LOXAHATCHEE RIVER WATER QUALITY TRENDS AND STANDARDS

TASK 2: FINAL REPORT

In Partial Fulfillment of PC P601857

For the Period

October 2005 through September 2006

Respectfully Submitted by

D. Albrey Arrington, Ph.D.
Director of Water Resources
Loxahatchee River District

October 30, 2006

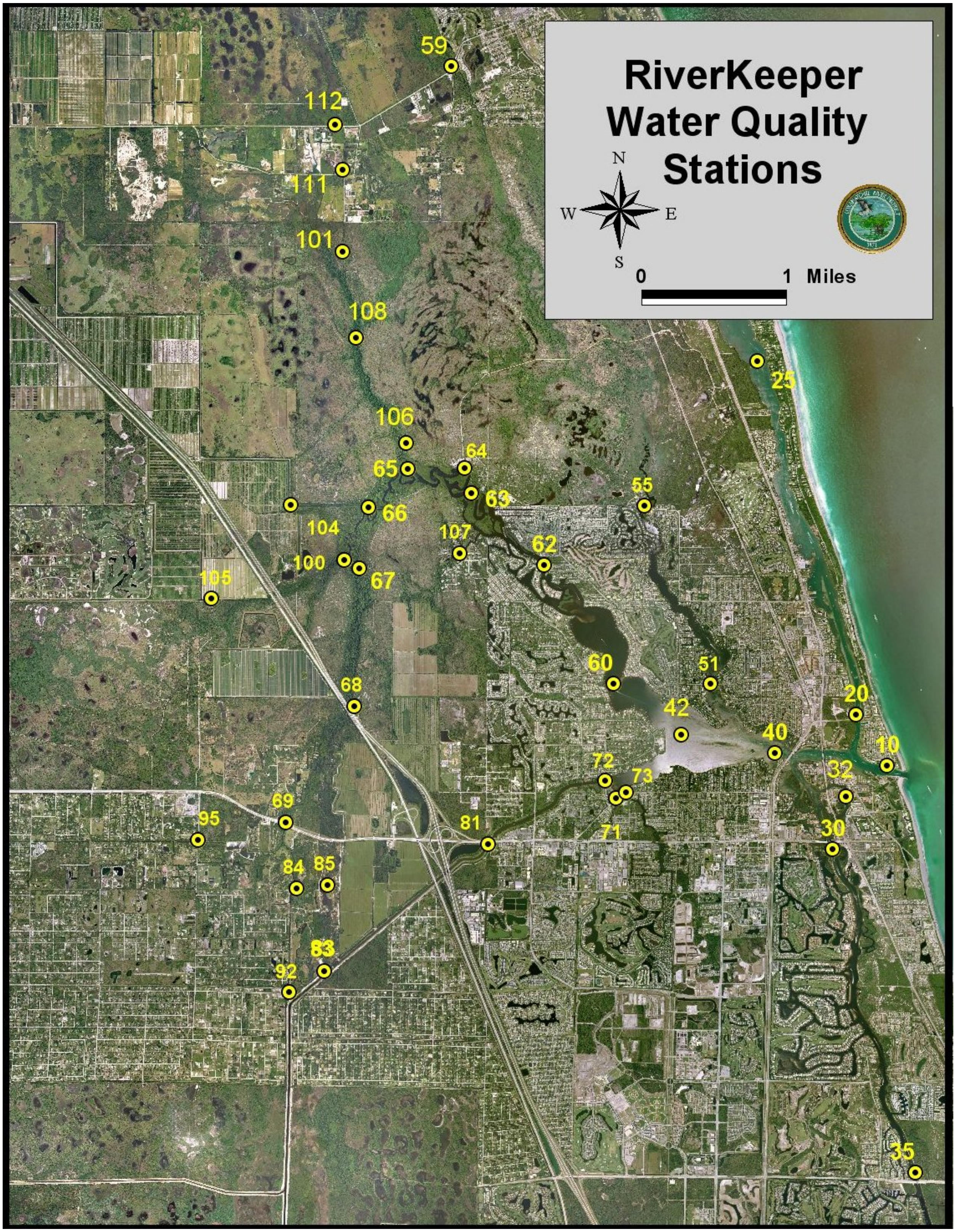


Figure 1. The Loxahatchee River District's water quality monitoring stations in the Loxahatchee River and associated waters.

Introduction

Since 1971 the Loxahatchee River District (LRD) has been fulfilling its mission to preserve and protect the Loxahatchee River through an innovative wastewater treatment and reuse program and an active water quality monitoring program. LRD staff have monitored water quality in the surface waters of the Loxahatchee River and associated waters (see Figure 1) in an effort to document the condition and ecological health of the river and to determine the location and extent of water quality issues that need to be addressed. Over these past 35 years, the Loxahatchee River District has contributed significantly to the understanding of the ecology of this river. While numerous reports have been written regarding the Loxahatchee River, perhaps none are as timely and as comprehensive as the recently published *Restoration Plan for the Northwest Fork of the Loxahatchee River* (SFWMD 2006). This document characterizes the watershed, discusses various restoration alternatives, and identifies the preferred restoration flow scenario. In particular, Table 10-1 of the restoration plan includes the interim water quality targets for the marine, polyhaline, mesohaline, wild and scenic, and freshwater tributary zones of the Loxahatchee River. The interim water quality targets were established by LRD and SFWMD scientists using bi-monthly water quality data collected by LRD over the eight year period 1995-2002.

Staff from the Loxahatchee River District's Wildpine Ecological Laboratory continue to collect bi-monthly water quality samples for nearly 30 parameters at approximately 40 sites located in the Loxahatchee River, its major tributaries, and associated waters (Figure 1). This water quality monitoring program, entitled RiverKeeper, was developed to identify long-term trends, and assess long-term compliance with the interim water quality targets. Furthermore, on-going results from this water quality monitoring program will be used to establish baseline conditions prior to modification of freshwater inflows resulting from the Comprehensive Everglades Restoration Project and the Northwest Fork Restoration Plan (CERP 2001; SFWMD 2006).

The purpose of this report is to provide a brief characterization and overview of the water quality conditions in Loxahatchee River over the previous year (September 2005 – July 2006). Water quality conditions over the past year are specifically compared to the established interim water quality targets (Figures 2, 3, and 4). Also, a system-wide, among-site comparison of the major water quality parameters analyzed is provided in Appendix A. Finally, all raw data used to generate this report are provided in electronic format (MS Excel) in the attached CD.

Study Area

The Loxahatchee River estuary encompasses approximately 400 ha and drains a watershed of approximately 700 km^2 located in northeastern Palm Beach County and southeastern Martin County, Florida, USA. Freshwater discharges into the estuary from the North Fork, the Northwest Fork, and the Southwest Fork of the Loxahatchee River. The hydrology of the basin has been substantially altered by flood control efforts since the 1950s. Historically (pre-1950), most surface water runoff reaching the estuary originated in the Loxahatchee and Hungryland Sloughs and flowed gradually to the Northwest Fork. In the 1930s the Lainhart Dam, a small fixed-weir dam, was constructed in the Northwest Fork at river mile 14.5 to reduce "over" drainage of upstream reaches of the Northwest Fork during the dry season. In 1958 a major canal (C-18) and flood control structure (S-46) were constructed to divert flows from the Northwest Fork to the Southwest Fork, which increased the intensity and decreased the duration of storm-related discharge to the estuary. Furthermore, since 1947 Jupiter inlet, the eastern link to the ocean, has been kept permanently open through ongoing dredging projects, which increased saltwater intrusion into the primarily freshwater Northwest Fork. Ongoing restoration efforts seek to increase base flows into the Northwest Fork, while not compromising the ecological integrity of downstream reaches (i.e., estuary) nor impairing valued ecosystem components of the estuary such as oysters and seagrasses (SFWMD 2006).

Materials and Methods

Water quality samples were collected once every other month (i.e., bi-monthly) at each station identified in Figure 1. GPS coordinates for each station are provided in Appendix B. Stations were accessed by boat or four wheel drive vehicle depending on location. At each station, physical water quality conditions (e.g., temperature, pH, conductivity, salinity, and dissolved oxygen) were evaluated using a Hydrolab multiprobe at the surface (0.3 m depth), though for stations 60 through 66 we also sampled at mid-depth and within 20 cm of the bottom. Nutrient, bacteriological, chlorophyll a, turbidity, total suspended solids, and water color samples were processed following Standard Methods by the Loxahatchee River District's Wildpine

Laboratory. A table showing probe calibration and Q/A & Q/C procedures for each parameter is provided in Appendix C. The Wildpine Laboratory is certified under the National Environmental Laboratory Accreditation Program (see Appendix D). Photosynthetically active radiation (PAR) was assessed by taking 3 replicates of PAR using 3 LI-COR spherical sensors (4 π) simultaneously located at 20 cm, 50 cm, and 100 cm below the water surface. Data were recorded on a LI-COR LI-1400 data logger.

Following LRD's previous work and the *Restoration Plan for the Northwest Fork of the Loxahatchee River* (SFWMD 2006), water quality was assessed for five zones of the river: marine, polyhaline, mesohaline, wild and scenic, and freshwater tributaries. The marine zone was characterized by stations 10, 20, and 30. The polyhaline zone was characterized by stations 51, 60, and 72. The mesohaline zone was characterized by stations 62, 63, and 64. The wild and scenic zone was characterized by stations 67, 68, and 69. The freshwater tributaries were characterized by stations 81 (C-18), 95 (Jupiter Farms), and 100 (Cypress Creek).

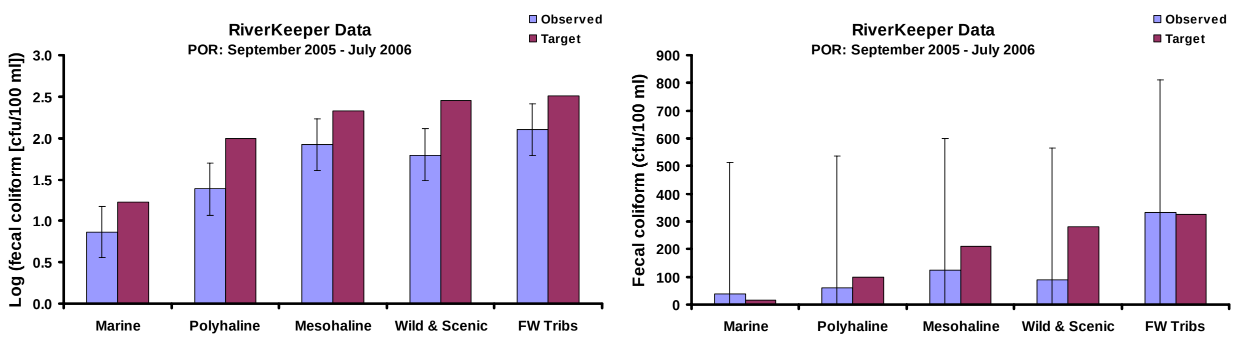


Figure 2. Comparison of observed fecal coliform values versus fecal coliform targets across the five salinity zones in the Loxahatchee River. Water quality targets (red bars) were taken from Table 10-1 of the *Restoration Plan for the Northwest Fork of the Loxahatchee River* (SFWMD 2006). Observed values (blue bars) are presented as the mean value with the error bars encompassing the 95% confidence interval (i.e., there is 95% certainty that the true mean conditions for the year correspond to values within the error bars). Note that fecal coliform values were presented as log transformed values (left panel) and as untransformed values (right panel).

Results & Discussion

We present water quality results, based on sampling over the previous year, using three different graphical approaches in order to highlight various aspects of the data. First, Figures 2, 3, and 4 clearly illustrate the comparison of average water quality conditions during the period September 2005 – July 2006 versus the interim water quality targets for each of the five zones of the Loxahatchee River. Second, Figure 5 shows how select water quality parameters change as you travel upstream in the river from the inlet to the G-92 structure, immediately downstream of the C-18 canal. Third, Appendix A includes one box and whisker plot per parameter that succinctly show among-site differences for all of the RiverKeeper sample sites.

