Final Report Appendices

An Ecosystem-Level Study of Florida's Springs

FWC Project Agreement No. 08010

Prepared for

Florida Fish and Wildlife Conservation Commission
St. Johns River Water Management District
Southwest Florida Water Management District
Florida Park Service
Florida Springs Initiative
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Appendix A

Methods

Description of Sampling Methods

The twelve spring systems sampled in this study are physically quite different, ranging from less than about 0.25 ha (0.62 ac) to over 16 ha (40 ac) in wetted surface area. In turn, water depths range from less than 1m (3 ft) in shallow run portions, to over 30 m (98 ft) in the deeper pools. Each spring has differing plant and animal species. Intensive sampling was conducted for about one week at each spring over a 12 month period.

Ecological sampling efforts were applied to this diverse group of springs in as consistent a fashion as practical. Biological systems are known to vary considerably due to seasonal variation in sunlight, temperature, and precipitation. Seasonal variation is somewhat reduced in spring-fed aquatic ecosystems due to the relatively consistent water temperature, volume, and water chemistry groundwater supply (Odum 1957a). One major environmental factor that is seasonally variable is the input of solar energy and seasonal variability was considered in data analysis. The following protocols were applied in this study to facilitate comparison between the twelve sites:

- The focus of each ecological study site was the spring pool, including the spring vent and pool area and the defining basin, as well as the upstream-most portion of the spring run (typically about 1 km in length);
- The study area was large enough to allow a significant and measurable change in dissolved oxygen concentrations due to plant productivity;
- Preferred sampling segments for collection of continuous field parameter data, as well as water quality, discharge, export, and plant and animal diversity and population data included: Segment 1 - the spring vent area to the downstream edge

of the spring pool or an intermediate point in the spring run that integrates all principal spring vents in a spring group, and Segment 2 – from the edge of the spring pool or the midpoint in the spring run area extending to a downstream spring run location that allows measurement of a relatively homogenous area of spring run habitat with constant flow and physical characteristics (such as shading by trees, water depths, channel width, dominant plant communities, etc.). Actual sampling points were dependent on site-specific conditions and were selected on a case-by-case basis as summarized in **Table A-1**.

TABLE A-1.
Sampling stations for the twelve study springs.

Water Management District	Spring	County	Station Name	Latitude	Longitude	Site Visit Date	Synoptic Sampling Dates	Notes
Northwest	**Jackson Blue**	Jackson	JBS-1	30.790440°	-85.140029°	08/18/08	01/12/09 - 01/15/09	In mouth of vent (~ 10 ft depth)
			JBS-2	30.790029°	-85.140431°			from fence across pool, in flow path
			JBS-3	30.787597°	-85.145097°			from idle speed buoy
	Ponce de Leon	Holmes	PDL-1	30.721082°	-85.930715°	08/18/08	09/8/09 - 9/11/09	by main vent,12' depth
			PDL-2	30.720779°	-85.930826°			just upstream weir, 2.5' depth
			PDL-3	30.719350°	-85.929910°			20' upstream Sandy Creek confluence, 3.4' depth
	Wakulla	Wakulla	WAK-1	30.235410°	-84.302360°	08/18/08	04/13/09 - 04/16/09	downstream of main vent (~ 15 ft depth)
			WAK-2	30.235598°	-84.301366°			on dock near USGS sonde
			WAK-3	30.234072°	-84.294293°			in main channel by service takeout ramp
St. Johns River	**De Leon**	Volusia	VDL-1	29.134328°	-81.362696°	07/29/08	10/06/08 - 10/09/08	near vent (~ 20 ft depth)
			VDL-2	29.134313°	-81.362938°			at upstream side of weir grate
			VDL-3	29.136303°	-81.365641°			on old piling near park boundary
	Silver	Marion	SS-1	29.21613°	-82.05266°	07/29/08	05/4/09 - 05/8/09	in main boil, about 34' water
			SS-2	29.21601°	-82.04697°			at turtle meadows, about 350 m, about 12'
			SS-3	29.21552°	-82.04153°			at 1,200 m, about 10'
	Silver Glen	Marion	SGS-a	29.245693°	-81.643773°	07/29/08	02/16/09 - 02/19/09	at middle post of barrier to "The Well" spring vent
			SGS-1	29.245819°	-81.643442°			downstream side of main spring vent (~ 10 ft depth)
			SGS-2	29.244966°	-81.643288°			at middle post of boat barrier line
			SGS-3	29.246130°	-81.639730°			from green channel marker #11 in run
Suwannee River	**Ichetucknee**	Columbia	IS-1	29.979743°	-82.758784°	07/28/08	07/6/09 - 07/9/09	upstream sonde, 80' below confluence of Blue Hole and run
			IS-2	29.964140°	-82.763630°		07/14/09	Mid-Point Tube Launch
			IS-3	29.960360°	-82.770956°			Dampier's Landing
			IS-4	29.954783°	-82.784478°			US27 final take-out point
	Madison Blue	Madison	MBS-1	30.480481°	-83.244427°	07/28/08	12/01/08 - 12/02/08	near vent (~ 25 ft depth)
			MBS-2	30.480586°	-83.244202°		01/02/09 - 01/06/09	from blue-white float line
			MBS-3	30.480736°	-83.243978°			from white float line at river interface
	Manatee	Levy	MS-1	29.489613°	-82.976743°	07/28/08	08/3/09 - 08/06/09	near vent at 26' depth
			MS-2	29.489398°	-82.977674°			just downstream swim area rope at 5' depth
			MS-3	29.489177°	-82.979996°			at 5' depth
Southwest	**Homosassa**	Citrus	HS-1	28.799161°	-82.588324°	08/13/08	11/03/08 - 11/06/08	from east side of fish bowl (~ 20 ft depth)
			HS-2	28.799618°	-82.589067°			from downstream side of foot bridge
			HS-3	28.799098°	-82.589770°			from bacteria warning sign post
	Rainbow	Marion	RS-1	29.101606°	-82.436950°	08/13/08	06/8/09 - 06/11/09	just upstream from park canoe launch area, about 10' depth
			RS-2	29.098430°	-82.436020°			at sign prohibiting further upstream motor boating, about 7' depth
			RS-3	29.093622°	-82.432912°			at 1,100 m downstream from swim area, about 12' depth
	Weeki Wachee	Hernando	WWS-1	28.517559°	-82.573367°	08/13/08	03/9/09 - 03/12/09	north of vent by metal post (~ 10 ft depth)
			WWS-2	28.519053°	-82.573949°			attached to sign post "No Vessels Upstream" sign
			WWS-3	28.518920°	-82.579090°			just upstream of Frazer Project Coast St. 2

Ecosystem data were collected from the 12 study springs between October 2008 and September 2009. For each of these springs, both a pool segment and a spring segment were sampled. The following ecological metrics were measured in each of the spring segments:

Physical Environment

- Insolation and photosynthetically active radiation (PAR) and underwater light transmission of PAR
- Stream discharge (water level and flow) and stream velocity
- Secchi disk visibility
- Segment morphometry (area and volume)
- Atmospheric oxygen diffusion rate as a function of velocity
- Water quality field parameters (temperature, pH, dissolved oxygen, conductance)

Water Chemistry

- Water chemistry (total Kjeldahl nitrogen, nitrate+nitrite nitrogen, ammonia nitrogen, soluble reactive phosphorus, total phosphorus, chloride, chlorophyll, color, and turbidity. Total nitrogen and organic nitrogen were calculated.)
- Nitrogen to phosphorus ratios were calculated

Biology

- Plant community characterization (species, coverage, algal depth)
- Macrofauna observations (species and counts)
- Adult aquatic insects (species and emergence rates)
- Human uses

Ecosystem Level

- Ecosystem metabolism metrics (gross primary productivity, net primary productivity, community respiration, P/R ratio, ecological efficiency)
- Nutrient assimilation
- Community export (fine particulate export)

Methods used for measurement of these parameters are described below.

Insolation and PAR

To measure photosynthetically active radiation (PAR) inputs LI-COR brand (light sensors models LI-190SA (pyranometer), LI-200SA (surface quantum sensor), and LI-192 underwater quantum sensor were placed in a representative area at each study system. (**Figures A-1 and A-2**). Data from these three sensors were recorded using a LI-1400 data logger every 15 minutes. During deployment the underwater sensor was cleaned as necessary (primarily to remove filamentous algae). The resulting PAR data were downloaded to a computer and utilized in metabolism Excel spreadsheets to calculate photosynthetic efficiency.



FIGURE A-1
Device to continuously measure photosynthetically available radiation (PAR), LI-COR sensors on top, data logger in box.

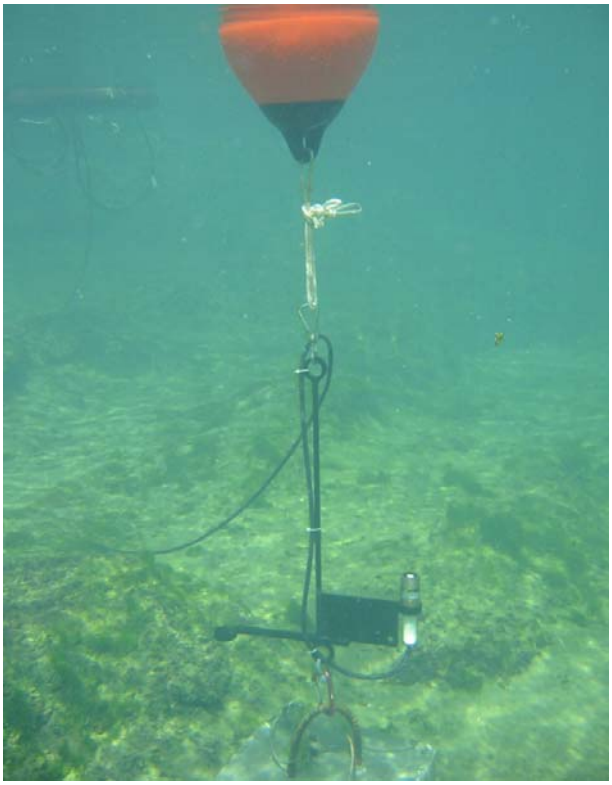


FIGURE A-2
Underwater LI COR sensor used to continuously measure PAR, cable goes to data logger.

Underwater Light Transmission

To estimate PAR underwater light transmission and attenuation coefficients, measurements at the upstream and downstream of each study segment were made. A LI-200SA sensor was used to measure PAR energy reaching the water surface, while an underwater LI-COR LI-192 sensor was used to measure PAR energy at multiple water depths. The underwater PAR sensor was attached to a weighted frame and readings logged at 15 to 30 cm (0.5 to 1 ft) depth intervals from the surface to the bottom water column (typically in an unshaded location). Measurements at each depth were collected following at least a ten second stabilization period. Light extinction (attenuation) coefficients were calculated from these data using the Lambert-Beer equation (Wetzel 2001):

$$Iz = Io(e^{-kz}) \qquad \textbf{[Equation 1]}$$

Where:

Iz = PAR at depth z

Io = PAR at the water surface

k = diffuse attenuation coefficient, m-1

z = water depth, m

Stream Discharge and Current Velocity

Stream discharge and velocity were measured at the upstream and downstream ends of each spring segment using a Marsh-McBirney Flo-Mate portable flow meter. At each location, a fiberglass tape was stretched across the stream channel perpendicular to the flow direction, allowing depth and velocity to be measured in at least 15 to 25 evenly-spaced segments (**Figure A-3**). At water depths less than 76 cm (2.5 ft), velocity was measured at 0.6 of the water column. For water depths greater than 76 cm (2.5 ft), velocity was measured at 0.2 and 0.8 fractional depths of the water column. For each of the resulting cross-section

sub-segments, velocity was multiplied by width and depth to calculate discharge. The cumulative discharge of all cross-section segments was calculated in a spreadsheet. The downstream segment at Jackson Blue Springs was not measured for discharge due to the width and minimal velocity at that site. Silver Springs discharge was not directly measured; instead discharge data from an established USGS station was utilized.



FIGURE A-3
Stream depth and velocity measurement along a cross-section of the Ichetucknee River.

Stream Segment Morphometry

Segment depths were measured by use of a recording depth finder linked to a global positioning system (GPS). These data were processed using Bentley PowerCivil™ software to extrapolate the wetted surface area and volume of each spring study segment. Nominal hydraulic residence times were calculated in a spreadsheet for each spring segment based on these estimated water volumes and the upstream and downstream flow estimates.

Secchi Disk Visibility

Water clarity was rapidly assessed using Secchi disk visibility, the distance were the disk disappears from sight. In spring systems, this distance is commonly greater than the depth of the water column and Secchi disk visibility must be measured horizontally. Secchi distance was measured with a 50 centimeter diameter white disk attached to the end of a tape measure and held below the surface of the water. A skin diver then extended the tape until the disk was no longer visible. Daily measurements were typically made between 10 A.M. and 3 P.M. when the sun was overhead for both the pool and run study segments.

Oxygen Diffusion Rate

Atmospheric oxygen diffusion rates were estimated through the use of the floating dome technique of Copeland and Duffer (1964) and modified by McKeller (1975). To measure oxygen diffusion, a dome-shaped plastic container of known volume is used. This dome floats on the water surface while an oxygen sensor remains in the headspace contained within (**Figure A-4**). To measure diffusion, the dome was inverted and filled with water, and then nitrogen gas was purged in to the dome to expel the water. This results in an anoxic atmosphere which gradually equilibrated with oxygen diffusing up from the water below. A field meter capable of logging dissolved oxygen concentrations (e.g., YSI 556 MPS) was used to record oxygen levels at 2 to 5 minute intervals. Both stream velocity and water depth were measured at the location of the diffusion dome. Experiments were typically run for one to 2 hours, allowing multiple measures to be made over the course of a day in different locations. Diffusion rates were calculated using a spreadsheet (see **Appendix E**). A regression between oxygen diffusion rate and current velocity was developed to estimate diffusion rates for correction of ecosystem metabolism estimates.

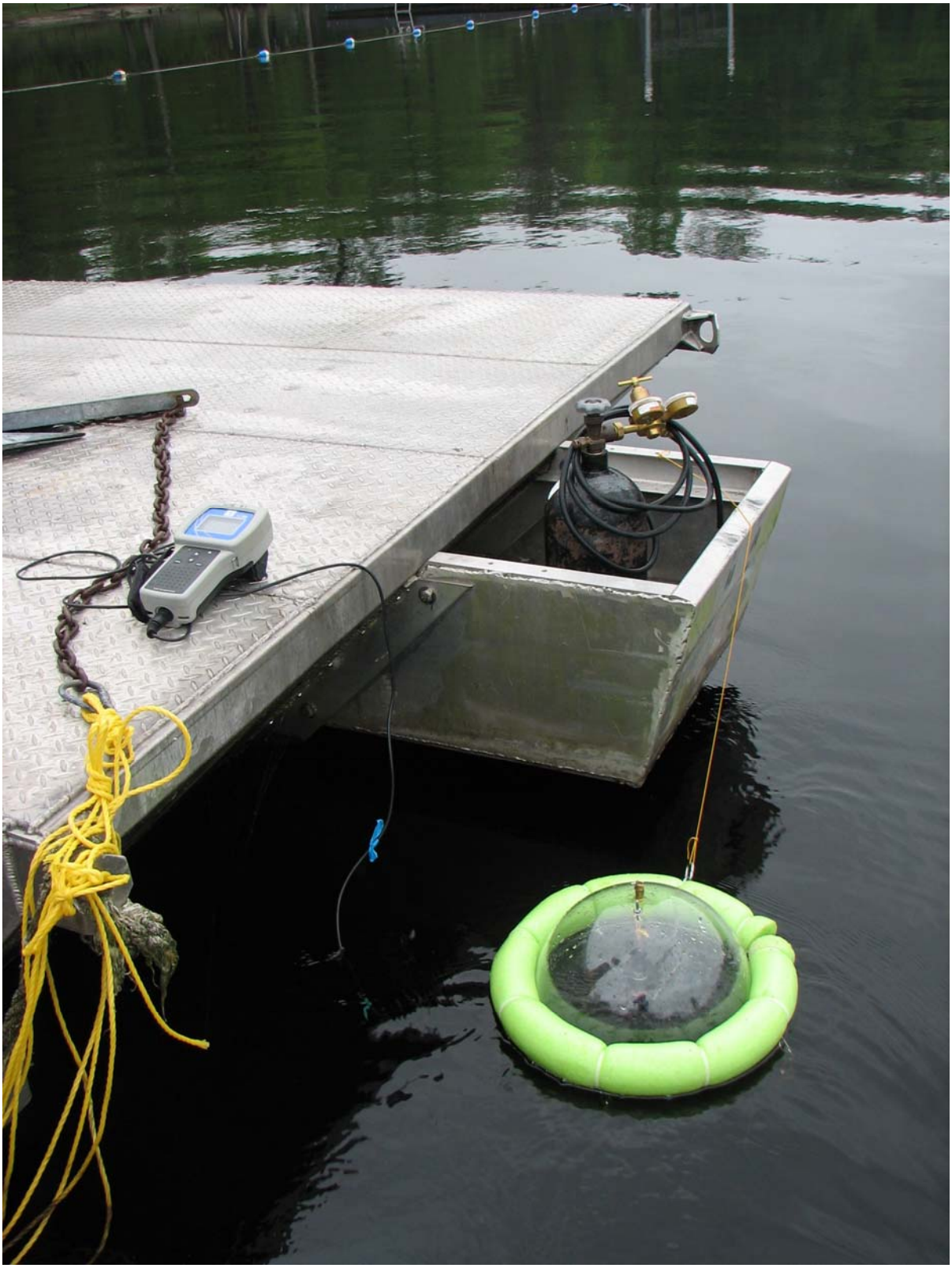


FIGURE A-4
Oxygen diffusion dome, with oxygen meter and nitrogen tank in background.

Water Quality

During segment sampling, field variables (water temperature, dissolved oxygen concentration, oxygen percent saturation, pH, conductivity and specific conductance) were measured and logged at 30 minute intervals using data sondes. The primary data sonde used was the YSI brand 6920 (In Situ brand Troll-9500 utilized at De Leon Springs). Oxygen data were collected using optical sensors with automated wipers, which proved to have robust calibration and no instrument drift during deployment. Data sondes were deployed near the middle of the water column at the upstream and downstream ends of each study segment for periods of at least 72-hours (**Figure A-5**). Data sondes were calibrated prior to deployment and subsequent to their retrieval for each sampling period following the manufacturers protocol. Field water quality variables were also measured using hand-held YSI 556 MPS meters to spot-check data sondes and collect additional spatial data.

Water chemistry samples were collected at the beginning and end of each study period, at both the upstream and downstream end of each of the two stream segment at each spring. This sampling strategy resulted in a total of six water chemistry data sets for each spring system. Water chemistry samples were collected as sub-surface grabs. A rinsed water collection bottle was used to collect water samples from about 30 cm (1 ft) below the water surface and used to fill acid-preserved sample bottles. Following collection, samples were placed in an ice-filled cooler and delivered for analysis within 24 hours. Water depth and field variables (temperature, dissolved oxygen, pH, and specific conductance using a YSI model 556 MPS) were also recorded during all water chemistry sampling events. Water chemistry samples were analyzed for the constituents listed in **Table A-2** by Advanced Environmental Labs, Gainesville FL, (FDOH certified laboratory # E82620).

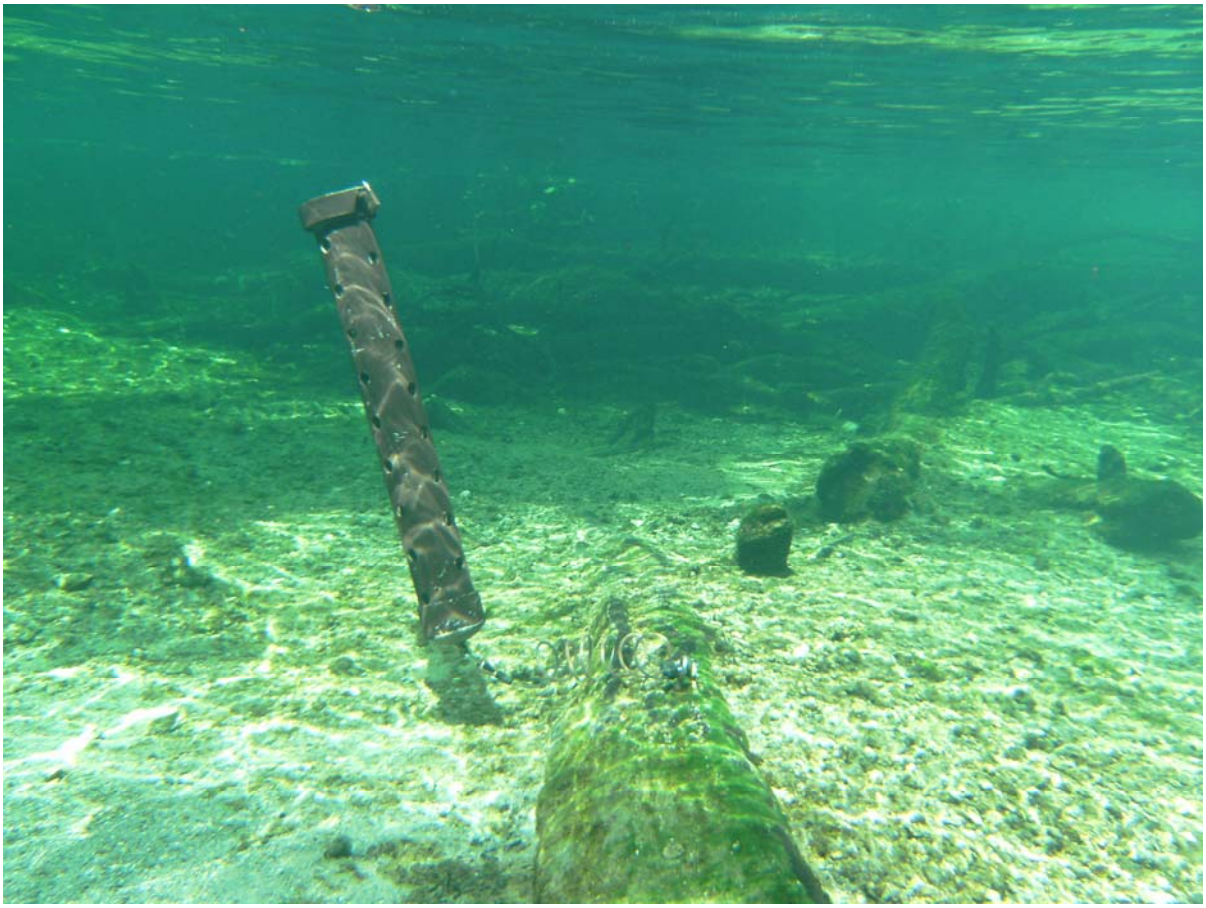


FIGURE A-5
Image of data sonde housing with holes in the housing allowing water to pass through while locking well cap and cable lock provide security.

TABLE A-2
Water quality constituents analyzed for each study spring.

Parameter	Units	Analytical Method	Reporting Limit
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.048
Nitrate+Nitrite Nitrogen	mg/L	EPA 353.2	0.015
Ammonia Nitrogen	mg/L	EPA 350.1	0.026
Total Phosphorus	mg/L	EPA 365.1	0.020
Soluble Reactive Phosphorus	mg/L	EPA 365.2	0.015
Chloride	mg/L	EPA 325.2	0.200
Chlorophyll	mg/L	SM10200H	2.5
Color	PCU	EPA 110.2	5
Turbidity	NTU	EPA 180.1	1

Plant Community Characterization

The distribution and percent cover of aquatic plant communities (macroalgae and submerged aquatic vegetation) in each of the study segments was estimated during the sampling events. Aquatic vegetative cover was documented for each segment at multiple sampling points (typically between 50 and 100 points). Observed plants were identified to species or lowest possible taxonomy and were categorized according to functional group (floating aquatic, submersed aquatic, emergent, or benthic algae). No quantitative plant biomass samples were collected due to concerns of destructive sampling. The depth of benthic filamentous algae was measured with a rod with graduated increments. Within each spring study area, a general sketch of the aquatic plant community was made.

Faunal Observations

While on site at each spring, the observed macrofauna (mammals, birds, reptiles, and amphibians) were identified to the lowest possible taxonomic level and their numbers quantified. Aquatic turtles were also counted during fish surveys. Species lists for each of these macrofauna categories were produced by segment location and spring.

Fish Surveys

Visual surveys of the fish communities were made in each segment of the study springs. Two exceptions to this sampling were: the run segment of De Leon Springs was not surveyed due to poor water visibility and Wakulla Springs was not sampled due to prohibitions on in-water activity for most of the spring. In addition, dip-net sampling was made at many of the study springs to collect small fish in densely vegetated habitats. Data from dip-net collections was primarily used to augment the species list developed for each spring. Multiple daily surveys (typically three) of fish communities were made by two

people using snorkel and/or SCUBA gear. The two fish observers started at an upstream location and worked their way downstream. Each observer partitioned the spring pool and run into equal halves. Observers noted the species (or lowest practical taxonomy) of all observed fish, and these observations were called out to a data recorder, who followed along in a boat. Following each survey, observers estimated the total length (average and range) by fish species. Fish density was calculated by dividing the average number of individuals counted by the area sampled. Biomass of fish species was estimated using published length-weight relationships (Schneider *et al*. 2000) and average species total lengths and numbers.

Adult Aquatic Insects

Aquatic insects were characterized based on collections made of adults as they emerged from the water. Insect emergence was measured through the use of floating pyramidal traps, each with a sampling area of 0.25 m^2 (**Figure A-6**). The design was based on traps used for midge and mosquito sampling from wetland and aquatic environments (Walton *et al*. 1999). Each trap was constructed of wood and had four sides covered with fiberglass window screen. Flotation was provided by foam "noodles" attached along the bottom wooden supports. The traps work under the premise that insects emerging into the trap generally seek the highest spot and in the process travel through an inverted funnel into a 500 mL jar inverted over the end of the funnel. A total of ten traps were deployed at locations along the periphery of the spring pool and run. At each location the substrate and water depth was noted. Traps were deployed and the jars containing the emergent insects collected at 24 hour intervals for a total of three collections. Insect identifications were made to the lowest practical taxonomy with the aid of FDEP staff. The number of insects captured

in traps was used to calculate emergence rates and extrapolated across the wetted area of the study segments.



FIGURE A-6
Trap used to collect adult aquatic insects as they emerge from the water.

Human Use

To characterize the amount of human use at each of the study springs, entry data were collected from FDEP (Bureau of Operational Services, Florida Park Service). For Silver Glen Springs these data were provide by the U.S. Forestry Service and for Jackson Blue Spring data were provided by Jackson County Parks Department. These data are available as monthly attendance records and are typically categorized into day use and overnight use. Jackson Blue Springs is only open to the public during summer months. During the

remainder of the year, cave divers can access the park, but records are not readily available for this usage. For each of the study springs, attendance data were used to calculate the average number (and standard deviation) of visitors for the period of record. In addition, the total number of visitors per year was calculated.

Detailed observations of human use were made during the time that each of the study springs was visited. These observations were made for the visible portions of the spring pool, run, and surrounding upland areas. Primary water contact activities were categorized as: wading (less than waist deep), bathing (greater than waist deep and less than neck deep), swimming, snorkeling, SCUBA diving, tubing, canoeing/kayaking, power boating, tour boating, and fishing. Primary out-of-water activities included: sitting, walking, sunbathing, and nature study.

For each of these activity categories, the counts of all persons within the observation area were made at about 15 minute intervals. This typically resulted in four days of observations per study spring; generally between the hours of 8 A.M. to 5 P.M. Individual counts were multiplied by 0.25 hours (15 minutes) to estimate the average person-hours throughout the period of observation. An illustration of these results for Wekiwa Spring is provided in **Figure A-7** for clarification of this methodology. The area under the curve in **Figure A-7** is equal to the total human-use during a one-day period and is reported in units of person-hours as follows:

$$\sum_{t1}^{t2} no.persons.dt = \text{person-hours} \qquad \textbf{[Equation 2]}$$

where:
T = time (hours)

A = area observed (ha)

t_1 = time (start)

t_2 = time (finish)

These person-hour estimates were in turn divided by the total observation interval in hours to estimate an average number of persons involved in in-water and out-of-water activities for each day of observation. Water and upland areas within the zone of observation were estimated from maps and aerial photographs to normalize data on a per-area basis:

Human-Use Density = no. persons/area counted **[Equation 3]**

The resulting data were tabulated and reported as the average number of persons and human-use density (persons per area) basis by activity and location.

For Wakulla Springs, additional intensive human use study was conducted from January to June, 2009. During each month, one week day and one weekend day was selected to conduct detailed human use observations. In-water human use at Wakulla Springs is limited to the swim area and activity categories in this location included: wading, bathing, swimming, snorkeling, and SCUBA. Out of water activity categories by the swim area included: sitting, sunbathing, walking, and viewing. In addition, the number of people engaged in boat tours during this time period was monitored as an "in-water" activity.

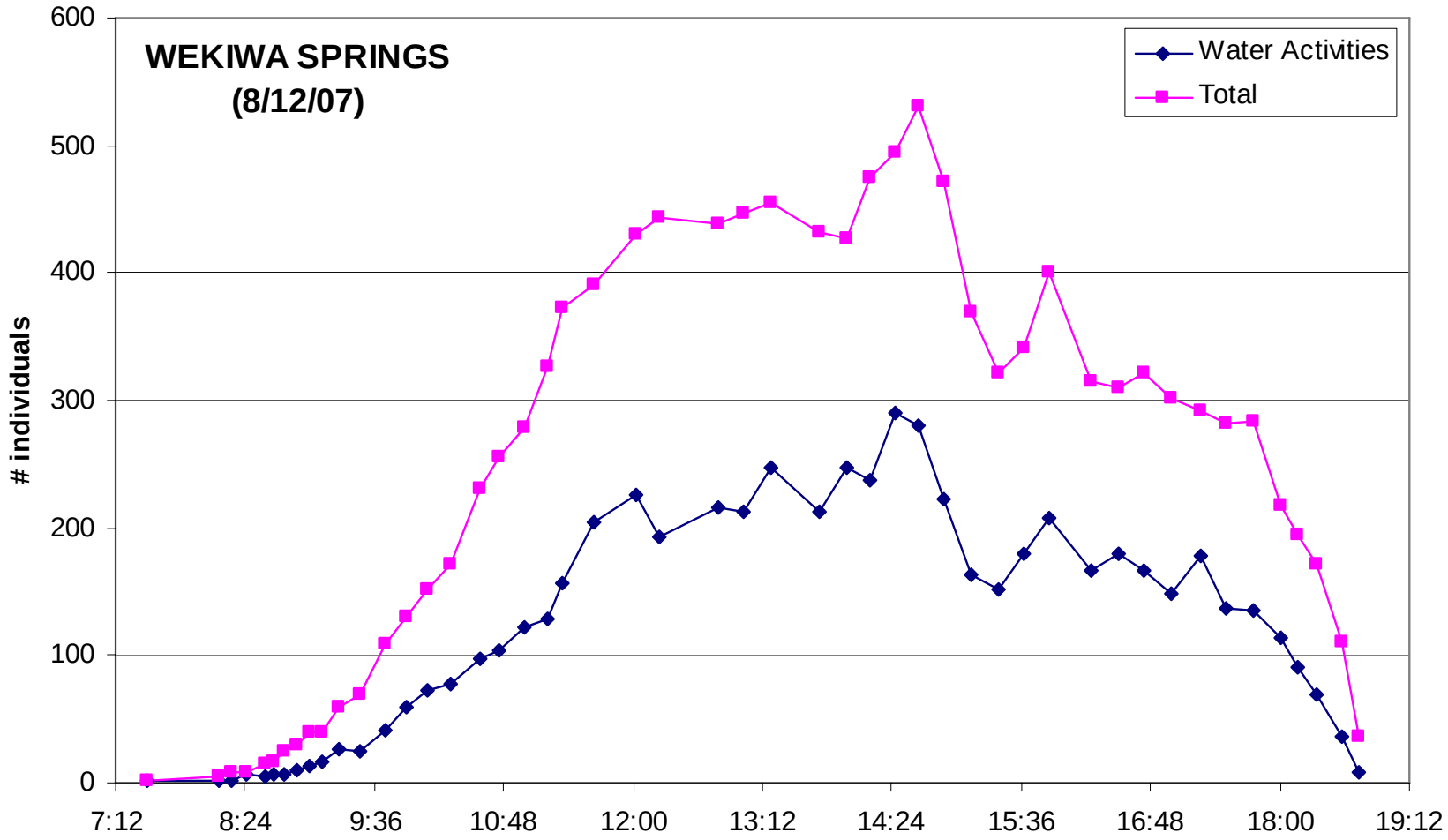


FIGURE A-7
Daily pattern of water-dependent human use observed at Wekiwa Springs on Sunday, August 12, 2007 (from WSI 2007b).

Ecosystem Metabolism

Ecosystem metabolism was calculated in each of the spring ecosystems using an Excel spreadsheet adaptation of the upstream/downstream dissolved oxygen (DO) change methods of H.T. Odum (1957a, 1957b). This method estimates and subtracts upstream from downstream DO mass fluxes corrected for atmospheric diffusion to determine the metabolic oxygen rate-of-change of the aquatic ecosystem. Dissolved oxygen mass inputs typically include spring discharges, atmospheric diffusion into the water column, accretion from other undocumented stream or spring seep inflows, and the release of DO as a by-product of aquatic plant photosynthesis. Oxygen losses include diffusion from the water column to the atmosphere (under super-saturated conditions), the metabolic respiration of the aquatic microbial, plant, and animal communities, and sediment biological oxygen demand. The downstream DO concentration measured at any time is the net effect of these gains and losses as shown in the following conceptual equation:

$$\Delta DO = GPP - CR + Din + A \qquad \textbf{[Equation 4]}$$

Where:

Δ DO = DO rate-of-change, g $O_2/m^2/d$

GPP = gross primary productivity, g $O_2/m^2/d$

CR = community respiration, g $O_2/m^2/d$

Din = diffusion into the water under unsaturated conditions, g $O_2/m^2/d$

A = accrual of DO from other spring boils, g $O_2/m^2/d$

The dissolved oxygen measurements used to estimate segment ecosystem metabolism were collected at the upstream and downstream end of each study segment at 30 minute intervals using recording data sondes (YSI 6920 or In Situ 9500) with optical DO sensors.

These data sondes were deployed for at least a 72-hour period, allowing three continuous diel periods of measurement for each of the two spring segments at each study site. Extended sonde deployments (about 30 days) were conducted at Ichetucknee and Wakulla Springs.

Upstream and downstream dissolved oxygen data were each shifted by one-half of the estimated travel time between the upstream and downstream stream segment stations and an oxygen rate-of-change curve was prepared. This curve was corrected for atmospheric diffusion based on measured percent oxygen saturation and oxygen diffusion rates corrected for water velocity. The corrected oxygen rate-of-change curve for each 24-hour period was used to estimate gross primary productivity (GPP), community respiration (CR), net primary productivity (NPP), production/respiration (P/R) ratio, and ecological efficiency. **Figure A-8** illustrates these metabolism measurements based on development of a typical oxygen rate-of-change curve. Descriptions of the ecosystem metabolism parameters follow below:

- Gross primary productivity (GPP) is the entire area under the oxygen rate-of-change curve calculated by extending the nighttime corrected oxygen rate-of-change through the daylight hours and estimating the entire area under the daytime curve in g $O_2/m^2/d$. GPP is a measure of all aquatic plant productivity occurring below the water surface within the stream segment. GPP includes primary productivity of both algae (including photosynthetic bacteria) and vascular plants.

- Community respiration (CR) is the average of the corrected nighttime oxygen rate-of-change values in g $O_2/m^2/d$. CR is a measure of the total dark metabolism of the entire submerged ecosystem within each stream segment. CR includes the

respiration of all microbes in the sediments and water column, respiration of bacteria, algae, and plants in the water column, and respiration of all aquatic animals, including protozoans, macroinvertebrates, crustaceans, and fish.

- Net primary productivity (NPP) is equal to the difference between these two estimates (GPP-CR). NPP provides an estimate of the net fixed carbon that remains each day after the respiratory needs of the aquatic ecosystem are met. CR may be higher than GPP in some streams and during some periods of time, indicating that there are unmeasured inputs of fixed carbon or losses of fixed carbon that were previously stored in the ecosystem.

- The P/R ratio or ecological quotient is equal to GPP/CR. A P/R ratio of one indicates that production and consumption are equally balanced. A ratio greater than one indicates an autotrophic aquatic ecosystem while a value less than one indicates a heterotrophic ecosystem.

- Ecological efficiency (EE) is equal to the rate of gross primary productivity divided by the incident PAR during a specified time interval. It estimates the overall efficiency of an aquatic ecosystem to utilize incident solar radiation, the principal forcing function for autotrophic stream ecosystems. PAR reaching the plant level was estimated based on river stage, the plant community characterization data for segment depth, and the light attenuation coefficient estimated for each sampling event. Ecological efficiency is reported as PAR Efficiency by dividing GPP in $O_2/m^2/d$ by $mol/m^2/d$, resulting in units of g O_2/mol. PAR Efficiency is also reported as a percentage using the conversion factors employed by Knight (1980; 1983): 4.22 Kcal/g O_2 and 52.27 Kcal/mole of photons (McCree 1972).

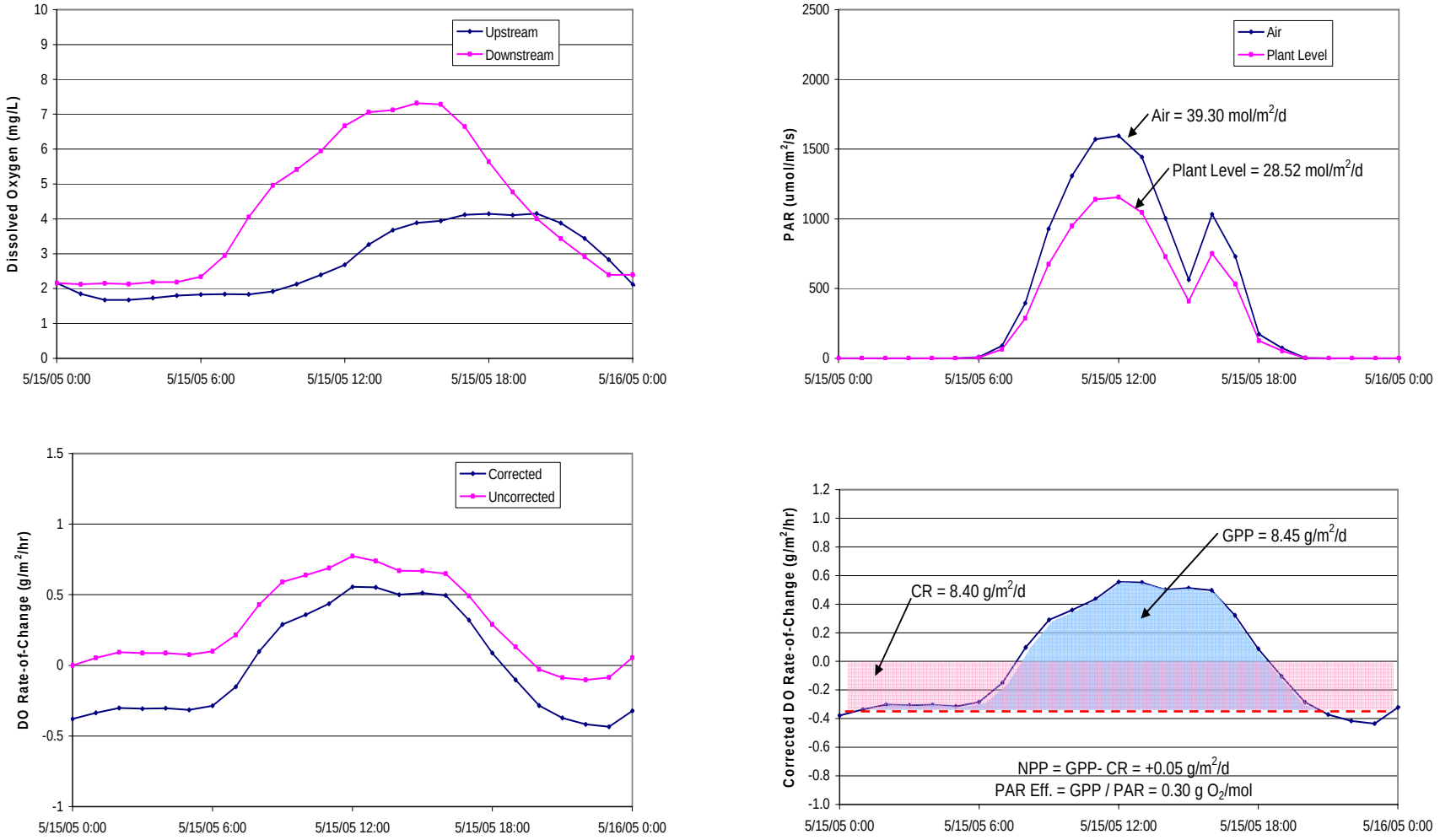


FIGURE A-8
Example determination of ecosystem metabolism based on upstream-downstream dissolved oxygen data (from WSI 2007).

Nutrient Assimilation

Nutrient assimilation/dissimilation rates for total nitrogen, nitrate, ammonia, total phosphorus, and soluble reactive phosphorus, were estimated for both study segments of each of the study springs by calculating upstream-downstream changes in nutrient mass. Average nutrient mass inputs and outputs were estimated based on average water chemistry concentrations and flows over the period of each study. Positive nutrient mass changes indicate assimilation/dissimilation of nutrients, while negative changes indicate an increase in nutrient mass with travel of the spring flow downstream.

Community Export

Community export of particulate suspended matter was quantified for each stream segment using a plankton net suspended in the current at mid-depth (**Figure A-9**). The mesh size on the plankton net was 153 μm. Three replicate plankton net samples were collected at the upstream and downstream end of each segment. Sample material collected in the plankton net were rinsed into a sample bottle and returned to the laboratory for wet, dry, and ash-free (combusted at an oven temperature of 450 °C) dry weight analyses. As samples were collected, the velocity of the water at the mouth of the net was measured as was the time of net deployment. This allowed the volume of water passing through the net to be calculated. The amount of material collected was expressed on a volume and area (based on upstream wetted-area) basis. Particulate export results are reported as dry weight (DW) and ash-free dry weight (AFDW) per upstream area per time (g DW/m^2/d and g AFDW/m^2/d, respectively). Overall particulate export for each study segment was calculated as the difference between the upstream and downstream export rates.

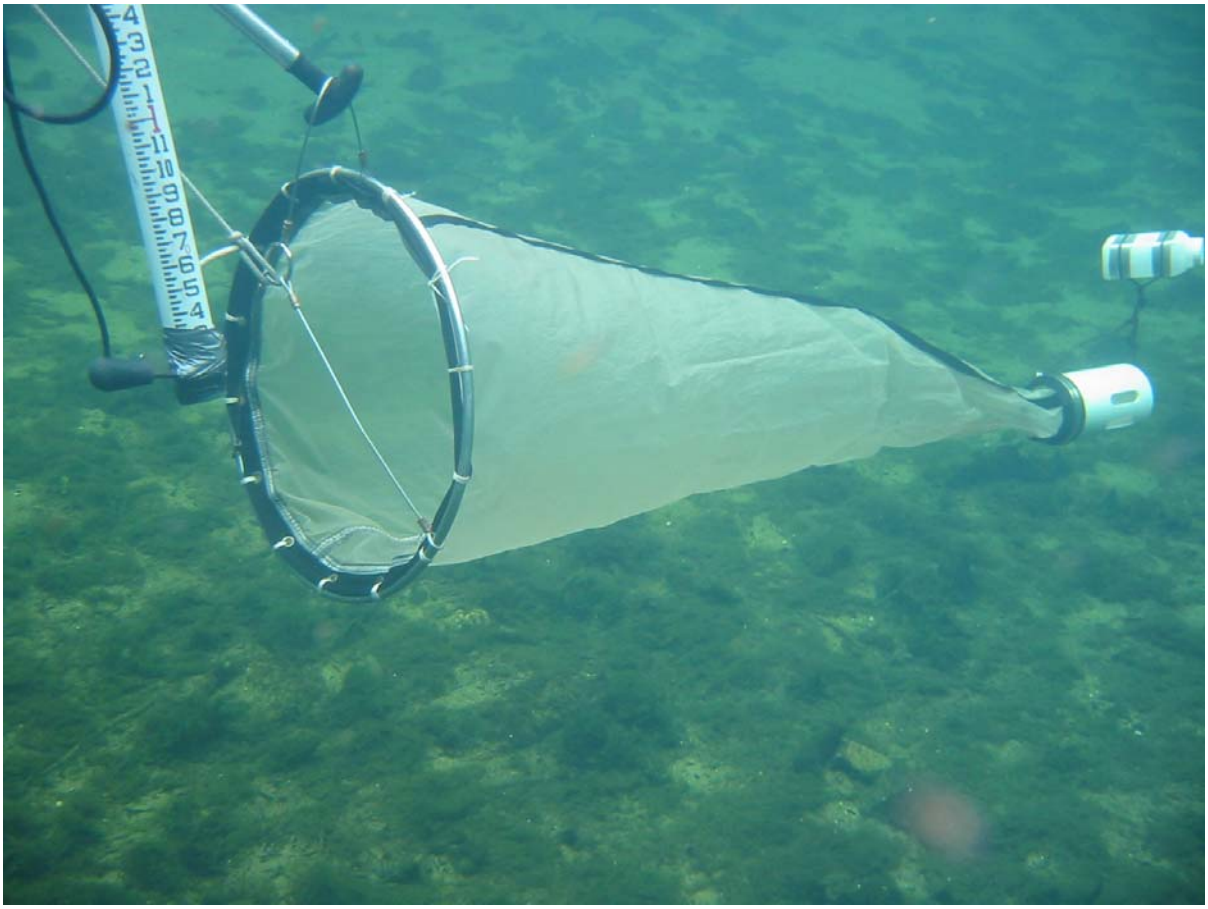


FIGURE A-9
Image of plankton net capturing suspended material with flow meter upstream.

Methods Literature Cited

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Appendix B

FDEP and US Forest Service Research Permits

Florida Department of Environmental Protection
Division of Recreation and Parks

Permit Number:
02250822

RESEARCH/COLLECTING PERMIT

This Permit Must Be Carried At All Times While Researching/Collecting

RENEWAL

Primary Holder:
Knight, Robert

Wetland Solutions, Inc.

Issue: 2/2/2009
Expiration: 2/2/2010

Additional Permittees:
Notestein, Sky
Clark, Ronald
Brennan, Henry
Keller, Chris
Segal, Debra

3502 NW 156th Ave.
Gainesville, FL 32653
(386) 462-9286 bknight@wetlandsolutionsinc.com

To Research/ Collect:
Collection of water quality data (emphasis on nitrates) using installed monitoring equipment.

In the Following Parks:
Ichetucknee Springs State Park

Standard Conditions:

1. Contact the Park Manager (PM) and Biologist (BIO) in advance of project start (2 weeks notice when possible), for coordination and arrangements. Due to the increasing popularity of research within state parks and their other duties and responsibilities, the park staff may not be available to physically assist with project activities but will provide guidance and direction.

Ichetucknee (386) 497-4690 PM Sherry McGowan BIO Ginger Morgan

2. Check in upon arrival at and departure from the park. Collected material is subject to inspection.
3. Collect only materials as stated above, in the quantities and manner indicated in the attached application form.
4. Any other applicable state and federal permits are the responsibility of the permittee.
5. Collected objects may not be sold, bartered, or traded.
6. Collect no state or federally listed, or rare endemic species or forms, unless otherwise stated in permit.
7. Research shall be conducted in such a manner as not to attract attention or cause damage to the environment.
8. Remove all flagging and project markings upon project completion.
9. The permit is non-transferable. At least one named collector (above) must be present.
10. The permittee and research associates will not be subject to park day-fees.
11. The permit is revocable.
12. The permit may be renewed upon written request. Consideration for renewal will be contingent up on submission of an interim progress report.
13. A final report, including species lists, museum voucher numbers, incidental observations, and any research reports concerning project data shall be submitted to the district biologist and the parks within one month of permit expiration. The report is the responsibility of the primary permit holder. Failure to submit a report may result in denial of future research requests.

Special Conditions and Restrictions:

1 Equipment installation must be closely coordinated with Park Biologist.

Approved:

Donald V. Forgione

Chief, Bureau of Parks District 2
Division of Recreation and Parks
District 2 Administration
4801 Camp Ranch Road
Gainesville, FL 32641-9299

Phone: (352) 955-2135
Suncom: 625-2135
FAX: (352) 955-2139

cc: District Biologist, Park Manager(s), Park Biologist(s)

Page 1 of 2

Florida Department of Environmental Protection
Division of Recreation and Parks

Permit Number
04060910

RESEARCH / COLLECTING PERMIT

This Permit Must Be Carried At All Times While Researching/Collecting

Applicant	Address	Issue Date
Knight, Robert Representing Wetland Solutions, Inc.	2809 NW 161 Court Gainesville, FL 32609 (386) 462-1003 bknight@wetlandsolutions.com	Friday, May 01, 2009 Expiration Date Friday, April 30, 2010

Additional Authorized Collector

Banks, Zach
Brennan, Henry
Clarke, Ronald
Keller, Chris
Notestein, Sky
Segal, Debra

Subject

Water Samples

Permitted Activity

Collection of data from instrument readings; collection of water chemistry samples; survey of flora and fauna; limited collection of aquatic invertebrates.

In the Following Park/s

District	
1	Ponce de Leon Springs State Park
2	Homosassa Springs Wildlife State Park
2	Madison Blue Springs
2	Manatee Springs State Park
2	Rainbow Springs State Park
3	De Leon Springs State Park
3	Silver River State Park
4	Weeki Wachee Springs State Park

Permitted Collection

Minimum number of aquatic insects; sufficient water samples for water chemistry testing where necessary.

Special Conditions or Restrictions

1. Important Contact information:
   a. Please refer to the attached list of state park biologists. If you collect from any park on this list, the named biologist is your primary contact.
   b. Please refer to the attached list of state parks. If the park has no assigned biologist, the park manager is your primary contact.
   c. Please refer to the attached map of district boundaries. In addition to contacting the manager or park biologist, you must also contact the appropriate District Biologist. The contact phone numbers for those staff are included on the list of biologists.

2. Contact the Park Manager and Park or District Biologist one week in advance of visits for coordination and arrangements. Failure to do this may result in denial of park entry.

3. Check in with the park manager upon arrival at and departure from the park. Collected material is subject to inspection.

4. Collect only materials as stated above, in the quantities and manner indicated.

5. Any other applicable state and federal permits are the responsibility of the permittee.

6. Collected objects may not be sold, bartered, or traded.

7. A project report containing a summary of research findings (including species lists and voucher numbers of museum donations where applicable) shall be appended to any renewal request, or submitted to the issuing office within 90 days of permit expiration.

8. Collecting shall be conducted in such a manner as not to attract attention or cause damage to the environment. Vehicular traffic shall be limited to park roads; other methods of access must be approved by park manager. All gates shall be left as found.

9. The permit is non-transferable. At least one named collector (above) must be present.

10. The permittee and research associates will not be subject to park day-fees.

11. The permit is revocable.

12. The permit may be extended or modified upon submission of the project report and a letter requesting renewal. Contact the issuing office for amendment or extension.

13. Operational concerns - Wakulla Springs: The park will be unable to provide a park boat or operator; therefor, downriver acces may not be possible. It is imperative that the researcher make all arrangements well in advance. Contact information is included in the attached lists.

FPS-R010 rev. 08/10/02

Page 2 of 2

Florida Department of Environmental Protection
Division of Recreation and Parks

Permit Number
04060910

RESEARCH / COLLECTING PERMIT

This Permit Must Be Carried At All Times While Researching/Collecting

14. Operational concerns - Weeki Wachee: Activities shall not interfere with the underwater theater shows; park manager has authority to resolve any issues associated with potential conflicts with other research projects.

Approved By	Issuing Office		
Donna Watkins Donna Watkins, Special Projects Coordinator	Division of Recreation and Parks Bureau of Natural and Cultural Resource 3900 Commonwealth Boulevard, MS 5 Tallahassee, Florida 32399-300	*Phone No.* 850-245-3104 *Fax No.* 850-245-3114

Attachments: Application for Research/Collecting Permit

cc: Affected District Biologist(s) And Park Manager(s)

FPS-R010 rev. 08/10/02

United States Department of Agriculture | Forest Service | National Forests in Florida

Ocala National Forest

Seminole Ranger District
40929 State Road 19
Umatilla, FL 32784
(352) 669-3153

Lake George Ranger District
17147 East Highway 40
Silver Springs, FL 34488
(352) 625-2520

File Code: 2720

Date: May 13, 2008

Mr. Robert L. Knight
Wetland Solutions, Inc.
2809 NW 161 Court
Gainesville, FL 32609

Dear Mr. Knight:

Enclosed is an approved copy of your special use permit for conducting research at Silver Glen Springs.

Please contact Pat Tooley regarding any questions.

Sincerely,

Carrie Christman

for JOHN RICHARD LINT
District Ranger

Enclosure

Caring for the Land and Serving People

Printed on Recycled Paper

Authorization ID: LAK225
Contact ID: WETLAND
Expiration Date: 12/31/2009
Use Code: 422

FS-2700-4 (05/03)
OMB 0596-0082

U.S. DEPARTMENT OF AGRICULTURE
Forest Service
SPECIAL USE PERMIT
AUTHORITY:
ORGANIC ADMINISTRATION ACT June 4, 1897

Wetland Solutions, Inc. of 2809 NW 161 Court, Gainesville, FL 32609 (hereinafter called the Holder) is hereby authorized to use or occupy National Forest System lands, to use subject to the conditions set out below, on the Ocala National Forest or Lake George Ranger District unit of the National Forest System.

This permit covers 5 acres, and/or --- miles and is described as: a portion of National Forest land known as Silver Glen Springs as shown on the location map attached to and made a part of this permit, and is issued for the purpose of:

Conducting environmental sampling for water chemistry, plant and animal life as part of a comprehensive ecological assessment of Florida's major spring systems.

The above described or defined area shall be referred to herein as the "permit area".

TERMS AND CONDITIONS

I. AUTHORITY AND GENERAL TERMS OF THE PERMIT

A. Authority. This permit is issued pursuant to the authorities enumerated at Title 36, Code of Federal Regulations, Section 251 Subpart B, as amended. This permit, and the activities or use authorized, shall be subject to the terms and conditions of the Secretary's regulations and any subsequent amendment to them.

B. Authorized Officer. The authorized officer is the Forest Supervisor or a delegated subordinate officer.

C. License. This permit is a license for the use of federally owned land and does not grant any permanent, possessory interest in real property, nor shall this permit constitute a contract for purposes of the Contract Disputes Act of 1978 (41 U.S.C. 611). Loss of the privileges granted by this permit by revocation, termination, or suspension is not compensable to the holder.

D. Amendment. This permit may be amended in whole or in part by the Forest Service when, at the discretion of the authorized officer, such action is deemed necessary or desirable to incorporate new terms, conditions, and stipulations as may be required by law, regulation, land management plans, or other management decisions.

E. Existing Rights. This permit is subject to all valid rights and claims of third parties. The United States is not liable to the holder for the exercise of any such right or claim.

F. Nonexclusive Use and Public Access. Unless expressly provided for in additional terms, use of the permit area is not exclusive. The Forest Service reserves the right to use or allow others to use any part of the permit area, including roads, for any purpose, provided, such use does not materially interfere with the holder's authorized use. A final determination of conflicting uses is reserved to the Forest Service.

G. Forest Service Right of Entry and Inspection. The Forest Service has the right of unrestricted access of the permitted area or facility to ensure compliance with laws, regulations, and ordinances and the terms and conditions of this permit.

H. Assignability. This permit is not assignable or transferable. If the holder through death, voluntary sale or transfer, enforcement of contract, foreclosure, or other valid legal proceeding ceases to be the owner of the improvements, this permit shall terminate.

1

I. Permit Limitations. Nothing in this permit allows or implies permission to build or maintain any structure or facility, or to conduct any activity unless specifically provided for in this permit. Any use not specifically identified in this permit must be approved by the authorized officer in the form of a new permit or permit amendment.

II. TENURE AND ISSUANCE OF A NEW PERMIT

A. Expiration at the End of the Authorized Period. This permit will expire at midnight on 12/31/2009. Expiration shall occur by operation of law and shall not require notice, any decision document, or any environmental analysis or other documentation.

B. Minimum Use or Occupancy of the Permit Area. Use or occupancy of the permit area shall be exercised at least 2 days each year, unless otherwise authorized in writing under additional terms of this permit.

C. Notification to Authorized Officer. If the holder desires issuance of a new permit after expiration, the holder shall notify the authorized officer in writing not less than six (6) months prior to the expiration date of this permit.

D. Conditions for Issuance of a New Permit. At the expiration or termination of an existing permit, a new permit may be issued to the holder of the previous permit or to a new holder subject to the following conditions:

1. The authorized use is compatible with the land use allocation in the Forest Land and Resource Management Plan.
2. The permit area is being used for the purposes previously authorized.
3. The permit area is being operated and maintained in accordance with the provisions of the permit.
4. The holder has shown previous good faith compliance with the terms and conditions of all prior or other existing permits, and has not engaged in any activity or transaction contrary to Federal contracts, permits laws, or regulations.

E. Discretion of Forest Service. Notwithstanding any provisions of any prior or other permit, the authorized officer may prescribe new terms, conditions, and stipulations when a new permit is issued. The decision whether to issue a new permit to a holder or successor in interest is at the absolute discretion of the Forest Service.

F. Construction. Any construction authorized by this permit may commence by N/A and shall be completed by N/A. If construction is not completed within the prescribed time, this permit may be revoked or suspended.

III. RESPONSIBILITIES OF THE HOLDER

A. Compliance with Laws, Regulations, and other Legal Requirements. The holder shall comply with all applicable Federal, State, and local laws, regulations, and standards, including but not limited to, the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., the Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq., the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S. C. 9601 et seq., and other relevant environmental laws, as well as public health and safety laws and other laws relating to the siting, construction, operation, and maintenance of any facility, improvement, or equipment on the property.

B. Plans. Plans for development, layout, construction, reconstruction, or alteration of improvements on the permit area, as well as revisions of such plans, must be prepared by a qualified individual acceptable to the authorized officer and shall be approved in writing prior to commencement of work. The holder may be required to furnish as-built plans, maps, or surveys, or other similar information, upon completion of construction.

C. Maintenance. The holder shall maintain the improvements and permit area to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the authorized officer and consistent with other provisions of this authorization. If requested, the holder shall comply with inspection requirements deemed appropriate by the authorized officer.

D. Hazard Analysis. The holder has a continuing responsibility to identify all hazardous conditions on the permit area which would affect the improvements, resources, or pose a risk of injury to individuals. Any non-emergency actions to abate such hazards shall be performed after consultation with the authorized officer. In emergency situations, the holder shall notify the authorized officer of its actions as soon as possible, but not more than 48 hours, after such actions have been taken.

E. Change of Address. The holder shall immediately notify the authorized officer of a change in address.

F. Change in Ownership. This permit is not assignable and terminates upon change of ownership of the improvements or control of the business entity. The holder shall immediately notify the authorized officer when a change in ownership or control of business entity is pending. Notification by the present holder and potential owner shall be executed using Form SF-299 Application for Transportation and Utility Systems and Facilities of Federal Lands, or Form FS-2700-3a, Holder Initiated Revocation of Existing Authorization, Request for a Special Use Permit. Upon receipt of the proper documentation, the authorized officer may issue a permit to the party who acquires ownership of, or a controlling interest in, the improvements or business entity.

IV. LIABILITY

For purposes of this section, "holder" includes the holder's heirs, assigns, agents, employees, and contractors.

A. The holder assumes all risk of loss to the authorized improvements.

B. The holder shall indemnify, defend, and hold the United States harmless for any violations incurred under any such laws and regulations or for judgments, claims, or demands assessed against the United States in connection with the holder's use or occupancy of the property. The holder's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property in connection with the occupancy or use of the property during the term of this permit. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. This paragraph shall survive the termination or revocation of this authorization, regardless of cause.

C. The holder has an affirmative duty to protect from damage the land, property, and interests of the United States.

D. In the event of any breach of the conditions of this authorization by the holder, the authorized officer may, on reasonable notice, cure the breach for the account at the expense of the holder. If the Forest Service at any time pays any sum of money or does any act which will require payment of money, or incurs any expense, including reasonable attorney's fees, in instituting, prosecuting, and/or defending any action or proceeding to enforce the United States rights hereunder, the sum or sums so paid by the United States, with all interests, costs and damages shall, at the election of the Forest Service, be deemed to be additional fees hereunder and shall be due from the holder to the Forest Service on the first day of the month following such election.

E. With respect to roads, the holder shall be proportionally liable for damages to all roads and trails of the United States open to public use caused by the holder's use to the same extent as provided above, except that liability shall not include reasonable and ordinary wear and tear.

F. The Forest Service has no duty to inspect the permit area or to warn of hazards and, if the Forest Service does inspect the permit area, it shall incur no additional duty nor liability for identified or non-identified hazards. This covenant may be enforced by the United States in a court of competent jurisdiction.

V. TERMINATION, REVOCATION, AND SUSPENSION

A. General. For purposes of this permit, "termination", "revocation", and "suspension" refer to the cessation of uses and privileges under the permit.

"Termination" refers to the cessation of the permit under its own terms without the necessity for any decision or action by the authorized officer. Termination occurs automatically when, by the terms of the permit, a fixed or agreed upon condition, event, or time occurs. For example, the permit terminates at expiration. Terminations are not appealable.

"Revocation" refers to an action by the authorized officer to end the permit because of noncompliance with any of the prescribed terms, or for reasons in the public interest. Revocations are appealable.

"Suspension" refers to a revocation which is temporary and the privileges may be restored upon the occurrence of prescribed actions or conditions. Suspensions are appealable.

B. Revocation or Suspension. The Forest Service may suspend or revoke this permit in whole or part for:

1. Noncompliance with Federal, State, or local laws and regulations.
2. Noncompliance with the terms and conditions of this permit.
3. Reasons in the public interest.
4. Abandonment or other failure of the holder to otherwise exercise the privileges granted.

C. Opportunity to Take Corrective Action. Prior to revocation or suspension for cause pursuant to Section V (B), the authorized officer shall give the holder written notice of the grounds for each action and a reasonable time, not to exceed 90 days, to complete the corrective action prescribed by the authorized officer.

D. Removal of Improvements. Prior to abandonment of the improvements or within a reasonable time following revocation or termination of this authorization, the holder shall prepare, for approval by the authorized officer, an abandonment plan for the permit area. The abandonment plan shall address removal of improvements and restoration of the permit area and prescribed time frames for these actions. If the holder fails to remove the improvements or restore the site within the prescribed time period, they become the property of the United States and may be sold, destroyed or otherwise disposed of without any liability to the United States. However, the holder shall remain liable for all cost associated with their removal, including costs of sale and impoundment, cleanup, and restoration of the site.

VI. FEES

A. Termination for Nonpayment. This permit shall automatically terminate without the necessity of prior notice when land use rental fees are 90 calendar days from the due date in arrears.

B. Fees for this use have been exempted or waived in full pursuant to 36 CFR 251.57, or revisions thereto, and direction in FSH 2709.11, chapter 30.

VII. OTHER PROVISIONS

A. Members of Congress. No Member of or Delegate to Congress or Resident Commissioner shall benefit from this permit either directly or indirectly, except when the authorized use provides a general benefit to a corporation.

B. Appeals and Remedies. Any discretionary decisions or determinations by the authorized officer are subject to the appeal regulations at 36 CFR 251, Subpart C, or revisions thereto.

C. Superior Clauses. In the event of any conflict between any of the preceding printed clauses or any provision thereof and any of the following clauses or any provision thereof, the preceding printed clauses shall control.

1. Submit Reports. The holder shall provide the authorized officer with a copy of all reports and publications resulting from the project including theses, dissertations, articles, monographs, etc. The final report on work performed shall be submitted in 1 copy to the Forest Service no later than 1 year following the completion of the research.

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0082.

This information is needed by the Forest Service to evaluate requests to use National Forest System lands and manage those lands to protect natural resources, administer the use, and ensure public health and safety. This information is required to obtain or retain a benefit. The authority for that requirement is provided by the Organic Act of 1897 and the Federal Land Policy and Management Act of 1976, which authorize the Secretary of Agriculture to promulgate rules and regulations for authorizing and managing National Forest System lands. These statutes, along with the Term Permit Act, National Forest Ski Area Permit Act, Granger-Thye Act, Mineral Leasing Act, Alaska Term Permit Act, Act of September 3, 1954, Wilderness Act, National Forest Roads and Trails Act, Act of November 16, 1973, Archaeological Resources Protection Act, and Alaska National Interest Lands Conservation Act, authorize the Secretary of Agriculture to issue authorizations for the use and occupancy of National Forest System lands. The Secretary of Agriculture's regulations at 36 CFR Part 251, Subpart B, establish procedures for issuing those authorizations.

The Privacy Act of 1974 (5 U.S.C. 552a) and the Freedom of Information Act (5 U.S.C. 552) govern the confidentiality to be provided for information received by the Forest Service Public reporting burden for collection of information, if requested, is estimated to average 1 hour per response for annual financial information; average 1 hour per response to prepare or update operation and/or maintenance plan; average 1 hour per response for inspection reports; and an average of 1 hour for each request that may include such things as reports, logs, facility and user information, sublease information, and other similar miscellaneous information requests. This includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

This permit is accepted subject to the conditions set out above.

Date May 9, 2008 WETLAND SOLUTIONS, INC.

(CORPORATE SEAL)

By: Robert L. Knight
~~(Vice)~~ President

ATTEST: Debra D. Regal

(Assistant) Secretary

The following certificate shall be executed by the Secretary or Assistant Secretary of the Corporation:

I Robert L. Knight certify that I am the _____ Secretary of the Corporation that executed the above permit; that Robert L. Knight who signed said permit on behalf of said Corporation was then President of said Corporation; that I know his/her signature on said permit is genuine; and that said permit was duly signed, sealed, and attested to for and on behalf of said Corporation by authority of its governing body

(CORPORATE SEAL)

Robert L. Knight
(~~Assistant~~ Secretary)

U. S. DEPARTMENT OF AGRICULTURE
Forest Service

By: Connie Christman
(Authorized Officer Signature)

for JOHN RICHARD LINT, District Ranger
(Name and Title)

5-13-08
(Date)

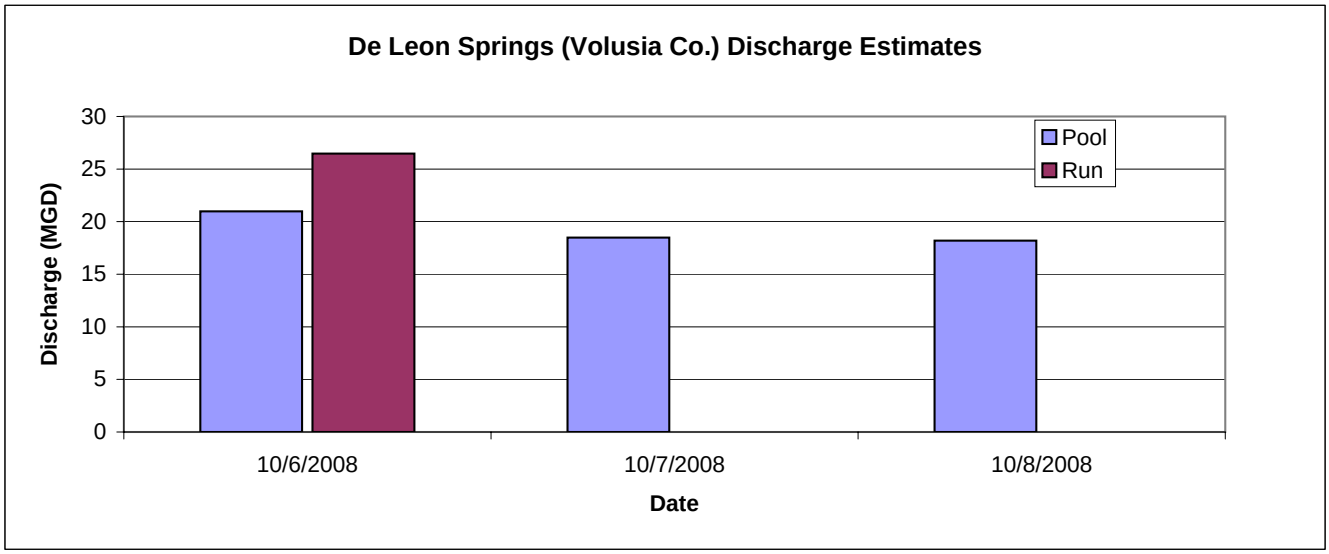
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Appendix C

Discharge

APPENDIX C
De Leon Springs Cross Sectional Flow Summaries - October 6-8 2008.

Date	Location	Segment Width (ft.)	Average Depth (ft.)	Velocity (ft/s)			Discharge		
				0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
	Main Weir	26.4	2.22	0.40	0.40	0.37	27.81	68,039	17.97
10/6/2008	Water Wheel	5.7	0.72	---	0.60	---	2.88	7,055	1.86
	Underwater Grate	4.0	---	---	0.19	---	1.77	4,324	1.14
						Sum	**32.46**	**79,418**	**20.98**
	Main Weir	26.4	2.22	0.35	0.35	0.33	24.77	60,612	16.01
10/7/2008	Water Wheel	5.7	0.70	---	0.41	---	2.27	5,564	1.47
	Underwater Grate	4.0	---	---	0.17	---	1.55	3,798	1.00
						Sum	**28.60**	**69,974**	**18.49**
	Main Weir	26.4	2.20	0.36	0.32	0.32	24.19	59,176	15.63
10/8/2008	Water Wheel	5.7	0.67	---	0.44	---	2.31	5,647	1.49
	Underwater Grate	4.0	---	---	0.18	---	1.65	4,042	1.07
						Sum	**28.15**	**68,865**	**18.19**
Average Spring Pool Values		**12.0**	**1.46**	**0.37**	**0.34**	**0.34**	**29.74**	**72,752**	**19.2**
10/06/08 Spring Run Values		**220.0**	**6.97**	**0.04**	**---**	**0.02**	**40.96**	**100,223**	**26.48**



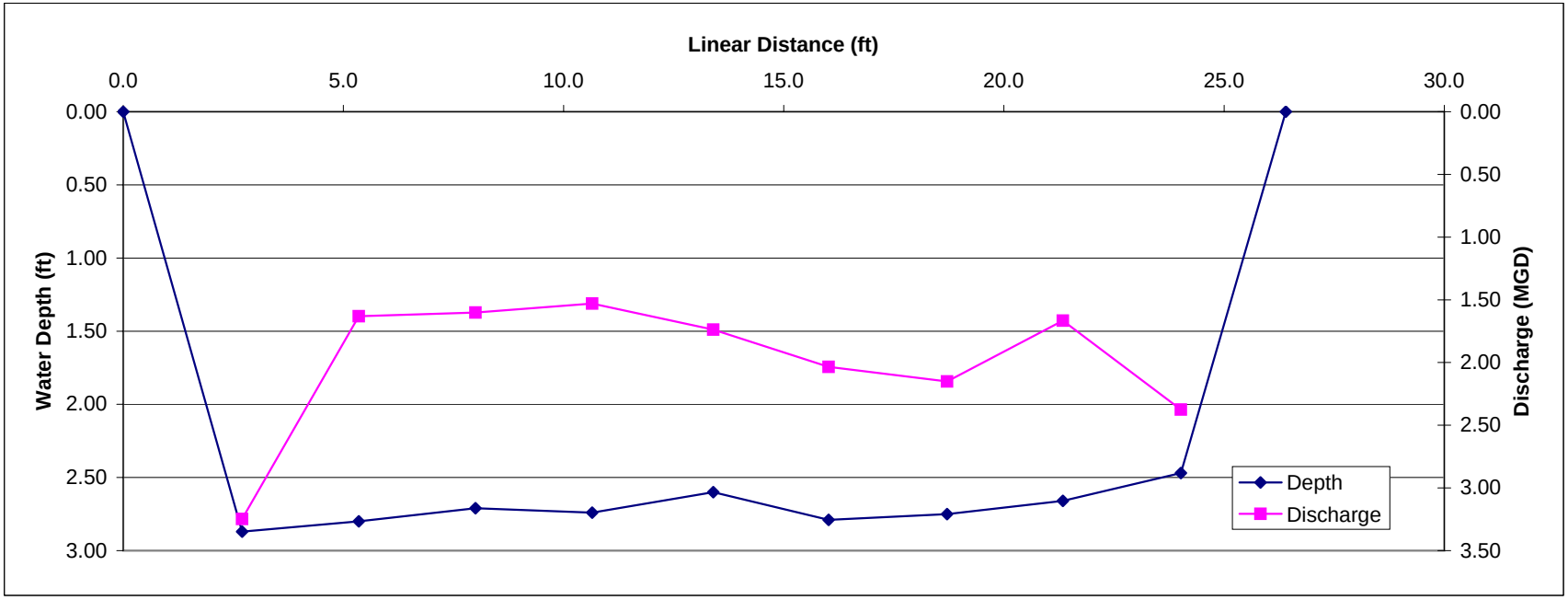


APPENDIX C
De Leon Springs (Volusia Co.) discharge measurement locations, inset figure shows detail of spring pool dishcarge measurement locations.

APPENDIX C

De Leon Springs Cross Sectional Flow at Main Weir - October 6, 2008.

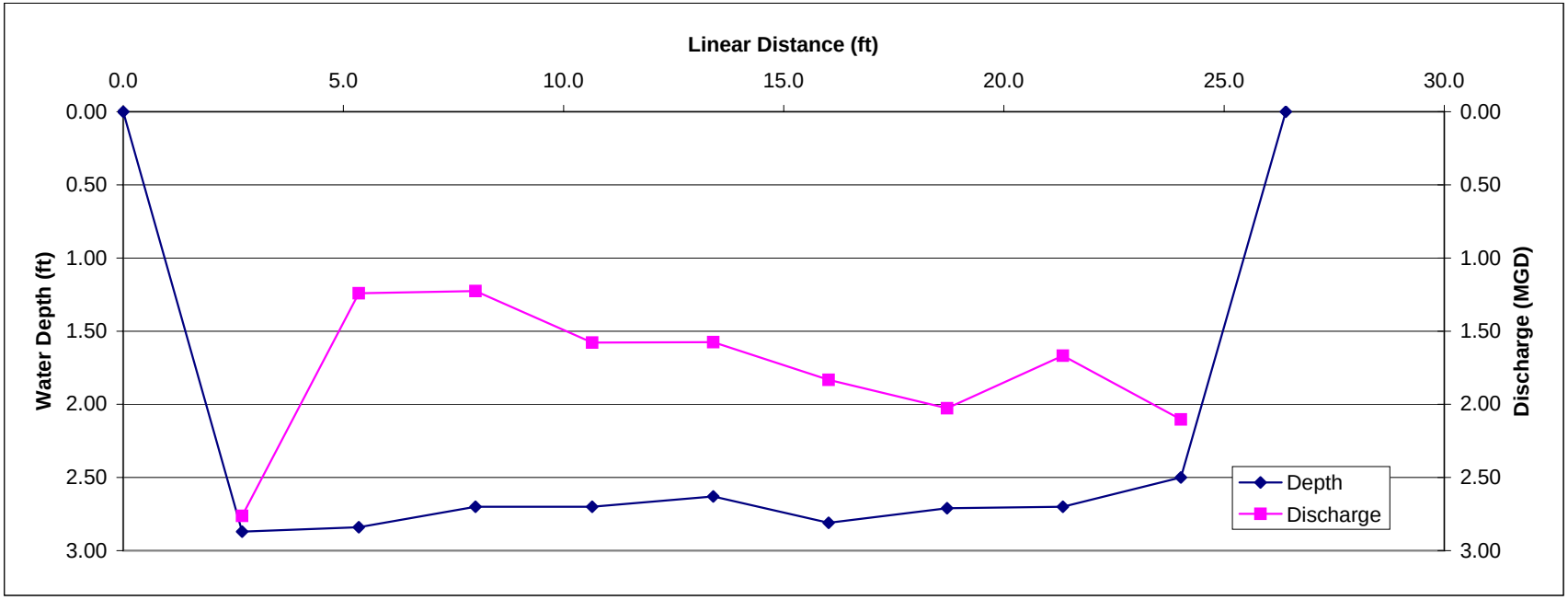
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	2.7	4.0	2.87	0.44		0.43	11.55	5.03	12294	3.25	13.41	18.07%	2.42
	5.4	2.7	2.80	0.35		0.33	7.42	2.52	6172	1.63	10.67	9.07%	0.97
	8.0	2.7	2.71	0.38		0.31	7.18	2.48	6062	1.60	11.58	8.91%	1.03
	10.7	2.7	2.74	0.34		0.30	7.40	2.37	5792	1.53	10.36	8.51%	0.88
	13.4	2.7	2.60	0.37		0.40	6.98	2.69	6576	1.74	11.28	9.66%	1.09
	16.0	2.7	2.79	0.46		0.39	7.41	3.15	7702	2.03	14.02	11.32%	1.59
	18.7	2.7	2.75	0.47		0.44	7.32	3.33	8143	2.15	14.33	11.97%	1.71
	21.3	2.7	2.66	0.38		0.35	7.06	2.58	6307	1.67	11.58	9.27%	1.07
	24.0	3.7	2.47		0.40		9.19	3.68	8992	2.38	12.19	13.22%	1.61
End	26.4		0.00										
		26.4	2.22	0.40	0.40	0.37	71.51	27.81	68039	17.97	12.16	100%	12.38
			(cm/s)	12.15	12.19	11.24							



APPENDIX C

De Leon Springs Cross Sectional Flow at Main Weir - October 7, 2008.

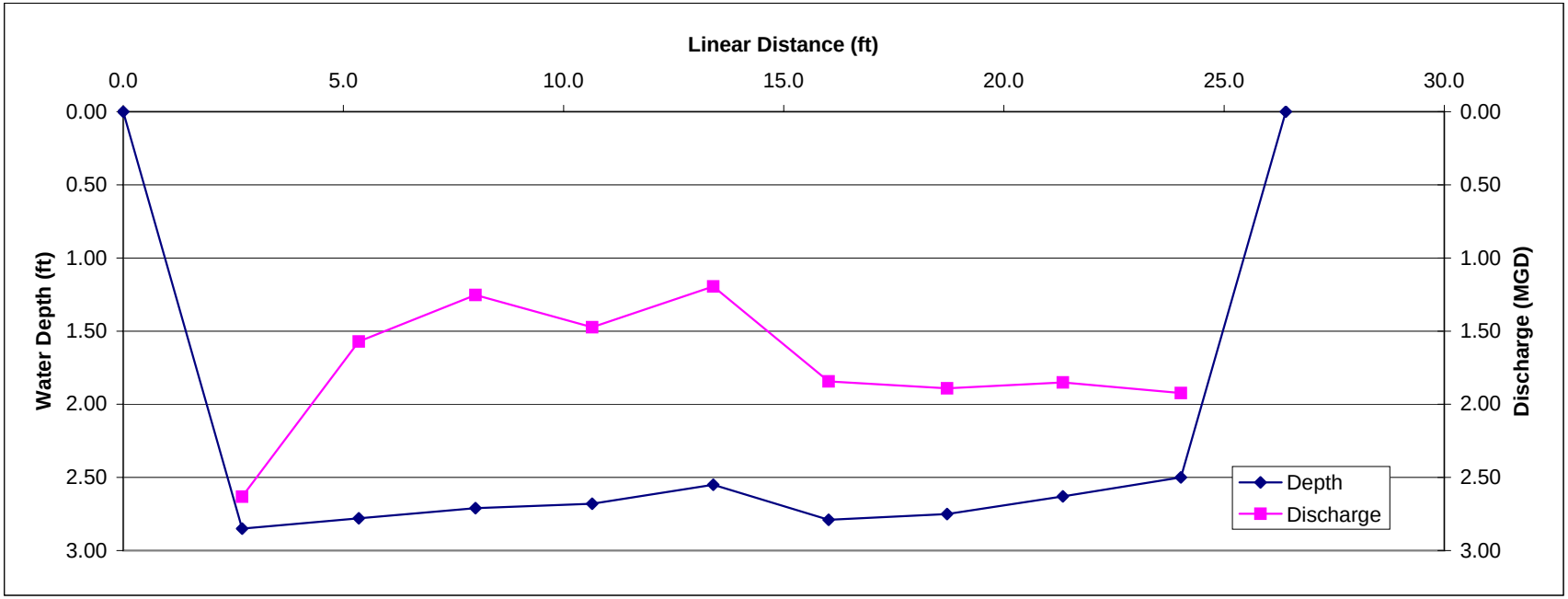
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	2.7	4.0	2.87	0.36		0.38	11.55	4.27	10457	2.76	10.97	17.25%	1.89
	5.4	2.7	2.84	0.28		0.23	7.53	1.92	4695	1.24	8.53	7.75%	0.66
	8.0	2.7	2.70	0.25		0.28	7.16	1.90	4639	1.23	7.62	7.65%	0.58
	10.7	2.7	2.70	0.33		0.34	7.29	2.44	5975	1.58	10.06	9.86%	0.99
	13.4	2.7	2.63	0.35		0.34	7.06	2.44	5960	1.57	10.67	9.83%	1.05
	16.0	2.7	2.81	0.42		0.34	7.46	2.84	6936	1.83	12.80	11.44%	1.46
	18.7	2.7	2.71	0.46		0.41	7.21	3.14	7672	2.03	14.02	12.66%	1.77
	21.3	2.7	2.70	0.37		0.35	7.17	2.58	6314	1.67	11.28	10.42%	1.17
	24.0	3.7	2.50		0.35		9.30	3.26	7964	2.10	10.67	13.14%	1.40
End	26.4		0.00										
		26.4	2.22	0.35	0.35	0.33	71.72	24.77	60612	16.01	10.74	100%	10.99
			(cm/s)	10.74	10.67	10.17							



APPENDIX C

De Leon Springs Cross Sectional Flow at Main Weir - October 8, 2008.

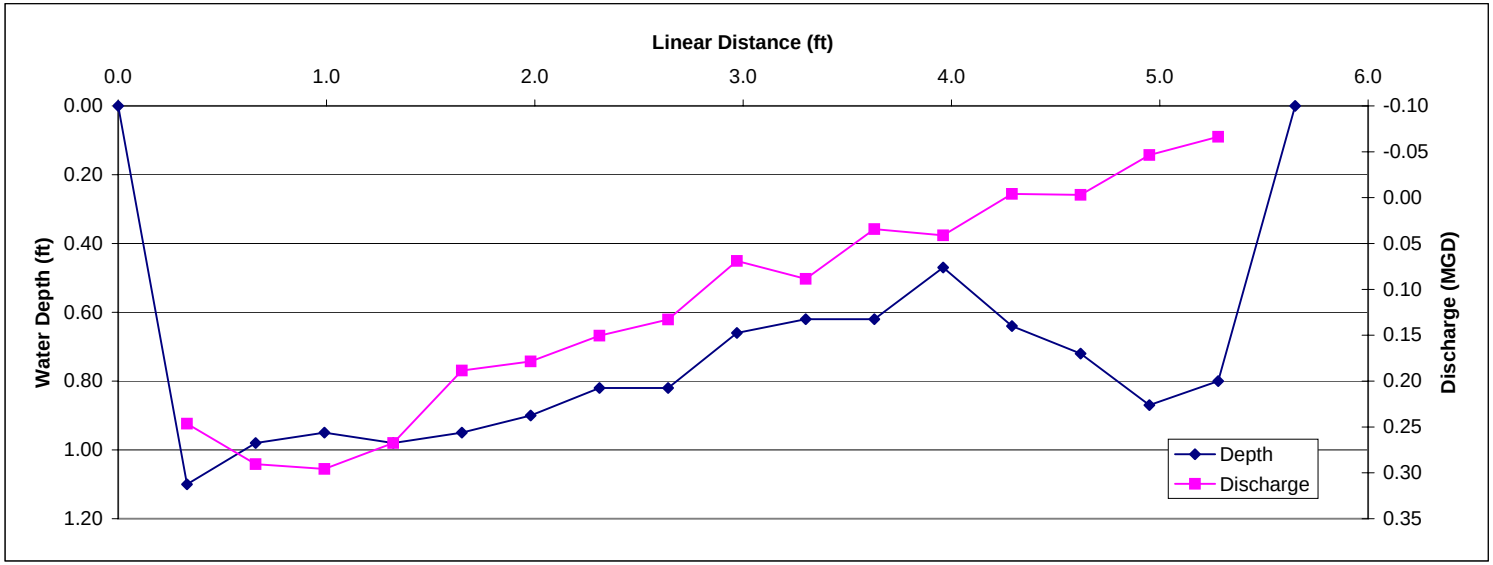
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	2.7	4.0	2.85	0.36		0.35	11.47	4.07	9963	2.63	10.97	16.84%	1.85
	5.4	2.7	2.78	0.39		0.27	7.37	2.43	5948	1.57	11.89	10.05%	1.19
	8.0	2.7	2.71	0.31		0.23	7.18	1.94	4744	1.25	9.45	8.02%	0.76
	10.7	2.7	2.68	0.30		0.33	7.24	2.28	5577	1.47	9.14	9.42%	0.86
	13.4	2.7	2.55	0.28		0.26	6.85	1.85	4523	1.19	8.53	7.64%	0.65
	16.0	2.7	2.79	0.42		0.35	7.41	2.85	6977	1.84	12.80	11.79%	1.51
	18.7	2.7	2.75	0.41		0.39	7.32	2.93	7159	1.89	12.50	12.10%	1.51
	21.3	2.7	2.63	0.43		0.39	6.98	2.86	7004	1.85	13.11	11.84%	1.55
	24.0	3.7	2.50		0.32		9.30	2.98	7281	1.92	9.75	12.30%	1.20
End	26.4		0.00										
		26.4	2.20	0.36	0.32	0.32	71.11	24.19	59176	15.63	10.91	100%	11.09
			(cm/s)	11.05	9.75	9.79							



APPENDIX C

De Leon Springs Cross Sectional Flow at Water Wheel Flume - October 6, 2008.

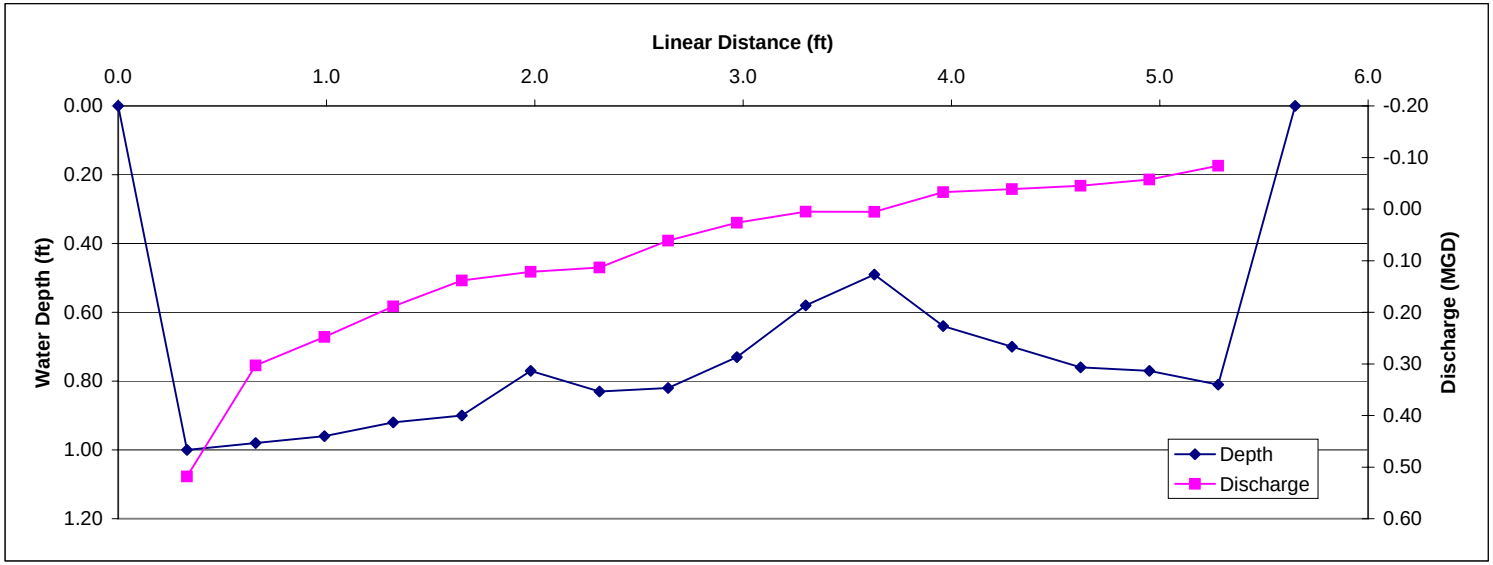
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	0.3	0.5	1.10		0.70		0.54	0.38	933	0.25	21.34	13.22%	2.82
	0.7	0.3	0.98		1.39		0.32	0.45	1100	0.29	42.37	15.59%	6.60
	1.0	0.3	0.95		1.46		0.31	0.46	1120	0.30	44.50	15.87%	7.06
	1.3	0.3	0.98		1.28		0.32	0.41	1013	0.27	39.01	14.36%	5.60
	1.7	0.3	0.95		0.93		0.31	0.29	713	0.19	28.35	10.11%	2.87
	2.0	0.3	0.90		0.93		0.30	0.28	676	0.18	28.35	9.58%	2.72
	2.3	0.3	0.82		0.86		0.27	0.23	569	0.15	26.21	8.07%	2.12
	2.6	0.3	0.82		0.76		0.27	0.21	503	0.13	23.16	7.13%	1.65
	3.0	0.3	0.66		0.49		0.22	0.11	261	0.07	14.94	3.70%	0.55
	3.3	0.3	0.62		0.67		0.20	0.14	335	0.09	20.42	4.75%	0.97
	3.6	0.3	0.62		0.26		0.20	0.05	130	0.03	7.92	1.84%	0.15
	4.0	0.3	0.47		0.41		0.16	0.06	156	0.04	12.50	2.21%	0.28
	4.3	0.3	0.64		-0.03		0.21	-0.01	-16	0.00	-0.91	-0.22%	0.00
	4.6	0.3	0.72		-0.02		0.24	0.00	-12	0.00	-0.61	-0.16%	0.00
	5.0	0.3	0.87		-0.25		0.29	-0.07	-176	-0.05	-7.62	-2.49%	0.19
	5.3	0.5	0.80		-0.24		0.43	-0.10	-251	-0.07	-7.32	-3.56%	0.26
End	5.7		0.00										
		5.7	0.72		0.60		4.60	2.88	7055	1.86	18.29	100%	33.84
			(cm/s)		18.29								



APPENDIX C

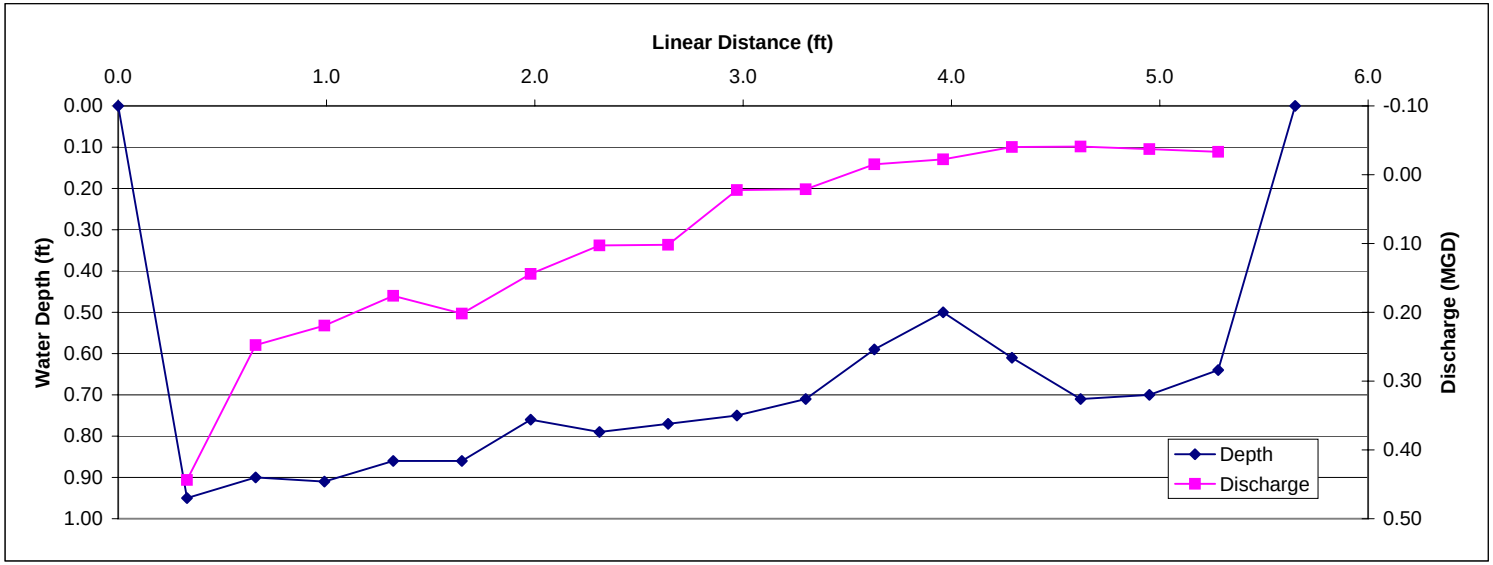
De Leon Springs Cross Sectional Flow at Water Wheel Flume - October 7, 2008.

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	0.3	0.5	1.00		1.62		0.50	0.80	1962	0.52	49.38	35.26%	17.41
	0.7	0.3	0.98		1.45		0.32	0.47	1147	0.30	44.20	20.62%	9.11
	1.0	0.3	0.96		1.21		0.32	0.38	938	0.25	36.88	16.85%	6.22
	1.3	0.3	0.92		0.96		0.30	0.29	713	0.19	29.26	12.82%	3.75
	1.7	0.3	0.90		0.72		0.30	0.21	523	0.14	21.95	9.40%	2.06
	2.0	0.3	0.77		0.74		0.25	0.19	460	0.12	22.56	8.27%	1.86
	2.3	0.3	0.83		0.64		0.27	0.18	429	0.11	19.51	7.71%	1.50
	2.6	0.3	0.82		0.35		0.27	0.09	232	0.06	10.67	4.16%	0.44
	3.0	0.3	0.73		0.17		0.24	0.04	100	0.03	5.18	1.80%	0.09
	3.3	0.3	0.58		0.04		0.19	0.01	19	0.00	1.22	0.34%	0.00
	3.6	0.3	0.49		0.05		0.16	0.01	20	0.01	1.52	0.36%	0.01
	4.0	0.3	0.64		-0.24		0.21	-0.05	-124	-0.03	-7.32	-2.23%	0.16
	4.3	0.3	0.70		-0.26		0.23	-0.06	-147	-0.04	-7.92	-2.64%	0.21
	4.6	0.3	0.76		-0.28		0.25	-0.07	-172	-0.05	-8.53	-3.09%	0.26
	5.0	0.3	0.77		-0.35		0.25	-0.09	-218	-0.06	-10.67	-3.91%	0.42
	5.3	0.5	0.81		-0.30		0.43	-0.13	-318	-0.08	-9.14	-5.72%	0.52
End	5.7		0.00										
		5.7	0.70		0.41		4.51	2.27	5564	1.47	12.42	100%	44.04
			(cm/s)		12.42								



APPENDIX C
De Leon Springs Cross Sectional Flow at Water Wheel Flume - October 8, 2008.

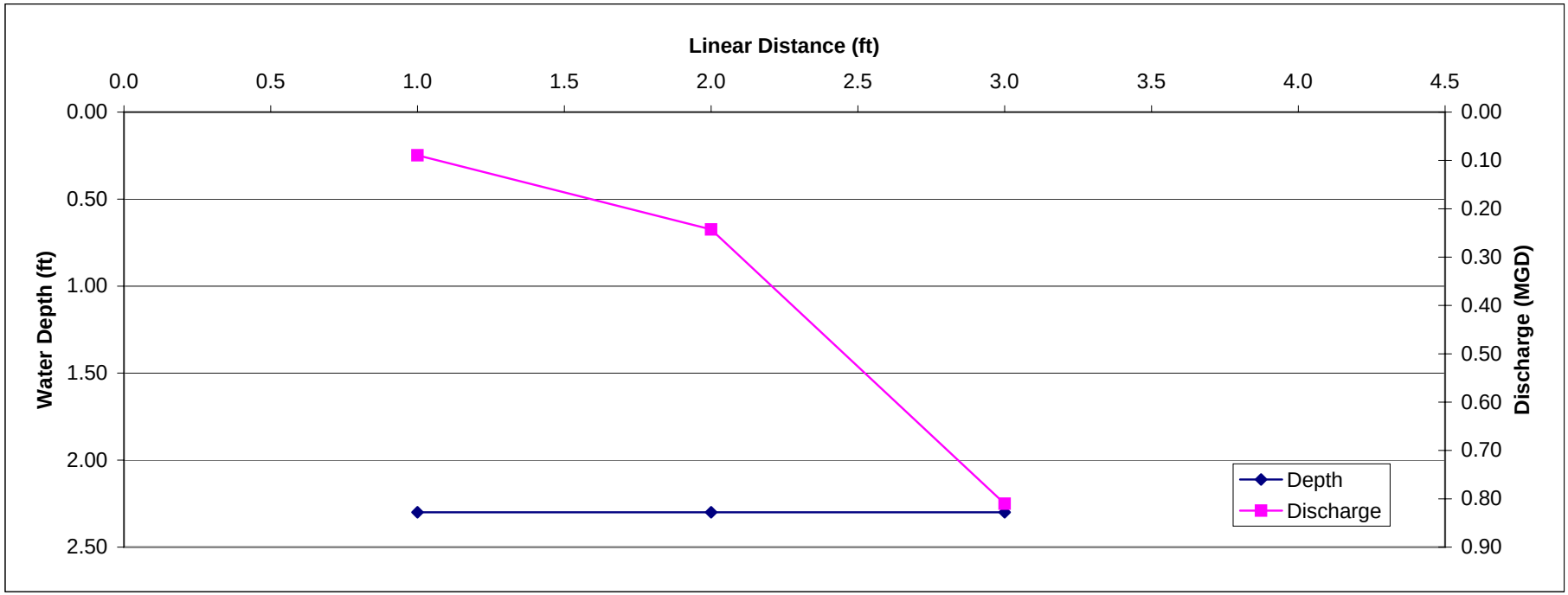
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	0.3	0.5	0.95		1.46		0.47	0.69	1680	0.44	44.50	29.75%	13.24
	0.7	0.3	0.90		1.29		0.30	0.38	937	0.25	39.32	16.60%	6.53
	1.0	0.3	0.91		1.13		0.30	0.34	830	0.22	34.44	14.70%	5.06
	1.3	0.3	0.86		0.96		0.28	0.27	667	0.18	29.26	11.80%	3.45
	1.7	0.3	0.86		1.10		0.28	0.31	764	0.20	33.53	13.53%	4.53
	2.0	0.3	0.76		0.89		0.25	0.22	546	0.14	27.13	9.67%	2.62
	2.3	0.3	0.79		0.61		0.26	0.16	389	0.10	18.59	6.89%	1.28
	2.6	0.3	0.77		0.62		0.25	0.16	385	0.10	18.90	6.83%	1.29
	3.0	0.3	0.75		0.14		0.25	0.03	85	0.02	4.27	1.50%	0.06
	3.3	0.3	0.71		0.14		0.23	0.03	80	0.02	4.27	1.42%	0.06
	3.6	0.3	0.59		-0.12		0.19	-0.02	-57	-0.02	-3.66	-1.01%	0.04
	4.0	0.3	0.50		-0.21		0.17	-0.03	-85	-0.02	-6.40	-1.50%	0.10
	4.3	0.3	0.61		-0.31		0.20	-0.06	-153	-0.04	-9.45	-2.70%	0.26
	4.6	0.3	0.71		-0.27		0.23	-0.06	-155	-0.04	-8.23	-2.74%	0.23
	5.0	0.3	0.70		-0.25		0.23	-0.06	-141	-0.04	-7.62	-2.50%	0.19
	5.3	0.5	0.64		-0.15		0.34	-0.05	-126	-0.03	-4.57	-2.23%	0.10
End	5.7		0.00										
		5.7	0.67		0.44		4.25	2.31	5647	1.49	13.39	100%	39.04
			(cm/s)		13.39								



APPENDIX C

De Leon Springs Cross Sectional Flow at Underwater Grate - October 6, 2008.

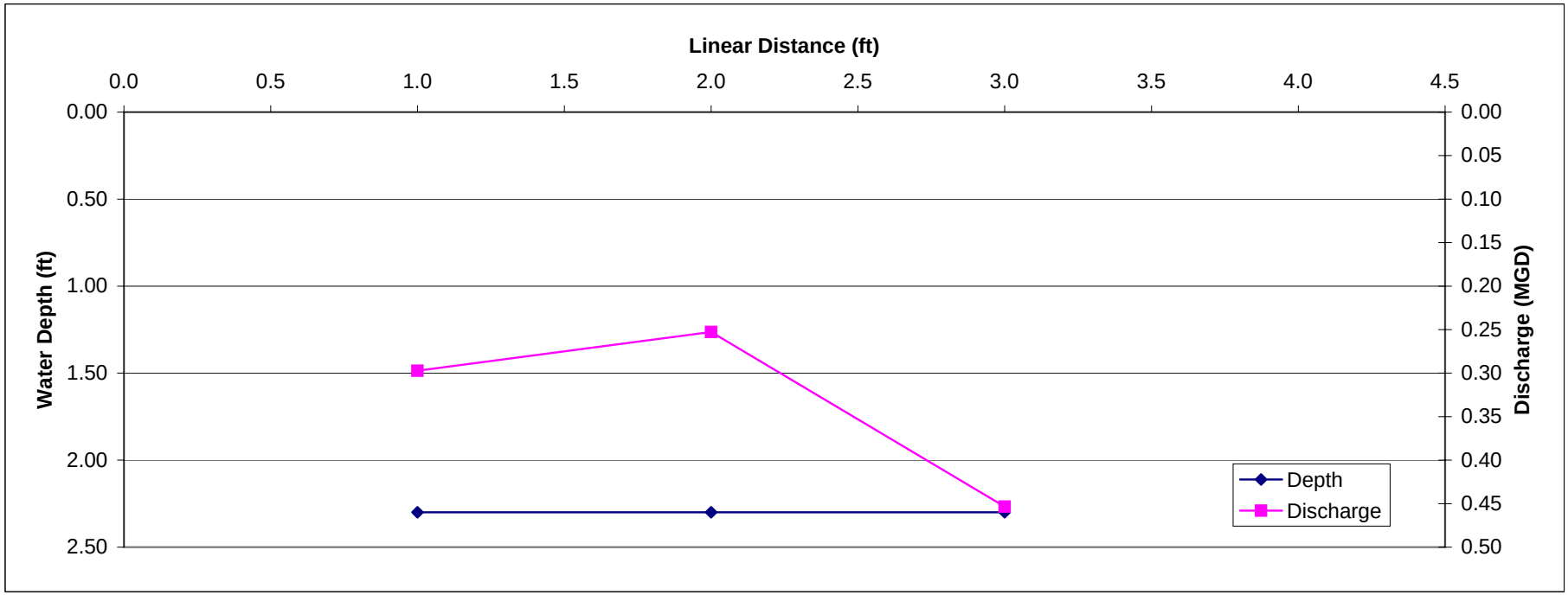
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	1.0	1.5	2.30		0.04		3.45	0.14	338	0.09	1.22	7.81%	0.10
	2.0	1.0	2.30		0.16		2.30	0.38	919	0.24	4.98	21.26%	1.06
	3.0	1.5	2.30		0.36		3.45	1.25	3067	0.81	11.07	70.93%	7.86
End	4.0												
		4.0	2.30		0.19		9.20	1.77	4324	1.14	5.76	100%	9.01
			(cm/s)		5.76								



APPENDIX C

De Leon Springs Cross Sectional Flow at Underwater Grate - October 7, 2008.

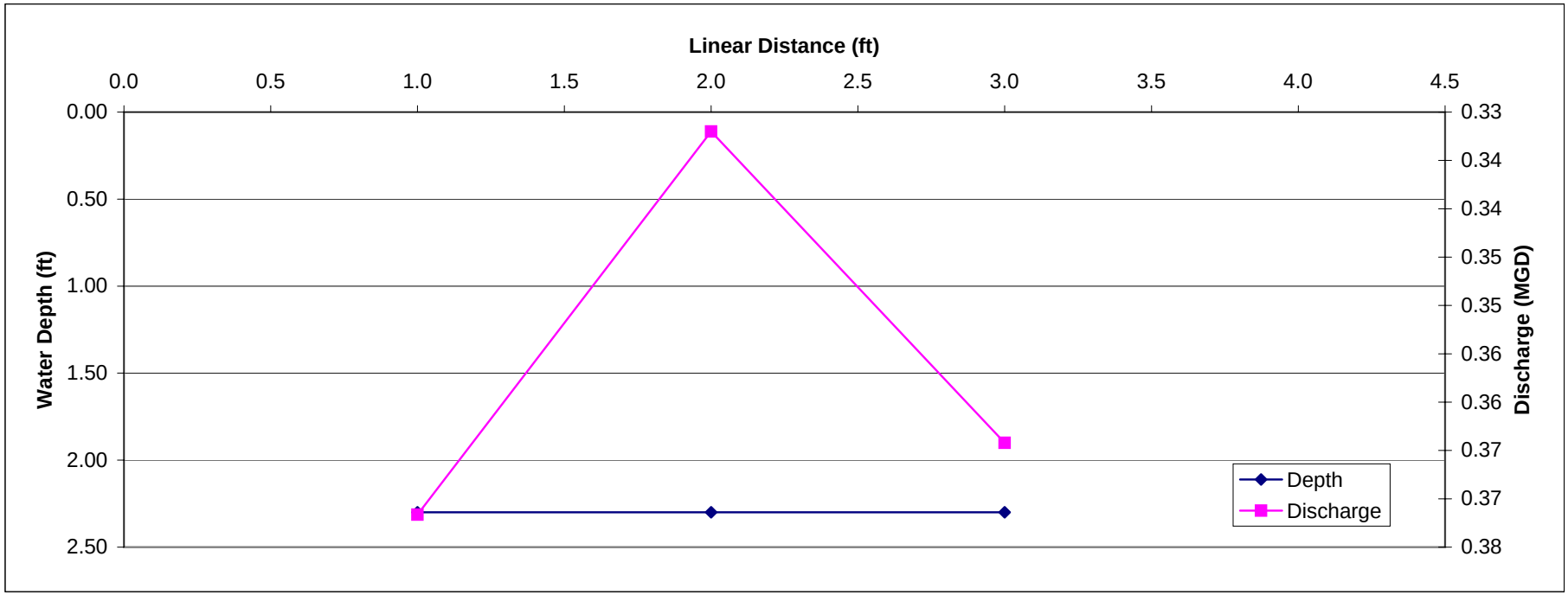
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	1.0	1.5	2.30		0.13		3.45	0.46	1125	0.30	4.06	29.63%	1.20
	2.0	1.0	2.30		0.17		2.30	0.39	957	0.25	5.18	25.19%	1.30
	3.0	1.5	2.30		0.20		3.45	0.70	1716	0.45	6.20	45.19%	2.80
End	4.0												
		4.0	2.30		0.17		9.20	1.55	3798	1.00	5.15	100%	5.31
			(cm/s)		5.15								



APPENDIX C

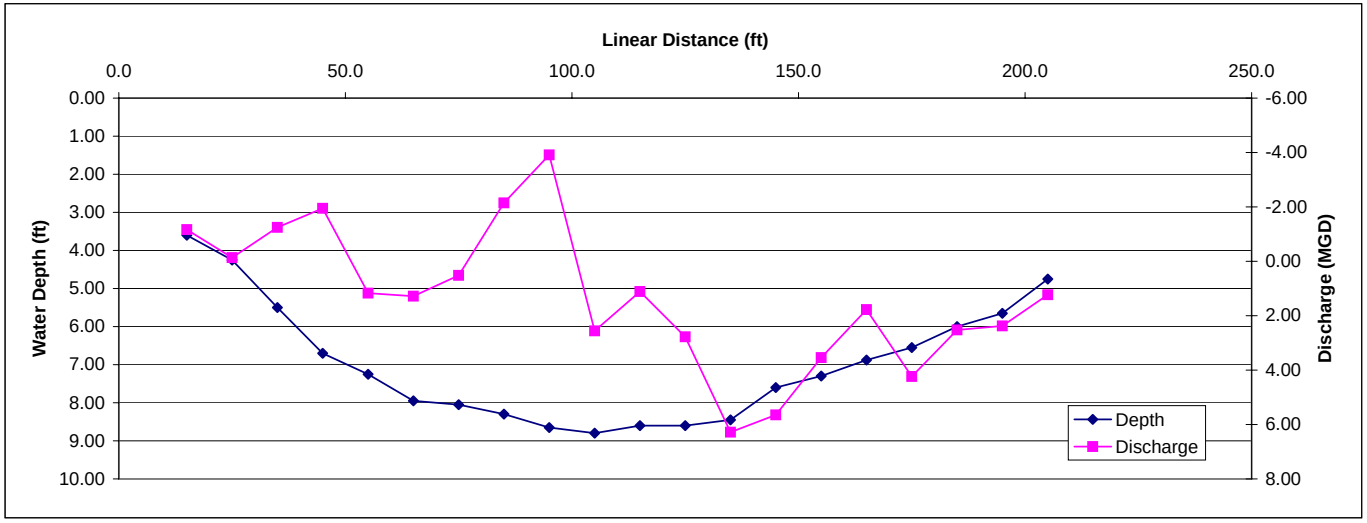
De Leon Springs Cross Sectional Flow at Underwater Grate - October 8, 2008.

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	1.0	1.5	2.30		0.17		3.45	0.58	1407	0.37	5.08	34.80%	1.77
	2.0	1.0	2.30		0.22		2.30	0.51	1257	0.33	6.81	31.09%	2.12
	3.0	1.5	2.30		0.16		3.45	0.56	1379	0.36	4.98	34.11%	1.70
End	4.0												
		4.0	2.30		0.18		9.20	1.65	4042	1.07	5.62	100%	5.58
			(cm/s)		5.62								



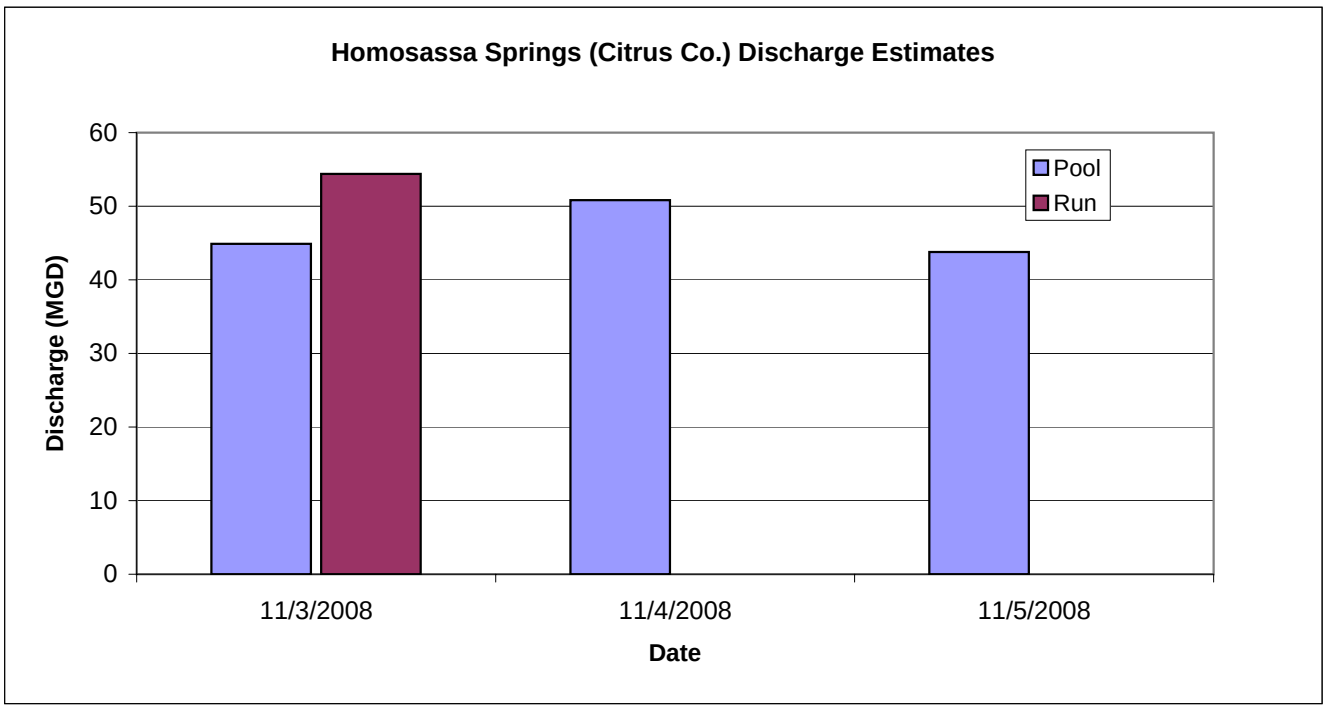
APPENDIX C
De Leon Springs Cross Sectional Flow at Park Boundary on Spring Run (St. 3) - October 6, 2008

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	15.0	20.0	3.60	-0.01		-0.04	72.00	-1.80	-4404	-1.16	-0.30	-4.39%	0.01
	25.0	10.0	4.25	-0.02		0.01	42.50	-0.21	-520	-0.14	-0.61	-0.52%	0.00
	35.0	10.0	5.50	-0.03		-0.04	55.00	-1.93	-4710	-1.24	-0.91	-4.70%	0.04
	45.0	10.0	6.70	-0.05		-0.04	67.00	-3.02	-7376	-1.95	-1.52	-7.36%	0.11
	55.0	10.0	7.25	0.03		0.02	72.50	1.81	4434	1.17	0.91	4.42%	0.04
	65.0	10.0	7.95	0.03		0.02	79.50	1.99	4863	1.28	0.91	4.85%	0.04
	75.0	10.0	8.05	0.04		-0.02	80.50	0.81	1969	0.52	1.22	1.97%	0.02
	85.0	10.0	8.30	-0.05		-0.03	83.00	-3.32	-8123	-2.15	-1.52	-8.10%	0.12
	95.0	10.0	8.65	-0.08		-0.06	86.50	-6.06	-14814	-3.91	-2.44	-14.78%	0.36
	105.0	10.0	8.80	0.11		-0.02	88.00	3.96	9688	2.56	3.35	9.67%	0.32
	115.0	10.0	8.60	0.08		-0.04	86.00	1.72	4208	1.11	2.44	4.20%	0.10
	125.0	10.0	8.60	0.08		0.02	86.00	4.30	10520	2.78	2.44	10.50%	0.26
	135.0	10.0	8.45	0.17		0.06	84.50	9.72	23775	6.28	5.18	23.72%	1.23
	145.0	10.0	7.60	0.15		0.08	76.00	8.74	21383	5.65	4.57	21.34%	0.98
	155.0	10.0	7.30	0.05		0.10	73.00	5.48	13395	3.54	1.52	13.37%	0.20
	165.0	10.0	6.88	0.04		0.04	68.80	2.75	6733	1.78	1.22	6.72%	0.08
	175.0	10.0	6.55	0.07		0.13	65.50	6.55	16025	4.23	2.13	15.99%	0.34
	185.0	10.0	6.00	0.07		0.06	60.00	3.90	9542	2.52	2.13	9.52%	0.20
	195.0	10.0	5.65	0.08		0.05	56.50	3.67	8985	2.37	2.44	8.97%	0.22
	205.0	20.0	4.75	0.02		0.02	95.00	1.90	4648	1.23	0.61	4.64%	0.03
End	220.0												
		220.0	6.97	0.04		0.02	1477.80	40.96	100223	26.48	1.19	100%	4.73
			(cm/s)	1.19		0.49							



APPENDIX C
Homosassa Springs Cross Sectional Flow Summaries - November 3-5, 2008.

Date	Location	Segment Width (ft.)	Average Depth (ft.)	Velocity (ft/s)			Discharge		
				0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
11/3/2008	Main Bridge (HS-2)	107.0	3.02	0.26	0.04	0.19	69.47	169,966	44.90
11/4/2008	Main Bridge (HS-2)	107.0	2.83	0.29	0.05	0.25	78.64	192,400	50.83
11/5/2008	Main Bridge (HS-2)	107.0	3.29	0.23	0.05	0.16	67.75	165,767	43.79
Average Spring Pool Values		**107.0**	**3.05**	**0.26**	**0.04**	**0.20**	**71.96**	**176,044.2**	**46.5**
11/3/2008	Spring Run (HS-3)	212.0	4.24	0.10	0.01	0.08	84.14	205,860	54.38



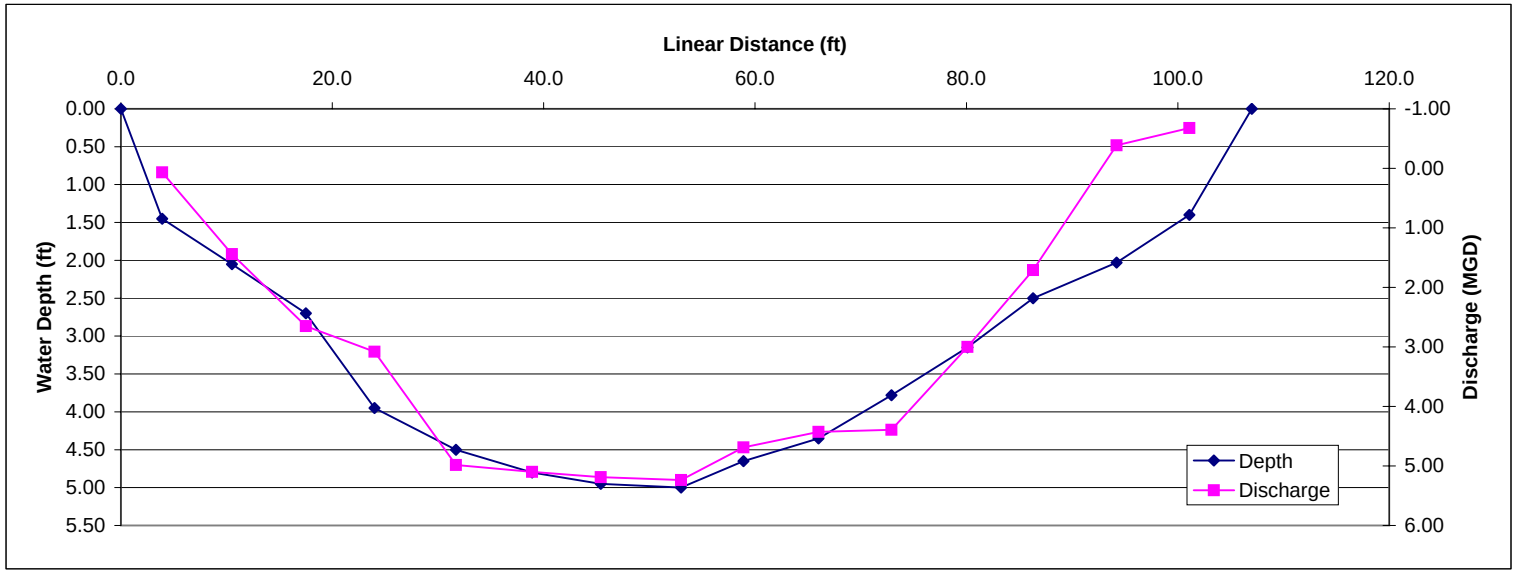


APPENDIX C
Homosassa Springs (Citrus Co.) discharge measurement locations.

APPENDIX C

Homosassa Springs Cross Sectional Flow at Main Bridge - November 3, 2008 at 12:00.

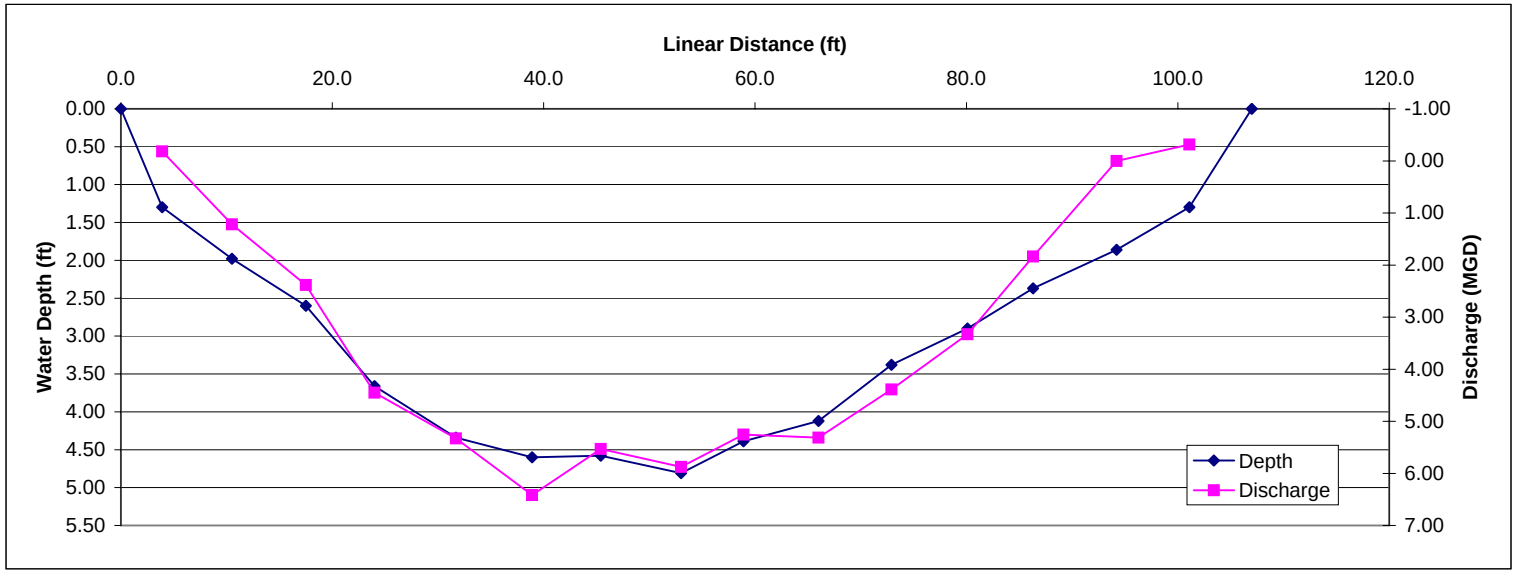
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	3.9	7.2	1.45		0.01		10.44	0.10	255	0.07	0.30	0.15%	0.00
	10.5	6.8	2.05		0.16		13.94	2.23	5457	1.44	4.88	3.21%	0.16
	17.5	6.8	2.70	0.25		0.20	18.23	4.10	10032	2.65	7.62	5.90%	0.45
	24.0	7.1	3.95	0.27		0.07	28.05	4.77	11664	3.08	8.23	6.86%	0.56
	31.7	7.5	4.50	0.23		0.23	33.53	7.71	18865	4.98	7.01	11.10%	0.78
	38.9	6.9	4.80	0.28		0.20	32.88	7.89	19306	5.10	8.53	11.36%	0.97
	45.4	7.1	4.95	0.31		0.15	34.90	8.03	19637	5.19	9.45	11.55%	1.09
	53.0	6.8	5.00	0.28		0.20	33.75	8.10	19817	5.24	8.53	11.66%	1.00
	58.9	6.5	4.65	0.27		0.21	30.23	7.25	17747	4.69	8.23	10.44%	0.86
	66.0	7.0	4.35	0.26		0.19	30.45	6.85	16762	4.43	7.92	9.86%	0.78
	72.9	7.1	3.78	0.28		0.23	26.65	6.80	16626	4.39	8.53	9.78%	0.83
	80.1	6.7	3.15	0.21		0.23	21.11	4.64	11360	3.00	6.40	6.68%	0.43
	86.3	7.1	2.50		0.15		17.63	2.64	6468	1.71	4.57	3.81%	0.17
	94.2	7.4	2.03		-0.04		15.02	-0.60	-1470	-0.39	-1.22	-0.86%	0.01
	101.1	9.4	1.40		-0.08		13.09	-1.05	-2562	-0.68	-2.44	-1.51%	0.04
End	107.0		0.00										
		107.0	3.02	0.26	0.04	0.19	359.87	69.47	169966	44.90	5.77	100%	8.13
			(cm/s)	8.05	1.22	5.82							



APPENDIX C

Homosassa Springs Cross Sectional Flow at Main Bridge - November 4, 2008 at 11:57.

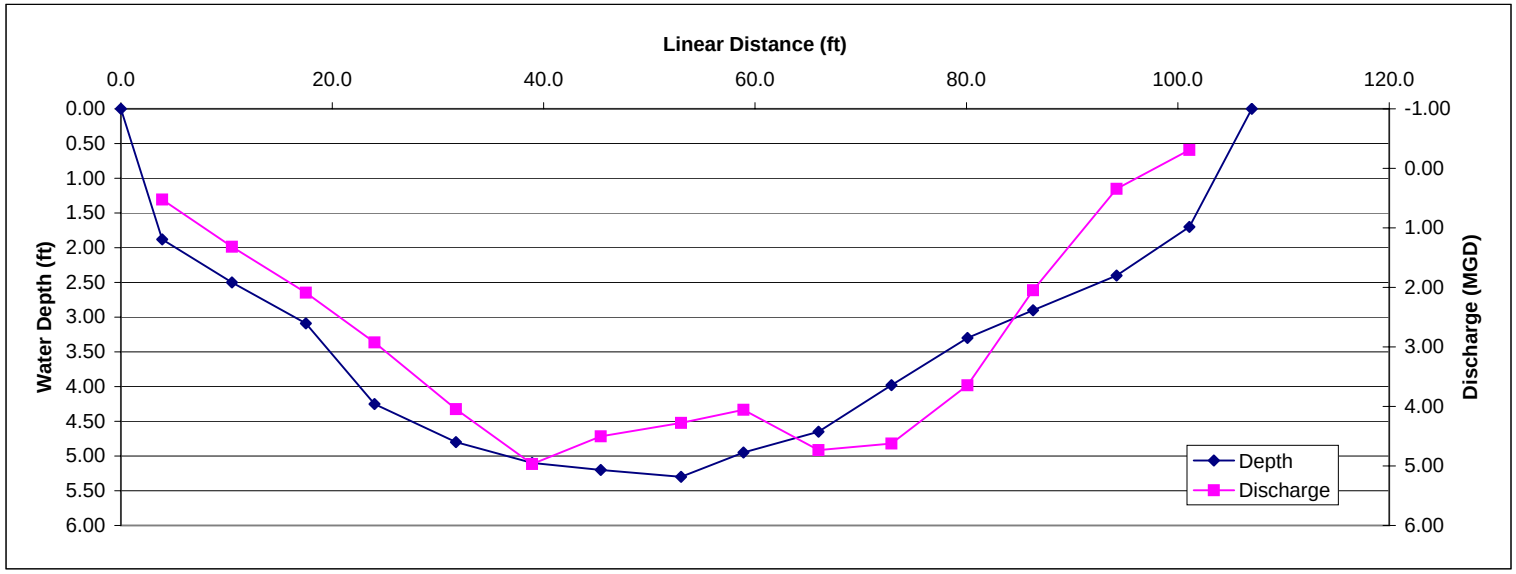
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	3.9	7.2	1.30		-0.03		9.36	-0.28	-687	-0.18	-0.91	-0.36%	0.00
	10.5	6.8	1.98		0.14		13.46	1.88	4612	1.22	4.27	2.40%	0.10
	17.5	6.8	2.60	0.25		0.17	17.55	3.69	9017	2.38	7.62	4.69%	0.36
	24.0	7.1	3.66	0.28		0.25	25.99	6.89	16848	4.45	8.53	8.76%	0.75
	31.7	7.5	4.34	0.27		0.24	32.33	8.24	20172	5.33	8.23	10.48%	0.86
	38.9	6.9	4.60	0.34		0.29	31.51	9.93	24284	6.42	10.36	12.62%	1.31
	45.4	7.1	4.58	0.29		0.24	32.29	8.56	20934	5.53	8.84	10.88%	0.96
	53.0	6.8	4.81	0.33		0.23	32.47	9.09	22242	5.88	10.06	11.56%	1.16
	58.9	6.5	4.39	0.27		0.30	28.54	8.13	19897	5.26	8.23	10.34%	0.85
	66.0	7.0	4.12	0.33		0.24	28.84	8.22	20109	5.31	10.06	10.45%	1.05
	72.9	7.1	3.38	0.27		0.30	23.83	6.79	16615	4.39	8.23	8.64%	0.71
	80.1	6.7	2.90	0.28		0.25	19.43	5.15	12597	3.33	8.53	6.55%	0.56
	86.3	7.1	2.37		0.17		16.71	2.84	6949	1.84	5.18	3.61%	0.19
	94.2	7.4	1.86		0.00		13.76	0.00	0	0.00	0.00	0.00%	0.00
	101.1	9.4	1.30		-0.04		12.16	-0.49	-1190	-0.31	-1.22	-0.62%	0.01
End	107.0		0.00										
		107.0	2.83	0.29	0.05	0.25	338.22	78.64	192400	50.83	6.40	100%	8.87
			(cm/s)	8.87	1.46	7.65							



APPENDIX C

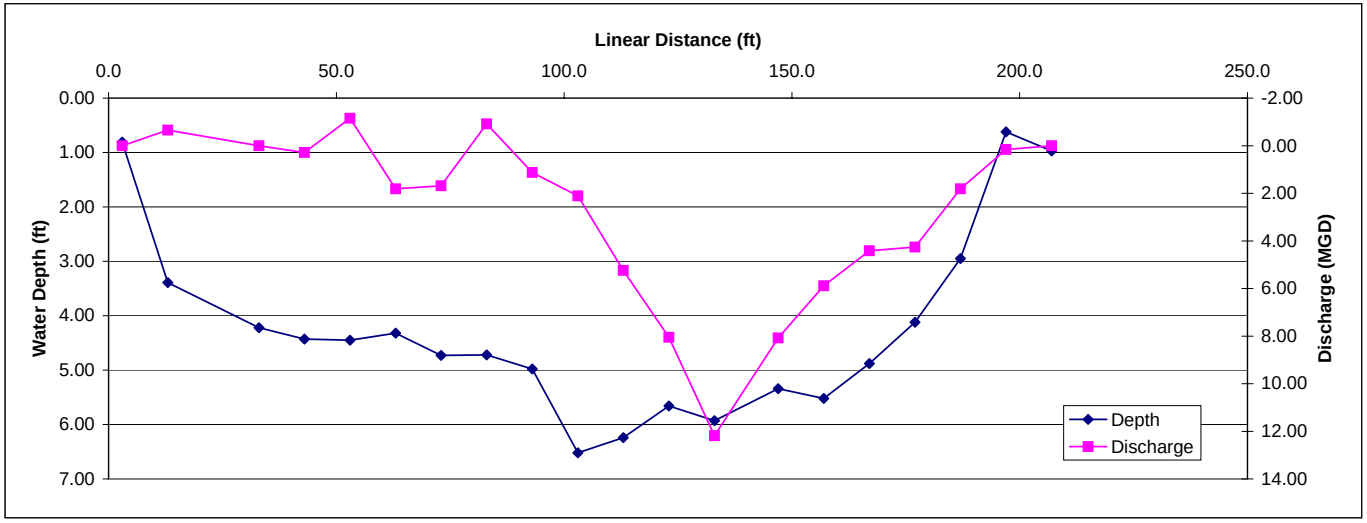
Homosassa Springs Cross Sectional Flow at Main Bridge - November 5, 2008 at 10:08.

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	3.9	7.2	1.88		0.06		13.54	0.81	1987	0.52	1.83	1.20%	0.02
	10.5	6.8	2.50		0.12		17.00	2.04	4991	1.32	3.66	3.01%	0.11
	17.5	6.8	3.09	0.19		0.12	20.86	3.23	7910	2.09	5.79	4.77%	0.28
	24.0	7.1	4.25	0.18		0.12	30.18	4.53	11074	2.93	5.49	6.68%	0.37
	31.7	7.5	4.80	0.21		0.14	35.76	6.26	15311	4.04	6.40	9.24%	0.59
	38.9	6.9	5.10	0.24		0.20	34.94	7.69	18804	4.97	7.32	11.34%	0.83
	45.4	7.1	5.20	0.25		0.13	36.66	6.97	17041	4.50	7.62	10.28%	0.78
	53.0	6.8	5.30	0.25		0.12	35.78	6.62	16192	4.28	7.62	9.77%	0.74
	58.9	6.5	4.95	0.28		0.11	32.18	6.27	15350	4.06	8.53	9.26%	0.79
	66.0	7.0	4.65	0.29		0.16	32.55	7.32	17918	4.73	8.84	10.81%	0.96
	72.9	7.1	3.98	0.29		0.22	28.06	7.16	17505	4.62	8.84	10.56%	0.93
	80.1	6.7	3.30	0.25		0.26	22.11	5.64	13794	3.64	7.62	8.32%	0.63
	86.3	7.1	2.90	0.14		0.17	20.45	3.17	7753	2.05	4.27	4.68%	0.20
	94.2	7.4	2.40		0.03		17.76	0.53	1304	0.34	0.91	0.79%	0.01
	101.1	9.4	1.70		-0.03		15.90	-0.48	-1167	-0.31	-0.91	-0.70%	0.01
End	107.0		0.00										
		107.0	3.29	0.23	0.05	0.16	393.69	67.75	165767	43.79	5.59	100%	7.25
			(cm/s)	7.12	1.37	4.85							



APPENDIX C
Homosassa Springs Cross Sectional Flow on Spring Run (St. 3) - November 3, 2008 at 15:00

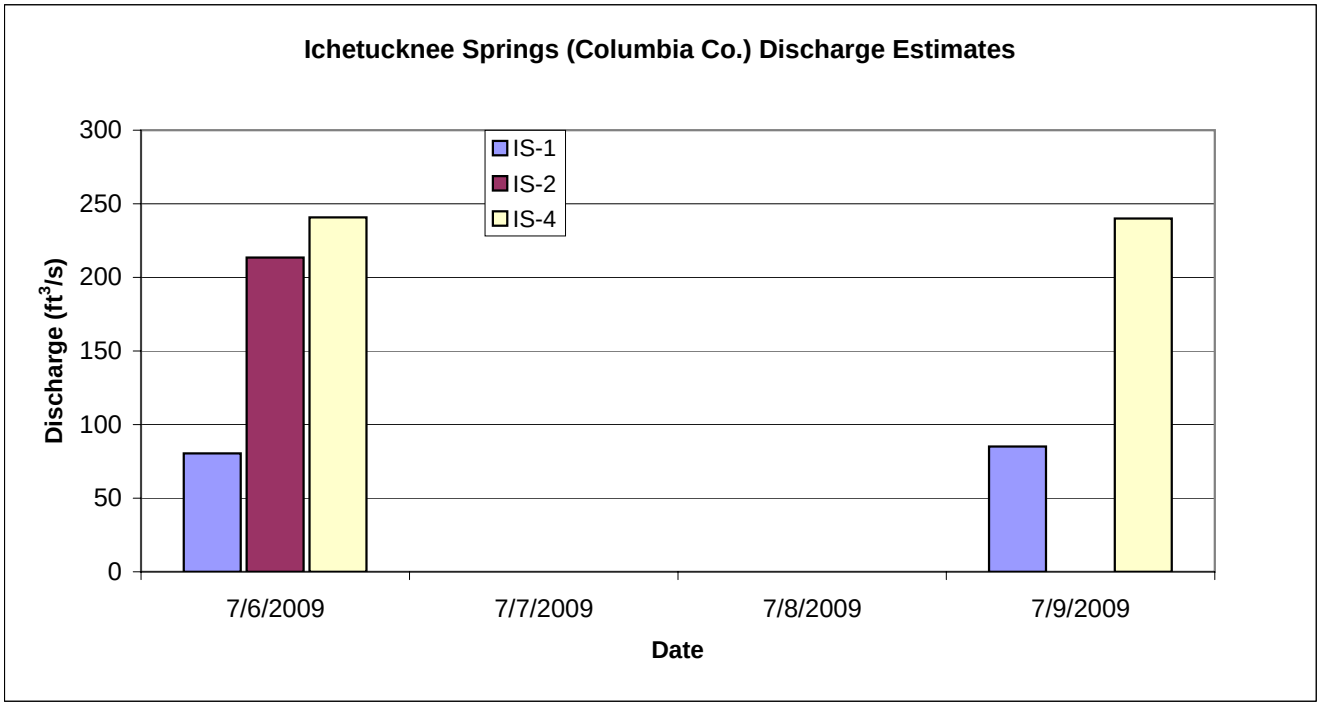
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	3.0	8.0	0.81		0.00		6.48	0.00	0	0.00	0.00	0.00%	0.00
	13.0	15.0	3.39	0.00		-0.04	50.85	-1.02	-2488	-0.66	0.00	-1.21%	0.00
	33.0	15.0	4.22	0.00		0.00	63.30	0.00	0	0.00	0.00	0.00%	0.00
	43.0	10.0	4.43	-0.08		0.10	44.30	0.44	1084	0.29	-2.44	0.53%	-0.01
	53.0	10.0	4.45	-0.06		-0.02	44.50	-1.78	-4355	-1.15	-1.83	-2.12%	0.04
	63.0	10.0	4.32	0.14		-0.01	43.20	2.81	6870	1.81	4.27	3.34%	0.14
	73.0	10.0	4.73	0.03		0.08	47.30	2.60	6365	1.68	0.91	3.09%	0.03
	83.0	10.0	4.72	-0.08		0.02	47.20	-1.42	-3464	-0.92	-2.44	-1.68%	0.04
	93.0	10.0	4.98	0.01		0.06	49.80	1.74	4264	1.13	0.30	2.07%	0.01
	103.0	10.0	6.52	0.13		-0.03	65.20	3.26	7976	2.11	3.96	3.87%	0.15
	113.0	10.0	6.24	0.14		0.12	62.40	8.11	19847	5.24	4.27	9.64%	0.41
	123.0	10.0	5.66	0.23		0.21	56.60	12.45	30465	8.05	7.01	14.80%	1.04
	133.0	12.0	5.93	0.32		0.21	71.16	18.86	46136	12.19	9.75	22.41%	2.19
	147.0	12.0	5.34	0.26		0.13	64.08	12.50	30571	8.08	7.92	14.85%	1.18
	157.0	10.0	5.52	0.24		0.09	55.20	9.11	22283	5.89	7.32	10.82%	0.79
	167.0	10.0	4.88	0.17		0.11	48.80	6.83	16715	4.42	5.18	8.12%	0.42
	177.0	10.0	4.12	0.11		0.21	41.20	6.59	16128	4.26	3.35	7.83%	0.26
	187.0	10.0	2.95	0.13		0.06	29.50	2.80	6857	1.81	3.96	3.33%	0.13
	197.0	10.0	0.62		0.04		6.20	0.25	607	0.16	1.22	0.29%	0.00
	207.0	10.0	0.97		0.00		9.70	0.00	0	0.00	0.00	0.00%	0.00
End	212.0												
		212.0	4.24	0.10	0.01	0.08	906.97	84.14	205860	54.38	2.64	100%	6.82
			(cm/s)		0.41								

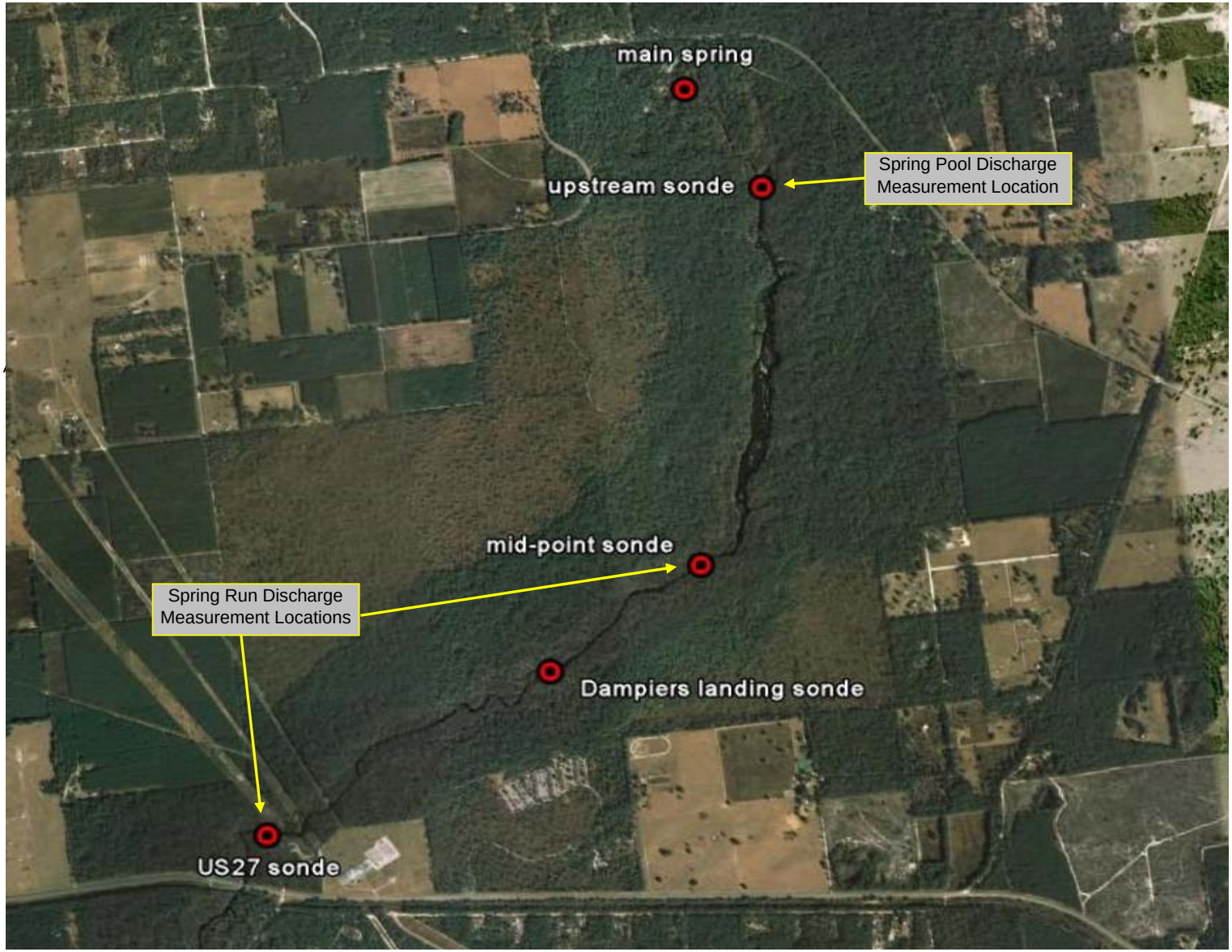


APPENDIX C
Ichetucknee Springs Cross Sectional Flow Summaries - July 6 and 9, 2009.

Date	Location	Segment Width (ft.)	Average Depth (ft.)	Velocity (ft/s)			Discharge		
				0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
7/6/09	IS-1	57.0	2.18	0.84	0.36	0.57	80.5	196,870	52.0
7/9//09	IS-1	59.0	2.14	1.03	0.29	0.66	85.1	208,125	55.0
Average IS-1 Values		**58.0**	**2.16**	**0.94**	**0.32**	**0.62**	**82.8**	**202,497**	**53.5**
7/9//09	IS-2	79.0	3.61	1.30	0.20	0.41	213.5	522,348	138.0
Average IS-2 Values		**79.0**	**3.61**	**1.30**	**0.20**	**0.41**	**213.5**	**522,348**	**138.0**
7/6/09	IS-4	78.0	3.69	1.41	0.1	0.44	240.7	588,932	155.6
7/9//09	IS-4	80.0	3.56	1.42	0.15	0.42	240.0	587,272	155.1
Average IS-4 Values		**79.0**	**3.62**	**1.41**	**0.11**	**0.43**	**240.4**	**588,102**	**155.4**

IS-1 is upstream sonde, IS-2 is mid-point dock, IS-3 is US27 dock



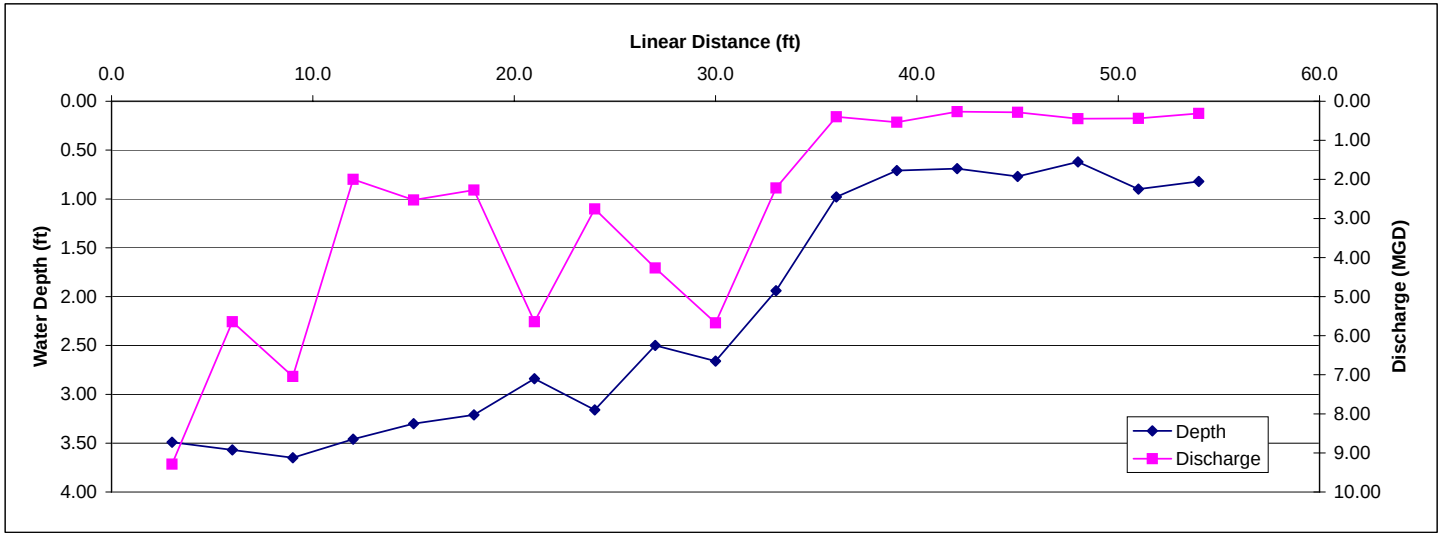


APPENDIX C
Ichetucknee Springs (Columbia Co.) discharge measurement locations.

APPENDIX C

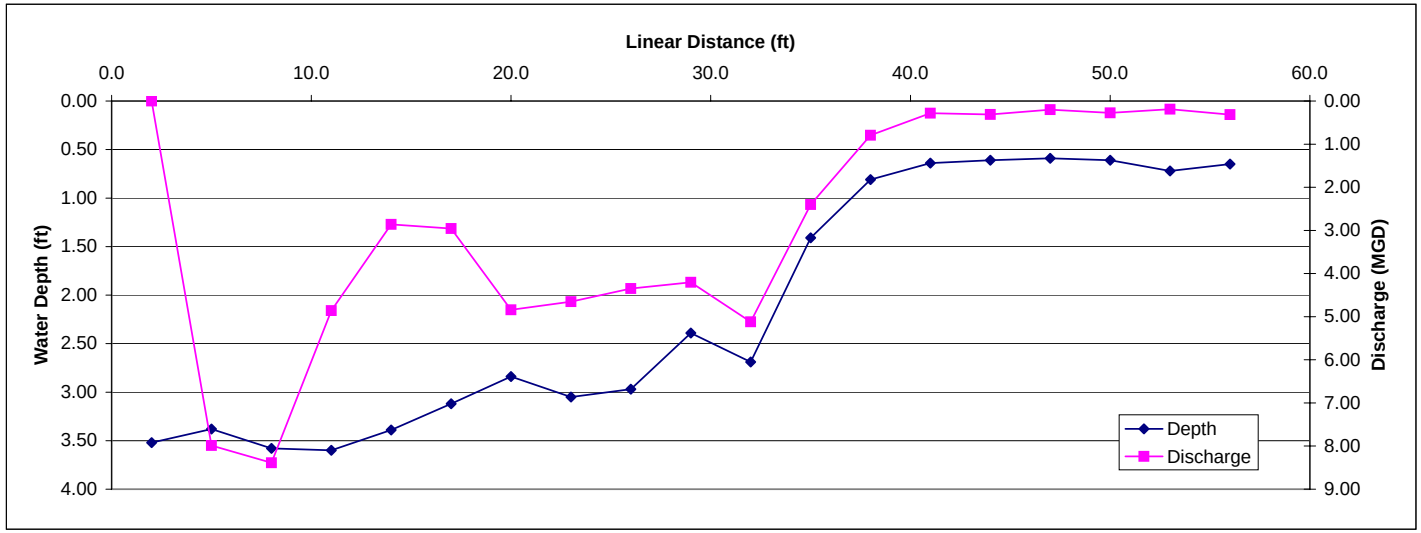
Ichetucknee Cross Sectional Flow at IS-1 on July 6, 2009 at 10:29

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	3.0	4.5	3.49	1.03		0.80	15.71	14.37	35157	9.29	31.39	17.86%	5.61
	6.0	3.0	3.57	0.98		0.65	10.71	8.73	21355	5.64	29.87	10.85%	3.24
	9.0	3.0	3.65	0.98		1.01	10.95	10.90	26656	7.04	29.87	13.54%	4.04
	12.0	3.0	3.46	0.59		0.01	10.38	3.09	7568	2.00	17.98	3.84%	0.69
	15.0	3.0	3.30	0.72		0.07	9.90	3.91	9567	2.53	21.95	4.86%	1.07
	18.0	3.0	3.21	0.53		0.20	9.63	3.51	8600	2.27	16.15	4.37%	0.71
	21.0	3.0	2.84	0.81		1.24	8.52	8.73	21366	5.64	24.69	10.85%	2.68
	24.0	3.0	3.16	0.67		0.23	9.48	4.27	10437	2.76	20.42	5.30%	1.08
	27.0	3.0	2.50		0.88		7.50	6.60	16147	4.27	26.82	8.20%	2.20
	30.0	3.0	2.66	1.25		0.95	7.98	8.78	21476	5.67	38.10	10.91%	4.16
	33.0	3.0	1.94		0.59		5.82	3.43	8401	2.22	17.98	4.27%	0.77
	36.0	3.0	0.98		0.21		2.94	0.62	1511	0.40	6.40	0.77%	0.05
	39.0	3.0	0.71		0.39		2.13	0.83	2032	0.54	11.89	1.03%	0.12
	42.0	3.0	0.69		0.20		2.07	0.41	1013	0.27	6.10	0.51%	0.03
	45.0	3.0	0.77		0.19		2.31	0.44	1074	0.28	5.79	0.55%	0.03
	48.0	3.0	0.62		0.37		1.86	0.69	1684	0.44	11.28	0.86%	0.10
	51.0	3.0	0.90		0.25		2.70	0.68	1651	0.44	7.62	0.84%	0.06
	54.0	4.5	0.82		0.13		3.69	0.48	1174	0.31	3.96	0.60%	0.02
End	57.0												
		57.0	2.18	0.84	0.36	0.57	124.28	80.47	196870	52.01	18.24	100%	26.66
			(cm/s)	25.60	10.87	17.46							



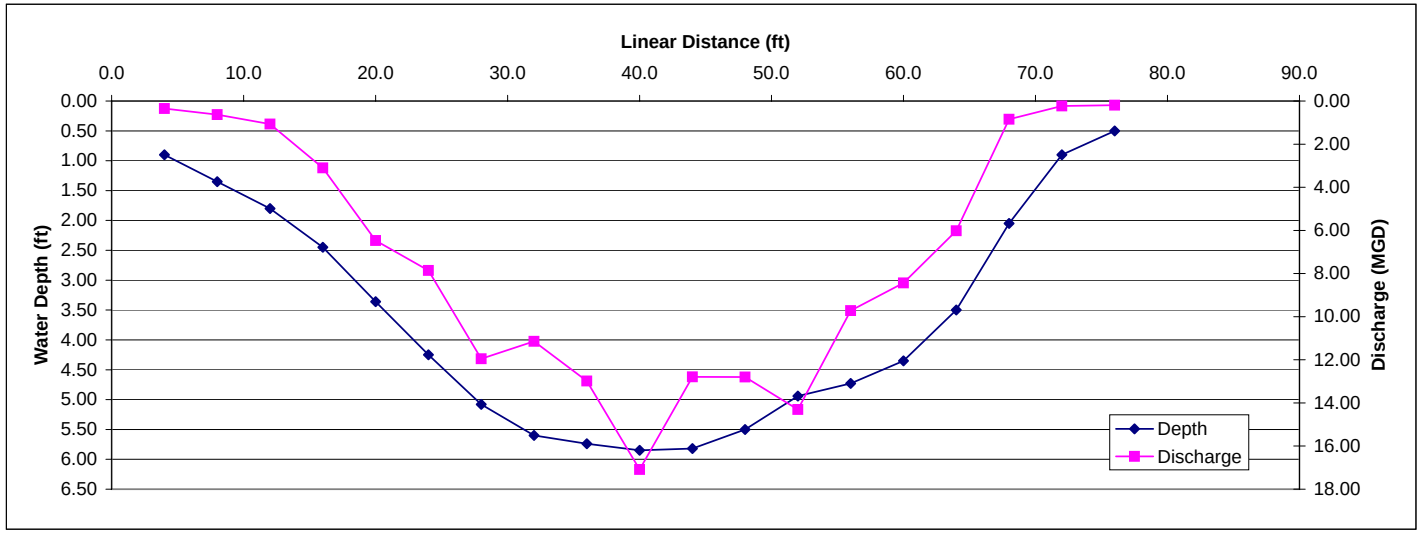
APPENDIX C
Ichetucknee Cross Sectional Flow at IS-1 on July 9, 2009 at 10:10

	Distance from Initial Point	Segment Width	Total Depth	Velocity (ft/s)			Segment Area	Discharge			Surface Velocity	Flow proportion	Weighted Velocity
	(ft.)	(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^2)	(ft^3/s)	(m^3/d)	(MGD)	(cm/s)	(%)	(cm/s)
Start	0.0												
	2.0	3.5	3.52	1.08		0.86	0.00	0.00	0	0.00	32.92	0.00%	0.00
	5.0	3.0	3.38	1.48		0.86	10.56	12.36	30228	7.99	45.11	14.52%	6.55
	8.0	3.0	3.58	1.55		1.01	10.14	12.98	31755	8.39	47.24	15.26%	7.21
	11.0	3.0	3.60	0.98		0.42	10.74	7.52	18393	4.86	29.87	8.84%	2.64
	14.0	3.0	3.39	0.62		0.20	10.80	4.43	10833	2.86	18.90	5.21%	0.98
	17.0	3.0	3.12	0.55		0.35	10.17	4.58	11197	2.96	16.76	5.38%	0.90
	20.0	3.0	2.84	0.99		0.61	9.36	7.49	18320	4.84	30.18	8.80%	2.66
	23.0	3.0	3.05	1.17		0.52	8.52	7.20	17614	4.65	35.66	8.46%	3.02
	26.0	3.0	2.97	0.82		0.65	9.15	6.73	16454	4.35	24.99	7.91%	1.98
	29.0	3.0	2.39		0.73		8.91	6.50	15913	4.20	22.25	7.65%	1.70
	32.0	3.0	2.69	1.09		1.12	7.17	7.92	19384	5.12	33.22	9.31%	3.09
	35.0	3.0	1.41		0.46		8.07	3.71	9082	2.40	14.02	4.36%	0.61
	38.0	3.0	0.81		0.29		4.23	1.23	3001	0.79	8.84	1.44%	0.13
	41.0	3.0	0.64		0.18		2.43	0.44	1070	0.28	5.49	0.51%	0.03
	44.0	3.0	0.61		0.25		1.92	0.48	1174	0.31	7.62	0.56%	0.04
	47.0	3.0	0.59		0.17		1.83	0.31	761	0.20	5.18	0.37%	0.02
	50.0	3.0	0.61		0.24		1.77	0.42	1039	0.27	7.32	0.50%	0.04
	53.0	3.0	0.72		0.16		1.83	0.29	716	0.19	4.88	0.34%	0.02
	56.0	4.5	0.65		0.15		3.24	0.49	1189	0.31	4.57	0.57%	0.03
End	59.0												
		59.0	2.14	1.03	0.29	0.66	120.84	85.07	208125	54.98	20.79	100%	31.64
			(cm/s)	31.49	8.91	20.12							



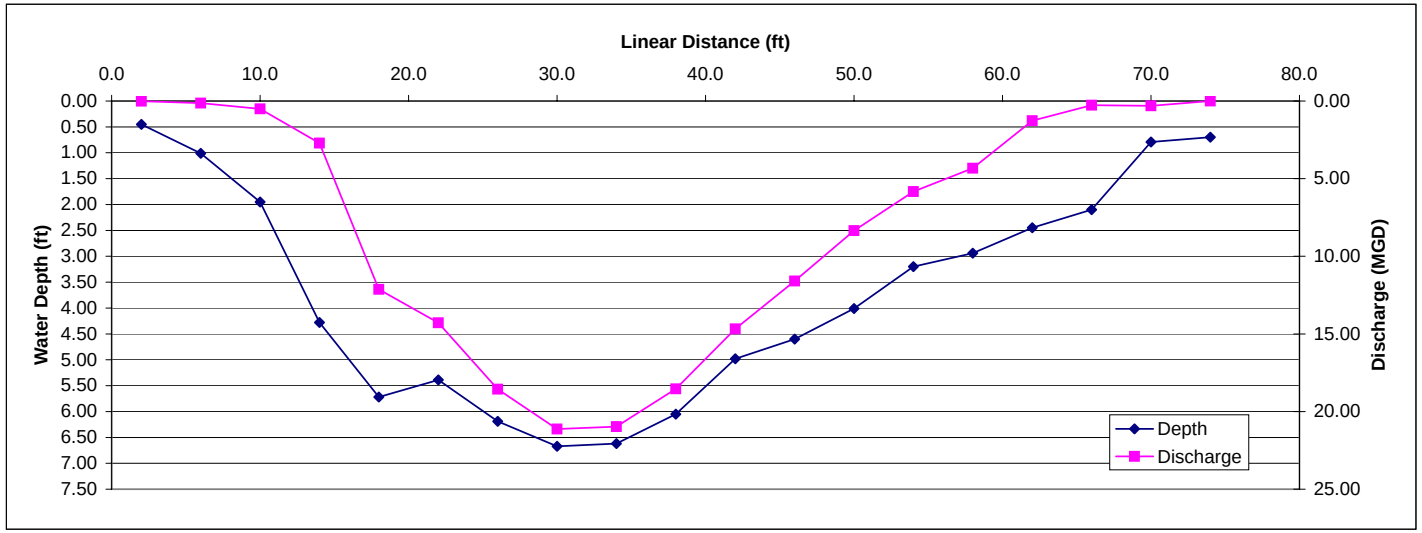
APPENDIX C
Ichetucknee Cross Sectional Flow at IS-2 on July 9, 2009 at 12:07 (staff gage = 3.14')

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	4.0	6.0	0.90		0.10		5.40	0.54	1321	0.35	3.05	0.25%	0.01
	8.0	4.0	1.35		0.18		5.40	0.97	2378	0.63	5.49	0.46%	0.02
	12.0	4.0	1.80		0.23		7.20	1.66	4052	1.07	7.01	0.78%	0.05
	16.0	4.0	2.45		0.49		9.80	4.80	11748	3.10	14.94	2.25%	0.34
	20.0	4.0	3.36	1.15		0.34	13.44	10.01	24497	6.47	35.05	4.69%	1.64
	24.0	4.0	4.25	1.17		0.26	17.00	12.16	29738	7.86	35.66	5.69%	2.03
	28.0	4.0	5.08	1.18		0.64	20.32	18.49	45240	11.95	35.97	8.66%	3.12
	32.0	4.0	5.60	1.35		0.19	22.40	17.25	42199	11.15	41.15	8.08%	3.32
	36.0	4.0	5.74	1.41		0.34	22.96	20.09	49152	12.98	42.98	9.41%	4.04
	40.0	4.0	5.85	1.55		0.71	23.40	26.44	64692	17.09	47.24	12.38%	5.85
	44.0	4.0	5.82	1.53		0.17	23.28	19.79	48413	12.79	46.63	9.27%	4.32
	48.0	4.0	5.50	1.61		0.19	22.00	19.80	48442	12.80	49.07	9.27%	4.55
	52.0	4.0	4.94	1.40		0.84	19.76	22.13	54146	14.30	42.67	10.37%	4.42
	56.0	4.0	4.73	1.22		0.37	18.92	15.04	36800	9.72	37.19	7.05%	2.62
	60.0	4.0	4.35	1.10		0.40	17.40	13.05	31928	8.43	33.53	6.11%	2.05
	64.0	4.0	3.50	0.88		0.45	14.00	9.31	22778	6.02	26.82	4.36%	1.17
	68.0	4.0	2.05		0.16		8.20	1.31	3210	0.85	4.88	0.61%	0.03
	72.0	4.0	0.90		0.10		3.60	0.36	881	0.23	3.05	0.17%	0.01
	76.0	5.0	0.50		0.12		2.50	0.30	734	0.19	3.66	0.14%	0.01
End	79.0												
		79.0	3.61	1.30	0.20	0.41	276.98	213.50	522348	137.99	27.16	100%	39.61
			(cm/s)	39.50	6.01	12.45							



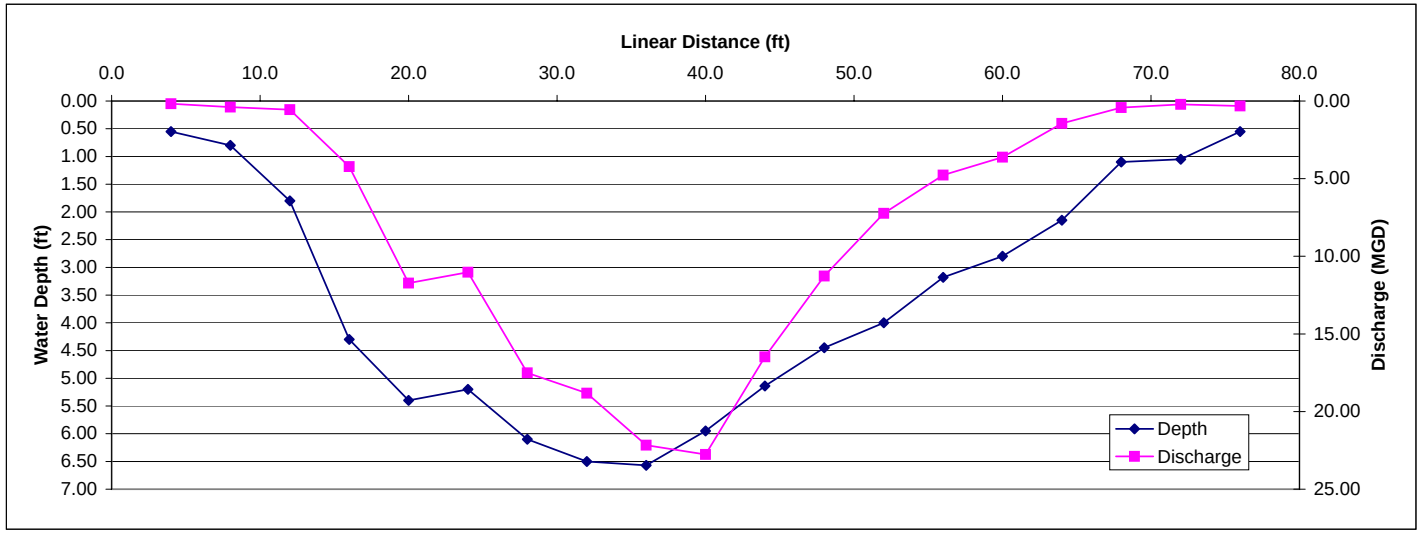
APPENDIX C
Ichetucknee Cross Sectional Flow at IS-3 on July 6, 2009 at 16:00

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	4.0	0.45		0.01		1.80	0.02	44	0.01	0.30	0.01%	0.00
	6.0	4.0	1.01		0.05		4.04	0.20	494	0.13	1.52	0.08%	0.00
	10.0	4.0	1.95		0.10		7.80	0.78	1908	0.50	3.05	0.32%	0.01
	14.0	4.0	4.28	0.37		0.12	17.12	4.19	10262	2.71	11.28	1.74%	0.20
	18.0	4.0	5.72	1.09		0.55	22.88	18.76	45902	12.13	33.22	7.79%	2.59
	22.0	4.0	5.39	1.20		0.85	21.56	22.10	54067	14.28	36.58	9.18%	3.36
	26.0	4.0	6.19	1.47		0.85	24.76	28.72	70270	18.56	44.81	11.93%	5.35
	30.0	4.0	6.67	1.74		0.71	26.68	32.68	79961	21.12	53.04	13.58%	7.20
	34.0	4.0	6.62	2.05		0.40	26.48	32.44	79362	20.97	62.48	13.48%	8.42
	38.0	4.0	6.05	2.31		0.06	24.20	28.68	70160	18.53	70.41	11.91%	8.39
	42.0	4.0	4.98	1.84		0.44	19.92	22.71	55559	14.68	56.08	9.43%	5.29
	46.0	4.0	4.60	1.71		0.24	18.40	17.94	43892	11.60	52.12	7.45%	3.88
	50.0	4.0	4.01	1.29		0.32	16.04	12.91	31591	8.35	39.32	5.36%	2.11
	54.0	4.0	3.20	1.00		0.41	12.80	9.02	22078	5.83	30.48	3.75%	1.14
	58.0	4.0	2.94	0.79		0.35	11.76	6.70	16400	4.33	24.08	2.78%	0.67
	62.0	4.0	2.45		0.20		9.80	1.96	4795	1.27	6.10	0.81%	0.05
	66.0	4.0	2.10		0.05		8.40	0.42	1028	0.27	1.52	0.17%	0.00
	70.0	4.0	0.79		0.15		3.16	0.47	1160	0.31	4.57	0.20%	0.01
	74.0	6.0	0.70		0.00		4.20	0.00	0	0.00	0.00	0.00%	0.00
End	78.0												
		78.0	3.69	1.41	0.08	0.44	281.80	240.72	588932	155.58	27.95	100%	48.67
			(cm/s)	42.82	2.44	13.46							



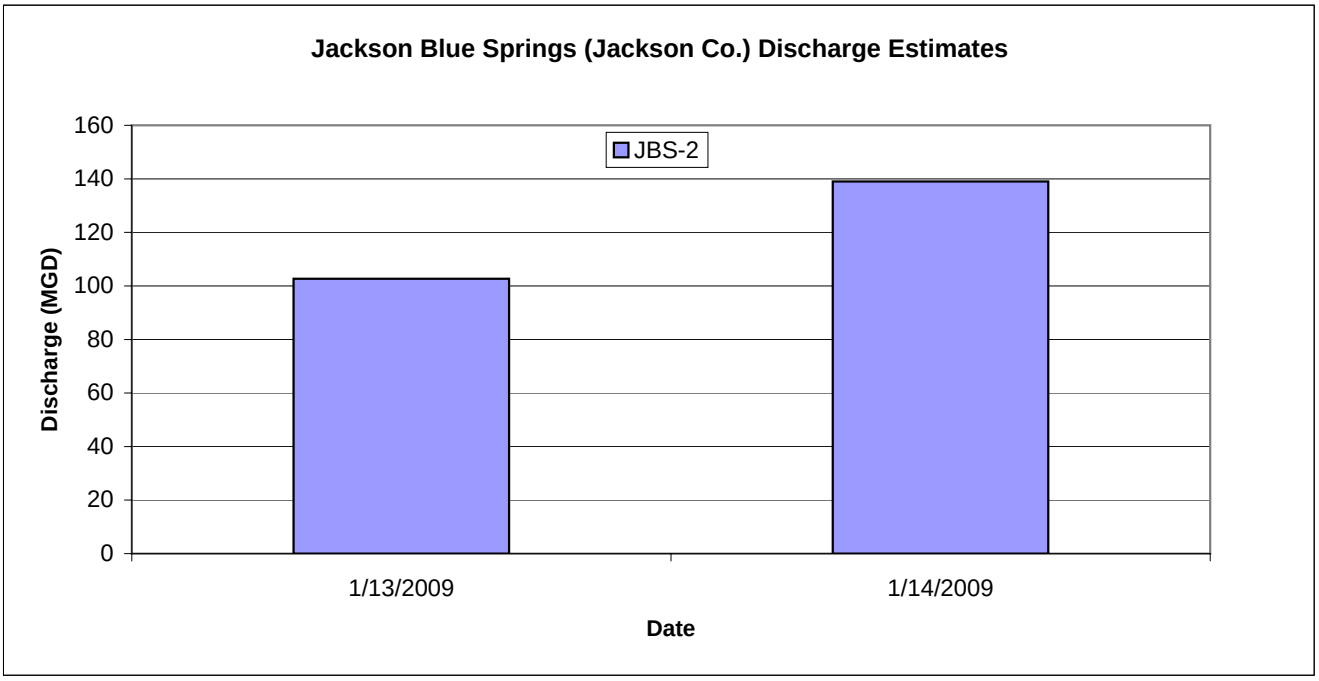
APPENDIX C
Ichetucknee Cross Sectional Flow at IS-4 on July 9, 2009 at 13:41

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	4.0	6.0	0.55		0.08		3.30	0.26	646	0.17	2.44	0.11%	0.00
	8.0	4.0	0.80		0.19		3.20	0.61	1488	0.39	5.79	0.25%	0.01
	12.0	4.0	1.80		0.12		7.20	0.86	2114	0.56	3.66	0.36%	0.01
	16.0	4.0	4.30	0.34		0.42	17.20	6.54	15991	4.22	10.36	2.72%	0.28
	20.0	4.0	5.40	1.34		0.34	21.60	18.14	44391	11.73	40.84	7.56%	3.09
	24.0	4.0	5.20	1.15		0.49	20.80	17.06	41729	11.02	35.05	7.11%	2.49
	28.0	4.0	6.10	1.36		0.86	24.40	27.08	66263	17.51	41.45	11.28%	4.68
	32.0	4.0	6.50	1.80		0.44	26.00	29.12	71244	18.82	54.86	12.13%	6.66
	36.0	4.0	6.57	2.16		0.45	26.28	34.30	83906	22.17	65.84	14.29%	9.41
	40.0	4.0	5.95	2.12		0.84	23.80	35.22	86178	22.77	64.62	14.67%	9.48
	44.0	4.0	5.14	2.10		0.38	20.56	25.49	62374	16.48	64.01	10.62%	6.80
	48.0	4.0	4.45	1.70		0.26	17.80	17.44	42678	11.27	51.82	7.27%	3.77
	52.0	4.0	4.00	1.24		0.16	16.00	11.20	27402	7.24	37.80	4.67%	1.76
	56.0	4.0	3.18	0.94		0.22	12.72	7.38	18050	4.77	28.65	3.07%	0.88
	60.0	4.0	2.80	0.80		0.20	11.20	5.60	13701	3.62	24.38	2.33%	0.57
	64.0	4.0	2.15		0.26		8.60	2.24	5471	1.45	7.92	0.93%	0.07
	68.0	4.0	1.10		0.15		4.40	0.66	1615	0.43	4.57	0.27%	0.01
	72.0	4.0	1.05		0.08		4.20	0.34	822	0.22	2.44	0.14%	0.00
	76.0	6.0	0.55		0.15		3.30	0.50	1211	0.32	4.57	0.21%	0.01
End	80.0												
		80.0	3.56	1.42	0.15	0.42	272.56	240.04	587272	155.14	29.00	100%	49.99
			(cm/s)	43.31	4.48	12.85							



APPENDIX C
Jackson Blue Springs Cross Sectional Flow Summaries - January 13 and 14, 2009.

Date	Location	Segment Width	Average Depth	Velocity (ft/s)			Discharge		
		(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
1/13/2009	JBS-2	210.0	4.44	0.15	0.02	0.05	102.71	251,278	66.38
1/14/2009	JBS-2	212.0	4.37	0.18	0.00	0.09	139.04	340,175	89.87
Avg Spring Pool Values		**211.0**	**4.40**	**0.16**	**0.01**	**0.07**	**120.87**	**295,727**	**78.1**





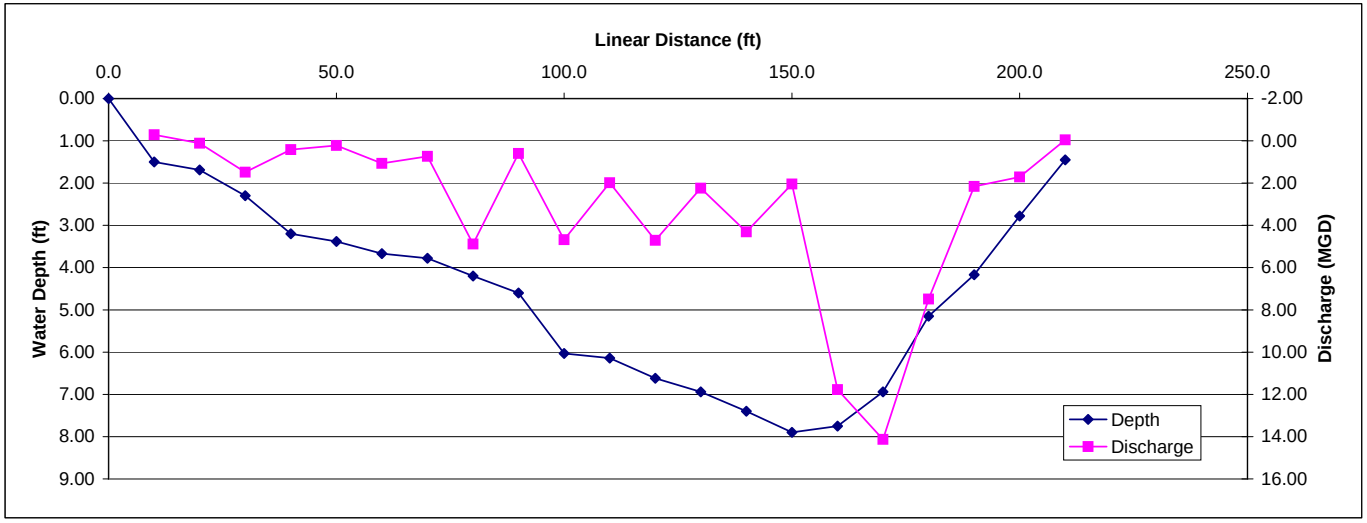
APPENDIX C
Jackson Blue Springs (Jackson Co.) discharge measurement location.



APPENDIX C
Jackson Blue Springs (Jackson Co.) discharge measurement location.

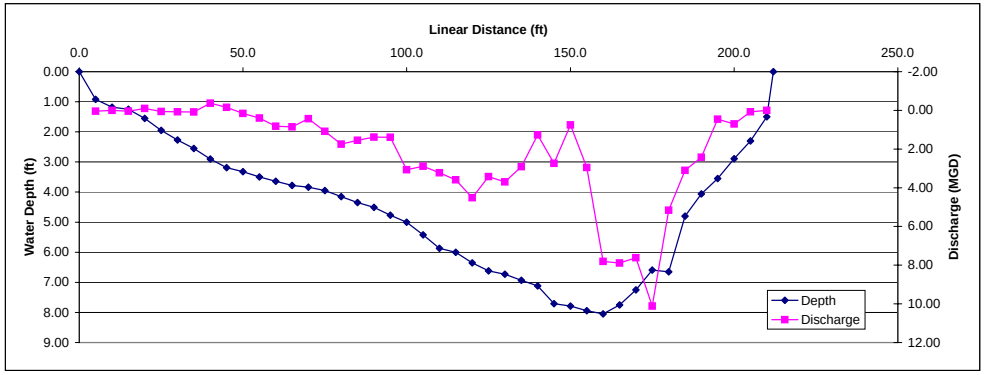
APPENDIX C
Jackson Blue Springs Cross Sectional Flow at JBS-2 - January 13, 2009

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	10.0	15.0	1.50		-0.02		22.50	-0.45	-1101	-0.29	-0.61	-0.44%	0.00
	20.0	10.0	1.69		0.01		16.90	0.17	413	0.11	0.30	0.16%	0.00
	30.0	10.0	2.30		0.10		23.00	2.30	5627	1.49	3.05	2.24%	0.07
	40.0	10.0	3.20	0.03		0.01	32.00	0.64	1566	0.41	0.91	0.62%	0.01
	50.0	10.0	3.38	0.01		0.01	33.80	0.34	827	0.22	0.30	0.33%	0.00
	60.0	10.0	3.67	0.05		0.04	36.70	1.65	4041	1.07	1.52	1.61%	0.02
	70.0	10.0	3.78	0.04		0.02	37.80	1.13	2774	0.73	1.22	1.10%	0.01
	80.0	10.0	4.20	0.26		0.10	42.00	7.56	18496	4.89	7.92	7.36%	0.58
	90.0	10.0	4.60	0.02		0.02	46.00	0.92	2251	0.59	0.61	0.90%	0.01
	100.0	10.0	6.03	0.17		0.07	60.30	7.24	17703	4.68	5.18	7.05%	0.37
	110.0	10.0	6.14	0.09		0.01	61.40	3.07	7511	1.98	2.74	2.99%	0.08
	120.0	10.0	6.62	0.16		0.06	66.20	7.28	17816	4.71	4.88	7.09%	0.35
	130.0	10.0	6.94	0.01		0.09	69.40	3.47	8490	2.24	0.30	3.38%	0.01
	140.0	10.0	7.40	0.17		0.01	74.00	6.66	16294	4.30	5.18	6.48%	0.34
	150.0	10.0	7.90	0.03		0.05	79.00	3.16	7731	2.04	0.91	3.08%	0.03
	160.0	10.0	7.75	0.40		0.07	77.50	18.21	44558	11.77	12.19	17.73%	2.16
	170.0	10.0	6.94	0.52		0.11	69.40	21.86	53485	14.13	15.85	21.29%	3.37
	180.0	10.0	5.15	0.25		0.20	51.50	11.59	28350	7.49	7.62	11.28%	0.86
	190.0	10.0	4.17	0.12		0.04	41.70	3.34	8162	2.16	3.66	3.25%	0.12
	200.0	10.0	2.78	0.22		-0.03	27.80	2.64	6461	1.71	6.71	2.57%	0.17
End	210.0	5.0	1.45		-0.01		7.25	-0.07	-177	-0.05	-0.30	-0.07%	0.00
		210.0	4.44	0.15	0.02	0.05	976.15	102.71	251278	66.38	3.82	100%	8.56
			(cm/s)	4.57	0.61	1.58							



APPENDIX C
Jackson Blue Springs Cross Sectional Flow at JBS-2 - January 14, 2009.

	Distance from Initial Point	Segment Width	Total Depth	Velocity (ft/s)			Segment Area	Discharge			Surface Velocity	Flow proportion	Weighted Velocity
	(ft.)	(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^2)	(ft^3/s)	(m^3/d)	(MGD)	(cm/s)	(%)	(cm/s)
Start	0.0		0.00										
	5.0	7.5	0.92		0.01		6.90	0.07	169	0.04	0.30	0.05%	0.00
	10.0	5.0	1.18		0.00		5.90	0.00	0	0.00	0.00	0.00%	0.00
	15.0	5.0	1.25		0.01		6.25	0.06	153	0.04	0.30	0.04%	0.00
	20.0	5.0	1.55		-0.02		7.75	-0.16	-379	-0.10	-0.61	-0.11%	0.00
	25.0	5.0	1.95		0.01		9.75	0.10	239	0.06	0.30	0.07%	0.00
	30.0	5.0	2.27		0.01		11.35	0.11	278	0.07	0.30	0.08%	0.00
	35.0	5.0	2.55	-0.01		0.03	12.75	0.13	312	0.08	-0.30	0.09%	0.00
	40.0	5.0	2.90	-0.03		-0.05	14.50	-0.58	-1419	-0.37	-0.91	-0.42%	0.00
	45.0	5.0	3.19	0.00		-0.03	15.95	-0.24	-585	-0.15	0.00	-0.17%	0.00
	50.0	5.0	3.32	-0.01		0.04	16.60	0.25	609	0.16	-0.30	0.18%	0.00
	55.0	5.0	3.50	0.02		0.05	17.50	0.61	1499	0.40	0.61	0.44%	0.00
	60.0	5.0	3.64	0.08		0.06	18.20	1.27	3117	0.82	2.44	0.92%	0.02
	65.0	5.0	3.78	0.11		0.03	18.90	1.32	3237	0.86	3.35	0.95%	0.03
	70.0	5.0	3.84	0.04		0.03	19.20	0.67	1644	0.43	1.22	0.48%	0.01
	75.0	5.0	3.95	0.10		0.07	19.75	1.68	4107	1.09	3.05	1.21%	0.04
	80.0	5.0	4.15	0.09		0.17	20.75	2.70	6600	1.74	2.74	1.94%	0.05
	85.0	5.0	4.35	0.10		0.12	21.75	2.39	5853	1.55	3.05	1.72%	0.05
	90.0	5.0	4.51	0.17		0.02	22.55	2.14	5241	1.38	5.18	1.54%	0.08
	95.0	5.0	4.77	0.09		0.09	23.85	2.15	5252	1.39	2.74	1.54%	0.04
	100.0	5.0	5.00	0.24		0.14	25.00	4.75	11621	3.07	7.32	3.42%	0.25
	105.0	5.0	5.42	0.22		0.11	27.10	4.47	10940	2.89	6.71	3.22%	0.22
	110.0	5.0	5.87	0.20		0.14	29.35	4.99	12207	3.22	6.10	3.59%	0.22
	115.0	5.0	6.00	0.22		0.15	30.00	5.55	13578	3.59	6.71	3.99%	0.27
	120.0	5.0	6.35	0.23		0.21	31.75	6.99	17089	4.51	7.01	5.02%	0.35
	125.0	5.0	6.62	0.16		0.16	33.10	5.30	12957	3.42	4.88	3.81%	0.19
	130.0	5.0	6.73	0.30		0.04	33.65	5.72	13996	3.70	9.14	4.11%	0.38
	135.0	5.0	6.93	0.24		0.02	34.65	4.50	11021	2.91	7.32	3.24%	0.24
	140.0	5.0	7.12	0.07		0.04	35.60	1.96	4790	1.27	2.13	1.41%	0.03
	145.0	5.0	7.71	0.18		0.04	38.55	4.24	10375	2.74	5.49	3.05%	0.17
	150.0	5.0	7.79	0.03		0.03	38.95	1.17	2859	0.76	0.91	0.84%	0.01
	155.0	5.0	7.94	0.10		0.13	39.70	4.57	11170	2.95	3.05	3.28%	0.10
	160.0	5.0	8.05	0.46		0.14	40.25	12.08	29542	7.80	14.02	8.68%	1.22
	165.0	5.0	7.75	0.46		0.17	38.75	12.21	29864	7.89	14.02	8.78%	1.23
	170.0	5.0	7.25	0.47		0.18	36.25	11.78	28824	7.61	14.33	8.47%	1.21
	175.0	5.0	6.59	0.48		0.47	32.95	15.65	38292	10.12	14.63	11.26%	1.65
	180.0	5.0	6.65	0.34		0.14	33.25	7.98	19524	5.16	10.36	5.74%	0.59
	185.0	5.0	4.80	0.24		0.16	24.00	4.80	11744	3.10	7.32	3.45%	0.25
	190.0	5.0	4.06	0.34		0.03	20.30	3.76	9188	2.43	10.36	2.70%	0.28
	195.0	5.0	3.55	0.16		-0.08	17.75	0.71	1737	0.46	4.88	0.51%	0.02
	200.0	5.0	2.89	0.15		0.00	14.45	1.08	2651	0.70	4.57	0.78%	0.04
	205.0	5.0	2.30		0.01		11.50	0.12	281	0.07	0.30	0.08%	0.00
	210.0	4.5	1.50		0.00		6.75	0.00	0	0.00	0.00	0.00%	0.00
End	212.0		0.00										
		212.0	4.37	0.18	0.00	0.09	963.75	139.04	340175	89.87	4.41	100%	9.24
			(cm/s)	5.41	0.11	2.73							

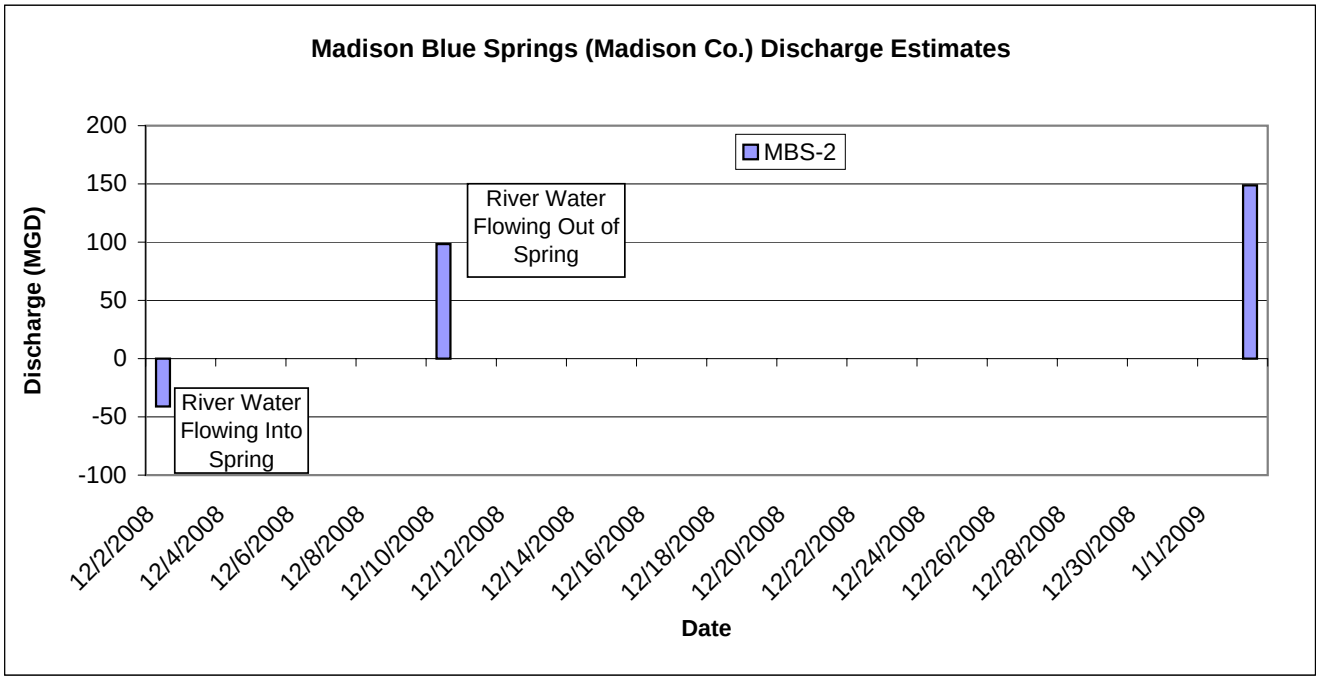


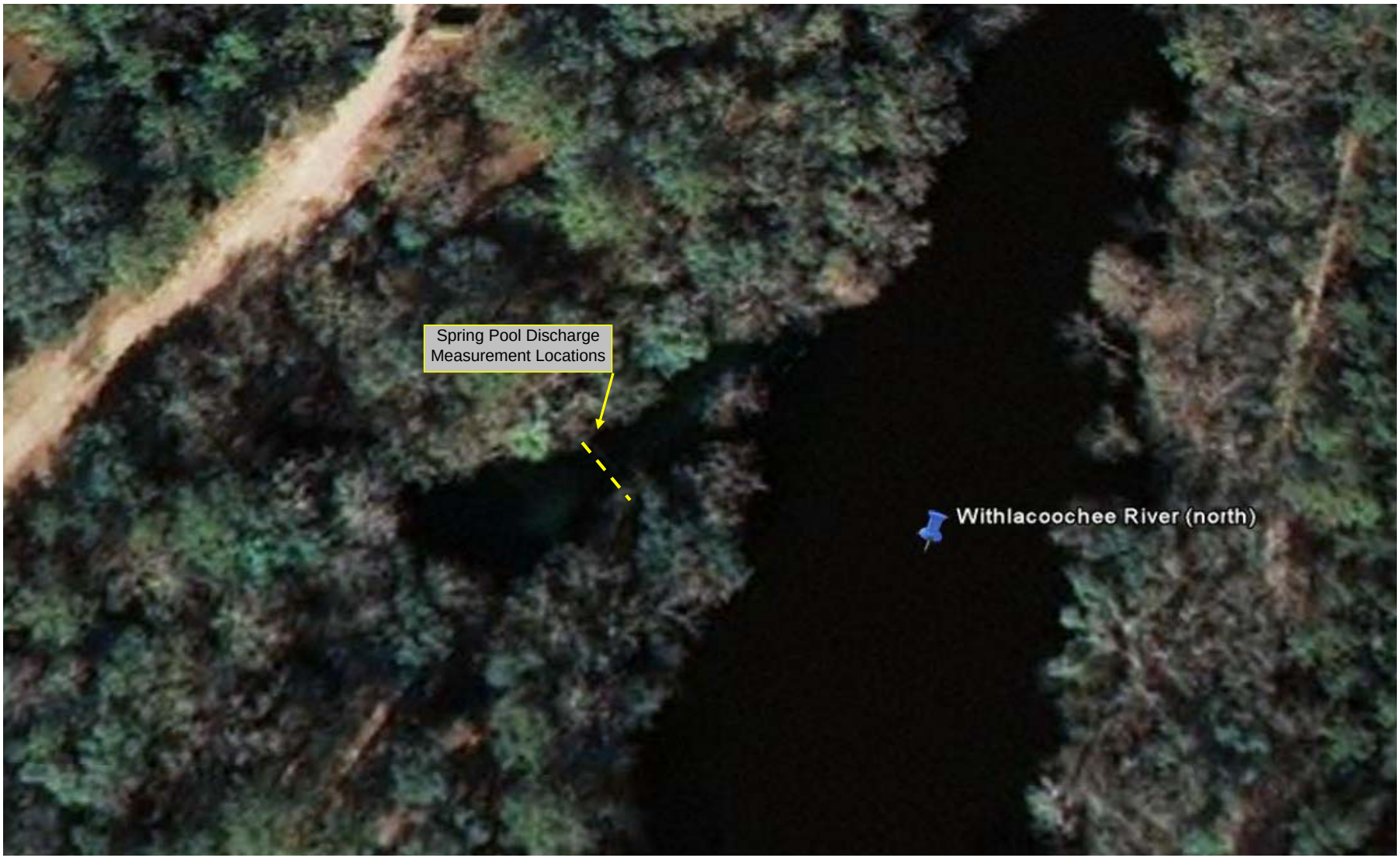
APPENDIX C

Madison Blue Springs Cross Sectional Flow Summaries - December 2 and 10, 2008 and January 2, 2009.

Date	Location	Segment Width	Average Depth	Velocity (ft/s)			Discharge *		
		(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
12/02/08	MBS-2	38.0	4.05	-0.30	-0.11	-0.22	-41.02	-100,370	-26.52
12/10/08	MBS-2	68.0	7.75	0.26	0.16	0.12	98.38	240,698	63.59
01/02/09	MBS-2	33.0	3.22	1.94	0.82	0.89	148.80	364,056	96.18
Avg (positive flow)		**50.5**	**5.48**	**1.10**	**0.49**	**0.51**	**123.59**	**302,377**	**79.9**

* 12/2/08 - Withlacoochee at flood stage, reverse flow in spring. Staff gage (by stairs) was 12.05 to 12.08 ft during measurements.





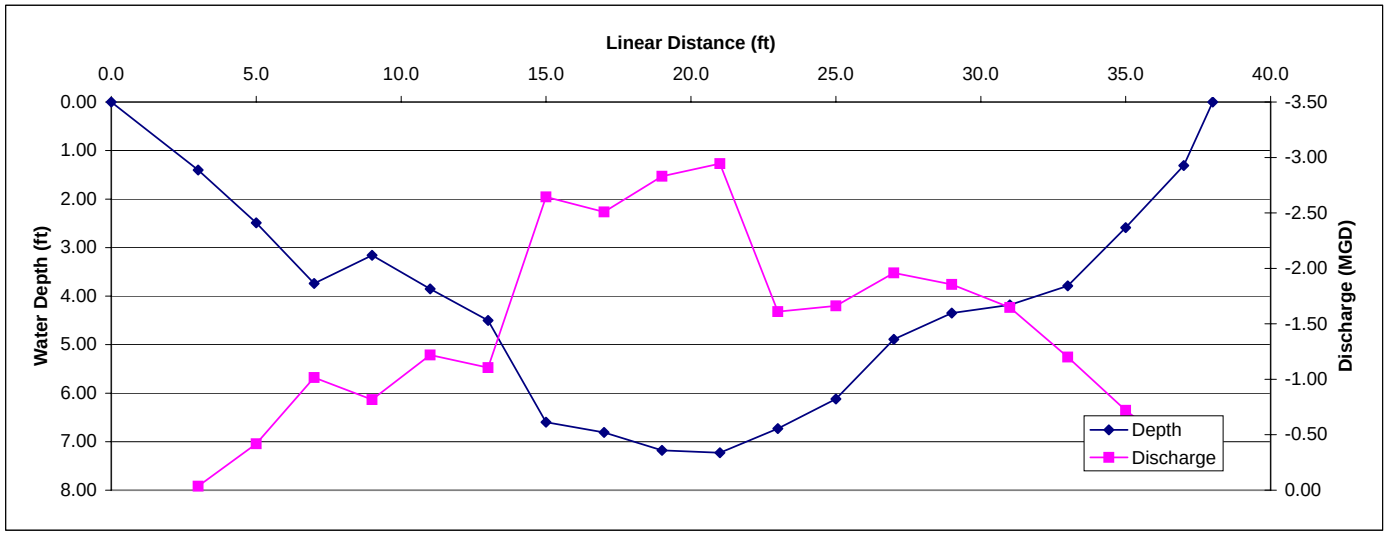
APPENDIX C
Madison Blue Springs (Madison Co.) discharge measurement location.

APPENDIX C

Madison Blue Springs Cross Sectional Flow at MBS-2 - December 2, 2008.

Withlacoochee at flood stage, spring was sucking water. Staff gage (by stairs) was 12.05 to 12.08 ft during measurements.

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	3.0	4.0	1.40		-0.01		5.60	-0.06	-137	-0.04	-0.30	0.14%	0.00
	5.0	2.0	2.49		-0.13		4.98	-0.65	-1584	-0.42	-3.96	1.58%	-0.06
	7.0	2.0	3.74	-0.30		-0.12	7.48	-1.57	-3843	-1.02	-9.14	3.83%	-0.35
	9.0	2.0	3.16	-0.22		-0.18	6.32	-1.26	-3092	-0.82	-6.71	3.08%	-0.21
	11.0	2.0	3.85	-0.31		-0.18	7.70	-1.89	-4615	-1.22	-9.45	4.60%	-0.43
	13.0	2.0	4.50	-0.21		-0.17	9.00	-1.71	-4184	-1.11	-6.40	4.17%	-0.27
	15.0	2.0	6.60	-0.38		-0.24	13.20	-4.09	-10011	-2.64	-11.58	9.97%	-1.16
	17.0	2.0	6.81	-0.32		-0.25	13.62	-3.88	-9497	-2.51	-9.75	9.46%	-0.92
	19.0	2.0	7.18	-0.48		-0.13	14.36	-4.38	-10716	-2.83	-14.63	10.68%	-1.56
	21.0	2.0	7.23	-0.43		-0.20	14.46	-4.55	-11144	-2.94	-13.11	11.10%	-1.46
	23.0	2.0	6.73	-0.17		-0.20	13.46	-2.49	-6092	-1.61	-5.18	6.07%	-0.31
	25.0	2.0	6.12	-0.28		-0.14	12.24	-2.57	-6289	-1.66	-8.53	6.27%	-0.53
	27.0	2.0	4.89	-0.32		-0.30	9.78	-3.03	-7418	-1.96	-9.75	7.39%	-0.72
	29.0	2.0	4.35	-0.30		-0.36	8.70	-2.87	-7024	-1.86	-9.14	7.00%	-0.64
	31.0	2.0	4.18	-0.30		-0.31	8.36	-2.55	-6238	-1.65	-9.14	6.22%	-0.57
	33.0	2.0	3.79	-0.19		-0.30	7.58	-1.86	-4544	-1.20	-5.79	4.53%	-0.26
	35.0	2.0	2.59	-0.26		-0.17	5.18	-1.11	-2725	-0.72	-7.92	2.71%	-0.22
	37.0	2.0	1.31		-0.19		2.62	-0.50	-1218	-0.32	-5.79	1.21%	-0.07
End	38.0		0.00										
		38.0	4.05	-0.30	-0.11	-0.22	164.64	-41.02	-100370	-26.52	-8.13	100%	-9.74
			(cm/s)	-9.08	-3.35	-6.60							

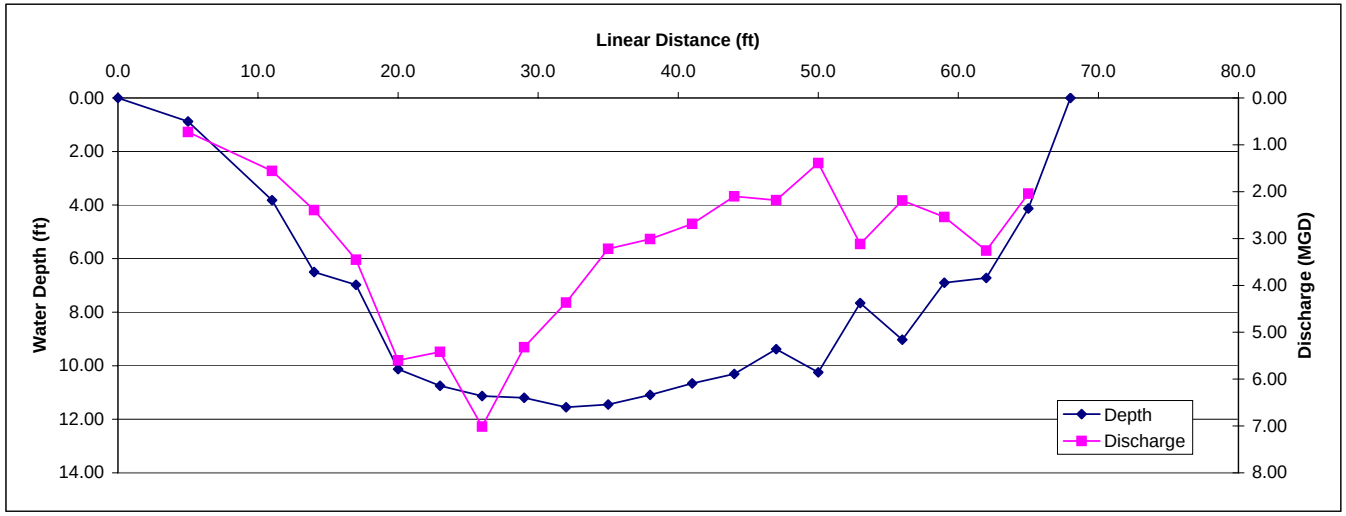


APPENDIX C

Madison Blue Springs Cross Sectional Flow at MBS-2 - December 10, 2008.

Withlacoochee at flood stage, but spring appeared to be discharging colored water. USGS Staff gage was 17.07 (~17.02 by stairs) during measurements.

	Distance from Initial Point	Segment Width	Total Depth	Velocity (ft/s)			Segment Area	Discharge			Surface Velocity	Flow proportion	Weighted Velocity
	(ft.)	(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^2)	(ft^3/s)	(m^3/d)	(MGD)	(cm/s)	(%)	(cm/s)
Start	0.0		0.00										
	5.0	8.0	0.88		0.16		7.04	1.13	2756	0.73	4.88	1.14%	0.06
	11.0	4.5	3.82	0.06		0.22	17.19	2.41	5888	1.56	1.83	2.45%	0.04
	14.0	3.0	6.50	0.32		0.06	19.50	3.71	9065	2.39	9.75	3.77%	0.37
	17.0	3.0	6.98	0.28		0.23	20.94	5.34	13064	3.45	8.53	5.43%	0.46
	20.0	3.0	10.13	0.32		0.25	30.39	8.66	21190	5.60	9.75	8.80%	0.86
	23.0	3.0	10.75	0.34		0.18	32.25	8.39	20515	5.42	10.36	8.52%	0.88
	26.0	3.0	11.13	0.35		0.30	33.39	10.85	26550	7.01	10.67	11.03%	1.18
	29.0	3.0	11.20	0.28		0.21	33.60	8.23	20140	5.32	8.53	8.37%	0.71
	32.0	3.0	11.55	0.28		0.11	34.65	6.76	16531	4.37	8.53	6.87%	0.59
	35.0	3.0	11.45	0.25		0.04	34.35	4.98	12186	3.22	7.62	5.06%	0.39
	38.0	3.0	11.09	0.23		0.05	33.27	4.66	11396	3.01	7.01	4.73%	0.33
	41.0	3.0	10.66	0.24		0.02	31.98	4.16	10171	2.69	7.32	4.23%	0.31
	44.0	3.0	10.31	0.23		-0.02	30.93	3.25	7946	2.10	7.01	3.30%	0.23
	47.0	3.0	9.38	0.29		-0.05	28.14	3.38	8262	2.18	8.84	3.43%	0.30
	50.0	3.0	10.25	0.24		-0.10	30.75	2.15	5266	1.39	7.32	2.19%	0.16
	53.0	3.0	7.66	0.22		0.20	22.98	4.83	11807	3.12	6.71	4.91%	0.33
	56.0	3.0	9.03	0.15		0.10	27.09	3.39	8285	2.19	4.57	3.44%	0.16
	59.0	3.0	6.90	0.21		0.17	20.70	3.93	9622	2.54	6.40	4.00%	0.26
	62.0	3.0	6.72	0.35		0.15	20.16	5.04	12331	3.26	10.67	5.12%	0.55
	65.0	4.5	4.13	0.21		0.13	18.59	3.16	7730	2.04	6.40	3.21%	0.21
End	68.0		0.00										
		68.0	7.75	0.26	0.16	0.12	527.89	98.38	240698	63.59	7.64	100%	8.37
			(cm/s)	7.78	4.88	3.61							

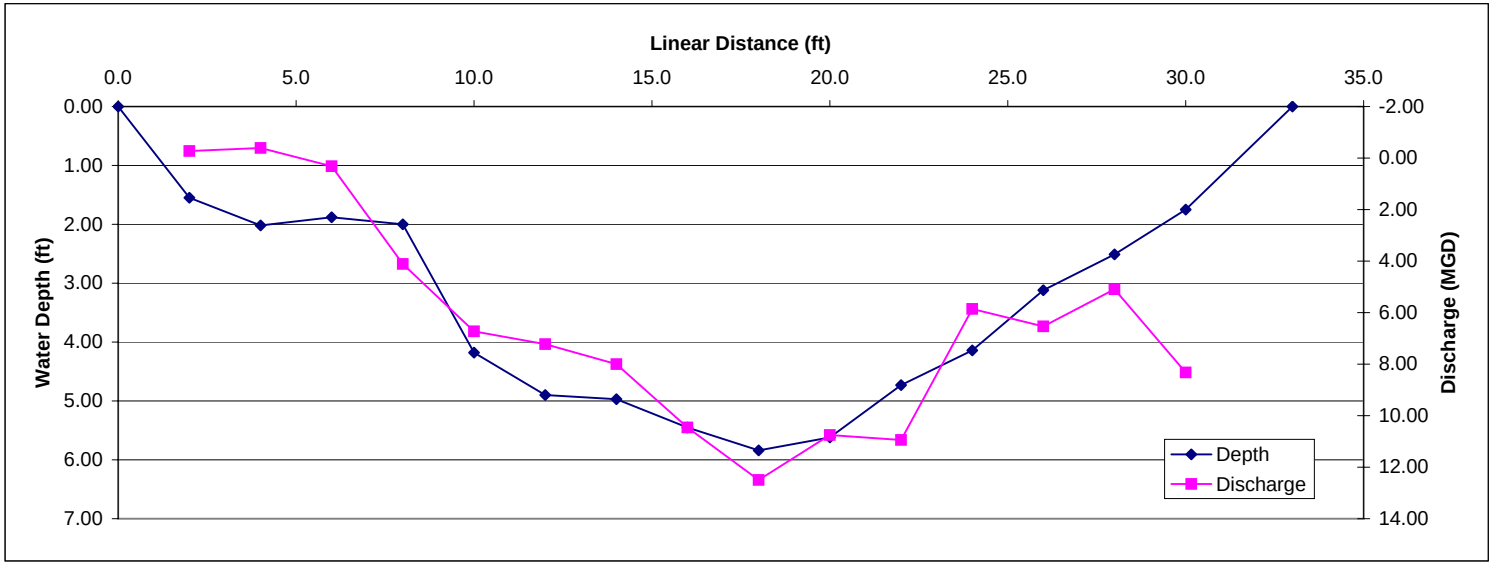


APPENDIX C

Madison Blue Springs Cross Sectional Flow at MBS-2 - January 2, 2009.

