Tarrant Regional Water District
Water Quality Trend Analysis 1989-2009
Final Report
Executive Summary

July 2011

Prepared for

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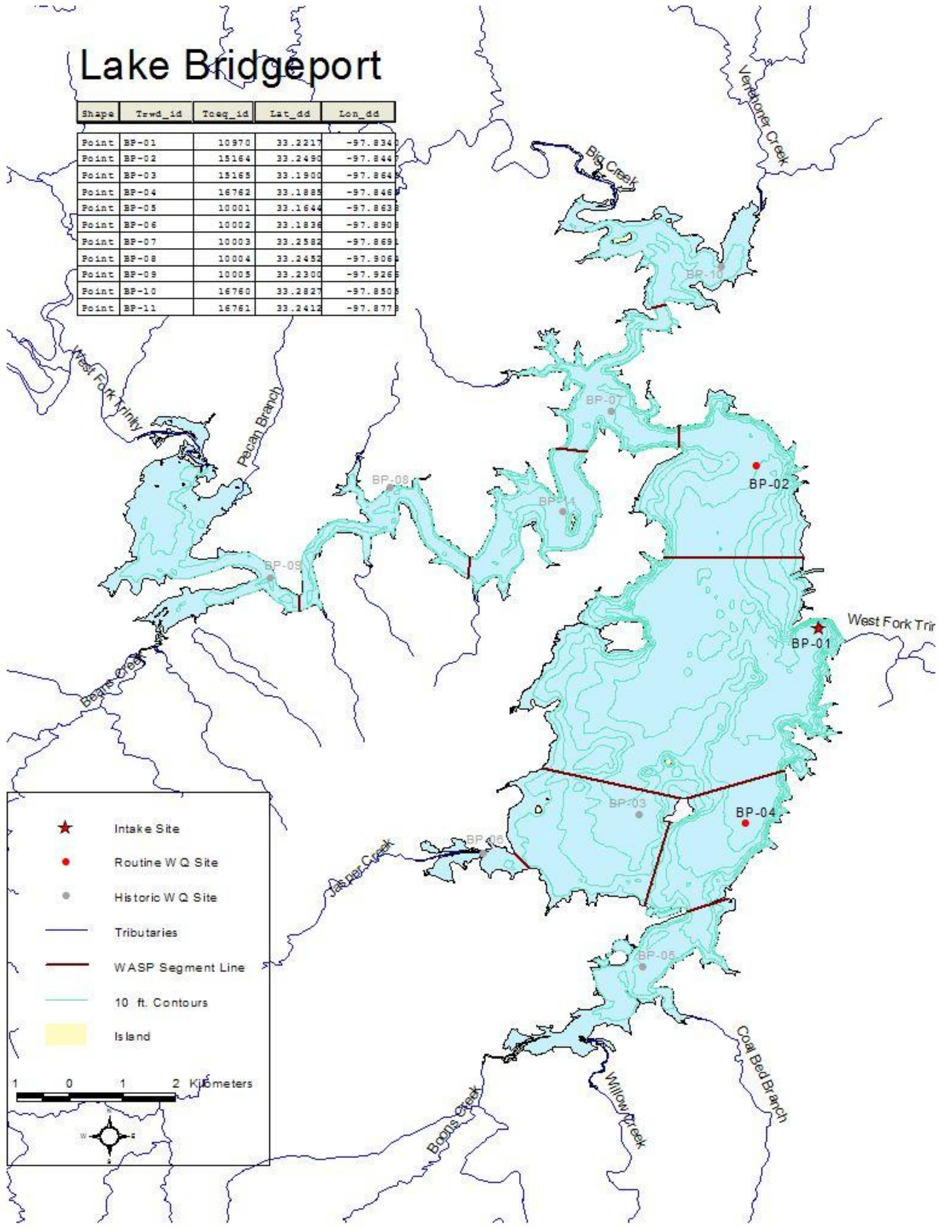
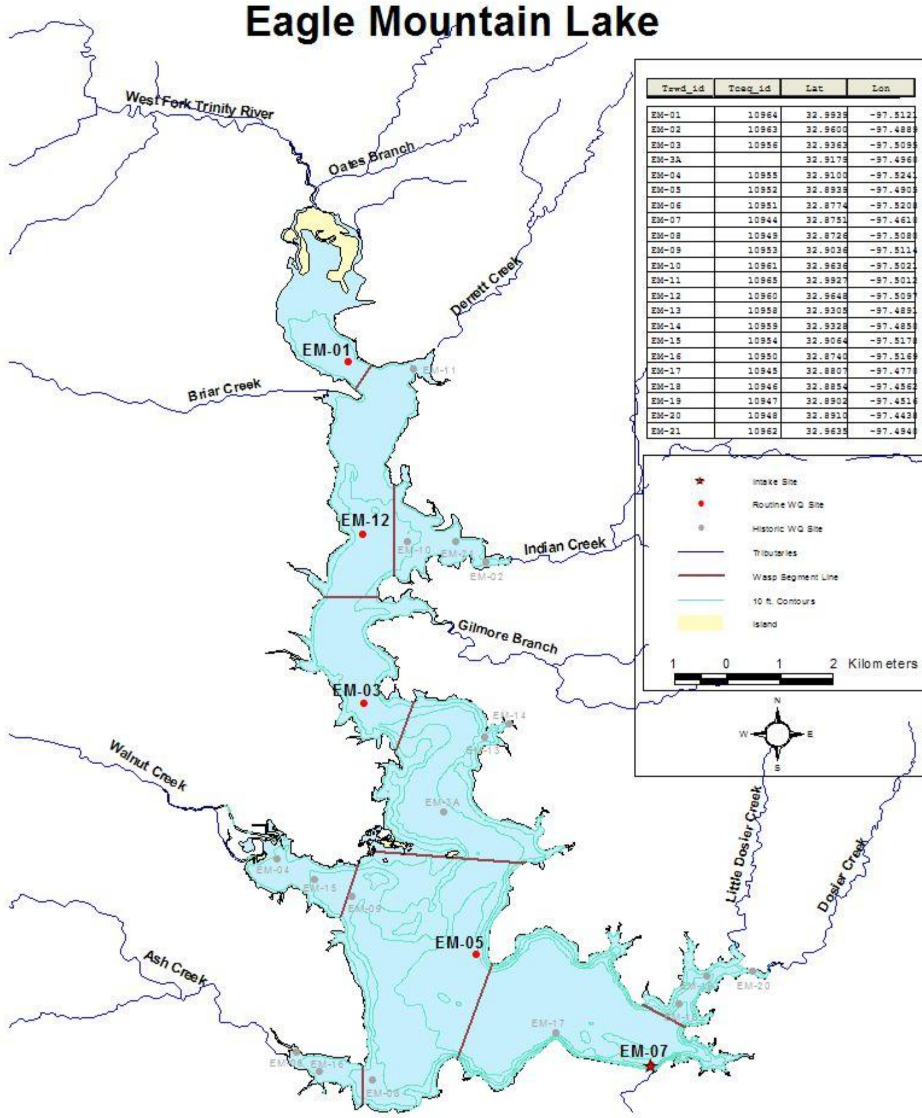
Data analyzed

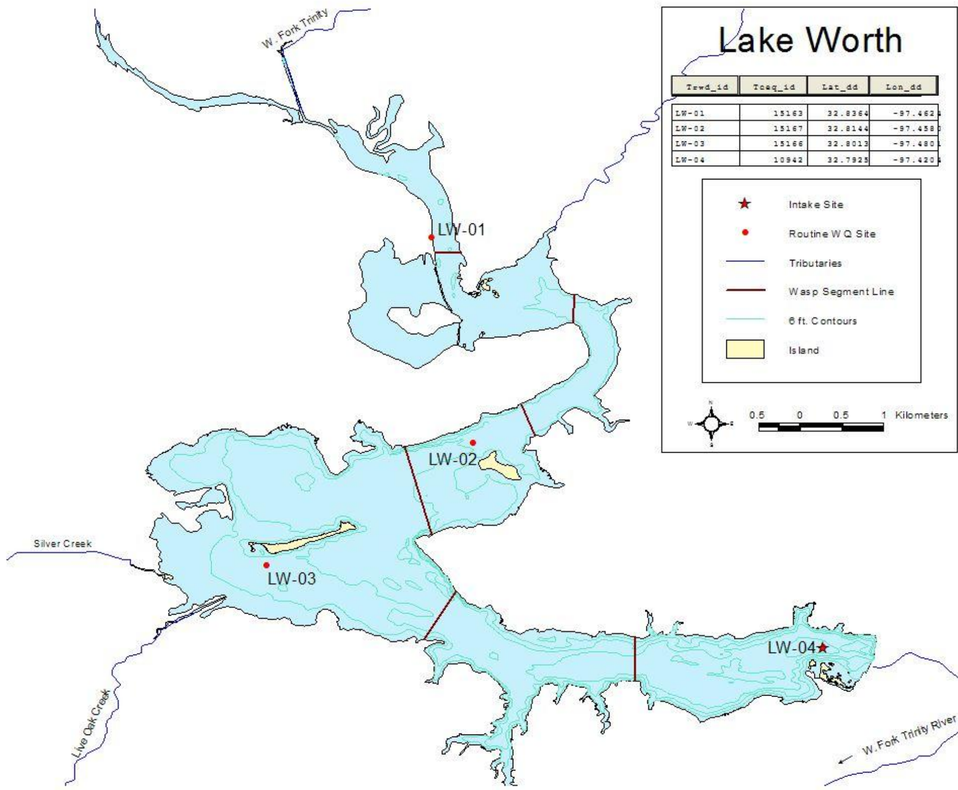
For this report, water quality data were analyzed from the period 1989-2009 were analyzed for seven reservoirs: Lake Bridgeport, Eagle Mountain Lake, Lake Worth, Benbrook Lake, Lake Arlington, Cedar Creek Lake, and Richland Chambers Lake. Data were sampled on a quarterly basis at 3 – 6 locations in each lake, and at 1 – 3 depths at each location. Locations where water quality data were sampled are illustrated in the maps that follow. For two lakes, data are unavailable for large portions of time within the 20 years examined: for Lake Worth, data from about 1995 to 2001 are unavailable; and for Lake Arlington data prior to 2001 are unavailable.



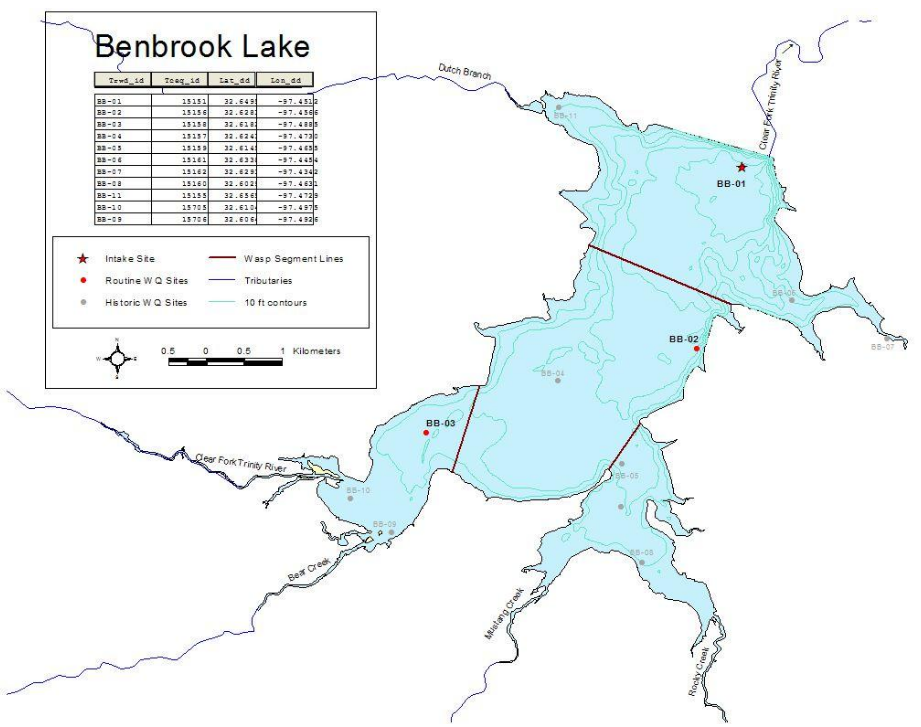
Locations sampled in Lake Bridgeport. Site BP-01 is defined as a Main pool site, and site BP-01B is the intake.



Locations sampled in Eagle Mountain Lake. Sites EM-05 and EM-07 are defined as Main pool sites, and site EM-07M is the intake.

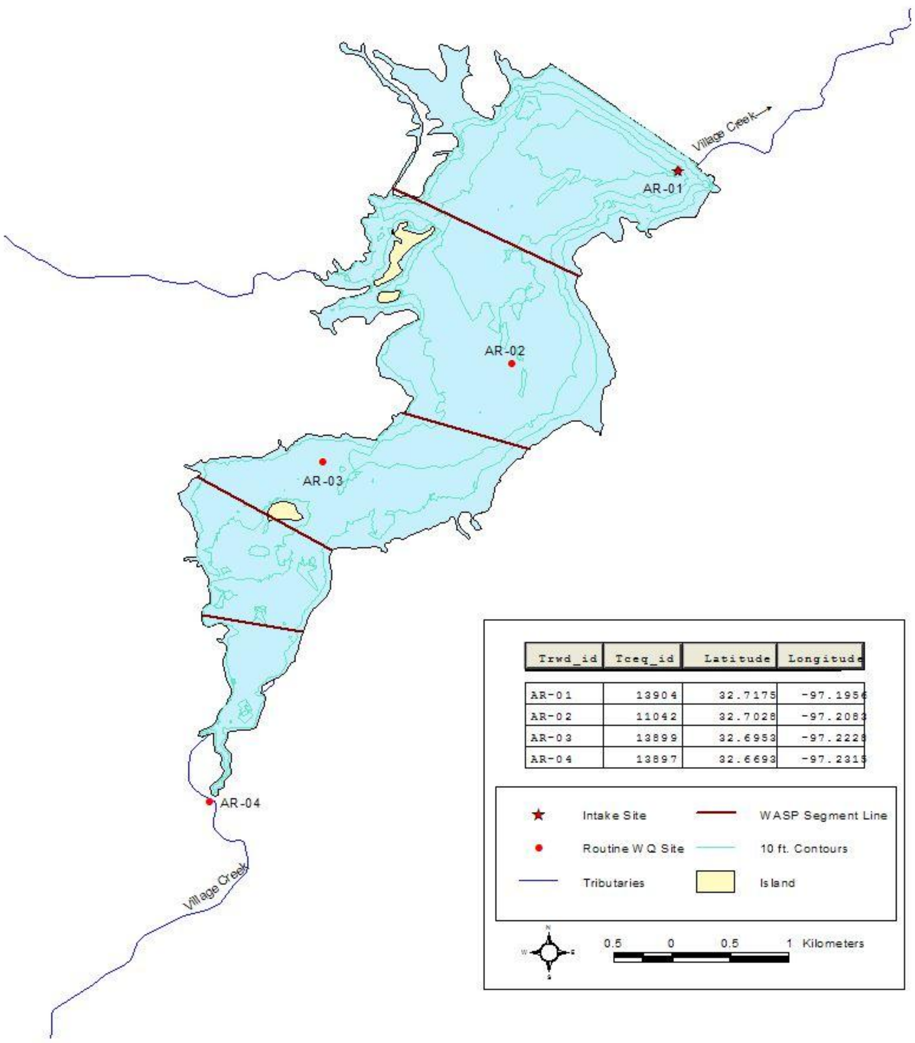


Locations sampled in Lake Worth. Site LW-04 is defined as a Main pool site, and site LW-04M is the intake.

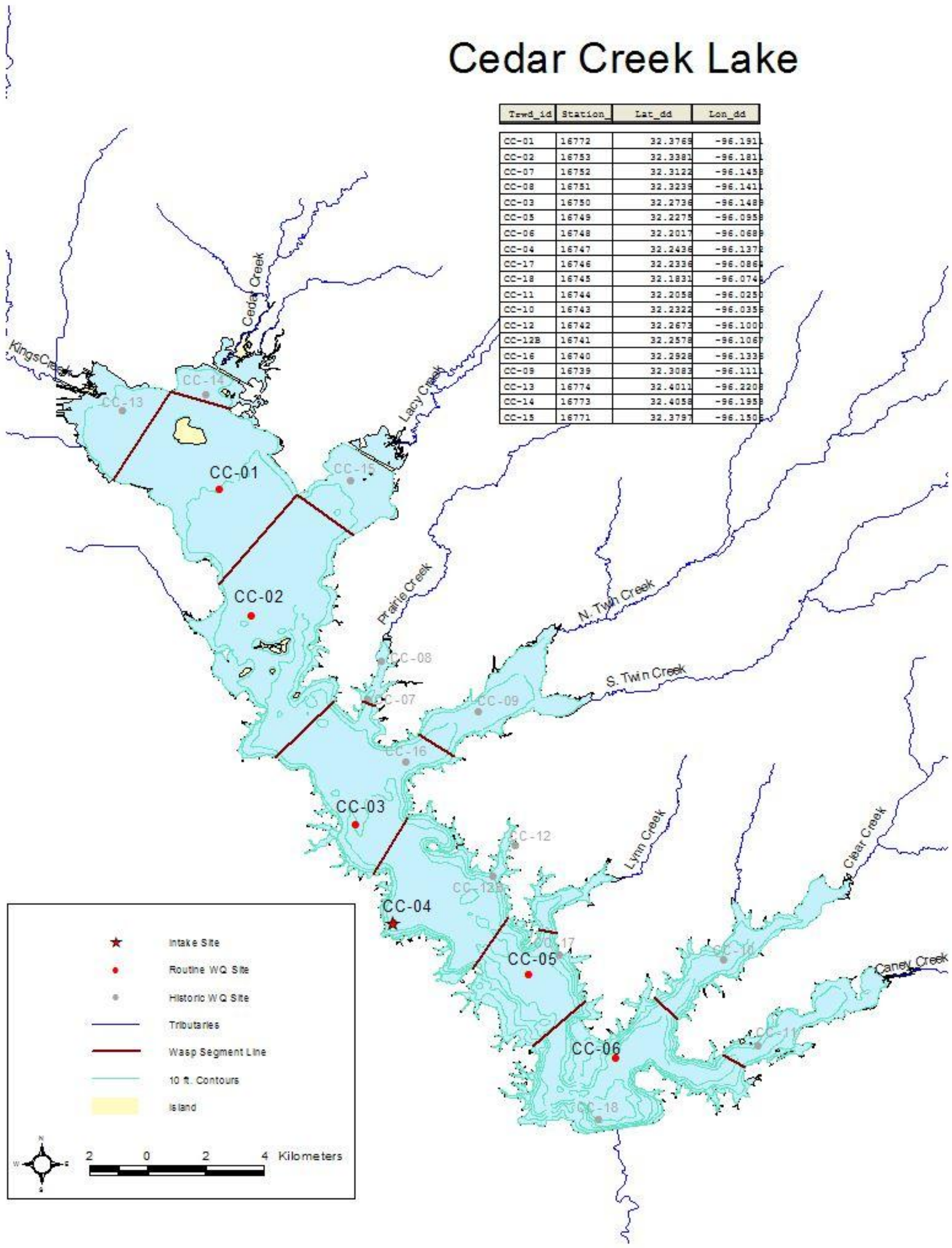


Locations sampled in Benbrook Lake. Sites BB-01 and BB-02 are defined as Main pool sites, and site BB-01T is the intake.

Lake Arlington

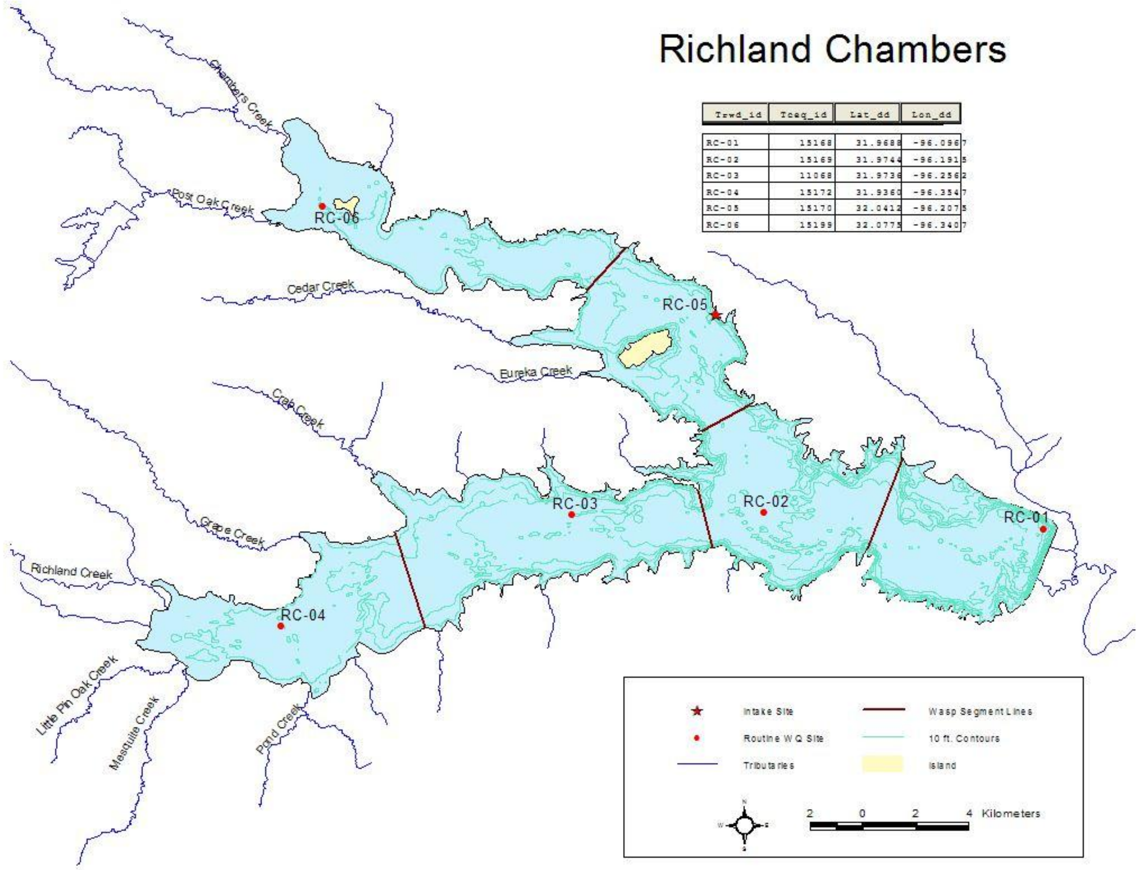


Locations sampled in Lake Arlington. Site AR-01 is defined as a Main pool site, and site AR-01M is the intake.



Tcwd_id	Station_	Lat_dd	Lon_dd
CC-01	16772	32.3769	-96.1911
CC-02	16753	32.3381	-96.1811
CC-07	16752	32.3122	-96.1458
CC-08	16751	32.3239	-96.1411
CC-03	16750	32.2736	-96.1489
CC-05	16749	32.2275	-96.0958
CC-06	16748	32.2017	-96.0689
CC-04	16747	32.2436	-96.1372
CC-17	16746	32.2336	-96.0864
CC-18	16745	32.1831	-96.0744
CC-11	16744	32.2058	-96.0250
CC-10	16743	32.2322	-96.0356
CC-12	16742	32.2673	-96.1000
CC-12B	16741	32.2578	-96.1067
CC-16	16740	32.2928	-96.1336
CC-09	16739	32.3083	-96.1111
CC-13	16774	32.4011	-96.2208
CC-14	16773	32.4058	-96.1958
CC-15	16771	32.3797	-96.1506

Locations sampled in Cedar Creek Lake. Sites CC-05 and CC-06 are defined as Main pool sites, and site CC-04M is the intake.



Locations sampled in Richland Chambers Lake. Sites RC-01 and RC-02 are defined as Main pool sites, and site RC-05M is the intake.

Overview

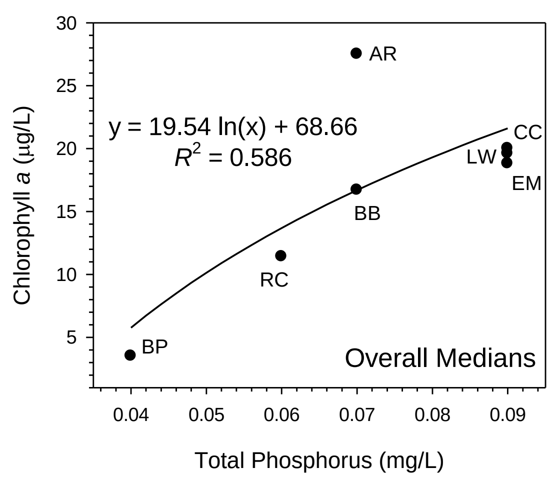
Trends in water quality over the period 1989-2009 were analyzed for seven reservoirs: Lake Bridgeport, Eagle Mountain Lake, Lake Worth, Benbrook Lake, Lake Arlington, Cedar Creek Lake, and Richland Chambers Lake.

Based on their high Chlorophyll *a* concentrations, most lakes are classified as eutrophic. Lake Bridgeport is mesotrophic by this criterion, while Lake Arlington is hypereutrophic. All lakes are eutrophic or hypereutrophic, based on their high Total Phosphorus Concentrations. They are all hypereutrophic based on Secchi Depth measurements, which are low. However, this latter classification is based largely on data from natural lakes in temperate climates that have small watersheds and low loading of inorganic suspended solids, where algal biomass is responsible for most of the observed turbidity of productive lakes. The reservoirs analyzed here have large watersheds and high loading of such solids, which doubtless contribute a large proportion of the observed turbidity. All lakes also have high proportions of blue-green algae, on average > 50% of the total abundance – another diagnostic of eutrophic lakes. TDS concentrations for all lakes are within the range conventionally regarded as freshwater. However, all lakes except Cedar Creek Lake have relatively high concentrations of alkalinity and chloride. These general patterns were found when examining data from all sampling events, data from main pool top sites only, and data from intake sites. Chlorophyll *a* concentrations were generally highest in quarter 3, which fell within the warm growing season for all lakes.

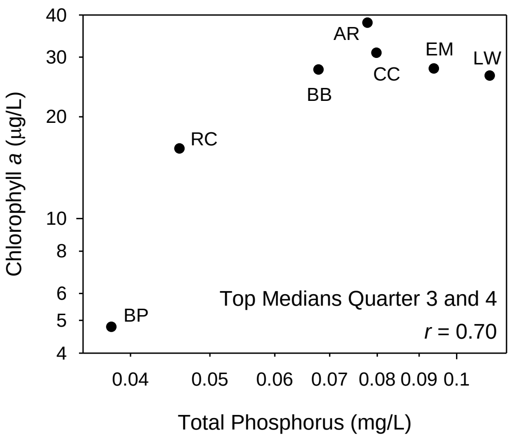
The symptoms of eutrophication appear most severe for Lake Arlington. It had the highest median Chlorophyll *a* and Total Nitrogen concentrations, and a comparatively high Total Phosphorus concentration, along with the lowest median Secchi Depth. Moreover, these indicators display significant trends towards still more eutrophic conditions (increasing nutrients and Chlorophyll *a*, with decreasing Secchi Depth). Indeed, some of these trends in Lake Arlington have the highest rates found in this analysis. However, for Lake Arlington, data are available only from 2001, and so it is possible that a period of unusually high rates of change was captured during this shortened period of observations.

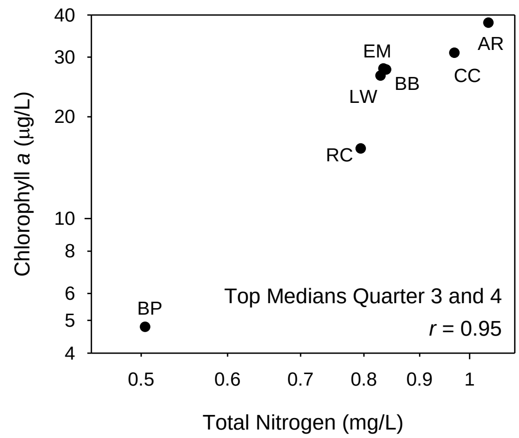
The other lakes also displayed indications of ongoing eutrophication, with significantly increasing Chlorophyll *a* and Total Nitrogen concentrations in all of them, when data from all sampling events are considered, and significantly increasing trends in most lakes when data from main pool top sites are considered. Significant increases in Total Phosphorus were found for Eagle Mountain, Benbrook, and Cedar Creek Lakes, in addition to Lake Arlington.

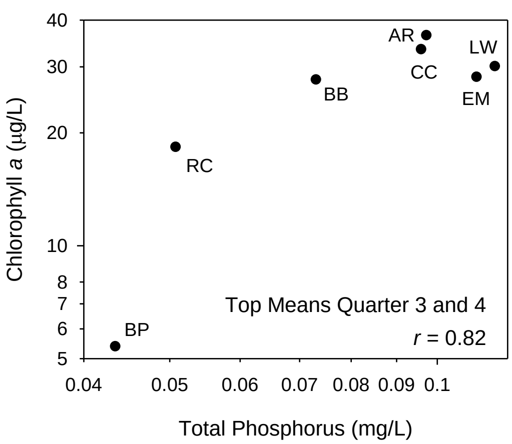
When regression analysis was used to identify factors that could explain variation in Chlorophyll *a* concentrations within lakes, few relationships with nutrients were consistently detected. Various indicators of meteorology and hydrology emerged as significantly related to Chlorophyll *a*, but without consistent patterns among lakes, suggesting individual responses of these lakes to such climatic variation. Positive relationships between Chlorophyll *a* and nutrients are expected, based on the biological requirement of algae for nutrients, and on empirical surveys making comparisons among lakes, rather than over time within lakes. The number of lakes involved here is small (7). Nevertheless, there is a significant positive relationship between Chlorophyll a and Total Phosphorus, when the medians of all data from each lake are used, and the natural logarithm of Total Phosphorus is taken (correlation r = 0.766, P = 0.045).

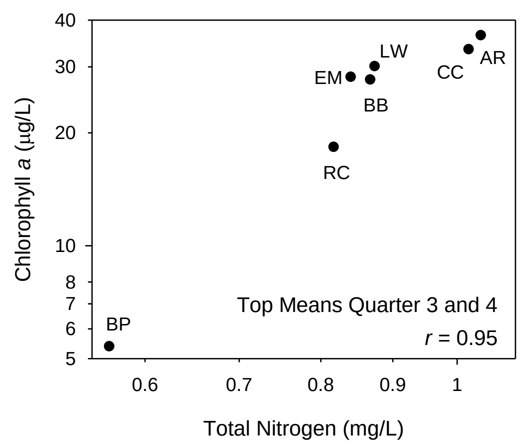


There is a also significant positive relationship between Chlorophyll *a* and Total Nitrogen among these lakes, when logarithms of medians from top samples collected in quarters 3 and 4 are considered (correlation $r = 0.95$, P = 0.001). For these data, there is a positive, but not statistically significant, relationship between Chlorophyll a and Total Phosphorus ($r = 0.70$, P = 0.080). When logarithms of means, instead of medians, are used for the same samples, there is a significant positive relationship between Chlorophyll *a* and Total Nitrogen (correlation $r = 0.95$, P = 0.001), and between Chlorophyll a and Total Phosphorus ($r = 0.82$, P = 0.024). These relationships are illustrated below. When other sets of data are considered (e.g. all sampling events, main pool data only, etc.) similar, but somewhat weaker relationships occur.

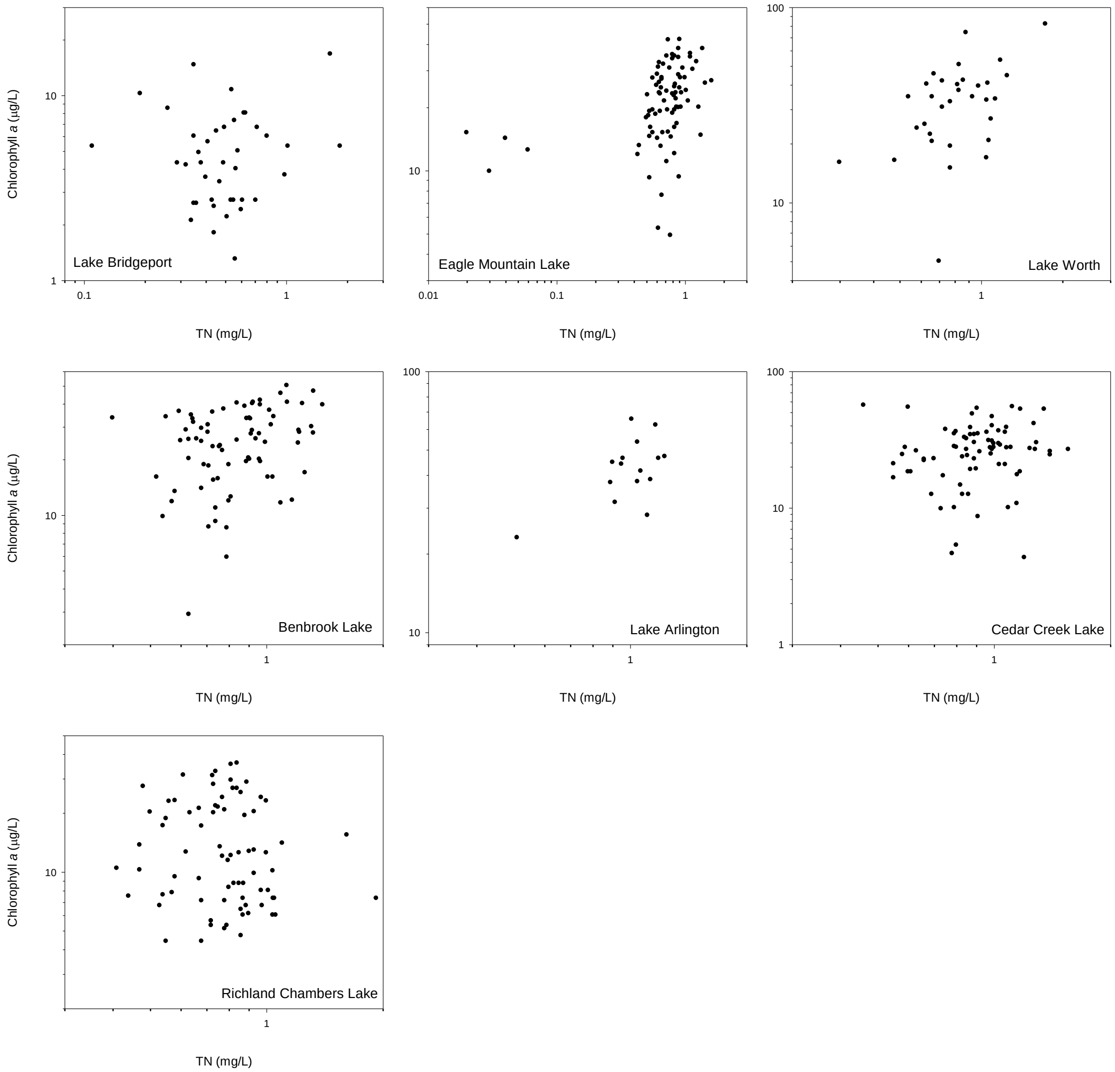


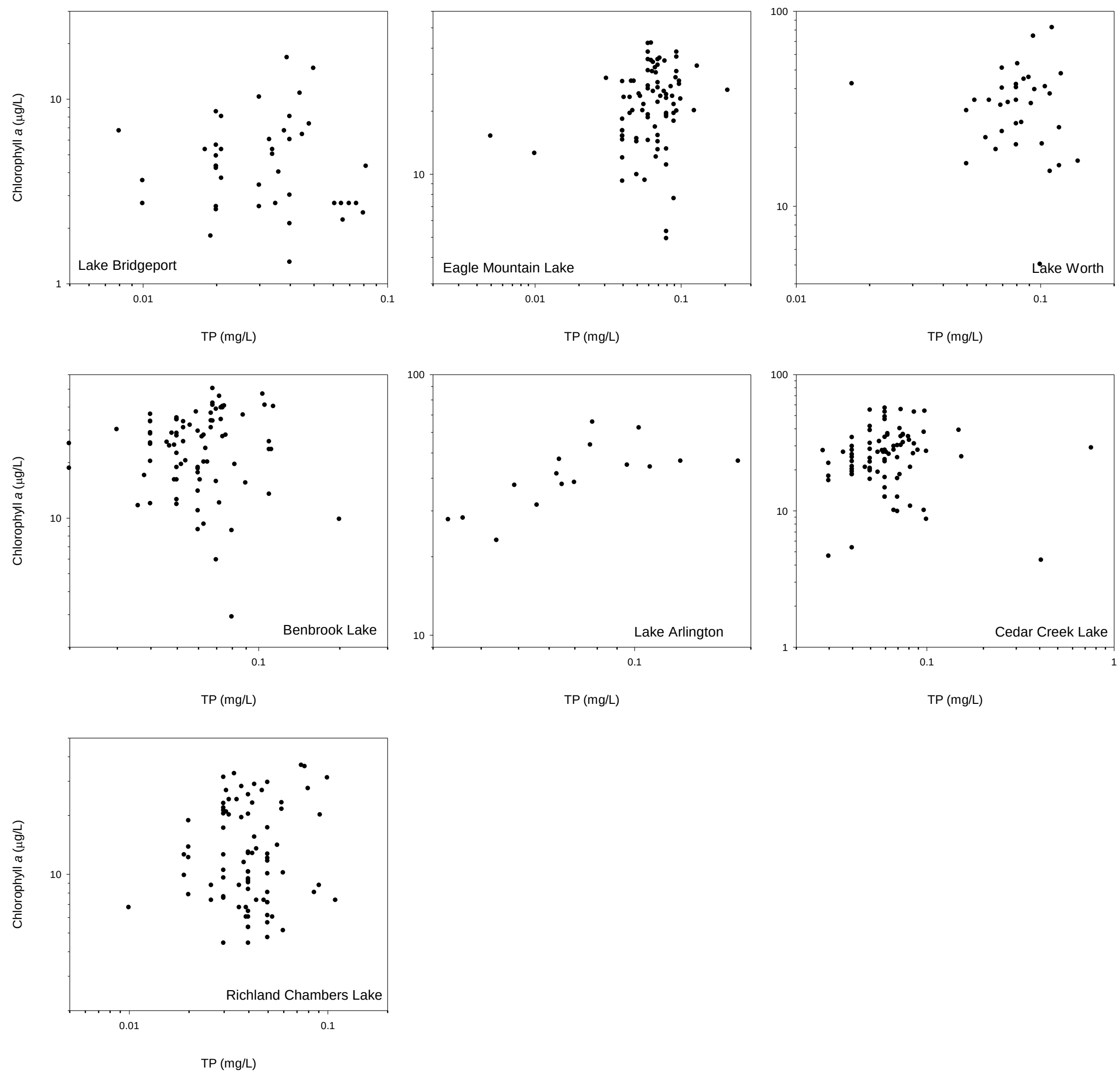






Despite these positive relationships seen when making comparisons among lakes, relationships between Chlorophyll *a* and nutrients appear to be weaker when examined over time, within lakes. The strongest relationships were found when restricting the data to main pool top samples collected during quarters 3 and 4. Based on partial correlations obtained during regression modeling, there was a significant positive relationship between Chlorophyll *a* and Total Nitrogen in three lakes: Eagle Mountain, Benbrook, and Richland Chambers. The figure below illustrates these within-lake relationships for main pool top data in all lakes, from quarters 3 and 4. Even in those lakes with a statistically significant relationship, there is evidently much variation in Chlorophyll *a* that is not explained by relationships with nutrients.


Lake Bridgeport
Eagle Mountain Lake
Lake Worth
Benbrook Lake
Lake Arlington
Cedar Creek Lake
Richland Chambers Lake
Chlorophyll a (µg/L)
TN (mg/L)
0.01
0.1
1
10
100



Trend Analysis

For selected parameters, summary maps of the lakes and their watersheds have been prepared displaying median values and trends. They are attached to the end of this Executive Summary. These summary maps were made using data from all sampling sites within a lake, using data from main pool top sites, and using data from the intake site only. Trends were calculated from regression analysis, and the expressions of rates of trends differ somewhat depending on what regression model was best suited to the properties of the data. For most parameters in most lakes, either a basic linear trend model or a logarithmic trend model was appropriate. For a basic model, the rate of trend is summarized as a linear increase or decrease over the period of record, in units per year, depending on the original units of parameter measurements. For a logarithmic trend model, the rate of trend is summarized as an Annual Percentage Rate of increase or decline that describes the average rate of change over the period of record. For some parameters in Lake Bridgeport and Richland Chambers Lake, a more complex, cubic trend model was needed in the regression analysis. All of these parameters displayed changes in apparent trends between the two decades of the study. To summarize these complex changes, two rates of trend are provided to summarize long-term overall trends versus those during the past decade: an annual average rate (units per year) over the 20-year period of record, and an annual average rate over the past 10 years (1999-2009).

Chlorophyll a

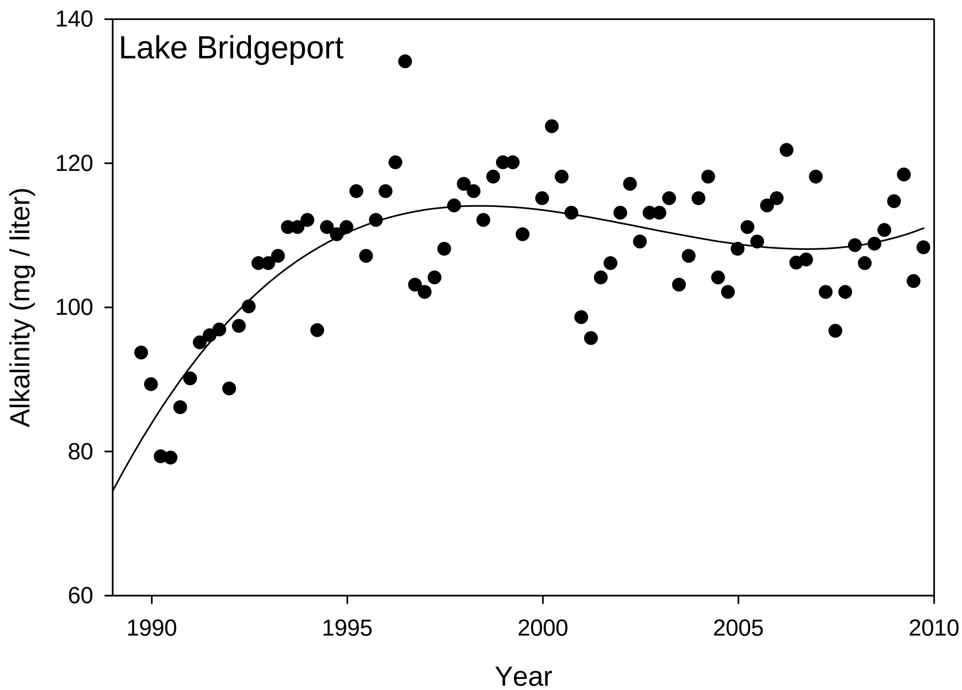
On an overall basis, using data from all sampling sites in a lake, median Chlorophyll *a* ranged from 3.5 mg/L for Lake Bridgeport to 27.5 mg/L in Lake Arlington. Overall median Chlorophyll *a* exceeded 15 mg/L in all lakes except Lake Bridgeport and Richland Chambers Lake. For data from main pool top samples, median Chlorophyll *a* was somewhat higher than overall, and ranged from 4.3 mg/L for Lake Bridgeport to 36.4 mg/L in Lake Arlington. Median Chlorophyll *a* at intake sites was similar to that observed on an overall basis, differing by up to 2 mg/L at most. Median Chlorophyll a at the intake sites was higher than overall for Lake Worth, Benbrook Lake, Lake Arlington, and Richland Chambers Lake.

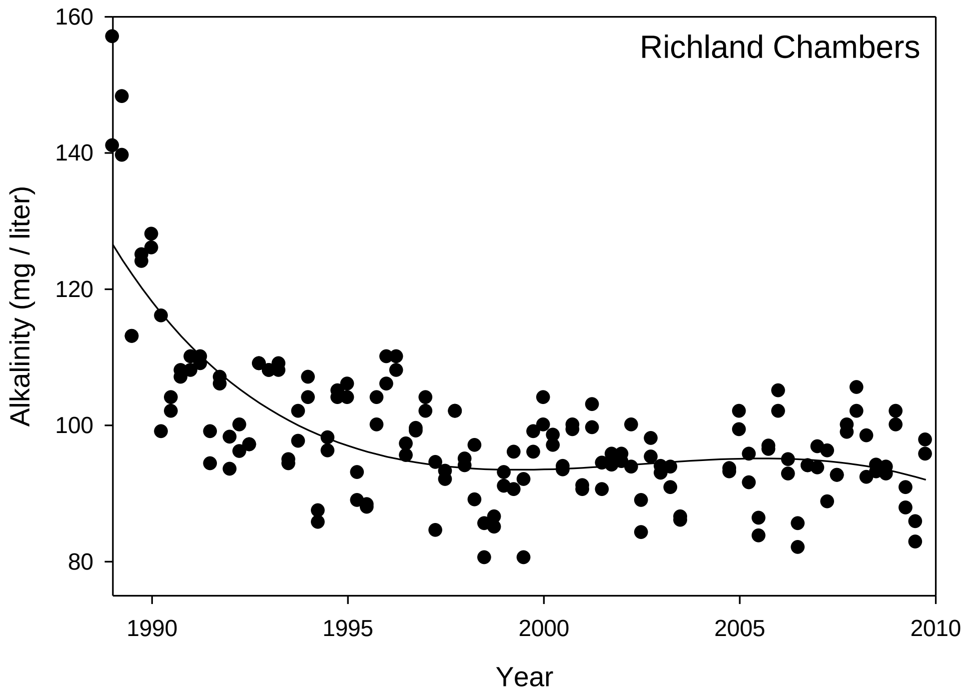
On an overall basis, Chlorophyll *a* significantly increased in all lakes. The highest rate of change was in Lake Arlington, with an Annual Percentage Rate of 6.23%, which would lead to a doubling of Chlorophyll *a*, already high in this lake, in about 11 years. However, this rapid rate of change is based on analyzing a short period of observations, half the length of data available for other lakes. A rapid, significant increase was also found for Cedar Creek Lake, another lake already high in Chlorophyll *a*, with an Annual Percentage Rate of 3.60%, corresponding to a doubling in 20 years. For data from main pool top sites, significant increases were found for four lakes: Eagle Mountain, Lake Worth, Benbrook, and Cedar Creek, with Annual Percentage Rates ranging from 2.53% to 3.62%, corresponding to doubling times of 28 to 19 years. For main pool top sites in Richland Chambers Lake, there was a complex trend of a decrease followed by a more recent increase in Chlorophyll *a*. When Chlorophyll *a* at intake sites was analyzed, significant increases at intake sites were noted at Eagle Mountain Lake, Benbrook Lake, Cedar Creek Lake, and Richland Chambers Lake, with modest Annual Percentage Rates of 2.25% to 3.05%.

Alkalinity

On an overall basis, using data from all sampling sites in a lake, median Alkalinity ranged from 51.5 mg/L for Cedar Creek Lake to 125 mg/L in Lake Worth. Overall median Alkalinity exceeded 98 mg/L in all lakes except Cedar Creek Lake. For data from main pool top samples, median Alkalinity ranged from 52.2 mg/L for Cedar Creek Lake to 123.6 mg/L in Lake Worth. Median Alkalinity at intake sites was similar to that observed on an overall basis, differing by up to 5 mg/L at most. Median Alkalinity at the intake sites was higher than overall for Lake Bridgeport, and Cedar Creek Lake.

On an overall basis, Alkalinity significantly increased at Cedar Creek Lake, at an Annual Percentage Rate of 1.06%. It decreased significantly in all other lakes, except for Lake Bridgeport, which displayed a complex trend. Alkalinity rose rapidly from 1989 until the late 1990's, when it leveled off and perhaps declined slightly. Over the entire period of record, Alkalinity in Lake Bridgeport increased at an average annual rate of 1.44 mg/L per year, but since 1999 it has declined at an average annual rate of -0.30 mg/L per year. For data from main pool top sites, Alkalinity significantly increased in Cedar Creek Lake, at an Annual Percentage Rate of 1.37%, and significantly decreased in Eagle Mountain Lake, Lake Worth, and Benbrook Lake. Alkalinity in Lake Bridgeport displayed a complex trend (illustrated in the following figure). Alkalinity rose rapidly from 1989 until the late 1990's, when it leveled off and perhaps declined slightly. Over the entire period of record, Alkalinity in Lake Bridgeport at main pool top sites increased at an average annual rate of 1.76 mg/L per year, but since 1999 it has decreased more slowly at an average annual rate of -0.26 mg/L per year. Alkalinity in main pool top sites at Richland Chambers Lake also underwent a complex trend, in this case a long-term decrease that was very rapid in the first decade of observations and then slower (illustrated in the following figure). When Alkalinity at intake sites was analyzed, fewer significant trends were detected. Alkalinity significantly increased at Cedar Creek Lake, at an Annual Percentage Rate of 1.33%. It decreased significantly in Eagle Mountain Lake, Benbrook Lake, and Richland Chambers Lake. Lake Bridgeport again displayed a complex trend (similar to that illustrated on an overall basis). Alkalinity rose rapidly from 1989 until the late 1990's, when it leveled off and perhaps declined slightly.





Total Organic Carbon

On an overall basis, using data from all sampling sites in a lake, median Total Organic Carbon ranged from 4.60 mg/L for Lake Bridgeport to 6.68 mg/L in Cedar Creek Lake. Overall median Total Organic Carbon exceeded 5 mg/L in all lakes except Lake Bridgeport and Benbrook Lake. Median Total Organic Carbon at intake sites was similar to that observed on an overall basis, differing by up to 0.24 mg/L at most. Median Total Organic Carbon at the intake sites was slightly higher than overall for Lake Bridgeport, and Benbrook Lake.

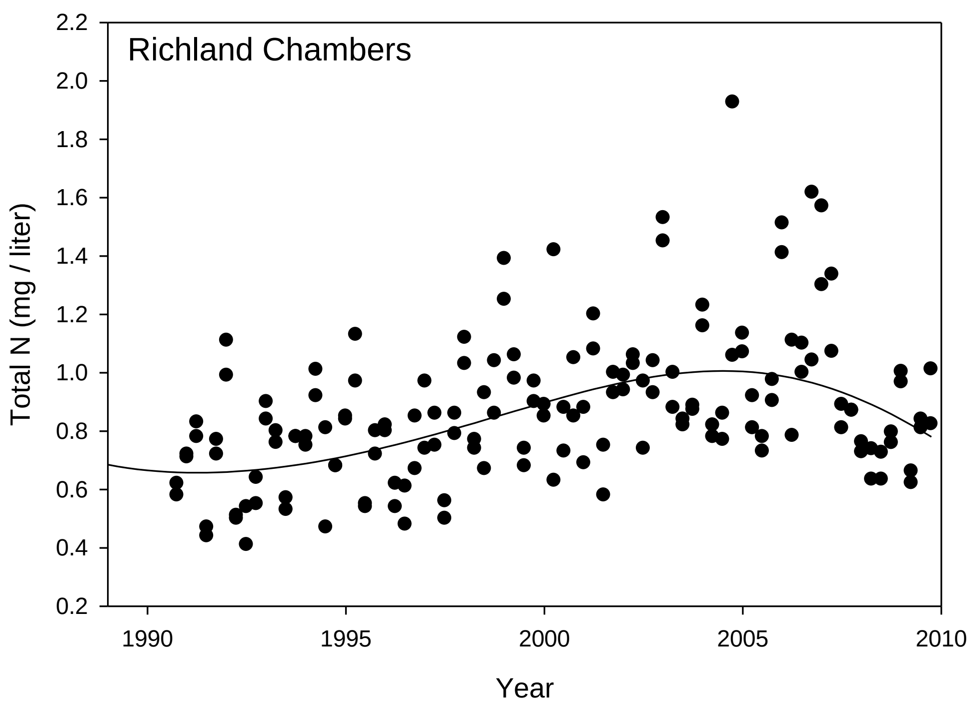
On an overall basis, Total Organic Carbon significantly increased in Lake Bridgeport, Benbrook Lake, and Cedar Creek Lake, although Annual Percentage Rates of increase were relatively low, at 0.5% or less. Total Organic Carbon decreased significantly in all other lakes, except for Eagle Mountain Lake, which had no significant trend. When Total Organic Carbon at intake sites was analyzed, fewer significant trends were detected. Total Organic Carbon significantly increased at Benbrook Lake, and Cedar Creek Lake, at an Annual Percentage Rates of less than 0.6%. It decreased significantly in Eagle Mountain Lake, and Richland Chambers Lake.

Total Nitrogen

On an overall basis, using data from all sampling sites in a lake, median Total Nitrogen ranged from 0.54 mg/L for Lake Bridgeport to 1.08 mg/L in Lake Arlington. Overall median Total Nitrogen exceeded 0.8 mg/L in all lakes except Lake Bridgeport. For data from main pool top sites, median Total Nitrogen ranged from 0.52 mg/L in Lake Bridgeport to 1.08 mg/L in Lake Arlington. Nitrogen at intake sites in most lakes was similar to that observed on an overall basis, but differed by up to 0.28 mg/L at Benbrook

Lake. Median Total Nitrogen at the intake sites was higher than overall for Eagle Mountain Lake, and Lake Worth.

On an overall basis, Total Nitrogen significantly increased at all lakes. Four lakes displayed logarithmic trends, with Annual Percentage Rates ranging from 1.15% at Cedar Creek Lake, to 4.11% at Lake Arlington. Three lakes displayed linear trends, with annual rates ranging from 0.02 to 0.03 mg/L per year. For data from main pool top sites, significant logarithmic trends were found in Lake Worth, Benbrook Lake, and Cedar Creek Lake, with Annual Percentage Rates ranging from 1.66% to 3.95%. For data from main pool top sites, significant linear trends were found in Bridgeport and Eagle Mountain Lakes, with annual average rates of 0.026 and 0.034 mg/L per year, respectively. For data from main pool top sites, there was a complex trend in Richland Chambers lake, with an increase over most of the period of observations, but with a decrease over about the last five years (illustrated below). When Total Nitrogen at intake sites was analyzed, fewer significant trends were detected. Total Nitrogen significantly increased at five lakes. Four lakes displayed logarithmic trends, with Annual Percentage Rates ranging from 1.18% at Cedar Creek Lake, to 2.98% at Benbrook Lake. One lake displayed a linear trend, Lake Bridgeport, with an annual rate of 0.02 mg/L per year.

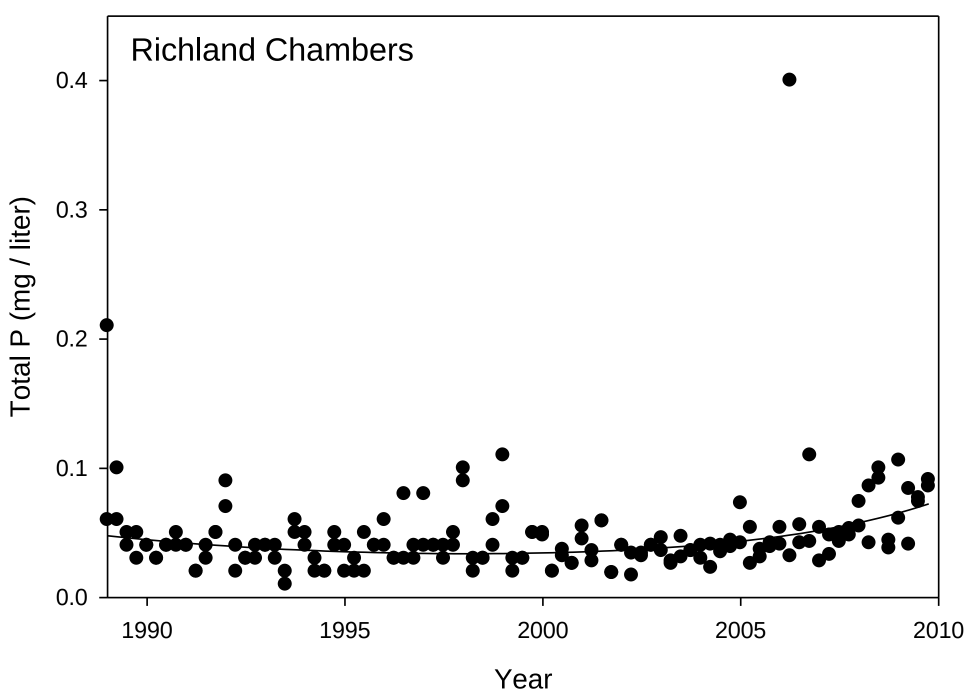


Total Phosphorus

On an overall basis, using data from all sampling sites in a lake, median Total Phosphorus ranged from 0.04 mg/L for Lake Bridgeport to 0.09 mg/L in Eagle Mountain Lake, Lake Worth, and Cedar Creek Lake. Overall median Total Phosphorus exceeded 0.07 mg/L in all lakes except Lake Bridgeport, and Richland Chambers Lake. For data from main pool top sites, median Total Phosphorus ranged from 0.03 mg/L for Lake Bridgeport to 0.07 mg/L in Eagle Mountain Lake, Lake Worth, and Cedar Creek Lake.

Median Total Phosphorus at intake sites was similar to that observed on an overall basis, differing by up to 0.02 mg/L at most. Median Total Phosphorus at the intake site was higher than overall only for Lake Bridgeport.

On an overall basis, Total Phosphorus significantly increased at four lakes, Eagle Mountain Lake, Benbrook Lake, Lake Arlington, and Cedar Creek Lake, with Annual Percentage Rates ranging from 0.64% at Cedar Creek Lake to 5.67% at Lake Arlington. This latter rate is very high, and would lead to a doubling of Total Phosphorus in about 13 years, though this rate is based on a short period of observations. Total Phosphorus had no significant trend in all other lakes. For data from main pool top sites, significant increases were found in Benbrook Lake, Lake Arlington, and Cedar Creek Lake, with Annual Percentage Rates ranging from 1.62% at Benbrook Lake to 13.29% at Lake Arlington. This latter rate is very high, and corresponds to a doubling time of 6 years, though this rate is based on a short period of observations. For data from main pool top sites, Richland Chambers Lake displayed a complex trend, with Total Phosphorus stable over most of the period of observations, but rising in about the last five years (illustrated below). When Total Phosphorus at intake sites was analyzed, fewer significant trends were detected. Total Phosphorus significantly increased at three lakes, Benbrook Lake, Lake Arlington, and Cedar Creek Lake, with Annual Percentage Rates ranging from 1.74% at Cedar Creek Lake to 12.32% at Lake Arlington. This latter rate is even higher than that found for the whole lake, and would lead to a doubling of Total Phosphorus in about 6 years, though again this rate is based on a short period of observations.



Dissolved Organic Carbon

On an overall basis, using data from all sampling sites in a lake, median Dissolved Organic Carbon ranged from 4.18 mg/L for Benbrook Lake to 6.09 mg/L in Cedar Creek

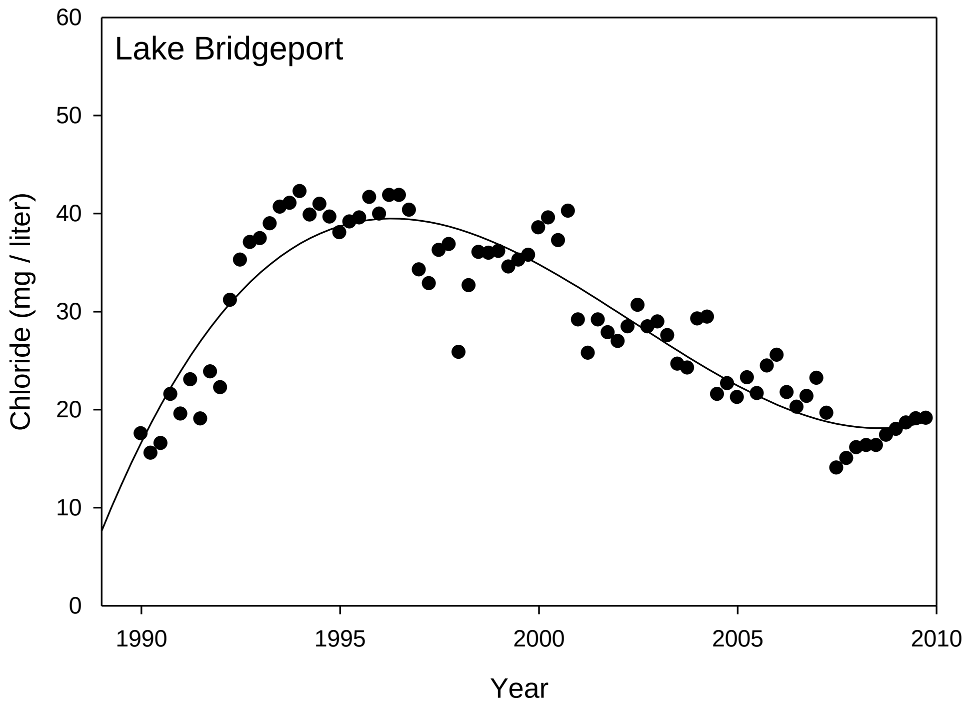
Lake. Overall median Dissolved Organic Carbon exceeded 6 mg/L only in Cedar Creek Lake. Median Dissolved Organic Carbon at intake sites was similar to that observed on an overall basis, differing by up to 0.22 mg/L at most. Median Dissolved Organic Carbon at the intake sites was higher than overall for five lakes: Lake Bridgeport, Eagle Mountain Lake, Lake Worth, Benbrook Lake and Lake Arlington.

On an overall basis, Dissolved Organic Carbon significantly increased at all lakes except Lake Arlington. Lake Bridgeport and Cedar Creek Lake displayed linear trends with annual rates of 0.01 and 0.07 mg/L per year, respectively. The other four lakes displayed logarithmic trends, with annual percentage rates ranging from 0.56% in Eagle Mountain Lake to 1.17% in Benbrook Lake. When Alkalinity at intake sites was analyzed, fewer significant trends were detected. Alkalinity significantly increased at four lakes, Lake Bridgeport, Benbrook Lake, Cedar Creek Lake, and Richland Chambers Lake. Lake Bridgeport and Cedar Creek Lake displayed linear increases at annual rates of 0.03 and 0.06 mg/L per year, respectively. Benbrook Lake and Richland Chambers Lake displayed logarithmic increases at Annual Percentage Rates of 1.29% and 0.63%, respectively.

Chloride

On an overall basis, using data from all sampling sites in a lake, median Chloride ranged from 10.3 mg/L for Richland Chambers Lake to 35.7 mg/L in Lake Worth. Overall median Chloride exceeded 20 mg/L in all lakes except Lake Arlington, Cedar Creek Lake, and Richland Chambers Lake. Using data from main pool top sites, median Chloride ranged from 9.7 mg/L for Richland Chambers Lake to 36.5 mg/L in Lake Worth. Median Chloride at intake sites was similar to that observed on an overall basis, differing by up to 2 mg/L at most. Median Chloride at the intake sites was higher than overall for Lake Bridgeport, Cedar Creek Lake, and Richland Chambers Lake.

On an overall basis, Chloride significantly increased at Cedar Creek Lake, at an Annual Percentage Rate of 0.77%. It decreased significantly at Eagle Mountain Lake. Lake Bridgeport displayed a complex trend. Chloride rose rapidly from 1989 until the mid 1990’s, when it leveled off and then declined. Over the entire period of record, Chloride in Lake Bridgeport increased at an average annual rate of 0.51 mg/L per year, but since 1999 it has declined at an average annual rate of -1.70 mg/L per year. For data from main pool top sites Chloride significantly increased at Cedar Creek Lake, at an Annual Percentage Rate of 2.88%. It decreased significantly at Lake Worth. For data from main pool top sites, Lake Bridgeport displayed a complex trend (illustrated below). Chloride rose rapidly from 1989 until the mid 1990’s, when it leveled off and then declined. Over the entire period of record, Chloride in Lake Bridgeport increased at an average annual rate of 0.54 mg/L per year, but since 1999 it has declined at an average annual rate of -1.66 mg/L per year. When Chloride at intake sites was analyzed, fewer significant trends were detected. Chloride decreased significantly in Eagle Mountain Lake. Lake Bridgeport again displayed a complex trend. Chloride rose rapidly from 1989 until the mid 1990’s, when it leveled off and then declined. Over the entire period of record, Chloride in Lake Bridgeport increased at an average annual rate of 0.56 mg/L per year, but since 1999 it has declined at an average annual rate of -1.63 mg/L per year.



Total Kjeldahl Nitrogen

On an overall basis, using data from all sampling sites in a lake, median Total Kjeldahl Nitrogen ranged from 0.48 mg/L for Lake Bridgeport to 1.02 mg/L in Lake Arlington. Overall median Total Kjeldahl Nitrogen exceeded 0.7 mg/L in all lakes except Lake Bridgeport.

Total Kjeldahl Nitrogen significantly increased at all lakes, except Lake Arlington, following logarithmic trends. Annual Percentage Rates of increase ranged from 1.82% at Richland Chambers Lake, to 4.80% at Lake Bridgeport. This latter rate is high enough to produce a doubling of Total Kjeldahl Nitrogen in 15 years.

TN:TP Ratio

On an overall basis, using data from all sampling sites in a lake, median TN:TP ranged from 9.02 for Eagle Mountain Lake to 14.7 in Richland Chambers Lake. Overall median TN:TP exceeded 10 in all lakes except Eagle Mountain Lake, and Lake Worth.

On an overall basis, TN:TP significantly increased at five lakes, Lake Bridgeport, Eagle Mountain Lake, Lake Worth, Benbrook Lake, and Richland Chambers Lake. All these lakes displayed logarithmic increase, at Annual Percentage Rates ranging from 0.84% for Richland Chambers Lake to 7.12% for Eagle Mountain Lake. TN:TP decreased significantly Lake Arlington, following a linear trend with an annual rate of -1.88 per year.

Total Suspended Solids

On an overall basis, using data from all sampling sites in a lake, median Total Suspended Solids ranged from 7.4 mg/L for Lake Bridgeport to 15.4 mg/L in Lake Worth. Overall median Total Suspended Solids exceeded 10 mg/L in four lakes, Eagle Mountain Lake, Lake Worth, Benbrook Lake, and Lake Arlington.

On an overall basis, Total Suspended Solids significantly increased at Benbrook Lake and Lake Arlington, at Annual Percentage Rates of 1.09% and 5.08%, respectively. This latter rate is high, and would lead to a doubling in 14 years.

Total Dissolved Solids

On an overall basis, using data from all sampling sites in a lake, median Total Dissolved Solids ranged from 119 mg/L for Cedar Creek Lake to 235 mg/L in Eagle Mountain Lake, and Lake Worth. Overall median Total Dissolved Solids exceeded 200 mg/L in four lakes, Lake Bridgeport, Eagle Mountain Lake, Lake Worth, and Benbrook Lake.

On an overall basis, Total Dissolved Solids significantly increased at Cedar Creek Lake, at an Annual Percentage Rate of 0.47%. It decreased significantly in Eagle Mountain Lake, Lake Worth, Benbrook Lake, and Richland Chambers Lake. In Lake Bridgeport, Total Dissolved Solids displayed a complex trend (similar to that illustrated for Alkalinity). Total Dissolved Solids rose rapidly from 1989 until the mid 1990's, when it leveled off and then declined. Over the entire period of record, Total Dissolved Solids in Lake Bridgeport increased at an average annual rate of 2.59 mg/L per year, but since 1999 it has declined at an average annual rate of -4.46 mg/L per year.

Secchi Depth

On an overall basis, using data from all sampling sites in a lake, median Secchi Depth ranged from 0.46 m for Lake Arlington to 1.14 m in Lake Bridgeport. Overall median Secchi Depth was less than 1 m all lakes, except Lake Bridgeport.

On an overall basis, Secchi Depth significantly decreased at Lake Arlington, Cedar Creek Lake, and Richland Chambers Lake. All lakes displayed a linear trend, with annual rates of decrease ranging -0.004 m per year at Cedar Creek Lake to -0.02 m per year at Lake Arlington. Secchi Depth increased significantly in Eagle Mountain Lake, and Lake Worth. In Lake Bridgeport, Secchi Depth displayed a complex trend (similar to that illustrated for Alkalinity). Secchi Depth rose rapidly from 1989 until the late 1990's, when it leveled off and then perhaps declined slightly. Over the entire period of record, Secchi Depth in Lake Bridgeport increased at an average annual rate of 0.04 m per year, but since 1999 it has declined at an average annual rate of -0.01 m per year.

Explanatory Analysis

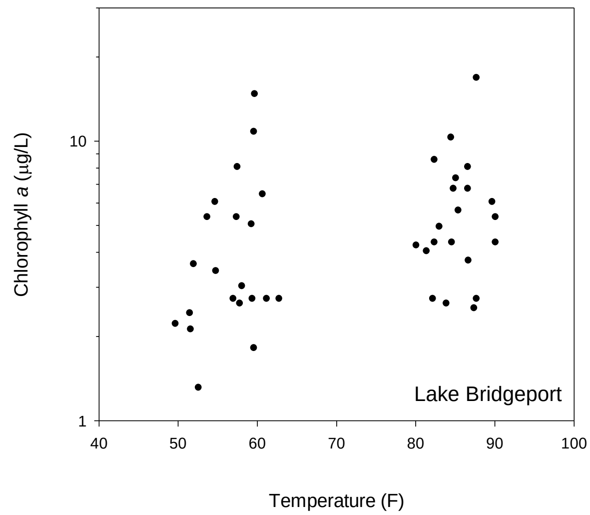
Multiple regression techniques were used to relate Chlorophyll *a* to Total Phosphorus, Total Nitrogen, and several hydrological and meteorological variables (Tributary Inflow, Pumpage where applicable, Lake Elevation, Standard Deviation of

Elevation, Air Temperature, Variation of Air Temperature from long-term means, and the Southern Oscillation Index that indicates El Niño events). These variables were selected in consultation with TRWD personnel, and are indicators of climatic, meteorological and hydrological conditions that can be expected to affect water quality. Each relates to factors that are likely to have both independent and related effects on various aspects of water quality. Air Temperature strongly affects evaporation, but also water temperature which in turn affects rates of biological processes that affect many aspects of water quality. Air Temperature has strong seasonal variation that can make it more difficult to detect influences of unusually warm or cold weather. Air Temperature Variation measures such unusual conditions, since it calculates the difference between observed Air Temperature and what is expected from the long-term average for the time of year. Thus it identifies unusually warm or cool summers, for example. The Southern Oscillation Index (SOI) is used to measure interannual cycles in climate associated with El-Niño events. Negative values of the SOI indicate El Niño events, during which weather in the north Texas region tends to be wetter and cooler than average. Positive values indicate La Niña events, during which weather in this region tends to be drier and warmer than average. During the 1990's there were two strong El Niño periods, while La Niña conditions prevailed in the early and late 2000's. Tributary Inflow affects the water balance of a reservoir, and loads dissolved and particulate substances derived from the watershed, both factors which can strongly affect water quality. Tributary Inflow and Elevation are obviously related variables, since high inflow will produce high Elevation, but Elevation also integrates the influence of water loss, e.g. evaporation and withdrawals. The Standard Deviation of Elevation (on a quarterly basis) increases when there is large change in Elevation, so it identifies periods of time when such large changes might have a disproportionate effect on water quality. For some of the reservoirs, a substantial part of inflow is made up by pumpage from other reservoirs, so such Pumpage was included this was the case, since the supplied water may have different quality than the receiving water, and so change its characteristics.

For this summary, relationships between Chlorophyll a and other variables are emphasized, for data from main pool top samples collected in quarters 3 and 4. Using this subset of the data usually produced regressions that explained a higher proportion of variance in Chlorophyll *a* than when other subsets of data were used. For the data presented here, regression models using hydrology, meteorology, and nutrients explained over 50% of the variance in Chlorophyll *a* for several lakes, and up to 95% for Lake Arlington. In these regression analyses, the significance and strength of nutrient effects is assessed after accounting statistically for hydrological and meteorological effects. Although nutrient effects were consistent among lakes to some degree, hydrological and meteorological effects appeared to vary among lakes, with different factors identified as important in different lakes.

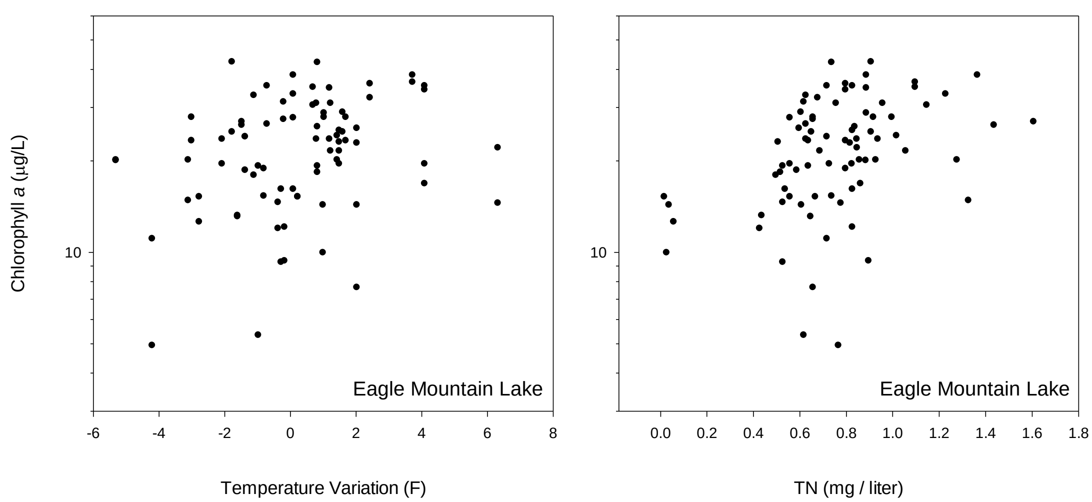
Lake Bridgeport

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Lake Bridgeport was significantly related to Air Temperature (shown below). Chlorophyll *a* tended to be higher under warm conditions. The regression model with all explanatory variables explained 34% of the variance in Chlorophyll *a*.



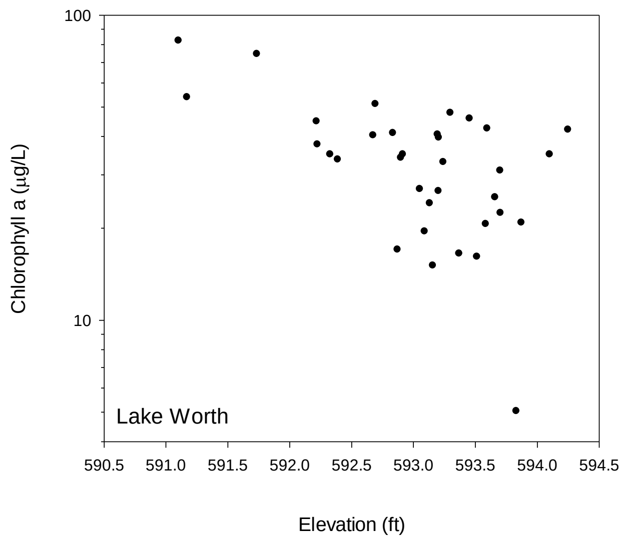
Eagle Mountain Lake

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Eagle Mountain Lake was significantly related to Air Temperature Variation and TN (shown below). Chlorophyll *a* tended to increase with TN, and under conditions that are warmer than long-term average conditions. The regression model with all explanatory variables explained 26% of the variance in Chlorophyll *a*.



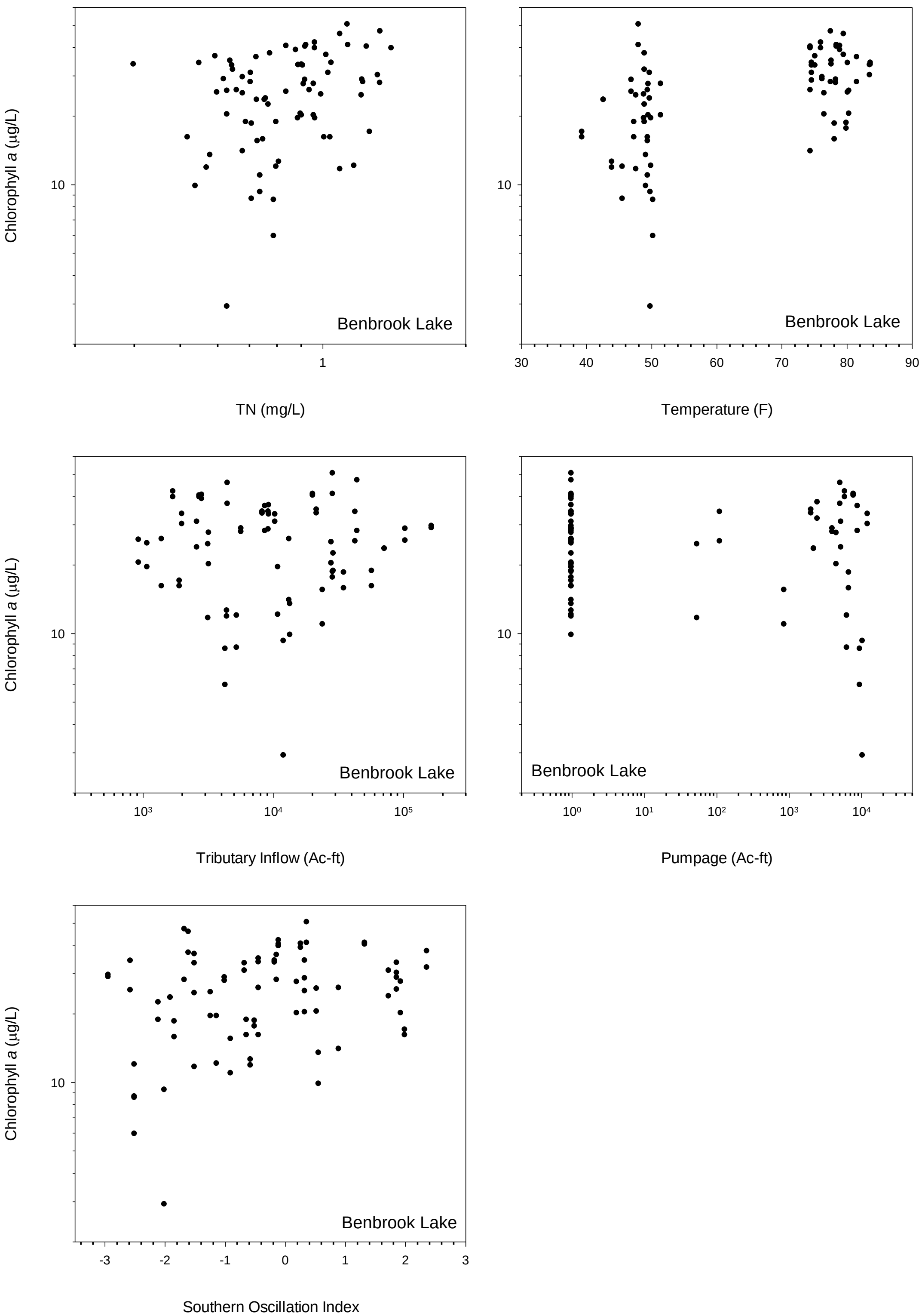
Lake Worth

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Lake Worth was significantly related to Elevation (shown below) and Air Temperature Variation. Chlorophyll *a* tended to decrease with Elevation, and tended to increases when weather was warmer than normal. The regression model with all explanatory variables explained 50% of the variance in Chlorophyll *a*.



Benbrook Lake

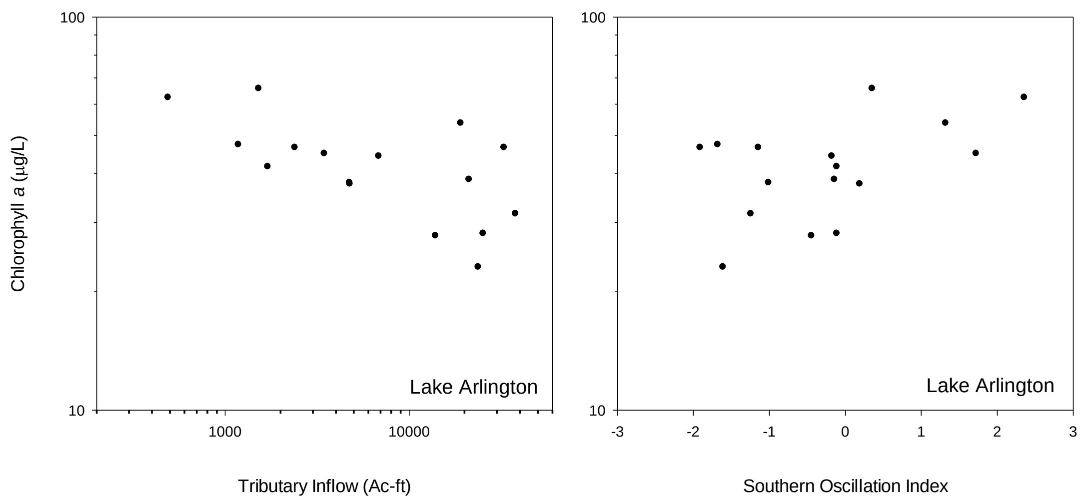
Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Benbrook Lake Worth was significantly related to TN, Air Temperature, Tributary Inflow, Pumpage, and SOI (shown below). Chlorophyll *a* tended to increase with TN, under warm conditions, when inflow is high and pumpage low, and during La Niña conditions. The regression model with all explanatory variables explained 56% of the variance in Chlorophyll *a*.