Comparison of average water quality conditions from September 2005 – July 2006 to the interim water quality targets reveals that water quality conditions in the Loxahatchee River met or exceeded interim target water quality conditions for the majority of parameters sampled throughout most zones of the river (see Figures 2, 3, and 4). However, a few notable exceptions warrant discussion. Figure 2 clearly shows that, on average, fecal coliform bacteria concentrations were lower (i.e., better) during the previous year than the stated water quality targets (i.e., the observed values were less than the target values in Figure 2). In particular, lower fecal coliform bacteria counts were most pronounced in the wild and scenic zone of the river. It should be noted that fecal coliform bacteria counts were log transformed prior to analysis because of their extreme variability, though Figure 2 presents both log transformed and untransformed values. None of the parameters presented in Figure 3 show any meaningful differences between observed and target water quality conditions.

Observed total suspended solids and turbidity values were significantly higher than the interim water quality targets in the marine zone and nearly so in the polyhaline zone (Figure 4). Concordantly, photosynthetically active radiation (PAR) was lower than the interim water quality target for the marine zone and for the polyhaline zone. Lower PAR means less light available for seagrasses, which may be detrimental if the low light conditions persist. Taken together, these data suggest the observed increase in turbidity and decline in light available to seagrasses were likely due to marine influences (e.g., rough seas led to increased turbidity), and not due to transport of sediments from within the watershed.

Of all the nutrients analyzed, only total nitrogen showed a deviation from the interim water quality target conditions (Figure 4). Observed total nitrogen concentrations were lower than interim water quality target conditions in the polyhaline zone but higher in the wild and scenic zone and nearly higher in the mesohaline zone and the freshwater tributaries. It appears that the nitrogen concentration of freshwater flowing into the system (i.e., from the C-18 and other tributaries) was higher than the interim water quality target conditions, and that these elevated nitrogen concentrations persisted downstream through the mesohaline zone but not into the polyhaline zone (where marine waters had a more pronounced effect).

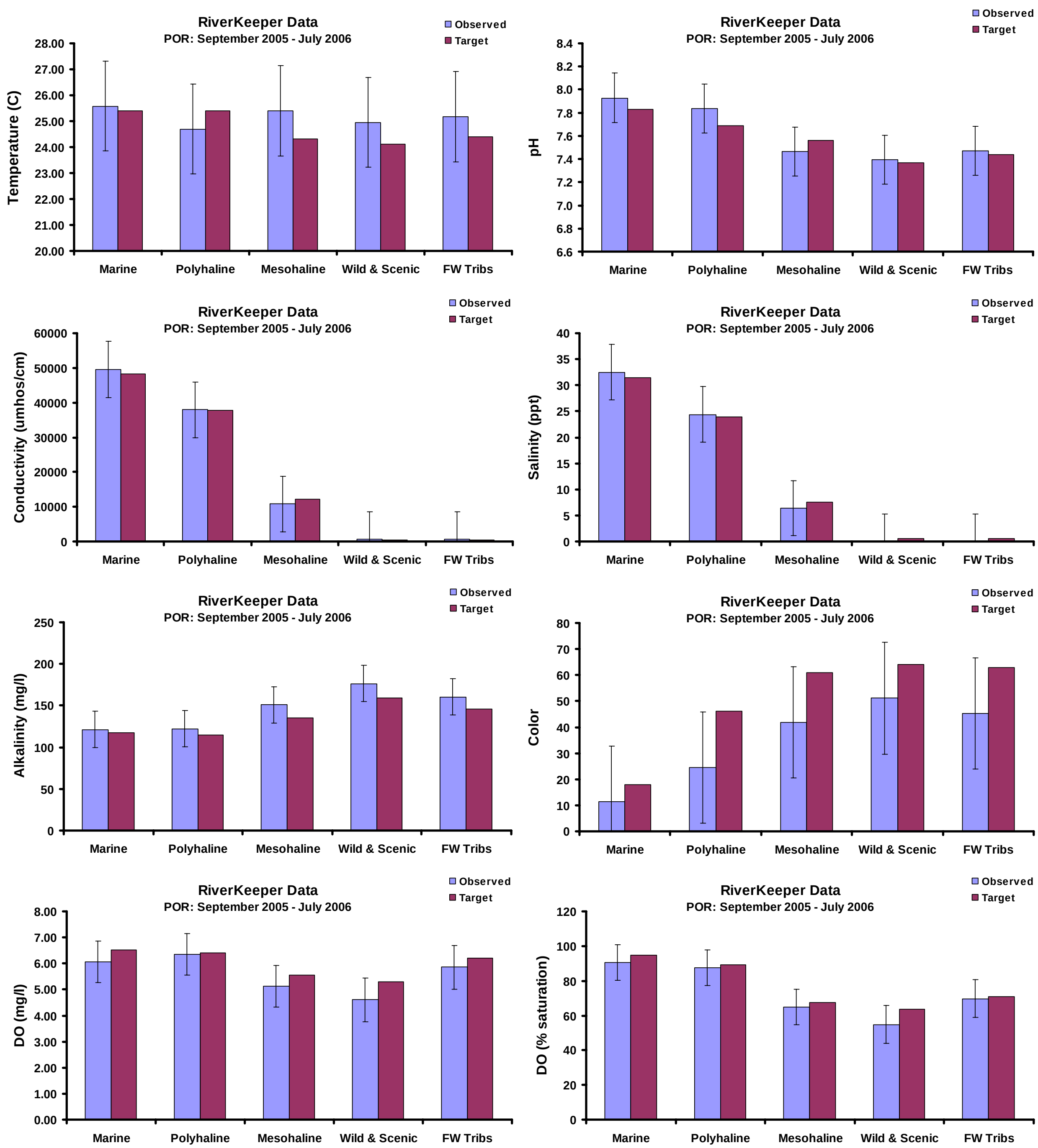


Figure 3. Comparison of observed water quality conditions versus water quality targets across the five salinity zones in the Loxahatchee River. Water quality targets (red bars) were taken from Table 10-1 of the *Restoration Plan for the Northwest Fork of the Loxahatchee River* (SFWMD 2006). Observed values (blue bars) are presented as the mean value with the error bars encompassing the 95% confidence interval (i.e., there is 95% certainty that the true mean conditions for the year correspond to values within the error bars).

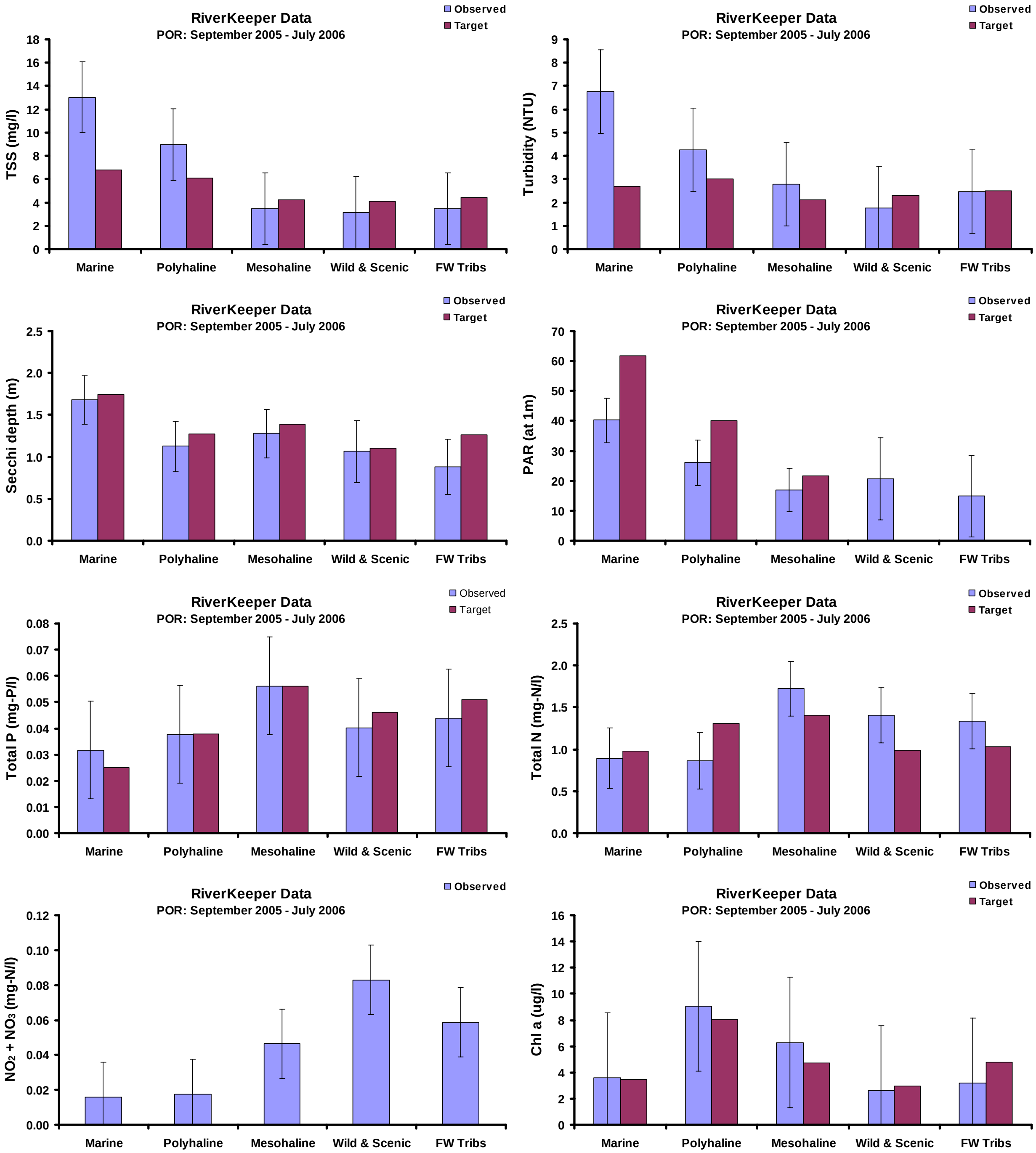


Figure 4. Comparison of observed water quality conditions versus water quality targets across the five salinity zones in the Loxahatchee River. Water quality targets (red bars) were taken from Table 10-1 of the *Restoration Plan for the Northwest Fork of the Loxahatchee River* (SFWMD 2006). Observed values (blue bars) are presented as the mean value with the error bars encompassing the 95% confidence interval (i.e., there is 95% certainty that the true mean conditions for the year correspond to values within the error bars). Note that target values were not available for NO_2 + NO_3.

Because the Loxahatchee River is a tidally influenced coastal river that flows relatively unimpeded from its headwaters (the G-92 structure) to the Jupiter inlet, it is reasonable to expect both physical (e.g., salinity) and chemical (e.g., nitrogen) characteristics of the water to vary as it travels from upstream to downstream locations. Figure 5 shows how salinity, dissolved oxygen, nitrate + nitrite, and orthophosphorus concentrations vary along the upstream – downstream gradient (i.e., from the inlet (station 10) to the G-92 structure (station 92)). It is immediately apparent that not all parameters show the same longitudinal trend (e.g., not all parameters have their peak at the same site). Salinity was highest in the inlet, which received the largest marine influence, and lowest in upstream reaches. Upstream from station 67 the waters were nearly always totally fresh. Dissolved oxygen, measured as percent saturation, was highest in the downstream marine waters. The availability of nitrate + nitrite was the lowest in the marine waters and highest near Trapper Nelson's zoo (station 67). Orthophosphorus concentrations were low in the headwaters (station 92) and in the marine and downstream estuary sites (stations 10, 40, 42). The highest concentrations of orthophosphorus occurred in the freshwater stations from station 67 to station 62. It appears that transport, biological transformation, sedimentation, and dilution drive upstream – downstream gradients in physical and chemical characteristics observed. Future work is needed to determine the relative magnitude of these processes, and their relative importance across both temporal and spatial scales in the Loxahatchee River watershed.

