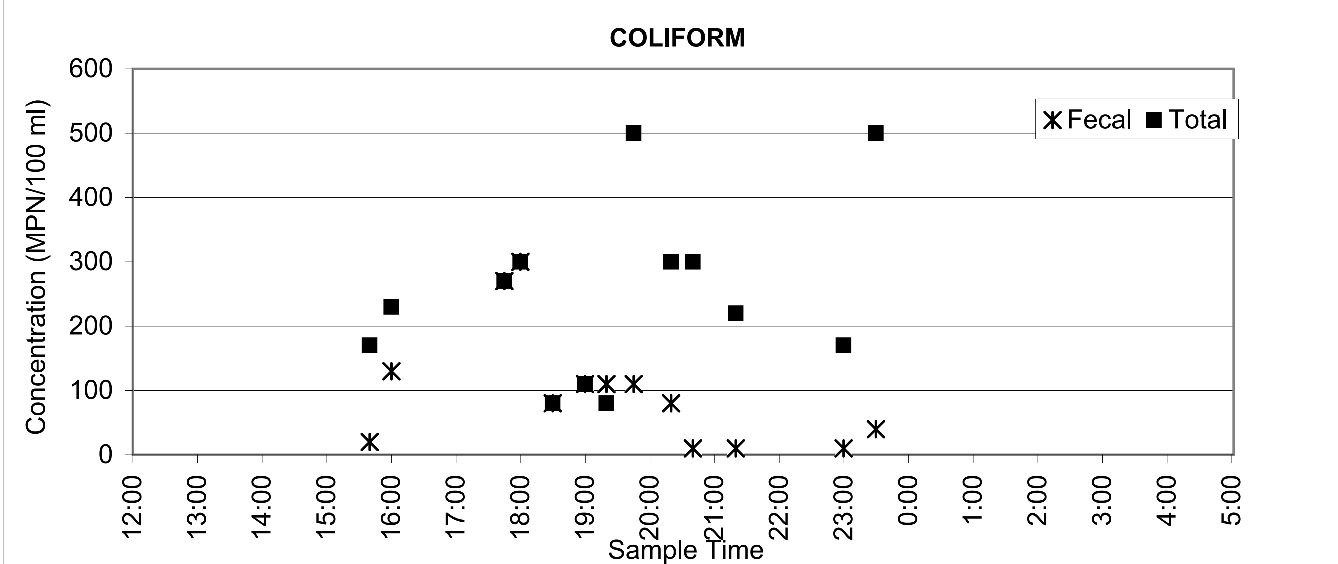

Station 14, Storm 3 (February 20, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

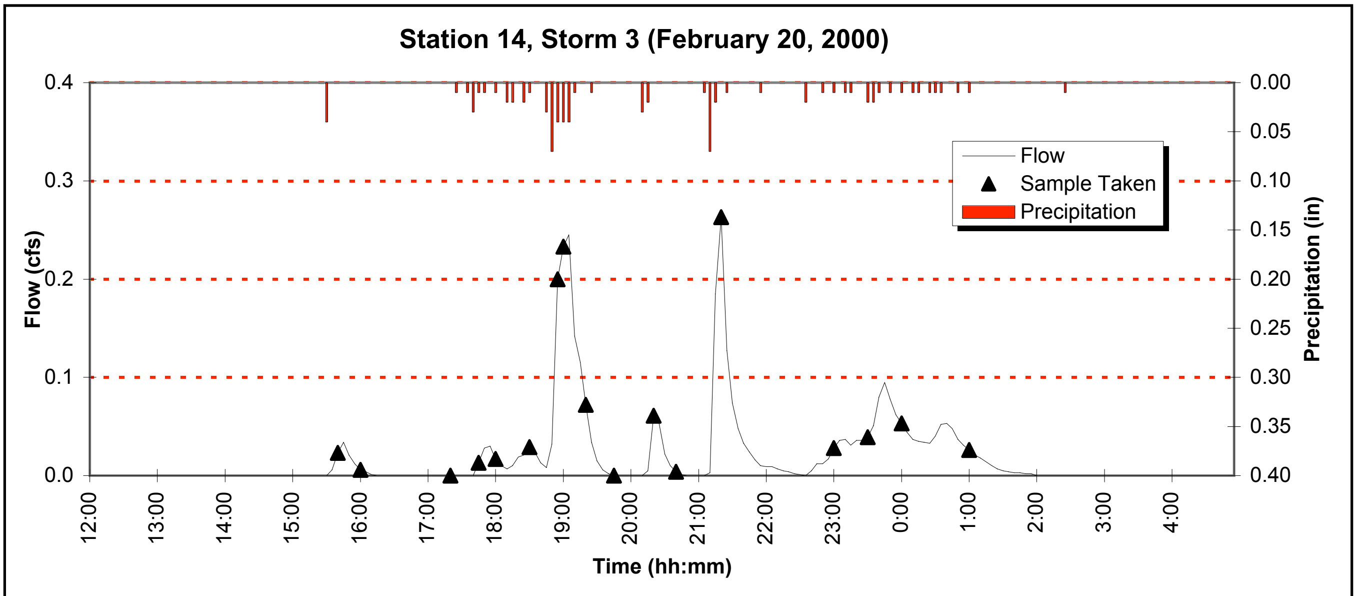

TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time

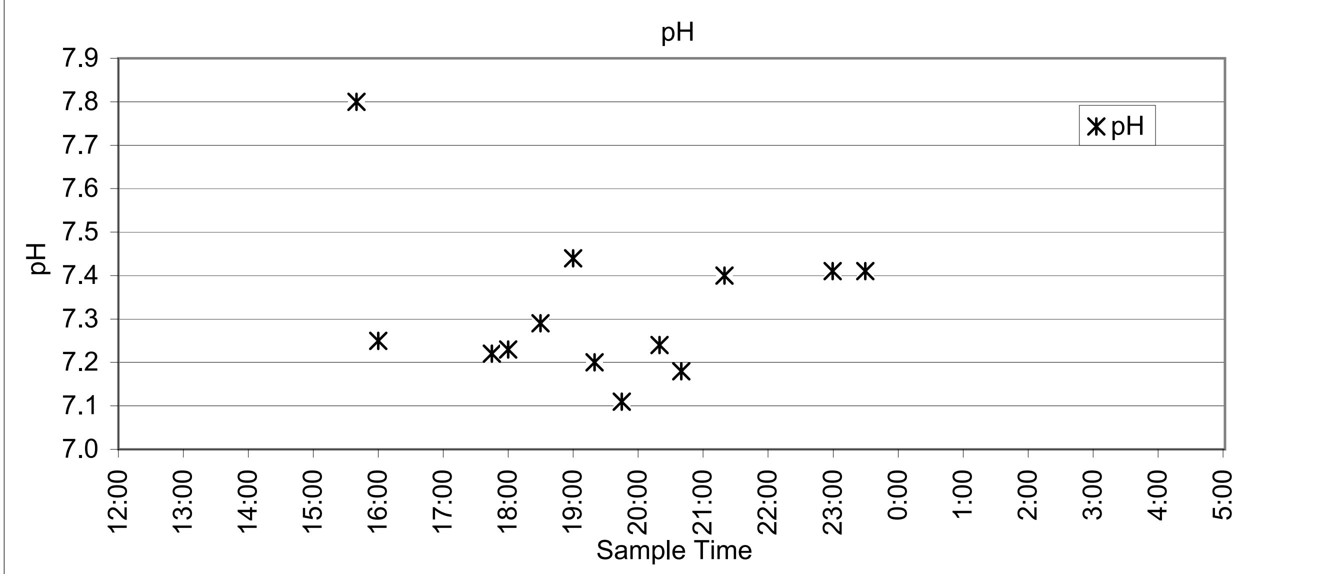

TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time

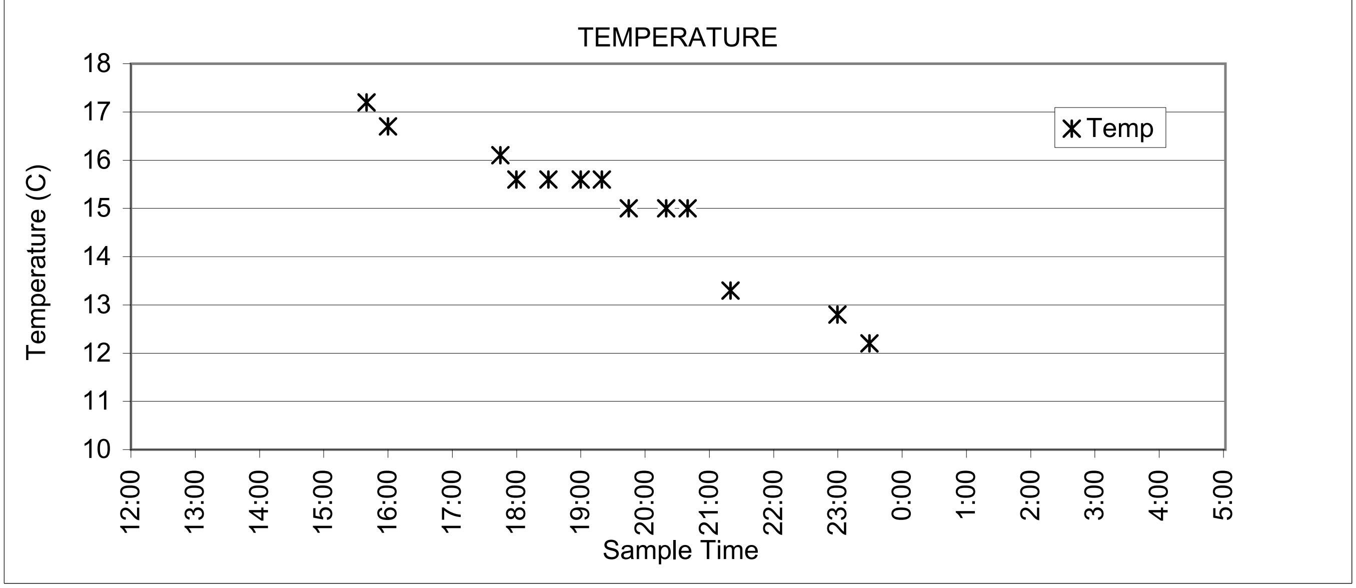

Station 14, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

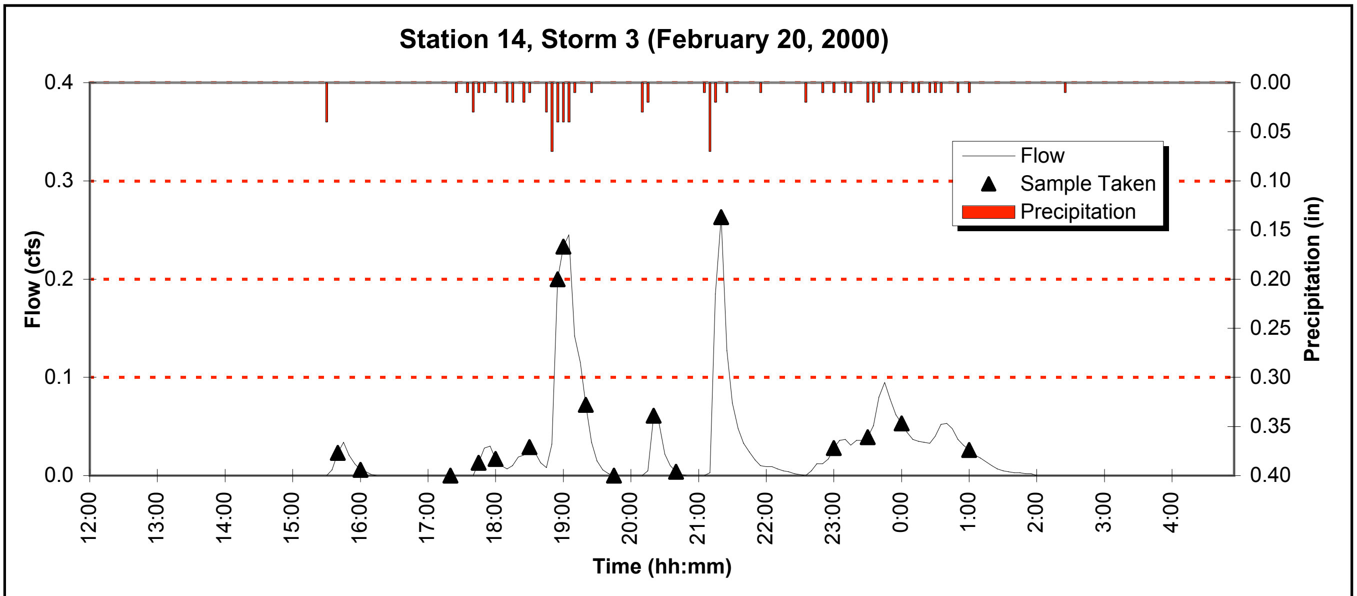

OIL & GREASE
Concentration (mg/l)
Sample Time
Oil & Grease


COLIFORM
Concentration (MPN/100 ml)
Sample Time
Fecal
Total

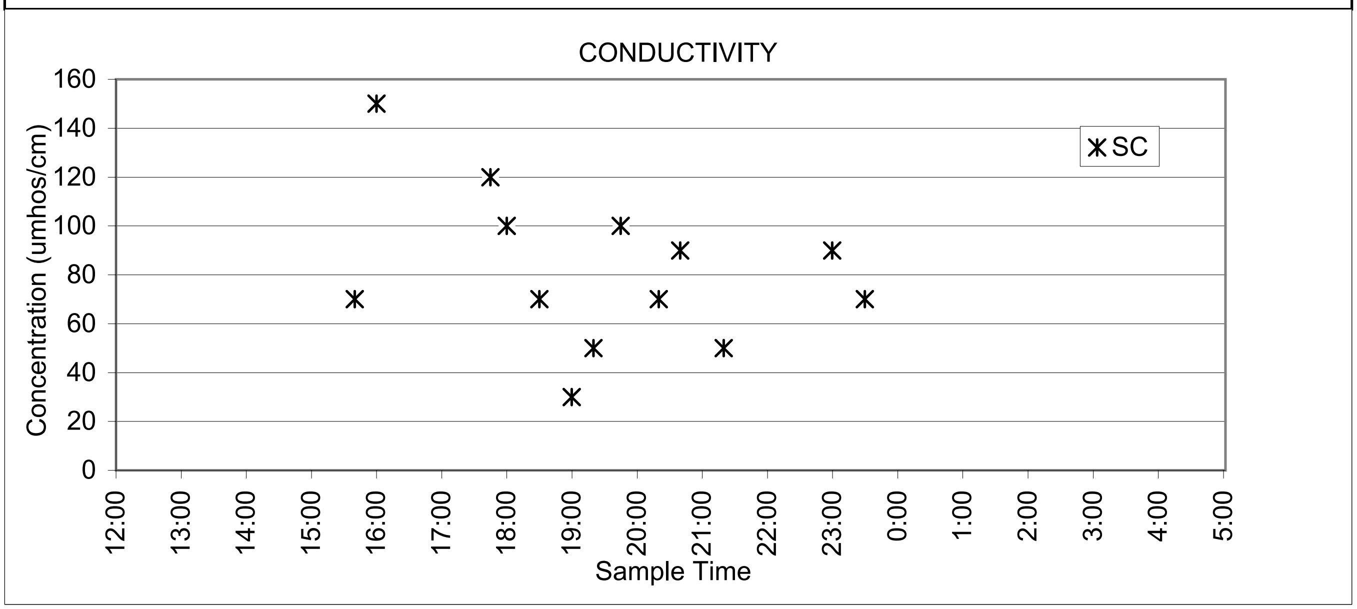

Station 14, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation


pH
pH
Sample Time

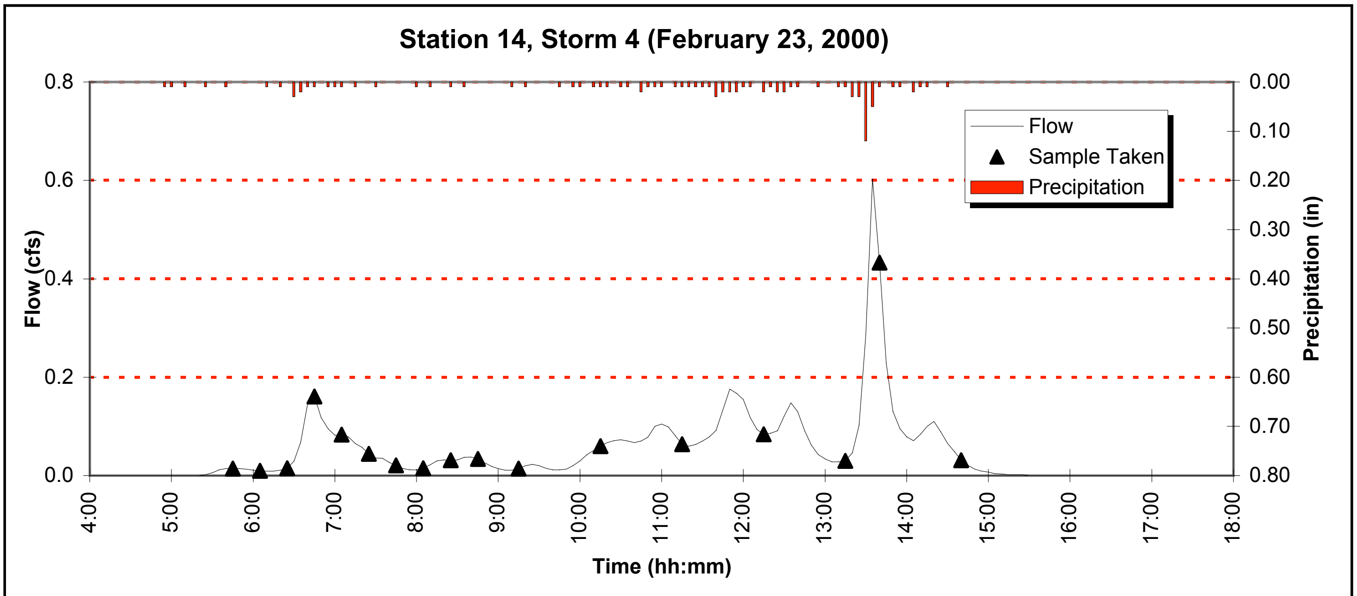

TEMPERATURE
Temp
Temperature (C)
Sample Time

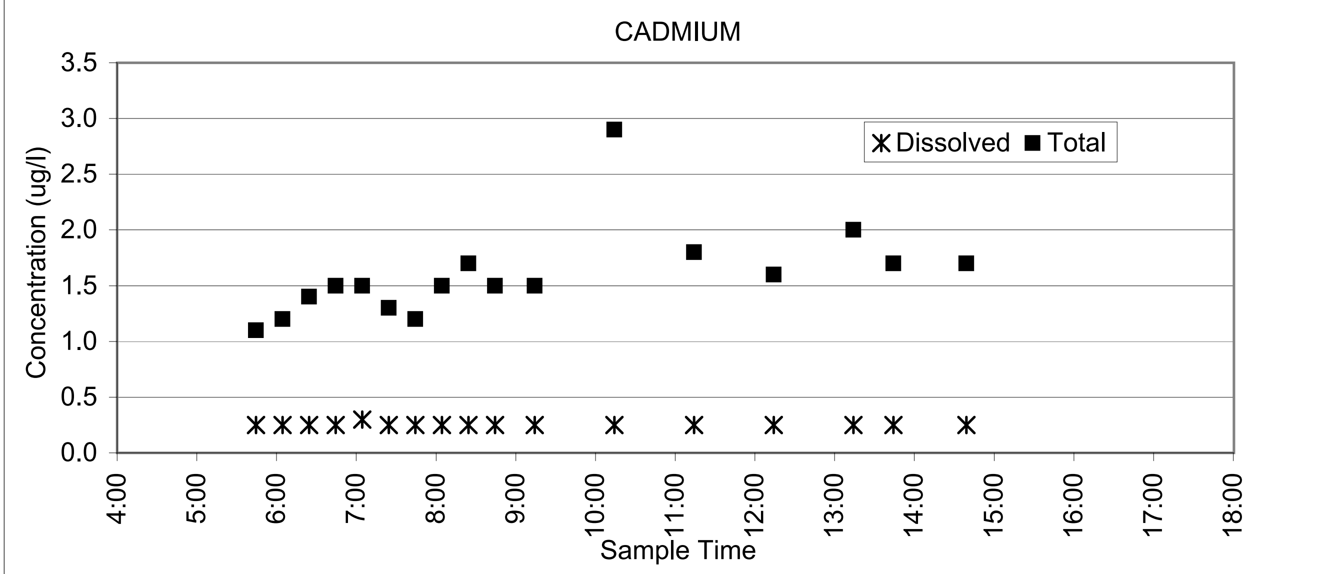


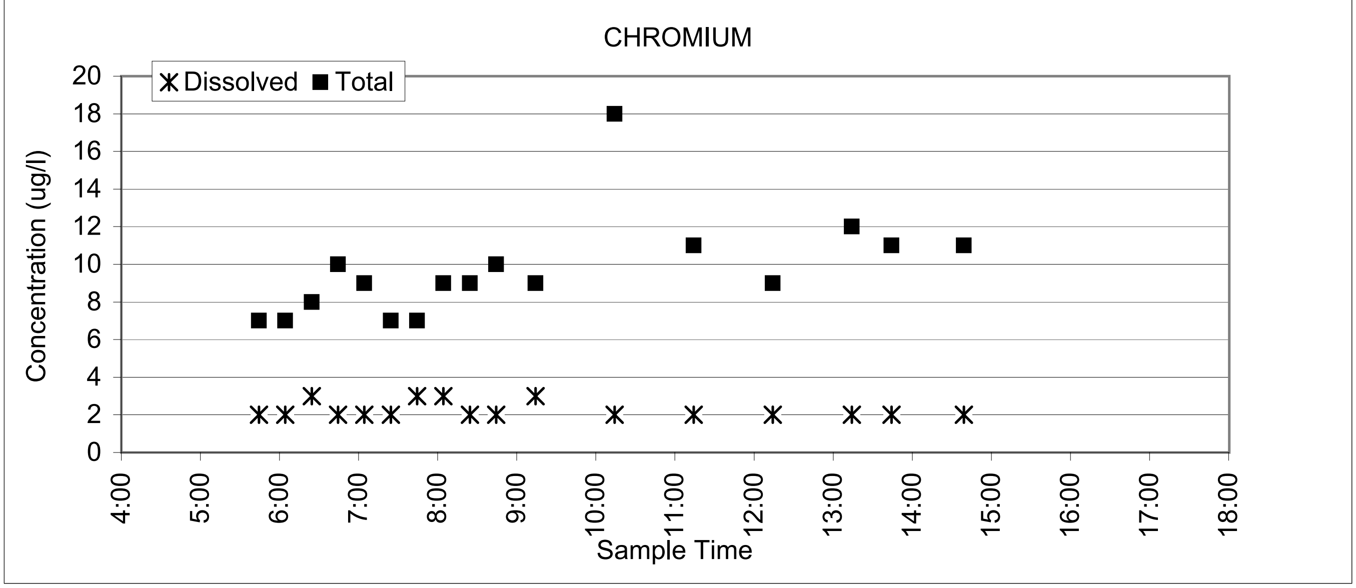
Station 14, Storm 3 (February 20, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
0.4
0.3
0.2
0.1
0.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00

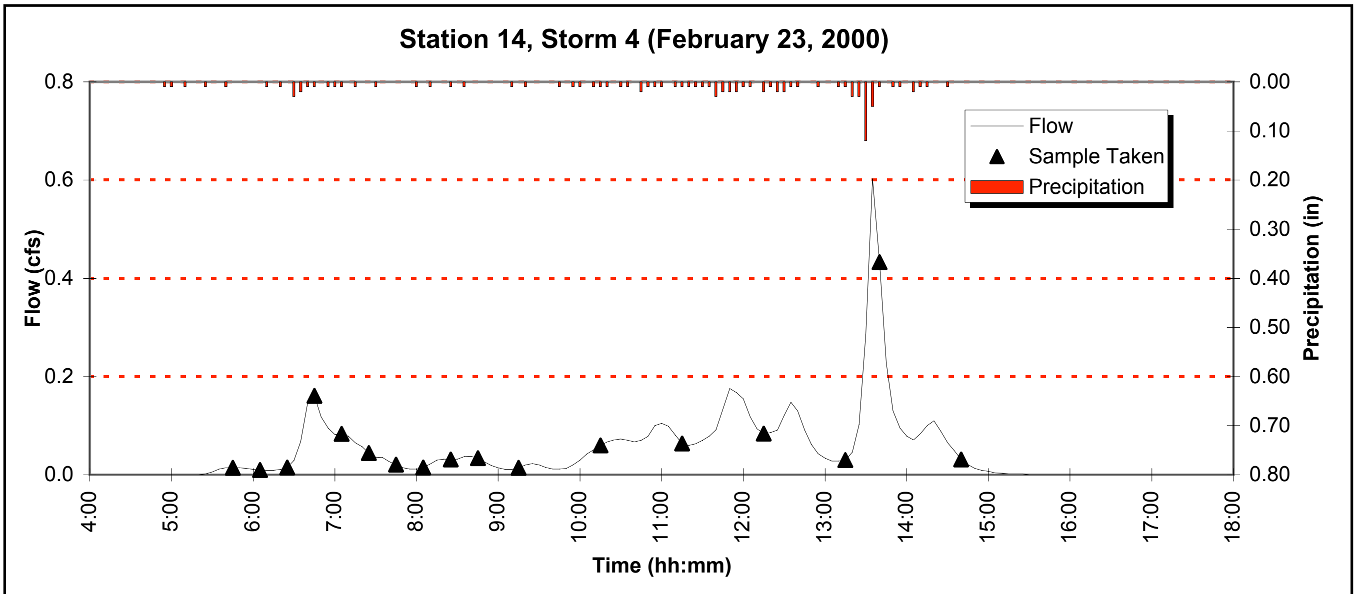


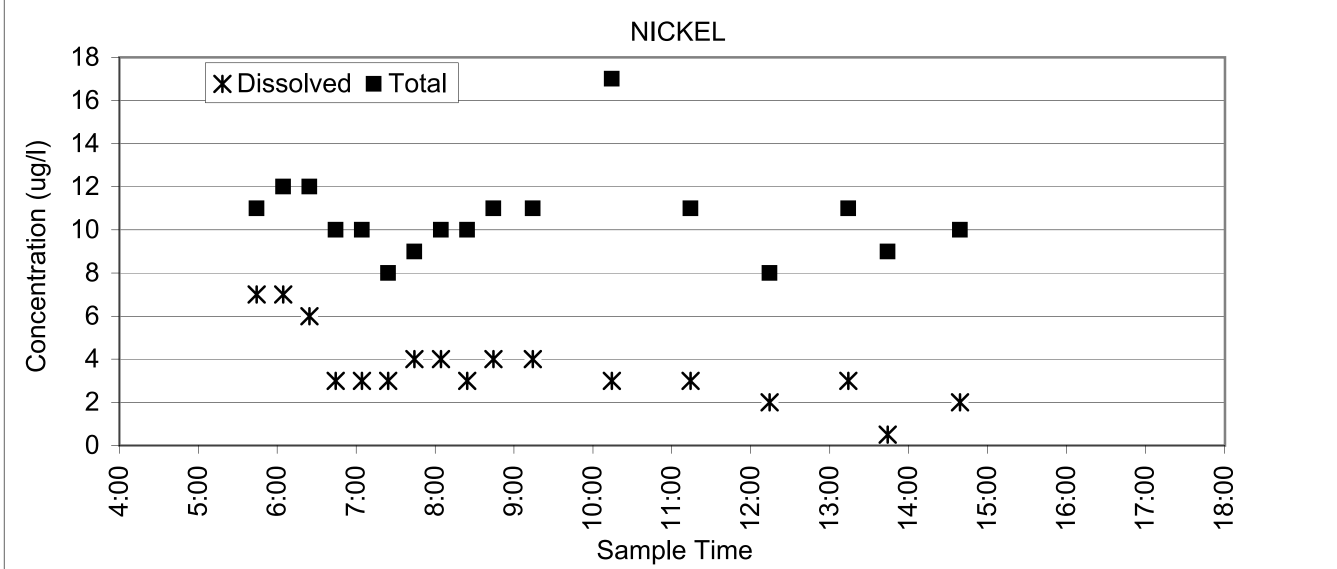
CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
SC
160
140
120
100
80
60
40
20
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00

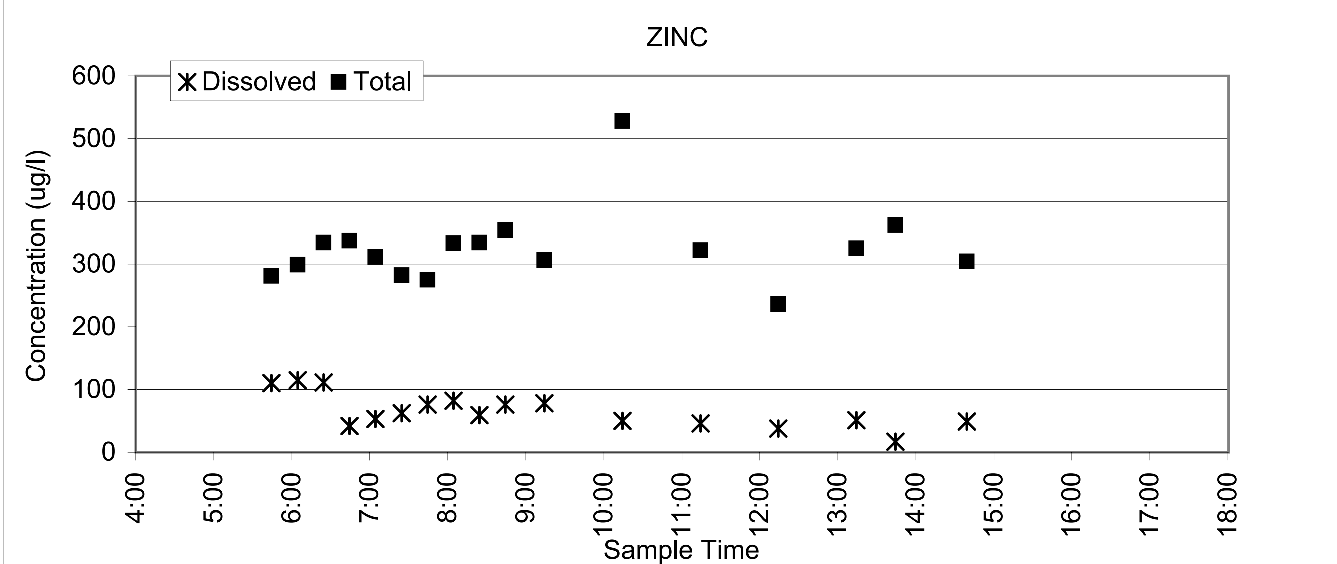

Station 14, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

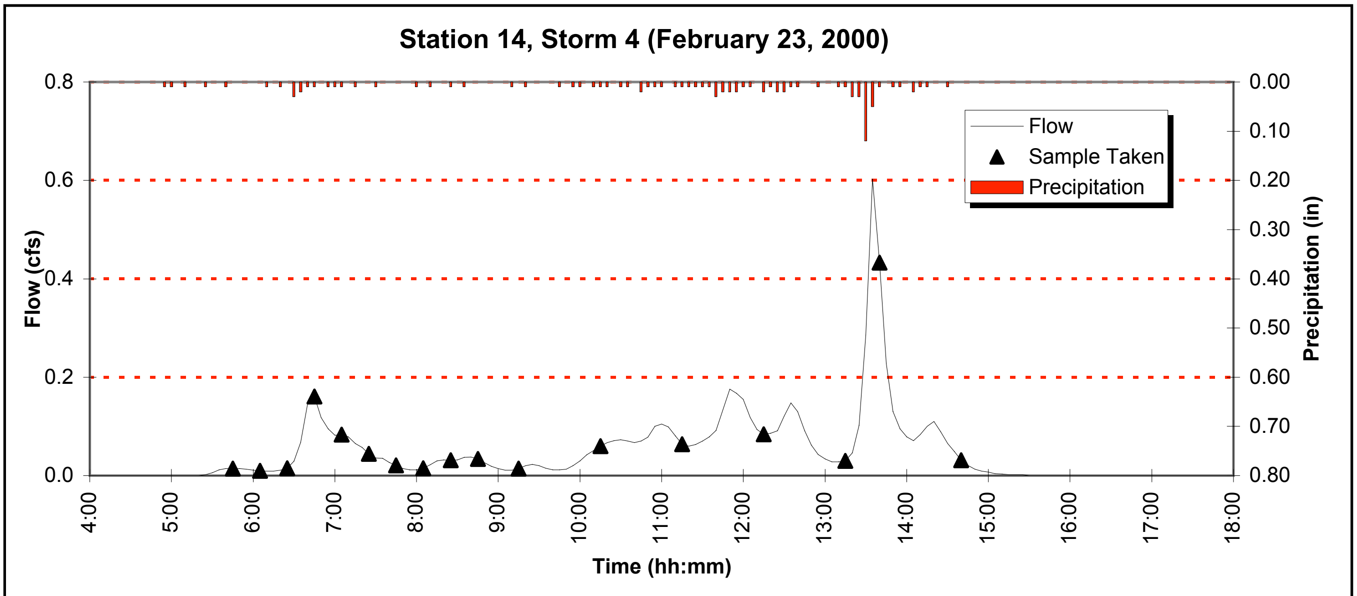

CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time


CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time

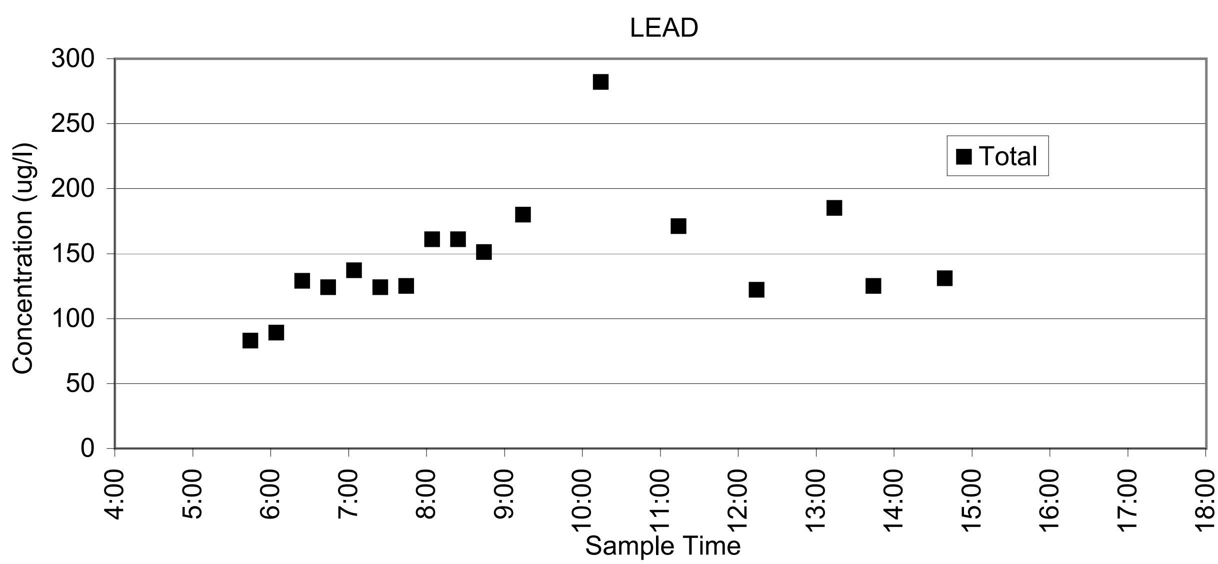

Station 14, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time

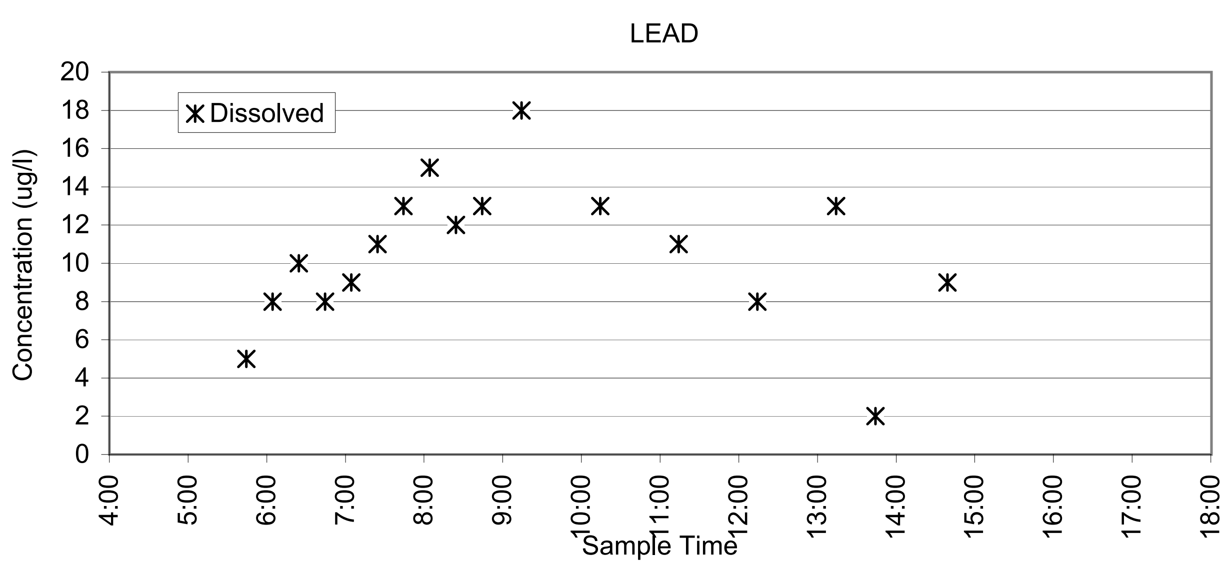

ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time



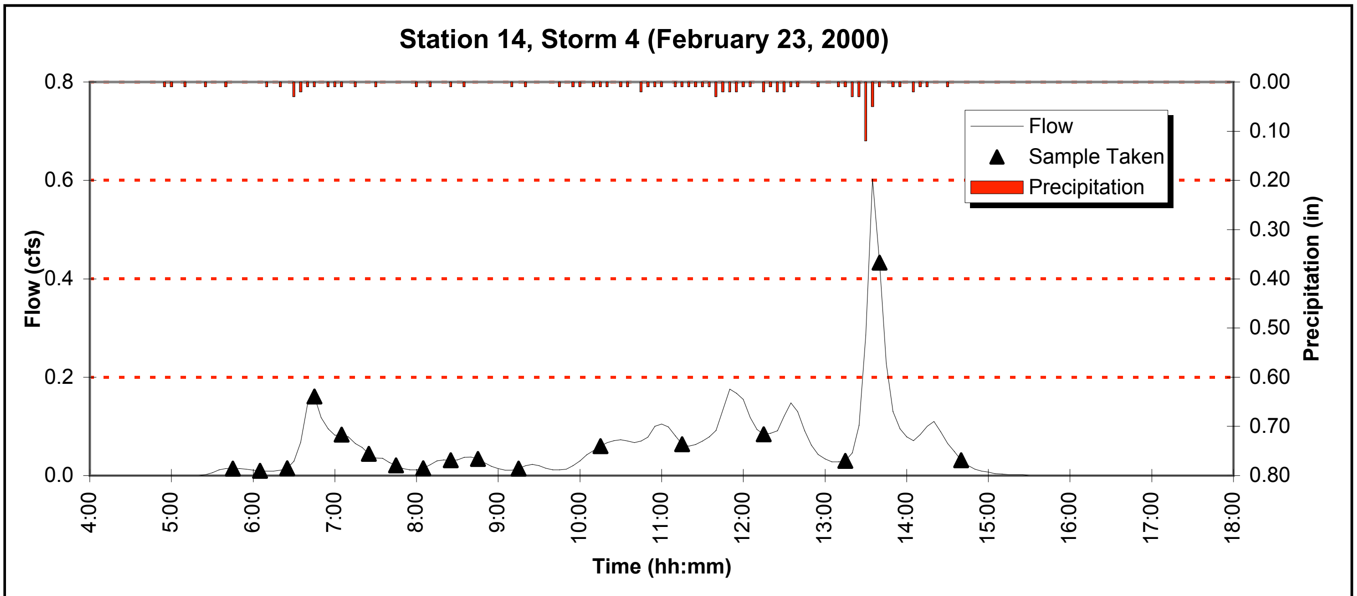
Station 14, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.8
0.6
0.4
0.2
0.0
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00



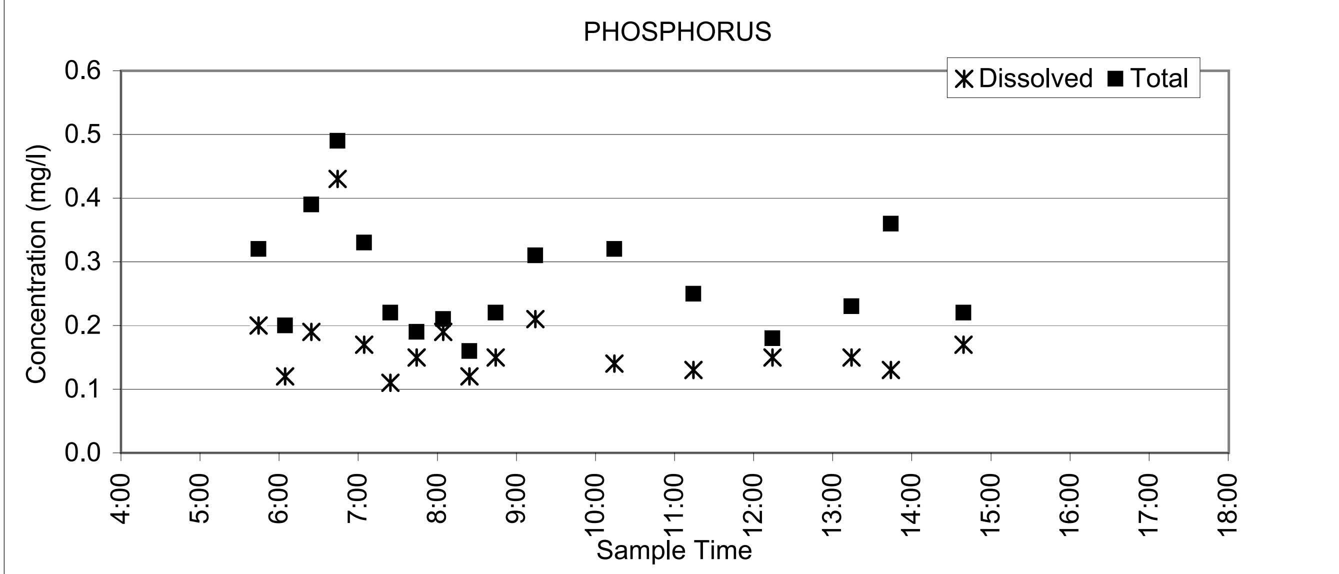
LEAD
Total
Concentration (ug/l)
Sample Time
300
250
200
150
100
50
0
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00



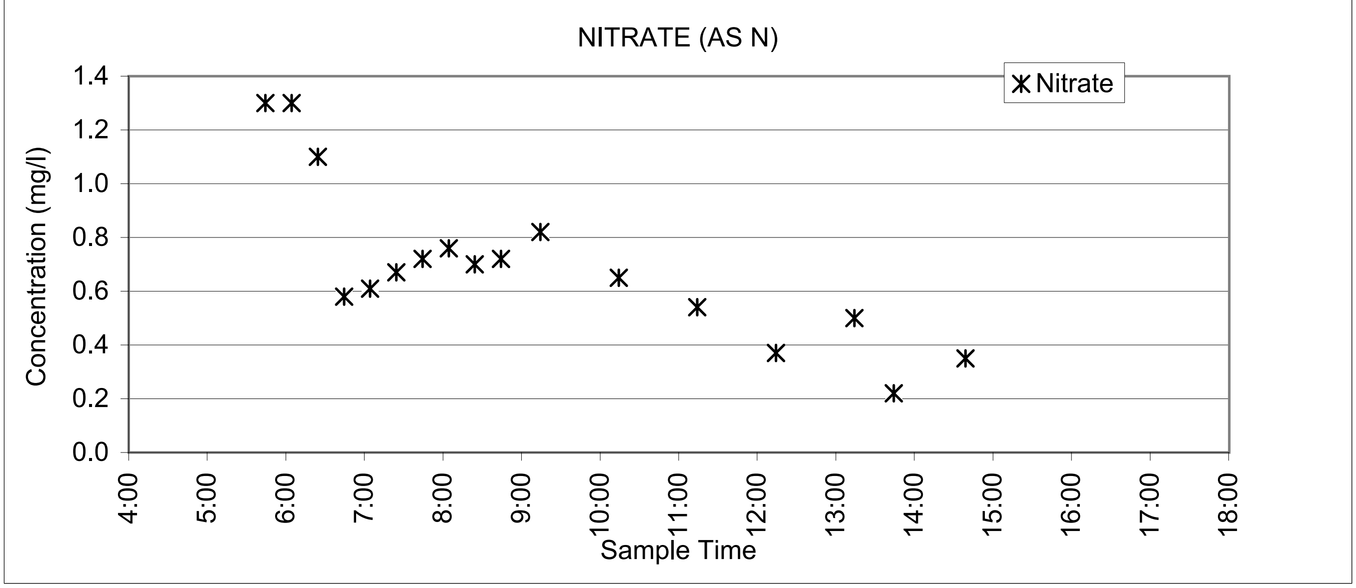
LEAD
Dissolved
Concentration (ug/l)
Sample Time
20
18
16
14
12
10
8
6
4
2
0
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00



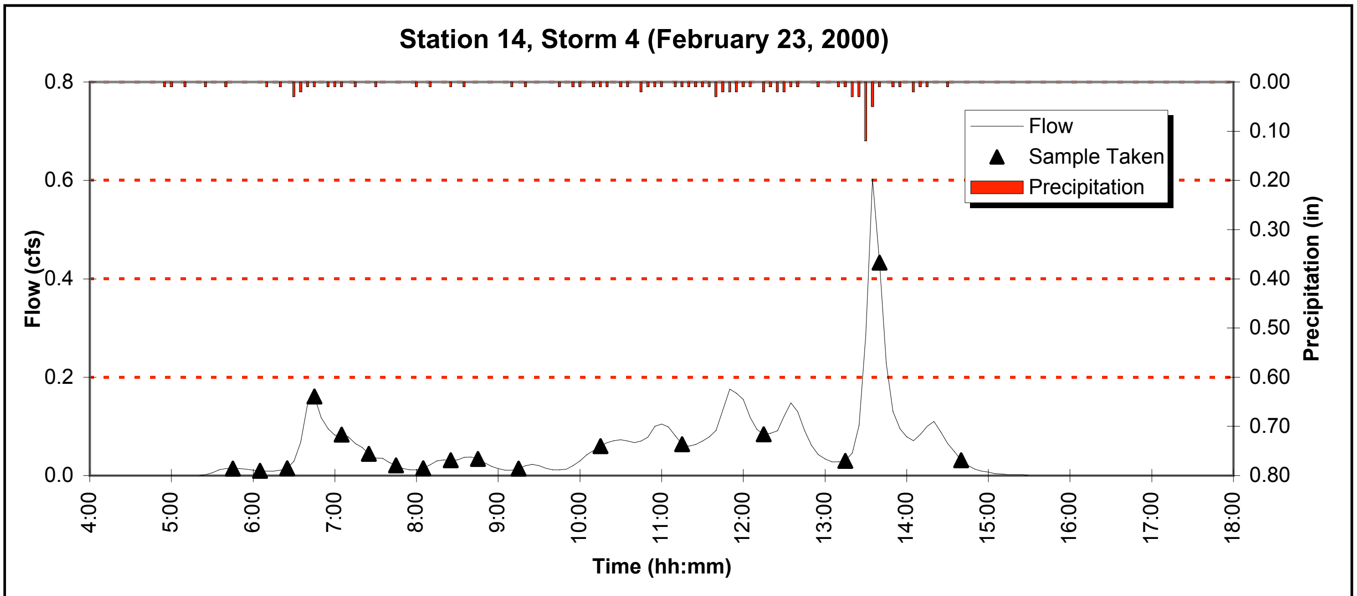
Station 14, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



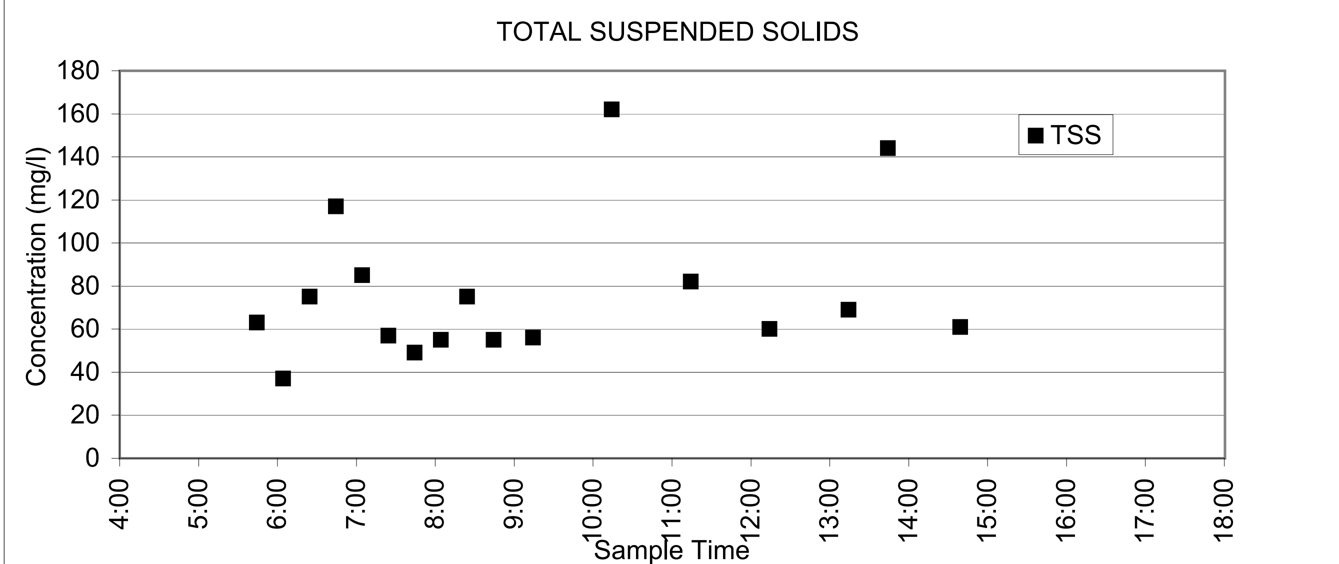
PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time



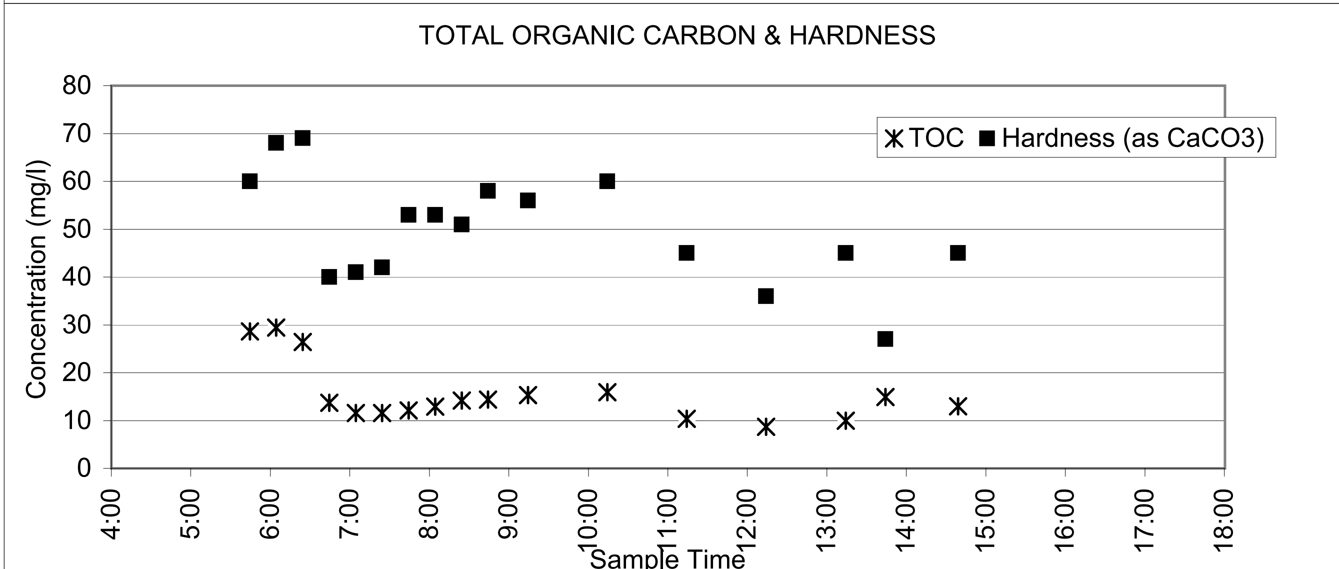
NITRATE (AS N)
Nitrate
Concentration (mg/l)
Sample Time



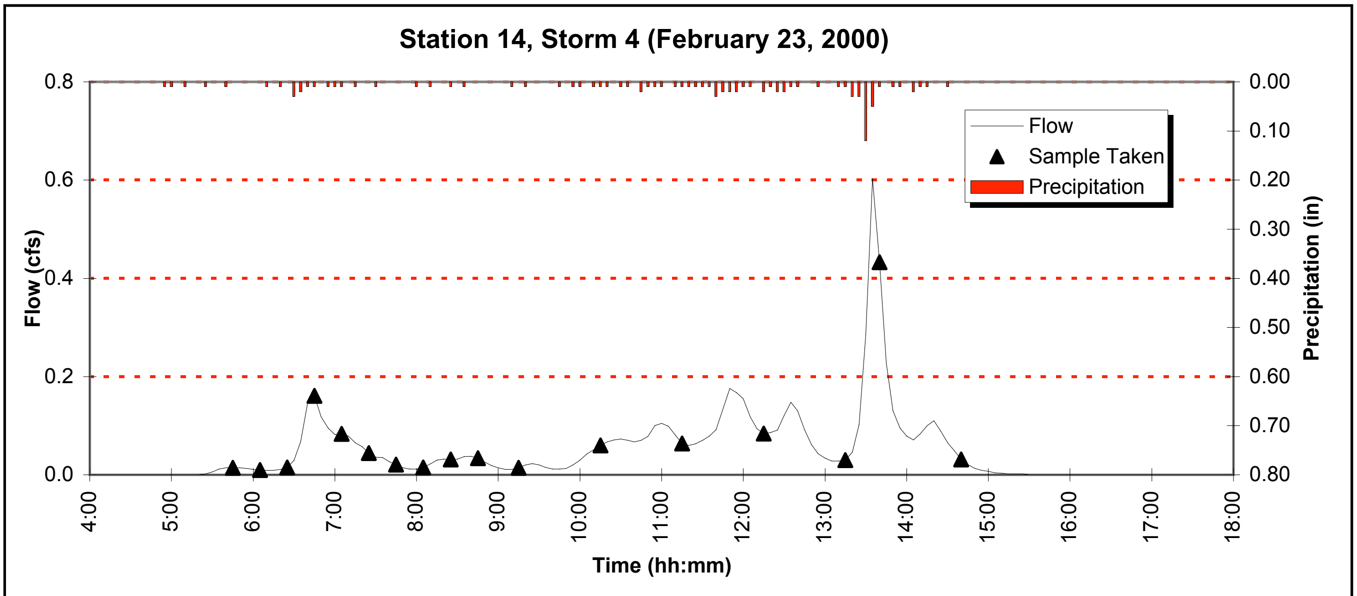
Station 14, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)



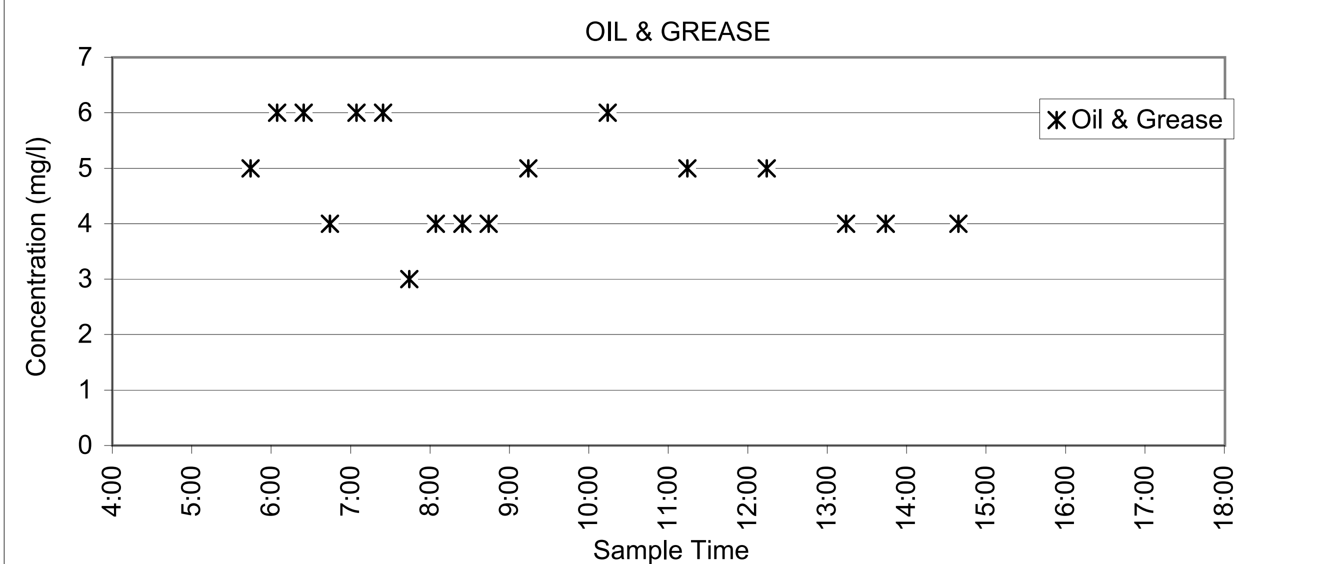
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time



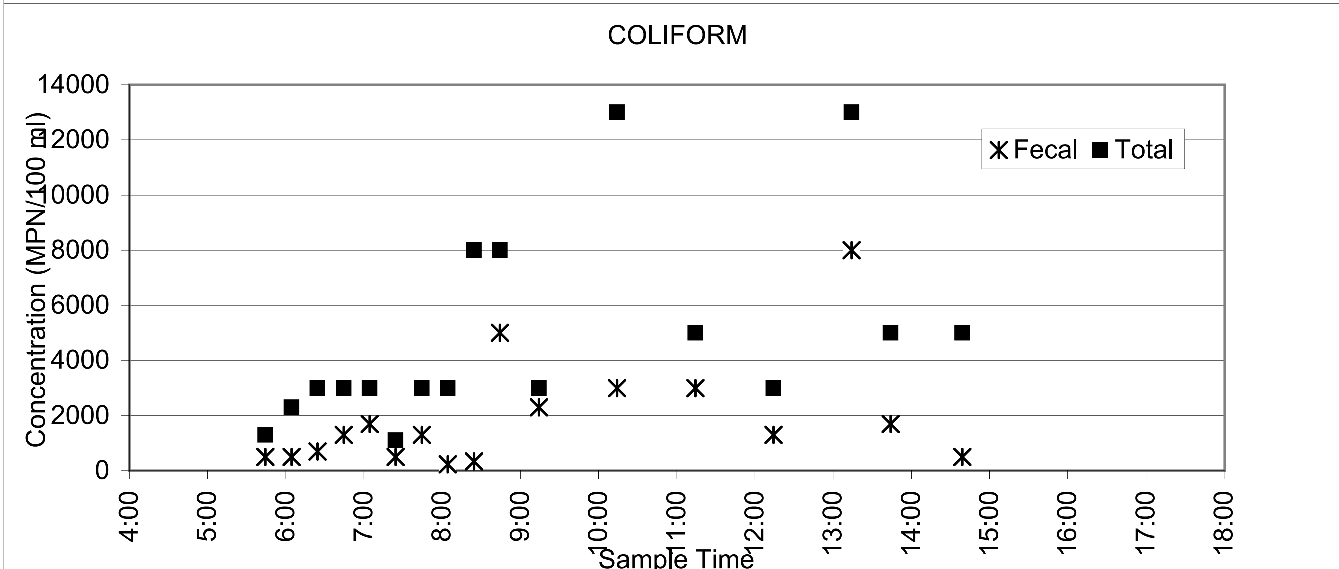
TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time



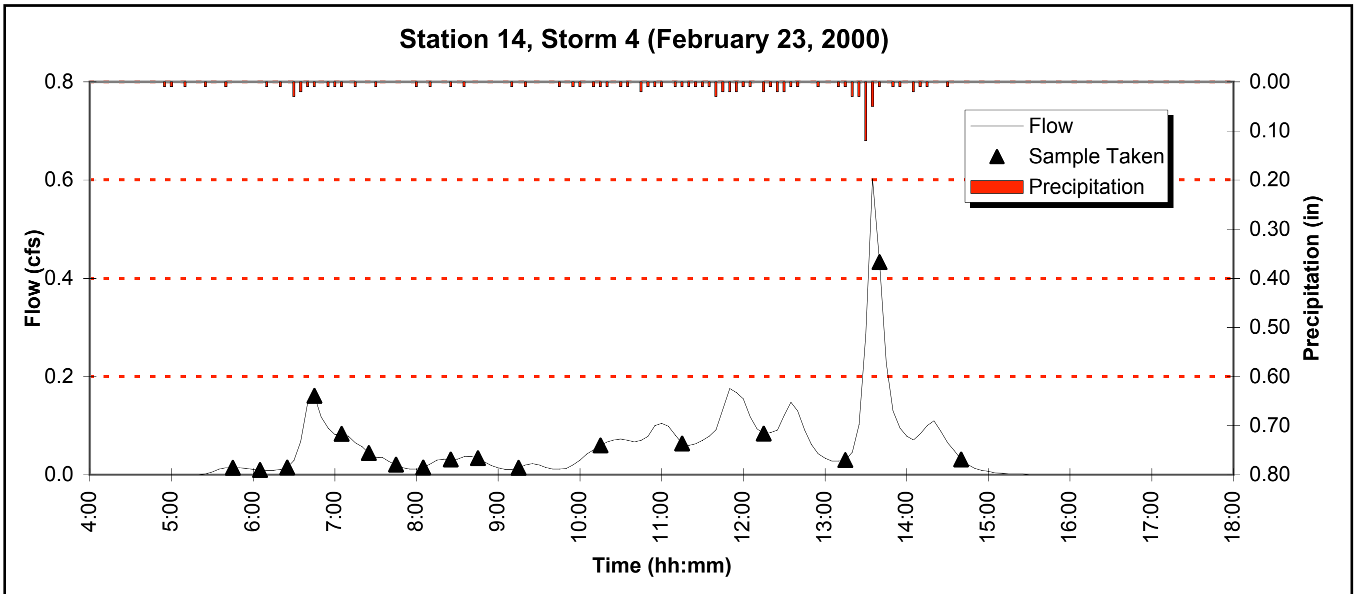
Station 14, Storm 4 (February 23, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

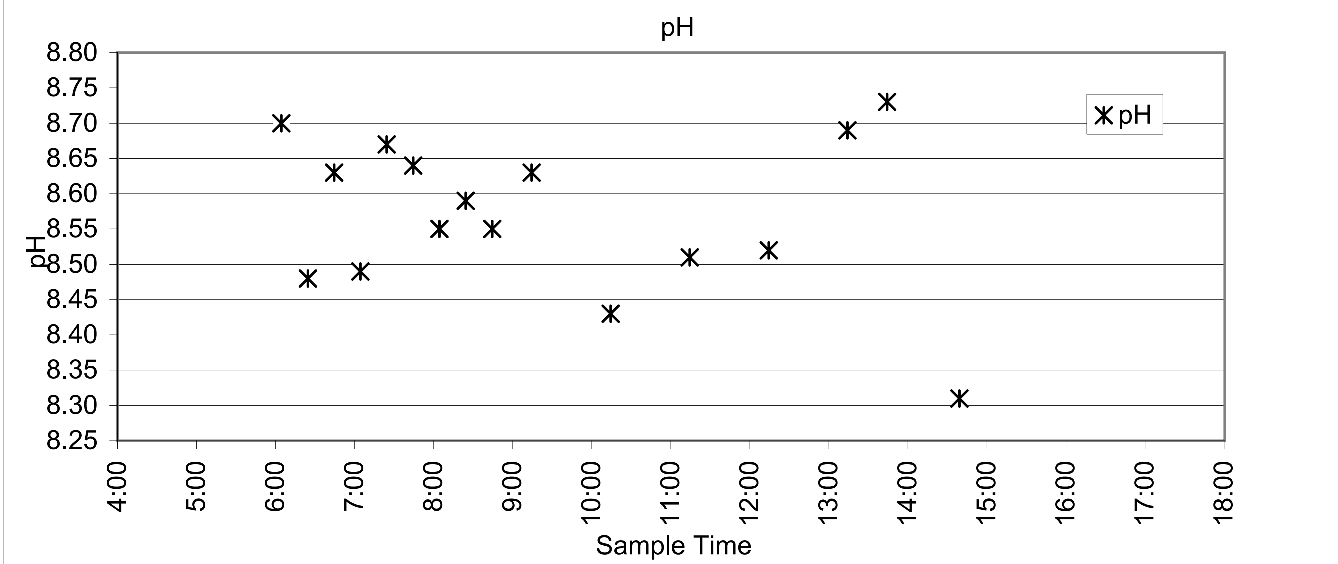


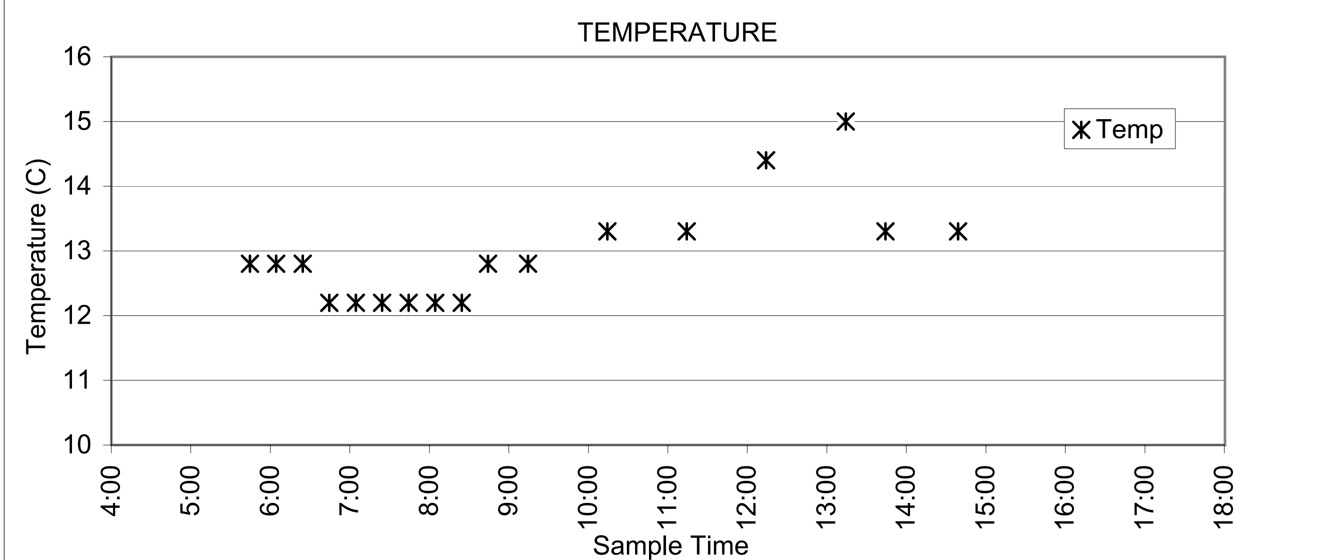
OIL & GREASE
Concentration (mg/l)
Sample Time
Oil & Grease

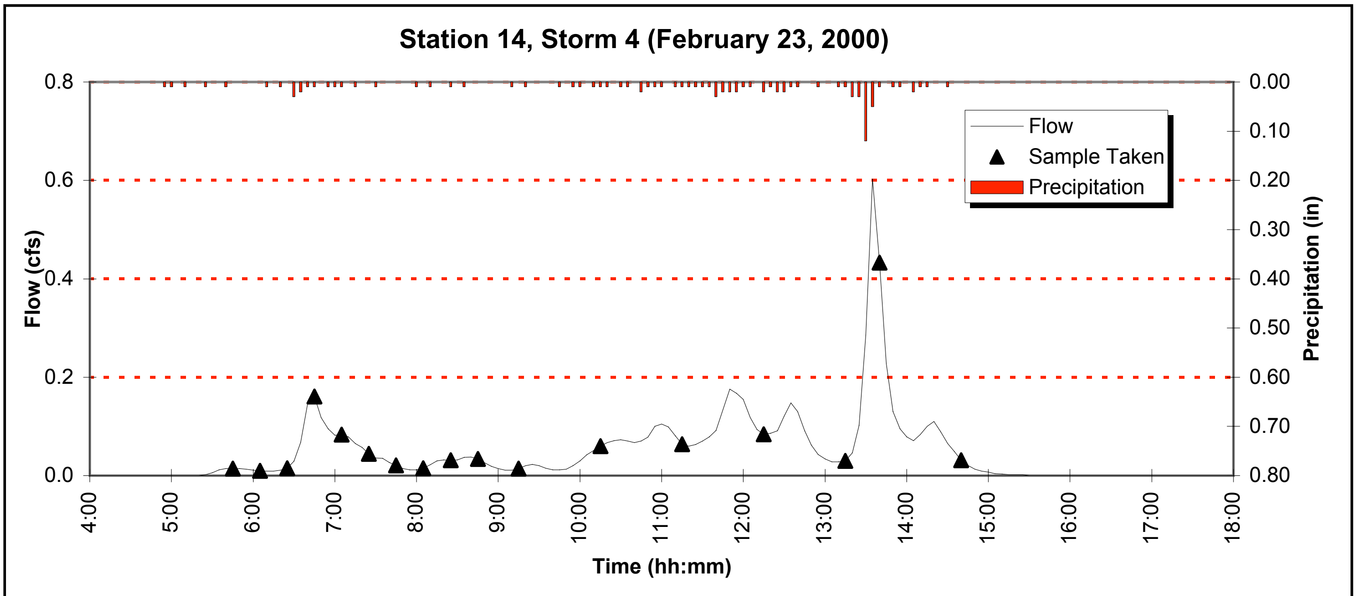


COLIFORM
Concentration (MPN/100 ml)
Sample Time
Fecal
Total

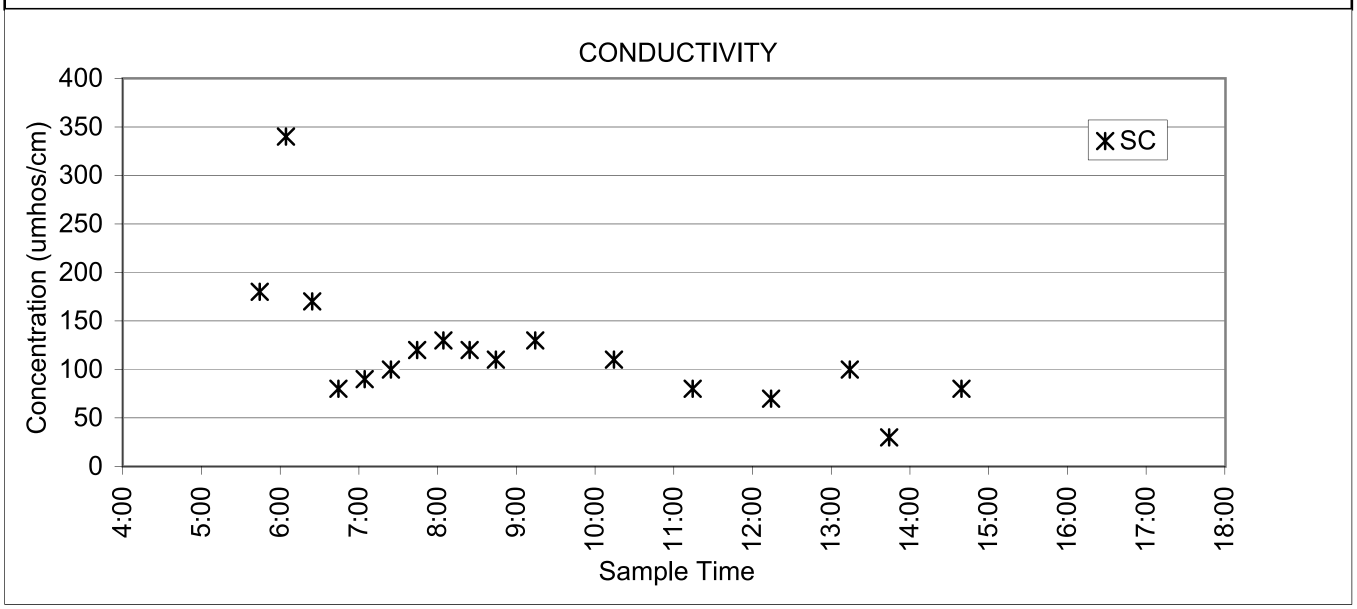

Station 14, Storm 4 (February 23, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


pH
pH
pH
Sample Time

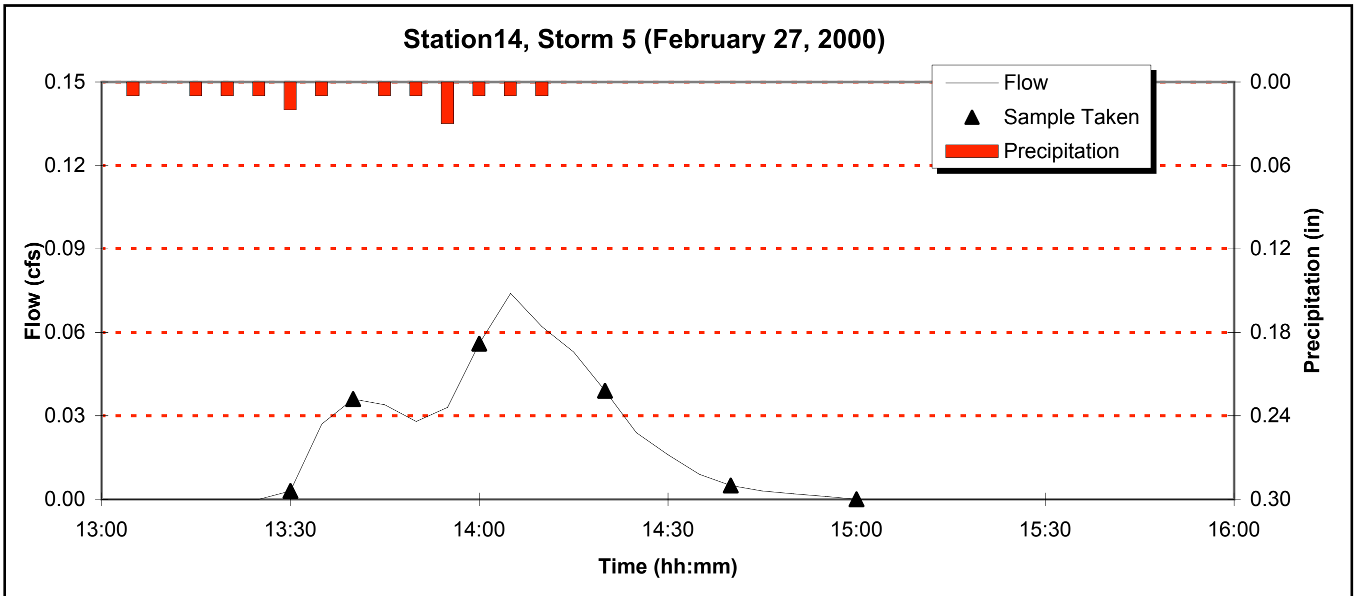

TEMPERATURE
Temp
Temperature (C)
Sample Time

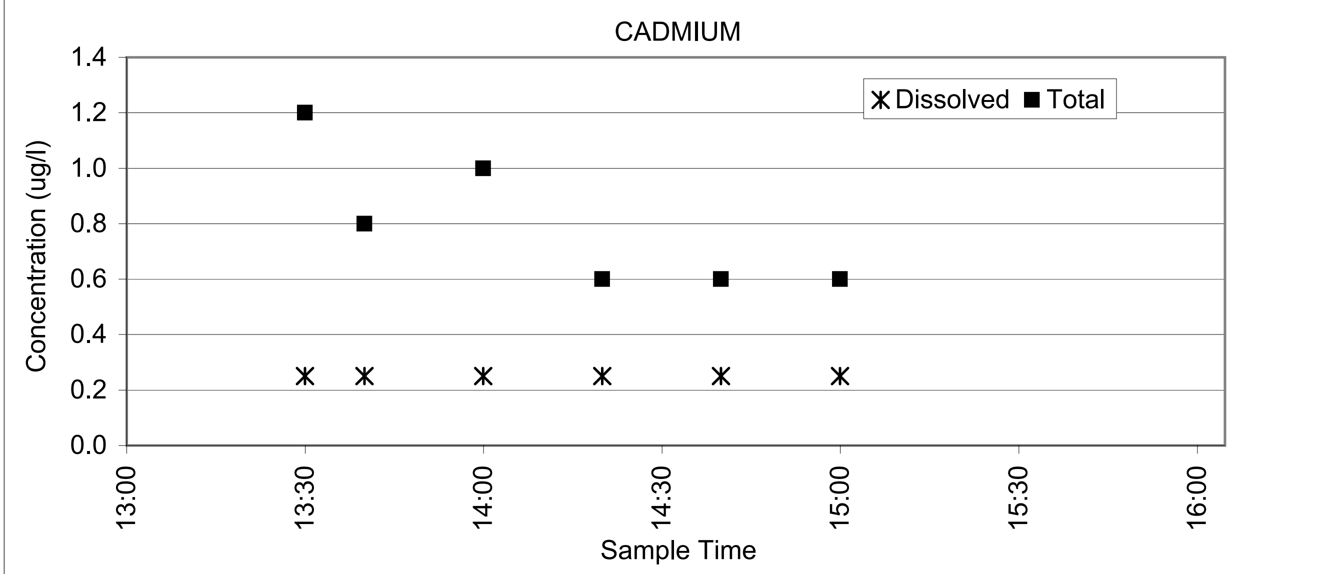


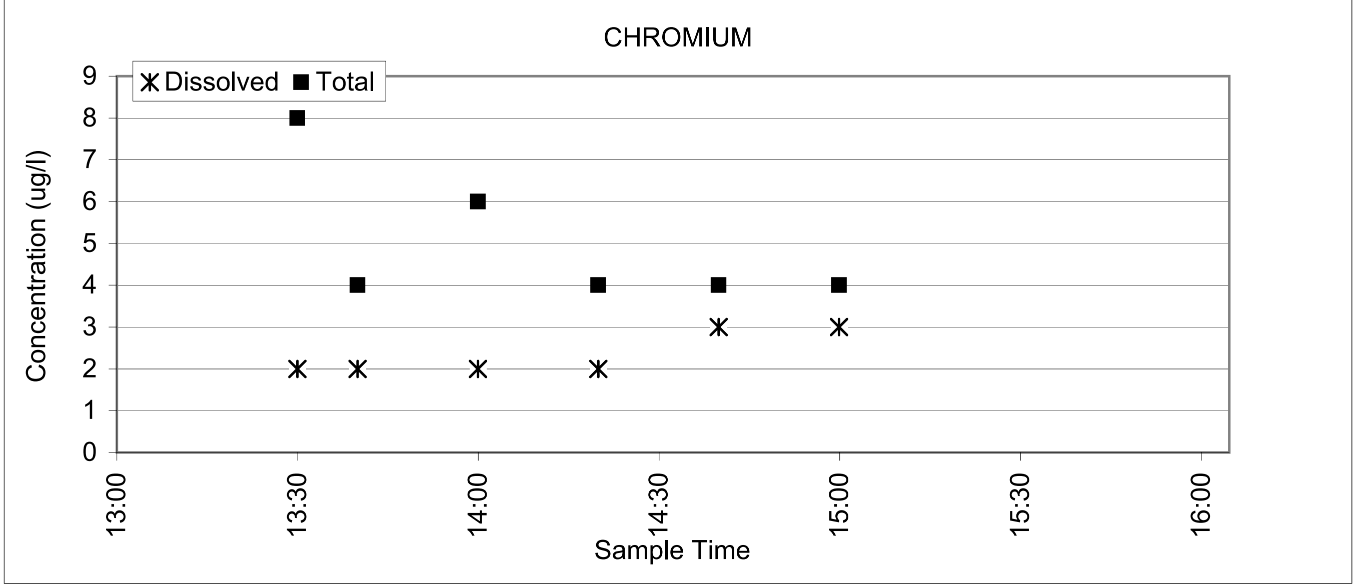
Station 14, Storm 4 (February 23, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
0.8
0.6
0.4
0.2
0.0
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00

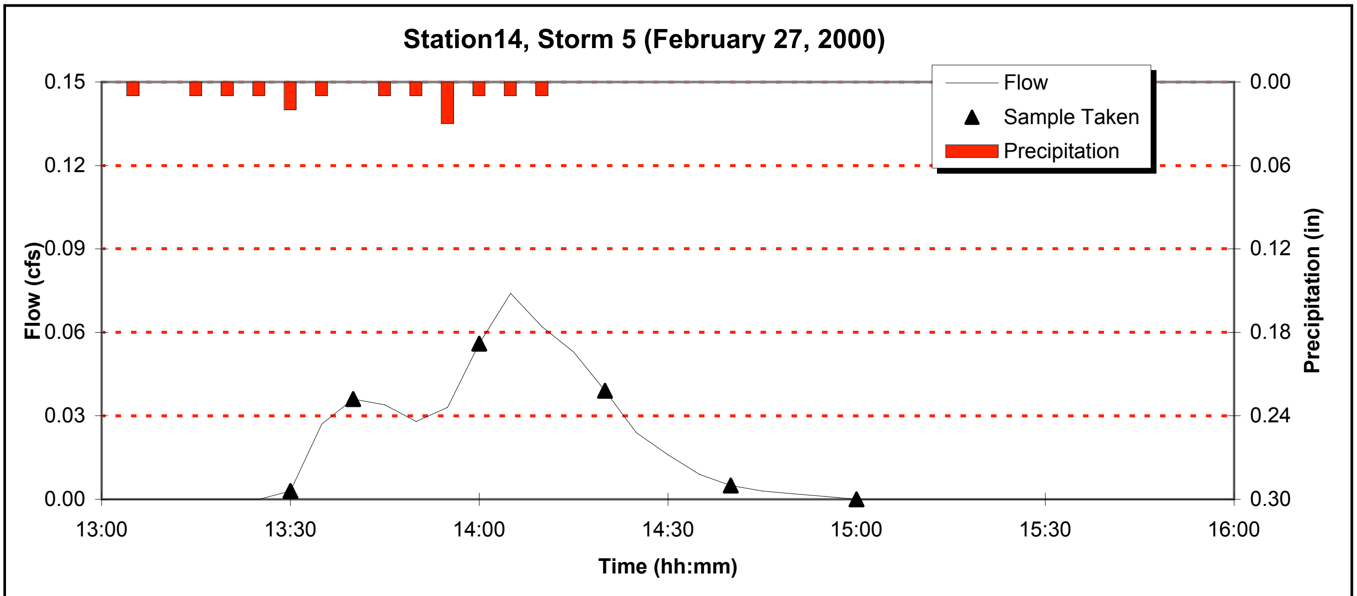


CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
SC
400
350
300
250
200
150
100
50
0
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00