Chlorophyll a (µg/L)
10
1
TN (mg/L)
Benbrook Lake
30
40
50
60
70
80
90
Temperature (F)
Benbrook Lake
10³
10⁴
10⁵
Tributary Inflow (Ac-ft)
Benbrook Lake
10⁰
10¹
10²
10³
10⁴
Pumpage (Ac-ft)
Benbrook Lake
-3
-2
-1
0
1
2
3
Southern Oscillation Index
Benbrook Lake

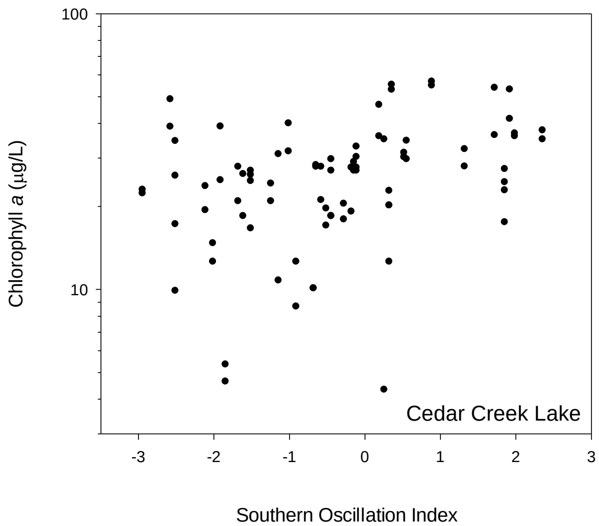
Lake Arlington

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Lake Arlington was significantly related to SOI and Tributary Inflow (shown below). Chlorophyll *a* tended to increase under La Niña conditions, when precipitation and hence inflow tend to be low. The regression model with all explanatory variables explained 95% of the variance in Chlorophyll *a*. Although pumpage can constitute a large flow for Lake Arlington, it did not emerge as significantly related to any of the response variables analyzed for Main Pool top samples.



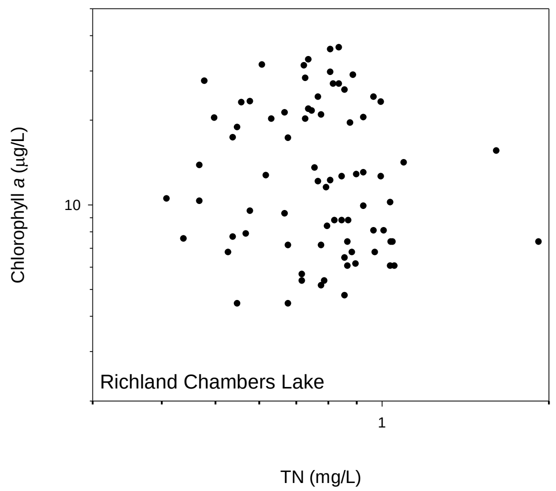
Cedar Creek Lake

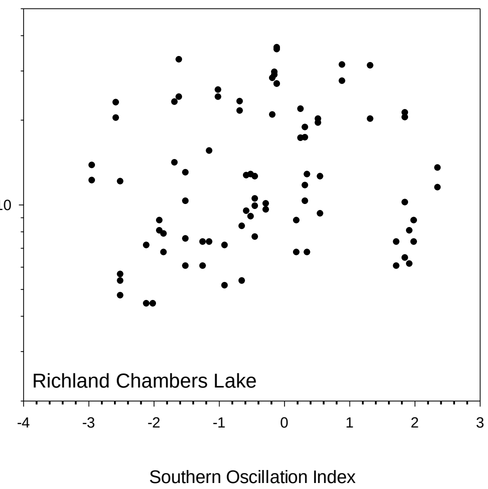
Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Cedar Creek Lake was significantly related only to SOI (shown below). Chlorophyll *a* tended to increase under La Niña conditions that are generally drier than average. The regression model with all explanatory variables explained 31% of the variance in Chlorophyll *a*.

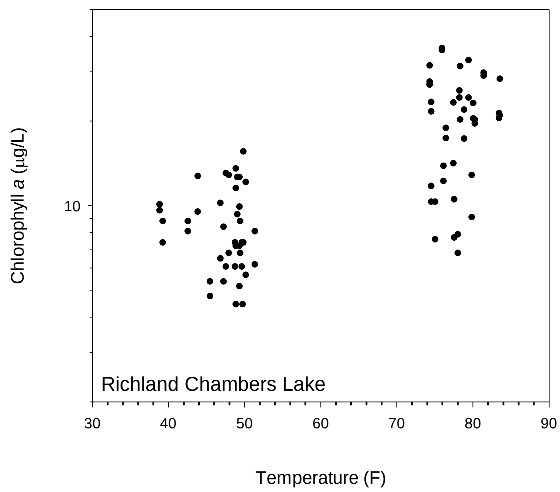


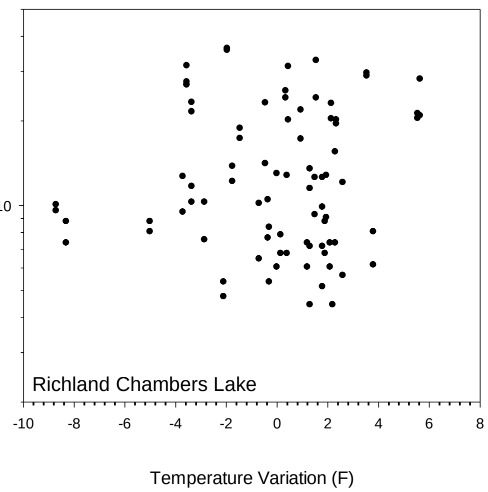
Richland Chambers Lake

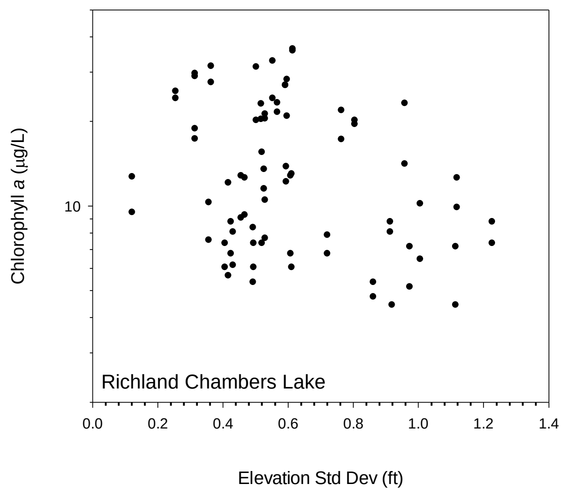
Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Richland Chambers Lake was significantly related to TN, SOI, Air Temperature, Air Temperature Variation, and Standard Deviation of Elevation (shown below). Chlorophyll *a* tended to increase with TN. It is also higher under La Niña conditions, warm conditions that are nevertheless cooler than long-term average conditions, and when Elevation has low variability. The regression model with all explanatory variables explained 71% of the variance in Chlorophyll *a*.


Chlorophyll a (µg/L)
10
Richland Chambers Lake
1
TN (mg/L)

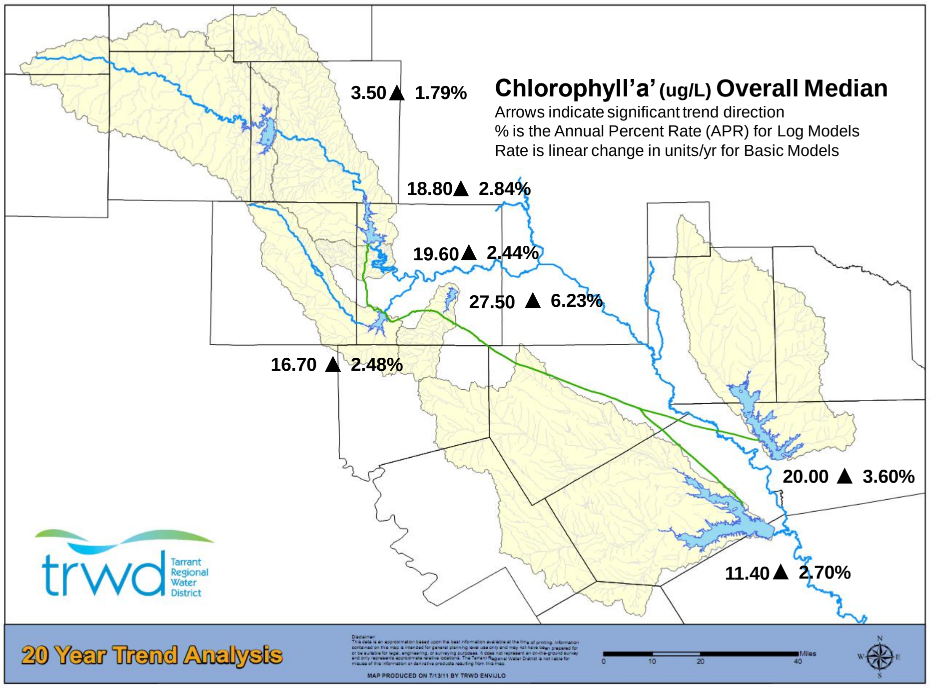

10
Richland Chambers Lake
-4
-3
-2
-1
0
1
2
3
Southern Oscillation Index

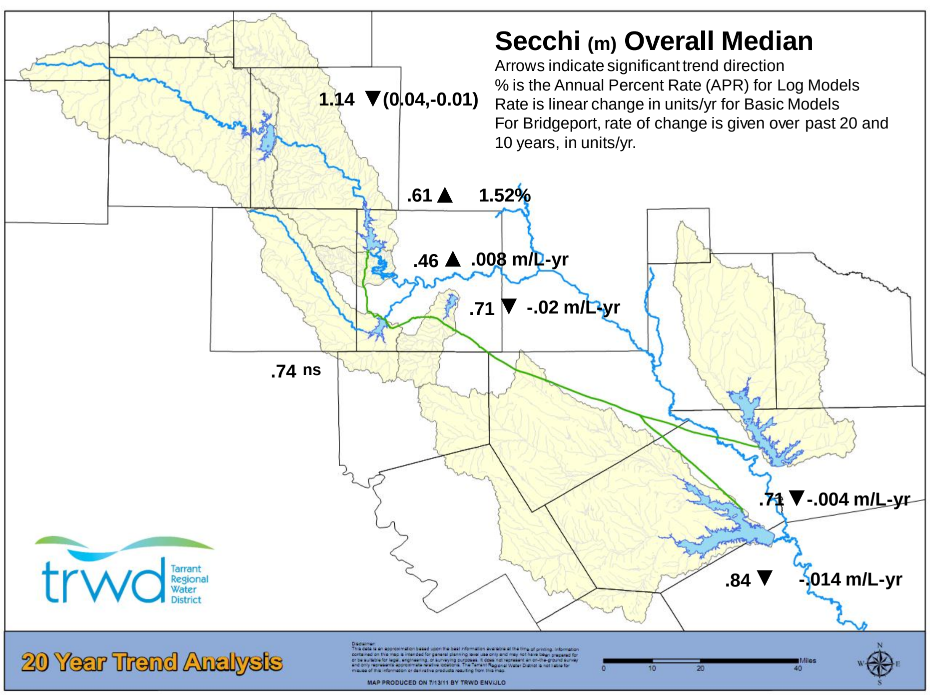

Chlorophyll a (µg/L)
10
Richland Chambers Lake
30
40
50
60
70
80
90
Temperature (F)

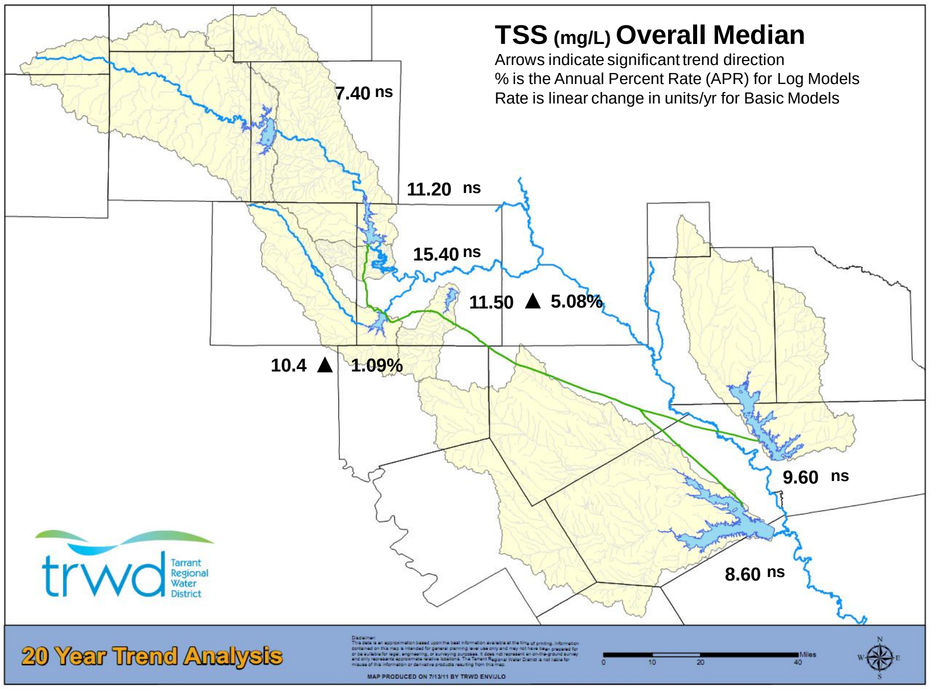

10
Richland Chambers Lake
-10
-8
-6
-4
-2
0
2
4
6
8
Temperature Variation (F)

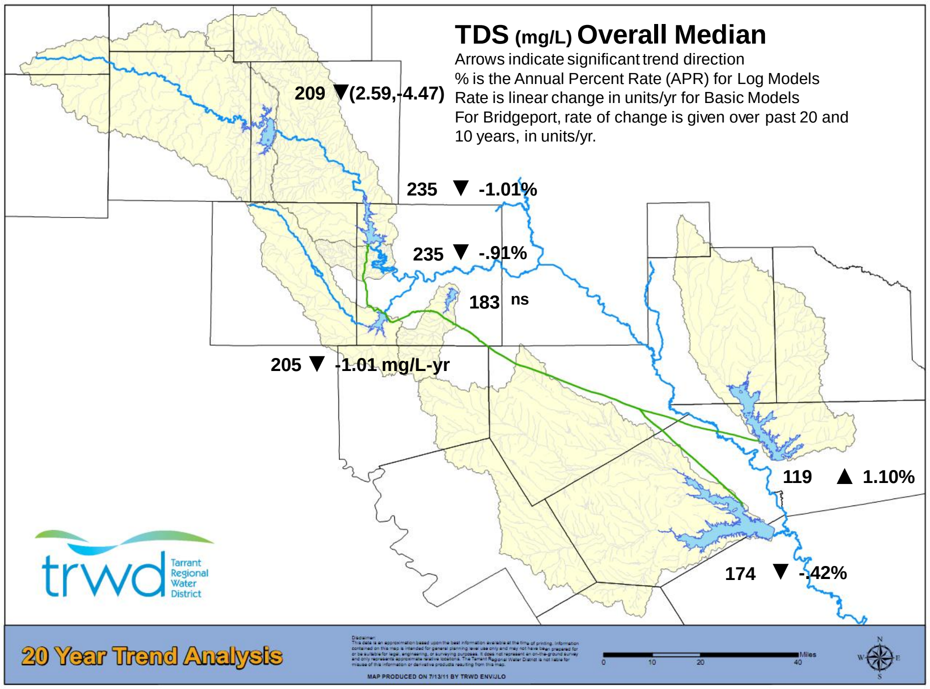

Chlorophyll a (µg/L)
10
Richland Chambers Lake
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Elevation Std Dev (ft)

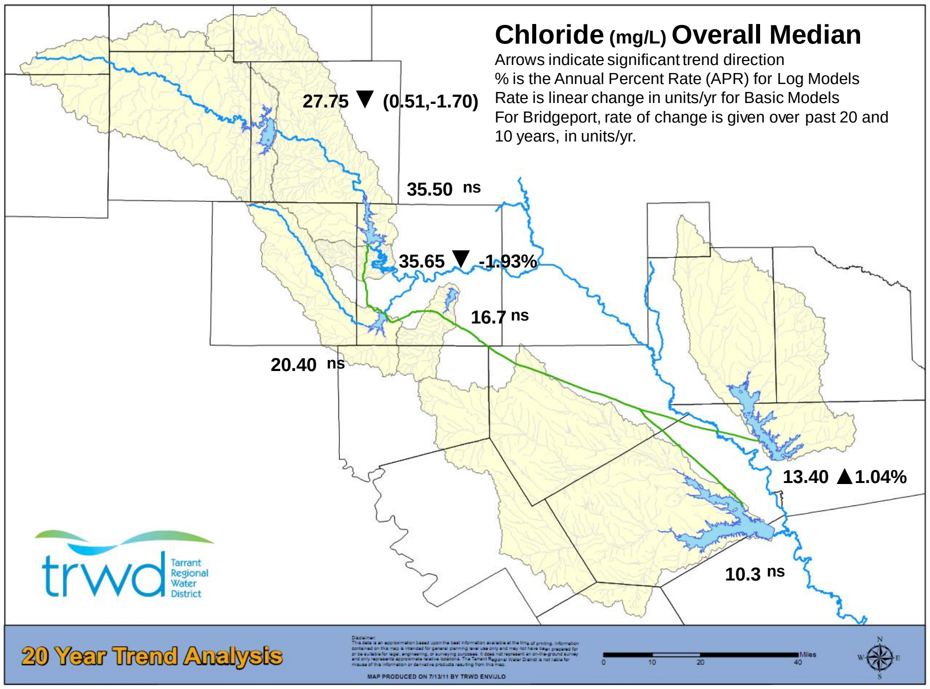
Overall Reservoir Results

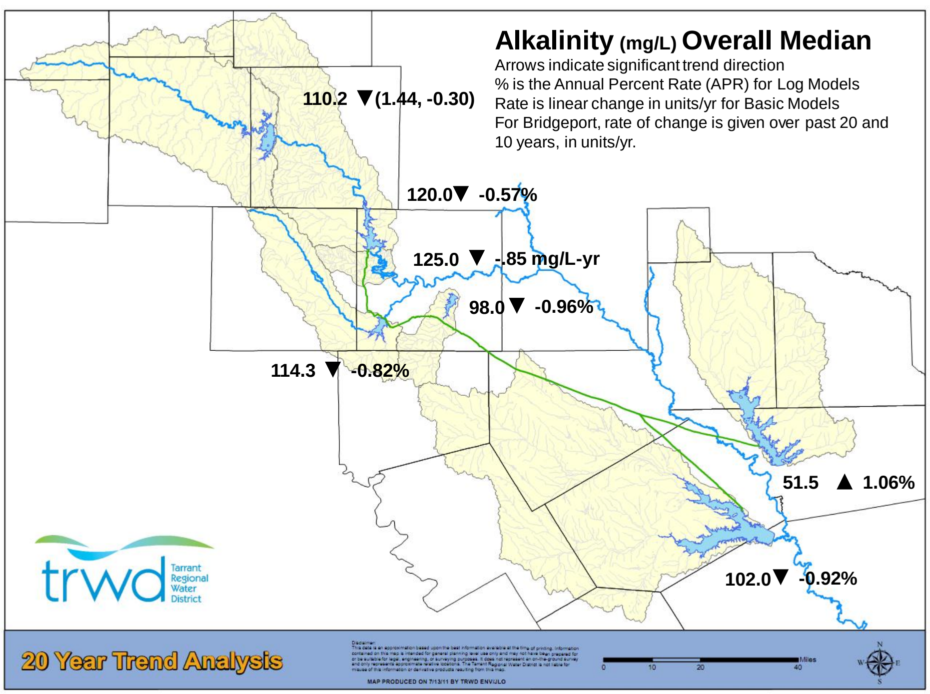


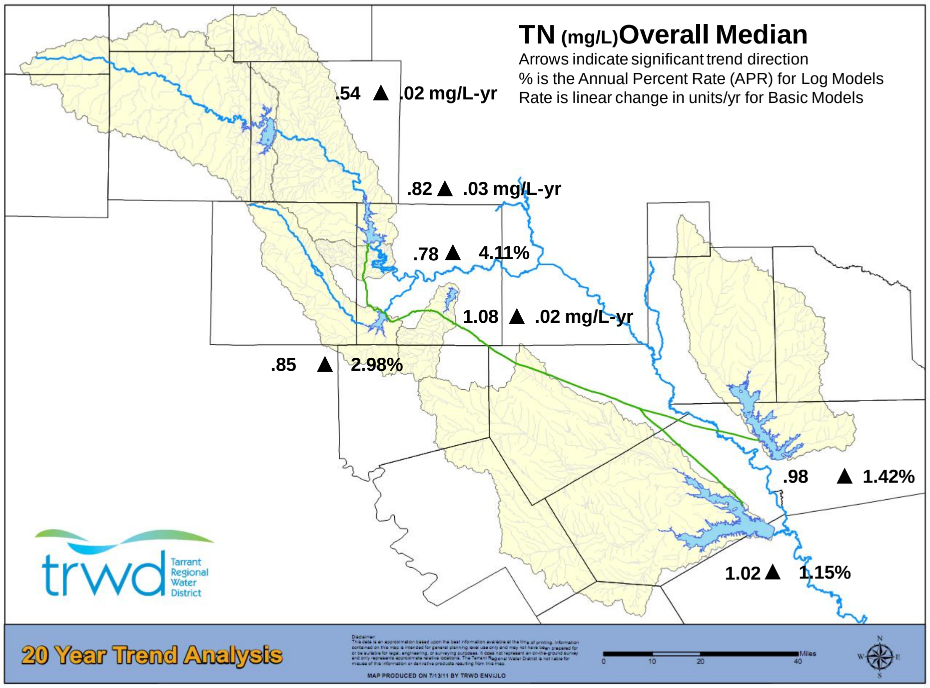


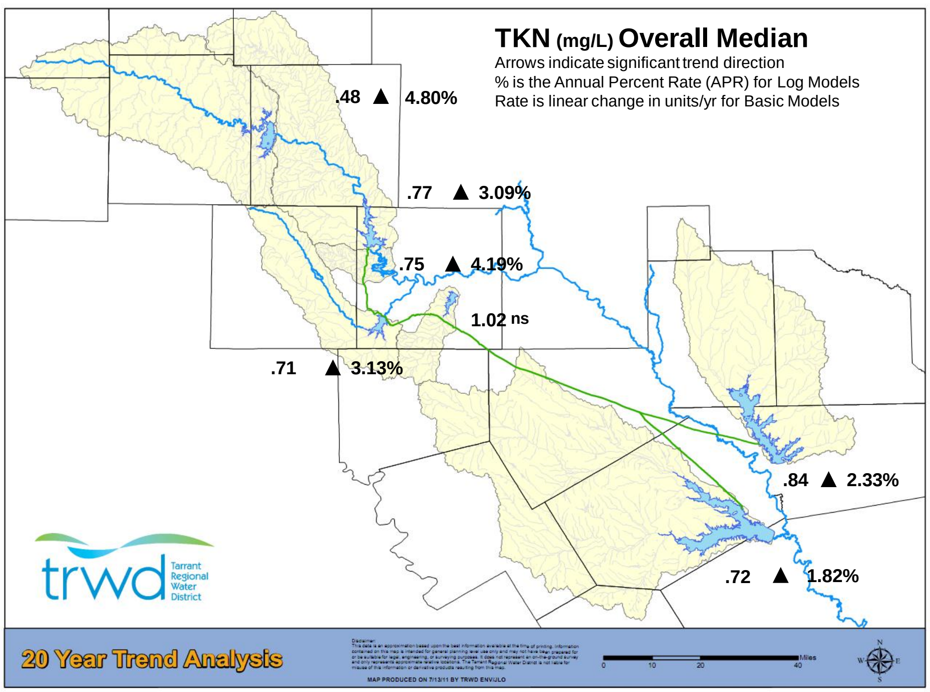

TSS (mg/L) Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
7.40 ns
11.20 ns
15.40 ns
11.50 ▲ 5.08%
10.4 ▲ 1.09%
9.60 ns
8.60 ns
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO
Miles

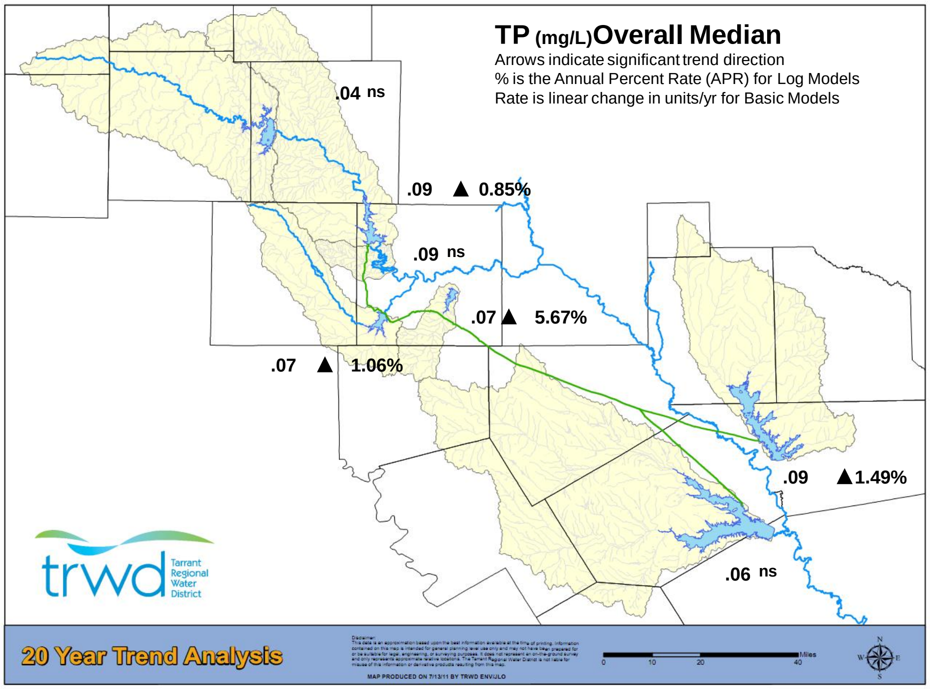

TDS (mg/L) Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
For Bridgeport, rate of change is given over past 20 and
10 years, in units/yr.
209 ▼(2.59,-4.47)
235 ▼ -1.01%
235 ▼ -.91%
183 ns
205 ▼ -1.01 mg/L-yr
119 ▲ 1.10%
174 ▼ -.42%
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO
Miles

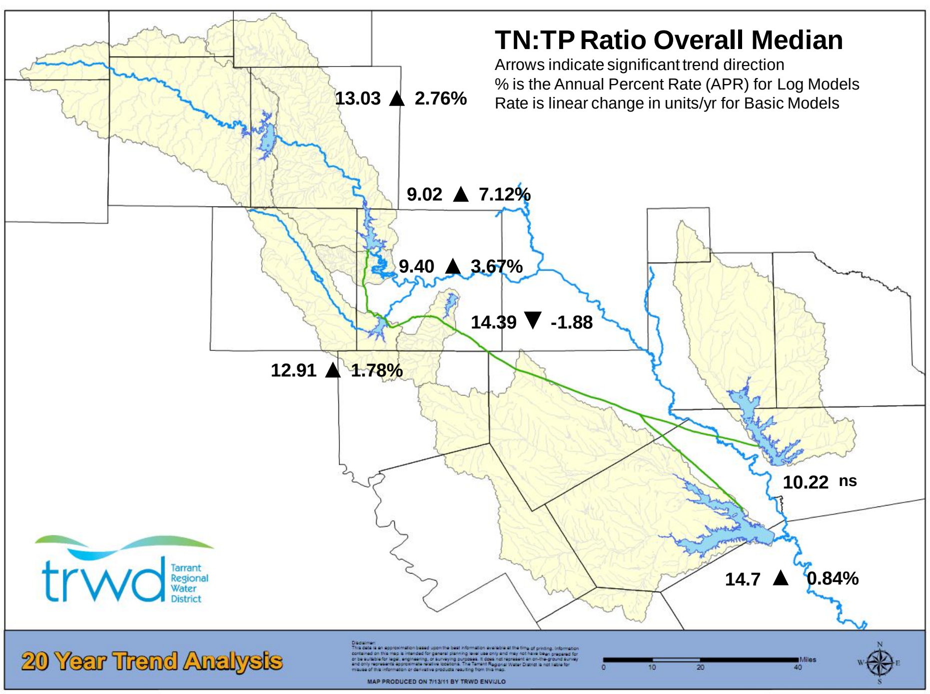

Chloride (mg/L) Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
For Bridgeport, rate of change is given over past 20 and 10 years, in units/yr.
27.75 ▼ (0.51,-1.70)
35.50 ns
35.65 ▼ -1.93%
16.7 ns
20.40 ns
13.40 ▲1.04%
10.3 ns
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO

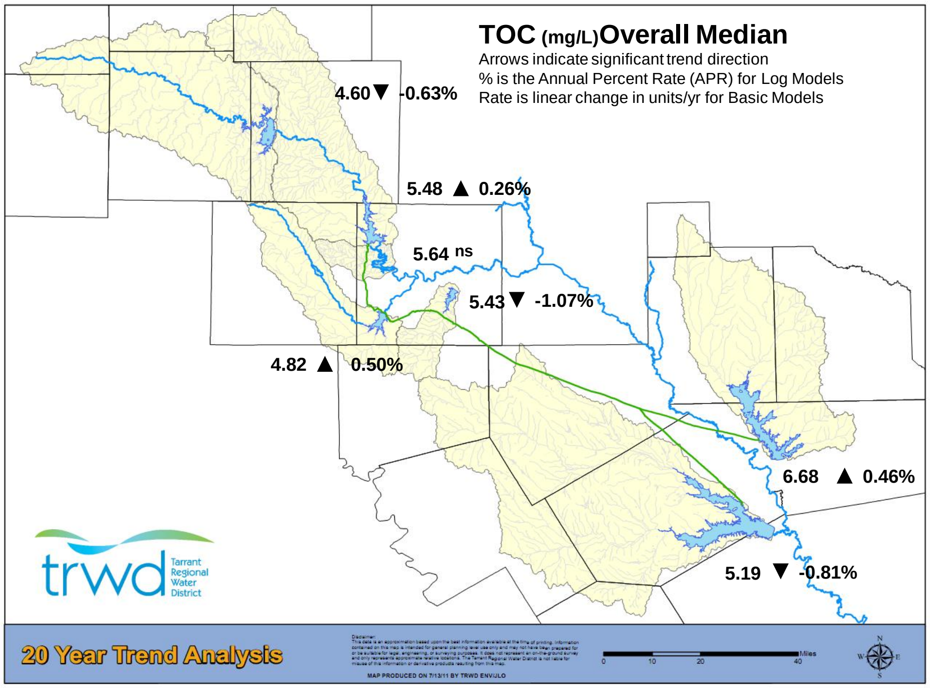

Alkalinity (mg/L) Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
For Bridgeport, rate of change is given over past 20 and 10 years, in units/yr.
110.2 ▼(1.44, -0.30)
120.0▼ -0.57%
125.0 ▼ -.85 mg/L-yr
98.0▼ -0.96%
114.3 ▼ -0.82%
51.5 ▲ 1.06%
102.0▼ -0.92%
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO

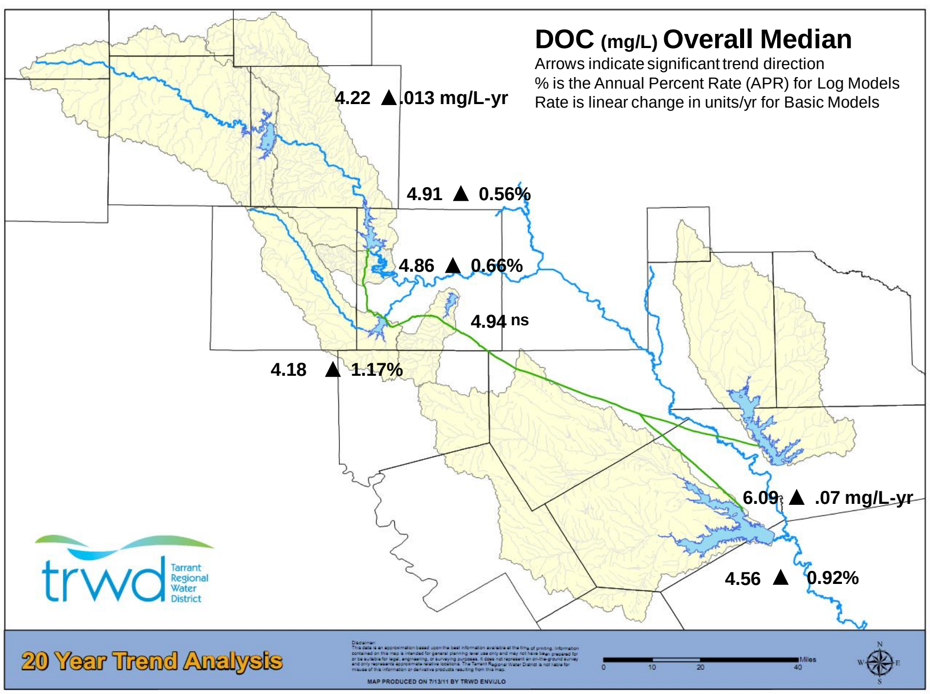

TN (mg/L)Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
.54 ▲ .02 mg/L-yr
.82 ▲ .03 mg/L-yr
.78 ▲ 4.11%
1.08 ▲ .02 mg/L-yr
.85 ▲ 2.98%
.98 ▲ 1.42%
1.02 ▲ 1.15%
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENVULO


TKN (mg/L) Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
.48 ▲ 4.80%
.77 ▲ 3.09%
.75 ▲ 4.19%
1.02 ns
.71 ▲ 3.13%
.84 ▲ 2.33%
.72 ▲ 1.82%
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENVULO

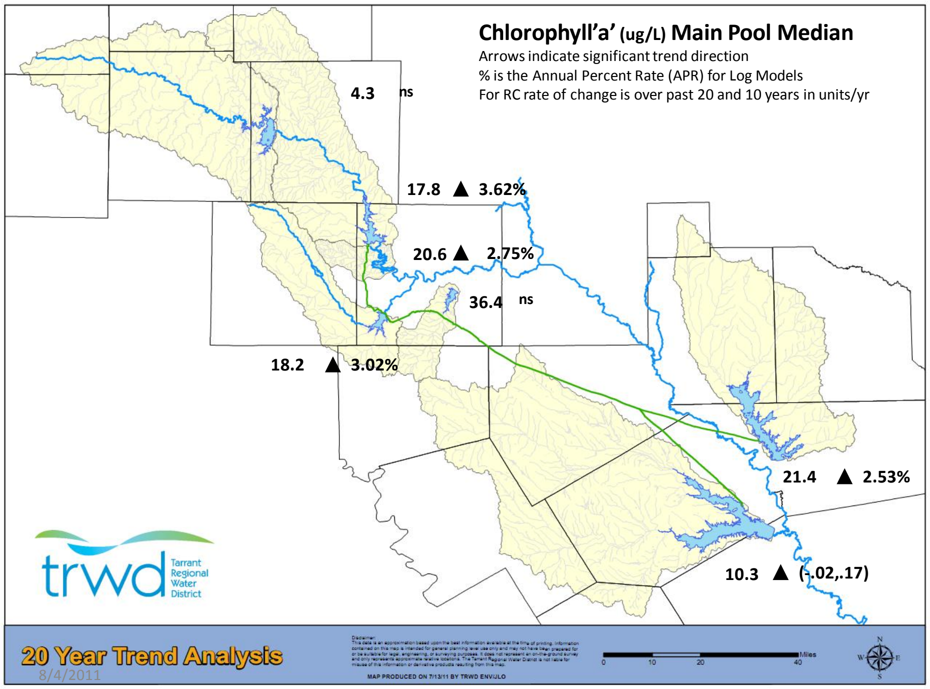

TP (mg/L)Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
.04 ns
.09 ▲ 0.85%
.09 ns
.07 ▲ 5.67%
.07 ▲ 1.06%
.09 ▲1.49%
.06 ns
trwd Tarrant Regional Water District
20 Year Trend Analysis

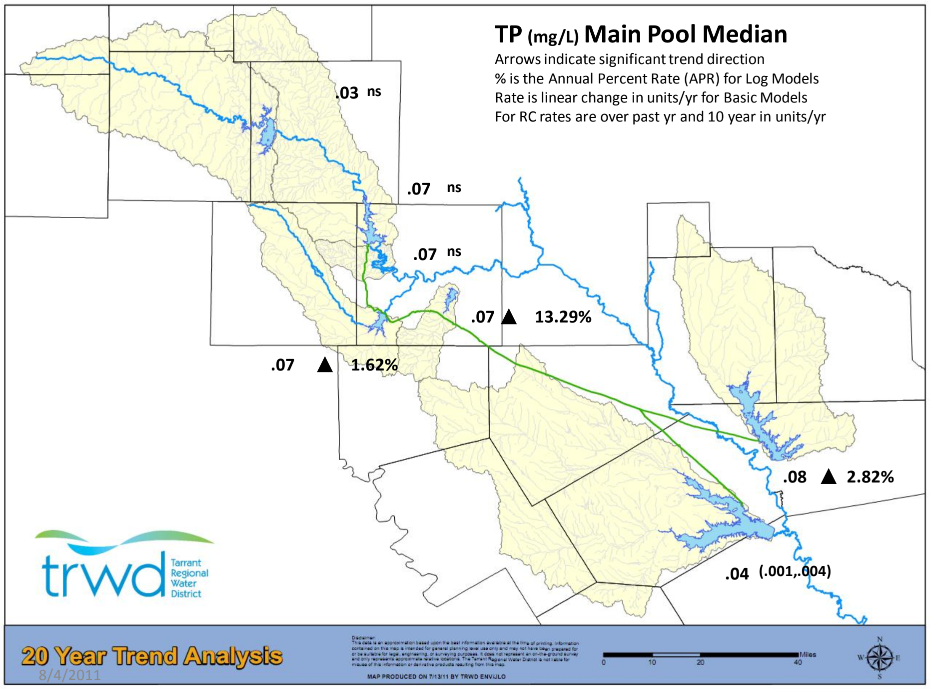

TN:TP Ratio Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
13.03 ▲ 2.76%
9.02 ▲ 7.12%
9.40 ▲ 3.67%
14.39 ▼ -1.88
12.91 ▲ 1.78%
10.22 ns
14.7 ▲ 0.84%
trwd Tarrant Regional Water District
20 Year Trend Analysis

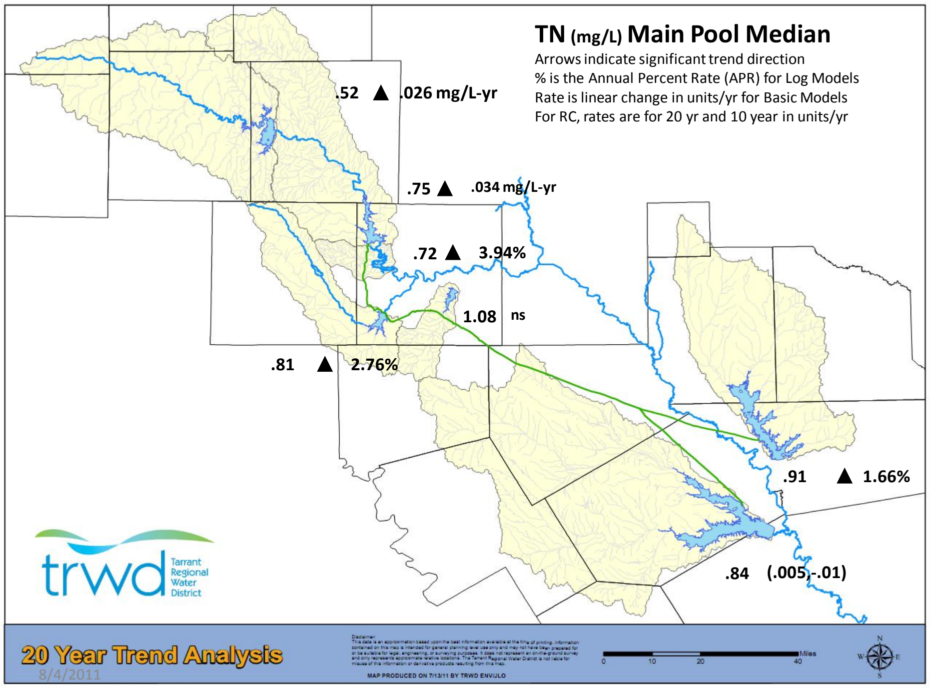

TOC (mg/L)Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
4.60 ▼ -0.63%
5.48 ▲ 0.26%
5.64 ns
5.43 ▼ -1.07%
4.82 ▲ 0.50%
6.68 ▲ 0.46%
5.19 ▼ -0.81%
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO
0 10 20 40 Miles

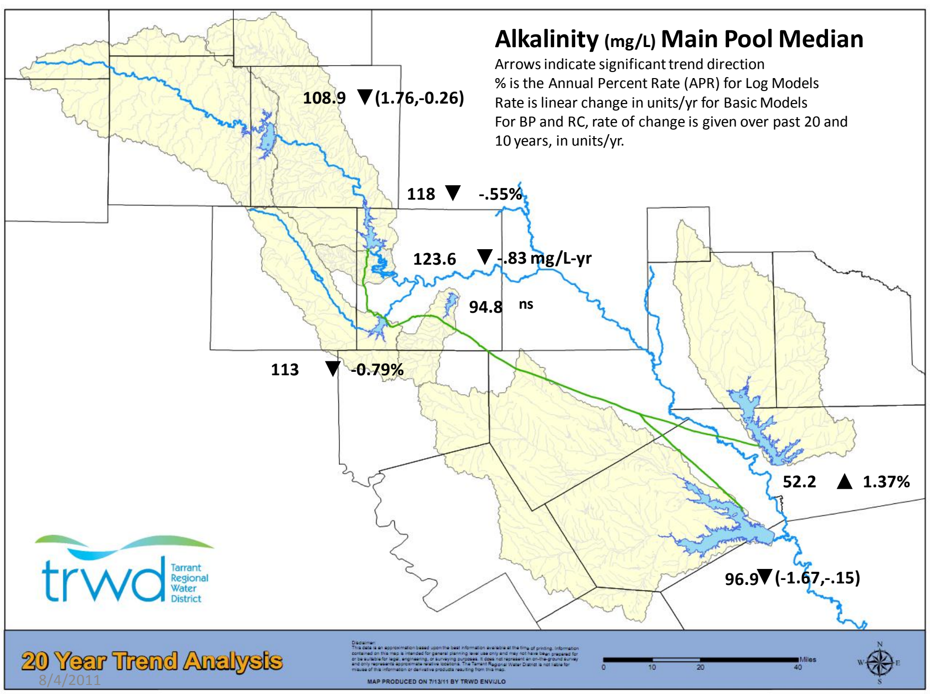

DOC (mg/L) Overall Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
4.22 ▲ .013 mg/L-yr
4.91 ▲ 0.56%
4.86 ▲ 0.66%
4.94 ns
4.18 ▲ 1.17%
6.09 ▲ .07 mg/L-yr
4.56 ▲ 0.92%
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO
0 10 20 40 Miles

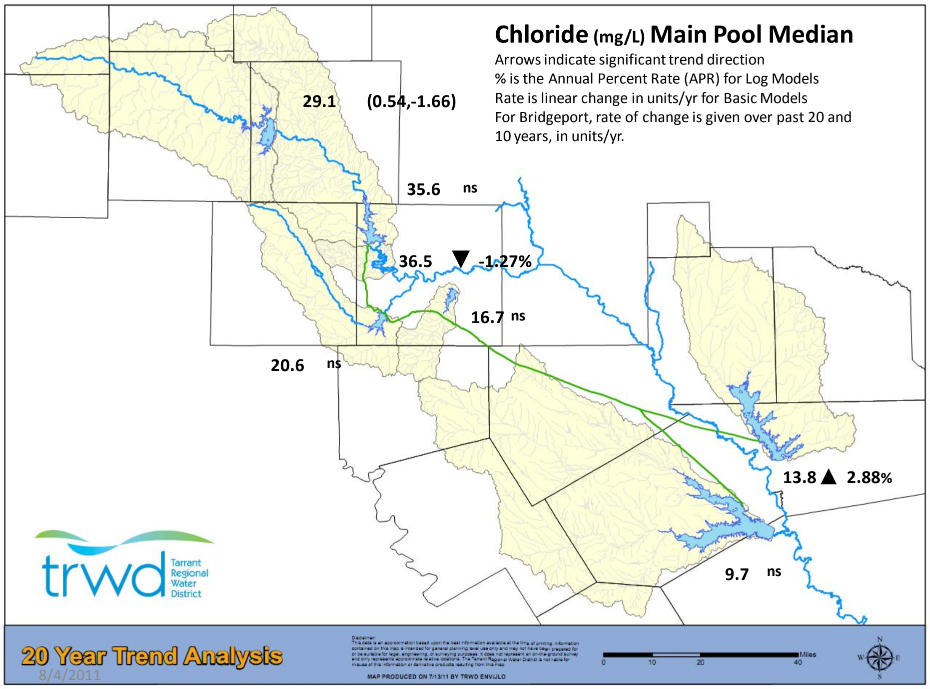
Main Lake Reservoir Results



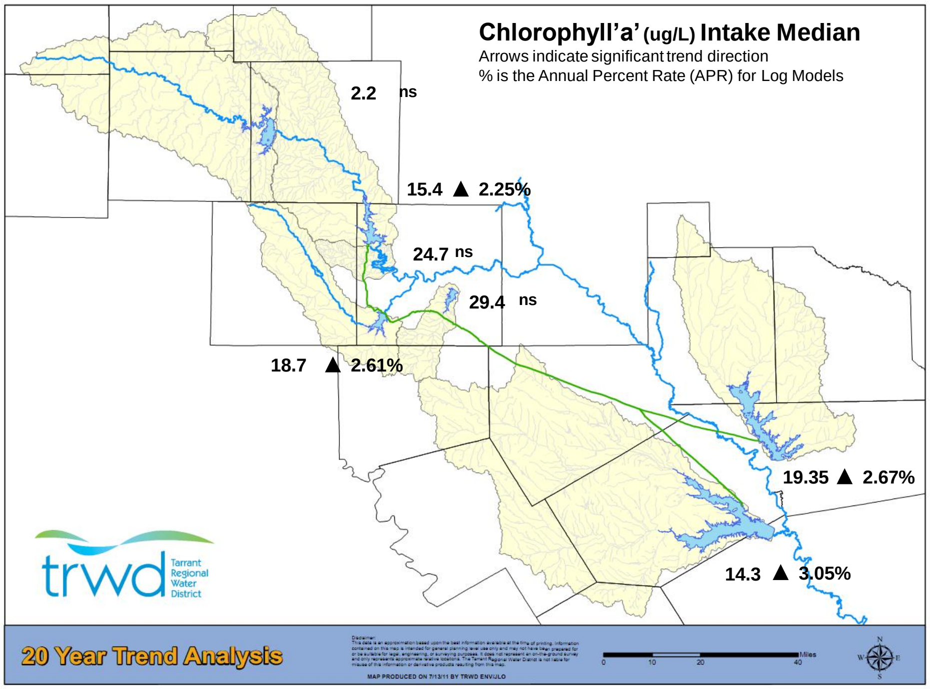


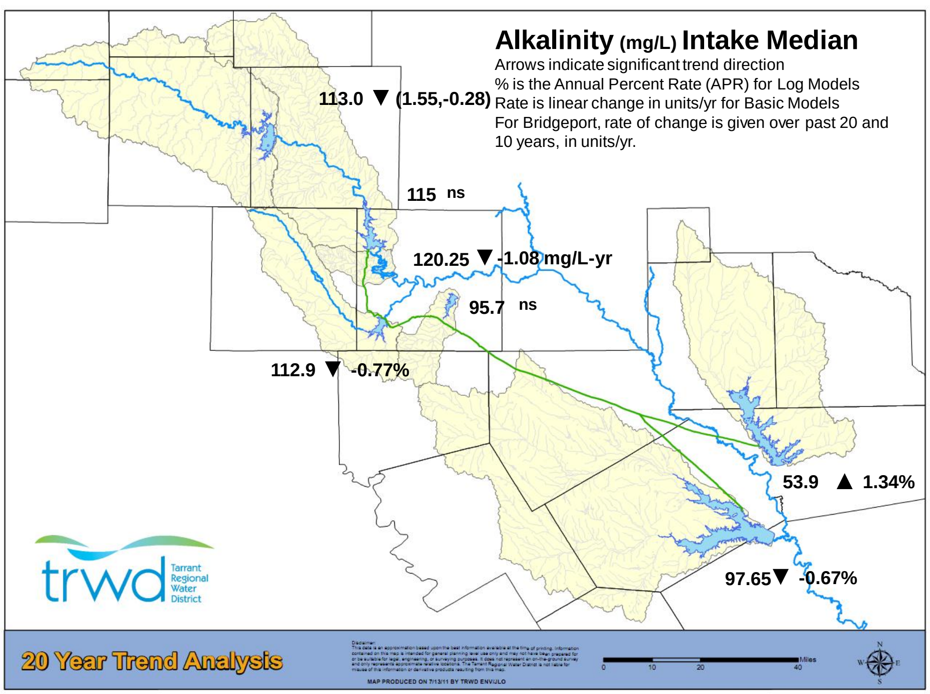

TN (mg/L) Main Pool Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
For RC, rates are for 20 yr and 10 year in units/yr
.52 ▲ .026 mg/L-yr
.75 ▲ .034 mg/L-yr
.72 ▲ 3.94%
1.08 ns
.81 ▲ 2.76%
.91 ▲ 1.66%
.84 (.005,-.01)
trwd Tarrant Regional Water District
20 Year Trend Analysis
8/4/2011
MAP PRODUCED ON 7/13/11 BY TRWD ENVULO

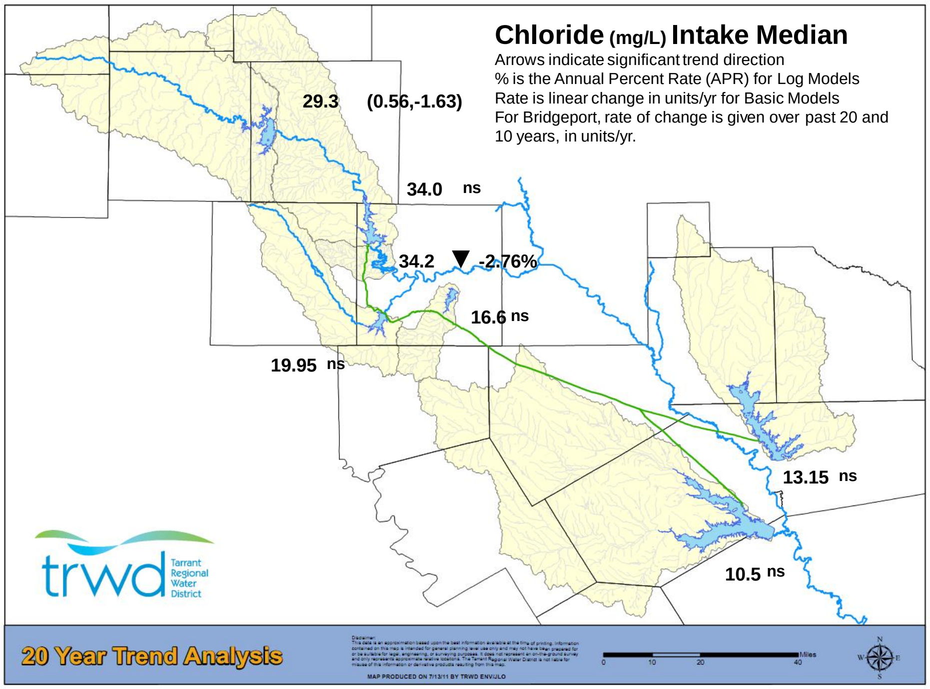

Alkalinity (mg/L) Main Pool Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
For BP and RC, rate of change is given over past 20 and 10 years, in units/yr.
108.9 ▼(1.76,-0.26)
118 ▼ -.55%
123.6 ▼-.83 mg/L-yr
94.8 ns
113 ▼ -0.79%
52.2 ▲ 1.37%
96.9▼(-1.67,-.15)
trwd Tarrant Regional Water District
20 Year Trend Analysis
8/4/2011
MAP PRODUCED ON 7/13/11 BY TRWD ENVULO

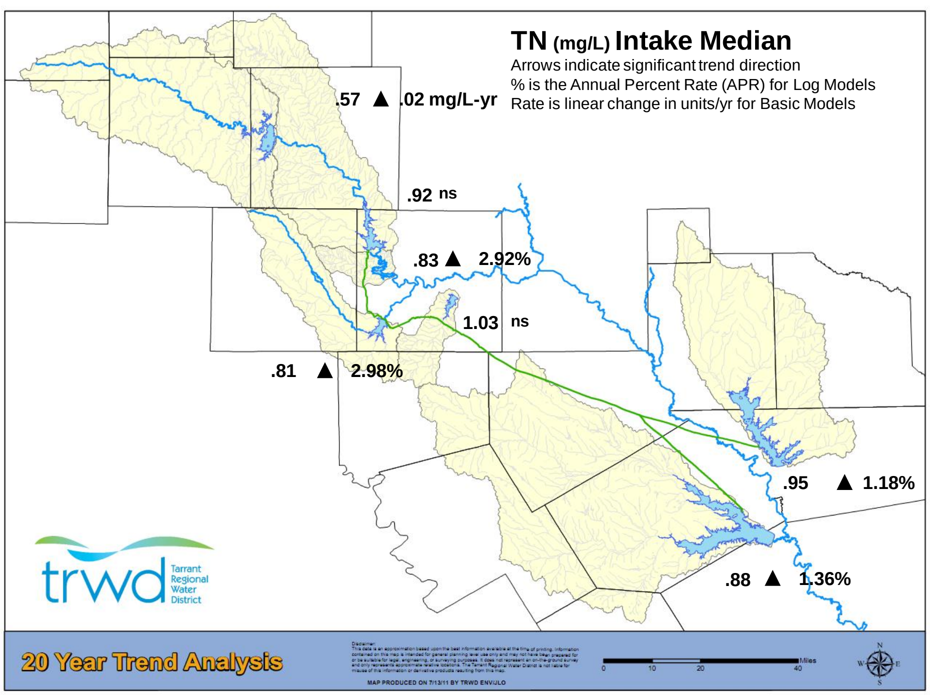

Chloride (mg/L) Main Pool Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
For Bridgeport, rate of change is given over past 20 and 10 years, in units/yr.
29.1
(0.54,-1.66)
35.6 ns
36.5 ▼ -1.27%
16.7 ns
20.6 ns
13.8 ▲ 2.88%
9.7 ns
trwd Tarrant Regional Water District
20 Year Trend Analysis
8/4/2011
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO
Miles
0 10 20 40
N
W
E
S

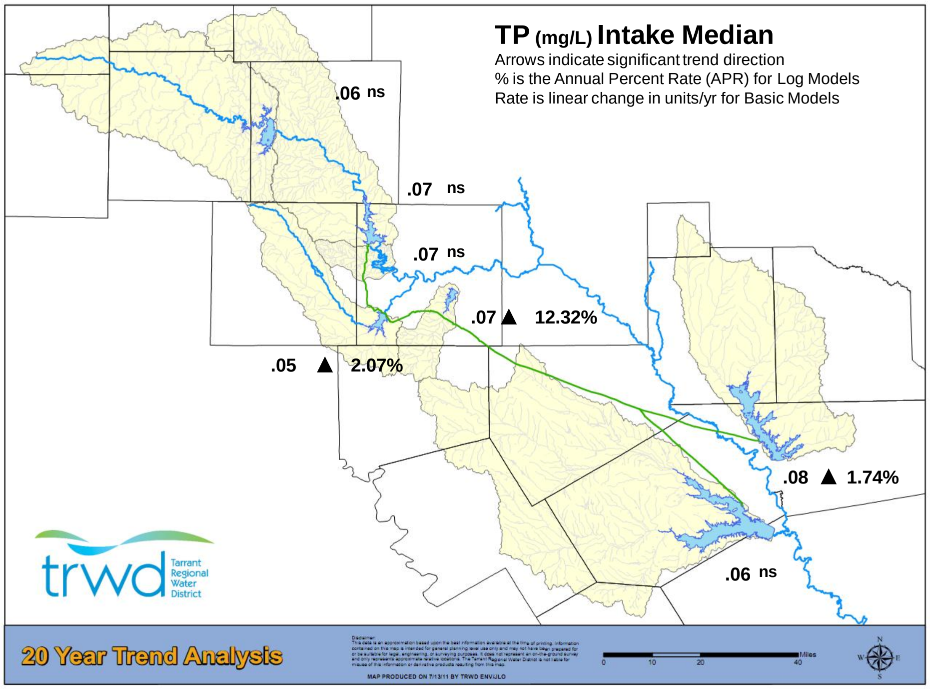
Intake sites on Reservoirs

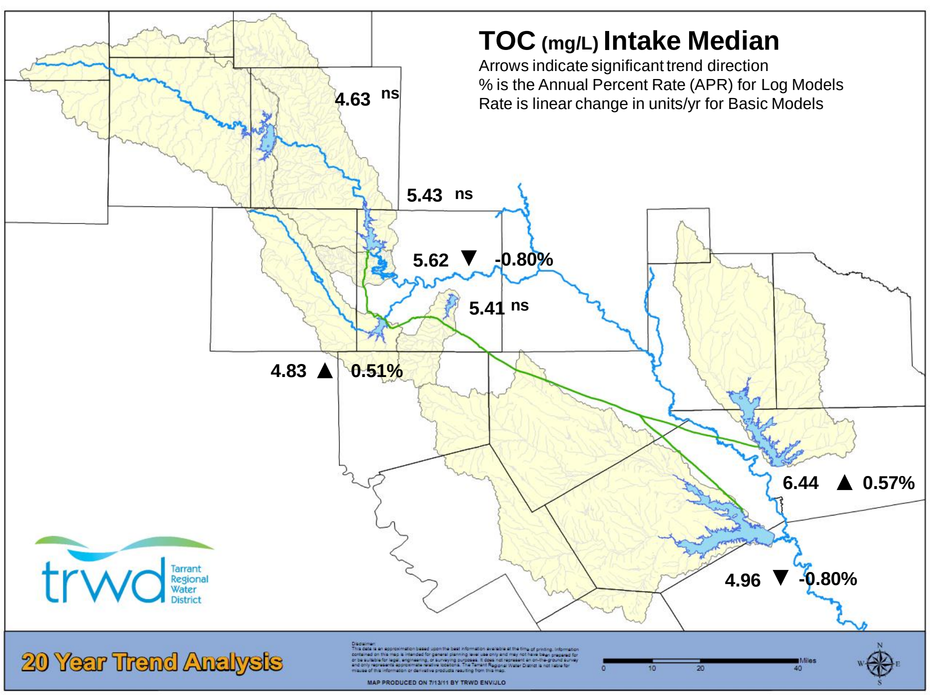


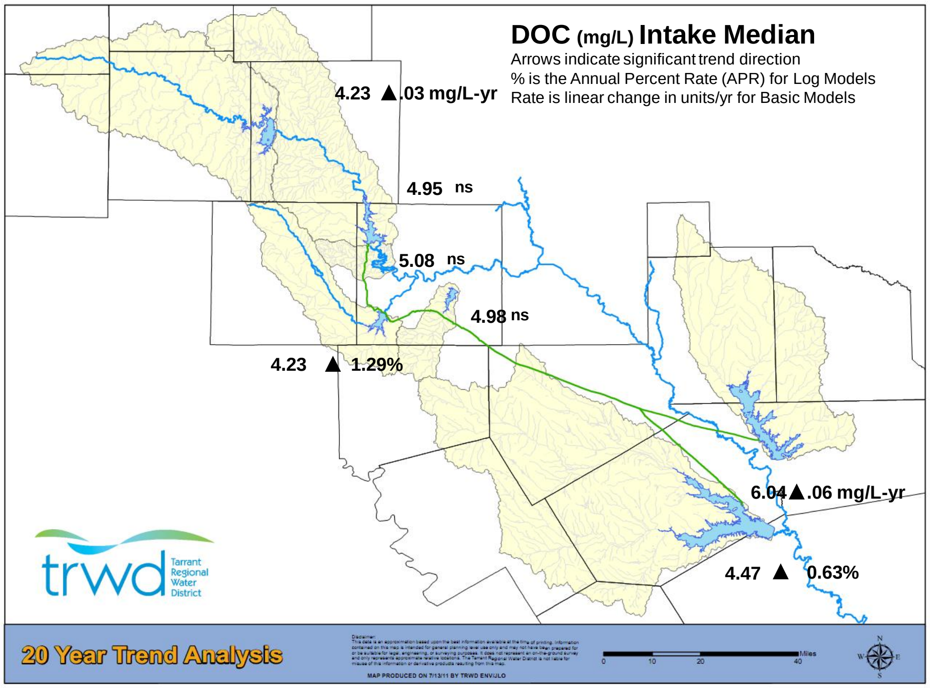


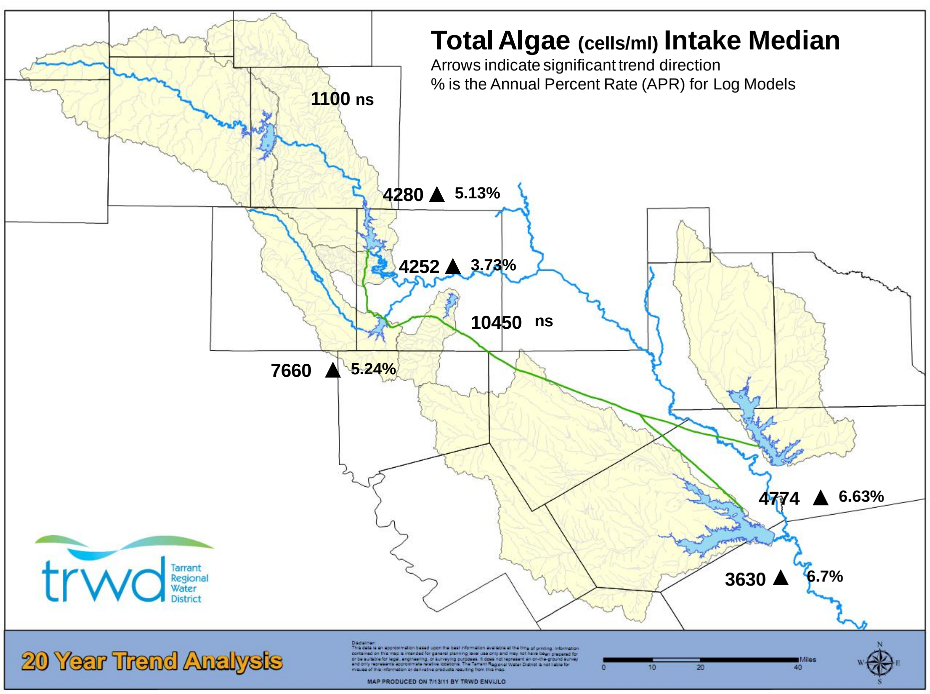

Chloride (mg/L) Intake Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
For Bridgeport, rate of change is given over past 20 and 10 years, in units/yr.
29.3 (0.56,-1.63)
34.0 ns
34.2 ▼ -2.76%
16.6 ns
19.95 ns
13.15 ns
10.5 ns
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO

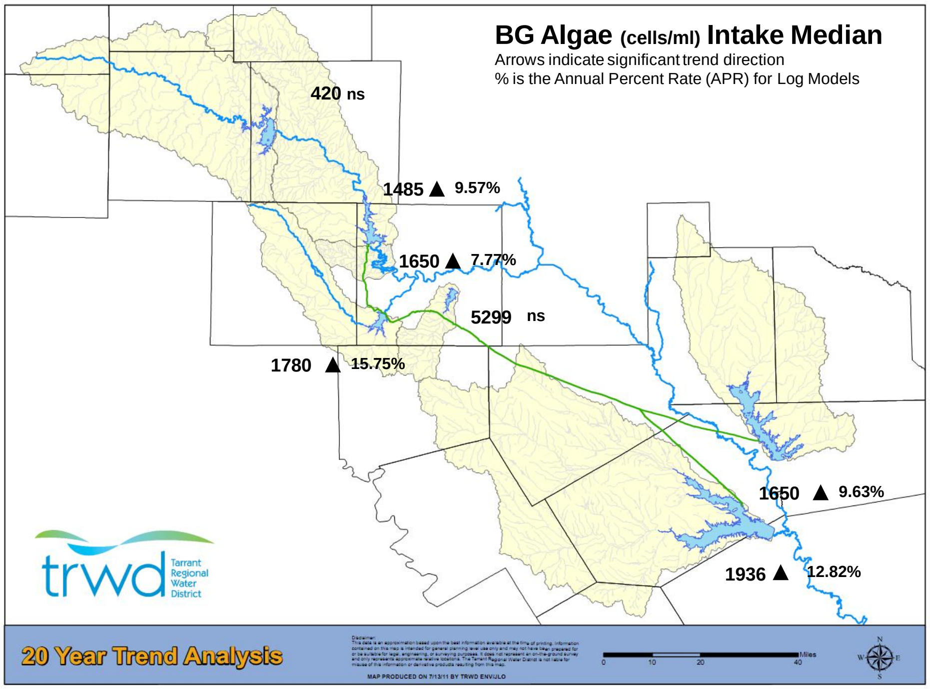

TN (mg/L) Intake Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
.57 ▲ .02 mg/L-yr
.92 ns
.83 ▲ 2.92%
1.03 ns
.81 ▲ 2.98%
.95 ▲ 1.18%
.88 ▲ 1.36%
trwd Tarrant Regional Water District
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENV/JLO


TP (mg/L) Intake Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
.06 ns
.07 ns
.07 ns
.07 ▲ 12.32%
.05 ▲ 2.07%
.08 ▲ 1.74%
.06 ns
trwd Tarrant Regional Water District
20 Year Trend Analysis


TOC (mg/L) Intake Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
4.63 ns
5.43 ns
5.62 ▼ -0.80%
5.41 ns
4.83 ▲ 0.51%
6.44 ▲ 0.57%
4.96 ▼ -0.80%
trwd Tarrant Regional Water District
20 Year Trend Analysis


DOC (mg/L) Intake Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
Rate is linear change in units/yr for Basic Models
4.23 ▲.03 mg/L-yr
4.95 ns
5.08 ns
4.98 ns
4.23 ▲ 1.29%
6.04▲.06 mg/L-yr
4.47 ▲ 0.63%
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENVULO


Total Algae (cells/ml) Intake Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
1100 ns
4280 ▲ 5.13%
4252 ▲ 3.73%
10450 ns
7660 ▲ 5.24%
4774 ▲ 6.63%
3630 ▲ 6.7%
20 Year Trend Analysis
MAP PRODUCED ON 7/13/11 BY TRWD ENVULO


BG Algae (cells/ml) Intake Median
Arrows indicate significant trend direction
% is the Annual Percent Rate (APR) for Log Models
420 ns
1485 ▲ 9.57%
1650 ▲ 7.77%
5299 ns
1780 ▲ 15.75%
1650 ▲ 9.63%
1936 ▲ 12.82%
trwd Tarrant Regional Water District
20 Year Trend Analysis

Tarrant Regional Water District
Water Quality Trend Analysis 1989-2009
Final Report
Technical Report

July 2011

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Introduction

The Tarrant Regional Water District routinely collects data for several water quality parameters on seven reservoirs: Lake Arlington, Benbrook Lake, Lake Bridgeport, Cedar Creek Lake, Eagle Mountain Lake, Richland Chambers Lake, and Lake Worth. For most reservoirs, available data cover the years 1990 – 2009 and have been collected quarterly from several sampling stations at two or three depths (top and bottom at some stations, top, middle and bottom at others). For two lakes, data are unavailable for large portions of time within the 20 years examined: for Lake Worth, data from about 1995 to 2001 are unavailable; and for Lake Arlington data prior to 2001 are unavailable. The index months for quarterly sampling in each lake are given in the table below. The sampling schedule for Cedar Creek Lake changed in 2001.

Reservoir	*Q1*	*Q2*	*Q3*	*Q4*
BP	Feb	May	Aug	Nov
EM	Jan	Apr	Jul	Oct
LW	Jan	Apr	Jul	Oct
AR	Feb	May	Aug	Nov
BB	Mar	Jun	Sep	Dec
CC	Feb/Jan	May/Apr	Aug/Jul	Sep/Oct
RC	Mar	Jun	Sep	Dec

The goals of this study are to identify trends in water quality and associations of variations in water quality with other variables that explain or predict this variation. To identify trends in water quality, descriptive regression models with time as an independent variable were used, with statistical adjustments for site and seasonal differences. These descriptive trend models were developed for each water quality parameter in each reservoir on a whole lake basis. Similar descriptive trend models were examined for selected parameters at intake sites and bottom sampling sites. The trends estimated from these models were summarized, when appropriate, as equivalent Annual Percentage Rates of change and doubling times or half-lives.

To identify variables that predict or explain variation in water quality, explanatory regression models were developed for selected water quality parameters. This modeling was done for all sampling sites on a whole lake basis, and for main pool sites using data from quarters three and four only. A large set of independent variables suggested by previous analyses was screened for collinearity (correlations among the independent variables), and a reduced set of independent variables was chosen for further analysis. Multiple regression models were used to identify independent variables with high explanatory and predictive power. This multiple regression approach was complemented by an approach that first performed a principal components analysis for the explanatory variables in each lake. A subset of the principal components representing most of the variability in explanatory variables was then used in regression models for the selected water quality parameters, thus providing a complementary means of assessing how water quality is associated with potential explanatory variables.

Methodology

Descriptive Statistics

Several standard descriptive statistics were calculated for each water quality parameter, on a lake-wide basis overall and for each quarter separately. These descriptive statistics were also calculated for intake sites only. In the text of this report, overall mean, standard deviation, and median are reported, along with medians for each quarter. Files in the electronic appendices to this report provide additional calculations of minima, maxima, and quartiles.

Descriptive Trend Regressions

Descriptive regressions were done in each reservoir for the following water quality parameters, for whole-lake, intake, and bottom samples as indicated in the following table. For main pool, top samples, descriptive trend regressions were done for Chloride, Alkalinity, TN, TP, and Chlorophyll *a*.

Whole Lake	**Intake Samples**
Chlorophyll *a* (Chl *a*)	Chlorophyll *a* (Chl *a*)
Secchi Depth	Dissolved Organic Carbon (DOC)
Algae Groups (abundance)	Total Organic Carbon (TOC)
Dissolved Oxygen (DO)	Total Phosphorus (TP)
Dissolved Organic Carbon (DOC)	Total Nitrogen (TN)
Total Organic Carbon (TOC)	Alkalinity
Ortho-PO_4	Chloride (Cl^-)
Total Phosphorus (TP)	
Ammonia Nitrogen (NH_3)	**Bottom Samples**
Nitrate-Nitrite Nitrogen (NO_x)	Orthophosphate (PO_4-P)
Total Kjeldahl Nitrogen (TKN)	Ammonia Nitrogen (NH_3-N)
Total Nitrogen (TN)	Dissolved Oxygen
Nitrogen:Phosphorus Ratio (TN:TP)	
Alkalinity	
Total Dissolved Solids (TDS)	
Total Suspended Solids (TSS)	
Chloride (Cl^-)	
Water Temperature	

Descriptive regressions will be based on this regression model, which assumes that data from all sites and all quarters share a common rate of trend, but which allows for site or seasonal differences in the average level of a water quality parameter:

$$Y_{ijt} = \beta_0 + \beta_i + \beta_j + \beta_{ij} + \beta_1 t + \varepsilon_{ijt} \qquad (1)$$

where Y_{ijt} is the response variable (a water quality parameter) in quarter i at site j and time t, β_0 is an intercept coefficient, β_i is an adjustment for quarter i, β_j is an adjustment for site j, β_{ij} is an adjustment for interactions between quarter and site, β_1 is the slope coefficient for time t, and $\varepsilon_{\mathrm{ijt}}$ is the error term. For analyses involving data subsets that had only one site (e.g. intake analyses), the β_j and β_{ij} terms do not apply. The adjustments for site account for systematic differences between sites in the level of the target water quality parameter, while the quarterly adjustments account for seasonal variations. The interaction coefficients account for the fact that such seasonal variations might differ between sites; for example, dissolved oxygen likely has different seasonal variation at bottom sampling sites than at surface sites. In this regression model (eq. 1), the coefficient β_1 measures the rate of trend and the primary goal of the analysis is to estimate this rate. The remaining parameters (β_0, β_i, β_j, β_{ij}) are "nuisance" parameters whose estimation serves primarily to reduce bias in the estimate of β_1. When the parameter being analyzed is not transformed, e.g. by taking logarithms, the parameter β_1 is the rate of trend per year in whatever units of measurement apply to the parameter. Thus it has a straightforward interpretation.

The regression model (eq. 1) can be estimated with missing values, which occurred to some extent in many of the data sets analyzed. It also allows for the differing periods of record characterizing some data sets. Many of the data sets analyzed showed statistical problems that can affect the accuracy and precision of the trend that is estimated. In many cases the residuals from regression model (1) showed skew, increasing variance for higher levels of the response variable, and more extreme values ("outliers") than would be expected for normally distributed errors. In many cases, a logarithmic transformation of the response variable was adequate to reduce these statistical problems, though it did not always eliminate them, especially the tendency for some data to have more extreme values than expected. Outliers were eliminated from the analysis only if the reported value appeared to be implausible given the typical range of the water quality parameter in question, or if a comment flag in the data file indicated a questionable result. For the parameter TN, calculated as the sum of NO_x-N and TKN, data were analyzed only if both underlying measurements were present.

For those water quality parameters that were log-transformed to reduce statistical problems, the coefficient β_1 in equation 1 is not a rate per year, as it is for data that are not transformed. However, β_1 can be re-expressed in several potentially informative ways. It can be converted to an Annual Percentage Rate of change (APR) similar to those used in financial calculations:

$$\mathrm{APR} = 100\left(e^{\beta_1} - 1\right) \qquad (2)$$

where e is the base of the natural logarithms. The APR can be used to forecast the a future value for a water quality parameter in a certain number of years, from its current value, according to the formula:

$$\text{Future value} = \text{Current value} \times \left[1 + \frac{\mathrm{APR}}{100}\right]^{\text{years}} \qquad (3)$$

Calculating a doubling time for increasing trends or a half-life for decreasing trends is another way to express the rate of trend estimated for log-transformed data. For an increasing trend, the estimated rate coefficient β_1 is positive, and the water quality parameter is forecasted to double in value at a time calculated by

$$\text{Doubling time} = \frac{\ln 2}{\beta_1} \tag{4}$$

For a decreasing trend, the estimated rate coefficient β_1 is negative, and the water quality parameter is forecasted to fall by half at a time calculated by

$$\text{Half life} = \frac{\ln 2}{\beta_1} \tag{5}$$

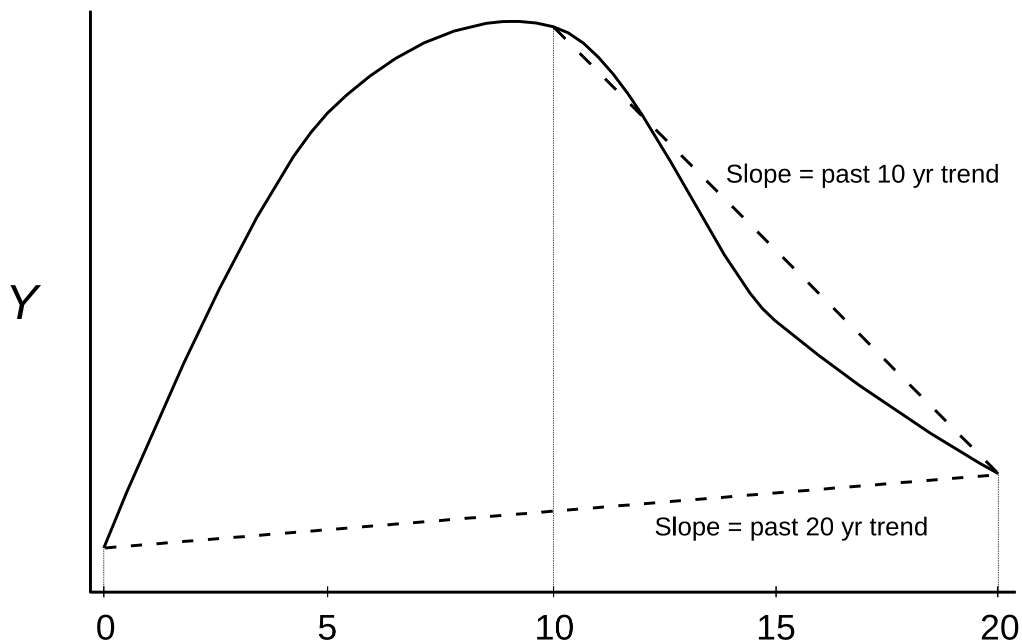
Another statistical problem encountered in many of the data sets analyzed was non-independence of the errors (ε_{ijt}) due to serial correlation. Autocorrelations were calculated for residuals from all regression models to assess this problem. In a previous trend analysis for the first ten years of data, problems of serial correlation were dealt with on a case-by-case basis in one of two ways. First, some trends differed among quarters (which was indicated by strong positive autocorrelation at lag 4, consistent with an annual period for serial correlation), and in such cases a regression model with separate trends for each quarter was estimated. Second, some models had longer-term autocorrelations that were associated with non-monotonic trends.

For the longer data sets analyzed here, the first approach did not prove helpful. Serial correlation did not have the annual period that would indicate separate trends for each quarter, and such models did not generally improve fit or reduce statistical problems of serial correlation, and their results are not reported here. Instead, when strong serial correlation was observed it was associated with long periods, roughly 2-5 years, which is a statistical similarity to some meteorological data sets, such as the Southern Oscillation Index that was used in explanatory regression modeling. This pattern of serial correlation is most evident in some of the plots of Chloride provided. The serial correlation present in some of the data sets analyzed has two potential effects on the trend results reported. First, the estimated trend coefficients are less precise and have more error than would occur for data without serial correlation. Second, the true significant level is raised above the nominal level of $\alpha = 0.05$ adopted here, so that the analysis is biased toward detecting significant trends. More sophisticated statistical techniques than the Ordinary Least Squares technique used here can potentially model such serial correlation and provide more precise trend estimates. However, such techniques are difficult to implement when data have more than a few missing values, and especially when data are missing for several successive values, which was common in the data sets analyzed here.

For a few of the data sets analyzed here, from Bridgeport Lake, strong serial correlation was associated with a clearly non-monotonic trend. The basic regression model used here (eq. 1), with or without a log transformation, assumes a monotonic trend – i.e. a continual increase or decrease. For Bridgeport Lake, the direction of trend in some parameters changed over time, from an increase to a decrease (or a plateau), and it was found that a cubic trend model was a good fit to the data. To obtain unbiased coefficient estimates for the complex, cubic trend, it was necessary to center the time data by subtracting the mean, prior to calculating squares and cubes of time. When a cubic trend model is used, three time-related coefficients appear in the regression model, and equation (1) is modified to become

$$Y_{ijt} = \beta_0 + \beta_i + \beta_j + \beta_{ij} + \beta_1 t + \beta_2 t^2 + \beta_3 t^3 + \varepsilon_{ijt} \tag{6}$$

In such cases, no single quantity characterizes the rate of trend, and indeed there are many ways that such trends might be quantified. Here, the procedure taken was to calculate two rates of trend over different time frames: the past 10 years, and the past 20 years. These calculations were made from the fitted regression model as displayed in the figure below.



Calculation of rate quantities for complex, cubic trends. The fitted regression model for parameter *Y* is show as the solid curve. The heavy, long-dashed lines show slopes calculated over the past 10 and past 20 years. These slopes estimate the net rates of trend over these time frames. In this case a long term increase is indicated, but must be interpreted in the context of large, more recent decrease.

For each parameter analyzed, an appropriate trend model was chosen during the analysis of data from all available sites for a given lake: the basic regression model (eq. 1), a similar model with log-transformed data, or a cubic trend model. Because an analysis using all available data likely best reveals the properties of the data, the same model chosen for the whole lake was applied to the subset analyses using data from intake or bottom sites only.

In the text of this report, the trend coefficients β_1 are reported for each regression, along with their P-value (statistical significance), and APR and doubling time or half-life when a logarithmic transformation was used. Complete regression output from Statistica, the program used to compute the analyses, is provided in the electronic appendix files, and includes such statistics as sums-of-squares, R^2, all model coefficients and standard errors, and residual plots examined to assess the statistical properties of the data and possible deviations from regression assumptions.

Explanatory Regression Methodology

Explanatory regression modeling was applied to Chloride, Alkalinity, TP, TN, and Chlorophyll *a* data from each reservoir, using data from top sites in quarters 3 and 4, and main pool top sites in the same quarters. Explanatory regression modeling was also applied to Orthophosphate, Ammonia-N, and Dissolved Oxygen for bottom sites in quarters 3 and 4, and to the abundance of Bluegreen Algae (log-transformed) and the proportion of Bluegreen Algae for top sites in quarters 3 and 4. A large number of potential independent variables were screened for inclusion in the analyses, and after exploratory analyses and consultation with TRWD personnel the following set was adopted:

Air Temperature
Air Temperature Variation (deviation from normal monthly long-term average)
Southern Oscillation Index (quarterly average)
Elevation (quarterly average)
Standard Deviation of Elevation (quarterly)
Tributary Inflow (quarterly, log-transformed)
Pumpage Into (quarterly, log-transformed, zero-corrected), for lakes where this applies
Total Phosphorus (log-transformed)
Total Nitrogen (log-transformed)
TN to TP Ratio
Dissolved Oxygen

Air Temperature data came from the 1926-2009 record for DFW airport collected by the National Oceanographic and Atmospheric Administration. Monthly average NOAA DFW temperature data for the period 1989 to 2009 were assigned to each reservoir's quarterly reference month. Variation in temperature was calculated by taking the monthly mean temperature from the 84 year period of record in the NOAA DFW database (1926 – 2009) and subtracting the monthly mean temperature for each reservoir for each of the 20 years in the study period of 1989 to 2009. Negative values indicate colder than average temperatures and positive values indicate warmer than average temperatures. Monthly data on the Southern Oscillation Index was downloaded from http://www.cgd.ucar.edu/cas/catalog/climind/soi.html. Monthly data was averaged for each quarter of the year to obtain a quarterly record. The Southern Oscillation Index (SOI) is used to measure interannual fluctuations in climate associated with El-Niño events. Negative values of the SOI indicate El Niño events, during which weather in the north Texas region tends to be wetter and cooler than average. Positive values indicate La Niña events, during which weather in this region tends to be drier and warmer than average. During the 1990's there were two strong El Niño periods, while La Niña conditions prevailed in the early and late 2000's. The value of the SOI is calculated from air pressure measurements at two locations in the Pacific Ocean (Tahiti and Darwin, Australia), because interannual temperature and air pressure variations in the Pacific

Ocean drive the meteorological patterns associated with El Niño events. SOI is considered to be a generalized indicator of long-term, global-scale weather variations. Day-to-day values are not considered informative, but averaged monthly to annual values are informative about long-term variations.