Assessment of the box and whisker plots provided in Appendix A show among-site differences in water quality across all RiverKeeper sampling sites. Similar to Figure 5, the salinity box and whisker plot (page 15) shows the diminution of salinity between stations 10 and 66. Perhaps more interesting is the turbidity box and whisker plot (page 16), which shows a large, significant increase in turbidity between stations 67 and 66, which appears to suggest that water discharging from Cypress Creek has negatively affected water clarity in the wild and scenic reach of the Loxahatchee River (i.e., at station 66). While an unfruitful effort has been made to locate the source of turbidity in Cypress Creek, it appears that more effort is warranted to determine the source of this turbidity and to remedy the problem.

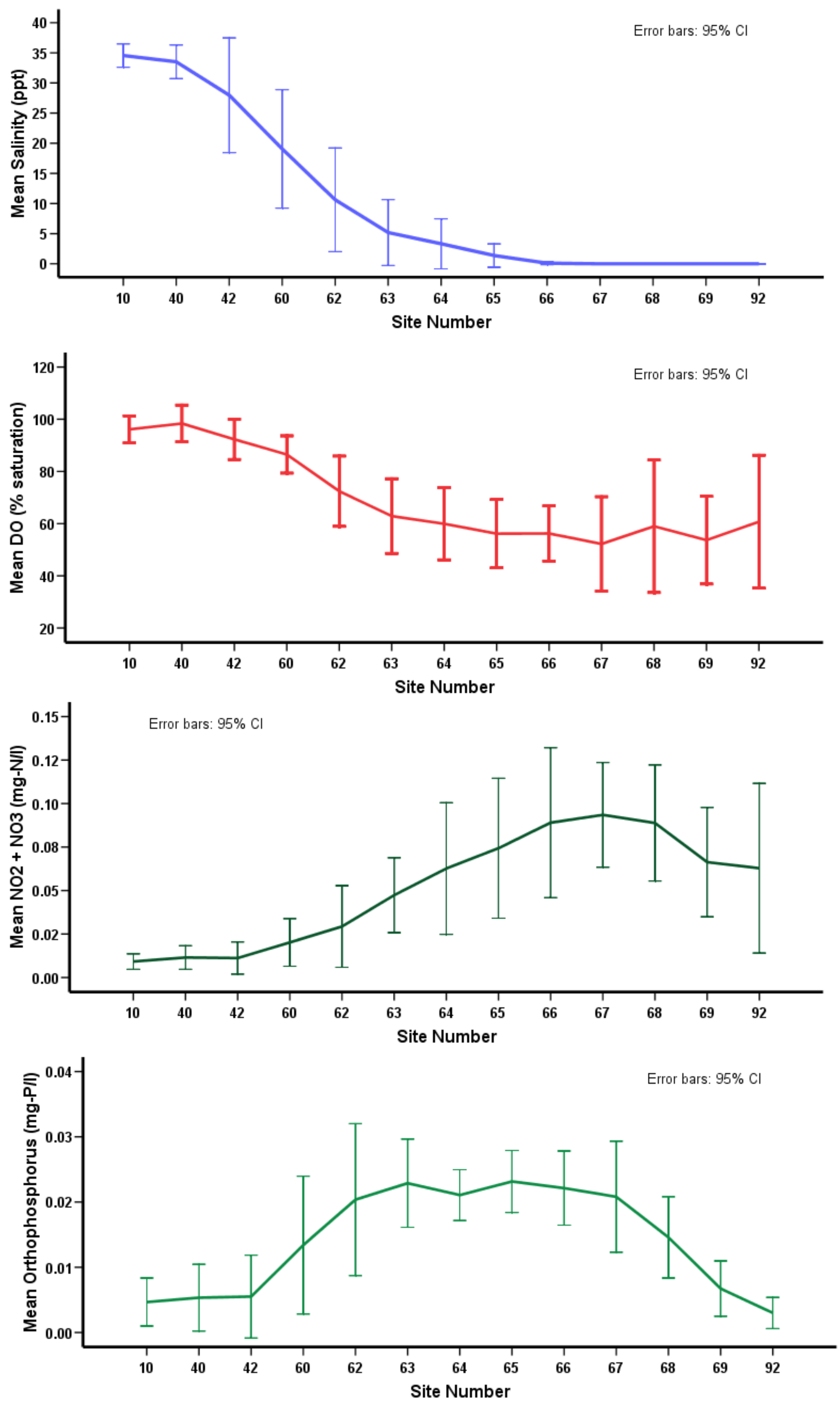


Figure 5. Downstream (Jupiter inlet @ station 10) to upstream (G-92 @ station 92) trends in physical conditions and nutrient concentrations vary according to parameter of interest.

In conclusion, we recommend that the bi-monthly RiverKeeper water quality monitoring program be continued and expanded. The RiverKeeper water quality monitoring program has been successfully used to identify long-term trends, and assess long-term compliance with the interim water quality targets (as illustrated in this report). Similarly, the resultant data represent the baseline conditions of the Loxahatchee River prior to modification of freshwater inflows resulting from the Comprehensive Everglades Restoration Project. However, there is some concern that bi-monthly water quality sampling is not sufficiently frequent to discern finer-scale temporal dynamics in the system. We, therefore, propose to increase sampling frequency from every two months to monthly at ten stations that span the length of the river and encompass key locations and tributaries (Figure 6). We look forward to working with SFWMD personnel to implement the proposed increase in sampling frequency.

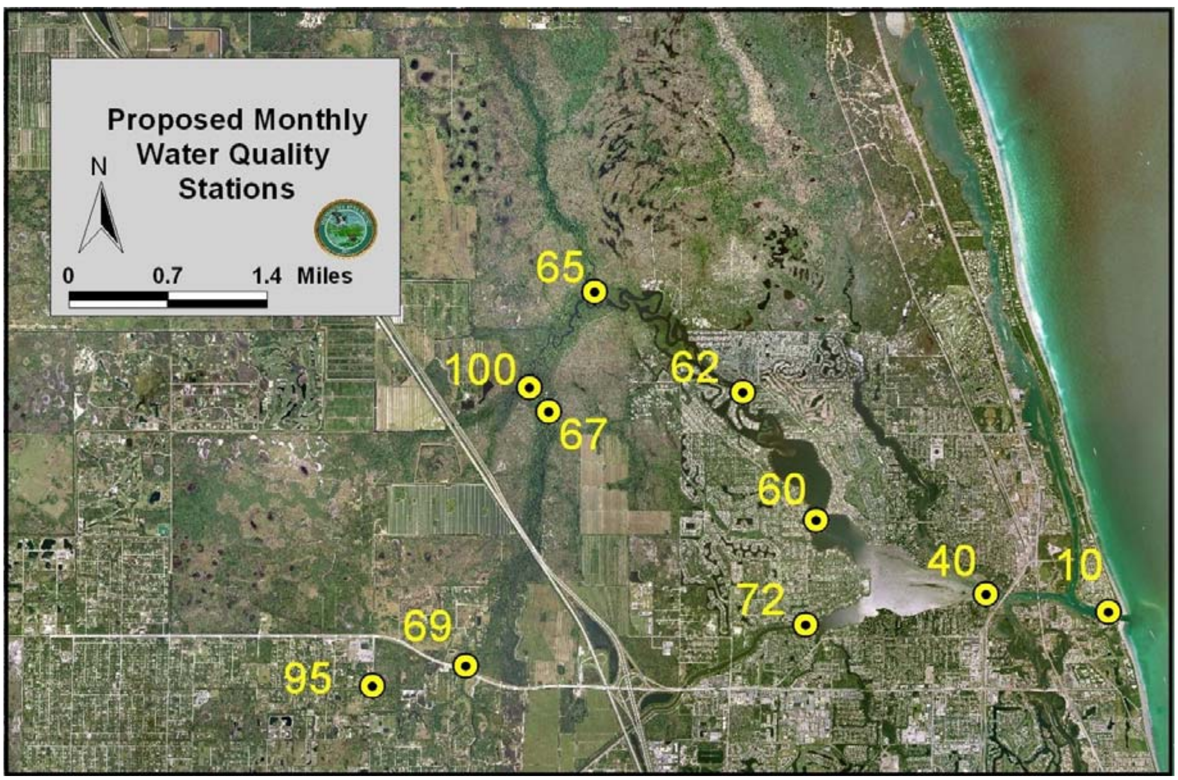


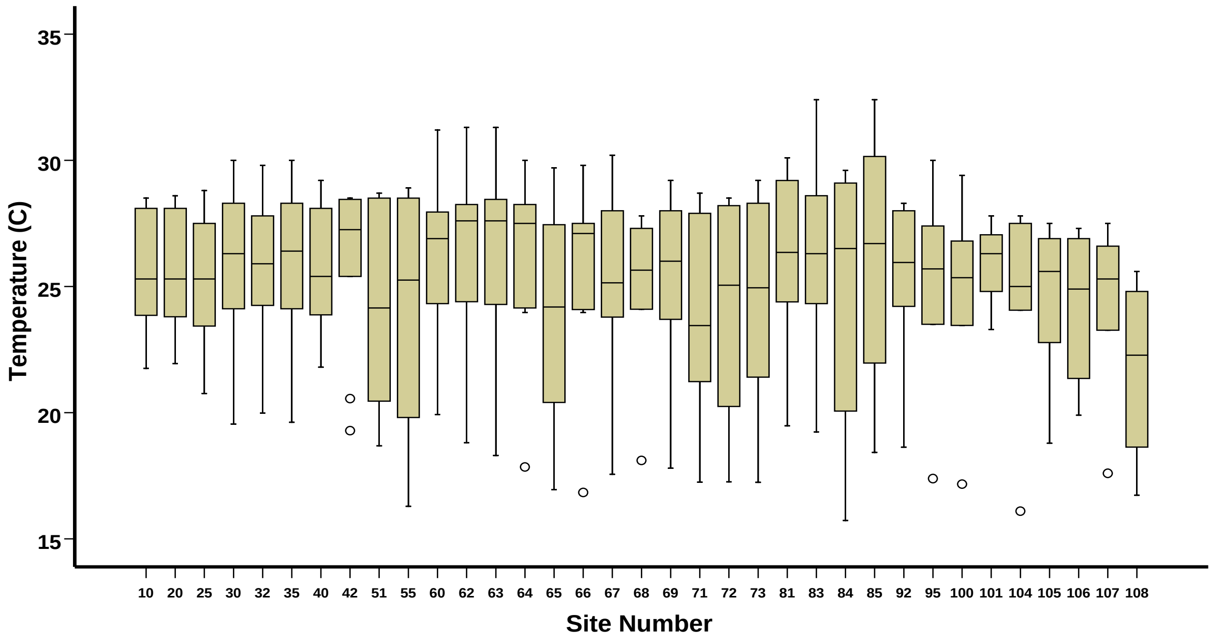
Figure 6. Proposed RiverKeeper water quality monthly monitoring sites.