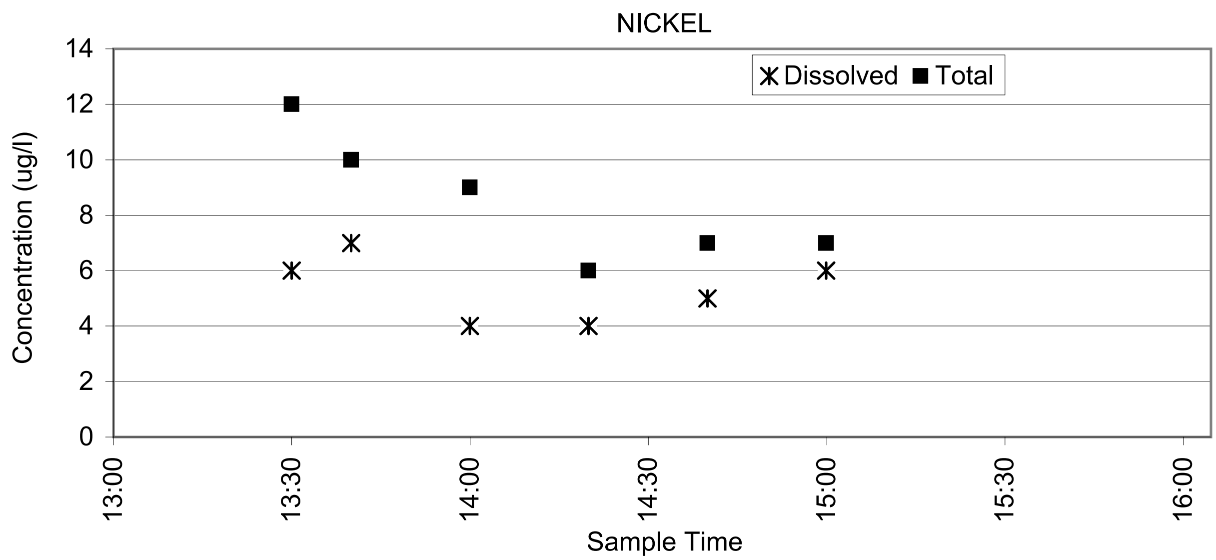

Station14, Storm 5 (February 27, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.15
0.12
0.09
0.06
0.03
0.00
0.00
0.06
0.12
0.18
0.24
0.30
13:00
13:30
14:00
14:30
15:00
15:30
16:00


CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
13:00
13:30
14:00
14:30
15:00
15:30
16:00

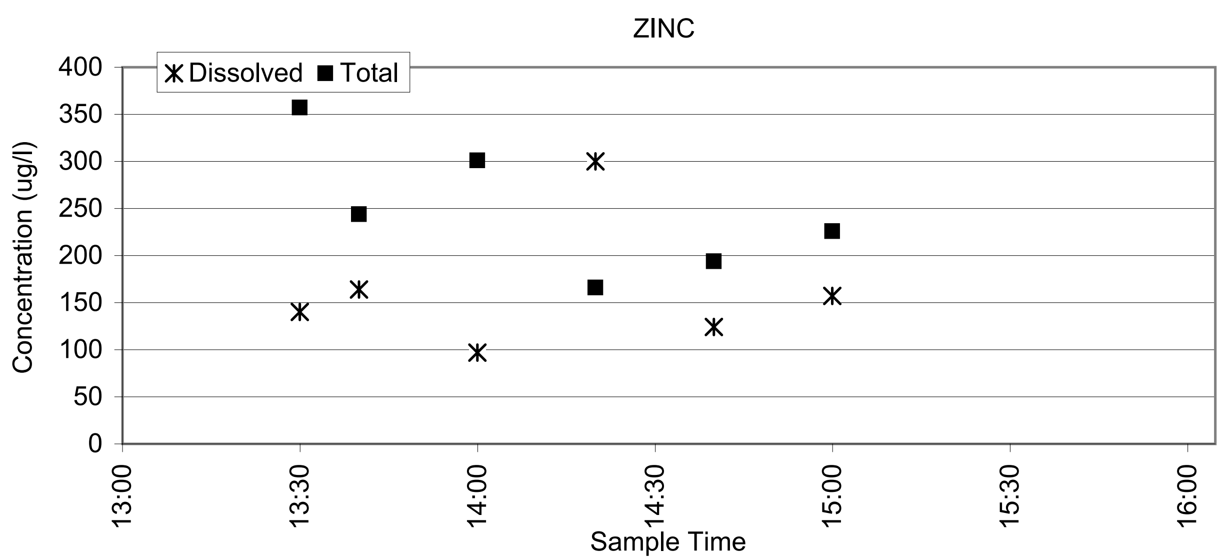

CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time
9
8
7
6
5
4
3
2
1
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00



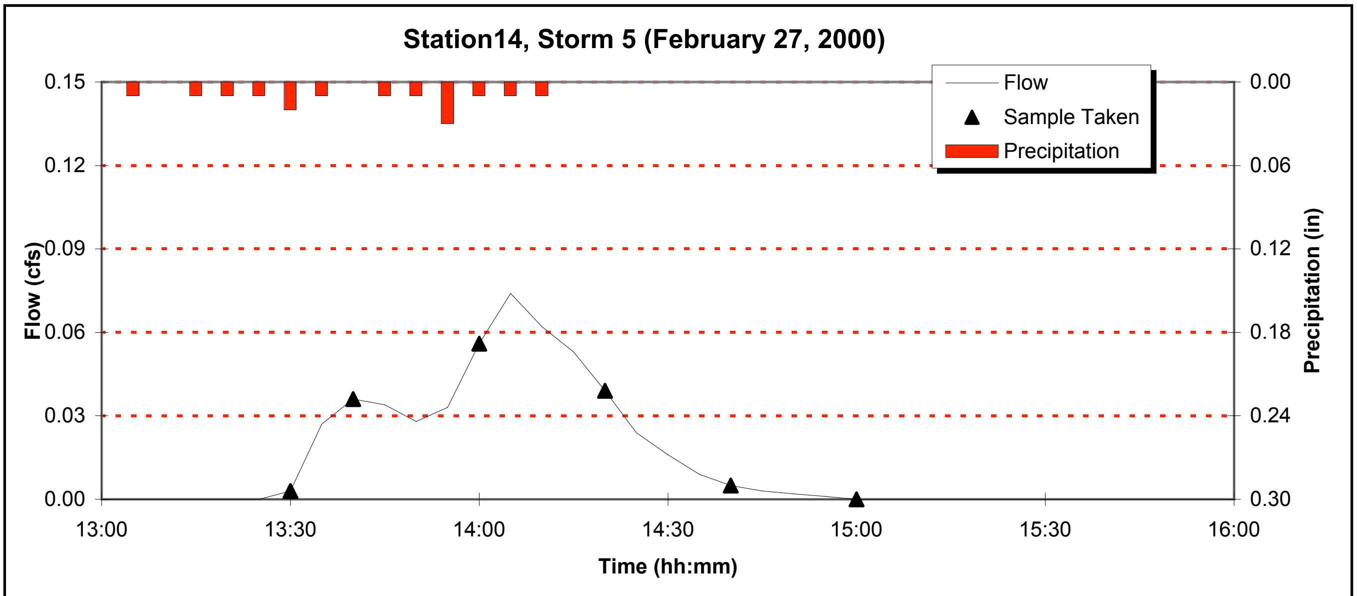
Station14, Storm 5 (February 27, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
0.15
0.12
0.09
0.06
0.03
0.00
0.00
0.06
0.12
0.18
0.24
0.30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Time (hh:mm)



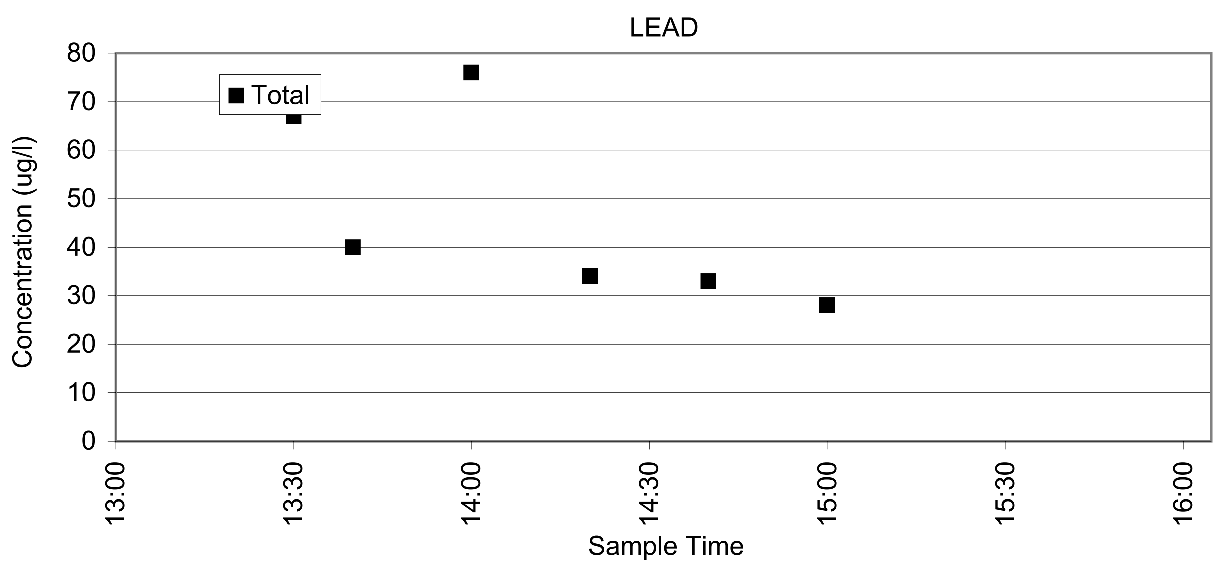
NICKEL
Dissolved
Total
Concentration (ug/l)
14
12
10
8
6
4
2
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Sample Time



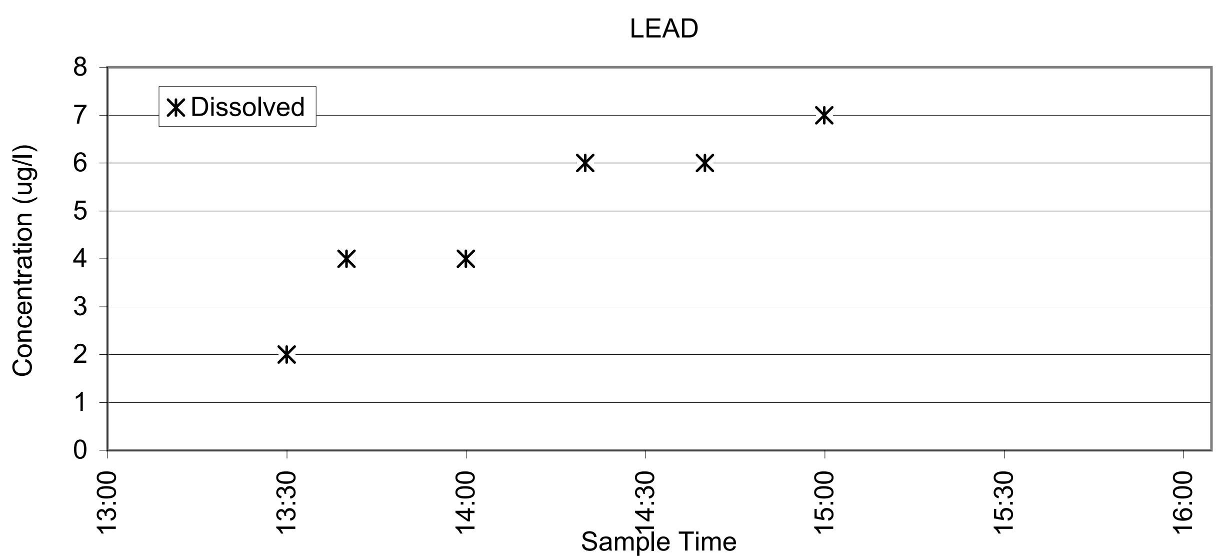
ZINC
Dissolved
Total
Concentration (ug/l)
400
350
300
250
200
150
100
50
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Sample Time



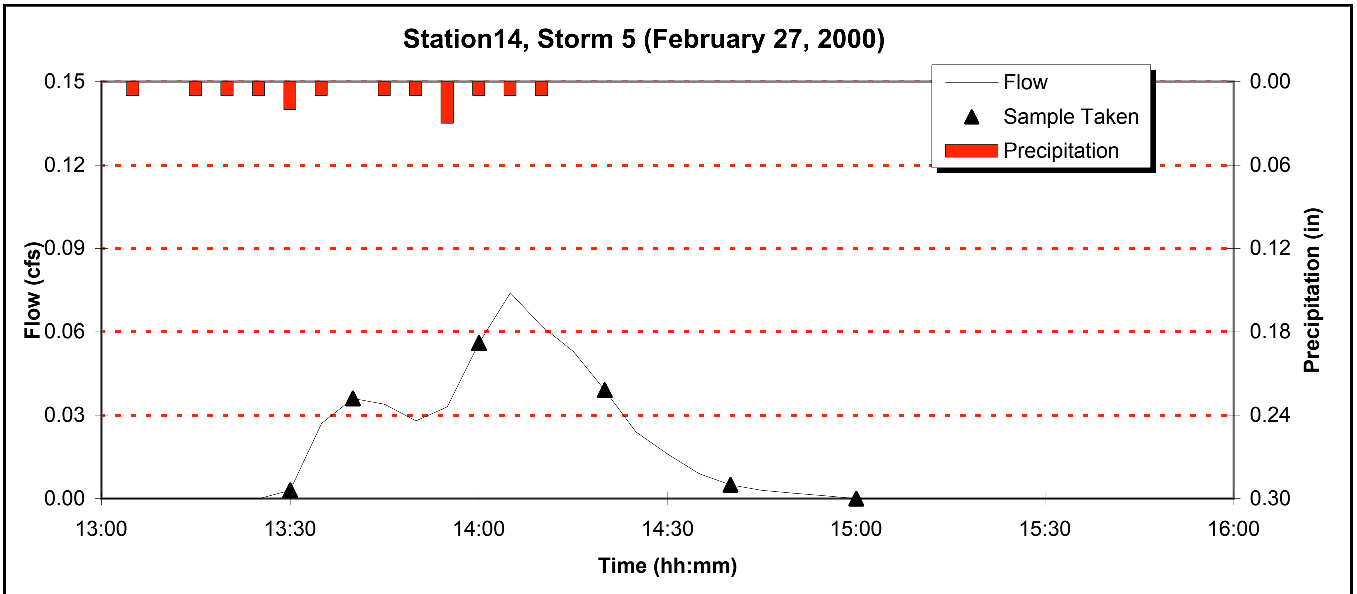
Station14, Storm 5 (February 27, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
0.15
0.12
0.09
0.06
0.03
0.00
0.00
0.06
0.12
0.18
0.24
0.30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Time (hh:mm)



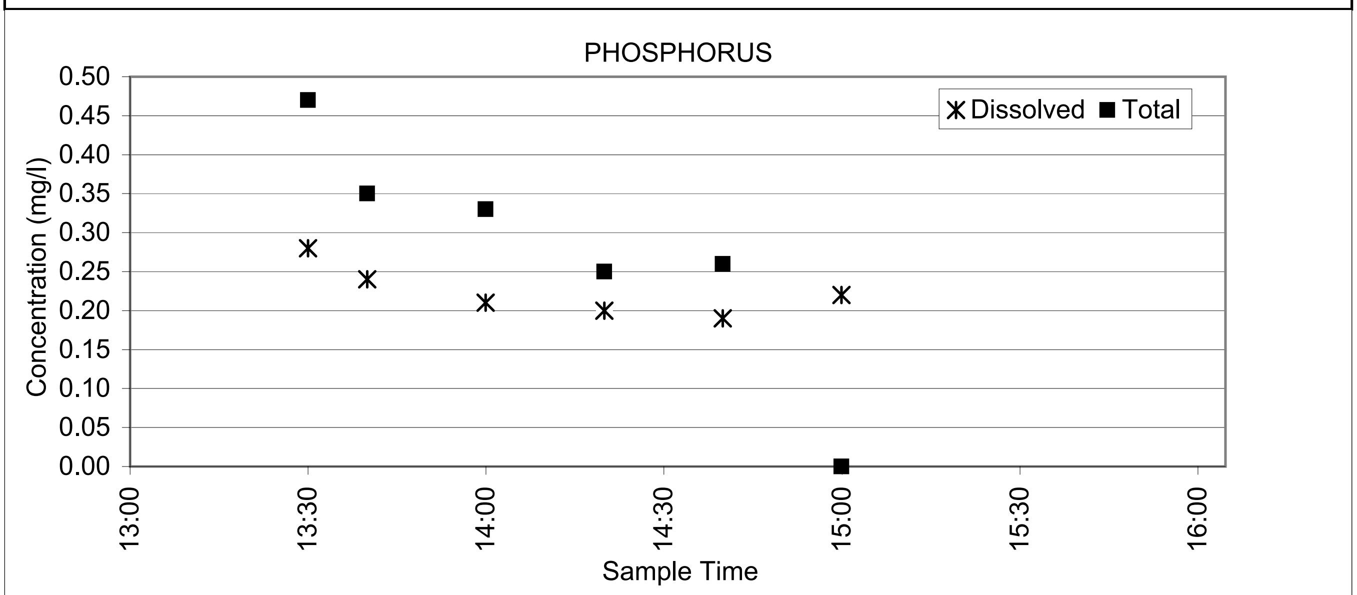
LEAD
Total
Concentration (ug/l)
80
70
60
50
40
30
20
10
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Sample Time



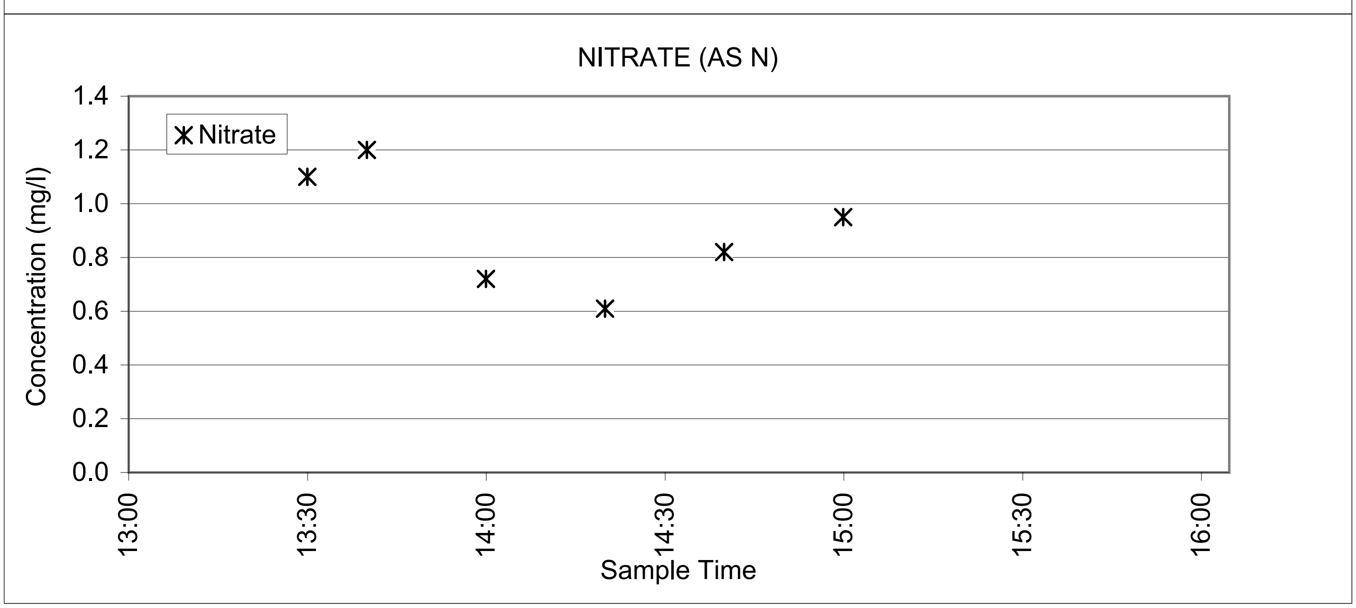
LEAD
Dissolved
Concentration (ug/l)
8
7
6
5
4
3
2
1
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Sample Time



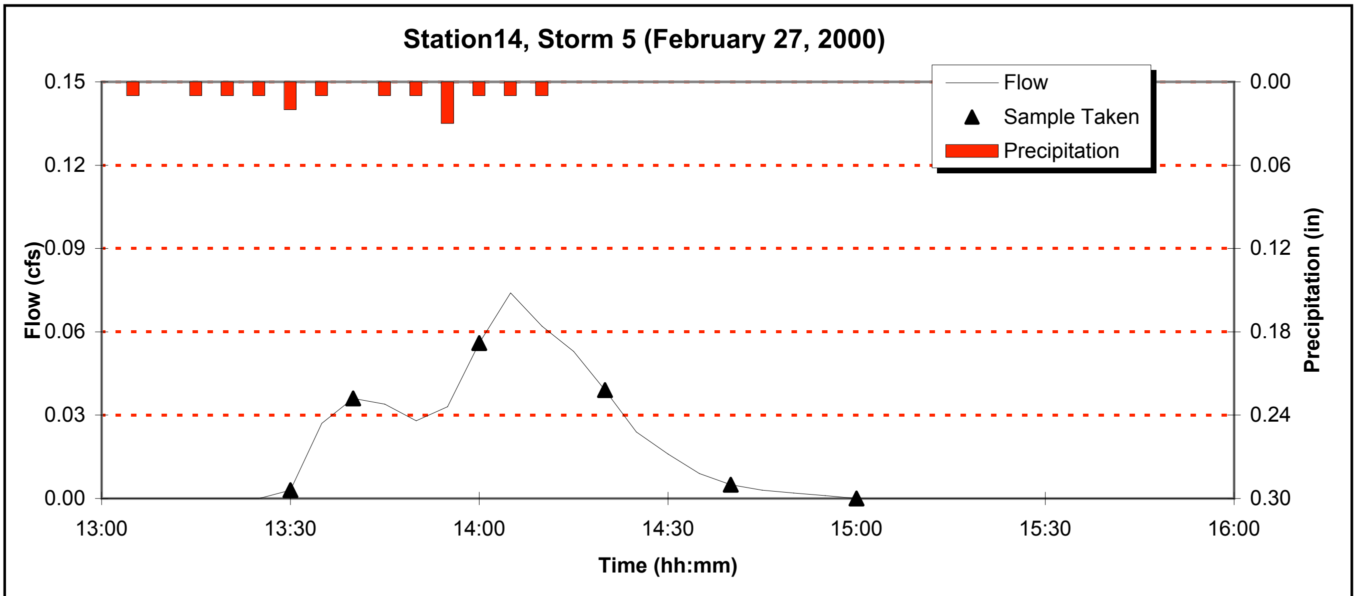
Station14, Storm 5 (February 27, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
0.15
0.12
0.09
0.06
0.03
0.00
0.00
0.06
0.12
0.18
0.24
0.30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Time (hh:mm)



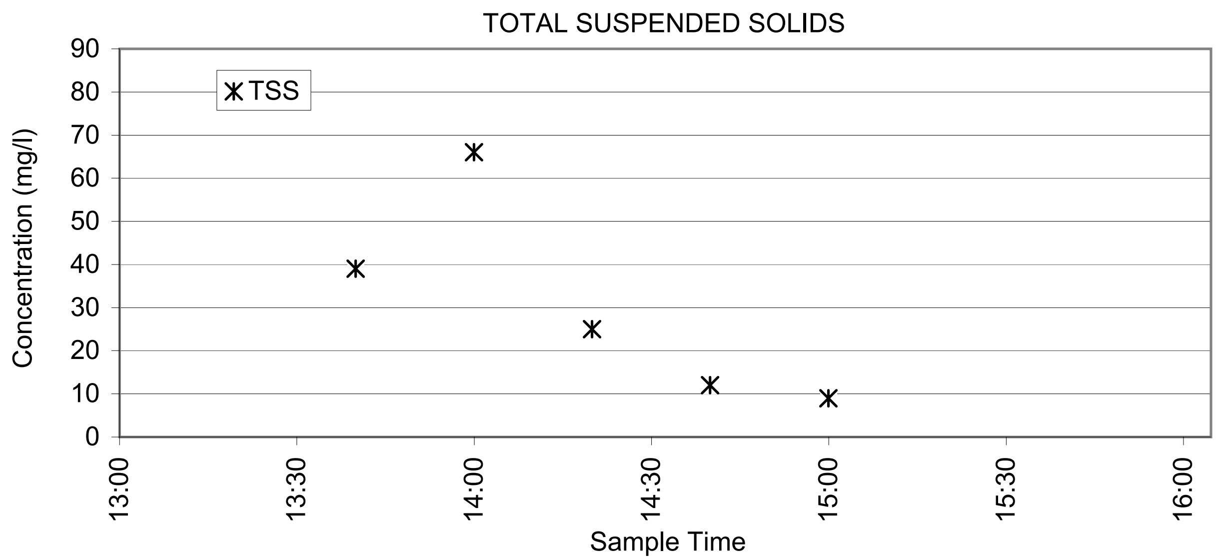
PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Sample Time



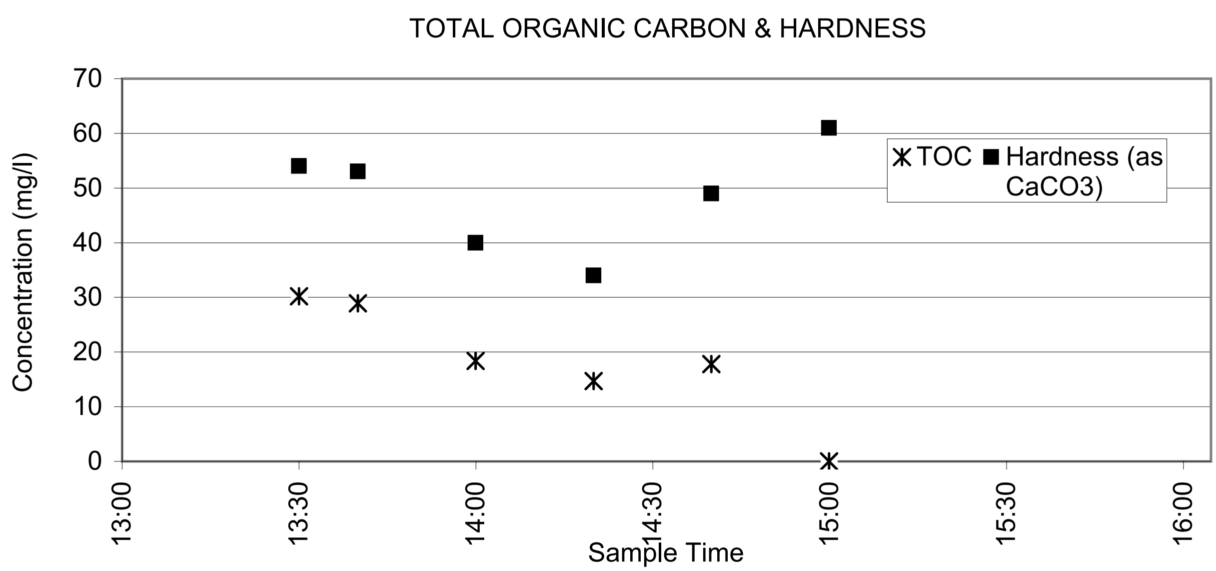
NITRATE (AS N)
Nitrate
Concentration (mg/l)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Sample Time



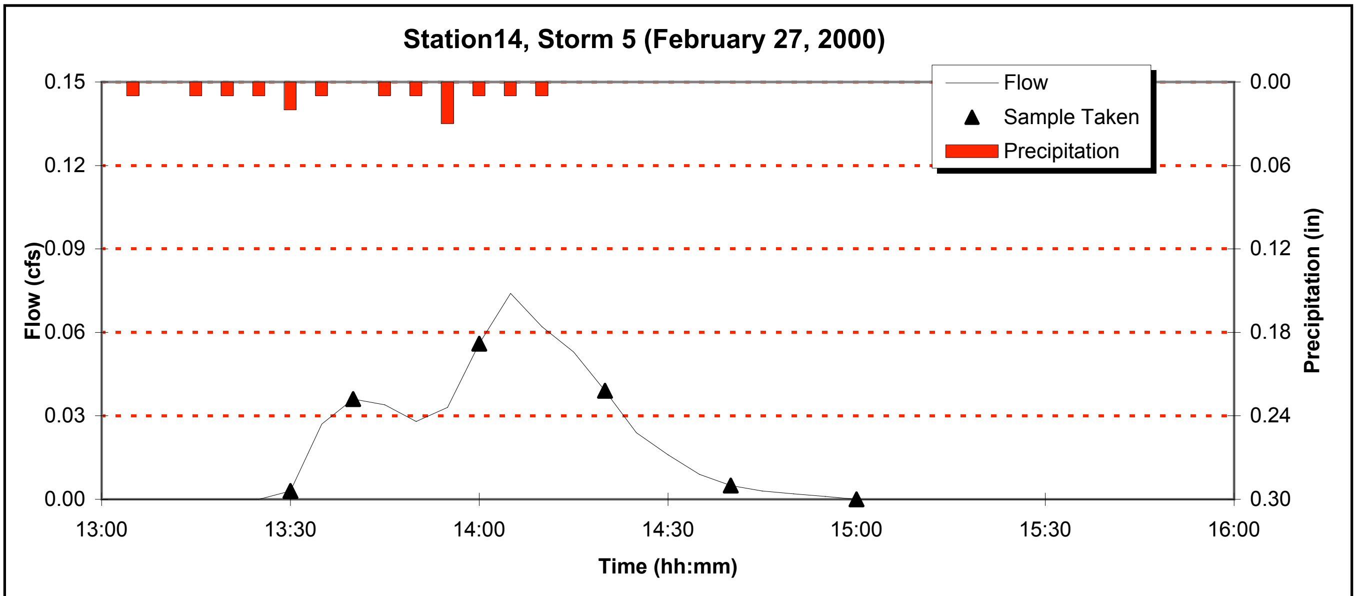
Station14, Storm 5 (February 27, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
0.15
0.12
0.09
0.06
0.03
0.00
0.00
0.06
0.12
0.18
0.24
0.30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Time (hh:mm)



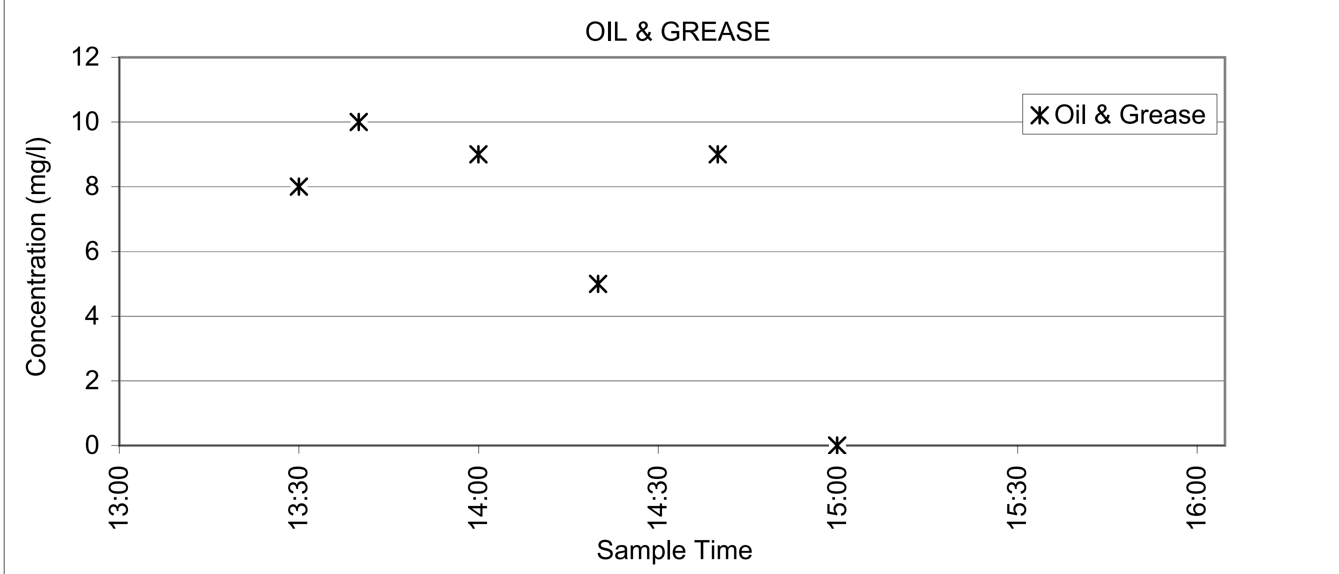
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
90
80
70
60
50
40
30
20
10
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Sample Time



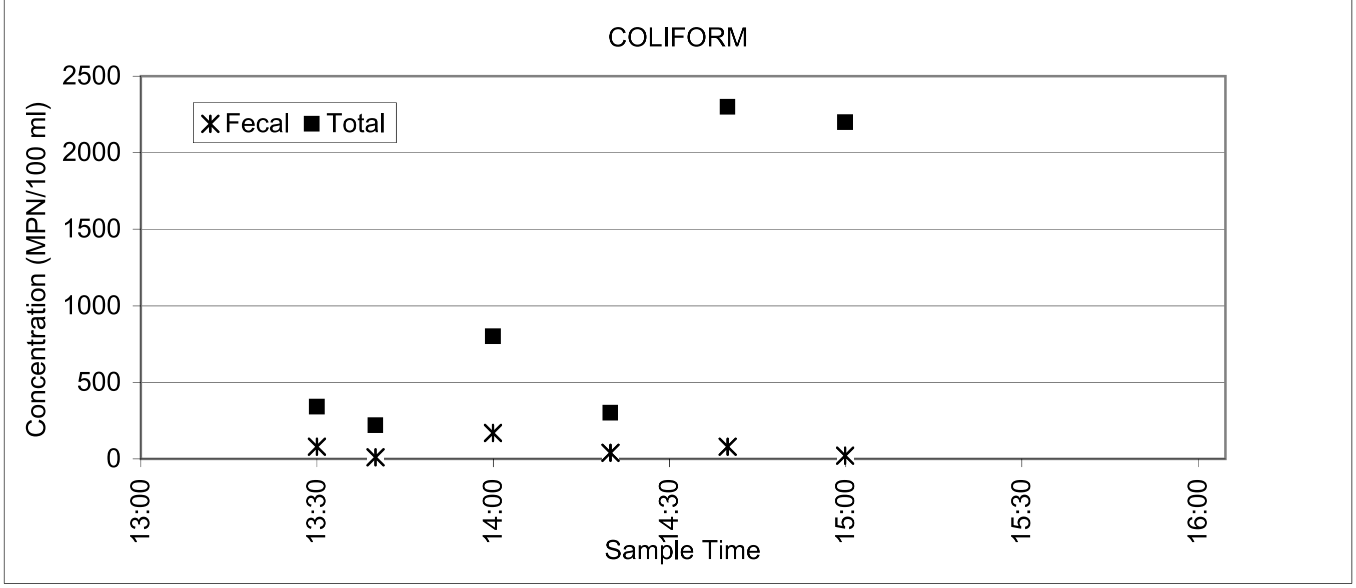
TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
70
60
50
40
30
20
10
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Sample Time



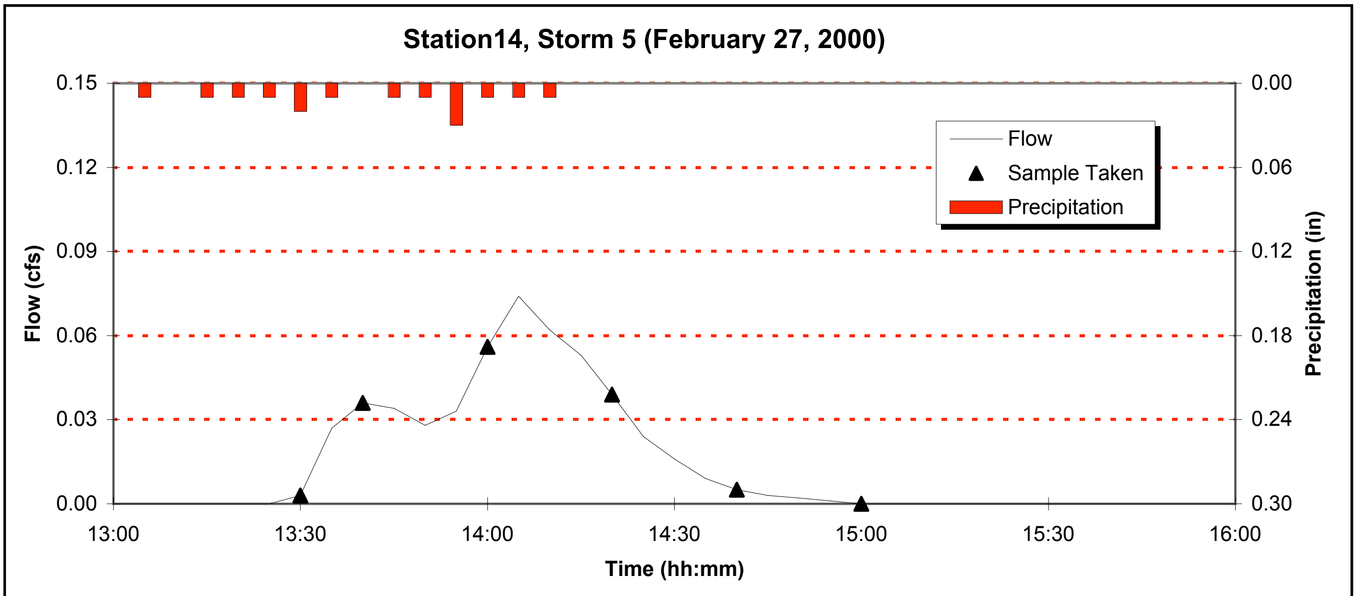
Station14, Storm 5 (February 27, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.15
0.12
0.09
0.06
0.03
0.00
0.00
0.06
0.12
0.18
0.24
0.30
13:00
13:30
14:00
14:30
15:00
15:30
16:00



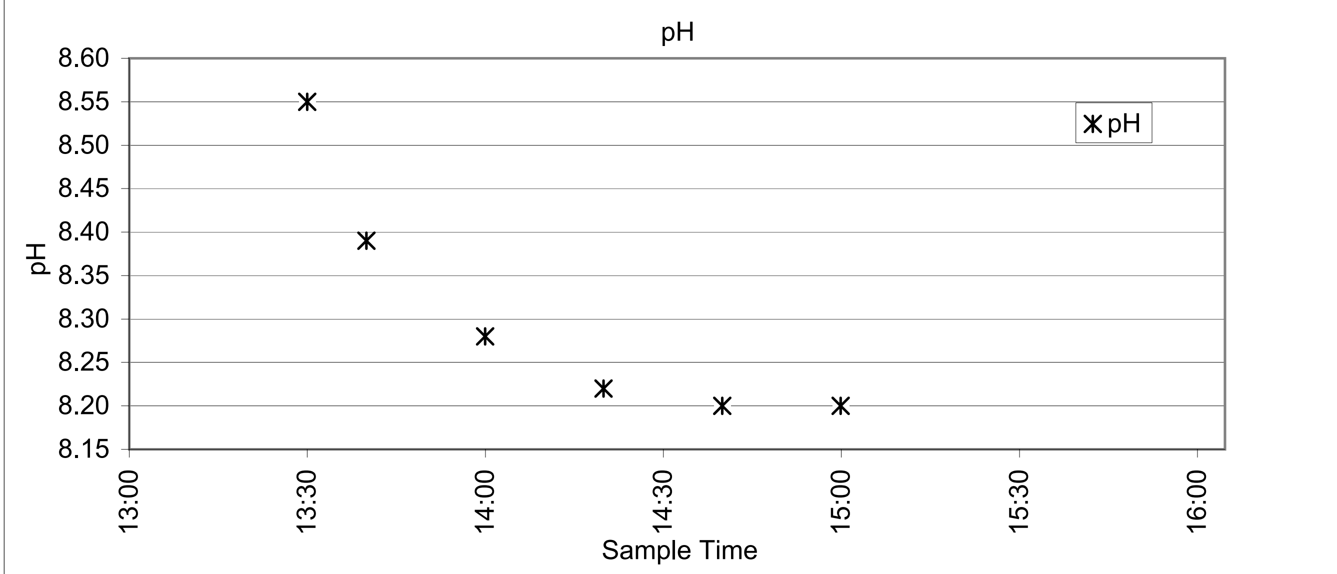
OIL & GREASE
Oil & Grease
Concentration (mg/l)
Sample Time
12
10
8
6
4
2
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00



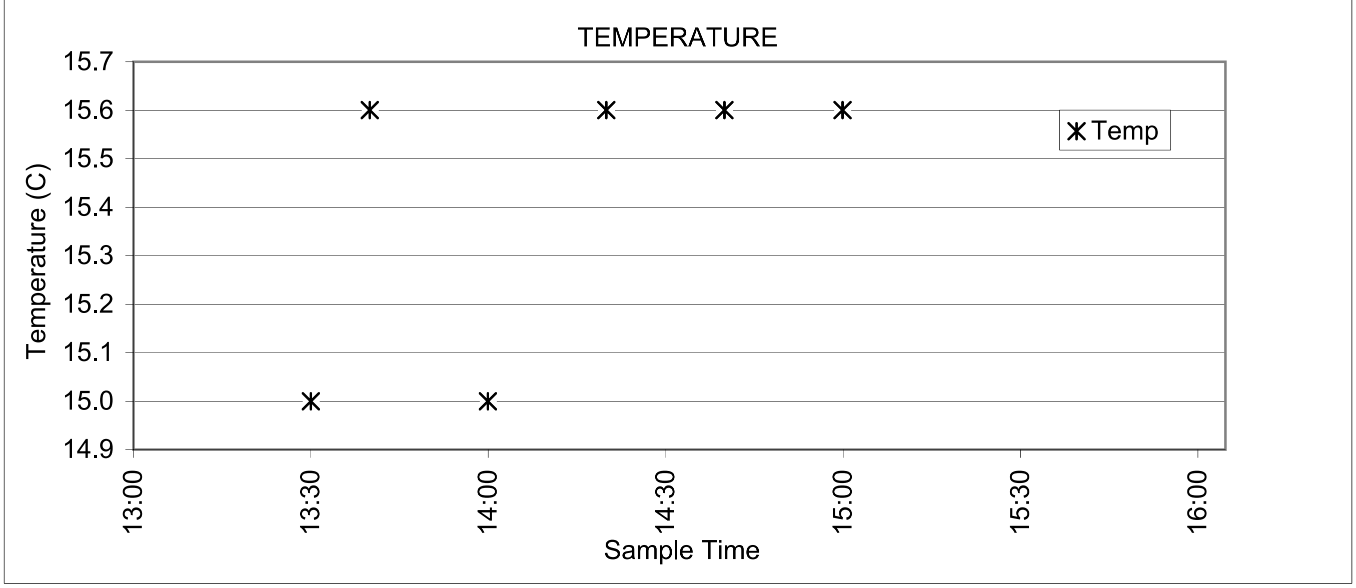
COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
Sample Time
2500
2000
1500
1000
500
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00



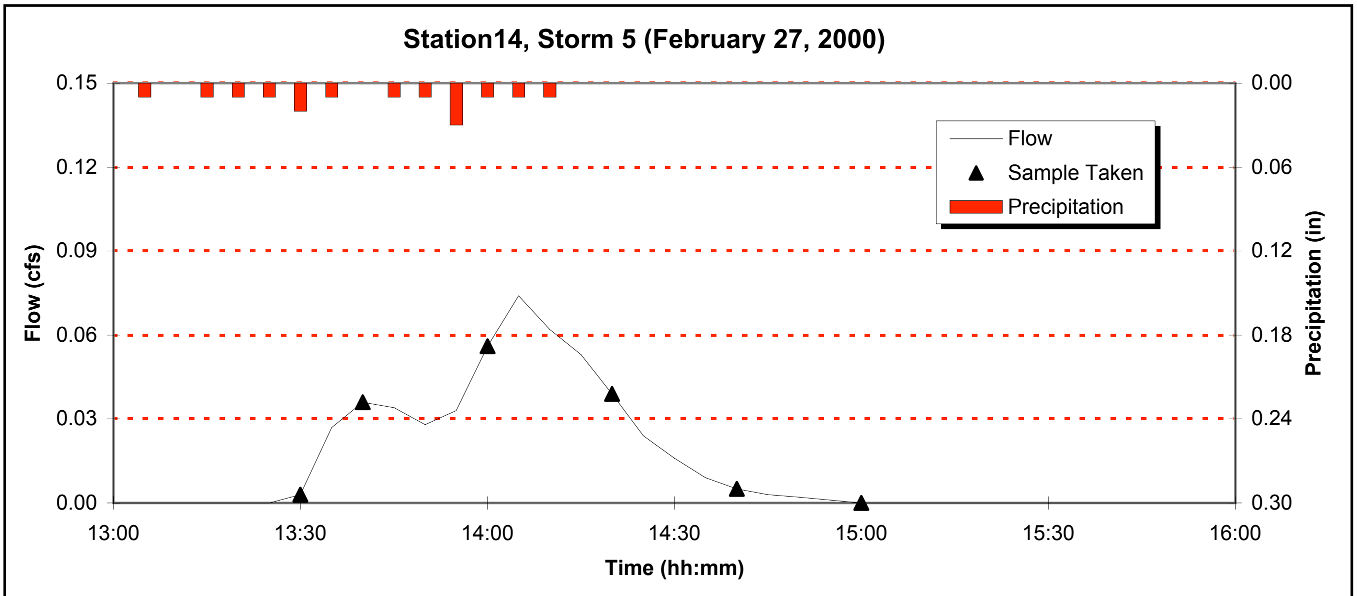
Station14, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
0.15
0.12
0.09
0.06
0.03
0.00
0.00
0.06
0.12
0.18
0.24
0.30
13:00
13:30
14:00
14:30
15:00
15:30
16:00

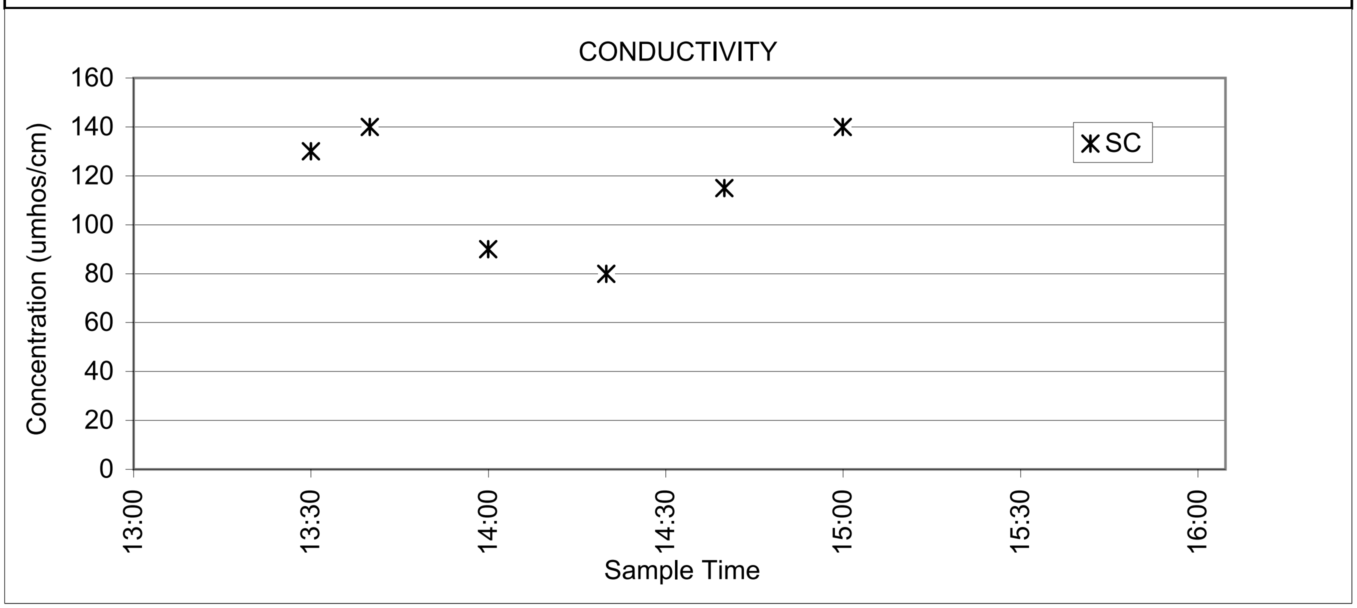


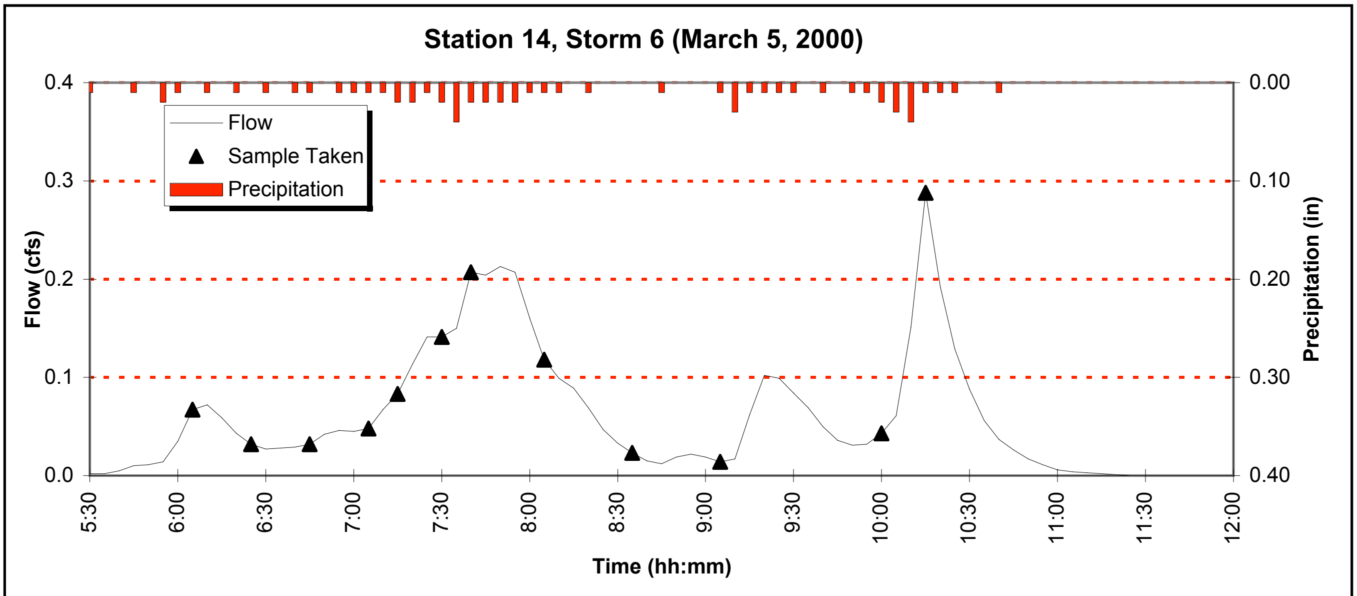
pH
pH
Sample Time
8.60
8.55
8.50
8.45
8.40
8.35
8.30
8.25
8.20
8.15
13:00
13:30
14:00
14:30
15:00
15:30
16:00



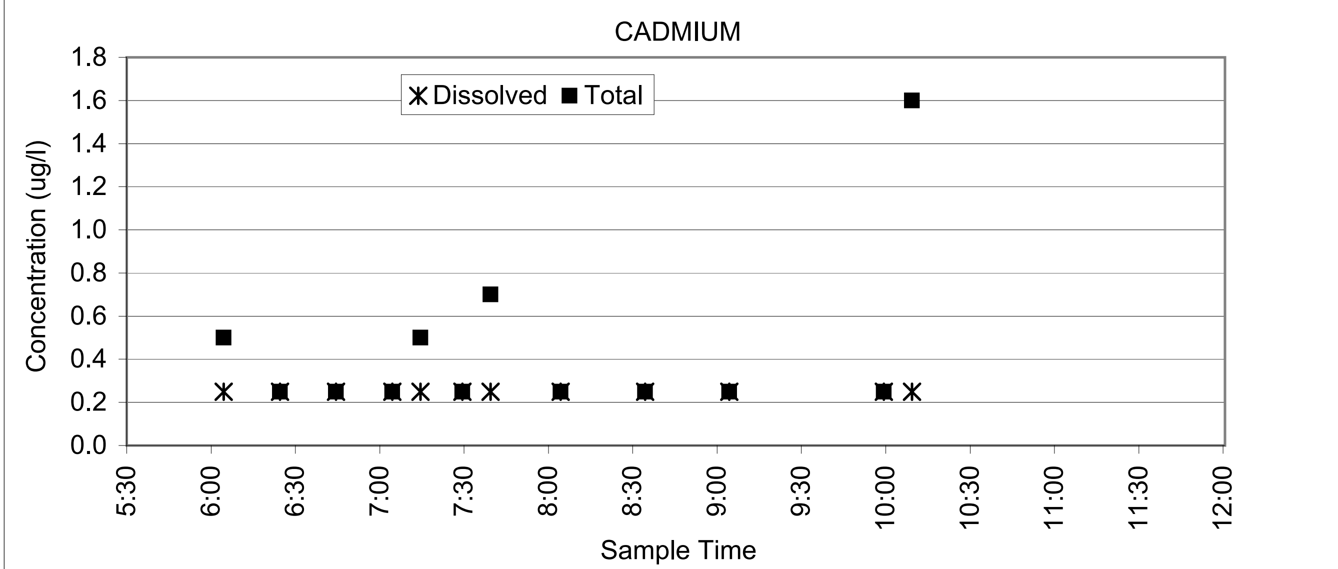
TEMPERATURE
Temp
Temperature (C)
Sample Time
15.7
15.6
15.5
15.4
15.3
15.2
15.1
15.0
14.9
13:00
13:30
14:00
14:30
15:00
15:30
16:00


Station14, Storm 5 (February 27, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.15
0.12
0.09
0.06
0.03
0.00
0.00
0.06
0.12
0.18
0.24
0.30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Flow
Sample Taken
Precipitation

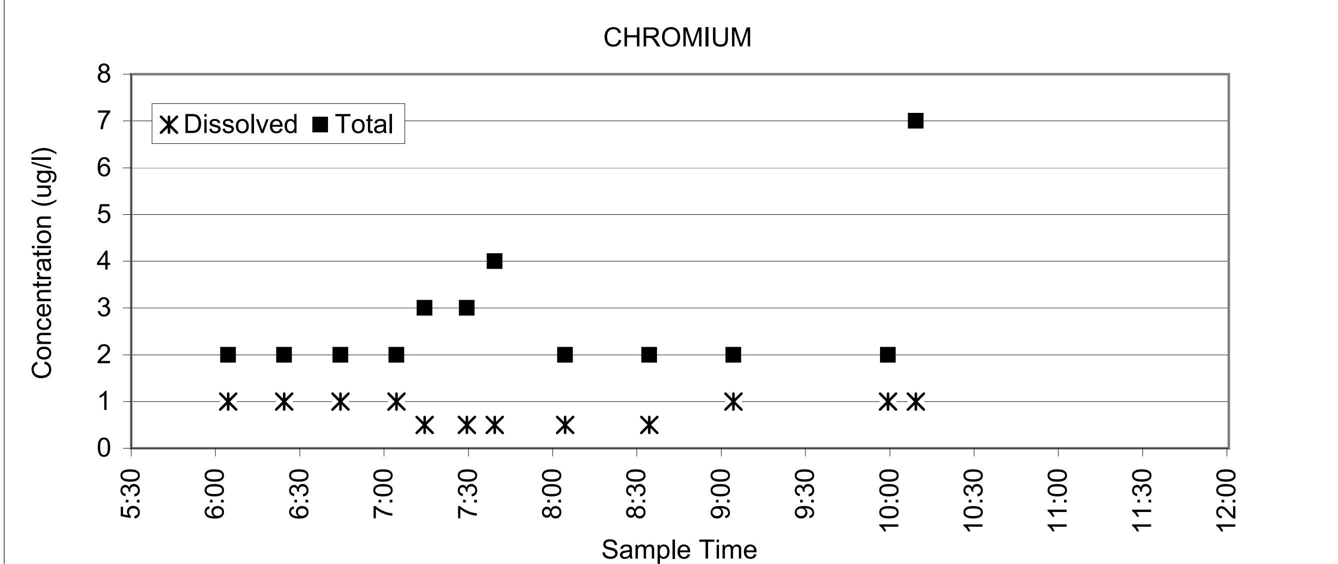

CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
160
140
120
100
80
60
40
20
0
13:00
13:30
14:00
14:30
15:00
15:30
16:00
SC



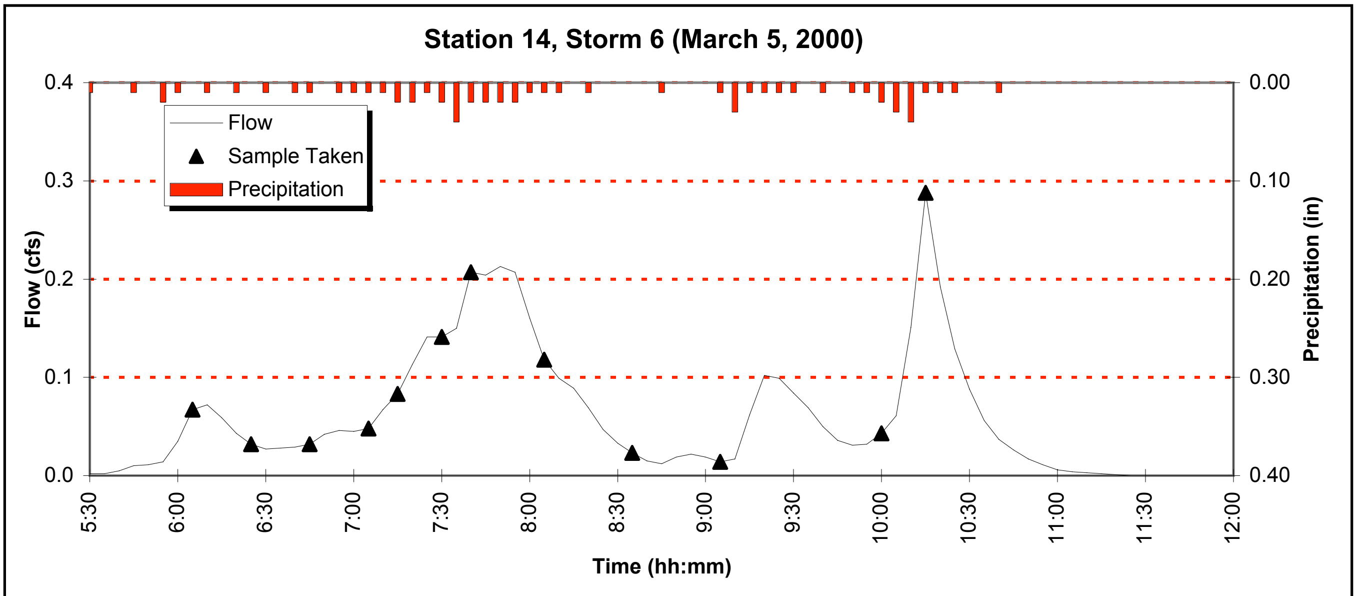
Station 14, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.4
0.3
0.2
0.1
0.0
0.00
0.10
0.20
0.30
0.40
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00



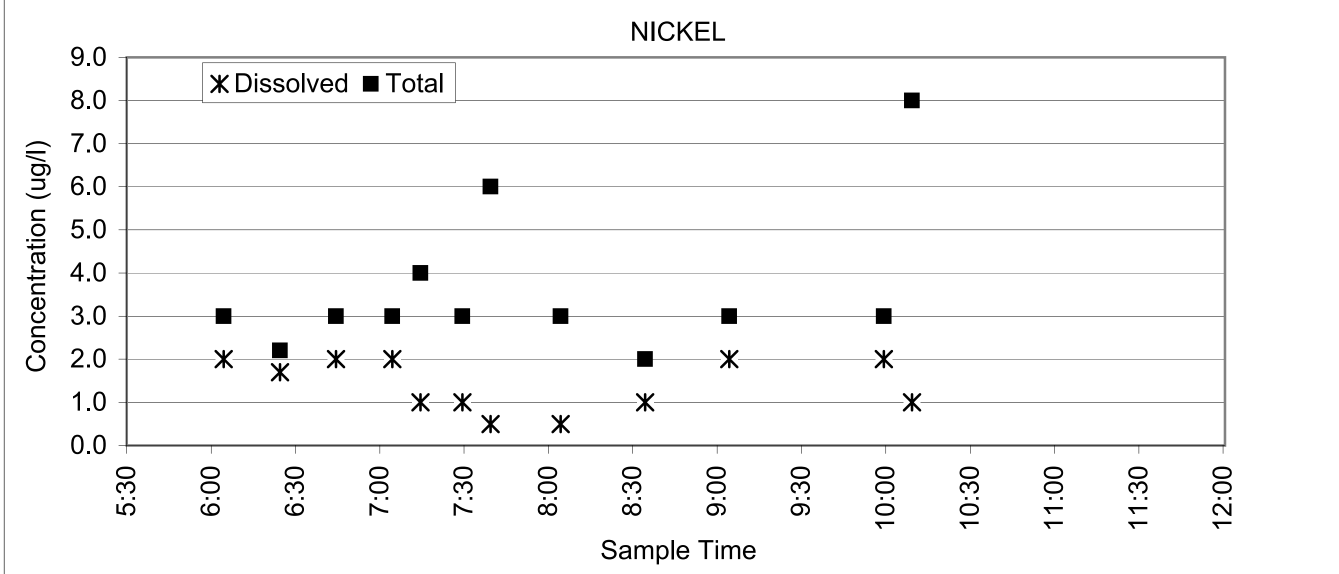
CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00



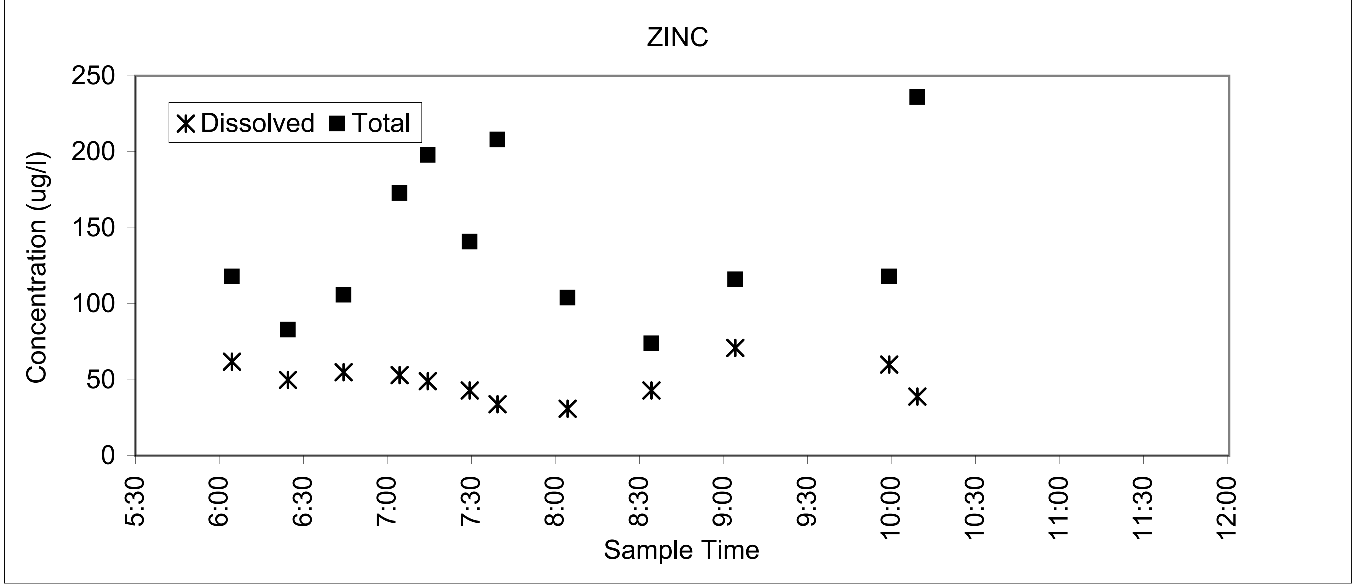
CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time
8
7
6
5
4
3
2
1
0
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00



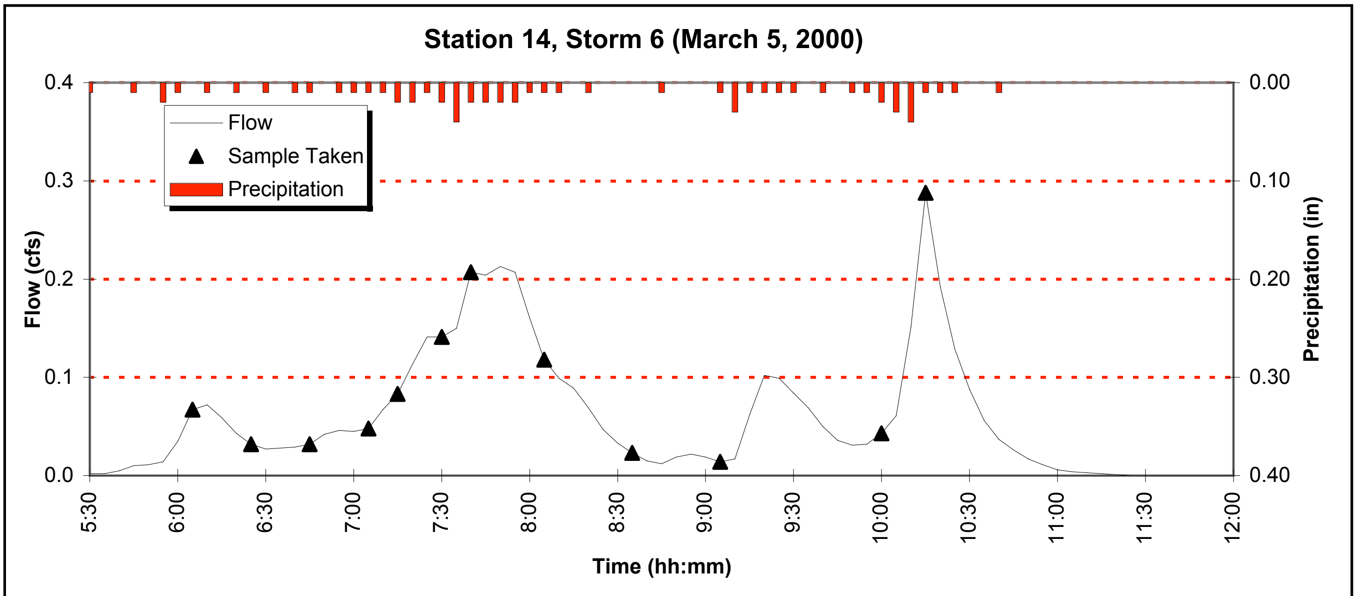
Station 14, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

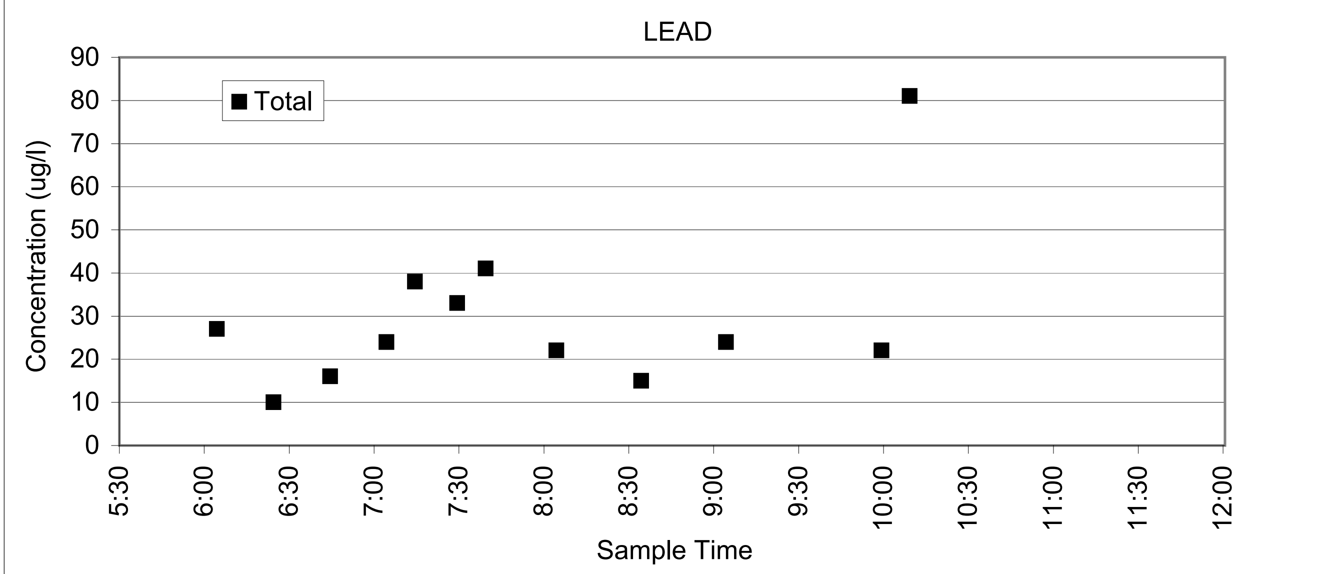


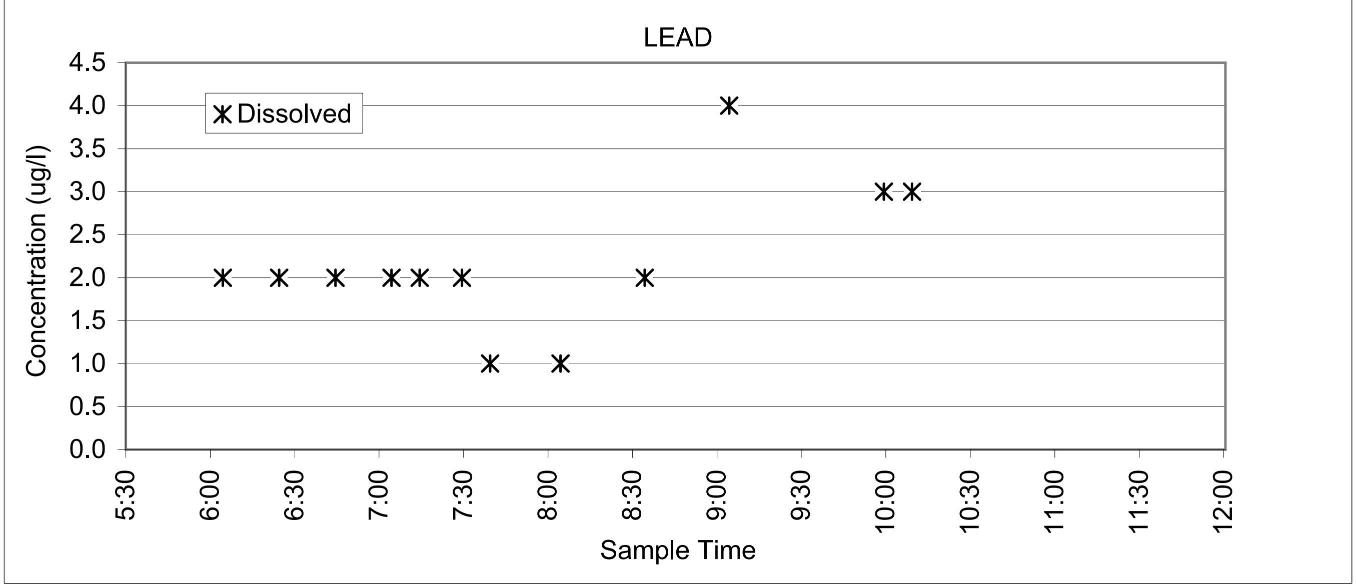
NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time

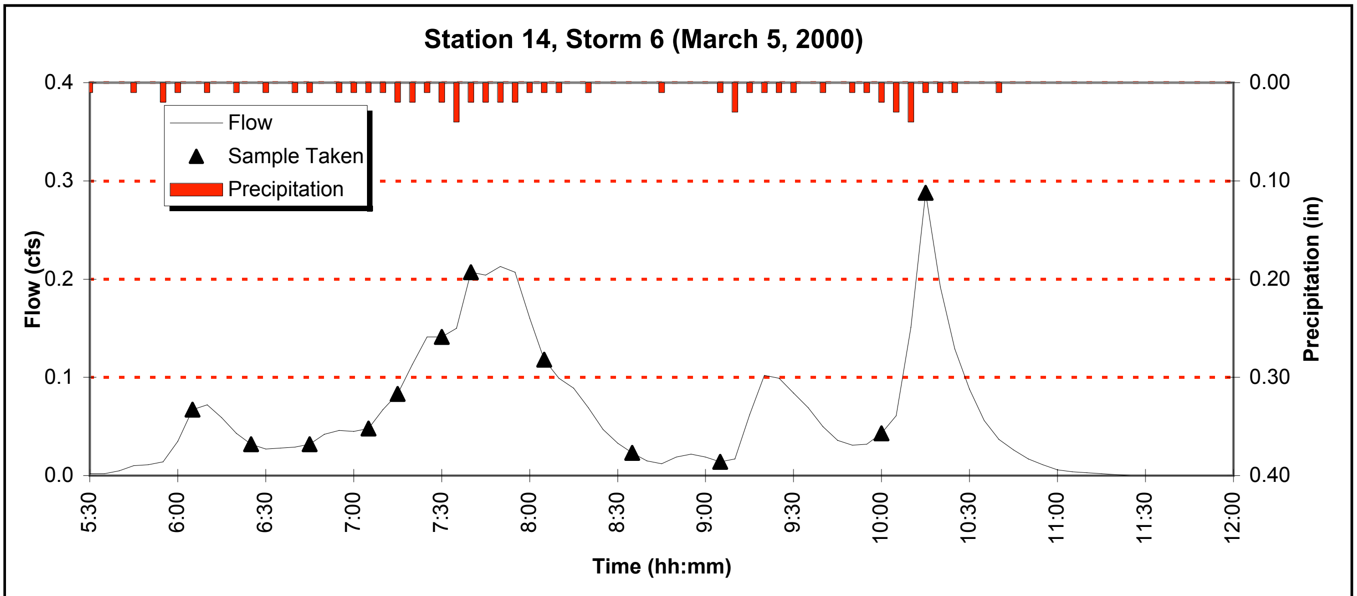


ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time

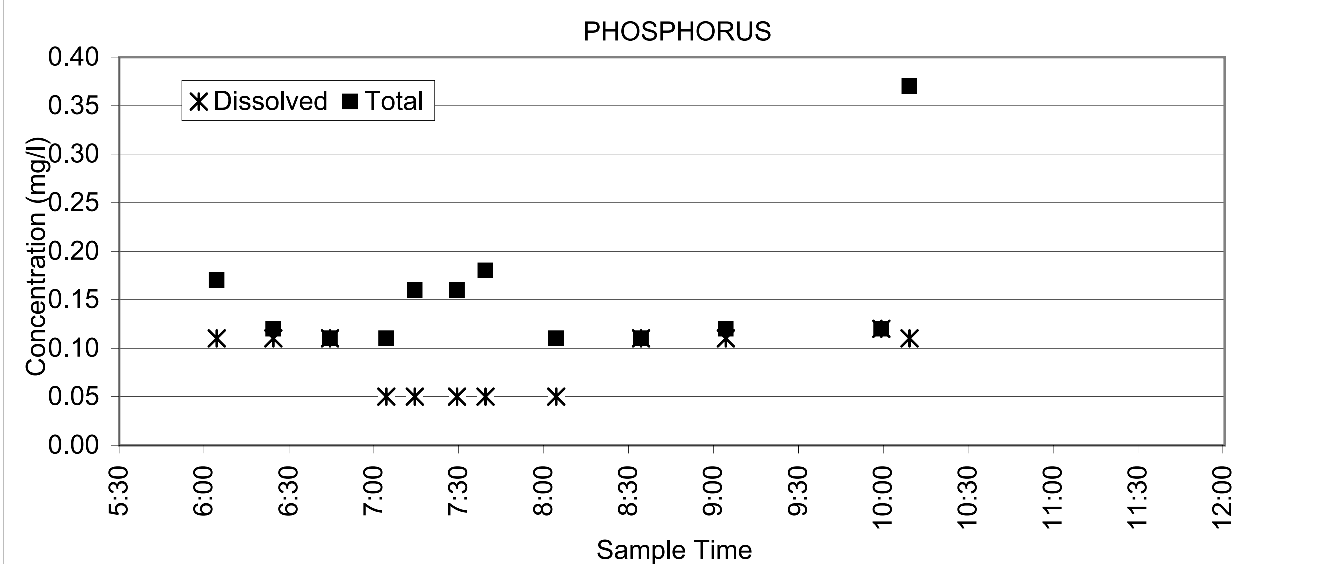

Station 14, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)


LEAD
Total
Concentration (ug/l)
Sample Time

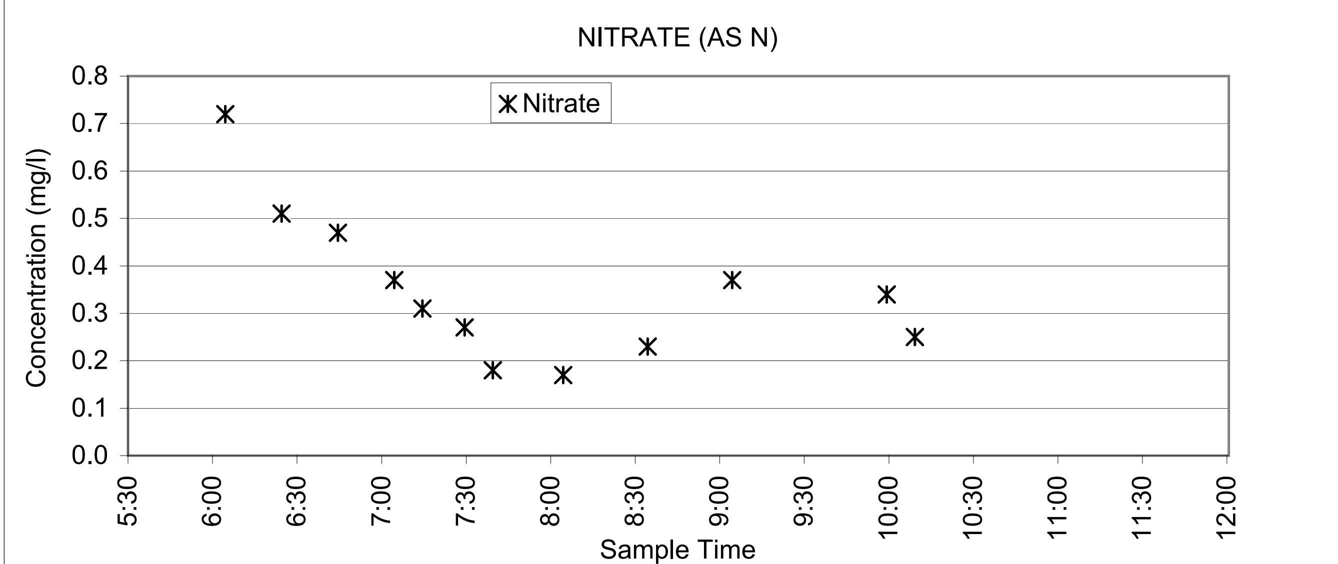

LEAD
Dissolved
Concentration (ug/l)
Sample Time



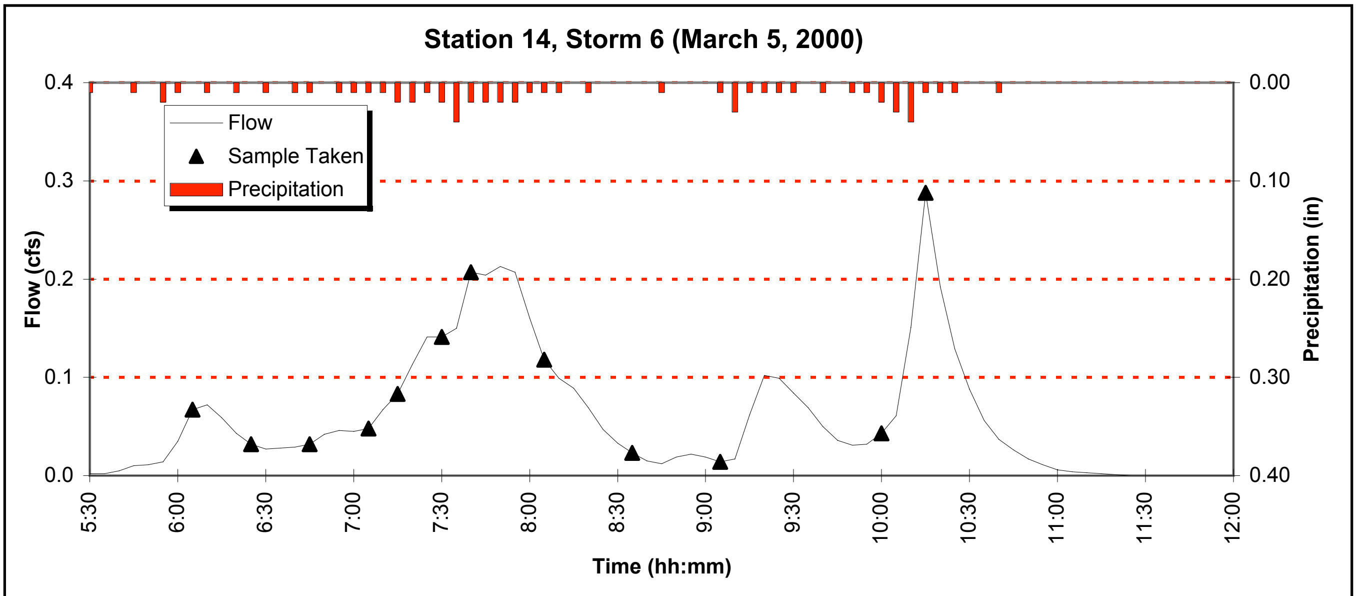
Station 14, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.4
0.3
0.2
0.1
0.0
0.00
0.10
0.20
0.30
0.40
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00

