WATER QUALITY DATABASE EVALUATION AND TREND ANALYSIS FOR: SHELBYVILLE LAKE

Prepared for

U.S. Army Engineer District, St. Louis
Corps of Engineers
1222 Spruce Street
St. Louis, MO 63103-2033

By

ARDL, Inc.
Mount Vernon, Illinois

Approved by:

____

Chief, Environmental Quality Section
U.S. Army Corps of Engineers
St. Louis District (CEMVS-ED-HQ))

Date Prepared: January, 2007

TABLE OF CONTENTS Page

1.0	EXECUTIVE SUMMARY	1
2.0	INTRODUCTION	2
3.0	LAKE WATER QUALITY DATA EVALUATION	2
3.1	Data Sets	2
3.2	Data Evaluation	2
3.2.1	Descriptive Statistics Summary and Trend Plots	4
3.3	All Sites	
3.3.1	Dissolved Oxygen	4
3.3.2	pH	4
3.3.3	Oxidation-Reduction Potential	8
3.3.4	Conductivity	8
3.3.5	Total Suspended Solids (TSS)-All Sites	12
3.3.6	Volatile Suspended Solids (VSS)-All Sites	12
3.3.7	Total Phosphorus	15
3.3.8	Orthophosphate (OPO4)-All Sites	15
3.3.9	Nitrate (NO3-N)-All Sites	18
3.3.10	Ammonia (NH3-N)-All Sites	18
3.3.11	Manganese-All Sites	21
3.3.12	Iron - All Sites	21
3.3.13	Alachlor l-All Sites	21
3.3.14	Atrazine-All Sites	25
3.3.15	Chlorophyll -All Sites	25
3.3.16	Pheophytin – All Sites	25
3.3.17	Total Organic Carbon	29
3.4	Individual Sites	
3.4.1	Overview	31
3.4.2	Chemical/Physical Properties	31
3.4.2.1	Dissolved Oxygen	31
3.4.2.2	pH	31
3.4.2.3	Oxidation-Reduction Potential	31
3.4.2.4	Conductivity	33
3.4.3	Suspended Solids	33
3.4.4	Nutrients	33
3.4.4.1	Phosphorus	33
3.4.4.2	Nitrate	34
3.4.4.3	Ammonia	34
3.4.5	Organics	34
3.4.5.1	Herbicides	34
3.4.5.2	Chlorophyll/Pheophytin	34
3.4.5.3	Total Organic Carbon	35
4.0	CONCLUSIONS AND RECOMMENDATIONS	35

TABLE OF CONTENTS (cont'd)

LIST OF FIGURES

		Page
1.	Location Map – Sampling Sites	3
Multiple Sites – Plotted Data/Statistics		
2.	Dissolved Oxygen, All Sites	6
3.	pH, All Sites	7
4a.	Oxidation-Reduction Potential (Linear)	9
4b	Oxidation-Reduction Potential (Logarithmic)	10
5.	Conductivity	11
6.	Total Suspended Solids	13
7.	Volatile Suspended Solids	14
8.	Total Phosphorus	16
9.	Soluble Phosphorous (ortho-Phosphate)	17
10.	Nitrate	19
11.	Ammonia	20
12.	Total Managanese – All Sites	22
13.	Total Iron - All Sites	23
14.	Alachlor – All Sites	24
15.	Atrazine – All Sites	26
16.	Chlorophyll – All Sites	27
17.	Pheophytin- All Sites	28
18.	Total Organic Carbon	30

LIST OF TABLES

Table 1 – Definitions for Descriptive Statistics 5
Table 2 - Site Specific Statistics 32

LIST OF APPENDICES

Appendix 1 – Individual Sites, Data Plots 36
Appendix 2 – Data Disk –All Corps Monitored Sites

1.0 EXECUTIVE SUMMARY

The purpose of this report is to provide a statistical analysis of water quality conditions within Shelbyville Lake during the period 2001-2005.

Statistical evaluations were performed using water quality data values acquired during the referenced period on a wide variety of organic, inorganic and biological parameters from a number of sampling points spread throughout the lake. Analytical data reviewed consisted of Shelbyville Lake water quality data collected from surface waters at seven (7) sites and from sub-surface water at one of those sites. The samples were collected by the Corps of Engineers, St. Louis District, Environmental Quality Section. Statistical analysis and the results were evaluated for seventeen (17) parameters for all sites that contained sufficient data (i.e. more than two years data and/or a sufficient number of data points above the detection limit) on a combined and individual basis.

The data collected indicated a generally improving to stable water quality within Shelbyville Lake.

2.0 INTRODUCTION

Water quality monitoring within the lakes and rivers under the control of the U.S. Army Corps of Engineers is essential to assure that environmental conditions are safe for human and wildlife contact and general usage. The Corps of Engineers, St. Louis District, Environmental Quality Section has maintained a database of monitoring sites within Shelbyville Lake since 1989. The data as collected is reviewed to assure that immediate environmental conditions are within acceptable ranges. The data are then archived within a database file.

The values regarding water quality in Shelbyville Lake which are presented herein were acquired during the calendar years 2001 to 2005. Statistical analysis of the data was performed on data sets from individual sampling sites within Shelbyville Lake. The statistical results are compared to applicable water quality standards currently in force by regulation (State and/or Federal). In those cases where there is no regulatory limited the values observed are compared to those which are generally accepted as a good range for water quality. Illinois regulations for general use waters appear in 35 Illinois Administrative Code, Section 302, Subpart B and in Illinois Integrated Water Quality Report, 2006.

Statistical analysis was performed on seven (7) surface or near surface monitoring sites within Shelbyville Lake. A total of seventeen (17) parameters were reviewed statistically. Additional parameters were analyzed on various occasions at several of the sites but were deemed an insufficient quantity and/or time span (less than five data points or less than 2 year time span) for statistical trend analysis.

3.0 SHELBYVILLE LAKE WATER QUALITY DATA EVALUATION

3.1 Data Sets

Data sets evaluated for Shelbyville Lake originated from field sampling by the St. Louis District Corps of Engineers Environmental Quality Section at seven (7) sites. Figure 1 shows the locations of these sites.

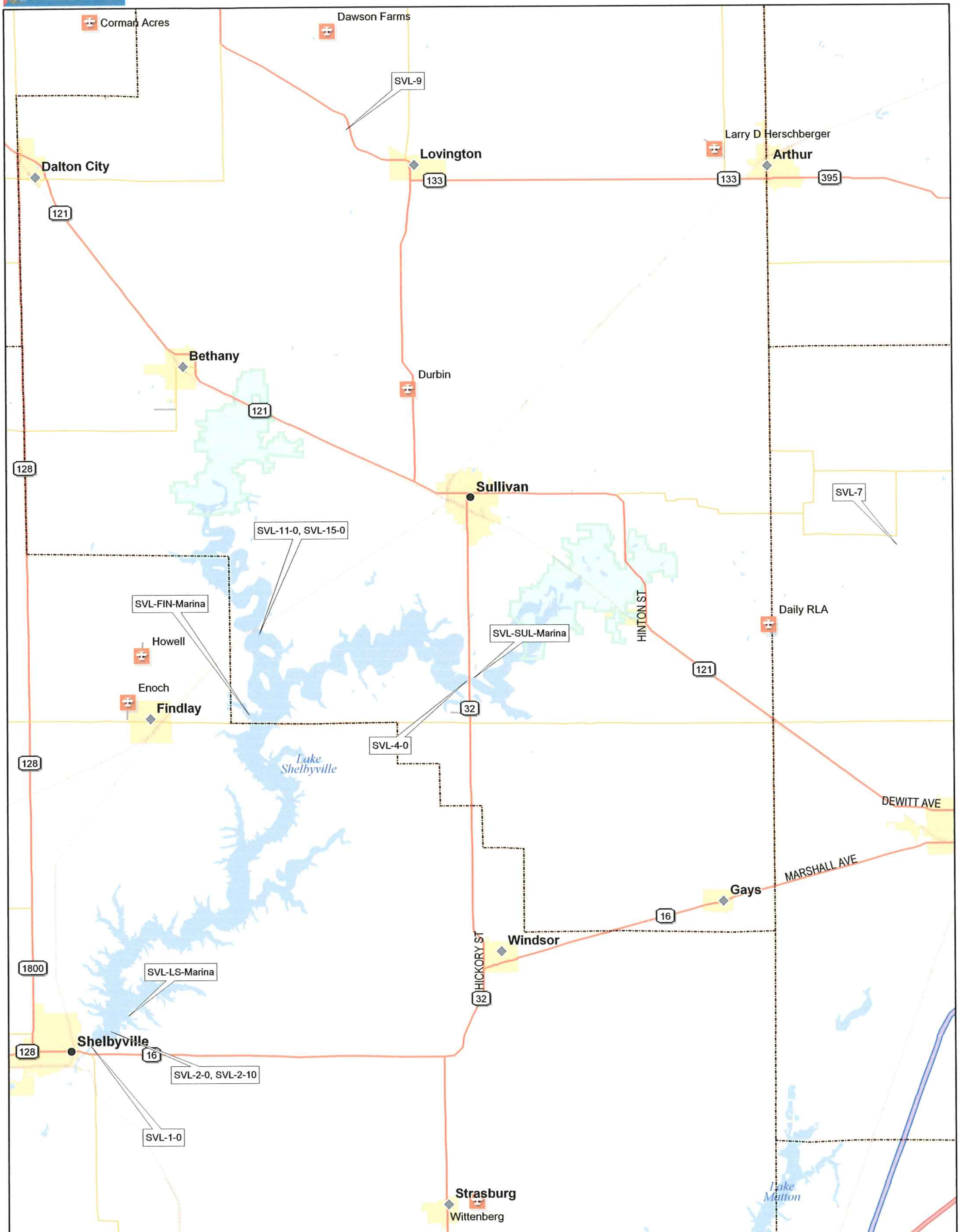
3.2 Evaluation

Evaluation of data was performed in two ways: 1) the combined values for each parameter observed at all sites; and 2) the values for each parameter observed at each site. A descriptive statistical summary of each parameter for all sites taken as a whole and for each site individually appears in Sections 3.3 and 3.4, below. The current levels are compared to State and/or Federal regulatory limits where such limits have been set. Trend analysis plots and descriptive statistics for all sites combined are provided in the various figures and tables the referenced sections. The equation for the trendline appears in the upper right hand corner of all plots. All data utilized from the monitored sites for this evaluation is provided in electronic format on CD which is attached hereto as an Appendix. The files on the disk can be accessed with Microsoft Excel.

DELORME

Figure 1 - Shelbyville Lake Site Location Map

Street Atlas USA® 2006



TN
MN (1.9°W)

Scale 1 : 200,000

1" = 3.16 mi

Data Zoom 10-0

3.2.1 Trend and Descriptive Statistics Analysis Summary

The descriptive statistics calculated and reviewed for the combined data sets are defined in Table 1.

3.3 Data From All Sites

3.3.1 Dissolved Oxygen

Figure 2 shows the data from all sites for Dissolved Oxygen (DO). The descriptive statistics for those data appear in the table below the plotted values.

Dissolved oxygen levels depend on temperature and atmospheric pressure as well as on the chemical and biological activities occurring in an aqueous system. A minimum quality standard of 5.0 mg dissolved oxygen/L has been established for general purpose waters Illinois.

Review of the figure will show that in general the observed values are in an approximate range of 5 to 10 mg/L. The mean, median and mode for the observed data were 6.3, 6.2 and 7.5, respectively. These data (excluding the exceptions noted below) indicate that D.O. levels in the system are acceptable and that those levels are stable.

The exceptions noted were:

- six values of less than 1 mg/L observed during summer months throughout the time span of the study at sites 2-10 and 11-0; and
- several values observed at differing sites which were well above the maximum solubility (12 mg/L) of oxygen in water which is warmer than 45° F (7° C).

The high values were excluded from the statistics and were not plotted.

3.3.2 pH

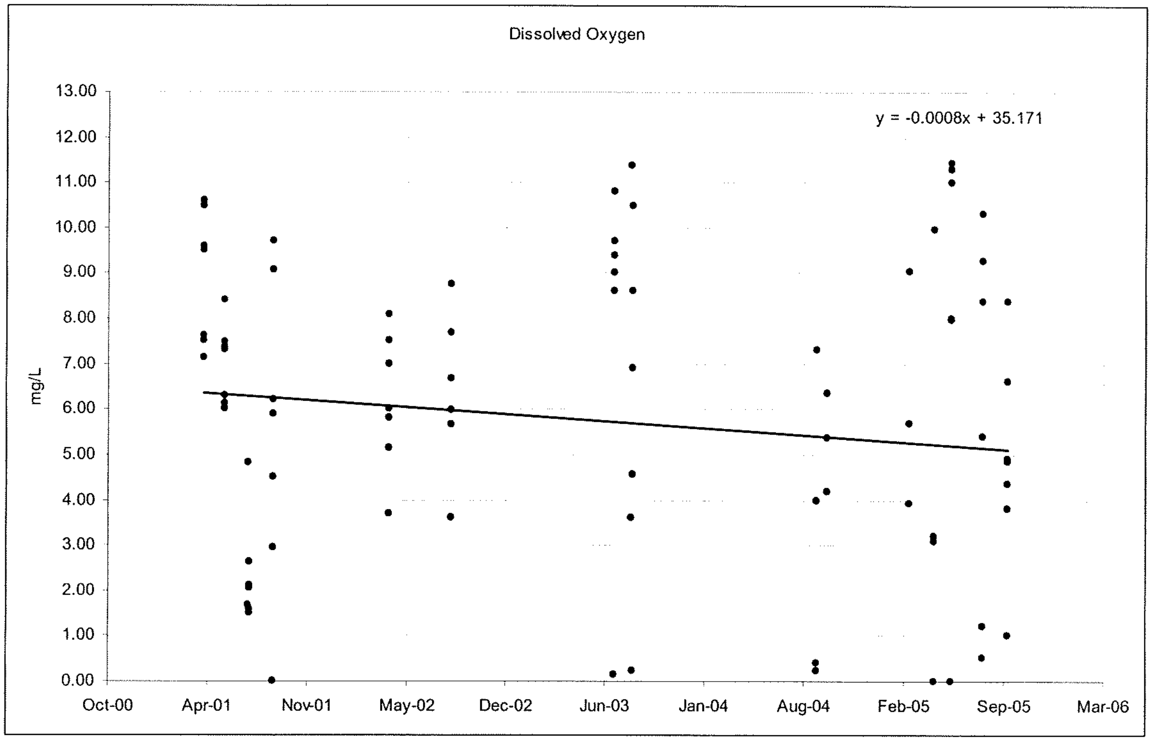
The value for pH is a logarithmic expression of the concentration of hydrogen ions. It is governed by the combined effects of dissolved gases (principally carbon dioxide) and the levels of the various salts which are present. A "neutral" system is pH 6 to 8. The pH of an acidic system is less than 6 and that of a basic system is greater than 8.

Review of the Figure 3 and the statistics in accompanying table shows that, when plotted on a logarithmic scale, individual measurements were closely similar in all sites at all times. The values, however, can be strongly influenced temporarily by local conditions associated with unusually hot or cold temperatures, flooding, increased runoff due to rainfall, erosion from land disturbances caused by agricultural activities or land development.

Table 1 – Definitions for Descriptive Statistics

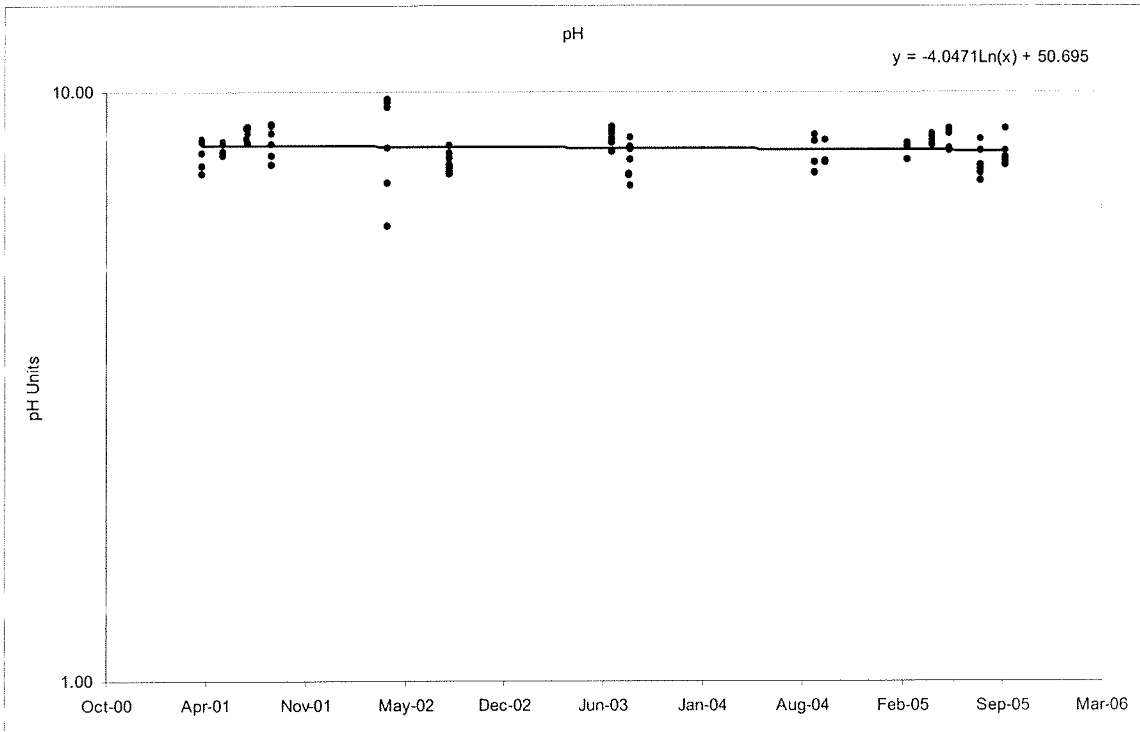
Statistic	Definition
Mean	Arithmetic average of all the data points.
Standard Error	Measure of the amount of error in the prediction of the Y(parameter of interest) data point for an individual X data point. A function of standard deviation and the number of measurements made.
Median	Number in the middle of a set of numbers; that is, half the numbers have values that are greater than the median, and half have values that are less.
Mode	Most frequently occurring, or repetitive, value in an array or range of data.
Standard Deviation	Measure of how widely values are dispersed from the average value
Variance	Calculation of potential difference from the norm/mean.
Kurtosis	Characterizes the relative peakedness or flatness of a distribution compared with the normal distribution. Positive kurtosis indicates a relatively peaked distribution. Negative kurtosis indicates a relatively flat distribution
Skewness	Characterizes the degree of asymmetry of a distribution around its mean. Positive skewness indicates a distribution with an asymmetric tail extending toward more positive values. Negative skewness indicates a distribution with an asymmetric tail extending toward more negative Values

Figure 2



Statistics	Values
Mean	6.22
Standard Error	0.335
Median	6.33
Mode	7.5
Standard Deviation	3.07
Sample Variance	9.4
Kurtosis	-0.79
Skewness	-0.27
Range	11.3
Minimum	0.14
Maximum	11.44
Sum	523
Count	84

Figure 3



Statistics	Values
Mean	8.04
Standard Error	0.063
Median	8.07
Mode	7.5
Standard Deviation	0.61
Sample Variance	0.4
Kurtosis	1.72
Skewness	0.03
Range	3.8
Minimum	5.90
Maximum	9.70
Sum	740
Count	92

Illinois regulations specify a characteristic pH in the range 6.5 to 9 for general purpose waters. Although the observed values are in an approximate range of 6 to 10, the mean, median and mode are at or near to neutrality and are well within state guidelines. The trendline for the parameter over the five year period reflected in the plot is virtually flat, indicating that the current general conditions will remain stable in the future.

3.3.3 ORP (Oxidation Reduction Potential)

Figure 4 shows the data from all sites for ORP. The descriptive statistics for those data appear in the table below the plotted values.

ORP is a logarithmic function dependent upon the net effects and the balance of the complex interactions of dissolved components, pH, temperature and other variables. A positive ORP indicates an excess of oxidizing components and a negative ORP indicates an excess of reducing agents. In general terms, a positive ORP is considered beneficial since the system is healthy and operating aerobically. A negative ORP, however, can indicate that a system is operating anaerobically, a condition which generally leads to generation of objectionable odors through putrefaction.

Linear and logarithmic values of ORP data are plotted in Figures 4A and 4B. The linear plot of ORP determinations (Figure 4A) emphasizes the variability in the individual measurements and tends to mask the reason for the relatively strong decline in the trendline over the period studied. Plotted logarithmically (Figure 4B), the negative slope of the line is better defined. Review of the figures will show that during the period studied, the mean of the values observed for ORP decreased steadily from a high of approximately 350 to a low of about 125. The data indicate that this trend will continue.

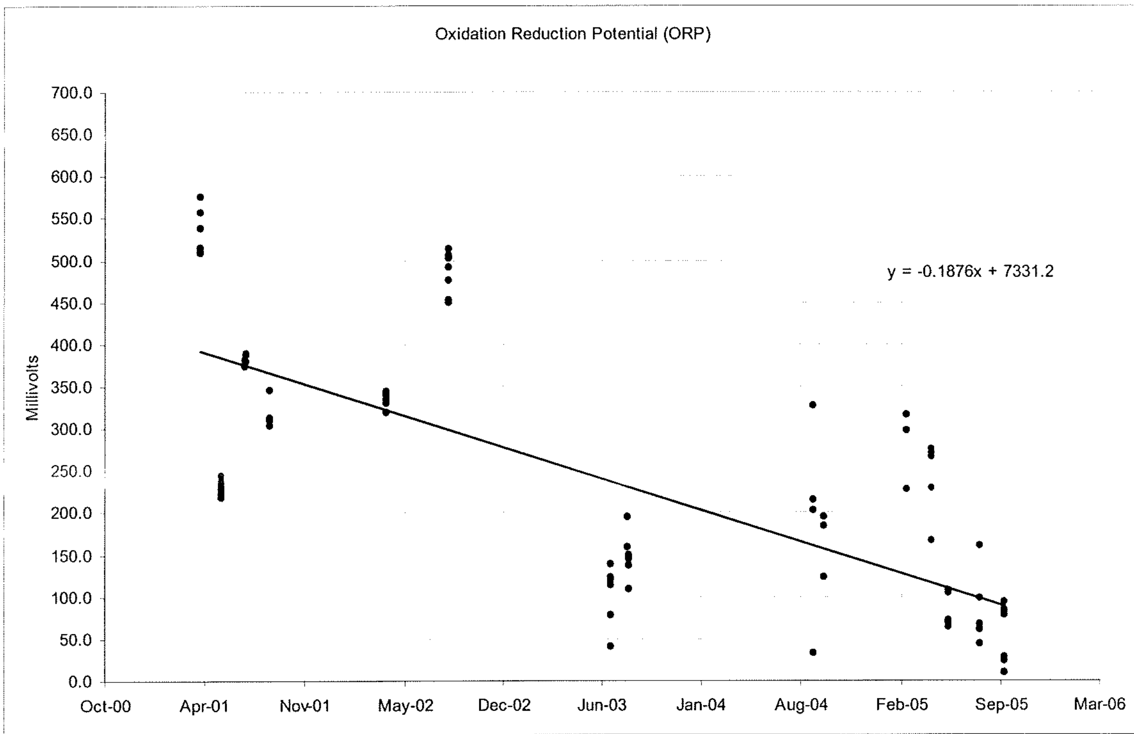
Note: Two values of negative ORP were observed during the course of the study. As noted above, negative values for ORP may indicate that there are problems in the system. In this case, however, the instances are isolated and appear not to have significance.

No specific regulations for ORP in general purpose waters have been generated by the states or federal government.

3.3.4 Conductivity

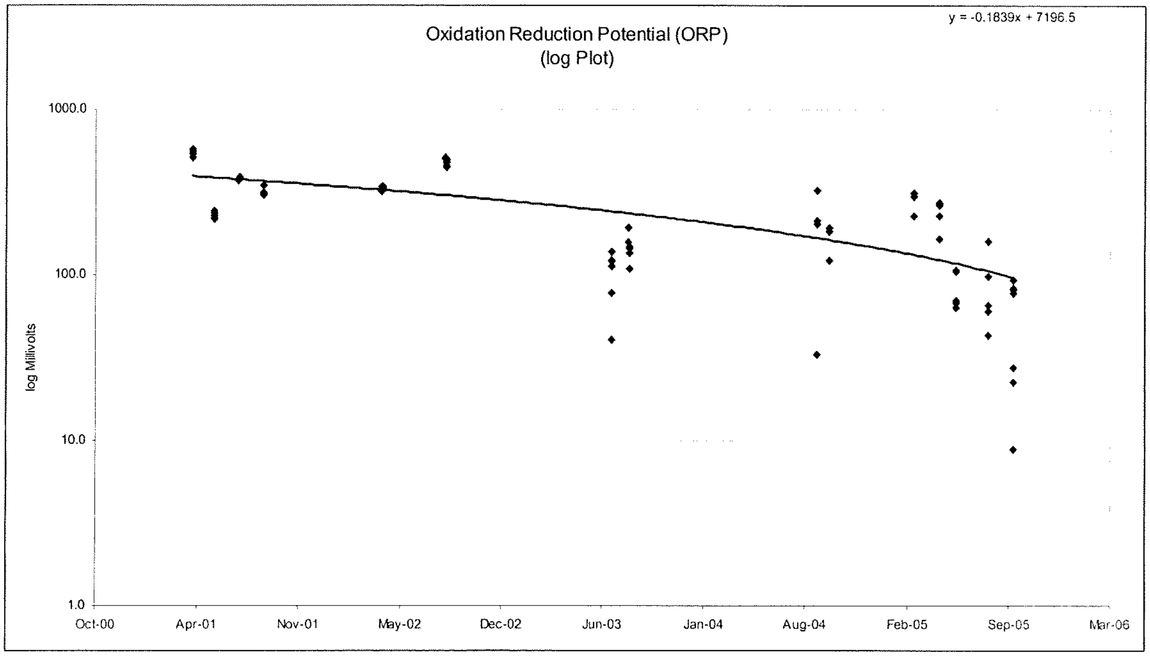
The data for conductivity appears in Figure 5.. The descriptive statistics for those data appear in the table below the plotted values.

Figure 4a



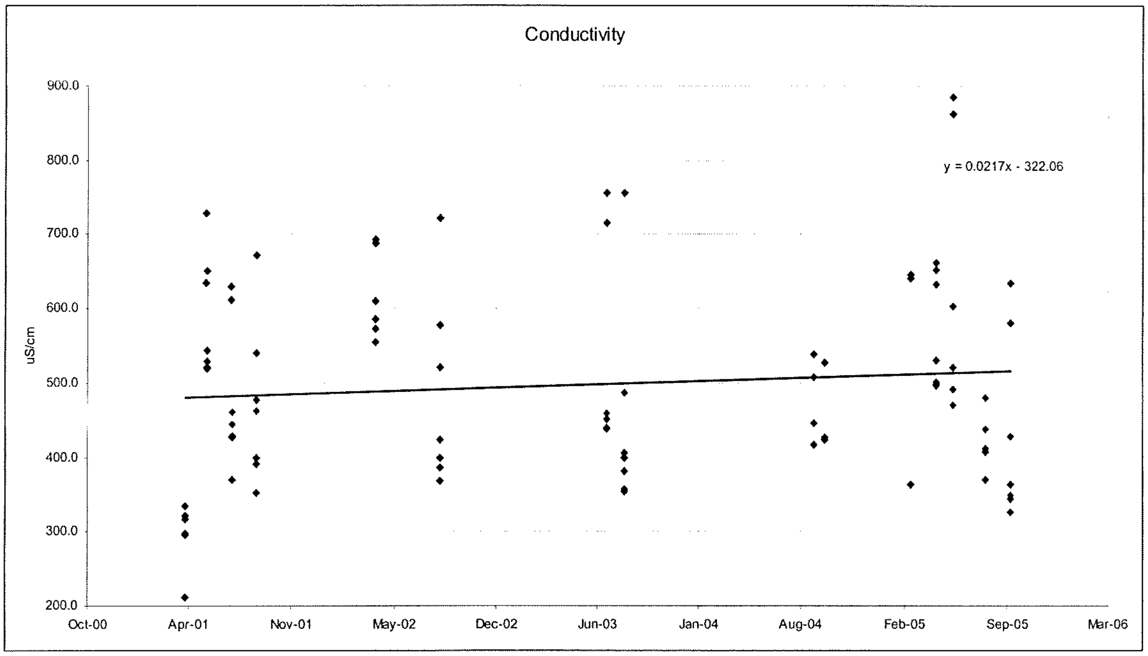
Statistics	Values
Mean	245.13
Standard Error	16.986
Median	229.50
Mode	380
Standard Deviation	161.14
Sample Variance	25967.3
Kurtosis	-0.73
Skewness	0.23
Range	711.0
Minimum	-136.00
Maximum	575.00
Sum	22062
Count	90

Figure 4B



y = -0.1839x + 7196.5
Oxidation Reduction Potential (ORP)
(log Plot)
1000.0
100.0
10.0
1.0
log Millivolts
Oct-00
Apr-01
Nov-01
May-02
Dec-02
Jun-03
Jan-04
Aug-04
Feb-05
Sep-05
Mar-06

Figure 5



Statistics	Values
Mean	497.69
Standard Error	13.878
Median	478.50
Mode	399
Standard Deviation	133.11
Sample Variance	17718.6
Kurtosis	0.09
Skewness	0.58
Range	674.0
Minimum	212.00
Maximum	886.00
Sum	45787
Count	92

Conductivity in an aqueous system is governed by the concentrations, mobility, oxidation state and other properties of dissolved ionized substances. Conductivity is also directly proportional to temperature and an approximate 2% rise in conductance of water occurs for every 1^{o} C rise in temperature in the system. Many of the ionized substances present in natural waters (especially carbonates which also impact system pH) are leached from local and watershed soil and rocks and many more are introduced by runoff from agricultural and land development activities. Most of the nutrients from agricultural runoff are ionized.

The complex of interactions which determines conductivity tends to make individual readings highly variable. The data acquired during the subject study reflect that variability. The maximum observed was 886 uS/cm. The mean, mode and median of the values, however, are all within a reasonable range (498, 475 and 399 uS/cm, respectively). There is a slight upward trend in those values but the data suggest that future values for this property will be of magnitudes similar to those found during the current study.

A standard for conductivity of 1667 uS/cm has been established for general purpose waters in Illinois,

3.3.5 Total Suspended Solids

The data for total suspended solids appears in Figure 6.. The descriptive statistics for those data appear in the table below the plotted values.