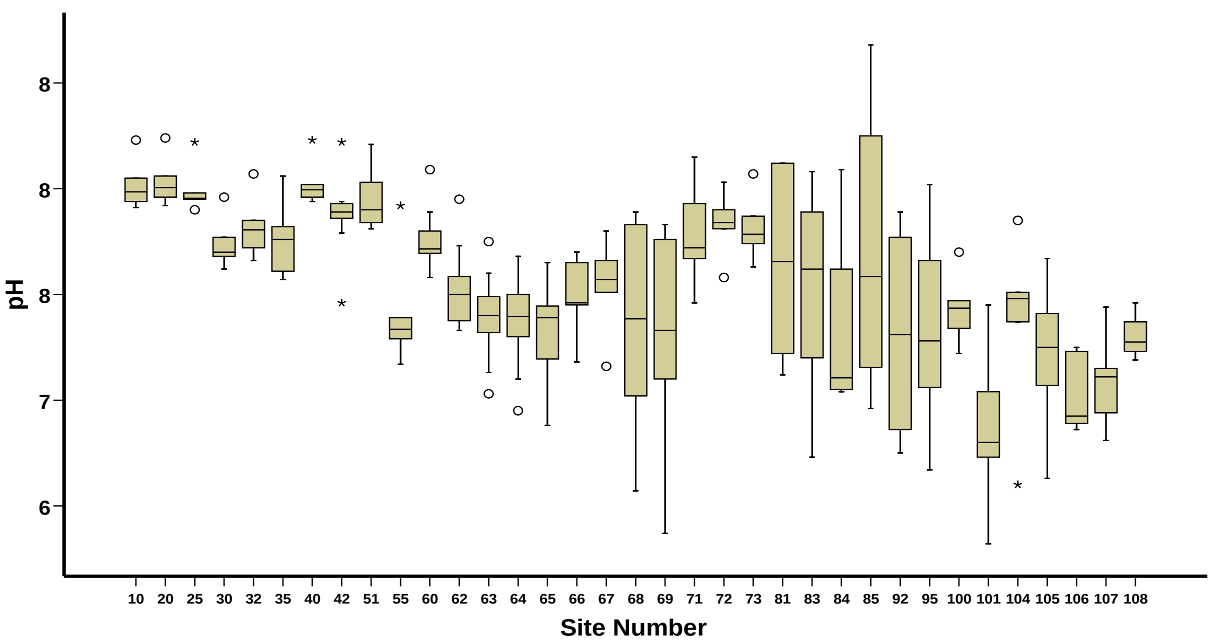
Literature Cited

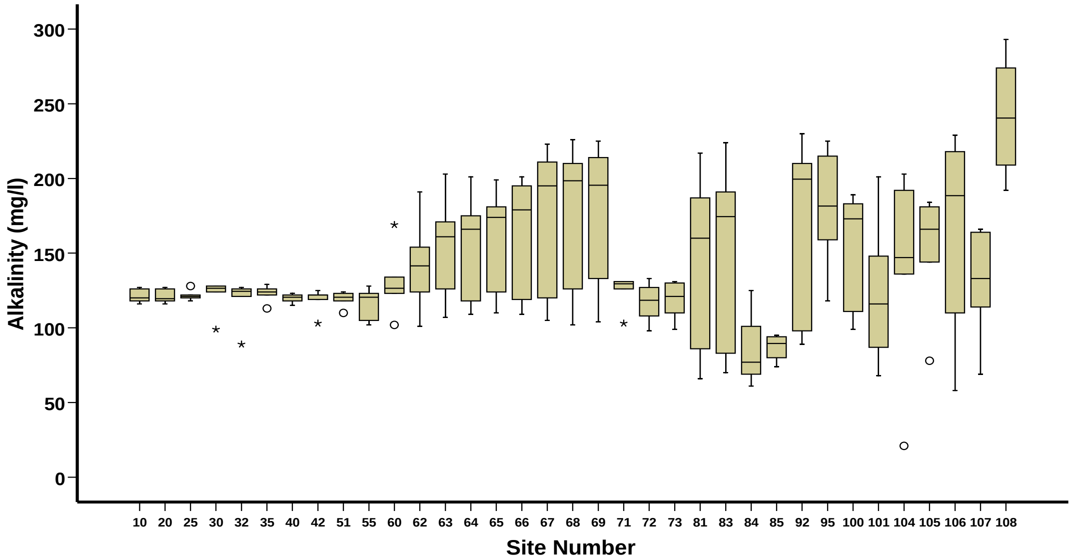
CERP (Comprehensive Everglades Restoration Plan). 2001. Baseline Report for the Comprehensive Everglades Restoration Plan. South Florida Water Management District, West Palm Beach, Florida.

SFWMD. 2006. Restoration Plan for the Northwest Fork of the Loxahatchee River. South Florida Water Management District, West Palm Beach, Florida.

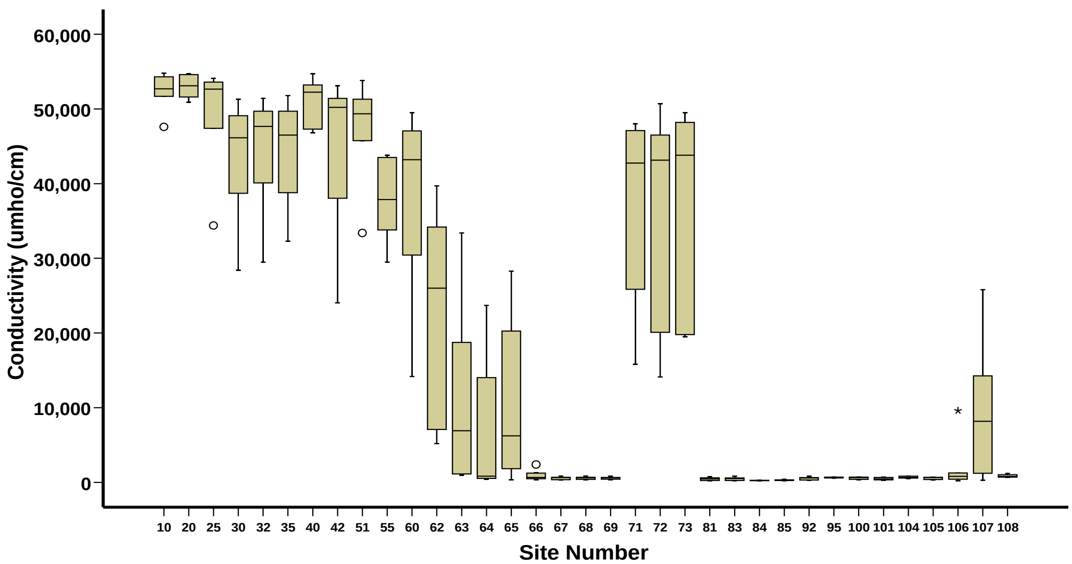
Appendix A. Box and whisker plots of Loxahatchee River District's RiverKeeper data for the period September 2005 through July 2006. Each parameter monitored is presented in a separate box and whisker plot (e.g., Temperature [C] – see below). Sampling sites are arranged across the x-axis. See Figure 1 for a map of sample site locations.







Alkalinity (mg/l)
0
50
100
150
200
250
300
10 20 25 30 32 35 40 42 51 55 60 62 63 64 65 66 67 68 69 71 72 73 81 83 84 85 92 95 100 101 104 105 106 107 108
Site Number



Conductivity (umho/cm)
0
10,000
20,000
30,000
40,000
50,000
60,000
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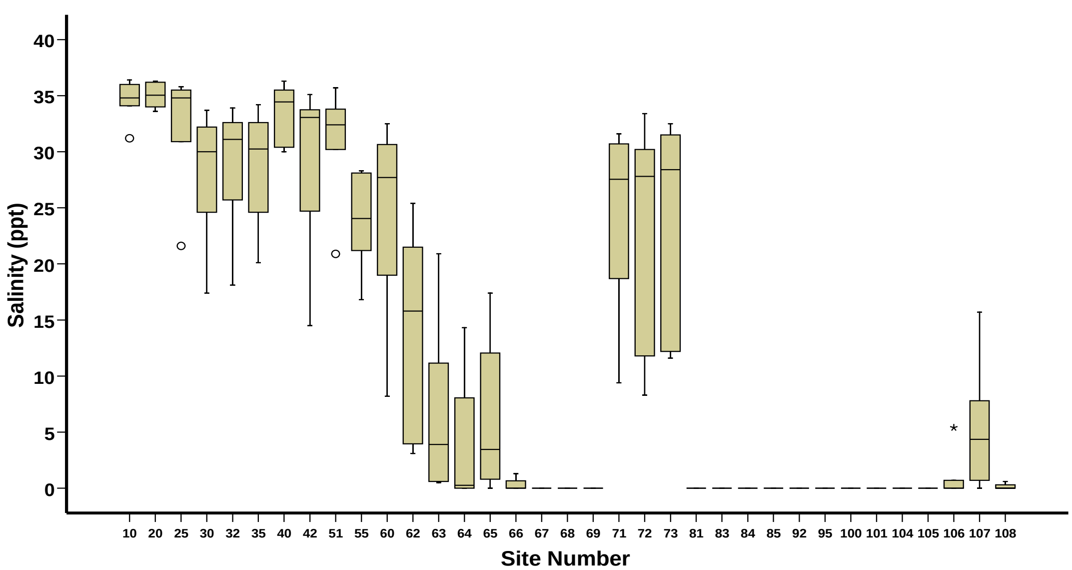
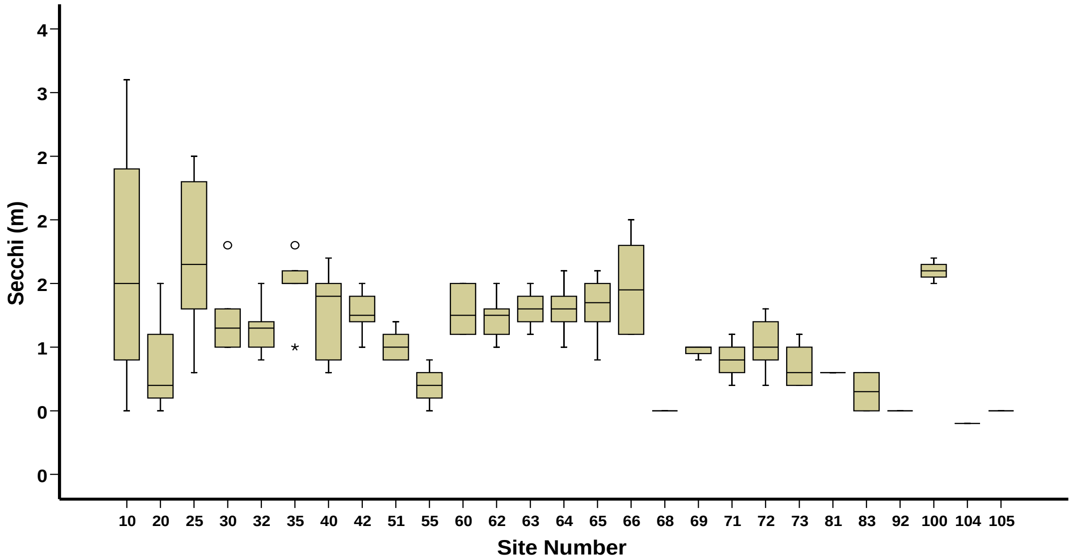
Site Number



Salinity (ppt)
0
5
10
15
20
25
30
35
40
10 20 25 30 32 35 40 42 51 55 60 62 63 64 65 66 67 68 69 71 72 73 81 83 84 85 92 95 100 101 104 105 106 107 108
Site Number