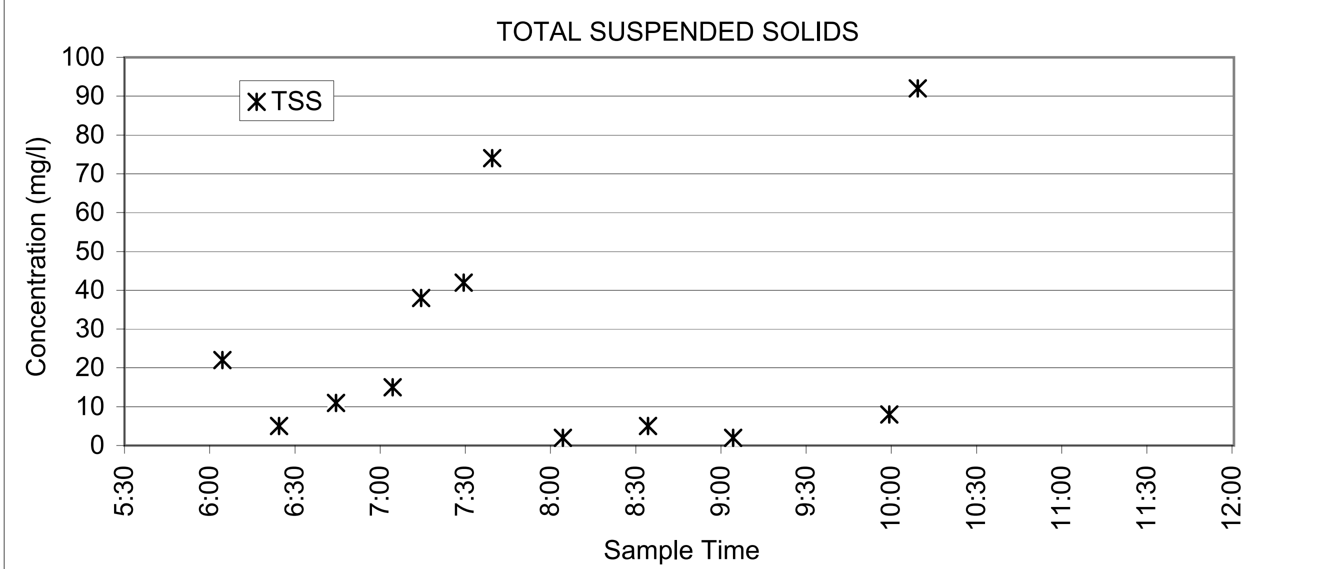


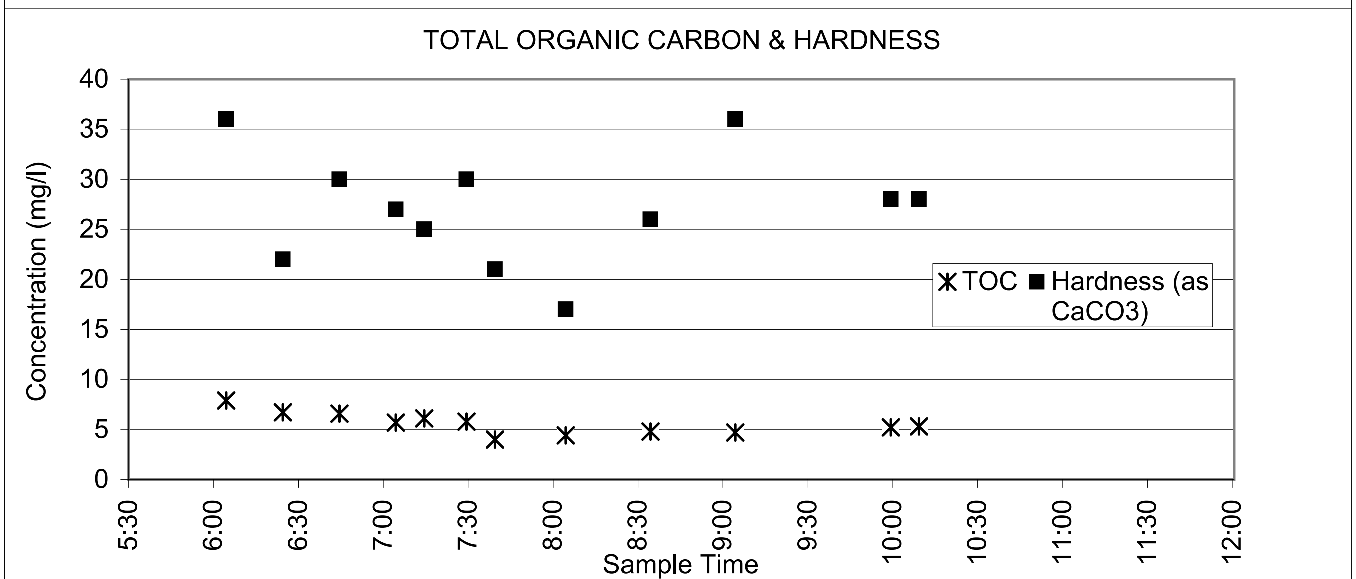
PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00

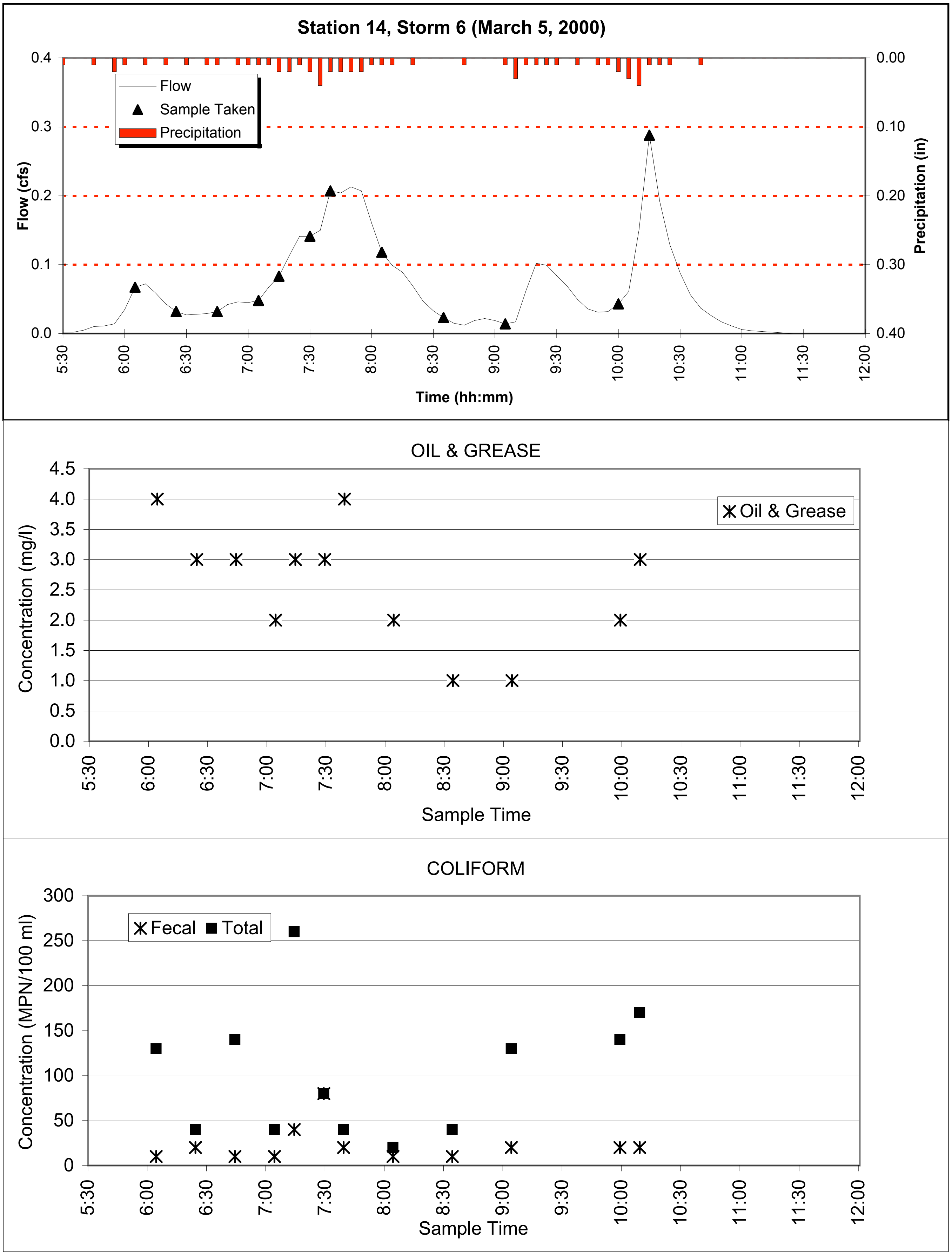


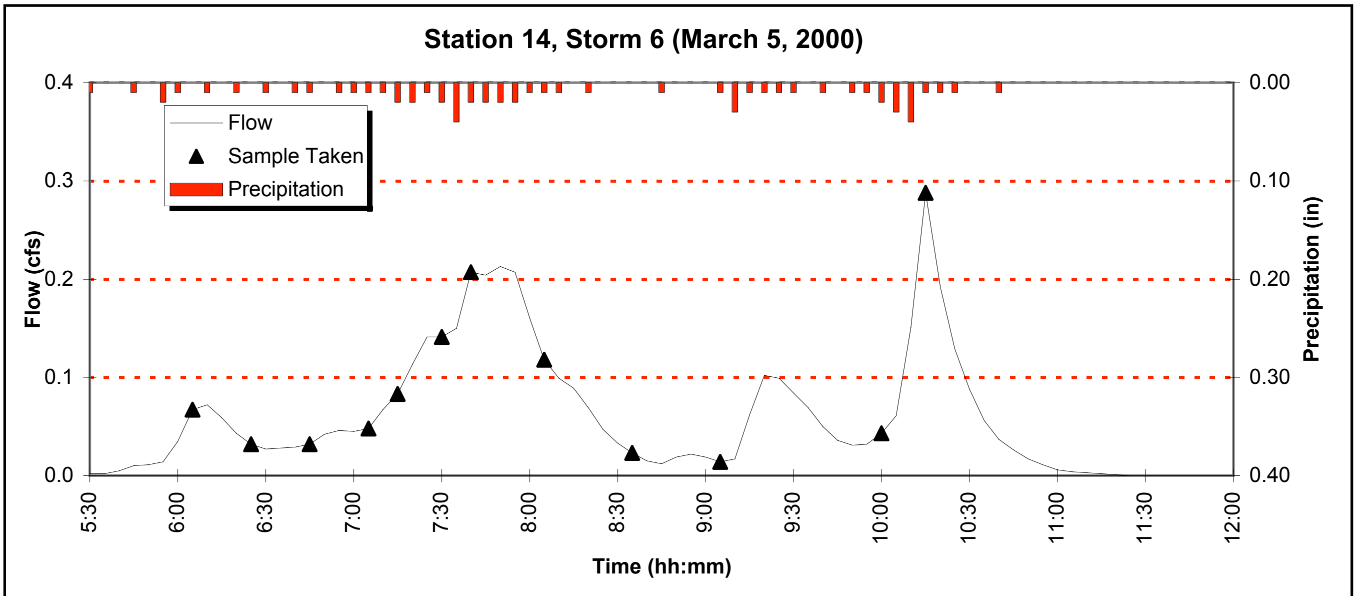
NITRATE (AS N)
Nitrate
Concentration (mg/l)
Sample Time
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00


Station 14, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

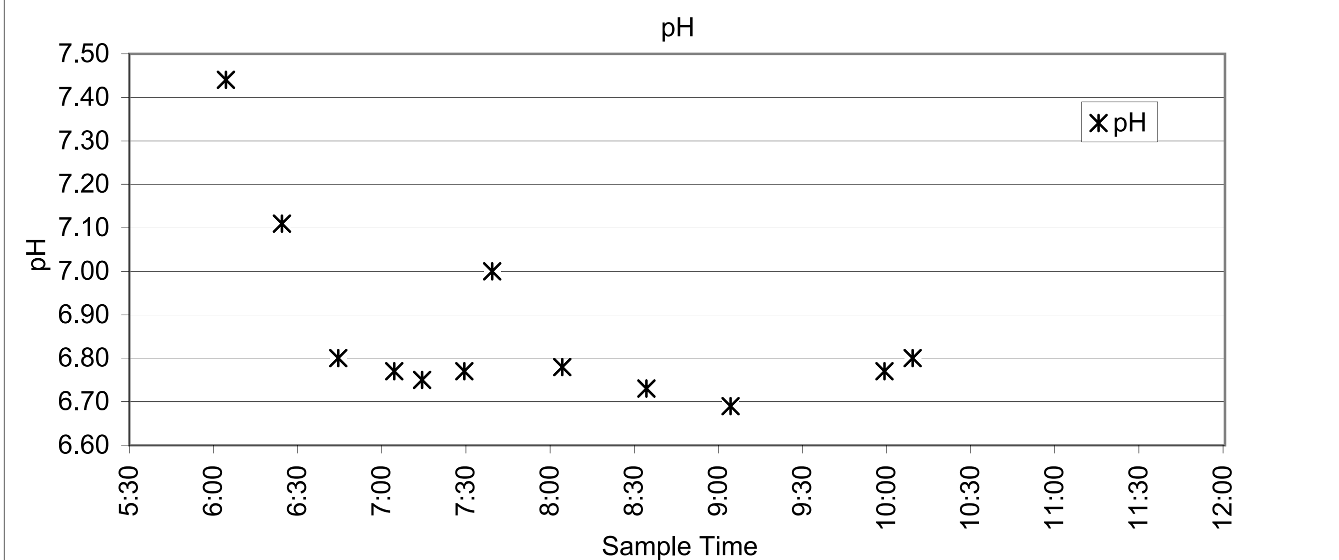

TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time


TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time

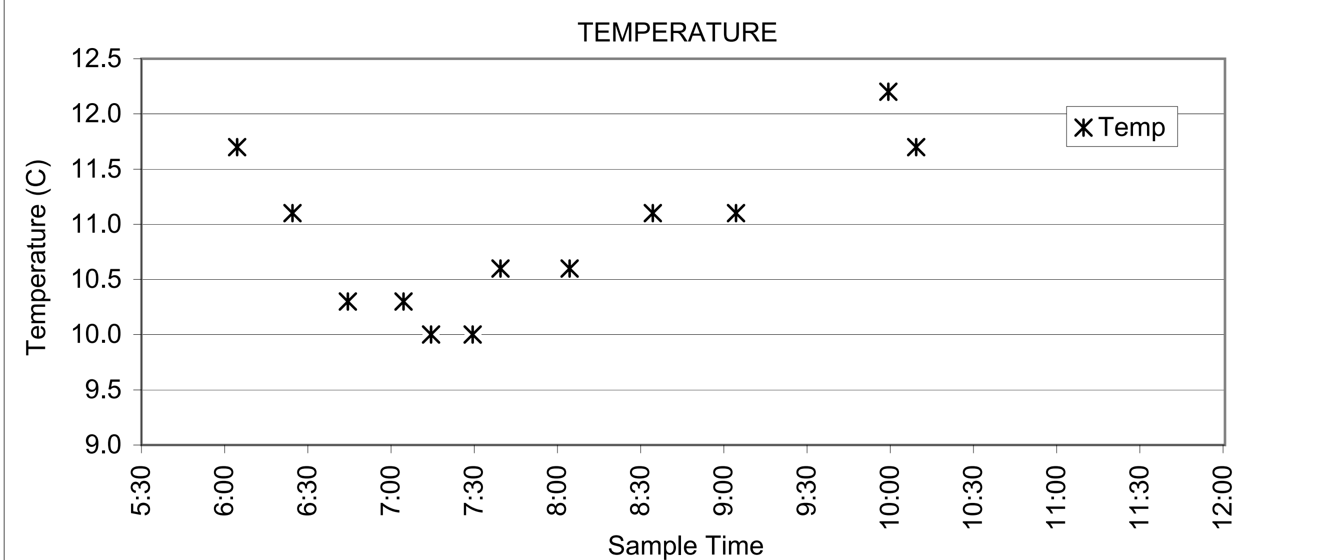

Station 14, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
OIL & GREASE
Oil & Grease
Concentration (mg/l)
Sample Time
COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
Sample Time



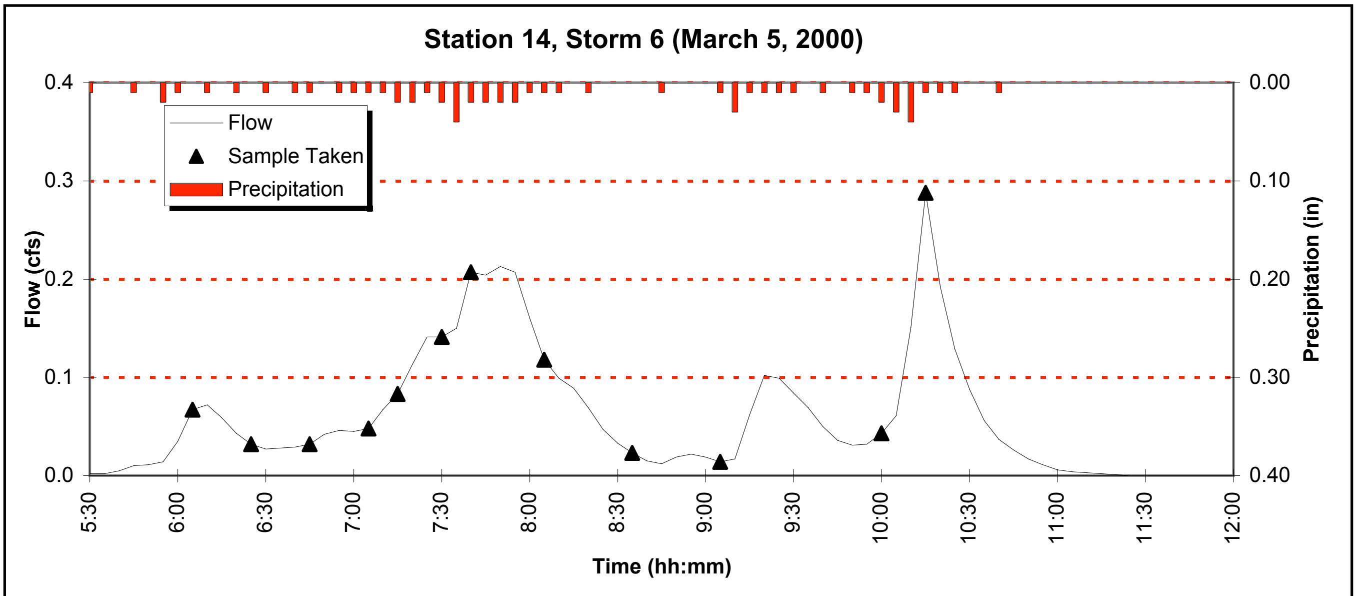
Station 14, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

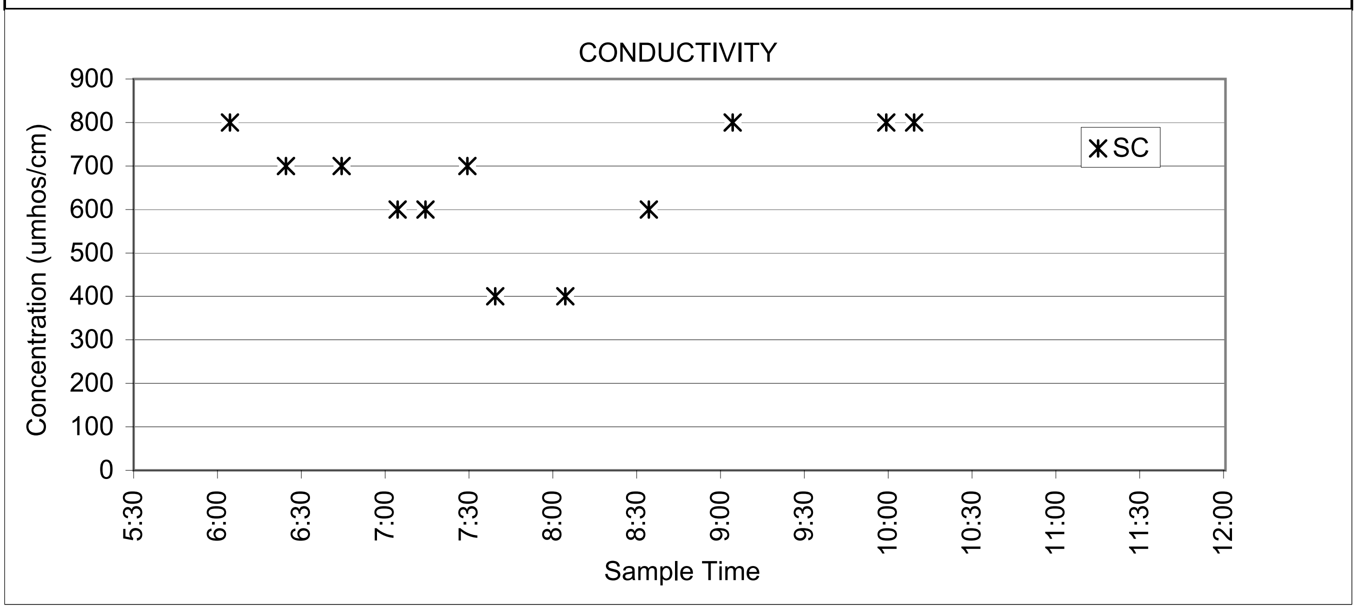


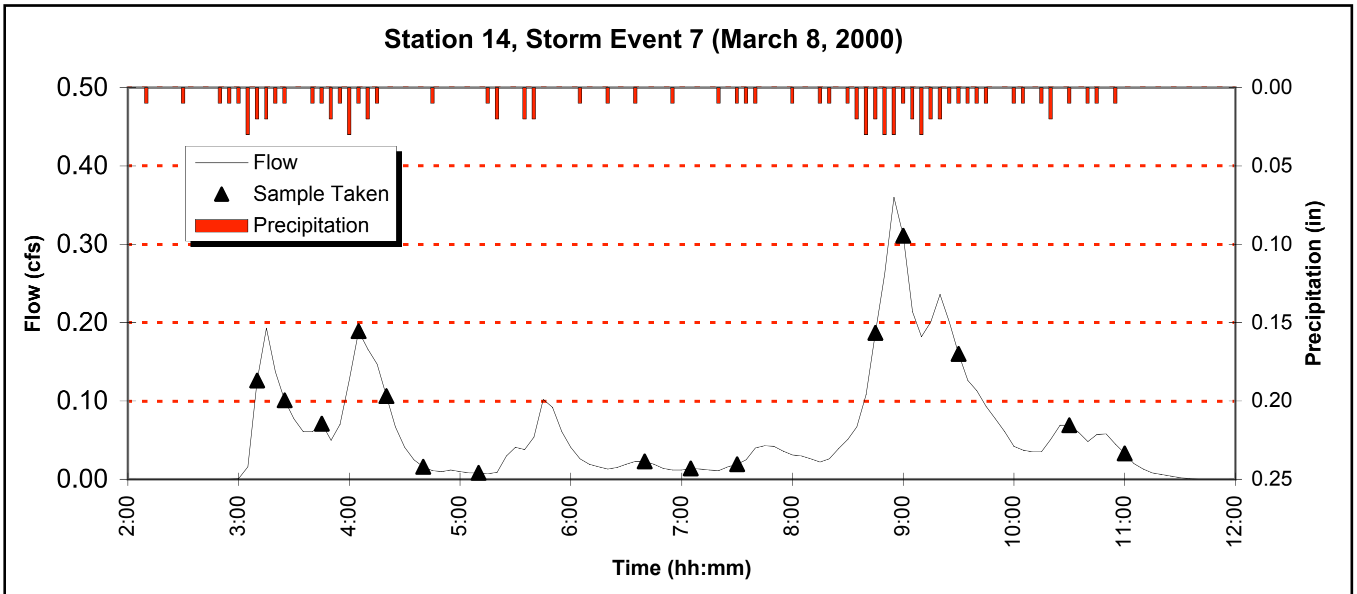
pH
pH
Sample Time



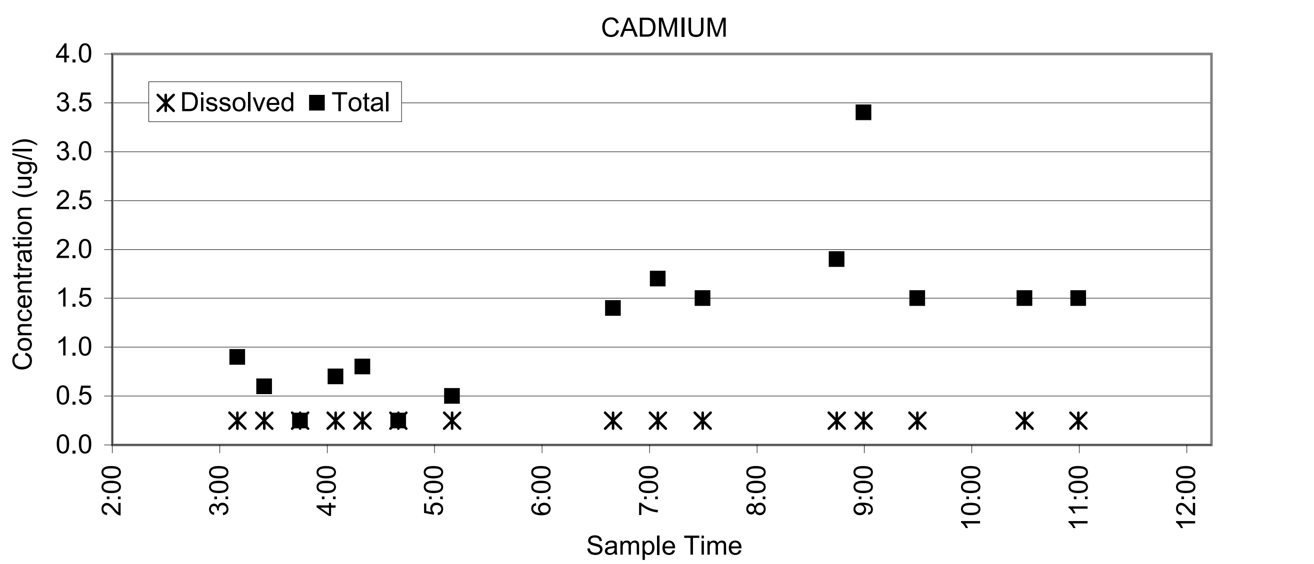
TEMPERATURE
Temp
Temperature (C)
Sample Time


Station 14, Storm 6 (March 5, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.4
0.3
0.2
0.1
0.0
0.00
0.10
0.20
0.30
0.40
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00

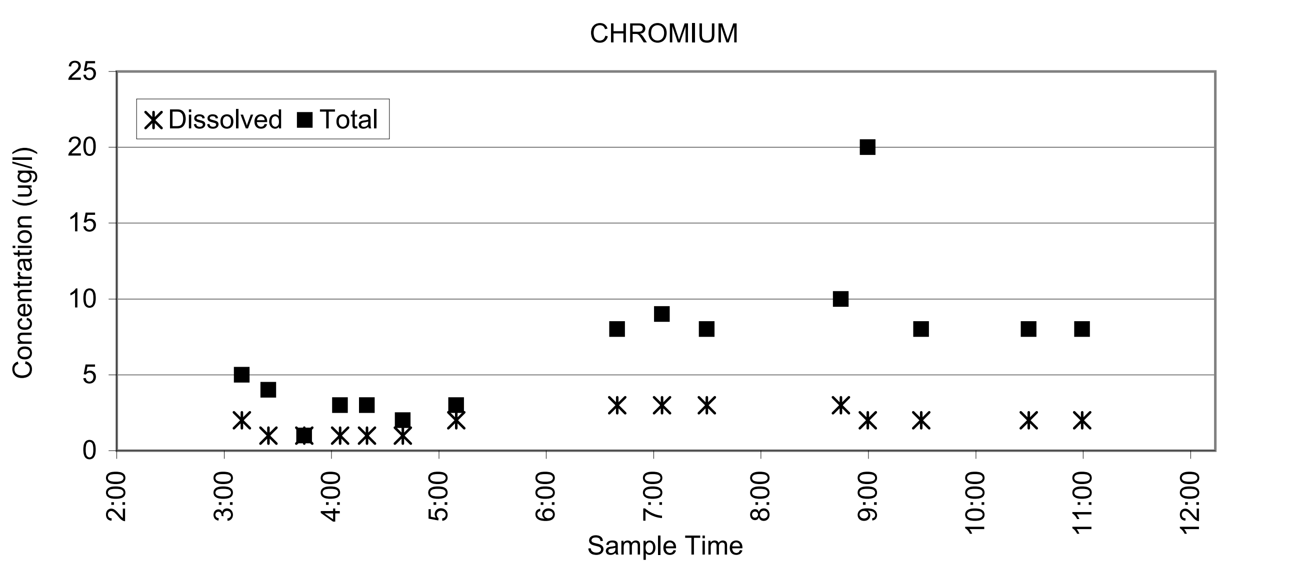

CONDUCTIVITY
Concentration (umhos/cm)
SC
Sample Time
900
800
700
600
500
400
300
200
100
0
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00



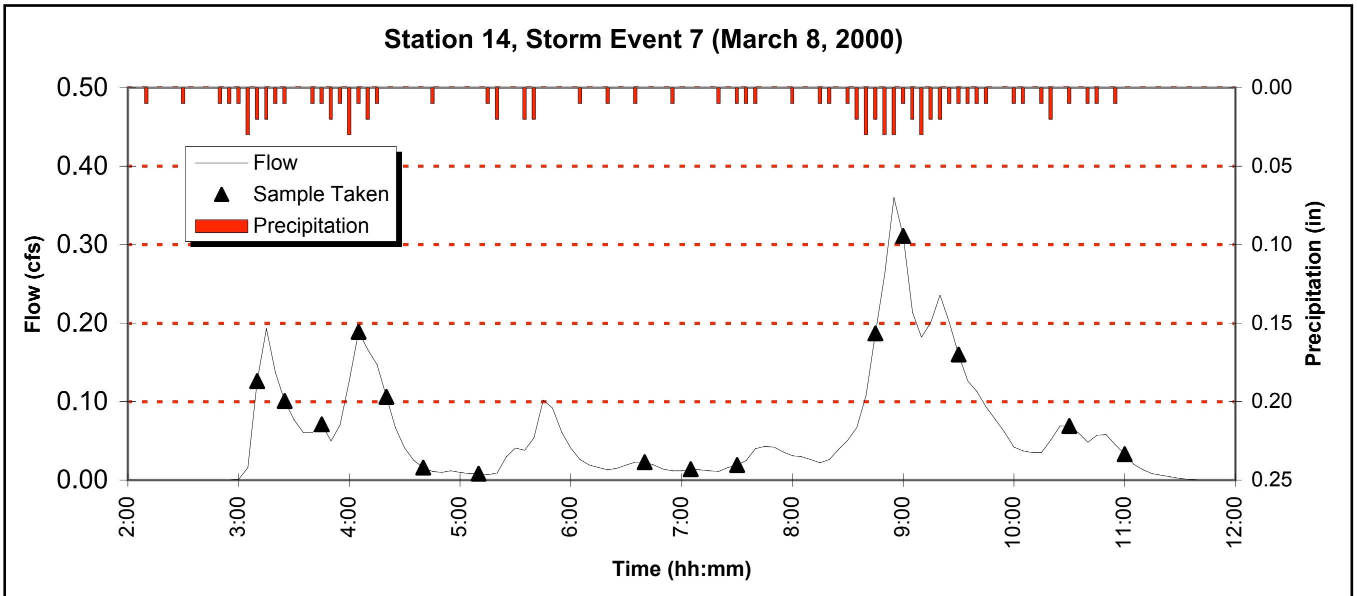
Station 14, Storm Event 7 (March 8, 2000)
Flow (cfs)
Precipitation (in)
Flow
Sample Taken
Precipitation
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.05
0.10
0.15
0.20
0.25
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Time (hh:mm)

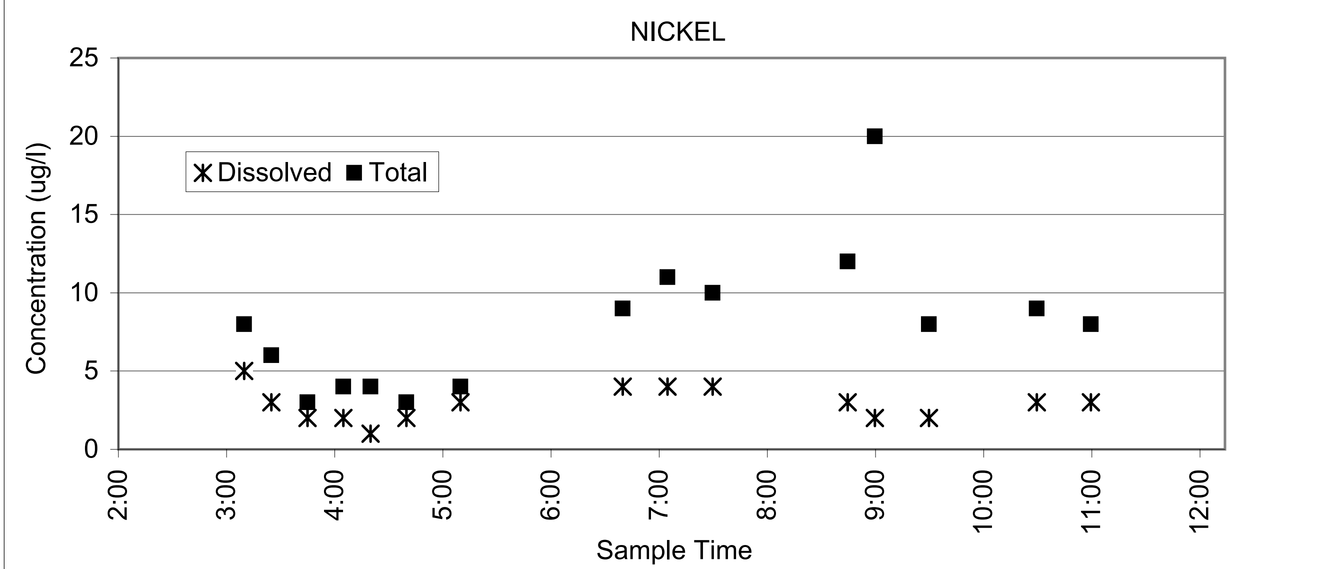


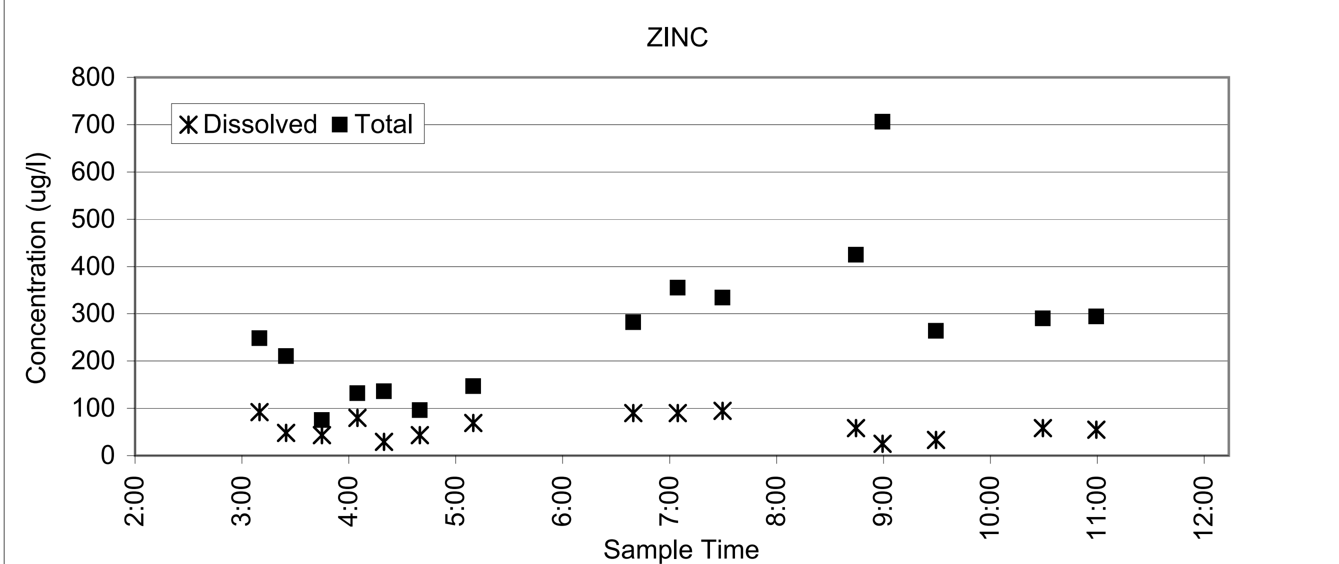
CADMIUM
Dissolved
Total
Concentration (ug/l)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Sample Time

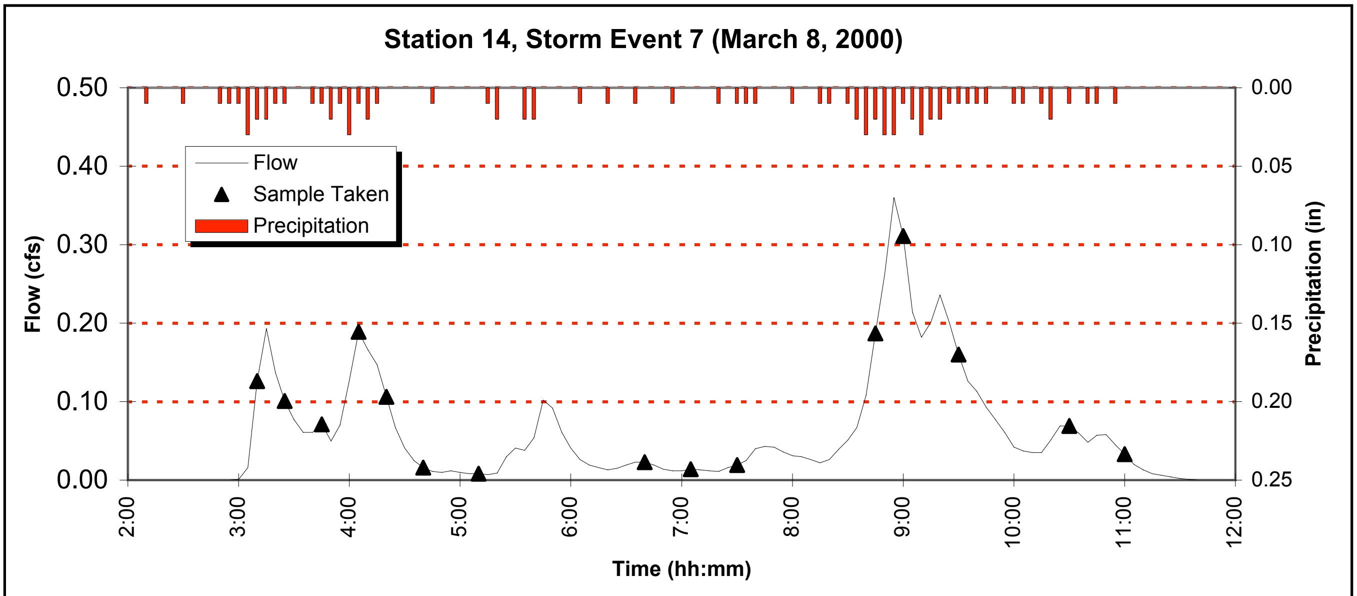


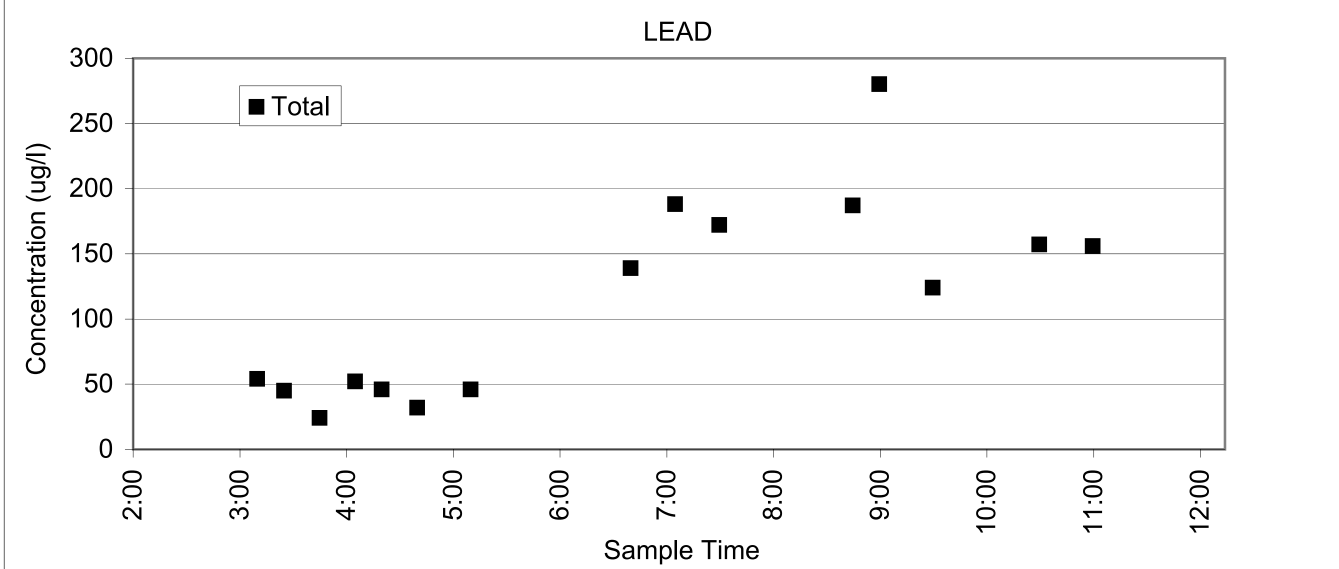
CHROMIUM
Dissolved
Total
Concentration (ug/l)
25
20
15
10
5
0
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Sample Time

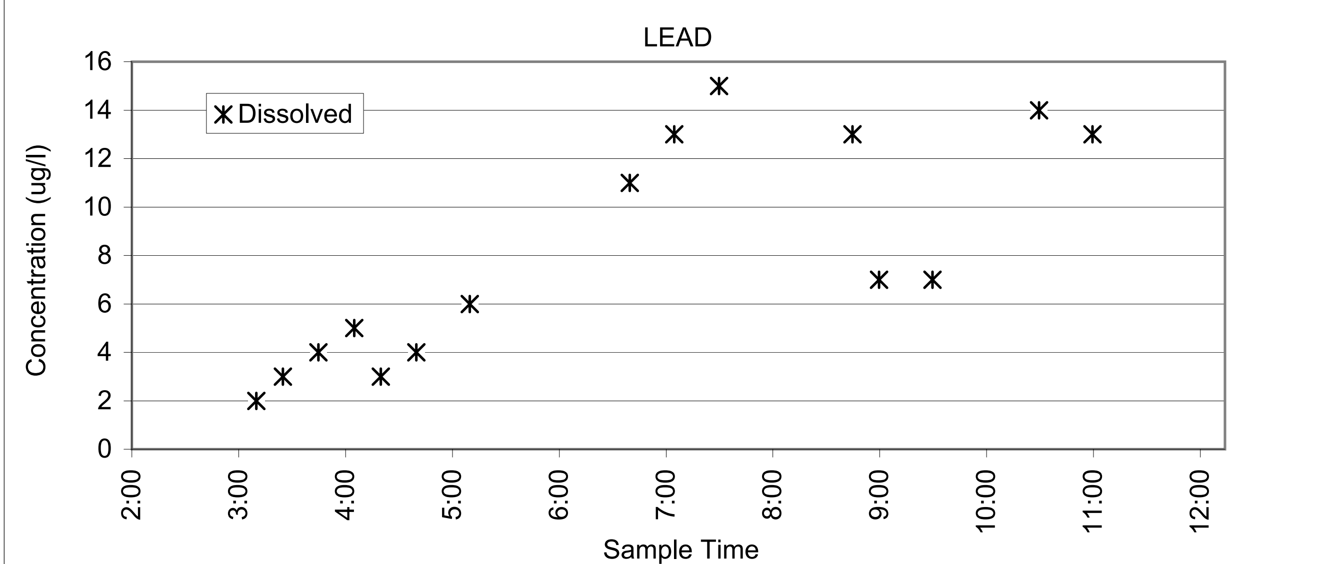

Station 14, Storm Event 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

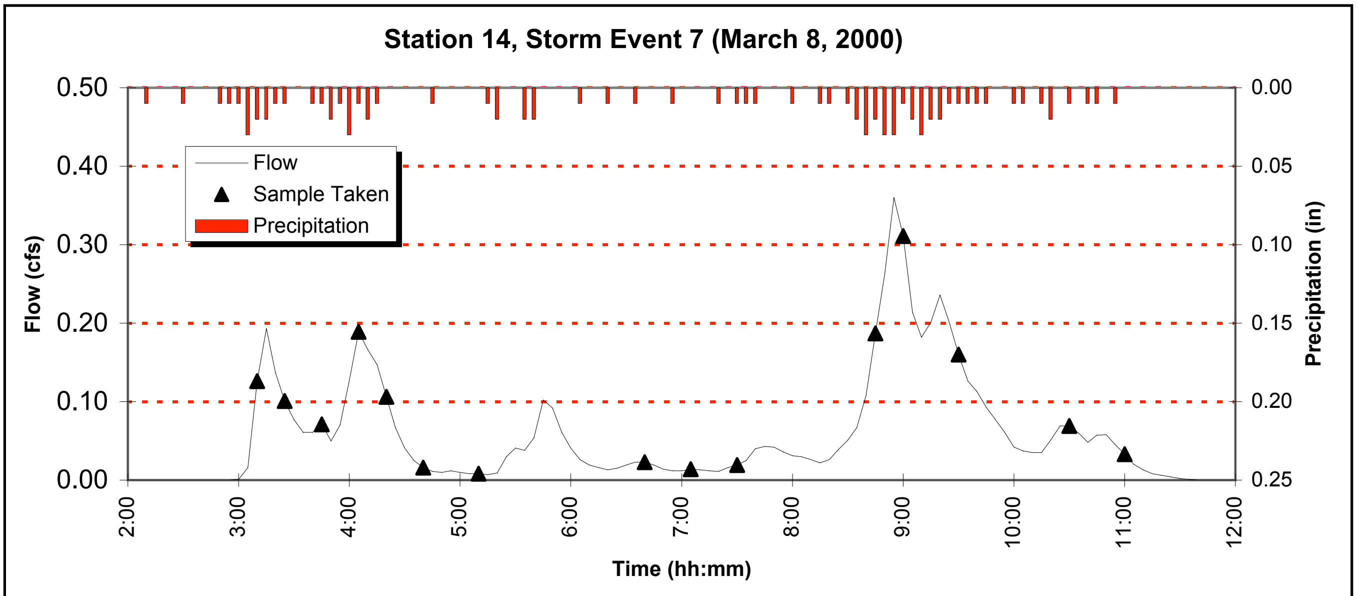

NICKEL
Dissolved
Total
Concentration (ug/l)
Sample Time

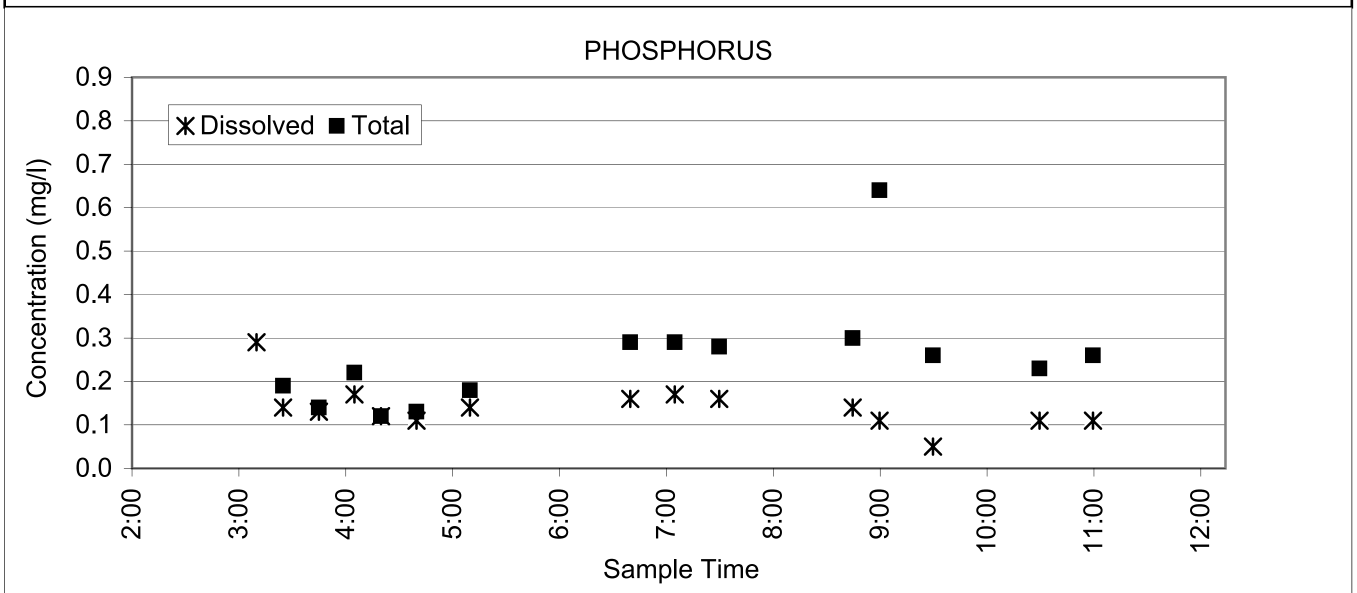

ZINC
Dissolved
Total
Concentration (ug/l)
Sample Time

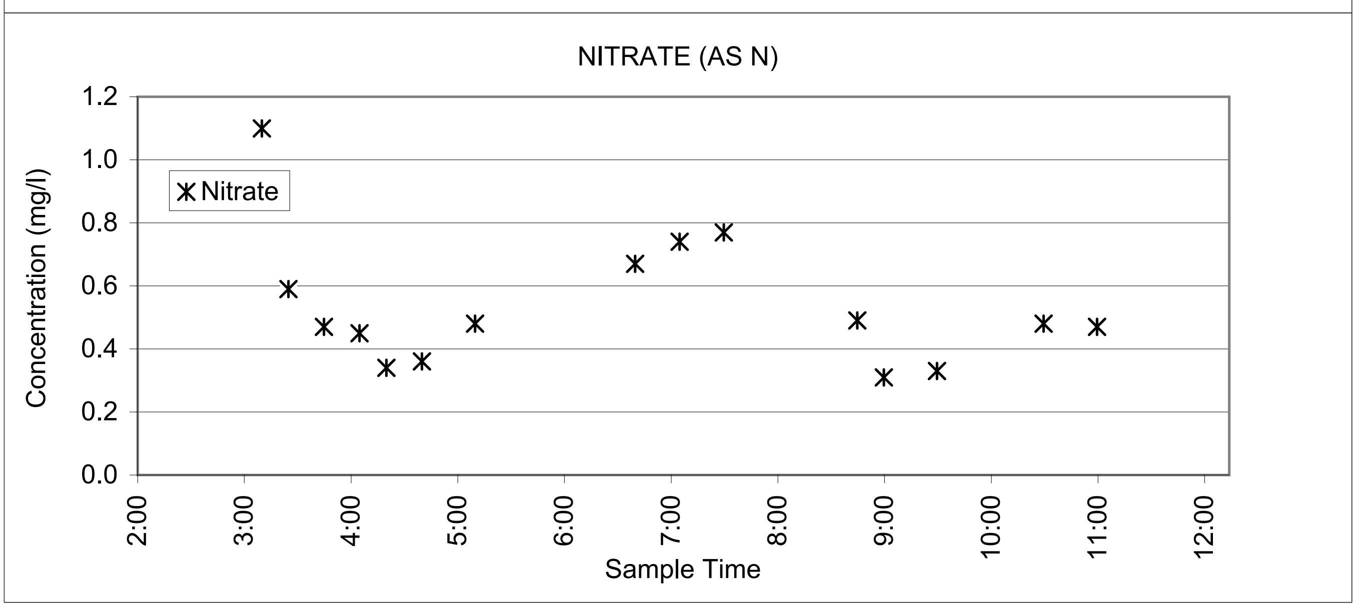

Station 14, Storm Event 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
0.50
0.40
0.30
0.20
0.10
0.00
0.05
0.15
0.25
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Time (hh:mm)

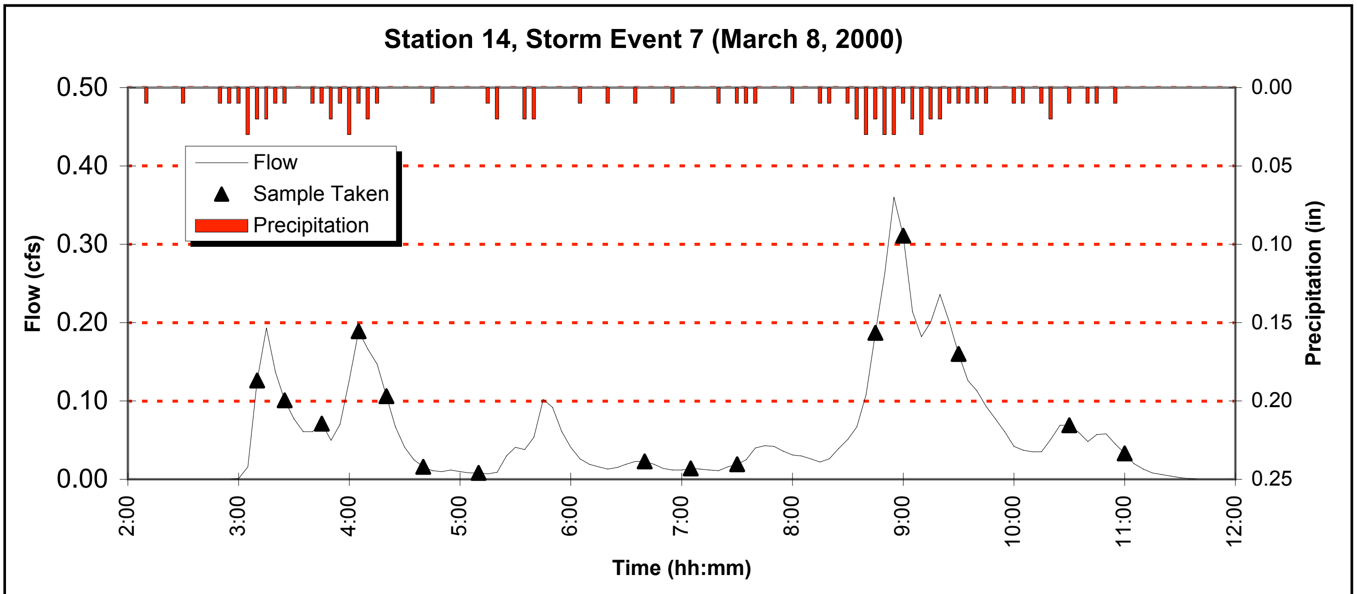

LEAD
Total
Concentration (ug/l)
300
250
200
150
100
50
0
Sample Time


LEAD
Dissolved
Concentration (ug/l)
16
14
12
10
8
6
4
2
0
Sample Time

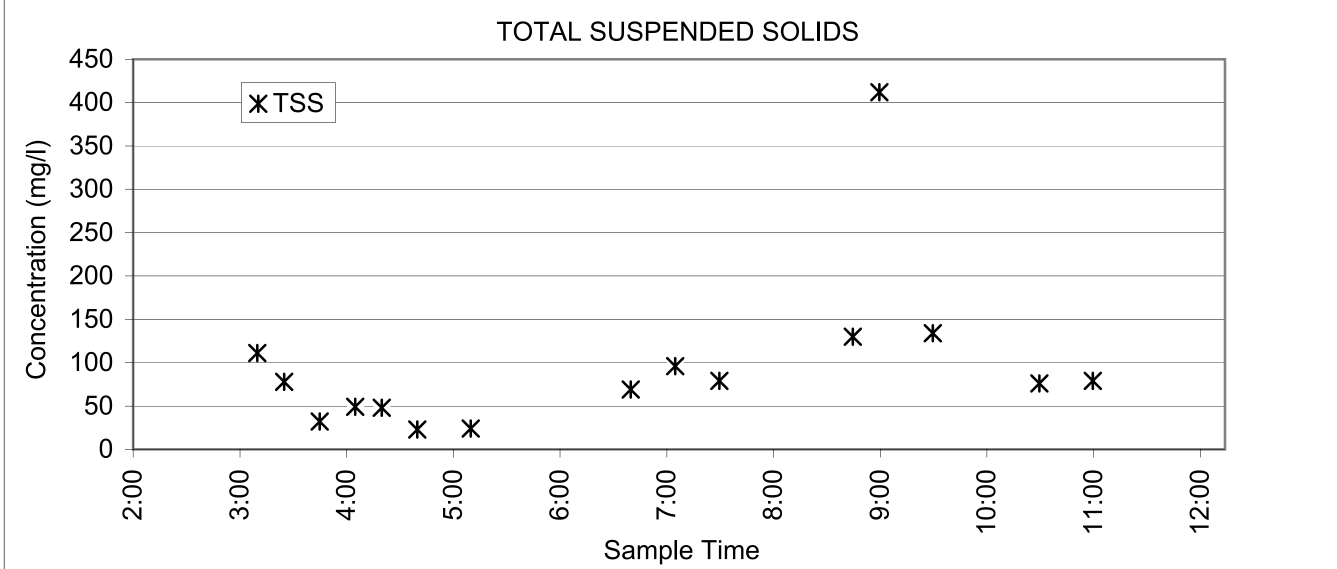

Station 14, Storm Event 7 (March 8, 2000)
Flow (cfs)
Precipitation (in)
Flow
Sample Taken
Precipitation
Time (hh:mm)


PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time

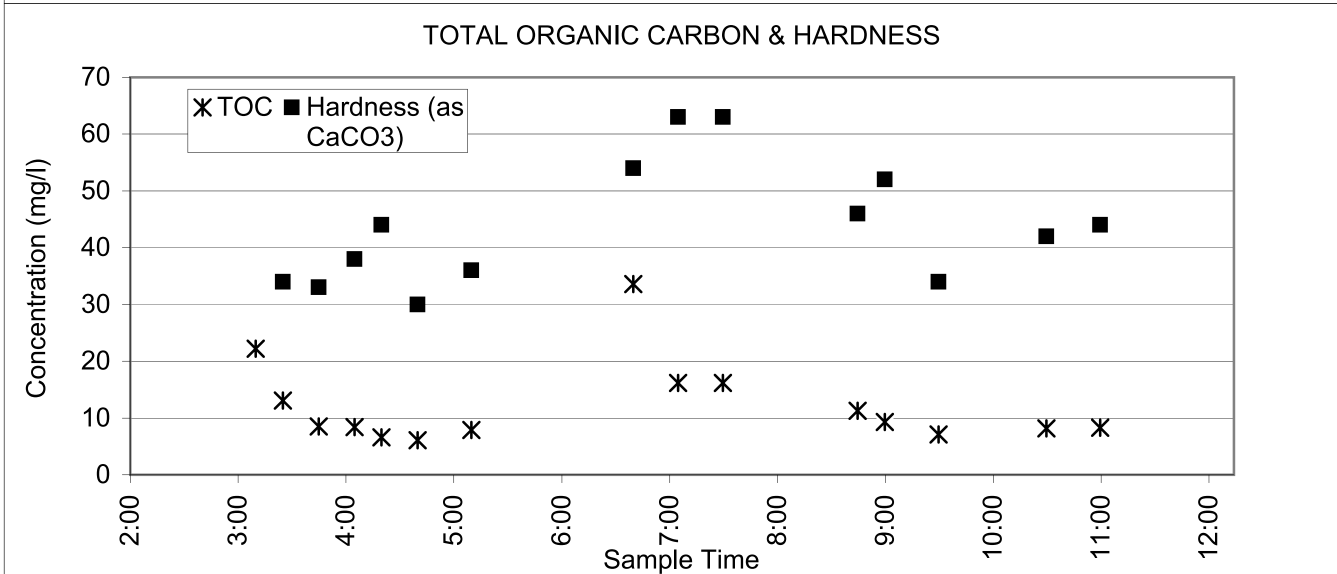

NITRATE (AS N)
Nitrate
Concentration (mg/l)
Sample Time



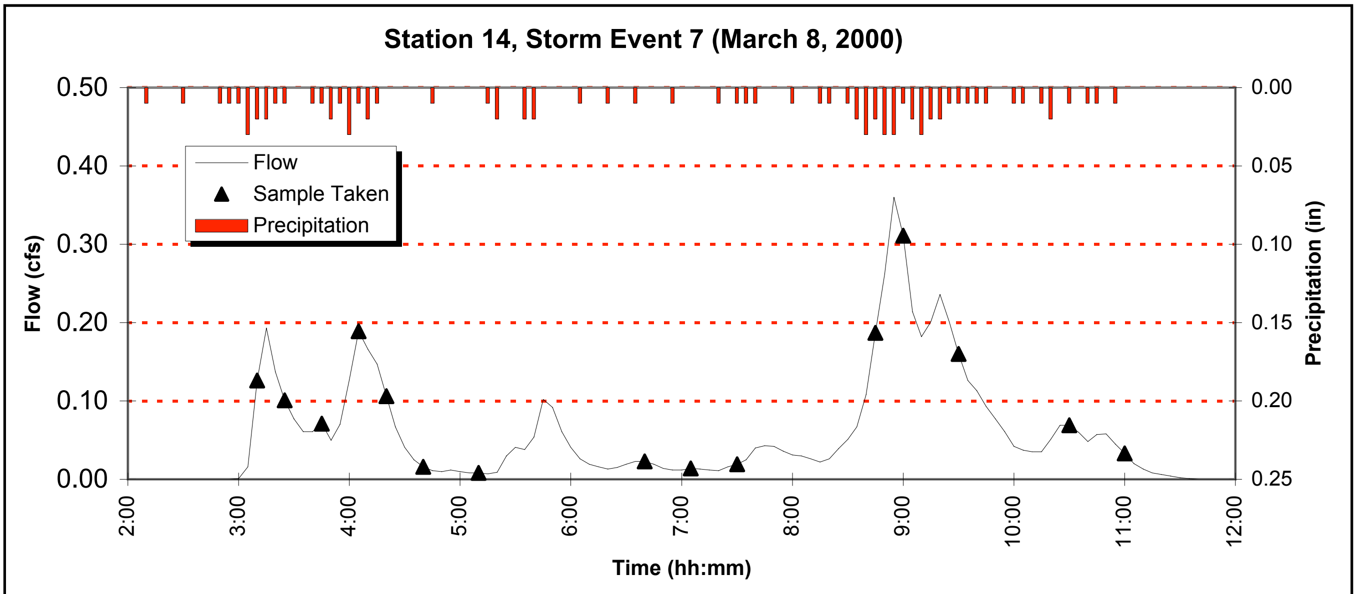
Station 14, Storm Event 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.05
0.10
0.15
0.20
0.25
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00

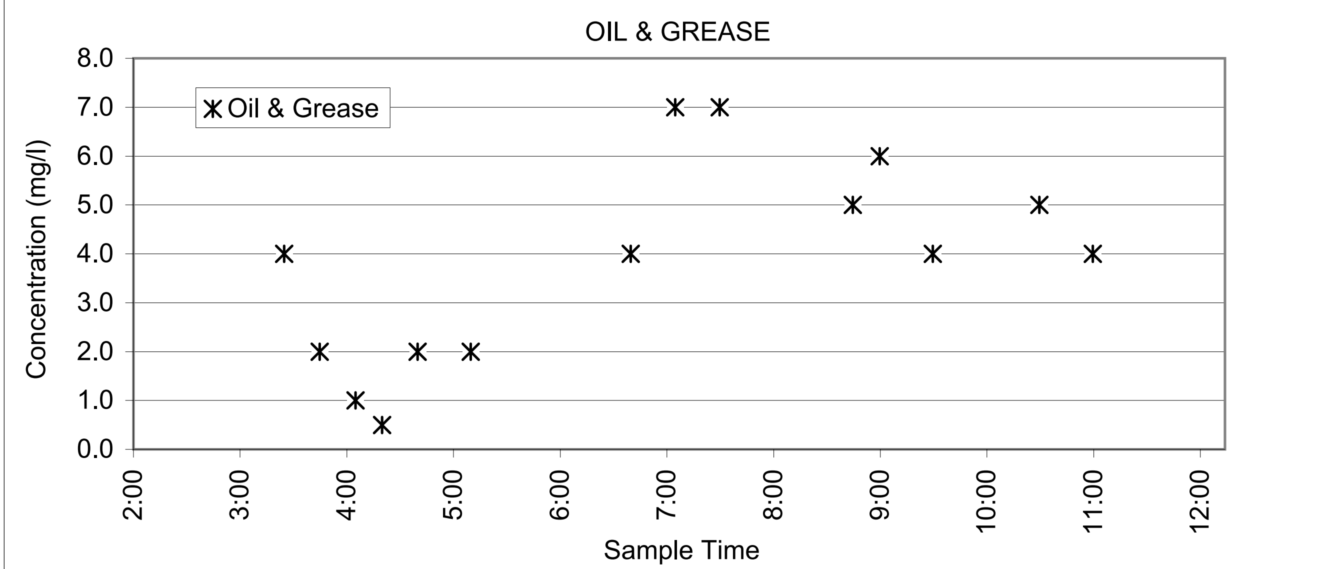


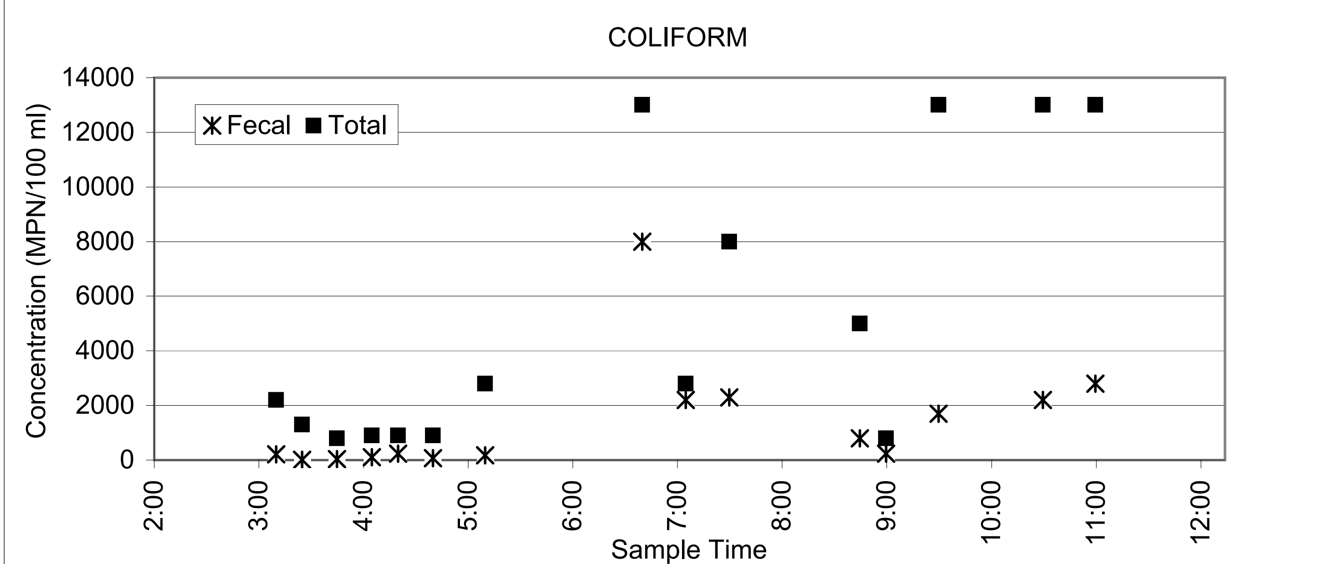
TOTAL SUSPENDED SOLIDS
TSS
Concentration (mg/l)
Sample Time
450
400
350
300
250
200
150
100
50
0
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00

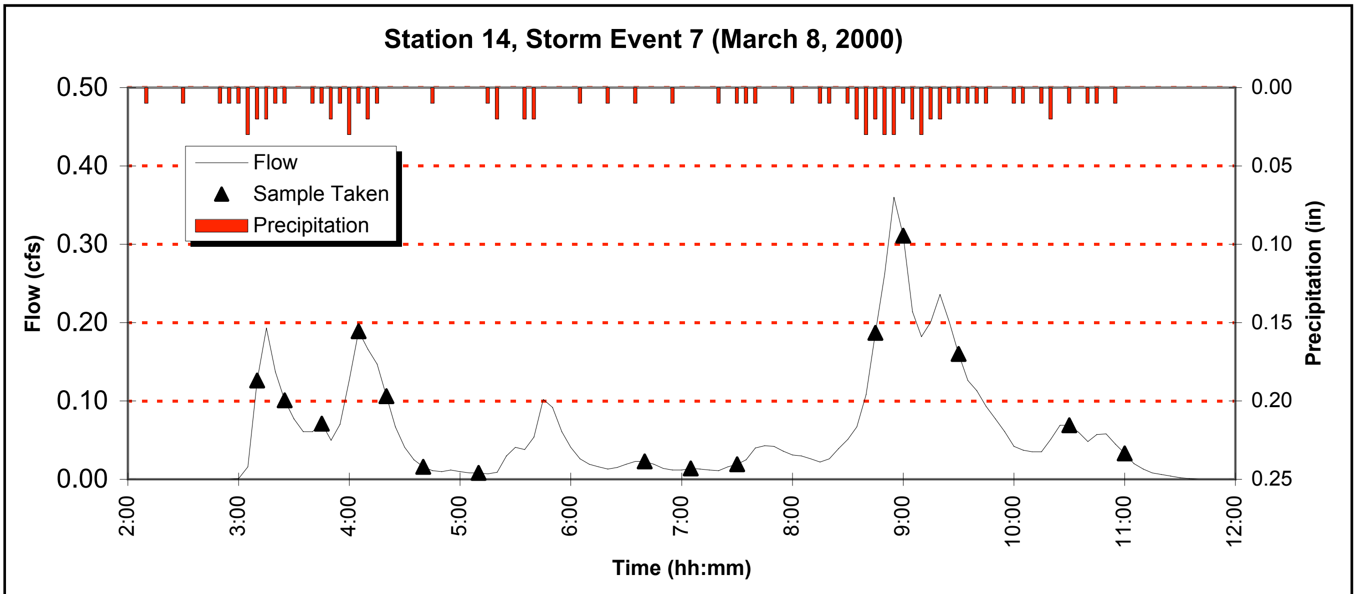


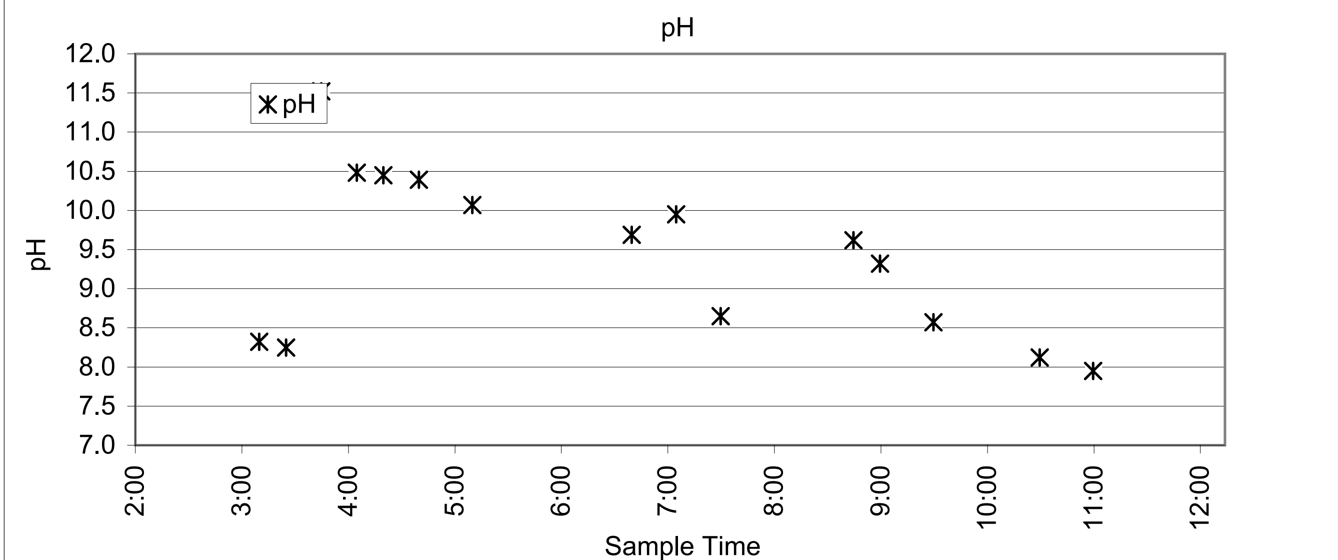
TOTAL ORGANIC CARBON & HARDNESS
TOC
Hardness (as CaCO3)
Concentration (mg/l)
Sample Time
70
60
50
40
30
20
10
0
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00

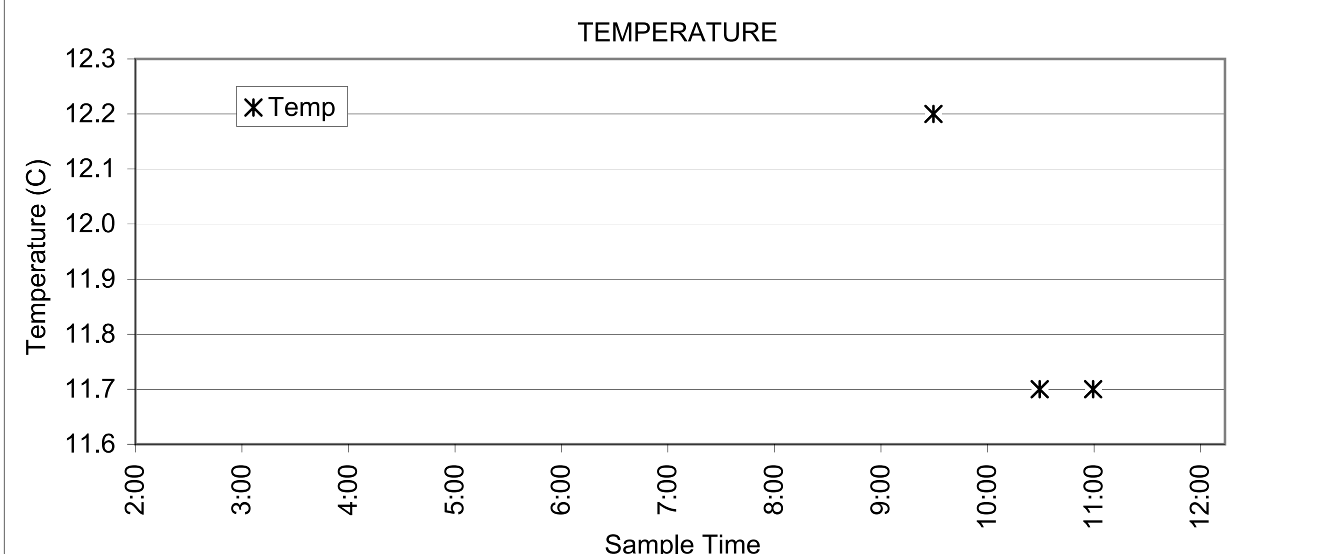

Station 14, Storm Event 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

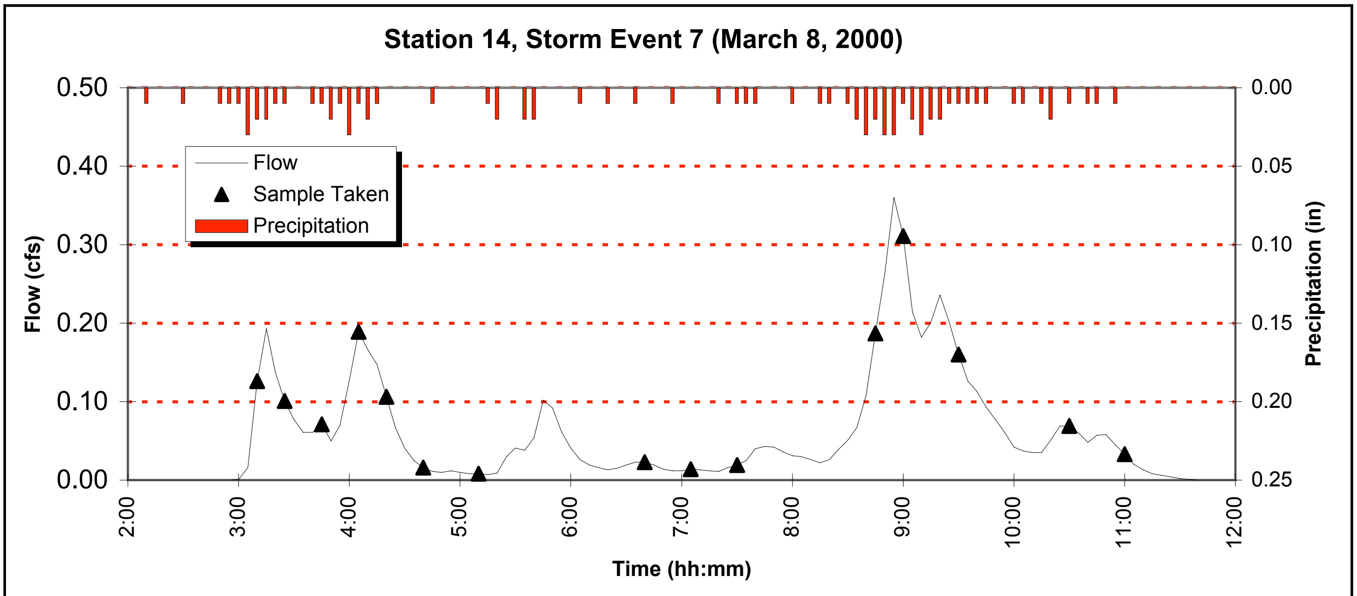

OIL & GREASE
Oil & Grease
Concentration (mg/l)
Sample Time

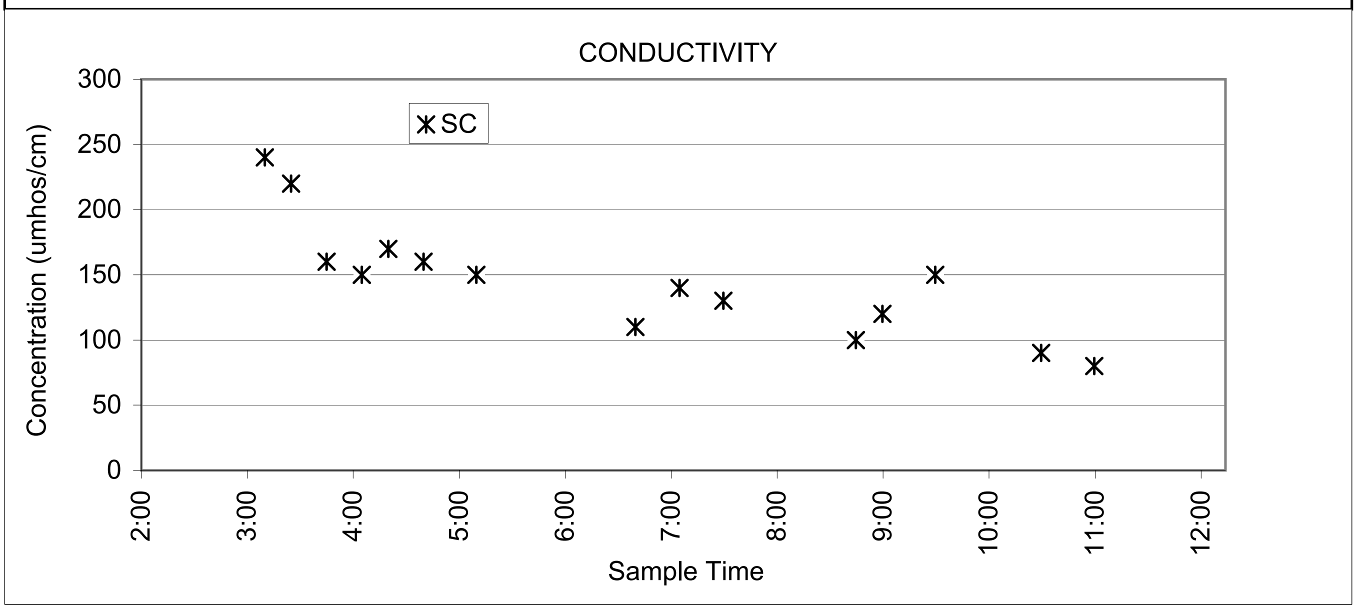

COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
Sample Time

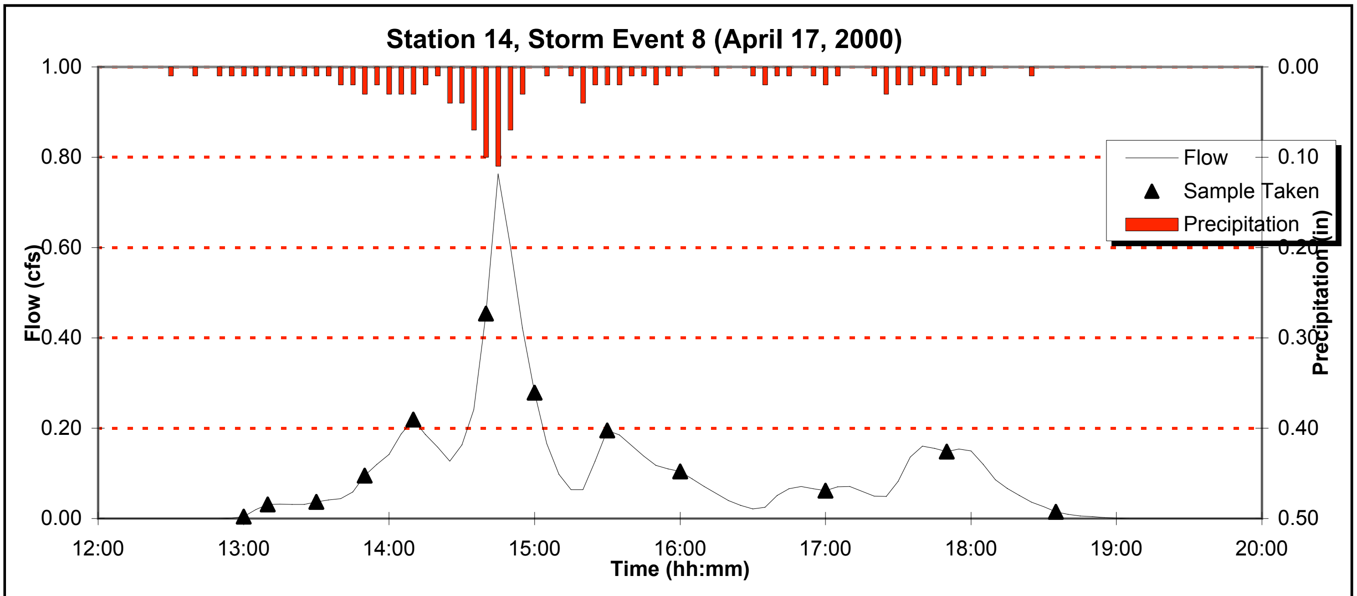

Station 14, Storm Event 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
0.50
0.40
0.30
0.20
0.10
0.00
0.05
0.15
0.25
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Time (hh:mm)