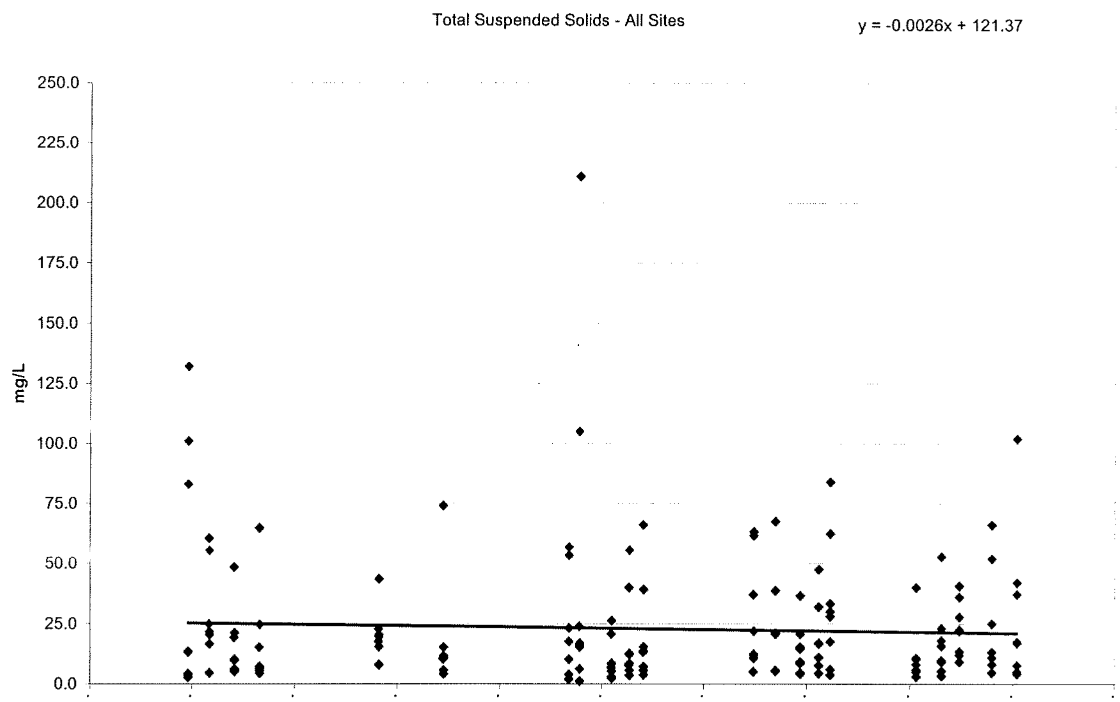
Suspended solids affect the clarity and appearance of water. In general, these solids are soil and/or plant particulates introduced to the system by local or watershed erosion or biomaterials produced by aquatic flora and fauna. Individual measurements taken at separate sites in the system are quite often highly variable because of these localized effects. Those effects are apparent in the plot of the data. The majority of values observed were 50 mg/L or less but twenty or so were above that level, sometimes significantly so.

No quality standard has been set by Illinois for suspended solids in general purpose waters.

3.3.6 Volatile Suspended Solids

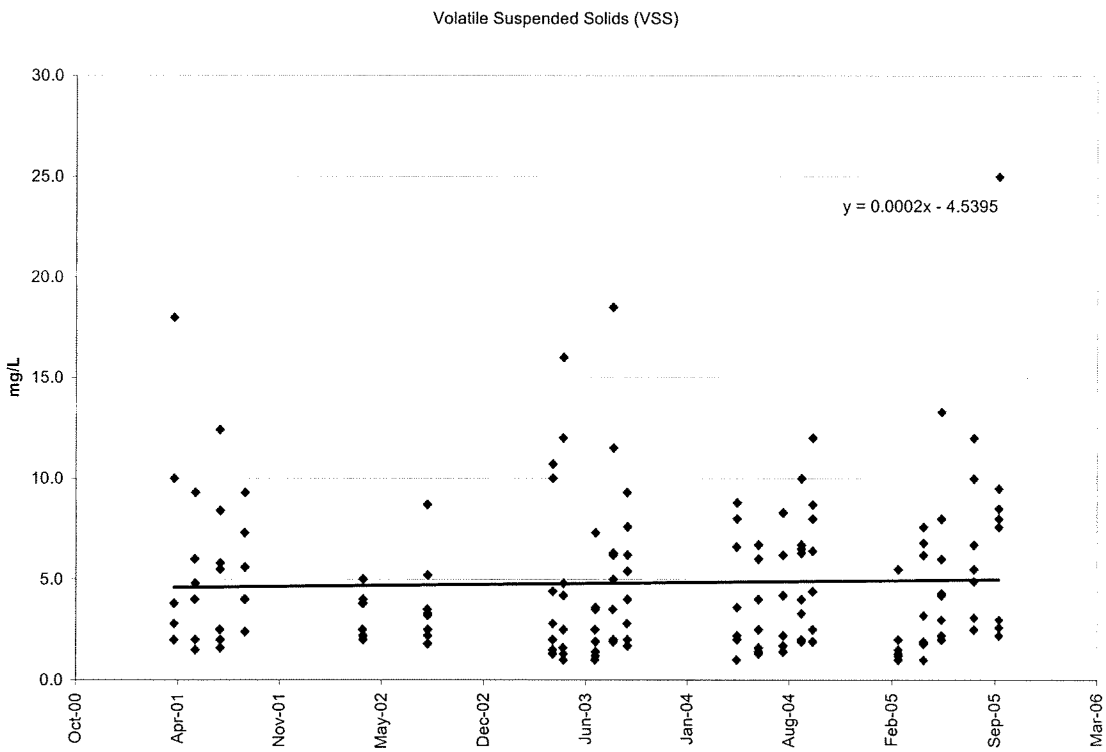
The data for volatile suspended solids appears in Figure 7. The descriptive statistics for those data appear in the table below the plotted values.

Figure 6



Statistics	Values
Mean	22.93
Standard Error	2.108
Median	13.40
Mode	5.6
Standard Deviation	27.24
Sample Variance	742.0
Kurtosis	14.93
Skewness	3.17
Range	209.9
Minimum	1.10
Maximum	211.00
Sum	3830
Count	167

Figure 7



Statistics	Values
Mean	4.82
Standard Error	0.291
Median	3.80
Mode	2
Standard Deviation	3.75
Sample Variance	14.1
Kurtosis	5.75
Skewness	1.95
Range	24.0
Minimum	1.00
Maximum	25.00
Sum	804
Count	167

Volatile suspended solids are usually organic and impact on the oxygen levels as they degrade. In general, those materials were found in low concentration at levels that were approximately one quarter of total solids. The trendline is flat, indicating that the current values are stable and that future determinations will be similar in distribution and magnitude.

There is no standard set by Illinois for volatile suspended solids in general purpose waters

3.3.7 Total Phosphorus

The data for total phosphorus appears in Figure 8. The descriptive statistics for those data appear in the table below the plotted values.

Phosphorus is an active nutrient. Elevated levels of the element in virtually any form (and other nutrients as well) adds to the risk of algal blooms and other problems associated with eutrophication-related water quality problems. The principal source of these materials is runoff from agricultural activities. The trendline is flat indicating that the characteristic is stable and that future data will parallel the values shown in the figure.

The average of these data exceeds the current quality standard for general use waters in Illinois (0.05 mg/L) by a factor of approximately 3. The maximum values observed, however, are in the order of 8 to 20 times the prescribed level. Based on the considerations outlined on page 32 of the 2006 Illinois Water Quality Report referenced above (see section 2.0). however, the lake remains acceptable as a Category 2 water since the none of the other uses are impaired.

3.3.8 Soluble Phosphorus (ortho Phosphate)

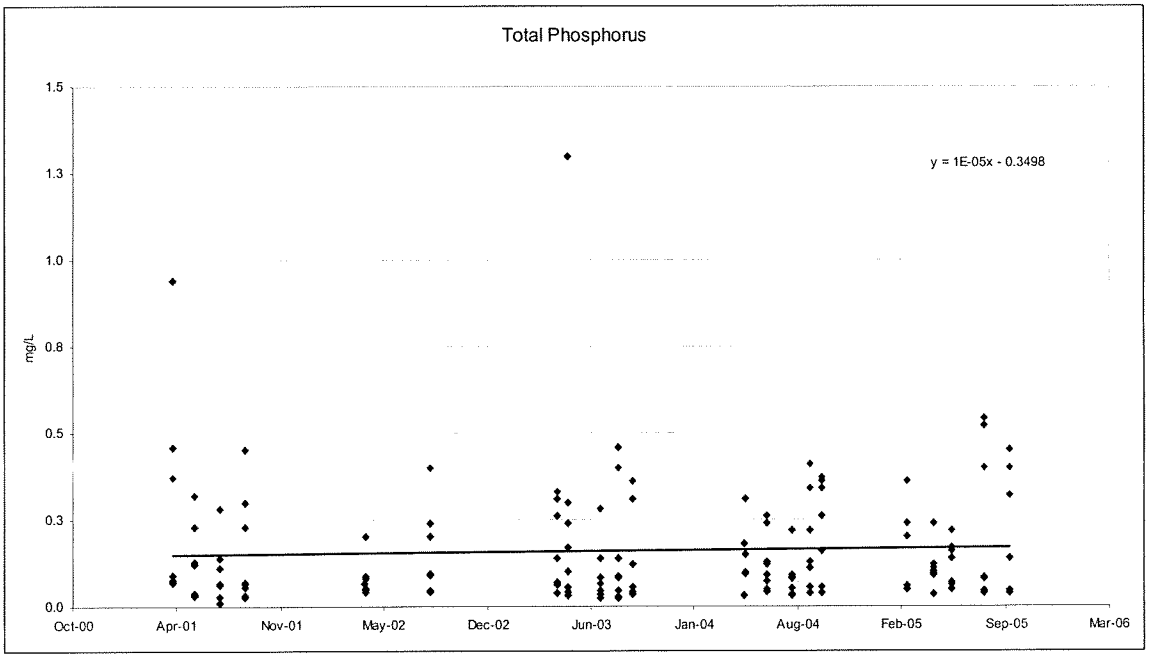
The data for ortho-phosphate appears in Figure 9. The descriptive statistics for those data appear in the table below the plotted values.

The data plotted in Figure 9 shows phosphorus which is in soluble form. The remarks relative to the action, environmental threat potential and origin of total phosphorus entities apply to soluble forms as well.

Evaluation of the data showed that the annual average for soluble phosphorus at all sites rose slightly to a peak in 2003 and thereafter began to decline. In a significant proportion of the data pairs, soluble phosphorus is approximately one-fourth total phosphorous, a value indicating that the profile of the nutrient in lake waters is stable.

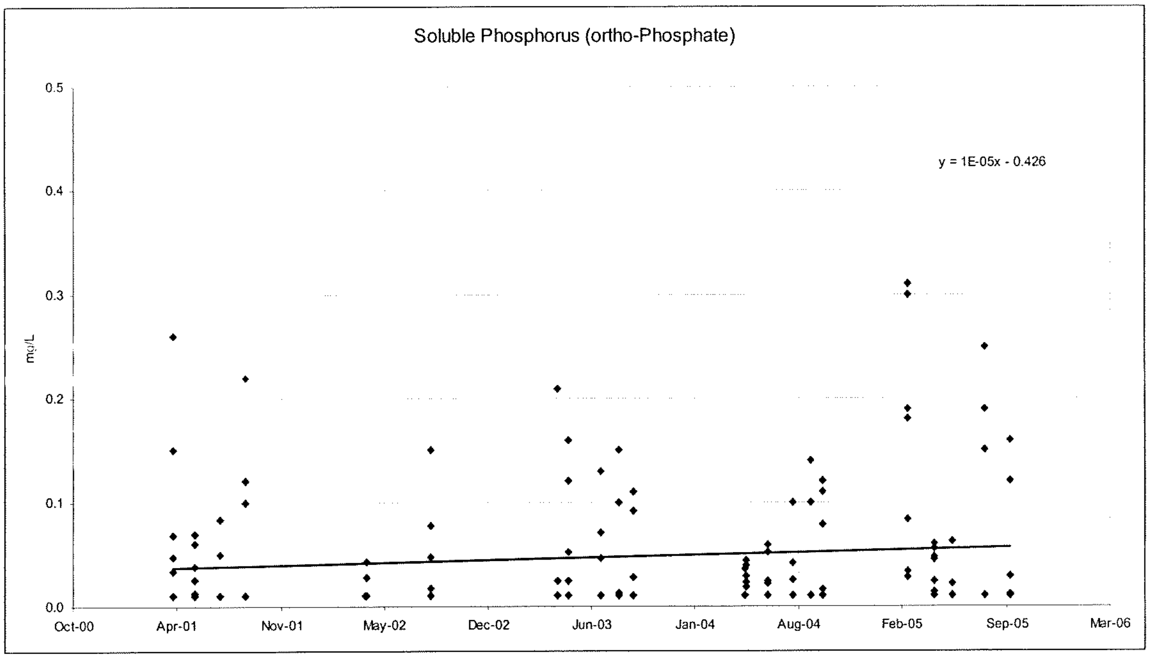
There is no water quality standard for this characteristic published by Illinois.

Figure 8



Statistics	Values
Mean	0.16
Standard Error	0.013
Median	0.10
Mode	0.14
Standard Deviation	0.16
Sample Variance	0.027
Kurtosis	15.42
Skewness	3.05
Range	1.3
Minimum	0.01
Maximum	1.30
Sum	27
Count	167

Figure 9



Statistics	Values
Mean	0.048
Standard Error	0.005
Median	0.010
Mode	0.010
Standard Deviation	0.064
Sample Variance	0.004
Kurtosis	4.64
Skewness	2.17
Range	0.3
Minimum	0.01
Maximum	0.31
Sum	8
Count	166

3.3.9 Nitrate

The data for nitrate appears in Figure 10. The descriptive statistics for those data appear in the table below the plotted values.

Nitrate, like phosphorus, is an active nutrient and can have a detrimental environmental effect when it degrades to nitrite, a nutrient for algae. Nitrates may be introduced into water systems by the decay of nitrogenous organic matter or runoff from both agricultural or industrial sites.

There is no general use standard of water quality for nitrate in Illinois. The limit for finished water, however, is 10 mg/L. Although a few of the values observed during the subject study exceed that level, the mean, median and mode of the observed data are well below it. The data show that the concentrations of this nutrient in the lake are stable and acceptable.

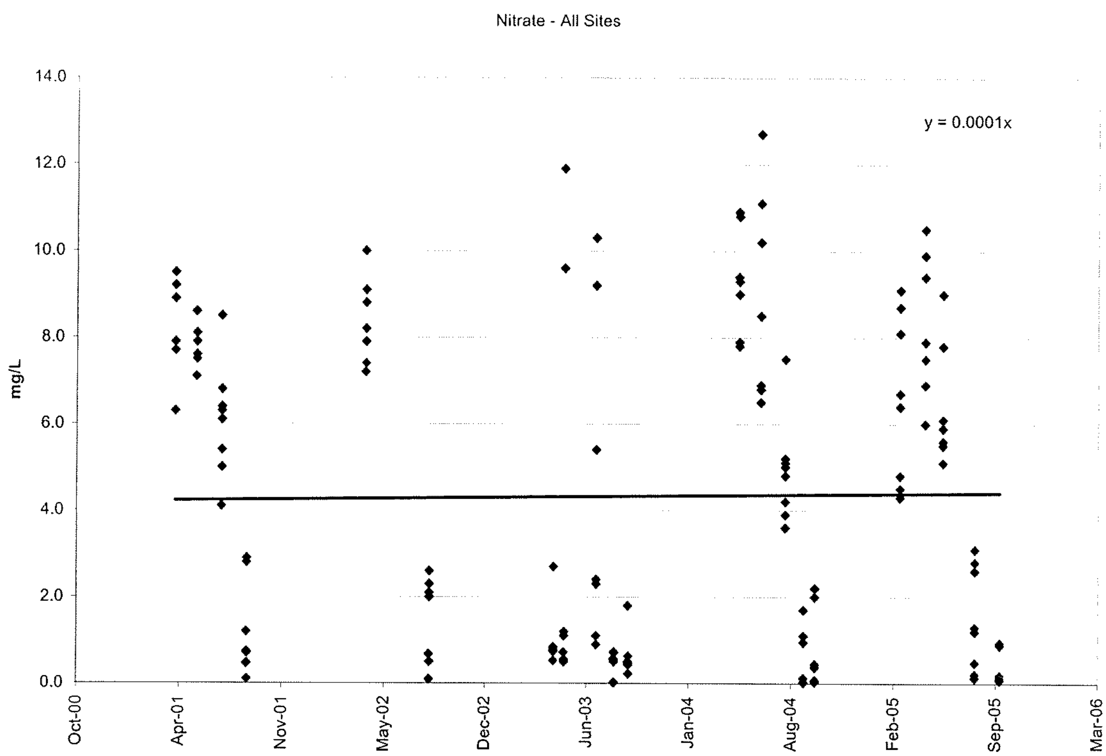
3.3.10 Ammonia

The data for ammonia appears in Figure 11. The descriptive statistics for those data appear in the table below the plotted values.

Like phosphorus and nitrate, ammonia is an active nutrient. It may be present in runoff from agricultural or industrial sites, may form in aqueous systems from the decay of nitrogenous wastes or may indicate the presence of improperly treated discharges from waste treatment plants. The levels of ammonia observed in lake samples are acceptable and stable.

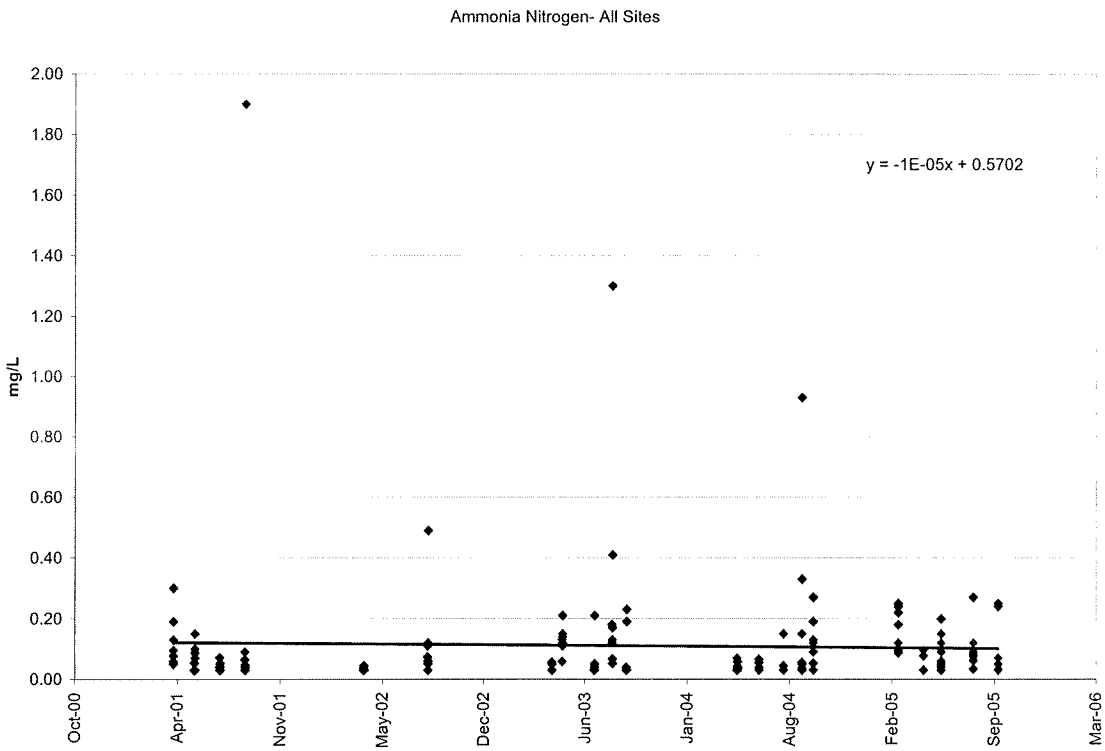
The current level of ammoniacal components in Shelbyville Lake water is well below the water quality standard of 15 mg/L for total ammonia in general purpose waters in Illinois. For unionized ammonia, however, the statutory level is far lower (0.10 mg/L). This does not apply to Shelbyville Lake waters (pH 6 to 10) found in Shelbyville Lake since the ionization constant of ammonia ($pK_b = 4.74$) ensures that all of the compound present will be completely ionized.

Figure 10



Statistics	Values
Mean	4.33
Standard Error	0.283
Median	4.00
Mode	7.9
Standard Deviation	3.65
Sample Variance	13.3
Kurtosis	-1.38
Skewness	0.29
Range	12.7
Minimum	0.02
Maximum	12.70
Sum	719
Count	166

Figure 11



Statistics	Values
Mean	0.11
Standard Error	0.015
Median	0.05
Mode	0.03
Standard Deviation	0.20
Sample Variance	0.0
Kurtosis	49.74
Skewness	6.43
Range	1.9
Minimum	0.03
Maximum	1.90
Sum	18
Count	166

3.3.11 Manganese

Manganese was evaluated in samples collected from two sites. The data are plotted in Figure 12. Statistics calculated from the data appear in the table below the chart.

Manganese was observed in all samples. The median and mode of observed data were approximately 0.04 mg/L and all but 5 values were 0.25 mg/L or less. The level of the metal in lake waters is stable.

The regulatory limit for general use waters in Illinois for manganese is 1 mg/L. The secondary maximum contaminant level (SMCL) for manganese in drinking water is 0.05 mg/L. SMCL values are set on aesthetic grounds and imply no health hazard.

3.3.12 Iron

Iron was evaluated in samples collected from two sites. The data are plotted in Figure 13 and statistics calculated from them appear in the table below the chart.

Iron was detected in all samples but one and all values which were observed except two were less than 0.5 mg/L (see note below). The median and mode in the range of 0.1 to 0.3 mg/L reflect the preponderance of low values. The data indicate the iron concentrations in lake waters are stable.

There is no regulatory limit for general use waters in Illinois for iron. The secondary maximum contaminant level (SMCL) for iron in drinking water is 0.3 mg/L. SMCL values are set on aesthetic grounds and imply no health hazard.

Note: A sample collected at Site 2-10, May, 2003 contained 30.1 mg/L iron. The value is not plotted and was not included in calculation of the trend line to more accurately reflect overall conditions in lake waters.

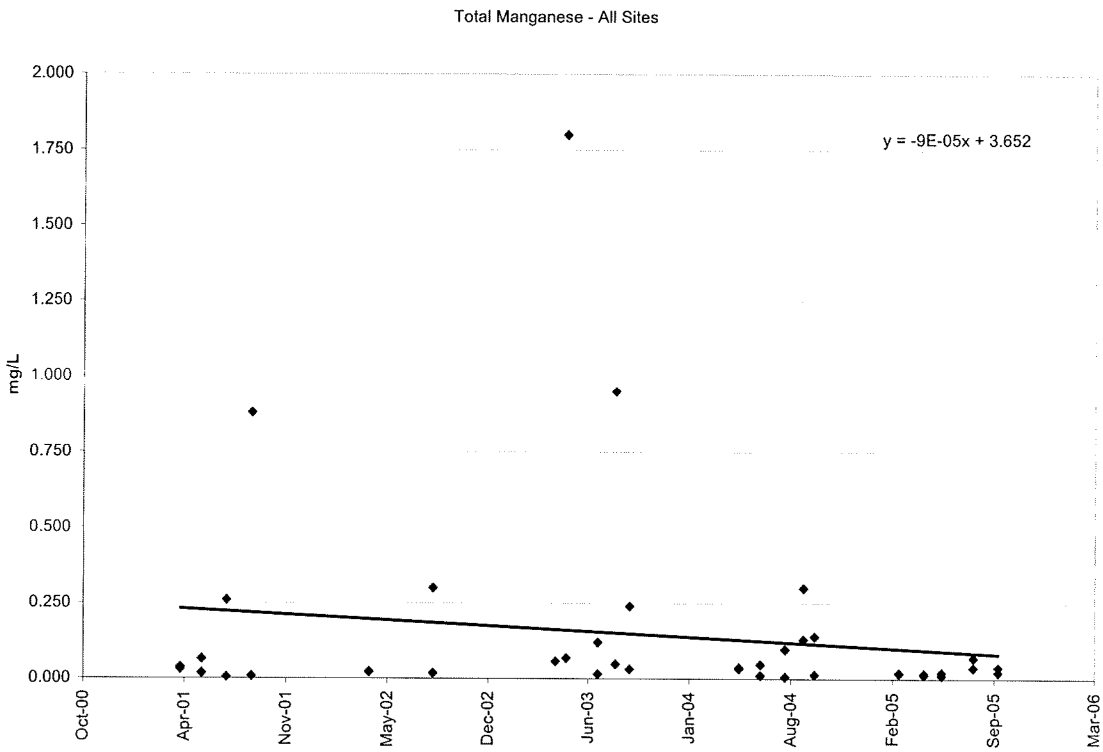
3.3.13 Alachlor

The data for Alachlor at all sites appears in Figure 14.

A total of 160 samples were evaluated for the pre-emergence herbicide, Alachlor. All values observed were less than the detection limit (approximately 0.05 ug/L. The plotted data are the reporting limits. These varied from sample to sample between 1.0 and 1.3 ug/L dependent on the volume available for analysis. The data did not support use of a trendline and no descriptive statistics appear below the plotted values.

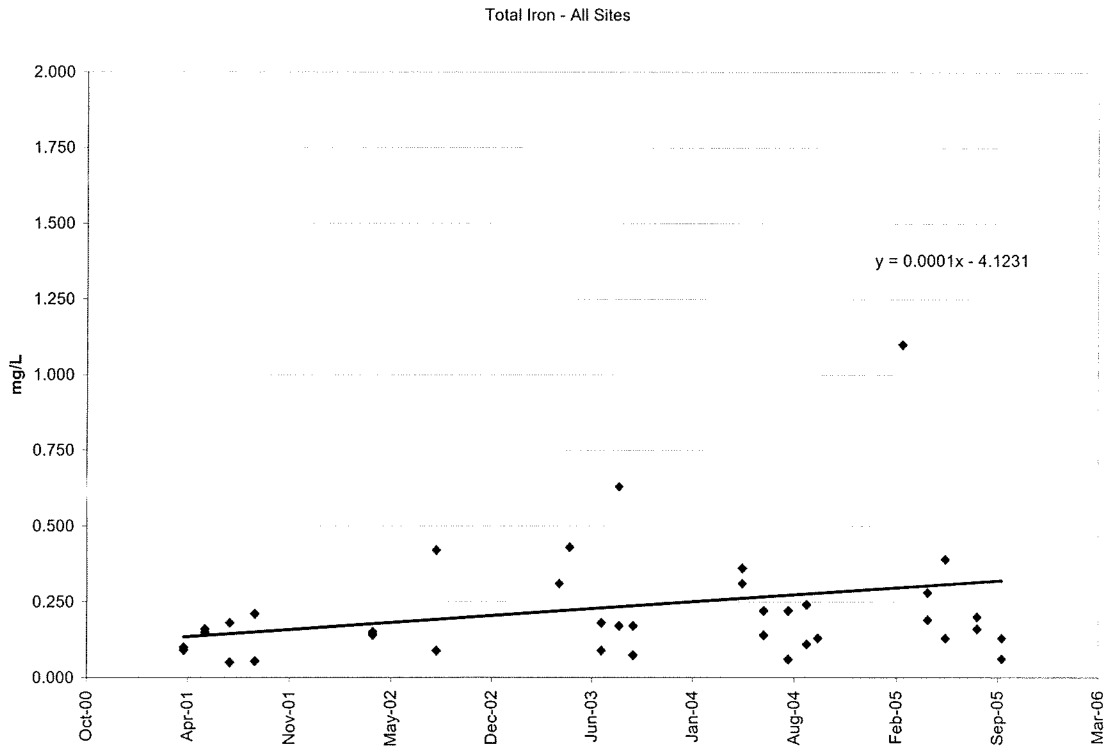
Because this compound is suspected to be carcinogenic a low regulatory limit of 2 ug/L has been set by the USEPA for drinking waters. No standard has been set by Illinois for general use waters.

Figure 12



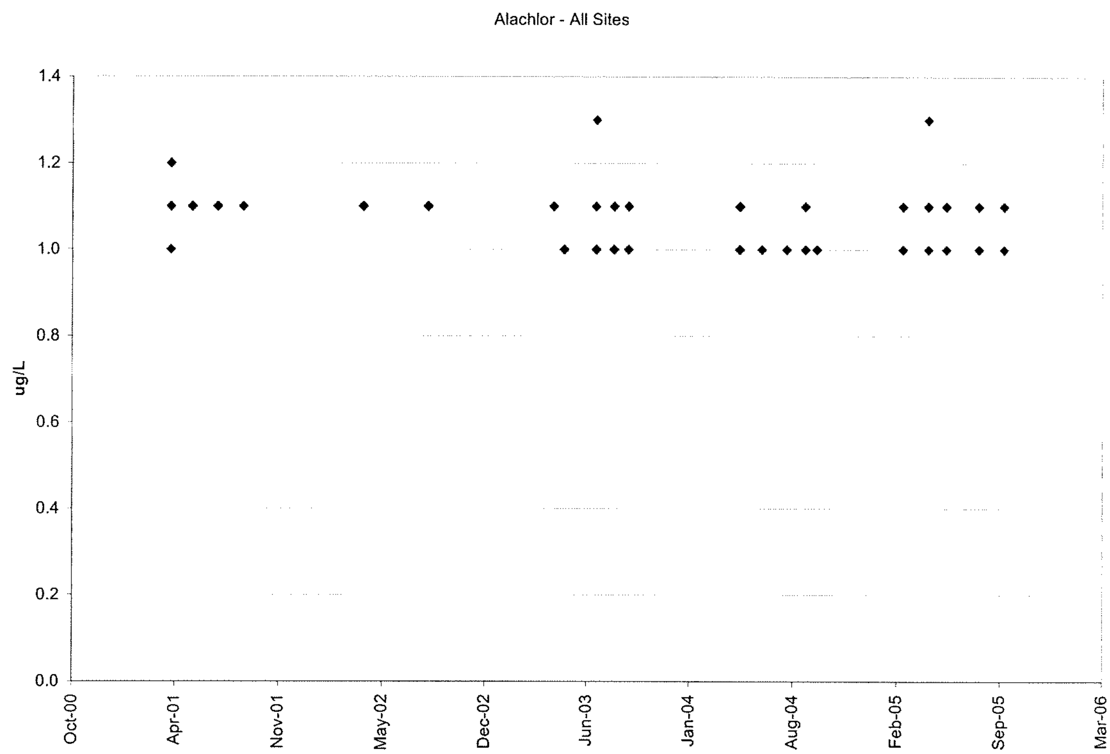
Statistics	Values
Mean	0.15
Standard Error	0.052
Median	0.04
Mode	0.037
Standard Deviation	0.33
Sample Variance	0.1
Kurtosis	16.19
Skewness	3.85
Range	1.8
Minimum	0.01
Maximum	1.80
Sum	6
Count	41

Figure 13



Statistics	Values
Mean	0.99
Standard Error	0.749
Median	0.17
Mode	0.13
Standard Deviation	4.79
Sample Variance	23.0
Kurtosis	40.79
Skewness	6.38
Range	30.9
Minimum	0.05
Maximum	30.90
Sum	40
Count	41

Figure 14



Alachlor - All Sites
ug/L
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Oct-00
Apr-01
Nov-01
May-02
Dec-02
Jun-03
Jan-04
Aug-04
Feb-05
Sep-05
Mar-06

3.3.14 Atrazine

The data for Atrazine at all sites appears in Figure 15. The descriptive statistics for those data appear in the table below the plotted values.