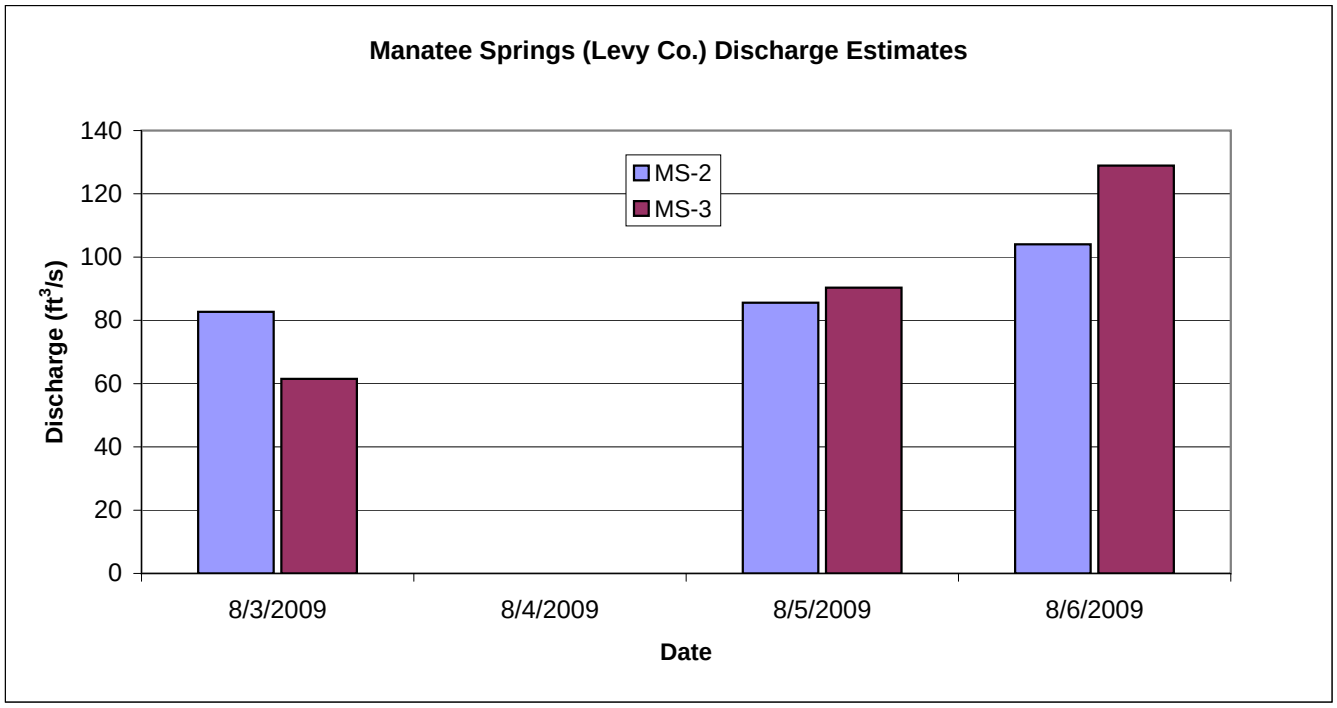
Withlacoochee below spring flood stage. Staff gage (by stairs) was 10.82' during measurements.

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0		0.00										
	2.0	3.0	1.55		-0.09		4.65	-0.42	-1024	-0.27	-2.74	-0.28%	0.01
	4.0	2.0	2.02		-0.15		4.04	-0.61	-1483	-0.39	-4.57	-0.41%	0.02
	6.0	2.0	1.88		0.13		3.76	0.49	1196	0.32	3.96	0.33%	0.01
	8.0	2.0	2.00		1.59		4.00	6.36	15560	4.11	48.46	4.27%	2.07
	10.0	2.0	4.18	2.02		0.47	8.36	10.41	25464	6.73	61.57	6.99%	4.31
	12.0	2.0	4.90	2.07		0.21	9.80	11.17	27333	7.22	63.09	7.51%	4.74
	14.0	2.0	4.97	2.08		0.41	9.94	12.38	30277	8.00	63.40	8.32%	5.27
	16.0	2.0	5.45	1.93		1.04	10.90	16.19	39602	10.46	58.83	10.88%	6.40
	18.0	2.0	5.84	1.83		1.48	11.68	19.33	47293	12.49	55.78	12.99%	7.25
	20.0	2.0	5.62	1.86		1.10	11.24	16.64	40699	10.75	56.69	11.18%	6.34
	22.0	2.0	4.73	1.88		1.70	9.46	16.93	41429	10.94	57.30	11.38%	6.52
	24.0	2.0	4.14	1.95		0.24	8.28	9.07	22182	5.86	59.44	6.09%	3.62
	26.0	2.0	3.12	1.86		1.38	6.24	10.11	24732	6.53	56.69	6.79%	3.85
	28.0	2.0	2.51		1.57		5.02	7.88	19282	5.09	47.85	5.30%	2.53
	30.0	4.0	1.75		1.84		7.00	12.88	31512	8.32	56.08	8.66%	4.85
End	33.0		0.00										
		33.0	3.22	1.94	0.82	0.89	114.37	148.80	364056	96.18	45.46	100%	57.79
			(cm/s)	59.20	24.84	27.19							



APPENDIX C
Manatee Springs Cross Sectional Flow Summaries - August 3, 5, and 6, 2009.

Date	Location	Segment Width (ft.)	Average Depth (ft.)	Velocity (ft/s)			Discharge		
				0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
8/3/2009	MS-2	87.0	3.77	0.28	-0.01	0.24	82.7	202,300	53.4
8/5/2009	MS-2	83.0	3.82	0.34	0.01	0.23	85.6	209,423	55.3
8/6/2009	MS-2	83.0	3.58	0.41	0.05	0.34	104.1	254,571	67.3
Average MS-2 Values		**84.3**	**3.72**	**0.34**	**0.02**	**0.27**	**90.8**	**222,098**	**58.7**
8/3/2009	MS-3	85.0	4.69	0.12	0.03	0.16	61.5	150,510	39.8
8/5/2009	MS-3	114.0	3.91	0.20	-0.02	0.19	90.3	220,965	58.4
8/6/2009	MS-3	86.0	4.07	0.35	0.10	0.37	128.9	315,400	83.3
Average MS-3 Values		**95.0**	**4.22**	**0.22**	**0.04**	**0.24**	**93.6**	**228,958**	**60.5**



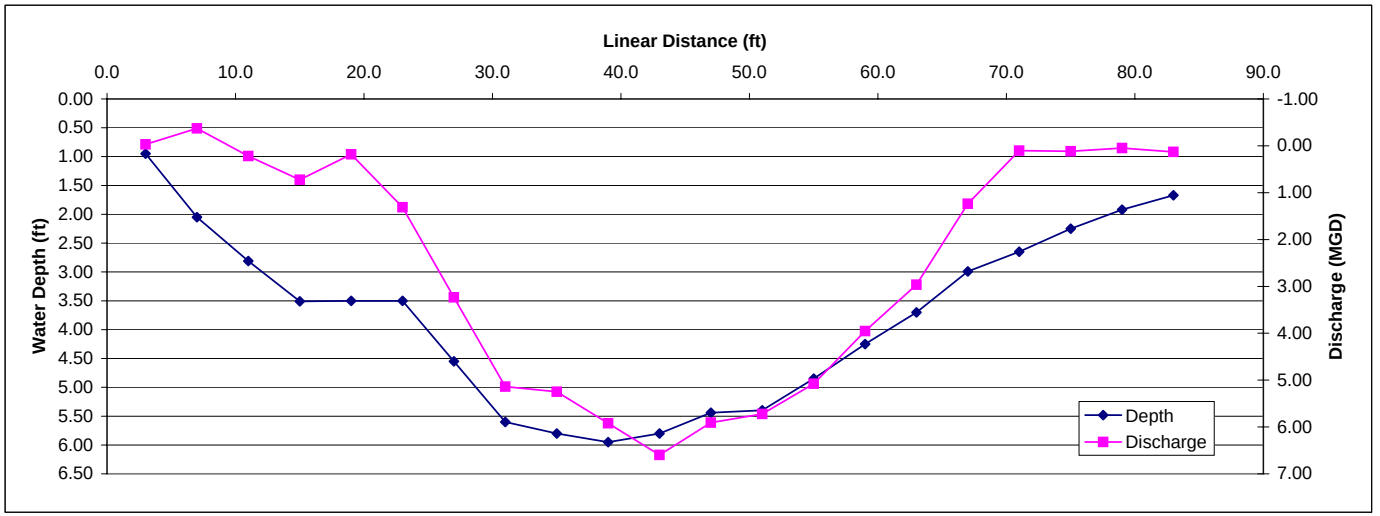


APPENDIX C
Manatee Springs (Levy Co.) discharge measurement locations.

APPENDIX C

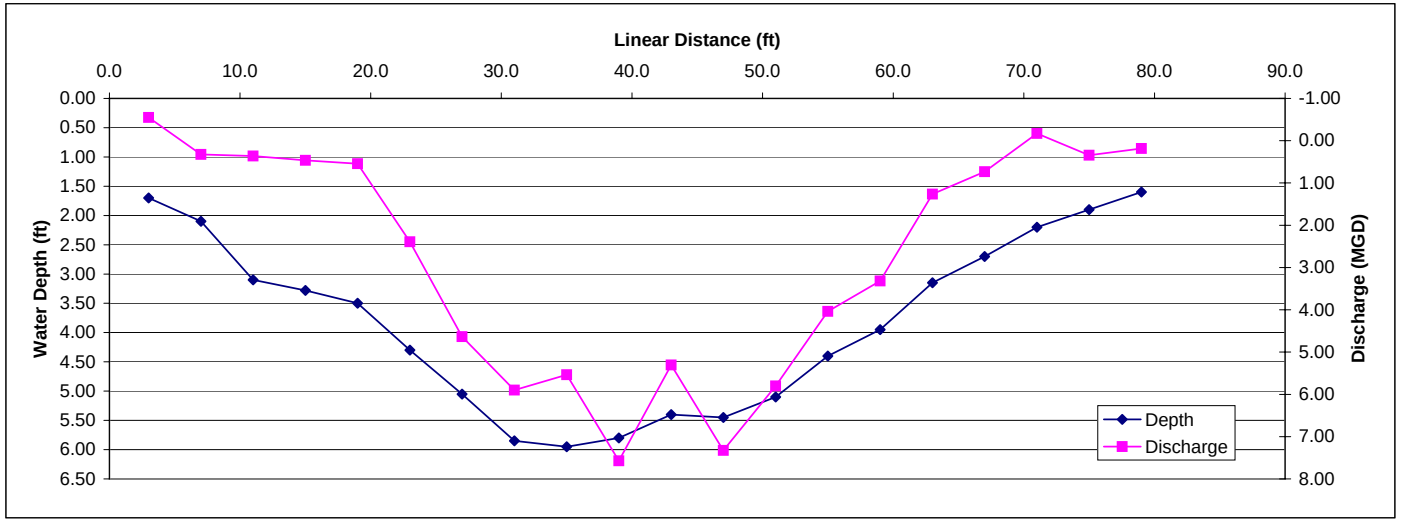
Manatee Cross Sectional Flow at MS-2 on August 3, 2009 at 14:30 (stage 2.62 ft).

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	3.0	5.0	0.95		-0.01		4.75	-0.05	-116	-0.03	-0.30	-0.06%	0.00
	7.0	4.0	2.05		-0.07		8.20	-0.57	-1404	-0.37	-2.13	-0.69%	0.01
	11.0	4.0	2.81	0.02		0.04	11.24	0.34	825	0.22	0.61	0.41%	0.00
	15.0	4.0	3.51	0.09		0.07	14.04	1.12	2748	0.73	2.74	1.36%	0.04
	19.0	4.0	3.50	0.01		0.03	14.00	0.28	685	0.18	0.30	0.34%	0.00
	23.0	4.0	3.50	0.14		0.15	14.00	2.03	4967	1.31	4.27	2.46%	0.10
	27.0	4.0	4.55	0.23		0.32	18.20	5.01	12245	3.23	7.01	6.05%	0.42
	31.0	4.0	5.60	0.38		0.33	22.40	7.95	19455	5.14	11.58	9.62%	1.11
	35.0	4.0	5.80	0.39		0.31	23.20	8.12	19866	5.25	11.89	9.82%	1.17
	39.0	4.0	5.95	0.39		0.38	23.80	9.16	22418	5.92	11.89	11.08%	1.32
	43.0	4.0	5.80	0.45		0.43	23.20	10.21	24975	6.60	13.72	12.35%	1.69
	47.0	4.0	5.44	0.52		0.32	21.76	9.14	22360	5.91	15.85	11.05%	1.75
	51.0	4.0	5.40	0.44		0.38	21.60	8.86	21667	5.72	13.41	10.71%	1.44
	55.0	4.0	4.85	0.44		0.37	19.40	7.86	19223	5.08	13.41	9.50%	1.27
	59.0	4.0	4.25	0.44		0.28	17.00	6.12	14973	3.96	13.41	7.40%	0.99
	63.0	4.0	3.70	0.31		0.31	14.80	4.59	11225	2.97	9.45	5.55%	0.52
	67.0	4.0	2.99	0.22		0.10	11.96	1.91	4682	1.24	6.71	2.31%	0.16
	71.0	4.0	2.65	0.01		0.02	10.60	0.16	389	0.10	0.30	0.19%	0.00
	75.0	4.0	2.25		0.02		9.00	0.18	440	0.12	0.61	0.22%	0.00
	79.0	4.0	1.92		0.01		7.68	0.08	188	0.05	0.30	0.09%	0.00
	83.0	6.0	1.67		0.02		10.02	0.20	490	0.13	0.61	0.24%	0.00
End	87.0												
		87.0	3.77	0.28	-0.01	0.24	320.85	82.69	202300	53.44	6.46	100%	12.01
			(cm/s)	8.53	-0.18	7.32							



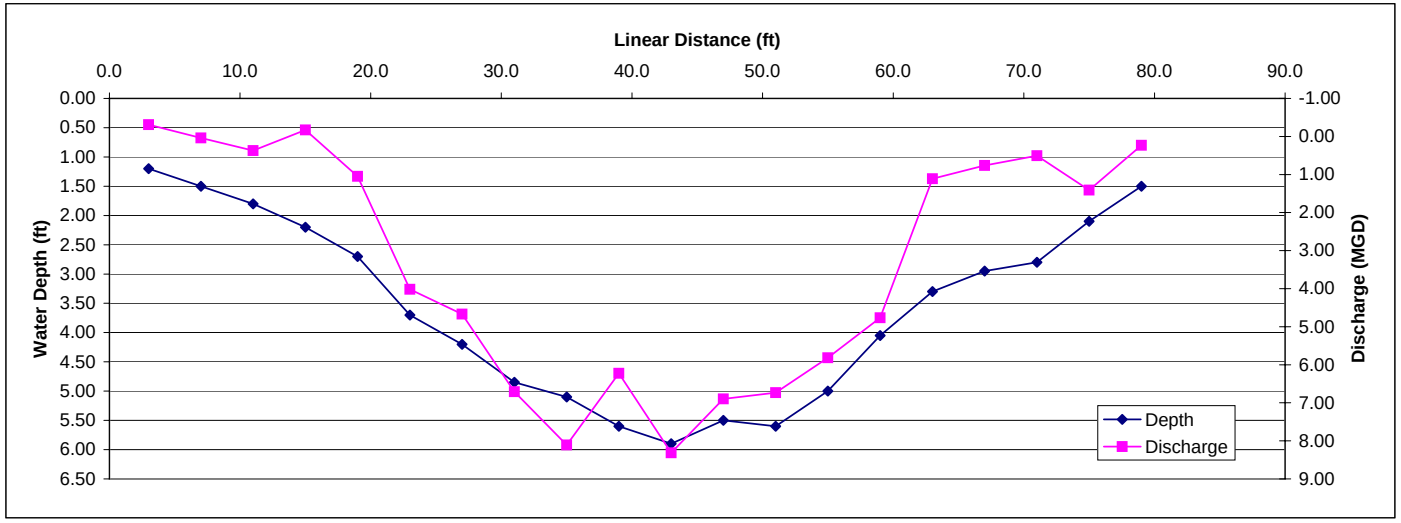
APPENDIX C
Manatee Cross Sectional Flow at MS-2 on August 5, 2009 at 14:05 (stage 2.58 ft)

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	3.0	5.0	1.70		-0.10		8.50	-0.85	-2080	-0.55	-3.05	-0.99%	0.03
	7.0	4.0	2.10		0.06		8.40	0.50	1233	0.33	1.83	0.59%	0.01
	11.0	4.0	3.10	0.07		0.02	12.40	0.56	1365	0.36	2.13	0.65%	0.01
	15.0	4.0	3.28	-0.01		0.12	13.12	0.72	1765	0.47	-0.30	0.84%	0.00
	19.0	4.0	3.50	0.10		0.02	14.00	0.84	2055	0.54	3.05	0.98%	0.03
	23.0	4.0	4.30	0.19		0.24	17.20	3.70	9047	2.39	5.79	4.32%	0.25
	27.0	4.0	5.05	0.41		0.30	20.20	7.17	17544	4.63	12.50	8.38%	1.05
	31.0	4.0	5.85	0.47		0.31	23.40	9.13	22327	5.90	14.33	10.66%	1.53
	35.0	4.0	5.95	0.40		0.32	23.80	8.57	20962	5.54	12.19	10.01%	1.22
	39.0	4.0	5.80	0.53		0.48	23.20	11.72	28664	7.57	16.15	13.69%	2.21
	43.0	4.0	5.40	0.46		0.30	21.60	8.21	20081	5.31	14.02	9.59%	1.34
	47.0	4.0	5.45	0.57		0.47	21.80	11.34	27734	7.33	17.37	13.24%	2.30
	51.0	4.0	5.10	0.49		0.39	20.40	8.98	21960	5.80	14.94	10.49%	1.57
	55.0	4.0	4.40	0.43		0.28	17.60	6.25	15286	4.04	13.11	7.30%	0.96
	59.0	4.0	3.95	0.42		0.23	15.80	5.14	12563	3.32	12.80	6.00%	0.77
	63.0	4.0	3.15	0.29		0.02	12.60	1.95	4778	1.26	8.84	2.28%	0.20
	67.0	4.0	2.70	0.21		0.00	10.80	1.13	2774	0.73	6.40	1.32%	0.08
	71.0	4.0	2.20		-0.03		8.80	-0.26	-646	-0.17	-0.91	-0.31%	0.00
	75.0	4.0	1.90		0.07		7.60	0.53	1302	0.34	2.13	0.62%	0.01
	79.0	6.0	1.60		0.03		9.60	0.29	705	0.19	0.91	0.34%	0.00
End	83.0												
		83.0	3.82	0.34	0.01	0.23	310.82	85.60	209423	55.32	7.71	100%	13.58
			(cm/s)	10.22	0.18	7.11							



APPENDIX C
Manatee Cross Sectional Flow at MS-2 on August 6, 2009 at 14:36 (stage 2.30 ft)

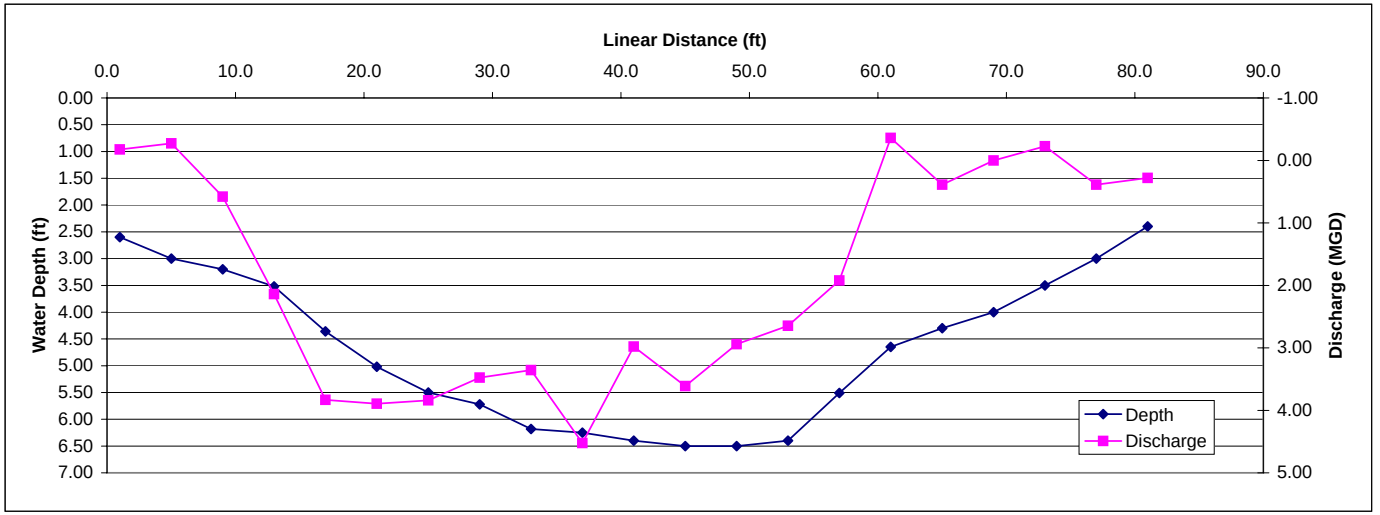
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	3.0	5.0	1.20		-0.08		6.00	-0.48	-1174	-0.31	-2.44	-0.46%	0.01
	7.0	4.0	1.50		0.01		6.00	0.06	147	0.04	0.30	0.06%	0.00
	11.0	4.0	1.80		0.08		7.20	0.58	1409	0.37	2.44	0.55%	0.01
	15.0	4.0	2.20		-0.03		8.80	-0.26	-646	-0.17	-0.91	-0.25%	0.00
	19.0	4.0	2.70	0.23		0.07	10.80	1.62	3963	1.05	7.01	1.56%	0.11
	23.0	4.0	3.70	0.54		0.30	14.80	6.22	15208	4.02	16.46	5.97%	0.98
	27.0	4.0	4.20	0.46		0.40	16.80	7.22	17674	4.67	14.02	6.94%	0.97
	31.0	4.0	4.85	0.51		0.56	19.40	10.38	25393	6.71	15.54	9.97%	1.55
	35.0	4.0	5.10	0.64		0.59	20.40	12.55	30695	8.11	19.51	12.06%	2.35
	39.0	4.0	5.60	0.47		0.39	22.40	9.63	23565	6.23	14.33	9.26%	1.33
	43.0	4.0	5.90	0.68		0.41	23.60	12.86	31468	8.31	20.73	12.36%	2.56
	47.0	4.0	5.50	0.54		0.43	22.00	10.67	26105	6.90	16.46	10.25%	1.69
	51.0	4.0	5.60	0.50		0.43	22.40	10.42	25484	6.73	15.24	10.01%	1.53
	55.0	4.0	5.00	0.39		0.51	20.00	9.00	22019	5.82	11.89	8.65%	1.03
	59.0	4.0	4.05	0.46		0.45	16.20	7.37	18034	4.76	14.02	7.08%	0.99
	63.0	4.0	3.30	0.17		0.09	13.20	1.72	4198	1.11	5.18	1.65%	0.09
	67.0	4.0	2.95	0.13		0.07	11.80	1.18	2887	0.76	3.96	1.13%	0.04
	71.0	4.0	2.80	0.07		0.07	11.20	0.78	1918	0.51	2.13	0.75%	0.02
	75.0	4.0	2.10		0.26		8.40	2.18	5343	1.41	7.92	2.10%	0.17
	79.0	6.0	1.50		0.04		9.00	0.36	881	0.23	1.22	0.35%	0.00
End	83.0												
		83.0	3.58	0.41	0.05	0.34	290.40	104.05	254571	67.25	9.25	100%	15.44
			(cm/s)	12.61	1.42	10.38							



APPENDIX C

Manatee Cross Sectional Flow at MS-3 on August 3, 2009 at 15:03 (staff 3.02 ft).

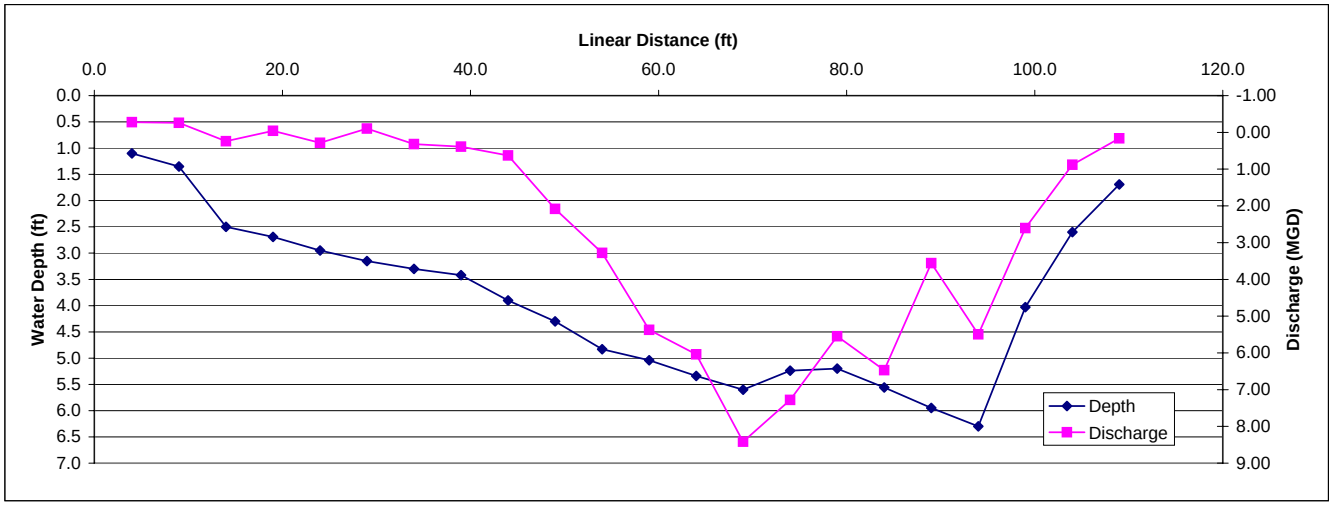
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	1.0	3.0	2.60	-0.04		-0.03	7.80	-0.27	-668	-0.18	-1.22	-0.44%	0.01
	5.0	4.0	3.00	-0.03		-0.04	12.00	-0.42	-1028	-0.27	-0.91	-0.68%	0.01
	9.0	4.0	3.20	0.03		0.11	12.80	0.90	2192	0.58	0.91	1.46%	0.01
	13.0	4.0	3.52	0.25		0.22	14.08	3.31	8095	2.14	7.62	5.38%	0.41
	17.0	4.0	4.36	0.36		0.32	17.44	5.93	14507	3.83	10.97	9.64%	1.06
	21.0	4.0	5.02	0.31		0.29	20.08	6.02	14738	3.89	9.45	9.79%	0.93
	25.0	4.0	5.50	0.24		0.30	22.00	5.94	14533	3.84	7.32	9.66%	0.71
	29.0	4.0	5.72	0.29		0.18	22.88	5.38	13155	3.48	8.84	8.74%	0.77
	33.0	4.0	6.18	0.27		0.15	24.72	5.19	12701	3.36	8.23	8.44%	0.69
	37.0	4.0	6.25	0.28		0.28	25.00	7.00	17126	4.52	8.53	11.38%	0.97
	41.0	4.0	6.40	0.04		0.32	25.60	4.61	11274	2.98	1.22	7.49%	0.09
	45.0	4.0	6.50	0.16		0.27	26.00	5.59	13676	3.61	4.88	9.09%	0.44
	49.0	4.0	6.50	0.13		0.22	26.00	4.55	11132	2.94	3.96	7.40%	0.29
	53.0	4.0	6.40	0.14		0.18	25.60	4.10	10021	2.65	4.27	6.66%	0.28
	57.0	4.0	5.51	0.10		0.17	22.04	2.98	7280	1.92	3.05	4.84%	0.15
	61.0	4.0	4.65	-0.10		0.04	18.60	-0.56	-1365	-0.36	-3.05	-0.91%	0.03
	65.0	4.0	4.30	0.04		0.03	17.20	0.60	1473	0.39	1.22	0.98%	0.01
	69.0	4.0	4.00	-0.08		0.08	16.00	0.00	0	0.00	-2.44	0.00%	0.00
	73.0	4.0	3.50	-0.09		0.04	14.00	-0.35	-856	-0.23	-2.74	-0.57%	0.02
	77.0	4.0	3.00	0.00		0.10	12.00	0.60	1468	0.39	0.00	0.98%	0.00
	81.0	6.0	2.40		0.03		14.40	0.43	1057	0.28	0.91	0.70%	0.01
End	85.0												
		85.0	4.69	0.12	0.03	0.16	396.24	61.52	150510	39.76	3.38	100%	6.88
			(cm/s)	3.51	0.91	4.92							



APPENDIX C

Manatee Cross Sectional Flow at MS-3 on August 5, 2009 at 14:05 (staff 2.58 ft).

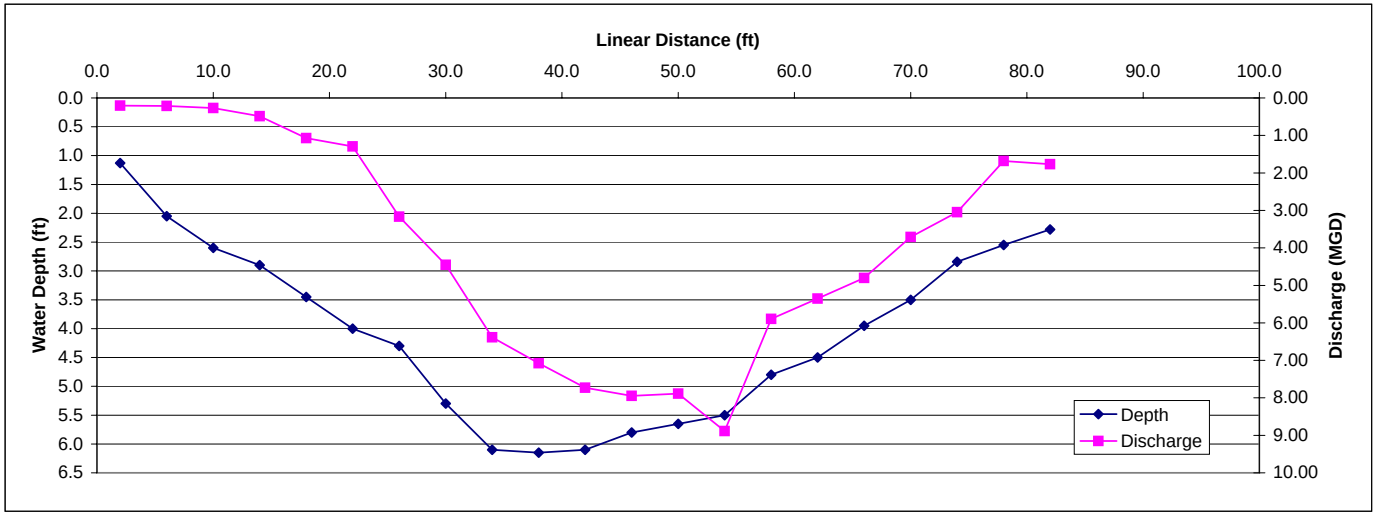
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	4.0	6.5	1.10		-0.06		7.15	-0.43	-1050	-0.28	-1.83	-0.47%	0.01
	9.0	5.0	1.35		-0.06		6.75	-0.41	-991	-0.26	-1.83	-0.45%	0.01
	14.0	5.0	2.50		0.03		12.50	0.38	917	0.24	0.91	0.42%	0.00
	19.0	5.0	2.69	0.01		-0.02	13.45	-0.07	-165	-0.04	0.30	-0.07%	0.00
	24.0	5.0	2.95	0.00		0.06	14.75	0.44	1083	0.29	0.00	0.49%	0.00
	29.0	5.0	3.15	-0.03		0.01	15.75	-0.16	-385	-0.10	-0.91	-0.17%	0.00
	34.0	5.0	3.30	-0.03		0.09	16.50	0.50	1211	0.32	-0.91	0.55%	-0.01
	39.0	5.0	3.42	0.10		-0.03	17.10	0.60	1464	0.39	3.05	0.66%	0.02
	44.0	5.0	3.90	0.05		0.05	19.50	0.98	2385	0.63	1.52	1.08%	0.02
	49.0	5.0	4.30	0.17		0.13	21.50	3.23	7890	2.08	5.18	3.57%	0.19
	54.0	5.0	4.83	0.15		0.27	24.15	5.07	12408	3.28	4.57	5.62%	0.26
	59.0	5.0	5.04	0.30		0.36	25.20	8.32	20346	5.37	9.14	9.21%	0.84
	64.0	5.0	5.34	0.38		0.32	26.70	9.35	22863	6.04	11.58	10.35%	1.20
	69.0	5.0	5.60	0.43		0.50	28.00	13.02	31854	8.42	13.11	14.42%	1.89
	74.0	5.0	5.24	0.44		0.42	26.20	11.27	27563	7.28	13.41	12.47%	1.67
	79.0	5.0	5.20	0.41		0.25	26.00	8.58	20992	5.55	12.50	9.50%	1.19
	84.0	5.0	5.56	0.35		0.37	27.80	10.01	24485	6.47	10.67	11.08%	1.18
	89.0	5.0	5.95	0.20		0.17	29.75	5.50	13465	3.56	6.10	6.09%	0.37
	94.0	5.0	6.30	0.30		0.24	31.50	8.51	20808	5.50	9.14	9.42%	0.86
	99.0	5.0	4.03	0.22		0.18	20.15	4.03	9860	2.60	6.71	4.46%	0.30
	104.0	5.0	2.60	0.12		0.09	13.00	1.37	3340	0.88	3.66	1.51%	0.06
	109.0	7.5	1.69		0.02		12.68	0.25	620	0.16	0.61	0.28%	0.00
End	114.0												
		114.0	3.91	0.20	-0.02	0.19	436.08	90.32	220965	58.37	4.85	100%	10.06
			(cm/s)	6.05	-0.53	5.86							



APPENDIX C

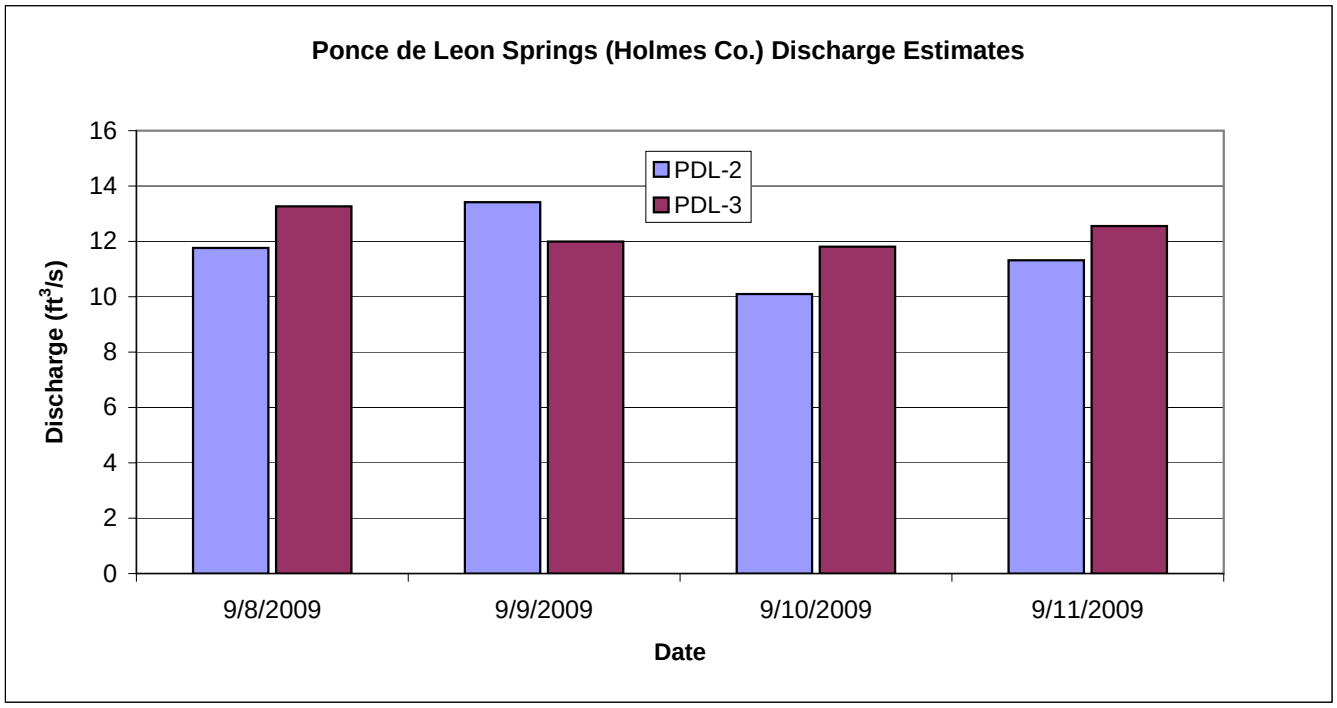
Manatee Cross Sectional Flow at MS-3 on August 6, 2009 at 13:35.

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	4.0	1.13		0.07		4.52	0.32	774	0.20	2.13	0.25%	0.01
	6.0	4.0	2.05		0.04		8.20	0.33	802	0.21	1.22	0.25%	0.00
	10.0	4.0	2.60	0.03		0.05	10.40	0.42	1018	0.27	0.91	0.32%	0.00
	14.0	4.0	2.90	0.05		0.08	11.60	0.75	1845	0.49	1.52	0.58%	0.01
	18.0	4.0	3.45	0.03		0.21	13.80	1.66	4052	1.07	0.91	1.28%	0.01
	22.0	4.0	4.00	0.15		0.10	16.00	2.00	4893	1.29	4.57	1.55%	0.07
	26.0	4.0	4.30	0.32		0.25	17.20	4.90	11993	3.17	9.75	3.80%	0.37
	30.0	4.0	5.30	0.39		0.26	21.20	6.89	16857	4.45	11.89	5.34%	0.64
	34.0	4.0	6.10	0.42		0.39	24.40	9.88	24177	6.39	12.80	7.67%	0.98
	38.0	4.0	6.15	0.36		0.53	24.60	10.95	26783	7.08	10.97	8.49%	0.93
	42.0	4.0	6.10	0.38		0.60	24.40	11.96	29251	7.73	11.58	9.27%	1.07
	46.0	4.0	5.80	0.54		0.52	23.20	12.30	30083	7.95	16.46	9.54%	1.57
	50.0	4.0	5.65	0.56		0.52	22.60	12.20	29858	7.89	17.07	9.47%	1.62
	54.0	4.0	5.50	0.51		0.74	22.00	13.75	33640	8.89	15.54	10.67%	1.66
	58.0	4.0	4.80	0.48		0.47	19.20	9.12	22313	5.89	14.63	7.07%	1.04
	62.0	4.0	4.50	0.49		0.43	18.00	8.28	20258	5.35	14.94	6.42%	0.96
	66.0	4.0	3.95	0.51		0.43	15.80	7.43	18168	4.80	15.54	5.76%	0.90
	70.0	4.0	3.50	0.42		0.40	14.00	5.74	14043	3.71	12.80	4.45%	0.57
	74.0	4.0	2.84	0.36		0.47	11.36	4.71	11534	3.05	10.97	3.66%	0.40
	78.0	4.0	2.55	0.24		0.27	10.20	2.60	6364	1.68	7.32	2.02%	0.15
	82.0	6.0	2.28		0.20		13.68	2.74	6694	1.77	6.10	2.12%	0.13
End	86.0												
		86.0	4.07	0.35	0.10	0.37	346.36	128.91	315400	83.32	9.51	100%	13.08
			(cm/s)	10.57	3.15	11.38							



APPENDIX C
Ponce de Leon Springs Cross Sectional Flow Summaries - September 8 to 11, 2009.

Date	Location	Segment Width	Average Depth	Velocity (ft/s)			Discharge		
		(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
9/8/2009	PDL-2	31.5	1.85	0.23	0.13	0.25	11.8	28,785	7.6
9/9/2009	PDL-2	31.5	1.83	0.27	0.14	0.25	13.4	32,817	8.7
9/10/2009	PDL-2	30.5	1.83	0.21	0.09	0.24	10.1	24,701	6.5
9/11/2009	PDL-2	30.9	1.81	0.24	0.12	0.25	11.3	27,687	7.3
Average PDL-2 Values		**31.1**	**1.83**	**0.24**	**0.12**	**0.25**	**11.6**	**28,497**	**7.5**
9/8/2009	PDL-3	36.0	1.97	0.25	0.15	0.26	13.3	32,459	8.6
9/9/2009	PDL-3	35.5	1.69	*n/a*	0.18	*n/a*	12.0	29,348	7.8
9/10/2009	PDL-3	35.2	1.46	*n/a*	0.18	*n/a*	11.8	28,895	7.6
9/11/2009	PDL-3	34.8	1.41	*n/a*	0.21	*n/a*	12.6	30,711	8.1
Average PDL-3 Values		**35.4**	**1.63**	**0.25**	**0.18**	**0.26**	**12.4**	**30,353**	**8.0**



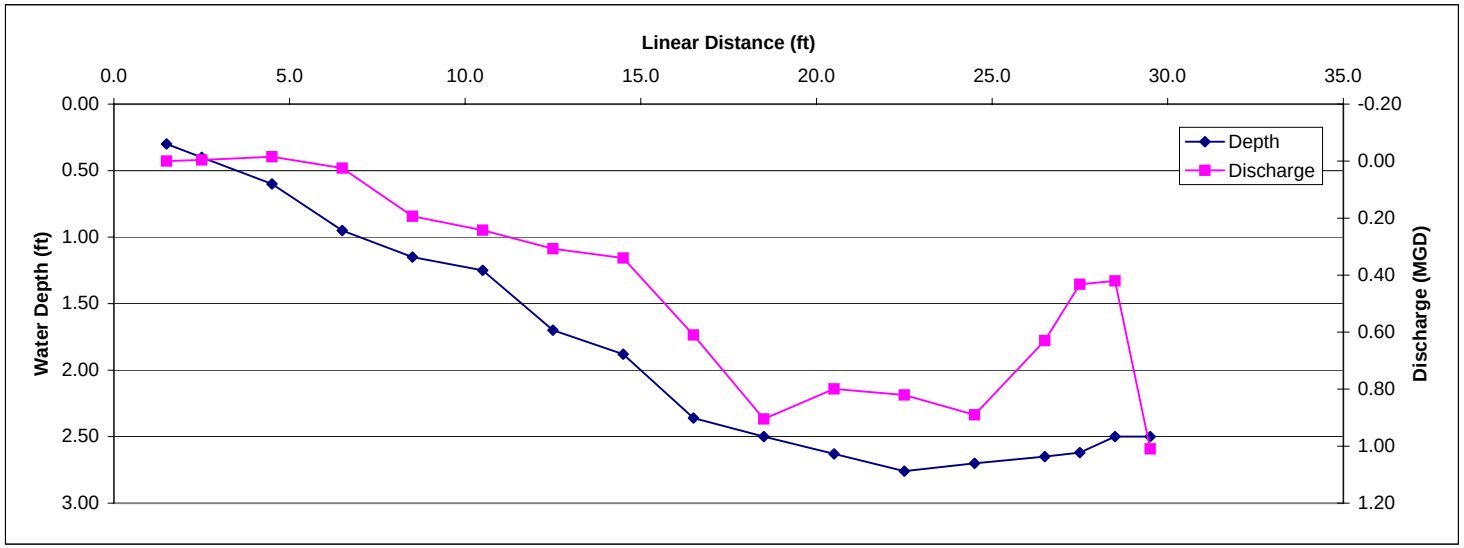


APPENDIX C
Ponce de Leon Springs (Holmes Co.) discharge measurement locations.

APPENDIX C

Ponce de Leon Cross Sectional Flow at PDL-2 on September 8, 2009 at 13:49.

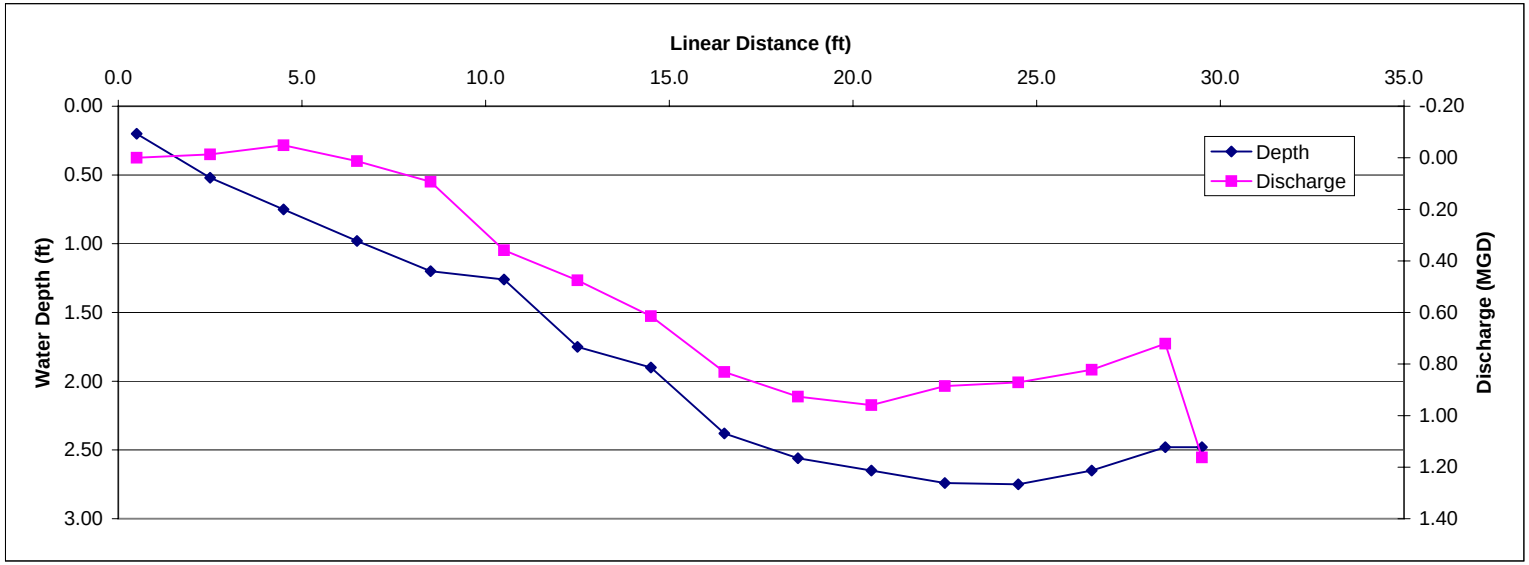
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	1.5	2.0	0.30		0.00		0.60	0.00	0	0.00	0.00	0.00%	0.00
	2.5	1.5	0.40		-0.01		0.60	-0.01	-15	0.00	-0.30	-0.05%	0.00
	4.5	2.0	0.60		-0.02		1.20	-0.02	-59	-0.02	-0.61	-0.20%	0.00
	6.5	2.0	0.95		0.02		1.90	0.04	93	0.02	0.61	0.32%	0.00
	8.5	2.0	1.15		0.13		2.30	0.30	732	0.19	3.96	2.54%	0.10
	10.5	2.0	1.25		0.15		2.50	0.38	917	0.24	4.57	3.19%	0.15
	12.5	2.0	1.70		0.14		3.40	0.48	1165	0.31	4.27	4.05%	0.17
	14.5	2.0	1.88		0.14		3.76	0.53	1288	0.34	4.27	4.47%	0.19
	16.5	2.0	2.36		0.20		4.72	0.94	2310	0.61	6.10	8.02%	0.49
	18.5	2.0	2.50		0.28		5.00	1.40	3425	0.90	8.53	11.90%	1.02
	20.5	2.0	2.63	0.24		0.23	5.26	1.24	3024	0.80	7.32	10.51%	0.77
	22.5	2.0	2.76	0.22		0.24	5.52	1.27	3106	0.82	6.71	10.79%	0.72
	24.5	2.0	2.70	0.23		0.28	5.40	1.38	3369	0.89	7.01	11.70%	0.82
	26.5	1.5	2.65	0.22		0.27	3.98	0.97	2383	0.63	6.71	8.28%	0.56
	27.5	1.0	2.62	0.26		0.25	2.62	0.67	1635	0.43	7.92	5.68%	0.45
	28.5	1.0	2.50		0.26		2.50	0.65	1590	0.42	7.92	5.52%	0.44
	29.5	2.5	2.50		0.25		6.25	1.56	3823	1.01	7.62	13.28%	1.01
End	31.5												
		31.5	1.85	0.23	0.13	0.25	57.51	11.77	28785	7.60	4.86	100%	6.89
			(cm/s)	7.13	3.91	7.74							



APPENDIX C

Ponce de Leon Cross Sectional Flow at PDL-2 on September 9, 2009 at 12:45.

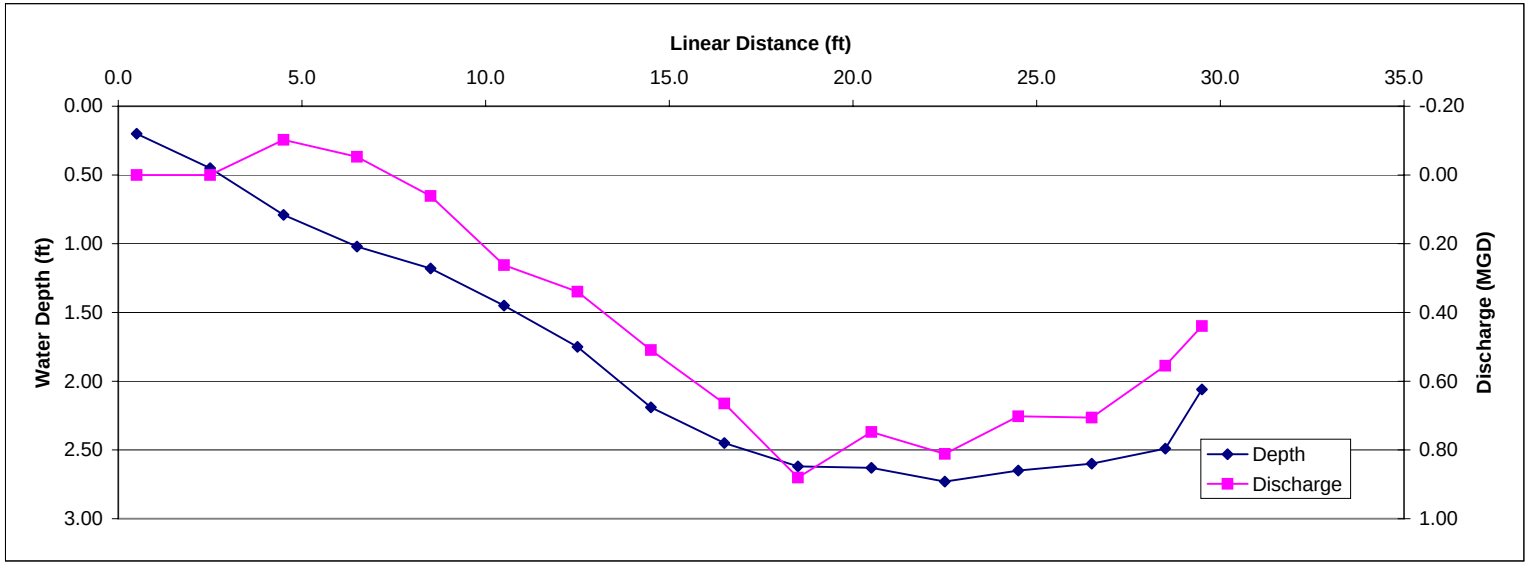
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	0.5	1.5	0.20		0.00		0.30	0.00	0	0.00	0.00	0.00%	0.00
	2.5	2.0	0.52		-0.02		1.04	-0.02	-51	-0.01	-0.61	-0.16%	0.00
	4.5	2.0	0.75		-0.05		1.50	-0.08	-183	-0.05	-1.52	-0.56%	0.01
	6.5	2.0	0.98		0.01		1.96	0.02	48	0.01	0.30	0.15%	0.00
	8.5	2.0	1.20		0.06		2.40	0.14	352	0.09	1.83	1.07%	0.02
	10.5	2.0	1.26		0.22		2.52	0.55	1356	0.36	6.71	4.13%	0.28
	12.5	2.0	1.75		0.21		3.50	0.74	1798	0.48	6.40	5.48%	0.35
	14.5	2.0	1.90		0.25		3.80	0.95	2324	0.61	7.62	7.08%	0.54
	16.5	2.0	2.38		0.27		4.76	1.29	3144	0.83	8.23	9.58%	0.79
	18.5	2.0	2.56	0.28		0.28	5.12	1.43	3507	0.93	8.53	10.69%	0.91
	20.5	2.0	2.65	0.30		0.26	5.30	1.48	3631	0.96	9.14	11.06%	1.01
	22.5	2.0	2.74	0.25		0.25	5.48	1.37	3352	0.89	7.62	10.21%	0.78
	24.5	2.0	2.75	0.25		0.24	5.50	1.35	3297	0.87	7.62	10.05%	0.77
	26.5	2.0	2.65	0.25		0.23	5.30	1.27	3112	0.82	7.62	9.48%	0.72
	28.5	1.5	2.48		0.30		3.72	1.12	2730	0.72	9.14	8.32%	0.76
	29.5	2.5	2.48		0.29		6.20	1.80	4399	1.16	8.84	13.40%	1.18
End	31.5												
		31.5	1.83	0.27	0.14	0.25	58.40	13.41	32817	8.67	5.47	100%	8.12
			(cm/s)	8.11	4.27	7.68							



APPENDIX C

Ponce de Leon Cross Sectional Flow at PDL-2 on September 10, 2009 at 10:58.

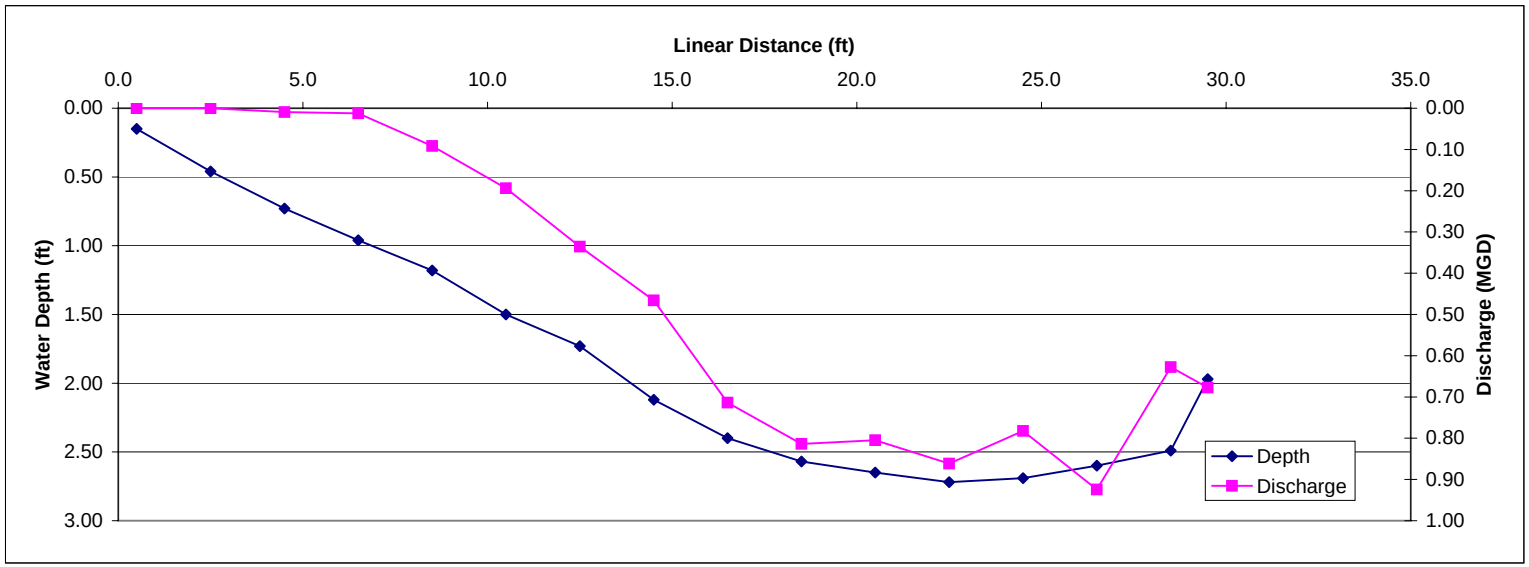
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	0.5	1.5	0.20		0.00		0.30	0.00	0	0.00	0.00	0.00%	0.00
	2.5	2.0	0.45		0.00		0.90	0.00	0	0.00	0.00	0.00%	0.00
	4.5	2.0	0.79		-0.10		1.58	-0.16	-387	-0.10	-3.05	-1.56%	0.05
	6.5	2.0	1.02		-0.04		2.04	-0.08	-200	-0.05	-1.22	-0.81%	0.01
	8.5	2.0	1.18		0.04		2.36	0.09	231	0.06	1.22	0.94%	0.01
	10.5	2.0	1.45		0.14		2.90	0.41	993	0.26	4.27	4.02%	0.17
	12.5	2.0	1.75		0.15		3.50	0.53	1284	0.34	4.57	5.20%	0.24
	14.5	2.0	2.19		0.18		4.38	0.79	1929	0.51	5.49	7.81%	0.43
	16.5	2.0	2.45		0.21		4.90	1.03	2518	0.67	6.40	10.19%	0.65
	18.5	2.0	2.62	0.27		0.25	5.24	1.36	3333	0.88	8.23	13.49%	1.11
	20.5	2.0	2.63	0.21		0.23	5.26	1.16	2831	0.75	6.40	11.46%	0.73
	22.5	2.0	2.73	0.20		0.26	5.46	1.26	3072	0.81	6.10	12.44%	0.76
	24.5	2.0	2.65	0.19		0.22	5.30	1.09	2658	0.70	5.79	10.76%	0.62
	26.5	2.0	2.60	0.19		0.23	5.20	1.09	2672	0.71	5.79	10.82%	0.63
	28.5	1.5	2.49		0.23		3.74	0.86	2102	0.56	7.01	8.51%	0.60
	29.5	1.5	2.06		0.22		3.09	0.68	1663	0.44	6.71	6.73%	0.45
End	30.5												
		30.5	1.83	0.21	0.09	0.24	56.15	10.10	24701	6.53	3.98	100%	6.46
			(cm/s)	6.46	2.85	7.25							



APPENDIX C

Ponce de Leon Cross Sectional Flow at PDL-2 on September 11, 2009 at 10:00.

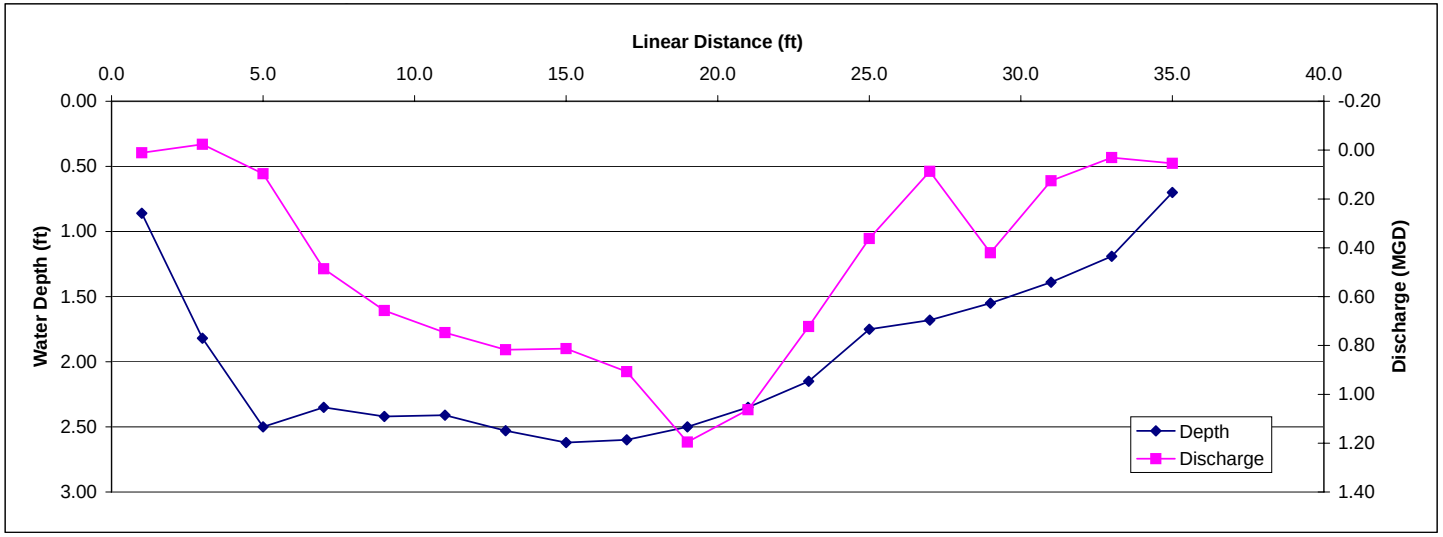
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	0.5	1.5	0.15		0.00		0.23	0.00	0	0.00	0.00	0.00%	0.00
	2.5	2.0	0.46		0.00		0.92	0.00	0	0.00	0.00	0.00%	0.00
	4.5	2.0	0.73		0.01		1.46	0.01	36	0.01	0.30	0.13%	0.00
	6.5	2.0	0.96		0.01		1.92	0.02	47	0.01	0.30	0.17%	0.00
	8.5	2.0	1.18		0.06		2.36	0.14	346	0.09	1.83	1.25%	0.02
	10.5	2.0	1.50		0.10		3.00	0.30	734	0.19	3.05	2.65%	0.08
	12.5	2.0	1.73		0.15		3.46	0.52	1270	0.34	4.57	4.59%	0.21
	14.5	2.0	2.12		0.17		4.24	0.72	1763	0.47	5.18	6.37%	0.33
	16.5	2.0	2.40		0.23		4.80	1.10	2701	0.71	7.01	9.76%	0.68
	18.5	2.0	2.57	0.25		0.24	5.14	1.26	3081	0.81	7.62	11.13%	0.85
	20.5	2.0	2.65	0.23		0.24	5.30	1.25	3047	0.81	7.01	11.01%	0.77
	22.5	2.0	2.72	0.25		0.24	5.44	1.33	3261	0.86	7.62	11.78%	0.90
	24.5	2.0	2.69	0.23		0.22	5.38	1.21	2962	0.78	7.01	10.70%	0.75
	26.5	2.0	2.60	0.26		0.29	5.20	1.43	3499	0.92	7.92	12.64%	1.00
	28.5	1.5	2.49		0.26		3.74	0.97	2376	0.63	7.92	8.58%	0.68
	29.5	1.9	1.97		0.28		3.74	1.05	2564	0.68	8.53	9.26%	0.79
End	30.9												
		30.9	1.81	0.24	0.12	0.25	56.32	11.32	27687	7.31	4.74	100%	7.07
			(cm/s)	7.44	3.52	7.50							



APPENDIX C

Ponce de Leon Cross Sectional Flow at PDL-3 on September 8, 2009 at 12:21.

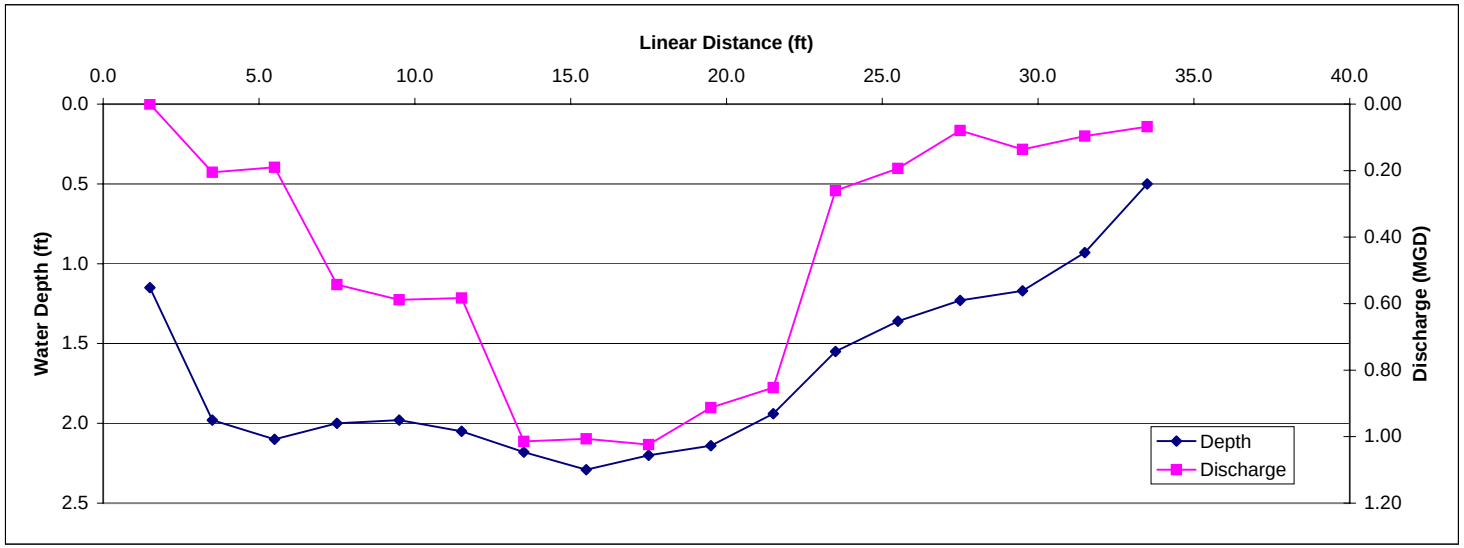
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	1.0	2.0	0.86		0.01		1.72	0.02	42	0.01	0.30	0.13%	0.00
	3.0	2.0	1.82		-0.01		3.64	-0.04	-89	-0.02	-0.30	-0.27%	0.00
	5.0	2.0	2.50		0.03		5.00	0.15	367	0.10	0.91	1.13%	0.01
	7.0	2.0	2.35		0.16		4.70	0.75	1840	0.49	4.88	5.67%	0.28
	9.0	2.0	2.42		0.21		4.84	1.02	2487	0.66	6.40	7.66%	0.49
	11.0	2.0	2.41		0.24		4.82	1.16	2830	0.75	7.32	8.72%	0.64
	13.0	2.0	2.53	0.23		0.27	5.06	1.27	3095	0.82	7.01	9.53%	0.67
	15.0	2.0	2.62	0.20		0.28	5.24	1.26	3077	0.81	6.10	9.48%	0.58
	17.0	2.0	2.60	0.32		0.22	5.20	1.40	3435	0.91	9.75	10.58%	1.03
	19.0	2.0	2.50		0.37		5.00	1.85	4526	1.20	11.28	13.94%	1.57
	21.0	2.0	2.35		0.35		4.70	1.65	4025	1.06	10.67	12.40%	1.32
	23.0	2.0	2.15		0.26		4.30	1.12	2735	0.72	7.92	8.43%	0.67
	25.0	2.0	1.75		0.16		3.50	0.56	1370	0.36	4.88	4.22%	0.21
	27.0	2.0	1.68		0.04		3.36	0.13	329	0.09	1.22	1.01%	0.01
	29.0	2.0	1.55		0.21		3.10	0.65	1593	0.42	6.40	4.91%	0.31
	31.0	2.0	1.39		0.07		2.78	0.19	476	0.13	2.13	1.47%	0.03
	33.0	2.0	1.19		0.02		2.38	0.05	116	0.03	0.61	0.36%	0.00
	35.0	2.0	0.70		0.06		1.40	0.08	206	0.05	1.83	0.63%	0.01
End	36.0												
		36.0	1.97	0.25	0.15	0.26	70.74	13.27	32459	8.57	4.96	100%	7.84
			(cm/s)	7.62	4.43	7.82							



APPENDIX C

Ponce de Leon Cross Sectional Flow at PDL-3 on September 9, 2009 at 15:38.

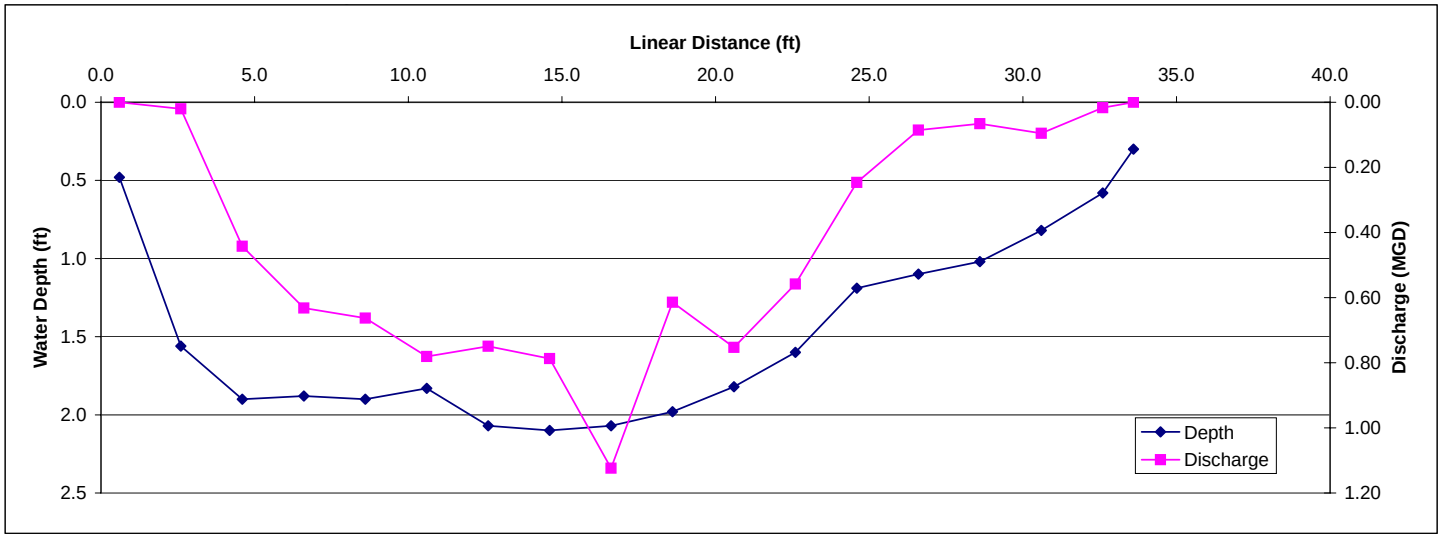
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	1.5	2.5	1.15		0.00		2.88	0.00	0	0.00	0.00	0.00%	0.00
	3.5	2.0	1.98		0.08		3.96	0.32	775	0.20	2.44	2.64%	0.06
	5.5	2.0	2.10		0.07		4.20	0.29	719	0.19	2.13	2.45%	0.05
	7.5	2.0	2.00		0.21		4.00	0.84	2055	0.54	6.40	7.00%	0.45
	9.5	2.0	1.98		0.23		3.96	0.91	2228	0.59	7.01	7.59%	0.53
	11.5	2.0	2.05		0.22		4.10	0.90	2207	0.58	6.71	7.52%	0.50
	13.5	2.0	2.18		0.36		4.36	1.57	3840	1.01	10.97	13.08%	1.44
	15.5	2.0	2.29		0.34		4.58	1.56	3810	1.01	10.36	12.98%	1.35
	17.5	2.0	2.20		0.36		4.40	1.58	3875	1.02	10.97	13.20%	1.45
	19.5	2.0	2.14		0.33		4.28	1.41	3456	0.91	10.06	11.77%	1.18
	21.5	2.0	1.94		0.34		3.88	1.32	3228	0.85	10.36	11.00%	1.14
	23.5	2.0	1.55		0.13		3.10	0.40	986	0.26	3.96	3.36%	0.13
	25.5	2.0	1.36		0.11		2.72	0.30	732	0.19	3.35	2.49%	0.08
	27.5	2.0	1.23		0.05		2.46	0.12	301	0.08	1.52	1.03%	0.02
	29.5	2.0	1.17		0.09		2.34	0.21	515	0.14	2.74	1.76%	0.05
	31.5	2.0	0.93		0.08		1.86	0.15	364	0.10	2.44	1.24%	0.03
	33.5	3.0	0.50		0.07		1.50	0.11	257	0.07	2.13	0.88%	0.02
End	35.5												
		35.5	1.69		0.18		58.58	12.00	29348	7.75	5.50	100%	8.48
			(cm/s)		5.50								



APPENDIX C

Ponce de Leon Cross Sectional Flow at PDL-3 on September 10, 2009 at 12:25.

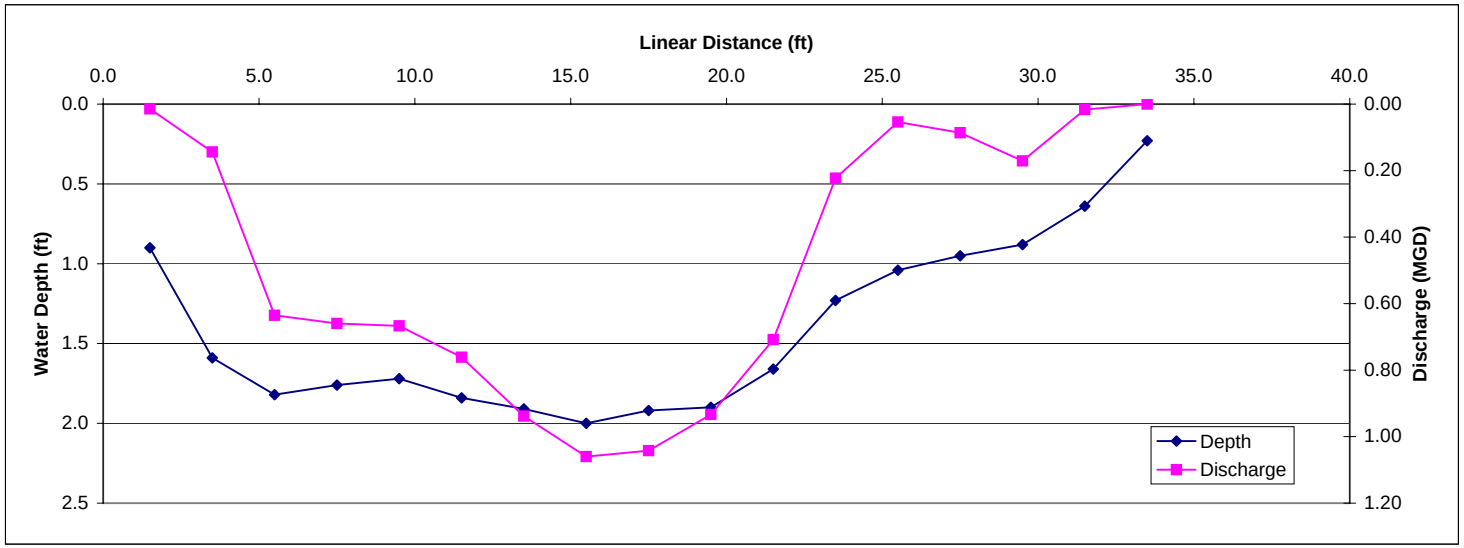
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	0.6	1.6	0.48		0.00		0.77	0.00	0	0.00	0.00	0.00%	0.00
	2.6	2.0	1.56		0.01		3.12	0.03	76	0.02	0.30	0.26%	0.00
	4.6	2.0	1.90		0.18		3.80	0.68	1673	0.44	5.49	5.79%	0.32
	6.6	2.0	1.88		0.26		3.76	0.98	2392	0.63	7.92	8.28%	0.66
	8.6	2.0	1.90		0.27		3.80	1.03	2510	0.66	8.23	8.69%	0.71
	10.6	2.0	1.83		0.33		3.66	1.21	2955	0.78	10.06	10.23%	1.03
	12.6	2.0	2.07		0.28		4.14	1.16	2836	0.75	8.53	9.82%	0.84
	14.6	2.0	2.10		0.29		4.20	1.22	2980	0.79	8.84	10.31%	0.91
	16.6	2.0	2.07		0.42		4.14	1.74	4254	1.12	12.80	14.72%	1.88
	18.6	2.0	1.98		0.24		3.96	0.95	2325	0.61	7.32	8.05%	0.59
	20.6	2.0	1.82		0.32		3.64	1.16	2850	0.75	9.75	9.86%	0.96
	22.6	2.0	1.60		0.27		3.20	0.86	2114	0.56	8.23	7.32%	0.60
	24.6	2.0	1.19		0.16		2.38	0.38	932	0.25	4.88	3.22%	0.16
	26.6	2.0	1.10		0.06		2.20	0.13	323	0.09	1.83	1.12%	0.02
	28.6	2.0	1.02		0.05		2.04	0.10	250	0.07	1.52	0.86%	0.01
	30.6	2.0	0.82		0.09		1.64	0.15	361	0.10	2.74	1.25%	0.03
	32.6	1.5	0.58		0.03		0.87	0.03	64	0.02	0.91	0.22%	0.00
	33.6	2.1	0.30		0.00		0.63	0.00	0	0.00	0.00	0.00%	0.00
End	35.2												
		35.2	1.46		0.18		51.95	11.81	28895	7.63	5.52	100%	8.73
			(cm/s)		5.52								



APPENDIX C

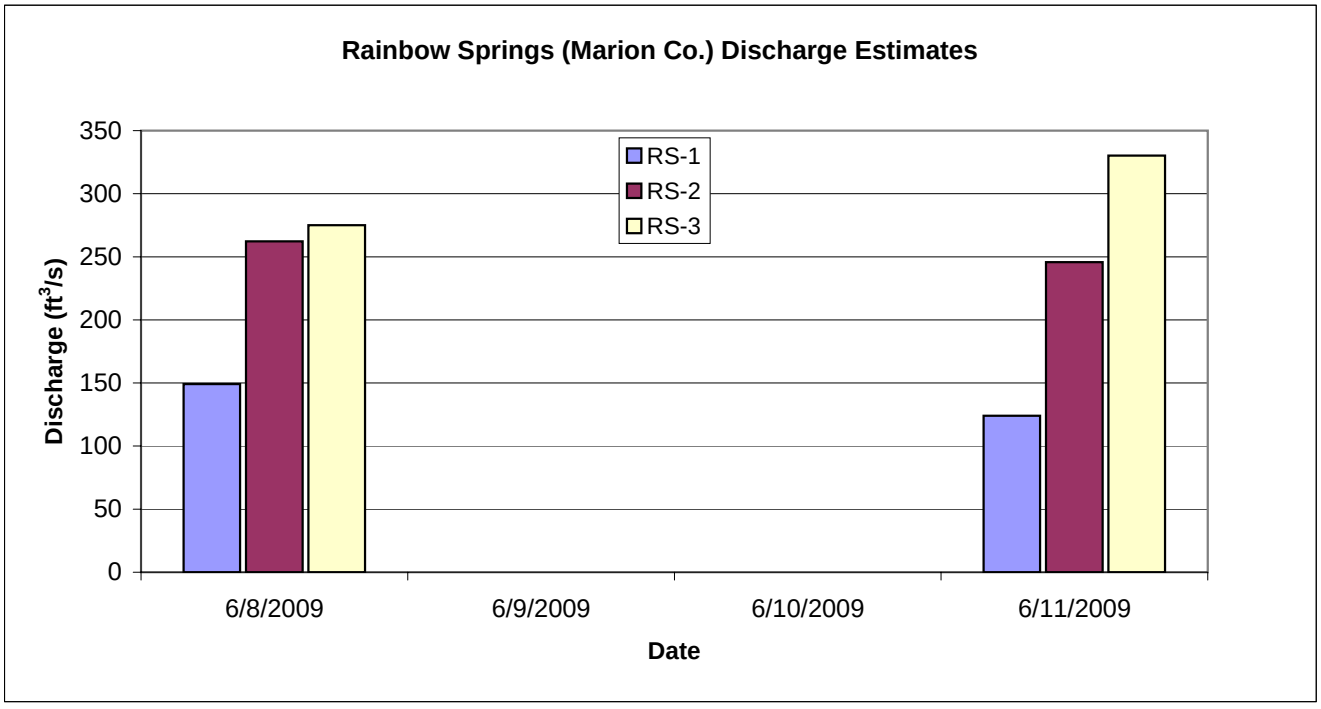
Ponce de Leon Cross Sectional Flow at PDL-3 on September 11, 2009 at 11:24.

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	1.5	2.5	0.90		0.01		2.25	0.02	55	0.01	0.30	0.18%	0.00
	3.5	2.0	1.59		0.07		3.18	0.22	545	0.14	2.13	1.77%	0.04
	5.5	2.0	1.82		0.27		3.64	0.98	2404	0.64	8.23	7.83%	0.64
	7.5	2.0	1.76		0.29		3.52	1.02	2497	0.66	8.84	8.13%	0.72
	9.5	2.0	1.72		0.30		3.44	1.03	2525	0.67	9.14	8.22%	0.75
	11.5	2.0	1.84		0.32		3.68	1.18	2881	0.76	9.75	9.38%	0.92
	13.5	2.0	1.91		0.38		3.82	1.45	3551	0.94	11.58	11.56%	1.34
	15.5	2.0	2.00		0.41		4.00	1.64	4012	1.06	12.50	13.07%	1.63
	17.5	2.0	1.92		0.42		3.84	1.61	3946	1.04	12.80	12.85%	1.64
	19.5	2.0	1.90		0.38		3.80	1.44	3533	0.93	11.58	11.50%	1.33
	21.5	2.0	1.66		0.33		3.32	1.10	2680	0.71	10.06	8.73%	0.88
	23.5	2.0	1.23		0.14		2.46	0.34	843	0.22	4.27	2.74%	0.12
	25.5	2.0	1.04		0.04		2.08	0.08	204	0.05	1.22	0.66%	0.01
	27.5	2.0	0.95		0.07		1.90	0.13	325	0.09	2.13	1.06%	0.02
	29.5	2.0	0.88		0.15		1.76	0.26	646	0.17	4.57	2.10%	0.10
	31.5	2.0	0.64		0.02		1.28	0.03	63	0.02	0.61	0.20%	0.00
	33.5	2.3	0.23		0.00		0.53	0.00	0	0.00	0.00	0.00%	0.00
End	34.8												
		34.8	1.41		0.21		48.50	12.55	30711	8.11	6.45	100%	10.14
			(cm/s)		6.45								



APPENDIX C
Rainbow Springs Cross Sectional Flow Summaries - June 8 and 11, 2009.

Date	Location	Segment Width (ft.)	Average Depth (ft.)	Velocity (ft/s)			Discharge		
				0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
6/8/2009	RS-1	101.0	8.68	0.19	*N/A*	0.11	149.2	364,965	96.4
6/11/2009	RS-1	100.0	8.21	0.20	*N/A*	0.05	124.0	303,476	80.2
Average RS-1 Values		**100.5**	**8.45**	**0.19**		**0.08**	**136.6**	**334,221**	**88.3**
6/8/2009	RS-2	208.0	7.82	0.30	*N/A*	0.02	262.3	641,687	169.5
6/11/2009	RS-2	195.0	7.30	0.28	*N/A*	0.05	245.8	601,283	158.8
Average RS-2 Values		**201.5**	**7.56**	**0.29**		**0.04**	**254.0**	**621,485**	**164.2**
6/8/2009	RS-3	133.0	7.00	0.38	0.05	0.10	275.1	673,041	177.8
6/11/2009	RS-3	138.0	6.97	0.46	0.12	0.12	330.3	807,993	213.5
Average RS-3 Values		**135.5**	**6.98**	**0.42**	**0.08**	**0.11**	**302.7**	**740,517**	**195.6**

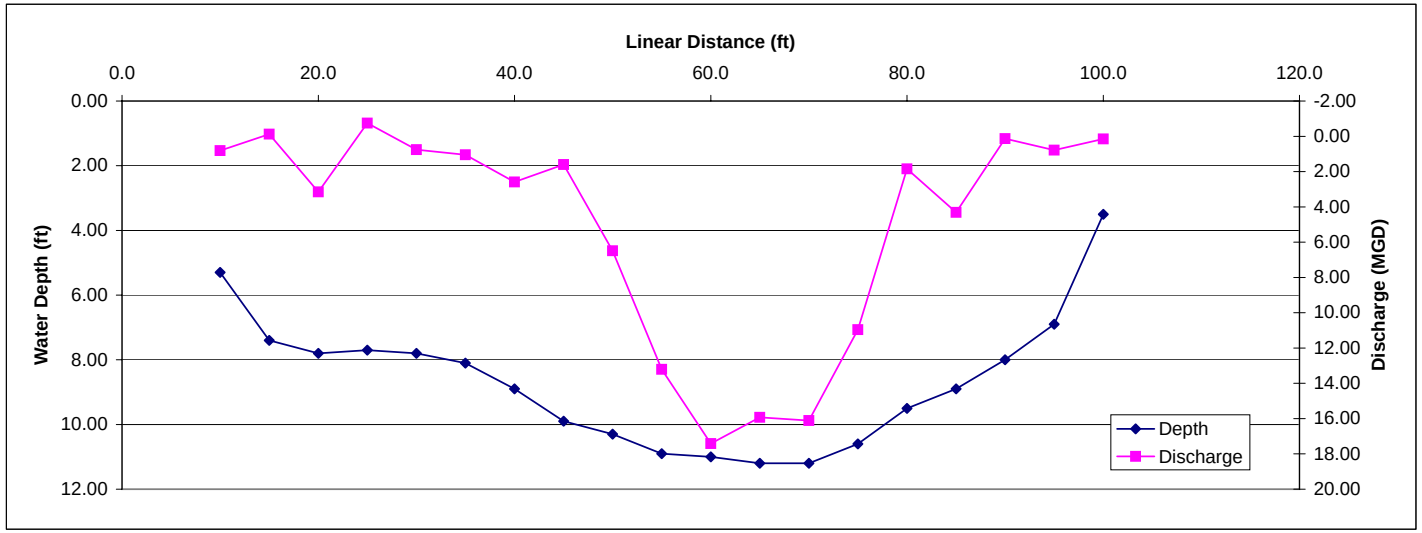




APPENDIX C
Rainbow Springs (Marion Co.) discharge measurement locations.

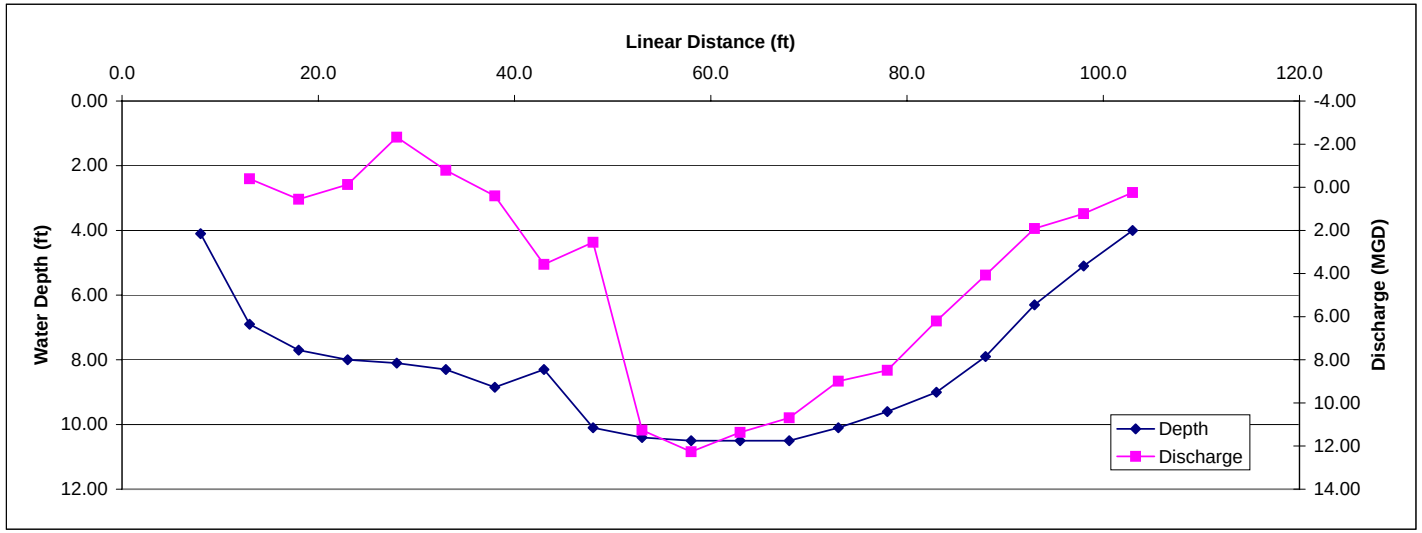
APPENDIX C
Rainbow Cross Sectional Flow at RS-1 on June 8, 2009 at 17:04

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	3.0												
	10.0	9.5	5.30	0.04		0.01	50.35	1.26	3080	0.81	1.22	0.84%	0.01
	15.0	5.0	7.40	-0.12		0.11	37.00	-0.19	-453	-0.12	-3.66	-0.12%	0.00
	20.0	5.0	7.80	0.07		0.18	39.00	4.88	11927	3.15	2.13	3.27%	0.07
	25.0	5.0	7.70	-0.11		0.05	38.50	-1.16	-2826	-0.75	-3.35	-0.77%	0.03
	30.0	5.0	7.80	0.08		-0.02	39.00	1.17	2862	0.76	2.44	0.78%	0.02
	35.0	5.0	8.10	0.04		0.04	40.50	1.62	3963	1.05	1.22	1.09%	0.01
	40.0	5.0	8.90	0.14		0.04	44.50	4.01	9799	2.59	4.27	2.68%	0.11
	45.0	5.0	9.90	0.06		0.04	49.50	2.48	6055	1.60	1.83	1.66%	0.03
	50.0	5.0	10.30	0.22		0.17	51.50	10.04	24570	6.49	6.71	6.73%	0.45
	55.0	5.0	10.90	0.52		0.23	54.50	20.44	50002	13.21	15.85	13.70%	2.17
	60.0	5.0	11.00	0.52		0.46	55.00	26.95	65935	17.42	15.85	18.07%	2.86
	65.0	5.0	11.20	0.57		0.31	56.00	24.64	60284	15.93	17.37	16.52%	2.87
	70.0	5.0	11.20	0.49		0.40	56.00	24.92	60969	16.11	14.94	16.71%	2.49
	75.0	5.0	10.60	0.57		0.07	53.00	16.96	41494	10.96	17.37	11.37%	1.98
	80.0	5.0	9.50	0.14		-0.02	47.50	2.85	6973	1.84	4.27	1.91%	0.08
	85.0	5.0	8.90	0.26		0.04	44.50	6.68	16331	4.31	7.92	4.47%	0.35
	90.0	5.0	8.00	0.09		-0.08	40.00	0.20	489	0.13	2.74	0.13%	0.00
	95.0	5.0	6.90	0.05		0.02	34.50	1.21	2954	0.78	1.52	0.81%	0.01
	100.0	6.5	3.50	-0.02		0.04	22.75	0.23	557	0.15	-0.61	0.15%	0.00
End	104.0												
		101.0	8.68	0.19		0.11	853.60	149.17	364965	96.42	5.79	100%	13.57
			(cm/s)	5.79		3.35							



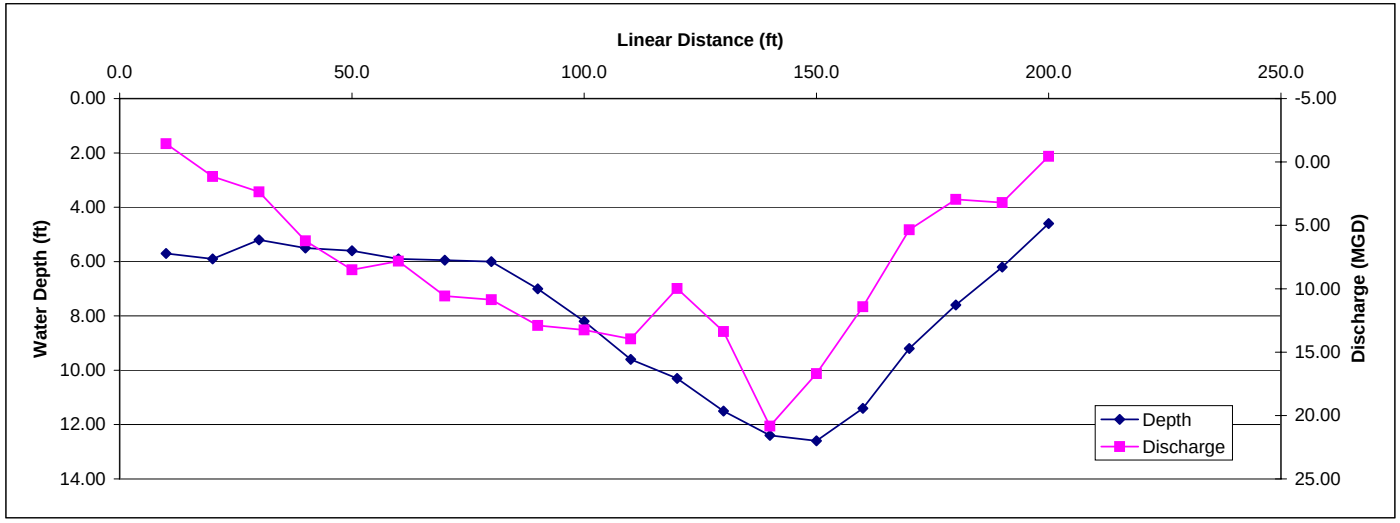
APPENDIX C
Rainbow Cross Sectional Flow at RS-1 on June 11, 2009 at 12:40

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	8.0		4.10	-0.05		-0.01							
	13.0	7.5	6.90	0.04		-0.08	30.75	-0.62	-1505	-0.40	1.22	-0.50%	-0.01
	18.0	5.0	7.70	0.03		0.02	34.50	0.86	2110	0.56	0.91	0.70%	0.01
	23.0	5.0	8.00	0.05		-0.06	38.50	-0.19	-471	-0.12	1.52	-0.16%	0.00
	28.0	5.0	8.10	-0.10		-0.08	40.00	-3.60	-8808	-2.33	-3.05	-2.90%	0.09
	33.0	5.0	8.30	0.06		-0.12	40.50	-1.22	-2973	-0.79	1.83	-0.98%	-0.02
	38.0	5.0	8.85	0.06		-0.03	41.50	0.62	1523	0.40	1.83	0.50%	0.01
	43.0	5.0	8.30	0.16		0.09	44.25	5.53	13533	3.58	4.88	4.46%	0.22
	48.0	5.0	10.10	0.12		0.07	41.50	3.94	9646	2.55	3.66	3.18%	0.12
	53.0	5.0	10.40	0.28		0.41	50.50	17.42	42625	11.26	8.53	14.05%	1.20
	58.0	5.0	10.50	0.49		0.24	52.00	18.98	46436	12.27	14.94	15.30%	2.29
	63.0	5.0	10.50	0.51		0.16	52.50	17.59	43029	11.37	15.54	14.18%	2.20
	68.0	5.0	10.50	0.54		0.09	52.50	16.54	40460	10.69	16.46	13.33%	2.19
	73.0	5.0	10.10	0.38		0.15	52.50	13.91	34038	8.99	11.58	11.22%	1.30
	78.0	5.0	9.60	0.47		0.05	50.50	13.13	32124	8.49	14.33	10.59%	1.52
	83.0	5.0	9.00	0.34		0.06	48.00	9.60	23487	6.20	10.36	7.74%	0.80
	88.0	5.0	7.90	0.27		0.01	45.00	6.30	15413	4.07	8.23	5.08%	0.42
	93.0	5.0	6.30	0.16		-0.01	39.50	2.96	7248	1.91	4.88	2.39%	0.12
	98.0	5.0	5.10	0.08		0.04	31.50	1.89	4624	1.22	2.44	1.52%	0.04
	103.0	7.5	4.00	0.01		0.01	38.25	0.38	936	0.25	0.30	0.31%	0.00
End	108.0												
		100.0	8.21	0.20		0.05	824.25	124.04	303476	80.17	6.34	100%	12.48
			(cm/s)	5.94		1.54							



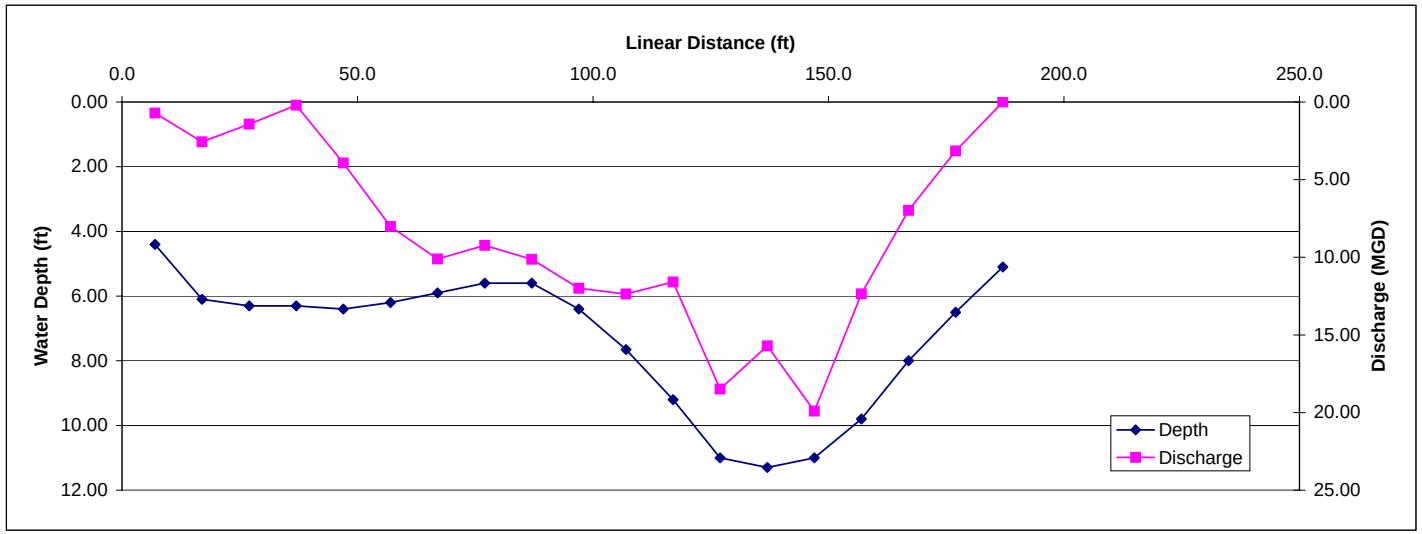
APPENDIX C
Rainbow Cross Sectional Flow atRS-2 on June 8, 2009 at 16:30

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	2.0												
	10.0	13.0	5.70	0.01		-0.07	74.10	-2.22	-5439	-1.44	0.30	-0.85%	0.00
	20.0	10.0	5.90	0.02		0.04	59.00	1.77	4330	1.14	0.61	0.67%	0.00
	30.0	10.0	5.20	0.22		-0.08	52.00	3.64	8906	2.35	6.71	1.39%	0.09
	40.0	10.0	5.50	0.40		-0.05	55.00	9.63	23548	6.22	12.19	3.67%	0.45
	50.0	10.0	5.60	0.51		-0.04	56.00	13.16	32197	8.51	15.54	5.02%	0.78
	60.0	10.0	5.90	0.43		-0.02	59.00	12.10	29591	7.82	13.11	4.61%	0.60
	70.0	10.0	5.95	0.52		0.03	59.50	16.36	40032	10.58	15.85	6.24%	0.99
	80.0	10.0	6.00	0.52		0.04	60.00	16.80	41102	10.86	15.85	6.41%	1.02
	90.0	10.0	7.00	0.56		0.01	70.00	19.95	48809	12.89	17.07	7.61%	1.30
	100.0	10.0	8.20	0.42		0.08	82.00	20.50	50155	13.25	12.80	7.82%	1.00
	110.0	10.0	9.60	0.43		0.02	96.00	21.60	52846	13.96	13.11		
	120.0	10.0	10.30	0.30		0.00	103.00	15.45	37800	9.99	8.84	5.89%	0.52
	130.0	10.0	11.50	0.29		0.07	115.00	20.70	50644	13.38	14.33	7.89%	1.13
	140.0	10.0	12.40	0.47		0.05	124.00	32.24	78878	20.84	8.23	12.29%	1.01
	150.0	10.0	12.60	0.27		0.14	126.00	25.83	63195	16.69	8.23	9.85%	0.81
	160.0	10.0	11.40	0.08		0.23	114.00	17.67	43231	11.42	2.44	6.74%	0.16
	170.0	10.0	9.20	0.13		0.05	92.00	8.28	20258	5.35	3.96	3.16%	0.13
	180.0	10.0	7.60	0.14		-0.02	76.00	4.56	11156	2.95	4.27	1.74%	0.07
	190.0	10.0	6.20	0.14		0.02	62.00	4.96	12135	3.21	4.27	1.89%	0.08
	200.0	15.0	4.60	0.04		-0.06	69.00	-0.69	-1688	-0.45	1.22	-0.26%	0.00
End	210.0												
		208.0	7.82	0.30		0.02	1603.60	262.28	641687	169.52	8.95	92%	10.14
			(cm/s)	8.99		0.67							



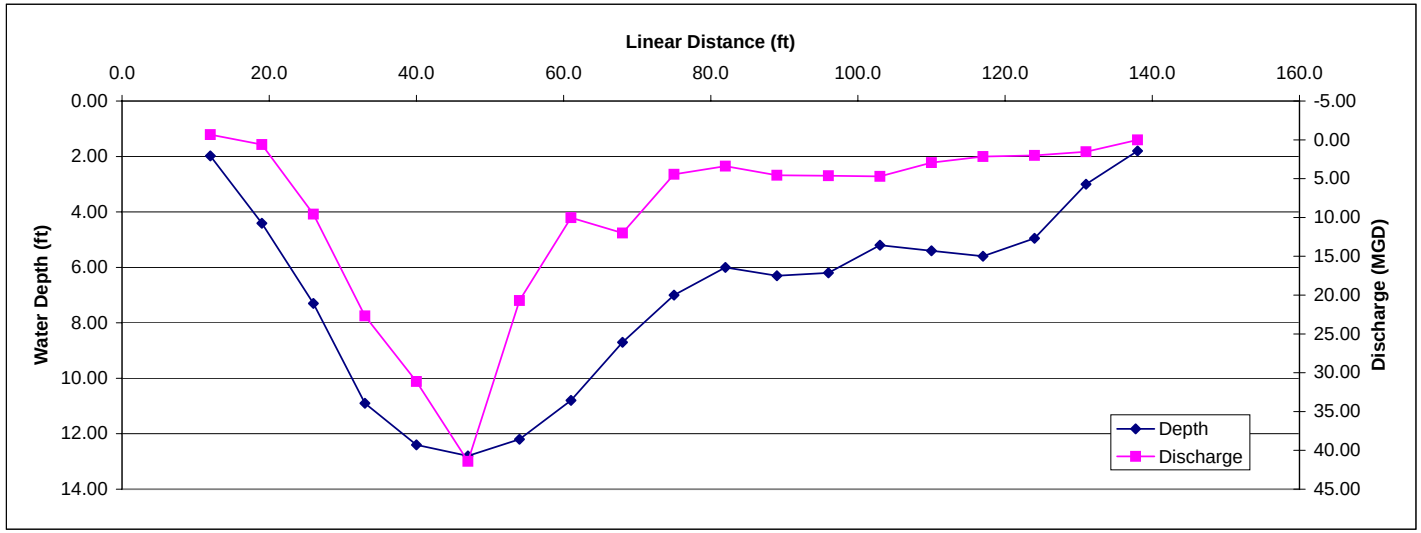
APPENDIX C
Rainbow Cross Sectional Flow atRS-2 on June 11, 2009 at 11:24

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	2.0												
	7.0	10.0	4.40	0.03		0.02	44.00	1.10	2691	0.71	0.91	0.45%	0.00
	17.0	10.0	6.10	0.11		0.02	61.00	3.97	9701	2.56	3.35	1.61%	0.05
	27.0	10.0	6.30	0.06		0.01	63.00	2.21	5395	1.43	1.83	0.90%	0.02
	37.0	10.0	6.30	0.04		-0.03	63.00	0.32	771	0.20	1.22	0.13%	0.00
	47.0	10.0	6.40	0.16		0.03	64.00	6.08	14875	3.93	4.88	2.47%	0.12
	57.0	10.0	6.20	0.26		0.14	62.00	12.40	30338	8.01	7.92	5.05%	0.40
	67.0	10.0	5.90	0.51		0.02	59.00	15.64	38252	10.11	15.54	6.36%	0.99
	77.0	10.0	5.60	0.46		0.05	56.00	14.28	34937	9.23	14.02	5.81%	0.81
	87.0	10.0	5.60	0.50		0.06	56.00	15.68	38362	10.13	15.24	6.38%	0.97
	97.0	10.0	6.40	0.51		0.07	64.00	18.56	45408	12.00	15.54	7.55%	1.17
	107.0	10.0	7.65	0.45		0.05	76.50	19.13	46791	12.36	13.72	7.78%	1.07
	117.0	10.0	9.20	0.32		0.07	92.00	17.94	43892	11.60	9.75	7.30%	0.71
	127.0	10.0	11.00	0.37		0.15	110.00	28.60	69972	18.49	11.28	11.64%	1.31
	137.0	10.0	11.30	0.37		0.06	113.00	24.30	59440	15.70	11.28	9.89%	1.11
	147.0	10.0	11.00	0.41		0.15	110.00	30.80	75355	19.91	12.50	12.53%	1.57
	157.0	10.0	9.80	0.31		0.08	98.00	19.11	46754	12.35	9.45	7.78%	0.73
	167.0	10.0	8.00	0.25		0.02	80.00	10.80	26423	6.98	7.62	4.39%	0.33
	177.0	10.0	6.50	0.18		-0.03	65.00	4.88	11927	3.15	5.49	1.98%	0.11
	187.0	15.0	5.10	0.02		-0.02	76.50	0.00	0	0.00	0.61	0.00%	0.00
End	197.0												
		195.0	7.30	0.28		0.05	1413.00	245.77	601283	158.85	8.53	100%	11.50
			(cm/s)	8.53		1.48							



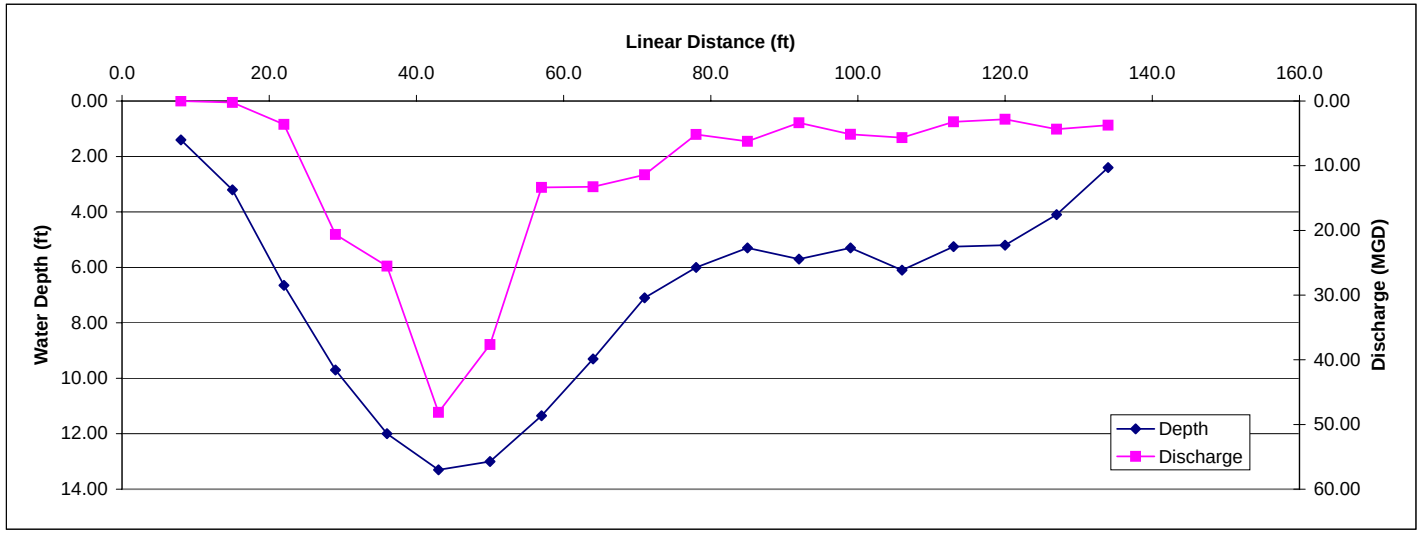
APPENDIX C
Rainbow Cross Sectional Flow at RS-3 on June 8, 2009 at 15:15

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	5.0												
	12.0	10.5	1.98		-0.05		20.79	-1.04	-2543	-0.67	-1.52	-0.38%	0.01
	19.0	7.0	4.41	0.03		0.03	30.87	0.93	2266	0.60	0.91	0.34%	0.00
	26.0	7.0	7.30	0.39		0.19	51.10	14.82	36256	9.58	11.89	5.39%	0.64
	33.0	7.0	10.90	0.70		0.22	76.30	35.10	85870	22.68	21.34	12.76%	2.72
	40.0	7.0	12.40	0.79		0.32	86.80	48.17	117861	31.14	24.08	17.51%	4.22
	47.0	7.0	12.80	0.87		0.56	89.60	64.06	156737	41.41	26.52	23.29%	6.18
	54.0	7.0	12.20	0.44		0.31	85.40	32.03	78352	20.70	13.41	11.64%	1.56
	61.0	7.0	10.80	0.34		0.07	75.60	15.50	37917	10.02	10.36	5.63%	0.58
	68.0	7.0	8.70	0.58		0.03	60.90	18.57	45444	12.01	17.68	6.75%	1.19
	75.0	7.0	7.00	0.37		-0.09	49.00	6.86	16784	4.43	11.28	2.49%	0.28
	82.0	7.0	6.00	0.28		-0.03	42.00	5.25	12845	3.39	8.53	1.91%	0.16
	89.0	7.0	6.30	0.35		-0.03	44.10	7.06	17263	4.56	10.67	2.56%	0.27
	96.0	7.0	6.20	0.35		-0.02	43.40	7.16	17520	4.63	10.67	2.60%	0.28
	103.0	7.0	5.20	0.33		0.07	36.40	7.28	17811	4.71	10.06	2.65%	0.27
	110.0	7.0	5.40	0.24		0.00	37.80	4.54	11098	2.93	7.32	1.65%	0.12
	117.0	7.0	5.60	0.12		0.05	39.20	3.33	8152	2.15	3.66	1.21%	0.04
	124.0	7.0	4.95	0.20		-0.02	34.65	3.12	7630	2.02	6.10	1.13%	0.07
	131.0	10.5	3.00	0.14		0.01	31.50	2.36	5780	1.53	4.27	0.86%	0.04
	138.0		1.80		0.15		0.00	0.00	0	0.00	4.57	0.00%	0.00
End	142.0												
		133.0	7.00	0.38	0.05	0.10	935.41	275.10	673041	177.80	10.62	100%	18.63
			(cm/s)	11.69	1.52	2.99							



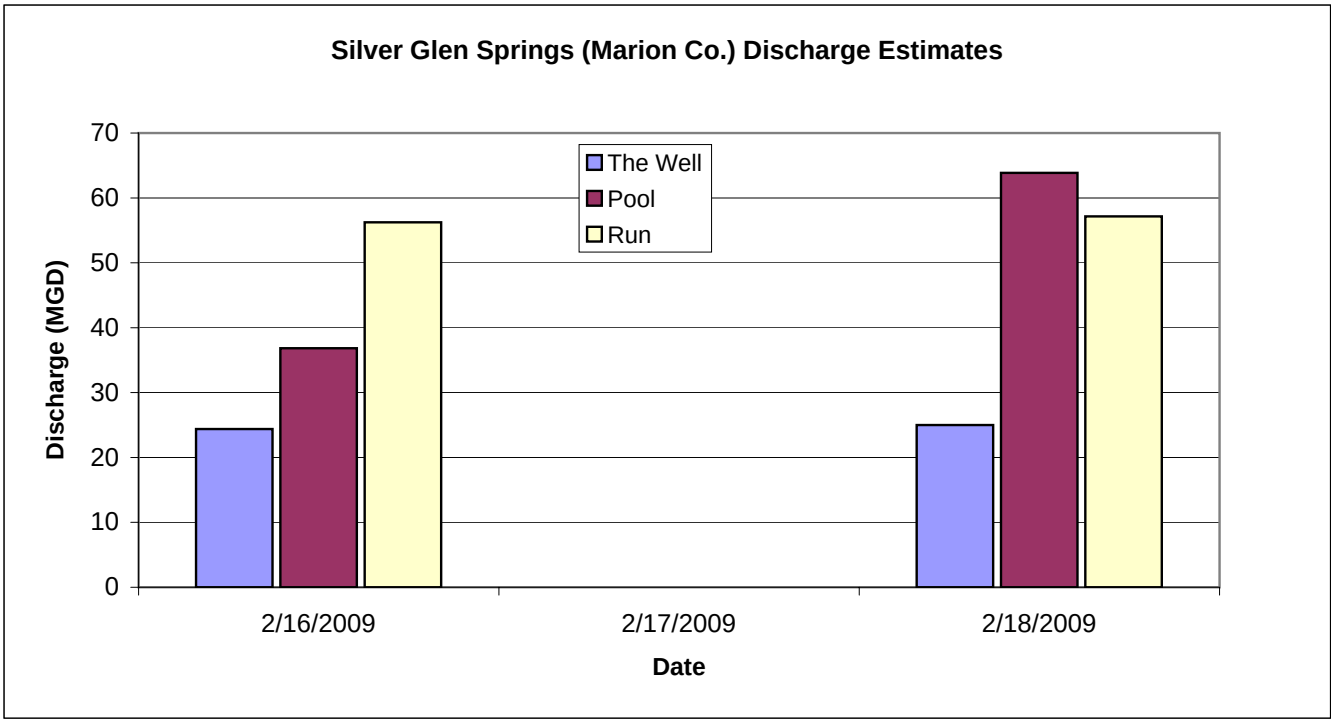
APPENDIX C
Rainbow Cross Sectional Flow at RS-3 on June 11, 2009 at 10:32

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	3.0												
	8.0	8.5	1.40		0.00		11.90	0.00	0	0.00	0.00	0.00%	0.00
	15.0	7.0	3.20	0.02		0.01	22.40	0.34	822	0.22	0.61	0.10%	0.00
	22.0	7.0	6.65	0.21		0.03	46.55	5.59	13667	3.61	6.40	1.69%	0.11
	29.0	7.0	9.70	0.70		0.24	67.90	31.91	78078	20.63	21.34	9.66%	2.06
	36.0	7.0	12.00	0.80		0.14	84.00	39.48	96591	25.52	24.38	11.95%	2.91
	43.0	7.0	13.30	1.12		0.48	93.10	74.48	182221	48.14	34.14	22.55%	7.70
	50.0	7.0	13.00	0.77		0.51	91.00	58.24	142489	37.64	23.47	17.63%	4.14
	57.0	7.0	11.35	0.29		0.23	79.45	20.66	50539	13.35	8.84	6.25%	0.55
	64.0	7.0	9.30	0.57		0.06	65.10	20.51	50171	13.25	17.37	6.21%	1.08
	71.0	7.0	7.10	0.52		0.19	49.70	17.64	43166	11.40	15.85	5.34%	0.85
	78.0	7.0	6.00	0.35		0.03	42.00	7.98	19524	5.16	10.67	2.42%	0.26
	85.0	7.0	5.30	0.55		-0.03	37.10	9.65	23600	6.23	16.76	2.92%	0.49
	92.0	7.0	5.70	0.30		-0.04	39.90	5.19	12690	3.35	9.14	1.57%	0.14
	99.0	7.0	5.30	0.44		-0.01	37.10	7.98	19515	5.16	13.41	2.42%	0.32
	106.0	7.0	6.10	0.38		0.03	42.70	8.75	21416	5.66	11.58	2.65%	0.31
	113.0	7.0	5.25	0.29		-0.02	36.75	4.96	12138	3.21	8.84	1.50%	0.13
	120.0	7.0	5.20	0.18		0.06	36.40	4.37	10687	2.82	5.49	1.32%	0.07
	127.0	7.0	4.10	0.27		0.20	28.70	6.74	16501	4.36	8.23	2.04%	0.17
	134.0	10.5	2.40		0.23	0.05	25.20	5.80	14180	3.75	7.01	1.76%	0.12
End	141.0												
		138.0	6.97	0.46	0.12	0.12	936.95	330.25	807993	213.45	12.82	100%	21.42
			(cm/s)	13.91	3.51	3.66							



APPENDIX C
Silver Glen Springs Cross Sectional Flow Summaries - February 16, 17, and 18, 2009.

Date	Location	Segment Width (ft.)	Average Depth (ft.)	Velocity (ft/s)			Discharge		
				0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
2/17/2009	The Well (SGS-a)	42.0	2.15	0.69	0.27	0.43	37.7	92,305	24.38
2/18/2009	The Well (SGS-a)	42.0	1.88	0.69	0.38	0.50	38.7	94,644	25.00
Average "The Well" Values		**42.0**	**2.02**	**0.69**	**0.32**	**0.46**	**38.2**	**93,475**	**24.7**
2/17/2009	Spring Pool (SGS-1)	172.0	2.45	0.14	0.09	0.12	57.0	139,398	36.83
2/18/2009	Spring Pool (SGS-1)	175.0	2.30	0.34	0.11	0.30	98.8	241,740	63.86
Average Spring Pool Values		**173.5**	**2.37**	**0.24**	**0.10**	**0.21**	**77.9**	**190,569**	**50.3**
2/16/2009	Spring Run (SGS-3)	120.0	3.86	0.37	0.09	0.04	87.0	212,905	56.24
2/18/2009	Spring Run (SGS-3)	120.0	3.77	0.40	0.15	0.03	88.4	216,386	57.16
Average Spring Run Values		**120.0**	**3.81**	**0.38**	**0.12**	**0.04**	**87.7**	**214,645**	**56.7**

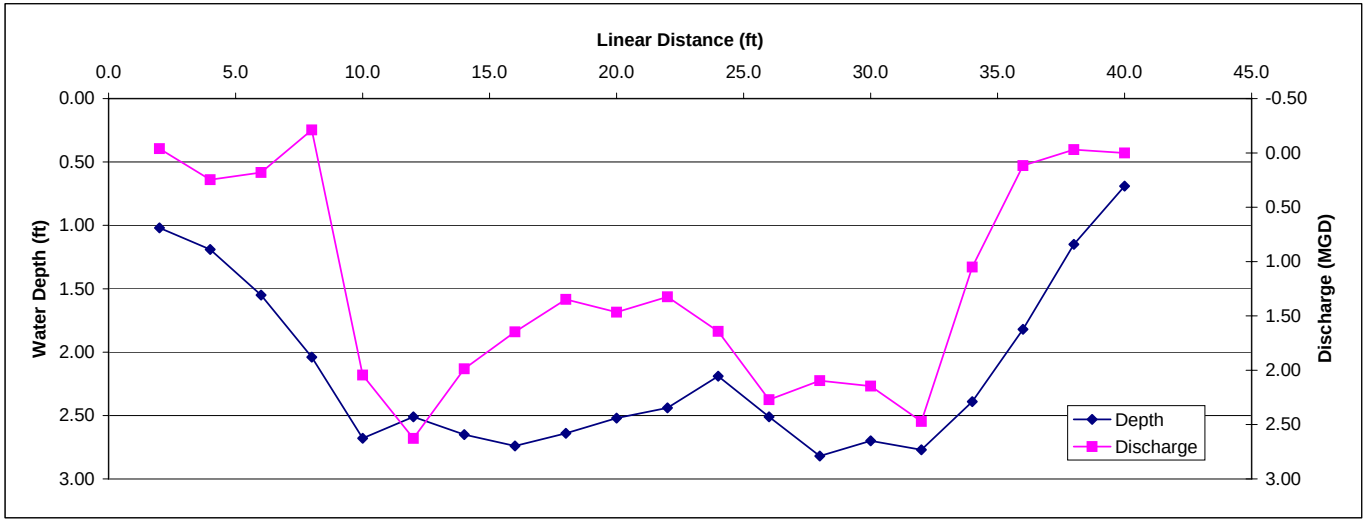




APPENDIX C
Silver Glen Springs (Marion Co.) discharge measurement locations.

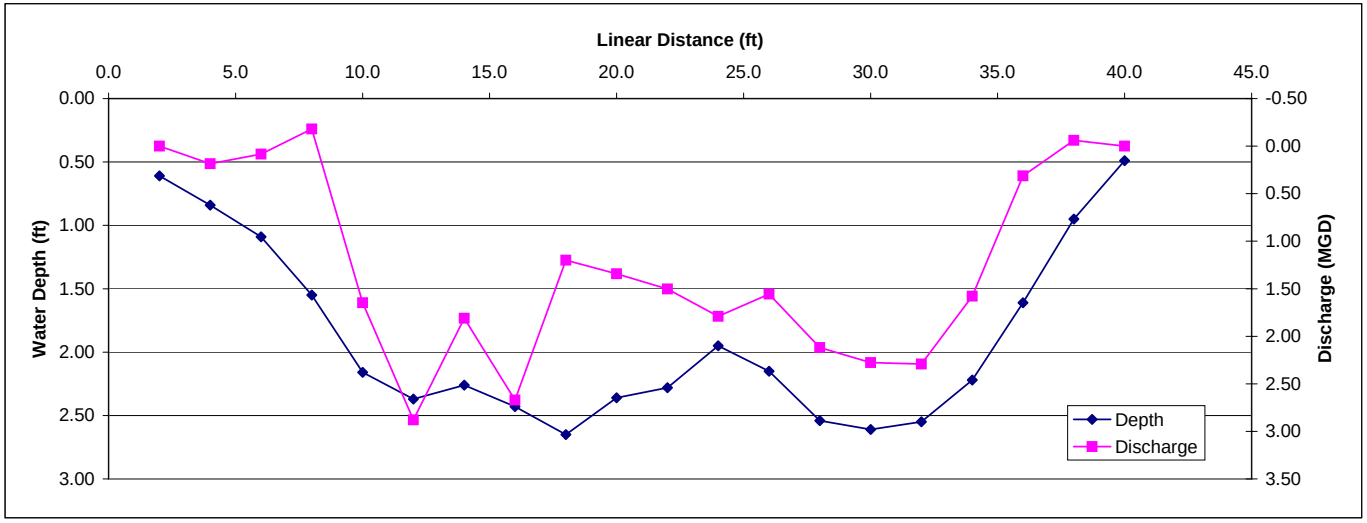
APPENDIX C
Silver Glen Springs Cross Sectional Flow at "The Well" vent - February 17, 2009 at 15:30

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	3.0	1.02		-0.02		3.06	-0.06	-150	-0.04	-0.61	-0.16%	0.00
	4.0	2.0	1.19		0.16		2.38	0.38	932	0.25	4.88	1.01%	0.05
	6.0	2.0	1.55		0.09		3.10	0.28	683	0.18	2.74	0.74%	0.02
	8.0	2.0	2.04		-0.08		4.08	-0.33	-799	-0.21	-2.44	-0.87%	0.02
	10.0	2.0	2.68	0.65		0.53	5.36	3.16	7737	2.04	19.81	8.38%	1.66
	12.0	2.0	2.51		0.81		5.02	4.07	9948	2.63	24.69	10.78%	2.66
	14.0	2.0	2.65	0.71		0.45	5.30	3.07	7521	1.99	21.64	8.15%	1.76
	16.0	2.0	2.74	0.71		0.22	5.48	2.55	6234	1.65	21.64	6.75%	1.46
	18.0	2.0	2.64	0.67		0.12	5.28	2.09	5103	1.35	20.42	5.53%	1.13
	20.0	2.0	2.52		0.45		5.04	2.27	5549	1.47	13.72	6.01%	0.82
	22.0	2.0	2.44		0.42		4.88	2.05	5015	1.32	12.80	5.43%	0.70
	24.0	2.0	2.19		0.58		4.38	2.54	6215	1.64	17.68	6.73%	1.19
	26.0	2.0	2.51		0.70		5.02	3.51	8597	2.27	21.34	9.31%	1.99
	28.0	2.0	2.82	0.65		0.50	5.64	3.24	7934	2.10	19.81	8.60%	1.70
	30.0	2.0	2.70	0.66		0.57	5.40	3.32	8125	2.15	20.12	8.80%	1.77
	32.0	2.0	2.77	0.75		0.63	5.54	3.82	9352	2.47	22.86	10.13%	2.32
	34.0	2.0	2.39		0.34		4.78	1.63	3976	1.05	10.36	4.31%	0.45
	36.0	2.0	1.82		0.05		3.64	0.18	445	0.12	1.52	0.48%	0.01
	38.0	2.0	1.15		-0.02		2.30	-0.05	-113	-0.03	-0.61	-0.12%	0.00
	40.0	3.0	0.69		0.00		2.07	0.00	0	0.00	0.00	0.00%	0.00
End	42.0												
		42.0	2.15	0.69	0.27	0.43	87.75	37.73	92305	24.38	12.62	100%	19.71
			(cm/s)	20.90	8.16	13.15							



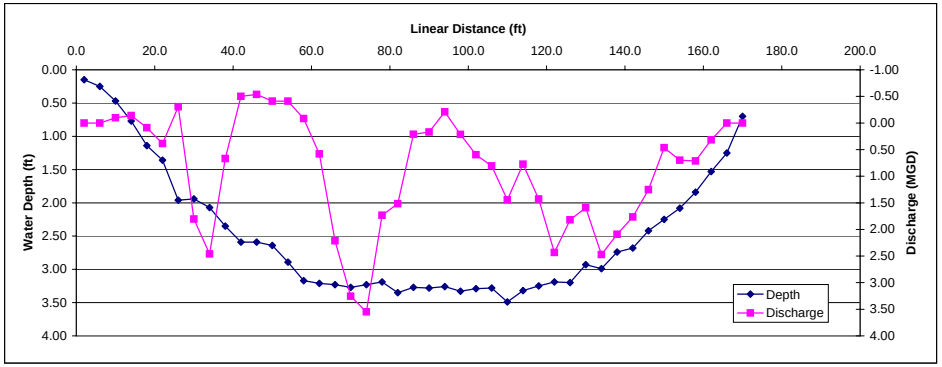
APPENDIX C
Silver Glen Springs Cross Sectional Flow at "The Well" vent - February 18, 2009 at 10:25

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	3.0	0.61		0.00		1.83	0.00	0	0.00	0.00	0.00%	0.00
	4.0	2.0	0.84		0.17		1.68	0.29	699	0.18	5.18	0.74%	0.04
	6.0	2.0	1.09		0.06		2.18	0.13	320	0.08	1.83	0.34%	0.01
	8.0	2.0	1.55		-0.09		3.10	-0.28	-683	-0.18	-2.74	-0.72%	0.02
	10.0	2.0	2.16		0.59		4.32	2.55	6236	1.65	17.98	6.59%	1.18
	12.0	2.0	2.37		0.94		4.74	4.46	10901	2.88	28.65	11.52%	3.30
	14.0	2.0	2.26		0.62		4.52	2.80	6856	1.81	18.90	7.24%	1.37
	16.0	2.0	2.43		0.85		4.86	4.13	10107	2.67	25.91	10.68%	2.77
	18.0	2.0	2.65	0.62		0.08	5.30	1.86	4538	1.20	18.90	4.80%	0.91
	20.0	2.0	2.36		0.44		4.72	2.08	5081	1.34	13.41	5.37%	0.72
	22.0	2.0	2.28		0.51		4.56	2.33	5690	1.50	15.54	6.01%	0.93
	24.0	2.0	1.95		0.71		3.90	2.77	6775	1.79	21.64	7.16%	1.55
	26.0	2.0	2.15		0.56		4.30	2.41	5891	1.56	17.07	6.22%	1.06
	28.0	2.0	2.54	0.76		0.53	5.08	3.28	8016	2.12	23.16	8.47%	1.96
	30.0	2.0	2.61	0.71		0.64	5.22	3.52	8621	2.28	21.64	9.11%	1.97
	32.0	2.0	2.55	0.65		0.74	5.10	3.54	8672	2.29	19.81	9.16%	1.82
	34.0	2.0	2.22		0.55		4.44	2.44	5975	1.58	16.76	6.31%	1.06
	36.0	2.0	1.61		0.15		3.22	0.48	1182	0.31	4.57	1.25%	0.06
	38.0	2.0	0.95		-0.05		1.90	-0.10	-232	-0.06	-1.52	-0.25%	0.00
	40.0	3.0	0.49		0.00		1.47	0.00	0	0.00	0.00	0.00%	0.00
End	42.0												
		42.0	1.88	0.69	0.38	0.50	76.44	38.68	94644	25.00	13.34	100%	20.72
			(cm/s)	20.88	11.45	15.16							



APPENDIX C
Silver Glen Springs Cross Sectional Flow at Pool - February 17, 2009 at 9:49

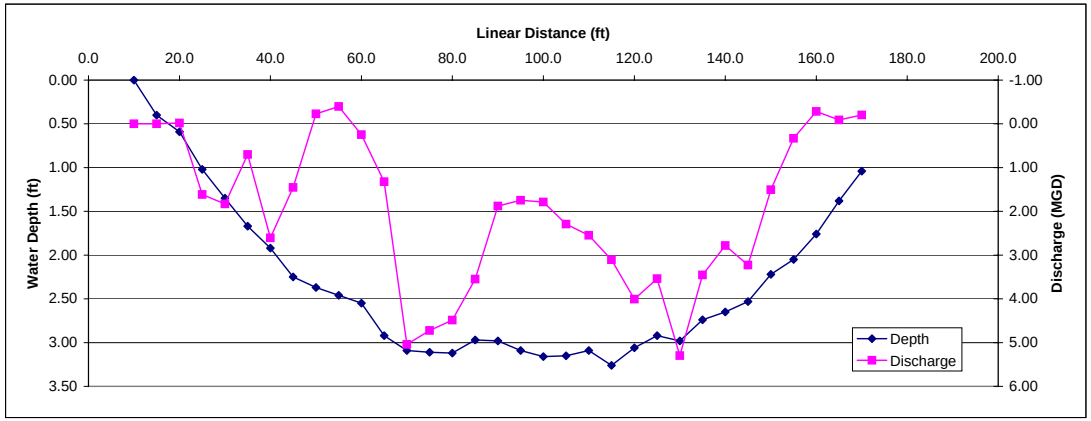
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	4.0	0.15		0.00		0.60	0.00	0	0.00	0.00	0.00%	0.00
	6.0	4.0	0.25		0.00		1.00	0.00	0	0.00	0.00	0.00%	0.00
	10.0	4.0	0.47		-0.08		1.88	-0.15	-368	-0.10	-2.44	-0.26%	0.01
	14.0	4.0	0.77		-0.07		3.08	-0.22	-527	-0.14	-2.13	-0.38%	0.01
	18.0	4.0	1.14		0.03		4.56	0.14	335	0.09	0.91	0.24%	0.00
	22.0	4.0	1.36		0.11		5.44	0.60	1464	0.39	3.35	1.05%	0.04
	26.0	4.0	1.96		-0.06		7.84	-0.47	-1151	-0.30	-1.83	-0.83%	0.02
	30.0	4.0	1.94		0.36		7.76	2.79	6835	1.81	10.97	4.90%	0.54
	34.0	4.0	2.07		0.46		8.28	3.81	9319	2.46	14.02	6.68%	0.94
	38.0	4.0	2.35		0.11		9.40	1.03	2530	0.67	3.35	1.81%	0.06
	42.0	4.0	2.59	-0.09		-0.06	10.36	-0.78	-1901	-0.50	-2.74	-1.36%	0.04
	46.0	4.0	2.59	-0.10		-0.06	10.36	-0.83	-2028	-0.54	-3.05	-1.45%	0.04
	50.0	4.0	2.64	-0.08		-0.04	10.56	-0.63	-1550	-0.41	-2.44	-1.11%	0.03
	54.0	4.0	2.89	-0.06		-0.05	11.56	-0.64	-1556	-0.41	-1.83	-1.12%	0.02
	58.0	4.0	3.17	0.04		-0.06	12.68	-0.13	-310	-0.08	1.22	-0.22%	0.00
	62.0	4.0	3.21	0.07		0.07	12.84	0.90	2199	0.58	2.13	1.58%	0.03
	66.0	4.0	3.23	0.29		0.24	12.92	3.42	8377	2.21	8.84	6.01%	0.53
	70.0	4.0	3.27	0.34		0.43	13.08	5.04	12320	3.25	10.36	8.84%	0.92
	74.0	4.0	3.23	0.44		0.41	12.92	5.49	13434	3.55	13.41	9.64%	1.29
	78.0	4.0	3.19	0.16		0.26	12.76	2.68	6556	1.73	4.88	4.70%	0.23
	82.0	4.0	3.35	0.30		0.05	13.40	2.35	5737	1.52	9.14	4.12%	0.38
	86.0	4.0	3.27	-0.03		0.08	13.08	0.33	800	0.21	-0.91	0.57%	-0.01
	90.0	4.0	3.28	0.01		0.03	13.12	0.26	642	0.17	0.30	0.46%	0.00
	94.0	4.0	3.26	-0.01		-0.04	13.04	-0.33	-798	-0.21	-0.30	-0.57%	0.00
	98.0	4.0	3.33	0.02		0.03	13.32	0.33	815	0.22	0.61	0.58%	0.00
	102.0	4.0	3.29	0.05		0.09	13.16	0.92	2254	0.60	1.52	1.62%	0.02
	106.0	4.0	3.28	0.15		0.04	13.12	1.25	3049	0.81	4.57	2.19%	0.10
	110.0	4.0	3.49	0.15		0.17	13.96	2.23	5465	1.44	4.57	3.92%	0.18
	114.0	4.0	3.32	0.08		0.10	13.28	1.20	2924	0.77	2.44	2.10%	0.05
	118.0	4.0	3.25	0.17		0.17	13.00	2.21	5407	1.43	5.18	3.88%	0.20
	122.0	4.0	3.19	0.36		0.23	12.76	3.76	9209	2.43	10.97	6.61%	0.72
	126.0	4.0	3.20	0.24		0.20	12.80	2.82	6890	1.82	7.32	4.94%	0.36
	130.0	4.0	2.93	0.28		0.14	11.72	2.46	6022	1.59	8.53	4.32%	0.37
	134.0	4.0	2.99	0.43		0.21	11.96	3.83	9364	2.47	13.11	6.72%	0.88
	138.0	4.0	2.74	0.22		0.37	10.96	3.23	7910	2.09	6.71	5.67%	0.38
	142.0	4.0	2.68	0.33		0.18	10.72	2.73	6688	1.77	10.06	4.80%	0.48
	146.0	4.0	2.42		0.20		9.68	1.94	4737	1.25	6.10	3.40%	0.21
	150.0	4.0	2.25		0.08		9.00	0.72	1762	0.47	2.44	1.26%	0.03
	154.0	4.0	2.08		0.13		8.32	1.08	2646	0.70	3.96	1.90%	0.08
	158.0	4.0	1.84		0.15		7.36	1.10	2701	0.71	4.57	1.94%	0.09
	162.0	4.0	1.53		0.08		6.12	0.49	1198	0.32	2.44	0.86%	0.02
	166.0	4.0	1.25		0.00		5.00	0.00	0	0.00	0.00	0.00%	0.00
	170.0	4.0	0.70		0.00		2.80	0.00	0	0.00	0.00	0.00%	0.00
End	172.0												
		172.0	2.45	0.14	0.09	0.12	421.56	56.98	139398	36.83	3.73	100%	9.29
			(cm/s)	4.41	2.69	3.74							



APPENDIX C

Silver Glen Springs Cross Sectional Flow at pool - February 18, 2009 at 10:50.

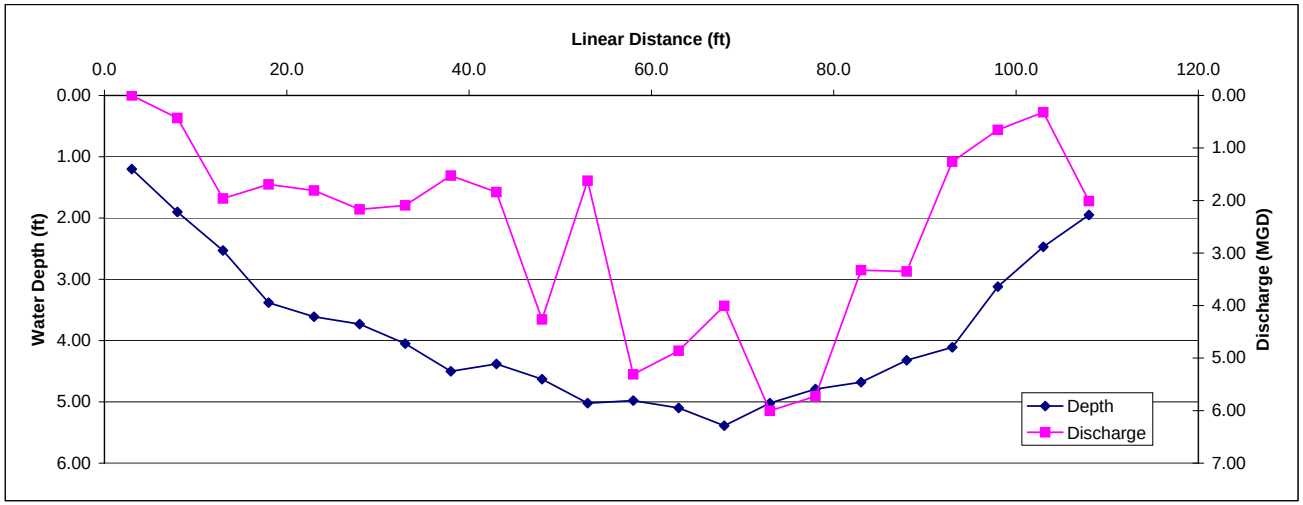
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	10.0	12.5	0.00		0.00		0.00	0.00	0	0.00	0.00	0.00%	0.00
	15.0	5.0	0.40		0.00		2.00	0.00	0	0.00	0.00	0.00%	0.00
	20.0	5.0	0.59		-0.01		2.95	-0.03	-72	-0.02	-0.30	-0.03%	0.00
	25.0	5.0	1.02		0.49		5.10	2.50	6114	1.62	14.94	2.53%	0.38
	30.0	5.0	1.35		0.42		6.75	2.84	6936	1.83	12.80	2.87%	0.37
	35.0	5.0	1.67		0.13		8.35	1.09	2656	0.70	3.96	1.10%	0.04
	40.0	5.0	1.92		0.42		9.60	4.03	9865	2.61	12.80	4.08%	0.52
	45.0	5.0	2.25		0.20		11.25	2.25	5505	1.45	6.10	2.28%	0.14
	50.0	5.0	2.37		-0.03		11.85	-0.36	-870	-0.23	-0.91	-0.36%	0.00
	55.0	5.0	2.46		-0.05		12.30	-0.62	-1505	-0.40	-1.52	-0.62%	0.01
	60.0	5.0	2.55	0.07		-0.01	12.75	0.38	936	0.25	2.13	0.39%	0.01
	65.0	5.0	2.92	0.22		0.06	14.60	2.04	5001	1.32	6.71	2.07%	0.14
	70.0	5.0	3.09	0.53		0.48	15.45	7.80	19089	5.04	16.15	7.90%	1.28
	75.0	5.0	3.11	0.49		0.45	15.55	7.31	17881	4.72	14.94	7.40%	1.10
	80.0	5.0	3.12	0.42		0.47	15.60	6.94	16984	4.49	12.80	7.03%	0.90
	85.0	5.0	2.97	0.39		0.35	14.85	5.49	13443	3.55	11.89	5.56%	0.66
	90.0	5.0	2.98	0.16		0.23	14.90	2.91	7109	1.88	4.88	2.94%	0.14
	95.0	5.0	3.09	0.18		0.17	15.45	2.70	6615	1.75	5.49	2.74%	0.15
	100.0	5.0	3.16	0.21		0.14	15.80	2.77	6765	1.79	6.40	2.80%	0.18
	105.0	5.0	3.15	0.22		0.23	15.75	3.54	8670	2.29	6.71	3.59%	0.24
	110.0	5.0	3.09	0.21		0.30	15.45	3.94	9639	2.55	6.40	3.99%	0.26
	115.0	5.0	3.26	0.31		0.28	16.30	4.81	11764	3.11	9.45	4.87%	0.46
	120.0	5.0	3.06	0.44		0.37	15.30	6.20	15160	4.00	13.41	6.27%	0.84
	125.0	5.0	2.92	0.43		0.32	14.60	5.48	13395	3.54	13.11	5.54%	0.73
	130.0	5.0	2.98	0.61		0.49	14.90	8.20	20050	5.30	18.59	8.29%	1.54
	135.0	5.0	2.74	0.37		0.41	13.70	5.34	13072	3.45	11.28	5.41%	0.61
	140.0	5.0	2.65	0.36		0.29	13.25	4.31	10536	2.78	10.97	4.36%	0.48
	145.0	5.0	2.53	0.41		0.38	12.65	5.00	12225	3.23	12.50	5.06%	0.63
	150.0	5.0	2.22		0.21		11.10	2.33	5703	1.51	6.40	2.36%	0.15
	155.0	5.0	2.05		0.05		10.25	0.51	1254	0.33	1.52	0.52%	0.01
	160.0	5.0	1.76		-0.05		8.80	-0.44	-1076	-0.28	-1.52	-0.45%	0.01
	165.0	5.0	1.38		-0.02		6.90	-0.14	-338	-0.09	-0.61	-0.14%	0.00
	170.0	7.5	1.04		-0.04		7.80	-0.31	-763	-0.20	-1.22	-0.32%	0.00
End	175.0												
		175.0	2.30	0.34	0.11	0.30	381.85	98.81	241740	63.86	7.16	100%	11.98
			(cm/s)	10.21	3.50	9.16							



APPENDIX C

Silver Glen Springs Cross Sectional Flow on Spring Run (St. 3) - February 16, 2009 at 14:53.

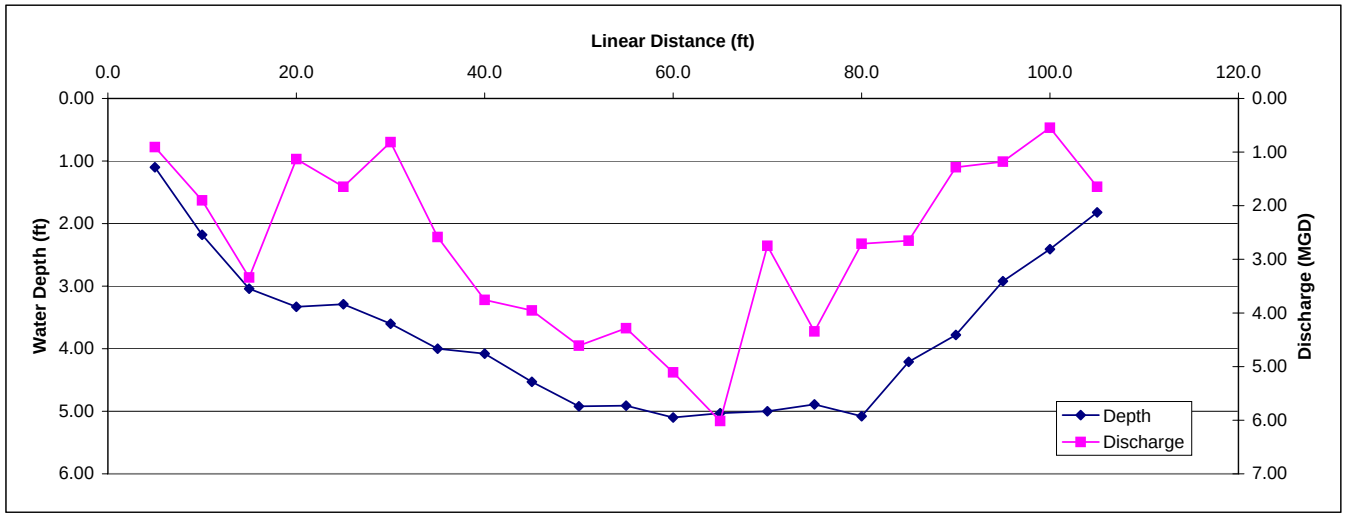
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	3.0	5.5	1.20		0.00		6.60	0.00	0	0.00	0.00	0.00%	0.00
	8.0	5.0	1.90		0.07		9.50	0.67	1627	0.43	2.13	0.76%	0.02
	13.0	5.0	2.53		0.24		12.65	3.04	7428	1.96	7.32	3.49%	0.26
	18.0	5.0	3.38	0.12		0.19	16.90	2.62	6409	1.69	3.66	3.01%	0.11
	23.0	5.0	3.61	0.28		0.03	18.05	2.80	6845	1.81	8.53	3.22%	0.27
	28.0	5.0	3.73	0.21		0.15	18.65	3.36	8213	2.17	6.40	3.86%	0.25
	33.0	5.0	4.05	0.36		-0.04	20.25	3.24	7927	2.09	10.97	3.72%	0.41
	38.0	5.0	4.50	0.26		-0.05	22.50	2.36	5780	1.53	7.92	2.71%	0.22
	43.0	5.0	4.38	0.34		-0.08	21.90	2.85	6965	1.84	10.36	3.27%	0.34
	48.0	5.0	4.63	0.51		0.06	23.15	6.60	16142	4.26	15.54	7.58%	1.18
	53.0	5.0	5.02	0.28		-0.08	25.10	2.51	6141	1.62	8.53	2.88%	0.25
	58.0	5.0	4.98	0.58		0.08	24.90	8.22	20104	5.31	17.68	9.44%	1.67
	63.0	5.0	5.10	0.56		0.03	25.50	7.52	18404	4.86	17.07	8.64%	1.48
	68.0	5.0	5.39	0.34		0.12	26.95	6.20	15165	4.01	10.36	7.12%	0.74
	73.0	5.0	5.02	0.59		0.15	25.10	9.29	22721	6.00	17.98	10.67%	1.92
	78.0	5.0	4.79	0.62		0.12	23.95	8.86	21680	5.73	18.90	10.18%	1.92
	83.0	5.0	4.68	0.48		-0.04	23.40	5.15	12595	3.33	14.63	5.92%	0.87
	88.0	5.0	4.32	0.45		0.03	21.60	5.18	12683	3.35	13.72	5.96%	0.82
	93.0	5.0	4.11	0.16		0.03	20.55	1.95	4776	1.26	4.88	2.24%	0.11
	98.0	5.0	3.12	0.07		0.06	15.60	1.01	2481	0.66	2.13	1.17%	0.02
	103.0	5.0	2.47		0.04		12.35	0.49	1209	0.32	1.22	0.57%	0.01
	108.0	14.5	1.95		0.11		28.28	3.11	7609	2.01	3.35	3.57%	0.12
End	120.0												
		120.0	3.86	0.37	0.09	0.04	443.43	87.02	212905	56.24	9.24	100%	12.96
			(cm/s)		2.80								



APPENDIX C

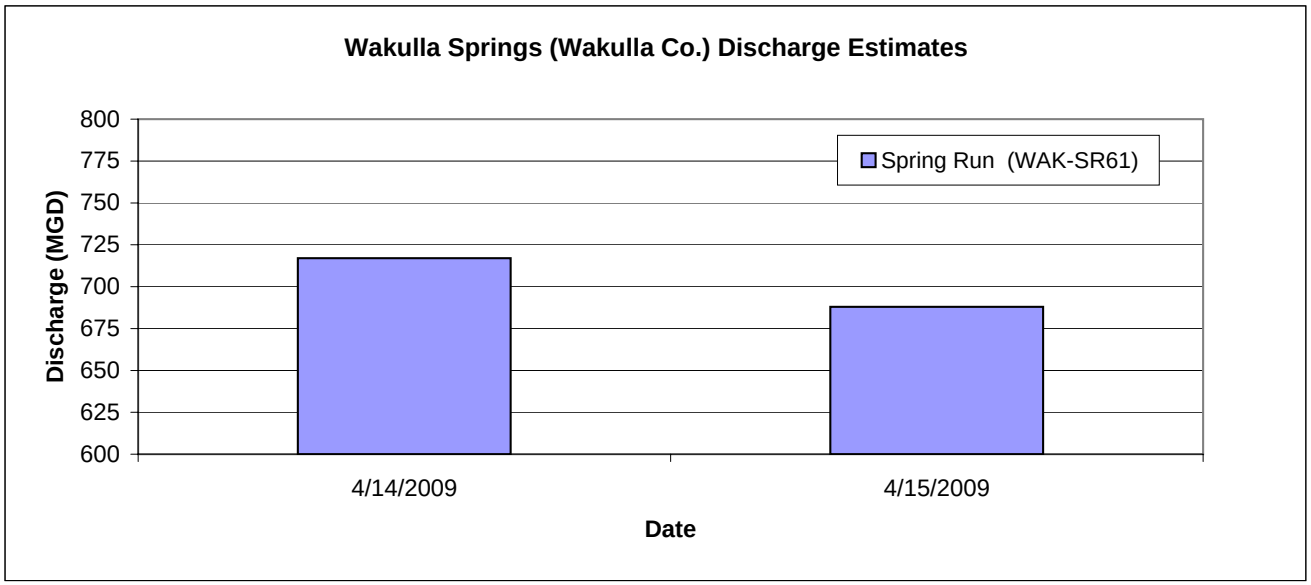
Silver Glen Springs Cross Sectional Flow on Spring Run (St. 3) - February 18, 2009 at 12:00.

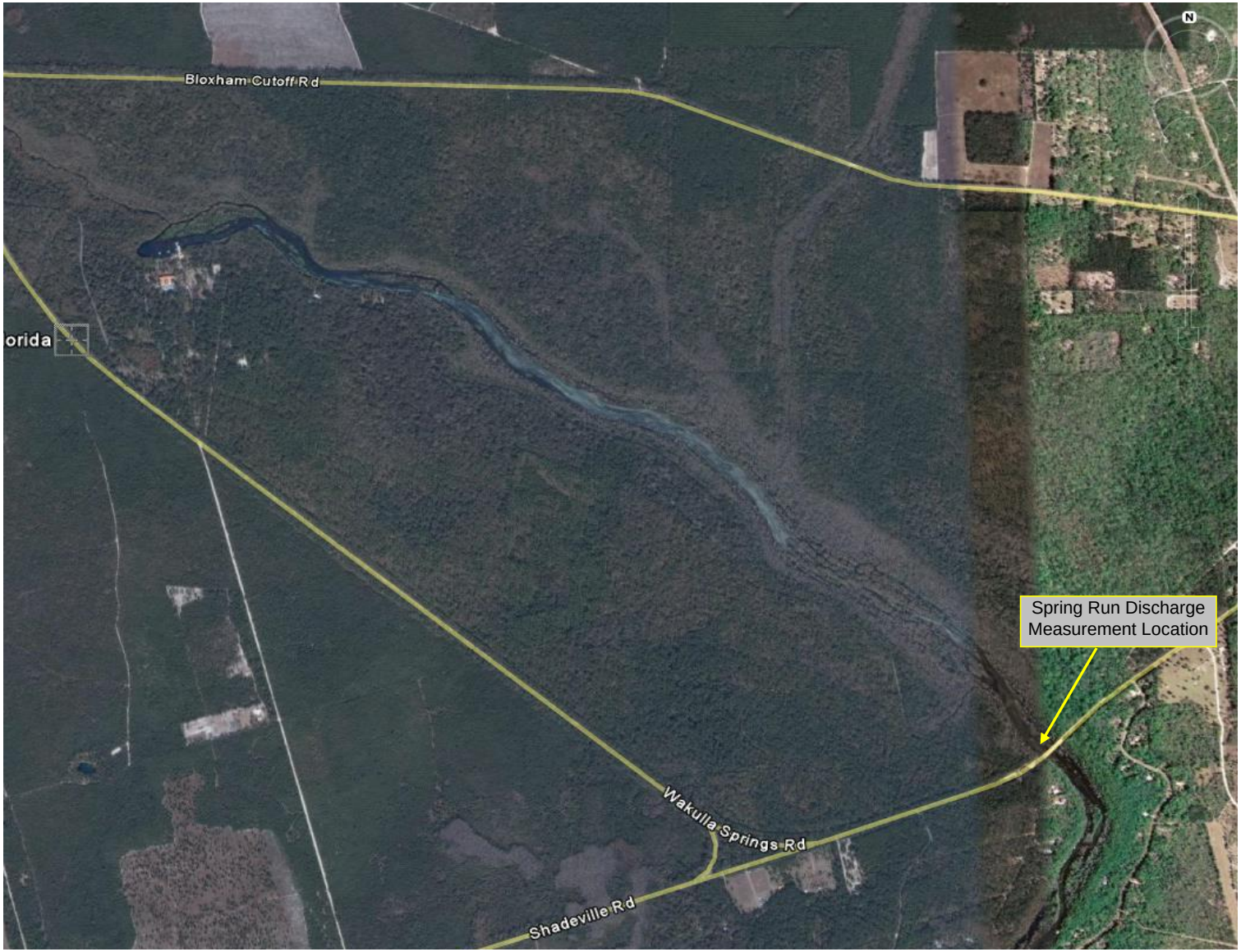
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	5.0	7.5	1.10		0.17		8.25	1.40	3431	0.91	5.18	1.59%	0.08
	10.0	5.0	2.18		0.27		10.90	2.94	7200	1.90	8.23	3.33%	0.27
	15.0	5.0	3.04	0.41		0.27	15.20	5.17	12644	3.34	12.50	5.84%	0.73
	20.0	5.0	3.33	0.14		0.07	16.65	1.75	4277	1.13	4.27	1.98%	0.08
	25.0	5.0	3.29	0.19		0.12	16.45	2.55	6238	1.65	5.79	2.88%	0.17
	30.0	5.0	3.60	0.18		-0.04	18.00	1.26	3083	0.81	5.49	1.42%	0.08
	35.0	5.0	4.00	0.37		0.03	20.00	4.00	9786	2.59	11.28	4.52%	0.51
	40.0	5.0	4.08	0.55		0.02	20.40	5.81	14224	3.76	16.76	6.57%	1.10
	45.0	5.0	4.53	0.50		0.04	22.65	6.12	14962	3.95	15.24	6.91%	1.05
	50.0	5.0	4.92	0.62		-0.04	24.60	7.13	17454	4.61	18.90	8.07%	1.52
	55.0	5.0	4.91	0.55		-0.01	24.55	6.63	16217	4.28	16.76	7.49%	1.26
	60.0	5.0	5.10	0.65		-0.03	25.50	7.91	19340	5.11	19.81	8.94%	1.77
	65.0	5.0	5.03	0.70		0.04	25.15	9.31	22767	6.01	21.34	10.52%	2.24
	70.0	5.0	5.00	0.36		-0.02	25.00	4.25	10398	2.75	10.97	4.81%	0.53
	75.0	5.0	4.89	0.51		0.04	24.45	6.72	16450	4.35	15.54	7.60%	1.18
	80.0	5.0	5.08	0.28		0.05	25.40	4.19	10254	2.71	8.53	4.74%	0.40
	85.0	5.0	4.21	0.43		-0.04	21.05	4.10	10043	2.65	13.11	4.64%	0.61
	90.0	5.0	3.78	0.19		0.02	18.90	1.98	4855	1.28	5.79	2.24%	0.13
	95.0	5.0	2.92	0.19		0.06	14.60	1.83	4465	1.18	5.79	2.06%	0.12
	100.0	5.0	2.41		0.07		12.05	0.84	2064	0.55	2.13	0.95%	0.02
	105.0	17.5	1.82		0.08		31.85	2.55	6234	1.65	2.44	2.88%	0.07
End	120.0												
		120.0	3.77	0.40	0.15	0.03	421.60	88.44	216386	57.16	10.76	100%	13.94
			(cm/s)		4.50								



APPENDIX C
Wakulla Springs Cross Sectional Flow Summaries - April 14 and 15 2009.

Date	Location	Segment Width (ft.)	Average Depth (ft.)	Velocity (ft/s)			Discharge		
				0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
4/14/2009	Spring Run (WAK-SR61)	424.0	3.82	0.77	0.13	0.56	1109.37	2,714,146	717.02
4/15/2009	Spring Run (WAK-SR61)	423.0	3.52	1.00	0.22	0.67	1064.48	2,604,331	688.01
Average Spring Run Values		**423.5**	**3.67**	**0.88**	**0.17**	**0.62**	**1086.9**	**2,659,239**	**702.5**

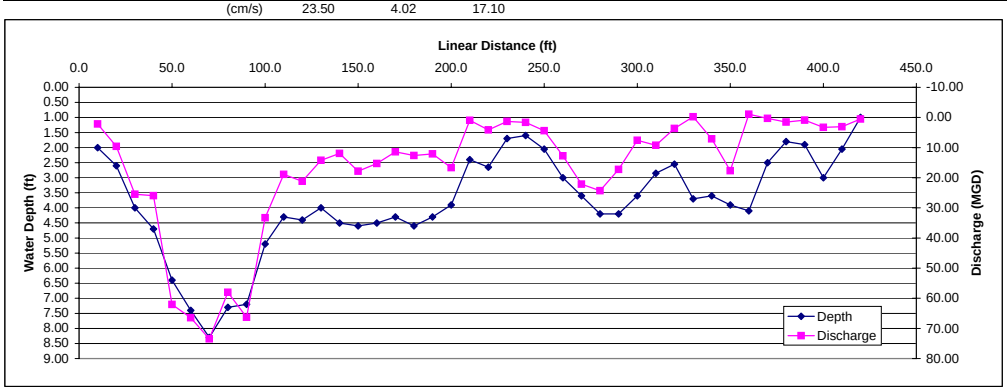




APPENDIX C
Wakulla Springs discharge measurement location (SR 61)

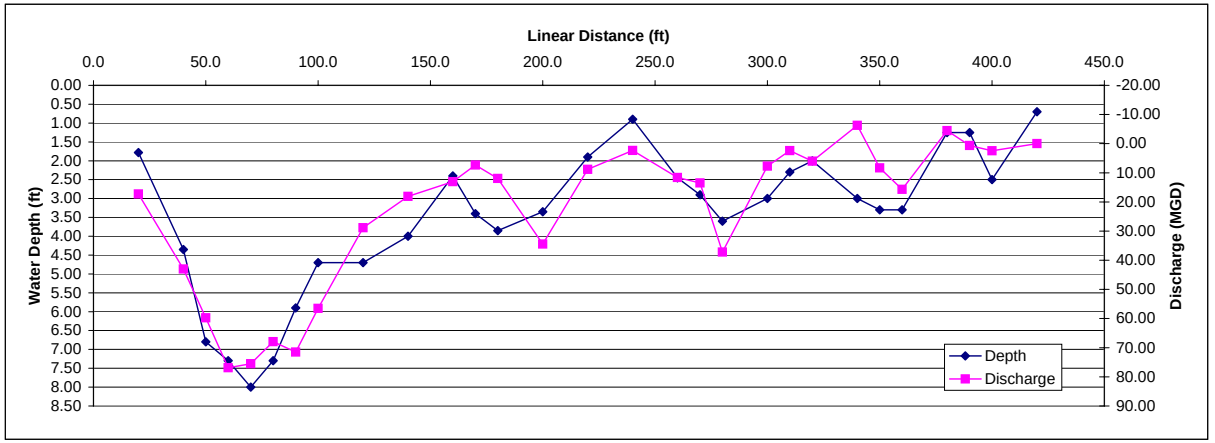
APPENDIX C
Wakulla Cross Sectional Flow at Bridge SR 61 - April 14, 2009 at 1600

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	10.0	15.0	2.00		0.11		30.00	3.30	8074	2.13	3.35	0.30%	0.01
	20.0	10.0	2.60	0.78		0.36	26.00	14.82	36258	9.58	23.77	1.34%	0.32
	30.0	10.0	4.00	0.90		1.07	40.00	39.40	96395	25.47	27.43	3.55%	0.97
	40.0	10.0	4.70	0.66		1.05	47.00	40.19	98316	25.97	20.12	3.62%	0.73
	50.0	10.0	6.40	1.54		1.46	64.00	96.00	234871	62.05	46.94	8.65%	4.06
	60.0	10.0	7.40	1.51		1.27	74.00	102.86	251655	66.48	46.02	9.27%	4.27
	70.0	10.0	8.30	1.36		1.38	83.00	113.71	278200	73.49	41.45	10.25%	4.25
	80.0	10.0	7.30	1.12		1.34	73.00	89.79	219678	58.03	34.14	8.09%	2.76
	90.0	10.0	7.20	1.58		1.27	72.00	102.60	251019	66.31	48.16	9.25%	4.45
	100.0	10.0	5.20	1.08		0.90	52.00	51.48	125950	33.27	32.92	4.64%	1.53
	110.0	10.0	4.30	0.78		0.58	43.00	29.24	71538	18.90	23.77	2.64%	0.63
	120.0	10.0	4.40	0.86		0.63	44.00	32.78	80199	21.19	26.21	2.95%	0.77
	130.0	10.0	4.00	0.83		0.27	40.00	22.00	53825	14.22	25.30	1.98%	0.50
	140.0	10.0	4.50	0.42		0.40	45.00	18.45	45139	11.92	12.80	1.66%	0.21
	150.0	10.0	4.60	0.93		0.27	46.00	27.60	67525	17.84	28.35	2.49%	0.71
	160.0	10.0	4.50	0.97		0.08	45.00	23.63	57800	15.27	29.57	2.13%	0.63
	170.0	10.0	4.30	0.74		0.08	43.00	17.63	43133	11.39	22.56	1.59%	0.36
	180.0	10.0	4.60	0.69		0.16	46.00	19.55	47831	12.64	21.03	1.76%	0.37
	190.0	10.0	4.30	0.79		0.08	43.00	18.71	45763	12.09	24.08	1.69%	0.41
	200.0	10.0	3.90	0.72		0.60	39.00	25.74	62975	16.64	21.95	2.32%	0.51
	210.0	10.0	2.40		0.06		24.00	1.44	3523	0.93	1.83	0.13%	0.00
	220.0	10.0	2.65	0.18		0.30	26.50	6.36	15560	4.11	5.49	0.57%	0.03
	230.0	10.0	1.70		0.12		17.00	2.04	4991	1.32	3.66	0.18%	0.01
	240.0	10.0	1.60		0.16		16.00	2.56	6263	1.65	4.88	0.23%	0.01
	250.0	10.0	2.05		0.33		20.50	6.77	16551	4.37	10.06	0.61%	0.06
	260.0	10.0	3.00	0.84		0.47	30.00	19.65	48075	12.70	25.60	1.77%	0.45
	270.0	10.0	3.60	1.05		0.85	36.00	34.20	83673	22.10	32.00	3.08%	0.99
	280.0	10.0	4.20	1.09		0.70	42.00	37.59	91967	24.30	33.22	3.39%	1.13
	290.0	10.0	4.20	0.54		0.73	42.00	26.67	65250	17.24	16.46	2.40%	0.40
	300.0	10.0	3.60	0.33		0.32	36.00	11.70	28625	7.56	10.06	1.05%	0.11
	310.0	10.0	2.85	0.58		0.42	28.50	14.25	34864	9.21	17.68	1.28%	0.23
	320.0	10.0	2.55	0.27		0.17	25.50	5.61	13725	3.63	8.23	0.51%	0.04
	330.0	10.0	3.70	-0.03		0.01	37.00	-0.37	-905	-0.24	-0.91	-0.03%	0.00
	340.0	10.0	3.60	0.02		0.08	36.00	10.98	26863	7.10	16.15	0.99%	0.16
	350.0	10.0	3.90	0.53		0.56	39.00	27.30	66792	17.64	25.60	2.46%	0.63
	360.0	10.0	4.10	0.84		-0.08	41.00	-1.64	-4012	-1.06	0.00	-0.15%	0.00
	370.0	10.0	2.50		0.02		25.00	0.50	1223	0.32	0.61	0.05%	0.00
	380.0	10.0	1.80		0.13		18.00	2.34	5725	1.51	3.96	0.21%	0.01
	390.0	10.0	1.90		0.07		19.00	1.33	3254	0.86	2.13	0.12%	0.00
	400.0	10.0	3.00	0.17		0.17	30.00	5.10	12478	3.30	5.18	0.46%	0.02
	410.0	10.0	2.05		0.23		20.50	4.72	11536	3.05	7.01	0.43%	0.03
	420.0	9.0	1.00		0.09		9.00	0.81	1982	0.52	2.74	0.07%	0.00
End	424.0												
		424.0	3.82	0.77	0.13	0.56	1613.50	1109.37	2714146	717.02	18.85	100%	32.75
			(cm/s)	23.50	4.02	17.10							



APPENDIX C
Wakulla Springs Cross Sectional Flow at SR 61 - April 15, 2009 at 1650

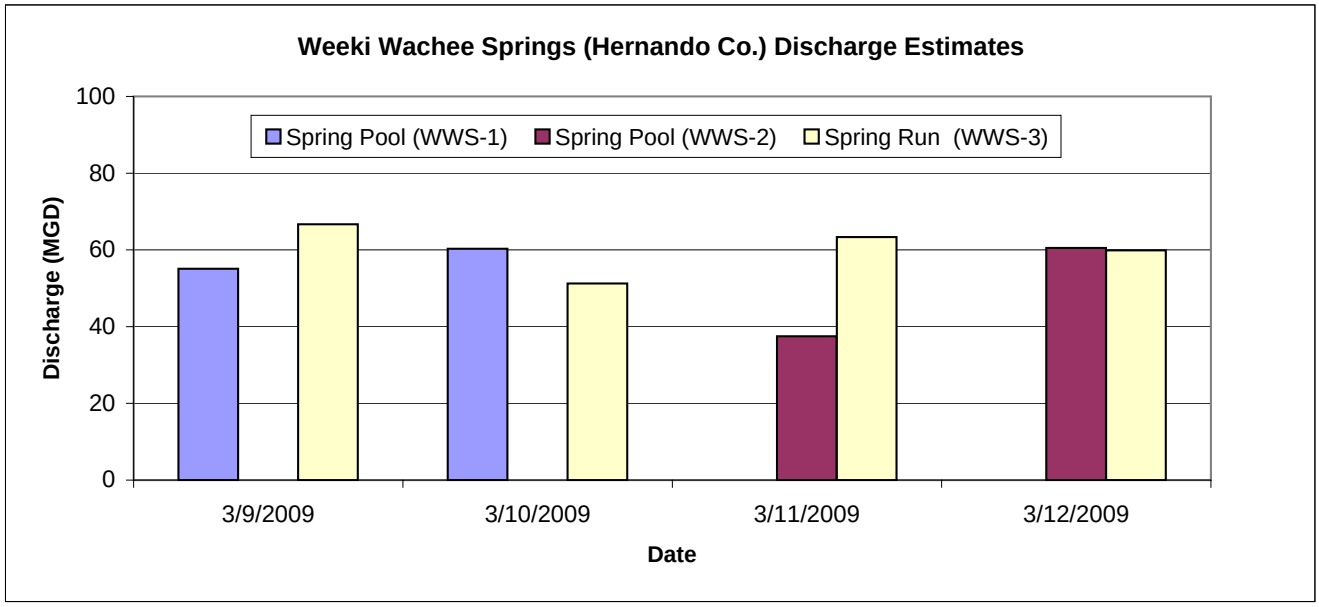
	Distance from Initial Point	Segment Width	Total Depth	Velocity (ft/s)			Segment Area	Discharge			Surface Velocity	Flow proportion	Weighted Velocity
	(ft.)	(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^2)	(ft^3/s)	(m^3/d)	(MGD)	(cm/s)	(%)	(cm/s)
Start	0.0												
	20.0	30.0	1.78		0.50		53.40	26.70	65324	17.26	15.24	2.51%	0.38
	40.0	15.0	4.35	1.39		0.65	65.25	66.56	162832	43.02	42.37	6.25%	2.65
	50.0	10.0	6.80	1.58		1.14	68.00	92.48	226259	59.77	48.16	8.69%	4.18
	60.0	10.0	7.30	1.84		1.42	73.00	118.99	291118	76.91	56.08	11.18%	6.27
	70.0	10.0	8.00	1.75		1.17	80.00	116.80	285760	75.49	53.34	10.97%	5.85
	80.0	10.0	7.30	1.38		1.50	73.00	105.12	257184	67.94	42.06	9.88%	4.15
	90.0	10.0	5.90	2.06		1.69	59.00	110.63	270652	71.50	62.79	10.39%	6.53
	100.0	15.0	4.70	1.38		1.10	70.50	87.42	213880	56.50	42.06	8.21%	3.45
	120.0	20.0	4.70	0.92		0.03	94.00	44.65	109240	28.86	28.04	4.19%	1.18
	140.0	20.0	4.00	0.69		0.01	80.00	28.00	68504	18.10	21.03	2.63%	0.55
	160.0	15.0	2.40		0.56		36.00	20.16	49323	13.03	17.07	1.89%	0.32
	170.0	10.0	3.40	0.63		0.04	34.00	11.39	27867	7.36	19.20	1.07%	0.21
	180.0	15.0	3.85	0.52		0.12	57.75	18.48	45213	11.94	15.85	1.74%	0.28
	200.0	20.0	3.35	0.95		0.64	67.00	53.27	130317	34.43	28.96	5.00%	1.45
	220.0	20.0	1.90		0.36		38.00	13.68	33469	8.84	10.97	1.29%	0.14
	240.0	20.0	0.90		0.20		18.00	3.60	8808	2.33	6.10	0.34%	0.02
	260.0	15.0	2.45		0.49		36.75	18.01	44057	11.64	14.94	1.69%	0.25
	270.0	10.0	2.90	0.81		0.63	29.00	20.88	51085	13.50	24.69	1.96%	0.48
	280.0	15.0	3.60	1.23		0.90	54.00	57.51	140703	37.17	37.49	5.40%	2.03
	300.0	15.0	3.00	0.19		0.34	45.00	11.93	29175	7.71	5.79	1.12%	0.06
	310.0	10.0	2.30		0.16		23.00	3.68	9003	2.38	4.88	0.35%	0.02
	320.0	15.0	2.00		0.31		30.00	9.30	22753	6.01	9.45	0.87%	0.08
	340.0	15.0	3.00	-0.45		0.02	45.00	-9.68	-23671	-6.25	-13.72	-0.91%	0.12
	350.0	10.0	3.30	0.59		0.19	33.00	12.87	31487	8.32	17.98	1.21%	0.22
	360.0	15.0	3.30	0.50		0.48	49.50	24.26	59342	15.68	15.24	2.28%	0.35
	380.0	15.0	1.25		-0.37		18.75	-6.94	-16973	-4.48	-11.28	-0.65%	0.07
	390.0	10.0	1.25		0.08		12.50	1.00	2447	0.65	2.44	0.09%	0.00
	400.0	15.0	2.50		0.10		37.50	3.75	9175	2.42	3.05	0.35%	0.01
	420.0	13.0	0.70		0.00		9.10	0.00	0	0.00	0.00	0.00%	0.00
End	423.0												
		423.0	3.52	1.00	0.22	0.67	1390.00	1064.48	2604331	688.01	21.39	100%	41.32
			(cm/s)	30.41	6.62	20.44							



APPENDIX C

Weeki Wachee Springs Cross Sectional Flow Summaries - March 9, 10, 11, and 12, 2009.

Date	Location	Segment Width	Average Depth	Velocity (ft/s)			Discharge		
		(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^3/s)	(m^3/d)	(MGD)
3/9/2009	Spring Pool (WWS-1)	38.0	4.23	0.57	0.23	0.74	92.48	226,262	59.8
3/9/2009	Spring Pool (WWS-1)	38.0	4.19	0.52	0.22	0.63	78.01	190,855	50.4
3/10/2009	Spring Pool (WWS-1)	38.0	4.49	0.64	0.21	0.68	94.75	231,811	61.2
3/10/2009	Spring Pool (WWS-1)	38.0	4.34	0.61	0.20	0.67	91.87	224,764	59.4
Average Values		**38.0**	**4.31**	**0.59**	**0.21**	**0.68**	**89.28**	**218,423**	**57.7**
3/11/2009	Spring Pool (WWS-2)	102.0	1.99	0.87	0.24	0.87	58.00	141,895	37.5
3/12/2009	Spring Pool (WWS-2)	102.0	1.44	0.00	0.58		93.63	229,077	60.5
Average Values		**102.0**	**1.71**	**0.44**	**0.41**	**0.87**	**75.81**	**185,486**	**49.0**
Spring Pool Average Values		**59.3**	**3.45**	**0.54**	**0.28**	**0.72**	**84.79**	**207,444**	**54.8**
3/9/2009	Spring Run (WWS-3)	65.0	2.28	0.93	0.27	0.90	103.14	252,339	66.7
3/10/2009	Spring Run (WWS-3)	65.0	2.19	0.80	0.25	0.71	79.33	194,077	51.3
3/11/2009	Spring Run (WWS-3)	65.0	2.33	0.85	0.47	0.86	97.99	239,740	63.3
3/12/2009	Spring Run (WWS-3)	70.0	2.41	0.81	0.26	0.77	92.65	226,667	59.9
Average Spring Run Values		**66.3**	**2.30**	**0.85**	**0.31**	**0.81**	**93.28**	**228,206**	**60.3**

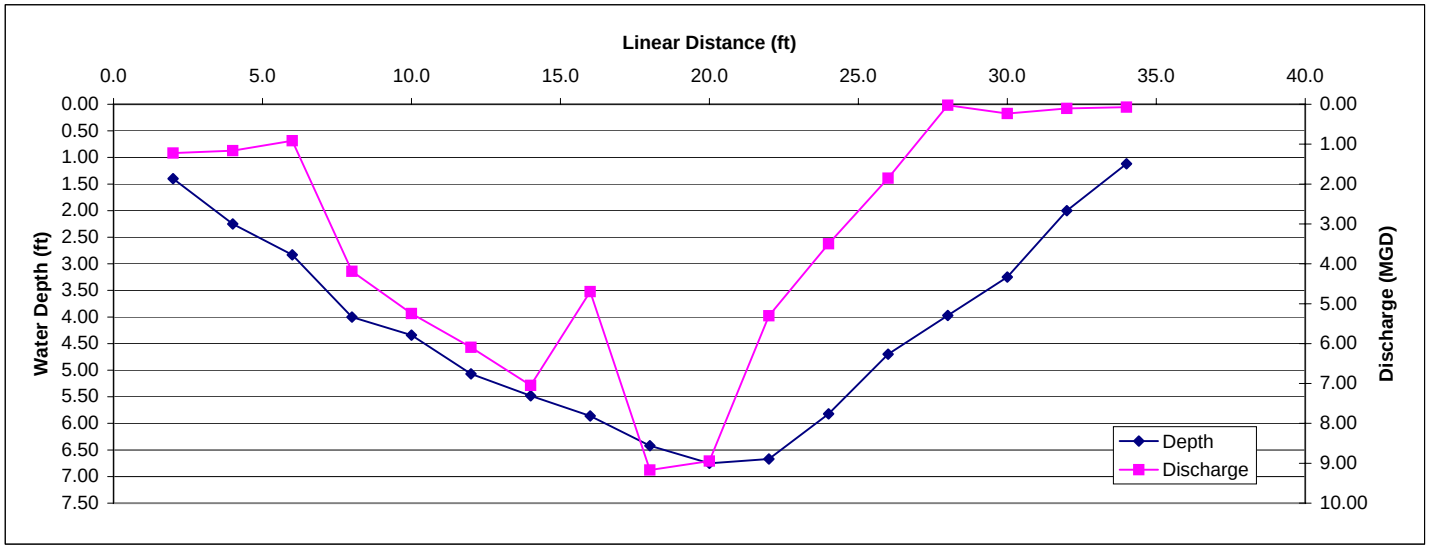




APPENDIX C
Weeki Wachee Springs (Hernando Co.) discharge measurement locations.

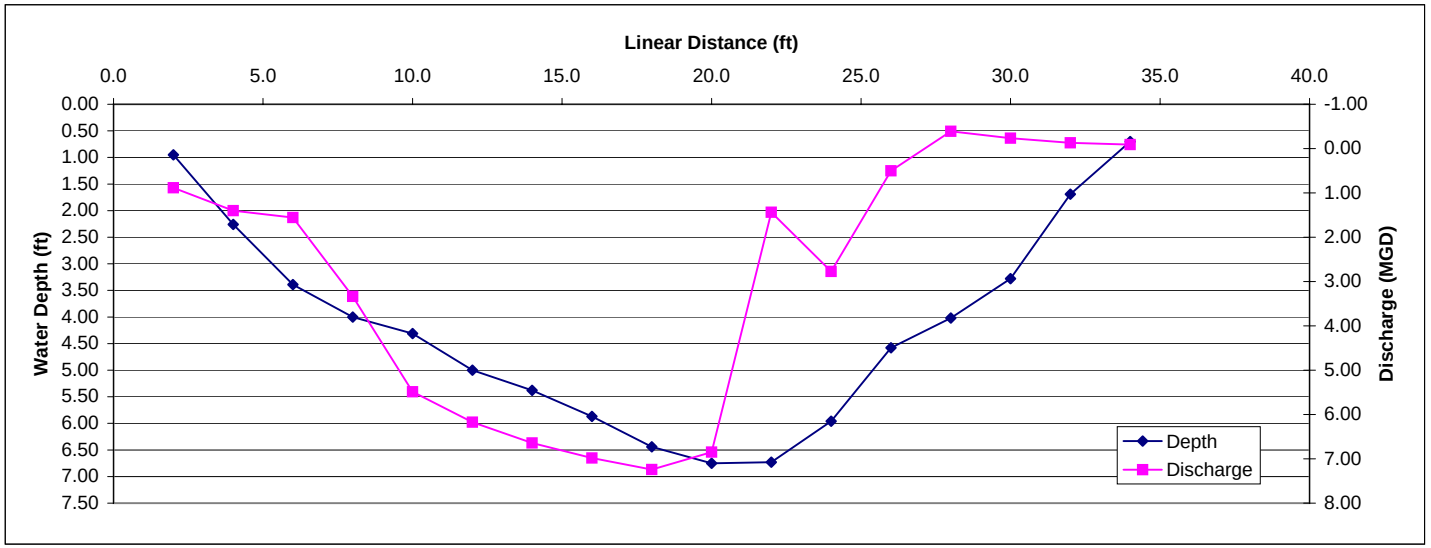
APPENDIX C
Weeki Wachee Cross Sectional Flow at Pool/Slide - March 9, 2009 at 14:20.