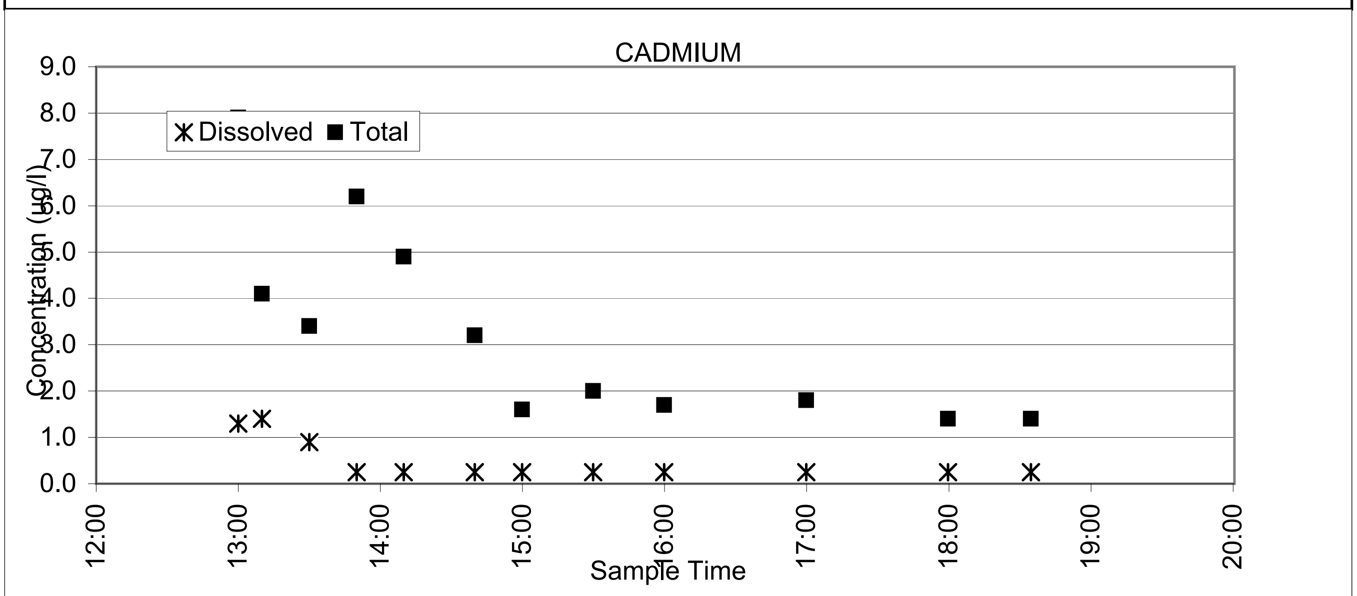

pH
pH
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Sample Time

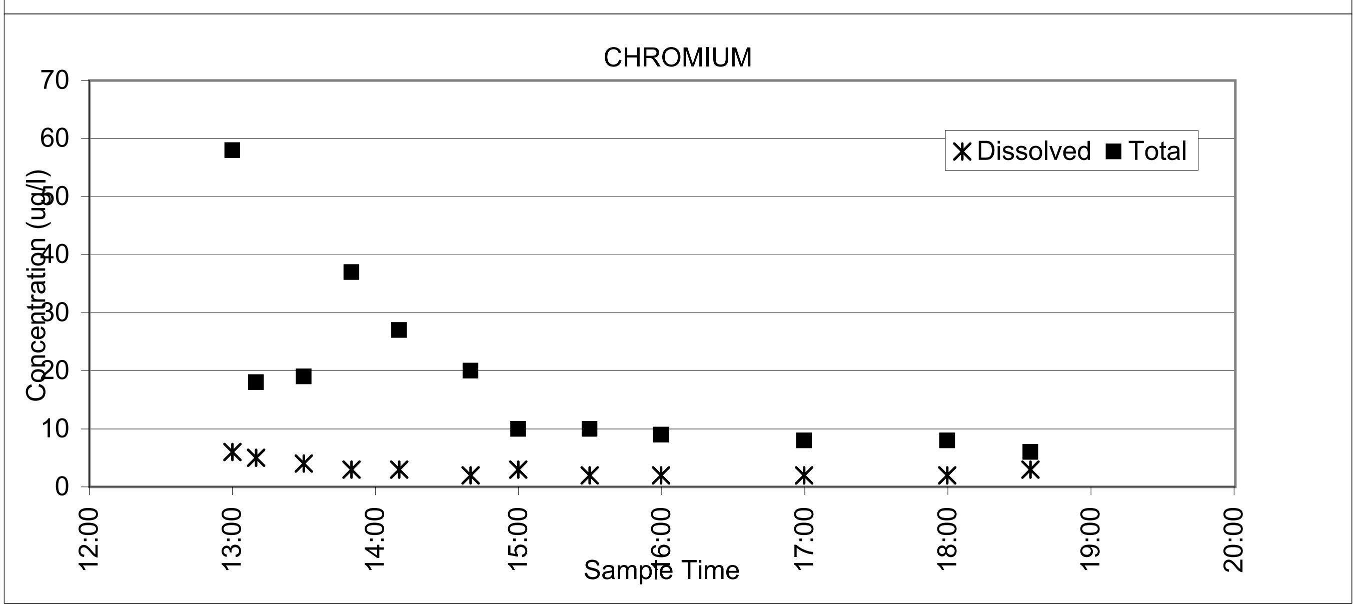

TEMPERATURE
Temp
Temperature (C)
12.3
12.2
12.1
12.0
11.9
11.8
11.7
11.6
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
Sample Time

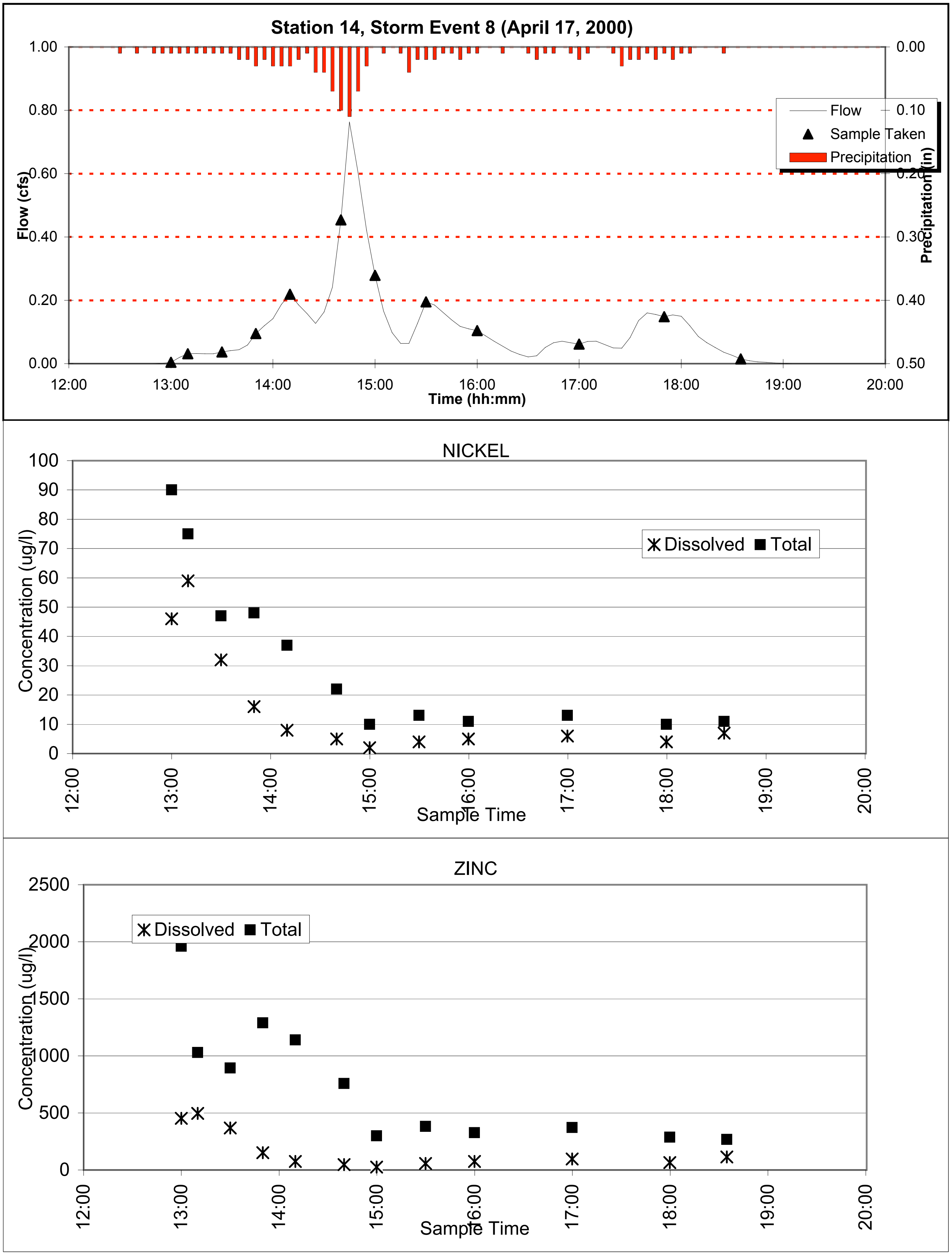

Station 14, Storm Event 7 (March 8, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.05
0.10
0.15
0.20
0.25
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00

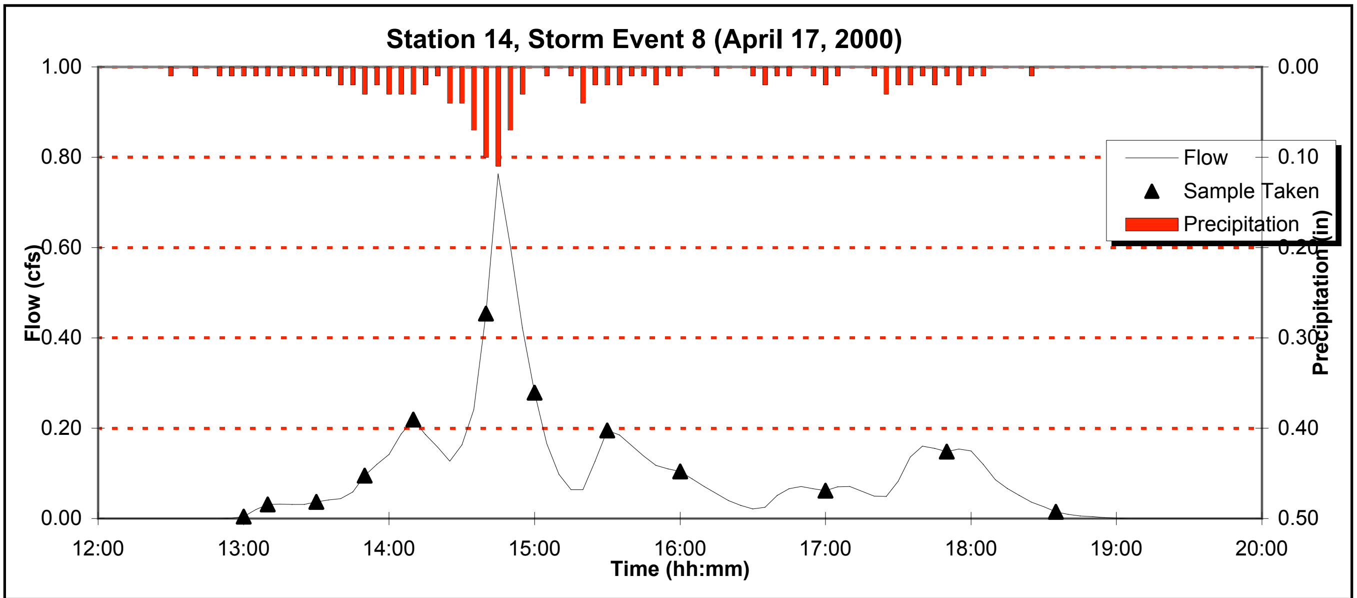

CONDUCTIVITY
SC
Concentration (umhos/cm)
Sample Time
300
250
200
150
100
50
0
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00

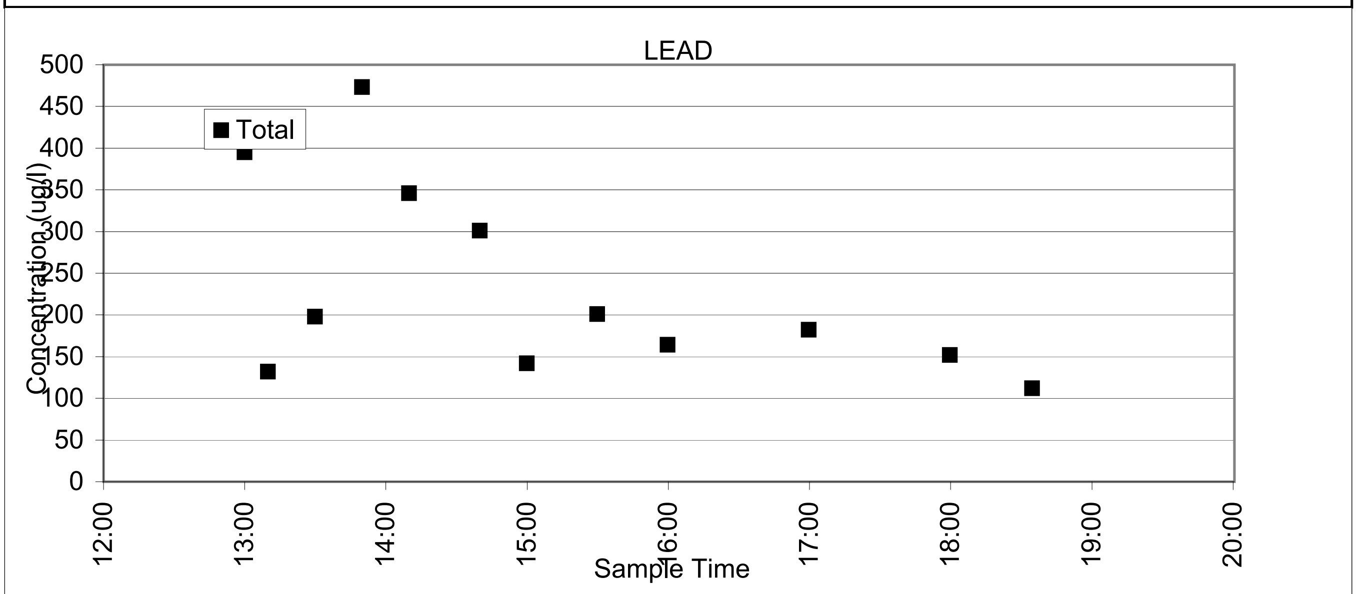

Station 14, Storm Event 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.10
0.20
0.30
0.40
0.50
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

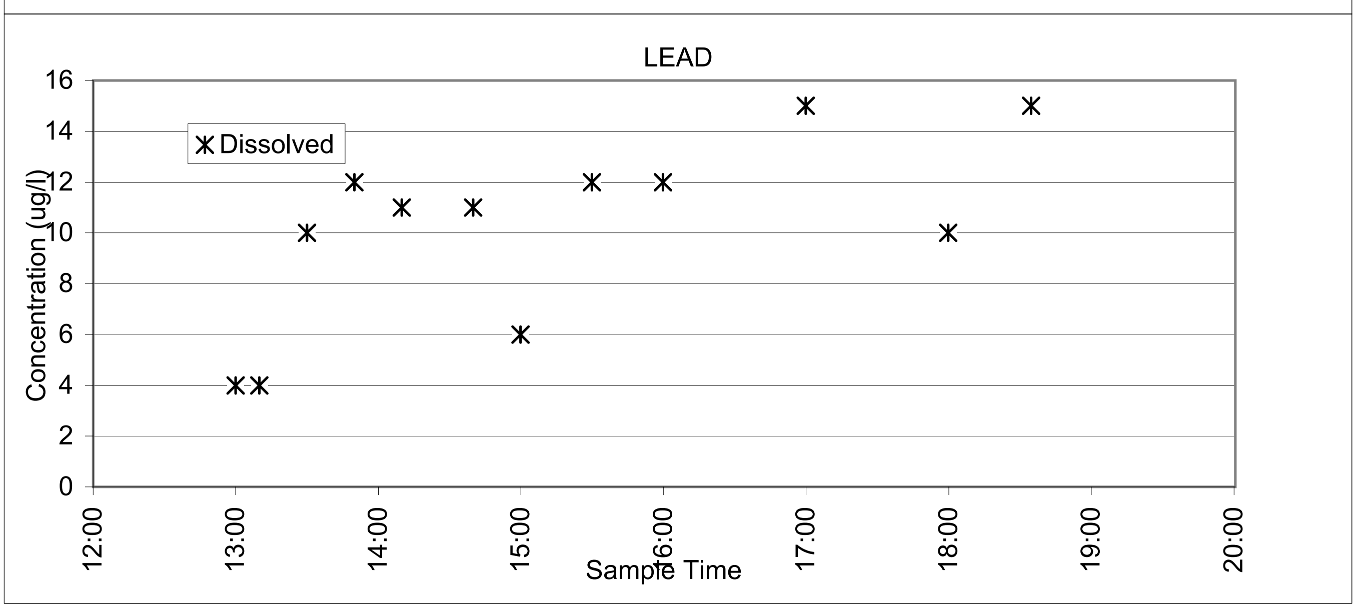

CADMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

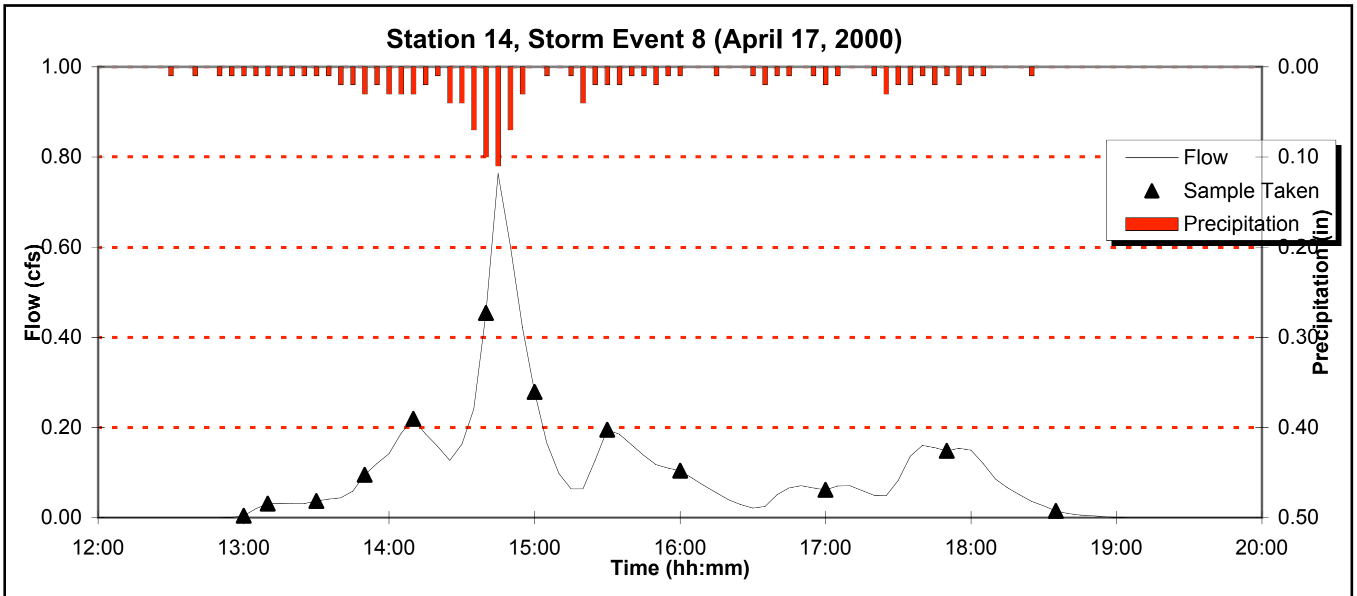

CHROMIUM
Dissolved
Total
Concentration (ug/l)
Sample Time
70
60
50
40
30
20
10
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

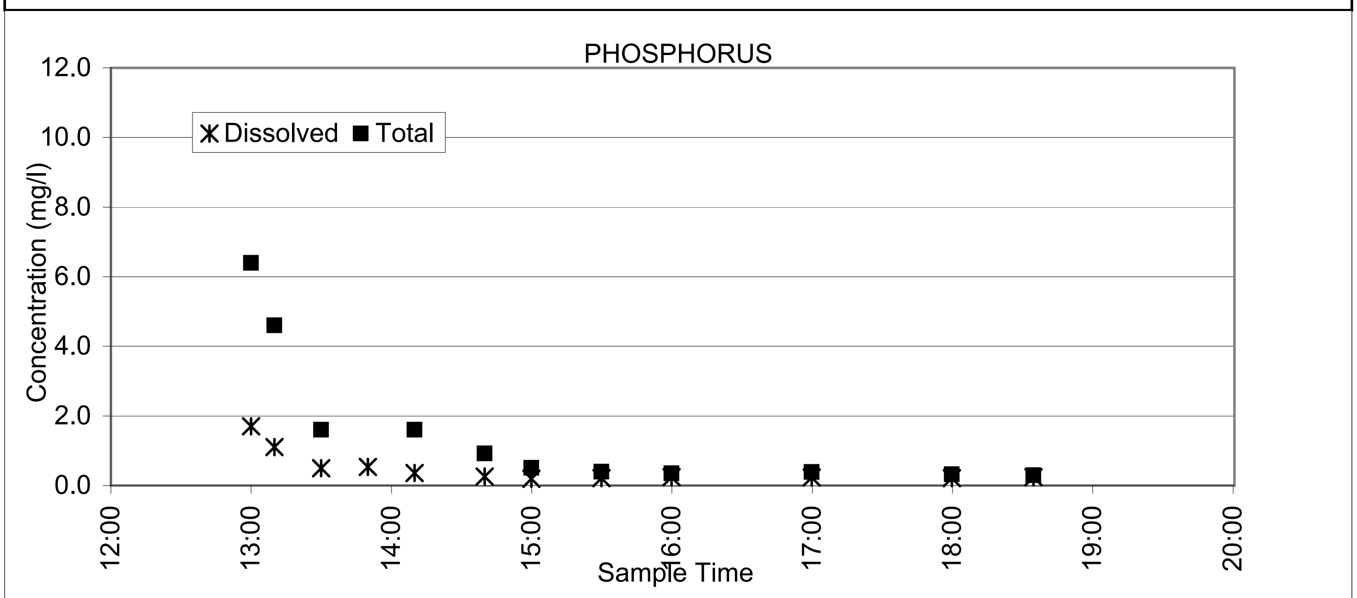

Station 14, Storm Event 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
NICKEL
Concentration (ug/l)
Sample Time
Dissolved
Total
ZINC
Concentration (ug/l)
Sample Time
Dissolved
Total

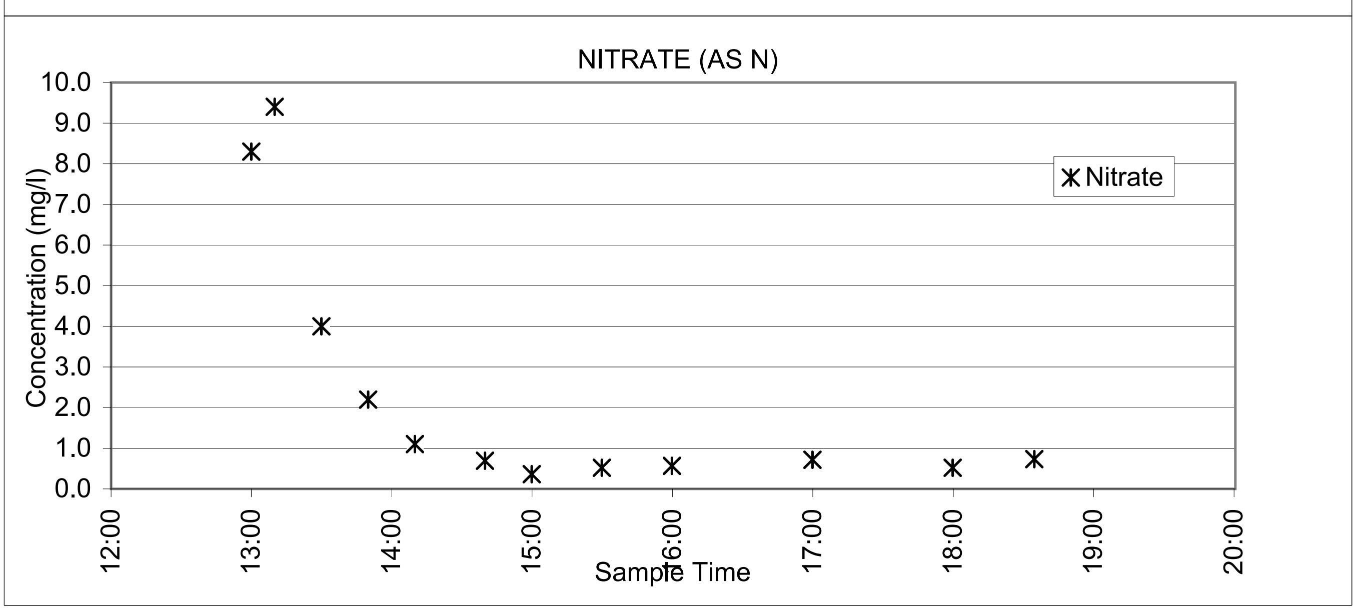

Station 14, Storm Event 8 (April 17, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)

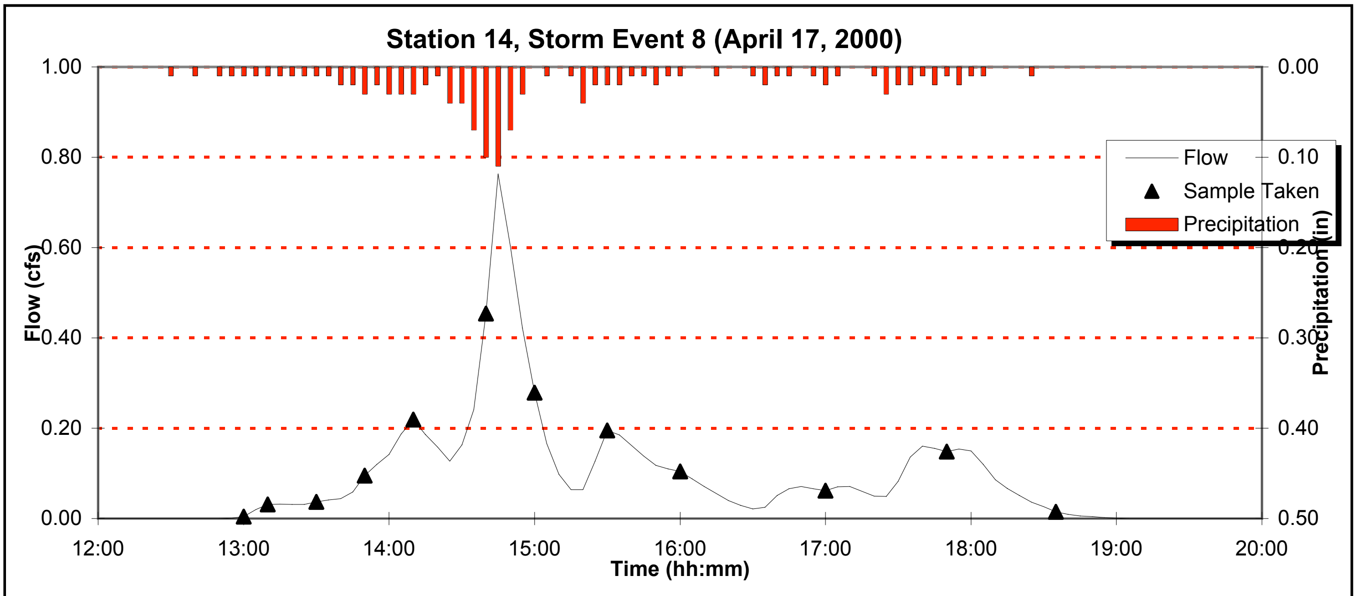

LEAD
Total
Concentration (ug/l)
Sample Time

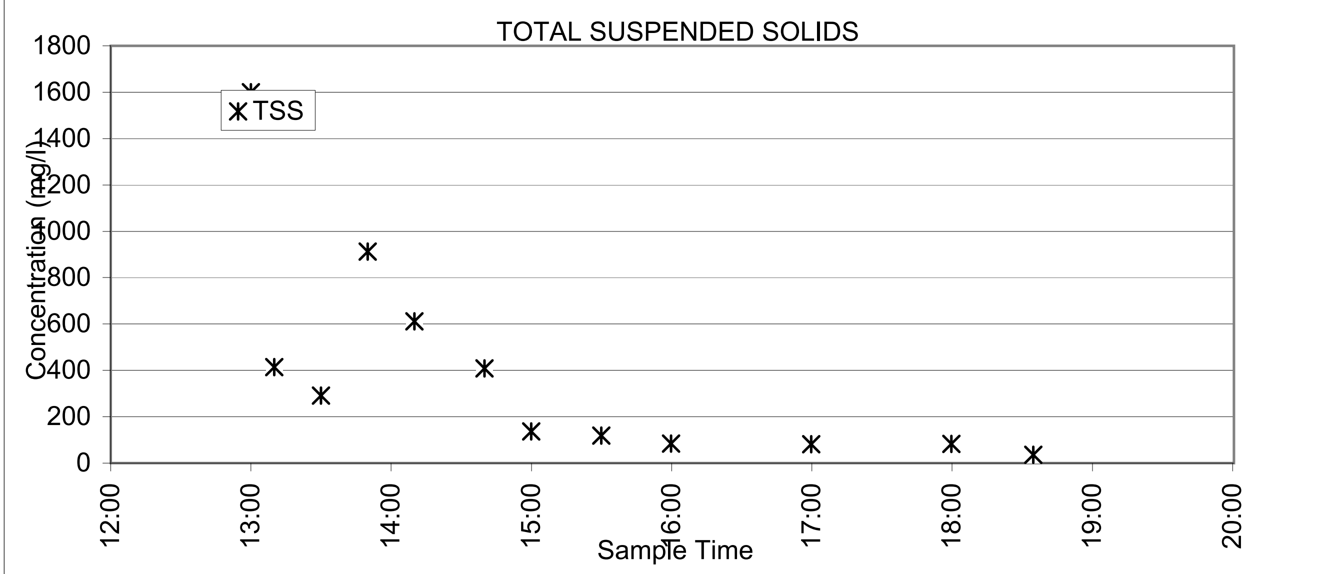

LEAD
Dissolved
Concentration (ug/l)
Sample Time

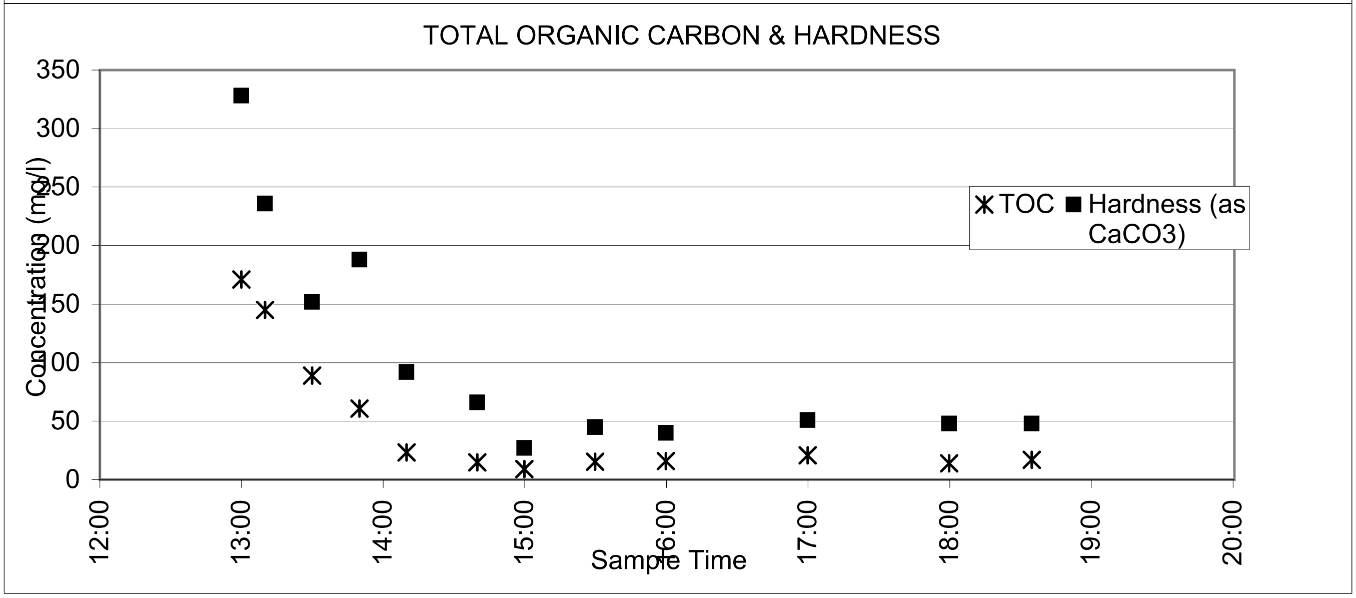

Station 14, Storm Event 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation

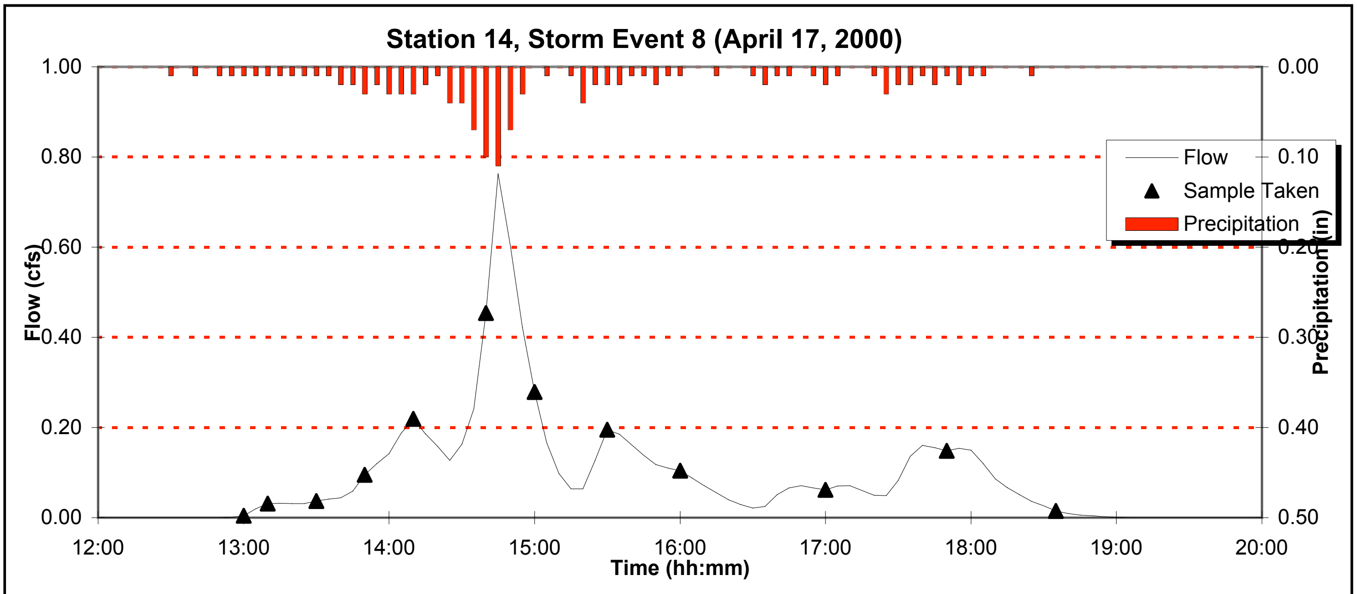

PHOSPHORUS
Dissolved
Total
Concentration (mg/l)
Sample Time

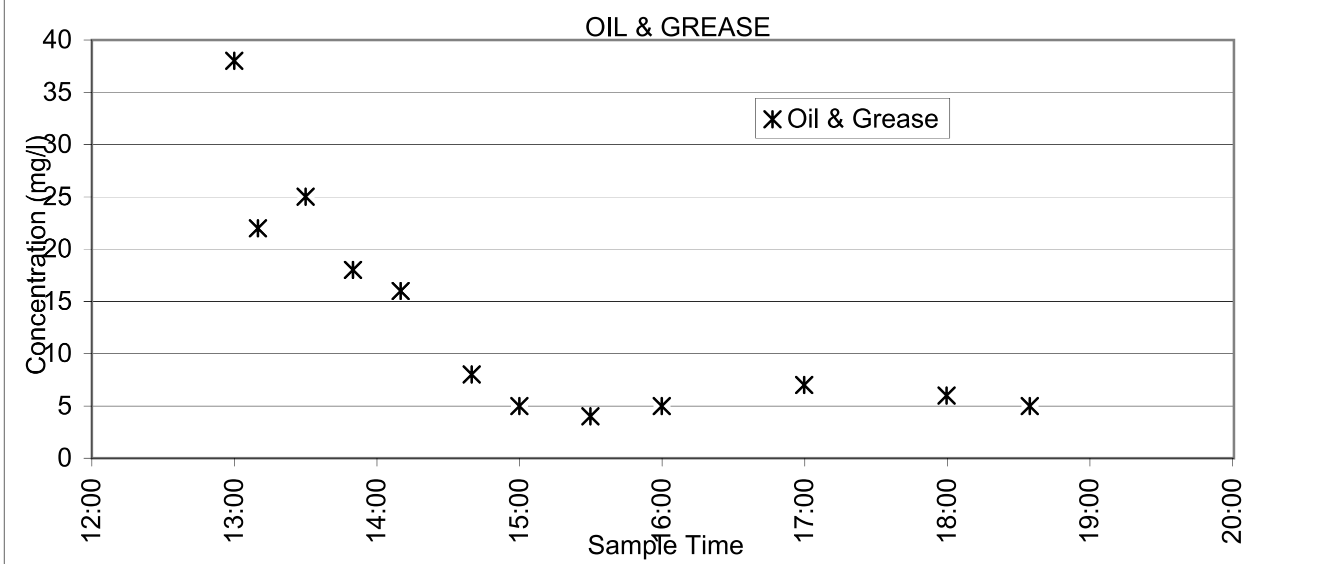

NITRATE (AS N)
Nitrate
Concentration (mg/l)
Sample Time

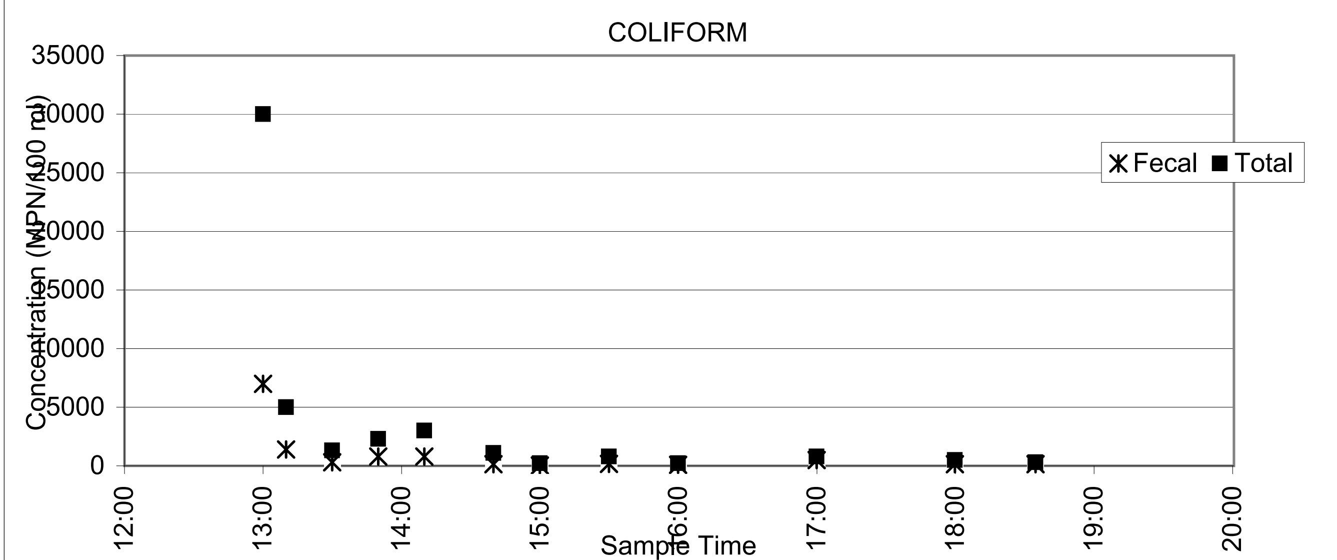

Station 14, Storm Event 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.10
0.20
0.30
0.40
0.50
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

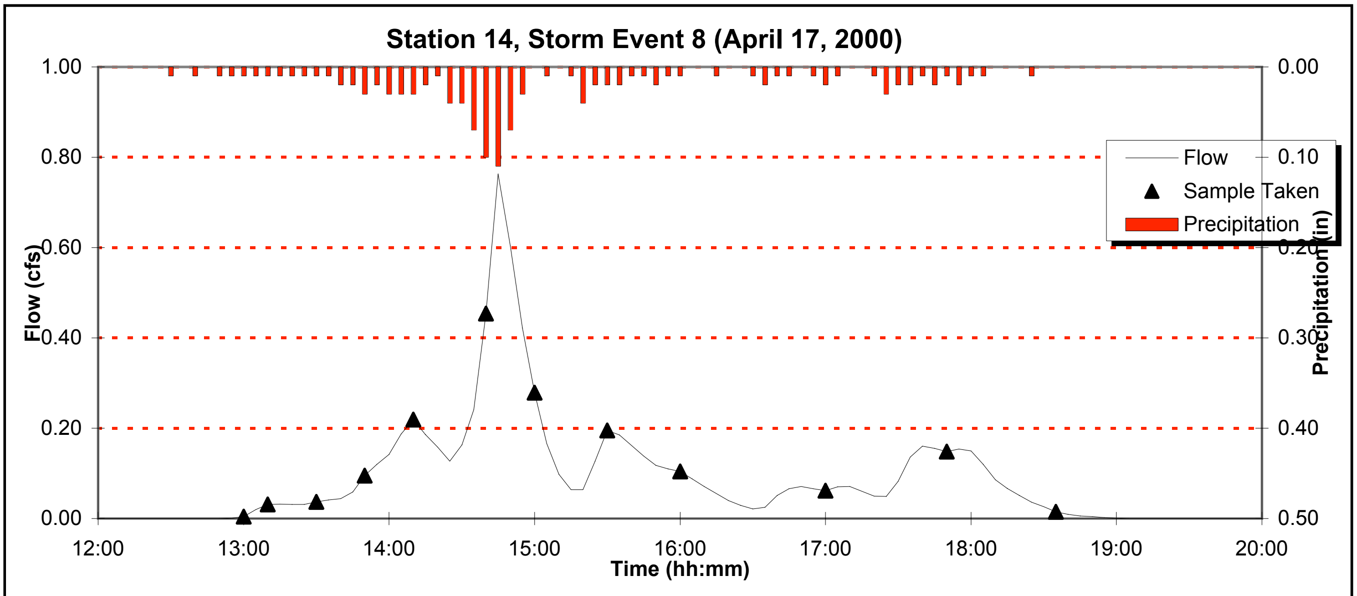

TOTAL SUSPENDED SOLIDS
Concentration (mg/l)
Sample Time
TSS
1800
1600
1400
1200
1000
800
600
400
200
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

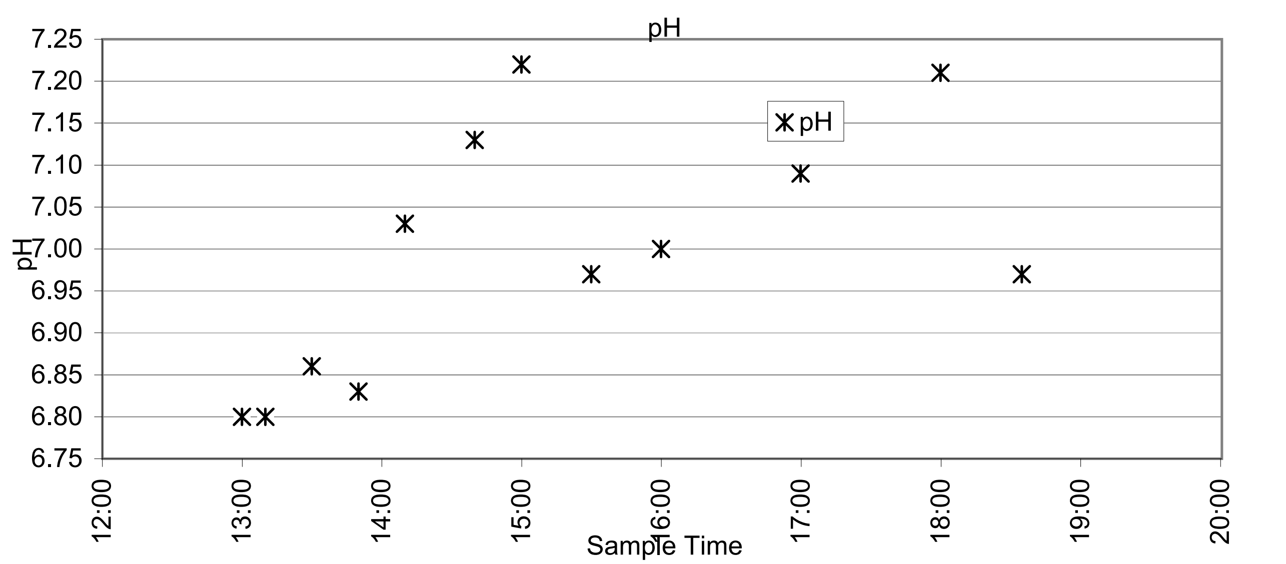

TOTAL ORGANIC CARBON & HARDNESS
Concentration (mg/l)
Sample Time
TOC
Hardness (as CaCO3)
350
300
250
200
150
100
50
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

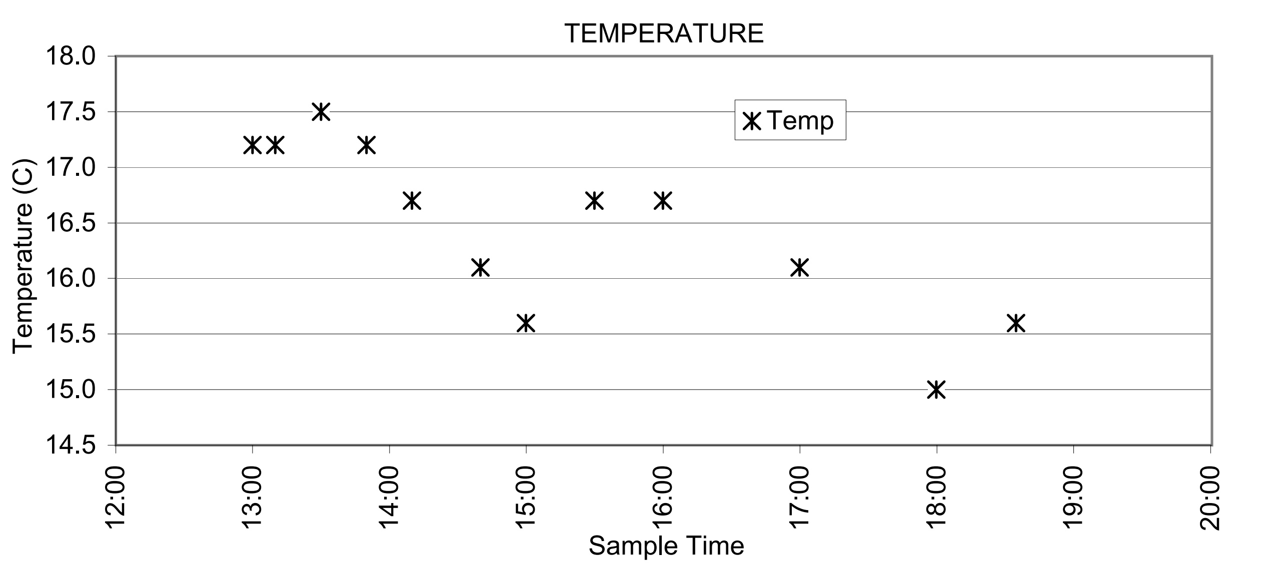

Station 14, Storm Event 8 (April 17, 2000)
Flow
Sample Taken
Precipitation
Flow (cfs)
Precipitation (in)
Time (hh:mm)
1.00
0.80
0.60
0.40
0.20
0.00
0.10
0.20
0.30
0.40
0.50
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

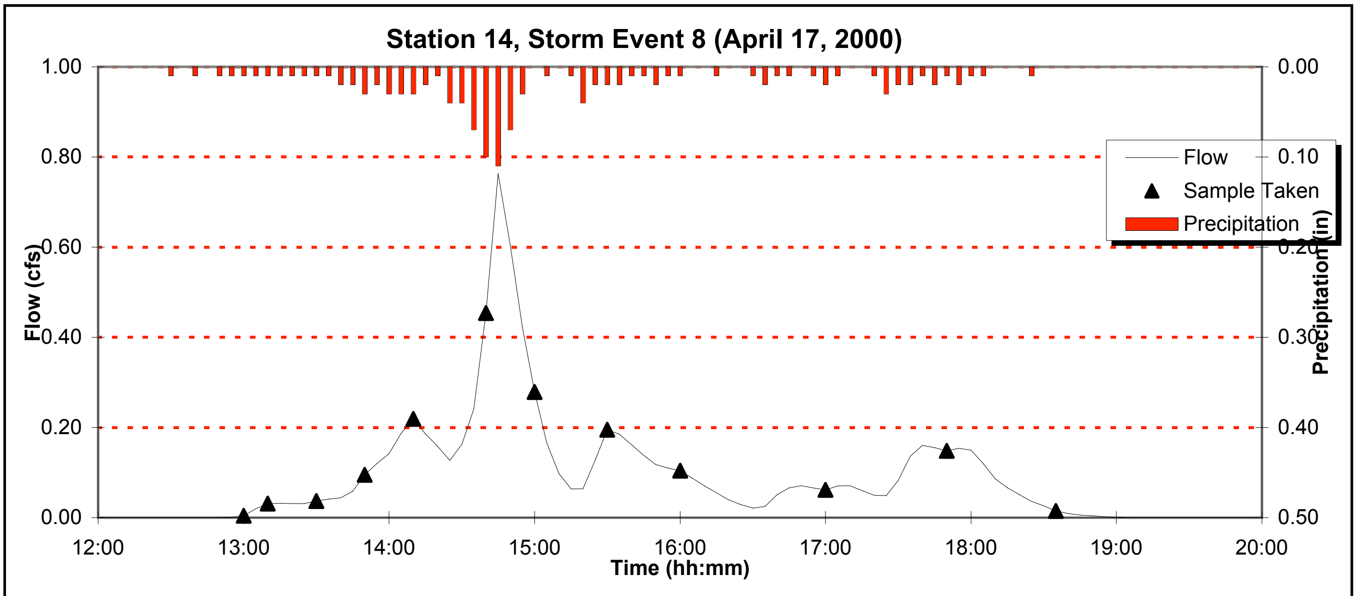

OIL & GREASE
Oil & Grease
Concentration (mg/l)
Sample Time
40
35
30
25
20
15
10
5
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

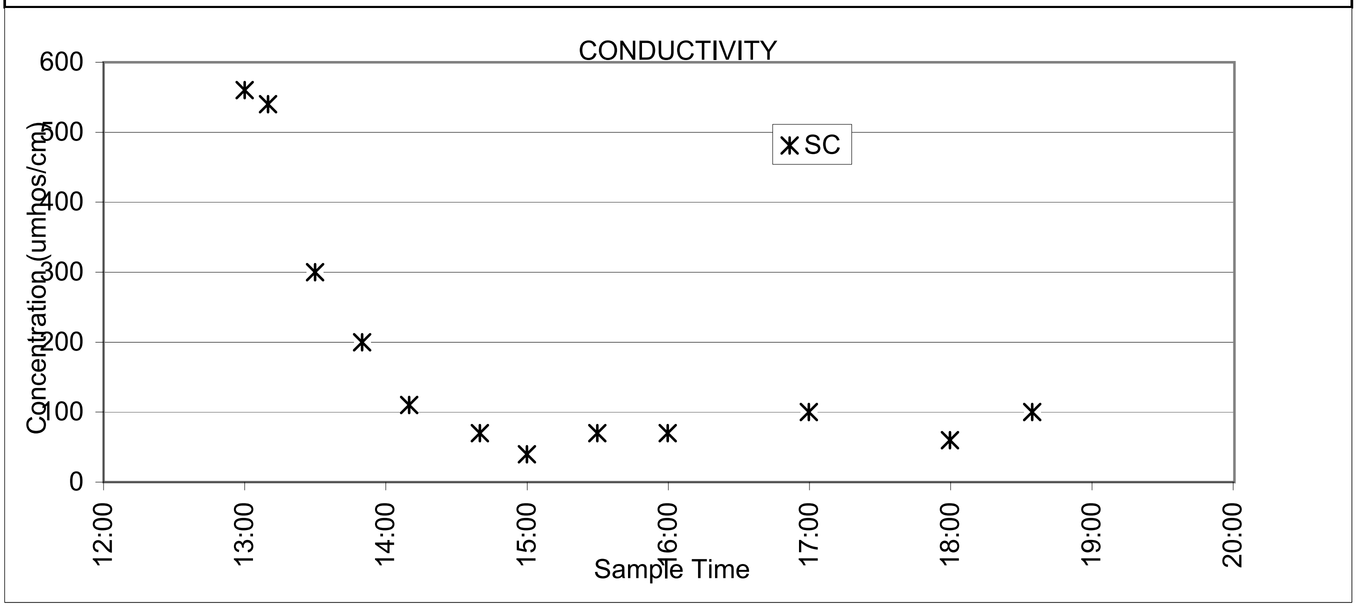

COLIFORM
Fecal
Total
Concentration (MPN/100 ml)
Sample Time
35000
30000
25000
20000
15000
10000
5000
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00


Station 14, Storm Event 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.00
0.80
0.60
0.40
0.20
0.00
0.10
0.20
0.30
0.40
0.50
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00


pH
pH
Sample Time
7.25
7.20
7.15
7.10
7.05
7.00
6.95
6.90
6.85
6.80
6.75
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00


TEMPERATURE
Temp
Temperature (C)
Sample Time
18.0
17.5
17.0
16.5
16.0
15.5
15.0
14.5
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00


Station 14, Storm Event 8 (April 17, 2000)
Flow (cfs)
Precipitation (in)
Time (hh:mm)
Flow
Sample Taken
Precipitation
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.10
0.20
0.30
0.40
0.50
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00


CONDUCTIVITY
Concentration (umhos/cm)
Sample Time
SC
600
500
400
300
200
100
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00

Appendix B
Analytical Results and Statistical Summary

Analytical Data for Site 1, Storm 1

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
			Sample	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	(as CaCO3)	(as N)	SS	TOC	Grease	Total	Fecal	pH	Conductivity	Temperature
Storm	Site	Date	Time	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)		(pH units)	(umho/cm)	(C)
1	1	25-Jan	5:20	0.25	3.1	3	28	33	126	7.5	32	10	922	67	585	0.83	1.1	270	3.5	626	62.5	5	5000	500	8.43	205	15.8
1	1	25-Jan	5:45	0.25	4	4	31	35	143	6	41	6	1420	45	633	1	1.3	282	4.7	930	66.5	3	8000	300	8.45	198	16.1
1	1	25-Jan	6:15	0.25	3.2	4	26	29	116	6	30	5	1050	40	545	0.92	1	190	4	632	51	5	8000	300	8.45	169	15.9
1	1	25-Jan	6:45	0.25	2.3	3	20	22	91	5	23	4	696	26	420	0.86	0.97	140	3.1	456	46.3	7	2300	1300	8.53	139	15.4
1	1	25-Jan	7:15	0.25	2.3	3	22	23	88	4	25	4	705	33	390	0.69	0.88	164	2.7	491	43.2	4	8000	300	8.56	134	15.0
1	1	25-Jan	7:45	0.25	2.1	2	18	20	83	4	20	4	590	31	374	0.86	1.1	296	2.2	446	37.4	3	2300	300	8.54	118	15.0
1	1	25-Jan	8:15	0.25	1.9	2	14	24	75	5	16	4	428	34	346	0.75	0.88	108	2.2	296	36.1	3	500	220	8.54	111	15.1
1	1	25-Jan	9:15	0.25	1.3	2	11	21	61	4	13	4	299	31	253	0.59	0.6	96	2	162	33.8	2	2200	340	8.39	111	15.2
1	1	25-Jan	10:15	0.25	1.3	3	11	24	59	5	13	5	333	43	239	0.24	0.64	100	2.5	104	31.3	4	1300	230	8.23	142	16.1
			Minimum	0.25	1.3	2	11	20	59	4	13	4	299	26	239	0.24	0.60	96	2.0	104	31.3	2	500	220	8.23	111	15.0
			Maximum	0.25	4.0	4	31	35	143	8	41	10	1420	67	633	1.00	1.30	296	4.7	930	66.5	7	8000	1300	8.56	205	16.1
			Median	0.25	2.3	3	20	24	88	5	23	4	696	34	390	0.83	0.97	164	2.7	456	43.2	4	2300	300	8.45	139	15.4
			Mean	0.25	2.4	3	20	26	94	5	24	5	716	39	421	0.75	0.94	183	3.0	460	45.3	4	4178	421	8.46	147	15.5
			Std Dev	0.00	0.9	1	7	5	29	1	9	2	366	12	140	0.23	0.22	81	0.9	255	12.5	2	3108	339	0.10	36	0.5
			Flow Weighted Mean	0.25	2.1	3	17	23	83	5	20	4	582	34	369	0.73	0.87	162	2.6	375	40.9	4	3332	430	8.46	132	15.3
			% Coeff. of Variance	0%	38%	27%	36%	21%	31%	23%	40%	38%	51%	31%	33%	30%	24%	44%	31%	55%	28%	38%	74%	81%	1%	24%	3%
			Relative % Difference	0%	102%	67%	95%	55%	83%	61%	104%	86%	130%	88%	90%	123%	74%	102%	81%	160%	72%	111%	176%	142%	4%	59%	7%

Analytical Data for Site 14, Storm 1

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
			Sample	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	(as CaCO3)	(as N)	SS	TOC	Grease	Total	Fecal	pH	Conductivity	Temperature
Storm	Site	Date	Time	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)		(pH units)	(umho/cm)	(C)
1	14	25-Jan	5:10	0.6	2	3	9	84	103	19	23	5	116	424	636	0.7	1.1	143	4.9	141	80	25	5000	800	7.28	410	16.1
1	14	25-Jan	5:40	0.7	1.8	3	11	62	114	16	21	6	144	335	600	0.97	0.97	138	3.5	139	84.5	29	8000	5000	7.34	340	15.6
1	14	25-Jan	6:00	0.6	2.2	2	11	51	112	14	22	5	214	284	641	0.71	0.77	105	2.8	111	86	20	5000	230	7.36	280	15.6
1	14	25-Jan	6:30	0.8	2.4	3	12	58	119	15	23	5	245	323	684	0.67	0.76	114	3	107	75	18	5000	3000	7.4	280	15.0
1	14	25-Jan	7:00	0.6	2.4	3	13	59	117	15	24	4	240	252	639	0.54	0.65	104	2.7	101	64	9	8000	3000	8.05	250	15.0
1	14	25-Jan	7:30	0.6	3	3	20	50	147	13	28	4	351	211	756	0.67	0.83	90	2.4	182	64.5	9	3000	10	8.06	230	15.0
1	14	25-Jan	8:00	0.25	2.8	2	14	40	126	9	20	4	269	124	618	0.77	0.88	76	1.5	186	42	12	5000	2300	9.2	150	15.0
1	14	25-Jan	9:00	0.5	2.5	2	13	42	120	9	20	4	248	138	540	0.53	0.71	82	1.6	124	48	7	3000	1400	7.49	170	15.0
			Minimum	0.25	1.8	2	9	40	103	9	20	4	116	124	540	0.53	0.65	76	1.5	101	42.0	7	3000	10	7.28	150	15.0
			Maximum	0.80	3.0	3	20	84	147	19	28	6	351	424	756	0.97	1.10	143	4.9	186	86.0	29	8000	5000	9.20	410	16.1
			Median	0.60	2.4	3	13	55	118	15	23	5	243	268	638	0.69	0.80	105	2.8	132	69.8	15	5000	1850	7.45	265	15.0
			Mean	0.58	2.4	3	13	56	120	14	23	5	228	261	639	0.70	0.83	107	2.8	136	68.0	16	5250	1968	7.77	264	15.3
			Std Dev	0.16	0.4	1	3	14	13	3	3	1	73	102	63	0.14	0.15	24	1.1	33	16.4	8	1909	1689	0.66	85	0.4
			Flow Weighted Mean																								
			% Coeff. of Variance	28%	17%	20%	25%	25%	11%	25%	12%	16%	32%	39%	10%	20%	18%	23%	39%	24%	24%	51%	36%	86%	8%	32%	3%
			Relative % Difference	105%	50%	40%	76%	71%	35%	71%	33%	40%	101%	109%	33%	59%	51%	61%	106%	59%	69%	122%	91%	199%	23%	93%	7%

Analytical Data for Site 1, Storm 2

Storm	Site	Date	Sample Time	Cadmium Dissolved (ug/L)	Cadmium Total (ug/L)	Chromium Dissolved (ug/L)	Chromium Total (ug/L)	Copper Dissolved (ug/L)	Copper Total (ug/L)	Nickel Dissolved (ug/L)	Nickel Total (ug/L)	Lead Dissolved (ug/L)	Lead Total (ug/L)	Zinc Dissolved (ug/L)	Zinc Total (ug/L)	Phosphorus Dissolved (mg/L)	Phosphorus Total (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrate (as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Oil & Grease (mg/L)	Coliform Total (MPN/100 ml)	Coliform Fecal (MPN/100 ml)	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
2	1	12-Feb	1:25	0.25	0.9	0.5	9	16	38	4	9	13	216	22	191	0.73	1	105	1.3	405	33	2	5000	10	8.13	102	12.5
2	1	12-Feb	1:55	0.25	1.3	2	14	11	55	2	14	16	499	18	253	0.42	0.48	92	1.5	232	17.8	0.5	1300	170	8.25	85	15
2	1	12-Feb	2:25	0.7	1.8	4	17	26	74	5	20	197	471	148	349	0.34	0.47	49	0.87	204	11.9	0.5	3000	60	8.24	50	12.5
2	1	12-Feb	3:55	0.25	0.25	0.5	4	4	19	0.5	3	6	95	14	89	0.34	0.36	34	0.76	164	6.9	0.5	220	20	7.93	40	12
			Minimum	0.25	0.3	1	4	4	19	1	3	6	95	14	89	0.34	0.36	34	0.8	164	6.9	1	220	10	7.93	40	12.0
			Maximum	0.70	1.8	4	17	26	74	5	20	197	499	148	349	0.73	1.00	105	1.5	405	33.0	2	5000	170	8.25	102	15.0
			Median	0.25	1.1	1	12	14	47	3	12	15	344	20	222	0.38	0.48	71	1.1	218	14.9	1	2150	40	8.19	68	12.5
			Mean	0.36	1.1	2	11	14	47	3	12	58	320	51	221	0.46	0.58	70	1.1	251	17.4	1	2380	65	8.14	69	13.0
			Std Dev	0.23	0.7	2	6	9	24	2	7	93	197	65	109	0.19	0.29	34	0.4	106	11.3	1	2088	73	0.15	29	1.4
			Flow Weighted Mean	0.27	0.5	1	6	7	27	1	6	36	168	32	125	0.28	0.31	34	0.68	142	7	0	707	35	6.33	37	9.8
			% Coeff. of Variance	62%	62%	95%	52%	65%	51%	70%	63%	160%	61%	129%	49%	41%	50%	48%	32%	42%	65%	86%	88%	113%	2%	42%	10%
			Relative % Difference	95%	151%	156%	124%	147%	118%	164%	148%	188%	136%	165%	119%	73%	94%	102%	65%	85%	131%	120%	183%	178%	4%	87%	22%

Analytical Data for Site 14, Storm 2

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
			Sample	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	(as CaCO3)	(as N)	SS	TOC	Grease	Total	Fecal	pH	Conductivity	Temperature
Storm	Site	Date	Time	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)		(pH units)	(umho/cm)	(C)
2	14	12-Feb	1:45	0.4	1.4	1	11	32	64	7	15	3	82	158	327	0.5	0.59	73	1	163	41.6	0.5	2200	700	8.51	220	13.3
2	14	12-Feb	2:00	0.25	1.8	1	14	20	75	5	15	8	166	89	412	0.65	0.71	59	0.85	224	28	1	3000	20	9.15	120	13.3
2	14	12-Feb	2:30	0.25	0.7	0.5	5	8	29	2	5	6	68	44	156	0.29	0.32	28	0.3	67	11.8	0.5	1100	230	9.51	50	13.3
2	14	12-Feb	3:00	0.25	0.9	0.5	4	5	23	1	4	2	45	44	151	0.33	0.35	21	0.2	55	6.9	1	230	40	9.76	30	13.3
2	14	12-Feb	3:30	0.25	0.7	1	4	5	24	1	4	3	45	49	128	0.33	0.36	24	0.21	58	7.2	1	2200	40	9.66	40	12.8
2	14	12-Feb	3:45	0.25	2.6	0.5	22	3	109	0.5	19	1	241	36	825	8.1	17	46	0.15	495	10.1	2	7000	110	9.85	20	12.8
2	14	12-Feb	4:00	0.25	0.4	0.5	2	4	18	0.5	2	2	19	33	75	0.32	0.34	16	0.16	27	5.9	0.5	500	300	10.14	30	12.8
			Minimum	0.25	0.4	1	2	3	18	1	2	1	19	33	75	0.29	0.32	16	0.2	27	5.9	1	230	20	8.51	20	12.8
			Maximum	0.40	2.6	1	22	32	109	7	19	8	241	158	825	8.10	17.00	73	1.0	495	41.6	2	7000	700	10.14	220	13.3
			Median	0.25	0.9	1	5	5	29	1	5	3	68	44	156	0.33	0.36	28	0.2	67	10.1	1	2200	110	9.66	40	13.3
			Mean	0.27	1.2	1	9	11	49	2	9	4	95	65	296	1.50	2.81	38	0.4	156	15.9	1	2319	206	9.51	73	13.1
			Std Dev	0.06	0.8	0	7	11	35	3	7	3	80	45	262	2.91	6.26	22	0.4	165	13.6	1	2294	242	0.54	73	0.3
			Flow Weighted Mean	0.25	1.4	1	10	5	54	1	9	3	115	43	369	2.84	5.73	32	0.23	204	10	1	3035	123	9.73	36	13.0
			% Coeff. of Variance	21%	64%	37%	82%	99%	71%	105%	76%	70%	84%	70%	88%	194%	223%	57%	87%	106%	86%	58%	99%	118%	6%	100%	2%
			Relative % Difference	46%	147%	67%	167%	166%	143%	173%	162%	156%	171%	131%	167%	186%	193%	128%	148%	179%	150%	120%	187%	189%	17%	167%	4%

Analytical Data for Site 1, Storm 3

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
			Sample	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	(as CaCO3)	(as N)	SS	TOC	Grease	Total	Fecal	pH	Conductivity	Temperature
Storm	Site	Date	Time	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)		(pH units)	(umho/cm)	(C)
3	1	20-Feb	14:15	0.25	0.25	3	6	6	24	1	7	8	99	13	130	0.1	0.53	32	0.55	482	8	2	170	40	8.15	60	Temperature
3	1	20-Feb	14:45	0.25	0.25	4	4.4	10	16	2	4	12	57	27	69	0.15	0.23	43	0.99	40	10.4	1	1300	110	7.75	100	Probe Broken
3	1	20-Feb	15:15	0.25	0.25	3	4	9	21	2	5	13	69	26	95	0.14	0.18	40	0.9	37	10.5	1	220	40	7.81	100	
3	1	20-Feb	15:45	0.25	0.25	2	4	7	19	2	4	13	97	20	95	0.12	0.29	45	0.84	890	9.9	2	270	200	7.76	90	
3	1	20-Feb	16:15	0.25	0.25	2	4	8	19	2	4	12	84	26	98	0.1	0.25	43	0.9	70	10.1	1	270	10	7.87	100	
3	1	20-Feb	16:45	0.25	0.6	3.6	4.4	10	21	2	4	10	76	31	90	0.18	0.19	45	1.1	25	10.7	1	330	20	7.8	120	
3	1	20-Feb	18:25	0.25	0.25	2	6	7	25	2	6	16	138	20	140	0.12	0.79	44	0.85	160	9.5	4	500	10	7.87	110	
3	1	20-Feb	19:25	0.25	0.25	2	3	4	16	0.5	3	7	69	14	69	0.05	0.25	24	0.39	61	6.2	2	1300	1300	7.88	100	
3	1	20-Feb	20:30	0.25	0.25	2	3	5	12	1	2	12	72	18	60	0.12	0.14	35	0.54	26	7	2	1700	1700	7.81	100	
3	1	20-Feb	21:30	0.25	0.25	1	2	4	15	0.5	3	11	83	16	77	0.05	0.18	28	0.42	76	6.4	2	1100	1100	7.75	100	
3	1	20-Feb	22:30	0.25	0.6	1.7	1.9	4	10	1	2	12	63	17	55	0.11	0.13	34	0.51	15	5.8	1	500	500	7.66	110	
3	1	20-Feb	23:30	0.25	0.7	7	8	4	12	1	2	18	102	15	67	0.12	0.15	39	0.57	20	8.4	2	800	500	7.72	120	
3	1	21-Feb	0:30	0.25	0.8	2	4	3	16	0.5	5	16	162	11	92	0.11	0.21	30	0.42	63	5.3	1	1700	1700	7.71	90	
3	1	21-Feb	1:30	0.25	0.25	1	3	2	12	0.5	3	10	99	7	66	0.05	0.19	23	0.27	39	9.4	0.5	270	10	7.93	80	
			Minimum	0.25	0.3	1	2	2	10	1	2	7	57	7	55	0.05	0.13	23	0.3	15	5.3	1	170	10	7.66	60	0.0
			Maximum	0.25	0.8	7	8	10	25	2	7	18	162	31	140	0.18	0.79	45	1.1	890	10.7	4	1700	1700	8.15	120	0.0
			Median	0.25	0.3	2	4	6	16	1	4	12	84	18	84	0.12	0.20	37	0.6	51	8.9	2	500	155	7.81	100	#NUM!
			Mean	0.25	0.4	3	4	6	17	1	4	12	91	19	86	0.11	0.27	36	0.7	143	8.4	2	745	517	7.82	99	#DIV/0!
			Std Dev	0.00	0.2	2	2	3	5	1	2	3	29	7	25	0.04	0.18	8	0.3	246	1.9	1	565	650	0.12	16	#DIV/0!
			Flow Weighted Mean	0.25	0.3	2	4	5	15	1	3	11	83	16	77	0.09	0.24	32	0.54	94	8	2	961	794	7.84	96	0.0
			% Coeff. of Variance	0%	55%	59%	40%	44%	27%	52%	39%	25%	32%	37%	29%	35%	68%	22%	39%	172%	23%	55%	76%	126%	2%	16%	#DIV/0!
			Relative % Difference	0%	105%	150%	123%	133%	86%	120%	111%	88%	96%	126%	87%	113%	143%	65%	121%	193%	68%	156%	164%	198%	6%	67%	#DIV/0!

Analytical Data for Site 14, Storm 3

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
			Sample	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	(as CaCO3)	(as N)	SS	TOC	Grease	Total	Fecal	pH	Conductivity	Temperature
Storm	Site	Date	Time	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)		(pH units)	(umho/cm)	(C)
3	14	20-Feb	15:40	0.25	8.2	0.5	10	13	70	3	12	2	190	31	382	0.11	0.32	37	0.32	211	15	4	170	20	7.80	70	17.2
3	14	20-Feb	16:00	0.25	4.2	3	4	21	36	7	8	5	33	100	176	0.18	0.24	49	0.94	14	25.2	5	230	130	7.25	150	16.7
3	14	20-Feb	17:45	0.25	2.9	2	13	14	87	4	16	4	191	64	564	0.15	0.34	58	0.54	296	14.9	3	270	270	7.22	120	16.1
3	14	20-Feb	18:00	0.25	2.6	3	6	13	34	4	7	6	52	66	185	0.18	0.23	36	0.67	38	15.7	4	300	300	7.23	100	15.6
3	14	20-Feb	18:30	0.25	1.7	2	5	10	32	3	6	5	48	62	178	0.14	0.17	30	0.5	49	11.2	5	80	80	7.29	70	15.6
3	14	20-Feb	19:00	0.25	2.9	2	15	5	97	1	16	2	183	29	868	0.11	0.62	44	0.32	351	9.4	4	110	110	7.44	30	15.6
3	14	20-Feb	19:20	0.25	1.7	3	5	7	23	2	4	2	34	40	121	0.11	0.17	22	0.39	46	6.8	4	80	110	7.20	50	15.6
3	14	20-Feb	19:45	0.3	1.3	5	6	12	27	3	5	5	30	87	149	0.15	0.17	38	0.63	11	10	3	500	110	7.11	100	15.0
3	14	20-Feb	20:20	0.25	1.3	2	6	9	43	2	7	4	70	54	287	0.14	0.16	30	0.42	85	10	5	300	80	7.24	70	15.0
3	14	20-Feb	20:40	0.25	2.2	3	5	11	27	3	6	5	35	72	165	0.14	0.15	36	0.51	15	10.2	5	300	10	7.18	90	15.0
3	14	20-Feb	21:20	0.25	1.7	2	9	6	46	1	8	2	89	37	352	0.12	0.31	28	0.28	147	6.6	5	220	10	7.40	50	13.3
3	14	20-Feb	23:00	0.25	0.9	2	4	11	35	3	6	9	72	77	223	0.15	0.18	40	0.42	2	9.2	4	170	10	7.41	90	12.8
3	14	20-Feb	23:30	0.25	0.9	1	4	8	29	2	5	6	69	50	156	0.15	0.18	36	0.35	42	8.5	2	500	40	7.41	70	12.2
3	14	21-Feb	0:00	0.25	0.25	1	2	7	15	1	4	4	29	39	79	0.13	0.13	23	0.27	14	6.3	1	500	20	7.40	60	11.7
3	14	21-Feb	1:00	0.25	0.5	1	2	7	18	2	3	4	26	55	98	0.11	0.14	30	0.29	10	5.8	2	130	10	7.29	70	11.7
			Minimum	0.25	0.3	1	2	5	15	1	3	2	26	29	79	0.11	0.13	22	0.3	2	5.8	1	80	10	7.11	30	11.7
			Maximum	0.30	8.2	5	15	21	97	7	16	9	191	100	868	0.18	0.62	58	0.9	351	25.2	5	500	300	7.80	150	17.2
			Median	0.25	1.7	2	5	10	34	3	6	4	52	55	178	0.14	0.18	36	0.4	42	10.0	4	230	80	7.29	70	15.0
			Mean	0.25	2.2	2	6	10	41	3	8	4	77	58	266	0.14	0.23	36	0.5	89	11.0	4	257	87	7.32	79	14.6
			Std Dev	0.01	2.0	1	4	4	24	2	4	2	61	21	210	0.02	0.13	10	0.2	112	5.0	1	147	92	0.17	30	1.8
			Flow Weighted Mean	0.25	1.5	2	6	8	39	2	7	4	71	49	276	0.13	0.25	32	0.37	89	8	3	219	58	7.34	63	13.8
			% Coeff. of Variance	5%	88%	52%	59%	40%	59%	56%	54%	44%	79%	36%	79%	17%	54%	27%	40%	126%	46%	34%	57%	105%	2%	38%	12%
			Relative % Difference	18%	188%	164%	153%	123%	146%	150%	137%	127%	152%	110%	167%	48%	131%	90%	111%	198%	125%	133%	145%	187%	9%	133%	38%

Analytical Data for Site 1, Storm 4

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
			Sample	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	(as CaCO3)	(as N)	SS	TOC	Grease	Total	Fecal	pH	Conductivity	Temperature
Storm	Site	Date	Time	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)		(pH units)	(umho/cm)	(C)
4	1	23-Feb	5:45	0.25	0.6	0.5	5	12	33	3	7	5	105	41	186	0.11	0.42	42	0.97	128	18.1	2	1700	500	6.95	*Conductivity	13.3
4	1	23-Feb	6:15	0.25	1.5	2	10	10	47	2	11	20	418	15	264	0.16	0.38	72	0.94	163	14.8	4	1300	300	7.42	Meter Broken	12.2
4	1	23-Feb	6:45	0.25	1.4	3	14	8	52	2	13	21	387	15	274	0.22	0.42	70	0.75	215	11.2	3	800	220	7.45		11.1
4	1	23-Feb	7:15	0.25	1.1	2	9	7	39	1	9	18	277	15	196	0.13	0.33	63	0.68	147	10.1	2	2300	170	7.58		11.1
4	1	23-Feb	7:45	0.25	1	2	8	7	36	1	8	19	249	18	178	0.3	0.31	55	0.68	108	10.2	2	3000	800	7.45		11.1
4	1	23-Feb	8:15	0.25	0.9	2	8	8	38	1	8	18	242	19	184	0.12	0.25	54	0.65	108	10.4	3	1700	500	7.49		11.1
4	1	23-Feb	8:45	0.25	0.8	3	9	8	34	2	8	20	218	40	164	0.14	0.23	54	0.69	66	11.2	1	2300	90	7.43		11.7
4	1	23-Feb	9:45	0.25	0.8	2	8	9	33	2	7	19	216	22	157	0.17	0.21	56	0.76	65	10.4	3	1700	130	7.37		12.2
4	1	23-Feb	10:45	0.25	1.1	2	10	6	41	0.5	9	10	200	15	196	0.13	0.34	40	0.43	140	8.4	1	5000	1300	7.41		12.2
4	1	23-Feb	11:45	0.25	0.9	1	8	5	36	0.5	7	9	179	13	177	0.2	0.4	39	0.38	160	7.2	2	800	70	7.35		12.2
4	1	23-Feb	12:45	0.25	0.8	2	7	5	31	0.5	6	6	144	11	157	0.11	0.45	30	0.28	146	5.5	0.5	230	80	7.34		12.2
4	1	23-Feb	13:45	0.25	0.8	2	8	5	31	0.5	7	7	145	12	145	0.16	0.45	30	0.33	178	5.8	0.5	230	40	7.23		11.7
4	1	23-Feb	14:45	0.25	0.7	2	5	6	26	0.5	5	10	119	19	119	0.16	0.32	29	0.3	160	5.3	1	500	230	7.22		11.7
			Minimum	0.25	0.6	1	5	5	26	1	5	5	105	11	119	0.11	0.21	29	0.3	65	5.3	1	230	40	6.95	0	11.1
			Maximum	0.25	1.5	3	14	12	52	3	13	21	418	41	274	0.30	0.45	72	1.0	215	18.1	4	5000	1300	7.58	0	13.3
			Median	0.25	0.9	2	8	7	36	1	8	18	216	15	178	0.16	0.34	54	0.7	146	10.2	2	1700	220	7.41	#NUM!	11.7
			Mean	0.25	1.0	2	8	7	37	1	8	14	223	20	184	0.16	0.35	49	0.6	137	9.9	2	1658	341	7.36	#DIV/0!	11.8
			Std Dev	0.00	0.3	1	2	2	7	1	2	6	95	10	43	0.05	0.08	15	0.2	43	3.7	1	1317	363	0.16	#DIV/0!	0.7
			Flow Weighted Mean	0.25	0.9	2	8	6	33	1	7	10	171	15	159	0.16	0.39	37	0.39	156	7	1	972	228	7.31	0	11.8
			% Coeff. of Variance	0%	28%	34%	27%	28%	19%	66%	26%	44%	43%	50%	23%	33%	24%	30%	39%	31%	37%	57%	79%	106%	2%	#DIV/0!	6%
			Relative % Difference	0%	86%	143%	95%	82%	67%	143%	89%	123%	120%	115%	79%	93%	73%	85%	110%	107%	109%	156%	182%	188%	9%	#DIV/0!	18%

Analytical Data for Site 14, Storm 4

Storm	Site	Date	Sample Time	Cadmium Dissolved (ug/L)	Cadmium Total (ug/L)	Chromium Dissolved (ug/L)	Chromium Total (ug/L)	Copper Dissolved (ug/L)	Copper Total (ug/L)	Nickel Dissolved (ug/L)	Nickel Total (ug/L)	Lead Dissolved (ug/L)	Lead Total (ug/L)	Zinc Dissolved (ug/L)	Zinc Total (ug/L)	Phosphorus Dissolved (mg/L)	Phosphorus Total (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrate (as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Oil & Grease (mg/L)	Coliform Total (MPN/100 ml)	Coliform Fecal (MPN/100 ml)	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
4	14	23-Feb	5:45	0.25	1.1	2	7	24	50	7	11	5	83	110	281	0.2	0.32	60	1.3	63	28.6	5	1300	500		180	12.8
4	14	23-Feb	6:05	0.25	1.2	2	7	23	54	7	12	8	89	115	299	0.12	0.2	68	1.3	37	29.4	6	2300	500	8.70	340	12.8
4	14	23-Feb	6:25	0.25	1.4	3	8	21	58	6	12	10	129	111	334	0.19	0.39	69	1.1	75	26.4	6	3000	700	8.48	170	12.8
4	14	23-Feb	6:45	0.25	1.5	2	10	10	56	3	10	8	124	42	337	0.43	0.49	40	0.58	117	13.7	4	3000	1300	8.63	80	12.2
4	14	23-Feb	7:05	0.3	1.5	2	9	13	62	3	10	9	137	53	311	0.17	0.33	41	0.61	85	11.6	6	3000	1700	8.49	90	12.2
4	14	23-Feb	7:25	0.25	1.3	2	7	15	59	3	8	11	124	62	282	0.11	0.22	42	0.67	57	11.6	6	1100	500	8.67	100	12.2
4	14	23-Feb	7:45	0.25	1.2	3	7	16	53	4	9	13	125	76	275	0.15	0.19	53	0.72	49	12.1	3	3000	1300	8.64	120	12.2
4	14	23-Feb	8:05	0.25	1.5	3	9	17	64	4	10	15	161	82	333	0.19	0.21	53	0.76	55	12.9	4	3000	230	8.55	130	12.2
4	14	23-Feb	8:25	0.25	1.7	2	9	14	65	3	10	12	161	59	334	0.12	0.16	51	0.7	75	14.2	4	8000	340	8.59	120	12.2
4	14	23-Feb	8:45	0.25	1.5	2	10	17	64	4	11	13	151	76	354	0.15	0.22	58	0.72	55	14.4	4	8000	5000	8.55	110	12.8
4	14	23-Feb	9:15	0.25	1.5	3	9	18	56	4	11	18	180	78	306	0.21	0.31	56	0.82	56	15.3	5	3000	2300	8.63	130	12.8
4	14	23-Feb	10:15	0.25	2.9	2	18	13	97	3	17	13	282	50	528	0.14	0.32	60	0.65	162	15.9	6	13000	3000	8.43	110	13.3
4	14	23-Feb	11:15	0.25	1.8	2	11	13	68	3	11	11	171	46	322	0.13	0.25	45	0.54	82	10.4	5	5000	3000	8.51	80	13.3
4	14	23-Feb	12:15	0.25	1.6	2	9	10	60	2	8	8	122	38	236	0.15	0.18	36	0.37	60	8.7	5	3000	1300	8.52	70	14.4
4	14	23-Feb	13:15	0.25	2	2	12	13	66	3	11	13	185	51	325	0.15	0.23	45	0.5	69	10	4	13000	8000	8.69	100	15.0
4	14	23-Feb	13:45	0.25	1.7	2	11	4	55	0.5	9	2	125	17	362	0.13	0.36	27	0.22	144	14.9	4	5000	1700	8.73	30	13.3
4	14	23-Feb	14:40	0.25	1.7	2	11	10	57	2	10	9	131	49	304	0.17	0.22	45	0.35	61	13	4	5000	500	8.31	80	13.3
			Minimum	0.25	1.1	2	7	4	50	1	8	2	83	17	236	0.11	0.16	27	0.2	37	8.7	3	1100	230	8.31	30	12.2
			Maximum	0.30	2.9	3	18	24	97	7	17	18	282	115	528	0.43	0.49	69	1.3	162	29.4	6	13000	8000	8.73	340	15.0
			Median	0.25	1.5	2	9	14	59	3	10	11	131	59	322	0.15	0.23	51	0.7	63	13.7	5	3000	1300	8.57	110	12.8
			Mean	0.25	1.6	2	10	15	61	4	11	10	146	66	325	0.17	0.27	50	0.7	77	15.5	5	4865	1875	8.57	120	12.9
			Std Dev	0.01	0.4	0	3	5	10	2	2	4	45	28	61	0.07	0.09	11	0.3	34	6.4	1	3622	2016	0.11	67	0.8
			Flow Weighted Mean	0.25	1.7	2	11	11	62	2	10	9	146	44	320	0.16	0.27	41	0.46	88	12	5	5571	2348	8.51	79	13.5
			% Coeff. of Variance	5%	26%	20%	28%	34%	17%	47%	19%	36%	31%	42%	19%	43%	33%	23%	43%	44%	41%	20%	74%	108%	1%	56%	6%
			Relative % Difference	18%	90%	40%	88%	143%	64%	173%	72%	160%	109%	148%	76%	119%	102%	88%	142%	126%	109%	67%	169%	189%	5%	168%	20%