Several exploratory regressions were done, and different subsets of these explanatory variables were selected for different response variables: in the table below an X indicates that an explanatory variables was included in the regression for a response variable.

	Response Variables			
Explanatory Variables	Cl, Alk, TP, TN, DO	Chl *a*	PO_4-P, NH_3-N	Bluegreens
Air Temp	X	X	X	X
Air Temp Var	X	X	X	
SOI	X	X	X	
Elevation	X	X	X	X
Elevation SD	X	X	X	
Trib Inflow	X	X	X	X
Pumpage	X	X	X	
TP		X		
TN		X		X
TN:TP				X
DO			X	X

For the first seven of these variables, a trend analysis was done using regression analysis, similar to the trend analyses described elsewhere in this report (see **Methodology** section, **Descriptive Trend Analyses** subsection). The first seven explanatory variables apply to an entire lake and are not differentiated by site. Therefore, the trend analysis for them did not have regression terms for site or site-by-quarter interactions (β_j and β_{ij} in equation 1).

Data for both Tributary Inflow and Pumpage Into varied by several orders of magnitude and were highly skewed, and it was necessary to log-transform these variables to obtain useful regressions. Additionally, some data series for Pumpage Into contained large numbers of zero values, for which a logarithm cannot be taken. This problem was addressed by adding a constant value k to all pumpage data prior to log-transformation, where k = ½ of the smallest positive value in the data series.

There was an acceptably low degree of correlation among the set of independent variables adopted for this analysis. The strength of the relationship between the response variable and all of the explanatory variables together was measured as the overall R^2 for the regression. Two measures of the strength of association between each response variable and each explanatory variable were estimated from the regression analyses: the partial correlation and the standardized coefficient. The partial correlation is the correlation coefficient between response variable and the given independent variable after accounting for all of the effects of the other independent variables. Like other correlations, the partial correlation ranges from -1 to 1, with values near zero indicating weak relationships. The sign of the partial correlation indicates whether the response variable increases (positive sign) or decreases (negative sign) as the explanatory variable increases. The standardized coefficient is the regression slope coefficient for an independent variable calculated from a regression in which the response variable and independent variables have been standardized (by subtracting the mean and dividing by the standard deviation). It is analogous to the slope coefficients calculated by conventional multiple regression, but the standardization step gives all variables the same scaling. As a result, standardized coefficients can be directly compared, and a larger value for one independent variable compared to another directly indicates a stronger influence. In contrast, in a conventional multiple regression, the magnitudes of the slope coefficients depend on the scaling and units of measurement for the different independent variables, and cannot be directly compared when these properties differ between independent variables, as was the case here. For both the partial correlation and the standardized coefficient, a null hypothesis that the independent variable has zero effect on the response variable can be tested by a *t*-test, and the P-value for such a test is also provided. This *t*-test and P-value are equivalent for the partial correlation and standardized coefficient, and are equivalent to the *t*-test for significance of a slope coefficient in a conventional multiple regression.

Results

Descriptive Statistics

The following tables report mean, median, quartiles, and standard deviation (SD) for all parameters in all lakes, using all available data for each parameter (all sites and quarters). According to conventional criteria (Rast et al. 1991), most lakes are classified as eutrophic according to mean Chl *a*; Lake Bridgeport is classified as mesotrophic and Lake Arlington as hyper-eutrophic. Most lakes are also classified as eutrophic according to mean TP; Cedar Creek Lake and Richland Chambers Lake are classified as hyper-eutrophic. All lakes are classified as hyper-eutrophic based on mean Secchi Depth. However, this latter classification is based largely on data from natural lakes in temperate climates that have small watersheds and low loading of inorganic suspended solids, where algal biomass is responsible for most of the observed turbidity of productive lakes. The reservoirs analyzed here have large watersheds and high loading of such solids, which doubtless contribute a large proportion of the observed turbidity. All lakes also have high proportions of blue-green algae, on average > 50% of the total abundance – another diagnostic of eutrophic lakes. TDS concentrations for all lakes are within the range conventionally regarded as freshwater. However, all lakes except Cedar Creek Lake have relatively high concentrations of alkalinity and chloride.

Summary Statistics for Lake Bridgeport

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	4.1	2.6	2.4	3.5	5.9	462
Secchi Depth (m)	1.22	0.62	0.83	1.14	1.55	164
Total Algae (units/ml)	1457	1231	700	1100	1816	202
Diatoms (units/ml)	336	416	80	180	440	199
Flagellates (units/ml)	113	157	22	66	132	199
Green Algae (units/ml)	188	275	22	88	220	199
Blue-green (units/ml)	818	1072	132	420	1088	199
Nutrient parameters:						
DO (mg/L)	7.85	3.25	7.12	8.49	10.08	420
DOC (mg/L)	4.33	0.79	3.96	4.22	4.63	334
TOC (mg/L)	4.73	0.70	4.30	4.60	5.05	367
Ortho-PO_4 (mg/L)	0.02	0.01	0.01	0.01	0.02	226
TP (mg/L)	0.06	0.05	0.03	0.04	0.07	378
NH_3 (mg/L)	0.10	0.07	0.03	0.07	0.14	378
NO_X (mg/L)	0.08	0.08	0.03	0.06	0.11	359
TKN (mg/L)	0.53	0.24	0.37	0.48	0.62	354
TN (mg/L)	0.59	0.25	0.44	0.54	0.71	358
TN:TP	15.5	11.4	8.39	13.0	18.81	358
Solids parameters:						
Alkalinity (mg/L)	107.7	11.9	103.0	110.2	115.0	447
TDS (mg/L)	203.1	39.9	183.5	209.0	225.0	415
TSS (mg/L)	10.3	8.5	5.5	7.4	11.5	377
Chloride (mg/L)	28.5	12.5	21.5	27.8	35.4	252

Summary Statistics for Eagle Mountain Lake

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	20.4	11.8	12.5	18.8	26.7	692
Secchi Depth (m)	0.65	0.32	0.41	0.61	0.87	412
Total Algae (units/ml)	6231	5605	2746	4280	7501	191
Diatoms (units/ml)	990	858	360	748	1304	188
Flagellates (units/ml)	183	202	50	110	225	188
Green Algae (units/ml)	1201	997	440	964	1631	188
Blue-green (units/ml)	3747	5315	280	1485	4784	188
Nutrient parameters:						
DO (mg/L)	7.80	3.13	6.48	8.08	10.10	418
DOC (mg/L)	4.98	0.61	4.60	4.91	5.25	593
TOC (mg/L)	5.67	1.05	5.14	5.48	6.03	645
Ortho-PO_4 (mg/L)	0.03	0.04	0.01	0.02	0.03	374
TP (mg/L)	0.10	0.06	0.07	0.09	0.12	697
NH_3 (mg/L)	0.08	0.09	0.05	0.05	0.09	698
NO_X (mg/L)	0.09	0.11	0.01	0.05	0.15	685
TKN (mg/L)	0.82	0.27	0.62	0.77	0.96	642
TN (mg/L)	0.84	0.35	0.65	0.82	1.03	515
TN:TP	10.1	6.3	6.42	9.0	13.00	516
Solids parameters:						
Alkalinity (mg/L)	121.7	16.6	110.0	120.0	130.0	650
TDS (mg/L)	239.0	36.9	214.0	235.0	256.0	656
TSS (mg/L)	16.0	15.7	7.7	11.2	18.5	690
Chloride (mg/L)	38.2	9.0	31.4	35.5	39.7	433

Summary Statistics for Lake Worth

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	22.4	13.4	14.2	19.6	27.7	369
Secchi Depth (m)	0.50	0.21	0.33	0.46	0.61	271
Total Algae (units/ml)	7102	7944	2435	4252	8646	164
Diatoms (units/ml)	939	775	433	660	1208	154
Flagellates (units/ml)	308	286	88	241	471	154
Green Algae (units/ml)	1064	893	480	792	1315	154
Blue-green (units/ml)	4799	7458	701	1650	5302	154
Nutrient parameters:						
DO (mg/L)	8.13	2.63	6.74	8.30	9.90	376
DOC (mg/L)	4.95	0.65	4.53	4.86	5.26	284
TOC (mg/L)	5.75	0.71	5.25	5.64	6.17	356
Ortho-PO_4 (mg/L)	0.02	0.02	0.01	0.01	0.02	320
TP (mg/L)	0.10	0.04	0.07	0.09	0.11	381
NH_3 (mg/L)	0.05	0.04	0.02	0.05	0.05	380
NO_X (mg/L)	0.04	0.10	0.01	0.01	0.03	359
TKN (mg/L)	0.80	0.30	0.60	0.75	0.95	380
TN (mg/L)	0.84	0.32	0.63	0.78	0.99	381
TN:TP	11.1	11.6	6.75	9.4	12.52	381
Solids parameters:						
Alkalinity (mg/L)	125.8	14.6	117.0	125.0	135.0	381
TDS (mg/L)	239.1	29.6	220.0	235.0	257.0	364
TSS (mg/L)	18.6	11.3	10.9	15.4	24.9	380
Chloride (mg/L)	36.1	10.6	30.2	35.7	40.2	276

Summary Statistics for Benbrook Lake

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	19.4	12.7	8.9	16.7	28.0	460
Secchi Depth (m)	0.79	0.29	0.61	0.74	0.94	229
Total Algae (units/ml)	8481	10995	2789	486	16242	114
Diatoms (units/ml)	633	586	242	480	947	110
Flagellates (units/ml)	214	211	44	140	253	110
Green Algae (units/ml)	1149	1631	347	775	1634	110
Blue-green (units/ml)	6465	10588	982	1780	13144	110
Nutrient parameters:						
DO (mg/L)	7.89	3.13	6.54	9.10	9.99	468
DOC (mg/L)	4.23	0.60	3.86	4.18	4.50	411
TOC (mg/L)	4.88	0.62	4.51	4.82	5.20	443
Ortho-PO_4 (mg/L)	0.02	0.03	0.01	0.01	0.02	288
TP (mg/L)	0.08	0.04	0.05	0.07	0.09	457
NH_3 (mg/L)	0.10	0.19	0.05	0.06	0.12	436
NO_X (mg/L)	0.13	0.28	0.02	0.07	0.20	463
TKN (mg/L)	0.78	0.31	0.60	0.71	0.91	464
TN (mg/L)	0.91	0.40	0.69	0.85	1.04	435
TN:TP	13.7	7.1	9.13	12.9	16.40	434
Solids parameters:						
Alkalinity (mg/L)	118.2	20.1	104.0	114.3	133.0	387
TDS (mg/L)	205.6	25.1	187.0	205.0	222.0	453
TSS (mg/L)	13.3	10.2	7.7	10.4	14.9	451
Chloride (mg/L)	21.2	4.4	17.9	20.4	24.3	275

Summary Statistics for Lake Arlington

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	31.3	18.0	18.7	27.5	41.6	208
Secchi Depth (m)	0.71	0.21	0.58	0.71	0.89	116
Total Algae (units/ml)	14093	10750	6650	1177	20807	96
Diatoms (units/ml)	1785	1697	605	1254	2321	96
Flagellates (units/ml)	234	224	66	187	330	96
Green Algae (units/ml)	1578	1066	781	1441	2184	96
Blue-green (units/ml)	10497	10777	2239	5929	17743	96
Nutrient parameters:						
DO (mg/L)	7.78	3.06	6.73	8.10	9.70	218
DOC (mg/L)	4.98	0.77	4.49	4.94	5.37	214
TOC (mg/L)	5.56	0.92	5.00	5.43	5.97	213
Ortho-PO_4 (mg/L)	0.02	0.02	0.01	0.01	0.02	234
TP (mg/L)	0.09	0.10	0.06	0.07	0.09	213
NH_3 (mg/L)	0.08	0.16	0.03	0.05	0.06	230
NO_X (mg/L)	0.18	0.17	0.03	0.14	0.27	227
TKN (mg/L)	1.01	0.27	0.85	1.02	1.14	218
TN (mg/L)	1.14	0.32	0.95	1.08	1.32	218
TN:TP	16.3	7.9	10.82	14.4	21.11	218
Solids parameters:						
Alkalinity (mg/L)	100.4	18.8	88.7	98.0	108.0	218
TDS (mg/L)	191.2	41.0	170.0	183.0	198.8	218
TSS (mg/L)	16.8	27.2	8.2	11.5	16.2	218
Chloride (mg/L)	18.2	6.7	14.6	16.7	19.0	218

Summary Statistics for Cedar Creek Lake

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	23.0	15.6	11.6	20.0	30.4	979
Secchi Depth (m)	0.70	0.33	0.46	0.71	0.91	446
Total Algae (units/ml)	9355	12028	3070	4774	10100	223
Diatoms (units/ml)	1226	835	599	1056	1656	220
Flagellates (units/ml)	180	180	60	126	240	220
Green Algae (units/ml)	1190	973	591	953	1540	220
Blue-green (units/ml)	6595	11542	536	1650	6765	220
Nutrient parameters:						
DO (mg/L)	7.33	3.37	5.68	8.33	9.75	558
DOC (mg/L)	6.19	1.01	5.47	6.09	6.68	775
TOC (mg/L)	6.85	1.19	6.06	6.68	7.41	969
Ortho-PO_4 (mg/L)	0.03	0.04	0.01	0.02	0.03	552
TP (mg/L)	0.11	0.07	0.07	0.09	0.14	977
NH_3 (mg/L)	0.08	0.11	0.05	0.05	0.08	871
NO_X (mg/L)	0.15	0.23	0.02	0.12	0.21	976
TKN (mg/L)	0.90	0.29	0.70	0.84	1.03	980
TN (mg/L)	1.04	0.36	0.82	0.98	1.19	896
TN:TP	11.2	5.7	7.42	10.2	13.67	896
Solids parameters:						
Alkalinity (mg/L)	52.1	8.6	45.6	51.5	56.5	839
TDS (mg/L)	121.8	17.2	111.0	119.0	132.0	846
TSS (mg/L)	15.8	79.1	6.7	9.6	16.4	966
Chloride (mg/L)	13.6	3.4	11.3	13.4	15.1	553

Summary Statistics for Richland Chambers Lake

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	14.9	12.5	6.6	11.4	19.4	868
Secchi Depth (m)	0.82	0.46	0.46	0.84	1.14	430
Total Algae (units/ml)	5962	7549	1720	3630	7370	229
Diatoms (units/ml)	636	691	256	460	704	225
Flagellates (units/ml)	203	283	44	110	220	225
Green Algae (units/ml)	805	760	330	560	968	225
Blue-green (units/ml)	4345	7195	580	1936	5420	225
Nutrient parameters:						
DO (mg/L)	7.20	3.57	6.00	8.20	9.68	847
DOC (mg/L)	4.74	0.91	4.22	4.56	5.05	742
TOC (mg/L)	5.60	1.56	4.78	5.19	5.97	862
Ortho-PO_4 (mg/L)	0.02	0.05	0.01	0.01	0.02	552
TP (mg/L)	0.11	0.14	0.04	0.06	0.11	869
NH_3 (mg/L)	0.15	0.33	0.05	0.05	0.10	831
NO_X (mg/L)	0.24	0.25	0.03	0.21	0.33	858
TKN (mg/L)	0.83	0.42	0.56	0.72	0.95	877
TN (mg/L)	1.05	0.47	0.77	1.02	1.20	800
TN:TP	15.9	10.2	8.90	13.19	20.27	800
Solids parameters:						
Alkalinity (mg/L)	104.0	16.3	93.8	102.0	110.0	843
TDS (mg/L)	182.3	50.6	160.0	174.0	191.0	833
TSS (mg/L)	19.3	33.5	5.2	8.6	17.6	869
Chloride (mg/L)	10.6	2.7	8.8	10.3	12.0	467

The following tables report the median values for each water quality parameter in each quarter, using all data from each lake. These display strong seasonal variations for many biological and nutrient parameters in most lakes, with a lesser degree of seasonal variation for solids parameters.

Quarter Medians for Lake Bridgeport

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (µg/L)	3.0	3.7	4.3	3.4
Secchi Depth (m)	0.94	1.14	1.93	0.86
Total Algae (units/ml)	860	1260	1672	990
Diatoms (units/ml)	176	180	136	286
Flagellates (units/ml)	66	44	55	66
Green Algae (units/ml)	44	60	110	180
Blue-green (units/ml)	264	528	1353	200
Nutrient parameters:				
DO (mg/L)	11.00	8.07	4.73	8.87
DOC (mg/L)	4.24	4.17	4.30	4.17
TOC (mg/L)	4.55	4.62	4.82	4.52
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
TP (mg/L)	0.04	0.05	0.04	0.05
NH_3 (mg/L)	0.07	0.07	0.10	0.05
NO_X (mg/L)	0.07	0.06	0.04	0.06
TKN (mg/L)	0.46	0.51	0.52	0.45
TN (mg/L)	0.55	0.60	0.55	0.53
TN:TP	15.5	13.2	11.4	11.5
Solids parameters:				
Alkalinity (mg/L)	113.0	112.0	108.4	109.0
TDS (mg/L)	212.0	210.5	202.0	217.0
TSS (mg/L)	6.4	8.6	7.4	7.3
Chloride (mg/L)	28.6	27.5	24.5	27.7

Quarter Medians for Eagle Mountain Lake

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	16.5	14.2	22.7	23.7
Secchi Depth (m)	0.62	0.58	0.66	0.56
Total Algae (units/ml)	3630	2736	6820	6300
Diatoms (units/ml)	814	720	462	1100
Flagellates (units/ml)	132	88	110	120
Green Algae (units/ml)	1463	902	430	1200
Blue-green (units/ml)	460	264	5324	3344
Nutrient parameters:				
DO (mg/L)	11.09	8.63	5.80	7.12
DOC (mg/L)	4.97	4.86	4.94	4.80
TOC (mg/L)	5.35	5.45	5.65	5.52
Ortho-PO_4 (mg/L)	0.01	0.02	0.02	0.02
TP (mg/L)	0.07	0.09	0.10	0.09
NH_3 (mg/L)	0.05	0.05	0.06	0.05
NO_X (mg/L)	0.09	0.04	0.01	0.06
TKN (mg/L)	0.74	0.76	0.83	0.77
TN (mg/L)	0.81	0.81	0.84	0.83
TN:TP	10.5	8.7	8.3	9.1
Solids parameters:				
Alkalinity (mg/L)	123.0	132.0	115.0	110.0
TDS (mg/L)	242.0	249.5	222.0	217.0
TSS (mg/L)	9.3	12.8	9.8	13.1
Chloride (mg/L)	36.1	34.4	34.8	35.8

Quarter Medians for Lake Worth

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	15.5	14.7	24.0	29.4
Secchi Depth (m)	0.53	0.43	0.50	0.41
Total Algae (units/ml)	2790	2112	6656	10868
Diatoms (units/ml)	783	396	600	1007
Flagellates (units/ml)	115	110	330	325
Green Algae (units/ml)	870	506	540	1278
Blue-green (units/ml)	734	704	3940	7458
Nutrient parameters:				
DO (mg/L)	11.04	8.52	6.51	7.40
DOC (mg/L)	4.89	4.72	4.90	4.91
TOC (mg/L)	5.40	5.40	5.75	5.94
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
TP (mg/L)	0.07	0.08	0.10	0.10
NH_3 (mg/L)	0.05	0.05	0.05	0.05
NO_X (mg/L)	0.03	0.01	0.01	0.01
TKN (mg/L)	0.67	0.72	0.78	0.88
TN (mg/L)	0.74	0.75	0.81	0.89
TN:TP	11.5	9.8	8.6	7.8
Solids parameters:				
Alkalinity (mg/L)	128.0	141.0	123.0	115.0
TDS (mg/L)	234.5	251.0	233.0	225.5
TSS (mg/L)	12.5	17.0	15.1	18.0
Chloride (mg/L)	36.1	33.6	34.2	37.7

Quarter Medians for Benbrook Lake

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	7.3	14.9	32.7	16.8
Secchi Depth (m)	0.61	0.91	0.79	0.71
Total Algae (units/ml)	1530	3340	8976	7625
Diatoms (units/ml)	241	700	440	641
Flagellates (units/ml)	114	154	88	198
Green Algae (units/ml)	341	980	590	1195
Blue-green (units/ml)	209	1580	8360	4862
Nutrient parameters:				
DO (mg/L)	9.69	6.66	6.36	9.97
DOC (mg/L)	4.00	4.21	4.14	4.20
TOC (mg/L)	4.62	4.84	4.89	4.90
Ortho-PO_4 (mg/L)	0.02	0.01	0.01	0.01
TP (mg/L)	0.07	0.06	0.08	0.07
NH_3 (mg/L)	0.13	0.05	0.06	0.05
NO_X (mg/L)	0.24	0.03	0.01	0.12
TKN (mg/L)	0.69	0.66	0.88	0.69
TN (mg/L)	0.97	0.71	0.92	0.80
TN:TP	13.7	13.1	11.4	11.8
Solids parameters:				
Alkalinity (mg/L)	131.8	123.5	102.0	111.0
TDS (mg/L)	224.5	208.0	187.0	198.5
TSS (mg/L)	11.6	10.3	9.1	10.2
Chloride (mg/L)	19.4	20.7	22.7	20.2

Quarter Medians for Lake Arlington

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	25.7	19.1	38.4	33.4
Secchi Depth (m)	0.61	0.81	0.76	0.69
Total Algae (units/ml)	7480	6402	21450	18216
Diatoms (units/ml)	1804	1364	341	1430
Flagellates (units/ml)	220	88	88	242
Green Algae (units/ml)	1584	1276	1144	1804
Blue-green (units/ml)	2948	1100	19965	15224
Nutrient parameters:				
DO (mg/L)	10.85	7.10	6.30	8.45
DOC (mg/L)	4.90	5.02	4.91	4.87
TOC (mg/L)	5.47	5.19	5.37	5.57
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
TP (mg/L)	0.07	0.07	0.08	0.08
NH_3 (mg/L)	0.04	0.04	0.05	0.05
NO_X (mg/L)	0.22	0.21	0.01	0.05
TKN (mg/L)	1.02	1.00	1.05	0.96
TN (mg/L)	1.17	1.22	1.06	1.00
TN:TP	18.9	16.8	13.2	12.9
Solids parameters:				
Alkalinity (mg/L)	104.5	108.1	85.6	91.5
TDS (mg/L)	195.0	197.5	170.0	173.0
TSS (mg/L)	14.2	11.4	8.2	12.7
Chloride (mg/L)	17.6	18.8	16.5	15.2

Quarter Medians for Cedar Creek Lake

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (µg/L)	16.0	13.4	27.4	28.0
Secchi Depth (m)	0.66	0.66	0.81	0.76
Total Algae (units/ml)	3509	3250	7832	10050
Diatoms (units/ml)	1364	1280	587	1122
Flagellates (units/ml)	187	88	110	140
Green Algae (units/ml)	1090	880	671	1166
Blue-green (units/ml)	597	528	6600	6864
Nutrient parameters:				
DO (mg/L)	10.50	8.00	5.34	7.97
DOC (mg/L)	6.08	6.16	6.00	6.14
TOC (mg/L)	6.63	6.63	6.61	6.82
Ortho-PO_4 (mg/L)	0.02	0.02	0.02	0.02
TP (mg/L)	0.09	0.10	0.10	0.09
NH_3 (mg/L)	0.05	0.05	0.05	0.05
NO_X (mg/L)	0.19	0.13	0.01	0.14
TKN (mg/L)	0.78	0.79	0.94	0.86
TN (mg/L)	1.00	0.93	0.97	1.03
TN:TP	10.3	9.9	9.4	11.8
Solids parameters:				
Alkalinity (mg/L)	47.2	45.9	53.8	55.0
TDS (mg/L)	115.5	123.0	119.0	118.0
TSS (mg/L)	10.4	9.9	8.0	9.3
Chloride (mg/L)	12.9	13.9	13.7	13.4

Quarter Medians for Richland Chambers Lake

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	8.2	10.7	19.6	10.2
Secchi Depth (m)	0.61	1.06	0.91	0.91
Total Algae (units/ml)	1700	3333	8800	4000
Diatoms (units/ml)	374	682	440	455
Flagellates (units/ml)	88	140	66	198
Green Algae (units/ml)	450	482	520	781
Blue-green (units/ml)	628	1112	8008	2277
Nutrient parameters:				
DO (mg/L)	9.66	6.80	5.84	9.39
DOC (mg/L)	4.47	4.64	4.63	4.50
TOC (mg/L)	5.09	5.17	5.41	5.14
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
TP (mg/L)	0.07	0.06	0.08	0.05
NH_3 (mg/L)	0.05	0.05	0.08	0.05
NO_X (mg/L)	0.33	0.20	0.01	0.21
TKN (mg/L)	0.67	0.75	0.88	0.64
TN (mg/L)	0.97	1.19	0.92	1.07
TN:TP	17.4	16.0	10.6	12.3
Solids parameters:				
Alkalinity (mg/L)	105.0	104.0	93.4	102.0
TDS (mg/L)	181.5	178.0	164.0	170.0
TSS (mg/L)	11.7	8.4	7.0	8.4
Chloride (mg/L)	10.1	9.8	10.7	10.4

The following tables report mean, median, quartiles and standard deviation (SD) for all parameters in all lakes, using data only from the intake site for each lake. Water quality parameters generally showed similar means, medians, and ranges of variation at the intake sites as were observed for the whole lake.

Summary Statistics for Lake Bridgeport Intake Site (BP-01B)

	Mean	**SD**	**25%-ile**	**Median**	**75%-ile**	**N**
Biological parameters:						
Chl *a* (µg/L)	2.8	2.1	1.2	2.2	3.3	83
Secchi Depth (m)	1.32	0.65	0.87	1.19	1.74	82
Nutrient parameters:						
DO (mg/L)	6.37	4.05	3.26	7.71	9.54	84
DOC (mg/L)	4.29	0.49	3.98	4.23	4.55	74
TOC (mg/L)	4.75	0.69	4.33	4.63	5.06	81
Ortho-PO_4 (mg/L)	0.02	0.02	0.01	0.02	0.03	83
TP (mg/L)	0.07	0.06	0.04	0.06	0.10	83
NH_3 (mg/L)	0.11	0.12	0.05	0.05	0.11	82
NO_X (mg/L)	0.08	0.07	0.02	0.06	0.11	80
TKN (mg/L)	0.56	0.24	0.39	0.50	0.72	79
TN (mg/L)	0.63	0.25	0.48	0.57	0.77	79
TN:TP	12.2	7.7	7.4	10.5	15.5	79
Solids parameters:						
Alkalinity (mg/L)	110.8	12.9	105.5	113.0	117.4	80
TDS (mg/L)	206.1	56.3	184.5	209.0	224.8	78
TSS (mg/L)	12.3	10.9	6.0	8.3	14.7	73
Chloride (mg/L)	32.0	18.7	22.8	29.3	37.7	74

Summary Statistics for Eagle Mountain Lake Intake Site (EM-07M)

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	16.6	7.8	11.6	15.4	20.5	49
Secchi Depth (m)	0.98	0.30	0.83	0.97	1.17	84
Nutrient parameters:						
DO (mg/L)	7.85	2.48	6.24	7.60	9.62	84
DOC (mg/L)	4.91	0.45	4.61	4.95	5.15	37
TOC (mg/L)	5.48	0.56	5.15	5.43	5.72	34
Ortho-PO_4 (mg/L)	0.02	0.01	0.01	0.01	0.020	48
TP (mg/L)	0.07	0.03	0.05	0.07	0.08	49
NH_3 (mg/L)	0.05	0.04	0.02	0.05	0.07	53
NO_X (mg/L)	0.10	0.15	0.01	0.04	0.14	41
TKN (mg/L)	0.84	0.25	0.67	0.82	0.98	42
TN (mg/L)	0.94	0.26	0.78	0.92	1.19	30
TN:TP	15.2	8.4	11.0	15.1	19.8	30
Solids parameters:						
Alkalinity (mg/L)	114.7	10.7	107.1	115.0	121.6	47
TDS (mg/L)	219.0	20.4	207.3	218.5	230.3	44
TSS (mg/L)	7.4	2.9	5.7	7.0	8.8	48
Chloride (mg/L)	33.6	7.7	30.2	34.0	36.8	41

Summary Statistics for Lake Worth Intake Site (LW-04M)

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	25.2	10.5	17.4	24.7	32.7	37
Secchi Depth (m)	0.70	0.22	0.58	0.66	0.83	68
Nutrient parameters:						
DO (mg/L)	7.53	2.91	5.94	8.19	9.50	43
DOC (mg/L)	5.03	0.62	4.71	5.08	5.52	29
TOC (mg/L)	5.63	0.57	5.25	5.62	6.04	36
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01	0.01	42
TP (mg/L)	0.07	0.02	0.06	0.07	0.09	41
NH_3 (mg/L)	0.05	0.03	0.02	0.05	0.05	42
NO_X (mg/L)	0.06	0.19	0.01	0.01	0.04	41
TKN (mg/L)	0.85	0.23	0.67	0.80	0.97	42
TN (mg/L)	0.89	0.32	0.70	0.83	1.05	43
TN:TP	12.7	3.9	9.8	12.3	15.0	41
Solids parameters:						
Alkalinity (mg/L)	121.2	12.6	112.3	120.3	129.8	42
TDS (mg/L)	230.9	27.2	211.0	232.0	243.5	39
TSS (mg/L)	11.0	3.8	7.7	10.4	12.9	42
Chloride (mg/L)	34.9	9.2	30.3	34.2	38.2	37

Summary Statistics for Benbrook Lake Intake Site (BB-01T)

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	19.7	11.5	9.5	18.7	27.9	82
Secchi Depth (m)	0.93	0.30	0.70	0.91	1.07	82
Nutrient parameters:						
DO (mg/L)	8.91	2.00	7.68	9.39	10.34	82
DOC (mg/L)	4.37	0.71	3.93	4.23	4.69	74
TOC (mg/L)	4.85	0.57	4.55	4.83	5.16	80
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01	0.02	74
TP (mg/L)	0.06	0.03	0.04	0.05	0.07	80
NH_3 (mg/L)	0.08	0.07	0.05	0.06	0.11	78
NO_X (mg/L)	0.11	0.11	0.01	0.05	0.17	77
TKN (mg/L)	0.76	0.25	0.59	0.70	0.89	77
TN (mg/L)	0.87	0.27	0.66	0.81	1.00	77
TN:TP	16.8	8.1	8.6	15.5	15.6	71
Solids parameters:						
Alkalinity (mg/L)	114.3	18.4	102.0	112.9	124.3	80
TDS (mg/L)	200.6	21.9	183.0	201.5	215.3	80
TSS (mg/L)	8.0	2.2	6.4	7.8	9.3	78
Chloride (mg/L)	20.8	3.6	18.3	20.0	23.3	58

Summary Statistics for Lake Arlington Intake Site (AR-01M)

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	32.8	15.2	21.4	29.4	40.7	33
Secchi Depth (m)	0.84	0.15	0.73	0.86	0.91	32
Nutrient parameters:						
DO (mg/L)	7.52	2.84	6.53	7.70	9.10	32
DOC (mg/L)	5.05	0.79	4.49	4.98	5.37	33
TOC (mg/L)	5.44	0.77	4.91	5.41	5.81	32
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01	0.01	33
TP (mg/L)	0.07	0.02	0.05	0.07	0.09	33
NH_3 (mg/L)	0.04	0.04	0.02	0.03	0.05	33
NO_X (mg/L)	0.11	0.13	0.02	0.03	0.03	32
TKN (mg/L)	0.98	0.24	0.84	1.00	1.14	33
TN (mg/L)	1.08	0.29	0.94	1.03	1.18	33
TN:TP	18.1	8.4	11.7	16.8	22.6	33
Solids parameters:						
Alkalinity (mg/L)	97.1	11.9	87.9	95.7	105.0	33
TDS (mg/L)	183.2	21.0	171.0	179.0	194.0	33
TSS (mg/L)	9.8	3.3	7.3	9.0	11.4	33
Chloride (mg/L)	17.0	3.4	14.7	16.6	18.5	33

Summary Statistics for Cedar Creek Lake Intake Site (CC-04M)

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	21.1	11.1	12.7	19.4	27.1	84
Secchi Depth (m)	0.80	0.22	0.71	0.76	0.91	77
Nutrient parameters:						
DO (mg/L)	7.65	2.40	6.31	7.58	9.53	80
DOC (mg/L)	6.02	0.82	5.57	6.04	6.49	67
TOC (mg/L)	6.47	0.88	6.00	6.44	7.06	83
Ortho-PO_4 (mg/L)	0.02	0.02	0.01	0.02	0.04	56
TP (mg/L)	0.09	0.03	0.07	0.08	0.10	84
NH_3 (mg/L)	0.07	0.05	0.05	0.05	0.08	64
NO_X (mg/L)	0.14	0.12	0.03	0.11	0.20	84
TKN (mg/L)	0.86	0.26	0.68	0.80	0.94	77
TN (mg/L)	1.00	0.27	0.83	0.95	1.09	77
TN:TP	12.2	4.9	6.7	11.1	11.6	77
Solids parameters:						
Alkalinity (mg/L)	53.4	8.9	46.8	53.9	57.4	80
TDS (mg/L)	122.8	19.2	110.0	120.0	132.0	80
TSS (mg/L)	8.4	3.8	6.5	7.6	9.7	84
Chloride (mg/L)	13.2	3.0	11.0	13.2	14.6	76

Summary Statistics for Richland Chambers Lake Intake Site (RC-05M)

	Mean	SD	25%-ile	Median	75%-ile	N
Biological parameters:						
Chl *a* (μg/L)	14.3	8.0	8.7	14.3	17.8	74
Secchi Depth (m)	0.84	0.26	0.66	0.84	0.94	73
Nutrient parameters:						
DO (mg/L)	7.95	2.50	6.52	8.37	9.86	79
DOC (mg/L)	4.47	0.50	4.06	4.47	4.75	68
TOC (mg/L)	5.21	1.00	4.69	4.96	5.30	74
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01	0.02	74
TP (mg/L)	0.07	0.04	0.05	0.06	0.08	74
NH_3 (mg/L)	0.08	0.13	0.05	0.05	0.07	74
NO_X (mg/L)	0.21	0.19	0.02	0.18	0.32	76
TKN (mg/L)	0.72	0.23	0.56	0.69	0.87	69
TN (mg/L)	0.84	0.40	0.73	0.88	1.09	69
TN:TP	12.3	7.7	7.0	10.4	16.7	66
Solids parameters:						
Alkalinity (mg/L)	98.3	10.5	92.7	97.7	104.0	74
TDS (mg/L)	173.2	23.7	159.0	171.5	181.8	72
TSS (mg/L)	10.6	4.7	7.8	10.2	13.4	74
Chloride (mg/L)	10.5	1.9	9.0	10.5	12.2	74

The following tables report the median values for each water quality parameter in each quarter, using data only from the intake site of each lake. Similar to the whole-lake quarterly medians, these display strong seasonal variations for many biological and nutrient parameters in most lakes, with a lesser degree of seasonal variation for solids parameters.

Quarter Medians for Lake Bridgeport Intake Site (BP-01B)

	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**
Biological parameters:				
Chl *a* (μg/L)	2.7	2.0	1.9	2.7
Secchi Depth (m)	0.97	1.22	2.24	0.86
Nutrient parameters:				
DO (mg/L)	10.84	5.77	0.10	8.45
DOC (mg/L)	4.33	4.10	4.32	4.17
TOC (mg/L)	4.59	4.60	4.96	4.52
Ortho-PO_4 (mg/L)	0.01	0.01	0.02	0.01
TP (mg/L)	0.04	0.08	0.10	0.05
NH_3 (mg/L)	0.05	0.05	0.24	0.05
NO_X (mg/L)	0.06	0.10	0.01	0.06
TKN (mg/L)	0.46	0.48	0.75	0.45
TN (mg/L)	0.55	0.58	0.75	0.53
TN:TP	15.9	8.8	8.9	10.7
Solids parameters:				
Alkalinity (mg/L)	113.0	114.0	118.0	109.0
TDS (mg/L)	207.5	210.5	208.0	202.0
TSS (mg/L)	6.0	12.1	8.2	7.9
Chloride (mg/L)	29.3	29.6	32.1	29.2

Quarter Medians for Eagle Mountain Lake Intake Site (EM-07M)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	14.1	10.5	20.7	18.7
Secchi Depth (m)	0.97	0.97	1.22	0.84
Nutrient parameters:				
DO (mg/L)	11.00	8.71	5.80	6.60
DOC (mg/L)	5.04	4.79	4.73	4.88
TOC (mg/L)	5.39	5.44	5.52	5.42
Ortho-PO_4 (mg/L)	0.01	0.02	0.01	0.02
TP (mg/L)	0.06	0.07	0.06	0.07
NH_3 (mg/L)	0.06	0.04	0.02	0.05
NO_X (mg/L)	0.09	0.01	0.01	0.10
TKN (mg/L)	0.82	0.97	0.76	0.79
TN (mg/L)	0.96	1.13	0.84	0.89
TN:TP	15.9	14.3	15.7	11.5
Solids parameters:				
Alkalinity (mg/L)	118.0	126.7	107.8	106.6
TDS (mg/L)	229.0	226.5	211.0	213.5
TSS (mg/L)	6.9	6.9	5.7	8.8
Chloride (mg/L)	34.4	31.3	33.2	34.3

Quarter Medians for Lake Worth Intake Site (LW-04M)

	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**
Biological parameters:				
Chl *a* (μg/L)	21.2	16.0	26.7	32.9
Secchi Depth (m)	0.69	0.66	0.81	0.58
Nutrient parameters:				
DO (mg/L)	10.85	8.52	4.00	6.11
DOC (mg/L)	5.17	4.97	5.20	4.89
TOC (mg/L)	5.37	5.34	5.76	5.93
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
TP (mg/L)	0.07	0.06	0.06	0.09
NH_3 (mg/L)	0.05	0.02	0.02	0.05
NO_X (mg/L)	0.02	0.01	0.01	0.01
TKN (mg/L)	0.78	0.75	0.78	0.97
TN (mg/L)	0.81	0.79	0.79	1.03
TN:TP	13.1	12.0	11.8	10.8
Solids parameters:				
Alkalinity (mg/L)	124.0	137.9	115.5	107.0
TDS (mg/L)	239.0	250.0	222.0	213.0
TSS (mg/L)	9.8	10.8	8.7	16.1
Chloride (mg/L)	37.6	30.8	34.0	37.7

Quarter Medians for Benbrook Lake Intake Site (BB-01T)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	8.0	17.5	33.1	19.4
Secchi Depth (m)	0.71	1.00	0.94	0.79
Nutrient parameters:				
DO (mg/L)	10.10	8.63	6.83	9.92
DOC (mg/L)	4.06	4.48	4.13	4.47
TOC (mg/L)	4.57	5.11	4.94	4.89
Ortho-PO_4 (mg/L)	0.02	0.01	0.01	0.01
TP (mg/L)	0.06	0.04	0.06	0.06
NH_3 (mg/L)	0.12	0.05	0.06	0.07
NO_X (mg/L)	0.23	0.01	0.02	0.11
TKN (mg/L)	0.73	0.64	0.82	0.69
TN (mg/L)	0.97	0.65	0.89	0.80
TN:TP	16.7	17.6	15.2	14.3
Solids parameters:				
Alkalinity (mg/L)	130.0	116.5	99.2	108.1
TDS (mg/L)	220.0	198.0	186.0	193.0
TSS (mg/L)	9.2	7.0	6.8	8.7
Chloride (mg/L)	19.3	20.1	21.2	21.3

Quarter Medians for Lake Arlington Intake Site (AR-01M)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	28.1	16.7	40.1	34.0
Secchi Depth (m)	0.83	0.99	0.89	0.79
Nutrient parameters:				
DO (mg/L)	10.85	6.80	5.15	8.02
DOC (mg/L)	5.29	5.00	4.70	4.82
TOC (mg/L)	5.75	4.92	5.14	5.34
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
TP (mg/L)	0.06	0.07	0.06	0.08
NH_3 (mg/L)	0.05	0.04	0.02	0.03
NO_X (mg/L)	0.17	0.17	0.02	0.03
TKN (mg/L)	1.02	0.94	1.01	0.97
TN (mg/L)	1.20	1.15	1.02	0.98
TN:TP	22.3	20.3	14.3	12.9
Solids parameters:				
Alkalinity (mg/L)	104.5	107.0	85.2	90.5
TDS (mg/L)	193.5	192.0	171.0	171.0
TSS (mg/L)	11.0	9.5	7.4	10.1
Chloride (mg/L)	17.0	18.0	16.8	15.2

Quarter Medians for Cedar Creek Lake Intake Site (CC-04M)

	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**
Biological parameters:				
Chl *a* (μg/L)	16.6	13.0	24.0	26.7
Secchi Depth (m)	0.76	0.91	1.11	0.90
Nutrient parameters:				
DO (mg/L)	10.15	7.58	5.53	7.91
DOC (mg/L)	6.26	6.04	5.83	6.03
TOC (mg/L)	6.55	6.33	6.40	6.54
Ortho-PO_4 (mg/L)	0.04	0.04	0.02	0.02
TP (mg/L)	0.12	0.10	0.10	0.10
NH_3 (mg/L)	0.05	0.05	0.06	0.05
NO_X (mg/L)	0.17	0.14	0.02	0.13
TKN (mg/L)	0.75	0.72	0.86	0.88
TN (mg/L)	0.97	0.84	0.91	1.02
TN:TP	9.9	10.7	10.6	13.5
Solids parameters:				
Alkalinity (mg/L)	48.5	45.5	55.6	54.7
TDS (mg/L)	112.0	122.0	121.0	116.5
TSS (mg/L)	8.4	7.8	6.8	6.9
Chloride (mg/L)	12.7	13.4	13.8	13.4

Quarter Medians for Richland Chambers Lake Intake Site (RC-05M)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Biological parameters:				
Chl *a* (μg/L)	7.4	10.3	21.4	14.5
Secchi Depth (m)	0.69	0.91	0.88	0.86
Nutrient parameters:				
DO (mg/L)	9.92	7.50	6.00	9.64
DOC (mg/L)	4.53	4.59	4.39	4.47
TOC (mg/L)	5.29	5.27	5.69	5.19
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
TP (mg/L)	0.07	0.06	0.06	0.06
NH_3 (mg/L)	0.05	0.05	0.05	0.05
NO_X (mg/L)	0.34	0.27	0.01	0.19
TKN (mg/L)	0.62	0.63	0.71	0.65
TN (mg/L)	1.06	0.88	0.72	0.84
TN:TP	12.8	10.0	15.4	6.7
Solids parameters:				
Alkalinity (mg/L)	105.8	94.7	88.4	100.0
TDS (mg/L)	183.0	175.5	154.5	166.0
TSS (mg/L)	10.7	9.4	9.0	10.2
Chloride (mg/L)	10.4	9.9	10.8	10.8

The following tables report mean, median, quartiles, and standard deviation (SD) for selected parameters in all lakes, using data main pool, top sites only.

Summary Statistics for Lake Bridgeport Main Pool Top Sites (BP-01)

	Mean	SD	25%-ile	Median	75%-ile	N
Chl *a* (µg/L)	12.9	6.3	2.6	4.3	6.5	80
TP (mg/L)	0.04	0.03	0.02	0.03	0.05	82
TN (mg/L)	0.58	0.28	0.42	0.52	0.64	80
Alkalinity (mg/L)	107.7	9.9	102.8	108.9	114.7	80
Chloride (mg/L)	29.5	8.5	22.1	29.1	37.3	76

Summary Statistics for Eagle Mountain Lake Main Pool Top Sites (EM-05, EM-07)

	Mean	SD	25%-ile	Median	75%-ile	N
Chl *a* (µg/L)	17.8	9.2	11.5	17.8	23.4	166
TP (mg/L)	0.07	0.03	0.05	0.07	0.08	167
TN (mg/L)	0.76	0.33	0.59	0.75	0.91	124
Alkalinity (mg/L)	118.7	12.5	110.0	118.0	127.1	160
Chloride (mg/L)	36.6	8.8	31.4	35.6	42.8	113

Summary Statistics for Lake Worth Main Pool Top Sites (LW-04)

	Mean	SD	25%-ile	Median	75%-ile	N
Chl *a* (µg/L)	25.0	15.6	14.4	20.6	34.7	68
TP (mg/L)	0.07	0.03	0.05	0.07	0.08	68
TN (mg/L)	0.79	0.27	0.60	0.72	0.93	67
Alkalinity (mg/L)	124.3	13.7	115.8	123.6	132.5	68
Chloride (mg/L)	35.9	9.7	29.6	36.5	41.1	65

Summary Statistics for Benbrook Lake Main Pool Top Sites (BB-01, BB-02)

	Mean	SD	25%-ile	Median	75%-ile	N
Chl *a* (µg/L)	19.7	11.8	9.5	18.2	28.1	164
TP (mg/L)	0.06	0.03	0.04	0.06	0.07	161
TN (mg/L)	0.87	0.27	0.66	0.81	1.01	154
Alkalinity (mg/L)	114.7	18.6	102.8	113.0	125.8	160
Chloride (mg/L)	21.2	4.3	17.9	20.6	24.12	137

Summary Statistics for Lake Arlington Main Pool Top Sites (AR-01)

	Mean	SD	25%-ile	Median	75%-ile	N
Chl *a* (µg/L)	35.7	15.0	23.8	36.4	45.1	32
TP (mg/L)	0.07	0.03	0.05	0.07	0.08	33
TN (mg/L)	1.11	0.26	0.95	1.08	1.19	33
Alkalinity (mg/L)	95.9	13.1	85.8	94.8	106.0	33
Chloride (mg/L)	16.9	3.4	14.6	16.7	18.5	33

Summary Statistics for Cedar Creek Lake Main Pool Top Sites (CC-05, CC-06)

	Mean	SD	25%-ile	Median	75%-ile	N
Chl *a* (µg/L)	22.7	11.0	14.5	21.4	28.2	168
TP (mg/L)	0.07	0.06	0.05	0.06	0.08	168
TN (mg/L)	0.94	0.23	0.79	0.91	1.04	154
Alkalinity (mg/L)	52.6	7.9	46.3	52.2	57.1	155
Chloride (mg/L)	14.2	3.1	11.9	13.8	15.6	74

Summary Statistics for Richland Chambers Lake
Main Pool Top Sites (RC-01, RC-02)

	Mean	SD	25%-ile	Median	75%-ile	N
Chl *a* (µg/L)	12.4	7.4	7.3	10.3	14.6	168
TP (mg/L)	0.05	0.04	0.03	0.04	0.05	168
TN (mg/L)	0.87	0.25	0.73	0.84	1.00	154
Alkalinity (mg/L)	98.9	11.5	93.0	96.9	104.0	160
Chloride (mg/L)	9.9	1.7	8.6	9.7	10.8	66

The following tables report the median values for selected water quality parameters in each quarter, using data only from main pool, top sites. Similar to the whole-lake quarterly medians, these display strong seasonal variations for many biological and nutrient parameters in most lakes, with a lesser degree of seasonal variation for solids parameters.

Quarter Medians for Lake Bridgeport Main Pool Top Sites (BP-01)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Chl *a* (µg/L)	3.0	5.8	4.6	3.2
TP (mg/L)	0.03	0.04	0.02	0.04
TN (mg/L)	0.54	0.54	0.44	0.54
Alkalinity (mg/L)	113.0	113.0	107.5	107.6
Chloride (mg/L)	29.0	28.9	32.9	28.1

Quarter Medians for Eagle Mountain Lake Main Pool Top Sites (EM-05, EM-07)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Chl *a* (µg/L)	15.2	12.5	19.7	23.3
TP (mg/L)	0.07	0.06	0.06	0.07
TN (mg/L)	0.80	0.74	0.73	0.79
Alkalinity (mg/L)	119.0	130.0	113.0	110.0
Chloride (mg/L)	36.0	34.4	35.5	35.7

Quarter Medians for Lake Worth Main Pool Top Sites (LW-04)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Chl *a* (µg/L)	15.4	14.5	30.7	37.4
TP (mg/L)	0.06	0.06	0.07	0.09
TN (mg/L)	0.72	0.66	0.77	0.84
Alkalinity (mg/L)	127.0	141.0	122.0	115.0
Chloride (mg/L)	35.6	33.4	35.1	37.9

Quarter Medians for Benbrook Lake Main Pool Top Sites (BB-01, BB-02)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Chl *a* (µg/L)	7.4	15.9	33.1	19.1
TP (mg/L)	0.07	0.04	0.06	0.06
TN (mg/L)	0.97	0.67	0.89	0.80
Alkalinity (mg/L)	130.0	116.5	98.4	108.1
Chloride (mg/L)	19.0	20.8	21.7	20.5

Quarter Medians for Lake Arlington Main Pool Top Sites (AR-01)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Chl *a* (µg/L)	23.5	19.6	39.9	45.5
TP (mg/L)	0.06	0.07	0.06	0.08
TN (mg/L)	1.19	1.08	1.06	1.01
Alkalinity (mg/L)	106.0	106.0	82.7	91.4
Chloride (mg/L)	17.1	17.8	17.3	15.3

Quarter Medians for Cedar Creek Lake Main Pool Top Sites (CC-05, CC-06)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Chl *a* (µg/L)	20.1	14.4	25.3	27.2
TP (mg/L)	0.07	0.06	0.06	0.06
TN (mg/L)	1.01	0.82	0.87	0.97
Alkalinity (mg/L)	50.6	45.0	52.5	55.0
Chloride (mg/L)	13.7	14.6	14.2	13.5

Quarter Medians for Richland Chambers Lake
Main Pool Top Sites (RC-01, RC-02)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Chl *a* (µg/L)	8.0	11.3	20.5	7.7
TP (mg/L)	0.05	0.03	0.04	0.04
TN (mg/L)	0.97	0.83	0.73	0.86
Alkalinity (mg/L)	102.0	96.1	92.9	99.1
Chloride (mg/L)	9.7	9.2	9.9	9.6

The following table reports mean, median, quartiles, and standard deviation (SD) for selected parameters in all lakes, using bottom sites only.

Summary Statistics for Bottom Sites

	Mean	SD	25%-ile	Median	75%-ile	N
Lake Bridgeport (BP-01B, BP-02B):						
DO (mg/L)	6.58	3.94	3.68	7.84	9.60	168
NH_3 (mg/L)	0.13	0.12	0.04	0.08	0.18	153
Ortho-PO_4 (mg/L)	0.02	0.02	0.01	0.01	0.03	153
Eagle Mountain Lake (EM-03B, EM-05B, EM-07B, EM-12B):						
DO (mg/L)	6.38	3.91	2.77	7.25	9.12	167
NH_3 (mg/L)	0.09	0.11	0.05	0.06	0.10	274
Ortho-PO_4 (mg/L)	0.04	0.06	0.01	0.02	0.04	160
Lake Worth (LW-04B):						
DO (mg/L)	6.20	3.82	3.37	6.90	8.63	67
NH_3 (mg/L)	0.06	0.06	0.04	0.05	0.07	68
Ortho-PO_4 (mg/L)	0.02	0.02	0.01	0.01	0.02	64
Benbrook Lake (BB-01B, BB-02B, BB-03B):						
DO (mg/L)	6.54	3.68	3.76	7.65	9.54	222
NH_3 (mg/L)	0.13	0.27	0.05	0.07	0.14	218
Ortho-PO_4 (mg/L)	0.02	0.03	0.01	0.01	0.02	151
Lake Arlington (AR-01B, AR-02B):						
DO (mg/L)	5.87	3.83	2.09	6.80	9.12	64
NH_3 (mg/L)	0.17	0.28	0.05	0.06	0.11	77
Ortho-PO_4 (mg/L)	0.02	0.03	0.01	0.01	0.02	77
Cedar Creek Lake (CC-04B, CC-05B, CC-06B):						
DO (mg/L)	5.50	3.92	0.80	6.17	9.04	239
NH_3 (mg/L)	0.11	0.16	0.05	0.05	0.09	365
Ortho-PO_4 (mg/L)	0.04	0.05	0.01	0.02	0.04	242
Richland Chambers Lake (RC-01B, RC-02B, RC-03B, RC-05B):						
DO (mg/L)	4.88	4.22	0.20	5.88	8.79	310
NH_3 (mg/L)	0.28	0.50	0.05	0.08	0.21	295
Ortho-PO_4 (mg/L)	0.04	0.05	0.01	0.02	0.04	226

The following table reports the median values for selected water quality parameters in each quarter, using data only from bottom sites. These redox-sensitive parameters display strong seasonal variations.

Quarter Medians for Bottom Sites

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Lake Bridgeport (BP-01B, BP-02B):				
DO (mg/L)	10.87	6.25	0.14	8.58
NH_3 (mg/L)	0.08	0.07	0.16	0.06
Ortho-PO_4 (mg/L)	0.01	0.017	0.02	0.013
Eagle Mountain Lake (EM-03B, EM-05B, EM-07B, EM-12B):				
DO (mg/L)	10.98	7.68	0.30	6.60
NH_3 (mg/L)	0.05	0.06	0.08	0.05
Ortho-PO_4 (mg/L)	0.02	0.02	0.03	0.02
Lake Worth (LW-04B):				
DO (mg/L)	10.75	8.21	0.26	5.61
NH_3 (mg/L)	0.05	0.05	0.05	0.05
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
Benbrook Lake (BB-01B, BB-02B, BB-03B):				
DO (mg/L)	9.30	1.50	4.90	9.60
NH_3 (mg/L)	0.14	0.06	0.08	0.05
Ortho-PO_4 (mg/L)	0.02	0.01	0.01	0.01
Lake Arlington (AR-01B, AR-02B):				
DO (mg/L)	10.15	5.87	0.20	7.10
NH_3 (mg/L)	0.05	0.05	0.39	0.09
Ortho-PO_4 (mg/L)	0.01	0.01	0.01	0.01
Cedar Creek Lake (CC-04B, CC-05B, CC-06B):				
DO (mg/L)	9.86	5.95	0.15	6.58
NH_3 (mg/L)	0.05	0.05	0.08	0.05
Ortho-PO_4 (mg/L)	0.02	0.03	0.05	0.02
Richland Chambers Lake (RC-01B, RC-02B, RC-03B, RC-05B):				
DO (mg/L)	9.16	0.20	0.24	8.52
NH_3 (mg/L)	0.05	0.08	0.43	0.06
Ortho-PO_4 (mg/L)	0.01	0.01	0.04	0.01

Descriptive Trend Regressions

Lake Bridgeport

Whole Lake Results

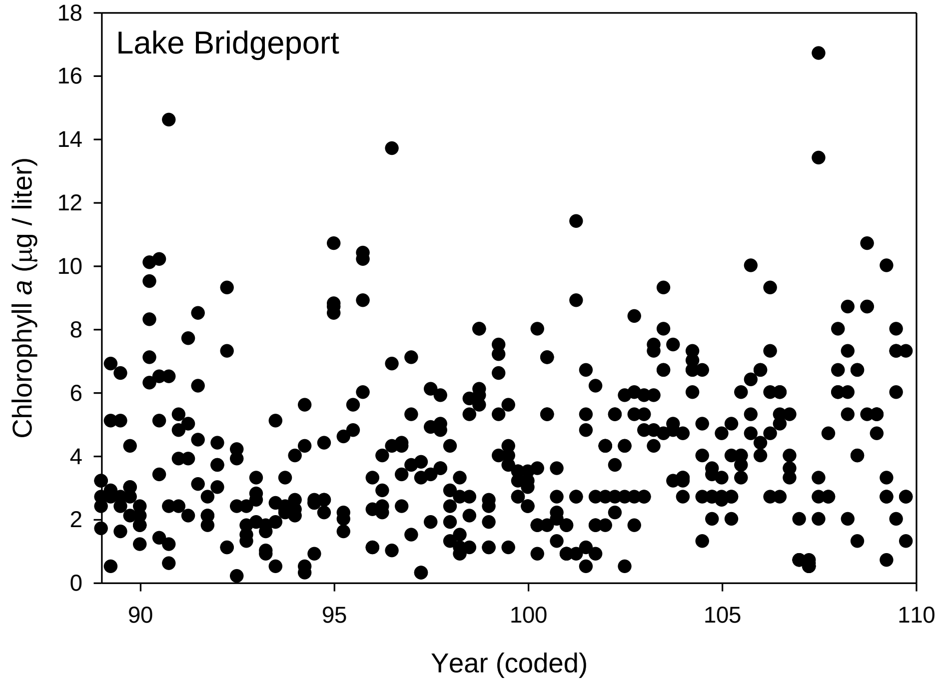
The following table presents trend coefficients and significance values, for trend regressions using all data from the lake. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

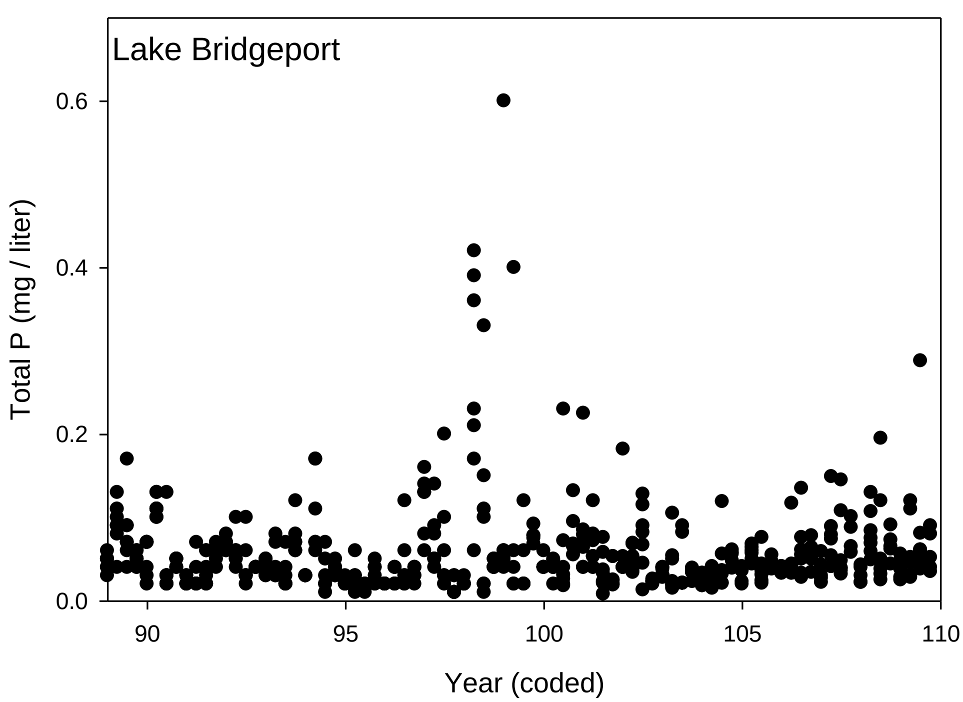
Several statistically significant trends were detected for Lake Bridgeport, using all the data. Chl *a* is increasing with an estimated doubling time of 39 years. This trend is one of increasing eutrophication and decreasing water quality. However, trends for other parameters related to eutrophication and nutrients are inconsistent. DOC is increasing, while TOC is decreasing. TN and TKN are increasing with doubling times of 15 years, though TP has no significant trend and dissolved N species are decreasing, as is Ortho-PO_4. Some of these inconsistencies between Chl a and nutrient trends may arise from the fact that TP is often associated with inorganic TSS. Some of the highest TP may occur when there is sediment-rich water with no algae. Moreover, sediment rich in TP can shade algae preventing their growth. Temperature also increased at a linear rate of 0.056 °C per year. Alkalinity, Chloride, TDS and Secchi Depth all displayed complex, non-monotonic trends that were fitted as cubic trend models (note that lower order linear and quadratic terms are not all significant, but were retained to avoid biased estimates of the trend coefficients). In all of these parameters, there was an increase in most of the 1990's followed by a decrease or a leveling-off. To summarize these trends, this table reports two calculations based on the fitted trend: the average annual rate over all 20 years of record, and the average annual rate over the last 10 years, in parentheses in the APR column.

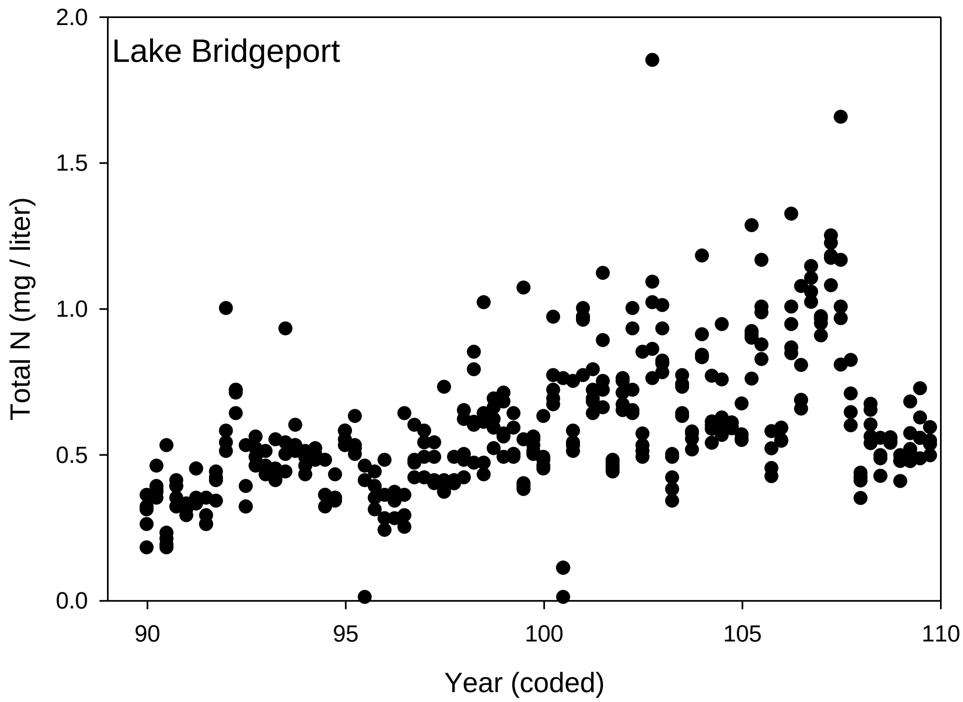
Summary of Lake Bridgeport Trend Analysis

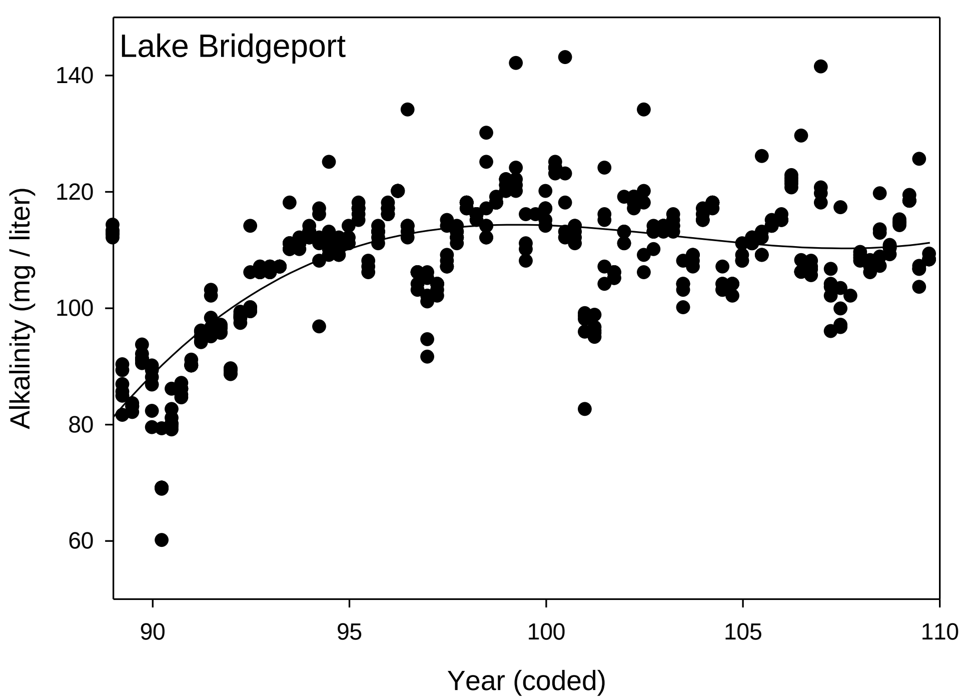
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.018**	**0.002**	**1.79**	**39**
Secchi Depth	**Cubic**			**(0.04,-0.01)**	
	Linear	**-0.013**	**0.35**		
	Quadratic	**-0.005**	**<0.001**		
	Cubic	**0.000**	**0.016**		
DO	Basic	-0.009	0.39		
DOC	**Basic**	**0.013**	**0.029**		
TOC	**Log**	**-0.006**	**<0.001**	**-0.63**	**109**
Ortho-PO_4	**Log**	**-0.017**	**<0.001**	**-1.70**	**40**
TP	Log	0.003	0.53	0.32	220
NH_3	**Log**	**-0.016**	**<0.001**	**-1.61**	**43**
NO_X	**Log**	**-0.046**	**<0.001**	**-4.51**	**15**
TKN	**Log**	**0.047**	**<0.001**	**4.80**	**15**
TN	**Basic**	**0.021**	**<0.001**		
TN:TP	**Log**	**0.027**	**<0.001**	**2.76**	**25**
Alkalinity	**Cubic**			**(1.44,-0.30)**	
	Linear	**-0.055**	**0.75**		
	Quadratic	**-0.168**	**<0.001**		
	Cubic	**0.014**	**<0.001**		
TDS	**Cubic**			**(2.59,-4.47)**	
	Linear	**-5.750**	**<0.001**		
	Quadratic	**-0.686**	**<0.001**		
	Cubic	**0.078**	**<0.001**		
TSS	Log	-0.001	0.79	-0.13	552
Chloride	**Cubic**			**(0.51,-1.70)**	
	Linear	**-1.870**	**<0.001**		
	Quadratic	**-0.214**	**<0.001**		
	Cubic	**0.022**	**<0.001**		
Temperature	**Basic**	**0.056**	**0.002**		

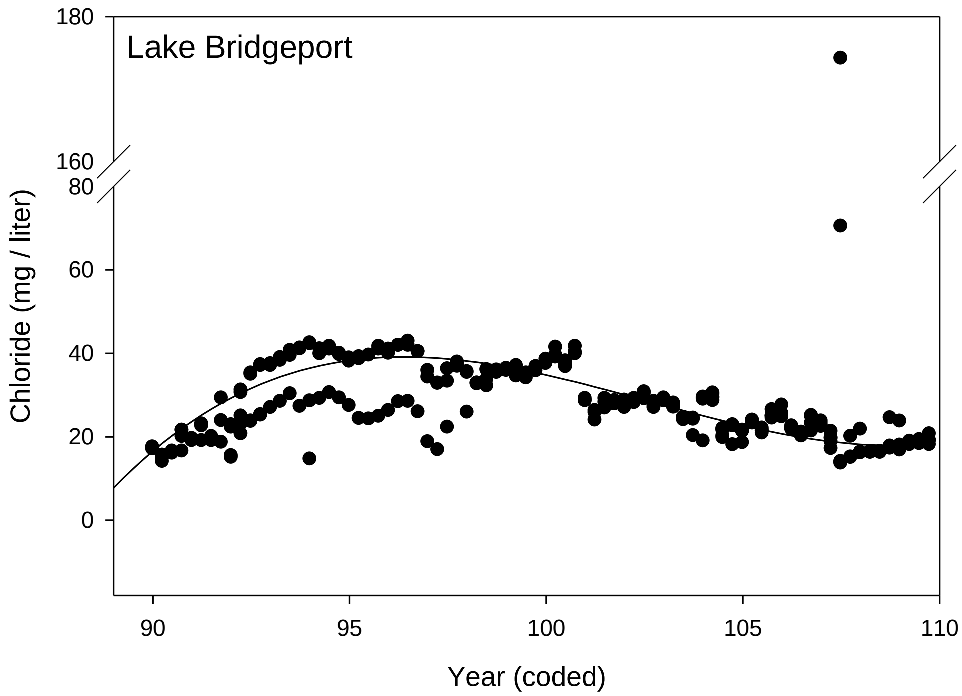
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride. The complex, cubic trend is displayed for the latter two parameters. For Chloride, the extreme values evident in the figure were regarded as outliers and were not included in the trend analysis.






Lake Bridgeport
Total N (mg / liter)
2.0
1.5
1.0
0.5
0.0
90
95
100
105
110
Year (coded)


Lake Bridgeport
Alkalinity (mg / liter)
140
120
100
80
60
90
95
100
105
110
Year (coded)



Main Pool Top Results

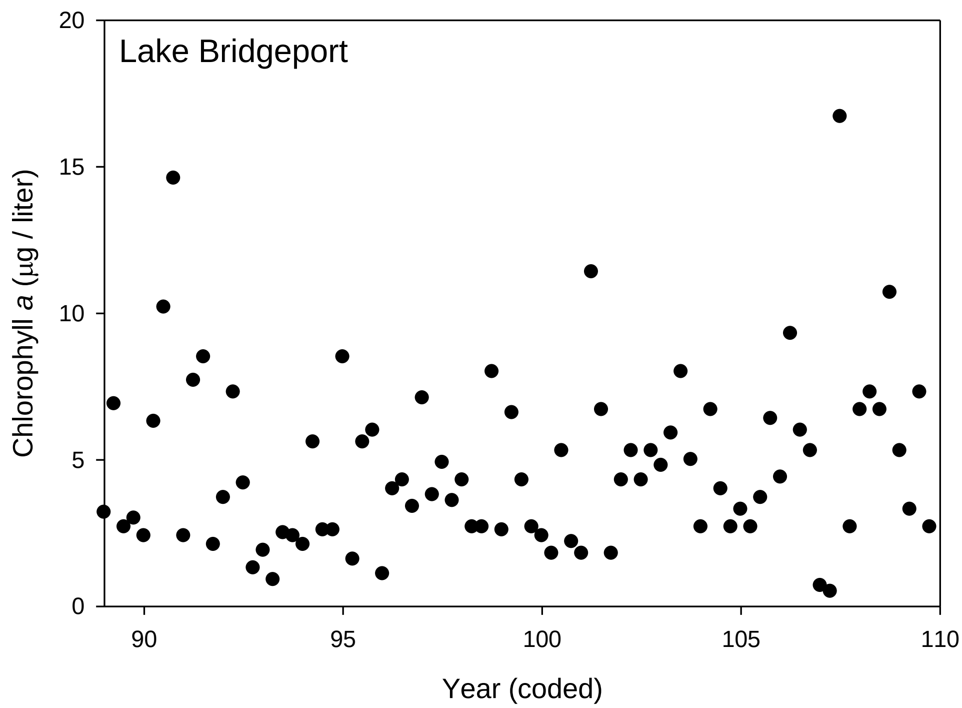
The following table presents trend coefficients and significance values, for trend regressions using data from main pool top sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

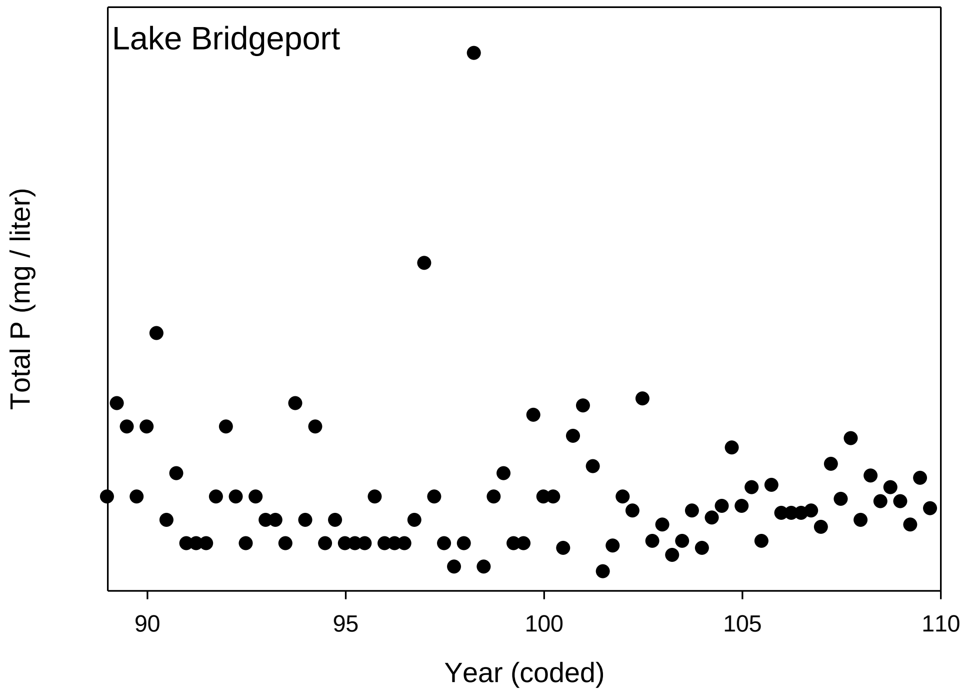
Fewer statistically significant trends were detected for Bridgeport Lake, using main pool top data, than for the whole lake. Chl *a* is no longer significantly increasing, nor is there a significant trend for TP. TN is increasing linearly at a rate of 0.026 mg/L per year. Similar to the whole-lake results, Alkalinity and Chloride at the intake displayed complex, non-monotonic trends that were fitted as cubic trend models. In these parameters, there was an increase in most of the 1990's followed by a decrease or a leveling-off. To summarize these trends, this table reports two calculations based on the fitted trend: the average annual rate over all 20 years of record, and the average annual rate over the last 10 years, in parentheses in the APR column.

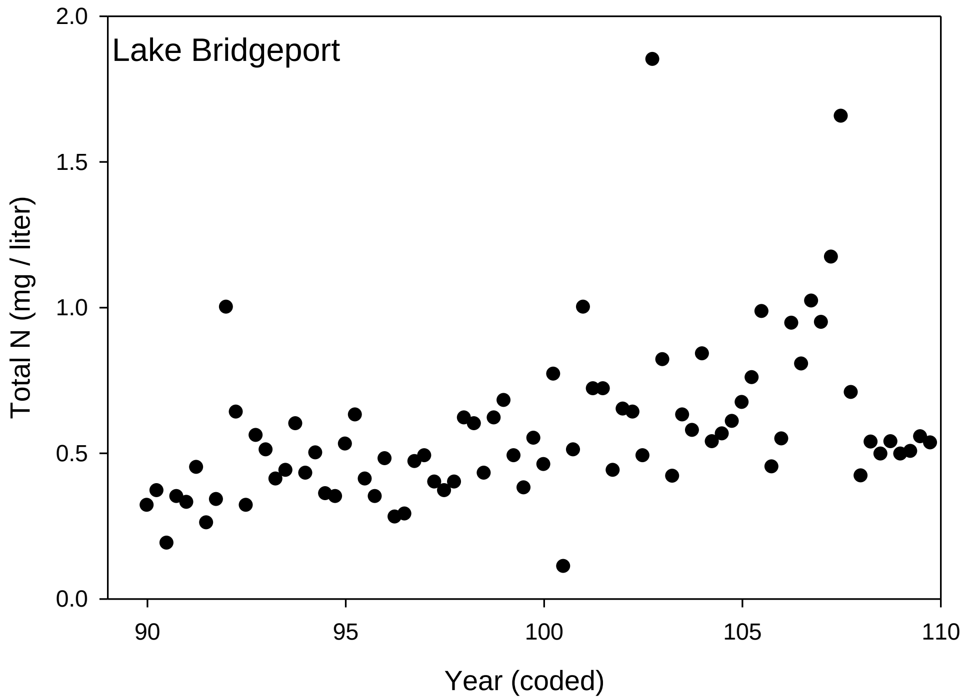
Summary of Lake Bridgeport Trend Analysis,
Main Pool Top Site (BP-01T)

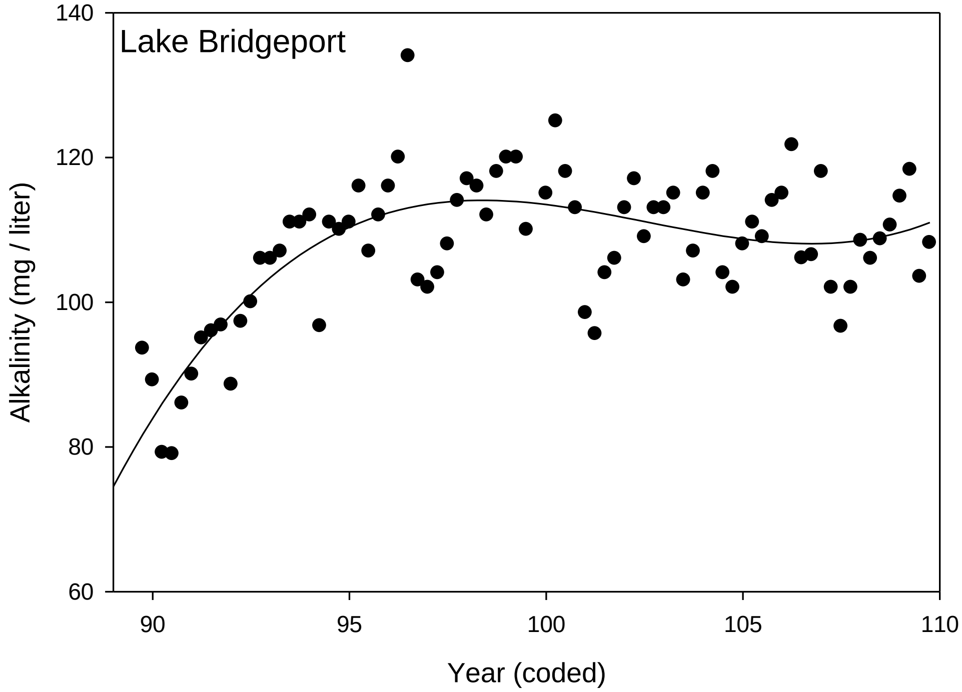
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	Log	0.010	0.38	1.01	69
TP	Log	-0.0030	0.77	-0.30	233
TN	**Basic**	**0.026**	**<0.001**		
Alkalinity	**Cubic**			**1.76, -0.26**	
	Linear	**-0.454**	**0.16**		
	Quadratic	**-0.196**	**<0.001**		
	Cubic	**0.021**	**<0.001**		
Chloride	**Cubic**			**0.54, -1.66**	
	Linear	**-1.972**	**<0.001**		
	Quadratic	**-0.213**	**<0.001**		
	Cubic	**0.023**	**<0.001**		

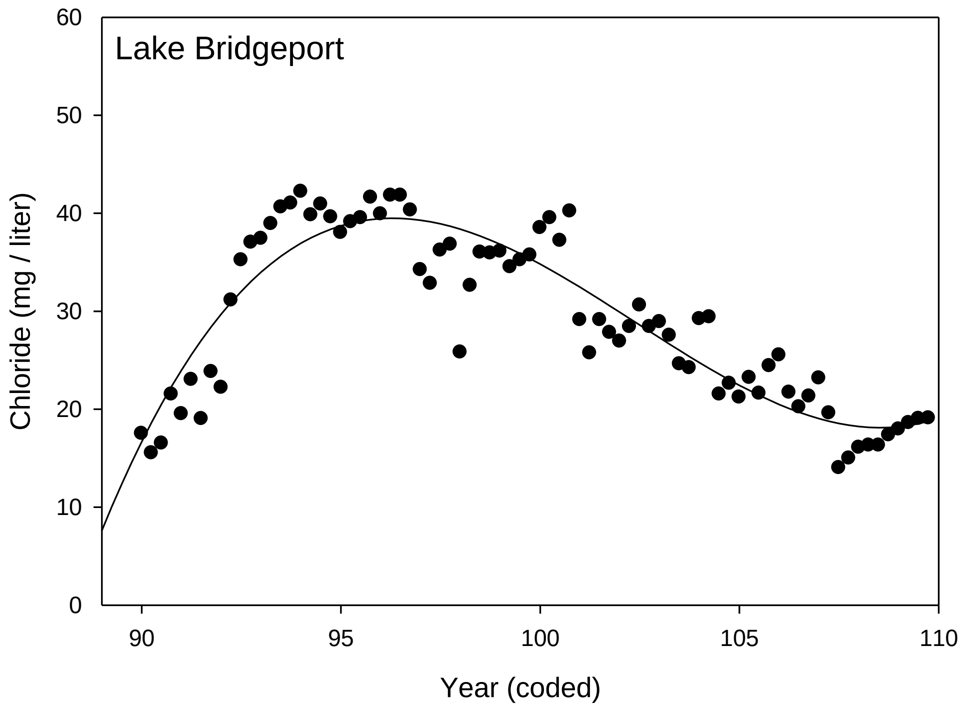
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at main pool top sites. The complex, cubic trend is displayed for the latter two parameters.