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	3.0	1.40		0.45		4.20	1.89	4624	1.22	13.72	2.04%	0.28
	4.0	2.0	2.25		0.40		4.50	1.80	4404	1.16	12.19	1.95%	0.24
	6.0	2.0	2.83	0.18		0.32	5.66	1.42	3462	0.91	5.49	1.53%	0.08
	8.0	2.0	4.00	0.78		0.84	8.00	6.48	15854	4.19	23.77	7.01%	1.67
	10.0	2.0	4.34	0.92		0.95	8.68	8.12	19856	5.25	28.04	8.78%	2.46
	12.0	2.0	5.07	0.91		0.95	10.14	9.43	23072	6.10	27.74	10.20%	2.83
	14.0	2.0	5.48	0.99		0.91	10.96	10.91	26680	7.05	32.92	11.79%	3.88
	16.0	2.0	5.86	1.08		1.14	11.72	7.27	17778	4.70	3.05	7.86%	0.24
	18.0	2.0	6.42	0.10		1.06	12.84	14.19	34713	9.17	35.05	15.34%	5.38
	20.0	2.0	6.75	1.15		0.96	13.50	13.84	33854	8.94	33.22	14.96%	4.97
	22.0	2.0	6.67	1.09		1.07	13.34	8.20	20072	5.30	4.88	8.87%	0.43
	24.0	2.0	5.82	0.16		0.77	11.64	5.41	13242	3.50	4.88	5.85%	0.29
	26.0	2.0	4.70	0.04		0.57	9.40	2.87	7014	1.85	1.22	3.10%	0.04
	28.0	2.0	3.97	-0.01		0.02	7.94	0.04	97	0.03	-0.30	0.04%	0.00
	30.0	2.0	3.25	0.07		0.04	6.50	0.36	875	0.23	2.13	0.39%	0.01
	32.0	2.0	2.00		0.04		4.00	0.16	391	0.10	1.22	0.17%	0.00
	34.0	5.0	1.12		0.02		5.60	0.11	274	0.07	0.61	0.12%	0.00
End	38.0												
		38.0	4.23	0.57	0.23	0.74	148.62	92.48	226262	59.77	13.52	100%	22.79
			(cm/s)	17.49	6.93	22.51							



APPENDIX C
Weeki Wachee Cross Sectional Flow at Pool/Slide - March 9, 2009 at 15:09

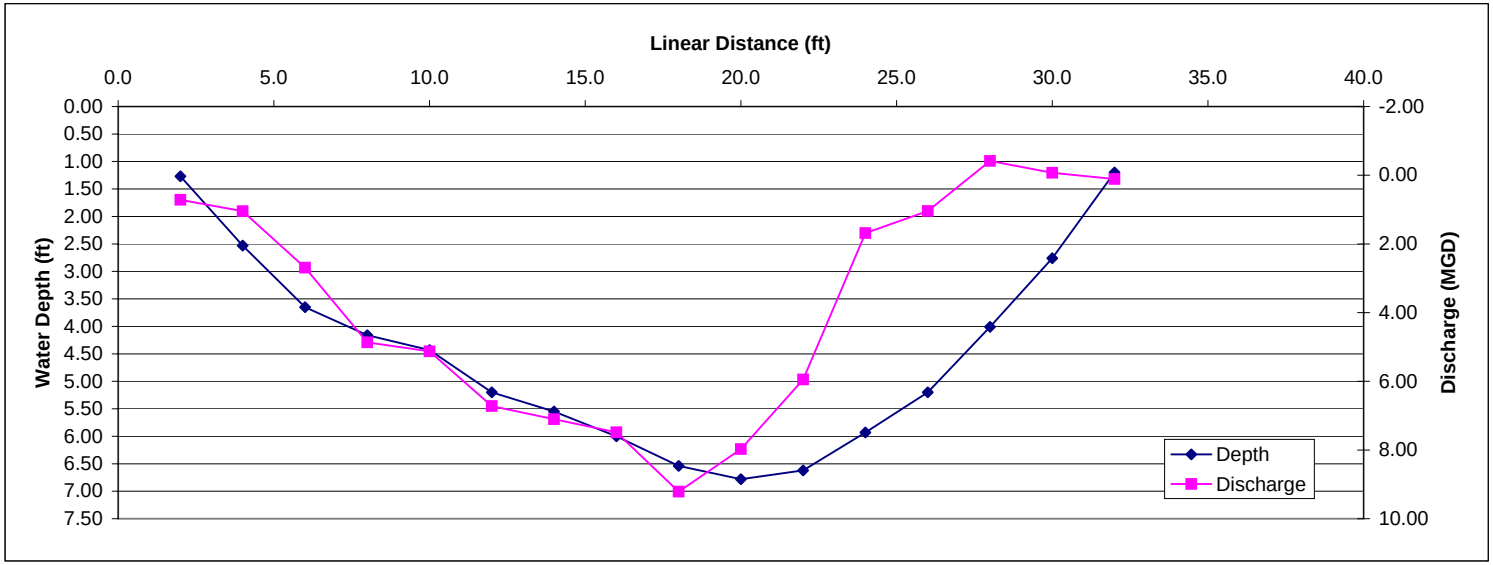
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	3.0	0.95		0.48		2.85	1.37	3347	0.88	14.63	1.75%	0.26
	4.0	2.0	2.26		0.48		4.52	2.17	5308	1.40	14.63	2.78%	0.41
	6.0	2.0	3.39	0.04		0.67	6.78	2.41	5889	1.56	1.22	3.09%	0.04
	8.0	2.0	4.00	0.72		0.57	8.00	5.16	12624	3.34	21.95	6.61%	1.45
	10.0	2.0	4.31	1.07		0.90	8.62	8.49	20773	5.49	32.61	10.88%	3.55
	12.0	2.0	5.00	0.98		0.93	10.00	9.55	23365	6.17	29.87	12.24%	3.66
	14.0	2.0	5.38	0.94		0.95	10.76	10.28	25141	6.64	29.26	13.17%	3.85
	16.0	2.0	5.87	0.96		0.90	11.74	10.80	26425	6.98	28.65	13.85%	3.97
	18.0	2.0	6.44	0.94		1.02	12.88	11.21	27415	7.24	21.95	14.36%	3.15
	20.0	2.0	6.75	0.72		0.87	13.50	10.60	25928	6.85	21.34	13.58%	2.90
	22.0	2.0	6.73	0.70		0.38	13.46	2.22	5434	1.44	-1.52	2.85%	-0.04
	24.0	2.0	5.96	-0.05		0.77	11.92	4.29	10499	2.77	-1.52	5.50%	-0.08
	26.0	2.0	4.58	-0.09		0.26	9.16	0.78	1905	0.50	-2.74	1.00%	-0.03
	28.0	2.0	4.02	-0.10		-0.05	8.04	-0.60	-1475	-0.39	-3.05	-0.77%	0.02
	30.0	2.0	3.28	-0.09		-0.02	6.56	-0.36	-883	-0.23	-2.74	-0.46%	0.01
	32.0	2.0	1.69		-0.06		3.38	-0.20	-496	-0.13	-1.83	-0.26%	0.00
	34.0	5.0	0.70		-0.04		3.50	-0.14	-343	-0.09	-1.22	-0.18%	0.00
End	38.0												
		38.0	4.19	0.52	0.22	0.63	145.67	78.01	190855	50.42	11.85	100%	23.12
			(cm/s)	15.80	6.55	19.11							



APPENDIX C

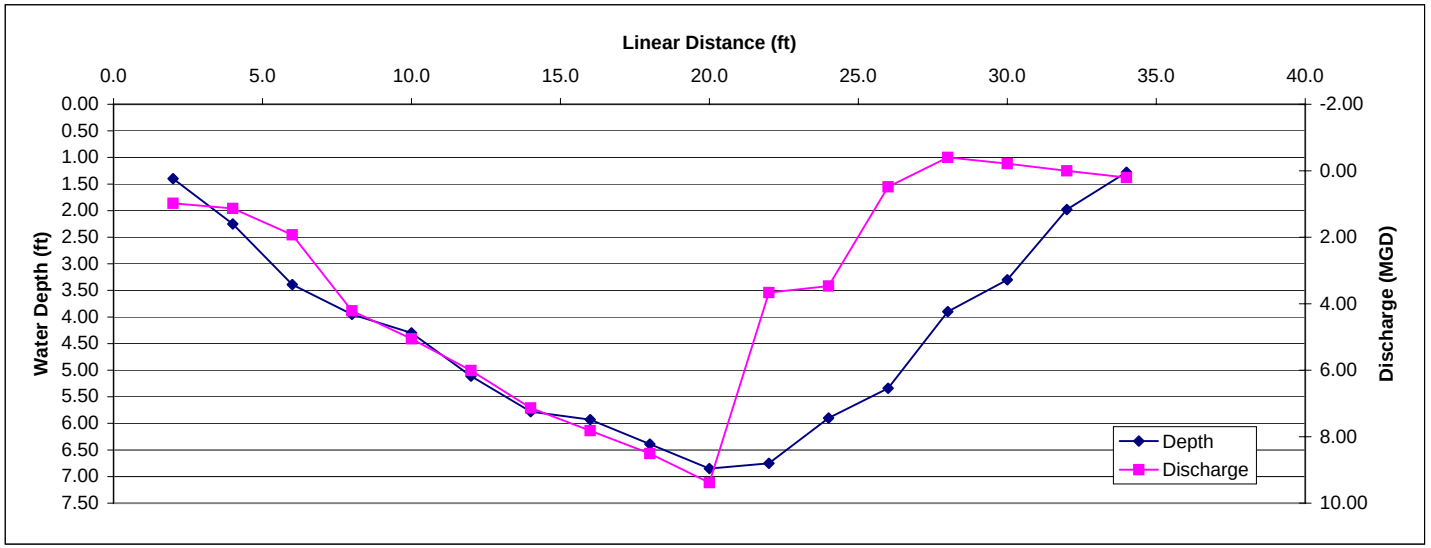
Weeki Wachee Cross Sectional Flow at Pool/Slide - March 10, 2009 at 10:35

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	3.0	1.27		0.29		3.81	1.10	2703	0.71	8.84	1.17%	0.10
	4.0	2.0	2.53		0.32		5.06	1.62	3961	1.05	9.75	1.71%	0.17
	6.0	2.0	3.65	0.39		0.75	7.30	4.16	10180	2.69	11.89	4.39%	0.52
	8.0	2.0	4.16	0.92		0.89	8.32	7.53	18422	4.87	28.04	7.95%	2.23
	10.0	2.0	4.43	0.75		1.04	8.86	7.93	19401	5.13	22.86	8.37%	1.91
	12.0	2.0	5.20	0.97		1.03	10.40	10.40	25444	6.72	29.57	10.98%	3.25
	14.0	2.0	5.55	0.98		1.03	11.10	10.99	26885	7.10	28.96	11.60%	3.36
	16.0	2.0	6.00	0.95		0.95	12.00	11.58	28331	7.48	29.87	12.22%	3.65
	18.0	2.0	6.54	0.98		1.02	13.08	14.26	34881	9.21	35.36	15.05%	5.32
	20.0	2.0	6.78	1.16		1.00	13.56	12.34	30190	7.98	24.99	13.02%	3.26
	22.0	2.0	6.62	0.82		0.98	13.24	9.20	22513	5.95	12.50	9.71%	1.21
	24.0	2.0	5.93	0.41		0.03	11.86	2.61	6384	1.69	12.50	2.75%	0.34
	26.0	2.0	5.20	0.09		0.22	10.40	1.61	3944	1.04	2.74	1.70%	0.05
	28.0	2.0	4.01	-0.08		-0.08	8.02	-0.64	-1570	-0.41	-2.44	-0.68%	0.02
	30.0	2.0	2.76	-0.05		0.01	5.52	-0.11	-270	-0.07	-1.52	-0.12%	0.00
	32.0	7.0	1.20		0.02		8.40	0.17	411	0.11	0.61	0.18%	0.00
End	38.0												
		38.0	4.49	0.64	0.21	0.68	150.93	94.75	231811	61.24	15.91	100%	25.39
			(cm/s)	19.44	6.40	20.80							



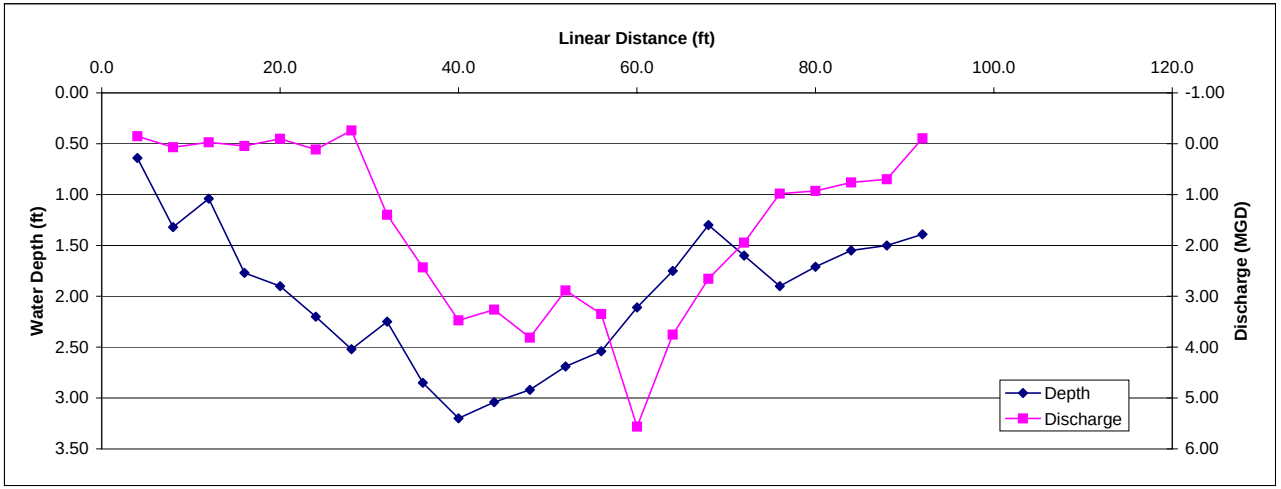
APPENDIX C
Weeki Wachee Cross Sectional Flow at Pool/Slide - March 10, 2009 at 11:10

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	3.0	1.40		0.36		4.20	1.51	3699	0.98	10.97	1.65%	0.18
	4.0	2.0	2.25		0.39		4.50	1.76	4294	1.13	11.89	1.91%	0.23
	6.0	2.0	3.39	0.20		0.68	6.78	2.98	7299	1.93	6.10	3.25%	0.20
	8.0	2.0	3.95	0.74		0.91	7.90	6.52	15946	4.21	22.56	7.09%	1.60
	10.0	2.0	4.30	0.88		0.94	8.60	7.83	19147	5.06	26.82	8.52%	2.28
	12.0	2.0	5.11	0.98		0.84	10.22	9.30	22754	6.01	29.87	10.12%	3.02
	14.0	2.0	5.78	0.89		0.89	11.56	11.04	27010	7.14	31.09	12.02%	3.74
	16.0	2.0	5.93	1.02		0.96	11.86	12.10	29597	7.82	32.92	13.17%	4.33
	18.0	2.0	6.39	1.08		0.92	12.78	13.16	32205	8.51	34.75	14.33%	4.98
	20.0	2.0	6.85	1.14		1.07	13.70	14.52	35529	9.39	32.00	15.81%	5.06
	22.0	2.0	6.75	1.05		0.67	13.50	5.67	13872	3.66	5.18	6.17%	0.32
	24.0	2.0	5.90	0.17		0.74	11.80	5.37	13136	3.47	5.18	5.84%	0.30
	26.0	2.0	5.34	-0.08		0.22	10.68	0.75	1829	0.48	-2.44	0.81%	-0.02
	28.0	2.0	3.90	-0.09		-0.07	7.80	-0.62	-1527	-0.40	-2.74	-0.68%	0.02
	30.0	2.0	3.30	-0.03		-0.07	6.60	-0.33	-807	-0.21	-0.91	-0.36%	0.00
	32.0	2.0	1.98		0.00		3.96	0.00	0	0.00	0.00	0.00%	0.00
	34.0	5.0	1.28		0.05		6.40	0.32	783	0.21	1.52	0.35%	0.01
End	38.0												
		38.0	4.34	0.61	0.20	0.67	152.84	91.87	224764	59.38	14.40	100%	26.25
			(cm/s)	18.64	6.10	20.40							



APPENDIX C
Weeki Wachee Cross Sectional Flow at Second Sonde - March 11, 2009 at 10 ;15

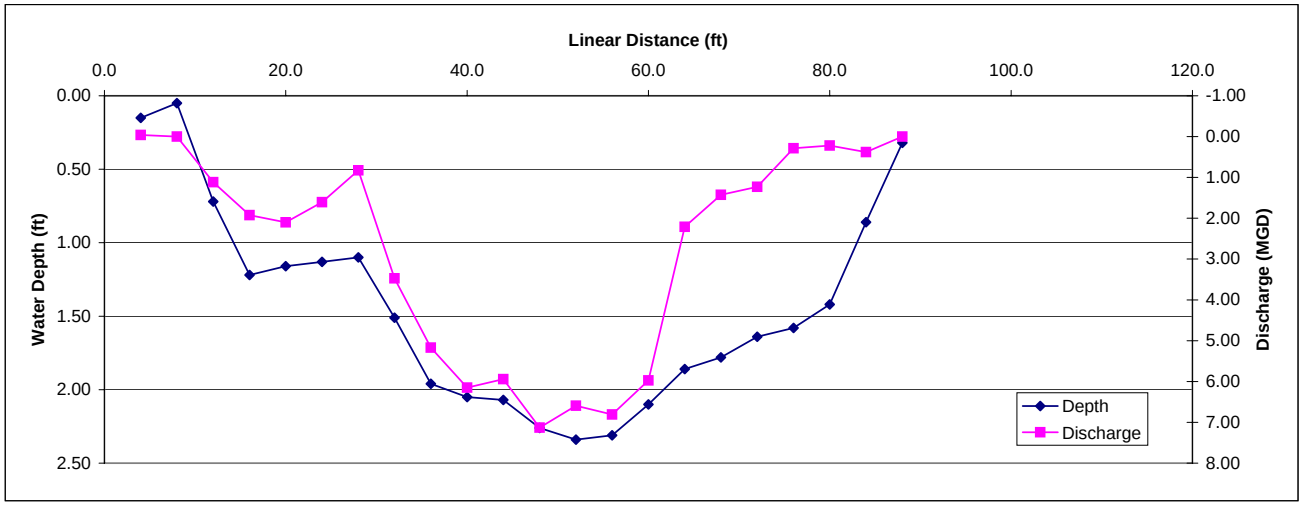
	Distance from Initial Point	Segment Width	Total Depth	Velocity (ft/s)			Segment Area	Discharge			Surface Velocity	Flow proportion	Weighted Velocity
	(ft.)	(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^2)	(ft^3/s)	(m^3/d)	(MGD)	(cm/s)	(%)	(cm/s)
Start	0.0												
	4.0	6.0	0.64		-0.06		3.84	-0.23	-564	-0.15	-1.83	-0.40%	0.01
	8.0	4.0	1.32		0.02		5.28	0.11	258	0.07	0.61	0.18%	0.00
	12.0	4.0	1.04		-0.01		4.16	-0.04	-102	-0.03	-0.30	-0.07%	0.00
	16.0	4.0	1.77		0.01		7.08	0.07	173	0.05	0.30	0.12%	0.00
	20.0	4.0	1.90		-0.02		7.60	-0.15	-372	-0.10	-0.61	-0.26%	0.00
	24.0	4.0	2.20		0.02		8.80	0.18	431	0.11	0.61	0.30%	0.00
	28.0	4.0	2.52		-0.04		10.08	-0.40	-986	-0.26	28.65	-0.70%	-0.20
	32.0	4.0	2.25		0.24		9.00	2.16	5285	1.40	7.32	3.72%	0.27
	36.0	4.0	2.85	0.54		0.66	11.40	3.76	9204	2.43	0.00	6.49%	0.00
	40.0	4.0	3.20	1.04		0.84	12.80	5.38	13153	3.47	0.00	9.27%	0.00
	44.0	4.0	3.04	1.06		0.83	12.16	5.05	12346	3.26	0.00	8.70%	0.00
	48.0	4.0	2.92	0.75		1.01	11.68	5.90	14431	3.81	0.00	10.17%	0.00
	52.0	4.0	2.69	0.91		0.83	10.76	4.47	10925	2.89	0.00	7.70%	0.00
	56.0	4.0	2.54	0.94		1.02	10.16	5.18	12677	3.35	0.00	8.93%	0.00
	60.0	4.0	2.11		1.02		8.44	8.61	21062	5.56	31.09	14.84%	4.61
	64.0	4.0	1.75		0.83		7.00	5.81	14215	3.76	25.30	10.02%	2.53
	68.0	4.0	1.30		0.79		5.20	4.11	10051	2.66	24.08	7.08%	1.71
	72.0	4.0	1.60		0.47		6.40	3.01	7359	1.94	14.33	5.19%	0.74
	76.0	4.0	1.90		0.20		7.60	1.52	3719	0.98	6.10	2.62%	0.16
	80.0	4.0	1.71		0.21		6.84	1.44	3514	0.93	6.40	2.48%	0.16
	84.0	4.0	1.55		0.19		6.20	1.18	2882	0.76	5.79	2.03%	0.12
	88.0	4.0	1.50		0.18		6.00	1.08	2642	0.70	5.49	1.86%	0.10
	92.0	12.0	1.39		-0.01		16.68	-0.17	-408	-0.11	-0.30	-0.29%	0.00
End	102.0												
		102.0	1.99	0.87	0.24	0.87	195.16	58.00	141895	37.49	6.65	100%	10.22
			(cm/s)	26.62	7.24	26.37							



APPENDIX C

Weeki Wachee Cross Sectional Flow at Second Sonde - March 12, 2009 at 11:00

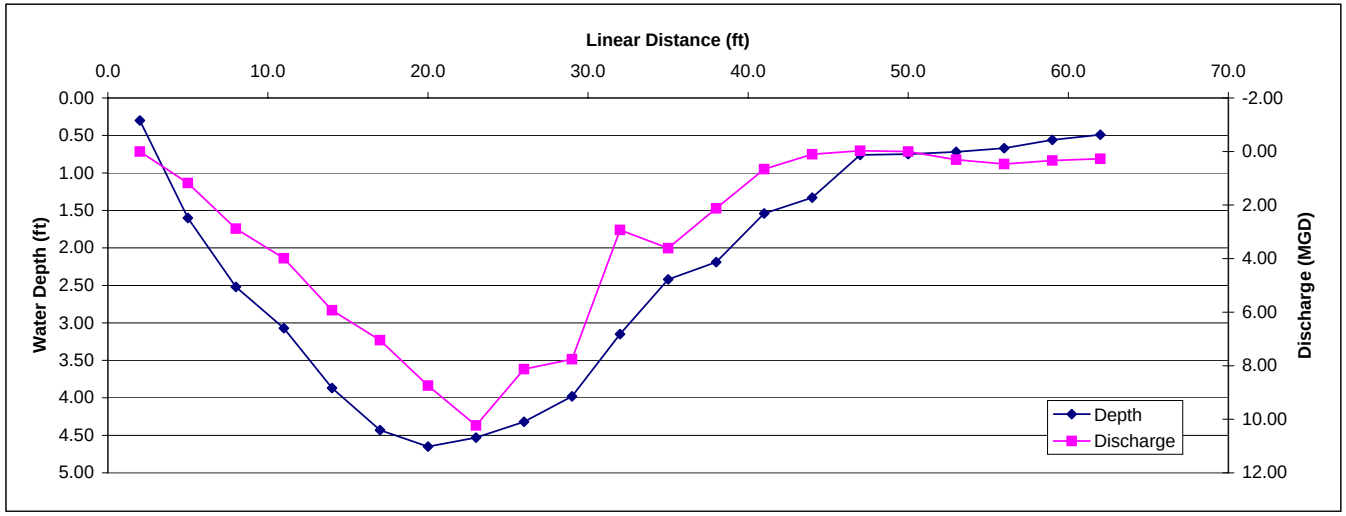
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	4.0	6.0	0.15		-0.07		0.90	-0.06	-154	-0.04	-2.13	-0.07%	0.00
	8.0	4.0	0.05		0.00		0.20	0.00	0	0.00	0.00	0.00%	0.00
	12.0	4.0	0.72		0.60		2.88	1.73	4228	1.12	18.29	1.85%	0.34
	16.0	4.0	1.22		0.61		4.88	2.98	7283	1.92	18.59	3.18%	0.59
	20.0	4.0	1.16		0.70		4.64	3.25	7946	2.10	21.34	3.47%	0.74
	24.0	4.0	1.13		0.55		4.52	2.49	6082	1.61	16.76	2.66%	0.45
	28.0	4.0	1.10		0.29		4.40	1.28	3122	0.82	8.84	1.36%	0.12
	32.0	4.0	1.51		0.89		6.04	5.38	13152	3.47	27.13	5.74%	1.56
	36.0	4.0	1.96		1.02		7.84	8.00	19565	5.17	31.09	8.54%	2.66
	40.0	4.0	2.05		1.16		8.20	9.51	23272	6.15	35.36	10.16%	3.59
	44.0	4.0	2.07		1.11		8.28	9.19	22486	5.94	33.83	9.82%	3.32
	48.0	4.0	2.26		1.22		9.04	11.03	26983	7.13	37.19	11.78%	4.38
	52.0	4.0	2.34		1.09		9.36	10.20	24961	6.59	33.22	10.90%	3.62
	56.0	4.0	2.31		1.14		9.24	10.53	25771	6.81	34.75	11.25%	3.91
	60.0	4.0	2.10		1.10		8.40	9.24	22606	5.97	33.53	9.87%	3.31
	64.0	4.0	1.86		0.46		7.44	3.42	8373	2.21	14.02	3.66%	0.51
	68.0	4.0	1.78		0.31		7.12	2.21	5400	1.43	9.45	2.36%	0.22
	72.0	4.0	1.64		0.29		6.56	1.90	4654	1.23	8.84	2.03%	0.18
	76.0	4.0	1.58		0.07		6.32	0.44	1082	0.29	2.13	0.47%	0.01
	80.0	4.0	1.42		0.06		5.68	0.34	834	0.22	1.83	0.36%	0.01
	84.0	4.0	0.86		0.17		3.44	0.58	1431	0.38	5.18	0.62%	0.03
	88.0	16.0	0.32		0.00		5.12	0.00	0	0.00	0.00	0.00%	0.00
End	102.0												
		102.0	1.44		0.58		130.50	93.63	229077	60.52	17.69	100%	29.54
			(cm/s)		17.69								



APPENDIX C

Weeki Wachee Cross Sectional Flow at Third Sonde - March 09, 2009 at 17:33

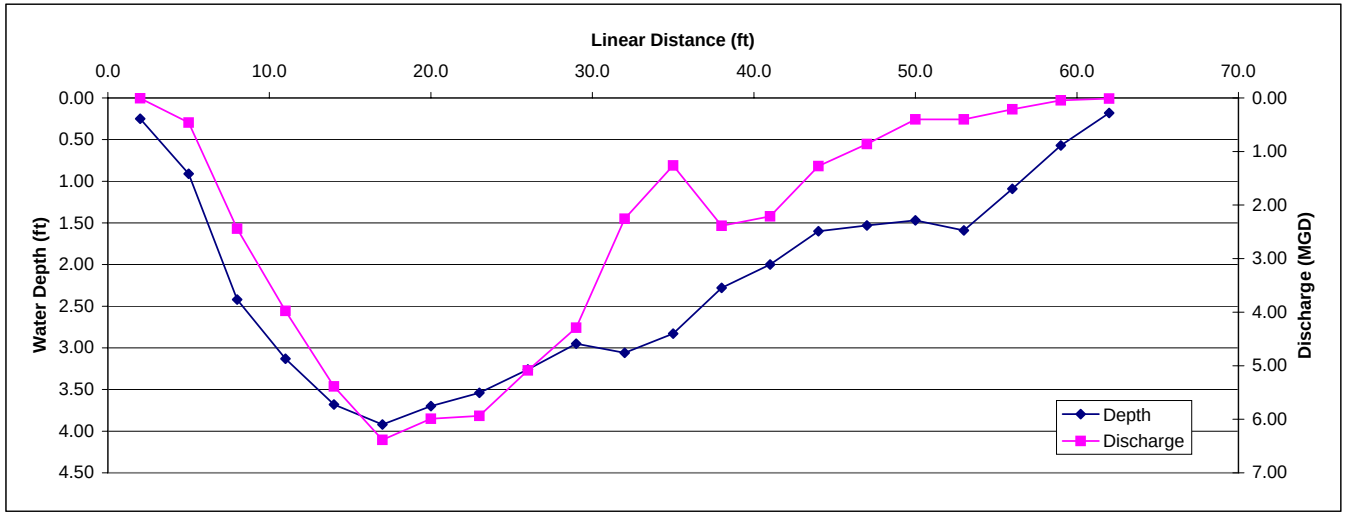
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	2.0	3.5	0.30		0.00		1.05	0.00	0	0.00	0.00	0.00%	0.00
	5.0	3.0	1.60		0.38		4.80	1.82	4463	1.18	11.58	1.77%	0.20
	8.0	3.0	2.52		0.59		7.56	4.46	10913	2.88	17.98	4.32%	0.78
	11.0	3.0	3.07	0.74		0.60	9.21	6.17	15097	3.99	22.56	5.98%	1.35
	14.0	3.0	3.87	0.73		0.85	11.61	9.17	22440	5.93	22.25	8.89%	1.98
	17.0	3.0	4.43	1.03		0.61	13.29	10.90	26662	7.04	31.39	10.57%	3.32
	20.0	3.0	4.65	0.94		0.86	13.95	13.53	33106	8.75	32.92	13.12%	4.32
	23.0	3.0	4.53	1.08		1.15	13.59	15.83	38735	10.23	35.97	15.35%	5.52
	26.0	3.0	4.32	1.18		1.05	12.96	12.57	30756	8.13	27.13	12.19%	3.31
	29.0	3.0	3.98	0.89		1.13	11.94	12.00	29358	7.76	26.82	11.63%	3.12
	32.0	3.0	3.15	0.88		0.96	9.45	4.54	11098	2.93	0.00	4.40%	0.00
	35.0	3.0	2.42		0.77		7.26	5.59	13677	3.61	23.47	5.42%	1.27
	38.0	3.0	2.19		0.50		6.57	3.29	8037	2.12	15.24	3.19%	0.49
	41.0	3.0	1.54		0.22		4.62	1.02	2487	0.66	6.71	0.99%	0.07
	44.0	3.0	1.33		0.04		3.99	0.16	390	0.10	1.22	0.15%	0.00
	47.0	3.0	0.76		-0.02		2.28	-0.05	-112	-0.03	-0.61	-0.04%	0.00
	50.0	3.0	0.75		0.00		2.25	0.00	0	0.00	0.00	0.00%	0.00
	53.0	3.0	0.72		0.22		2.16	0.48	1163	0.31	6.71	0.46%	0.03
	56.0	3.0	0.67		0.36		2.01	0.72	1770	0.47	10.97	0.70%	0.08
	59.0	3.0	0.56		0.31		1.68	0.52	1274	0.34	9.45	0.50%	0.05
	62.0	4.5	0.49		0.19		2.21	0.42	1025	0.27	5.79	0.41%	0.02
End	65.0												
		65.0	2.28	0.93	0.27	0.90	144.44	103.14	252339	66.66	14.64	100%	25.90
			(cm/s)	28.46	8.35	27.47							



APPENDIX C

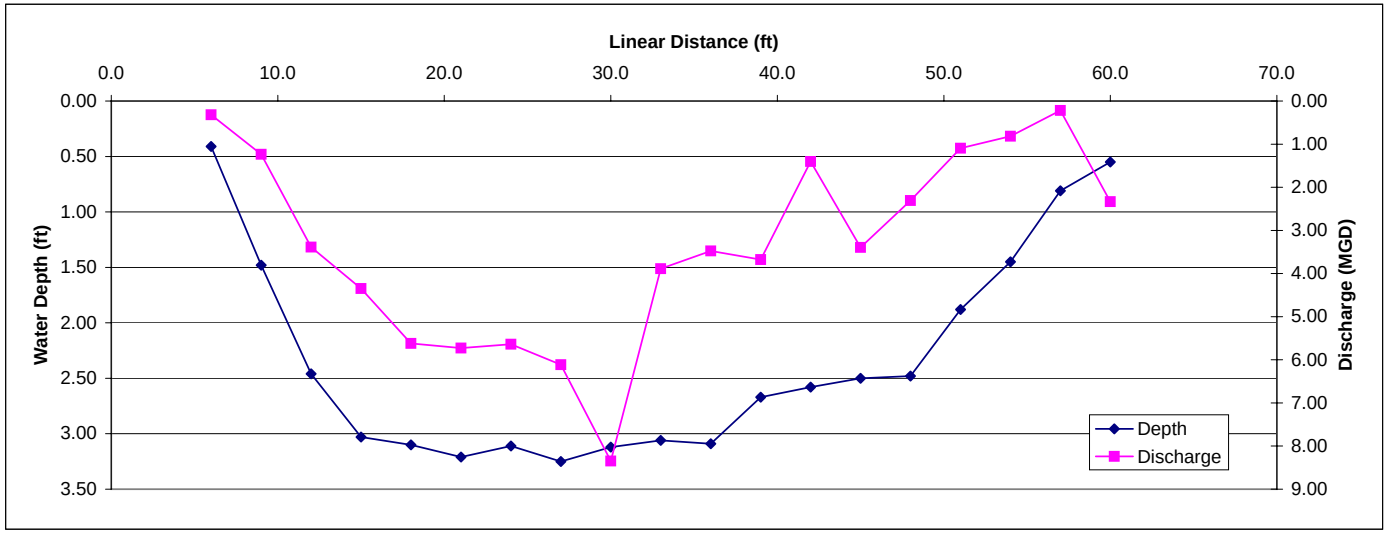
Weeki Wachee Cross Sectional Flow at Third Sonde - March 10, 2009 at 17:45

	Distance from Initial Point	Segment Width	Total Depth	Velocity (ft/s)			Segment Area	Discharge			Surface Velocity	Flow proportion	Weighted Velocity
	(ft.)	(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^2)	(ft^3/s)	(m^3/d)	(MGD)	(cm/s)	(%)	(cm/s)
Start	0.0												
	2.0	3.5	0.25		0.01		0.88	0.01	21	0.01	0.30	0.01%	0.00
	5.0	3.0	0.91		0.26		2.73	0.71	1737	0.46	7.92	0.89%	0.07
	8.0	3.0	2.42		0.52		7.26	3.78	9236	2.44	15.85	4.76%	0.75
	11.0	3.0	3.13	0.77		0.54	9.39	6.15	15048	3.98	23.47	7.75%	1.82
	14.0	3.0	3.68	0.86		0.65	11.04	8.34	20393	5.39	26.21	10.51%	2.75
	17.0	3.0	3.92	0.92		0.76	11.76	9.88	24168	6.38	28.04	12.45%	3.49
	20.0	3.0	3.70	0.84		0.86	11.10	9.27	22676	5.99	24.69	11.68%	2.88
	23.0	3.0	3.54	0.81		0.80	10.62	9.19	22475	5.94	28.35	11.58%	3.28
	26.0	3.0	3.26	0.93		0.83	9.78	7.87	19262	5.09	23.77	9.92%	2.36
	29.0	3.0	2.95	0.78		0.76	8.85	6.64	16239	4.29	22.56	8.37%	1.89
	32.0	3.0	3.06	0.74		0.76	9.18	3.49	8535	2.25	0.00	4.40%	0.00
	35.0	3.0	2.83	0.55		0.46	8.49	1.95	4777	1.26	0.00	2.46%	0.00
	38.0	3.0	2.28		0.54		6.84	3.69	9037	2.39	16.46	4.66%	0.77
	41.0	3.0	2.00		0.57		6.00	3.42	8367	2.21	17.37	4.31%	0.75
	44.0	3.0	1.60		0.41		4.80	1.97	4815	1.27	12.50	2.48%	0.31
	47.0	3.0	1.53		0.29		4.59	1.33	3257	0.86	8.84	1.68%	0.15
	50.0	3.0	1.47		0.14		4.41	0.62	1511	0.40	4.27	0.78%	0.03
	53.0	3.0	1.59		0.13		4.77	0.62	1517	0.40	3.96	0.78%	0.03
	56.0	3.0	1.09		0.10		3.27	0.33	800	0.21	3.05	0.41%	0.01
	59.0	3.0	0.57		0.04		1.71	0.07	167	0.04	1.22	0.09%	0.00
	62.0	4.5	0.18		0.02		0.81	0.02	40	0.01	0.61	0.02%	0.00
End	65.0												
		65.0	2.19	0.80	0.25	0.71	138.28	79.33	194077	51.27	12.83	100%	21.36
			(cm/s)	24.38	7.70	21.74							



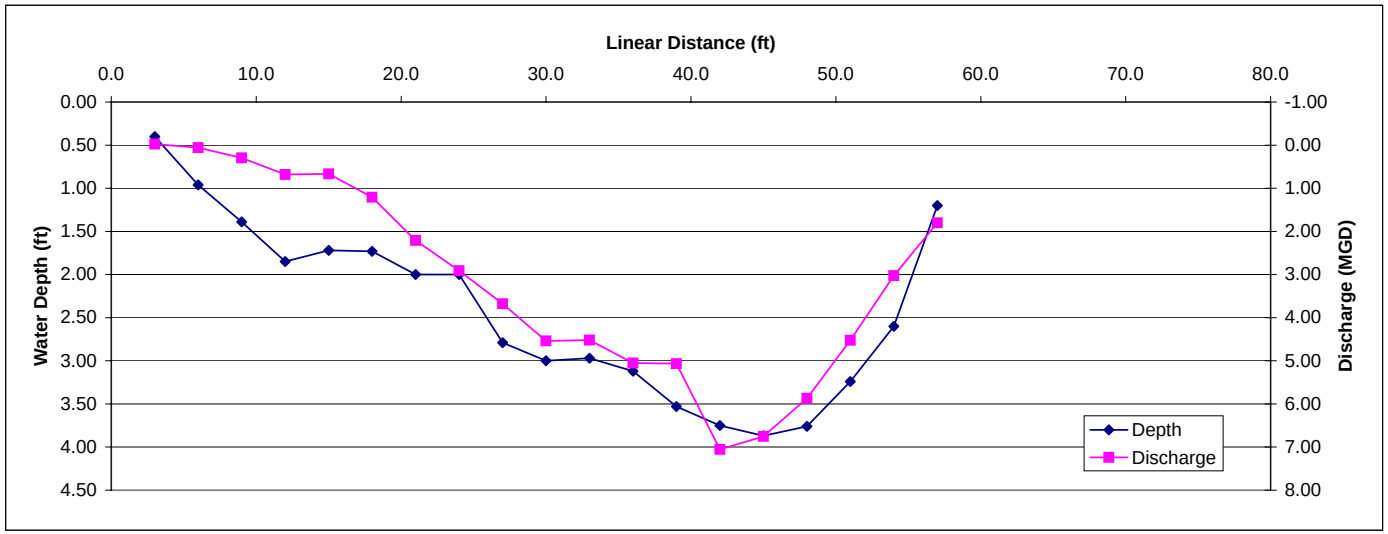
APPENDIX C
Weeki Wachee Cross Sectional Flow at Pool/Slide - March 11, 2009 at 11:00

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	Velocity (ft/s) 0.6 x depth	Velocity (ft/s) 0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	Discharge (m^3/d)	Discharge (MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	6.0	7.5	0.41		0.16		3.08	0.49	1204	0.32	4.88	0.50%	0.02
	9.0	3.0	1.48		0.43		4.44	1.91	4671	1.23	13.11	1.95%	0.26
	12.0	3.0	2.46		0.71		7.38	5.24	12820	3.39	21.64	5.35%	1.16
	15.0	3.0	3.03	0.76		0.72	9.09	6.73	16457	4.35	23.16	6.86%	1.59
	18.0	3.0	3.10	0.91		0.96	9.30	8.70	21274	5.62	27.74	8.87%	2.46
	21.0	3.0	3.21	1.06		0.78	9.63	8.86	21676	5.73	32.31	9.04%	2.92
	24.0	3.0	3.11	0.87		0.91	9.33	8.72	21343	5.64	29.26	8.90%	2.60
	27.0	3.0	3.25	0.96		0.93	9.75	9.46	23138	6.11	30.78	9.65%	2.97
	30.0	3.0	3.12	1.01		1.86	9.36	12.92	31602	8.35	27.43	13.18%	3.62
	33.0	3.0	3.06	0.90		0.81	9.18	6.01	14711	3.89	0.00	6.14%	0.00
	36.0	3.0	3.09	0.50		0.43	9.27	5.38	13154	3.48	0.00	5.49%	0.00
	39.0	3.0	2.67	0.73		0.65	8.01	5.69	13914	3.68	0.00	5.80%	0.00
	42.0	3.0	2.58	0.77		0.56	7.74	2.17	5302	1.40	0.00	2.21%	0.00
	45.0	3.0	2.50		0.70		7.50	5.25	12845	3.39	21.34	5.36%	1.14
	48.0	3.0	2.48		0.48		7.44	3.57	8737	2.31	14.63	3.64%	0.53
	51.0	3.0	1.88		0.30		5.64	1.69	4140	1.09	9.14	1.73%	0.16
	54.0	3.0	1.45		0.29		4.35	1.26	3086	0.82	8.84	1.29%	0.11
	57.0	3.0	0.81		0.14		2.43	0.34	832	0.22	4.27	0.35%	0.01
	60.0	6.5	0.55		1.01		3.58	3.61	8834	2.33	30.78	3.68%	1.13
End	65.0												
		65.0	2.33	0.85	0.47	0.86	136.49	97.99	239740	63.33	15.75	100%	20.70
			(cm/s)	25.82	14.29	26.24							



APPENDIX C
Weeki Wachee Cross Sectional Flow at Third Sonde - March 12, 2009 at 9:55

	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)	Surface Velocity (cm/s)	Flow proportion (%)	Weighted Velocity (cm/s)
Start	0.0												
	3.0	4.5	0.40		-0.02		1.80	-0.04	-88	-0.02	-0.61	-0.04%	0.00
	6.0	3.0	0.96		0.03		2.88	0.09	211	0.06	0.91	0.09%	0.00
	9.0	3.0	1.39		0.11		4.17	0.46	1122	0.30	3.35	0.50%	0.02
	12.0	3.0	1.85		0.19		5.55	1.05	2580	0.68	5.79	1.14%	0.07
	15.0	3.0	1.72		0.20		5.16	1.03	2525	0.67	6.10	1.11%	0.07
	18.0	3.0	1.73		0.36		5.19	1.87	4571	1.21	10.97	2.02%	0.22
	21.0	3.0	2.00		0.57		6.00	3.42	8367	2.21	17.37	3.69%	0.64
	24.0	3.0	2.00		0.75		6.00	4.50	11010	2.91	23.47	4.86%	1.14
	27.0	3.0	2.79	0.77		0.56	8.37	5.69	13925	3.68	24.38	6.14%	1.50
	30.0	3.0	3.00	0.80		0.78	9.00	7.02	17175	4.54	0.00	7.58%	0.00
	33.0	3.0	2.97	0.78		0.75	8.91	6.99	17112	4.52	29.87	7.55%	2.26
	36.0	3.0	3.12	0.82		0.76	9.36	7.82	19121	5.05	17.37	8.44%	1.47
	39.0	3.0	3.53	0.91		0.86	10.59	7.84	19173	5.07	18.90	8.46%	1.60
	42.0	3.0	3.75	1.01		0.93	11.25	10.91	26698	7.05	30.78	11.78%	3.63
	45.0	3.0	3.87	0.98		0.82	11.61	10.45	25564	6.75	29.87	11.28%	3.37
	48.0	3.0	3.76	0.83		0.78	11.28	9.08	22216	5.87	25.30	9.80%	2.48
	51.0	3.0	3.24	0.57		0.87	9.72	7.00	17122	4.52	17.37	7.55%	1.31
	54.0	3.0	2.60	0.62		0.58	7.80	4.68	11450	3.02	18.90	5.05%	0.95
	57.0	14.5	1.20		0.16		17.40	2.78	6811	1.80	4.88	3.00%	0.15
End	70.0												
		70.0	2.41	0.81	0.26	0.77	152.04	92.65	226667	59.88	15.00	100%	20.86
			(cm/s)	24.66	7.96	23.44							



Appendix D

Light Transmission

APPENDIX D

De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES (October 2008)

Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	VDL-1	10/6/2008	12:48	1	6.71	0.250	77.86	22.14
	VDL-1	10/6/2008	12:48	2	6.71	0.225	79.82	20.18
	VDL-1	10/8/2008	14:47	1	7.92	0.216	80.59	19.41
	VDL-1	10/8/2008	14:47	2	7.92	0.206	81.41	18.59
	VDL-2	10/6/2008	13:10	1	0.91	0.301	74.02	25.98
	VDL-2	10/6/2008	13:10	2	0.91	0.282	75.45	24.55
	VDL-2	10/7/2008	8:20	1	2.13	0.387	67.90	32.10
	VDL-2	10/7/2008	8:20	2	2.13	0.374	68.80	31.20
	VDL-2	10/7/2008	10:49	1	2.13	0.357	69.96	30.04
	VDL-2	10/7/2008	10:49	2	2.13	0.384	68.14	31.86
	VDL-2	10/7/2008	15:35	1	2.13	0.453	63.55	36.45
	VDL-2	10/7/2008	15:35	2	2.13	0.432	64.92	35.08
	VDL-2	10/9/2008	12:14	1	1.83	0.279	75.67	24.33
	VDL-2	10/9/2008	12:14	2	1.83	0.177	83.75	16.25
Spring Run	VDL-dock	10/6/2008	16:43	1	1.52	1.259	28.39	71.61
	VDL-dock	10/6/2008	16:43	2	1.52	1.365	25.54	74.46
	VDL-dock	10/9/2008	11:50	1	2.13	1.172	30.96	69.04
	VDL-dock	10/9/2008	11:50	2	2.13	1.189	30.45	69.55
	VDL-3	10/7/2008	9:35	1	1.52	1.971	13.93	86.07
	VDL-3	10/7/2008	9:35	2	1.52	2.110	12.12	87.88
	VDL-3	10/7/2008	13:25	1	1.52	1.825	16.12	83.88
	VDL-3	10/7/2008	13:25	2	1.52	2.039	13.02	86.98
	VDL-3	10/8/2008	13:55	1	2.13	1.613	19.93	80.07
	VDL-3	10/8/2008	13:55	2	2.13	1.726	17.80	82.20

Averages

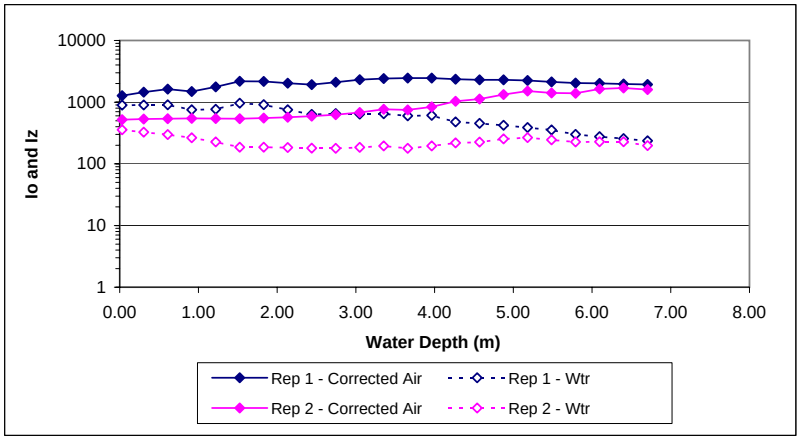
Spring Pool	**VDL-1**	**7.32**	**0.22**	**79.92**	**20.08**
	VDL-2	**1.83**	**0.34**	**71.22**	**28.78**
	Pool	**3.40**	**0.31**	**73.70**	**26.30**
Spring Run	**VDL-dock**	**1.83**	**1.25**	**28.84**	**71.16**
	VDL-3	**1.73**	**1.88**	**15.49**	**84.51**
	Run	**1.77**	**1.63**	**20.83**	**79.17**

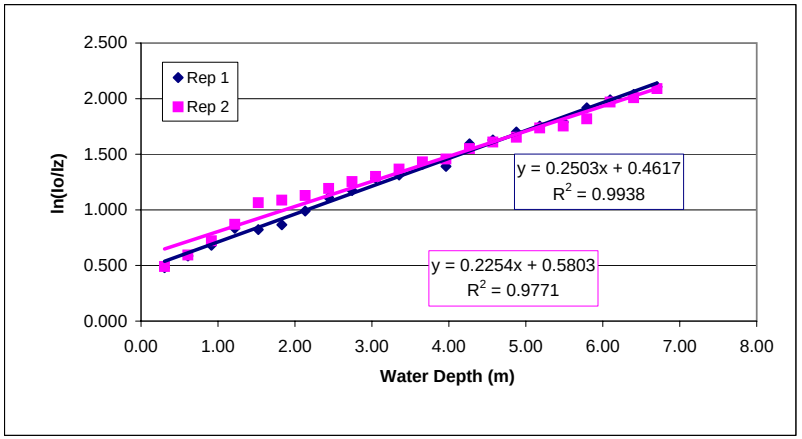
APPENDIX D

De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-1 - 10/06/2008 12:48

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,270.3	1,315.0	895.2	6.80			0.03	518.7	540.5	356.3	5.88		
0.30	1,456.7	1,507.0	901.3	6.80	0.480	1.575	0.30	532.9	555.2	326.5	5.79	0.490	1.608
0.61	1,622.6	1,678.0	904.2	6.81	0.585	0.959	0.61	540.1	562.6	298.3	5.70	0.594	0.974
0.91	1,487.7	1,539.0	752.8	6.62	0.681	0.745	0.91	544.0	566.6	264.4	5.58	0.721	0.789
1.22	1,766.2	1,826.0	766.6	6.64	0.835	0.685	1.22	542.6	565.2	227.2	5.43	0.871	0.714
1.52	2,185.5	2,258.0	960.3	6.87	0.822	0.540	1.52	537.8	560.2	185.6	5.22	1.064	0.698
1.83	2,172.9	2,245.0	913.8	6.82	0.866	0.474	1.83	550.6	573.4	185.7	5.22	1.087	0.594
2.13	2,025.4	2,093.0	753.1	6.62	0.989	0.464	2.13	569.8	593.2	184.2	5.22	1.129	0.529
2.44	1,924.4	1,989.0	633.6	6.45	1.111	0.456	2.44	591.5	615.5	179.6	5.19	1.192	0.489
2.74	2,106.9	2,177.0	651.4	6.48	1.174	0.428	2.74	624.8	649.9	178.3	5.18	1.254	0.457
3.05	2,319.4	2,396.0	641.6	6.46	1.285	0.422	3.05	678.4	705.1	184.8	5.22	1.300	0.427
3.35	2,417.5	2,497.0	650.3	6.48	1.313	0.392	3.35	766.5	795.9	195.6	5.28	1.366	0.407
3.66	2,462.1	2,543.0	600.9	6.40	1.410	0.386	3.66	747.0	775.8	178.5	5.18	1.432	0.391
3.96	2,456.3	2,537.0	611.0	6.42	1.391	0.351	3.96	839.3	870.9	195.5	5.28	1.457	0.368
4.27	2,360.2	2,438.0	479.5	6.17	1.594	0.373	4.27	1,031.6	1,069.0	218.8	5.39	1.551	0.363
4.57	2,302.0	2,378.0	452.0	6.11	1.628	0.356	4.57	1,126.7	1,167.0	225.2	5.42	1.610	0.352
4.88	2,305.8	2,382.0	421.3	6.04	1.700	0.349	4.88	1,325.6	1,372.0	253.8	5.54	1.653	0.339
5.18	2,244.7	2,319.0	388.9	5.96	1.753	0.338	5.18	1,511.0	1,563.0	266.1	5.58	1.737	0.335
5.49	2,126.3	2,197.0	355.0	5.87	1.790	0.326	5.49	1,411.0	1,460.0	244.3	5.50	1.754	0.320
5.79	2,039.9	2,108.0	299.8	5.70	1.918	0.331	5.79	1,393.6	1,442.0	226.3	5.42	1.818	0.314
6.10	2,014.7	2,082.0	275.6	5.62	1.989	0.326	6.10	1,635.2	1,691.0	228.2	5.43	1.969	0.323
6.40	1,971.0	2,037.0	256.9	5.55	2.038	0.318	6.40	1,696.4	1,754.0	227.8	5.43	2.008	0.314
6.71	1,937.1	2,002.0	235.7	5.46	2.106	0.314	6.71	1,597.4	1,652.0	197.7	5.29	2.089	0.312

k (diffuse attenuation coefficient = slope, m-1)			0.250	k (diffuse attenuation coefficient = slope, m-1)		0.225
k average			0.496	k average		0.519
percent transmittance @	1.0	meter	77.86	percent transmittance @	1.0	meter	79.82
Birgean Percentile Absorption (1m)			22.14	Birgean Percentile Absorption (1m)			20.18





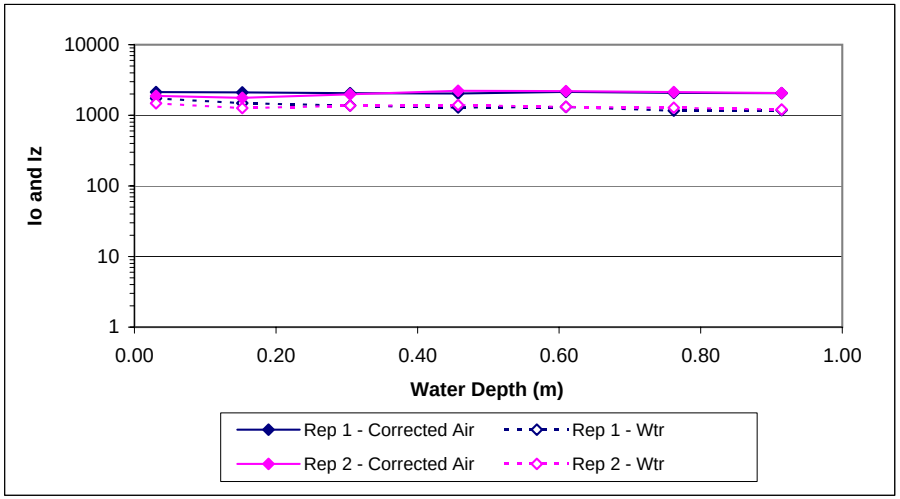
APPENDIX D

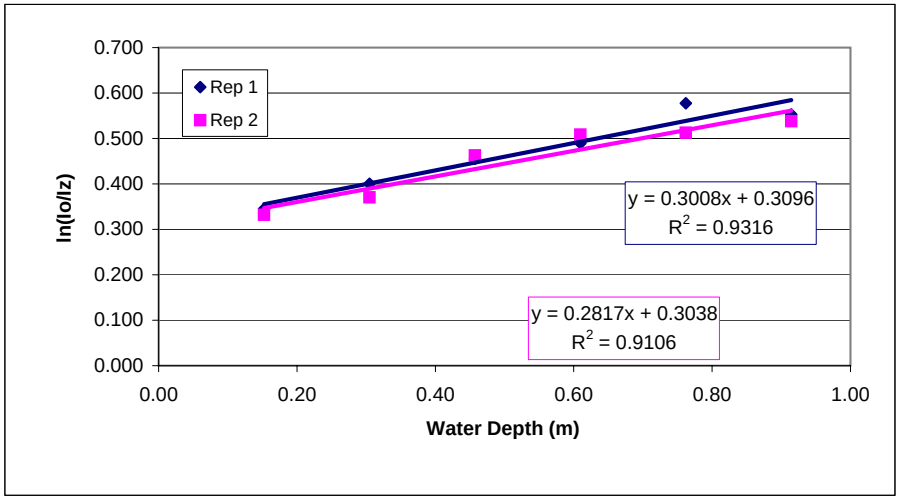
De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-2 - 10/06/2008 13:10

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,130.2	2,201.0	1,742.0	7.46			0.03	1,880.8	1,944.0	1,481.0	7.30		
0.15	2,106.9	2,177.0	1,492.0	7.31	0.345	2.264	0.15	1,767.2	1,827.0	1,268.0	7.15	0.332	2.178
0.30	2,056.4	2,125.0	1,378.0	7.23	0.400	1.313	0.30	1,985.6	2,052.0	1,371.0	7.22	0.370	1.215
0.46	2,039.9	2,108.0	1,294.0	7.17	0.455	0.996	0.46	2,223.4	2,297.0	1,400.0	7.24	0.463	1.012
0.61	2,146.7	2,218.0	1,316.0	7.18	0.489	0.803	0.61	2,200.1	2,273.0	1,323.0	7.19	0.509	0.834
0.76	2,073.9	2,143.0	1,164.0	7.06	0.578	0.758	0.76	2,132.1	2,203.0	1,277.0	7.15	0.513	0.673
0.91	2,054.5	2,123.0	1,182.0	7.07	0.553	0.605	0.91	2,065.2	2,134.0	1,206.0	7.10	0.538	0.588

k (diffuse attenuation coefficient = slope, m-1)			0.301	
k average			1.123	
percent transmittance @	1.0	meter	74.02	
Birgean Percentile Absorption (1m)			25.98	

k (diffuse attenuation coefficient = slope, m-1)			0.282
k average			1.083
percent transmittance @	1.0	meter	75.45
Birgean Percentile Absorption (1m)			24.55





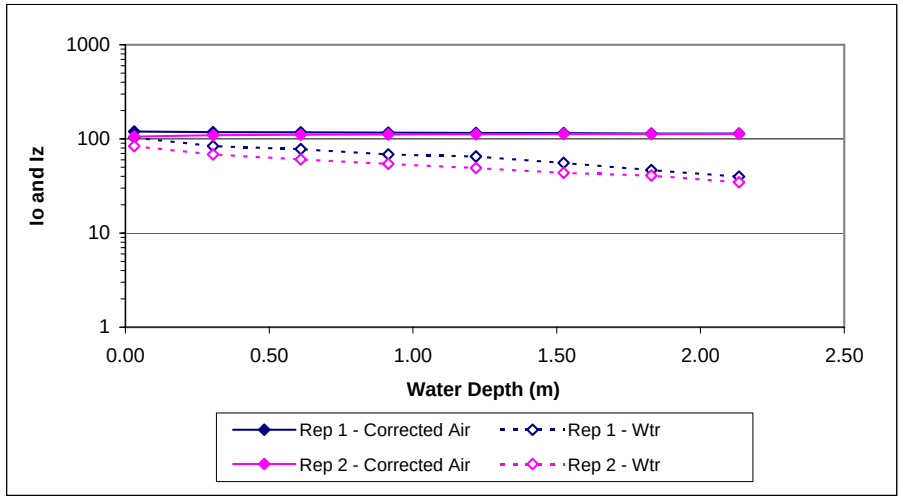
APPENDIX D

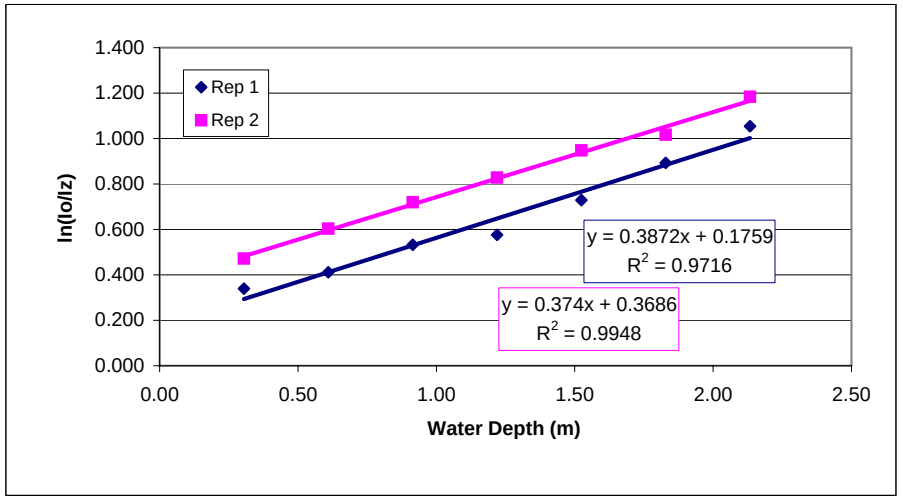
De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-2 - 10/07/2008 8:20

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	119.7	129.4	103.8	4.64			0.03	105.6	114.9	83.9	4.43		
0.30	118.0	127.7	84.1	4.43	0.339	1.113	0.30	109.7	119.1	68.5	4.23	0.472	1.547
0.61	117.8	127.4	78.0	4.36	0.412	0.675	0.61	110.8	120.2	60.6	4.10	0.603	0.990
0.91	116.8	126.4	68.6	4.23	0.533	0.583	0.91	111.7	121.2	54.4	4.00	0.720	0.787
1.22	115.8	125.4	65.1	4.18	0.576	0.473	1.22	112.2	121.7	49.0	3.89	0.828	0.679
1.52	115.3	124.9	55.6	4.02	0.729	0.478	1.52	112.8	122.3	43.7	3.78	0.948	0.622
1.83	114.1	123.6	46.7	3.84	0.893	0.488	1.83	112.8	122.3	40.8	3.71	1.017	0.556
2.13	114.0	123.5	39.7	3.68	1.054	0.494	2.13	113.1	122.6	34.6	3.54	1.184	0.555

k (diffuse attenuation coefficient = slope, m-1)			0.387	
k average			0.615	
percent transmittance @	1.0	meter	67.90	
Birgean Percentile Absorption (1m)			32.10	

k (diffuse attenuation coefficient = slope, m-1)			0.374
k average			0.819
percent transmittance @	1.0	meter	68.80
Birgean Percentile Absorption (1m)			31.20



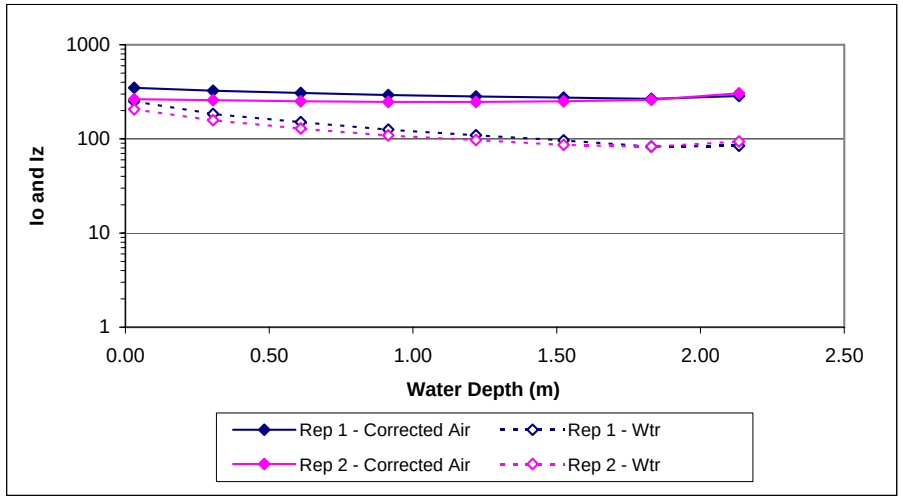


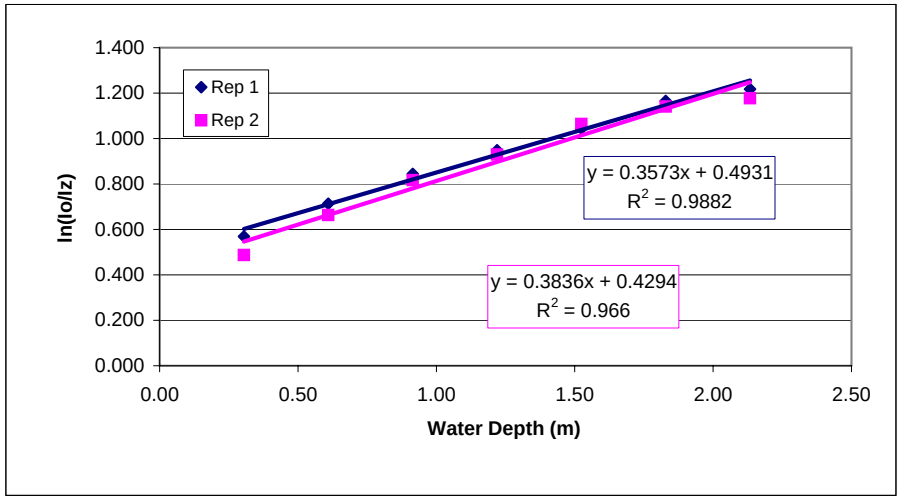
APPENDIX D

De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-2 - 10/07/2008 10:49

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	349.1	365.8	250.8	5.52			0.03	264.3	278.4	206.8	5.33		
0.30	325.2	341.1	184.1	5.22	0.569	1.866	0.30	258.0	271.9	158.5	5.07	0.487	1.598
0.61	308.2	323.6	151.0	5.02	0.713	1.170	0.61	251.0	264.7	129.3	4.86	0.663	1.088
0.91	292.2	307.1	125.6	4.83	0.844	0.923	0.91	247.2	260.8	109.2	4.69	0.817	0.894
1.22	282.5	297.1	109.4	4.70	0.948	0.778	1.22	247.0	260.6	97.5	4.58	0.929	0.762
1.52	274.8	289.2	96.8	4.57	1.044	0.685	1.52	251.4	265.1	86.7	4.46	1.064	0.698
1.83	265.9	280.0	82.9	4.42	1.166	0.637	1.83	260.1	274.1	83.1	4.42	1.141	0.624
2.13	285.8	300.6	84.6	4.44	1.217	0.571	2.13	305.7	321.1	94.2	4.55	1.178	0.552

k (diffuse attenuation coefficient = slope, m-1)			0.357	k (diffuse attenuation coefficient = slope, m-1)		0.384
k average			0.947	k average		0.888
percent transmittance @	1.0	meter	69.96	percent transmittance @	1.0	meter	68.14
Birgean Percentile Absorption (1m)			30.04	Birgean Percentile Absorption (1m)			31.86



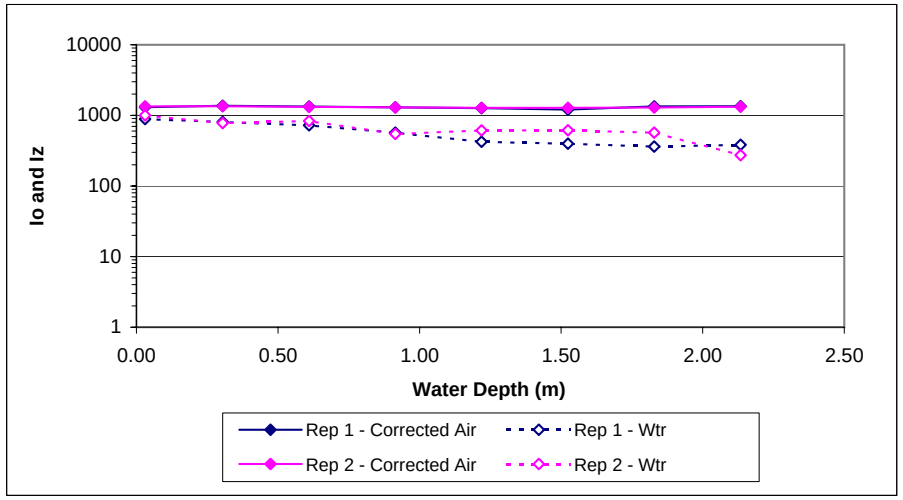


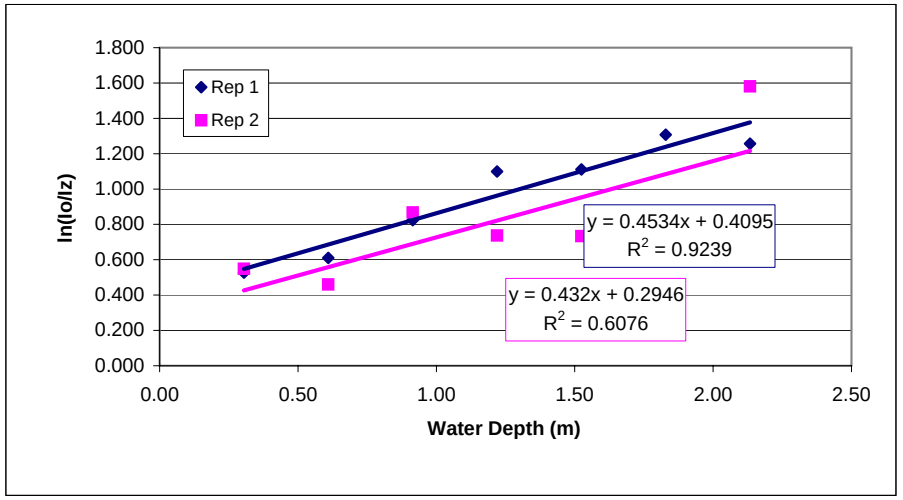
APPENDIX D

De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-2 - 10/07/2008 15:35

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,308.2	1,354.0	887.0	6.79			0.03	1,343.1	1,390.0	1,001.0	6.91		
0.30	1,366.4	1,414.0	806.4	6.69	0.527	1.730	0.30	1,349.9	1,397.0	779.9	6.66	0.549	1.800
0.61	1,337.3	1,384.0	726.1	6.59	0.611	1.002	0.61	1,320.8	1,367.0	833.8	6.73	0.460	0.755
0.91	1,299.4	1,345.0	570.2	6.35	0.824	0.901	0.91	1,301.4	1,347.0	546.7	6.30	0.867	0.948
1.22	1,269.4	1,314.0	422.9	6.05	1.099	0.902	1.22	1,279.1	1,324.0	612.0	6.42	0.737	0.605
1.52	1,210.2	1,253.0	398.6	5.99	1.111	0.729	1.52	1,281.0	1,326.0	615.5	6.42	0.733	0.481
1.83	1,340.2	1,387.0	362.5	5.89	1.308	0.715	1.83	1,293.6	1,339.0	568.6	6.34	0.822	0.449
2.13	1,346.0	1,393.0	383.0	5.95	1.257	0.589	2.13	1,327.6	1,374.0	273.2	5.61	1.581	0.741

k (diffuse attenuation coefficient = slope, m-1)			0.453	k (diffuse attenuation coefficient = slope, m-1)		0.432
k average			0.938	k average		0.826
percent transmittance @	1.0	meter	63.55	percent transmittance @	1.0	meter	64.92
Birgean Percentile Absorption (1m)			36.45	Birgean Percentile Absorption (1m)			35.08



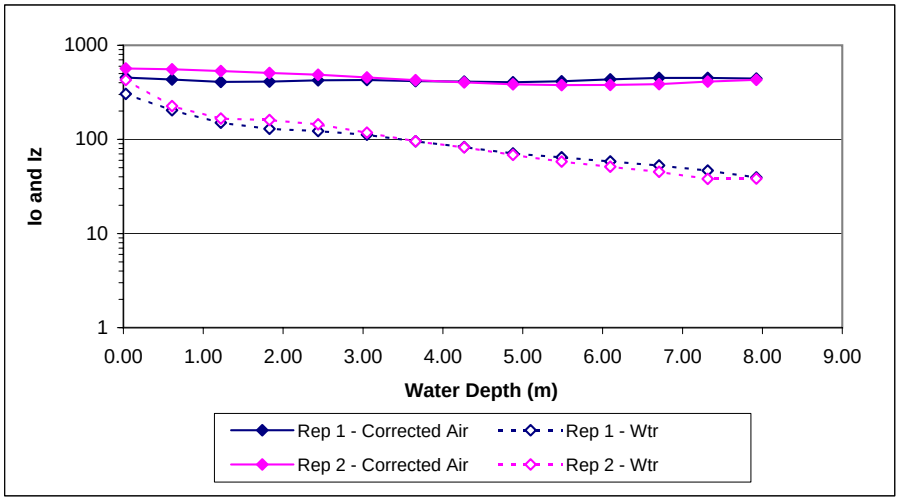


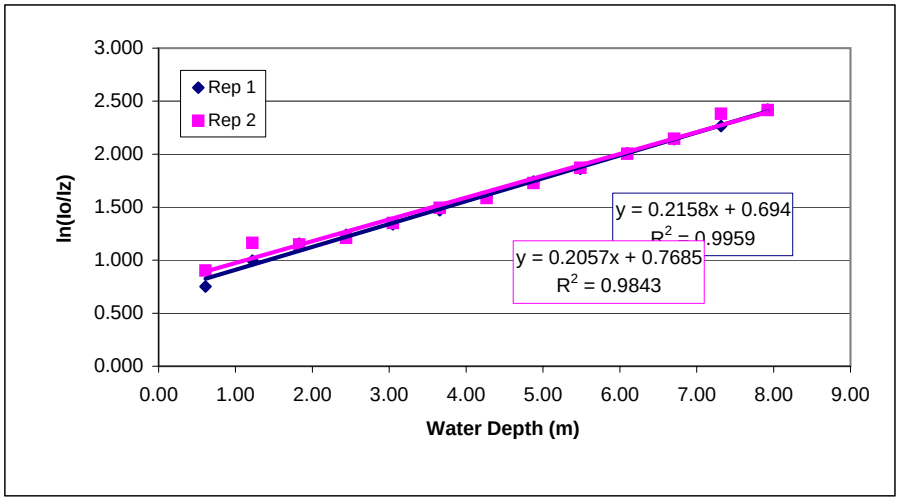
APPENDIX D

De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-1 - 10/08/2008 14:47

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	453.6	473.5	304.0	5.72			0.03	566.9	590.2	428.2	6.06		
0.61	432.2	451.4	203.9	5.32	0.751	1.232	0.61	556.7	579.7	225.9	5.42	0.902	1.480
1.22	407.8	426.3	150.7	5.02	0.996	0.817	1.22	533.3	555.6	166.7	5.12	1.163	0.954
1.83	411.6	430.2	129.6	4.86	1.156	0.632	1.83	507.6	529.1	161.0	5.08	1.148	0.628
2.44	424.0	443.0	122.9	4.81	1.238	0.508	2.44	485.9	506.7	144.8	4.98	1.211	0.496
3.05	428.0	447.1	112.2	4.72	1.339	0.439	3.05	456.1	476.0	118.2	4.77	1.350	0.443
3.66	416.3	435.0	95.5	4.56	1.472	0.402	3.66	425.8	444.8	95.6	4.56	1.494	0.408
4.27	410.8	429.4	83.1	4.42	1.599	0.375	4.27	402.8	421.1	82.4	4.41	1.586	0.372
4.88	404.5	422.9	70.9	4.26	1.741	0.357	4.88	385.2	403.0	68.5	4.23	1.727	0.354
5.49	415.1	433.8	64.5	4.17	1.861	0.339	5.49	377.3	394.8	58.1	4.06	1.871	0.341
6.10	433.8	453.1	58.2	4.06	2.008	0.329	6.10	379.5	397.1	51.2	3.94	2.003	0.329
6.71	449.8	469.5	52.8	3.97	2.142	0.319	6.71	386.9	404.7	45.2	3.81	2.146	0.320
7.32	449.9	469.6	46.7	3.84	2.266	0.310	7.32	411.7	430.3	38.1	3.64	2.381	0.326
7.92	443.3	462.8	39.4	3.67	2.421	0.305	7.92	429.3	448.4	38.4	3.65	2.415	0.305

k (diffuse attenuation coefficient = slope, m-1)			0.216	k (diffuse attenuation coefficient = slope, m-1)		0.206
k average			0.490	k average		0.520
percent transmittance @	1.0	meter	80.59	percent transmittance @	1.0	meter	81.41
Birgean Percentile Absorption (1m)			19.41	Birgean Percentile Absorption (1m)			18.59



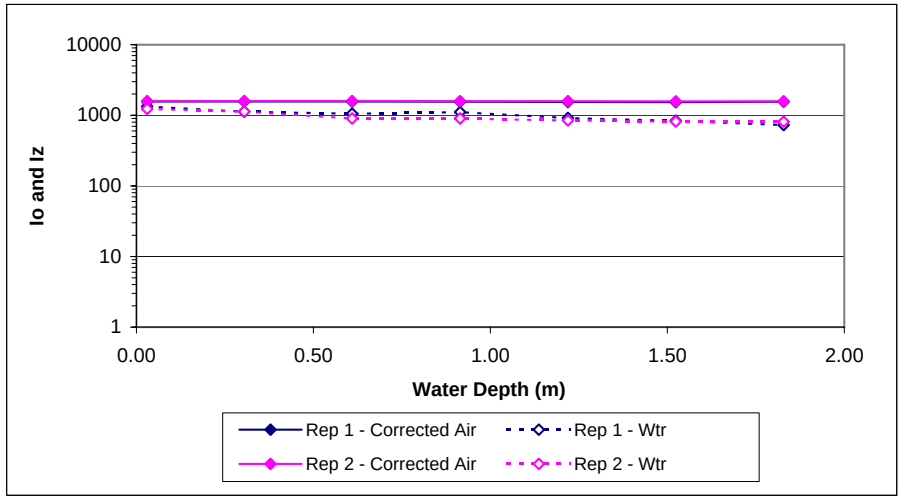


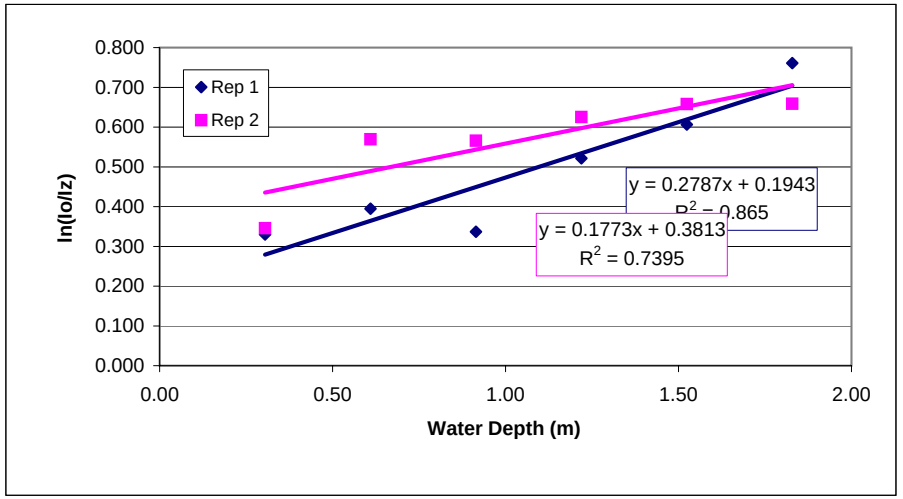
APPENDIX D

De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-2 - 10/09/2008 12:14

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,572.1	1,626.0	1,337.0	7.20			0.03	1,586.7	1,641.0	1,232.0	7.12		
0.30	1,569.2	1,623.0	1,128.0	7.03	0.330	1.083	0.30	1,593.5	1,648.0	1,128.0	7.03	0.345	1.133
0.61	1,565.4	1,619.0	1,055.0	6.96	0.395	0.647	0.61	1,593.5	1,648.0	901.6	6.80	0.570	0.934
0.91	1,558.6	1,612.0	1,113.0	7.01	0.337	0.368	0.91	1,586.7	1,641.0	901.1	6.80	0.566	0.619
1.22	1,542.1	1,595.0	915.4	6.82	0.522	0.428	1.22	1,586.7	1,641.0	849.1	6.74	0.625	0.513
1.52	1,538.2	1,591.0	838.9	6.73	0.606	0.398	1.52	1,577.0	1,631.0	816.6	6.71	0.658	0.432
1.83	1,561.5	1,615.0	729.6	6.59	0.761	0.416	1.83	1,574.1	1,628.0	814.6	6.70	0.659	0.360

k (diffuse attenuation coefficient = slope, m-1)			0.279	k (diffuse attenuation coefficient = slope, m-1)	0.177
k average			0.557	k average	0.665
percent transmittance @	1.0	meter	75.67	percent transmittance @ 1.0 meter	83.75
Birgean Percentile Absorption (1m)			24.33	Birgean Percentile Absorption (1m)	16.25





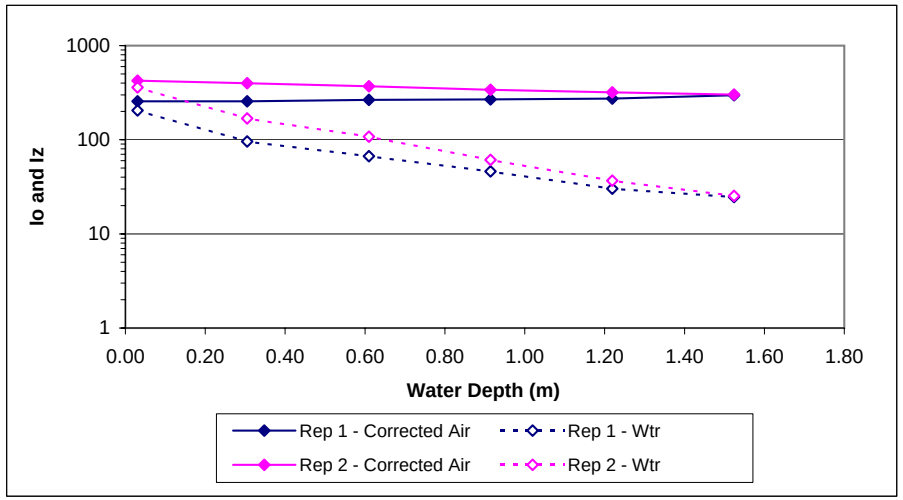
APPENDIX D

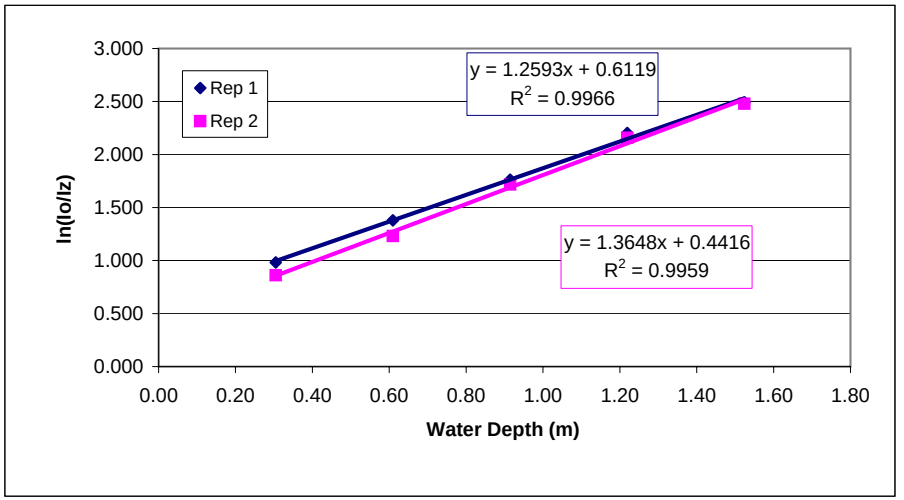
De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-dock - 10/06/2008 16:43

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	256.2	270.0	205.0	5.32			0.03	424.2	443.2	359.6	5.88		
0.30	255.9	269.7	95.8	4.56	0.983	3.224	0.30	398.3	416.5	168.2	5.13	0.862	2.828
0.61	265.6	279.7	66.9	4.20	1.379	2.262	0.61	369.8	387.1	107.9	4.68	1.232	2.021
0.91	268.4	282.6	46.1	3.83	1.762	1.927	0.91	340.1	356.5	61.1	4.11	1.717	1.878
1.22	274.1	288.5	30.3	3.41	2.203	1.807	1.22	318.8	334.6	36.8	3.61	2.159	1.771
1.52	297.0	312.1	24.6	3.20	2.490	1.634	1.52	302.1	317.3	25.3	3.23	2.479	1.626

k (diffuse attenuation coefficient = slope, m-1)			1.259	
k average			2.171	
percent transmittance @	1.0	meter	28.39	
Birgean Percentile Absorption (1m)			71.61	

k (diffuse attenuation coefficient = slope, m-1)			1.365
k average			2.025
percent transmittance @	1.0	meter	25.54
Birgean Percentile Absorption (1m)			74.46



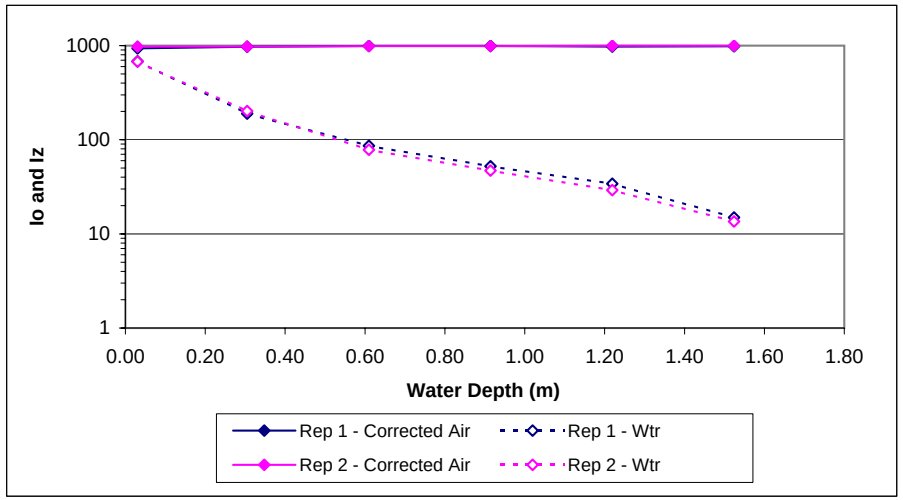


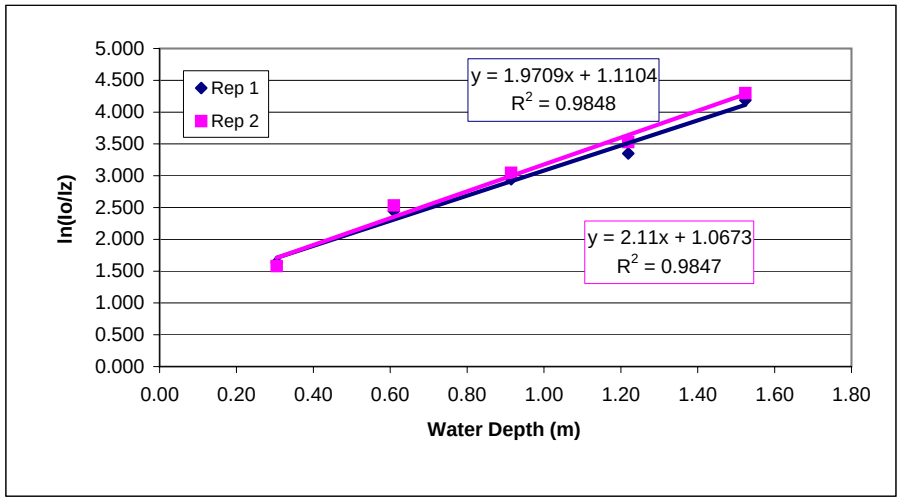
APPENDIX D

De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-3 - 10/07/2008 09:35

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	935.4	969.9	680.7	6.52			0.03	978.2	1,014.0	676.6	6.52		
0.30	974.3	1,010.0	189.6	5.24	1.637	5.370	0.30	978.2	1,014.0	201.6	5.31	1.579	5.182
0.61	993.7	1,030.0	86.3	4.46	2.444	4.009	0.61	986.9	1,023.0	78.4	4.36	2.533	4.155
0.91	993.7	1,030.0	52.3	3.96	2.944	3.220	0.91	989.8	1,026.0	47.1	3.85	3.046	3.331
1.22	975.3	1,011.0	34.2	3.53	3.351	2.748	1.22	995.7	1,032.0	29.2	3.38	3.528	2.894
1.52	984.0	1,020.0	15.0	2.70	4.187	2.747	1.52	994.7	1,031.0	13.5	2.60	4.298	2.820

k (diffuse attenuation coefficient = slope, m-1)			1.971	k (diffuse attenuation coefficient = slope, m-1)	2.110
k average			3.619	k average	3.676
percent transmittance @	1.0	meter	13.93	percent transmittance @ 1.0 meter	12.12
Birgean Percentile Absorption (1m)			86.07	Birgean Percentile Absorption (1m)	87.88



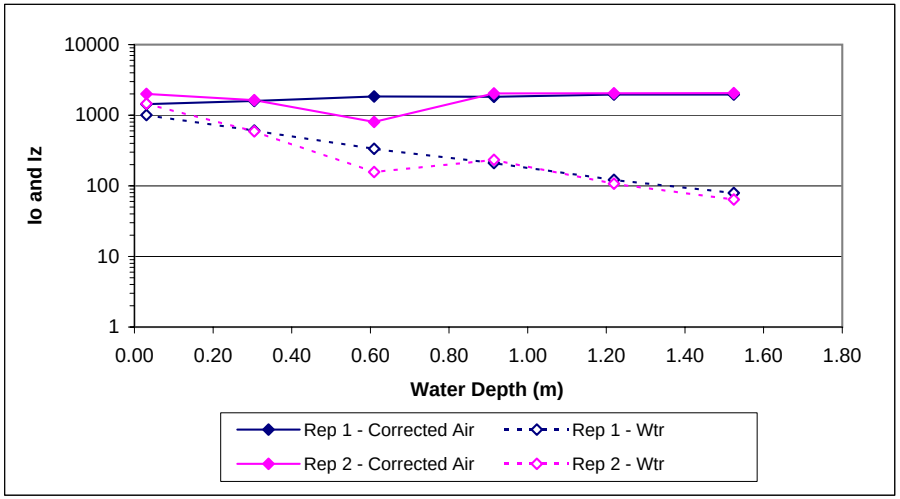


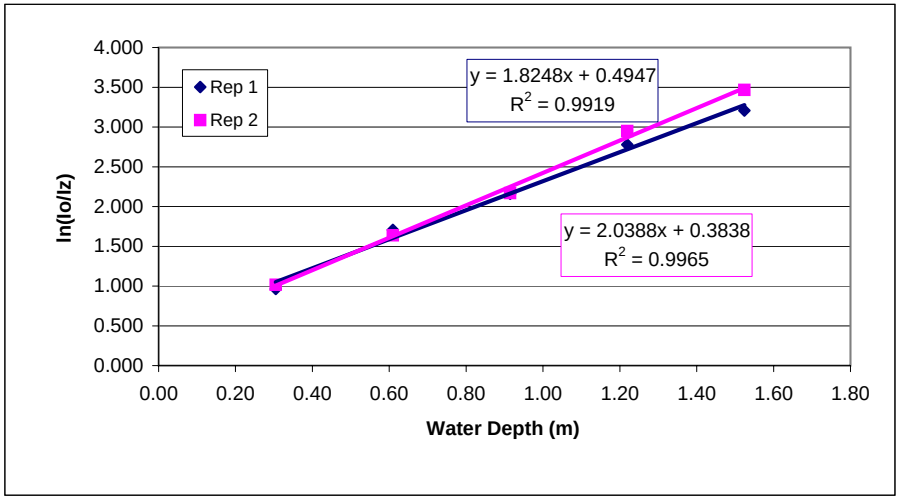
APPENDIX D

De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-3 - 10/07/2008 13:25

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,434.3	1,484.0	1,005.0	6.91			0.03	2,005.0	2,072.0	1,459.0	7.29		
0.30	1,593.5	1,648.0	608.1	6.41	0.963	3.161	0.30	1,635.2	1,691.0	592.2	6.38	1.016	3.332
0.61	1,839.0	1,901.0	334.1	5.81	1.706	2.798	0.61	806.3	836.9	156.7	5.05	1.638	2.687
0.91	1,827.4	1,889.0	210.4	5.35	2.162	2.364	0.91	2,039.9	2,108.0	233.0	5.45	2.170	2.373
1.22	1,959.4	2,025.0	121.8	4.80	2.778	2.279	1.22	2,049.6	2,118.0	107.3	4.68	2.950	2.419
1.52	1,960.3	2,026.0	79.3	4.37	3.208	2.105	1.52	2,052.5	2,121.0	64.1	4.16	3.467	2.275

k (diffuse attenuation coefficient = slope, m-1)			1.825	k (diffuse attenuation coefficient = slope, m-1)	2.039
k average			2.541	k average	2.617
percent transmittance @	1.0	meter	16.12	percent transmittance @ 1.0 meter	13.02
Birgean Percentile Absorption (1m)			83.88	Birgean Percentile Absorption (1m)	86.98





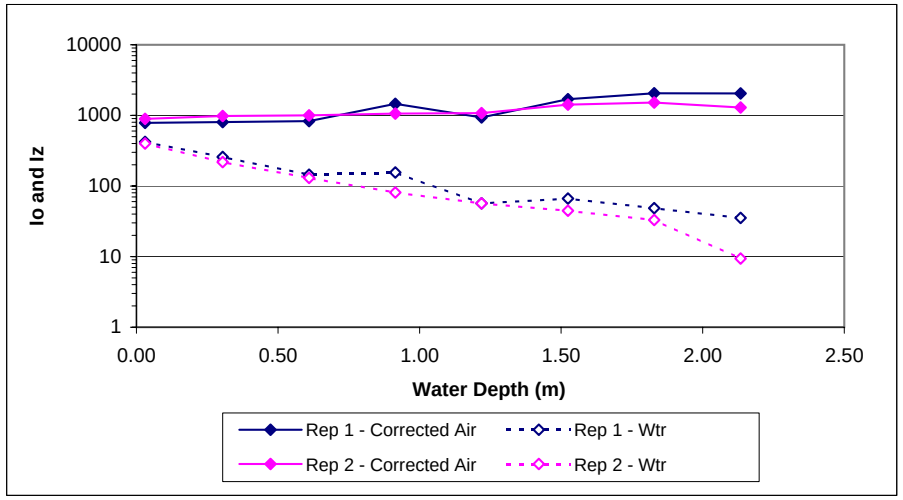
APPENDIX D

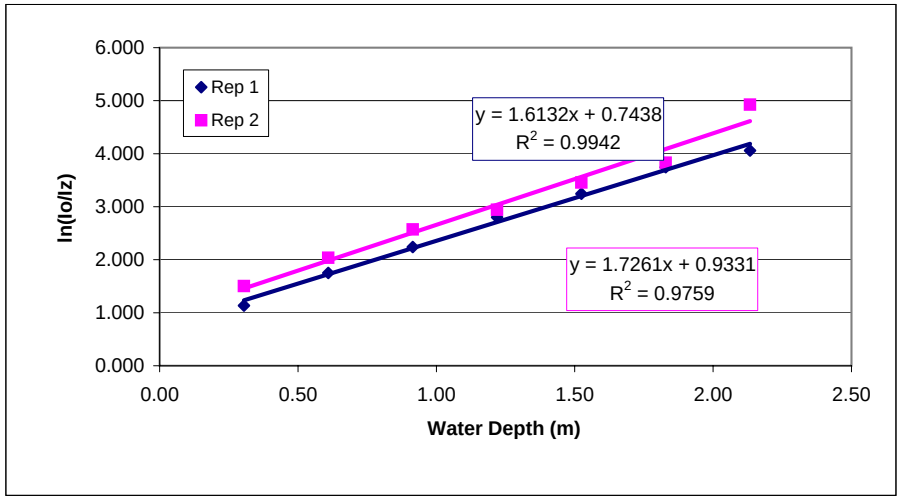
De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-3 - 10/08/2008 13:55

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	783.5	813.4	420.1	6.04			0.03	894.4	927.6	399.3	5.99		
0.30	803.0	833.5	258.1	5.55	1.135	3.724	0.30	983.1	1,019.0	218.6	5.39	1.503	4.932
0.61	831.1	862.4	144.4	4.97	1.750	2.871	0.61	999.6	1,036.0	130.4	4.87	2.037	3.341
0.91	1,455.7	1,506.0	155.2	5.04	2.239	2.448	0.91	1,061.7	1,100.0	81.1	4.40	2.572	2.812
1.22	936.0	970.5	56.8	4.04	2.802	2.298	1.22	1,076.2	1,115.0	56.8	4.04	2.943	2.414
1.52	1,699.3	1,757.0	66.2	4.19	3.245	2.129	1.52	1,416.9	1,466.0	44.7	3.80	3.455	2.267
1.83	2,058.4	2,127.0	48.7	3.88	3.745	2.048	1.83	1,521.7	1,574.0	33.1	3.50	3.830	2.094
2.13	2,046.7	2,115.0	35.3	3.57	4.059	1.902	2.13	1,289.7	1,335.0	9.4	2.24	4.924	2.308

k (diffuse attenuation coefficient = slope, m-1)			1.613	
k average			2.489	
percent transmittance @	1.0	meter	19.93	
Birgean Percentile Absorption (1m)			80.07	

k (diffuse attenuation coefficient = slope, m-1)			1.726	
k average			2.881	
percent transmittance @	1.0	meter	17.80	
Birgean Percentile Absorption (1m)			82.20	





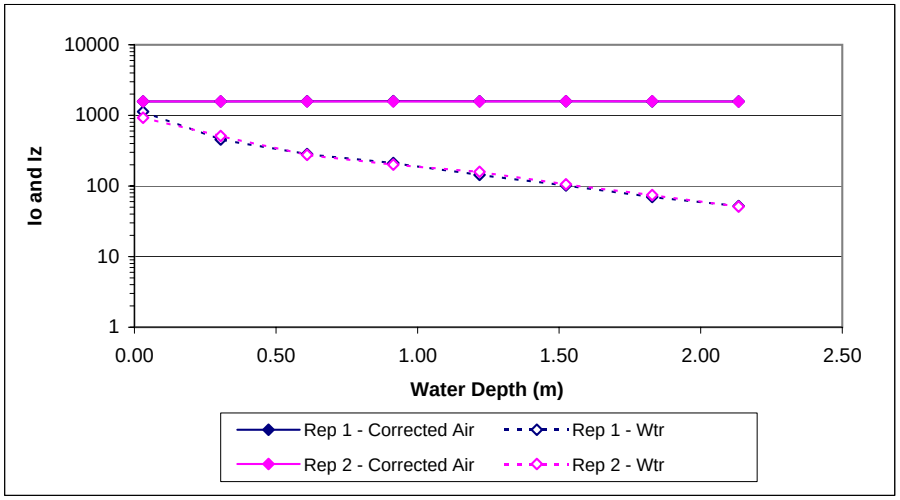
APPENDIX D

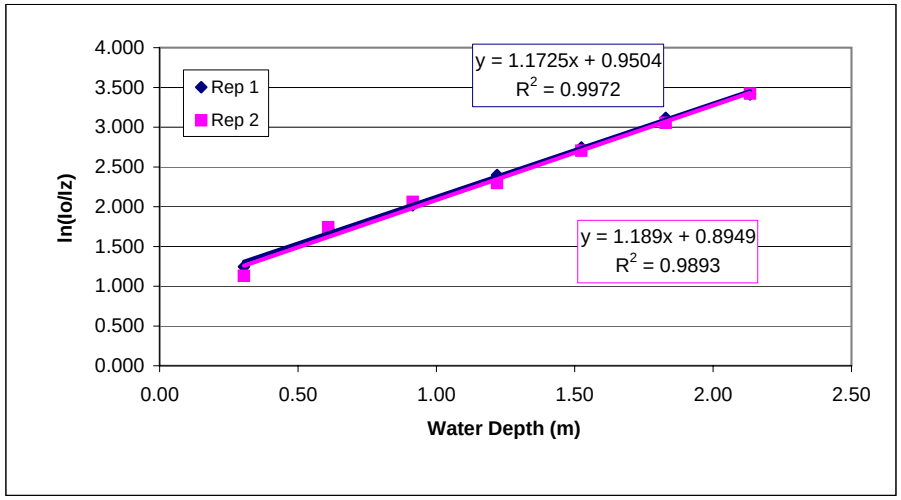
De Leon Springs (Volusia Co.) PAR ATTENUATION ESTIMATES - VDL-dock - 10/09/2008 11:30

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,578.9	1,633.0	1,131.0	7.03			0.03	1,574.1	1,628.0	926.7	6.83		
0.30	1,578.9	1,633.0	454.4	6.12	1.246	4.086	0.30	1,578.0	1,632.0	509.8	6.23	1.130	3.707
0.61	1,586.7	1,641.0	282.6	5.64	1.725	2.830	0.61	1,578.9	1,633.0	276.6	5.62	1.742	2.858
0.91	1,591.6	1,646.0	211.6	5.35	2.018	2.207	0.91	1,577.0	1,631.0	200.8	5.30	2.061	2.254
1.22	1,585.7	1,640.0	144.0	4.97	2.399	1.968	1.22	1,578.9	1,633.0	158.6	5.07	2.298	1.885
1.52	1,580.9	1,635.0	101.7	4.62	2.744	1.800	1.52	1,580.9	1,635.0	105.9	4.66	2.703	1.774
1.83	1,577.0	1,631.0	69.9	4.25	3.117	1.704	1.83	1,580.9	1,635.0	74.5	4.31	3.054	1.670
2.13	1,574.1	1,628.0	51.9	3.95	3.412	1.599	2.13	1,572.1	1,626.0	51.3	3.94	3.423	1.604

k (diffuse attenuation coefficient = slope, m-1)			1.172	
k average			2.314	
percent transmittance @	1.0	meter	30.96	
Birgean Percentile Absorption (1m)			69.04	

k (diffuse attenuation coefficient = slope, m-1)			1.189
k average			2.250
percent transmittance @	1.0	meter	30.45
Birgean Percentile Absorption (1m)			69.55





APPENDIX D

Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES (November 2008)

Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	HS-1	11/3/2008	14:06	1	4.57	0.650	52.18	47.82
	HS-1	11/3/2008	14:06	2	4.57	0.503	60.45	39.55
	HS-1	11/5/2008	11:00	1	7.32	0.358	69.91	30.09
	HS-1	11/5/2008	11:00	2	7.32	0.318	72.76	27.24
Spring Run	HS-2	11/3/2008	10:21	1	1.52	0.255	77.50	22.50
	HS-2	11/3/2008	10:21	2	1.52	0.269	76.43	23.57
	HS-2	11/4/2008	15:44	1	0.91	0.533	58.68	41.32
	HS-2	11/4/2008	15:44	2	0.91	0.451	63.70	36.30
	HS-2	11/5/2008	11:56	1	1.07	0.800	44.91	55.09
	HS-2	11/5/2008	11:56	2	1.07	0.655	51.93	48.07
	HS-3	11/3/2008	10:41	1	1.83	0.306	73.61	26.39
	HS-3	11/3/2008	10:41	2	1.83	0.214	80.75	19.25
	HS-3	11/4/2008	15:02	1	1.22	0.462	62.99	37.01
	HS-3	11/4/2008	15:02	2	1.22	0.644	52.50	47.50
	HS-3	11/5/2008	12:40	1	1.22	0.569	56.62	43.38
	HS-3	11/5/2008	12:40	2	1.22	0.440	64.38	35.62

Averages

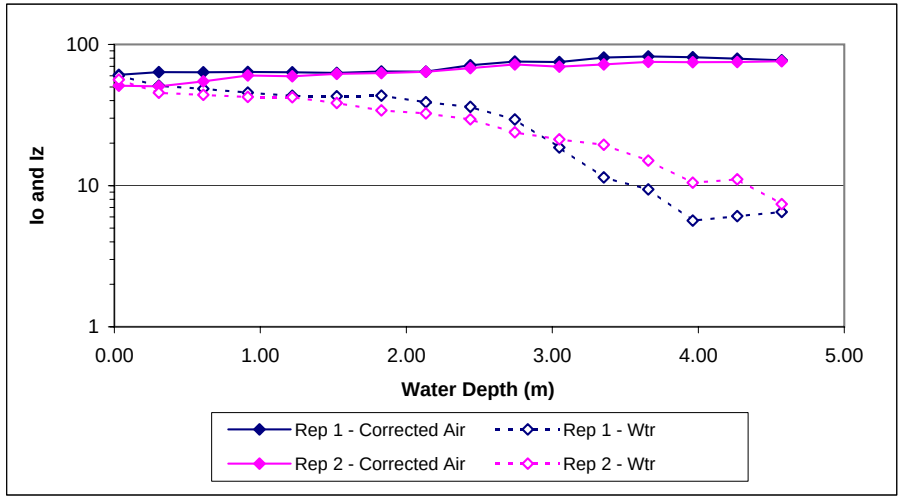
Spring Pool	**HS-1**	**5.94**	**0.46**	**63.82**	**36.18**
	Pool	**5.94**	**0.46**	**63.82**	**36.18**
Spring Run	**HS-2**	**1.17**	**0.49**	**62.19**	**37.81**
	HS-3	**1.42**	**0.44**	**65.14**	**34.86**
	Run	**1.30**	**0.47**	**63.67**	**36.33**

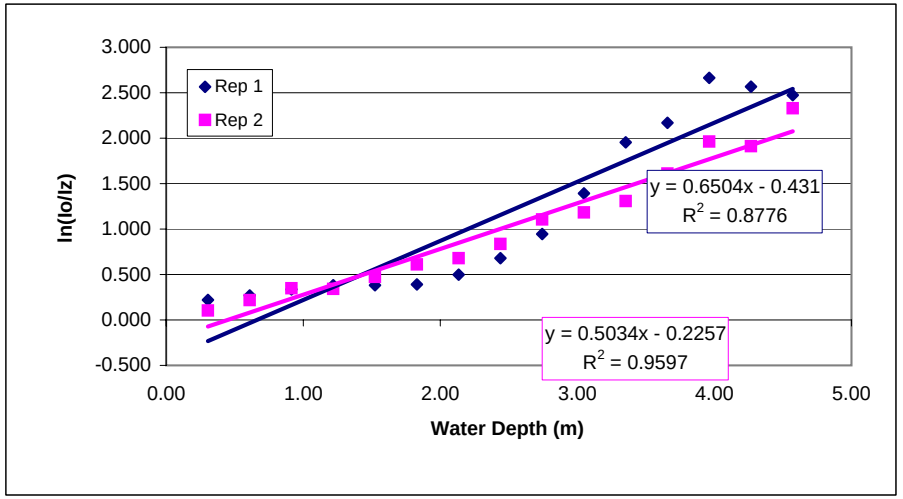
APPENDIX D

Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES - HS-1 - 11/03/2008 14:06

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	60.9	68.8	60.1	4.10			0.03	51.1	58.7	56.4	4.03		
0.30	63.6	71.6	51.0	3.93	0.220	0.723	0.30	50.5	58.1	45.5	3.82	0.104	0.342
0.61	63.5	71.5	48.5	3.88	0.270	0.443	0.61	54.7	62.4	44.0	3.78	0.219	0.359
0.91	63.9	71.9	45.7	3.82	0.336	0.367	0.91	60.2	68.1	42.5	3.75	0.349	0.381
1.22	63.5	71.5	43.3	3.77	0.382	0.314	1.22	59.5	67.3	42.2	3.74	0.342	0.281
1.52	62.9	70.9	42.9	3.76	0.382	0.251	1.52	61.9	69.8	38.5	3.65	0.474	0.311
1.83	64.3	72.3	43.4	3.77	0.392	0.214	1.83	62.8	70.7	34.1	3.53	0.610	0.334
2.13	64.2	72.2	39.0	3.66	0.499	0.234	2.13	64.1	72.1	32.5	3.48	0.680	0.319
2.44	71.3	79.5	36.1	3.59	0.680	0.279	2.44	68.0	76.2	29.5	3.38	0.836	0.343
2.74	75.6	84.0	29.4	3.38	0.945	0.344	2.74	72.1	80.4	23.9	3.17	1.105	0.403
3.05	75.0	83.3	18.6	2.93	1.392	0.457	3.05	69.6	77.8	21.3	3.06	1.184	0.388
3.35	80.7	89.2	11.4	2.44	1.954	0.583	3.35	72.1	80.4	19.5	2.97	1.308	0.390
3.66	82.3	90.9	9.4	2.24	2.170	0.593	3.66	75.3	83.6	15.0	2.71	1.611	0.440
3.96	81.2	89.7	5.7	1.73	2.664	0.672	3.96	74.8	83.2	10.5	2.35	1.964	0.496
4.27	79.3	87.8	6.1	1.81	2.567	0.602	4.27	75.0	83.4	11.1	2.41	1.913	0.448
4.57	77.3	85.7	6.5	1.87	2.474	0.541	4.57	76.1	84.4	7.4	2.00	2.330	0.510

k (diffuse attenuation coefficient = slope, m-1)			0.650	k (diffuse attenuation coefficient = slope, m-1)		0.503
k average			0.441	k average		0.383
percent transmittance @	1.0	meter	52.18	percent transmittance @	1.0	meter	60.45
Birgean Percentile Absorption (1m)			47.82	Birgean Percentile Absorption (1m)			39.55



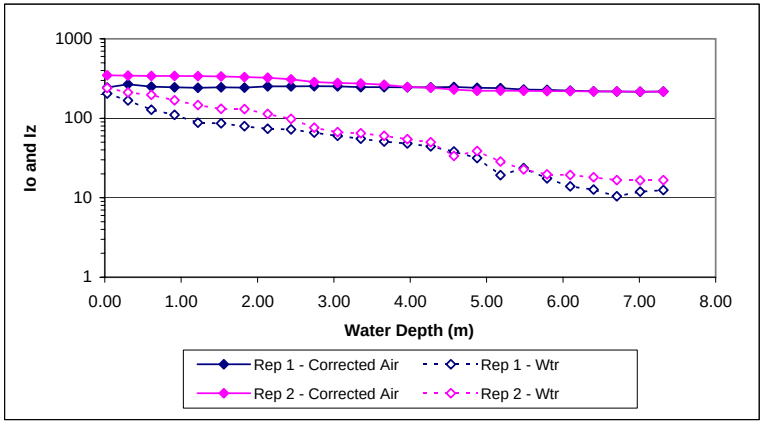


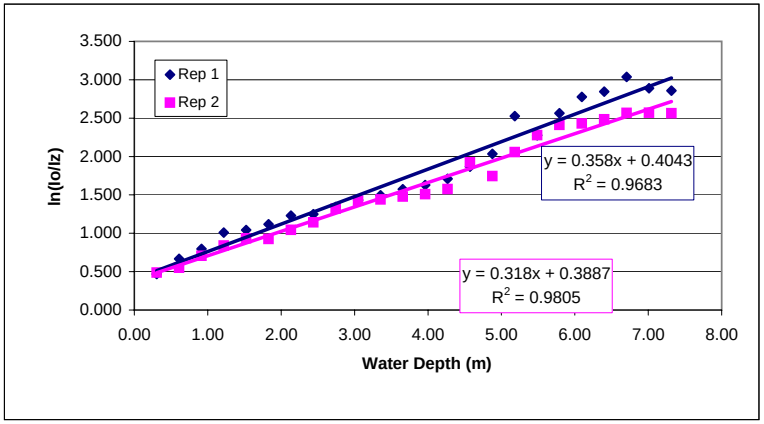
APPENDIX D

Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES - HS-1 - 11/05/2008 11:00

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	244.5	258.0	205.3	5.32			0.03	346.8	363.4	240.4	5.48		
0.30	268.2	282.4	167.7	5.12	0.470	1.540	0.30	344.7	361.2	211.7	5.36	0.487	1.599
0.61	250.0	263.7	128.2	4.85	0.668	1.096	0.61	341.6	358.0	197.0	5.28	0.550	0.903
0.91	245.2	258.7	110.6	4.71	0.796	0.871	0.91	341.3	357.7	168.4	5.13	0.706	0.772
1.22	241.6	255.0	88.1	4.48	1.009	0.828	1.22	339.8	356.2	146.6	4.99	0.841	0.690
1.52	245.0	258.5	86.5	4.46	1.042	0.683	1.52	336.1	352.4	132.0	4.88	0.935	0.613
1.83	242.7	256.1	79.4	4.37	1.117	0.611	1.83	330.3	346.4	130.9	4.87	0.926	0.506
2.13	252.1	265.8	73.7	4.30	1.230	0.576	2.13	323.5	339.4	113.8	4.73	1.045	0.490
2.44	252.8	266.5	72.5	4.28	1.249	0.512	2.44	308.9	324.4	98.6	4.59	1.142	0.468
2.74	253.0	266.8	66.1	4.19	1.343	0.490	2.74	285.5	300.2	76.2	4.33	1.321	0.481
3.05	251.9	265.6	60.2	4.10	1.432	0.470	3.05	278.0	292.5	67.0	4.20	1.423	0.467
3.35	246.9	260.5	55.4	4.02	1.494	0.446	3.35	273.7	288.1	64.8	4.17	1.440	0.430
3.66	246.3	259.8	51.0	3.93	1.574	0.430	3.66	264.3	278.4	60.3	4.10	1.478	0.404
3.96	245.1	258.6	48.2	3.87	1.627	0.411	3.96	247.3	260.9	54.7	4.00	1.508	0.381
4.27	245.1	258.6	44.4	3.79	1.709	0.400	4.27	241.5	254.9	49.9	3.91	1.576	0.369
4.57	248.2	261.8	38.3	3.65	1.868	0.409	4.57	230.4	243.5	33.7	3.52	1.924	0.421
4.88	242.1	255.5	31.6	3.45	2.035	0.417	4.88	222.1	234.9	38.8	3.66	1.745	0.358
5.18	240.3	253.7	19.2	2.96	2.526	0.487	5.18	223.2	236.0	28.5	3.35	2.058	0.397
5.49	230.3	243.4	23.7	3.16	2.276	0.415	5.49	221.8	234.6	22.7	3.12	2.279	0.415
5.79	228.3	241.3	17.6	2.87	2.564	0.443	5.79	220.0	232.8	19.7	2.98	2.412	0.417
6.10	223.2	236.0	13.9	2.63	2.776	0.455	6.10	220.0	232.7	19.4	2.96	2.430	0.399
6.40	218.2	230.9	12.7	2.54	2.845	0.445	6.40	217.4	230.1	18.1	2.90	2.484	0.388
6.71	217.7	230.4	10.5	2.35	3.037	0.453	6.71	217.7	230.4	16.7	2.82	2.568	0.383
7.01	215.4	228.0	12.0	2.48	2.890	0.412	7.01	216.2	228.8	16.5	2.81	2.570	0.367
7.32	217.7	230.4	12.5	2.52	2.858	0.391	7.32	216.3	228.9	16.7	2.81	2.563	0.350

k (diffuse attenuation coefficient = slope, m-1)			0.358	k (diffuse attenuation coefficient = slope, m-1)		0.318
k average			0.570	k average		0.519
percent transmittance @	1.0	meter	69.91	percent transmittance @	1.0	meter	72.76
Birgean Percentile Absorption (1m)			30.09	Birgean Percentile Absorption (1m)			27.24



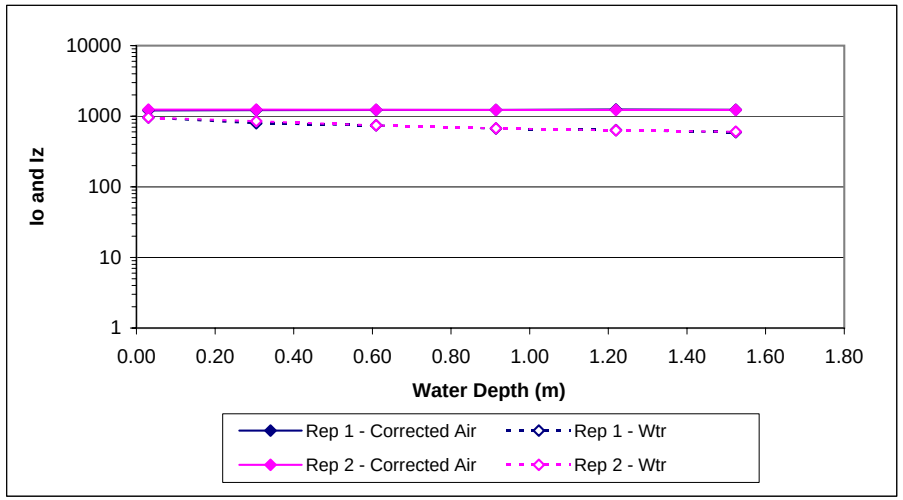


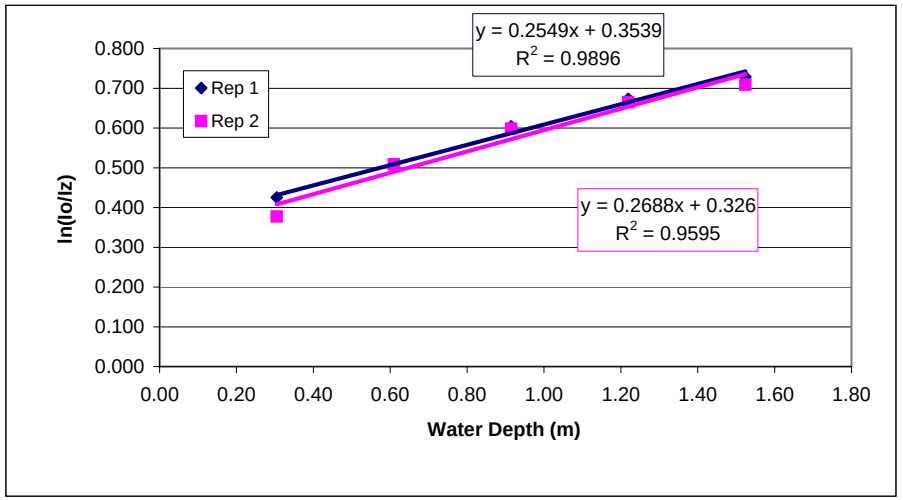
APPENDIX D

Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES - HS-2 - 11/03/2008 10:21

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,208.2	1,251.0	961.2	6.87			0.03	1,239.3	1,283.0	962.6	6.87		
0.30	1,219.9	1,263.0	797.3	6.68	0.425	1.395	0.30	1,242.2	1,286.0	851.6	6.75	0.378	1.239
0.61	1,227.6	1,271.0	742.1	6.61	0.503	0.826	0.61	1,234.4	1,278.0	742.2	6.61	0.509	0.835
0.91	1,226.7	1,270.0	670.4	6.51	0.604	0.661	0.91	1,227.6	1,271.0	674.7	6.51	0.599	0.655
1.22	1,248.0	1,292.0	636.5	6.46	0.673	0.552	1.22	1,227.6	1,271.0	631.3	6.45	0.665	0.545
1.52	1,232.5	1,276.0	594.7	6.39	0.729	0.478	1.52	1,228.6	1,272.0	604.6	6.40	0.709	0.465

k (diffuse attenuation coefficient = slope, m-1)			0.255	k (diffuse attenuation coefficient = slope, m-1)		0.269
k average			0.782	k average		0.748
percent transmittance @	1.0	meter	77.50	percent transmittance @	1.0 meter	76.43
Birgean Percentile Absorption (1m)			22.50	Birgean Percentile Absorption (1m)		23.57





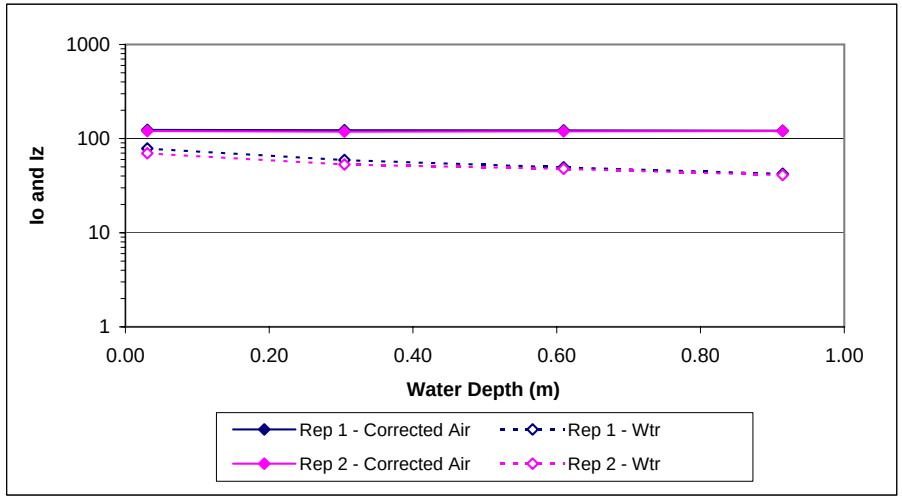
APPENDIX D

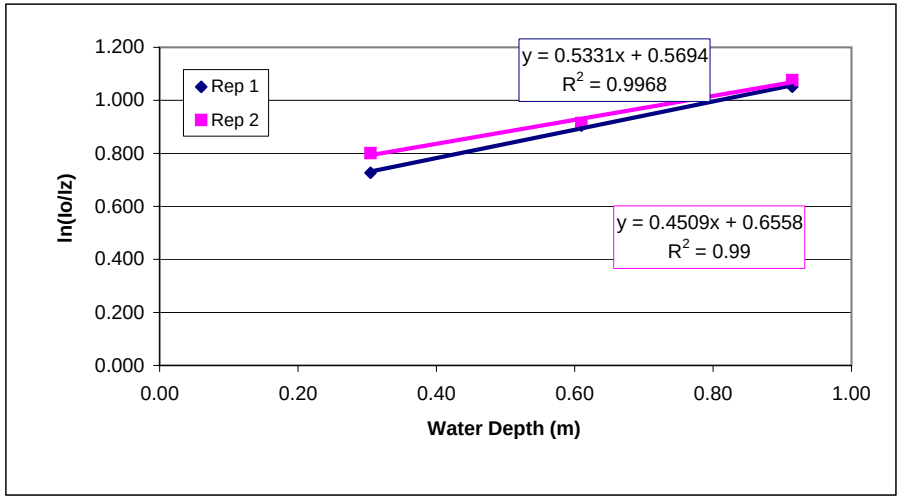
Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES - HS-2 - 11/04/2008 15:44

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	123.9	133.7	78.5	4.36			0.03	120.4	130.1	69.9	4.25		
0.30	122.7	132.5	59.3	4.08	0.727	2.384	0.30	118.3	128.0	53.1	3.97	0.801	2.629
0.61	122.2	132.0	49.4	3.90	0.905	1.485	0.61	119.3	129.0	47.8	3.87	0.915	1.500
0.91	121.3	131.1	42.4	3.75	1.052	1.150	0.91	120.4	130.1	41.0	3.71	1.076	1.177

k (diffuse attenuation coefficient = slope, m-1)			0.533	
k average			1.673	
percent transmittance @	1.0	meter	58.68	
Birgean Percentile Absorption (1m)			41.32	

k (diffuse attenuation coefficient = slope, m-1)			0.451
k average			1.769
percent transmittance @	1.0	meter	63.70
Birgean Percentile Absorption (1m)			36.30



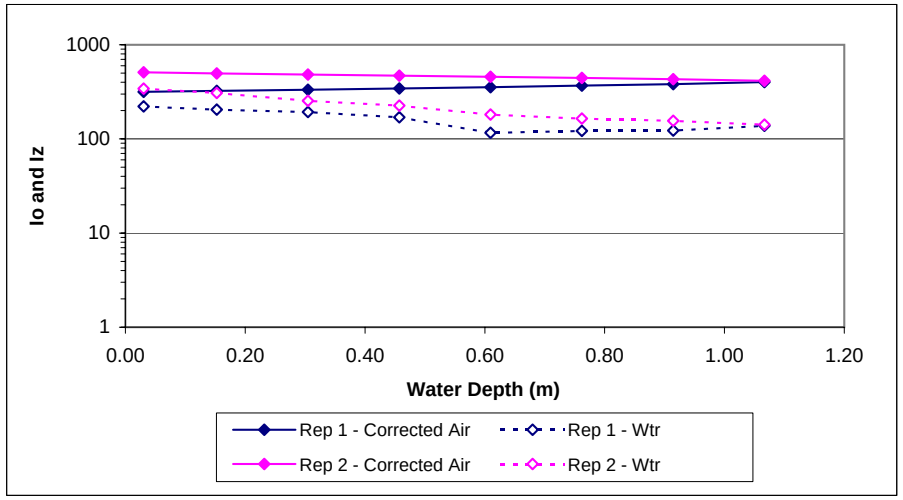


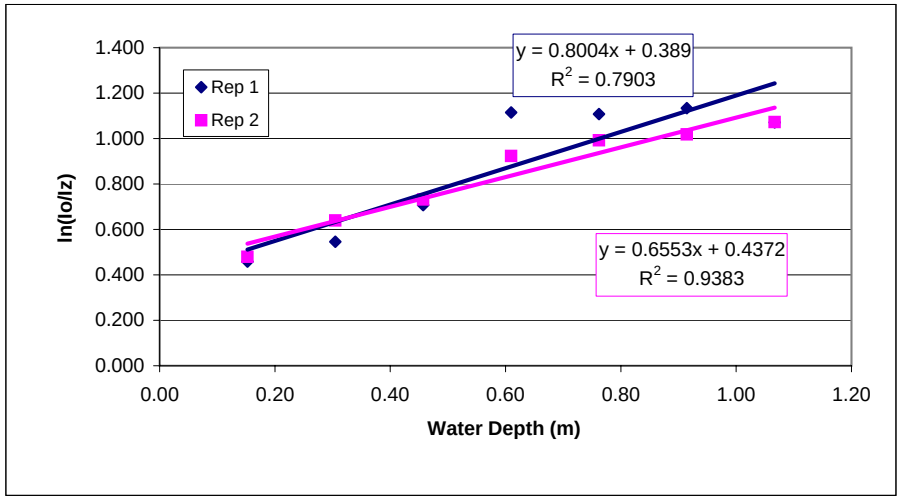
APPENDIX D

Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES - HS-2 - 11/05/2008 11:56

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	316.7	332.4	221.7	5.40			0.03	510.6	532.2	342.2	5.84		
0.15	324.2	340.1	205.0	5.32	0.458	3.007	0.15	497.0	518.2	307.6	5.73	0.480	3.149
0.30	333.5	349.7	193.2	5.26	0.546	1.791	0.30	482.3	503.0	254.5	5.54	0.639	2.097
0.46	344.0	360.5	169.6	5.13	0.707	1.547	0.46	469.9	490.2	226.1	5.42	0.731	1.600
0.61	353.9	370.7	116.1	4.75	1.115	1.828	0.61	456.6	476.5	181.3	5.20	0.924	1.515
0.76	368.5	385.8	121.7	4.80	1.108	1.454	0.76	444.4	464.0	164.8	5.10	0.992	1.302
0.91	381.5	399.2	122.8	4.81	1.134	1.240	0.91	430.6	449.8	155.6	5.05	1.018	1.113
1.07	402.3	420.6	137.8	4.93	1.071	1.004	1.07	414.7	433.4	141.9	4.96	1.073	1.005

k (diffuse attenuation coefficient = slope, m-1)			0.800	k (diffuse attenuation coefficient = slope, m-1)		0.655
k average			1.696	k average		1.683
percent transmittance @	1.0	meter	44.91	percent transmittance @	1.0	meter	51.93
Birgean Percentile Absorption (1m)			55.09	Birgean Percentile Absorption (1m)			48.07



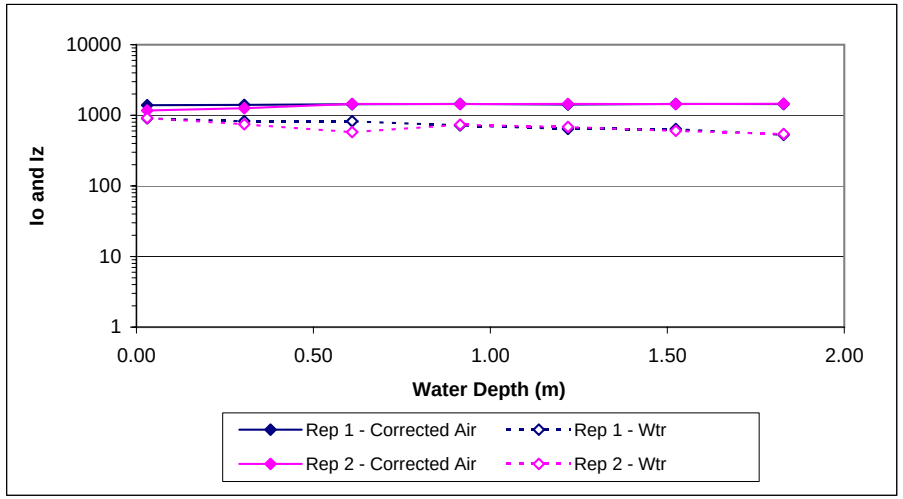


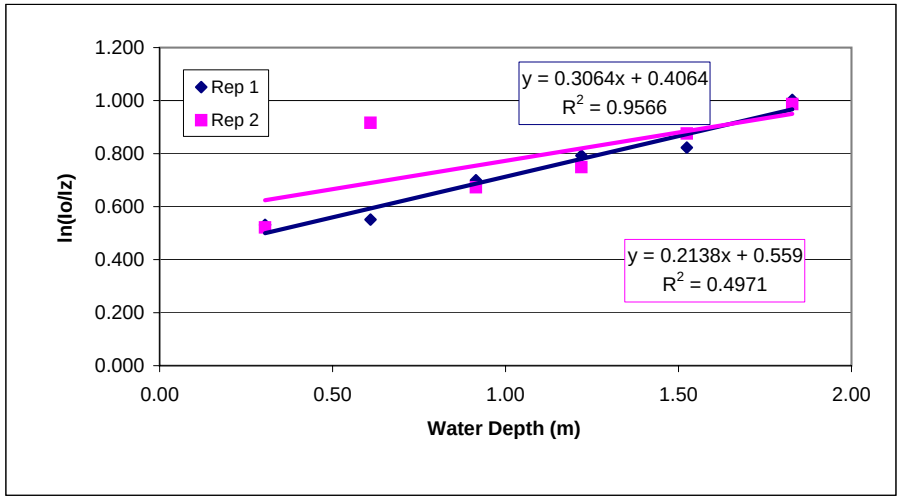
APPENDIX D

Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES - HS-3 - 11/03/2008 10:41

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,394.5	1,443.0	905.0	6.81			0.03	1,168.4	1,210.0	917.8	6.82		
0.30	1,404.3	1,453.0	825.8	6.72	0.531	1.742	0.30	1,259.6	1,304.0	747.8	6.62	0.521	1.711
0.61	1,435.3	1,485.0	827.4	6.72	0.551	0.904	0.61	1,447.0	1,497.0	578.7	6.36	0.916	1.503
0.91	1,448.9	1,499.0	720.0	6.58	0.699	0.765	0.91	1,440.2	1,490.0	734.8	6.60	0.673	0.736
1.22	1,420.8	1,470.0	643.1	6.47	0.793	0.650	1.22	1,447.0	1,497.0	684.1	6.53	0.749	0.614
1.52	1,453.7	1,504.0	638.4	6.46	0.823	0.540	1.52	1,446.0	1,496.0	602.2	6.40	0.876	0.575
1.83	1,446.0	1,496.0	530.5	6.27	1.003	0.548	1.83	1,460.5	1,511.0	544.5	6.30	0.987	0.540

k (diffuse attenuation coefficient = slope, m-1)			0.306	k (diffuse attenuation coefficient = slope, m-1)		0.214
k average			0.858	k average		0.946
percent transmittance @	1.0	meter	73.61	percent transmittance @	1.0	meter	80.75
Birgean Percentile Absorption (1m)			26.39	Birgean Percentile Absorption (1m)			19.25





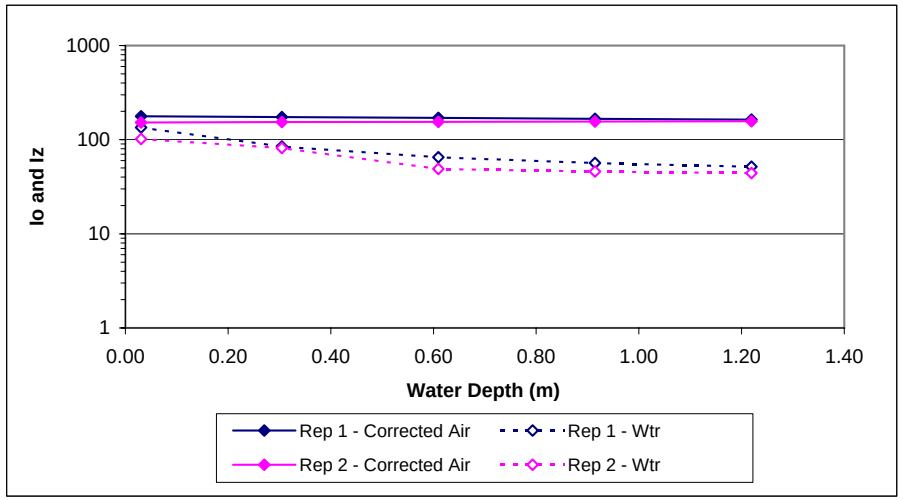
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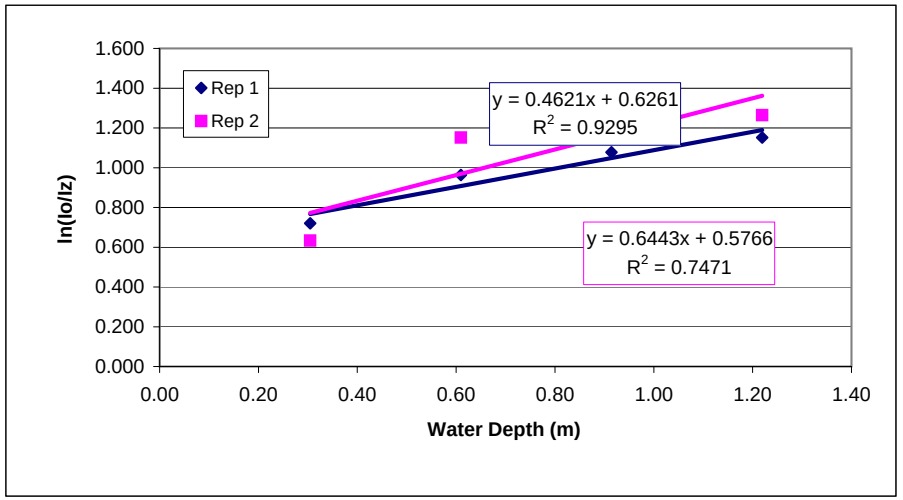
Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES - HS-3 - 11/04/2008 15:02

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	177.5	189.0	135.0	4.91			0.03	152.4	163.1	101.9	4.62		
0.30	174.0	185.4	84.7	4.44	0.720	2.363	0.30	154.1	164.8	81.8	4.40	0.633	2.077
0.61	170.4	181.6	65.0	4.17	0.963	1.580	0.61	154.8	165.6	49.0	3.89	1.151	1.889
0.91	166.3	177.4	56.6	4.04	1.078	1.179	0.91	155.6	166.4	45.9	3.83	1.221	1.335
1.22	163.5	174.5	51.7	3.94	1.152	0.945	1.22	156.8	167.6	44.3	3.79	1.264	1.037

k (diffuse attenuation coefficient = slope, m-1)			0.462	
k average			1.517	
percent transmittance @	1.0	meter	62.99	
Birgean Percentile Absorption (1m)			37.01	

k (diffuse attenuation coefficient = slope, m-1)			0.644	
k average			1.585	
percent transmittance @	1.0	meter	52.50	
Birgean Percentile Absorption (1m)			47.50	





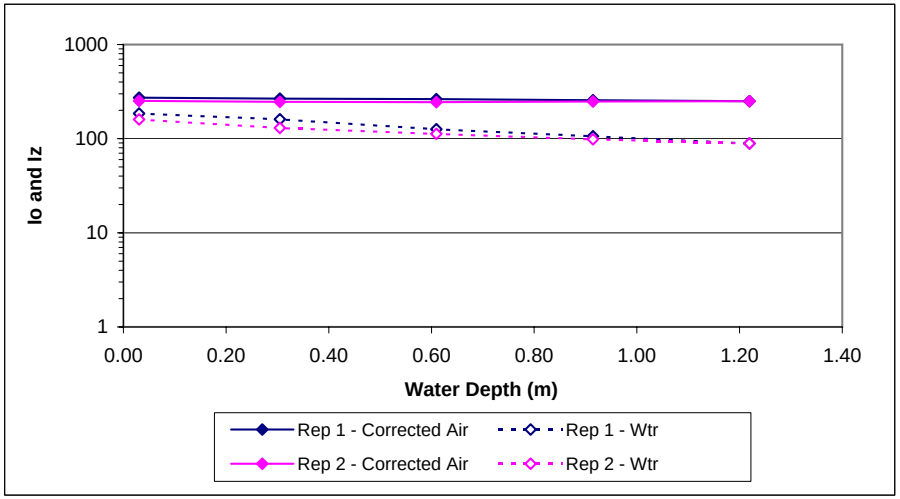
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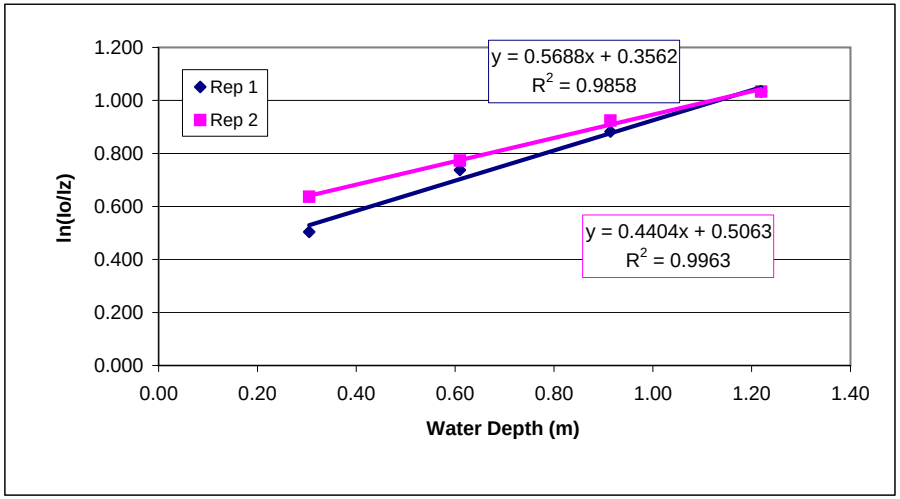
Homosassa Springs (Citrus Co.) PAR ATTENUATION ESTIMATES - HS-3 - 11/05/2008 12:40

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	272.5	286.8	184.8	5.22			0.03	251.7	265.4	160.3	5.08		
0.30	266.5	280.7	161.0	5.08	0.504	1.654	0.30	246.4	260.0	130.4	4.87	0.637	2.088
0.61	263.7	277.8	126.1	4.84	0.738	1.210	0.61	244.4	257.9	112.8	4.73	0.773	1.268
0.91	256.2	270.1	106.0	4.66	0.883	0.965	0.91	248.7	262.3	98.7	4.59	0.924	1.011
1.22	249.8	263.5	88.9	4.49	1.034	0.848	1.22	249.8	263.5	88.9	4.49	1.034	0.848

k (diffuse attenuation coefficient = slope, m-1)			0.569	
k average			1.169	
percent transmittance @	1.0	meter	56.62	
Birgean Percentile Absorption (1m)			43.38	

k (diffuse attenuation coefficient = slope, m-1)			0.440
k average			1.304
percent transmittance @	1.0	meter	64.38
Birgean Percentile Absorption (1m)			35.62





APPENDIX D

Ichetucknee River LIGHT ATTENUATION ESTIMATES 2008

Station	Date	Rep	Max Depth (m)	k (diffuse attenuation coefficient = slope, m-1)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
IS-1	7/7/2009	1	1.07	0.090	91.42	8.58
	7/7/2009	2	1.07	0.184	83.16	16.84
IS-2	7/7/2009	1	0.61	0.196	82.181	17.819
	7/7/2009	2	0.61	0.185	83.08	16.92
IS-3	7/6/2009	1	0.91	0.265	76.69	23.31
	7/6/2009	2	0.91	0.493	61.11	38.89
IS-4	7/6/2009	1	1.22	0.549	57.77	42.23
	7/6/2009	2	1.22	0.885	41.29	58.71
	7/7/2009	1	1.07	0.745	47.46	52.54
	7/7/2009	2	1.07	0.913	40.14	59.86
Averages						
IS-1			1.07	0.137	87.29	12.71
IS-2			0.61	0.191	82.63	17.37
IS-3			0.91	0.379	68.90	31.10
IS-4			1.14	0.773	46.67	53.33

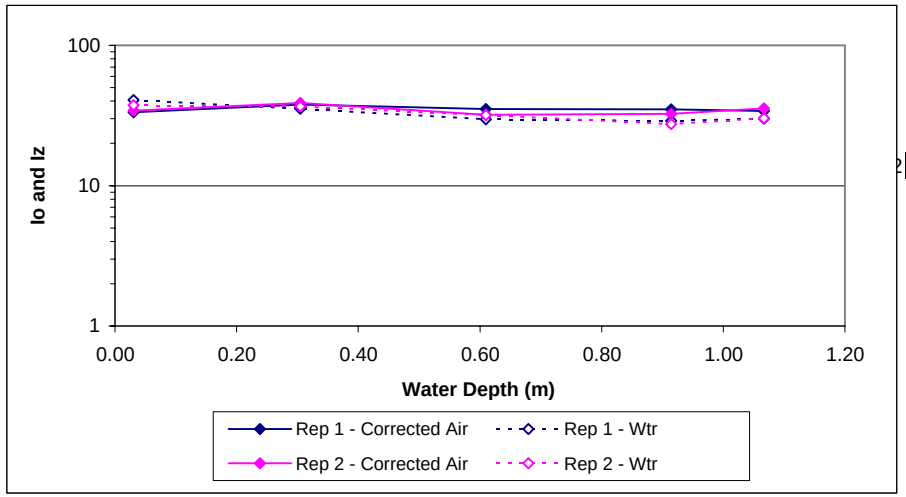
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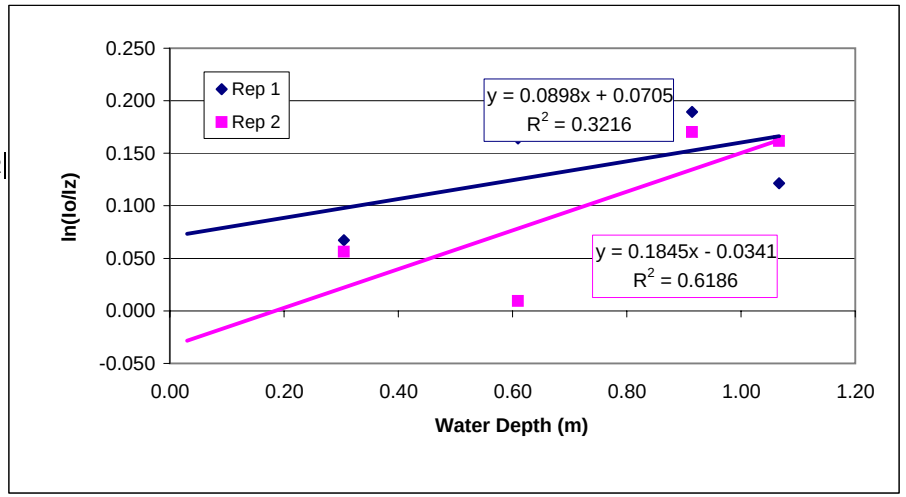
Ichetucknee RIver LIGHT ATTENUATION ESTIMATES - ICH_US - 07/07/2009 11:45

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	33	40.37	40.76	3.71			0.03	34	41.41	37.46	3.62		
0.30	38	45.00	35.33	3.56	0.067	0.221	0.30	39	46.00	36.64	3.60	0.056	0.184
0.61	35	42.23	29.79	3.39	0.164	0.269	0.61	32	39.12	31.78	3.46	0.009	0.016
0.91	35	42.14	28.97	3.37	0.189	0.207	0.91	32	39.55	27.41	3.31	0.170	0.186
1.07	34	41.09	30.11	3.40	0.121	0.114	1.07	35	42.60	30.17	3.41	0.162	0.151

k (diffuse attenuation coefficient = slope, m-1)			0.090	
k average			0.203	
percent transmittance @	1.0	meter	91.42	
Birgean Percentile Absorption (1m)			8.58	

k (diffuse attenuation coefficient = slope, m-1)			0.184
k average			0.134
percent transmittance @	1.0	meter	83.16
Birgean Percentile Absorption (1m)			16.84





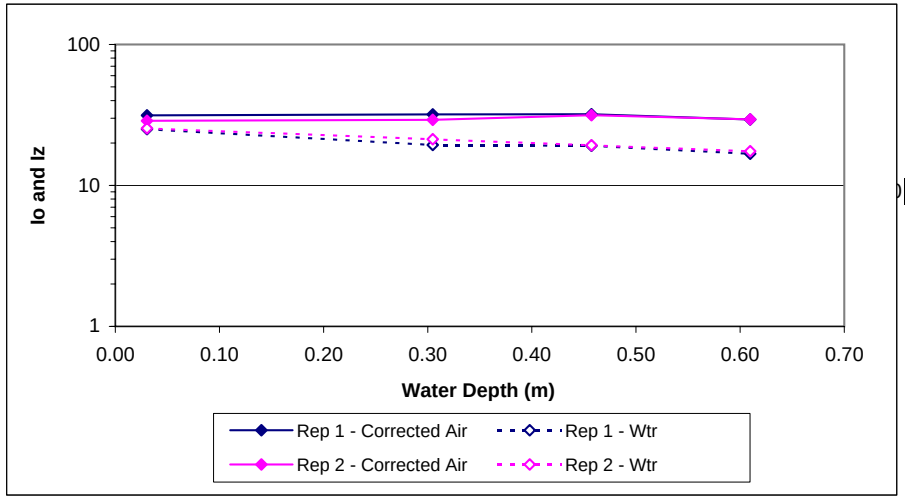
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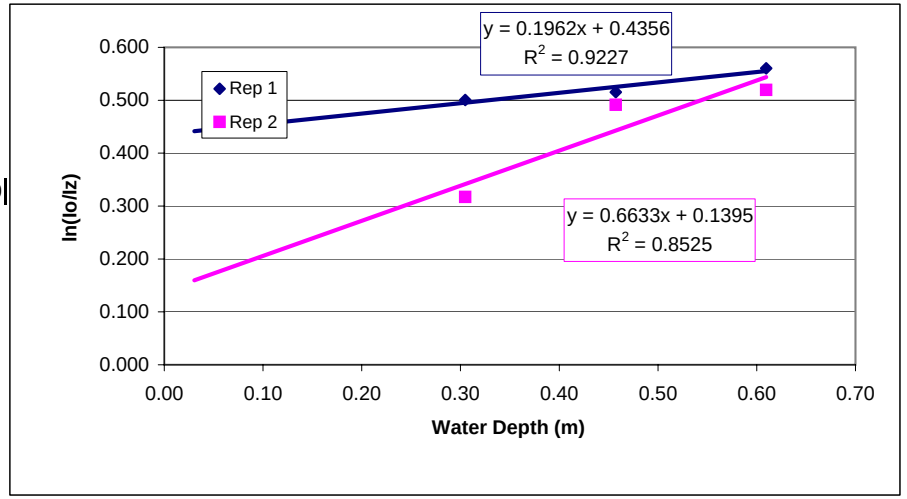
Ichetucknee RIver LIGHT ATTENUATION ESTIMATES - ICH_MP - 07/07/2009 10:30; cloudy/rainy

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	31	38.42	25.09	3.22			0.03	29	35.71	25.39	3.23		
0.30	32	38.95	19.35	2.96	0.500	1.642	0.30	29	36.18	21.28	3.06	0.317	1.041
0.46	32	39.03	19.11	2.95	0.515	1.127	0.46	32	38.55	19.29	2.96	0.491	1.075
0.61	29	36.34	16.78	2.82	0.560	0.919	0.61	29	36.38	17.50	2.86	0.520	0.852

k (diffuse attenuation coefficient = slope, m-1)			0.196	
k average			1.229	
percent transmittance @	1.0	meter	82.18	
Birgean Percentile Absorption (1m)			17.82	

k (diffuse attenuation coefficient = slope, m-1)			0.185
k average			0.989
percent transmittance @	1.0	meter	83.08
Birgean Percentile Absorption (1m)			16.92



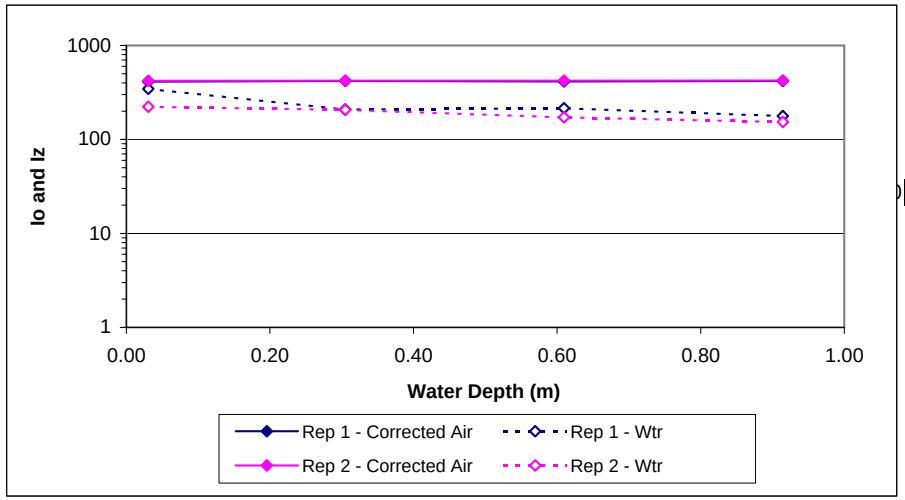


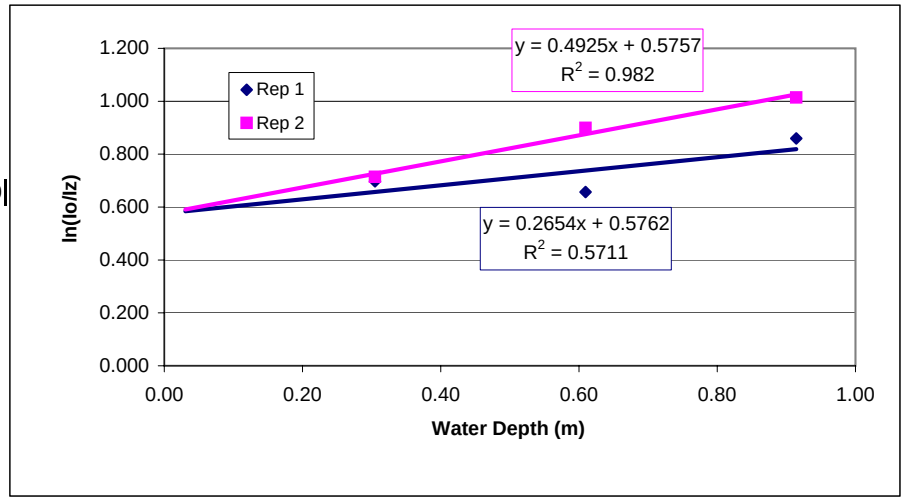
APPENDIX D

Ichetucknee River LIGHT ATTENUATION ESTIMATES - ICH_DAMP - 07/06/2009 14:30; cloudy

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	412	430	345.9	5.85			0.03	420	439	223.1	5.41		
0.30	418	437	208.3	5.34	0.698	2.288	0.30	422	440	206.4	5.33	0.714	2.343
0.61	414	433	214.8	5.37	0.657	1.078	0.61	422	441	171.8	5.15	0.899	1.475
0.91	419	438	177.6	5.18	0.859	0.940	0.91	423	442	153.5	5.03	1.014	1.109

k (diffuse attenuation coefficient = slope, m-1)		0.265	0.493
k average		1.435	1.642
percent transmittance @	1.0 meter	76.69	61.11
Birgean Percentile Absorption (1m)		23.31	38.89



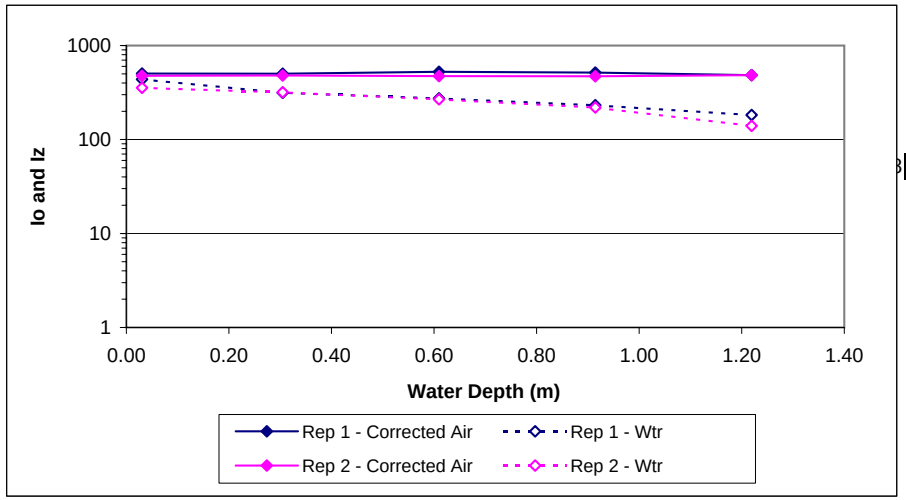


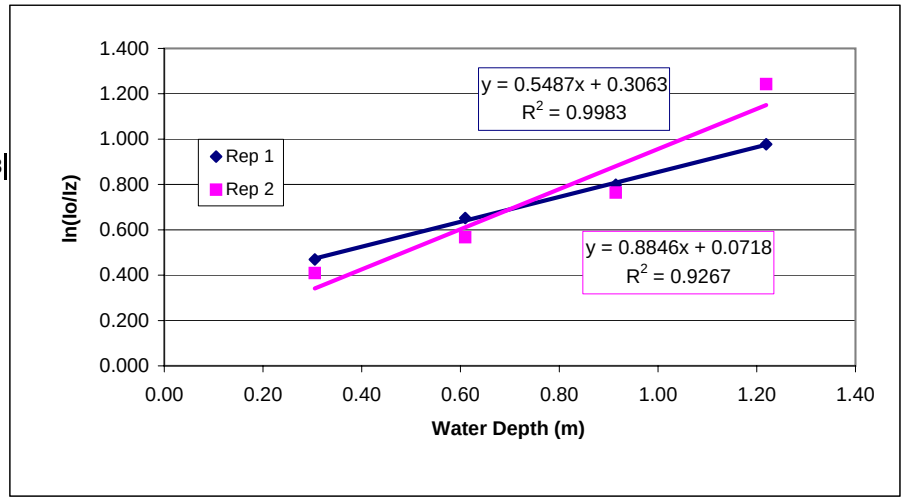
APPENDIX D

Ichetucknee River US27 at dock LIGHT ATTENUATION ESTIMATES - 07/06/2009 16:45; cloudy

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	504	525	438.1	6.08			0.03	477	498	355.7	5.87		
0.30	502	524	314.2	5.75	0.469	1.538	0.30	480	501	318.9	5.76	0.410	1.344
0.61	526	548	274.1	5.61	0.652	1.070	0.61	472	493	267.8	5.59	0.567	0.930
0.91	515	537	231.8	5.45	0.799	0.874	0.91	471	492	219.6	5.39	0.764	0.835
1.22	485	506	182.5	5.21	0.977	0.802	1.22	484	505	139.8	4.94	1.243	1.019

k (diffuse attenuation coefficient = slope, m-1)			0.549	k (diffuse attenuation coefficient = slope, m-1)	0.885
k average			1.071	k average	1.032
percent transmittance @	1.0	meter	57.77	percent transmittance @ 1.0 meter	41.29
Birgean Percentile Absorption (1m)			42.23	Birgean Percentile Absorption (1m)	58.71



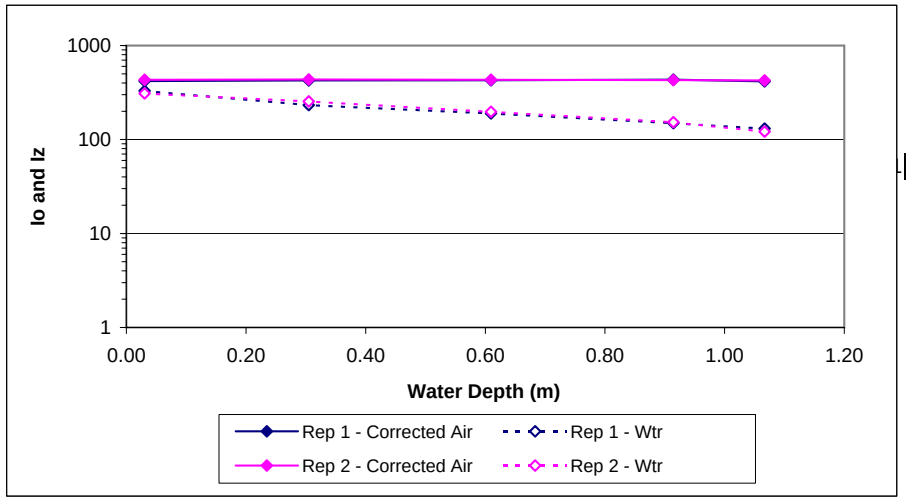


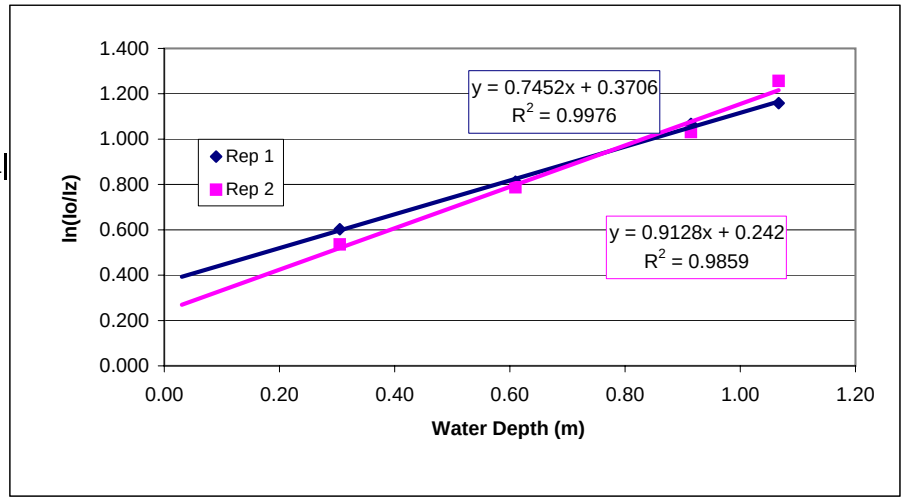
APPENDIX D

Ichetucknee River US27 at dock LIGHT ATTENUATION ESTIMATES - 07/07/2009 16:30; cloudy

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	419	438	330.2	5.80			0.03	432	451	310.2	5.74		
0.30	425	444	232.5	5.45	0.603	1.977	0.30	435	454	254.6	5.54	0.536	1.758
0.61	427	446	189.4	5.24	0.812	1.332	0.61	433	452	197.0	5.28	0.787	1.292
0.91	435	454	149.5	5.01	1.067	1.167	0.91	429	448	152.8	5.03	1.031	1.128
1.07	416	435	130.5	4.87	1.159	1.086	1.07	426	445	121.2	4.80	1.257	1.178

k (diffuse attenuation coefficient = slope, m-1)			0.745	k (diffuse attenuation coefficient = slope, m-1)	0.913
k average			1.390	k average	1.339
percent transmittance @	1.0	meter	47.46	percent transmittance @ 1.0 meter	40.14
Birgean Percentile Absorption (1m)			52.54	Birgean Percentile Absorption (1m)	59.86





APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES (January 2009)

Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	JBS-1	1/12/2009	14:45	1	1.37	0.295	74.46	25.54
	JBS-1	1/12/2009	14:45	2	1.37	0.252	77.74	22.26
	JBS-1	1/13/2009	10:57	1	1.52	0.413	66.18	33.82
	JBS-1	1/13/2009	10:57	2	1.52	0.236	78.96	21.04
	JBS-1	1/13/2009	11:16	1	1.52	0.243	78.41	21.59
	JBS-1	1/13/2009	11:16	2	1.52	0.280	75.57	24.43
	JBS-1	1/14/2009	16:27	1	1.22	0.360	69.75	30.25
	JBS-1	1/14/2009	16:27	2	1.22	0.180	83.55	16.45
Spring Run	JBS-3	1/12/2009	15:29	1	1.83	0.281	75.48	24.52
	JBS-3	1/12/2009	15:29	2	1.83	0.161	85.16	14.84
	JBS-3	1/13/2009	11:26	1	1.83	0.281	75.49	24.51
	JBS-3	1/13/2009	11:26	2	1.83	0.178	83.70	16.30
	JBS-3	1/13/2009	11:43	1	1.83	0.462	62.99	37.01
	JBS-3	1/13/2009	11:43	2	1.83	0.398	67.16	32.84
	JBS-3	1/14/2009	11:03	1	1.83	0.109	89.64	10.36
	JBS-3	1/14/2009	11:03	2	1.83	0.052	94.95	5.05

Averages

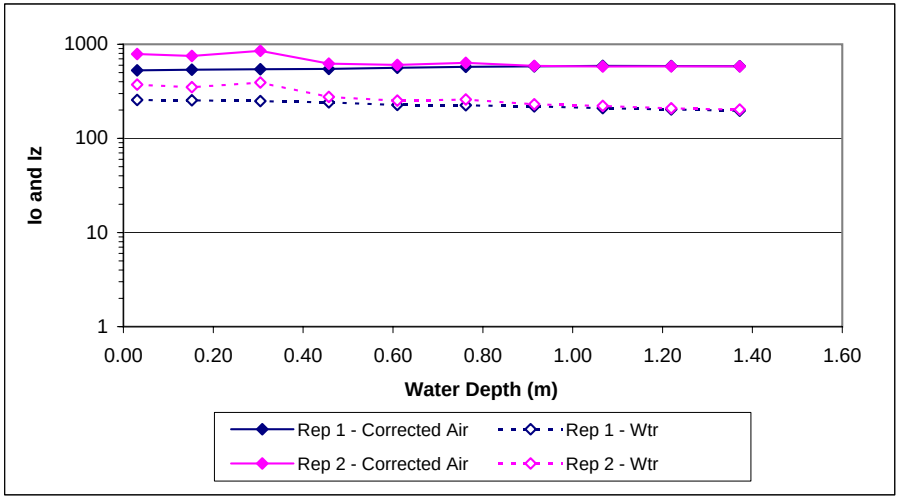
Spring Pool	**JBS-1**				**1.41**	**0.282**	**75.58**	**24.42**
Spring Run	**JBS-3**				**1.83**	**0.240**	**79.32**	**20.68**

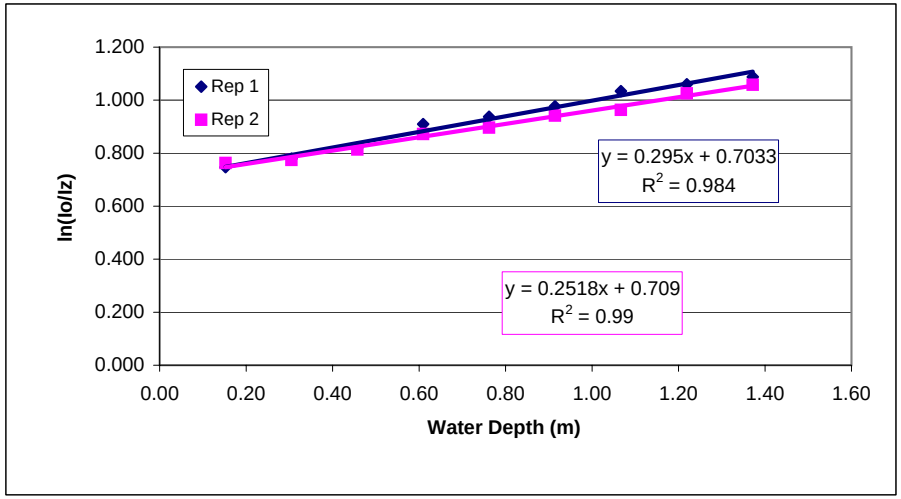
APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES - JBS-1 - 1/12/2009 14:45

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	529.3	551.5	256.5	5.55			0.03	789.0	819.0	373.2	5.92		
0.15	536.1	558.5	254.0	5.54	0.747	4.902	0.15	752.7	781.6	351.0	5.86	0.763	5.005
0.30	542.4	565.0	248.8	5.52	0.779	2.557	0.30	850.2	882.1	391.8	5.97	0.775	2.542
0.46	547.8	570.5	241.1	5.49	0.821	1.795	0.46	623.2	648.2	276.2	5.62	0.814	1.780
0.61	562.8	586.0	226.6	5.42	0.910	1.492	0.61	603.4	627.8	252.3	5.53	0.872	1.430
0.76	575.8	599.4	225.5	5.42	0.937	1.230	0.76	635.6	661.0	259.4	5.56	0.896	1.176
0.91	582.6	606.4	219.4	5.39	0.977	1.068	0.91	590.2	614.2	230.2	5.44	0.942	1.030
1.07	588.7	612.7	209.4	5.34	1.034	0.969	1.07	579.6	603.3	221.2	5.40	0.963	0.903
1.22	587.3	611.2	203.5	5.32	1.060	0.869	1.22	582.2	606.0	208.8	5.34	1.026	0.841
1.37	585.2	609.1	197.2	5.28	1.088	0.793	1.37	583.4	607.2	202.5	5.31	1.058	0.771

k (diffuse attenuation coefficient = slope, m-1)			0.295	k (diffuse attenuation coefficient = slope, m-1)		0.252
k average			1.742	k average		1.720
percent transmittance @	1.0	meter	74.46	percent transmittance @	1.0	meter	77.74
Birgean Percentile Absorption (1m)			25.54	Birgean Percentile Absorption (1m)			22.26



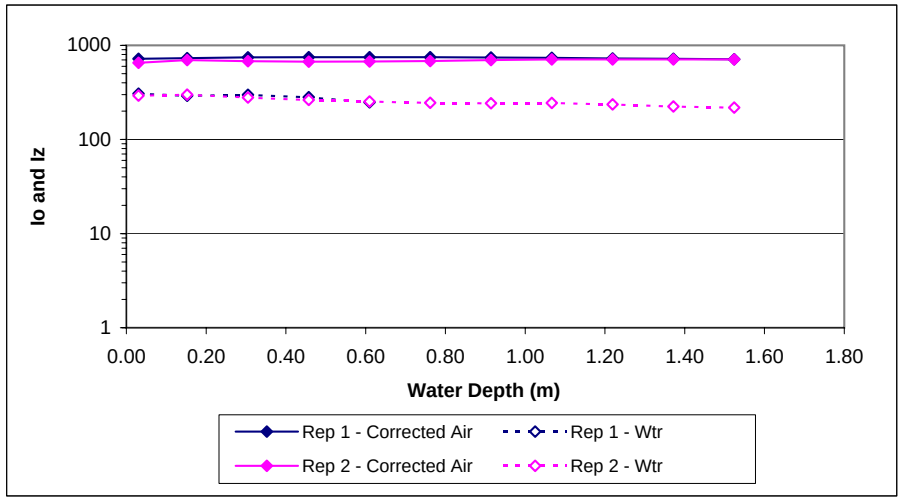


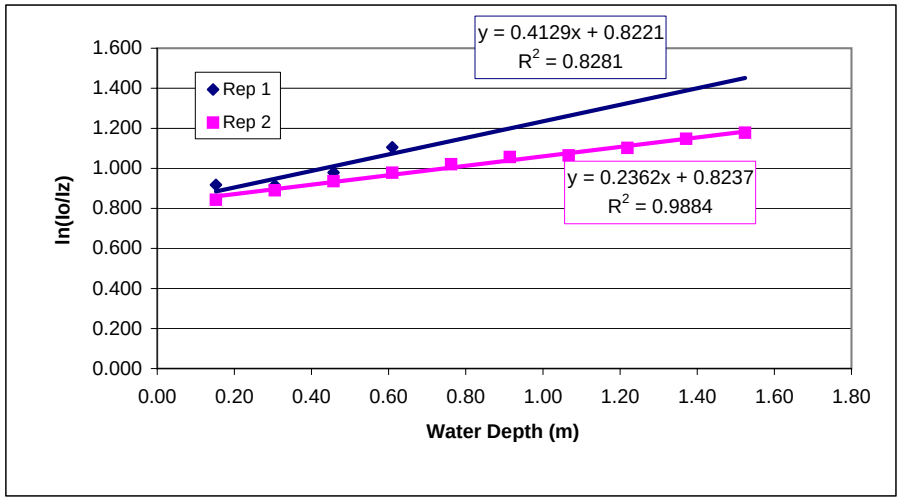
APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES - JBS-1 - 1/13/2009 10:57

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	720.1	748.0	306.3	5.72			0.03	654.0	679.9	292.5	5.68		
0.15	730.4	758.7	291.9	5.68	0.917	6.019	0.15	696.4	723.6	299.7	5.70	0.843	5.532
0.30	745.4	774.1	298.4	5.70	0.915	3.003	0.30	679.6	706.3	278.9	5.63	0.891	2.922
0.46	749.0	777.8	281.3	5.64	0.979	2.142	0.46	671.0	697.5	263.3	5.57	0.936	2.046
0.61	748.7	777.5	247.8	5.51	1.106	1.814	0.61	672.8	699.3	252.9	5.53	0.978	1.605
0.76	749.6	778.4					0.76	681.2	708.0	245.5	5.50	1.021	1.339
0.91	741.7	770.3					0.91	697.7	725.0	242.5	5.49	1.057	1.156
1.07	737.4	765.9					1.07	708.6	736.2	244.4	5.50	1.064	0.998
1.22	726.7	754.9					1.22	709.5	737.1	235.6	5.46	1.102	0.904
1.37	720.5	748.5					1.37	707.4	735.0	224.6	5.41	1.147	0.836
1.52	711.9	739.6					1.52	708.7	736.3	218.2	5.39	1.178	0.773

k (diffuse attenuation coefficient = slope, m-1)			0.413	k (diffuse attenuation coefficient = slope, m-1)		0.236
k average			3.244	k average		1.811
percent transmittance @	1.0	meter	66.18	percent transmittance @	1.0	meter	78.96
Birgean Percentile Absorption (1m)			33.82	Birgean Percentile Absorption (1m)			21.04





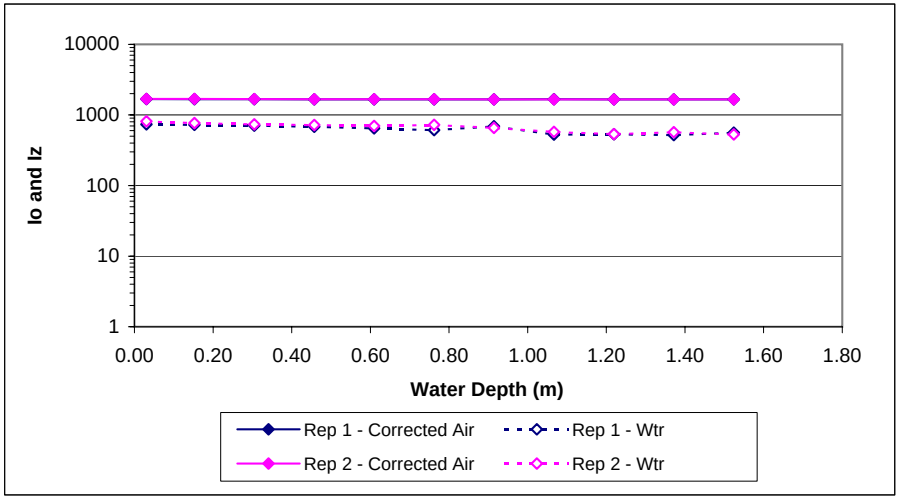
Note: Data flagged > 0.7m for Replicate 1 - Questionable Data

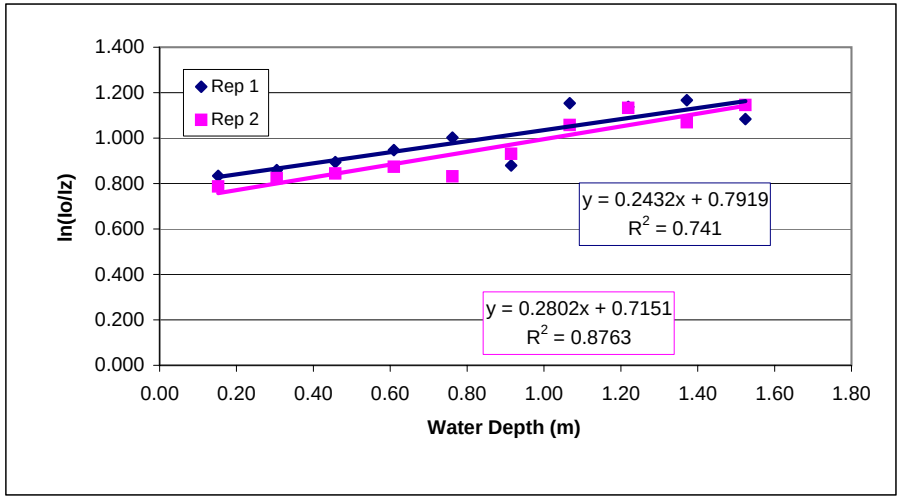
APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES - JBS-1 - 1/13/2009 11:16

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,677.9	1,735.0	735.2	6.60			0.03	1,690.6	1,748.0	811.8	6.70		
0.15	1,672.1	1,729.0	726.2	6.59	0.834	5.473	0.15	1,686.7	1,744.0	767.5	6.64	0.787	5.166
0.30	1,668.2	1,725.0	706.7	6.56	0.859	2.818	0.30	1,677.0	1,734.0	735.5	6.60	0.824	2.704
0.46	1,665.3	1,722.0	681.0	6.52	0.894	1.956	0.46	1,674.1	1,731.0	719.8	6.58	0.844	1.846
0.61	1,664.3	1,721.0	645.4	6.47	0.947	1.554	0.61	1,670.2	1,727.0	697.1	6.55	0.874	1.433
0.76	1,663.4	1,720.0	610.6	6.41	1.002	1.315	0.76	1,668.2	1,725.0	726.0	6.59	0.832	1.092
0.91	1,665.3	1,722.0	690.8	6.54	0.880	0.962	0.91	1,664.3	1,721.0	655.8	6.49	0.931	1.019
1.07	1,666.3	1,723.0	525.8	6.26	1.153	1.081	1.07	1,660.5	1,717.0	576.4	6.36	1.058	0.992
1.22	1,663.4	1,720.0	533.5	6.28	1.137	0.933	1.22	1,660.5	1,717.0	534.6	6.28	1.133	0.930
1.37	1,662.4	1,719.0	517.5	6.25	1.167	0.851	1.37	1,663.4	1,720.0	570.7	6.35	1.070	0.780
1.52	1,661.4	1,718.0	562.1	6.33	1.084	0.711	1.52	1,662.4	1,719.0	528.5	6.27	1.146	0.752

k (diffuse attenuation coefficient = slope, m-1)			0.243	k (diffuse attenuation coefficient = slope, m-1)		0.280
k average			1.765	k average		1.671
percent transmittance @	1.0	meter	78.41	percent transmittance @	1.0	meter	75.57
Birgean Percentile Absorption (1m)			21.59	Birgean Percentile Absorption (1m)			24.43



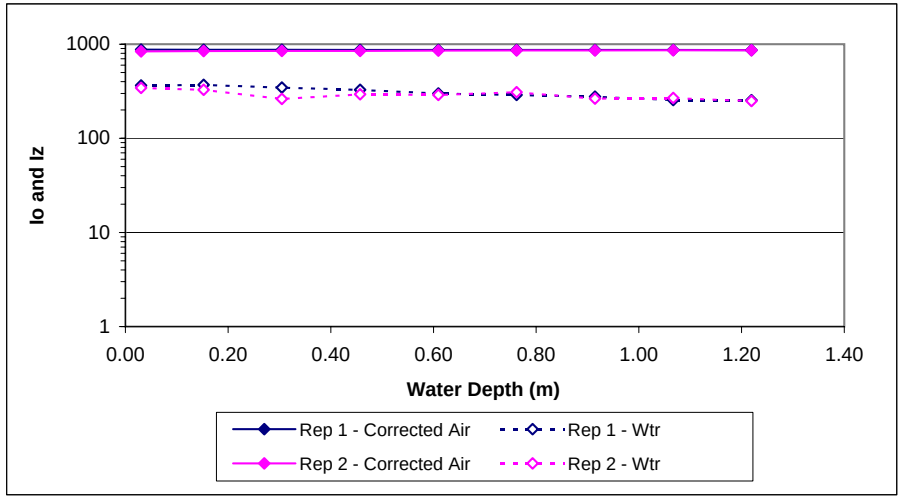


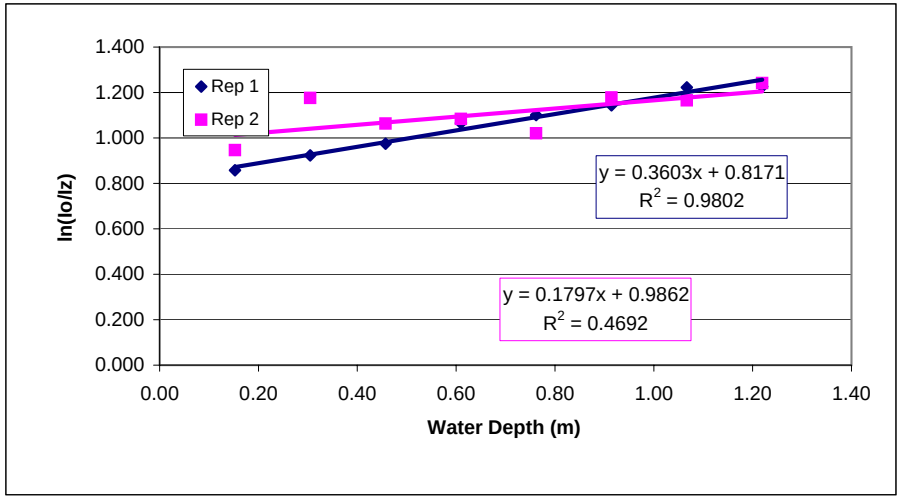
APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES - JBS-1 - 1/14/2009 16:27

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	876.4	909.1	364.7	5.90			0.03	837.7	869.2	343.7	5.84		
0.15	873.3	905.9	370.3	5.91	0.858	5.630	0.15	844.5	876.2	327.8	5.79	0.946	6.209
0.30	872.0	904.6	346.4	5.85	0.923	3.029	0.30	848.4	880.2	261.8	5.57	1.176	3.857
0.46	869.4	901.9	328.0	5.79	0.975	2.132	0.46	849.5	881.4	293.4	5.68	1.063	2.325
0.61	869.2	901.7	299.5	5.70	1.065	1.748	0.61	854.9	887.0	289.3	5.67	1.084	1.778
0.76	868.9	901.4	289.1	5.67	1.100	1.444	0.76	857.2	889.3	308.9	5.73	1.021	1.339
0.91	867.8	900.2	276.5	5.62	1.144	1.251	0.91	859.1	891.3	264.4	5.58	1.178	1.289
1.07	866.9	899.3	255.3	5.54	1.222	1.146	1.07	861.5	893.8	268.6	5.59	1.166	1.093
1.22	864.9	897.3	253.9	5.54	1.226	1.005	1.22	863.0	895.3	249.3	5.52	1.242	1.019

k (diffuse attenuation coefficient = slope, m-1)			0.360	k (diffuse attenuation coefficient = slope, m-1)		0.180
k average			2.173	k average		2.364
percent transmittance @	1.0	meter	69.75	percent transmittance @	1.0	meter	83.55
Birgean Percentile Absorption (1m)			30.25	Birgean Percentile Absorption (1m)			16.45



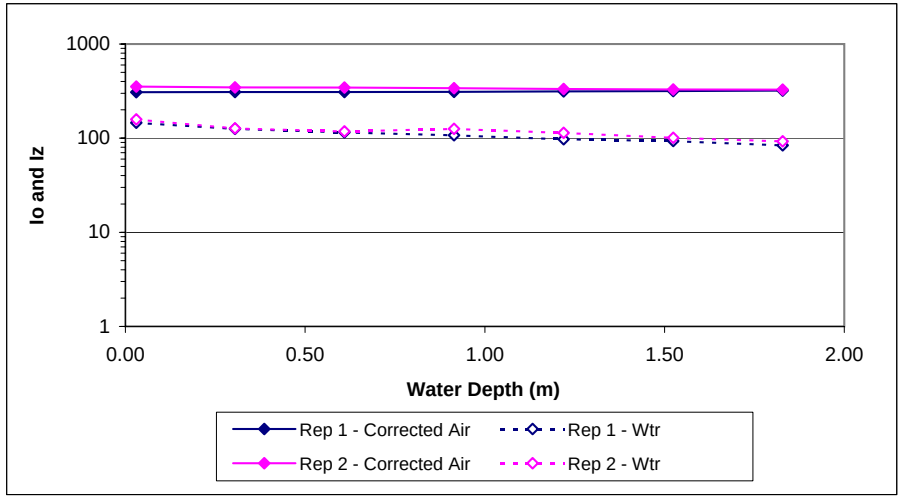


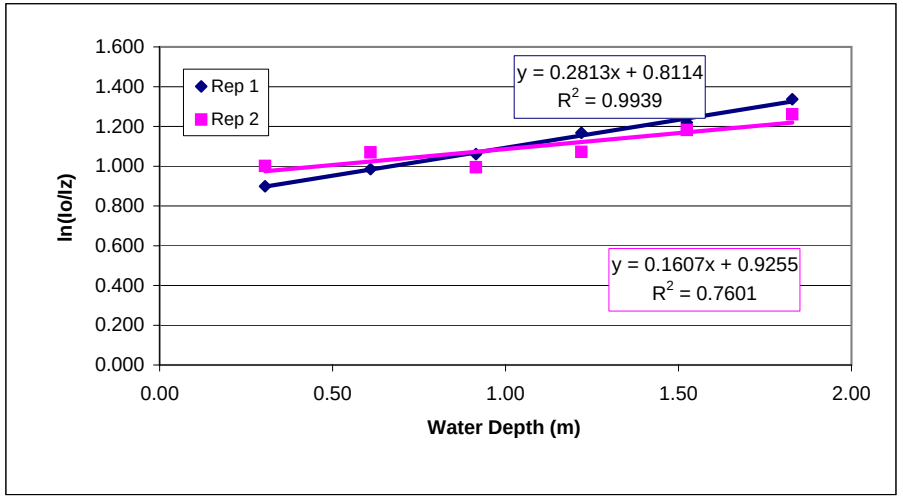
APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES - JBS-3 - 1/12/2009 15:29

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	307.8	323.2	146.0	4.98			0.03	353.1	369.9	158.3	5.06		
0.30	309.0	324.5	125.8	4.83	0.899	2.949	0.30	346.3	362.9	127.2	4.85	1.002	3.286
0.61	308.9	324.4	115.4	4.75	0.985	1.615	0.61	344.5	361.0	118.2	4.77	1.070	1.755
0.91	310.9	326.4	107.6	4.68	1.061	1.160	0.91	339.6	356.0	125.6	4.83	0.995	1.088
1.22	313.8	329.4	97.6	4.58	1.168	0.958	1.22	333.3	349.5	114.1	4.74	1.072	0.879
1.52	316.4	332.1	93.5	4.54	1.220	0.800	1.52	329.5	345.6	101.0	4.62	1.183	0.776
1.83	319.8	335.6	84.0	4.43	1.337	0.731	1.83	327.2	343.2	92.7	4.53	1.261	0.690

k (diffuse attenuation coefficient = slope, m-1)			0.281	k (diffuse attenuation coefficient = slope, m-1)		0.161
k average			1.369	k average		1.412
percent transmittance @	1.0	meter	75.48	percent transmittance @	1.0	meter	85.16
Birgean Percentile Absorption (1m)			24.52	Birgean Percentile Absorption (1m)			14.84



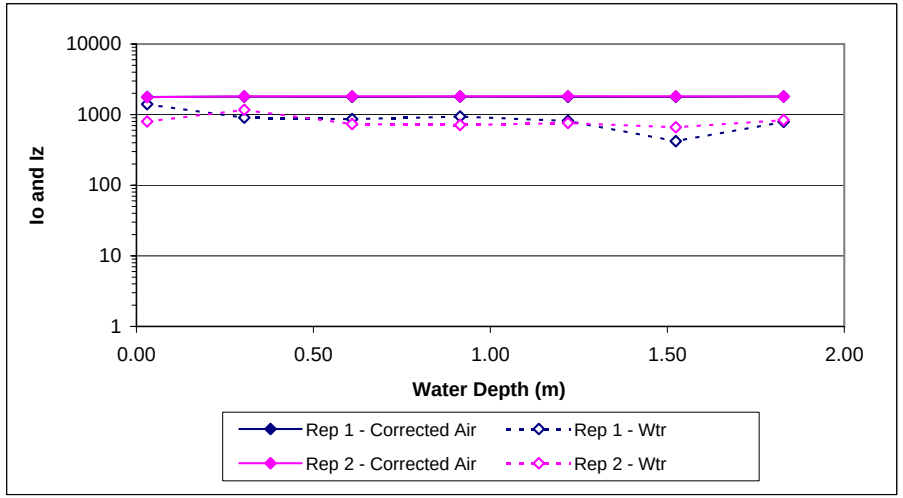


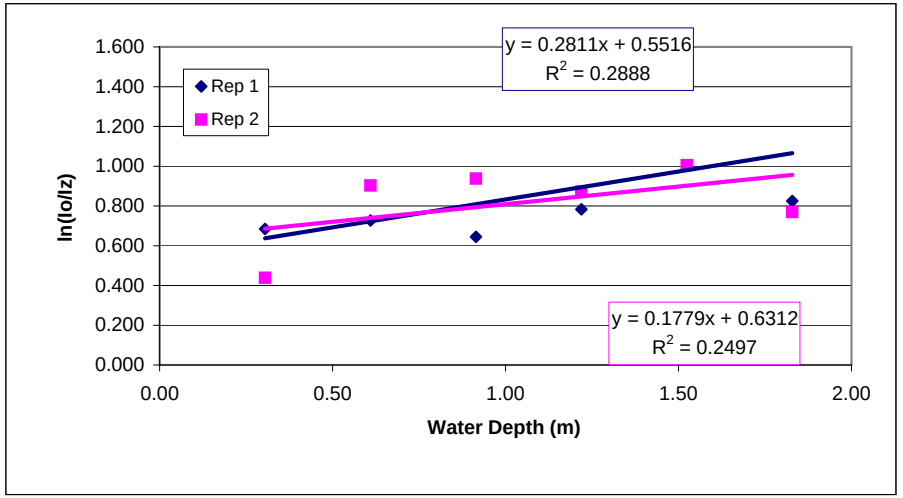
APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES - JBS-3 - 1/13/2009 11:26

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,774.0	1,834.0	1,404.0	7.25			0.03	1,765.3	1,825.0	801.9	6.69		
0.30	1,794.4	1,855.0	905.2	6.81	0.684	2.245	0.30	1,816.7	1,878.0	1,172.0	7.07	0.438	1.438
0.61	1,789.5	1,850.0	865.3	6.76	0.727	1.192	0.61	1,813.8	1,875.0	735.2	6.60	0.903	1.481
0.91	1,794.4	1,855.0	941.9	6.85	0.645	0.705	0.91	1,819.6	1,881.0	712.7	6.57	0.937	1.025
1.22	1,782.7	1,843.0	815.0	6.70	0.783	0.642	1.22	1,824.5	1,886.0	762.9	6.64	0.872	0.715
1.52	1,789.5	1,850.0	421.6	6.04	1.446	0.949	1.52	1,815.7	1,877.0	664.3	6.50	1.006	0.660
1.83	1,807.0	1,868.0	791.9	6.67	0.825	0.451	1.83	1,808.0	1,869.0	837.6	6.73	0.769	0.421

k (diffuse attenuation coefficient = slope, m-1)			0.281	k (diffuse attenuation coefficient = slope, m-1)		0.178
k average			1.031	k average		0.957
percent transmittance @	1.0	meter	75.49	percent transmittance @	1.0	meter	83.70
Birgean Percentile Absorption (1m)			24.51	Birgean Percentile Absorption (1m)			16.30



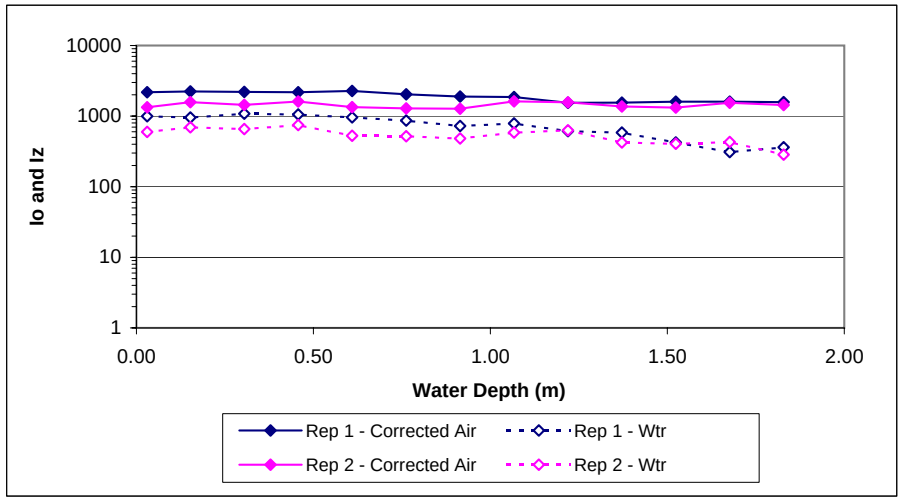


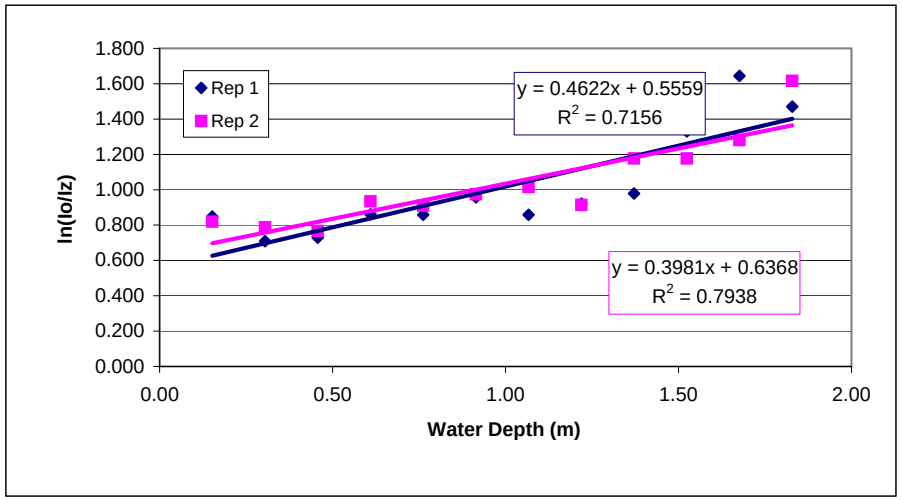
APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES - JBS-3 - 1/13/2009 11:43

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,176.8	2,249.0	994.6	6.90			0.03	1,333.4	1,380.0	598.7	6.39		
0.15	2,234.0	2,308.0	956.6	6.86	0.848	5.565	0.15	1,576.0	1,630.0	694.7	6.54	0.819	5.375
0.30	2,204.9	2,278.0	1,085.0	6.99	0.709	2.326	0.30	1,439.2	1,489.0	654.8	6.48	0.788	2.584
0.46	2,181.6	2,254.0	1,053.0	6.96	0.728	1.593	0.46	1,606.1	1,661.0	746.0	6.61	0.767	1.677
0.61	2,269.0	2,344.0	959.1	6.87	0.861	1.413	0.61	1,343.1	1,390.0	527.4	6.27	0.935	1.533
0.76	2,040.9	2,109.0	865.0	6.76	0.858	1.127	0.76	1,285.9	1,331.0	517.6	6.25	0.910	1.194
0.91	1,888.5	1,952.0	725.3	6.59	0.957	1.047	0.91	1,276.1	1,321.0	481.8	6.18	0.974	1.065
1.07	1,859.4	1,922.0	787.8	6.67	0.859	0.805	1.07	1,616.8	1,672.0	585.6	6.37	1.016	0.952
1.22	1,543.0	1,596.0	614.1	6.42	0.921	0.756	1.22	1,570.2	1,624.0	629.3	6.44	0.914	0.750
1.37	1,552.7	1,606.0	583.5	6.37	0.979	0.714	1.37	1,372.2	1,420.0	422.8	6.05	1.177	0.858
1.52	1,597.4	1,652.0	422.5	6.05	1.330	0.873	1.52	1,319.8	1,366.0	406.8	6.01	1.177	0.772
1.68	1,602.2	1,657.0	309.6	5.74	1.644	0.981	1.68	1,545.9	1,599.0	429.4	6.06	1.281	0.764
1.83	1,577.0	1,631.0	362.5	5.89	1.470	0.804	1.83	1,437.2	1,487.0	285.4	5.65	1.617	0.884

k (diffuse attenuation coefficient = slope, m-1)			0.462	k (diffuse attenuation coefficient = slope, m-1)		0.398
k average			1.500	k average		1.534
percent transmittance @	1.0	meter	62.99	percent transmittance @	1.0	meter	67.16
Birgean Percentile Absorption (1m)			37.01	Birgean Percentile Absorption (1m)			32.84



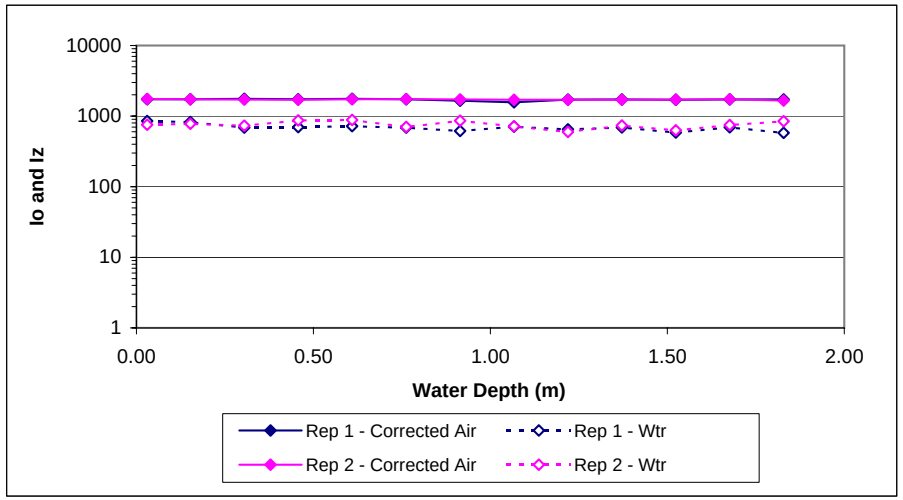


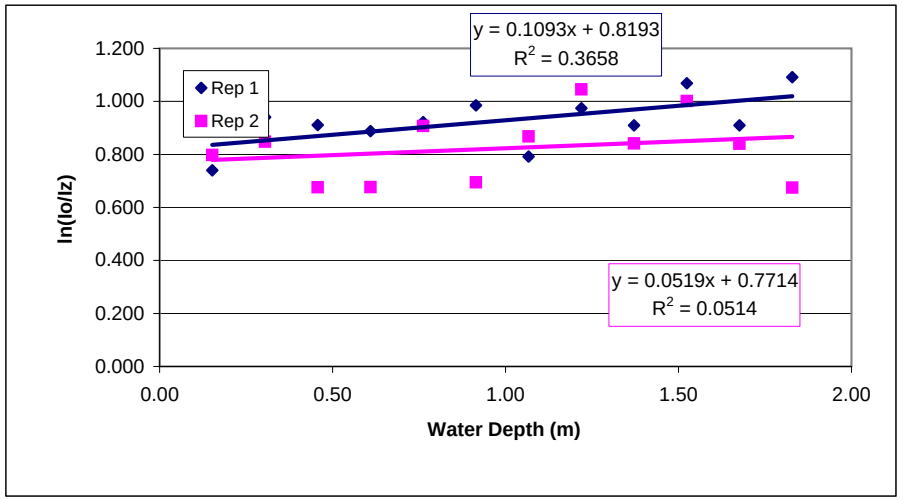
APPENDIX D

Jackson Blue Springs (Jackson Co.) PAR ATTENUATION ESTIMATES - JBS-3 - 1/14/2009 11:03

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,732.3	1,791.0	852.6	6.75			0.03	1,750.7	1,810.0	757.3	6.63		
0.15	1,727.4	1,786.0	824.2	6.71	0.740	4.855	0.15	1,730.3	1,789.0	779.0	6.66	0.798	5.237
0.30	1,756.5	1,816.0	685.9	6.53	0.940	3.085	0.30	1,711.9	1,770.0	733.0	6.60	0.848	2.783
0.46	1,735.2	1,794.0	697.8	6.55	0.911	1.992	0.46	1,707.0	1,765.0	868.2	6.77	0.676	1.479
0.61	1,755.6	1,815.0	722.5	6.58	0.888	1.456	0.61	1,736.2	1,795.0	882.6	6.78	0.677	1.110
0.76	1,729.4	1,788.0	688.2	6.53	0.921	1.209	0.76	1,743.9	1,803.0	703.8	6.56	0.907	1.191
0.91	1,648.3	1,704.5	615.4	6.42	0.985	1.077	0.91	1,725.5	1,784.0	861.2	6.76	0.695	0.760
1.07	1,567.3	1,621.0	710.1	6.57	0.792	0.742	1.07	1,709.0	1,767.0	717.3	6.58	0.868	0.814
1.22	1,715.8	1,774.0	647.7	6.47	0.974	0.799	1.22	1,701.2	1,759.0	597.9	6.39	1.046	0.858
1.37	1,719.7	1,778.0	692.5	6.54	0.910	0.663	1.37	1,707.0	1,765.0	736.0	6.60	0.841	0.613
1.52	1,707.0	1,765.0	586.3	6.37	1.069	0.701	1.52	1,710.0	1,768.0	628.2	6.44	1.001	0.657
1.68	1,721.6	1,780.0	693.2	6.54	0.910	0.543	1.68	1,730.3	1,789.0	747.0	6.62	0.840	0.501
1.83	1,725.5	1,784.0	579.4	6.36	1.091	0.597	1.83	1,663.4	1,720.0	847.0	6.74	0.675	0.369

k (diffuse attenuation coefficient = slope, m-1)			0.109	k (diffuse attenuation coefficient = slope, m-1)		0.052
k average			1.477	k average		1.364
percent transmittance @	1.0	meter	89.64	percent transmittance @	1.0	meter	94.95
Birgean Percentile Absorption (1m)			10.36	Birgean Percentile Absorption (1m)			5.05





APPENDIX D

Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES (December 2008 and January 2009)

Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	MBS-1	12/1/2008	13:40	1	6.10	0.180	83.57	16.43
	MBS-1	12/1/2008	13:40	2	6.10	0.346	70.73	29.27
	MBS-1	12/2/2008	14:32	1	0.91	1.429	23.95	76.05
	MBS-1	12/2/2008	14:32	2	0.91	3.235	3.94	96.06
	MBS-1	1/2/2009	11:35	1	6.71	0.267	76.57	23.43
	MBS-1	1/2/2009	11:35	2	6.71	0.321	72.51	27.49
Spring Run	MBS-2	12/1/2008	14:13	1	1.07	1.041	35.31	64.69
	MBS-2	12/1/2008	14:13	2	1.07	0.400	67.03	32.97
	MBS-2	12/10/2008	11:19	1	1.83	2.559	7.74	92.26
	MBS-2	12/10/2008	11:19	2	1.83	2.521	8.04	91.96
	MBS-2	1/2/2009	11:22	1	0.91	1.517	21.93	78.07
	MBS-2	1/2/2009	11:22	2	0.91	0.242	78.51	21.49
	MBS-3	12/1/2008	14:38	1	1.07	3.062	4.68	95.32
	MBS-3	12/1/2008	14:38	2	1.07	3.182	4.15	95.85
	MBS-3	1/2/2009	10:49	1	1.37	0.553	57.50	42.50
	MBS-3	1/2/2009	10:49	2	1.37	0.625	53.52	46.48

Averages

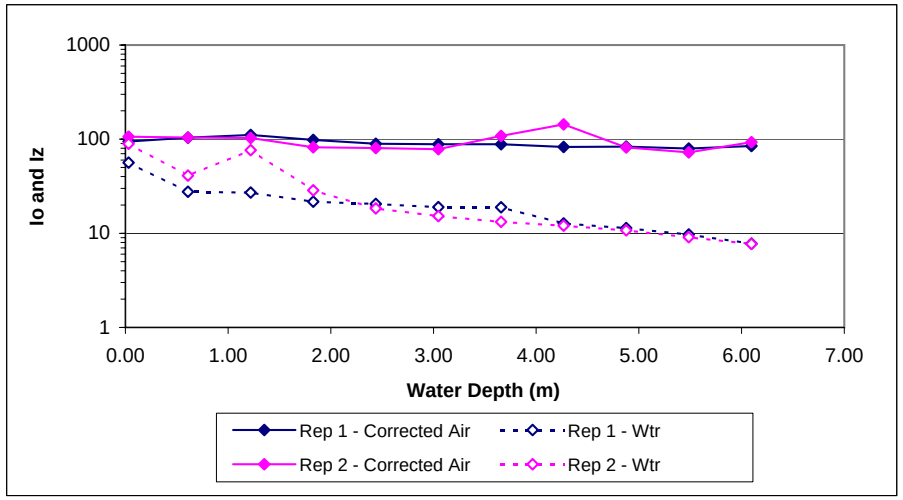
Spring Pool	**MBS-1 Pool**				**4.57**	**0.96**	**55.21**	**44.79**
Spring Run	**MBS-2**				**1.27**	**1.38**	**36.43**	**63.57**
	MBS-3				**1.22**	**1.86**	**29.96**	**70.04**
	Run				**1.25**	**1.57**	**33.84**	**66.16**

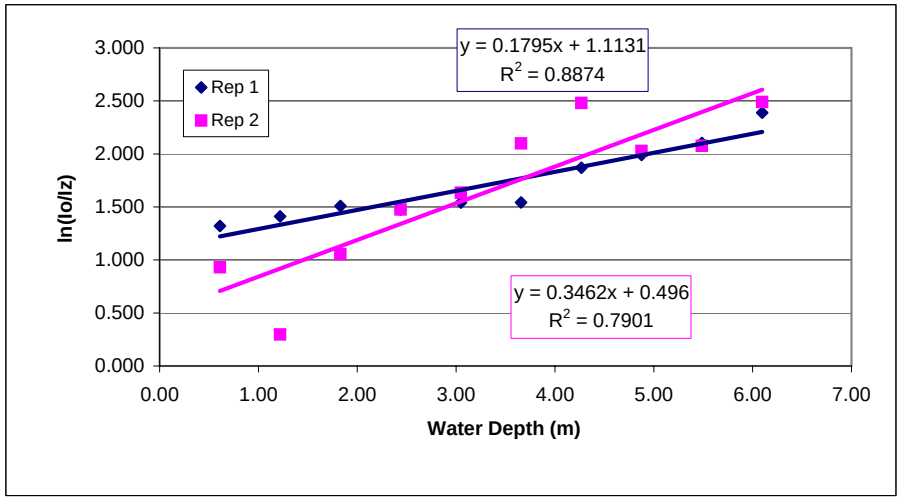
APPENDIX D

Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES - MBS-1 - 12/01/2008 13:40

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	94.3	103.2	56.3	4.03			0.03	106.3	115.6	89.3	4.49		
0.61	103.6	112.8	27.6	3.32	1.321	2.167	0.61	104.0	113.2	41.0	3.71	0.931	1.527
1.22	110.9	120.3	27.1	3.30	1.410	1.157	1.22	103.1	112.3	76.6	4.34	0.298	0.244
1.83	98.2	107.2	21.7	3.08	1.510	0.826	1.83	82.1	90.7	28.6	3.35	1.055	0.577
2.44	89.5	98.3	20.5	3.02	1.474	0.604	2.44	80.4	88.9	18.4	2.91	1.475	0.605
3.05	88.4	97.1	18.9	2.94	1.540	0.505	3.05	78.2	86.6	15.3	2.72	1.634	0.536
3.66	88.2	97.0	18.9	2.94	1.543	0.422	3.66	108.2	117.6	13.3	2.58	2.100	0.574
4.27	82.7	91.3	12.7	2.54	1.870	0.438	4.27	143.8	154.2	12.0	2.49	2.481	0.581
4.88	83.3	91.9	11.4	2.43	1.991	0.408	4.88	81.8	90.3	10.8	2.37	2.029	0.416
5.49	79.5	88.0	9.7	2.27	2.104	0.383	5.49	72.4	80.7	9.1	2.21	2.076	0.378
6.10	84.7	93.3	7.8	2.05	2.388	0.392	6.10	92.9	101.8	7.7	2.04	2.489	0.408

k (diffuse attenuation coefficient = slope, m-1)			0.180	k (diffuse attenuation coefficient = slope, m-1)	0.346
k average			0.730	k average	0.585
percent transmittance @	1.0	meter	83.57	percent transmittance @ 1.0 meter	70.73
Birgean Percentile Absorption (1m)			16.43	Birgean Percentile Absorption (1m)	29.27



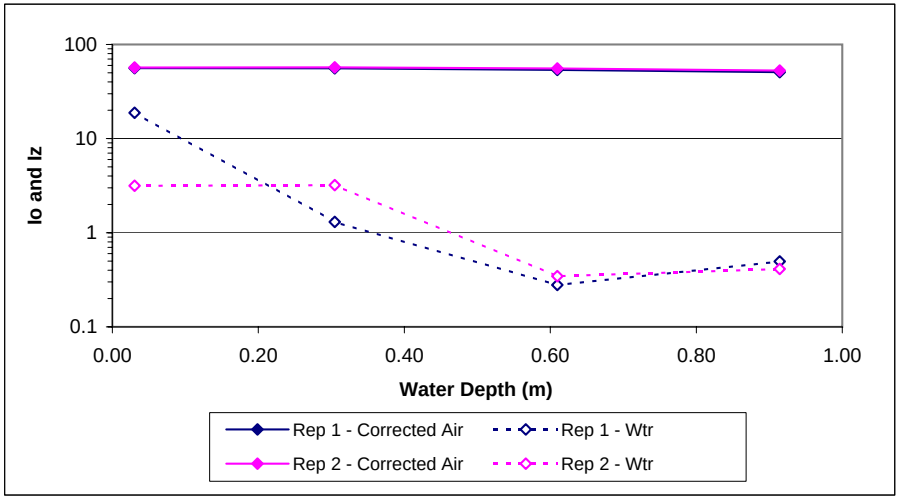


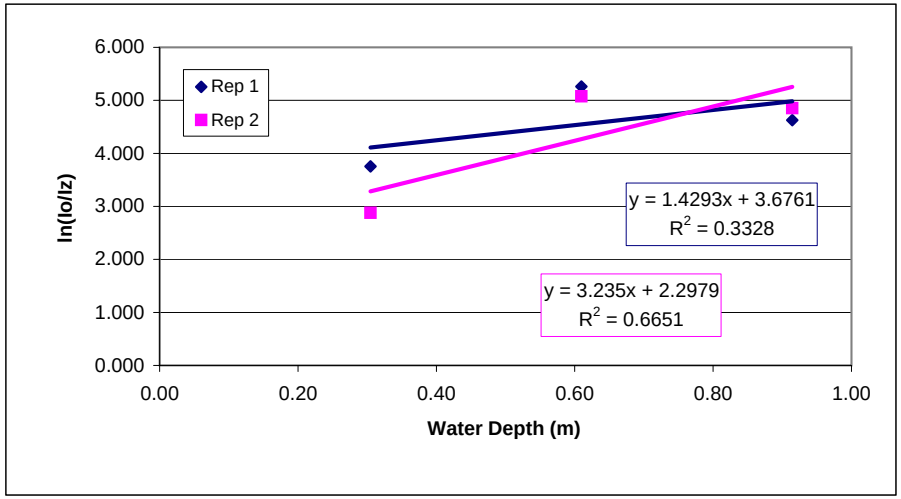
APPENDIX D

Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES - MBS-1 - 12/02/2008 14:32

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	55.9	63.7	18.8	2.93			0.03	56.8	64.6	3.2	1.15		
0.30	55.8	63.5	1.3	0.27	3.756	12.322	0.30	57.2	65.0	3.2	1.17	2.880	9.449
0.61	53.7	61.4	0.3	-1.28	5.260	8.628	0.61	55.5	63.3	0.3	-1.06	5.078	8.330
0.91	50.8	58.4	0.5	-0.70	4.627	5.060	0.91	52.8	60.5	0.4	-0.89	4.852	5.306

k (diffuse attenuation coefficient = slope, m-1)			1.429	3.235
k average			8.670	7.695
percent transmittance @	1.0 meter		23.95	3.94
Birgean Percentile Absorption (1m)			76.05	96.06



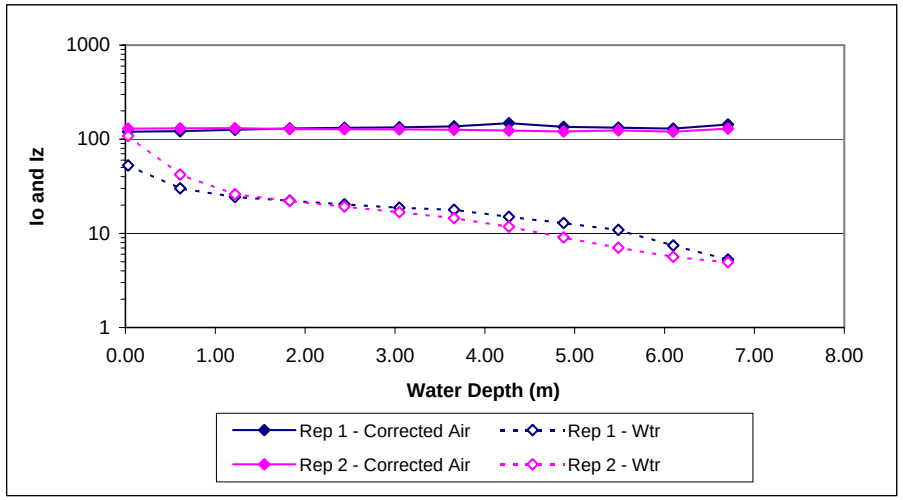


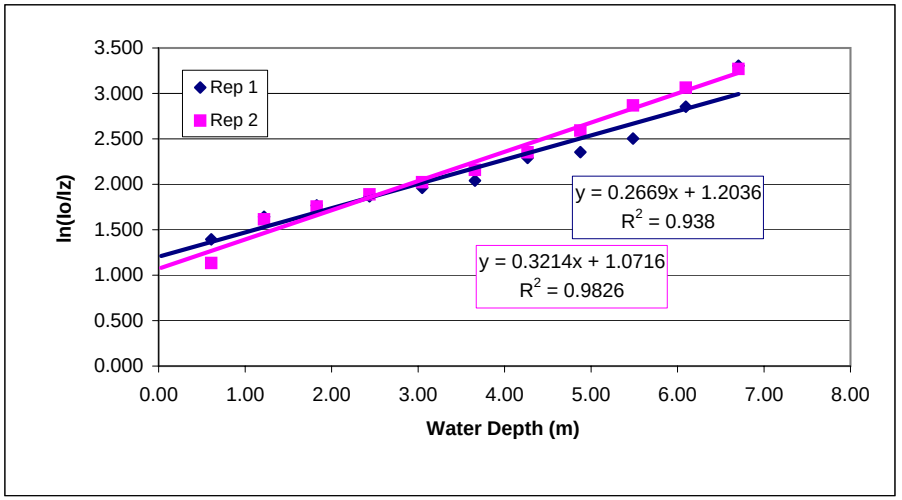
APPENDIX D

Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES - MBS-1 - 1/02/2009 11:35

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	120.3	130.0	52.7	3.96			0.03	129.6	139.6	108.3	4.68		
0.61	121.6	131.4	30.2	3.41	1.394	2.287	0.61	130.8	140.8	42.1	3.74	1.133	1.859
1.22	126.2	136.1	24.4	3.19	1.643	1.348	1.22	131.0	141.0	26.1	3.26	1.615	1.325
1.83	130.2	140.2	22.2	3.10	1.767	0.966	1.83	128.0	138.0	22.1	3.10	1.756	0.960
2.44	132.1	142.2	20.4	3.02	1.869	0.766	2.44	127.5	137.4	19.3	2.96	1.888	0.774
3.05	133.6	143.7	18.8	2.93	1.961	0.643	3.05	127.0	136.9	16.8	2.82	2.023	0.664
3.66	136.9	147.1	17.8	2.88	2.040	0.558	3.66	126.0	135.9	14.6	2.68	2.159	0.590
4.27	148.3	158.9	15.0	2.71	2.290	0.537	4.27	123.9	133.7	11.8	2.47	2.352	0.551
4.88	135.5	145.7	12.9	2.55	2.354	0.483	4.88	120.9	130.6	9.1	2.20	2.591	0.531
5.49	132.8	142.9	10.9	2.39	2.503	0.456	5.49	124.4	134.2	7.1	1.95	2.869	0.523
6.10	129.4	139.4	7.5	2.01	2.853	0.468	6.10	120.6	130.3	5.6	1.73	3.064	0.503
6.71	143.6	154.0	5.3	1.66	3.305	0.493	6.71	129.9	139.9	4.9	1.60	3.269	0.488

k (diffuse attenuation coefficient = slope, m-1)			0.267	k (diffuse attenuation coefficient = slope, m-1)		0.321
k average			0.819	k average		0.797
percent transmittance @	1.0	meter	76.57	percent transmittance @	1.0	meter	72.51
Birgean Percentile Absorption (1m)			23.43	Birgean Percentile Absorption (1m)			27.49



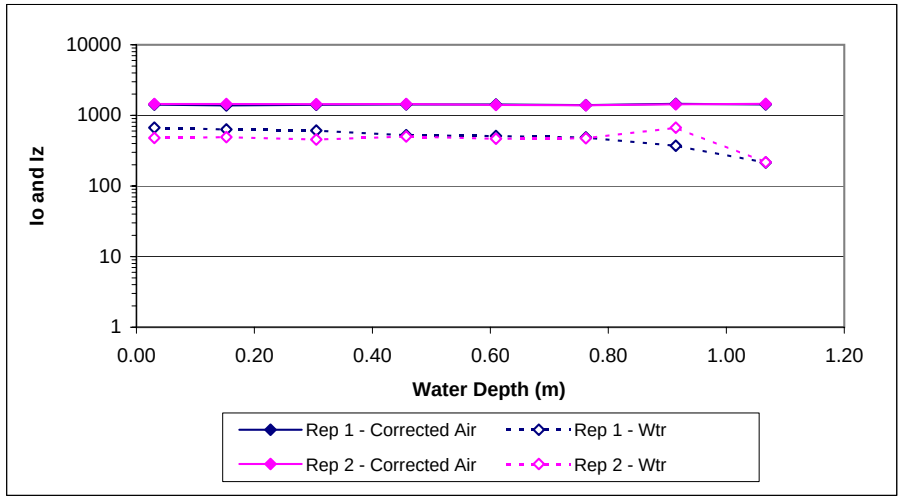


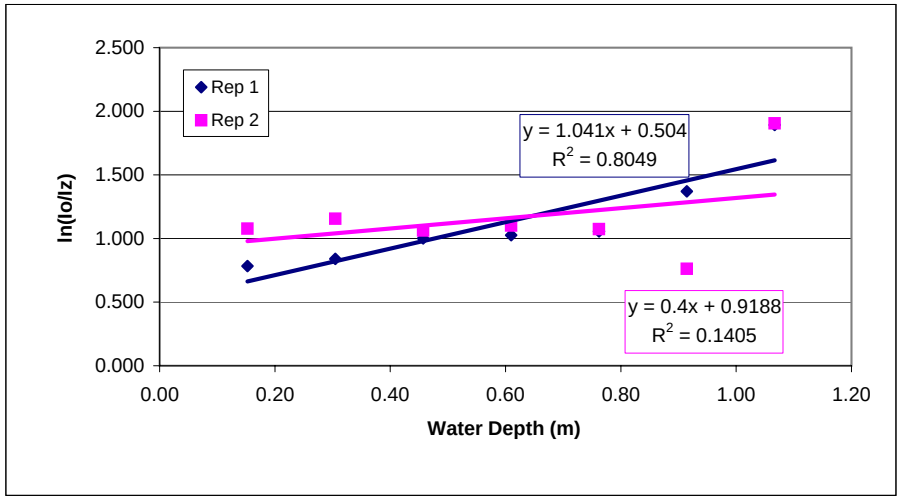
APPENDIX D

Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES - MBS-2 - 12/01/2008 14:13

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,422.7	1,472.0	670.9	6.51			0.03	1,447.0	1,497.0	480.4	6.17		
0.15	1,385.8	1,434.0	632.9	6.45	0.784	5.143	0.15	1,449.9	1,500.0	493.6	6.20	1.078	7.070
0.30	1,414.9	1,464.0	610.6	6.41	0.840	2.757	0.30	1,445.0	1,495.0	455.0	6.12	1.156	3.791
0.46	1,426.6	1,476.0	524.5	6.26	1.001	2.189	0.46	1,452.8	1,503.0	501.9	6.22	1.063	2.325
0.61	1,425.6	1,475.0	511.0	6.24	1.026	1.683	0.61	1,409.1	1,458.0	468.3	6.15	1.102	1.807
0.76	1,401.3	1,450.0	487.4	6.19	1.056	1.386	0.76	1,392.6	1,441.0	475.7	6.16	1.074	1.410
0.91	1,460.5	1,511.0	370.9	5.92	1.371	1.499	0.91	1,435.3	1,485.0	669.9	6.51	0.762	0.833
1.07	1,426.6	1,476.0	215.0	5.37	1.892	1.774	1.07	1,459.6	1,510.0	217.2	5.38	1.905	1.786

k (diffuse attenuation coefficient = slope, m-1)			1.041	k (diffuse attenuation coefficient = slope, m-1)	0.400
k average			2.347	k average	2.717
percent transmittance @	1.0	meter	35.31	percent transmittance @ 1.0 meter	67.03
Birgean Percentile Absorption (1m)			64.69	Birgean Percentile Absorption (1m)	32.97



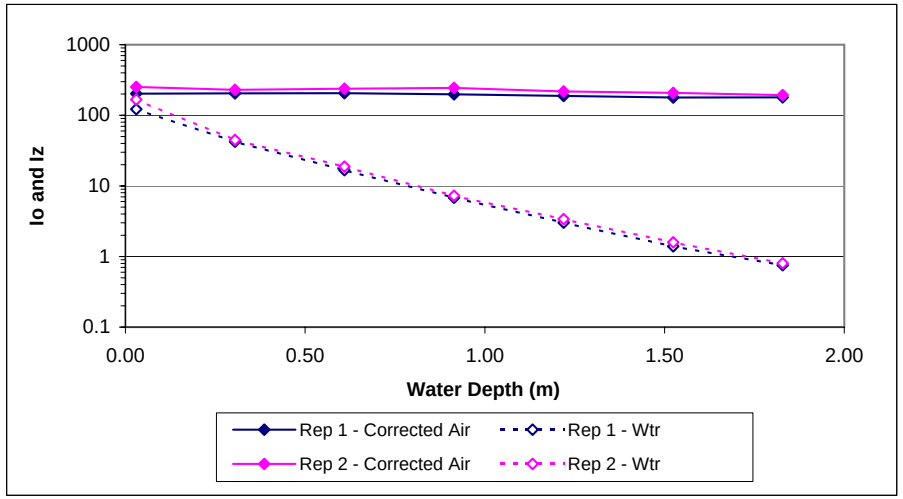


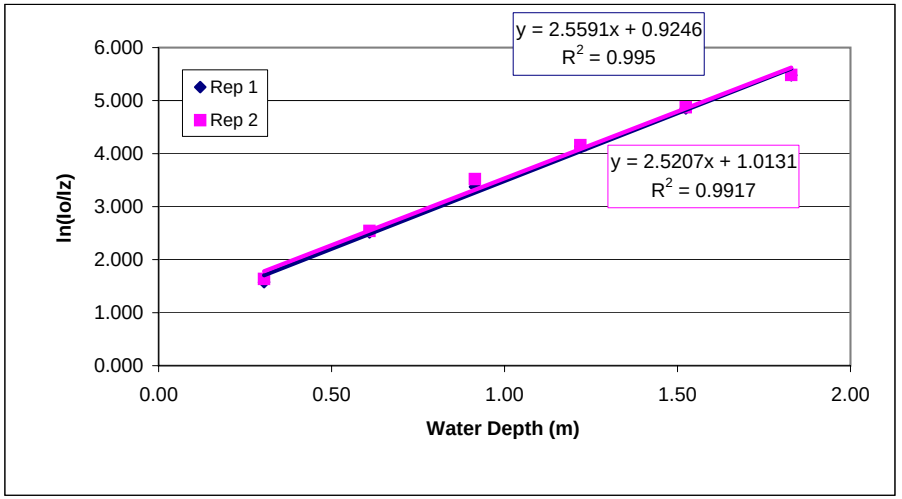
APPENDIX D

Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES - MBS-2 - 12/10/2008 11:19

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	202.2	214.4	121.9	4.80			0.03	252.5	266.2	166.9	5.12		
0.30	204.8	217.1	42.4	3.75	1.575	5.169	0.30	230.1	243.2	44.9	3.80	1.635	5.365
0.61	206.1	218.4	16.7	2.82	2.513	4.122	0.61	238.3	251.6	18.8	2.93	2.541	4.168
0.91	198.3	210.4	6.8	1.92	3.373	3.688	0.91	244.7	258.2	7.3	1.98	3.518	3.847
1.22	188.5	200.3	3.0	1.10	4.134	3.391	1.22	217.4	230.1	3.4	1.22	4.160	3.412
1.52	178.7	190.2	1.4	0.33	4.854	3.185	1.52	207.8	220.2	1.6	0.46	4.875	3.199
1.83	180.1	191.6	0.8	-0.29	5.478	2.996	1.83	193.7	205.6	0.8	-0.22	5.485	2.999

k (diffuse attenuation coefficient = slope, m-1)			2.559	k (diffuse attenuation coefficient = slope, m-1)	2.521
k average			3.758	k average	3.832
percent transmittance @	1.0	meter	7.74	percent transmittance @ 1.0 meter	8.04
Birgean Percentile Absorption (1m)			92.26	Birgean Percentile Absorption (1m)	91.96



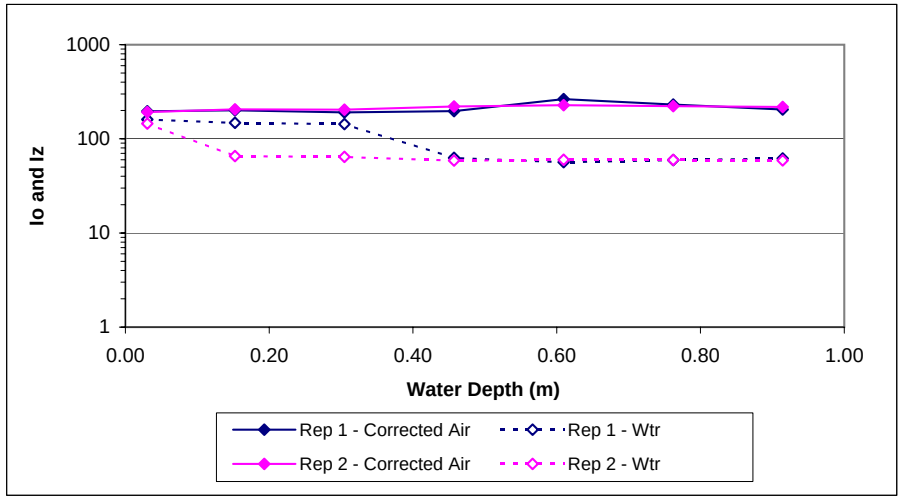


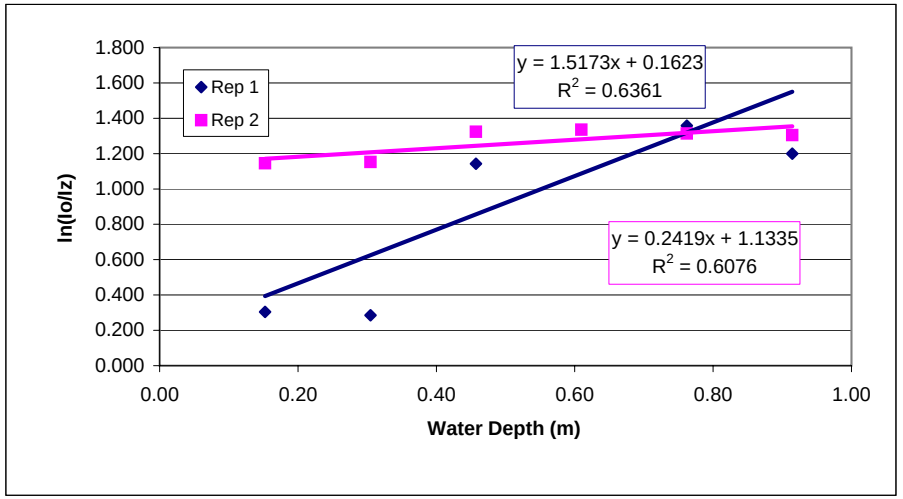
APPENDIX D

Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES - MBS-2 - 1/2/2009 11:22

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	196.6	208.6	160.6	5.08			0.03	192.7	204.6	145.2	4.98		
0.15	200.7	212.9	148.1	5.00	0.304	1.995	0.15	206.1	218.4	65.6	4.18	1.145	7.515
0.30	191.1	203.0	143.7	4.97	0.285	0.936	0.30	203.9	216.2	64.4	4.16	1.153	3.783
0.46	196.9	208.9	62.8	4.14	1.143	2.499	0.46	220.9	233.7	58.8	4.07	1.324	2.895
0.61	263.9	278.0	56.5	4.03	1.541	2.527	0.61	228.2	241.2	60.0	4.10	1.335	2.190
0.76	231.5	244.6	59.5	4.09	1.358	1.782	0.76	222.3	235.1	59.8	4.09	1.314	1.724
0.91	205.2	217.5	61.8	4.12	1.199	1.312	0.91	217.9	230.6	59.1	4.08	1.305	1.427

k (diffuse attenuation coefficient = slope, m-1)			1.517	k (diffuse attenuation coefficient = slope, m-1)		0.242
k average			1.842	k average		3.256
percent transmittance @	1.0	meter	21.93	percent transmittance @	1.0	meter	78.51
Birgean Percentile Absorption (1m)			78.07	Birgean Percentile Absorption (1m)			21.49



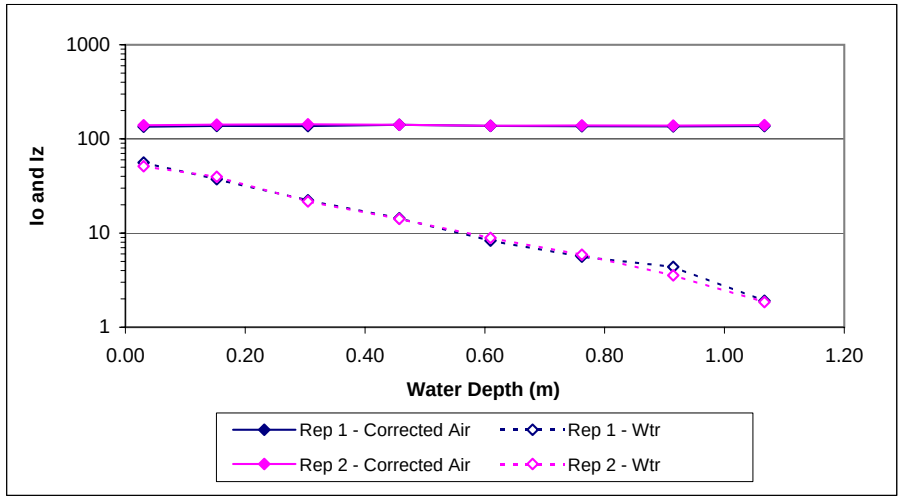


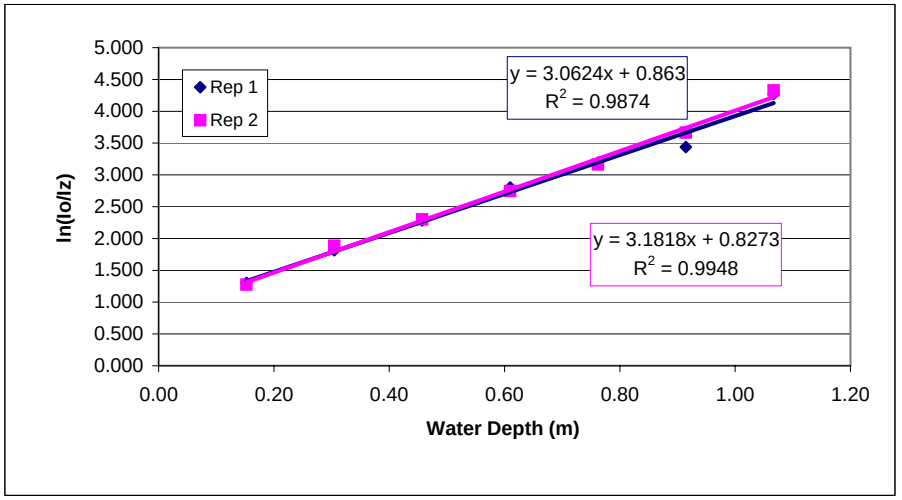
APPENDIX D

Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES - MBS-3 - 12/01/2008 14:38