Analytical Data for Site 1, Storm 5

Storm	Site	Date	Sample Time	Cadmium Dissolved (ug/L)	Cadmium Total (ug/L)	Chromium Dissolved (ug/L)	Chromium Total (ug/L)	Copper Dissolved (ug/L)	Copper Total (ug/L)	Nickel Dissolved (ug/L)	Nickel Total (ug/L)	Lead Dissolved (ug/L)	Lead Total (ug/L)	Zinc Dissolved (ug/L)	Zinc Total (ug/L)	Phosphorus Dissolved (mg/L)	Phosphorus Total (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrate (as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Oil & Grease (mg/L)	Coliform Total (MPN/100 ml)	Coliform Fecal (MPN/100 ml)	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
5	1	27-Feb	13:00	0.25	1.1	1	70	18	45	4	10	3	113	79	317	0.25	0.68	64	3.3	442	25.8	3	2300	230	7.63	150	13.9
5	1	27-Feb	13:20	0.25	1.1	2	8	8	39	2	9	11	176	43	218	0.12	0.63	42	1.8	171	12.7	3	230	40	8.14	80	12.8
5	1	27-Feb	13:45	0.25	0.7	2	6	7	33	2	6	10	133	20	152	0.14	0.31	39	1.1	90	8.4	2	220	40	8.1	70	12.8
5	1	27-Feb	14:05	0.25	0.5	2	5	7	23	1	5	10	107	19	115	0.15	0.33	36	0.91	67	8.4	2	500	40	8.08	70	12.8
5	1	27-Feb	14:25	0.25	0.25	2	4	7	21	2	4	8	81	23	98	0.15	0.21	36	0.78	45	7.1	2	300	80	8.05	60	12.8
5	1	27-Feb	14:45	0.25	0.6	2	5	6	25	1	5	8	98	20	116	0.14	0.26	32	0.65	54	6.8	1	130	40	7.9	60	13.3
5	1	27-Feb	15:05	0.25	0.6	2	4	8	26	2	4	9	93	25	97	0.14	0.17	35	0.76	42	6.8	2	300	40	7.96	70	13.3
			Minimum	0.25	0.3	1	4	6	21	1	4	3	81	19	97	0.12	0.17	32	0.7	42	6.8	1	130	40	7.63	60	12.8
			Maximum	0.25	1.1	2	70	18	45	4	10	11	176	79	317	0.25	0.68	64	3.3	442	25.8	3	2300	230	8.14	150	13.9
			Median	0.25	0.6	2	5	7	26	2	5	9	107	23	116	0.14	0.31	36	0.9	67	8.4	2	300	40	8.05	70	12.8
			Mean	0.25	0.7	2	15	9	30	2	6	8	114	33	159	0.16	0.37	41	1.3	130	10.9	2	569	73	7.98	80	13.1
			Std Dev	0.00	0.3	0	24	4	9	1	2	3	32	22	81	0.04	0.20	11	1.0	145	6.9	1	772	71	0.18	32	0.4
			Flow Weighted Mean	0.25	0.7	2	8	7	30	2	6	9	122	28	149	0.14	0.37	38	1.16	100	9	2	330	52	8.04	72	12.9
			% Coeff. of Variance	0%	45%	20%	168%	48%	30%	50%	39%	31%	28%	67%	51%	27%	55%	27%	72%	111%	64%	32%	136%	97%	2%	40%	3%
			Relative % Difference	0%	126%	67%	178%	100%	73%	120%	86%	114%	74%	122%	106%	70%	120%	67%	134%	165%	117%	100%	179%	141%	6%	86%	8%

Analytical Data for Site 14, Storm 5

Storm	Site	Date	Sample Time	Cadmium Dissolved (ug/L)	Cadmium Total (ug/L)	Chromium Dissolved (ug/L)	Chromium Total (ug/L)	Copper Dissolved (ug/L)	Copper Total (ug/L)	Nickel Dissolved (ug/L)	Nickel Total (ug/L)	Lead Dissolved (ug/L)	Lead Total (ug/L)	Zinc Dissolved (ug/L)	Zinc Total (ug/L)	Phosphorus Dissolved (mg/L)	Phosphorus Total (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrate (as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Oil & Grease (mg/L)	Coliform Total (MPN/100 ml)	Coliform Fecal (MPN/100 ml)	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
5	14	27-Feb	13:30	0.25	1.2	2	8	27	58	6	12	2	67	140	357	0.28	0.47	54	1.1	81	30.2	8	340	80	8.55	130	15.0
5	14	27-Feb	13:40	0.25	0.8	2	4	24	47	7	10	4	40	164	244	0.24	0.35	53	1.2	39	28.9	10	220	10	8.39	140	15.6
5	14	27-Feb	14:00	0.25	1	2	6	17	48	4	9	4	76	97	301	0.21	0.33	40	0.72	66	18.4	9	800	170	8.28	90	15.0
5	14	27-Feb	14:20	0.25	0.6	2	4	16	33	4	6	6	34	300	166	0.2	0.25	34	0.61	25	14.7	5	300	40	8.22	80	15.6
5	14	27-Feb	14:40	0.25	0.6	3	4	21	35	5	7	6	33	124	194	0.19	0.26	49	0.82	12	17.8	9	2300	80	8.20	115	15.6
5	14	27-Feb	15:00	0.25	0.6	3	4	23	32	6	7	7	28	157	226	0.22	0	61	0.95	9	0	0	2200	20	8.20	140	15.6
			Minimum	0.25	0.6	2	4	16	32	4	6	2	28	97	166	0.19	0.00	34	0.6	9	0.0	0	220	10	8.20	80	15.0
			Maximum	0.25	1.2	3	8	27	58	7	12	7	76	300	357	0.28	0.47	61	1.2	81	30.2	10	2300	170	8.55	140	15.6
			Median	0.25	0.7	2	4	22	41	6	8	5	37	149	235	0.22	0.30	51	0.9	32	18.1	9	570	60	8.25	123	15.6
			Mean	0.25	0.8	2	5	21	42	5	9	5	46	164	248	0.22	0.28	49	0.9	39	18.3	7	1027	67	8.31	116	15.4
			Std Dev	0.00	0.3	1	2	4	10	1	2	2	20	71	70	0.03	0.16	10	0.2	29	11.0	4	970	59	0.14	26	0.3
			Flow Weighted Mean	0.25	0.7	2	5	18	40	5	8	5	47	201	221	0.21	0.29	40	0.75	38	18	7	676	79	8.26	95	15.4
			% Coeff. of Variance	0%	32%	22%	33%	20%	25%	23%	27%	38%	43%	43%	28%	15%	57%	20%	25%	76%	60%	55%	94%	88%	2%	22%	2%
			Relative % Difference	0%	67%	40%	67%	51%	58%	55%	67%	111%	92%	102%	73%	38%	200%	57%	65%	160%	200%	200%	165%	178%	4%	55%	4%

Analytical Data for Site 1, Storm 6

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
Storm	Site	Date	Sample Time	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (mg/L)	Total	(as CaCO3) (mg/L)	(as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Grease (mg/L)	Total (MPN/100 ml)	Fecal	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
6	1	5-Mar	5:30	0.25	0.25	1.6	1.7	4	10	0.5	2	5	36	22	78	0.12	0.15	32	0.71	12	3.7	1	40	10	6.83	20	10.0
6	1	5-Mar	6:00	0.25	0.25	1.6	1.9	3	11	0.5	2	4	43	18	59	0.11	0.19	24	0.6	27	3.6	0.5	130	10	6.96	20	10.0
6	1	5-Mar	6:30	0.25	0.25	1	2	3	10	0.5	2	4	32	18	66	0.11	0.16	24	0.61	10	3.8	0.5	70	10	6.87	50	10.0
6	1	5-Mar	7:00	0.25	0.25	1	2	3	11	0.5	2	4	46	16	59	0.12	0.18	30	0.58	31	4.1	1	20	10	6.97	60	10.0
6	1	5-Mar	7:30	0.25	0.25	1	2	4	10	0.5	2	5	47	18	50	0.12	0.19	28	0.5	17	4.2	2	700	10	6.85	60	10.0
6	1	5-Mar	8:00	0.25	0.25	0.5	2	4	14	0.5	3	6	65	18	80	0.12	0.35	27	0.4	40	4.3	1	10	10	6.58	60	10.0
6	1	5-Mar	8:30	0.25	0.25	1	2	3	11	0.5	2	4	47	16	54	0.11	0.18	19	0.31	37	3.7	0.5	10	10	6.56	50	10.0
6	1	5-Mar	8:45	0.25	0.25	1	2	4	15	0.5	3	4	59	18	104	0.13	0.22	24	0.33	25	4	1	70	10	6.56	50	10.0
6	1	5-Mar	9:25	0.25	0.25	1	2	4	15	1	2	5	47	20	100	0.17	0.25	22	0.33	16	4.4	2	20	20	6.61	50	10.6
6	1	5-Mar	10:25	0.25	0.25	2	3	5	16	0.5	3	6	60	21	70	0.14	0.14	28	0.39	29	4.9	2	80	10	6.81	50	10.6
6	1	5-Mar	10:55	0.25	0.25	1	2	4	13	0.5	2	5	48	21	62	0.16	0.19	26	0.32	23	4.4	2	80	10	6.83	50	11.1
6	1	5-Mar	11:25	0.25	0.25	1	2	5	15	0.5	3	5	46	26	73	0.16	0.18	26	0.34	24	4.9	1	40	40	6.93	50	11.7
6	1	5-Mar	11:55	0.25	0.25	2	2	6	14	1	2	7	43	27	61	0.14	0.16	32	0.46	12	5.7	1	20	10	7.15	60	12.2
			Minimum	0.25	0.3	1	2	3	10	1	2	4	32	16	50	0.11	0.14	19	0.3	10	3.6	1	10	10	6.56	20	10.0
			Maximum	0.25	0.3	2	3	6	16	1	3	7	65	27	104	0.17	0.35	32	0.7	40	5.7	2	700	40	7.15	60	12.2
			Median	0.25	0.3	1	2	4	13	1	2	5	47	18	66	0.12	0.18	26	0.4	24	4.2	1	40	10	6.83	50	10.0
			Mean	0.25	0.3	1	2	4	13	1	2	5	48	20	70	0.13	0.20	26	0.5	23	4.3	1	99	13	6.81	48	10.5
			Std Dev	0.00	0.0	0	0	1	2	0	0	1	9	3	17	0.02	0.05	4	0.1	10	0.6	1	184	9	0.18	13	0.7
			Flow Weighted Mean	0.25	0.3	1	2	4	12	1	2	5	43	21	74	0.13	0.17	29	0.56	18	4	1	70	12	6.80	36	10.2
			% Coeff. of Variance	0%	0%	37%	15%	23%	18%	33%	21%	19%	19%	17%	23%	16%	28%	14%	30%	41%	14%	50%	185%	65%	3%	28%	7%
			Relative % Difference	0%	0%	120%	55%	67%	46%	67%	40%	55%	68%	51%	70%	43%	86%	51%	78%	120%	45%	120%	194%	120%	9%	100%	20%

Analytical Data for Site 14, Storm 6

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
			Sample	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	(as CaCO3)	(as N)	SS	TOC	Grease	Total	Fecal	pH	Conductivity	Temperature
Storm	Site	Date	Time	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)		(pH units)	(umho/cm)	(C)
6	14	5-Mar	6:05	0.25	0.5	1	2	8	20	2	3	2	27	62	118	0.11	0.17	36	0.72	22	7.9	4	130	10	7.44	800	11.7
6	14	5-Mar	6:25	0.25	0.25	1	2	7	13	1.7	2.2	2	10	50	83	0.11	0.12	22	0.51	5	6.7	3	40	20	7.11	700	11.1
6	14	5-Mar	6:45	0.25	0.25	1	2	8	16	2	3	2	16	55	106	0.11	0.11	30	0.47	11	6.6	3	140	10	6.80	700	10.3
6	14	5-Mar	7:05	0.25	0.25	1	2	7	18	2	3	2	24	53	173	0.05	0.11	27	0.37	15	5.7	2	40	10	6.77	600	10.3
6	14	5-Mar	7:15	0.25	0.5	0.5	3	6	24	1	4	2	38	49	198	0.05	0.16	25	0.31	38	6.1	3	260	40	6.75	600	10.0
6	14	5-Mar	7:30	0.25	0.25	0.5	3	6	21	1	3	2	33	43	141	0.05	0.16	30	0.27	42	5.8	3	80	80	6.77	700	10.0
6	14	5-Mar	7:40	0.25	0.7	0.5	4	4	25	0.5	6	1	41	34	208	0.05	0.18	21	0.18	74	4	4	40	20	7.00	400	10.6
6	14	5-Mar	8:05	0.25	0.25	0.5	2	4	14	0.5	3	1	22	31	104	0.05	0.11	17	0.17	2	4.4	2	20	10	6.78	400	10.6
6	14	5-Mar	8:35	0.25	0.25	0.5	2	7	15	1	2	2	15	43	74	0.11	0.11	26	0.23	5	4.8	1	40	10	6.73	600	11.1
6	14	5-Mar	9:05	0.25	0.25	1	2	10	17	2	3	4	24	71	116	0.11	0.12	36	0.37	2	4.7	1	130	20	6.69	800	11.1
6	14	5-Mar	10:00	0.25	0.25	1	2	8	15	2	3	3	22	60	118	0.12	0.12	28	0.34	8	5.2	2	140	20	6.77	800	12.2
6	14	5-Mar	10:10	0.25	1.6	1	7	6	38	1	8	3	81	39	236	0.11	0.37	28	0.25	92	5.3	3	170	20	6.80	800	11.7
			Minimum	0.25	0.3	1	2	4	13	1	2	1	10	31	74	0.05	0.11	17	0.2	2	4.0	1	20	10	6.69	400	10.0
			Maximum	0.25	1.6	1	7	10	38	2	8	4	81	71	236	0.12	0.37	36	0.7	92	7.9	4	260	80	7.44	800	12.2
			Median	0.25	0.3	1	2	7	18	1	3	2	24	50	118	0.11	0.12	28	0.3	13	5.5	3	105	20	6.78	700	10.8
			Mean	0.25	0.4	1	3	7	20	1	4	2	29	49	140	0.09	0.15	27	0.3	26	5.6	3	103	23	6.87	658	10.9
			Std Dev	0.00	0.4	0	1	2	7	1	2	1	19	12	52	0.03	0.07	6	0.2	30	1.1	1	72	20	0.22	144	0.7
			Flow Weighted Mean	0.25	0.5	1	3	7	20	1	4	2	30	50	133	0.09	0.16	28	0.42	26	6	3	101	19	7.02	678	11.2
			% Coeff. of Variance	0%	89%	33%	54%	25%	35%	44%	48%	39%	63%	24%	37%	37%	48%	21%	45%	113%	20%	39%	70%	89%	3%	22%	7%
			Relative % Difference	0%	146%	67%	111%	86%	98%	120%	120%	120%	156%	78%	105%	82%	108%	72%	124%	191%	66%	120%	171%	156%	11%	67%	20%

Analytical Data for Site 1, Storm 7

Storm	Site	Date	Sample Time	Cadmium Dissolved (ug/L)	Cadmium Total	Chromium Dissolved (ug/L)	Chromium Total	Copper Dissolved (ug/L)	Copper Total	Nickel Dissolved (ug/L)	Nickel Total	Lead Dissolved (ug/L)	Lead Total	Zinc Dissolved (ug/L)	Zinc Total	Phosphorus Dissolved (mg/L)	Phosphorus Total	Hardness (as CaCO3) (mg/L)	Nitrate (as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Oil & Grease (mg/L)	Coliform Total (MPN/100 ml)	Coliform Fecal	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
7	1	8-Mar	3:25	0.25	1.6	3	12	9	47	3	13	19	393	21	301	0.14	0.52	87	1.3	215	13.6	4	1700	140	7.41	150	10.0
7	1	8-Mar	3:55	0.25	1.3	3	9	6	39	2	10	20	299	17	244	0.11	0.34	62	0.94	186	9.1	3	80	40	7.66	100	10.0
7	1	8-Mar	4:25	0.25	0.6	2	4	4	22	1	5	12	131	13	110	0.1	0.2	37	0.61	85	6.9	2	170	40	7.49	70	10.0
7	1	8-Mar	4:55	0.25	0.6	2	5	5	21	1	5	13	153	14	115	0.05	0.21	44	0.57	90	7.2	3	80	20	7.55	70	10.0
7	1	8-Mar	5:25	0.25	0.8	2	6	5	28	1	6	12	180	13	152	0.05	0.24	45	0.49	126	7	2	500	10	7.62	60	10.0
7	1	8-Mar	5:55	0.25	0.6	2	4	6	23	1	5	13	141	20	115	0.12	0.19	42	0.54	70	6.9	4	300	300	7.48	70	10.0
7	1	8-Mar	6:15	0.25	0.7	2	5	5	26	1	6	11	141	15	198	0.12	0.24	40	0.46	101	7.2	3	500	130	7.45	60	10.0
7	1	8-Mar	7:15	0.25	0.6	2	5	6	25	1	5	14	137	21	121	0.11	0.18	40	0.51	62	7.6	2	300	80	7.70	80	10.6
7	1	8-Mar	8:00	0.25	0.9	2	7	7	35	1	7	15	196	22	181	0.12	0.24	49	0.51	123	10	2	140	40	7.80	80	10.6
7	1	8-Mar	8:25	0.25	0.9	2	7	6	31	1	8	13	171	19	182	0.14	0.26	50	0.46	125	8.3	3	230	40	7.75	70	11.1
7	1	8-Mar	9:20	0.25	1.1	1	8	5	41	0.5	9	7	179	13	198	0.12	0.38	42	0.29	238	6.9	4	1100	70	7.61	50	11.1
7	1	8-Mar	10:15	0.25	0.8	2	6	6	28	1	5	10	132	19	136	0.12	0.26	40	0.3	91	6.9	3	1400	900	7.98	50	11.1
7	1	8-Mar	11:15	0.25	0.6	2	4	70	23	1	4	11	96	22	147	0.12	0.17	39	0.35	43	6.5	3	500	300	8.00	60	11.1
			Minimum	0.25	0.6	1	4	4	21	1	4	7	96	13	110	0.05	0.17	37	0.3	43	6.5	2	80	10	7.41	50	10.0
			Maximum	0.25	1.6	3	12	70	47	3	13	20	393	22	301	0.14	0.52	87	1.3	238	13.6	4	1700	900	8.00	150	11.1
			Median	0.25	0.8	2	6	6	28	1	6	13	153	19	152	0.12	0.24	42	0.5	101	7.2	3	300	70	7.62	70	10.0
			Mean	0.25	0.9	2	6	11	30	1	7	13	181	18	169	0.11	0.26	47	0.6	120	8.0	3	538	162	7.65	75	10.4
			Std Dev	0.00	0.3	0	2	18	8	1	3	3	80	4	57	0.03	0.10	14	0.3	60	2.0	1	527	242	0.19	26	0.5
			Flow Weighted Mean	0.25	0.8	2	6	15	30	1	6	11	155	17	158	0.11	0.26	43	0.44	119	7	3	661	243	7.73	64	10.7
			% Coeff. of Variance	0%	37%	24%	37%	166%	27%	53%	38%	27%	44%	20%	33%	26%	37%	29%	49%	50%	25%	26%	98%	149%	2%	35%	5%
			Relative % Difference	0%	91%	100%	100%	178%	76%	143%	106%	96%	121%	51%	93%	95%	101%	81%	127%	139%	71%	67%	182%	196%	8%	100%	11%

Analytical Data for Site 14, Storm 7

Storm	Site	Date	Sample Time	Cadmium Dissolved (ug/L)	Cadmium Total (ug/L)	Chromium Dissolved (ug/L)	Chromium Total (ug/L)	Copper Dissolved (ug/L)	Copper Total (ug/L)	Nickel Dissolved (ug/L)	Nickel Total (ug/L)	Lead Dissolved (ug/L)	Lead Total (ug/L)	Zinc Dissolved (ug/L)	Zinc Total (ug/L)	Phosphorus Dissolved (mg/L)	Phosphorus Total (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrate (as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Oil & Grease (mg/L)	Coliform Total (MPN/100 ml)	Coliform Fecal (MPN/100 ml)	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
7	14	8-Mar	3:10	0.25	0.9	2	5	19	40	5	8	2	54	92	248	0.29	0.78	60	1.1	111	22.2	7	2200	210	8.57	150	12.2
7	14	8-Mar	3:25	0.25	0.6	1	4	9	28	3	6	3	45	48	210	0.14	0.19	34	0.59	78	13.1	4	1300	10	8.12	90	11.7
7	14	8-Mar	3:45	0.25	0.25	1	1	7	13	2	3	4	24	43	75	0.13	0.14	33	0.47	32	8.5	2	800	40	7.95	80	11.7
7	14	8-Mar	4:05	0.25	0.7	1	3	7	23	2	4	5	52	80	132	0.17	0.22	38	0.45	49	8.4	1	900	110	7.87	80	11.7
7	14	8-Mar	4:20	0.25	0.8	1	3	5	24	1	4	3	46	29	136	0.12	0.12	44	0.34	48	6.6	0.5	900	230	7.89	60	11.7
7	14	8-Mar	4:40	0.25	0.25	1	2	6	15	2	3	4	32	43	96	0.11	0.13	30	0.36	23	6.1	2	900	70	7.77	70	11.7
7	14	8-Mar	5:10	0.25	0.5	2	3	10	23	3	4	6	46	69	147	0.14	0.18	36	0.48	24	7.9	2	2800	170	8.29	100	11.7
7	14	8-Mar	6:40	0.25	1.4	3	8	17	53	4	9	11	139	90	282	0.16	0.29	54	0.67	69	33.6	4	13000	8000	8.15	140	12.2
7	14	8-Mar	7:05	0.25	1.7	3	9	16	65	4	11	13	188	90	355	0.17	0.29	63	0.74	96	16.2	7	2800	2200	7.88	150	12.2
7	14	8-Mar	7:30	0.25	1.5	3	8	17	58	4	10	15	172	95	334	0.16	0.28	63	0.77	79	16.2	7	8000	2300	7.94	150	12.2
7	14	8-Mar	8:45	0.25	1.9	3	10	14	77	3	12	13	187	58	425	0.14	0.3	46	0.49	130	11.3	5	5000	800	7.95	110	12.2
7	14	8-Mar	9:00	0.25	3.4	2	20	8	115	2	20	7	280	25	706	0.11	0.64	52	0.31	412	9.3	6	800	230	8.12	60	12.2
7	14	8-Mar	9:30	0.25	1.5	2	8	9	55	2	8	7	124	33	264	0.05	0.26	34	0.33	134	7.1	4	13000	1700	7.77	60	12.2
7	14	8-Mar	10:30	0.25	1.5	2	8	13	60	3	9	14	157	58	290	0.11	0.23	42	0.48	76	8.2	5	13000	2200	8.02	80	12.8
7	14	8-Mar	11:00	0.25	1.5	2	8	13	59	3	8	13	156	55	294	0.11	0.26	44	0.47	79	8.3	4	13000	2800	8.03	100	12.8
			Minimum	0.25	0.3	1	1	5	13	1	3	2	24	25	75	0.05	0.12	30	0.3	23	6.1	1	800	10	7.77	60	11.7
			Maximum	0.25	3.4	3	20	19	115	5	20	15	280	95	706	0.29	0.78	63	1.1	412	33.6	7	13000	8000	8.57	150	12.8
			Median	0.25	1.4	2	8	10	53	3	8	7	124	58	264	0.14	0.26	44	0.5	78	8.5	4	2800	230	7.95	90	12.2
			Mean	0.25	1.2	2	7	11	47	3	8	8	113	61	266	0.14	0.29	45	0.5	96	12.2	4	5227	1405	8.02	99	12.1
			Std Dev	0.00	0.8	1	5	5	28	1	4	5	77	24	158	0.05	0.18	11	0.2	94	7.4	2	5218	2086	0.21	34	0.4
			Flow Weighted Mean	0.25	1.6	2	8	11	58	3	9	8	138	51	319	0.12	0.30	43	0.46	133	12	4	6827	1652	7.99	86	12.2
			% Coeff. of Variance	0%	66%	41%	70%	40%	58%	37%	56%	58%	68%	40%	59%	37%	64%	25%	39%	98%	61%	54%	100%	149%	3%	34%	3%
			Relative % Difference	0%	173%	100%	181%	117%	159%	133%	148%	153%	168%	117%	162%	141%	147%	71%	112%	179%	139%	173%	177%	200%	10%	86%	9%

Analytical Data for Site 1, Storm 8

				Cadmium		Chromium		Copper		Nickel		Lead		Zinc		Phosphorus		Hardness	Nitrate			Oil &	Coliform				
Storm	Site	Date	Sample Time	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (ug/L)	Total	Dissolved (mg/L)	Total	(as CaCO3) (mg/L)	(as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Grease (mg/L)	Total (MPN/100 ml)	Fecal	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
8	1	4/17/2000	12:25	0.25	2.5	4	17	29	102	8	22	14	470	80	496	0.47	1.5	113	4.1	403	35.6	15	8000	2300	8.32	240	Temperature
8	1	4/17/2000	12:55	0.25	2	3	14	25	75	7	18	14	350	60	367	0.38	1	94	3.3	323	29.6	4	1300	1300	8.25	220	probe broken
8	1	4/17/2000	13:25	0.25	1.3	3	10	14	49	3	10	11	211	32	234	0.27	0.54	56	1.5	226	14	5	300	130	11.52	160	
8	1	4/17/2000	13:55	0.25	1.3	2	10	15	58	3	11	14	258	37	255	0.26	0.79	82	1.4	225	14	5	130	130	10.48	150	
8	1	4/17/2000	14:25	0.25	1.2	3	8	14	44	3	9	15	233	38	206	0.28	0.42	190	1.5	154	13.9	4	300	230	10.45	170	
8	1	4/17/2000	14:55	0.25	1	2	8	12	41	3	8	14	196	32	185	0.23	0.34	49	1.2	136	12.2	5	300	130	10.39	160	
8	1	4/17/2000	15:25	0.25	0.9	2	7	10	37	2	8	13	167	32	187	0.23	0.53	47	1	182	12.3	5	300	10	10.07	150	
8	1	4/17/2000	15:52	0.25	0.7	2	6	7	28	1	6	7	126	22	136	0.16	0.76	34	0.67	131	7.2	4	220	10	9.69	110	
8	1	4/17/2000	16:55	0.25	0.7	2	5	10	32	2	6	12	124	34	139	0.18	0.33	46	0.84	77	9.3	5	2300	1300	9.95	140	
8	1	4/17/2000	17:55	0.25	0.9	2	7	11	36	3	11	15	169	36	175	0.16	0.3	130	0.98	104	11.1	5	5000	5000	8.65	130	
8	1	4/17/2000	18:27	0.25	1	2	12	6	50	1	12	11	331	16	236	0.15	0.35	40	0.66	344	7.1	3	8000	40	9.62	100	
8	1	4/17/2000	19:20	0.25	0.25	2	4	8	24	2	4	10	96	28	110	0.15	0.23	29	0.71	41	6.6	3	230	40	9.32	120	
			Minimum	0.25	0.3	2	4	6	24	1	4	7	96	16	110	0.15	0.23	29	0.7	41	6.6	3	130	10	8.25	100	0.0
			Maximum	0.25	2.5	4	17	29	102	8	22	15	470	80	496	0.47	1.50	190	4.1	403	35.6	15	8000	5000	11.52	240	0.0
			Median	0.25	1.0	2	8	12	43	3	10	14	204	33	197	0.23	0.47	53	1.1	168	12.3	5	300	130	9.82	150	#NUM!
			Mean	0.25	1.1	2	9	13	48	3	10	13	228	37	227	0.24	0.59	76	1.5	196	14.4	5	2198	885	9.73	154	#DIV/0!
			Std Dev	0.00	0.6	1	4	7	22	2	5	2	110	17	108	0.10	0.37	48	1.1	112	9.0	3	3052	1489	0.97	41	#DIV/0!
			Flow Weighted Mean	0.25	1.0	2	8	11	42	3	9	12	196	32	195	0.21	0.51	63	1.18	169	12	5	1837	4294	9.85	141	0.0
			% Coeff. of Variance	0%	52%	28%	42%	52%	46%	68%	49%	19%	48%	46%	48%	41%	63%	64%	73%	58%	63%	60%	139%	168%	10%	27%	#DIV/0!
			Relative % Difference	0%	164%	67%	124%	131%	124%	156%	138%	73%	132%	133%	127%	103%	147%	147%	145%	163%	137%	133%	194%	199%	33%	82%	#DIV/0!

Analytical Data for Site 14, Storm 8

Storm	Site	Date	Sample Time	Cadmium Dissolved (ug/L)	Cadmium Total (ug/L)	Chromium Dissolved (ug/L)	Chromium Total (ug/L)	Copper Dissolved (ug/L)	Copper Total (ug/L)	Nickel Dissolved (ug/L)	Nickel Total (ug/L)	Lead Dissolved (ug/L)	Lead Total (ug/L)	Zinc Dissolved (ug/L)	Zinc Total (ug/L)	Phosphorus Dissolved (mg/L)	Phosphorus Total (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrate (as N) (mg/L)	SS (mg/L)	TOC (mg/L)	Oil & Grease (mg/L)	Coliform Total (MPN/100 ml)	Coliform Fecal (MPN/100 ml)	pH (pH units)	Conductivity (umho/cm)	Temperature (C)
8	14	4/17/2000	13:00	1.3	7.9	6	58	118	306	46	90	4	395	453	1960	1.7	6.4	328	8.3	1600	171	38	30000	7000	6.80	560	17.2
8	14	4/17/2000	13:10	1.4	4.1	5	18	91	153	59	75	4	132	496	1030	1.1	4.6	236	9.4	414	145	22	5000	1400	6.80	540	17.2
8	14	4/17/2000	13:30	0.9	3.4	4	19	64	147	32	47	10	198	368	893	0.5	1.6	152	4	291	88.8	25	1300	300	6.86	300	17.5
8	14	4/17/2000	13:50	0.25	6.2	3	37	44	199	16	48	12	473	152	1290	0.53	10	188	2.2	913	60.8	18	2300	800	6.83	200	17.2
8	14	4/17/2000	14:10	0.25	4.9	3	27	28	162	8	37	11	346	75	1140	0.36	1.6	92	1.1	612	23.2	16	3000	800	7.03	110	16.7
8	14	4/17/2000	14:40	0.25	3.2	2	20	19	125	5	22	11	301	47	758	0.26	0.92	66	0.69	409	14.9	8	1100	130	7.13	70	16.1
8	14	4/17/2000	15:00	0.25	1.6	3	10	9	60	2	10	6	142	25	299	0.19	0.51	27	0.36	137	9	5	230	40	7.22	40	15.6
8	14	4/17/2000	15:30	0.25	2	2	10	17	84	4	13	12	201	57	381	0.21	0.4	45	0.52	119	15.3	4	800	170	6.97	70	16.7
8	14	4/17/2000	16:00	0.25	1.7	2	9	19	71	5	11	12	164	75	327	0.24	0.35	40	0.57	84	16	5	230	80	7.00	70	16.7
8	14	4/17/2000	17:00	0.25	1.8	2	8	23	81	6	13	15	182	96	373	0.23	0.39	51	0.72	81	20.8	7	800	500	7.09	100	16.1
8	14	4/17/2000	18:00	0.25	1.4	2	8	14	73	4	10	10	152	64	288	0.21	0.32	48	0.52	83	13.9	6	500	130	7.21	60	15.0
8	14	4/17/2000	18:35	0.25	1.4	3	6	21	54	7	11	15	112	114	267	0.24	0.29	48	0.73	36	17.1	5	300	130	6.97	100	15.6
			Minimum	0.25	1.4	2	6	9	54	2	10	4	112	25	267	0.19	0.29	27	0.4	36	9.0	4	230	40	6.80	40	15.0
			Maximum	1.40	7.9	6	58	118	306	59	90	15	473	496	1960	1.70	10.00	328	9.4	1600	171.0	38	30000	7000	7.22	560	17.5
			Median	0.25	2.6	3	14	22	105	7	18	11	190	86	570	0.25	0.72	59	0.7	214	18.9	8	950	235	6.99	100	16.7
			Mean	0.49	3.3	3	19	39	126	16	32	10	233	169	751	0.48	2.28	110	2.4	398	49.7	13	3797	957	6.99	185	16.5
			Std Dev	0.44	2.1	1	15	35	73	19	28	4	117	169	532	0.46	3.11	96	3.2	462	56.0	11	8372	1947	0.15	185	0.8
			Flow Weighted Mean	0.27	2.3	2	13	19	90	6	17	10	203	70	494	0.25	0.90	55	0.75	220	18	7	843	222	7.10	80	16.0
			% Coeff. of Variance	91%	64%	43%	80%	89%	58%	118%	86%	37%	50%	100%	71%	96%	136%	87%	131%	116%	113%	81%	221%	203%	2%	100%	5%
			Relative % Difference	139%	140%	100%	163%	172%	140%	187%	160%	116%	123%	181%	152%	160%	189%	170%	185%	191%	180%	162%	197%	198%	6%	173%	15%

Appendix C
Data Quality

1999-2000 Storm Water Analytical Results - Metals
Monitoring Station 1

Appendix C

					Cadmium (ug/L)		Chromium (ug/L)		Copper (ug/L)		Nickel (ug/L)		Lead (ug/L)		Zinc (ug/L)	
Site	Event	Date	Sample Time	Sample Type	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
1	1	1/25/2000	5:20		0.5 U	3.1	3	28	33	126	7.5	32	10	922	67	585
1	1	1/25/2000	5:45		0.5 U	4	4	31	35	143	6	41	6	1420	45	633
1	1	1/25/2000	6:15		0.5 U	3.2	4	26	29	116	6	30	5	1050	40	545
1	1	1/25/2000	6:45		0.5 U	2.3	3	20	22	91	5	23	4	696	26	420
1	1	1/25/2000	7:15		0.5 U	2.3	3	22	23	88	4	25	4	705	33	390
1	1	1/25/2000	7:45		0.5 U	2.1	2	18	20	83	4	20	4	590	31	374
1	1	1/25/2000	8:15		0.5 U	1.9	2	14	24	75	5	16	4	428	34	346
1	1	1/25/2000	9:15		0.5 U	1.3	2	11	21	61	4	13	4	299	31	253
1	1	1/25/2000	10:15		0.5 U	1.3	3	11	24	59	5	13	5	333	43	239
1	2	2/12/2000	1:25		0.5 U	0.9	1 U	9	16	38	4	9	13	216	22	191
1	2	2/12/2000	1:55		0.5 U	1.3	2	14	11	55	2	14	16	499	18	253
1	2	2/12/2000	2:25		0.7	1.8 #	4	17 #	26 #	74 #	5	20 #	197 #	471 #	148 #	349 #
1	2	2/12/2000	2:25	DUP	0.5 U	0.9 #	1 U	9 #	5 #	36 #	1 U	9 #	11 #	222 #	13 #	163 #
1	2	2/12/2000	2:55		0.5 U	3.4	1 U	54	4	136	1 U	48	5	937	14	876
1	2	2/12/2000	3:55		0.5 U	0.5 U	1 U	4	4	19	1 U	3	6	95	14	89
1	3	2/20/2000	14:15		0.5 U#	0.5 U#	3 #	6 #	6 #	24 #	1 #	7 #	8 #	99 #	13 #	130 #
1	3	2/20/2000	14:45		0.5 U#	0.5 U#	4 #	4 #	10 #	16 #	2 #	4 #	12 #	57 #	27 #	69 #
1	3	2/20/2000	15:15		0.5 U#	0.5 U#	3 #	4 #	9 #	21 #	2 #	5 #	13 #	69 #	26 #	95 #
1	3	2/20/2000	15:45		0.5 U#	0.5 U#	2 #	4 #	7 #	19 #	2 #	4 #	13 #	97 #	20 #	95 #
1	3	2/20/2000	16:15		0.5 U#	0.5 U#	2 #	4 #	8 #	19 #	2 #	4 #	12 #	84 #	26 #	98 #
1	3	2/20/2000	16:45		0.5 U#	0.6 #	3.6 #	4 #	10 #	21 #	2 #	4 #	10 #	76 #	31 #	90 #
1	3	2/20/2000	18:25		0.5 U#	0.5 U#	2 #	6 #	7 #	25 #	2 #	6 #	16 #	138 #	20 #	140 #
1	3	2/20/2000	19:25		0.5 U#	0.5 U#	2 #	3 #	4 #	16 #	1 U#	3 #	7 #	69 #	14 #	69 #
1	3	2/20/2000	20:30		0.5 U#	0.5 U#	2 #	3 #	5 #	12 #	1 #	2 #	12 #	72 #	18 #	60 #
1	3	2/20/2000	21:30		0.5 U#	0.5 U#	1 #	2 #	4 #	15 #	1 U#	3 #	11 #	83 #	16 #	77 #
1	3	2/20/2000	22:30		0.5 U#	0.6 #	1.7 #	1.9 #	4 #	10 #	1 #	2 #	12 #	63 #	17 #	55 #
1	3	2/20/2000	23:30		0.5 U#	0.7 #	7 #	8 #	4 #	12 #	1 #	2 #	18 #	102 #	15 #	67 #
1	3	2/21/2000	0:30		0.5 U#	0.8 #	2 #	4 #	3 #	16 #	1 U#	5 #	16 #	162 #	11 #	92 #
1	3	2/21/2000	1:30		0.5 U#	0.5 U#	1 #	3 #	2 #	12 #	1 U#	3 #	10 #	99 #	7 #	66 #
1	4	2/23/2000	5:45		0.5 U	0.6	1 U	5	12	33	3	7	5	105	41	186
1	4	2/23/2000	6:15		0.5 U	1.5	2	10	10	47	2	11	20	418	15	264
1	4	2/23/2000	6:45		0.5 U	1.4	3	14	8	52	2	13	21	387	15	274
1	4	2/23/2000	7:15		0.5 U	1.1	2	9	7	39	1	9	18	277	15	196
1	4	2/23/2000	7:45		0.5 U	1	2	8	7	36	1	8	19	249	18	178
1	4	2/23/2000	8:15		0.5 U	0.9	2	8	8	38	1	8	18	242	19	184
1	4	2/23/2000	8:45		0.5 U	0.8	3	9	8	34	2	8	20	218	40	164
1	4	2/23/2000	9:45		0.5 U	0.8	2	8	9	33	2	7	19	216	22	157
1	4	2/23/2000	10:45		0.5 U	1.1	2	10	6	41	1 U	9	10	200	15	196
1	4	2/23/2000	11:45		0.5 U	0.9	1	8	5	36	1 U	7	9	179	13	177
1	4	2/23/2000	12:45		0.5 U	0.8	2	7	5	31	1 U	6	6	144	11	157
1	4	2/23/2000	13:45		0.5 U	0.8	2	8	5	31	1 U	7	7	145	12	145
1	4	2/23/2000	14:45		0.5 U	0.7	2	5	6	26	1 U	5	10	119	19	119

1999-2000 Storm Water Analytical Results - Metals
Monitoring Station 1

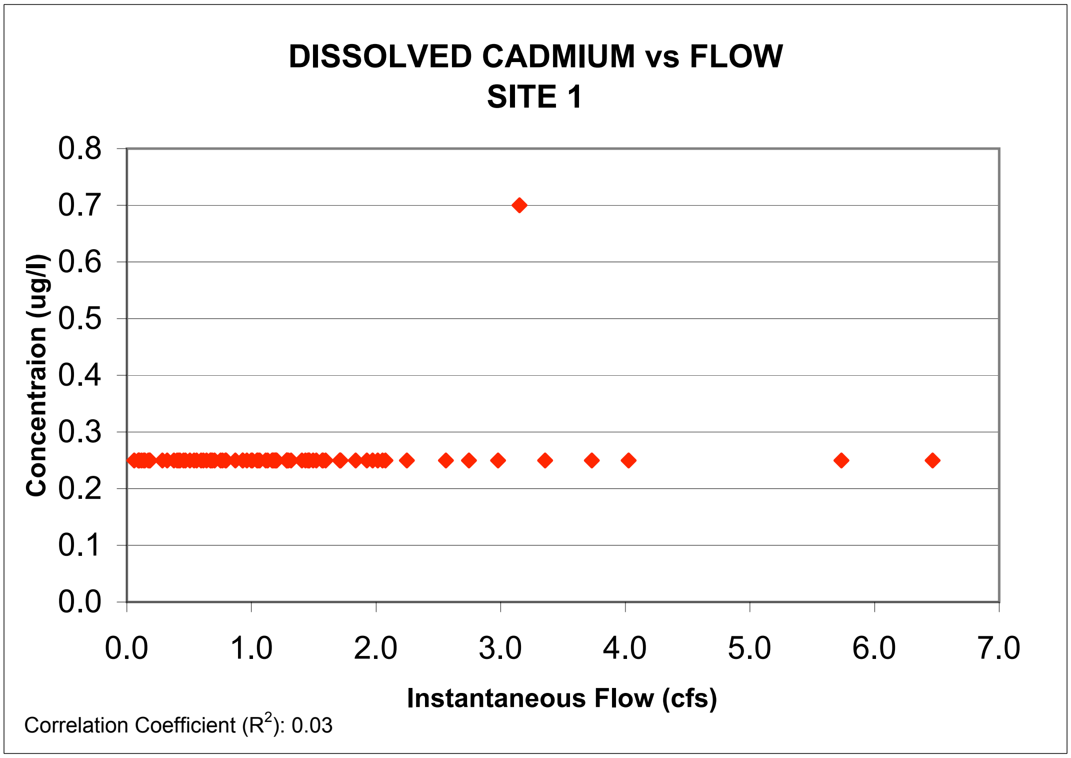
Appendix C

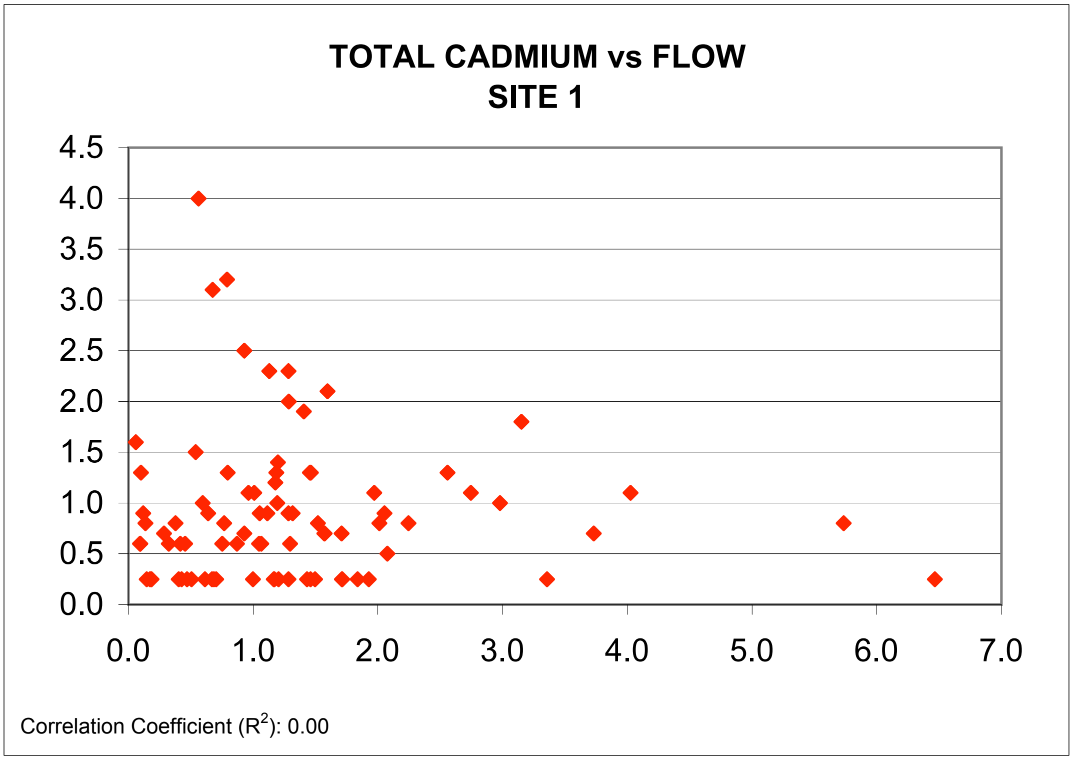
Site	Event	Date	Sample Time	Sample Type	Cadmium Dissolved (ug/L)	Cadmium Total (ug/L)	Chromium Dissolved (ug/L)	Chromium Total (ug/L)	Copper Dissolved (ug/L)	Copper Total (ug/L)	Nickel Dissolved (ug/L)	Nickel Total (ug/L)	Lead Dissolved (ug/L)	Lead Total (ug/L)	Zinc Dissolved (ug/L)	Zinc Total (ug/L)
1	5	2/27/2000	13:00		0.5 U	1.1	1	70	18	45	4	10	3	113	79	317
1	5	2/27/2000	13:20		0.5 U	1.1	2	8	8	39	2	9	11	176	43	218
1	5	2/27/2000	13:45		0.5 U	0.7	2	6	7	33	2	6	10	133	20	152
1	5	2/27/2000	13:45	DUP	0.5 U	0.6	2	5	7	27	2	6	10	126	20	147
1	5	2/27/2000	14:05		0.5 U	0.5	2	5	7	23	1	5	10	107	19	115
1	5	2/27/2000	14:25		0.5 U	0.5 U	2	4	7	21	2	4	8	81	23	98
1	5	2/27/2000	14:45		0.5 U	0.6	2	5	6	25	1	5	8	98	20	116
1	5	2/27/2000	15:05		0.5 U	0.6	2	4	8	26	2	4	9	93	25	97
1	6	3/5/2000	5:30		0.5 U	0.5 U	1.6	1.7	4	10	1 U	2	5	36	22	78
1	6	3/5/2000	6:00		0.5 U	0.5 U	1.6	1.9	3	11	1 U	2	4	43	18	59
1	6	3/5/2000	6:30		0.5 U	0.5 U	1	2	3	10	1 U	2	4	32	18	66
1	6	3/5/2000	7:00		0.5 U	0.5 U	1	2	3	11	1 U	2	4	46	16	59
1	6	3/5/2000	7:30		0.5 U	0.5 U	1	2	4	10	1 U	2	5	47	18	50
1	6	3/5/2000	8:00		0.5 U	0.5 U	1 U	2	4	14	1 U	3	6	65	18	80
1	6	3/5/2000	8:30		0.5 U	0.5 U	1	2	3	11	1 U	2	4	47	16	54
1	6	3/5/2000	8:45		0.5 U	0.5 U	1	2	4	15	1 U	3	4	59	18	104
1	6	3/5/2000	9:25		0.5 U	0.5 U	1	2	4	15	1	2	5	47	20	100
1	6	3/5/2000	10:25		0.5 U	0.5 U	2	3	5	16	1 U	3	6	60	21	70
1	6	3/5/2000	10:55		0.5 U	0.5 U	1	2	4	13	1 U	2	5	48	21	62
1	6	3/5/2000	11:25		0.5 U	0.5 U	1	2	5	15	1 U	3	5	46	26	73
1	6	3/5/2000	11:55		0.5 U	0.5 U	2	2	6	14	1	2	7	43	27	61
1	7	3/8/2000	3:25		0.5 U	1.6	3	12	9	47	3	13	19	393	21	301
1	7	3/8/2000	3:55		0.5 U	1.3	3	9	6	39	2	10	20	299	17	244
1	7	3/8/2000	4:25		0.5 U	0.6	2	4	4	22	1	5	12	131	13	110
1	7	3/8/2000	4:55		0.5 U	0.6	2	5	5	21	1	5	13	153	14	115
1	7	3/8/2000	5:25		0.5 U	0.8	2	6	5	28	1	6	12	180	13	152
1	7	3/8/2000	5:55		0.5 U	0.6	2	4	6	23	1	5	13	141	20	115
1	7	3/8/2000	6:15		0.5 U	0.7	2	5	5	26	1	6	11	141	15	198
1	7	3/8/2000	7:15		0.5 U	0.6	2	5	6	25	1	5	14	137	21	121
1	7	3/8/2000	8:00		0.5 U	0.9	2	7	7	35	1	7	15	196	22	181
1	7	3/8/2000	8:25		0.5 U	0.9	2	7	6	31	1	8	13	171	19	182
1	7	3/8/2000	9:20		0.5 U	1.1	1	8	5	41	1 U	9	7	179	13	198
1	7	3/8/2000	10:15		0.5 U	0.8	2	6	6	28	1	5	10	132	19	136
1	7	3/8/2000	11:15		0.5 U	0.6	2	4	70	23	1	4	11	96	22	147
1	8	4/17/2000	12:25		0.5 U	2.5	4	17	29	102	8	22	14	470	80	496
1	8	4/17/2000	12:55		0.5 U	2	3	14	25	75	7	18	14	350	60	367
1	8	4/17/2000	13:25		0.5 U	1.3	3	10	14	49	3	10	11	211	32	234
1	8	4/17/2000	13:55		0.5 U	1.3	2	10	15	58	3	11	14	258	37	255
1	8	4/17/2000	14:25		0.5 U	1.2	3	8	14	44	3	9	15	233	38	206
1	8	4/17/2000	14:55		0.5 U	1	2	8	12	41	3	8	14	196	32	185
1	8	4/17/2000	15:25		0.5 U	0.9	2	7	10	37	2	8	13	167	32	187
1	8	4/17/2000	15:52		0.5 U	0.7	2	6	7	28	1	6	7	126	22	136
1	8	4/17/2000	16:55		0.5 U	0.7	2	5	10	32	2	6	12	124	34	139
1	8	4/17/2000	17:55		0.5 U	0.9	2	7	11	36	3	11	15	169	36	175
1	8	4/17/2000	18:27		0.5 U	1	2	12	6	50	1	12	11	331	16	236
1	8	4/17/2000	19:20		0.5 U	0.5 U	2	4	8	24	2	4	10	96	28	110

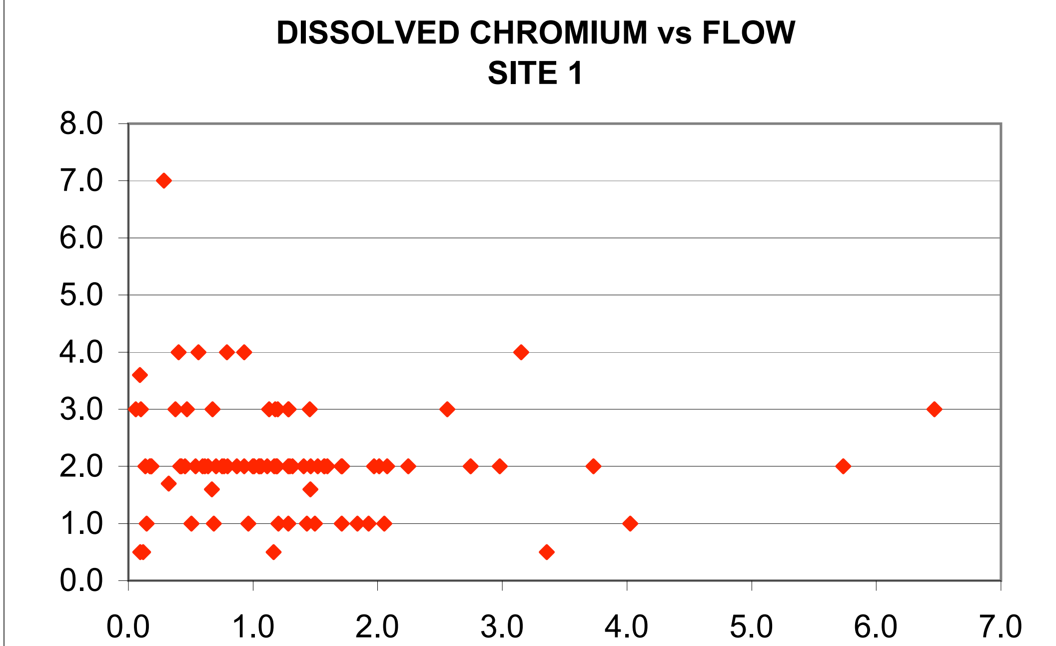
Notes:

U = Not detected at a concentration greater than the reporting limit shown
# = Parameter analyzed, but result estimated due to laboratory or field QC deficiency.

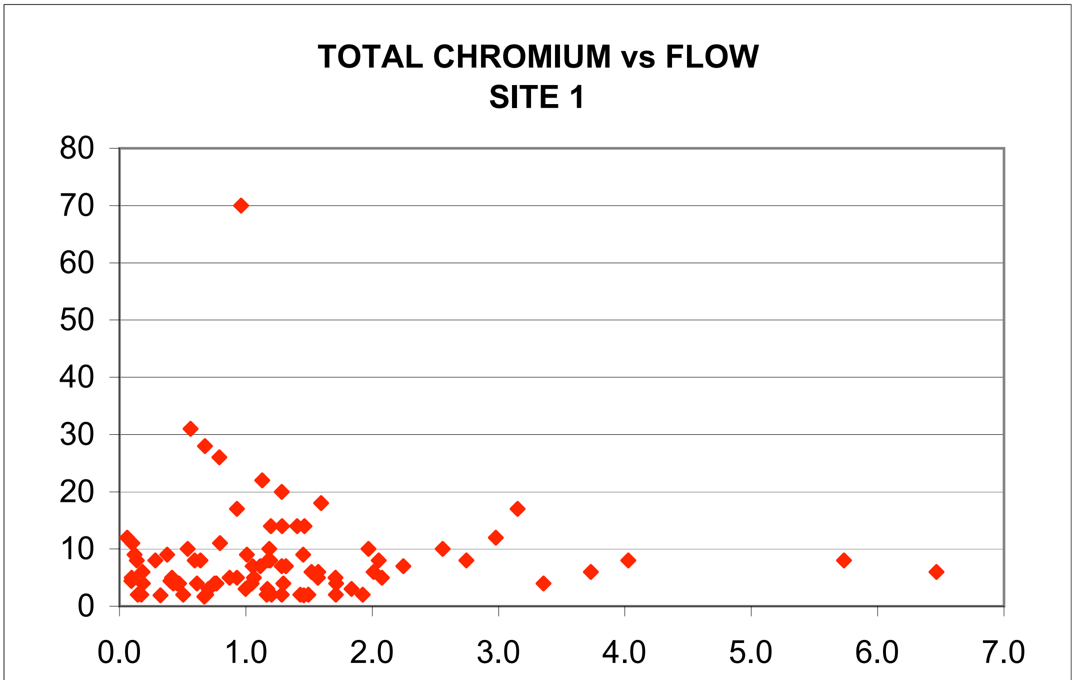
Appendix D
Correlation Analysis Results


DISSOLVED CADMIUM vs FLOW
SITE 1
Concentraion (ug/l)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Instantaneous Flow (cfs)
Correlation Coefficient (R2): 0.03

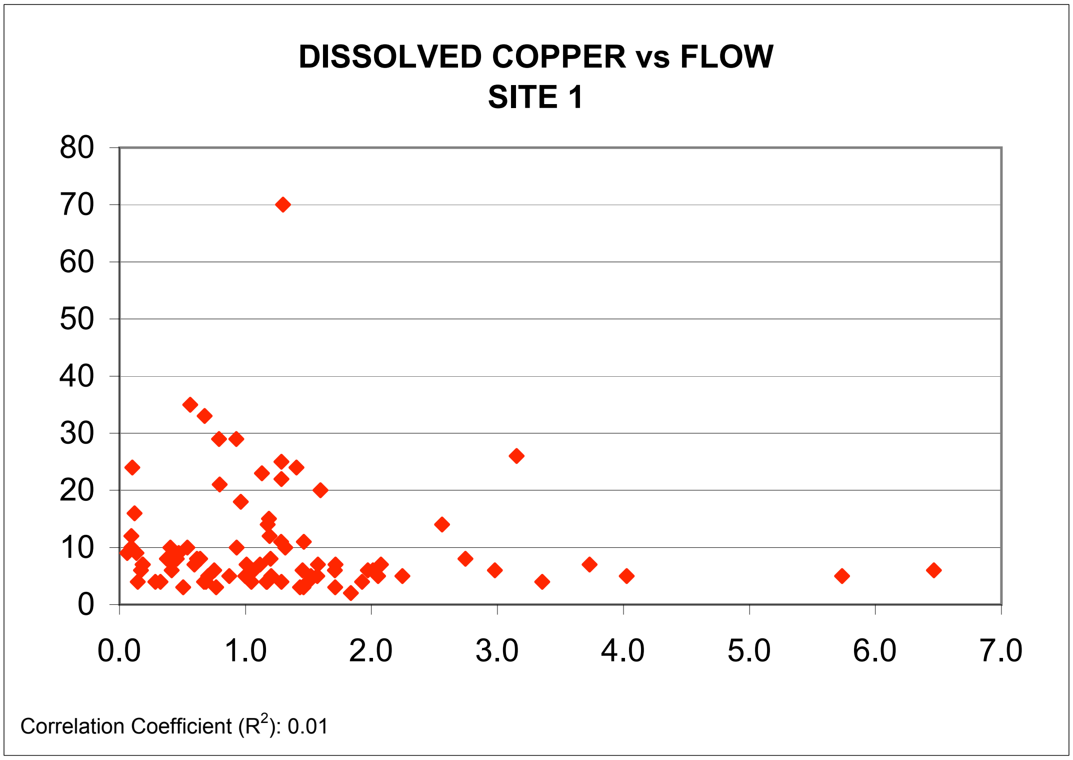

TOTAL CADMIUM vs FLOW
SITE 1
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R2): 0.00

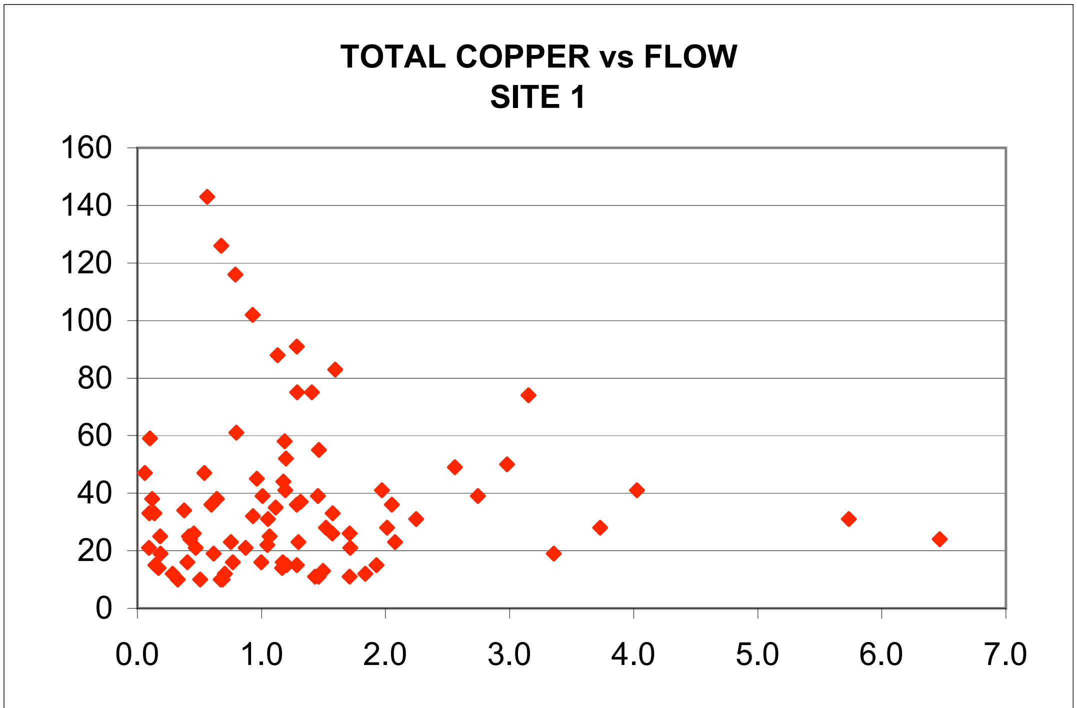


Correlation Coefficient (R^2): 0.01

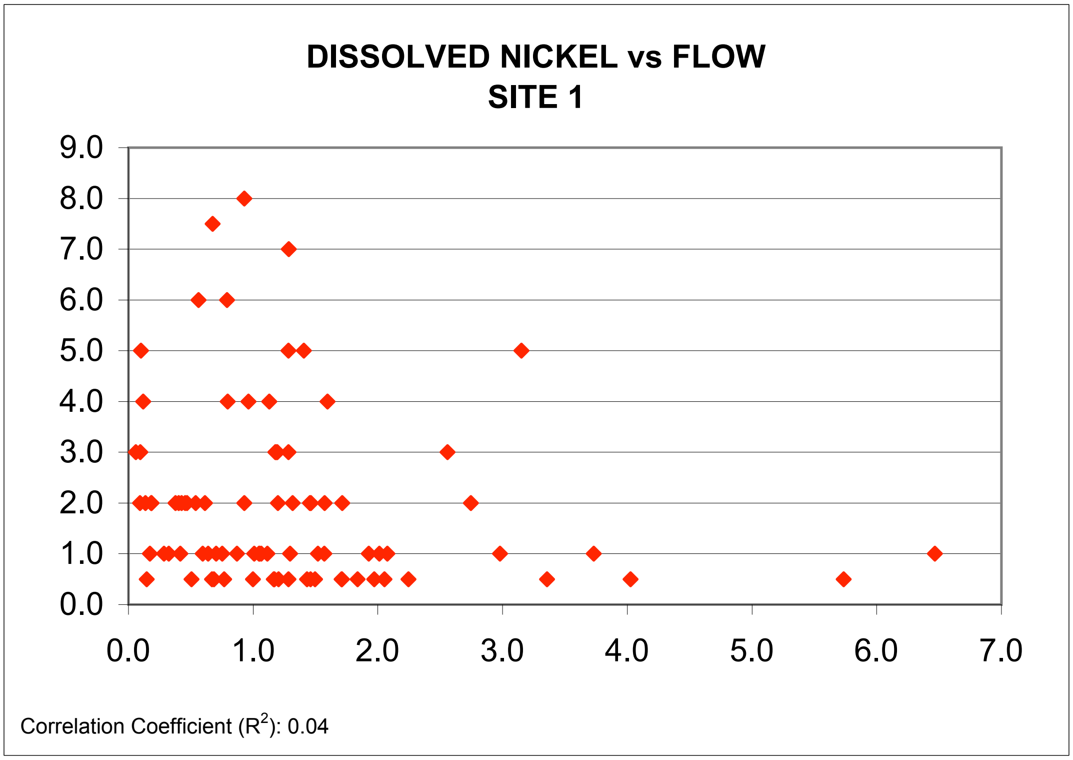


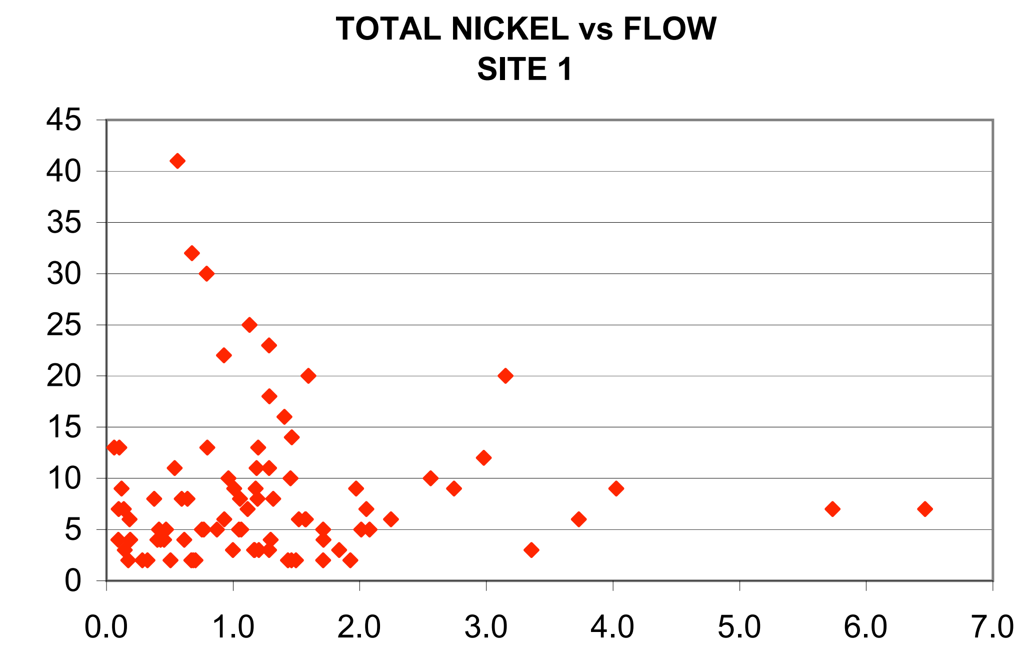
Correlation Coefficient (R^2): 0.00


DISSOLVED COPPER vs FLOW
SITE 1
80
70
60
50
40
30
20
10
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R^2): 0.01

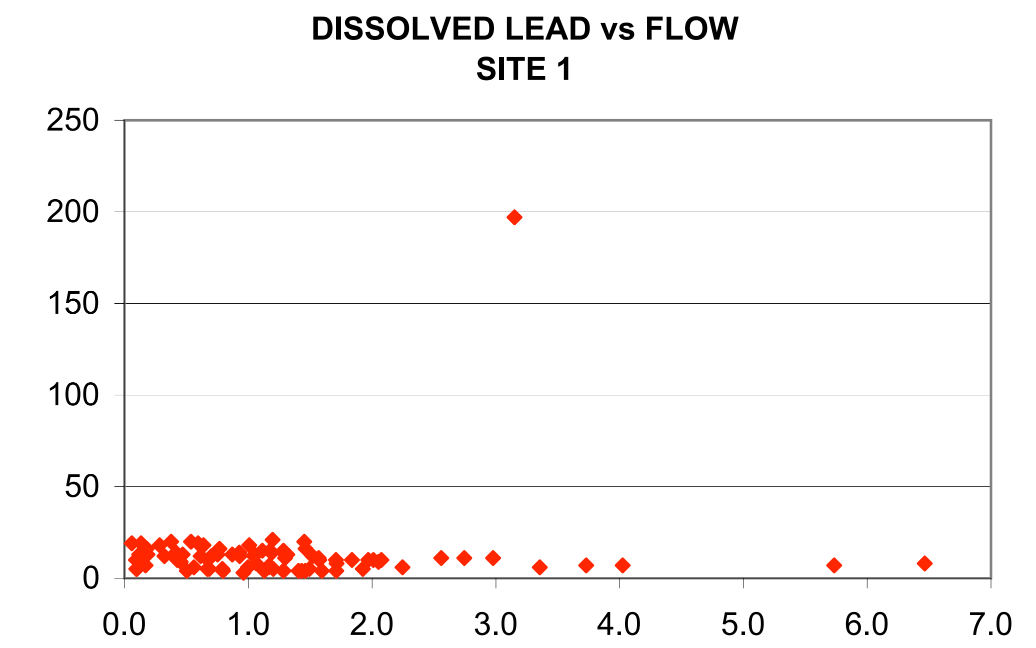


Correlation Coefficient (R^2): 0.00

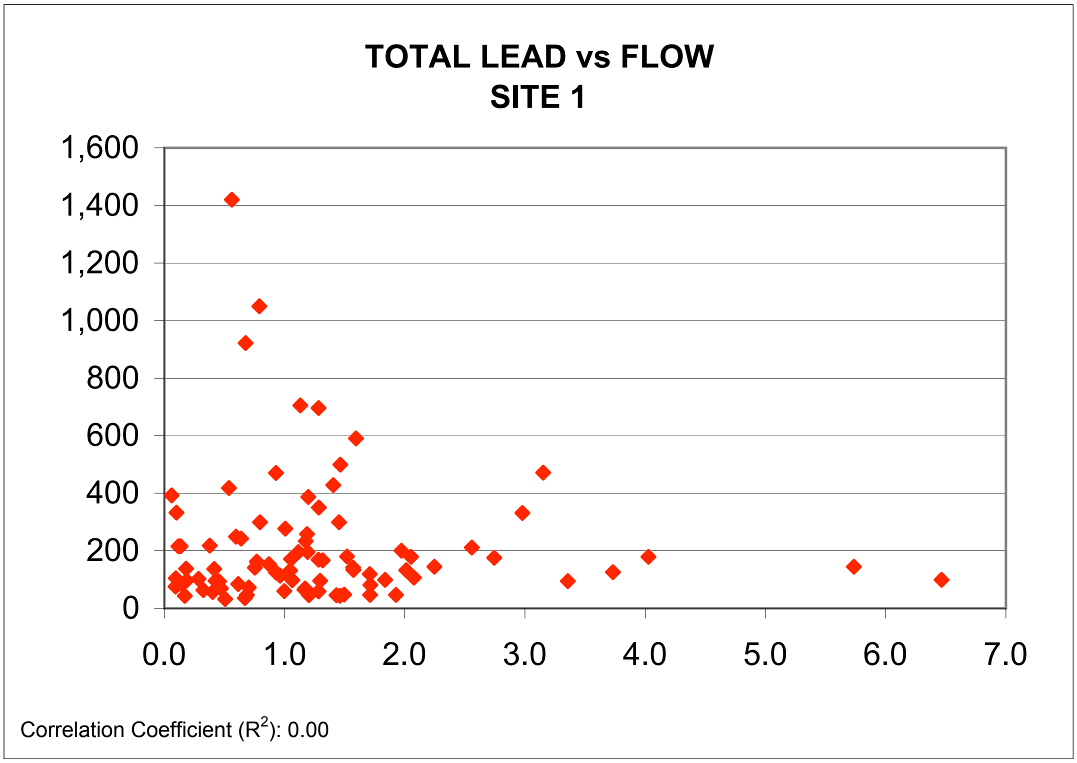

DISSOLVED NICKEL vs FLOW
SITE 1
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R2): 0.04



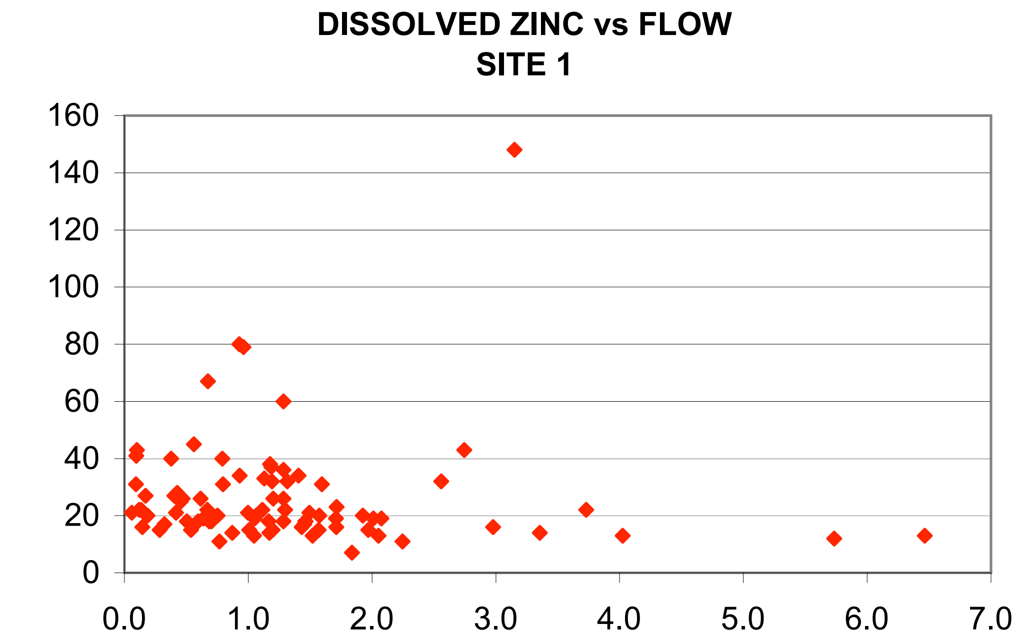
Correlation Coefficient (R^2): 0.00



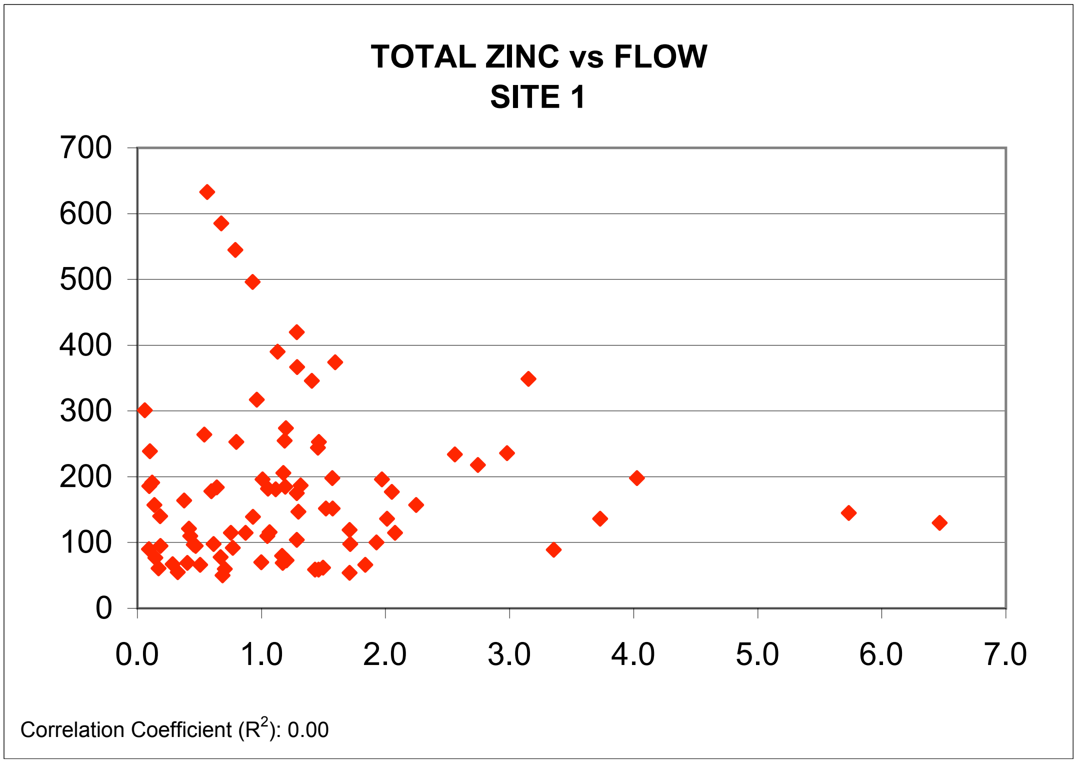
Correlation Coefficient (R^2): 0.01

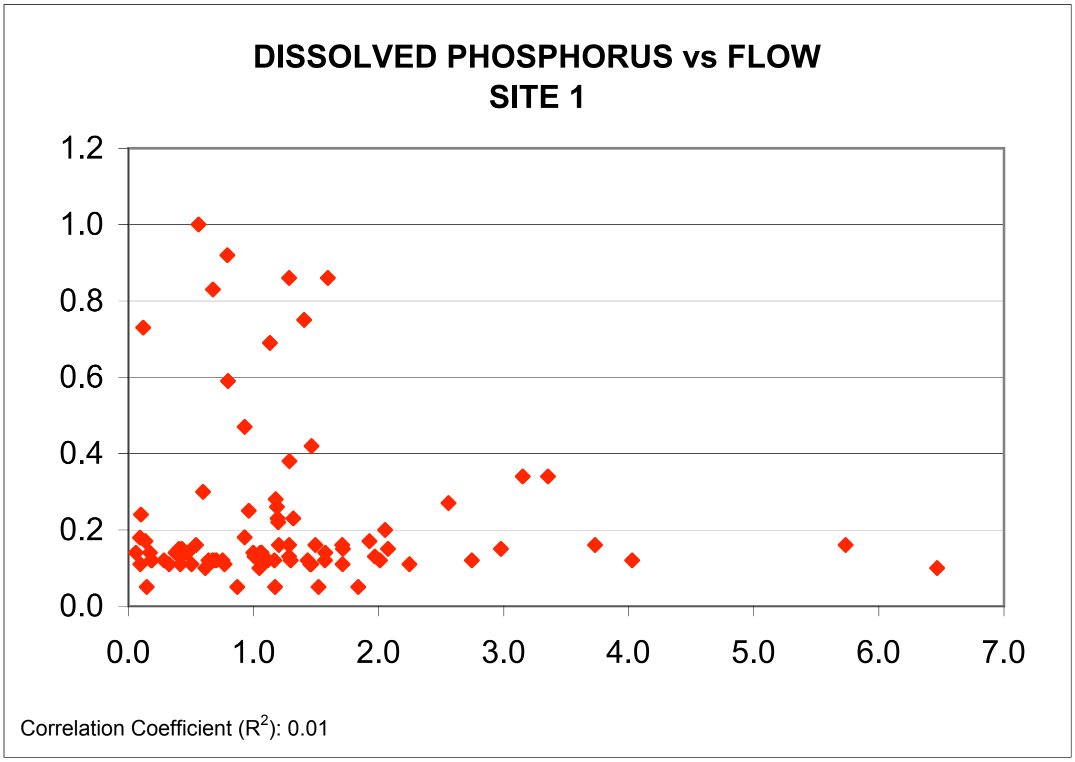


TOTAL LEAD vs FLOW
SITE 1
1,600
1,400
1,200
1,000
800
600
400
200
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R^2): 0.00

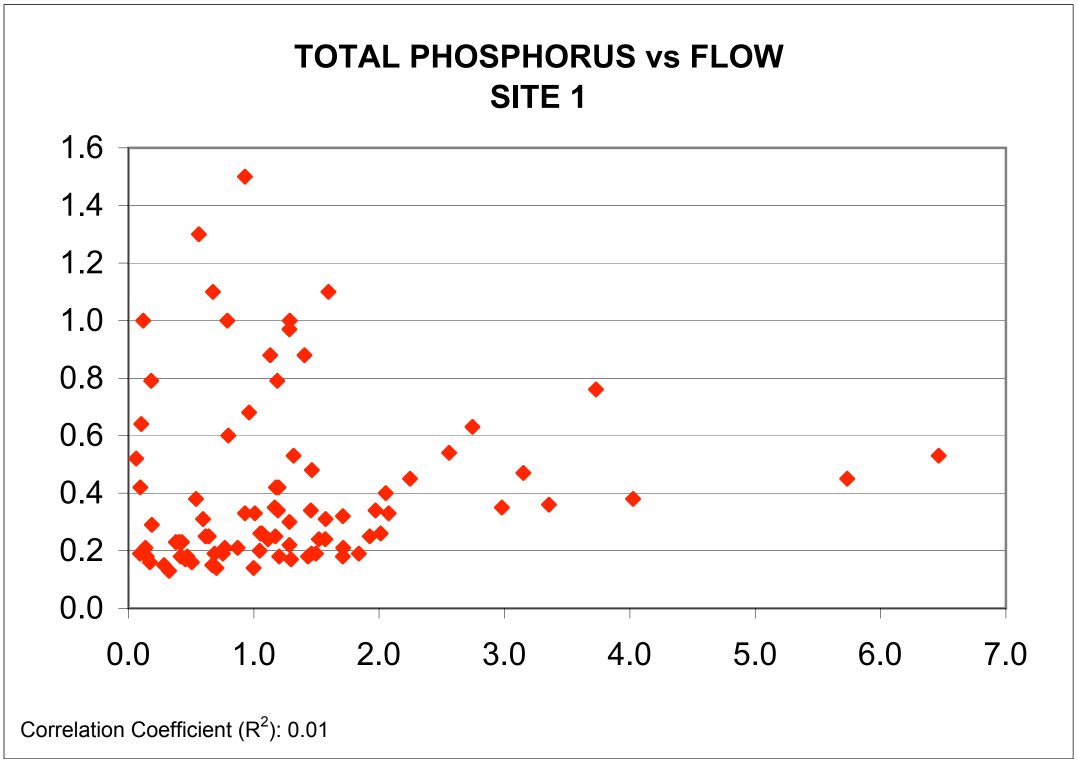


Correlation Coefficient (R^2): 0.00

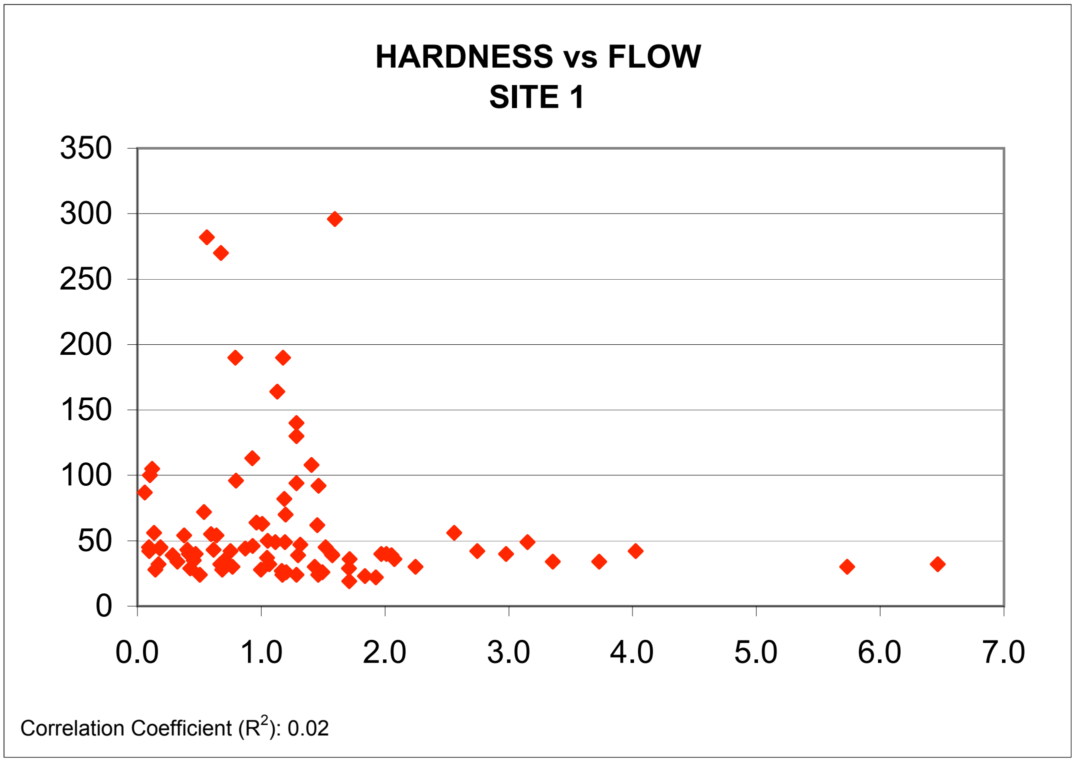

TOTAL ZINC vs FLOW
SITE 1
700
600
500
400
300
200
100
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R^2): 0.00