Secchi (m)
Site Number
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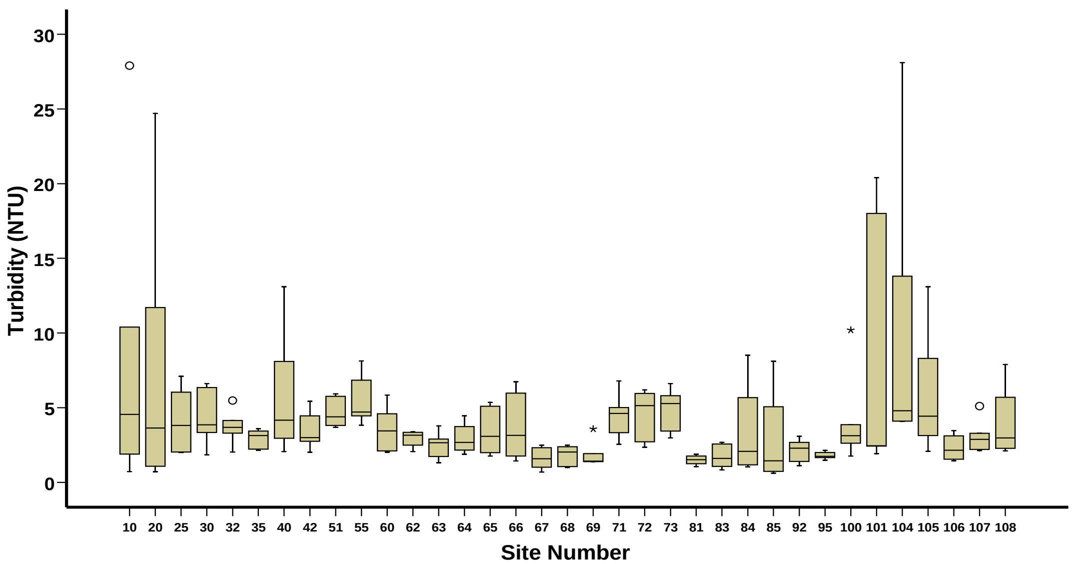
Turbidity (NTU)
Site Number
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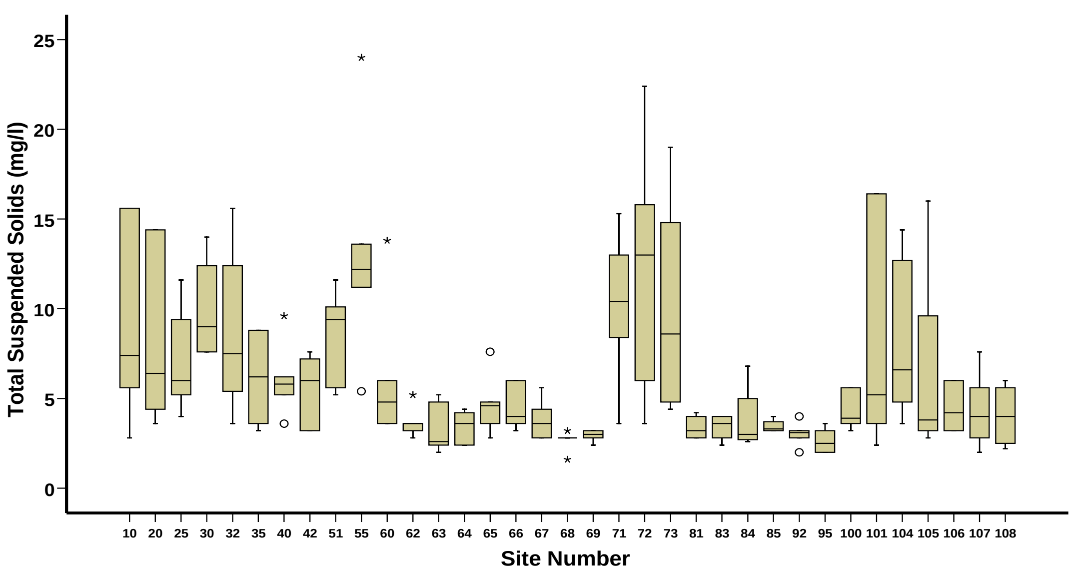
Total Suspended Solids (mg/l)
Site Number
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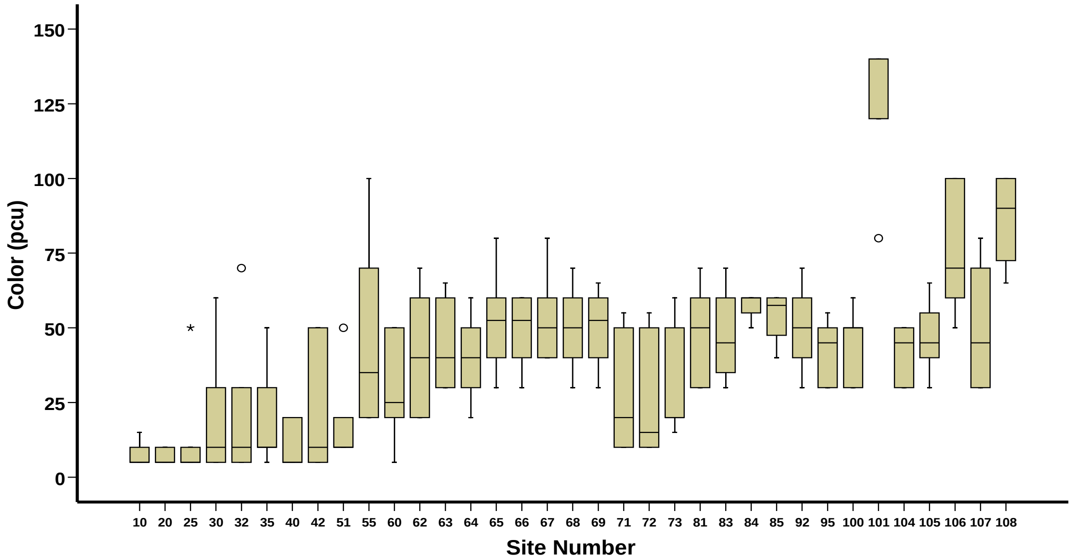
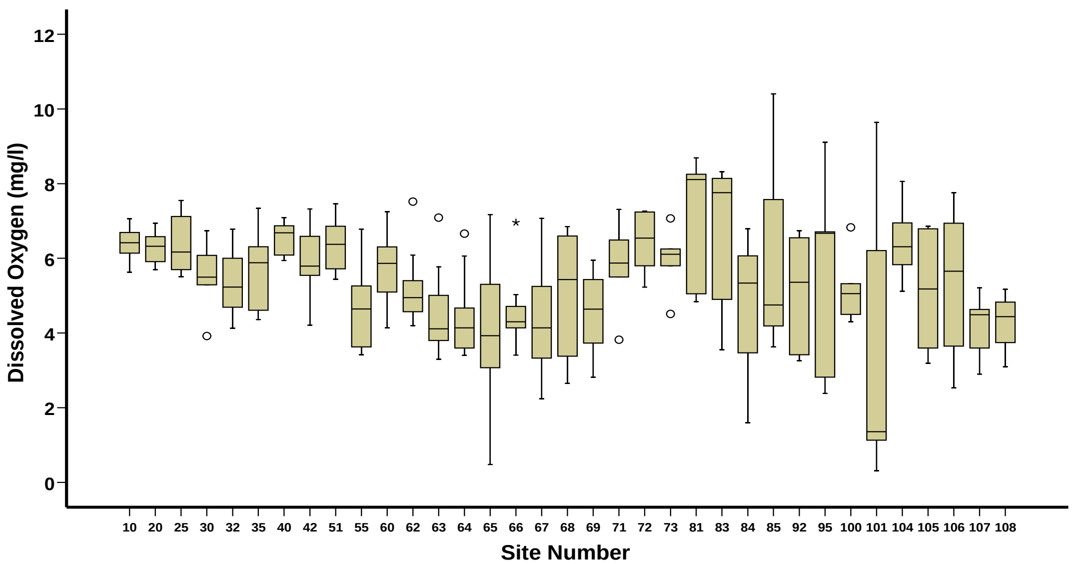

Color (pcu)
150
125
100
75
50
25
0
10 20 25 30 32 35 40 42 51 55 60 62 63 64 65 66 67 68 69 71 72 73 81 83 84 85 92 95 100 101 104 105 106 107 108
Site Number


Dissolved Oxygen (mg/l)
12
10
8
6
4
2
0
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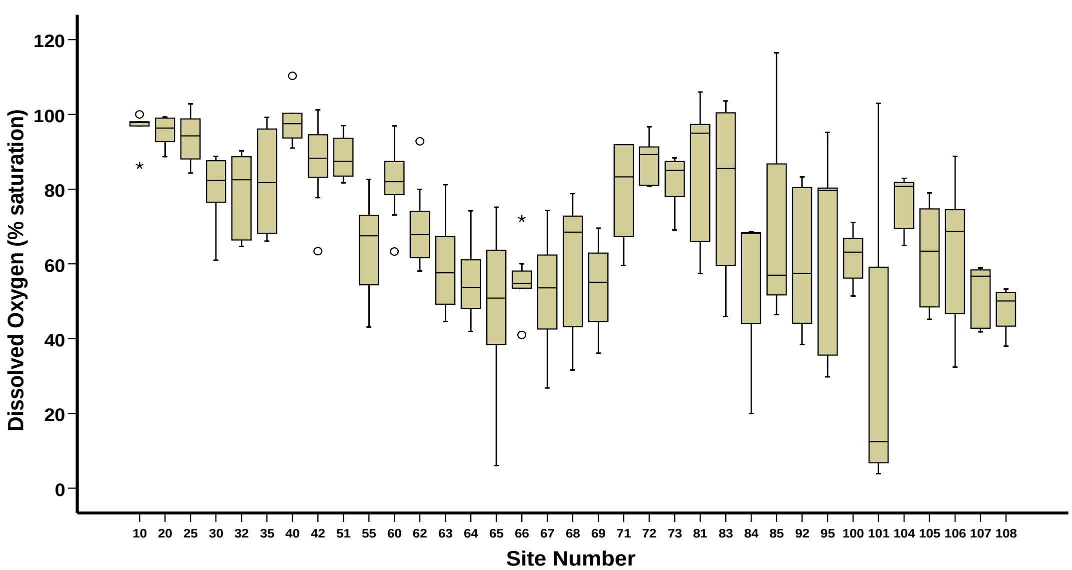
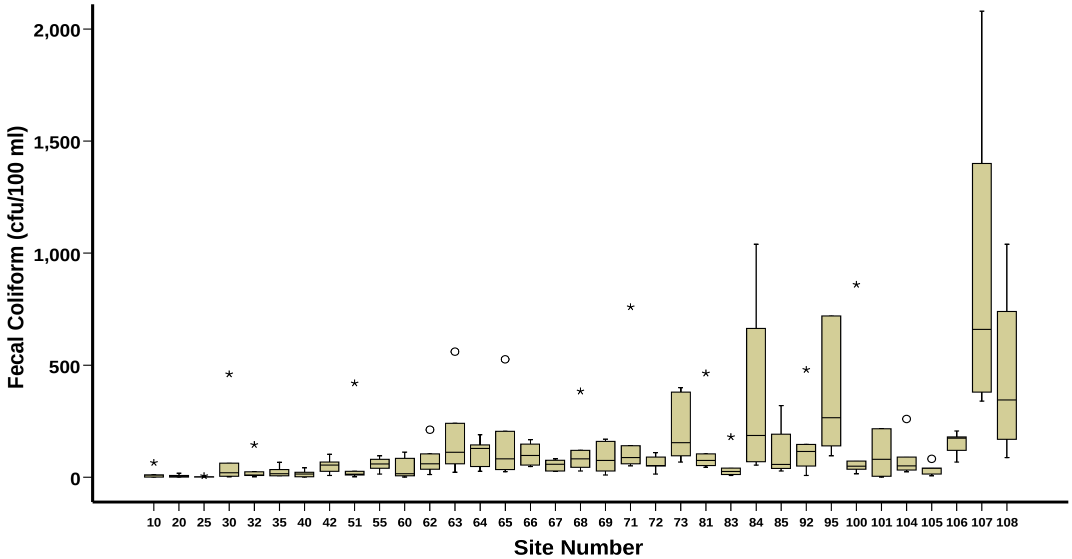
Site Number


Dissolved Oxygen (% saturation)
120
100
80
60
40
20
0
10 20 25 30 32 35 40 42 51 55 60 62 63 64 65 66 67 68 69 71 72 73 81 83 84 85 92 95 100 101 104 105 106 107 108
Site Number