A total of 167 samples were analyzed for the herbicide, Atrazine. The reporting limit for this compound varied from sample to sample between 1.0 and 1.4 ug/L. A total of 106 of the values obtained were below the detection limit. These values do not appear in the data plot.

Of the remaining observations, 61 values were above the detection limit. Thirty-one of those were below the reporting limit and are, by convention, estimated values. The plot in Figure 15 shows these estimated values and those above reporting limits. The presence of the compound has had no significant effect on water quality in Shelbyville Lake

Because this compound is suspected to be carcinogenic a low regulatory limit of 3 ug/L has been set by the USEPA for drinking waters. No standard has been set by Illinois for general use waters.

3.3.15 Chlorophyll

The data for chlorophyll at all sites appears in Figure 16. The descriptive statistics for those data appear in the table below the plotted values.

Chlorophyll is the photosynthetic pigment present in all plant except the fungi and bacteria. There are three forms of the pigment, chlorophyll A, B and C. The concentration of chlorophyll is an indicator of the rate of formation of organic carbon in the plant bodies from atmospheric carbon dioxide.

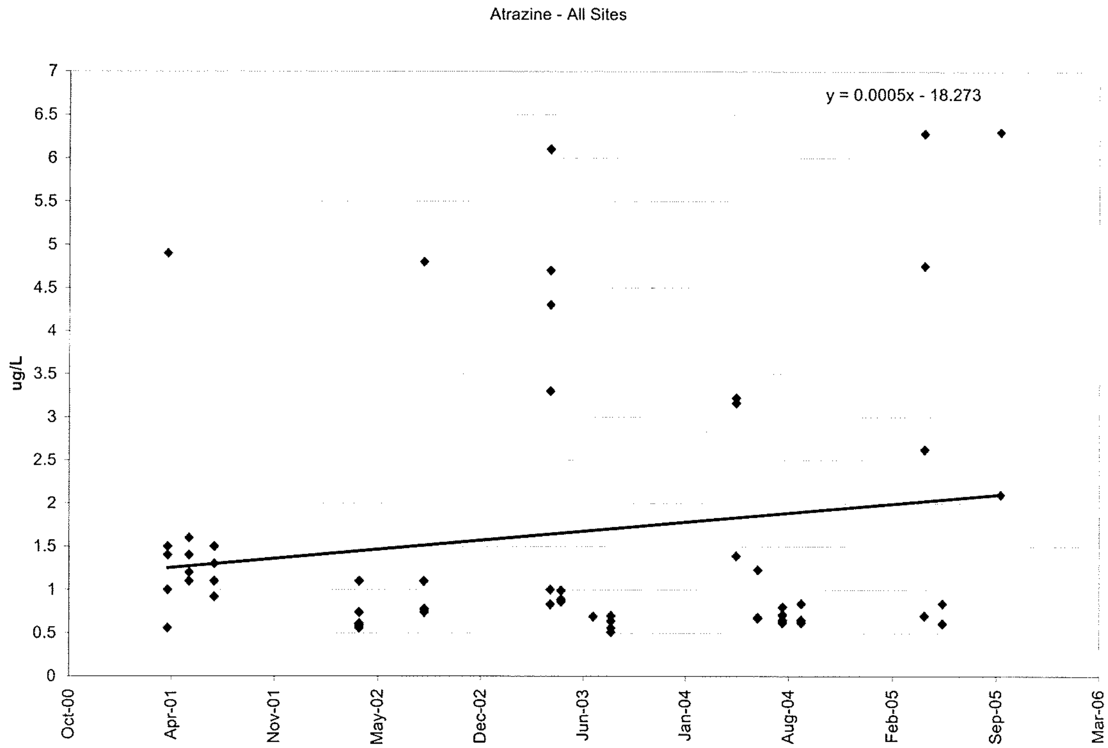
There is no regulatory limit for chlorophyll. The values from previous studies and the one described herein are highly similar. The mean and median values for the property were within a few points and there was an increasing trendline in the data. Evaluation of data indicates an increase in primary productivity in lake waters.

3.3.16 Pheophytin

The data for pheophytin at all sites appears in Figure 17. The descriptive statistics for those data appear in the table below the plotted values.

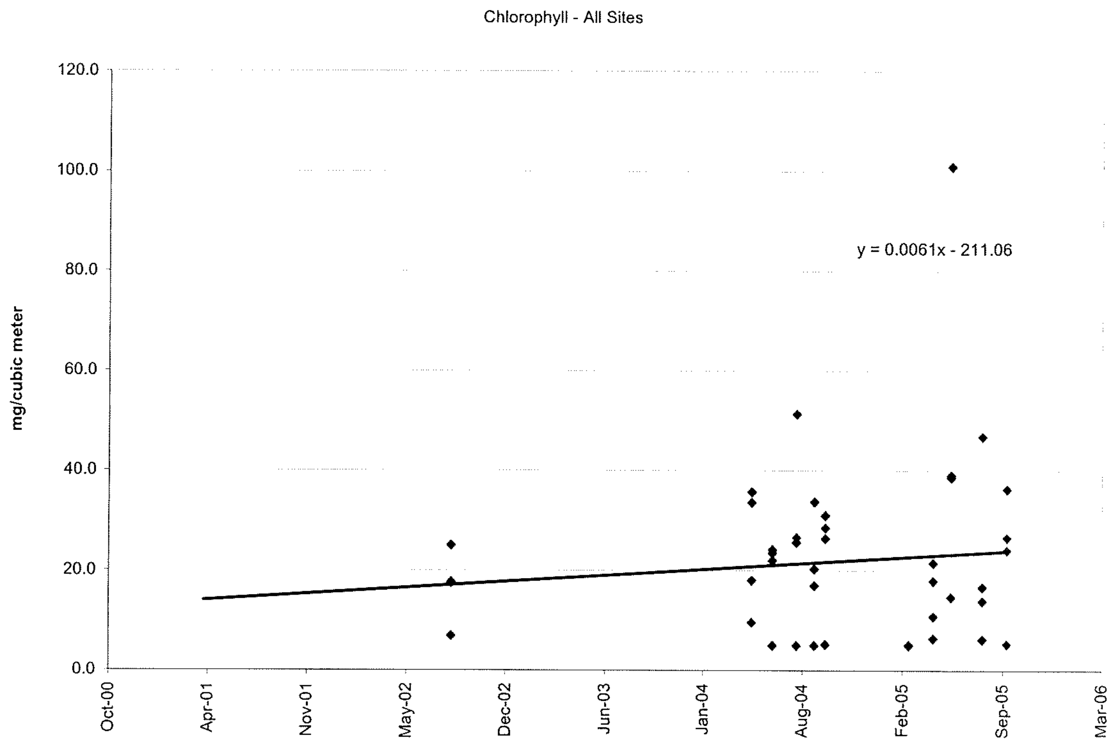
Pheophytin is a photosynthetic pigment and degradation product of chlorophyll. It is a general indicator of the health of the chlorophyll available in the system. There is no regulatory limit for the compound.

Figure 15



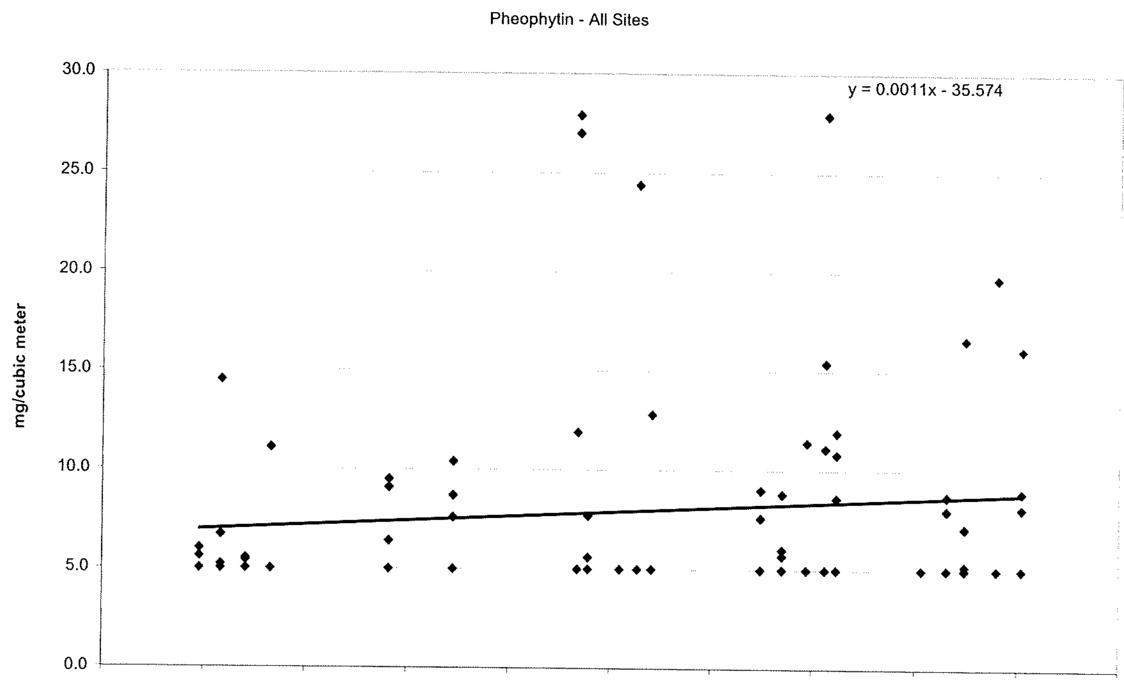
Statistics	Values
Mean	1.64
Standard Error	0.201
Median	0.99
Mode	1.1
Standard Deviation	1.57
Sample Variance	2.5
Kurtosis	2.31
Skewness	1.85
Range	5.8
Minimum	0.51
Maximum	6.30
Sum	100
Count	61

Figure 16



Statistics	Values
Mean	21.82
Standard Error	2.620
Median	19.15
Mode	5
Standard Deviation	17.38
Sample Variance	302.0
Kurtosis	8.99
Skewness	2.32
Range	96.0
Minimum	5.00
Maximum	101.00
Sum	960
Count	44

Figure 17



Statistics	Values
Mean	7.96
Standard Error	0.573
Median	5.20
Mode	5
Standard Deviation	5.28
Sample Variance	27.9
Kurtosis	6.07
Skewness	2.47
Range	22.9
Minimum	5.00
Maximum	27.90
Sum	677
Count	85

As with chlorophyll, data from the current and previous studies are highly similar with the average and median values in good agreement. Pheophytin was not detected in a significant number of samples. Those occasions are shown on the at 5 mg/cubic meter, the reporting limit for the material. The data strongly indicate that the life cycles in lake waers utilizing photosynthesis are stable and healthy.

3.3.17 Total Organic Carbon

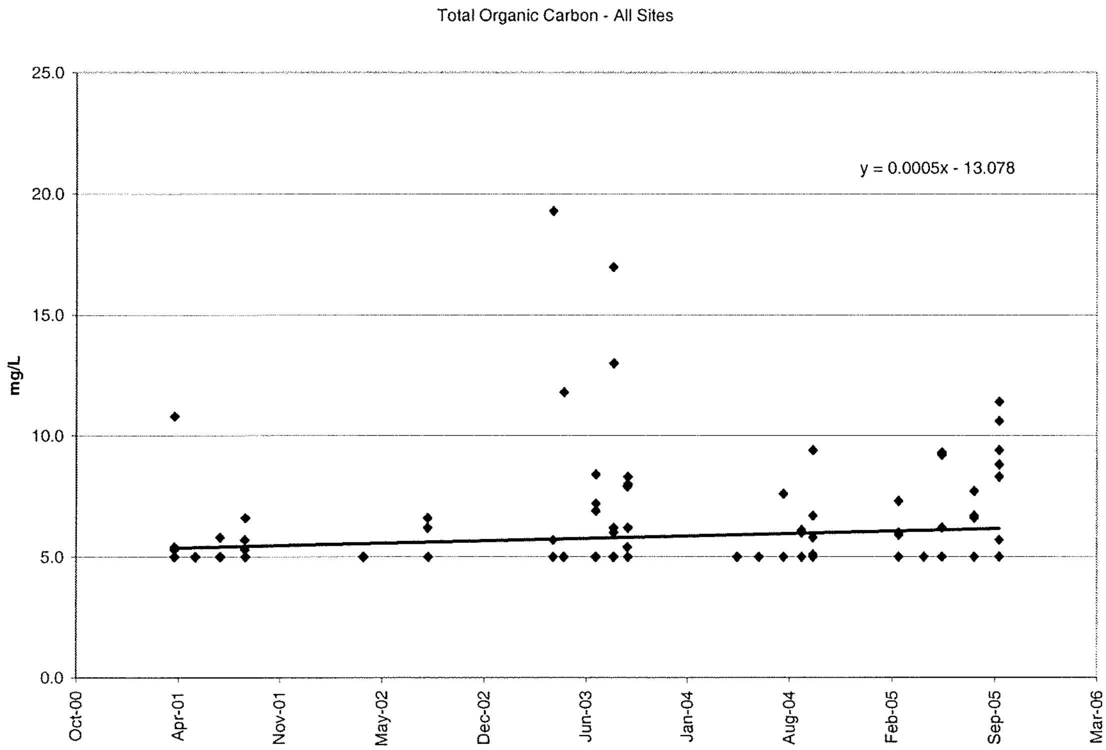
The data for total organic carbon at all sites appears in Figure 18. The descriptive statistics for those data appear in the table below the plotted values.

Total organic carbon measurements are important in water quality monitoring. The measurement provides an index for estimating the levels of toxins, teratogens and other organic materials which may increase the demand for available oxygen in the system.

The values observed at all sites during the current study were an average of 6.9 and a median of 6.4 mg/L. These data strongly suggest that all aspects of dealing with organic materials in Shelbyville Lake are stable and healthy.

There is no regulatory limit set for this property.

Figure 18



Statistics	Values
Mean	5.81
Standard Error	0.155
Median	5.00
Mode	5
Standard Deviation	2.01
Sample Variance	4.0
Kurtosis	18.51
Skewness	3.86
Range	14.3
Minimum	5.00
Maximum	19.30
Sum	970
Count	167

3.4 Individual Sites

3.4.1 Overview

Surface waters from seven sites and subsurface water from one site were evaluated during performance of the subject study. The locations of these sites are shown in Figure 1, above. As noted: SVL-1-0, -2-0, and -2-10 are located on the lower portions of the lake near the dam; SVL-4-0 is located on the upper reaches of the easternmost part of the lake near Illinois 32; and SVL-11-0 and -15-0 on the upper reaches of the northernmost portion of the lake. Sites SVL-7 and -9 are off-lake and are located in watershed areas to the north and east, respectively.

In the text below the data are compared between sites and to the values found at all sites. Plots of the levels found for properties evaluated at each site appear in Appendix 1. Two statistics (average and median) calculated from those data appear in Table 2.

As review of that table and the plots of the data acquired during the study shows water quality values in samples taken from the body of the lake were generally nominal. The exceptions to that trend are noted in the paragraphs below. Those exceptions are often associated with the values found in the watershed run-off in Sites 7 and 9.

3.4.2 Chemical/Physical Properties

3.4.2.1 Dissolved Oxygen

The profile of dissolved oxygen was similar at all sites. Mean and median levels and trend lines were essentially flat

3.4.2.2 pH

The profile of pH was also reasonably constant at all sites. In all cases, trend lines were flat.

3.4.2.3 Oxidation-Reduction Potential (ORP)

When data from all sites were considered (see Figure 4) there was a substantial, time related reduction in ORP of approximately 10% for each 5 months of the study period. The slope of trend lines for individual sites was similar and the mean and median of observed values at each of the sites were in general agreement.

Table 2 – Site Specific Statistics

		1	11	15	2	2-10	4	7	9
Dissolved Oxygen (mg/L)	mean	7.50	7.51	---	6.72	4.29	6.60	5.90	5.34
	median	7.5	8.74	---	6.4	6.4	6.65	5.74	4.9
pH	mean	7.78	8.53	---	8.18	7.93	8.32	7.88	7.70
	median	7.90	8.47	---	8.19	7.89	8.23	7.93	7.54
ORP (mv)	mean	251	247	---	235	225	231	272	262
	median	249	228	---	206	248	202	238	271
Conductivity (uS/cm)	mean	449	429	---	428	447	509	651	590
	median	456	378	---	427	434	486	649	630
TSS (mg/L)	mean	7.4	18	19	4.9	20	39	45	31
	median	6.2	17	15	4.4	6.4	39	39	21
VSS (mg/L)	mean	2.2	5.3	5.5	1.9	3.4	8.2	6.8	5.3
	median	2.0	5.5	5.4	1.9	2.2	8.4	6.3	2.8
Total Phosphorus (mg/L)	mean	0.080	0.124	0.141	0.058	0.141	0.283	0.265	0.197
	median	0.057	0.120	0.120	0.038	0.046	0.300	0.235	0.120
Soluble Phosphorus (mg/L)	mean	0.029	0.028	0.033	0.028	0.028	0.083	0.095	0.060
	median	0.010	0.010	0.010	0.010	0.010	0.068	0.092	0.029
Nitrate (mg/L)	mean	3.64	4.25	4.13	3.87	3.94	4.27	4.95	5.64
	median	3.10	3.90	2.95	2.80	2.90	4.20	5.65	7.10
Ammonia (mg/L	mean	0.304	0.055	0.062	0.081	0.131	0.095	0.073	0.076
	median	0.150	0.039	0.033	0.052	0.050	0.049	0.045	0.054
Manganese (mg/L	mean	0.171	---	---	---	0.125	---	---	---
	median	0.065	---	---	---	0.019	---	---	---
Iron (mg/L	mean	0.289	---	---	---	1.72	---	---	---
	median	0.210	---	---	---	0.135	---	---	---
Alachlor (ug/L	mean	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	median	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Atrazine (ug/L	mean	0.821	1.80	1.79	0.792	---	2.60	1.23	4.80
	median	0.700	1.23	1.17	0.740	---	1.39	1.05	4.80
Chlorophyll (mg/cu.m)	mean	---	22	23	6.8	---	36	---	---
	median	---	22	24	5.3	---	34	---	---
Pheophytin (mg/L)	mean	---	6.7	7.8	5.0	---	12	---	5.0
	median	---	6.0	5.5	5.0	---	11	---	5.0
TOC (mg/L)	mean	5.3	5.6	5.5	5.4	6.6	5.9	5.3	6.8
	median	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

3.4.2.4 Conductivity

Trend lines were essentially flat for all sites excepting SVL-7 and SVL-9 where there was an upward slope observed over the course of the study. Mean and median values at those two sites were somewhat higher (approximately 600 uS/cm) than those at on-lake sites. Those increases may be related to increased agricultural or land development activities in the areas drained.

3.4.3 Total and Volatile Suspended Solids

Suspended solids values were reasonable and in general agreement at all on-lake sites except for SVL-4-0 where an increase was observed and SVL-1-0 where values were lower. The ratio of total suspended solids to volatile suspended solids was approximately 3:1 at all sites excepting SVL-4-0 and in the subsurface samples taken at Site-2-10. The higher values of that ratio in surface samples at SVL-4, -7 and -9 suggest increased erosion of soils without a corresponding rise in the levels of plant wastes.

3.4.4 Nutrients

As shown in tables below, date related patterns of variation in the observed levels of some nutrients were noted in the data acquired during the study. These variations may be related to agricultural activity in the area.

3.4.4.1 Phosphorus

As already noted, total phosphorus values in all locations in the lake are above Illinois regulations for general use waters by factors of two to almost 5. Of all sites, the highest averages for total phosphorus were found at SVL-4-0 and the two off-lake sites.

As shown in the tables below the total phosphorus observed was relatively constant throughout the years of the study although median levels in 2001and 2002 were approximately half the values noted in 2003 through 2005. Further, in the months of March, May and September, there were increases noted which may have been due to seasonal applications of agricultural chemicals.

By Year	**2001**	**2002**	**2003**	**2004**	**2005**
mean	0.159	0.115	0.170	0.157	0.175
median	0.075	0.098	0.230	0.114	0.146

By Month	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
Mean	0.233	0.158	0.174	0.125	0.125	0.160	0.187
Median	0.240	0.093	0.120	0.105	0.073	0.093	0.140

3.4.4.2 Nitrate

Levels of this compound in lake pose no threat to overall water quality. Although average and median levels were higher in the off-lake sites, the compound generally was present at approximately the same levels in the plot of data from all sites (Figure 10). It is noteworthy that in July a decline begins in the observed values and that decline becomes pronounced in August and September, extending to a decrease in the mean values noted in those months. The changes are probably associated with seasonal agricultural practices.

MAR	APR	MAY	JUN	JUL	AUG	SEP
6.58	7.31	5.81	8.90	4.14	0.95	0.64
6.55	7.90	6.60	8.50	4.15	0.70	0.44

3.4.4.3 Ammonia

Levels of this compound in lake pose no threat to overall water quality. There was general agreement in the levels found in all sites in all years of the study. There were however, increases and/or decreases by factors of approximately 2 to 3 in the mean and median values observed in the months of April, June and August. The most probable cause for those changes is seasonal agricultural practices.

By Month	MAR	APR	MAY	JUN	JUL	AUG	SEP
Mean	0.171	0.063	0.099	0.039	0.061	0.227	0.110
Median	0.180	0.036	0.095	0.030	0.037	0.066	0.062

3.4.5 Organics

3.4.5.1 Herbicides

The levels of the nitrogen-phosphorus herbicides Atrazine and Alachlor were evaluated in samples collected from Shelbyville Lake sites.

As already noted, no concentrations of Alachlor above the detection limit of 0.5 ug/L were detected in any of the samples collected.

Atrazine, however, was observed in samples from several sites at concentrations above the detection limit of 0.5 ug/L but below the reporting limit of approximately 1 ug/L. These values and the higher concentrations found appear in the plots of individual sampling sites. The months when the highest levels were observed were in April, May and June. The lowest were observed in August and September.

3.4.5.2 Chlorophyll/Pheophytin

Chlorophyll levels at sites SVL-4, -11 and -15 were high. High levels of pheophytin were observed only in samples from Site SVL-4. Excepting March, high levels of chlorophyll were noted in all months of the years studied. There was no corresponding change in the concentrations of pheophytin observed except at Site -4-0.

3.4.5.3 Total Organic Carbon (TOC)

Excepting occasional high levels of TOC observed in all samples, most contained less than the minimum detectible level. That situation is reflected in the plots of these data by the heavy concentration of points at the 5 mg/L level. These was no significant difference in this property observed in any particular month or year of the study

4.0 CONCLUSIONS AND RECOMMENDATIONS

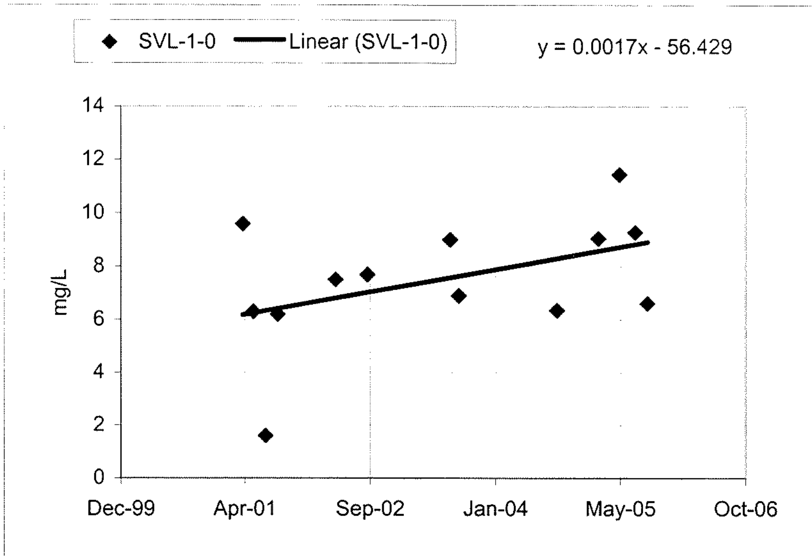
The result of the evaluations in this document are compared in the table below to those described in the referenced previous report

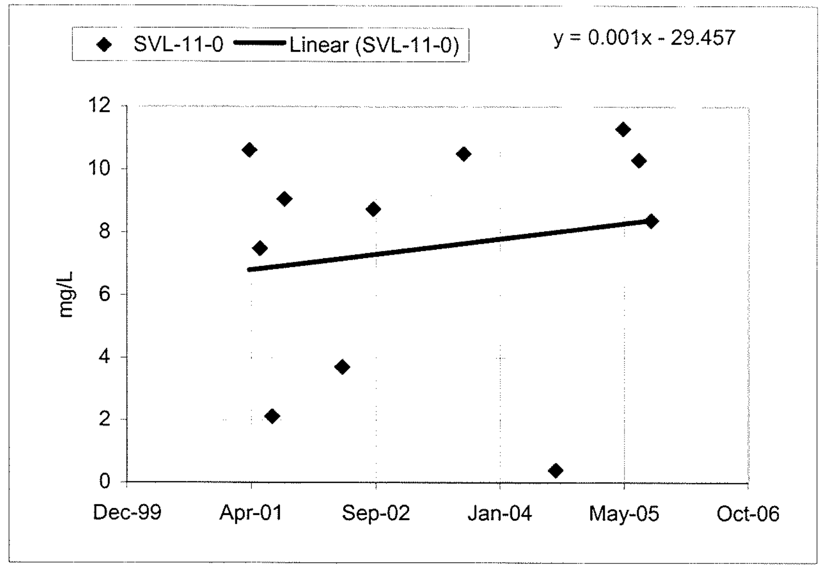
PARAMETER	TREND
Dissolved Oxygen	Stable
pH	Stable
Oxidation Reduction Potential	Improving
Conductivity	Stable
Total Suspended Solids	Stable
Volatile Suspended Solids	Stable
Total Phosphorus	Stable but high
Soluble Phosphorous (ortho-Phosphate)	Stable
Nitrate	Cyclic
Ammonia	Cyclic
Manganese	---
Iron	---
Alachlor	Stable
Atrazine	Cyclic
Chlorophyll	Stable
Pheophytin	Stable
Total Organic Carbon (TOC)	Stable

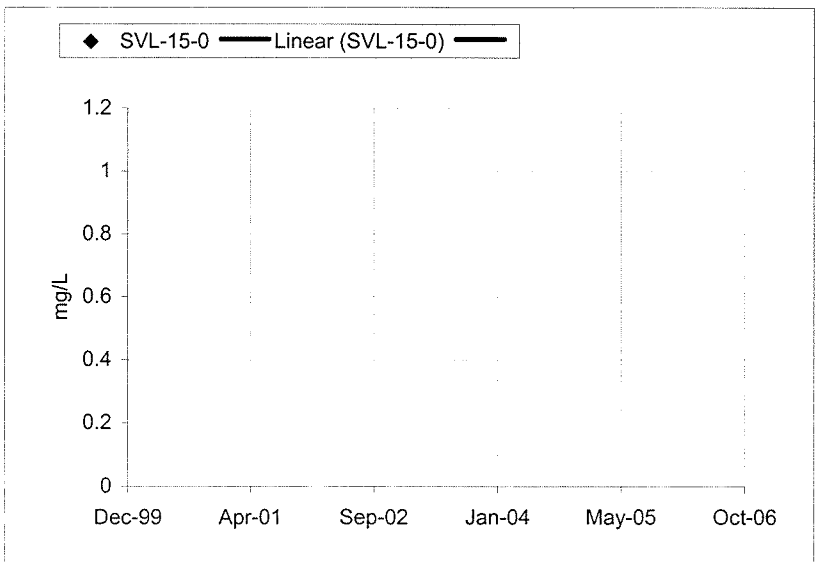
The trends noted suggest that the condition of Shelbyville Lake has improved and is stable. Efforts to achieve better control of the phosphate levels in the system should be considered.