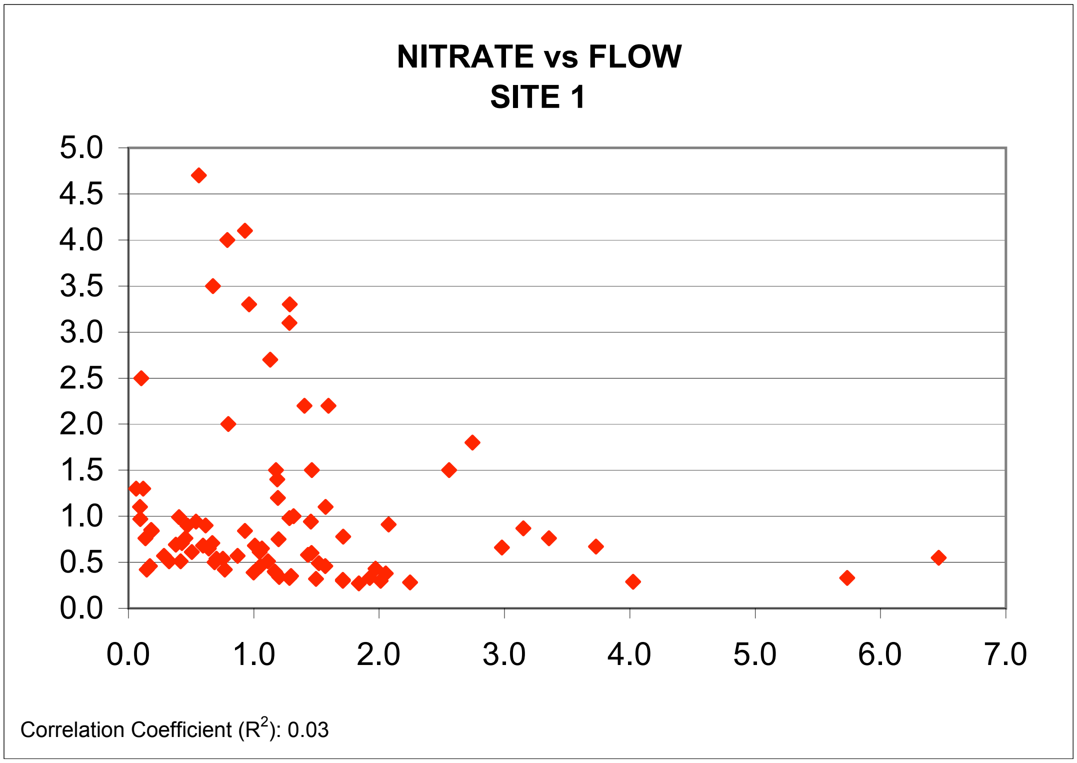


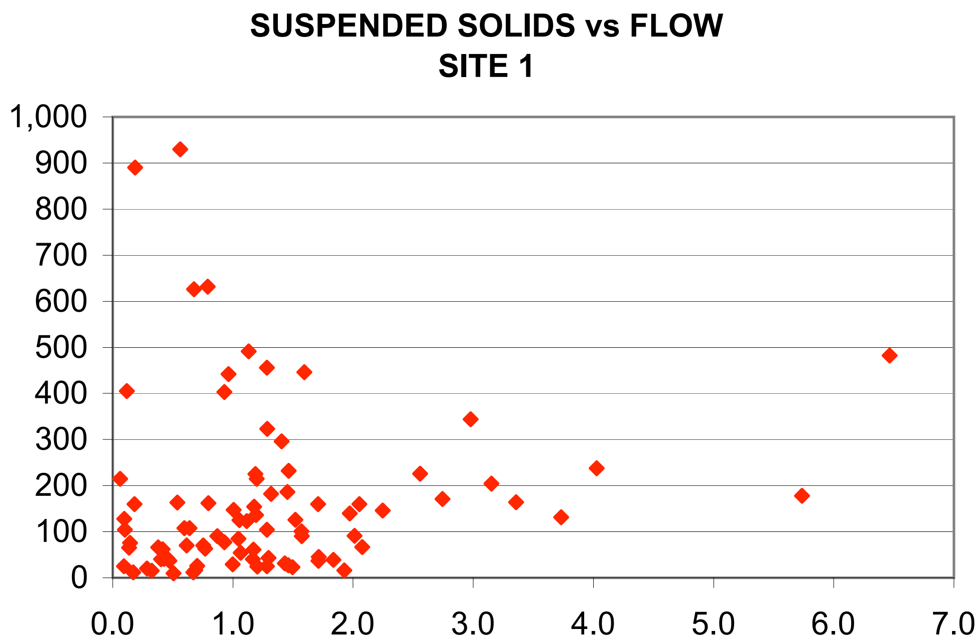
DISSOLVED PHOSPHORUS vs FLOW
SITE 1
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R2): 0.01



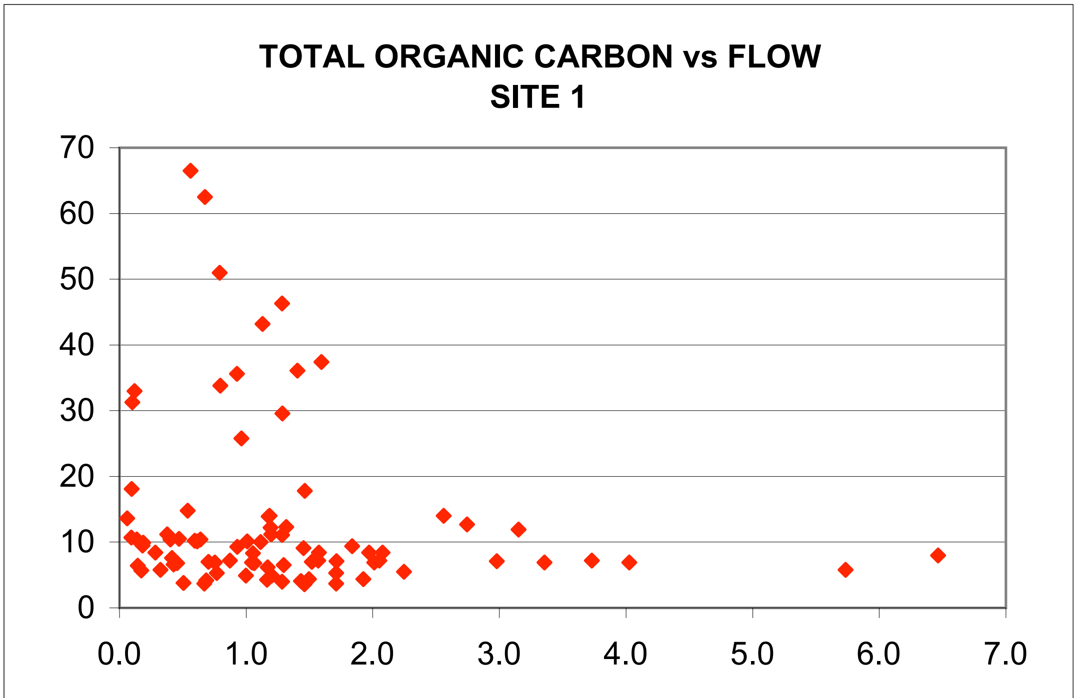
TOTAL PHOSPHORUS vs FLOW
SITE 1
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R^2): 0.01


HARDNESS vs FLOW
SITE 1
350
300
250
200
150
100
50
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R^2): 0.02

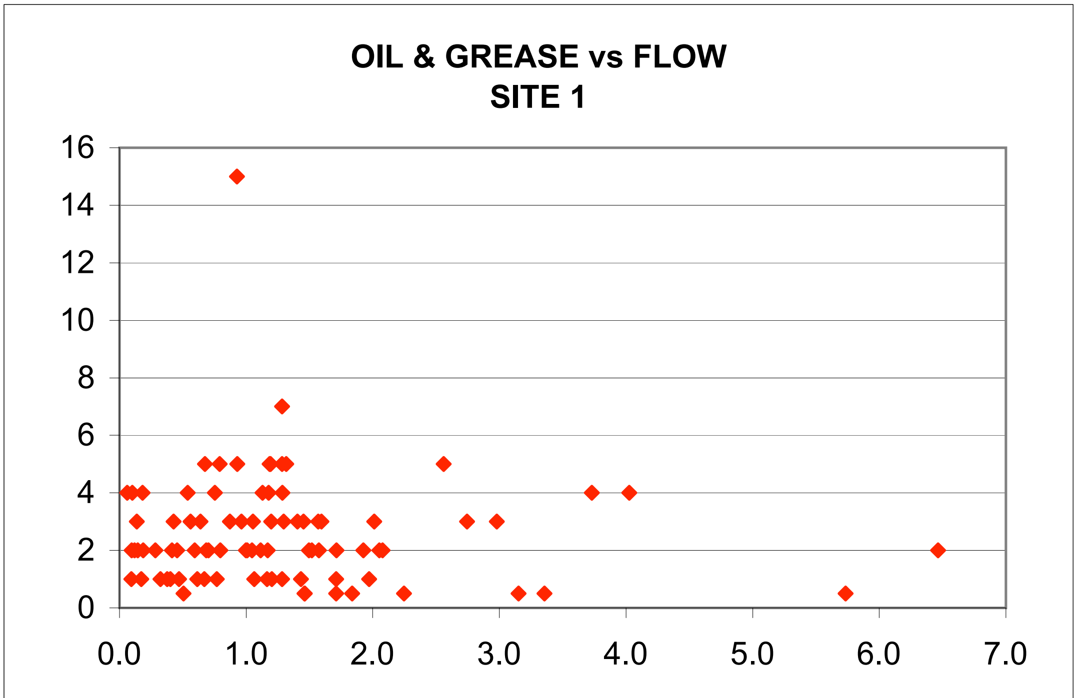

NITRATE vs FLOW
SITE 1
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R2): 0.03



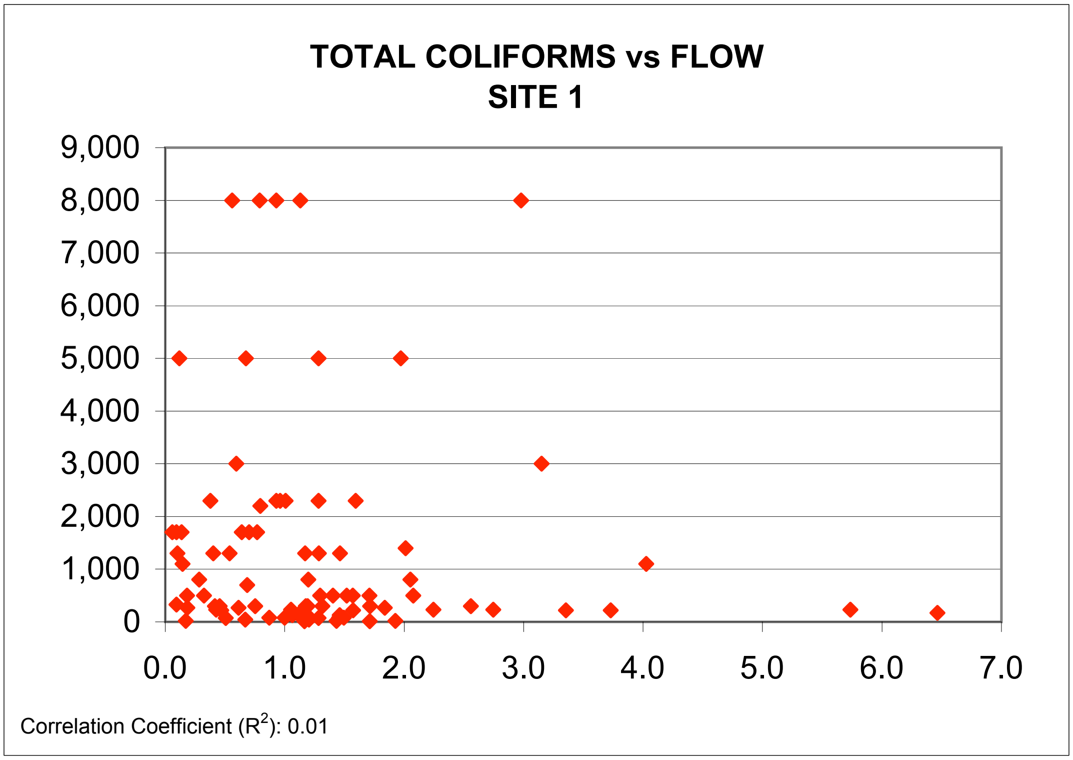
Correlation Coefficient (R^2): 0.01

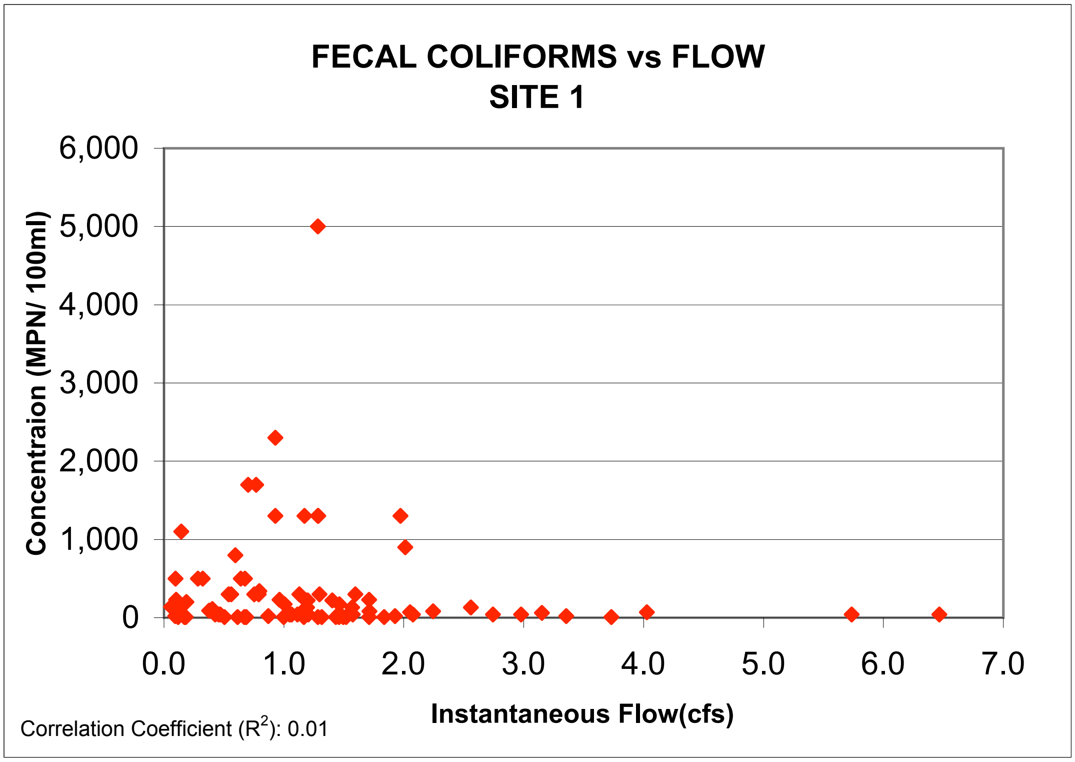


Correlation Coefficient (R^2): 0.03

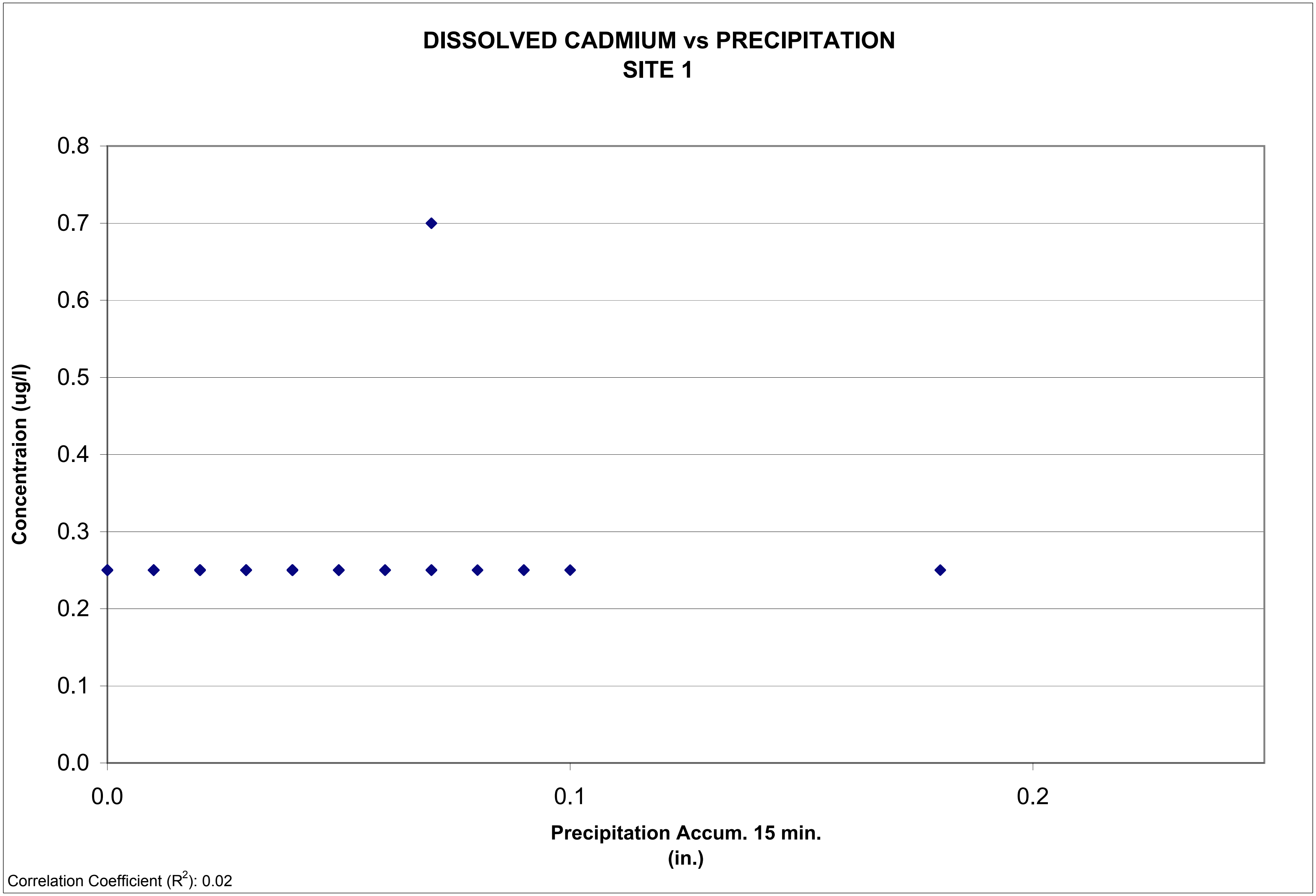


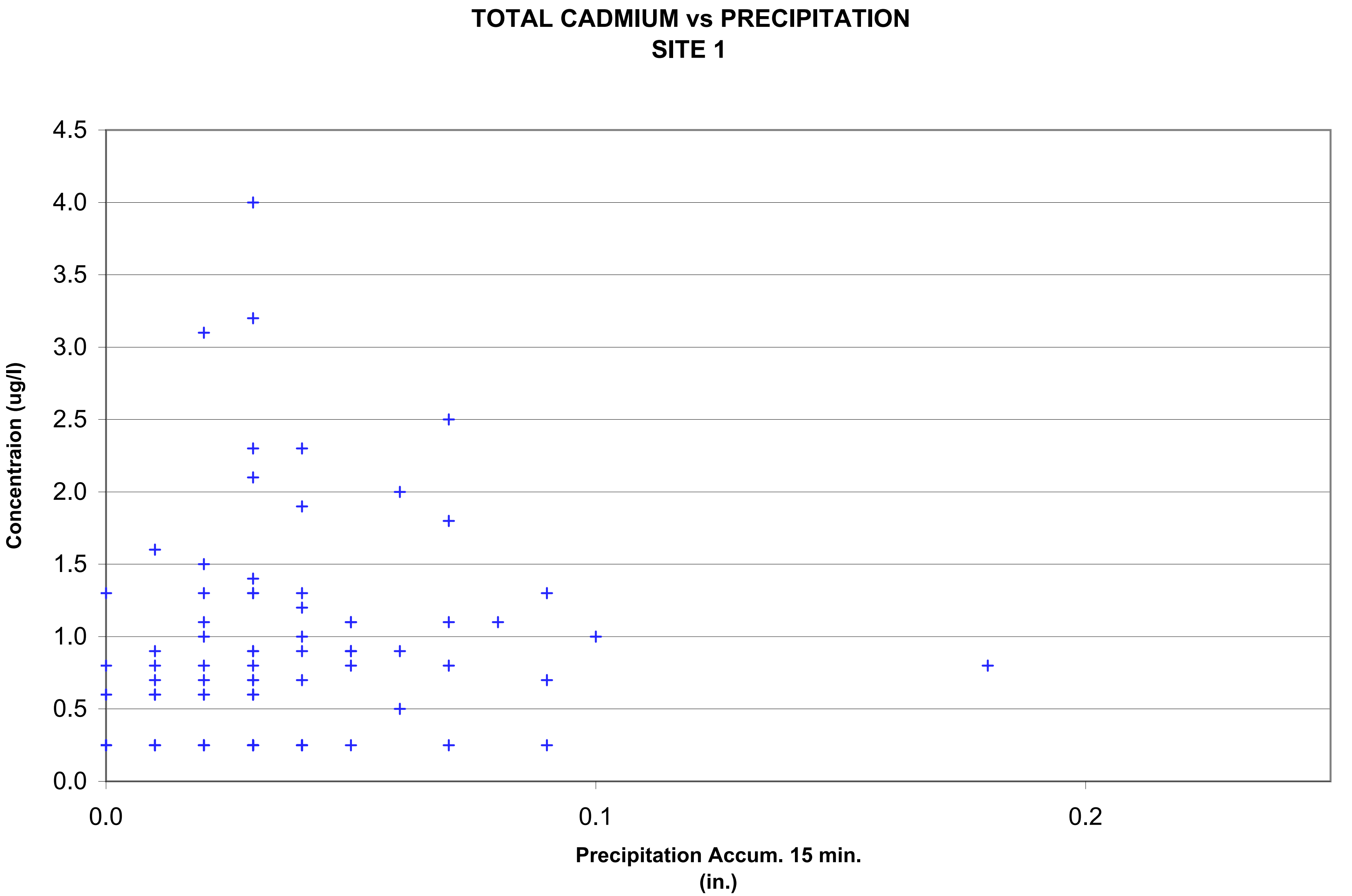
Correlation Coefficient (R^2): 0.01


TOTAL COLIFORMS vs FLOW
SITE 1
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Correlation Coefficient (R2): 0.01

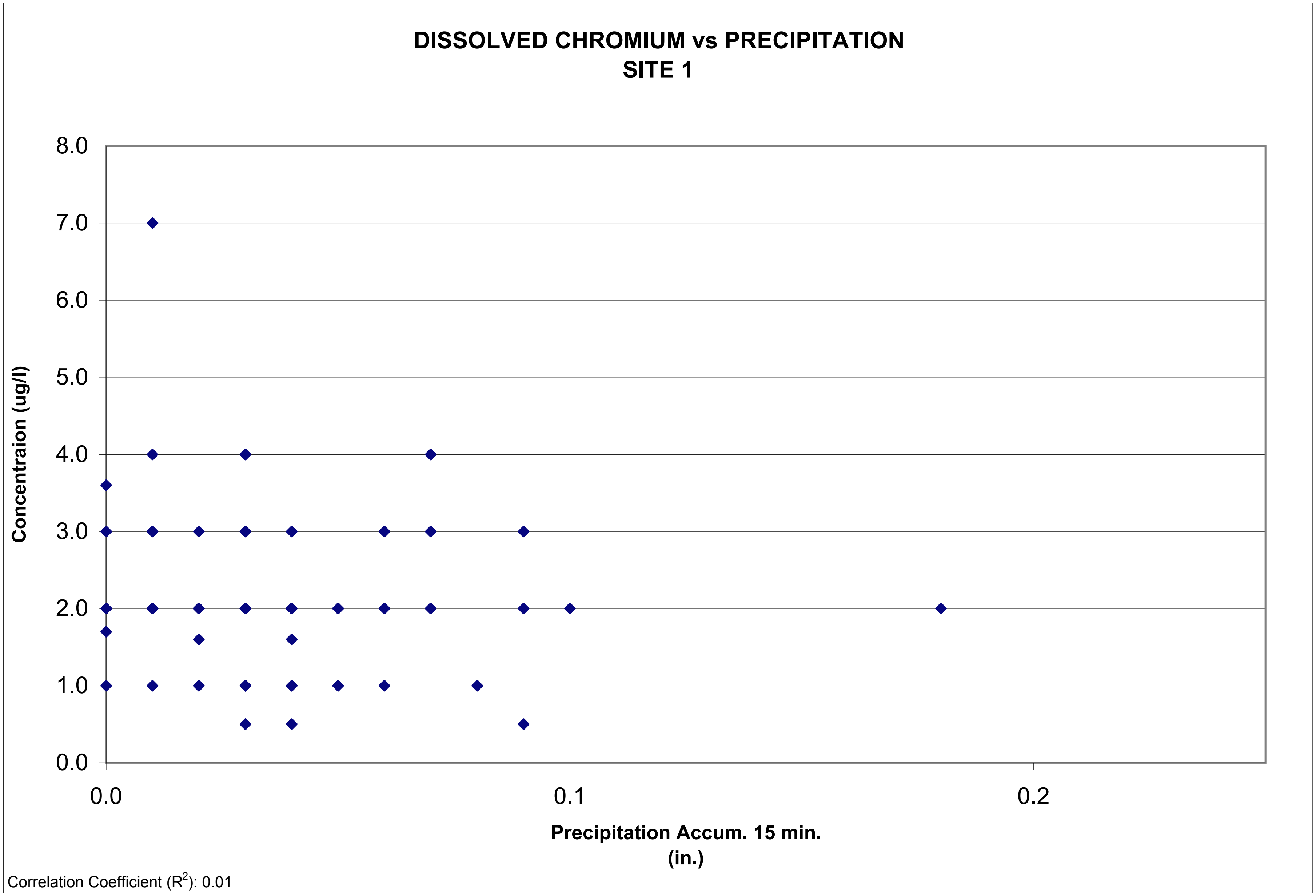


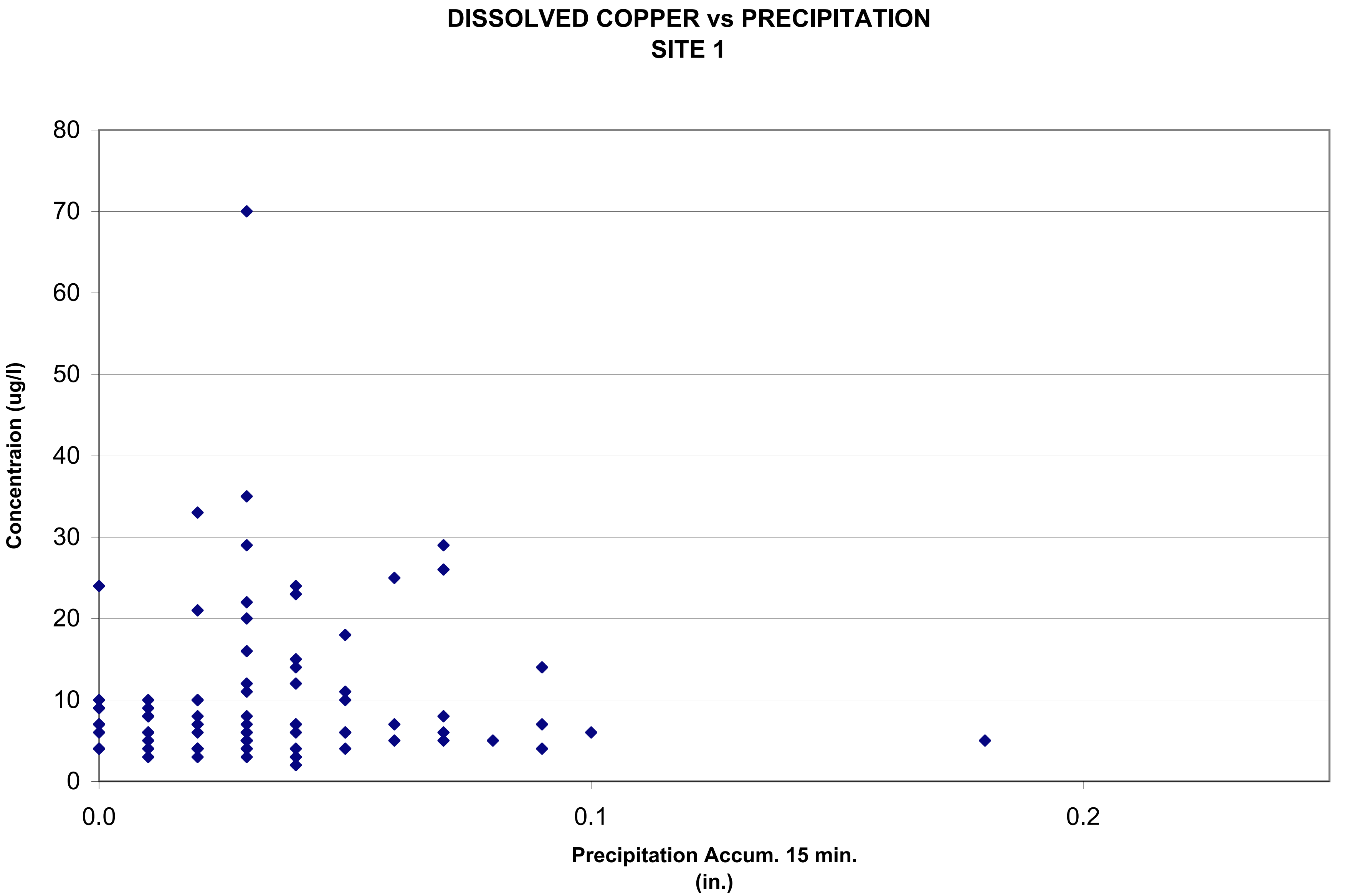
FECAL COLIFORMS vs FLOW
SITE 1
6,000
5,000
4,000
3,000
2,000
1,000
0
Concentraion (MPN/ 100ml)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Instantaneous Flow(cfs)
Correlation Coefficient (R^2): 0.01


DISSOLVED CADMIUM vs PRECIPITATION
SITE 1
Concentraion (ug/l)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R2): 0.02

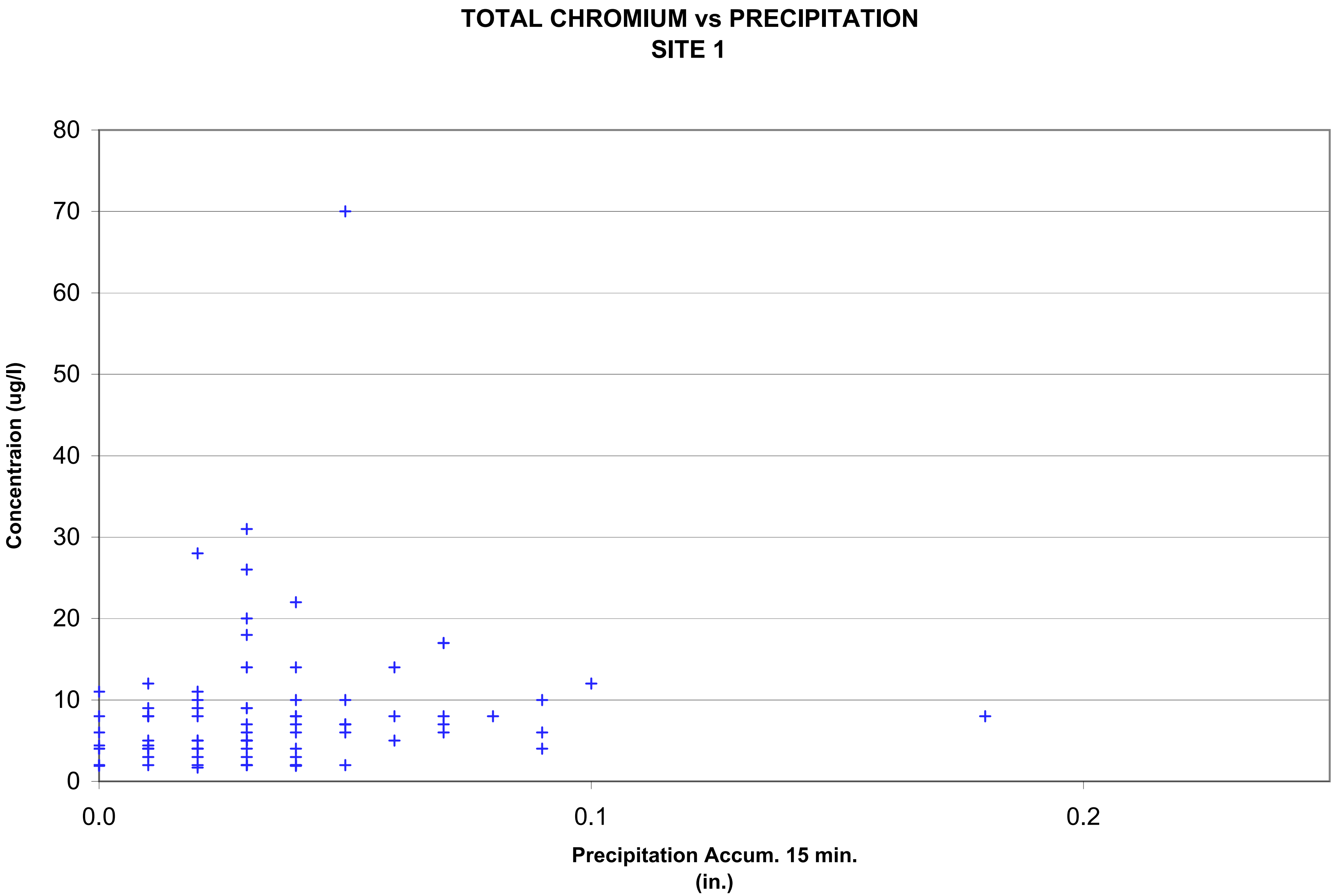


Correlation Coefficient (R^2): 0.02

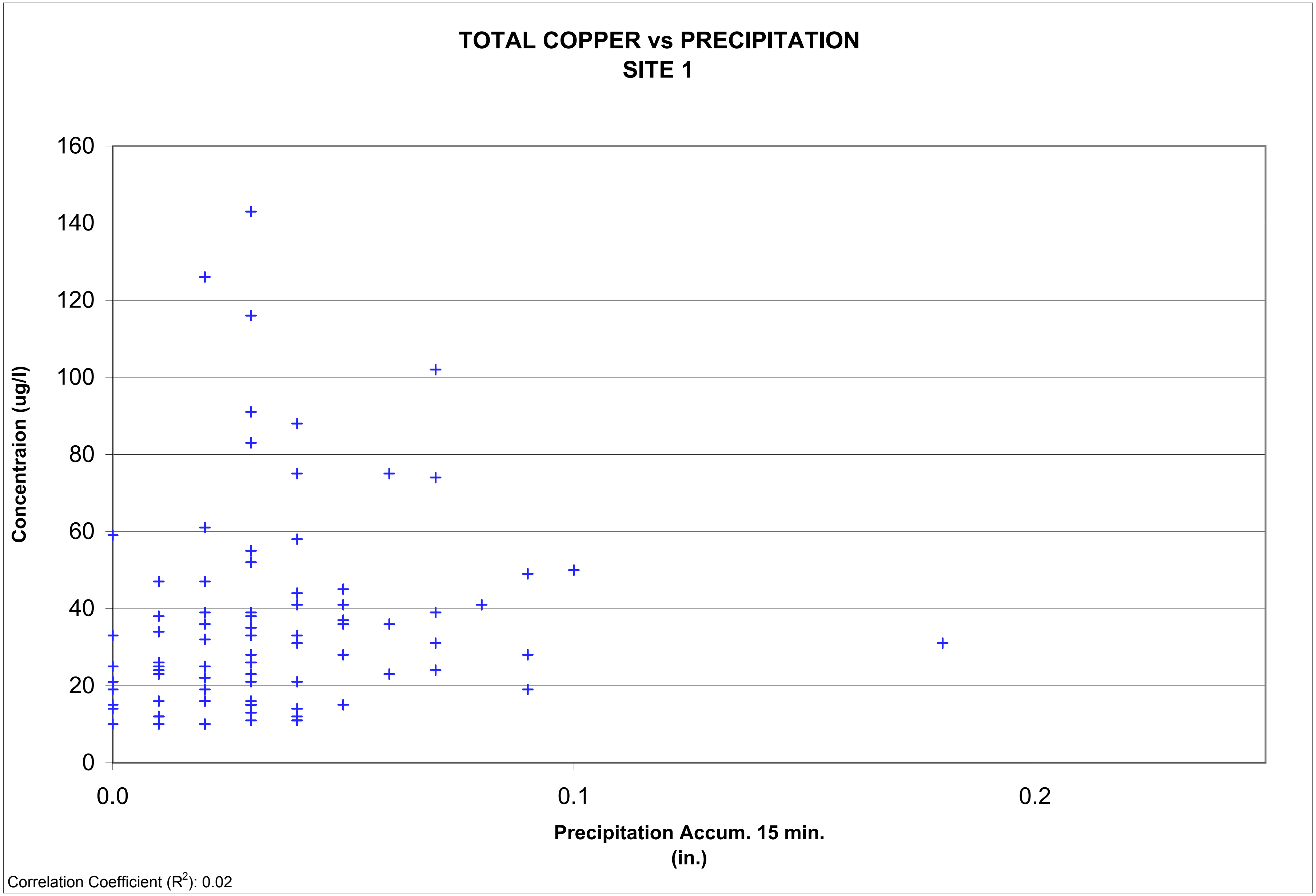

DISSOLVED CHROMIUM vs PRECIPITATION
SITE 1
Concentraion (ug/l)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.01



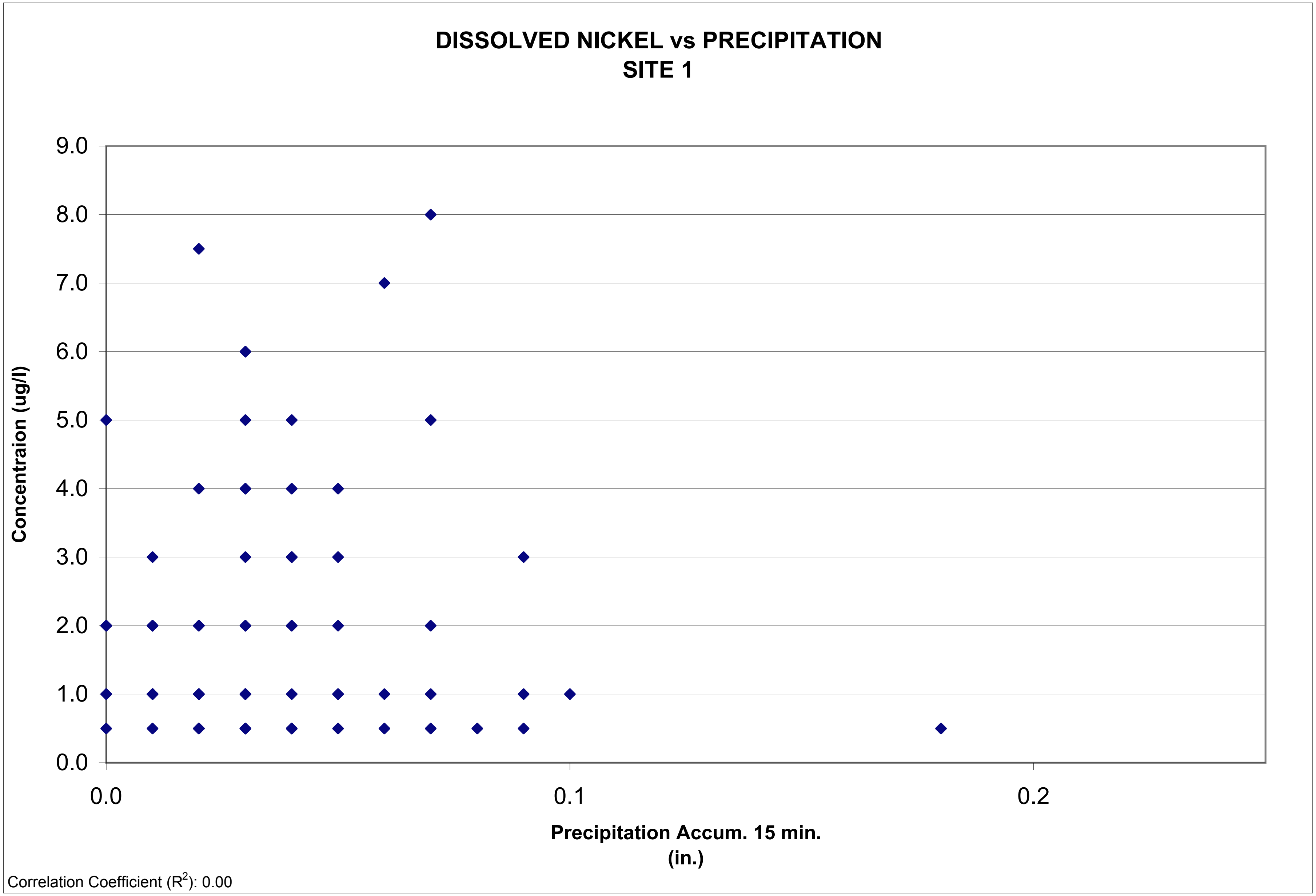
Correlation Coefficient (R^2): 0.00

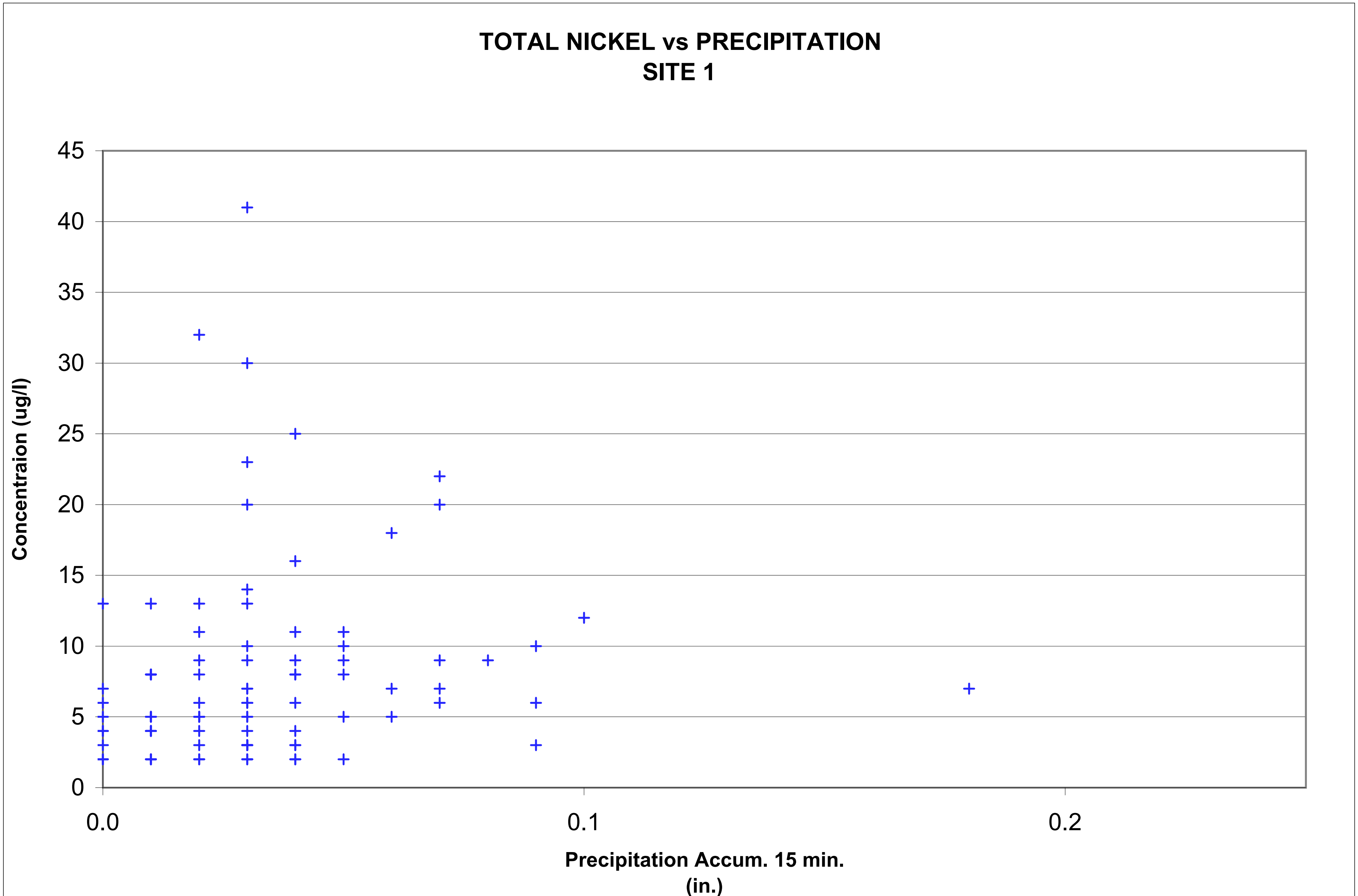


Correlation Coefficient (R^2): 0.02

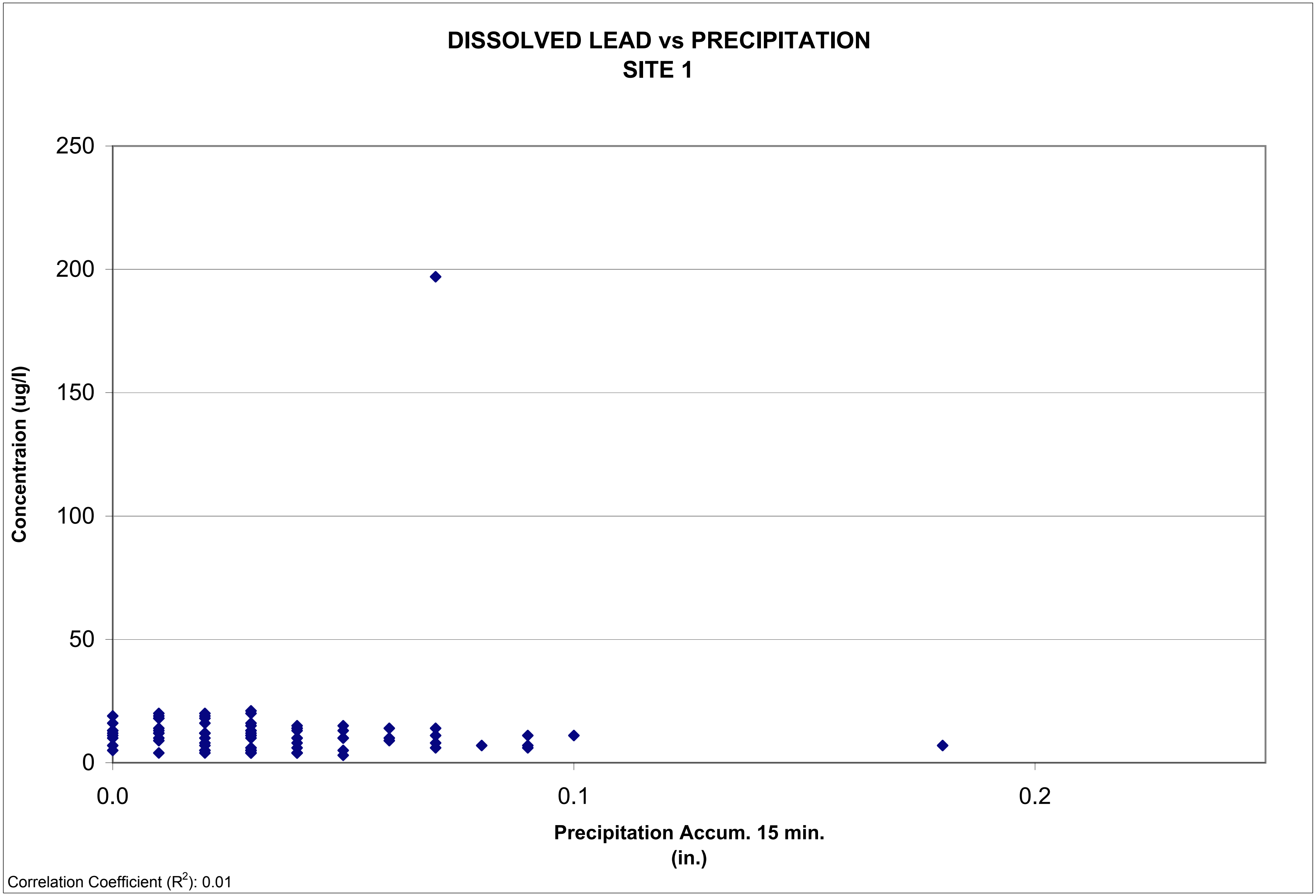


TOTAL COPPER vs PRECIPITATION
SITE 1
Concentraion (ug/l)
160
140
120
100
80
60
40
20
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.02

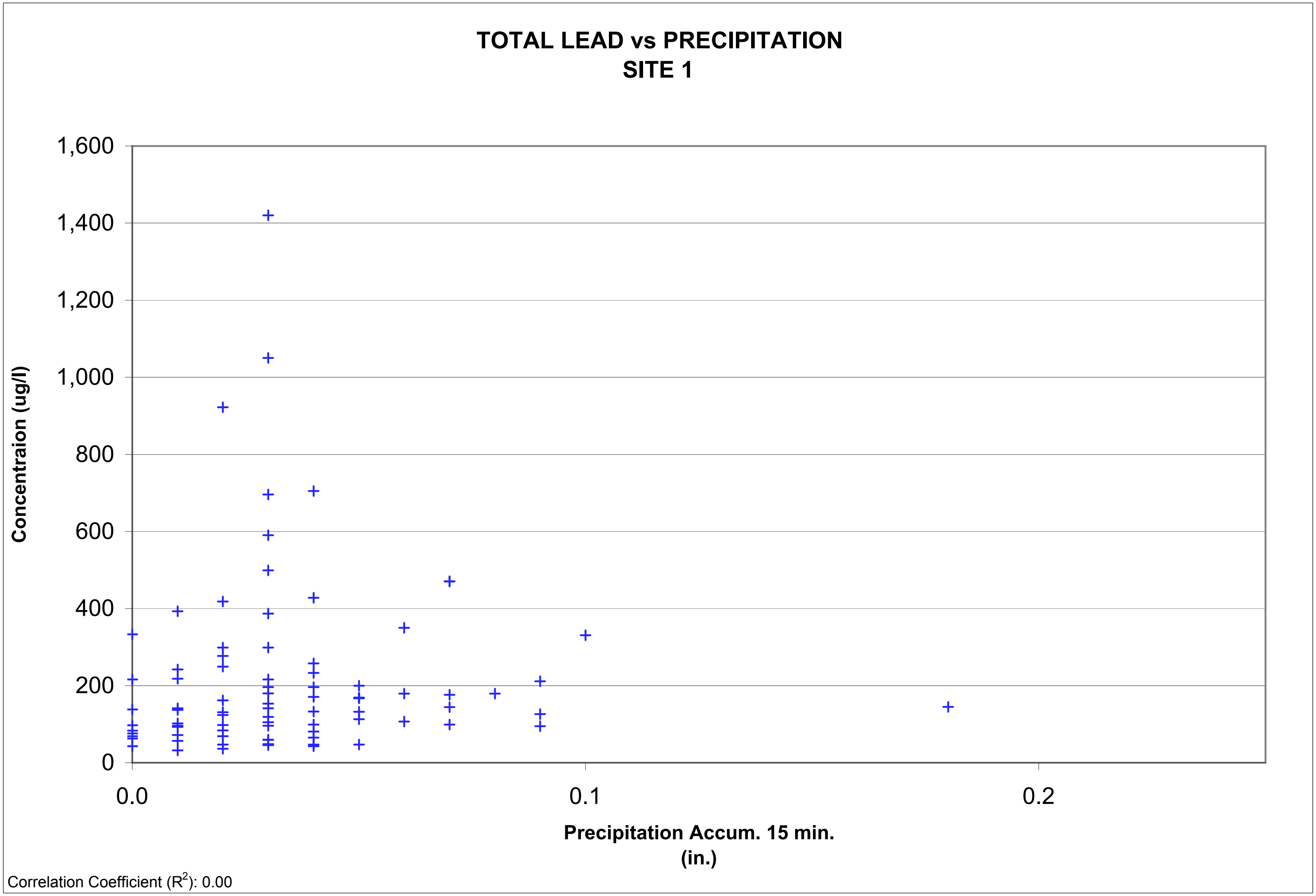

DISSOLVED NICKEL vs PRECIPITATION
SITE 1
Concentraion (ug/l)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R2): 0.00

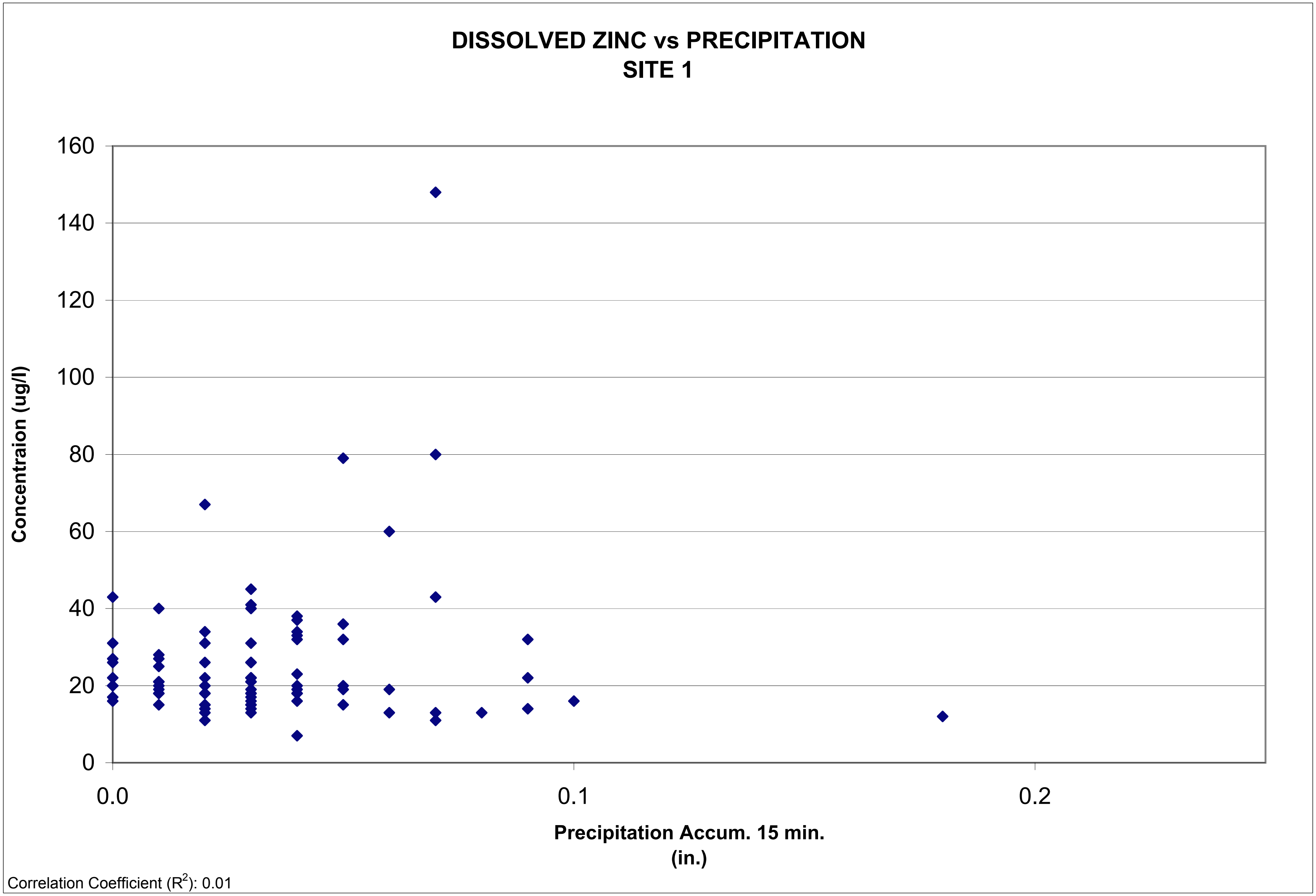


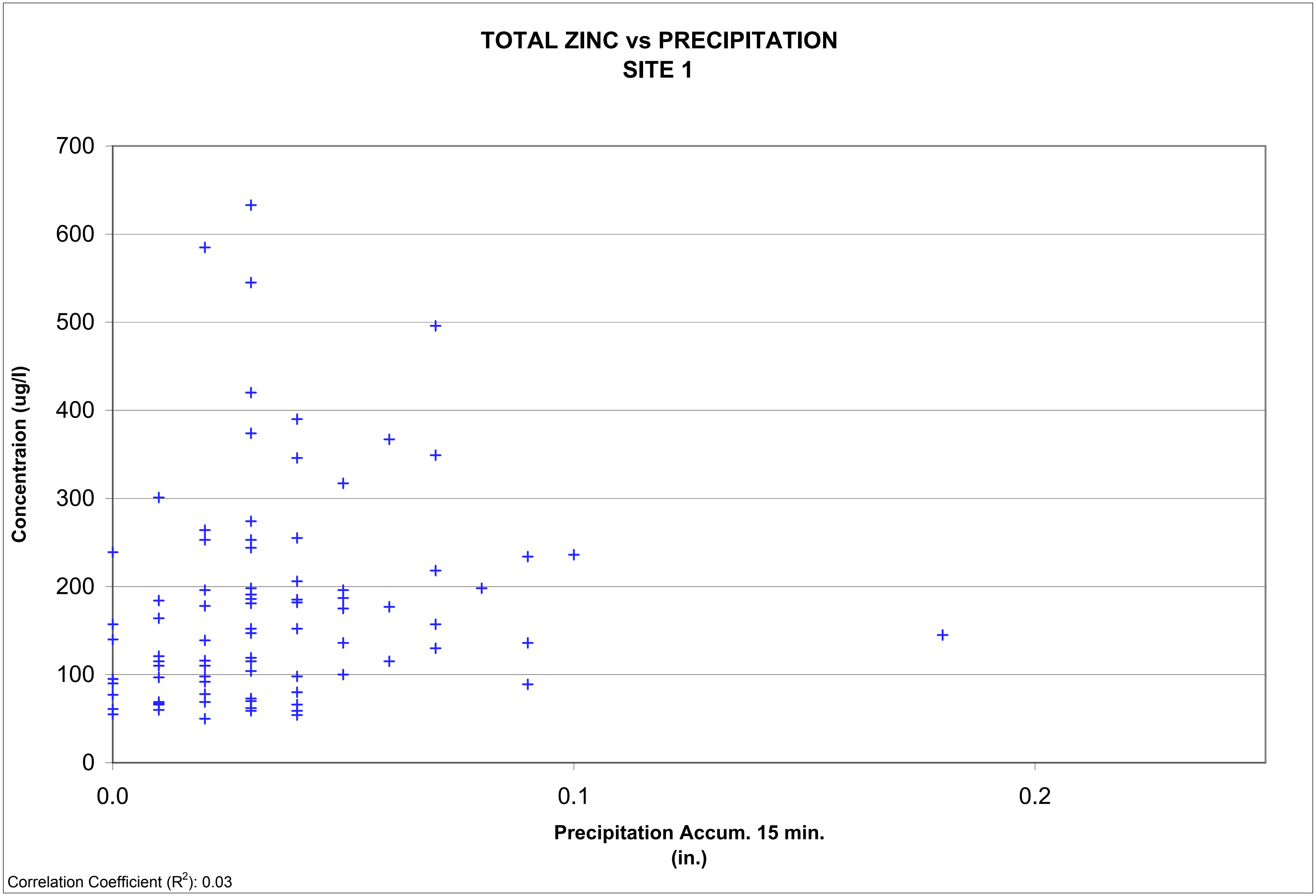
Correlation Coefficient (R^2): 0.02

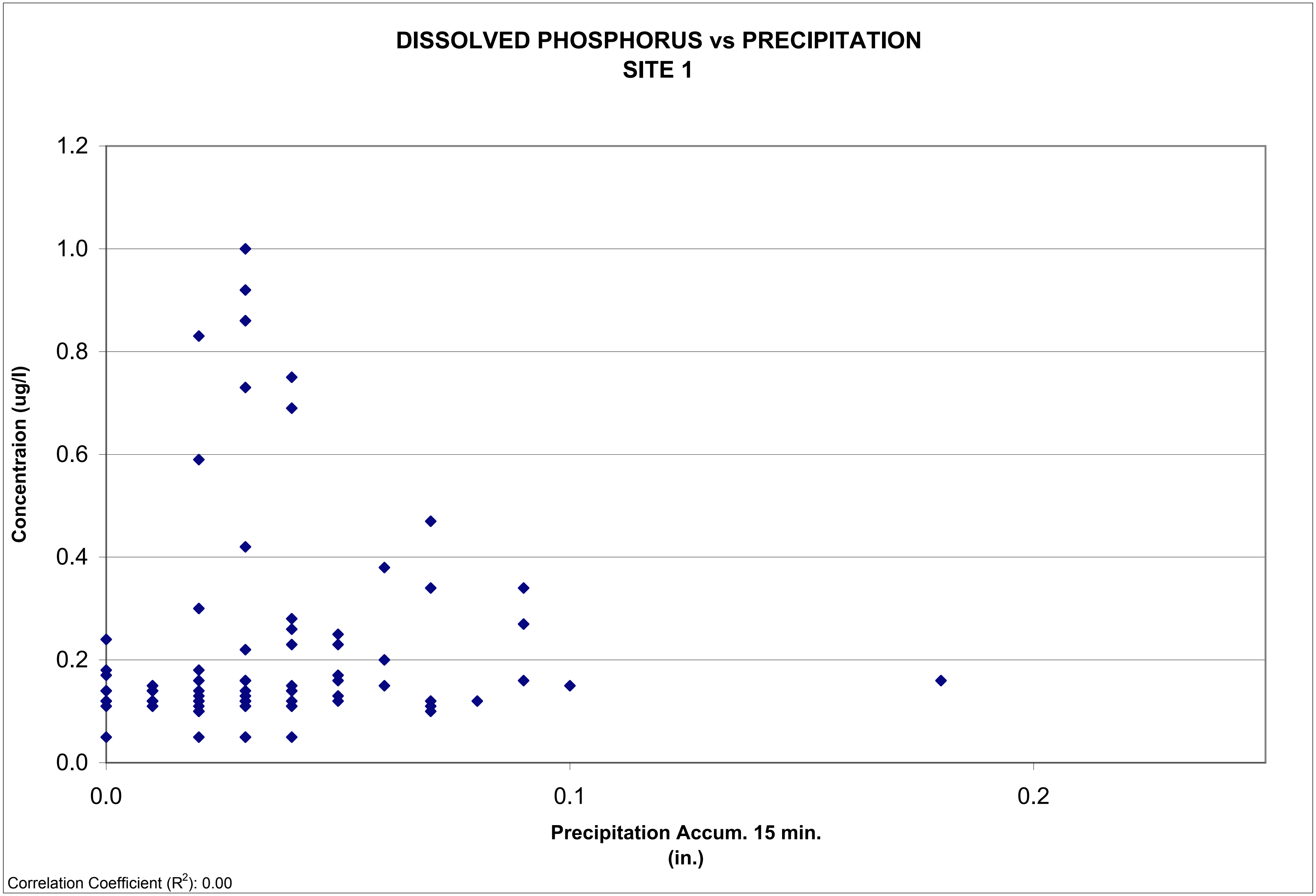


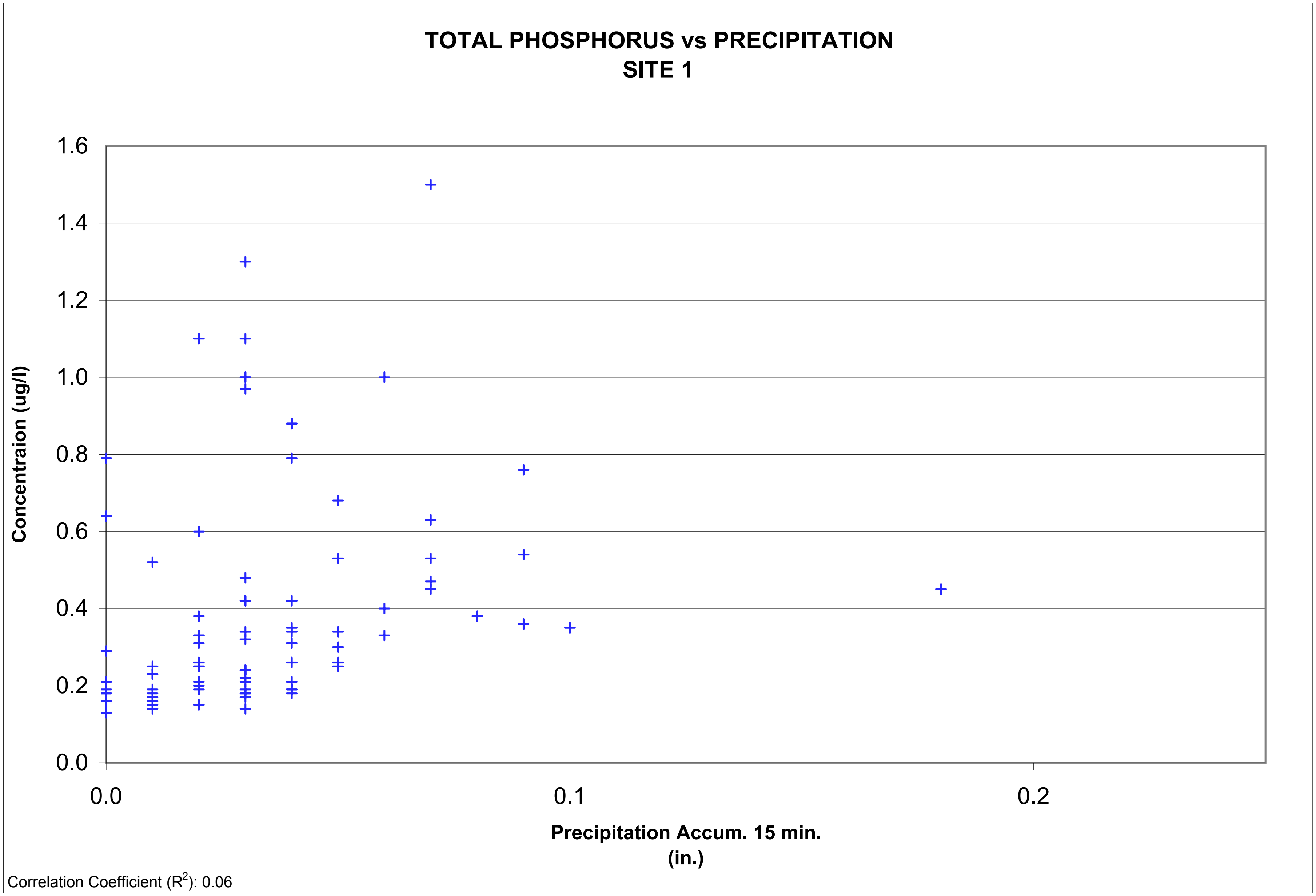
DISSOLVED LEAD vs PRECIPITATION
SITE 1
Concentraion (ug/l)
250
200
150
100
50
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.01

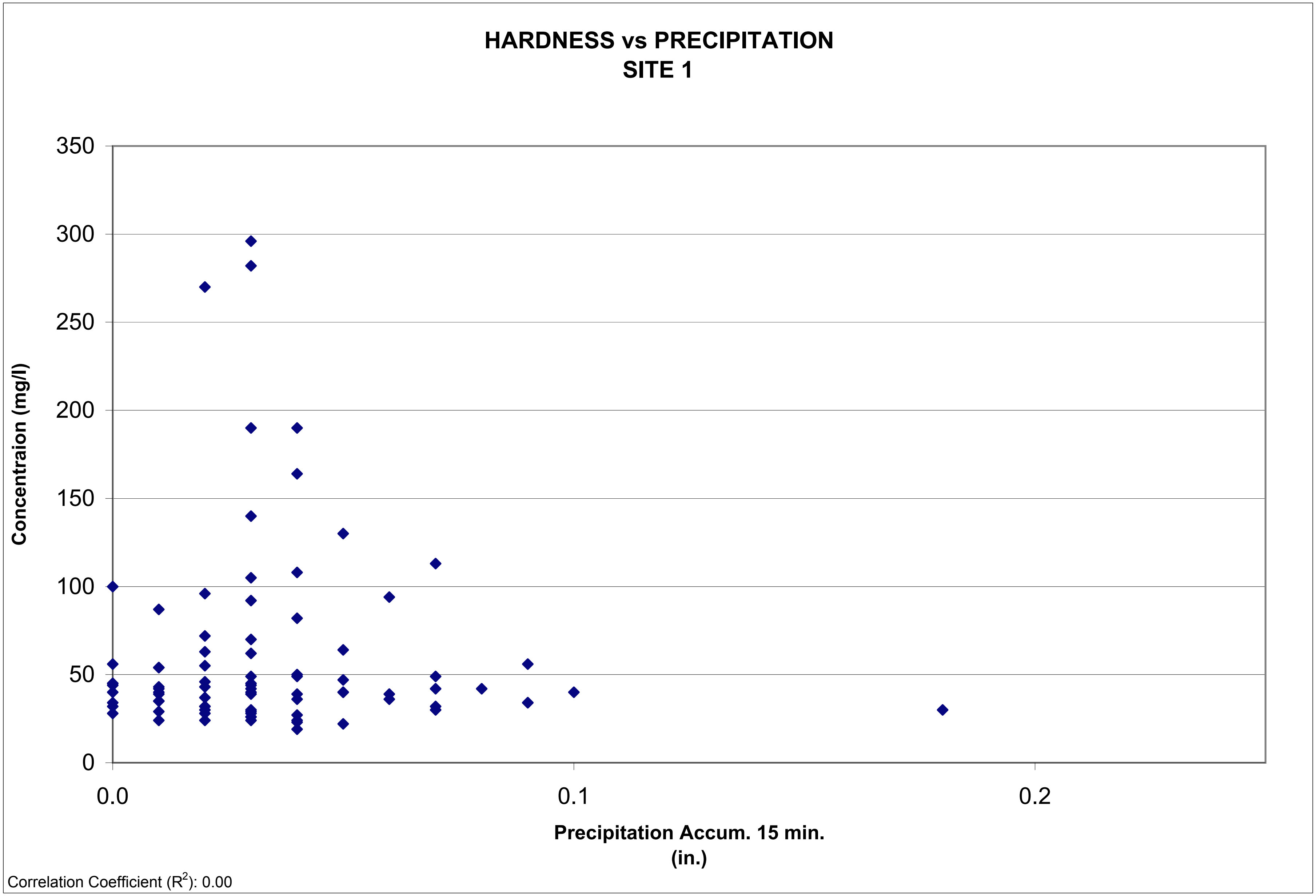

TOTAL LEAD vs PRECIPITATION
SITE 1
Concentraion (ug/l)
1,600
1,400
1,200
1,000
800
600
400
200
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.00

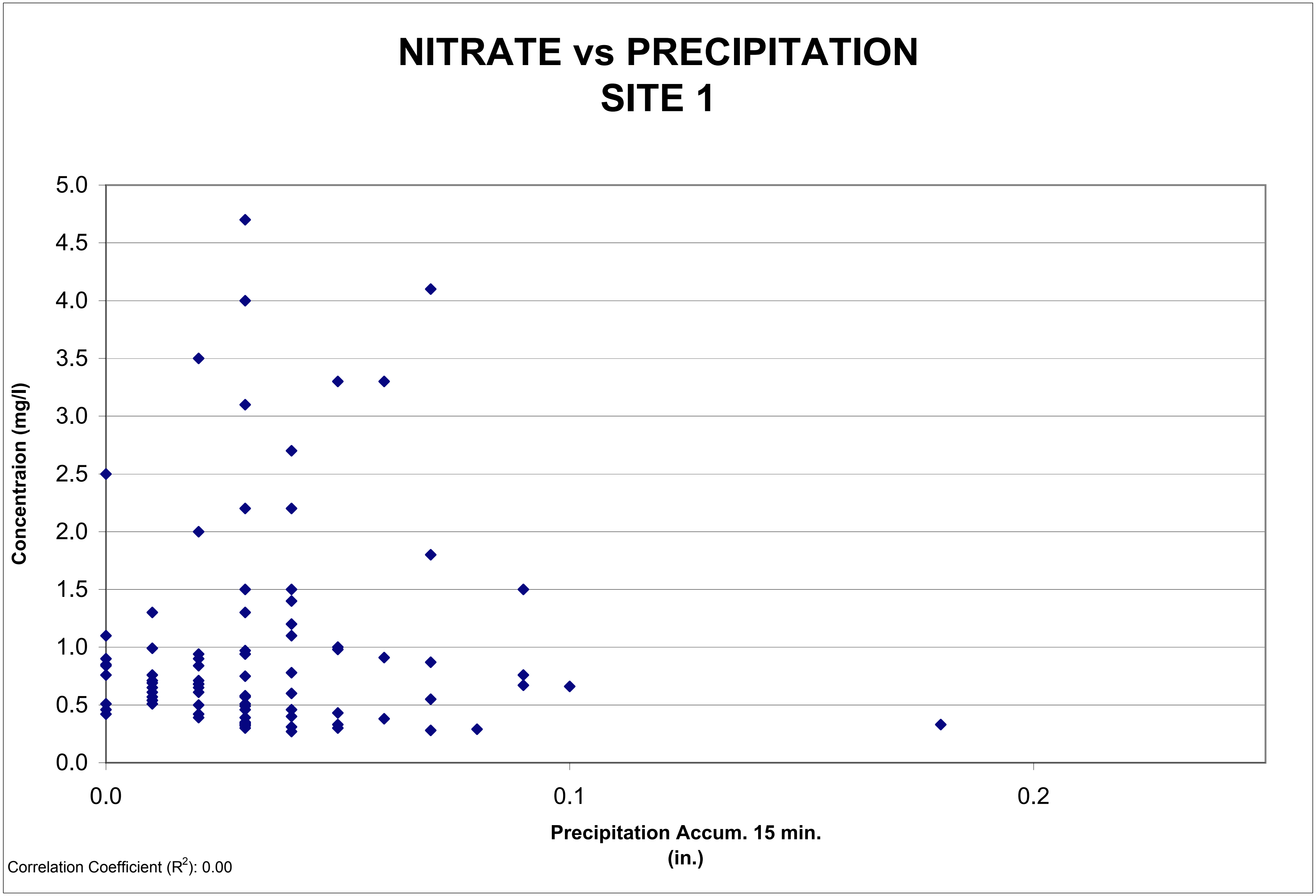

DISSOLVED ZINC vs PRECIPITATION
SITE 1
Concentraion (ug/l)
160
140
120
100
80
60
40
20
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.01

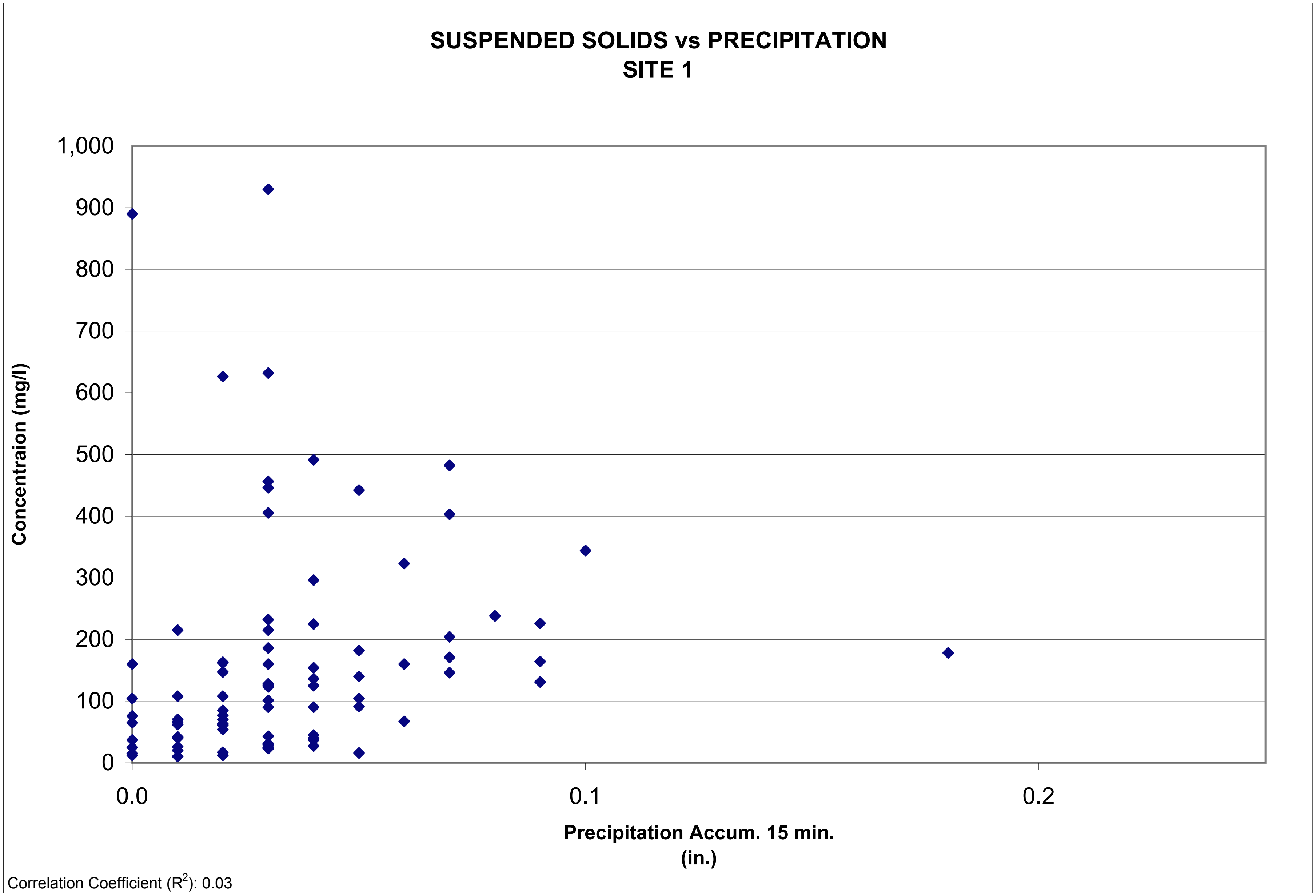

TOTAL ZINC vs PRECIPITATION
SITE 1
Concentraion (ug/l)
0
100
200
300
400
500
600
700
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R2): 0.03

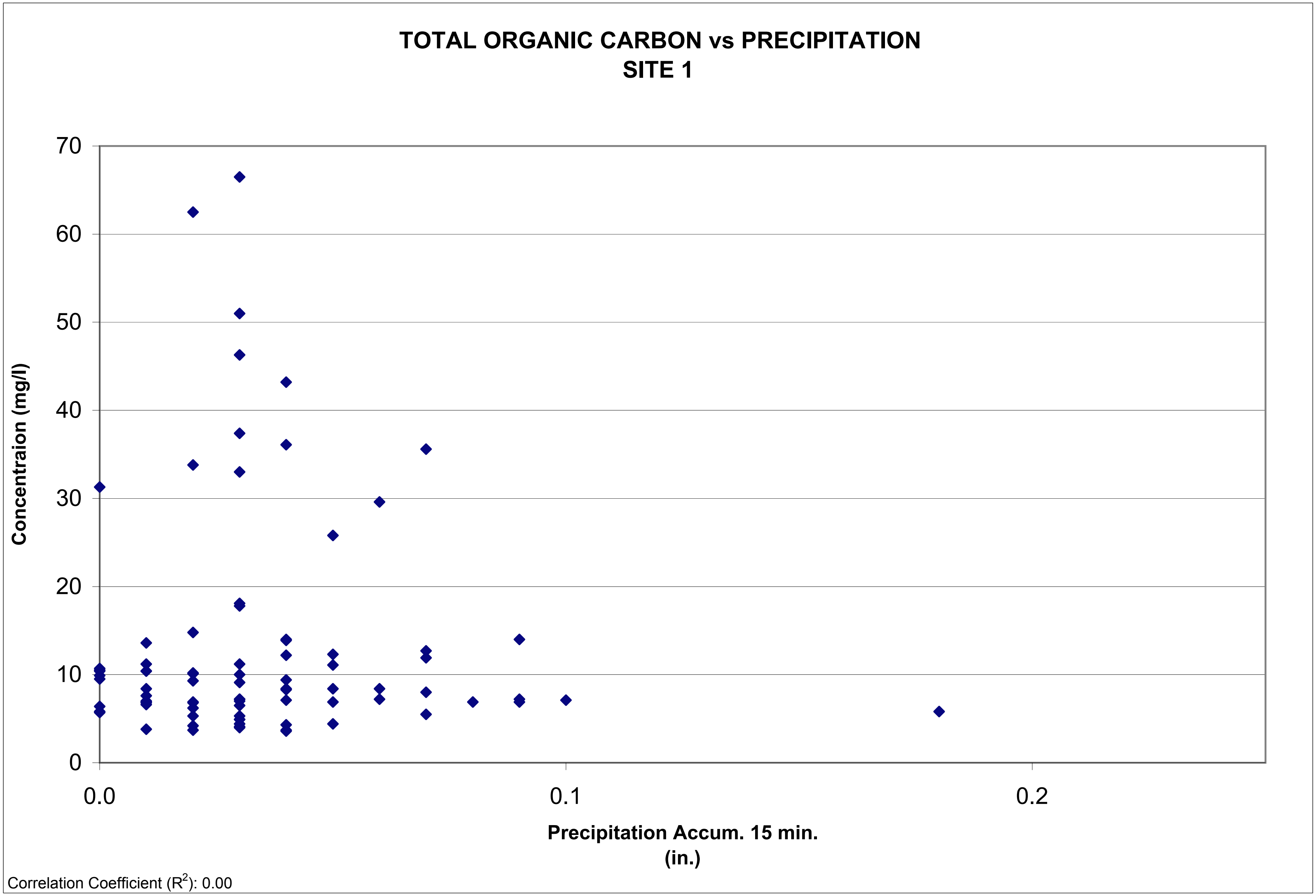

DISSOLVED PHOSPHORUS vs PRECIPITATION
SITE 1
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Concentraion (ug/l)
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.00

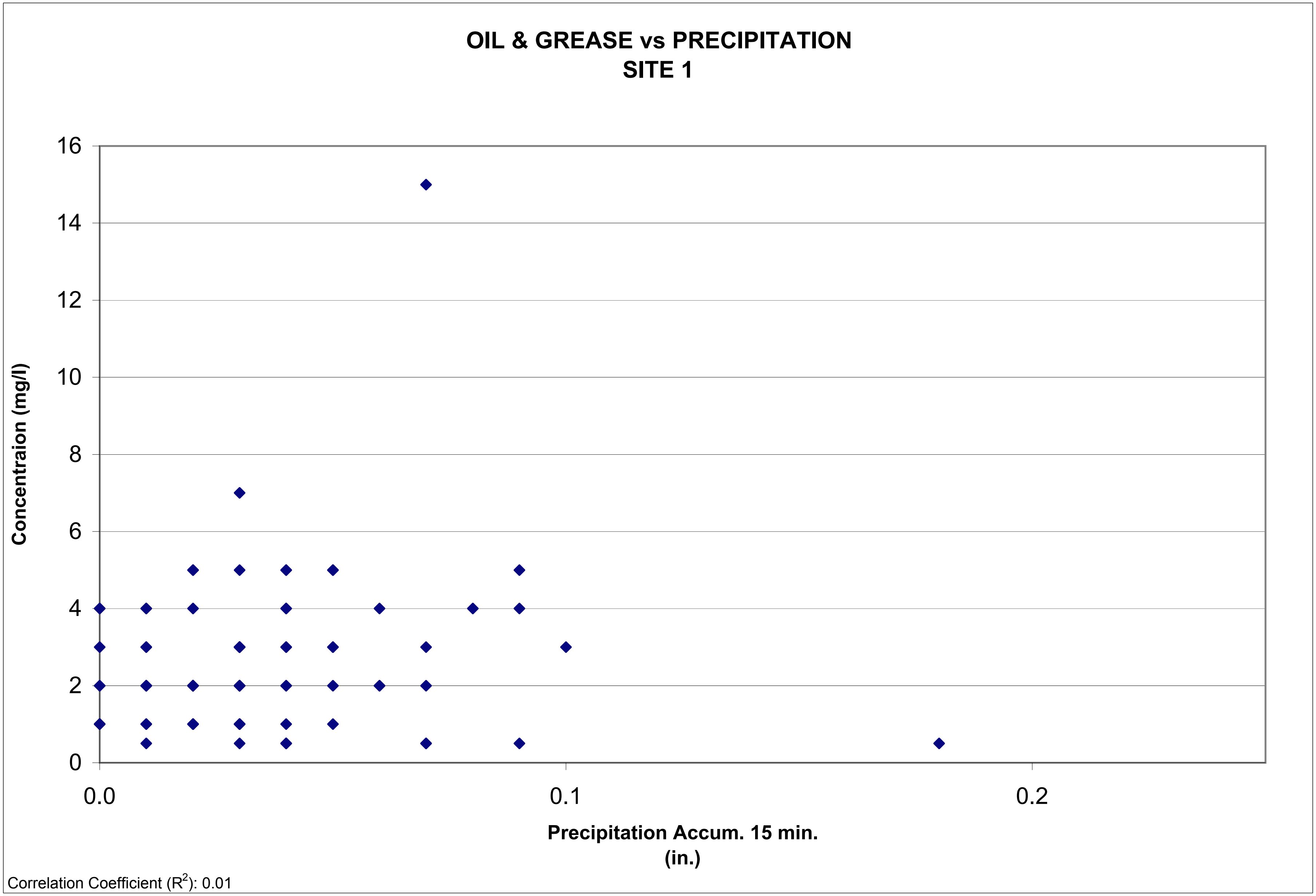

TOTAL PHOSPHORUS vs PRECIPITATION
SITE 1
Concentraion (ug/l)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R2): 0.06