Fecal Coliform (cfu/100 ml)
2,000
1,500
1,000
500
0
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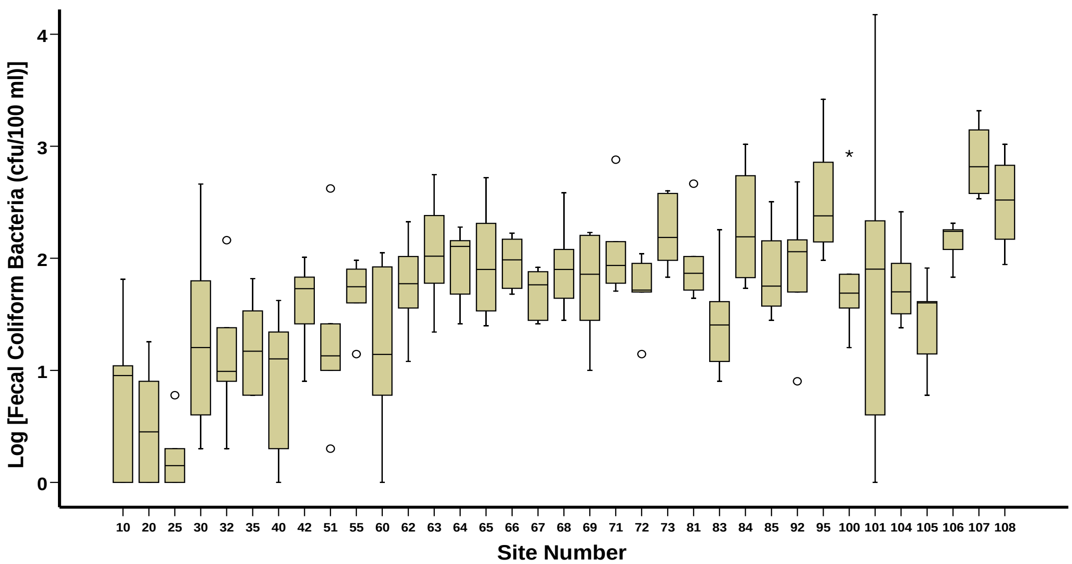
Site Number


Log [Fecal Coliform Bacteria (cfu/100 ml)]
4
3
2
1
0
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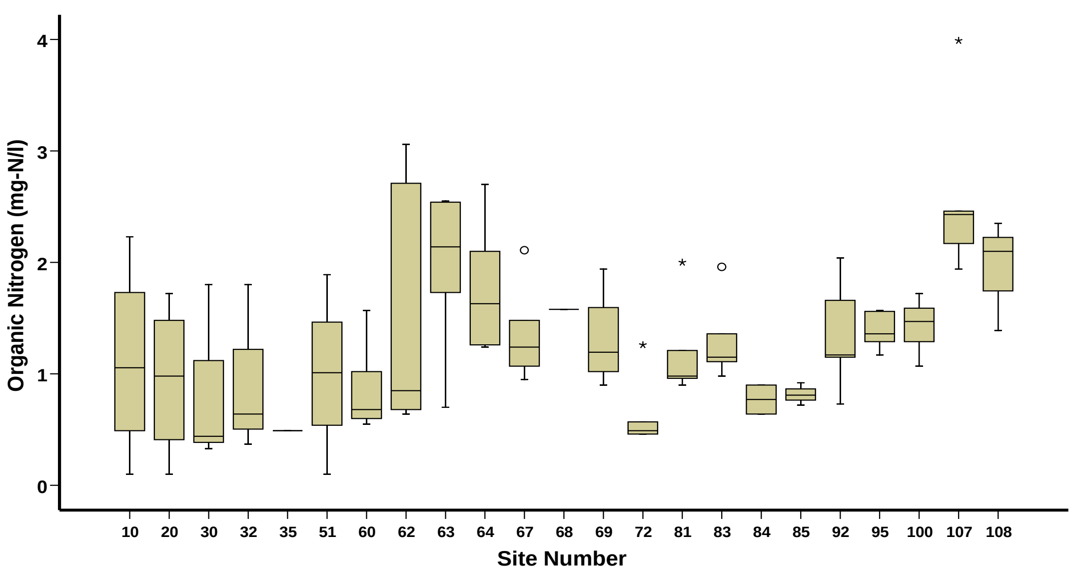
Site Number


Organic Nitrogen (mg-N/l)
4
3
2
1
0
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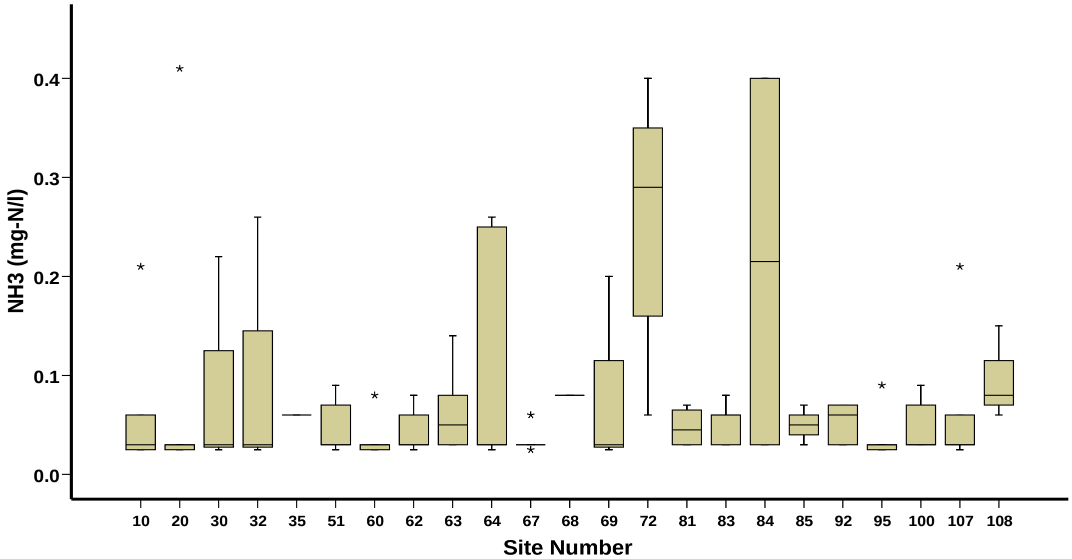
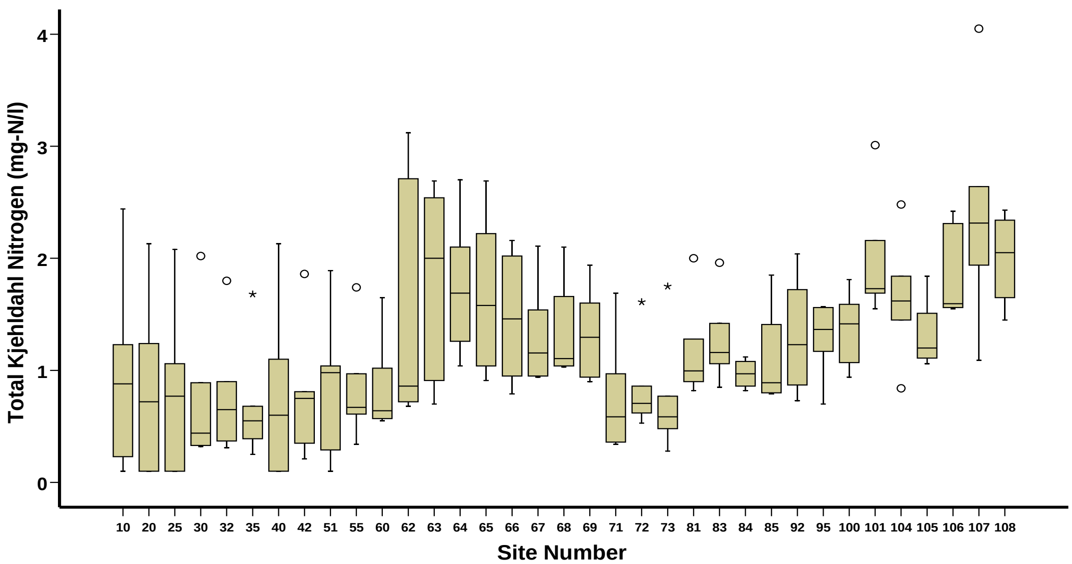
Site Number


NH3 (mg-N/l)
0.4
0.3
0.2
0.1
0.0
10 20 30 32 35 51 60 62 63 64 67 68 69 72 81 83 84 85 92 95 100 107 108
Site Number


Total Kjehldahl Nitrogen (mg-N/l)
4
3
2
1
0
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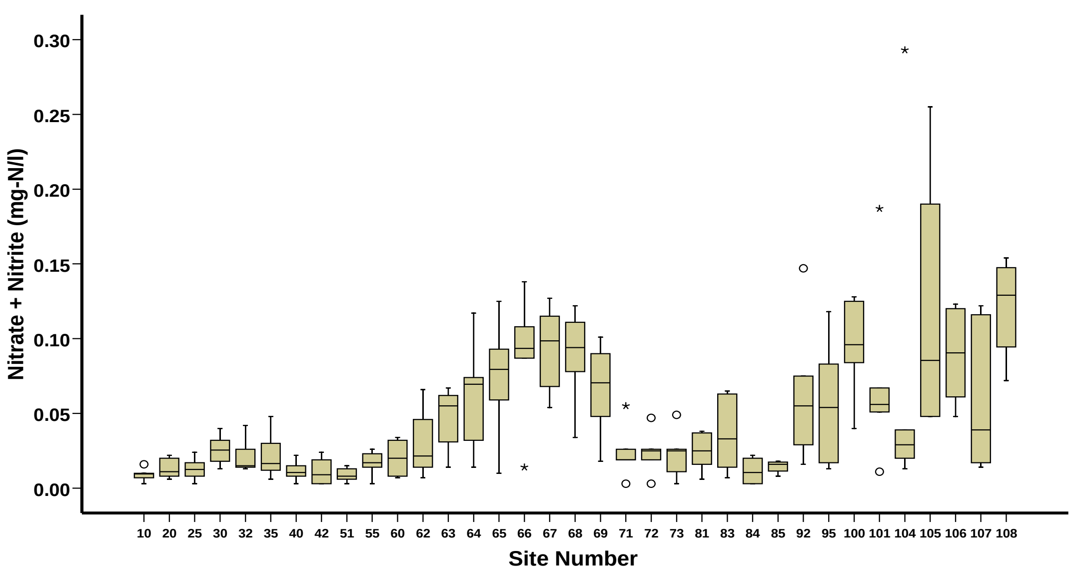
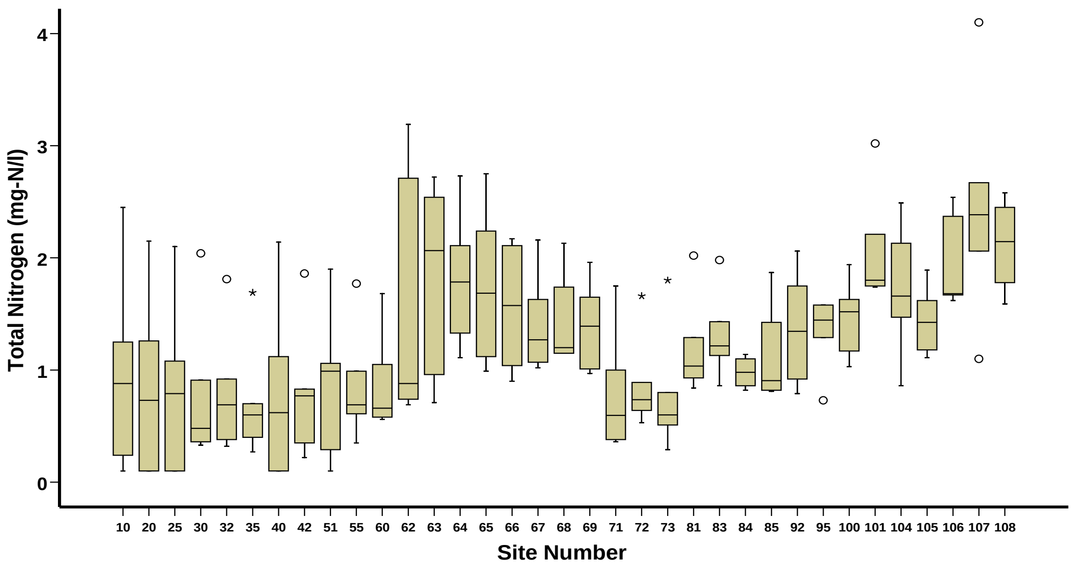
Site Number