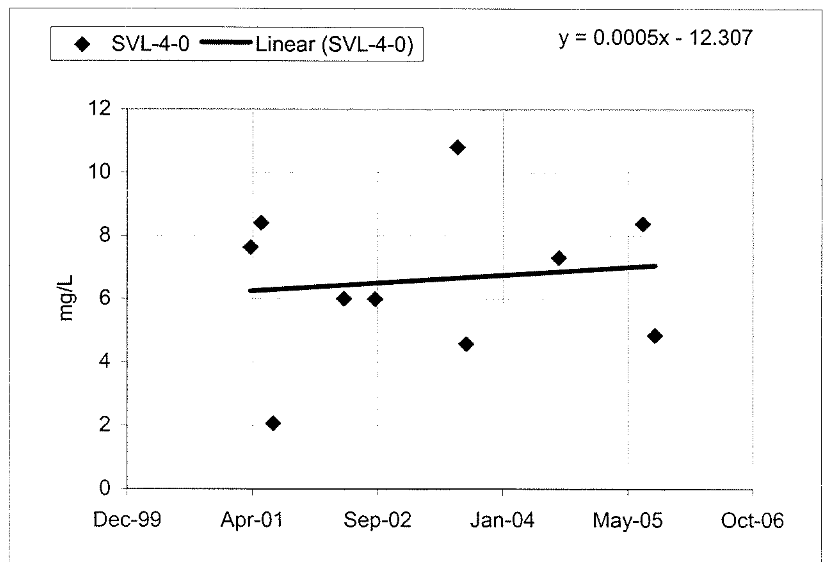
Appendix 1 – Plots of Data Collected from Individual Sample Sites

DIssolved Oxygen

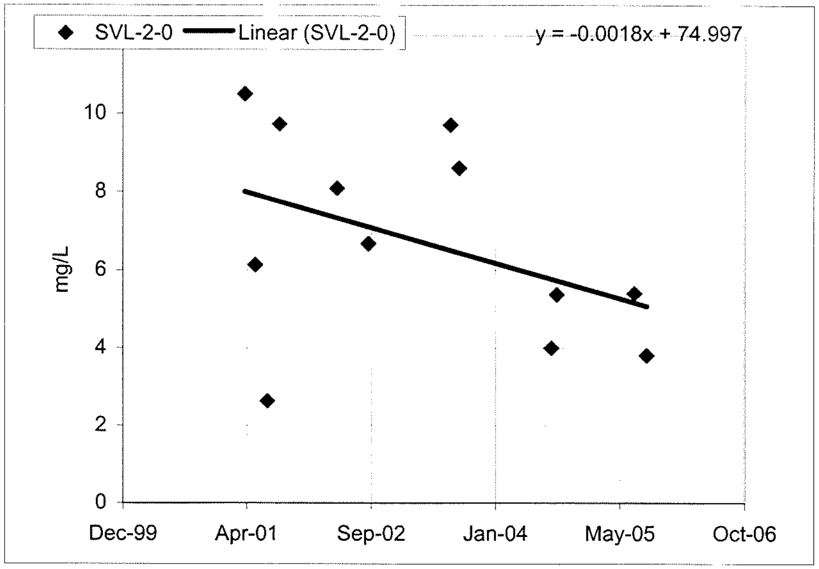


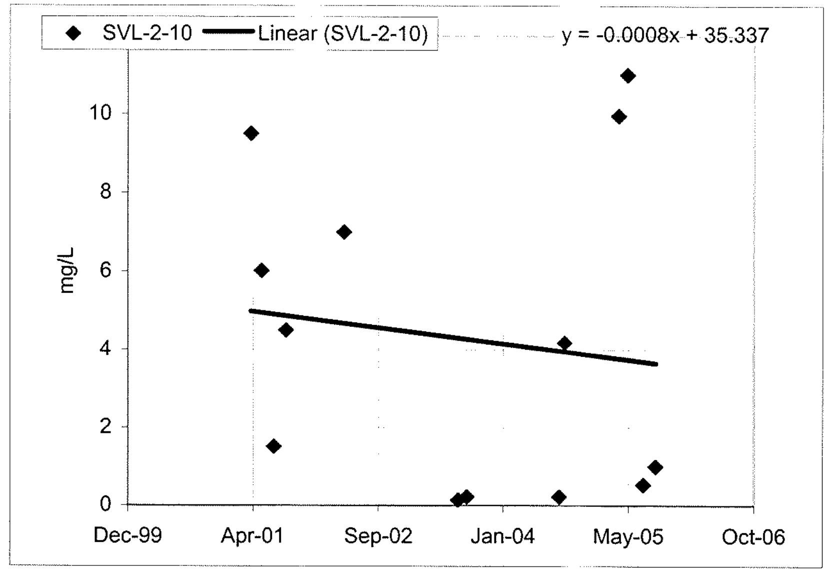


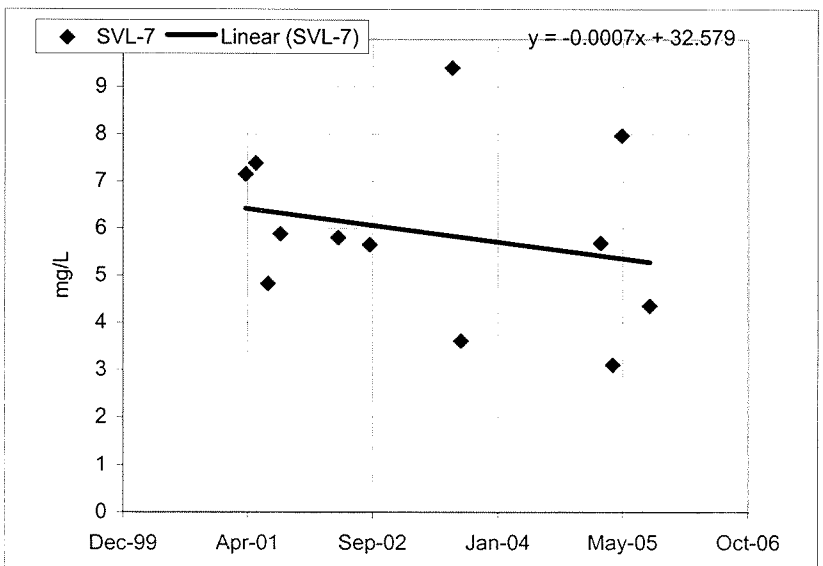


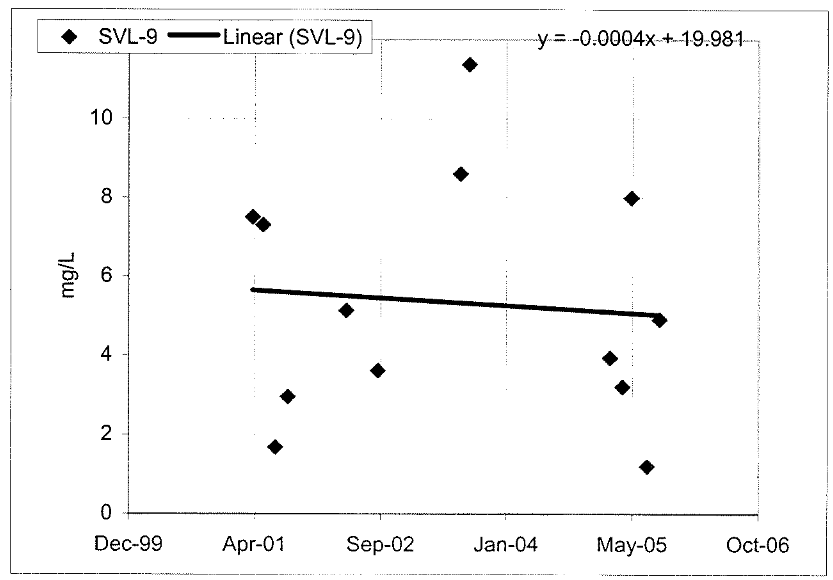


DIssolved Oxygen

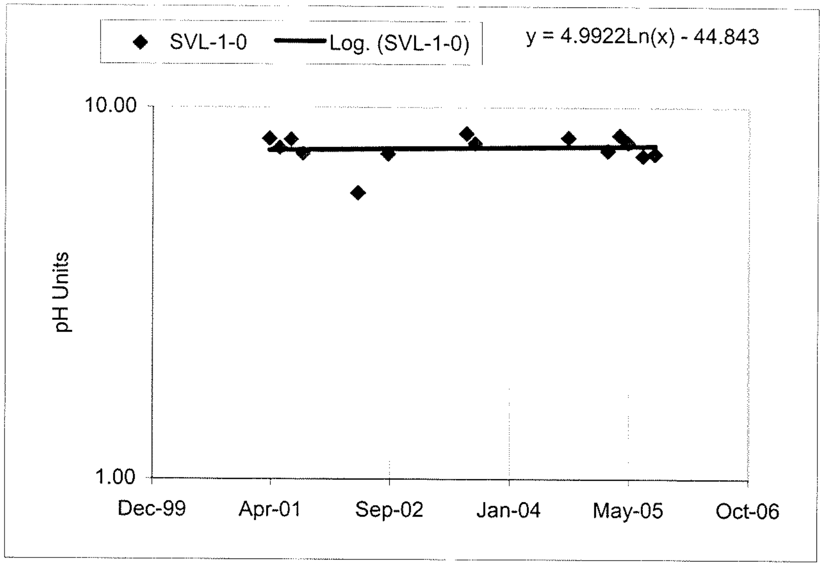


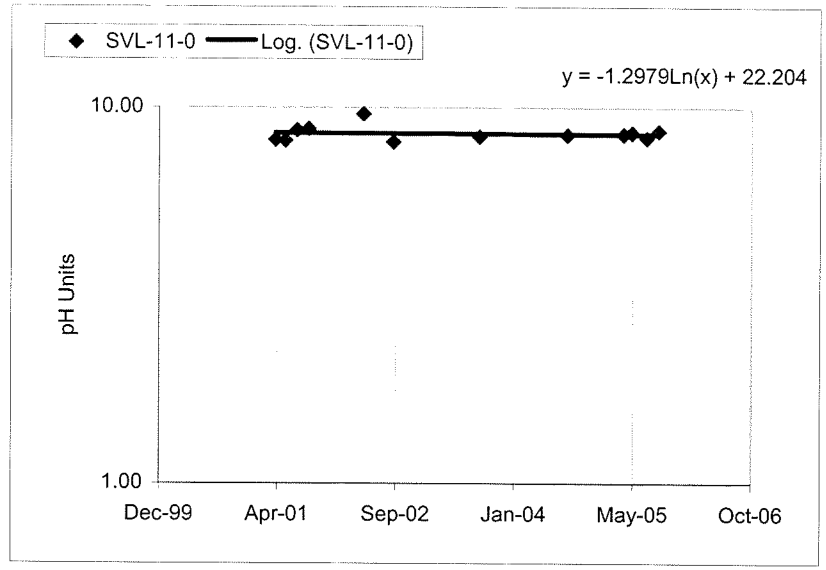


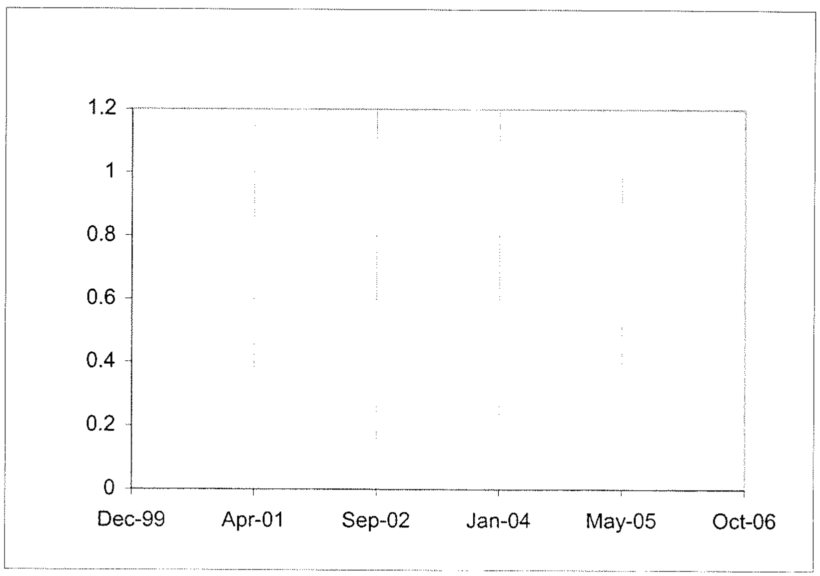


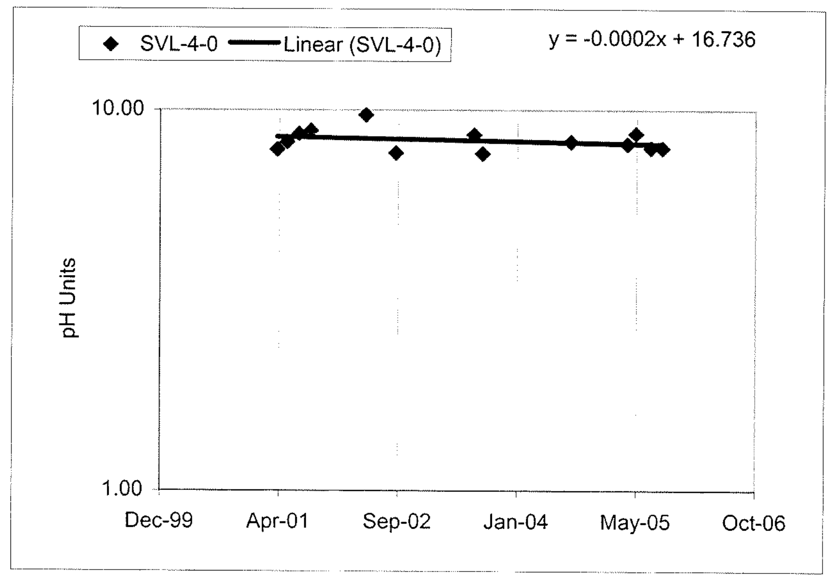


pH

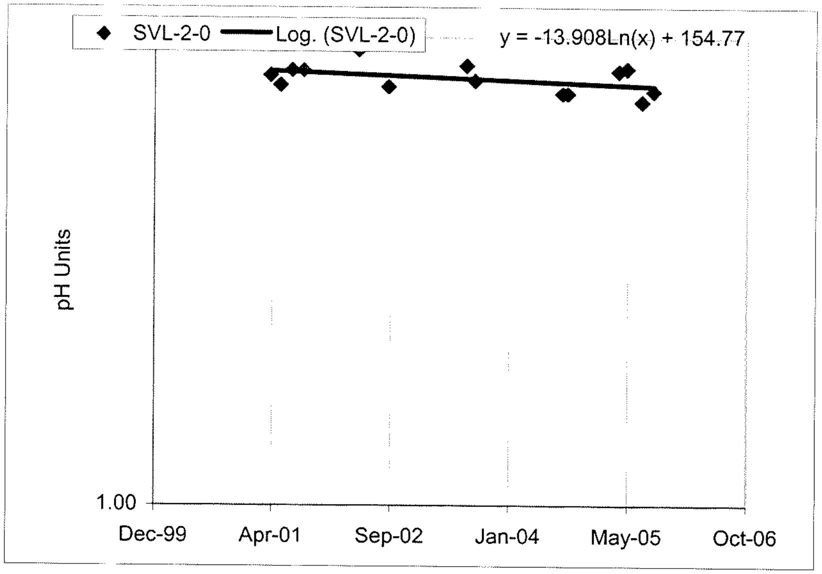

SVL-1-0
Log. (SVL-1-0)
y = 4.9922Ln(x) - 44.843
pH Units
10.00
1.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06


SVL-11-0
Log. (SVL-11-0)
y = -1.2979Ln(x) + 22.204
pH Units
10.00
1.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

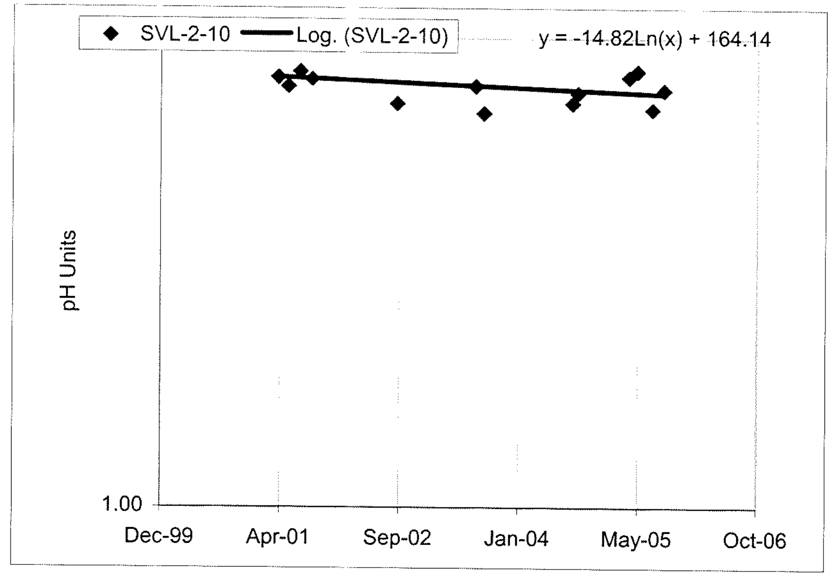

1.2
1
0.8
0.6
0.4
0.2
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06


SVL-4-0
Linear (SVL-4-0)
y = -0.0002x + 16.736
pH Units
10.00
1.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

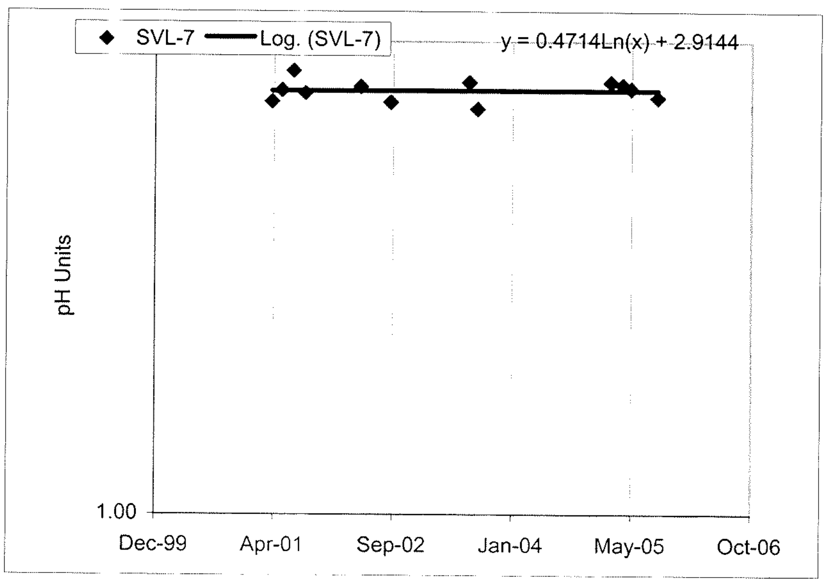
pH



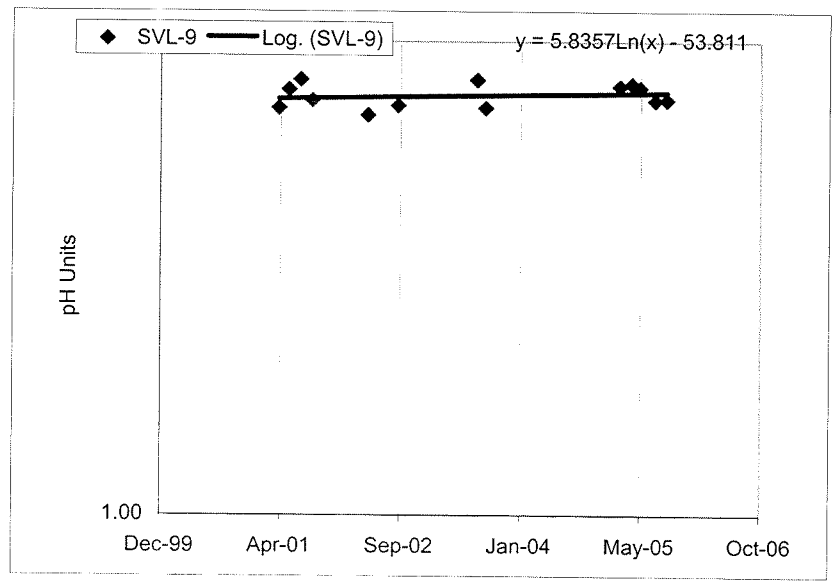
SVL-2-0
Log. (SVL-2-0)
y = -13.908Ln(x) + 154.77
pH Units
1.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06



SVL-2-10
Log. (SVL-2-10)
y = -14.82Ln(x) + 164.14
pH Units
1.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

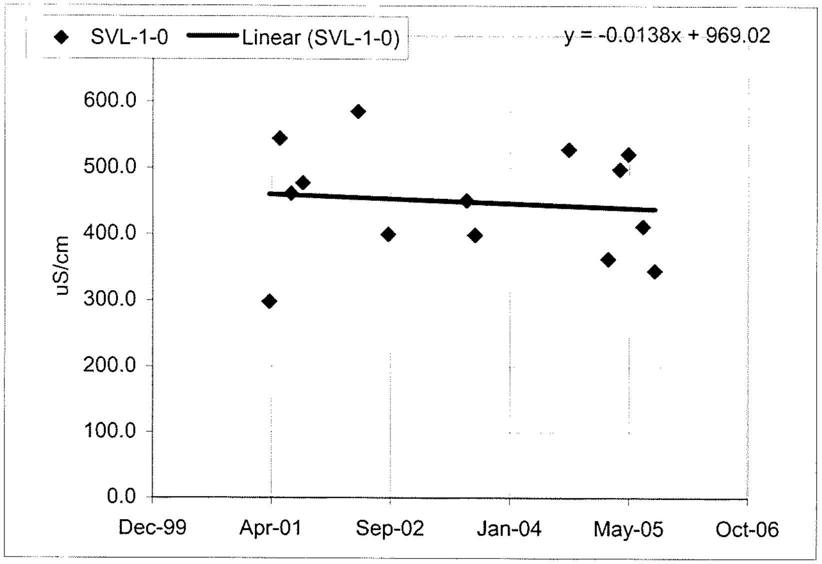


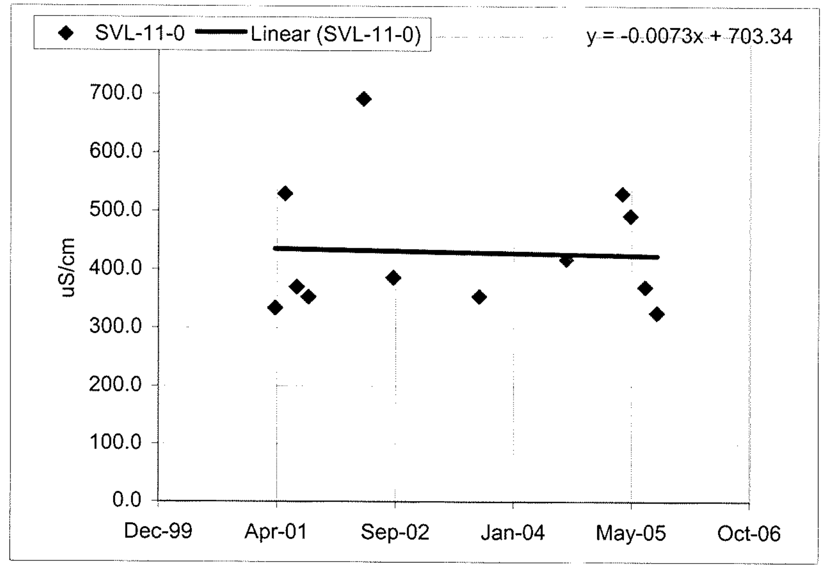
SVL-7
Log. (SVL-7)
y = 0.4714Ln(x) + 2.9144
pH Units
1.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

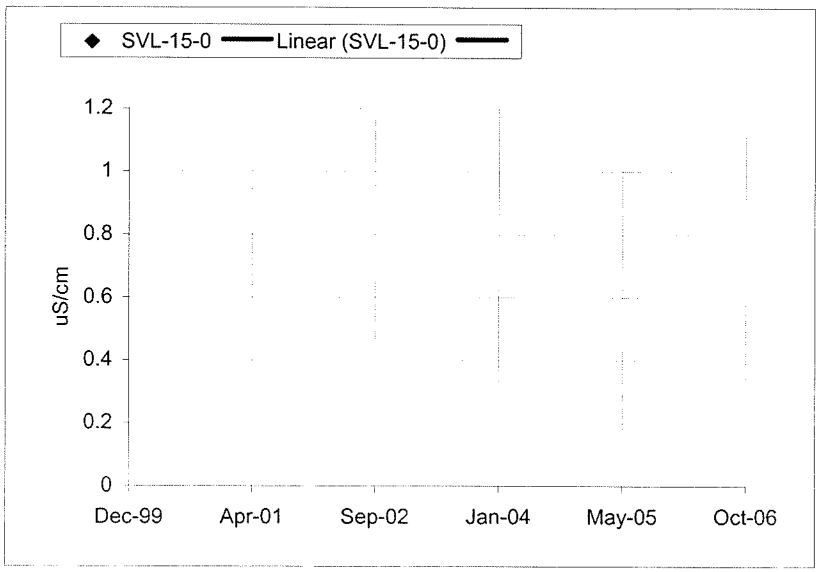


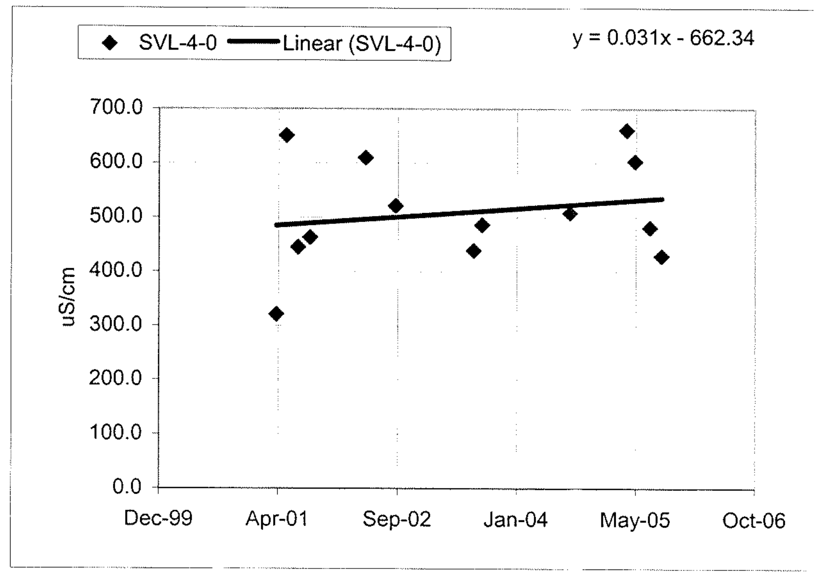
SVL-9
Log. (SVL-9)
y = 5.8357Ln(x) - 53.811
pH Units
1.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