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	134.8	145.0	56.2	4.03			0.03	139.5	149.8	51.4	3.94		
0.15	137.7	147.9	37.4	3.62	1.303	8.550	0.15	141.8	152.2	39.6	3.68	1.276	8.375
0.30	136.7	146.9	22.3	3.10	1.815	5.954	0.30	142.7	153.1	21.6	3.07	1.886	6.188
0.46	141.0	151.4	14.4	2.67	2.284	4.996	0.46	141.3	151.7	14.1	2.65	2.302	5.035
0.61	137.3	147.5	8.3	2.12	2.803	4.598	0.61	138.2	148.5	8.9	2.18	2.746	4.505
0.76	136.5	146.7	5.6	1.72	3.192	4.189	0.76	139.3	149.6	5.9	1.77	3.163	4.151
0.91	136.0	146.2	4.4	1.47	3.439	3.761	0.91	138.6	148.9	3.6	1.27	3.665	4.008
1.07	137.1	147.3	1.9	0.65	4.274	4.006	1.07	140.2	150.5	1.8	0.61	4.329	4.058

k (diffuse attenuation coefficient = slope, m-1)			3.062	k (diffuse attenuation coefficient = slope, m-1)	3.182
k average			5.150	k average	5.189
percent transmittance @	1.0	meter	4.68	percent transmittance @ 1.0 meter	4.15
Birgean Percentile Absorption (1m)			95.32	Birgean Percentile Absorption (1m)	95.85





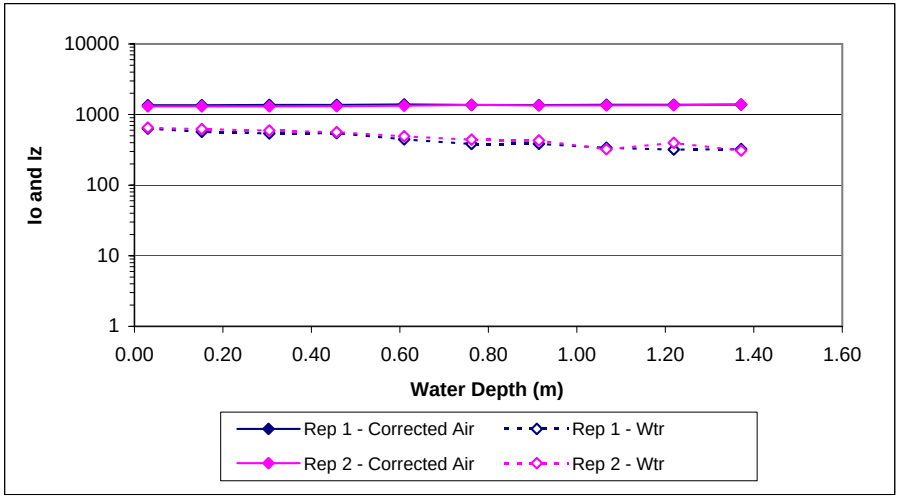
APPENDIX D

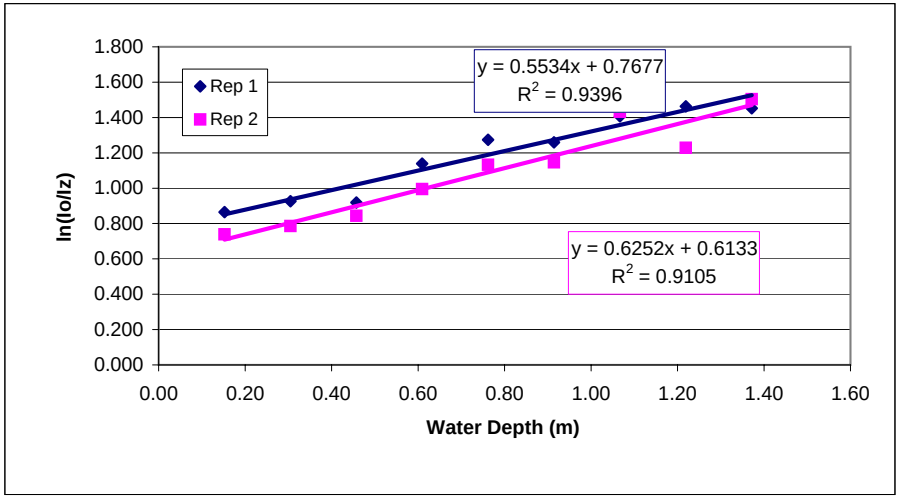
Madison Blue Springs (Madison Co.) PAR ATTENUATION ESTIMATES - MBS-3 - 1/02/2009 10:49

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,351.8	1,399.0	631.6	6.45			0.03	1,308.2	1,354.0	651.6	6.48		
0.15	1,353.8	1,401.0	570.4	6.35	0.864	5.671	0.15	1,307.2	1,353.0	624.3	6.44	0.739	4.849
0.30	1,367.4	1,415.0	541.4	6.29	0.926	3.040	0.30	1,305.3	1,351.0	594.7	6.39	0.786	2.579
0.46	1,368.3	1,416.0	546.0	6.30	0.919	2.009	0.46	1,310.1	1,356.0	563.6	6.33	0.844	1.845
0.61	1,390.7	1,439.0	445.2	6.10	1.139	1.868	0.61	1,331.5	1,378.0	492.4	6.20	0.995	1.632
0.76	1,370.3	1,418.0	383.4	5.95	1.274	1.672	0.76	1,366.4	1,414.0	440.4	6.09	1.132	1.486
0.91	1,360.6	1,408.0	386.2	5.96	1.259	1.377	0.91	1,349.9	1,397.0	429.1	6.06	1.146	1.253
1.07	1,379.0	1,427.0	337.6	5.82	1.407	1.319	1.07	1,350.9	1,398.0	322.4	5.78	1.433	1.343
1.22	1,378.0	1,426.0	319.1	5.77	1.463	1.200	1.22	1,355.7	1,403.0	396.8	5.98	1.229	1.008
1.37	1,385.8	1,434.0	324.2	5.78	1.453	1.059	1.37	1,389.7	1,438.0	308.9	5.73	1.504	1.096

k (diffuse attenuation coefficient = slope, m-1)			0.553
k average			2.135
percent transmittance @	1.0	meter	57.50
Birgean Percentile Absorption (1m)			42.50

k (diffuse attenuation coefficient = slope, m-1)			0.625
k average			1.899
percent transmittance @	1.0	meter	53.52
Birgean Percentile Absorption (1m)			46.48





APPENDIX D

Manatee Springs (Levy Co.) PAR ATTENUATION ESTIMATES (August 2009)

Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	MS-1	8/4/2009	10:30	1	3.66	0.165	84.81	15.19
	MS-1	8/4/2009	10:30	2	3.66	0.153	85.81	14.19
	MS-1	8/6/2009	9:53	1	4.27	0.244	78.32	21.68
	MS-1	8/6/2009	9:53	2	4.27	0.259	77.19	22.81
Spring Run	MS-2	8/3/2009	13:48	1	1.52	0.267	76.54	23.46
	MS-2	8/3/2009	13:48	2	1.52	0.261	77.00	23.00
	MS-2	8/4/2009	10:40	1	1.07	0.314	73.07	26.93
	MS-2	8/4/2009	10:40	2	1.07	0.201	81.76	18.24
	MS-2	8/5/2009	14:05	1	1.52	0.733	48.04	48.04
	MS-2	8/5/2009	14:05	2	1.52	0.477	62.08	37.92
	MS-2	8/6/2009	10:19	1	1.22	0.243	78.41	21.59
	MS-2	8/6/2009	10:19	2	1.22	0.351	70.42	29.58
	MS-3	8/3/2009	15:35	1	1.52	0.377	68.59	31.41
	MS-3	8/3/2009	15:35	2	1.52	0.238	78.79	21.21
	MS-3	8/4/2009	11:06	1	1.22	0.268	76.46	23.54
	MS-3	8/4/2009	11:06	2	1.22	0.330	71.92	28.08
	MS-3	8/4/2009	14:54	1	1.52	0.263	76.85	23.15
	MS-3	8/4/2009	14:54	2	1.52	0.598	54.98	45.02
	MS-3	8/5/2009	14:05	1	1.22	0.507	60.26	39.74
	MS-3	8/5/2009	14:05	2	1.22	0.432	64.93	35.07
	MS-3	8/6/2009	10:30	1	1.22	0.177	83.78	16.22
	MS-3	8/6/2009	10:30	2	1.22	0.182	83.39	16.61

Averages

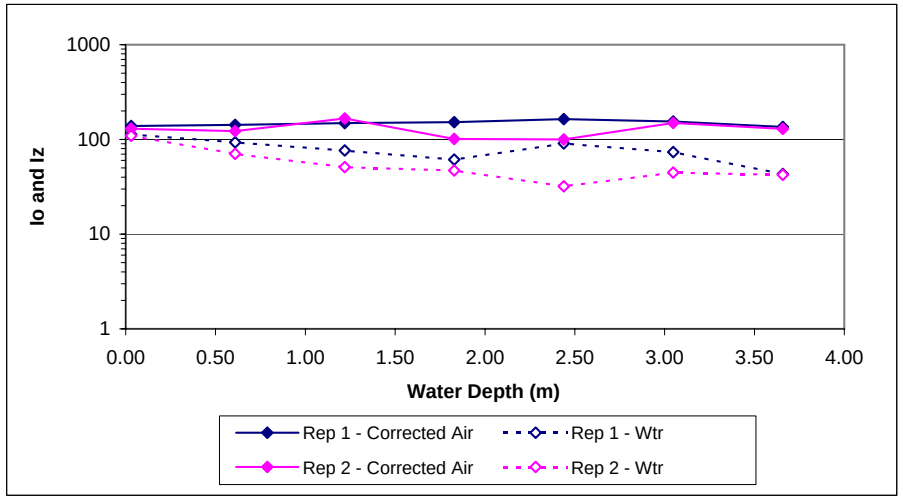
Spring Pool	**MS-1**	**3.96**	**0.21**	**81.53**	**18.47**
Spring Run	**MS-2**	**1.33**	**0.36**	**70.91**	**28.59**
	MS-3	**1.34**	**0.34**	**71.99**	**28.01**
Spring Run	**MS-2 & 3**	**1.34**	**0.35**	**71.51**	**28.27**

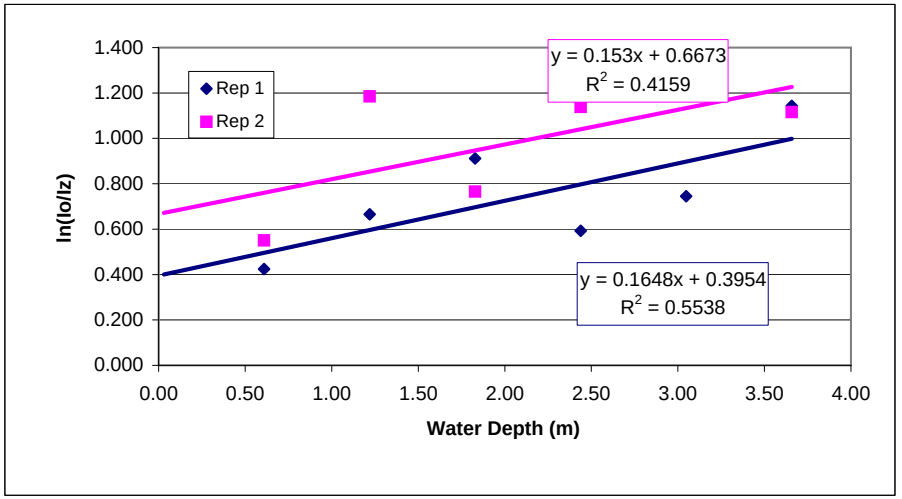
APPENDIX D

Manatee Springs PAR ATTENUATION ESTIMATES - MS-1 - 8/04/2009 10:30. (Tree cover, sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	138.7	149.0	113.4	4.73			0.03	129.9	139.9	109.3	4.69		
0.61	142.6	153.0	93.3	4.54	0.424	0.696	0.61	122.3	132.1	70.5	4.26	0.551	0.903
1.22	148.8	159.4	76.5	4.34	0.665	0.546	1.22	166.8	177.9	51.0	3.93	1.185	0.972
1.83	152.2	162.9	61.2	4.11	0.912	0.498	1.83	101.2	110.3	47.0	3.85	0.766	0.419
2.44	163.9	174.9	90.6	4.51	0.593	0.243	2.44	99.9	109.0	32.0	3.47	1.139	0.467
3.05	154.6	165.4	73.4	4.30	0.745	0.244	3.05	149.3	159.9	44.7	3.80	1.207	0.396
3.66	135.5	145.7	43.2	3.77	1.143	0.313	3.66	129.0	139.0	42.3	3.74	1.116	0.305

k (diffuse attenuation coefficient = slope, m-1)			0.165	k (diffuse attenuation coefficient = slope, m-1)	0.153
k average			0.423	k average	0.577
percent transmittance @	1.0	meter	84.81	percent transmittance @ 1.0 meter	85.81
Birgean Percentile Absorption (1m)			15.19	Birgean Percentile Absorption (1m)	14.19





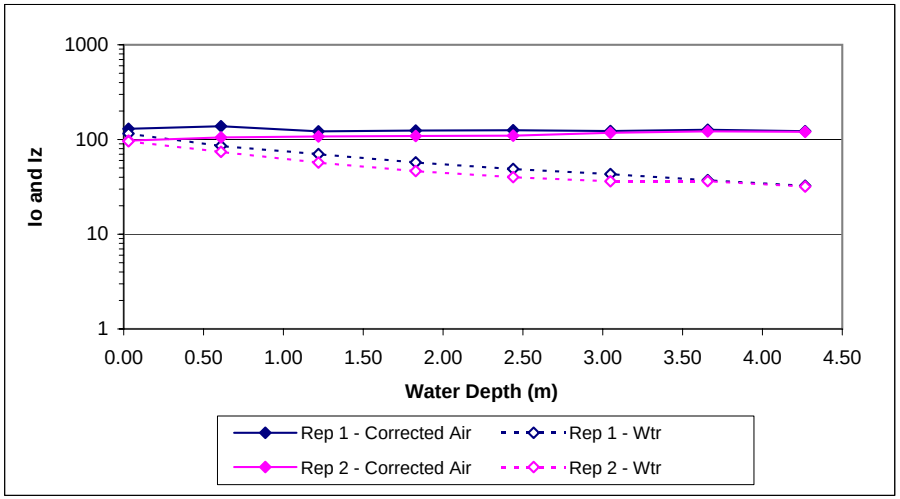
APPENDIX D

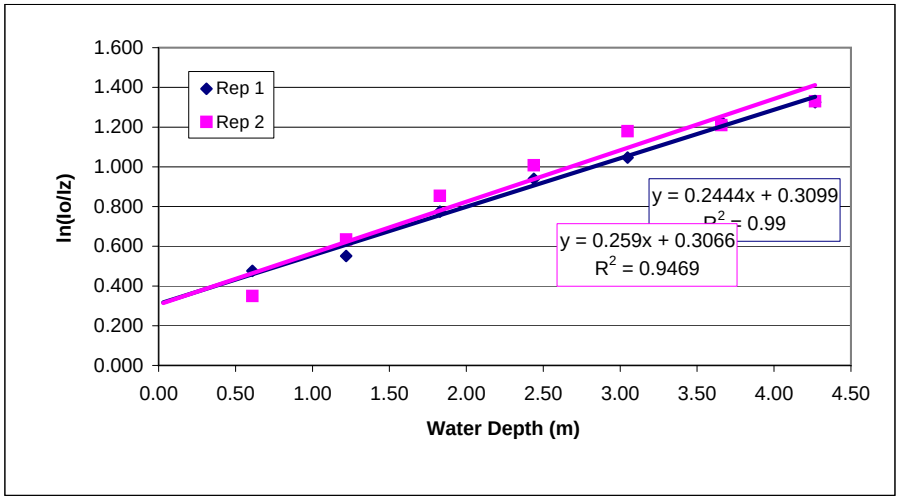
Manatee Springs PAR ATTENUATION ESTIMATES - MS-1 - 08/06/2009 09:53 at pool (complete cloud cover)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	129.7	139.7	115.4	4.75			0.03	97.3	106.3	95.7	4.56		
0.61	137.8	148.1	85.6	4.45	0.476	0.782	0.61	105.1	114.4	74.1	4.31	0.350	0.574
1.22	121.7	131.5	70.2	4.25	0.551	0.452	1.22	107.5	116.8	57.0	4.04	0.634	0.520
1.83	124.6	134.4	57.4	4.05	0.774	0.423	1.83	109.1	118.5	46.5	3.84	0.854	0.467
2.44	125.3	135.2	49.0	3.89	0.940	0.385	2.44	109.7	119.1	40.0	3.69	1.008	0.413
3.05	123.1	132.9	43.2	3.77	1.047	0.343	3.05	117.8	127.4	36.2	3.59	1.180	0.387
3.66	127.0	136.9	37.2	3.62	1.227	0.335	3.66	122.1	131.9	36.4	3.59	1.210	0.331
4.27	122.4	132.2	32.5	3.48	1.326	0.311	4.27	120.7	130.4	31.9	3.46	1.330	0.312

k (diffuse attenuation coefficient = slope, m-1)			0.244
k average			0.433
percent transmittance @	1.0	meter	78.32
Birgean Percentile Absorption (1m)			21.68

k (diffuse attenuation coefficient = slope, m-1)			0.259
k average			0.429
percent transmittance @	1.0	meter	77.19
Birgean Percentile Absorption (1m)			22.81





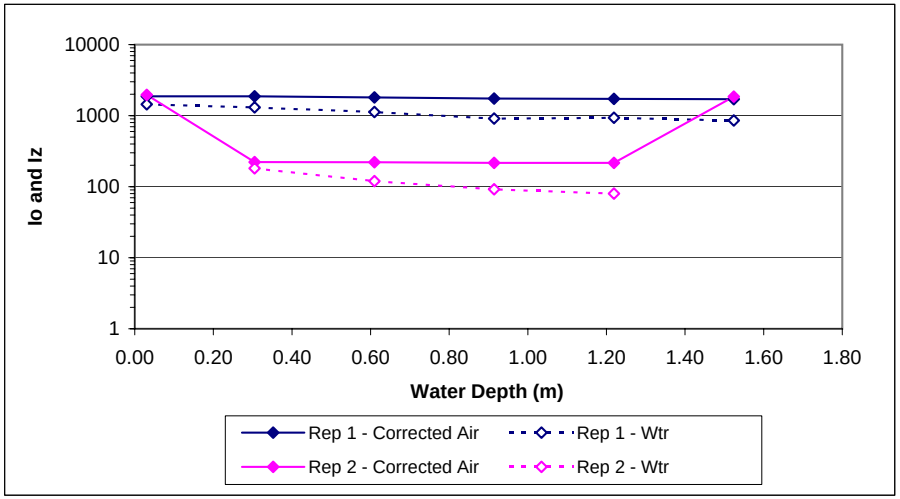
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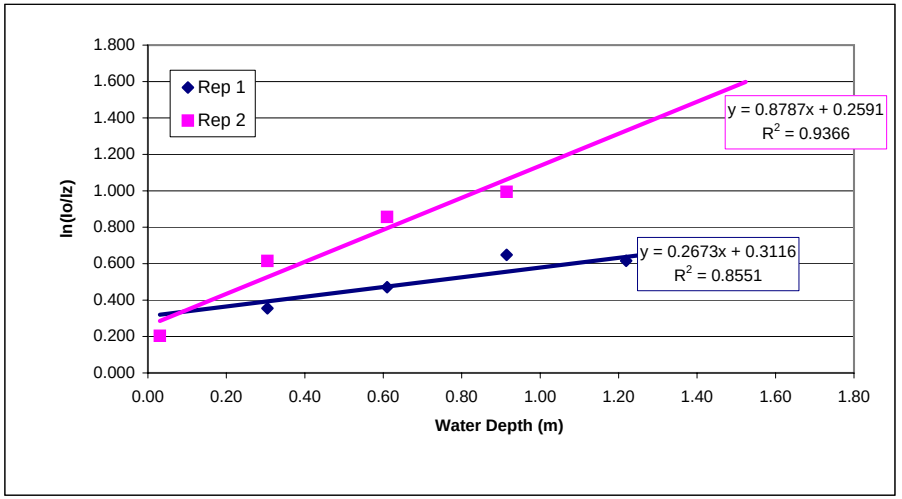
Manatee Springs PAR ATTENUATION ESTIMATES - MS-2 - 08/03/2009 13:48 (overcast)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,869.1	1932.0	1448	7.28			0.03	1,959.4	2,025.0				
0.30	1,871.1	1934.0	1312	7.18	0.355	1.165	0.30	222.2	235.0	181.2	5.20	0.204	0.669
0.61	1,807.0	*1868.0*	1128	7.03	0.471	0.773	0.61	221.2	234.0	119.6	4.78	0.615	1.009
0.91	1,743.0	1802.0	911.6	6.82	0.648	0.709	0.91	216.3	228.9	91.9	4.52	0.856	0.937
1.22	1,727.4	1786.0	932.8	6.84	0.616	0.505	1.22	216.3	228.9	80.0	4.38	0.995	0.816
1.52	1,710.0	1768.0	857.8	6.75	0.690	0.453	1.52	1,849.7	1,912.0				

k (diffuse attenuation coefficient = slope, m-1)			0.267	
k average			0.721	
percent transmittance @	1.0	meter	76.54	
Birgean Percentile Absorption (1m)			23.46	

k (diffuse attenuation coefficient = slope, m-1)			0.261	
k average			0.858	
percent transmittance @	1.0	meter	77.00	
Birgean Percentile Absorption (1m)			23.00	





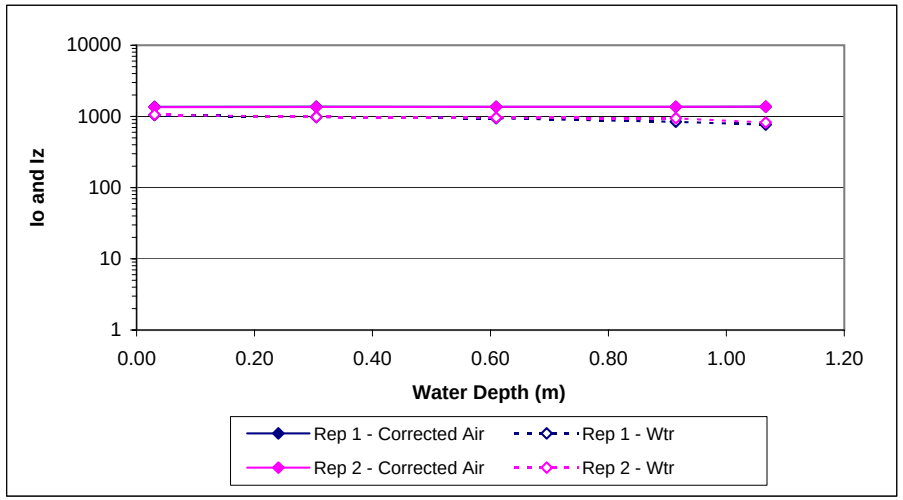
APPENDIX D

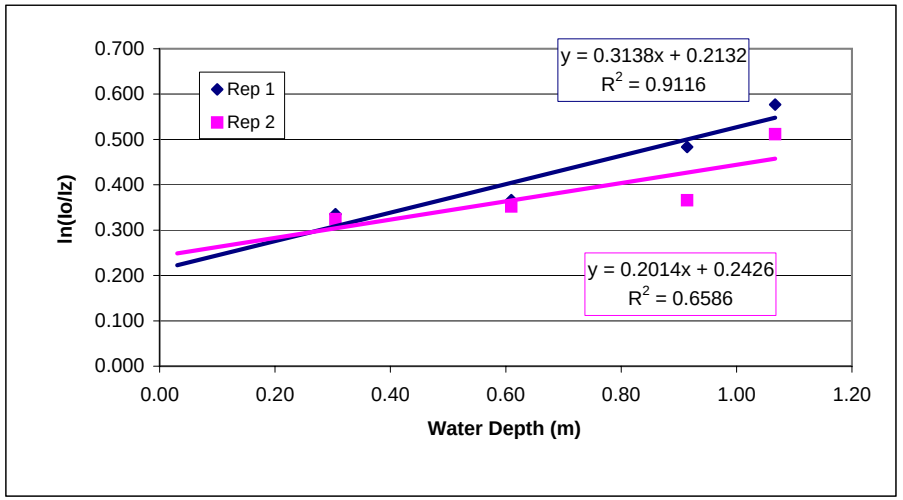
Manatee Springs PAR ATTENUATION ESTIMATES - MS-2 - 8/04/2009 10:40 (Partly cloudy)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,367.4	1,415.0	1,045.0	6.95			0.03	1,352.8	1,400.0	1,059.0	6.97		
0.30	1,372.2	1,420.0	981.4	6.89	0.335	1.100	0.30	1,358.6	1,406.0	982.5	6.89	0.324	1.063
0.61	1,365.4	1,413.0	946.7	6.85	0.366	0.601	0.61	1,361.6	1,409.0	957.4	6.86	0.352	0.578
0.91	1,366.4	1,414.0	842.7	6.74	0.483	0.529	0.91	1,362.5	1,410.0	945.0	6.85	0.366	0.400
1.07	1,368.3	1,416.0	768.6	6.64	0.577	0.541	1.07	1,371.3	1,419.0	822.2	6.71	0.511	0.479

k (diffuse attenuation coefficient = slope, m-1)			0.314	
k average			0.692	
percent transmittance @	1.0	meter	73.07	
Birgean Percentile Absorption (1m)			26.93	

k (diffuse attenuation coefficient = slope, m-1)			0.201	
k average			0.630	
percent transmittance @	1.0	meter	81.76	
Birgean Percentile Absorption (1m)			18.24	





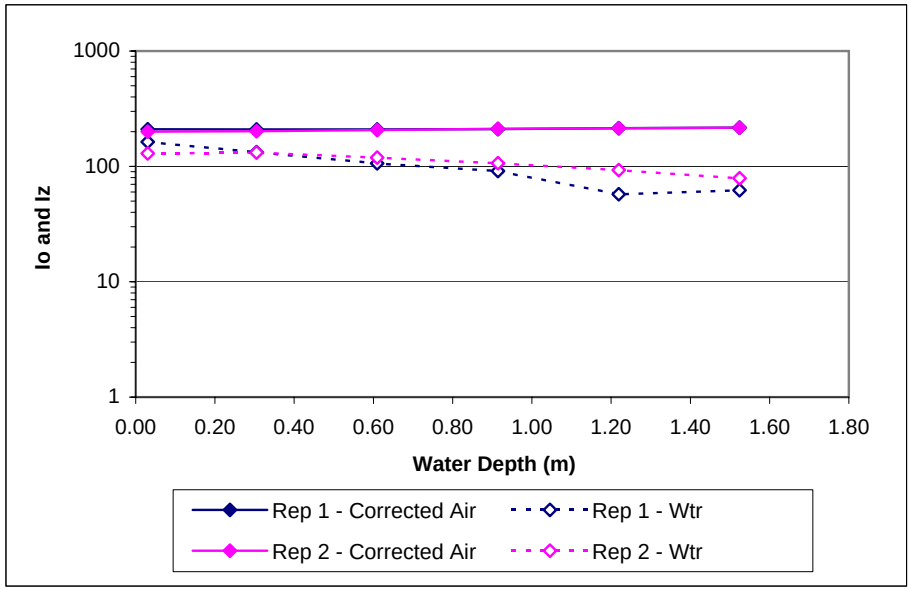
APPENDIX D

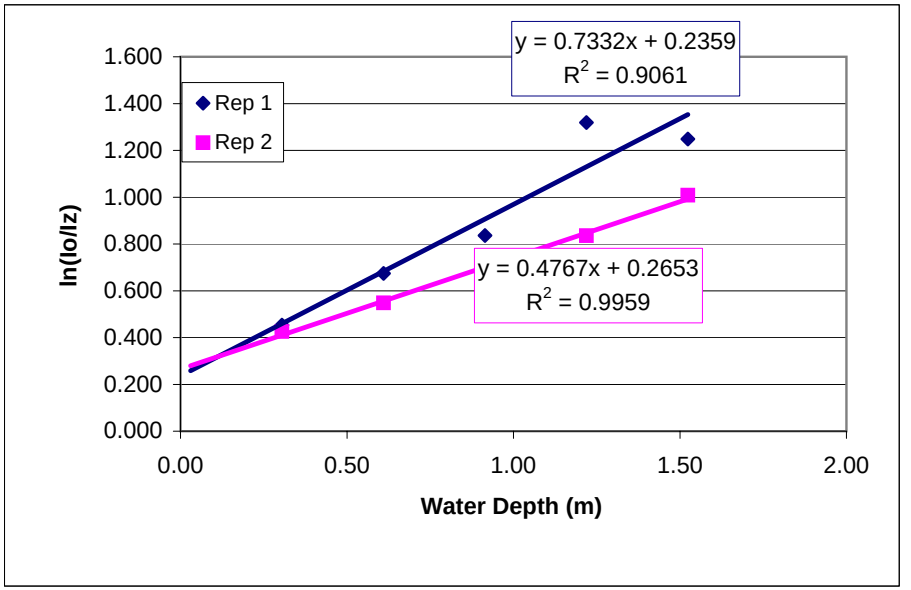
Manatee Springs PAR ATTENUATION ESTIMATES - MS-2 - 8/05/2009 14:05 (Cloudy)

Depth (m) z	Replicate 1 corr Air (lo)	raw Air (lo)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (lo)	raw Air (lo)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	209.5	221.9	163.0	5.09			0.03	199.7	211.8	129.4	4.86		
0.30	209.2	221.6	132.9	4.89	0.454	1.488	0.30	202.2	214.4	132.1	4.88	0.426	1.397
0.61	208.8	221.2	106.4	4.67	0.674	1.106	0.61	206.5	218.8	119.3	4.78	0.548	0.900
0.91	210.4	222.9	91.2	4.51	0.836	0.915	0.91	212.1	224.6	106.6	4.67	0.688	0.752
1.22	214.8	227.4	57.4	4.05	1.319	1.082	1.22	214.1	226.7	92.9	4.53	0.835	0.685
1.52	216.7	229.4	62.2	4.13	1.249	0.819	1.52	216.7	229.3	79.0	4.37	1.009	0.662

k (diffuse attenuation coefficient = slope, m-1)		0.733	
k average		1.082	
percent transmittance @	1.0 meter	48.04	
Birgean Percentile Absorption (1m)		51.96	

k (diffuse attenuation coefficient = slope, m-1)		0.477
k average		0.879
percent transmittance @	1.0 meter	62.08
Birgean Percentile Absorption (1m)		37.92



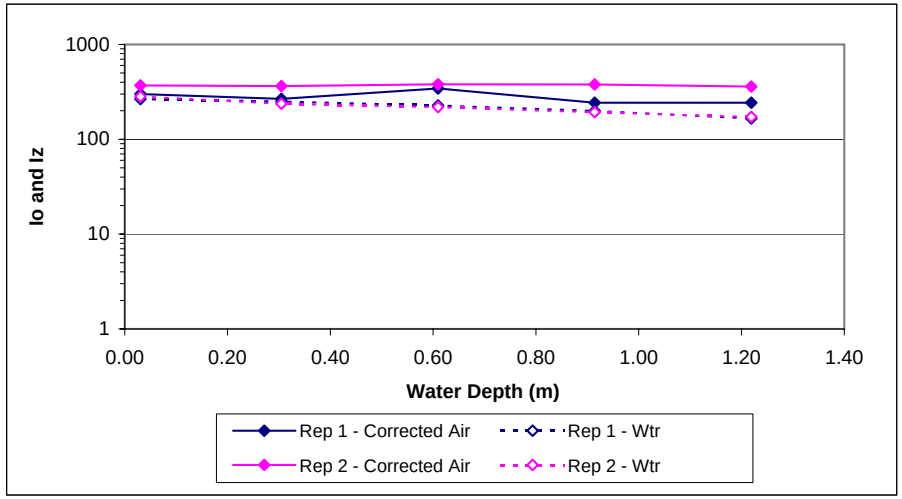


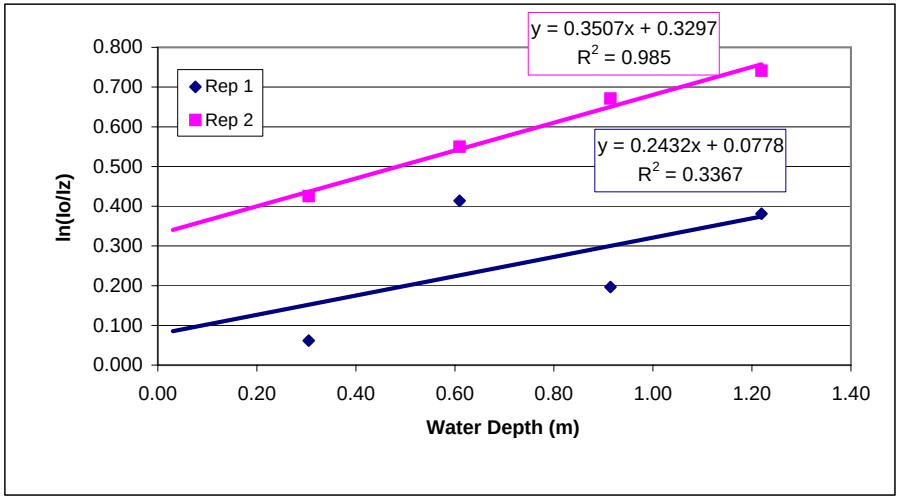
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Manatee Springs PAR ATTENUATION ESTIMATES - MS-2 - 08/06/2009 10:19 (slightly overcast)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	300.0	256.5	265.5	5.58		
0.30	266.4	280.6	250.6	5.52	0.061	0.202
0.61	344.2	360.7	227.6	5.43	0.414	0.678
0.91	243.0	256.4	199.6	5.30	0.197	0.215
1.22	243.0	*256.4*	166.0	5.11	0.381	0.312
k (diffuse attenuation coefficient = slope, m-1)						0.243
k average						0.365
percent transmittance @			1.0 meter			78.41
Birgean Percentile Absorption (1m)						21.59

Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	369.4	386.7	283.1	5.65		
0.30	363.7	380.8	237.7	5.47	0.425	1.395
0.61	379.4	397.0	218.9	5.39	0.550	0.902
0.91	378.8	396.4	193.6	5.27	0.671	0.734
1.22	360.5	377.5	171.8	5.15	0.741	0.608
k (diffuse attenuation coefficient = slope, m-1)						0.351
k average						1.011
percent transmittance @			1.0 meter			70.42
Birgean Percentile Absorption (1m)						29.58



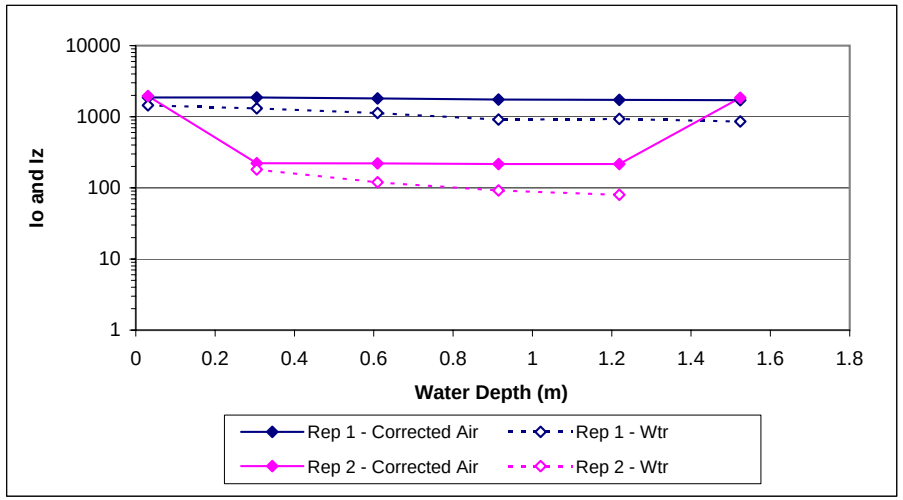


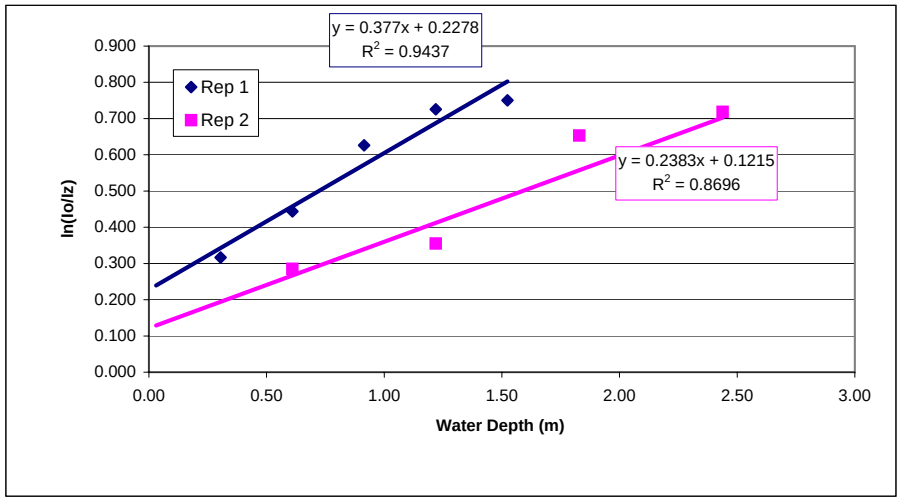
APPENDIX D

Manatee Springs PAR ATTENUATION ESTIMATES - MS-3 - 08/03/2009 15:35 (overcast; location: 40m upstream from Sonde 3)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	148.9	159.5	126.1	4.84			0.03	131.6	141.7	107.7	4.68		
0.30	150.6	161.2	109.7	4.70	0.317	1.039	0.61	129.6	139.6	97.4	4.58	0.285	0.468
0.61	150.4	161.0	96.46	4.57	0.444	0.728	1.22	126.5	136.4	88.7	4.49	0.355	0.291
0.91	149.9	160.5	80.1	4.38	0.626	0.685	1.83	123.3	133.1	64.2	4.16	0.653	0.357
1.22	143.3	153.7	69.4	4.24	0.726	0.595	2.13	124.6	134.4	71.4	4.27	0.557	0.261
1.52	134.1	144.2	63.3	4.15	0.750	0.492	2.44	129.4	139.4	63.1	4.14	0.719	0.295

k (diffuse attenuation coefficient = slope, m-1)			0.377	k (diffuse attenuation coefficient = slope, m-1)		0.238
k average			0.708	k average		0.334
percent transmittance @	1.0	meter	68.59	percent transmittance @	1.0	meter	78.79
Birgean Percentile Absorption (1m)			31.41	Birgean Percentile Absorption (1m)			21.21



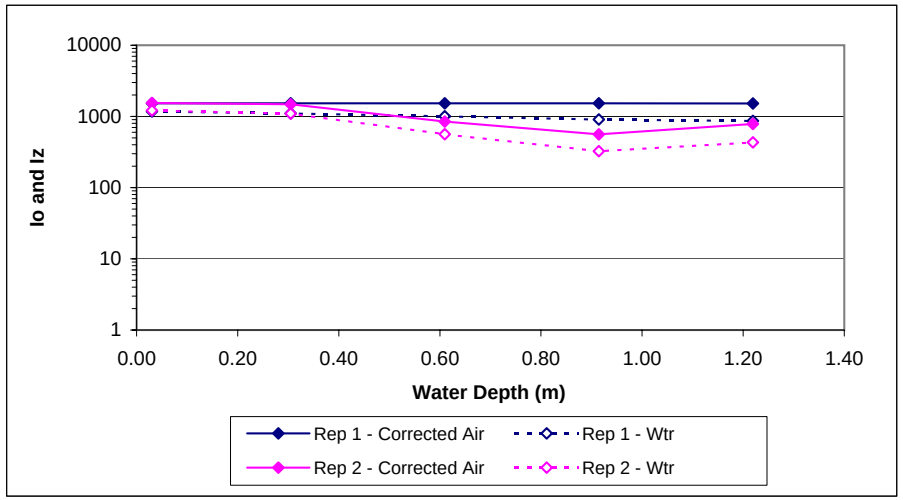


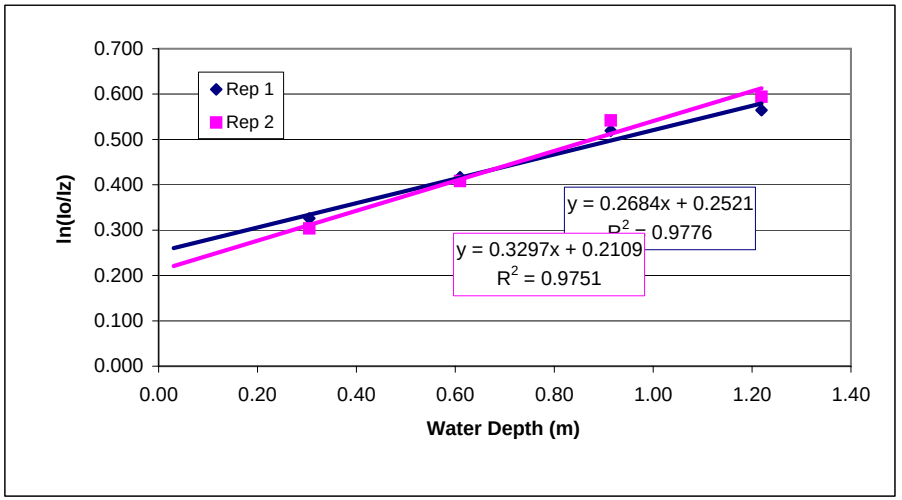
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Manatee Springs PAR ATTENUATION ESTIMATES - MS-3 - 8/04/2009 11:06 (partly cloudy to cloudy)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,530.4	1583	1,174.0	7.07			0.03	1,541.1	1,594.0	1,210.0	7.10		
0.30	1,529.4	1582	1,104.0	7.01	0.326	1.069	0.30	1,483.8	1,535.0	1,095.0	7.00	0.304	0.997
0.61	1,524.6	1577	1,005.0	6.91	0.417	0.684	0.61	846.0	877.8	562.4	6.33	0.408	0.670
0.91	1,525.6	1578	907.5	6.81	0.519	0.568	0.91	560.0	583.1	325.7	5.79	0.542	0.593
1.22	1,522.7	1575	865.9	6.76	0.564	0.463	1.22	784.3	814.2	432.9	6.07	0.594	0.487

k (diffuse attenuation coefficient = slope, m-1)			0.268	k (diffuse attenuation coefficient = slope, m-1)	0.330
k average			0.774	k average	0.687
percent transmittance @	1.0	meter	76.46	percent transmittance @ 1.0 meter	71.92
Birgean Percentile Absorption (1m)			23.54	Birgean Percentile Absorption (1m)	28.08





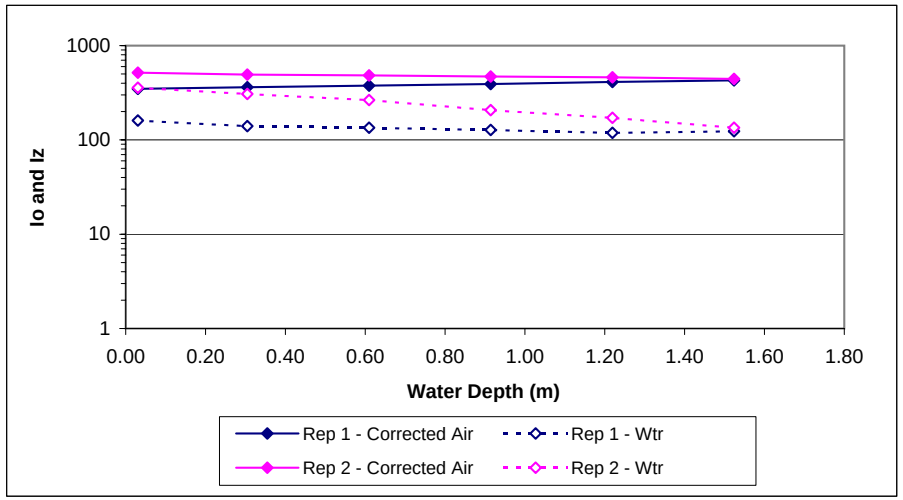
APPENDIX D

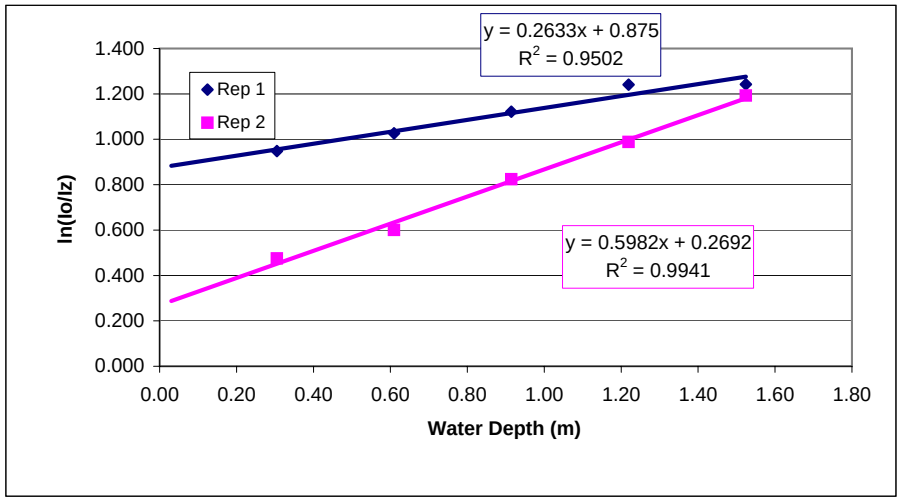
Manatee Springs PAR ATTENUATION ESTIMATES - MS-3 - 8/04/2009 14:54. (Very Overcast/Cloudy)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	347.8	364.4	160.5	5.08			0.03	517.7	539.5	357.4	5.88		
0.30	361.5	378.6	140.1	4.94	0.948	3.110	0.30	493.8	514.9	307.1	5.73	0.475	1.558
0.61	375.8	393.3	134.7	4.90	1.026	1.683	0.61	483.2	504.0	265.1	5.58	0.600	0.985
0.91	391.1	409.1	127.4	4.85	1.122	1.227	0.91	471.3	491.7	206.7	5.33	0.824	0.901
1.22	411.2	429.8	118.9	4.78	1.241	1.018	1.22	460.9	481.0	171.5	5.14	0.989	0.811
1.52	428.6	447.7	123.8	4.82	1.242	0.815	1.52	444.2	463.8	134.8	4.90	1.193	0.783

k (diffuse attenuation coefficient = slope, m-1)			0.263	
k average			1.571	
percent transmittance @	1.0	meter	76.85	
Birgean Percentile Absorption (1m)			23.15	

k (diffuse attenuation coefficient = slope, m-1)			0.598	
k average			1.008	
percent transmittance @	1.0	meter	54.98	
Birgean Percentile Absorption (1m)			45.02	





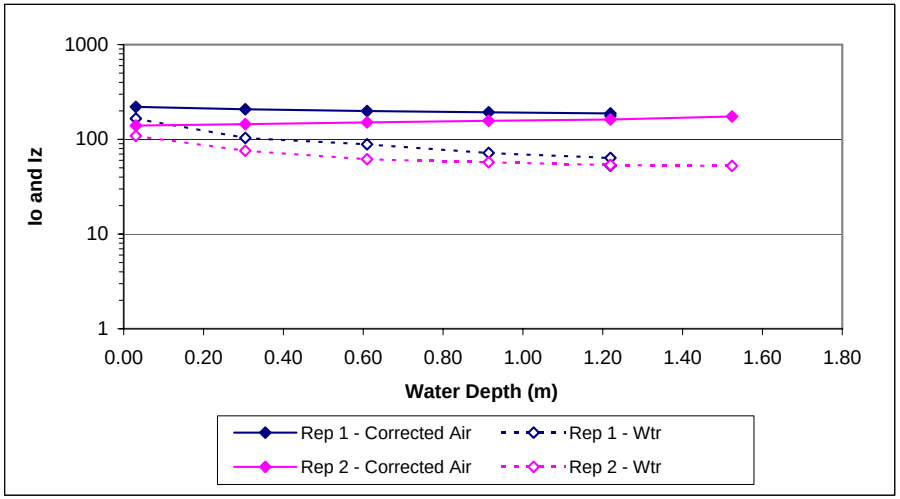
APPENDIX D

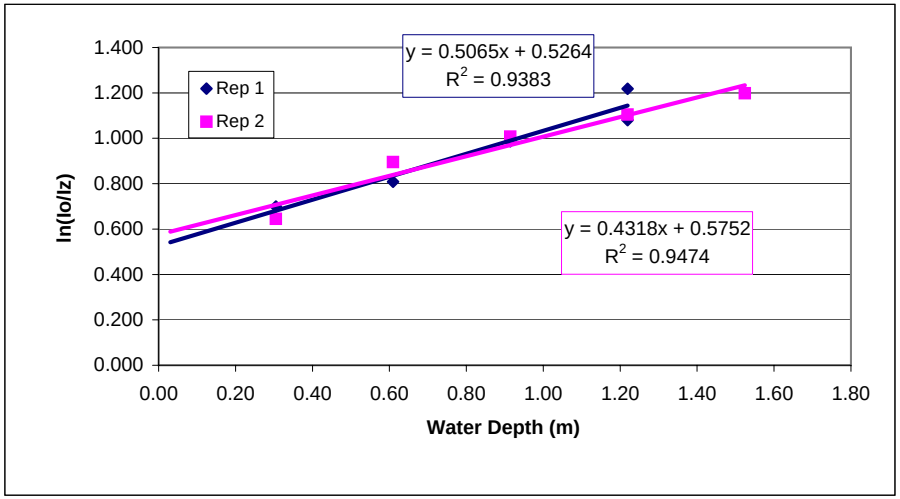
Manatee Springs PAR ATTENUATION ESTIMATES - MS-3 - 8/05/2009 14:05. (Cloudy weather)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	220.2	233.0	165.6	5.11			0.03	139.6	149.9	108.9	4.69		
0.30	208.1	220.5	103.4	4.64	0.699	2.295	0.30	144.6	155.1	75.9	4.33	0.645	2.116
0.61	199.1	211.2	88.7	4.49	0.808	1.326	0.61	151.0	161.7	61.7	4.12	0.895	1.469
0.91	192.9	204.8	71.9	4.27	0.987	1.079	0.91	157.1	167.9	57.4	4.05	1.007	1.101
1.22	187.4	199.2	63.6	4.15	1.080	0.886	1.22	162.1	173.1	53.7	3.98	1.104	0.906
1.22	177.8	189.3	52.6	3.96	1.218	0.999	1.52	174.1	185.5	52.5	3.96	1.199	0.787

k (diffuse attenuation coefficient = slope, m-1)			0.507
k average			1.317
percent transmittance @	1.0	meter	60.26
Birgean Percentile Absorption (1m)			39.74

k (diffuse attenuation coefficient = slope, m-1)			0.432
k average			1.276
percent transmittance @	1.0	meter	64.93
Birgean Percentile Absorption (1m)			35.07





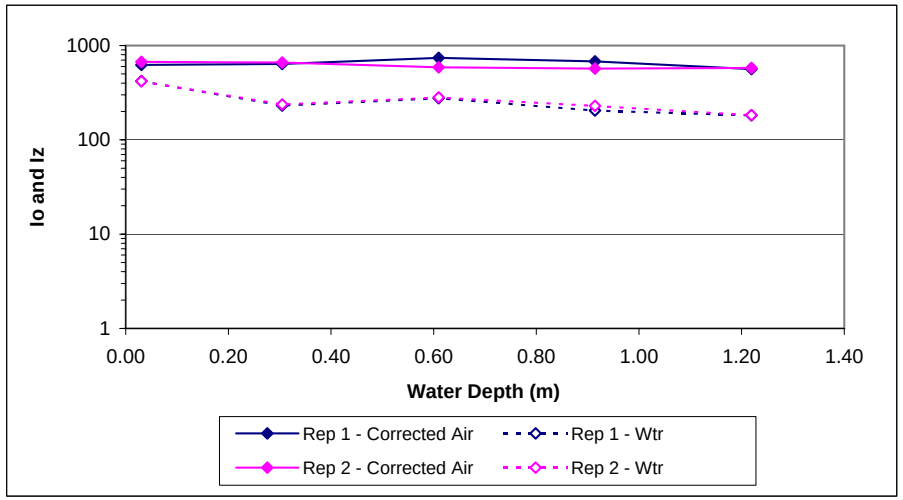
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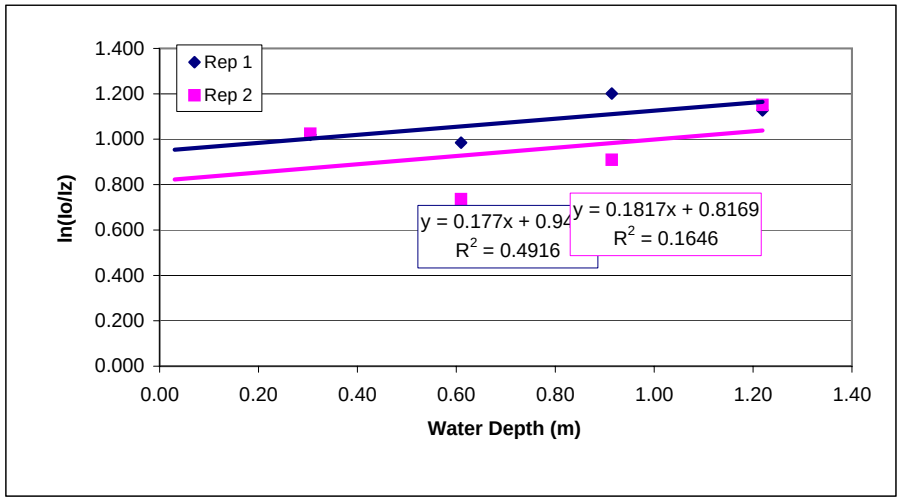
Manatee Springs PAR ATTENUATION ESTIMATES - MS-3 - 08/06/2009 10:30 (slightly overcast)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	622.7	647.7	420.4	6.04			0.03	671.7	698.2	417.6	6.03		
0.30	639.1	664.6	230.6	5.44	1.019	3.344	0.30	661.2	687.4	237.4	5.47	1.024	3.361
0.61	739.2	767.7	276.0	5.62	0.985	1.616	0.61	588.5	612.4	281.8	5.64	0.736	1.208
0.91	679.3	706.0	204.3	5.32	1.201	1.314	0.91	569.2	592.6	229.2	5.43	0.910	0.995
1.22	563.0	586.2	182.4	5.21	1.127	0.924	1.22	578.9	602.6	183.1	5.21	1.151	0.944

k (diffuse attenuation coefficient = slope, m-1)			0.177	
k average			1.800	
percent transmittance @	1.0	meter	83.78	
Birgean Percentile Absorption (1m)			16.22	

k (diffuse attenuation coefficient = slope, m-1)			0.182
k average			1.627
percent transmittance @	1.0	meter	83.39
Birgean Percentile Absorption (1m)			16.61





APPENDIX D

Ponce de Leon Springs (Holmes Co.) PAR ATTENUATION ESTIMATES (September 2009)

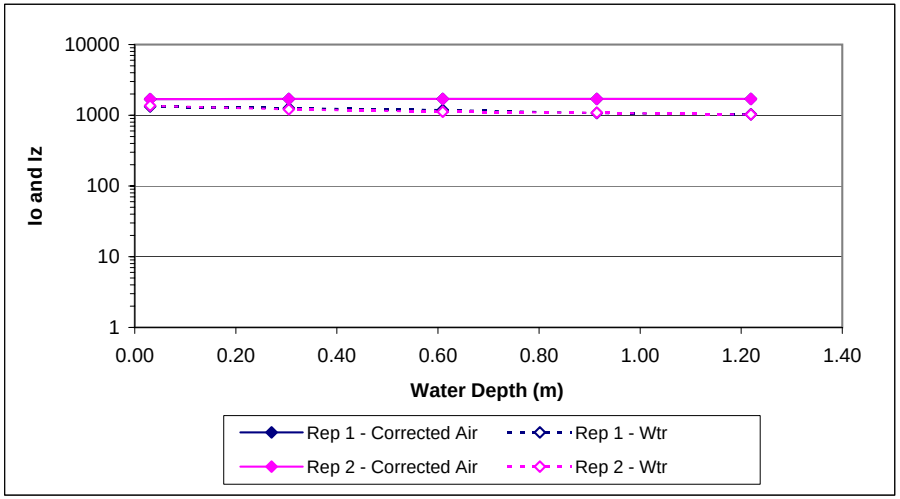
Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	PDL-1	9/9/2009	13:40	1	1.22	0.229	79.50	20.50
	PDL-1	9/9/2009	13:40	2	1.22	0.174	84.00	16.00
	PDL-1	9/10/2009	15:55	1	1.52	0.247	78.08	21.92
	PDL-1	9/10/2009	15:55	2	1.52	0.198	82.03	17.97
Spring Run	PDL-3	9/9/2009	17:04	1	0.61	0.535	58.58	41.42
	PDL-3	9/9/2009	17:04	2	0.61	0.516	59.71	40.29
	PDL-3	9/10/2009	16:28	1	0.61	0.111	89.53	10.47
	PDL-3	9/10/2009	16:28	2	0.61	0.327	72.09	27.91
Averages								
Spring Pool	**PDL-1**				**1.22**	**0.20**	**81.75**	**18.25**
Spring Run	**PDL-3**				**0.61**	**0.37**	**69.98**	**30.02**

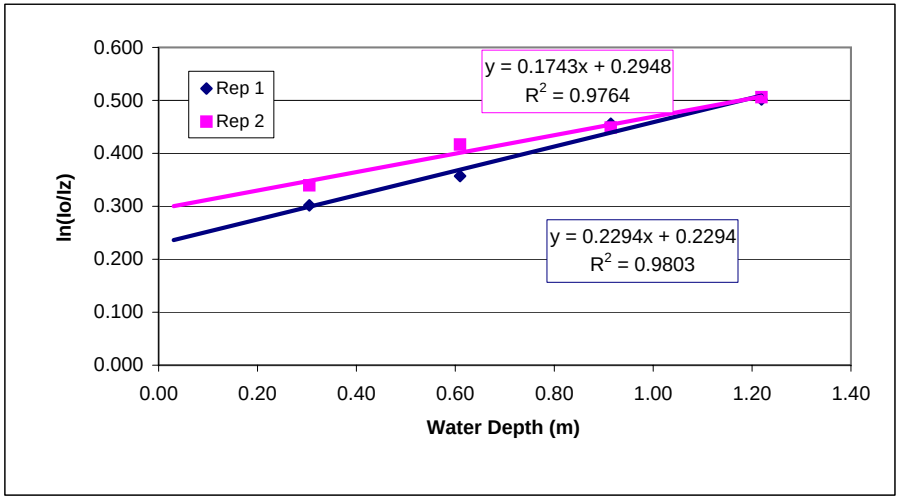
APPENDIX D

Ponce de Leon Springs PAR ATTENUATION ESTIMATES - PDL-1 - 9/09/2009 13:40 (sunny).

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,695.4	1,753.0	1,330.0	7.19			0.03	1,693.5	1,751.0	1,364.0	7.22		
0.30	1,698.3	1,756.0	1,256.0	7.14	0.302	0.990	0.30	1,702.2	1,760.0	1,212.0	7.10	0.340	1.114
0.61	1,699.3	1,757.0	1,189.0	7.08	0.357	0.586	0.61	1,703.2	1,761.0	1,123.0	7.02	0.416	0.683
0.91	1,699.3	1,757.0	1,077.0	6.98	0.456	0.499	0.91	1,702.2	1,760.0	1,087.0	6.99	0.448	0.490
1.22	1,701.2	1,759.0	1,030.0	6.94	0.502	0.412	1.22	1,700.3	1,758.0	1,025.0	6.93	0.506	0.415

k (diffuse attenuation coefficient = slope, m-1)		0.229	k (diffuse attenuation coefficient = slope, m-1)	0.174
k average		0.621	k average	0.676
percent transmittance @	1.0 meter	79.50	percent transmittance @ 1.0 meter	84.00
Birgean Percentile Absorption (1m)		20.50	Birgean Percentile Absorption (1m)	16.00



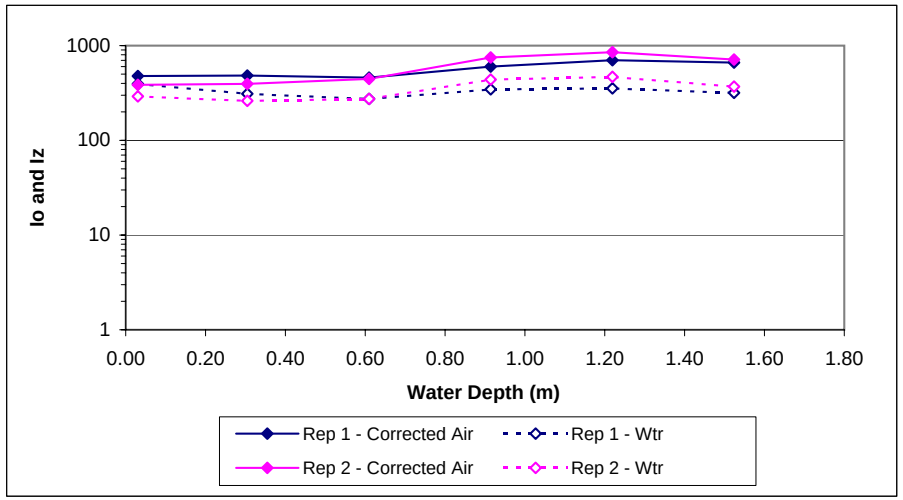


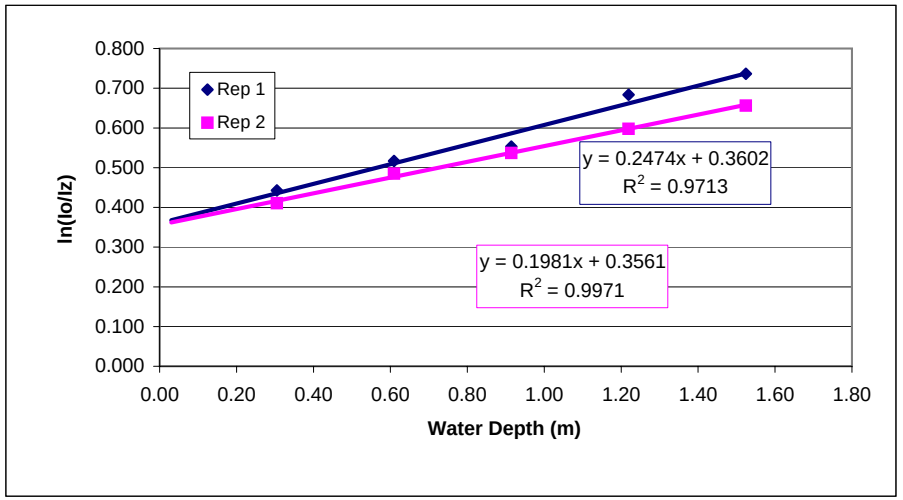
APPENDIX D

Ponce de Leon Springs PAR ATTENUATION ESTIMATES - PDL-1 - 09/10/2009 15:55 (partly cloudy).

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	477.3	497.9	394.4	5.98		
0.30	483.4	504.2	310.5	5.74	0.443	1.453
0.61	459.4	479.4	274.0	5.61	0.517	0.848
0.91	601.5	625.8	346.0	5.85	0.553	0.605
1.22	701.9	729.3	354.3	5.87	0.684	0.561
1.52	662.0	688.2	317.0	5.76	0.736	0.483
k (diffuse attenuation coefficient = slope, m-1)						0.247
k average						0.790
percent transmittance @			1.0 meter			78.08
Birgean Percentile Absorption (1m)						21.92

Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	385.8	403.6	291.5	5.68		
0.30	394.0	412.0	261.3	5.57	0.411	1.347
0.61	444.7	464.3	273.8	5.61	0.485	0.796
0.91	750.6	779.5	438.8	6.08	0.537	0.587
1.22	851.6	883.5	468.3	6.15	0.598	0.490
1.52	711.9	739.6	369.4	5.91	0.656	0.430
k (diffuse attenuation coefficient = slope, m-1)						0.198
k average						0.730
percent transmittance @			1.0 meter			82.03
Birgean Percentile Absorption (1m)						17.97



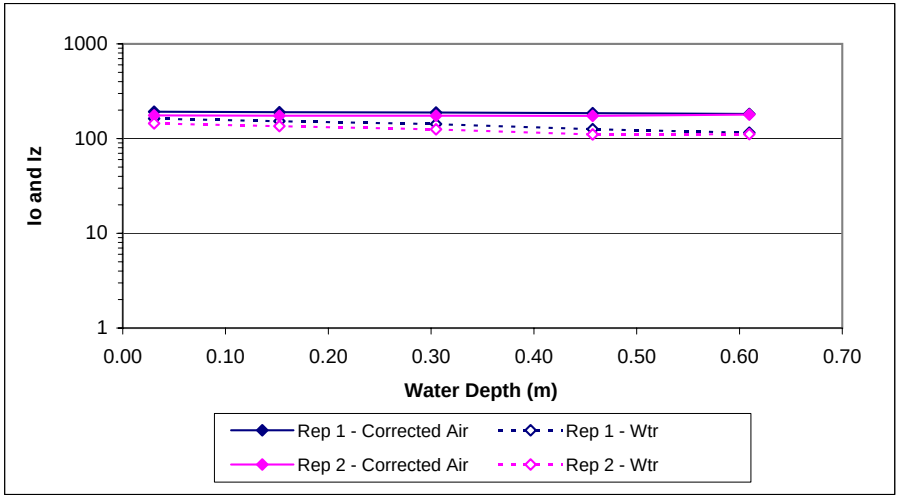


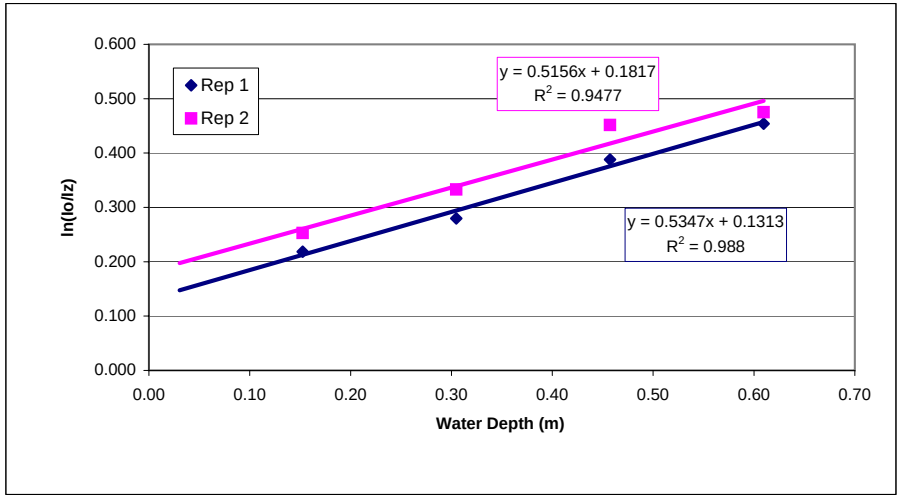
APPENDIX D

Ponce de Leon Springs PAR ATTENUATION ESTIMATES - PDL-3 - 09/09/2009 17:04 (overcast).

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	192.6	204.5	162.9	5.09			0.03	175.7	187.1	144.7	4.97		
0.15	190.0	201.8	152.7	5.03	0.218	1.433	0.15	174.7	186.1	135.7	4.91	0.253	1.659
0.30	188.5	200.3	142.5	4.96	0.280	0.918	0.30	174.5	185.9	125.1	4.83	0.333	1.093
0.46	185.3	197.0	125.7	4.83	0.388	0.849	0.46	173.8	185.1	110.6	4.71	0.452	0.988
0.61	182.0	193.6	115.6	4.75	0.454	0.745	0.61	179.0	190.5	111.3	4.71	0.475	0.779

k (diffuse attenuation coefficient = slope, m-1)			0.535	k (diffuse attenuation coefficient = slope, m-1)		0.516
k average			0.986	k average		1.130
percent transmittance @	1.0	meter	58.58	percent transmittance @	1.0	meter	59.71
Birgean Percentile Absorption (1m)			41.42	Birgean Percentile Absorption (1m)			40.29



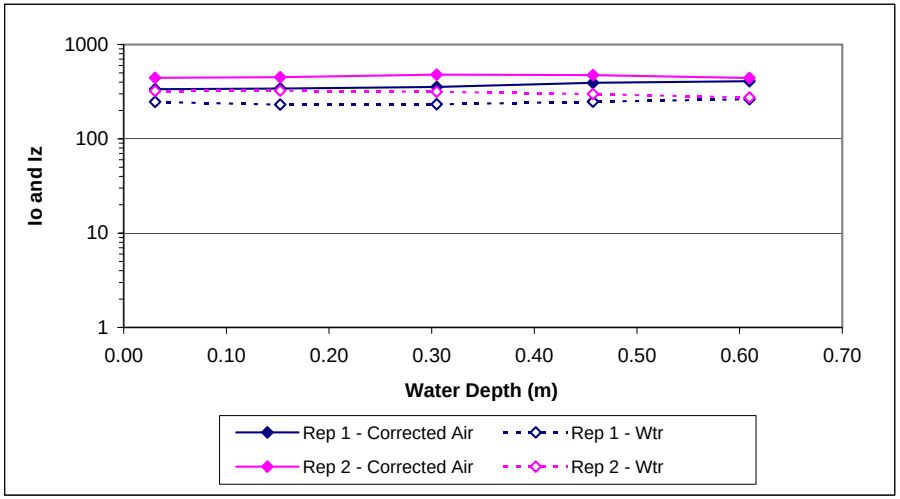


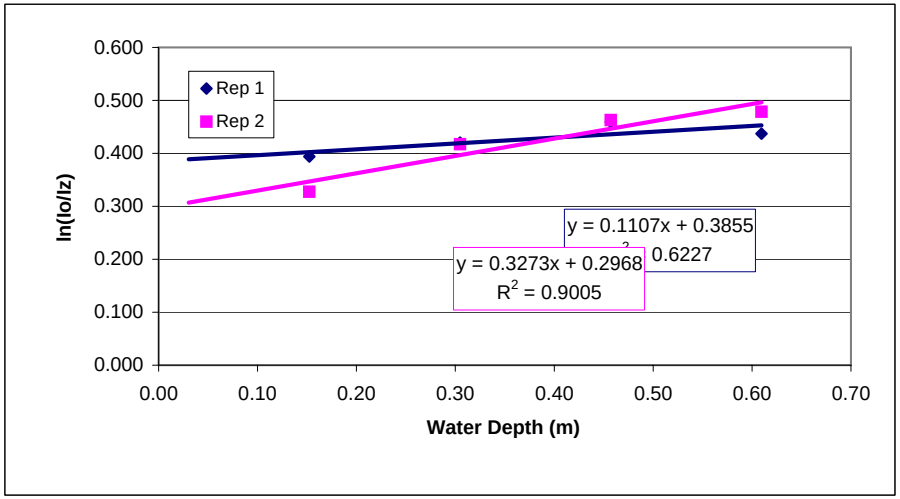
APPENDIX D

Ponce de Leon Springs PAR ATTENUATION ESTIMATES - PDL-3 - 9/10/2009 16:28 (partly cloudy).

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	335.8	352.1	247.1	5.51			0.03	443.5	463.0	322.6	5.78		
0.15	342.0	358.5	230.7	5.44	0.394	2.584	0.15	450.3	470.0	324.5	5.78	0.328	2.149
0.30	355.0	371.9	233.2	5.45	0.420	1.379	0.30	480.2	500.9	316.4	5.76	0.417	1.369
0.46	392.7	410.7	248.1	5.51	0.459	1.004	0.46	474.1	494.6	298.5	5.70	0.463	1.012
0.61	408.7	427.2	264.0	5.58	0.437	0.717	0.61	442.2	461.7	274.0	5.61	0.479	0.785

k (diffuse attenuation coefficient = slope, m-1)			0.111	k (diffuse attenuation coefficient = slope, m-1)	0.327
k average			1.656	k average	1.329
percent transmittance @	1.0	meter	89.53	percent transmittance @ 1.0 meter	72.09
Birgean Percentile Absorption (1m)			10.47	Birgean Percentile Absorption (1m)	27.91





APPENDIX D

Rainbow Springs (Marion Co.) PAR ATTENUATION ESTIMATES (June 2009)

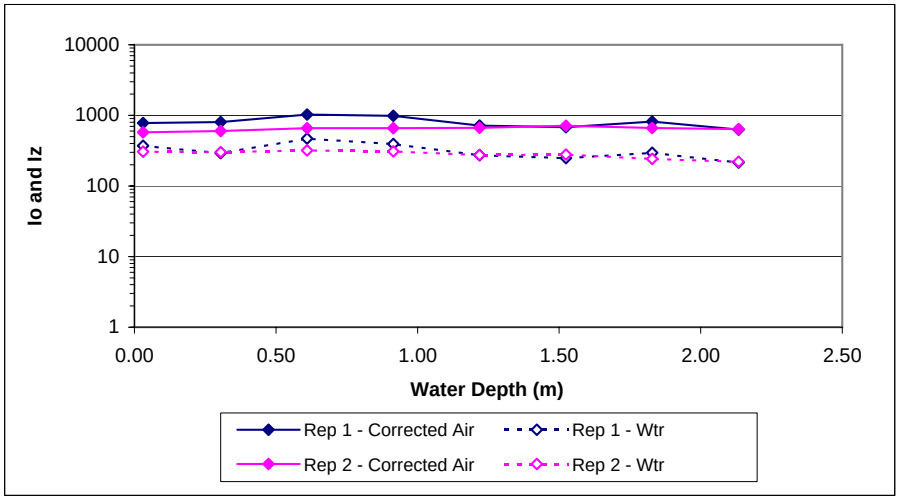
Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	RS-1	6/8/2009	17:35	1	2.13	0.086	91.73	8.27
	RS-1	6/8/2009	17:35	2	2.13	0.219	80.31	19.69
	RS-1	6/9/2009	13:45	1	2.44	0.110	89.58	10.42
	RS-1	6/9/2009	13:45	2	2.44	0.130	87.85	12.15
	RS-1	6/10/2009	10:25	1	2.13	0.269	76.42	23.58
	RS-1	6/10/2009	10:25	2	2.13	0.227	79.73	20.27
	RS-1	6/11/2009	12:32	1	2.44	0.241	78.61	21.39
	RS-1	6/11/2009	12:32	2	2.44	0.208	81.22	18.78
Spring Run	RS-2	6/8/2009	17:16	1	1.22	0.217	80.50	19.50
	RS-2	6/8/2009	17:16	2	1.22	0.282	75.41	24.59
	RS-2	6/9/2009	14:40	1	1.83	0.176	83.90	16.10
	RS-2	6/9/2009	14:40	2	1.83	0.263	76.84	23.16
	RS-2	6/10/2009	11:31	1	1.83	0.183	83.25	16.75
	RS-2	6/10/2009	11:31	2	1.83	0.111	89.49	10.51
	RS-2	6/11/2009	11:19	1	1.83	0.294	74.54	25.46
	RS-2	6/11/2009	11:19	2	1.83	0.237	78.89	21.11
	RS-3	6/8/2009	15:56	1	3.05	0.256	77.44	22.56
	RS-3	6/8/2009	15:56	2	3.05	0.618	53.92	46.08
	RS-3	6/9/2009	15:30	1	2.44	0.333	71.70	28.30
	RS-3	6/9/2009	15:30	2	2.44	0.348	70.63	29.37
	RS-3	6/10/2009	14:20	1	2.44	0.122	88.53	11.47
	RS-3	6/10/2009	14:20	2	2.74	0.126	88.18	11.82
	RS-3	6/11/2009	10:35	1	3.05	0.237	78.90	21.10
	RS-3	6/11/2009	10:35	2	3.05	0.216	80.56	19.44
Averages								
Spring Pool	**RS-1**				**2.24**	**0.17**	**84.27**	**15.73**
Spring Run	**RS-2 & 3**				**2.23**	**0.25**	**78.29**	**21.71**

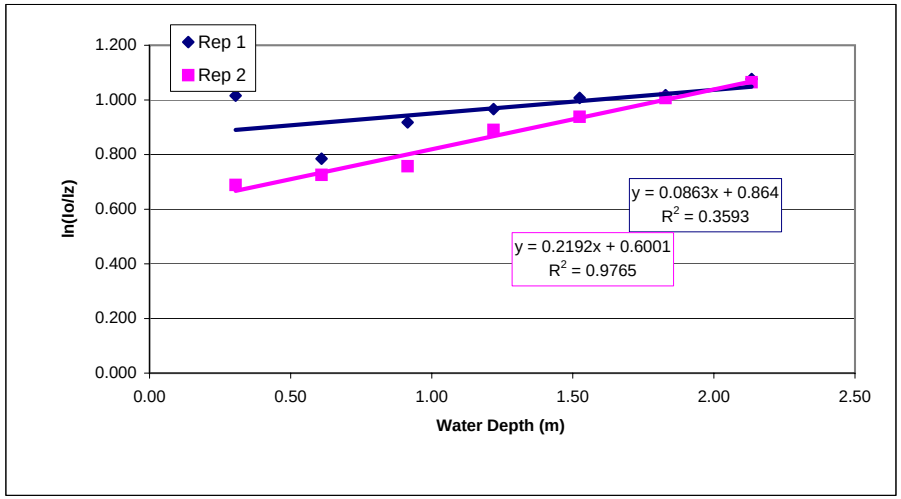
APPENDIX D

Rainbow Springs PAR ATTENUATION ESTIMATES - RS-1 - 6/08/2009 17:35

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	779.3	809.0	370.9	5.92			0.03	577.3	600.9	307.0	5.73		
0.30	806.3	836.9	292.1	5.68	1.015	3.331	0.30	600.1	624.4	301.4	5.71	0.689	2.259
0.61	1,027.7	1065.0	468.8	6.15	0.785	1.288	0.61	659.1	685.2	319.0	5.77	0.726	1.190
0.91	984.0	1020.0	393.0	5.97	0.918	1.004	0.91	660.0	686.1	309.5	5.73	0.757	0.828
1.22	717.3	745.2	273.0	5.61	0.966	0.792	1.22	667.5	693.9	274.0	5.61	0.890	0.730
1.52	681.9	708.7	249.1	5.52	1.007	0.661	1.52	712.0	739.7	278.6	5.63	0.938	0.616
1.83	817.2	848.1	295.4	5.69	1.018	0.556	1.83	662.4	688.6	242.0	5.49	1.007	0.551
2.13	628.9	654.1	214.4	5.37	1.076	0.504	2.13	639.9	665.4	220.7	5.40	1.064	0.499

k (diffuse attenuation coefficient = slope, m-1)			0.086	k (diffuse attenuation coefficient = slope, m-1)	0.219
k average			1.162	k average	0.953
percent transmittance @	1.0	meter	91.73	percent transmittance @ 1.0 meter	80.31
Birgean Percentile Absorption (1m)			8.27	Birgean Percentile Absorption (1m)	19.69





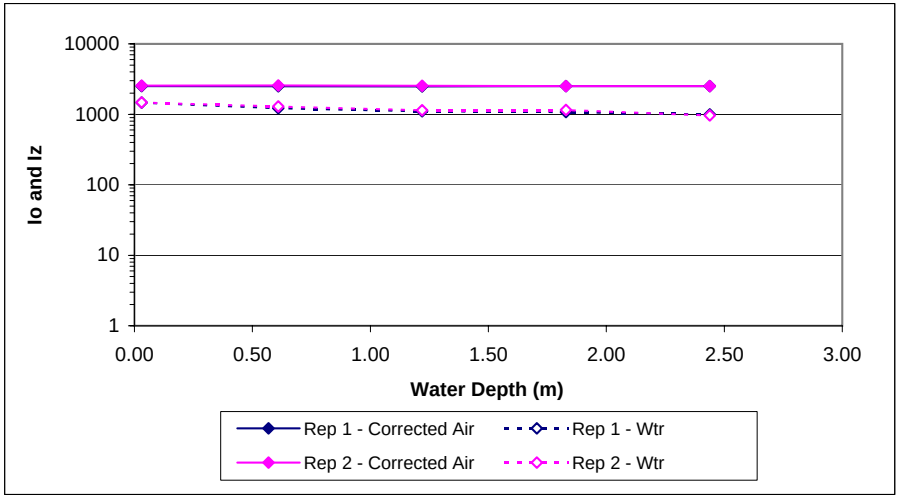
APPENDIX D

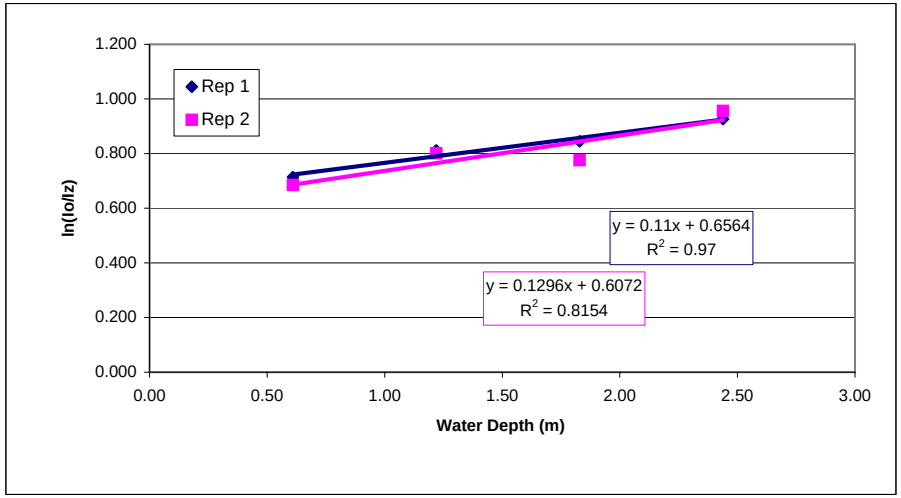
Rainbow Springs PAR ATTENUATION ESTIMATES - RS-1 - 6/08/2009 13:45 (sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,516.4	2599.0	1469	7.29			0.03	2,551.4	2,635.0	1,479.0	7.30		
0.61	2,497.0	2579.0	1223	7.11	0.714	1.171	0.61	2,568.9	2,653.0	1,295.0	7.17	0.685	1.124
1.22	2,492.2	2574.0	1107	7.01	0.812	0.666	1.22	2,546.5	2,630.0	1,143.0	7.04	0.801	0.657
1.83	2,516.4	2599.0	1081.0	6.99	0.845	0.462	1.83	2,511.6	2,594.0	1,156.0	7.05	0.776	0.424
2.44	2,516.4	2599.0	996.6	6.90	0.926	0.380	2.44	2,509.7	2,592.0	964.2	6.87	0.957	0.392

k (diffuse attenuation coefficient = slope, m-1)		0.110	
k average		0.670	
percent transmittance @	1.0 meter	89.58	
Birgean Percentile Absorption (1m)		10.42	

k (diffuse attenuation coefficient = slope, m-1)		0.130
k average		0.649
percent transmittance @	1.0 meter	87.85
Birgean Percentile Absorption (1m)		12.15



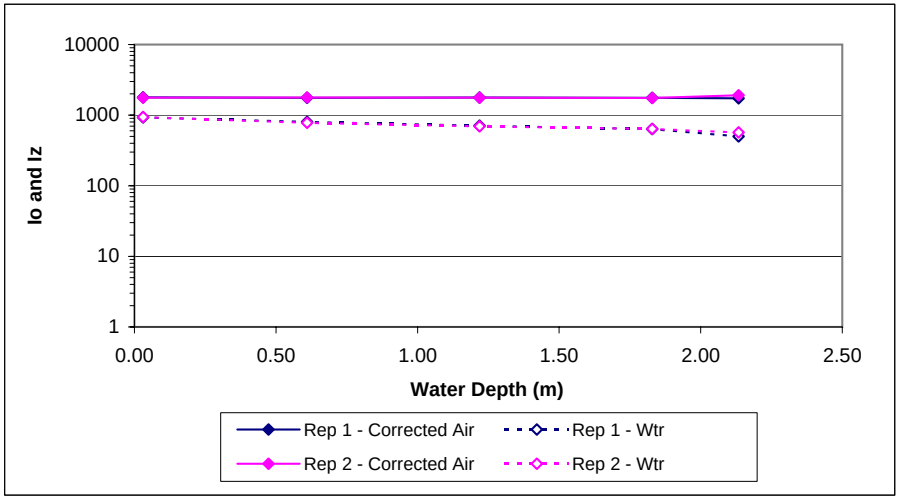


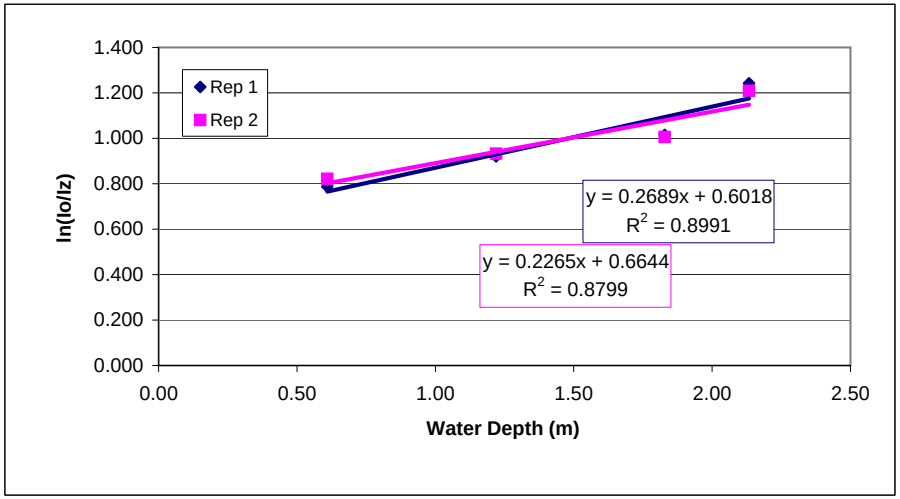
APPENDIX D

Rainbow Springs PAR ATTENUATION ESTIMATES - RS-1 - 6/102009 10:25 (mostly cloudy)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,789.5	1850.0	931.6	6.84		
0.61	1,763.3	1823.0	802.7	6.69	0.787	1.291
1.22	1,780.8	1841.0	709.4	6.56	0.920	0.755
1.83	1,755.6	1815.0	636.2	6.46	1.015	0.555
2.13	1,732.3	1791.0	500.3	6.22	1.242	0.582
k (diffuse attenuation coefficient = slope, m-1)						0.269
k average						0.796
percent transmittance @			1.0 meter			76.42
Birgean Percentile Absorption (1m)						23.58

Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,768.2	1,828.0	938.6	6.84		
0.61	1,775.0	1,835.0	780.3	6.66	0.822	1.348
1.22	1,767.2	1,827.0	695.5	6.54	0.933	0.765
1.83	1,751.7	1,811.0	640.9	6.46	1.005	0.550
2.13	1,907.9	1,972.0	569.3	6.34	1.209	0.567
k (diffuse attenuation coefficient = slope, m-1)						0.227
k average						0.807
percent transmittance @			1.0 meter			79.73
Birgean Percentile Absorption (1m)						20.27

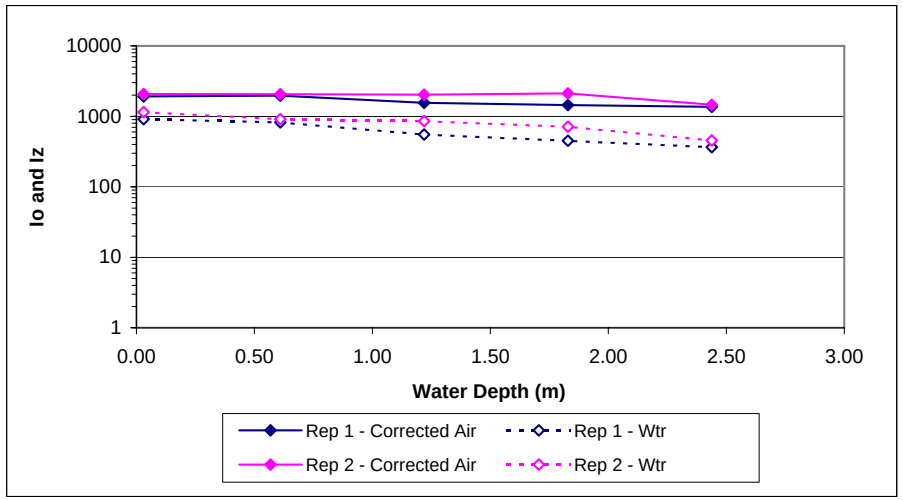


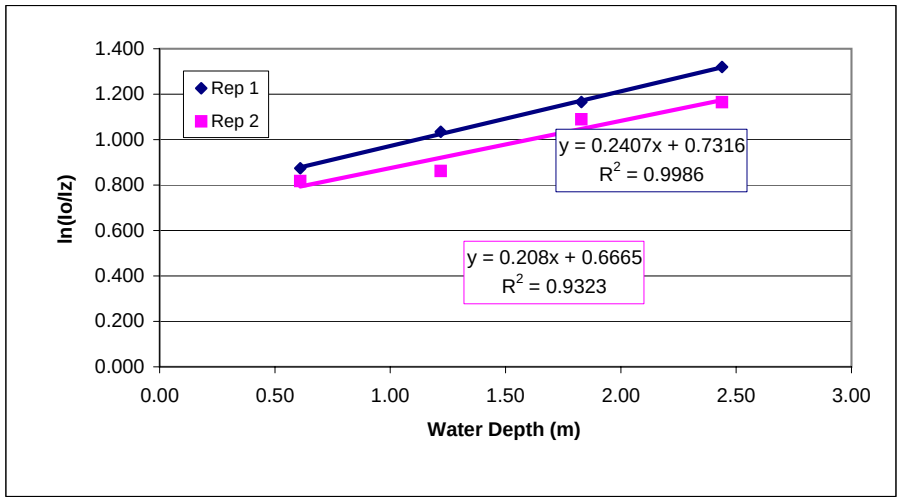


APPENDIX D
Rainbow Springs PAR ATTENUATION ESTIMATES - RS-1 - 6/11/2009 12:32

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,919.6	1984.0	912.1	6.82		
0.61	1,968.1	2034.0	821.2	6.71	0.874	1.434
1.22	1,558.6	1612.0	553.9	6.32	1.035	0.849
1.83	1,444.0	1494.0	450.2	6.11	1.166	0.637
2.44	1,368.3	1416.0	365.7	5.90	1.320	0.541
k (diffuse attenuation coefficient = slope, m-1)						0.241
k average						0.865
percent transmittance @			1.0 meter			78.61
Birgean Percentile Absorption (1m)						21.39

Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,072.0	2,141.0	1,149.0	7.05		
0.61	2,065.2	2,134.0	911.6	6.82	0.818	1.341
1.22	2,029.3	2,097.0	856.8	6.75	0.862	0.707
1.83	2,119.5	2,190.0	713.0	6.57	1.089	0.596
2.44	1,459.6	1,510.0	455.4	6.12	1.165	0.478
k (diffuse attenuation coefficient = slope, m-1)						0.208
k average						0.781
percent transmittance @			1.0 meter			81.22
Birgean Percentile Absorption (1m)						18.78



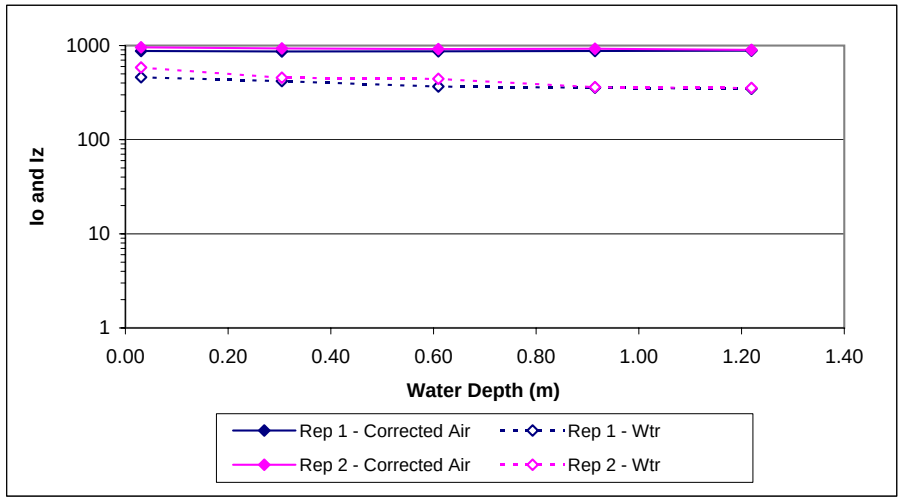


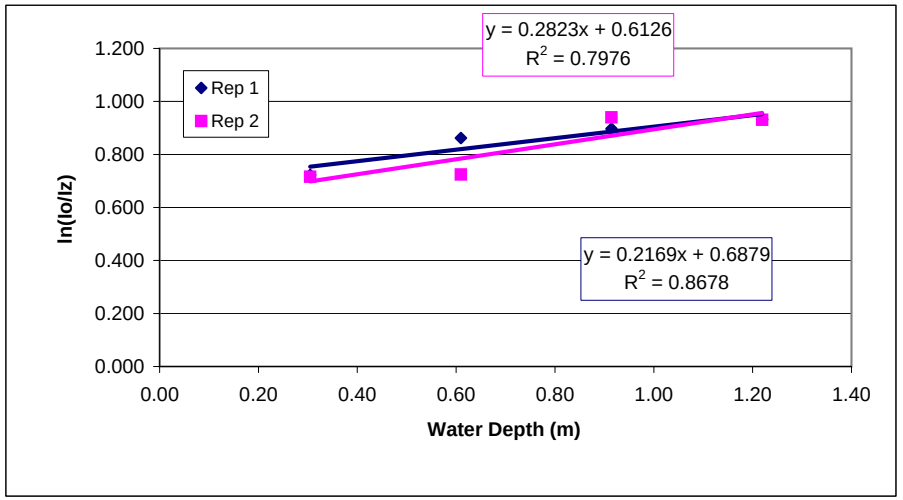
APPENDIX D

Rainbow Springs PAR ATTENUATION ESTIMATES - RS-2 - 6/08/2009 17:16 (overcast)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	873.9	906.5	461.6	6.13			0.03	956.6	991.7	585.0	6.37		
0.30	864.9	897.3	420.0	6.04	0.722	2.370	0.30	931.1	965.5	455.2	6.12	0.716	2.348
0.61	868.9	901.4	366.9	5.91	0.862	1.414	0.61	915.9	949.8	443.8	6.10	0.725	1.189
0.91	876.6	909.3	357.5	5.88	0.897	0.981	0.91	926.5	960.7	361.9	5.89	0.940	1.028
1.22	883.3	916.2	348.1	5.85	0.931	0.764	1.22	898.0	931.4	354.1	5.87	0.931	0.763

k (diffuse attenuation coefficient = slope, m-1)			0.217	k (diffuse attenuation coefficient = slope, m-1)	0.282
k average			1.382	k average	1.332
percent transmittance @	1.0	meter	80.50	percent transmittance @ 1.0 meter	75.41
Birgean Percentile Absorption (1m)			19.50	Birgean Percentile Absorption (1m)	24.59



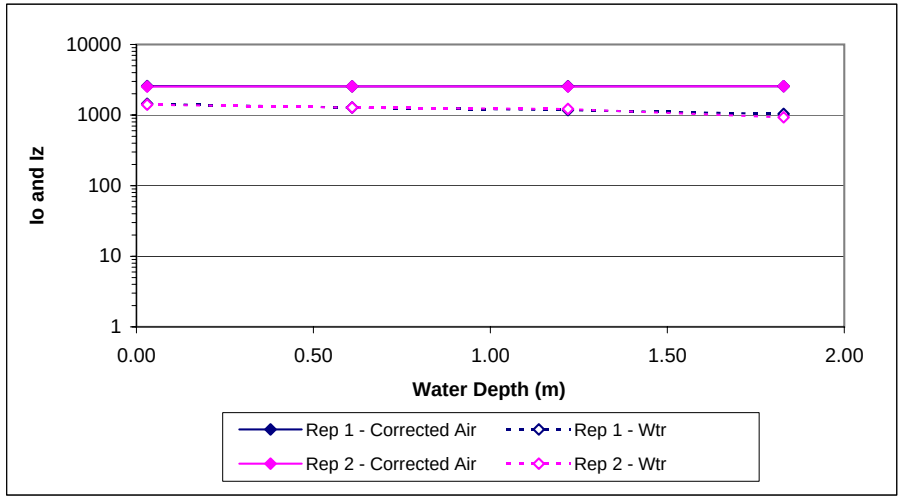


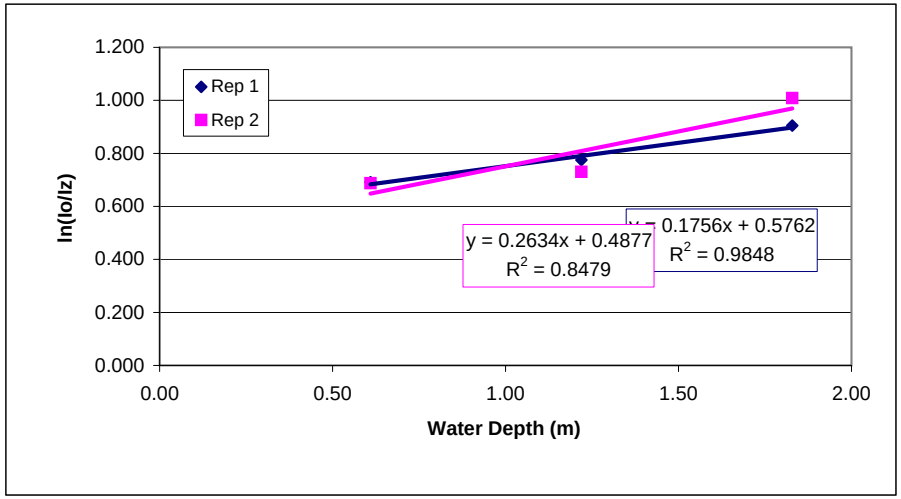
APPENDIX D

Rainbow Springs PAR ATTENUATION ESTIMATES - RS-2 - 6/09/2009 14:40 (sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,572.7	2,657.0	1,446.0	7.28			0.03	2,531.0	2,614.0	1,409.0	7.25		
0.61	2,552.4	2,636.0	1,279.0	7.15	0.691	1.133	0.61	2,541.7	2,625.0	1,278.0	7.15	0.688	1.128
1.22	2,561.1	2,645.0	1,180.0	7.07	0.775	0.636	1.22	2,540.7	2,624.0	1,224.0	7.11	0.730	0.599
1.83	2,565.9	2,650.0	1,038.0	6.95	0.905	0.495	1.83	2,558.2	2,642.0	933.0	6.84	1.009	0.552

k (diffuse attenuation coefficient = slope, m-1)			0.176	k (diffuse attenuation coefficient = slope, m-1)		0.263
k average			0.755	k average		0.759
percent transmittance @	1.0	meter	83.90	percent transmittance @	1.0	meter	76.84
Birgean Percentile Absorption (1m)			16.10	Birgean Percentile Absorption (1m)			23.16





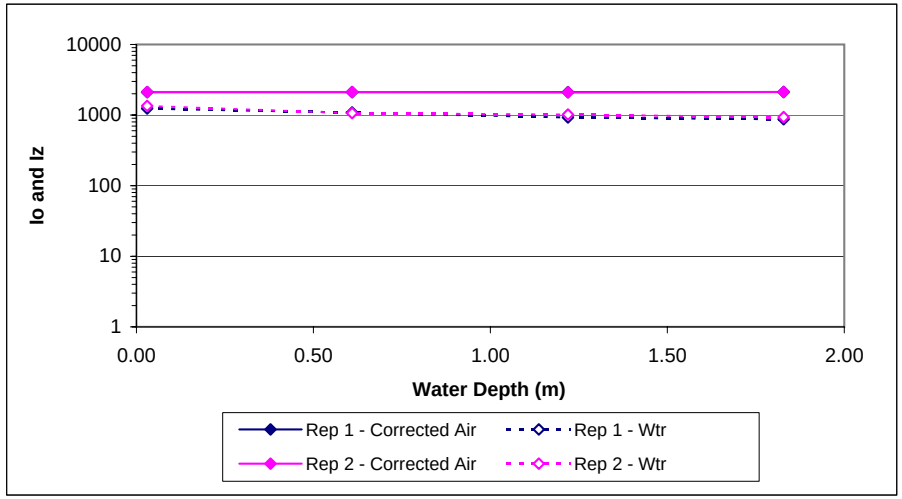
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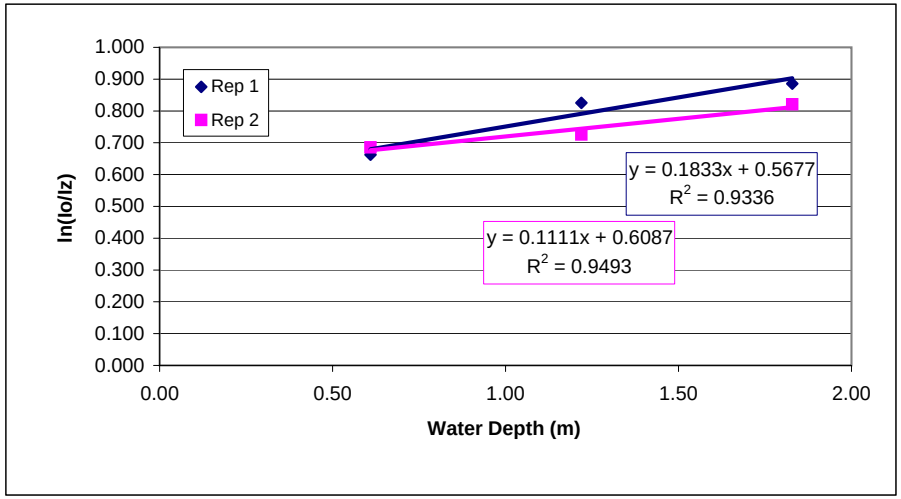
Rainbow Springs PAR ATTENUATION ESTIMATES - RS-2 - 6/10/2009 11:31

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,107.9	2,178.0	1,243.0	7.13	0.528	17.328	0.03	2,128.2	2,199.0	1,350.0	7.21	0.455	14.934
0.61	2,111.7	2,182.0	1,089.0	6.99	0.662	1.086	0.61	2,119.5	2,190.0	1,068.0	6.97	0.685	1.124
1.22	2,112.7	2,183.0	925.3	6.83	0.826	0.677	1.22	2,104.0	2,174.0	1,018.0	6.93	0.726	0.595
1.83	2,124.4	2,195.0	876.1	6.78	0.886	0.484	1.83	2,121.5	2,192.0	933.6	6.84	0.821	0.449

k (diffuse attenuation coefficient = slope, m-1)			0.183	
k average			4.894	
percent transmittance @	1.0	meter	83.25	
Birgean Percentile Absorption (1m)			16.75	

k (diffuse attenuation coefficient = slope, m-1)			0.111
k average			4.276
percent transmittance @	1.0	meter	89.49
Birgean Percentile Absorption (1m)			10.51



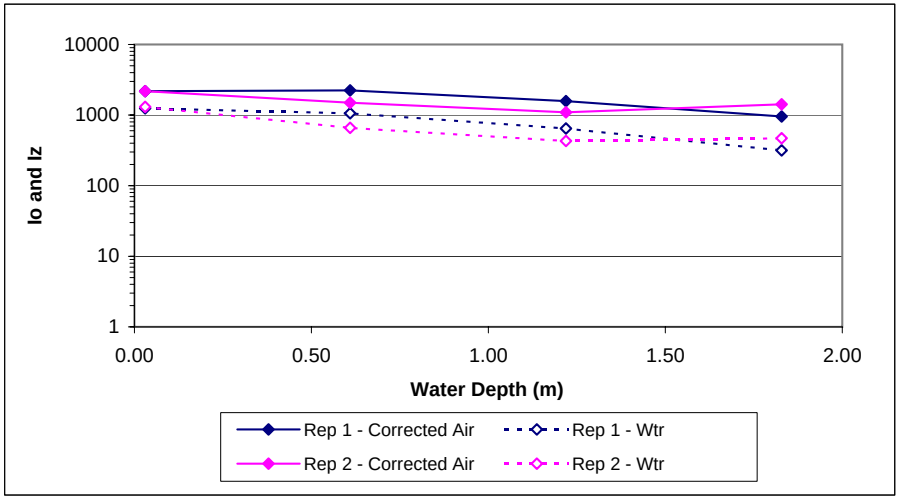


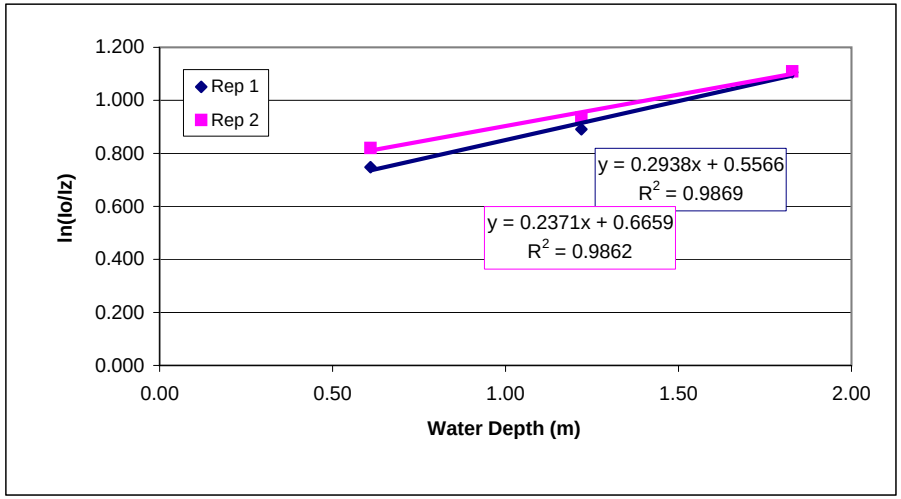
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Rainbow Springs PAR ATTENUATION ESTIMATES - RS-2 - 6/11/2009 11:19

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,175.8	2248	1,248.0	7.13	0.556	18.237	0.03	2,176.8	2,249.0	1,307.0	7.18	0.510	16.736
0.61	2,240.8	2315	1,061.0	6.97	0.748	1.226	0.61	1,497.4	1,549.0	659.3	6.49	0.820	1.346
1.22	1,577.0	1631	647.0	6.47	0.891	0.731	1.22	1,095.6	1,135.0	430.0	6.06	0.935	0.767
1.83	956.9	992.1	316.7	5.76	1.106	0.605	1.83	1,421.7	1,471.0	468.8	6.15	1.109	0.607

k (diffuse attenuation coefficient = slope, m-1)		0.294	k (diffuse attenuation coefficient = slope, m-1)	0.237
k average		6.731	k average	4.864
percent transmittance @	1.0 meter	74.54	percent transmittance @ 1.0 meter	78.89
Birgean Percentile Absorption (1m)		25.46	Birgean Percentile Absorption (1m)	21.11





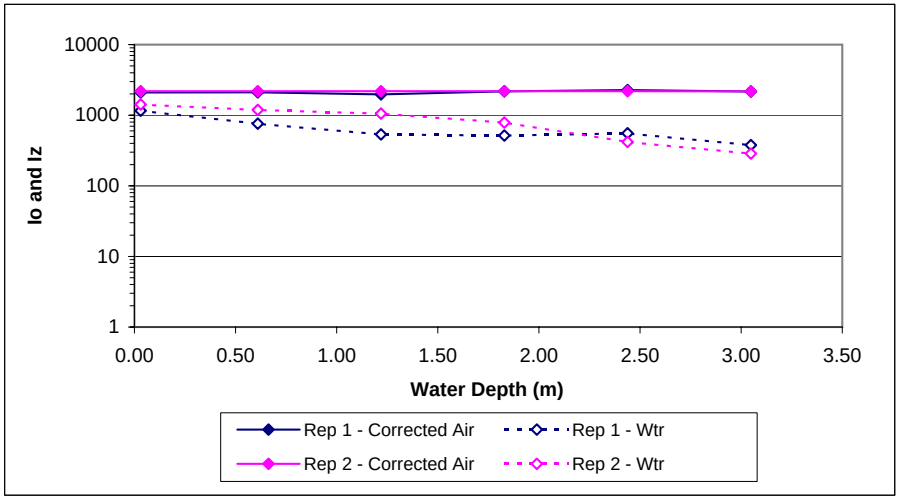
APPENDIX D

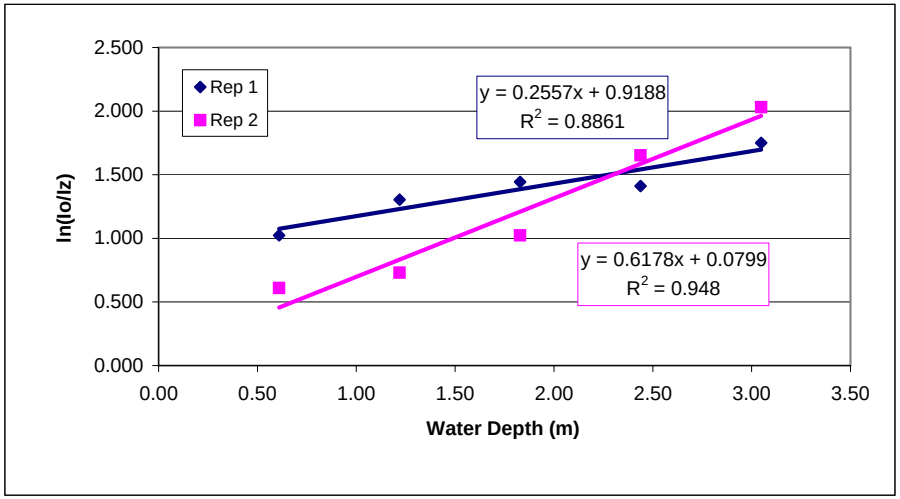
Rainbow Springs PAR ATTENUATION ESTIMATES - RS-3 - 6/08/2009 15:56 (sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,105.0	2,175.0	1,160.0	7.06	0.596	19.550	0.03	2,191.3	2,264.0	1,417.0	7.26	0.436	14.303
0.61	2,109.8	2,180.0	757.6	6.63	1.024	1.680	0.61	2,193.3	2,266.0	1,192.0	7.08	0.610	1.000
1.22	1,974.9	2,041.0	536.2	6.28	1.304	1.069	1.22	2,192.3	2,265.0	1,056.0	6.96	0.730	0.599
1.83	2,180.7	2,253.0	514.9	6.24	1.443	0.789	1.83	2,189.4	2,262.0	786.7	6.67	1.024	0.560
2.44	2,277.7	2,353.0	555.8	6.32	1.411	0.578	2.44	2,186.5	2,259.0	418.7	6.04	1.653	0.678
3.05	2,170.9	2,243.0	377.2	5.93	1.750	0.574	3.05	2,177.7	2,250.0	285.6	5.65	2.031	0.666

k (diffuse attenuation coefficient = slope, m-1)			0.256	
k average			4.040	
percent transmittance @	1.0	meter	77.44	
Birgean Percentile Absorption (1m)			22.56	

k (diffuse attenuation coefficient = slope, m-1)			0.618	
k average			2.968	
percent transmittance @	1.0	meter	53.92	
Birgean Percentile Absorption (1m)			46.08	



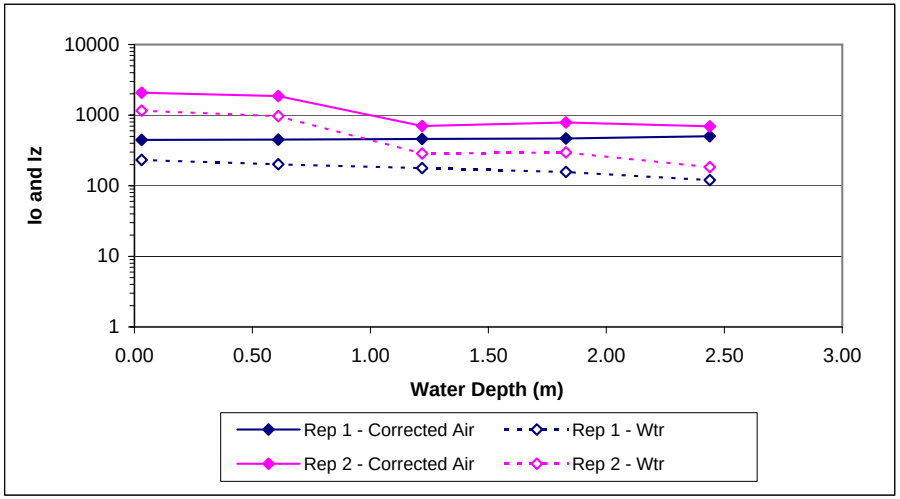


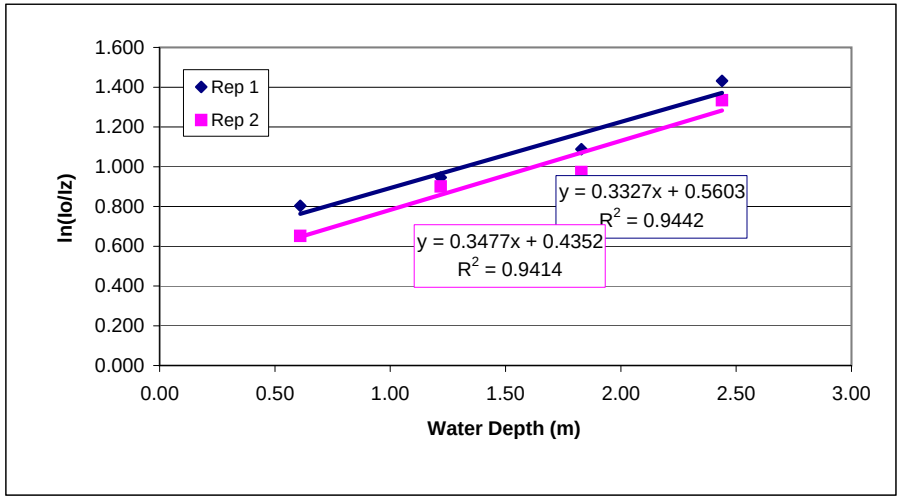
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Rainbow Springs PAR ATTENUATION ESTIMATES - RS-3 - 6/09/2009 15:30 (sun with passing clouds)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	445.6	465.2	232.2	5.45			0.03	2,075.8	2,145.0	1,160.0	7.06		
0.61	450.9	470.7	201.9	5.31	0.804	1.318	0.61	1,867.2	1,930.0	972.8	6.88	0.652	1.070
1.22	459.3	479.3	178.4	5.18	0.946	0.776	1.22	703.2	730.6	285.7	5.65	0.901	0.739
1.83	467.1	487.4	157.3	5.06	1.088	0.595	1.83	786.7	816.7	297.3	5.69	0.973	0.532
2.44	503.7	525.1	120.3	4.79	1.432	0.587	2.44	696.5	723.7	183.4	5.21	1.334	0.547

k (diffuse attenuation coefficient = slope, m-1)			0.333	k (diffuse attenuation coefficient = slope, m-1)	0.348
k average			0.819	k average	0.722
percent transmittance @	1.0	meter	71.70	percent transmittance @ 1.0 meter	70.63
Birgean Percentile Absorption (1m)			28.30	Birgean Percentile Absorption (1m)	29.37



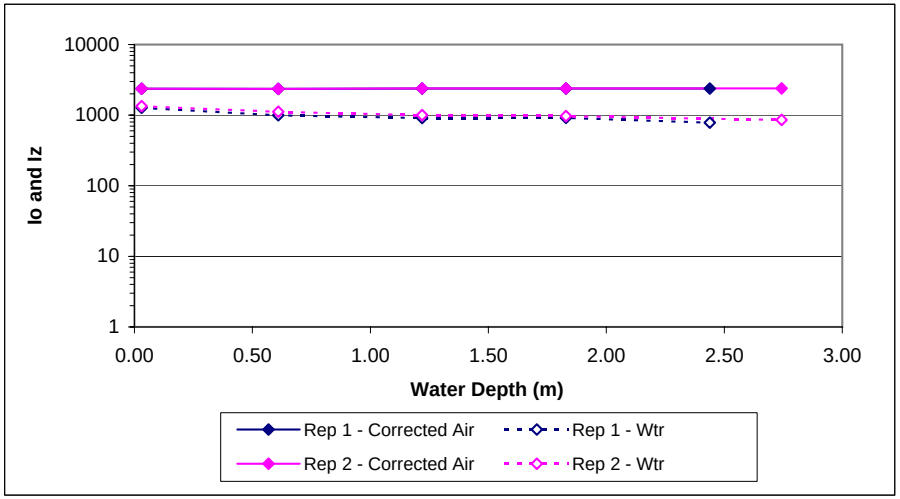


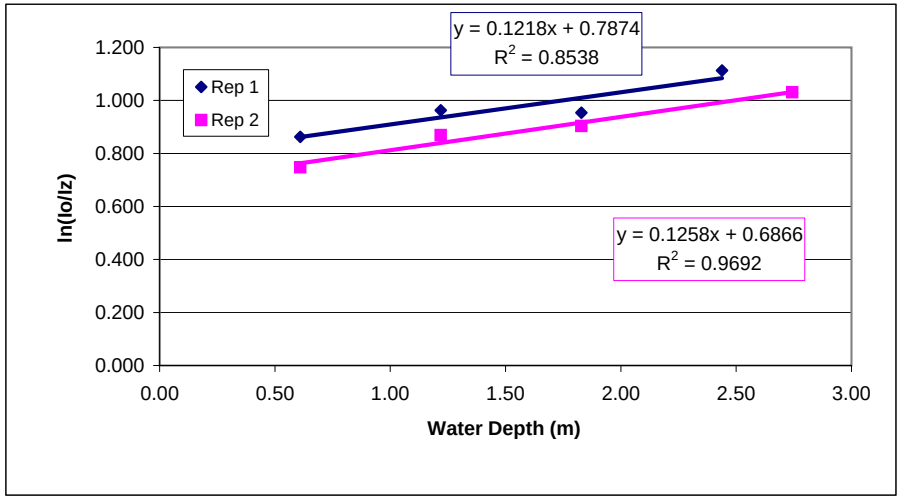
APPENDIX D

Rainbow Springs PAR ATTENUATION ESTIMATES - RS-3 - 6/10/2009 14:20 (sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,371.8	2,450.0	1,271.0	7.15			0.03	2,372.8	2,451.0	1,338.0	7.20		
0.61	2,357.3	2,435.0	995.0	6.90	0.863	1.415	0.61	2,358.3	2,436.0	1,116.0	7.02	0.748	1.227
1.22	2,381.5	2,460.0	909.3	6.81	0.963	0.790	1.22	2,389.3	2,468.0	1,002.0	6.91	0.869	0.713
1.83	2,379.6	2,458.0	916.8	6.82	0.954	0.522	1.83	2,395.1	2,474.0	970.5	6.88	0.903	0.494
2.44	2,385.4	2,464.0	783.8	6.66	1.113	0.456	2.74	2,397.1	2,476.0	855.0	6.75	1.031	0.376

k (diffuse attenuation coefficient = slope, m-1)			0.122	k (diffuse attenuation coefficient = slope, m-1)	0.126
k average			0.796	k average	0.702
percent transmittance @	1.0	meter	88.53	percent transmittance @ 1.0 meter	88.18
Birgean Percentile Absorption (1m)			11.47	Birgean Percentile Absorption (1m)	11.82





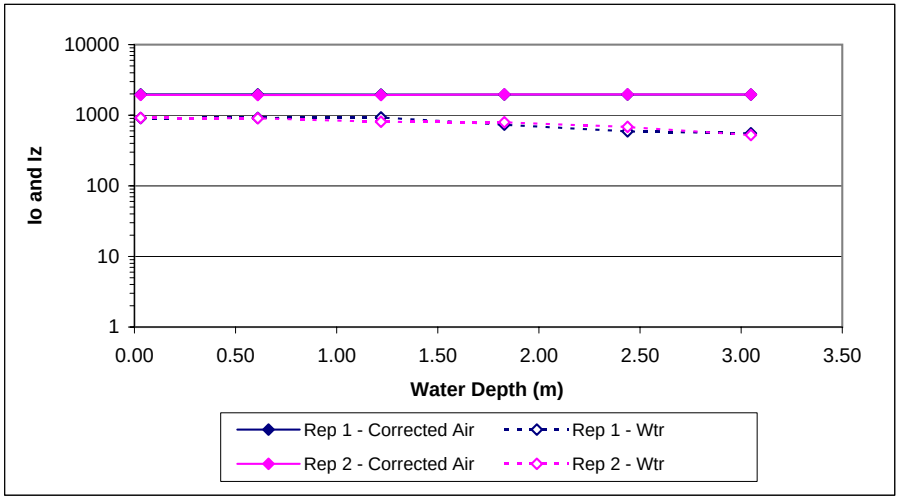
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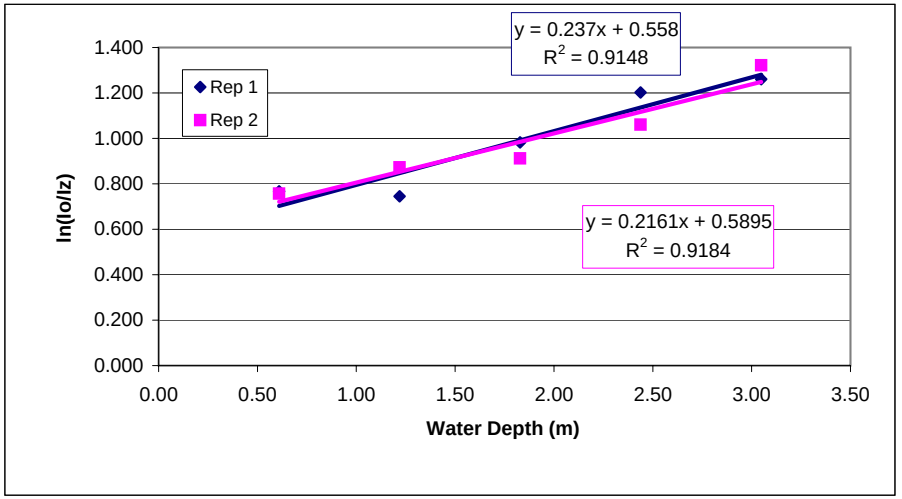
Rainbow Springs PAR ATTENUATION ESTIMATES - RS-3 - 6/11/2009 10:35 (sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,973.0	2,039.0	913.9	6.82	0.770	25.248	0.03	1,942.9	2,008.0	916.2	6.82	0.752	24.662
0.61	1,971.0	2,037.0	915.4	6.82	0.767	1.258	0.61	1,934.1	1,999.0	907.4	6.81	0.757	1.242
1.22	1,962.3	2,028.0	931.6	6.84	0.745	0.611	1.22	1,934.1	1,999.0	808.3	6.69	0.872	0.716
1.83	1,966.2	2,032.0	736.0	6.60	0.983	0.537	1.83	1,976.8	2,043.0	793.9	6.68	0.912	0.499
2.44	1,963.3	2,029.0	589.9	6.38	1.202	0.493	2.44	1,973.0	2,039.0	683.2	6.53	1.061	0.435
3.05	1,959.4	2,025.0	555.4	6.32	1.261	0.414	3.05	1,963.3	2,029.0	523.6	6.26	1.322	0.434

k (diffuse attenuation coefficient = slope, m-1)			0.237	
k average			4.760	
percent transmittance @	1.0	meter	78.90	
Birgean Percentile Absorption (1m)			21.10	

k (diffuse attenuation coefficient = slope, m-1)			0.216	
k average			4.664	
percent transmittance @	1.0	meter	80.56	
Birgean Percentile Absorption (1m)			19.44	





APPENDIX D

Silver Glen Springs (Marion Co.) PAR ATTENUATION ESTIMATES (February 2009)

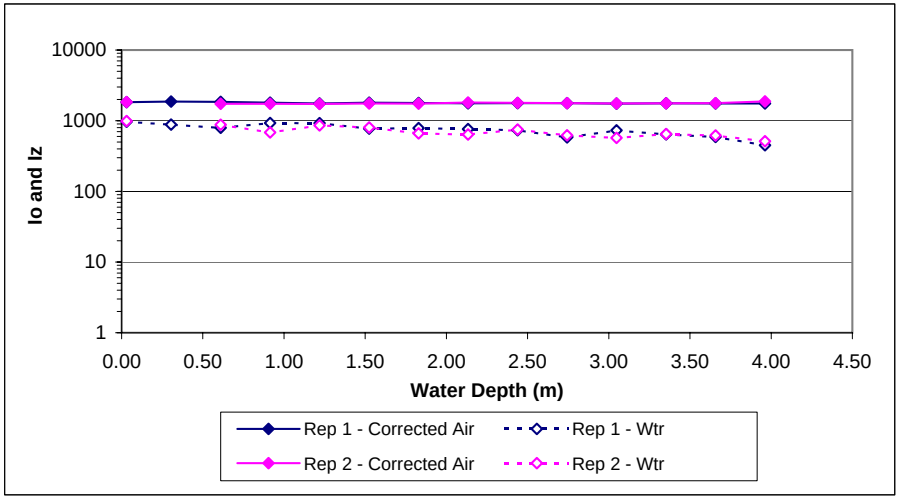
Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	SGS-1	2/17/2009	14:50	1	3.96	0.137	87.21	12.79
	SGS-1	2/17/2009	14:50	2	3.96	0.135	87.41	12.59
	SGS-1	2/18/2009	14:36	1	3.66	0.146	86.38	13.62
	SGS-1	2/18/2009	14:36	2	3.66	0.170	84.34	15.66
	SGS-2	2/16/2009	16:15	1	0.91	1.514	22.01	77.99
	SGS-2	2/16/2009	16:15	2	0.91	0.721	48.65	51.35
	SGS-2	2/18/2009	13:50	1	0.61	0.389	67.74	32.26
	SGS-2	2/18/2009	13:50	2	0.61	0.176	83.85	16.15
Spring Run	SGS-3	2/16/2009	15:30	1	0.91	0.680	50.66	49.34
	SGS-3	2/16/2009	15:30	2	0.91	0.693	50.00	50.00
	SGS-3	2/17/2009	13:25	1	1.07	0.765	46.55	53.45
	SGS-3	2/17/2009	13:25	2	1.07	0.401	66.94	33.06
	SGS-3	2/18/2009	12:50	1	0.91	0.246	78.21	21.79
	SGS-3	2/18/2009	12:50	2	0.91	0.309	73.44	26.56
Averages								
Spring Pool	**JBS-1**				**2.29**	**0.42**	**70.95**	**29.05**
Spring Run	**JBS-3**				**0.97**	**0.52**	**60.97**	**39.03**

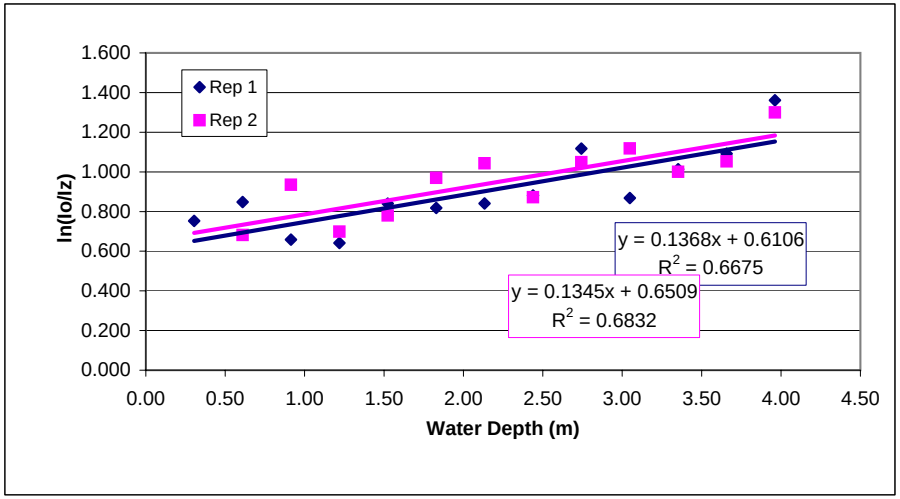
APPENDIX D

Silver Glen Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SGS-1 - 2/17/2009 14:50

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,824.5	1886	966.4	6.87			0.03	1,838.1	1,900.0	989.3	6.90		
0.30	1,866.2	1929	879.4	6.78	0.752	2.469	0.30						
0.61	1,849.7	1912	792.4	6.68	0.848	1.391	0.61	1,732.3	1,791.0	875.8	6.78	0.682	1.119
0.91	1,796.3	1857	929.7	6.83	0.659	0.720	0.91	1,738.1	1,797.0	682.4	6.53	0.935	1.022
1.22	1,755.6	1815	924	6.83	0.642	0.526	1.22	1,725.5	1,784.0	858.2	6.75	0.698	0.573
1.52	1,795.4	1856	775	6.65	0.840	0.551	1.52	1,754.6	1,814.0	804.2	6.69	0.780	0.512
1.83	1,777.9	1838	784.6	6.67	0.818	0.447	1.83	1,742.0	1,801.0	660.5	6.49	0.970	0.530
2.13	1,767.2	1827	762.6	6.64	0.840	0.394	2.13	1,808.0	1,869.0	636.8	6.46	1.044	0.489
2.44	1,774.0	1834	734.8	6.60	0.881	0.361	2.44	1,794.4	1,855.0	749.9	6.62	0.872	0.358
2.74	1,771.1	1831	579.5	6.36	1.117	0.407	2.74	1,775.0	1,835.0	621.9	6.43	1.049	0.382
3.05	1,740.0	1799	730.2	6.59	0.868	0.285	3.05	1,749.8	1,809.0	571.9	6.35	1.118	0.367
3.35	1,762.4	1822	639.8	6.46	1.013	0.302	3.35	1,764.3	1,824.0	648.5	6.47	1.001	0.299
3.66	1,756.5	1816	589.4	6.38	1.092	0.299	3.66	1,768.2	1,828.0	617.1	6.43	1.053	0.288
3.96	1,754.6	1814	449.7	6.11	1.361	0.344	3.96	1,876.9	1,940.0	511.6	6.24	1.300	0.328

k (diffuse attenuation coefficient = slope, m-1)			0.137	k (diffuse attenuation coefficient = slope, m-1)	0.135
k average			0.654	k average	0.522
percent transmittance @	1.0	meter	87.21	percent transmittance @ 1.0 meter	87.41
Birgean Percentile Absorption (1m)			12.79	Birgean Percentile Absorption (1m)	12.59



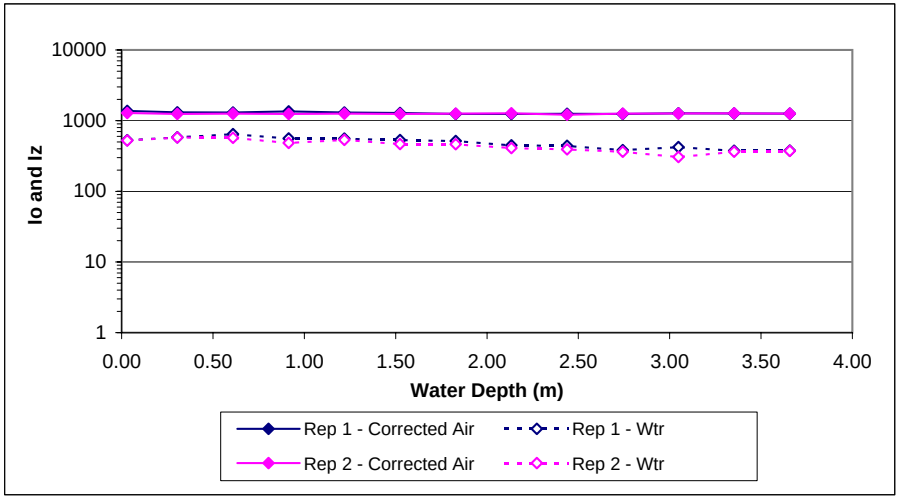


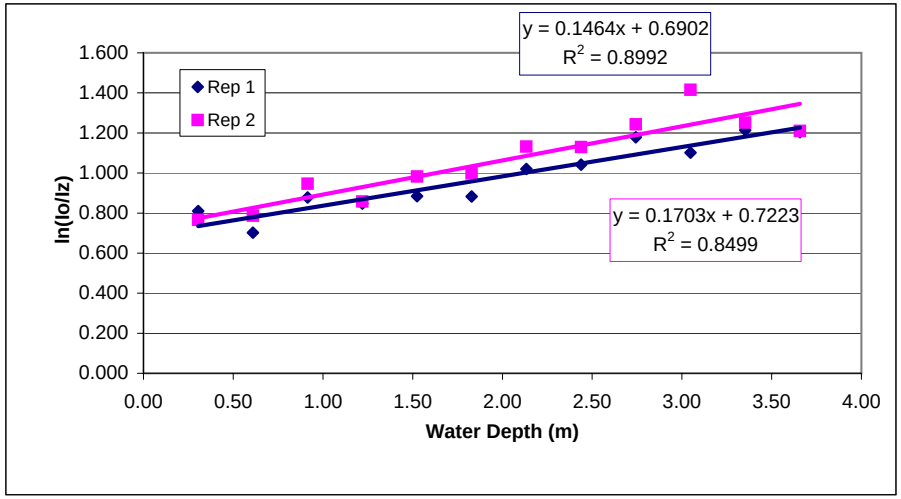
APPENDIX D

Silver Glen Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SGS-1 - 2/18/2009 14:36

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,369.3	1,417.0	528.8	6.27			0.03	1,282.9	1,328.0	523.1	6.26		
0.30	1,307.2	1,353.0	581.6	6.37	0.810	2.657	0.30	1,244.1	1,288.0	578.4	6.36	0.766	2.513
0.61	1,303.3	1,349.0	645.6	6.47	0.702	1.152	0.61	1,255.8	1,300.0	571.6	6.35	0.787	1.291
0.91	1,348.9	1,396.0	560.9	6.33	0.878	0.960	0.91	1,245.1	1,289.0	483.2	6.18	0.947	1.035
1.22	1,302.4	1,348.0	557.8	6.32	0.848	0.695	1.22	1,257.7	1,302.0	533.3	6.28	0.858	0.704
1.52	1,285.9	1,331.0	530.9	6.27	0.885	0.580	1.52	1,244.1	1,288.0	465.9	6.14	0.982	0.644
1.83	1,245.1	1,289.0	515.2	6.24	0.882	0.483	1.83	1,256.7	1,301.0	463.5	6.14	0.997	0.545
2.13	1,243.1	1,287.0	448.2	6.11	1.020	0.478	2.13	1,267.4	1,312.0	408.8	6.01	1.132	0.530
2.44	1,249.9	1,294.0	441.0	6.09	1.042	0.427	2.44	1,213.1	1,256.0	392.2	5.97	1.129	0.463
2.74	1,243.1	1,287.0	382.8	5.95	1.178	0.429	2.74	1,255.8	1,300.0	362.4	5.89	1.243	0.453
3.05	1,268.4	1,313.0	421.7	6.04	1.101	0.361	3.05	1,260.6	1,305.0	306.1	5.72	1.415	0.464
3.35	1,265.5	1,310.0	375.7	5.93	1.214	0.362	3.35	1,270.3	1,315.0	363.4	5.90	1.252	0.373
3.66	1,253.8	1,298.0	376.2	5.93	1.204	0.329	3.66	1,253.8	1,298.0	373.8	5.92	1.210	0.331

k (diffuse attenuation coefficient = slope, m-1)			0.146	k (diffuse attenuation coefficient = slope, m-1)	0.170
k average			0.980	k average	0.779
percent transmittance @	1.0	meter	86.38	percent transmittance @ 1.0 meter	84.34
Birgean Percentile Absorption (1m)			13.62	Birgean Percentile Absorption (1m)	15.66



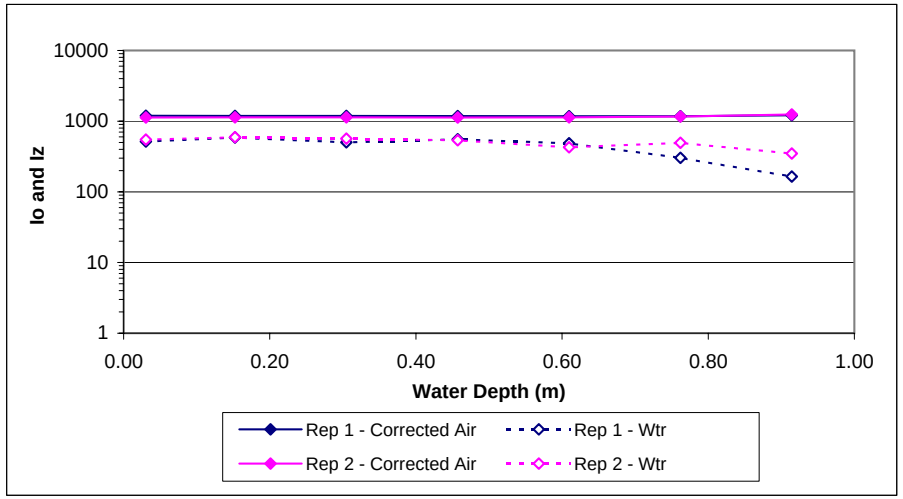


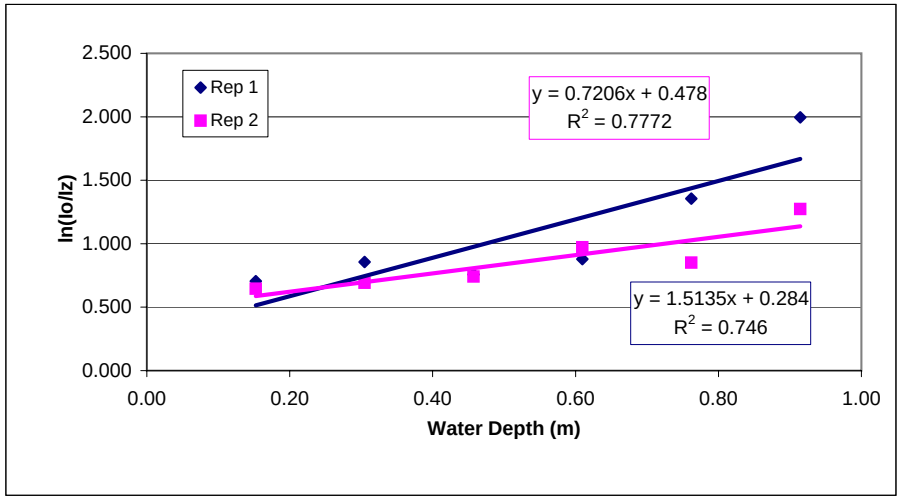
APPENDIX D

Silver Glen Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SGS-2 - 2/16/2009 16:15

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,191.7	1,234.0	515.6	6.25			0.03	1,125.7	1,166.0	549.0	6.31		
0.15	1,185.9	1,228.0	586.1	6.37	0.705	4.624	0.15	1,133.5	1,174.0	594.4	6.39	0.645	4.236
0.30	1,183.9	1,226.0	503.2	6.22	0.856	2.807	0.30	1,131.5	1,172.0	566.3	6.34	0.692	2.271
0.46	1,182.0	1,224.0	554.2	6.32	0.757	1.657	0.46	1,128.6	1,169.0	538.1	6.29	0.741	1.620
0.61	1,171.3	1,213.0	486.2	6.19	0.879	1.442	0.61	1,130.6	1,171.0	427.7	6.06	0.972	1.595
0.76	1,176.2	1,218.0	303.3	5.71	1.355	1.779	0.76	1,158.7	1,200.0	495.0	6.20	0.851	1.116
0.91	1,208.2	1,251.0	164.3	5.10	1.995	2.182	0.91	1,242.2	1,286.0	347.8	5.85	1.273	1.392

k (diffuse attenuation coefficient = slope, m-1)			1.514	k (diffuse attenuation coefficient = slope, m-1)			0.721
k average			2.415	k average			2.038
percent transmittance @	1.0	meter	22.01	percent transmittance @	1.0	meter	48.65
Birgean Percentile Absorption (1m)			77.99	Birgean Percentile Absorption (1m)			51.35





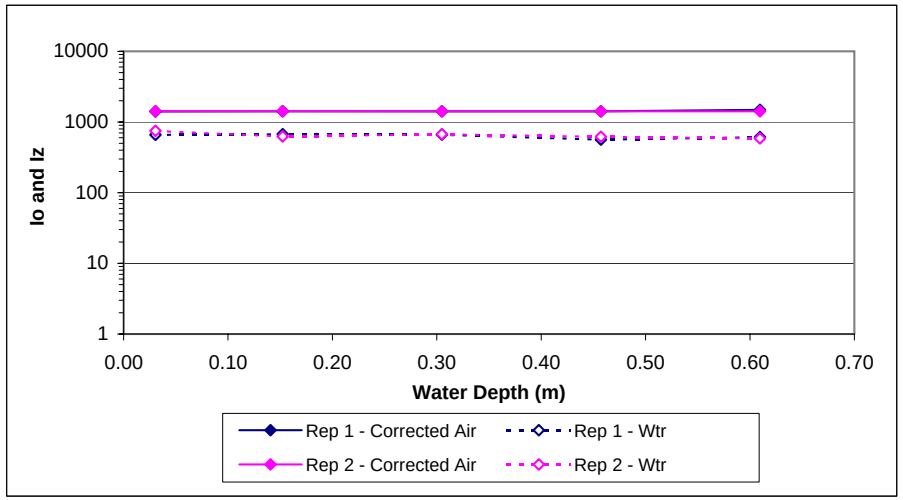
APPENDIX D

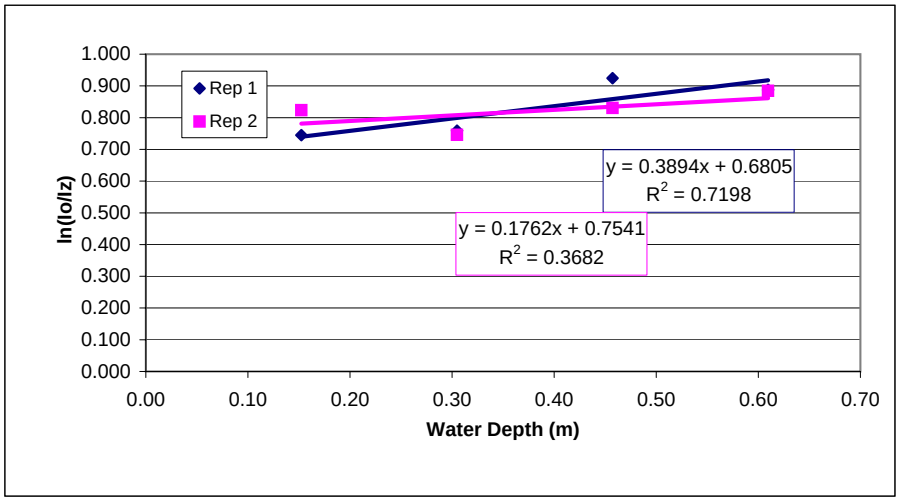
Silver Glen Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SGS-2 - 2/18/2009 13:50

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,406.2	1,455.0	656.7	6.49			0.03	1,420.8	1,470.0	748.5	6.62		
0.15	1,415.9	1,465.0	672.3	6.51	0.745	4.887	0.15	1,425.6	1,475.0	625.7	6.44	0.823	5.403
0.30	1,414.0	1,463.0	661.9	6.50	0.759	2.490	0.30	1,415.9	1,465.0	671.5	6.51	0.746	2.448
0.46	1,417.8	1,467.0	562.7	6.33	0.924	2.021	0.46	1,419.8	1,469.0	618.7	6.43	0.831	1.817
0.61	1,482.9	1,534.0	610.4	6.41	0.888	1.456	0.61	1,419.8	1,469.0	586.1	6.37	0.885	1.451

k (diffuse attenuation coefficient = slope, m-1)			0.389	
k average			2.714	
percent transmittance @	1.0	meter	67.74	
Birgean Percentile Absorption (1m)			32.26	

k (diffuse attenuation coefficient = slope, m-1)			0.176	
k average			2.780	
percent transmittance @	1.0	meter	83.85	
Birgean Percentile Absorption (1m)			16.15	





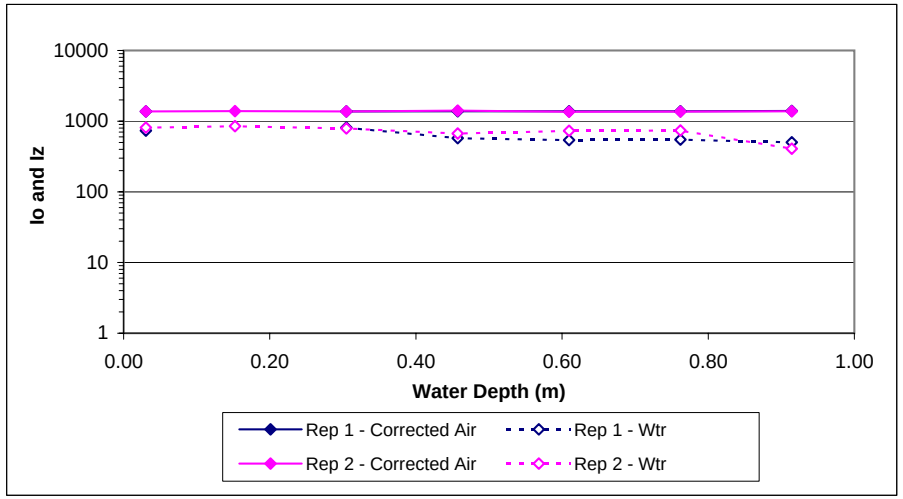
APPENDIX D

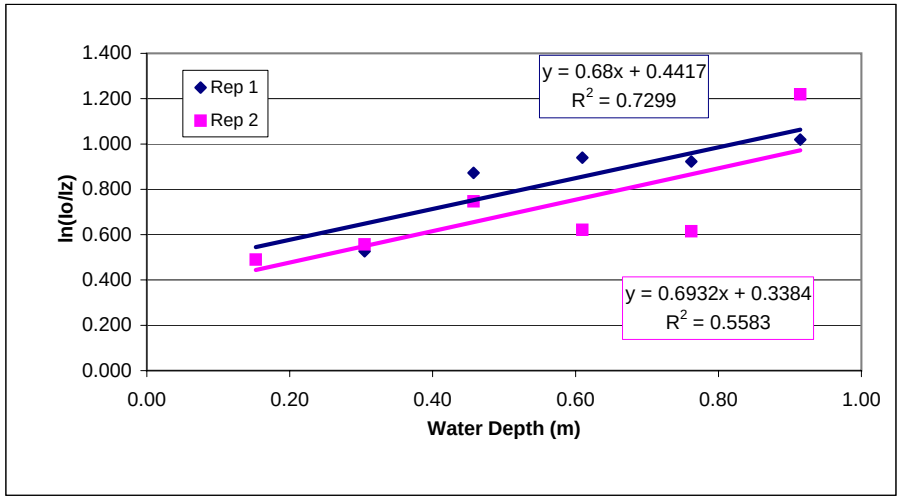
Silver Glen Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SGS-3 - 2/16/2009 15:30

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,374.2	1,422.0	734.7	6.60			0.03	1,375.1	1,423.0	809.3	6.70		
0.15							0.15	1,384.8	1,433.0	848.6	6.74	0.490	3.214
0.30	1,371.3	1,419.0	810.0	6.70	0.526	1.727	0.30	1,375.1	1,423.0	788.0	6.67	0.557	1.827
0.46	1,379.0	1,427.0	576.1	6.36	0.873	1.909	0.46	1,412.0	1,461.0	669.2	6.51	0.747	1.633
0.61	1,381.0	1,429.0	539.6	6.29	0.940	1.542	0.61	1,361.6	1,409.0	731.5	6.60	0.621	1.019
0.76	1,377.1	1,425.0	547.4	6.31	0.923	1.211	0.76	1,365.4	1,413.0	738.3	6.60	0.615	0.807
0.91	1,390.7	1,439.0	501.6	6.22	1.020	1.115	0.91	1,381.0	1,429.0	407.9	6.01	1.220	1.334

k (diffuse attenuation coefficient = slope, m-1)			0.680
k average			1.501
percent transmittance @	1.0	meter	50.66
Birgean Percentile Absorption (1m)			49.34

k (diffuse attenuation coefficient = slope, m-1)			0.693
k average			1.639
percent transmittance @	1.0	meter	50.00
Birgean Percentile Absorption (1m)			50.00



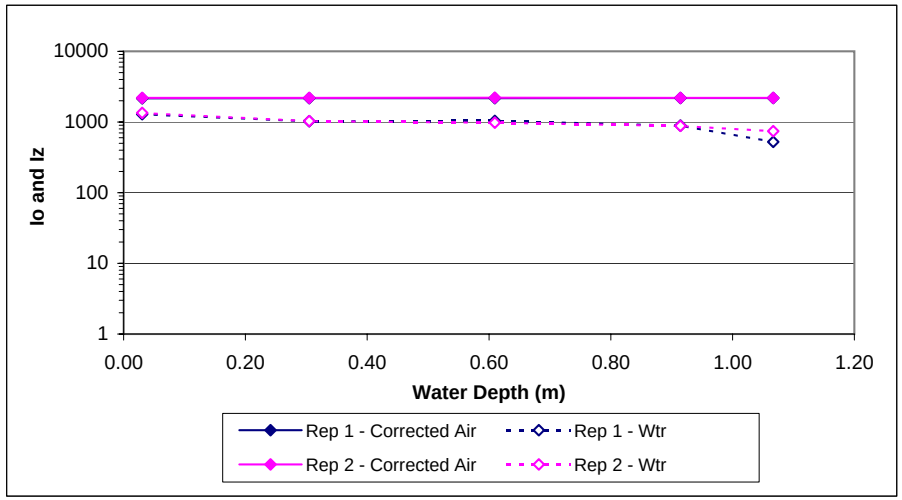


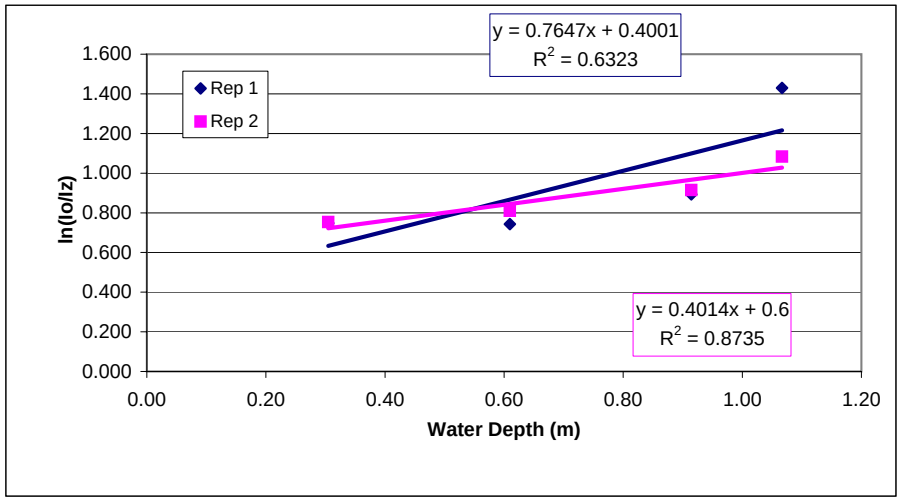
APPENDIX D

Silver Glen Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SGS-3 - 2/17/2009 13:25

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,165.1	2,237.0	1,290.0	7.16			0.03	2,190.4	2,263.0	1,346.0	7.20		
0.30	2,170.0	2,242.0	1,027.0	6.93	0.748	2.454	0.30	2,190.4	2,263.0	1,031.0	6.94	0.754	2.472
0.61	2,176.8	2,249.0	1,035.0	6.94	0.743	1.220	0.61	2,200.1	2,273.0	978.5	6.89	0.810	1.329
0.91	2,179.7	2,252.0	892.1	6.79	0.893	0.977	0.91	2,199.1	2,272.0	881.0	6.78	0.915	1.000
1.07	2,187.4	2,260.0	523.6	6.26	1.430	1.340	1.07	2,195.2	2,268.0	742.6	6.61	1.084	1.016

k (diffuse attenuation coefficient = slope, m-1)			0.765	k (diffuse attenuation coefficient = slope, m-1)	0.401
k average			1.498	k average	1.454
percent transmittance @	1.0	meter	46.55	percent transmittance @ 1.0 meter	66.94
Birgean Percentile Absorption (1m)			53.45	Birgean Percentile Absorption (1m)	33.06





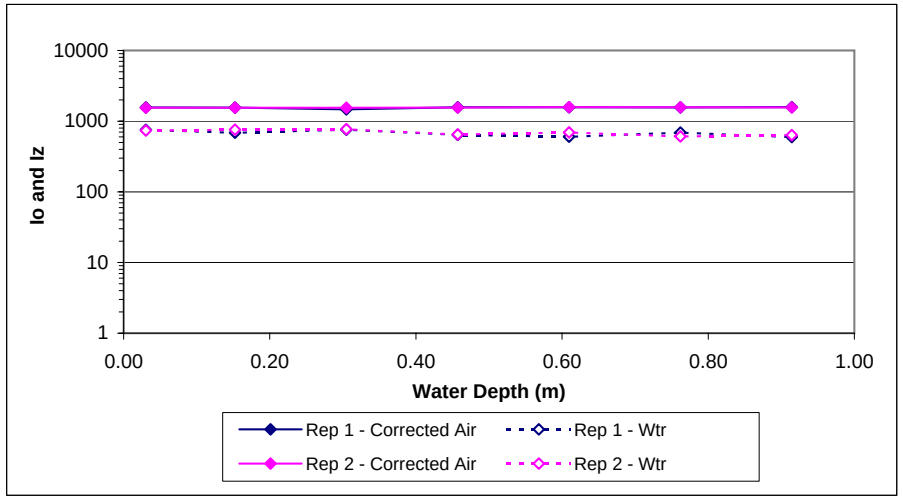
APPENDIX D

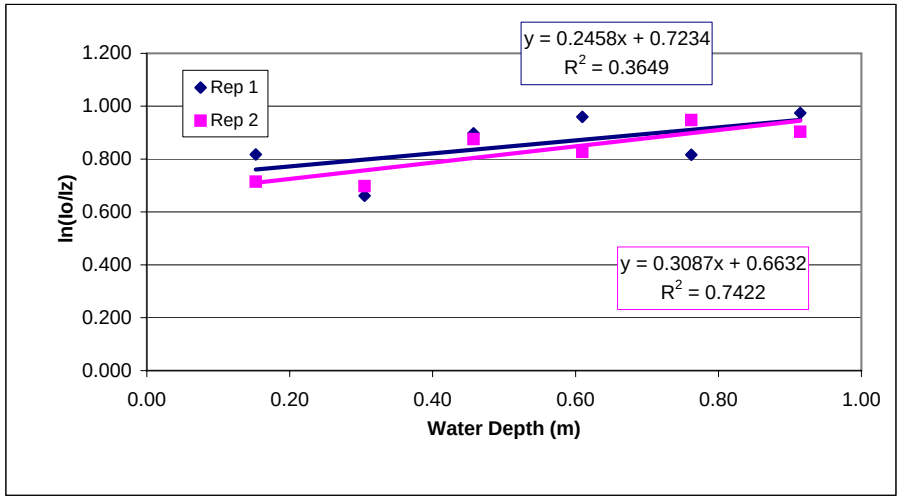
Silver Glen Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SGS-3 - 2/18/2009 12:50

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,561.5	1,615.0	752.6	6.62			0.03	1,545.0	1,598.0	739.6	6.61		
0.15	1,552.7	1,606.0	685.5	6.53	0.818	5.365	0.15	1,546.9	1,600.0	757.0	6.63	0.715	4.689
0.30	1,470.2	1,521.0	758.8	6.63	0.661	2.170	0.30	1,545.0	1,598.0	769.0	6.65	0.698	2.289
0.46	1,572.1	1,626.0	641.0	6.46	0.897	1.962	0.46	1,555.7	1,609.0	647.9	6.47	0.876	1.916
0.61	1,569.2	1,623.0	601.0	6.40	0.960	1.574	0.61	1,582.8	1,637.0	692.0	6.54	0.827	1.357
0.76	1,559.5	1,613.0	689.2	6.54	0.817	1.072	0.76	1,571.2	1,625.0	609.0	6.41	0.948	1.244
0.91	1,577.0	1,631.0	595.3	6.39	0.974	1.065	0.91	1,565.4	1,619.0	634.1	6.45	0.904	0.988

k (diffuse attenuation coefficient = slope, m-1)			0.246
k average			2.201
percent transmittance @	1.0	meter	78.21
Birgean Percentile Absorption (1m)			21.79

k (diffuse attenuation coefficient = slope, m-1)			0.309
k average			2.081
percent transmittance @	1.0	meter	73.44
Birgean Percentile Absorption (1m)			26.56





APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES (May 2009)

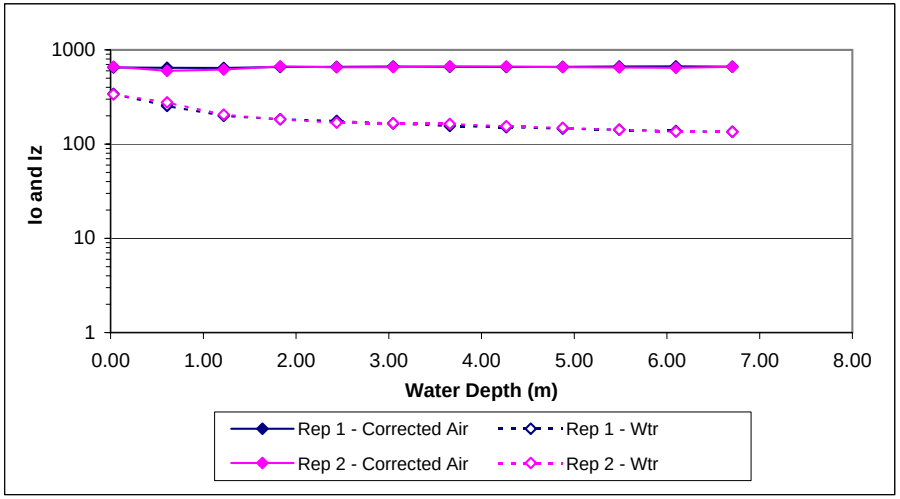
Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	SS-1	5/4/2009	17:20	1	6.71	0.092	91.18	8.82
	SS-1	5/4/2009	17:20	2	6.71	0.104	90.16	9.84
	SS-1	5/5/2009	16:00	1	6.10	0.130	87.79	12.21
	SS-1	5/5/2009	16:00	2	6.10	0.185	83.10	16.90
	SS-1	5/7/2009	15:40	1	6.10	0.108	89.79	10.21
	SS-1	5/7/2009	15:40	2	6.10	0.097	90.77	9.23
Spring Run	SS-2	5/4/2009	16:12	1	2.44	0.149	86.14	13.86
	SS-2	5/4/2009	16:12	2	2.44	0.213	80.85	19.15
	SS-2	5/5/2009	15:15	1	2.44	0.312	73.20	26.80
	SS-2	5/5/2009	15:15	2	2.44	0.244	78.38	21.62
	SS-2	5/7/2009	14:45	1	2.44	0.135	87.34	12.66
	SS-2	5/7/2009	14:45	2	2.44	0.094	90.99	9.01
	SS-2	5/8/2009	12:20	1	2.44	0.138	87.08	12.92
	SS-2	5/8/2009	12:20	2	2.44	0.224	79.91	20.09
	SS-3	5/4/2009	15:35	1	2.44	0.164	84.88	15.12
	SS-3	5/4/2009	15:35	2	2.44	0.183	83.30	16.70
	SS-3	5/5/2009	14:36	1	2.44	0.146	86.41	13.59
	SS-3	5/5/2009	14:36	2	2.44	0.168	84.49	15.51
	SS-3	5/7/2009	13:35	1	2.74	0.137	87.16	12.84
	SS-3	5/7/2009	13:35	2	2.74	0.246	78.22	21.78
	SS-3	5/8/2009	11:34	1	2.44	0.349	70.53	29.47
	SS-3	5/8/2009	11:34	2	2.44	0.179	83.57	16.43
Averages								
Spring Pool	**SS-1**				**6.30**	**0.12**	**88.80**	**11.20**
Spring Run	**SS-2 & 3**				**2.48**	**0.19**	**82.65**	**17.35**

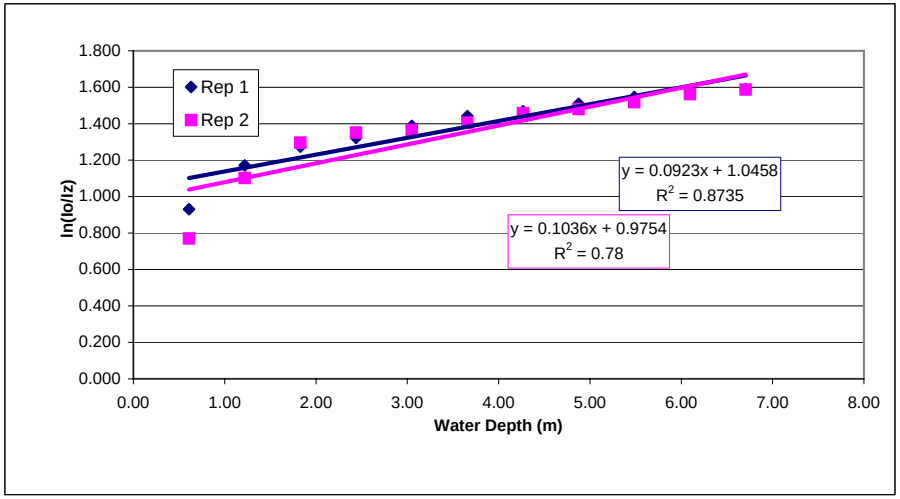
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-1 - 5/4/2009 17:20 (late sun with clouds)

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	651.0	676.8	340.8	5.83			0.03	662.5	688.7	337.5	5.82		
0.61	645.6	671.3	254.6	5.54	0.931	1.526	0.61	598.2	622.4	276.9	5.62	0.770	1.263
1.22	643.4	669.0	199.4	5.30	1.171	0.961	1.22	617.6	642.4	205.2	5.32	1.102	0.904
1.83	657.4	683.4	183.9	5.21	1.274	0.697	1.83	668.6	695.0	183.0	5.21	1.296	0.709
2.44	661.0	687.2	176.1	5.17	1.323	0.542	2.44	652.1	678.0	168.9	5.13	1.351	0.554
3.05	664.6	690.9	165.8	5.11	1.388	0.456	3.05	655.0	681.0	167.1	5.12	1.366	0.448
3.66	660.3	686.4	156.2	5.05	1.442	0.394	3.66	668.6	695.0	163.9	5.10	1.406	0.384
4.27	657.5	683.5	151.5	5.02	1.468	0.344	4.27	665.1	691.4	154.8	5.04	1.458	0.342
4.88	661.5	687.7	146.2	4.98	1.510	0.310	4.88	654.7	680.7	149.0	5.00	1.480	0.304
5.49	665.9	692.2	141.9	4.96	1.546	0.282	5.49	649.6	675.4	142.3	4.96	1.518	0.277
6.10	667.3	693.6	137.8	4.93	1.577	0.259	6.10	645.6	671.3	135.4	4.91	1.562	0.256
6.71	663.2	689.4	135.2	4.91	1.590	0.237	6.71	659.7	685.8	134.9	4.90	1.587	0.237

k (diffuse attenuation coefficient = slope, m-1)			0.092	k (diffuse attenuation coefficient = slope, m-1)		0.104
k average			0.546	k average		0.516
percent transmittance @	1.0	meter	91.18	percent transmittance @	1.0	meter	90.16
Birgean Percentile Absorption (1m)			8.82	Birgean Percentile Absorption (1m)			9.84



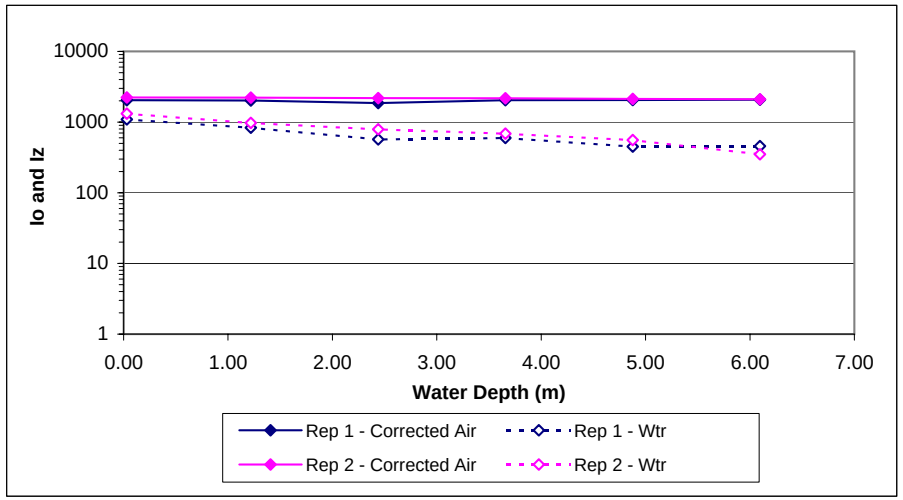


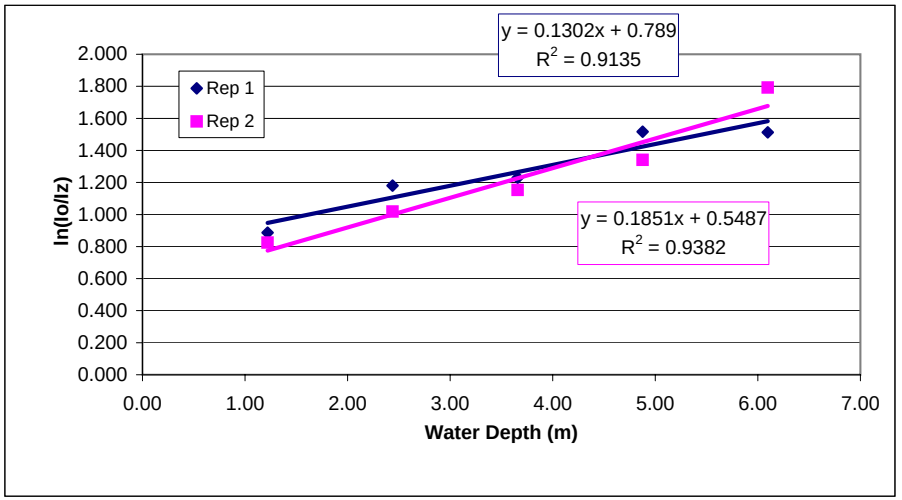
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-1 - 5/5/2009 16:00 (mostly sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,040.9	2,109.0	1,089.0	6.99			0.03	2,223.4	2,297.0	1,316.0	7.18		
1.22	2,020.5	2,088.0	832.2	6.72	0.887	0.728	1.22	2,220.4	2,294.0	973.3	6.88	0.825	0.676
2.44	1,854.6	1,917.0	569.5	6.34	1.181	0.484	2.44	2,183.6	2,256.0	788.7	6.67	1.018	0.418
3.66	2,037.0	2,105.0	595.7	6.39	1.230	0.336	3.66	2,171.9	2,244.0	685.3	6.53	1.154	0.315
4.88	2,054.5	2,123.0	451.0	6.11	1.516	0.311	4.88	2,131.2	2,202.0	557.6	6.32	1.341	0.275
6.10	2,074.9	2,144.0	457.0	6.12	1.513	0.248	6.10	2,106.9	2,177.0	351.0	5.86	1.792	0.294

k (diffuse attenuation coefficient = slope, m-1)			0.130	k (diffuse attenuation coefficient = slope, m-1)		0.185
k average			0.421	k average		0.396
percent transmittance @	1.0	meter	87.79	percent transmittance @	1.0	meter	83.10
Birgean Percentile Absorption (1m)			12.21	Birgean Percentile Absorption (1m)			16.90



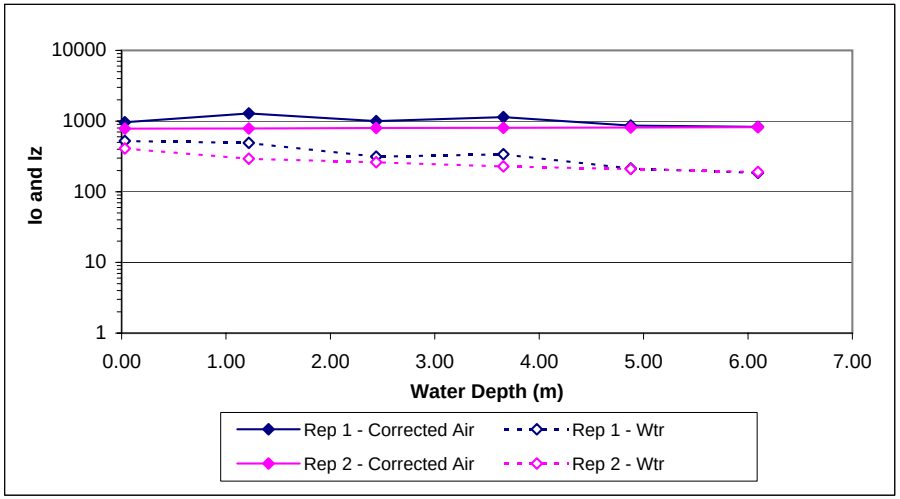


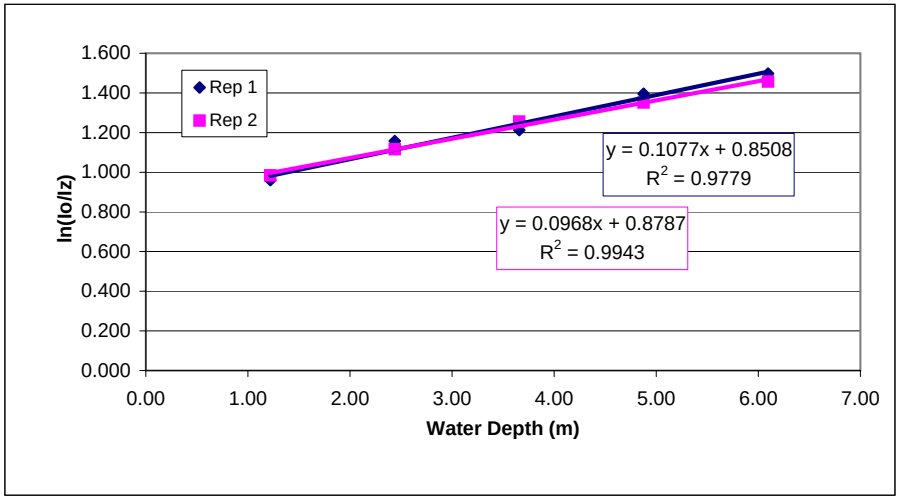
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-1 - 5/7/2009 15:31 (mostly cloudy)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	961.7	997.0	524.2	6.26			0.03	781.3	811.1	409.8	6.02		
1.22	1,282.9	1328.0	491.0	6.20	0.960	0.788	1.22	784.1	814.0	292.9	5.68	0.985	0.808
2.44	997.6	1034.0	313.7	5.75	1.157	0.474	2.44	799.7	830.1	262.1	5.57	1.116	0.457
3.66	1,139.3	1180.0	338.9	5.83	1.212	0.331	3.66	802.5	833.0	228.7	5.43	1.255	0.343
4.88	861.8	894.1	213.4	5.36	1.396	0.286	4.88	811.8	842.5	210.1	5.35	1.352	0.277
6.10	828.3	859.5	185.3	5.22	1.497	0.246	6.10	817.7	848.6	190.5	5.25	1.457	0.239

k (diffuse attenuation coefficient = slope, m-1)			0.108	k (diffuse attenuation coefficient = slope, m-1)	0.097
k average			0.425	k average	0.425
percent transmittance @	1.0	meter	89.79	percent transmittance @ 1.0 meter	90.77
Birgean Percentile Absorption (1m)			10.21	Birgean Percentile Absorption (1m)	9.23



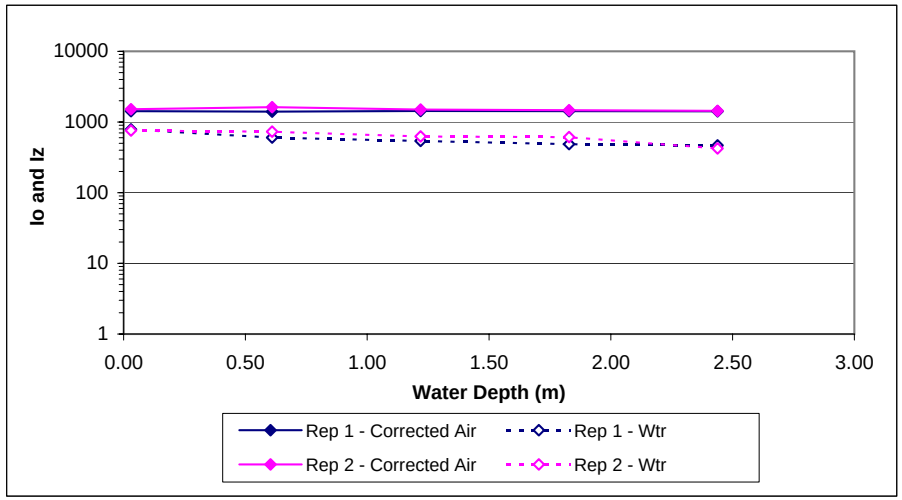


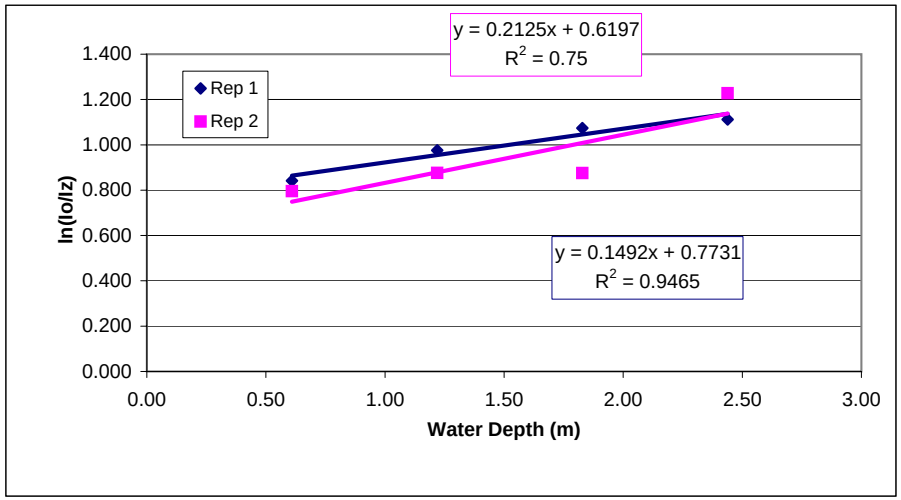
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-2 - 5/4/2009 16:12 (hazy with clouds)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,421.7	1,471.0	783.9	6.66			0.03	1,515.9	1,568.0	758.1	6.63		
0.61	1,399.4	1,448.0	603.4	6.40	0.841	1.380	0.61	1,620.7	1,676.0	731.4	6.59	0.796	1.305
1.22	1,430.5	1,480.0	539.3	6.29	0.975	0.800	1.22	1,498.4	1,550.0	624.1	6.44	0.876	0.718
1.83	1,420.8	1,470.0	485.6	6.19	1.074	0.587	1.83	1,469.3	1,520.0	612.4	6.42	0.875	0.479
2.44	1,414.9	1,464.0	465.5	6.14	1.112	0.456	2.44	1,441.1	1,491.0	422.2	6.05	1.228	0.503

k (diffuse attenuation coefficient = slope, m-1)			0.149	k (diffuse attenuation coefficient = slope, m-1)	0.213
k average			0.806	k average	0.751
percent transmittance @	1.0	meter	86.14	percent transmittance @ 1.0 meter	80.85
Birgean Percentile Absorption (1m)			13.86	Birgean Percentile Absorption (1m)	19.15



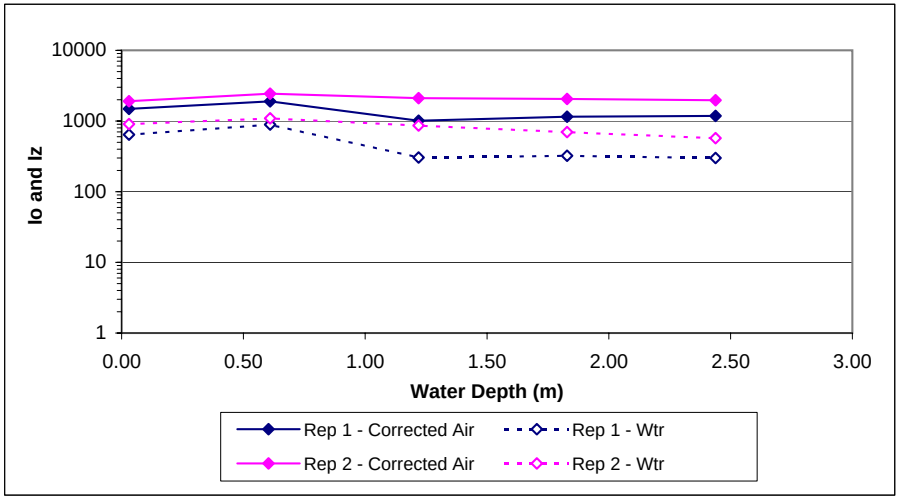


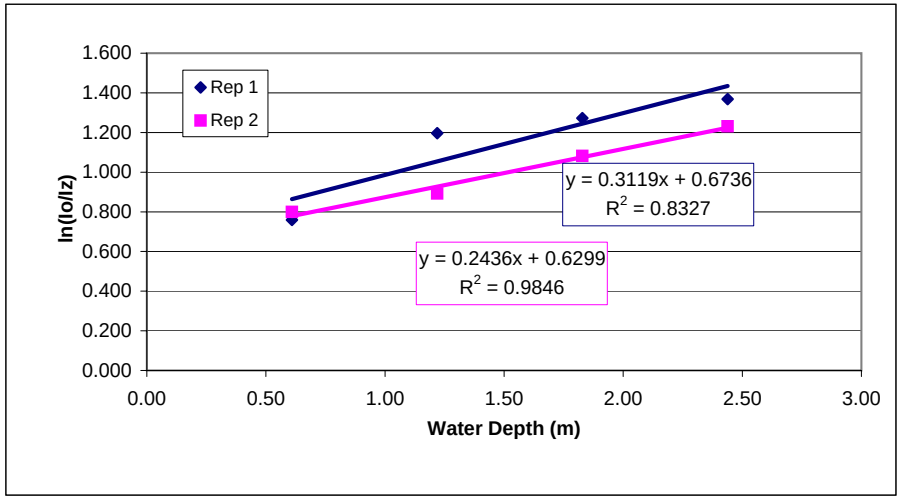
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-2 - 5/5/2009 15:15 (passing clouds)

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,480.9	1,532.0	640.8	6.46			0.03	1,904.1	1,968.0	905.3	6.81		
0.61	1,898.2	1,962.0	888.2	6.79	0.759	1.246	0.61	2,433.0	2,513.0	1,094.0	7.00	0.799	1.311
1.22	1,008.3	1,045.0	304.8	5.72	1.196	0.981	1.22	2,104.0	2,174.0	861.9	6.76	0.892	0.732
1.83	1,149.0	1,190.0	322.0	5.77	1.272	0.696	1.83	2,052.5	2,121.0	695.6	6.54	1.082	0.592
2.44	1,177.2	1,219.0	299.7	5.70	1.368	0.561	2.44	1,962.3	2,028.0	572.9	6.35	1.231	0.505

k (diffuse attenuation coefficient = slope, m-1)			0.312	k (diffuse attenuation coefficient = slope, m-1)		0.244
k average			0.871	k average		0.785
percent transmittance @	1.0	meter	73.20	percent transmittance @	1.0	meter	78.38
Birgean Percentile Absorption (1m)			26.80	Birgean Percentile Absorption (1m)			21.62



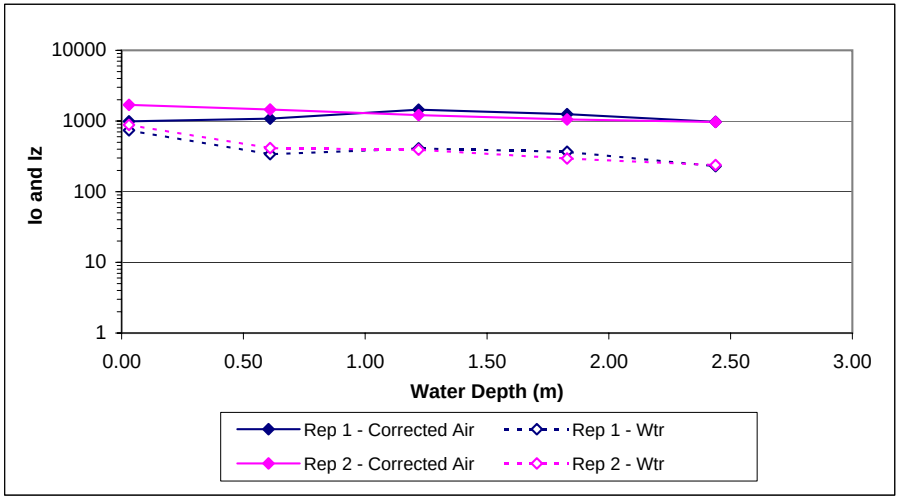


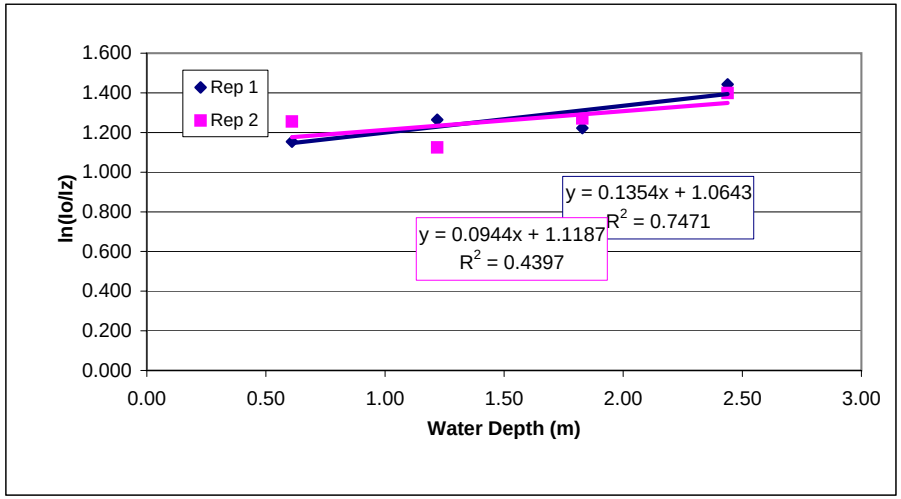
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-2 - 5/7/2009 14:45 (mostly cloudy)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	986.0	1,022.0	736.7	6.60			0.03	1,688.6	1,746.0	882.6	6.78		
0.61	1,078.2	1,117.0	340.2	5.83	1.153	1.892	0.61	1,450.8	1,501.0	413.3	6.02	1.256	2.060
1.22	1,447.0	1,497.0	408.8	6.01	1.264	1.037	1.22	1,212.1	1,255.0	393.6	5.98	1.125	0.923
1.83	1,249.0	1,293.0	367.8	5.91	1.223	0.668	1.83	1,052.0	1,090.0	295.1	5.69	1.271	0.695
2.44	971.4	1,007.0	229.6	5.44	1.442	0.592	2.44	965.6	1,001.0	238.4	5.47	1.399	0.574

k (diffuse attenuation coefficient = slope, m-1)			0.135	k (diffuse attenuation coefficient = slope, m-1)	0.094
k average			1.047	k average	1.063
percent transmittance @	1.0	meter	87.34	percent transmittance @ 1.0 meter	90.99
Birgean Percentile Absorption (1m)			12.66	Birgean Percentile Absorption (1m)	9.01



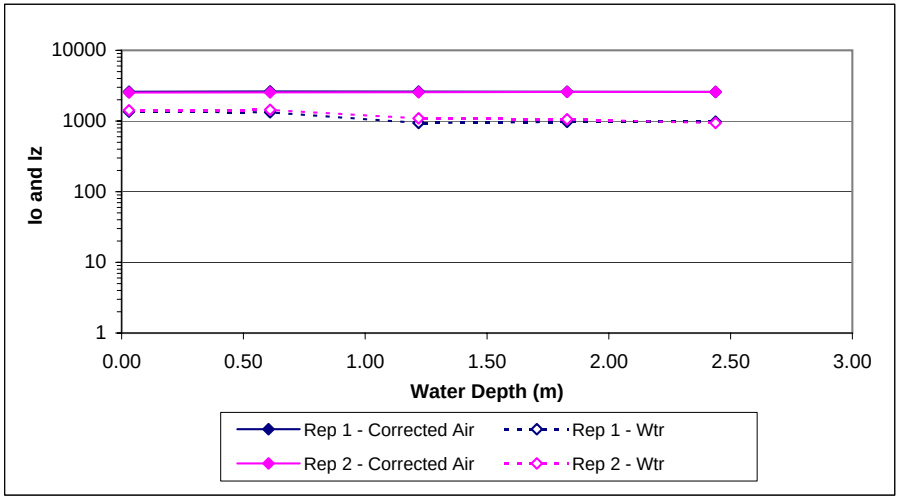


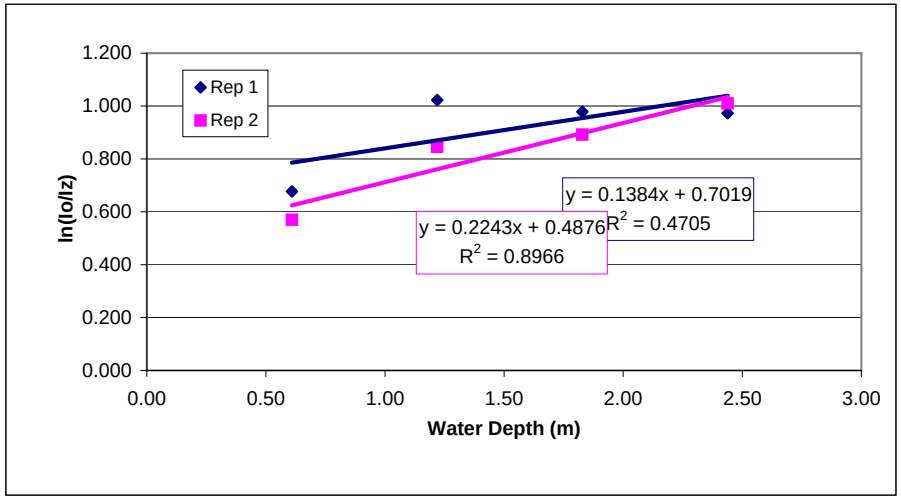
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-2 - 5/8/2009 12:20 (clear and sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,586.3	2,671.0	1,356.0	7.21			0.03	2,525.2	2,608.0	1,414.0	7.25		
0.61	2,621.3	2,707.0	1,332.0	7.19	0.677	1.111	0.61	2,538.8	2,622.0	1,436.0	7.27	0.570	0.935
1.22	2,610.6	2,696.0	938.8	6.84	1.023	0.839	1.22	2,546.5	2,630.0	1,093.0	7.00	0.846	0.694
1.83	2,593.1	2,678.0	974.9	6.88	0.978	0.535	1.83	2,573.7	2,658.0	1,055.0	6.96	0.892	0.488
2.44	2,582.4	2,667.0	976.1	6.88	0.973	0.399	2.44	2,575.6	2,660.0	937.9	6.84	1.010	0.414

k (diffuse attenuation coefficient = slope, m-1)			0.138	k (diffuse attenuation coefficient = slope, m-1)	0.224
k average			0.721	k average	0.633
percent transmittance @	1.0	meter	87.08	percent transmittance @ 1.0 meter	79.91
Birgean Percentile Absorption (1m)			12.92	Birgean Percentile Absorption (1m)	20.09





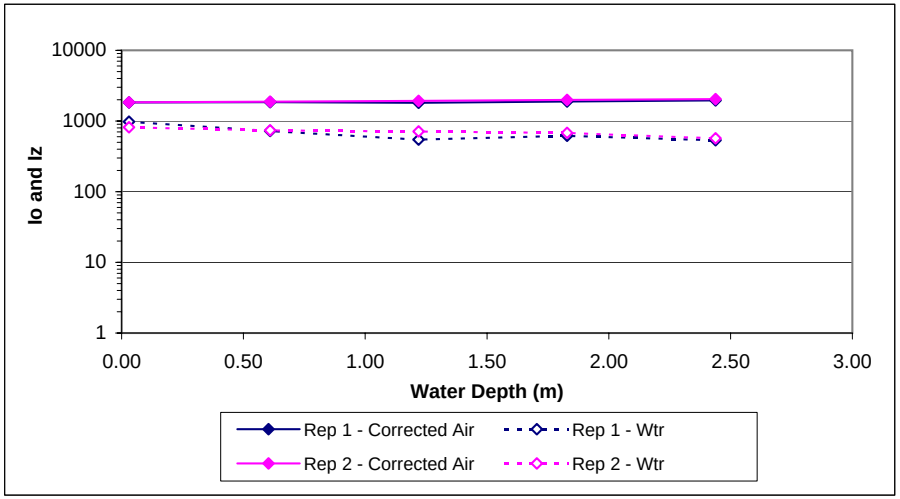
APPENDIX D

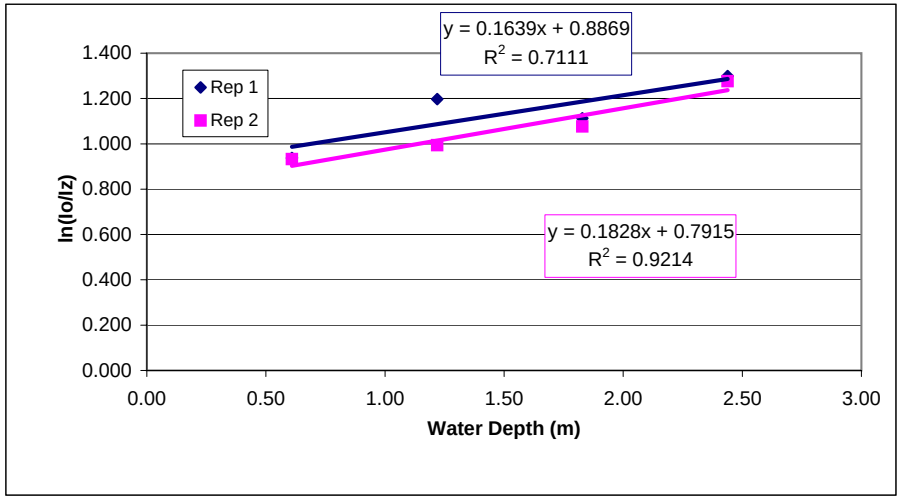
Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-3 - 5/4/2009 15:35 (sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,828.4	1,890.0	977.0	6.88			0.03	1,836.1	1,898.0	815.1	6.70		
0.61	1,845.8	1,908.0	722.6	6.58	0.938	1.538	0.61	1,874.9	1,938.0	737.6	6.60	0.933	1.530
1.22	1,810.9	1,872.0	546.9	6.30	1.197	0.982	1.22	1,923.5	1,988.0	711.9	6.57	0.994	0.815
1.83	1,883.7	1,947.0	619.2	6.43	1.113	0.608	1.83	1,990.4	2,057.0	678.2	6.52	1.077	0.589
2.44	1,955.5	2,021.0	533.4	6.28	1.299	0.533	2.44	2,040.9	2,109.0	569.3	6.34	1.277	0.524

k (diffuse attenuation coefficient = slope, m-1)			0.164
k average			0.915
percent transmittance @	1.0	meter	84.88
Birgean Percentile Absorption (1m)			15.12

k (diffuse attenuation coefficient = slope, m-1)			0.183
k average			0.864
percent transmittance @	1.0	meter	83.30
Birgean Percentile Absorption (1m)			16.70



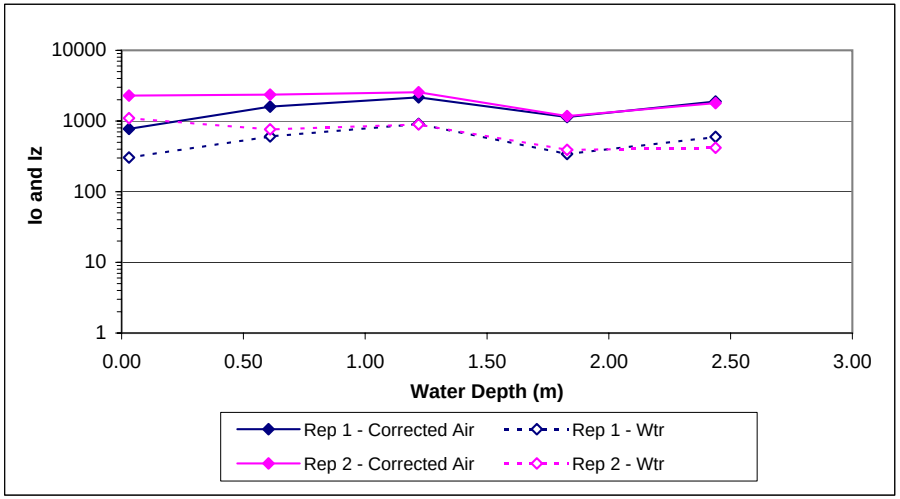


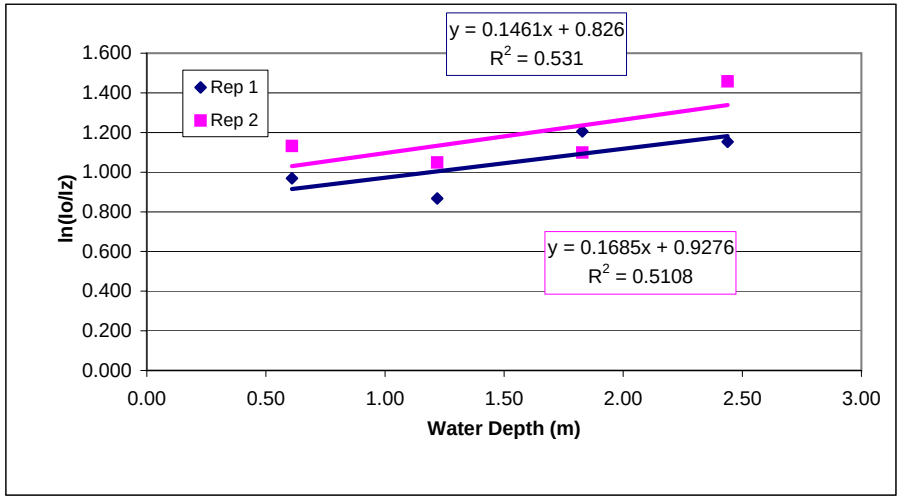
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-3 - 5/5/2009 14:36 (passing clouds)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	774.3	803.9	304.4	5.72			0.03	2,289.3	2,365.0	1,097.0	7.00		
0.61	1,592.5	1,647.0	604.3	6.40	0.969	1.590	0.61	2,363.1	2,441.0	761.7	6.64	1.132	1.857
1.22	2,159.3	2,231.0	907.2	6.81	0.867	0.711	1.22	2,552.4	2,636.0	894.4	6.80	1.049	0.860
1.83	1,139.3	1,180.0	341.4	5.83	1.205	0.659	1.83	1,172.3	1,214.0	390.7	5.97	1.099	0.601
2.44	1,884.7	1,948.0	594.8	6.39	1.153	0.473	2.44	1,793.4	1,854.0	417.4	6.03	1.458	0.598

k (diffuse attenuation coefficient = slope, m-1)			0.146	k (diffuse attenuation coefficient = slope, m-1)	0.168
k average			0.858	k average	0.979
percent transmittance @	1.0	meter	86.41	percent transmittance @ 1.0 meter	84.49
Birgean Percentile Absorption (1m)			13.59	Birgean Percentile Absorption (1m)	15.51



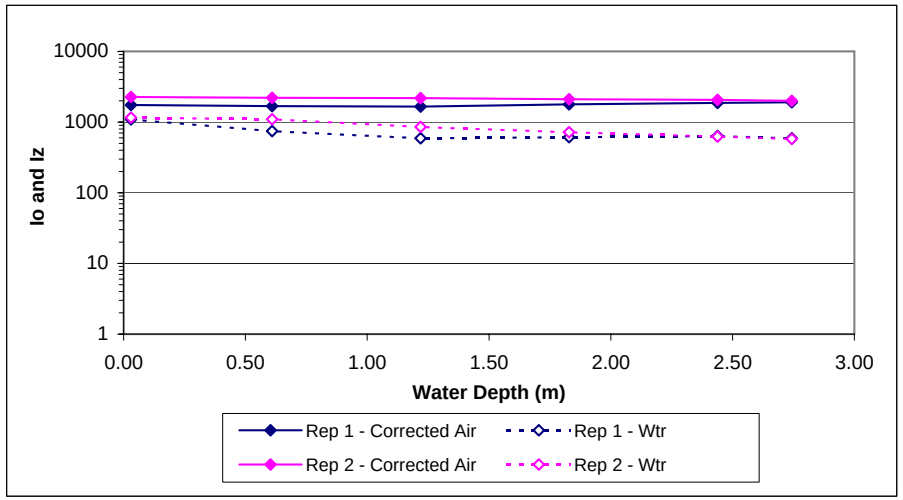


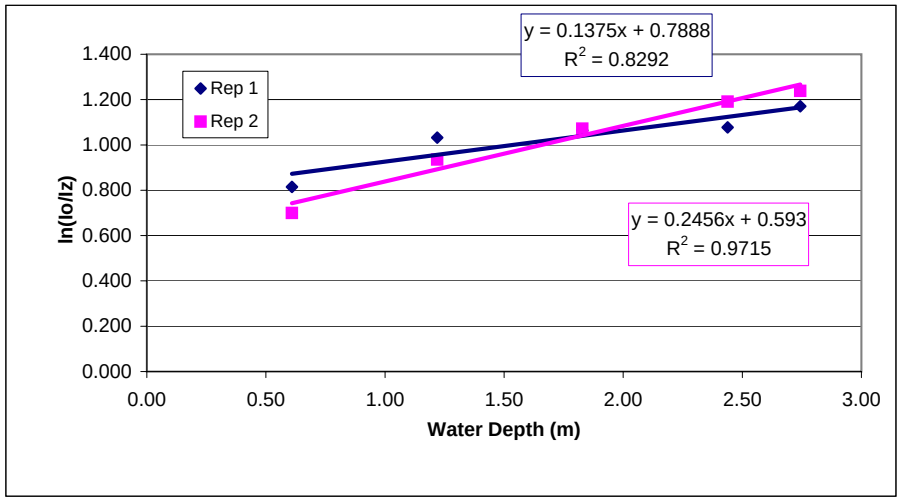
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-3 - 5/7/2009 13:35 (mostly sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,741.0	1,800.0	1,091.0	6.99			0.03	2,261.2	2,336.0	1,158.0	7.05		
0.61	1,682.8	1,740.0	745.0	6.61	0.815	1.337	0.61	2,207.8	2,281.0	1,097.0	7.00	0.699	1.147
1.22	1,652.7	1,709.0	588.7	6.38	1.032	0.847	1.22	2,181.6	2,254.0	855.8	6.75	0.936	0.768
1.83	1,776.9	1,837.0	613.0	6.42	1.064	0.582	1.83	2,102.0	2,172.0	720.0	6.58	1.071	0.586
2.44	1,867.2	1,930.0	635.7	6.45	1.077	0.442	2.44	2,059.3	2,128.0	625.9	6.44	1.191	0.488
2.74	1,905.0	1,969.0	591.0	6.38	1.170	0.427	2.74	1,996.3	2,063.0	578.5	6.36	1.239	0.452

k (diffuse attenuation coefficient = slope, m-1)			0.137	k (diffuse attenuation coefficient = slope, m-1)		0.246
k average			0.727	k average		0.688
percent transmittance @	1.0	meter	87.16	percent transmittance @	1.0	meter	78.22
Birgean Percentile Absorption (1m)			12.84	Birgean Percentile Absorption (1m)			21.78



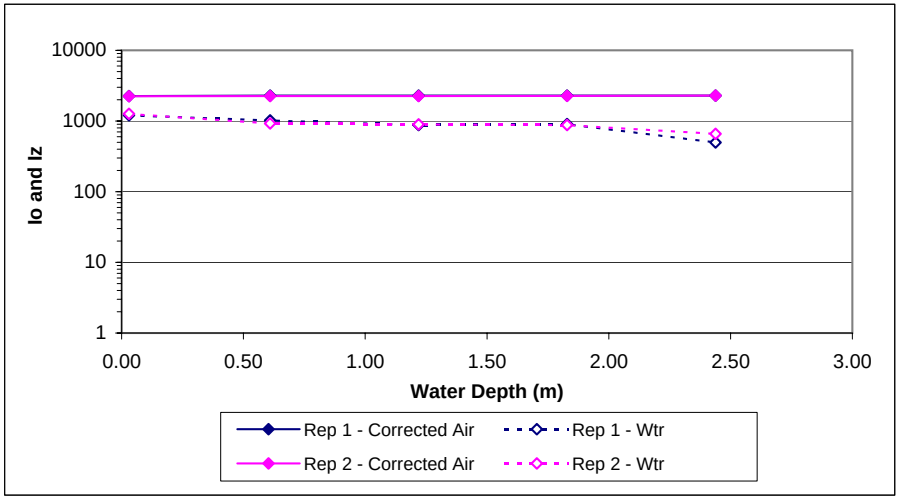


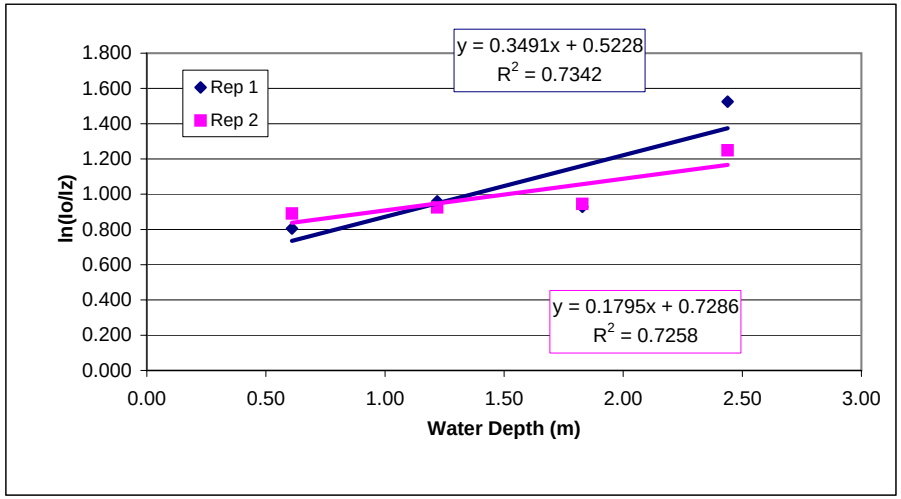
APPENDIX D

Silver Springs (Marion Co.) PAR ATTENUATION ESTIMATES - SS-3 - 5/8/2009 11:34 (sunny overhead)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,257.3	2,332.0	1,206.0	7.10			0.03	2,245.7	2,320.0	1,260.0	7.14		
0.61	2,282.6	2,358.0	1,020.0	6.93	0.805	1.321	0.61	2,250.5	2,325.0	923.8	6.83	0.890	1.461
1.22	2,283.5	2,359.0	874.5	6.77	0.960	0.787	1.22	2,254.4	2,329.0	893.9	6.80	0.925	0.759
1.83	2,290.3	2,366.0	904.9	6.81	0.929	0.508	1.83	2,260.2	2,335.0	878.8	6.78	0.945	0.517
2.44	2,283.5	2,359.0	496.8	6.21	1.525	0.626	2.44	2,290.3	2,366.0	657.1	6.49	1.249	0.512

k (diffuse attenuation coefficient = slope, m-1)			0.349	k (diffuse attenuation coefficient = slope, m-1)	0.179
k average			0.810	k average	0.812
percent transmittance @	1.0	meter	70.53	percent transmittance @ 1.0 meter	83.57
Birgean Percentile Absorption (1m)			29.47	Birgean Percentile Absorption (1m)	16.43