Nitrate + Nitrite (mg-N/l)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
10 20 25 30 32 35 40 42 51 55 60 62 63 64 65 66 67 68 69 71 72 73 81 83 84 85 92 95 100 101 104 105 106 107 108
Site Number


Total Nitrogen (mg-N/l)
Site Number
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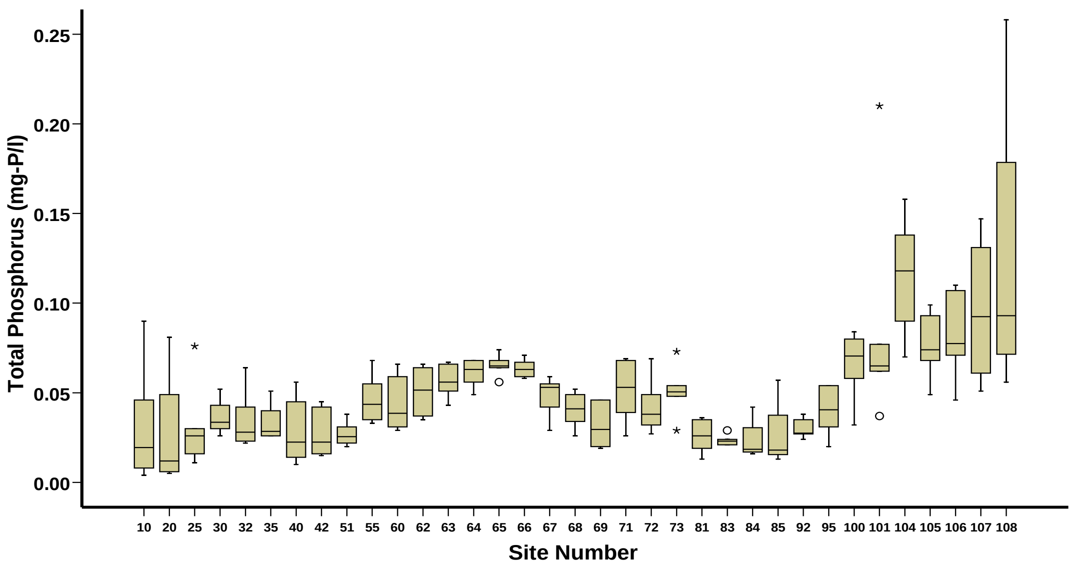
Total Phosphorus (mg-P/l)
Site Number
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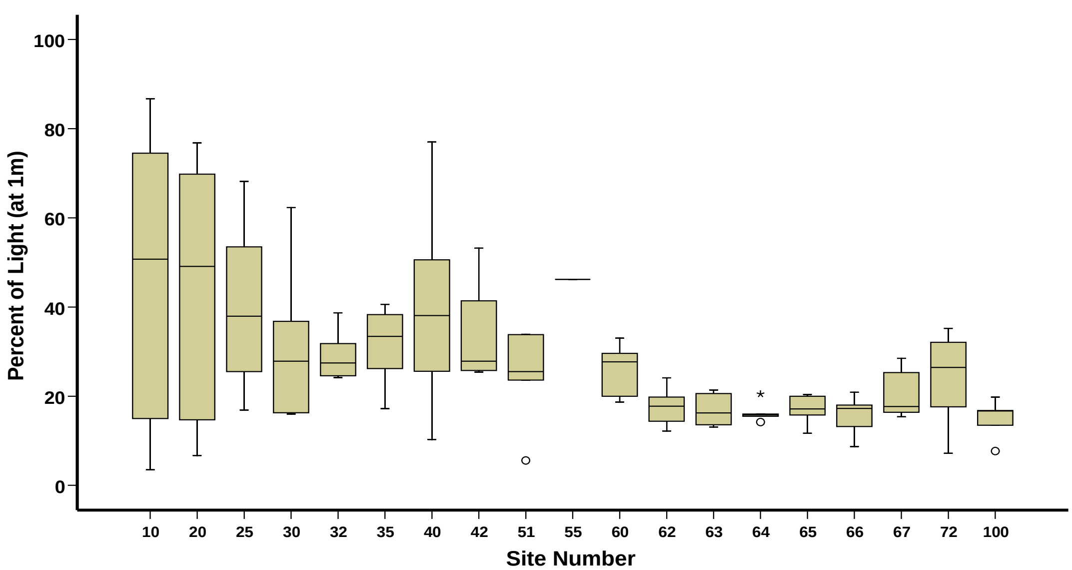
Percent of Light (at 1m)
Site Number
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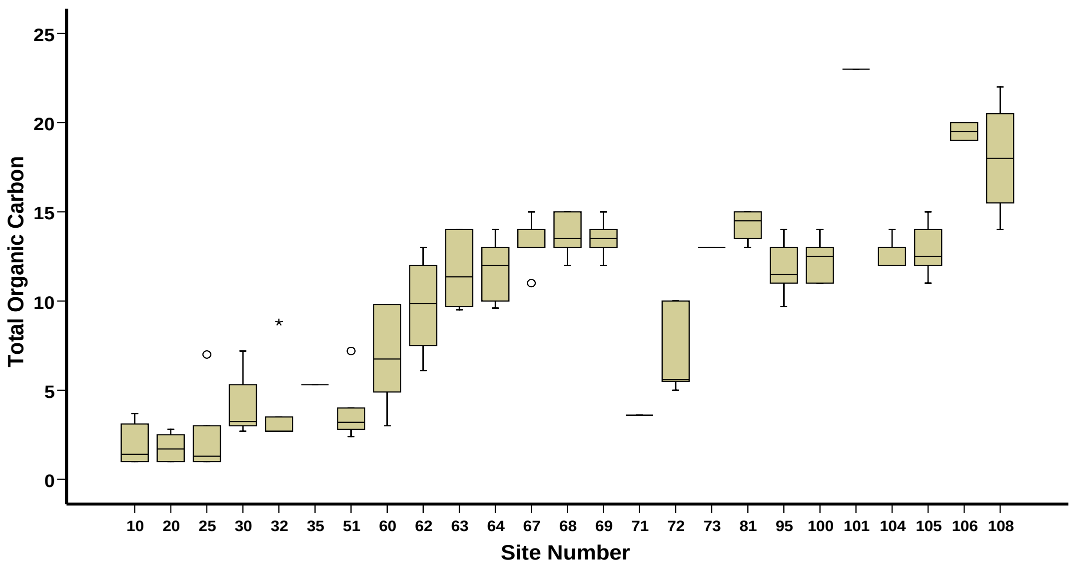
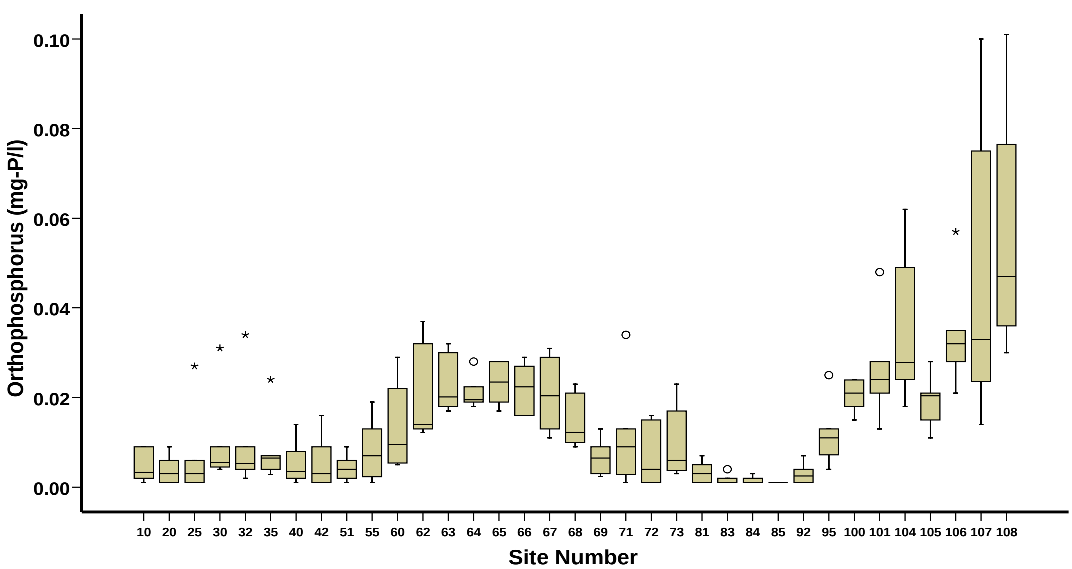

Total Organic Carbon
0
5
10
15
20
25
10 20 25 30 32 35 51 60 62 63 64 67 68 69 71 72 73 81 95 100 101 104 105 106 108
Site Number


Orthophosphorus (mg-P/l)
0.00
0.02
0.04
0.06
0.08
0.10
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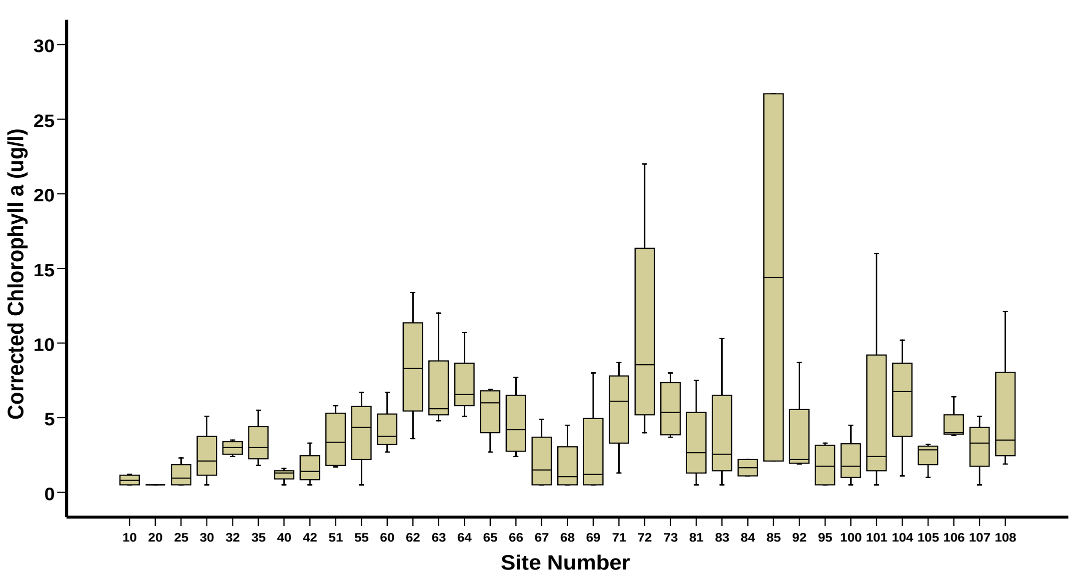
Site Number


Corrected Chlorophyll a (ug/l)
0
5
10
15
20
25
30
10 20 25 30 32 35 40 42 51 55 60 62 63 64 65 66 67 68 69 71 72 73 81 83 84 85 92 95 100 101 104 105 106 107 108
Site Number

Appendix B. Coordinates of the monitoring sites in decimal degrees using WGS 84 Datum.