Conductivity

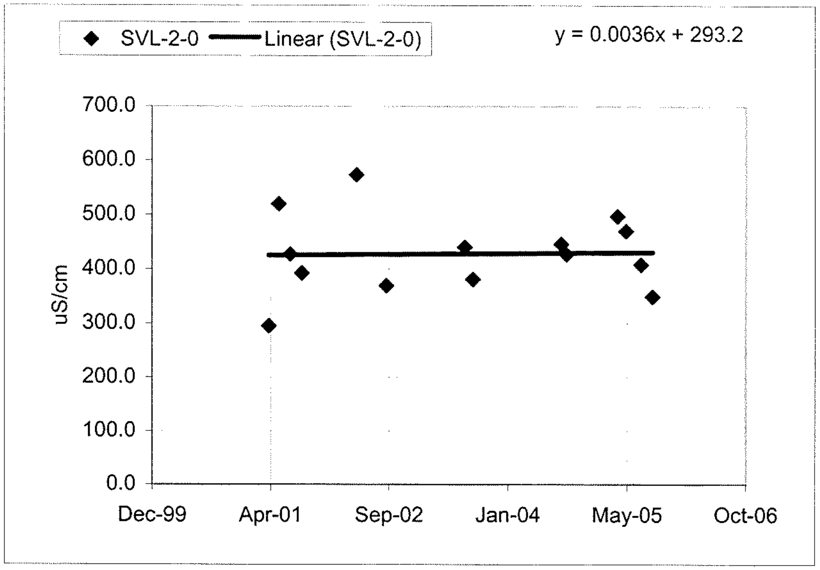


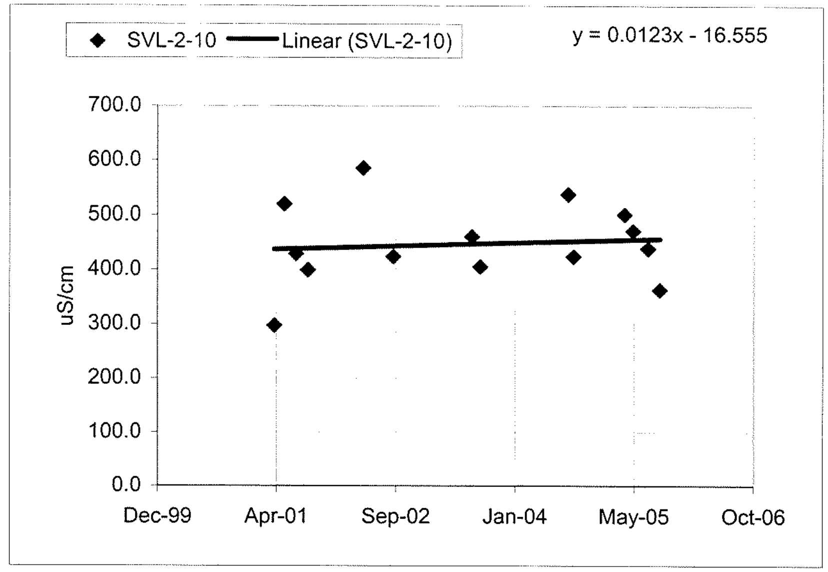


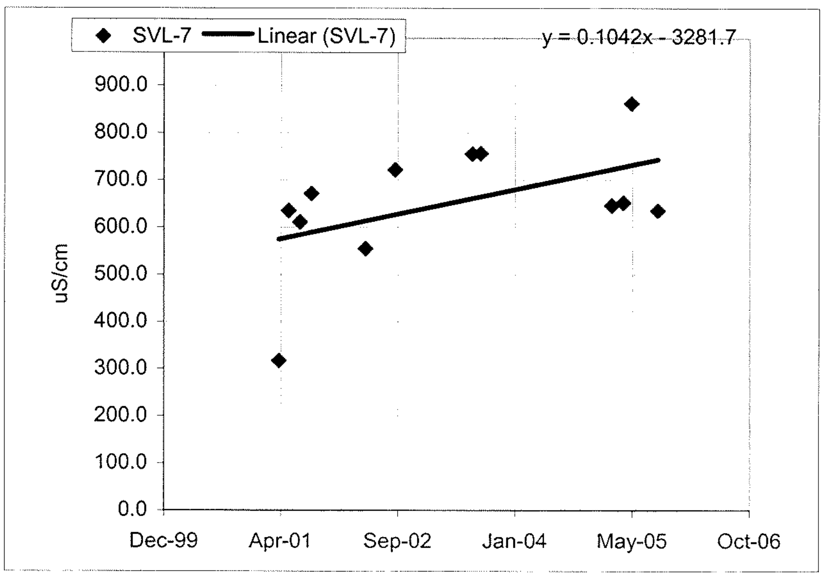


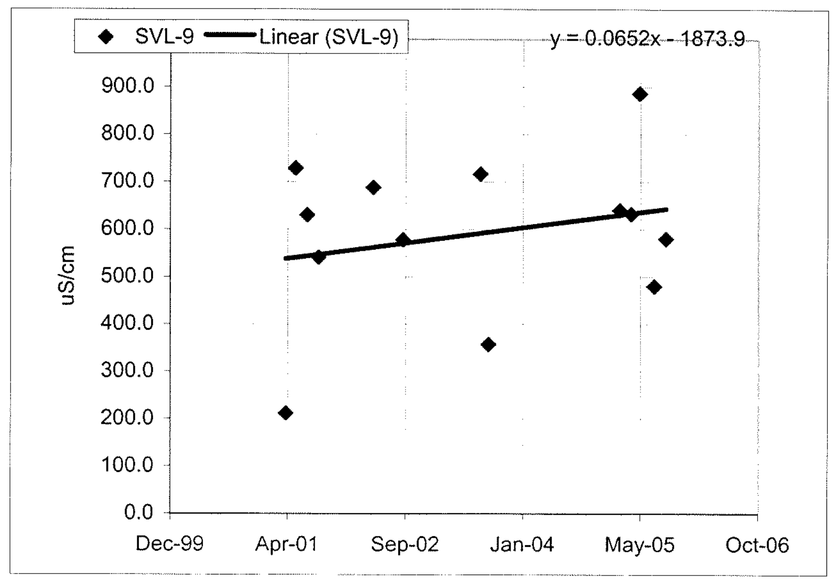


Conductivity

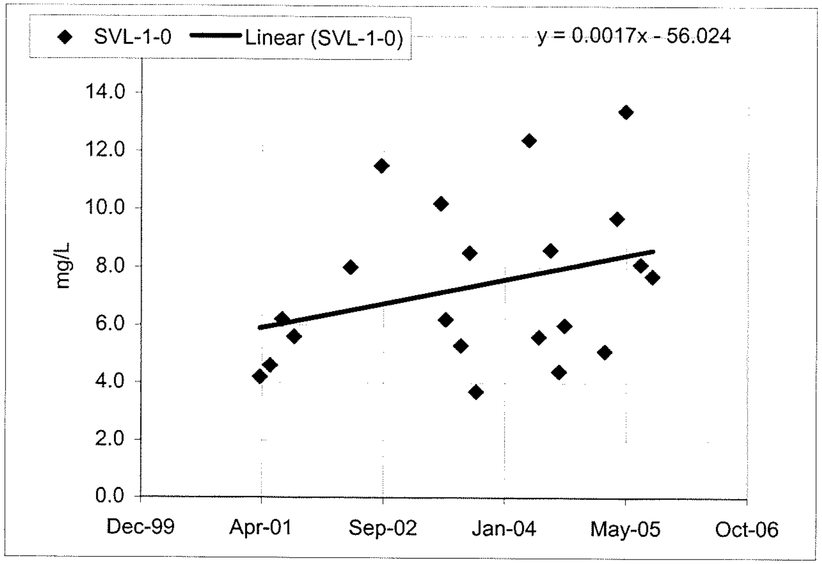


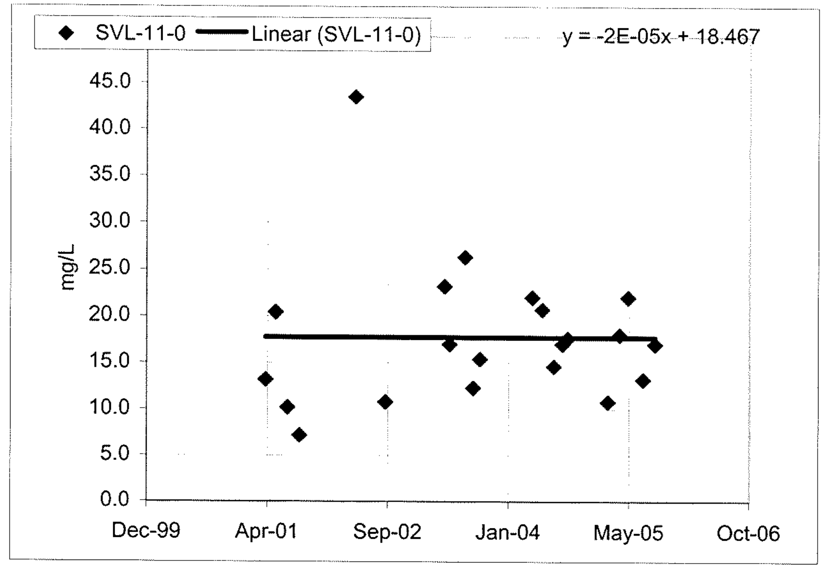


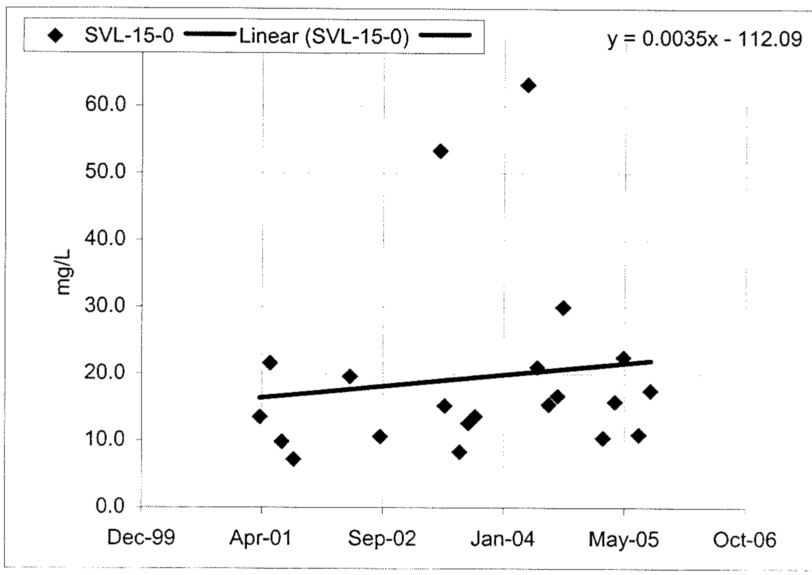


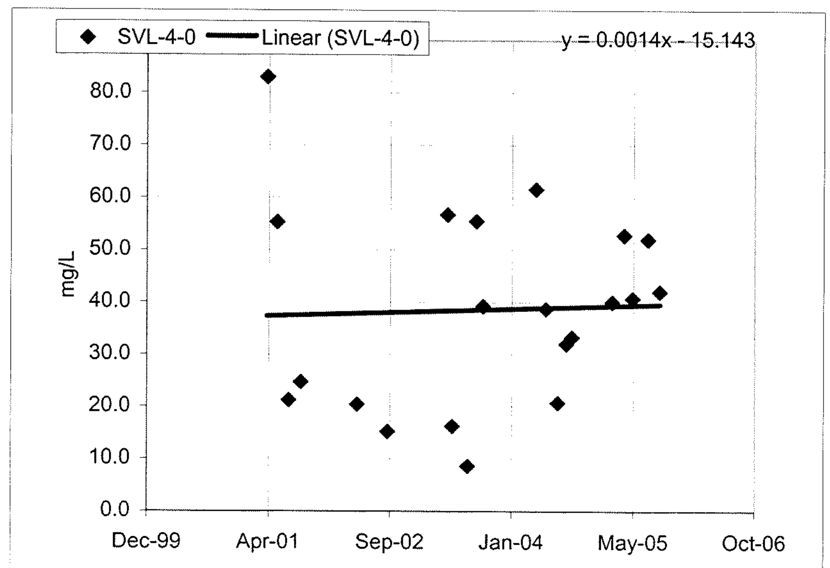


Total Suspended Solids (TSS)

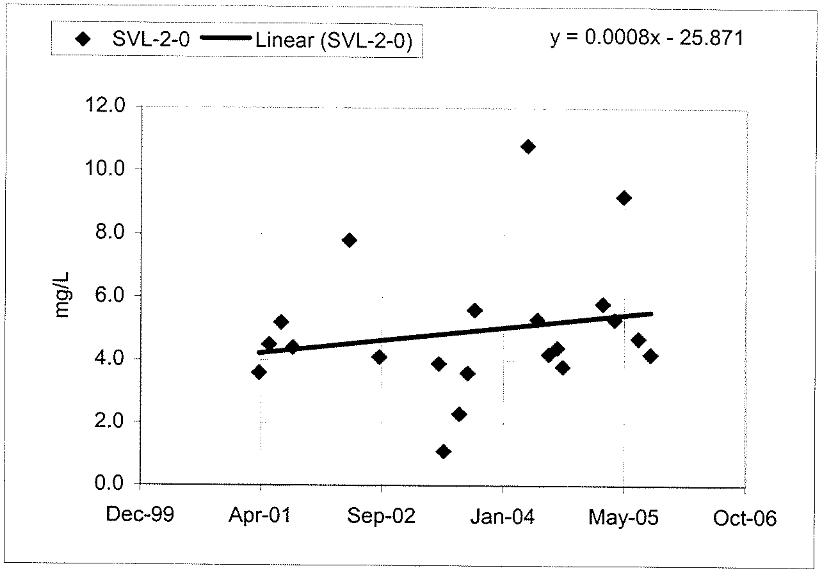


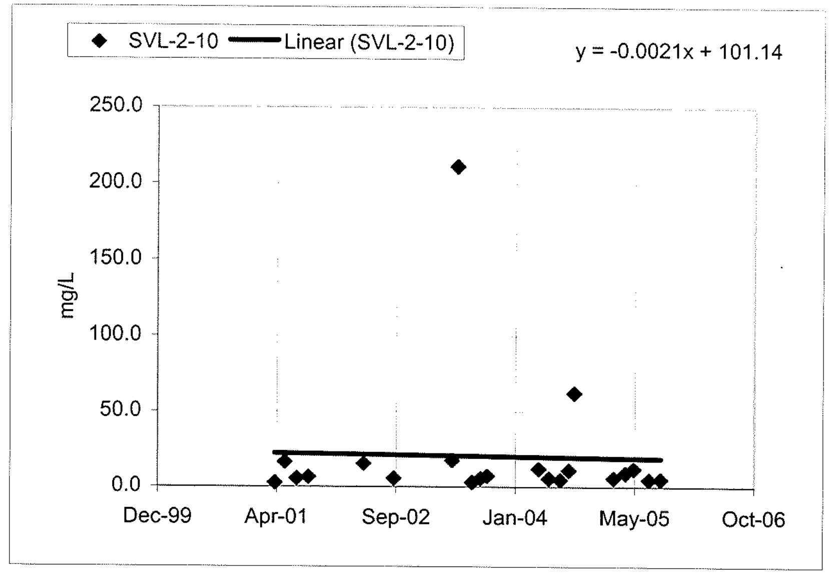


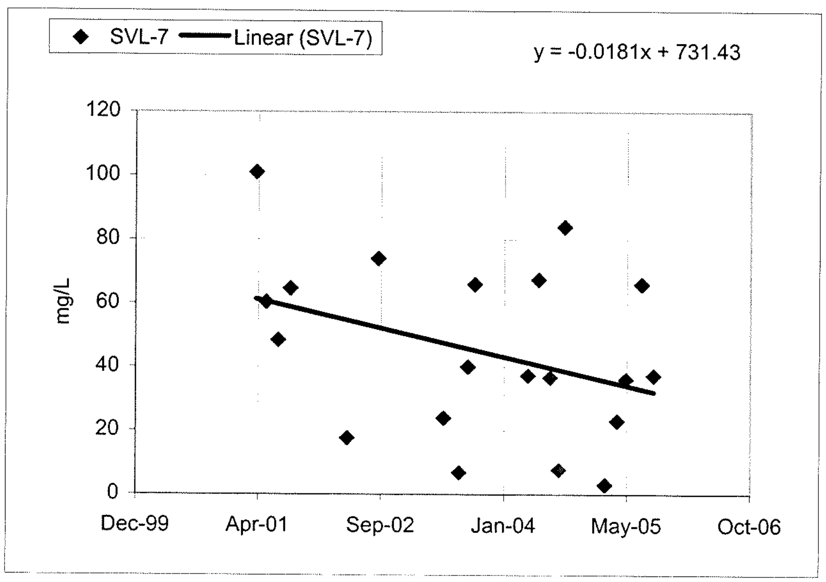


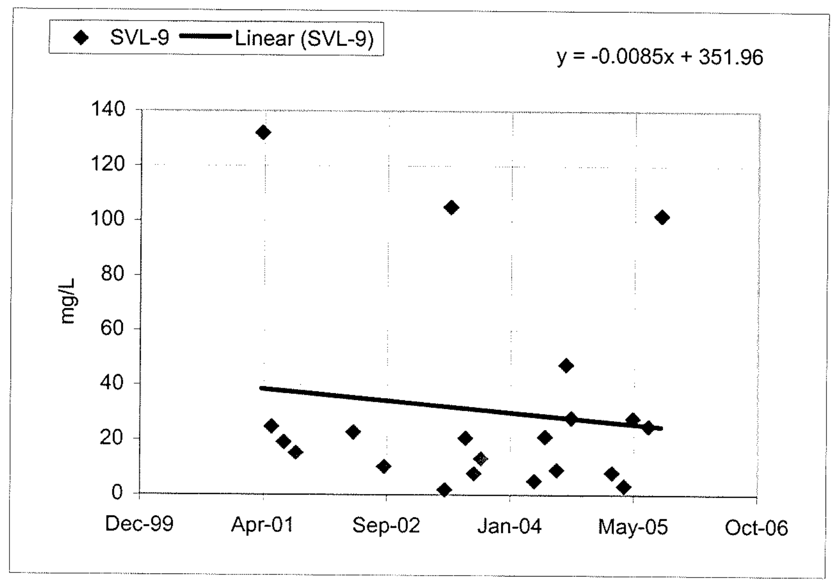


Total Suspended Solids (TSS)

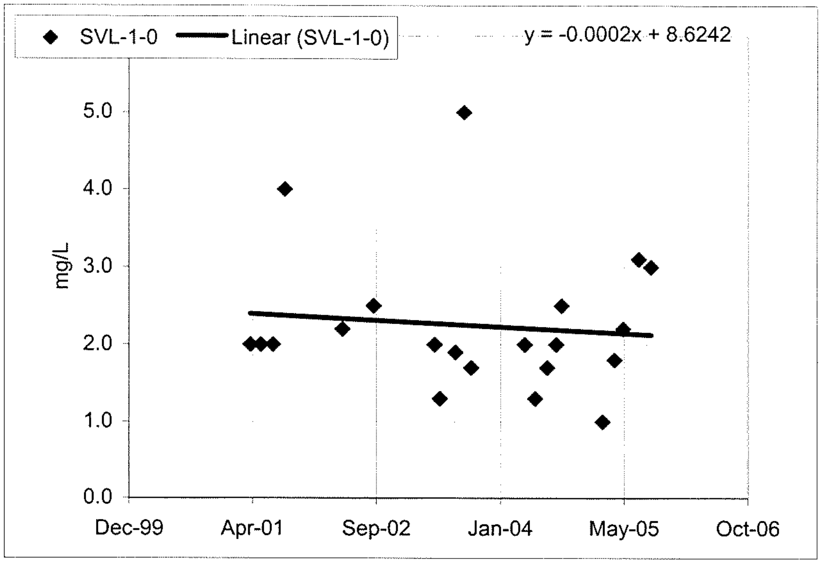


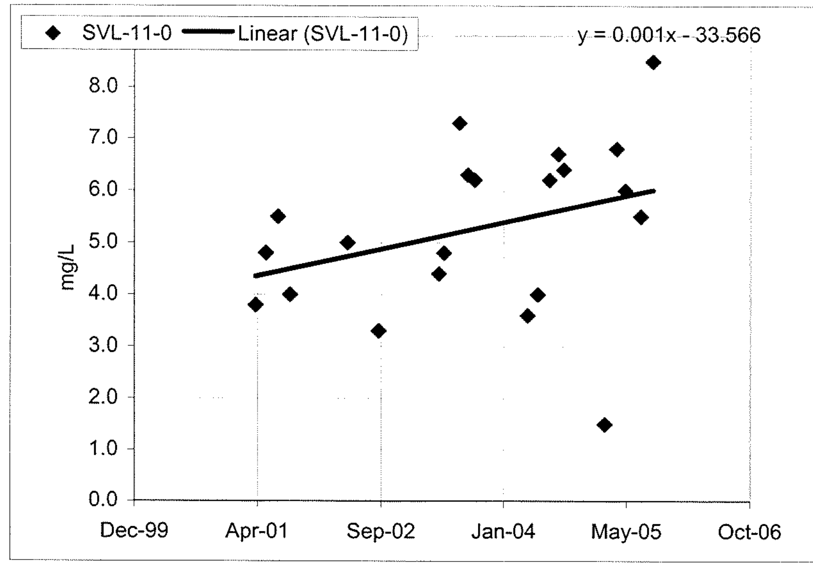


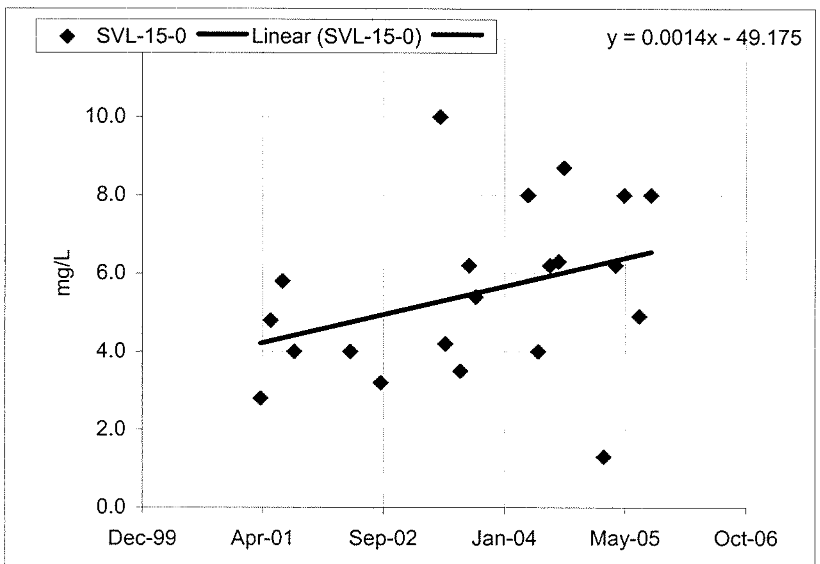


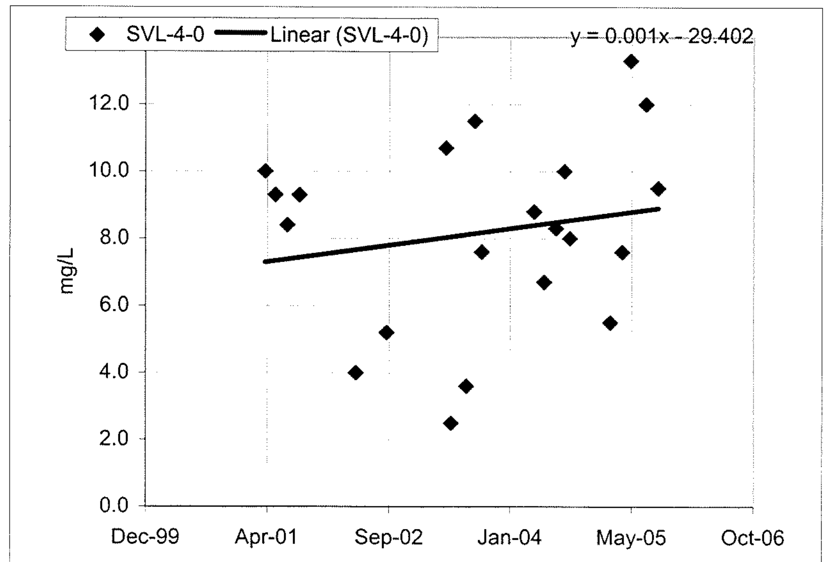


Volatile Suspended Solids (VSS)

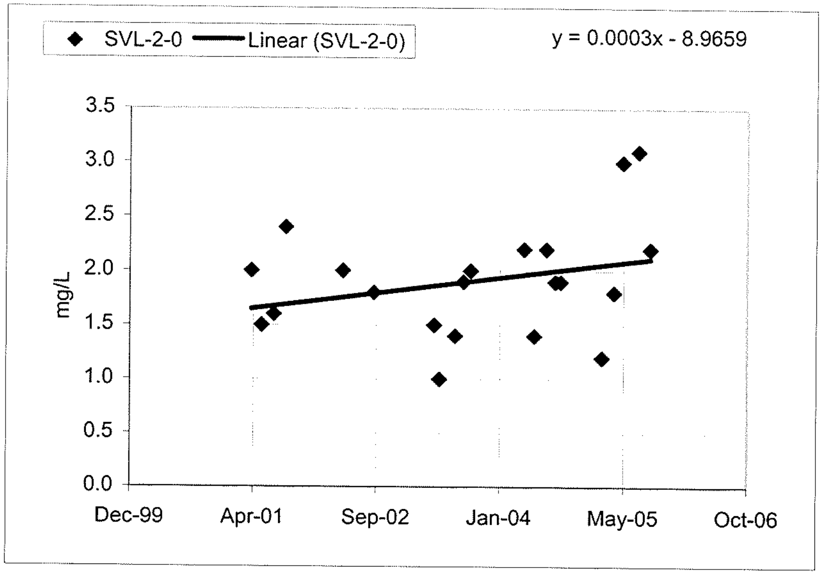


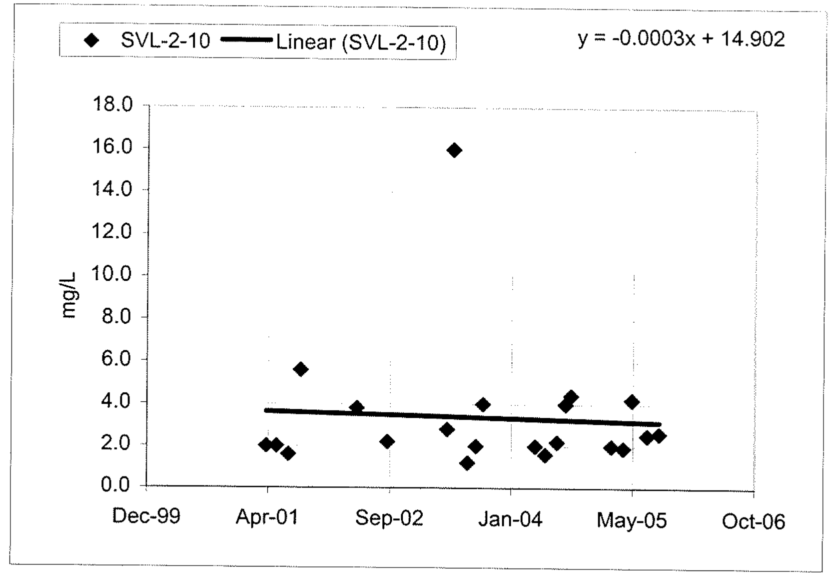


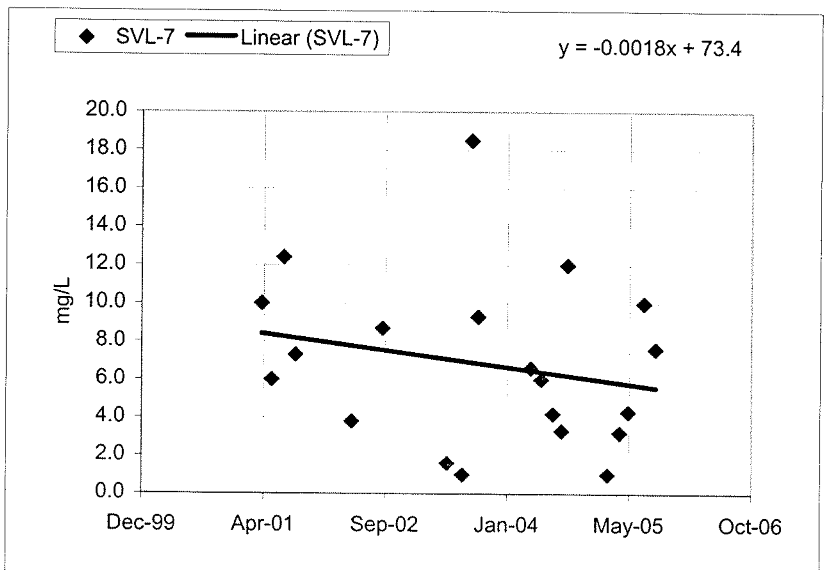


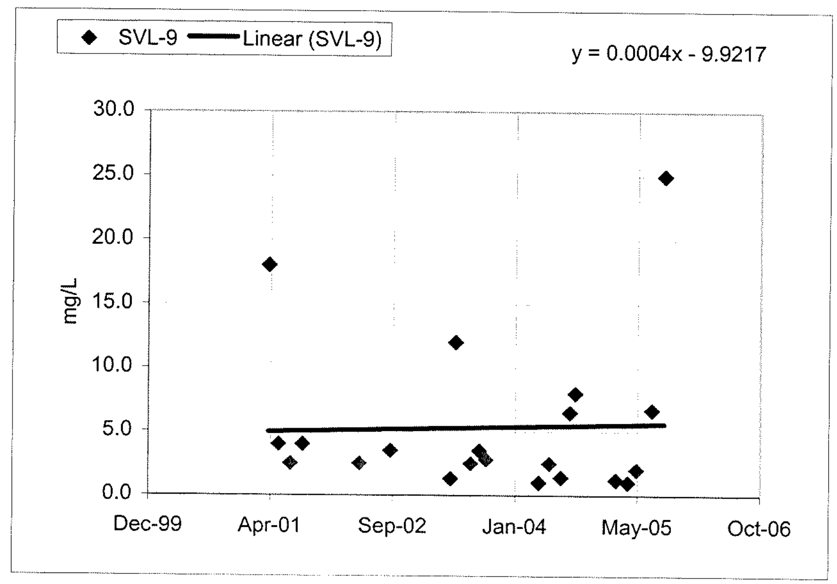


Volatile Suspended Solids (VSS)