Lake Bridgeport
Total P (mg / liter)
90
95
100
105
110
Year (coded)


Lake Bridgeport
Total N (mg / liter)
2.0
1.5
1.0
0.5
0.0
90
95
100
105
110
Year (coded)





Intake Site Results

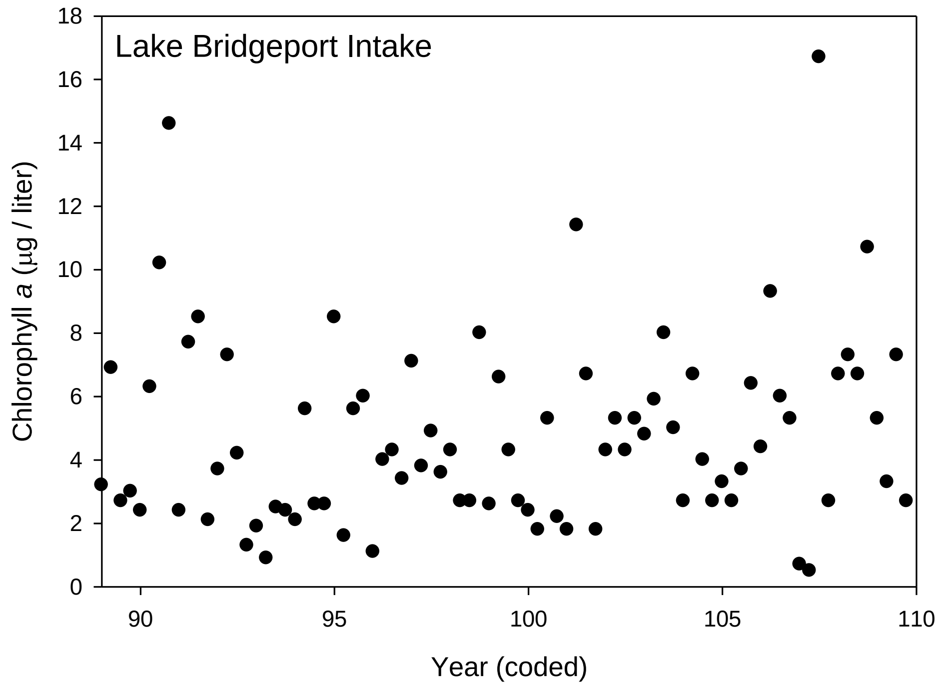
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

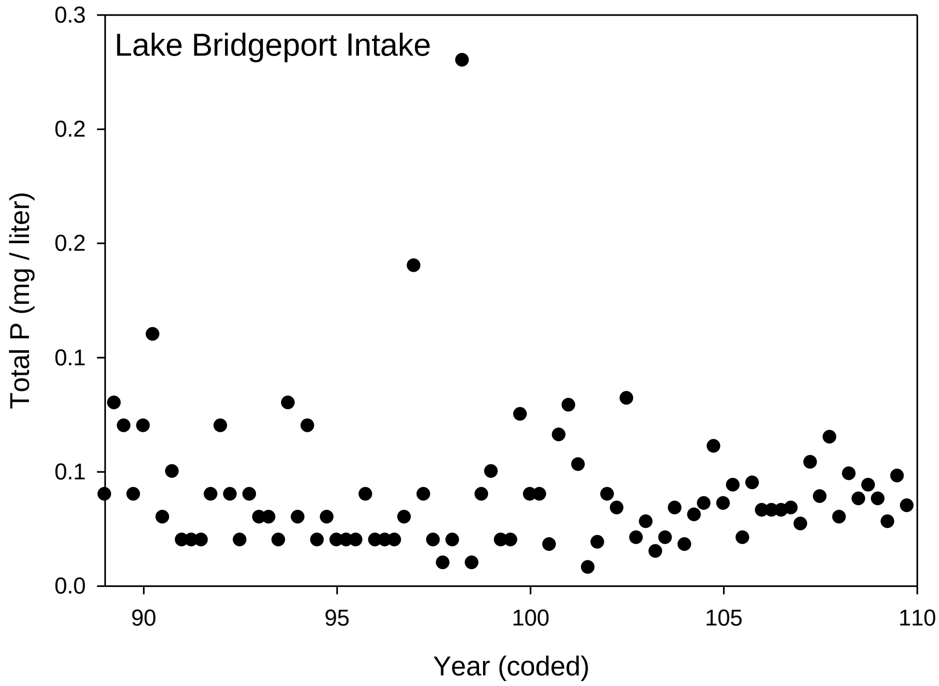
Fewer statistically significant trends were detected for Bridgeport Lake, using intake site data, than for the whole lake. Chl *a* is no longer significantly increasing, nor are there significant trends for TOC, or TP. DOC is increasing linearly at a rate of 0.025 mg/L per year and TN is increasing linearly at a rate of 0.020 mg/L per year. Similar to the whole-lake results, Alkalinity and Chloride at the intake displayed complex, non-monotonic trends that were fitted as cubic trend models. In these parameters, there was an increase in most of the 1990's followed by a decrease or a leveling-off. To summarize these trends, this table reports two calculations based on the fitted trend: the average annual rate over all 20 years of record, and the average annual rate over the last 10 years, in parentheses in the APR column.

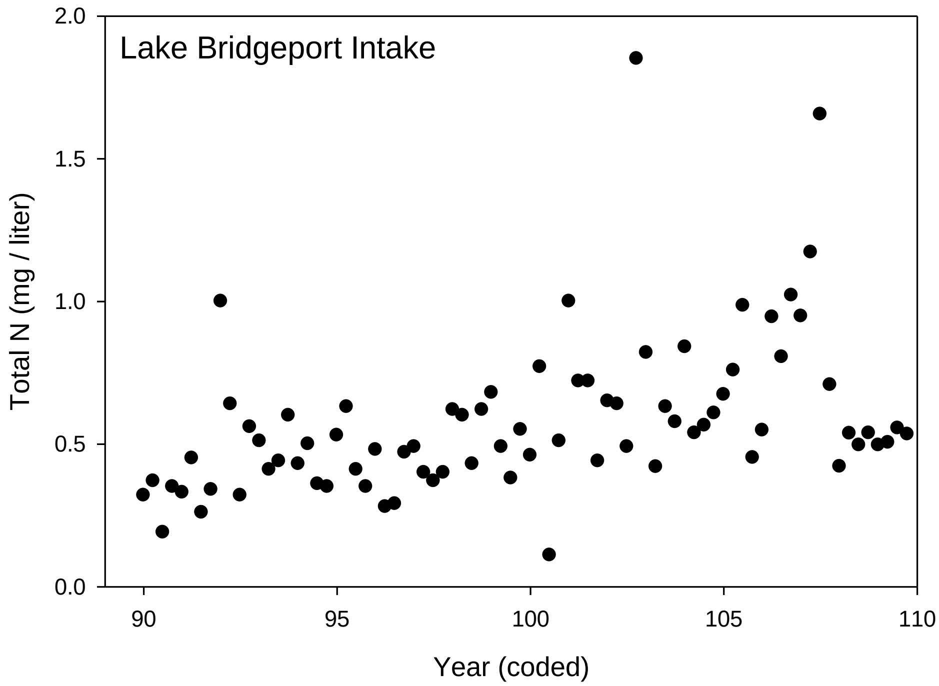
Summary of Lake Bridgeport Trend Analysis Intake Site (BP-01B)

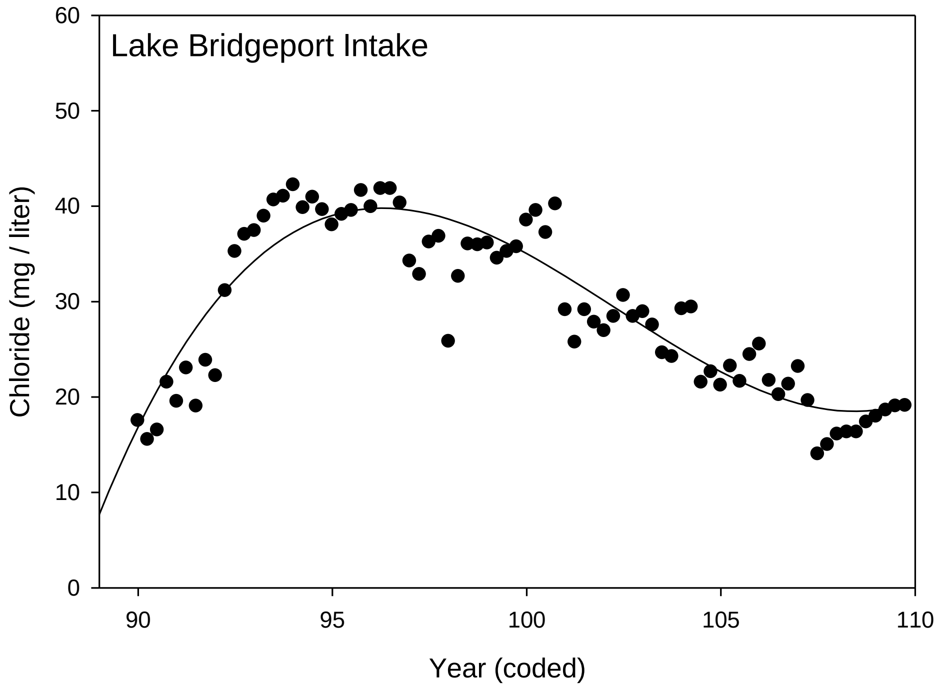
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	Log	0.025	0.068	2.55	28
DOC	**Basic**	**0.025**	**0.015**		
TOC	Log	-0.003	0.30	-0.26	261
TP	Log	0.0002	0.98	0.02	3709
TN	**Basic**	**0.020**	**<0.001**		
Alkalinity	**Cubic**			**(1.55,-0.28)**	
	Linear	**0.046**	**0.91**		
	Quadratic	**-0.176**	**<0.001**		
	Cubic	**0.014**	**0.015**		
Chloride	**Cubic**			**(0.56,-1.63)**	
	Linear	**-1.995**	**<0.001**		
	Quadratic	**-0.212**	**<0.001**		
	Cubic	**0.024**	**<0.001**		

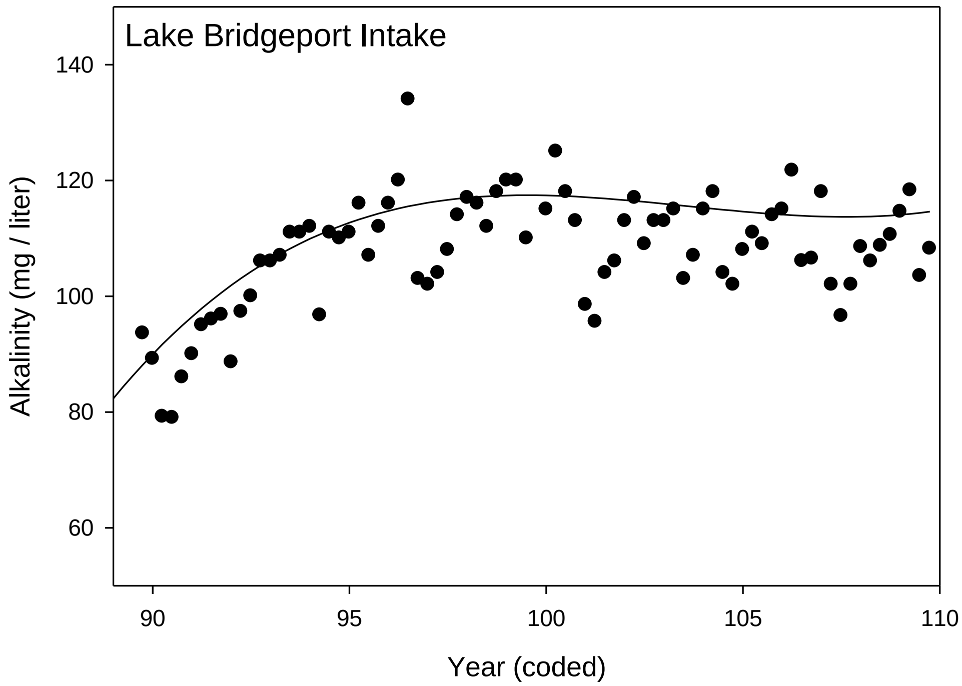
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the intake site. The complex, cubic trend is displayed for the latter two parameters.


Lake Bridgeport Intake
Chlorophyll a (µg / liter)
Year (coded)
0
2
4
6
8
10
12
14
16
18
90
95
100
105
110


Lake Bridgeport Intake
Total P (mg / liter)
Year (coded)
0.0
0.1
0.1
0.2
0.2
0.3
90
95
100
105
110


Lake Bridgeport Intake
Total N (mg / liter)
2.0
1.5
1.0
0.5
0.0
90
95
100
105
110
Year (coded)


Lake Bridgeport Intake
Chloride (mg / liter)
60
50
40
30
20
10
0
90
95
100
105
110
Year (coded)



Bottom Site Results

The following table presents trend coefficients and significance values, for trend regressions using data from bottom sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement. Two significant trends were detected: NH_3 and Ortho-PO_4 are decreasing with half-lives of 36 and 38 years respectively. This result may indicate a trend towards reduced internal loading of these nutrients from anoxia in deep waters and sediments.

Summary of Lake Bridgeport Trend Analysis Bottom Sites (BP-01B, BP-02B)

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
DO	Basic	-0.027	0.174		
NH_3	Log	-0.019	0.005	-1.91	36
Ortho-PO_4	Log	-0.018	0.013	-1.80	38

Eagle Mountain Lake

Whole Lake Results

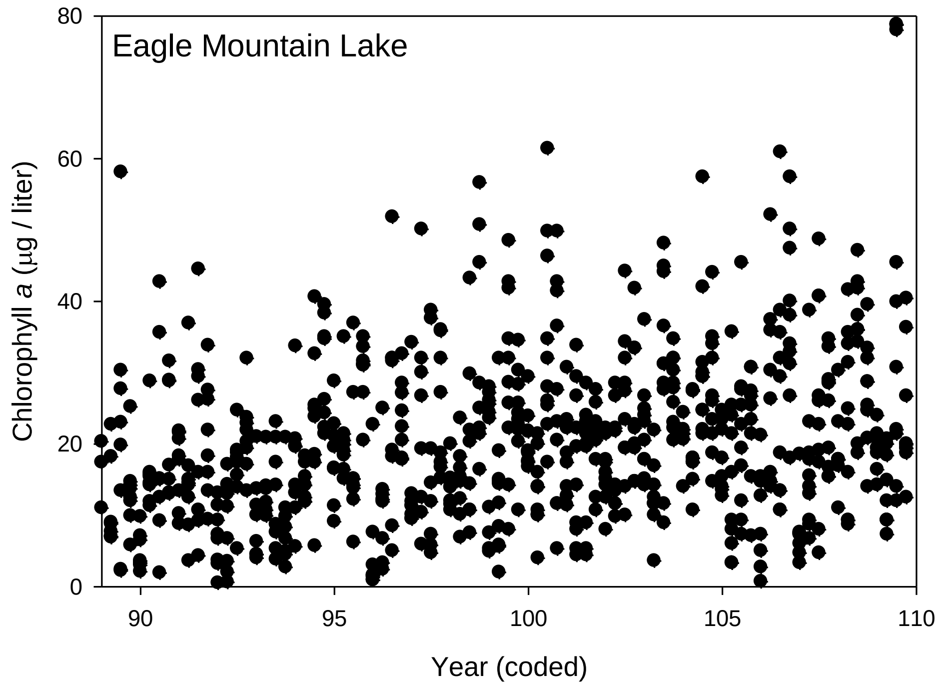
The following table presents trend coefficients and significance values, for trend regressions using all data from the lake. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

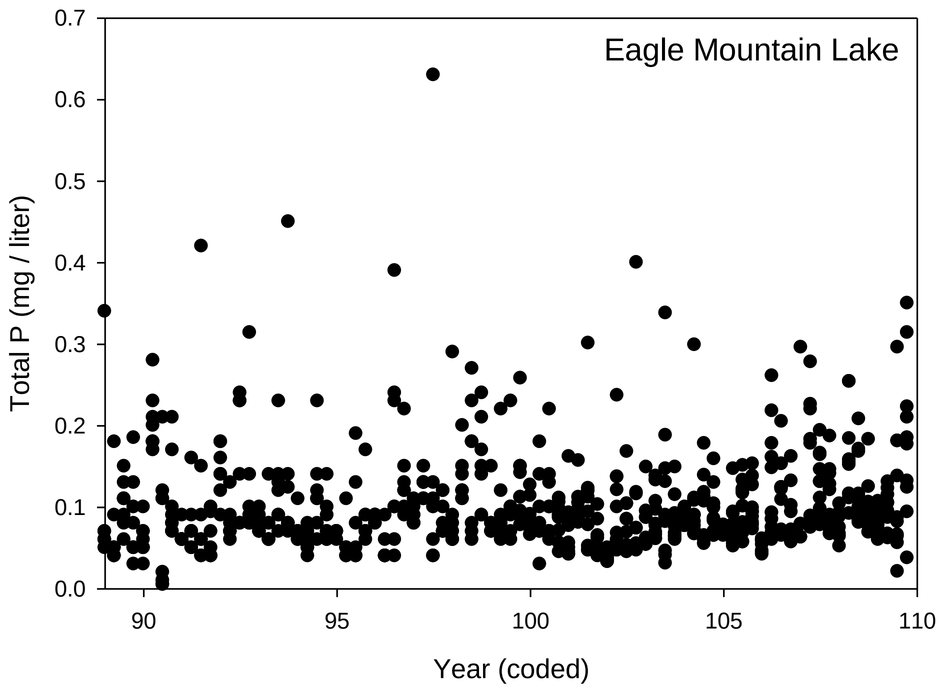
Several statistically significant trends were detected for Eagle Mountain Lake, using all the data. Chl *a* is increasing with an estimated doubling time of 25 years. This trend is one of increasing eutrophication and decreasing water quality. DOC and TOC are also increasing, but more slowly with doubling times of 125 and 270 years, respectively. TP, TN and TKN are all increasing, though Ortho-PO_4 is decreasing. In contrast to these trends consistent with ongoing eutrophication, Secchi Depth is increasing with a doubling time of 46 years. Alkalinity and TDS are decreasing.

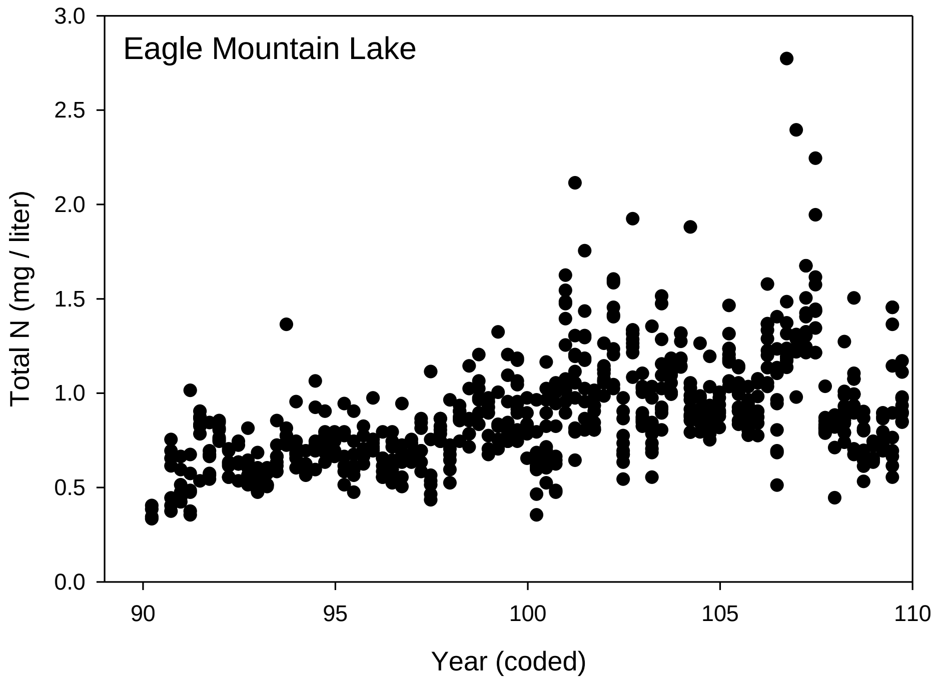
Summary of Eagle Mountain Lake Trend Analysis

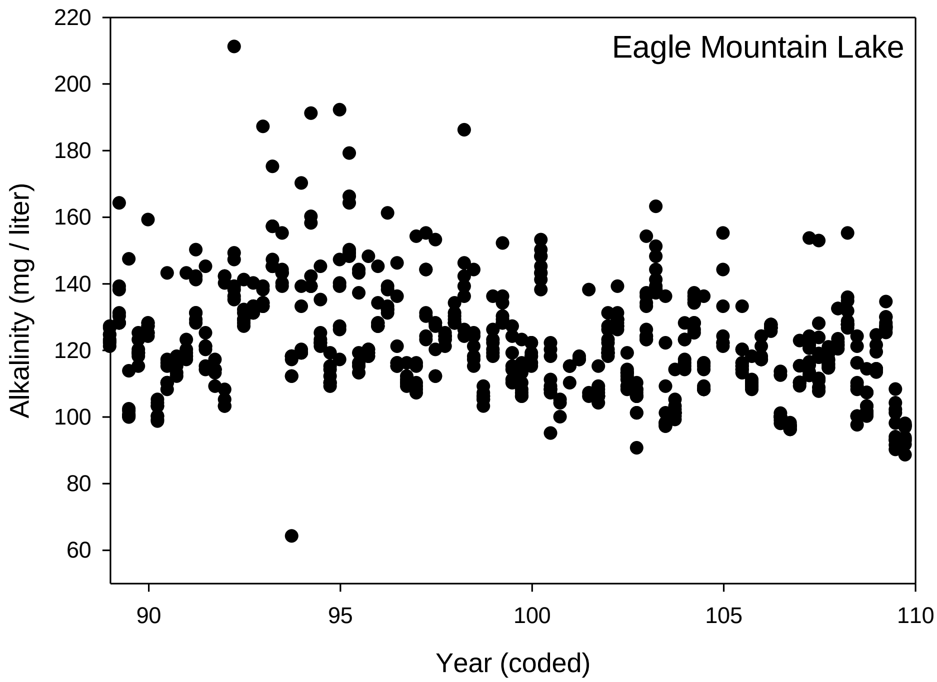
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.028**	**<0.001**	**2.84**	**25**
Secchi Depth	**Log**	**0.015**	**<0.001**	**1.52**	**46**
DO	**Basic**	**-0.034**	**0.003**		
DOC	**Log**	**0.006**	**<0.001**	**0.56**	**125**
TOC	**Log**	**0.003**	**0.007**	**0.26**	**270**
Ortho-PO_4	**Log**	**-0.039**	**<0.001**	**-3.84**	**18**
TP	**Log**	**0.008**	**0.002**	**0.85**	**82**
NH_3	Log	-0.001	0.84	-0.06	1075
NO_X	Log	-0.011	0.14	-1.14	60
TKN	**Log**	**0.030**	**<0.001**	**3.09**	**23**
TN	**Basic**	**0.031**	**<0.001**		
TN:TP	**Log**	**0.042**	**<0.001**	**4.29**	**17**
Alkalinity	**Log**	**-0.006**	**<0.001**	**-0.57**	**121**
TDS	**Log**	**-0.010**	**<0.001**	**-1.01**	**68**
TSS	Log	0.003	0.23	0.32	216
Chloride	Basic	-0.095	0.18		
Temperature	Basic	-0.010	0.50		

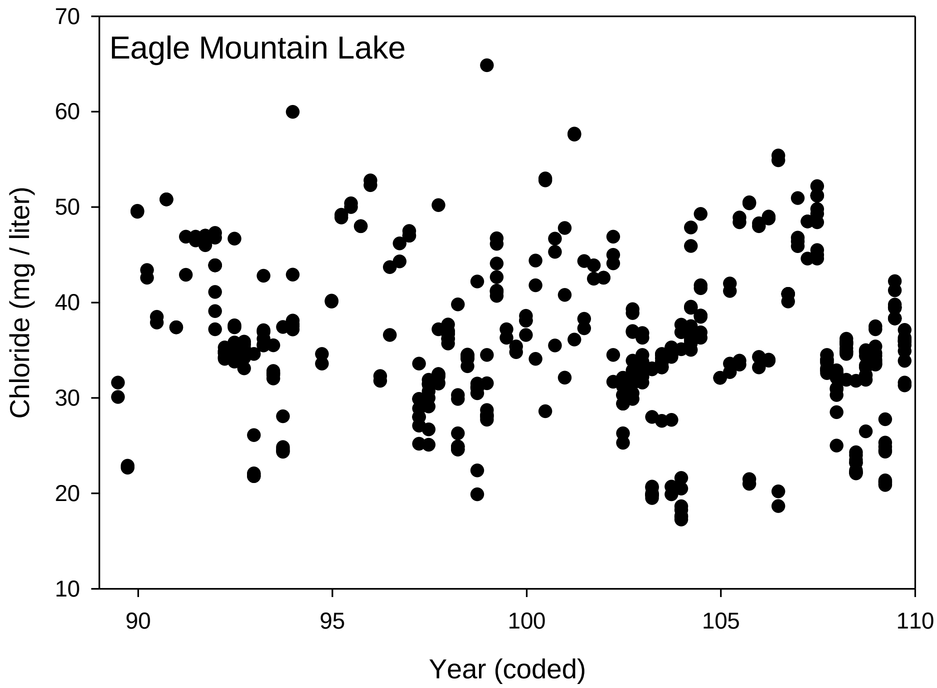
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride.






Eagle Mountain Lake
Total N (mg / liter)
Year (coded)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
90
95
100
105
110


Eagle Mountain Lake
Alkalinity (mg / liter)
Year (coded)
60
80
100
120
140
160
180
200
220
90
95
100
105
110



Main Pool Top Site Results

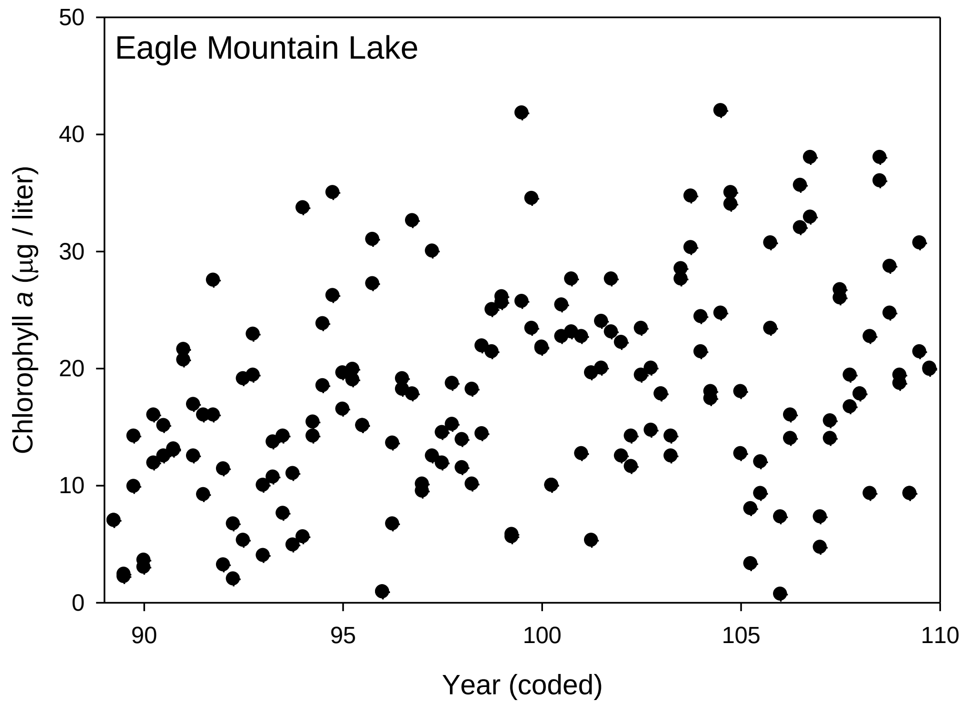
The following table presents trend coefficients and significance values, for trend regressions using data from the main pool top sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

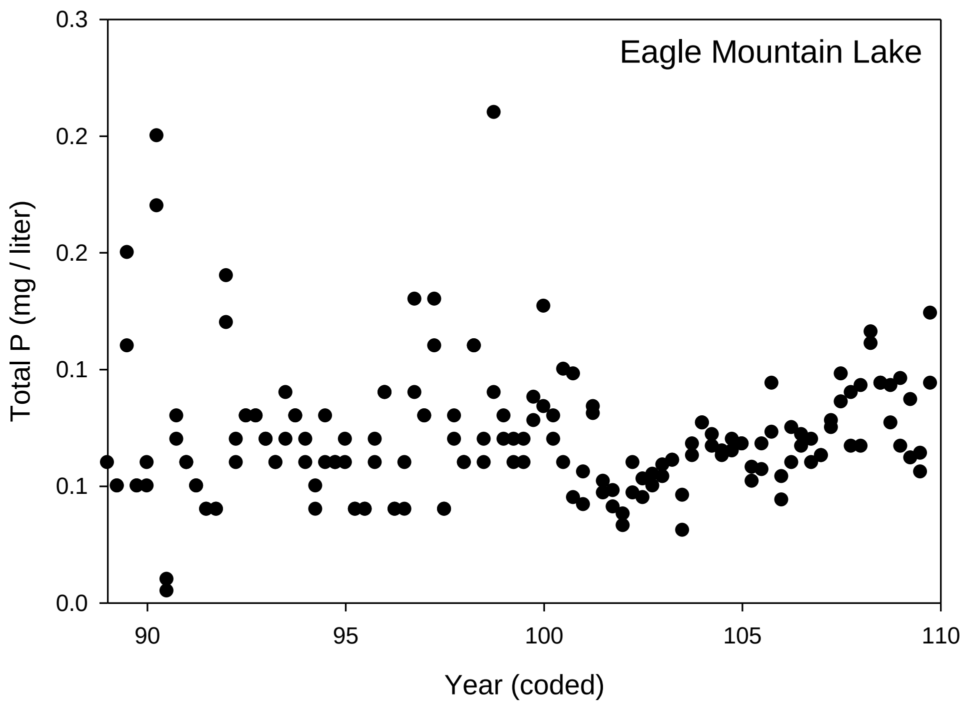
Using main pool top data, Chl *a* is significantly increasing, as it is in the whole lake, with a doubling time of 19 years. TP and Chloride, like the whole lake, do not show significant trends. TN is increasing at a rate of 0.034 mg/L per year. Alkalinity is decreasing, with a half-life of 125 years.

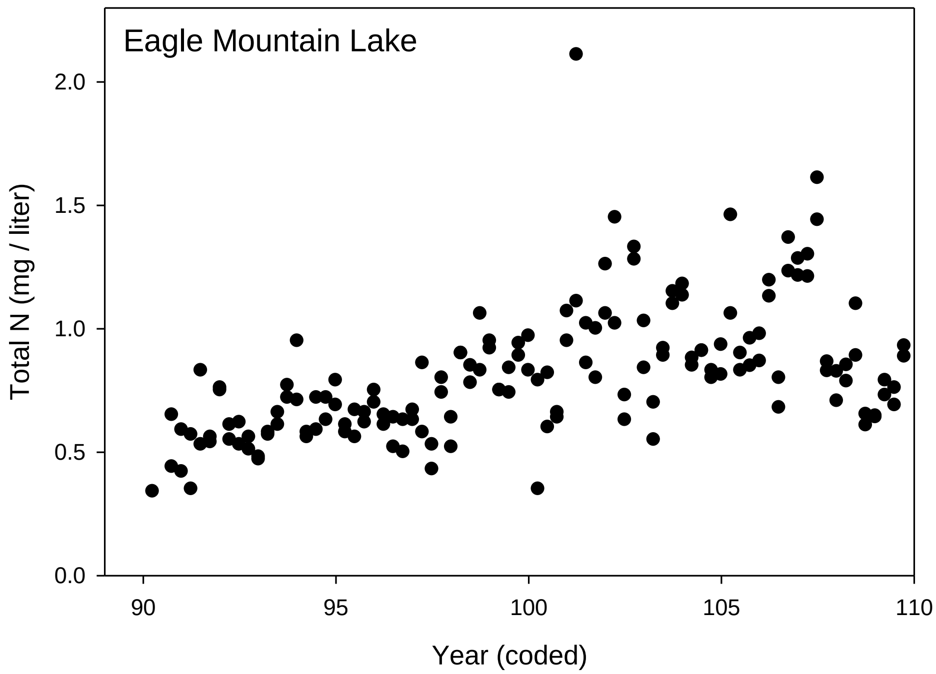
Summary of Eagle Mountain Lake Trend Analysis, Main Pool Top Sites (EM-05T, EM-07T)

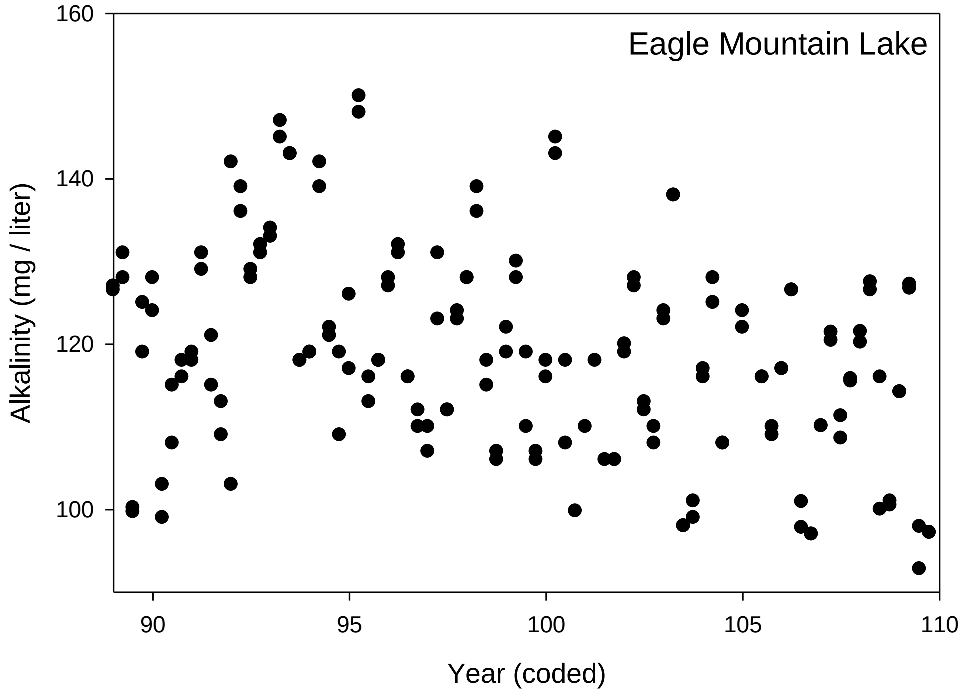
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.036**	**<0.001**	**3.62**	**19**
TP	Log	0.010	0.052	1.04	67
TN	**Basic**	**0.026**	**<0.001**		
Alkalinity	**Log**	**-0.006**	**<0.001**	**-0.55**	**125**
Chloride	Basic	-0.026	0.85		

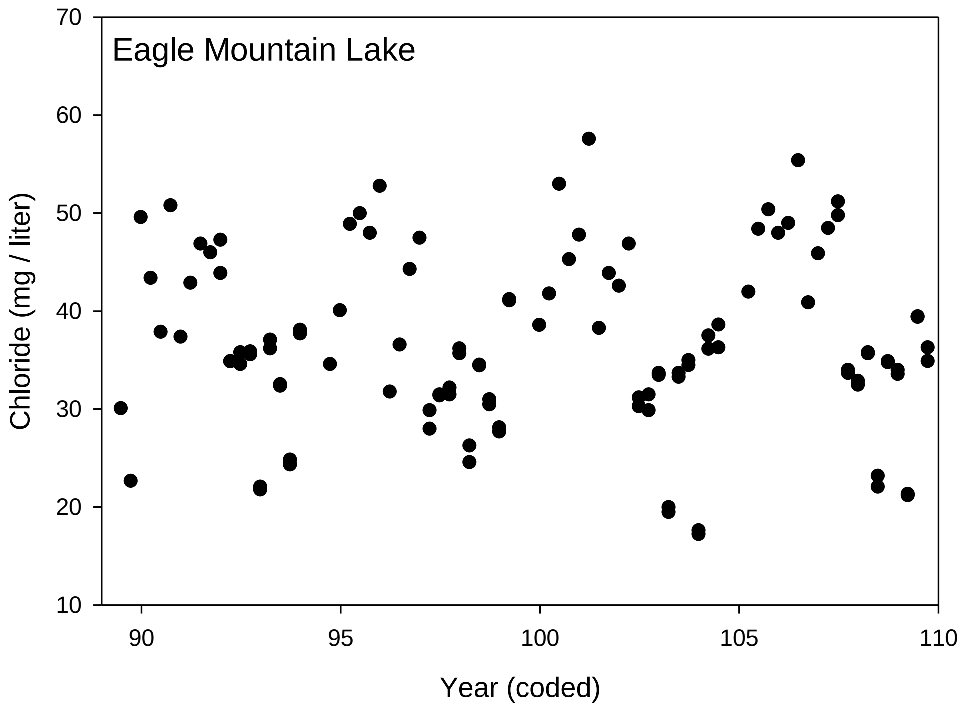
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at main pool top sites.


Eagle Mountain Lake
Chlorophyll a (µg / liter)
Year (coded)
0
10
20
30
40
50
90
95
100
105
110


Eagle Mountain Lake
Total P (mg / liter)
Year (coded)
0.0
0.1
0.1
0.2
0.2
0.3
90
95
100
105
110


Eagle Mountain Lake
Total N (mg / liter)
0.0
0.5
1.0
1.5
2.0
90
95
100
105
110
Year (coded)


Eagle Mountain Lake
Alkalinity (mg / liter)
100
120
140
160
90
95
100
105
110
Year (coded)



Intake Site Results

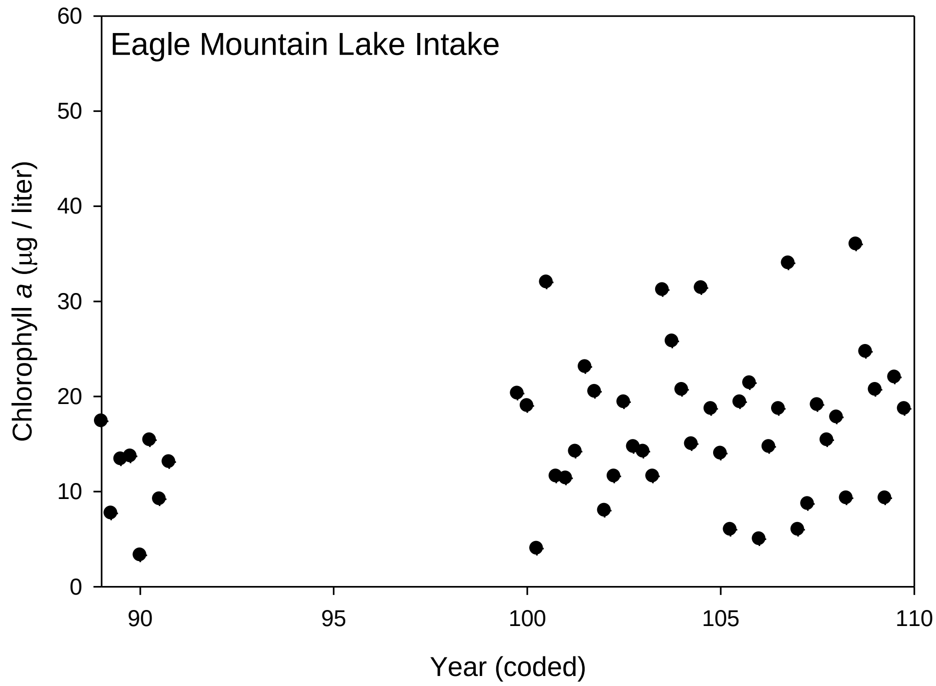
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

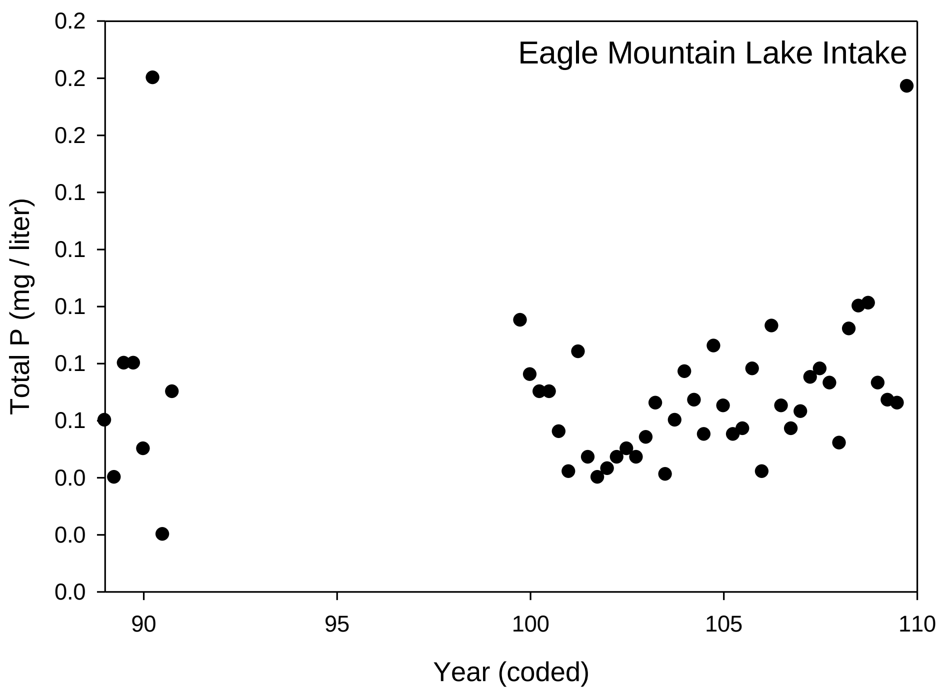
Only one statistically significant trend was detected for Eagle Mountain Lake, using intake site data. Chl *a* is significantly increasing, with a doubling time of 31 years. Though no other trends are significant, this result echoes the indications of eutrophication seen in the whole-lake analysis.

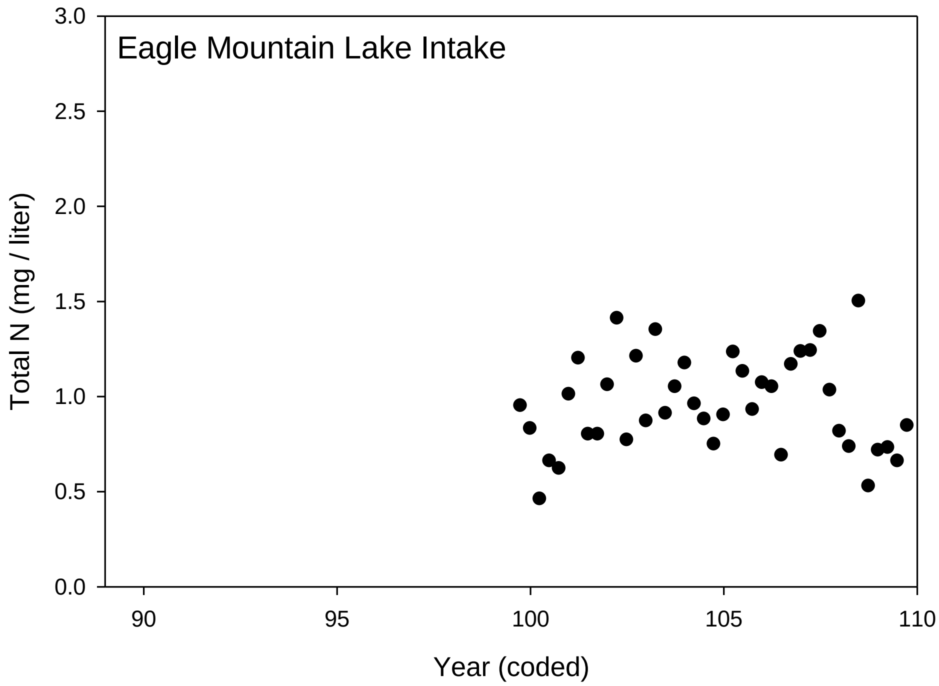
Summary of Eagle Mountain Lake Trend Analysis Intake Site (EM-07M)

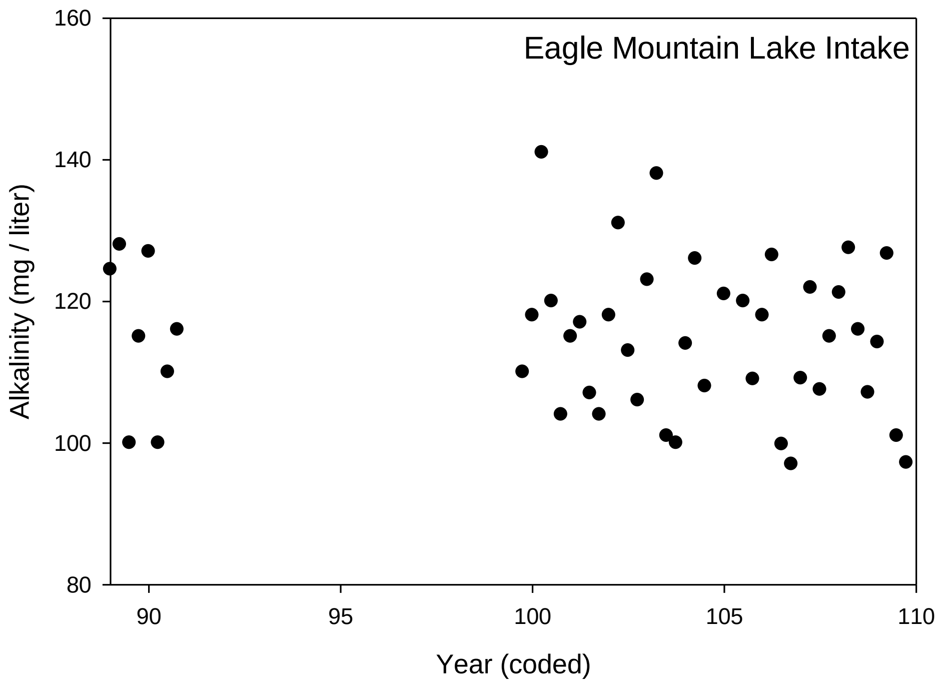
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.022**	**0.030**	**2.25**	**31**
DOC	Log	-0.004	0.41	-0.43	161
TOC	Log	0.004	0.13	0.45	155
TP	Log	0.011	0.18	1.14	61
TN	Basic	0.004	0.75		
Alkalinity	Log	-0.001	0.56	-0.09	743
Chloride	Basic	-0.003	0.62		

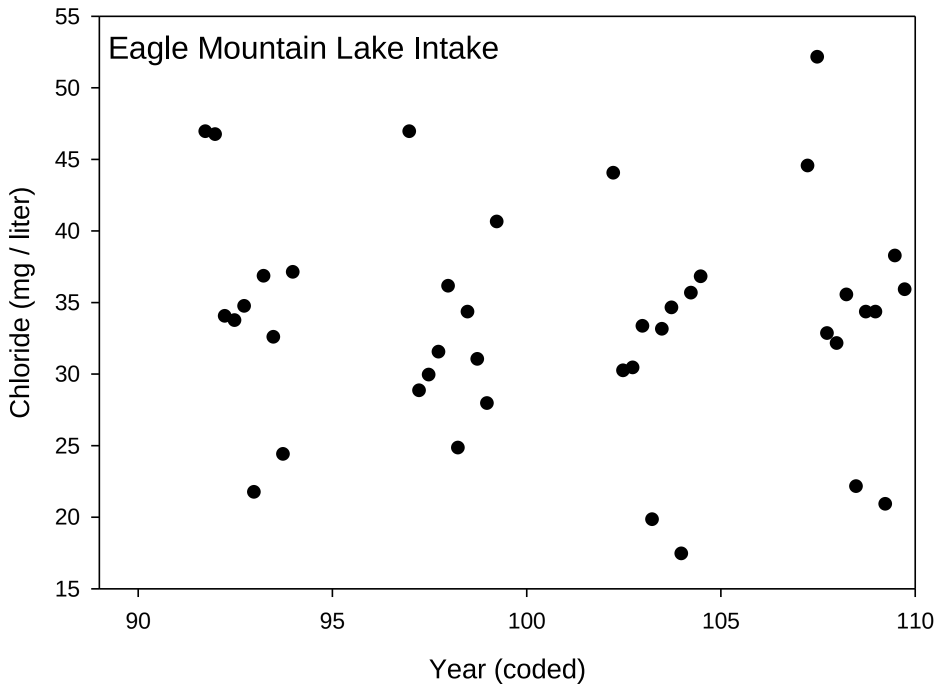
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the intake site.






Eagle Mountain Lake Intake
Total N (mg / liter)
Year (coded)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
90
95
100
105
110


Eagle Mountain Lake Intake
Alkalinity (mg / liter)
Year (coded)
160
140
120
100
80
90
95
100
105
110



Bottom Site Results

The following table presents trend coefficients and significance values, for trend regressions using data from bottom sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement. Two significant trends were detected. DO is decreasing at a linear rate of 0.059 mg/L per year, a trend consistent with eutrophication. Ortho-PO_4 is also decreasing with a half-life of 27 years, suggesting decreasing internal loading of P from anoxic deep waters and sediments despite other indicators of eutrophication.

Summary of Eagle Mountain Lake Trend Analysis Bottom Sites (EM-03B, EM-05B, EM-07B, EM-12B)

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
DO	**Basic**	**-0.059**	**0.008**		
NH_3	Log	0.007	0.205	0.74	94
Ortho-PO_4	**Log**	**-0.026**	**0.010**	**-2.55**	**27**

Lake Worth

Whole Lake Results

The following table presents trend coefficients and significance values, for trend regressions using all data from the lake. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

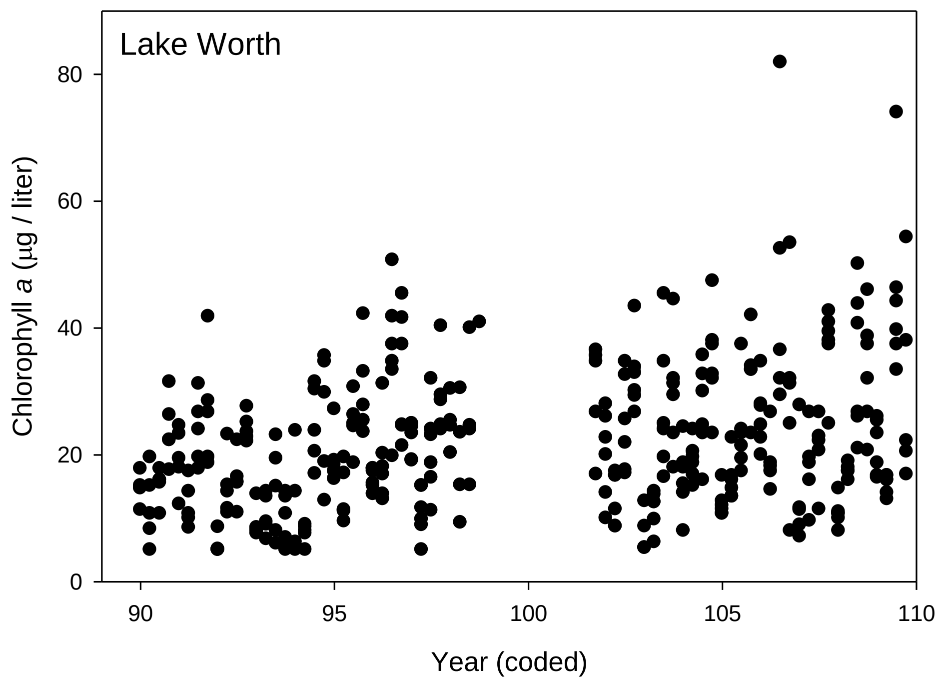
Several statistically significant trends were detected for Lake Worth, using all the data. Chl *a* is increasing with an estimated doubling time of 29 years. This trend is one of increasing eutrophication and decreasing water quality. DOC also increasing, with a doubling time of 105 years, though TOC is not. TN and TKN are increasing, with doubling times of 17 years, though TP is not. Dissolved nutrients are significantly decreasing. Secchi Depth is increasing at a linear rate of 0.008 m per year. Alkalinity, TDS and Chloride are decreasing, while temperature is increasing at a linear rate of 0.041 °C per year. In general, these trends are consistent with ongoing eutrophication, perhaps more related to increasing N supply than P supply.

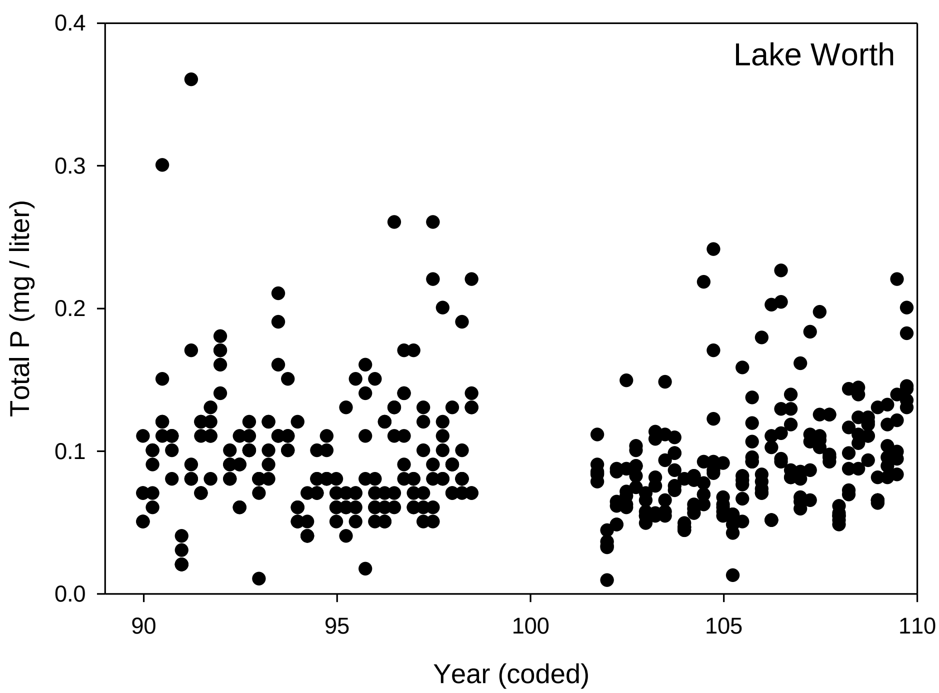
There were gaps in all the data over the time period of about 1996 – 2001. The regression trend models used can accommodate such a block of missing values, but the ability to detect complex, curvilinear trends is reduced.

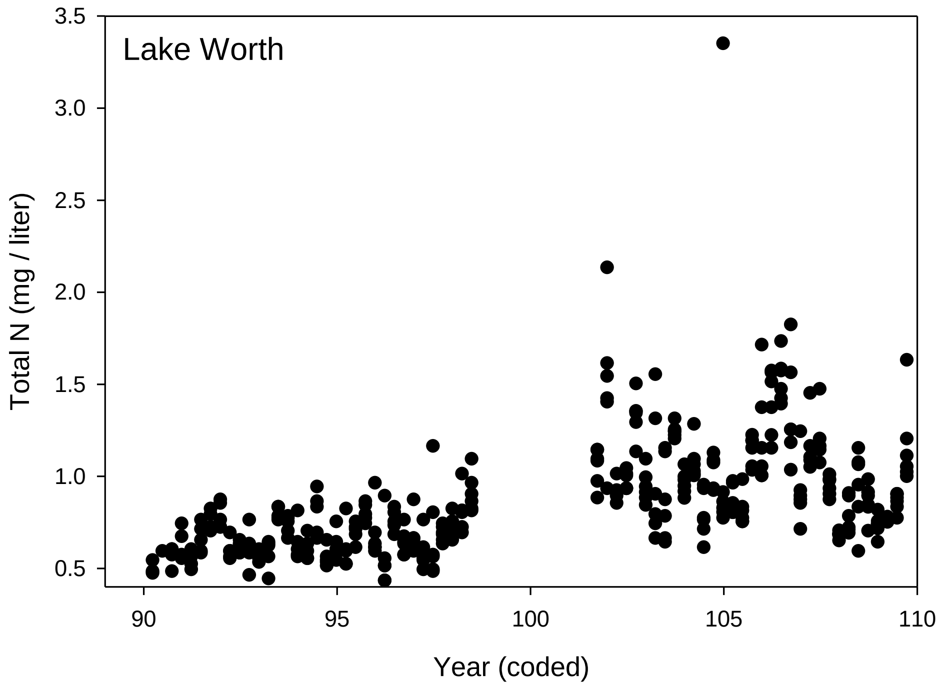
Summary of Lake Worth Trend Analysis

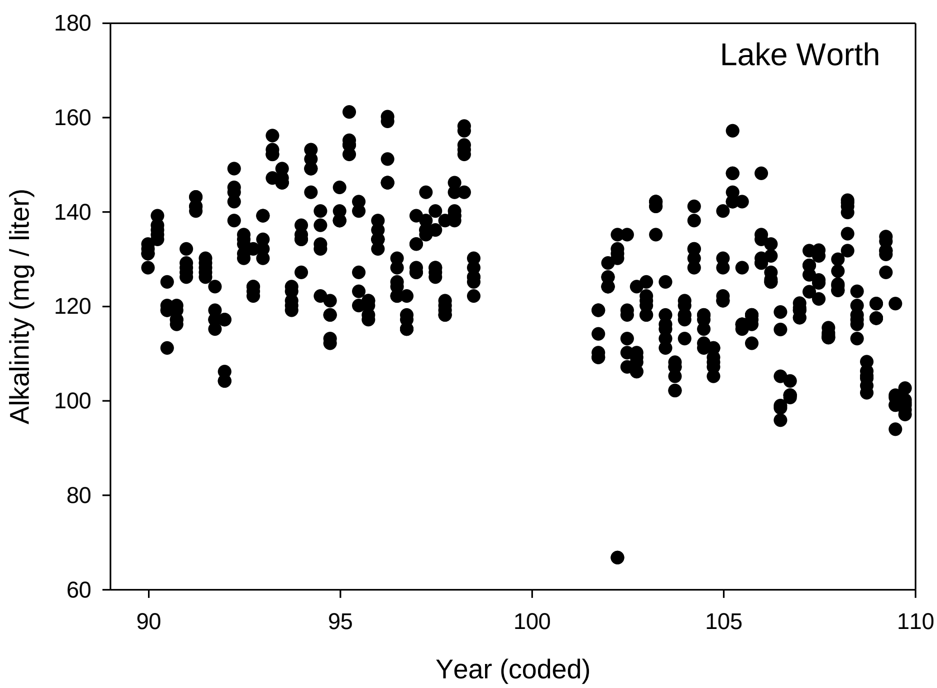
Parameter	**Model**	**Time Coefficient**	**P-value**	**APR (%)**	**Double/Half Time (yr)**
Chl *a*	**Log**	**0.024**	**<0.001**	**2.44**	**29**
Secchi Depth	**Basic**	**0.008**	**<0.001**		
DO	Basic	-0.009	0.44		
DOC	**Log**	**0.007**	**<0.001**	**0.66**	**105**
TOC	Log	0.000	0.99	0.00	37629
Ortho-PO_4	**Log**	**-0.024**	**<0.001**	**-2.40**	**29**
TP	Log	0.004	0.23	0.39	178
NH_3	**Log**	**-0.058**	**<0.001**	**-5.66**	**12**
NO_X	**Log**	**-0.019**	**0.023**	**-1.91**	**36**
TKN	**Log**	**0.041**	**<0.001**	**4.19**	**17**
TN	**Log**	**0.040**	**<0.001**	**4.11**	**17**
TN:TP	**Log**	**0.036**	**<0.001**	**3.67**	**19**
Alkalinity	**Basic**	**-0.855**	**<0.001**		
TDS	**Log**	**-0.009**	**<0.001**	**-0.91**	**76**
TSS	Log	0.003	0.73	0.31	224
Chloride	**Log**	**-0.020**	**<0.001**	**-1.93**	**36**
Temperature	**Basic**	**0.041**	**0.006**		

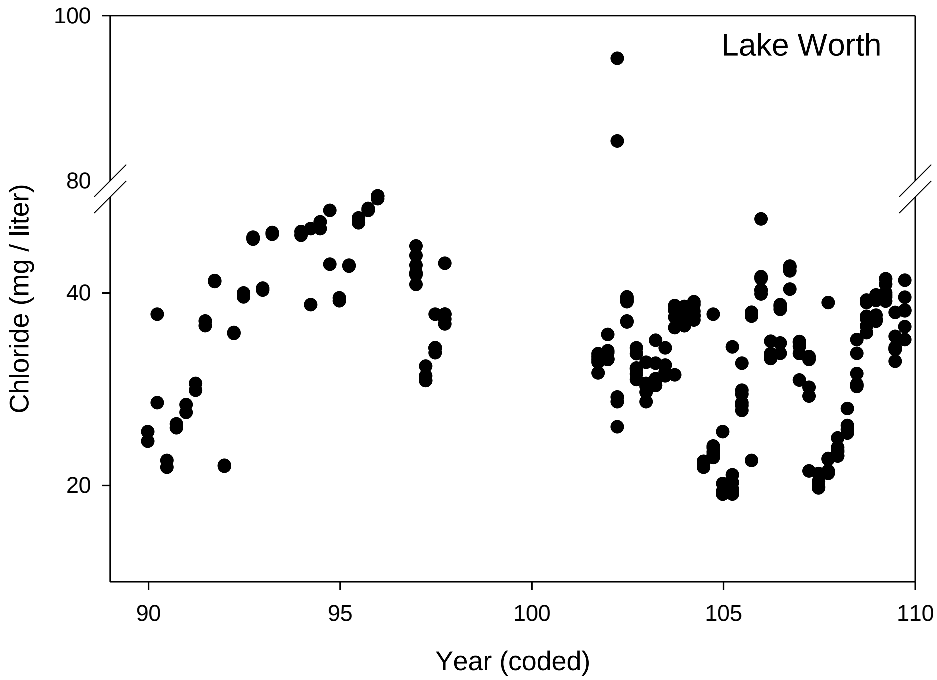
The following figures present the data for five parameters, Chl *a*, TN, TP, Alkalinity, and Chloride.






Lake Worth
Total N (mg / liter)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
90
95
100
105
110
Year (coded)


Lake Worth
Alkalinity (mg / liter)
180
160
140
120
100
80
60
90
95
100
105
110
Year (coded)



Main Pool Top Site Results

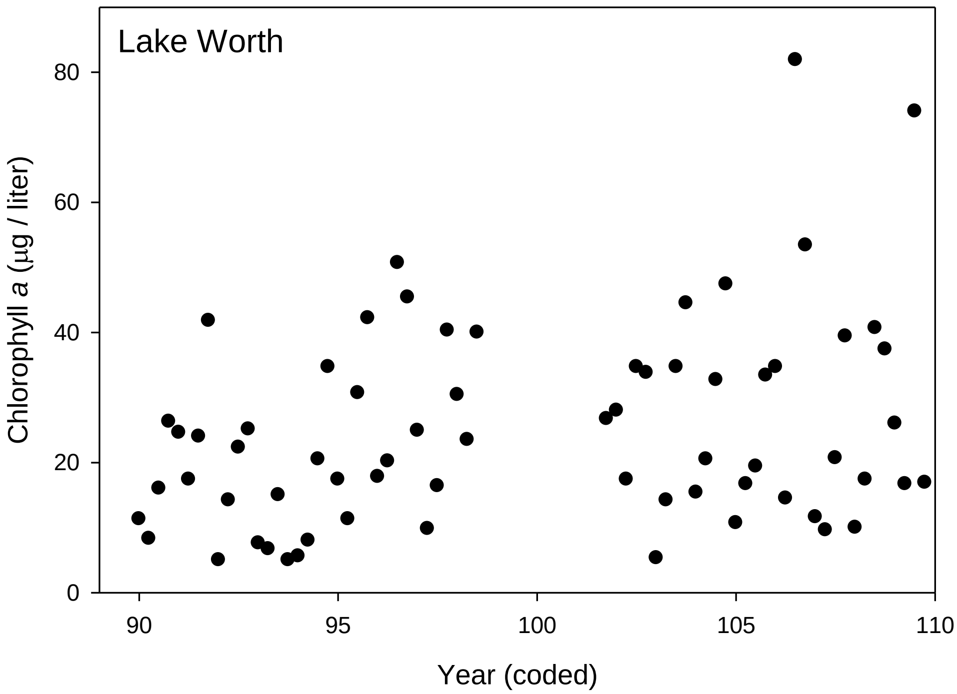
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

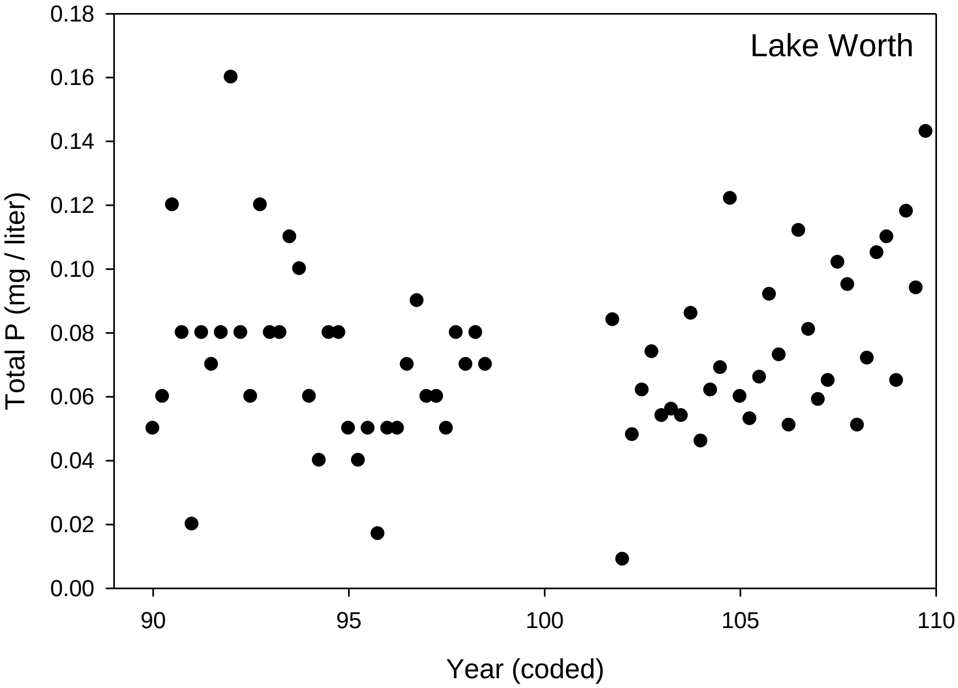
Several statistically significant trends were detected for Lake Worth, using main pool top data, and all resemble trends in the whole lake. Chl *a* is significantly increasing, with a doubling time of 26 years. TN is also increasing, with a doubling time of 18 years. Alkalinity and Chloride are decreasing.

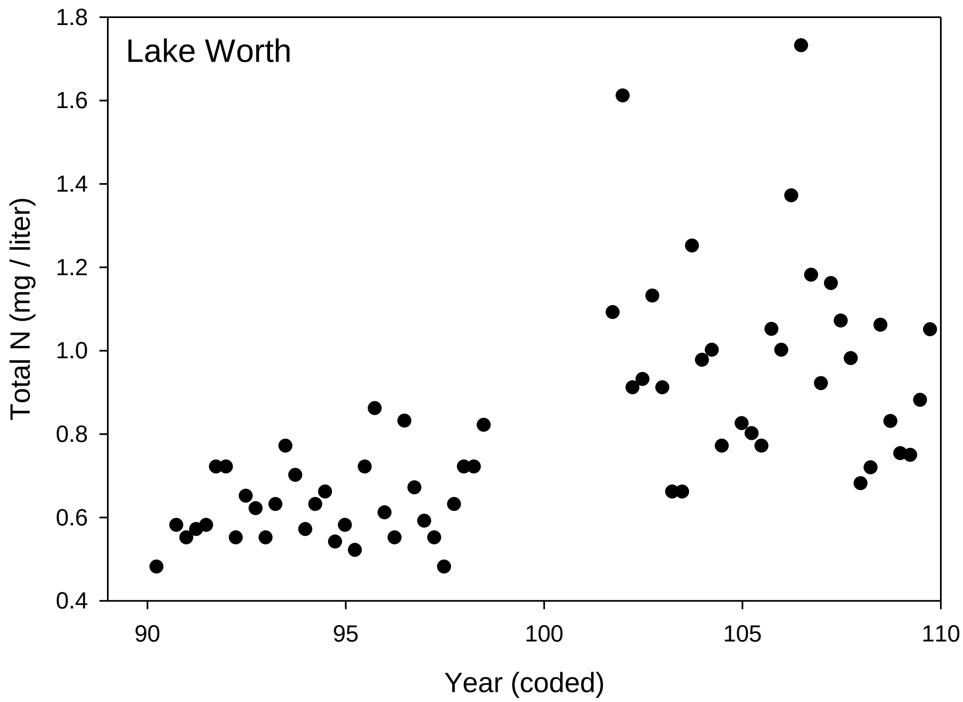
Summary of Lake Worth Trend Analysis,
Main Pool Top Site (LW-04T)

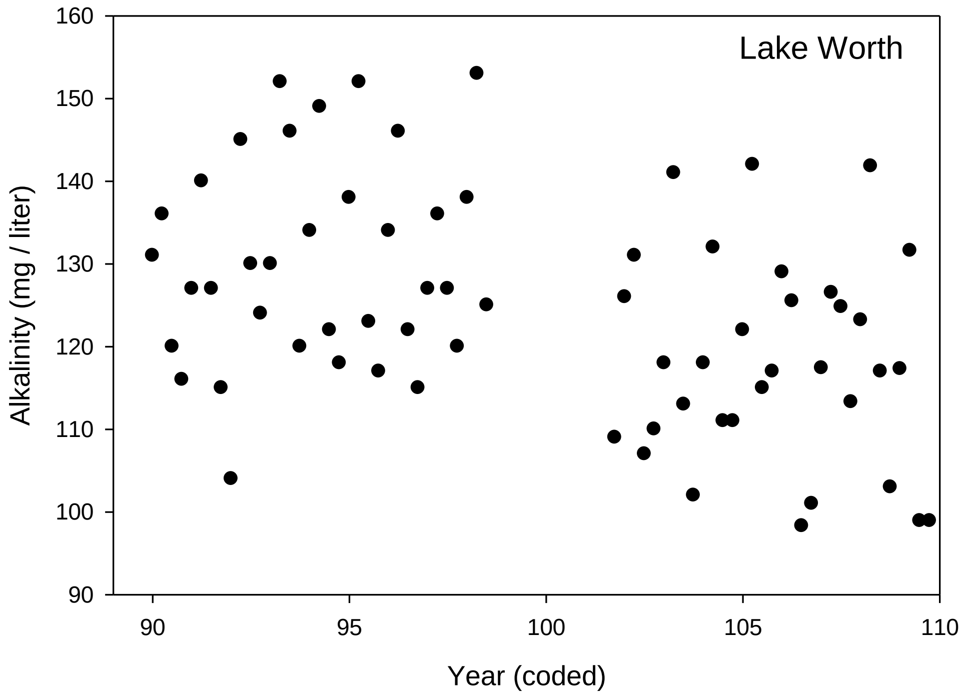
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.027**	**0.007**	**2.75**	**26**
TP	Log	0.008	0.35	0.79	88
TN	**Log**	**0.039**	**<0.001**	**3.94**	**18**
Alkalinity	**Basic**	**-0.835**	**<0.001**		
Chloride	**Log**	**-0.013**	**0.018**	**-1.27**	**54**

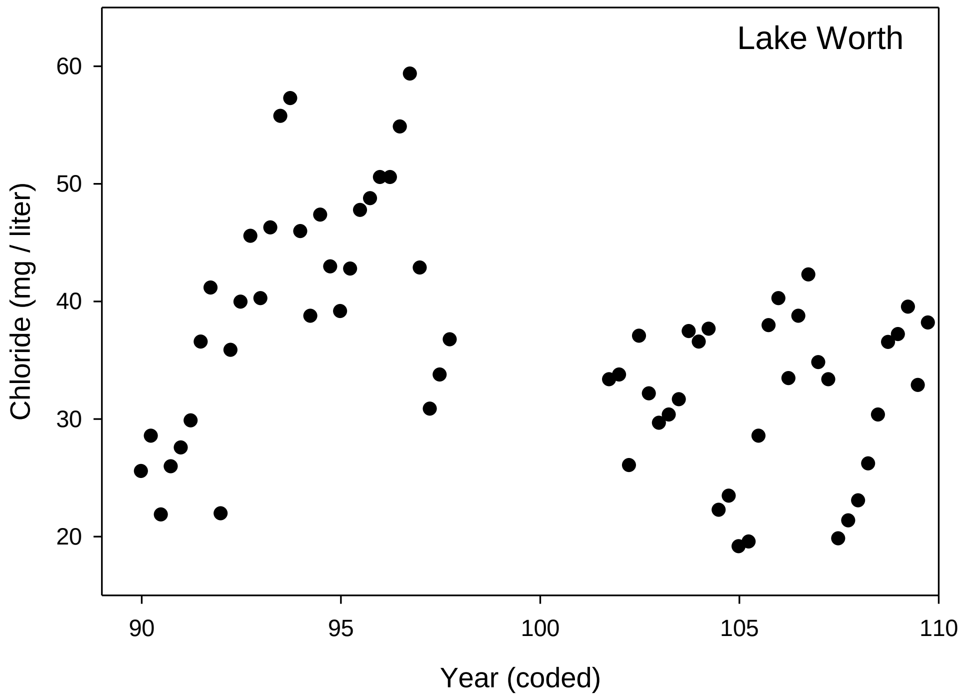
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the main pool top site.


Lake Worth
Chlorophyll a (µg / liter)
0
20
40
60
80
90
95
100
105
110
Year (coded)


Lake Worth
Total P (mg / liter)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
90
95
100
105
110
Year (coded)


Lake Worth
Total N (mg / liter)
Year (coded)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
90
95
100
105
110


Lake Worth
Alkalinity (mg / liter)
Year (coded)
160
150
140
130
120
110
100
90
90
95
100
105
110



Intake Site Results

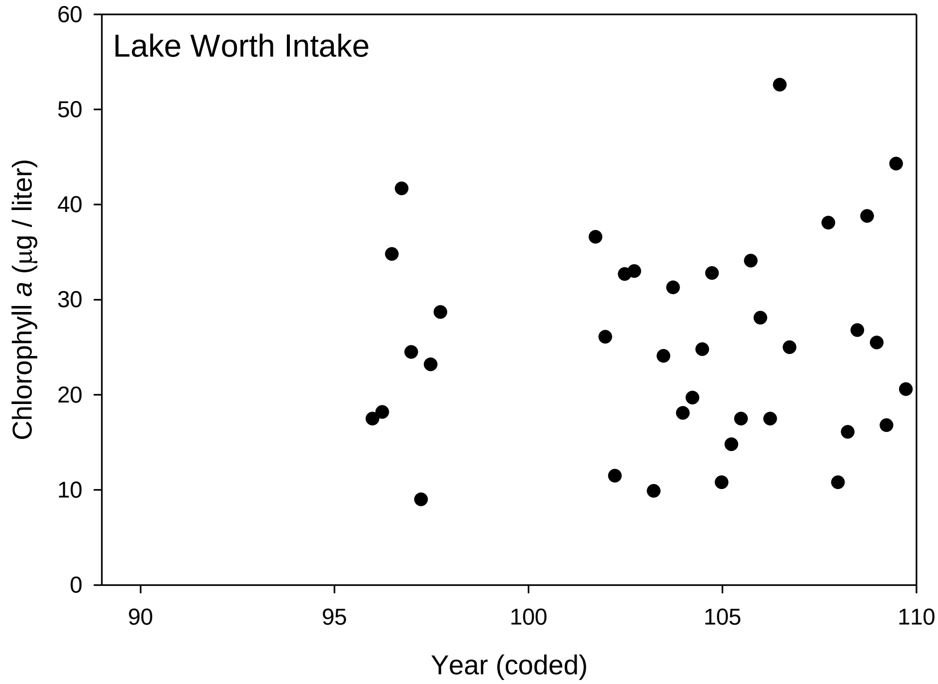
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

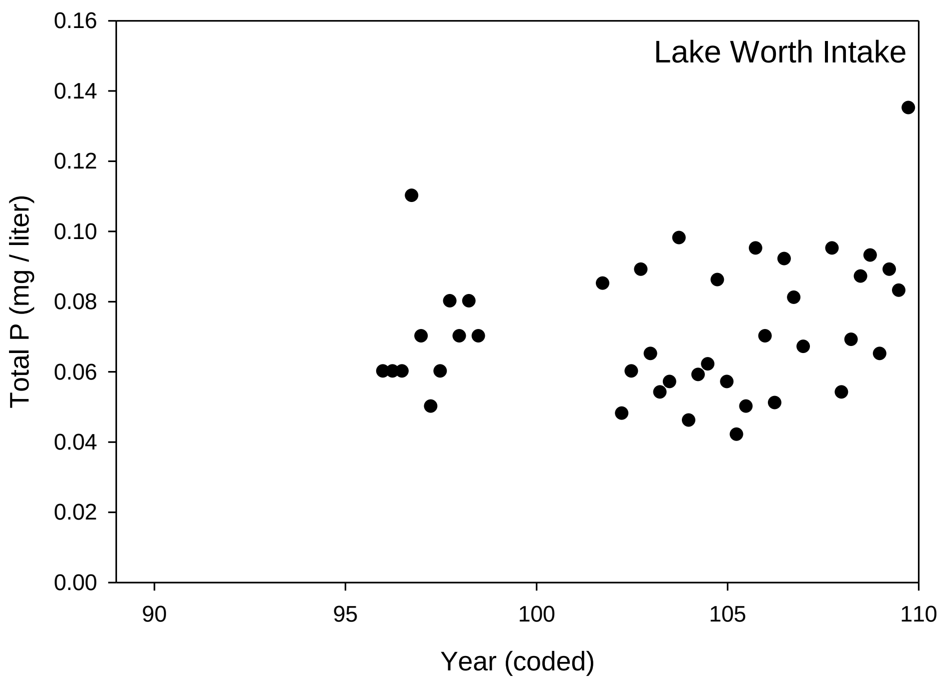
Several statistically significant trends were detected for Lake Worth, using intake site data. However, Chl *a* is no longer significantly increasing, though TN is, with a doubling time of 24 years. TOC is significantly decreasing, along with Alkalinity and Chloride. These results suggest that the tendency towards eutrophication characterizing the whole lake may be less applicable to the intake site. However, data are sparser at the intake site than at some others, so there is less statistical power to detect trends.

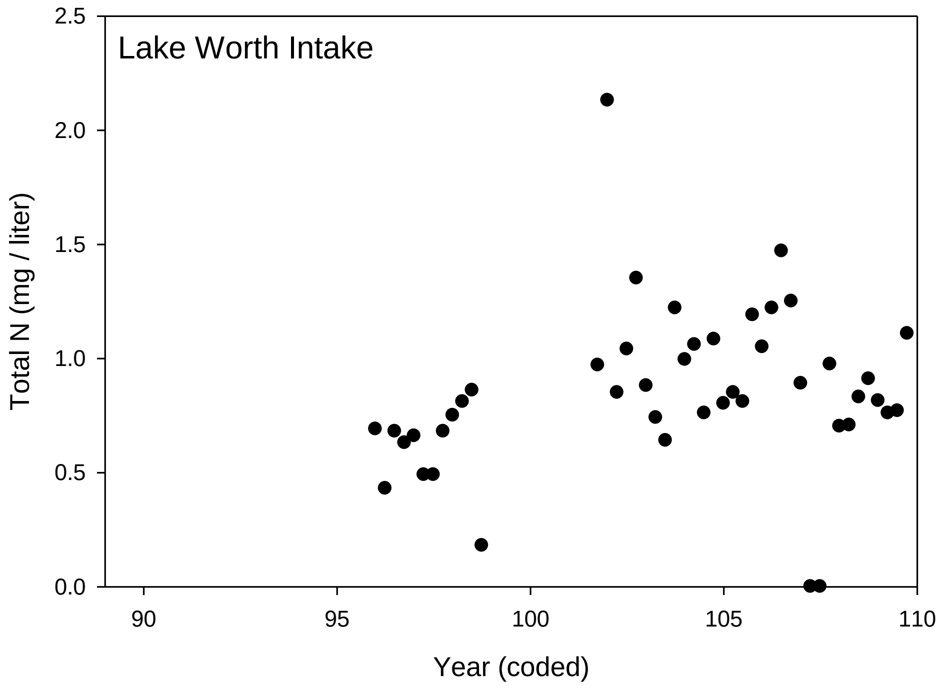
Summary of Lake Worth Analysis Intake Site (LW-04M)

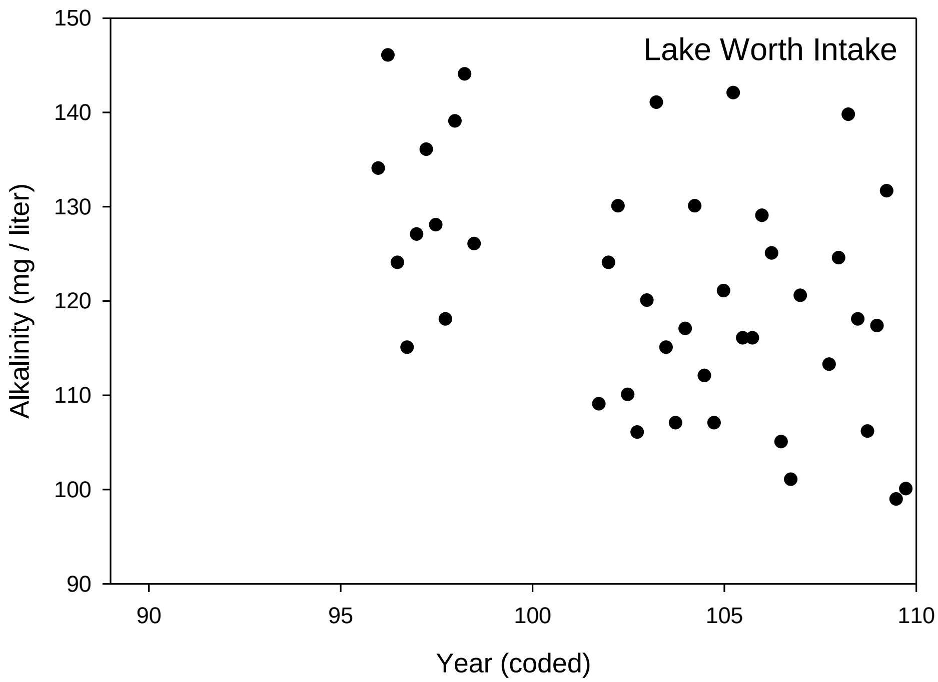
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	Log	0.002	0.89	0.16	421
DOC	Log	-0.052	0.29	-5.05	13
TOC	**Log**	**-0.008**	**0.035**	**-0.80**	**86**
TP	Log	0.008	0.22	0.85	82
TN	**Log**	**0.029**	**0.006**	**2.92**	**24**
Alkalinity	**Basic**	**-1.080**	**<0.001**		
Chloride	**Log**	**-0.028**	**0.007**	**-2.76**	**25**

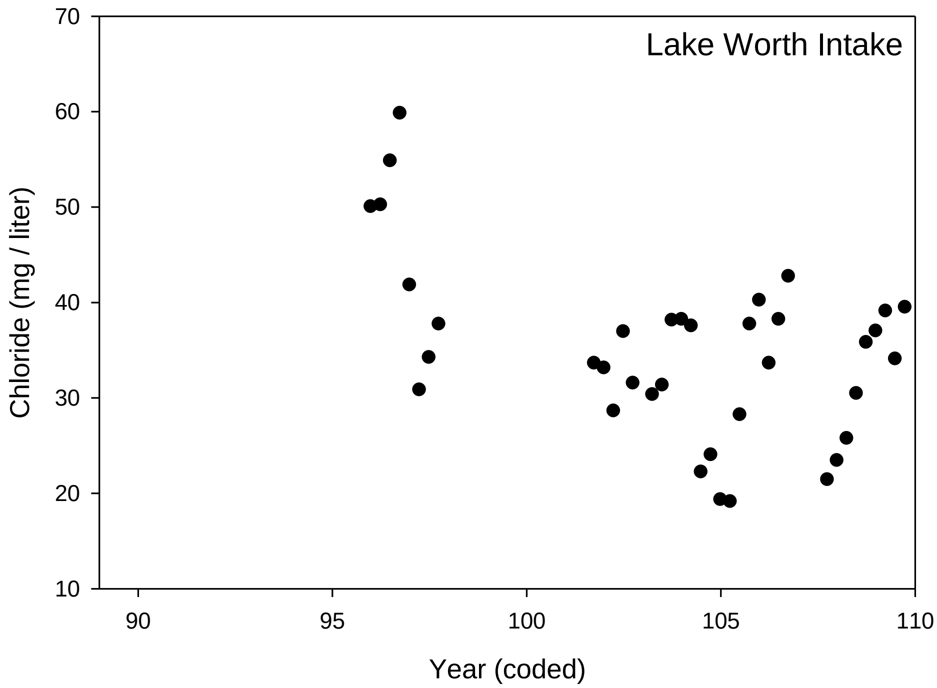
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the intake site.