APPENDIX D

Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES (Apr 2009)

Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	WAK-1	4/13/2009	15:45	1	1.52	1.619	19.82	80.18
	WAK-1	4/13/2009	15:45	2	1.52	1.784	16.79	83.21
	WAK-1	4/14/2009	14:44	1	2.44	1.358	25.72	74.28
	WAK-1	4/14/2009	14:44	2	2.44	1.334	26.35	73.65
	WAK-1	4/15/2009	14:30	1	2.44	1.894	15.05	84.95
	WAK-1	4/15/2009	14:30	2	2.44	2.098	12.27	87.73
Spring Run	WAK-2	4/13/2009	17:05	1	1.52	1.682	18.59	81.41
	WAK-2	4/13/2009	17:05	2	1.52	1.637	19.46	80.54
	WAK-2	4/14/2009	13:00	1	1.83	1.538	21.48	78.52
	WAK-2	4/14/2009	13:00	2	1.83	1.613	19.94	80.06
	WAK-2	4/15/2009	14:44	1	1.22	1.814	16.31	83.69
	WAK-2	4/15/2009	14:44	2	1.22	1.997	13.57	86.43
	WAK-3	4/13/2009	14:57	1	1.22	1.554	21.14	78.86
	WAK-3	4/13/2009	14:57	2	1.22	1.714	18.02	81.98
	WAK-3	4/14/2009	12:45	1	1.22	1.548	21.26	78.74
	WAK-3	4/14/2009	12:45	2	1.22	2.096	12.30	87.70
	WAK-3	4/15/2009	16:00	1	1.22	1.648	19.23	80.77
	WAK-3	4/15/2009	16:00	2	1.22	1.431	23.90	76.10
Averages								
Spring Pool	**WAK-1**				**2.13**	**1.68**	**19.33**	**80.67**
Spring Run	**WAK-2 & 3**				**1.37**	**1.69**	**18.77**	**81.23**

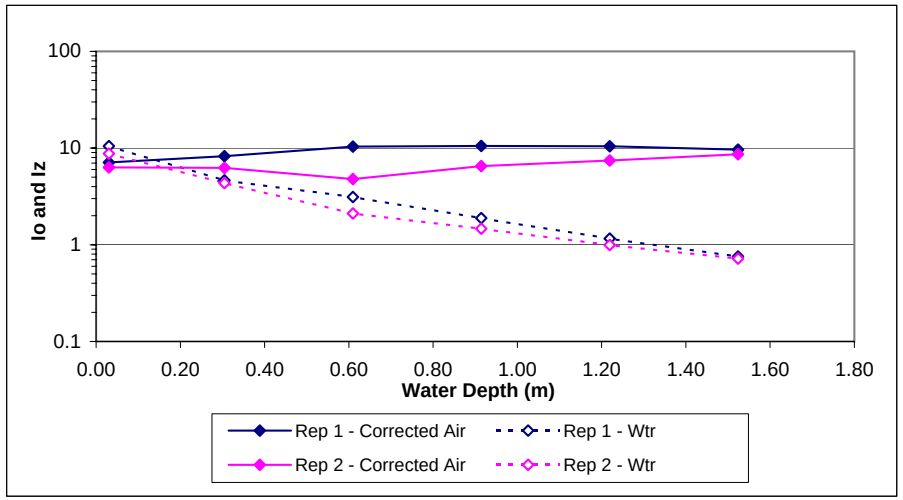
APPENDIX D

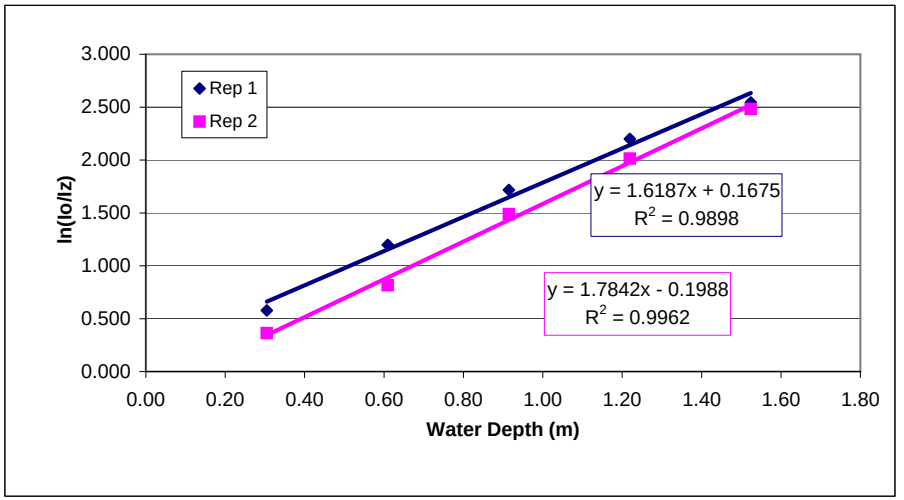
Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-1 - 4/13/2009 15:45 (very cloudy overhead and tannic water)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	7.1	13.38	10.47	2.35			0.03	6.3	12.6	8.8	2.17		
0.30	8.3	14.57	4.63	1.53	0.578	1.898	0.30	6.2	12.5	4.3	1.47	0.363	1.190
0.61	10.3	16.72	3.12	1.14	1.198	1.966	0.61	4.8	11.0	2.1	0.75	0.816	1.339
0.91	10.5	16.91	1.89	0.64	1.717	1.878	0.91	6.5	12.8	1.5	0.39	1.488	1.627
1.22	10.5	16.84	1.16	0.15	2.199	1.804	1.22	7.5	13.7	1.0	-0.01	2.013	1.651
1.52	9.6	15.99	0.756	-0.28	2.545	1.670	1.52	8.6	15.0	0.7	-0.33	2.483	1.629

k (diffuse attenuation coefficient = slope, m-1)			1.619
k average			1.843
percent transmittance @	1.0	meter	19.82
Birgean Percentile Absorption (1m)			80.18

k (diffuse attenuation coefficient = slope, m-1)			1.784
k average			1.487
percent transmittance @	1.0	meter	16.79
Birgean Percentile Absorption (1m)			83.21





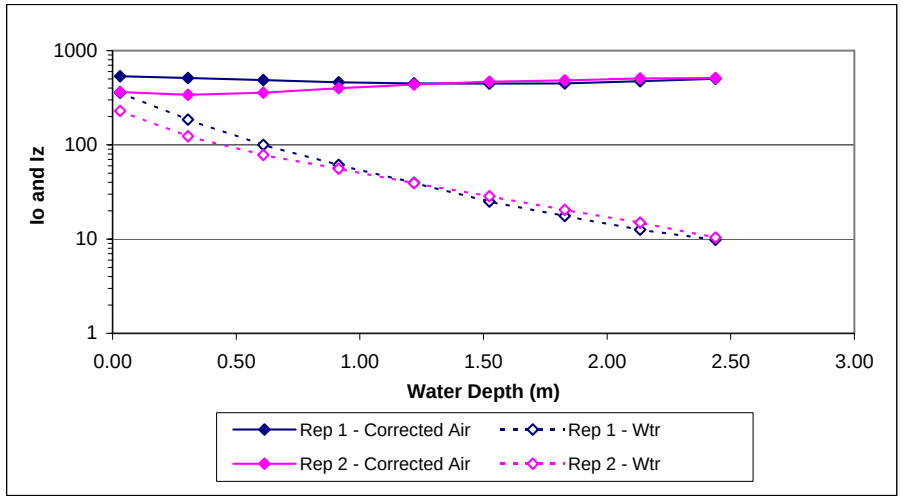
APPENDIX D

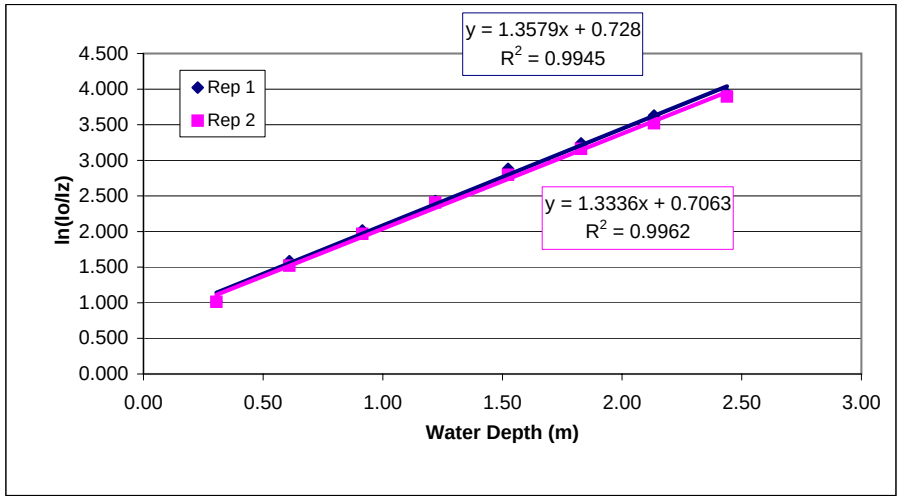
Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-1 - 4/14/2009 11:55 (cloudy)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	535.8	558.2	358.3	5.88			0.03	364.0	381.1	228.8	5.43		
0.30	511.8	533.4	185.4	5.22	1.015	3.331	0.30	340.0	356.4	123.5	4.82	1.013	3.323
0.61	487.7	508.6	100.0	4.61	1.585	2.599	0.61	357.1	374.0	78.0	4.36	1.521	2.495
0.91	460.4	480.5	61.3	4.12	2.016	2.205	0.91	399.7	417.9	55.9	4.02	1.968	2.152
1.22	449.0	468.7	39.6	3.68	2.429	1.992	1.22	436.4	455.7	39.2	3.67	2.409	1.976
1.52	446.7	466.3	25.1	3.22	2.880	1.890	1.52	467.9	488.2	28.6	3.35	2.797	1.835
1.83	448.7	468.4	17.6	2.87	3.237	1.770	1.83	482.6	503.3	20.5	3.02	3.161	1.728
2.13	474.7	495.2	12.6	2.53	3.629	1.701	2.13	505.8	527.2	15.0	2.71	3.520	1.650
2.44	503.0	524.4	9.8	2.29	3.934	1.613	2.44	512.3	533.9	10.4	2.34	3.896	1.598

k (diffuse attenuation coefficient = slope, m-1)			1.358	
k average			2.138	
percent transmittance @	1.0	meter	25.72	
Birgean Percentile Absorption (1m)			74.28	

k (diffuse attenuation coefficient = slope, m-1)			1.334
k average			2.095
percent transmittance @	1.0	meter	26.35
Birgean Percentile Absorption (1m)			73.65





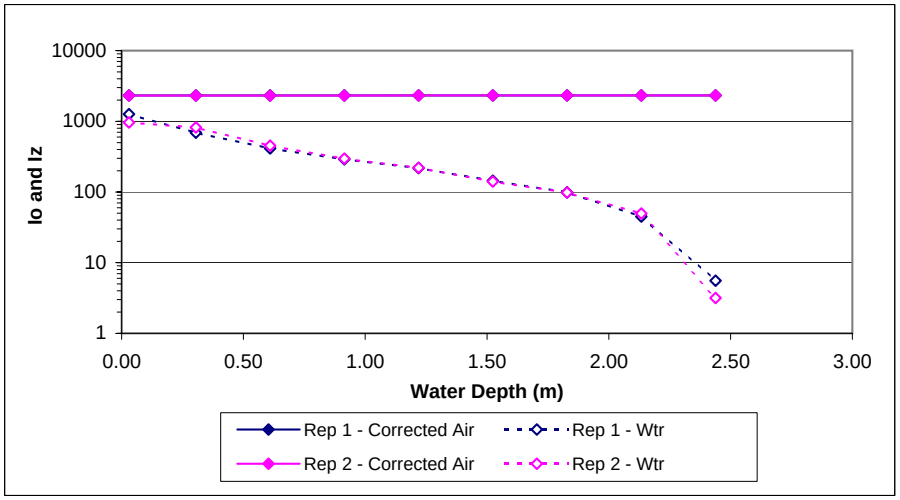
APPENDIX D

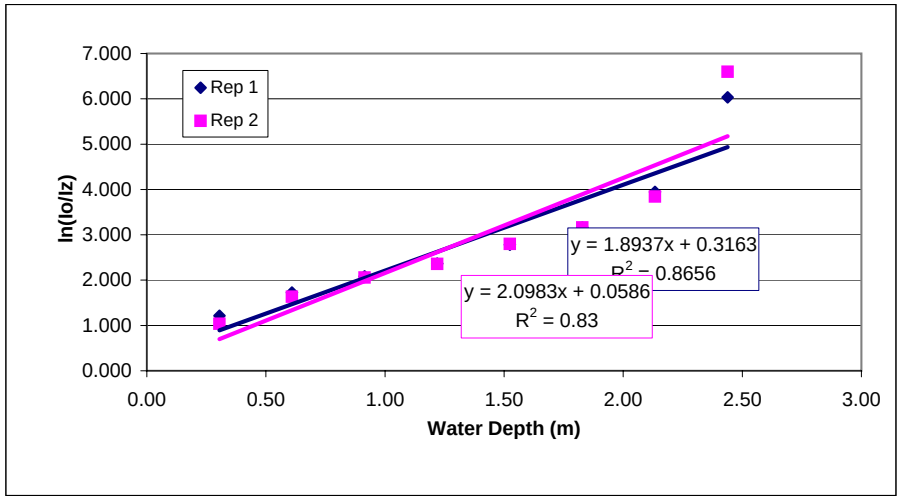
Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-1 - 4/15/2009 12:02 (clear and sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,329.1	2406.0	1264.0	7.14			0.03	2,317.5	2,394.0	962.6	6.87		
0.30	2,327.2	2404.0	690.8	6.54	1.215	3.985	0.30	2,317.5	2,394.0	820.4	6.71	1.038	3.407
0.61	2,325.3	2402.0	414.1	6.03	1.725	2.831	0.61	2,313.6	2,390.0	451.4	6.11	1.634	2.681
0.91	2,325.3	2402.0	289.8	5.67	2.082	2.277	0.91	2,317.5	2,394.0	296.2	5.69	2.057	2.250
1.22	2,326.2	2403.0	218.3	5.39	2.366	1.941	1.22	2,319.4	2,396.0	219.7	5.39	2.357	1.933
1.52	2,324.3	2401.0	144.2	4.97	2.780	1.824	1.52	2,319.4	2,396.0	140.9	4.95	2.801	1.838
1.83	2,323.3	2400.0	98.5	4.59	3.161	1.729	1.83	2,320.4	2,397.0	98.2	4.59	3.163	1.729
2.13	2,320.4	2397.0	44.8	3.80	3.947	1.850	2.13	2,322.3	2,399.0	49.7	3.91	3.845	1.802
2.44	2,320.4	2397.0	5.6	1.72	6.033	2.474	2.44	2,321.4	2,398.0	3.2	1.15	6.596	2.705

k (diffuse attenuation coefficient = slope, m-1)			1.894	
k average			2.364	
percent transmittance @	1.0	meter	15.05	
Birgean Percentile Absorption (1m)			84.95	

k (diffuse attenuation coefficient = slope, m-1)			2.098
k average			2.293
percent transmittance @	1.0	meter	12.27
Birgean Percentile Absorption (1m)			87.73



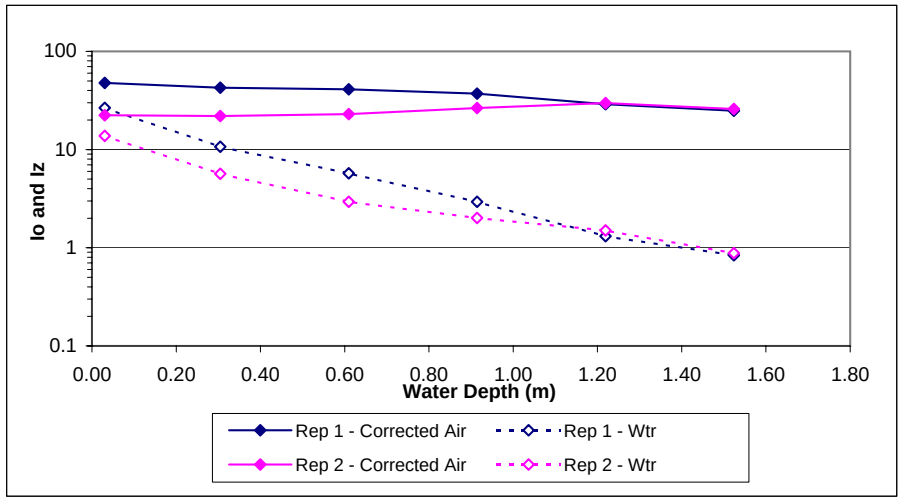


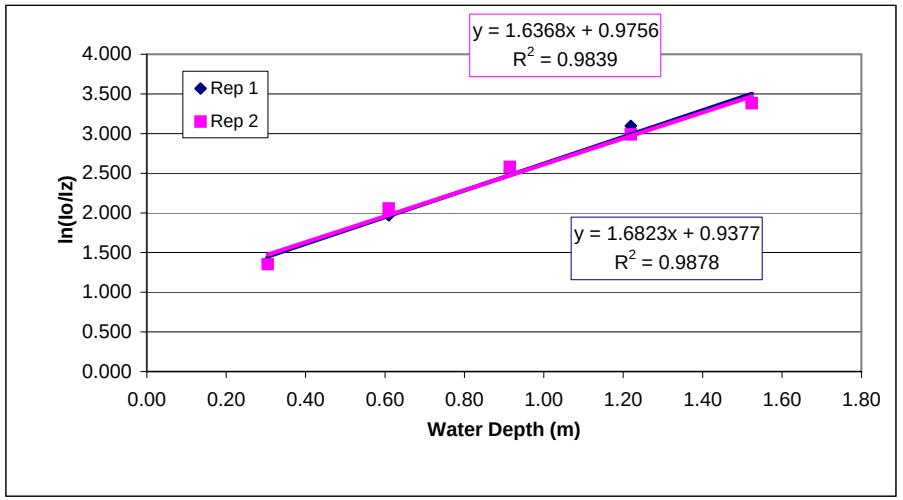
APPENDIX D

Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-2 - 4/13/2009 15:29 (very cloudy overhead and tannic water)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	47.8	55.3	26.6	3.28			0.03	22.4	29.1	13.8	2.62		
0.30	42.7	50.1	10.7	2.37	1.387	4.550	0.30	21.9	28.7	5.7	1.73	1.354	4.444
0.61	41.2	48.5	5.7	1.75	1.972	3.234	0.61	23.0	29.7	2.9	1.08	2.056	3.373
0.91	37.2	44.4	2.9	1.08	2.537	2.774	0.91	26.5	33.4	2.0	0.70	2.579	2.821
1.22	29.0	35.9	1.3	0.27	3.097	2.540	1.22	29.8	36.8	1.5	0.41	2.989	2.452
1.52	24.9	31.7	0.8	-0.17	3.388	2.223	1.52	25.9	32.8	0.9	-0.13	3.382	2.219

k (diffuse attenuation coefficient = slope, m-1)			1.682	k (diffuse attenuation coefficient = slope, m-1)		1.637
k average			3.064	k average		3.062
percent transmittance @	1.0	meter	18.59	percent transmittance @	1.0	meter	19.46
Birgean Percentile Absorption (1m)			81.41	Birgean Percentile Absorption (1m)			80.54





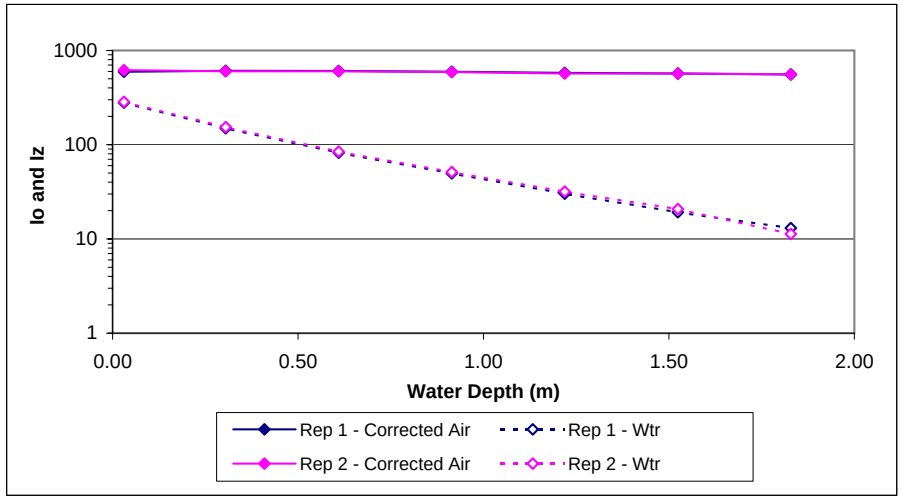
APPENDIX D

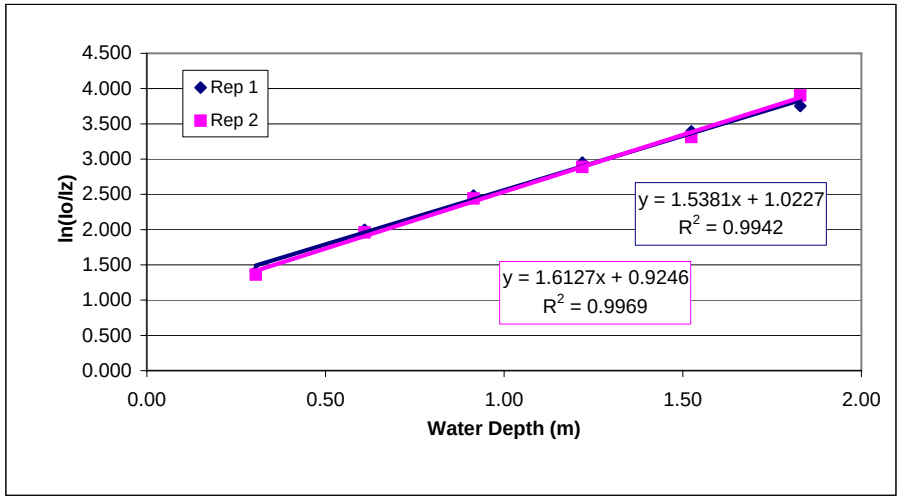
Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-2 - 4/14/2009 11:20 (cloudy)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	594.2	618.3	279.4	5.63			0.03	617.8	642.6	285.0	5.65		
0.30	608.0	632.5	149.5	5.01	1.403	4.602	0.30	601.2	625.5	153.9	5.04	1.363	4.470
0.61	606.7	631.2	82.3	4.41	1.998	3.277	0.61	601.2	625.5	84.6	4.44	1.961	3.217
0.91	595.6	619.8	49.7	3.91	2.483	2.715	0.91	589.9	613.9	51.3	3.94	2.443	2.671
1.22	579.3	603.0	30.3	3.41	2.951	2.420	1.22	570.1	593.5	31.8	3.46	2.888	2.369
1.52	570.6	594.0	19.2	2.95	3.392	2.226	1.52	570.4	593.8	20.8	3.03	3.312	2.173
1.83	555.9	578.9	13.0	2.57	3.754	2.053	1.83	559.1	582.2	11.3	2.42	3.903	2.134

k (diffuse attenuation coefficient = slope, m-1)			1.538	
k average			2.882	
percent transmittance @	1.0	meter	21.48	
Birgean Percentile Absorption (1m)			78.52	

k (diffuse attenuation coefficient = slope, m-1)			1.613
k average			2.839
percent transmittance @	1.0	meter	19.94
Birgean Percentile Absorption (1m)			80.06



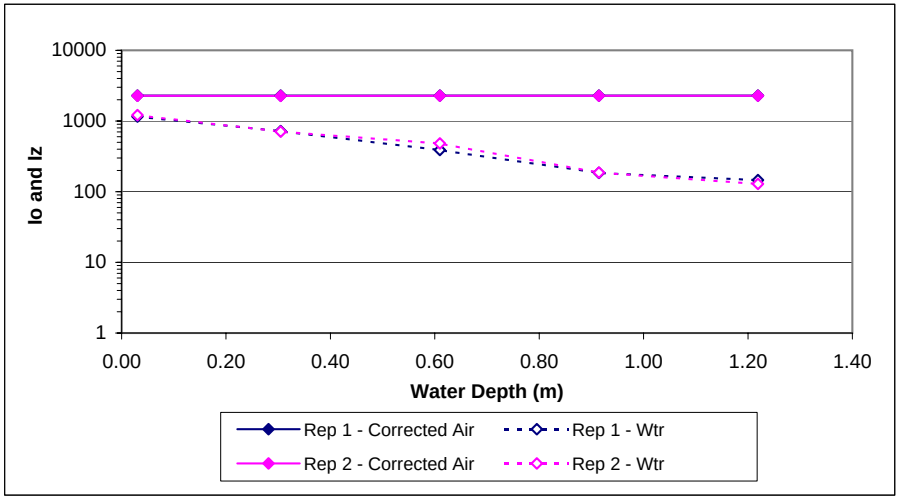


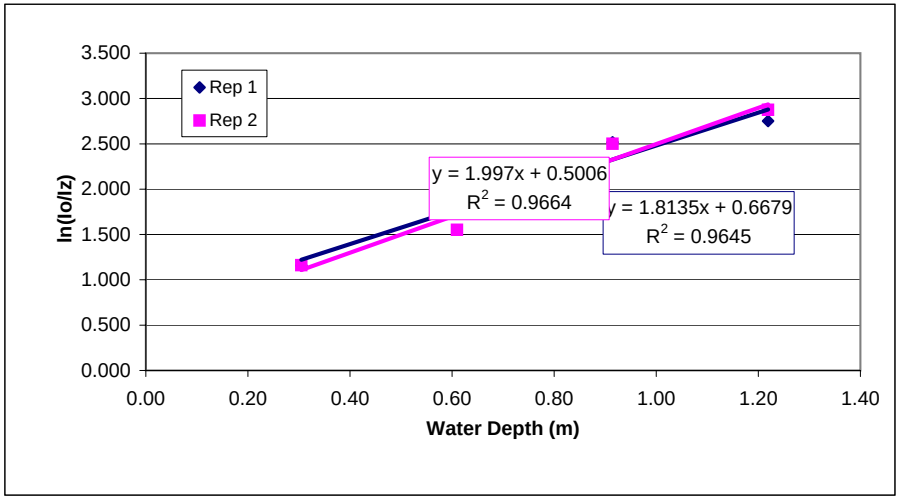
APPENDIX D

Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-2 - 4/15/2009 11:45 (clear and sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,286.4	2,362.0	1,158.0	7.05			0.03	2,272.9	2,348.0	1,214.0	7.10		
0.30	2,287.4	2,363.0	719.0	6.58	1.157	3.797	0.30	2,265.1	2,340.0	708.6	6.56	1.162	3.813
0.61	2,285.5	2,361.0	388.0	5.96	1.773	2.909	0.61	2,271.9	2,347.0	481.4	6.18	1.552	2.545
0.91	2,284.5	2,360.0	184.5	5.22	2.516	2.752	0.91	2,273.8	2,349.0	186.5	5.23	2.501	2.735
1.22	2,282.6	2,358.0	145.6	4.98	2.752	2.257	1.22	2,278.7	2,354.0	128.6	4.86	2.875	2.358

k (diffuse attenuation coefficient = slope, m-1)			1.814	k (diffuse attenuation coefficient = slope, m-1)	1.997
k average			2.929	k average	2.863
percent transmittance @	1.0	meter	16.31	percent transmittance @ 1.0 meter	13.57
Birgean Percentile Absorption (1m)			83.69	Birgean Percentile Absorption (1m)	86.43



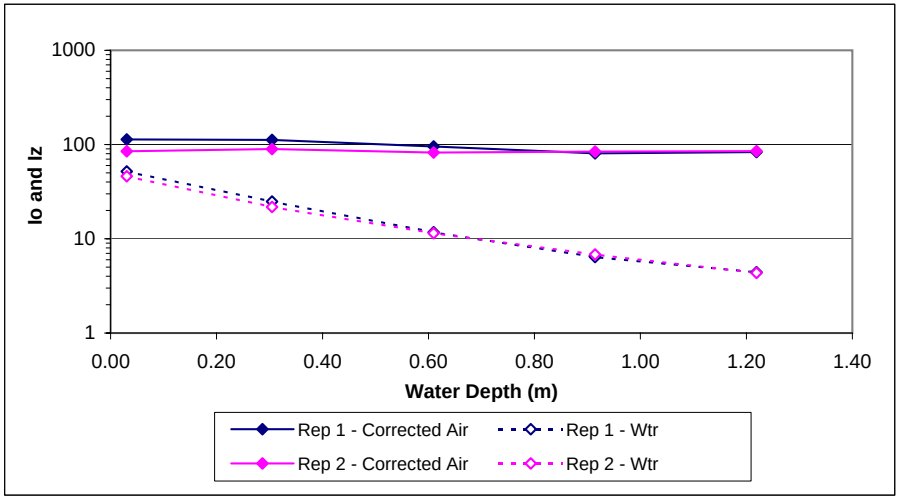


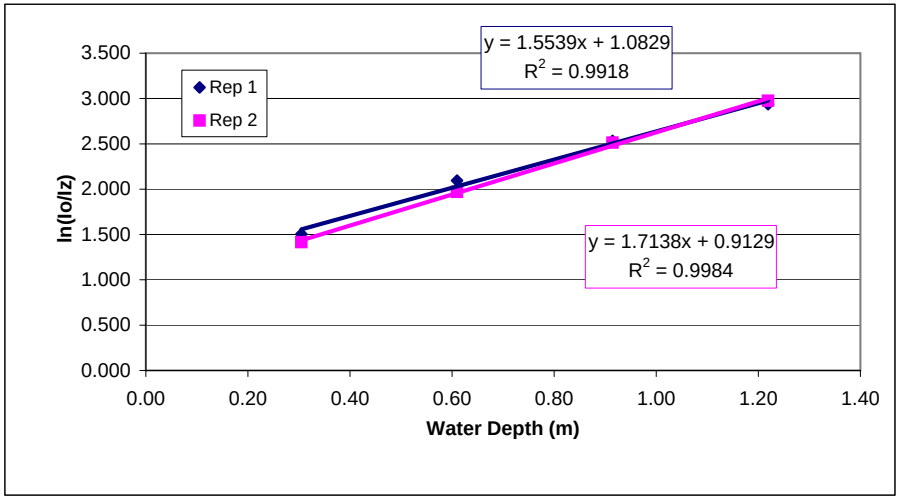
APPENDIX D

Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-3 - 4/13/2009 14:45 (very cloudy and tannic water)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	113.5	123.0	51.9	3.95			0.03	84.9	93.5	46.2	3.83		
0.30	111.8	121.3	24.9	3.21	1.504	4.935	0.30	89.6	98.4	21.7	3.08	1.416	4.647
0.61	95.3	104.3	11.7	2.46	2.094	3.436	0.61	82.1	90.7	11.5	2.44	1.970	3.231
0.91	80.6	89.2	6.4	1.86	2.532	2.769	0.91	84.1	92.8	6.8	1.92	2.513	2.748
1.22	83.2	91.8	4.4	1.48	2.937	2.409	1.22	85.3	94.0	4.4	1.47	2.977	2.441

k (diffuse attenuation coefficient = slope, m-1)			1.554	k (diffuse attenuation coefficient = slope, m-1)	1.714
k average			3.387	k average	3.267
percent transmittance @	1.0	meter	21.14	percent transmittance @ 1.0 meter	18.02
Birgean Percentile Absorption (1m)			78.86	Birgean Percentile Absorption (1m)	81.98





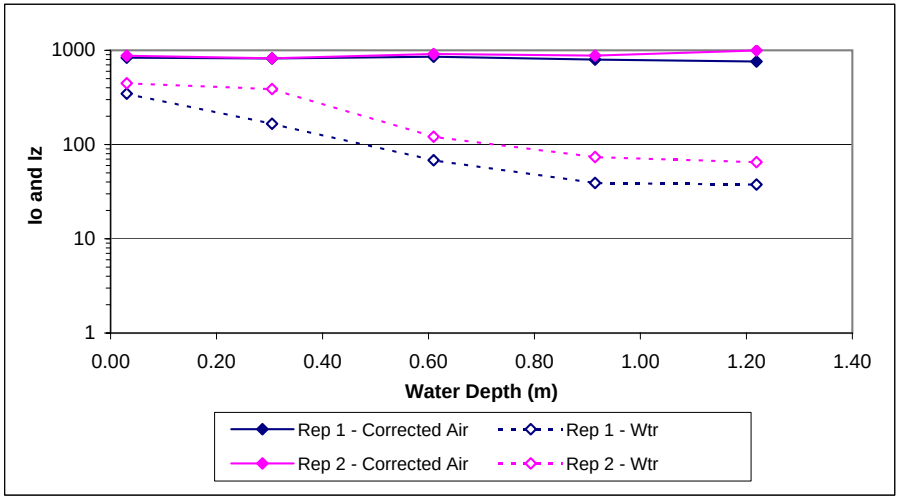
APPENDIX D

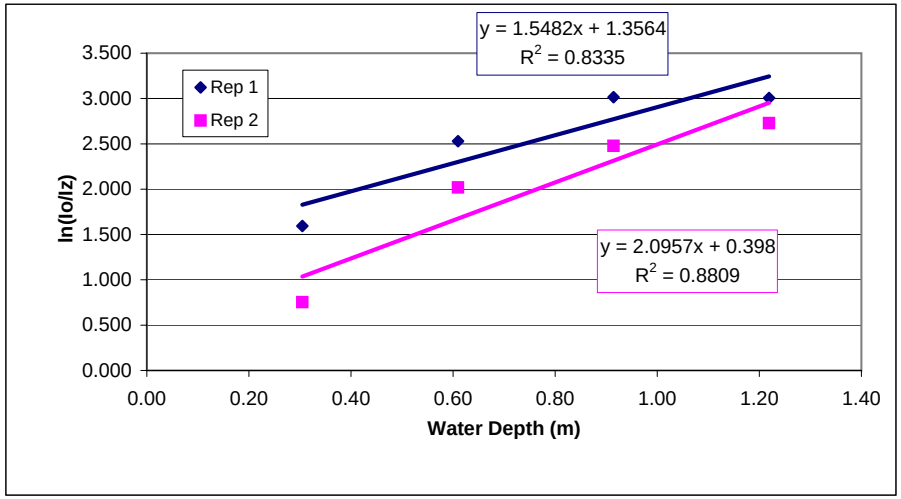
Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-3 - 4/14/2009 14:33 cloudy overhead

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	835.4	866.9	346.1	5.85			0.03	874.8	907.5	447.4	6.10		
0.30	819.2	850.2	166.3	5.11	1.595	5.232	0.30	823.9	855.0	388.1	5.96	0.753	2.470
0.61	855.8	887.9	68.2	4.22	2.530	4.150	0.61	914.3	948.2	121.3	4.80	2.020	3.314
0.91	795.8	826.1	39.1	3.67	3.014	3.296	0.91	878.9	911.7	73.8	4.30	2.478	2.710
1.22	760.8	790.0	37.7	3.63	3.006	2.466	1.22	997.6	1,034.0	65.1	4.18	2.729	2.239

k (diffuse attenuation coefficient = slope, m-1)			1.548	
k average			3.786	
percent transmittance @	1.0	meter	21.26	
Birgean Percentile Absorption (1m)			78.74	

k (diffuse attenuation coefficient = slope, m-1)			2.096	
k average			2.683	
percent transmittance @	1.0	meter	12.30	
Birgean Percentile Absorption (1m)			87.70	



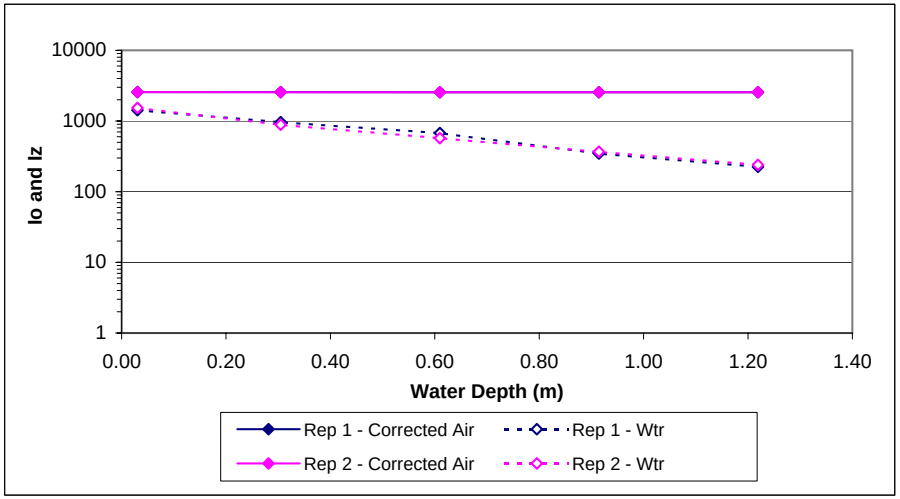


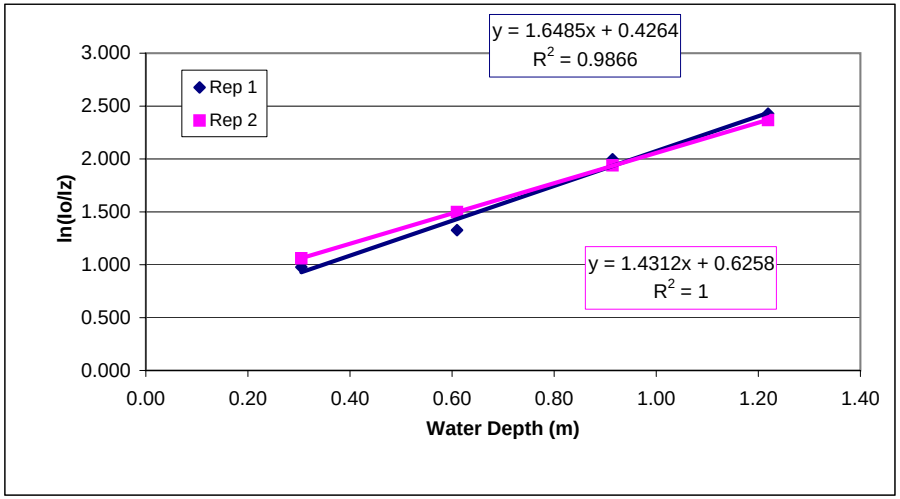
APPENDIX D

Wakulla Springs (Wakulla Co.) PAR ATTENUATION ESTIMATES - WAK-3 - 4/15/2009 14:00 (sunny)

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,562.1	2,646.0	1,421.0	7.26			0.03	2,564.0	2,648.0	1,528.0	7.33		
0.30	2,559.1	2,643.0	963.2	6.87	0.977	3.206	0.30	2,556.2	2,640.0	884.7	6.79	1.061	3.481
0.61	2,552.4	2,636.0	676.9	6.52	1.327	2.177	0.61	2,554.3	2,638.0	571.6	6.35	1.497	2.456
0.91	2,550.4	2,634.0	346.3	5.85	1.997	2.184	0.91	2,551.4	2,635.0	366.7	5.90	1.940	2.121
1.22	2,549.4	2,633.0	224.7	5.41	2.429	1.992	1.22	2,549.4	2,633.0	238.9	5.48	2.368	1.942

k (diffuse attenuation coefficient = slope, m-1)			1.648	k (diffuse attenuation coefficient = slope, m-1)	1.431
k average			2.390	k average	2.500
percent transmittance @	1.0	meter	19.23	percent transmittance @ 1.0 meter	23.90
Birgean Percentile Absorption (1m)			80.77	Birgean Percentile Absorption (1m)	76.10





APPENDIX D

Weeki Wachee Springs (Hernando Co.) PAR ATTENUATION ESTIMATES (March 2009)

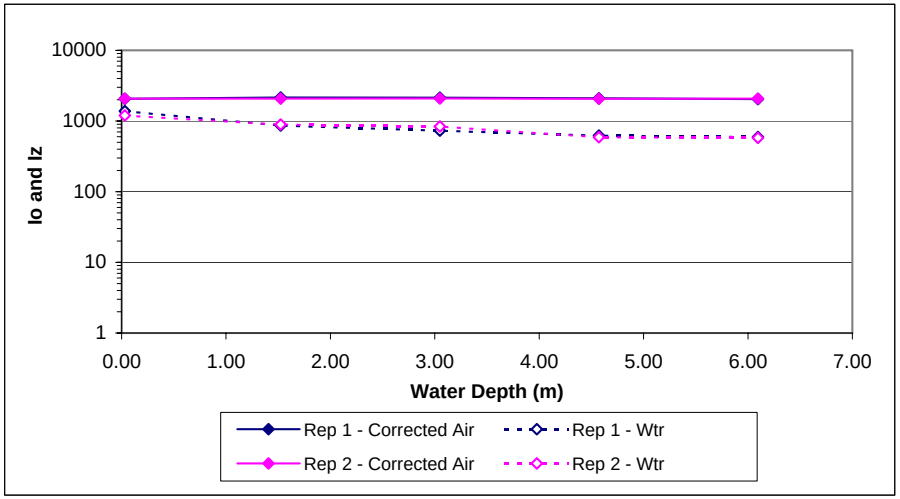
Location	Station	Date	Time	Rep	Max Depth (m)	PAR attenuation coefficient (k/m)	Percent Transmittance (1m)	Birgean Percentile Absorption (1m)
Spring Pool	WWS-1	3/9/2009	15:39	1	6.10	0.072	93.01	6.99
	WWS-1	3/9/2009	15:39	2	6.10	0.107	89.84	10.16
	WWS-1	3/10/2009	14:44	1	3.05	0.175	83.95	16.05
	WWS-1	3/10/2009	14:44	2	3.05	0.252	77.76	22.24
	WWS-1	3/11/2009	14:30	1	3.05	0.369	69.15	30.85
	WWS-1	3/11/2009	14:30	2	3.05	0.343	70.98	29.02
Spring Run	WWS-2	3/9/2009	17:05	1	0.76	1.316	26.83	73.17
	WWS-2	3/9/2009	17:05	2	0.76	1.843	15.84	84.16
	WWS-2	3/10/2009	13:00	1	0.76	0.591	55.38	44.62
	WWS-2	3/10/2009	13:00	2	0.76	0.616	53.99	46.01
	WWS-2	3/11/2009	14:44	1	0.46	0.153	85.85	14.15
	WWS-2	3/11/2009	14:44	2	0.46	0.855	42.54	57.46
	WWS-3	3/9/2009	14:57	1	1.22	0.260	77.12	22.88
	WWS-3	3/9/2009	14:57	2	1.22	0.421	65.63	34.37
	WWS-3	3/10/2009	12:45	1	0.76	0.407	66.55	33.45
	WWS-3	3/10/2009	12:45	2	0.76	0.358	69.87	30.13
	WWS-3	3/11/2009	16:00	1	0.91	0.366	69.38	30.62
	WWS-3	3/11/2009	16:00	2	0.91	0.472	62.36	37.64
Averages								
Spring Pool	**WWS-1**				**4.06**	**0.22**	**80.78**	**19.22**
Spring Run	**WWS-2 & 3**				**0.81**	**0.64**	**57.61**	**42.39**

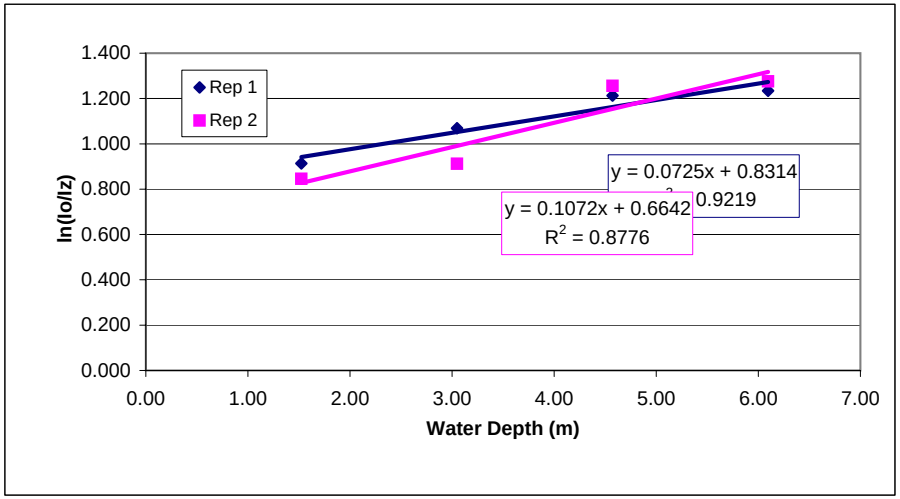
APPENDIX D

Weeki Wachee Springs (Hernando Co.) PAR ATTENUATION ESTIMATES - WWS-1 - 3/9/2009 15:39

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,059.3	2,128.0	1,379.0	7.23			0.03	2,075.8	2,145.0	1,199.0	7.09		
1.52	2,148.6	2,220.0	861.7	6.76	0.914	0.600	1.52	2,070.0	2,139.0	888.2	6.79	0.846	0.555
3.05	2,133.1	2,204.0	732.3	6.60	1.069	0.351	3.05	2,080.7	2,150.0	835.6	6.73	0.912	0.299
4.57	2,094.3	2,164.0	622.6	6.43	1.213	0.265	4.57	2,066.1	2,135.0	588.4	6.38	1.256	0.275
6.10	2,040.9	2,109.0	594.3	6.39	1.234	0.202	6.10	2,067.1	2,136.0	577.0	6.36	1.276	0.209

k (diffuse attenuation coefficient = slope, m-1)			0.072	k (diffuse attenuation coefficient = slope, m-1)	0.107
k average			0.355	k average	0.335
percent transmittance @	1.0	meter	93.01	percent transmittance @ 1.0 meter	89.84
Birgean Percentile Absorption (1m)			6.99	Birgean Percentile Absorption (1m)	10.16





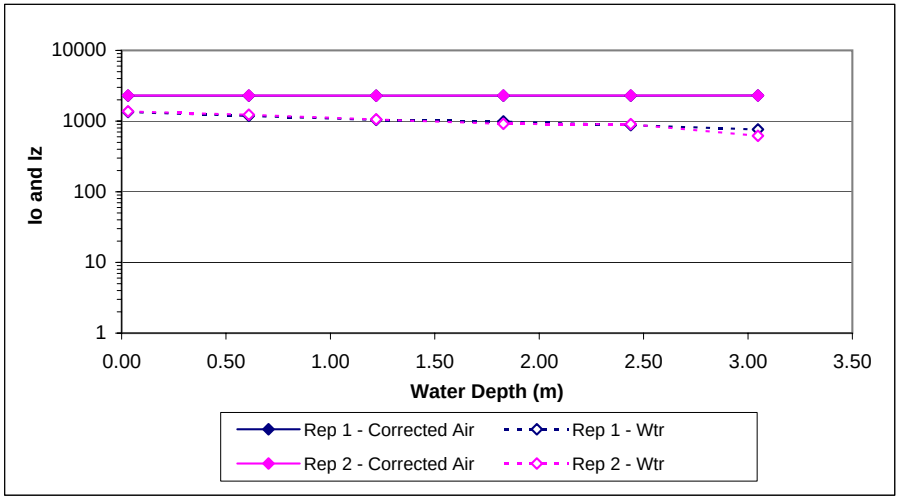
APPENDIX D

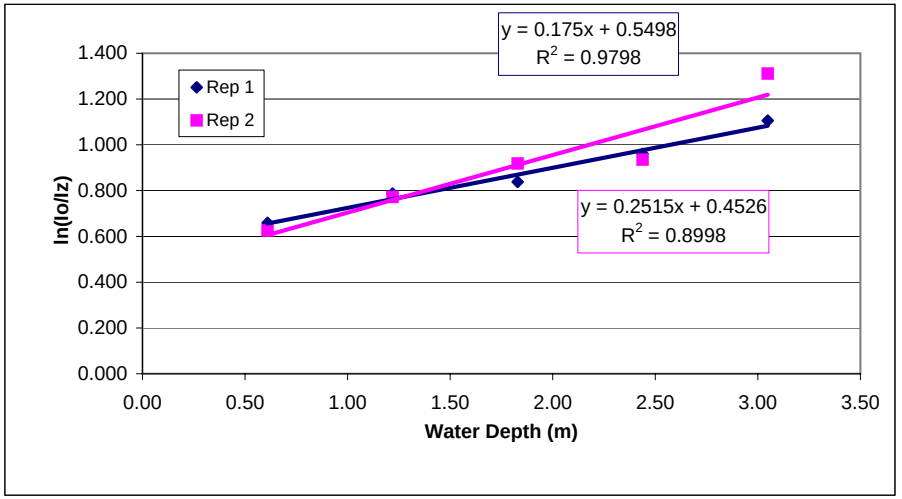
Weeki Wachee Springs (Hernando Co.) PAR ATTENUATION ESTIMATES - WWS-1 - 3/10/2009 14:44

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,292.3	2,368.0	1,343.0	7.20			0.03	2,301.0	2,377.0	1,369.0	7.22		
0.61	2,290.3	2,366.0	1,185.0	7.08	0.659	1.081	0.61	2,297.1	2,373.0	1,229.0	7.11	0.625	1.026
1.22	2,288.4	2,364.0	1,042.0	6.95	0.787	0.645	1.22	2,293.2	2,369.0	1,059.0	6.97	0.773	0.634
1.83	2,287.4	2,363.0	989.7	6.90	0.838	0.458	1.83	2,295.2	2,371.0	915.9	6.82	0.919	0.502
2.44	2,291.3	2,367.0	877.0	6.78	0.960	0.394	2.44	2,298.1	2,374.0	902.3	6.80	0.935	0.383
3.05	2,295.2	2,371.0	759.8	6.63	1.106	0.363	3.05	2,298.1	2,374.0	619.5	6.43	1.311	0.430

k (diffuse attenuation coefficient = slope, m-1)			0.175
k average			0.588
percent transmittance @	1.0	meter	83.95
Birgean Percentile Absorption (1m)			16.05

k (diffuse attenuation coefficient = slope, m-1)			0.252
k average			0.595
percent transmittance @	1.0	meter	77.76
Birgean Percentile Absorption (1m)			22.24





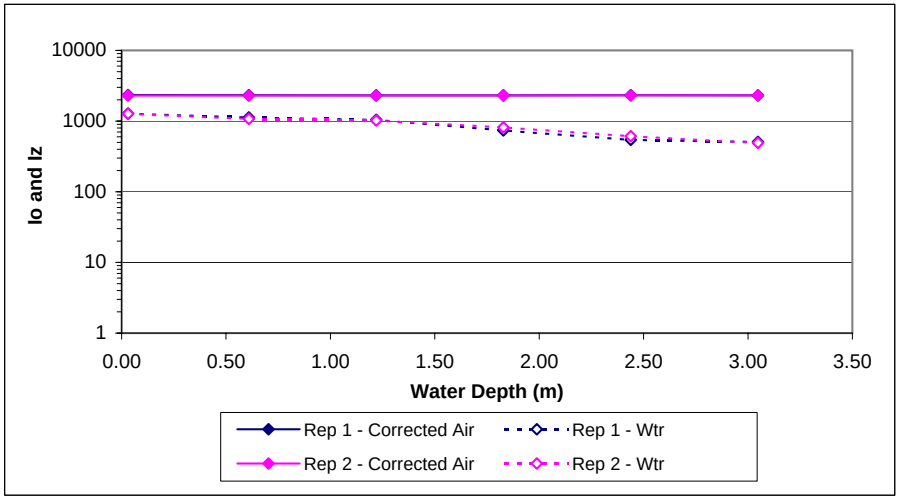
APPENDIX D

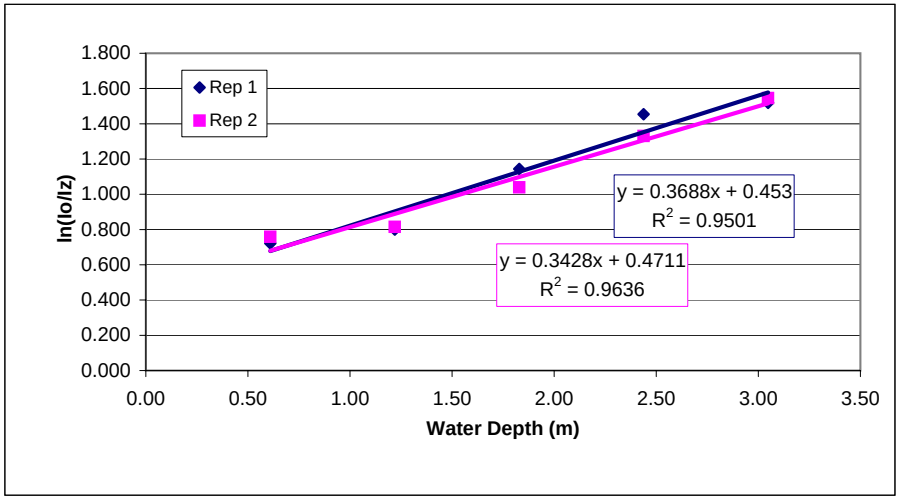
Weeki Wachee Springs (Hernando Co.) PAR ATTENUATION ESTIMATES - WWS-1 - 3/11/2009 14:30

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,331.1	2,408.0	1,277.0	7.15			0.03	2,295.2	2,371.0	1,272.0	7.15		
0.61	2,321.4	2,398.0	1,128.0	7.03	0.722	1.184	0.61	2,300.0	2,376.0	1,077.0	6.98	0.759	1.245
1.22	2,315.6	2,392.0	1,041.0	6.95	0.799	0.656	1.22	2,301.0	2,377.0	1,018.0	6.93	0.816	0.669
1.83	2,312.6	2,389.0	736.8	6.60	1.144	0.625	1.83	2,303.9	2,380.0	815.0	6.70	1.039	0.568
2.44	2,321.4	2,398.0	542.5	6.30	1.454	0.596	2.44	2,317.5	2,394.0	612.7	6.42	1.330	0.546
3.05	2,312.6	2,389.0	506.4	6.23	1.519	0.498	3.05	2,312.6	2,389.0	492.8	6.20	1.546	0.507

k (diffuse attenuation coefficient = slope, m-1)			0.369
k average			0.712
percent transmittance @	1.0	meter	69.15
Birgean Percentile Absorption (1m)			30.85

k (diffuse attenuation coefficient = slope, m-1)			0.343
k average			0.707
percent transmittance @	1.0	meter	70.98
Birgean Percentile Absorption (1m)			29.02



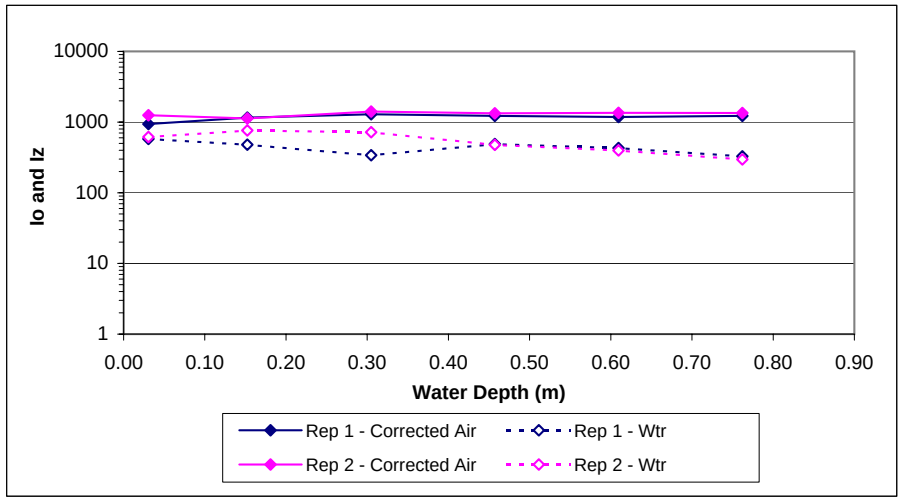


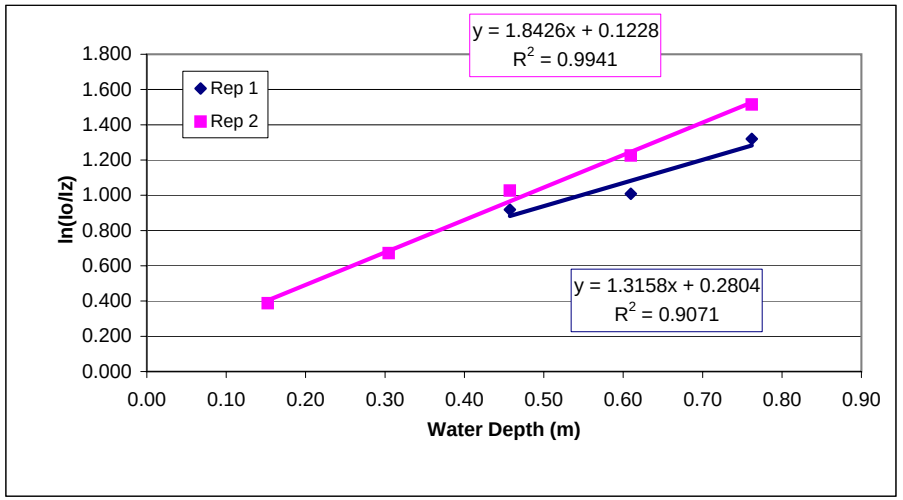
APPENDIX D

Weeki Wachee Springs (Hernando Co.) PAR ATTENUATION ESTIMATES - WWS-2 - 3/09/2009 17:05

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	937.4	972.0	577.0	6.36			0.03	1,250.9	1,295.0	615.1	6.42		
0.15	1,153.9	1,195.0	*478.4*				0.15	1,123.8	1,164.0	762.7	6.64	0.388	2.543
0.30	1,292.6	1,338.0	*339.8*				0.30	1,407.2	1,456.0	718.6	6.58	0.672	2.205
0.46	1,222.8	1,266.0	487.8	6.19	0.919	2.010	0.46	1,329.5	1,376.0	476.4	6.17	1.026	2.245
0.61	1,178.1	1,220.0	429.8	6.06	1.008	1.654	0.61	1,351.8	1,399.0	396.9	5.98	1.226	2.010
0.76	1,223.7	1,267.0	326.9	5.79	1.320	1.732	0.76	1,346.0	1,393.0	295.9	5.69	1.515	1.988

k (diffuse attenuation coefficient = slope, m-1)			1.316	k (diffuse attenuation coefficient = slope, m-1)		1.843
k average			1.799	k average		2.198
percent transmittance @	1.0	meter	26.83	percent transmittance @	1.0	meter	15.84
Birgean Percentile Absorption (1m)			73.17	Birgean Percentile Absorption (1m)			84.16





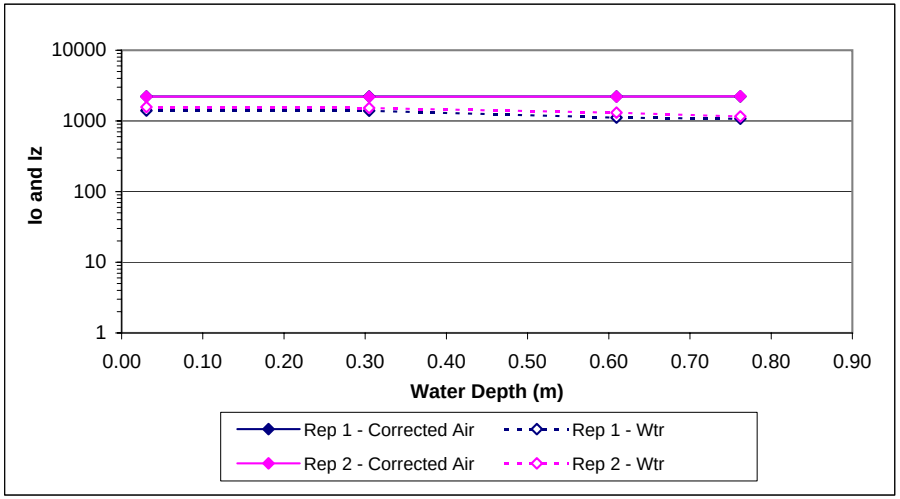
values in red not used in graph or calculated values

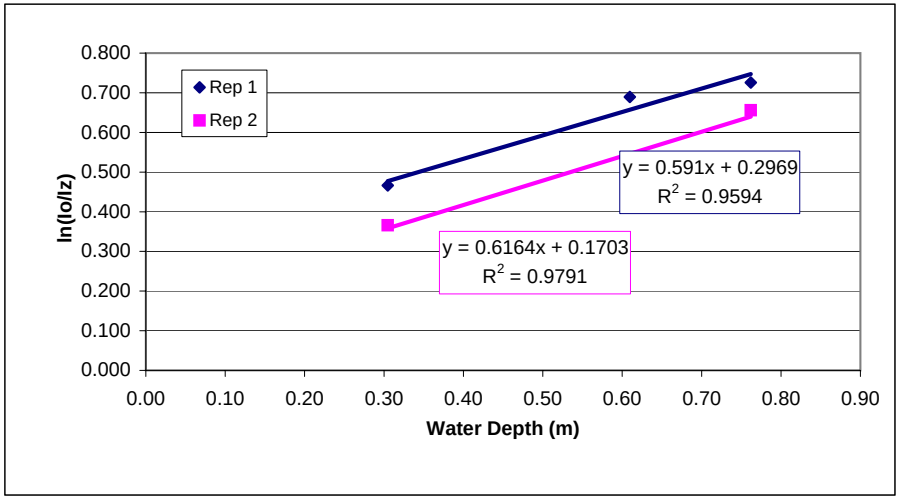
APPENDIX D

Weeki Wache Springs (Hernando Co.) PAR ATTENUATION ESTIMATES - WWS-2 - 3/10/2009 13:00

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,214.6	2,288.0	1,405.0	7.25			0.03	2,201.0	2,274.0	1,570.0	7.36		
0.30	2,217.5	2,291.0	1,391.0	7.24	0.466	1.530	0.30	2,199.1	2,272.0	1,525.0	7.33	0.366	1.201
0.61	2,221.4	2,295.0	1,115.0	7.02	0.689	1.131	0.61	2,204.9	2,278.0	1,308.0	7.18	0.522	0.857
0.76	2,219.5	2,293.0	1,074.0	6.98	0.726	0.953	0.76	2,223.4	2,297.0	1,154.0	7.05	0.656	0.861

k (diffuse attenuation coefficient = slope, m-1)			0.591	k (diffuse attenuation coefficient = slope, m-1)	0.616
k average			1.204	k average	0.973
percent transmittance @	1.0	meter	55.38	percent transmittance @ 1.0 meter	53.99
Birgean Percentile Absorption (1m)			44.62	Birgean Percentile Absorption (1m)	46.01



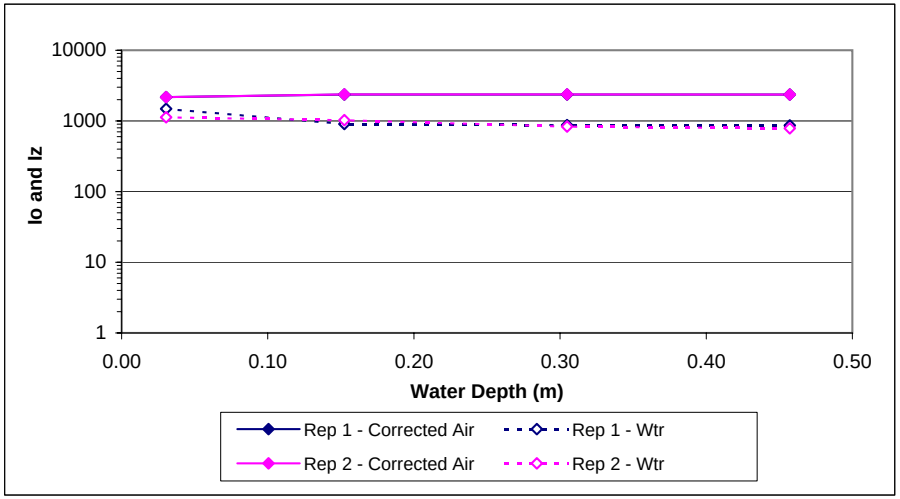


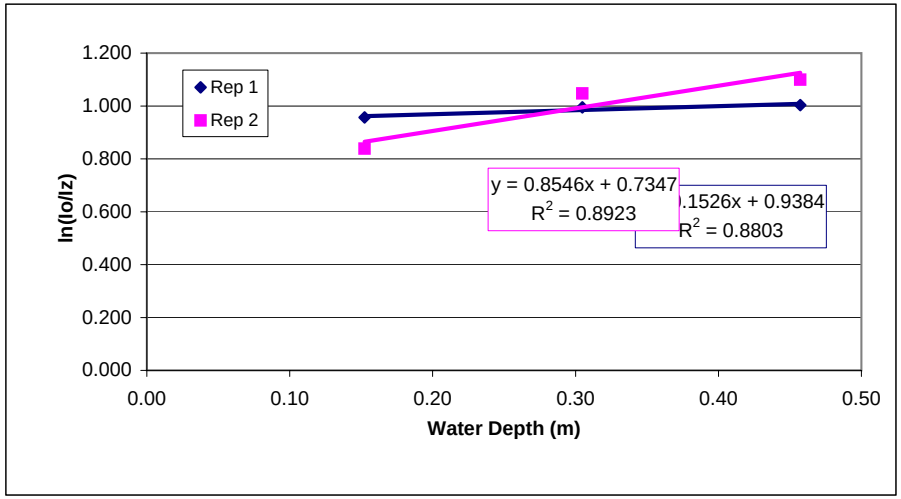
APPENDIX D

Weeki Wache Springs (Hernando Co.) PAR ATTENUATION ESTIMATES - WWS-2 - 3/11/2009 14:44

Depth (m)	Replicate 1						Depth (m)	Replicate 2					
	corr	raw						corr	raw				
z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Air (Io)	Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,176.8	2,249.0	1,485.0	7.30			0.03	2,172.9	2,245.0	1,128.0	7.03		
0.15	2,357.3	2,435.0	905.6	6.81	0.957	6.277	0.15	2,373.8	2,452.0	1,026.0	6.93	0.839	5.504
0.30	2,358.3	2,436.0	872.1	6.77	0.995	3.264	0.30	2,370.9	2,449.0	831.8	6.72	1.047	3.436
0.46	2,358.3	2,436.0	864.8	6.76	1.003	2.194	0.46	2,365.0	2,443.0	787.8	6.67	1.099	2.404

k (diffuse attenuation coefficient = slope, m-1)		0.153	k (diffuse attenuation coefficient = slope, m-1)	0.855
k average		3.912	k average	3.782
percent transmittance @	1.0 meter	85.85	percent transmittance @	1.0 meter 42.54
Birgean Percentile Absorption (1m)		14.15	Birgean Percentile Absorption (1m)	57.46





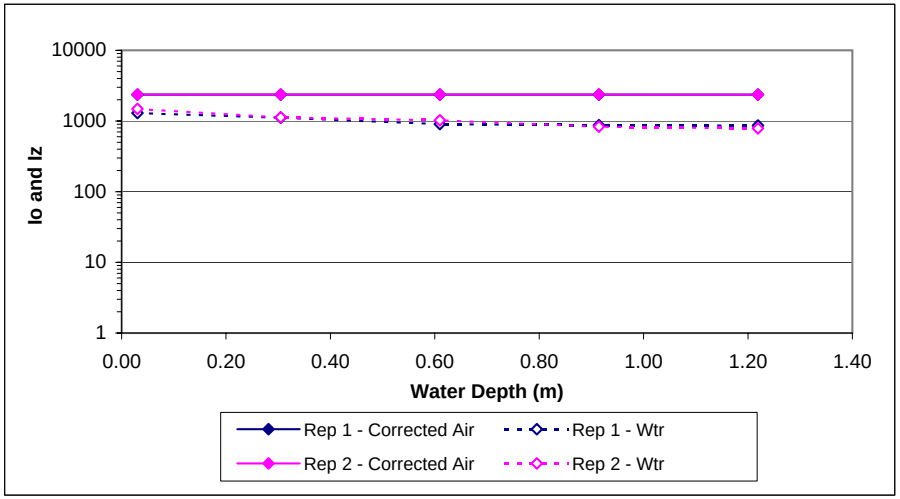
APPENDIX D

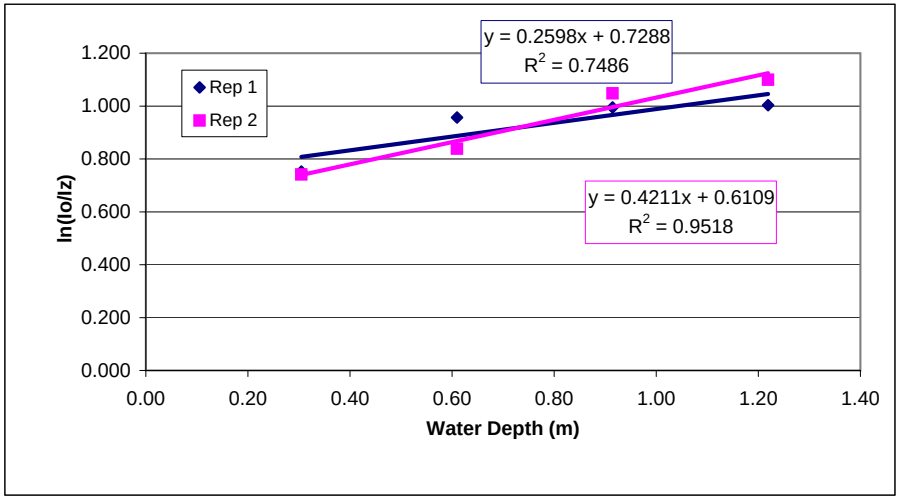
Weeki Wachee Springs (Hernando Co.) PAR ATTENUATION ESTIMATES - WWS-3 - 3/9/2009 14:57

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,362.1	2,440.0	1,295.0	7.17			0.03	2,370.9	2,449.0	1,485.0	7.30		
0.30	2,359.2	2,437.0	1,112.0	7.01	0.752	2.468	0.30	2,367.0	2,445.0	1,128.0	7.03	0.741	2.432
0.61	2,357.3	2,435.0	905.6	6.81	0.957	1.569	0.61	2,373.8	2,452.0	1,026.0	6.93	0.839	1.376
0.91	2,358.3	2,436.0	872.1	6.77	0.995	1.088	0.91	2,370.9	2,449.0	831.3	6.72	1.048	1.146
1.22	2,358.3	2,436.0	864.6	6.76	1.003	0.823	1.22	2,365.0	2,443.0	787.8	6.67	1.099	0.902

k (diffuse attenuation coefficient = slope, m-1)			0.260	
k average			1.487	
percent transmittance @	1.0	meter	77.12	
Birgean Percentile Absorption (1m)			22.88	

k (diffuse attenuation coefficient = slope, m-1)			0.421
k average			1.464
percent transmittance @	1.0	meter	65.63
Birgean Percentile Absorption (1m)			34.37





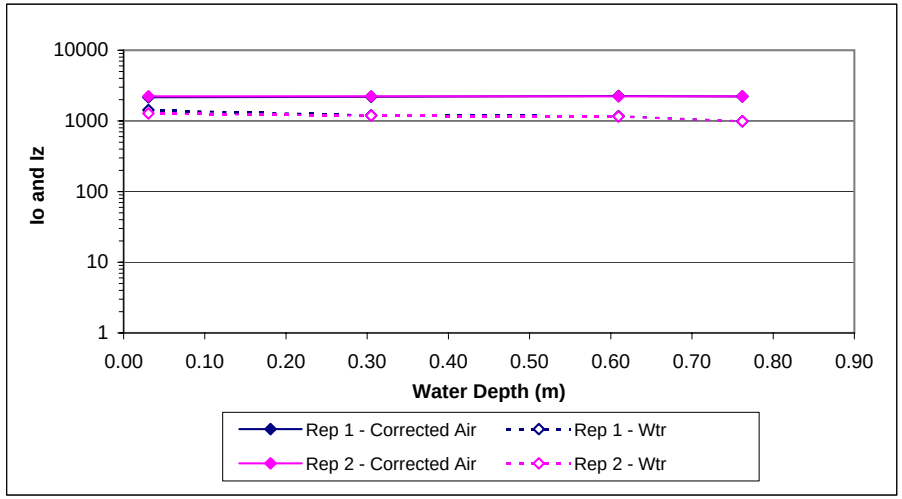
APPENDIX D

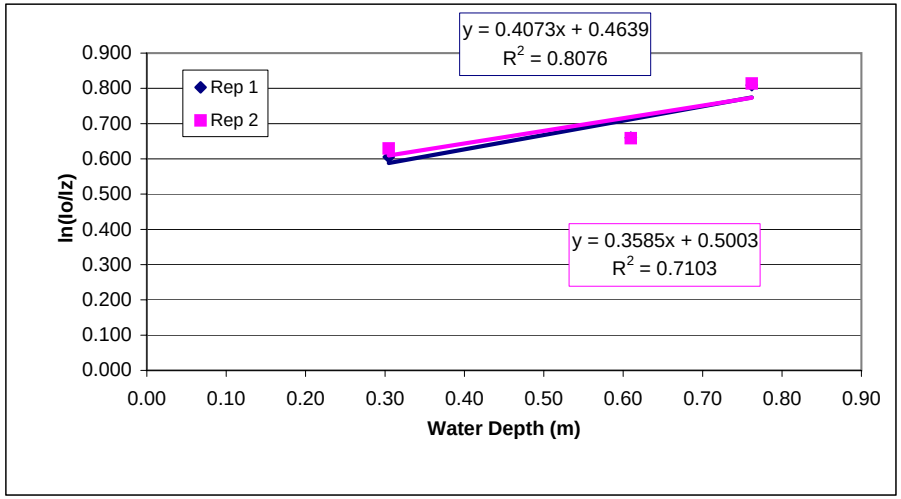
Weeki Wachee Springs (Hernando Co.) PAR ATTENUATION ESTIMATES - WWS-3 - 3/10/2009 12:45

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	2,159.3	2,231.0	1,426.0	7.26			0.03	2,233.1	2,307.0	1,276.0	7.15		
0.30	2,193.3	2,266.0	1,197.0	7.09	0.606	1.987	0.30	2,224.3	2,298.0	1,185.0	7.08	0.630	2.066
0.61	2,255.4	2,330.0	1,166.0	7.06	0.660	1.082	0.61	2,231.1	2,305.0	1,155.0	7.05	0.658	1.080
0.76	2,214.6	2,288.0	985.9	6.89	0.809	1.062	0.76	2,224.3	2,298.0	985.8	6.89	0.814	1.068

k (diffuse attenuation coefficient = slope, m-1)			0.407
k average			1.377
percent transmittance @	1.0	meter	66.55
Birgean Percentile Absorption (1m)			33.45

k (diffuse attenuation coefficient = slope, m-1)			0.358
k average			1.405
percent transmittance @	1.0	meter	69.87
Birgean Percentile Absorption (1m)			30.13



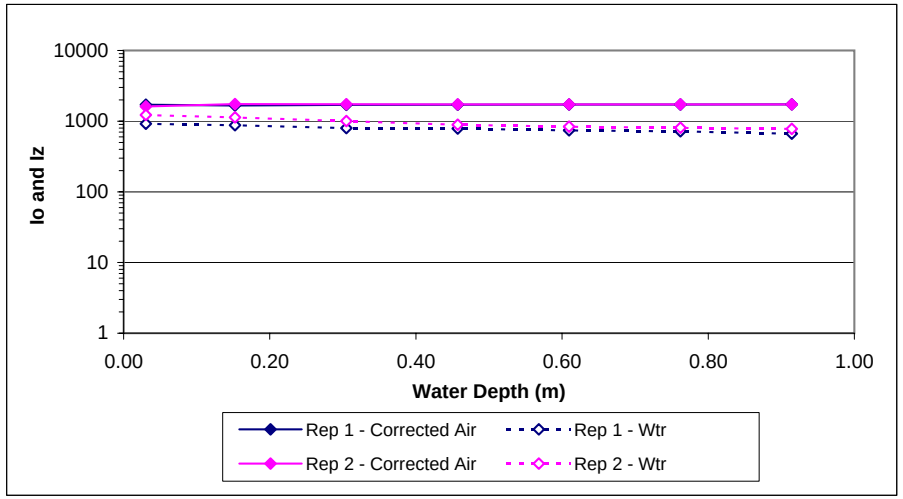


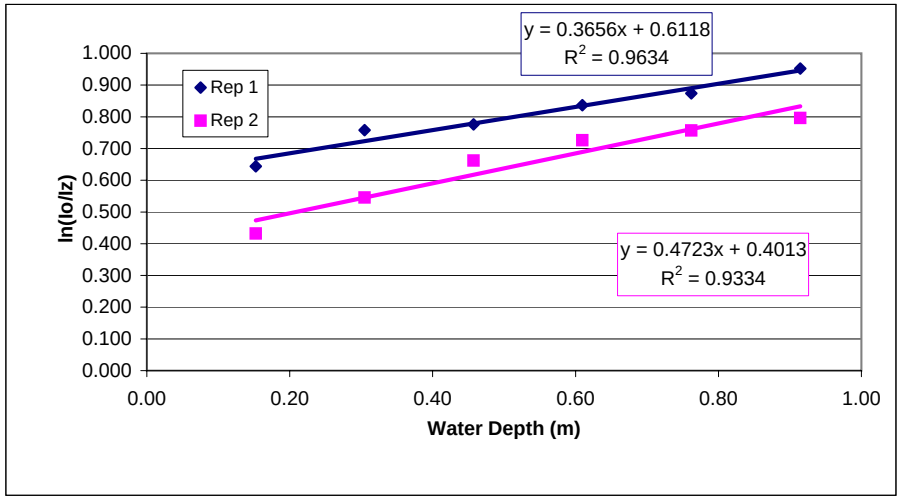
APPENDIX D

Weeki Wachee Springs (Herando Co.) PAR ATTENUATION ESTIMATES - WWS-3 - 3/11/2009 16:00

Depth (m) z	Replicate 1 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)	Depth (m) z	Replicate 2 corr Air (Io)	raw Air (Io)	Water (Iz)	ln(Iz)	ln(Io/Iz)	k (m-1)
0.03	1,704.1	1,762.0	916.7	6.82			0.03	1,611.9	1,667.0	1,225.0	7.11		
0.15	1,668.2	1,725.0	876.2	6.78	0.644	4.225	0.15	1,743.9	1,803.0	1,132.0	7.03	0.432	2.836
0.30	1,701.2	1,759.0	797.4	6.68	0.758	2.486	0.30	1,732.3	1,791.0	1,004.0	6.91	0.545	1.790
0.46	1,709.0	1,767.0	786.4	6.67	0.776	1.698	0.46	1,729.4	1,788.0	891.8	6.79	0.662	1.449
0.61	1,717.7	1,776.0	743.9	6.61	0.837	1.373	0.61	1,725.5	1,784.0	834.6	6.73	0.726	1.191
0.76	1,719.7	1,778.0	717.6	6.58	0.874	1.147	0.76	1,722.6	1,781.0	808.0	6.69	0.757	0.993
0.91	1,725.5	1,784.0	665.9	6.50	0.952	1.041	0.91	1,725.5	1,784.0	778.2	6.66	0.796	0.871

k (diffuse attenuation coefficient = slope, m-1)			0.366	k (diffuse attenuation coefficient = slope, m-1)		0.472
k average			1.995	k average		1.522
percent transmittance @	1.0	meter	69.38	percent transmittance @	1.0	meter	62.36
Birgean Percentile Absorption (1m)			30.62	Birgean Percentile Absorption (1m)			37.64





Appendix E

Oxygen Diffusion

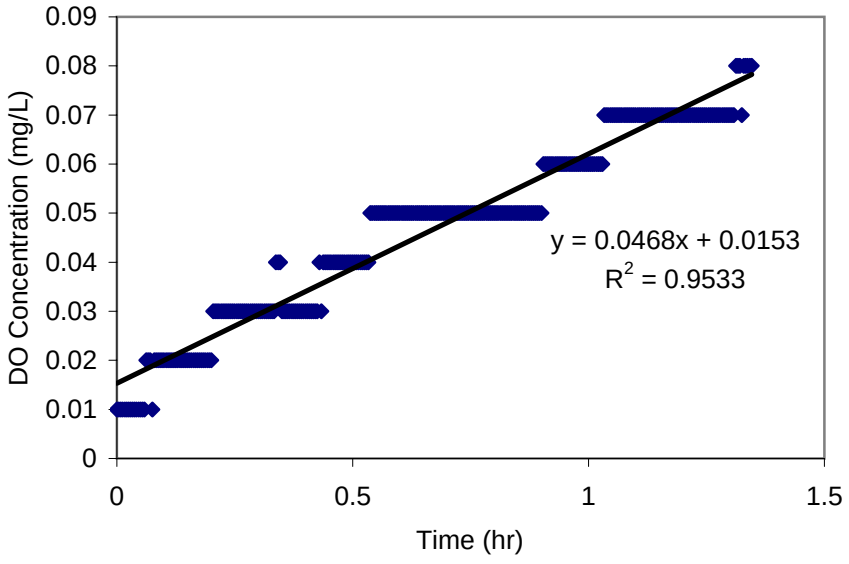
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	De Leon Springs	**Date**	Oct 6 2008
Station	VDL-2	**Time**	12:20

Air Temperature (^{o}C)	24.25
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.10
Air DO %Sat	97.30
Water Depth (m)	0.85
Current Velocity (cm/s)	14.02
Water Temperature (^{o}C)	22.79
Water DO (mg/L)	0.95
Water DO % Sat	11.01
Delta DO %Sat in Dome	1.10
Avg DO %Sat in Dome	0.73
Elapsed Time (hr)	1.35
Avg. DO % Sat Deficit	10.28
Calculated Diffusion Rate k (g/m^2/hr)	2.25

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



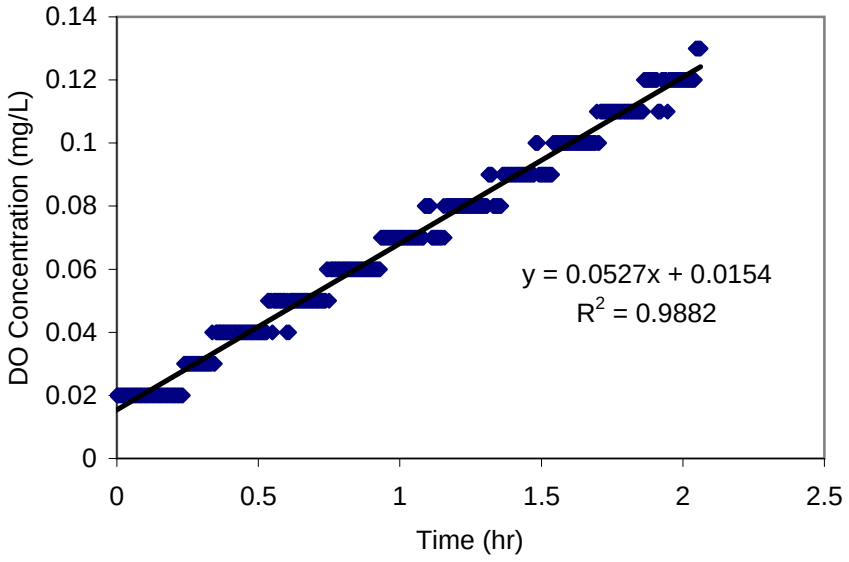
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	De Leon Springs	**Date**	Oct 6 2008
Station	VDL-2	**Time**	13:57

Air Temperature (^{o}C)	25.65
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.72
Air DO %Sat	94.50
Water Depth (m)	0.82
Current Velocity (cm/s)	15.85
Water Temperature (^{o}C)	22.82
Water DO (mg/L)	0.91
Water DO % Sat	10.59
Delta DO %Sat in Dome	1.50
Avg DO %Sat in Dome	0.97
Elapsed Time (hr)	2.06
Avg. DO % Sat Deficit	9.62
Calculated Diffusion Rate k (g/m^2/hr)	2.13

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



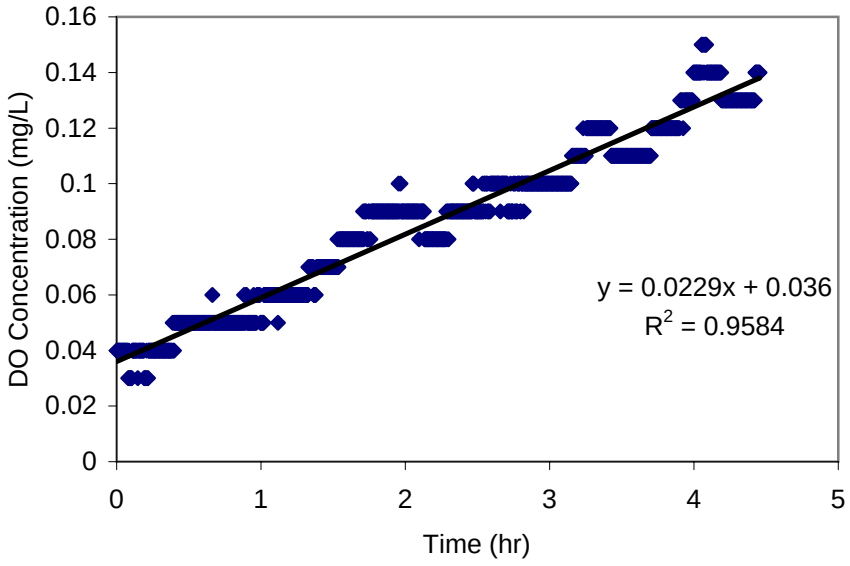
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	De Leon Springs	**Date**	Oct 7 2008
Station	VDL-2	**Time**	8:50

Air Temperature (^{o}C)	22.84
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.57
Air DO %Sat	99.10
Water Depth (m)	0.85
Current Velocity (cm/s)	14.33
Water Temperature (^{o}C)	22.69
Water DO (mg/L)	0.85
Water DO % Sat	9.84
Delta DO %Sat in Dome	1.70
Avg DO %Sat in Dome	1.27
Elapsed Time (hr)	4.45
Avg. DO % Sat Deficit	8.57
Calculated Diffusion Rate k (g/m^2/hr)	1.27

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



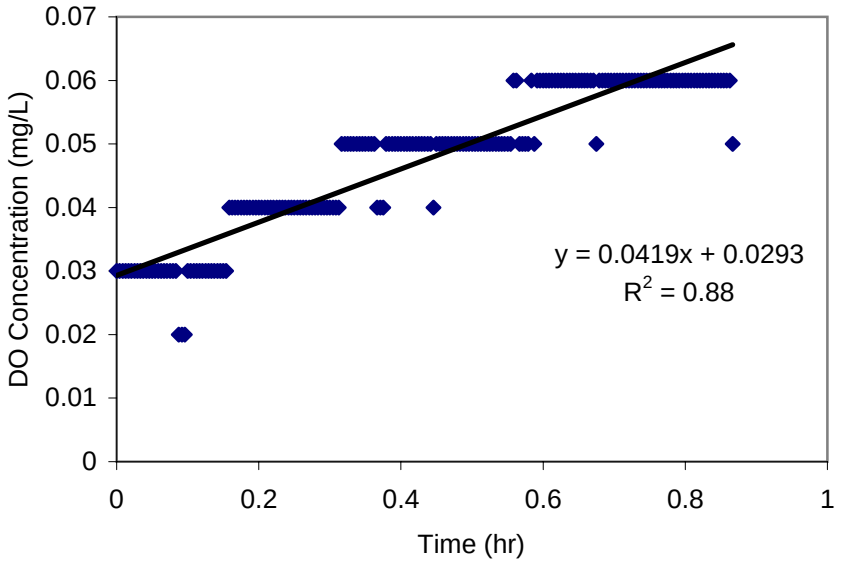
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	De Leon Springs	**Date**	Oct 8 2008
Station	VDL-2	**Time**	8:18

Air Temperature (^{o}C)	21.86
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.90
Air DO %Sat	101.40
Water Depth (m)	0.84
Current Velocity (cm/s)	19.51
Water Temperature (^{o}C)	22.52
Water DO (mg/L)	0.61
Water DO % Sat	7.12
Delta DO %Sat in Dome	0.50
Avg DO %Sat in Dome	0.60
Elapsed Time (hr)	0.87
Avg. DO % Sat Deficit	6.52
Calculated Diffusion Rate k (g/m^2/hr)	2.53

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



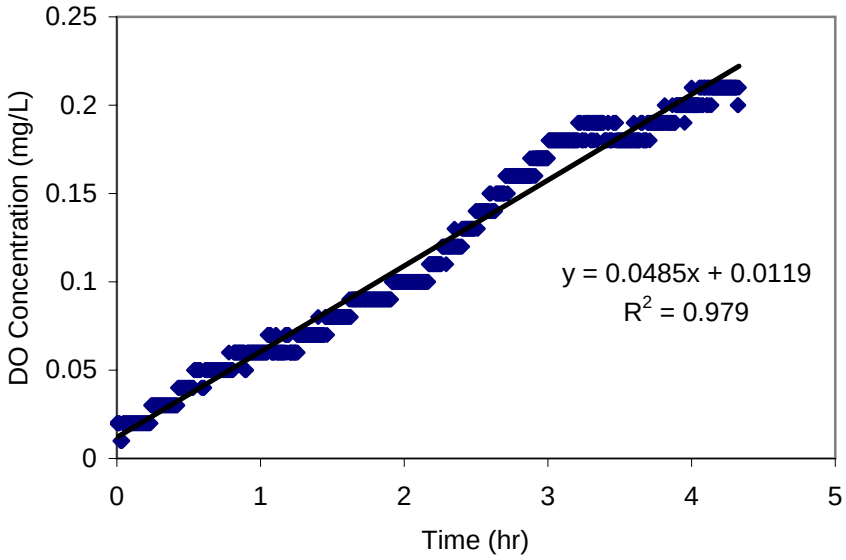
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	De Leon Springs	**Date**	Oct 8 2008
Station	VDL-2	**Time**	12:41

Air Temperature (^{o}C)	21.86
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.90
Air DO %Sat	101.40
Water Depth (m)	0.84
Current Velocity (cm/s)	19.51
Water Temperature (^{o}C)	22.63
Water DO (mg/L)	0.80
Water DO % Sat	9.22
Delta DO %Sat in Dome	2.40
Avg DO %Sat in Dome	1.50
Elapsed Time (hr)	4.33
Avg. DO % Sat Deficit	7.72
Calculated Diffusion Rate k (g/m^2/hr)	2.05

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



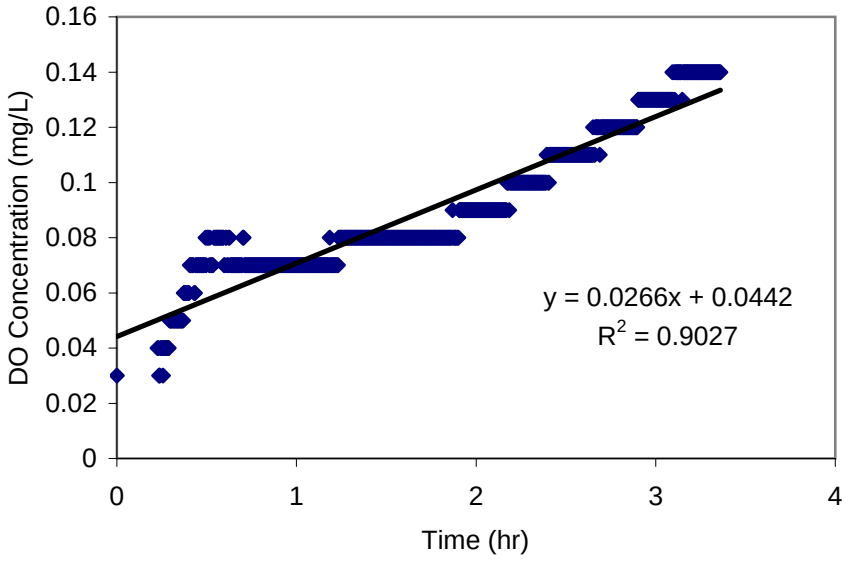
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	De Leon Springs	**Date**	Oct 9 2008
Station	VDL-2	**Time**	8:44

Air Temperature (^{o}C)	22.77
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.76
Air DO %Sat	101.60
Water Depth (m)	0.84
Current Velocity (cm/s)	14.63
Water Temperature (^{o}C)	22.59
Water DO (mg/L)	0.81
Water DO % Sat	9.38
Delta DO %Sat in Dome	1.80
Avg DO %Sat in Dome	1.35
Elapsed Time (hr)	3.36
Avg. DO % Sat Deficit	8.03
Calculated Diffusion Rate k (g/m^2/hr)	1.90

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



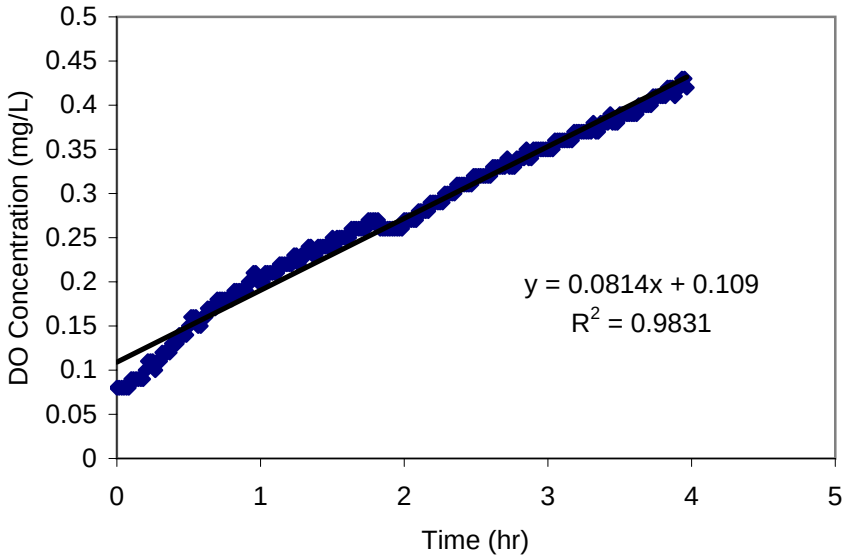
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Homosassa Springs	**Date**	Nov 4 2008
Station	HS-2	**Time**	9:35

Air Temperature (^{o}C)	19.61
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.83
Air DO %Sat	107.20
Water Depth (m)	1.72
Current Velocity (cm/s)	5.36
Water Temperature (^{o}C)	23.20
Water DO (mg/L)	3.97
Water DO % Sat	47.00
Delta DO %Sat in Dome	4.20
Avg DO %Sat in Dome	3.22
Elapsed Time (hr)	3.97
Avg. DO % Sat Deficit	43.78
Calculated Diffusion Rate k (g/m^2/hr)	0.70

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



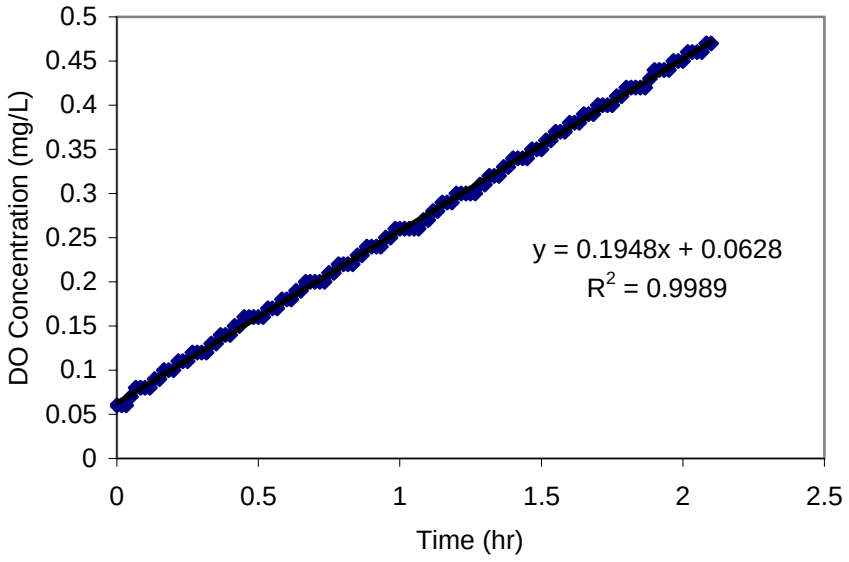
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Homosassa Springs	**Date**	Nov 4 2008
Station	HS-2	**Time**	13:40

Air Temperature (^{o}C)	21.24
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.28
Air DO %Sat	104.70
Water Depth (m)	1.55
Current Velocity (cm/s)	11.34
Water Temperature (^{o}C)	23.30
Water DO (mg/L)	3.99
Water DO % Sat	47.15
Delta DO %Sat in Dome	4.90
Avg DO %Sat in Dome	3.19
Elapsed Time (hr)	2.10
Avg. DO % Sat Deficit	43.96
Calculated Diffusion Rate k (g/m^2/hr)	1.52

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



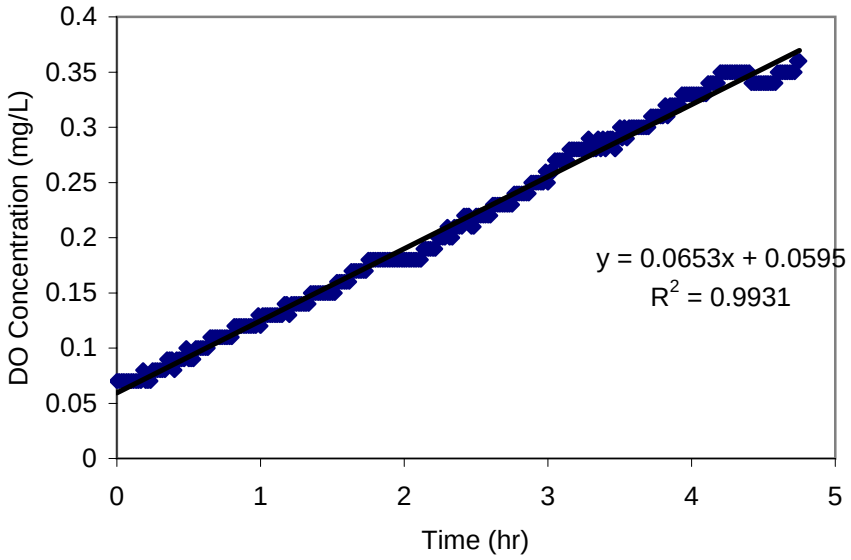
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Homosassa Springs	**Date**	Nov 5 2008
Station	HS-2	**Time**	8:50

Air Temperature (^{o}C)	17.25
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.68
Air DO %Sat	100.80
Water Depth (m)	1.79
Current Velocity (cm/s)	3.66
Water Temperature (^{o}C)	22.98
Water DO (mg/L)	3.86
Water DO % Sat	45.60
Delta DO %Sat in Dome	4.00
Avg DO %Sat in Dome	2.64
Elapsed Time (hr)	4.75
Avg. DO % Sat Deficit	42.96
Calculated Diffusion Rate k (g/m^2/hr)	0.57

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



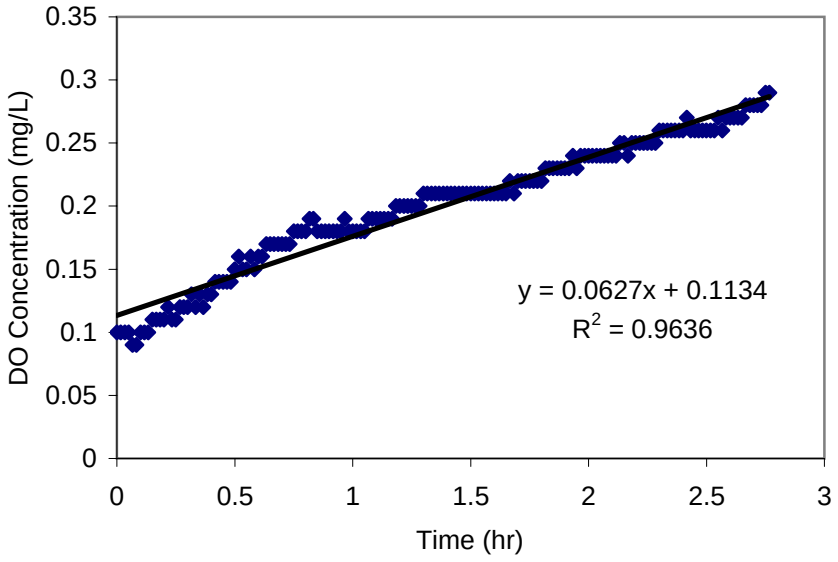
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Homosassa Springs	**Date**	Nov 6 2008
Station	HS-2	**Time**	8:58

Air Temperature (^{o}C)	15.01
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.60
Air DO %Sat	95.30
Water Depth (m)	1.77
Current Velocity (cm/s)	4.66
Water Temperature (^{o}C)	23.23
Water DO (mg/L)	4.16
Water DO % Sat	49.30
Delta DO %Sat in Dome	3.30
Avg DO %Sat in Dome	2.76
Elapsed Time (hr)	2.77
Avg. DO % Sat Deficit	46.54
Calculated Diffusion Rate k (g/m^2/hr)	0.75

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



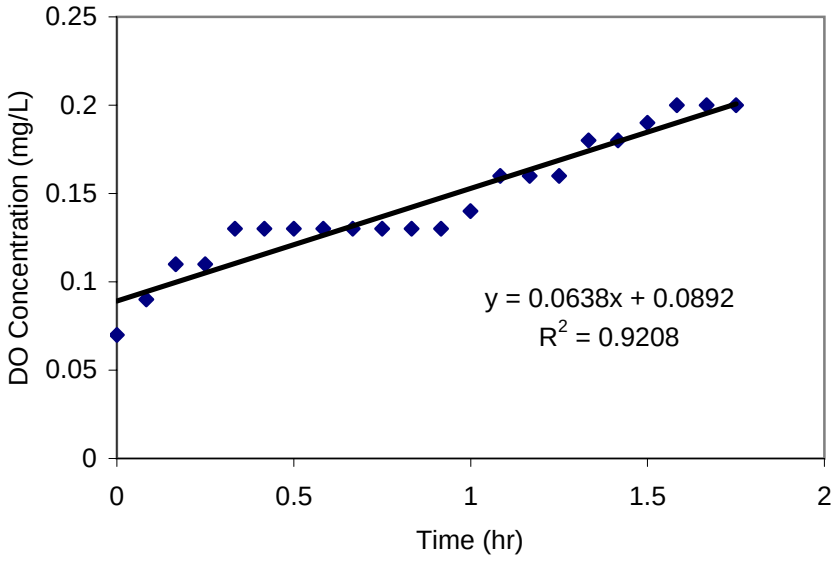
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	Jun 5 2008
Station	IS-4	**Time**	9:59

Air Temperature (^{o}C)	23.41
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.72
Air DO %Sat	102.90
Water Depth (m)	1.62
Current Velocity (cm/s)	11.58
Water Temperature (^{o}C)	22.01
Water DO (mg/L)	5.31
Water DO % Sat	60.79
Delta DO %Sat in Dome	2.20
Avg DO %Sat in Dome	2.12
Elapsed Time (hr)	1.75
Avg. DO % Sat Deficit	58.67
Calculated Diffusion Rate k (g/m^2/hr)	0.61

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



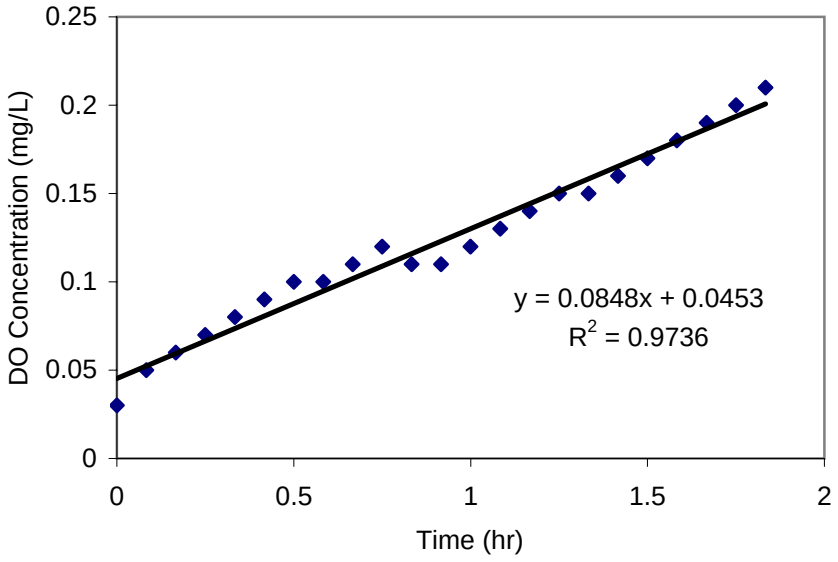
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	Jun 5 2008
Station	IS-4	**Time**	12:04

Air Temperature (^{o}C)	23.41
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	8.72
Air DO %Sat	102.90
Water Depth (m)	1.62
Current Velocity (cm/s)	11.58
Water Temperature (^{o}C)	22.78
Water DO (mg/L)	7.12
Water DO % Sat	82.74
Delta DO %Sat in Dome	2.60
Avg DO %Sat in Dome	1.88
Elapsed Time (hr)	1.83
Avg. DO % Sat Deficit	80.86
Calculated Diffusion Rate k (g/m^{2}/hr)	0.50

Dome Surface Area (m^{2})	0.073
Dome Total Gas Volume (cm^{3})	8250
Dome Total Oxygen Volume (cm^{3})	1733
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



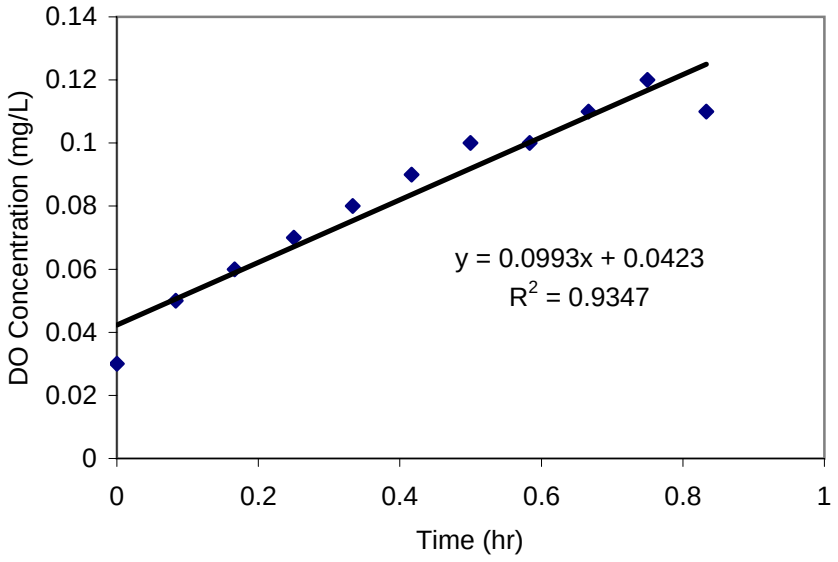
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	Jun 5 2008
Station	IS-4	**Time**	14:24

Air Temperature (^{o}C)	23.41
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.72
Air DO %Sat	102.90
Water Depth (m)	1.62
Current Velocity (cm/s)	11.58
Water Temperature (^{o}C)	23.75
Water DO (mg/L)	8.48
Water DO % Sat	100.36
Delta DO %Sat in Dome	1.40
Avg DO %Sat in Dome	1.29
Elapsed Time (hr)	0.83
Avg. DO % Sat Deficit	99.07
Calculated Diffusion Rate k (g/m^2/hr)	0.48

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



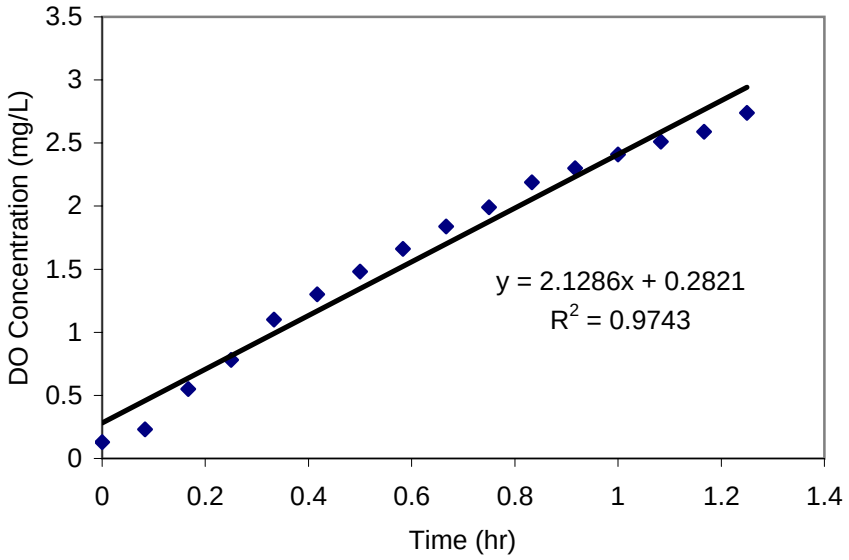
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	Jun 5 2008
Station	IS-4	**Time**	15:24

Air Temperature (^{o}C)	23.41
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	8.72
Air DO %Sat	102.90
Water Depth (m)	1.62
Current Velocity (cm/s)	56.29
Water Temperature (^{o}C)	24.35
Water DO (mg/L)	8.93
Water DO % Sat	106.87
Delta DO %Sat in Dome	39.40
Avg DO %Sat in Dome	24.29
Elapsed Time (hr)	1.25
Avg. DO % Sat Deficit	82.58
Calculated Diffusion Rate k (g/m^{2}/hr)	10.85

Dome Surface Area (m^{2})	0.073
Dome Total Gas Volume (cm^{3})	8250
Dome Total Oxygen Volume (cm^{3})	1733
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



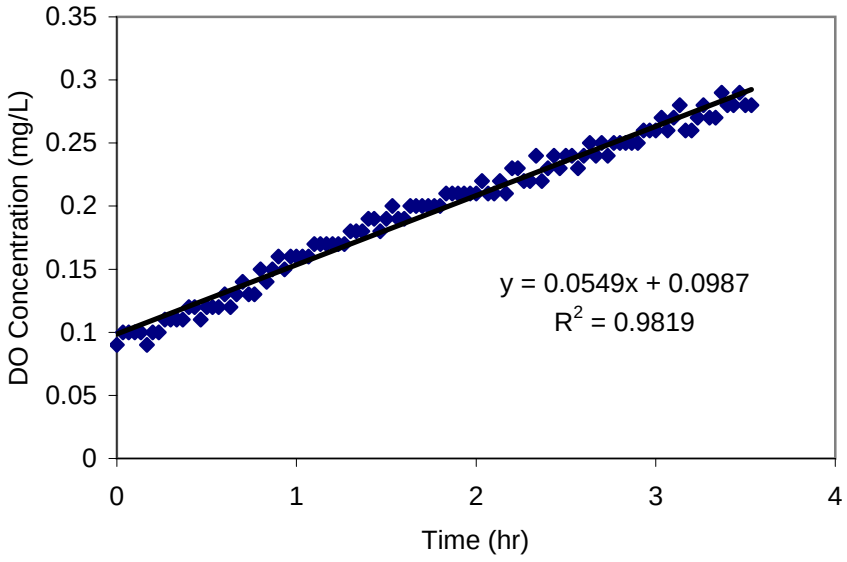
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 6, 2009
Station	IS-4	**Time**	8:56

Air Temperature (^{o}C)	22.93
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.70
Air DO %Sat	101.30
Water Depth (m)	1.44
Current Velocity (cm/s)	4.57
Water Temperature (^{o}C)	22.81
Water DO (mg/L)	5.27
Water DO % Sat	60.75
Delta DO %Sat in Dome	2.20
Avg DO %Sat in Dome	2.37
Elapsed Time (hr)	3.53
Avg. DO % Sat Deficit	58.38
Calculated Diffusion Rate k (g/m^2/hr)	0.26

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



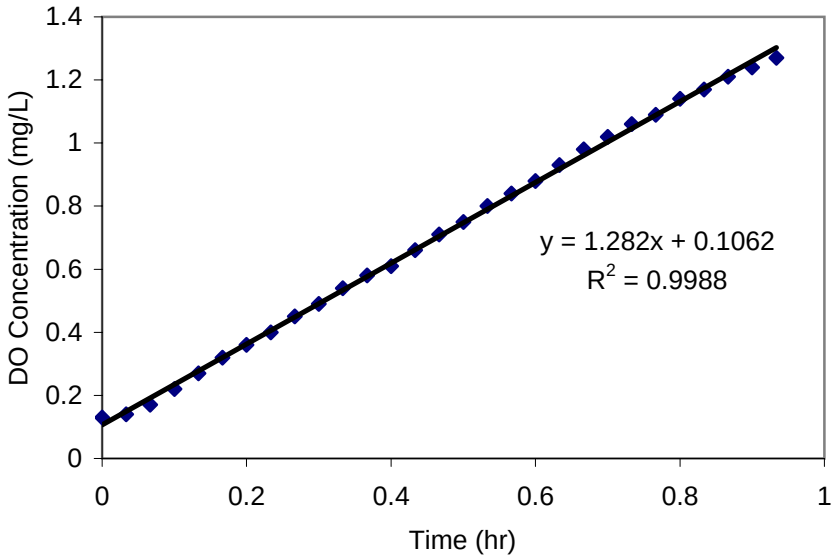
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 6, 2009
Station	IS-4	**Time**	12:49

Air Temperature (^{o}C)	22.93
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.70
Air DO %Sat	101.30
Water Depth (m)	1.44
Current Velocity (cm/s)	30.48
Water Temperature (^{o}C)	22.81
Water DO (mg/L)	5.27
Water DO % Sat	60.75
Delta DO %Sat in Dome	14.50
Avg DO %Sat in Dome	8.62
Elapsed Time (hr)	0.93
Avg. DO % Sat Deficit	52.13
Calculated Diffusion Rate k (g/m^2/hr)	7.31

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



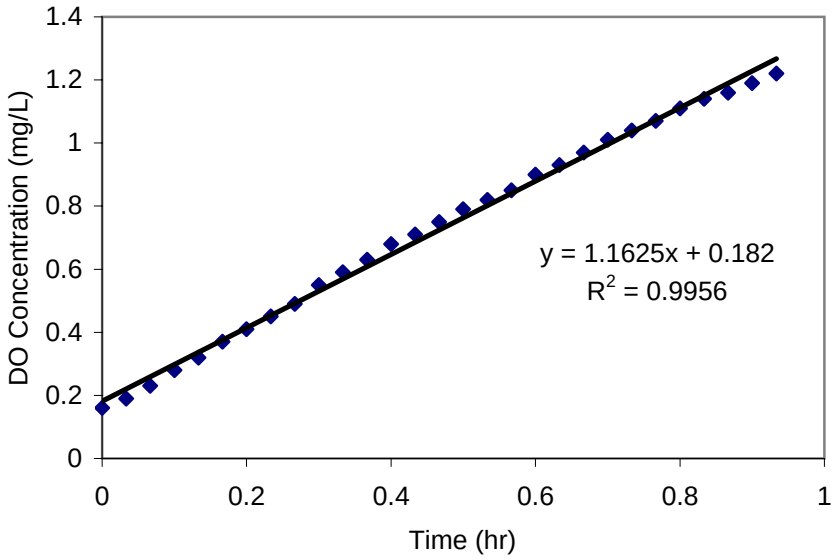
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 6, 2009
Station	IS-4	**Time**	13:50

Air Temperature (^{o}C)	22.93
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.70
Air DO %Sat	101.30
Water Depth (m)	1.44
Current Velocity (cm/s)	30.48
Water Temperature (^{o}C)	22.81
Water DO (mg/L)	5.27
Water DO % Sat	60.75
Delta DO %Sat in Dome	14.70
Avg DO %Sat in Dome	9.65
Elapsed Time (hr)	0.93
Avg. DO % Sat Deficit	51.10
Calculated Diffusion Rate k (g/m^2/hr)	7.56

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



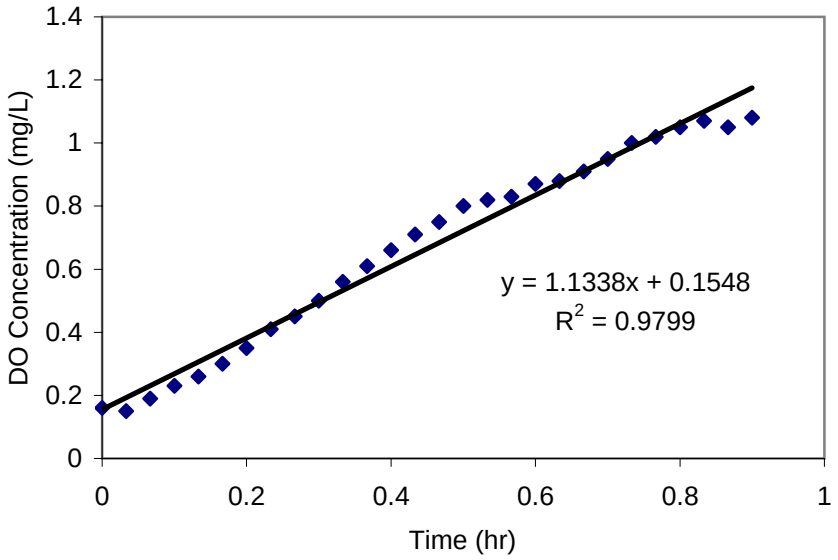
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 6, 2009
Station	IS-4	**Time**	14:50

Air Temperature (^{o}C)	22.93
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.70
Air DO %Sat	101.30
Water Depth (m)	1.44
Current Velocity (cm/s)	33.53
Water Temperature (^{o}C)	22.81
Water DO (mg/L)	5.27
Water DO % Sat	60.75
Delta DO %Sat in Dome	13.00
Avg DO %Sat in Dome	8.58
Elapsed Time (hr)	0.90
Avg. DO % Sat Deficit	52.17
Calculated Diffusion Rate k (g/m^2/hr)	6.79

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



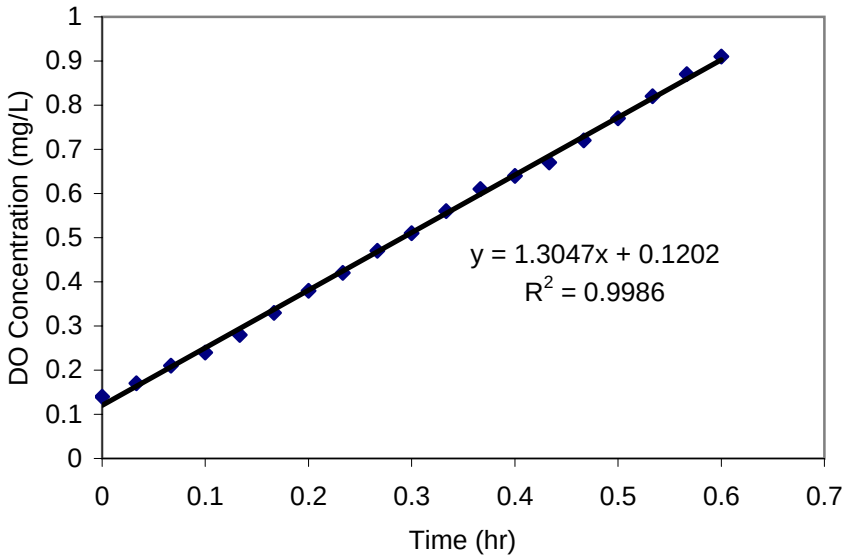
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 6, 2009
Station	IS-4	**Time**	14:50

Air Temperature (^{o}C)	22.93
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.97
Air DO %Sat	100.90
Water Depth (m)	1.44
Current Velocity (cm/s)	33.53
Water Temperature (^{o}C)	22.81
Water DO (mg/L)	5.27
Water DO % Sat	60.75
Delta DO %Sat in Dome	9.90
Avg DO %Sat in Dome	6.68
Elapsed Time (hr)	0.60
Avg. DO % Sat Deficit	54.07
Calculated Diffusion Rate k (g/m^2/hr)	7.49

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



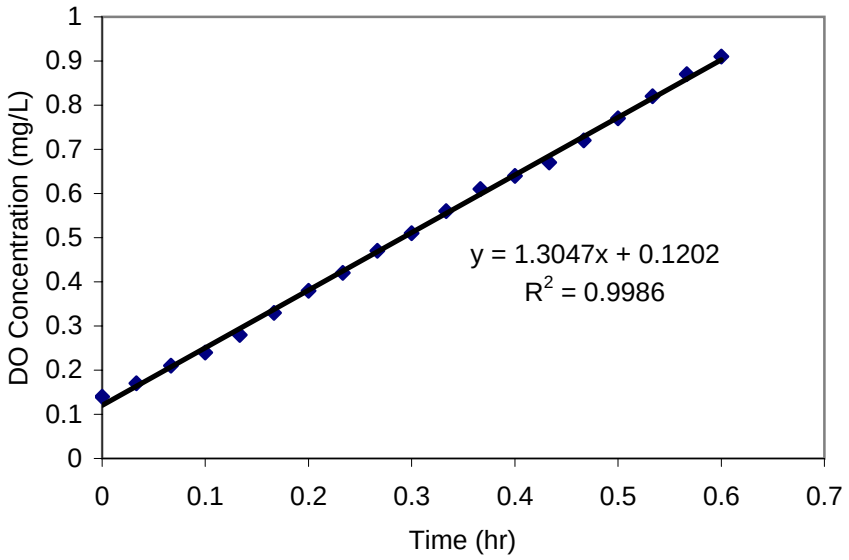
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 7, 2009
Station	IS-2	**Time**	10:24

Air Temperature (^{o}C)	23.17
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.12
Air DO %Sat	106.70
Water Depth (m)	1.58
Current Velocity (cm/s)	19.81
Water Temperature (^{o}C)	22.44
Water DO (mg/L)	5.30
Water DO % Sat	61.30
Delta DO %Sat in Dome	2.60
Avg DO %Sat in Dome	2.70
Elapsed Time (hr)	1.97
Avg. DO % Sat Deficit	58.60
Calculated Diffusion Rate k (g/m^2/hr)	0.55

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



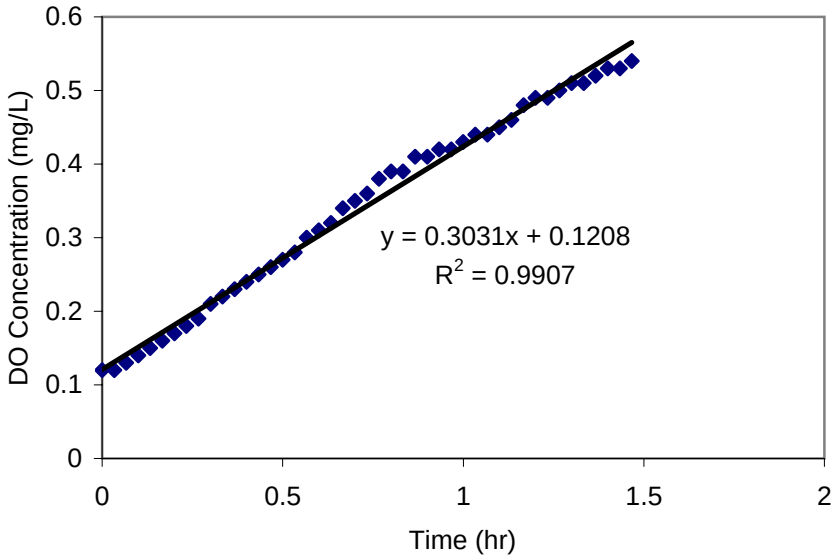
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 7, 2009
Station	IS-2	**Time**	12:55

Air Temperature (^{o}C)	24.59
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.54
Air DO %Sat	102.40
Water Depth (m)	0.92
Current Velocity (cm/s)	20.12
Water Temperature (^{o}C)	23.18
Water DO (mg/L)	6.52
Water DO % Sat	76.40
Delta DO %Sat in Dome	5.00
Avg DO %Sat in Dome	4.12
Elapsed Time (hr)	1.47
Avg. DO % Sat Deficit	72.28
Calculated Diffusion Rate k (g/m^2/hr)	1.15

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



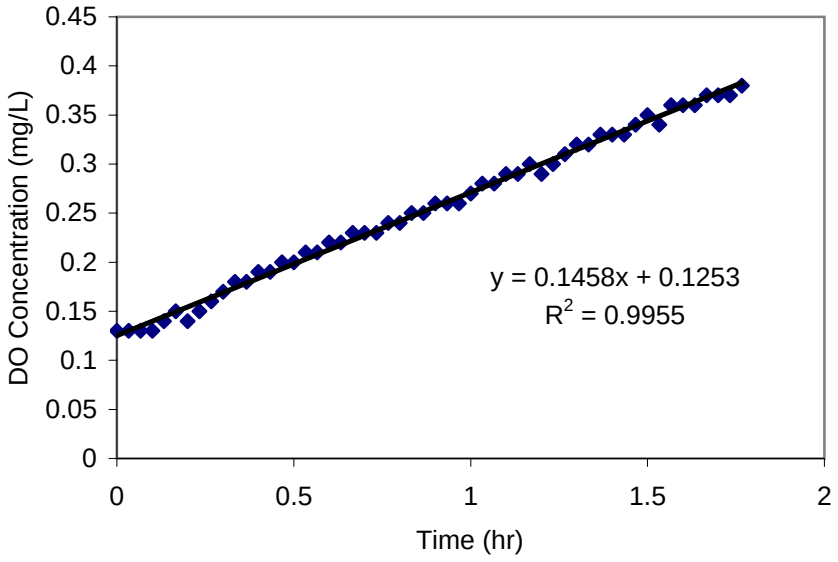
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 7, 2009
Station	IS-2	**Time**	14:53

Air Temperature (^{o}C)	22.63
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.17
Air DO %Sat	105.00
Water Depth (m)	0.72
Current Velocity (cm/s)	11.58
Water Temperature (^{o}C)	22.96
Water DO (mg/L)	6.40
Water DO % Sat	74.75
Delta DO %Sat in Dome	3.00
Avg DO %Sat in Dome	3.03
Elapsed Time (hr)	1.77
Avg. DO % Sat Deficit	71.72
Calculated Diffusion Rate k (g/m^2/hr)	0.58

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



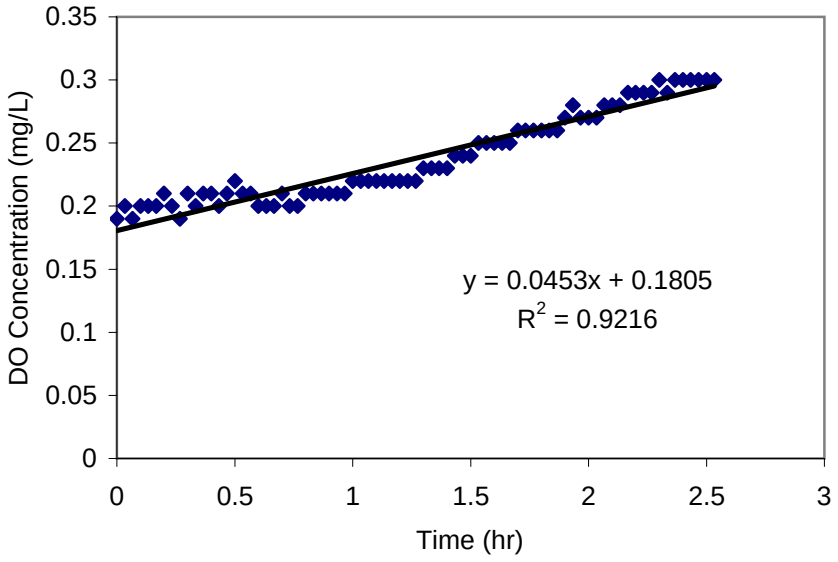
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 9, 2009
Station	IS-1	**Time**	10:02

Air Temperature (^{o}C)	26.73
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.16
Air DO %Sat	101.60
Water Depth (m)	0.82
Current Velocity (cm/s)	11.89
Water Temperature (^{o}C)	21.89
Water DO (mg/L)	4.23
Water DO % Sat	48.25
Delta DO %Sat in Dome	1.40
Avg DO %Sat in Dome	2.89
Elapsed Time (hr)	2.53
Avg. DO % Sat Deficit	45.36
Calculated Diffusion Rate k (g/m^2/hr)	0.30

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



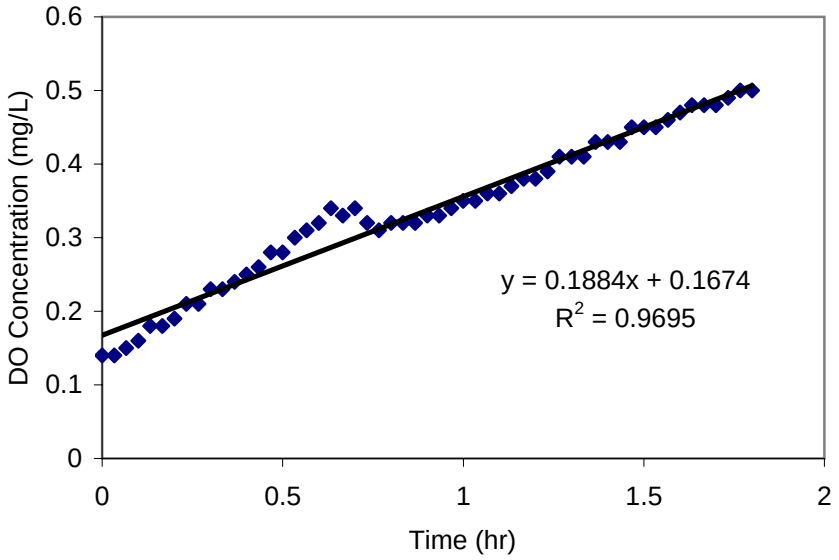
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ichetucknee Springs	**Date**	July 9, 2009
Station	IS-1	**Time**	13:43

Air Temperature (^{o}C)	23.88
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.31
Air DO %Sat	98.40
Water Depth (m)	1.01
Current Velocity (cm/s)	21.34
Water Temperature (^{o}C)	21.90
Water DO (mg/L)	4.14
Water DO % Sat	47.15
Delta DO %Sat in Dome	4.50
Avg DO %Sat in Dome	4.06
Elapsed Time (hr)	1.80
Avg. DO % Sat Deficit	43.09
Calculated Diffusion Rate k (g/m^2/hr)	1.42

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



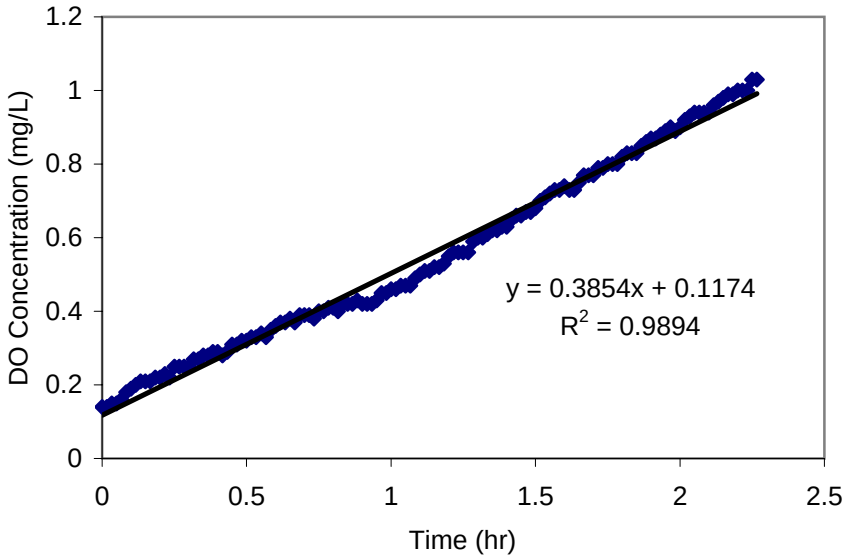
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Jackson Blue Sprimgs	**Date**	Jan 12 2009
Station	JBS-1	**Time**	14:58

Air Temperature (^{o}C)	13.24
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	12.34
Air DO %Sat	117.80
Water Depth (m)	2.23
Current Velocity (cm/s)	16.46
Water Temperature (^{o}C)	20.56
Water DO (mg/L)	7.03
Water DO % Sat	69.95
Delta DO %Sat in Dome	9.70
Avg DO %Sat in Dome	6.32
Elapsed Time (hr)	2.27
Avg. DO % Sat Deficit	63.63
Calculated Diffusion Rate k (g/m^{2}/hr)	1.71

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



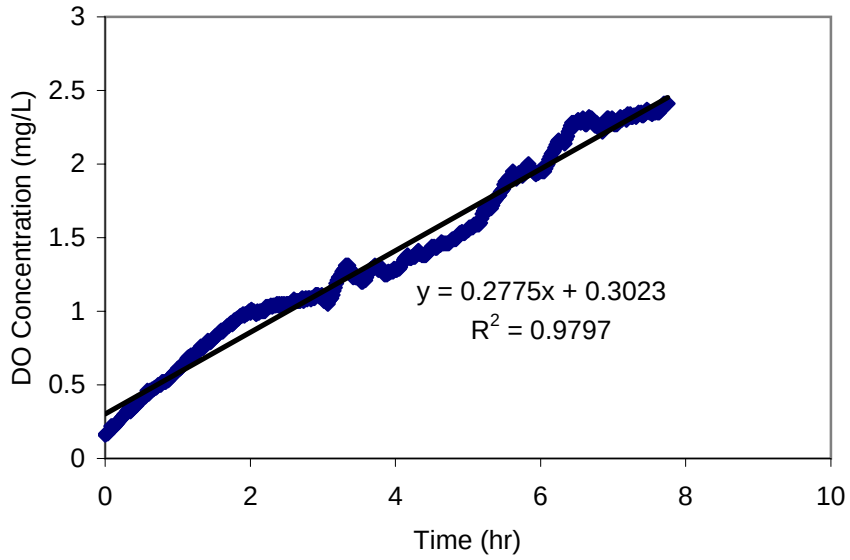
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Jackson Blue Sprimgs	**Date**	Jan 13 2009
Station	JBS-1	**Time**	9:55

Air Temperature (^{o}C)	10.09
Density of Air @ above temp (g/cm^3)	0.0013
Air DO (mg/L)	12.05
Air DO %Sat	107.00
Water Depth (m)	2.16
Current Velocity (cm/s)	17.37
Water Temperature (^{o}C)	20.55
Water DO (mg/L)	6.58
Water DO % Sat	73.20
Delta DO %Sat in Dome	29.30
Avg DO %Sat in Dome	17.21
Elapsed Time (hr)	7.75
Avg. DO % Sat Deficit	55.99
Calculated Diffusion Rate k (g/m^2/hr)	1.73

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



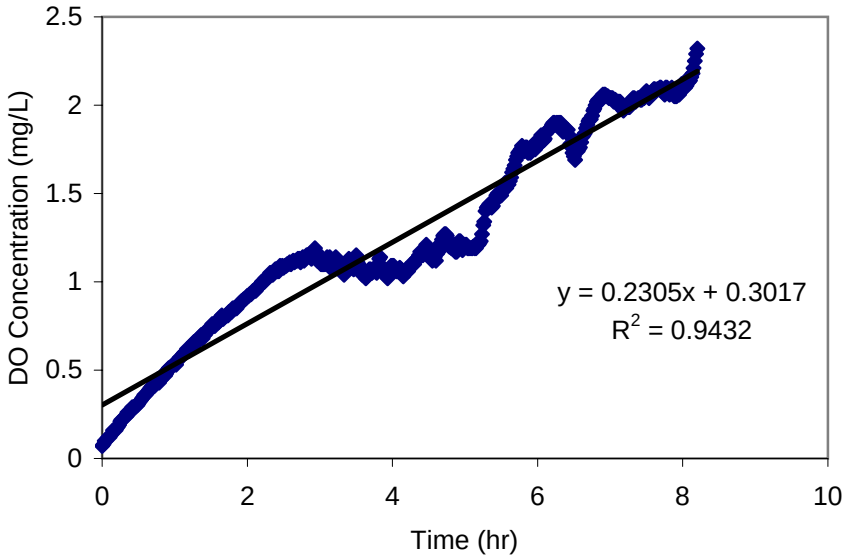
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Jackson Blue Sprimgs	**Date**	Jan 14 2009
Station	JBS-1	**Time**	9:38

Air Temperature (^{o}C)	5.92
Density of Air @ above temp (g/cm^3)	0.0013
Air DO (mg/L)	12.45
Air DO %Sat	99.80
Water Depth (m)	2.19
Current Velocity (cm/s)	15.54
Water Temperature (^{o}C)	20.55
Water DO (mg/L)	6.30
Water DO % Sat	70.10
Delta DO %Sat in Dome	27.00
Avg DO %Sat in Dome	15.40
Elapsed Time (hr)	8.20
Avg. DO % Sat Deficit	54.70
Calculated Diffusion Rate k (g/m^2/hr)	1.57

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



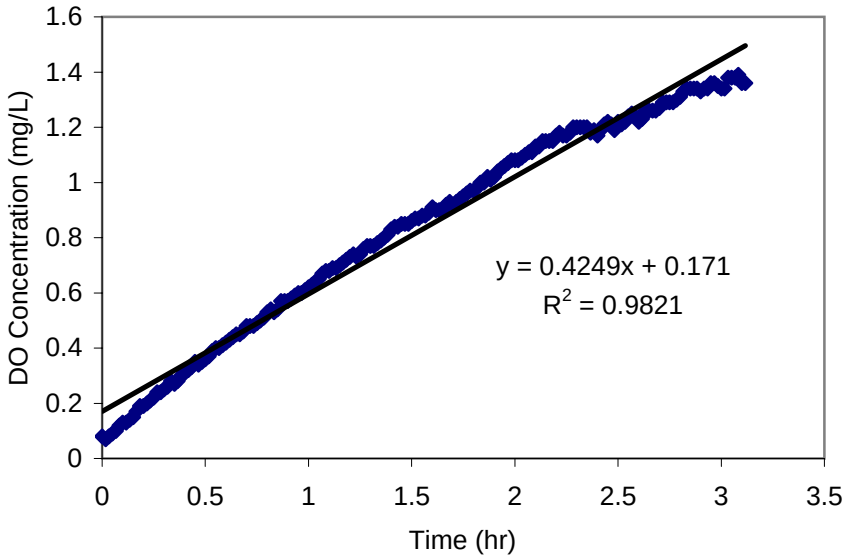
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Jackson Blue Sprimgs	**Date**	Jan 15 2009
Station	JBS-1	**Time**	9:33

Air Temperature (^{o}C)	10.74
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	10.08
Air DO %Sat	90.80
Water Depth (m)	2.16
Current Velocity (cm/s)	17.07
Water Temperature (^{o}C)	20.53
Water DO (mg/L)	5.75
Water DO % Sat	63.90
Delta DO %Sat in Dome	15.20
Avg DO %Sat in Dome	9.14
Elapsed Time (hr)	3.12
Avg. DO % Sat Deficit	54.76
Calculated Diffusion Rate k (g/m^2/hr)	2.28

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



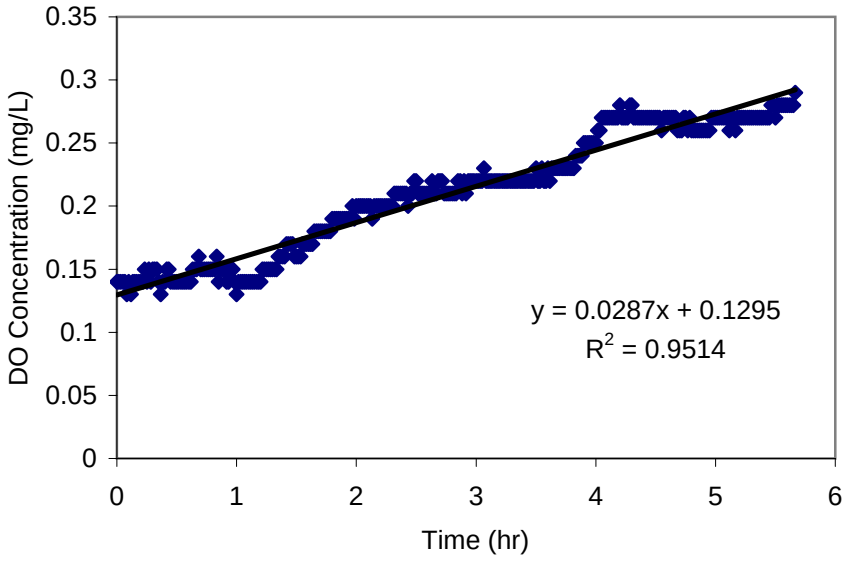
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Madison Blue Sprimgs	**Date**	Dec 1 2008
Station	MB-2	**Time**	10:43

Air Temperature (^{o}C)	11.20
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	11.59
Air DO %Sat	105.70
Water Depth (m)	1.01
Current Velocity (cm/s)	4.88
Water Temperature (^{o}C)	20.89
Water DO (mg/L)	1.48
Water DO % Sat	16.60
Delta DO %Sat in Dome	1.80
Avg DO %Sat in Dome	2.43
Elapsed Time (hr)	5.67
Avg. DO % Sat Deficit	14.17
Calculated Diffusion Rate k (g/m^2/hr)	0.66

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



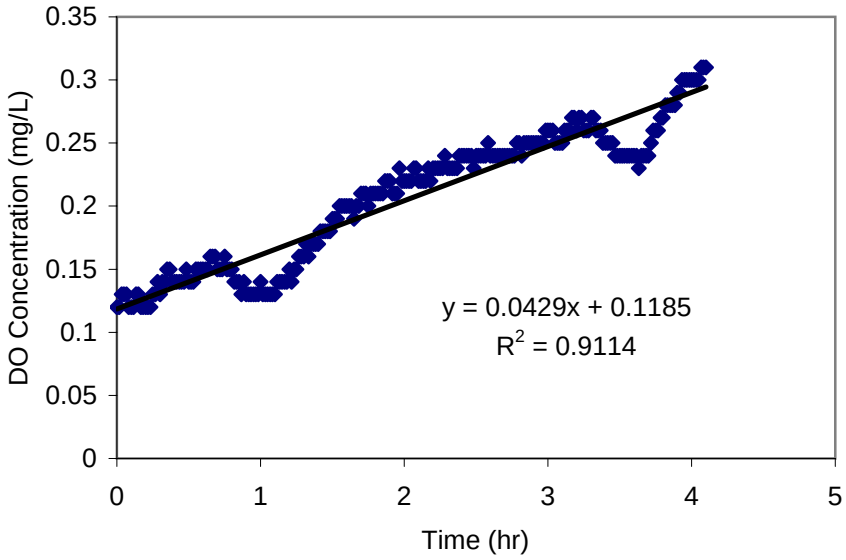
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Madison Blue Sprimgs	**Date**	Dec 2 2008
Station	MB-2	**Time**	11:04

Air Temperature (^{o}C)	8.82
Density of Air @ above temp (g/cm^3)	0.0013
Air DO (mg/L)	14.49
Air DO %Sat	125.10
Water Depth (m)	0.27
Current Velocity (cm/s)	3.66
Water Temperature (^{o}C)	14.49
Water DO (mg/L)	7.42
Water DO % Sat	72.75
Delta DO %Sat in Dome	1.90
Avg DO %Sat in Dome	2.11
Elapsed Time (hr)	4.10
Avg. DO % Sat Deficit	70.64
Calculated Diffusion Rate k (g/m^2/hr)	0.20

Dome Surface Area (m^2)	0.073
Dome Total Gas Volume (cm^3)	8250
Dome Total Oxygen Volume (cm^3)	1733
Density of Air @ 30^{o}C (g/cm^3)	0.0012



Note: river flooding, spring has reversed to sink

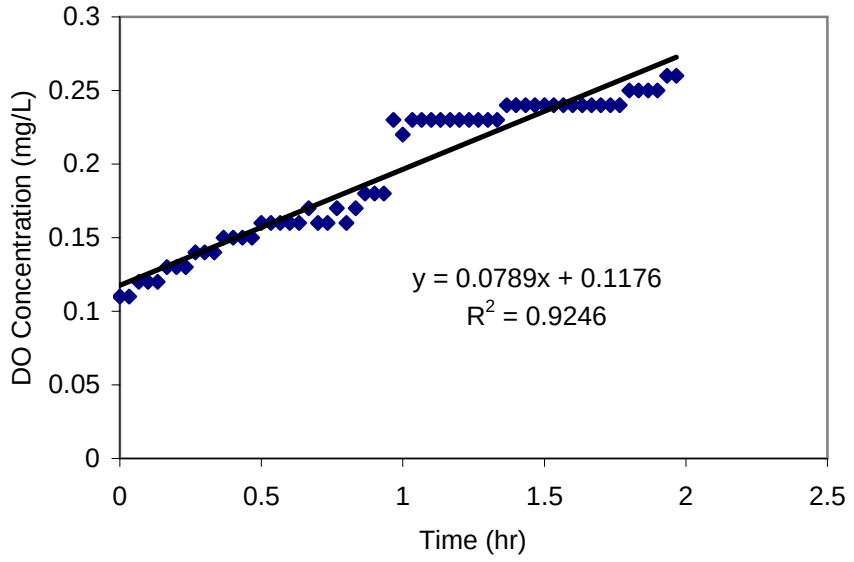
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Manatee Springs	**Date**	August 4, 2009
Station	MS-2	**Time**	10:05

Air Temperature (^{o}C)	24.52
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.63
Air DO %Sat	91.50
Water Depth (m)	1.28
Current Velocity (cm/s)	30.18
Water Temperature (^{o}C)	22.28
Water DO (mg/L)	1.17
Water DO % Sat	13.45
Delta DO %Sat in Dome	2.30
Avg DO %Sat in Dome	2.65
Elapsed Time (hr)	1.97
Avg. DO % Sat Deficit	10.80
Calculated Diffusion Rate k (g/m^2/hr)	2.64

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012

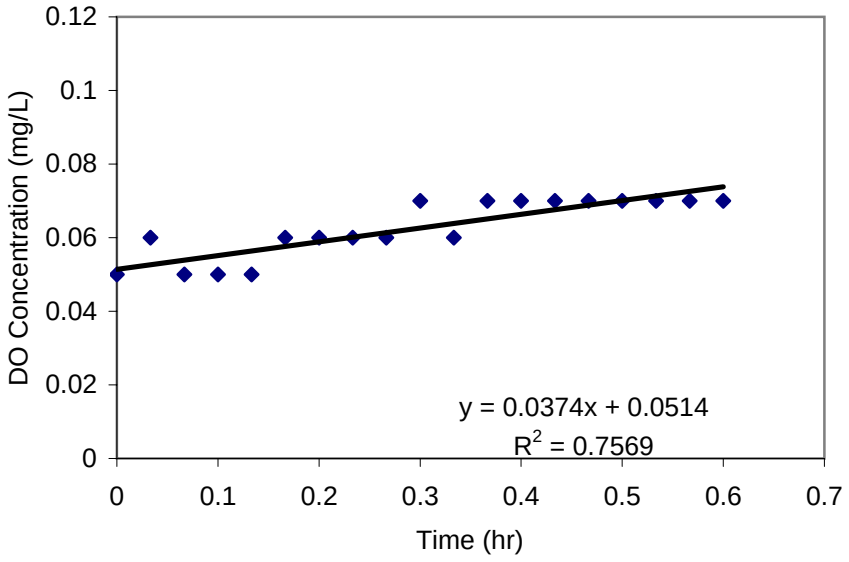


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Manatee Springs	**Date**	August 4, 2009
Station	MS-2	**Time**	12:22

Air Temperature (^{o}C)	24.52
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	7.63
Air DO %Sat	91.50
Water Depth (m)	1.34
Current Velocity (cm/s)	18.59
Water Temperature (^{o}C)	22.29
Water DO (mg/L)	1.20
Water DO % Sat	13.90
Delta DO %Sat in Dome	0.80
Avg DO %Sat in Dome	1.07
Elapsed Time (hr)	0.60
Avg. DO % Sat Deficit	12.83
Calculated Diffusion Rate k (g/m^{2}/hr)	2.53

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



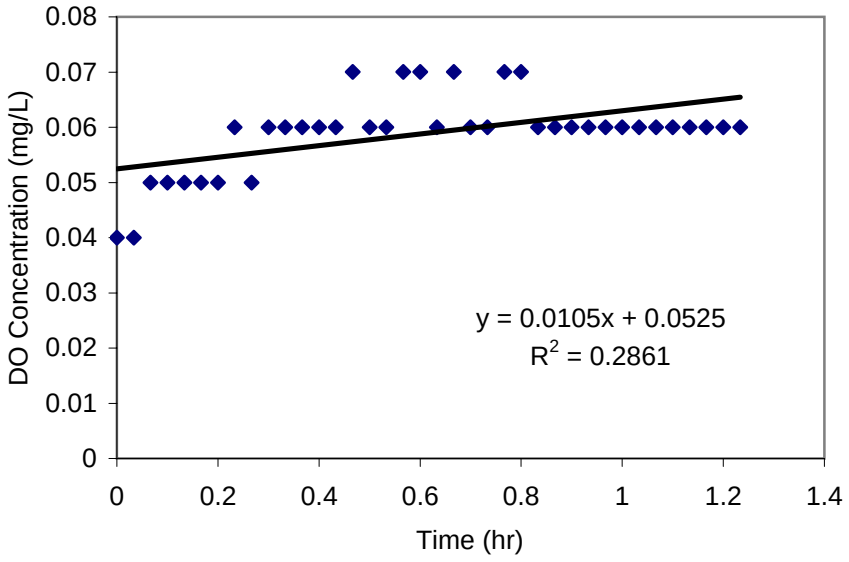
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Manatee Springs	**Date**	August 5, 2009
Station	MS-2	**Time**	14:05

Air Temperature (^{o}C)	25.12
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.15
Air DO %Sat	98.90
Water Depth (m)	1.55
Current Velocity (cm/s)	8.53
Water Temperature (^{o}C)	22.35
Water DO (mg/L)	1.31
Water DO % Sat	15.15
Delta DO %Sat in Dome	0.50
Avg DO %Sat in Dome	0.79
Elapsed Time (hr)	1.23
Avg. DO % Sat Deficit	14.36
Calculated Diffusion Rate k (g/m^2/hr)	0.69

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



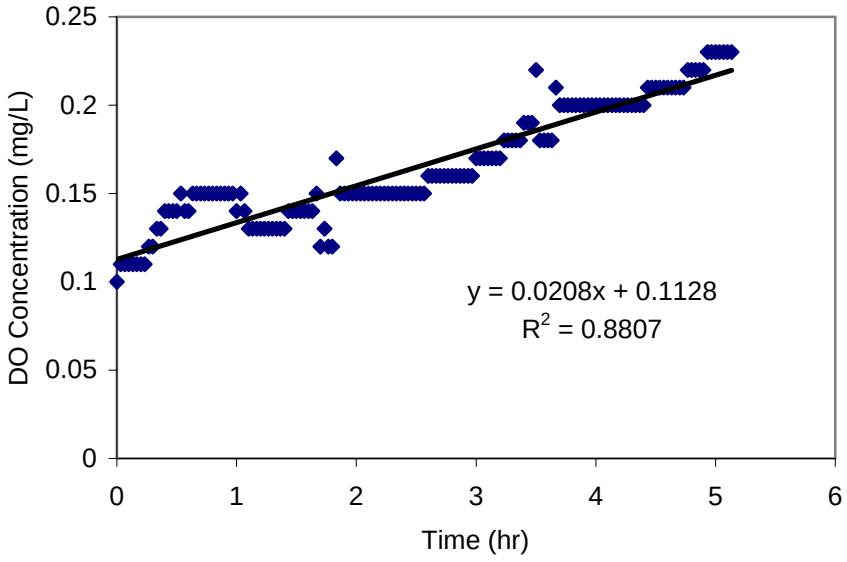
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Manatee Springs	**Date**	August 6, 2009
Station	MS-2	**Time**	9:29

Air Temperature (^{o}C)	25.01
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.27
Air DO %Sat	100.00
Water Depth (m)	1.52
Current Velocity (cm/s)	23.47
Water Temperature (^{o}C)	22.30
Water DO (mg/L)	1.24
Water DO % Sat	14.30
Delta DO %Sat in Dome	2.40
Avg DO %Sat in Dome	2.51
Elapsed Time (hr)	5.13
Avg. DO % Sat Deficit	11.79
Calculated Diffusion Rate k (g/m^2/hr)	0.97

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



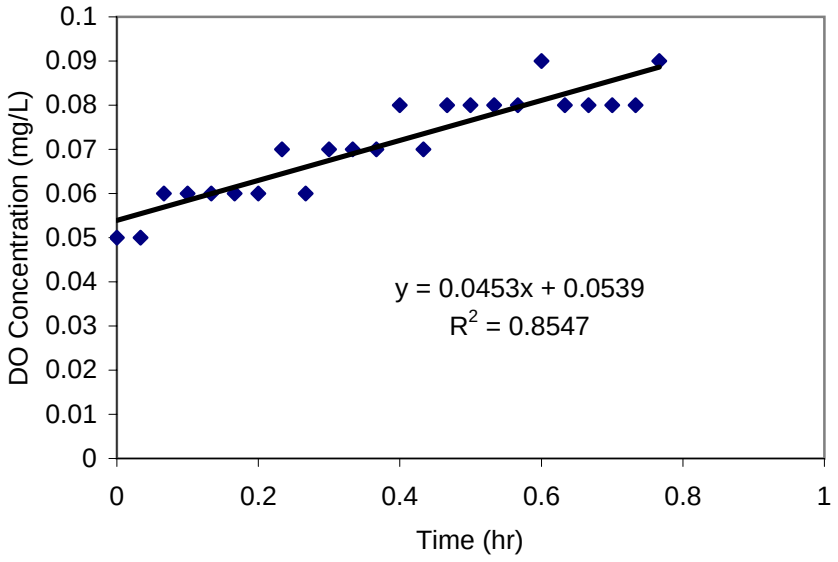
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Manatee Springs	**Date**	August 4, 2009
Station	Between MS-2 and MS-3	**Time**	14:28

Air Temperature (^{o}C)	27.99
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.22
Air DO %Sat	92.20
Water Depth (m)	0.79
Current Velocity (cm/s)	4.57
Water Temperature (^{o}C)	22.47
Water DO (mg/L)	2.22
Water DO % Sat	25.70
Delta DO %Sat in Dome	0.50
Avg DO %Sat in Dome	0.87
Elapsed Time (hr)	0.77
Avg. DO % Sat Deficit	24.83
Calculated Diffusion Rate k (g/m^2/hr)	0.63

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012

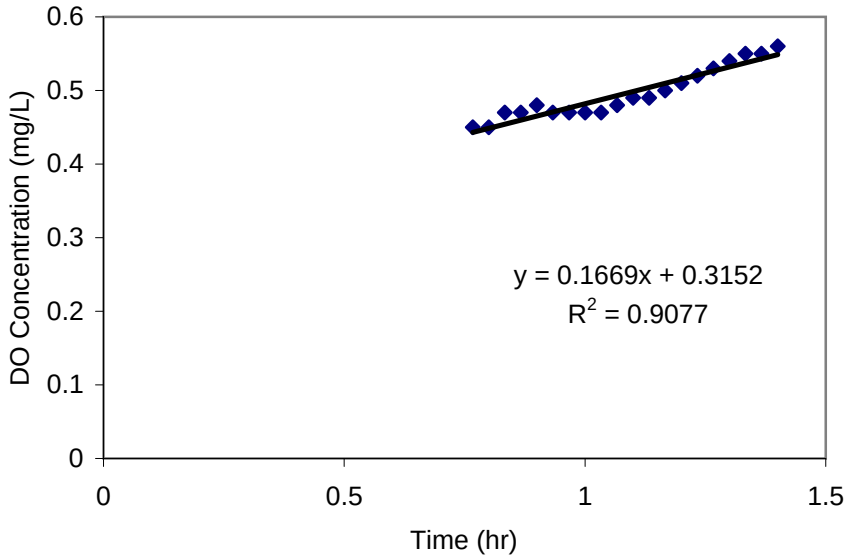


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Ponce de Leon Springs	**Date**	September 9, 2009
Station	PDL-2	**Time**	10:05

Air Temperature (^oC)	25.74
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.60
Air DO %Sat	93.30
Water Depth (m)	0.61
Current Velocity (cm/s)	7.92
Water Temperature (^oC)	20.34
Water DO (mg/L)	3.96
Water DO % Sat	43.80
Delta DO %Sat in Dome	3.20
Avg DO %Sat in Dome	7.18
Elapsed Time (hr)	0.63
Avg. DO % Sat Deficit	36.62
Calculated Diffusion Rate k ($g/m^2/hr$)	3.35

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

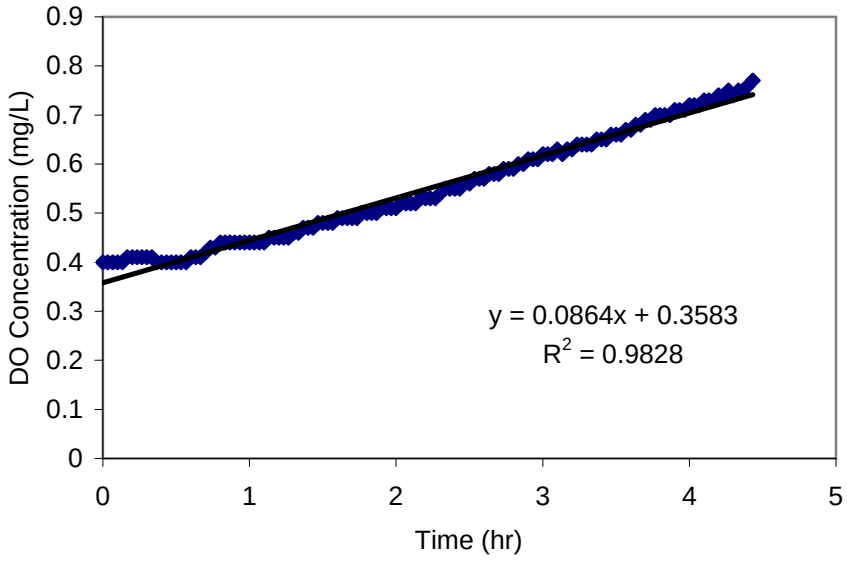


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Ponce de Leon Springs	**Date**	September 10, 2009
Station	Between PDL-2 and PDL-3	**Time**	11:16

Air Temperature (^oC)	26.35
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.12
Air DO %Sat	100.70
Water Depth (m)	0.27
Current Velocity (cm/s)	9.75
Water Temperature (^oC)	20.21
Water DO (mg/L)	4.82
Water DO % Sat	53.25
Delta DO %Sat in Dome	4.30
Avg DO %Sat in Dome	6.48
Elapsed Time (hr)	4.43
Avg. DO % Sat Deficit	46.77
Calculated Diffusion Rate k ($g/m^2/hr$)	0.50

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

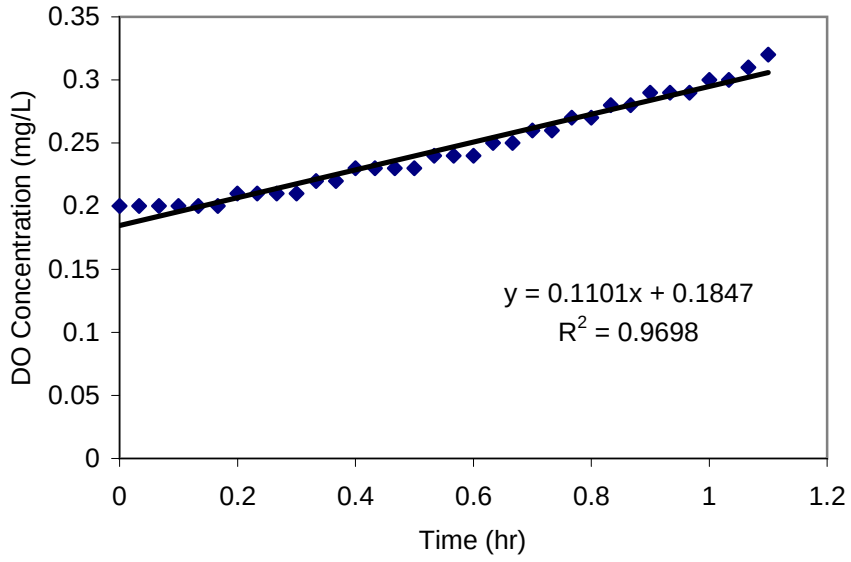


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Ponce de Leon Springs	**Date**	September 10, 2009
Station	Between PDL-2 and PDL-3	**Time**	15:50

Air Temperature (^oC)	23.61
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.69
Air DO %Sat	90.40
Water Depth (m)	0.24
Current Velocity (cm/s)	8.84
Water Temperature (^oC)	20.21
Water DO (mg/L)	4.65
Water DO % Sat	51.40
Delta DO %Sat in Dome	1.50
Avg DO %Sat in Dome	2.86
Elapsed Time (hr)	1.10
Avg. DO % Sat Deficit	48.54
Calculated Diffusion Rate k ($g/m^2/hr$)	0.69

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



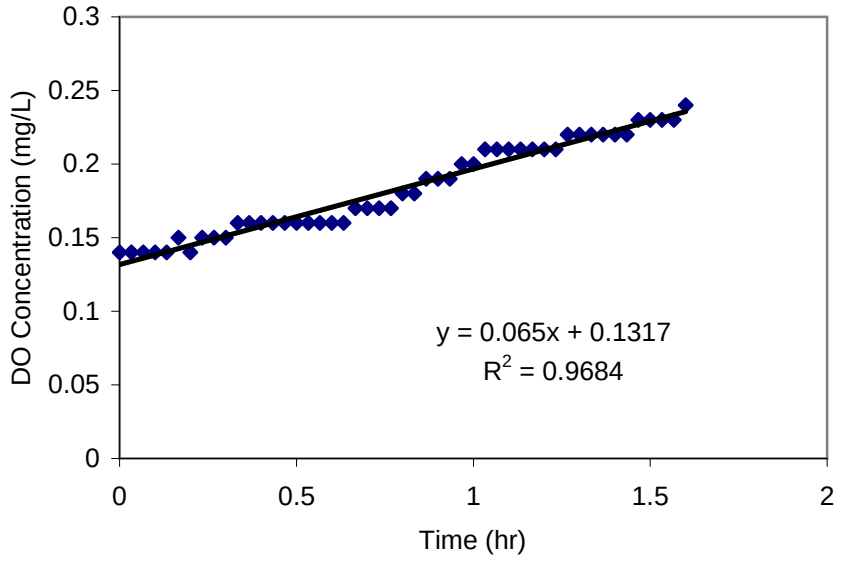
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Ponce de Leon Springs	**Date**	September 9, 2009
Station	PDL-3	**Time**	14:24

Air Temperature (^oC)	23.82
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.72
Air DO %Sat	86.20
Water Depth (m)	0.91
Current Velocity (cm/s)	7.62
Water Temperature (^oC)	20.36
Water DO (mg/L)	5.00
Water DO % Sat	55.50
Delta DO %Sat in Dome	1.40
Avg DO %Sat in Dome	2.52
Elapsed Time (hr)	1.60
Avg. DO % Sat Deficit	52.98
Calculated Diffusion Rate k ($g/m^2/hr$)	0.40

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



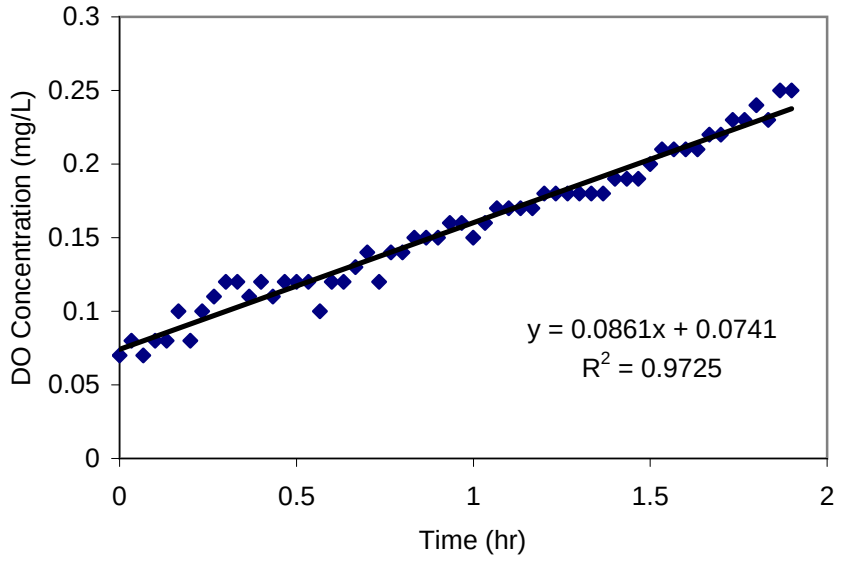
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 8, 2009
Station	RS-1	**Time**	11:21

Air Temperature (^{o}C)	23.59
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	9.39
Air DO %Sat	110.60
Water Depth (m)	2.84
Current Velocity (cm/s)	3.35
Water Temperature (^{o}C)	23.30
Water DO (mg/L)	7.90
Water DO % Sat	92.25
Delta DO %Sat in Dome	3.00
Avg DO %Sat in Dome	2.28
Elapsed Time (hr)	1.90
Avg. DO % Sat Deficit	89.97
Calculated Diffusion Rate k (g/m^{2}/hr)	0.43

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



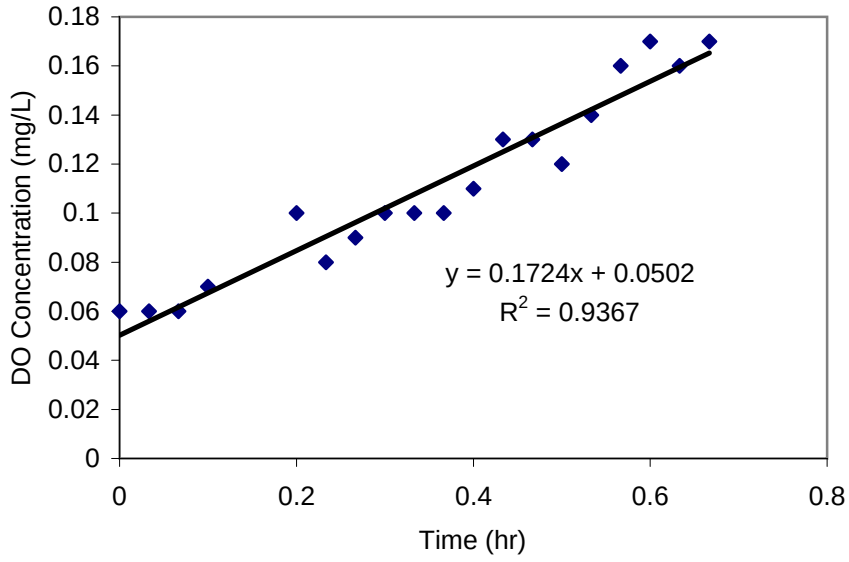
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 9, 2009
Station	RS-1	**Time**	13:28

Air Temperature (^oC)	23.80
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.01
Air DO %Sat	106.70
Water Depth (m)	2.32
Current Velocity (cm/s)	7.92
Water Temperature (^oC)	23.40
Water DO (mg/L)	7.85
Water DO % Sat	92.30
Delta DO %Sat in Dome	1.70
Avg DO %Sat in Dome	1.55
Elapsed Time (hr)	0.67
Avg. DO % Sat Deficit	90.75
Calculated Diffusion Rate k ($g/m^2/hr$)	0.69

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



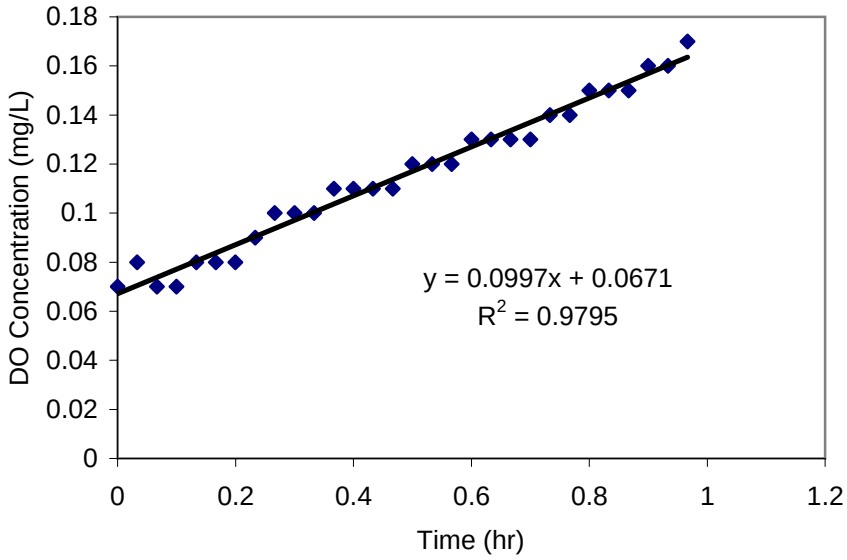
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 10, 2009
Station	RS-1	**Time**	10:11

Air Temperature (^oC)	28.81
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.35
Air DO %Sat	107.50
Water Depth (m)	2.62
Current Velocity (cm/s)	13.41
Water Temperature (^oC)	23.14
Water DO (mg/L)	6.54
Water DO % Sat	76.50
Delta DO %Sat in Dome	1.80
Avg DO %Sat in Dome	1.64
Elapsed Time (hr)	0.97
Avg. DO % Sat Deficit	74.86
Calculated Diffusion Rate k ($g/m^2/hr$)	0.60

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



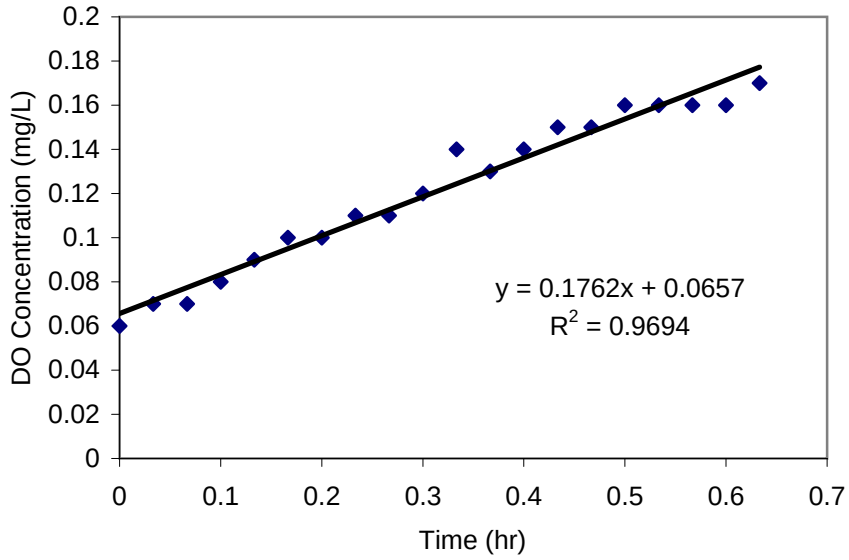
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 11, 2009
Station	RS-1	**Time**	12:24

Air Temperature (^oC)	31.36
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	6.61
Air DO %Sat	89.40
Water Depth (m)	3.54
Current Velocity (cm/s)	16.46
Water Temperature (^oC)	23.22
Water DO (mg/L)	6.38
Water DO % Sat	74.80
Delta DO %Sat in Dome	1.60
Avg DO %Sat in Dome	1.67
Elapsed Time (hr)	0.63
Avg. DO % Sat Deficit	73.13
Calculated Diffusion Rate k ($g/m^2/hr$)	0.82

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



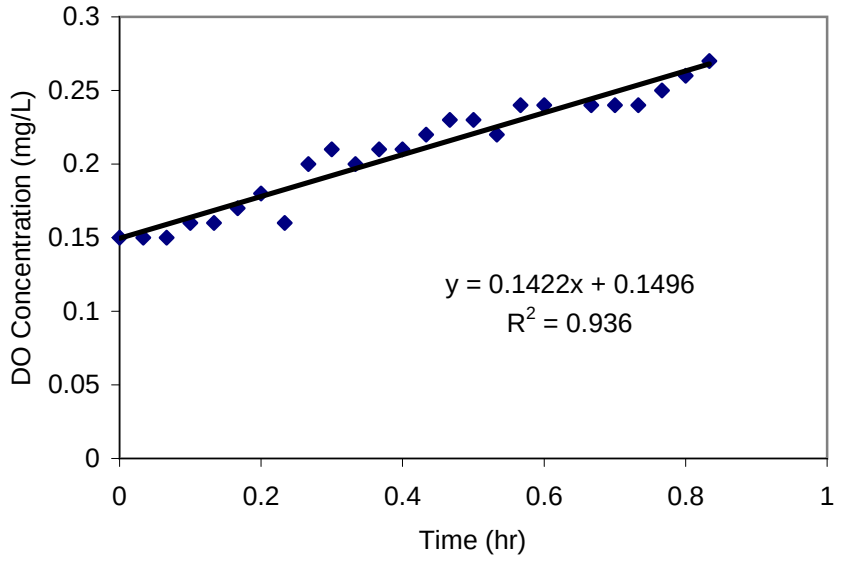
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 8, 2009
Station	RS-2	**Time**	10:14

Air Temperature (^oC)	26.79
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.85
Air DO %Sat	122.50
Water Depth (m)	2.37
Current Velocity (cm/s)	16.15
Water Temperature (^oC)	23.16
Water DO (mg/L)	7.07
Water DO % Sat	82.90
Delta DO %Sat in Dome	1.70
Avg DO %Sat in Dome	2.75
Elapsed Time (hr)	0.83
Avg. DO % Sat Deficit	80.15
Calculated Diffusion Rate k ($g/m^2/hr$)	0.62

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



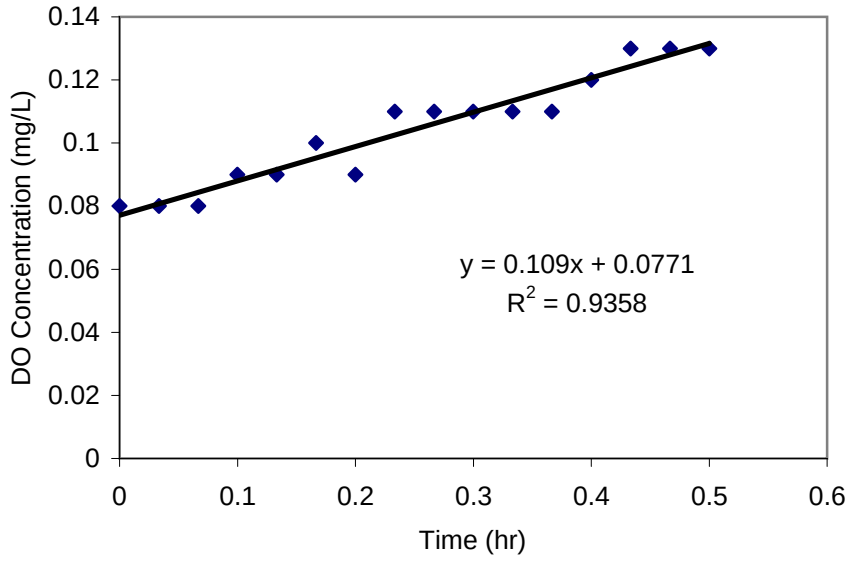
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 8, 2009
Station	RS-2	**Time**	16:49

Air Temperature (^oC)	23.07
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.22
Air DO %Sat	107.60
Water Depth (m)	1.95
Current Velocity (cm/s)	15.24
Water Temperature (^oC)	23.55
Water DO (mg/L)	7.97
Water DO % Sat	93.90
Delta DO %Sat in Dome	0.80
Avg DO %Sat in Dome	1.62
Elapsed Time (hr)	0.50
Avg. DO % Sat Deficit	92.28
Calculated Diffusion Rate k ($g/m^2/hr$)	0.43

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



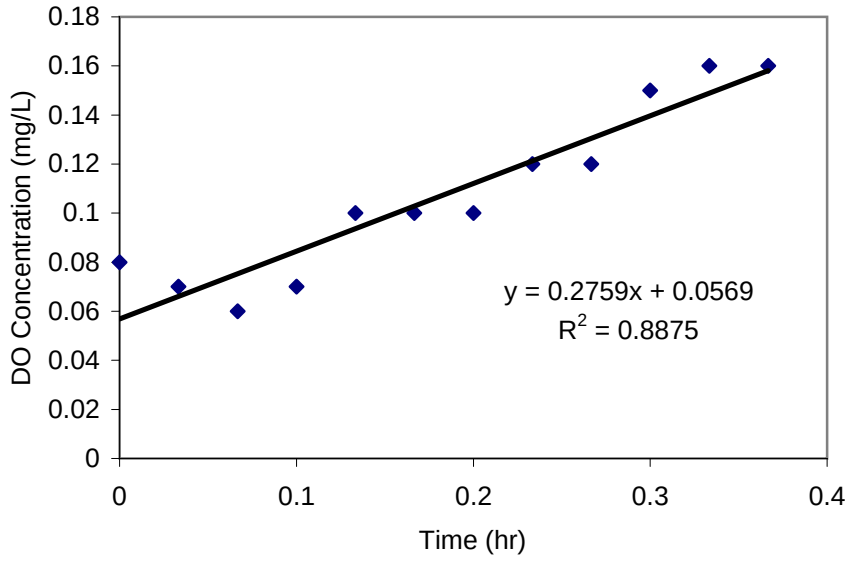
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 9, 2009
Station	RS-2	**Time**	14:36

Air Temperature (^oC)	23.72
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.05
Air DO %Sat	106.80
Water Depth (m)	2.41
Current Velocity (cm/s)	10.36
Water Temperature (^oC)	23.67
Water DO (mg/L)	8.66
Water DO % Sat	102.25
Delta DO %Sat in Dome	1.40
Avg DO %Sat in Dome	1.46
Elapsed Time (hr)	0.37
Avg. DO % Sat Deficit	100.79
Calculated Diffusion Rate k ($g/m^2/hr$)	0.93

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



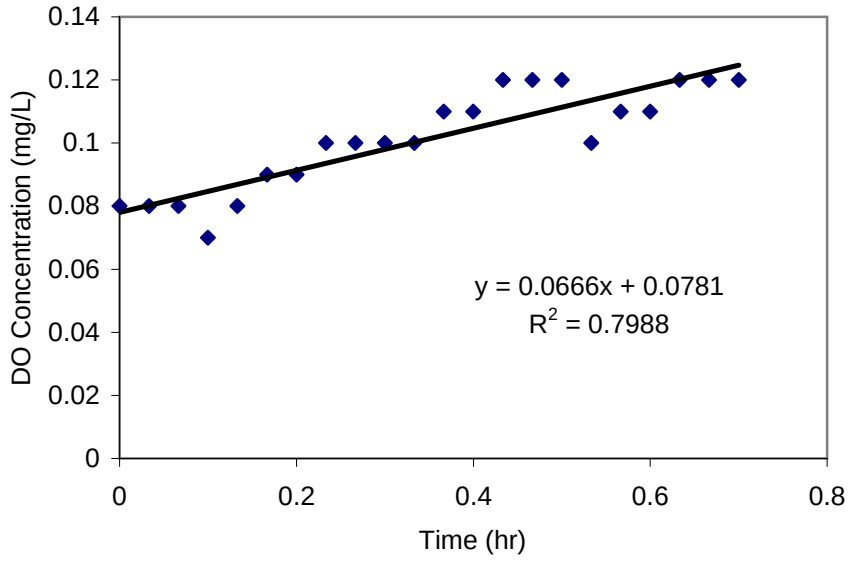
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 10, 2009
Station	RS-2	**Time**	11:28

Air Temperature (^oC)	29.59
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	0.00
Air DO %Sat	0.00
Water Depth (m)	2.38
Current Velocity (cm/s)	13.72
Water Temperature (^oC)	23.46
Water DO (mg/L)	7.31
Water DO % Sat	85.80
Delta DO %Sat in Dome	1.00
Avg DO %Sat in Dome	1.43
Elapsed Time (hr)	0.70
Avg. DO % Sat Deficit	84.37
Calculated Diffusion Rate k ($g/m^2/hr$)	0.41

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

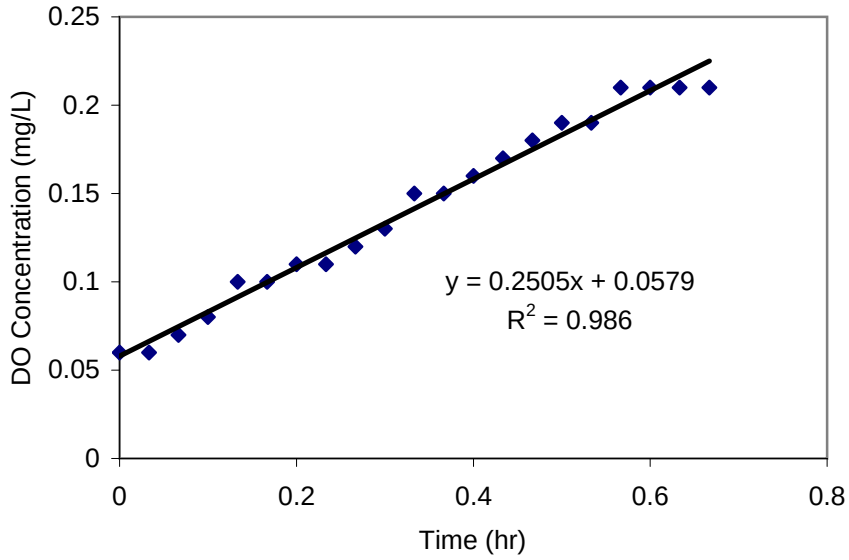


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 11, 2009
Station	RS-2	**Time**	11:24

Air Temperature (^oC)	31.70
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	6.98
Air DO %Sat	0.00
Water Depth (m)	2.16
Current Velocity (cm/s)	17.07
Water Temperature (^oC)	23.40
Water DO (mg/L)	6.37
Water DO % Sat	74.90
Delta DO %Sat in Dome	2.20
Avg DO %Sat in Dome	1.90
Elapsed Time (hr)	0.67
Avg. DO % Sat Deficit	73.00
Calculated Diffusion Rate k ($g/m^2/hr$)	1.08

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



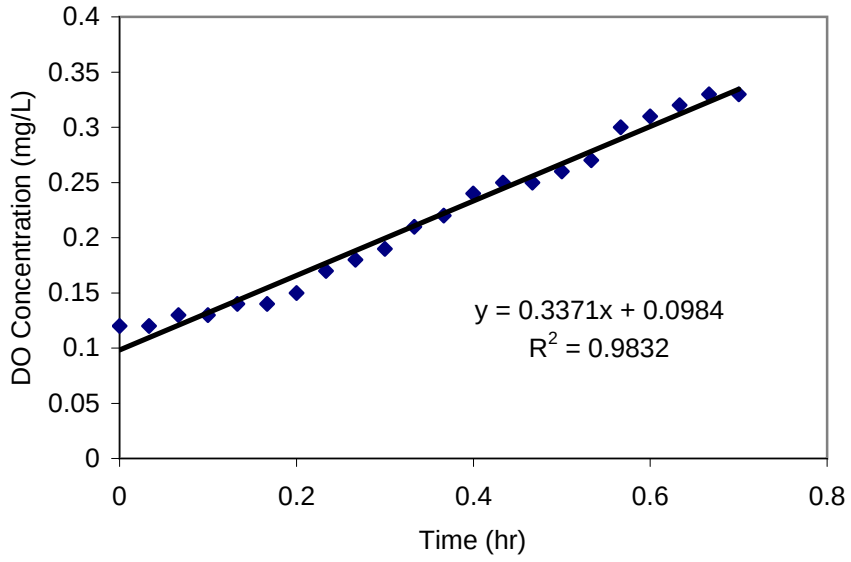
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 8, 2009
Station	RS-3	**Time**	15:16

Air Temperature (^{o}C)	24.25
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	9.15
Air DO %Sat	110.50
Water Depth (m)	3.20
Current Velocity (cm/s)	25.60
Water Temperature (^{o}C)	23.86
Water DO (mg/L)	9.26
Water DO % Sat	109.50
Delta DO %Sat in Dome	3.90
Avg DO %Sat in Dome	3.26
Elapsed Time (hr)	0.70
Avg. DO % Sat Deficit	106.24
Calculated Diffusion Rate k (g/m^{2}/hr)	1.28

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



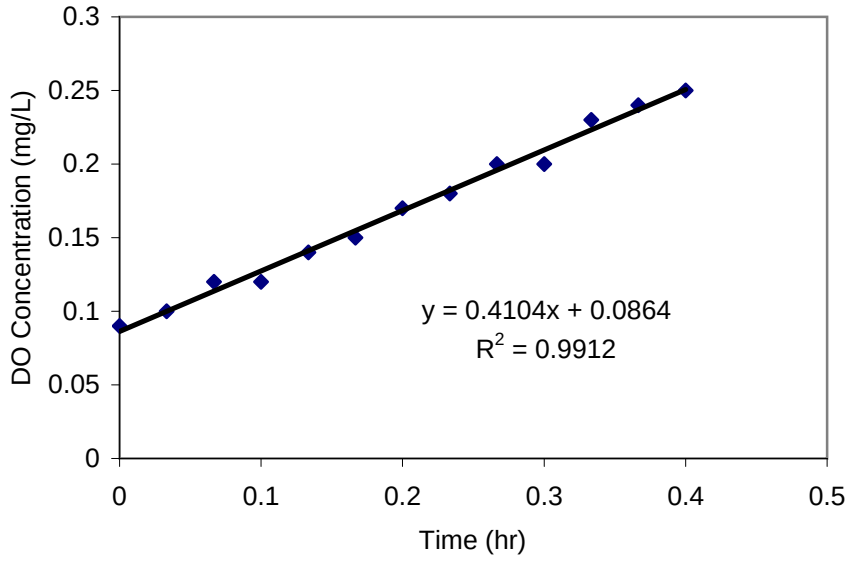
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 9, 2009
Station	RS-3	**Time**	15:26

Air Temperature (^{o}C)	24.50
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	8.90
Air DO %Sat	106.70
Water Depth (m)	3.08
Current Velocity (cm/s)	21.03
Water Temperature (^{o}C)	24.19
Water DO (mg/L)	10.04
Water DO % Sat	119.75
Delta DO %Sat in Dome	2.10
Avg DO %Sat in Dome	2.11
Elapsed Time (hr)	0.40
Avg. DO % Sat Deficit	117.64
Calculated Diffusion Rate k (g/m^{2}/hr)	1.09

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



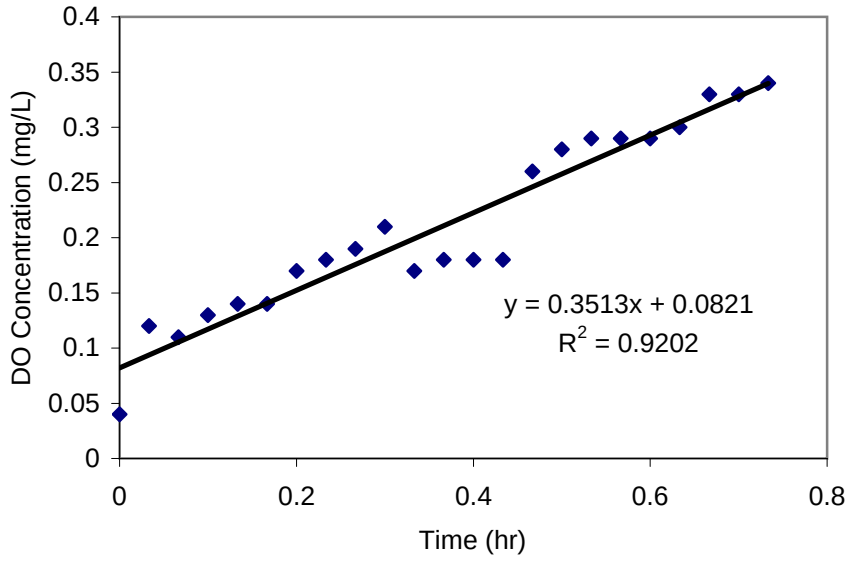
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 10, 2009
Station	RS-3	**Time**	14:11

Air Temperature (^oC)	26.53
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.80
Air DO %Sat	109.60
Water Depth (m)	3.14
Current Velocity (cm/s)	30.78
Water Temperature (^oC)	24.17
Water DO (mg/L)	8.78
Water DO % Sat	104.75
Delta DO %Sat in Dome	4.00
Avg DO %Sat in Dome	2.75
Elapsed Time (hr)	0.73
Avg. DO % Sat Deficit	102.00
Calculated Diffusion Rate k ($g/m^2/hr$)	1.30

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



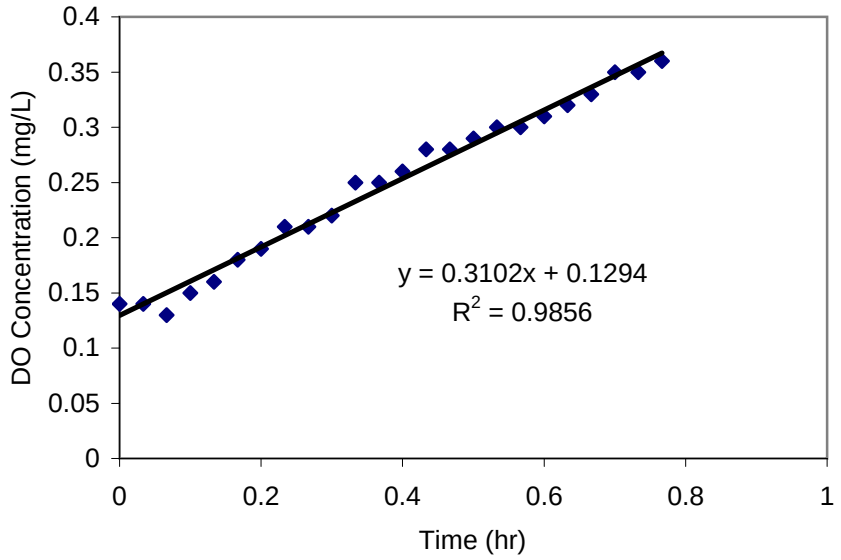
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Rainbow Springs	**Date**	June 11, 2009
Station	RS-3	**Time**	10:12

Air Temperature (^oC)	26.14
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.43
Air DO %Sat	91.40
Water Depth (m)	2.83
Current Velocity (cm/s)	27.13
Water Temperature (^oC)	23.34
Water DO (mg/L)	7.01
Water DO % Sat	82.35
Delta DO %Sat in Dome	3.60
Avg DO %Sat in Dome	3.44
Elapsed Time (hr)	0.77
Avg. DO % Sat Deficit	78.91
Calculated Diffusion Rate k ($g/m^2/hr$)	1.44

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



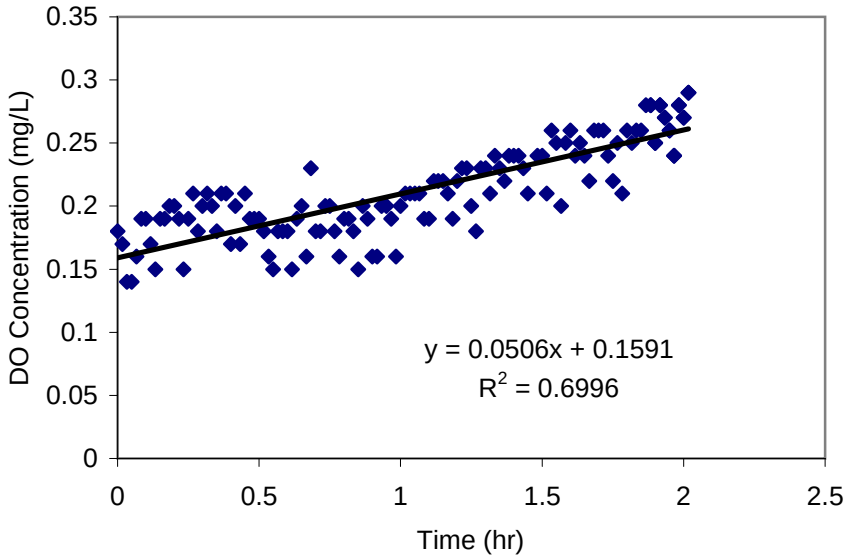
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Silver Springs	**Date**	May 4, 2009
Station	Boat Basin	**Time**	14:45

Air Temperature (^{o}C)	24.92
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	8.07
Air DO %Sat	97.70
Water Depth (m)	1.11
Current Velocity (cm/s)	2.44
Water Temperature (^{o}C)	23.75
Water DO (mg/L)	4.47
Water DO % Sat	52.95
Delta DO %Sat in Dome	2.00
Avg DO %Sat in Dome	2.92
Elapsed Time (hr)	2.02
Avg. DO % Sat Deficit	50.03
Calculated Diffusion Rate k (g/m^{2}/hr)	0.48

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



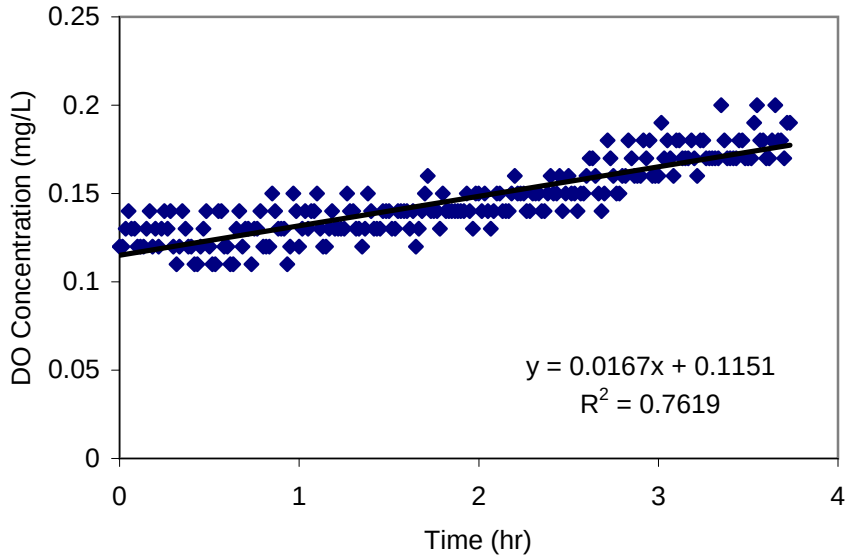
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Silver Springs	**Date**	May 8, 2009
Station	Boat Basin	**Time**	10:03

Air Temperature (^{o}C)	24.76
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	8068.00
Air DO %Sat	104.70
Water Depth (m)	0.75
Current Velocity (cm/s)	3.35
Water Temperature (^{o}C)	23.36
Water DO (mg/L)	2.76
Water DO % Sat	32.35
Delta DO %Sat in Dome	1.20
Avg DO %Sat in Dome	1.78
Elapsed Time (hr)	3.73
Avg. DO % Sat Deficit	30.57
Calculated Diffusion Rate k (g/m^{2}/hr)	0.26

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



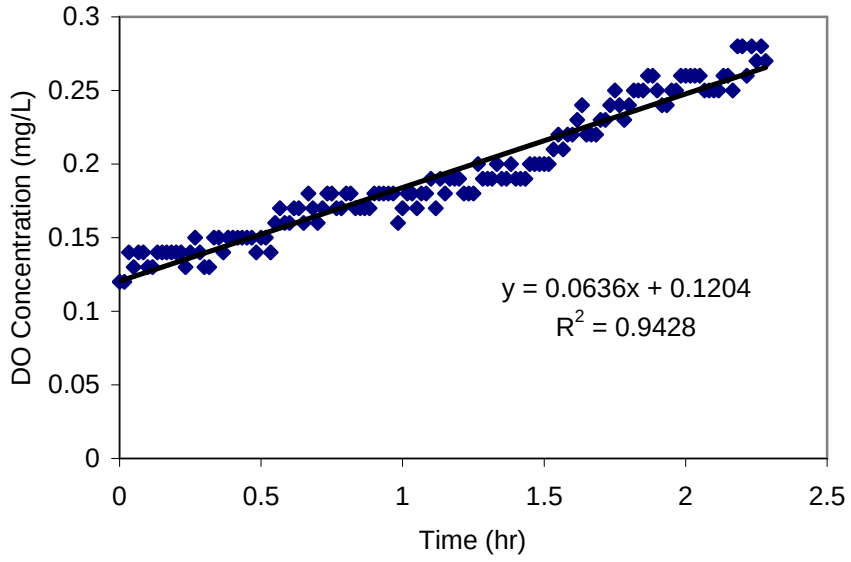
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Silver Springs	**Date**	May 5, 2009
Station	SS-2.5	**Time**	11:48

Air Temperature (^{o}C)	26.94
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.82
Air DO %Sat	98.00
Water Depth (m)	1.59
Current Velocity (cm/s)	14.33
Water Temperature (^{o}C)	23.88
Water DO (mg/L)	4.89
Water DO % Sat	57.95
Delta DO %Sat in Dome	2.50
Avg DO %Sat in Dome	2.93
Elapsed Time (hr)	2.28
Avg. DO % Sat Deficit	55.02
Calculated Diffusion Rate k (g/m^2/hr)	0.48

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



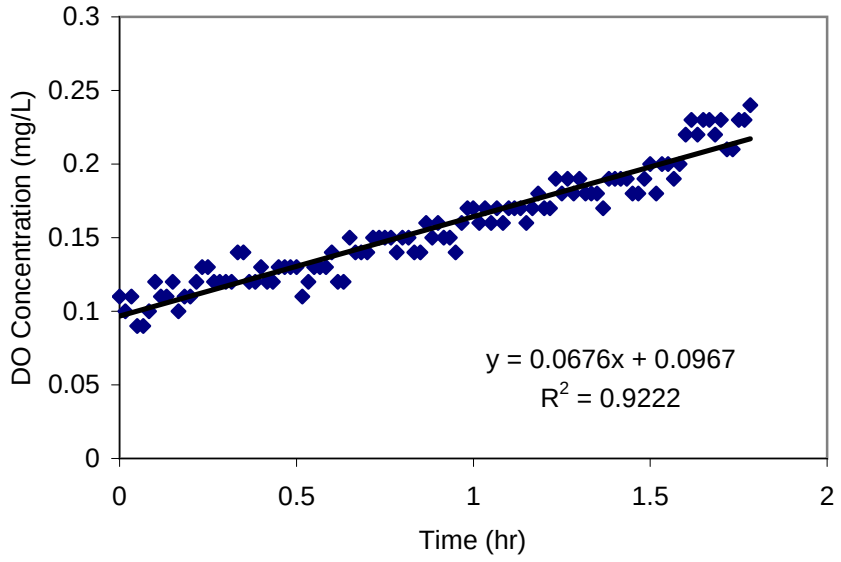
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Silver Springs	**Date**	May 5, 2009
Station	SS-2.5	**Time**	15:10

Air Temperature (^{o}C)	26.94
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.82
Air DO %Sat	98.00
Water Depth (m)	1.59
Current Velocity (cm/s)	14.33
Water Temperature (^{o}C)	23.99
Water DO (mg/L)	4.96
Water DO % Sat	59.00
Delta DO %Sat in Dome	1.90
Avg DO %Sat in Dome	2.21
Elapsed Time (hr)	1.78
Avg. DO % Sat Deficit	56.79
Calculated Diffusion Rate k (g/m^2/hr)	0.45

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012

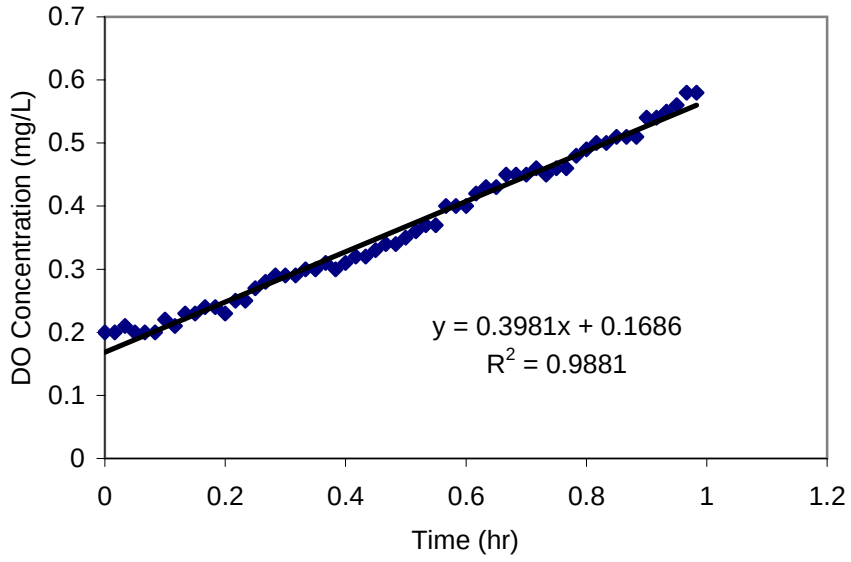


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Silver Springs	**Date**	May 7, 2009
Station	SS-3	**Time**	13:20

Air Temperature (^oC)	28.32
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.22
Air DO %Sat	105.80
Water Depth (m)	3.35
Current Velocity (cm/s)	34.75
Water Temperature (^oC)	24.10
Water DO (mg/L)	5.55
Water DO % Sat	65.70
Delta DO %Sat in Dome	5.20
Avg DO %Sat in Dome	4.70
Elapsed Time (hr)	0.98
Avg. DO % Sat Deficit	61.00
Calculated Diffusion Rate k ($g/m^2/hr$)	2.09

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



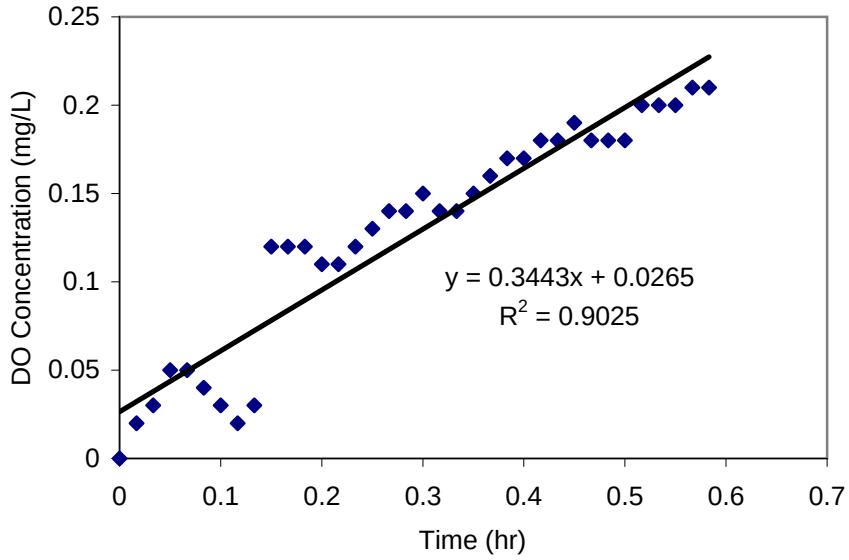
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Silver Springs	**Date**	May 7, 2009
Station	SS-2	**Time**	14:40

Air Temperature (^oC)	31.12
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.09
Air DO %Sat	109.10
Water Depth (m)	2.59
Current Velocity (cm/s)	19.20
Water Temperature (^oC)	23.78
Water DO (mg/L)	4.57
Water DO % Sat	55.90
Delta DO %Sat in Dome	2.70
Avg DO %Sat in Dome	1.63
Elapsed Time (hr)	0.58
Avg. DO % Sat Deficit	54.27
Calculated Diffusion Rate k ($g/m^2/hr$)	2.04