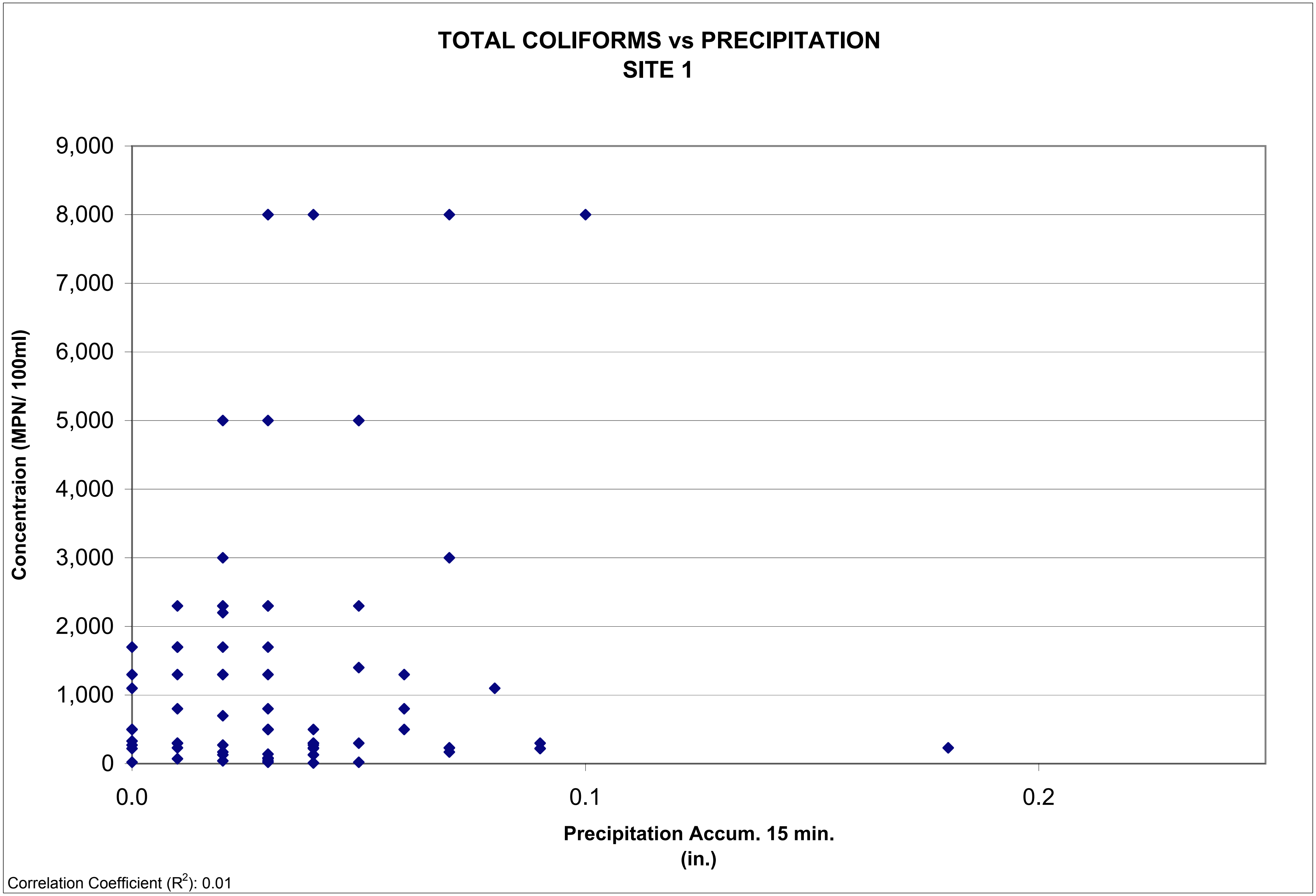

HARDNESS vs PRECIPITATION
SITE 1
Concentraion (mg/l)
350
300
250
200
150
100
50
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R2): 0.00

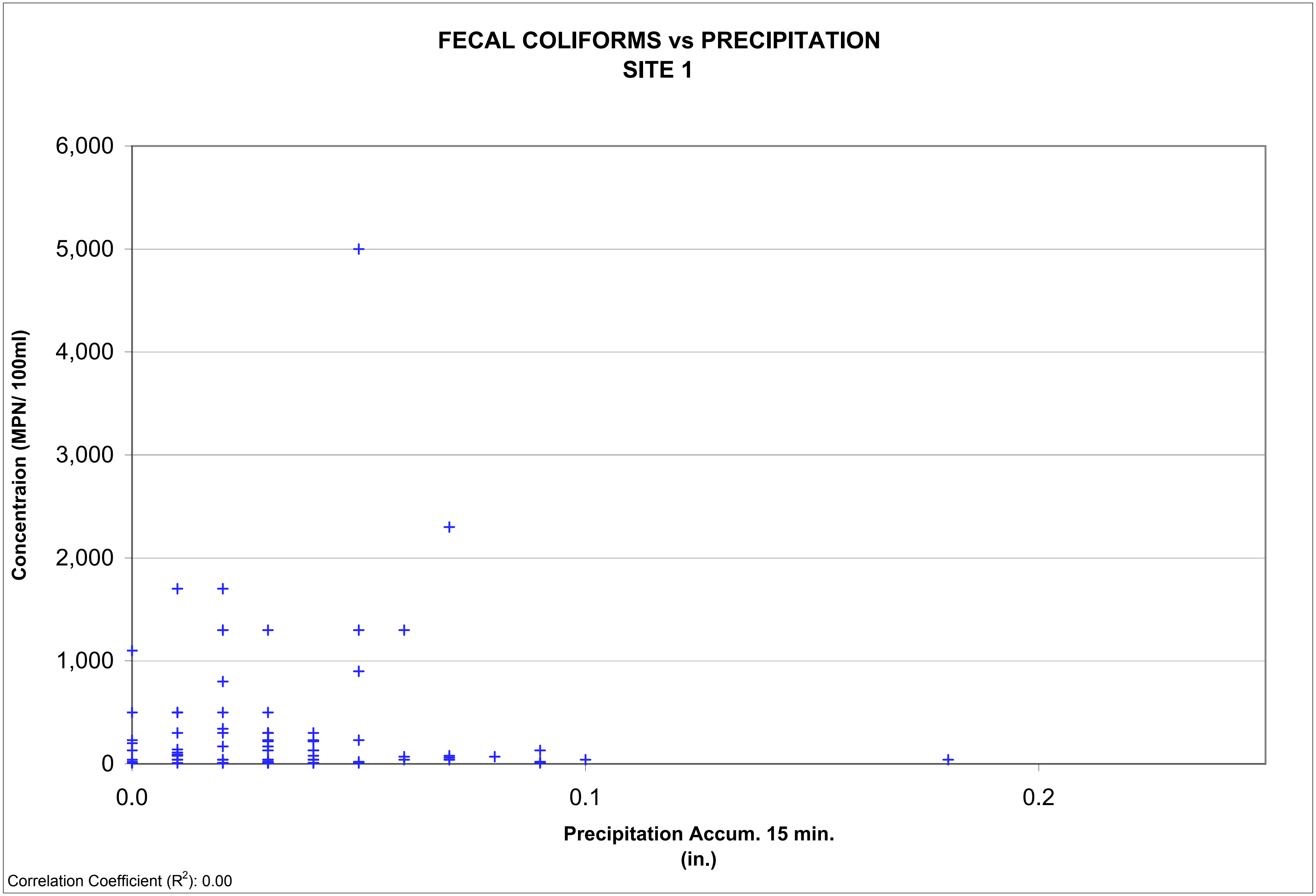

NITRATE vs PRECIPITATION
SITE 1
Concentraion (mg/l)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.00


SUSPENDED SOLIDS vs PRECIPITATION
SITE 1
Concentraion (mg/l)
1,000
900
800
700
600
500
400
300
200
100
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.03

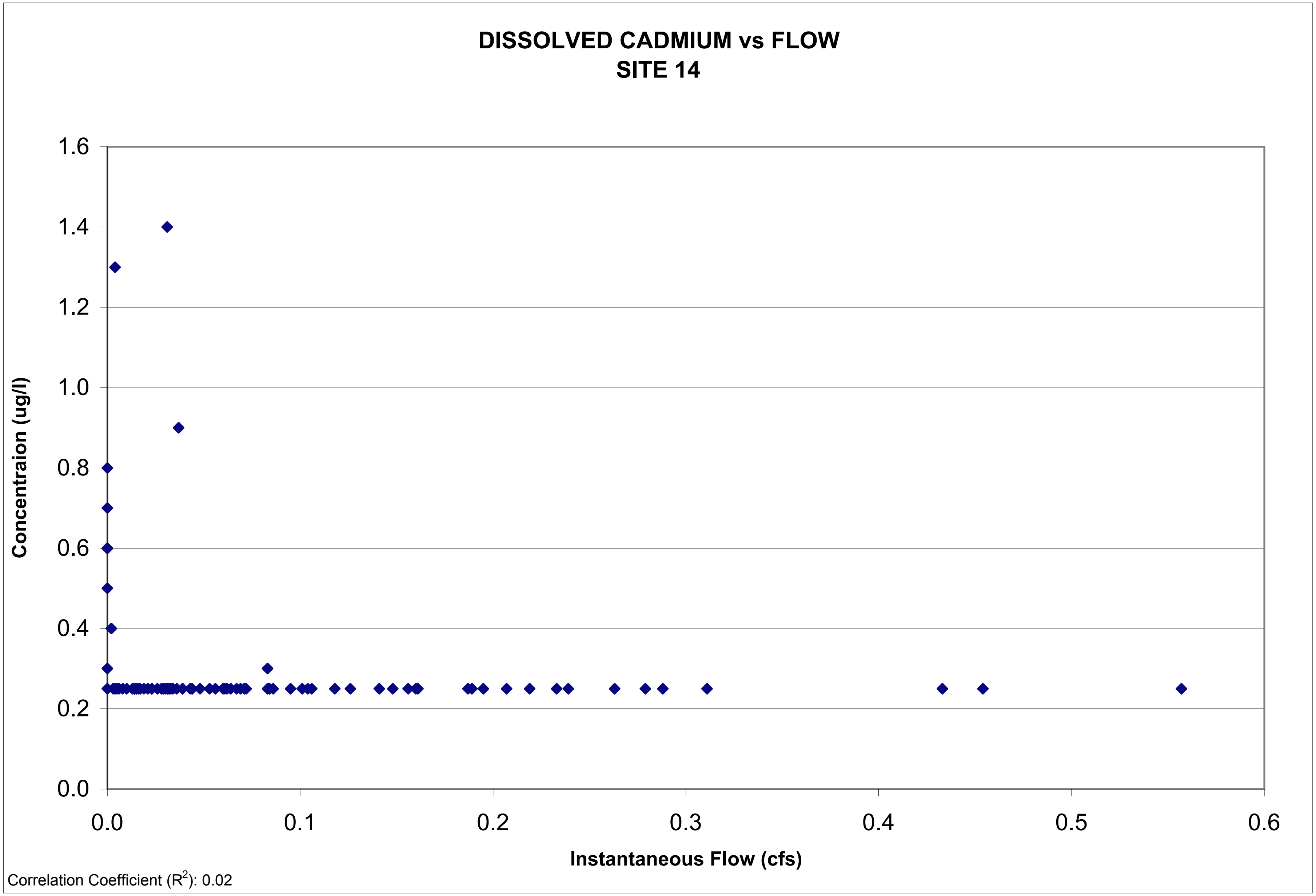

TOTAL ORGANIC CARBON vs PRECIPITATION
SITE 1
Concentraion (mg/l)
70
60
50
40
30
20
10
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.00

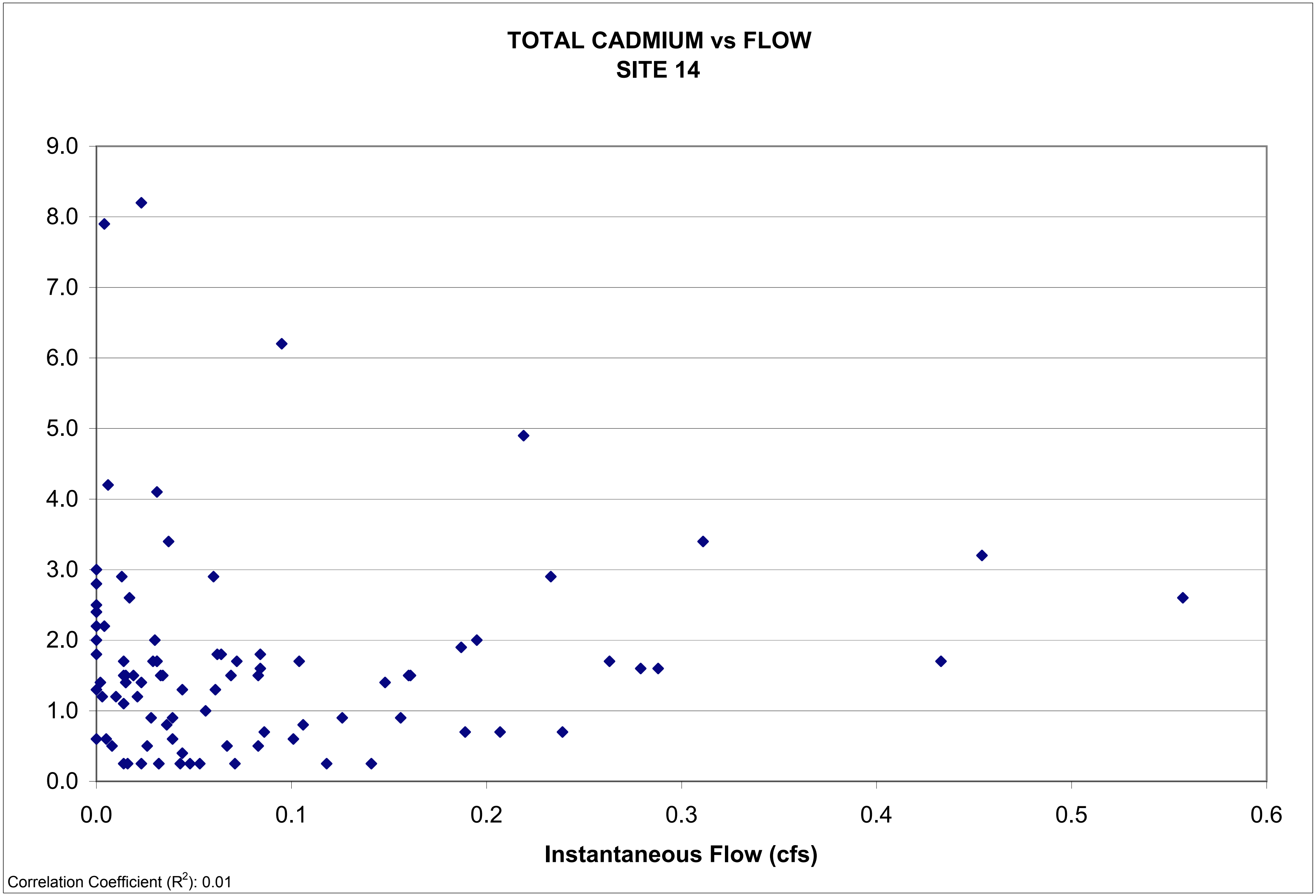

OIL & GREASE vs PRECIPITATION
SITE 1
Concentraion (mg/l)
16
14
12
10
8
6
4
2
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.01

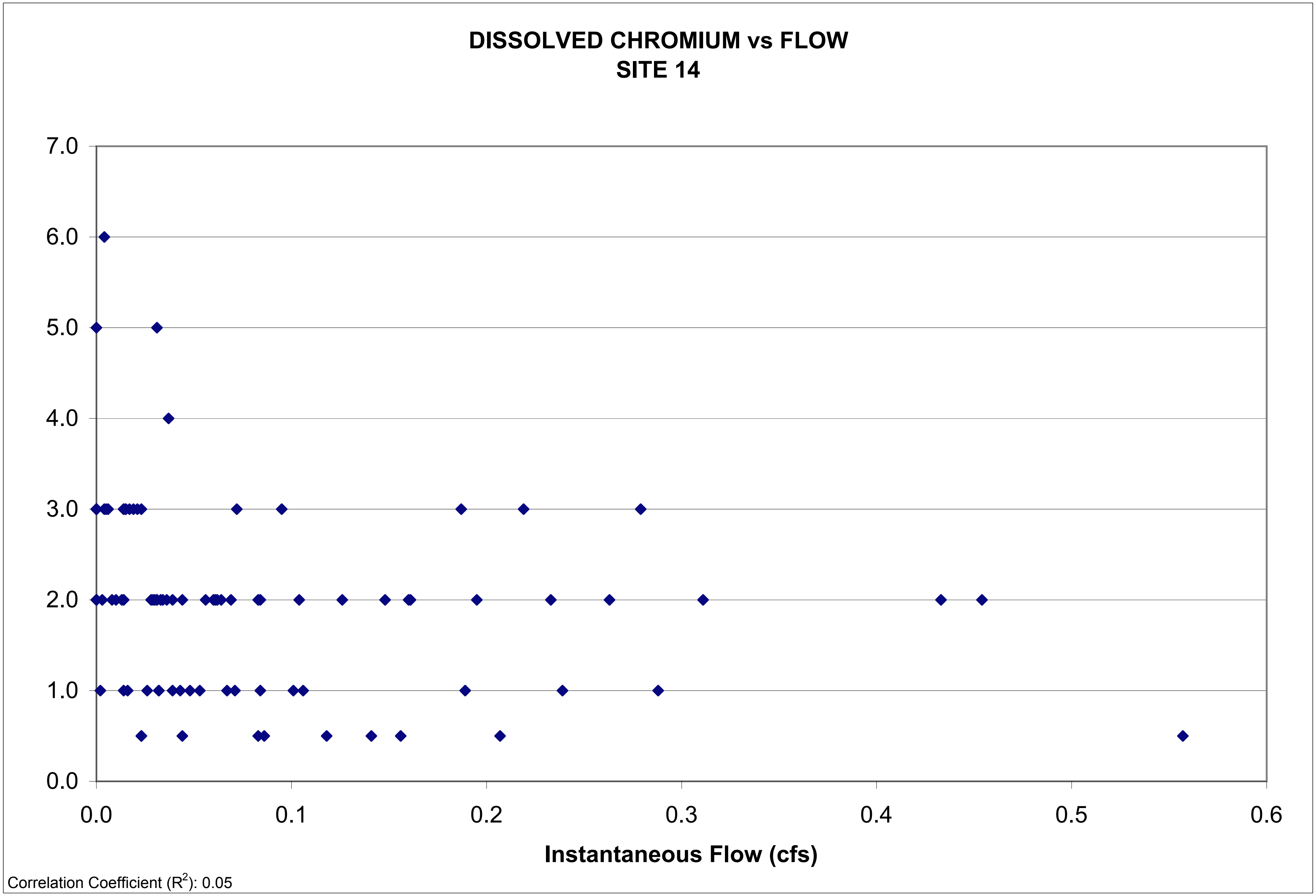

TOTAL COLIFORMS vs PRECIPITATION
SITE 1
Concentraion (MPN/ 100ml)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.01

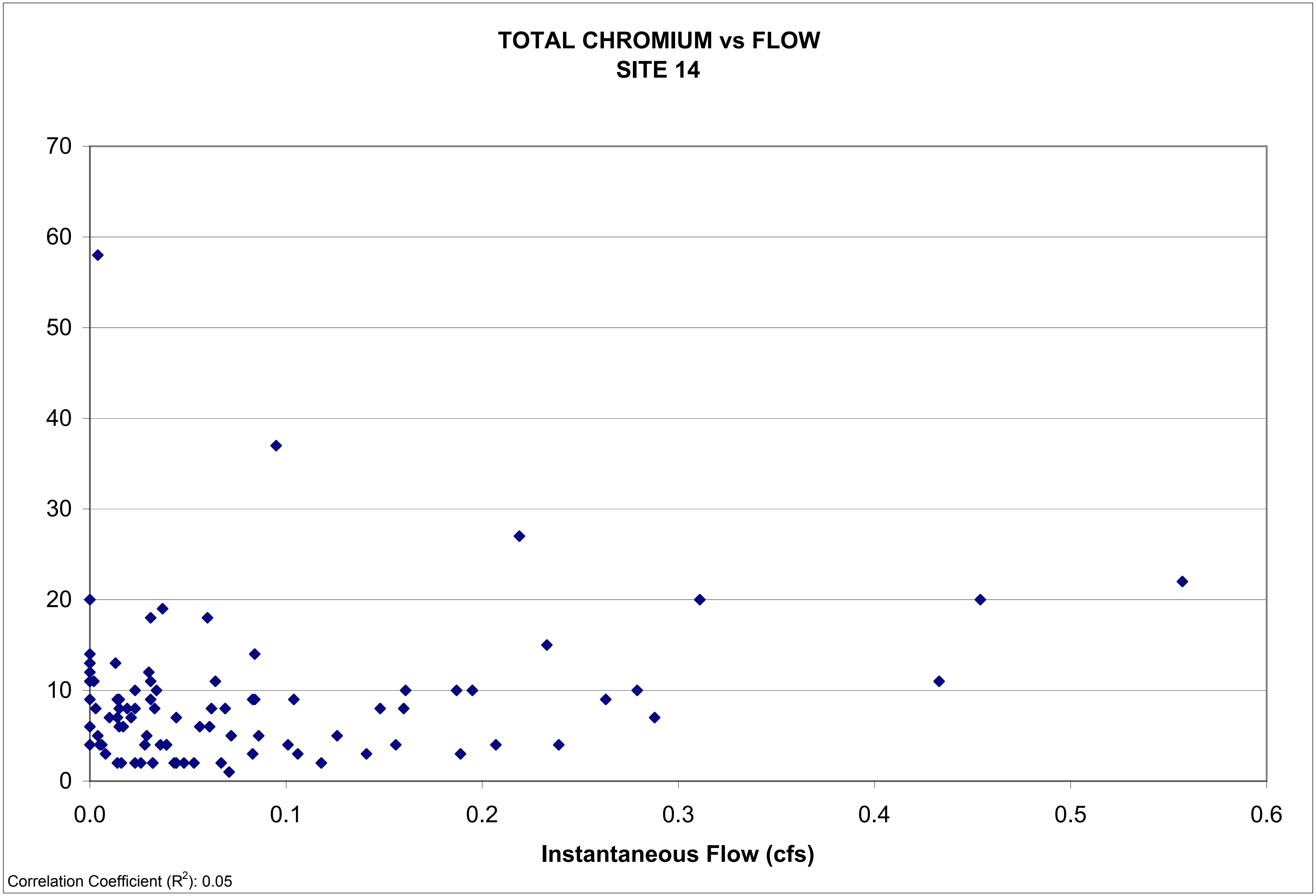


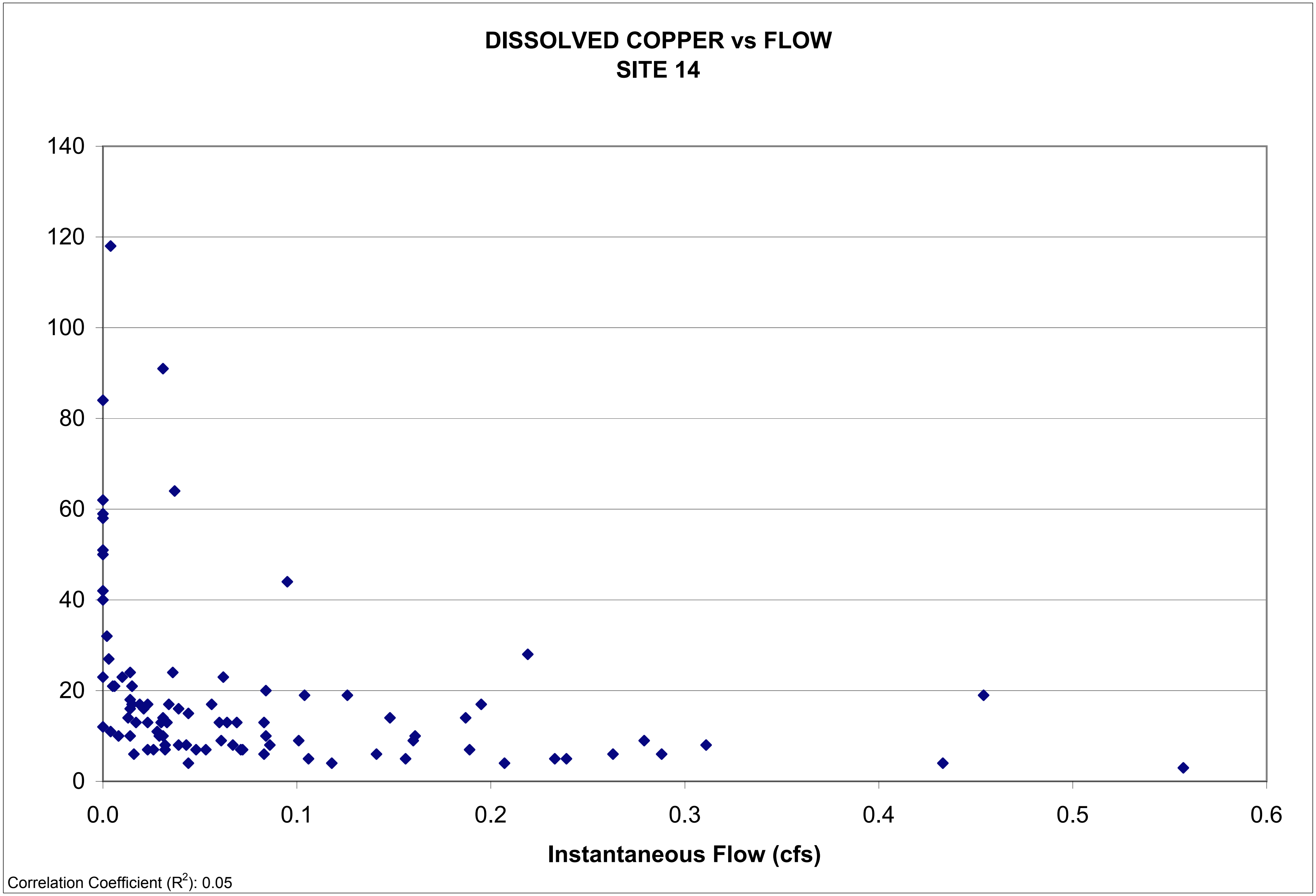
FECAL COLIFORMS vs PRECIPITATION
SITE 1
Concentraion (MPN/ 100ml)
6,000
5,000
4,000
3,000
2,000
1,000
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.00

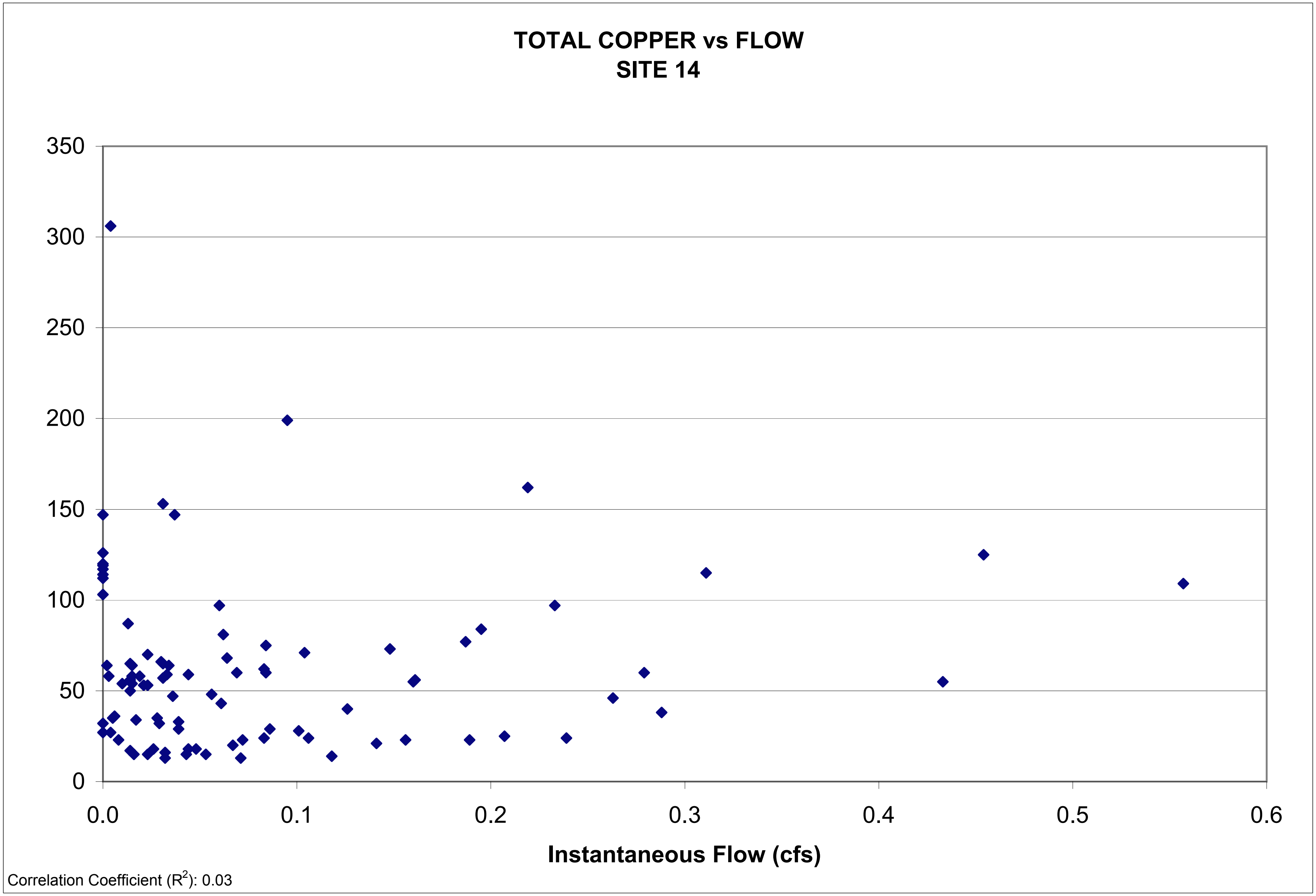

DISSOLVED CADMIUM vs FLOW
SITE 14
Concentraion (ug/l)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.02

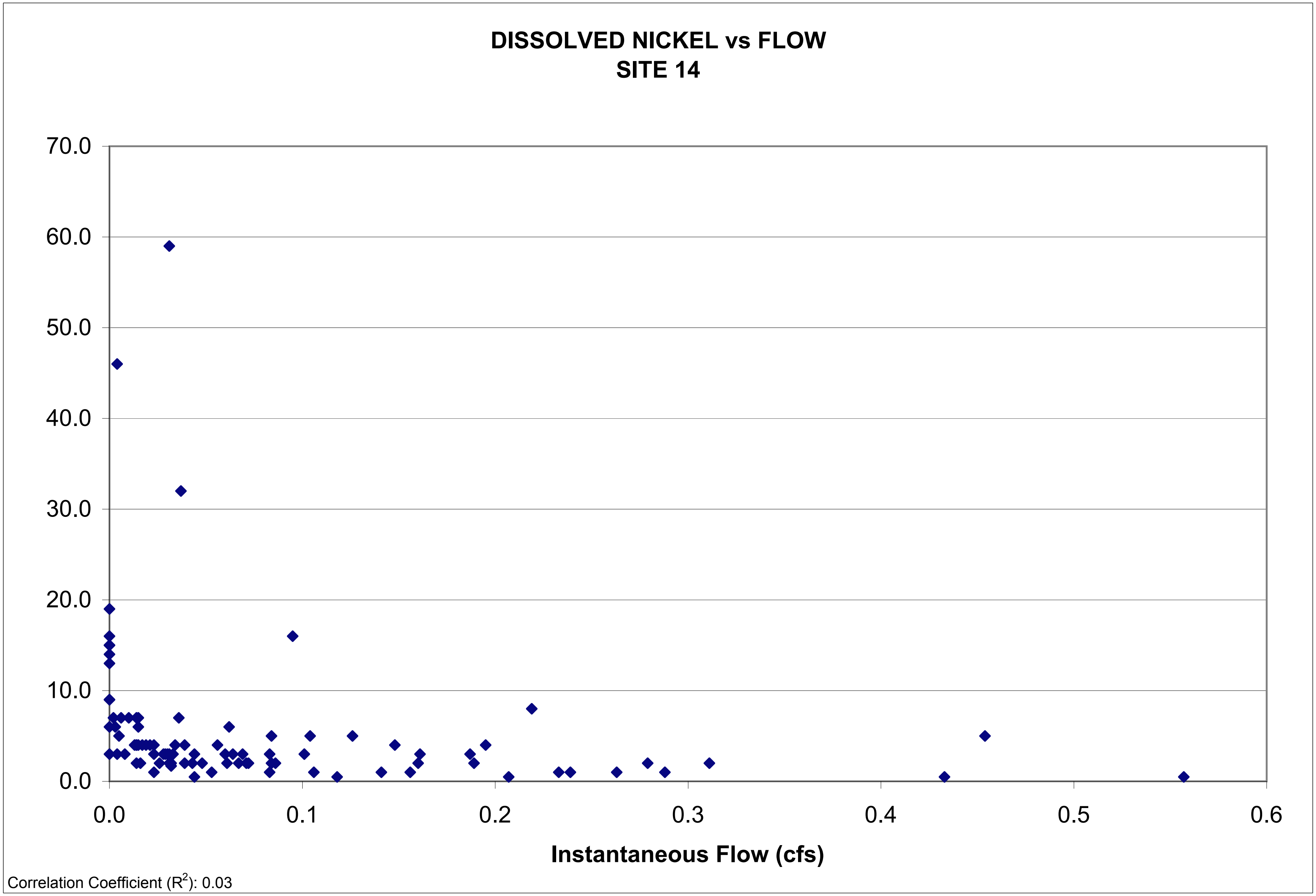

TOTAL CADMIUM vs FLOW
SITE 14
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.01

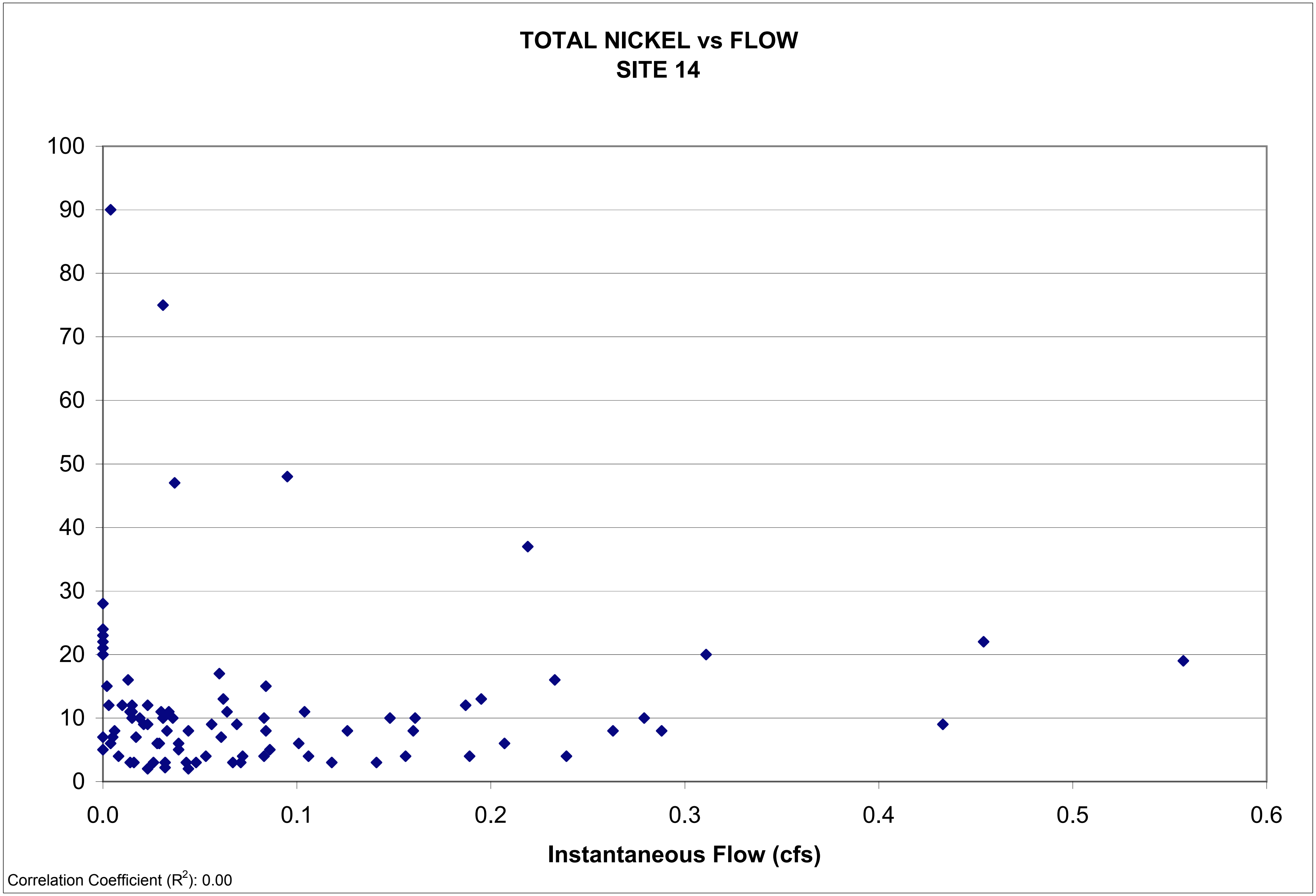

DISSOLVED CHROMIUM vs FLOW
SITE 14
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.05

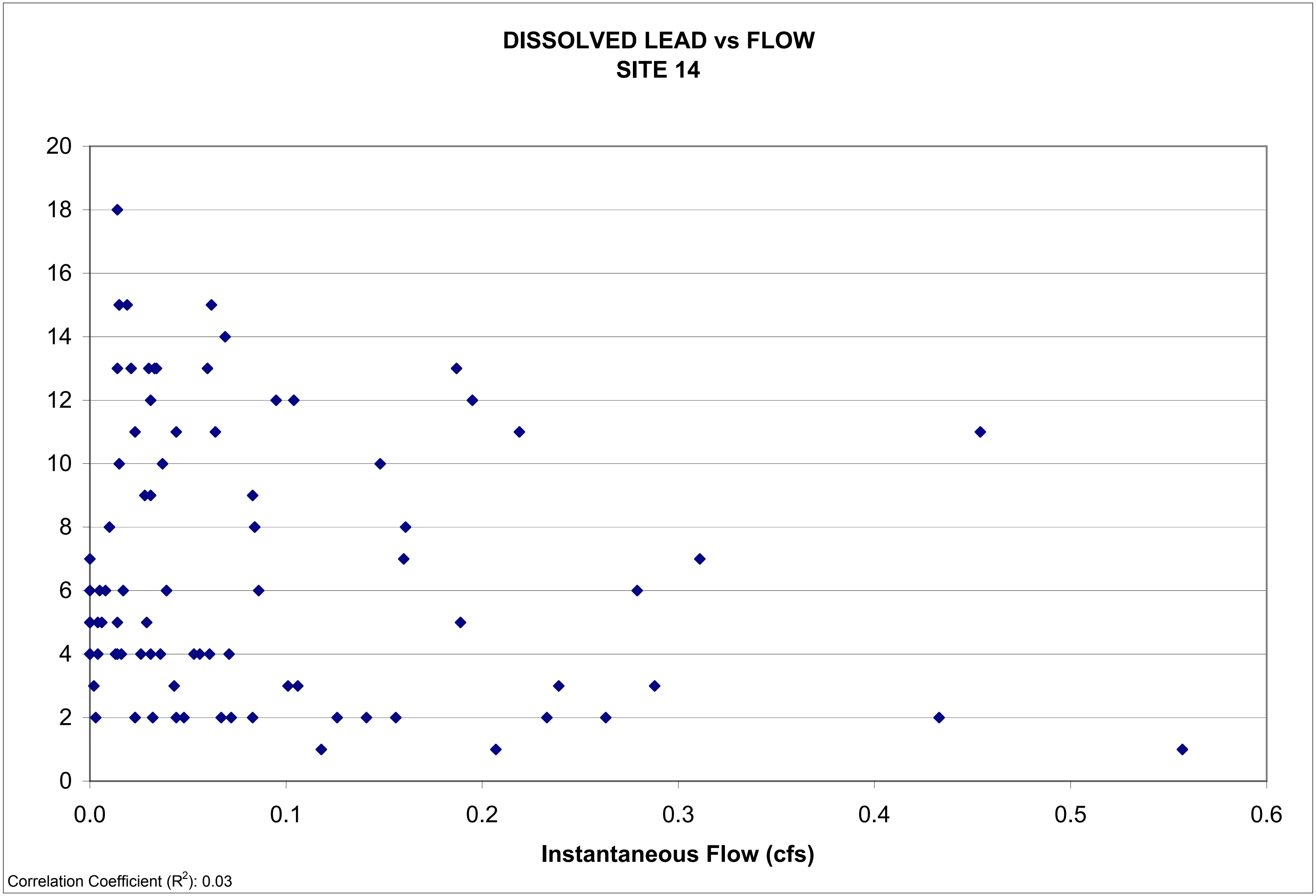

TOTAL CHROMIUM vs FLOW
SITE 14
70
60
50
40
30
20
10
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R2): 0.05

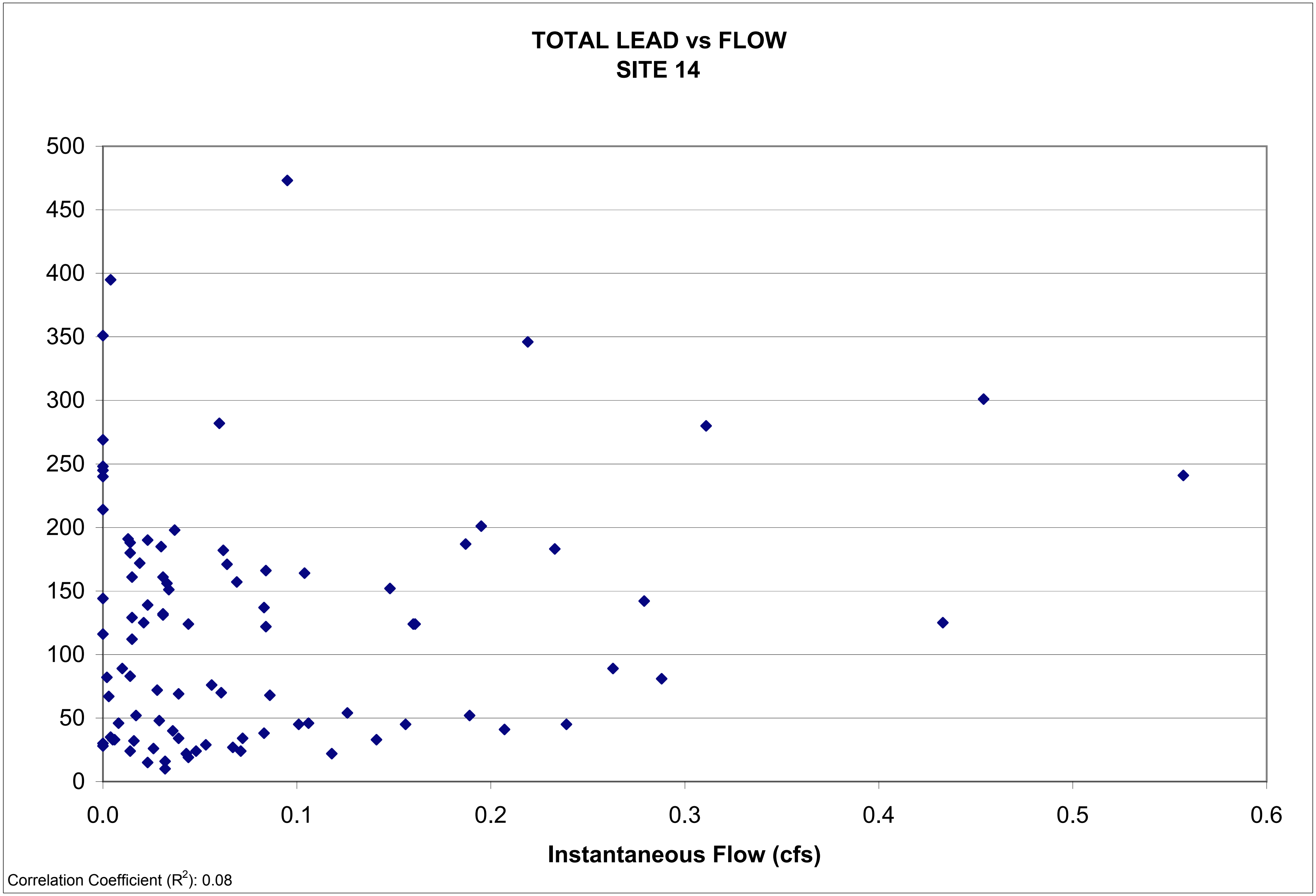

DISSOLVED COPPER vs FLOW
SITE 14
140
120
100
80
60
40
20
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R2): 0.05

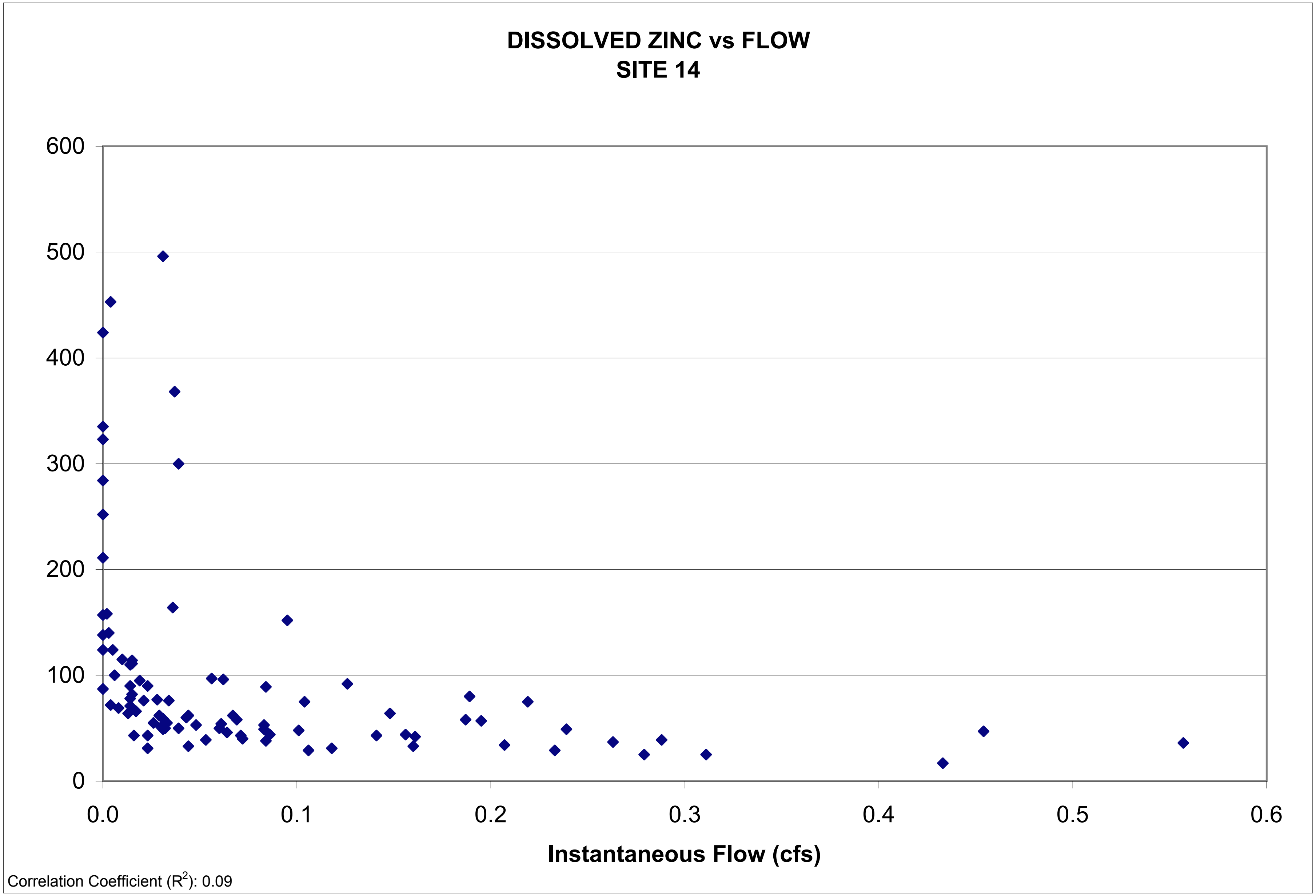

TOTAL COPPER vs FLOW
SITE 14
350
300
250
200
150
100
50
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.03

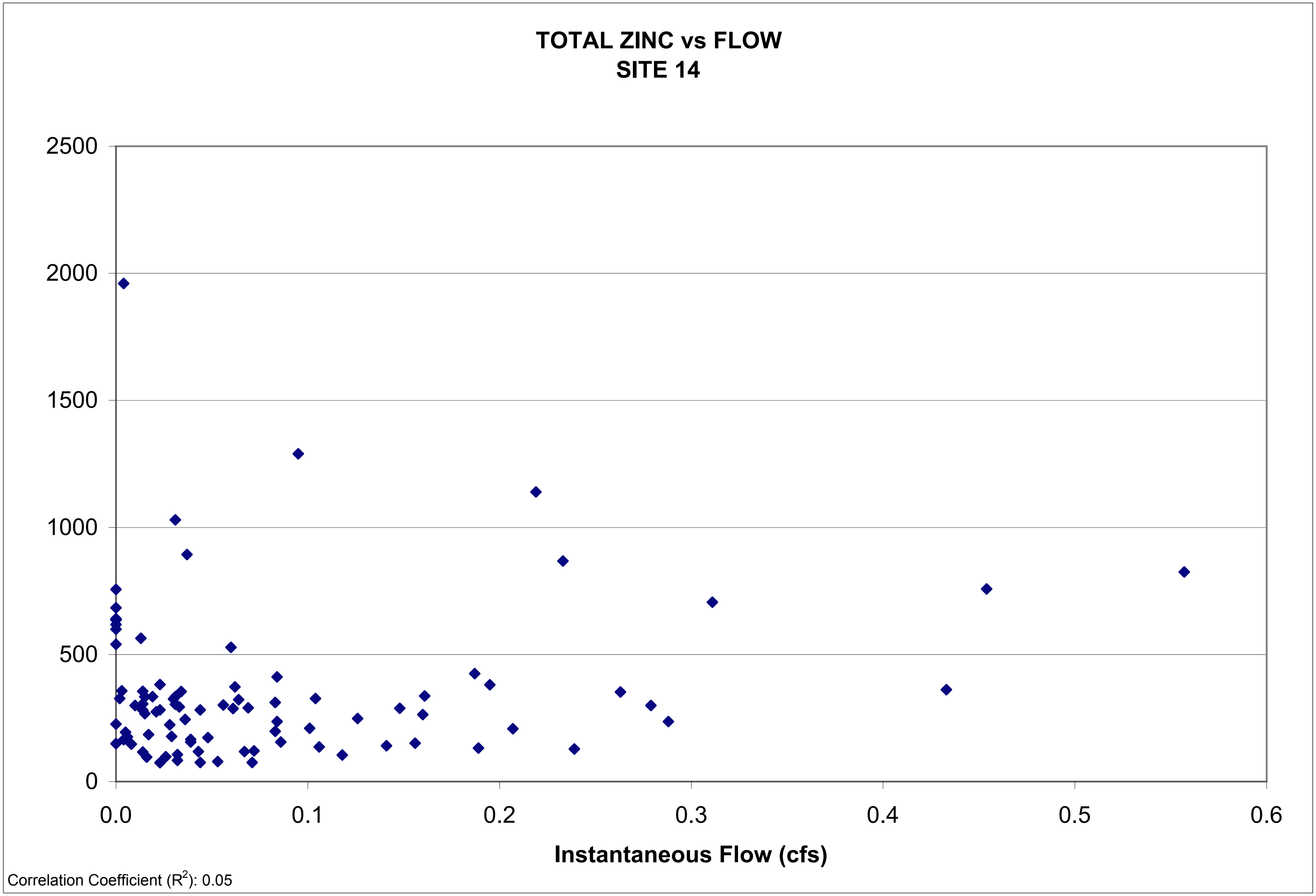

DISSOLVED NICKEL vs FLOW
SITE 14
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.03

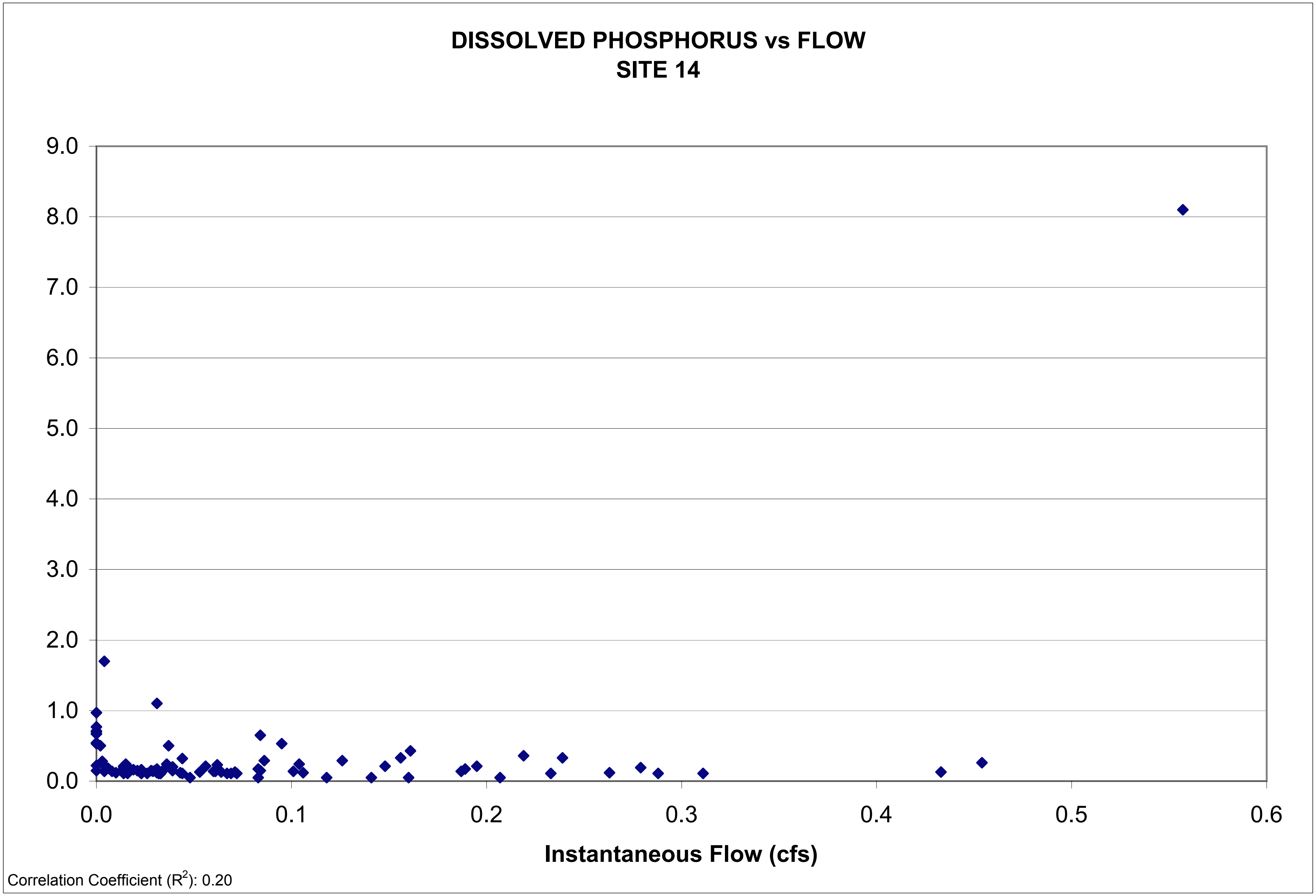

TOTAL NICKEL vs FLOW
SITE 14
100
90
80
70
60
50
40
30
20
10
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.00

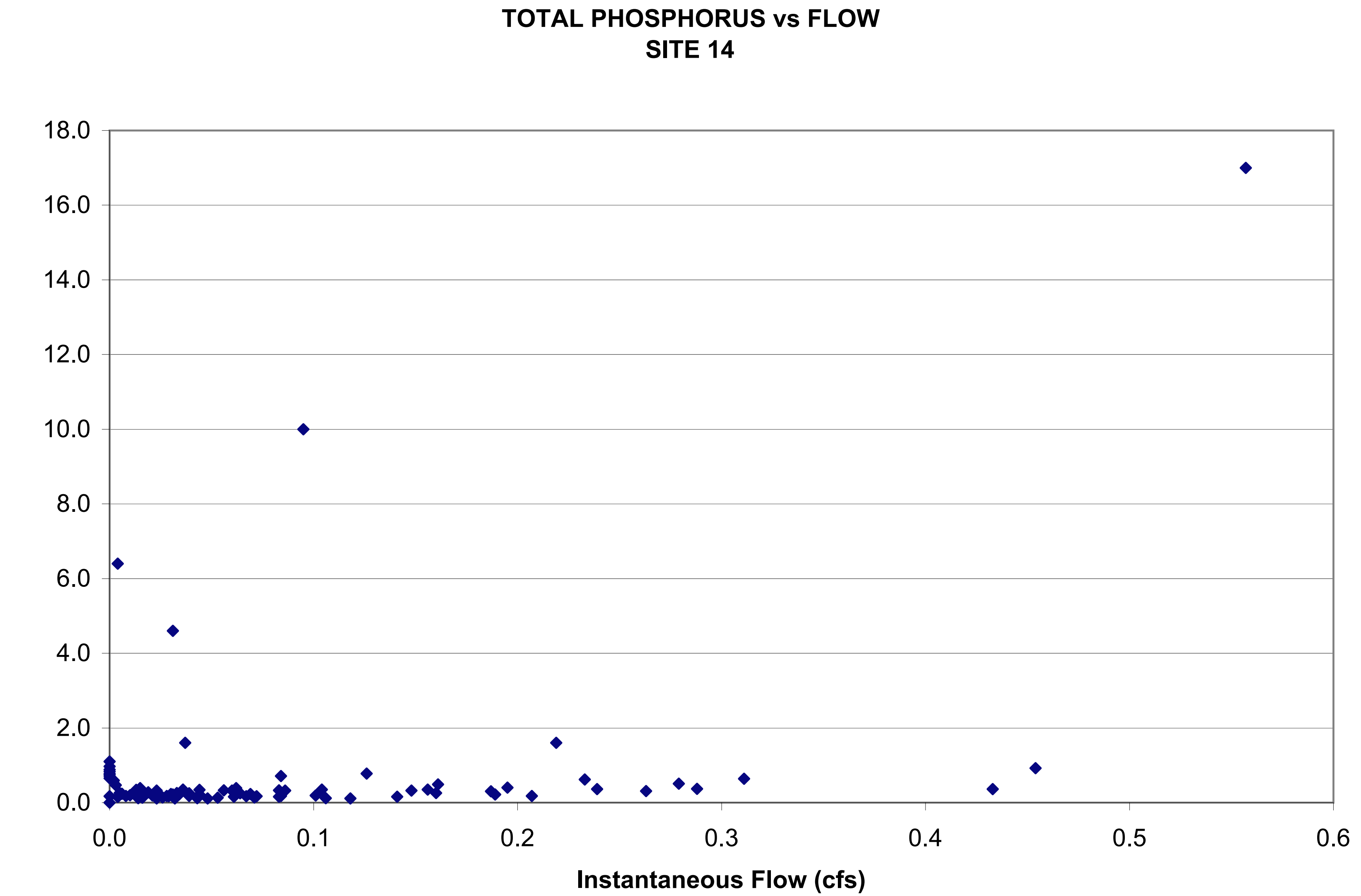

DISSOLVED LEAD vs FLOW
SITE 14
20
18
16
14
12
10
8
6
4
2
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.03


TOTAL LEAD vs FLOW
SITE 14
500
450
400
350
300
250
200
150
100
50
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R2): 0.08

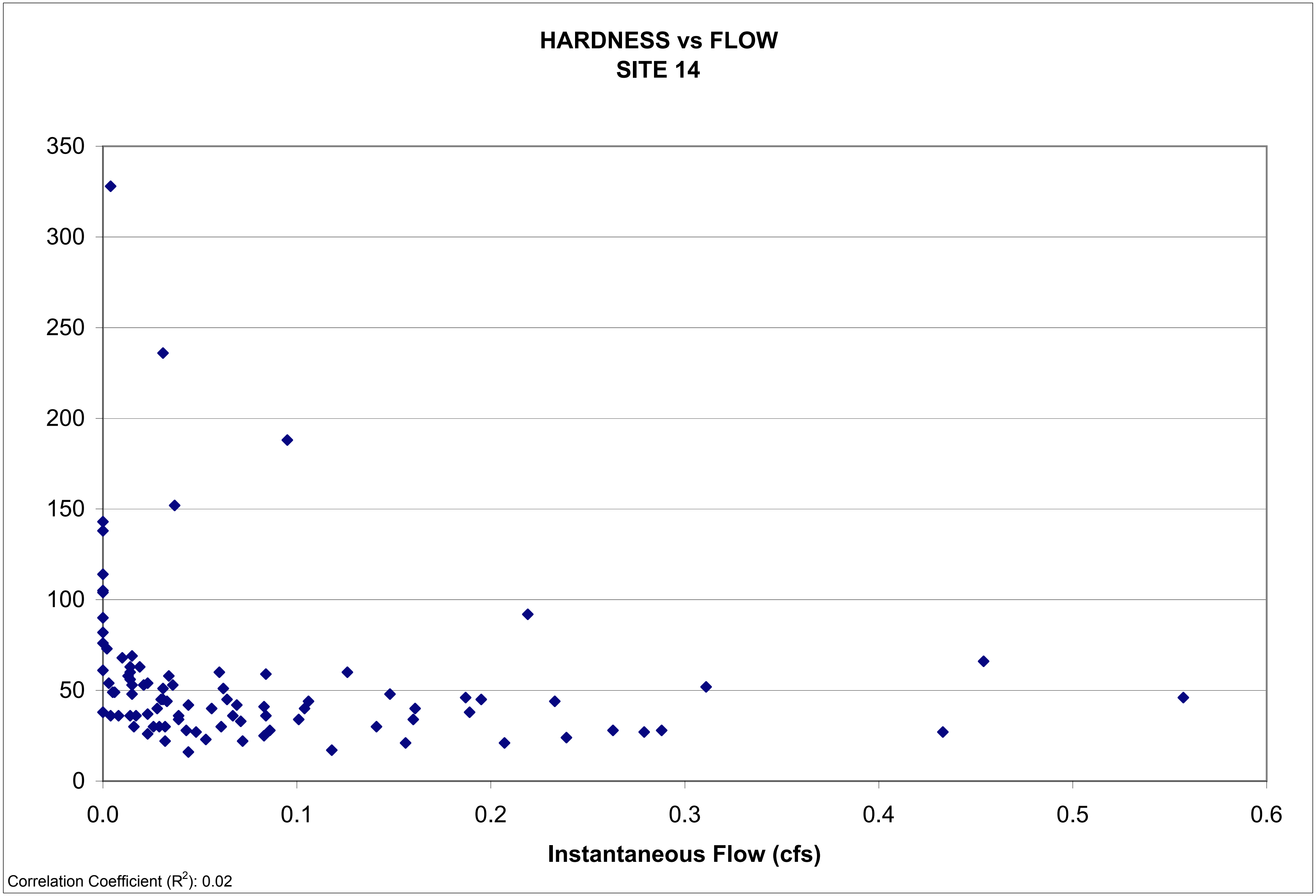

DISSOLVED ZINC vs FLOW
SITE 14
600
500
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.09

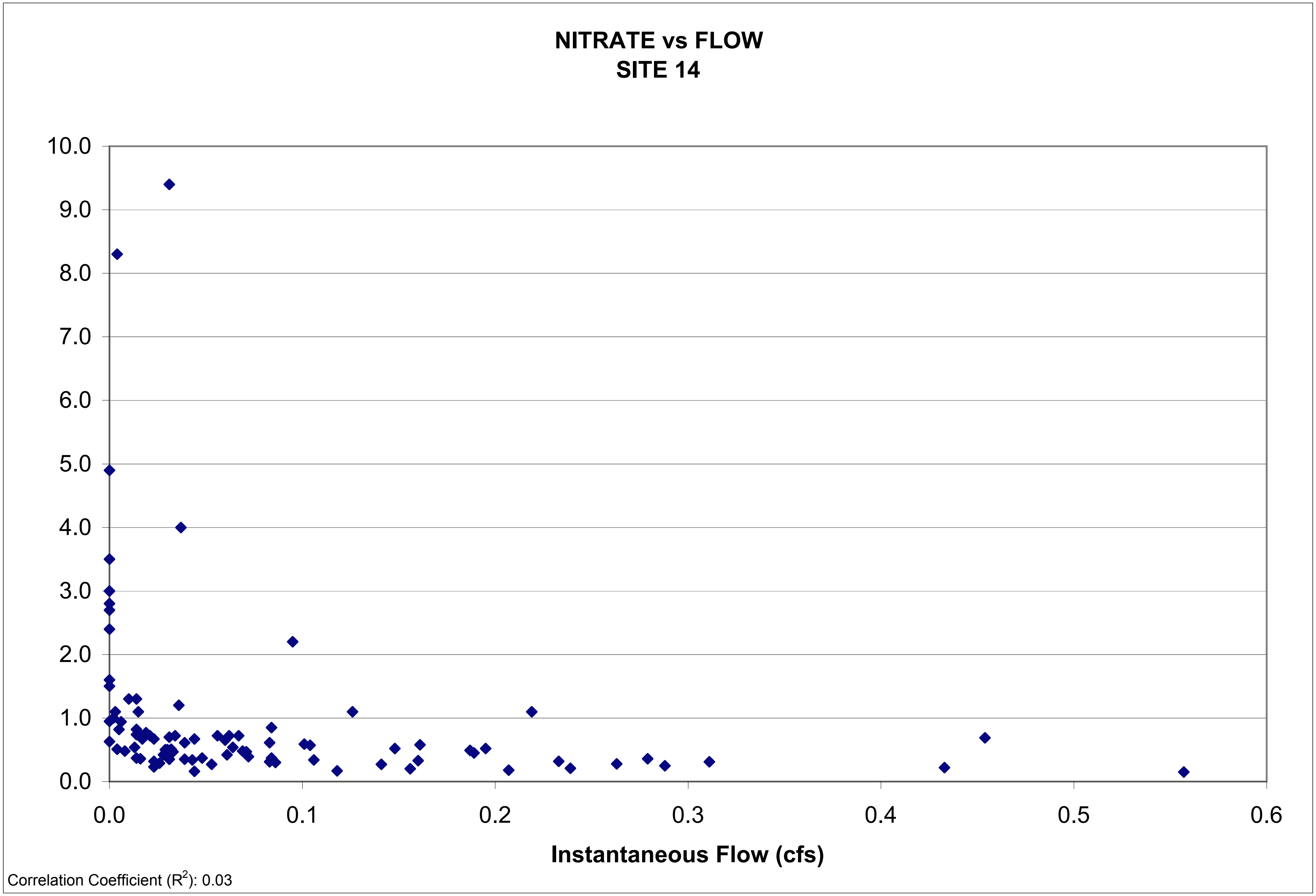

TOTAL ZINC vs FLOW
SITE 14
2500
2000
1500
1000
500
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.05

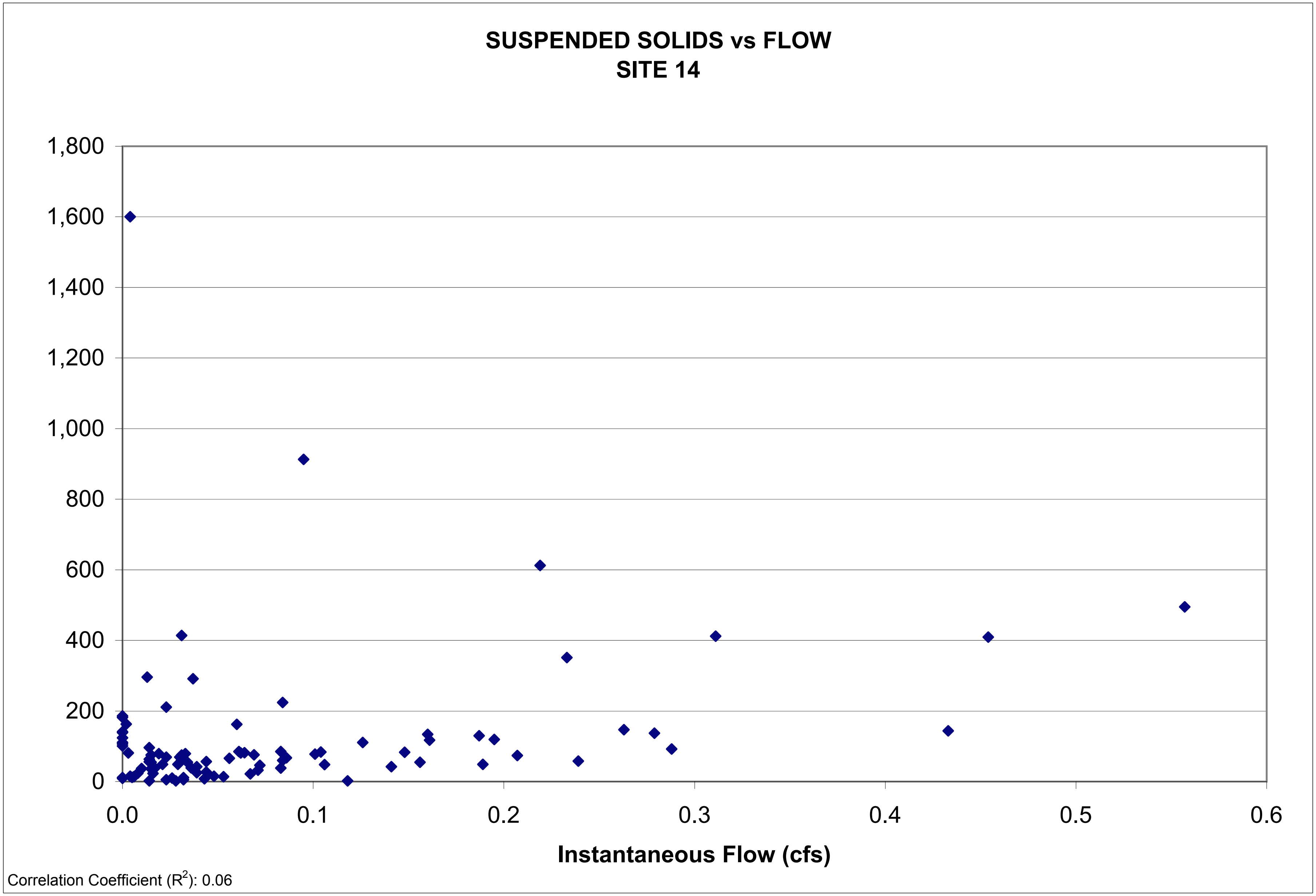

DISSOLVED PHOSPHORUS vs FLOW
SITE 14
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.20

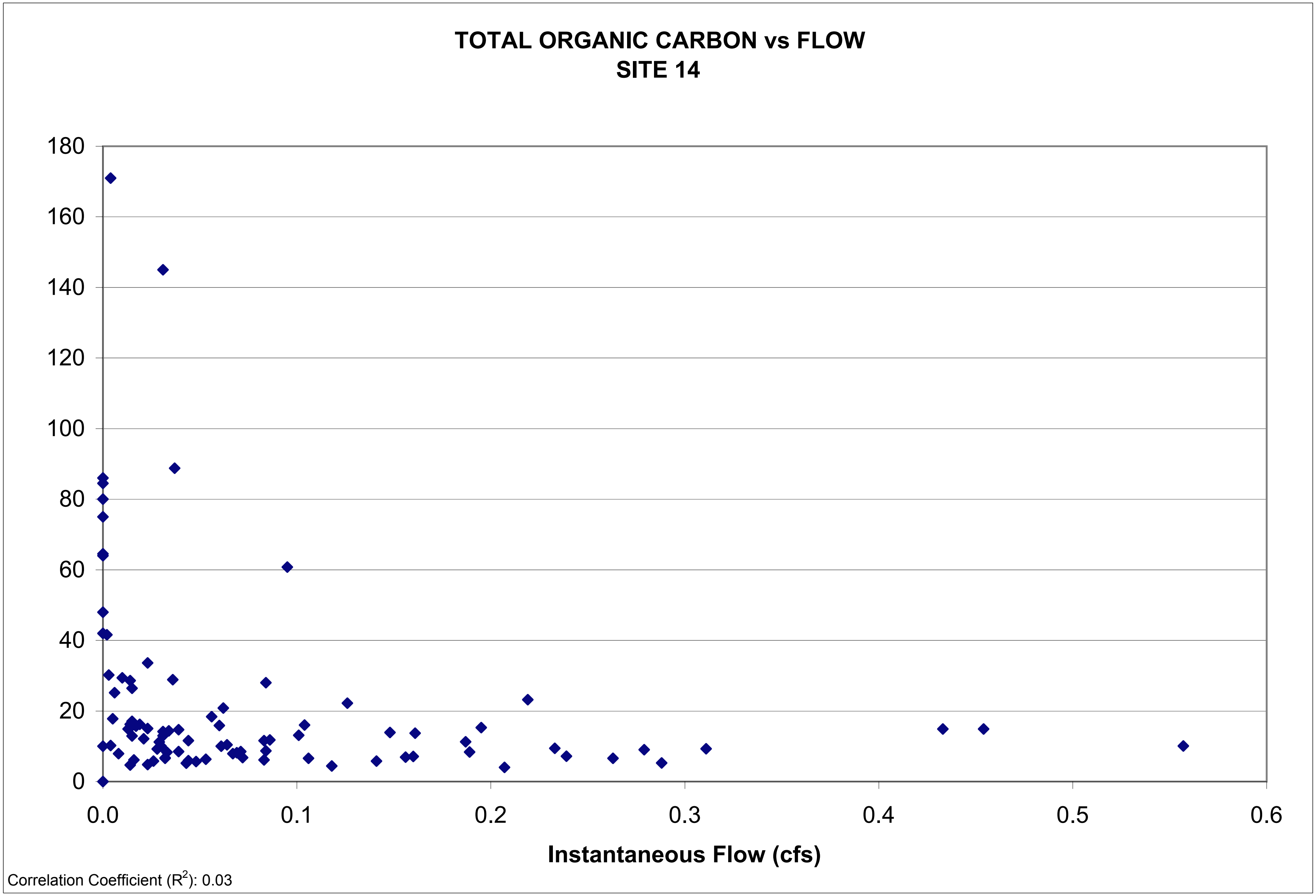


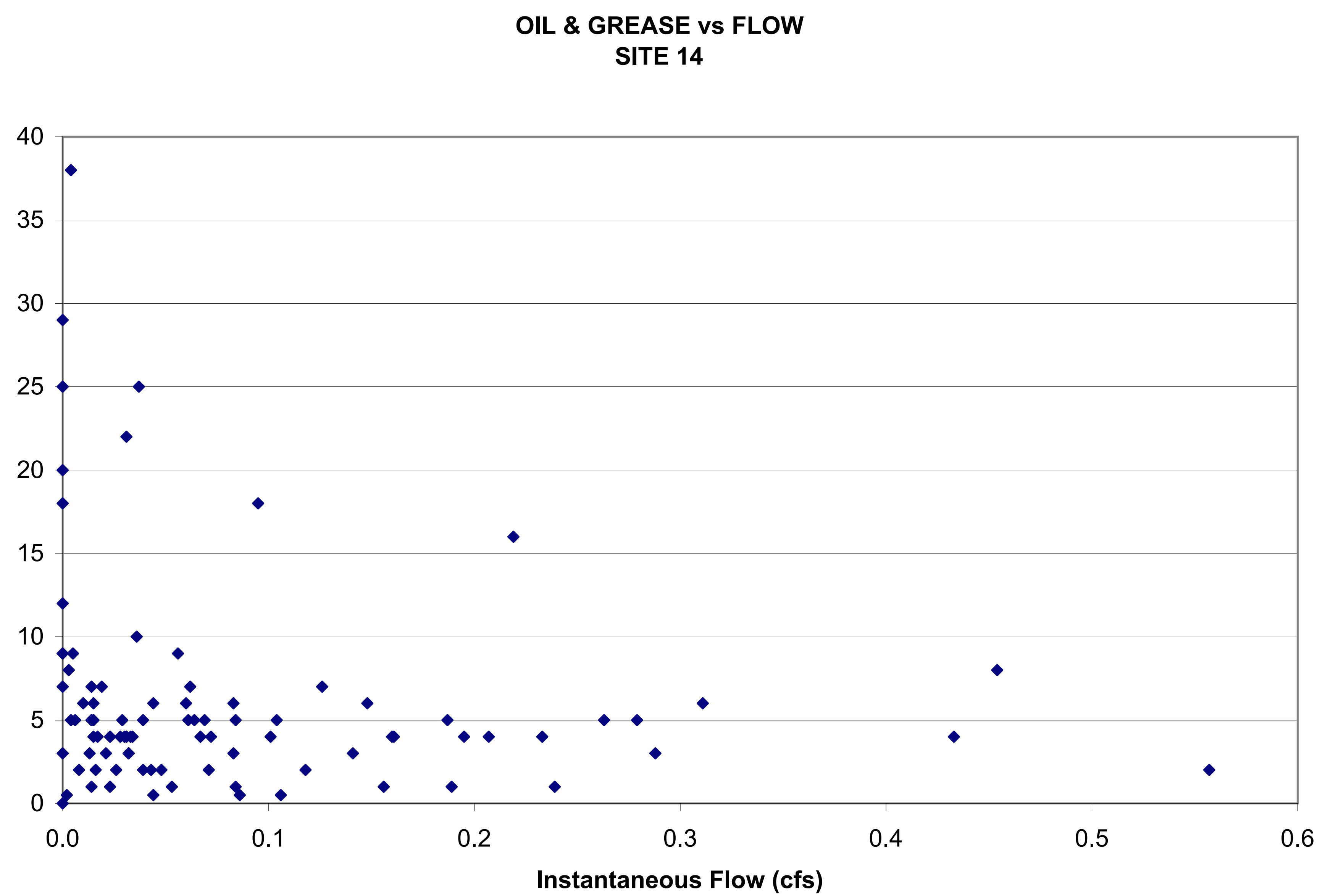
Correlation Coefficient (R^2): 0.15


HARDNESS vs FLOW
SITE 14
350
300
250
200
150
100
50
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.02