Lake Worth Intake
Total N (mg / liter)
Year (coded)
2.5
2.0
1.5
1.0
0.5
0.0
90
95
100
105
110


Lake Worth Intake
Alkalinity (mg / liter)
Year (coded)
150
140
130
120
110
100
90
90
95
100
105
110



Bottom Site Results

The following table presents trend coefficients and significance values, for trend regressions using data from bottom sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement. Two significant trends were detected. DO is decreasing at a linear rate of 0.090 mg/L per year, a trend consistent with eutrophication. Ortho-PO_4 is also decreasing with a half-life of 34 years, suggesting decreasing internal loading of P from anoxic deep waters and sediments despite other indicators of eutrophication.

Summary of Lake Worth Trend Analysis Bottom Sites (LW-04B)

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
DO	**Basic**	**-0.090**	**0.020**		
NH_3	Log	-0.005	0.552	-0.52	132
Ortho-PO_4	**Log**	**-0.021**	**0.036**	**-2.04**	**34**

Benbrook Lake

Whole Lake Results

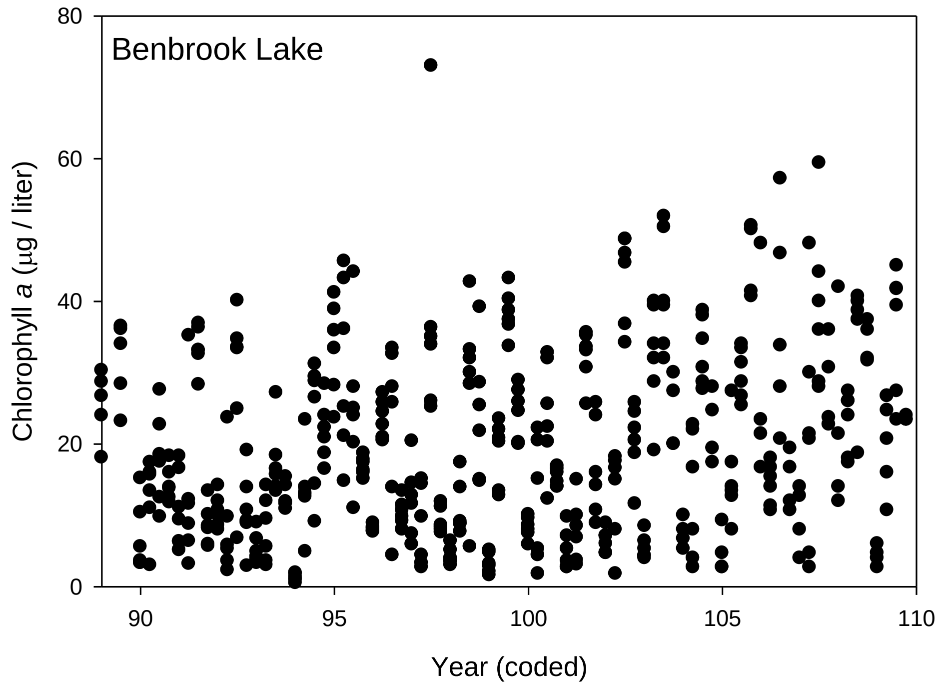
The following table presents trend coefficients and significance values, for trend regressions using all data from the lake. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

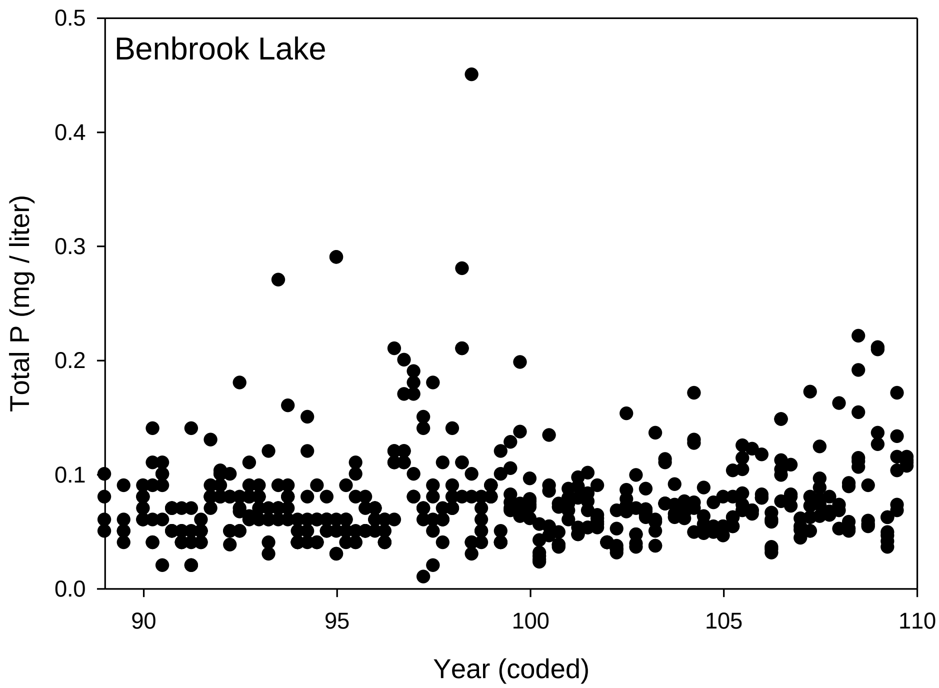
Several statistically significant trends were detected for Benbrook Lake, using all the data. Chl *a* is increasing with an estimated doubling time of 28 years. This trend is one of increasing eutrophication and decreasing water quality. DOC and TOC are also increasing, with doubling times of 60 and 140 years, respectively. TP, TN and TKN are increasing. These are further indicators of ongoing eutrophication. Dissolved nutrients are significantly decreasing. Alkalinity and TDS are also decreasing.

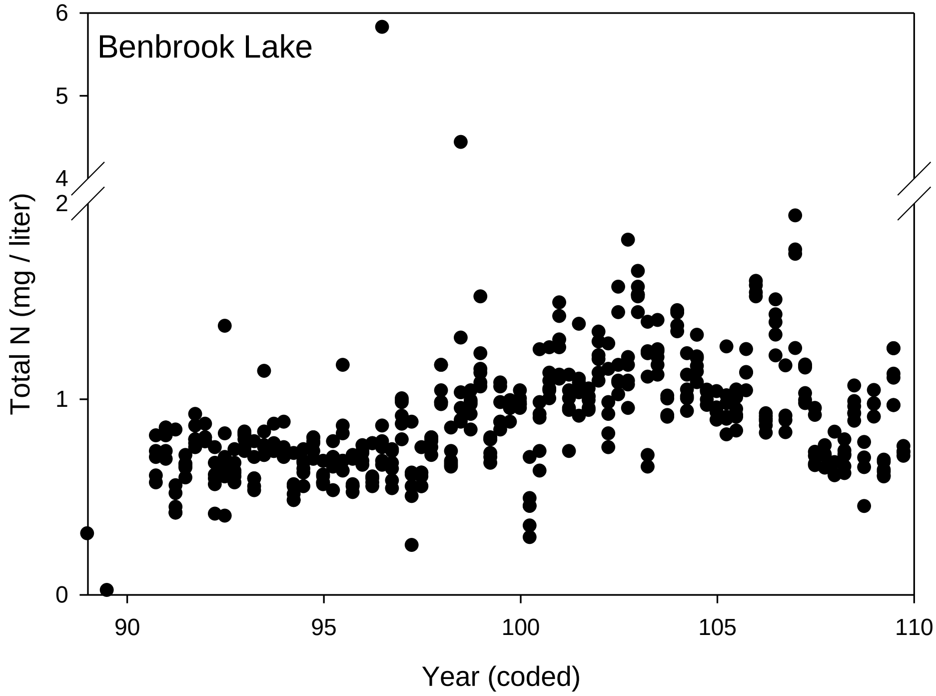
Summary of Benbrook Lake Trend Analysis

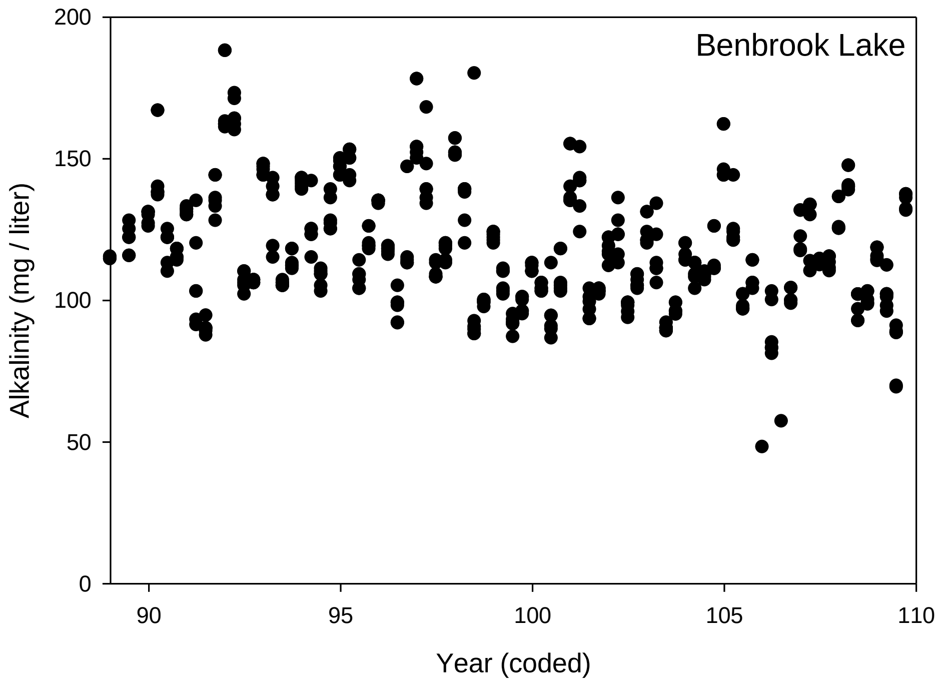
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.025**	**<0.001**	**2.48**	**28**
Secchi Depth	Log	0.000	0.97	-0.01	4855
DO	Basic	-0.004	0.72		
DOC	**Log**	**0.012**	**<0.001**	**1.17**	**60**
TOC	**Log**	**0.005**	**0.003**	**0.50**	**140**
Ortho-PO_4	**Log**	**-0.048**	**<0.001**	**-4.73**	**14**
TP	**Log**	**0.011**	**0.002**	**1.06**	**66**
NH_3	**Log**	**-0.026**	**<0.001**	**-2.60**	**26**
NO_X	**Log**	**-0.019**	**0.020**	**-1.93**	**36**
TKN	**Log**	**0.031**	**<0.001**	**3.13**	**23**
TN	**Log**	**0.029**	**<0.001**	**2.98**	**24**
TN:TP	**Log**	**0.018**	**<0.001**	**1.78**	**39**
Alkalinity	**Log**	**-0.008**	**<0.001**	**-0.82**	**84**
TDS	**Basic**	**-1.015**	**<0.001**		
TSS	**Log**	**0.011**	**<0.001**	**1.09**	**64**
Chloride	Basic	-0.010	0.85		
Temperature	Basic	0.016	0.28		

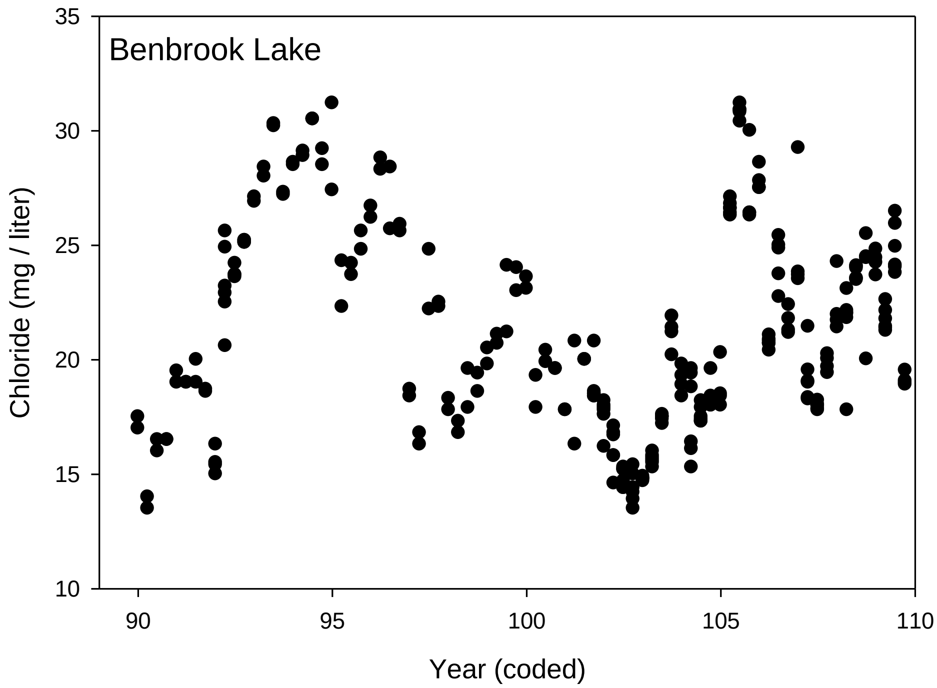
The following figures present the data for five parameters, Chl *a*, TN, TP, Alkalinity, and Chloride.






Benbrook Lake
Total N (mg / liter)
6
5
4
2
1
0
90
95
100
105
110
Year (coded)


Benbrook Lake
Alkalinity (mg / liter)
200
150
100
50
0
90
95
100
105
110
Year (coded)



Main Pool Top Site Results

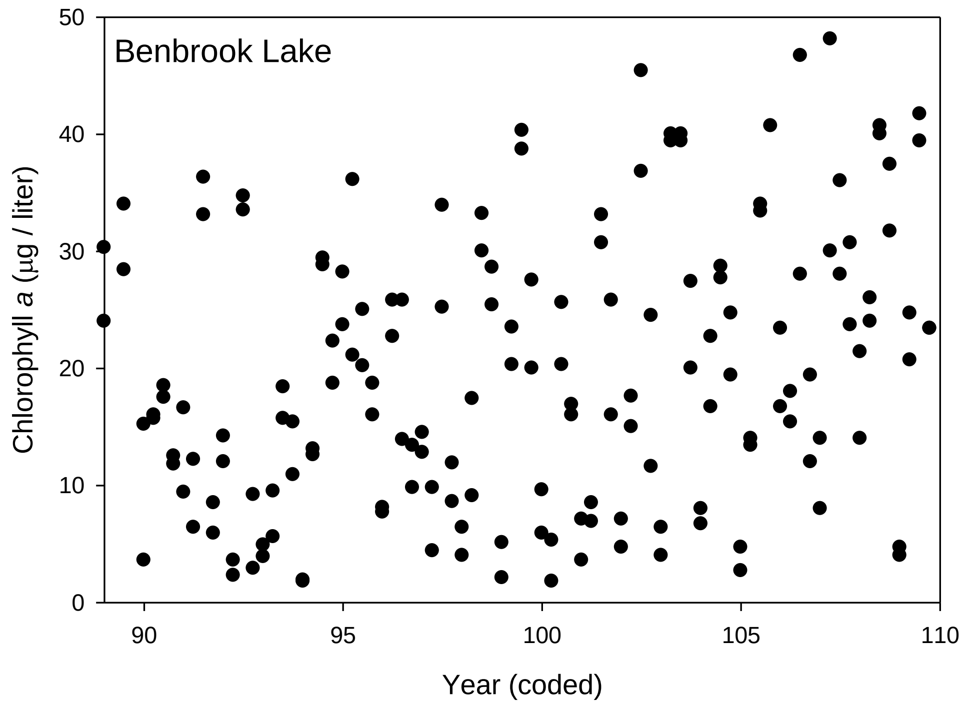
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

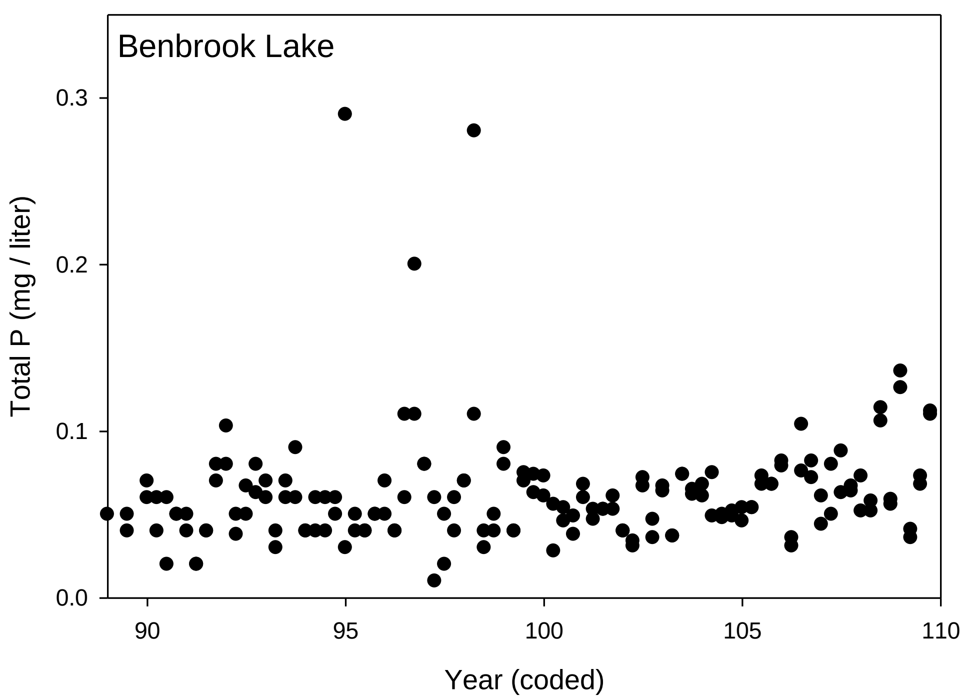
Similar to the whole lake, all parameters examined except Chloride had statistically significant trends for Benbrook Lake, using main pool site data. Except for Alkalinity which decreased, these parameters increased. The doubling time for Chl *a* is 23 years; doubling times were similar or longer for nutrients. These results suggest that the tendency towards eutrophication characterizing the whole lake is also applicable to the main pool top sites.

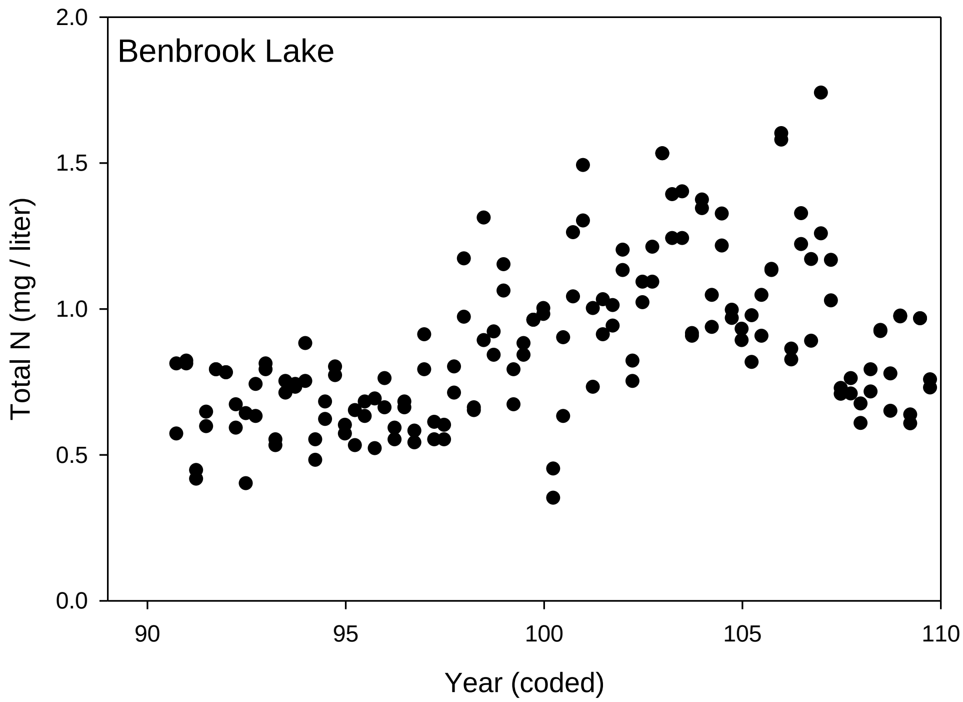
Summary of Benbrook Lake Trend Analysis,
Main Pool Top Sites (BB-01T, BB-02T)

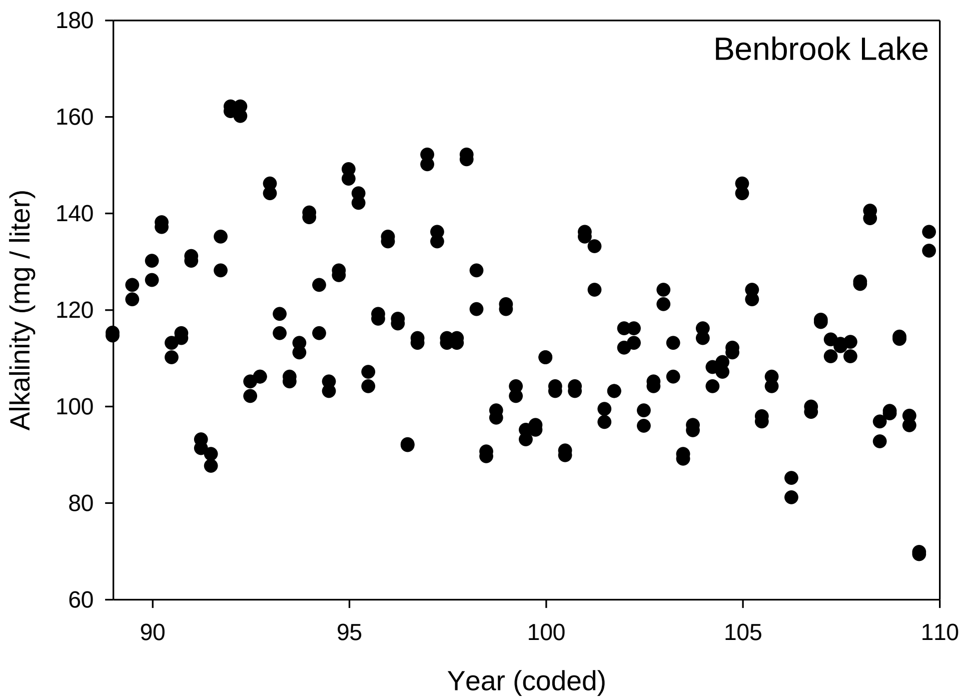
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.030**	**<0.001**	**3.02**	**23**
TP	**Log**	**0.016**	**0.003**	**1.62**	**43**
TN	**Log**	**0.027**	**<0.001**	**2.76**	**25**
Alkalinity	**Log**	**-0.008**	**<0.001**	**-0.79**	**87**
Chloride	Basic	-0.014	0.84		

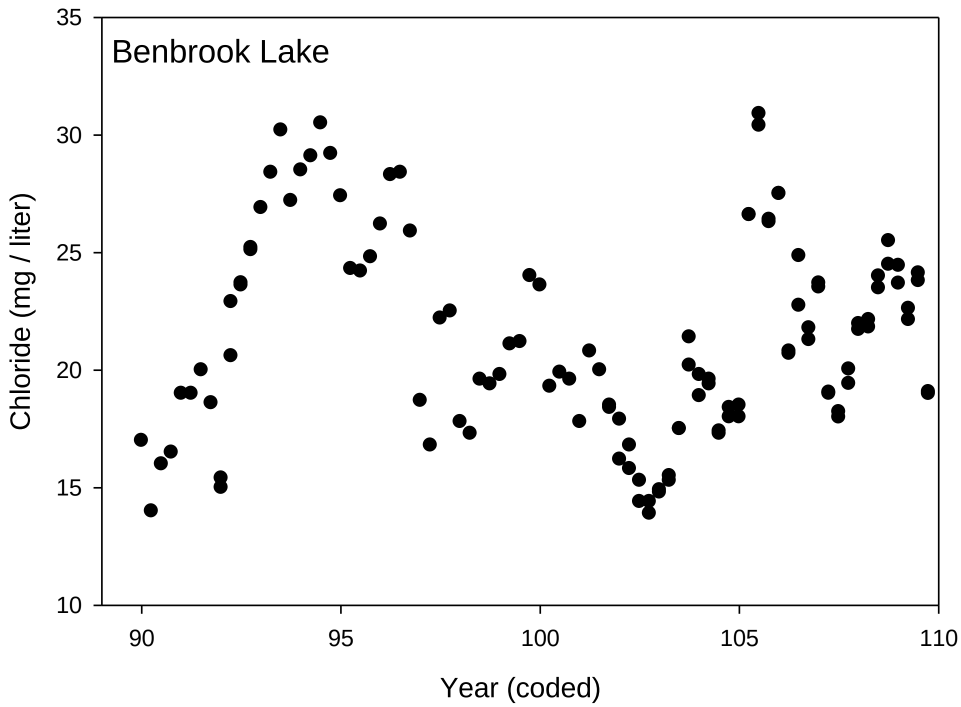
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the main pool top sites.






Benbrook Lake
Total N (mg / liter)
2.0
1.5
1.0
0.5
0.0
90
95
100
105
110
Year (coded)


Benbrook Lake
Alkalinity (mg / liter)
180
160
140
120
100
80
60
90
95
100
105
110
Year (coded)



Intake Site Results

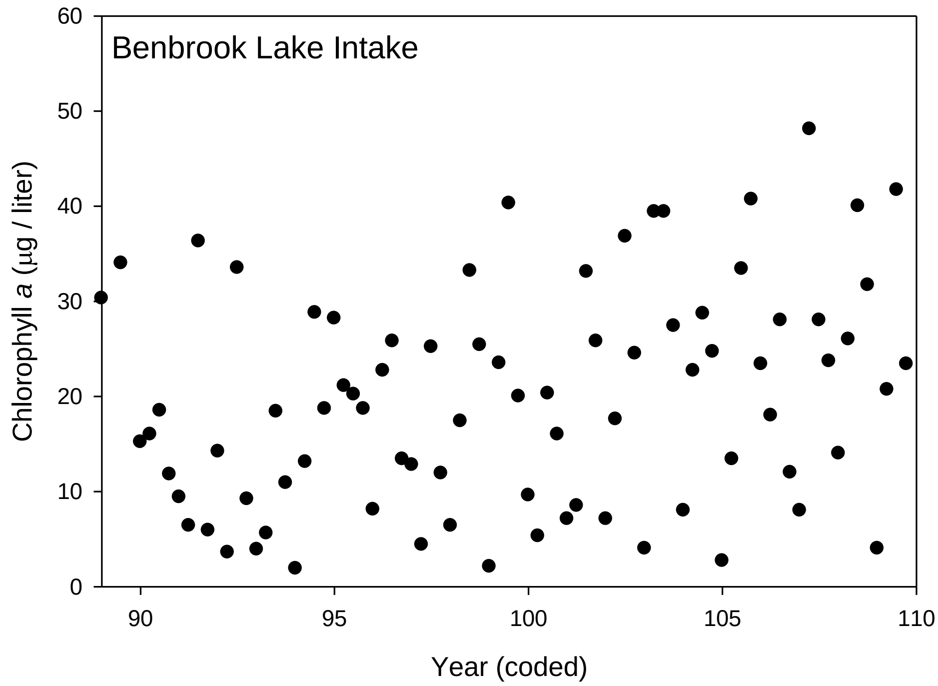
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

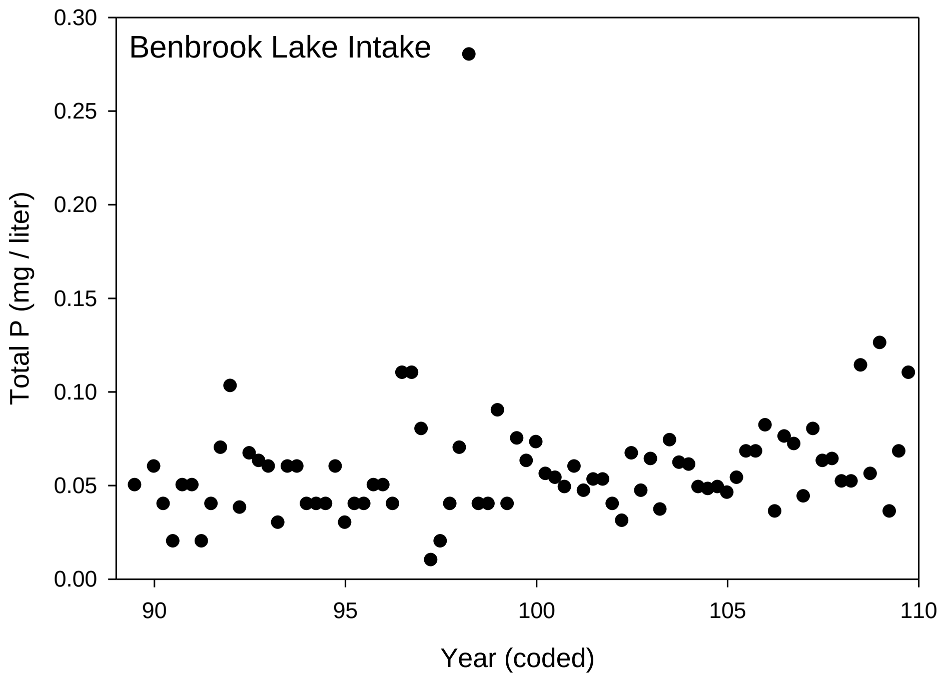
All parameters examined except Chloride had statistically significant trends for Benbrook Lake, using intake site data. Except for Alkalinity which decreased, these parameters increased. The doubling time for Chl *a* is 27 years; doubling times were similar or longer for nutrients. These results suggest that the tendency towards eutrophication characterizing the whole lake is also applicable to the intake site.

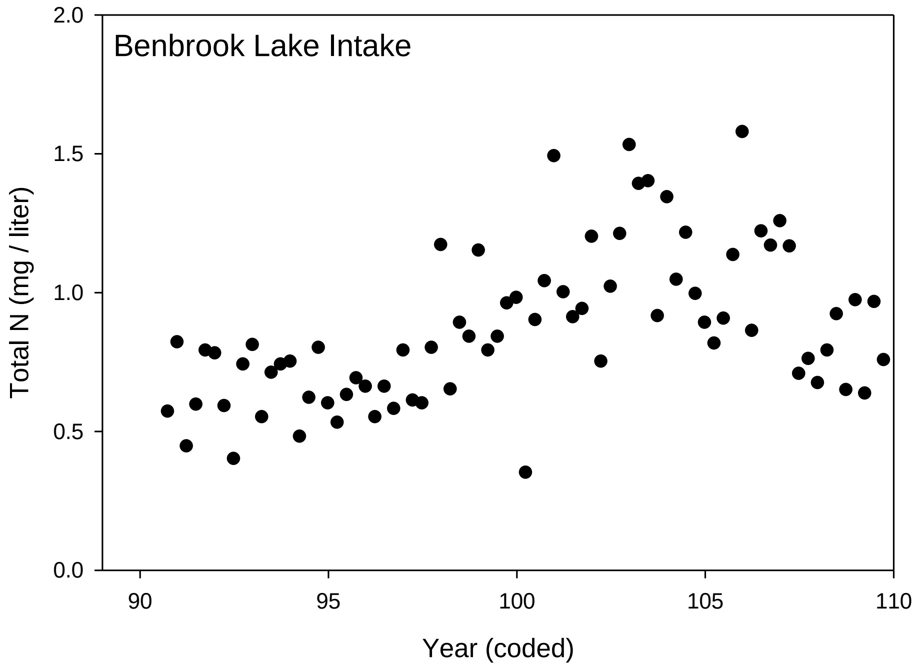
Summary of Benbrook Lake Analysis Intake Site (BB-01T)

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.026**	**0.021**	**2.61**	**27**
DOC	**Log**	**0.013**	**<0.001**	**1.29**	**54**
TOC	**Log**	**0.005**	**0.019**	**0.51**	**136**
TP	**Log**	**0.020**	**0.013**	**2.07**	**34**
TN	**Log**	**0.029**	**<0.001**	**2.98**	**24**
Alkalinity	**Log**	**-0.008**	**0.001**	**-0.78**	**89**
Chloride	Basic	0.097	0.34		

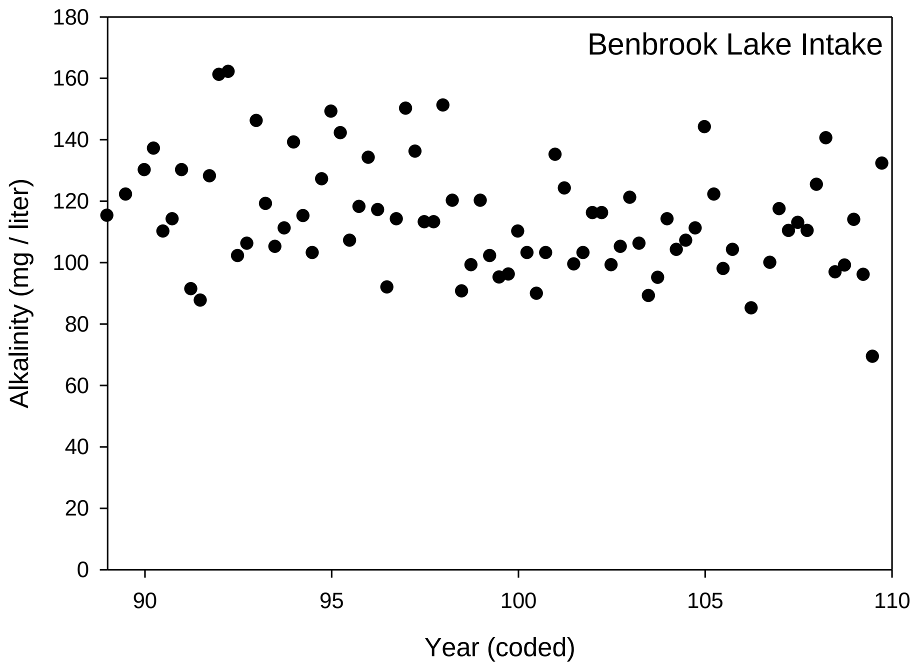
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the intake site.



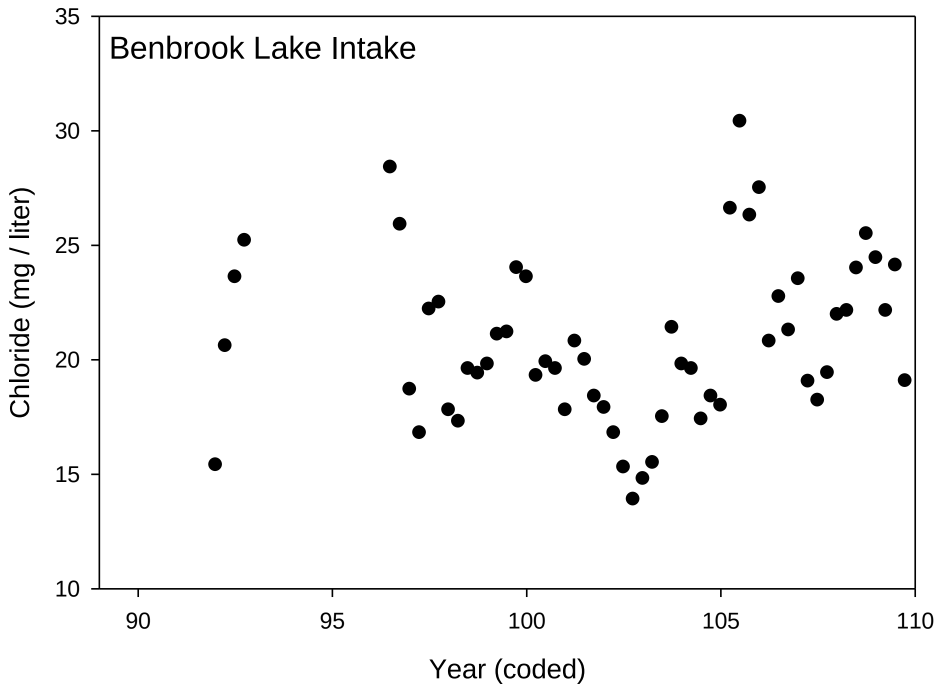




Benbrook Lake Intake
Total N (mg / liter)
Year (coded)
2.0
1.5
1.0
0.5
0.0
90
95
100
105
110



Benbrook Lake Intake
Alkalinity (mg / liter)
Year (coded)
180
160
140
120
100
80
60
40
20
0
90
95
100
105
110



Bottom Site Results

The following table presents trend coefficients and significance values, for trend regressions using data from bottom sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement. Two significant trends were detected. Although DO had no significant trend, both NH_3 and Ortho-PO_4 are decreasing with a half-lives of 35 and 14 years, respectively. These results suggest decreasing internal loading of P from anoxic deep waters and sediments despite other indicators of eutrophication.

Summary of Benbrook Lake Trend Analysis Bottom Sites (BB-01B, BB-02B, BB-03B)

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
DO	Basic	-0.007	0.710		
NH_3	**Log**	**-0.020**	**0.029**	**-1.97**	**35**
Ortho-PO_4	**Log**	**-0.049**	**0.000**	**-4.82**	**14**

Lake Arlington

Whole Lake Results

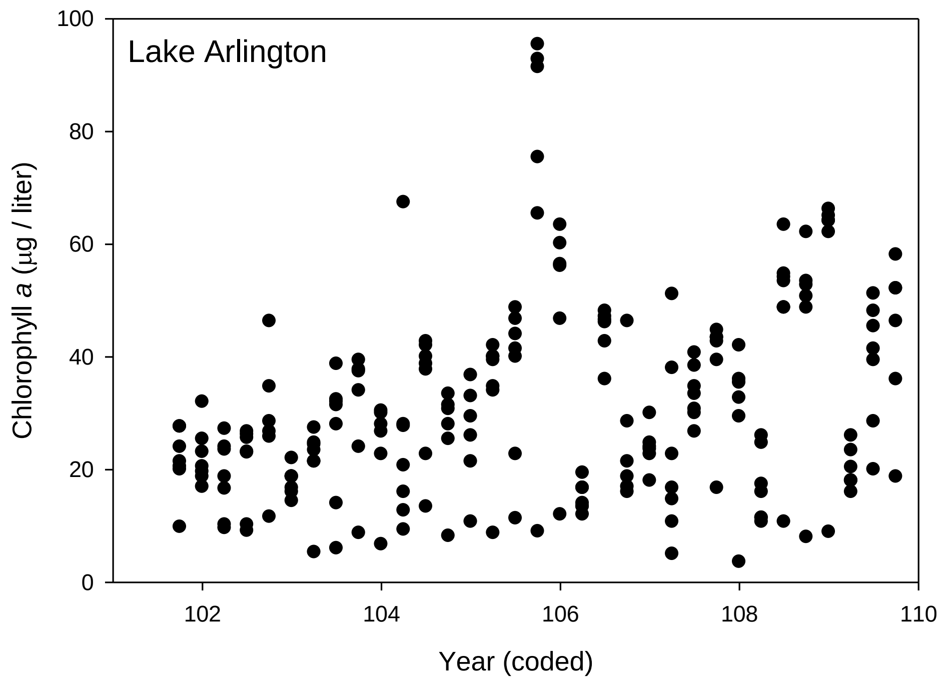
The following table presents trend coefficients and significance values, for trend regressions using all data from the lake. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

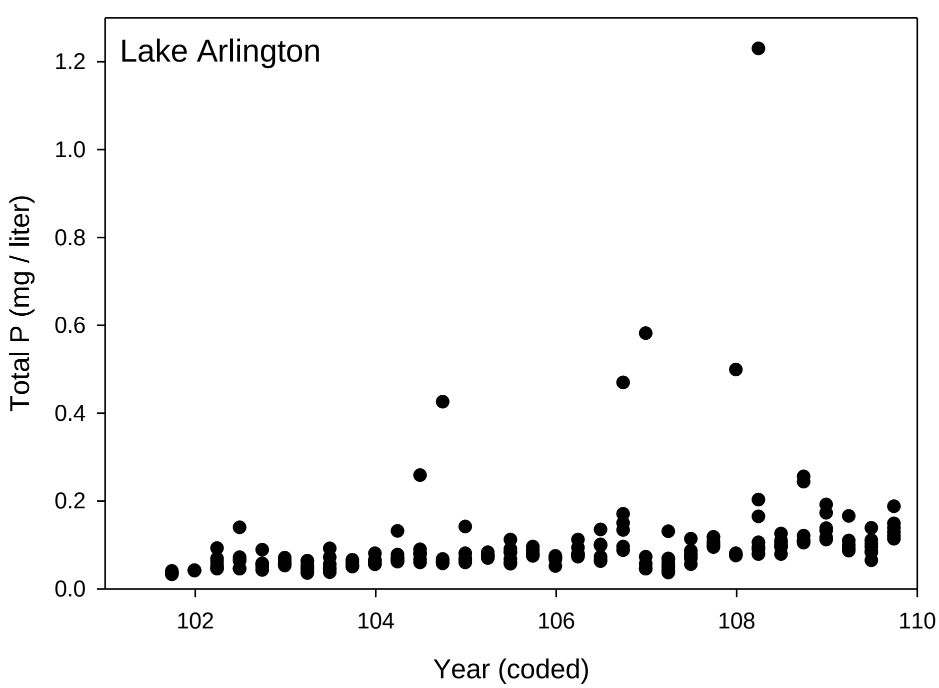
Several statistically significant trends were detected for Lake Arlington, using all the data. Chl *a* is increasing with an estimated doubling time of 11 years. This trend is one of increasing eutrophication and decreasing water quality. TP is increasing with a doubling time of 13 years, while TN is increasing at a linear rate of 0.025 mg/L per year. Secchi Depth is also decreasing at a linear rate of 0.024 m per year. All of these trends are consistent with ongoing eutrophication. TOC is decreasing, however, as are NH_3 and Ortho-PO_4. TSS is increasing with a doubling time of 14 years. Water temperature is also increasing at a linear rate of 0.183 °C per year. However, for Lake Arlington, data are available only from 2001, and so it is possible that a period of unusually high rates of change was captured during this shortened period of observations.

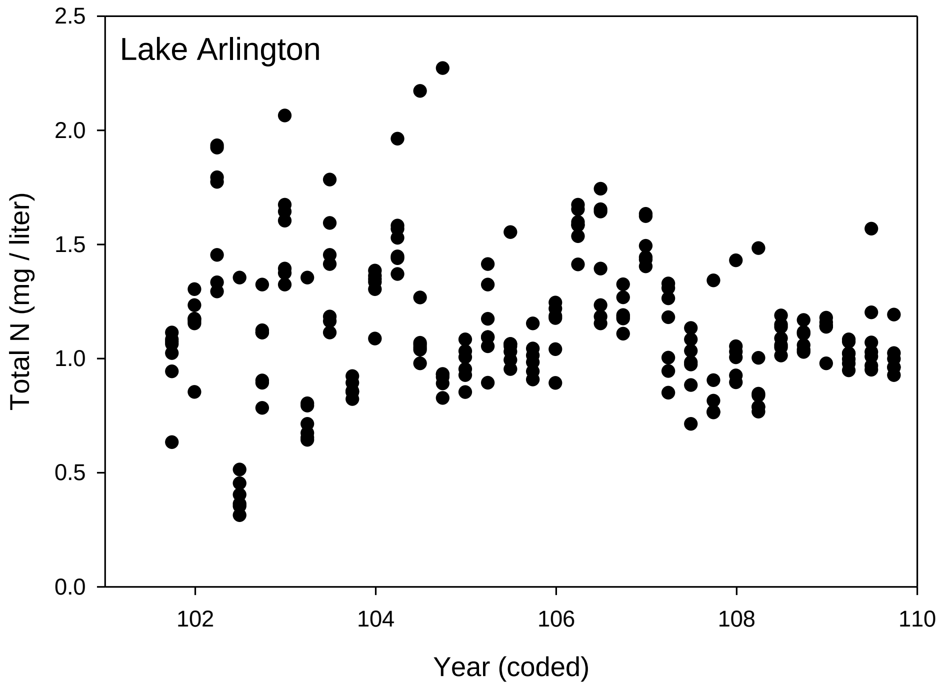
Summary of Lake Arlington Trend Analysis

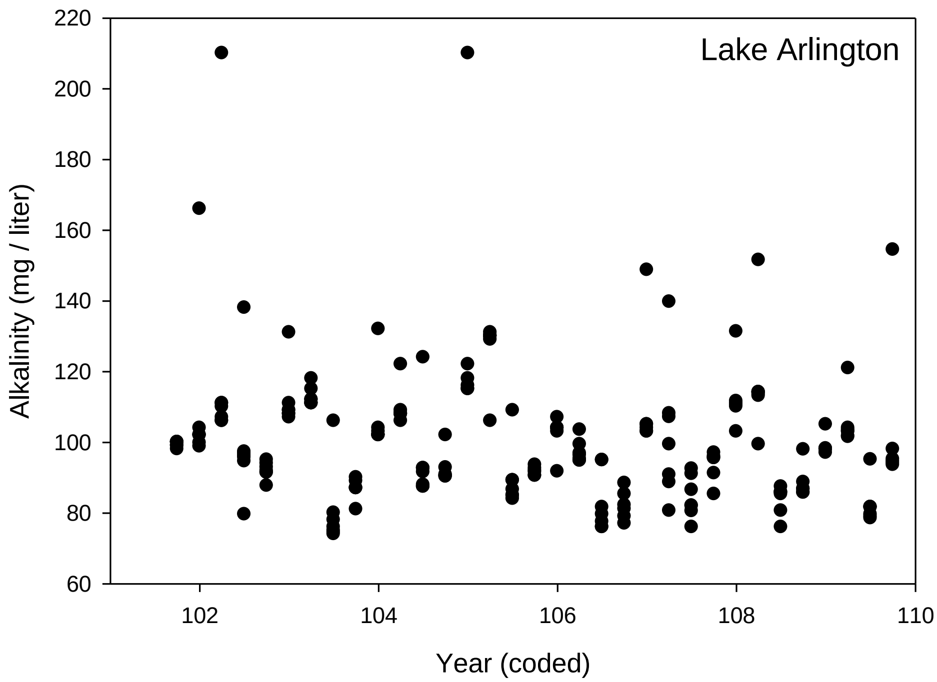
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.060**	**<0.001**	**6.23**	**11**
Secchi Depth	**Basic**	**-0.024**	**<0.001**		
DO	Basic	0.020	0.68		
DOC	Log	-0.008	0.088	-0.76	91
TOC	**Log**	**-0.011**	**0.016**	**-1.07**	**64**
Ortho-PO_4	**Log**	**-0.004**	**0.81**	**-0.45**	**155**
TP	**Log**	**0.055**	**<0.001**	**5.67**	**13**
NH_3	**Log**	**-0.035**	**0.040**	**-3.42**	**20**
NO_X	Log	-0.040	0.26	-3.90	17
TKN	Log	-0.002	0.85	-0.16	436
TN	**Basic**	**0.025**	**0.021**		
TN:TP	**Basic**	**-1.878**	**<0.001**		
Alkalinity	**Log**	**-0.010**	**0.003**	**-0.96**	**72**
TDS	Log	-0.002	0.53	-0.23	307
TSS	**Log**	**0.050**	**<0.001**	**5.08**	**14**
Chloride	Log	0.010	0.14	1.04	67
Temperature	**Basic**	**0.183**	**<0.001**		

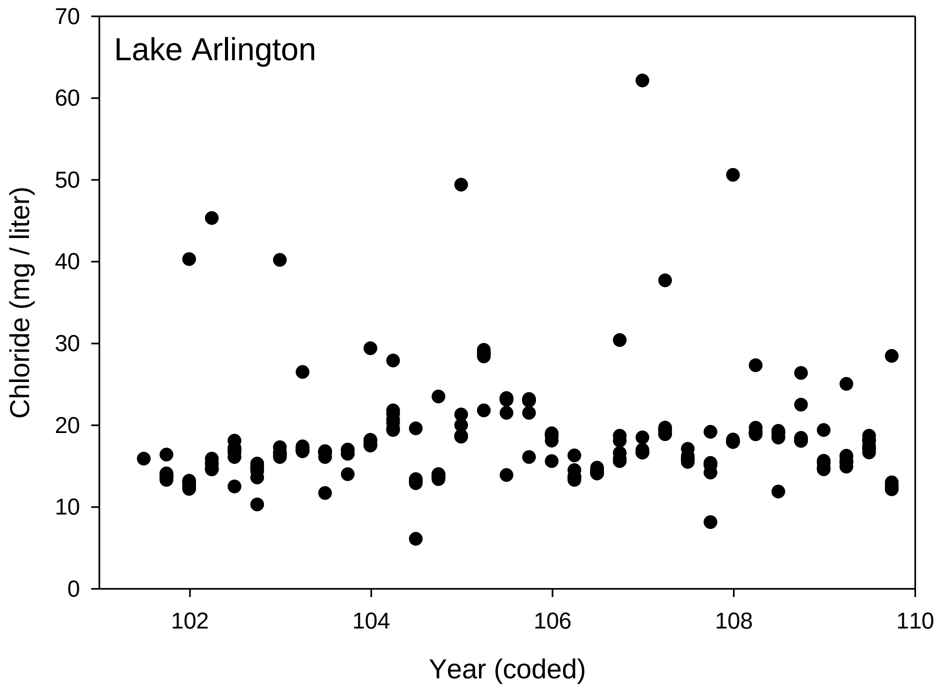
The following figures present the data for five parameters, Chl *a*, TN, TP, Alkalinity, and Chloride. The very high value displayed for TP is flagged as a verified value in the data file, so it was included in the analysis.






Lake Arlington
Total N (mg / liter)
0.0
0.5
1.0
1.5
2.0
2.5
102
104
106
108
110
Year (coded)


Lake Arlington
Alkalinity (mg / liter)
60
80
100
120
140
160
180
200
220
102
104
106
108
110
Year (coded)



Main Pool Top Site Results

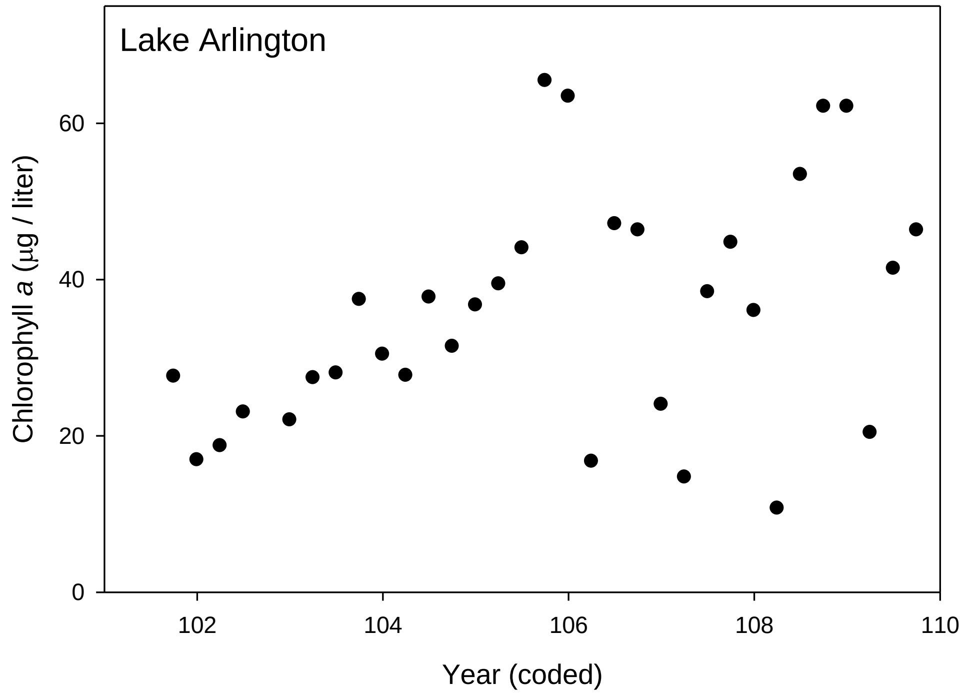
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

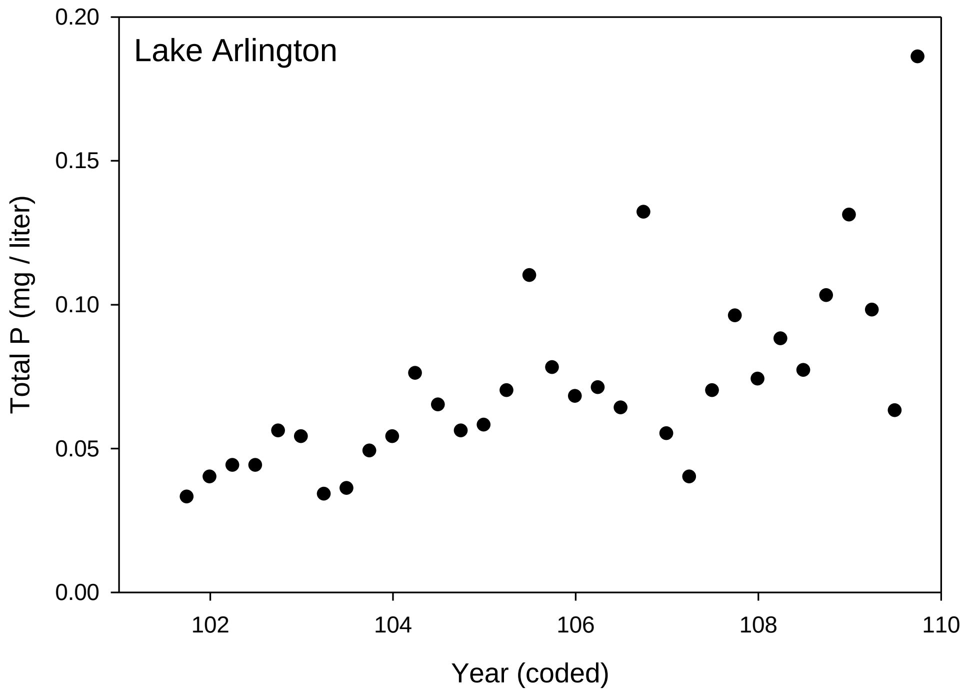
Only one statistically significant trend was detected for Lake Arlington, using main pool top site data. TP increased very rapidly with a doubling time of 6 years. This trend is consistent with the indications of eutrophication seen in the whole-lake analysis. However, since data are available only from 2001, it is possible that a period of unusually high rates of change was captured during this short period of observations. The short period of record for Lake Arlington also reduces statistical power while making anomalous results more likely. Both the very strong trend for TP and the lack of trends for other parameters should be regarded cautiously.

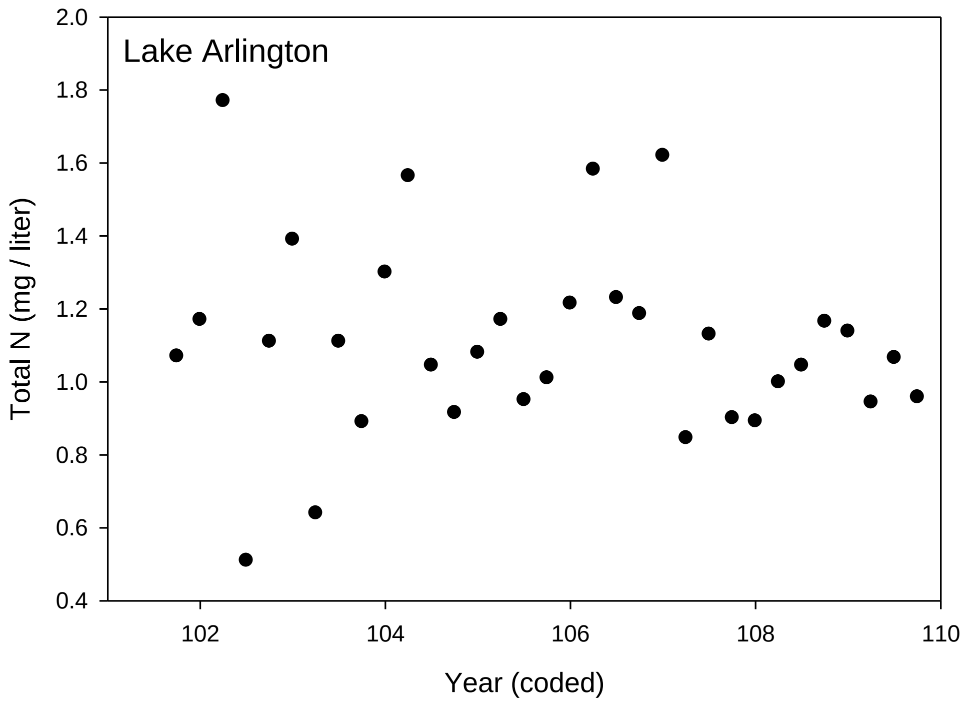
Summary of Lake Arlington Trend Analysis,
Main Pool Top Site (AR-01T)

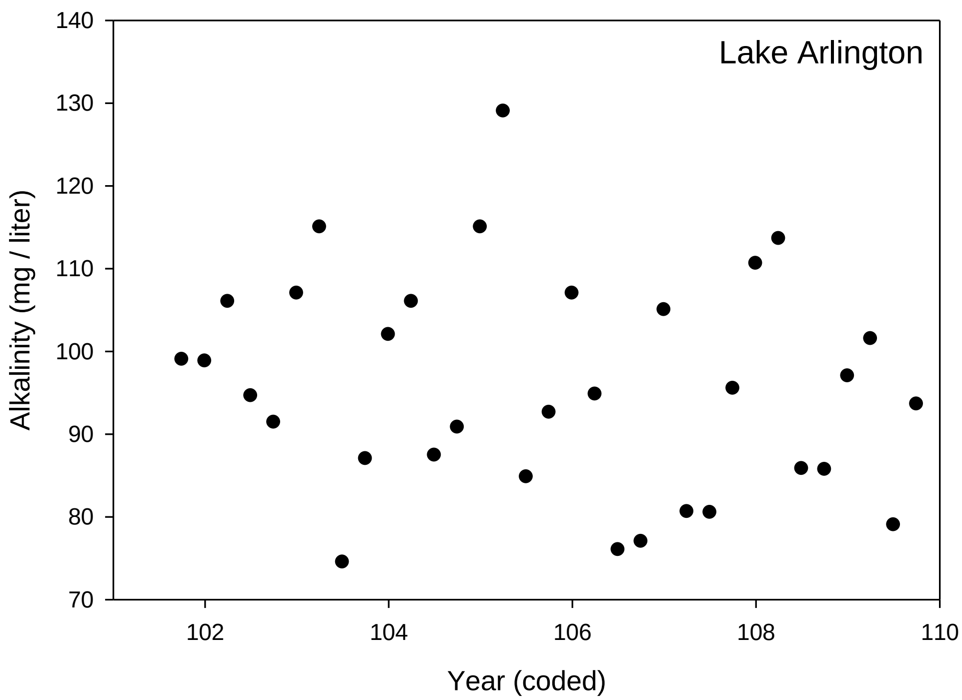
Parameter	**Model**	**Time Coefficient**	**P-value**	**APR (%)**	**Double/Half Time (yr)**
Chl *a*	Log	0.048	0.093	4.88	15
TP	**Log**	**0.125**	**<0.001**	**13.29**	**6**
TN	Basic	-0.009	0.65		
Alkalinity	Log	-0.008	0.23	-0.81	85
Chloride	Log	0.008	0.58	0.80	87

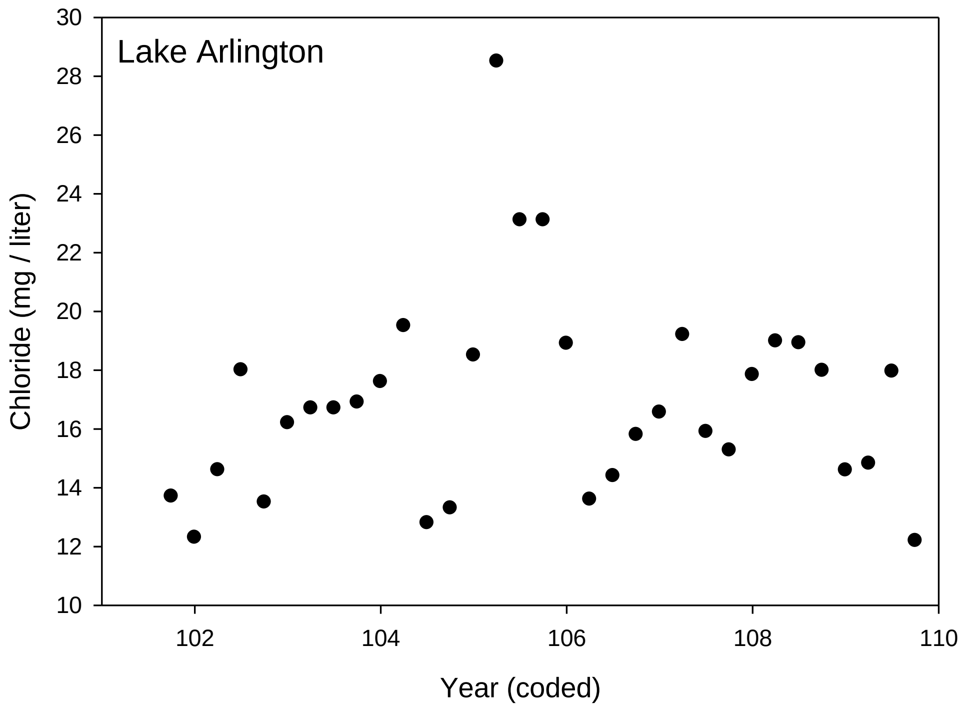
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the main pool top site.






Lake Arlington
Total N (mg / liter)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
102
104
106
108
110
Year (coded)


Lake Arlington
Alkalinity (mg / liter)
140
130
120
110
100
90
80
70
102
104
106
108
110
Year (coded)



Intake Site Results

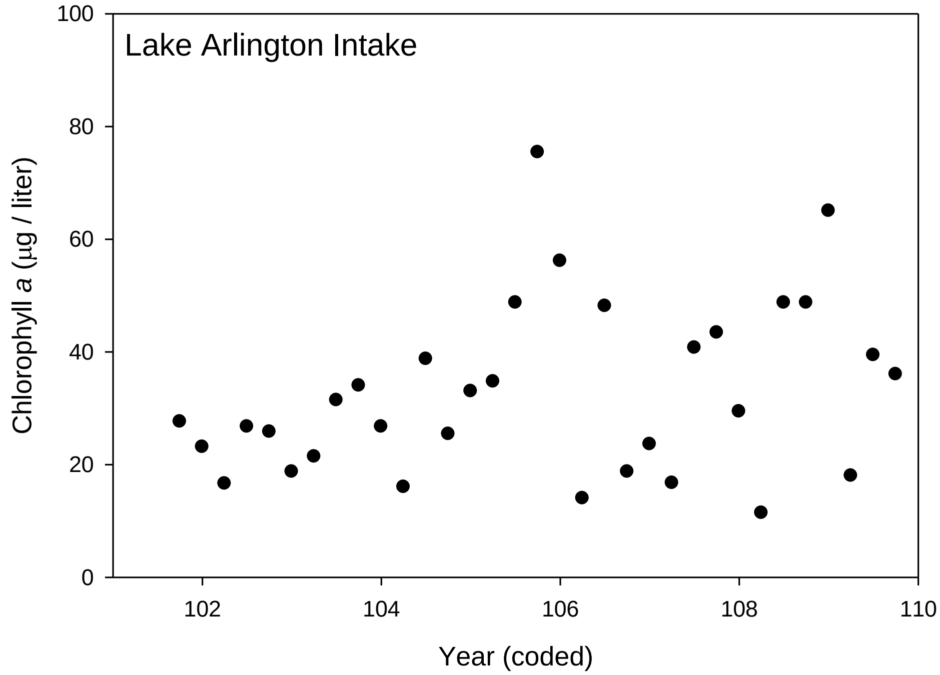
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

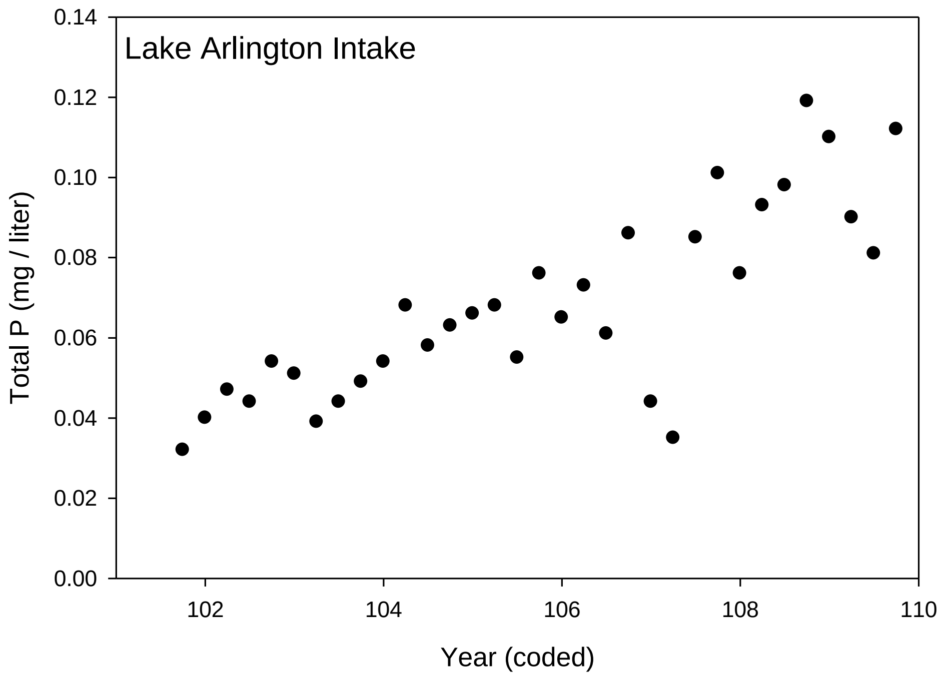
Only one statistically significant trend was detected for Lake Arlington, using intake site data. TP increased very rapidly with a doubling time of 6 years. This trend is consistent with the indications of eutrophication seen in the whole-lake analysis. The period of record is shorter for Lake Arlington than for other lakes, which reduces statistical power while making anomalous results more likely. Both the very strong trend for TP and the lack of trends for other parameters should be regarded cautiously.

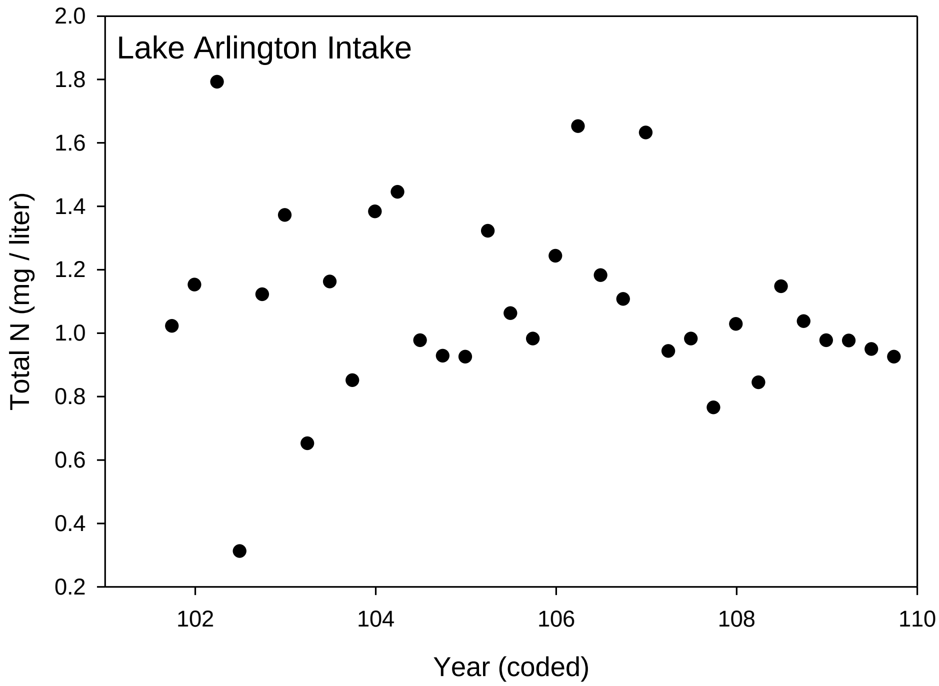
Summary of Lake Arlington Analysis Intake Site (AR-01M)

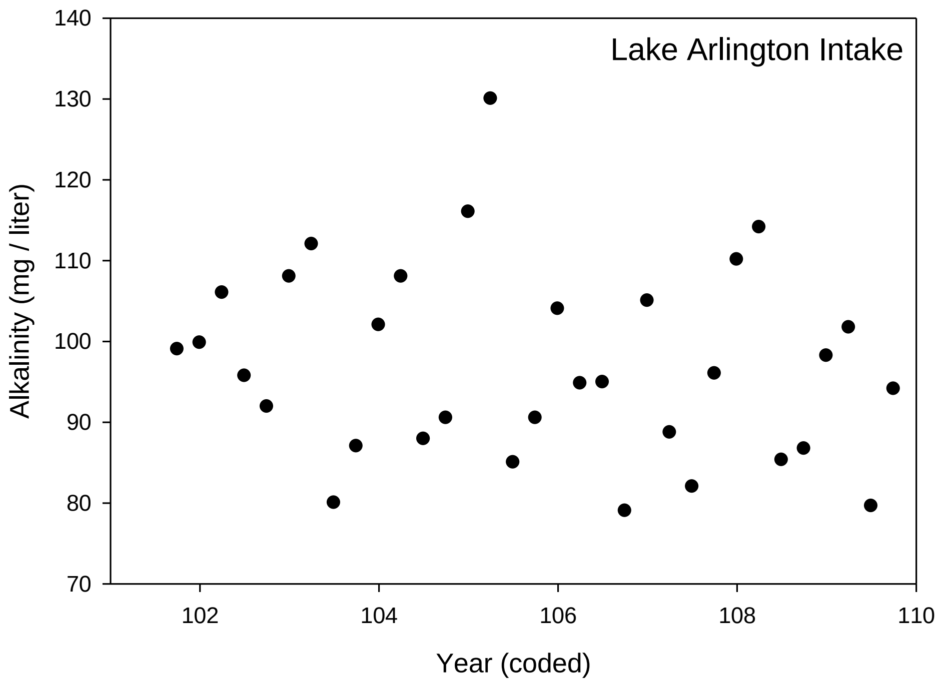
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	Log	0.047	0.074	4.86	15
DOC	Log	-0.004	0.71	-0.41	168
TOC	Log	-0.012	0.24	-1.23	56
TP	**Log**	**0.116**	**<0.001**	**12.32**	**6**
TN	Basic	-0.012	0.56		
Alkalinity	Log	-0.008	0.20	-0.76	91
Chloride	Log	0.007	0.62	0.69	101

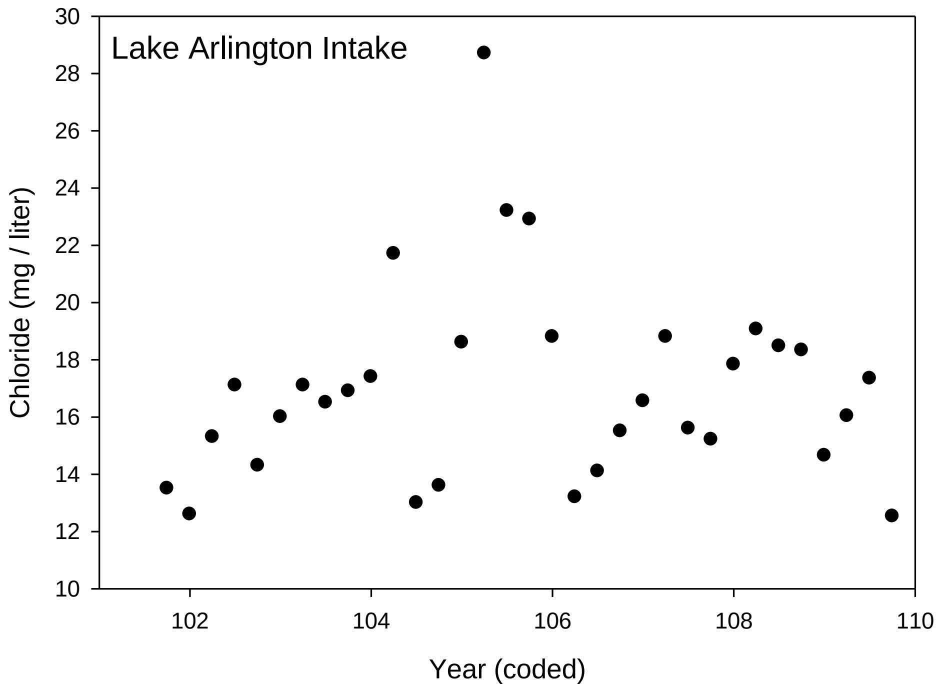
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the intake site.






Lake Arlington Intake
Total N (mg / liter)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
102
104
106
108
110
Year (coded)


Lake Arlington Intake
Alkalinity (mg / liter)
140
130
120
110
100
90
80
70
102
104
106
108
110
Year (coded)



Bottom Site Results

The following table presents trend coefficients and significance values, for trend regressions using data from bottom sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement. No significant trends were detected for the parameters examined.

Summary of Lake Arlington Trend Analysis Bottom Sites (AR-01B, AR-02B)

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
DO	Basic	-0.123	0.252		
NH_3	Log	-0.086	0.081	-8.28	8
Ortho-PO_4	Log	-0.045	0.321	-4.43	15

Cedar Creek Lake

Whole Lake Results

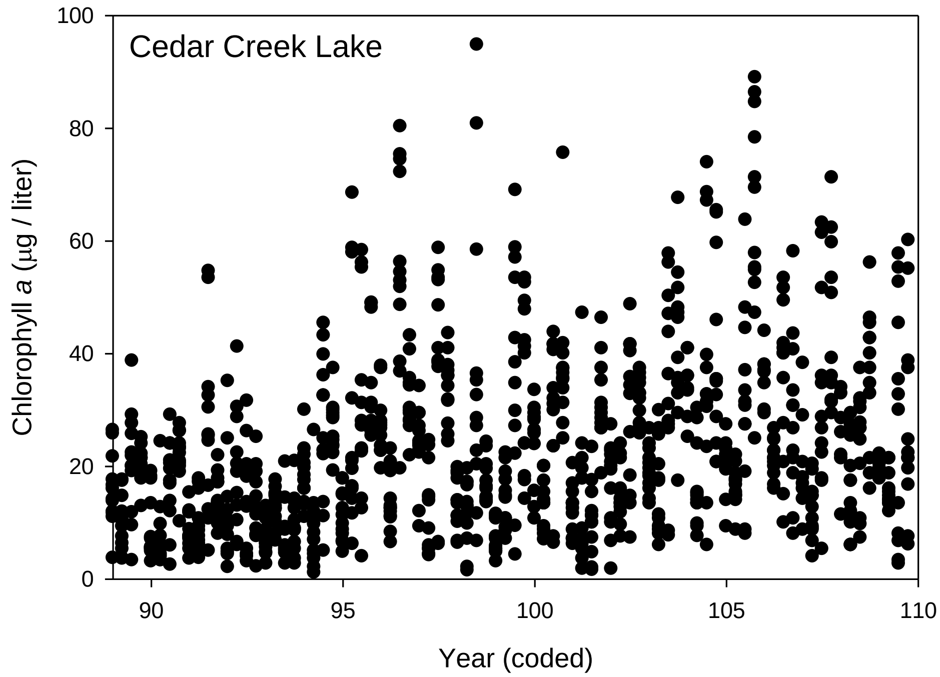
The following table presents trend coefficients and significance values, for trend regressions using all data from the lake. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

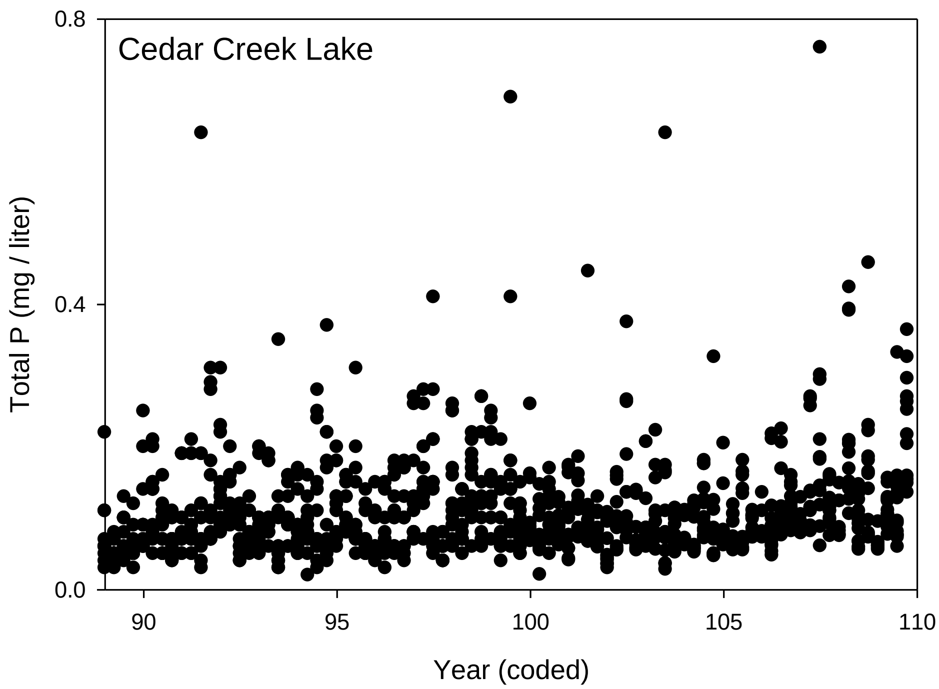
Several statistically significant trends were detected for Cedar Creek Lake, using all the data. Chl *a* is increasing with an estimated doubling time of 20 years. This trend is one of increasing eutrophication and decreasing water quality. TP, TKN and TN are increasing with doubling times of 30-49 years. Secchi Depth is also decreasing at a linear rate of 0.004 m per year. TOC and DOC are increasing. All of these trends are consistent with ongoing eutrophication. NO_x is decreasing, however. Alkalinity, TDS and Chloride are increasing with doubling times of 64-91 years. Water temperature is also increasing at a linear rate of 0.085 °C per year.