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



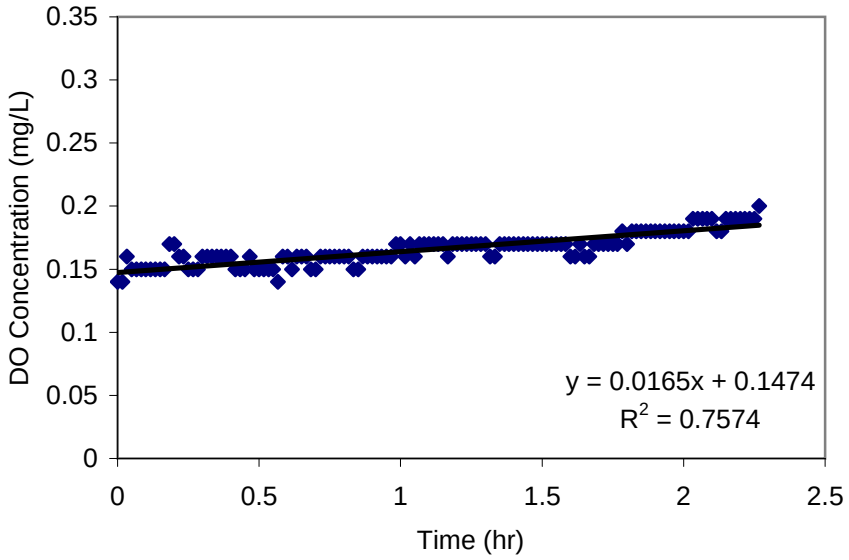
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Silver Glen Springs	**Date**	Feb 18 2009
Station	SGS-1	**Time**	10:15

Air Temperature (^{o}C)	18.85
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.76
Air DO %Sat	94.40
Water Depth (m)	0.64
Current Velocity (cm/s)	25.60
Water Temperature (^{o}C)	23.08
Water DO (mg/L)	2.81
Water DO % Sat	33.00
Delta DO %Sat in Dome	3.10
Avg DO %Sat in Dome	3.33
Elapsed Time (hr)	2.27
Avg. DO % Sat Deficit	29.67
Calculated Diffusion Rate k (g/m^2/hr)	1.15

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^{o}C (g/cm^3)	0.0012



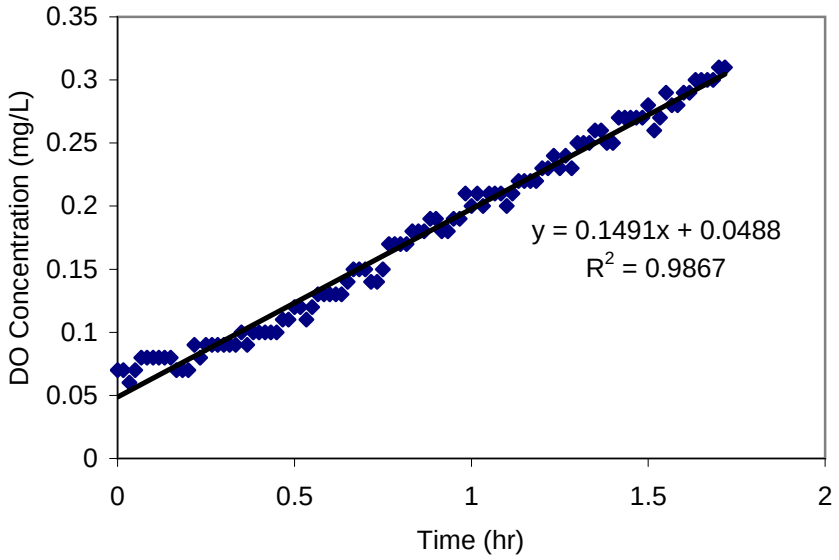
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Silver Glen Springs	**Date**	Feb 18 2009
Station	SGS-1	**Time**	14:47

Air Temperature (^{o}C)	22.80
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	8.43
Air DO %Sat	97.90
Water Depth (m)	0.64
Current Velocity (cm/s)	25.60
Water Temperature (^{o}C)	23.07
Water DO (mg/L)	2.54
Water DO % Sat	29.80
Delta DO %Sat in Dome	3.00
Avg DO %Sat in Dome	2.28
Elapsed Time (hr)	1.72
Avg. DO % Sat Deficit	27.52
Calculated Diffusion Rate k (g/m^{2}/hr)	1.56

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012

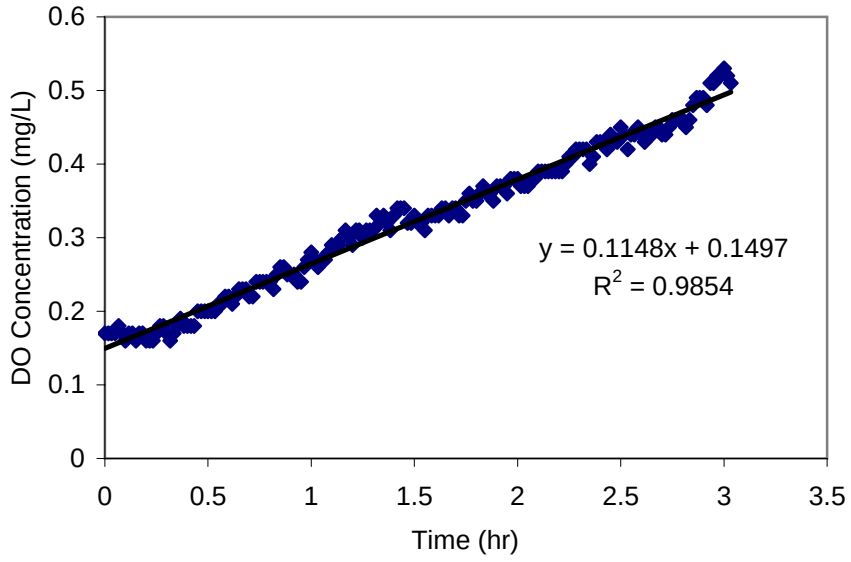


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Silver Glen Springs	**Date**	Feb 19 2009
Station	SGS-1	**Time**	9:18

Air Temperature (^oC)	19.27
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.46
Air DO %Sat	102.60
Water Depth (m)	0.73
Current Velocity (cm/s)	29.57
Water Temperature (^oC)	23.07
Water DO (mg/L)	2.79
Water DO % Sat	33.05
Delta DO %Sat in Dome	4.50
Avg DO %Sat in Dome	3.85
Elapsed Time (hr)	3.03
Avg. DO % Sat Deficit	29.20
Calculated Diffusion Rate k ($g/m^2/hr$)	1.26

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

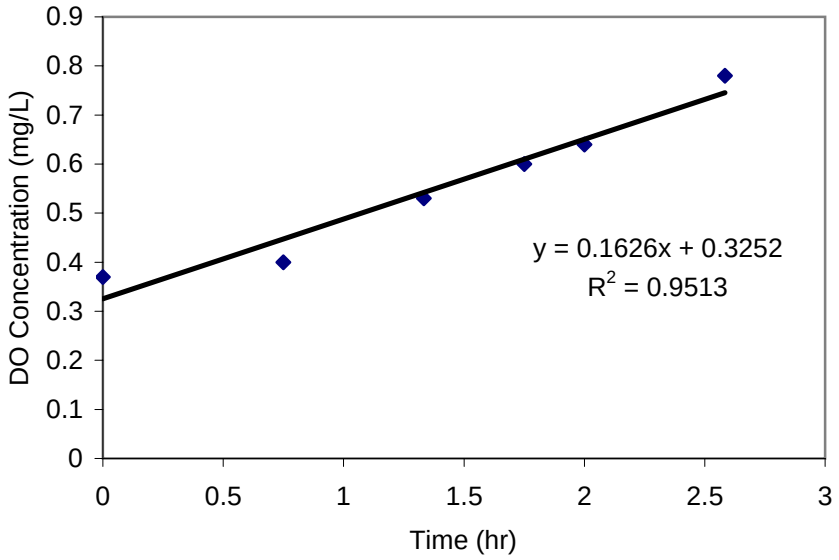


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Wakulla Springs	**Date**	Apr 13, 2009
Station	WAK-2	**Time**	11:50

Air Temperature (^oC)	23.90
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.71
Air DO %Sat	102.00
Water Depth (m)	2.41
Current Velocity (cm/s)	35.05
Water Temperature (^oC)	20.23
Water DO (mg/L)	2.29
Water DO % Sat	25.25
Delta DO %Sat in Dome	4.60
Avg DO %Sat in Dome	6.30
Elapsed Time (hr)	2.58
Avg. DO % Sat Deficit	18.95
Calculated Diffusion Rate k ($g/m^2/hr$)	2.30

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



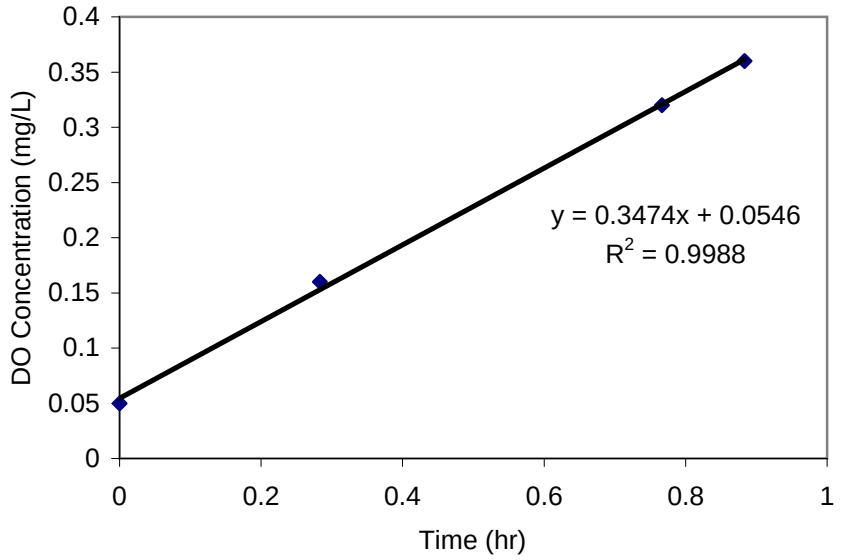
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Wakulla Springs	**Date**	Apr 13, 2009
Station	WAK-2	**Time**	14:30

Air Temperature (^oC)	20.70
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.14
Air DO %Sat	101.70
Water Depth (m)	2.41
Current Velocity (cm/s)	36.58
Water Temperature (^oC)	20.23
Water DO (mg/L)	2.22
Water DO % Sat	24.55
Delta DO %Sat in Dome	3.40
Avg DO %Sat in Dome	2.50
Elapsed Time (hr)	0.88
Avg. DO % Sat Deficit	22.05
Calculated Diffusion Rate k ($g/m^2/hr$)	4.31

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

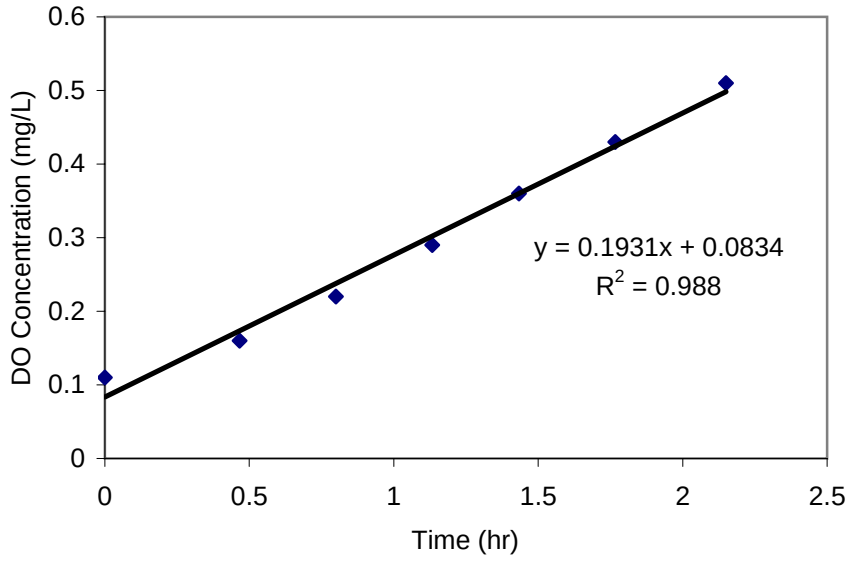


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Wakulla Springs	**Date**	Apr 14, 2009
Station	WAK-2	**Time**	8:54

Air Temperature (^oC)	19.48
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.70
Air DO %Sat	94.80
Water Depth (m)	2.96
Current Velocity (cm/s)	40.23
Water Temperature (^oC)	20.28
Water DO (mg/L)	2.15
Water DO % Sat	23.65
Delta DO %Sat in Dome	4.60
Avg DO %Sat in Dome	3.43
Elapsed Time (hr)	2.15
Avg. DO % Sat Deficit	20.22
Calculated Diffusion Rate k ($g/m^2/hr$)	2.63

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

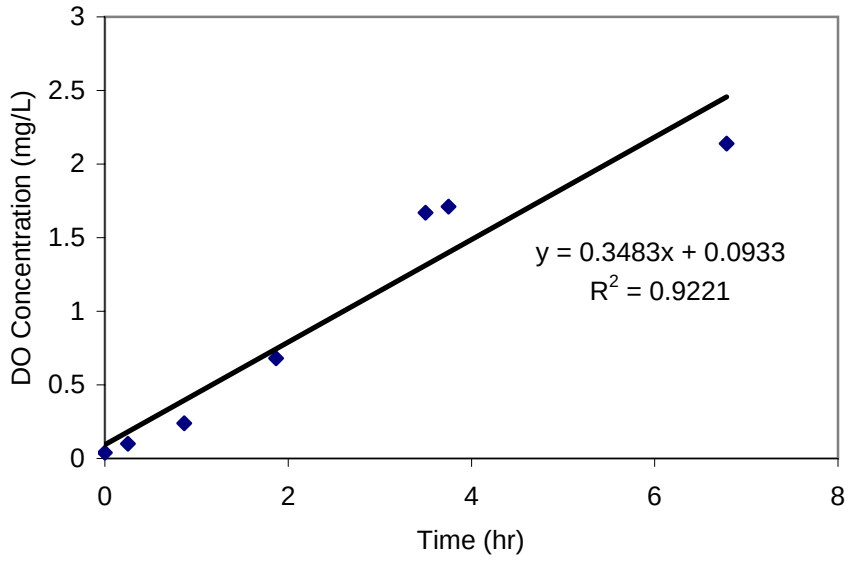


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Wakulla Springs	**Date**	Apr 14, 2009
Station	WAK-2	**Time**	11:05

Air Temperature (^oC)	21.30
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	8.71
Air DO %Sat	98.40
Water Depth (m)	2.96
Current Velocity (cm/s)	40.23
Water Temperature (^oC)	20.30
Water DO (mg/L)	2.06
Water DO % Sat	22.80
Delta DO %Sat in Dome	26.10
Avg DO %Sat in Dome	11.57
Elapsed Time (hr)	6.78
Avg. DO % Sat Deficit	11.23
Calculated Diffusion Rate k ($g/m^2/hr$)	8.45

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

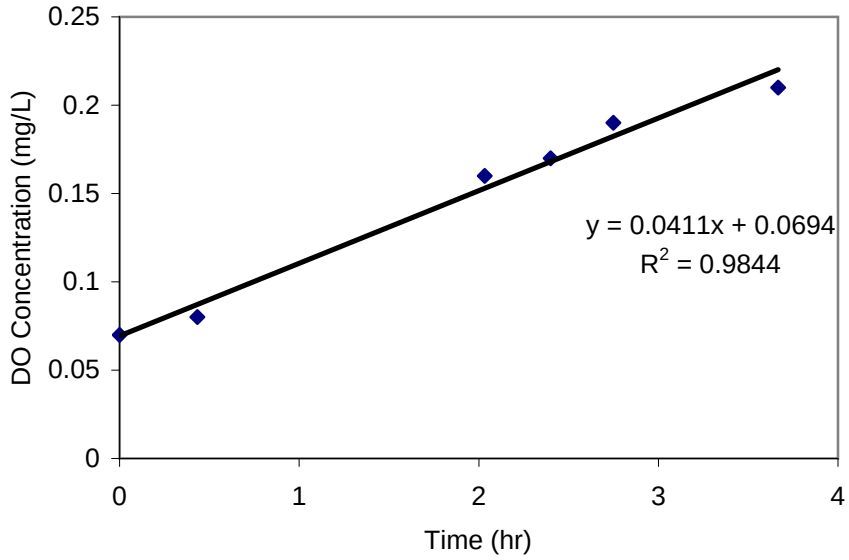


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Wakulla Springs	**Date**	Apr 15, 2009
Station	WAK-2	**Time**	9:25

Air Temperature (^oC)	10.70
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	11.14
Air DO %Sat	100.90
Water Depth (m)	2.13
Current Velocity (cm/s)	1.83
Water Temperature (^oC)	20.41
Water DO (mg/L)	2.31
Water DO % Sat	25.85
Delta DO %Sat in Dome	2.00
Avg DO %Sat in Dome	1.70
Elapsed Time (hr)	3.67
Avg. DO % Sat Deficit	24.15
Calculated Diffusion Rate k ($g/m^2/hr$)	0.58

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

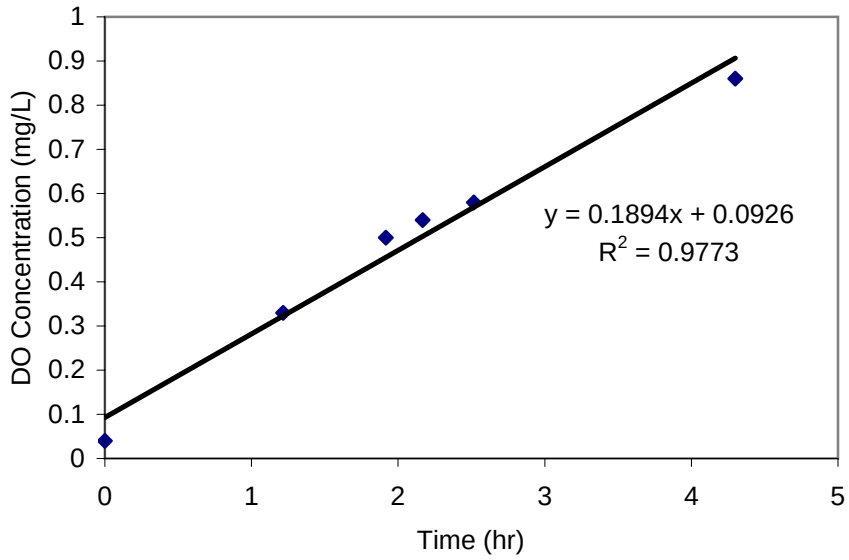


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Wakulla Springs	**Date**	Apr 15, 2009
Station	WAK-2	**Time**	13:17

Air Temperature (^oC)	24.90
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	7.53
Air DO %Sat	93.20
Water Depth (m)	1.19
Current Velocity (cm/s)	25.60
Water Temperature (^oC)	20.35
Water DO (mg/L)	2.02
Water DO % Sat	22.25
Delta DO %Sat in Dome	9.70
Avg DO %Sat in Dome	6.03
Elapsed Time (hr)	4.30
Avg. DO % Sat Deficit	16.22
Calculated Diffusion Rate k ($g/m^2/hr$)	3.39

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



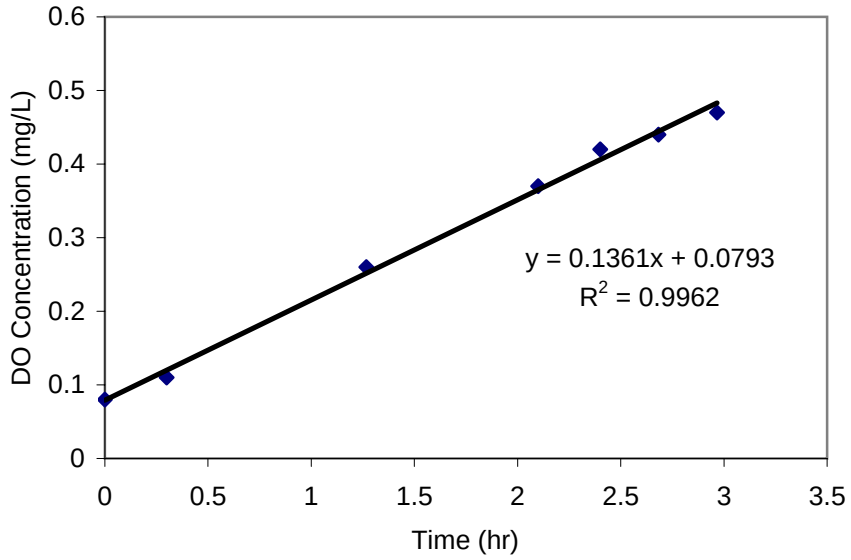
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Wakulla Springs	**Date**	Apr 16, 2009
Station	WAK-2	**Time**	9:15

Air Temperature (^oC)	12.39
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	10.75
Air DO %Sat	100.50
Water Depth (m)	1.19
Current Velocity (cm/s)	14.33
Water Temperature (^oC)	20.44
Water DO (mg/L)	2.17
Water DO % Sat	23.70
Delta DO %Sat in Dome	5.00
Avg DO %Sat in Dome	3.93
Elapsed Time (hr)	2.97
Avg. DO % Sat Deficit	19.77
Calculated Diffusion Rate k ($g/m^2/hr$)	2.17

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012

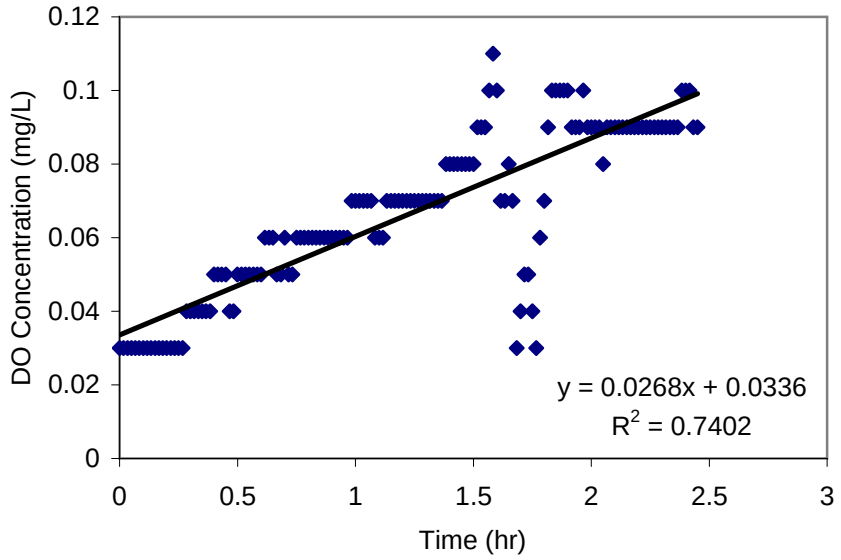


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Weeki Wachee Spring	**Date**	Mar 09 2009
Station	WWS-1	**Time**	14:26

Air Temperature (^{o}C)	26.00
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	8.09
Air DO %Sat	100.00
Water Depth (m)	3.41
Current Velocity (cm/s)	9.14
Water Temperature (^{o}C)	23.62
Water DO (mg/L)	1.61
Water DO % Sat	18.95
Delta DO %Sat in Dome	0.90
Avg DO %Sat in Dome	0.82
Elapsed Time (hr)	2.45
Avg. DO % Sat Deficit	18.13
Calculated Diffusion Rate k (g/m^{2}/hr)	0.49

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



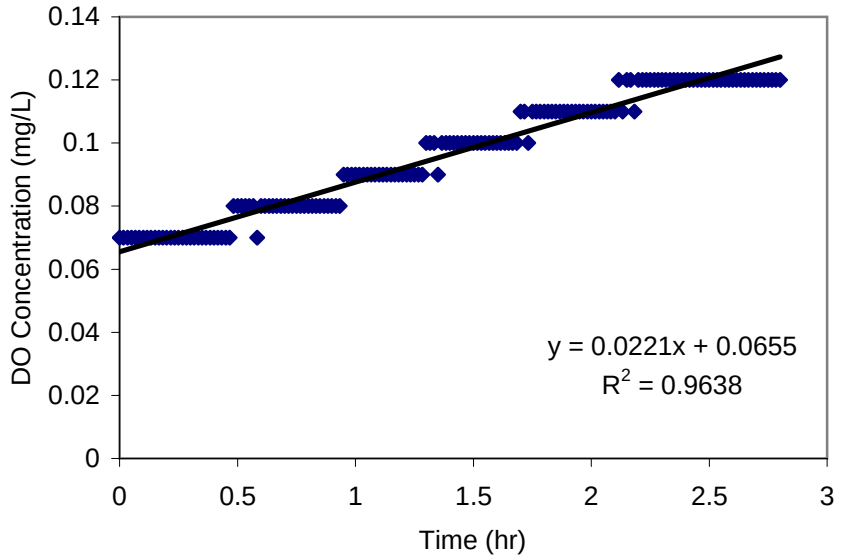
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Weeki Wachee Spring	**Date**	Mar 10 2009
Station	WWS-1.5	**Time**	10:12

Air Temperature (^oC)	15.06
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.61
Air DO %Sat	95.40
Water Depth (m)	0.81
Current Velocity (cm/s)	1.52
Water Temperature (^oC)	23.69
Water DO (mg/L)	1.97
Water DO % Sat	23.25
Delta DO %Sat in Dome	0.90
Avg DO %Sat in Dome	1.42
Elapsed Time (hr)	2.80
Avg. DO % Sat Deficit	21.83
Calculated Diffusion Rate k ($g/m^2/hr$)	0.37

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



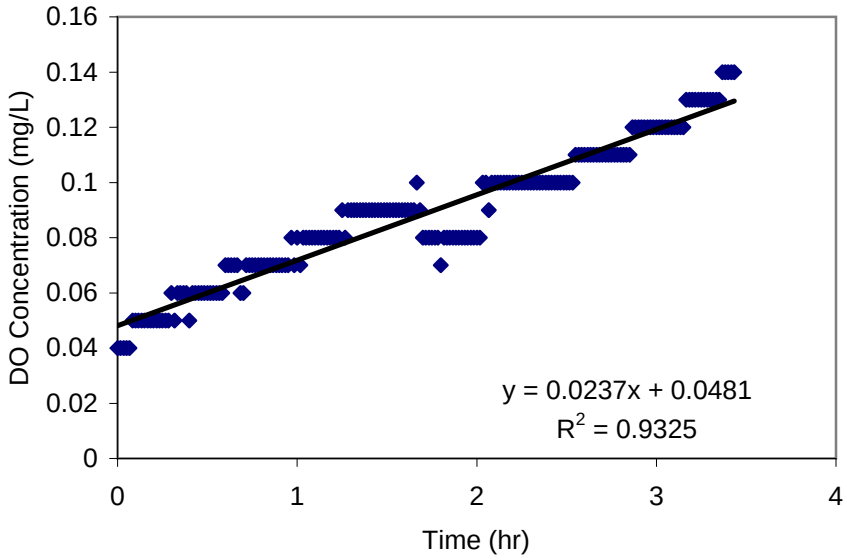
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Weeki Wachee Spring	**Date**	Mar 10 2009
Station	WWS-1.5	**Time**	13:03

Air Temperature (^{o}C)	20.00
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	9.15
Air DO %Sat	100.70
Water Depth (m)	0.81
Current Velocity (cm/s)	1.52
Water Temperature (^{o}C)	23.69
Water DO (mg/L)	1.97
Water DO % Sat	23.25
Delta DO %Sat in Dome	1.80
Avg DO %Sat in Dome	1.43
Elapsed Time (hr)	3.43
Avg. DO % Sat Deficit	21.82
Calculated Diffusion Rate k (g/m^{2}/hr)	0.60

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012

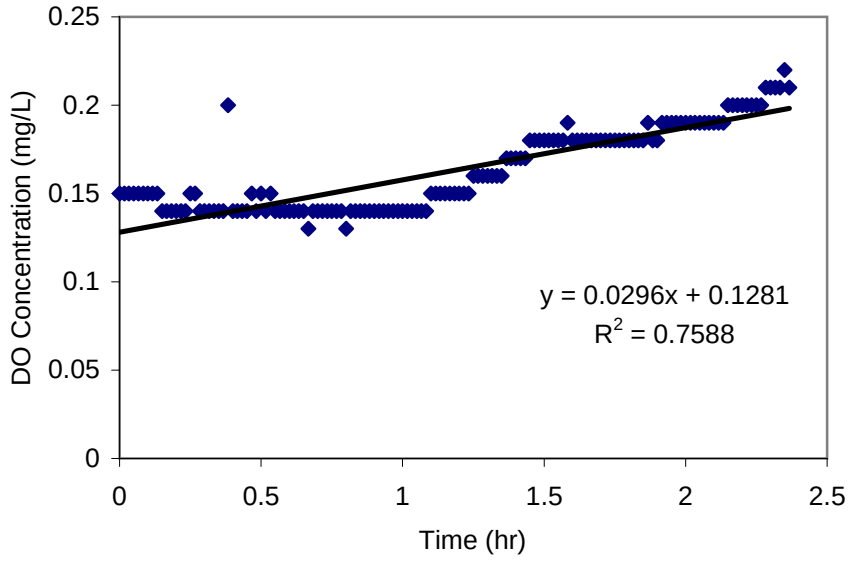


APPENDIX E
Oxygen Diffusion Rate Estimates

Site	Weeki Wachee Spring	**Date**	Mar 11 2009
Station	WWS-2	**Time**	9:31

Air Temperature (^oC)	13.16
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	10.50
Air DO %Sat	100.00
Water Depth (m)	0.47
Current Velocity (cm/s)	3.66
Water Temperature (^oC)	23.68
Water DO (mg/L)	2.12
Water DO % Sat	25.10
Delta DO %Sat in Dome	1.20
Avg DO %Sat in Dome	2.14
Elapsed Time (hr)	2.37
Avg. DO % Sat Deficit	22.96
Calculated Diffusion Rate k ($g/m^2/hr$)	0.56

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



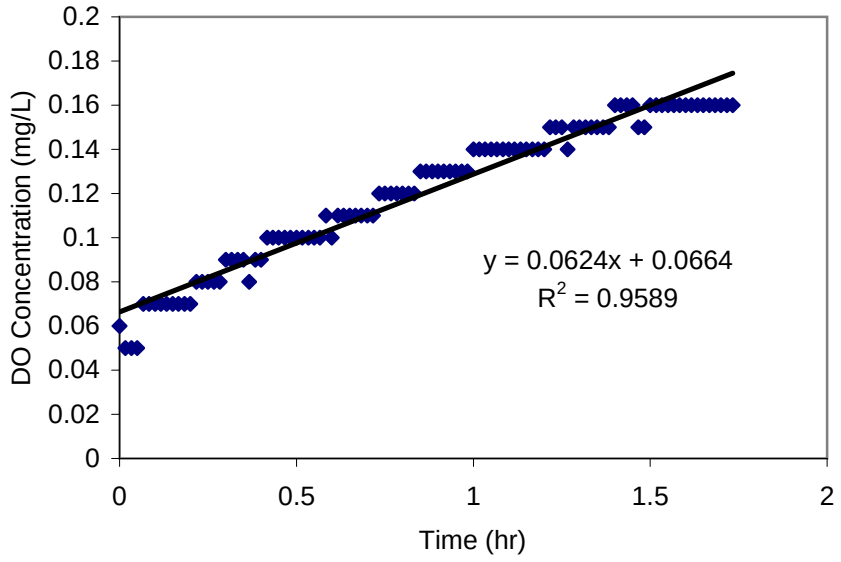
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Weeki Wachee Spring	**Date**	Mar 11 2009
Station	WWS-2	**Time**	11:55

Air Temperature (^oC)	21.08
Density of Air @ above temp (g/cm^3)	0.0012
Air DO (mg/L)	9.02
Air DO %Sat	101.40
Water Depth (m)	0.47
Current Velocity (cm/s)	10.97
Water Temperature (^oC)	23.68
Water DO (mg/L)	2.12
Water DO % Sat	25.10
Delta DO %Sat in Dome	1.50
Avg DO %Sat in Dome	1.50
Elapsed Time (hr)	1.73
Avg. DO % Sat Deficit	23.60
Calculated Diffusion Rate k ($g/m^2/hr$)	0.91

Dome Surface Area (m^2)	0.067
Dome Total Gas Volume (cm^3)	6582
Dome Total Oxygen Volume (cm^3)	1382
Density of Air @ 30^oC (g/cm^3)	0.0012



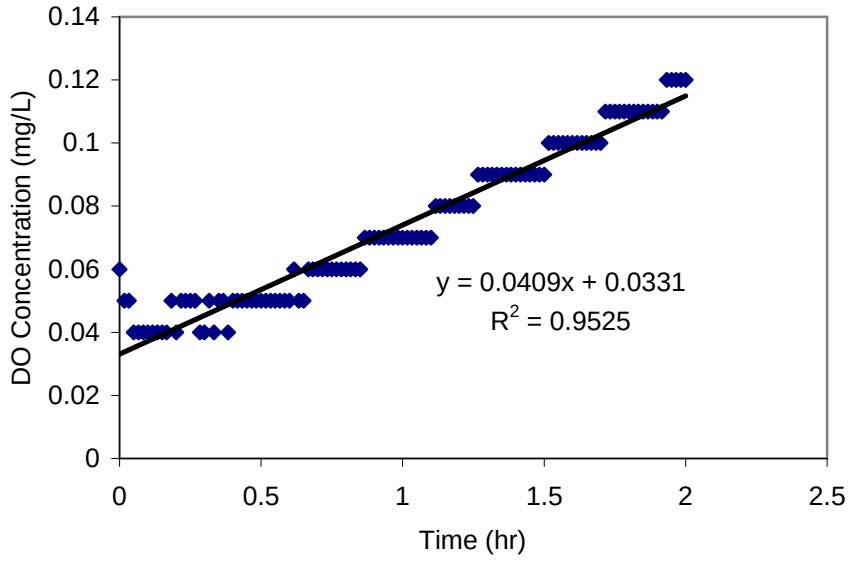
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Weeki Wachee Spring	**Date**	Mar 11 2009
Station	WWS-2	**Time**	14:35

Air Temperature (^{o}C)	21.08
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	9.02
Air DO %Sat	101.40
Water Depth (m)	0.47
Current Velocity (cm/s)	10.97
Water Temperature (^{o}C)	23.68
Water DO (mg/L)	2.12
Water DO % Sat	25.10
Delta DO %Sat in Dome	1.20
Avg DO %Sat in Dome	1.10
Elapsed Time (hr)	2.00
Avg. DO % Sat Deficit	24.00
Calculated Diffusion Rate k (g/m^{2}/hr)	0.62

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



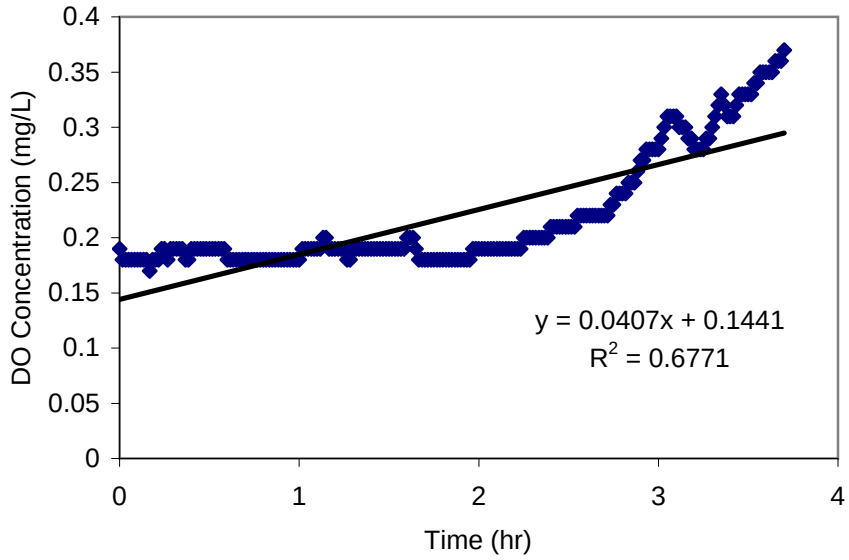
APPENDIX E

Oxygen Diffusion Rate Estimates

Site	Weeki Wachee Spring	**Date**	Mar 12 2009
Station	WWS-2	**Time**	9:13

Air Temperature (^{o}C)	15.94
Density of Air @ above temp (g/cm^{3})	0.0012
Air DO (mg/L)	9.88
Air DO %Sat	100.00
Water Depth (m)	0.67
Current Velocity (cm/s)	25.30
Water Temperature (^{o}C)	23.67
Water DO (mg/L)	2.32
Water DO % Sat	27.40
Delta DO %Sat in Dome	3.20
Avg DO %Sat in Dome	3.11
Elapsed Time (hr)	3.70
Avg. DO % Sat Deficit	24.29
Calculated Diffusion Rate k (g/m^{2}/hr)	0.89

Dome Surface Area (m^{2})	0.067
Dome Total Gas Volume (cm^{3})	6582
Dome Total Oxygen Volume (cm^{3})	1382
Density of Air @ 30^{o}C (g/cm^{3})	0.0012



Appendix F

Particulate Export

APPENDIX F

De Leon Springs (Volusia Co.) - Particulate Export Summary - October 6, 7, and 8, 2008

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
VDL-SEG1 (st. 1 to st. 2)	10/6/08	UP	0	0	0.00	0.00
		DOWN	6,261	976	2.28	0.35
		Segment	6,261	976	2.28	0.35
	10/7/08	UP	0	0	0.00	0.00
		DOWN	5,079	1,949	1.85	0.71
		Segment	5,079	1,949	1.85	0.71
	10/8/08	UP	0	0	0.00	0.00
		DOWN	17,012	2,591	6.18	0.94
		Segment	17,012	2,591	6.18	0.94
VDL-SEG2 (st. 2 to st. 3)	10/6/08	UP	6,261	976	2.28	0.35
		DOWN	5,676	4,673	0.14	0.11
		Segment	-586	3,697	-0.01	0.09
	10/7/08	UP	5,079	1,949	1.85	0.71
		DOWN	4,393	2,293	0.11	0.06
		Segment	-686	344	-0.02	0.01
	10/8/08	UP	17,012	2,591	6.18	0.94
		DOWN	42,109	17,352	1.03	0.43
		Segment	25,097	14,761	0.62	0.36

Location	Volume (m^3)	Area (m^2)
Spring Pool	4,898	2,752
Spring Run	77,777	37,959
Combined	82,675	40,711

APPENDIX F

Particulate Export Measurements from De Leon Springs (Volusia Co.) - 10/06/08 - 10/08/08

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
VDL 2	10/6/08	15:30	1	2,752	261	0.92	0.1886	0.085	4.20	46	46	0.33	0.29	87.88	0.040
		15:45	2	2,752	238	0.92	0.1886	0.091	4.10	40	40	0.35	0.28	80.00	0.070
		16:00	3	2,752	278	0.92	0.1886	0.094	4.95	51	51	0.36	0.31	85.83	0.051
VDL 3	10/6/08	11:28	1	40,711	469	1.16	0.1886	0.015	1.35	47	47	0.10	0.03	30.00	0.070
		11:40	2	40,711	562	1.16	0.1886	0.012	1.29	37	37	0.08	0.01	12.50	0.070
		11:50	3	40,711	515	1.16	0.1886	0.012	1.18	33	33	0.04	0.00	0.00	0.040
VDL 2	10/7/08	10:30	1	2,752	367	0.81	0.1886	0.076	5.27	63	63	0.64	0.46	71.88	0.180
		10:48	2	2,752	238	0.81	0.1886	0.079	3.56	61	61	0.23	0.12	52.17	0.110
		11:00	3	2,752	253	0.81	0.1886	0.079	3.78	50	50	0.12	0.05	41.67	0.070
VDL 3	10/7/08	13:20	1	40,711	124	1.16	0.1886	0.061	1.43	40	40	0.06	0.03	50.00	0.030
		13:30	2	40,711	161	1.16	0.1886	0.037	1.11	36	36	0.05	0.03	60.00	0.020
		13:40	3	40,711	168	1.16	0.1886	0.043	1.35	48	48	0.06	0.02	33.33	0.040
VDL 2	10/8/08	9:30	1	2,752	244	0.80	0.1886	0.091	4.21	55	55	0.89	0.73	82.02	0.160
		9:45	2	2,752	155	0.80	0.1886	0.070	2.05	49	49	0.20	0.15	75.00	0.050
		10:05	3	2,752	178	0.80	0.1886	0.094	3.17	*52*	*52*	1.37	1.21	88.32	0.160
VDL 3	10/8/08	13:51	1	40,711	240	1.16	0.1886	0.046	2.07	60	60	1.94	1.34	69.07	0.600
		13:58	2	40,711	180	1.16	0.1886	0.040	1.34	46	46	0.34	0.10	29.41	0.240
		14:08	3	40,711	210	1.16	0.1886	0.040	1.57	40	40	0.11	0.03	27.27	0.080

Note(s):

VDL3 sample #1 large algal mass, out of character for stn

APPENDIX F

Particulate Export Measurements from De Leon Springs (Volusia Co.) - 10/06/08 - 10/08/08

Station	Date	Start Time	Sample #	Total Sample		Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
				Dry Wt. (g)	Ash-Free Dry Wt. (g)						
VDL 2	10/6/08	15:30	1	0.330	0.0400	0.07856	0.00952	6,239	756	2.267	0.275
		15:45	2	0.350	0.0700	0.08529	0.01706	6,773	1,355	2.461	0.492
		16:00	3	0.360	0.0510	0.07268	0.01030	5,772	818	2.097	0.297
VDL 3	10/6/08	11:28	1	0.100	0.0700	0.07419	0.05193	7,436	5,205	0.183	0.128
		11:40	2	0.080	0.0700	0.06192	0.05418	6,205	5,430	0.152	0.133
		11:50	3	0.040	0.0400	0.03378	0.03378	3,386	3,386	0.083	0.083
VDL 2	10/7/08	10:30	1	0.640	0.1800	0.12136	0.03413	8,492	2,388	3.086	0.868
		10:48	2	0.230	0.1100	0.06467	0.03093	4,525	2,164	1.644	0.786
		11:00	3	0.120	0.0700	0.03174	0.01851	2,221	1,296	0.807	0.471
VDL 3	10/7/08	13:20	1	0.060	0.0300	0.04209	0.02105	4,219	2,109	0.104	0.052
		13:30	2	0.050	0.0200	0.04503	0.01801	4,513	1,805	0.111	0.044
		13:40	3	0.060	0.0400	0.04438	0.02959	4,448	2,965	0.109	0.073
VDL 2	10/8/08	9:30	1	0.890	0.1600	0.21153	0.03803	14,567	2,619	5.293	0.952
		9:45	2	0.200	0.0500	0.09761	0.02440	6,722	1,680	2.442	0.611
		10:05	3	1.370	0.1600	0.43196	0.05045	29,747	3,474	10.809	1.262
VDL 3	10/8/08	13:51	1	1.940	0.6000	0.93757	0.28997	93,966	29,061	2.308	0.714
		13:58	2	0.340	0.2400	0.25279	0.17844	25,336	17,884	0.622	0.439
		14:08	3	0.110	0.0800	0.07010	0.05098	7,026	5,110	0.173	0.126

Note(s):

VDL3 sample #1 large algal mass, out of character for stn

APPENDIX F

Homosassa Springs (Citrus Co.) - Particulate Export Event Summary - November 3, 4, and 5, 2008

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
HS-SEG1 (st. 1 to st. 2)	11/3/08	UP	0	0	0.00	0.00
		DOWN	10,015	1,508	1.98	0.30
		Segment	10,015	1,508	1.98	0.30
	11/4/08	UP	0	0	0.00	0.00
		DOWN	5,513	880	1.09	0.17
		Segment	5,513	880	1.09	0.17
	11/5/08	UP	0	0	0.00	0.00
		DOWN	11,779	1,538	2.32	0.30
		Segment	11,779	1,538	2.32	0.30
HS-SEG2 (st. 2 to st. 3)	11/3/08	UP	10,015	1,508	1.98	0.30
		DOWN	34,956	9,285	3.09	0.82
		Segment	24,941	7,778	3.99	1.24
	11/4/08	UP	5,513	880	1.09	0.17
		DOWN	19,245	3,415	1.70	0.30
		Segment	13,732	2,536	2.20	0.41
	11/5/08	UP	11,779	1,538	2.32	0.30
		DOWN	8,749	2,076	0.77	0.18
		Segment	-3,029	538	-0.48	0.09

Location	Volume (m^3)	Area (m^2)
Spring Pool	5,578	5,068
Spring Run	6,775	6,251
Combined	12,353	11,318

APPENDIX F

Particulate Export Measurements from Homosassa Springs (Citrus Co.) - 11/03/08 - 11/05/08

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
HS 2	11/3/08	12:17	1	5,068	300	1.97	0.1886	0.064	3.62	35	35	0.14	0.11	78.57	0.030
		12:31	2	5,068	603	1.97	0.1886	0.064	7.28	48	48	0.24	0.18	75.00	0.060
		12:48	3	5,068	604	1.97	0.1886	0.061	6.94	60	60	0.73	0.66	90.41	0.070
HS 3	11/3/08	15:03	1	11,318	322	2.38	0.1886	0.009	0.56	30	30	0.18	0.14	77.78	0.040
		15:15	2	11,318	310	2.38	0.1886	0.024	1.43	45	45	0.19	0.12	63.16	0.070
		15:28	3	11,318	335	2.38	0.1886	0.034	2.12	31	31	0.11	0.08	72.73	0.030
HS 2	11/4/08	15:34	1	5,068	240	2.23	0.1886	0.085	3.86	30	30	0.08	0.07	87.50	0.010
		15:40	2	5,068	315	2.23	0.1886	0.070	4.16	40	40	0.14	0.12	85.71	0.020
		15:49	3	5,068	375	2.23	0.1886	0.067	4.74	30	30	0.15	0.12	80.00	0.030
HS 3	11/4/08	14:50	1	11,318	360	2.38	0.1886	0.024	1.66	25	25	0.24	0.20	83.33	0.040
		15:10	2	11,318	423	2.38	0.1886	0.030	2.43	47	47	0.17	0.12	70.59	0.050
		15:14	3	11,318	345	2.38	0.1886	0.030	1.98	40	40	0.13	0.12	92.31	0.010
HS 2	11/5/08	11:55	1	5,068	330	1.92	0.1886	0.024	1.52	45	45	0.16	0.14	87.50	0.020
		12:06	2	5,068	379	1.92	0.1886	0.034	2.40	36	36	0.12	0.11	91.67	0.010
		12:21	3	5,068	332	1.92	0.1886	0.030	1.91	34	34	0.11	0.09	81.82	0.020
HS 3	11/5/08	12:36	1	11,318	330	2.38	0.1886	0.024	1.52	29	29	0.10	0.08	80.00	0.020
		12:52	2	11,318	370	2.38	0.1886	0.043	2.98	42	42	0.10	0.07	70.00	0.030
		13:06	3	11,318	414	2.38	0.1886	0.037	2.86	29	29	0.08	0.06	75.00	0.020

APPENDIX F

Particulate Export Measurements from Homosassa Springs (Citrus Co.) - 11/03/08 - 11/05/08

Station	Date	Start Time	Sample #	Total Sample		Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
				Dry Wt. (g)	Ash-Free Dry Wt. (g)						
HS 2	11/3/08	12:17	1	0.140	0.030	0.03866	0.00828	6,571	1,408	1.297	0.278
		12:31	2	0.240	0.060	0.03297	0.00824	5,605	1,401	1.106	0.276
		12:48	3	0.730	0.070	0.10514	0.01008	17,870	1,714	3.526	0.338
HS 3	11/3/08	15:03	1	0.180	0.040	0.32419	0.07204	66,737	14,831	5.897	1.310
		15:15	2	0.190	0.070	0.13329	0.04911	27,440	10,109	2.424	0.893
		15:28	3	0.110	0.030	0.05193	0.01416	10,691	2,916	0.945	0.258
HS 2	11/4/08	15:34	1	0.080	0.010	0.02071	0.00259	3,985	498	0.786	0.098
		15:40	2	0.140	0.020	0.03362	0.00480	6,468	924	1.276	0.182
		15:49	3	0.150	0.030	0.03163	0.00633	6,086	1,217	1.201	0.240
HS 3	11/4/08	14:50	1	0.240	0.040	0.14498	0.02416	29,846	4,974	2.637	0.440
		15:10	2	0.170	0.050	0.06992	0.02057	14,394	4,234	1.272	0.374
		15:14	3	0.130	0.010	0.06556	0.00504	13,496	1,038	1.192	0.092
HS 2	11/5/08	11:55	1	0.160	0.020	0.10544	0.01318	17,479	2,185	3.449	0.431
		12:06	2	0.120	0.010	0.05008	0.00417	8,301	692	1.638	0.137
		12:21	3	0.110	0.020	0.05764	0.01048	9,556	1,737	1.886	0.343
HS 3	11/5/08	12:36	1	0.100	0.020	0.06590	0.01318	13,567	2,713	1.199	0.240
		12:52	2	0.100	0.030	0.03359	0.01008	6,914	2,074	0.611	0.183
		13:06	3	0.080	0.020	0.02802	0.00700	5,767	1,442	0.510	0.127

APPENDIX F

Ichetucknee Springs - Particulate Export Event Summary - July 6 - 9, 2009

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
IS-SEG0 (boil to st. 1)	7/6/09	UP	0	0	0.00	0.00
		DOWN	217,578	63,522	19.00	5.55
		Segment	217,578	63,522	19.00	5.55
	7/6/09	UP	0	0	0.00	0.00
		DOWN	22,664	11,484	1.98	0.54
		Segment	22,664	11,484	1.98	1.00
IS-SEG1 (st. 1 to st. 2)	7/6/09	UP	217,578	63,522	19.00	5.55
		DOWN	162,642	90,625	1.42	0.79
		Segment	-54,936	27,104	-0.53	0.26
IS-SEG 1-3 (st. 1 to st. 4)	7/7/09	UP	22,664	11,484	1.98	0.54
		DOWN	168,288	100,186	0.98	0.58
		Segment	145,624	88,702	0.91	0.55

Location	Volume (m^3)	Area (m^2)
To IS-1	5,644	11,449
IS-1 to IS-2	67,940	103,442
IS-2 to IS-3	7,932	20,501
IS-3 to IS-4	20,326	36,289
Combined	101,843	171,680

APPENDIX F

Particulate Export Measurements from the Ichetucknee River - 7/6/09 - 7/7/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
IS-1	7/6/09	11:27	1	11,449	120	2.28	0.1886	0.232	5.24	90	60	2.02	1.00	49.50	1.020
		11:30	2	11,449	60	2.28	0.1886	0.213	2.41	80	60	3.70	3.14	84.86	0.560
		11:35	3	11,449	60	2.28	0.1886	0.238	2.69	80	60	1.40	0.66	47.14	0.740
IS-2	7/6/09	13:20	1	114,891	60	6.05	0.1886	0.229	2.59	60	58	0.53	0.22	41.51	0.310
		13:30	2	114,891	60	6.05	0.1886	0.229	2.59	100	60	0.63	0.26	41.27	0.370
		13:38	3	114,891	60	6.05	0.1886	0.229	2.59	80	45	0.46	0.23	50.00	0.230
IS-1	7/7/09	11:49	1	11,449	60	2.34	0.1886	0.305	3.45	70	60	0.19	0.10	52.63	0.090
		11:56	2*	11,449	60	2.34	0.1886	0.305	3.45	104	60	2.51	1.34	53.39	1.170
		12:03	3	11,449	60	2.34	0.1886	0.305	3.45	66	60	0.50	0.24	48.00	0.260
IS-4	7/7/09	16:27	1	171,680	60	6.81	0.1886	0.396	4.48	75	60	1.12	0.46	41.07	0.660
		16:35	2	171,680	60	6.81	0.1886	0.396	4.48	84	60	0.88	0.36	40.91	0.520
		16:41	3	171,680	60	6.81	0.1886	0.396	4.48	82	60	0.89	0.35	39.33	0.540

Note(s):

* IS-1 7/7/09 PT #2 and #3 - Heavy human use (Tubers) - Not used in analysis

APPENDIX F

Particulate Export Measurements from the Ichetucknee River - 7/6/09 - 7/7/09

Station	Date	Start Time	Sample #	Total Sample Dry Wt. (g)	Total Sample Ash-Free Dry Wt. (g)	Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
IS-1	7/6/09	11:27	1	3.030	1.5300	0.57803	0.29188	113,797	57,462	9.939	5.019
		11:30	2	4.933	0.7467	2.04359	0.30930	402,321	60,892	35.140	5.319
		11:35	3	1.867	0.9867	0.69394	0.36680	136,616	72,211	11.933	6.307
IS-2	7/6/09	13:20	1	0.548	0.3207	0.21198	0.12399	110,725	64,764	0.964	0.564
		13:30	2	1.050	0.6167	0.40596	0.23842	212,049	124,537	1.846	1.084
		13:38	3	0.818	0.4089	0.31617	0.15809	165,151	82,576	1.437	0.719
IS-1	7/7/09	11:49	1	0.222	0.1050	0.06428	0.03045	13,021	6,168	1.137	0.539
		11:56	2*	4.351	2.0280	1.26156	0.58806	255,562	119,127	22.322	10.405
		12:03	3	0.550	0.2860	0.15948	0.08293	32,308	16,800	2.822	1.467
IS-4	7/7/09	16:27	1	1.400	0.8250	0.31227	0.18402	183,666	108,232	1.070	0.630
		16:35	2	1.232	0.7280	0.27480	0.16238	161,626	95,506	0.941	0.556
		16:41	3	1.216	0.7380	0.27131	0.16461	159,571	96,818	0.929	0.564

Note(s):

* IS-1 7/7/09 PT #2 and #3 - Heavy human use (Tubers) - Not used in analysis

APPENDIX F

Particulate Export Measurements from the Ichetucknee River IS-4 - 7/6/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (cfs)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (ft/s)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
													Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
IS-4	7/6/09	9:09	1	171,680	120	240.7	6.82	0.1886	0.28	0.085	1.93	122	68	0.34	0.15	44.12	0.1900
		9:34	2	171,680	120	240.7	6.82	0.1886	0.49	0.149	3.38	118	74	0.73	0.34	46.58	0.3900
		10:09	3	171,680	120	240.7	6.82	0.1886	0.40	0.122	2.76	139	65	0.46	0.21	45.65	0.2500
		10:48	4	171,680	120	240.7	6.82	0.1886	0.46	0.140	3.17	150	67	0.30	0.12	40.00	0.1800
		11:09	5	171,680	120	240.7	6.82	0.1886	0.65	0.198	4.48	114	76	0.74	0.34	45.95	0.4000
		11:22	6	171,680	120	240.7	6.82	0.1886	0.63	0.192	4.35	153	66	0.47	0.21	44.68	0.2600
		11:40	7	171,680	120	240.7	6.82	0.1886	0.25	0.076	1.72	104	68	0.54	0.25	46.30	0.2900
		12:11	8	171,680	120	240.7	6.82	0.1886	0.19	0.058	1.31	132	64	0.40	0.18	45.00	0.2200
		12:39	9	171,680	120	240.7	6.82	0.1886	0.33	0.101	2.28	137	69	0.45	0.22	48.89	0.2300
		13:10	10	171,680	120	240.7	6.82	0.1886	0.38	0.116	2.62	142	68	0.32	0.17	53.13	0.1500
		13:38	11	171,680	120	240.7	6.82	0.1886	0.29	0.088	2.00	134	71	0.39	0.17	43.59	0.2200
		14:08	12	171,680	120	240.7	6.82	0.1886	0.61	0.186	4.21	123	68	0.58	0.27	46.55	0.3100
		14:38	13	171,680	120	240.7	6.82	0.1886	0.65	0.198	4.48	154	68	0.46	0.21	45.65	0.2500
		15:08	14	171,680	120	240.7	6.82	0.1886	0.38	0.116	2.62	113	67	0.70	0.33	47.14	0.3700
		15:28	15	171,680	120	240.7	6.82	0.1886	0.53	0.162	3.66	148	66	0.41	0.18	43.90	0.2300
		16:39	16	171,680	120	240.7	6.82	0.1886	0.45	0.137	3.10	180	62	0.34	0.16	47.06	0.1800

APPENDIX F

Particulate Export Measurements from the Ichetucknee River IS-4 - 7/6/09

Station	Date	Start Time	Sample #	Total Sample Dry Wt. (g)	Total Sample Ash-Free Dry Wt. (g)	Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
IS-4	7/6/09	9:09	1	0.610	0.3409	0.31586	0.17651	186,020	103,952	1.084	0.605
		9:34	2	1.164	0.6219	0.34443	0.18401	202,845	108,369	1.182	0.631
		10:09	3	0.984	0.5346	0.35655	0.19378	209,984	114,122	1.223	0.665
		10:48	4	0.672	0.4030	0.21169	0.12701	124,671	74,803	0.726	0.436
		11:09	5	1.110	0.6000	0.24759	0.13383	145,813	78,818	0.849	0.459
		11:22	6	1.090	0.6027	0.25074	0.13871	147,670	81,690	0.860	0.476
		11:40	7	0.826	0.4435	0.47896	0.25722	282,075	151,485	1.643	0.882
		12:11	8	0.825	0.4537	0.62954	0.34625	370,755	203,915	2.160	1.188
		12:39	9	0.893	0.4567	0.39255	0.20064	231,183	118,160	1.347	0.688
		13:10	10	0.668	0.3132	0.25496	0.11951	150,152	70,384	0.875	0.410
		13:38	11	0.736	0.4152	0.36799	0.20758	216,720	122,253	1.262	0.712
		14:08	12	1.049	0.5607	0.24935	0.13328	146,852	78,490	0.855	0.457
		14:38	13	1.042	0.5662	0.23237	0.12629	136,849	74,375	0.797	0.433
		15:08	14	1.181	0.6240	0.45044	0.23809	265,280	140,220	1.545	0.817
		15:28	15	0.919	0.5158	0.25151	0.14109	148,120	83,091	0.863	0.484
		16:39	16	0.987	0.5226	0.31803	0.16837	187,298	99,158	1.091	0.578

APPENDIX F

Particulate Export Measurements from the Ichetucknee River IS-2 - 7/7/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (cfs)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (ft/s)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
													Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
IS-2	7/7/09	10:05	1	114,891	120	213.5	6.05	0.1886	0.70	0.213	4.83	124	64	0.50	0.23	46.00	0.2700
		10:36	2	114,891	120	213.5	6.05	0.1886	0.75	0.229	5.17	88	62	0.59	0.28	47.46	0.3100
		10:56	3	114,891	200	213.5	6.05	0.1886	0.81	0.247	9.31	124	62	0.57	0.26	45.61	0.3100
		11:23	4	114,891	148	213.5	6.05	0.1886	0.92	0.280	7.83	92	60	0.64	0.29	45.31	0.3500
		11:45	5	114,891	124	213.5	6.05	0.1886	0.86	0.262	6.13	110	60	0.48	0.24	50.00	0.2400
		12:15	6	114,891	130	213.5	6.05	0.1886	0.70	0.213	5.23	96	62	0.61	0.29	47.54	0.3200
		12:45	7	114,891	144	213.5	6.05	0.1886	0.75	0.229	6.21	98	60	0.62	0.28	45.16	0.3400
		13:16	8	114,891	125	213.5	6.05	0.1886	0.75	0.229	5.39	100	68	0.75	0.36	48.00	0.3900
		14:08	9	114,891	120	213.5	6.05	0.1886	0.75	0.229	5.17	118	66	0.79	0.30	37.97	0.4900
		14:37	10	114,891	121	213.5	6.05	0.1886	0.75	0.229	5.22	124	64	0.66	0.33	50.00	0.3300
		15:09	11	114,891	123	213.5	6.05	0.1886	0.67	0.204	4.74	144	70	0.51	0.25	49.02	0.2600
		15:46	12	114,891	125	213.5	6.05	0.1886	0.75	0.229	5.39	104	64	0.58	0.28	48.28	0.3000
		16:18	13	114,891	162	213.5	6.05	0.1886	0.80	0.244	7.45	136	62	0.55	0.26	47.27	0.2900
		16:45	14	114,891	125	213.5	6.05	0.1886	0.73	0.223	5.24	154	68	0.38	0.18	47.37	0.2000

APPENDIX F

Particulate Export Measurements from the Ichetucknee River IS-2 - 7/7/09

Station	Date	Start Time	Sample #	Total Sample Dry Wt. (g)	Total Sample Ash-Free Dry Wt. (g)	Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
IS-2	7/7/09	10:05	1	0.969	0.523	0.20065	0.10835	104,808	56,596	0.912	0.493
		10:36	2	0.837	0.440	0.16188	0.08506	84,560	44,430	0.736	0.387
		10:56	3	1.140	0.620	0.12243	0.06659	63,952	34,781	0.557	0.303
		11:23	4	0.981	0.537	0.12539	0.06857	65,498	35,819	0.570	0.312
		11:45	5	0.880	0.440	0.14357	0.07179	74,994	37,497	0.653	0.326
		12:15	6	0.945	0.495	0.18058	0.09473	94,326	49,482	0.821	0.431
		12:45	7	1.013	0.555	0.16313	0.08946	85,213	46,730	0.742	0.407
		13:16	8	1.103	0.574	0.20468	0.10644	106,916	55,596	0.931	0.484
		14:08	9	1.412	0.876	0.27304	0.16935	142,622	88,462	1.241	0.770
		14:37	10	1.279	0.639	0.24516	0.12258	128,057	64,028	1.115	0.557
		15:09	11	1.049	0.535	0.22149	0.11292	115,696	58,982	1.007	0.513
		15:46	12	0.943	0.488	0.17491	0.09047	91,364	47,257	0.795	0.411
		16:18	13	1.206	0.636	0.16196	0.08540	84,599	44,607	0.736	0.388
		16:45	14	0.861	0.453	0.16408	0.08636	85,709	45,110	0.746	0.393

APPENDIX F

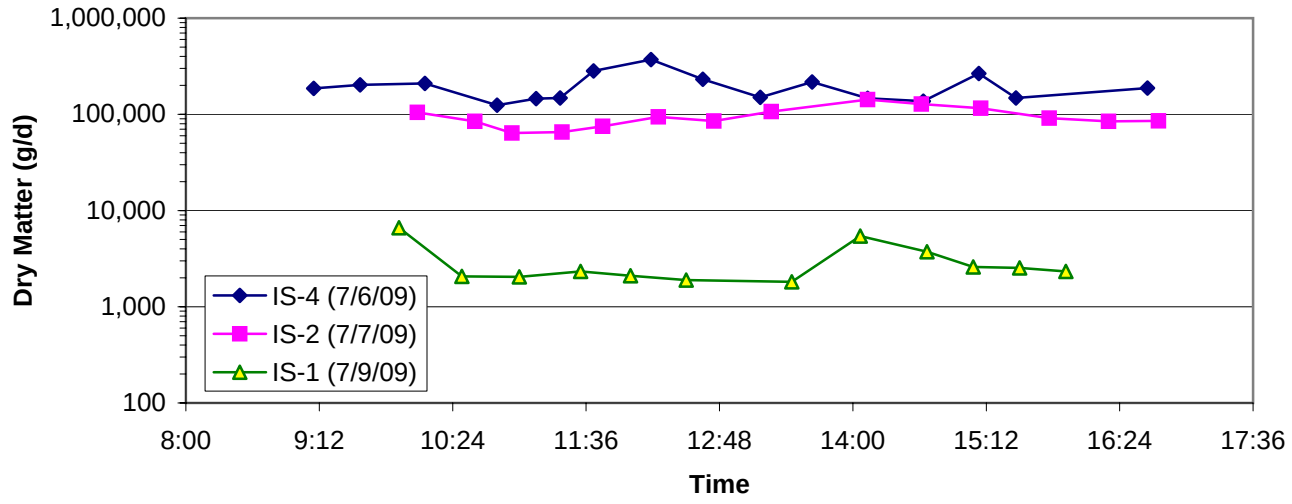
Particulate Export Measurements from the Ichetucknee River IS-1 - 7/9/09

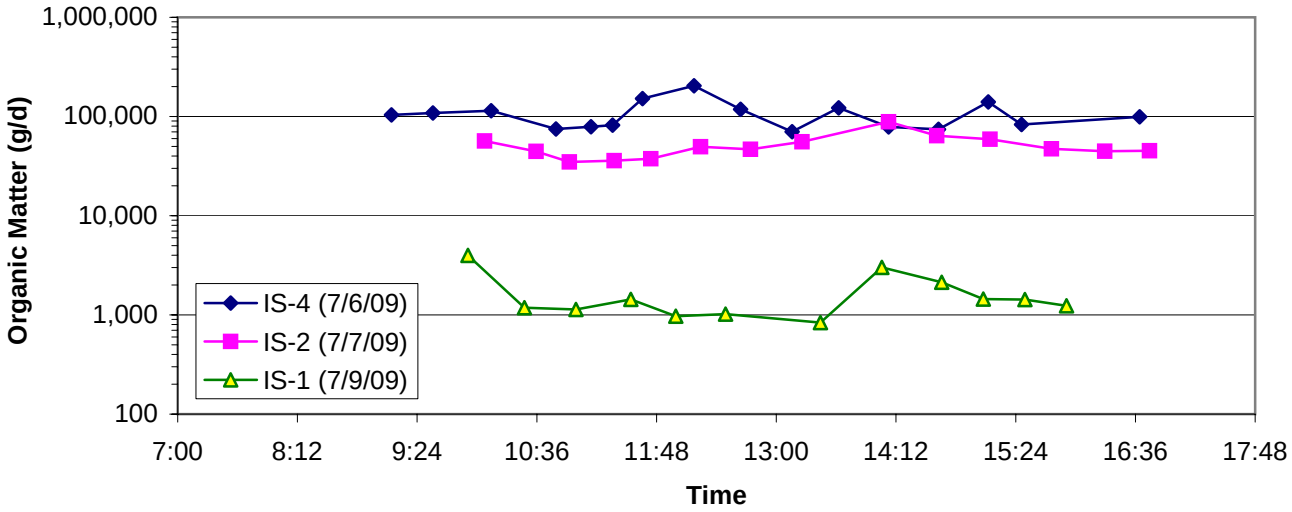
Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
IS-1	7/9/09	9:55	1	11,449	182	2.41	0.1886	0.152	5.23	110	66	0.10	0.04	40.00	0.0600
		10:29	2	11,449	300	2.41	0.1886	0.137	7.76	66	60	0.07	0.03	42.86	0.0400
		11:00	3	11,449	420	2.41	0.1886	0.116	9.17	60	60	0.09	0.04	44.44	0.0500
		11:33	4	11,449	603	2.41	0.1886	0.125	14.21	77	63	0.13	0.05	38.46	0.0800
		12:00	5	11,449	606	2.41	0.1886	0.113	12.89	48	48	0.13	0.07	53.85	0.0600
		12:30	6	11,449	606	2.41	0.1886	0.125	14.28	48	48	0.13	0.06	46.15	0.0700
		13:27	7	11,449	600	2.41	0.1886	0.155	17.59	79	67	0.13	0.07	53.85	0.0600
		14:04	8	11,449	600	2.41	0.1886	0.122	13.79	63	63	0.36	0.16	44.44	0.2000
		14:40	9	11,449	603	2.41	0.1886	0.131	14.90	79	62	0.21	0.09	42.86	0.1200
		15:05	10	11,449	601	2.41	0.1886	0.131	14.85	70	68	0.18	0.08	44.44	0.1000
		15:30	11	11,449	603	2.41	0.1886	0.134	15.25	72	62	0.16	0.07	43.75	0.0900
		15:55	12	11,449	600	2.41	0.1886	0.134	15.17	57	57	0.17	0.08	47.06	0.0900

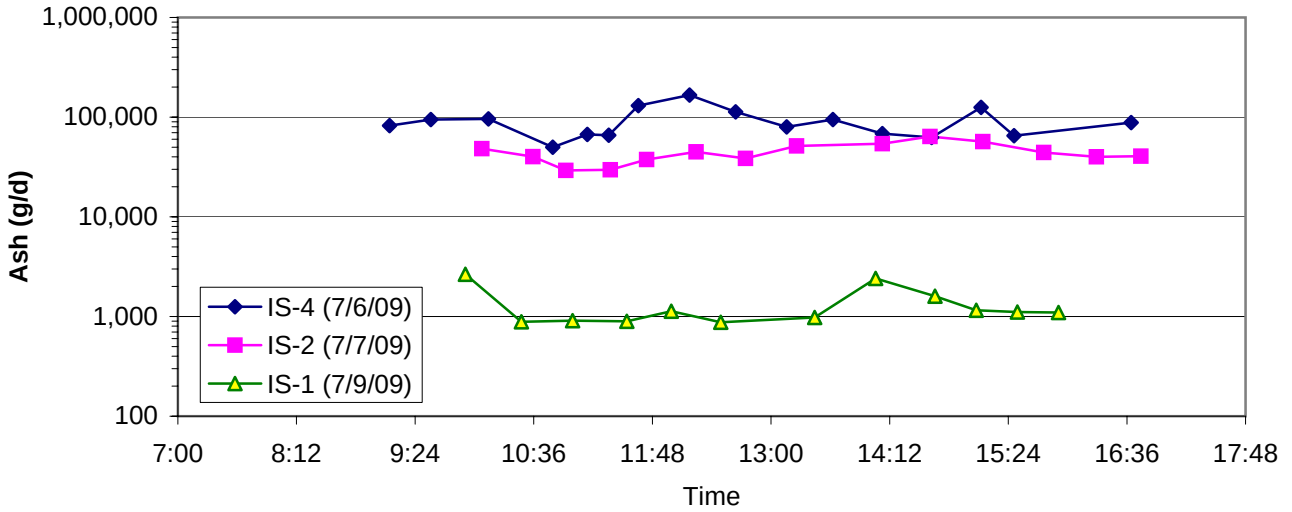
APPENDIX F

Particulate Export Measurements from the Ichetucknee River IS-1 - 7/9/09

Station	Date	Start Time	Sample #	Total Sample Dry Wt. (g)	Total Sample Ash-Free Dry Wt. (g)	Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
IS-1	7/9/09	9:55	1	0.167	0.100	0.03186	0.01912	6,632	3,979	0.579	0.348
		10:29	2	0.077	0.044	0.00992	0.00567	2,065	1,180	0.180	0.103
		11:00	3	0.090	0.050	0.00981	0.00545	2,042	1,134	0.178	0.099
		11:33	4	0.159	0.098	0.01118	0.00688	2,327	1,432	0.203	0.125
		12:00	5	0.130	0.060	0.01009	0.00466	2,099	969	0.183	0.085
		12:30	6	0.130	0.070	0.00910	0.00490	1,895	1,020	0.165	0.089
		13:27	7	0.153	0.071	0.00872	0.00402	1,814	837	0.158	0.073
		14:04	8	0.360	0.200	0.02610	0.01450	5,431	3,017	0.474	0.264
		14:40	9	0.268	0.153	0.01795	0.01026	3,737	2,135	0.326	0.187
		15:05	10	0.185	0.103	0.01247	0.00693	2,596	1,442	0.227	0.126
		15:30	11	0.186	0.105	0.01218	0.00685	2,536	1,426	0.221	0.125
		15:55	12	0.170	0.090	0.01120	0.00593	2,332	1,234	0.204	0.108







APPENDIX F

Particulate Export Measurements from Ichetucknee River

APPENDIX F

Jackson Blue Springs (Jackson Co.) - Particulate Export Event Summary - January 12, 13, and 14, 2009

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
JBS-SEG1 (st. 1 to st. 2)	1/12/09	UP	0	0	0.00	0.00
		DOWN	4,934	685	1.21	0.17
		Segment	4,934	685	1.21	0.17
	1/13/09	UP	0	0	0.00	0.00
		DOWN	1,215	543	0.30	0.13
		Segment	1,215	543	0.30	0.13
	1/14/09	UP	0	0	0.00	0.00
		DOWN	2,449	484	0.60	0.12
		Segment	2,449	484	0.60	0.12
JBS-SEG2 (st. 2 to st. 3)	1/12/09	UP	4,934	685	1.21	0.17
		DOWN	1,059	0	0.01	0.00
		Segment	-3,875	-685	-0.04	-0.01
	1/13/09	UP	1,215	543	0.30	0.13
		DOWN	2,572	882	0.02	0.01
		Segment	1,357	339	0.01	0.00
	1/14/09	UP	2,449	484	0.60	0.12
		DOWN	3,711	1,590	0.04	0.02
		Segment	1,262	1,107	0.01	0.01

Location	Volume (m^3)	Area (m^2)
To Stn. 2	4,175	4,081
To Stn. 3	104,116	103,319
Combined	108,291	107,400

APPENDIX F

Particulate Export Measurements from Jackson Blue Springs (Jackson Co.) - 1/12/09 - 1/14/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
JBS 2	1/12/09	14:46	1	4,081	398	3.17	0.1886	0.040	2.97	34	34	0.04	0.04	100.00	0.000
		14:57	2	4,081	647	3.17	0.1886	0.012	1.49	47	47	0.05	0.04	80.00	0.010
		15:12	3	4,081	944	3.17	0.1886	0.073	13.02	21	21	0.09	0.08	88.89	0.010
JBS 3	1/12/09	15:45	1	103,319	901	3.17	0.1886	0.015	2.59	35	35	0.01	0.01	100.00	0.000
JBS 2	1/13/09	9:46	1	4,081	1,440	2.97	0.1886	0.037	9.93	44	44	0.03	0.02	66.67	0.010
		10:22	2	4,081	900	2.97	0.1886	0.037	6.21	28	28	0.04	0.02	50.00	0.020
JBS 3	1/13/09	11:04	1	103,319	1,020	2.97	0.1886	0.012	2.35	54	54	0.03	0.02	66.67	0.010
		11:26	2	103,319	840	2.97	0.1886	0.012	1.93	31	31	0.01	0.01	100.00	0.000
		11:43	3	103,319	960	2.97	0.1886	0.009	1.66	36	36	0.02	0.01	50.00	0.010
JBS 2	1/14/09	13:20	1	4,081	980	2.86	0.1886	0.043	7.89	24	24	0.05	0.03	60.00	0.020
		13:42	2	4,081	916	2.86	0.1886	0.052	8.95	39	39	0.16	0.14	87.50	0.020
		14:02	3	4,081	980	2.86	0.1886	0.049	9.01	32	32	0.05	0.04	80.00	0.010
JBS 3	1/14/09	10:33	1	103,319	900	2.86	0.1886	0.009	1.55	35	35	0.04	0.03	75.00	0.010
		10:55	2	103,319	900	2.86	0.1886	0.009	1.55	28	28	0.01	0.00	0.00	0.010
		11:14	3	103,319	900	2.86	0.1886	0.009	1.55	52	52	0.02	0.01	50.00	0.010

Note(s):

APPENDIX F

Particulate Export Measurements from Jackson Blue Springs (Jackson Co.) - 1/12/09 - 1/14/09

Station	Date	Start Time	Sample #	Total Sample		Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
				Dry Wt. (g)	Ash-Free Dry Wt. (g)						
JBS 2	1/12/09	14:46	1	0.040	0.000	0.01345	0.00000	3,688	0	0.904	0.000
		14:57	2	0.050	0.010	0.03361	0.00672	9,217	1,843	2.259	0.452
		15:12	3	0.090	0.010	0.00691	0.00077	1,895	211	0.464	0.052
JBS 3	1/12/09	15:45	1	0.010	0.000	0.00386	0.00000	1,059	0	0.010	0.000
JBS 2	1/13/09	9:46	1	0.030	0.010	0.00302	0.00101	776	259	0.190	0.063
		10:22	2	0.040	0.020	0.00644	0.00322	1,655	827	0.405	0.203
JBS 3	1/13/09	11:04	1	0.030	0.010	0.01279	0.00426	3,285	1,095	0.032	0.011
		11:26	2	0.010	0.000	0.00518	0.00000	1,330	0	0.013	0.000
		11:43	3	0.020	0.010	0.01208	0.00604	3,103	1,551	0.030	0.015
JBS 2	1/14/09	13:20	1	0.050	0.020	0.00634	0.00254	1,565	626	0.383	0.153
		13:42	2	0.160	0.020	0.01788	0.00223	4,412	551	1.081	0.135
		14:02	3	0.050	0.010	0.00555	0.00111	1,369	274	0.336	0.067
JBS 3	1/14/09	10:33	1	0.040	0.010	0.02578	0.00644	6,361	1,590	0.062	0.015
		10:55	2	0.010	0.010	0.00644	0.00644	1,590	1,590	0.015	0.015
		11:14	3	0.020	0.010	0.01289	0.00644	3,181	1,590	0.031	0.015

Note(s):

APPENDIX F

Madison Blue Springs (Madison Co.) - Particulate Export Event Summary - 12/1/08 and 1/2/09.

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
MBS-SEG1 (st. 1 to st. 2)	12/1/08	UP	0	0	0.00	0.00
		DOWN	3,678	2,061	8.34	4.67
		Segment	3,678	2,061	8.34	4.67
	1/2/09	UP	0	0	0.00	0.00
		DOWN	12,111	4,330	27.45	9.81
		Segment	12,111	4,330	27.45	9.81
MBS-SEG2 (st. 2 to st. 3)	12/1/08	UP	3,678	2,061	8.34	4.67
		DOWN	12,380	5,543	11.51	5.15
		Segment	8,703	3,482	8.09	3.24
	1/2/09	UP	12,111	4,330	27.45	9.81
		DOWN	59,615	9,592	55.44	8.92
		Segment	47,503	5,262	44.17	4.89

Location	Volume (m^3)	Area (m^2)
Spring Pool	2,457	441
Spring Run	1,618	634
Combined	4,075	1,075

APPENDIX F

Particulate Export Measurements from Madison Blue Springs (Madison Co.) - 12/01/08 and 1/2/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
MBS-2	12/1/08	13:56	1	441	300	1.91	0.1886	0.037	2.07	33	33	0.04	0.02	50.00	0.020
		14:05	2	441	270	1.91	0.1886	0.024	1.24	31	31	0.03	0.01	33.33	0.020
		14:19	3	441	300	1.91	0.1886	0.030	1.72	50	50	0.04	0.02	50.00	0.020
MBS-3	12/1/08	14:40	1	1,075	315	1.91	0.1886	0.012	0.72	26	26	0.07	0.04	57.14	0.030
		14:49	2	1,075	289	1.91	0.1886	0.006	0.33	20	20	0.02	0.01	50.00	0.010
		15:58	3	1,075	300	1.91	0.1886	0.018	1.03	35	35	0.07	0.04	57.14	0.030
MBS-2	1/2/09	11:07	1	441	180	5.73	0.1886	0.518	17.59	55	55	0.48	0.32	66.67	0.160
		11:14	2	441	180	5.73	0.1886	0.503	17.07	48	48	0.38	0.24	63.16	0.140
		11:20	3	441	180	5.73	0.1886	0.494	16.76	45	45	0.40	0.25	62.50	0.150
MBS-3	1/2/09	10:40	1	1,075	300	5.73	0.1886	0.137	7.76	46	46	1.11	0.96	86.49	0.150
		10:46	2	1,075	300	5.73	0.1886	0.152	8.62	40	40	0.94	0.74	78.72	0.200
		10:55	3	1,075	300	5.73	0.1886	0.158	8.97	50	50	0.98	0.84	85.71	0.140

Note(s): Only sampled 12/1/08 due to river flooding

12/1/08 sampling: MBS-3 samples are representative of the eddy at the spring run/river. The majority of the material appears to be from the river.

1/02/09 sampling: spring was discharging water

APPENDIX F

Particulate Export Measurements from Madison Blue Springs (Madison Co.) - 12/01/08 and 1/2/09

Station	Date	Start Time	Sample #	Total Sample		Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
				Dry Wt. (g)	Ash-Free Dry Wt. (g)						
MBS-2	12/1/08	13:56	1	0.040	0.020	0.01933	0.00967	3,198	1,599	7.249	3.624
		14:05	2	0.030	0.020	0.02416	0.01611	3,997	2,665	9.061	6.041
		14:19	3	0.040	0.020	0.02320	0.01160	3,837	1,919	8.698	4.349
MBS-3	12/1/08	14:40	1	0.070	0.030	0.09666	0.04142	15,989	6,853	14.869	6.372
		14:49	2	0.020	0.010	0.06020	0.03010	9,959	4,979	9.261	4.630
		15:58	3	0.070	0.030	0.06766	0.02900	11,193	4,797	10.408	4.461
MBS-2	1/2/09	11:07	1	0.480	0.160	0.02729	0.00910	13,506	4,502	30.615	10.205
		11:14	2	0.380	0.140	0.02226	0.00820	11,017	4,059	24.972	9.200
		11:20	3	0.400	0.150	0.02387	0.00895	11,811	4,429	26.773	10.040
MBS-3	1/2/09	10:40	1	1.110	0.150	0.14305	0.01933	70,796	9,567	65.834	8.897
		10:46	2	0.940	0.200	0.10903	0.02320	53,958	11,480	50.176	10.676
		10:55	3	0.980	0.140	0.10930	0.01561	54,090	7,727	50.300	7.186

Note(s): Only sampled 12/1/08 due t
12/1/08 sampling: MBS-3 sa
1/02/09 sampling: spring wa

APPENDIX F

Manatee Springs (Levy Co.) - Particulate Export Event Summary - August 3-5, 2009.

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
MS-SEG1 (st. 1 to st. 2)	8/3/09	UP	0	0	0.00	0.00
		DOWN	2,735	1,459	1.04	0.56
		Segment	2,735	1,459	1.04	0.56
	8/4/09	UP	0	0	0.00	0.00
		DOWN	2,684	1,134	1.03	0.43
		Segment	2,684	1,134	1.03	0.43
	8/5/09	UP	0	0	0.00	0.00
		DOWN	5,431	2,356	2.07	0.90
		Segment	5,431	2,356	2.07	0.90
MS-SEG2 (st. 2 to st. 3)	8/3/09	UP	2,735	1,459	1.04	0.56
		DOWN	9,948	5,546	1.25	0.70
		Segment	7,212	4,087	1.35	0.76
	8/4/09	UP	2,684	1,134	1.03	0.43
		DOWN	8,668	5,348	1.09	0.67
		Segment	5,984	4,215	1.12	0.79
	8/5/09	UP	5,431	2,356	2.07	0.90
		DOWN	3,643	2,161	0.46	0.27
		Segment	-1,789	-194	-0.33	-0.04

Location	Volume (m^3)	Area (m^2)
To Stn. 2	3,683	2,618
To Stn. 3	5,015	5,352
Combined	8,698	7,970

APPENDIX F

Particulate Export Measurements from Manatee Springs (Levy Co.) - 08/3/09 - 08/5/09.

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
MS-2	8/3/09	10:50	1	2,618	180	2.57	0.1886	0.183	6.21	88	64	0.06	0.03	50.00	0.030
		11:10	2	2,618	312	2.57	0.1886	0.152	8.97	67	67	0.11	0.03	27.27	0.080
		11:20	3	2,618	300	2.57	0.1886	0.171	9.66	49	49	0.11	0.07	63.64	0.040
MS-3	8/3/09	15:10	1	7,970	300	2.65	0.1886	0.034	1.90	58	58	0.10	0.04	40.00	0.060
		15:18	2	7,970	300	2.65	0.1886	0.030	1.72	62	62	0.08	0.04	50.00	0.040
		15:25	3	7,970	300	2.65	0.1886	0.040	2.24	58	58	0.07	0.03	42.86	0.040
MS-2	8/4/09	14:17	1	2,618	305	2.57	0.1886	0.085	4.91	62	62	0.07	0.04	57.14	0.030
		14:22	2	2,618	303	2.57	0.1886	0.098	5.57	65	65	0.06	0.04	66.67	0.020
		14:30	3	2,618	300	2.57	0.1886	0.094	5.35	60	60	0.06	0.03	50.00	0.030
MS-3	8/4/09	15:01	1	7,970	300	2.65	0.1886	0.009	0.52	55	55	0.03	0.01	33.33	0.020
		15:08	2	7,970	480	2.65	0.1886	0.015	1.38	50	50	0.05	0.02	40.00	0.030
		15:23	3	7,970	600	2.65	0.1886	0.018	2.07	55	55	0.04	0.02	50.00	0.020
MS-2	8/5/09	15:03	1	2,618	300	2.57	0.1886	0.055	3.10	58	58	0.08	0.04	50.00	0.040
		15:08	2	2,618	300	2.57	0.1886	0.061	3.45	55	55	0.07	0.04	57.14	0.030
		15:16	3	2,618	300	2.57	0.1886	0.052	2.93	46	46	0.08	0.05	62.50	0.030
MS-3	8/5/09	10:05	1	7,970	300	2.65	0.1886	0.116	6.55	46	46	0.12	0.06	50.00	0.060
		10:15	2	7,970	300	2.65	0.1886	0.070	3.97	33	33	0.04	0.01	25.00	0.030
		10:25	3	7,970	300	2.65	0.1886	0.091	5.17	45	45	0.10	0.04	40.00	0.060

Note(s):

APPENDIX F

Particulate Export Measurements from Manatee Springs (Levy Co.) - 08/3/09 - 08/5/09.

Station	Date	Start Time	Sample #	Total Sample Dry Wt. (g)	Total Sample Ash-Free Dry Wt. (g)	Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
MS-2	8/3/09	10:50	1	0.083	0.041	0.01329	0.00665	2,952	1,476	1.127	0.564
		11:10	2	0.110	0.080	0.01227	0.00892	2,725	1,982	1.041	0.757
		11:20	3	0.110	0.040	0.01139	0.00414	2,530	920	0.966	0.351
MS-3	8/3/09	15:10	1	0.100	0.060	0.05272	0.03163	12,071	7,243	1.515	0.909
		15:18	2	0.080	0.040	0.04640	0.02320	10,623	5,311	1.333	0.666
		15:25	3	0.070	0.040	0.03123	0.01784	7,150	4,086	0.897	0.513
MS-2	8/4/09	14:17	1	0.070	0.030	0.01426	0.00611	3,167	1,357	1.210	0.518
		14:22	2	0.060	0.020	0.01077	0.00359	2,391	797	0.913	0.304
		14:30	3	0.060	0.030	0.01122	0.00561	2,493	1,246	0.952	0.476
MS-3	8/4/09	15:01	1	0.030	0.020	0.05799	0.03866	13,278	8,852	1.666	1.111
		15:08	2	0.050	0.030	0.03625	0.02175	8,299	4,979	1.041	0.625
		15:23	3	0.040	0.020	0.01933	0.00967	4,426	2,213	0.555	0.278
MS-2	8/5/09	15:03	1	0.080	0.040	0.02578	0.01289	5,725	2,862	2.187	1.093
		15:08	2	0.070	0.030	0.02030	0.00870	4,508	1,932	1.722	0.738
		15:16	3	0.080	0.030	0.02729	0.01023	6,061	2,273	2.315	0.868
MS-3	8/5/09	10:05	1	0.120	0.060	0.01831	0.00916	4,193	2,097	0.526	0.263
		10:15	2	0.040	0.030	0.01009	0.00756	2,309	1,732	0.290	0.217
		10:25	3	0.100	0.060	0.01933	0.01160	4,426	2,656	0.555	0.333

Note(s):

APPENDIX F

Ponce de Leon Springs (Holmes Co.) - Particulate Export Event Summary - September 8-10, 2009.

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
PDL-SEG1 (st. 1 to st. 2)	9/8/09	UP	0	0	0.00	0.00
		DOWN	378	139	0.24	0.09
		Segment	378	139	0.24	0.09
	9/9/09	UP	0	0	0.00	0.00
		DOWN	1,873	282	1.17	0.18
		Segment	1,873	282	1.17	0.18
	9/10/09	UP	0	0	0.00	0.00
		DOWN	2,083	243	1.31	0.15
		Segment	2,083	243	1.31	0.15
PDL-SEG2 (st. 2 to st. 3)	9/8/09	UP	378	139	0.24	0.09
		DOWN	175	78	0.05	0.02
		Segment	-203	-61	-0.11	-0.03
	9/9/09	UP	1,873	282	1.17	0.18
		DOWN	246	120	0.07	0.03
		Segment	-1,627	-162	-0.87	-0.09
	9/10/09	UP	2,083	243	1.31	0.15
		DOWN	356	175	0.10	0.05
		Segment	-1,727	-69	-0.92	-0.04

Location	Volume (m^3)	Area (m^2)
To Stn. 2	1,708	1,595
To Stn. 3	868	1,869
Combined	2,576	3,464

APPENDIX F

Particulate Export Measurements from Ponce de Leon Springs (Holmes Co.) - 09/8/09 - 09/10/09.

Station	Date	Start Time	Sample #	Upstream Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
PDL-2	9/8/09	13:54	1	1,595	600	0.33	0.1886	0.040	4.48	38	38	0.03	0.02	66.67	0.010
		14:08	2	1,595	600	0.33	0.1886	0.021	2.41	55	55	0.02	0.01	50.00	0.010
		14:21	3	1,595	600	0.33	0.1886	0.021	2.41	50	50	0.06	0.04	66.67	0.020
PDL-3	9/8/09	12:42	1	3,464	300	0.35	0.1886	0.043	2.41	35	35	0.02	0.01	50.00	0.010
		12:49	2	3,464	600	0.35	0.1886	0.046	5.17	40	40	0.03	0.02	66.67	0.010
		13:04	3	3,464	600	0.35	0.1886	0.055	6.21	48	48	0.02	0.01	50.00	0.010
PDL-2	9/9/09	13:04	1	1,595	600	0.33	0.1886	0.024	2.76	45	45	0.08	0.07	87.50	0.010
		13:18	2	1,595	600	0.33	0.1886	0.015	1.72	46	46	0.24	0.22	91.67	0.020
		13:33	3	1,595	600	0.33	0.1886	0.018	2.07	44	44	0.06	0.03	50.00	0.030
PDL-3	9/9/09	16:00	1	3,464	600	0.35	0.1886	0.067	7.59	42	42	0.04	0.02	50.00	0.020
		16:15	2	3,464	600	0.35	0.1886	0.058	6.55	33	33	0.03	0.01	33.33	0.020
		16:26	3	3,464	600	0.35	0.1886	0.043	4.83	40	40	0.07	0.04	57.14	0.030
PDL-2	9/10/09	11:13	1	1,595	600	0.33	0.1886	0.024	2.76	35	35	0.07	0.05	78.57	0.015
		11:25	2	1,595	600	0.33	0.1886	0.034	3.79	63	60	0.03	0.02	66.67	0.010
		11:40	3	1,595	600	0.33	0.1886	0.015	1.72	42	42	0.32	0.29	90.62	0.030
PDL-3	9/10/09	12:41	1	3,464	600	0.35	0.1886	0.046	5.17	50	50	0.08	0.04	50.00	0.040
		12:55	2	3,464	600	0.35	0.1886	0.061	6.90	51	51	0.05	0.02	40.00	0.030
		13:07	3	3,464	600	0.35	0.1886	0.043	4.83	50	50	0.06	0.03	58.33	0.025

Note(s):

APPENDIX F

Particulate Export Measurements from Ponce de Leon Springs (Holmes Co.) - 09/8/09 - 09/10/09.

Station	Date	Start Time	Sample #	Total Sample		Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
				Dry Wt. (g)	Ash-Free Dry Wt. (g)						
PDL-2	9/8/09	13:54	1	0.030	0.0100	0.00669	0.00223	191	64	0.120	0.040
		14:08	2	0.020	0.0100	0.00828	0.00414	236	118	0.148	0.074
		14:21	3	0.060	0.0200	0.02485	0.00828	708	236	0.444	0.148
PDL-3	9/8/09	12:42	1	0.020	0.0100	0.00828	0.00414	251	126	0.073	0.036
		12:49	2	0.030	0.0100	0.00580	0.00193	176	59	0.051	0.017
		13:04	3	0.020	0.0100	0.00322	0.00161	98	49	0.028	0.014
PDL-2	9/9/09	13:04	1	0.080	0.0100	0.02900	0.00362	826	103	0.518	0.065
		13:18	2	0.240	0.0200	0.13919	0.01160	3,966	331	2.487	0.207
		13:33	3	0.060	0.0300	0.02900	0.01450	826	413	0.518	0.259
PDL-3	9/9/09	16:00	1	0.040	0.0200	0.00527	0.00264	160	80	0.046	0.023
		16:15	2	0.030	0.0200	0.00458	0.00305	139	93	0.040	0.027
		16:26	3	0.070	0.0300	0.01450	0.00621	440	189	0.127	0.054
PDL-2	9/10/09	11:13	1	0.070	0.0150	0.02537	0.00544	723	155	0.453	0.097
		11:25	2	0.032	0.0105	0.00830	0.00277	237	79	0.148	0.049
		11:40	3	0.320	0.0300	0.18558	0.01740	5,289	496	3.316	0.311
PDL-3	9/10/09	12:41	1	0.080	0.0400	0.01547	0.00773	469	235	0.136	0.068
		12:55	2	0.050	0.0300	0.00725	0.00435	220	132	0.064	0.038
		13:07	3	0.060	0.0250	0.01243	0.00518	377	157	0.109	0.045

Note(s):

APPENDIX F

Rainbow Springs (Marion Co.) - Particulate Export Event Summary - June 8, 9, and 10, 2009

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
RS-SEG0	6/8/09	UP	0	0	0.00	0.00
(pool to st. 1)		DOWN	34,445	15,620	6.84	3.10
		Segment	34,445	15,620	6.84	3.10
	6/9/09	UP	0	0	0.00	0.00
		DOWN	9,737	4,943	1.93	0.98
		Segment	9,737	4,943	1.93	0.98
	6/10/09	UP	0	0	0.00	0.00
		DOWN	3,962	2,719	0.79	0.54
		Segment	3,962	2,719	0.79	0.54
RS-SEG1	6/8/09	UP	34,445	15,620	6.84	3.10
(st. 1 to st. 2)		DOWN	18,219	7,087	0.68	0.26
		Segment	-16,226	-8,533	-0.75	-0.39
	6/9/09	UP	9,737	4,943	1.93	0.98
		DOWN	10,060	4,629	0.38	0.17
		Segment	323	-313	0.01	-0.01
	6/10/09	UP	3,962	2,719	0.79	0.54
		DOWN	10,433	5,534	0.39	0.21
		Segment	6,471	2,815	0.30	0.13
RS-SEG2	6/8/09	UP	18,219	7,087	0.68	0.26
(st. 2 to st. 3)		DOWN	18,357	6,068	0.37	0.12
		Segment	138	-1,019	0.01	-0.04
	6/9/09	UP	10,060	4,629	0.38	0.17
		DOWN	34,082	16,351	0.68	0.33
		Segment	24,022	11,722	1.02	0.50
	6/10/09	UP	10,433	5,534	0.39	0.21
		DOWN	37,233	14,372	0.74	0.29
		Segment	26,800	8,837	1.14	0.38
RS-SEG 1-2	6/8/09	UP	34,445	15,620	6.84	3.10
(st. 1 to st. 3)		DOWN	18,357	6,068	0.37	0.12
		Segment	-16,088	-9,552	-0.36	-0.21
	6/9/09	UP	9,737	4,943	1.93	0.98
		DOWN	34,082	16,351	0.68	0.33
		Segment	24,345	11,409	0.54	0.25
	6/10/09	UP	3,962	2,719	0.79	0.54
		DOWN	37,233	14,372	0.74	0.29
		Segment	33,271	11,653	1.41	0.50

Location	Volume (m^3)	Area (m^2)
Pool to RS-1	8,245	5,033
RS-1 to RS-2	31,952	21,726
RS-2 to RS-3	30,761	23,529
Combined		

APPENDIX F

Particulate Export Measurements from Rainbow Springs (Marion Co.) - 6/08/2009 to 6/10/2009

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
RS 1	6/8/09	11:25	1	5,033	600	15.83	0.1886	0.012	1.38	30	30	0.08	0.05	62.50	0.030
		11:25	2	5,033	600	15.83	0.1886	0.009	1.03	32	32	0.01	0.00	25.00	0.008
		12:14	3	5,033	600	15.83	0.1886	0.034	3.79	28	28	0.03	0.01	33.33	0.020
RS 2	6/8/09	10:24	1	26,759	600	15.83	0.1886	0.046	5.17	26	26	0.09	0.05	55.56	0.040
		10:36	2	26,759	600	15.83	0.1886	0.040	4.48	45	45	0.06	0.03	50.00	0.030
		10:41	3	26,759	600	15.83	0.1886	0.055	6.21	34	34	0.12	0.08	66.67	0.040
RS 2	6/8/09	16:25	1	26,759	420	15.89	0.1886	0.046	3.62	32	32	0.05	0.03	60.00	0.020
		16:38	2	26,759	600	15.89	0.1886	0.040	4.48	20	30	0.05	0.03	60.00	0.020
		16:51	3	26,759	600	15.89	0.1886	0.055	6.21	40	38	0.05	0.04	80.00	0.010
RS 3	6/8/09	15:15	1	50,287	300	15.89	0.1886	0.177	10.00	61	60	0.10	0.06	60.00	0.040
		15:26	2	50,287	300	15.89	0.1886	0.177	10.00	70	60	0.15	0.11	73.33	0.040
		15:38	3	50,287	300	15.89	0.1886	0.177	10.00	68	60	0.11	0.07	63.64	0.040
RS 1	6/9/09	13:29	1	5,033	600	15.83	0.1886	0.104	11.73	37	37	0.04	0.01	25.00	0.030
		13:42	2	5,033	600	15.83	0.1886	0.064	7.24	48	48	0.06	0.03	50.00	0.030
		13:55	3	5,033	600	15.83	0.1886	0.064	7.24	56	56	0.07	0.04	57.14	0.030
RS 2	6/9/09	14:37	1	26,759	300	15.83	0.1886	0.094	5.35	52	52	0.04	0.02	50.00	0.020
		14:45	2	26,759	300	15.83	0.1886	0.101	5.69	50	50	0.05	0.03	60.00	0.020
		14:54	3	26,759	300	15.83	0.1886	0.122	6.90	50	50	0.04	0.02	50.00	0.020
RS 3	6/9/09	15:25	1	50,287	300	15.86	0.1886	0.168	9.49	68	68	0.37	0.19	51.35	0.180
		15:35	2	50,287	300	15.86	0.1886	0.180	10.17	58	58	0.22	0.12	54.55	0.100
		15:43	3	50,287	300	15.86	0.1886	0.177	10.00	68	68	0.14	0.07	50.00	0.070
RS 1	6/10/09	10:12	1	5,033	600	15.63	0.1886	0.085	9.66	54	54	0.03	0.01	33.33	0.020
		10:25	2	5,033	600	15.63	0.1886	0.085	9.66	42	42	0.02	0.01	25.00	0.015
		10:38	3	5,033	600	15.63	0.1886	0.073	8.28	61	61	0.03	0.01	33.33	0.020
RS 2	6/10/09	11:29	1	26,759	600	15.69	0.1886	0.052	5.86	34	34	0.06	0.03	50.00	0.030
		11:43	2	26,759	600	15.70	0.1886	0.079	8.97	38	38	0.07	0.04	57.14	0.030
		11:58	3	26,759	600	15.70	0.1886	0.070	7.93	36	36	0.04	0.01	25.00	0.030
RS 3	6/10/09	14:45	1	50,287	600	15.74	0.1886	0.168	18.97	63	63	0.24	0.13	54.17	0.110
		14:59	2	50,287	600	15.74	0.1886	0.146	16.56	72	64	0.64	0.41	64.06	0.230
		15:15	3	50,287	600	15.74	0.1886	0.146	16.56	60	60	0.43	0.26	60.47	0.170

APPENDIX F

Particulate Export Measurements from Rainbow Springs (Marion Co.) - 6/08/2009 to 6/10/2009

Station	Date	Start Time	Sample #	Total Sample		Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
				Dry Wt. (g)	Ash-Free Dry Wt. (g)						
RS 1	6/8/09	11:25	1	0.080	0.0300	0.05799	0.02174	79,304	29,739	15.758	5.909
		11:25	2	0.010	0.0075	0.00966	0.00725	13,217	9,913	2.626	1.970
		12:14	3	0.030	0.0200	0.00791	0.00527	10,814	7,209	2.149	1.433
RS 2	6/8/09	10:24	1	0.090	0.0400	0.01740	0.00773	23,791	10,574	0.889	0.395
		10:36	2	0.060	0.0300	0.01338	0.00669	18,301	9,150	0.684	0.342
		10:41	3	0.120	0.0400	0.01933	0.00644	26,435	8,812	0.988	0.329
RS 2	6/8/09	16:25	1	0.050	0.0200	0.01381	0.00552	18,949	7,580	0.708	0.283
		16:38	2	0.033	0.0133	0.00743	0.00297	10,203	4,081	0.381	0.153
		16:51	3	0.053	0.0105	0.00848	0.00170	11,636	2,327	0.435	0.087
RS 3	6/8/09	15:15	1	0.102	0.0407	0.01016	0.00407	13,951	5,580	0.277	0.111
		15:26	2	0.175	0.0467	0.01750	0.00467	24,013	6,404	0.478	0.127
		15:38	3	0.125	0.0453	0.01246	0.00453	17,107	6,221	0.340	0.124
RS 1	6/9/09	13:29	1	0.040	0.0300	0.00341	0.00256	4,665	3,499	0.927	0.695
		13:42	2	0.060	0.0300	0.00828	0.00414	11,329	5,665	2.251	1.126
		13:55	3	0.070	0.0300	0.00966	0.00414	13,217	5,665	2.626	1.126
RS 2	6/9/09	14:37	1	0.040	0.0200	0.00748	0.00374	10,233	5,116	0.382	0.191
		14:45	2	0.050	0.0200	0.00879	0.00351	12,016	4,806	0.449	0.180
		14:54	3	0.040	0.0200	0.00580	0.00290	7,930	3,965	0.296	0.148
RS 3	6/9/09	15:25	1	0.370	0.1800	0.03901	0.01898	53,445	26,000	1.063	0.517
		15:35	2	0.220	0.1000	0.02162	0.00983	29,624	13,465	0.589	0.268
		15:43	3	0.140	0.0700	0.01400	0.00700	19,176	9,588	0.381	0.191
RS 1	6/10/09	10:12	1	0.030	0.0200	0.00311	0.00207	4,195	2,797	0.834	0.556
		10:25	2	0.020	0.0150	0.00207	0.00155	2,797	2,098	0.556	0.417
		10:38	3	0.030	0.0200	0.00362	0.00242	4,894	3,263	0.973	0.648
RS 2	6/10/09	11:29	1	0.060	0.0300	0.01023	0.00512	13,870	6,935	0.518	0.259
		11:43	2	0.070	0.0300	0.00781	0.00335	10,590	4,538	0.396	0.170
		11:58	3	0.040	0.0300	0.00504	0.00378	6,840	5,130	0.256	0.192
RS 3	6/10/09	14:45	1	0.240	0.1100	0.01265	0.00580	17,210	7,888	0.342	0.157
		14:59	2	0.720	0.2587	0.04349	0.01563	59,158	21,260	1.176	0.423
		15:15	3	0.430	0.1700	0.02597	0.01027	35,331	13,968	0.703	0.278

APPENDIX F

Silver Springs (Marion Co.) - Particualte Export Event Summary - May 4, 5, and 7, 2009

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
SS-SEG1 (st. 1 to st. 2)	5/4/09	UP	0	0	0.00	0.00
		DOWN	53,410	22,311	1.21	0.51
		Segment	53,410	22,311	1.21	0.51
	5/5/09	UP	0	0	0.00	0.00
		DOWN	138,768	54,368	3.15	1.23
		Segment	138,768	54,368	3.15	1.23
	5/7/09	UP	0	0	0.00	0.00
		DOWN	103,651	43,232	2.35	0.98
		Segment	103,651	43,232	2.35	0.98
SS-SEG2 (st. 2 to st. 3)	5/4/09	UP	53,410	22,311	1.21	0.51
		DOWN	105,998	47,071	1.34	0.59
		Segment	52,588	24,759	0.66	0.31
	5/5/09	UP	138,768	54,368	3.15	1.23
		DOWN	87,955	36,880	1.11	0.46
		Segment	-50,813	-17,487	-0.64	-0.22
	5/7/09	UP	103,651	43,232	2.35	0.98
		DOWN	233,812	101,935	2.94	1.28
		Segment	130,161	58,704	1.64	0.74

Location	Volume (m^3)	Area (m^2)
Segment 1	67,134	44,096
Segment 2	120,274	79,396
Combined	187,409	123,493

APPENDIX F

Particulate Export Measurements from Silver Springs (Marion Co.) - 05/4/09 - 05/7/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
SS 2	5/4/09	15:24	1	44,096	201	12.12	0.1886	0.213	8.09	57	57	0.22	0.11	50.00	0.110
		15:39	2	44,096	179	12.12	0.1886	0.238	8.02	67	60	0.18	0.10	55.56	0.080
		15:56	3	44,096	118	12.12	0.1886	0.241	5.36	58	58	0.54	0.33	61.11	0.210
SS 3	5/4/09	16:15	1	79,396	240	12.12	0.1886	0.116	5.24	55	55	0.61	0.34	55.74	0.270
		16:25	2	79,396	240	12.12	0.1886	0.128	5.79	47	47	0.62	0.33	53.23	0.290
		16:35	3	79,396	240	12.12	0.1886	0.113	5.10	60	60	0.41	0.24	58.54	0.170
SS 2	5/5/09	15:18	1	44,096	120	12.07	0.1886	0.186	4.21	61	60	0.53	0.30	56.60	0.230
		15:26	2	44,096	120	12.07	0.1886	0.213	4.83	65	60	0.63	0.41	65.08	0.220
		15:34	3	44,096	120	12.07	0.1886	0.207	4.69	63	60	0.58	0.35	60.34	0.230
SS 3	5/5/09	14:25	1	79,396	249	12.07	0.1886	0.238	11.16	47	47	0.66	0.39	59.09	0.270
		14:33	2	79,396	180	12.07	0.1886	0.280	9.52	60	60	0.54	0.29	53.70	0.250
		14:42	3	79,396	180	12.07	0.1886	0.256	8.69	54	48	1.06	0.63	59.43	0.430
SS 2	5/7/09	14:43	1	44,096	180	12.01	0.1886	0.195	6.62	94	60	0.24	0.13	54.17	0.110
		14:51	2	44,096	180	12.01	0.1886	0.189	6.41	80	60	0.52	0.33	63.46	0.190
		14:58	3	44,096	180	12.01	0.1886	0.198	6.72	80	60	0.68	0.38	55.88	0.300
SS 3	5/7/09	13:42	1	79,396	180	12.01	0.1886	0.128	4.35	40	40	0.92	0.54	58.70	0.380
		13:51	2	79,396	180	12.01	0.1886	0.183	6.21	65	60	0.31	0.16	51.61	0.150
		14:00	3	79,396	260	12.01	0.1886	0.140	6.87	90	60	1.88	1.05	55.85	0.830

Note(s):

APPENDIX F

Particulate Export Measurements from Silver Springs (Marion Co.) - 05/4/09 - 05/7/09

Station	Date	Start Time	Sample #	Total Sample		Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
				Dry Wt. (g)	Ash-Free Dry Wt. (g)						
SS 2	5/4/09	15:24	1	0.220	0.110	0.02720	0.01360	28,483	14,242	0.646	0.323
		15:39	2	0.201	0.089	0.02505	0.01113	26,225	11,655	0.595	0.264
		15:56	3	0.540	0.210	0.10078	0.03919	105,523	41,037	2.393	0.931
SS 3	5/4/09	16:15	1	0.610	0.270	0.11637	0.05151	121,842	53,930	1.535	0.679
		16:25	2	0.620	0.290	0.10701	0.05005	112,045	52,408	1.411	0.660
		16:35	3	0.410	0.170	0.08033	0.03331	84,107	34,874	1.059	0.439
SS 2	5/5/09	15:18	1	0.539	0.234	0.12807	0.05558	133,532	57,948	3.028	1.314
		15:26	2	0.682	0.238	0.14136	0.04936	147,389	51,469	3.342	1.167
		15:34	3	0.609	0.242	0.12985	0.05149	135,384	53,687	3.070	1.217
SS 3	5/5/09	14:25	1	0.660	0.270	0.05912	0.02419	61,644	25,218	0.776	0.318
		14:33	2	0.540	0.250	0.05673	0.02627	59,153	27,386	0.745	0.345
		14:42	3	1.193	0.484	0.13722	0.05566	143,070	58,038	1.802	0.731
SS 2	5/7/09	14:43	1	0.376	0.172	0.05679	0.02603	58,918	27,004	1.336	0.612
		14:51	2	0.693	0.253	0.10809	0.03949	112,148	40,977	2.543	0.929
		14:58	3	0.907	0.400	0.13482	0.05948	139,886	61,714	3.172	1.400
SS 3	5/7/09	13:42	1	0.920	0.380	0.21172	0.08745	219,674	90,735	2.767	1.143
		13:51	2	0.336	0.162	0.05410	0.02618	56,132	27,161	0.707	0.342
		14:00	3	2.820	1.245	0.41022	0.18111	425,629	187,910	5.361	2.367

Note(s):

APPENDIX F

Silver Glen Springs (Marion Co.) - Particulate Export Event Summary - February 16, 17, and 18, 2009

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
SGS-SEG1 (st. 1 to st. 2)	2/16/09	UP	0	0	0.00	0.00
		DOWN	2,990	954	1.22	0.39
		Segment	2,990	954	1.22	0.39
	2/17/09	UP	0	0	0.00	0.00
		DOWN	5,696	3,396	2.33	1.39
		Segment	5,696	3,396	2.33	1.39
	2/18/09	UP	0	0	0.00	0.00
		DOWN	11,913	7,129	4.88	2.92
		Segment	11,913	7,129	4.88	2.92
SGS-SEG2 (st. 2 to st. 3)	2/16/09	UP	2,990	954	1.22	0.39
		DOWN	35,562	19,906	0.99	0.56
		Segment	32,572	18,953	0.91	0.53
	2/17/09	UP	5,696	3,396	2.33	1.39
		DOWN	11,165	5,859	0.31	0.16
		Segment	5,470	2,463	0.15	0.07
	2/18/09	UP	11,913	7,129	4.88	2.92
		DOWN	10,633	6,648	0.30	0.19
		Segment	-1,279	-481	-0.04	-0.01

Location	Volume (m^3)	Area (m^2)
To Stn. 2	1,875	2,442
To Stn. 3	21,766	35,836
Combined	23,641	38,278

APPENDIX F

Particulate Export Measurements from Silver Glen Springs (Marion Co.) - 2/16/09 - 2/18/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
SGS 2	2/16/09	16:09	1	2,442	373	1.94	0.1886	0.040	2.79	32	32	0.07	0.05	71.43	0.020
		16:18	2	2,442	543	1.94	0.1886	0.030	3.12	26	26	0.04	0.03	75.00	0.010
		16:30	3	2,442	597	1.94	0.1886	0.040	4.46	28	28	0.07	0.04	57.14	0.030
SGS 3	2/16/09	15:27	1	35,836	216	1.94	0.1886	0.098	3.97	126	126	1.22	0.45	36.89	0.770
		15:39	2	35,836	115	1.94	0.1886	0.085	1.85	62	62	0.38	0.19	50.00	0.190
		15:44	3	35,836	115	1.94	0.1886	0.107	2.31	45	45	0.29	0.15	51.72	0.140
SGS 2	2/17/09	9:52	1	2,442	604	2.06	0.1886	0.043	4.86	43	43	0.18	0.07	38.89	0.110
		10:08	2	2,442	600	2.06	0.1886	0.055	6.21	43	43	0.20	0.08	40.00	0.120
		10:23	3	2,442	605	2.06	0.1886	0.046	5.22	45	45	0.14	0.06	42.86	0.080
SGS 3	2/17/09	10:52	1	35,836	359	2.06	0.1886	0.067	4.54	47	47	0.11	0.07	63.64	0.040
		11:02	2	35,836	388	2.06	0.1886	0.082	6.02	63	63	0.17	0.10	58.82	0.070
		11:20	3	35,836	353	2.06	0.1886	0.085	5.68	98	66	0.52	0.22	42.31	0.300
SGS 2	2/18/09	13:45	1	2,442	480	1.89	0.1886	0.049	4.41	48	48	0.20	0.10	50.00	0.100
		13:57	2	2,442	420	1.89	0.1886	0.046	3.62	44	44	0.13	0.07	53.85	0.060
		14:07	3	2,442	300	1.89	0.1886	0.058	3.28	36	36	0.45	0.15	33.33	0.300
SGS 3	2/18/09	12:49	1	35,836	480	1.89	0.1886	0.088	8.00	59	59	0.31	0.14	45.16	0.170
		13:00	2	35,836	420	1.89	0.1886	0.107	8.45	40	40	0.25	0.05	20.00	0.200
		13:12	3	35,836	420	1.89	0.1886	0.122	9.66	60	75	1.53	0.60	39.22	0.930

Note(s):

APPENDIX F

Particulate Export Measurements from Silver Glen Springs (Marion Co.) - 2/16/09 - 2/18/09

Station	Date	Start Time	Sample #	Total Sample Dry Wt. (g)	Total Sample Ash-Free Dry Wt. (g)	Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
SGS 2	2/16/09	16:09	1	0.070	0.020	0.02512	0.00718	4,202	1,200	1.720	0.492
		16:18	2	0.040	0.010	0.01282	0.00320	2,144	536	0.878	0.219
		16:30	3	0.070	0.030	0.01569	0.00673	2,625	1,125	1.075	0.461
SGS 3	2/16/09	15:27	1	1.220	0.770	0.30709	0.19382	51,371	32,422	1.433	0.905
		15:39	2	0.380	0.190	0.20532	0.10266	34,347	17,173	0.958	0.479
		15:44	3	0.290	0.140	0.12535	0.06052	20,970	10,123	0.585	0.282
SGS 2	2/17/09	9:52	1	0.180	0.110	0.03703	0.02263	6,585	4,024	2.696	1.648
		10:08	2	0.200	0.120	0.03222	0.01933	5,729	3,437	2.346	1.408
		10:23	3	0.140	0.080	0.02684	0.01534	4,773	2,727	1.954	1.117
SGS 3	2/17/09	10:52	1	0.110	0.040	0.02423	0.00881	4,309	1,567	0.120	0.044
		11:02	2	0.170	0.070	0.02823	0.01163	5,020	2,067	0.140	0.058
		11:20	3	0.772	0.445	0.13591	0.07841	24,167	13,943	0.674	0.389
SGS 2	2/18/09	13:45	1	0.200	0.100	0.04531	0.02265	7,408	3,704	3.033	1.517
		13:57	2	0.130	0.060	0.03590	0.01657	5,870	2,709	2.404	1.109
		14:07	3	0.450	0.300	0.13735	0.09157	22,459	14,973	9.196	6.131
SGS 3	2/18/09	12:49	1	0.310	0.170	0.03875	0.02125	6,335	3,474	0.177	0.097
		13:00	2	0.250	0.200	0.02959	0.02367	4,838	3,871	0.135	0.108
		13:12	3	1.224	0.744	0.12676	0.07705	20,727	12,598	0.578	0.352

Note(s):

APPENDIX F

Wakulla Springs (Wakulla Co.) - Particulate Export Event Summary - Apr 13, 14, and 15, 2009

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
WAK-SEG1 (st. 1 to st. 2)	4/13/09	UP	0	0	0.00	0.00
		DOWN	1,601	855	0.10	0.05
		Segment	1,601	855	0.10	0.05
	4/14/09	UP	0	0	0.00	0.00
		DOWN	46,165	891	2.94	0.06
		Segment	46,165	891	2.94	0.06
	4/15/09	UP	0	0	0.00	0.00
		DOWN	8,382	3,886	0.53	0.25
		Segment	8,382	3,886	0.53	0.25
WAK-SEG2 (st. 2 to st. 3)	4/13/09	UP	1,601	855	0.10	0.05
		DOWN	104,582	28,793	1.73	0.48
		Segment	102,981	27,938	1.71	0.46
	4/14/09	UP	46,165	891	2.94	0.06
		DOWN	65,399	38,321	1.08	0.64
		Segment	19,234	37,430	0.32	0.62
	4/15/09	UP	8,382	3,886	0.53	0.25
		DOWN	166,740	58,529	2.76	0.97
		Segment	158,359	54,643	2.63	0.91

Location	Volume (m^3)	Area (m^2)
To Stn. 2	49,607	15,685
To Stn. 3	50,237	60,318
Combined	99,844	76,003

APPENDIX F

Particulate Export Measurements from Wakulla Springs (Wakulla Co.) - 04/13/09 - 04/15/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
WAK 2	4/13/09	13:52	1	15,685	1,200	28.39	0.1886	0.299	67.59	33	33	0.04	0.01	25.00	0.030
		14:22	2	15,685	1,200	28.39	0.1886	0.320	72.42	50	50	0.04	0.02	50.00	0.020
		14:50	3	15,685	1,200	28.39	0.1886	0.271	61.39	40	40	0.05	0.03	60.00	0.020
WAK 3	4/13/09	14:04	1	60,318	360	28.39	0.1886	0.384	26.07	55	55	1.24	0.97	78.23	0.270
		14:12	2	60,318	341	28.39	0.1886	0.341	21.95	60	60	1.14	0.79	69.30	0.350
		14:35	3	60,318	289	28.39	0.1886	0.329	17.94	60	60	0.51	0.35	68.63	0.160
WAK 2	4/14/09	10:02	1	15,685	1,200	29.40	0.1886	0.302	68.28	60	60	0.05	0.03	60.00	0.020
		10:33	2	15,685	1,200	29.40	0.1886	0.323	73.11	60	60	0.05	0.02	40.00	0.030
		11:00	3	15,685	1,200	29.40	0.1886	0.253	57.25	60	60	3.04	3.02	99.34	0.020
WAK 3	4/14/09	13:50	1	60,318	223	29.40	0.1886	0.506	21.28	140	60	0.31	0.09	29.03	0.220
		13:57	2	60,318	195	29.40	0.1886	0.549	20.17	75	60	0.24	0.12	50.00	0.120
		14:10	3	60,318	145	29.40	0.1886	0.561	15.33	90	60	0.29	0.15	51.72	0.140
WAK 2	4/15/09	14:36	1	15,685	450	30.14	0.1886	0.116	9.83	35	35	0.04	0.02	50.00	0.020
		14:49	2	15,685	600	30.14	0.1886	0.171	19.31	60	60	0.04	0.02	50.00	0.020
		15:05	3	15,685	707	30.14	0.1886	0.107	14.22	55	55	0.05	0.03	60.00	0.020
WAK 3	4/15/09	13:35	1	60,318	192	30.14	0.1886	0.451	16.33	100	60	0.43	0.21	48.84	0.220
		13:41	2	60,318	184	30.14	0.1886	0.396	13.75	60	60	0.80	0.60	75.00	0.200
		13:50	3	60,318	140	30.14	0.1886	0.299	7.89	55	55	0.71	0.47	66.20	0.240

Note(s):

APPENDIX F

Particulate Export Measurements from Wakulla Springs (Wakulla Co.) - 04/13/09 - 04/15/09

Station	Date	Start Time	Sample #	Total Sample Dry Wt. (g)	Total Sample Ash-Free Dry Wt. (g)	Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
WAK 2	4/13/09	13:52	1	0.040	0.030	0.00059	0.00044	1,451	1,089	0.093	0.069
		14:22	2	0.040	0.020	0.00055	0.00028	1,355	677	0.086	0.043
		14:50	3	0.050	0.020	0.00081	0.00033	1,998	799	0.127	0.051
WAK 3	4/13/09	14:04	1	1.240	0.270	0.04756	0.01036	116,650	25,400	1.934	0.421
		14:12	2	1.140	0.350	0.05193	0.01594	127,371	39,105	2.112	0.648
		14:35	3	0.510	0.160	0.02843	0.00892	69,725	21,874	1.156	0.363
WAK 2	4/14/09	10:02	1	0.050	0.020	0.00073	0.00029	1,860	744	0.119	0.047
		10:33	2	0.050	0.030	0.00068	0.00041	1,737	1,042	0.111	0.066
		11:00	3	3.040	0.020	0.05310	0.00035	134,899	887	8.601	0.057
WAK 3	4/14/09	13:50	1	0.723	0.513	0.03400	0.02413	86,361	61,289	1.432	1.016
		13:57	2	0.300	0.150	0.01487	0.00744	37,775	18,888	0.626	0.313
		14:10	3	0.435	0.210	0.02837	0.01369	72,061	34,788	1.195	0.577
WAK 2	4/15/09	14:36	1	0.040	0.020	0.00407	0.00203	10,597	5,299	0.676	0.338
		14:49	2	0.040	0.020	0.00207	0.00104	5,393	2,697	0.344	0.172
		15:05	3	0.050	0.020	0.00352	0.00141	9,154	3,662	0.584	0.233
WAK 3	4/15/09	13:35	1	0.717	0.367	0.04388	0.02245	114,259	58,458	1.894	0.969
		13:41	2	0.800	0.200	0.05819	0.01455	151,518	37,879	2.512	0.628
		13:50	3	0.710	0.240	0.09003	0.03043	234,444	79,249	3.887	1.314

Note(s):

APPENDIX F

Weeki Wachee Springs (Hernando Co.) - Particulate Export Event Summary - March 9, 10, and 11, 2009

Segment	Date	Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
WWS-SEG1 (st. 1 to st. 2)	3/9/09	UP	0	0	0.00	0.00
		DOWN	41,483	3,800	6.32	0.58
		Segment	41,483	3,800	6.32	0.58
	3/10/09	UP	0	0	0.00	0.00
		DOWN	15,039	2,233	2.29	0.34
		Segment	15,039	2,233	2.29	0.34
	3/11/09	UP	0	0	0.00	0.00
		DOWN	47,923	2,429	7.30	0.37
		Segment	47,923	2,429	7.30	0.37
WWS-SEG2 (st. 2 to st. 3)	3/9/09	UP	41,483	3,800	6.32	0.58
		DOWN	29,522	11,479	1.38	0.54
		Segment	-11,961	7,679	-0.56	0.36
	3/10/09	UP	15,039	2,233	2.29	0.34
		DOWN	5,964	3,309	0.28	0.15
		Segment	-9,074	1,076	-0.42	0.05
	3/11/09	UP	47,923	2,429	7.30	0.37
		DOWN	14,398	6,985	0.67	0.33
		Segment	-33,525	4,556	-1.57	0.21

Location	Volume (m^3)	Area (m^2)
To Stn. 2	9,887	6,564
To Stn. 3	19,207	21,406
Combined	29,094	27,970

APPENDIX F

Particulate Export Measurements from Weeki Wachee Springs (Hernando Co.) - 03/09/09 - 03/11/09

Station	Date	Start Time	Sample #	Upsteam Area (m^2)	Time of Tow (s)	Flow Rate (m^3/s)	Net Area (m^2)	Water Velocity (m/s)	Volume Filtered (m^3)	Total Sample Volume (mL)	Laboratory Analysis				
											Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)
WWS 2	3/9/09	16:11	1	6,564	336	3.46	0.1886	0.131	8.30	59	59	1.47	1.36	92.52	0.110
		16:24	2*	6,564	180	3.46	0.1886	0.198	6.72	56	56	3.01	2.95	98.01	0.060
		16:34	3	6,564	260	3.46	0.1886	0.201	9.86	46	46	0.99	0.87	87.88	0.120
WWS 3	3/9/09	16:57	1	21,406	184	3.46	0.1886	0.174	6.03	39	39	0.13	0.07	53.85	0.060
		17:05	2	21,406	247	3.46	0.1886	0.128	5.96	49	49	0.84	0.52	61.90	0.320
		17:17	3	21,406	245	3.46	0.1886	0.155	7.18	61	61	0.96	0.59	61.46	0.370
WWS 2	3/10/09	10:26	1	6,564	367	3.45	0.1886	0.085	5.91	55	55	0.41	0.36	87.80	0.050
		10:31	2	6,564	358	3.45	0.1886	0.098	6.58	52	52	0.33	0.29	87.88	0.040
		10:40	3	6,564	284	3.45	0.1886	0.094	5.06	46	46	0.16	0.12	75.00	0.040
WWS 3	3/10/09	9:37	1	21,406	300	3.45	0.1886	0.262	14.83	52	52	0.38	0.19	50.00	0.190
		9:45	2	21,406	255	3.45	0.1886	0.250	12.02	41	41	0.21	0.08	38.10	0.130
		9:53	3	21,406	278	3.45	0.1886	0.238	12.46	50	50	0.21	0.09	42.86	0.120
WWS 2	3/11/09	11:38	1	6,564	255	3.45	0.1886	0.253	12.17	52	52	1.95	1.87	95.90	0.080
		11:45	2	6,564	257	3.45	0.1886	0.262	12.70	60	60	1.79	1.68	93.85	0.110
		11:54	3	6,564	316	3.45	0.1886	0.274	16.35	60	60	2.95	2.80	94.92	0.150
WWS 3	3/11/09	9:40	1	21,406	366	3.45	0.1886	0.207	14.30	60	60	1.38	0.78	56.52	0.600
		9:50	2	21,406	171	3.45	0.1886	0.226	7.27	44	44	0.15	0.07	46.67	0.080
		10:03	3	21,406	216	3.45	0.1886	0.213	8.69	42	42	0.24	0.09	37.50	0.150

Note(s):

WWS-2 3/9/09 PT# 2 - questionable data, not used in analyses

APPENDIX F

Particulate Export Measurements from Weeki Wachee Springs (Hernando Co.) - 03/09/09 - 03/11/09

Station	Date	Start Time	Sample #	Total Sample		Dry Matter (g/m^3)	Organic Matter (g/m^3)	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
				Dry Wt. (g)	Ash-Free Dry Wt. (g)						
WWS 2	3/9/09	16:11	1	1.470	0.110	0.17702	0.01325	52,944	3,962	8.066	0.604
		16:24	2*	3.010	0.060	0.44759	0.00892	133,872	2,669	20.395	0.407
		16:34	3	0.990	0.120	0.10037	0.01217	30,021	3,639	4.574	0.554
WWS 3	3/9/09	16:57	1	0.130	0.060	0.02157	0.00995	6,450	2,977	0.301	0.139
		17:05	2	0.840	0.320	0.14088	0.05367	42,135	16,051	1.968	0.750
		17:17	3	0.960	0.370	0.13367	0.05152	39,980	15,409	1.868	0.720
WWS 2	3/10/09	10:26	1	0.410	0.050	0.06942	0.00847	20,720	2,527	3.157	0.385
		10:31	2	0.330	0.040	0.05012	0.00607	14,959	1,813	2.279	0.276
		10:40	3	0.160	0.040	0.03162	0.00790	9,438	2,359	1.438	0.359
WWS 3	3/10/09	9:37	1	0.380	0.190	0.02563	0.01281	7,649	3,824	0.357	0.179
		9:45	2	0.210	0.130	0.01747	0.01082	5,215	3,229	0.244	0.151
		9:53	3	0.210	0.120	0.01685	0.00963	5,029	2,874	0.235	0.134
WWS 2	3/11/09	11:38	1	1.950	0.080	0.16029	0.00658	47,845	1,963	7.289	0.299
		11:45	2	1.790	0.110	0.14090	0.00866	42,057	2,585	6.407	0.394
		11:54	3	2.950	0.150	0.18047	0.00918	53,866	2,739	8.206	0.417
WWS 3	3/11/09	9:40	1	1.380	0.600	0.09647	0.04194	28,795	12,519	1.345	0.585
		9:50	2	0.150	0.080	0.02062	0.01100	6,156	3,283	0.288	0.153
		10:03	3	0.240	0.150	0.02762	0.01726	8,243	5,152	0.385	0.241

Note(s):

WWS-2 3/9/09 PT# 2 - questionable data, not used in analyses

Appendix G

Field Parameters and Water Chemistry

APPENDIX G

Detail Water Quality by Spring and Station

			FIELD PARAMETERS					BIOLOGICAL	GENERAL INORGANIC	NITROGEN					PHOSPHORUS		PHYSICAL	
Spring	Station	Date	DO (%)	DO (mg/L)	pH (SU)	SpCond (umhos/cm)	Wtr Temp (C)	Chl-a corr (µg/L)	Cl-T (mg/L)	NH_4-N (mg/L)	NOx-N (mg/L)	OrgN (mg/L)	TKN (mg/L)	TN (mg/L)	OrthoP (mg/L)	TP (mg/L)	Color (CPU)	Turb (NTU)
De Leon	VDL-1	10/6/08	6.10	0.530	7.32	946	22.6	1.10	188	0.078	0.768	0.052	0.130	0.898	0.058	0.055	5.00	0.060
De Leon	VDL-1	10/8/08	8.34	0.720	7.48	944	22.7											
De Leon	VDL-1	10/9/08	10.6	0.910	7.23	948	22.8	1.10	191	0.142	0.784	0.00	0.090	0.874	0.064	0.063	5.00	0.090
De Leon	VDL-2	10/6/08	8.15	0.705	7.39	945	22.6	1.10	190	0.054	0.758	0.026	0.080	0.838	0.060	0.060	5.00	0.060
De Leon	VDL-2	10/9/08	12.4	1.06	7.44	948	22.9	0.550	191	0.108	0.776	0.00	0.100	0.876	0.059	0.063	10.0	0.120
De Leon	VDL-3	10/6/08	39.2	3.35	8.12	989	23.5	10.7	204	0.018	0.337	0.492	0.510	0.847	0.048	0.089	40.0	1.51
De Leon	VDL-3	10/8/08	30.0	2.52	7.47	984	23.9											
De Leon	VDL-3	10/9/08	76.3	6.21	7.53	1,022	25.7	13.9	213	0.086	0.133	0.804	0.890	1.02	0.036	0.087	60.0	2.13
Homosassa	HS-1	11/3/08	44.1	3.71	7.64	5,110	23.3	0.550	1,400	0.053	0.548	0.027	0.040	0.628	0.023	0.029	2.50	0.800
Homosassa	HS-1	11/4/08	44.3	3.73	8.04	4,364	23.3											
Homosassa	HS-1	11/5/08	43.2	3.63	8.24	4,951	23.3											
Homosassa	HS-1	11/6/08	42.9	3.62	7.58	3,705	23.3	1.10	1,100	0.005	0.560	0.071	0.040	0.640	0.020	0.024	5.00	0.720
Homosassa	HS-2	11/3/08	49.8	4.18	7.30	4,593	23.3	0.550	1,330	0.040	0.523	0.060	0.100	0.623	0.024	0.030	2.50	0.820
Homosassa	HS-2	11/5/08	46.9	3.96	8.07	4,369	23.2											
Homosassa	HS-2	11/6/08	49.7	4.20	7.73	3,519	23.2	2.10	1,020	0.005	0.554	0.101	0.110	0.664	0.022	0.024	5.00	0.610
Homosassa	HS-3	11/3/08	55.5	4.66	7.52	4,034	23.6	0.550	396	0.017	0.532	0.093	0.110	0.642	0.024	0.024	2.50	0.280
Homosassa	HS-3	11/4/08	46.2	3.91	7.94	3,579	23.0											
Homosassa	HS-3	11/5/08	50.3	4.25	8.12	4,032	22.9											
Homosassa	HS-3	11/6/08	54.2	4.60	7.64	2,998	23.2	2.10	320	0.005	0.534	0.101	0.110	0.644	0.022	0.019	5.00	0.280
Ichetucknee	ICH_BLUE_HOLE	1/19/09	21.4	1.89	7.54	307	21.6											
Ichetucknee	ICH_BLUE_HOLE	7/6/09	16.6	1.46	7.35	307	21.7				0.800							
Ichetucknee	ICH_BLUE_HOLE	7/7/09	18.1	1.59	7.36	312	32.7											
Ichetucknee	ICH_BLUE_HOLE	7/9/09	17.1	1.51	7.39	310	21.7				0.800							
Ichetucknee	ICH_DEVILS	7/6/09	1.12	0.100	7.52	362	21.8				0.400							
Ichetucknee	ICH_DEVILS	7/7/09	2.00	0.180	7.53	362	21.8											
Ichetucknee	ICH_DEVILS	7/9/09	1.10	0.100	7.41	365	21.8				0.400							
Ichetucknee	ICH_MAIN	1/19/09	39.7	3.47	7.53	325	21.7											
Ichetucknee	ICH_MAIN	7/6/09	43.3	3.80	7.81	324	21.8				1.10							
Ichetucknee	ICH_MAIN	7/7/09	42.2	3.71	6.67	328	21.7											
Ichetucknee	ICH_MAIN	7/9/09	41.7	3.67	7.34	327	21.7				1.00							
Ichetucknee	ICH_MILLPOND	7/6/09	7.80	0.690	7.52	397	21.9				0.200							
Ichetucknee	ICH_MILLPOND	7/7/09	12.5	1.09	7.56	402	21.9											
Ichetucknee	ICH_MILLPOND	7/9/09	11.5	1.00	7.37	400	21.9				0.200							
Ichetucknee	ICH_MISSION	7/6/09	6.10	0.530	7.51	336	21.7				0.500							
Ichetucknee	ICH_MISSION	7/7/09	5.80	0.510	7.41	341	21.7											
Ichetucknee	ICH_MISSION	7/9/09	2.20	0.190	7.34	339	21.7				0.500							

APPENDIX G

Detail Water Quality by Spring and Station

			FIELD PARAMETERS					BIOLOGICAL	GENERAL INORGANIC	NITROGEN					PHOSPHORUS		PHYSICAL	
Spring	Station	Date	DO (%)	DO (mg/L)	pH (SU)	SpCond (umhos/cm)	Wtr Temp (C)	Chl-a corr (µg/L)	Cl-T (mg/L)	NH_4-N (mg/L)	NOx-N (mg/L)	OrgN (mg/L)	TKN (mg/L)	TN (mg/L)	OrthoP (mg/L)	TP (mg/L)	Color (CPU)	Turb (NTU)
Ichetucknee	IS-1	6/19/09	44.4	3.88	7.47	310	21.9											
Ichetucknee	IS-1	7/6/09	34.2	3.00	7.54	310	21.8	2.10	5.00	0.013	0.674	0.027	0.040	0.714	0.029	0.058	2.50	0.190
Ichetucknee	IS-1	7/7/09	41.4	3.63	7.46	315	22.0											
Ichetucknee	IS-1	7/9/09	40.2	3.52	7.46	315	21.9	0.550	5.00	0.054	0.644	0.026	0.040	0.724	0.033	0.047	2.50	0.240
Ichetucknee	IS-2	1/19/09	71.5	6.32	7.87	332	21.4											
Ichetucknee	IS-2	2/3/09	75.1	6.75	8.00	321	20.6											
Ichetucknee	IS-2	6/19/09	53.1	4.64	7.54	330	21.9											
Ichetucknee	IS-2	7/6/09	64.7	5.64	7.79	332	22.3	2.10	7.00	0.005	0.396	0.031	0.040	0.436	0.036	0.068	2.50	0.370
Ichetucknee	IS-2	7/9/09	83.3	7.07	7.83	337	23.5	2.10	7.00	0.056	0.367	0.024	0.040	0.447	0.045	0.073	2.50	0.330
Ichetucknee	IS-3	1/19/09	65.9	5.89	7.80	333	20.8											
Ichetucknee	IS-3	2/3/09	70.8	6.44	7.91	323	20.0											
Ichetucknee	IS-3	6/19/09	46.2	4.06	7.38	333	21.6											
Ichetucknee	IS-3	7/6/09	67.5	5.85	7.81	334	22.4											
Ichetucknee	IS-3	7/9/09	87.0	7.41	8.73	339	23.3											
Ichetucknee	IS-4	1/19/09	64.1	5.78	7.74	334	20.4											
Ichetucknee	IS-4	2/3/09	68.7	6.30	7.92	324	19.5											
Ichetucknee	IS-4	6/19/09	48.3	4.25	7.34	333	21.6											
Ichetucknee	IS-4	7/6/09	71.8	6.19	7.96	332	22.7	2.10	7.00	0.019	0.369	0.021	0.040	0.409	0.039	0.076	2.50	0.390
Ichetucknee	IS-4	7/7/09	89.6	7.60	7.79	338	23.5											
Ichetucknee	IS-4	7/9/09	83.1	7.10	7.76	326	23.4	2.10	6.00	0.098	0.341	0.00	0.040	0.421	0.041	0.096	5.00	1.29
Jackson Blue	JBS-1	1/12/09	76.6	6.89	7.59	255	20.5											
Jackson Blue	JBS-1	1/13/09	75.9	6.82	7.54	264	20.6	1.10	5.00	0.046	3.44	0.034	0.040	3.52	0.020	0.021	2.50	0.040
Jackson Blue	JBS-1	1/15/09	69.1	6.21	7.51	245	20.6	1.10	4.00	0.059	3.19	0.041	0.100	3.29	0.016	0.019	2.50	0.030
Jackson Blue	JBS-2	1/12/09	77.5	6.97	7.59	252	20.6											
Jackson Blue	JBS-2	1/13/09	75.1	6.74	7.57	265	20.6	1.10	5.00	0.005	3.44	0.071	0.040	3.52	0.030	0.019	2.50	0.060
Jackson Blue	JBS-2	1/15/09	69.8	6.27	7.48	246	20.6	1.10	4.00	0.009	3.46	0.071	0.040	3.54	0.016	0.019	2.50	0.030
Jackson Blue	JBS-3	1/12/09	115	10.4	8.12	255	20.3											
Jackson Blue	JBS-3	1/13/09	105	9.49	7.96	268	20.6	1.10	5.00	0.064	3.42	0.016	0.040	3.50	0.016	0.016	2.50	0.040
Jackson Blue	JBS-3	1/15/09	94.5	8.56	7.86	246	20.1	1.10	4.00	0.100	3.34	0.00	0.040	3.42	0.016	0.019	2.50	0.920
Madison Blue	MBS-1	12/1/08	17.3	1.55	7.68	280	20.9	1.10	5.00	0.113	1.46	0.027	0.140	1.60	0.049	0.040	5.00	0.040
Madison Blue	MBS-1	12/2/08	71.3	7.27	6.79	88.4	14.5											
Madison Blue	MBS-1	12/11/08																
Madison Blue	MBS-1	1/2/09	14.5	1.30	7.49	284	20.5	1.10	6.00	0.068	1.43	0.062	0.130	1.56	0.043	0.039	5.00	0.250
Madison Blue	MBS-1	1/6/09	14.2	1.28	7.63	275	20.6											
Madison Blue	MBS-2	12/1/08	15.3	1.37	7.67	280	20.9	1.10	5.00	0.031	1.48	0.149	0.180	1.66	0.047	0.038	5.00	0.050
Madison Blue	MBS-2	12/10/08						1.10	8.00	0.056	0.264	0.614	0.670	0.934	0.051	0.079	100	8.44
Madison Blue	MBS-2	12/11/08	31.2	3.01	7.78	166	17.0											
Madison Blue	MBS-2	1/2/09	14.9	1.34	7.47	284	20.5											
Madison Blue	MBS-2	1/6/09	14.6	1.31	7.65	274	20.6											
Madison Blue	MBS-3	12/1/08	19.9	1.79	7.72	275	20.6	2.10	6.00	0.086	1.46	0.284	0.370	1.83	0.049	0.040	5.00	0.015
Madison Blue	MBS-3	1/2/09	15.4	1.38	7.48	284	20.5	1.10	6.00	0.057	1.44	0.163	0.220	1.66	0.040	0.039	5.00	0.310
Madison Blue	MBS-3	1/6/09	15.1	1.35	7.64	274	20.6											

APPENDIX G

Detail Water Quality by Spring and Station

			FIELD PARAMETERS					BIOLOGICAL	GENERAL INORGANIC	NITROGEN					PHOSPHORUS		PHYSICAL	
Spring	Station	Date	DO (%)	DO (mg/L)	pH (SU)	SpCond (umhos/cm)	Wtr Temp (C)	Chl-a corr (µg/L)	Cl-T (mg/L)	NH_4-N (mg/L)	NOx-N (mg/L)	OrgN (mg/L)	TKN (mg/L)	TN (mg/L)	OrthoP (mg/L)	TP (mg/L)	Color (CPU)	Turb (NTU)
Manatee	MS-1	8/3/09	13.3	1.17	6.98	478	22.3	0.550	9.00	0.005	2.00	0.211	0.220	2.22	0.026	0.009	2.50	0.360
Manatee	MS-1	8/4/09	12.3	1.07	7.10	503	22.3											
Manatee	MS-1	8/5/09	12.6	1.09	7.08	503	22.3											
Manatee	MS-1	8/6/09	13.0	1.13	7.13	513	22.3	1.10	9.00	0.005	1.99	0.281	0.290	2.28	0.031	0.037	2.50	0.110
Manatee	MS-2	8/3/09	15.7	1.37	7.00	478	22.3	0.550	9.00	0.012	1.33	0.218	0.230	1.56	0.026	0.003	2.50	0.330
Manatee	MS-2	8/4/09	14.2	1.24	7.13	504	22.3											
Manatee	MS-2	8/5/09	14.5	1.26	7.09	504	22.3											
Manatee	MS-2	8/6/09	14.6	1.27	7.14	513	22.3	0.550	9.00	0.005	2.02	0.321	0.330	2.35	0.031	0.035	2.50	0.100
Manatee	MS-3	8/3/09	19.8	1.72	7.09	478	22.3	1.10	9.00	0.005	1.32	0.221	0.230	1.55	0.027	0.003	2.50	0.340
Manatee	MS-3	8/4/09	25.2	2.19	7.14	504	22.5											
Manatee	MS-3	8/5/09	23.0	1.99	7.12	503	22.4											
Manatee	MS-3	8/6/09	21.7	1.88	7.19	513	22.4	0.550	9.00	0.005	1.97	0.271	0.280	2.25	0.038	0.042	2.50	0.180
Ponce de Leon	PDL-1	9/8/09	40.5	3.68	7.64	218	20.1	1.10	3.00	0.031	0.280	0.059	0.090	0.370	0.024	0.023	2.50	0.120
Ponce de Leon	PDL-1	9/9/09	40.7	3.69	7.90	215	20.2											
Ponce de Leon	PDL-1	9/10/09	40.1	3.34	7.45	228	20.1											
Ponce de Leon	PDL-1	9/11/09	38.5	3.50	7.50	209	20.0	1.10	3.00	0.128	0.270	0.00	0.100	0.370	0.014	0.003	2.50	0.110
Ponce de Leon	PDL-2	9/8/09	43.8	3.98	7.62	218	20.2	0.550	3.00	0.036	0.267	0.044	0.040	0.347	0.023	0.029	2.50	0.700
Ponce de Leon	PDL-2	9/9/09	43.2	3.89	8.01	213	20.4											
Ponce de Leon	PDL-2	9/10/09	43.7	3.97	7.32	229	20.1											
Ponce de Leon	PDL-2	9/11/09	40.4	3.68	7.54	209	20.1	2.10	3.00	0.005	0.292	0.071	0.040	0.372	0.035	0.003	2.50	0.130
Ponce de Leon	PDL-3	9/8/09	52.5	4.75	7.71	217	20.3	0.550	3.00	0.029	0.276	0.051	0.040	0.356	0.024	0.026	2.50	0.280
Ponce de Leon	PDL-3	9/9/09	59.0	5.32	7.71	215	20.4											
Ponce de Leon	PDL-3	9/10/09	56.0	5.06	7.69	228	20.4											
Ponce de Leon	PDL-3	9/11/09	53.9	4.87	7.55	209	20.2	1.10	3.00	0.039	0.287	0.041	0.040	0.367	0.012	0.003	2.50	0.190
Rainbow	RS-1	6/8/09	85.0	7.24	8.14	147	23.3	0.550	7.00	0.178	1.61	0.00	0.040	1.69	0.033	0.030	2.50	0.060
Rainbow	RS-1	6/9/09	92.8	7.90	7.92	193	23.5											
Rainbow	RS-1	6/10/09	77.8	6.65	7.98	196	23.2											
Rainbow	RS-1	6/11/09	74.2	6.33	7.93	197	23.2	2.10	5.00	0.112	1.88	0.00	0.080	1.96	0.029	0.051	2.50	0.060
Rainbow	RS-2	6/8/09	83.0	6.87	7.66	190	23.1	1.10	5.00	0.099	1.81	0.00	0.040	1.89	0.031	0.030	2.50	0.080
Rainbow	RS-2	6/9/09	102	8.64	8.01	204	23.6											
Rainbow	RS-2	6/10/09	86.1	7.33	8.05	228	23.5											
Rainbow	RS-2	6/11/09	74.9	6.35	7.69	304	23.4	1.10	6.00	0.119	1.64	0.041	0.160	1.80	0.033	0.033	2.50	0.220
Rainbow	RS-3	6/8/09	91.9	7.83	7.76	220	23.4	1.10	6.00	0.072	1.67	0.008	0.040	1.75	0.031	0.035	2.50	0.040
Rainbow	RS-3	6/9/09	12.0	10.1	8.08	259	24.2											
Rainbow	RS-3	6/10/09	105	8.76			24.2											
Rainbow	RS-3	6/11/09	82.6	7.06	7.90	248	23.3	2.10	5.00	0.105	1.60	0.00	0.040	1.68	0.031	0.038	2.50	0.110

APPENDIX G

Detail Water Quality by Spring and Station

			FIELD PARAMETERS					BIOLOGICAL	GENERAL INORGANIC	NITROGEN					PHOSPHORUS		PHYSICAL	
Spring	Station	Date	DO (%)	DO (mg/L)	pH (SU)	SpCond (umhos/cm)	Wtr Temp (C)	Chl-a corr (µg/L)	Cl-T (mg/L)	NH_4-N (mg/L)	NOx-N (mg/L)	OrgN (mg/L)	TKN (mg/L)	TN (mg/L)	OrthoP (mg/L)	TP (mg/L)	Color (CPU)	Turb (NTU)
Silver	SS-1	5/4/09	23.4	2.01	7.24	421	23.2	1.10	11.0	0.005	1.10	0.071	0.040	1.18	0.044	0.053	2.50	0.015
Silver	SS-1	5/7/09	29.1	2.51	7.27	489	23.3	1.10	11.0	0.020	1.12	0.080	0.100	1.22	0.040	0.040	2.50	0.030
Silver	SS-1	5/8/09	25.2	2.15	7.25	482	23.3											
Silver	SS-2	5/4/09	53.0	4.48	7.36	429	23.7	2.10	11.0	0.005	1.16	0.071	0.040	1.24	0.036	0.043	2.50	0.015
Silver	SS-2	5/7/09	53.7	4.53	7.38	481	23.8	1.10	11.0	0.009	1.14	0.071	0.080	1.22	0.034	0.033	2.50	0.060
Silver	SS-2	5/8/09	54.0	4.56	7.34	490	23.6											
Silver	SS-3	5/4/09	58.6	4.96	7.38	419	23.8	0.550	12.0	0.005	1.16	0.071	0.040	1.24	0.036	0.041	2.50	0.015
Silver	SS-3	5/7/09	66.0	5.54	7.47	472	24.1	0.550	11.0	0.016	1.19	0.064	0.040	1.27	0.035	0.038	2.50	0.060
Silver	SS-3	5/8/09	55.4	4.70	7.36	475	23.7											
Silver Glen	SGS-1	2/16/09	39.9	3.41	7.91	1,608	23.2											
Silver Glen	SGS-1	2/17/09	34.0	2.90	7.86	1,816	23.1	0.550	419	0.015	0.047	0.065	0.040	0.127	0.020	0.028	2.50	0.030
Silver Glen	SGS-1	2/18/09	37.2	3.17	7.84	1,854	23.1											
Silver Glen	SGS-1	2/19/09	36.0	3.06	7.85	1,837	23.0	0.550	435	0.029	0.056	0.051	0.040	0.136	0.026	0.024	2.50	0.015
Silver Glen	SGS-2	2/16/09	39.5	3.37	7.86	1,703	23.0											
Silver Glen	SGS-2	2/17/09	66.0	5.65	8.26	1,827	22.8	1.10	441	0.021	0.024	0.089	0.110	0.134	0.016	0.030	2.50	0.013
Silver Glen	SGS-2	2/18/09	45.6	3.88	7.99	1,903	23.2											
Silver Glen	SGS-2	2/19/09	64.9	5.51	8.34	1,853	23.2	2.10	440	0.024	0.038	0.056	0.040	0.118	0.026	0.024	2.50	0.015
Silver Glen	SGS-3	2/16/09	81.0	6.88	8.47	1,677	22.2											
Silver Glen	SGS-3	2/17/09	70.6	6.00	8.22	1,875	22.9	2.10	463	0.022	0.020	0.128	0.150	0.170	0.021	0.033	2.50	0.060
Silver Glen	SGS-3	2/18/09	92.5	7.82	8.53	1,939	23.3											
Silver Glen	SGS-3	2/19/09	56.9	4.87	8.05	1,917	22.8	1.10	454	0.020	0.019	0.060	0.040	0.099	0.024	0.024	5.00	0.015
Silver Glen	SGS-A	2/16/09	32.7	2.79	7.85	1,768	23.1											
Silver Glen	SGS-A	2/18/09	34.2	2.92	7.76	2,050	23.1											
Silver Glen	SGS-A	2/19/09	32.9	2.78	7.82	2,029	23.1											
Wakulla	WAK-1	3/16/09	24.9	2.22	7.54	327	20.7											
Wakulla	WAK-1	4/13/09	24.5	2.22	7.22	246	20.2	1.10	7.00	0.021	0.486	0.199	0.220	0.706	0.030	0.035	70.0	0.310
Wakulla	WAK-1	4/14/09	24.2	2.18	7.26	250	20.2											
Wakulla	WAK-1	4/15/09	21.6	1.98	7.34	295	20.2											
Wakulla	WAK-1	4/16/09	22.3	2.05	7.23	290	20.3	0.550	8.00	0.031	0.475	0.169	0.200	0.675	0.025	0.034	50.0	0.220
Wakulla	WAK-2	3/16/09	39.6	3.53	7.64	326	20.9											
Wakulla	WAK-2	4/13/09	25.1	2.22	7.19	246	20.1	1.10	7.00	0.023	0.458	0.157	0.180	0.638	0.027	0.035	60.0	0.380
Wakulla	WAK-2	4/14/09	25.1	2.27	7.20	249	20.2											
Wakulla	WAK-2	4/15/09	26.1	2.35	7.33	295	20.3											
Wakulla	WAK-2	4/16/09	24.0	2.17	7.31	290	20.3	0.550	8.00	0.022	0.479	0.098	0.120	0.599	0.023	0.029	50.0	0.290
Wakulla	WAK-3	3/16/09	79.5	7.07	7.91	323	21.3											
Wakulla	WAK-3	4/13/09	33.8	2.98	7.20	245	20.3	1.10	7.00	0.017	0.445	0.243	0.260	0.705	0.028	0.033	80.0	0.470
Wakulla	WAK-3	4/15/09	47.2	4.24	7.37	295	20.6											
Wakulla	WAK-3	4/16/09	32.9	2.96	7.31	290	20.3	1.10	8.00	0.024	0.465	0.146	0.170	0.635	0.025	0.029	50.0	0.420
Weeki Wachee	WWS-1	3/9/09	18.4	1.55	7.52	295	23.6	0.550	7.00	0.167	0.750	0.00	0.040	0.830	0.010	0.021	2.50	0.015
Weeki Wachee	WWS-1	3/12/09	19.3	1.64	7.50	345	23.6	1.10	8.00	0.036	0.724	0.044	0.040	0.804	0.008	0.016	2.50	0.015
Weeki Wachee	WWS-2	3/9/09	26.9	2.27	7.56	294	23.9	0.550	8.00	0.018	0.737	0.044	0.040	0.817	0.010	0.016	2.50	0.015
Weeki Wachee	WWS-2	3/12/09	28.9	2.44	7.58	344	23.8	0.550	8.00	0.019	0.707	0.062	0.100	0.807	0.006	0.016	5.00	0.030
Weeki Wachee	WWS-3	3/9/09	51.6	4.33	7.65	292	24.2	0.550	8.00	0.035	0.696	0.105	0.140	0.836	0.008	0.016	2.50	0.210
Weeki Wachee	WWS-3	3/12/09	47.5	4.03	7.64	343	23.6	0.550	8.00	0.036	0.693	0.044	0.040	0.773	0.006	0.016	2.50	0.080

Note: Value presented at half the detection limit when laboratory reported as below the detection limit.

APPENDIX G

Average nitrogen to phosphorus ratios (both by atoms and by weight) by spring, station, and date.

					Nutrient Ratios (molar)	Nutrient Ratios (weight)	
Spring	Station	Date	NO_3 atoms	PO_4 atoms	NO_X-N : OrthoP	NO_X-N : OrthoP	TN : TP
De Leon	VDL-1	10/6/08	3.3007E+25	1.1273E+24	29.3	13.2	16.3
De Leon	VDL-1	10/9/08	3.3695E+25	1.2439E+24	27.1	12.3	13.9
De Leon	VDL-2	10/6/08	3.2578E+25	1.1661E+24	27.9	12.6	14.0
De Leon	VDL-2	10/9/08	3.3351E+25	1.1467E+24	29.1	13.2	13.9
De Leon	VDL-3	10/6/08	1.4484E+25	9.3291E+23	15.5	7.0	9.5
De Leon	VDL-3	10/9/08	5.7161E+24	6.9968E+23	8.2	3.7	11.8
Homosassa	HS-1	11/3/08	2.3552E+25	4.4702E+23	52.7	23.8	21.7
Homosassa	HS-1	11/6/08	2.4068E+25	3.8871E+23	61.9	28.0	26.7
Homosassa	HS-2	11/3/08	2.2478E+25	4.6646E+23	48.2	21.8	20.8
Homosassa	HS-2	11/6/08	2.3810E+25	4.2758E+23	55.7	25.2	27.7
Homosassa	HS-3	11/3/08	2.2865E+25	4.6646E+23	49.0	22.2	26.8
Homosassa	HS-3	11/6/08	2.2951E+25	4.2758E+23	53.7	24.3	33.9
Ichetucknee	IS-1	7/6/09	2.8968E+25	5.6363E+23	51.4	23.2	12.3
Ichetucknee	IS-1	7/9/09	2.7678E+25	6.4138E+23	43.2	19.5	15.4
Ichetucknee	IS-2	7/6/09	1.7019E+25	6.9968E+23	24.3	11.0	6.4
Ichetucknee	IS-2	7/9/09	1.5773E+25	8.7460E+23	18.0	8.2	6.1
Ichetucknee	IS-4	7/6/09	1.5859E+25	7.5799E+23	20.9	9.5	5.4
Ichetucknee	IS-4	7/9/09	1.4656E+25	7.9686E+23	18.4	8.3	4.4
Jackson Blue	JBS-1	1/13/09	1.4785E+26	3.8871E+23	380.3	172.0	167.6
Jackson Blue	JBS-1	1/15/09	1.3710E+26	3.1097E+23	440.9	199.4	173.2
Jackson Blue	JBS-2	1/13/09	1.4785E+26	5.8307E+23	253.6	114.7	185.3
Jackson Blue	JBS-2	1/15/09	1.4871E+26	3.1097E+23	478.2	216.3	186.3
Jackson Blue	JBS-3	1/13/09	1.4699E+26	3.1097E+23	472.7	213.8	218.8
Jackson Blue	JBS-3	1/15/09	1.4355E+26	3.1097E+23	461.6	208.8	180.0
Madison Blue	MBS-1	12/1/08	6.2749E+25	9.5235E+23	65.9	29.8	40.0
Madison Blue	MBS-1	1/2/09	6.1459E+25	8.3573E+23	73.5	33.3	40.0
Madison Blue	MBS-2	12/1/08	6.3608E+25	9.1348E+23	69.6	31.5	43.7
Madison Blue	MBS-2	12/10/08	1.1346E+25	9.9122E+23	11.4	5.2	11.8
Madison Blue	MBS-3	12/1/08	6.2749E+25	9.5235E+23	65.9	29.8	45.8
Madison Blue	MBS-3	1/2/09	6.1889E+25	7.7743E+23	79.6	36.0	42.6
Manatee	MS-1	8/3/09	8.5957E+25	5.0533E+23	170.1	76.9	246.7
Manatee	MS-1	8/6/09	8.5527E+25	6.0251E+23	142.0	64.2	61.6
Manatee	MS-2	8/3/09	5.7161E+25	5.0533E+23	113.1	51.2	520.0
Manatee	MS-2	8/6/09	8.6817E+25	6.0251E+23	144.1	65.2	67.1
Manatee	MS-3	8/3/09	5.6732E+25	5.2476E+23	108.1	48.9	516.7
Manatee	MS-3	8/6/09	8.4668E+25	7.3855E+23	114.6	51.8	53.6
Ponce de Leon	PDL-1	9/8/09	1.2034E+25	4.6646E+23	25.8	11.7	16.1
Ponce de Leon	PDL-1	9/11/09	1.1604E+25	2.7210E+23	42.6	19.3	123.3
Ponce de Leon	PDL-2	9/8/09	1.1475E+25	4.4702E+23	25.7	11.6	12.0
Ponce de Leon	PDL-2	9/11/09	1.2550E+25	6.8025E+23	18.4	8.3	124.0
Ponce de Leon	PDL-3	9/8/09	1.1862E+25	4.6646E+23	25.4	11.5	13.7
Ponce de Leon	PDL-3	9/11/09	1.2335E+25	2.3323E+23	52.9	23.9	122.3
Rainbow	RS-1	6/8/09	6.9195E+25	6.4138E+23	107.9	48.8	56.3
Rainbow	RS-1	6/11/09	8.0800E+25	5.6363E+23	143.4	64.8	38.4
Rainbow	RS-2	6/8/09	7.7791E+25	6.0251E+23	129.1	58.4	63.0
Rainbow	RS-2	6/11/09	7.0485E+25	6.4138E+23	109.9	49.7	54.5
Rainbow	RS-3	6/8/09	7.1774E+25	6.0251E+23	119.1	53.9	50.0
Rainbow	RS-3	6/11/09	6.8766E+25	6.0251E+23	114.1	51.6	44.2
Silver	SS-1	5/4/09	4.7276E+25	8.5517E+23	55.3	25.0	22.3
Silver	SS-1	5/7/09	4.8136E+25	7.7743E+23	61.9	28.0	30.5
Silver	SS-2	5/4/09	4.9855E+25	6.9968E+23	71.3	32.2	28.8
Silver	SS-2	5/7/09	4.8996E+25	6.6081E+23	74.1	33.5	37.0
Silver	SS-3	5/4/09	4.9855E+25	6.9968E+23	71.3	32.2	30.2
Silver	SS-3	5/7/09	5.1144E+25	6.8025E+23	75.2	34.0	33.4
Silver Glen	SGS-1	2/17/09	2.0200E+24	3.8871E+23	5.2	2.4	4.5
Silver Glen	SGS-1	2/19/09	2.4068E+24	5.0533E+23	4.8	2.2	5.7
Silver Glen	SGS-2	2/17/09	1.0315E+24	3.1097E+23	3.3	1.5	4.5
Silver Glen	SGS-2	2/19/09	1.6332E+24	5.0533E+23	3.2	1.5	4.9
Silver Glen	SGS-3	2/17/09	8.5957E+23	4.0815E+23	2.1	1.0	5.2
Silver Glen	SGS-3	2/19/09	8.1659E+23	4.6646E+23	1.8	0.8	4.1
Wakulla	WAK-1	4/13/09	2.0888E+25	5.8307E+23	35.8	16.2	20.2
Wakulla	WAK-1	4/16/09	2.0415E+25	4.8589E+23	42.0	19.0	19.9
Wakulla	WAK-2	4/13/09	1.9684E+25	5.2476E+23	37.5	17.0	18.2
Wakulla	WAK-2	4/16/09	2.0587E+25	4.4702E+23	46.1	20.8	20.7
Wakulla	WAK-3	4/13/09	1.9125E+25	5.4420E+23	35.1	15.9	21.4
Wakulla	WAK-3	4/16/09	1.9985E+25	4.8589E+23	41.1	18.6	21.9
Weeki Wachee	WWS-1	3/9/09	3.2234E+25	1.9436E+23	165.8	75.0	39.5
Weeki Wachee	WWS-1	3/12/09	3.1116E+25	1.5549E+23	200.1	90.5	50.3
Weeki Wachee	WWS-2	3/9/09	3.1675E+25	1.9436E+23	163.0	73.7	51.1
Weeki Wachee	WWS-2	3/12/09	3.0386E+25	1.1661E+23	260.6	117.8	50.4
Weeki Wachee	WWS-3	3/9/09	2.9913E+25	1.5549E+23	192.4	87.0	52.3
Weeki Wachee	WWS-3	3/12/09	2.9784E+25	1.1661E+23	255.4	115.5	48.3

APPENDIX G

Average nitrogen to phosphorus ratios (both by atoms and by weight) by spring and station.

Water Management District	Spring	Station	N	Mean NOX-N : OrthoP (atomic)	Mean NOX-N : OrthoP (weight)	Mean TN : TP (weight)
NWFWMD	Jackson Blue	JBS-1	2	410.6	185.7	170.4
		JBS-2	2	365.9	165.5	185.8
		JBS-3	2	467.1	211.3	199.4
	Ponce de Leon	PDL-1	2	34.2	15.5	69.7
		PDL-2	2	22.1	10.0	68.0
		PDL-3	2	39.2	17.7	68.0
	Wakulla	WAK-1	2	38.9	17.6	20.0
		WAK-2	2	41.8	18.9	19.4
		WAK-3	2	38.1	17.2	21.6
SJRWMD	De Leon	VDL-1	2	28.2	12.7	15.1
		VDL-2	2	28.5	12.9	13.9
		VDL-3	2	11.9	5.4	10.6
	Silver	SS-1	2	58.6	26.5	26.4
		SS-2	2	72.7	32.9	32.9
		SS-3	2	73.2	33.1	31.8
	Silver Glen	SGS-1	2	5.0	2.3	5.1
		SGS-2	2	3.3	1.5	4.7
		SGS-3	2	1.9	0.9	4.6
SRWMD	Ichetucknee	IS-1	2	47.3	21.4	13.9
		IS-2	2	21.2	9.6	6.3
		IS-4	2	19.7	8.9	4.9
	Madison Blue	MBS-1	2	69.7	31.5	40.0
		MBS-2	2	40.5	18.3	27.8
		MBS-3	2	72.8	32.9	44.2
	Manatee	MS-1	2	156.0	70.6	154.1
		MS-2	2	128.6	58.2	293.6
		MS-3	2	111.4	50.4	285.1
SWFWMD	Homosassa	HS-1	2	57.3	25.9	24.2
		HS-2	2	51.9	23.5	24.2
		HS-3	2	51.3	23.2	30.3
	Rainbow	RS-1	2	125.6	56.8	47.4
		RS-2	2	119.5	54.0	58.8
		RS-3	2	116.6	52.7	47.1
	Weeki Wachee	WWS-1	2	183.0	82.8	44.9
		WWS-2	2	211.8	95.8	50.8
		WWS-3	2	223.9	101.3	50.3

N:P ratios can be reported by weight or by atomic (i.e. molar) ratio, the commonly reported Redfield ratio for N:P of 16:1 is expressed in atomic units and represents an N:P ratio of approximately 7:1 by weight.

APPENDIX G

Average nitrogen to phosphorus ratios (both by atoms and by weight) by spring.

Water Management District	Spring	N	Mean NOX-N : OrthoP (atomic)	Mean NOX-N : OrthoP (weight)	Mean TN : TP (weight)
NWFWMD	Jackson Blue	6	414.5	187.5	185.2
	Ponce de Leon	6	31.8	14.4	68.6
	Wakulla	6	39.6	17.9	20.4
SJRWMD	De Leon	6	22.8	10.3	13.2
	Silver	6	68.2	30.8	30.4
	Silver Glen	6	3.4	1.5	4.8
SRWMD	Ichetucknee	6	29.4	13.3	8.3
	Madison Blue	6	61.0	27.6	37.3
	Manatee	6	132.0	59.7	244.3
SWFWMD	Homosassa	6	53.5	24.2	26.2
	Rainbow	6	120.6	54.5	51.1
	Weeki Wachee	6	206.2	93.3	48.6

N:P ratios can be reported by weight or by atomic (i.e. molar) ratio, the commonly reported Redfield ratio for N:P of 16:1 is expressed in atomic units and represents an N:P ratio of approximately 7:1 by weight.

Appendix H

Water Chemistry Mass Balance

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN De LEON SPRINGS (VOLUISA CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
VDL-1 to VDL-2	0.28	10/6/2008	0.078	79,418	6.2	22.5	0.054	79,418	4.3	15.6	0.024	30.8	1.9	6.93	30.8
		10/9/2008	0.142	68,865	9.8	35.5	0.108	68,865	7.4	27.0	0.034	23.9	2.3	8.51	23.9
		POR	0.108	74,141	8.0	29.0	0.079	74,141	5.9	21.3	0.029	26.6	2.1	7.72	26.6
VDL-2 to VDL-3	3.80	10/6/2008	0.054	79,418	4.3	1.1	0.018	79,418	1.4	0.4	0.036	66.7	2.9	0.75	66.7
		10/9/2008	0.108	68,865	7.4	2.0	0.086	68,865	5.9	1.6	0.022	20.4	1.5	0.40	20.4
		POR	0.079	74,141	5.9	1.5	0.050	74,141	3.7	1.0	0.029	37.3	2.2	0.58	37.3
VDL-1 to VDL-3	4.07	10/6/2008	0.078	79,418	6.2	1.5	0.018	79,418	1.4	0.4	0.060	76.9	4.8	1.17	76.9
		10/9/2008	0.142	68,865	9.8	2.4	0.086	68,865	5.9	1.5	0.056	39.4	3.9	0.95	39.4
		POR	0.108	74,141	8.0	2.0	0.050	74,141	3.7	0.9	0.058	54.0	4.3	1.06	54.0

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN De LEON SPRINGS (VOLUISA CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
VDL-1 to VDL-2	0.28	10/6/2008	0.768	79,418	61.0	221.6	0.758	79,418	60.2	218.7	0.010	1.3	0.8	2.89	1.3
		10/9/2008	0.784	68,865	54.0	196.2	0.776	68,865	53.4	194.2	0.008	1.0	0.6	2.00	1.0
		POR	0.775	74,141	57.5	208.9	0.766	74,141	56.8	206.5	0.009	1.2	0.7	2.44	1.2
VDL-2 to VDL-3	3.80	10/6/2008	0.758	79,418	60.2	15.9	0.337	79,418	26.8	7.1	0.421	55.5	33.4	8.81	55.5
		10/9/2008	0.776	68,865	53.4	14.1	0.133	68,865	9.2	2.4	0.643	82.9	44.3	11.67	82.9
		POR	0.766	74,141	56.8	15.0	0.242	74,141	18.0	4.7	0.524	68.4	38.9	10.24	68.4
VDL-1 to VDL-3	4.07	10/6/2008	0.768	79,418	61.0	15.0	0.337	79,418	26.8	6.6	0.431	56.1	34.2	8.41	56.1
		10/9/2008	0.784	68,865	54.0	13.3	0.133	68,865	9.2	2.2	0.651	83.0	44.8	11.01	83.0
		POR	0.775	74,141	57.5	14.1	0.242	74,141	18.0	4.4	0.533	68.8	39.5	9.71	68.8

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN De LEON SPRINGS (VOLUISA CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
VDL-1 to VDL-2	0.28	10/6/2008	0.130	79,418	10.3	37.5	0.080	79,418	6.4	23.1	0.050	38.5	4.0	14.43	38.5
		10/9/2008	0.090	68,865	6.2	22.5	0.100	68,865	6.9	25.0	-0.010	-11.1	-0.7	-2.50	-11.1
		POR	0.111	74,141	8.3	30.0	0.089	74,141	6.6	24.1	0.022	19.9	1.6	5.96	19.9
VDL-2 to VDL-3	3.80	10/6/2008	0.080	79,418	6.4	1.7	0.510	79,418	40.5	10.7	-0.430	-537.5	-34.1	-9.00	-537.5
		10/9/2008	0.100	68,865	6.9	1.8	0.890	68,865	61.3	16.1	-0.790	-790.0	-54.4	-14.33	-790.0
		POR	0.089	74,141	6.6	1.7	0.686	74,141	50.9	13.4	-0.597	-668.8	-44.3	-11.66	-668.8
VDL-1 to VDL-3	4.07	10/6/2008	0.130	79,418	10.3	2.5	0.510	79,418	40.5	9.9	-0.380	-292.3	-30.2	-7.41	-292.3
		10/9/2008	0.090	68,865	6.2	1.5	0.890	68,865	61.3	15.1	-0.800	-888.9	-55.1	-13.53	-888.9
		POR	0.111	74,141	8.3	2.0	0.686	74,141	50.9	12.5	-0.575	-516.1	-42.6	-10.47	-516.1

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN De LEON SPRINGS (VOLUISA CO.) - TOTAL NITROGEN (TN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
VDL-1 to VDL-2	0.28	10/6/2008	0.898	79,418	71.3	259.1	0.838	79,418	66.6	241.8	0.060	6.7	4.8	17.31	6.7
		10/9/2008	0.874	68,865	60.2	218.7	0.876	68,865	60.3	219.2	-0.002	-0.2	-0.1	-0.50	-0.2
		POR	0.887	74,141	65.8	238.9	0.856	74,141	63.4	230.5	0.031	3.5	2.3	8.41	3.5
VDL-2 to VDL-3	3.80	10/6/2008	0.838	79,418	66.6	17.5	0.847	79,418	67.3	17.7	-0.009	-1.1	-0.7	-0.19	-1.1
		10/9/2008	0.876	68,865	60.3	15.9	1.020	68,865	70.2	18.5	-0.144	-16.4	-9.9	-2.61	-16.4
		POR	0.856	74,141	63.4	16.7	0.927	74,141	68.8	18.1	-0.072	-8.4	-5.3	-1.40	-8.4
VDL-1 to VDL-3	4.07	10/6/2008	0.898	79,418	71.3	17.5	0.847	79,418	67.3	16.5	0.051	5.7	4.1	0.99	5.7
		10/9/2008	0.874	68,865	60.2	14.8	1.020	68,865	70.2	17.3	-0.146	-16.7	-10.1	-2.47	-16.7
		POR	0.887	74,141	65.8	16.2	0.927	74,141	68.8	16.9	-0.040	-4.6	-3.0	-0.74	-4.6

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN De LEON SPRINGS (VOLUISA CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
VDL-1 to VDL-2	0.28	10/6/2008	0.058	79,418	4.6	16.7	0.060	79,418	4.8	17.3	-0.002	-3.4	-0.2	-0.58	-3.4
		10/9/2008	0.064	68,865	4.4	16.0	0.059	68,865	4.1	14.8	0.005	7.8	0.3	1.25	7.8
		POR	0.061	74,141	4.5	16.4	0.060	74,141	4.4	16.0	0.001	2.1	0.1	0.34	2.1
VDL-2 to VDL-3	3.80	10/6/2008	0.060	79,418	4.8	1.3	0.048	79,418	3.8	1.0	0.012	20.0	1.0	0.25	20.0
		10/9/2008	0.059	68,865	4.1	1.1	0.036	68,865	2.5	0.7	0.023	39.0	1.6	0.42	39.0
		POR	0.060	74,141	4.4	1.2	0.042	74,141	3.1	0.8	0.017	28.7	1.3	0.33	28.7
VDL-1 to VDL-3	4.07	10/6/2008	0.058	79,418	4.6	1.1	0.048	79,418	3.8	0.9	0.010	17.2	0.8	0.20	17.2
		10/9/2008	0.064	68,865	4.4	1.1	0.036	68,865	2.5	0.6	0.028	43.8	1.9	0.47	43.8
		POR	0.061	74,141	4.5	1.1	0.042	74,141	3.1	0.8	0.018	30.2	1.4	0.33	30.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN De LEON SPRINGS (VOLUISA CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
VDL-1 to VDL-2	0.28	10/6/2008	0.055	79,418	4.4	15.9	0.060	79,418	4.8	17.3	-0.005	-9.1	-0.4	-1.44	-9.1
		10/9/2008	0.063	68,865	4.3	15.8	0.063	68,865	4.3	15.8	0.000	0.0	0.0	0.00	0.0
		POR	0.059	74,141	4.4	15.8	0.061	74,141	4.6	16.5	-0.003	-4.6	-0.2	-0.72	-4.6
VDL-2 to VDL-3	3.80	10/6/2008	0.060	79,418	4.8	1.3	0.089	79,418	7.1	1.9	-0.029	-48.3	-2.3	-0.61	-48.3
		10/9/2008	0.063	68,865	4.3	1.1	0.087	68,865	6.0	1.6	-0.024	-38.1	-1.7	-0.44	-38.1
		POR	0.061	74,141	4.6	1.2	0.088	74,141	6.5	1.7	-0.027	-43.5	-2.0	-0.52	-43.5
VDL-1 to VDL-3	4.07	10/6/2008	0.055	79,418	4.4	1.1	0.089	79,418	7.1	1.7	-0.034	-61.8	-2.7	-0.66	-61.8
		10/9/2008	0.063	68,865	4.3	1.1	0.087	68,865	6.0	1.5	-0.024	-38.1	-1.7	-0.41	-38.1
		POR	0.059	74,141	4.4	1.1	0.088	74,141	6.5	1.6	-0.029	-50.0	-2.2	-0.53	-50.0

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN HOMOSASSA SPRINGS (CITRUS CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
HS-1 to HS-2	0.51	11/3/2008	0.053	169,966	9.0	17.8	0.040	169,966	6.8	13.4	0.013	24.5	2.2	4.36	24.5
		11/6/2008	0.009	165,767	1.5	2.9	0.009	165,767	1.5	2.9	0.000	0.0	0.0	0.00	0.0
		POR	0.031	167,867	5.3	10.4	0.025	167,867	4.1	8.2	0.007	21.0	1.1	2.18	21.0
HS-2 to HS-3	0.63	11/3/2008	0.040	169,966	6.8	10.9	0.017	169,966	2.9	4.6	0.023	57.5	3.9	6.25	57.5
		11/6/2008	0.009	165,767	1.5	2.4	0.009	165,767	1.5	2.4	0.000	0.0	0.0	0.00	0.0
		POR	0.025	167,867	4.1	6.6	0.013	167,867	2.2	3.5	0.012	47.2	2.0	3.13	47.2
HS-1 to HS-3	1.13	11/3/2008	0.053	169,966	9.0	8.0	0.017	169,966	2.9	2.6	0.036	67.9	6.1	5.41	67.9
		11/6/2008	0.009	165,767	1.5	1.3	0.009	165,767	1.5	1.3	0.000	0.0	0.0	0.00	0.0
		POR	0.031	167,867	5.3	4.6	0.013	167,867	2.2	1.9	0.018	58.3	3.1	2.70	58.3

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN HOMOSASSA SPRINGS (CITRUS CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
HS-1 to HS-2	0.51	11/3/2008	0.548	169,966	93.1	183.8	0.523	169,966	88.9	175.4	0.025	4.6	4.2	8.38	4.6
		11/6/2008	0.560	165,767	92.8	183.2	0.554	165,767	91.8	181.2	0.006	1.1	1.0	1.96	1.1
		POR	0.554	167,867	93.0	183.5	0.538	167,867	90.4	178.3	0.016	2.8	2.6	5.17	2.8
HS-2 to HS-3	0.63	11/3/2008	0.523	169,966	88.9	142.2	0.532	169,966	90.4	144.7	-0.009	-1.7	-1.5	-2.45	-1.7
		11/6/2008	0.554	165,767	91.8	146.9	0.534	165,767	88.5	141.6	0.020	3.6	3.3	5.30	3.6
		POR	0.538	167,867	90.4	144.6	0.533	167,867	89.5	143.1	0.005	1.0	0.9	1.43	1.0
HS-1 to HS-3	1.13	11/3/2008	0.548	169,966	93.1	82.3	0.532	169,966	90.4	79.9	0.016	2.9	2.7	2.40	2.9
		11/6/2008	0.560	165,767	92.8	82.0	0.534	165,767	88.5	78.2	0.026	4.6	4.3	3.81	4.6
		POR	0.554	167,867	93.0	82.2	0.533	167,867	89.5	79.1	0.021	3.8	3.5	3.11	3.8

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN HOMOSASSA SPRINGS (CITRUS CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
HS-1 to HS-2	0.51	11/3/2008	0.080	169,966	13.6	26.8	0.100	169,966	17.0	33.5	-0.020	-25.0	-3.4	-6.71	-25.0
		11/6/2008	0.080	165,767	13.3	26.2	0.110	165,767	18.2	36.0	-0.030	-37.5	-5.0	-9.81	-37.5
		POR	0.080	167,867	13.4	26.5	0.105	167,867	17.6	34.8	-0.025	-31.2	-4.2	-8.26	-31.2
HS-2 to HS-3	0.63	11/3/2008	0.100	169,966	17.0	27.2	0.110	169,966	18.7	29.9	-0.010	-10.0	-1.7	-2.72	-10.0
		11/6/2008	0.110	165,767	18.2	29.2	0.110	165,767	18.2	29.2	0.000	0.0	0.0	0.00	0.0
		POR	0.105	167,867	17.6	28.2	0.110	167,867	18.5	29.5	-0.005	-4.8	-0.8	-1.36	-4.8
HS-1 to HS-3	1.13	11/3/2008	0.080	169,966	13.6	12.0	0.110	169,966	18.7	16.5	-0.030	-37.5	-5.1	-4.51	-37.5
		11/6/2008	0.080	165,767	13.3	11.7	0.110	165,767	18.2	16.1	-0.030	-37.5	-5.0	-4.39	-37.5
		POR	0.080	167,867	13.4	11.9	0.110	167,867	18.5	16.3	-0.030	-37.5	-5.0	-4.45	-37.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN HOMOSASSA SPRINGS (CITRUS CO.) - TOTAL NITROGEN (TN)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
HS-1 to HS-2	0.51	11/3/2008	0.628	169,966	106.7	210.6	0.623	169,966	105.9	209.0	0.005	0.8	0.8	1.68	0.8
		11/6/2008	0.640	165,767	106.1	209.4	0.664	165,767	110.1	217.2	-0.024	-3.8	-4.0	-7.85	-3.7
		POR	0.634	167,867	106.4	210.0	0.643	167,867	108.0	213.1	-0.009	-1.5	-1.6	-3.09	-1.5
HS-2 to HS-3	0.63	11/3/2008	0.623	169,966	105.9	169.4	0.642	169,966	109.1	174.6	-0.019	-3.0	-3.2	-5.17	-3.0
		11/6/2008	0.664	165,767	110.1	176.1	0.644	165,767	106.8	170.8	0.020	3.0	3.3	5.30	3.0
		POR	0.643	167,867	108.0	172.8	0.643	167,867	107.9	172.7	0.000	0.0	0.0	0.07	0.0
HS-1 to HS-3	1.13	11/3/2008	0.628	169,966	106.7	94.3	0.642	169,966	109.1	96.4	-0.014	-2.2	-2.4	-2.10	-2.2
		11/6/2008	0.640	165,767	106.1	93.7	0.644	165,767	106.8	94.3	-0.004	-0.6	-0.7	-0.59	-0.6
		POR	0.634	167,867	106.4	94.0	0.643	167,867	107.9	95.4	-0.009	-1.4	-1.5	-1.34	-1.4

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN HOMOSASSA SPRINGS (CITRUS CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
HS-1 to HS-2	0.51	11/3/2008	0.023	169,966	3.9	7.7	0.024	169,966	4.1	8.0	-0.001	-4.3	-0.2	-0.34	-4.3
		11/6/2008	0.020	165,767	3.3	6.5	0.022	165,767	3.6	7.2	-0.002	-10.0	-0.3	-0.65	-10.0
		POR	0.022	167,867	3.6	7.1	0.023	167,867	3.9	7.6	-0.001	-6.9	-0.3	-0.49	-6.9
HS-2 to HS-3	0.63	11/3/2008	0.024	169,966	4.1	6.5	0.024	169,966	4.1	6.5	0.000	0.0	0.0	0.00	0.0
		11/6/2008	0.022	165,767	3.6	5.8	0.022	165,767	3.6	5.8	0.000	0.0	0.0	0.00	0.0
		POR	0.023	167,867	3.9	6.2	0.023	167,867	3.9	6.2	0.000	0.0	0.0	0.00	0.0
HS-1 to HS-3	1.13	11/3/2008	0.023	169,966	3.9	3.5	0.024	169,966	4.1	3.6	-0.001	-4.3	-0.2	-0.15	-4.3
		11/6/2008	0.020	165,767	3.3	2.9	0.022	165,767	3.6	3.2	-0.002	-10.0	-0.3	-0.29	-10.0
		POR	0.022	167,867	3.6	3.2	0.023	167,867	3.9	3.4	-0.001	-6.9	-0.3	-0.22	-6.9

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN HOMOSASSA SPRINGS (CITRUS CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
HS-1 to HS-2	0.51	11/3/2008	0.029	169,966	4.9	9.7	0.030	169,966	5.1	10.1	-0.001	-3.4	-0.2	-0.34	-3.4
		11/6/2008	0.024	165,767	4.0	7.9	0.024	165,767	4.0	7.9	0.000	0.0	0.0	0.00	0.0
		POR	0.027	167,867	4.5	8.8	0.027	167,867	4.5	9.0	-0.001	-1.9	-0.1	-0.17	-1.9
HS-2 to HS-3	0.63	11/3/2008	0.030	169,966	5.1	8.2	0.024	169,966	4.1	6.5	0.006	20.0	1.0	1.63	20.0
		11/6/2008	0.024	165,767	4.0	6.4	0.019	165,767	3.1	5.0	0.005	20.8	0.8	1.33	20.8
		POR	0.027	167,867	4.5	7.3	0.022	167,867	3.6	5.8	0.006	20.4	0.9	1.48	20.4
HS-1 to HS-3	1.13	11/3/2008	0.029	169,966	4.9	4.4	0.024	169,966	4.1	3.6	0.005	17.2	0.8	0.75	17.2
		11/6/2008	0.024	165,767	4.0	3.5	0.019	165,767	3.1	2.8	0.005	20.8	0.8	0.73	20.8
		POR	0.027	167,867	4.5	3.9	0.022	167,867	3.6	3.2	0.005	18.8	0.8	0.74	18.8

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN ICHETUCKNEE SPRINGS (COLUMBIA CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
IS-1 to IS-2	10.34	07/06/09	0.013	194,837	2.5	0.2	0.009	468,202	4.2	0.4	0.004	30.8	-1.7	-0.16	-66.4
		07/09/09	0.054	205,123	11.1	1.1	0.056	468,202	26.2	2.5	-0.002	-3.7	-15.1	-1.46	-136.7
		POR	0.034	199,980	6.8	0.7	0.033	468,202	15.2	1.5	0.002	4.5	-8.4	-0.81	-123.6
IS-2 to IS-4	5.68	07/06/09	0.009	468,202	4.2	0.7	0.019	557,341	10.6	1.9	-0.010	-111.1	-6.4	-1.12	-151.3
		07/09/09	0.056	468,202	26.2	4.6	0.098	559,871	54.9	9.7	-0.042	-75.0	-28.6	-5.04	-109.3
		POR	0.033	468,202	15.2	2.7	0.059	558,606	32.7	5.8	-0.026	-80.3	-17.5	-3.08	-115.1
IS-1 to IS-4	16.02	07/06/09	0.013	194,837	2.5	0.2	0.019	557,341	10.6	0.7	-0.006	-46.2	-8.1	-0.50	-318.1
		07/09/09	0.054	205,123	11.1	0.7	0.098	559,871	54.9	3.4	-0.044	-81.5	-43.8	-2.73	-395.3
		POR	0.034	199,980	6.8	0.4	0.059	558,606	32.7	2.0	-0.025	-72.2	-25.9	-1.62	-381.0

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN ICHETUCKNEE SPRINGS (COLUMBIA CO.) - NITRITE+NITRATE (NO_X-N)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
IS-1 to IS-2	10.34	07/06/09	0.674	194,837	131.3	12.7	0.396	468,202	185.4	17.9	0.278	41.2	-54.1	-5.23	-41.2
		07/09/09	0.644	205,123	132.1	12.8	0.367	468,202	171.8	16.6	0.277	43.0	-39.7	-3.84	-30.1
		POR	0.659	199,980	131.7	12.7	0.382	468,202	178.6	17.3	0.277	42.1	-46.9	-4.53	-35.6
IS-2 to IS-4	5.68	07/06/09	0.396	468,202	185.4	32.6	0.369	557,341	205.7	36.2	0.027	6.8	-20.3	-3.57	-10.9
		07/09/09	0.367	468,202	171.8	30.3	0.341	559,871	190.9	33.6	0.026	7.1	-19.1	-3.36	-11.1
		POR	0.382	468,202	178.6	31.5	0.355	558,606	198.3	34.9	0.027	7.0	-19.7	-3.46	-11.0
IS-1 to IS-4	16.02	07/06/09	0.674	194,837	131.3	8.2	0.369	557,341	205.7	12.8	0.305	45.3	-74.3	-4.64	-56.6
		07/09/09	0.644	205,123	132.1	8.2	0.341	559,871	190.9	11.9	0.303	47.0	-58.8	-3.67	-44.5
		POR	0.659	199,980	131.7	8.2	0.355	558,606	198.3	12.4	0.304	46.1	-66.6	-4.16	-50.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN ICHETUCKNEE SPRINGS (COLUMBIA CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
IS-1 to IS-2	10.34	07/06/09	0.080	194,837	15.6	1.5	0.08	468,202	37.5	3.6	0.000	0.0	-21.9	-2.11	-140.3
		07/09/09	0.080	205,123	16.4	1.6	0.08	468,202	37.5	3.6	0.000	0.0	-21.0	-2.03	-128.3
		POR	0.080	199,980	16.0	1.5	0.080	468,202	37.5	3.6	0.000	0.0	-21.5	-2.07	-134.1
IS-2 to IS-4	5.68	07/06/09	0.080	468,202	37.5	6.6	0.08	557,341	44.6	7.9	0.000	0.0	-7.1	-1.26	-19.0
		07/09/09	0.080	468,202	37.5	6.6	0.08	559,871	44.8	7.9	0.000	0.0	-7.3	-1.29	-19.6
		POR	0.080	468,202	37.5	6.6	0.080	558,606	44.7	7.9	0.000	0.0	-7.2	-1.27	-19.3
IS-1 to IS-4	16.02	07/06/09	0.080	194,837	15.6	1.0	0.080	557,341	44.6	2.8	0.000	0.0	-29.0	-1.81	-186.1
		07/09/09	0.080	205,123	16.4	1.0	0.080	559,871	44.8	2.8	0.000	0.0	-28.4	-1.77	-172.9
		POR	0.080	199,980	16.0	1.0	0.080	558,606	44.7	2.8	0.000	0.0	-28.7	-1.79	-179.3

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN ICHETUCKNEE SPRINGS (COLUMBIA CO.) - TOTAL NITROGEN (TN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
IS-1 to IS-2	10.34	07/06/09	0.714	194,837	139.1	13.4	0.436	468,202	204.1	19.7	0.278	38.9	-65.0	-6.29	-46.7
		07/09/09	0.724	205,123	148.5	14.4	0.447	468,202	209.3	20.2	0.277	38.3	-60.8	-5.88	-40.9
		POR	0.719	199,980	143.8	13.9	0.442	468,202	206.7	20.0	0.278	38.6	-62.9	-6.08	-43.7
IS-2 to IS-4	5.68	07/06/09	0.436	468,202	204.1	35.9	0.409	557,341	228.0	40.1	0.027	6.2	-23.8	-4.19	-11.7
		07/09/09	0.447	468,202	209.3	36.9	0.421	559,871	235.7	41.5	0.026	5.8	-26.4	-4.65	-12.6
		POR	0.442	468,202	206.7	36.4	0.415	558,606	231.8	40.8	0.026	6.0	-25.1	-4.42	-12.2
IS-1 to IS-4	16.02	07/06/09	0.714	194,837	139.1	8.7	0.409	557,341	228.0	14.2	0.305	42.7	-88.8	-5.54	-63.9
		07/09/09	0.724	205,123	148.5	9.3	0.421	559,871	235.7	14.7	0.303	41.9	-87.2	-5.44	-58.7
		POR	0.719	199,980	143.8	9.0	0.415	558,606	231.8	14.5	0.304	42.3	-88.0	-5.49	-61.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN ICHETUCKNEE SPRINGS (COLUMBIA CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
IS-1 to IS-2	10.34	07/06/09	0.029	194,837	5.7	0.5	0.036	468,202	16.9	1.6	-0.007	-24.1	-11.2	-1.08	-198.3
		07/09/09	0.033	205,123	6.8	0.7	0.045	468,202	21.1	2.0	-0.012	-36.4	-14.3	-1.38	-211.3
		POR	0.031	199,980	6.2	0.6	0.041	468,202	19.0	1.8	-0.009	-30.4	-12.8	-1.23	-205.4
IS-2 to IS-4	5.68	07/06/09	0.036	468,202	16.9	3.0	0.039	557,341	21.7	3.8	-0.003	-8.3	-4.9	-0.86	-29.0
		07/09/09	0.045	468,202	21.1	3.7	0.041	559,871	23.0	4.0	0.004	8.9	-1.9	-0.33	-8.9
		POR	0.041	468,202	19.0	3.3	0.040	558,606	22.3	3.9	0.000	1.2	-3.4	-0.60	-17.8
IS-1 to IS-4	16.02	07/06/09	0.029	194,837	5.7	0.4	0.039	557,341	21.7	1.4	-0.010	-34.5	-16.1	-1.00	-284.7
		07/09/09	0.033	205,123	6.8	0.4	0.041	559,871	23.0	1.4	-0.008	-24.2	-16.2	-1.01	-239.1
		POR	0.031	199,980	6.2	0.4	0.040	558,606	22.3	1.4	-0.009	-28.8	-16.1	-1.01	-259.8

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN ICHETUCKNEE SPRINGS (COLUMBIA CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
IS-1 to IS-2	10.34	07/06/09	0.058	194,837	11.3	1.1	0.068	468,202	31.8	3.1	-0.010	-17.2	-20.5	-1.99	-181.7
		07/09/09	0.047	205,123	9.6	0.9	0.073	468,202	34.2	3.3	-0.026	-55.3	-24.5	-2.37	-254.5
		POR	0.052	199,980	10.5	1.0	0.071	468,202	33.0	3.2	-0.018	-34.6	-22.5	-2.18	-215.2
IS-2 to IS-4	5.68	07/06/09	0.068	468,202	31.8	5.6	0.076	557,341	42.4	7.5	-0.008	-11.8	-10.5	-1.85	-33.0
		07/09/09	0.073	468,202	34.2	6.0	0.096	559,871	53.7	9.5	-0.023	-31.5	-19.6	-3.45	-57.3
		POR	0.071	468,202	33.0	5.8	0.086	558,606	48.1	8.5	-0.016	-22.0	-15.0	-2.65	-45.6
IS-1 to IS-4	16.02	07/06/09	0.058	194,837	11.3	0.7	0.076	557,341	42.4	2.6	-0.018	-31.0	-31.1	-1.94	-274.8
		07/09/09	0.047	205,123	9.6	0.6	0.096	559,871	53.7	3.4	-0.049	-104.3	-44.1	-2.75	-457.5
		POR	0.052	199,980	10.5	0.7	0.086	558,606	48.1	3.0	-0.034	-64.3	-37.6	-2.35	-358.9

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN JACKSON BLUE SPRINGS (JACKSON CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
JBS-1 to JBS-2	0.41	01/13/09	0.046	256,789	11.8	28.9	0.005	256,789	1.2	2.8	0.042	90.2	10.7	26.11	90.2
		01/15/09	0.059	237,573	14.0	34.3	0.009	237,573	2.1	5.2	0.050	84.7	11.9	29.11	84.7
		POR	0.052	247,181	12.9	31.6	0.007	247,181	1.6	4.0	0.046	87.2	11.3	27.61	87.2
JBS-2 to JBS-3	10.33	01/13/09	0.005	256,789	1.2	0.1	0.064	256,789	16.4	1.6	-0.060	-1322.2	-15.3	-1.48	-1322.2
		01/15/09	0.009	237,573	2.1	0.2	0.100	237,573	23.8	2.3	-0.091	-1011.1	-21.6	-2.09	-1011.1
		POR	0.007	247,181	1.6	0.2	0.081	247,181	20.1	1.9	-0.075	-1120.3	-18.4	-1.79	-1120.3
JBS-1 to JBS-3	10.74	01/13/09	0.046	256,789	11.8	1.1	0.064	256,789	16.4	1.5	-0.018	-39.1	-4.6	-0.43	-39.1
		01/15/09	0.059	237,573	14.0	1.3	0.100	237,573	23.8	2.2	-0.041	-69.5	-9.7	-0.91	-69.5
		POR	0.052	247,181	12.9	1.2	0.081	247,181	20.1	1.9	-0.029	-55.6	-7.2	-0.67	-55.6

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN JACKSON BLUE SPRINGS (JACKSON CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
JBS-1 to JBS-2	0.41	01/13/09	3.440	256,789	883.4	2164.5	3.440	256,789	883.4	2164.5	0.000	0.0	0.0	0.00	0.0
		01/15/09	3.190	237,573	757.9	1857.0	3.460	237,573	822.0	2014.2	-0.270	-8.5	-64.1	-157.18	-8.5
		POR	3.320	247,181	820.6	2010.8	3.450	247,181	852.7	2089.4	-0.130	-3.9	-32.1	-78.59	-3.9
JBS-2 to JBS-3	10.33	01/13/09	3.440	256,789	883.4	85.5	3.420	256,789	878.2	85.0	0.020	0.6	5.1	0.50	0.6
		01/15/09	3.460	237,573	822.0	79.6	3.340	237,573	793.5	76.8	0.120	3.5	28.5	2.76	3.5
		POR	3.450	247,181	852.7	82.5	3.382	247,181	835.9	80.9	0.068	2.0	16.8	1.63	2.0
JBS-1 to JBS-3	10.74	01/13/09	3.440	256,789	883.4	82.2	3.420	256,789	878.2	81.8	0.020	0.6	5.1	0.48	0.6
		01/15/09	3.190	237,573	757.9	70.6	3.340	237,573	793.5	73.9	-0.150	-4.7	-35.6	-3.32	-4.7
		POR	3.320	247,181	820.6	76.4	3.382	247,181	835.9	77.8	-0.062	-1.9	-15.3	-1.42	-1.9

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN JACKSON BLUE SPRINGS (JACKSON CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
JBS-1 to JBS-2	0.41	01/13/09	0.040	256,789	10.3	25.2	0.040	256,789	10.3	25.2	0.000	0.0	0.0	0.00	0.0
		01/15/09	0.100	237,573	23.8	58.2	0.040	237,573	9.5	23.3	0.060	60.0	14.3	34.93	60.0
		POR	0.069	247,181	17.0	41.7	0.040	247,181	9.9	24.2	0.029	41.9	7.1	17.46	41.9
JBS-2 to JBS-3	10.33	01/13/09	0.040	256,789	10.3	1.0	0.040	256,789	10.3	1.0	0.000	0.0	0.0	0.00	0.0
		01/15/09	0.040	237,573	9.5	0.9	0.040	237,573	9.5	0.9	0.000	0.0	0.0	0.00	0.0
		POR	0.040	247,181	9.9	1.0	0.040	247,181	9.9	1.0	0.000	0.0	0.0	0.00	0.0
JBS-1 to JBS-3	10.74	01/13/09	0.040	256,789	10.3	1.0	0.040	256,789	10.3	1.0	0.000	0.0	0.0	0.00	0.0
		01/15/09	0.100	237,573	23.8	2.2	0.040	237,573	9.5	0.9	0.060	60.0	14.3	1.33	60.0
		POR	0.069	247,181	17.0	1.6	0.040	247,181	9.9	0.9	0.029	41.9	7.1	0.66	41.9

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN JACKSON BLUE SPRINGS (JACKSON CO.) - TOTAL NITROGEN (TN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
JBS-1 to JBS-2	0.41	01/13/09	3.520	256,789	903.9	2214.9	3.520	256,789	903.9	2214.9	0.000	0.0	0.0	0.00	0.0
		01/15/09	3.290	237,573	781.6	1915.3	3.540	237,573	841.0	2060.8	-0.250	-7.6	-59.4	-145.54	-7.6
		POR	3.409	247,181	842.8	2065.1	3.530	247,181	872.5	2137.8	-0.120	-3.5	-29.7	-72.77	-3.5
JBS-2 to JBS-3	10.33	01/13/09	3.520	256,789	903.9	87.5	3.500	256,789	898.8	87.0	0.020	0.6	5.1	0.50	0.6
		01/15/09	3.540	237,573	841.0	81.4	3.420	237,573	812.5	78.6	0.120	3.4	28.5	2.76	3.4
		POR	3.530	247,181	872.5	84.4	3.462	247,181	855.6	82.8	0.068	1.9	16.8	1.63	1.9
JBS-1 to JBS-3	10.74	01/13/09	3.520	256,789	903.9	84.2	3.500	256,789	898.8	83.7	0.020	0.6	5.1	0.48	0.6
		01/15/09	3.290	237,573	781.6	72.8	3.420	237,573	812.5	75.7	-0.130	-4.0	-30.9	-2.88	-4.0
		POR	3.409	247,181	842.8	78.5	3.462	247,181	855.6	79.7	-0.052	-1.5	-12.9	-1.20	-1.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN JACKSON BLUE SPRINGS (JACKSON CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
JBS-1 to JBS-2	0.41	01/13/09	0.020	256,789	5.1	12.6	0.030	256,789	7.7	18.9	-0.010	-50.0	-2.6	-6.29	-50.0
		01/15/09	0.016	237,573	3.8	9.3	0.016	237,573	3.8	9.3	0.000	0.0	0.0	0.00	0.0
		POR	0.018	247,181	4.5	10.9	0.023	247,181	5.8	14.1	-0.005	-28.7	-1.3	-3.15	-28.7
JBS-2 to JBS-3	10.33	01/13/09	0.030	256,789	7.7	0.7	0.016	256,789	4.1	0.4	0.014	46.7	3.6	0.35	46.7
		01/15/09	0.016	237,573	3.8	0.4	0.016	237,573	3.8	0.4	0.000	0.0	0.0	0.00	0.0
		POR	0.023	247,181	5.8	0.6	0.016	247,181	4.0	0.4	0.007	31.2	1.8	0.17	31.2
JBS-1 to JBS-3	10.74	01/13/09	0.020	256,789	5.1	0.5	0.016	256,789	4.1	0.4	0.004	20.0	1.0	0.10	20.0
		01/15/09	0.016	237,573	3.8	0.4	0.016	237,573	3.8	0.4	0.000	0.0	0.0	0.00	0.0
		POR	0.018	247,181	4.5	0.4	0.016	247,181	4.0	0.4	0.002	11.5	0.5	0.05	11.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN JACKSON BLUE SPRINGS (JACKSON CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
JBS-1 to JBS-2	0.41	01/13/09	0.021	256,789	5.4	13.2	0.019	256,789	4.9	12.0	0.002	9.5	0.5	1.26	9.5
		01/15/09	0.019	237,573	4.5	11.1	0.019	237,573	4.5	11.1	0.000	0.0	0.0	0.00	0.0
		POR	0.020	247,181	5.0	12.1	0.019	247,181	4.7	11.5	0.001	5.2	0.3	0.63	5.2
JBS-2 to JBS-3	10.33	01/13/09	0.019	256,789	4.9	0.5	0.016	256,789	4.1	0.4	0.003	15.8	0.8	0.07	15.8
		01/15/09	0.019	237,573	4.5	0.4	0.019	237,573	4.5	0.4	0.000	0.0	0.0	0.00	0.0
		POR	0.019	247,181	4.7	0.5	0.017	247,181	4.3	0.4	0.002	8.2	0.4	0.04	8.2
JBS-1 to JBS-3	10.74	01/13/09	0.021	256,789	5.4	0.5	0.016	256,789	4.1	0.4	0.005	23.8	1.3	0.12	23.8
		01/15/09	0.019	237,573	4.5	0.4	0.019	237,573	4.5	0.4	0.000	0.0	0.0	0.00	0.0
		POR	0.020	247,181	5.0	0.5	0.017	247,181	4.3	0.4	0.003	13.0	0.6	0.06	13.0

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MADISON BLUE SPRINGS (MADISON CO.) - AMMONIA (NH_3-N)

					Inflow				Outflow				Removal				
					Segment - Up				Segment - Down								
	Segment Area				Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Parameter	Units	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
MBS-1 to MBS-2	0.04	NH_3-N	mg/L	12/01/08	0.113	183,493	20.7	470.0	0.031	183,493	5.7	128.9	0.082	72.6	15.0	341.06	72.6
				01/02/09	0.068	364,056	24.8	561.1	0.063	364,056	22.8	515.8	0.006	8.1	2.0	45.39	8.1
				POR	0.083	273,774	22.7	515.6	0.052	273,774	14.2	322.4	0.031	37.5	8.5	193.23	37.5
MBS-2 to MBS-3	0.06	NH_3-N	mg/L	12/01/08	0.031	183,493	5.7	89.7	0.086	183,493	15.8	248.8	-0.055	-177.4	-10.1	-159.13	-177.4
				01/02/09	0.063	364,056	22.8	358.8	0.057	364,056	20.8	327.2	0.006	8.8	2.0	31.57	8.8
				POR	0.052	273,774	14.2	224.2	0.067	273,774	18.3	288.0	-0.015	-28.4	-4.0	-63.78	-28.4
MBS-1 to MBS-3	0.11	NH_3-N	mg/L	12/01/08	0.113	183,493	20.7	192.8	0.086	183,493	15.8	146.7	0.027	23.9	5.0	46.07	23.9
				01/02/09	0.068	364,056	24.8	230.2	0.057	364,056	20.8	193.0	0.011	16.2	4.0	37.24	16.2
				POR	0.083	273,774	22.7	211.5	0.067	273,774	18.3	169.9	0.016	19.7	4.5	41.66	19.7

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MADISON BLUE SPRINGS (MADISON CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
MBS-1 to MBS-2	0.04	12/01/08	1.460	183,493	267.9	6072.6	1.480	183,493	271.6	6155.8	-0.020	-1.4	-3.7	-83.19	-1.4
		01/02/09	1.430	364,056	520.6	11800.6	1.435	364,056	522.4	11841.9	-0.005	-0.3	-1.8	-41.26	-0.3
		POR	1.440	273,774	394.2	8936.6	1.450	273,774	397.0	8998.8	-0.010	-0.7	-2.7	-62.22	-0.7
MBS-2 to MBS-3	0.06	12/01/08	1.480	183,493	271.6	4282.1	1.460	183,493	267.9	4224.2	0.020	1.4	3.7	57.87	1.4
		01/02/09	1.435	364,056	522.4	8237.5	1.440	364,056	524.2	8266.2	-0.005	-0.3	-1.8	-28.70	-0.3
		POR	1.450	273,774	397.0	6259.8	1.447	273,774	396.1	6245.2	0.003	0.2	0.9	14.58	0.2
MBS-1 to MBS-3	0.11	12/01/08	1.460	183,493	267.9	2491.3	1.460	183,493	267.9	2491.3	0.000	0.0	0.0	0.00	0.0
		01/02/09	1.430	364,056	520.6	4841.2	1.440	364,056	524.2	4875.0	-0.010	-0.7	-3.6	-33.85	-0.7
		POR	1.440	273,774	394.2	3666.2	1.447	273,774	396.1	3683.1	-0.007	-0.5	-1.8	-16.93	-0.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MADISON BLUE SPRINGS (MADISON CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
MBS-1 to MBS-2	0.04	12/01/08	0.140	183,493	25.7	582.3	0.180	183,493	33.0	748.7	-0.040	-28.6	-7.3	-166.37	-28.6
		01/02/09	0.130	364,056	47.3	1072.8	0.175	364,056	63.7	1444.1	-0.045	-34.6	-16.4	-371.35	-34.6
		POR	0.133	273,774	36.5	827.5	0.177	273,774	48.4	1096.4	-0.043	-32.5	-11.9	-268.86	-32.5
MBS-2 to MBS-3	0.06	12/01/08	0.180	183,493	33.0	520.8	0.370	183,493	67.9	1070.5	-0.190	-105.6	-34.9	-549.73	-105.6
		01/02/09	0.175	364,056	63.7	1004.6	0.220	364,056	80.1	1262.9	-0.045	-25.7	-16.4	-258.32	-25.7
		POR	0.177	273,774	48.4	762.7	0.270	273,774	74.0	1166.7	-0.094	-53.0	-25.6	-404.02	-53.0
MBS-1 to MBS-3	0.11	12/01/08	0.140	183,493	25.7	238.9	0.370	183,493	67.9	631.3	-0.230	-164.3	-42.2	-392.46	-164.3
		01/02/09	0.130	364,056	47.3	440.1	0.220	364,056	80.1	744.8	-0.090	-69.2	-32.8	-304.69	-69.2
		POR	0.133	273,774	36.5	339.5	0.270	273,774	74.0	688.1	-0.137	-102.7	-37.5	-348.57	-102.7