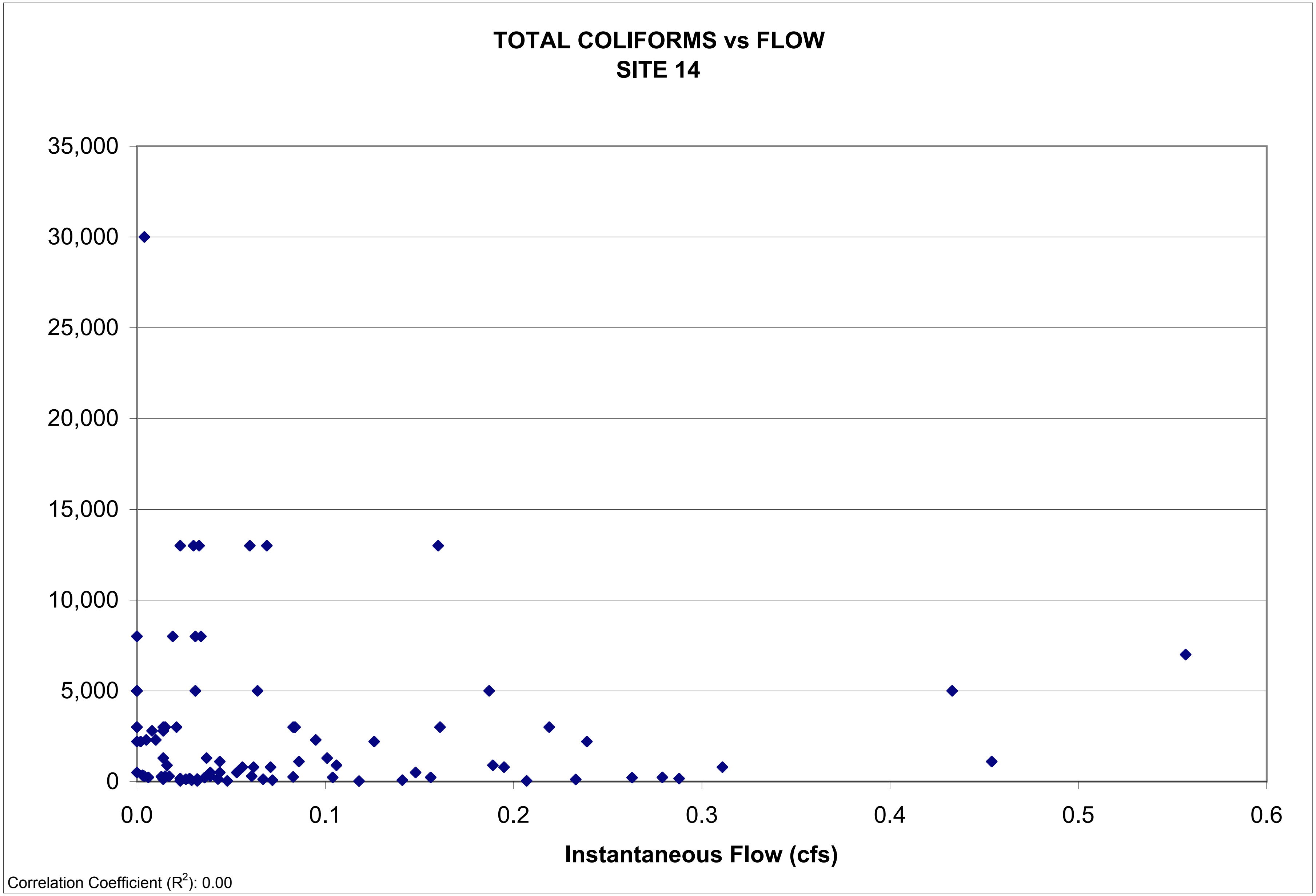

NITRATE vs FLOW
SITE 14
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.03

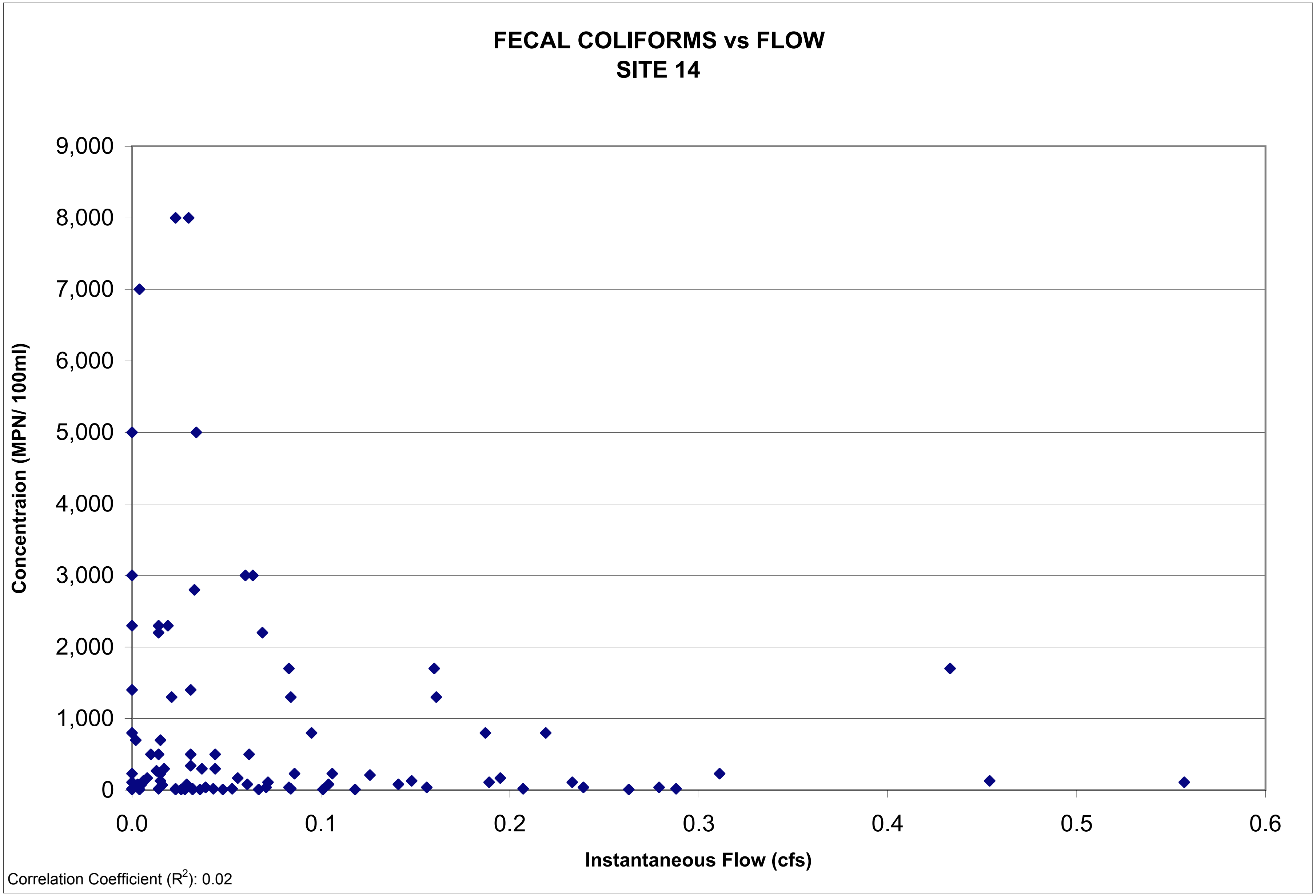

SUSPENDED SOLIDS vs FLOW
SITE 14
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.06

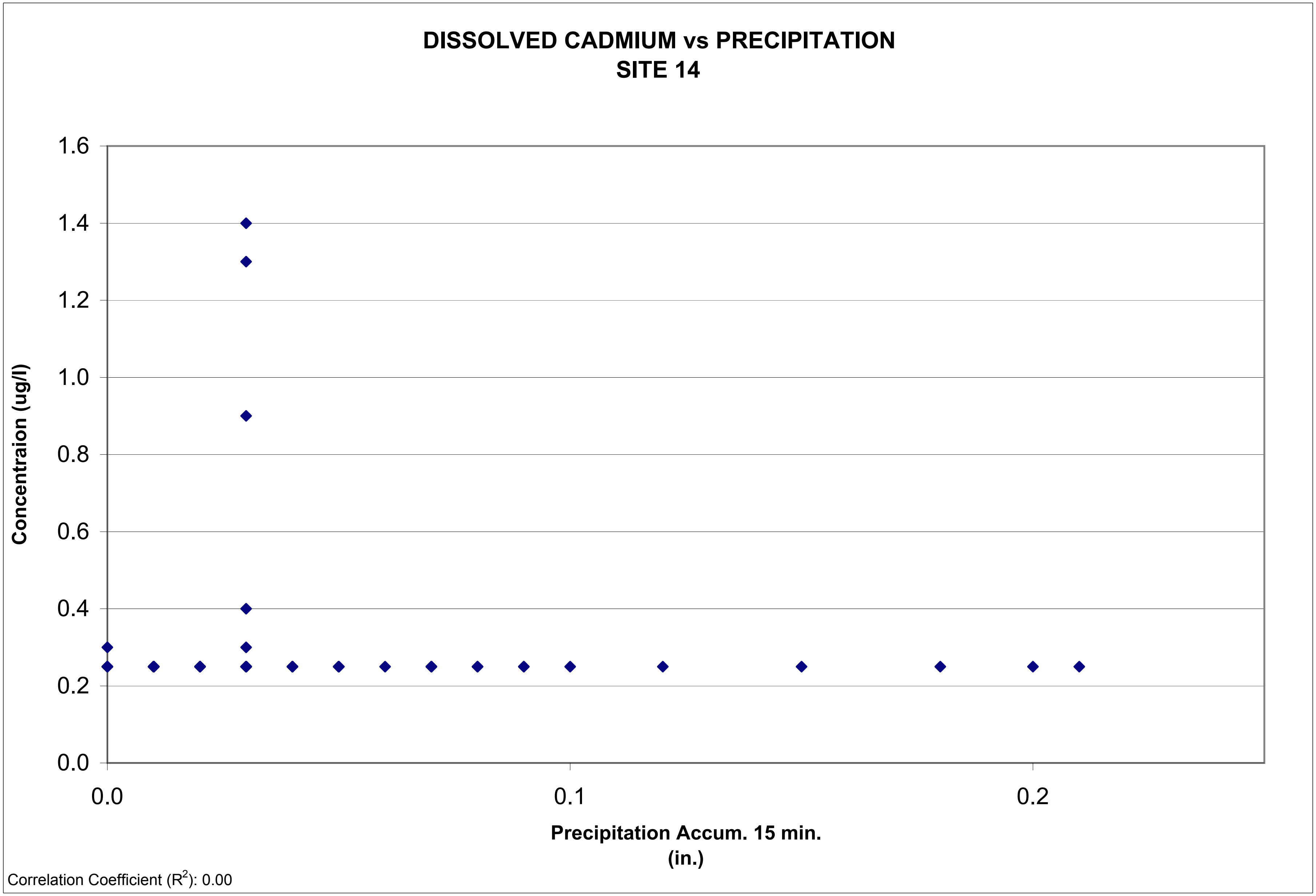

TOTAL ORGANIC CARBON vs FLOW
SITE 14
180
160
140
120
100
80
60
40
20
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.03

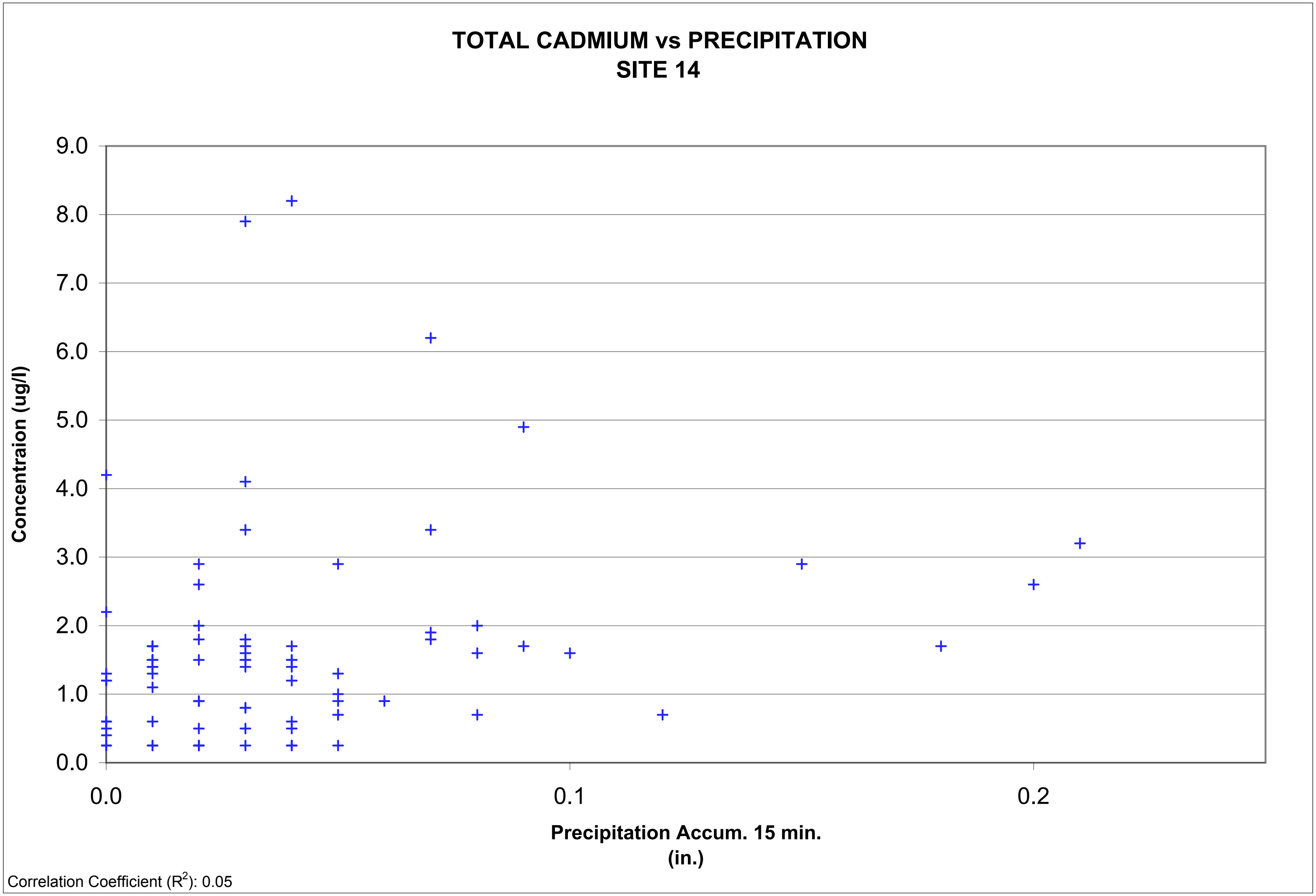


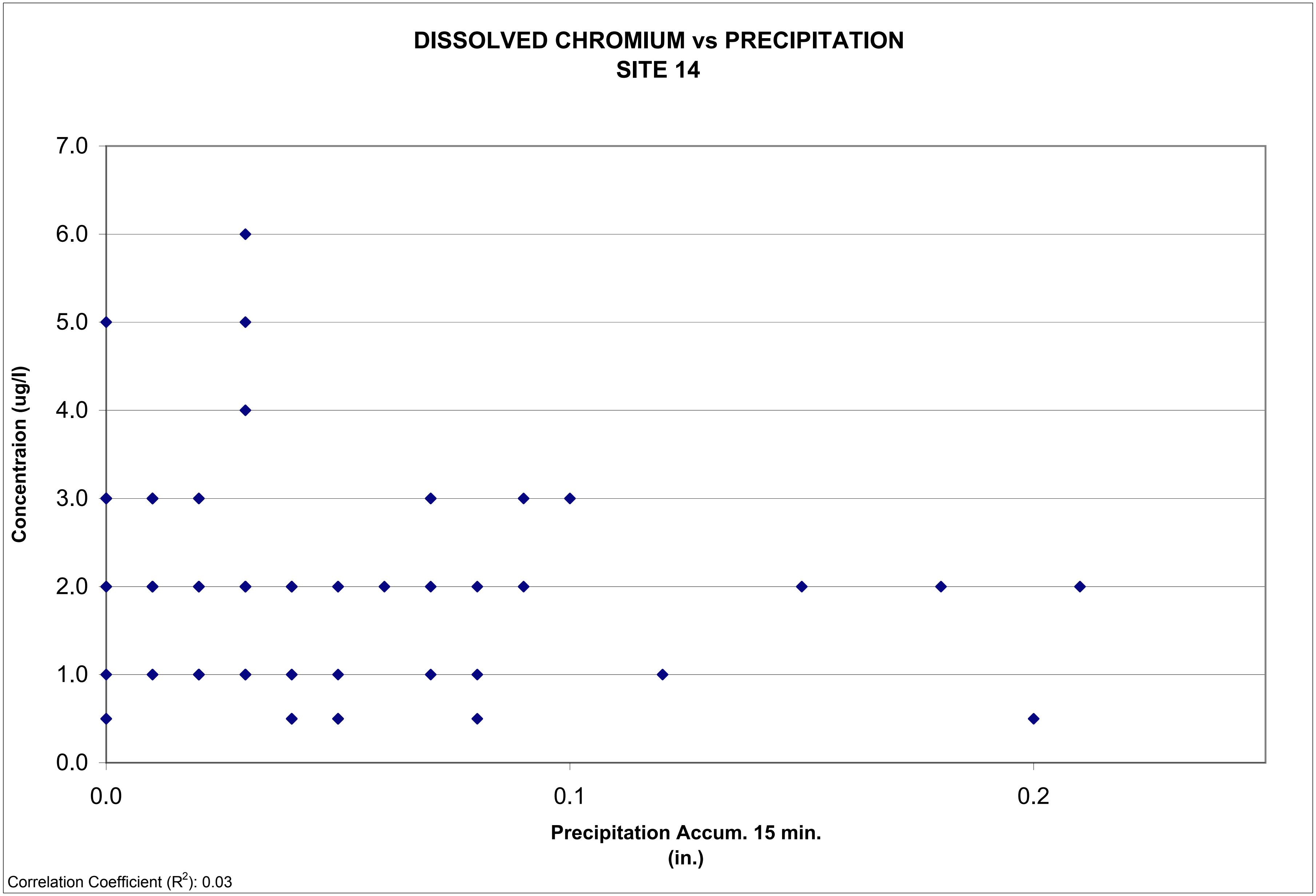
Correlation Coefficient (R^2): 0.00

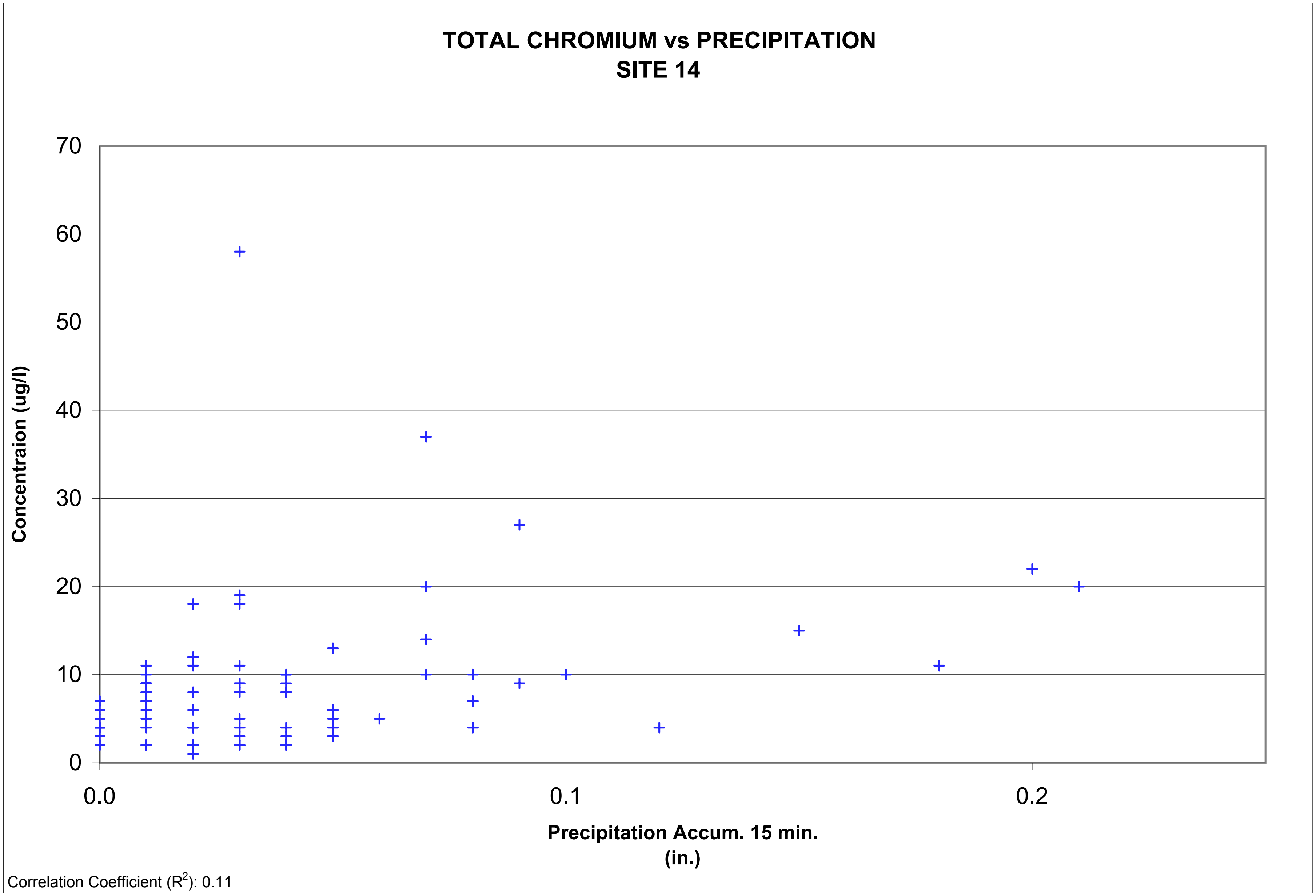

TOTAL COLIFORMS vs FLOW
SITE 14
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.00

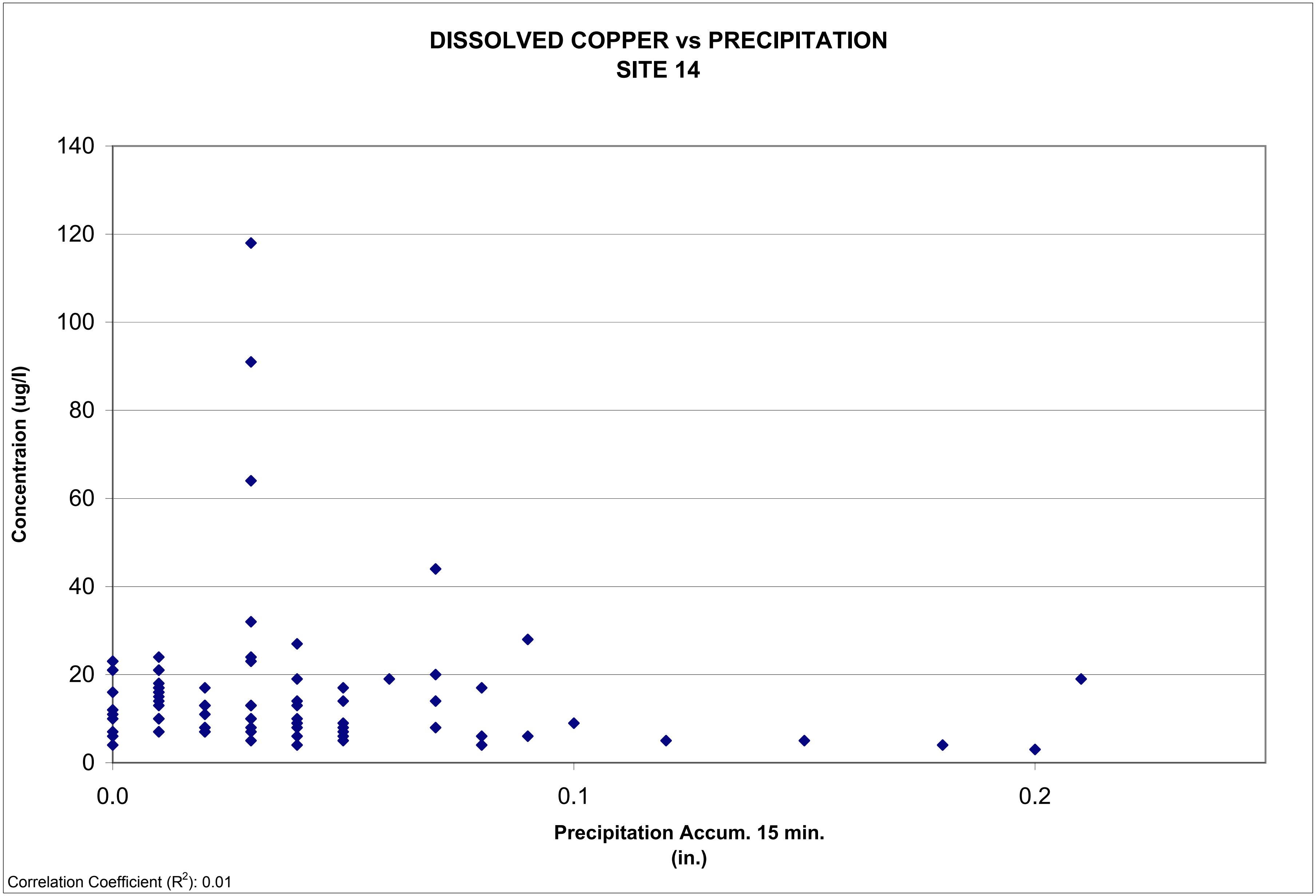

FECAL COLIFORMS vs FLOW
SITE 14
Concentraion (MPN/ 100ml)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Instantaneous Flow (cfs)
Correlation Coefficient (R^2): 0.02


DISSOLVED CADMIUM vs PRECIPITATION
SITE 14
Concentraion (ug/l)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.00

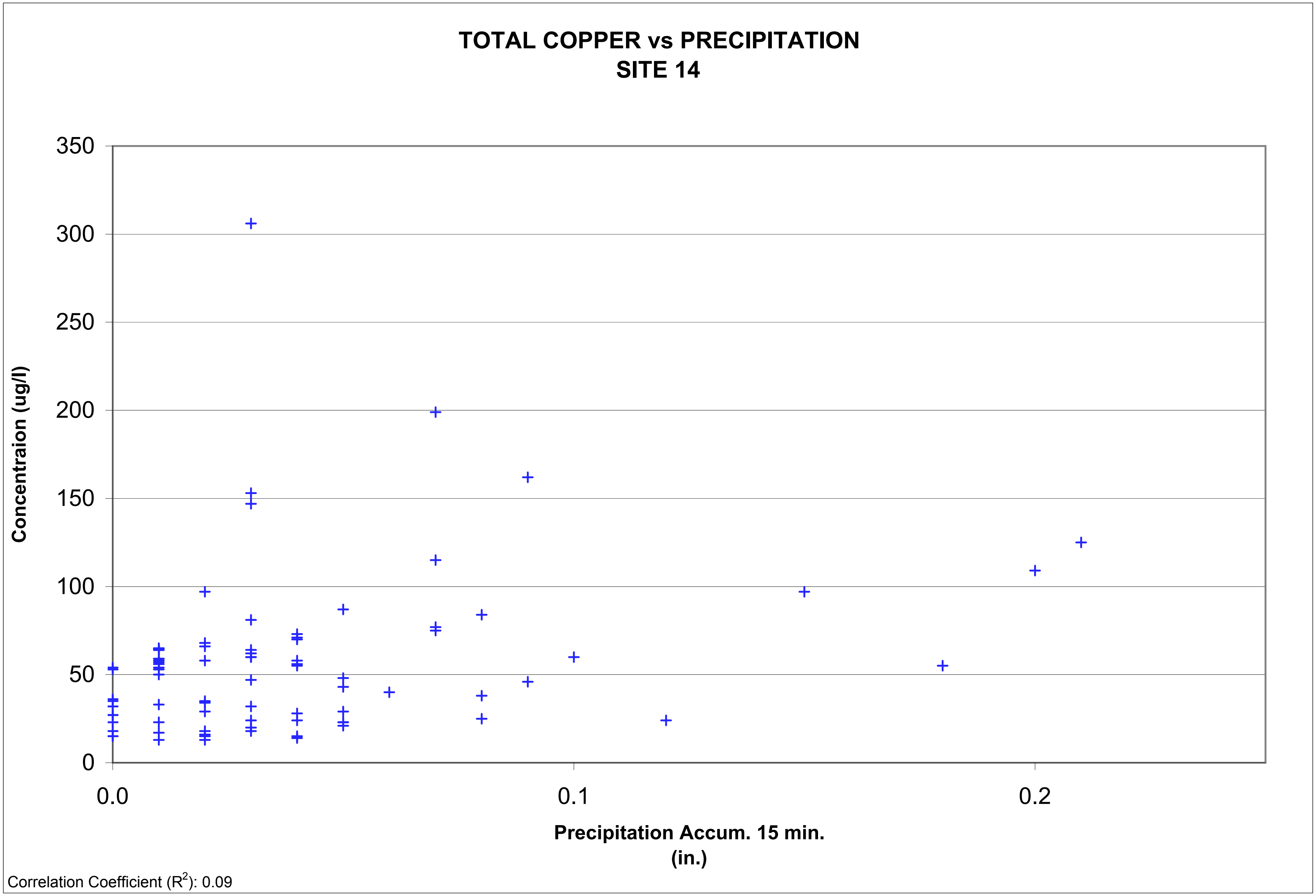

TOTAL CADMIUM vs PRECIPITATION
SITE 14
Concentraion (ug/l)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.05

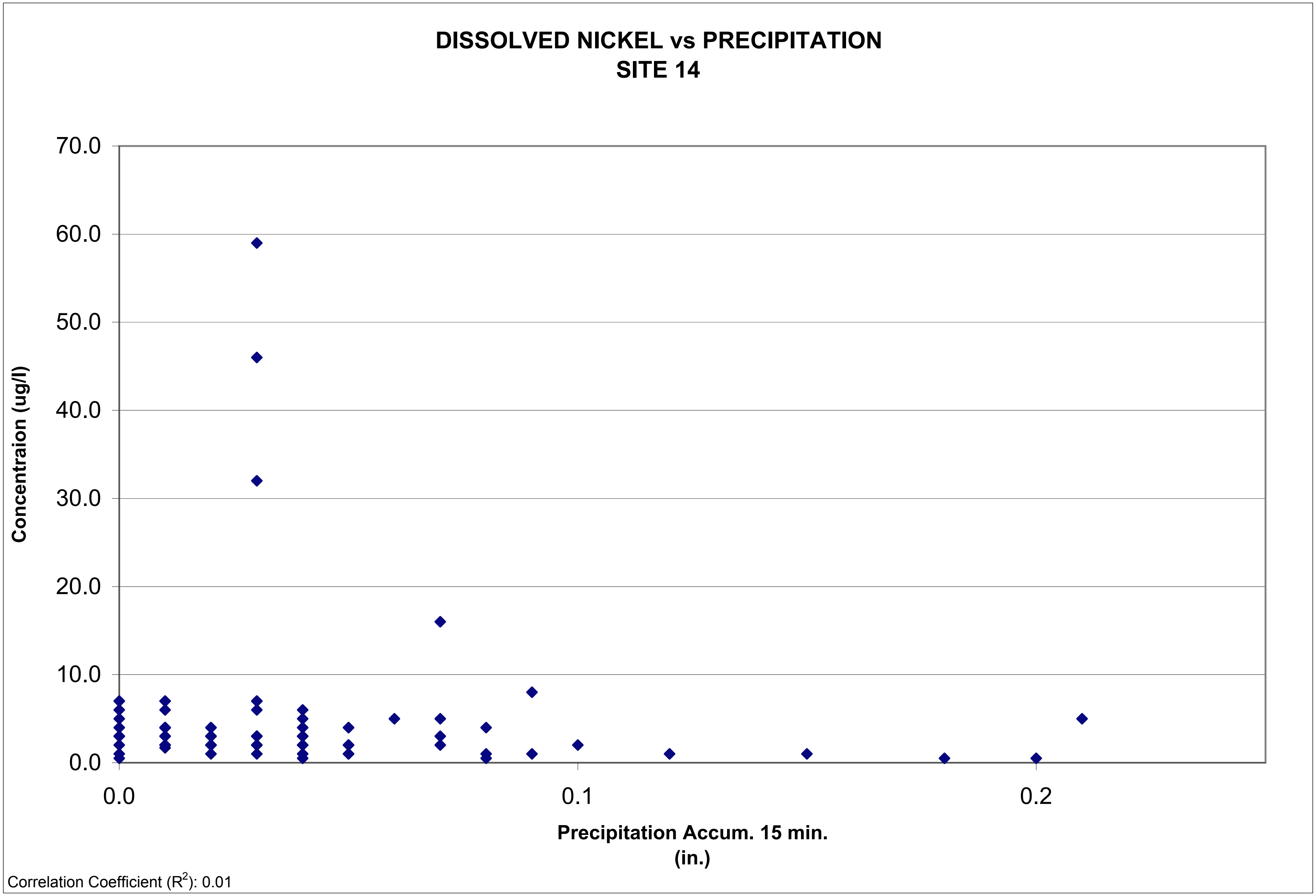

DISSOLVED CHROMIUM vs PRECIPITATION
SITE 14
Concentraion (ug/l)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.03

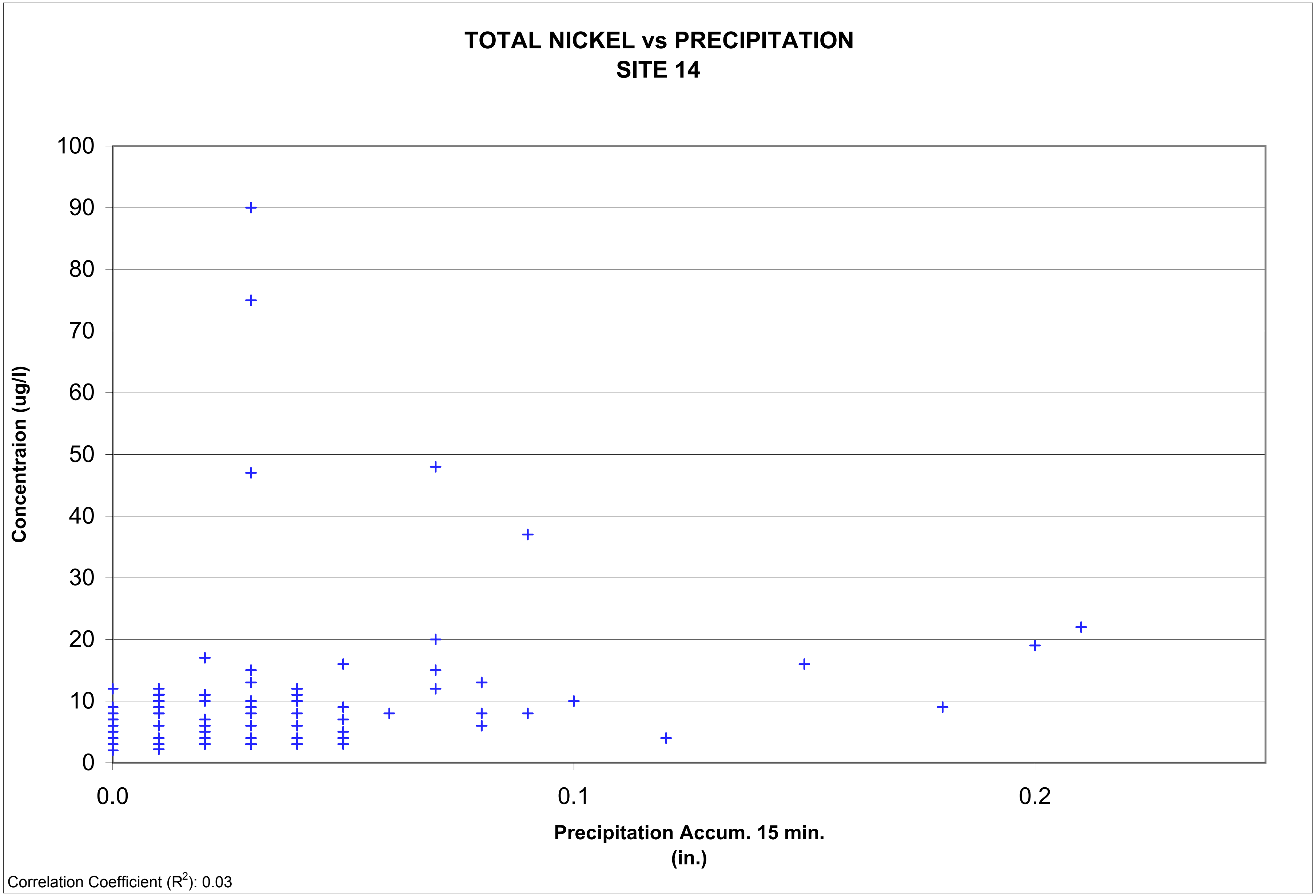

TOTAL CHROMIUM vs PRECIPITATION
SITE 14
Concentraion (ug/l)
70
60
50
40
30
20
10
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.11

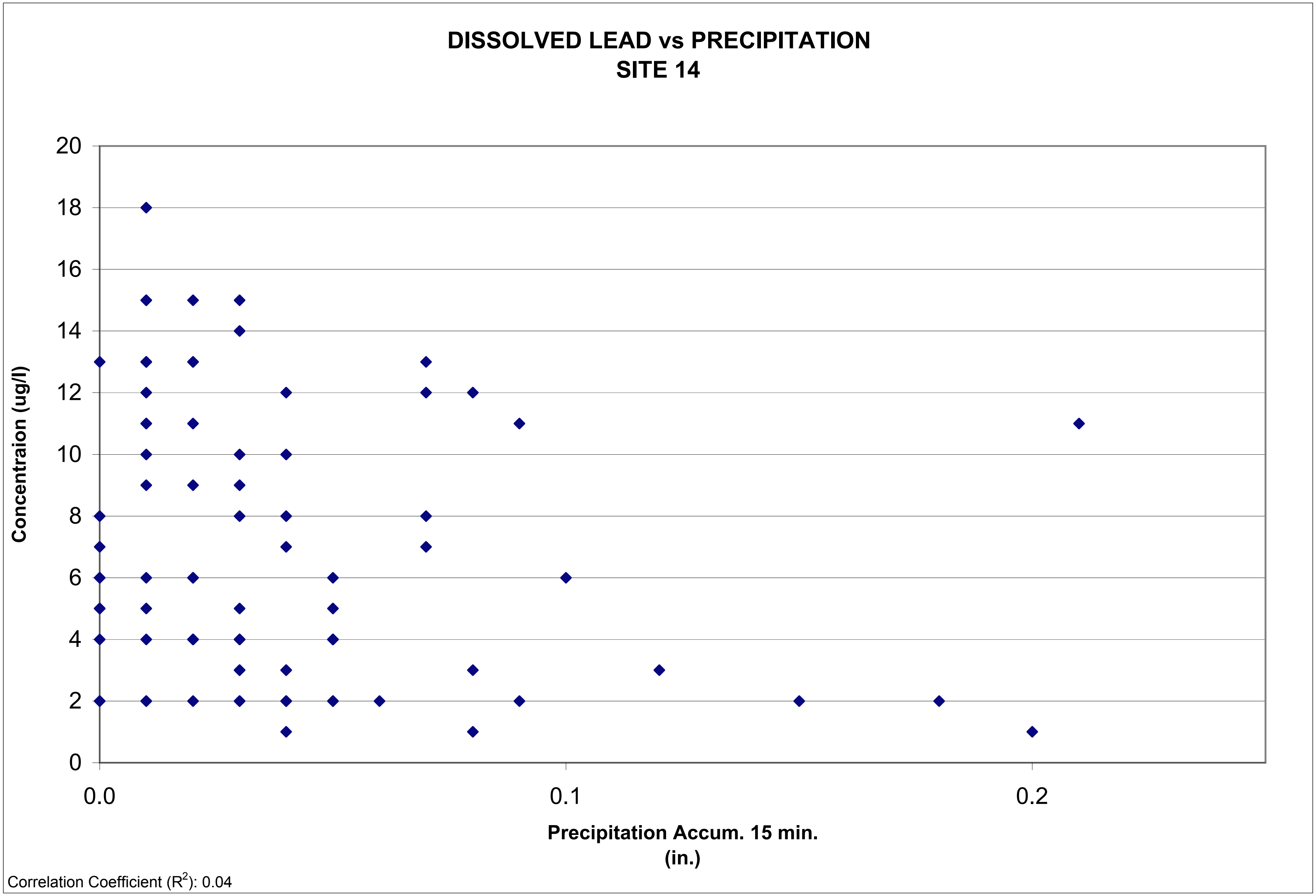


DISSOLVED COPPER vs PRECIPITATION
SITE 14
Concentraion (ug/l)
140
120
100
80
60
40
20
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.01

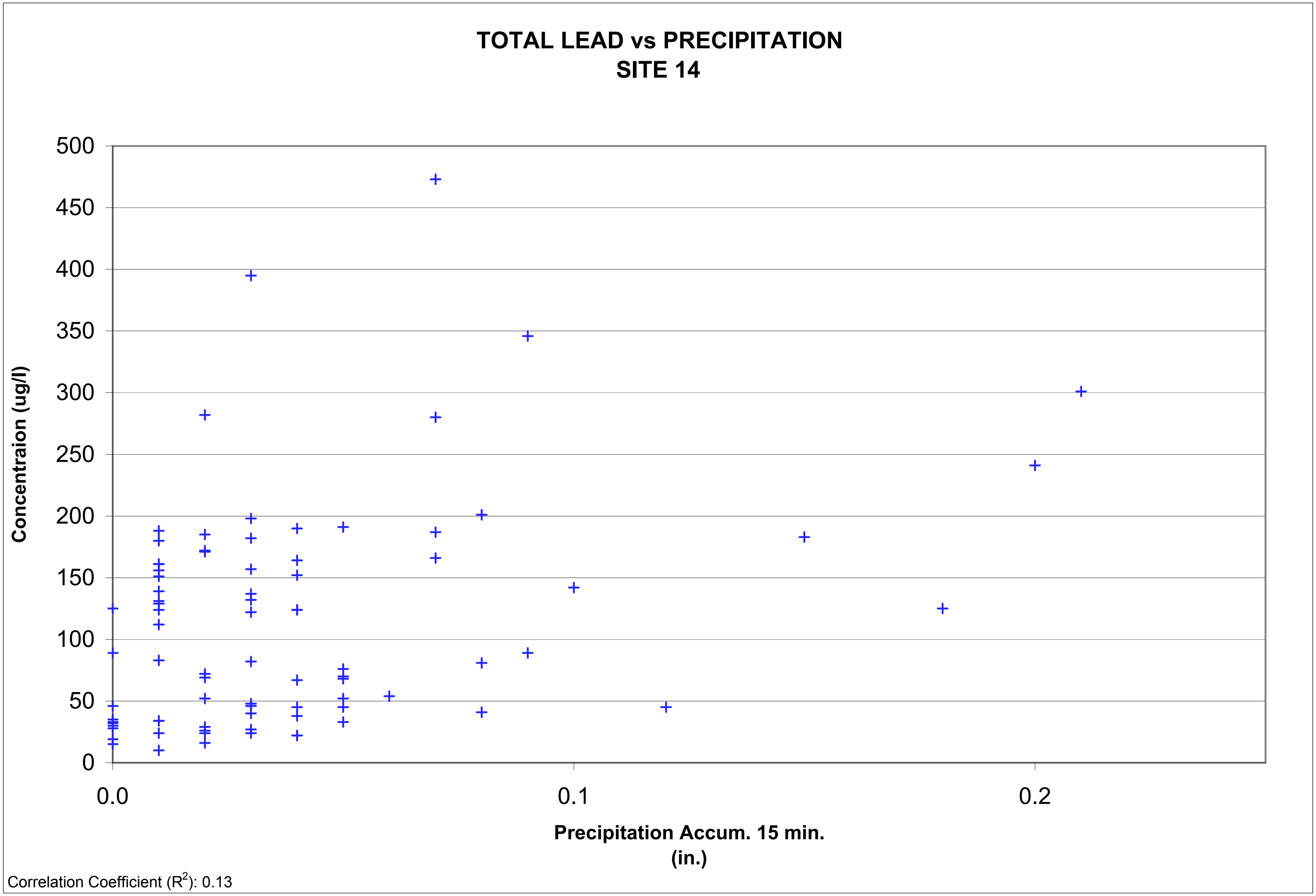

TOTAL COPPER vs PRECIPITATION
SITE 14
Concentraion (ug/l)
350
300
250
200
150
100
50
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.09

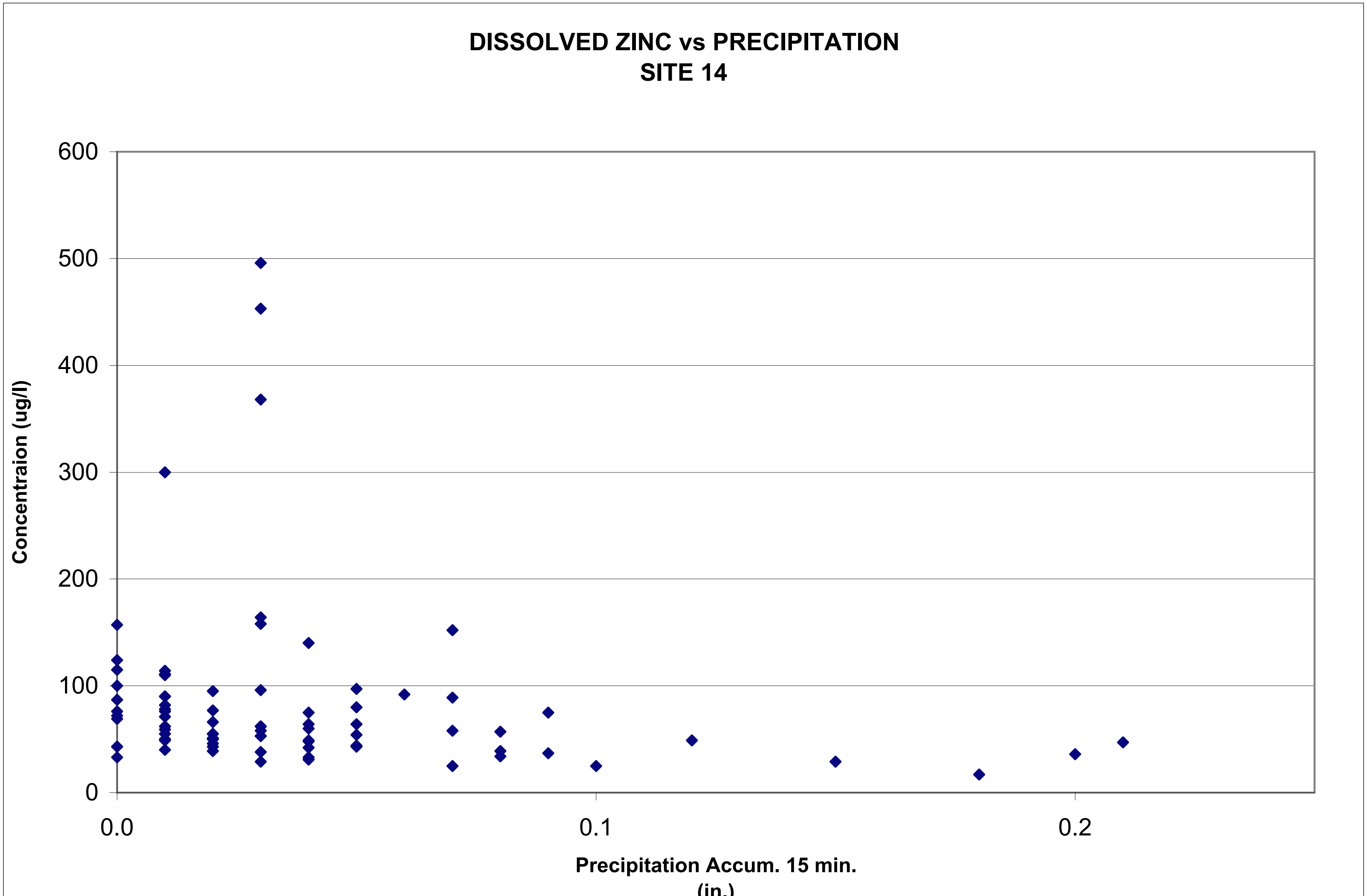

DISSOLVED NICKEL vs PRECIPITATION
SITE 14
Concentraion (ug/l)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.01


TOTAL NICKEL vs PRECIPITATION
SITE 14
Concentraion (ug/l)
100
90
80
70
60
50
40
30
20
10
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.03

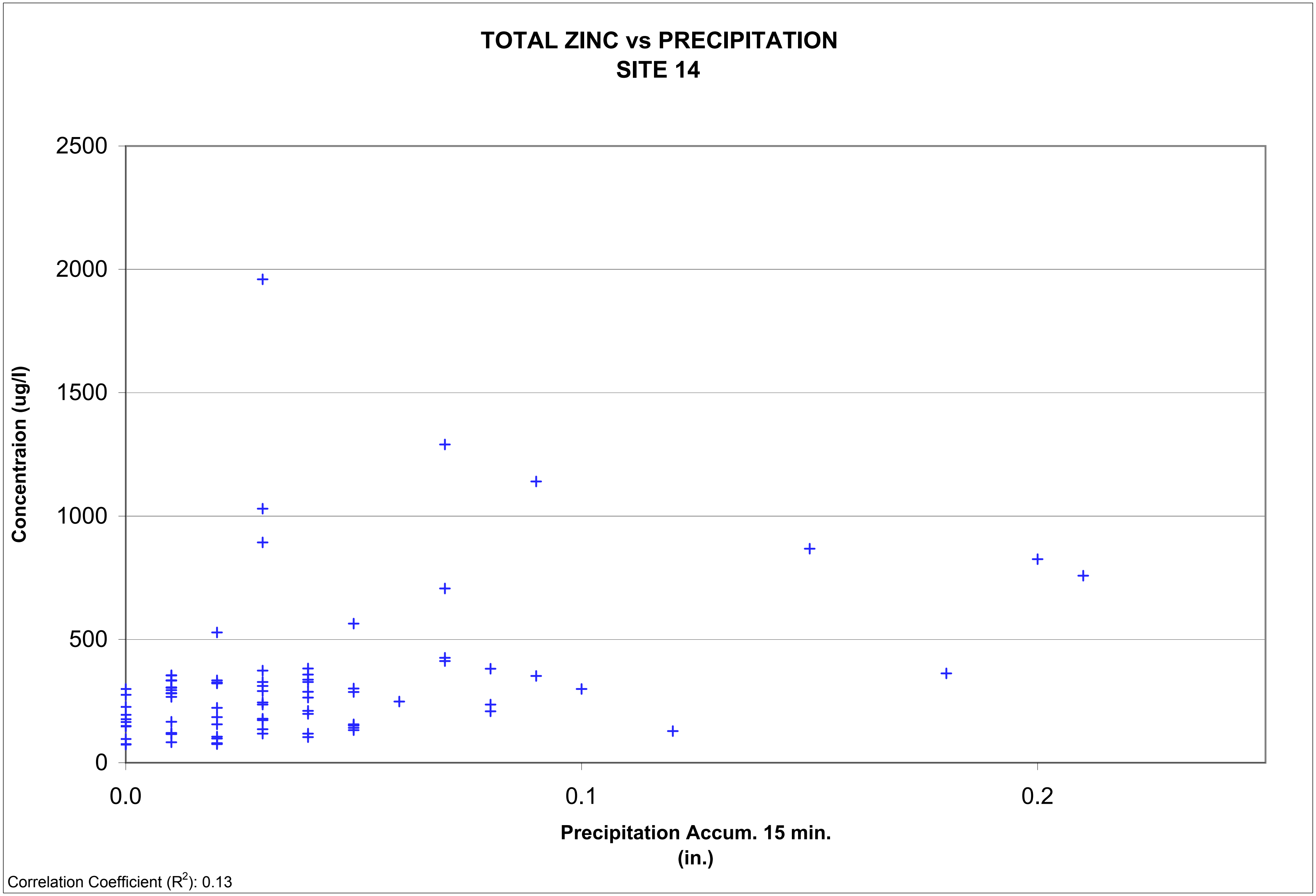


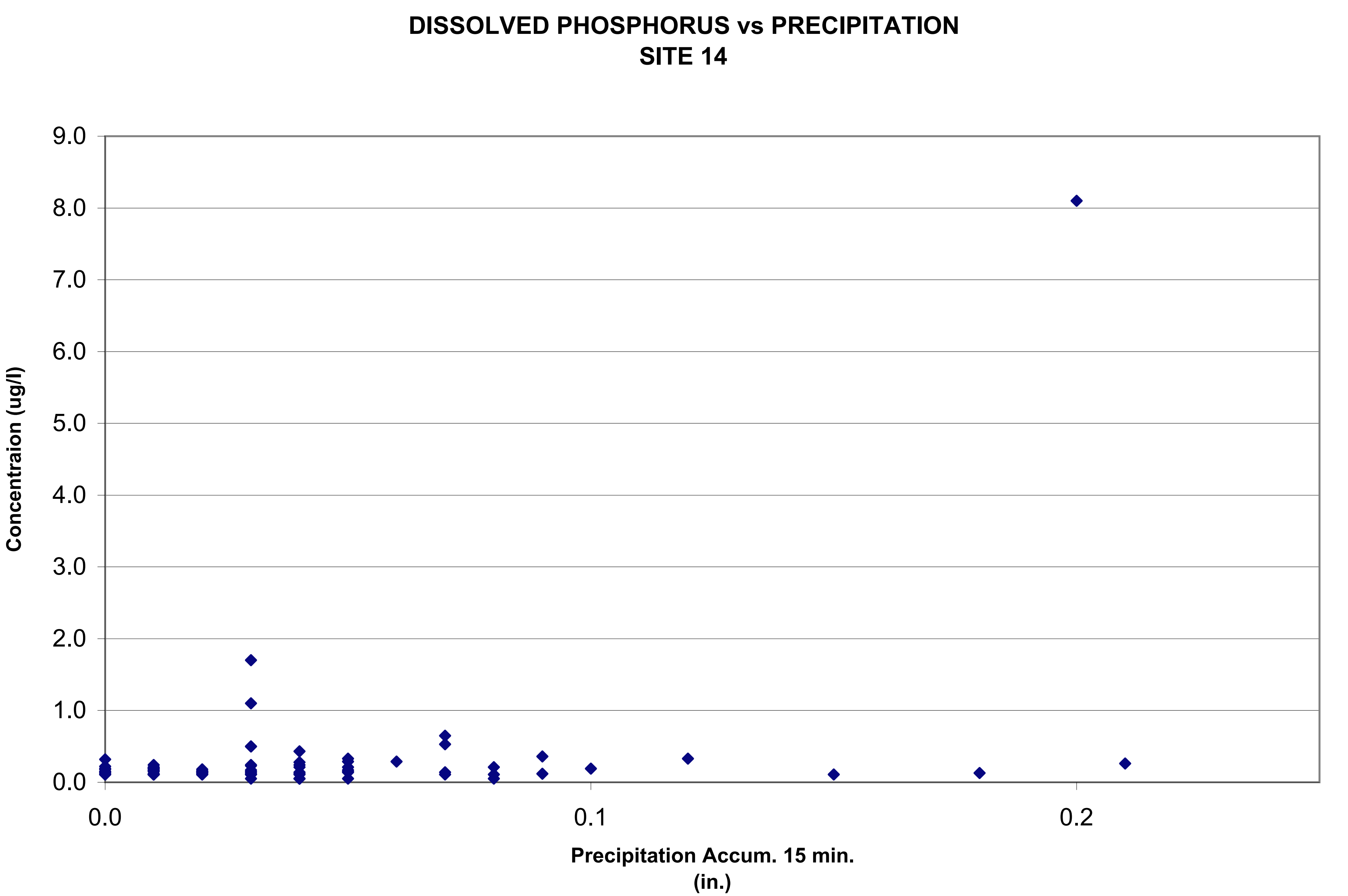
DISSOLVED LEAD vs PRECIPITATION
SITE 14
Concentraion (ug/l)
0
2
4
6
8
10
12
14
16
18
20
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.04


TOTAL LEAD vs PRECIPITATION
SITE 14
Concentraion (ug/l)
500
450
400
350
300
250
200
150
100
50
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.13

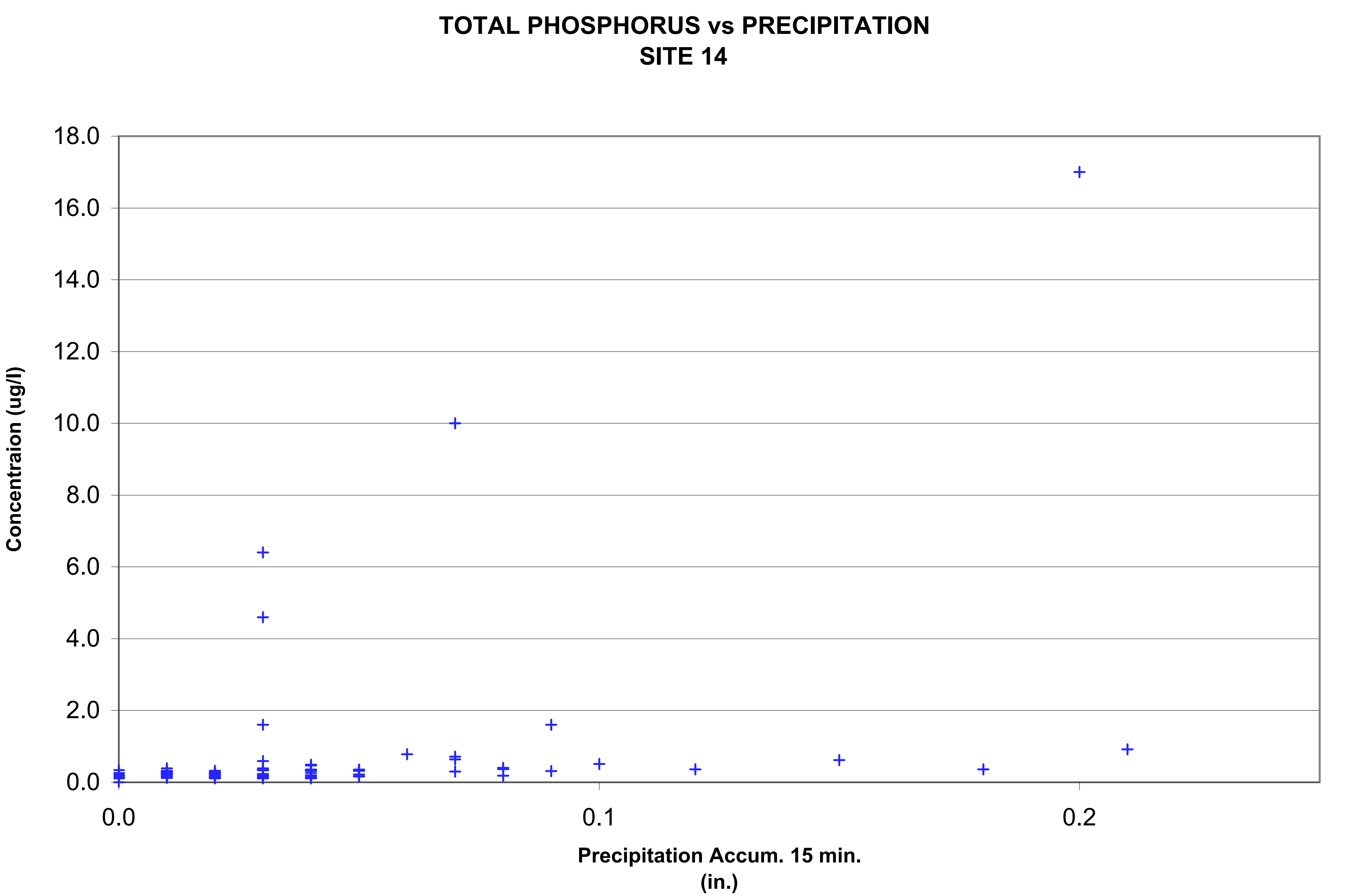


Correlation Coefficient (R^2): 0.03

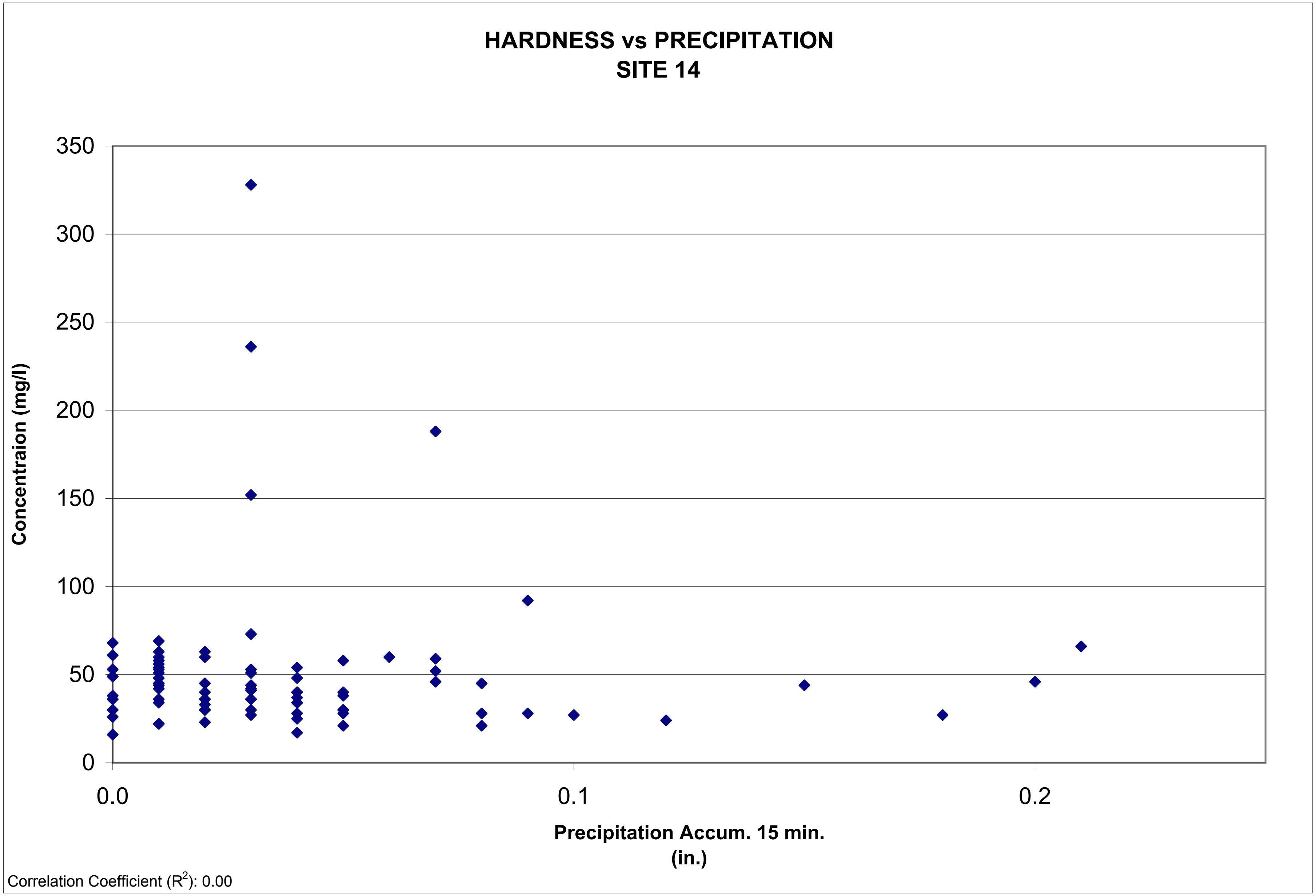

TOTAL ZINC vs PRECIPITATION
SITE 14
Concentraion (ug/l)
2500
2000
1500
1000
500
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.13

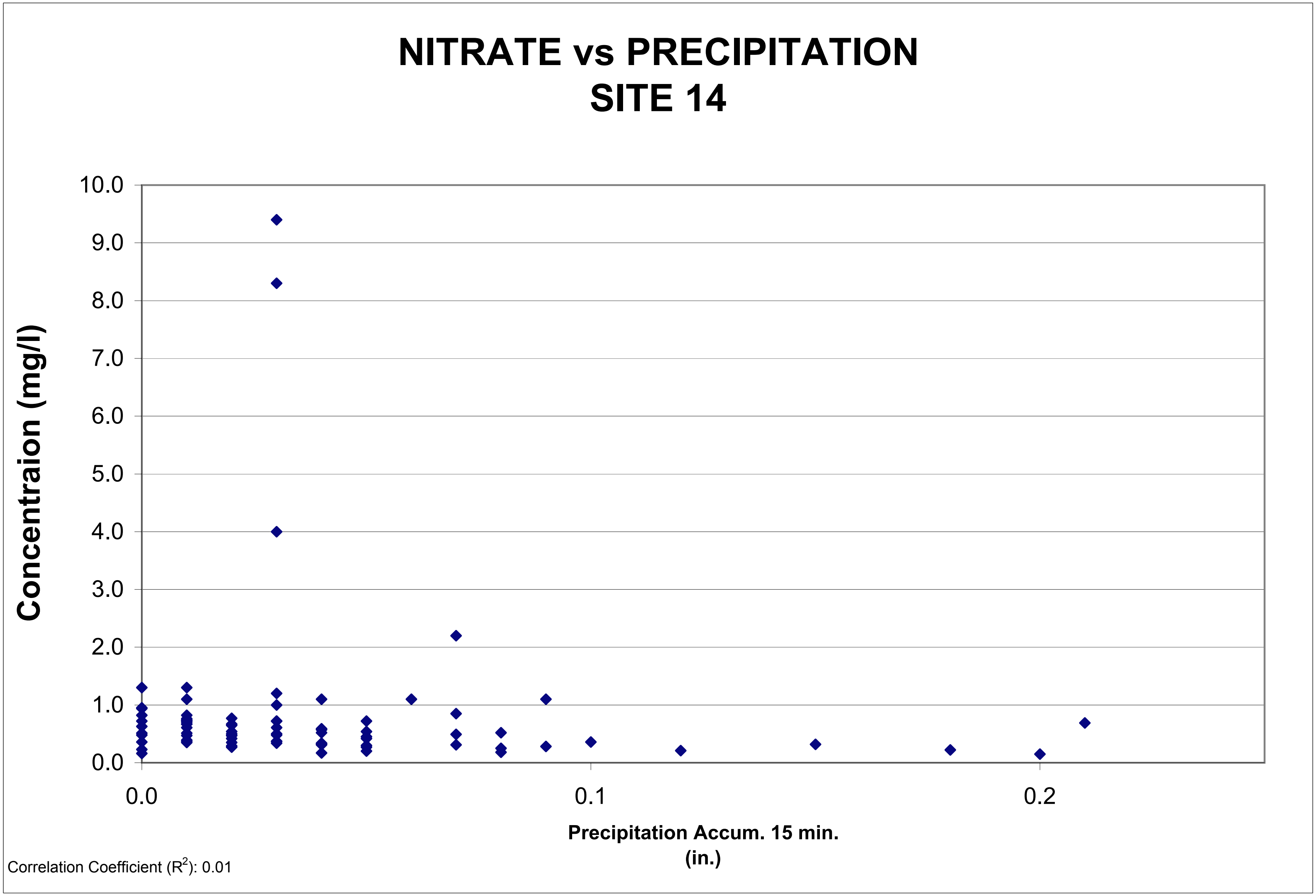


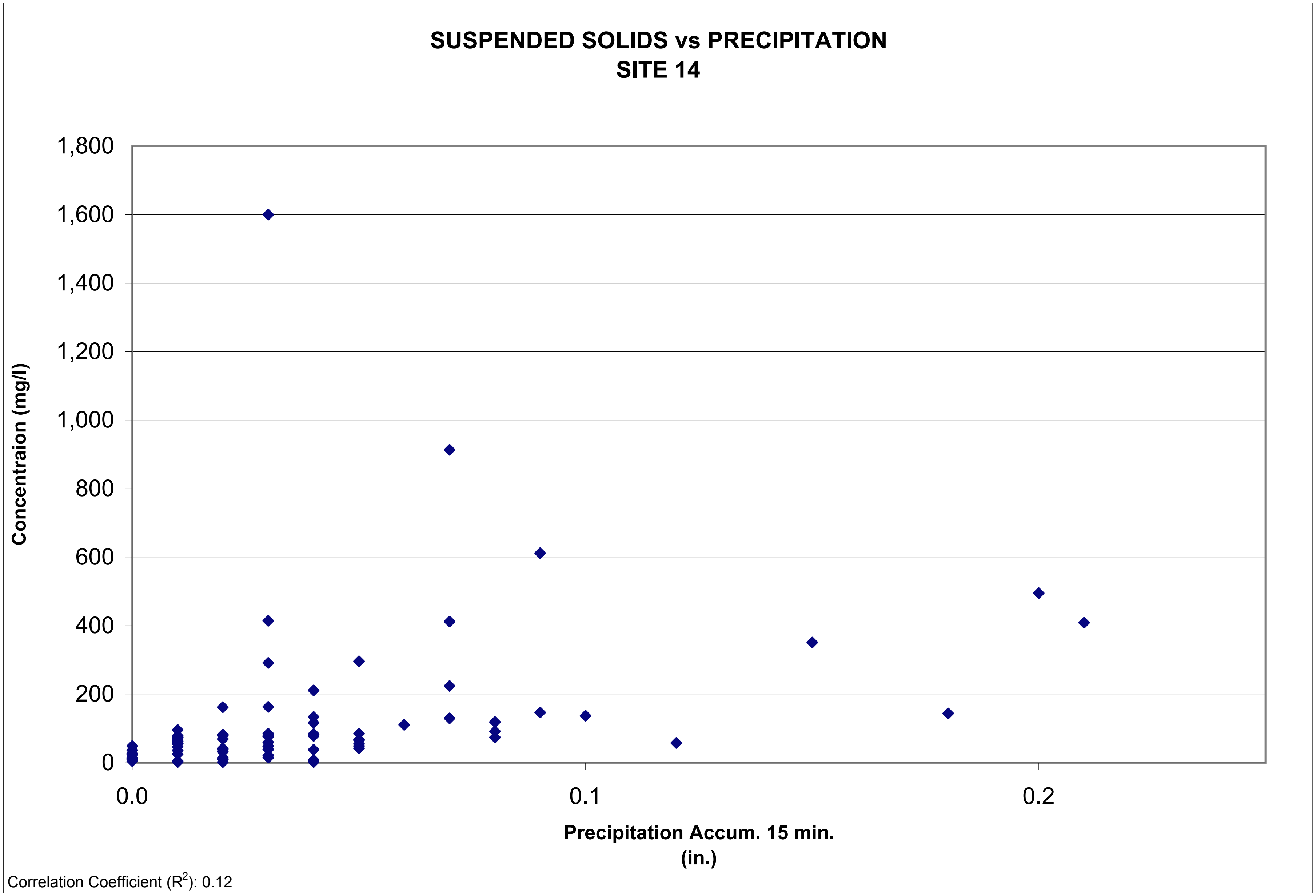
Correlation Coefficient (R^2): 0.18



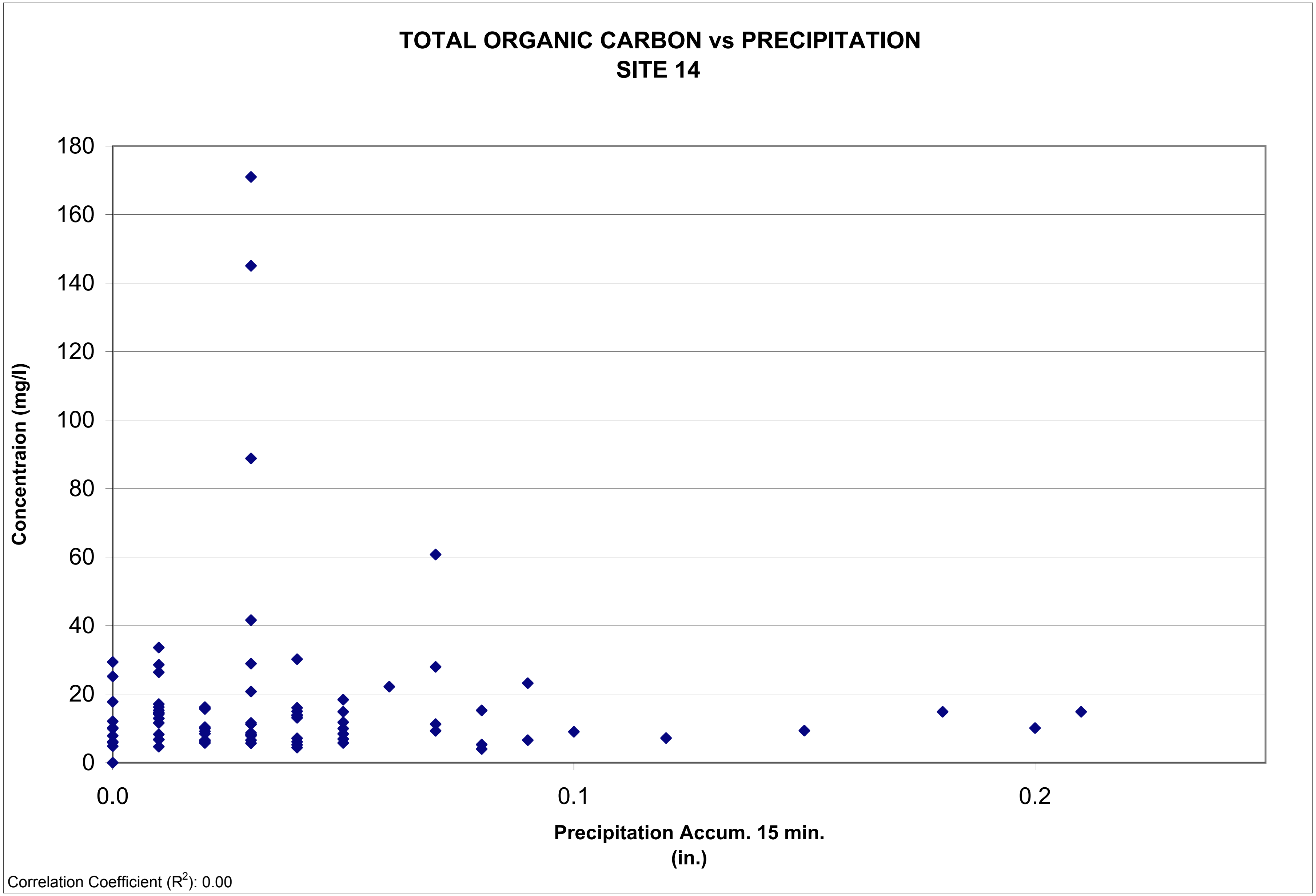
Correlation Coefficient (R^2): 0.17

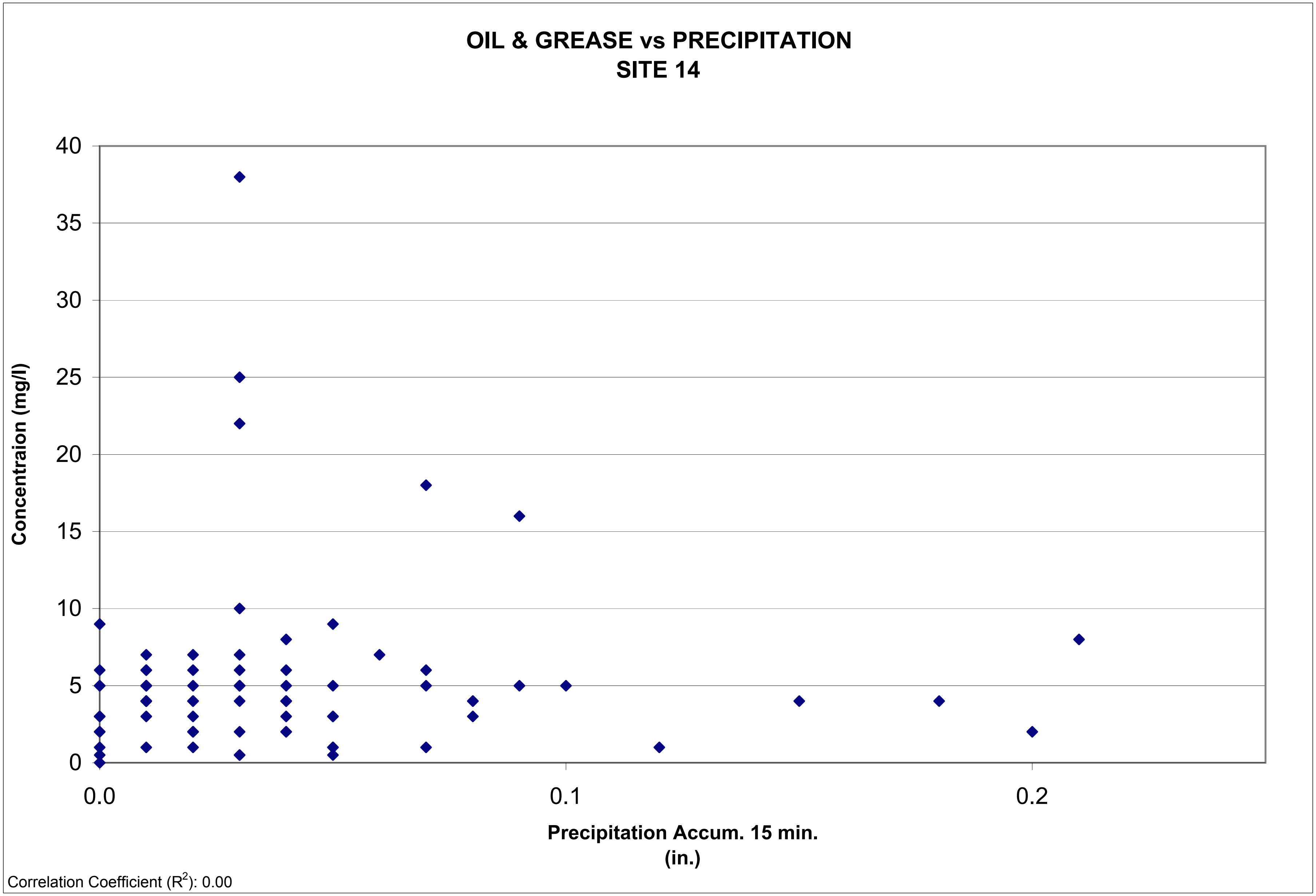

HARDNESS vs PRECIPITATION
SITE 14
Concentraion (mg/l)
350
300
250
200
150
100
50
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.00

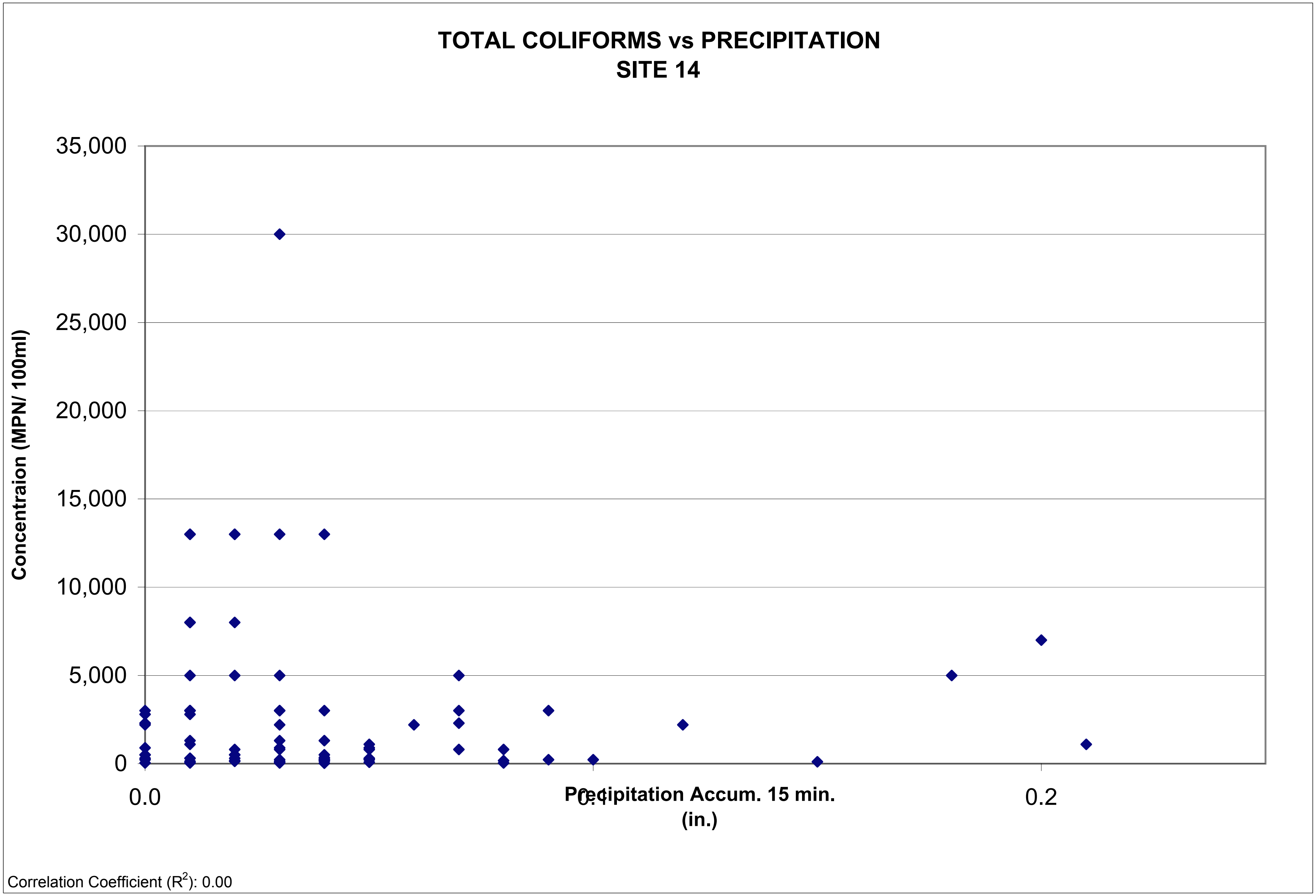

NITRATE vs PRECIPITATION
SITE 14
Concentraion (mg/l)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.01



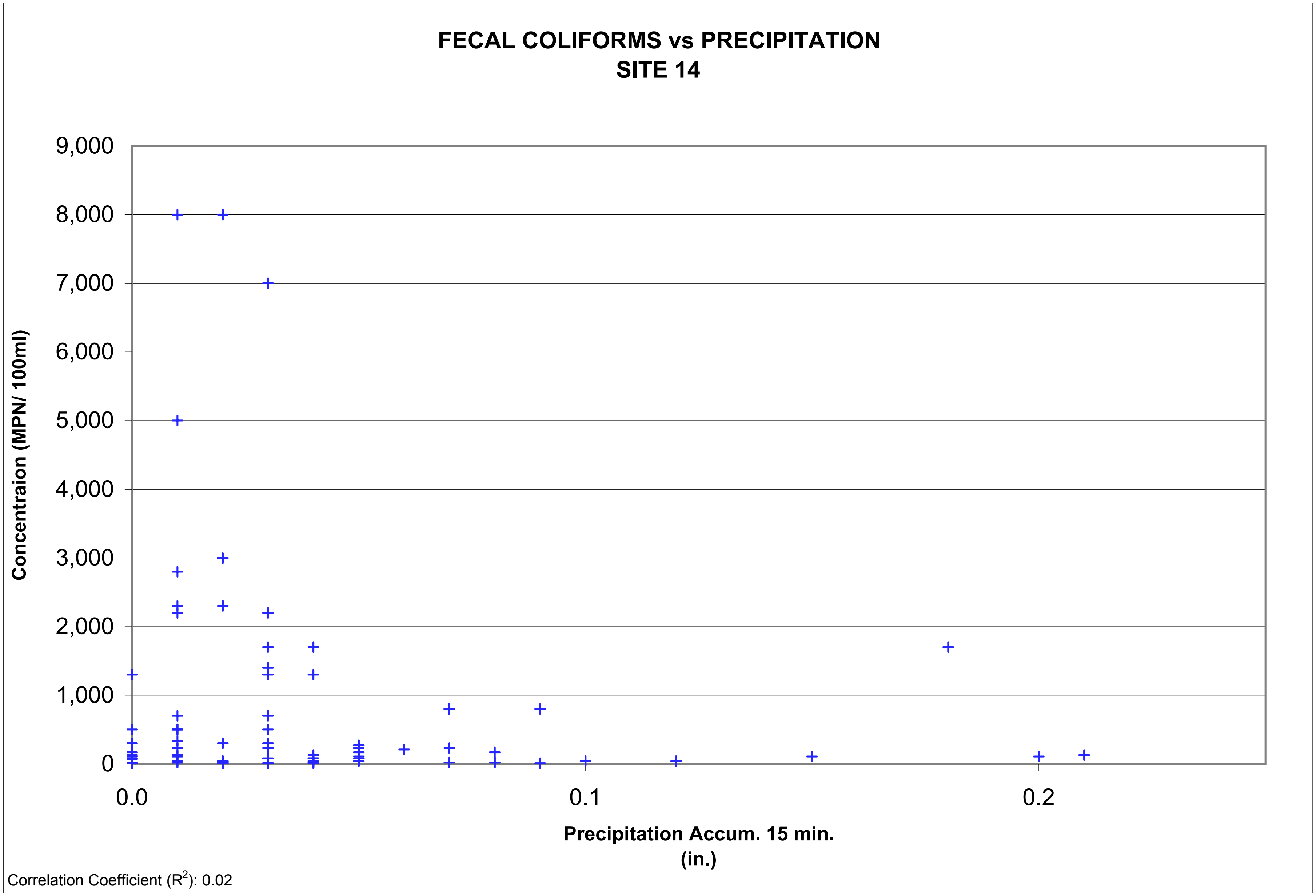
SUSPENDED SOLIDS vs PRECIPITATION
SITE 14
Concentraion (mg/l)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.12


TOTAL ORGANIC CARBON vs PRECIPITATION
SITE 14
Concentraion (mg/l)
180
160
140
120
100
80
60
40
20
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.00


OIL & GREASE vs PRECIPITATION
SITE 14
Concentraion (mg/l)
40
35
30
25
20
15
10
5
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R2): 0.00



TOTAL COLIFORMS vs PRECIPITATION
SITE 14
Concentraion (MPN/ 100ml)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0.0
0.1
0.2
Precipitation Accum. 15 min. (in.)
Correlation Coefficient (R^2): 0.00


FECAL COLIFORMS vs PRECIPITATION
SITE 14
Concentraion (MPN/ 100ml)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0.0
0.1
0.2
Precipitation Accum. 15 min.
(in.)
Correlation Coefficient (R^2): 0.02