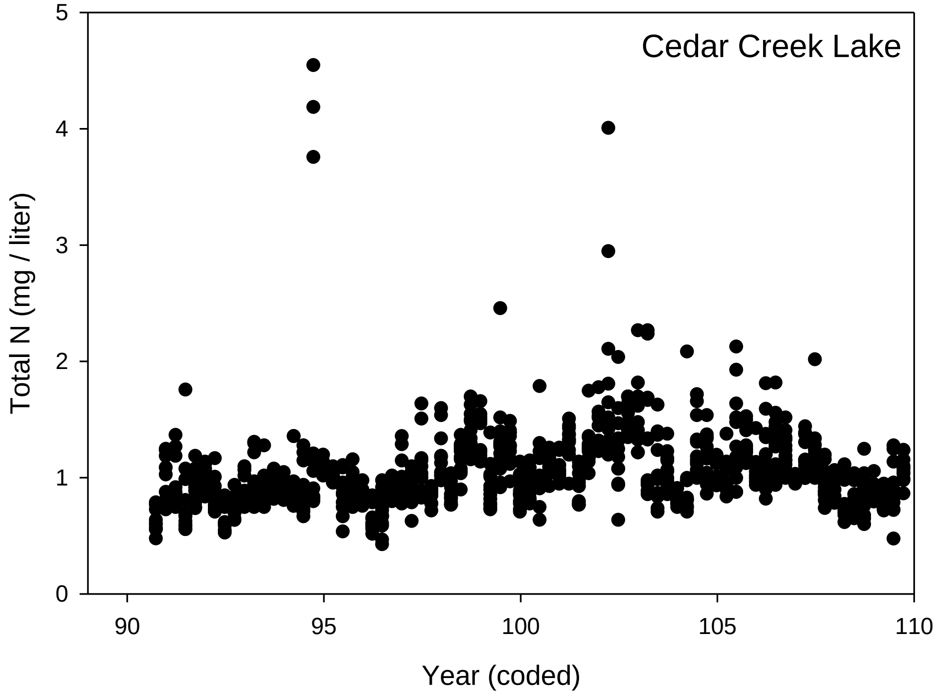
Summary of Cedar Creek Lake Trend Analysis

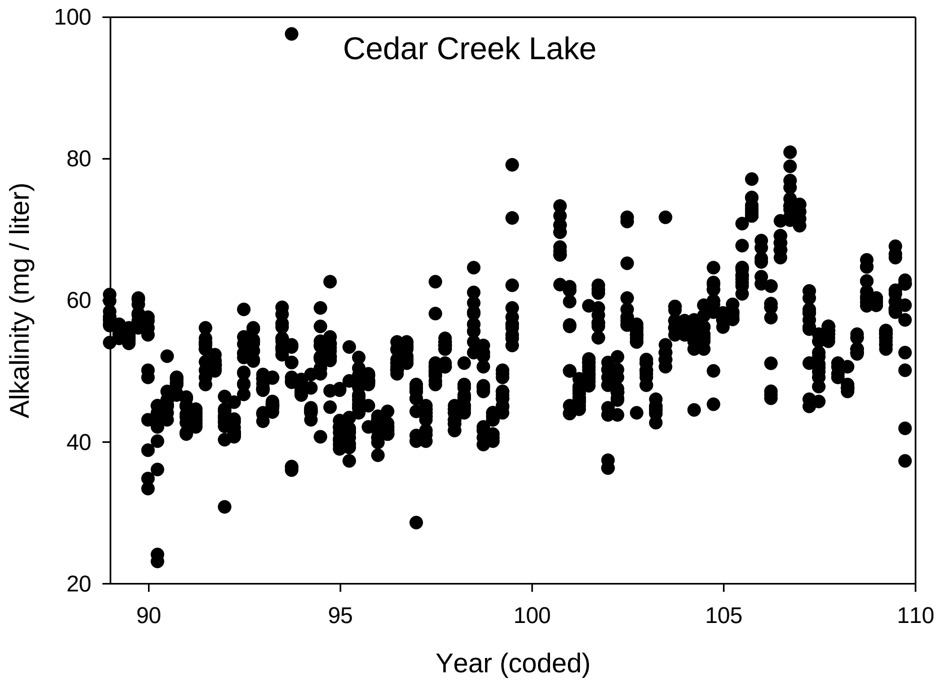
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.035**	**<0.001**	**3.60**	**20**
Secchi Depth	**Basic**	**-0.004**	**0.004**		
DO	**Basic**	**-0.058**	**<0.001**		
DOC	**Basic**	**0.069**	**<0.001**		
TOC	**Log**	**0.005**	**<0.001**	**0.46**	**151**
Ortho-PO_4	log	-0.008	0.12	-0.76	91
TP	**Log**	**0.015**	**<0.001**	**1.49**	**47**
NH_3	Log	-0.003	0.37	-0.27	255
NO_X	**Log**	**-0.049**	**<0.001**	**-4.78**	**14**
TKN	**Log**	**0.023**	**<0.001**	**2.33**	**30**
TN	**Log**	**0.014**	**<0.001**	**1.42**	**49**
TN:TP	Log	0.004	0.13	0.38	181
Alkalinity	**Log**	**0.010**	**<0.001**	**1.06**	**66**
TDS	**Log**	**0.011**	**<0.001**	**1.10**	**64**
TSS	Log	0.001	0.76	0.07	947
Chloride	**Log**	**0.010**	**<0.001**	**1.04**	**67**
Temperature	**Basic**	**0.085**	**<0.001**		

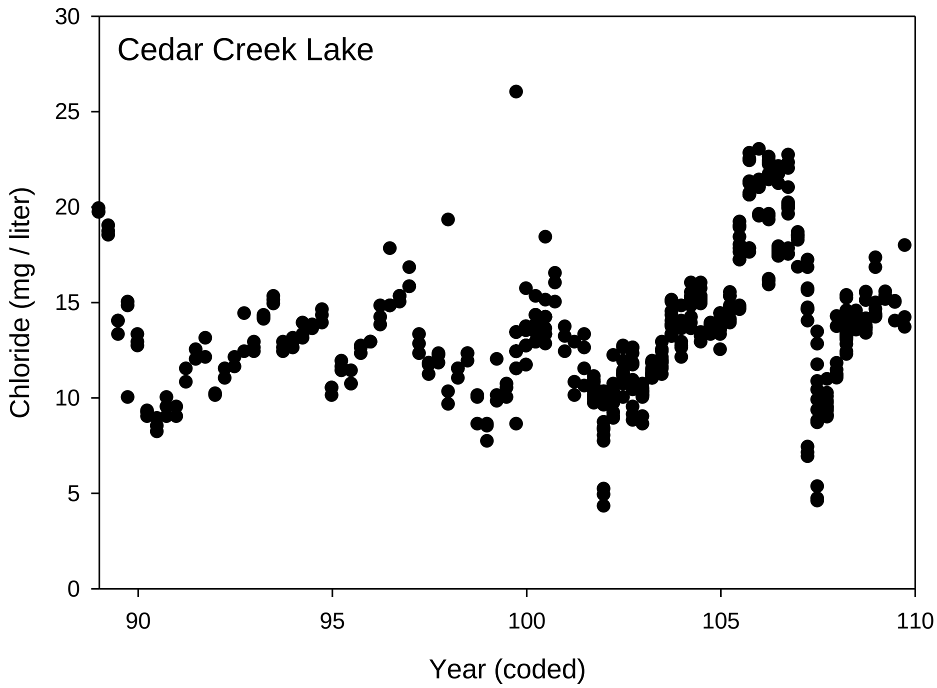
The following figures present the data for five parameters, Chl *a*, TN, TP, Alkalinity, and Chloride. The very high value displayed for TP is flagged as a verified value in the data file, so it was included in the analysis.


Cedar Creek Lake
Chlorophyll *a* (µg / liter)
Year (coded)
0
20
40
60
80
100
90
95
100
105
110


Cedar Creek Lake
Total P (mg / liter)
Year (coded)
0.0
0.4
0.8
90
95
100
105
110


Cedar Creek Lake
Total N (mg / liter)
Year (coded)
0
1
2
3
4
5
90
95
100
105
110


Cedar Creek Lake
Alkalinity (mg / liter)
Year (coded)
20
40
60
80
100
90
95
100
105
110



Main Pool Top Sites Results

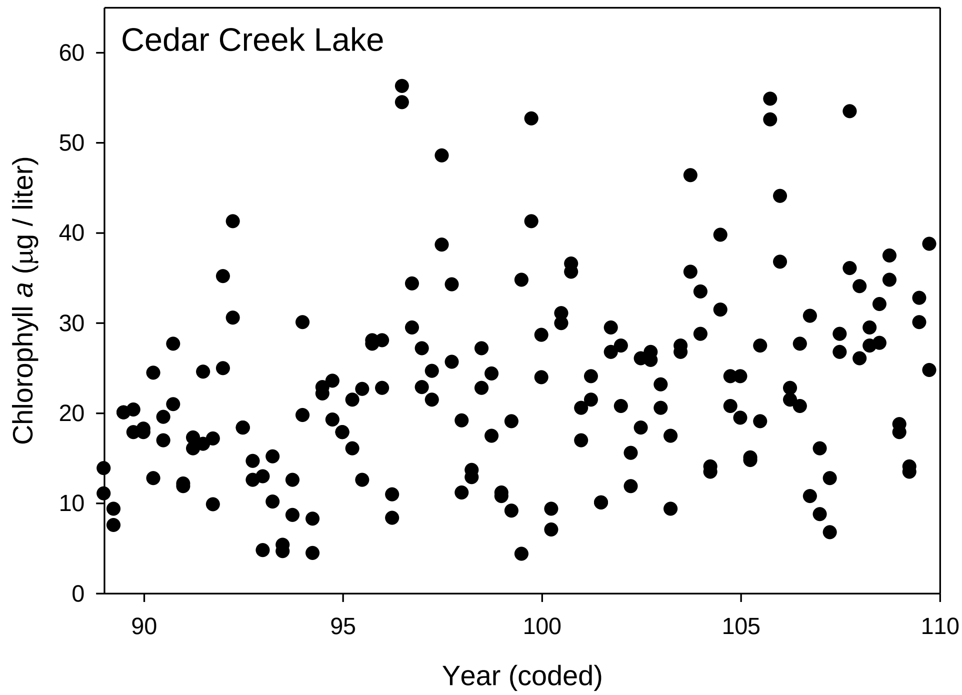
The following table presents trend coefficients and significance values, for trend regressions using data from the main pool top sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

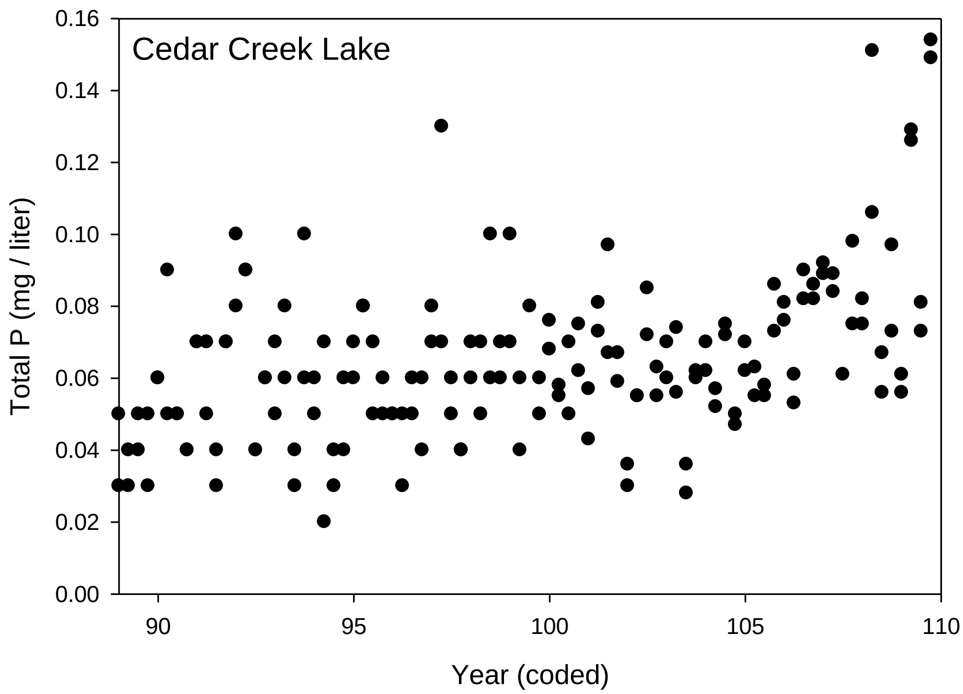
Statistically significant trends were detected for all parameters examined, using intake main pool top site data. These trends are all consistent with results for the whole lake. Chl a increased with a doubling time of 28 yr, while TP and TN increased with doubling times of 25 and 42 years, respectively. These trends are consistent with the indications of eutrophication seen in the whole-lake analysis. Alkalinity and Chloride also increased, with doubling times of 51 and 24 years, respectively.

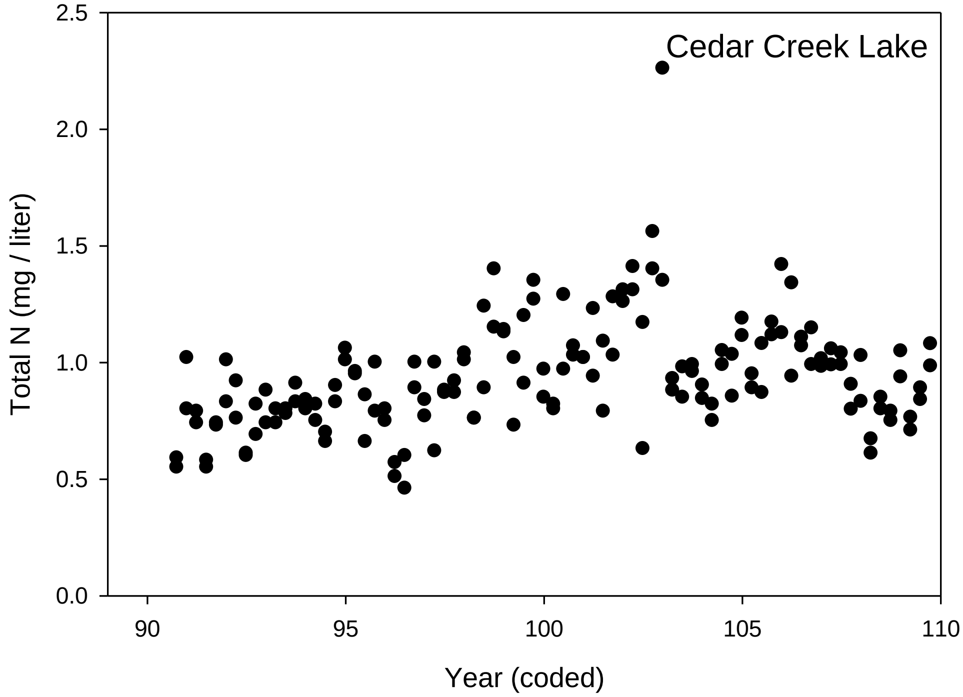
Summary of Cedar Creek Lake Trend Analysis, Main Pool Top Sites (CC-05T, CC-06T)

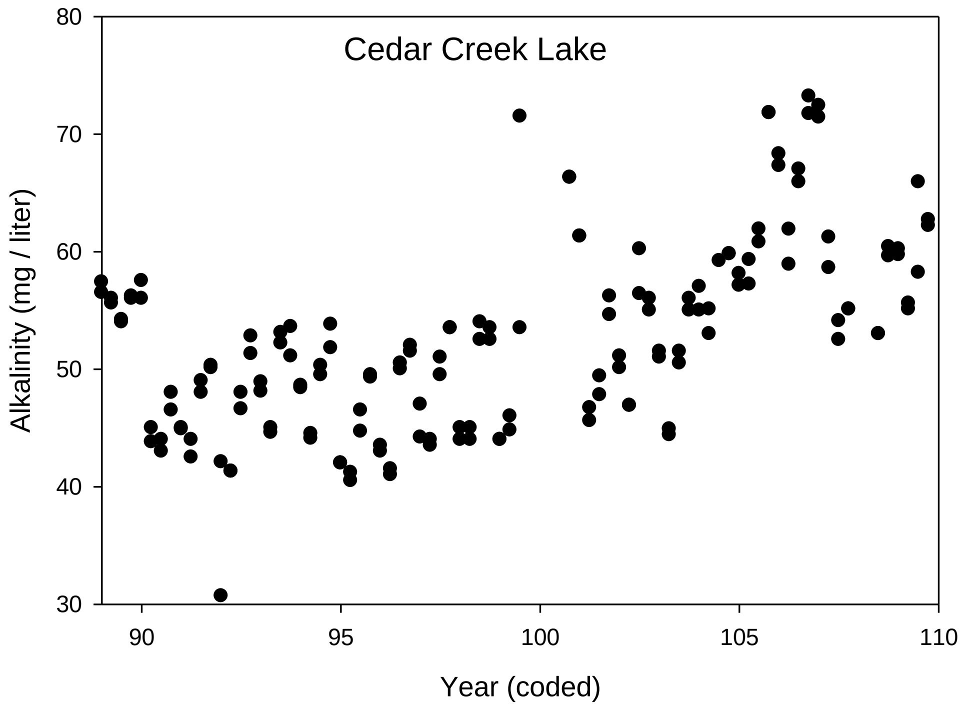
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.025**	**<0.001**	**2.53**	**28**
TP	**Log**	**0.028**	**<0.001**	**2.82**	**25**
TN	**Log**	**0.016**	**<0.001**	**1.66**	**42**
Alkalinity	**Log**	**0.014**	**<0.001**	**1.37**	**51**
Chloride	**Log**	**0.028**	**0.007**	**2.88**	**24**

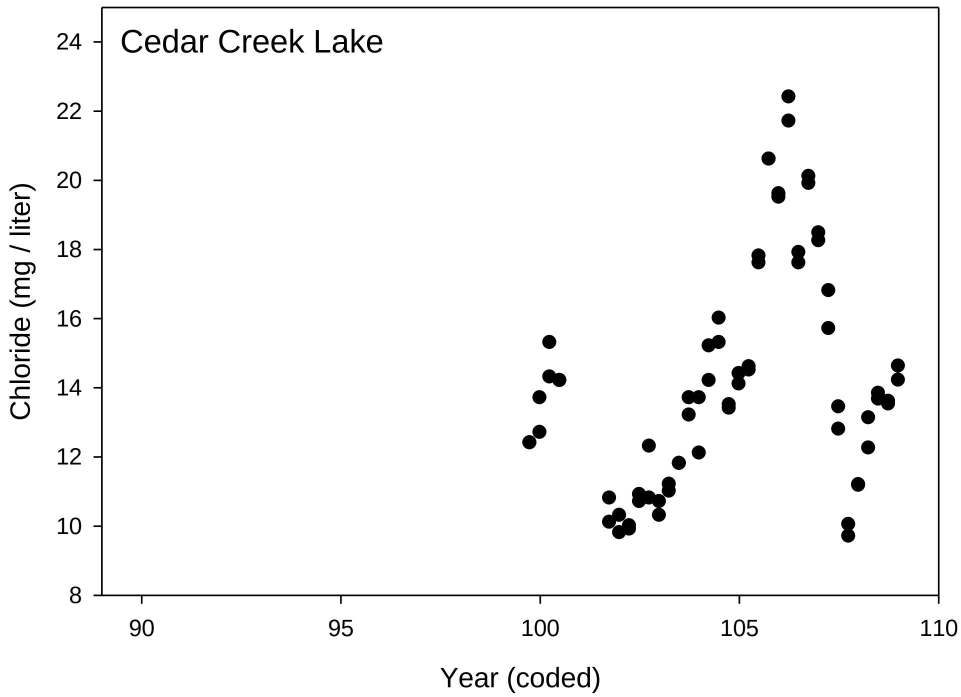
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the main pool top sites.






Cedar Creek Lake
Total N (mg / liter)
Year (coded)
0.0
0.5
1.0
1.5
2.0
2.5
90
95
100
105
110


Cedar Creek Lake
Alkalinity (mg / liter)
Year (coded)
30
40
50
60
70
80
90
95
100
105
110



Intake Site Results

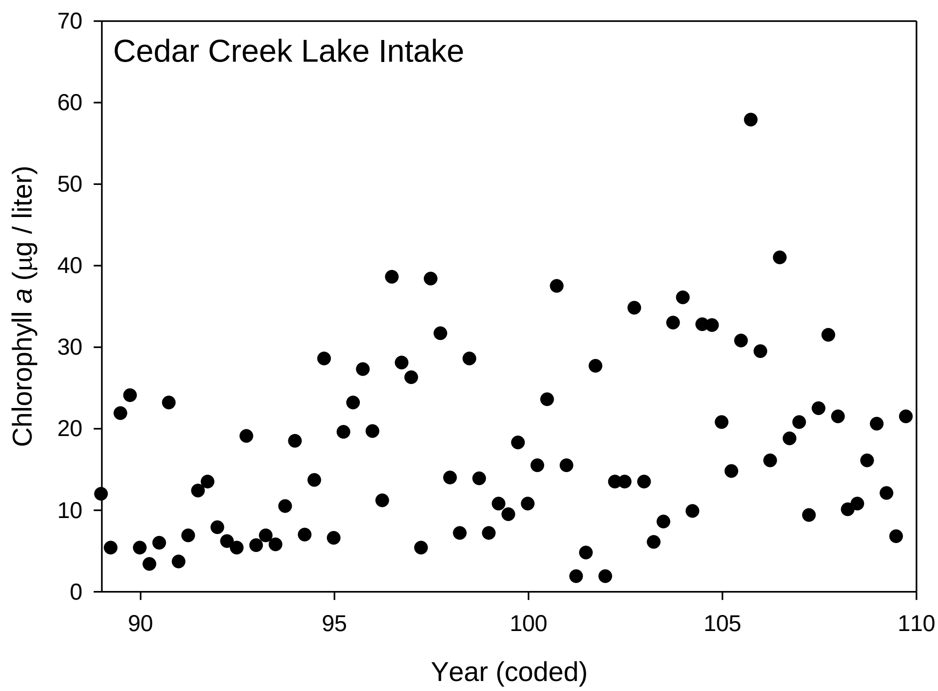
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

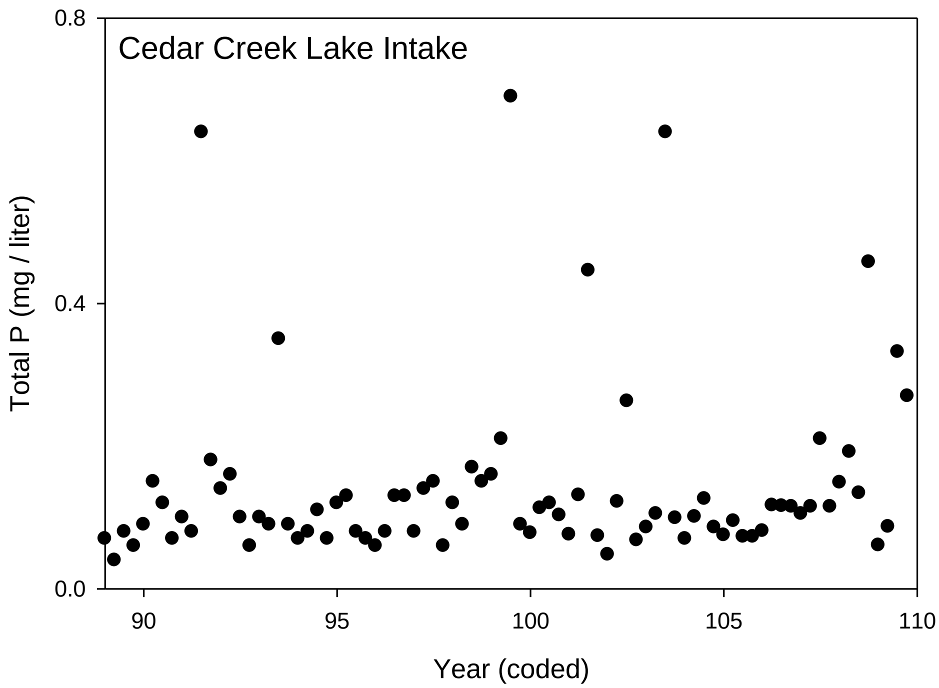
Statistically significant trends were detected for all parameters examined, except Chloride, in Cedar Creek Lake, using intake site data. Chl a increased with a doubling time of 25 yr, while TP and TN increased with doubling times of 40 and 59 years, respectively. DOC and TOC also increased. These trends are consistent with the indications of eutrophication seen in the whole-lake analysis.

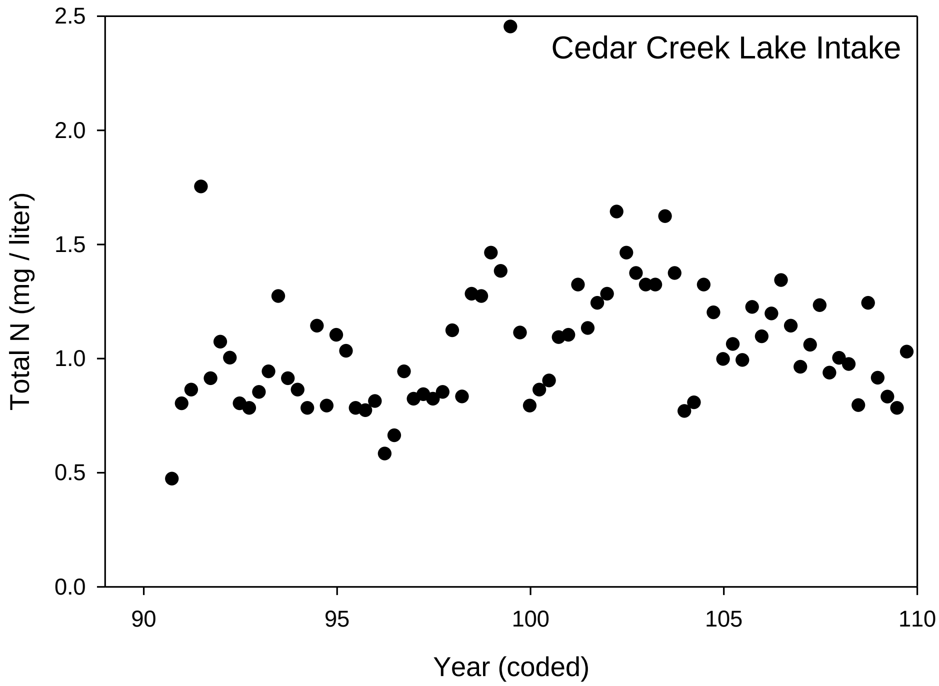
Summary of Cedar Creek Lake Analysis Intake Site (CC-04M)

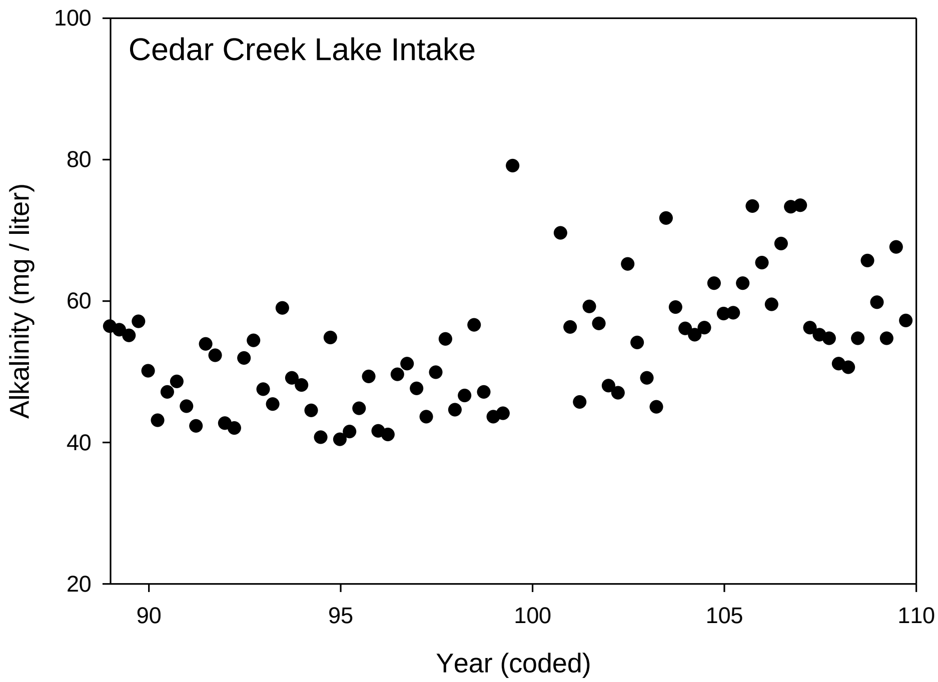
Parameter	**Model**	**Time Coefficient**	**P-value**	**APR (%)**	**Double/Half Time (yr)**
Chl *a*	**Log**	**0.026**	**0.002**	**2.67**	**26**
DOC	**Basic**	**0.064**	**<0.001**		
TOC	**Log**	**0.006**	**0.008**	**0.57**	**121**
TP	**Log**	**0.017**	**0.005**	**1.74**	**40**
TN	**Log**	**0.012**	**0.020**	**1.18**	**59**
Alkalinity	**Log**	**0.013**	**<0.001**	**1.34**	**52**
Chloride	Log	0.005	0.22	0.55	127

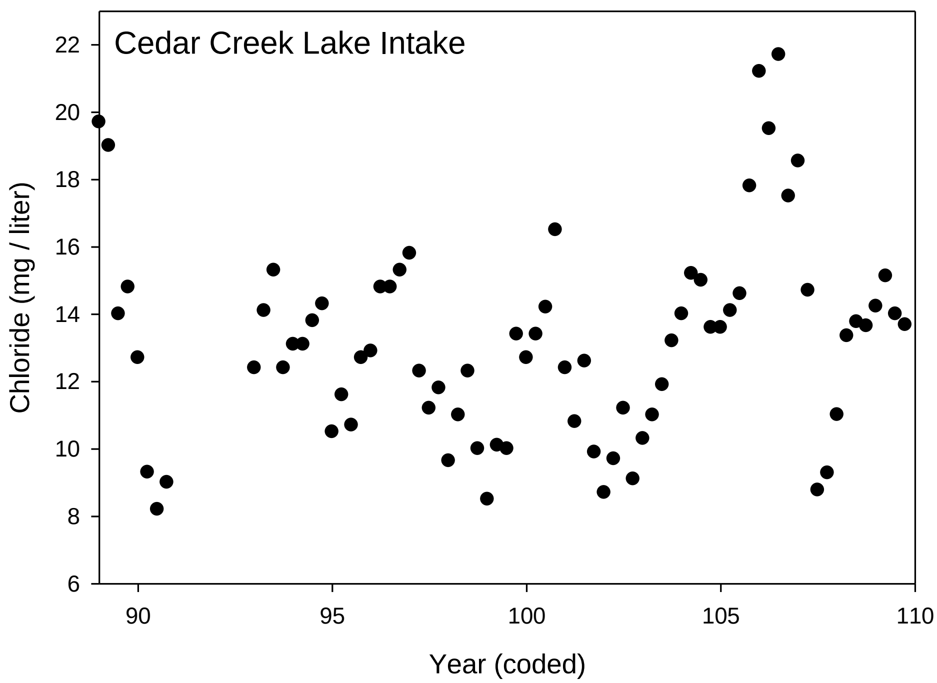
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the intake site.






Cedar Creek Lake Intake
Total N (mg / liter)
Year (coded)
0.0
0.5
1.0
1.5
2.0
2.5
90
95
100
105
110


Cedar Creek Lake Intake
Alkalinity (mg / liter)
Year (coded)
20
40
60
80
100
90
95
100
105
110



Bottom Site Results

The following table presents trend coefficients and significance values, for trend regressions using data from bottom sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement. Only one significant trend was detected. DO decreased at a linear rate of 0.055 mg/L per year. This result indicates a result consistent with other indicators of eutrophication, indicating deep water oxygen depletion. However, trends are not significant for NH_3 and Ortho-PO_4, suggesting that attendant internal loading of these nutrients is not increasing.

Summary of Cedar Creek Lake Trend Analysis Bottom Sites (CC-04B, CC-05B, CC-06B)

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
DO	**Basic**	**-0.055**	**0.013**		
NH_3	Log	0.003	0.575	0.31	222
Ortho-PO_4	Log	-0.007	0.424	-0.68	102

Richland Chambers Lake

Whole Lake Results

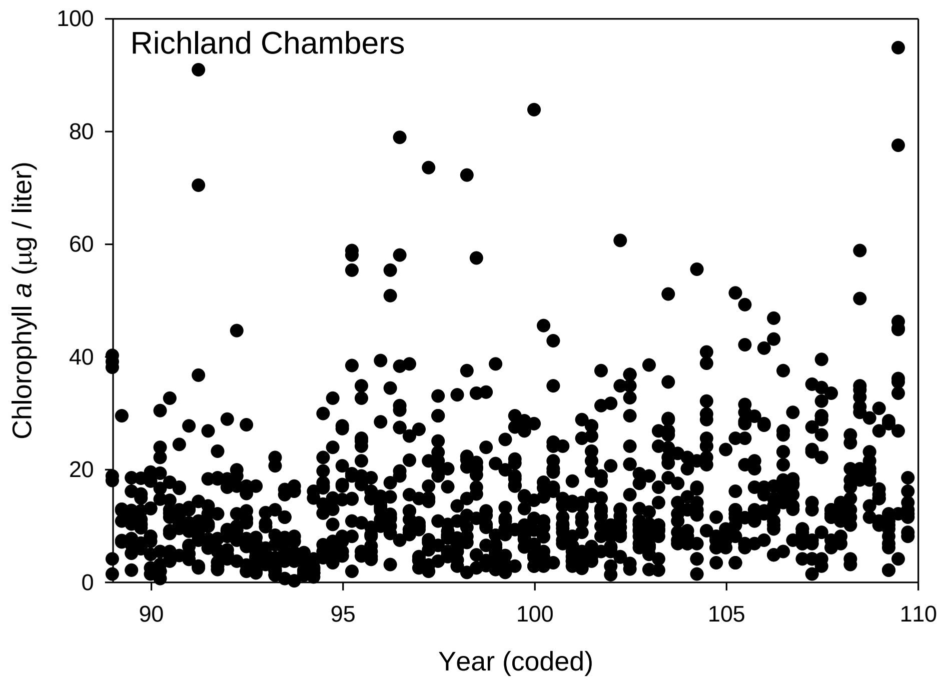
The following table presents trend coefficients and significance values, for trend regressions using all data from the lake. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

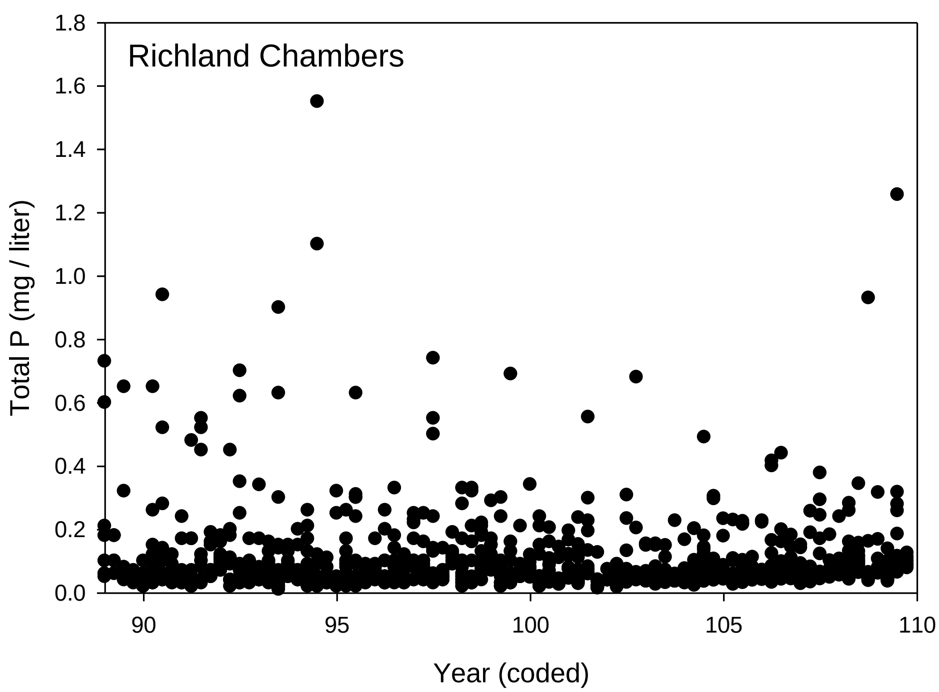
Several statistically significant trends were detected for Richland Chambers Lake, using all the data. Chl *a* is increasing with an estimated doubling time of 26 years. This trend is one of increasing eutrophication and decreasing water quality. TKN and TN are increasing with doubling times of 39 and 61 years, respectively. Secchi Depth is also decreasing at a linear rate of 0.014 m per year. All of these trends are consistent with ongoing eutrophication. DOC is also increasing, though TOC is decreasing, as are dissolved inorganic nutrients. Alkalinity and TDS are decreasing. Water temperature is also increasing at a linear rate of 0.030 °C per year.

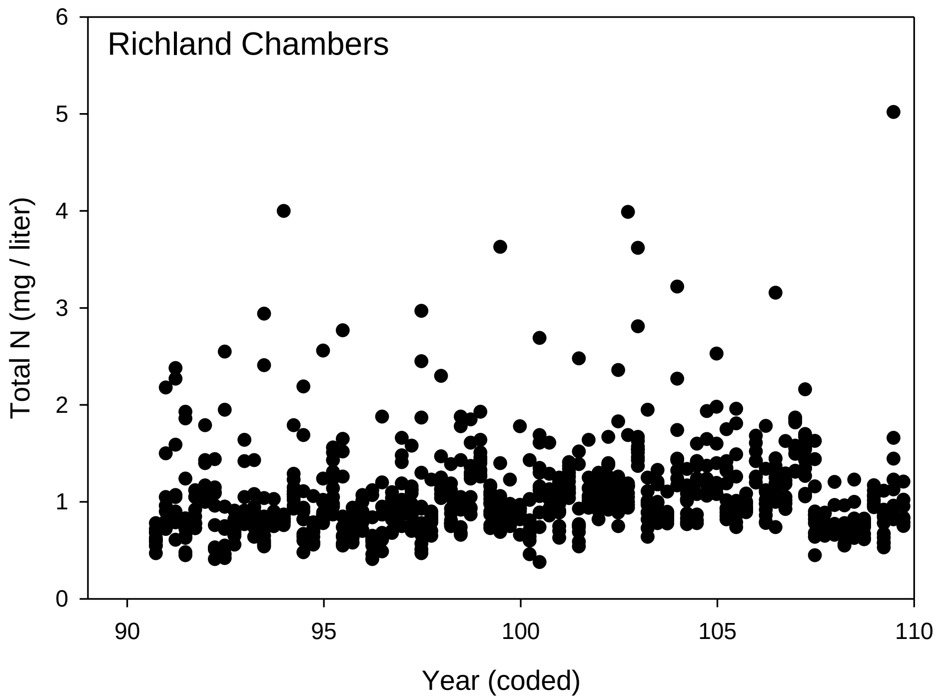
Summary of Richland Chambers Lake Trend Analysis

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.027**	**<0.001**	**2.70**	**26**
Secchi Depth	**Basic**	**-0.014**	**<0.001**		
DO	**Basic**	**0.033**	**<0.001**		
DOC	**Log**	**0.009**	**<0.001**	**0.92**	**75**
TOC	**Log**	**-0.008**	**<0.001**	**-0.81**	**85**
Ortho-PO_4	**Log**	**-0.046**	**<0.001**	**-4.48**	**15**
TP	Log	0.0004	0.90	0.0004	1650
NH_3	**Log**	**-0.395**	**<0.001**	**-32.65**	**2**
NO_X	**Log**	**-0.034**	**<0.001**	**-3.30**	**21**
TKN	**Log**	**0.018**	**<0.001**	**1.82**	**39**
TN	**Log**	**0.011**	**<0.001**	**1.15**	**61**
TN:TP	**Log**	**0.008**	**0.023**	**0.84**	**83**
Alkalinity	**Log**	**-0.009**	**<0.001**	**-0.92**	**75**
TDS	**Log**	**-0.004**	**<0.001**	**-0.42**	**166**
TSS	Log	0.005	0.12	0.47	146
Chloride	Log	-0.002	0.26	-0.24	285
Temperature	**Basic**	**0.030**	**0.025**		

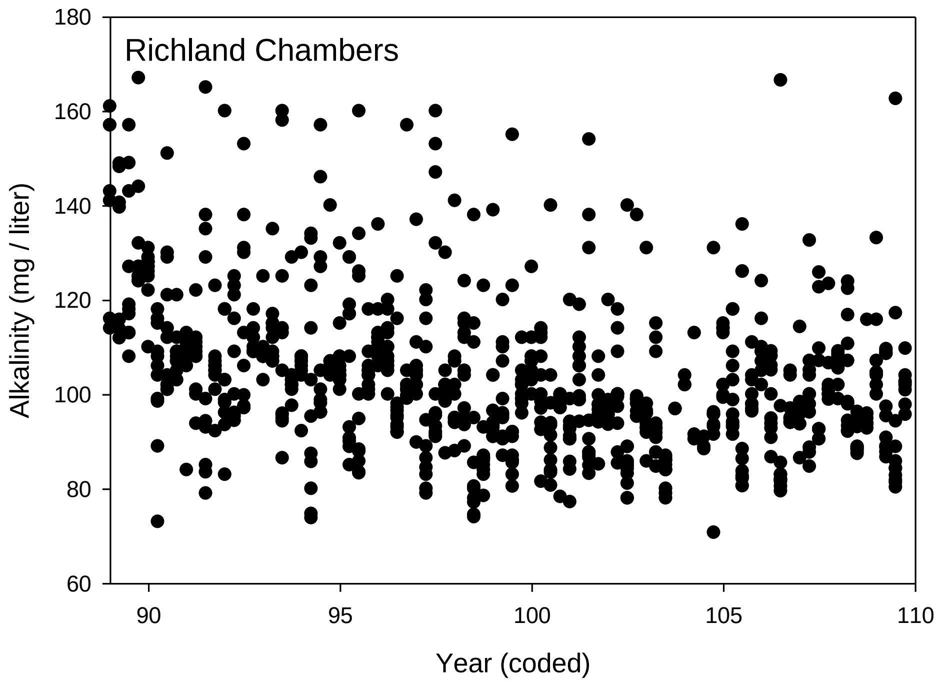
The following figures present the data for five parameters, Chl *a*, TN, TP, Alkalinity, and Chloride. The very high value displayed for TP is flagged as a verified value in the data file, so it was included in the analysis.



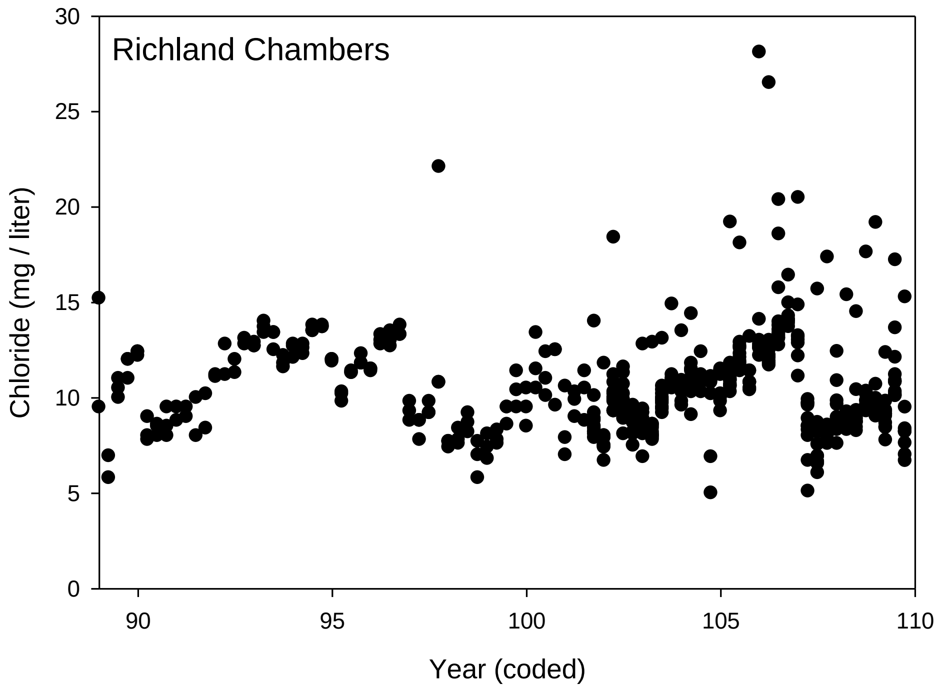




Richland Chambers
Total N (mg / liter)
Year (coded)
0
1
2
3
4
5
6
90
95
100
105
110



Richland Chambers
Alkalinity (mg / liter)
Year (coded)
60
80
100
120
140
160
180
90
95
100
105
110



Main Pool Top Sites Results

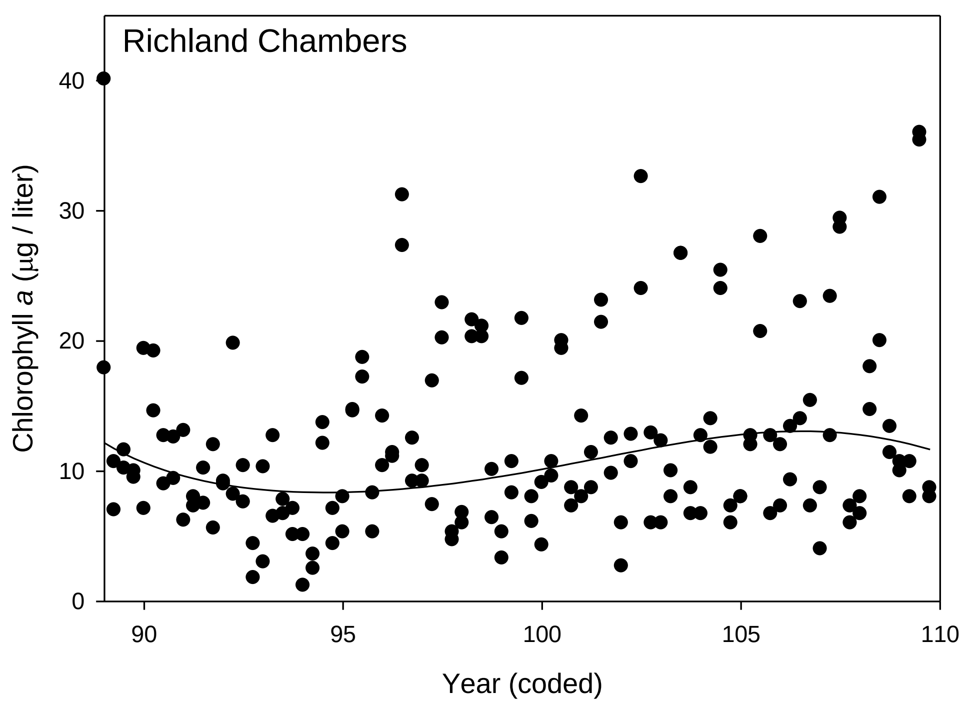
The following table presents trend coefficients and significance values, for trend regressions using data from the main pool top sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

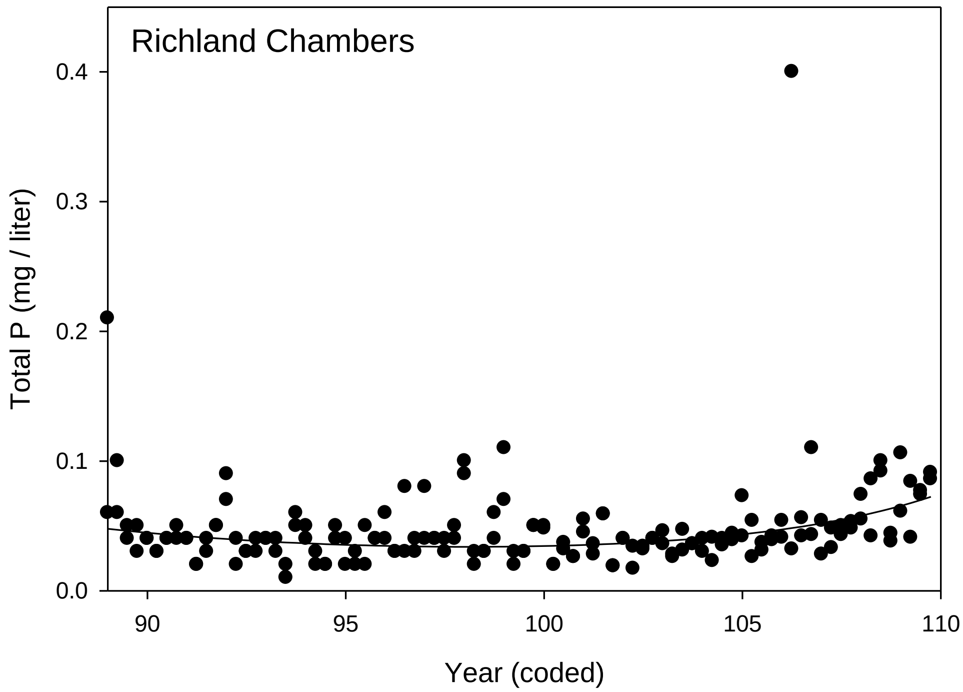
Statistically significant trends were detected for several parameters examined, in Richland Chambers Lake using main pool top data. All of these were complex trends where both a log-transformation and cubic trend model were used. For all of these trends, the net rate of trend over 20 years, and over the past 10 years was calculated to convey the different trends over these time frames. Chl *a* displayed a net decrease over all 20 years, at a rate of -0.02 mg/L per year; but over the past 10 years it increased at a rate of 0.17 mg/L per year. Chl *a* displayed an increase over all 20 years, at a rate of 0.001 mg/L per year; but over the past 10 years it increased at a more rapid rate of 0.004 mg/L per year. Although TN displayed an increase over all 20 years at a rate of 0.005 mg/L per year, it decreased over the past 10 years at a more rapid rate of -0.01 mg/L per year. Taken together, these trends suggest that although no overall trend to eutrophication occurred, during the past 10 years both Chl *a* and TP have increased, which may indicate that eutrophication has recently begun in this lake. Alkalinity decreased over both the past 10 and the past 20 years, while Chloride did not have a significant trend.

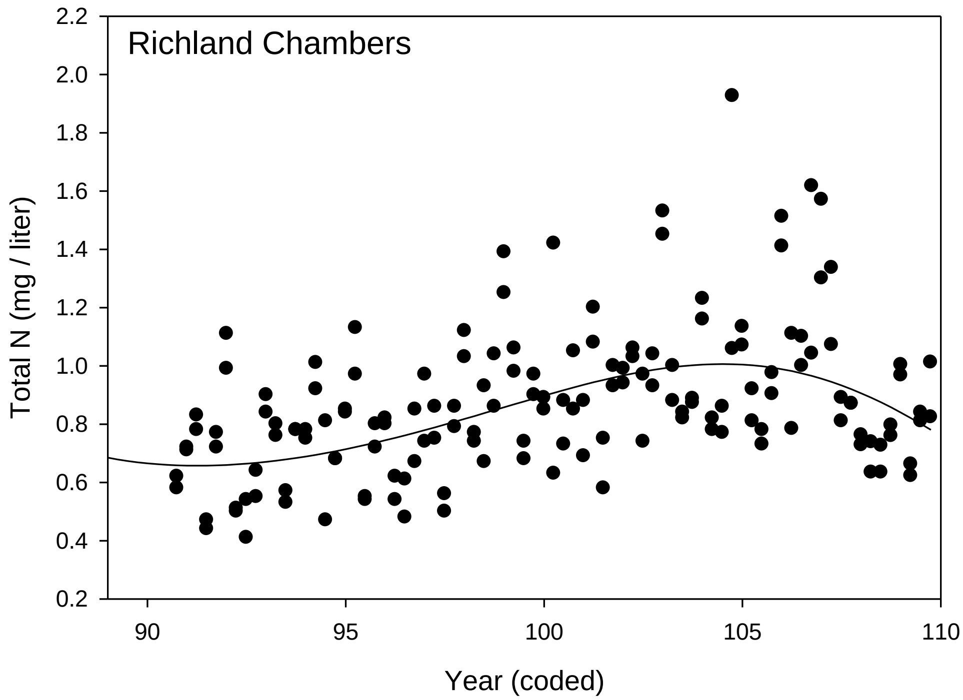
Summary of Richland Chambers Lake Trend Analysis,
Main Pool Top Sites (RC-01T, RC-02T)

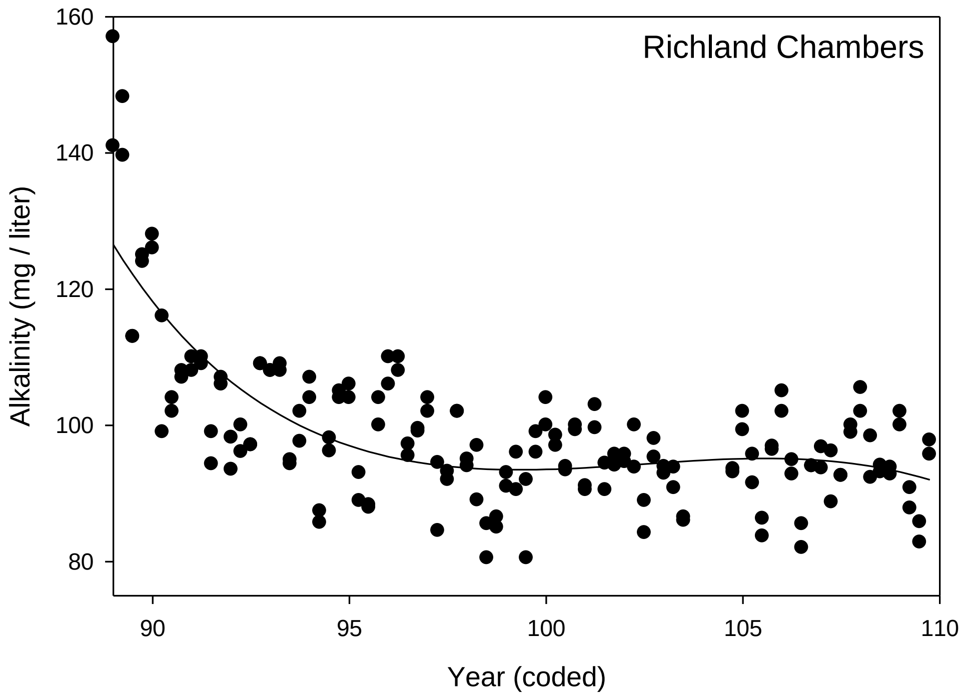
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log-Cubic**			**(-0.02, 0.17)**	
	Linear	**0.054**	**< 0.001**		
	Quadratic	**0.0018**	**0.092**		
	Cubic	**-0.00052**	**0.011**		
TP	**Log-Cubic**			**(0.001, 0.004)**	
	Linear	**0.012**	**0.33**		
	Quadratic	**0.0051**	**< 0.001**		
	Cubic	**7.1E-05**	**0.69**		
TN	**Log-Cubic**			**(0.005, -0.01)**	
	Linear	**0.046**	**< 0.001**		
	Quadratic	**-0.0017**	**0.013**		
	Cubic	**-0.00036696**	**0.002**		
Alkalinity	**Log-Cubic**			**(-1.67, -0.15)**	
	Linear	**0.00011**	**0.96**		
	Quadratic	**0.0013**	**< 0.001**		
	Cubic	**-0.00014**	**< 0.001**		
Chloride	Log	0.0026	0.78	0.26	264

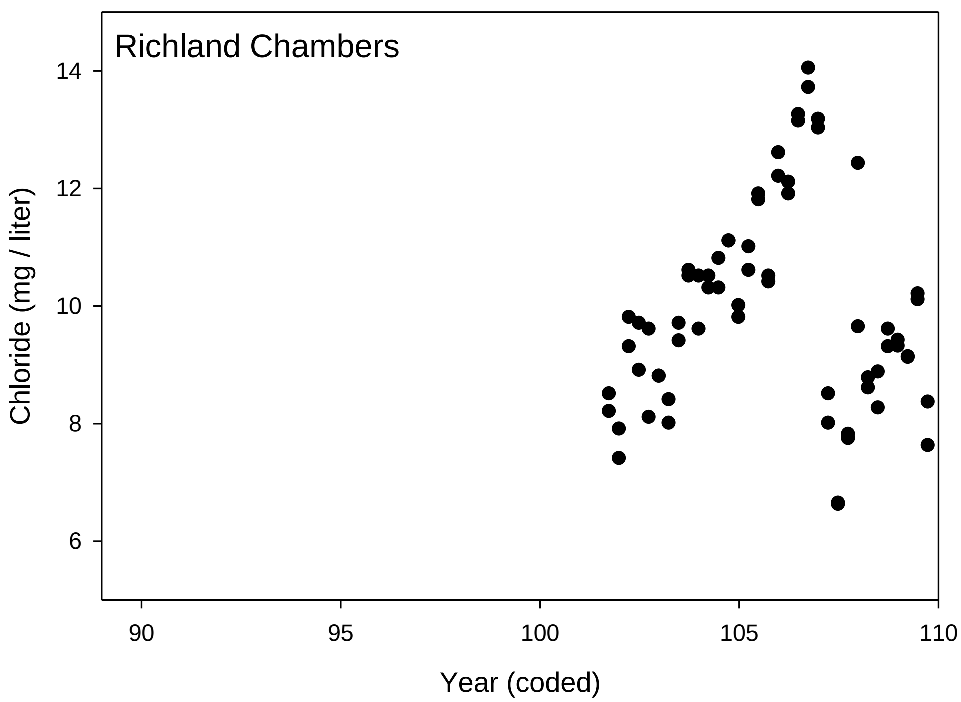
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the main pool top sites.




Richland Chambers
Total P (mg / liter)
0.0
0.1
0.2
0.3
0.4
90
95
100
105
110
Year (coded)


Richland Chambers
Total N (mg / liter)
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
90
95
100
105
110
Year (coded)





Intake Site Results

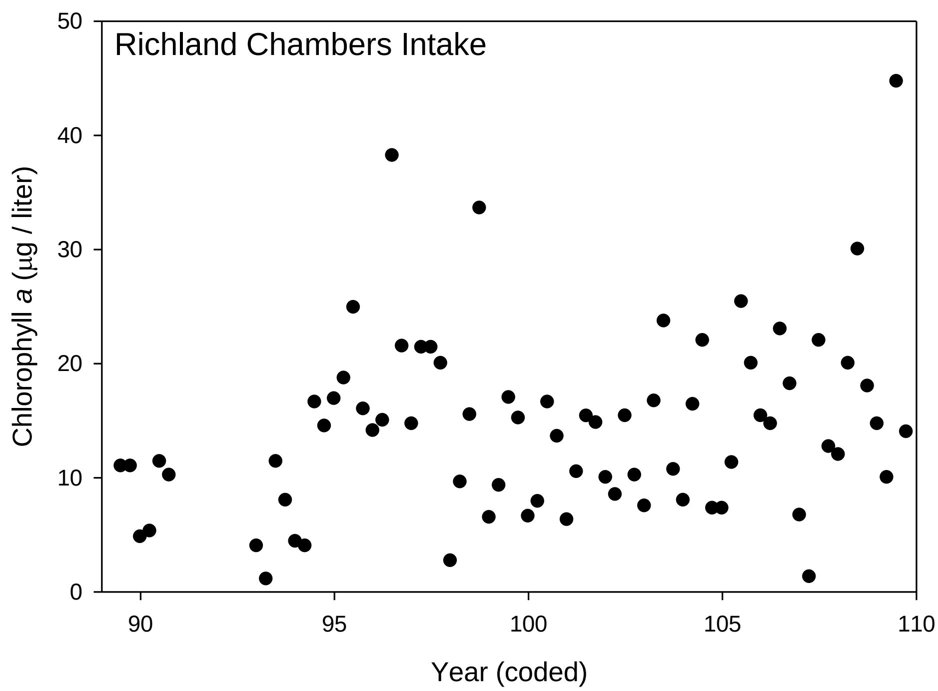
The following table presents trend coefficients and significance values, for trend regressions using data from the intake site. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

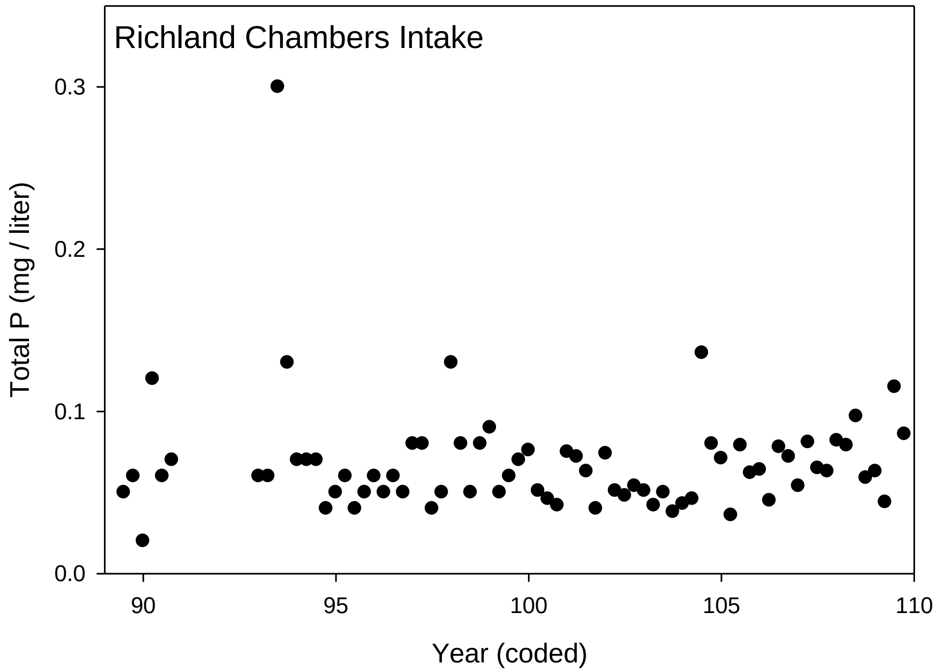
Statistically significant trends were detected for several parameters examined, in Richland Chambers Lake using intake site data. Chl a increased with a doubling time of 23 yr, while TN increased with a doubling time 51 years. DOC also increased, while TOC decreased. These trends are largely consistent with the indications of eutrophication seen in the whole-lake analysis. Alkalinity also decreased.

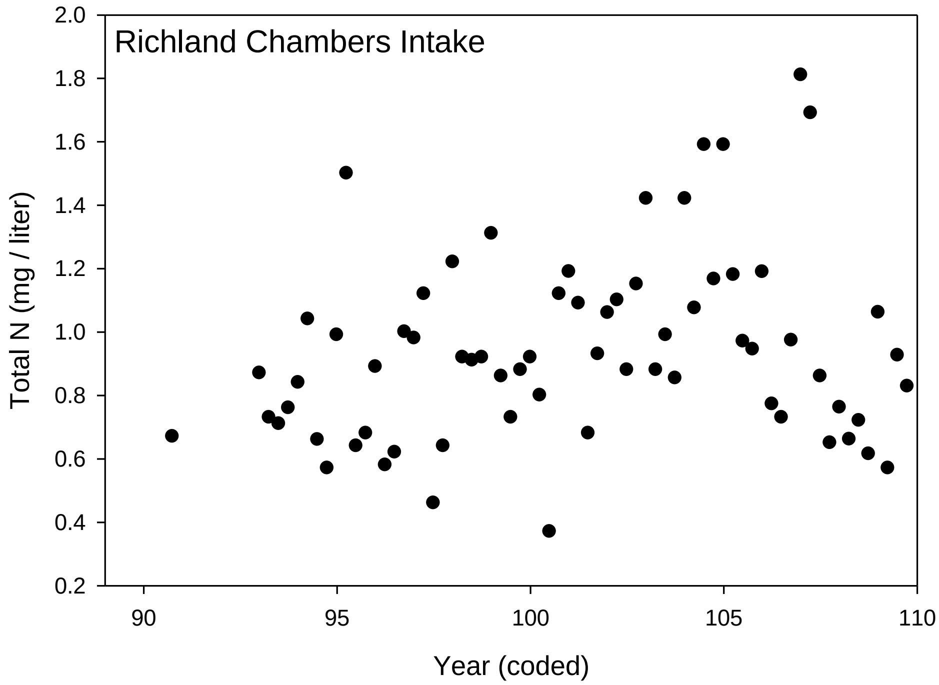
Summary of Richland Chambers Lake Analysis Intake Site (RC-05M)

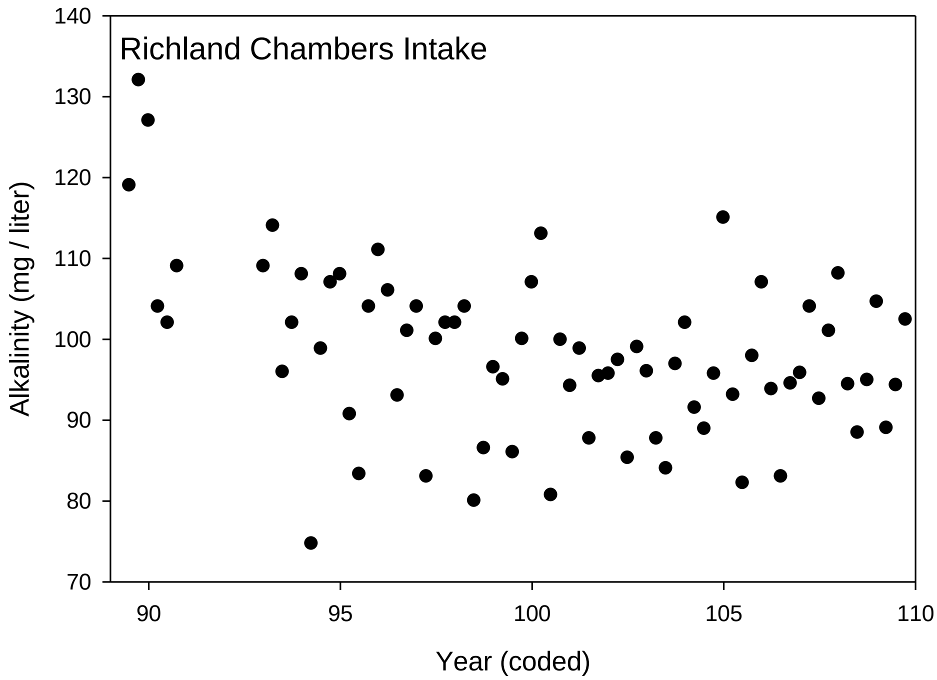
Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Chl *a*	**Log**	**0.030**	**0.009**	**3.05**	**23**
DOC	**Log**	**0.006**	**0.020**	**0.64**	**109**
TOC	**Log**	**-0.008**	**0.014**	**-0.80**	**86**
TP	Log	0.003	0.71	0.30	232
TN	**Log**	**0.014**	**0.039**	**1.36**	**51**
Alkalinity	**Log**	**-0.007**	**<0.001**	**-0.67**	**104**
Chloride	Log	-0.006	0.14	-0.58	119

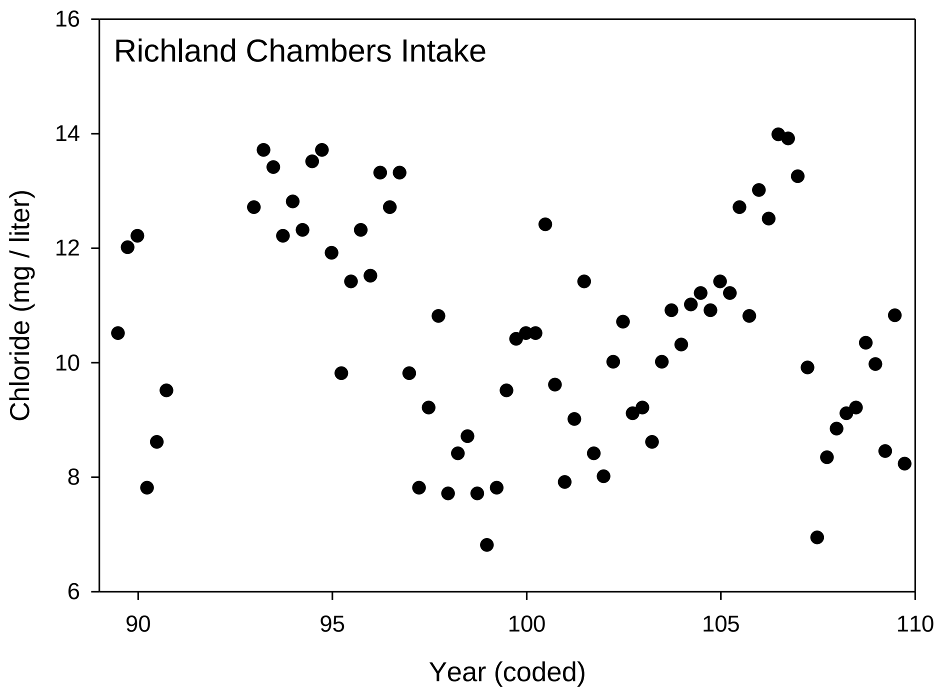
The following figures present the data for five parameters, Chl a, TN, TP, Alkalinity, and Chloride, at the intake site.




Richland Chambers Intake
Total P (mg / liter)
0.0
0.1
0.2
0.3
90
95
100
105
110
Year (coded)


Richland Chambers Intake
Total N (mg / liter)
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
90
95
100
105
110
Year (coded)





Bottom Site Results

The following table presents trend coefficients and significance values, for trend regressions using data from bottom sites. APR and doubling times or half-lives are calculated for regressions using a logarithmic transformation. When the Basic Model (without logarithmic transformation) is used, the time coefficient is the rate of trend in units / year, where the units are those of the water quality parameter measurement.

Significant trend was detected for NH_3 and Ortho-PO_4, which both decreased with half-lives of 16 years. This result suggests that internal loading of these nutrients is not increasing, despite other indications of eutrophication in this lake.

Summary of Richland Chambers Lake Trend Analysis Bottom Sites (RC-01B, RC-02B, RC-03B, RC-05B)

Parameter	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
DO	Basic	0.025	0.137		
NH_3	Log	-0.043	<0.001	-4.18	16
Ortho-PO_4	Log	-0.044	<0.001	-4.27	16

Trend Analysis for Algae – All Lakes

Data on algae were collected at only one site on each lake, and trends were analyzed by descriptive regression only for data from top samples. Therefore the regression model (equation 1) was modified by removing site terms (β_j) and site-by-quarter interaction terms (β_{ij}). Four response variables were analyzed relating to algae, the abundances of Total Algae, Bluegreen Algae, and Green Algae, and the proportion of Bluegreen Algae in relation to Total Algae. The first three of these variables were log-transformed for the trend analysis.

Seven tables follow summarizing the results for each of the seven lakes. For Lake Bridgeport, no algal variable showed a significant trend, although the abundance of Bluegreen Algae increased with a non-significant trend. Also for Lake Arlington, no algal variable showed a significant trend, though all of them increased with non-significant trends, Bluegreen Algae especially rapidly. Data series for Lake Arlington were very short, and so power to detect trends was low. In all other lakes, abundances of both Total Algae and Bluegreen Algae increased significantly and rapidly, with relatively short doubling times (ranging 5-9 years for Bluegreen Algae, and 11-19 years for Total Algae). In addition, the proportion of Bluegreen Algae increased significantly in Lake Worth, Cedar Creek Lake, and Richland Chambers Lake. The abundance of Green Algae increases significantly in Eagle Mountain Lake only.

Summary of Lake Bridgeport Trend Analysis Algae Top Samples Only

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Total Algae	Log	-0.010	0.48	-1.04	66
Bluegreens	Log	0.026	0.29	2.67	26
Greens	Log	-0.021	0.39	-2.09	33
Proportion Bluegreens	Basic	0.003	0.56		

Summary of Eagle Mountain Lake Trend Analysis
Algae Top Samples Only

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Total Algae	**Log**	**0.050**	**<0.001**	**5.13**	**14**
Bluegreens	**Log**	**0.091**	**<0.001**	**9.57**	**8**
Greens	**Log**	**0.043**	**0.014**	**4.37**	**16**
Proportion Bluegreens	Basic	0.007	0.12		

Summary of Lake Worth Trend Analysis
Algae Top Samples Only

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Total Algae	**Log**	**0.037**	**0.003**	**3.73**	**19**
Bluegreens	**Log**	**0.075**	**<0.001**	**7.77**	**9**
Greens	Log	0.017	0.28	1.70	41
Proportion Bluegreens	**Basic**	**0.010**	**0.017**		

Summary of Benbrook Lake Trend Analysis
Algae Top Samples Only

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Total Algae	**Log**	**0.051**	**0.040**	**5.24**	**14**
Bluegreens	**Log**	**0.146**	**<0.001**	**15.75**	**5**
Greens	Log	0.067	0.059	6.90	10
Proportion Bluegreens	Basic	0.008	0.25		

Summary of Lake Arlington Trend Analysis
Algae Top Samples Only

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Total Algae	Log	0.033	0.46	3.37	21
Bluegreens	Log	0.050	0.29	5.16	14
Greens	Log	0.011	0.87	1.11	63
Proportion Bluegreens	Basic	0.011	0.14		

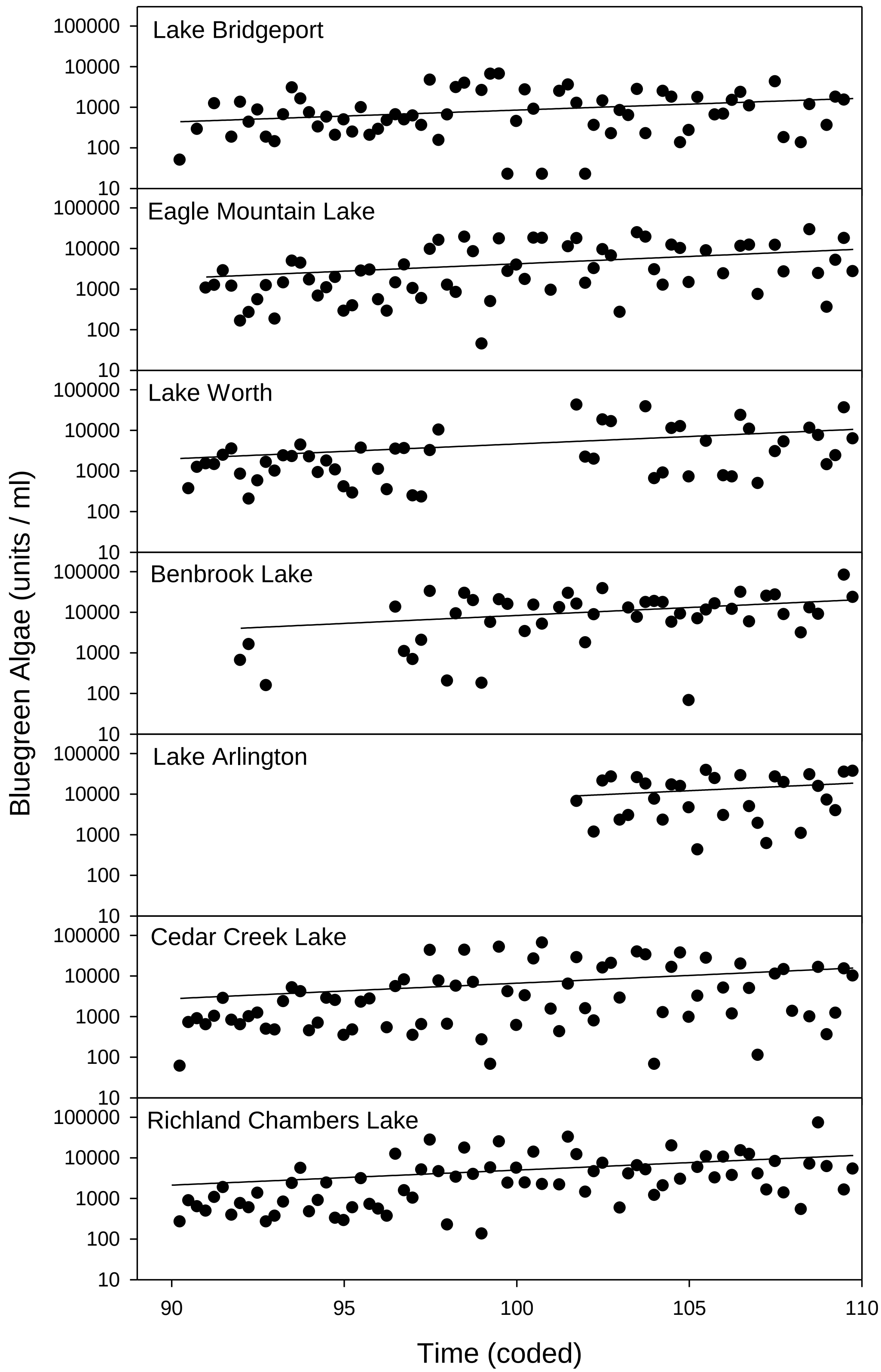
Summary of Cedar Creek Lake Trend Analysis
Algae Top Samples Only

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Total Algae	**Log**	**0.064**	**<0.001**	**6.63**	**11**
Bluegreens	**Log**	**0.092**	**<0.001**	**9.63**	**8**
Greens	Log	0.029	0.069	2.93	24
Proportion Bluegreens	**Basic**	**0.013**	**0.001**		

Summary of Richland Chambers Lake Trend Analysis
Algae Top Samples Only

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
Total Algae	**Log**	**0.065**	**<0.001**	**6.70**	**11**
Bluegreens	**Log**	**0.121**	**<0.001**	**12.82**	**6**
Greens	Log	0.009	0.64	0.90	77
Proportion Bluegreens	**Basic**	**0.019**	**<0.001**		

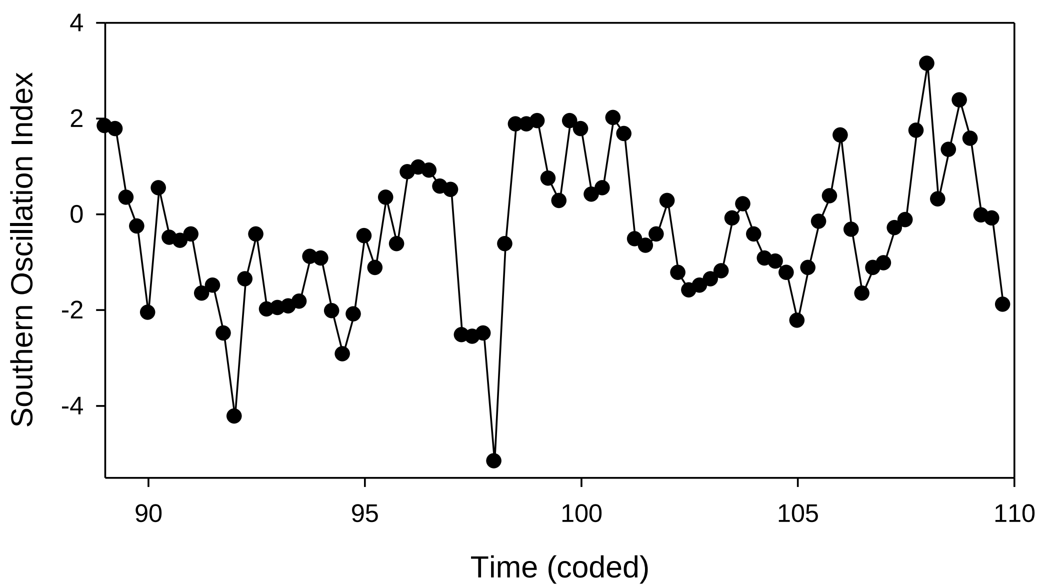
Because significant increasing trends of Bluegreen Algae were noted in five of seven lakes, data in all lakes are shown in the following figures.


Lake Bridgeport
Eagle Mountain Lake
Lake Worth
Benbrook Lake
Lake Arlington
Cedar Creek Lake
Richland Chambers Lake
100000
10000
1000
100
10
Bluegreen Algae (units / ml)
90
95
100
105
110
Time (coded)

Explanatory Regressions

Independent Variables

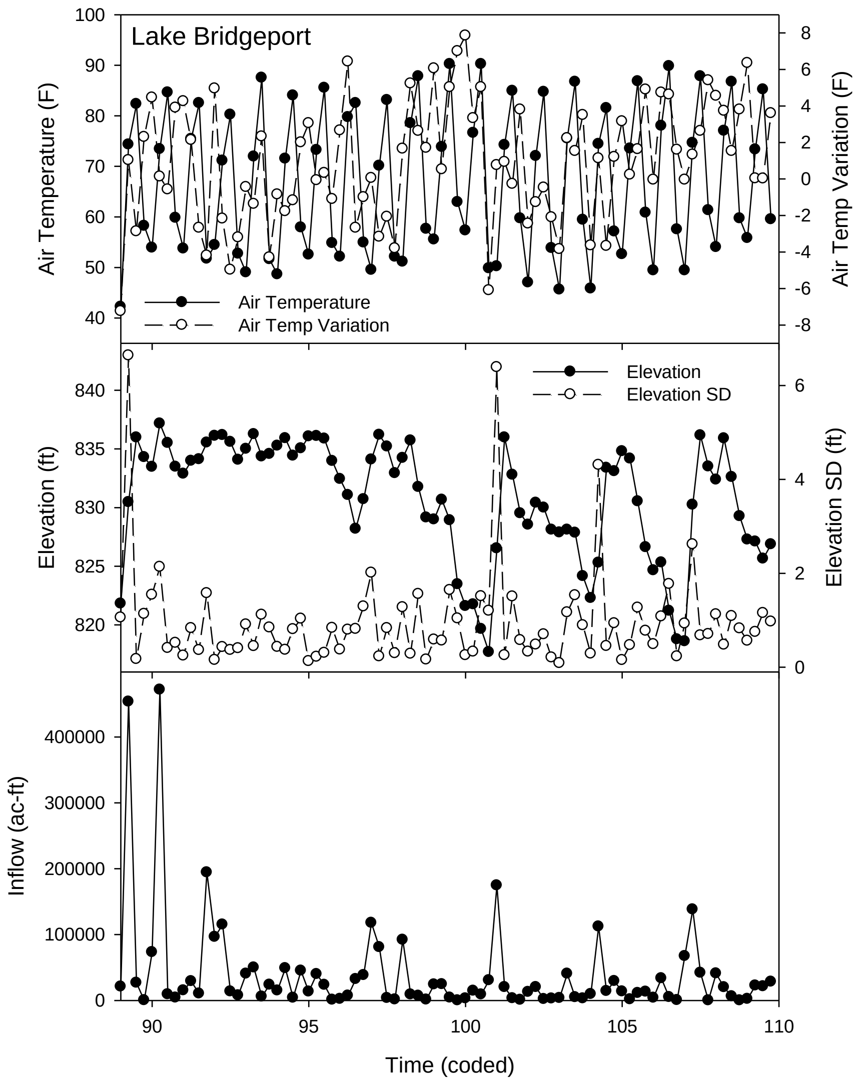
For those explanatory variables not already analyzed, a trend analysis was conducted (for Southern Oscillation Index, Air Temperature, Air Temperature Variation, Elevation, Elevation Standard Deviation, Tributary Inflow, and Pumpage Into). The SOI variable is a general indicator of climatic conditions and was averaged over quarters, so that it was the same data series for all lakes. It showed a significant increasing trend over the period of record, but with large variations around this trend (figure below).