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MADISON BLUE SPRINGS (MADISON CO.) - TOTAL NITROGEN (TN)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
MBS-1 to MBS-2	0.04	12/01/08	1.600	183,493	293.6	6654.9	1.660	183,493	304.6	6904.5	-0.060	-3.7	-11.0	-249.56	-3.7
		01/02/09	1.560	364,056	567.9	12873.4	1.610	364,056	586.1	13286.0	-0.050	-3.2	-18.2	-412.61	-3.2
		POR	1.573	273,774	430.8	9764.2	1.627	273,774	445.4	10095.2	-0.053	-3.4	-14.6	-331.08	-3.4
MBS-2 to MBS-3	0.06	12/01/08	1.660	183,493	304.6	4802.9	1.830	183,493	335.8	5294.7	-0.170	-10.2	-31.2	-491.86	-10.2
		01/02/09	1.610	364,056	586.1	9242.0	1.660	364,056	604.3	9529.1	-0.050	-3.1	-18.2	-287.02	-3.1
		POR	1.627	273,774	445.4	7022.5	1.717	273,774	470.1	7411.9	-0.090	-5.5	-24.7	-389.44	-5.5
MBS-1 to MBS-3	0.11	12/01/08	1.600	183,493	293.6	2730.1	1.830	183,493	335.8	3122.6	-0.230	-14.4	-42.2	-392.46	-14.4
		01/02/09	1.560	364,056	567.9	5281.3	1.660	364,056	604.3	5619.8	-0.100	-6.4	-36.4	-338.54	-6.4
		POR	1.573	273,774	430.8	4005.7	1.717	273,774	470.1	4371.2	-0.144	-9.1	-39.3	-365.50	-9.1

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MADISON BLUE SPRINGS (MADISON CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
MBS-1 to MBS-2	0.04	12/01/08	0.049	183,493	9.0	203.8	0.047	183,493	8.6	195.5	0.002	4.1	0.4	8.32	4.1
		01/02/09	0.043	364,056	15.7	354.8	0.042	364,056	15.1	342.5	0.001	3.5	0.5	12.38	3.5
		POR	0.045	273,774	12.3	279.3	0.043	273,774	11.9	269.0	0.002	3.7	0.5	10.35	3.7
MBS-2 to MBS-3	0.06	12/01/08	0.047	183,493	8.6	136.0	0.049	183,493	9.0	141.8	-0.002	-4.3	-0.4	-5.79	-4.3
		01/02/09	0.042	364,056	15.1	238.2	0.040	364,056	14.6	229.6	0.002	3.6	0.5	8.61	3.6
		POR	0.043	273,774	11.9	187.1	0.043	273,774	11.8	185.7	0.000	0.8	0.1	1.41	0.8
MBS-1 to MBS-3	0.11	12/01/08	0.049	183,493	9.0	83.6	0.049	183,493	9.0	83.6	0.000	0.0	0.0	0.00	0.0
		01/02/09	0.043	364,056	15.7	145.6	0.040	364,056	14.6	135.4	0.003	7.0	1.1	10.16	7.0
		POR	0.045	273,774	12.3	114.6	0.043	273,774	11.8	109.5	0.002	4.4	0.5	5.08	4.4

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MADISON BLUE SPRINGS (MADISON CO.) - TOTAL PHOSPHORUS (TP)

					Inflow				Outflow				Removal				
					Segment - Up				Segment - Down								
	Segment Area				Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Parameter	Units	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
MBS-1 to MBS-2	0.04	TP	mg/L	12/01/08	0.040	183,493	7.3	166.4	0.038	183,493	7.0	158.1	0.002	5.0	0.4	8.32	5.0
				01/02/09	0.039	364,056	14.2	321.8	0.039	364,056	14.2	321.8	0.000	0.0	0.0	0.00	0.0
				POR	0.039	273,774	10.8	244.1	0.039	273,774	10.6	239.9	0.001	1.7	0.2	4.16	1.7
MBS-2 to MBS-3	0.06	TP	mg/L	12/01/08	0.038	183,493	7.0	109.9	0.040	183,493	7.3	115.7	-0.002	-5.3	-0.4	-5.79	-5.3
				01/02/09	0.039	364,056	14.2	223.9	0.039	364,056	14.2	223.9	0.000	0.0	0.0	0.00	0.0
				POR	0.039	273,774	10.6	166.9	0.039	273,774	10.8	169.8	-0.001	-1.7	-0.2	-2.89	-1.7
MBS-1 to MBS-3	0.11	TP	mg/L	12/01/08	0.040	183,493	7.3	68.3	0.040	183,493	7.3	68.3	0.000	0.0	0.0	0.00	0.0
				01/02/09	0.039	364,056	14.2	132.0	0.039	364,056	14.2	132.0	0.000	0.0	0.0	0.00	0.0
				POR	0.039	273,774	10.8	100.1	0.039	273,774	10.8	100.1	0.000	0.0	0.0	0.00	0.0

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MANATEE SPRINGS (LEVY CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
MS-1 to MS-2	0.26	8/3/2009	0.009	202,300	1.8	7.0	0.012	202,300	2.4	9.3	-0.003	-33.3	-0.6	-2.32	-33.3
		8/6/2009	0.009	254,571	2.3	8.8	0.009	254,571	2.3	8.8	0.000	0.0	0.0	0.00	0.0
		POR	0.009	228,435	2.1	7.9	0.010	228,435	2.4	9.0	-0.001	-14.8	-0.3	-1.16	-14.8
MS-2 to MS-3	0.54	8/3/2009	0.012	202,300	2.4	4.5	0.009	202,300	1.8	3.4	0.003	25.0	0.6	1.13	25.0
		8/6/2009	0.009	254,571	2.3	4.3	0.009	254,571	2.3	4.3	0.000	0.0	0.0	0.00	0.0
		POR	0.010	228,435	2.4	4.4	0.009	228,435	2.1	3.8	0.001	12.9	0.3	0.57	12.9
MS-1 to MS-3	0.80	8/3/2009	0.009	202,300	1.8	2.3	0.009	202,300	1.8	2.3	0.000	0.0	0.0	0.00	0.0
		8/6/2009	0.009	254,571	2.3	2.9	0.009	254,571	2.3	2.9	0.000	0.0	0.0	0.00	0.0
		POR	0.009	228,435	2.1	2.6	0.009	228,435	2.1	2.6	0.000	0.0	0.0	0.00	0.0

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MANATEE SPRINGS (LEVY CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
MS-1 to MS-2	0.26	8/3/2009	2.000	202,300	404.6	1545.5	1.330	202,300	269.1	1027.7	0.670	33.5	135.5	517.73	33.5
		8/6/2009	1.990	254,571	506.6	1935.1	2.020	254,571	514.2	1964.2	-0.030	-1.5	-7.6	-29.17	-1.5
		POR	1.994	228,435	455.6	1740.3	1.714	228,435	391.6	1496.0	0.280	14.0	64.0	244.28	14.0
MS-2 to MS-3	0.54	8/3/2009	1.330	202,300	269.1	502.7	1.320	202,300	267.0	498.9	0.010	0.8	2.0	3.78	0.8
		8/6/2009	2.020	254,571	514.2	960.8	1.970	254,571	501.5	937.0	0.050	2.5	12.7	23.78	2.5
		POR	1.714	228,435	391.6	731.8	1.682	228,435	384.3	718.0	0.032	1.9	7.4	13.78	1.9
MS-1 to MS-3	0.80	8/3/2009	2.000	202,300	404.6	507.7	1.320	202,300	267.0	335.1	0.680	34.0	137.6	172.60	34.0
		8/6/2009	1.990	254,571	506.6	635.6	1.970	254,571	501.5	629.2	0.020	1.0	5.1	6.39	1.0
		POR	1.994	228,435	455.6	571.6	1.682	228,435	384.3	482.1	0.312	15.7	71.3	89.50	15.7

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MANATEE SPRINGS (LEVY CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
MS-1 to MS-2	0.26	8/3/2009	0.220	202,300	44.5	170.0	0.230	202,300	46.5	177.7	-0.010	-4.5	-2.0	-7.73	-4.5
		8/6/2009	0.290	254,571	73.8	282.0	0.330	254,571	84.0	320.9	-0.040	-13.8	-10.2	-38.90	-13.8
		POR	0.259	228,435	59.2	226.0	0.286	228,435	65.3	249.3	-0.027	-10.3	-6.1	-23.31	-10.3
MS-2 to MS-3	0.54	8/3/2009	0.230	202,300	46.5	86.9	0.230	202,300	46.5	86.9	0.000	0.0	0.0	0.00	0.0
		8/6/2009	0.330	254,571	84.0	157.0	0.280	254,571	71.3	133.2	0.050	15.2	12.7	23.78	15.2
		POR	0.286	228,435	65.3	122.0	0.258	228,435	58.9	110.1	0.028	9.8	6.4	11.89	9.8
MS-1 to MS-3	0.80	8/3/2009	0.220	202,300	44.5	55.8	0.230	202,300	46.5	58.4	-0.010	-4.5	-2.0	-2.54	-4.5
		8/6/2009	0.290	254,571	73.8	92.6	0.280	254,571	71.3	89.4	0.010	3.4	2.5	3.19	3.4
		POR	0.259	228,435	59.2	74.2	0.258	228,435	58.9	73.9	0.001	0.4	0.3	0.33	0.4

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MANATEE SPRINGS (LEVY CO.) - TOTAL NITROGEN (TN)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
MS-1 to MS-2	0.26	8/3/2009	2.220	202,300	449.1	1715.5	1.560	202,300	315.6	1205.5	0.660	29.7	133.5	510.00	29.7
		8/6/2009	2.280	254,571	580.4	2217.0	2.350	254,571	598.2	2285.1	-0.070	-3.1	-17.8	-68.07	-3.1
		POR	2.253	228,435	514.8	1966.2	2.000	228,435	456.9	1745.3	0.253	11.2	57.8	220.97	11.2
MS-2 to MS-3	0.54	8/3/2009	1.560	202,300	315.6	589.7	1.550	202,300	313.6	585.9	0.010	0.6	2.0	3.78	0.6
		8/6/2009	2.350	254,571	598.2	1117.8	2.250	254,571	572.8	1070.2	0.100	4.3	25.5	47.57	4.3
		POR	2.000	228,435	456.9	853.7	1.940	228,435	443.2	828.1	0.060	3.0	13.7	25.67	3.0
MS-1 to MS-3	0.80	8/3/2009	2.220	202,300	449.1	563.5	1.550	202,300	313.6	393.4	0.670	30.2	135.5	170.06	30.2
		8/6/2009	2.280	254,571	580.4	728.3	2.250	254,571	572.8	718.7	0.030	1.3	7.6	9.58	1.3
		POR	2.253	228,435	514.8	645.9	1.940	228,435	443.2	556.1	0.313	13.9	71.6	89.82	13.9

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MANATEE SPRINGS (LEVY CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
MS-1 to MS-2	0.26	8/3/2009	0.026	202,300	5.3	20.1	0.026	202,300	5.3	20.1	0.000	0.0	0.0	0.00	0.0
		8/6/2009	0.031	254,571	7.9	30.1	0.031	254,571	7.9	30.1	0.000	0.0	0.0	0.00	0.0
		POR	0.029	228,435	6.6	25.1	0.029	228,435	6.6	25.1	0.000	0.0	0.0	0.00	0.0
MS-2 to MS-3	0.54	8/3/2009	0.026	202,300	5.3	9.8	0.027	202,300	5.5	10.2	-0.001	-3.8	-0.2	-0.38	-3.8
		8/6/2009	0.031	254,571	7.9	14.7	0.038	254,571	9.7	18.1	-0.007	-22.6	-1.8	-3.33	-22.6
		POR	0.029	228,435	6.6	12.3	0.033	228,435	7.6	14.1	-0.004	-15.1	-1.0	-1.85	-15.1
MS-1 to MS-3	0.80	8/3/2009	0.026	202,300	5.3	6.6	0.027	202,300	5.5	6.9	-0.001	-3.8	-0.2	-0.25	-3.8
		8/6/2009	0.031	254,571	7.9	9.9	0.038	254,571	9.7	12.1	-0.007	-22.6	-1.8	-2.24	-22.6
		POR	0.029	228,435	6.6	8.3	0.033	228,435	7.6	9.5	-0.004	-15.1	-1.0	-1.24	-15.1

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN MANATEE SPRINGS (LEVY CO.) - TOTAL PHOSPHORUS (TP)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
MS-1 to MS-2	0.26	8/3/2009	0.009	202,300	1.8	7.0	0.006	202,300	1.2	4.6	0.003	33.3	0.6	2.32	33.3
		8/6/2009	0.037	254,571	9.4	36.0	0.035	254,571	8.9	34.0	0.002	5.4	0.5	1.94	5.4
		POR	0.025	228,435	5.6	21.5	0.022	228,435	5.1	19.3	0.002	9.9	0.6	2.13	9.9
MS-2 to MS-3	0.54	8/3/2009	0.006	202,300	1.2	2.3	0.006	202,300	1.2	2.3	0.000	0.0	0.0	0.00	0.0
		8/6/2009	0.035	254,571	8.9	16.6	0.042	254,571	10.7	20.0	-0.007	-20.0	-1.8	-3.33	-20.0
		POR	0.022	228,435	5.1	9.5	0.026	228,435	6.0	11.1	-0.004	-17.6	-0.9	-1.66	-17.6
MS-1 to MS-3	0.80	8/3/2009	0.009	202,300	1.8	2.3	0.006	202,300	1.2	1.5	0.003	33.3	0.6	0.76	33.3
		8/6/2009	0.037	254,571	9.4	11.8	0.042	254,571	10.7	13.4	-0.005	-13.5	-1.3	-1.60	-13.5
		POR	0.025	228,435	5.6	7.1	0.026	228,435	6.0	7.5	-0.001	-5.9	-0.3	-0.42	-5.9

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN PONCE DE LEON SPRINGS (HOLMES CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
PDL-1 to PDL-2	0.16	9/8/2009	0.031	28,785	0.9	5.6	0.036	28,785	1.0	6.5	-0.005	-16.1	-0.1	-0.90	-16.1
		9/11/2009	0.128	27,687	3.5	22.2	0.009	27,687	0.2	1.6	0.119	93.0	3.3	20.66	93.0
		POR	0.079	28,236	2.2	13.9	0.023	28,236	0.6	4.0	0.056	71.0	1.6	9.88	71.0
PDL-2 to PDL-3	0.19	9/8/2009	0.036	28,785	1.0	5.5	0.029	28,785	0.8	4.5	0.007	19.4	0.2	1.08	19.4
		9/11/2009	0.009	27,687	0.2	1.3	0.039	27,687	1.1	5.8	-0.030	-333.3	-0.8	-4.44	-333.3
		POR	0.023	28,236	0.6	3.4	0.034	28,236	1.0	5.1	-0.011	-48.9	-0.3	-1.68	-48.9
PDL-1 to PDL-3	0.35	9/8/2009	0.031	28,785	0.9	2.6	0.029	28,785	0.8	2.4	0.002	6.5	0.1	0.17	6.5
		9/11/2009	0.128	27,687	3.5	10.2	0.039	27,687	1.1	3.1	0.089	69.5	2.5	7.11	69.5
		POR	0.079	28,236	2.2	6.4	0.034	28,236	1.0	2.8	0.045	56.8	1.3	3.64	56.8

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN PONCE DE LEON SPRINGS (HOLMES CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
PDL-1 to PDL-2	0.16	9/8/2009	0.280	28,785	8.1	50.5	0.267	28,785	7.7	48.2	0.013	4.6	0.4	2.35	4.6
		9/11/2009	0.270	27,687	7.5	46.9	0.292	27,687	8.1	50.7	-0.022	-8.1	-0.6	-3.82	-8.1
		POR	0.275	28,236	7.8	48.7	0.279	28,236	7.9	49.4	-0.004	-1.5	-0.1	-0.74	-1.5
PDL-2 to PDL-3	0.19	9/8/2009	0.267	28,785	7.7	41.1	0.276	28,785	7.9	42.5	-0.009	-3.4	-0.3	-1.39	-3.4
		9/11/2009	0.292	27,687	8.1	43.3	0.287	27,687	7.9	42.5	0.005	1.7	0.1	0.74	1.7
		POR	0.279	28,236	7.9	42.2	0.281	28,236	7.9	42.5	-0.002	-0.8	-0.1	-0.32	-0.8
PDL-1 to PDL-3	0.35	9/8/2009	0.280	28,785	8.1	23.3	0.276	28,785	7.9	22.9	0.004	1.4	0.1	0.33	1.4
		9/11/2009	0.270	27,687	7.5	21.6	0.287	27,687	7.9	22.9	-0.017	-6.3	-0.5	-1.36	-6.3
		POR	0.275	28,236	7.8	22.4	0.281	28,236	7.9	22.9	-0.006	-2.3	-0.2	-0.51	-2.3

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN PONCE DE LEON SPRINGS (HOLMES CO.) - TOTAL KJELDAHL NITROGEN (TKN)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
PDL-1 to PDL-2	0.16	9/8/2009	0.090	28,785	2.6	16.2	0.080	28,785	2.3	14.4	0.010	11.1	0.3	1.80	11.1
		9/11/2009	0.100	27,687	2.8	17.4	0.080	27,687	2.2	13.9	0.020	20.0	0.6	3.47	20.0
		POR	0.095	28,236	2.7	16.8	0.080	28,236	2.3	14.2	0.015	15.7	0.4	2.64	15.7
PDL-2 to PDL-3	0.19	9/8/2009	0.080	28,785	2.3	12.3	0.080	28,785	2.3	12.3	0.000	0.0	0.0	0.00	0.0
		9/11/2009	0.080	27,687	2.2	11.9	0.080	27,687	2.2	11.9	0.000	0.0	0.0	0.00	0.0
		POR	0.080	28,236	2.3	12.1	0.080	28,236	2.3	12.1	0.000	0.0	0.0	0.00	0.0
PDL-1 to PDL-3	0.35	9/8/2009	0.090	28,785	2.6	7.5	0.080	28,785	2.3	6.6	0.010	11.1	0.3	0.83	11.1
		9/11/2009	0.100	27,687	2.8	8.0	0.080	27,687	2.2	6.4	0.020	20.0	0.6	1.60	20.0
		POR	0.095	28,236	2.7	7.7	0.080	28,236	2.3	6.5	0.015	15.7	0.4	1.21	15.7

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN PONCE DE LEON SPRINGS (HOLMES CO.) - TOTAL NITROGEN (TN)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down				Conc		Mass		
Site	Segment Area (ha)	Date	Conc (mg/L)	Flow (m^3/d)	Mass (kg/d)	Mass (kg/ha/d)	Conc (mg/L)	Flow (m^3/d)	Mass (kg/d)	Mass (kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
PDL-1 to PDL-2	0.16	9/8/2009	0.370	28,785	10.7	66.8	0.347	28,785	10.0	62.6	0.023	6.2	0.7	4.15	6.2
		9/11/2009	0.370	27,687	10.2	64.2	0.372	27,687	10.3	64.6	-0.002	-0.5	-0.1	-0.35	-0.5
		POR	0.370	28,236	10.4	65.5	0.359	28,236	10.1	63.6	0.011	2.9	0.3	1.90	2.9
PDL-2 to PDL-3	0.19	9/8/2009	0.347	28,785	10.0	53.4	0.356	28,785	10.2	54.8	-0.009	-2.6	-0.3	-1.39	-2.6
		9/11/2009	0.372	27,687	10.3	55.1	0.367	27,687	10.2	54.4	0.005	1.3	0.1	0.74	1.3
		POR	0.359	28,236	10.1	54.3	0.361	28,236	10.2	54.6	-0.002	-0.6	-0.1	-0.32	-0.6
PDL-1 to PDL-3	0.35	9/8/2009	0.370	28,785	10.7	30.7	0.356	28,785	10.2	29.6	0.014	3.8	0.4	1.16	3.8
		9/11/2009	0.370	27,687	10.2	29.6	0.367	27,687	10.2	29.3	0.003	0.8	0.1	0.24	0.8
		POR	0.370	28,236	10.4	30.2	0.361	28,236	10.2	29.5	0.009	2.3	0.2	0.70	2.3

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN PONCE DE LEON SPRINGS (HOLMES CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down				Conc		Mass		
Site	Segment Area (ha)	Date	Conc (mg/L)	Flow (m^3/d)	Mass (kg/d)	Mass (kg/ha/d)	Conc (mg/L)	Flow (m^3/d)	Mass (kg/d)	Mass (kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
PDL-1 to PDL-2	0.16	9/8/2009	0.024	28,785	0.7	4.3	0.023	28,785	0.7	4.2	0.001	4.2	0.0	0.18	4.2
		9/11/2009	0.014	27,687	0.4	2.4	0.035	27,687	1.0	6.1	-0.021	-150.0	-0.6	-3.65	-150.0
		POR	0.019	28,236	0.5	3.4	0.029	28,236	0.8	5.1	-0.010	-51.2	-0.3	-1.73	-51.2
PDL-2 to PDL-3	0.19	9/8/2009	0.023	28,785	0.7	3.5	0.024	28,785	0.7	3.7	-0.001	-4.3	0.0	-0.15	-4.3
		9/11/2009	0.035	27,687	1.0	5.2	0.012	27,687	0.3	1.8	0.023	65.7	0.6	3.41	65.7
		POR	0.029	28,236	0.8	4.4	0.018	28,236	0.5	2.7	0.011	37.3	0.3	1.63	37.3
PDL-1 to PDL-3	0.35	9/8/2009	0.024	28,785	0.7	2.0	0.024	28,785	0.7	2.0	0.000	0.0	0.0	0.00	0.0
		9/11/2009	0.014	27,687	0.4	1.1	0.012	27,687	0.3	1.0	0.002	14.3	0.1	0.16	14.3
		POR	0.019	28,236	0.5	1.6	0.018	28,236	0.5	1.5	0.001	5.1	0.0	0.08	5.1

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN PONCE DE LEON SPRINGS (HOLMES CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
PDL-1 to PDL-2	0.16	9/8/2009	0.023	28,785	0.7	4.2	0.029	28,785	0.8	5.2	-0.006	-26.1	-0.2	-1.08	-26.1
		9/11/2009	0.006	27,687	0.2	1.0	0.006	27,687	0.2	1.0	0.000	0.0	0.0	0.00	0.0
		POR	0.015	28,236	0.4	2.6	0.018	28,236	0.5	3.1	-0.003	-20.9	-0.1	-0.54	-20.9
PDL-2 to PDL-3	0.19	9/8/2009	0.029	28,785	0.8	4.5	0.026	28,785	0.7	4.0	0.003	10.3	0.1	0.46	10.3
		9/11/2009	0.006	27,687	0.2	0.9	0.006	27,687	0.2	0.9	0.000	0.0	0.0	0.00	0.0
		POR	0.018	28,236	0.5	2.7	0.016	28,236	0.5	2.4	0.002	8.6	0.0	0.23	8.6
PDL-1 to PDL-3	0.35	9/8/2009	0.023	28,785	0.7	1.9	0.026	28,785	0.7	2.2	-0.003	-13.0	-0.1	-0.25	-13.0
		9/11/2009	0.006	27,687	0.2	0.5	0.006	27,687	0.2	0.5	0.000	0.0	0.0	0.00	0.0
		POR	0.015	28,236	0.4	1.2	0.016	28,236	0.5	1.3	-0.002	-10.4	0.0	-0.12	-10.4

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN RAINBOW SPRINGS (MARION CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
RS-1 to RS-2	2.17	06/08/09	0.178	364,965	65.0	29.9	0.099	641,687	63.5	29.2	0.079	44.4	1.4	0.66	2.2
		06/11/09	0.112	303,476	34.0	15.6	0.119	601,283	71.6	32.9	-0.007	-6.2	-37.6	-17.29	-110.5
		POR	0.148	334,221	49.5	22.8	0.109	621,485	67.5	31.1	0.039	26.6	-18.1	-8.31	-36.5
RS-2 to RS-3	2.35	06/08/09	0.099	641,687	63.5	27.0	0.072	673,041	48.5	20.6	0.027	27.3	15.1	6.40	23.7
		06/11/09	0.119	601,283	71.6	30.4	0.105	807,993	84.8	36.1	0.014	11.8	-13.3	-5.65	-18.6
		POR	0.109	621,485	67.5	28.7	0.090	740,517	66.6	28.3	0.019	17.2	0.9	0.38	1.3
RS-1 to RS-3	4.53	06/08/09	0.178	364,965	65.0	14.4	0.072	673,041	48.5	10.7	0.106	59.6	16.5	3.65	25.4
		06/11/09	0.112	303,476	34.0	7.5	0.105	807,993	84.8	18.7	0.007	6.3	-50.8	-11.24	-149.6
		POR	0.148	334,221	49.5	10.9	0.090	740,517	66.6	14.7	0.058	39.2	-17.2	-3.79	-34.7

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN RAINBOW SPRINGS (MARION CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
RS-1 to RS-2	2.17	06/08/09	1.610	364,965	587.6	270.5	1.81	641,687	1161.5	534.6	-0.200	-12.4	-573.9	-264.14	-97.7
		06/11/09	1.880	303,476	570.5	262.6	1.64	601,283	986.1	453.9	0.240	12.8	-415.6	-191.28	-72.8
		POR	1.733	334,221	579.1	266.5	1.728	621,485	1073.8	494.2	0.005	0.3	-494.7	-227.71	-85.4
RS-2 to RS-3	2.35	06/08/09	1.810	641,687	1161.5	493.6	1.67	673,041	1124.0	477.7	0.140	7.7	37.5	15.93	3.2
		06/11/09	1.640	601,283	986.1	419.1	1.60	807,993	1292.8	549.5	0.040	2.4	-306.7	-130.35	-31.1
		POR	1.728	621,485	1073.8	456.4	1.632	740,517	1208.4	513.6	0.096	5.6	-134.6	-57.21	-12.5
RS-1 to RS-3	4.53	06/08/09	1.610	364,965	587.6	129.8	1.670	673,041	1124.0	248.4	-0.060	-3.7	-536.4	-118.53	-91.3
		06/11/09	1.880	303,476	570.5	126.1	1.600	807,993	1292.8	285.7	0.280	14.9	-722.3	-159.60	-126.6
		POR	1.733	334,221	579.1	128.0	1.632	740,517	1208.4	267.0	0.101	5.8	-629.3	-139.06	-108.7

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN RAINBOW SPRINGS (MARION CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
RS-1 to RS-2	2.17	06/08/09	0.080	364,965	29.2	13.4	0.08	641,687	51.3	23.6	0.000	0.0	-22.1	-10.19	-75.8
		06/11/09	0.080	303,476	24.3	11.2	0.16	601,283	96.2	44.3	-0.080	-100.0	-71.9	-33.11	-296.3
		POR	0.080	334,221	26.7	12.3	0.119	621,485	73.8	34.0	-0.039	-48.4	-47.0	-21.65	-175.9
RS-2 to RS-3	2.35	06/08/09	0.080	641,687	51.3	21.8	0.08	673,041	53.8	22.9	0.000	0.0	-2.5	-1.07	-4.9
		06/11/09	0.160	601,283	96.2	40.9	0.08	807,993	64.6	27.5	0.080	50.0	31.6	13.42	32.8
		POR	0.119	621,485	73.8	31.4	0.080	740,517	59.2	25.2	0.039	32.6	14.5	6.17	19.7
RS-1 to RS-3	4.53	06/08/09	0.080	364,965	29.2	6.5	0.080	673,041	53.8	11.9	0.000	0.0	-24.6	-5.45	-84.4
		06/11/09	0.080	303,476	24.3	5.4	0.080	807,993	64.6	14.3	0.000	0.0	-40.4	-8.92	-166.2
		POR	0.080	334,221	26.7	5.9	0.080	740,517	59.2	13.1	0.000	0.0	-32.5	-7.18	-121.6

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN RAINBOW SPRINGS (MARION CO.) - TOTAL NITROGEN (TN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
RS-1 to RS-2	2.17	06/08/09	1.690	364,965	616.8	283.9	1.89	641,687	1212.8	558.2	-0.200	-11.8	-596.0	-274.33	-96.6
		06/11/09	1.960	303,476	594.8	273.8	1.80	601,283	1082.3	498.2	0.160	8.2	-487.5	-224.38	-82.0
		POR	1.813	334,221	605.8	278.8	1.846	621,485	1147.5	528.2	-0.034	-1.9	-541.7	-249.35	-89.4
RS-2 to RS-3	2.35	06/08/09	1.890	641,687	1212.8	515.5	1.75	673,041	1177.8	500.6	0.140	7.4	35.0	14.86	2.9
		06/11/09	1.800	601,283	1082.3	460.0	1.68	807,993	1357.4	576.9	0.120	6.7	-275.1	-116.93	-25.4
		POR	1.846	621,485	1147.5	487.7	1.712	740,517	1267.6	538.8	0.135	7.3	-120.1	-51.03	-10.5
RS-1 to RS-3	4.53	06/08/09	1.690	364,965	616.8	136.3	1.750	673,041	1177.8	260.3	-0.060	-3.6	-561.0	-123.97	-91.0
		06/11/09	1.960	303,476	594.8	131.4	1.680	807,993	1357.4	300.0	0.280	14.3	-762.6	-168.52	-128.2
		POR	1.813	334,221	605.8	133.9	1.712	740,517	1267.6	280.1	0.101	5.6	-661.8	-146.24	-109.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN RAINBOW SPRINGS (MARION CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
RS-1 to RS-2	2.17	06/08/09	0.033	364,965	12.0	5.5	0.031	641,687	19.9	9.2	0.002	6.1	-7.8	-3.61	-65.2
		06/11/09	0.029	303,476	8.8	4.1	0.030	601,283	18.0	8.3	-0.001	-3.4	-9.2	-4.25	-105.0
		POR	0.031	334,221	10.4	4.8	0.031	621,485	19.0	8.7	0.001	2.1	-8.5	-3.93	-82.0
RS-2 to RS-3	2.35	06/08/09	0.031	641,687	19.9	8.5	0.031	673,041	20.9	8.9	0.000	0.0	-1.0	-0.41	-4.9
		06/11/09	0.030	601,283	18.0	7.7	0.031	807,993	25.0	10.6	-0.001	-3.3	-7.0	-2.98	-38.9
		POR	0.031	621,485	19.0	8.1	0.031	740,517	23.0	9.8	0.000	-1.6	-4.0	-1.70	-21.0
RS-1 to RS-3	4.53	06/08/09	0.033	364,965	12.0	2.7	0.031	673,041	20.9	4.6	0.002	6.1	-8.8	-1.95	-73.2
		06/11/09	0.029	303,476	8.8	1.9	0.031	807,993	25.0	5.5	-0.002	-6.9	-16.2	-3.59	-184.6
		POR	0.031	334,221	10.4	2.3	0.031	740,517	23.0	5.1	0.000	0.6	-12.5	-2.77	-120.3

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN RAINBOW SPRINGS (MARION CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
RS-1 to RS-2	2.17	06/08/09	0.030	364,965	10.9	5.0	0.030	641,687	19.3	8.9	0.000	0.0	-8.3	-3.82	-75.8
		06/11/09	0.051	303,476	15.5	7.1	0.033	601,283	19.8	9.1	0.018	35.3	-4.4	-2.01	-28.2
		POR	0.040	334,221	13.2	6.1	0.031	621,485	19.5	9.0	0.008	20.4	-6.3	-2.92	-47.9
RS-2 to RS-3	2.35	06/08/09	0.030	641,687	19.3	8.2	0.035	673,041	23.6	10.0	-0.005	-16.7	-4.3	-1.83	-22.4
		06/11/09	0.033	601,283	19.8	8.4	0.038	807,993	30.7	13.0	-0.005	-15.2	-10.9	-4.62	-54.7
		POR	0.031	621,485	19.5	8.3	0.037	740,517	27.1	11.5	-0.005	-16.5	-7.6	-3.22	-38.8
RS-1 to RS-3	4.53	06/08/09	0.030	364,965	10.9	2.4	0.035	673,041	23.6	5.2	-0.005	-16.7	-12.6	-2.79	-115.1
		06/11/09	0.051	303,476	15.5	3.4	0.038	807,993	30.7	6.8	0.013	25.5	-15.2	-3.36	-98.4
		POR	0.040	334,221	13.2	2.9	0.037	740,517	27.1	6.0	0.003	7.3	-13.9	-3.08	-105.3

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER GLEN SPRINGS (MARION CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SGS-1 to SGS-2	0.24	02/17/09	0.015	139,398	2.1	8.6	0.021	139,398	2.9	12.0	-0.006	-40.0	-0.8	-3.43	-40.0
		02/19/09	0.029	139,398	4.0	16.6	0.024	139,398	3.3	13.7	0.005	17.2	0.7	2.85	17.2
		POR	0.022	139,398	3.1	12.6	0.023	139,398	3.1	12.8	0.000	-2.3	-0.1	-0.29	-2.3
SGS-2 to SGS-3	3.58	02/17/09	0.021	139,398	2.9	0.8	0.022	139,398	3.1	0.9	-0.001	-4.8	-0.1	-0.04	-4.8
		02/19/09	0.024	139,398	3.3	0.9	0.020	139,398	2.8	0.8	0.004	16.7	0.6	0.16	16.7
		POR	0.023	139,398	3.1	0.9	0.021	139,398	2.9	0.8	0.002	6.7	0.2	0.06	6.7
SGS-1 to SGS-3	3.83	02/17/09	0.015	139,398	2.1	0.5	0.022	139,398	3.1	0.8	-0.007	-46.7	-1.0	-0.25	-46.7
		02/19/09	0.029	139,398	4.0	1.1	0.020	139,398	2.8	0.7	0.009	31.0	1.3	0.33	31.0
		POR	0.022	139,398	3.1	0.8	0.021	139,398	2.9	0.8	0.001	4.5	0.1	0.04	4.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER GLEN SPRINGS (MARION CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SGS-1 to SGS-2	0.24	02/17/09	0.047	139,398	6.6	26.8	0.024	139,398	3.3	13.7	0.023	48.9	3.2	13.13	48.9
		02/19/09	0.056	139,398	7.8	32.0	0.038	139,398	5.3	21.7	0.018	32.1	2.5	10.28	32.1
		POR	0.052	139,398	7.2	29.4	0.031	139,398	4.3	17.7	0.021	39.8	2.9	11.70	39.8
SGS-2 to SGS-3	3.58	02/17/09	0.024	139,398	3.3	0.9	0.021	139,398	2.9	0.8	0.003	12.5	0.4	0.12	12.5
		02/19/09	0.038	139,398	5.3	1.5	0.019	139,398	2.6	0.7	0.019	50.0	2.6	0.74	50.0
		POR	0.031	139,398	4.3	1.2	0.020	139,398	2.8	0.8	0.011	35.5	1.5	0.43	35.5
SGS-1 to SGS-3	3.83	02/17/09	0.047	139,398	6.6	1.7	0.021	139,398	2.9	0.8	0.026	55.3	3.6	0.95	55.3
		02/19/09	0.056	139,398	7.8	2.0	0.019	139,398	2.6	0.7	0.037	66.1	5.2	1.35	66.1
		POR	0.052	139,398	7.2	1.9	0.020	139,398	2.8	0.7	0.032	61.2	4.4	1.15	61.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER GLEN SPRINGS (MARION CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SGS-1 to SGS-2	0.24	02/17/09	0.080	139,398	11.2	45.7	0.110	139,398	15.3	62.8	-0.030	-37.5	-4.2	-17.13	-37.5
		02/19/09	0.080	139,398	11.2	45.7	0.080	139,398	11.2	45.7	0.000	0.0	0.0	0.00	0.0
		POR	0.080	139,398	11.2	45.7	0.095	139,398	13.2	54.2	-0.015	-18.8	-2.1	-8.56	-18.8
SGS-2 to SGS-3	3.58	02/17/09	0.110	139,398	15.3	4.3	0.150	139,398	20.9	5.8	-0.040	-36.4	-5.6	-1.56	-36.4
		02/19/09	0.080	139,398	11.2	3.1	0.080	139,398	11.2	3.1	0.000	0.0	0.0	0.00	0.0
		POR	0.095	139,398	13.2	3.7	0.115	139,398	16.0	4.5	-0.020	-21.1	-2.8	-0.78	-21.1
SGS-1 to SGS-3	3.83	02/17/09	0.080	139,398	11.2	2.9	0.150	139,398	20.9	5.5	-0.070	-87.5	-9.8	-2.55	-87.5
		02/19/09	0.080	139,398	11.2	2.9	0.080	139,398	11.2	2.9	0.000	0.0	0.0	0.00	0.0
		POR	0.080	139,398	11.2	2.9	0.115	139,398	16.0	4.2	-0.035	-43.8	-4.9	-1.27	-43.8

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER GLEN SPRINGS (MARION CO.) - TOTAL NITROGEN (TN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SGS-1 to SGS-2	0.24	02/17/09	0.127	139,398	17.7	72.5	0.134	139,398	18.7	76.5	-0.007	-5.5	-1.0	-4.00	-5.5
		02/19/09	0.136	139,398	19.0	77.6	0.118	139,398	16.4	67.4	0.018	13.2	2.5	10.28	13.2
		POR	0.132	139,398	18.3	75.1	0.126	139,398	17.6	71.9	0.006	4.2	0.8	3.14	4.2
SGS-2 to SGS-3	3.58	02/17/09	0.134	139,398	18.7	5.2	0.171	139,398	23.8	6.7	-0.037	-27.6	-5.2	-1.44	-27.6
		02/19/09	0.118	139,398	16.4	4.6	0.099	139,398	13.8	3.9	0.019	16.1	2.6	0.74	16.1
		POR	0.126	139,398	17.6	4.9	0.135	139,398	18.8	5.3	-0.009	-7.1	-1.3	-0.35	-7.1
SGS-1 to SGS-3	3.83	02/17/09	0.127	139,398	17.7	4.6	0.171	139,398	23.8	6.2	-0.044	-34.6	-6.1	-1.60	-34.6
		02/19/09	0.136	139,398	19.0	5.0	0.099	139,398	13.8	3.6	0.037	27.2	5.2	1.35	27.2
		POR	0.132	139,398	18.3	4.8	0.135	139,398	18.8	4.9	-0.004	-2.7	-0.5	-0.13	-2.7

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER GLEN SPRINGS (MARION CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
SGS-1 to SGS-2	0.24	02/17/09	0.020	139,398	2.8	11.4	0.016	139,398	2.2	9.1	0.004	20.0	0.6	2.28	20.0
		02/19/09	0.026	139,398	3.6	14.8	0.026	139,398	3.6	14.8	0.000	0.0	0.0	0.00	0.0
		POR	0.023	139,398	3.2	13.1	0.021	139,398	2.9	12.0	0.002	8.7	0.3	1.14	8.7
SGS-2 to SGS-3	3.58	02/17/09	0.016	139,398	2.2	0.6	0.021	139,398	2.9	0.8	-0.005	-31.3	-0.7	-0.19	-31.3
		02/19/09	0.026	139,398	3.6	1.0	0.024	139,398	3.3	0.9	0.002	7.7	0.3	0.08	7.7
		POR	0.021	139,398	2.9	0.8	0.023	139,398	3.1	0.9	-0.002	-7.1	-0.2	-0.06	-7.1
SGS-1 to SGS-3	3.83	02/17/09	0.020	139,398	2.8	0.7	0.021	139,398	2.9	0.8	-0.001	-5.0	-0.1	-0.04	-5.0
		02/19/09	0.026	139,398	3.6	0.9	0.024	139,398	3.3	0.9	0.002	7.7	0.3	0.07	7.7
		POR	0.023	139,398	3.2	0.8	0.023	139,398	3.1	0.8	0.001	2.2	0.1	0.02	2.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER GLEN SPRINGS (MARION CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SGS-1 to SGS-2	0.24	02/17/09	0.028	139,398	3.9	16.0	0.030	139,398	4.2	17.1	-0.002	-7.1	-0.3	-1.14	-7.1
		02/19/09	0.024	139,398	3.3	13.7	0.024	139,398	3.3	13.7	0.000	0.0	0.0	0.00	0.0
		POR	0.026	139,398	3.6	14.8	0.027	139,398	3.8	15.4	-0.001	-3.8	-0.1	-0.57	-3.8
SGS-2 to SGS-3	3.58	02/17/09	0.030	139,398	4.2	1.2	0.033	139,398	4.6	1.3	-0.003	-10.0	-0.4	-0.12	-10.0
		02/19/09	0.024	139,398	3.3	0.9	0.024	139,398	3.3	0.9	0.000	0.0	0.0	0.00	0.0
		POR	0.027	139,398	3.8	1.1	0.029	139,398	4.0	1.1	-0.002	-5.6	-0.2	-0.06	-5.6
SGS-1 to SGS-3	3.83	02/17/09	0.028	139,398	3.9	1.0	0.033	139,398	4.6	1.2	-0.005	-17.9	-0.7	-0.18	-17.9
		02/19/09	0.024	139,398	3.3	0.9	0.024	139,398	3.3	0.9	0.000	0.0	0.0	0.00	0.0
		POR	0.026	139,398	3.6	0.9	0.029	139,398	4.0	1.0	-0.003	-9.6	-0.3	-0.09	-9.6

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER SPRINGS (MARION CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SS-1 to SS-2	4.41	05/04/09	0.009	1,047,033	9.4	2.1	0.009	1,047,033	9.4	2.1	0.000	0.0	0.0	0.00	0.0
		05/07/09	0.020	1,037,552	20.8	4.7	0.009	1,037,552	9.3	2.1	0.011	55.0	11.4	2.59	55.0
		POR	0.014	1,042,292	15.1	3.4	0.009	1,042,292	9.4	2.1	0.005	37.8	5.7	1.29	37.8
SS-2 to SS-3	3.53	05/04/09	0.009	1,047,033	9.4	2.7	0.009	1,047,033	9.4	2.7	0.000	0.0	0.0	0.00	0.0
		05/07/09	0.009	1,037,552	9.3	2.6	0.016	1,037,552	16.6	4.7	-0.007	-77.8	-7.3	-2.06	-77.8
		POR	0.009	1,042,292	9.4	2.7	0.012	1,042,292	13.0	3.7	-0.003	-38.7	-3.6	-1.03	-38.7
SS-1 to SS-3	7.94	05/04/09	0.009	1,047,033	9.4	1.2	0.009	1,047,033	9.4	1.2	0.000	0.0	0.0	0.00	0.0
		05/07/09	0.020	1,037,552	20.8	2.6	0.016	1,037,552	16.6	2.1	0.004	20.0	4.2	0.52	20.0
		POR	0.014	1,042,292	15.1	1.9	0.012	1,042,292	13.0	1.6	0.002	13.8	2.1	0.26	13.8

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER SPRINGS (MARION CO.) - NITRITE+NITRATE (NO_X-N)

			Inflow				Outflow				Removal				
			Segment - Up				Segment - Down								
	Segment Area		Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	(ha)	Date	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(%)	(kg/d)	(kg/ha/d)	(%)
SS-1 to SS-2	4.41	05/04/09	1.100	1,047,033	1151.7	261.2	1.16	1,047,033	1214.6	275.4	-0.060	-5.5	-62.8	-14.25	-5.5
		05/07/09	1.120	1,037,552	1162.1	263.5	1.14	1,037,552	1182.8	268.2	-0.020	-1.8	-20.8	-4.71	-1.8
		POR	1.110	1,042,292	1156.9	262.4	1.150	1,042,292	1198.7	271.8	-0.040	-3.6	-41.8	-9.48	-3.6
SS-2 to SS-3	3.53	05/04/09	1.160	1,047,033	1214.6	344.1	1.16	1,047,033	1214.6	344.1	0.000	0.0	0.0	0.00	0.0
		05/07/09	1.140	1,037,552	1182.8	335.1	1.19	1,037,552	1234.7	349.8	-0.050	-4.4	-51.9	-14.70	-4.4
		POR	1.150	1,042,292	1198.7	339.6	1.175	1,042,292	1224.6	346.9	-0.025	-2.2	-25.9	-7.35	-2.2
SS-1 to SS-3	7.94	05/04/09	1.100	1,047,033	1151.7	145.1	1.160	1,047,033	1214.6	153.0	-0.060	-5.5	-62.8	-7.91	-5.5
		05/07/09	1.120	1,037,552	1162.1	146.4	1.190	1,037,552	1234.7	155.5	-0.070	-6.2	-72.6	-9.15	-6.2
		POR	1.110	1,042,292	1156.9	145.7	1.175	1,042,292	1224.6	154.2	-0.065	-5.9	-67.7	-8.53	-5.9

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER SPRINGS (MARION CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SS-1 to SS-2	4.41	05/04/09	0.080	1,047,033	83.8	19.0	0.08	1,047,033	83.8	19.0	0.000	0.0	0.0	0.00	0.0
		05/07/09	0.100	1,037,552	103.8	23.5	0.08	1,037,552	83.0	18.8	0.020	20.0	20.8	4.71	20.0
		POR	0.090	1,042,292	93.8	21.3	0.080	1,042,292	83.4	18.9	0.010	11.1	10.4	2.35	11.1
SS-2 to SS-3	3.53	05/04/09	0.080	1,047,033	83.8	23.7	0.08	1,047,033	83.8	23.7	0.000	0.0	0.0	0.00	0.0
		05/07/09	0.080	1,037,552	83.0	23.5	0.08	1,037,552	83.0	23.5	0.000	0.0	0.0	0.00	0.0
		POR	0.080	1,042,292	83.4	23.6	0.080	1,042,292	83.4	23.6	0.000	0.0	0.0	0.00	0.0
SS-1 to SS-3	7.94	05/04/09	0.080	1,047,033	83.8	10.5	0.080	1,047,033	83.8	10.5	0.000	0.0	0.0	0.00	0.0
		05/07/09	0.100	1,037,552	103.8	13.1	0.080	1,037,552	83.0	10.5	0.020	20.0	20.8	2.61	20.0
		POR	0.090	1,042,292	93.8	11.8	0.080	1,042,292	83.4	10.5	0.010	11.1	10.4	1.31	11.1

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER SPRINGS (MARION CO.) - TOTAL NITROGEN (TN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SS-1 to SS-2	4.41	05/04/09	1.180	1,047,033	1235.5	280.2	1.24	1,047,033	1298.3	294.4	-0.060	-5.1	-62.8	-14.25	-5.1
		05/07/09	1.220	1,037,552	1265.8	287.1	1.22	1,037,552	1265.8	287.1	0.000	0.0	0.0	0.00	0.0
		POR	1.200	1,042,292	1250.7	283.6	1.230	1,042,292	1282.1	290.7	-0.030	-2.5	-31.4	-7.12	-2.5
SS-2 to SS-3	3.53	05/04/09	1.240	1,047,033	1298.3	367.8	1.24	1,047,033	1298.3	367.8	0.000	0.0	0.0	0.00	0.0
		05/07/09	1.220	1,037,552	1265.8	358.6	1.27	1,037,552	1317.7	373.3	-0.050	-4.1	-51.9	-14.70	-4.1
		POR	1.230	1,042,292	1282.1	363.2	1.255	1,042,292	1308.0	370.5	-0.025	-2.0	-25.9	-7.35	-2.0
SS-1 to SS-3	7.94	05/04/09	1.180	1,047,033	1235.5	155.6	1.240	1,047,033	1298.3	163.5	-0.060	-5.1	-62.8	-7.91	-5.1
		05/07/09	1.220	1,037,552	1265.8	159.4	1.270	1,037,552	1317.7	166.0	-0.050	-4.1	-51.9	-6.53	-4.1
		POR	1.200	1,042,292	1250.7	157.5	1.255	1,042,292	1308.0	164.7	-0.055	-4.6	-57.3	-7.22	-4.6

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER SPRINGS (MARION CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SS-1 to SS-2	4.41	05/04/09	0.044	1,047,033	46.1	10.4	0.036	1,047,033	37.7	8.5	0.008	18.2	8.4	1.90	18.2
		05/07/09	0.040	1,037,552	41.5	9.4	0.034	1,037,552	35.3	8.0	0.006	15.0	6.2	1.41	15.0
		POR	0.042	1,042,292	43.8	9.9	0.035	1,042,292	36.5	8.3	0.007	16.7	7.3	1.66	16.7
SS-2 to SS-3	3.53	05/04/09	0.036	1,047,033	37.7	10.7	0.036	1,047,033	37.7	10.7	0.000	0.0	0.0	0.00	0.0
		05/07/09	0.034	1,037,552	35.3	10.0	0.035	1,037,552	36.3	10.3	-0.001	-2.9	-1.0	-0.29	-2.9
		POR	0.035	1,042,292	36.5	10.3	0.036	1,042,292	37.0	10.5	0.000	-1.4	-0.5	-0.15	-1.4
SS-1 to SS-3	7.94	05/04/09	0.044	1,047,033	46.1	5.8	0.036	1,047,033	37.7	4.7	0.008	18.2	8.4	1.05	18.2
		05/07/09	0.040	1,037,552	41.5	5.2	0.035	1,037,552	36.3	4.6	0.005	12.5	5.2	0.65	12.5
		POR	0.042	1,042,292	43.8	5.5	0.036	1,042,292	37.0	4.7	0.007	15.5	6.8	0.85	15.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN SILVER SPRINGS (MARION CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
SS-1 to SS-2	4.41	05/04/09	0.053	1,047,033	55.5	12.6	0.043	1,047,033	45.0	10.2	0.010	18.9	10.5	2.37	18.9
		05/07/09	0.040	1,037,552	41.5	9.4	0.033	1,037,552	34.2	7.8	0.007	17.5	7.3	1.65	17.5
		POR	0.047	1,042,292	48.5	11.0	0.038	1,042,292	39.6	9.0	0.009	18.3	8.9	2.01	18.3
SS-2 to SS-3	3.53	05/04/09	0.043	1,047,033	45.0	12.8	0.041	1,047,033	42.9	12.2	0.002	4.7	2.1	0.59	4.7
		05/07/09	0.033	1,037,552	34.2	9.7	0.038	1,037,552	39.4	11.2	-0.005	-15.2	-5.2	-1.47	-15.2
		POR	0.038	1,042,292	39.6	11.2	0.040	1,042,292	41.2	11.7	-0.001	-3.9	-1.5	-0.44	-3.9
SS-1 to SS-3	7.94	05/04/09	0.053	1,047,033	55.5	7.0	0.041	1,047,033	42.9	5.4	0.012	22.6	12.6	1.58	22.6
		05/07/09	0.040	1,037,552	41.5	5.2	0.038	1,037,552	39.4	5.0	0.002	5.0	2.1	0.26	5.0
		POR	0.047	1,042,292	48.5	6.1	0.040	1,042,292	41.2	5.2	0.007	15.1	7.3	0.92	15.1

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WAKULLA SPRINGS (WAKULLA CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WAK-1 to WAK-2	1.57	04/13/09	0.021	2,452,641	51.5	32.8	0.023	2,452,641	56.4	36.0	-0.002	-9.5	-4.9	-3.13	-9.5
		04/16/09	0.031	2,513,143	77.9	49.7	0.022	2,513,143	55.3	35.2	0.009	29.0	22.6	14.42	29.0
		POR	0.026	2,482,892	64.7	41.3	0.022	2,482,892	55.8	35.6	0.004	13.7	8.9	5.65	13.7
WAK-2 to WAK-3	6.03	04/13/09	0.023	2,452,641	56.4	9.4	0.017	2,452,641	41.7	6.9	0.006	26.1	14.7	2.44	26.1
		04/16/09	0.022	2,513,143	55.3	9.2	0.024	2,513,143	60.3	10.0	-0.002	-9.1	-5.0	-0.83	-9.1
		POR	0.022	2,482,892	55.8	9.3	0.021	2,482,892	51.0	8.5	0.002	8.7	4.8	0.80	8.7
WAK-1 to WAK-3	7.60	04/13/09	0.021	2,452,641	51.5	6.8	0.017	2,452,641	41.7	5.5	0.004	19.0	9.8	1.29	19.0
		04/16/09	0.031	2,513,143	77.9	10.3	0.024	2,513,143	60.3	7.9	0.007	22.6	17.6	2.31	22.6
		POR	0.026	2,482,892	64.7	8.5	0.021	2,482,892	51.0	6.7	0.006	21.2	13.7	1.80	21.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WAKULLA SPRINGS (WAKULLA CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WAK-1 to WAK-2	1.57	04/13/09	0.486	2,452,641	1192.0	760.0	0.458	2,452,641	1123.3	716.2	0.028	5.8	68.7	43.78	5.8
		04/16/09	0.475	2,513,143	1193.7	761.1	0.479	2,513,143	1203.8	767.5	-0.004	-0.8	-10.1	-6.41	-0.8
		POR	0.480	2,482,892	1192.9	760.5	0.469	2,482,892	1163.6	741.8	0.012	2.5	29.3	18.69	2.5
WAK-2 to WAK-3	6.03	04/13/09	0.458	2,452,641	1123.3	186.2	0.445	2,452,641	1091.4	180.9	0.013	2.8	31.9	5.29	2.8
		04/16/09	0.479	2,513,143	1203.8	199.6	0.465	2,513,143	1168.6	193.7	0.014	2.9	35.2	5.83	2.9
		POR	0.469	2,482,892	1163.6	192.9	0.455	2,482,892	1130.0	187.3	0.014	2.9	33.5	5.56	2.9
WAK-1 to WAK-3	7.60	04/13/09	0.486	2,452,641	1192.0	156.8	0.445	2,452,641	1091.4	143.6	0.041	8.4	100.6	13.23	8.4
		04/16/09	0.475	2,513,143	1193.7	157.1	0.465	2,513,143	1168.6	153.8	0.010	2.1	25.1	3.31	2.1
		POR	0.480	2,482,892	1192.9	156.9	0.455	2,482,892	1130.0	148.7	0.025	5.3	62.8	8.27	5.3

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WAKULLA SPRINGS (WAKULLA CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WAK-1 to WAK-2	1.57	04/13/09	0.220	2,452,641	539.6	344.0	0.18	2,452,641	441.5	281.5	0.040	18.2	98.1	62.55	18.2
		04/16/09	0.200	2,513,143	502.6	320.5	0.12	2,513,143	301.6	192.3	0.080	40.0	201.1	128.18	40.0
		POR	0.210	2,482,892	521.1	332.2	0.150	2,482,892	371.5	236.9	0.060	28.7	149.6	95.36	28.7
WAK-2 to WAK-3	6.03	04/13/09	0.180	2,452,641	441.5	73.2	0.26	2,452,641	637.7	105.7	-0.080	-44.4	-196.2	-32.53	-44.4
		04/16/09	0.120	2,513,143	301.6	50.0	0.17	2,513,143	427.2	70.8	-0.050	-41.7	-125.7	-20.83	-41.7
		POR	0.150	2,482,892	371.5	61.6	0.214	2,482,892	532.5	88.3	-0.065	-43.3	-160.9	-26.68	-43.3
WAK-1 to WAK-3	7.60	04/13/09	0.220	2,452,641	539.6	71.0	0.260	2,452,641	637.7	83.9	-0.040	-18.2	-98.1	-12.91	-18.2
		04/16/09	0.200	2,513,143	502.6	66.1	0.170	2,513,143	427.2	56.2	0.030	15.0	75.4	9.92	15.0
		POR	0.210	2,482,892	521.1	68.6	0.214	2,482,892	532.5	70.1	-0.005	-2.2	-11.4	-1.49	-2.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WAKULLA SPRINGS (WAKULLA CO.) - TOTAL NITROGEN (TN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WAK-1 to WAK-2	1.57	04/13/09	0.706	2,452,641	1731.6	1104.0	0.64	2,452,641	1564.8	997.6	0.068	9.6	166.8	106.33	9.6
		04/16/09	0.675	2,513,143	1696.4	1081.5	0.60	2,513,143	1505.4	959.8	0.076	11.3	191.0	121.77	11.3
		POR	0.690	2,482,892	1714.0	1092.7	0.618	2,482,892	1535.1	978.7	0.072	10.4	178.9	114.05	10.4
WAK-2 to WAK-3	6.03	04/13/09	0.638	2,452,641	1564.8	259.4	0.71	2,452,641	1729.1	286.7	-0.067	-10.5	-164.3	-27.24	-10.5
		04/16/09	0.599	2,513,143	1505.4	249.6	0.64	2,513,143	1595.8	264.6	-0.036	-6.0	-90.5	-15.00	-6.0
		POR	0.618	2,482,892	1535.1	254.5	0.670	2,482,892	1662.5	275.6	-0.051	-8.3	-127.4	-21.12	-8.3
WAK-1 to WAK-3	7.60	04/13/09	0.706	2,452,641	1731.6	227.8	0.705	2,452,641	1729.1	227.5	0.001	0.1	2.5	0.32	0.1
		04/16/09	0.675	2,513,143	1696.4	223.2	0.635	2,513,143	1595.8	210.0	0.040	5.9	100.5	13.23	5.9
		POR	0.690	2,482,892	1714.0	225.5	0.670	2,482,892	1662.5	218.7	0.021	3.0	51.5	6.77	3.0

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WAKULLA SPRINGS (WAKULLA CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WAK-1 to WAK-2	1.57	04/13/09	0.030	2,452,641	73.6	46.9	0.027	2,452,641	66.2	42.2	0.003	10.0	7.4	4.69	10.0
		04/16/09	0.025	2,513,143	62.8	40.1	0.023	2,513,143	57.8	36.9	0.002	8.0	5.0	3.20	8.0
		POR	0.027	2,482,892	68.2	43.5	0.025	2,482,892	62.0	39.5	0.002	9.1	6.2	3.95	9.1
WAK-2 to WAK-3	6.03	04/13/09	0.027	2,452,641	66.2	11.0	0.028	2,452,641	68.7	11.4	-0.001	-3.7	-2.5	-0.41	-3.7
		04/16/09	0.023	2,513,143	57.8	9.6	0.025	2,513,143	62.8	10.4	-0.002	-8.7	-5.0	-0.83	-8.7
		POR	0.025	2,482,892	62.0	10.3	0.026	2,482,892	65.8	10.9	-0.002	-6.0	-3.7	-0.62	-6.0
WAK-1 to WAK-3	7.60	04/13/09	0.030	2,452,641	73.6	9.7	0.028	2,452,641	68.7	9.0	0.002	6.7	4.9	0.65	6.7
		04/16/09	0.025	2,513,143	62.8	8.3	0.025	2,513,143	62.8	8.3	0.000	0.0	0.0	0.00	0.0
		POR	0.027	2,482,892	68.2	9.0	0.026	2,482,892	65.8	8.7	0.001	3.6	2.5	0.32	3.6

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WAKULLA SPRINGS (WAKULLA CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WAK-1 to WAK-2	1.57	04/13/09	0.035	2,452,641	85.8	54.7	0.035	2,452,641	85.8	54.7	0.000	0.0	0.0	0.00	0.0
		04/16/09	0.034	2,513,143	85.4	54.5	0.029	2,513,143	72.9	46.5	0.005	14.7	12.6	8.01	14.7
		POR	0.034	2,482,892	85.6	54.6	0.032	2,482,892	79.4	50.6	0.003	7.3	6.3	4.01	7.3
WAK-2 to WAK-3	6.03	04/13/09	0.035	2,452,641	85.8	14.2	0.033	2,452,641	80.9	13.4	0.002	5.7	4.9	0.81	5.7
		04/16/09	0.029	2,513,143	72.9	12.1	0.029	2,513,143	72.9	12.1	0.000	0.0	0.0	0.00	0.0
		POR	0.032	2,482,892	79.4	13.2	0.031	2,482,892	76.9	12.8	0.001	3.1	2.5	0.41	3.1
WAK-1 to WAK-3	7.60	04/13/09	0.035	2,452,641	85.8	11.3	0.033	2,452,641	80.9	10.6	0.002	5.7	4.9	0.65	5.7
		04/16/09	0.034	2,513,143	85.4	11.2	0.029	2,513,143	72.9	9.6	0.005	14.7	12.6	1.65	14.7
		POR	0.034	2,482,892	85.6	11.3	0.031	2,482,892	76.9	10.1	0.004	10.2	8.7	1.15	10.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WEEKI WACHEE SPRINGS (HERNANDO CO.) - AMMONIA (NH_3-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WWS-1 to WWS-2	0.66	03/09/09	0.167	226,262	37.8	57.6	0.036	226,262	8.1	12.4	0.131	78.4	29.6	45.16	78.4
		03/12/09	0.036	226,667	8.2	12.4	0.038	226,667	8.6	13.1	-0.002	-5.6	-0.5	-0.69	-5.6
		POR	0.101	226,464	23.0	35.0	0.037	226,464	8.4	12.8	0.064	63.5	14.6	22.23	63.5
WWS-2 to WWS-3	2.14	03/09/09	0.036	226,262	8.1	3.8	0.035	226,262	7.9	3.7	0.001	2.8	0.2	0.11	2.8
		03/12/09	0.038	226,667	8.6	4.0	0.036	226,667	8.2	3.8	0.002	5.3	0.5	0.21	5.3
		POR	0.037	226,464	8.4	3.9	0.036	226,464	8.0	3.8	0.002	4.1	0.3	0.16	4.1
WWS-1 to WWS-3	2.80	03/09/09	0.167	226,262	37.8	13.5	0.035	226,262	7.9	2.8	0.132	79.0	29.9	10.68	79.0
		03/12/09	0.036	226,667	8.2	2.9	0.036	226,667	8.2	2.9	0.000	0.0	0.0	0.00	0.0
		POR	0.101	226,464	23.0	8.2	0.036	226,464	8.0	2.9	0.066	65.0	14.9	5.34	65.0

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WEEKI WACHEE SPRINGS (HERNANDO CO.) - NITRITE+NITRATE (NO_X-N)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WWS-1 to WWS-2	0.66	03/09/09	0.750	226,262	169.7	258.5	0.737	226,262	166.8	254.0	0.013	1.7	2.9	4.48	1.7
		03/12/09	0.724	226,667	164.1	250.0	0.707	226,667	160.3	244.1	0.017	2.3	3.9	5.87	2.3
		POR	0.737	226,464	166.9	254.3	0.722	226,464	163.5	249.1	0.015	2.0	3.4	5.18	2.0
WWS-2 to WWS-3	2.14	03/09/09	0.737	226,262	166.8	77.9	0.696	226,262	157.5	73.6	0.041	5.6	9.3	4.33	5.6
		03/12/09	0.707	226,667	160.3	74.9	0.693	226,667	157.1	73.4	0.014	2.0	3.2	1.48	2.0
		POR	0.722	226,464	163.5	76.4	0.694	226,464	157.3	73.5	0.027	3.8	6.2	2.91	3.8
WWS-1 to WWS-3	2.80	03/09/09	0.750	226,262	169.7	60.7	0.696	226,262	157.5	56.3	0.054	7.2	12.2	4.37	7.2
		03/12/09	0.724	226,667	164.1	58.7	0.693	226,667	157.1	56.2	0.031	4.3	7.0	2.51	4.3
		POR	0.737	226,464	166.9	59.7	0.694	226,464	157.3	56.2	0.042	5.8	9.6	3.44	5.8

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WEEKI WACHEE SPRINGS (HERNANDO CO.) - TOTAL KJELDAHL NITROGEN (TKN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WWS-1 to WWS-2	0.66	03/09/09	0.080	226,262	18.1	27.6	0.080	226,262	18.1	27.6	0.000	0.0	0.0	0.00	0.0
		03/12/09	0.080	226,667	18.1	27.6	0.100	226,667	22.7	34.5	-0.020	-25.0	-4.5	-6.91	-25.0
		POR	0.080	226,464	18.1	27.6	0.090	226,464	20.4	31.1	-0.010	-12.5	-2.3	-3.45	-12.5
WWS-2 to WWS-3	2.14	03/09/09	0.080	226,262	18.1	8.5	0.140	226,262	31.7	14.8	-0.060	-75.0	-13.6	-6.34	-75.0
		03/12/09	0.100	226,667	22.7	10.6	0.080	226,667	18.1	8.5	0.020	20.0	4.5	2.12	20.0
		POR	0.090	226,464	20.4	9.5	0.110	226,464	24.9	11.6	-0.020	-22.2	-4.5	-2.11	-22.2
WWS-1 to WWS-3	2.80	03/09/09	0.080	226,262	18.1	6.5	0.140	226,262	31.7	11.3	-0.060	-75.0	-13.6	-4.85	-75.0
		03/12/09	0.080	226,667	18.1	6.5	0.080	226,667	18.1	6.5	0.000	0.0	0.0	0.00	0.0
		POR	0.080	226,464	18.1	6.5	0.110	226,464	24.9	8.9	-0.030	-37.5	-6.8	-2.43	-37.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WEEKI WACHEE SPRINGS (HERNANDO CO.) - TOTAL NITROGEN (TN)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WWS-1 to WWS-2	0.66	03/09/09	0.830	226,262	187.8	286.1	0.817	226,262	184.9	281.6	0.013	1.6	2.9	4.48	1.6
		03/12/09	0.804	226,667	182.2	277.6	0.807	226,667	182.9	278.7	-0.003	-0.4	-0.7	-1.04	-0.4
		POR	0.817	226,464	185.0	281.9	0.812	226,464	183.9	280.1	0.005	0.6	1.1	1.72	0.6
WWS-2 to WWS-3	2.14	03/09/09	0.817	226,262	184.9	86.4	0.836	226,262	189.2	88.4	-0.019	-2.3	-4.3	-2.01	-2.3
		03/12/09	0.807	226,667	182.9	85.5	0.773	226,667	175.2	81.9	0.034	4.2	7.7	3.60	4.2
		POR	0.812	226,464	183.9	85.9	0.804	226,464	182.2	85.1	0.008	0.9	1.7	0.80	0.9
WWS-1 to WWS-3	2.80	03/09/09	0.830	226,262	187.8	67.1	0.836	226,262	189.2	67.6	-0.006	-0.7	-1.4	-0.49	-0.7
		03/12/09	0.804	226,667	182.2	65.2	0.773	226,667	175.2	62.6	0.031	3.9	7.0	2.51	3.9
		POR	0.817	226,464	185.0	66.1	0.804	226,464	182.2	65.1	0.013	1.5	2.8	1.01	1.5

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WEEKI WACHEE SPRINGS (HERNANDO CO.) - SOLUBLE REACTIVE PHOSPHORUS (SRP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WWS-1 to WWS-2	0.66	03/09/09	0.010	226,262	2.3	3.4	0.010	226,262	2.3	3.4	0.000	0.0	0.0	0.00	0.0
		03/12/09	0.008	226,667	1.8	2.8	0.006	226,667	1.4	2.1	0.002	25.0	0.5	0.69	25.0
		POR	0.009	226,464	2.0	3.1	0.008	226,464	1.8	2.8	0.001	11.1	0.2	0.35	11.1
WWS-2 to WWS-3	2.14	03/09/09	0.010	226,262	2.3	1.1	0.008	226,262	1.8	0.8	0.002	20.0	0.5	0.21	20.0
		03/12/09	0.006	226,667	1.4	0.6	0.006	226,667	1.4	0.6	0.000	0.0	0.0	0.00	0.0
		POR	0.008	226,464	1.8	0.8	0.007	226,464	1.6	0.7	0.001	12.5	0.2	0.11	12.5
WWS-1 to WWS-3	2.80	03/09/09	0.010	226,262	2.3	0.8	0.008	226,262	1.8	0.6	0.002	20.0	0.5	0.16	20.0
		03/12/09	0.008	226,667	1.8	0.6	0.006	226,667	1.4	0.5	0.002	25.0	0.5	0.16	25.0
		POR	0.009	226,464	2.0	0.7	0.007	226,464	1.6	0.6	0.002	22.2	0.5	0.16	22.2

APPENDIX H

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN WEEKI WACHEE SPRINGS (HERNANDO CO.) - TOTAL PHOSPHORUS (TP)

Site	Segment Area (ha)	Date	Inflow Segment - Up Conc (mg/L)	Inflow Segment - Up Flow (m^3/d)	Inflow Segment - Up Mass (kg/d)	Inflow Segment - Up Mass (kg/ha/d)	Outflow Segment - Down Conc (mg/L)	Outflow Segment - Down Flow (m^3/d)	Outflow Segment - Down Mass (kg/d)	Outflow Segment - Down Mass (kg/ha/d)	Removal Conc (mg/L)	Removal Conc (%)	Removal Mass (kg/d)	Removal Mass (kg/ha/d)	Removal Mass (%)
WWS-1 to WWS-2	0.66	03/09/09	0.021	226,262	4.8	7.2	0.016	226,262	3.6	5.5	0.005	23.8	1.1	1.72	23.8
		03/12/09	0.016	226,667	3.6	5.5	0.016	226,667	3.6	5.5	0.000	0.0	0.0	0.00	0.0
		POR	0.018	226,464	4.2	6.4	0.016	226,464	3.6	5.5	0.002	13.5	0.6	0.86	13.5
WWS-2 to WWS-3	2.14	03/09/09	0.016	226,262	3.6	1.7	0.016	226,262	3.6	1.7	0.000	0.0	0.0	0.00	0.0
		03/12/09	0.016	226,667	3.6	1.7	0.016	226,667	3.6	1.7	0.000	0.0	0.0	0.00	0.0
		POR	0.016	226,464	3.6	1.7	0.016	226,464	3.6	1.7	0.000	0.0	0.0	0.00	0.0
WWS-1 to WWS-3	2.80	03/09/09	0.021	226,262	4.8	1.7	0.016	226,262	3.6	1.3	0.005	23.8	1.1	0.40	23.8
		03/12/09	0.016	226,667	3.6	1.3	0.016	226,667	3.6	1.3	0.000	0.0	0.0	0.00	0.0
		POR	0.018	226,464	4.2	1.5	0.016	226,464	3.6	1.3	0.002	13.5	0.6	0.20	13.5

Appendix I

Aquatic Vegetation

APPENDIX I

De Leon Springs (Volusia Co.) submersed aquatic vegetation observations from October 2008.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool	filamentous green algae	*Spirogyra sp.*	1	5
	muskgrass	*Chara sp.*	2	3
	southern naiad	*Najas guadalupensis*	3	1
	tape grass	*Vallisneria americana*	4	1
	hydrilla	*Hydrilla verticillata*	5	1
Spring Run	filamentous cyanobacteria	*Lyngbya sp.*	1	*trace*
	southern naiad	*Najas guadalupensis*	2	*trace*
	tape grass	*Vallisneria americana*	3	*trace*
	hydrilla	*Hydrilla verticillata*	4	*trace*
	coon-tail	*Ceratophyllum demersum*	5	*trace*
	widgeon grass	*Ruppia maritima*	6	*trace*

APPENDIX I

De Leon Springs (Volusia Co.) emergent and floating aquatic vegetation observations from October 2008.

Location	Common name	Scientific name
Spring Pool	--- *	---
Spring Run	water hemlock	*Cicuta maculata*
	water hyacinth	*Eichhornia crassipes*
	pennywort	*Hydrocotyle sp.*
	saltmarsh mallow	*Kosteletzkya virginica*
	duckweed	*Lemna sp.*
	water primrose	*Ludwigia peruviana*
	climbing hempvine	*Mikania scandens*
	spatterdock	*Nuphar luteum*
	water lettuce	*Pistia stratiotes*
	smartweed	*Polygonum sp.*
	pickerelweed	*Pontederia cordata*
	American cupscalegrass	*Sacciolepis striata*
	arrowhead	*Sagittaria lancifolia*
	water fern	*Salvinia minima*
	cattail	*Typha sp.*

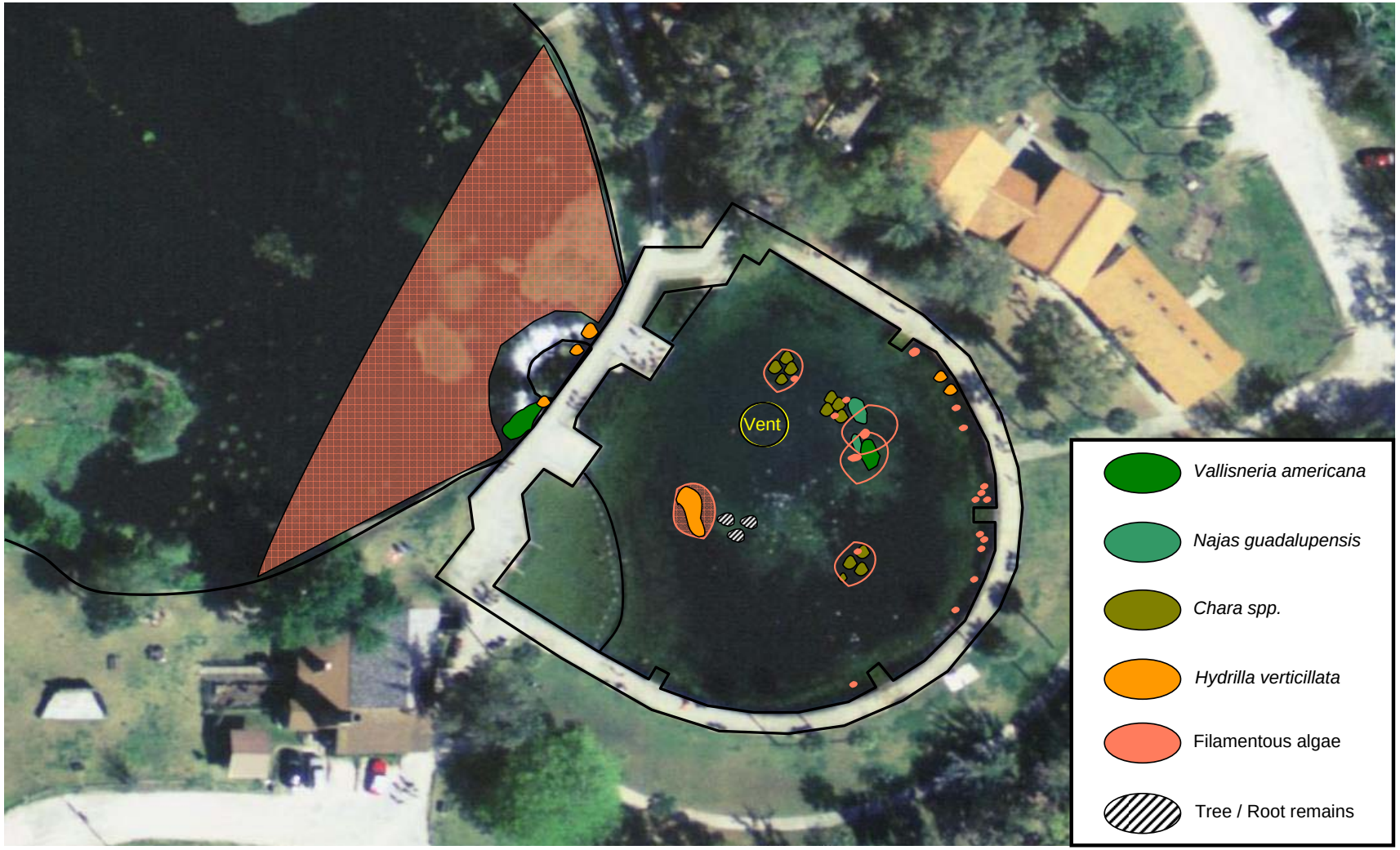
** No emergent or floating vegetation occurs in spring pool.*

APPENDIX I

De Leon Springs (Volusia Co.) riparian vegetation observations from October 2008.

Location	Common name	Scientific name
Spring Pool	--- *	---
Spring Run	red maple	*Acer rubrum*
	hickory	*Carya sp.*
	Florida dogwood	*Cornus foemina*
	ash	*Fraxinus sp.*
	Dahoon holly	*Ilex cassine*
	sweetgum	*Liquidambar styraciflua*
	wax myrtle	*Myrica cerifera*
	cabbage palm	*Sabal palmetto*
	bald cypress	*Taxodium distichum*

** No riparian vegetation occurs over spring pool, run coverage is 7 %.*



APPENDIX I
De Leon Springs (Volusia Co.) submersed aquatic vegetation map from October 2008.

APPENDIX I

Homosassa Springs (Citrus Co.) submersed aquatic vegetation observations from November 2008.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool	widgeon grass	*Ruppia maritima*	1	< 1%
	horned pondweed	*Zannichellia palustris*	2	<1%
	southern naiad	*Najas guadalupensis*	3	<1%
Spring Run	filamentous green algae	*Chaetomorpha sp.*	1	56
	filamentous cyanobacteria	*Lyngbya sp.*	2	5
	widgeon grass	*Ruppia maritima*	3	<1%
	horned pondweed	*Zannichellia palustris*	4	<1%
	southern naiad	*Najas guadalupensis*	5	<1%

APPENDIX I

Homosassa Springs (Citrus Co.) emergent and floating aquatic vegetation observations from November 2008.

Location	Common name	Scientific name
Spring Pool	--- *	---
Spring Run	giant leather fern	*Acrostichum danaeifolium*
	alligator weed	*Alternanthera philoxeroides*
	mosquito fern	*Azolla caroliniana*
	water hemlock	*Cicuta maculata*
	sawgrass	*Cladium jamaicense*
	day flower	*Commelina sp.*
	water hyacinth	*Eichhornia crassipes*
	spider lily	*Hymenocallis sp.*
	common reed	*Phragmites australis*
	sedge	*Scirpus sp.*

** No emergent or floating vegetation occurs in spring boil*

APPENDIX I
Homosassa Springs (Citrus Co.) riparian vegetation observations from November 2008.

Location	Common name	Scientific name
Spring Pool	red maple	*Acer rubrum*
	saltbush	*Baccharis halimifolia*
	Florida dogwood	*Cornus foemina*
	persimmon	*Diospyros virginiana*
	Dahoon holly	*Ilex cassine*
	southern red cedar	*Juniperus silicicola*
	wax myrtle	*Myrica cerifera*
	Boston fern	*Nephrolepis exaltata*
	swamp bay	*Persea palustis*
	water oak	*Quercus nigra*
	live oak	*Quercus virginiana*
	cabbage palm	*Sabal pametto*
	Carolina basswood	*Tilia caroliniana*
Spring Run	red maple	*Acer rubrum*
	climbing aster	*Aster carolinianus*
	saltbush	*Baccharis halimifolia*
	Florida dogwood	*Cornus foemina*
	persimmon	*Diospyros virginiana*
	Dahoon holly	*Ilex cassine*
	southern red cedar	*Juniperus silicicola*
	climbing hemp vine	*Mikania scandens*
	wax myrtle	*Myrica cerifera*
	tupelo	*Nyssa sp.*
	swamp bay	*Persea palustris*
	live oak	*Quercus virginiana*
	cabbage palm	*Sabal palmetto*

**approximately 20% of pool and 15% of run is shaded by riparian vegetation*



APPENDIX I
Homosassa Springs (Citrus Co.) submersed aquatic vegetation map from November 2008.

APPENDIX I
Ichetucknee Springs (Columbia Co.) submersed aquatic vegetation observations from July 2009.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pools				
Ichetucknee (main)	red ludwigia	*Ludwigia repens*	1	15
Blue hole (jug)	strap-leaf sagittaria	*Sagittaria kurziana*	1	85
Mission group	strap-leaf sagittaria	*Sagittaria kurziana*	1	90
	red ludwigia	*Ludwigia repens*	2	5
Devils (boiling)	strap-leaf sagittaria	*Sagittaria kurziana*	1	40
Millpond	strap-leaf sagittaria	*Sagittaria kurziana*	1	95
Spring Run	strap-leaf sagittaria	*Sagittaria kurziana*	1	
	tape grass	*Vallisneria americana*	2	
	muskgrass	*Chara sp.*	3	
	red ludwigia	*Ludwigia repens*	4	
	pennywort	*Hydrocotyle sp.*	5	
	wild rice	*Zizania aquatica*	6	
	water cress	*Nasturtium officinale*	7	
	coontail	*Ceratophyllum demersum*	8	
Spring Pools and Run	filamentous green algae	*Cladophora sp.*	1	
	filamentous yellow-green algae	*Vaucheria sp.*	2	
	filamentous cyanobacteria	*Lyngbya sp.*	3	
	filamentous green algae	*Spirogyra sp.*	4	

APPENDIX I

Ichetucknee Springs (Columbia Co.) emergent and floating aquatic vegetation observations from July 2009.

Location	Common name	Scientific name
Spring Run	caric sedge	*Carex sp.*
	water hemlock	*Cicuta maculata*
	cyperus sedge	*Cyperus sp.*
	pennywort	*Hydrocotyle sp.*
	spider lily	*Hymenocallis sp.*
	duckweed	*Lemna sp.*
	cardinal flower	*Lobelia cardinalis*
	water lettuce	*Pistia stratiotes*
	water fern	*Salvinia minima*
	bulrush	*Scirpus sp.*
	cat-tail	*Typha sp.*
	wild rice	*Zizania aquatica*

APPENDIX I
Ichetucknee Springs (Columbia Co.) riparian vegetation observations from July 2009.

Location	Common name	Scientific name
Spring Run	red maple	*Acer rubrum*
	saltbush	*Baccharis halimifolia*
	hornbeam	*Carpinus caroliniana*
	buttonbush	*Cephalanthus occidentalis*
	wild hydrangea	*Decumaria barbara*
	persimmon	*Diospyros virginiana*
	ash	*Fraxinus sp.*
	Dahoon holly	*Ilex cassine*
	Virginia willow	*Itea virginica*
	southern red cedar	*Juniperus silicicola*
	wax myrtle	*Myrica cerifera*
	tupelo	*Nyssa sp.*
	laurel oak	*Quercus laurifolia*
	overcup oak	*Quercus lyrata*
	live oak	*Quercus virginiana*
	poison ivy	*Rhus radicans*
	blue-stem palm	*Sabal minor*
	bald cypress	*Taxodium distichum*
	Bartram's airplant	*Tillandsia bartramii*
	grape	*Vitis sp.*

**approximately 49% of pools and 65% of run is shaded by riparian vegetation*

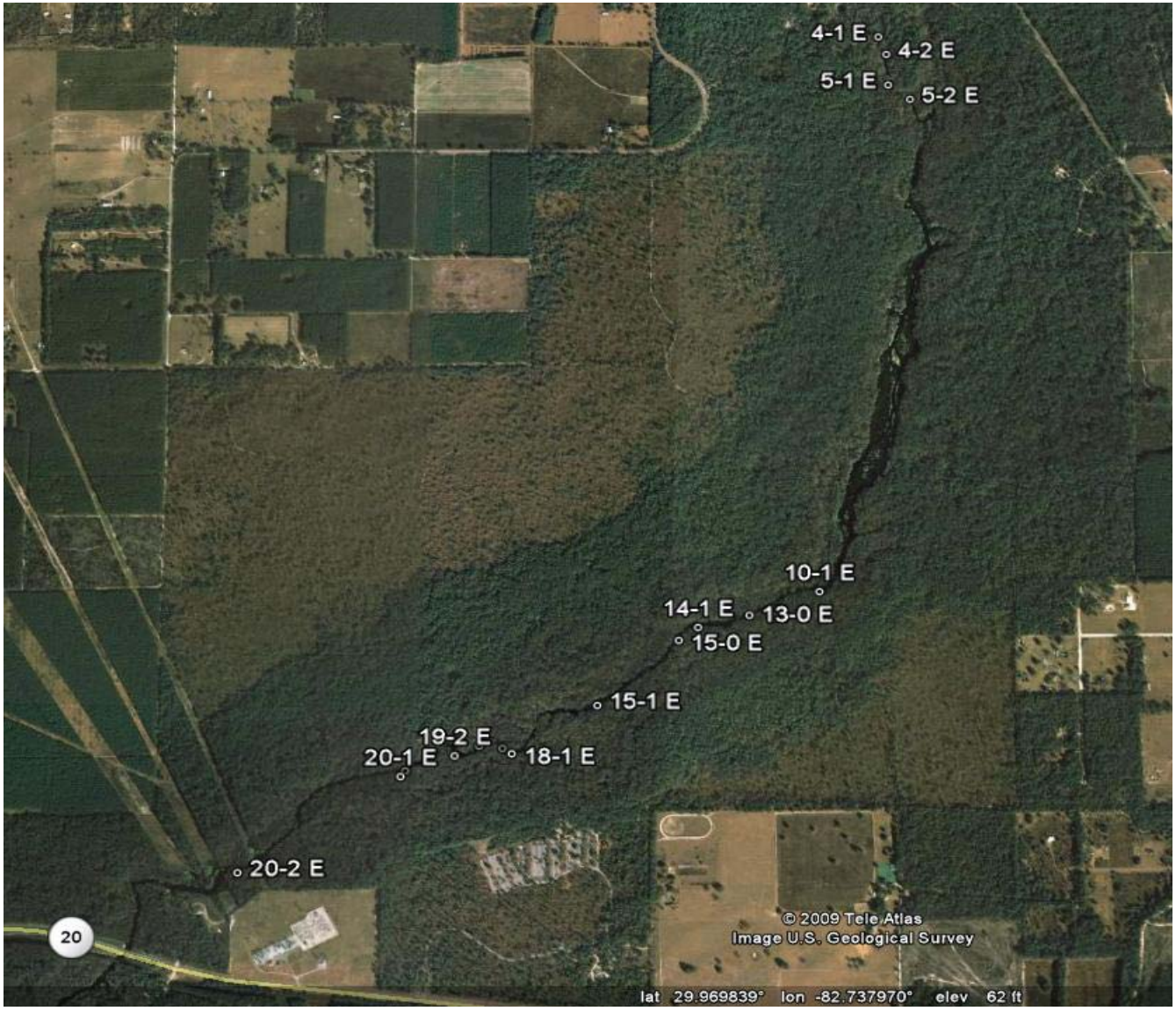
APPENDIX I

Percent cover of SAV for the Ichetucknee River July 7, 2009.

Transect	Linear Distance from top dock (km)	Percent Cover (%)														
		SAG	VAL	CHA	HYM	CER	LUD	HYD	ZIZ	Canopy Cover	AVG VEG	SAND	SILT	ALGAE	SAV	BARE
4-1	0.14	47				5	10	30		80	22.9	5.6		30.0	52.9	5.6
4-2	0.21	60			20		50	28		90	39.4	11.1			39.4	11.1
5-1	0.32	30					5	1	4	60	9.9	19.4		60.0	69.9	19.4
5-2	0.41	41			20			7		100	22.4	7.0	11.6		22.4	18.6
10-1	2.40	50	80				60				63.3	40.3		50.0	113.3	40.3
12-1	2.55		50		1	1				75	17.3	50.0			17.3	50.0
13-0	2.65	10	60							80	35.0	30.0			35.0	30.0
14-1	2.83	30	35	20							28.3	15.0			28.3	15.0
15-0	2.92	20	75							60	47.5	5.0			47.5	5.0
15-1	3.28	20	60							40	40.0	20.0			40.0	20.0
18-1	3.64	15	25							75	20.0	40.0		20.0	40.0	40.0
19-0	3.69	30	65					1		75	32.0	5.0		1.0	33.0	5.0
19-1	3.80	1	95		4					40	33.3				33.3	0.0
19-2	3.89		95							25	95.0	4.0	3.0		95.0	7.0
20-0	4.09	85			2			1		20	29.3	10.0		2.0	31.3	10.0
20-1	4.12	80								15	80.0	20.0			80.0	20.0
20-2	4.79	50								10	50.0	50.0			50.0	50.0

Key:

SAG	Sagittaria kurziana
VAL	Valisineria americana
CHA	Chara (prob.)zeylonica
HYM	Hymenocallis rotata
CER	Ceratophyllum
LUD	Ludwigia repens
HYD	Hydrocotyle (prob.) verticillata
ZIZ	Zizania aquatica



Transect	LAT	LONG
4-1E	29.98310	-82.76039
4-1W	29.98304	-82.76066
4-2E	29.98248	-82.76011
4-2W	29.98241	-82.76049
5-1E	29.98143	-82.76005
5-1W	29.98142	-82.76003
5-2E	29.98093	-82.75927
5-2W	29.98085	-82.75936
10-1E	29.96433	-82.76245
10-1W	29.96454	-82.76248
12-1E	29.96378	-82.76381
12-1W	29.96406	-82.76419
13-0E	29.96356	-82.76486
13-0W	29.96361	-82.76487
14-1E	29.96316	-82.76662
14-1W	29.96332	-82.76662
15-0E	29.96274	-82.76728
15-0W	29.96278	-82.76740
15-1E	29.96062	-82.77005
15-1W	29.96074	-82.77009
18-1E	29.95907	-82.77295
18-1W	29.95913	-82.77297
19-0E	29.95924	-82.77327
19-0W	29.95924	-82.77343
19-1E	29.95931	-82.77407
19-1W	29.95944	-82.77432
19-2E	29.95900	-82.77490
19-2W	29.95912	-82.77481
20-0E	29.95851	-82.77658
20-0W	29.95862	-82.77663
20-1E	29.95833	-82.77673
20-1W	29.95860	-82.77686
20-2E	29.95526	-82.78218
20-2W	29.95553	-82.78227

Source: DEP

APPENDIX I
Ichetucknee River FDEP vegetation transects (east side point shown).

APPENDIX I

Jackson Blue Springs (Jackson Co.) submersed aquatic vegetation observations from January 2009.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool	tape grass	*Vallisneria americana*	1	25
	coontail	*Ceratophyllum demersum*	2	15
	southern naiad	*Najas guadalupensis*	3	3
	muskgrass	*Chara sp.*	4	2
Spring Run	coontail	*Ceratophyllum demersum*	1	77
	tape grass	*Vallisneria americana*	2	46
	muskgrass	*Chara sp.*	3	1
	filamentous green algae	*Spirogyra sp.*	4	1

from plankton tow material:

filamentous green algae *Spirogyra sp.*

APPENDIX I

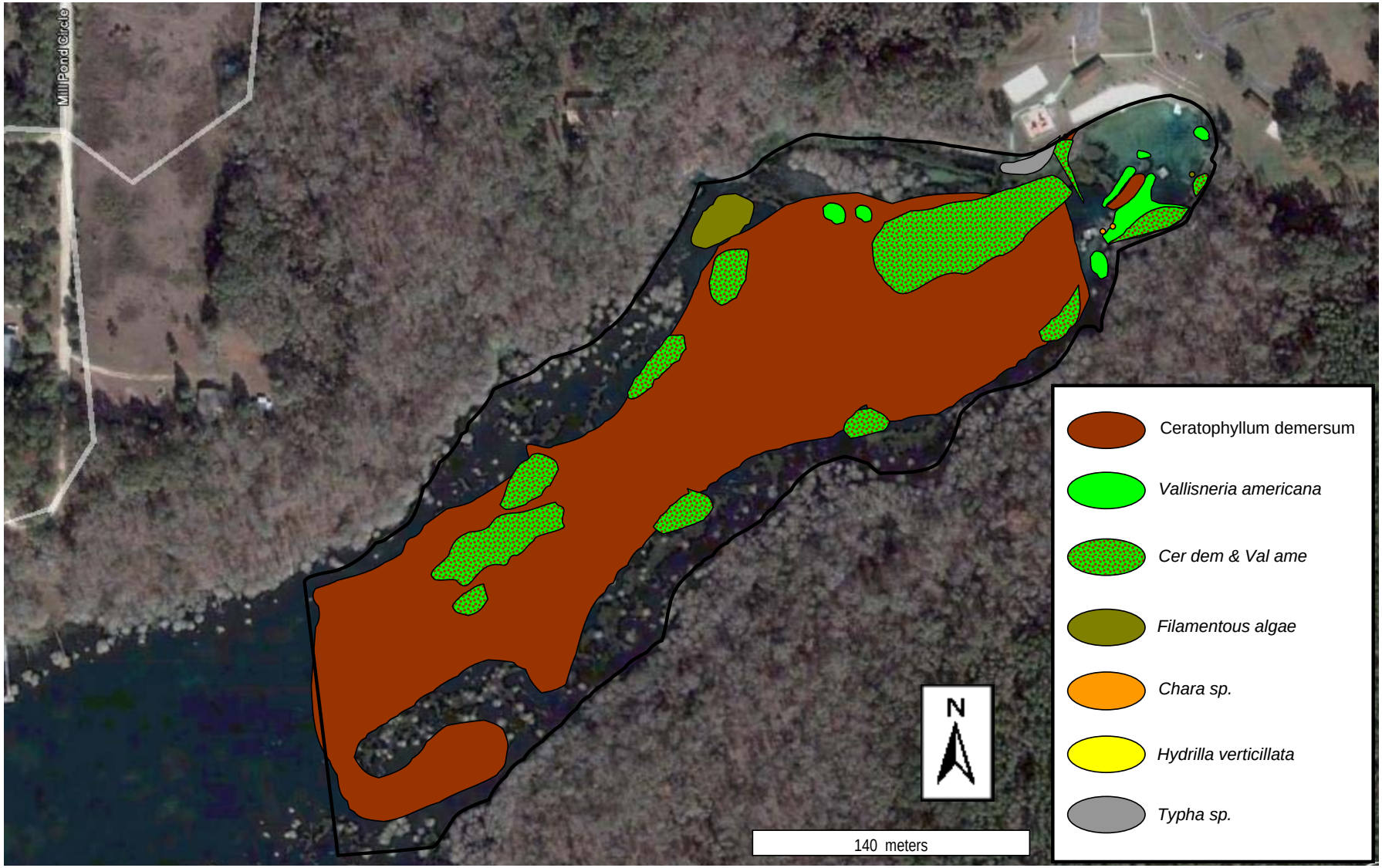
Jackson Blue Springs (Jackson Co.) emergent and floating aquatic vegetation observations from January 2009.

Location	Common name	Scientific name
Spring Pool	alligator weed	*Alternanthera philoxeroides*
	pennywort	*Hydrocotyle sp.*
	duckweed	*Lemna sp.*
	cat-tail	*Typha sp.*
Spring Run	caric sedge	*Carex sp.*
	saw grass	*Cladium jamaicense*
	duckweed	*Lemna sp.*
	pickerelweed	*Pontederia cordata*
	cat-tail	*Typha sp.*
	water-meal	*Wolffia sp.*

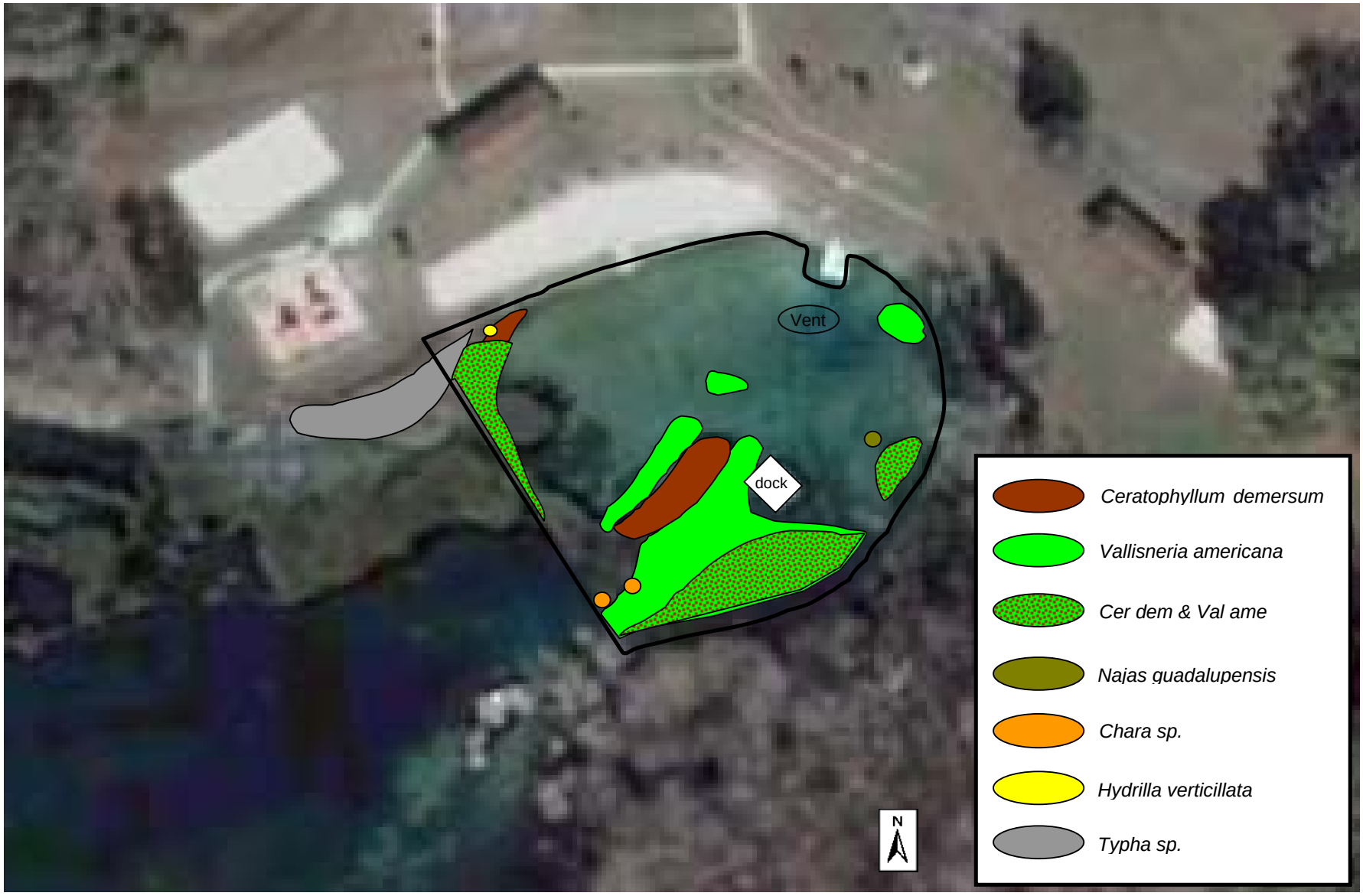
APPENDIX I
Jackson Blue Springs (Jackson Co.) riparian vegetation observations from January 2009.

Location	Common name	Scientific name
Spring Pool	hickory	*Carya sp.*
	oak	*Quercus sp.*
	bald cypress*	*Taxodium distichum*
Spring Run	southern red cedar	*Juniperus silicicola*
	swamp bay	*Persea palustris*
	bald cypress*	*Taxodium distichum*

* dominant riparian vegetation
**approximately 5% of pool and run is shaded by riparian vegetation*



APPENDIX I
Jackson Blue Springs (Jackson Co.) submersed aquatic vegetation map from January 2009.



APPENDIX I
Jackson Blue Springs (Jackson Co.) submersed aquatic vegetation map from January 2009 - pool.

APPENDIX I
Madison Blue Springs (Madison Co.) submersed aquatic vegetation observations from December 2008.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool	filamentous yellow-green algae	*Vaucheria sp.*	1	31
	water moss	*Fontinalis sp.*	2	<1
Spring Run	filamentous yellow-green algae	Vaucheria sp.	1	17
	water moss	*Fontinalis sp.*	2	<1
	from plankton tow material:			
	filamentous green algae	*Spirogyra sp.*		
	filamentous cyanobacteria	*Lyngbya sp.*		
	filamentous yellow-green algae	*Vaucheria sp.*		

APPENDIX I

Madison Blue Springs (Madison Co.) emergent and floating aquatic vegetation observations from December 2008.

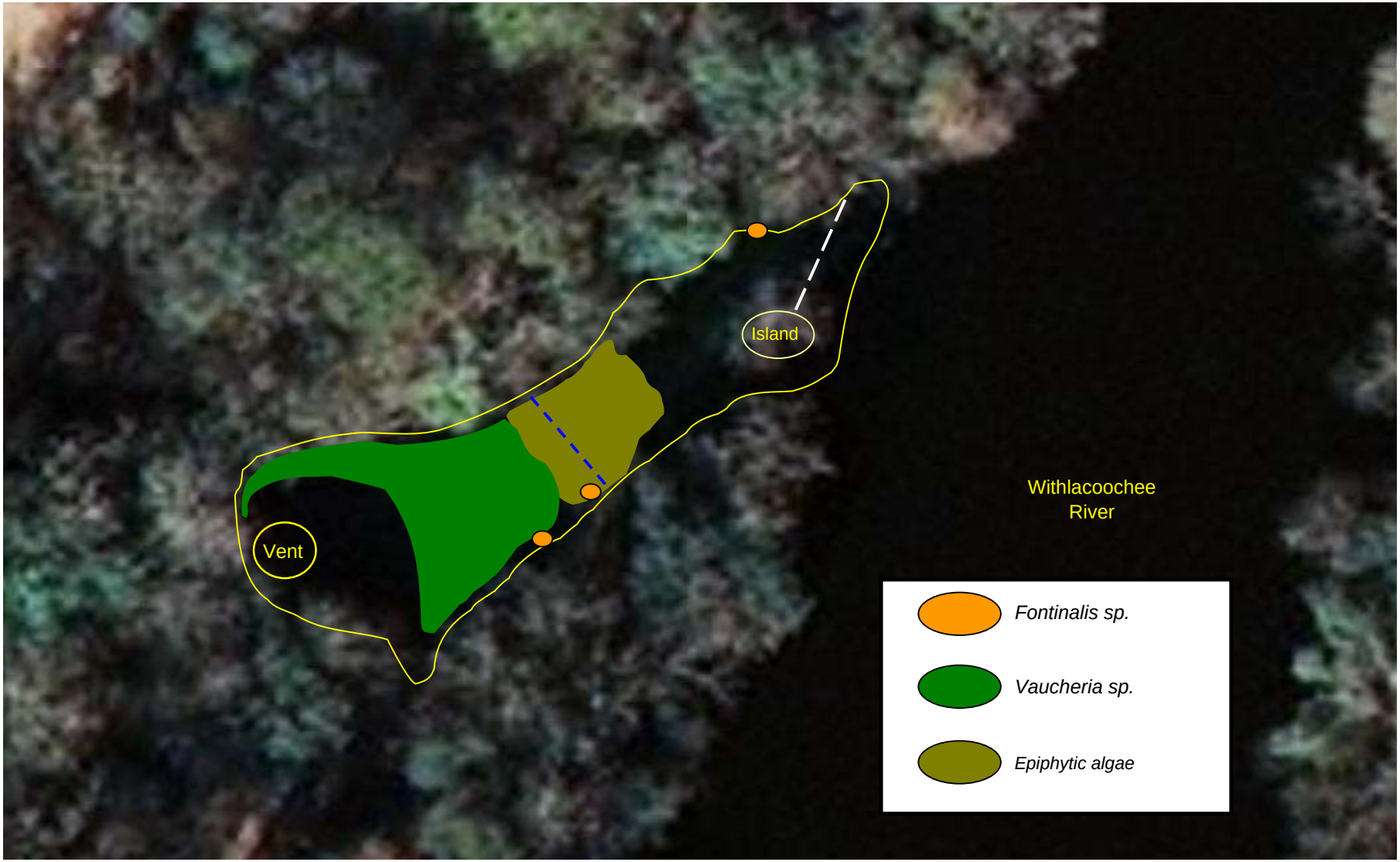
Location	Common name	Scientific name
Spring Pool	--- *	---
Spring Run	--- *	---

** No emergent or floating vegetation were in spring pool or run.*

APPENDIX I
Madison Blue Springs (Madison Co.) riparian vegetation observations from December 2008.

Location	Common name	Scientific name
Spring Pool	hickory	*Carya sp.*
	sugarberry	*Celtis laevigata*
	climbing fig	*Ficus pumila*
	sweetgum	*Liquidambar styraciflua*
	Japanese honeysuckle	*Lonicera japonica*
	loblolly pine	*Pinus taeda*
	laurel oak	*Quercus laurifolia*
	live oak	*Quercus virginiana*
	blue-stem palm	*Sabal minor*
	cabbage palm	*Sabal palmetto*
	saw palmetto	*Serenoa repens*
	green briar	*Smilax sp.*
	bald cypress	*Taxodium distichum*
	elm	*Ulmus sp.*
	grape	*Vitis sp.*
Spring Run	buttonbush	*Cephalanthus occidentalis*
	sweetgum	*Liquidambar styraciflua*
	laurel oak	*Quercus laurifolia*
	cabbage palm	*Sabal palmetto*
	bald cypress	*Taxodium distichum*

**approximately 25% of pool and 50% of run is shaded by riparian vegetation*



APPENDIX I
Madison Blue Springs (Madison Co.) submersed aquatic vegetation map from December 2008.

APPENDIX I

Manatee Springs (Levy Co.) submersed aquatic vegetation observations from August 2009.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool [1]	filamentous yellow-green algae	*Vaucheria sp.*	1*	56
	filamentous green algae	*Spirogyra sp.*		
	filamentous cyanobacteria	*Lyngbya sp.*		
	filamentous green algae	*Hydrodictyon sp.*		
	hydrilla	*Hydrilla verticillata*	2	<1
	southern naiad	*Najas guadalupensis*	3	<1
Spring Run	filamentous yellow-green algae	*Vaucheria sp.*	1*	83
	filamentous green algae	*Spirogyra sp.*		
	filamentous cyanobacteria	*Lyngbya sp.*		
	spatterdock	*Nuphar luteum*	2	<1
	fanwort	*Cabomba caroliniana*	3	<1

[1] *pool area goes to rope separating swimming and canoe zones.*

** filamentous algae presented in relative abundance as found in microscopic examinations*

Vaucheria identified as Vaucheria geminata by Stevenson et al. 2007

APPENDIX I

Manatee Springs (Levy Co.) emergent and floating aquatic vegetation observations from August 2009.

Location	Common name	Scientific name
Spring Pool [1]	east Indian hygrophila	*Hygrophila polysperma*
	duckweed	*Lemna sp.*
	water fern	*Salvinia minima*
Spring Run	alligator weed	*Alternanthera philoxeroides*
	caric sedge	*Carex sp.*
	swamp lily	*Crinum americanum*
	white-top sedge	*Dichromena colorata*
	pennywort	*Hydrocotyle sp.*
	east Indian hygrophila	*Hygrophila polysperma*
	duckweed	*Lemna sp.*
	spatterdock	*Nuphar luteum*
	panic grass	*Panicum sp.*
	water fern	*Salvinia minima*
	lizard's tail	*Saururus cernuus*

[1] *pool area goes to rope separating swimming and canoe zones.*

APPENDIX I
Manatee Springs (Levy Co.) riparian vegetation observations from August 2009.

Location	Common name	Scientific name
Spring Pool [1]	red maple	*Acer rubrum*
	pepper vine	*Ampelopsis arborea*
	Florida dogwood	*Cornus foemina*
	ash	*Fraxinus sp.*
	wax myrtle	*Myrica cerifera*
	live oak	*Quercus virginiana*
	willow	*Salix sp.*
	bald cypress	*Taxodium distichum*
Spring Run	red maple	*Acer rubrum*
	supplejack vine	*Berchemia scandens*
	buttonbush	*Cephalanthus occidentalis*
	Florida dogwood	*Cornus foemina*
	persimmon	*Diospyros virginiana*
	ash	*Fraxinus sp.*
	tupelo	*Nyssa sp.*
	poison ivy	*Rhus radicans*
	willow	*Salix sp.*
	bald cypress	*Taxodium distichum*
	Bartram's airplant	*Tillandsia bartramii*

**approximately 30% of the spring pool and 50% the surveyed run was shaded by riparian vegetation*

[1] pool area goes to rope separating swimming and canoe zones.

APPENDIX I

Ponce de Leon Springs (Holmes Co.) submersed aquatic vegetation observations from September 2009.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool	filamentous green algae	*Hydrodictyon sp.*	1*	25
	filamentous green algae	*Spirogyra sp.*		
	filamentous green algae	*Ulothrix sp.*		
	filamentous cyanobacteria	*Lyngbya sp.*		
	filamentous red algae	*Batrachospermum sp.*		
	southern naiad	*Najas guadalupensis*	2	20
	Illinois pondweed	*Potamogeton illinoensis*	3	15
	muskgrass	*Chara sp.*	4	8
	red ludwigia	*Ludwigia repens*	5	5
	water moss	*Brachelyma sp.*	6	2
	liverwort	*Porella pinnata*	7	1
Spring Run	red ludwigia	*Ludwigia repens*	1	4
	muskgrass	*Chara sp.*	2	2
	water moss	*Brachelyma sp.*	3	1
	liverwort	*Porella pinnata*	4	1

** filamentous algae presented in relative abundance as found in microscopic examinations*

APPENDIX I

Ponce de Leon Springs (Holmes Co.) emergent aquatic vegetation observations from September 2009.

Location	Common name	Scientific name
Spring Pool	caric sedge	*Carex sp.*
	lake hygrophila	*Hygrophila lacustris*
	red ludwigia	*Ludwigia repens*
	spoonflower	*Peltandra sagittifolia*
Spring Run	caric sedge	*Carex sp.*
	pennywort	*Hydrocotyle sp.*
	lake hygrophila	*Hygrophila lacustris*
	cardinal flower	*Lobelia cardinalis*
	red ludwigia	*Ludwigia repens*
	spoonflower	*Peltandra sagittifolia*
	lizard's tail	*Saururus cernuus*

[*] *no floating aquatic plants present in pool or run.*

APPENDIX I
Ponce de Leon Springs (Holmes Co.) riparian vegetation observations from September 2009.

Location	Common name	Scientific name
Spring Pool	pepper vine	*Ampelopsis arborea*
	saltbush	*Baccharis halimifolia*
	ash	*Fraxinus sp.*
	southern red cedar	*Juniperus silicicola*
	climbing hemp vine	*Mikania scandens*
	wax myrtle	*Myrica cerifera*
	loblolly pine	*Pinus taeda*
	live oak	*Quercus virginiana*
	bald cypress	*Taxodium distichum*
Spring Run	red maple	*Acer rubrum*
	hornbeam	*Carpinus caroliniana*
	titi	*Cyrilla racemiflora*
	ash	*Fraxinus sp.*
	dahoon holly	*Ilex cassine*
	American holly	*Ilex opaca*
	southern magnolia	*Magnolia grandiflora*
	tupelo	*Nyssa sp.*
	sycamore	*Platanus occidentalis*
	blue-stem palm	*Sabal minor*
	bald cypress	*Taxodium distichum*
	grape	*Vitis sp.*

**approximately 35% of the spring pool and 85% the surveyed run was shaded by riparian vegetation*

APPENDIX I

Rainbow Springs (Marion Co.) submersed aquatic vegetation observations from June 2009.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool [1]	Illinois pondweed	*Potamogeton illinoensis*	1	40
	strap-leaf sagittaria	*Sagittaria kurziana*	2	
	bladderwort	*Utricularia sp.*	3	
	variable-leaf milfoil	*Myriophyllum heterophyllum*	4	
Spring Run [2]	strap-leaf sagittaria	*Sagittaria kurziana*	1	80
	Illinois pondweed	*Potamogeton illinoensis*	2	
	tape grass	*Vallisneria americana*	3	
	bladderwort	*Utricularia sp.*	4	
	red ludwigia	*Ludwigia repens*	5	
	hydrilla	*Hydrilla verticillata*	6	
	variable-leaf milfoil	*Myriophyllum heterophyllum*	7	
	coontail	*Ceratophyllum demersum*	8	
	water moss	*Fontinalis sp.*	9	
	southern naiad	*Najas guadalupensis*	10	

[1] *pool area goes to canoe launch area*

[2] *spring run only surveyed in upper 1,100 meters*

from plankton tow material:

filamentous green algae	*Cladophora sp.*
filamentous cyanobacteria	*Lyngbya sp.*
filamentous green algae	*Spirogyra sp.*
filamentous yellow-green algae	*Vaucheria sp.*

APPENDIX I

Rainbow Springs (Marion Co.) emergent and floating aquatic vegetation observations from June 2009.

Location	Common name	Scientific name
Spring Pool [1]	water hemlock	*Cicuta maculata*
	umbrella flat sedge	*Cyperus involucratus*
	pennywort	*Hydrocotyle sp.*
	climbing hemp vine	*Mikania scandens*
	Egyptian paspalidium	*Paspalidium geminatum*
Spring Run [2]	water hemlock	*Cicuta maculata*
	saw grass	*Cladium jamaicense*
	wild taro	*Colocasia esculenta*
	swamp lily	*Crinum americanum*
	umbrella flat sedge	*Cyperus involucratus*
	pennywort	*Hydrocotyle sp.*
	climbing hemp vine	*Mikania scandens*
	maidencane	*Panicum hemitomon*
	Egyptian paspalidium	*Paspalidium geminatum*
	arrowhead	*Sagittaria lancifolia*

[1] *pool area goes to canoe launch area*

[2] *spring run only surveyed in upper 1,100 meters*

APPENDIX I
Rainbow Springs (Marion Co.) riparian vegetation observations from June 2009.

Location	Common name	Scientific name
Spring Pool [1]	live oak	*Quercus virginiana*
	cabbage palm	*Sabal palmetto*
Spring Run [2]	red maple	*Acer rubrum*
	climbing aster	*Aster carolinianus*
	buttonbush	*Cephalanthus occidentalis*
	Florida dogwood	*Cornus foemina*
	ash	*Fraxinus sp.*
	Dahoon holly	*Ilex cassine*
	wax myrtle	*Myrica cerifera*
	Virginia creeper	*Parthenocissus quinquefolia*
	swamp bay	*Persea palustris*
	laurel oak	*Quercus laurifolia*
	live oak	*Quercus virginiana*
	cabbage palm	*Sabal palmetto*
	willow	*Salix sp.*
	American elderberry	*Sambucus canadensis*
	bald cypress	*Taxodium distichum*
	grape	*Vitis sp.*

**approximately 5% of the spring pool and 5% the surveyed run was shaded by riparian vegetation*

[1] *pool area goes to canoe launch area*

[2] *spring run only surveyed in upper 1,100 meters*

APPENDIX I
Silver Glen Springs (Marion Co.) submersed aquatic vegetation observations from February 2009.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool	filamentous cyanobacteria	*Lyngbya sp.*	1	40
	horned pondweed	*Zannichellia palustris*	2	8
	tape grass	*Vallisneria americana*	3	5
	hydrilla	*Hydrilla verticillata*	4	1
	muskgrass	*Chara sp.*	5	1
	widgeon grass	*Ruppia maritima*	6	<1
Spring Run	tape grass	*Vallisneria americana*	1	57
	filamentous cyanobacteria	*Lyngbya sp.*	2	46
	hydrilla	*Hydrilla verticillata*	3	3
	southern naiad	*Najas guadalupensis*	4	2
	coontail	*Ceratophyllum demersum*	5	1

spring pool goes to rope boat barrier

from plankton tow material:

filamentous green algae	*Cladophora sp.*
filamentous green algae	*Enteromorpha*
filamentous cyanobacteria	*Lyngbya sp.*
filamentous green algae	*Spirogyra sp.*

APPENDIX I

Silver Glen Springs (Marion Co.) emergent and floating aquatic vegetation observations from February 2009.

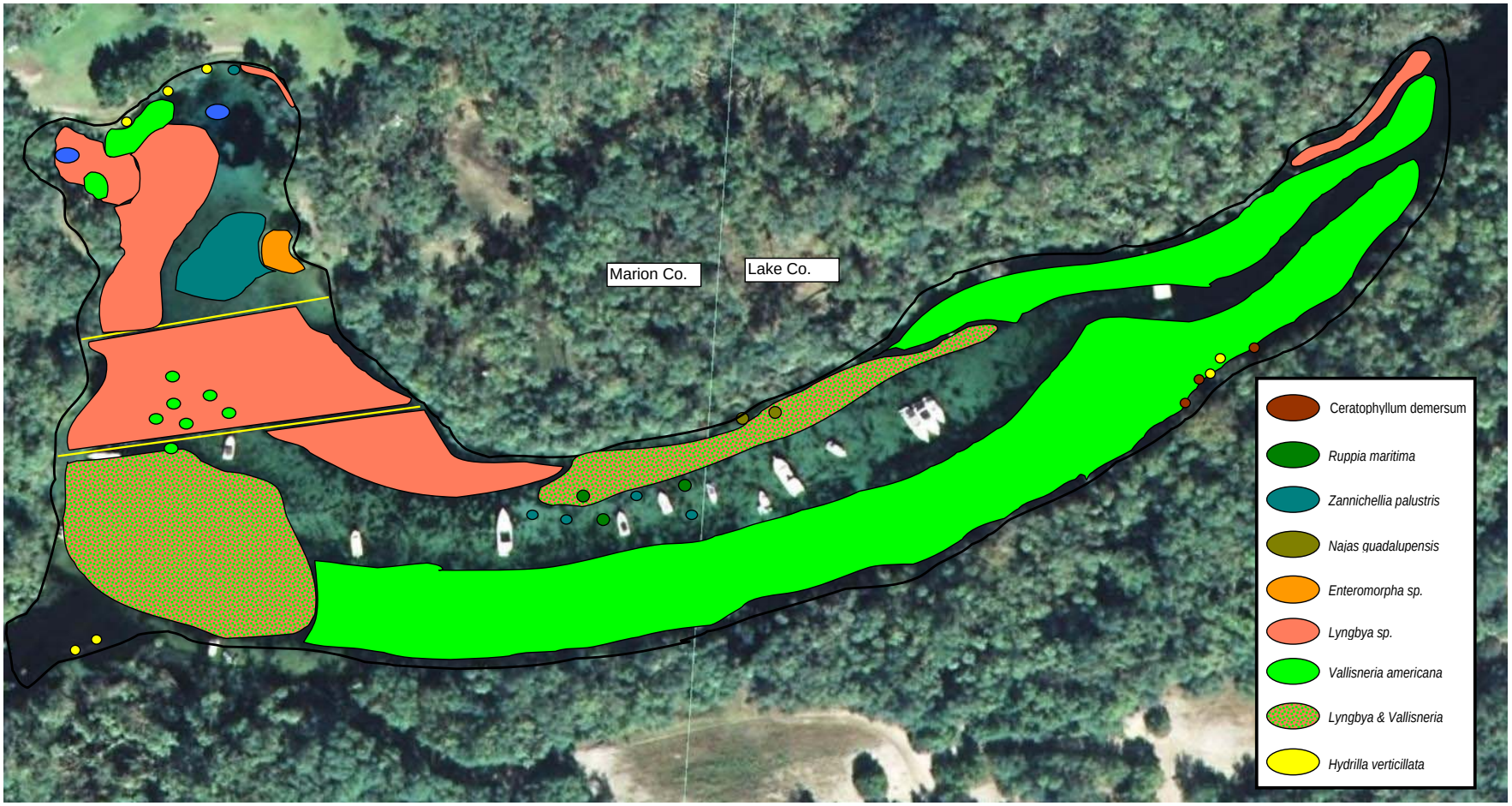
Location	Common name	Scientific name
Spring Pool	water hyacinth	*Eichhornia crassipes*
	pennywort	*Hydrocotyle sp.*
	torpedo grass	*Panicum repens*
	water lettuce	*Pistia stratiotes*
Spring Run	water hyacinth	*Eichhornia crassipes*
	pennywort	*Hydrocotyle sp.*
	duckweed	*Lemna sp.*
	spatterdock	*Nuphar luteum*
	water lettuce	*Pistia stratiotes*
	pickerelweed	*Pontederia cordata*
	cat-tail	*Typha sp.*

spring pool goes to rope boat barrier

APPENDIX I
Silver Glen Springs (Marion Co.) riparian vegetation observations from February 2009.

Location	Common name	Scientific name
Spring Pool	saltbush	*Baccharis halimifolia*
	southern red cedar	*Juniperus silicicola*
	sweetgum	*Liquidambar styraciflua*
	wax myrtle	*Myrica cerifera*
	laurel oak	*Quercus laurifolia*
	live oak	*Quercus virginiana*
	cabbage palm	*Sabal palmetto*
Spring Run	red maple	*Acer rubrum*
	southern red cedar	*Juniperus silicicola*
	sweetgum	*Liquidambar styraciflua*
	wax myrtle	*Myrica cerifera*
	swamp bay	*Persea palustris*
	laurel oak	*Quercus laurifolia*
	live oak	*Quercus virginiana*
	cabbage palm	*Sabal palmetto*
	bald cypress	*Taxodium distichum*

**approximately 5% of pool and run is shaded by riparian vegetation*
spring pool goes to rope boat barrier



APPENDIX I
Silver Glen Springs (Marion Co.) submersed aquatic vegetation map from February 2009

APPENDIX I
Silver Springs (Marion Co.) submersed aquatic vegetation observations from May 2009.

Location	Common name	Scientific name	Coverage (%)
Spring Pool [1]	strap-leaf sagittaria	*Sagittaria kurziana*	80
	filamentous green algae	*Spirogyra sp.*	
	filamentous yellow-green algae	*Vaucheria sp.*	
Spring Run [2]	strap-leaf sagittaria	*Sagittaria kurziana*	75
	filamentous green algae	*Spirogyra sp.*	
	filamentous cyanobacteria	*Lyngbya sp.*	
	filamentous yellow-green algae	*Vaucheria sp.*	
	coontail	*Ceratophyllum demersum*	
	southern naiad	*Najas guadalupensis*	
	muskgrass	*Chara sp.*	
	tape grass	*Vallisneria americana*	

[1] *pool area goes to boat basin canal*

[2] *spring run only surveyed in upper 1,200 meters*

APPENDIX I

Silver Springs (Marion Co.) emergent and floating aquatic vegetation observations from May 2009.

Location	Common name	Scientific name
Spring Pool [1]	none in spring pool	
Spring Run [2]	water hemlock	*Cicuta maculata*
	saw grass	*Cladium jamaicense*
	swamp lily	*Crinum americanum*
	flat sedge	*Cyperus sp.*
	pennywort	*Hydrocotyle sp.*
	duckweed	*Lemna sp.*
	cardinal flower	*Lobelia cardinalis*
	spatterdock	*Nuphar luteum*
	maidencane	*Panicum hemitomon*
	smartweed	*Polygonum sp.*
	pickerelweed	*Pontederia cordata*
	arrowhead	*Sagittaria lancifolia*
	bullrush	*Scirpus sp.*
	cat-tail	*Typha sp.*

[1] *pool area goes to boat basin canal*

[2] *spring run only surveyed in upper 1,200 meters*

APPENDIX I
Silver Springs (Marion Co.) riparian vegetation observations from May 2009.

Location	Common name	Scientific name
Spring Pool [1]	cabbage palm	*Sabal palmetto*
Spring Run [2]	red maple	*Acer rubrum*
	buttonbush	*Cephalanthus occidentalis*
	Florida dogwood	*Cornus foemina*
	wild hydrangea	*Decumaria barbara*
	persimmon	*Diospyros virginiana*
	ash	*Fraxinus sp.*
	Dahoon holly	*Ilex cassine*
	sweetgum	*Liquidambar styraciflua*
	wax myrtle	*Myrica cerifera*
	Virginia creeper	*Parthenocissus quinquefolia*
	swamp bay	*Persea palustris*
	poison ivy	*Rhus radicans*
	cabbage palm	*Sabal palmetto*
	willow	*Salix sp.*
	American elderberry	*Sambucus canadensis*
	bald cypress	*Taxodium distichum*

**approximately 0% of the spring pool and 10% the surveyed run was shaded by riparian vegetation*

[1] *pool area goes to boat basin canal*

[2] *spring run only surveyed in upper 1,200 meters*

APPENDIX I
Wakulla Springs (Wakulla Co.) submersed aquatic vegetation observations from April 2009.

Location	Common name	Scientific name	Relative Abundance
Spring Pool [1]	hydrilla	*Hydrilla verticillata*	1
	tape grass	*Vallisneria americana*	2
	southern naiad	*Najas guadalupensis*	3
Spring Run [2]	hydrilla	*Hydrilla verticillata*	1
	southern naiad	*Najas guadalupensis*	2
	strap-leaf sagittaria	*Sagittaria kurziana*	3
	Illinois pondweed	*Potamogeton illinoensis*	4
	tape grass	*Vallisneria americana*	5
	muskgrass	*Chara sp.*	6

[1] *pool area goes to boat docks*

[2] *spring run only surveyed in upper 1,000 meters*

from plankton tow material:

filamentous green algae	*Cladophora sp.*
filamentous red algae	*Compsopogon sp.*
filamentous cyanobacteria	*Lyngbya sp.*
filamentous green algae	*Spirogyra sp.*
filamentous yellow-green algae	*Vaucheria sp.*

APPENDIX I

Wakulla Springs (Wakulla Co.) emergent and floating aquatic vegetation observations from April 2009.

Location	Common name	Scientific name
Spring Pool [1]	water hemlock	*Cicuta maculata*
	swamp lily	*Crinum americanum*
	flat sedge	*Cyperus sp.*
	duckweed	*Lemna sp.*
	pickerelweed	*Pontederia cordata*
Spring Run [2]	water hemlock	*Cicuta maculata*
	saw grass	*Cladium jamaicense*
	swamp lily	*Crinum americanum*
	flat sedge	*Cyperus sp.*
	duckweed	*Lemna sp.*
	fragrant water lily	*Nymphaea odorata*
	smartweed	*Polygonum sp.*
	pickerelweed	*Pontederia cordata*
	arrowhead	*Sagittaria lancifolia*
	duck potato	*Sagittaria latifolia*
	bullrush	*Scirpus sp.*
	cat-tail	*Typha sp.*

[1] *pool area goes to boat docks*

[2] *spring run only surveyed in upper 1,000 meters*

APPENDIX I
Wakulla Springs (Wakulla Co.) riparian vegetation observations from April 2009.

Location	Common name	Scientific name
Spring Pool [1]	red maple	*Acer rubrum*
	ash	*Fraxinus sp.*
	wax myrtle	*Myrica cerifera*
	oak	*Quercus sp.*
	bald cypress	*Taxodium distichum*
Spring Run [2]	red maple	*Acer rubrum*
	saltbush	*Baccharis halimifolia*
	buttonbush	*Cephalanthus occidentalis*
	Florida dogwood	*Cornus foemina*
	wild hydrangea	*Decumaria barbara*
	persimmon	*Diospyros virginiana*
	Dahoon holly	*Ilex cassine*
	Virginia willow	*Itea virginica*
	wax myrtle	*Myrica cerifera*
	swamp bay	*Persea palustris*
	poison ivy	*Rhus radicans*
	swamp rose	*Rosa palustris*
	blue-stem palm	*Sabal minor*
	cabbage palm	*Sabal palmetto*
	willow	*Salix sp.*
	bald cypress	*Taxodium distichum*

**approximately 2% of the spring pool and 10% the surveyed run was shaded by riparian vegetation*

[1] *pool area goes to boat docks*

[2] *spring run only surveyed in upper 1,000 meters*

APPENDIX I

Weeki Wachee Springs (Hernando Co.) submersed aquatic vegetation observations from March 2009.

Location	Common name	Scientific name	Relative Abundance	Coverage (%)
Spring Pool [1]	filamentous green algae	*Hydrodictyon sp.*	1*	15
	filamentous yellow-green algae	*Vaucheria sp.*		
	filamentous green algae	*Spirogyra sp.*		
	filamentous green algae	*Mougeotia sp.*		
	filamentous cyanobacteria	*Lyngbya sp.*		
	tape grass	*Vallisneria americana*	2	5
	muskgrass	*Chara sp.*	3	1
	hydrilla	*Hydrilla verticillata*	4	< 1
Spring Run [2]	filamentous yellow-green algae	*Vaucheria sp.*	1*	43.3
	filamentous green algae	*Hydrodictyon sp.*		
	filamentous green algae	*Spirogyra sp.*		
	filamentous green algae	*Mougeotia sp.*		
	filamentous cyanobacteria	*Lyngbya sp.*		
	muskgrass	*Chara sp.*	2	15
	tape grass	*Vallisneria americana*	3	<1
	strap-leaf sagittaria	*Sagittaria kurziana*	4	<1

[1] pool area goes to constriction below bottom slide

[2] spring run only surveyed in upper 1,000 meters

** filamentous algae presented in relative abundance as found in microscopic examinations.*

APPENDIX I

Weeki Wachee Springs (Hernando Co.) emergent and floating aquatic vegetation observations from March 2009.

Location	Common name	Scientific name
Spring Pool [1]	umbrella flat sedge	*Cyperus involucratus*
	torpedo grass	*Panicum repens*
	three-square bulrush	*Scirpus pungens*
Spring Run [2]	water hemlock	*Cicuta maculata*
	saw grass	*Cladium jamaicense*
	wild taro	*Colocasia esculenta*
	pennywort	*Hydrocotyle sp.*
	climbing hempvine	*Mikania scandens*
	water lettuce	*Pistia stratiotes*
	smartweed	*Polygonum sp.*
	marsh fern	*Thelypteris palustris*
	cat-tail	*Typha sp.*

[1] *pool area goes to constriction below bottom slide*

[2] *spring run only surveyed in upper 1,000 meters*

APPENDIX I
Weeki Wachee Springs (Hernando Co.) riparian vegetation observations from March 2009.

Location	Common name	Scientific name
Spring Pool [1]	umbrella flat sedge	*Cyperus involucratus*
	swamp bay	*Persea palustris*
	split-leaf philodendron	*Philodendron bipinnatifidum*
	lady palm	*Rhapis excelsa*
	bald cypress	*Taxodium distichum*
Spring Run [2]	red maple	*Acer rubrum*
	rattan vine	*Berchemia scandens*
	Florida dogwood	*Cornus foemina*
	Dahoon holly	*Ilex cassine*
	sweetgum	*Liquidambar styraciflua*
	fetterbush	*Lyonia lucida*
	southern magnolia	*Magnolia grandiflora*
	wax myrtle	*Myrica cerifera*
	swamp bay	*Persea palustris*
	sand pine	*Pinus clausa*
	slash pine	*Pinus elliottii*
	laurel oak	*Quercus laurifolia*
	live oak	*Quercus virginiana*
	azalea	*Rhododendron sp.*
	poison ivy	*Rhus radicans*
	cabbage palm	*Sabal palmetto*
	willow	*Salix sp.*
	American elderberry	*Sambucus canadensis*
	saw palmetto	*Serenoa repens*
	bald cypress	*Taxodium distichum*
	grape	*Vitis sp.*

**approximately 1% of the spring pool and 10% the surveyed run was shaded by riparian vegetation*

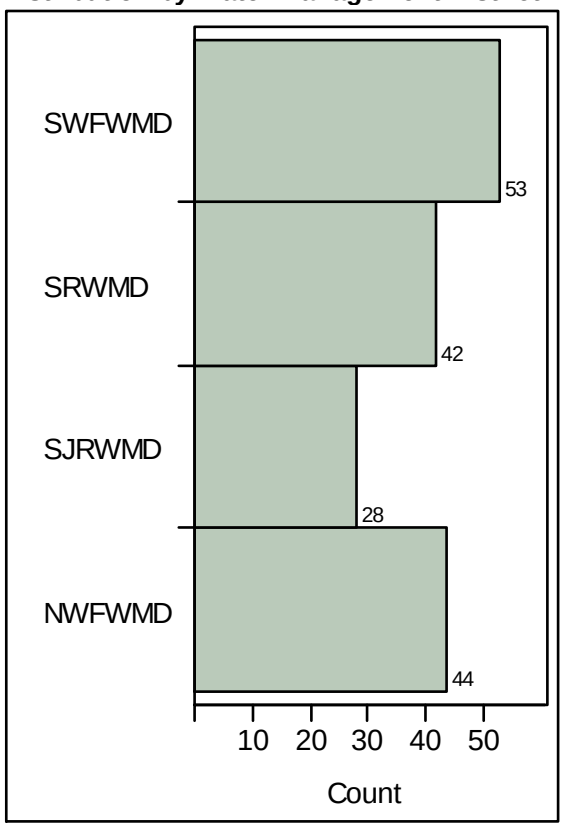
[1] *pool area goes to constriction below bottom slide*

[2] *spring run only surveyed in upper 1,000 meters*

Appendix J

Aquatic Emergent Insects

Distribution by Water Management District



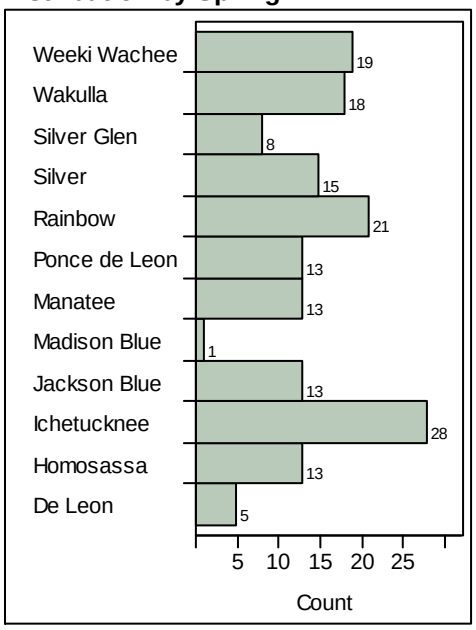
Frequencies

Level	Count	Prob
NWFWMD	44	0.26347
SJRWMD	28	0.16766
SRWMD	42	0.25150
SWFWMD	53	0.31737
Total	167	1.00000

4 Levels

FIGURE J
Distribution of the number of unique adult aquatic invertebrates as identified to the lowest practical taxonomy by water management district.

Distribution by Spring



Frequencies

Level	Count	Prob
De Leon	5	0.02994
Homosassa	13	0.07784
Ichetucknee	28	0.16766
Jackson Blue	13	0.07784
Madison Blue	1	0.00599
Manatee	13	0.07784
Ponce de Leon	13	0.07784
Rainbow	21	0.12575
Silver	15	0.08982
Silver Glen	8	0.04790
Wakulla	18	0.10778
Weeki Wachee	19	0.11377
Total	167	1.00000

12 Levels

FIGURE J
Distribution of the number of unique adult aquatic invertebrates as identified to the lowest practical taxonomy by spring.

Distribution by Date (Median)

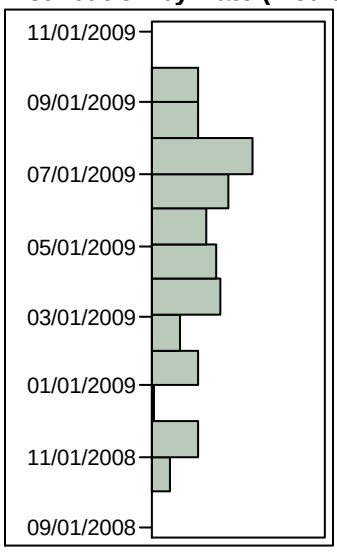
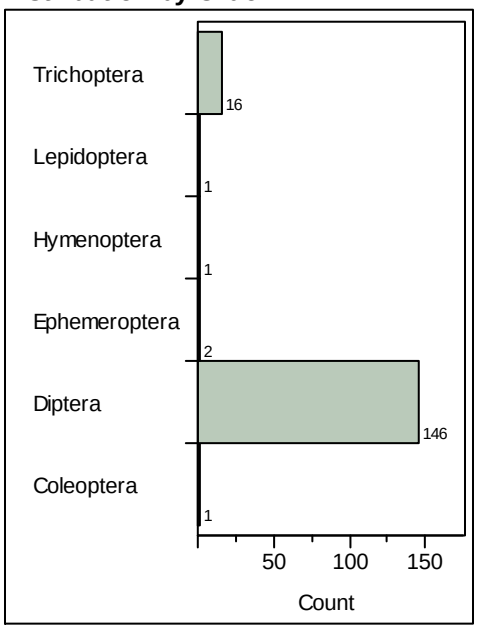


FIGURE J
Distribution of unique adult aquatic invertebrates as identified to the lowest practical taxonomy by sampling month.

Distribution by Order



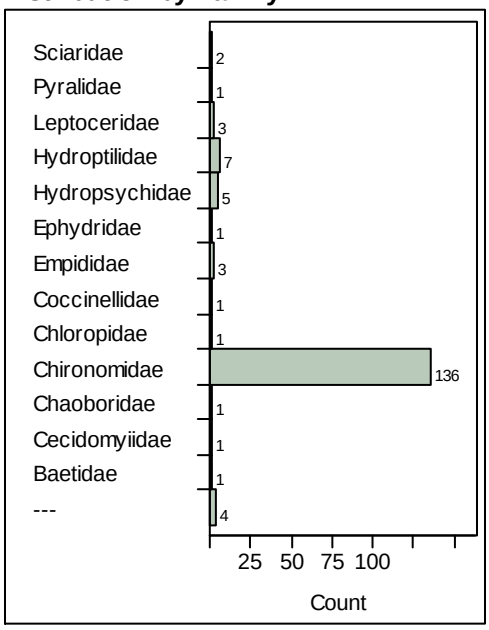
Frequencies

Level	Count	Prob
Coleoptera	1	0.00599
Diptera	146	0.87425
Ephemeroptera	2	0.01198
Hymenoptera	1	0.00599
Lepidoptera	1	0.00599
Trichoptera	16	0.09581
Total	167	1.00000

N Missing
0
6 Levels

FIGURE J
Distribution of the number of unique adult aquatic invertebrates as identified by order.

Distribution by Family



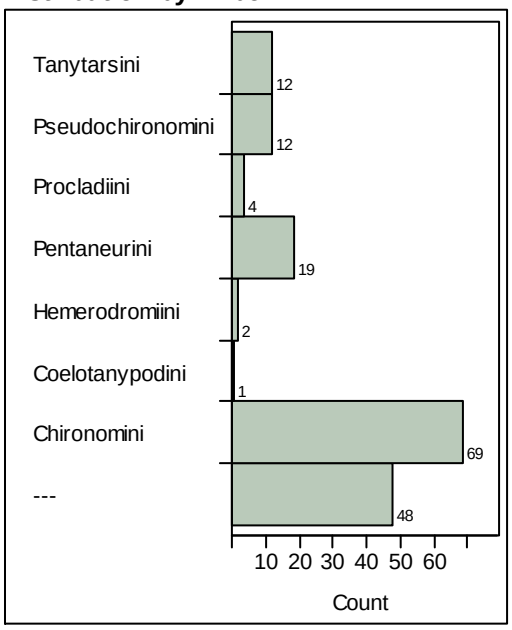
Frequencies

Level	Count	Prob
---	4	0.02395
Baetidae	1	0.00599
Cecidomyiidae	1	0.00599
Chaoboridae	1	0.00599
Chironomidae	136	0.81437
Chloropidae	1	0.00599
Coccinellidae	1	0.00599
Empididae	3	0.01796
Ephydridae	1	0.00599
Hydropsychidae	5	0.02994
Hydroptilidae	7	0.04192
Leptoceridae	3	0.01796
Pyralidae	1	0.00599
Sciaridae	2	0.01198
Total	167	1.00000

N Missing
0
14 Levels

FIGURE J
Distribution of the number of unique adult aquatic invertebrates as identified by family.

Distribution by Tribe



Frequencies

Level	Count	Prob
---	48	0.28743
Chironomini	69	0.41317
Coelotanypodini	1	0.00599
Hemerodromiini	2	0.01198
Pentaneurini	19	0.11377
Procladiini	4	0.02395
Pseudochironomini	12	0.07186
Tanytarsini	12	0.07186
Total	167	1.00000

8 Levels

FIGURE J
Distribution of the number of unique adult aquatic invertebrates as identified by tribe.

Distribution by Lowest Practical Taxonomy

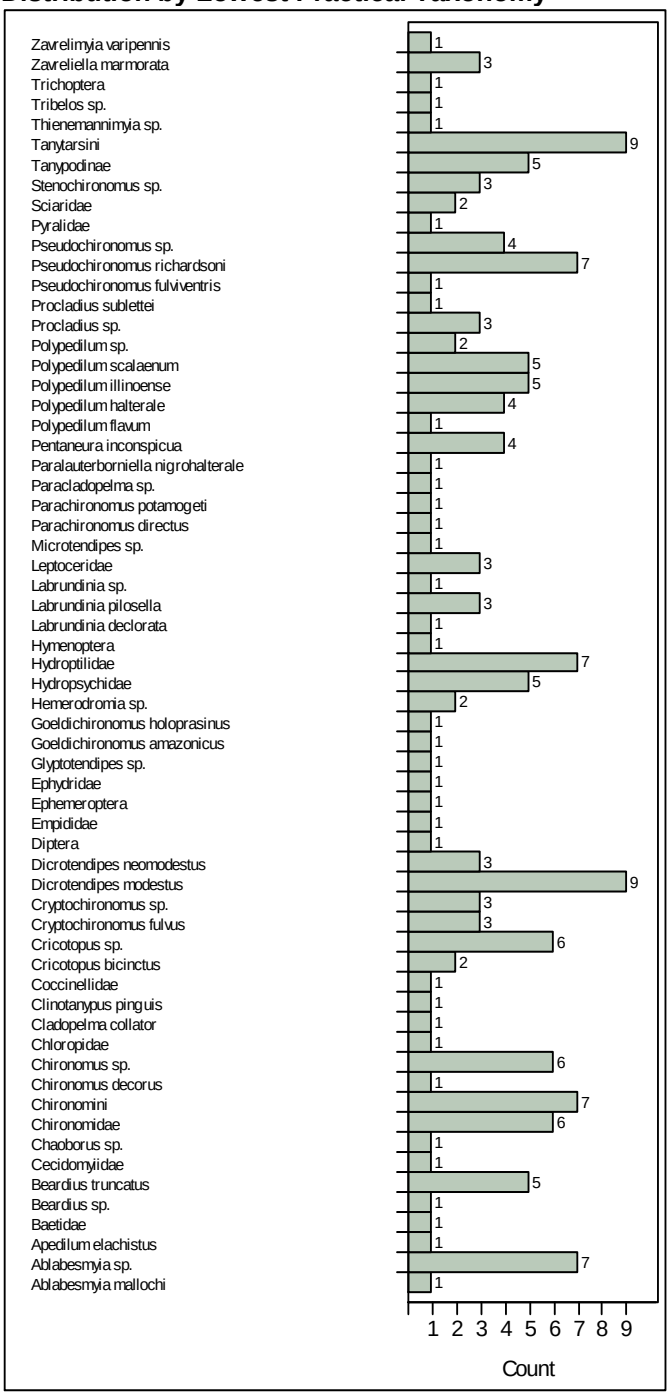


FIGURE J
Distribution of the count of unique adult aquatic invertebrate as identified to the lowest practical taxonomy for all 12 springs.

Frequencies

Level	Count	Prob
Ablabesmyia mallochi	1	0.00599
Ablabesmyia sp.	7	0.04192
Apedilum elachistus	1	0.00599
Baetidae	1	0.00599
Beardius sp.	1	0.00599
Beardius truncatus	5	0.02994
Cecidomyiidae	1	0.00599
Chaoborus sp.	1	0.00599
Chironomidae	6	0.03593
Chironomini	7	0.04192
Chironomus decorus	1	0.00599
Chironomus sp.	6	0.03593
Chloropidae	1	0.00599
Cladopelma collator	1	0.00599
Clinotanypus pinguis	1	0.00599
Coccinellidae	1	0.00599
Cricotopus bicinctus	2	0.01198
Cricotopus sp.	6	0.03593
Cryptochironomus fulvus	3	0.01796
Cryptochironomus sp.	3	0.01796
Dicrotendipes modestus	9	0.05389
Dicrotendipes neomodestus	3	0.01796
Diptera	1	0.00599
Empididae	1	0.00599
Ephemeroptera	1	0.00599
Ephydridae	1	0.00599
Glyptotendipes sp.	1	0.00599
Goeldichironomus amazonicus	1	0.00599
Goeldichironomus holoprasinus	1	0.00599
Hemerodromia sp.	2	0.01198
Hydropsychidae	5	0.02994
Hydroptilidae	7	0.04192
Hymenoptera	1	0.00599
Labrundinia declorata	1	0.00599
Labrundinia pilosella	3	0.01796
Labrundinia sp.	1	0.00599
Leptoceridae	3	0.01796
Microtendipes sp.	1	0.00599
Parachironomus directus	1	0.00599
Parachironomus potamogeti	1	0.00599
Paracladopelma sp.	1	0.00599
Paralauterborniella nigrohalterale	1	0.00599
Pentaneura inconspicua	4	0.02395
Polypedilum flavum	1	0.00599
Polypedilum halterale	4	0.02395
Polypedilum illinoense	5	0.02994
Polypedilum scalaenum	5	0.02994
Polypedilum sp.	2	0.01198
Procladius sp.	3	0.01796
Procladius sublettei	1	0.00599
Pseudochironomus fulviventris	1	0.00599
Pseudochironomus richardsoni	7	0.04192
Pseudochironomus sp.	4	0.02395
Pyralidae	1	0.00599
Sciaridae	2	0.01198
Stenochironomus sp.	3	0.01796
Tanypodinae	5	0.02994
Tanytarsini	9	0.05389
Thienemannimyia sp.	1	0.00599
Tribelos sp.	1	0.00599
Trichoptera	1	0.00599
Zavreliella marmorata	3	0.01796
Zavrelimyia varipennis	1	0.00599
Total	167	1.00000

63 Levels



APPENDIX J
Location of macroinvertebrate emergence traps for De Leon Springs State Park (Volusia Co.) during October 6 to 9, 2008.

APPENDIX J

Macroinvertebrate emergence trap meta data for De Leon Springs State Park (Volusia Co.) during October 6 to 9, 2008.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m)	Substrate
Spring Pool	10/7/2008	2	29.134397°	-81.362882°	3.22	rock/algae
	10/7/2008	3	29.134021°	-81.362957°	2.58	sand/algae
	10/7/2008	5	29.134273°	-81.362961°	1.50	rock/algae
	10/7/2008	8	29.133970°	-81.362609°	3.54	sand/algae
	10/7/2008	10	29.134159°	-81.362460°	4.03	sand/algae
Spring Run	10/7/2008	1	29.135350°	-81.363750°	5.10	organics/algae
	10/7/2008	4	29.135467°	-81.365067°	5.15	organics/algae
	10/7/2008	6	29.135900°	-81.365700°	4.50	organics/algae
	10/7/2008	7	29.135000°	-81.364867°	7.40	organics/algae
	10/7/2008	9	29.134367°	-81.363617°	6.30	organics/algae

APPENDIX J

Summary of emergent invertebrates captured from De Leon Springs on October 7, 2008

Location	Collection Date	Time	Trap #	*Parachironomus directus*	*Goeldichironomus holoprasinus*	*Goeldichironomus amazonicus*	*Glyptotendipes sp.*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	10/7/2008	14:08	2					0	0	0	
	10/7/2008	14:12	3					0	0	0	
Spring Pool	10/7/2008	14:10	5			1		1	4	11,008	
	10/7/2008	14:15	8					0	0	0	
	10/7/2008	14:16	10					0	0	0	
	10/7/2008	13:16	1	24			1	25	100		3,795,900
	10/7/2008	13:08	4	1				1	4		151,836
Spring Run	10/7/2008	13:05	6	2				2	8		303,672
	10/7/2008	13:10	7	2				2	8		303,672
	10/7/2008	13:13	9	18	5		1	24	96		3,644,064
			SUM	**47**	**5**	**1**	**2**	**55**		**11,008**	**8,199,144**
			Spring Pool Average	**0**	**0**	**0.2**	**0**	**0.2**	**0.8**		
			Spring Run Average	**9.4**	**1**	**0**	**0.4**	**10.8**	**43.2**		
			Grand Average	**4.7**	**0.5**	**0.1**	**0.2**	**5.5**	**22**	**2,202**	**1,639,829**

APPENDIX J
Summary of emergent invertebrates captured from De Leon Springs on October 8, 2008

Location	Collection Date	Time	Trap	*Parachironomus directus*	*Chaoborus sp.*	*Glyptotendipes sp.*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	10/8/2008	8:40	2				0	0	0	
	10/8/2008	8:40	3				0	0	0	
Spring Pool	10/8/2008	8:40	5				0	0	0	
	10/8/2008	8:40	8				0	0	0	
	10/8/2008	8:40	10				0	0	0	
	10/8/2008	9:00	1	5	2		7	28		1,062,852
	10/8/2008	9:00	4	2			2	8		303,672
Spring Run	10/8/2008	9:00	6		1		1	4		151,836
	10/8/2008	9:00	7		1		1	4		151,836
	10/8/2008	9:00	9	18	5	2	25	100		3,795,900
			SUM	**25**	**9**	**2**	**36**		**0**	**5,466,096**
			Spring Pool Average	**0**	**0**	**0**	**0**	**0**		
			Spring Run Average	**5**	**1.8**	**0.4**	**7.2**	**28.8**		
			Grand Average	**2.5**	**0.9**	**0.2**	**3.6**	**14.4**	**0**	**1,093,219**

APPENDIX J

Summary of emergent invertebrates captured from De Leon Springs on October 9, 2008.

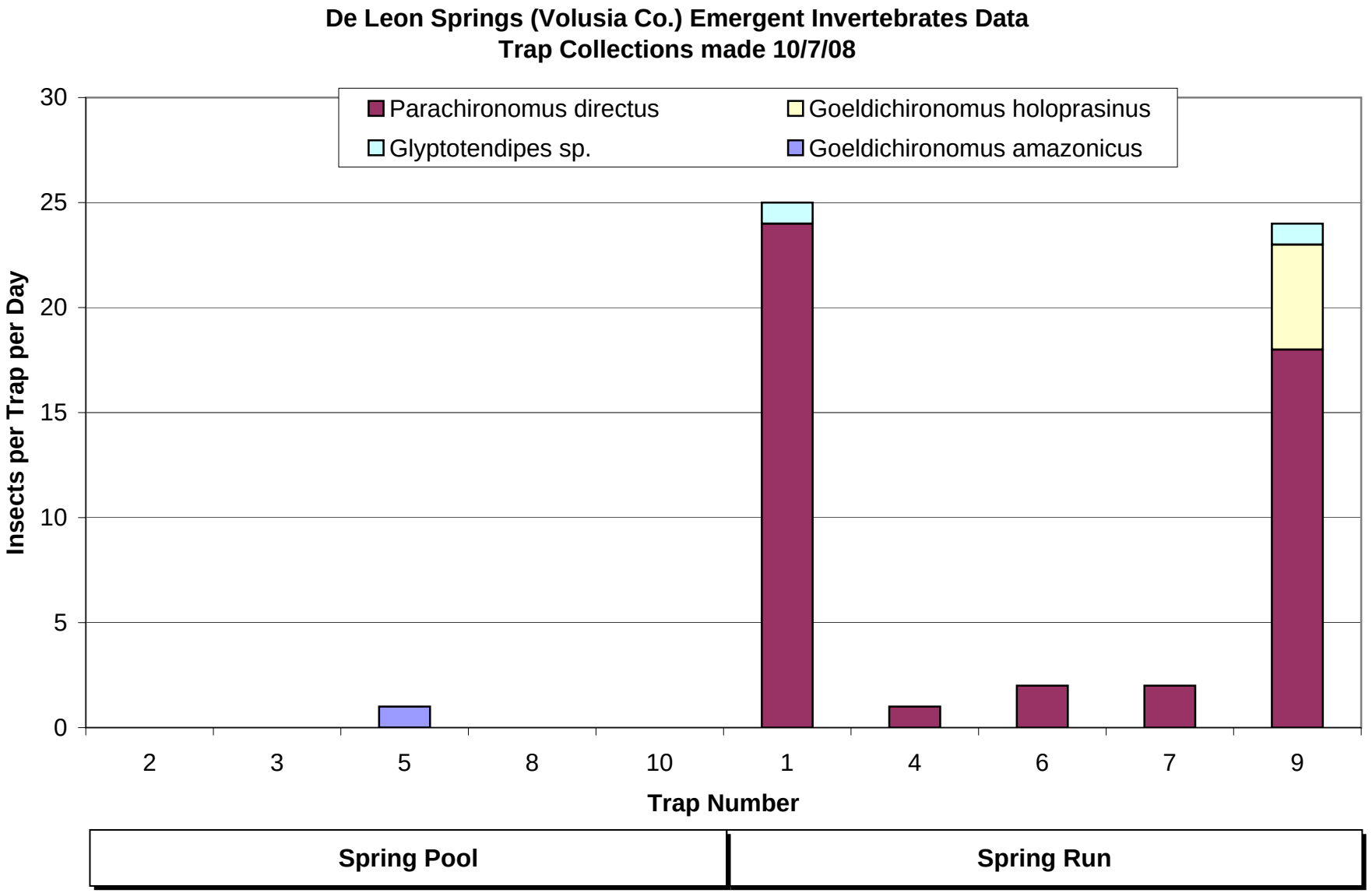
Location	Collection Date	Time	Trap	*Parachironomus directus*	*Goeldichironomus holoprasinus*	*Glyptotendipes sp.*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	10/9/2008	11:10	2				0	0	0	
	10/9/2008	11:10	3				0	0	0	
Spring Pool	10/9/2008	11:10	5				0	0	0	
	10/9/2008	11:10	8				0	0	0	
	10/9/2008	11:10	10				0	0	0	
	10/9/2008	11:20	1	5	5		10	40		1,518,360
	10/9/2008	11:20	4		4	1	5	20		759,180
Spring Run	10/9/2008	11:20	6	1			1	4		151,836
	10/9/2008	11:20	7	1	1		2	8		303,672
	10/9/2008	11:20	9	12	9	4	25	100		3,795,900
			SUM	**19**	**19**	**5**	**43**		**0**	**6,528,948**
			Spring Pool Average	**0**	**0**	**0**	**0**	**0**		
			Spring Run Average	**3.8**	**3.8**	**1**	**8.6**	**34.4**		
			Grand Average	**1.9**	**1.9**	**0.5**	**4.3**	**17.2**	**0**	**1,305,790**

APPENDIX J

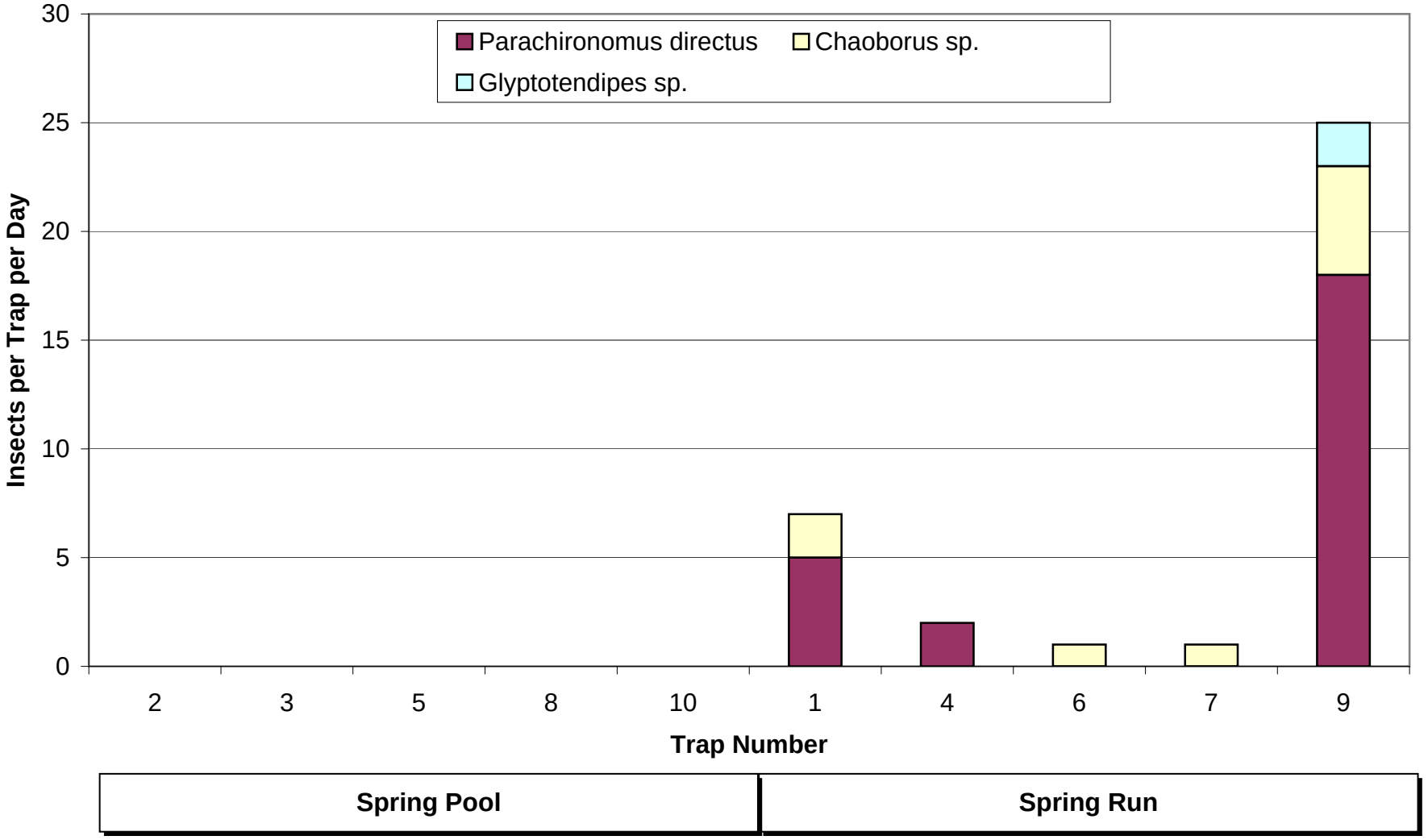
Summary of emergent invertebrates captured during October 7, 8, and 9, 2008.

Location	Collection Date	Total Emergent Invertebrates	Emergence Rate (#/m^2/day) *	Emergence Rate (#/day) *
Spring Pool	10/7/2008	1	0.8	2,202
	10/8/2008	0	0	0
	10/9/2008	0	0	0
	Average	**0.3**	**0.3**	**734**
Spring Run	10/7/2008	54	43.2	1,639,829
	10/8/2008	36	28.8	1,093,219
	10/9/2008	43	34.4	1,305,790
	Average	**44.3**	**35.5**	**1,346,279**
	Grand Average	**22.3**	**17.9**	**673,507**

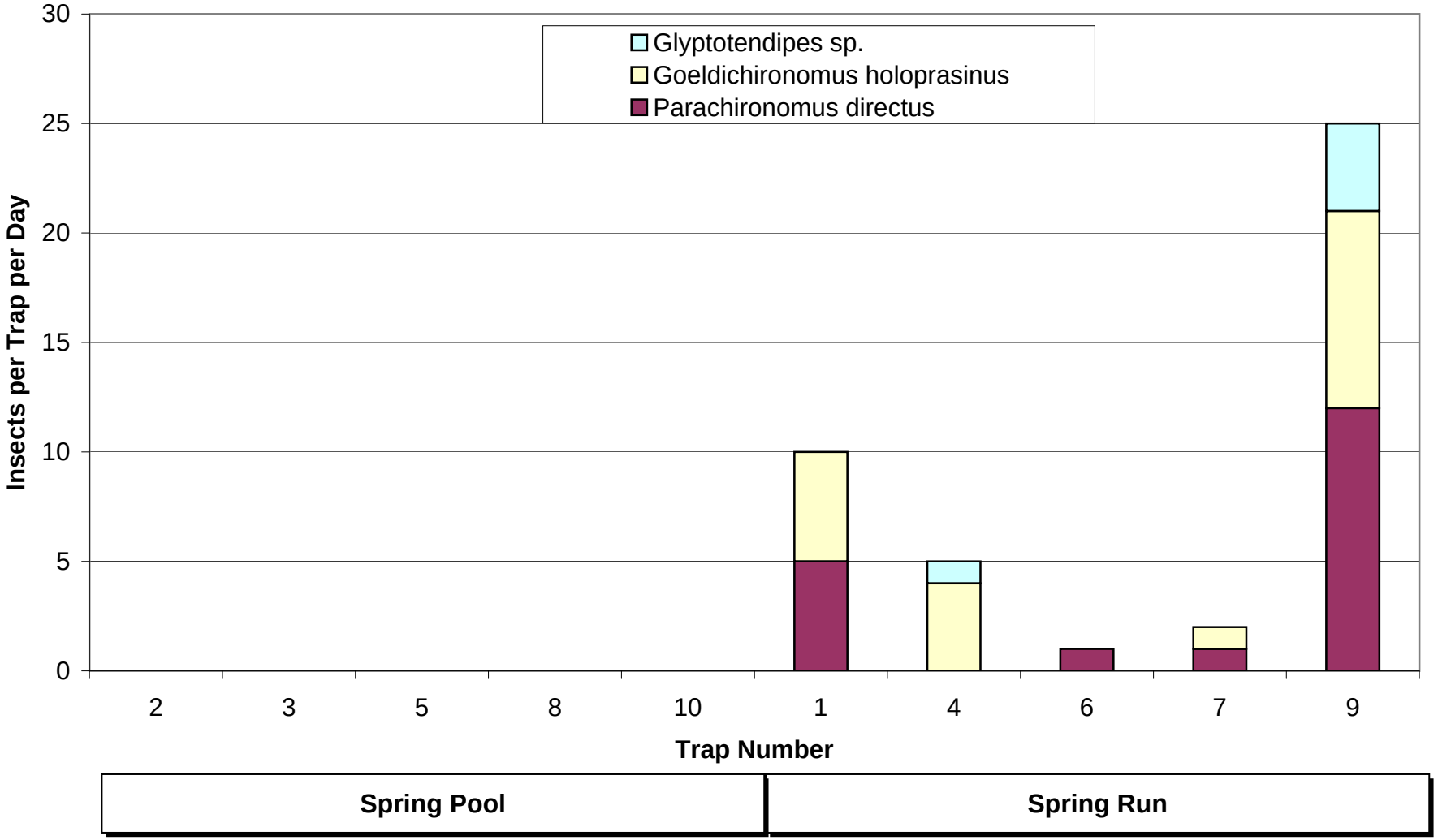
* Based on a spring pool area of 2,752 m^2 and spring run area of 37,959 m^2.


De Leon Springs (Volusia Co.) Emergent Invertebrates Data
Trap Collections made 10/7/08
Parachironomus directus
Goeldichironomus holoprasinus
Glyptotendipes sp.
Goeldichironomus amazonicus
Insects per Trap per Day
30
25
20
15
10
5
0
2
3
5
8
10
1
4
6
7
9
Trap Number
Spring Pool
Spring Run

De Leon Springs (Volusia Co.) Emergent Invertebrates Data
Trap Collections made 10/8/08



De Leon Springs (Volusia Co.) Emergent Invertebrates Data
Trap Collections made 10/9/08





APPENDIX J
Location of macroinvertebrate emergence traps for Homosassa Springs (Citrus Co.) during November 3 to 4, 2008.



APPENDIX J
Location of macroinvertebrate emergence traps for Homosassa Springs (Citrus Co.) during November 4 to 6, 2008.

APPENDIX J

Macroinvertebrate emergence trap meta data for Homosassa Springs (Citrus Co.) during November 3 to 5, 2008.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	11/3/2008	1	28.799601°	-82.588912°		
	11/3/2008	2	28.799820°	-82.588982°		
	11/3/2008	3	28.799879°	-82.588673°		
	11/3/2008	4	28.799540°	-82.588251°		
	11/3/2008	5	28.799125°	-82.588368°		
Spring Run	11/3/2008	6	28.799065°	-82.589284°	2.17	sand/detritus
	11/3/2008	7	28.799334°	-82.589018°	1.54	sand/algae
	11/3/2008	8	28.799383°	-82.589817°	3.12	algae
	11/3/2008	9	28.799614°	-82.589290°	1.04	sand/algae
	11/3/2008	10	28.798867°	-82.589667°	1.16	algae

** staff gage at bridge = 0.51 ft at 16:00*

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	11/4/2008 to 11/5/2008	Not sampled				
Spring Run	11/4/2008 to 11/5/2008	1	28.799094°	-82.589100°	1.05	Lyngbya
		2	28.799450°	-82.589550°	1.78	sand
		3	28.798933°	-82.589433°	1.50	Lyngbya
		4	28.799550°	-82.589367°	3.20	algae/Naiad
		6	28.799065°	-82.589284°		sand/detritus
		7	28.799334°	-82.589018°		sand/algae
		8	28.799383°	-82.589817°		algae
		9	28.799614°	-82.589290°		sand/algae
		10	28.798867°	-82.589667°		algae

** staff gage at bridge = 1.26 ft at 09:32 (11/4/08); 1.49 ft at 09:31 (11/5/08)*

APPENDIX J

Summary of emergent invertebrates captured from Homosassa Springs on November 4, 2008

Location	Collection Date	Time	Trap #	*Dicrotendipes modestus*	*Chironomini*	*Zavreliella marmorata*	*Polypedilum sp.*	*Zavreliella marmorata*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	11/4/2008	8:30	1	3	3				6	24	121,622	
	11/4/2008	8:20	2	1		1			2	8	40,541	
Spring Pool	11/4/2008	8:25	3		3		3		6	24	121,622	
	11/4/2008	8:35	4	3					3	12	60,811	
	11/4/2008	8:15	5	Trap Damaged - No Collections					N/A	N/A	N/A	
	11/4/2008	9:55	6	1	21		1		23	92		575,046
	11/4/2008	9:58	7	1	1				2	8		50,004
Spring Run	11/4/2008	10:17	8	1	2				3	12		75,006
	11/4/2008	10:04	9		2		1	1	4	16		100,008
	11/4/2008	10:23	10	1	6				7	28		175,014
			SUM	**11**	**38**	**1**	**5**	**1**	**56**		**344,594**	**975,079**
			Spring Pool Average	**1.75**	**1.50**	**0.25**	**0.75**	**0.00**	**4.25**	**17.00**		
			Spring Run Average	**0.80**	**6.40**	**0.00**	**0.40**	**0.20**	**7.80**	**31.20**		
			Grand Average	**1.22**	**4.22**	**0.11**	**0.56**	**0.11**	**6.22**	**24.89**	**86,149**	**195,016**

APPENDIX J
Summary of emergent invertebrates captured from Homosassa Springs on November 5, 2008

Location	Collection Date	Time	Trap	*Dicrotendipes modestus*	*Chironomini*	*Zavreliella marmorata*	*Polypedilum sp.*	*Zavreliella marmorata*	*Chironomus sp.*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
Spring Pool	11/5/2008							Not Sampled					
	11/5/2008	9:53	1	4	15			6		25	100		625,050
	11/5/2008	9:38	2	1			1			2	8		50,004
	11/5/2008	9:47	3		14	1	3			18	72		450,036
	11/5/2008	9:35	4	4	5				1	10	40		250,020
Spring Run	11/5/2008	9:50	6	6	34			2	1	43	172		1,075,087
	11/5/2008	9:56	7							0	0		0
	11/5/2008	9:41	8	1	4	1				6	24		150,012
	11/5/2008	9:32	9	7	3		1		5	16	64		400,032
	11/5/2008	9:44	10	6	15	4	1			26	104		650,052
			SUM	**29**	**90**	**6**	**6**	**8**	**7**	**146**		**0**	**3,650,294**
			Spring Pool Average	**N/A**									
			Spring Run Average	**3.22**	**10.00**	**0.67**	**0.67**	**0.89**	**0.78**	**16.22**	**64.89**		
			Grand Average	**3.22**	**10.00**	**0.67**	**0.67**	**0.89**	**0.78**	**16.22**	**64.89**	**N/A**	**405,588**

APPENDIX J
Summary of emergent invertebrates captured from Homosassa Springs on November 6, 2008

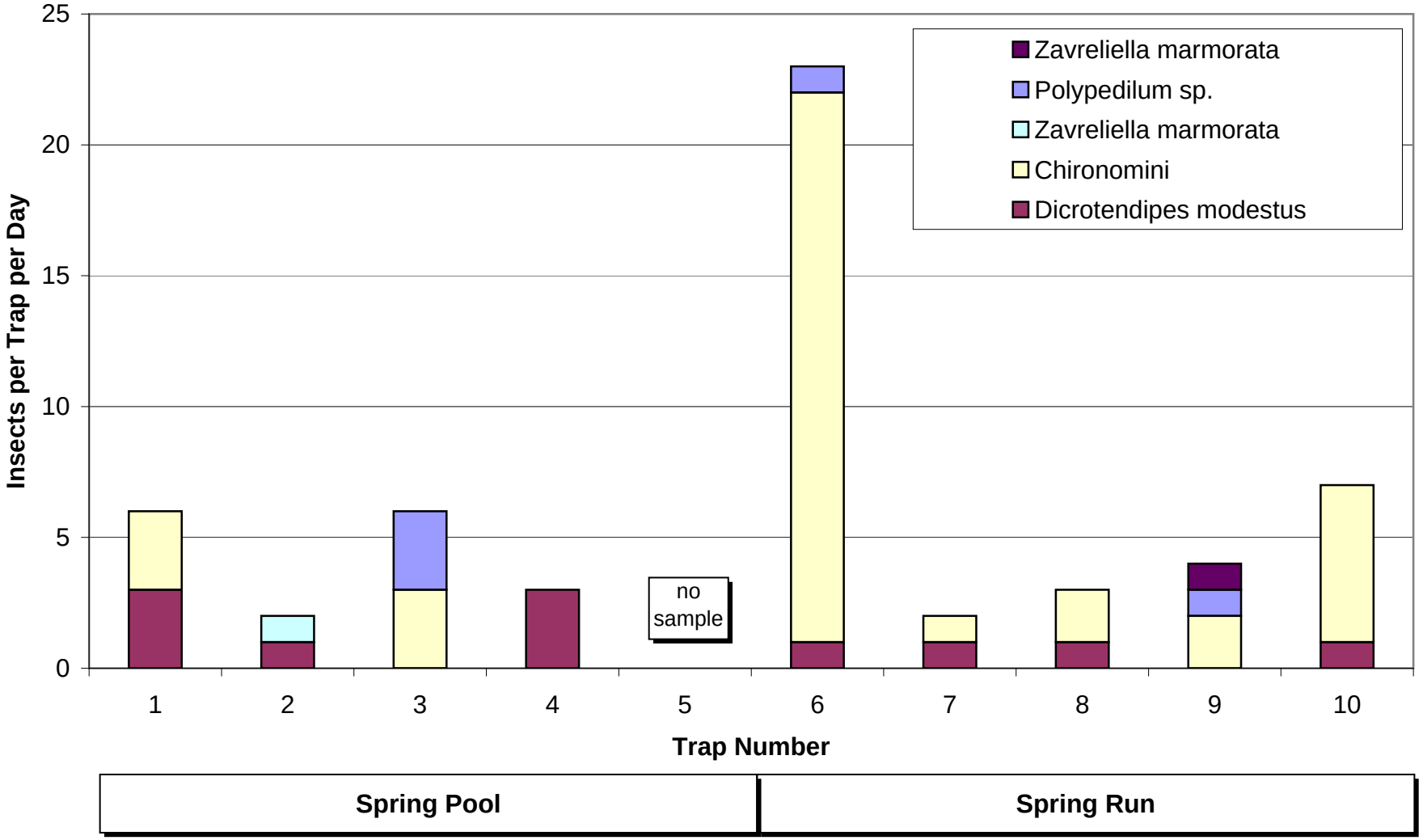
Location	Collection Date	Time	Trap	*Chironomidae*	*Chironomus sp.*	*Dicrotendipes modestus*	*Dicrotendipes neomodestus*	*Polypedilum halterale*	*Polypedilum illinoense*	*Polypedilum scalaenum*	*Pseudochironomus richardsoni*	*Tanytarsini*	*Trichoptera - Hydroptilidae*	*Zavreliella marmorata*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
Spring Pool	11/6/2008										Not Sampled							
	11/6/2008	9:25	1	3		7		2				1			13	52		325,026
	11/6/2008	9:37	2					1			1				2	8		50,004
	11/6/2008	9:19	3	13	1	6		1	1					1	23	92		575,046
	11/6/2008	9:34	4	4		6		2		1			1		14	56		350,028
Spring Run	11/6/2008	9:22	6	10		16	1	5	1						33	132		825,067
	11/6/2008	9:28	7			2									2	8		50,004
	11/6/2008	9:40	8			2		1				1		1	5	20		125,010
	11/6/2008	9:31	9	16		8	1	2	1	1	1				30	120		750,060
	11/6/2008	9:16	10	4		10		6							20	80		500,040
			SUM	**50**	**1**	**57**	**2**	**20**	**3**	**2**	**2**	**2**	**1**	**2**	**142**		**0**	**3,550,286**
			Spring Pool Average	**N/A**												**0**		
			Spring Run Average	**5.56**	**0.11**	**6.33**	**0.22**	**2.22**	**0.33**	**0.22**	**0.22**	**0.22**	**0.11**	**0.22**	**15.78**	**113.60**		
			Grand Average	**5.56**	**0.11**	**6.33**	**0.22**	**2.22**	**0.33**	**0.22**	**0.22**	**0.22**	**0.11**	**0.22**	**15.78**	**63.11**	**N/A**	**394,476**

APPENDIX J
Summary of emergent invertebrates captured during November 4, 5, and 6, 2008.

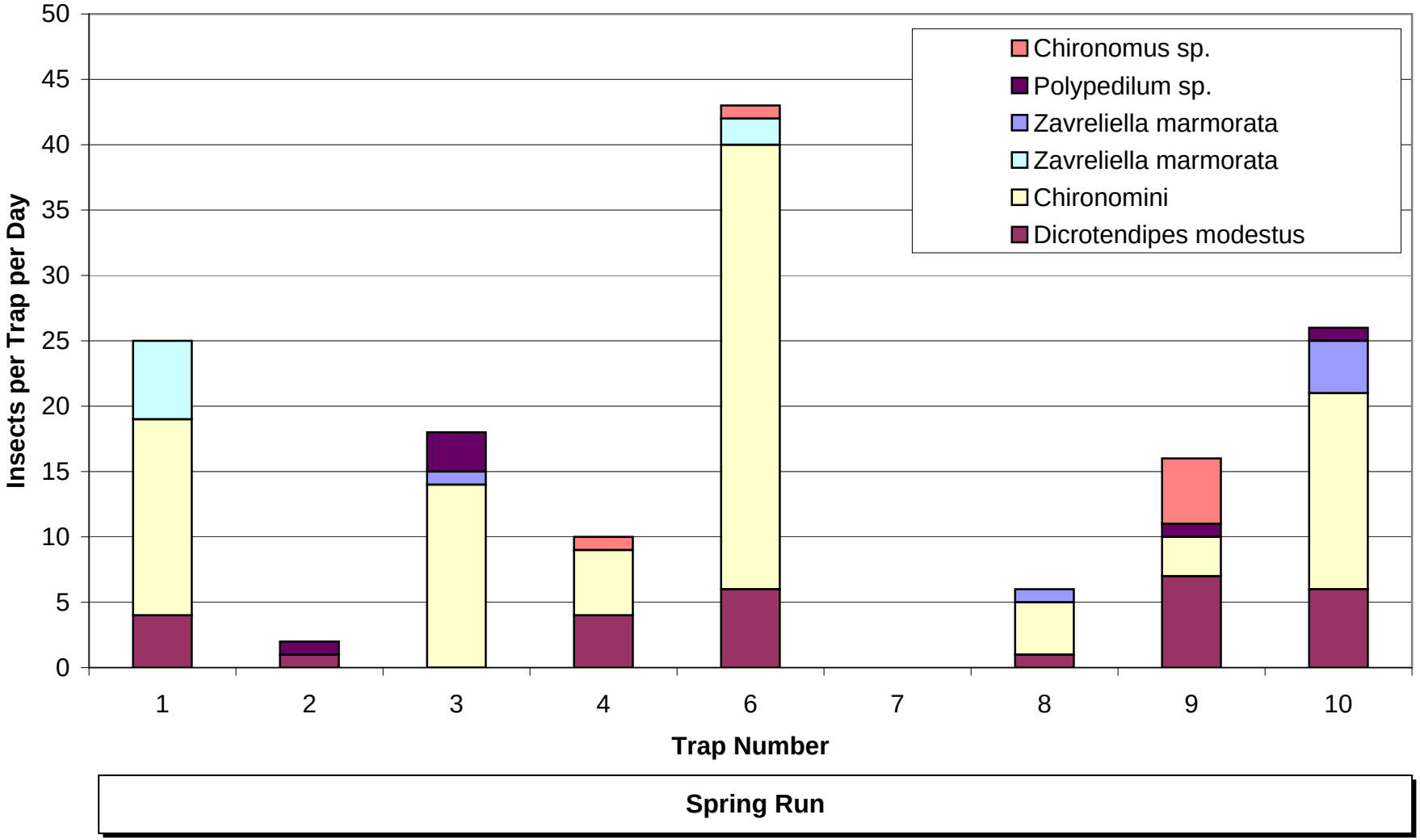
Location	Collection Date	Total Emergent Invertebrates	Emergence Rate (#/m^2/day) *	Emergence Rate (#/day) *
Spring Pool	11/4/2008	17	17	86,149
	Average	**17**	**17.0**	**86,149**
Spring Run	11/4/2008	39	31.2	195,016
	11/5/2008	146	64.9	405,588
	11/6/2008	142	113.6	394,476
	Average	**109**	**69.9**	**331,693**
	Grand Average	**86**	**56.7**	**270,307**

* Based on a spring pool area of 5068 m^2 and spring run area of 6251 m^2.

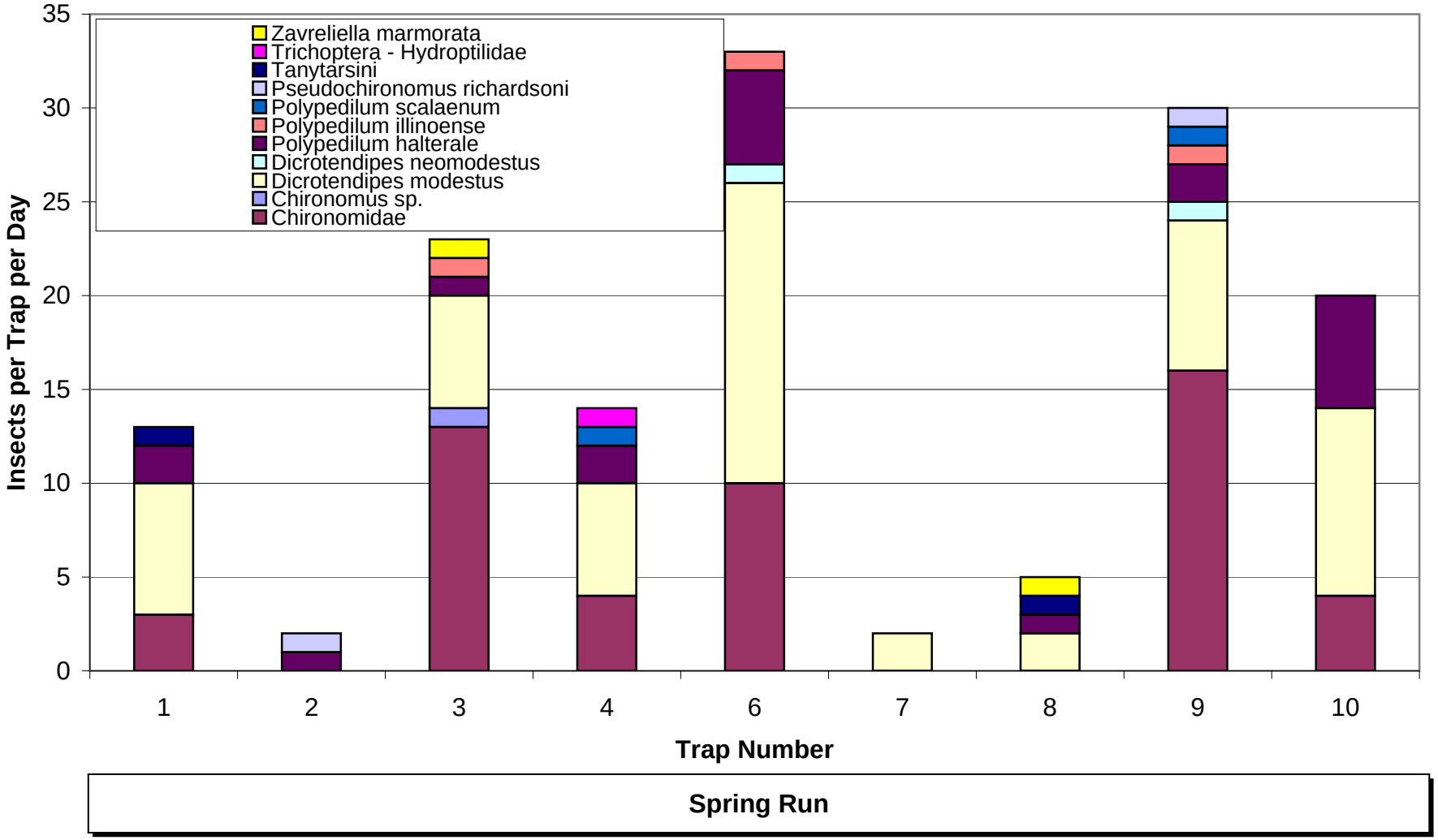
Homosassa Springs (Citrus Co.) Emergent Invertebrates Data
Trap Collections made 11/4/08

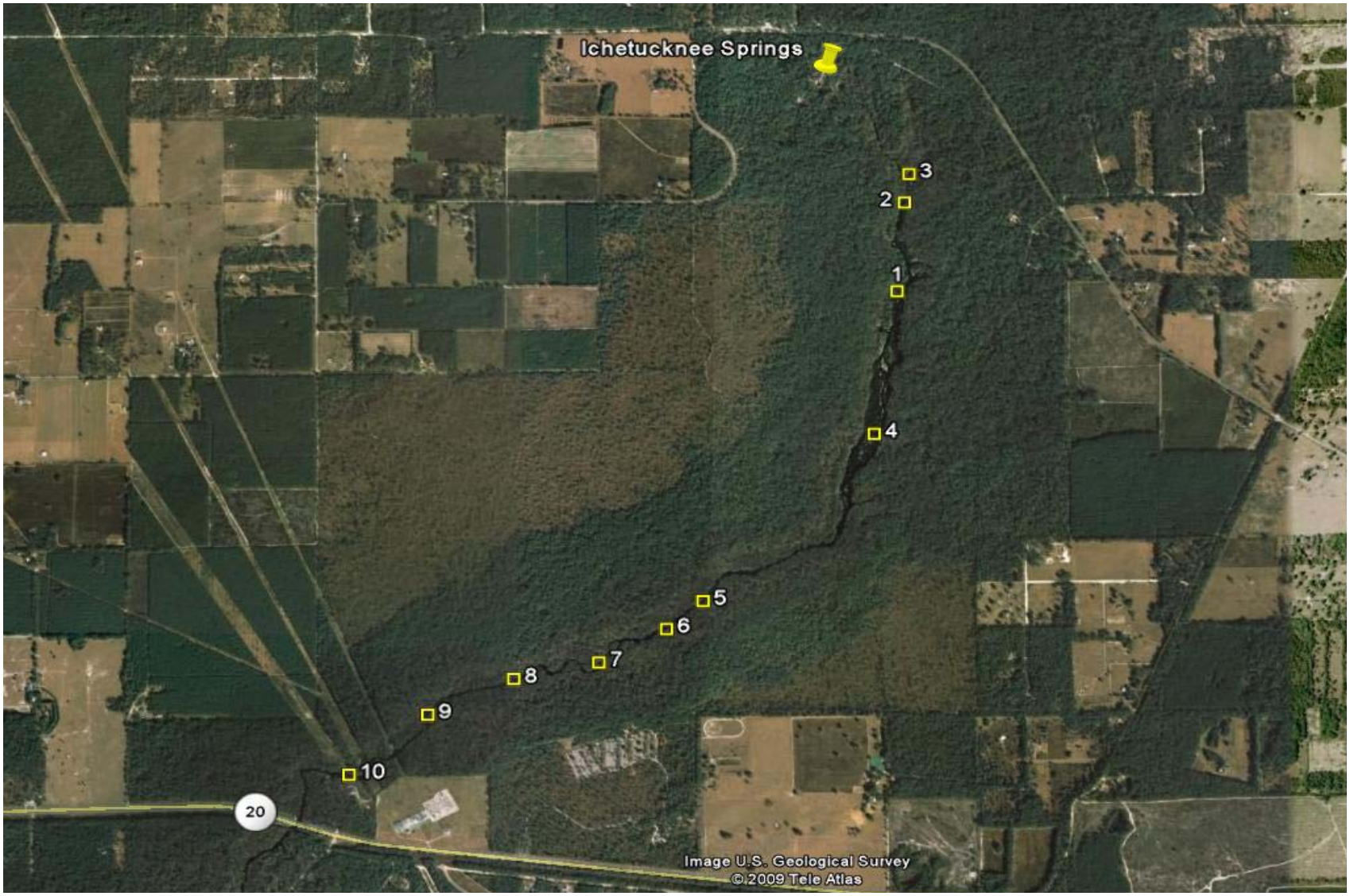


Homosassa Springs (Citrus Co.) Emergent Invertebrates Data
Trap Collections made 11/5/08



Homosassa Springs (Citrus Co.) Emergent Invertebrates Data
Trap Collections made 11/6/08





APPENDIX J
Location of macroinvertebrate emergence traps for Ichetucknee Springs (Columbia Co.) during July 6 to 9, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Ichetucknee Springs (Columbia Co.) during July 6 to 9, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Run	7/6/2009	1	29.975250°	-82.759240°	0.5	*Chara sp.*
	7/6/2009	2	29.979065°	-82.758904°	0.7	*Sagittaria kurziana*
	7/6/2009	3	29.980290°	-82.758688°	1.3	*Sagittaria kurziana*
	7/6/2009	4	29.969150°	-82.760280°	0.3	*Sagittaria kurziana* / *Zizania aquatica*
	7/6/2009	5	29.962058°	-82.767922°	0.6	*Sagittaria kurziana*
	7/6/2009	6	29.960882°	-82.769545°	0.4	woody debris
	7/6/2009	7	29.959470°	-82.772550°	0.9	*Sagittaria kurziana*
	7/6/2009	8	29.958778°	-82.776334°	0.8	*Sagittaria kurziana* / woody debris
	7/6/2009	9	29.957270°	-82.780140°	0.2	*Chara sp.*
	7/6/2009	10	29.954750°	-82.783610°	0.8	*Sagittaria kurziana* / mud

** USGS gage (US27) height reported as 14.58' on 7/6/09 at 10:00*

APPENDIX J
Summary of emergent invertebrates captured from Ichetucknee Springs on July 7, 2009.

Location	Collection Date	Time	Trap #	*Beardius*	*Cecidomyiidae*	*Chironomini*	*Cricotopus bicinctus*	*Cricotopus sp.*	*Cryptochironomus fulvus*	*Dicrotendipes modestus*	*Pentaneura inconspicua*	*Polypedilum halterale*	*Procladius*	*Pseudochironomus sp.*	*Tanypodinae*	*Tanytarsini*	*Trichoptera - Hydroptilidae*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Run Emergence Rate (#/day)
Spring Run	7/7/2009	12:51	1			1												1	4	434,128
	7/7/2009	12:10	2			1	7			6					3	3	1	21	84	9,116,688
	7/7/2009	11:30	3															0	0	0
	7/7/2009	13:45	4	5		2	1					2				1		11	44	4,775,408
	7/7/2009	14:00	5		1	2	1		1				2	1	1	2		11	44	4,775,408
	7/7/2009	14:30	6		1	1		2							1	28		33	132	14,326,224
	7/7/2009	15:00	7									3				14	1	18	72	7,814,304
	7/7/2009	15:15	8			1					2					5		8	32	3,473,024
	7/7/2009	15:30	9													24	1	25	100	10,853,200
	7/7/2009	16:00	10			1	5			2					3	20		31	124	13,457,968
			SUM	**5**	**2**	**9**	**14**	**2**	**1**	**8**	**2**	**5**	**2**	**1**	**8**	**97**	**3**	**159**		**69,026,352**
			Average	**0.50**	**0.20**	**0.90**	**1.40**	**0.20**	**0.10**	**0.80**	**0.20**	**0.50**	**0.20**	**0.10**	**0.80**	**9.70**	**0.30**	**15.90**	**63.60**	**6,902,635**

APPENDIX J

Summary of emergent invertebrates captured from Ichetucknee Springs on July 9, 2009.

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Chironomini*	*Chironomus sp.*	*Cricotopus bicinctus*	*Cricotopus sp.*	*Cryptochironomus sp.*	*Dicrotendipes neomodestus*	*Ephemeroptera*	*Labrundinia pilosella*	*Lepidoptera - Pryalidae*	*Pentaneura inconspicua*	*Polypedilum flavum*	*Polypedilum halterale*	*Polypedilum scaleanum*	*Pseudochironomus richardsoni*	*Stenochironomus sp.*	*Tanypodinae*	*Tanytarsini*	*Tribelos sp.*	*Trichoptera - Hydropsychidae*	*Trichoptera - Hydroptilidae*	*Trichoptera - Leptoceridae*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Run Emergence Rate (#/day)
Spring Run	7/9/2009	10:56	1		1															1						2	4	868,256
	7/9/2009	10:35	2		3		15			1			1	2		1	1	4			20		1	2		51	102	22,140,528
	7/9/2009	9:59	3																		9	2				11	22	4,775,408
	7/9/2009	11:15	4																							0	0	0
	7/9/2009	11:30	5	4	3							6		15		1					14		3	2	1	49	98	21,272,272
	7/9/2009	12:30	6	4	5		6			1	1			13	1	1			2		54		4		2	94	188	40,808,032
	7/9/2009	13:15	7		2									6							8		1	2		19	38	8,248,432
	7/9/2009	13:45	8	1	1							1		12				1	1		4		1			22	44	9,550,816
	7/9/2009	14:15	9	8	2	2	5	1	1					9		1	2	1	2		129		4	4		171	342	74,235,888
	7/9/2009	14:30	10	2	1		4			1				4					1		50			1		64	128	27,784,192
			SUM	**19**	**18**	**2**	**30**	**1**	**1**	**3**	**1**	**7**	**1**	**61**	**1**	**4**	**3**	**6**	**6**	**1**	**288**	**2**	**14**	**11**	**3**	**483**		**209,683,824**
			Average	**1.90**	**1.80**	**0.20**	**3.00**	**0.10**	**0.10**	**0.30**	**0.10**	**0.70**	**0.10**	**6.10**	**0.10**	**0.40**	**0.30**	**0.60**	**0.60**	**0.10**	**28.80**	**0.20**	**1.40**	**1.10**	**0.30**	**48.30**	**96.60**	**20,968,382**

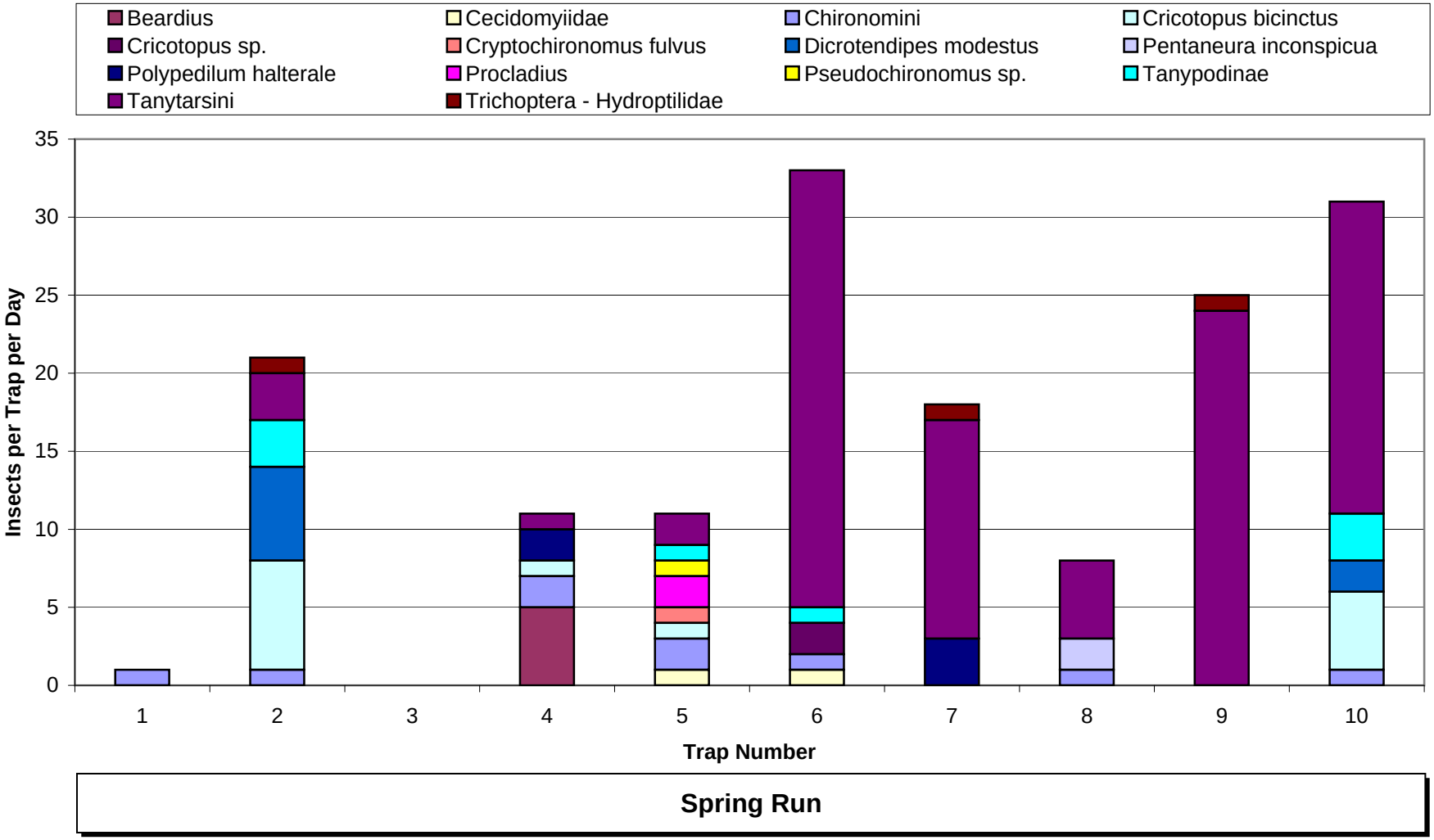
APPENDIX J

Summary of emergent invertebrates captured from Ichetucknee Springs during July 7 and 9, 2009.

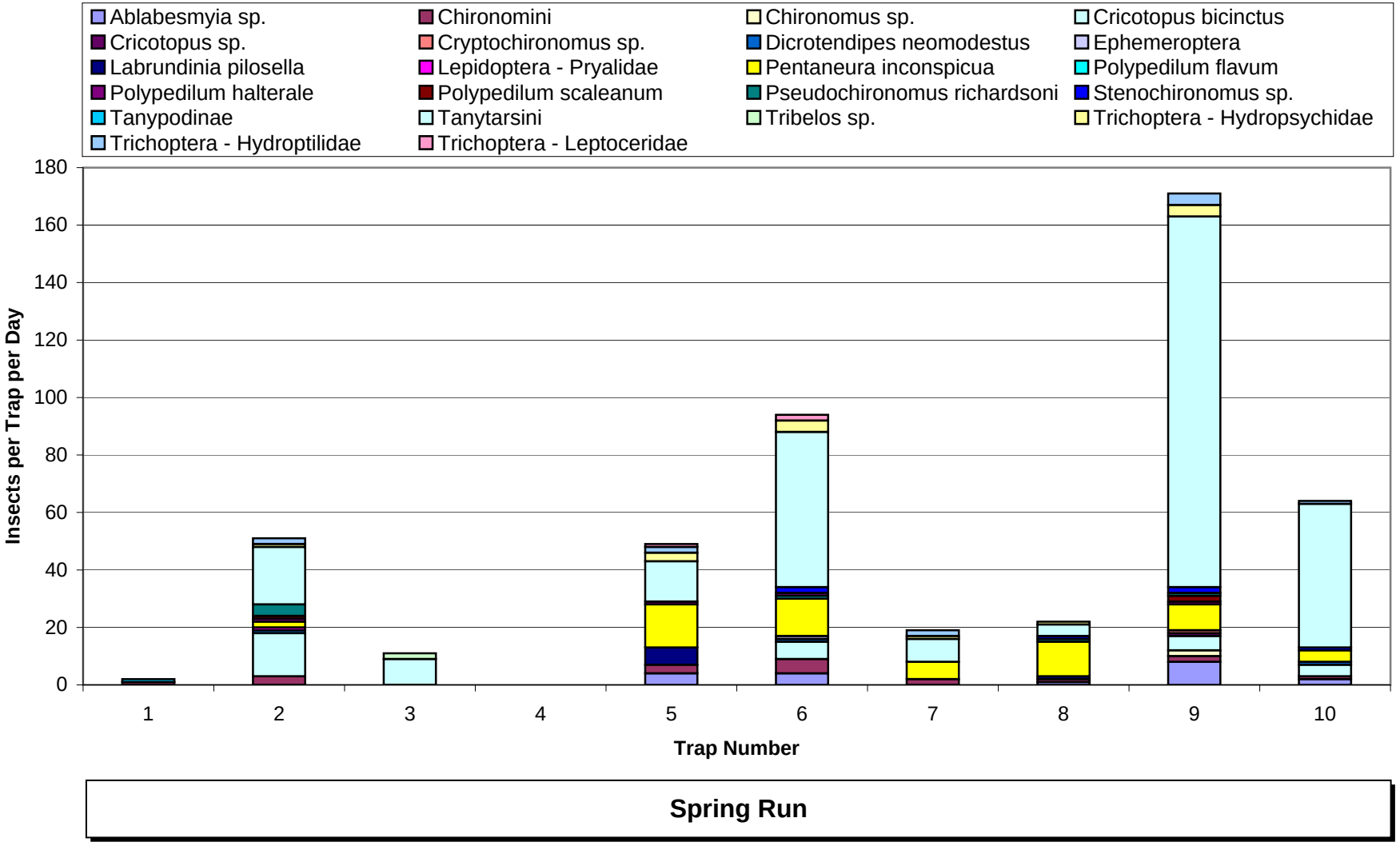
Location	Collection Date	Total Emergent Invertebrates	Average Emergence Rate (#/m^2/day) *	Average Emergence Rate (#/day) *
Spring Run	7/7/2009	159	63.60	6,902,635
	7/9/2009	483	96.60	20,968,382
	Average	**321**	**80.1**	**13,935,509**

* Based on a spring run area of 108,532 m^2.

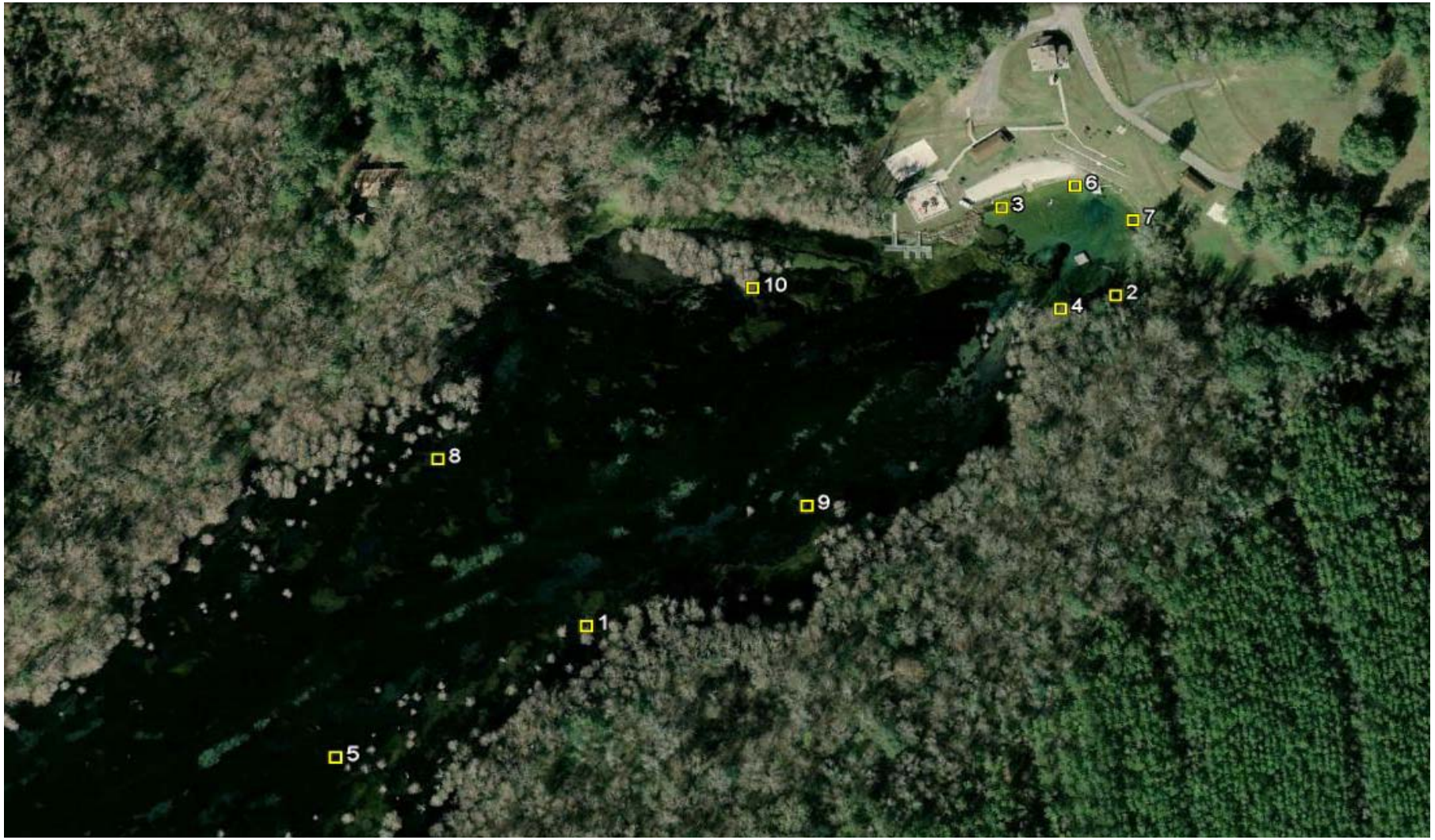
Ichetucknee Springs (Columbia Co.) Emergent Invertebrates Data
Trap Collections made 7/07/09



Ichetucknee Springs (Columbia Co.) Emergent Invertebrates Data
Trap Collections made 7/09/09



Spring Run



APPENDIX J
Location of macroinvertebrate emergence traps for Jackson Blue Springs (Jackson Co.) during January 13 to 15, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Jackson Blue Springs (Jackson Co.) during January 13 to 15, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	1/12/2009	2	30.79003°	-85.14001°	1.5	sand / algae
	1/12/2009	3	30.79047°	-85.14056°	0.5	sand / algae
	1/12/2009	4	30.78999°	-85.14031°	3.0	sand / *Vallisneria*
	1/12/2009	6	30.79054°	-85.14018°	3.5	sand
	1/12/2009	7	30.79043°	-85.14054°	2.0	duckweed / *Vallisneria*
Spring Run	1/12/2009	1	30.78856°	-85.14245°	4.0	*Ceratophyllum* / *Vallisneria*
	1/12/2009	5	30.78801°	-85.14354°	5.0	sparse *Ceratophyllum*
	1/12/2009	8	30.78927°	-85.14316°	5.2	dense *Ceratophyllum*
	1/12/2009	9	30.78908°	-85.14146°	4.6	dense *Ceratophyllum*
	1/12/2009	10	30.79005°	-85.14172°	3.0	dense *Ceratophyllum*

** USGS stage reading = 13.42 ft at 12:00*

APPENDIX J

Summary of emergent invertebrates captured from Jackson Blue Springs on January 13, 2009.

Location	Collection Date	Time	Trap #	Chironomidae	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	1/13/2009	9:30	2		0	0	0	
	1/13/2009	9:32	3		0	0	0	
Spring Pool	1/13/2009	9:34	4		0	0	0	
	1/13/2009	9:36	6		0	0	0	
	1/13/2009	9:38	7		0	0	0	
	1/13/2009	9:20	1	1	1	4		413,276
	1/13/2009	9:15	5		0	0		0
Spring Run	1/13/2009	9:10	8	1	1	4		413,276
	1/13/2009	9:25	9		0	0		0
	1/13/2009	9:05	10		0	0		0
			SUM	**2**	**2**		**0**	**826,552**
			Spring Pool Average	**0.00**	**0.00**	**0.00**		
			Spring Run Average	**0.40**	**0.40**	**1.60**		
			Grand Average	**0.20**	**0.20**	**0.80**	**0**	**165,310**

APPENDIX J

Summary of emergent invertebrates captured from Jackson Blue Springs on January 14, 2009

Location	Collection Date	Time	Trap #	Chironomidae	*Chironomus sp.*	*Beardius truncatus*	*Parachironomus potamogeti*	*Polypedilum halterale*	*Cladopelma collator*	*Apedilum elachistus*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	1/14/2009	8:56	2								0	0	0	
	1/14/2009	8:50	3								0	0	0	
Spring Pool	1/14/2009	8:58	4								0	0	0	
	1/14/2009	8:52	6								0	0	0	
	1/14/2009	8:54	7							1	1	4	16,324	
	1/14/2009	9:25	1	1							1	4		413,276
	1/14/2009	9:20	5	2	1	2	1	1	2		9	36		3,719,484
Spring Run	1/14/2009	9:15	8								0	0		0
	1/14/2009	9:30	9								0	0		0
	1/14/2009	9:10	10				1		1		2	8		826,552
			SUM	**3**	**1**	**2**	**2**	**1**	**3**	**1**	**13**		**16,324**	**4,959,312**
			Spring Pool Average	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.20**	**0.20**	**0.80**		
			Spring Run Average	**0.60**	**0.20**	**0.40**	**0.40**	**0.20**	**0.60**	**0.00**	**2.40**	**9.60**		
			Grand Average	**0.30**	**0.10**	**0.20**	**0.20**	**0.10**	**0.30**	**0.10**	**1.30**	**5.20**	**3,265**	**991,862**

APPENDIX J

Summary of emergent invertebrates captured from Jackson Blue Springs on January 15, 2009.