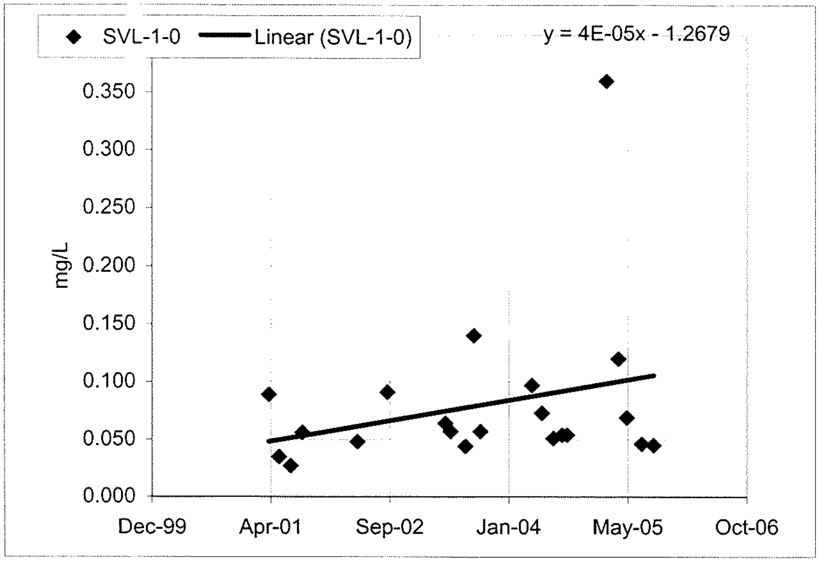


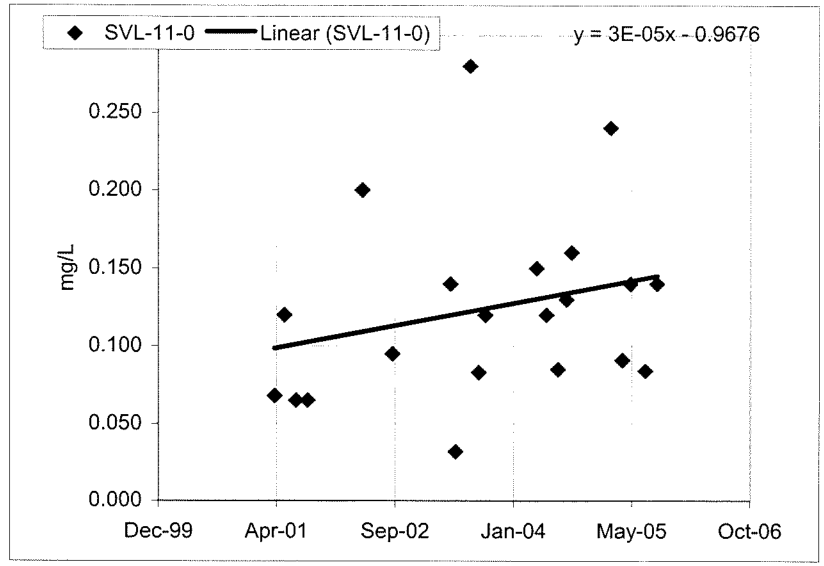


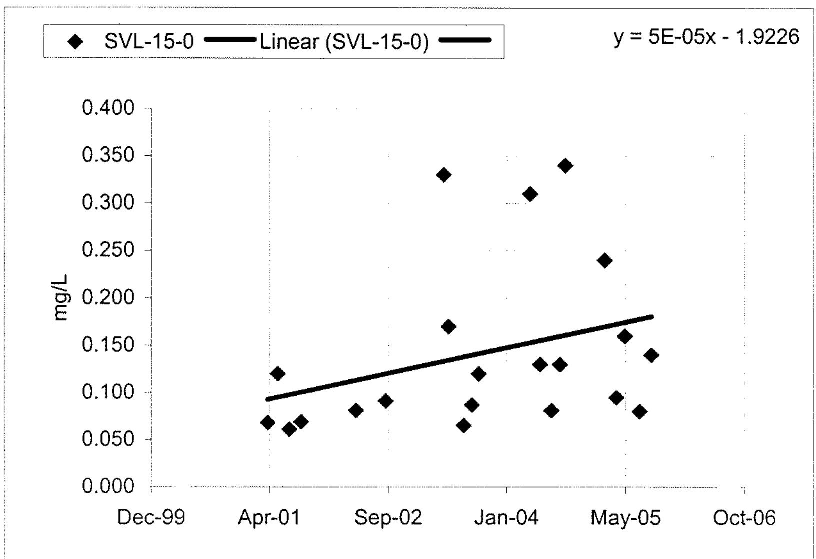


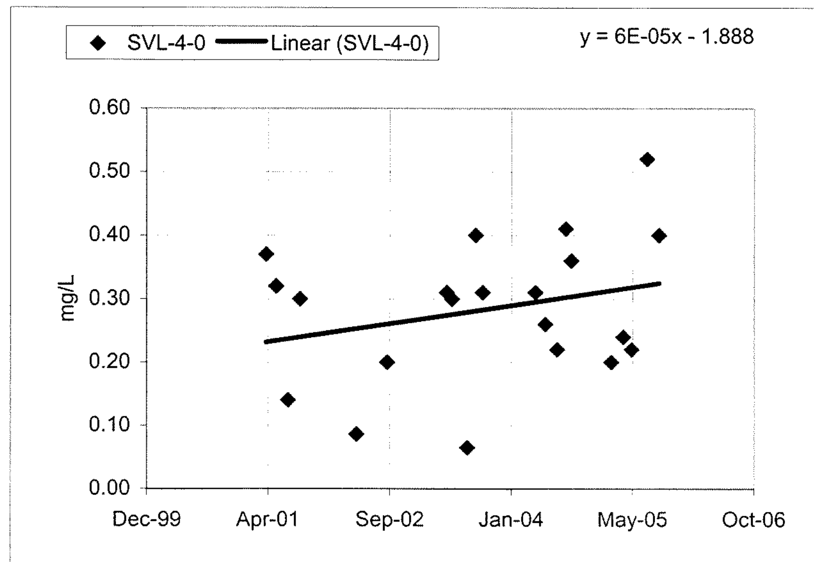


Total Phosphorus

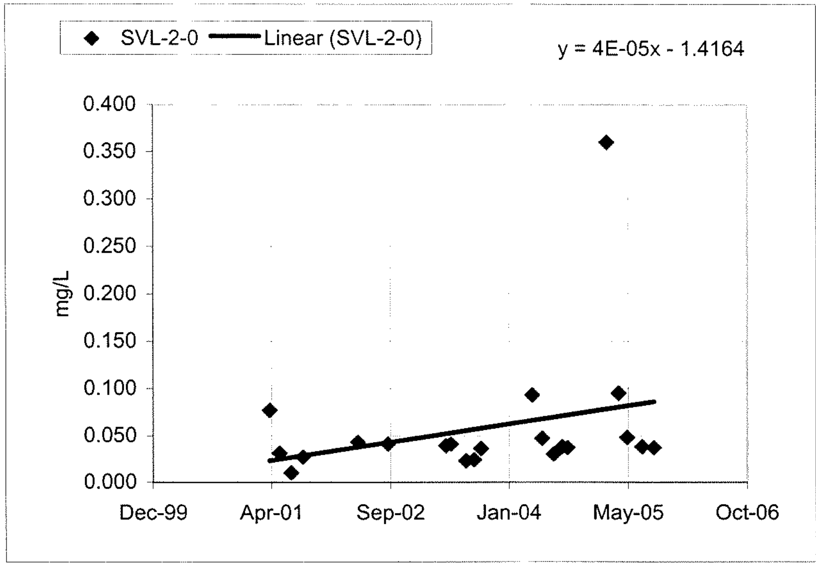


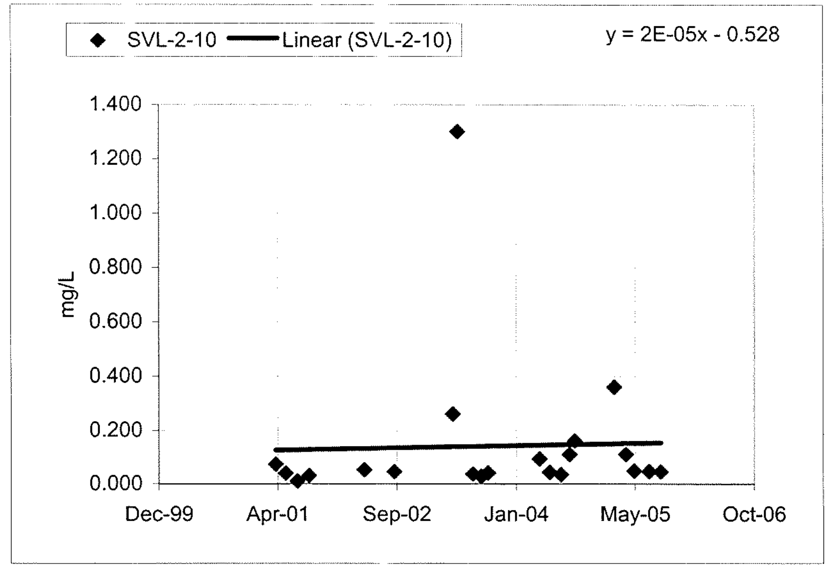


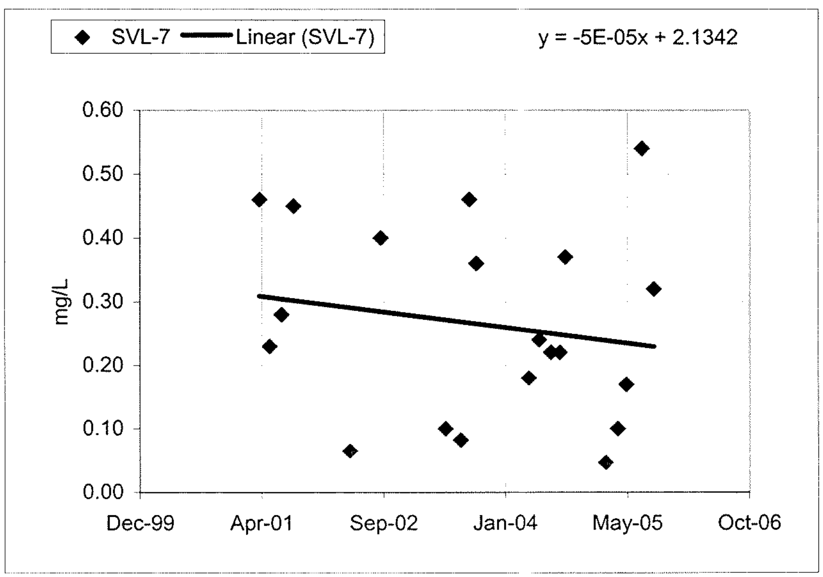


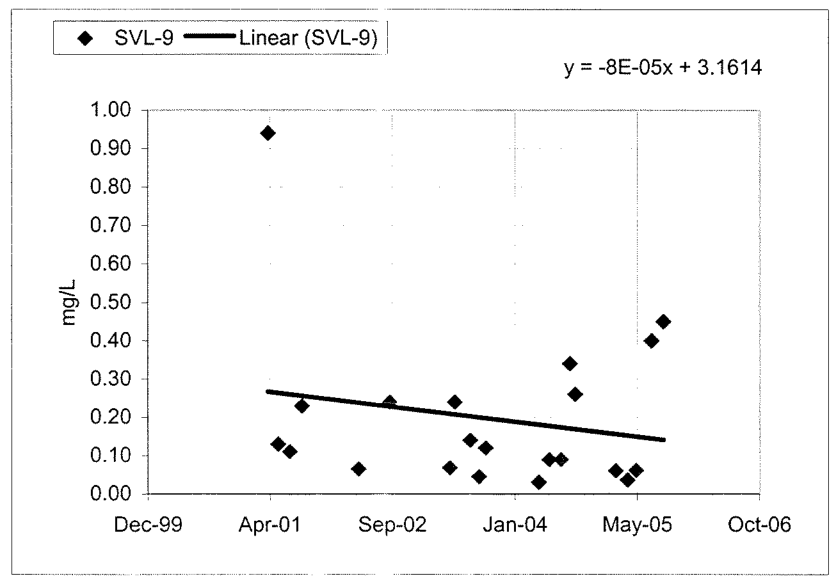


Total Phosphorus

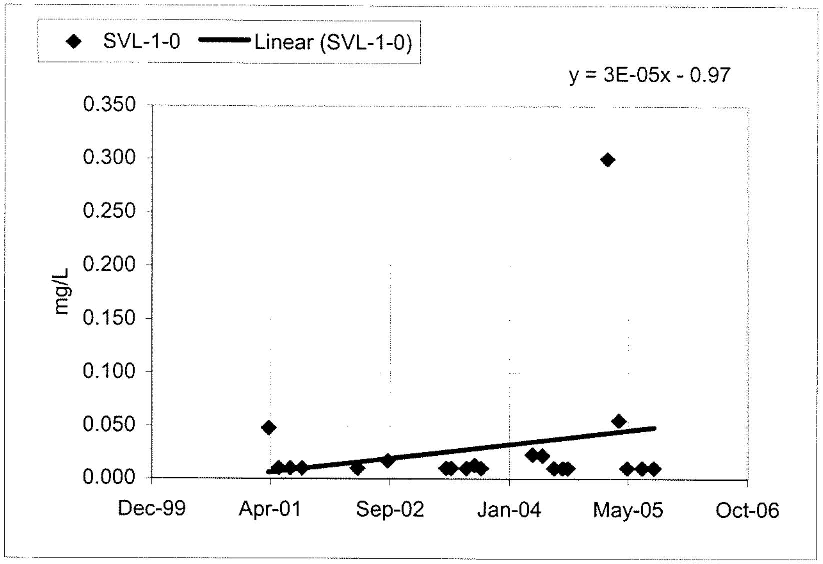


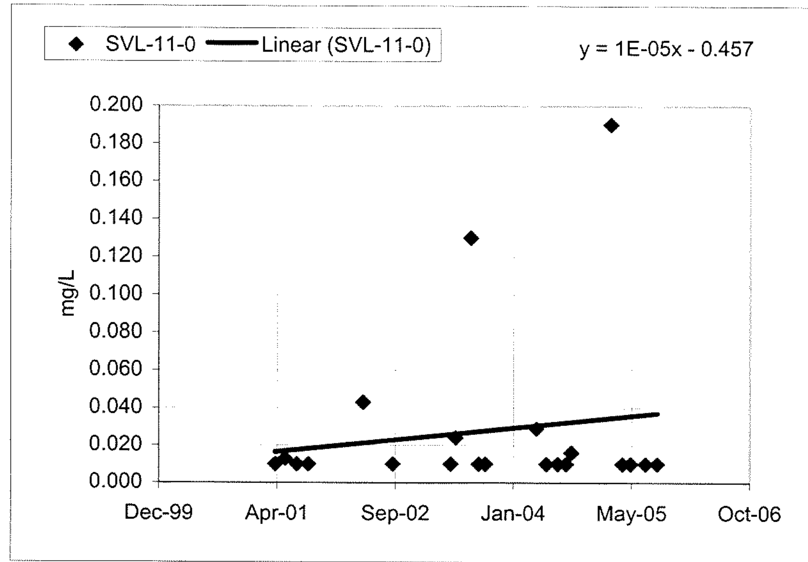


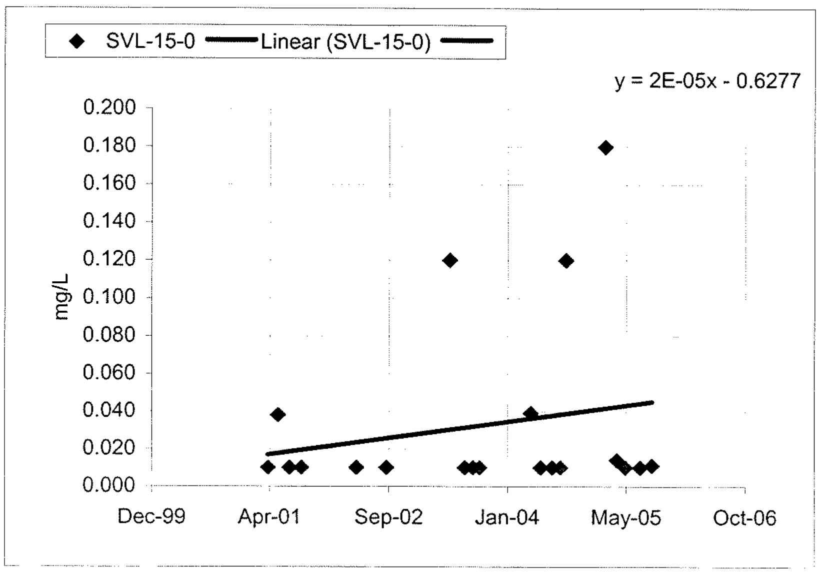


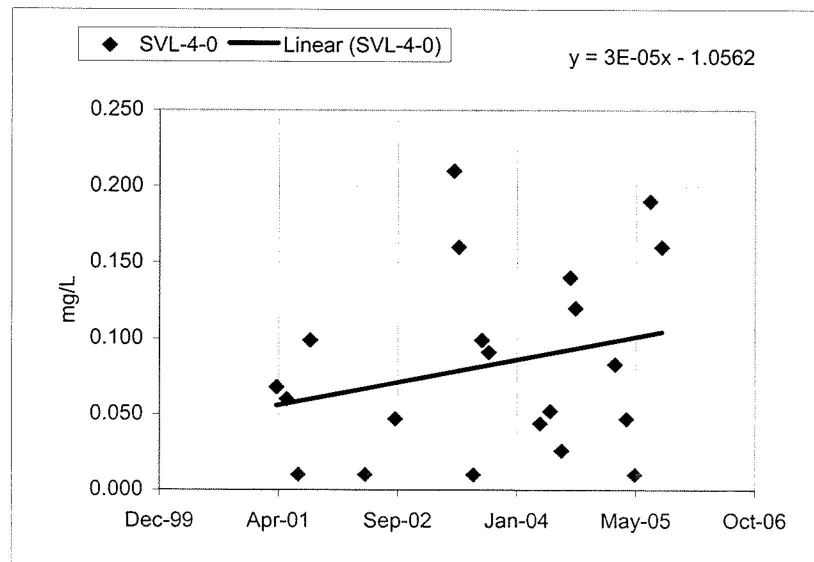


Soluble Phosphorus (ortho-Phosphate)

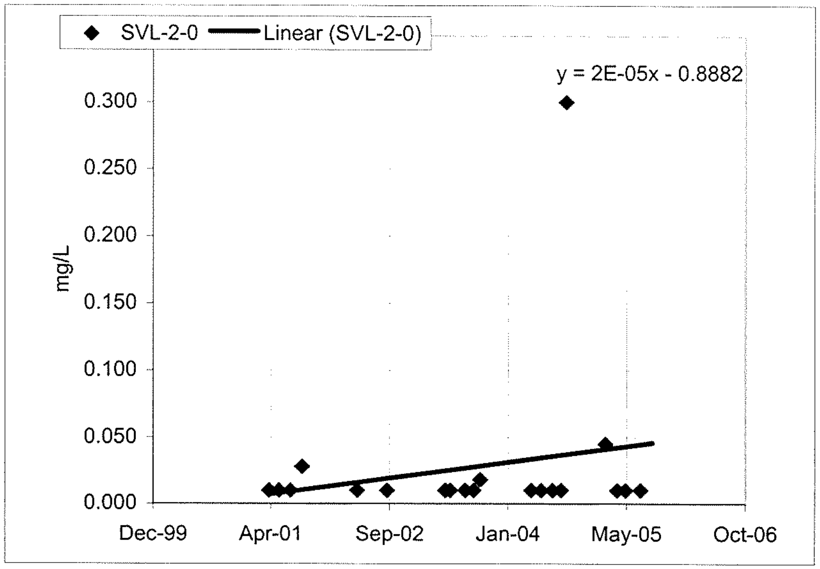


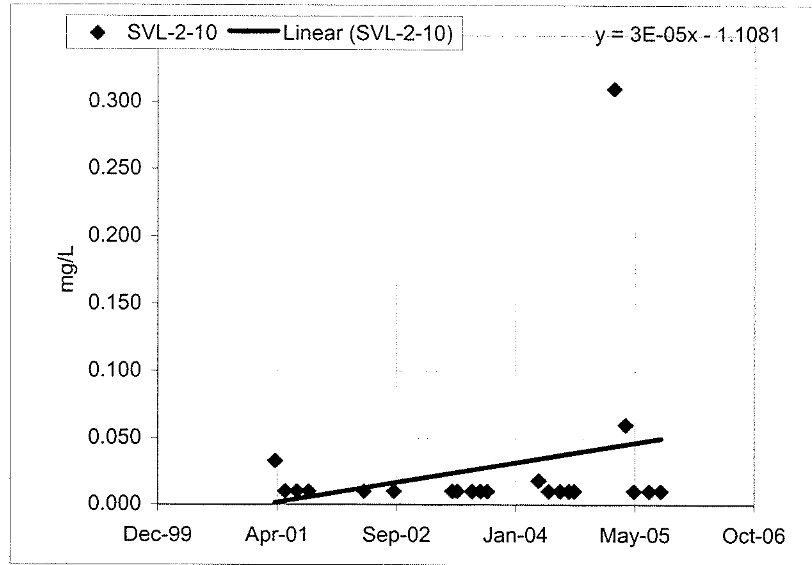


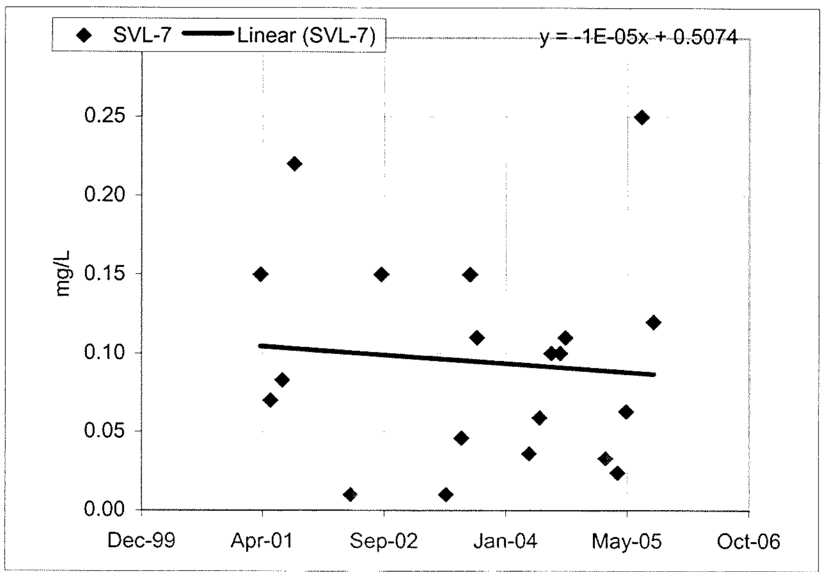


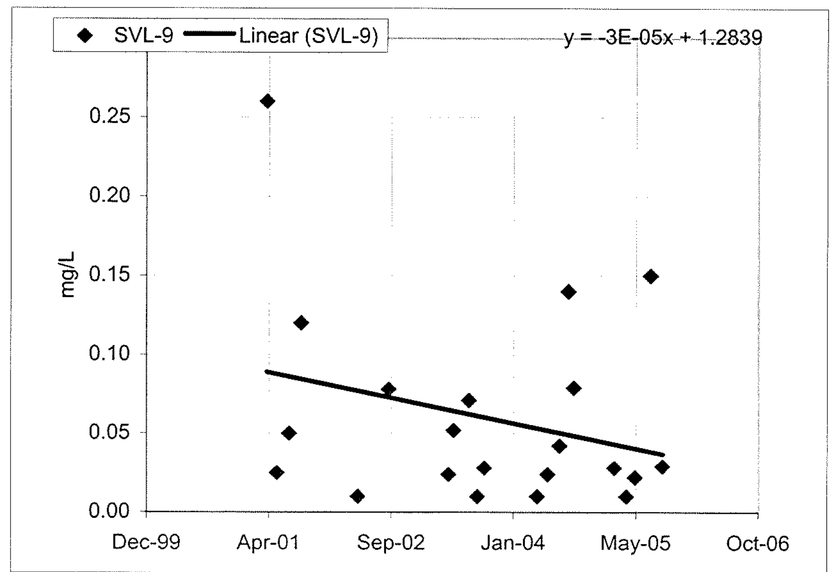


Soluble Phosphorus (ortho-Phosphate)

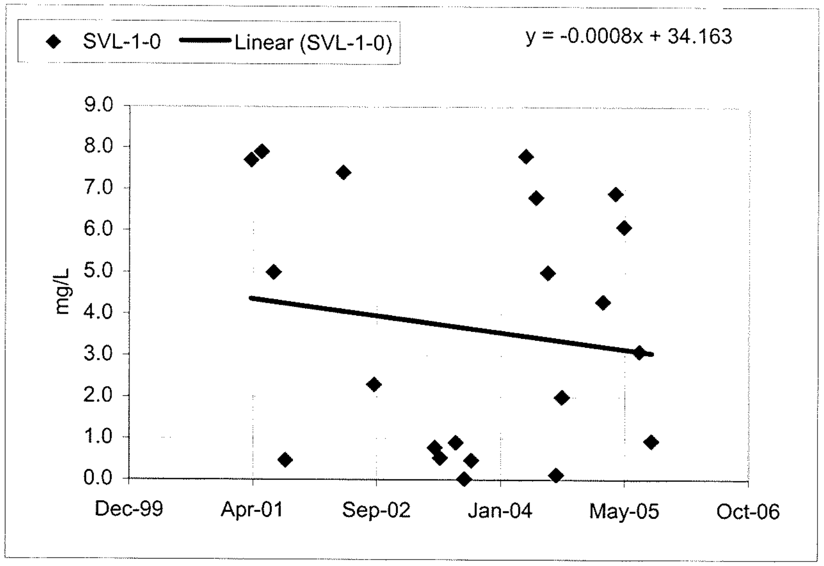


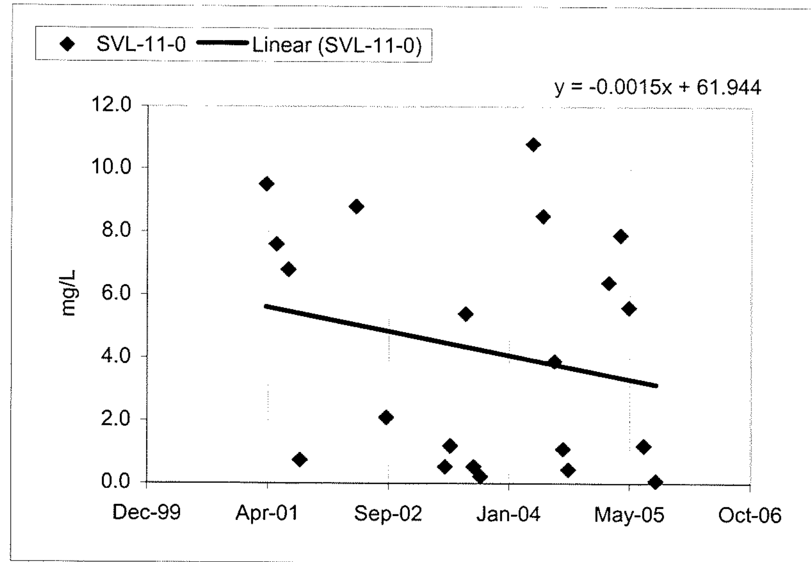


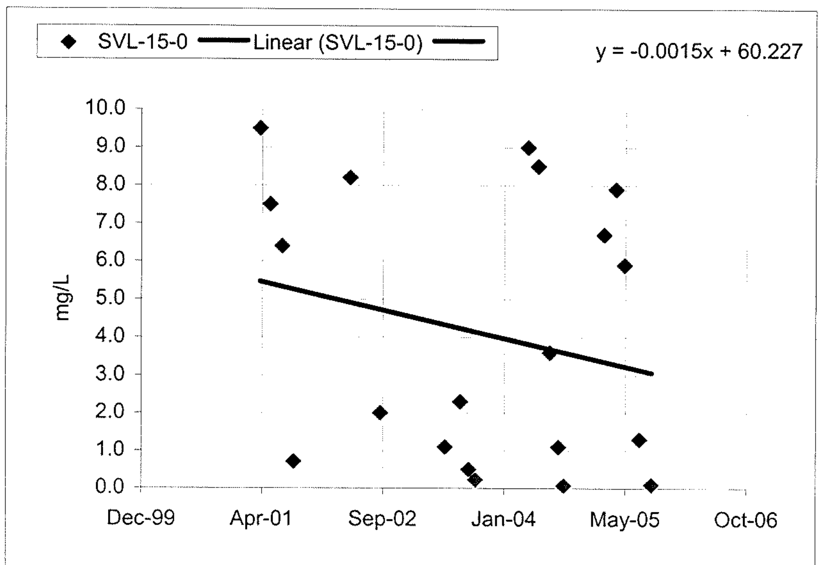


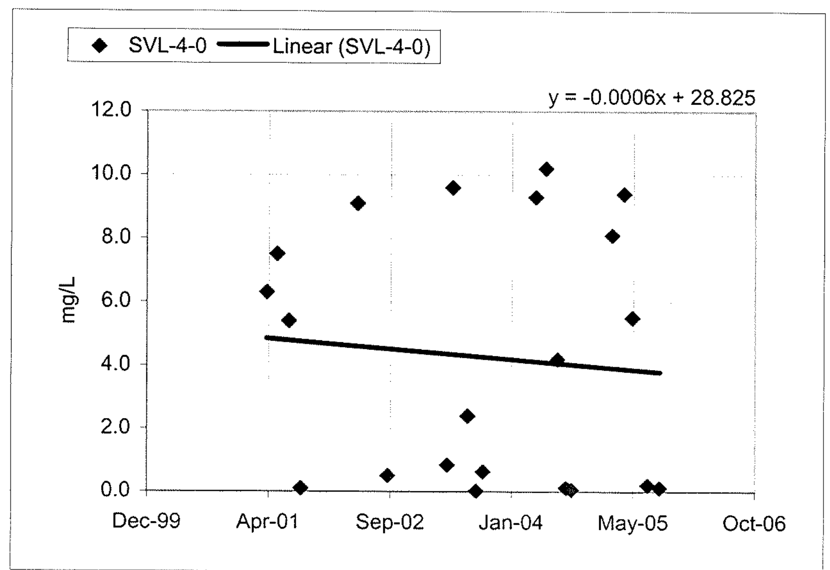


Nitrate

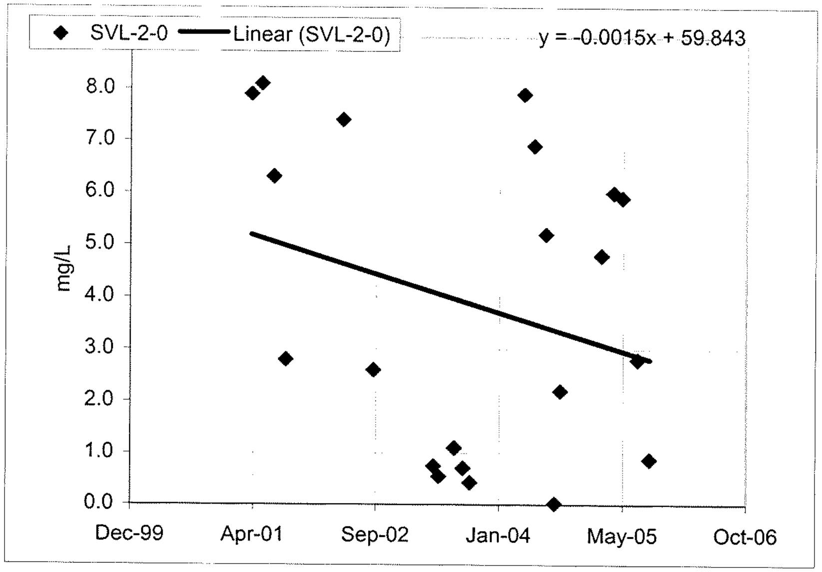

SVL-1-0
Linear (SVL-1-0)
y = -0.0008x + 34.163
mg/L
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

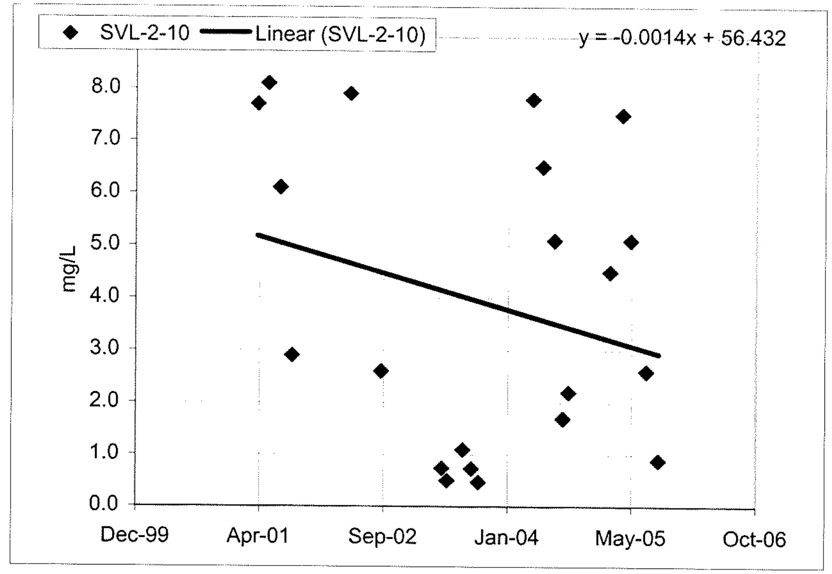

SVL-11-0
Linear (SVL-11-0)
y = -0.0015x + 61.944
mg/L
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

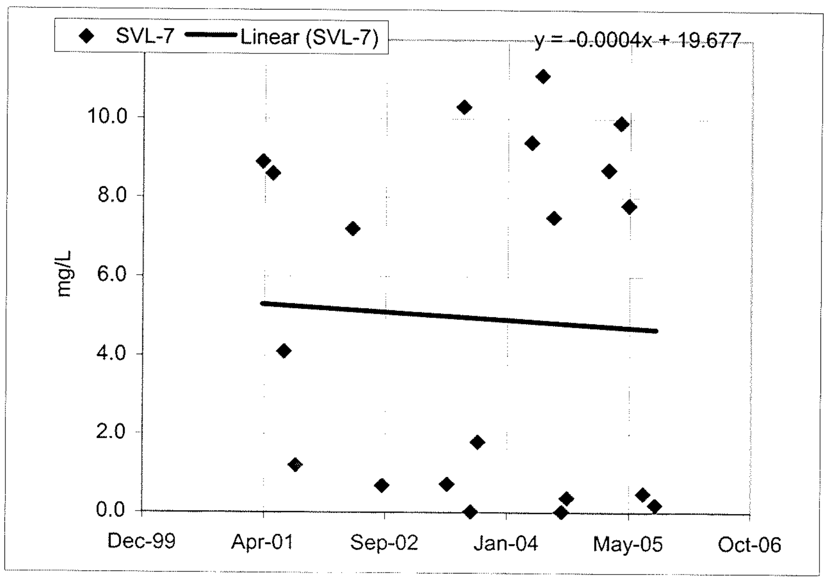

SVL-15-0
Linear (SVL-15-0)
y = -0.0015x + 60.227
mg/L
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

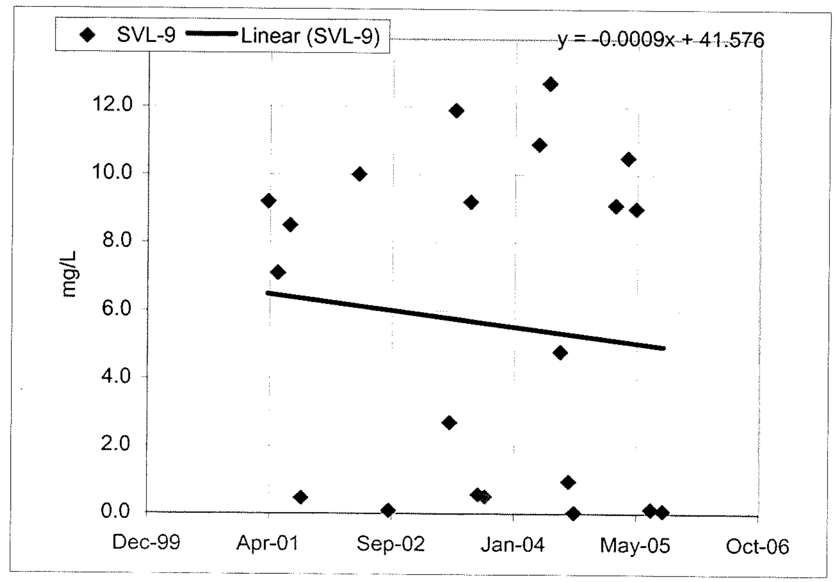

SVL-4-0
Linear (SVL-4-0)
y = -0.0006x + 28.825
mg/L
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

Nitrate

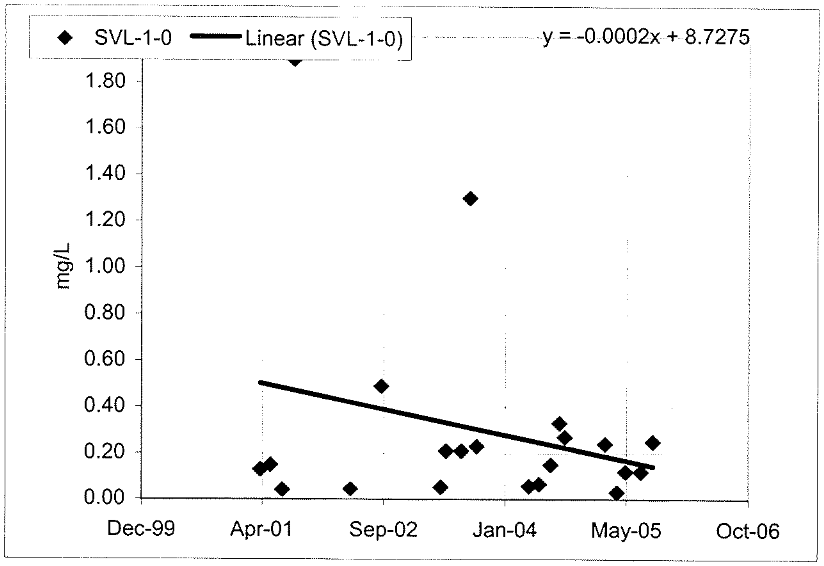

SVL-2-0
Linear (SVL-2-0)
y = -0.0015x + 59.843
mg/L
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