In Lake Bridgeport, Air Temperature and Air Temperature Variation both significantly increased (due to the mathematical relationship between these variables, they always share the same trend). Elevation significantly decreased. All explanatory variables displayed large short-term variation around their long-term means and trends.

Summary of Lake Bridgeport Trend Analysis Explanatory Variables

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
SOI	**Basic**	**0.059**	**0.034**		
Air Temp.	**Basic**	**0.154**	**0.008**		
Air Temp. Var.	**Basic**	**0.154**	**0.008**		
Elevation	**Basic**	**-0.388**	**<0.001**		
Elevation SD	Log	0.010	0.50	1.05	66
Trib. Inflow	Log	-0.045	0.084	-4.41	15

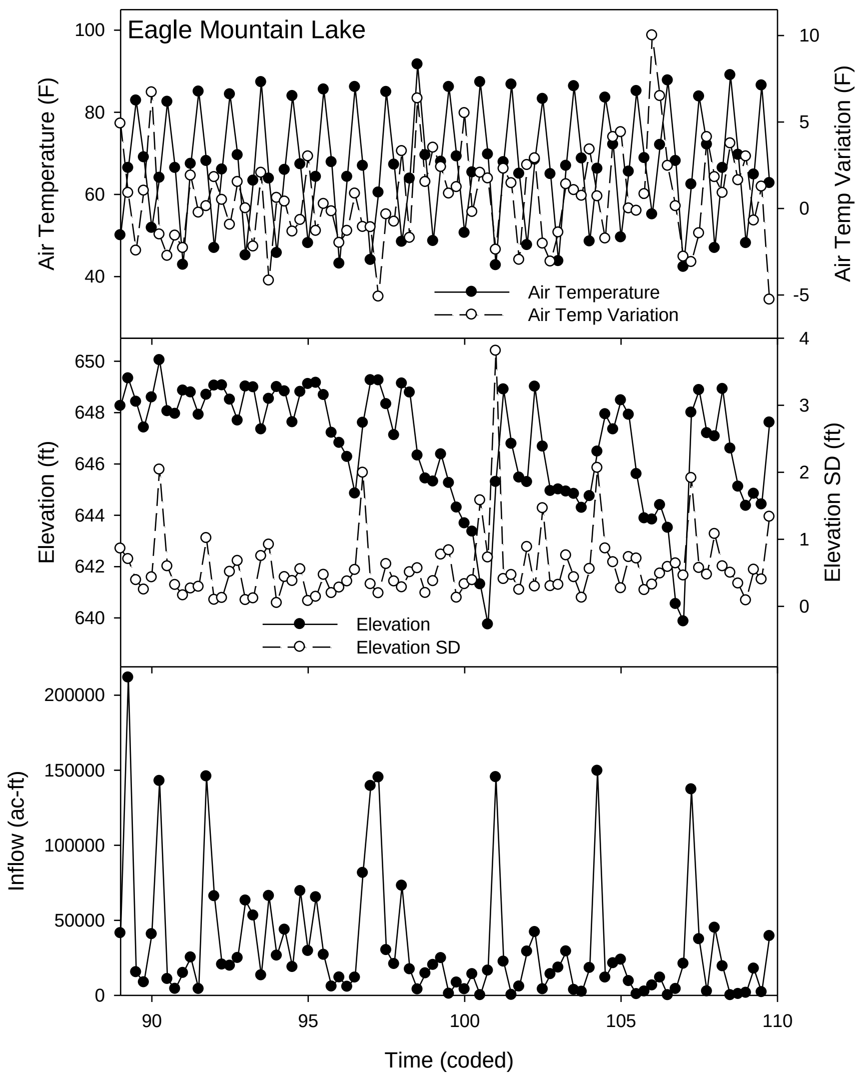


Lake Bridgeport
Air Temperature
Air Temp Variation
Air Temperature (F)
Air Temp Variation (F)
Elevation
Elevation SD
Elevation (ft)
Elevation SD (ft)
Inflow (ac-ft)
Time (coded)

In Eagle Mountain Lake, Elevation and Tributary Inflow significantly decreased. All explanatory variables displayed large short-term variation around their long-term means and trends.

Summary of Eagle Mountain Lake Trend Analysis Explanatory Variables

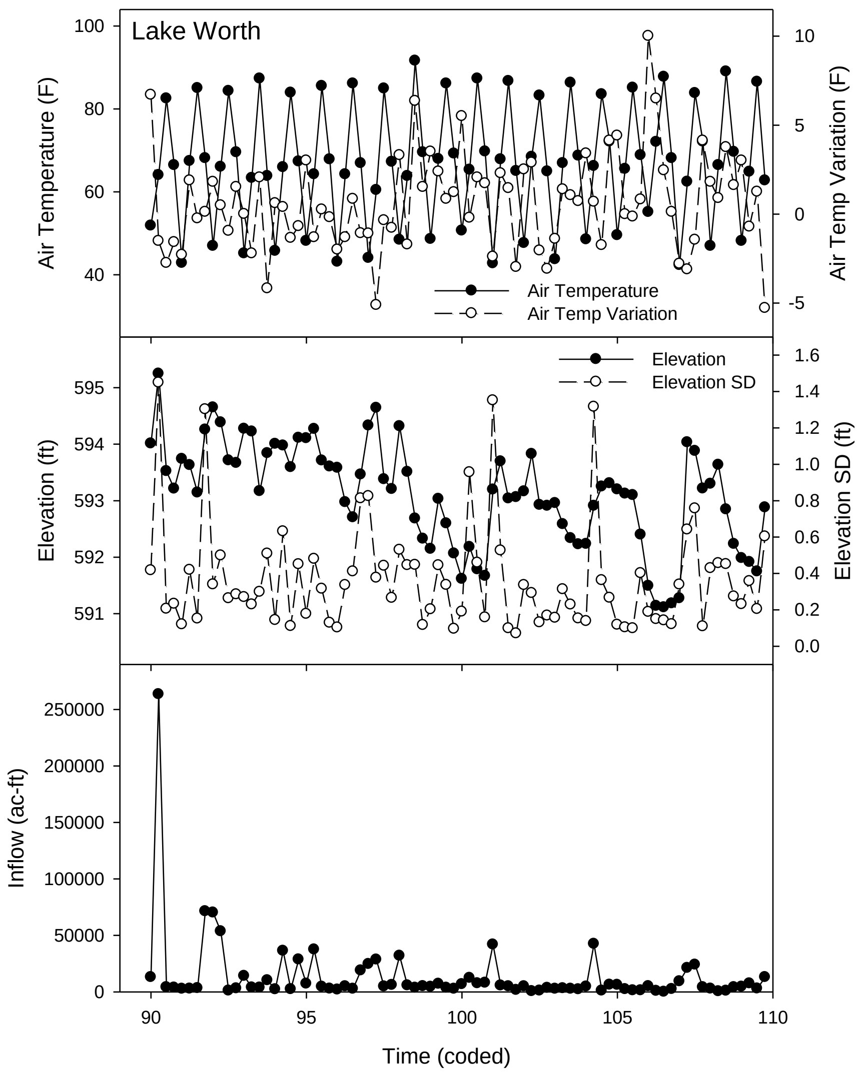
Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
SOI	**Basic**	**0.059**	**0.034**		
Air Temp.	Basic	0.069	0.15		
Air Temp. Var.	Basic	0.069	0.15		
Elevation	**Basic**	**-0.196**	**<0.001**		
Elevation SD	Log	0.027	0.06	2.69	26
Trib. Inflow	**Log**	**-0.080**	**<0.001**	**-7.71**	**9**



In Lake Worth, Elevation, and Tributary Inflow significantly decreased. All explanatory variables displayed large short-term variation around their long-term means and trends.

Summary of Lake Worth Trend Analysis Explanatory Variables

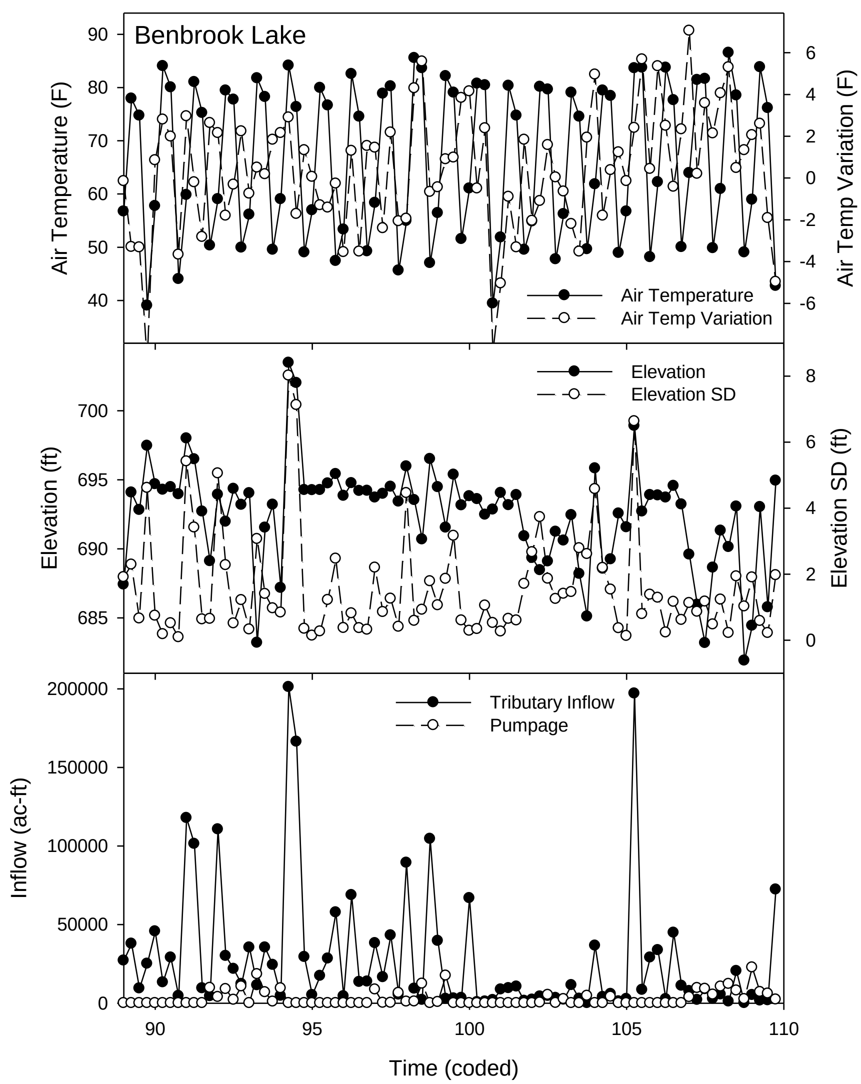
Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
SOI	**Basic**	**0.059**	**0.034**		
Air Temp.	Basic	0.087	0.093		
Air Temp. Var.	Basic	0.087	0.093		
Elevation	**Basic**	**-0.094**	**<0.001**		
Elevation SD	Log	-0.015	0.27	-1.44	48
Trib. Inflow	**Log**	**-0.065**	**0.004**	**-6.32**	**11**



In Lake Benbrook, Temperature and Air Temperature Variation significantly increased. Elevation and Tributary Inflow significantly decreased. All explanatory variables displayed large short-term variation around their long-term means and trends.

Summary of Benbrook Lake Trend Analysis Explanatory Variables

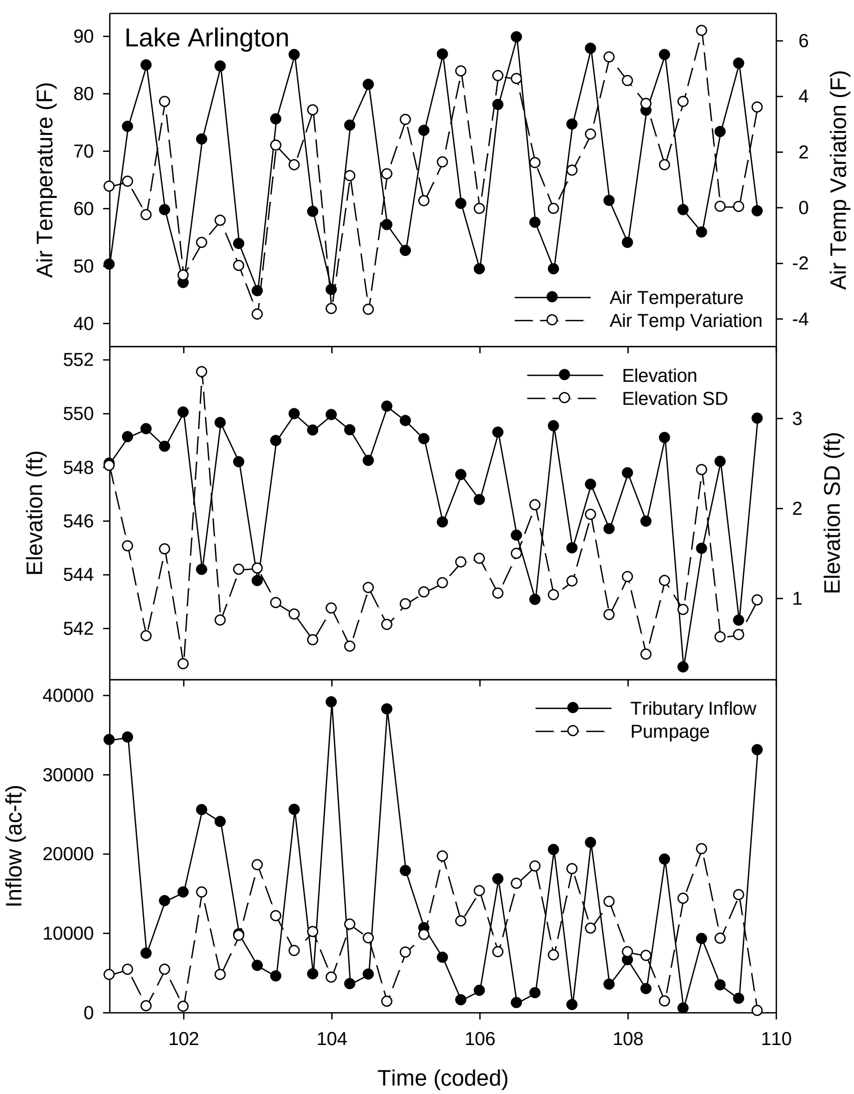
Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
SOI	**Basic**	**0.059**	**0.034**		
Air Temp.	**Basic**	**0.120**	**0.023**		
Air Temp. Var.	**Basic**	**0.120**	**0.023**		
Elevation	**Basic**	**-0.231**	**<0.001**		
Elevation SD	Log	-0.005	0.80	-0.47	146
Trib. Inflow	**Log**	**-0.094**	**<0.001**	**-8.97**	**7**
Pumpage Into	Log	0.025	0.56	2.52	28



In Lake Arlington, Temperature and Air Temperature Variation significantly increased. Elevation and Tributary Inflow significantly decreased. All explanatory variables displayed large short-term variation around their long-term means and trends.

Summary of Lake Arlington Trend Analysis Explanatory Variables

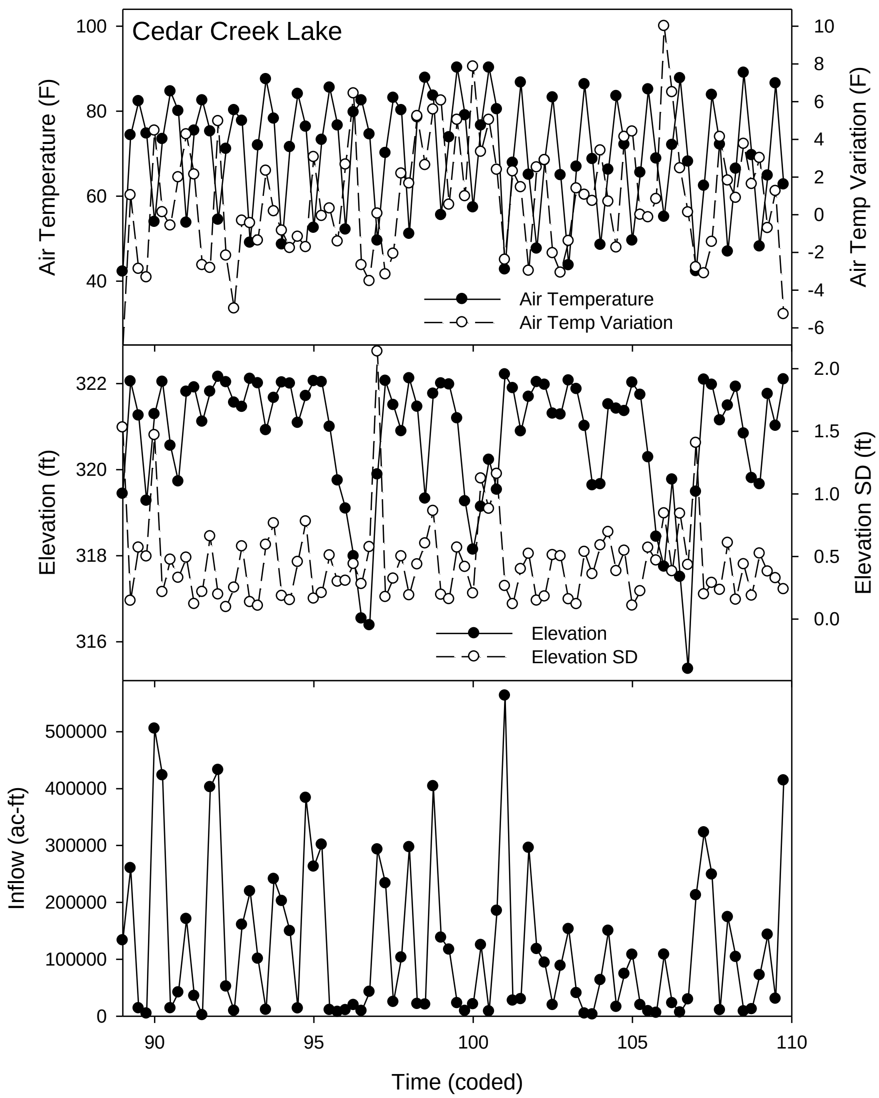
Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
SOI	**Basic**	**0.059**	**0.034**		
Air Temp.	**Basic**	**0.444**	**0.006**		
Air Temp. Var.	**Basic**	**0.444**	**0.006**		
Elevation	**Basic**	**-0.371**	**0.024**		
Elevation SD	Log	-0.012	0.75	-1.14	60
Trib. Inflow	**Log**	**-0.177**	**0.017**	**-16.20**	**4**
Pumpage Into	Log	0.055	0.43	5.69	13



In Cedar Creek Lake, Temperature significantly increased. The index month for this lake changed in 2001, so trends in Air Temperature and Air Temperature Variation were not equivalent (and the latter did not have a significant trend). All explanatory variables displayed large short-term variation around their long-term means and trends.

Summary of Cedar Creek Lake Trend Analysis Explanatory Variables

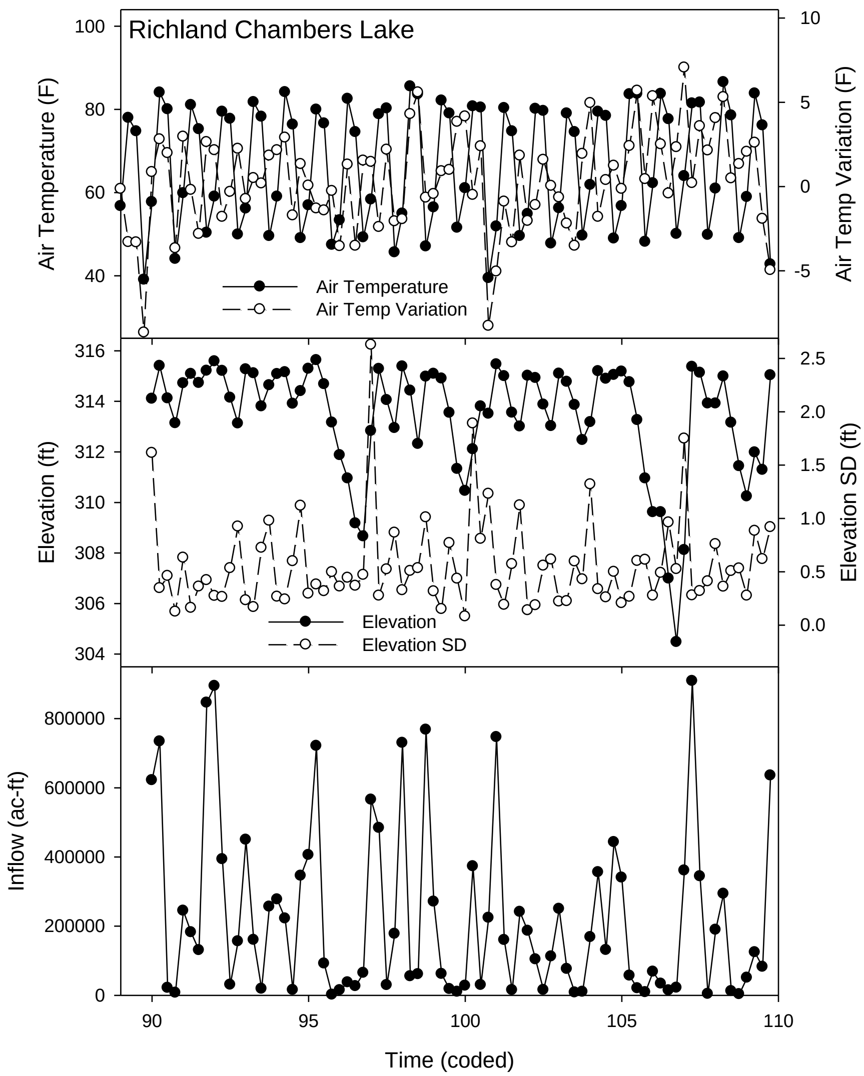
Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
SOI	**Basic**	**0.059**	**0.034**		
Air Temp.	**Basic**	**-0.281**	**<0.001**		
Air Temp. Var.	Basic	0.107	0.057		
Elevation	Basic	-0.032	0.23		
Elevation SD	Log	0.002	0.90	0.15	454
Trib. Inflow	Log	-0.017	0.44	-1.66	41



In Richland Chambers Lake, Temperature and Air Temperature Variation significantly increased. Elevation significantly decreased. All explanatory variables displayed large short-term variation around their long-term means and trends.

Summary of Richland Chambers Lake Trend Analysis Explanatory Variables

Variable	Model	Time Coefficient	P-value	APR (%)	Double/Half Time (yr)
SOI	**Basic**	**0.059**	**0.034**		
Air Temp.	**Basic**	**0.120**	**0.023**		
Air Temp. Var.	**Basic**	**0.120**	**0.023**		
Elevation	**Basic**	**-0.122**	**0.003**		
Elevation SD	Log	0.010	0.41	1.01	69
Trib. Inflow	Log	-0.044	0.10	-4.28	16



Explanatory Regression Results for Lake Bridgeport

Top Samples, Quarters 3 and 4

Using all top samples from quarters 3 and 4, Chloride in Lake Bridgeport was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 13% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Lake Bridgeport was significantly related only to Elevation. This relationship indicated that Alkalinity decreases as Elevation increases. Possibly, decreases in Elevation are accompanied by evaporation that concentrates Alkalinity, and increases in Elevation by inflow that dilutes Alkalinity. The R^2 for the multiple regression indicates that 17% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, TP in Lake Bridgeport was significantly related to Air Temperature and Tributary Inflow. These relationships indicated that TP decreases with increasing Air Temperature, and increases with Tributary Inflow. Possibly, loading of TP is associated with strong inflow. The R^2 for the multiple regression indicates that 15% of the variance in TP was explained by the set of explanatory variables together. TN in Lake Bridgeport was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that only 8% of the variance in TN was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, Chlorophyll *a* in Lake Bridgeport was significantly related to Air Temperature, Air Temperature Variation, and Elevation SD. The relationships indicated that Chlorophyll *a* is higher under conditions that are warm, both on an absolute basis and in relation to long-term average conditions, and that it also decreases when Elevation is variable. Possibly, warm weather promotes algal growth, while variability of lake level or inflow reduces it. The R^2 for the multiple regression indicates that 30% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Lake Bridgeport Top Samples
Summary of Regression for Chloride (R^2 = 0.131)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.141	0.141	0.36
Air Temperature	-0.032	-0.035	0.83
Air Temp. Var.	-0.183	-0.198	0.23
Elevation	0.240	0.278	0.11
Elevation SD	-0.0001	-0.0001	1.00
Log Trib. Inflow	-0.065	-0.074	0.67

Lake Bridgeport Top Samples
Summary of Regression for Alkalinity (R^2 = 0.169)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.046	0.046	0.66
Air Temperature	-0.038	-0.037	0.72
Air Temp. Var.	-0.140	-0.154	0.19
Elevation	**-0.341**	**-0.380**	**0.001**
Elevation SD	0.089	0.095	0.40
Log Trib. Inflow	-0.055	-0.056	0.61

Lake Bridgeport Top Samples
Summary of Regression for Log TP (R^2 = 0.151)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.027	0.027	0.777
Air Temperature	**-0.231**	**-0.236**	**0.015**
Air Temp. Var.	0.055	0.060	0.567
Elevation	-0.205	-0.225	0.031
Elevation SD	0.029	0.032	0.761
Log Trib. Inflow	**0.223**	**0.238**	**0.019**

Lake Bridgeport Top Samples
Summary of Regression for Log TN (R^2 = 0.083)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.018	-0.019	0.88
Air Temperature	-0.086	-0.093	0.49
Air Temp. Var.	0.068	0.075	0.58
Elevation	-0.194	-0.230	0.11
Elevation SD	-0.011	-0.013	0.93
Log Trib. Inflow	-0.040	-0.045	0.75

Lake Bridgeport Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.304)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.217	0.204	0.08
Air Temperature	**0.329**	**0.336**	**0.007**
Air Temp. Var.	**0.328**	**0.337**	**0.007**
Elevation	0.076	0.082	0.54
Elevation SD	**-0.298**	**-0.328**	**0.015**
Log TP	0.079	0.078	0.53
Log TN	0.059	0.053	0.64
Log Trib. Inflow	0.039	0.042	0.75

Main Pool Top Samples, Quarters 3 and 4

Using Main Pool top samples from quarters 3 and 4, Chloride in Lake Bridgeport was significantly related only to Air Temperature Variation. This relationship indicated that Chloride decreases as Air Temperature increases above long-term average conditions. The R^2 for the multiple regression indicates that 22% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Lake Bridgeport was not significantly related only to any of the explanatory variables, although the relationship with Elevation was almost significant. This relationship indicated that Alkalinity decreases as Elevation increases, similar to the relationship that was significant for all top samples. The R^2 for the multiple regression indicates that 17% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, TP in Lake Bridgeport was not significantly related to any of the explanatory variables, although the relationship with Air Temperature was almost significant. This relationship indicated that TP decreases with increasing Air Temperature, similar to the relationship that was significant for all top samples. The R^2 for the multiple regression indicates that 23% of the variance in TP was explained by the set of explanatory variables together. TN in Lake Bridgeport was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that only 5% of the variance in TN was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Lake Bridgeport was significantly related to Air Temperature. The relationship indicated that Chlorophyll *a* is higher under conditions that are warm. The R^2 for the multiple regression indicates that 34% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Lake Bridgeport Main Pool Top Samples
Summary of Regression for Chloride (R^2 = 0.221)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.188	0.186	0.32
Air Temperature	-0.112	-0.116	0.55
Air Temp. Var.	**-0.394**	**-0.439**	**0.031**
Elevation	0.210	0.227	0.27
Elevation SD	0.190	0.220	0.32
Log Trib. Inflow	-0.243	-0.266	0.20

Lake Bridgeport Main Pool Top Samples
Summary of Regression for Alkalinity (R^2 = 0.172)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.109	0.109	0.55
Air Temperature	0.035	0.034	0.85
Air Temp. Var.	-0.167	-0.182	0.35
Elevation	-0.341	-0.380	0.052
Elevation SD	0.027	0.029	0.88
Log Trib. Inflow	-0.020	-0.021	0.91

Lake Bridgeport Main Pool Top Samples
Summary of Regression for Log TP (R^2 = 0.229)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.084	0.080	0.64
Air Temperature	-0.338	-0.342	0.051
Air Temp. Var.	0.079	0.083	0.66
Elevation	-0.108	-0.111	0.54
Elevation SD	-0.205	-0.219	0.24
Log Trib. Inflow	0.307	0.320	0.077

Lake Bridgeport Main Pool Top Samples
Summary of Regression for Log TN (R^2 = 0.052)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.045	-0.048	0.81
Air Temperature	-0.121	-0.133	0.51
Air Temp. Var.	0.051	0.058	0.78
Elevation	-0.089	-0.106	0.63
Elevation SD	-0.058	-0.072	0.75
Log Trib. Inflow	-0.056	-0.065	0.76

Lake Bridgeport Main Pool Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.338)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.249	0.224	0.18
Air Temperature	**0.443**	**0.464**	**0.014**
Air Temp. Var.	0.259	0.249	0.17
Elevation	0.056	0.055	0.77
Elevation SD	-0.331	-0.361	0.074
Log TP	0.157	0.148	0.41
Log TN	0.122	0.100	0.52
Log Trib. Inflow	-0.047	-0.048	0.80

Bottom Samples, Quarters 3 and 4, Redox-Sensitive Parameters

Using all bottom samples from quarters 3 and 4, Dissolved Oxygen in Lake Bridgeport was significantly related to Air Temperature and Air Temperature Variation. The relationship with Air Temperature indicated that Dissolved Oxygen decreases under warm conditions, while the relationship with Air Temperature Variation indicates that this trend is mitigated when conditions are warmer than long-term average conditions. It is likely that during warm weather both decomposition rates and water column stability increase, contributing to a depletion of oxygen in deeper waters. The R^2 for the multiple regression indicates that 84% of the variance in Dissolved Oxygen was explained by the set of explanatory variables together.

NH_3 in Lake Bridgeport was significantly related only to Dissolved Oxygen. This relationship indicated that NH_3 increases as Dissolved Oxygen decreases. It is likely that the conditions of high decomposition rates and water column stability that produce oxygen depletion in deep waters favor NH_3 accumulation. The R^2 for the multiple regression indicates that 29% of the variance in NH_3 was explained by the set of explanatory variables together. Ortho-PO_4 in Lake Bridgeport was significantly related only to Dissolved Oxygen. This relationship indicated that Ortho-PO_4 increases as Dissolved Oxygen decreases. It is likely that the conditions of high decomposition rates and water column stability produce oxygen depletion in deep waters and favor Ortho-PO_4 accumulation. The R^2 for the multiple regression indicates that 21% of the variance in Ortho-PO_4 was explained by the set of explanatory variables together.

Lake Bridgeport Bottom Samples
Summary of Regression for DO (R^2 = 0.841)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.138	0.060	0.25
Air Temperature	**-0.908**	**-0.936**	**< 0.001**
Air Temp. Var.	**0.239**	**0.117**	**0.042**
Elevation	-0.001	-0.001	0.99
Elevation SD	0.040	0.019	0.74
Log Trib. Inflow	-0.128	-0.058	0.28

Lake Bridgeport Bottom Samples
Summary of Regression for Log NH_3 (R^2 = 0.286)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.307**	**-0.689**	**0.013**
SOI	0.128	0.121	0.31
Air Temperature	-0.110	-0.245	0.38
Air Temp. Var.	-0.017	-0.019	0.89
Elevation	0.031	0.030	0.81
Elevation SD	0.167	0.177	0.18
Log Trib. Inflow	-0.102	-0.100	0.42

Lake Bridgeport Bottom Samples
Summary of Regression for Log Ortho-PO_4 (R^2 = 0.206)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.295**	**-0.695**	**0.017**
SOI	-0.106	-0.105	0.40
Air Temperature	-0.203	-0.486	0.10
Air Temp. Var.	-0.013	-0.015	0.92
Elevation	0.135	0.141	0.28
Elevation SD	0.013	0.015	0.92
Log Trib. Inflow	0.092	0.094	0.47

Bluegreen Algae, Top Samples, Quarters 3 and 4

Using top samples from quarters 3 and 4, the abundance of Bluegreen Algae in Lake Bridgeport was significantly related only to Air Temperature. This relationship indicated that the abundance of Bluegreen Algae increases as Air Temperature increases. The R^2 for the multiple regression indicates that 70% of the variance in the abundance of Bluegreen Algae was explained by the set of explanatory variables together. The proportion of Bluegreen Algae in Lake Bridgeport was significantly related only to Air Temperature. This relationship indicated that the proportion of Bluegreen Algae increases as Air Temperature increases, similar to the relationship that was significant for abundance. The R^2 for the multiple regression indicates that 63% of the variance in the proportion of Bluegreen Algae was explained by the set of explanatory variables together.

Lake Bridgeport Top Samples, Quarters 3 and 4
Summary of Regression for Log Abundance of Bluegreen Algae (R^2 = 0.698)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.300	0.220	0.128
TN:TP	-0.062	-0.045	0.758
DO	0.159	0.139	0.430
Air Temp.	**0.714**	**0.908**	**< 0.001**
Elevation	0.298	0.178	0.132
Log Trib. Inflow	-0.298	-0.186	0.131

Lake Bridgeport Top Samples, Quarters 3 and 4
Summary of Regression for Proportion of Bluegreen Algae (R^2 = 0.634)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.116	0.090	0.549
TN:TP	0.016	0.013	0.933
DO	-0.087	-0.085	0.654
Air Temp.	**0.594**	**0.734**	**0.001**
Elevation	-0.027	-0.017	0.888
Log Trib. Inflow	-0.021	-0.014	0.912

Explanatory Regression Results for Eagle Mountain Lake

Top Samples, Quarters 3 and 4

Using all top samples from quarters 3 and 4, Chloride in Eagle Mountain Lake was significantly related only to Air Temperature. The relationship indicated that Chloride increases under warm conditions. The R^2 for the multiple regression indicates that only about 5% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Eagle Mountain Lake was significantly related to SOI, Air Temperature Variation, and Elevation. These relationships indicated that Alkalinity increases under El Niño conditions, under conditions warmer than long-term averages, and as Elevation increases. Possibly, the wetter conditions of El Niño are associated with higher Elevation and loading of alkalinity from the catchment. The regression model also indicates that unusually warm conditions can increase Alkalinity, possibly due evaporation that concentrates Alkalinity. The R^2 for the multiple regression indicates that 34% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, TP in Eagle Mountain Lake was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that only 4% of the variance in TP was explained by the set of explanatory variables together. TN in Eagle Mountain Lake was significantly related only to Air Temperature Variation. This relationship indicated that TN increased under conditions that are cooler than the long-term average conditions. The R^2 for the multiple regression indicates that 13% of the variance in TN was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, Chlorophyll *a* in Eagle Mountain Lake was significantly related to SOI, Air Temperature Variation, Elevation, and TP and TN. The relationships indicated that Chlorophyll *a* increases with both nutrients, TP and TN. It is also higher under conditions that are warmer than long-term average conditions, when Elevation is low, and during El Niño conditions. The R^2 for the multiple regression indicates that 20% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Eagle Mountain Lake Top Samples
Summary of Regression for Chloride (R^2 = 0.053)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.065	0.084	0.52
Air Temperature	**0.200**	**0.243**	**0.046**
Air Temp. Var.	-0.135	-0.196	0.18
Elevation	0.015	0.018	0.88
Elevation SD	-0.119	-0.136	0.24
Log Trib. Inflow	0.064	0.084	0.53

Eagle Mountain Lake Top Samples
Summary of Regression for Alkalinity (R^2 = 0.341)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.214**	**-0.222**	**0.007**
Air Temperature	0.115	0.111	0.15
Air Temp. Var.	**0.334**	**0.371**	**< 0.001**
Elevation	**0.383**	**0.439**	**< 0.001**
Elevation SD	-0.149	-0.135	0.064
Log Trib. Inflow	0.057	0.065	0.48

Eagle Mountain Lake Top Samples
Summary of Regression for Log TP (R^2 = 0.040)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.117	0.142	0.129
Air Temperature	-0.112	-0.130	0.146
Air Temp. Var.	0.063	0.075	0.417
Elevation	0.029	0.035	0.709
Elevation SD	0.070	0.075	0.366
Log Trib. Inflow	0.017	0.021	0.827

Eagle Mountain Lake Top Samples
Summary of Regression for Log TN (R^2 = 0.127)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.014	0.016	0.86
Air Temperature	0.014	0.016	0.86
Air Temp. Var.	**-0.206**	**-0.250**	**0.009**
Elevation	-0.155	-0.180	0.053
Elevation SD	-0.139	-0.146	0.082
Log Trib. Inflow	-0.140	-0.169	0.080

Eagle Mountain Lake Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.203)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.160**	**-0.188**	**0.046**
Air Temperature	0.051	0.055	0.528
Air Temp. Var.	**0.205**	**0.244**	**0.010**
Elevation	**-0.202**	**-0.231**	**0.012**
Elevation SD	0.053	0.053	0.516
Log TP	**0.181**	**0.185**	**0.024**
Log TN	**0.230**	**0.248**	**0.004**
Log Trib. Inflow	0.049	0.057	0.55

Main Pool Top Samples, Quarters 3 and 4

Using Main Pool top samples from quarters 3 and 4, Chloride in Eagle Mountain Lake was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that only about 3% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Eagle Mountain Lake was significantly related to SOI, Air Temperature Variation, and Elevation. These relationships indicated that Alkalinity increases under El Niño conditions, under conditions warmer than long-term averages, and as Elevation increases. Possibly, the wetter conditions of El Niño are associated with higher Elevation and loading of Alkalinity from the catchment, while unusually warm conditions increase evaporation that concentrates Alkalinity. The R^2 for the multiple regression indicates that 42% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, TP in Eagle Mountain Lake was significantly related only to Air Temperature. The relationship indicates that TP increased under cool conditions. The R^2 for the multiple regression indicates that 15% of the variance in TP was explained by the set of explanatory variables together. TN in Eagle Mountain Lake was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 20% of the variance in TN was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Eagle Mountain Lake was significantly related to Air Temperature Variation, Elevation and TN. The relationships indicated that Chlorophyll *a* increases with TN, and under conditions that are warmer than long-term average conditions. The R^2 for the multiple regression indicates that 26% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Eagle Mountain Lake Main Pool Top Samples
Summary of Regression for Chloride (R^2 = 0.030)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.095	0.120	0.52
Air Temperature	0.117	0.138	0.43
Air Temp. Var.	-0.094	-0.126	0.53
Elevation	-0.049	-0.060	0.74
Elevation SD	-0.018	-0.020	0.90
Log Trib. Inflow	-0.019	-0.025	0.90

Eagle Mountain Lake Main Pool Top Samples
Summary of Regression for Alkalinity (R^2 = 0.424)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.377**	**-0.381**	**0.001**
Air Temperature	-0.032	-0.028	0.80
Air Temp. Var.	**0.464**	**0.506**	**< 0.001**
Elevation	**0.431**	**0.460**	**< 0.001**
Elevation SD	-0.035	-0.030	0.773
Log Trib. Inflow	0.041	0.042	0.74

Eagle Mountain Lake Main Pool Top Samples
Summary of Regression for Log TP (R^2 = 0.150)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.192	0.219	0.104
Air Temperature	**-0.283**	**-0.317**	**0.015**
Air Temp. Var.	0.128	0.143	0.280
Elevation	0.066	0.076	0.579
Elevation SD	0.122	0.124	0.304
Log Trib. Inflow	0.033	0.039	0.781

Eagle Mountain Lake Main Pool Top Samples
Summary of Regression for Log TN (R^2 = 0.200)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.057	0.065	0.65
Air Temperature	-0.033	-0.035	0.79
Air Temp. Var.	-0.220	-0.256	0.073
Elevation	-0.235	-0.268	0.056
Elevation SD	-0.171	-0.171	0.17
Log Trib. Inflow	-0.132	-0.154	0.29

Eagle Mountain Lake Main Pool Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.261)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.072	-0.084	0.57
Air Temperature	-0.204	-0.231	0.10
Air Temp. Var.	**0.269**	**0.313**	**0.030**
Elevation	-0.196	-0.225	0.12
Elevation SD	0.132	0.131	0.30
Log TP	-0.043	-0.045	0.73
Log TN	**0.294**	**0.303**	**0.017**
Log Trib. Inflow	-0.012	-0.014	0.92

Bottom Samples, Quarters 3 and 4, Redox-Sensitive Parameters

Using all bottom samples from quarters 3 and 4, Dissolved Oxygen in Eagle Mountain Lake was significantly related to Air Temperature. The relationship with Air Temperature indicated that Dissolved Oxygen decreases under warm conditions. It is likely that during warm weather both decomposition rates and water column stability increase, contributing to a depletion of oxygen in deeper waters. The R^2 for the multiple regression indicates that 67% of the variance in Dissolved Oxygen was explained by the set of explanatory variables together.

NH_3 in Eagle Mountain Lake was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 13% of the variance in NH_3 was explained by the set of explanatory variables together. Ortho-PO_4 in Eagle Mountain Lake was significantly related only to Elevation SD. This relationship indicated that Ortho-PO_4 increases as variability in Elevation decreases. Possibly, conditions of low variation in Elevation promote water column stability that favors Ortho-PO_4 accumulation in deeper waters. The R^2 for the multiple regression indicates that 36% of the variance in Ortho-PO_4 was explained by the set of explanatory variables together.

Eagle Mountain Lake Bottom Samples
Summary of Regression for DO (R^2 = 0.669)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.043	0.030	0.72
Air Temperature	**-0.782**	**-0.842**	**< 0.001**
Air Temp. Var.	0.175	0.123	0.140
Elevation	0.190	0.138	0.11
Elevation SD	-0.035	-0.022	0.77
Log Trib. Inflow	0.064	0.048	0.59

Eagle Mountain Lake Bottom Samples
Summary of Regression for Log NH_3 (R^2 = 0.125)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	-0.042	-0.073	0.73
SOI	-0.125	-0.147	0.30
Air Temperature	-0.004	-0.007	0.98
Air Temp. Var.	-0.083	-0.096	0.50
Elevation	-0.138	-0.165	0.26
Elevation SD	0.221	0.231	0.068
Log Trib. Inflow	-0.184	-0.222	0.13

Eagle Mountain Lake Bottom Samples
Summary of Regression for Log Ortho-PO_4 (R^2 = 0.362)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	-0.221	-0.314	0.063
SOI	0.030	0.029	0.80
Air Temperature	0.166	0.251	0.16
Air Temp. Var.	-0.007	-0.007	0.95
Elevation	0.205	0.211	0.085
Elevation SD	**-0.271**	**-0.246**	**0.021**
Log Trib. Inflow	0.102	0.106	0.39

Bluegreen Algae, Top Samples, Quarters 3 and 4

Using top samples from quarters 3 and 4, the abundance of Bluegreen Algae in Eagle Mountain Lake was not significantly related any of the explanatory variables. The R^2 for the multiple regression indicates that 44% of the variance in the abundance of Bluegreen Algae was explained by the set of explanatory variables together. The proportion of Bluegreen Algae in Eagle Mountain Lake was also not significantly related to any of the explanatory variables. However, the relationship with Air Temperature was close to significance, and indicated that the proportion of Bluegreen Algae might increase as Air Temperature increases. The R^2 for the multiple regression indicates that 34% of the variance in the proportion of Bluegreen Algae was explained by the set of explanatory variables together.

Eagle Mountain Lake Top Samples, Quarters 3 and 4
Summary of Regression for Log Abundance of Bluegreen Algae (R^2 = 0.443)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.334	0.349	0.077
TN:TP	0.141	0.146	0.466
DO	0.070	0.062	0.717
Air Temp.	0.212	0.211	0.270
Elevation	-0.289	-0.292	0.129
Log Trib. Inflow	-0.102	-0.102	0.599

Eagle Mountain Lake Top Samples, Quarters 3 and 4
Summary of Regression for Proportion of Bluegreen Algae (R^2 = 0.340)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.216	0.237	0.253
TN:TP	0.189	0.212	0.318
DO	0.001	0.001	0.997
Air Temp.	0.360	0.409	0.051
Elevation	-0.052	-0.056	0.784
Log Trib. Inflow	-0.060	-0.064	0.754

Explanatory Regression Results for Lake Worth

Top Samples, Quarters 3 and 4

Using all top samples from quarters 3 and 4, Chloride in Lake Worth was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 9% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Lake Worth was significantly related to SOI, Air Temperature, and Elevation. These relationships indicated that Alkalinity increases under El Niño conditions, under warm conditions, and as Elevation increases. Possibly, the wetter conditions of El Niño produce higher Elevation and loading of Alkalinity from the catchment, while warm conditions increase evaporation that concentrates Alkalinity. The R^2 for the multiple regression indicates that 50% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, TP in Lake Worth was significantly related only to Elevation. This relationship indicated that TP increases when Elevation is low. The R^2 for the multiple regression indicates that 9% of the variance in TP was explained by the set of explanatory variables together. TN in Lake Worth was significantly related to Air Temperature and Elevation. This relationship indicated that TN increases under cool conditions and when Elevation is low. The R^2 for the multiple regression indicates that 26% of the variance in TN was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Lake Worth was significantly related only to Elevation. The relationships indicated that Chlorophyll *a* is higher when Elevation is low, a condition that also favors high TP and TN, although there is no significant relationship directly between Chlorophyll *a* and nutrients. The R^2 for the multiple regression indicates that 14% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Lake Worth Top Samples
Summary of Regression for Chloride (R^2 = 0.083)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.004	0.005	0.97
Air Temperature	-0.094	-0.111	0.41
Air Temp. Var.	-0.035	-0.042	0.76
Elevation	-0.139	-0.160	0.22
Elevation SD	0.172	0.257	0.13
Log Trib. Inflow	0.009	0.015	0.94

Lake Worth Top Samples
Summary of Regression for Alkalinity (R^2 = 0.500)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.210**	**-0.152**	**0.018**
Air Temperature	**0.430**	**0.336**	**< 0.001**
Air Temp. Var.	0.156	0.112	0.081
Elevation	**0.532**	**0.444**	**< 0.001**
Elevation SD	-0.027	-0.019	0.76
Log Trib. Inflow	-0.132	-0.094	0.14

Lake Worth Top Samples
Summary of Regression for Log TP (R^2 = 0.090)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.048	0.056	0.59
Air Temperature	0.110	0.129	0.22
Air Temp. Var.	-0.031	-0.036	0.73
Elevation	**-0.197**	**-0.236**	**0.026**
Elevation SD	0.096	0.144	0.28
Log Trib. Inflow	0.126	0.212	0.16

Lake Worth Top Samples
Summary of Regression for Log TN (R^2 = 0.263)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.021	0.022	0.82
Air Temperature	**-0.190**	**-0.207**	**0.039**
Air Temp. Var.	-0.085	-0.094	0.36
Elevation	**-0.421**	**-0.490**	**< 0.001**
Elevation SD	0.083	0.114	0.37
Log Trib. Inflow	-0.050	-0.076	0.59

Lake Worth Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.144)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.063	0.073	0.51
Air Temperature	-0.033	-0.040	0.72
Air Temp. Var.	0.066	0.078	0.49
Elevation	**-0.196**	**-0.252**	**0.037**
Elevation SD	0.065	0.097	0.49
Log TP	-0.139	-0.138	0.14
Log TN	0.163	0.174	0.082
Log Trib. Inflow	0.038	0.064	0.69

Main Pool Top Samples, Quarters 3 and 4

Using Main Pool top samples from quarters 3 and 4, Chloride in Lake Worth was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 7% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Lake Worth was significantly related to Air Temperature and Elevation. These relationships indicated that Alkalinity increases under warm conditions, and as Elevation increases. Possibly, higher Elevation is associated with loading of Alkalinity from the catchment, while warm conditions increase evaporation that concentrates Alkalinity. The R^2 for the multiple regression indicates that 56% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, TP in Lake Worth was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 12% of the variance in TP was explained by the set of explanatory variables together. TN in Lake Worth was significantly related to Air Temperature and Elevation. This relationship indicated that TN increases under cool conditions, and when Elevation is low. The R^2 for the multiple regression indicates that 41% of the variance in TN was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Lake Worth was significantly related to Air Temperature Variation and Elevation. The relationship indicated that Chlorophyll *a* is higher when Air Temperature is above normal, and when Elevation is low. Low Elevation also favors high TN, although there is no significant relationship directly between Chlorophyll *a* and TN. The R^2 for the multiple regression indicates that 50% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Lake Worth Main Pool Top Samples
Summary of Regression for Chloride (R^2 = 0.070)

Explanatory Variable	**Partial Correlation**	**Standardized Coefficient**	**P-value**
SOI	-0.108	-0.122	0.59
Air Temperature	-0.112	-0.130	0.58
Air Temp. Var.	-0.010	-0.011	0.96
Elevation	0.000	0.000	1.00
Elevation SD	0.138	0.210	0.49
Log Trib. Inflow	-0.037	-0.062	0.86

Lake Worth Main Pool Top Samples
Summary of Regression for Alkalinity (R^2 = 0.561)

Explanatory Variable	**Partial Correlation**	**Standardized Coefficient**	**P-value**
SOI	-0.195	-0.160	0.32
Air Temperature	**0.422**	**0.377**	**0.025**
Air Temp. Var.	0.290	0.249	0.135
Elevation	**0.603**	**0.615**	**0.001**
Elevation SD	-0.039	-0.040	0.85
Log Trib. Inflow	-0.060	-0.069	0.76

Lake Worth Main Pool Top Samples
Summary of Regression for Log TP (R^2 = 0.119)

Explanatory Variable	**Partial Correlation**	**Standardized Coefficient**	**P-value**
SOI	0.010	0.012	0.96
Air Temperature	-0.074	-0.085	0.71
Air Temp. Var.	0.006	0.007	0.97
Elevation	-0.226	-0.267	0.25
Elevation SD	0.106	0.157	0.59
Log Trib. Inflow	0.121	0.200	0.54

Lake Worth Main Pool Top Samples
Summary of Regression for Log TN (R^2 = 0.413)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.158	0.153	0.44
Air Temperature	**-0.404**	**-0.420**	**0.041**
Air Temp. Var.	0.045	0.045	0.83
Elevation	**-0.394**	**-0.406**	**0.046**
Elevation SD	0.284	0.358	0.16
Log Trib. Inflow	-0.286	-0.400	0.16

Lake Worth Main Pool Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.500)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.025	-0.023	0.91
Air Temperature	-0.163	-0.159	0.45
Air Temp. Var.	**0.407**	**0.417**	**0.048**
Elevation	**-0.442**	**-0.487**	**0.030**
Elevation SD	0.156	0.186	0.47
Log TP	-0.391	-0.324	0.059
Log TN	0.085	0.079	0.69
Log Trib. Inflow	0.050	0.065	0.81

Bottom Samples, Quarters 3 and 4, Redox-Sensitive Parameters

Using all bottom samples from quarters 3 and 4, Dissolved Oxygen in Lake Worth was significantly related to Air Temperature. The relationship with Air Temperature indicated that Dissolved Oxygen decreases under warm conditions. It is likely that during warm weather both decomposition rates and water column stability increase, contributing to a depletion of oxygen in deeper waters. The R^2 for the multiple regression indicates that 49% of the variance in Dissolved Oxygen was explained by the set of explanatory variables together.

NH_3 in Lake Worth was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 3% of the variance in NH_3 was explained by the set of explanatory variables together. Ortho-PO_4 in Lake Worth was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 34% of the variance in Ortho-PO_4 was explained by the set of explanatory variables together.

Lake Worth Bottom Samples
Summary of Regression for DO (R^2 = 0.490)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.180	-0.158	0.37
Air Temperature	**-0.648**	**-0.744**	**< 0.001**
Air Temp. Var.	0.323	0.299	0.10
Elevation	0.178	0.155	0.37
Elevation SD	-0.177	-0.201	0.38
Log Trib. Inflow	-0.074	-0.093	0.72

Lake Worth Bottom Samples
Summary of Regression for Log NH_3 (R^2 = 0.034)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	0.105	0.146	0.61
SOI	-0.003	-0.004	0.99
Air Temperature	0.139	0.222	0.50
Air Temp. Var.	-0.103	-0.132	0.62
Elevation	-0.025	-0.030	0.91
Elevation SD	-0.084	-0.132	0.68
Log Trib. Inflow	0.111	0.194	0.59

Lake Worth Bottom Samples
Summary of Regression for Log Ortho-PO_4 (R^2 = 0.341)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	0.155	0.178	0.45
SOI	-0.026	-0.026	0.90
Air Temperature	0.283	0.385	0.16
Air Temp. Var.	-0.263	-0.288	0.19
Elevation	0.378	0.405	0.057
Elevation SD	-0.230	-0.305	0.26
Log Trib. Inflow	-0.036	-0.051	0.86

Bluegreen Algae, Top Samples, Quarters 3 and 4

Using top samples from quarters 3 and 4, the abundance of Bluegreen Algae in Lake Worth was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 68% of the variance in the abundance of Bluegreen Algae was explained by the set of explanatory variables together. The proportion of Bluegreen Algae in Lake Worth was significantly related only to TN. This relationship indicated that the proportion of Bluegreen Algae increases as TN increases. The R^2 for the multiple regression indicates that 72% of the variance in the proportion of Bluegreen Algae was explained by the set of explanatory variables together.

Lake Worth Top Samples, Quarters 3 and 4
Summary of Regression for Log Abundance of Bluegreen Algae (R^2 = 0.682)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.397	0.398	0.075
TN:TP	0.119	0.122	0.606
DO	0.157	0.118	0.498
Air Temp.	-0.297	-0.228	0.192
Elevation	-0.375	-0.302	0.094
Log Trib. Inflow	-0.138	-0.116	0.550

Lake Worth Top Samples, Quarters 3 and 4
Summary of Regression for Proportion of Bluegreen Algae (R^2 = 0.724)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	**0.497**	**0.492**	**0.022**
TN:TP	0.246	0.239	0.283
DO	0.044	0.031	0.850
Air Temp.	0.031	0.021	0.893
Elevation	-0.294	-0.214	0.196
Log Trib. Inflow	-0.077	-0.060	0.739

Explanatory Regression Results for Benbrook Lake

Top Samples, Quarters 3 and 4

Using all top samples from quarters 3 and 4, Chloride in Benbrook Lake was significantly related to Elevation and Tributary Inflow. These relationships indicated that Chloride increases with both Elevation and Tributary Inflow. Possibly, loading of Chloride is associated with inflow and rises in Elevation. The R^2 for the multiple regression indicates that 37% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Benbrook Lake was significantly related to SOI, Air Temperature, and Tributary Inflow. These relationships indicated that Alkalinity increases under El Niño conditions, cool conditions, and with increased inflow. Possibly, the relatively wet conditions of El Niño increase the loading of Alkalinity delivered with inflow. The R^2 for the multiple regression indicates that 45% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, TP in Benbrook Lake was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that only 6% of the variance in TP was explained by the set of explanatory variables together. TN in Benbrook Lake was significantly related only to Elevation. This relationship indicated that TN increases when Elevation is low. The R^2 for the multiple regression indicates that 21% of the variance in TN was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, Chlorophyll *a* in Benbrook Lake was significantly related to SOI, Air Temperature, Elevation, TN, Tributary Inflow, and Pumpage. These relationships indicated that Chlorophyll *a* is higher when TN is high. It is also higher under La Niña conditions, warm conditions, when inflow is higher, and when Elevation and Pumpage are low. The R^2 for the multiple regression indicates that 56% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Benbrook Lake Top Samples
Summary of Regression for Chloride (R^2 = 0.372)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.195	0.165	0.12
Air Temperature	0.196	0.179	0.12
Air Temp. Var.	0.236	0.204	0.060
Elevation	**0.249**	**0.330**	**0.047**
Elevation SD	-0.192	-0.173	0.13
Log Trib. Inflow	**0.319**	**0.372**	**0.010**
Log Pumpage	-0.045	-0.045	0.72

Benbrook Lake Top Samples
Summary of Regression for Alkalinity (R^2 = 0.452)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.326**	**-0.277**	**0.001**
Air Temperature	**-0.515**	**-0.484**	**< 0.001**
Air Temp. Var.	0.095	0.075	0.327
Elevation	-0.049	-0.059	0.618
Elevation SD	-0.178	-0.159	0.066
Log Trib. Inflow	**0.326**	**0.349**	**0.001**
Log Pumpage	0.038	0.036	0.69

Benbrook Lake Top Samples
Summary of Regression for Log TP (R^2 = 0.062)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.150	0.159	0.12
Air Temperature	-0.086	-0.090	0.37
Air Temp. Var.	0.044	0.045	0.64
Elevation	-0.124	-0.199	0.20
Elevation SD	0.043	0.049	0.66
Log Trib. Inflow	0.160	0.215	0.094
Log Pumpage	0.060	0.075	0.53

Benbrook Lake Top Samples
Summary of Regression for Log TN (R^2 = 0.209)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.104	0.101	0.29
Air Temperature	0.017	0.017	0.86
Air Temp. Var.	-0.078	-0.074	0.43
Elevation	**-0.246**	**-0.373**	**0.011**
Elevation SD	0.191	0.209	0.051
Log Trib. Inflow	-0.160	-0.197	0.10
Log Pumpage	-0.199	-0.230	0.04

Benbrook Lake Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.559)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**0.286**	**0.218**	**0.003**
Air Temperature	**0.592**	**0.540**	**< 0.001**
Air Temp. Var.	-0.094	-0.066	0.35
Elevation	**-0.246**	**-0.287**	**0.012**
Elevation SD	0.170	0.141	0.086
Log TP	0.069	0.048	0.49
Log TN	**0.311**	**0.246**	**0.001**
Log Trib. Inflow	**0.269**	**0.264**	**0.006**
Log Pumpage	**-0.243**	**-0.218**	**0.013**

Main Pool Top Samples, Quarters 3 and 4

Using Main Pool top samples from quarters 3 and 4, Chloride in Benbrook Lake was significantly related only to Tributary Inflow. This relationship indicated that Chloride increases with Tributary Inflow. Possibly, loading of Chloride is associated with inflow. The R^2 for the multiple regression indicates that 35% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Benbrook Lake was significantly related to SOI, Air Temperature, and Tributary Inflow. These relationships indicated that Alkalinity increases under El Niño conditions, cool conditions, and with increased inflow. Possibly, the relatively wet conditions of El Niño increase the loading of Alkalinity delivered with inflow. The R^2 for the multiple regression indicates that 47% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, TP in Benbrook Lake was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 10% of the variance in TP was explained by the set of explanatory variables together. TN in Benbrook Lake was significantly related to Elevation and Elevation SD. These relationships indicated that TN increases when Elevation is low and variable. The R^2 for the multiple regression indicates that 24% of the variance in TN was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Benbrook Lake was significantly related to SOI, Air Temperature, TN, Tributary Inflow, and Pumpage. These relationships indicated that Chlorophyll *a* is higher when TN is high. It is also higher under La Niña conditions, warm conditions, when inflow is higher, and when Pumpage is low. The R^2 for the multiple regression indicates that 56% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Benbrook Lake Main Pool Top Samples
Summary of Regression for Chloride (R^2 = 0.350)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.137	0.118	0.35
Air Temperature	0.163	0.147	0.26
Air Temp. Var.	0.240	0.209	0.10
Elevation	0.266	0.356	0.065
Elevation SD	-0.142	-0.130	0.33
Log Trib. Inflow	**0.303**	**0.355**	**0.034**
Log Pumpage	0.021	0.021	0.89

Benbrook Lake Main Pool Top Samples
Summary of Regression for Alkalinity (R^2 = 0.470)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.376**	**-0.321**	**0.001**
Air Temperature	**-0.496**	**-0.453**	**< 0.001**
Air Temp. Var.	0.099	0.076	0.41
Elevation	-0.055	-0.066	0.65
Elevation SD	-0.173	-0.152	0.15
Log Trib. Inflow	**0.355**	**0.377**	**0.003**
Log Pumpage	0.034	0.032	0.78

Benbrook Lake Main Pool Top Samples
Summary of Regression for Log TP (R^2 = 0.101)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.119	0.123	0.32
Air Temperature	-0.203	-0.213	0.087
Air Temp. Var.	0.047	0.047	0.69
Elevation	-0.163	-0.258	0.17
Elevation SD	0.095	0.107	0.43
Log Trib. Inflow	0.182	0.240	0.13
Log Pumpage	0.088	0.107	0.46

Benbrook Lake Main Pool Top Samples
Summary of Regression for Log TN (R^2 = 0.242)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.091	0.086	0.46
Air Temperature	-0.068	-0.066	0.58
Air Temp. Var.	-0.044	-0.040	0.72
Elevation	**-0.275**	**-0.411**	**0.023**
Elevation SD	**0.246**	**0.267**	**0.044**
Log Trib. Inflow	-0.192	-0.233	0.12
Log Pumpage	-0.203	-0.231	0.10

Benbrook Lake Main Pool Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.555)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**0.346**	**0.270**	**0.004**
Air Temperature	**0.590**	**0.545**	**< 0.001**
Air Temp. Var.	-0.119	-0.085	0.34
Elevation	-0.200	-0.236	0.11
Elevation SD	0.176	0.149	0.16
Log TP	-0.017	-0.012	0.89
Log TN	**0.306**	**0.246**	**0.013**
Log Trib. Inflow	**0.257**	**0.254**	**0.037**
Log Pumpage	**-0.247**	**-0.223**	**0.045**

Bottom Samples, Quarters 3 and 4, Redox-Sensitive Parameters

Using all bottom samples from quarters 3 and 4, Dissolved Oxygen in Benbrook Lake was significantly related only to Air Temperature. This relationship indicated that Dissolved Oxygen decreases under warm conditions. It is likely that during warm weather both decomposition rates and water column stability increase, contributing to a depletion of oxygen in deeper waters. The R^2 for the multiple regression indicates that 68% of the variance in Dissolved Oxygen was explained by the set of explanatory variables together.

NH_3 in Benbrook Lake was significantly related to Dissolved Oxygen, Air Temperature, and Elevation SD. These relationships indicated that NH_3 increases as Dissolved Oxygen decreases, and after accounting for this relationship it increases under cool conditions and when variability in Elevation is low. It is likely that the conditions of high decomposition rates and water column stability that produce oxygen depletion in deep waters favor NH_3 accumulation, and that these processes are also influenced by meteorology and hydrology. The R^2 for the multiple regression indicates that 38% of the variance in NH_3 was explained by the set of explanatory variables together. Ortho-PO_4 in Benbrook Lake was significantly related to Dissolved Oxygen, SOI, Air Temperature, and Air Temperature Variation. These relationships indicated that Ortho-PO_4 increases as Dissolved Oxygen decreases, and complex relationships with meteorology. Ortho-PO_4 increases under El Niño conditions and under cool conditions, but after accounting for these relationships, Ortho-PO_4 also increases when temperatures are warmer than long-term average conditions. It is likely that the conditions of high decomposition rates and water column stability produce oxygen depletion in deep waters and favor Ortho-PO_4 accumulation, but apparently these processes are also influenced by meteorology. The R^2 for the multiple regression indicates that 26% of the variance in Ortho-PO_4 was explained by the set of explanatory variables together.

Benbrook Lake Bottom Samples
Summary of Regression for DO (R^2 = 0.676)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.157	-0.098	0.11
Air Temperature	**-0.796**	**-0.820**	**< 0.001**
Air Temp. Var.	0.165	0.100	0.090
Elevation	-0.071	-0.068	0.46
Elevation SD	-0.072	-0.049	0.46
Log Trib. Inflow	0.045	0.035	0.65
Log Pumpage	-0.123	-0.090	0.21

Benbrook Lake Bottom Samples
Summary of Regression for Log NH_3 (R^2 = 0.375)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.520**	**-0.818**	**< 0.001**
SOI	-0.008	-0.007	0.94
Air Temperature	**-0.234**	**-0.332**	**0.023**
Air Temp. Var.	0.084	0.072	0.42
Elevation	0.196	0.259	0.057
Elevation SD	**-0.278**	**-0.271**	**0.006**
Log Trib. Inflow	-0.187	-0.204	0.070
Log Pumpage	-0.087	-0.091	0.40

Benbrook Lake Bottom Samples
Summary of Regression for Log Ortho-PO_4 (R^2 = 0.259)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.418**	**-0.769**	**0.001**
SOI	**-0.268**	**-0.267**	**0.032**
Air Temperature	**-0.362**	**-0.671**	**0.003**
Air Temp. Var.	**0.262**	**0.256**	**0.037**
Elevation	0.134	0.191	0.29
Elevation SD	-0.152	-0.156	0.23
Log Trib. Inflow	0.013	0.015	0.92
Log Pumpage	0.105	0.117	0.41

Bluegreen Algae, Top Samples, Quarters 3 and 4

Using top samples from quarters 3 and 4, the abundance of Bluegreen Algae in Benbrook Lake was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 19% of the variance in the abundance of Bluegreen Algae was explained by the set of explanatory variables together. The proportion of Bluegreen Algae in Lake Bridgeport was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 20% of the variance in the proportion of Bluegreen Algae was explained by the set of explanatory variables together.

Benbrook Lake Pool Top Samples, Quarters 3 and 4
Summary of Regression for Log Abundance of Bluegreen Algae (R^2 = 0.192)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.197	0.194	0.224
TN:TP	-0.059	-0.056	0.718
DO	-0.121	-0.136	0.455
Air Temp.	0.235	0.281	0.145
Elevation	-0.057	-0.065	0.728
Log Trib. Inflow	-0.077	-0.087	0.635

Benbrook Lake Top Samples, Quarters 3 and 4
Summary of Regression for Proportion of Bluegreen Algae (R^2 = 0.195)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.031	0.031	0.834
TN:TP	-0.050	-0.048	0.739
DO	-0.226	-0.257	0.126
Air Temp.	0.192	0.229	0.197
Elevation	0.076	0.084	0.613
Log Trib. Inflow	-0.112	-0.123	0.455

Explanatory Regression Results for Lake Arlington

Top Samples, Quarters 3 and 4

Using all top samples from quarters 3 and 4, Chloride in Lake Arlington was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 13% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Lake Arlington was significantly related only to Air Temperature. This relationship indicated that Alkalinity decreases under warm conditions. The R^2 for the multiple regression indicates that 30% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, TP in Lake Arlington was significantly related to Elevation and Pumpage. These relationships indicated that TP increases with decreasing elevation and when Pumpage is low. The R^2 for the multiple regression indicates that 43% of the variance in TP was explained by the set of explanatory variables together. TN in Lake Arlington was significantly related only to Elevation SD. This relationship indicated that TN increases when variability in Elevation is high. The R^2 for the multiple regression indicates that 17% of the variance in TN was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, Chlorophyll *a* in Lake Arlington was significantly related to TP and Pumpage. These relationships indicated that Chlorophyll *a* is higher when TP is low, which is unexpected, and when Pumpage is low. The R^2 for the multiple regression indicates that 28% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

For all responses analyzed, data are available only from 2001, and this relatively short period of record for Lake Arlington reduced statistical power while making anomalous results more likely.

Lake Arlington Top Samples
Summary of Regression for Chloride (R^2 = 0.126)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.115	0.139	0.37
Air Temperature	-0.0002	-0.0002	1.00
Air Temp. Var.	-0.015	-0.017	0.91
Elevation	-0.143	-0.251	0.27
Elevation SD	0.121	0.133	0.35
Log Trib. Inflow	-0.058	-0.112	0.66
Log Pumpage	-0.124	-0.175	0.34

Lake Arlington Top Samples
Summary of Regression for Alkalinity (R^2 = 0.301)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.094	0.102	0.47
Air Temperature	**-0.448**	**-0.451**	**< 0.001**
Air Temp. Var.	-0.251	-0.268	0.051
Elevation	0.204	0.328	0.11
Elevation SD	0.061	0.058	0.64
Log Trib. Inflow	-0.137	-0.246	0.29
Log Pumpage	-0.138	-0.174	0.29

Lake Arlington Top Samples
Summary of Regression for Log TP (R^2 = 0.434)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.043	0.042	0.74
Air Temperature	-0.042	-0.035	0.74
Air Temp. Var.	-0.018	-0.017	0.89
Elevation	**-0.442**	**-0.698**	**< 0.001**
Elevation SD	0.128	0.112	0.32
Log Trib. Inflow	-0.073	-0.119	0.57
Log Pumpage	**-0.456**	**-0.593**	**< 0.001**

Lake Arlington Top Samples
Summary of Regression for Log TN (R^2 = 0.168)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.001	0.001	1.00
Air Temperature	0.075	0.075	0.57
Air Temp. Var.	-0.005	-0.006	0.97
Elevation	0.005	0.009	0.97
Elevation SD	**0.282**	**0.306**	**0.032**
Log Trib. Inflow	-0.212	-0.429	0.11
Log Pumpage	-0.202	-0.291	0.13

Lake Arlington Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.280)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.046	0.051	0.74
Air Temperature	0.088	0.087	0.53
Air Temp. Var.	0.089	0.094	0.52
Elevation	-0.155	-0.286	0.26
Elevation SD	0.241	0.254	0.079
Log TP	**-0.393**	**-0.537**	**0.003**
Log TN	0.045	0.043	0.75
Log Trib. Inflow	-0.264	-0.516	0.054
Log Pumpage	**-0.443**	**-0.729**	**0.001**

Main Pool Top Samples, Quarters 3 and 4

Using Main Pool top samples from quarters 3 and 4, Chloride in Lake Arlington was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 37% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Lake Arlington was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 49% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, TP in Lake Arlington was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 53% of the variance in TP was explained by the set of explanatory variables together. TN in Lake Arlington was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 40% of the variance in TN was explained by the set of explanatory variables together.

For these first four response variables, sample sizes were small when restricted only to main pool samples, so the power to detect significant relationships with individual explanatory variables was low, even though multiple regressions explained large amounts of variance.

Despite this low power, using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Lake Arlington was significantly related to SOI and Tributary Inflow. These relationships indicated that Chlorophyll *a* is higher under La Niña conditions, when precipitation and hence inflow tend to be low. The R^2 for the multiple regression indicates that 95% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Lake Arlington Main Pool Top Samples
Summary of Regression for Chloride (R^2 = 0.369)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.334	0.364	0.32
Air Temperature	0.331	0.302	0.32
Air Temp. Var.	0.121	0.119	0.72
Elevation	0.127	0.192	0.71
Elevation SD	-0.020	-0.019	0.95
Log Trib. Inflow	-0.094	-0.162	0.78
Log Pumpage	0.188	0.234	0.58

Lake Arlington Main Pool Top Samples
Summary of Regression for Alkalinity (R^2 = 0.485)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.198	0.188	0.56
Air Temperature	-0.547	-0.508	0.082
Air Temp. Var.	-0.056	-0.049	0.87
Elevation	0.305	0.432	0.36
Elevation SD	-0.075	-0.062	0.83
Log Trib. Inflow	-0.047	-0.073	0.89
Log Pumpage	-0.125	-0.139	0.72

Lake Arlington Main Pool Top Samples
Summary of Regression for Log TP (R^2 = 0.527)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.006	0.005	0.99
Air Temperature	-0.055	-0.041	0.87
Air Temp. Var.	0.050	0.042	0.88
Elevation	-0.456	-0.664	0.16
Elevation SD	0.296	0.245	0.38
Log Trib. Inflow	-0.114	-0.170	0.74
Log Pumpage	-0.576	-0.746	0.063

Lake Arlington Main Pool Top Samples
Summary of Regression for Log TN (R^2 = 0.400)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.201	0.205	0.58
Air Temperature	0.003	0.003	0.99
Air Temp. Var.	-0.105	-0.100	0.77
Elevation	-0.071	-0.103	0.85
Elevation SD	0.505	0.517	0.14
Log Trib. Inflow	-0.219	-0.377	0.54
Log Pumpage	-0.204	-0.250	0.57

Lake Arlington Main Pool Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.949)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**0.820**	**0.414**	**0.024**
Air Temperature	0.410	0.131	0.36
Air Temp. Var.	0.155	0.044	0.74
Elevation	0.652	0.436	0.11
Elevation SD	0.582	0.252	0.17
Log TP	0.692	0.393	0.085
Log TN	0.465	0.158	0.29
Log Trib. Inflow	**-0.887**	**-0.960**	**0.008**
Log Pumpage	-0.677	-0.435	0.095

Bottom Samples, Quarters 3 and 4, Redox-Sensitive Parameters

Using all bottom samples from quarters 3 and 4, Dissolved Oxygen in Lake Arlington was significantly related only to Air Temperature. This relationship indicated that Dissolved Oxygen decreases under warm conditions. It is likely that during warm weather both decomposition rates and water column stability increase, contributing to a depletion of oxygen in deeper waters. The R^2 for the multiple regression indicates that 75% of the variance in Dissolved Oxygen was explained by the set of explanatory variables together.

NH_3 in Lake Arlington was significantly related only to Dissolved Oxygen. This relationship indicated that NH_3 increases as Dissolved Oxygen decreases. It is likely that the conditions of high decomposition rates and water column stability that produce oxygen depletion in deep waters favor NH_3 accumulation. The R^2 for the multiple regression indicates that 37% of the variance in NH_3 was explained by the set of explanatory variables together. Ortho-PO_4 in Lake Arlington was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 34% of the variance in Ortho-PO_4 was explained by the set of explanatory variables together.

For all responses analyzed, data are available only from 2001, and this relatively short period of record for Lake Arlington reduced statistical power while making anomalous results more likely.

Lake Arlington Bottom Samples
Summary of Regression for DO (R^2 = 0.750)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.367	0.255	0.055
Air Temperature	**-0.838**	**-0.830**	**< 0.001**
Air Temp. Var.	-0.236	-0.149	0.23
Elevation	0.365	0.369	0.056
Elevation SD	0.292	0.175	0.13
Log Trib. Inflow	-0.215	-0.238	0.27
Log Pumpage	0.246	0.195	0.21

Lake Arlington Bottom Samples
Summary of Regression for Log NH_3 (R^2 = 0.369)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.499**	**-0.844**	**0.025**
SOI	-0.033	-0.033	0.89
Air Temperature	-0.373	-0.580	0.11
Air Temp. Var.	-0.204	-0.203	0.39
Elevation	0.051	0.080	0.83
Elevation SD	-0.046	-0.042	0.85
Log Trib. Inflow	0.009	0.014	0.97
Log Pumpage	0.346	0.429	0.14

Lake Arlington Bottom Samples
Summary of Regression for Log Ortho-PO_4 (R^2 = 0.338)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	-0.365	-0.588	0.11
SOI	-0.107	-0.110	0.65
Air Temperature	-0.137	-0.205	0.56
Air Temp. Var.	-0.230	-0.235	0.33
Elevation	0.110	0.176	0.65
Elevation SD	-0.118	-0.113	0.62
Log Trib. Inflow	-0.241	-0.417	0.31
Log Pumpage	-0.138	-0.166	0.56

Bluegreen Algae, Top Samples, Quarters 3 and 4

Using top samples from quarters 3 and 4, the abundance of Bluegreen Algae in Lake Arlington was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 33% of the variance in the abundance of Bluegreen Algae was explained by the set of explanatory variables together. The proportion of Bluegreen Algae in Lake Arlington was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 64% of the variance in the proportion of Bluegreen Algae was explained by the set of explanatory variables together. In these regressions, high values of R^2 together with lack of significance occurred because the sample size was small. For all responses analyzed, data are available only from 2001, and this relatively short period of record for Lake Arlington reduced statistical power while making anomalous results more likely.

Lake Arlington Top Samples, Quarters 3 and 4
Summary of Regression for Log Abundance of Bluegreen Algae (R^2 = 0.326)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.176	0.191	0.604
TN:TP	-0.174	-0.183	0.609
DO	-0.175	-0.209	0.608
Air Temp.	0.325	0.397	0.329
Elevation	0.298	0.535	0.373
Log Trib. Inflow	-0.118	-0.184	0.729

Lake Arlington Top Samples, Quarters 3 and 4
Summary of Regression for Proportion of Bluegreen Algae (R^2 = 0.635)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	-0.002	-0.002	0.995
TN:TP	0.135	0.104	0.692
DO	-0.552	-0.575	0.079
Air Temp.	0.229	0.200	0.499
Elevation	0.401	0.552	0.222
Log Trib. Inflow	-0.265	-0.313	0.430

Explanatory Regression Results for Cedar Creek Lake

Top Samples, Quarters 3 and 4

Using all top samples from quarters 3 and 4, Chloride in Cedar Creek Lake was significantly related to SOI and Elevation. These relationships indicate that Chloride increases under La Niña conditions and when Elevation is low. Possibly, these variables indicate relatively dry conditions under which Chloride is concentrated by evaporation. The R^2 for the multiple regression indicates that 51% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Cedar Creek Lake was significantly related to Air Temperature, Air Temperature Variation, Elevation, Elevation SD, and Tributary Inflow. These relationships indicated that Alkalinity increases as Air Temperature decreases, but also when it is higher than long-term average conditions. Alkalinity also increases when Elevation is low but variable, and when Tributary Inflow is low. This pattern of effects suggests that possibly, indicators of dry conditions are accompanied by evaporation that concentrates Alkalinity. The R^2 for the multiple regression indicates that 37% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, TP in Cedar Creek Lake was significantly related to Elevation SD and Tributary Inflow. These relationships indicated that TP increases with low variability in Elevation and high Tributary Inflow. Possibly, loading of TP is associated with strong inflow. The R^2 for the multiple regression indicates that 12% of the variance in TP was explained by the set of explanatory variables together. TN in Cedar Creek Lake was significantly related to Air Temperature and Elevation SD. These relationships indicate that TN increases under cool conditions and when Elevation is variable. The R^2 for the multiple regression indicates that 19% of the variance in TN was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, Chlorophyll *a* in Cedar Creek Lake was significantly related to SOI, Elevation SD, Log TN, and Tributary Inflow. These relationships indicated that Chlorophyll *a* is higher when TN is high. It is also higher under La Niña conditions that are generally drier than average, when variation in Elevation is low, and when Tributary Inflow is low. The R^2 for the multiple regression indicates that 33% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Cedar Creek Lake Top Samples
Summary of Regression for Chloride (R^2 = 0.507)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.264**	**-0.238**	**0.007**
Air Temperature	-0.106	-0.095	0.28
Air Temp. Var.	0.057	0.052	0.57
Elevation	**-0.565**	**-0.572**	**< 0.001**
Elevation SD	0.168	0.153	0.087
Log Trib. Inflow	-0.186	-0.172	0.058

Cedar Creek Lake Top Samples
Summary of Regression for Alkalinity (R^2 = 0.370)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.075	-0.068	0.30
Air Temperature	**-0.395**	**-0.418**	**< 0.001**
Air Temp. Var.	**0.273**	**0.274**	**< 0.001**
Elevation	**-0.341**	**-0.339**	**< 0.001**
Elevation SD	**0.245**	**0.253**	**0.001**
Log Trib. Inflow	**-0.173**	**-0.191**	**0.016**

Cedar Creek Lake Top Samples
Summary of Regression for Log TP (R^2 = 0.124)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.139	0.153	0.047
Air Temperature	0.072	0.085	0.30
Air Temp. Var.	0.039	0.046	0.58
Elevation	-0.083	-0.093	0.23
Elevation SD	**-0.182**	**-0.220**	**0.009**
Log Trib. Inflow	**0.323**	**0.434**	**< 0.001**

Cedar Creek Lake Top Samples
Summary of Regression for Log TN (R^2 = 0.187)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.097	0.105	0.18
Air Temperature	**-0.269**	**-0.317**	**< 0.001**
Air Temp. Var.	0.103	0.124	0.16
Elevation	0.051	0.055	0.48
Elevation SD	**0.257**	**0.320**	**< 0.001**
Log Trib. Inflow	0.011	0.013	0.89

Cedar Creek Lake Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.330)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**0.165**	**0.165**	**0.024**
Air Temperature	-0.105	-0.115	0.15
Air Temp. Var.	-0.058	-0.064	0.43
Elevation	-0.101	-0.100	0.17
Elevation SD	**-0.154**	**-0.183**	**0.036**
Log TP	0.136	0.133	0.064
Log TN	**0.314**	**0.338**	**< 0.001**
Log Trib. Inflow	**-0.201**	**-0.248**	**0.006**

Main Pool Top Samples, Quarters 3 and 4

Using Main Pool top samples from quarters 3 and 4, Chloride in Cedar Creek Lake was significantly related only to Elevation. This relationship indicates that Chloride increases when Elevation is low. Possibly, Elevation is low under relatively dry conditions for which Chloride is concentrated by evaporation. The R^2 for the multiple regression indicates that 61% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Cedar Creek Lake was significantly related to Air Temperature, Air Temperature Variation, and Elevation. These relationships indicated that Alkalinity increases as Air Temperature decreases, but also when it is higher than long-term average conditions. Alkalinity also increases when Elevation is low. Possibly, Elevation is low under relatively dry conditions for which Alkalinity is concentrated by evaporation. The R^2 for the multiple regression indicates that 35% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, TP in Cedar Creek Lake was significantly related to Elevation SD and Tributary Inflow. These relationships indicated that TP increases with low variability in Elevation and high Tributary Inflow. Possibly, loading of TP is associated with strong inflow. The R^2 for the multiple regression indicates that 20% of the variance in TP was explained by the set of explanatory variables together. TN in Cedar Creek Lake was significantly related to Air Temperature and Elevation SD. These relationships indicate that TN increases under cool conditions and when Elevation is variable. The R^2 for the multiple regression indicates that 29% of the variance in TN was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Cedar Creek Lake was significantly related only to SOI. This relationship indicated that Chlorophyll *a* is higher under La Niña conditions that are generally drier than average. The R^2 for the multiple regression indicates that 31% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Cedar Creek Lake Main Pool Top Samples
Summary of Regression for Chloride (R^2 = 0.605)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.200	-0.198	0.30
Air Temperature	0.230	0.194	0.23
Air Temp. Var.	-0.019	-0.016	0.92
Elevation	**-0.707**	**-0.764**	**< 0.001**
Elevation SD	-0.085	-0.081	0.66
Log Trib. Inflow	-0.039	-0.034	0.84

Cedar Creek Lake Main Pool Top Samples
Summary of Regression for Alkalinity (R^2 = 0.347)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.077	-0.071	0.52
Air Temperature	**-0.412**	**-0.446**	**< 0.001**
Air Temp. Var.	**0.316**	**0.328**	**0.006**
Elevation	**-0.290**	**-0.289**	**0.012**
Elevation SD	0.219	0.228	0.061
Log Trib. Inflow	-0.065	-0.072	0.58

Cedar Creek Lake Main Pool Top Samples
Summary of Regression for Log TP (R^2 = 0.203)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.189	0.200	0.096
Air Temperature	0.073	0.082	0.52
Air Temp. Var.	0.131	0.148	0.25
Elevation	-0.092	-0.097	0.42
Elevation SD	**-0.265**	**-0.311**	**0.018**
Log Trib. Inflow	**0.392**	**0.517**	**< 0.001**

Cedar Creek Lake Main Pool Top Samples
Summary of Regression for Log TN (R^2 = 0.297)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.145	0.146	0.22
Air Temperature	**-0.351**	**-0.397**	**0.002**
Air Temp. Var.	0.171	0.193	0.15
Elevation	0.064	0.064	0.59
Elevation SD	**0.329**	**0.388**	**0.005**
Log Trib. Inflow	0.003	0.003	0.98

Cedar Creek Lake Main Pool Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.307)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**0.364**	**0.397**	**0.002**
Air Temperature	-0.150	-0.174	0.21
Air Temp. Var.	-0.131	-0.148	0.28
Elevation	-0.128	-0.129	0.29
Elevation SD	-0.148	-0.188	0.22
Log TP	-0.140	-0.141	0.25
Log TN	0.134	0.146	0.27
Log Trib. Inflow	-0.049	-0.062	0.69

Bottom Samples, Quarters 3 and 4, Redox-Sensitive Parameters

Using all bottom samples from quarters 3 and 4, Dissolved Oxygen in Cedar Creek Lake was significantly related to Air Temperature, Elevation, Elevation SD, and Tributary Inflow. The relationship with Air Temperature indicated that Dissolved Oxygen decreases under warm conditions. It is likely that during warm weather both decomposition rates and water column stability increase, contributing to a depletion of oxygen in deeper waters. In addition, Dissolved Oxygen decreases when Elevation is high and its variability is low, and when Tributary Inflow is low, factors that might additionally favor water column stability. The R^2 for the multiple regression indicates that 48% of the variance in Dissolved Oxygen was explained by the set of explanatory variables together.