Station	Latitude	Longitude	Station	Latitude	Longitude
10	26.945337639	-80.073825550	71	26.940627368	-80.120039977
20	26.953155294	-80.079008208	72	26.943294866	-80.121860971
25	27.007173848	-80.095378275	73	26.941468840	-80.118219722
30	26.932570076	-80.083156281	81	26.933736107	-80.141795559
32	26.940644699	-80.080911837	83	26.914514336	-80.169874995
35	26.883161038	-80.069530134	84	26.927200979	-80.174485510
40	26.947386072	-80.092820038	85	26.927679594	-80.169124324
42	26.950239941	-80.108793911	92	26.911314725	-80.175888274
51	26.957959120	-80.103746020	95	26.934725440	-80.191174483
55	26.985301640	-80.114836422	100	26.977266552	-80.165974449
57	27.003023652	-80.122179727	101	27.023802186	-80.165826223
58	27.036062850	-80.139438576	102	27.020768362	-80.173695921
59	27.052419955	-80.147136065	103	27.007608724	-80.173902609
60	26.958044581	-80.120270262	104	26.985785966	-80.175007368
62	26.976287767	-80.131916059	105	26.971485286	-80.188653132
63	26.987305421	-80.144271885	106	26.994781472	-80.155140725
64	26.991109025	-80.145302861	107	26.978191835	-80.146332086
65	26.991137909	-80.155045620	108	27.011121488	-80.163694292
66	26.985330292	-80.161806702	109	27.022879552	-80.167995196
67	26.976002794	-80.163348247	110	27.043817365	-80.194077186
68	26.954927363	-80.164359272	111	27.036378054	-80.165660602
69	26.937309460	-80.176155231	112	27.043773986	-80.167337373

Appendix C. Description of probe calibration and Q/A & Q/C procedures.

TABLE OF CALIBRATION ACCEPTANCE CRITERIA

Effective Date: 4/24/03 Rev. 4 on 10/1/05

PARAMETER/ METHOD	BLANK (mg/L)	MDL (mg/L)	# OF INITIAL STDS	INITIAL CALIB CORR COEF OR % R	2ND STD % R	CONTINUING CALIB STD % R	[HISTORICAL VALUES] PRECISION OF DUPS % RPD	ACCURACY OF SPIKES % R	SAMPLE HOLD TIMES
Fecal Coliform SM9222D MF	1 pre-1 post + every 10 samples less than MDL	1 cfu/ 100 mLs	N/A	N/A	N/A	N/A	[0 - 50] every 10 samples or matrix set	N/A	6 hours
Total Coliform SM9222B MF	1 pre-1 post + every 10 samples less than MDL	1 cfu/ 100 mLs	N/A	N/A	N/A	N/A	[0 - 50] every 10 samples or matrix set	N/A	6 hours
Ammonia-N EPA 350.2 low-Color, Nessler's	1 pre- + every 10 samples less than MDL	0.05	6 to bracket samples	>/= 0.995	90 - 110 one varied prior to sample analysis	80 - 120 every 10 samples at varied conc + end	[0 - 25] every 10 samples or matrix set	[85 - 115] every 10 samples or matrix set	28 days
Ammonia-N EPA 350.2 high-Titrimetric	1 pre- + every10 samples less than MDL	0.2	4 to bracket samples	>/= 0.995	90 - 110 one varied prior to sample analysis	80 - 120 every 10 samples at varied conc + end	[0 - 8] every 10 samples or matrix set	[85-115] every 10 samples or matrix set	28 days
TKN EPA 351.2 Block, AA	1 pre- + every 10 samples less than MDL	0.2	4 to bracket samples	>/= 0.995	90 - 110 one varied prior to sample analysis	90 -110 every 10 samples at varied conc + end	[0 - 29] every 10 samples or matrix set	90 - 110 every 10 samples or matrix set	28 days
Nitrate+Nitrate-N EPA 353.2 low-Cd Reduc, AA	1 pre- + every 10 samples less than MDL	0.006	5 to bracket samples	>/= 0.995	90 - 110 one varied prior to sample analysis	90 -110 every 10 samples at varied conc + end	[0 - 25] every 10 samples or matrix set	90 -110 every 10 samples or matrix set	48 hours

PARAMETER/ METHOD	BLANK (mg/L)	MDL (mg/L)	# OF INITIAL STDS	INITIAL CALIB CORR COEF OR % R	2ND STD % R	CONTINUING CALIB STD % R	PRECISION OF DUPS % RPD	ACCURACY OF SPIKES % R	SAMPLE HOLD TIMES
Nitrate+Nitrate-N EPA 353.2 high-Cd Reduc, AA	1 pre- + every 10 samples less than MDL	0.06	4 to bracket samples	>/= 0.995	90 - 110 one varied prior to sample analysis	90 -110 every 10 samples at varied conc + end	[0 - 17] every 10 samples or matrix set	90 -110 every 10 samples or matrix set	28 days
Ortho-Phosphate EPA 365.2 Color, Ascorbic	1 pre- + every 10 samples less than MDL	0.002	6 to bracket samples	>/= 0.995 98 -102 published	90 - 110 one varied prior to sample analysis	80 -120 every 10 samples at varied conc + end	[0 - 30] every 10 samples or matrix set	[90 - 110] every 10 samples or matrix set	48 hours
Total Phosphorus EPA 365.2 low-Color, Ascorbic	1 pre- + every 10 samples less than MDL	0.002	6 to bracket samples	>/= 0.995 98 -102 published	90 - 110 one varied prior to sample analysis	80 -120 every 10 samples at varied conc + end	[0 - 30] every 10 samples or matrix set	[85 - 115] every 10 samples or matrix set	28 days
Total Phosphorus EPA 365.2 high-Color, Ascorbic	1 pre- + every 10 samples less than MDL	0.004	6 to bracket samples	>/= 0.995 98 -102 published	90 - 110 one varied prior to sample analysis	80 -120 every 10 samples at varied conc + end	[0 - 12] every 10 samples or matrix set	[85 - 115] every 10 samples or matrix set	28 days
BOD EPA 405.1 5 day, 20 C	1 dil. H20- 1 seed Bk every 10 samples </= 0.2	2.0 published	1 GGA	85 - 115	85 - 115 one varied prior to sample analysis	80 -120 every 10 samples at varied conc + end	[0 - 30] every 10 samples or matrix set	[75 - 125] every 10 samples or matrix set	48 hours
NOTE: Must meet 2.0 mg/L minimum DO depletion (initial minus final) and 1.0 mg/L residual (final) DO for each test bottle.									
CBOD SM5210B 5 day, 20 C	1 dil. H20- 1 seed Bk every 10 samples </= 0.2	2.0 published	1 GGA	85 - 115 published in method	85 - 115 one varied prior to sample analysis	80 -120 every 10 samples at varied conc + end	[0 - 30] every 10 samples or matrix set	[75 - 125] every 10 samples or matrix set	48 hours
NOTE: Must meet 2.0 mg/L minimum DO depletion (initial minus final) and 1.0 mg/L residual (final) DO for each test bottle.									

PARAMETER/ METHOD	BLANK (mg/L)	MDL (mg/L)	# OF INITIAL STDS	INITIAL CALIB CORR COEF OR % R	2ND STD % R	CONTINUING CALIB STD % R	PRECISION OF DUPS % RPD	ACCURACY OF SPIKES % R	SAMPLE HOLD TIMES
Alkalinity EPA 310.1 Titrimetric, pH 4.5	1 pre- + every 10 samples less than MDL	1	min of 2 bracket samples	>/= 0.995	90 - 110 one varied prior to sample analysis	80 -120 every 10 samples at varied conc + end	[0 - 5] every 10 samples or matrix set	[85 - 115] every 10 samples or matrix set	14 days
Chloride SM4500Cl- B Argentometric	1 pre- + every 10 samples less than MDL	0.5	min of 2 bracket samples	>/= 0.995	90 - 110 one varied prior to sample analysis	80 -120 every 10 samples at varied conc + end	[0 - 3] every 10 samples or matrix set	[80 - 120] every 10 samples or matrix set	28 days
Conductivity EPA 120.1 Meter	1 pre- + every 10 samples less than MDL	1 umhos/cm	min of 2 to bracket samples	95-105	95-105 one varied prior to sample analysis	95-105 every 10 samples at varied conc + end	[0 - 2] every 10 samples or matrix set	N/A	28 days
TDS (filterable) EPA 160.1 Gravimetric, 180 C	1 pre- + every 10 samples less than MDL	10	1	90 - 110	90 - 110	N/A	[0 - 6] every 10 samples or matrix set	N/A	7 days
TSS (non- filterable) EPA 160.2 Gravimetric, 104 C	1 pre- + every 10 samples less than MDL	1	1	80 - 120	80 - 120	N/A	[0 - 50] every 10 samples or matrix set	N/A	7 days
NOTE: Choose sample size to yield between 2.5 & 200 mg residue and complete filtration time within 10 min.									
Sulfate EPA 375.2 Color, MTB, AA	1 pre- + every 10 samples less than MDL	10	6 to bracket samples	>/= 0.995	90 - 110 one varied prior to sample analysis	90 -110 every 10 samples at varied conc + end	[0 - 15] every 10 samples or matrix set	90 -110 every 10 samples or matrix set	28 days
Turbidity EPA 180.1	1 DI H2O every 20 samples less than MDL	0.1 NTU	4 formazin quarterly	95 - 105	95 - 105 2 gelex stds to bracket analysis	95 - 105 1 gelex every 10 samples or at end	[0 - 11] every 10 samples or matrix set	N/A	48 hours

PARAMETER/ METHOD	BLANK (mg/L)	MDL (mg/L)	# OF INITIAL STDS	INITIAL CALIB CORR COEF OR % R	2ND STD % R	CONTINUING CALIB STD % R	PRECISION OF DUPS % RPD	ACCURACY OF SPIKES % R	SAMPLE HOLD TIMES
pH EPA 150.1	N/A	N/A	2 or 3 to bracket samples	90 - 105 % efficiency of electrode	+/- 0.2 units	+/- 0.2 units	0 - 5	N/A	analyze immediately
Chlorophyll a	1 pre	1	none	N/A	none	N/A	0 - 30	N/A	21 days
Color	1 pre	5	none	N/A	none	N/A	0 - 5	N/A	48 hours

Appendix D. Discussion of data accuracy

Loxahatchee River District

WildPine Ecological Laboratory
NELAP Certification # E56025
2500 Jupiter Park, Jupiter, Florida 33458-8964
Telephone (561) 747-5709 Fax (561) 743-3027
wildpine@loxahatcheeriver.org

October 1, 2006

Client: SFWMD

Re: RIVERKEEPER FINAL REPORT FOR 2006

To Client:

Analytical results reported by the WildPine Lab in this report have been reviewed for compliance with the Loxahatchee River District's Quality Systems Manual and meet applicable Standard Operating Procedures and Lab Methods as required by the July 2003 National Environmental Laboratory Accreditation Program (NELAP). The analytical results in this report represent the samples as they were collected according to the DEP Standard Operating Procedures for Field Activities (DEP-SOP-001/01) unless otherwise noted.

FDOH has certified the Loxahatchee River District (E56026) in compliance with FAC 64E-1 for the examination of environmental samples in the following categories:

NON-POTABLE WATER – General Chemistry, Microbiology

Please direct any quality assurance or quality control questions resulting from this report to the Lab Manager or Assistant Lab Manager at (561) 747-5709.

Respectfully submitted,

Lorene Bachman, Lab Manager Susan Noel, Asst. Lab Manager

Appendix E. Raw data and associated files.

Raw data are provided in electronic format on the attached CD. Also, formulas for parameter conversion and calculation, taken from the Hydrolab manual, are included as a separate pdf file on the attached CD.