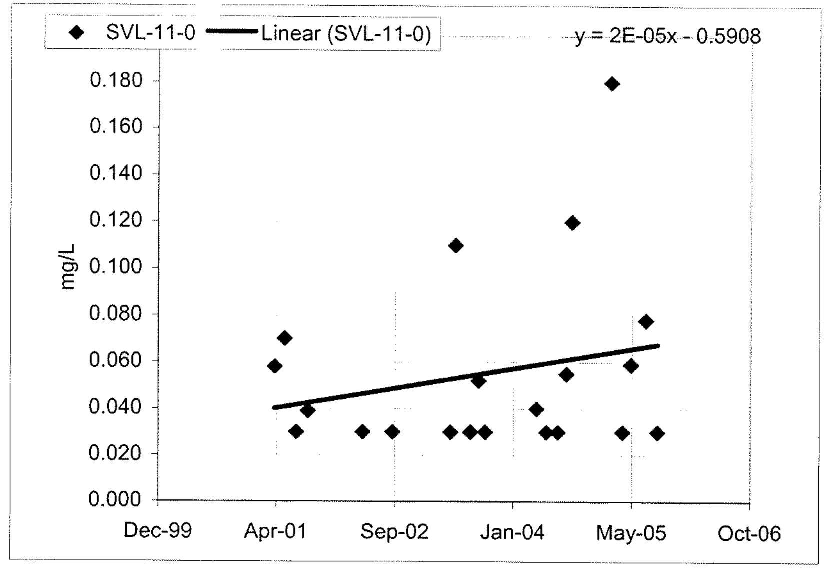

SVL-2-10
Linear (SVL-2-10)
y = -0.0014x + 56.432
mg/L
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

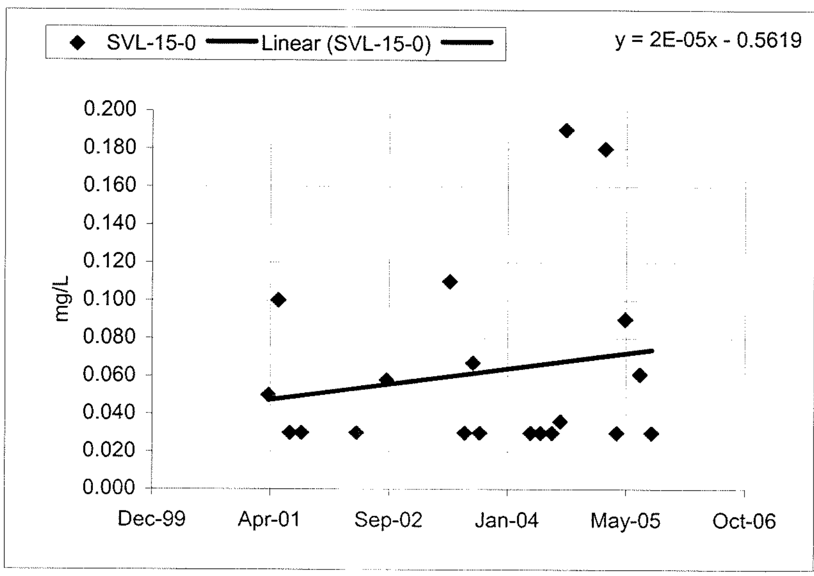

SVL-7
Linear (SVL-7)
y = -0.0004x + 19.677
mg/L
10.0
8.0
6.0
4.0
2.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

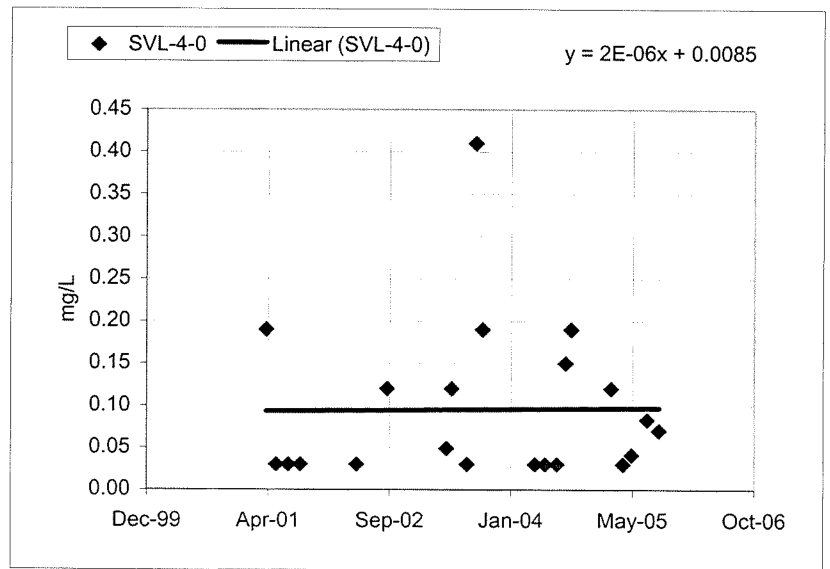

SVL-9
Linear (SVL-9)
y = -0.0009x + 41.576
mg/L
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

Ammonia

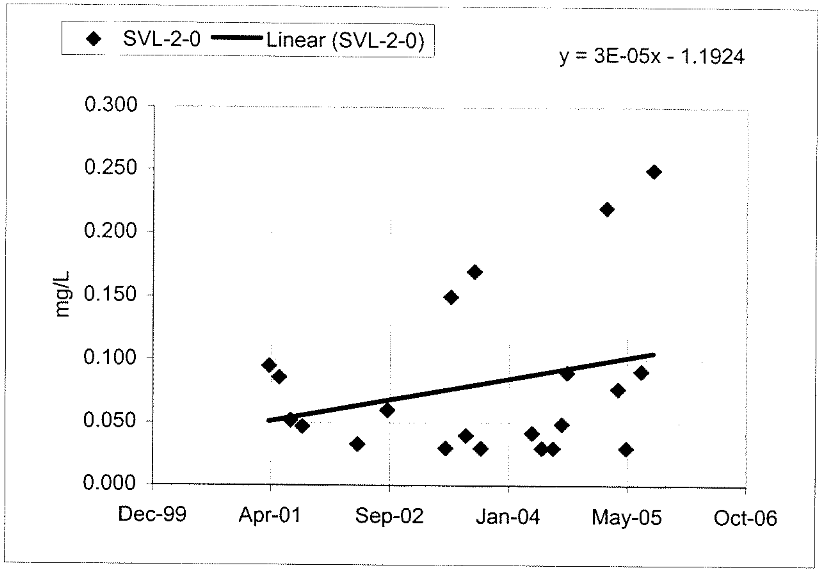

SVL-1-0
Linear (SVL-1-0)
y = -0.0002x + 8.7275
mg/L
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

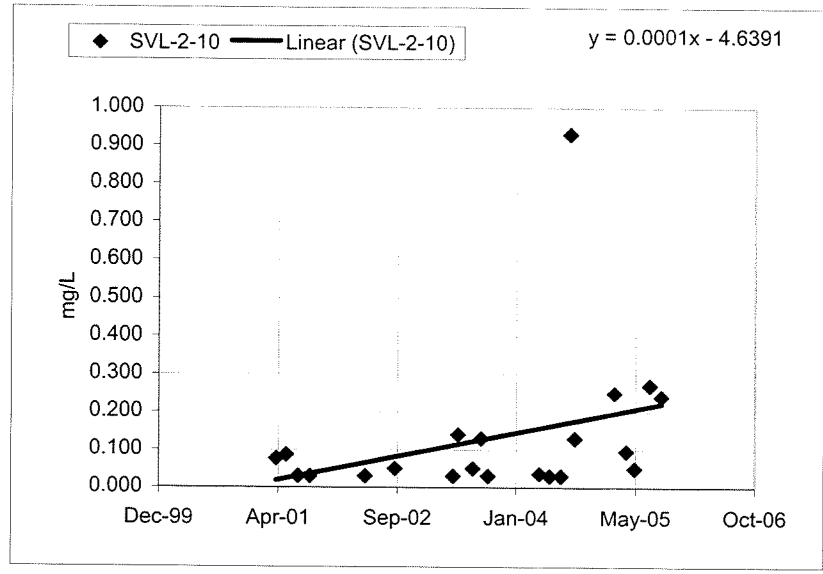

SVL-11-0
Linear (SVL-11-0)
y = 2E-05x - 0.5908
mg/L
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

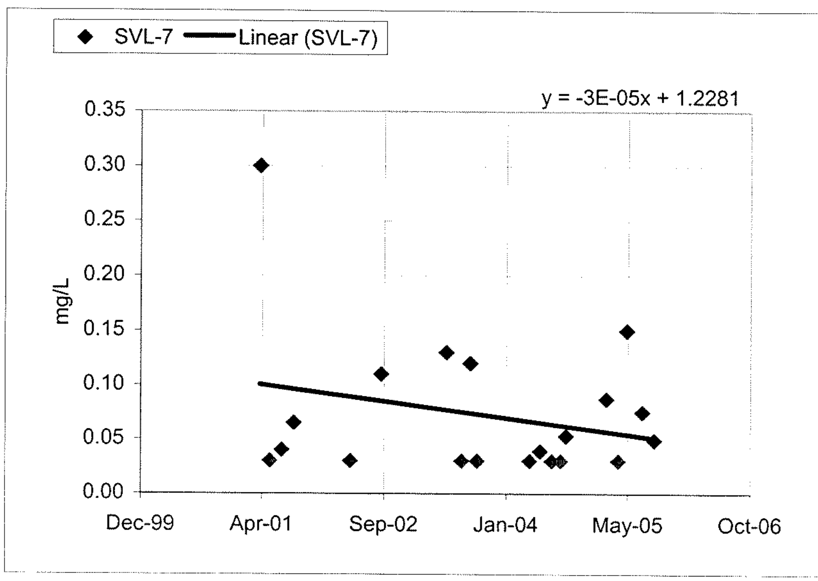

SVL-15-0
Linear (SVL-15-0)
y = 2E-05x - 0.5619
mg/L
0.200
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

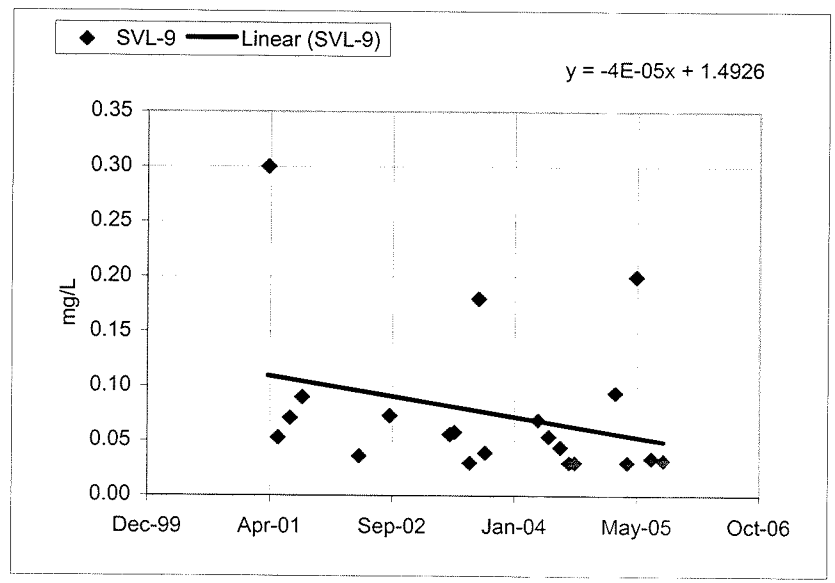

SVL-4-0
Linear (SVL-4-0)
y = 2E-06x + 0.0085
mg/L
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

Ammonia


SVL-2-0
Linear (SVL-2-0)
y = 3E-05x - 1.1924
mg/L
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

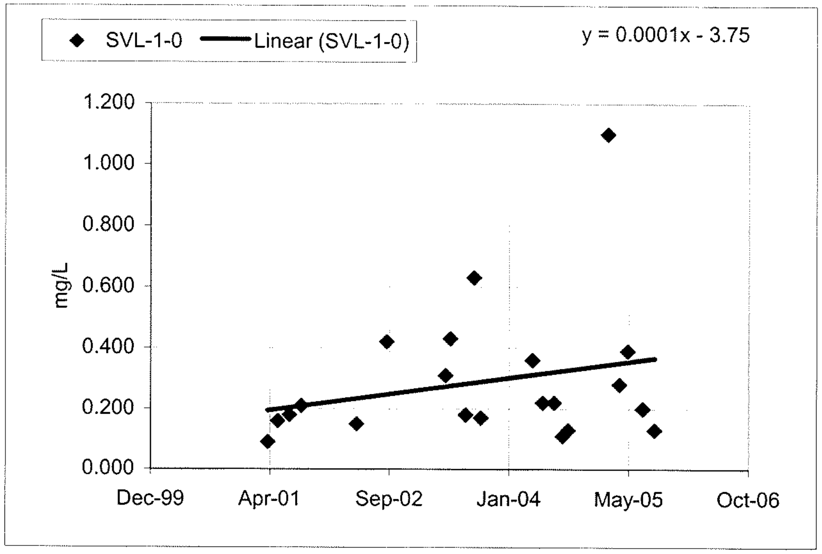

SVL-2-10
Linear (SVL-2-10)
y = 0.0001x - 4.6391
mg/L
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06


SVL-7
Linear (SVL-7)
y = -3E-05x + 1.2281
mg/L
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

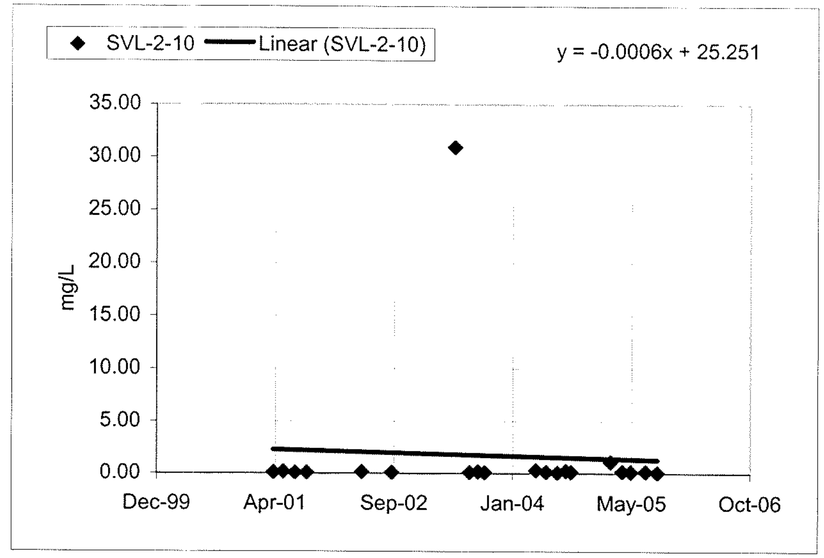

SVL-9
Linear (SVL-9)
y = -4E-05x + 1.4926
mg/L
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