NH_3 in Cedar Creek Lake was significantly related only to Dissolved Oxygen. This relationship indicated that NH_3 increases as Dissolved Oxygen decreases. It is likely that the conditions of high decomposition rates and water column stability that produce oxygen depletion in deep waters favor NH_3 accumulation. The R^2 for the multiple regression indicates that 30% of the variance in NH_3 was explained by the set of explanatory variables together. Ortho-PO_4 in Cedar Creek Lake was significantly related only to Dissolved Oxygen. This relationship indicated that Ortho-PO_4 increases as Dissolved Oxygen decreases. It is likely that the conditions of high decomposition rates and water column stability produce oxygen depletion in deep waters and favor Ortho-PO_4 accumulation. The R^2 for the multiple regression indicates that 28% of the variance in Ortho-PO_4 was explained by the set of explanatory variables together.

Cedar Creek Lake Bottom Samples
Summary of Regression for DO (R^2 = 0.479)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	-0.150	-0.126	0.11
Air Temperature	**-0.453**	**-0.436**	**< 0.001**
Air Temp. Var.	0.057	0.050	0.54
Elevation	**-0.199**	**-0.172**	**0.031**
Elevation SD	**0.268**	**0.253**	**0.004**
Log Trib. Inflow	**0.318**	**0.323**	**< 0.001**

Cedar Creek Lake Bottom Samples
Summary of Regression for Log NH_3 (R^2 = 0.303)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.362**	**-0.449**	**< 0.001**
SOI	-0.105	-0.102	0.26
Air Temperature	0.137	0.154	0.14
Air Temp. Var.	0.025	0.026	0.79
Elevation	0.063	0.063	0.50
Elevation SD	-0.102	-0.112	0.28
Log Trib. Inflow	0.084	0.099	0.37

Cedar Creek Lake Bottom Samples
Summary of Regression for Log Ortho-PO_4 (R^2 = 0.283)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.336**	**-0.416**	**< 0.001**
SOI	-0.154	-0.153	0.10
Air Temperature	0.049	0.055	0.61
Air Temp. Var.	-0.074	-0.073	0.44
Elevation	0.150	0.153	0.11
Elevation SD	-0.038	-0.040	0.69
Log Trib. Inflow	-0.025	-0.029	0.79

Bluegreen Algae, Top Samples, Quarters 3 and 4

Using top samples from quarters 3 and 4, the abundance of Bluegreen Algae in Cedar Creek Lake was significantly related only to TN. This relationship indicated that the abundance of Bluegreen Algae increases as TN increases. The R^2 for the multiple regression indicates that 36% of the variance in the abundance of Bluegreen Algae was explained by the set of explanatory variables together. The proportion of Bluegreen Algae in Cedar Creek Lake was significantly related only to TN. This relationship indicated that the proportion of Bluegreen Algae increases as TN increases, similar to the relationship that was significant for abundance. The R^2 for the multiple regression indicates that 32% of the variance in the proportion of Bluegreen Algae was explained by the set of explanatory variables together.

Cedar Creek Lake Top Samples, Quarters 3 and 4
Summary of Regression for Log Abundance of Bluegreen Algae (R^2 = 0.360)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	**0.491**	**0.644**	**0.004**
TN:TP	-0.088	-0.101	0.632
DO	-0.169	-0.148	0.354
Air Temp.	0.112	0.102	0.540
Elevation	-0.006	-0.006	0.973
Log Trib. Inflow	-0.165	-0.163	0.367

Cedar Creek Lake Top Samples, Quarters 3 and 4
Summary of Regression for Proportion of Bluegreen Algae (R^2 = 0.321)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	**0.369**	**0.467**	**0.038**
TN:TP	0.027	0.032	0.882
DO	-0.260	-0.239	0.151
Air Temp.	0.230	0.220	0.205
Elevation	-0.141	-0.137	0.441
Log Trib. Inflow	-0.057	-0.058	0.755

Explanatory Regression Results for Richland Chambers Lake

Top Samples, Quarters 3 and 4

Using all top samples from quarters 3 and 4, Chloride in Richland Chambers Lake was significantly related to SOI and Elevation. These relationships indicated that Chloride increases under El Niño conditions and when Elevation is low. The R^2 for the multiple regression indicates that 45% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Richland Chambers Lake was significantly related to SOI, Air Temperature, Elevation, Elevation SD, and Tributary Inflow. These relationships indicated that Alkalinity increases under El Niño conditions, under cool conditions, when Elevation is high but has low variability, and when Tributary Inflow is low. The R^2 for the multiple regression indicates that 54% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, TP in Richland Chambers Lake was significantly related to Elevation, Elevation SD, and Tributary Inflow. These relationships indicated that TP increases with decreasing Elevation and low variability in Elevation, and increases with Tributary Inflow. Possibly, loading of TP is associated with strong inflow. However, the R^2 for the multiple regression indicates that only 7% of the variance in TP was explained by the set of explanatory variables together. TN in Richland Chambers Lake was significantly related to all of the explanatory variables. These relationships indicated that TN was higher under La Niña conditions, cool conditions that were nevertheless warmer than long-term average conditions, when Elevation was low but its variability was high, and when Tributary Inflow was high. The R^2 for the multiple regression indicates that 25% of the variance in TN was explained by the set of explanatory variables together.

Using all top samples from quarters 3 and 4, Chlorophyll *a* in Richland Chambers Lake was significantly related to SOI, Air Temperature, Air Temperature Variation, Elevation, Elevation SD, TP and TN. These relationships indicated that Chlorophyll *a* is higher when both nutrients, TP and TN are higher. It is also higher under La Niña conditions, warm conditions that are nevertheless cooler than long-term average conditions, and when Elevation is low and has little variability. The R^2 for the multiple regression indicates that 51% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Richland Chambers Lake Top Samples
Summary of Regression for Chloride (R^2 = 0.450)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.362**	**-0.337**	**0.001**
Air Temperature	0.101	0.080	0.36
Air Temp. Var.	0.031	0.025	0.78
Elevation	**-0.540**	**-0.546**	**< 0.001**
Elevation SD	0.047	0.039	0.67
Log Trib. Inflow	-0.144	-0.140	0.19

Richland Chambers Lake Top Samples
Summary of Regression for Alkalinity (R^2 = 0.539)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.396**	**-0.307**	**< 0.001**
Air Temperature	**-0.711**	**-0.752**	**< 0.001**
Air Temp. Var.	0.081	0.057	0.32
Elevation	**0.225**	**0.172**	**0.006**
Elevation SD	**-0.224**	**-0.178**	**0.006**
Log Trib. Inflow	**-0.182**	**-0.155**	**0.026**

Richland Chambers Lake Top Samples
Summary of Regression for Log TP (R^2 = 0.068)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.063	0.064	0.44
Air Temperature	-0.024	-0.026	0.76
Air Temp. Var.	-0.060	-0.060	0.46
Elevation	**-0.163**	**-0.174**	**0.044**
Elevation SD	**-0.201**	**-0.225**	**0.012**
Log Trib. Inflow	**0.184**	**0.223**	**0.022**

Richland Chambers Lake Top Samples
Summary of Regression for Log TN (R^2 = 0.250)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**0.150**	**0.163**	**0.045**
Air Temperature	**-0.177**	**-0.186**	**0.022**
Air Temp. Var.	**0.217**	**0.236**	**0.004**
Elevation	**-0.262**	**-0.265**	**0.001**
Elevation SD	**0.185**	**0.186**	**0.022**
Log Trib. Inflow	**0.219**	**0.202**	**0.013**

Richland Chambers Lake Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.511)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**0.189**	**0.245**	**0.003**
Air Temperature	**0.655**	**0.648**	**< 0.001**
Air Temp. Var.	**-0.219**	**-0.281**	**0.001**
Elevation	**-0.115**	**-0.142**	**0.087**
Elevation SD	**-0.192**	**-0.224**	**0.006**
Log TP	**0.127**	**0.168**	**0.042**
Log TN	**0.234**	**0.269**	**0.001**
Log Trib. Inflow	0.066	0.075	0.37

Main Pool Top Samples, Quarters 3 and 4

Using Main Pool top samples from quarters 3 and 4, Chloride in Richland Chambers Lake was significantly related to SOI and Elevation. These relationships indicated that Chloride increases under El Niño conditions and when Elevation is low. The R^2 for the multiple regression indicates that 67% of the variance in Chloride was explained by the set of explanatory variables together. Alkalinity in Richland Chambers Lake was significantly related to SOI, Air Temperature, Elevation, Elevation SD. These relationships indicated that Alkalinity increases under El Niño conditions, under cool conditions, and when Elevation is high but has low variability. The R^2 for the multiple regression indicates that 50% of the variance in Alkalinity was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, TP in Richland Chambers Lake was significantly related only to Elevation SD. This relationship indicated that TP increases with low variability in Elevation. The R^2 for the multiple regression indicates that 13% of the variance in TP was explained by the set of explanatory variables together. TN in Richland Chambers Lake was significantly related to Air Temperature, Air Temperature Variation, and Elevation. These relationships indicated that TN was higher under cool conditions that were nevertheless warmer than long-term average conditions, and when Elevation was low. The R^2 for the multiple regression indicates that 31% of the variance in TN was explained by the set of explanatory variables together.

Using Main Pool top samples from quarters 3 and 4, Chlorophyll *a* in Richland Chambers Lake was significantly related to SOI, Air Temperature, Air Temperature Variation, Elevation SD, and TN. These relationships indicated that Chlorophyll *a* is higher when TN is higher. It is also higher under La Niña conditions, warm conditions that are nevertheless cooler than long-term average conditions, and when Elevation has low variability. The R^2 for the multiple regression indicates that 71% of the variance in Chlorophyll *a* was explained by the set of explanatory variables together.

Richland Chambers Lake Main Pool Top Samples
Summary of Regression for Chloride (R^2 = 0.671)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.483**	**-0.488**	**0.007**
Air Temperature	0.028	0.046	0.81
Air Temp. Var.	0.127	0.196	0.31
Elevation	**-0.629**	**-0.650**	**< 0.001**
Elevation SD	-0.138	-0.200	0.30
Log Trib. Inflow	-0.245	-0.261	0.17

Richland Chambers Lake Main Pool Top Samples
Summary of Regression for Alkalinity (R^2 = 0.500)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**-0.410**	**-0.332**	**< 0.001**
Air Temperature	**-0.665**	**-0.690**	**< 0.001**
Air Temp. Var.	0.019	0.014	0.88
Elevation	**0.254**	**0.203**	**0.032**
Elevation SD	**-0.251**	**-0.209**	**0.034**
Log Trib. Inflow	-0.151	-0.134	0.21

Richland Chambers Lake Main Pool Top Samples
Summary of Regression for Log TP (R^2 = 0.132)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.107	0.106	0.36
Air Temperature	-0.154	-0.158	0.19
Air Temp. Var.	-0.100	-0.097	0.39
Elevation	-0.222	-0.233	0.056
Elevation SD	**-0.236**	**-0.257**	**0.041**
Log Trib. Inflow	0.201	0.233	0.084

Richland Chambers Lake Main Pool Top Samples
Summary of Regression for Log TN (R^2 = 0.311)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.152	0.134	0.20
Air Temperature	**-0.352**	**-0.337**	**0.002**
Air Temp. Var.	**0.241**	**0.213**	**0.040**
Elevation	**-0.288**	**-0.274**	**0.014**
Elevation SD	0.134	0.127	0.26
Log Trib. Inflow	0.160	0.165	0.18

Richland Chambers Lake Main Pool Top Samples
Summary of Regression for Log Chlorophyll *a* (R^2 = 0.708)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	**0.298**	**0.180**	**0.012**
Air Temperature	**0.812**	**0.872**	**< 0.001**
Air Temp. Var.	**-0.354**	**-0.220**	**0.002**
Elevation	-0.133	-0.085	0.27
Elevation SD	**-0.249**	**-0.164**	**0.036**
Log TP	0.172	0.102	0.15
Log TN	**0.376**	**0.267**	**0.001**
Log Trib. Inflow	0.075	0.051	0.54

Bottom Samples, Quarters 3 and 4, Redox-Sensitive Parameters

Using all bottom samples from quarters 3 and 4, Dissolved Oxygen in Richland Chambers Lake was significantly related to Air Temperature, Air Temperature Variation, and Tributary Inflow. The relationship with Air Temperature indicated that Dissolved Oxygen decreases under warm conditions, while the relationship with Air Temperature Variation indicates that this trend is mitigated when conditions are warmer than long-term average conditions. It is likely that during warm weather both decomposition rates and water column stability increase, contributing to a depletion of oxygen in deeper waters. The relationship with Tributary Inflow indicated that Dissolved Oxygen decreases with inflow. Possibly, inflow is associated with loading of organic matter that consumes oxygen as it decomposes. The R^2 for the multiple regression indicates that 83% of the variance in Dissolved Oxygen was explained by the set of explanatory variables together.

NH_3 in Richland Chambers Lake was significantly related only to Dissolved Oxygen. This relationship indicated that NH_3 increases as Dissolved Oxygen decreases. It is likely that the conditions of high decomposition rates and water column stability that produce oxygen depletion in deep waters favor NH_3 accumulation. The R^2 for the multiple regression indicates that 59% of the variance in NH_3 was explained by the set of explanatory variables together. Ortho-PO_4 in Richland Chambers Lake was significantly related to Dissolved Oxygen and SOI. These relationships indicated that Ortho-PO_4 increases as Dissolved Oxygen decreases, and during La Niña conditions. It is likely that the conditions of high decomposition rates and water column stability produce oxygen depletion in deep waters and favor Ortho-PO_4 accumulation. The R^2 for the multiple regression indicates that 40% of the variance in Ortho-PO_4 was explained by the set of explanatory variables together.

Richland Chambers Lake Bottom Samples
Summary of Regression for DO (R^2 = 0.831)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
SOI	0.034	0.076	0.38
Air Temperature	**-0.917**	**-0.902**	**< 0.001**
Air Temp. Var.	**0.175**	**0.388**	**< 0.001**
Elevation	-0.043	-0.094	0.28
Elevation SD	0.015	0.032	0.71
Log Trib. Inflow	**-0.134**	**-0.261**	**0.002**

Richland Chambers Lake Bottom Samples
Summary of Regression for Log NH_3 (R^2 = 0.589)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.528**	**-0.926**	**< 0.001**
SOI	-0.082	-0.055	0.37
Air Temperature	-0.134	-0.209	0.15
Air Temp. Var.	0.147	0.104	0.11
Elevation	-0.047	-0.033	0.61
Elevation SD	0.018	0.013	0.84
Log Trib. Inflow	-0.107	-0.084	0.25

Richland Chambers Lake Bottom Samples
Summary of Regression for Log Ortho-PO_4 (R^2 = 0.402)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
DO	**-0.367**	**-0.777**	**< 0.001**
SOI	**-0.227**	**-0.188**	**0.032**
Air Temperature	-0.147	-0.304	0.17
Air Temp. Var.	0.289	0.252	0.01
Elevation	0.014	0.012	0.90
Elevation SD	-0.023	-0.020	0.83
Log Trib. Inflow	-0.064	-0.060	0.55

Bluegreen Algae, Top Samples, Quarters 3 and 4

Using top samples from quarters 3 and 4, the abundance of Bluegreen Algae in Richland Chambers Lake was not significantly related to any of the explanatory variables. The R^2 for the multiple regression indicates that 34% of the variance in the abundance of Bluegreen Algae was explained by the set of explanatory variables together. The proportion of Bluegreen Algae in Richland Chambers Lake was significantly related only to Air Temperature. This relationship indicated that the proportion of Bluegreen Algae increases as Air Temperature increases. The R^2 for the multiple regression indicates that 48% of the variance in the proportion of Bluegreen Algae was explained by the set of explanatory variables together.

Richland Chambers Lake Top Samples, Quarters 3 and 4
Summary of Regression for Log Abundance of Bluegreen Algae (R^2 = 0.342)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.232	0.223	0.235
TN:TP	0.134	0.119	0.498
DO	-0.029	-0.042	0.883
Air Temp.	0.297	0.450	0.125
Elevation	-0.099	-0.095	0.615
Log Trib. Inflow	-0.231	-0.223	0.236

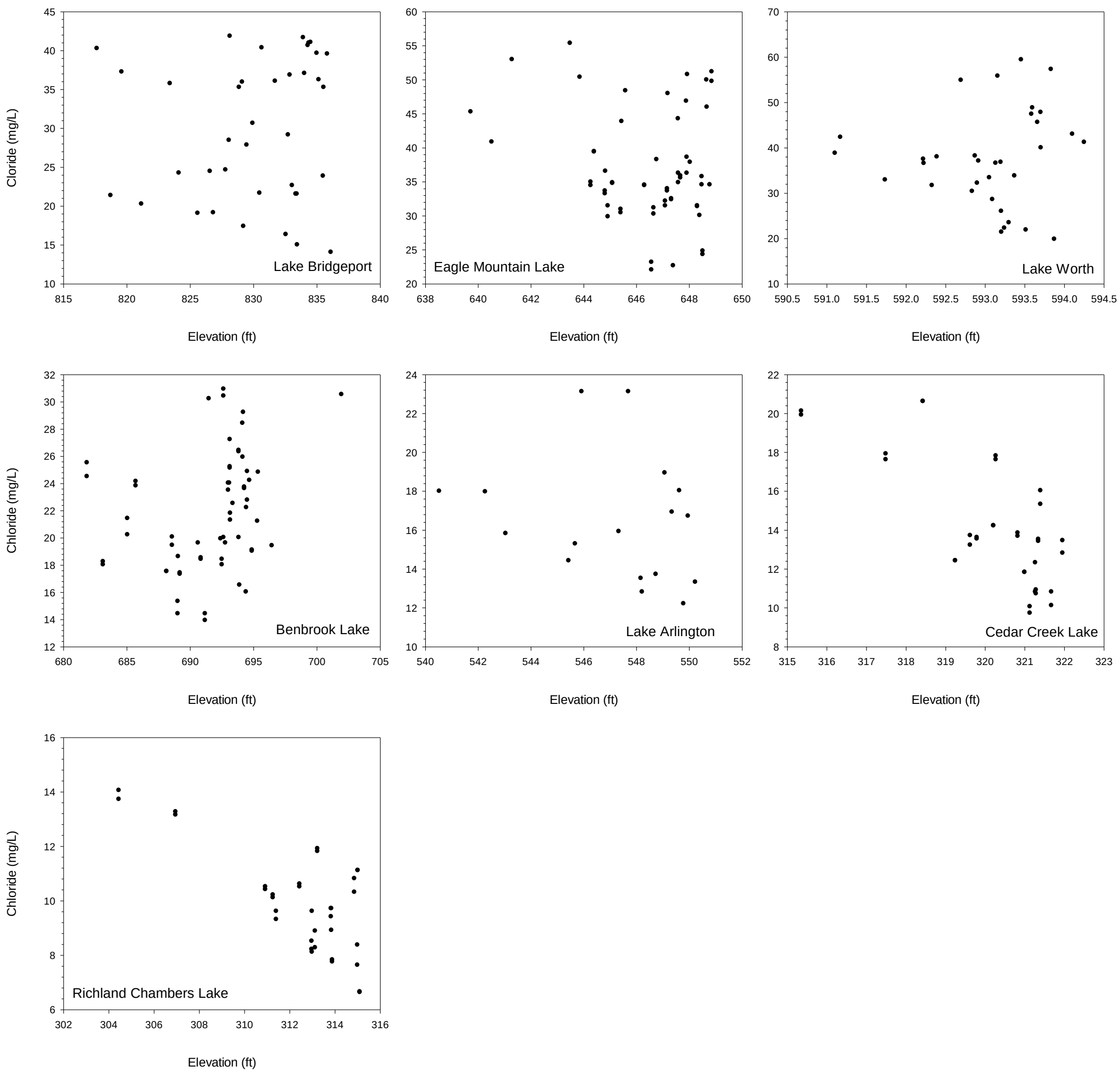
Richland Chambers Lake Top Samples, Quarters 3 and 4
Summary of Regression for Proportion of Bluegreen Algae (R^2 = 0.477)

Explanatory Variable	Partial Correlation	Standardized Coefficient	P-value
TN	0.332	0.294	0.084
TN:TP	0.041	0.032	0.836
DO	-0.038	-0.049	0.848
Air Temp.	**0.400**	**0.563**	**0.035**
Elevation	-0.148	-0.127	0.452
Log Trib. Inflow	-0.214	-0.182	0.275

Summary and Illustrations of Explanatory Regressions

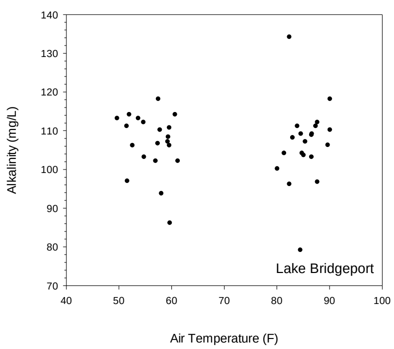
Chloride

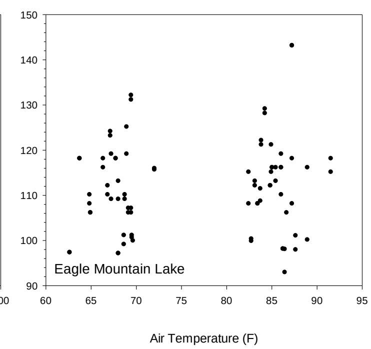
Chloride was more predictable (higher R^2) in the easternmost lakes (Richland Chambers and Cedar Creek) where $R^2 > 0.6$ was obtained, than in the other lakes, with $R^2 < 0.4$. Elevation had a significant partial correlation with chloride in the two easternmost lakes; in Richland Chambers and in other lakes explanatory variables with strong partial correlations also included Air Temperature, Tributary Inflow, and SOI. Relationships with Elevation are illustrated below for Main Pool Top samples, from quarters 3 and 4. Where there is a strong relationship, Chloride tends to be higher when Elevation is low.

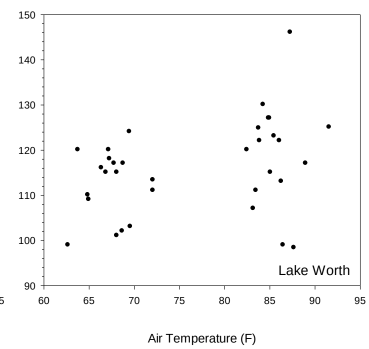


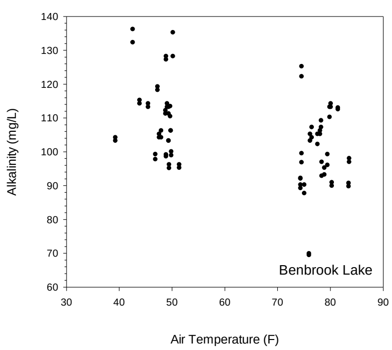
Alkalinity

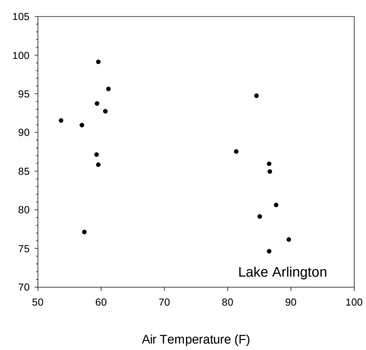
Alkalinity was more predictable in Lake Worth, where $R^2 > 0.5$ was obtained, than in the other lakes. Air Temperature, Air Temperature Variation, SOI, Elevation, Elevation SD, and Tributary Inflow were all significant in various lakes. Relationships with Air Temperature are illustrated below for Main Pool Top samples, from quarters 3 and 4. Where there is a relationship, Alkalinity tends to be higher when Air Temperature is low, except in Lake Worth, which shows an opposite tendency. Depending on the index month for the lake in question, quarter 4 may be colder than quarter 3.

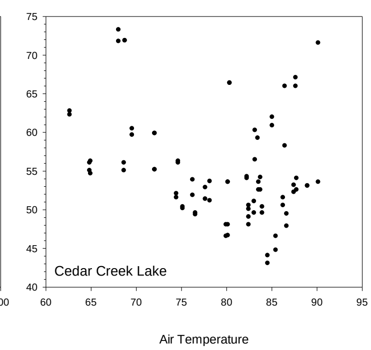


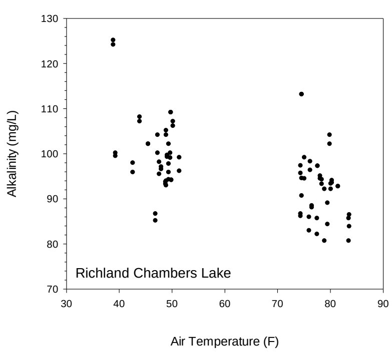






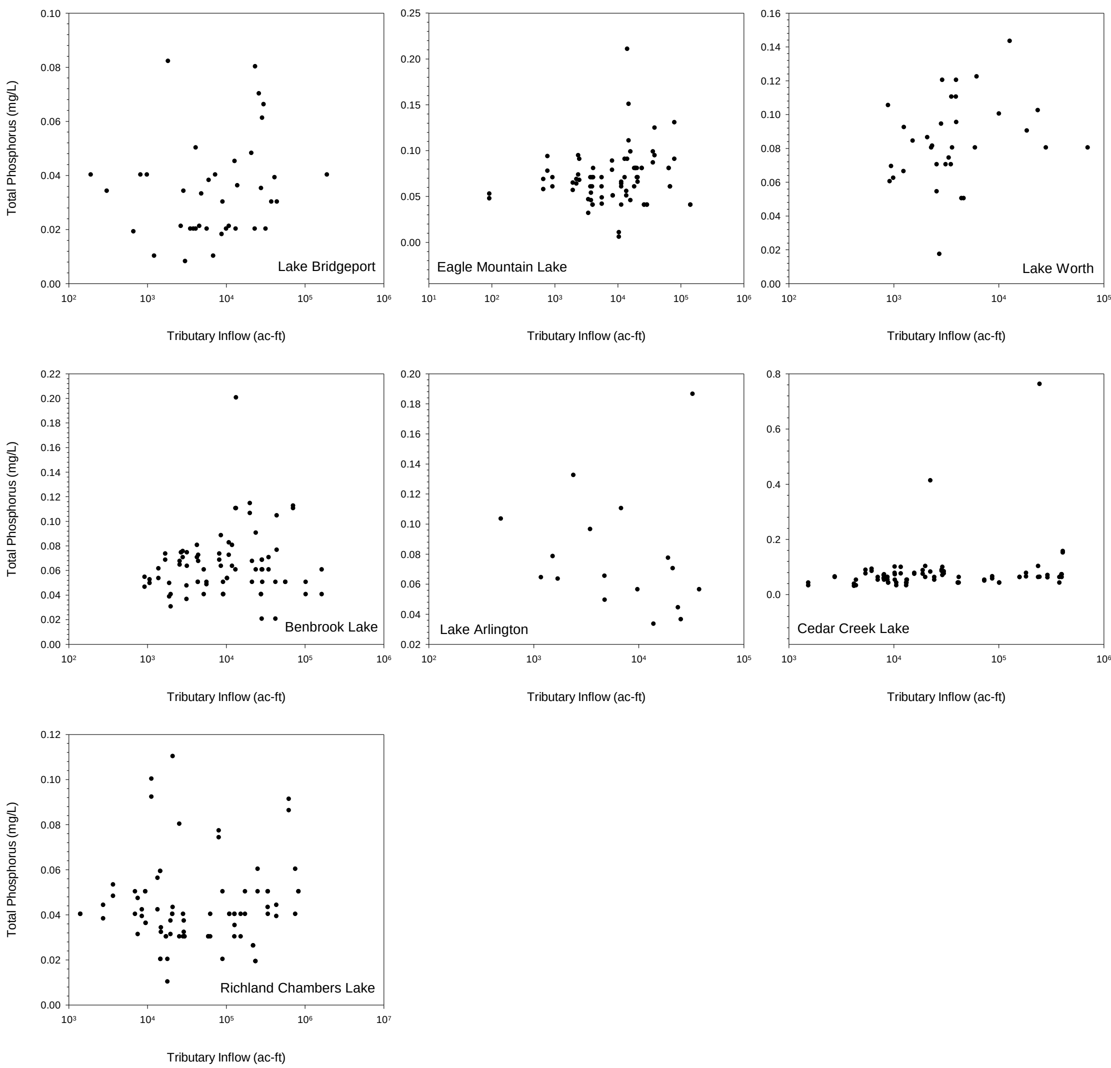






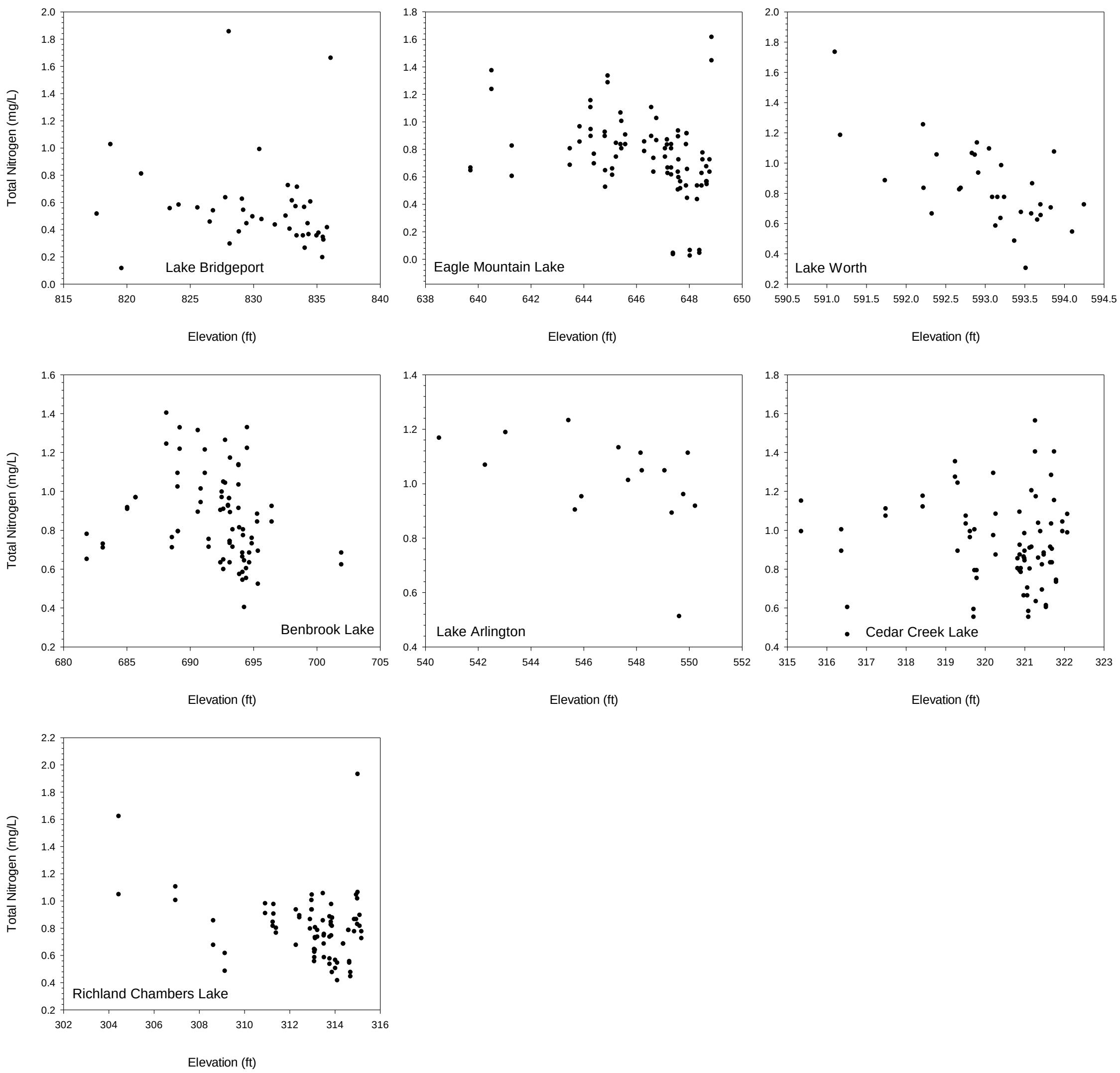
Total Phosphorus

Total Phosphorus was most predictable in Lake Arlington, where $R^2 > 0.4$ was obtained, than in the other lakes. Several of the explanatory variables were significant in various lakes. Relationships with Tributary Inflow are illustrated below for Main Pool Top samples, from quarters 3 and 4. Where there is a relationship, Total Phosphorus tends to be higher when Tributary Inflow is higher.



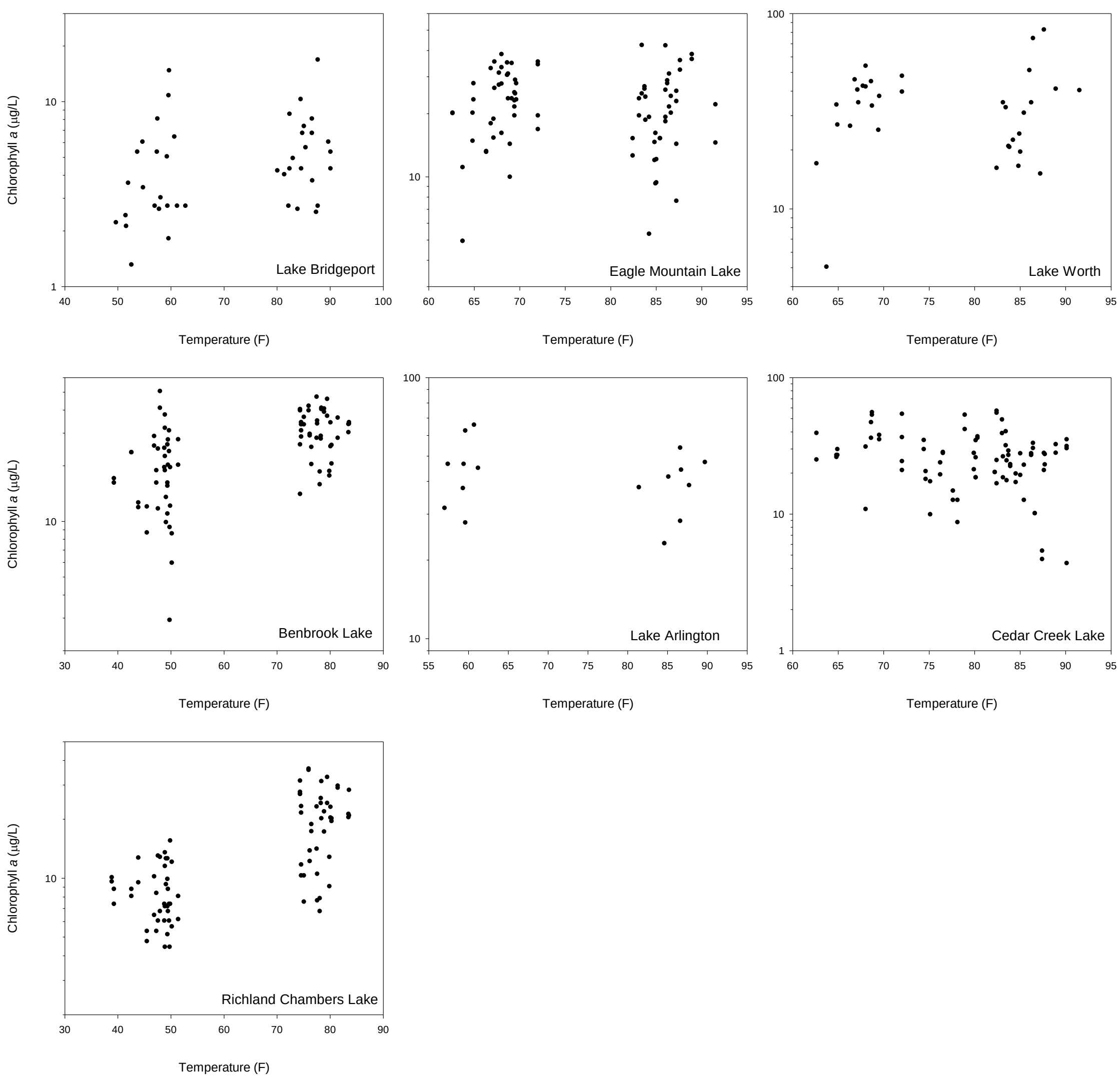
Total Nitrogen

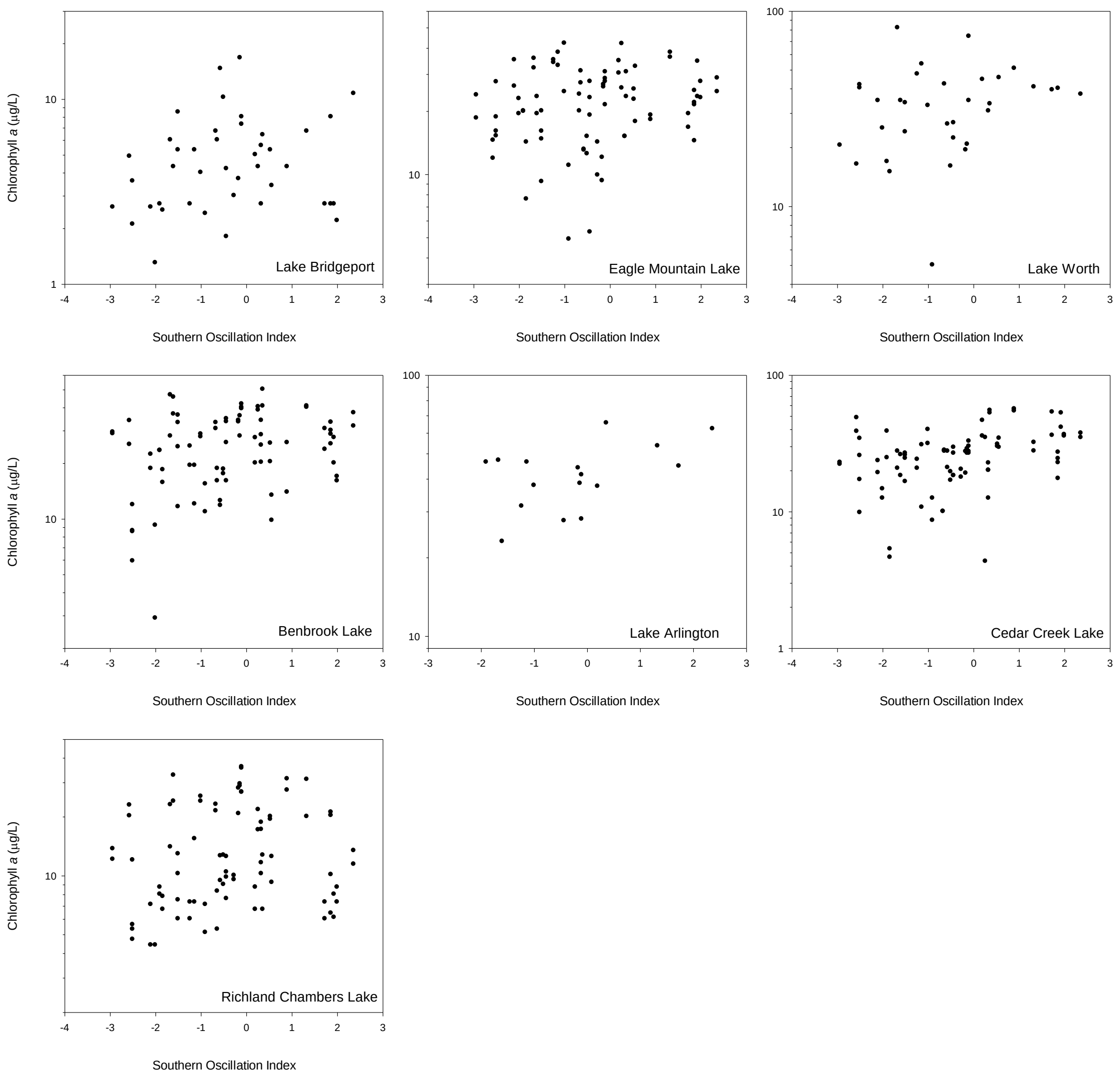
Total Nitrogen was most predictable in Richland Chambers Lake, where $R^2 > 0.4$ was obtained for Main Pool Top samples, than in the other lakes. Several of the explanatory variables were significant in various lakes, but Elevation and Elevation SD were significant in the largest number of lakes. Relationships with Elevation are illustrated below for Main Pool Top samples, from quarters 3 and 4. Where there is a relationship, Total Nitrogen tends to be higher when Elevation is lower.

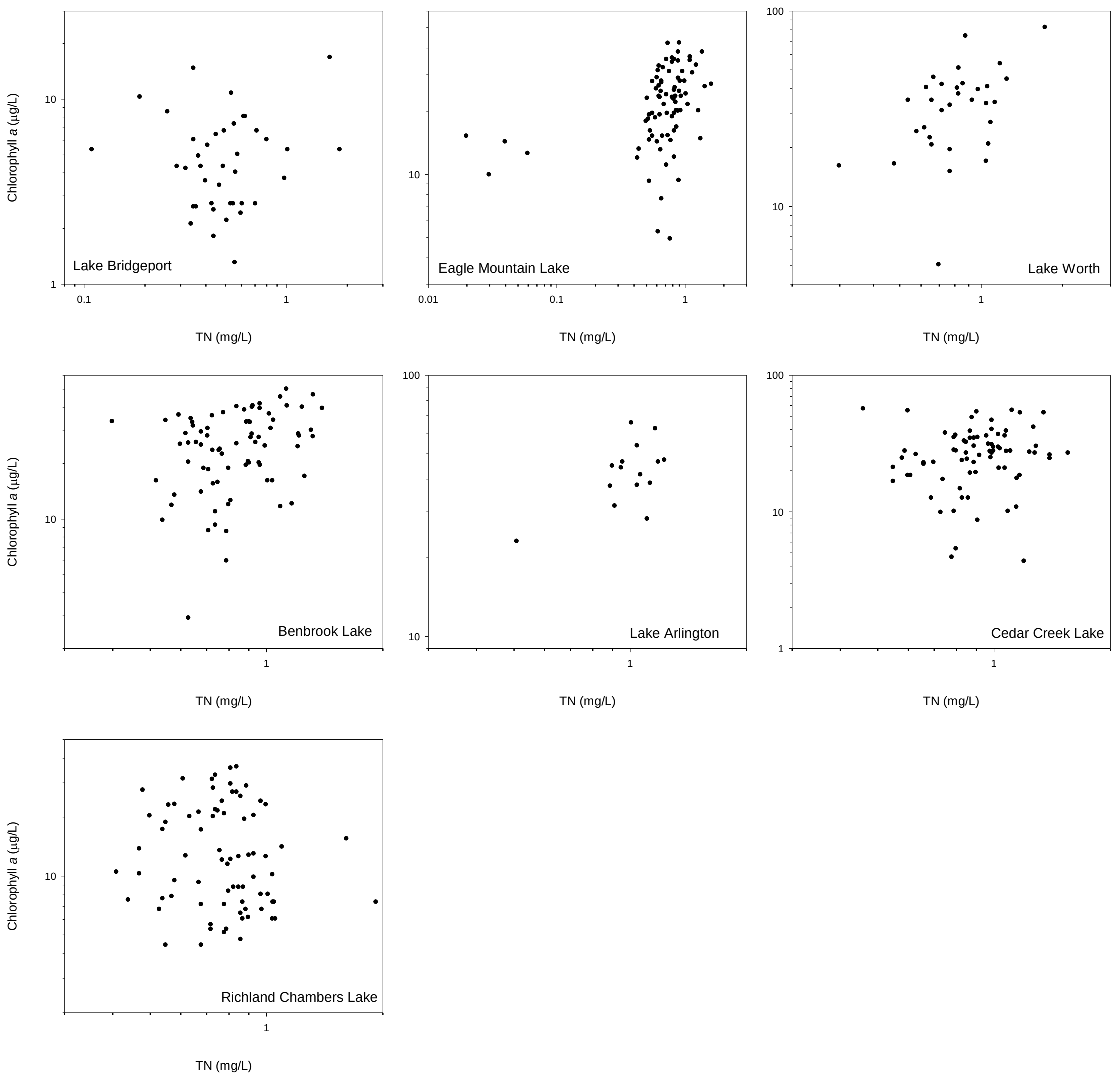


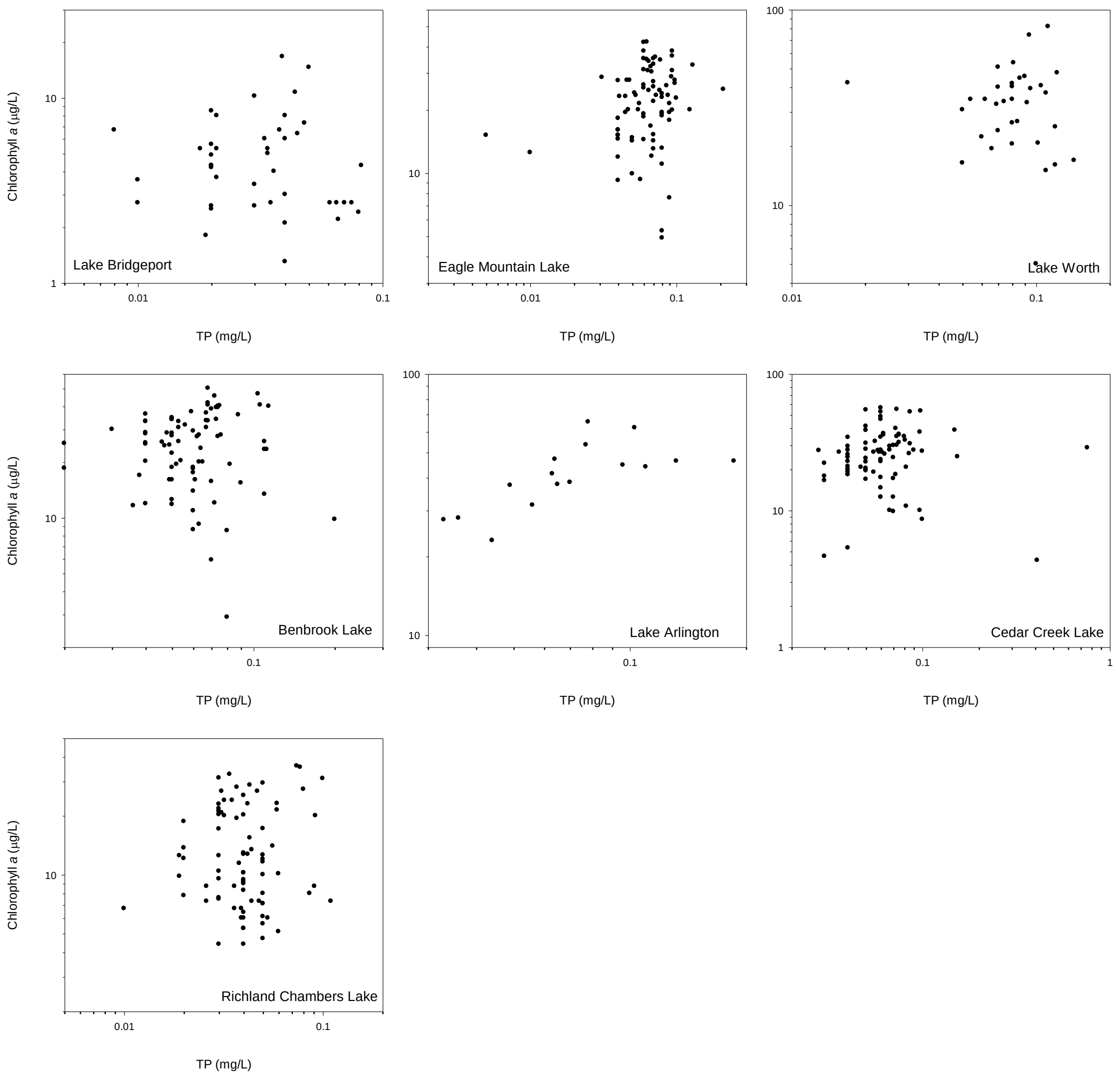
Chlorophyll *a*

Chlorophyll was most predictable for data restricted to Main Pool Top samples for quarters 3 and 4, where $R^2 > 0.5$ was obtained for several lakes, up to $R^2 = 0.95$ for Lake Arlington. Several of the explanatory variables were significant in various lakes, with Air Temperature, SOI, and TN being significant in several of the lakes. Relationships with Air Temperature, SOI, TN and TP are illustrated below for Main Pool Top samples, from quarters 3 and 4. Where there are relationships, Chlorophyll *a* tends to be higher when Temperature is higher, when SOI is in a positive phase, and when TN is higher, although relationships with TP appear to be weak.



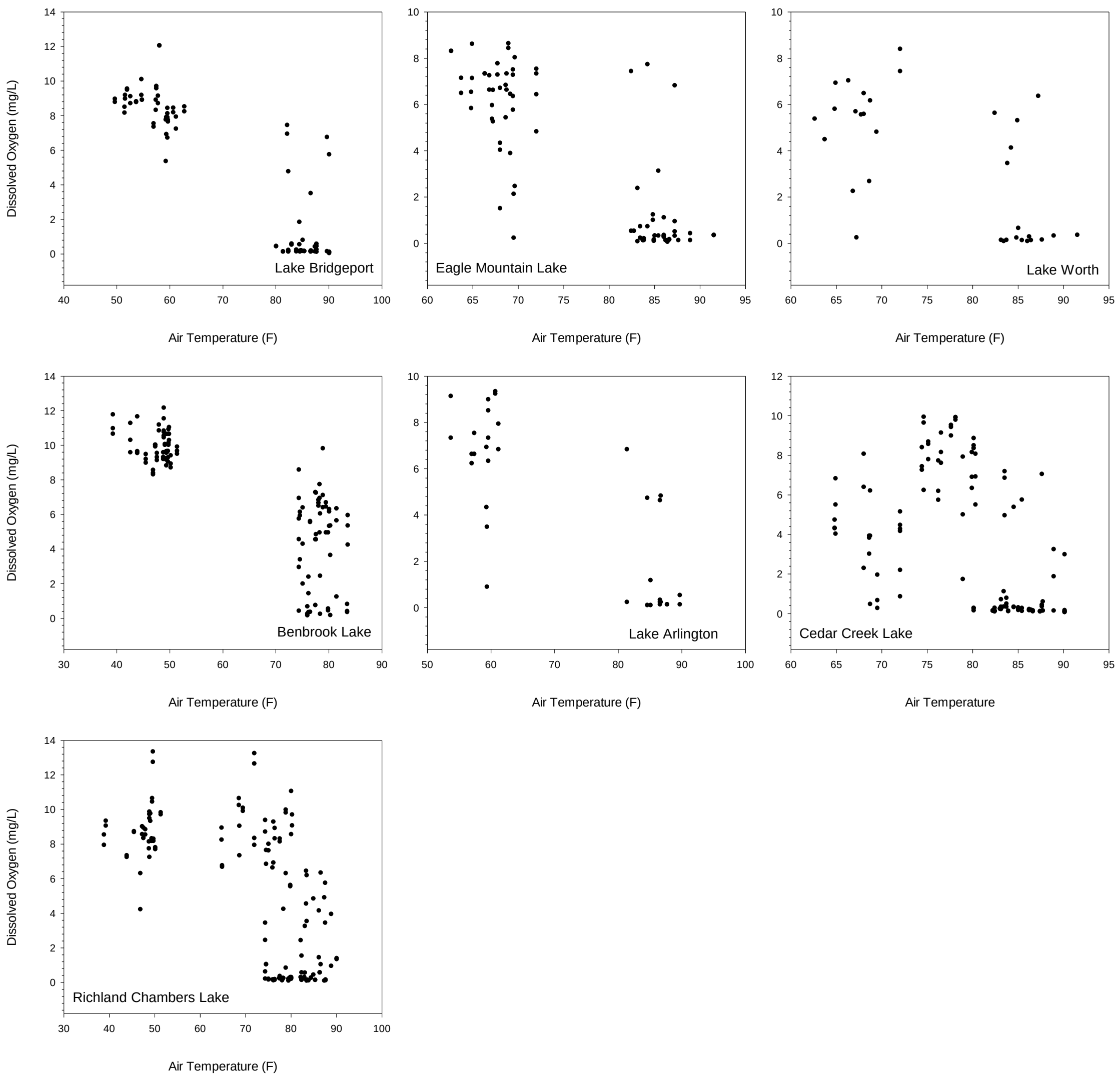

Lake Bridgeport
Eagle Mountain Lake
Lake Worth
Benbrook Lake
Lake Arlington
Cedar Creek Lake
Richland Chambers Lake
Chlorophyll a (µg/L)
Southern Oscillation Index


Lake Bridgeport
Eagle Mountain Lake
Lake Worth
Benbrook Lake
Lake Arlington
Cedar Creek Lake
Richland Chambers Lake
Chlorophyll a (µg/L)
TN (mg/L)


Chlorophyll a (µg/L)
TP (mg/L)
Lake Bridgeport
Eagle Mountain Lake
Lake Worth
Benbrook Lake
Lake Arlington
Cedar Creek Lake
Richland Chambers Lake

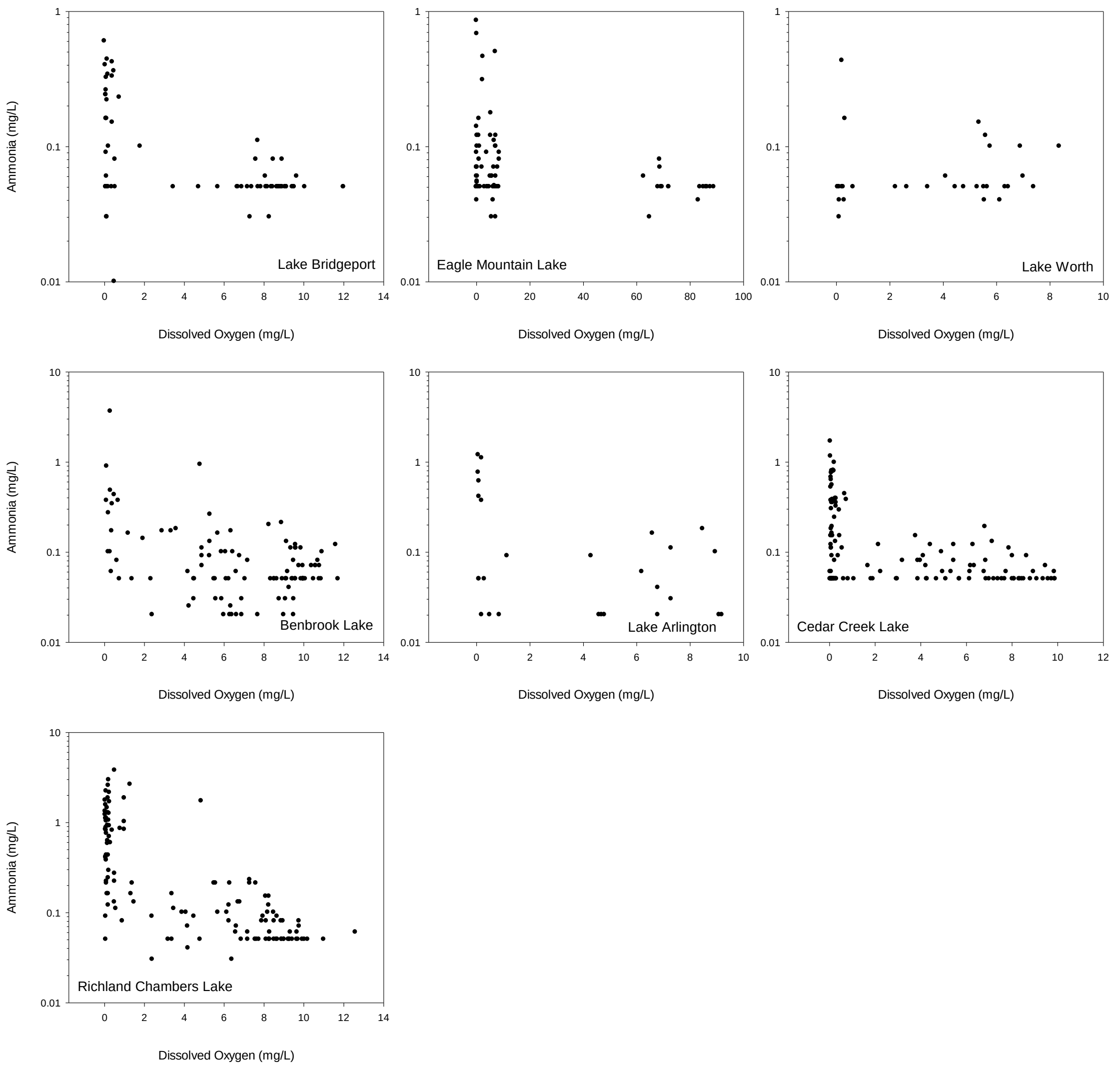
Dissolved Oxygen

Dissolved Oxygen was moderately to highly predictable for Bottom samples for quarters 3 and 4, where $R^2 > 0.4$ was obtained for all lakes, up to $R^2 = 0.84$ for Eagle Mountain Lake. Air Temperature was significant in all lakes. Relationships with Air Temperature are illustrated below for Bottom samples, from quarters 3 and 4. Dissolved Oxygen tends to be lower when Temperature is higher, regardless of whether quarter 4 is much colder or only a little colder than quarter 3.



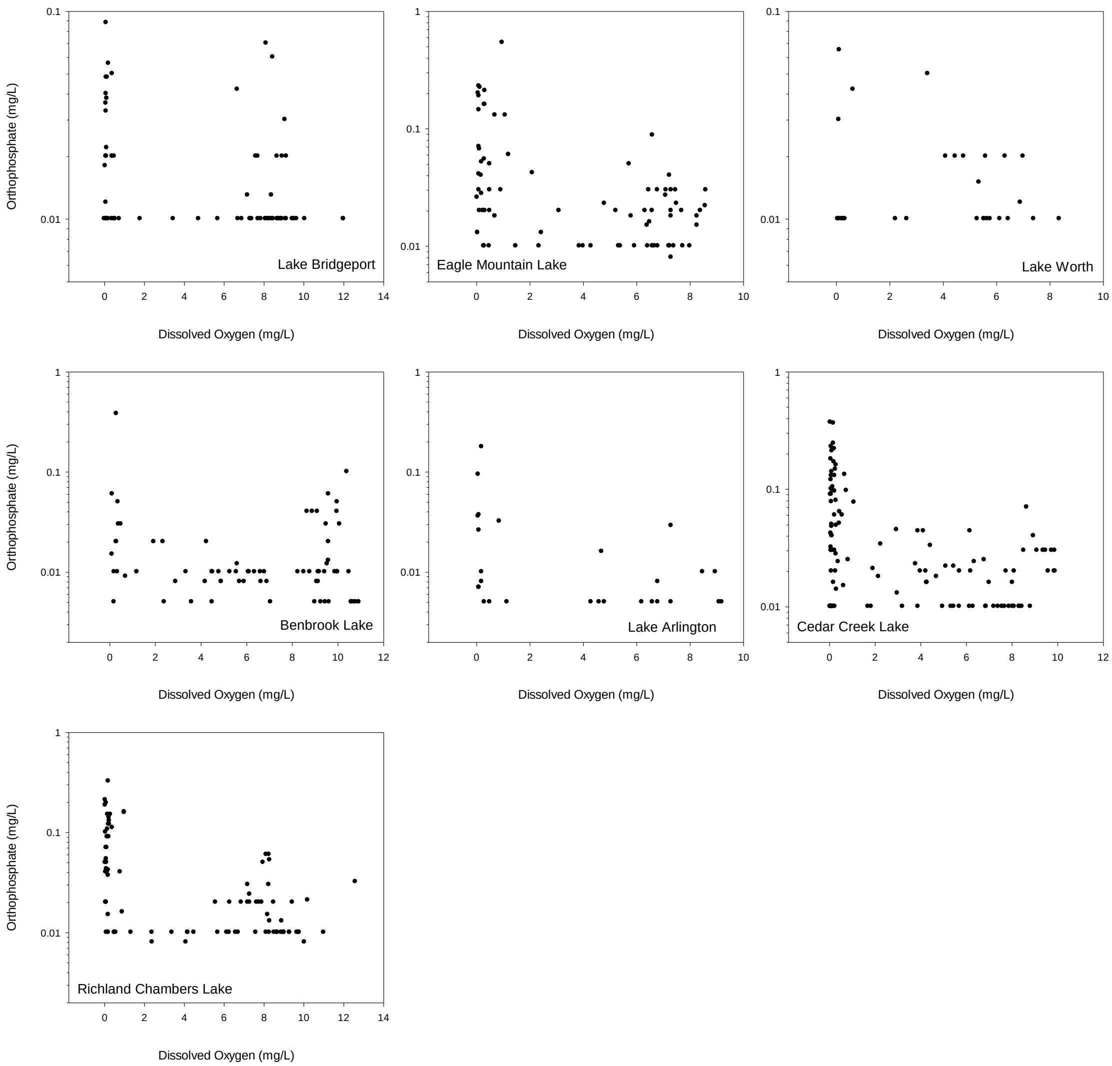
Ammonia Nitrogen

In exploratory regressions it was clear that Ammonia Nitrogen was strongly related to Dissolved Oxygen, so it was included as an explanatory variable. Ammonia Nitrogen was most predictable in the four easternmost lakes, with $R^2 > 0.3$. Dissolved Oxygen was a significant explanatory variable in five lakes. Relationships with Dissolved Oxygen are illustrated below for Bottom samples, from quarters 3 and 4. Ammonia Nitrogen tends to be higher when Dissolved Oxygen is lower.



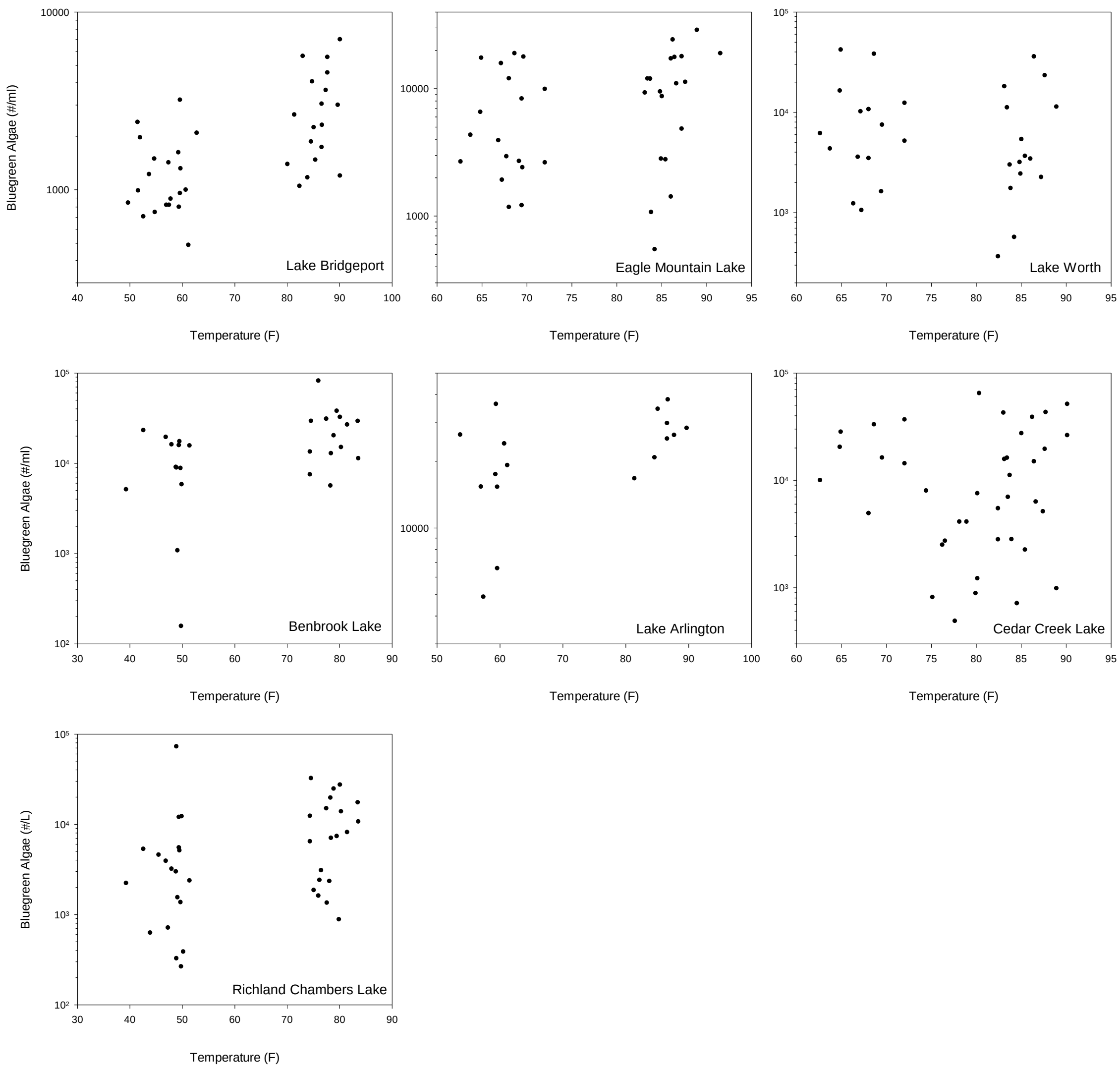
Orthophosphate

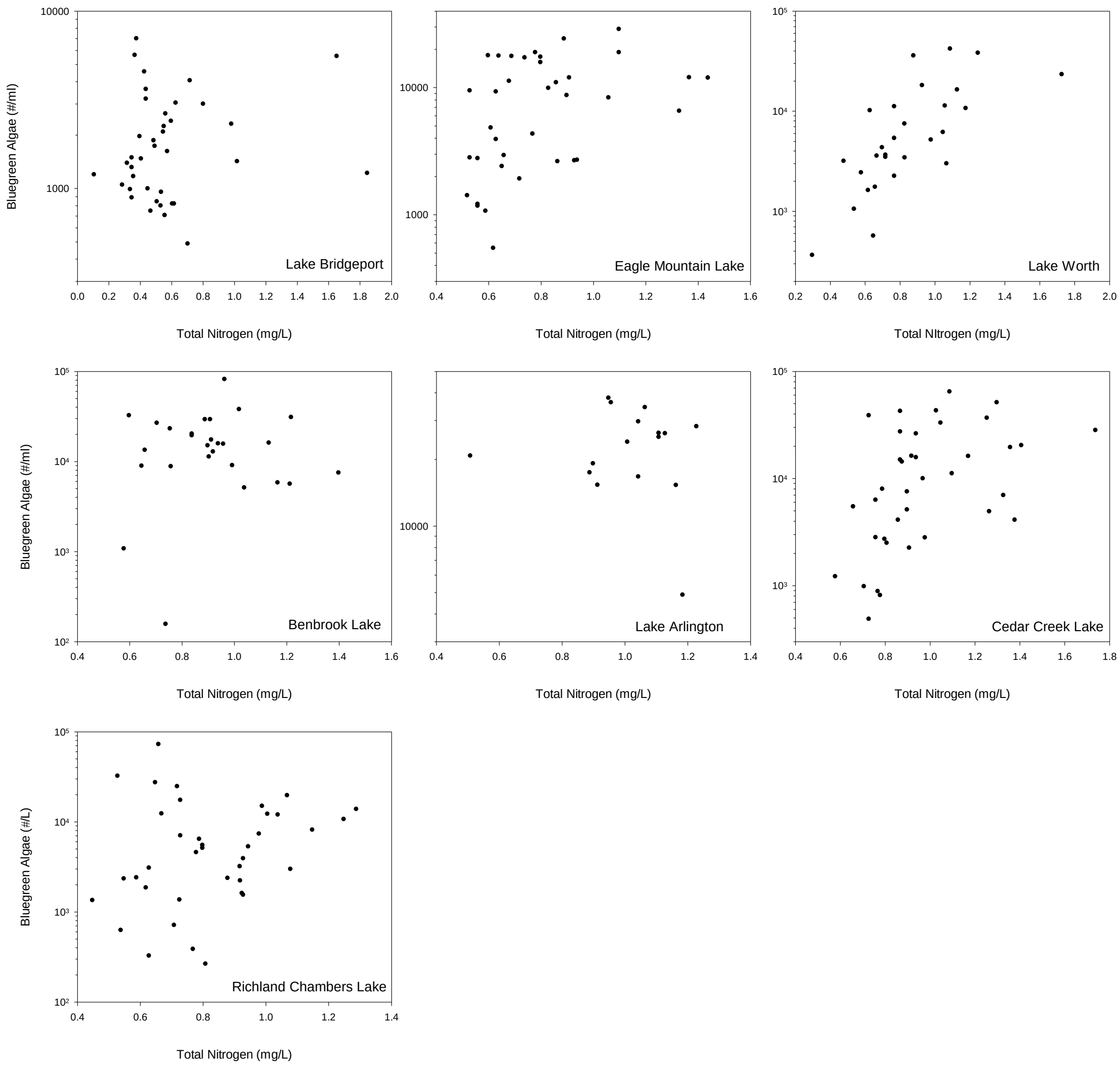
In exploratory regressions it was clear that Orthophosphate was strongly related to Dissolved Oxygen, so it was included as an explanatory variable. Orthophosphate was weakly to moderately predictable, with R^2 ranging 0.21 to 0.34 among lakes. Dissolved Oxygen was a significant explanatory variable in four lakes. Relationships with Dissolved Oxygen are illustrated below for Bottom samples, from quarters 3 and 4. Orthophosphate tends to be higher when Dissolved Oxygen is lower.



Abundance of Bluegreen Algae

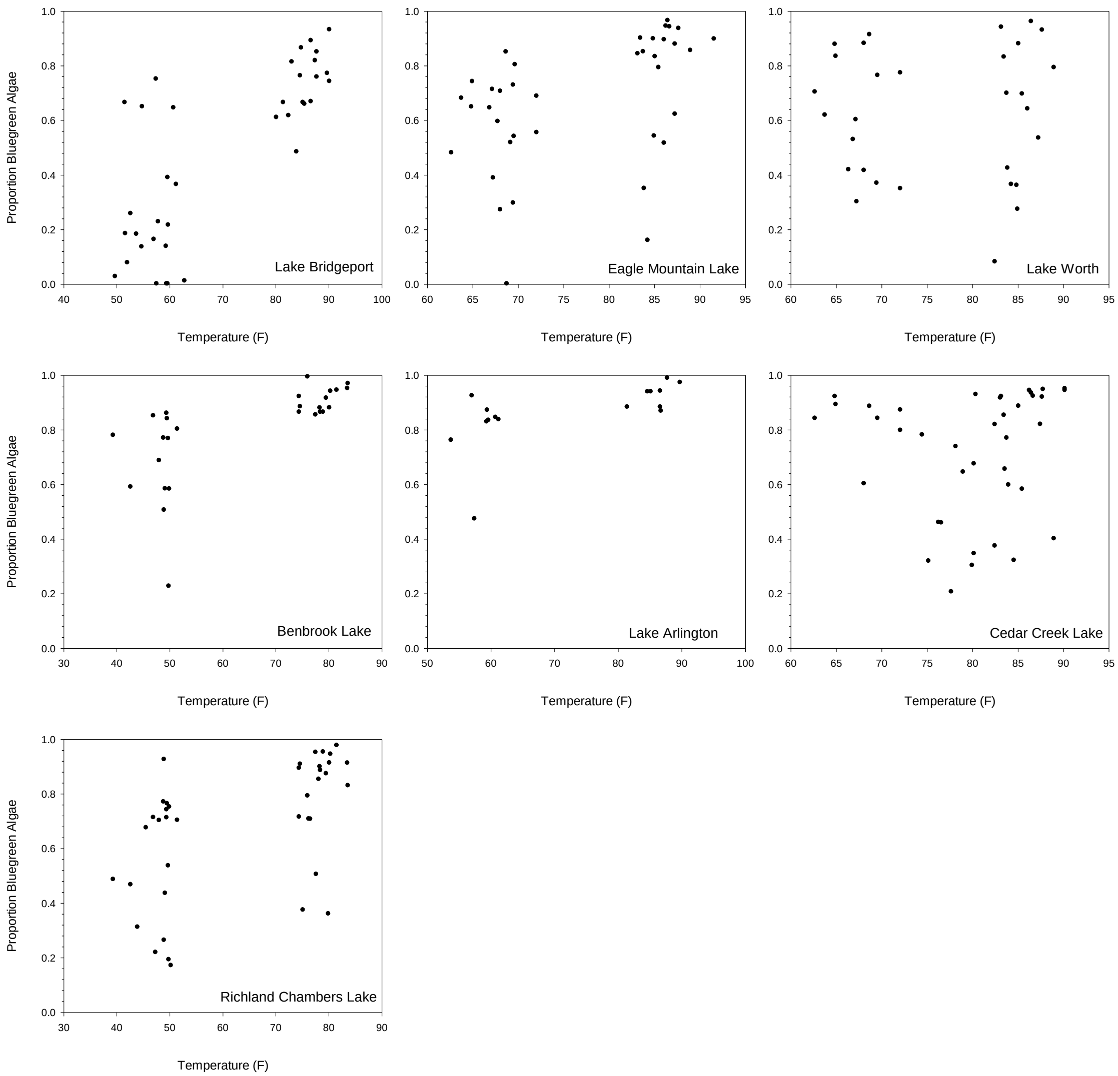
The abundance of Bluegreen Algae was most predictable for Lake Bridgeport and Lake Worth (R^2 = 0.70 and 0.68 respectively), and less so for other lakes (R^2 from 0.20 to 0.44). Only Air Temperature and TN were significant in any of the lakes. Partly because of small sample size, significant relationships were not found for any explanatory variable in many of the lakes. Relationships with Air Temperature and TN are illustrated below. Where there are relationships, the abundance of Bluegreen Algae tends to be higher when Temperature and TN are higher. For relationships with TN, the direction of cause and effect is unclear. High TN can contribute to eutrophication and provide nutrients that stimulate Bluegreen Algae, but some of these algae are also nitrogen-fixing species that can produce TN.

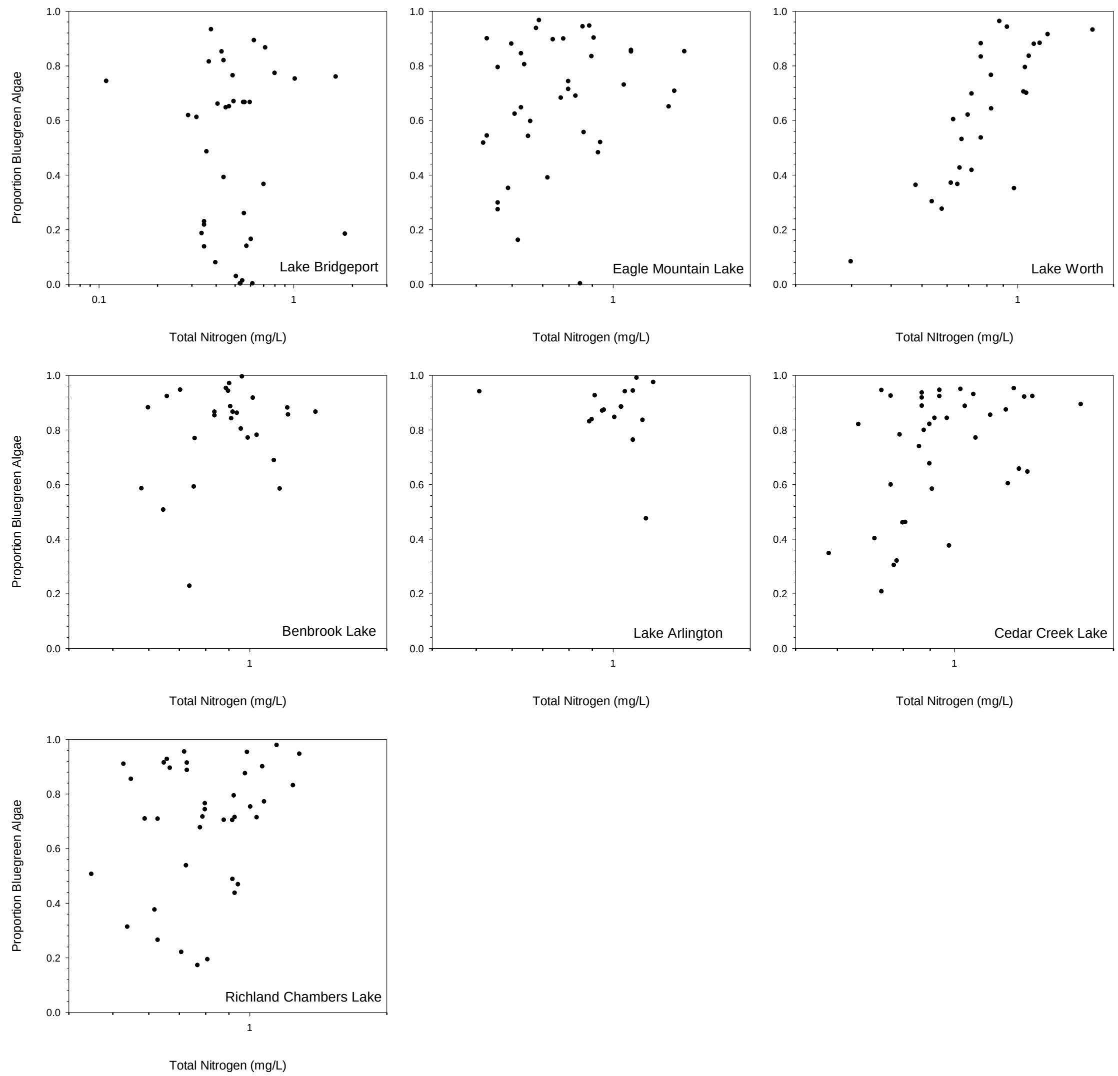




Proportion of Bluegreen Algae

The proportion of Bluegreen Algae was most predictable for Lake Bridgeport, Lake Worth, and Lake Arlington (R^2 from 0.63 to 0.72), and less so for other lakes (R^2 from 0.20 to 0.48). Only Air Temperature and TN were significant in any of the lakes. Partly because of small sample size, significant relationships were not found for any explanatory variable in many of the lakes. Relationships with Air Temperature and TN are illustrated below. Where there are relationships, the proportion of Bluegreen Algae tends to be higher when Temperature and TN are higher. For relationships with TN, the direction of cause and effect is unclear. High TN can contribute to eutrophication and provide nutrients that stimulate Bluegreen Algae, but some of these algae are also nitrogen-fixing species that can produce TN.


Lake Bridgeport
Eagle Mountain Lake
Lake Worth
Benbrook Lake
Lake Arlington
Cedar Creek Lake
Richland Chambers Lake
Proportion Bluegreen Algae
Temperature (F)



References

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Rast, W., V.H. Smith, and J.A. Thornton. 1991. Characteristics of eutrophication, p. 37-63. In: Ryding, S.O., and W. Rast, eds. *The Control of Eutrophication in Lakes and Reservoirs. Man and the Biosphere Series*, **vol. 1**. UNESCO and Parthenon Publishing Group, Paris.