Iron and Manganese

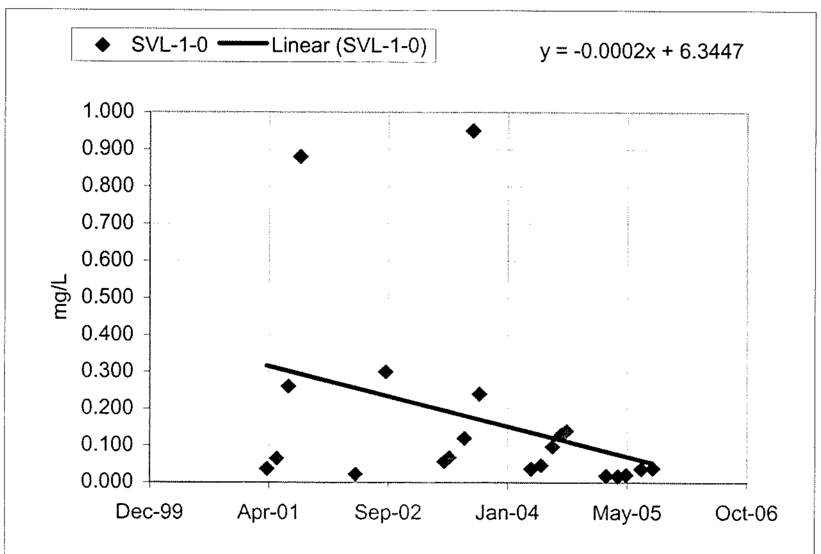
Iron



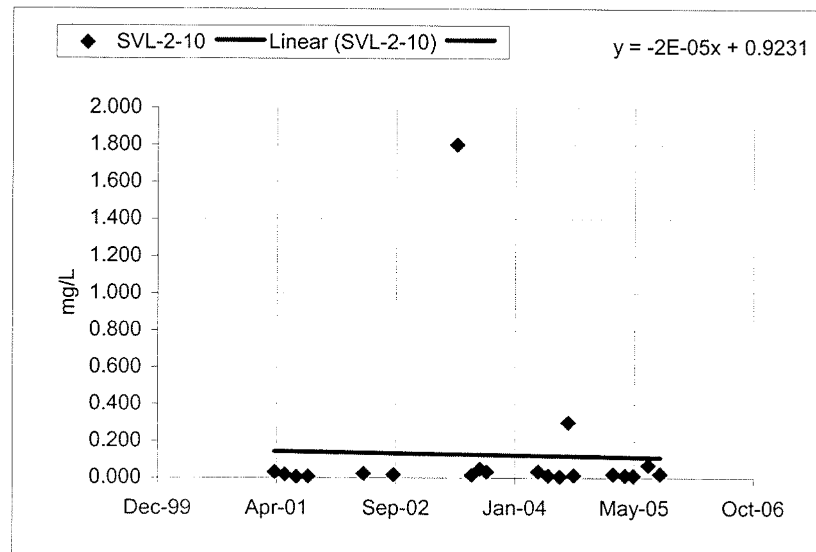
Iron



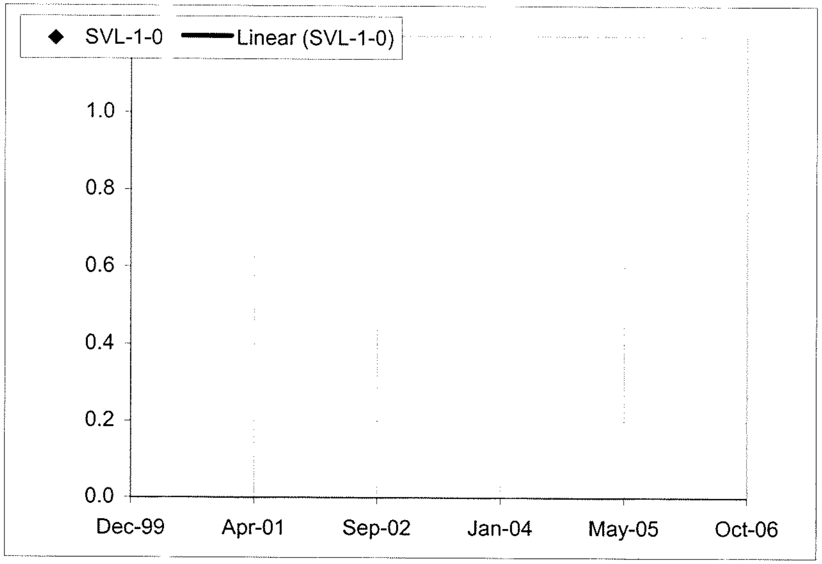
Manganese

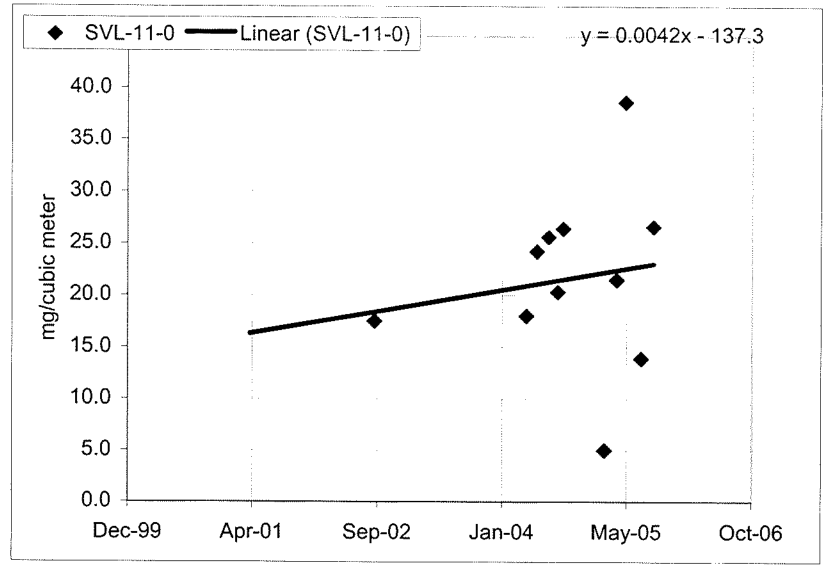


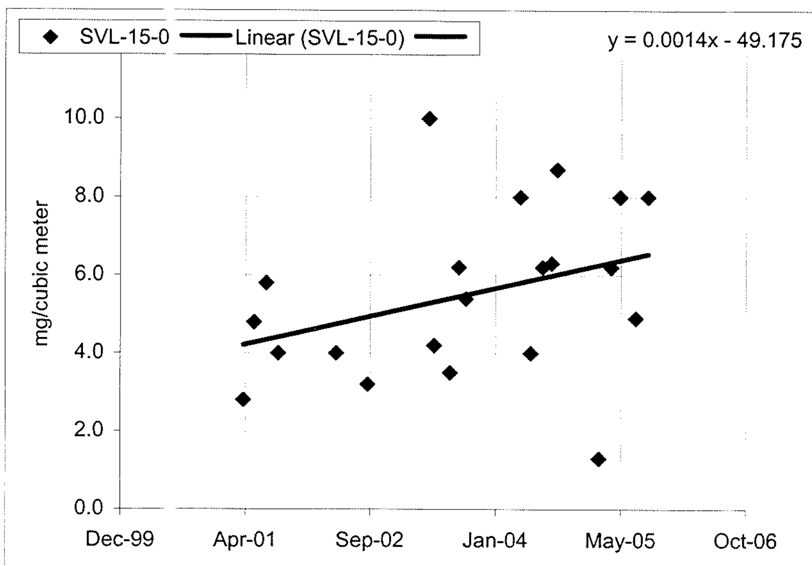
Manganese

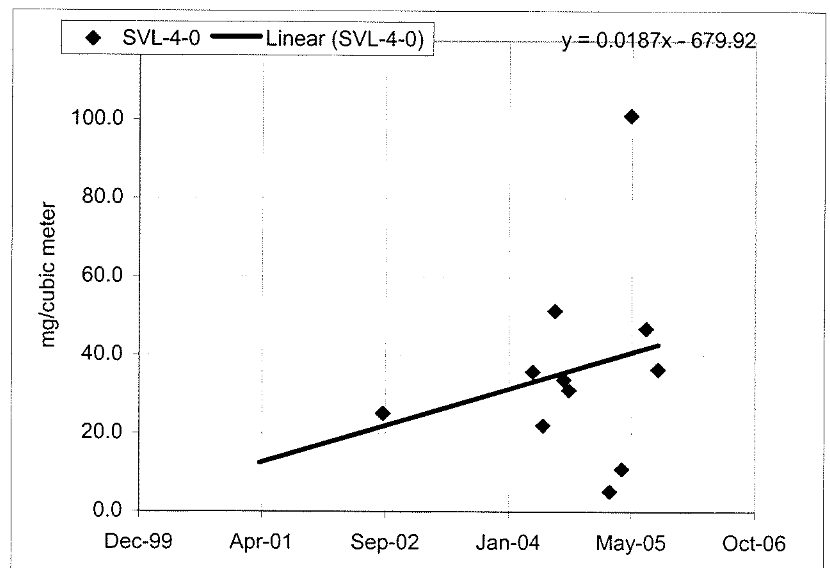


Chlorophyll

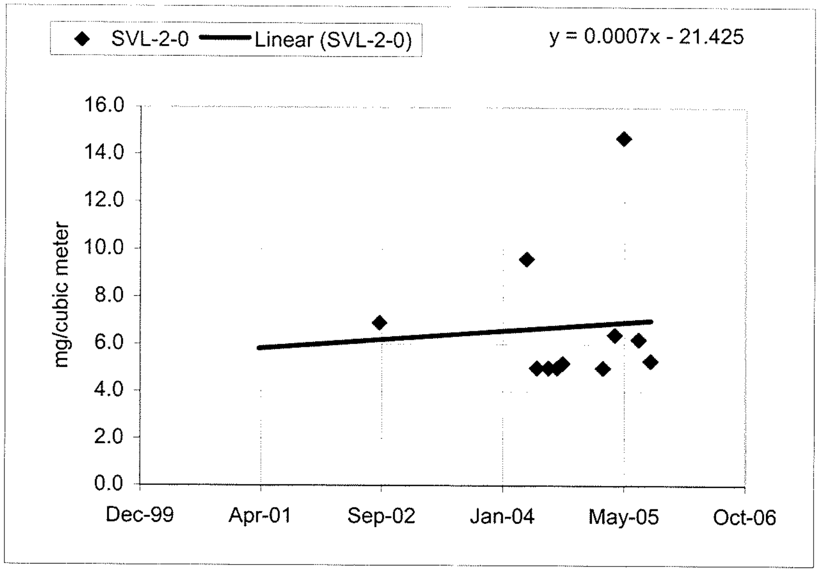


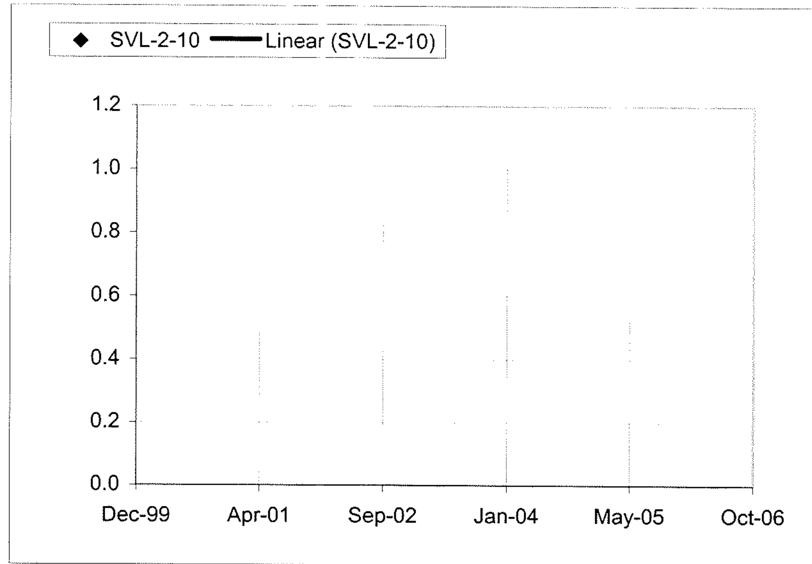


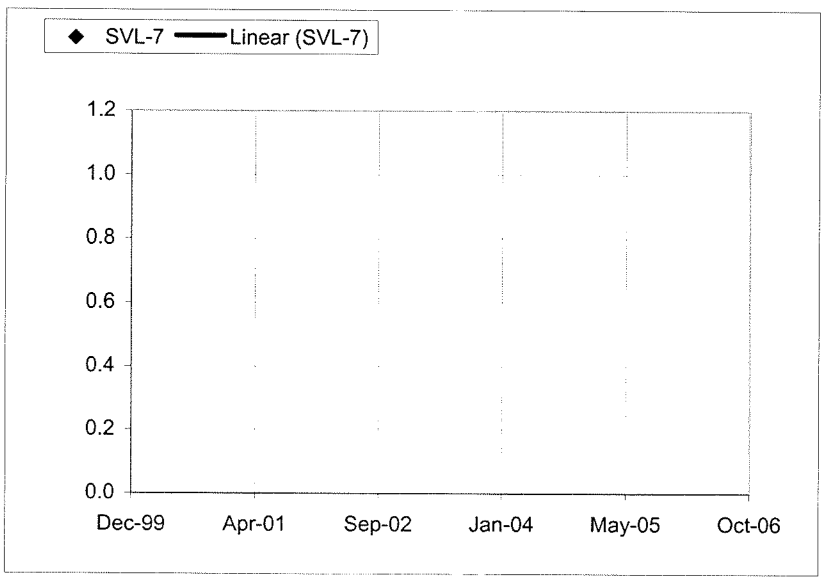


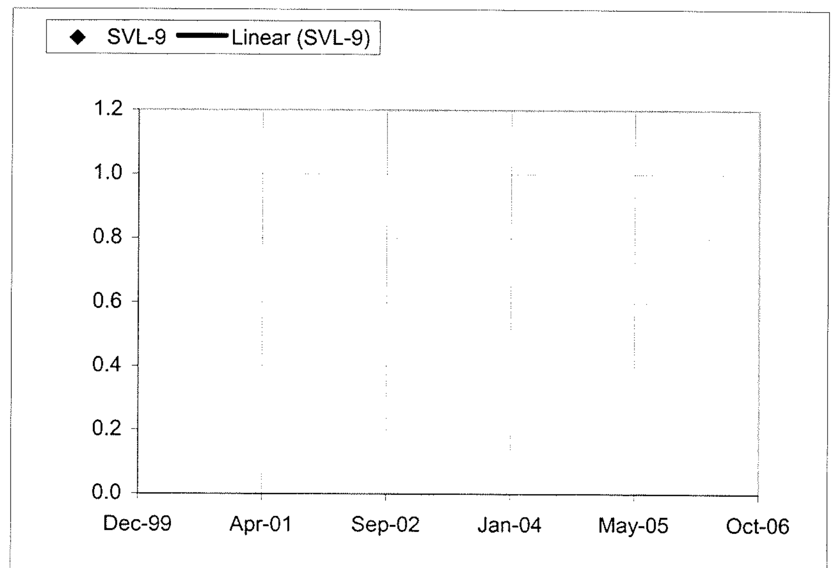


Chlorophyll

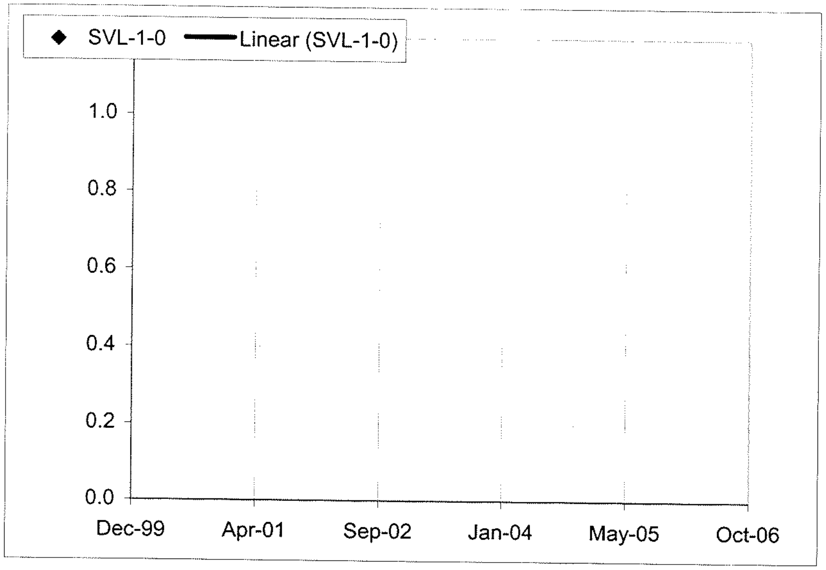


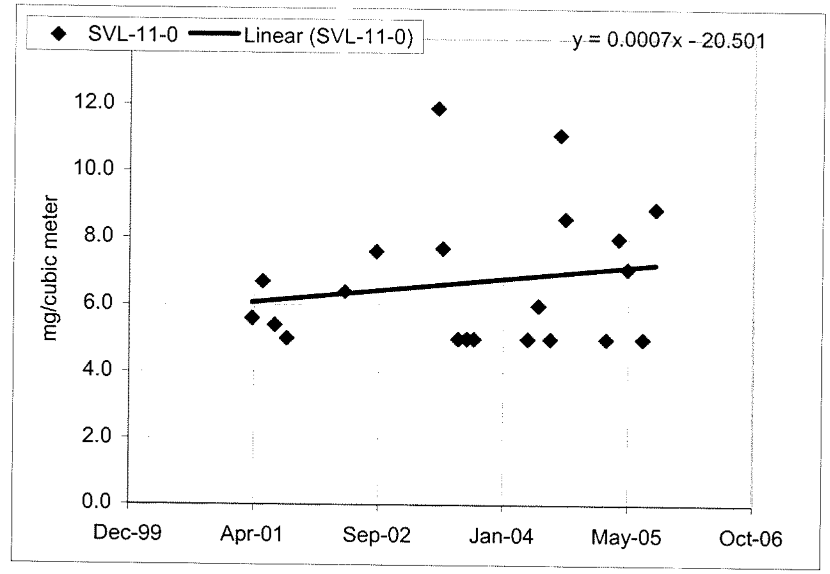


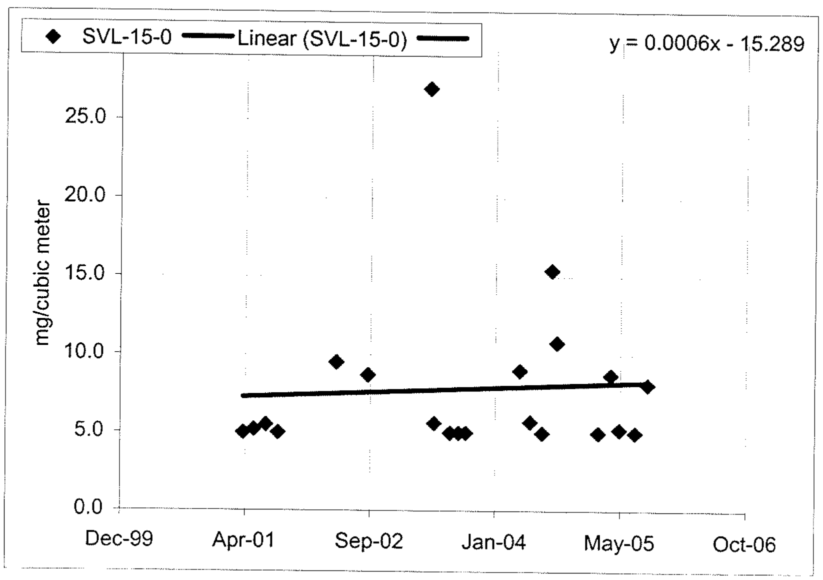


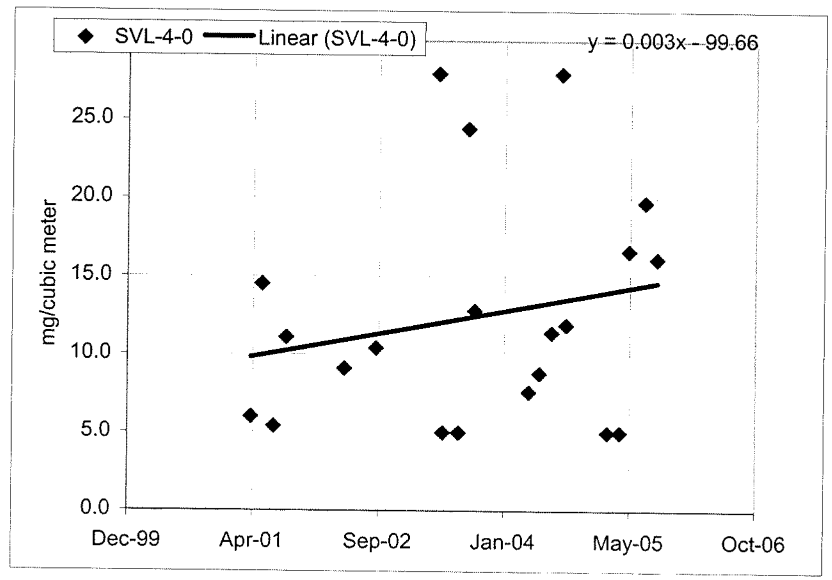


Pheophytin

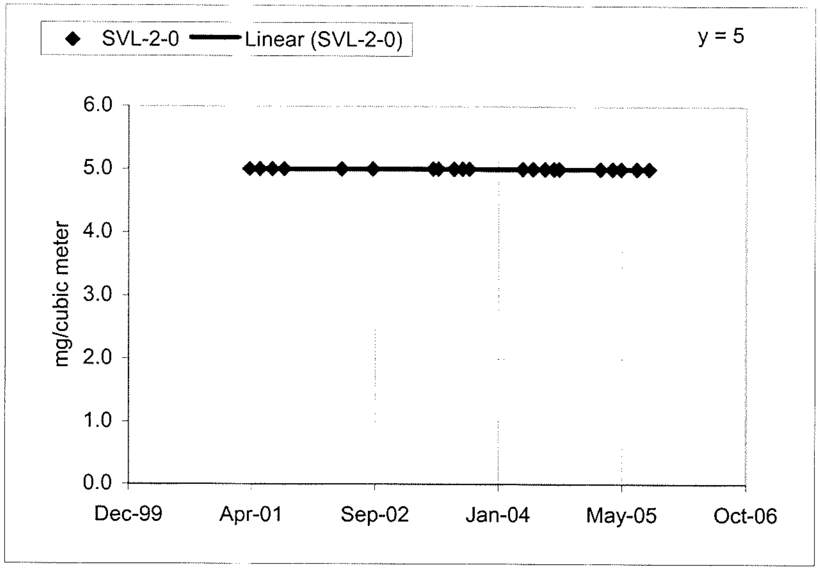

SVL-1-0
Linear (SVL-1-0)
1.0
0.8
0.6
0.4
0.2
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

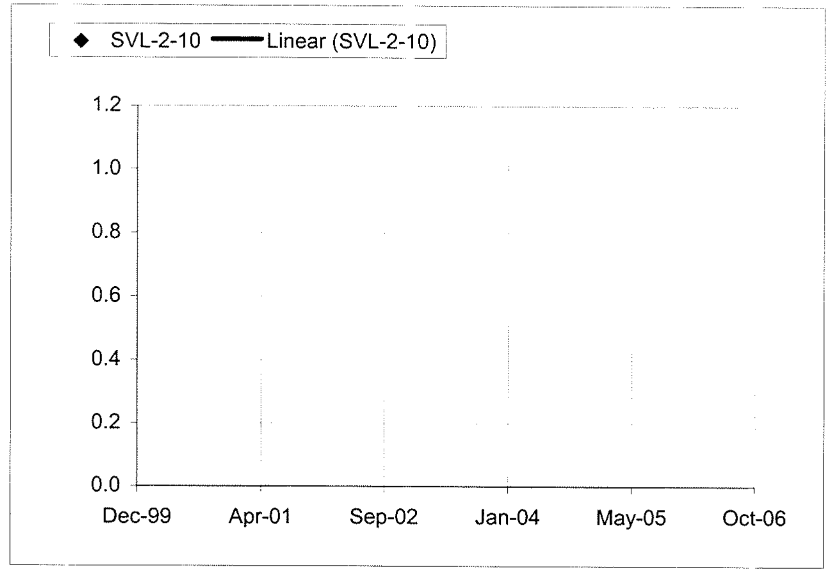

SVL-11-0
Linear (SVL-11-0)
y = 0.0007x - 20.501
mg/cubic meter
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

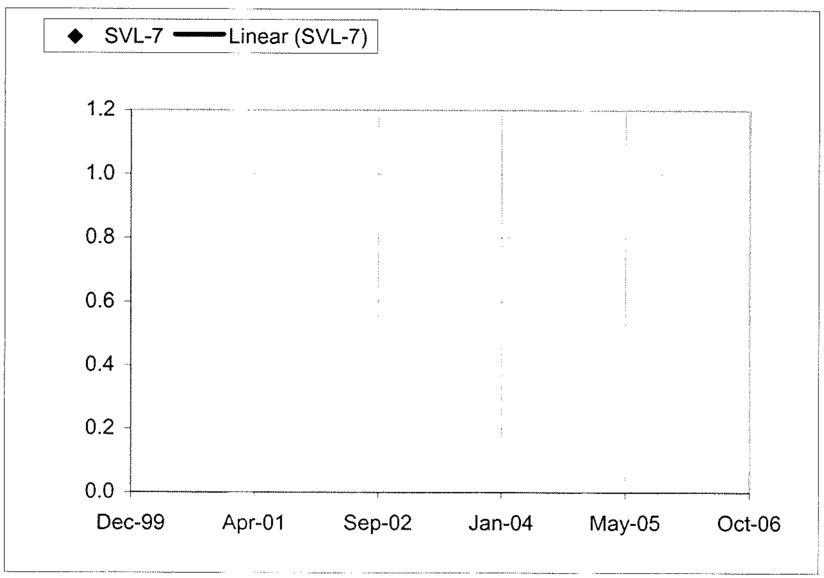

SVL-15-0
Linear (SVL-15-0)
y = 0.0006x - 15.289
mg/cubic meter
25.0
20.0
15.0
10.0
5.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

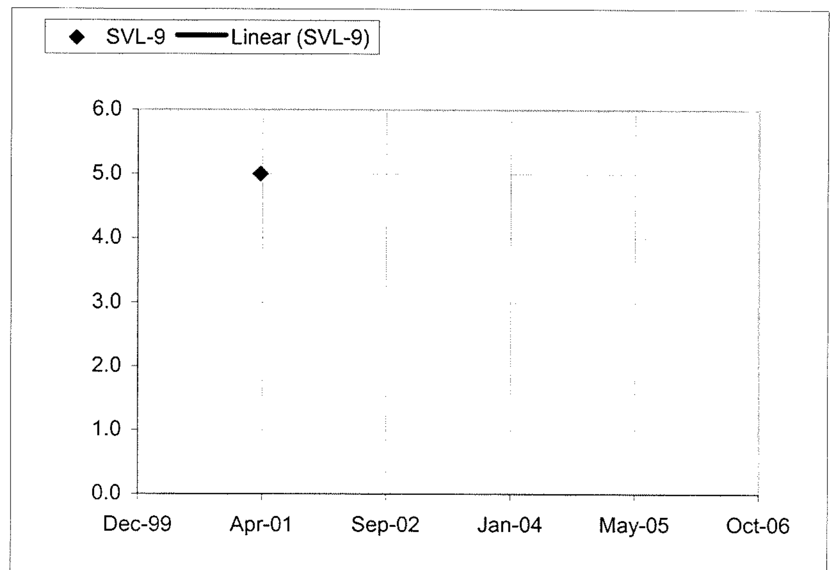

SVL-4-0
Linear (SVL-4-0)
y = 0.003x - 99.66
mg/cubic meter
25.0
20.0
15.0
10.0
5.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

Pheophytin

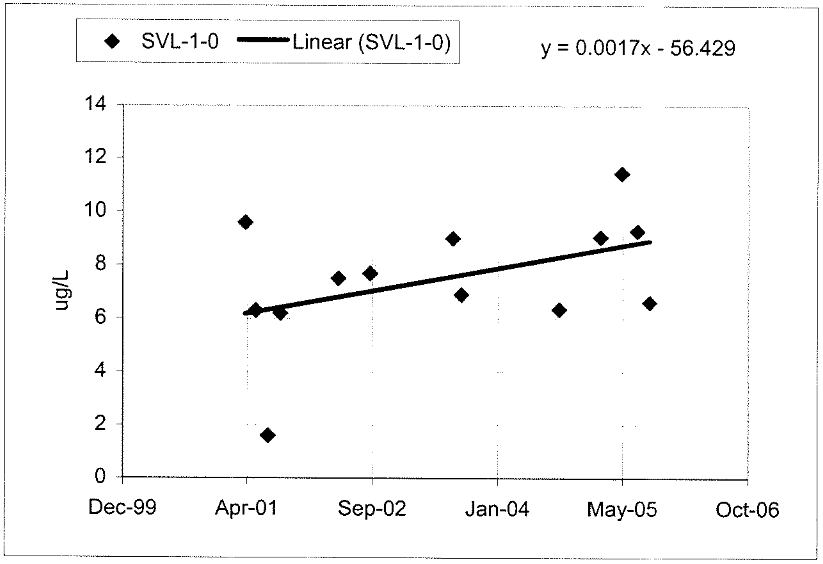

SVL-2-0
Linear (SVL-2-0)
y = 5
mg/cubic meter
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

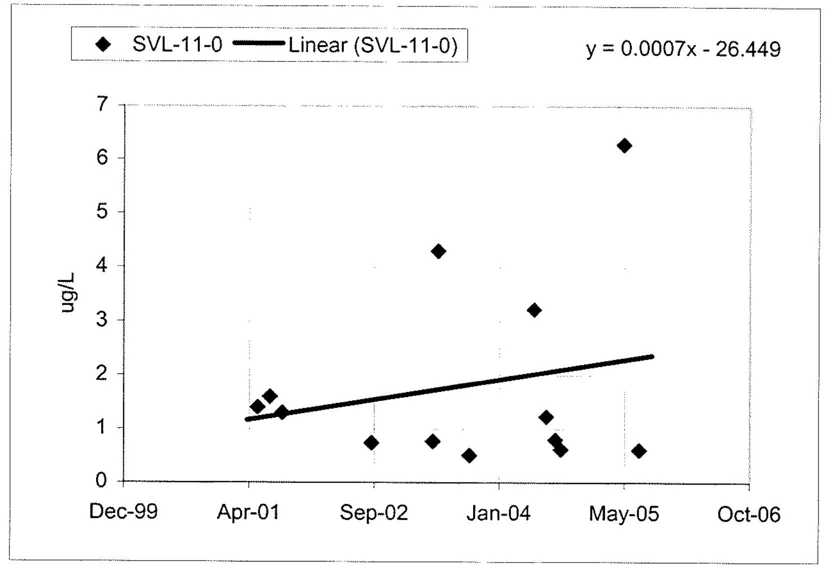

SVL-2-10
Linear (SVL-2-10)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

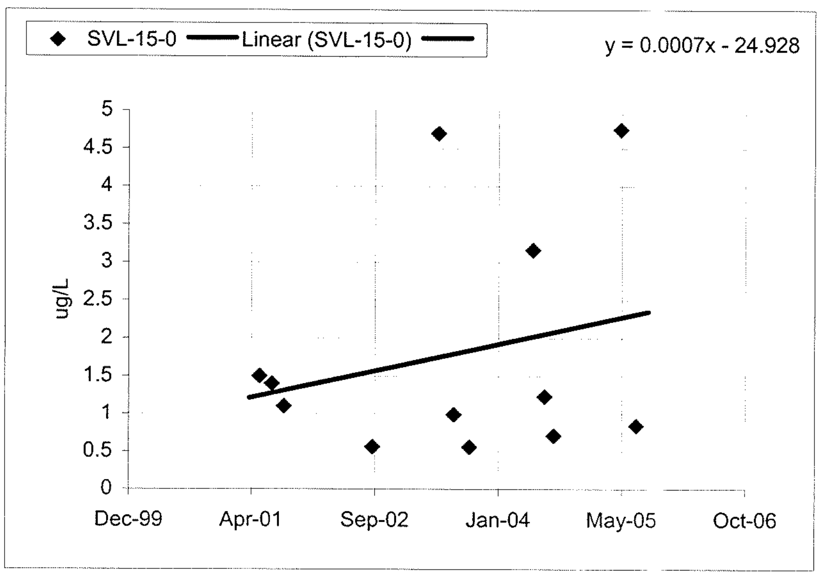

SVL-7
Linear (SVL-7)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

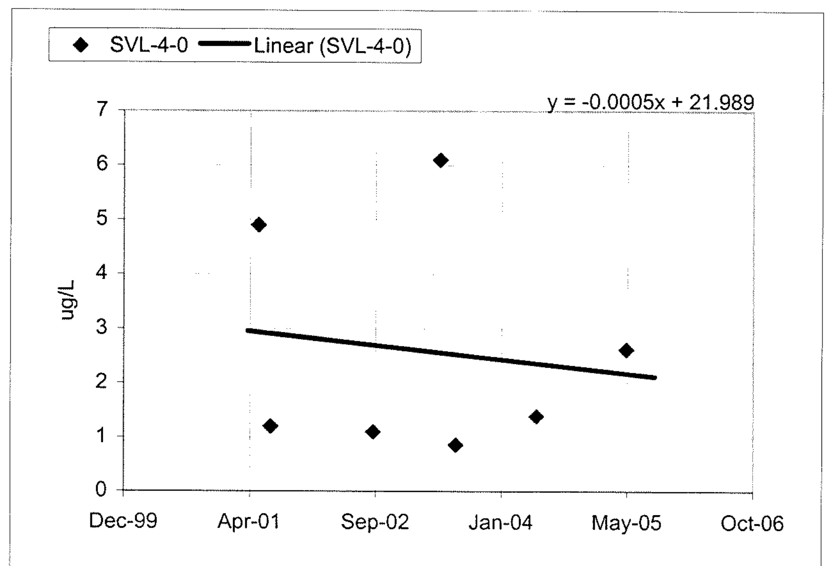

SVL-9
Linear (SVL-9)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

Atrazine

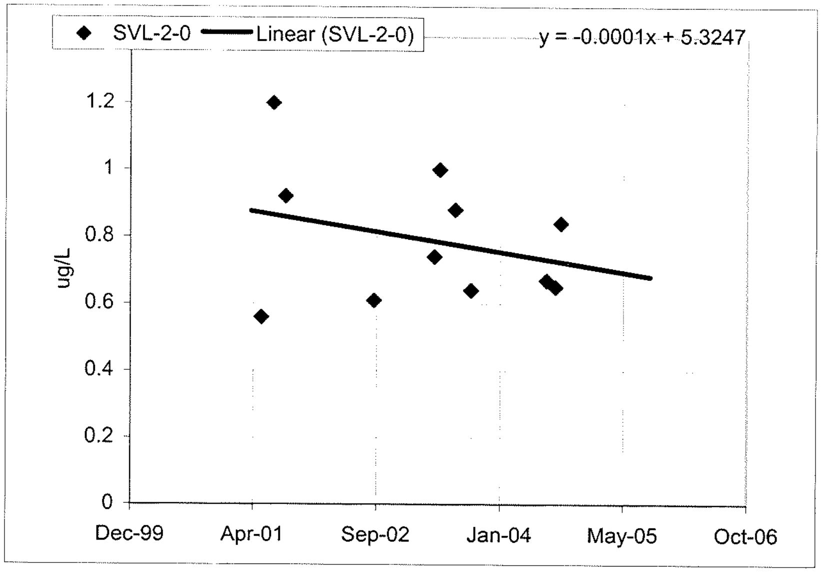

SVL-1-0
Linear (SVL-1-0)
y = 0.0017x - 56.429
ug/L
14
12
10
8
6
4
2
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06


SVL-11-0
Linear (SVL-11-0)
y = 0.0007x - 26.449
ug/L
7
6
5
4
3
2
1
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

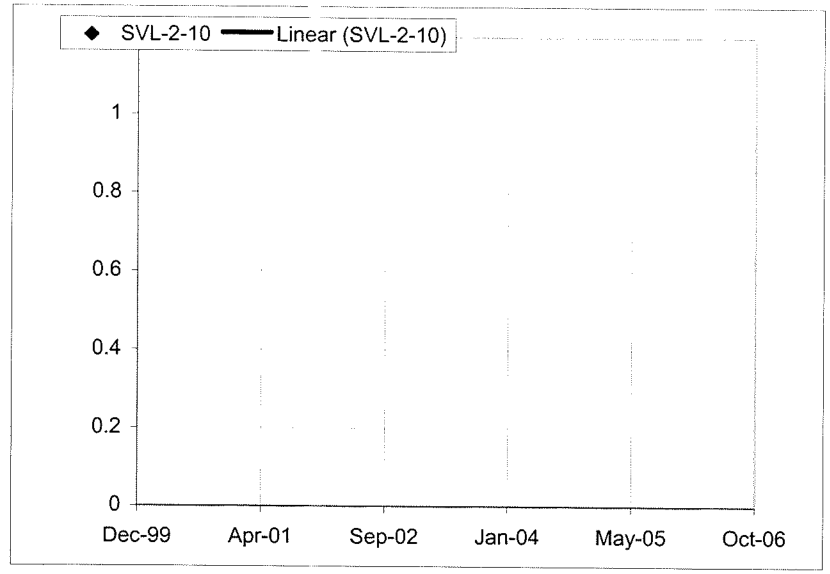

SVL-15-0
Linear (SVL-15-0)
y = 0.0007x - 24.928
ug/L
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06


SVL-4-0
Linear (SVL-4-0)
y = -0.0005x + 21.989
ug/L
7
6
5
4
3
2
1
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

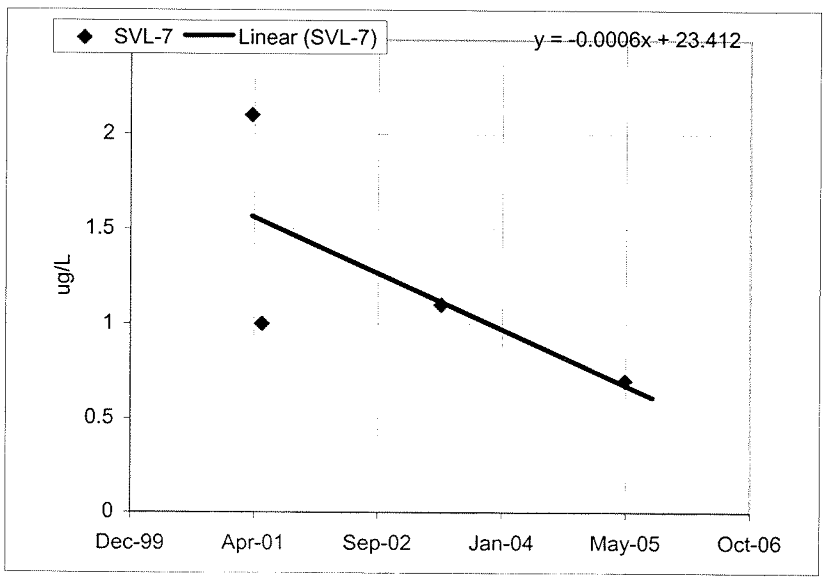
Atrazine



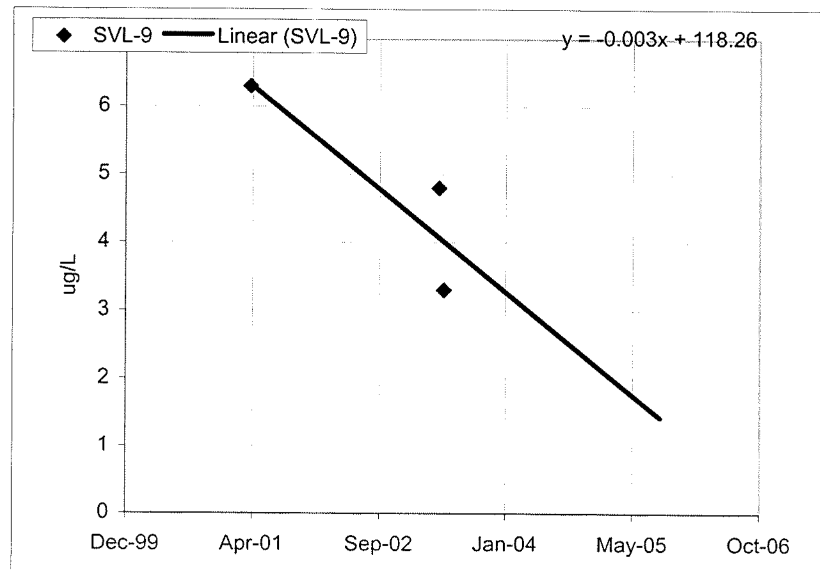
SVL-2-0
Linear (SVL-2-0)
y = -0.0001x + 5.3247
ug/L
1.2
1
0.8
0.6
0.4
0.2
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06



SVL-2-10
Linear (SVL-2-10)
1
0.8
0.6
0.4
0.2
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

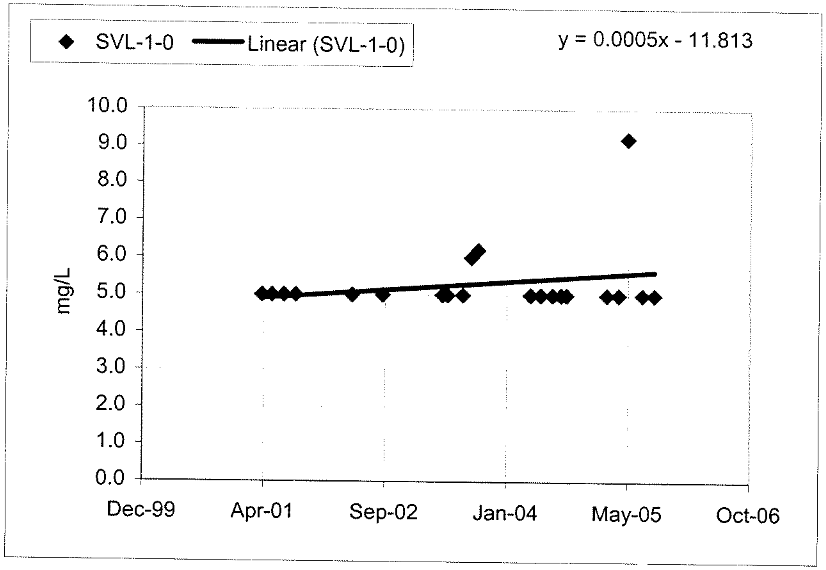


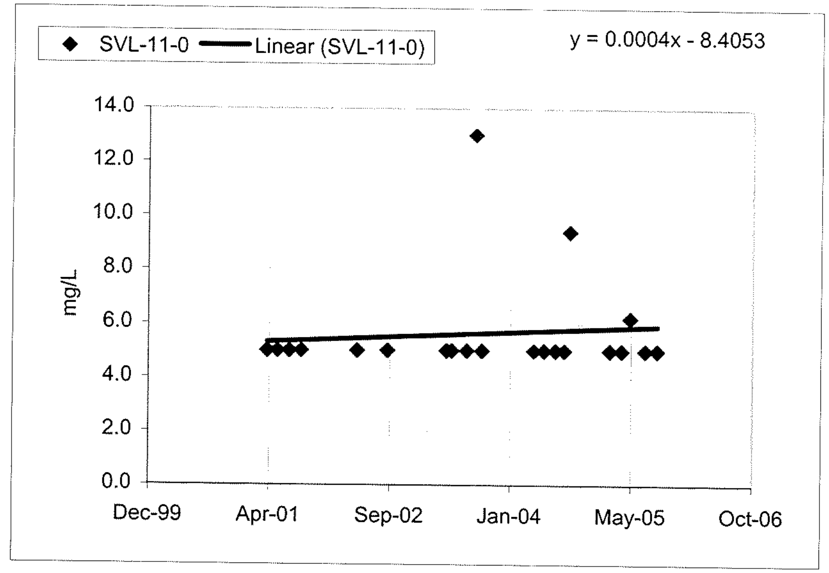
SVL-7
Linear (SVL-7)
y = -0.0006x + 23.412
ug/L
2
1.5
1
0.5
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

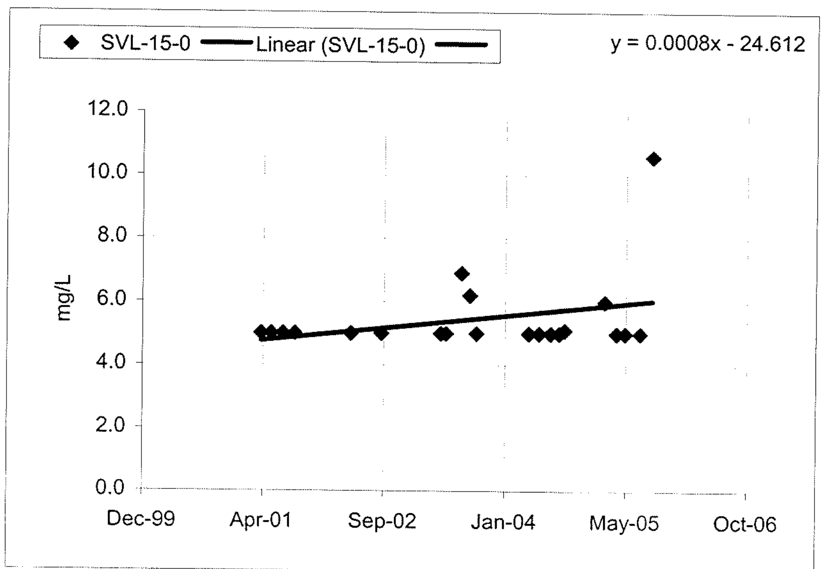


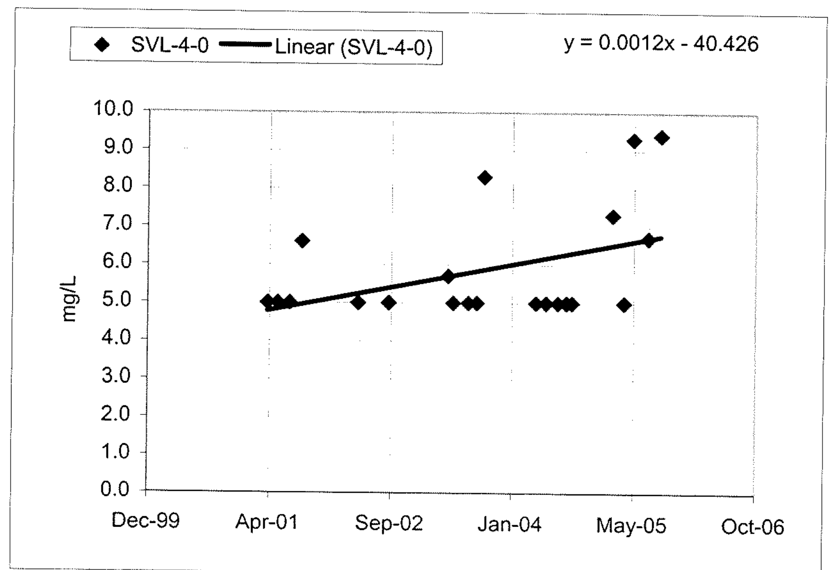
SVL-9
Linear (SVL-9)
y = -0.003x + 118.26
ug/L
6
5
4
3
2
1
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06

Total Organic Carbon (TOC)









Total Organic Carbon (TOC)