Location	Collection Date	Time	Trap #	*Chironomidae*	*Pseudochironomus richardsoni*	*Polypedilum scalaenum*	*Hydroptilidae*	*Beardius truncatus*	*Polypedilum halterale*	*Ablabesmyia mallochi*	*Chironomus sp.*	*Cladopelma collator*	*Cryptochironomus sp.*	*Cricotopus sp.*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	1/15/2009	9:36	2		1										1	4	16,324	
	1/15/2009	9:30	3	2											2	8	32,648	
Spring Pool	1/15/2009	9:38	4	1		1	2								4	16	65,296	
	1/15/2009	9:32	6												0	0	0	
	1/15/2009	9:34	7												0	0	0	
	1/15/2009	10:30	1	1											1	4		413,276
	1/15/2009	10:20	5	8				6	1	1	1				17	68		7,025,692
Spring Run	1/15/2009	10:10	8	4								1			5	20		2,066,380
	1/15/2009	10:40	9	1				1					1	1	4	16		1,653,104
	1/15/2009	10:00	10	2											2	8		826,552
			SUM	**19**	**1**	**1**	**2**	**7**	**1**	**1**	**1**	**1**	**1**	**1**	**36**		**114,268**	**11,985,004**
			Spring Pool Average	**0.60**	**0.20**	**0.20**	**0.40**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.40**	**5.60**		
			Spring Run Average	**3.20**	**0.00**	**0.00**	**0.00**	**1.40**	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**5.80**	**23.20**		
			Grand Average	**1.90**	**0.10**	**0.10**	**0.20**	**0.70**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**3.60**	**14.40**	**22,854**	**2,397,001**

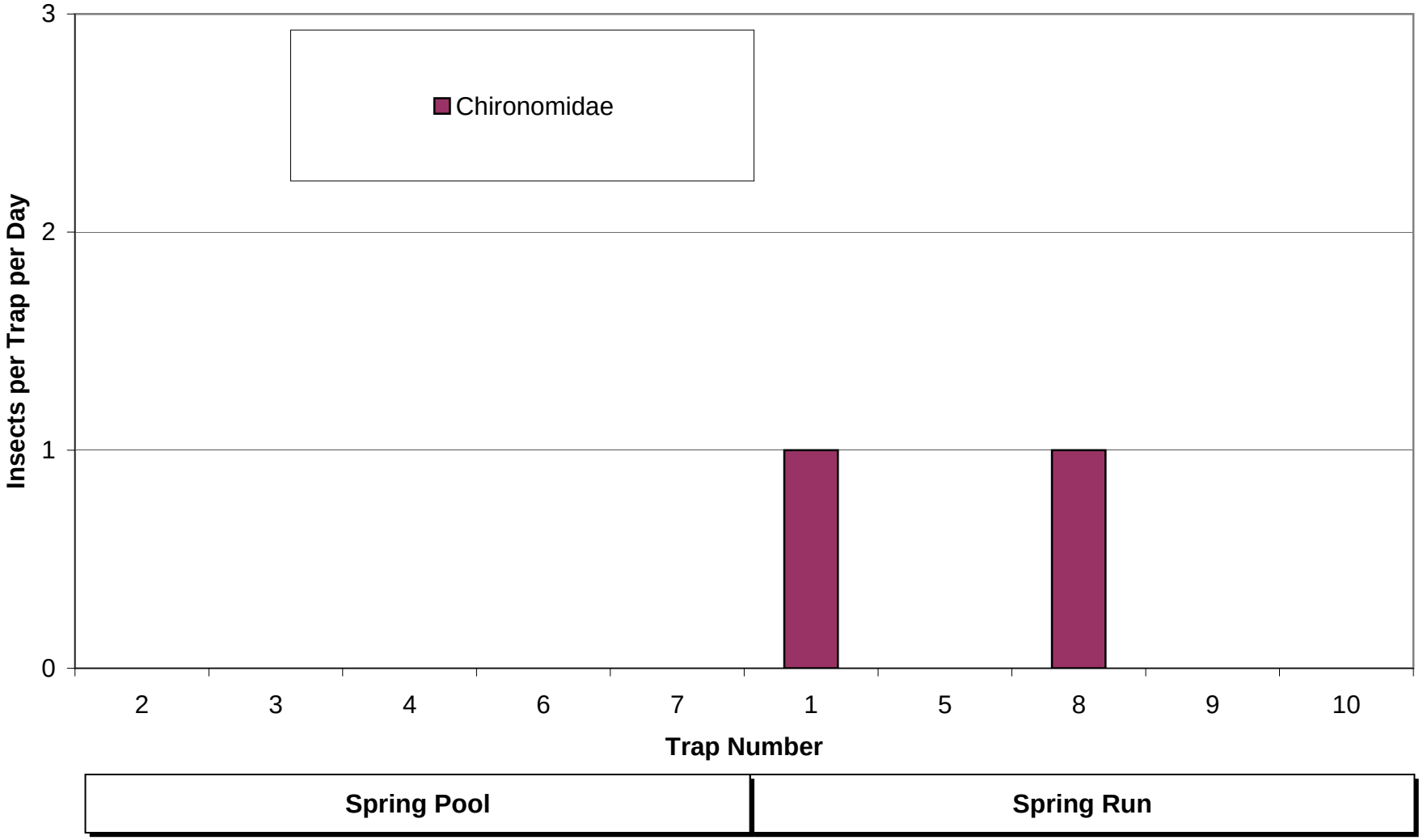
APPENDIX J

Summary of emergent invertebrates captured from Jackson Blue Springs during January 13, 14, and 15, 2009.

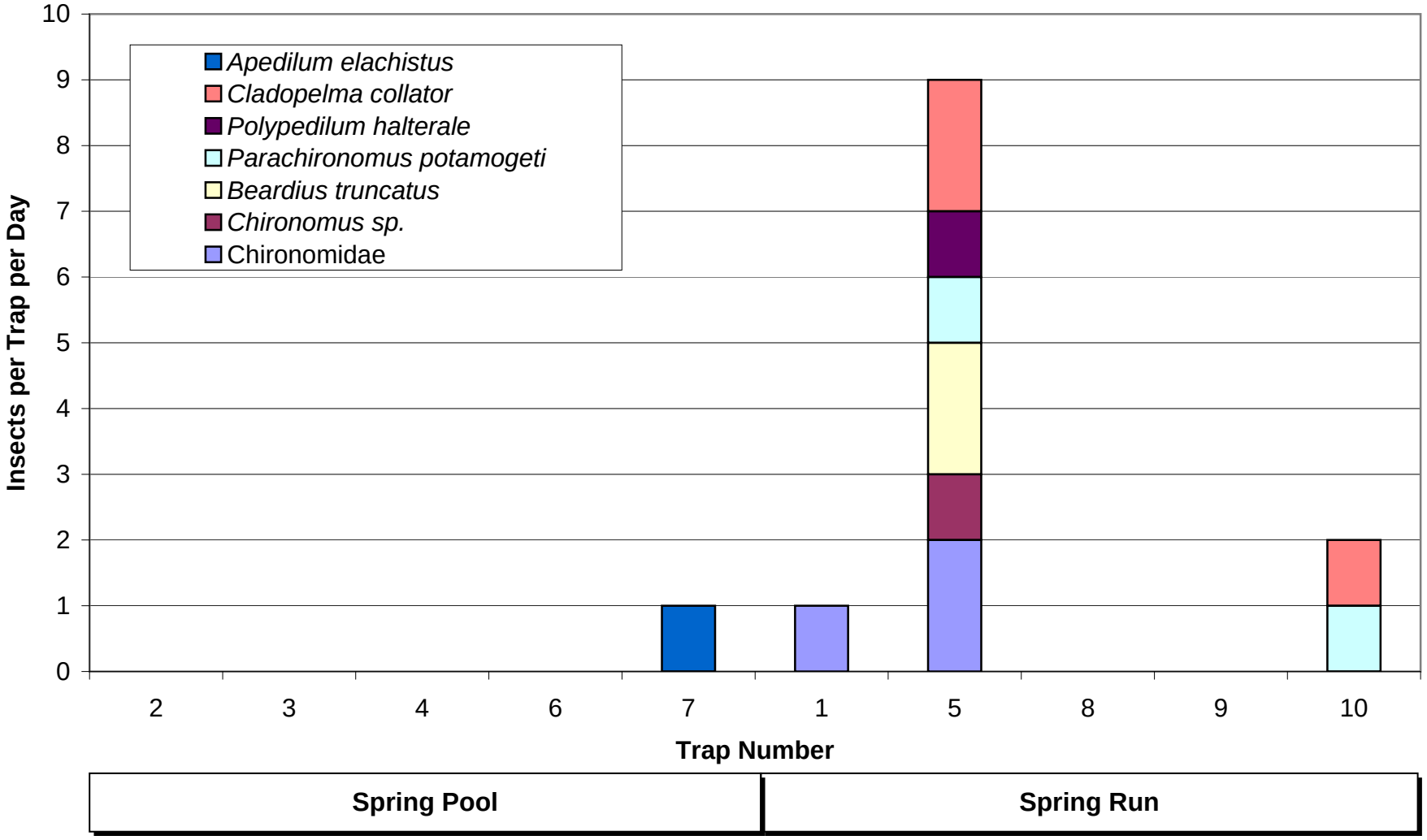
Location	Collection Date	Total Emergent Invertebrates	Emergence Rate (#/m^2/day) *	Emergence Rate (#/day) *
Spring Pool	1/13/2009	0	0.00	0
	1/14/2009	1	0.80	3,265
	1/15/2009	7	5.60	22,854
	Average	**3**	**2.1**	**8,706**
Spring Run	1/13/2009	2	1.60	165,310
	1/14/2009	12	9.60	991,862
	1/15/2009	29	23.20	2,397,001
	Average	**14**	**11.5**	**1,184,725**
	Grand Average	**9**	**6.8**	**596,715**

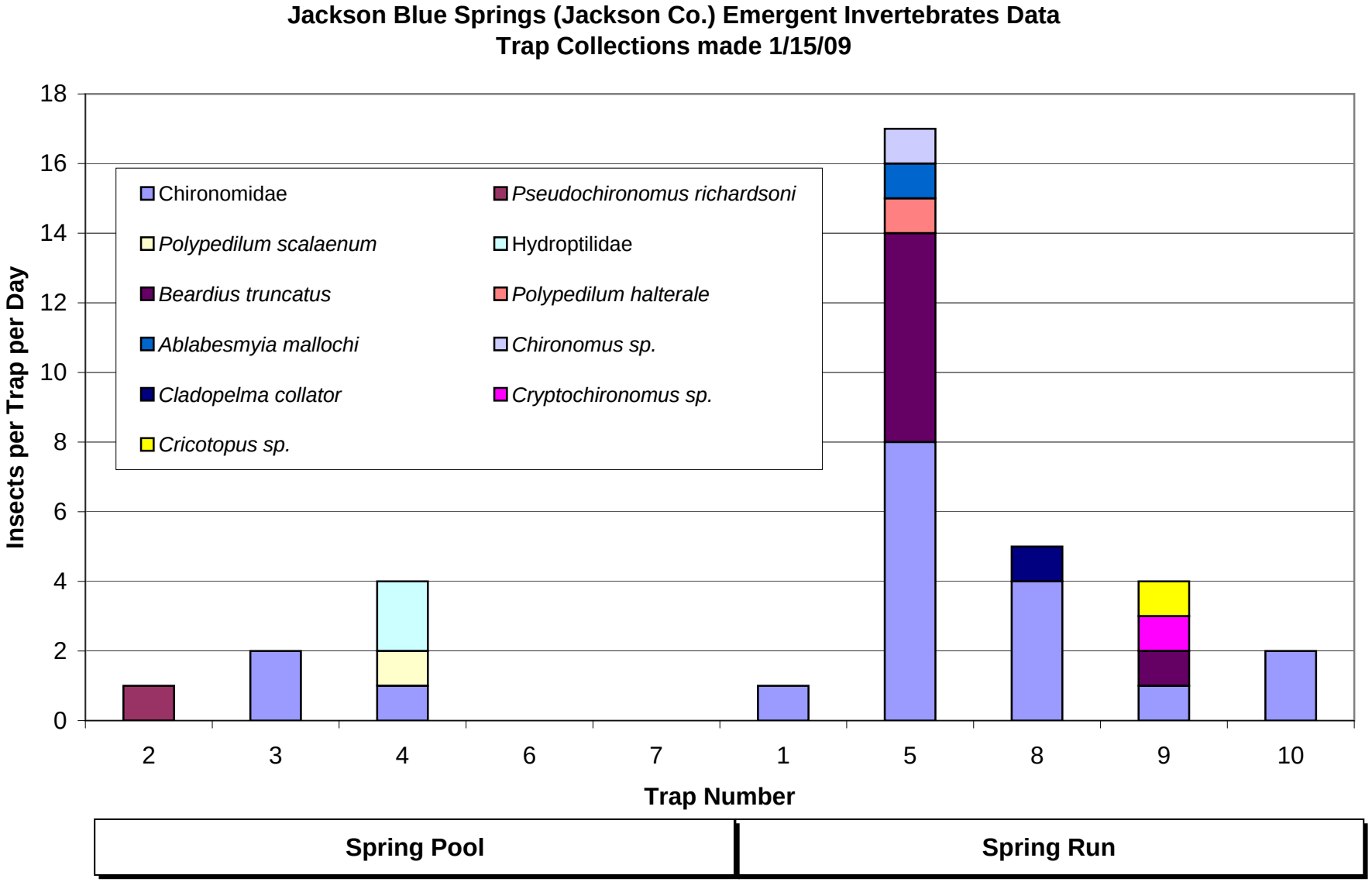
* Based on a spring pool area of 4,081 m^2 and spring run area of 103,319 m^2.

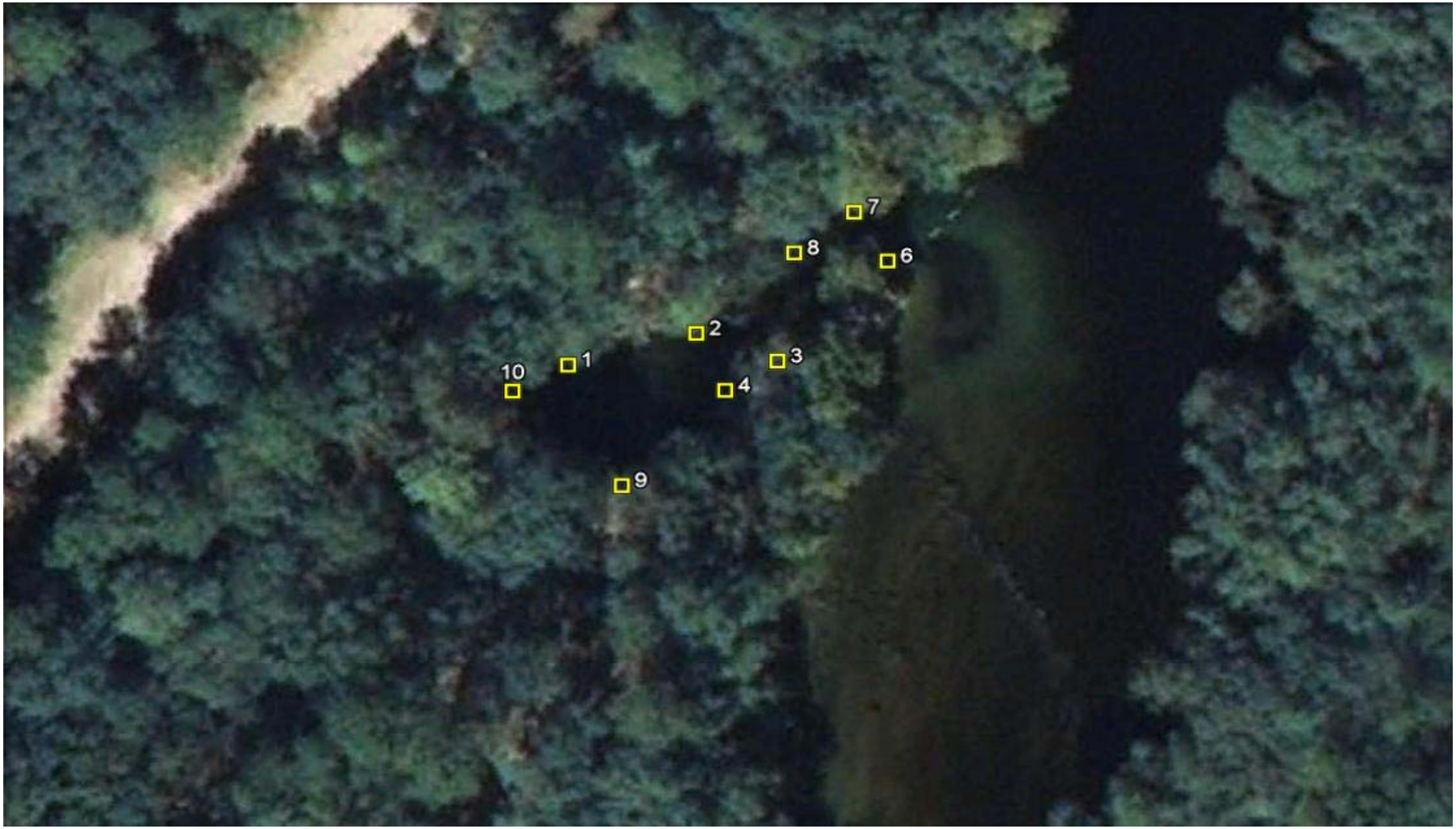
Jackson Blue Springs (Jackson Co.) Emergent Invertebrates Data
Trap Collections made 1/13/09



Jackson Blue Springs (Jackson Co.) Emergent Invertebrates Data
Trap Collections made 1/14/09




Jackson Blue Springs (Jackson Co.) Emergent Invertebrates Data
Trap Collections made 1/15/09
Insects per Trap per Day
0
2
4
6
8
10
12
14
16
18
Chironomidae
Pseudochironomus richardsoni
Polypedilum scalaenum
Hydroptilidae
Beardius truncatus
Polypedilum halterale
Ablabesmyia mallochi
Chironomus sp.
Cladopelma collator
Cryptochironomus sp.
Cricotopus sp.
2
3
4
6
7
1
5
8
9
10
Trap Number
Spring Pool
Spring Run



APPENDIX J
Location of macroinvertebrate emergence traps for Madison Blue Springs (Madison Co.) during December 1 to 2, 2008.

APPENDIX J

Macroinvertebrate emergence trap meta data for Madison Blue Springs (Madison Co.) during December 1 to 2, 2008.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	12/2/2008	1	30.480561°	-83.244399°	7.62	rock wall
	12/2/2008	2	30.480600°	-83.244230°	1.83	rock/algae
	12/2/2008	4	30.480530°	-83.244192°	0.73	rock/algae
	12/2/2008	9	30.480413°	-83.244328°	1.07	rock
	12/2/2008	10	30.480529°	-83.244472°	1.04	algae
Spring Run	12/2/2008	3	30.480566°	-83.244123°	1.37	rock/algae
	12/2/2008	6	30.480689°	-83.243978°	1.52	sand/debris
	12/2/2008	7	30.480749°	-83.244022°	1.46	sand/debris
	12/2/2008	8	30.480699°	-83.244101°	1.92	sand/debris
	12/2/2008	5	N/A	N/A	N/A	N/A

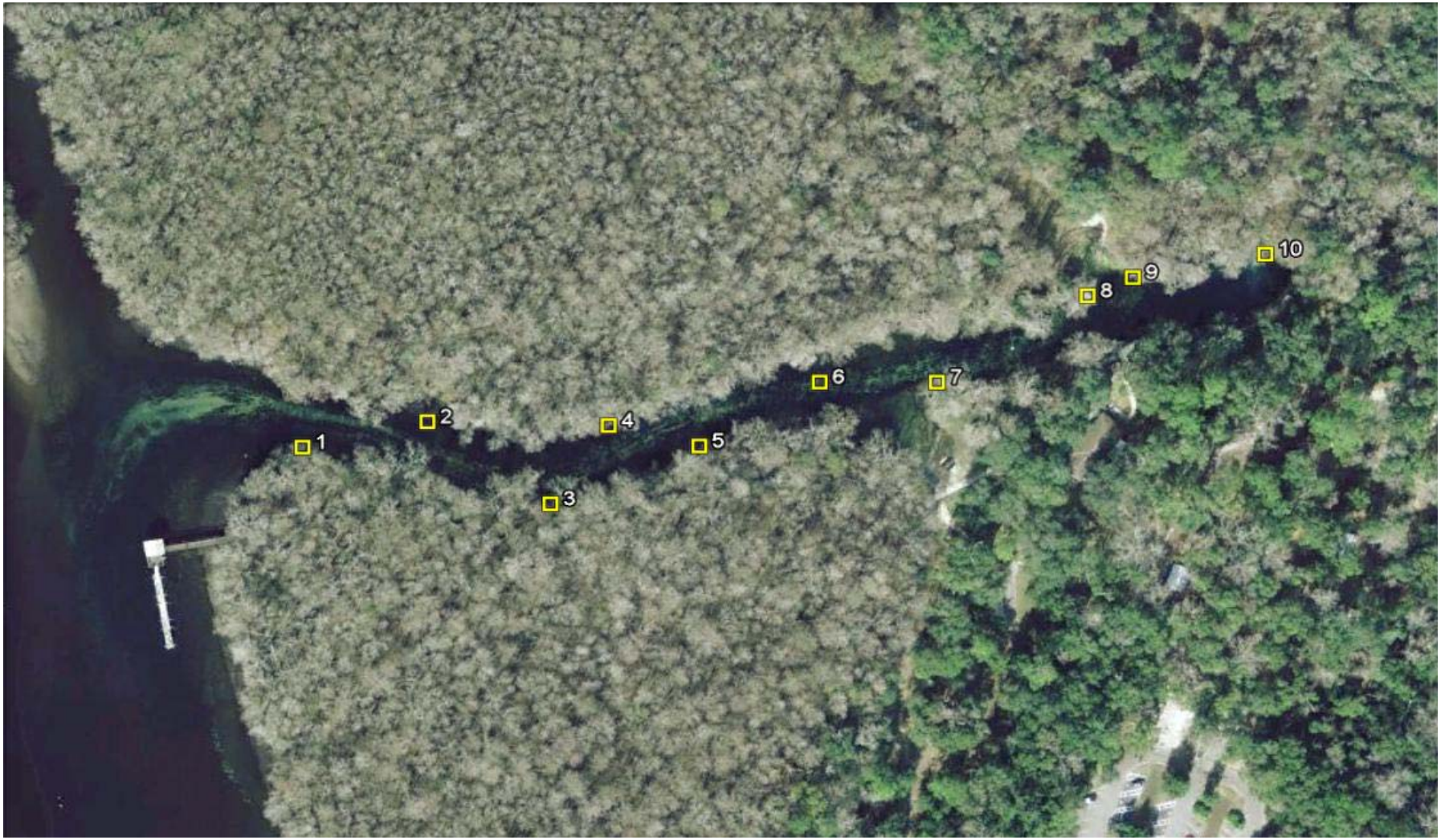
** staff gage by stairs to pool = 11.8 ft at 08:00*

APPENDIX J
Summary of emergent invertebrates captured from Madison Blue Springs during December 2, 2008.

Location	Collection Date	Total Emergent Invertebrates	Emergence Rate (#/m^2/day) *	Emergence Rate (#/day) *
Spring Pool	12/2/2008	0	0	0
	Average	**0.0**	**0.0**	**0**
Spring Run	12/2/2008	0	0	0
	Average	**0.0**	**0.0**	**0**
	Grand Average	**0.0**	**0.0**	**0**

* Based on a spring pool area of 441 m^2 and spring run area of 634 m^2.

NO INSECTS CAPTURED IN THE NINE TRAPS
SPRING FLOODED DURING TRAP DEPLOYMENT
WITHLACOOCHEE RIVER WATER WAS TURBID AND COLD (~15 C)
HOWEVER- THERE WAS A SWARM OF DIPTERA (Empididae) BY POOL STAIRS



APPENDIX J
Location of macroinvertebrate emergence traps for Manatee Springs (Levy Co.) during August 3 to 6, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Manatee Springs (Levy Co.) during August 3 to 6, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Run	8/3/2009	1	29.489086°	-82.980126°	0.55	filamentous algae
	8/3/2009	2	29.489170°	-82.979690°	0.73	filamentous algae
	8/3/2009	3	29.488900°	-82.979260°	0.46	filamentous algae
	8/3/2009	4	29.489157°	-82.979057°	0.47	filamentous algae
	8/3/2009	5	29.489090°	-82.978740°	0.37	filamentous algae
	8/3/2009	6	29.489300°	-82.978320°	1.14	filamentous algae
	8/3/2009	7	29.489300°	-82.977910°	1.33	filamentous algae
Spring Pool	8/3/2009	8	29.489584°	-82.977384°	0.59	filamentous algae
	8/3/2009	9	29.489644°	-82.977226°	0.87	filamentous algae
	8/3/2009	10	29.489721°	-82.976763°	0.45	filamentous algae / sand

** USGS staff gage (spring pool) water level was 2.62' on 8/3/09 at 14:30*

APPENDIX J

Summary of emergent invertebrates captured from Manatee Springs on August 4, 2009.

Location	Collection Date	Time	Trap #	*Chironomini*	*Dicrotendipes modestus*	*Trichoptera: Hydroptilidae*	*Labrundinia sp.*	*Pentaneura inconspicua*	*Procladius sp.*	*Tanytarsini*	*Zavreliella marmorata*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	8/4/2009	10:23	1							1		1	4		21,408
	8/4/2009	10:28	2	7	1	1	1		1	15	4	30	120		642,240
	8/4/2009	10:32	3	2						54	1	57	228		1,220,256
Spring Run	8/4/2009	10:37	4					1		6	1	8	32		171,264
	8/4/2009	10:42	5									0	0		0
	8/4/2009	10:46	6							5		5	20		107,040
	8/4/2009	10:49	7							5		5	20		107,040
	8/4/2009	9:49	8							4		4	16	41,888	
Spring Pool	8/4/2009	9:52	9							3		3	12	31,416	
	8/4/2009	9:55	10							2		2	8	20,944	
			SUM	**9**	**1**	**1**	**1**	**1**	**1**	**95**	**6**	**115**		**94,248**	**2,269,248**
			Spring Pool Average	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.00**	**0.00**	**3.00**	**12.00**		
			Spring Run Average	**1.29**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**12.29**	**0.86**	**15.14**	**60.57**		
			Grand Average	**0.90**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**9.50**	**0.60**	**11.50**	**46.00**	**31,416**	**324,178**

APPENDIX J
Summary of emergent invertebrates captured from Manatee Springs on August 5, 2009.

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Ephydridae*	*Chironomini*	*Chironomus sp.*	*Dicrotendipes modestus*	*Polypedilum scalaenum*	*Tanytarsini*	*Zavreliella marmorata*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	8/5/2009	9:00	1			8				82	4	94	376		2,012,352
	8/5/2009	9:05	2	5		2	2	7		24	3	43	172		920,544
	8/5/2009	9:10	3		1	1				14	1	17	68		363,936
Spring Run	8/5/2009	9:15	4		2			2				4	16		85,632
	8/5/2009	9:20	5									0	0		0
	8/5/2009	9:25	6									0	0		0
	8/5/2009	9:30	7				1			11		12	48		256,896
	8/5/2009	9:35	8									0	0	0	
Spring Pool	8/5/2009	9:40	9									0	0	0	
	8/5/2009	9:45	10						2			2	8	20,944	
			SUM	**5**	**3**	**11**	**3**	**9**	**2**	**131**	**8**	**172**		**20,944**	**3,639,360**
			Spring Pool Average	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.67**	**0.00**	**0.00**	**0.67**	**2.67**		
			Spring Run Average	**0.71**	**0.43**	**1.57**	**0.43**	**1.29**	**0.00**	**18.71**	**1.14**	**24.29**	**97.14**		
			Grand Average	**0.50**	**0.30**	**1.10**	**0.30**	**0.90**	**0.20**	**13.10**	**0.80**	**17.20**	**68.80**	**6,981**	**519,909**

APPENDIX J

Summary of emergent invertebrates captured from Manatee Springs on August 6, 2009.

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Ephydridae*	*Chironomini*	*Dicrotendipes modestus*	*Labrundinia sp.*	*Tanypodinae*	*Tanytarsini*	*Zavreliella marmorata*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	8/6/2009	10:05	1	8			4	1		84	1	98	392		2,097,984
	8/6/2009	10:10	2						1	1	1	3	12		64,224
	8/6/2009	10:15	3		1				1	6	3	11	44		235,488
Spring Run	8/6/2009	10:18	4	1	2	1					1	5	20		107,040
	8/6/2009	10:22	5									0	0		0
	8/6/2009	10:26	6			1						1	4		21,408
	8/6/2009	10:30	7							25		25	100		535,200
	8/6/2009	10:35	8							5		5	20	52,360	
Spring Pool	8/6/2009	10:40	9							2		2	8	20,944	
	8/6/2009	10:45	10							1		1	4	10,472	
			SUM	**9**	**3**	**2**	**4**	**1**	**2**	**124**	**6**	**151**		**83,776**	**3,061,344**
			Spring Pool Average	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.67**	**0.00**	**2.67**	**10.67**		
			Spring Run Average	**1.29**	**0.43**	**0.29**	**0.57**	**0.14**	**0.29**	**16.57**	**0.86**	**20.43**	**81.71**		
			Grand Average	**0.90**	**0.30**	**0.20**	**0.40**	**0.10**	**0.20**	**12.40**	**0.60**	**15.10**	**60.40**	**27,925**	**437,335**

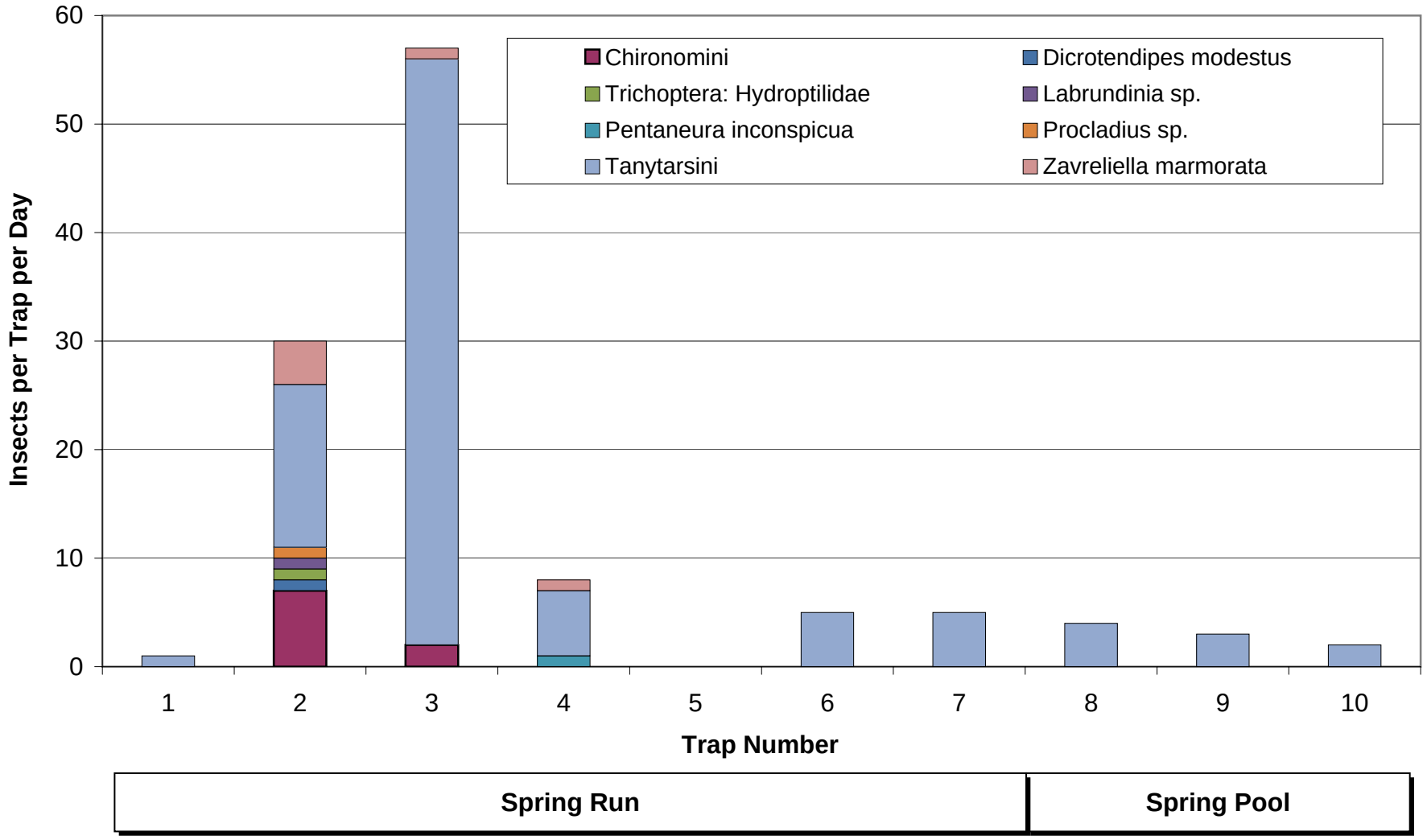
APPENDIX J

Summary of emergent invertebrates captured from Manatee Springs on August 4, 5, and 6, 2009.

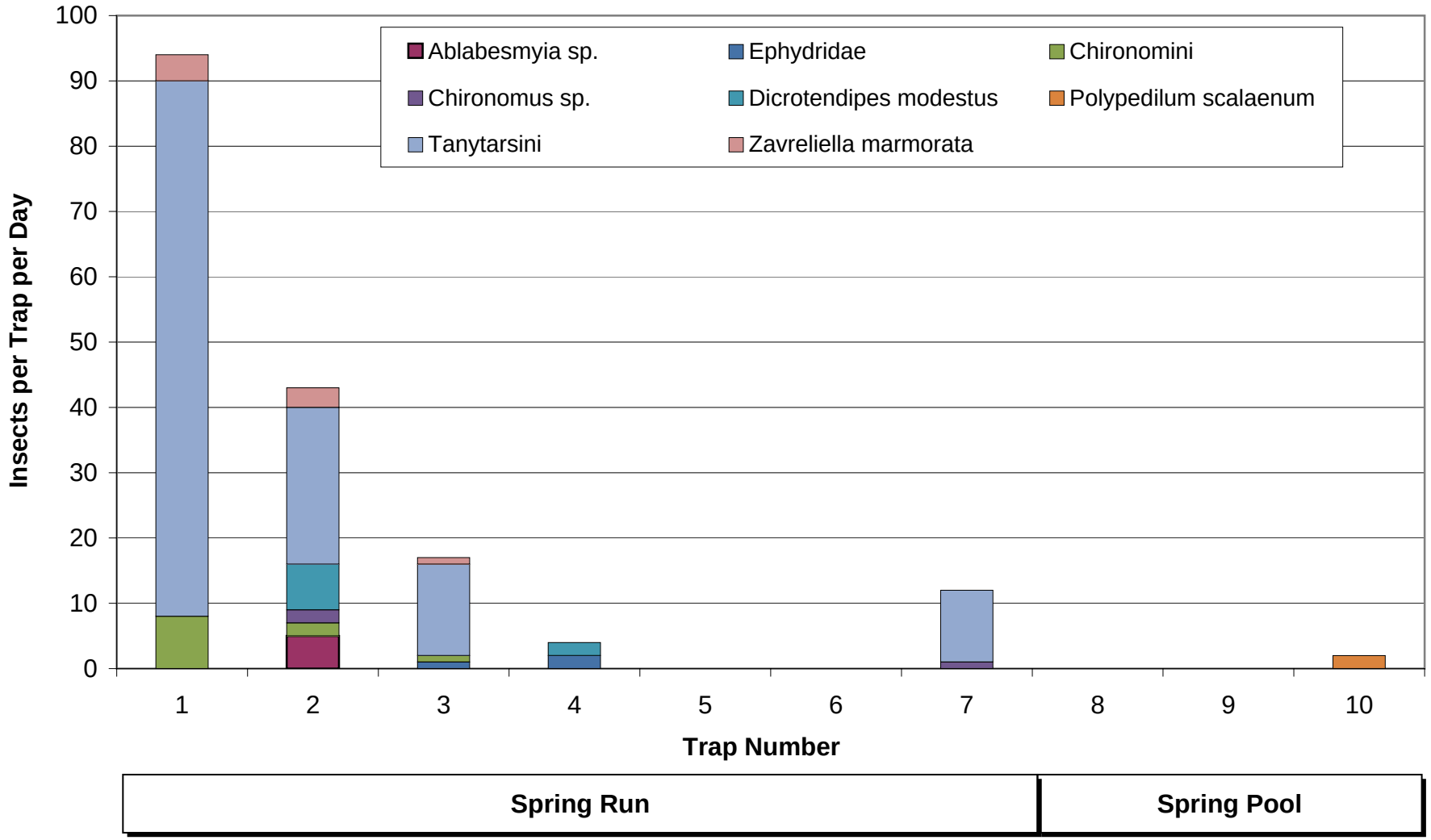
Location	Collection Date	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Emergence Rate (#/day) *
Spring Pool	8/4/2009	9	12.00	31,416
	8/5/2009	2	2.67	6,981
	8/6/2009	8	10.67	27,925
	Average	**6**	**8.4**	**22,108**
Spring Run	8/4/2009	106	60.57	324,178
	8/5/2009	170	97.14	519,909
	8/6/2009	143	81.71	437,335
	Average	**140**	**79.8**	**427,141**
	Grand Average	**73**	**44.1**	**224,624**

* Based on a spring pool area of 2,618 m^2 and spring run area of 5,352 m^2.

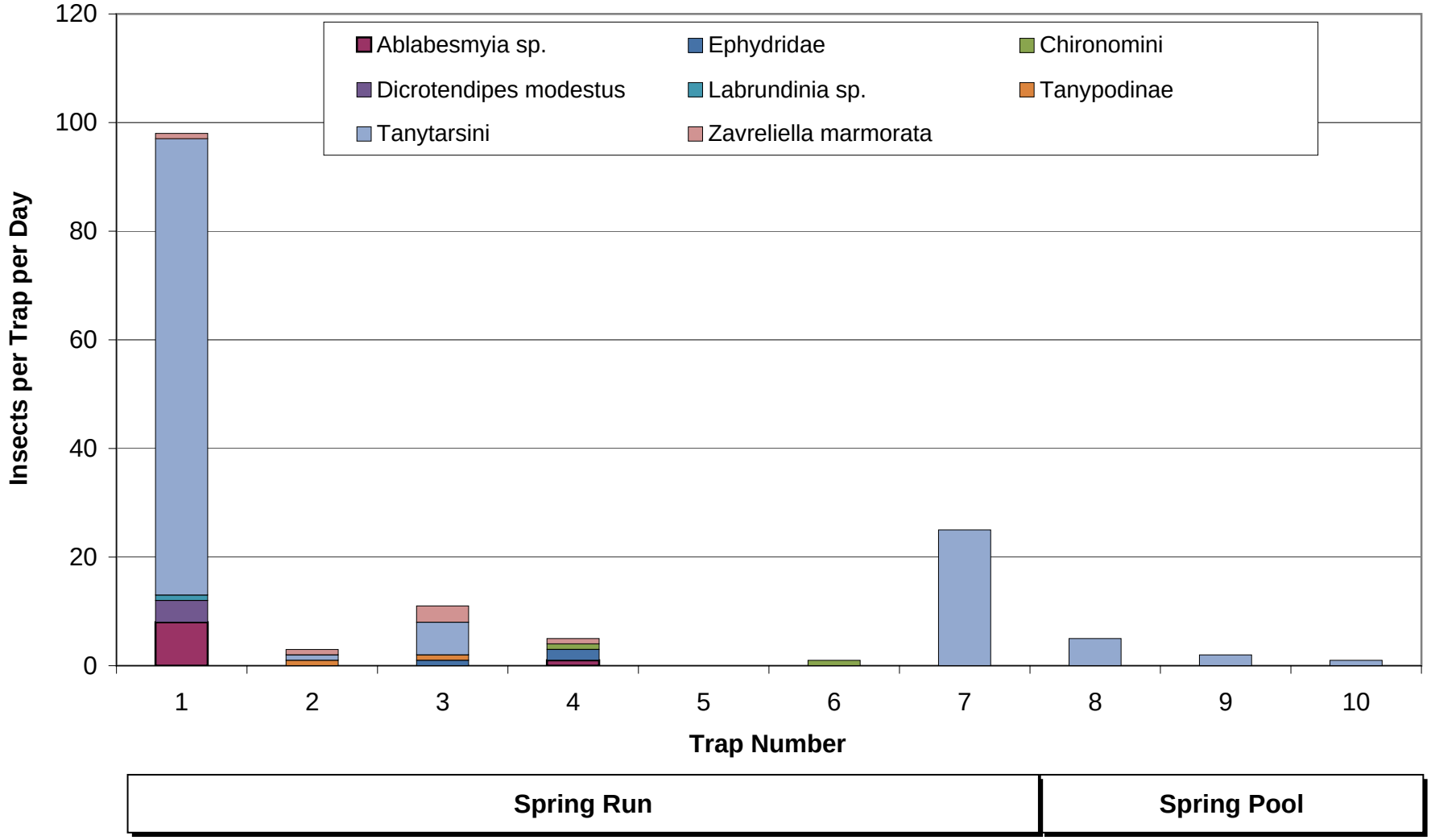
Manatee Springs (Levy Co.) Emergent Invertebrates Data
Trap Collections made 8/4/09



Manatee Springs (Levy Co.) Emergent Invertebrates Data
Trap Collections made 8/5/09



Manatee Springs (Levy Co.) Emergent Invertebrates Data
Trap Collections made 8/6/09





APPENDIX J
Location of macroinvertebrate emergence traps for Ponce de Leon Springs (Holmes Co.) during September 8 to 11, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Ponce de Leon Springs (Holmes Co.) during September 8 to 11, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	9/8/2009	2	30.721191°	-85.930830°	0.61	sand / *Najas guadalupensis*
	9/8/2009	4	30.720920°	-85.930960°	0.98	sand / *Chara sp.*
	9/8/2009	6	30.721026°	-85.930858°	0.68	sand / *Potamogeton illinoensis*
	9/8/2009	9	30.721144°	-85.930669°	0.76	*Potamogeton illinoensis* / *Najas guadalupensis*
	9/8/2009	10	30.721020°	-85.930990°	1.16	organic debris / leaf litter
Spring Run	9/8/2009	1	30.720740°	-85.930630°	0.32	sand
	9/8/2009	3	30.719410°	-85.929863°	0.85	sand / woody debris
	9/8/2009	5	30.720210°	-85.930270°	0.55	*Brachelyma* / woody debris
	9/8/2009	7	30.719560°	-85.929770°	0.85	sand / *Brachelyma*
	9/8/2009	8	30.719830°	-85.930150°	0.50	sand / *Brachelyma*

** no staff gage in pool or run; water levels in run dropped about 0.3 m during sampling as levels in Sandy Creek fell.*

APPENDIX J
Summary of emergent invertebrates captured from Ponce de Leon Springs on September 9, 2009

Location	Collection Date	Time	Trap #	*Chironomini*	*Microtendipes sp.*	*Polypedilum sp.*	*Stenochironomus sp.*	*Tanytarsini*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	9/9/2009	9:40	2						0	0	0	
	9/9/2009	9:32	4						0	0	0	
Spring Pool	9/9/2009	9:30	6	1				2	3	12	19,140	
	9/9/2009	9:44	9					2	2	8	12,760	
	9/9/2009	9:35	10					2	2	8	12,760	
	9/9/2009	10:00	1						0	0		0
	9/9/2009	10:20	3			1	1	15	17	68		127,092
Spring Run	9/9/2009	10:10	5						0	0		0
	9/9/2009	10:17	7					4	4	16		29,904
	9/9/2009	10:14	8		1				1	4		7,476
			SUM	**1**	**1**	**1**	**1**	**25**	**29**		**44,660**	**164,472**
			Spring Pool Average	**0.20**	**0.00**	**0.00**	**0.00**	**1.20**	**1.40**	**5.60**		
			Spring Run Average	**0.00**	**0.20**	**0.20**	**0.20**	**3.80**	**4.40**	**17.60**		
			Grand Average	**0.10**	**0.10**	**0.10**	**0.10**	**2.50**	**2.90**	**11.60**	**8,932**	**32,894**

APPENDIX J

Summary of emergent invertebrates captured from Ponce de Leon Springs on September 10, 2009.

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Chironomini*	*Dicrotendipes modestus*	*Microtendipes sp.*	*Paracladopelma sp.*	*Polypedilum sp.*	*Tanytarsini*	*Trichoptera: Hydropsychidae*	*Trichoptera: Hydroptilidae*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	9/10/2009	11:04	2							1			1	4	6,380	
	9/10/2009	10:50	4							1	2		3	12	19,140	
Spring Pool	9/10/2009	10:54	6			1				1		1	3	12	19,140	
	9/10/2009	11:08	9							5			5	20	31,900	
	9/10/2009	11:00	10							1			1	4	6,380	
	9/10/2009	11:20	1					1					1	4		7,476
	9/10/2009	11:30	3	2	5		4		2	19			32	128		239,232
Spring Run	9/10/2009	11:24	5										0	0		0
	9/10/2009	11:27	7		1					5			6	24		44,856
	9/10/2009	11:26	8		1					2			3	12		22,428
			SUM	**2**	**7**	**1**	**4**	**1**	**2**	**35**	**2**	**1**	**55**		**82,940**	**313,992**
			Spring Pool Average	**0.00**	**0.00**	**0.20**	**0.00**	**0.00**	**0.00**	**1.80**	**0.40**	**0.20**	**2.60**	**10.40**		
			Spring Run Average	**0.40**	**1.40**	**0.00**	**0.80**	**0.20**	**0.40**	**5.20**	**0.00**	**0.00**	**8.40**	**33.60**		
			Grand Average	**0.20**	**0.70**	**0.10**	**0.40**	**0.10**	**0.20**	**3.50**	**0.20**	**0.10**	**5.50**	**22.00**	**16,588**	**62,798**

APPENDIX J
Summary of emergent invertebrates captured from Ponce de Leon Springs on September 11, 2009

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Chironomini*	*Dicrotendipes modestus*	*Microtendipes sp.*	*Polypedilum illinoense*	*Polypedilum scalaenum*	*Polypedilum sp.*	*Pseudochironomus sp.*	*Stenochironomus sp.*	*Tanytarsini*	*Trichoptera: Hydropsychidae*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	9/11/2009	9:12	2							1			1		2	8	12,760	
	9/11/2009	9:00	4										1	1	2	8	12,760	
Spring Pool	9/11/2009	9:04	6								1				1	4	6,380	
	9/11/2009	9:14	9			2									2	8	12,760	
	9/11/2009	9:08	10												0	0	0	
	9/11/2009	9:55	1						1				12		13	52		97,188
	9/11/2009	10:05	3	7	5		13	7	5			1	33		71	284		530,796
Spring Run	9/11/2009	9:57	5				1		1						2	8		14,952
	9/11/2009	10:03	7	1									1		2	8		14,952
	9/11/2009	10:00	8				1						1		2	8		14,952
			SUM	**8**	**5**	**2**	**15**	**7**	**7**	**1**	**1**	**1**	**49**	**1**	**97**		**44,660**	**672,840**
			Spring Pool Average	**0.00**	**0.00**	**0.40**	**0.00**	**0.00**	**0.00**	**0.20**	**0.20**	**0.00**	**0.40**	**0.20**	**1.40**	**5.60**		
			Spring Run Average	**1.60**	**1.00**	**0.00**	**3.00**	**1.40**	**1.40**	**0.00**	**0.00**	**0.20**	**9.40**	**0.00**	**18.00**	**72.00**		
			Grand Average	**0.80**	**0.50**	**0.20**	**1.50**	**0.70**	**0.70**	**0.10**	**0.10**	**0.10**	**4.90**	**0.10**	**9.70**	**38.80**	**8,932**	**134,568**

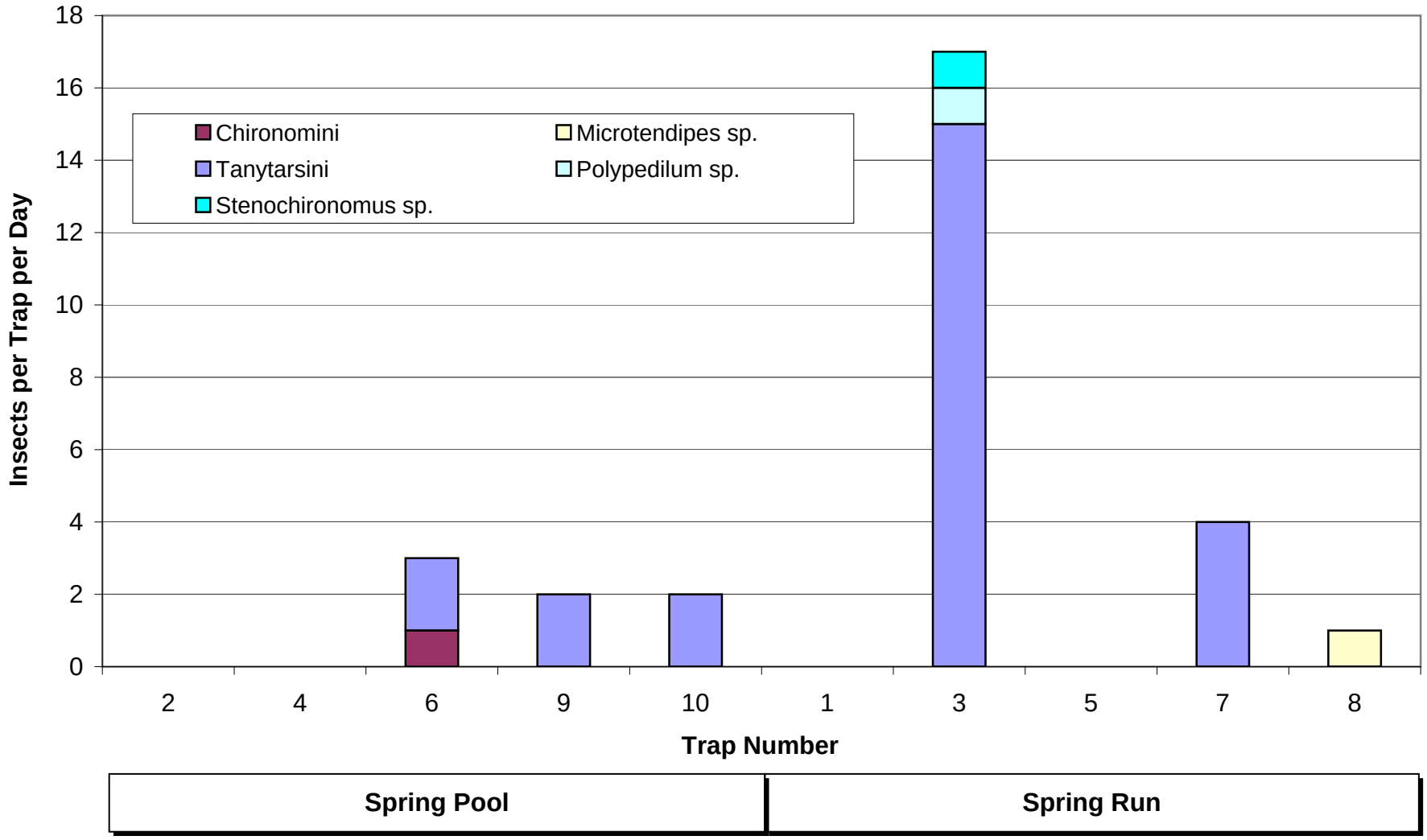
APPENDIX J

Summary of emergent invertebrates captured from Ponce de Leon Springs during September 9, 10, and 11, 2009.

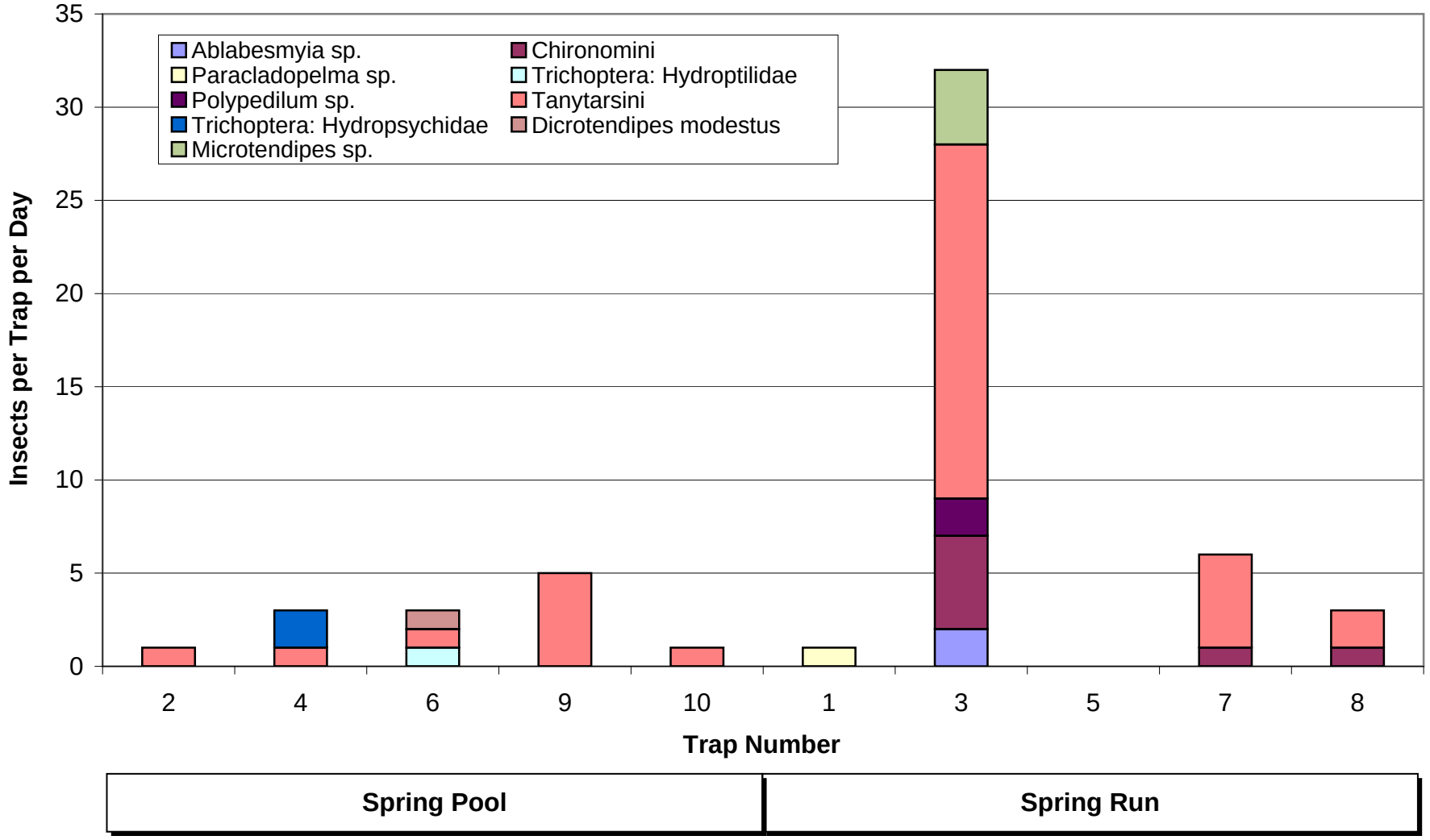
Location	Collection Date	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Emergence Rate (#/day) *
Spring Pool	9/9/2009	7	5.60	8,932
	9/10/2009	13	10.40	16,588
	9/11/2009	7	5.60	8,932
	Average	**9.0**	**7.2**	**11,484**
Spring Run	9/9/2009	22	17.60	32,894
	9/10/2009	42	33.60	62,798
	9/11/2009	90	72.00	134,568
	Average	**51.3**	**41.1**	**76,754**
	Grand Average	**30.2**	**24.1**	**44,119**

* Based on a spring pool area of 1,595 m^2 and spring run area of 1,869 m^2.

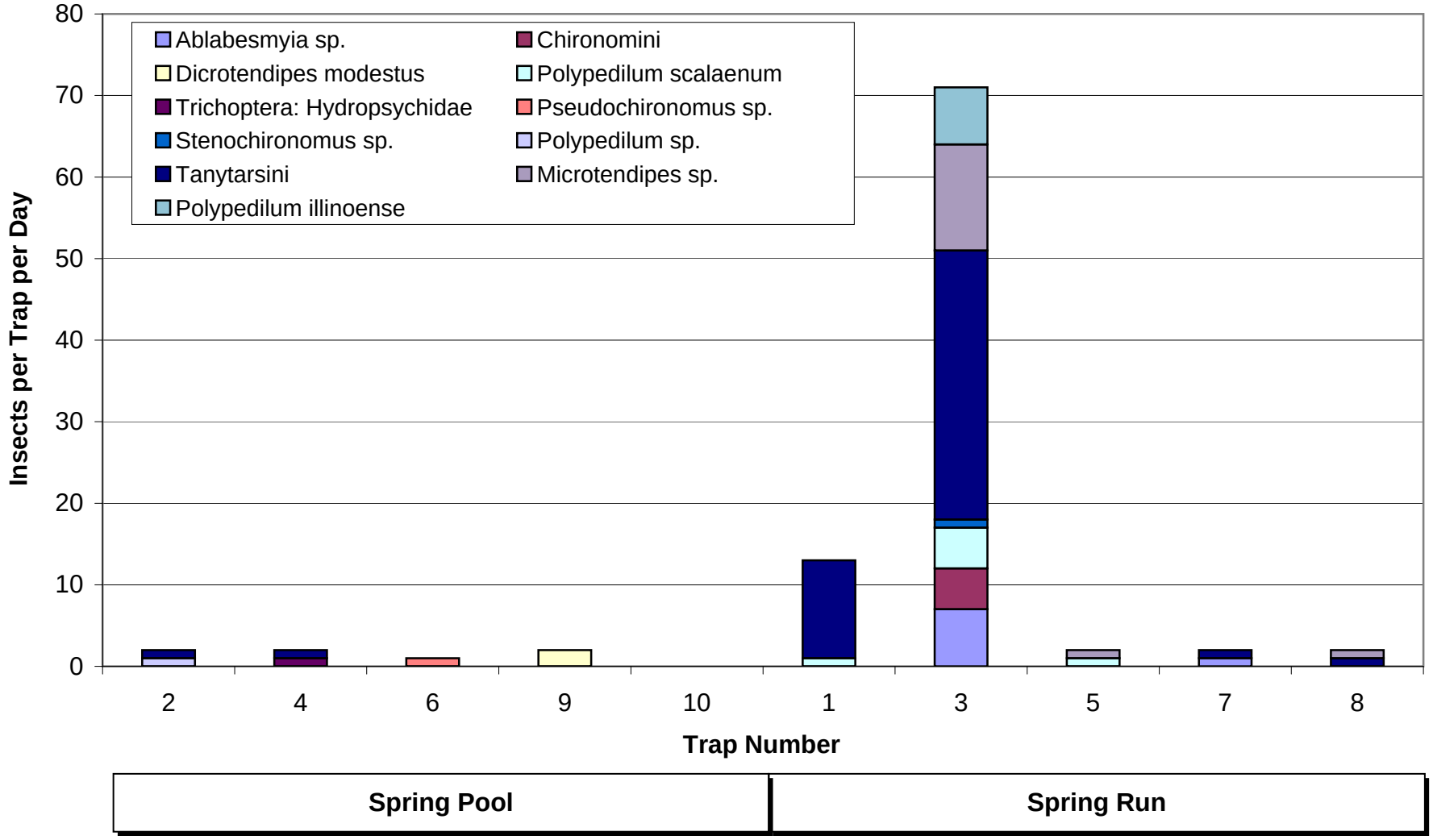
Ponce de Leon Springs (Holmes Co.) Emergent Invertebrates Data
Trap Collections made 9/9/09



Ponce de Leon Springs (Holmes Co.) Emergent Invertebrates Data
Trap Collections made 9/10/09



Ponce de Leon Springs (Holmes Co.) Emergent Invertebrates Data
Trap Collections made 9/11/09





APPENDIX J

Location of macroinvertebrate emergence traps for Rainbow Springs (Marion Co.) during Jun 8 to 11, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Rainbow Springs (Marion Co.) during June 8 to 11, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	6/8/2009	1	29.102610°	-82.437590°	2.1	*Potamogeton illinoensis* / sand
	6/8/2009	2	29.101900°	-82.437340°	1.3	filamentous algae / sand
Spring Run	6/8/2009	3	29.100610°	-82.436890°	2.0	sand
	6/8/2009	4	29.100040°	-82.436780°	1.7	sand / woody debris
	6/8/2009	5	29.098920°	-82.436610°	2.3	sand
	6/8/2009	6	29.097690°	-82.435560°	0.4	*Sagittaria kurziana* / filamentous algae
	6/8/2009	7	29.093910°	-82.432900°	1.3	*Sagittaria kurziana* / filamentous algae
	6/8/2009	8	29.094260°	-82.433440°	0.7	*Sagittaria kurziana* / sand
	6/8/2009	9	29.095840°	-82.434520°	1.0	*Sagittaria kurziana* / filamentous algae
	6/8/2009	10	29.096860°	-82.435230°	0.9	*Sagittaria kurziana*

** USGS gage height reported as 4.08' on 6/8/09 at 10:00*

APPENDIX J
Summary of emergent invertebrates captured from Rainbow Springs on June 9, 2009

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Beardius truncatus*	*Chironomini*	*Cricotopus bicinctus*	*Dicrotendipes modestus*	*Hemerodromia sp.*	*Hymenoptera*	*Pseudochironomus richardsoni*	*Pseudochironomus sp.*	*Tanypodinae*	*Tanytarsini*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
Spring Pool	6/9/2009	13:10	1					18				2		6	26	104	536,640	
	6/9/2009	13:15	2				1	21		1	2		2	7	34	136	0	
Spring Run	6/9/2009	13:20	3											1	1	4		208,800
	6/9/2009	13:25	4												0	0		0
	6/9/2009	13:30	5											1	1	4		208,800
	6/9/2009	13:35	6			1		1						1	3	12		626,400
	6/9/2009	13:40	7											1	1	4		208,800
	6/9/2009	13:45	8						10					5	15	60		3,132,000
	6/9/2009	13:50	9		6										6	24		1,252,800
	6/9/2009	13:55	10	3					2			1		12	18	72		3,758,400
			SUM	**3**	**6**	**1**	**1**	**40**	**12**	**1**	**2**	**3**	**2**	**34**	**105**		**536,640**	**9,396,000**
			Spring Pool Average	**0.00**	**0.00**	**0.00**	**0.50**	**19.50**	**0.00**	**0.50**	**1.00**	**1.00**	**1.00**	**6.50**	**30.00**	**120.00**		
			Spring Run Average	**0.38**	**0.75**	**0.13**	**0.00**	**0.13**	**1.50**	**0.00**	**0.00**	**0.13**	**0.00**	**2.63**	**5.63**	**22.50**		
			Grand Average	**0.30**	**0.60**	**0.10**	**0.10**	**4.00**	**1.20**	**0.10**	**0.20**	**0.30**	**0.20**	**3.40**	**10.50**	**42.00**	**268,320**	**1,174,500**

APPENDIX J
Summary of emergent invertebrates captured from Rainbow Springs on June 10, 2009.

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Beardius truncatus*	*Chironomini*	*Chironomus sp.*	*Cricotopus sp.*	*Dicrotendipes modestus*	*Dicrotendipes neomodestus*	*Hemerodromia sp.*	*Labrundinia pilosella*	*Pseudochironomus fulviventris*	*Pseudochironomus richardsoni*	*Tanytarsini*	*Trichoptera - Leptoceridae*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
Spring Pool	6/10/2009	13:10	1	2				1	33	1					11		48	192	990,720	
	6/10/2009	13:15	2	1		1			30	2		1		3	3		41	164	846,240	
Spring Run	6/10/2009	13:20	3						6						2		8	32		1,670,400
	6/10/2009	13:25	4										1	1			2	8		417,600
	6/10/2009	13:30	5														0	0		0
	6/10/2009	13:35	6			1	1								1		3	12		626,400
	6/10/2009	13:40	7			1											1	4		208,800
	6/10/2009	13:45	8	2		1					18					1	22	88		4,593,600
	6/10/2009	13:50	9		1												1	4		208,800
	6/10/2009	13:55	10														0	0		0
			SUM	**5**	**1**	**4**	**1**	**1**	**69**	**3**	**18**	**1**	**1**	**4**	**17**	**1**	**126**		**1,836,960**	**7,725,600**
			Spring Pool Average	**1.50**	**0.00**	**0.50**	**0.00**	**0.50**	**31.50**	**1.50**	**0.00**	**0.50**	**0.00**	**1.50**	**7.00**	**0.00**	**44.50**	**178.00**		
			Spring Run Average	**0.25**	**0.13**	**0.38**	**0.13**	**0.00**	**0.75**	**0.00**	**2.25**	**0.00**	**0.13**	**0.13**	**0.38**	**0.13**	**4.63**	**18.50**		
			Grand Average	**0.50**	**0.10**	**0.40**	**0.10**	**0.10**	**6.90**	**0.30**	**1.80**	**0.10**	**0.10**	**0.40**	**1.70**	**0.10**	**12.60**	**50.40**	**918,480**	**965,700**

APPENDIX J
Summary of emergent invertebrates captured from Rainbow Springs on June 11, 2009

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Beardius truncatus*	*Chironomidae*	*Chironomini*	*Cricotopus sp.*	*Dicrotendipes modestus*	*Dicrotendipes neomodestus*	*Hemerodromia sp.*	*Labrundinia pilosella*	*Procladius*	*Procladius sublettei*	*Pseudochironomus richardsoni*	*Pseudochironomus sp.*	*Tanypodinae*	*Tanytarsini*	*Thienemannimyia sp.*	*Trichoptera - Leptoceridae*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
Spring Pool	6/11/2009	13:05	1	4	2			1	11			1						24			43	172	887,520	
	6/11/2009	13:10	2	4					28	3		3	4					3	1		46	184	949,440	
Spring Run	6/11/2009	13:15	3						3												3	12		626,400
	6/11/2009	13:20	4																		0	0		0
	6/11/2009	13:25	5																		0	0		0
	6/11/2009	13:30	6				2											2			4	16		835,200
	6/11/2009	13:35	7				1					1						1			3	12		626,400
	6/11/2009	13:40	8	1		10		1	1		25			9	1	3	2	8		3	64	256		13,363,200
	6/11/2009	13:45	9		1											1					2	8		417,600
	6/11/2009	13:50	10				1	3	4	2	1			1	2	4	1	7		1	27	108		5,637,600
			SUM	**9**	**3**	**10**	**4**	**5**	**47**	**5**	**26**	**5**	**4**	**10**	**3**	**8**	**3**	**45**	**1**	**4**	**192**		**1,836,960**	**21,506,400**
			Spring Pool Average	**4.00**	**1.00**	**0.00**	**0.00**	**0.50**	**19.50**	**1.50**	**0.00**	**2.00**	**2.00**	**0.00**	**0.00**	**0.00**	**0.00**	**13.50**	**0.50**	**0.00**	**44.50**	**178.00**		
			Spring Run Average	**0.13**	**0.13**	**1.25**	**0.50**	**0.50**	**1.00**	**0.25**	**3.25**	**0.13**	**0.00**	**1.25**	**0.38**	**1.00**	**0.38**	**2.25**	**0.00**	**0.50**	**12.88**	**51.50**		
			Grand Average	**0.90**	**0.30**	**1.00**	**0.40**	**0.50**	**4.70**	**0.50**	**2.60**	**0.50**	**0.40**	**1.00**	**0.30**	**0.80**	**0.30**	**4.50**	**0.10**	**0.40**	**19.20**	**76.80**	**918,480**	**2,688,300**

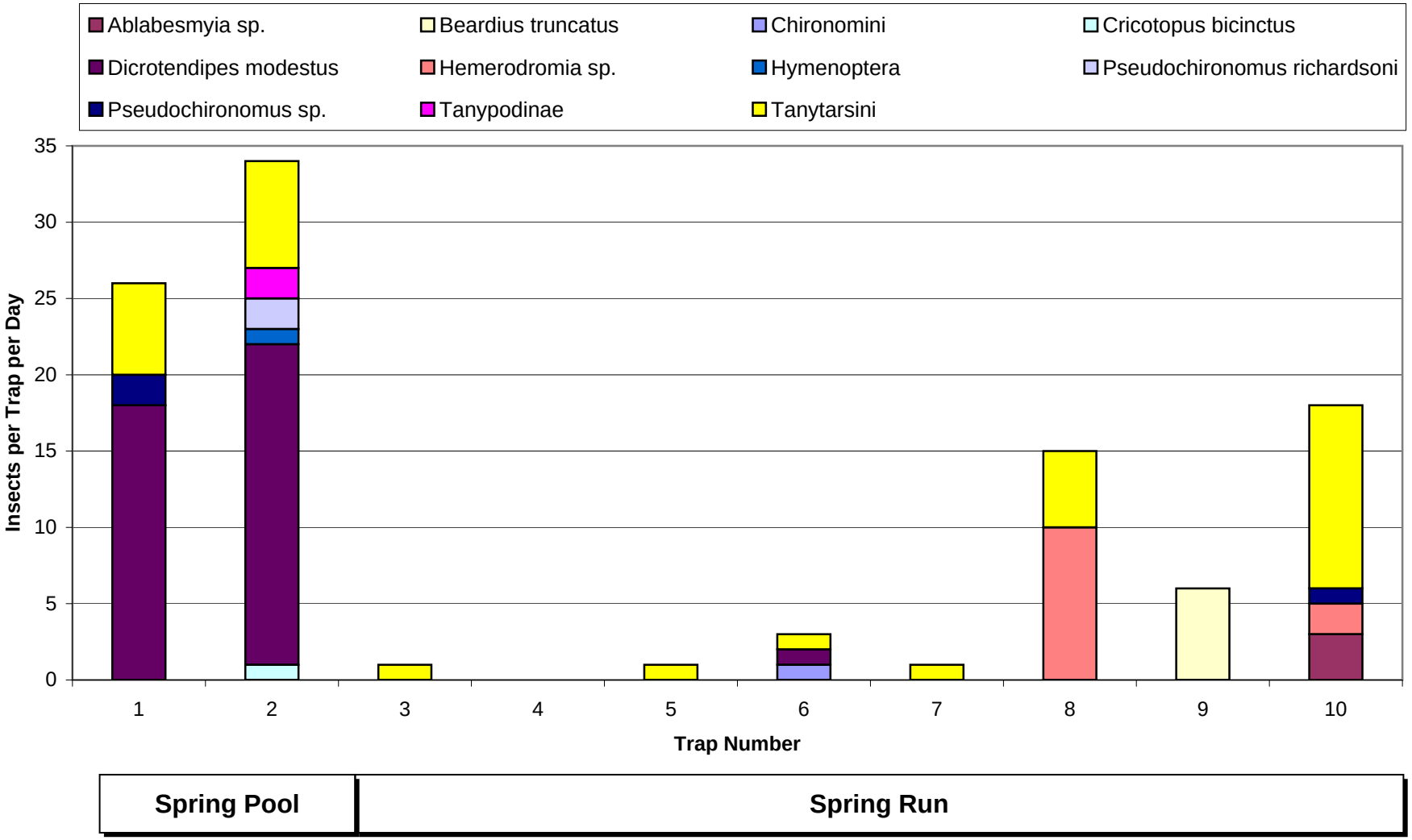
APPENDIX J

Summary of emergent invertebrates captured from Rainbow Springs during June 9, 10, and 11, 2009.

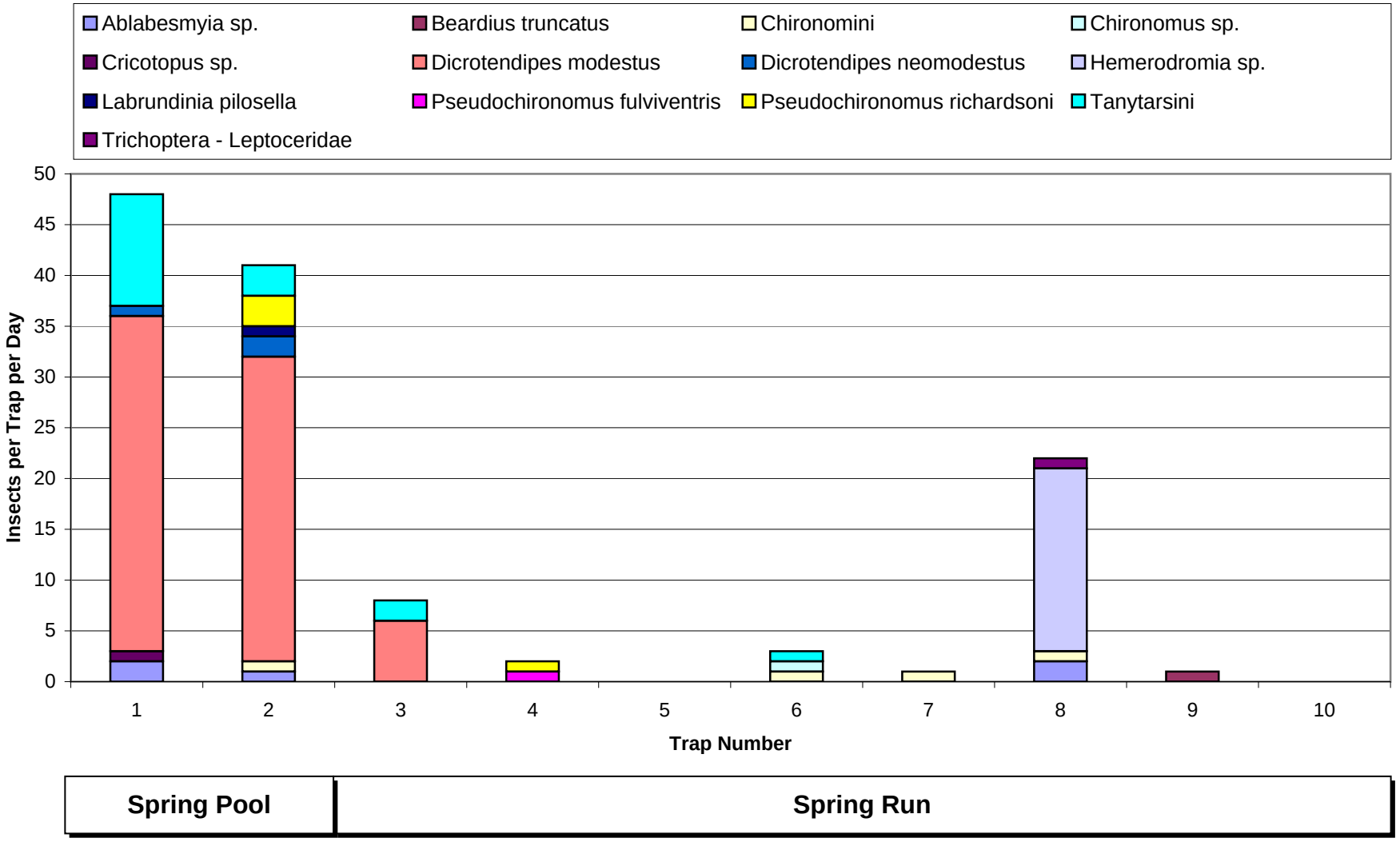
Location	Collection Date	Total Emergent Invertebrates	Average Emergence Rate (#/m^2/day) *	Average Emergence Rate (#/day) *
Spring Pool	6/9/2009	60	120.00	268,320
	6/10/2009	89	178.00	918,480
	6/11/2009	89	178.00	918,480
	Average	**79**	**158.7**	**701,760**
Spring Run	6/9/2009	45	22.50	1,174,500
	6/10/2009	37	18.50	965,700
	6/11/2009	103	51.50	2,688,300
	Average	**62**	**30.8**	**1,609,500**
	Grand Average	**71**	**94.8**	**1,155,630**

* Based on a spring pool area of 5,160 m^2 and spring run area of 52,200 m^2.

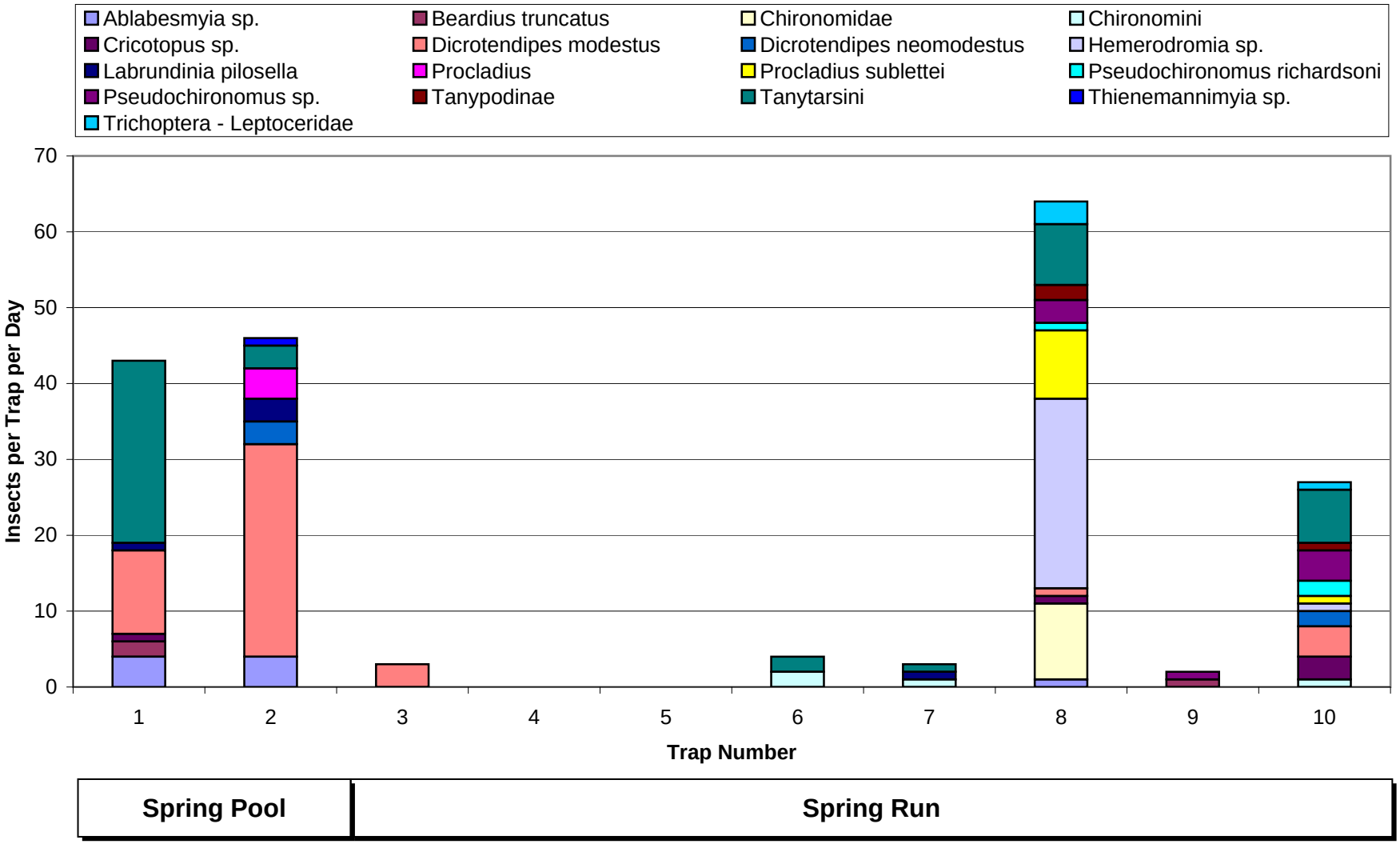
Rainbow Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 6/09/09

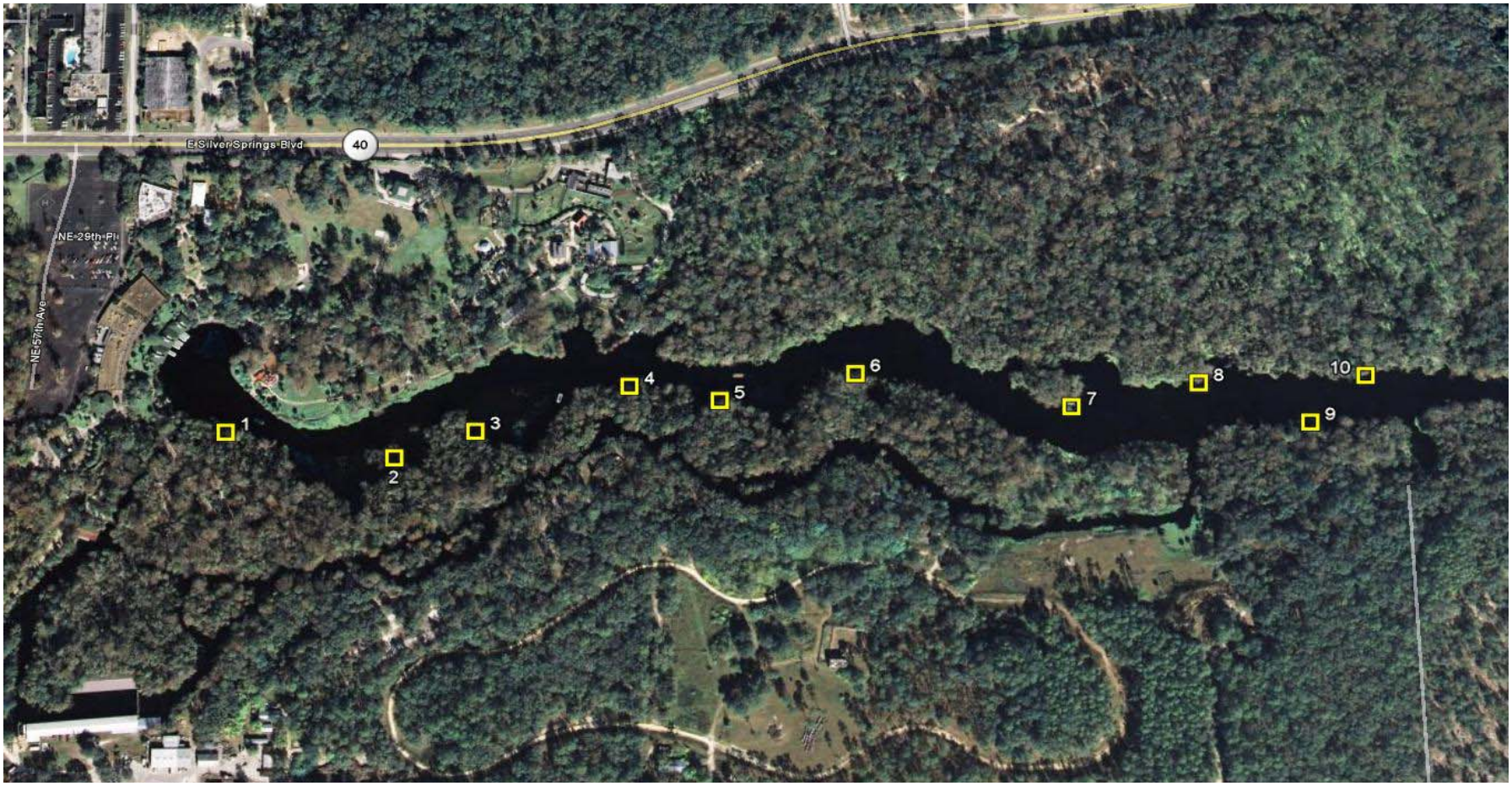


Rainbow Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 6/10/09



Rainbow Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 6/11/09





APPENDIX J
Location of macroinvertebrate emergence traps for Silver Springs (Marion Co.) during May 4 to 8, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Silver Springs (Marion Co.) during May 4 to 8, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Run	5/4/2009	1	29.215342°	-82.052659°	0.9	*Sagittaria* w/ heavy epiphytes
	5/4/2009	2	29.215080°	-82.051030°	0.3	filamentous algae
	5/4/2009	3	29.215310°	-82.050250°	1.3	filamentous algae
	5/4/2009	4	29.215700°	-82.048760°	0.4	over filamentous algae / mud
	5/4/2009	5	29.215554°	-82.047888°	0.9	*Sagittaria* / filamentous algae
	5/4/2009	6	29.215780°	-82.046570°	0.6	*Sagittaria* w/ heavy epiphytes
	5/4/2009	7	29.215440°	-82.044490°	1.3	*Ceratophyllum* / filamentous algae
	5/4/2009	8	29.215638°	-82.043249°	1.1	*Sagittaria kurziana*
	5/4/2009	9	29.215260°	-82.042190°	0.4	*Sagittaria kurziana*
	5/4/2009	10	29.215680°	-82.041630°	0.9	filamentous algae

** USGS staff gage (1,200 m) value 0.76 ft at 13:00*

APPENDIX J

Summary of emergent invertebrates captured from Silver Springs (Marion Co.) on May 5, 2009.

Location	Collection Date	Time	Trap #	*Beardius truncatus*	*Chironomini*	*Cricotopus sp.*	*Hemerodromia sp.*	*Tanytarsini*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Run Emergence Rate (#/day)
Spring Run	5/5/2009	13:45	1				6		6	24	1,770,096
	5/5/2009	13:51	2						0	0	0
	5/5/2009	13:56	3		4				4	16	1,180,064
	5/5/2009	14:02	4		1				1	4	295,016
	5/5/2009	14:07	5				13	1	14	56	4,130,224
	5/5/2009	14:11	6	2		2			4	16	1,180,064
	5/5/2009	14:16	7		18		6		24	96	7,080,384
	5/5/2009	14:20	8		2		1		3	12	885,048
	5/5/2009	14:26	9				26	3	29	116	8,555,464
	5/5/2009	14:31	10		1				1	4	295,016
			SUM	**2**	**26**	**2**	**52**	**4**	**86**		**25,371,376**
			Average	**0.20**	**2.60**	**0.20**	**5.20**	**0.40**	**8.60**	**34.40**	**2,537,138**

APPENDIX J

Summary of emergent invertebrates captured from Silver Springs (Marion Co.) on May 7, 2009.

Location	Collection Date	Time	Trap #	*Beardius truncatus*	*Chironomini*	*Cricotopus sp.*	*Dicrotendipes modestus*	*Diptera*	*Hemerodromia sp.*	*Labrundinia pilosella*	*Pentaneura inconspicua*	*Pseudochironomus sp.*	*Tanypodinae*	*Tanytarsini*	*Trichoptera - Hydropsychidae*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Run Emergence Rate (#/day)
Spring Run	5/7/2009	12:15	1		3		83		47					11		144	288	42,482,304
	5/7/2009	12:21	2											1		1	2	295,016
	5/7/2009	12:27	3	7												7	14	2,065,112
	5/7/2009	12:33	4											1		1	2	295,016
	5/7/2009	12:39	5						7							7	14	2,065,112
	5/7/2009	12:45	6	5								1				6	12	1,770,096
	5/7/2009	12:51	7		11		3		103	68		6	3	90	1	285	570	84,079,560
	5/7/2009	12:57	8	1												1	2	295,016
	5/7/2009	13:03	9		4	10			46		4			224	1	289	578	85,259,624
	5/7/2009	13:10	10					1								1	2	295,016
			SUM	**13**	**18**	**10**	**86**	**1**	**203**	**68**	**4**	**7**	**3**	**327**	**2**	**742**		**218,901,872**
			Average	**1.30**	**1.80**	**1.00**	**8.60**	**0.10**	**20.30**	**6.80**	**0.40**	**0.70**	**0.30**	**32.70**	**0.20**	**74.20**	**148.40**	**21,890,187**

APPENDIX J
Summary of emergent invertebrates captured from Silver Springs (Marion Co.) on May 8, 2009.

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Beardius truncatus*	*Chironomidae*	*Chironomini*	*Chironomus sp.*	*Cricotopus sp.*	*Dicrotendipes modestus*	*Hemerodromia sp.*	*Labrundinia pilosella*	*Pentaneura inconspicua*	*Pseudochironomus sp.*	*Tanytarsini*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Run Emergence Rate (#/day)
Spring Run	5/8/2009	10:15	1			12					31					43	172	12,685,688
	5/8/2009	10:20	2					1							3	4	16	1,180,064
	5/8/2009	10:26	3		4		1									5	20	1,475,080
	5/8/2009	10:31	4													0	0	0
	5/8/2009	10:37	5					3			30				2	35	140	10,325,560
	5/8/2009	10:42	6						3						5	8	32	2,360,128
	5/8/2009	10:48	7	29			19	10		77	68	49		10		262	1048	77,294,192
	5/8/2009	10:53	8		5						2				2	9	36	2,655,144
	5/8/2009	10:59	9				5				55	3	3		5	71	284	20,946,136
	5/8/2009	11:05	10													0	0	0
			SUM	**29**	**9**	**12**	**25**	**14**	**3**	**77**	**186**	**52**	**3**	**10**	**17**	**437**		**128,921,992**
			Average	**3.22**	**1.00**	**1.33**	**2.78**	**1.56**	**0.33**	**8.56**	**20.67**	**5.78**	**0.33**	**1.11**	**1.89**	**48.56**	**194.22**	**14,324,666**

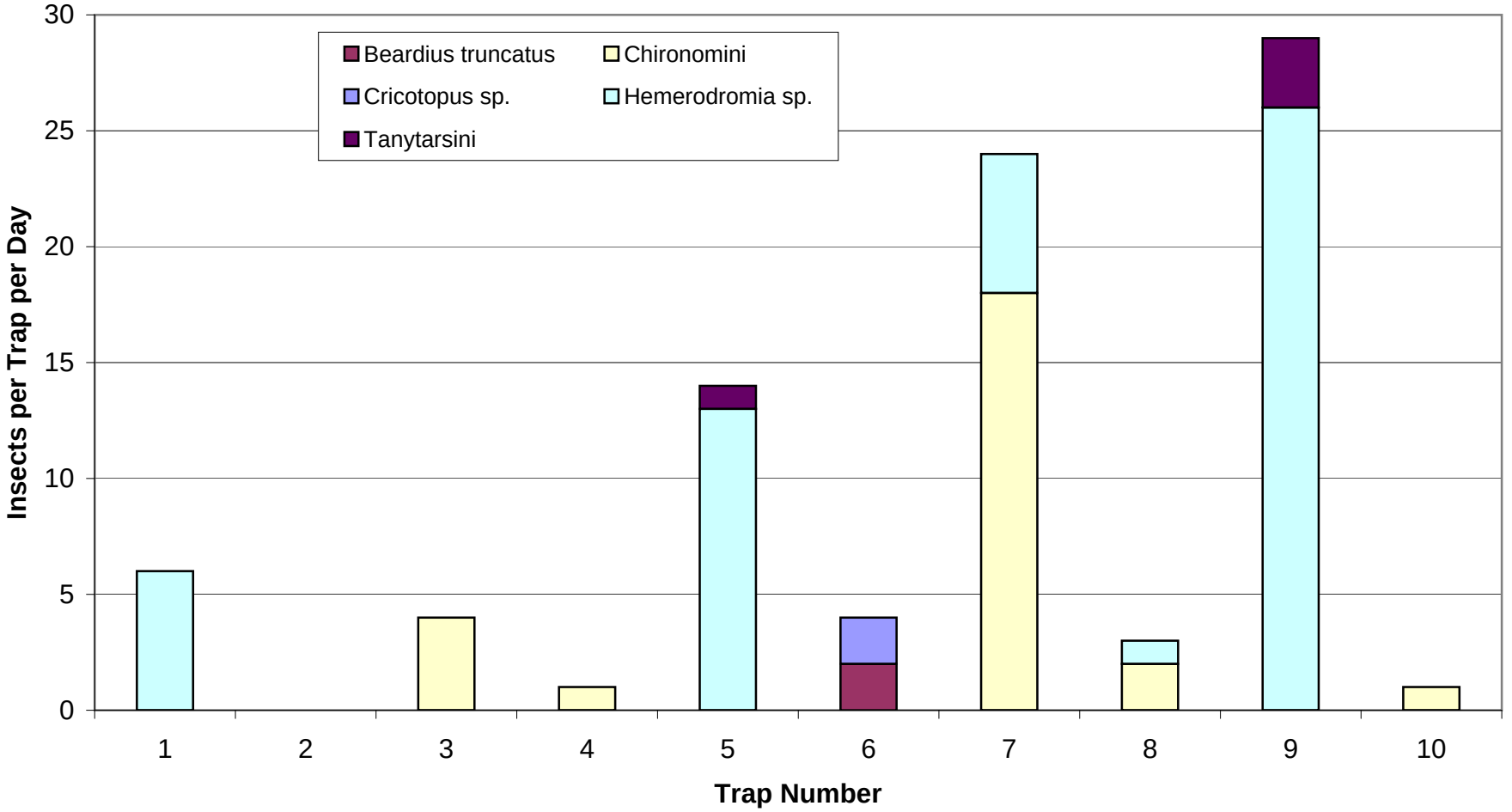
APPENDIX J
Summary of emergent invertebrates captured from Silver Springs during May 5, 7, and 8, 2009.

Location	Collection Date	Total Emergent Invertebrates	Average Emergence Rate (#/m^2/day)	Average Emergence Rate (#/day) *
Spring Run	5/5/2009	86	34.40	2,537,138
	5/7/2009	742	148.40	21,890,187
	5/8/2009	437	194.22	14,324,666
	Average	**422**	**125.7**	**12,917,330**

** Based on a spring run area of 73,754 m^2.*

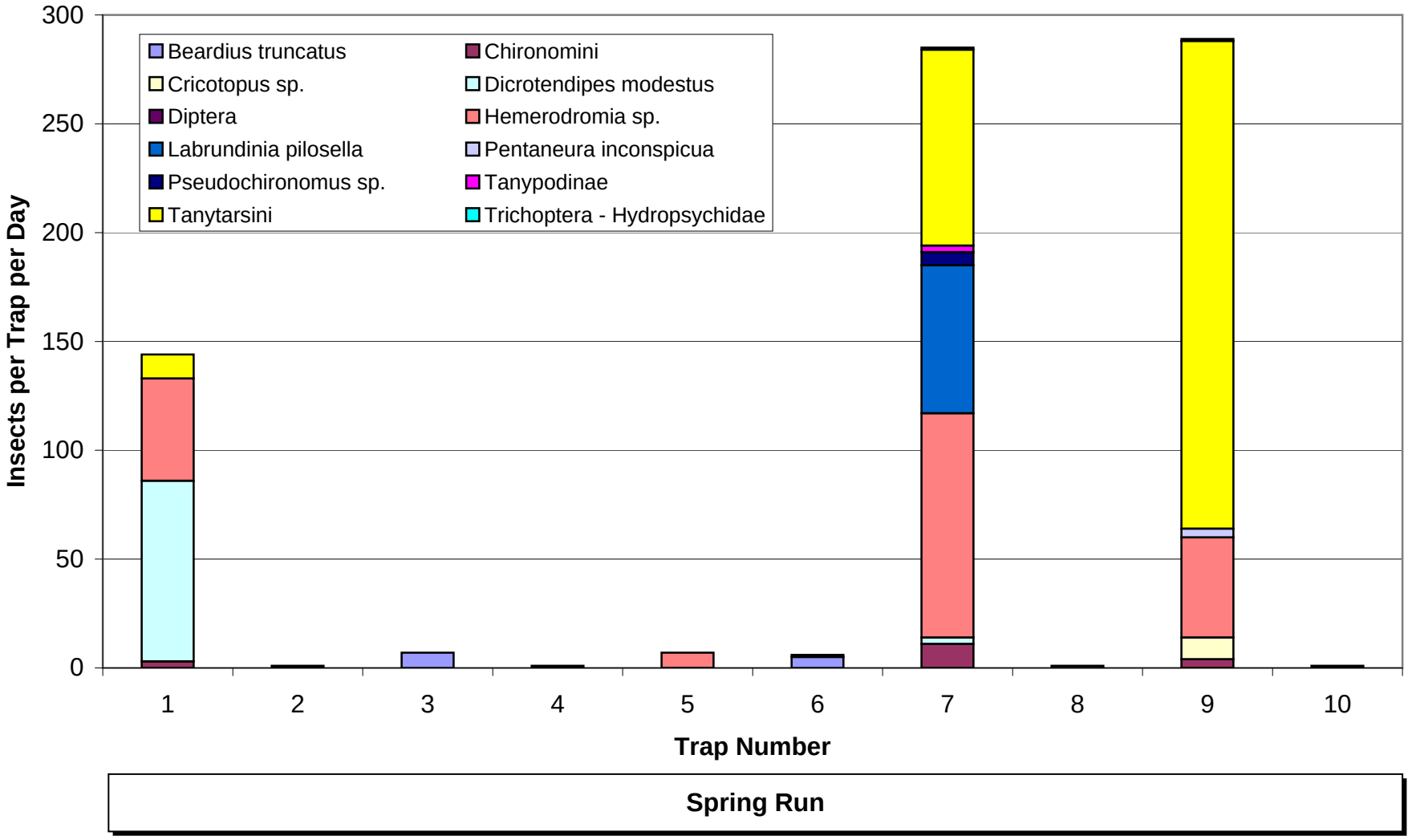
All traps placed in run, pool not sampled due to glass bottom boats, tours, and aesthetics.

Silver Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 5/5/09

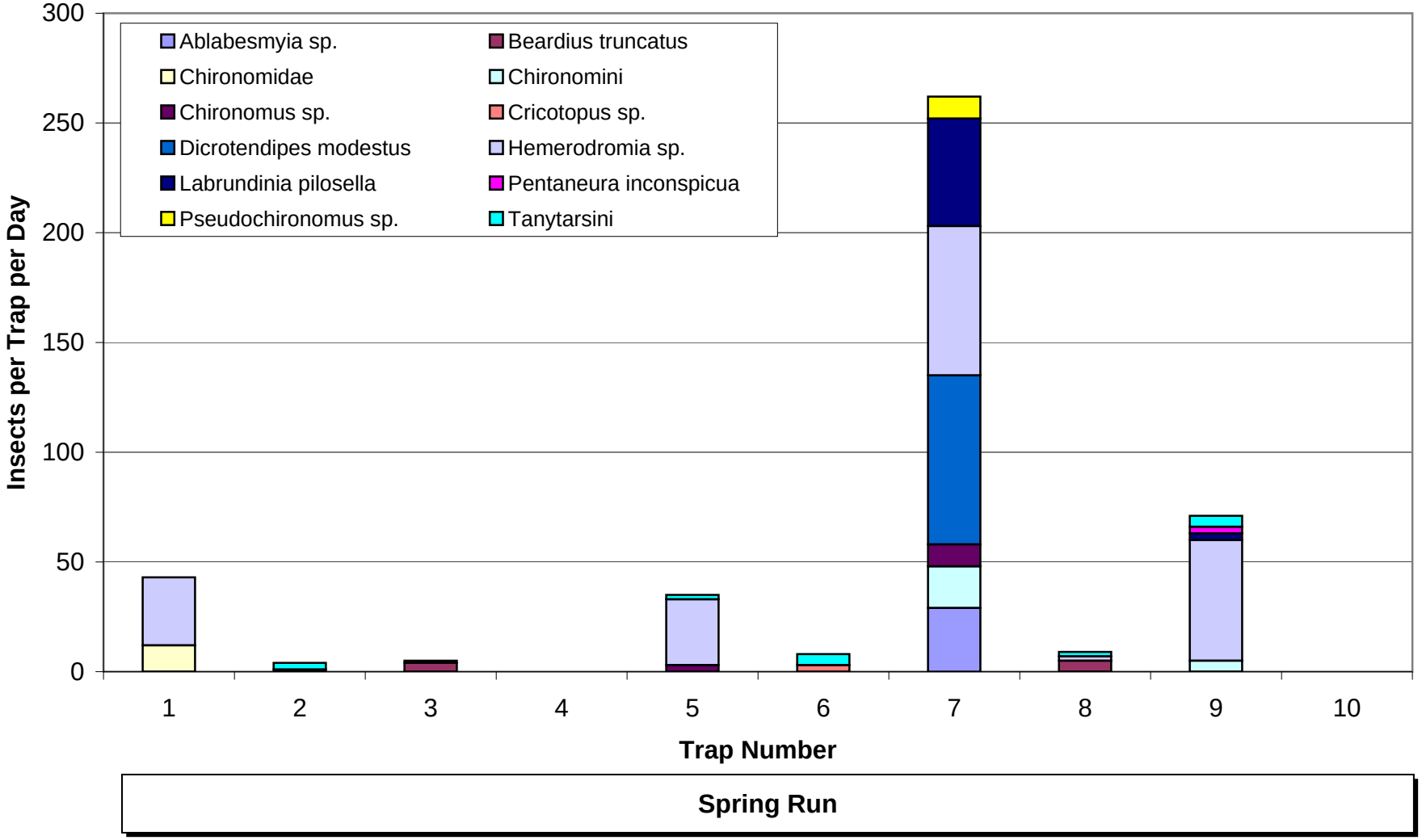


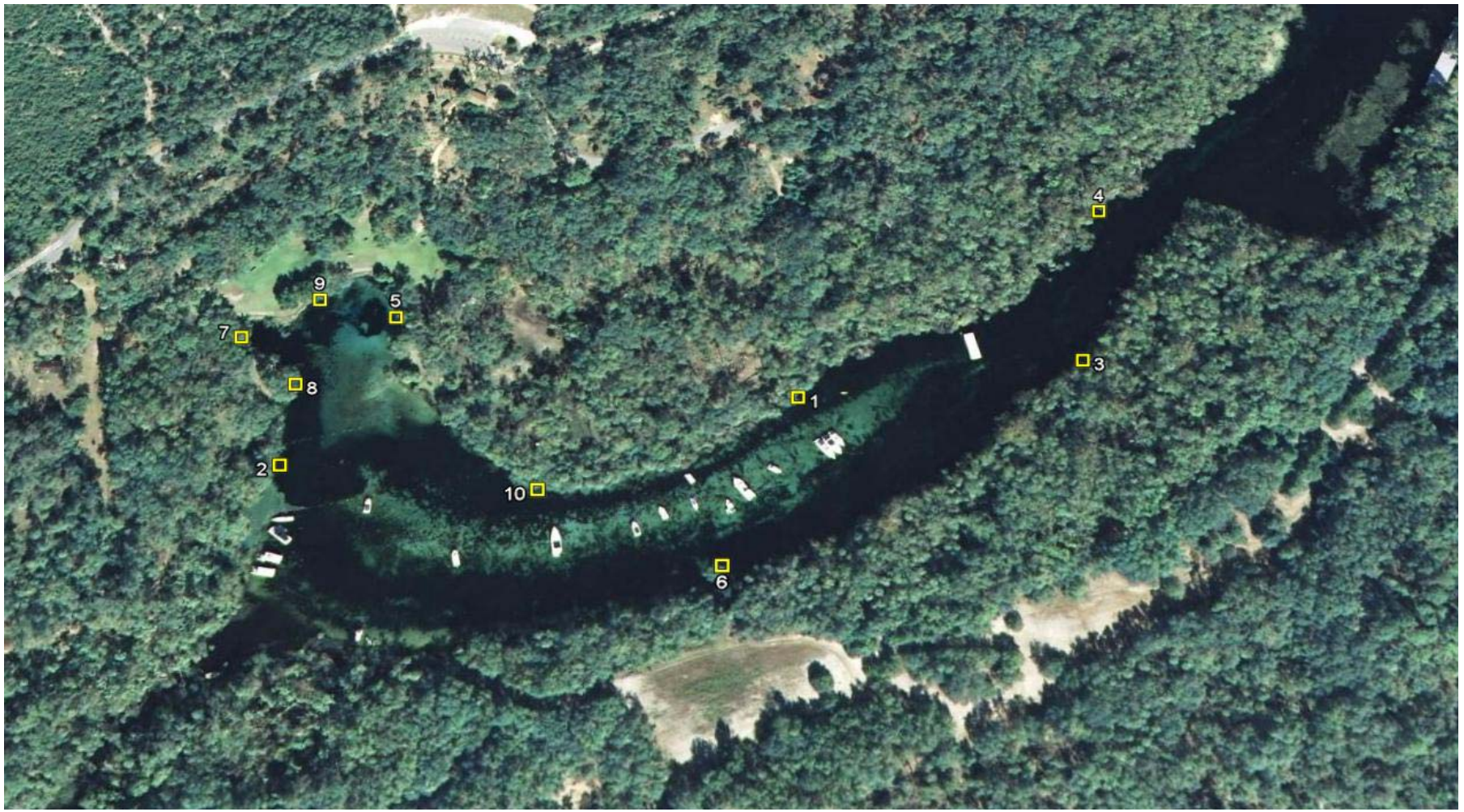
Spring Run

Silver Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 5/7/09



Silver Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 5/8/09





APPENDIX J
Location of macroinvertebrate emergence traps for Silver Glen Springs (Marion Co.) during February 16 to 18, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Silver Glen Springs (Marion Co.) during February 16 to 18, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	2/16/2009	2	29.24511°	-81.64374°	0.3	*Vallisneria*
	2/16/2009	5	29.24579°	-81.64326°	0.3	*Lyngbya*
	2/16/2009	7	29.24572°	-81.64398°	0.5	sand / *Lyngbya*
	2/16/2009	8	29.24548°	-81.64370°	0.7	shell / *Lyngbya*
	2/16/2009	9	29.24589°	-81.64362°	0.5	*Vallisneria / Hydrilla*
Spring Run	2/16/2009	1	29.24534°	-81.64138°	0.8	*Vallisneria / Lyngbya*
	2/16/2009	3	29.24547°	-81.64005°	0.4	*Vallisneria / Lyngbya*
	2/16/2009	4	29.24621°	-81.63989°	0.3	*Lyngbya*
	2/16/2009	6	29.24459°	-81.64174°	1.2	*Vallisneria*
	2/16/2009	10	29.24496°	-81.64257°	0.5	sand / *Lyngbya*

** tidal system, USGS stage reading = 0.42 ft at 11:45*

APPENDIX J
Summary of emergent invertebrates captured from Silver Glen Springs on February 17, 2009.

Location	Collection Date	Time	Trap #	*Tanytarsini*	*Chironomidae*	*Pseudochironomus richardsoni*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	1/13/2009	9:30	2				0	0	0	
	1/13/2009	9:32	5			1	1	4	9,768	
Spring Pool	1/13/2009	9:34	7				0	0	0	
	1/13/2009	9:36	8				0	0	0	
	1/13/2009	9:38	9				0	0	0	
	1/13/2009	9:20	1				0	0		0
	1/13/2009	9:15	3				0	0		0
Spring Run	1/13/2009	9:10	4	1	2		3	12		430,032
	1/13/2009	9:25	6			1	1	4		143,344
	1/13/2009	9:05	10		2		2	8		286,688
			SUM	**1**	**4**	**2**	**7**		**9,768**	**860,064**
			Spring Pool Average	**0.00**	**0.00**	**0.20**	**0.20**	**0.80**		
			Spring Run Average	**0.20**	**0.80**	**0.20**	**1.20**	**4.80**		
			Grand Average	**0.10**	**0.40**	**0.20**	**0.70**	**2.80**	**1,954**	**172,013**

APPENDIX J
Summary of emergent invertebrates captured from Silver Glen Springs on February 18, 2009

Location	Collection Date	Time	Trap #	*Tanytarsini*	*Chironomidae*	*Polypedilum halterale*	*Chloropidae*	*Dicrotendipes modestus*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	1/14/2009	8:56	2						0	0	0	
	1/14/2009	8:50	5						0	0	0	
Spring Pool	1/14/2009	8:58	7						0	0	0	
	1/14/2009	8:52	8						0	0	0	
	1/14/2009	8:54	9		1			1	2	8	19,536	
	1/14/2009	9:25	1						0	0		0
	1/14/2009	9:20	3	1	1		1	1	4	16		573,376
Spring Run	1/14/2009	9:15	4	1	1				2	8		286,688
	1/14/2009	9:30	6		1	1			2	8		286,688
	1/14/2009	9:10	10						0	0		0
			SUM	**2**	**4**	**1**	**1**	**2**	**10**		**19,536**	**1,146,752**
			Spring Pool Average	**0.00**	**0.20**	**0.00**	**0.00**	**0.20**	**0.40**	**1.60**		
			Spring Run Average	**0.40**	**0.60**	**0.20**	**0.20**	**0.20**	**1.60**	**6.40**		
			Grand Average	**0.20**	**0.40**	**0.10**	**0.10**	**0.20**	**1.00**	**4.00**	**3,907**	**229,350**

APPENDIX J

Summary of emergent invertebrates captured from Silver Glen Springs on February 19, 2009

Location	Collection Date	Time	Trap #	*Pseudochironomus richardsoni*	*Chironomidae*	*Dicrotendipes modestus*	*Tanytarsini*	*Chloropidae*	*Polypedilum illinoense*	*Cricotopus sp.*	*Polypedilum halterale*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	1/15/2009	9:36	2									0	0	0	
	1/15/2009	9:30	5	6								6	24	58,608	
Spring Pool	1/15/2009	9:38	7	1	3		1				3	8	32	78,144	
	1/15/2009	9:32	8									0	0	0	
	1/15/2009	9:34	9	1		1			2			4	16	39,072	
	1/15/2009	10:30	1	2	2							4	16		573,376
	1/15/2009	10:20	3		1	1	1	1				4	16		573,376
Spring Run	1/15/2009	10:10	4		2							2	8		286,688
	1/15/2009	10:40	6			3			1	1		5	20		716,720
	1/15/2009	10:00	10									0	0		0
			SUM	**10**	**8**	**5**	**2**	**1**	**3**	**1**	**3**	**33**		**175,824**	**2,150,160**
			Spring Pool Average	**1.60**	**0.60**	**0.20**	**0.20**	**0.00**	**0.40**	**0.00**	**0.60**	**3.60**	**14.40**		
			Spring Run Average	**0.40**	**1.00**	**0.80**	**0.20**	**0.20**	**0.20**	**0.20**	**0.00**	**3.00**	**12.00**		
			Grand Average	**1.00**	**0.80**	**0.50**	**0.20**	**0.10**	**0.30**	**0.10**	**0.30**	**3.30**	**13.20**	**35,165**	**430,032**

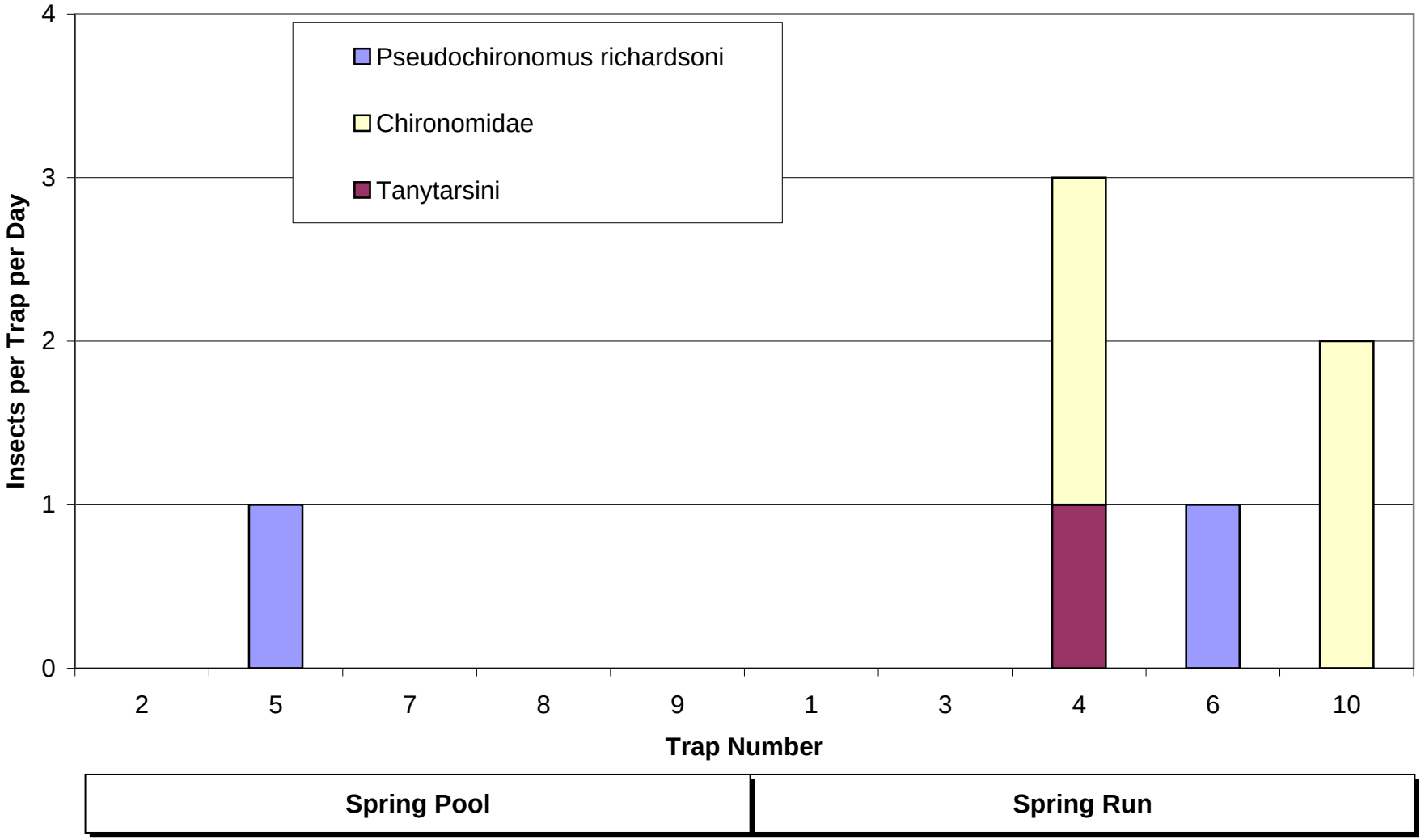
APPENDIX J

Summary of emergent invertebrates captured from Silver Glen Springs during February 17, 18, and 19, 2009.

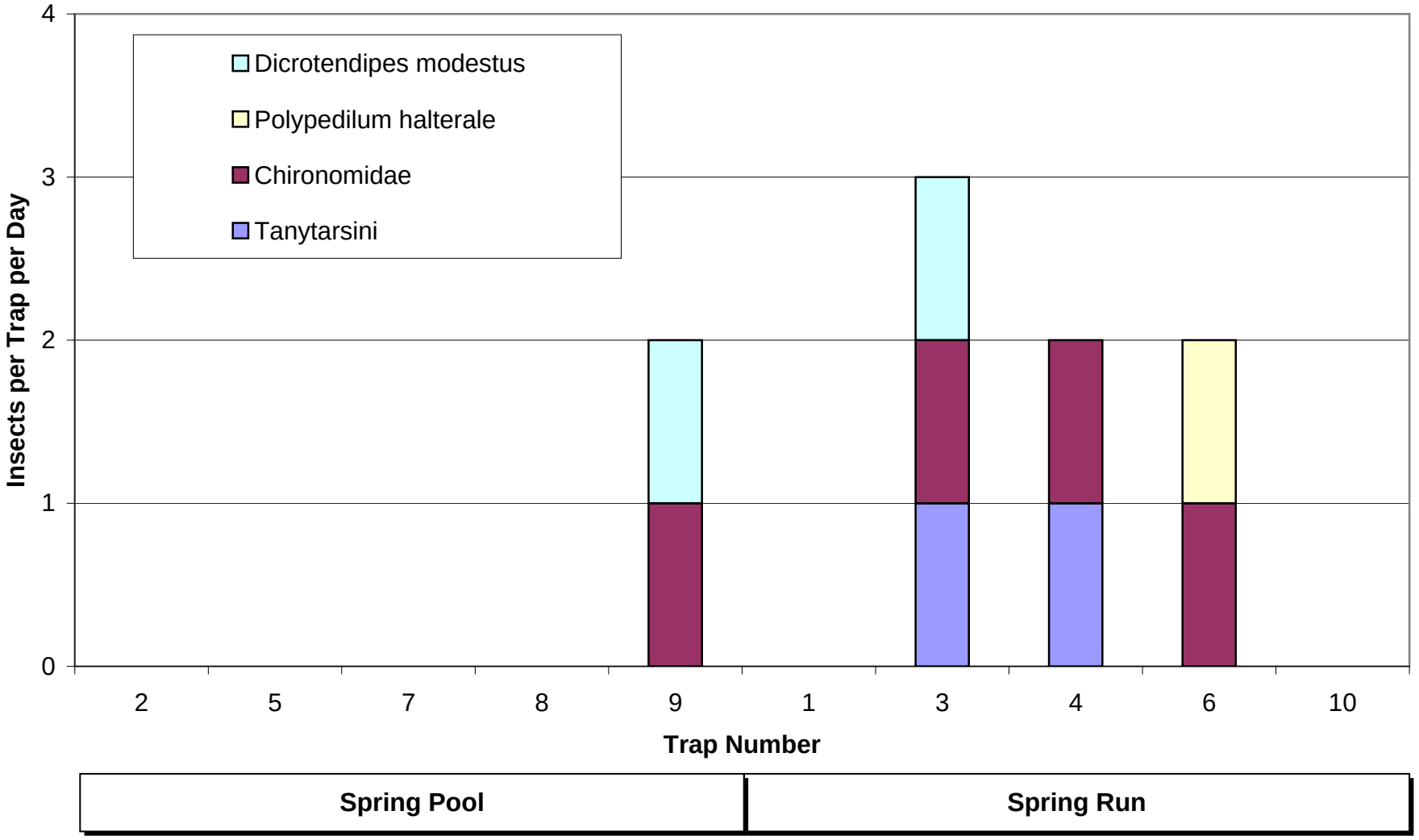
Location	Collection Date	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Emergence Rate (#/day) *
Spring Pool	2/17/2009	1	0.80	1,954
	2/18/2009	2	1.60	3,907
	2/19/2009	18	14.40	35,165
	Average	**7**	**5.6**	**13,675**
Spring Run	2/17/2009	6	4.80	172,013
	2/18/2009	8	6.40	229,350
	2/19/2009	15	12.00	430,032
	Average	**10**	**7.7**	**277,132**
	Grand Average	**8**	**6.7**	**145,403**

* Based on a spring pool area of 2,442 m^2 and spring run area of 35,836 m^2.

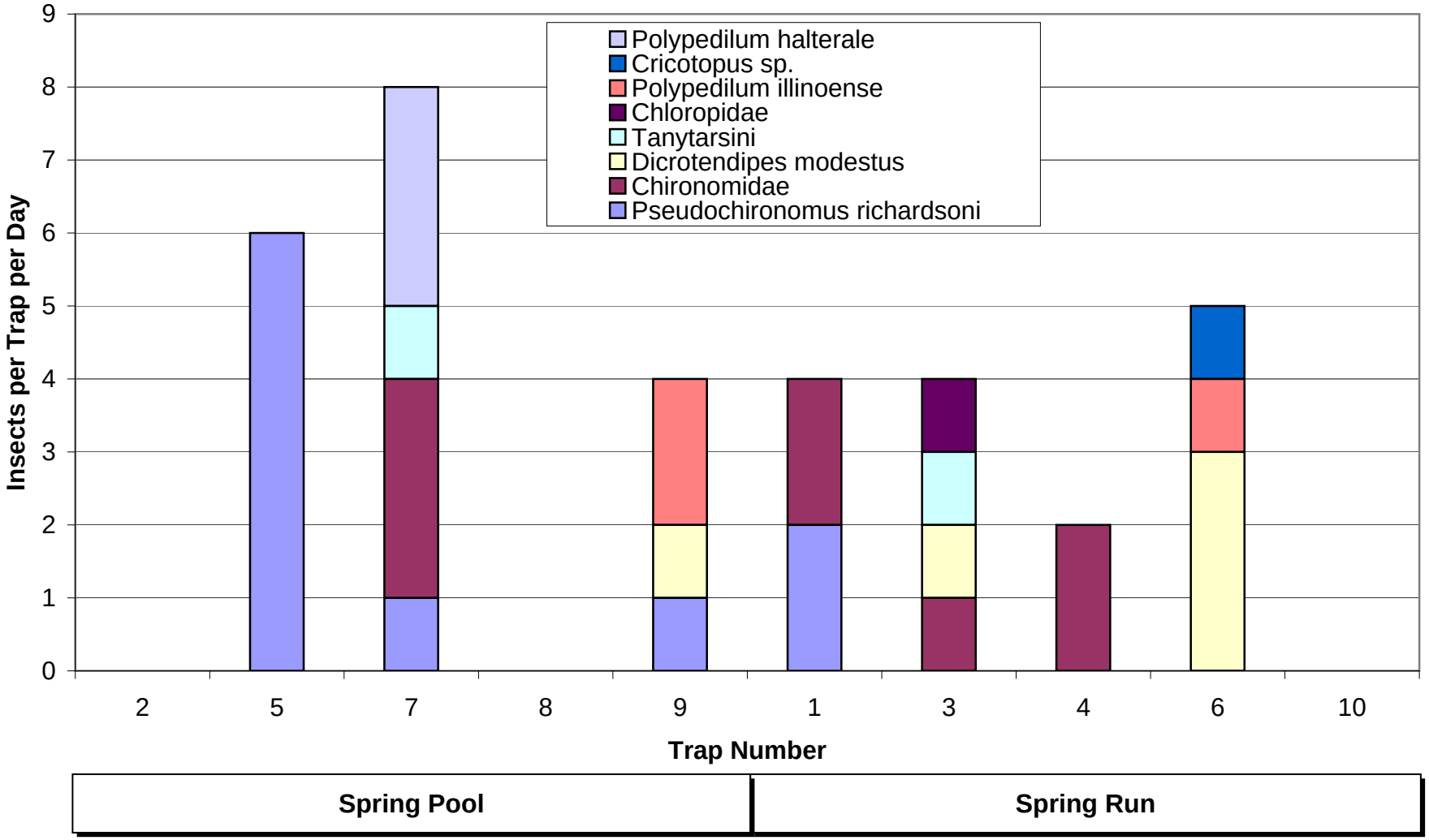
Silver Glen Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 2/17/09

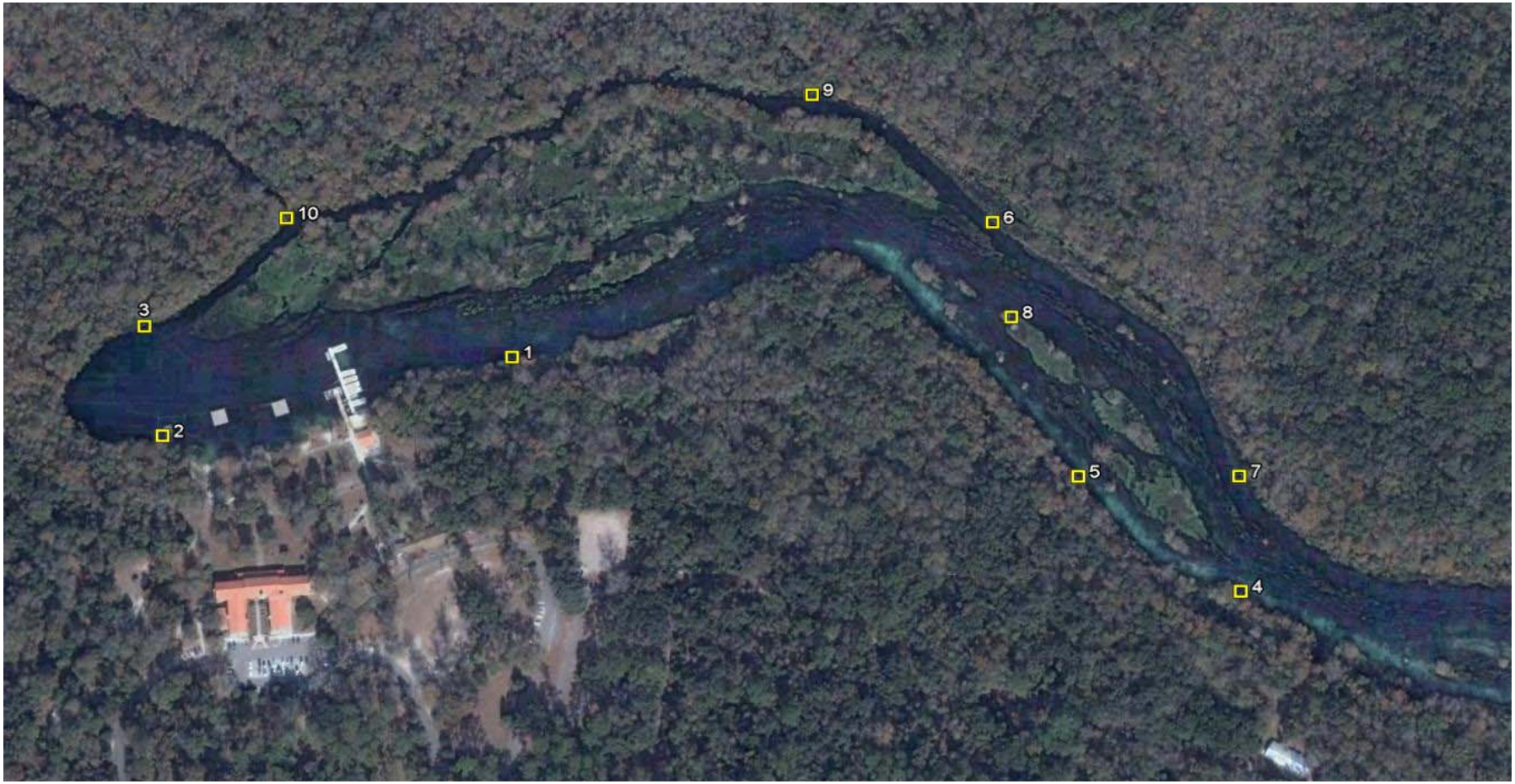


Silver Glen Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 2/18/09



Silver Glen Springs (Marion Co.) Emergent Invertebrates Data
Trap Collections made 2/19/09





APPENDIX J
Location of macroinvertebrate emergence traps for Wakulla Springs (Wakulla Co.) during April 13 to 16, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Wakulla Springs (Wakulla Co.) during April 13 to 16, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	4/13/2009	2	30.235090°	-84.302510°	1.8	sparse Hydrilla / Vallisneria
	4/13/2009	3	30.235796°	-84.302688°	0.9	flooded Pontederia / Crinum
Spring Run	4/13/2009	1	30.235681°	-84.300123°	0.8	filamentous algae / sand
	4/13/2009	4	30.234317°	-84.294994°	0.9	Sagittaria kurziana / sand
	4/13/2009	5	30.235040°	-84.296170°	0.6	filamentous algae / sand
	4/13/2009	6	30.236678°	-84.296824°	0.7	filamentous algae / sand
	4/13/2009	7	30.235080°	-84.295060°	0.5	sand / shell
	4/13/2009	8	30.236060°	-84.296670°	0.9	dense Hydrilla
	4/13/2009	9	30.237480°	-84.298120°	0.9	Sagittaria kurziana / Nymphaea
	4/13/2009	10	30.236540°	-84.301749°	1.3	Sagittaria kurziana / detritus

** FDEP boat dock staff gage was 3.27' on 4/14/09 at 08:50*

APPENDIX J

Summary of emergent invertebrates captured from Wakulla Springs on April 14, 2009.

Location	Collection Date	Time	Trap #	*Beardius truncatus*	*Chironomini*	*Dicrotendipes modestus*	*Diptera - Sciaridae*	*Polypedilum illinoense*	*Tanytarsini*	*Trichoptera - Hydropsychidae*	*Zavreliella marmorata*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
Spring Pool	4/14/2009	13:10	2				1				3	4	16	250,960	
	4/14/2009	13:15	3						2		1	3	12	0	
Spring Run	4/14/2009	13:20	1	1		2						3	12		723,816
	4/14/2009	13:25	4		11	3		1	2			17	68		4,101,624
	4/14/2009	13:30	5		1							1	4		241,272
	4/14/2009	13:35	6						1			1	4		241,272
	4/14/2009	13:40	7							1		1	4		241,272
	4/14/2009	13:45	8									0	0		0
	4/14/2009	13:50	9		1				1			2	8		482,544
	4/14/2009	13:55	10		4	5						9	36		2,171,448
			SUM	**1**	**17**	**10**	**1**	**1**	**6**	**1**	**4**	**41**		**250,960**	**8,203,248**
			Spring Pool Average	**0.00**	**0.00**	**0.00**	**0.50**	**0.00**	**1.00**	**0.00**	**2.00**	**3.50**	**14.00**		
			Spring Run Average	**0.13**	**2.13**	**1.25**	**0.00**	**0.13**	**0.50**	**0.13**	**0.00**	**4.25**	**17.00**		
			Grand Average	**0.10**	**1.70**	**1.00**	**0.10**	**0.10**	**0.60**	**0.10**	**0.40**	**4.10**	**16.40**	**125,480**	**1,025,406**

APPENDIX J
Summary of emergent invertebrates captured from Wakulla Springs on April 15, 2009

Location	Collection Date	Time	Trap #	*Beardius truncatus*	*Chironomini*	*Cryptochironomus sp.*	*Dicrotendipes modestus*	*Polypedilum illinoense*	*Pseudochironomus richardsoni*	*Stenochironomus sp.*	*Tanypodinae*	*Tanytarsini*	*Trichoptera: Hydropsychidae*	*Trichoptera: Hydroptilidae*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
Spring Pool	4/15/2009	13:10	2	1						1					2	8	125,480	
	4/15/2009	13:15	3						2		2	3			7	28	439,180	
Spring Run	4/15/2009	13:20	1					1				1			2	8		482,544
	4/15/2009	13:25	4		9	1	3					2			15	60		3,619,080
	4/15/2009	13:30	5		1				1		2				4	16		965,088
	4/15/2009	13:35	6		1						2	1	1		5	20		1,206,360
	4/15/2009	13:40	7		2				1		3			1	7	28		1,688,904
	4/15/2009	13:45	8								1				1	4		241,272
	4/15/2009	13:50	9		4										4	16		965,088
	4/15/2009	13:55	10		4										4	16		965,088
			SUM	**1**	**21**	**1**	**3**	**1**	**4**	**1**	**10**	**7**	**1**	**1**	**51**		**564,660**	**10,133,424**
			Spring Pool Average	**0.50**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	**0.50**	**1.00**	**1.50**	**0.00**	**0.00**	**4.50**	**18.00**		
			Spring Run Average	**0.00**	**2.63**	**0.13**	**0.38**	**0.13**	**0.25**	**0.00**	**1.00**	**0.50**	**0.13**	**0.13**	**5.25**	**21.00**		
			Grand Average	**0.10**	**2.10**	**0.10**	**0.30**	**0.10**	**0.40**	**0.10**	**1.00**	**0.70**	**0.10**	**0.10**	**5.10**	**20.40**	**282,330**	**1,266,678**

APPENDIX J
Summary of emergent invertebrates captured from Wakulla Springs on April 16, 2009.

Location	Collection Date	Time	Trap #	*Ablabesmyia sp.*	*Beardius truncatus*	*Chironomini*	*Coleoptera - Coccinellidae*	*Cryptochironomus fulvus*	*Dicrotendipes modestus*	*Labrundinia declorata*	*Polypedilum illinoense*	*Pseudochironomus richardsoni*	*Tanypodinae*	*Tanytarsini*	*Trichoptera - Hydropsychidae*	*Trichoptera - Hydroptilidae*	*Trichoptera - Leptoceridae*	*Zavreliella marmorata*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
Spring Pool	4/16/2009	9:30	2															4	4	16	250,960	
	4/16/2009	9:35	3		2				1		1	4						1	9	36	564,660	
Spring Run	4/16/2009	9:40	1																0	0		0
	4/16/2009	9:45	4			9	1	1	2					6		1		1	21	84		5,066,712
	4/16/2009	9:50	5			3						9		1					13	52		3,136,536
	4/16/2009	9:55	6			1						1				1			3	12		723,816
	4/16/2009	10:00	7			1			1	1	1			1	1				6	24		1,447,632
	4/16/2009	10:05	8	1					1										2	8		482,544
	4/16/2009	10:10	9											1			1		2	8		482,544
	4/16/2009	10:15	10			8			3				1					2	14	56		3,377,808
			SUM	**1**	**2**	**22**	**1**	**1**	**8**	**1**	**2**	**14**	**1**	**9**	**1**	**2**	**1**	**8**	**74**		**815,620**	**14,717,592**
			Spring Pool Average	**0.00**	**1.00**	**0.00**	**0.00**	**0.00**	**0.50**	**0.00**	**0.50**	**2.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.50**	**6.50**	**26.00**		
			Spring Run Average	**0.13**	**0.00**	**2.75**	**0.13**	**0.13**	**0.88**	**0.13**	**0.13**	**1.25**	**0.13**	**1.13**	**0.13**	**0.25**	**0.13**	**0.38**	**7.63**	**30.50**		
			Grand Average	**0.10**	**0.20**	**2.20**	**0.10**	**0.10**	**0.80**	**0.10**	**0.20**	**1.40**	**0.10**	**0.90**	**0.10**	**0.20**	**0.10**	**0.80**	**7.40**	**29.60**	**407,810**	**1,839,699**

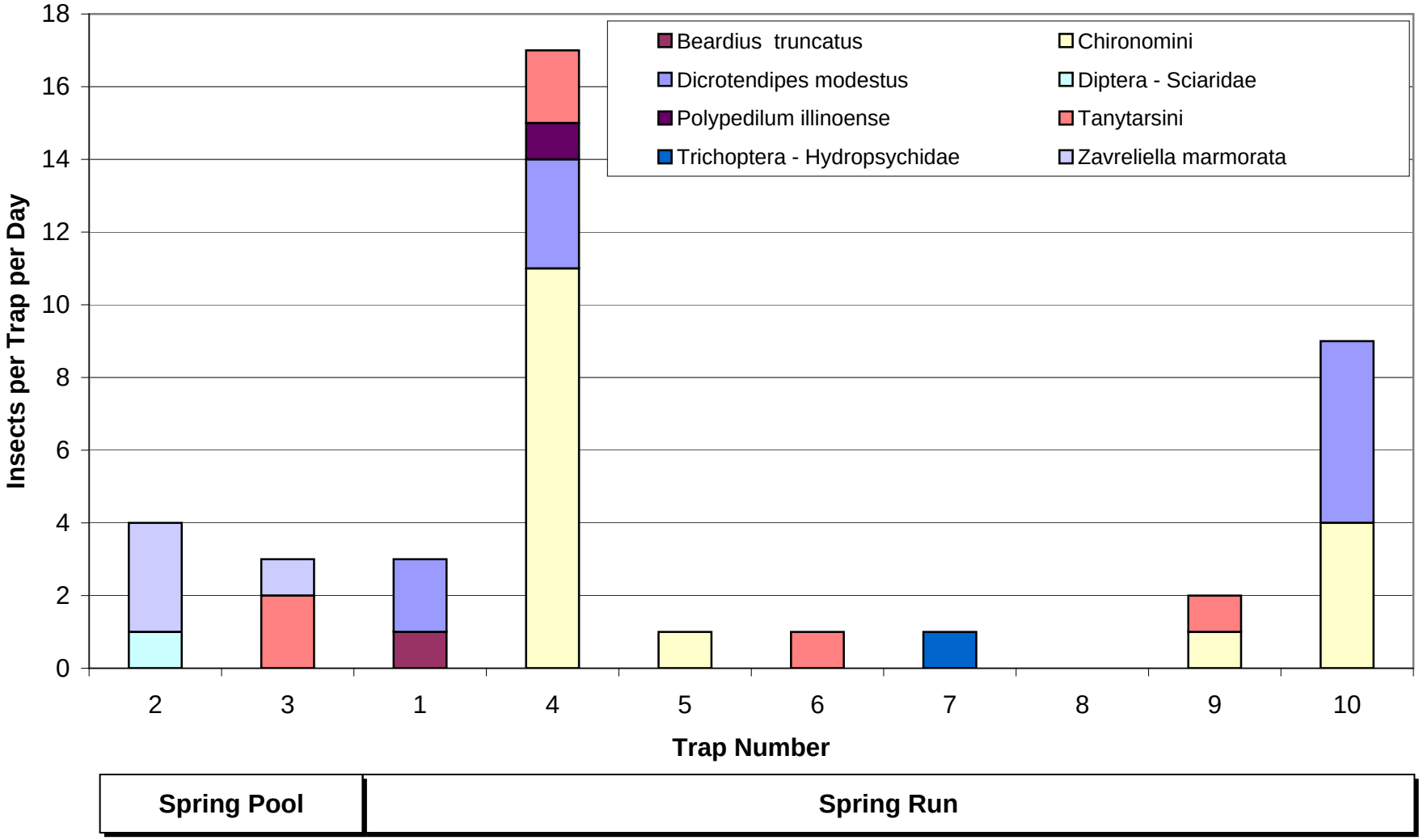
APPENDIX J

Summary of emergent invertebrates captured from Wakulla Springs during April 14, 15, and 16, 2009.

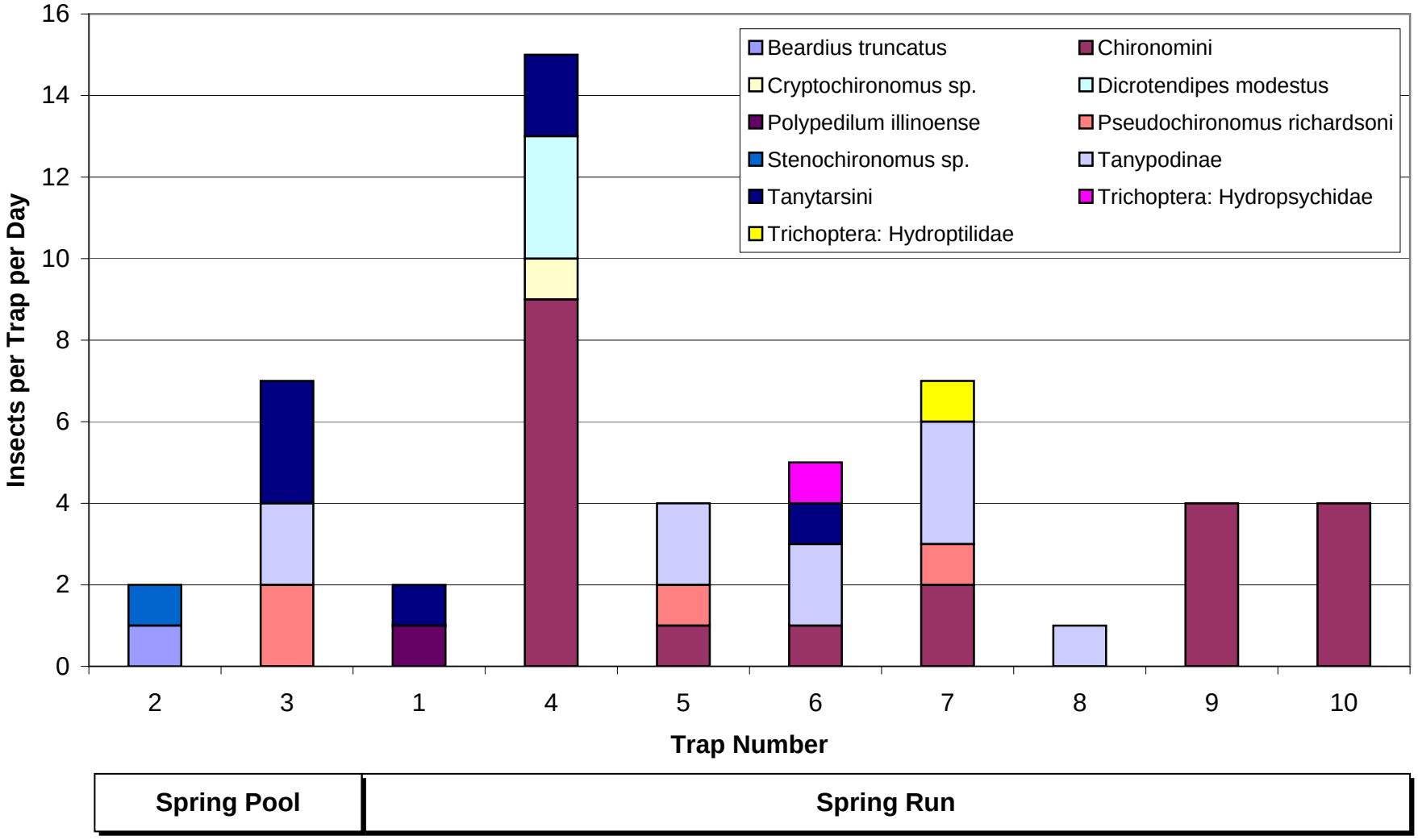
Location	Collection Date	Total Emergent Invertebrates	Average Emergence Rate (#/m^2/day) *	Average Emergence Rate (#/day) *
Spring Pool	4/14/2009	7	14.0	125,480
	4/15/2009	9	18.0	282,330
	4/16/2009	13	26.0	407,810
	Average	**10**	**19.3**	**271,873**
Spring Run	4/14/2009	34	17.0	1,025,406
	4/15/2009	42	21.0	1,266,678
	4/16/2009	61	30.5	1,839,699
	Average	**46**	**22.8**	**1,377,261**
	Grand Average	**28**	**21.1**	**824,567**

* Based on a spring pool area of 15,685 m^2 and spring run area of 60,318 m^2.

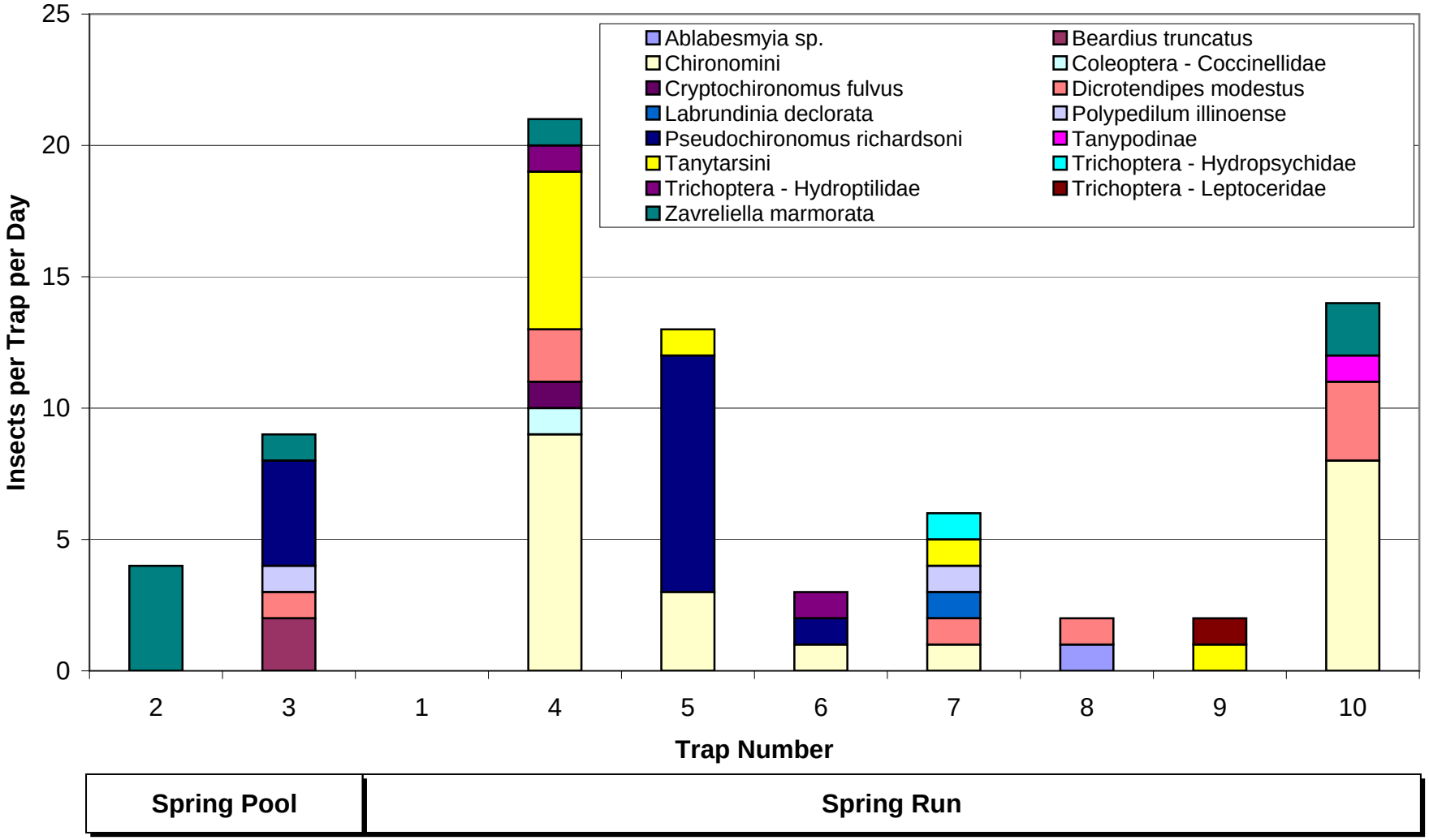
Wakulla Springs (Wakulla Co.) Emergent Invertebrates Data
Trap Collections made 4/14/09



Wakulla Springs (Wakulla Co.) Emergent Invertebrates Data
Trap Collections made 4/15/09



Wakulla Springs (Wakulla Co.) Emergent Invertebrates Data
Trap Collections made 4/16/09





APPENDIX J
Location of macroinvertebrate emergence traps for Weeki Wachee Springs (Hernando Co.) during March 10 to 12, 2009.

APPENDIX J

Macroinvertebrate emergence trap meta data for Weeki Wachee Springs (Hernando Co.) during March 10 to 12, 2009.

Location	Date	Trap #	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Water Depth (m) *	Substrate
Spring Pool	3/10/2009	6	28.518134°	-82.573357°	0.3	sand
	3/10/2009	8	28.517649°	-82.573212°	0.6	algae/sand
	3/10/2009	10	28.517800°	-82.573470°	0.8	sand
Spring Run	3/10/2009	1	28.517670°	-82.578190°	0.1	algae/sand
	3/10/2009	2	28.518742°	-82.577554°	0.1	algae/sand
	3/10/2009	3	28.519518°	-82.575026°	0.1	algae/sand
	3/10/2009	4	28.518794°	-82.575790°	0.5	algae
	3/10/2009	5	28.518891°	-82.578951°	0.5	algae/sand
	3/10/2009	7	28.518950°	-82.573560°	0.1	algae/sand
	3/10/2009	9	28.519120°	-82.573970°	0.5	sand

** no staff gage*

APPENDIX J

Summary of emergent invertebrates captured from Weeki Wachee Springs on March 10, 2009

Location	Collection Date	Time	Trap #	*Beardius truncatus*	*Trichoptera: Hydropsychidae*	*Trichoptera: Hydroptilidae*	*Chironomidae*	*Polypedilum illinoense*	*Paralauterborniella nigrohalterale*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	3/10/2009	9:10	6	8			3			11	44	84,876	
Spring Pool	3/10/2009	9:20	8				1		1	2	8	15,432	
	3/10/2009	9:00	10	3			1			4	16	30,864	
	3/10/2009	9:50	1							0	0		0
	3/10/2009	9:40	2							0	0		0
	3/10/2009	9:30	3							0	0		0
Spring Run	3/10/2009	9:35	4							0	0		0
	3/10/2009	9:45	5	1	1	2				4	16		311,632
	3/10/2009	9:15	7	1			3	1		5	20		389,540
	3/10/2009	9:25	9							0	0		0
			SUM	**13**	**1**	**2**	**8**	**1**	**1**	**26**		**131,172**	**701,172**
			Spring Pool Average	**3.67**	**0.00**	**0.00**	**1.67**	**0.00**	**0.33**	**5.67**	**22.67**		
			Spring Run Average	**0.29**	**0.14**	**0.29**	**0.43**	**0.14**	**0.00**	**1.29**	**5.14**		
			Grand Average	**1.30**	**0.10**	**0.20**	**0.80**	**0.10**	**0.10**	**2.60**	**10.40**	**43,724**	**100,167**

APPENDIX J
Summary of emergent invertebrates captured from Weeki Wachee Springs on March 11, 2009.

Location	Collection Date	Time	Trap #	*Chironomus decorus*	*Trichoptera: Hydropsychidae*	*Trichoptera: Hydroptilidae*	*Trichoptera*	*Pseudochironomus richardsoni*	*Dicrotendipes modestus*	*Beardius truncatus*	*Chironomidae*	*Diptera: Sciaridae*	*Polypedilum illinoense*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	3/11/2009	8:55	6		1					5	4	1		11	44	84,876	
Spring Pool	3/11/2009	8:45	8	2		1			1					4	16	30,864	
	3/11/2009	8:50	10						2	4	1			7	28	54,012	
	3/11/2009	9:20	1											0	0		0
	3/11/2009	9:15	2	1										1	4		77,908
	3/11/2009	9:05	3	1										1	4		77,908
Spring Run	3/11/2009	9:10	4		1		1							2	8		155,816
	3/11/2009	9:25	5		1	1		1	1	3				7	28		545,356
	3/11/2009	9:00	7			1		3		1	3		1	9	36		701,172
	3/11/2009	9:05	9							1				1	4		77,908
			SUM	**4**	**3**	**3**	**1**	**4**	**4**	**14**	**8**	**1**	**1**	**43**		**169,752**	**1,636,068**
			Spring Pool Average	**0.67**	**0.33**	**0.33**	**0.00**	**0.00**	**1.00**	**3.00**	**1.67**	**0.33**	**0.00**	**7.33**	**29.33**		
			Spring Run Average	**0.29**	**0.29**	**0.29**	**0.14**	**0.57**	**0.14**	**0.71**	**0.43**	**0.00**	**0.14**	**3.00**	**12.00**		
			Grand Average	**0.40**	**0.30**	**0.30**	**0.10**	**0.40**	**0.40**	**1.40**	**0.80**	**0.10**	**0.10**	**4.30**	**17.20**	**56,584**	**233,724**

APPENDIX J

Summary of emergent invertebrates captured from Weeki Wachee Springs on March 12, 2009.

Location	Collection Date	Time	Trap #	*Paralauterborniella nigrohalterale*	*Ablabesmyia sp.*	*Chironomus decorus*	*Clinotanypus pinguis*	*Tanytarsini*	*Zavrelimyia varipennis*	*Pseudochironomus richardsoni*	*Beardius truncatus*	*Cryptochironomus fulvus*	*Chironomidae*	*Cricotopus sp.*	*Dicrotendipes modestus*	*Pentaneura inconspicua*	*Trichoptera: Hydropsychidae*	*Trichoptera: Hydroptilidae*	*Ephemeroptera: Baetidae*	*Diptera: Sciaridae*	*Polypedilum illinoense*	Total Emergent Invertebrates	Emergence Rate (#/m^2/day)	Pool Emergence Rate (#/day)	Run Emergence Rate (#/day)
	3/12/2009	9:10	6					1			4	1	9					1				16	64	123,456	
Spring Pool	3/12/2009	9:00	8			2		3		1	1		3		1							11	44	84,876	
	3/12/2009	9:05	10			4					6		4		7							21	84	162,036	
	3/12/2009	9:40	1	4	1																	5	20		389,540
	3/12/2009	9:35	2	4		3	1	1														9	36		701,172
	3/12/2009	9:25	3			4			1													5	20		389,540
Spring Run	3/12/2009	9:30	4	2		1		2		1	5	1	10									22	88		1,713,976
	3/12/2009	9:45	5					2		2	2		7	1		3	2	3	1			23	92		1,791,884
	3/12/2009	9:15	7			2				2	2		4							1	1	12	48		934,896
	3/12/2009	9:20	9										2	2			3	1				8	32		623,264
		SUM		**10**	**1**	**16**	**1**	**9**	**1**	**6**	**20**	**2**	**39**	**3**	**8**	**3**	**5**	**5**	**1**	**1**	**1**	**132**		**370,368**	**6,544,272**
		Spring Pool Average		**0.00**	**0.00**	**2.00**	**0.00**	**1.33**	**0.00**	**0.33**	**3.67**	**0.33**	**5.33**	**0.00**	**2.67**	**0.00**	**0.00**	**0.33**	**0.00**	**0.00**	**0.00**	**16.00**	**64.00**		
		Spring Run Average		**1.43**	**0.14**	**1.43**	**0.14**	**0.71**	**0.14**	**0.71**	**1.29**	**0.14**	**3.29**	**0.43**	**0.00**	**0.43**	**0.71**	**0.57**	**0.14**	**0.14**	**0.14**	**12.00**	**48.00**		
		Grand Average		**1.00**	**0.10**	**1.60**	**0.10**	**0.90**	**0.10**	**0.60**	**2.00**	**0.20**	**3.90**	**0.30**	**0.80**	**0.30**	**0.50**	**0.50**	**0.10**	**0.10**	**0.10**	**13.20**	**52.80**	**123,456**	**934,896**

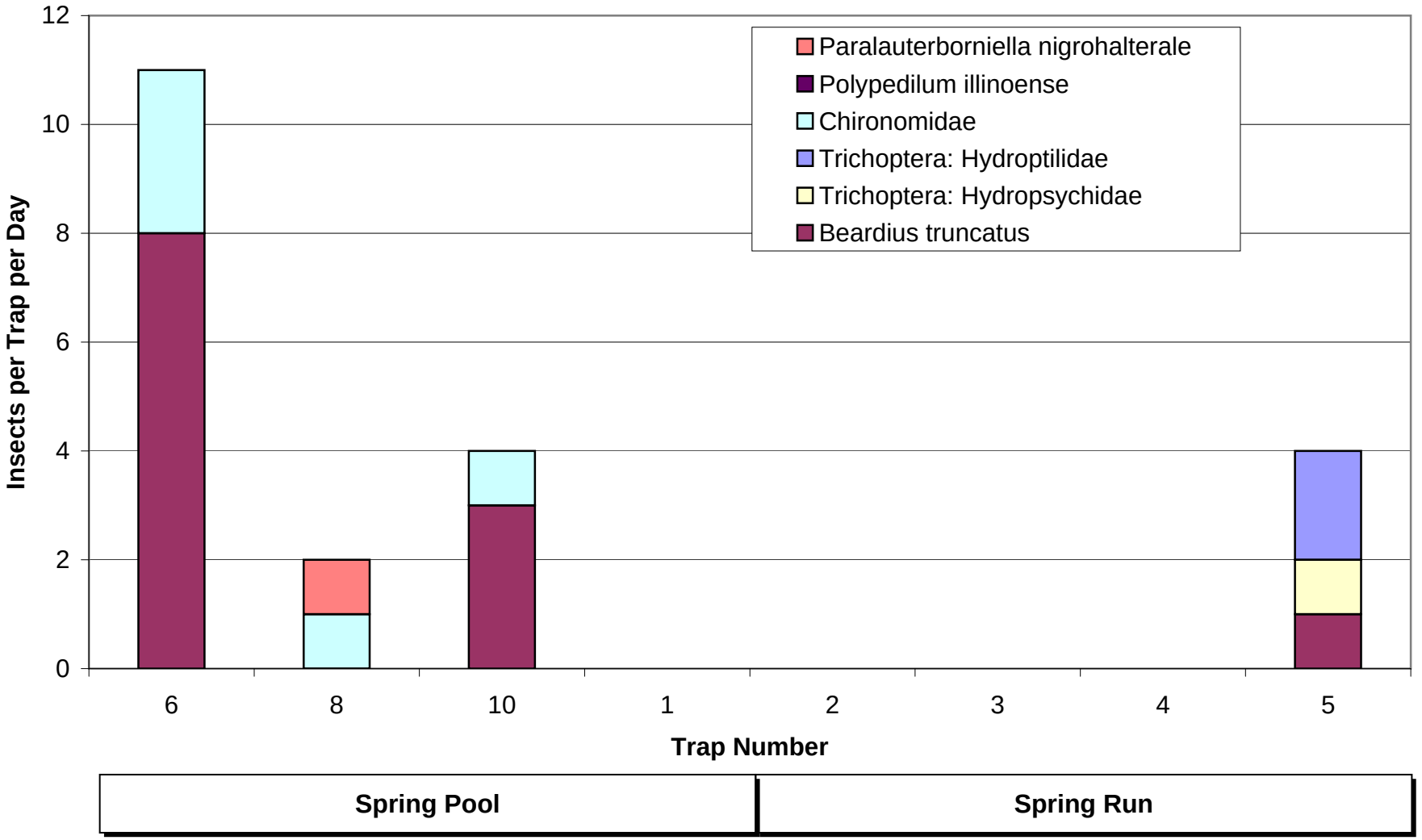
APPENDIX J

Summary of emergent invertebrates captured from Weeki Wachee Springs during March 10, 11, and 12, 2009.

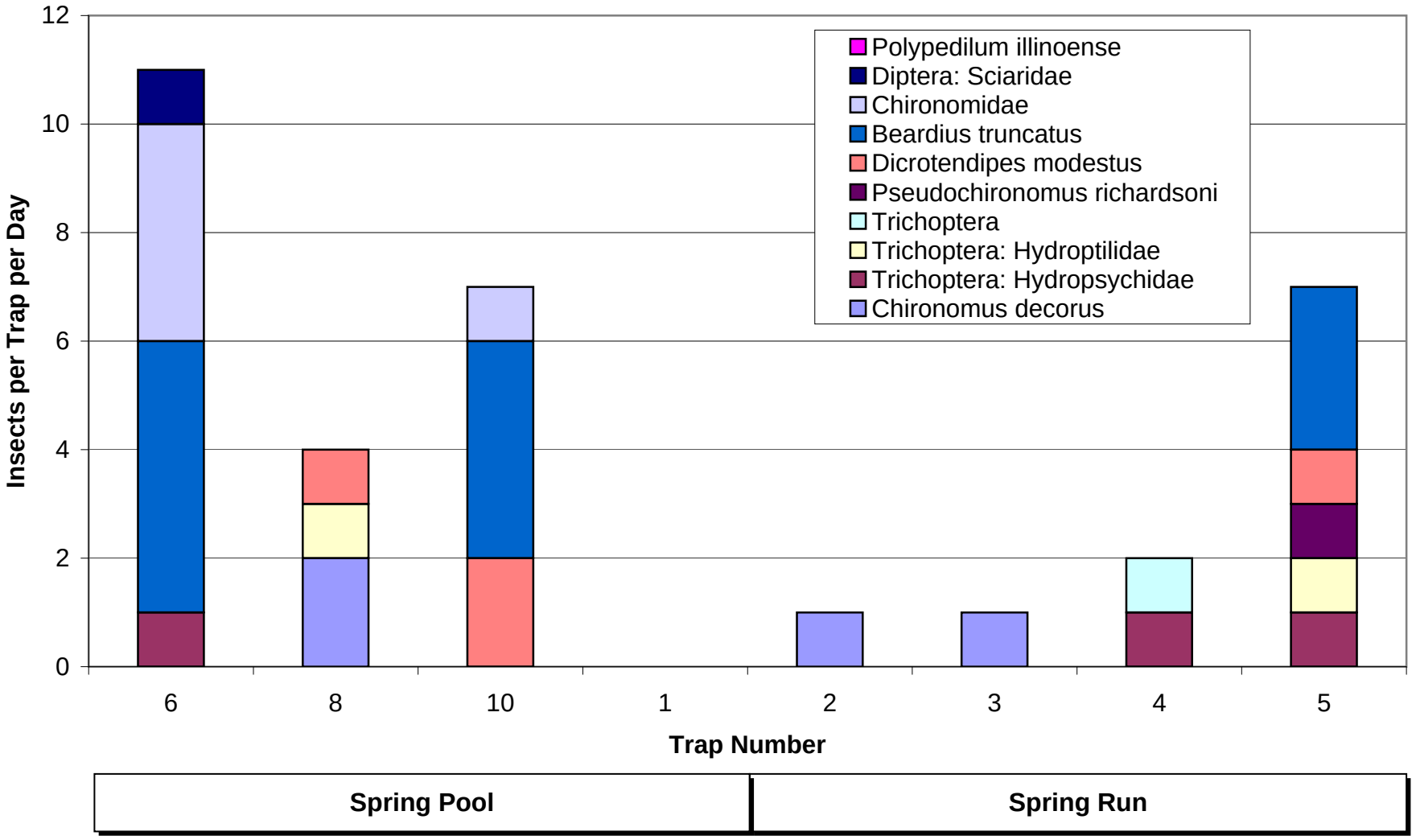
Location	Collection Date	Total Emergent Invertebrates	Emergence Rate (#/m^2/day) *	Emergence Rate (#/day) *
Spring Pool	3/10/2009	17	22.67	43,724
	3/11/2009	22	29.33	56,584
	3/12/2009	48	64.00	123,456
	Average	**29**	**38.7**	**74,588**
Spring Run	3/10/2009	4	5.14	100,167
	3/11/2009	11	12.00	233,724
	3/12/2009	64	48.00	934,896
	Average	**26**	**21.7**	**422,929**
	Grand Average	**28**	**30.2**	**248,759**

* Based on a spring pool area of 1,929 m^2 and spring run area of 19,477 m^2.

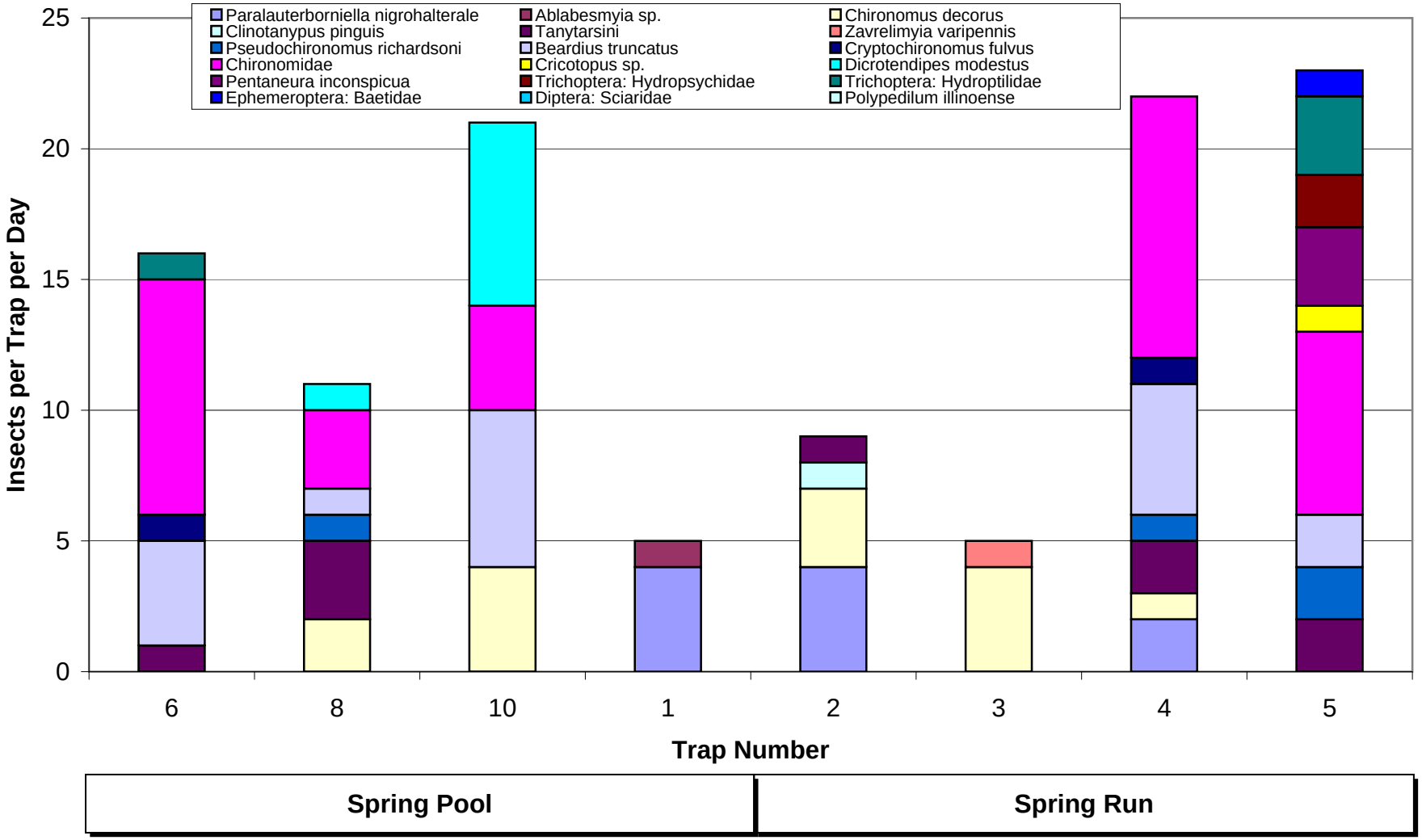
Weeki Wachee Springs (Hernando Co.) Emergent Invertebrates Data
Trap Collections made 3/10/09



Weeki Wachee Springs (Hernando Co.) Emergent Invertebrates Data
Trap Collections made 3/11/09



Weeki Wachee Springs (Hernando Co.) Emergent Invertebrates Data
Trap Collections made 3/12/09



Appendix K

Fish

APPENDIX K

Comparison of fish density and biomass by spring.

Density

WMD	Spring Name	Sampled Area (ha)	Total Fish	Density (#/ha)
NWFWMD	Jackson Blue *	0.41	1,087	**2,663**
NWFWMD	Ponce de Leon	0.35	2,794	**8,064**
SJRWMD	De Leon *	0.28	2,635	**9,575**
SJRWMD	Silver	7.94	10,805	**1,361**
SJRWMD	Silver Glen	3.83	5,518	**1,441**
SRWMD	Ichetucknee	10.85	12,343	**1,137**
SRWMD	Madison Blue	0.11	742	**6,900**
SRWMD	Manatee	0.66	7,775	**11,846**
SWFWMD	Homosassa	1.13	6,606	**5,836**
SWFWMD	Rainbow	5.03	9,502	**1,889**
SWFWMD	Weeki Wachee	2.14	4,399	**2,055**

Biomass

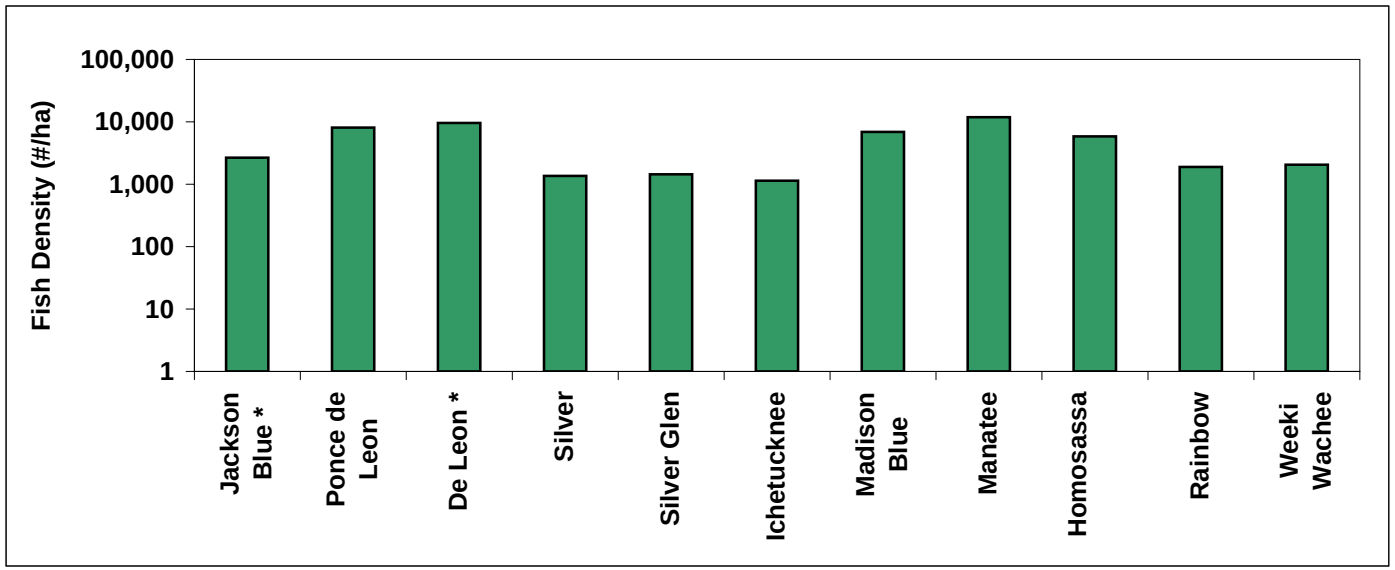
WMD	Spring Name	Sampled Area (ha)	Total Biomass (kg)	Biomass (kg/ha)
NWFWMD	Jackson Blue *	0.41	117.3	**287.4**
NWFWMD	Ponce de Leon	0.35	12.21	**35.2**
SJRWMD	De Leon *	0.28	98.2	**356.7**
SJRWMD	Silver	7.94	1,559.6	**196.4**
SJRWMD	Silver Glen	3.83	1,004.6	**262.4**
SRWMD	Ichetucknee	10.85	975.7	**89.9**
SRWMD	Madison Blue	0.11	34.7	**322.9**
SRWMD	Manatee	0.66	966.04	**1,471.8**
SWFWMD	Homosassa	1.13	4,811.4	**4,250.7**
SWFWMD	Rainbow	5.03	571.2	**113.6**
SWFWMD	Weeki Wachee	2.14	688.0	**321.4**

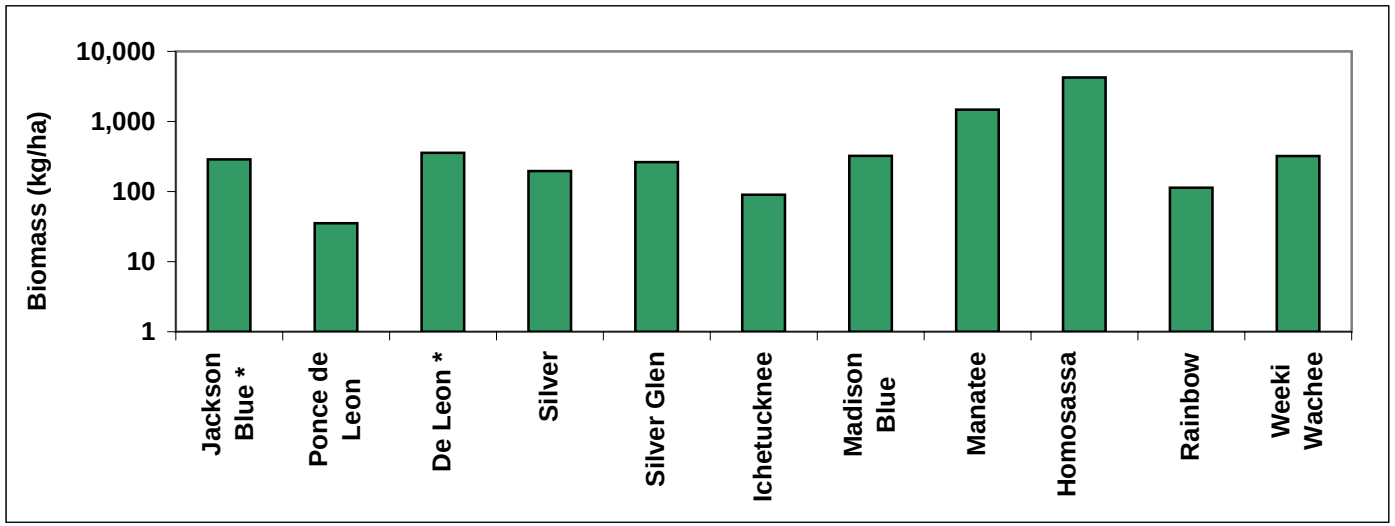
** Only pool sampled.*

Wakulla Springs survey was qualitative only.

APPENDIX K

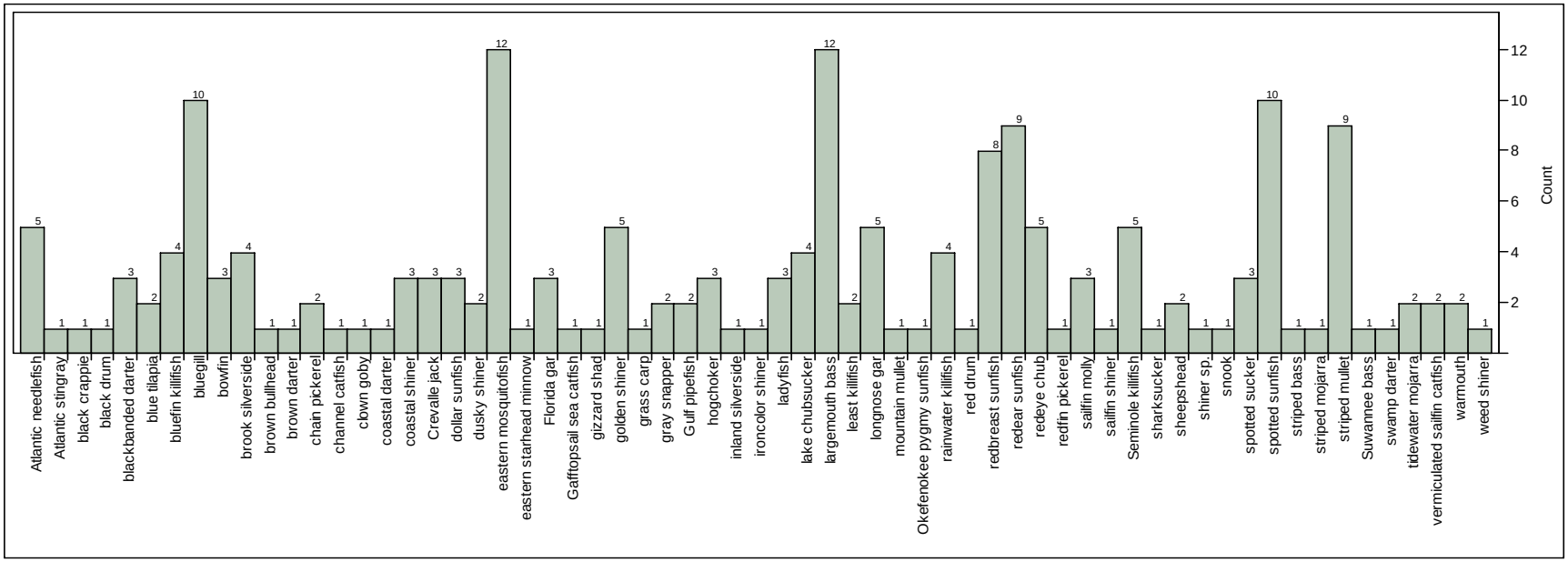
Comparison of fish density and biomass by spring.





APPENDIX K

The number of springs that each species of fish was observed at.



APPENDIX K

Results of visual fish surveys (snorkel/SCUBA) from De Leon Springs (Volusia Co.) during October 6, 7, and 9, 2008.

		Estimated Field Observations					Estimated Fish Measurements					
Common Name	**Scientific Name**	**10/6/2008**	**10/7/2008**	**10/9/2008**	**Average**	**Std. Dev.**	**Length (mm)**	**Girth (mm)**	**Weight (kg)**	**Biomass (kg)**	**Biomass per area (kg/ha)**	**Fish Density (n/ha)**
SPRING POOL												
Lake Chubsucker	*Erimyzon sucetta* *	5	5	4	4.7	0.6	152.4	101.6	0.0490	0.23	0.83	17.0
Seminole Killifish	*Fundulus seminolis*	24	24	31	26.3	4.0	114.3	63.5	0.0163	0.43	1.56	95.7
Eastern Mosquitofish	*Gambusia holbrooki*	4	12	34	16.7	15.5	38.1	25.4	0.0007	0.01	0.04	60.6
Largemouth Bass	*Micropterus salmoides*	11	8	14	11.0	3.0	203.2	127.0	0.1102	1.21	4.41	40.0
Striped Mullet	*Mugil cephalus*	4	8	8	6.7	2.3	254.0	152.4	0.2090	1.39	5.06	24.2
Golden Shiner	*Notemigonus crysoleucas*	225	1,065	655	648.3	420.0	101.6	63.5	0.0130	8.45	30.71	2,355.9
Hogchoker	*Trinectes maculatus*	-	2	1	1.0	1.0	50.8	50.8	0.0027	0.00	0.01	3.6
Sunfish group	*Lepomis spp.*	1,640	2,340	1,781	1,920.3	370.2	114.3	152.4	0.0450	86.44	314.10	6,978.0
Redbreast Sunfish	*Lepomis auritus*	-	-	5	1.7	2.9	101.6	95.3	---	---	---	---
Warmouth	*Lepomis gulosus*	-	-	3	1.0	1.7	152.4	203.2	---	---	---	---
Bluegill	*Lepomis macrochirus*	-	-	814	271.3	470.0	101.6	101.6	---	---	---	---
Dollar Sunfish	*Lepomis marginatus*	-	-	135	45.0	77.9	88.9	76.2	---	---	---	---
Redear Sunfish	*Lepomis microlophus*	-	-	575	191.7	332.0	152.4	127.0	---	---	---	---
Spotted Sunfish	*Lepomis punctatus*	-	-	249	83.0	143.8	127.0	114.3	---	---	---	---
Total	**13**	**1,913**	**3,464**	**2,528**	**2,635.0**	**781.0**				**98.17**	**356.72**	**9,574.9**
SPRING RUN												
Ladyfish	*Elops saurus*											
Seminole Killifish	*Fundulus seminolis*											
Eastern Mosquitofish	*Gambusia holbrooki*											
Bluegill	*Lepomis macrochirus*											
Largemouth Bass	*Micropterus salmoides*											
Striped Mullet	*Mugil cephalus*											
Golden Shiner	*Notemigonus crysoleucas*											
Atlantic Needlefish	*Strongylura marina*											
Total	**11**											

Unable to quantify the fish community in the "spring run", due to tannic waters and poor visibility.

Location	Sampled Area (ha)
Spring Pool	0.2752
Spring Run	3.7959

Notes

Unable to quantify the fish community in the "spring run", due to tannic waters and poor visibility.

The fish numbers are likely much higher than normal (recon trip had few *Lepomis* only).

Park staff and exercise swimmers report much higher than normal fish numbers during the sampling week; and that there were even more fish in the pool immediately following the peak of flooding.

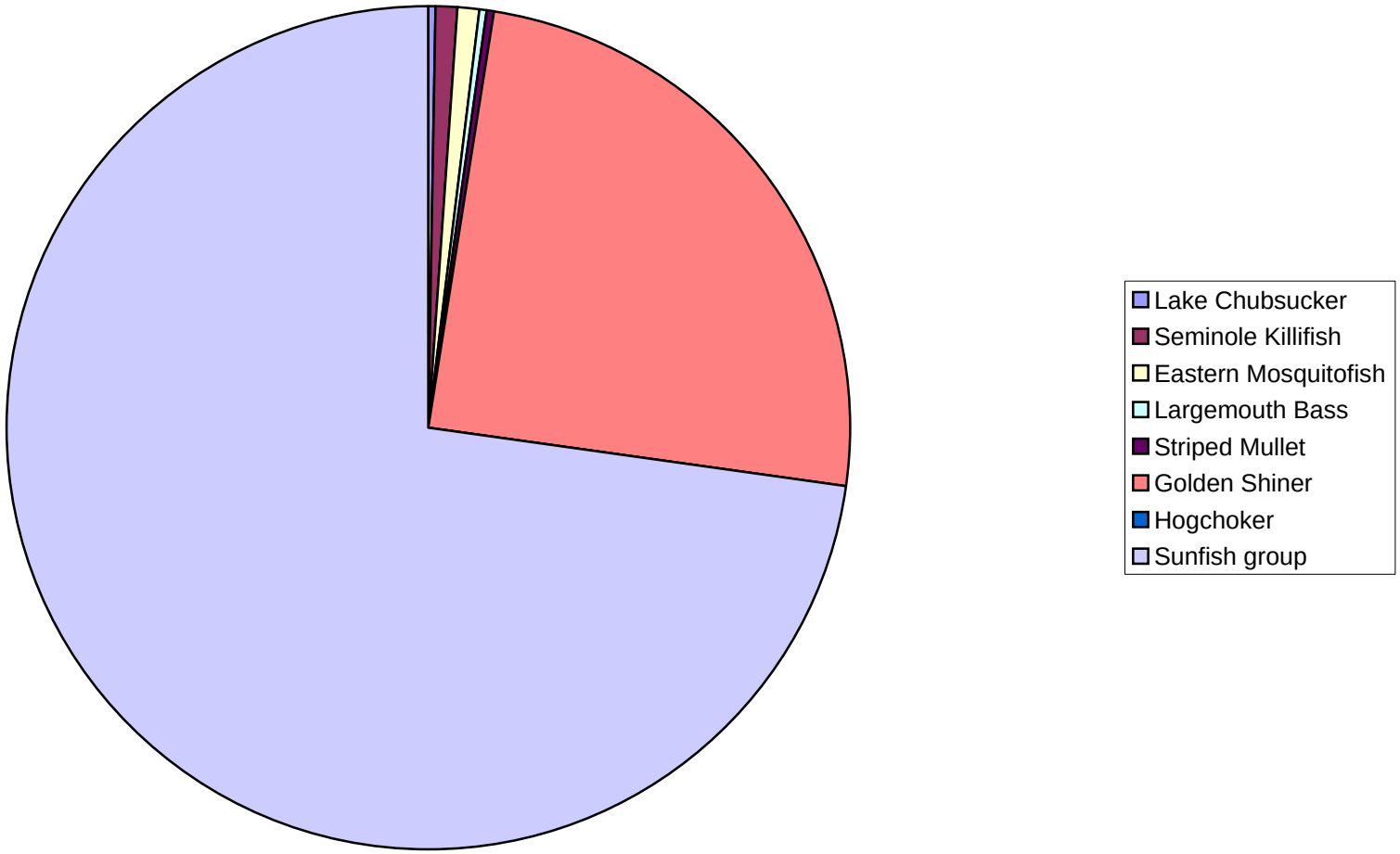
These same people report the flooding of the St. Johns (from TS Fay) "pushed" the fish up into the pool area.

One swimmer described seeing two surface slicks (boils) in the pool, she then realized one was a school of fish (golden shiners, shad?).

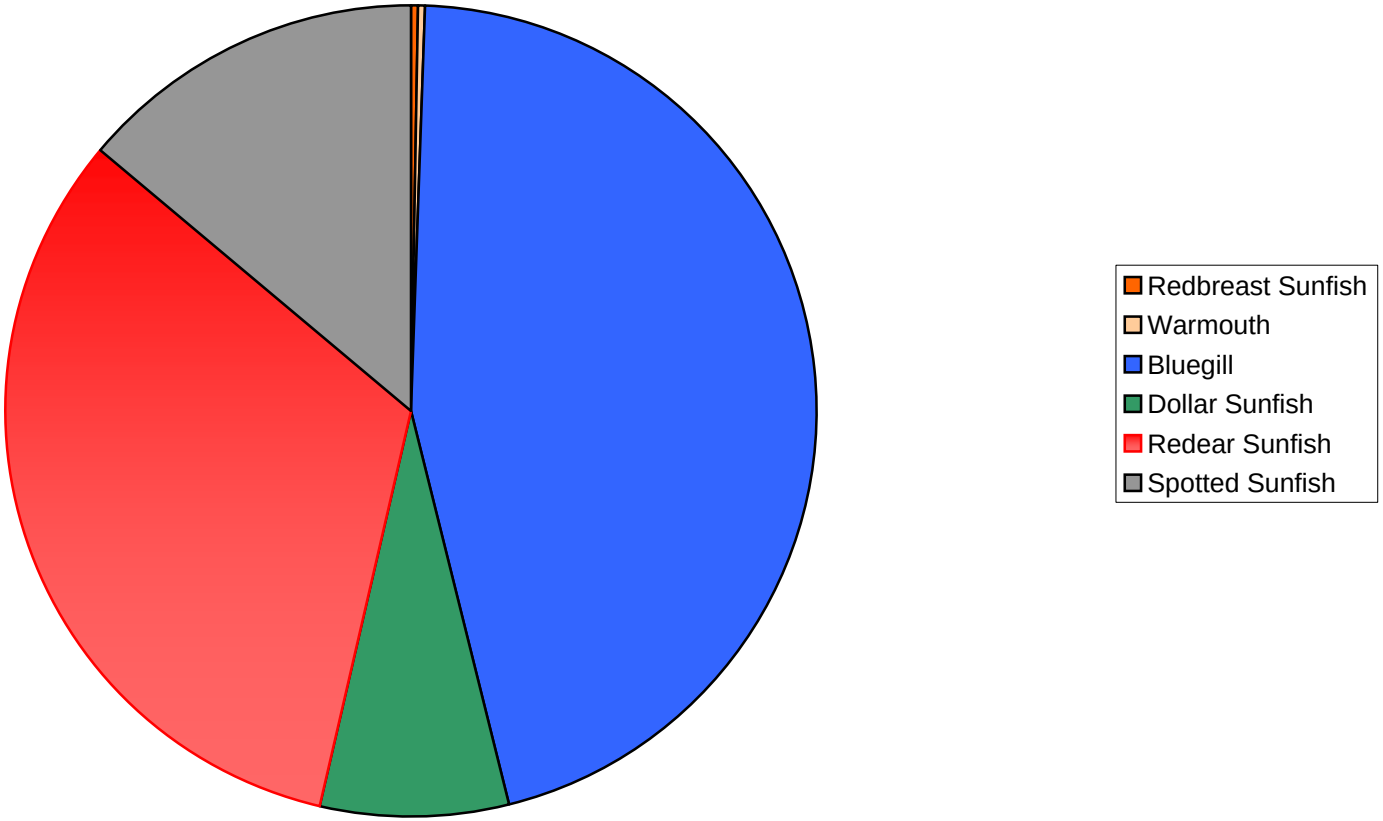
A swimmer reported seeing several large gizzard shad and one sailfin catfish before our sampling; as well as hundreds of hogchokers in the spring run

* Provisional identification by Steve Walsh as juvenile Lake Chubsucker (*Erimyzon sucetta*); but if a shiner then dusky shiner, (*Notropis cummingsae)* .

De Leon Springs (Volusia Co.) Fish Species Composition
Average Spring Pool (October 6, 7, and 9, 2008)



De Leon Springs (Volusia Co.) Pool
Estimated *Lepomis spp.* Composition



Results of visual fish survey from Homosassa Springs (Citrus Co.) during November 3 to 6, 2008.

		Estimated Field Observations							Estimated Fish Measurements					
Common Name	Scientific Name	11/3/08	11/3/08	11/4/08	11/5/08	11/6/08	Average	Std. Dev.	Length (mm)	Girth (mm)	Weight (kg)	Biomass (kg)	Biomass per area (kg/ha)	Fish Density (n/ha)
SPRING POOL														
Sheepshead	*Archosargus probatocephalus*	-	7	5	9	20	8.2	7.4	304.8	266.7	0.5671	4.65	9.18	16.2
Gafftopsail Sea Catfish	*Bagre marinus*	-	-	-	1	-	0.2	0.4	381.0	254.0	0.8232	0.16	0.32	0.4
Crevalle Jack	*Caranx hippos*	47	85	600	50	50	166.4	242.9	457.2	406.4	2.0135	335.04	661.09	328.3
Snook	*Centropomus undecimalis*	286	383	1,000	104	1,000	554.6	418.7	914.4	304.8	5.4736	3,035.64	5,989.82	1,094.3
Striped Mojarra	*Eugerres plumieri*	-	-	-	-	1	0.2	0.4	254.0	254.0	0.3775	0.08	0.15	0.4
Sharksucker	*Echeneis naucrates*	-	-	-	1	2	0.6	0.9	304.8	152.4	0.2968	0.18	0.35	1.2
Ladyfish	*Elops saurus*	75	28	1	24	25	30.6	27.1	457.2	177.8	0.7737	23.67	46.71	60.4
Tidewater Mojarra	*Eucinostomus harengulus*	-	100	-	235	-	67.0	103.4	63.5	50.8	0.0041	0.27	0.54	132.2
Eastern Mosquitofish	*Gambusia holbrooki*	-	-	-	10	-	2.0	4.5	38.1	25.4	0.0007	0.00	0.00	3.9
Florida Gar	*Lepisosteus platyrhincus*	-	1	7	50	-	11.6	21.7	457.2	152.4	0.6473	7.51	14.82	22.9
Sunfish	*Lepomis sp.*	-	-	3	3	-	1.2	1.6	152.4	203.2	0.1092	0.13	0.26	2.4
Gray (Mangrove) Snapper	*Lutjanus griseus*	7,800	4,100	7,000	4,150	2,000	5,010.0	2,365.0	254.0	152.4	0.2090	1,047.24	2,066.38	9,885.6
Inland Silverside	*Menidia beryllina*	-	250	-	100	-	70.0	109.5	50.8	25.4	0.0012	0.08	0.16	138.1
Largemouth Bass	*Micropterus salmoides*	-	-	-	2	-	0.4	0.9	254.0	152.4	0.2090	0.08	0.16	0.8
Striped Mullet	*Mugil cephalus*	-	3	40	-	-	8.6	17.6	457.2	228.6	1.0348	8.90	17.56	17.0
Black Drum	*Pogonias cromis*	-	1	3	2	-	1.2	1.3	508.0	304.8	1.7676	2.12	4.19	2.4
Red Drum	*Sciaenops ocellatus*	-	2	4	19	4	5.8	7.6	609.6	304.8	2.5098	14.56	28.72	11.4
Atlantic Needlefish	*Strongylura marina*	27	20	-	-	-	9.4	13.1	279.4	38.1	0.0505	0.47	0.94	18.5
Total	**18**	**8,235**	**4,980**	**8,663**	**4,760**	**3,102**	**5,948.0**	**2,400.5**				**4,480.8**	**8,841.3**	**11,736.4**

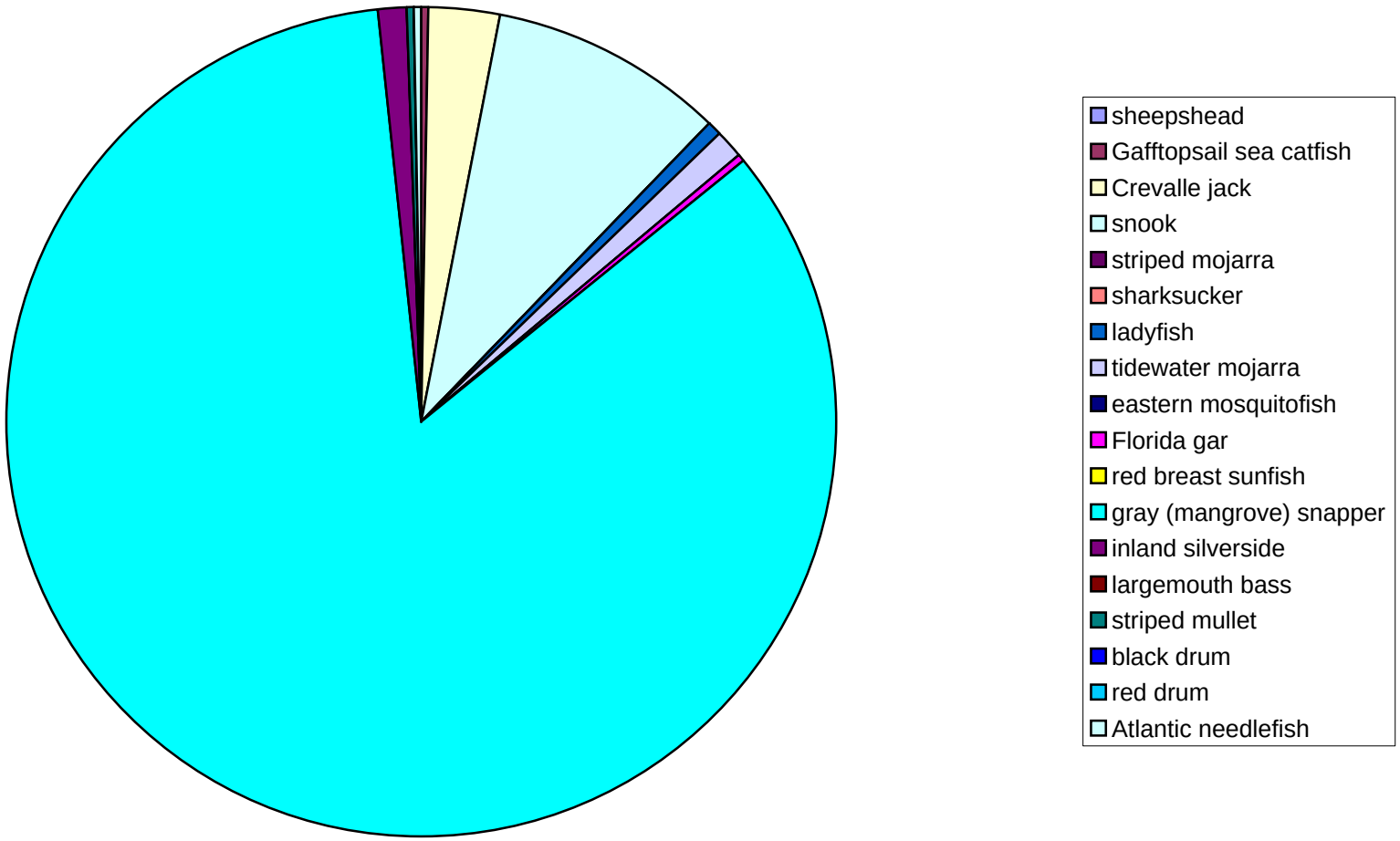
		Estimated Field Observations						Estimated Fish Measurements					
Common Name	Scientific Name	11/3/08	11/4/08	11/4/08	11/6/08	Average	Std. Dev.	Length (mm)	Girth (mm)	Weight (kg)	Biomass (kg)	Biomass per area (kg/ha)	Fish Density (n/ha)
SPRING RUN													
Bowfin	*Amia calva*	1	-	-	-	0.3	0.5	457.2	254.0	1.1689	0.29	0.58	0.5
Sheepshead	*Archosargus probatocephalus*	14	112	47	2	43.8	49.3	304.8	266.7	0.5671	24.81	48.96	86.3
Crevalle Jack	*Caranx hippos*	150	145	125	20	110.0	61.0	457.2	406.4	2.0135	221.48	437.02	217.0
Sharksucker	*Echeneis naucrates*	-	1	-	-	0.3	0.5	304.8	152.4	0.2968	0.07	0.15	0.5
Tidewater Mojarra	*Eucinostomus harengulus*	100	165	203	250	179.5	63.4	63.5	50.8	0.0041	0.73	1.44	354.2
Florida Gar	*Lepisosteus platyrhincus*	-	2	-	-	0.5	1.0	508.0	152.4	0.7927	0.40	0.78	1.0
Bluegill	*Lepomis macrochirus*	-	4	4	-	2.0	2.3	101.6	101.6	0.0225	0.04	0.09	3.9
Rainwater Killifish	*Lucania parva*	-	-	-	200	50.0	100.0	38.1	25.4	0.0007	0.03	0.07	98.7
Gray (Mangrove) Snapper	*Lutjanus griseus*	200	80	570	50	225.0	239.0	254.0	152.4	0.2090	47.03	92.80	444.0
Inland Silverside	*Menidia beryllina*	-	-	-	20	5.0	10.0	50.8	25.4	0.0012	0.01	0.01	9.9
Clown Goby	*Microgobius gulosus*	-	-	-	1	0.3	0.5	76.2	25.4	0.0026	0.00	0.00	0.5
Largemouth Bass	*Micropterus salmoides*	-	-	2	3	1.3	1.5	254.0	152.4	0.2090	0.26	0.52	2.5
Striped Mullet	*Mugil cephalus*	2	90	3	28	30.8	41.3	457.2	228.6	1.0348	31.82	62.78	60.7
Black Drum	*Pogonias cromis*	-	3	-	-	0.8	1.5	508.0	304.8	1.7676	1.33	2.62	1.5
Red Drum	*Sciaenops ocellatus*	-	2	1	-	0.8	1.0	609.6	304.8	2.5098	1.88	3.71	1.5
Atlantic Needlefish	*Strongylura marina*	-	5	-	25	7.5	11.9	279.4	38.1	0.0505	0.38	0.75	14.8
Total	**16**	**467**	**609**	**955**	**599**	**657.5**	**208.6**				**330.6**	**652.3**	**1,297.4**

Location	Sampled Area (ha)
Spring Pool	0.5068
Spring Run	0.6251

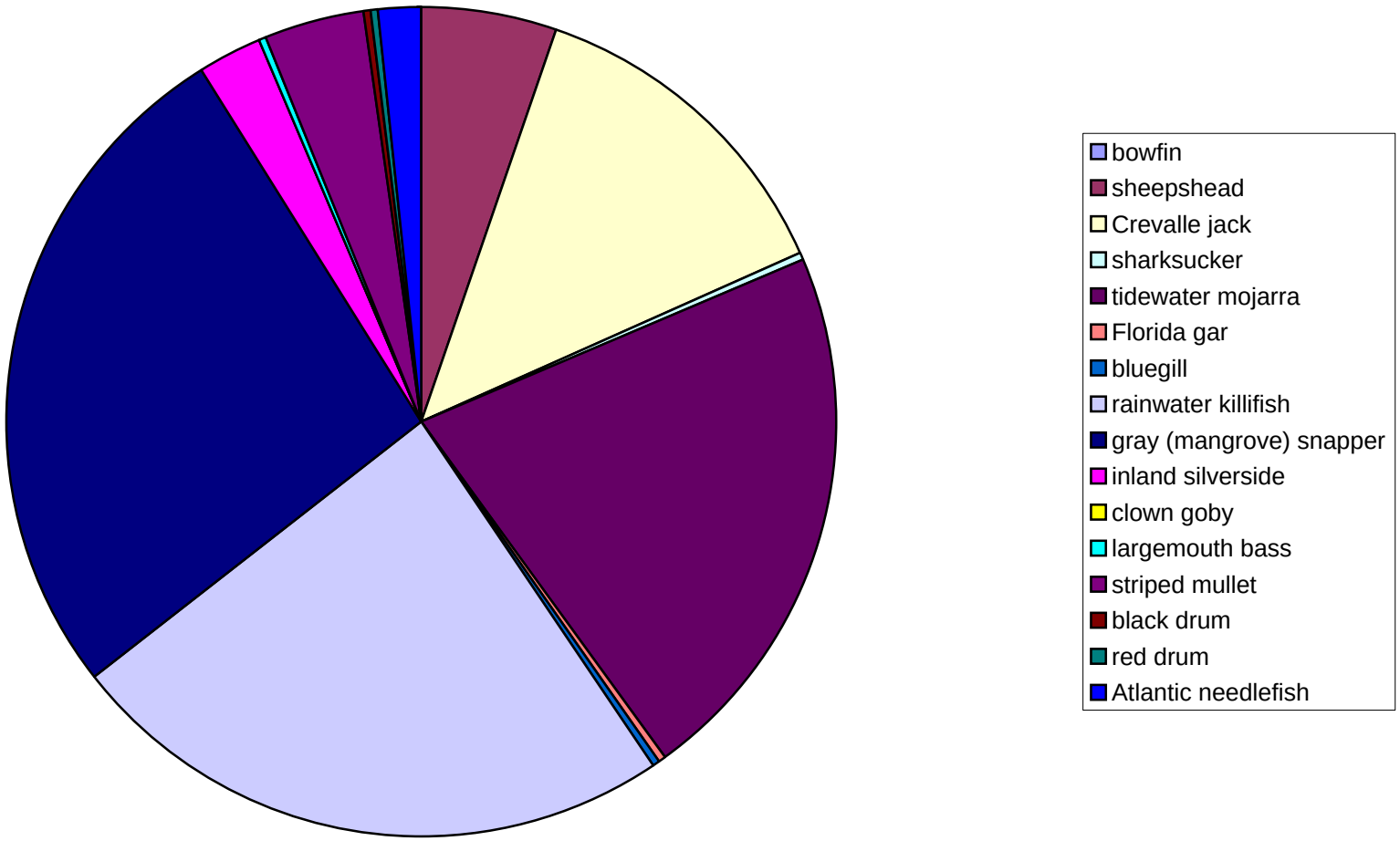
Notes

Park staff and volunteers report that the big schools of snapper and jacks stay for several days then leave
Observed red drum eating lettuce during manatee feeding.
Snapper stay near surface and around fish bowl. Jacks circle just north of fish bowl.
Snook are mostly along the walls of the spring vent and deeper, under the fish bowl.
One albino snapper in school.
Some 3 to 5 inch snapper along the banks of pool area.
Florida gar surround the edges of the spring pools and are easily overlooked.
A person was (almost) caught attempting to spear fish in the spring pool this year.
Following our sampling a picture of an adult loggerhead turtle was taken on the downstream edge of the bridge.
Many more creatures would utilize the spring pool area if the bridge barriers were not in place.
The smallest fish, are easily overlooked from the boat. These numbers really just indicate presence.

Homosassa Springs (Citrus Co.) Fish Species Composition
Average Spring Pool (November 3, 4, 5, and 6, 2008)



Homosassa Springs (Citrus Co.) Fish Species Composition
Average Spring Run (November3, 4, and 6, 2008)



APPENDIX K

Results from snorkel fish count at Ichetucknee Springs on July 14, 2009.

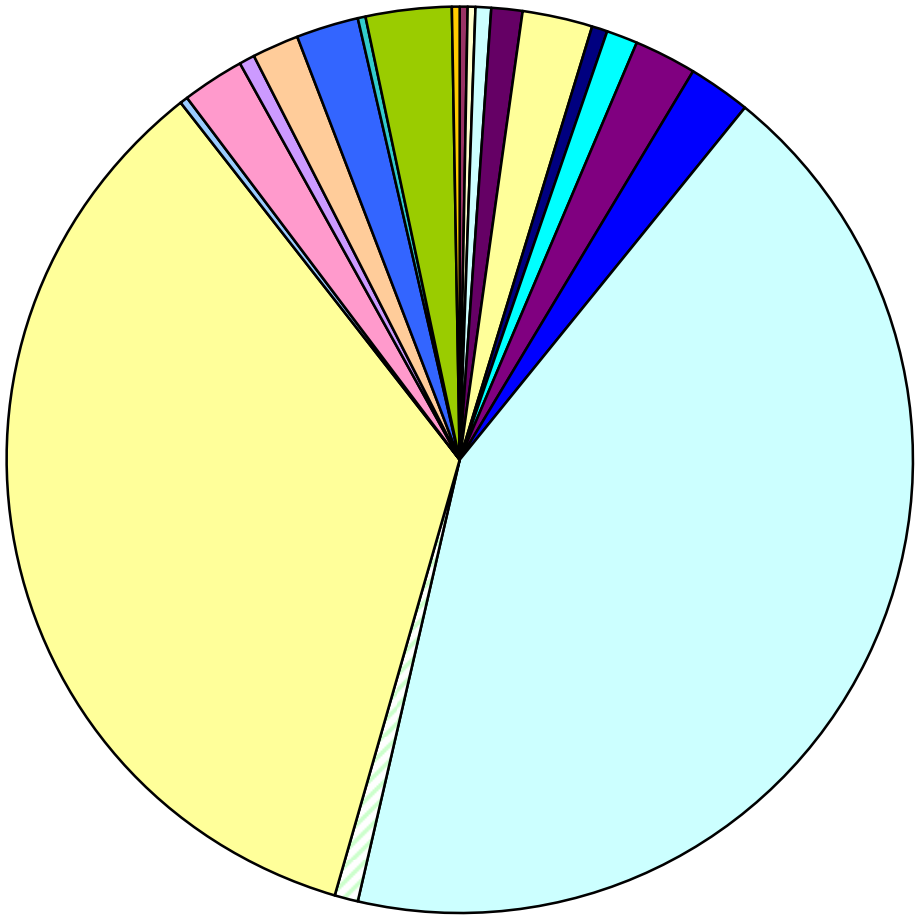
		Estimated Field Observations								Estimated Fish Measurements					
Common Name	**Scientific Name**	**Seg. 1**	**Seg. 2**	**Seg. 3**	**Seg. 4**	**Seg. 5**	**Seg. 6**	**Seg. 7**	**Total**	**Length (mm)**	**Girth (mm)**	**Weight (kg)**	**Biomass (kg)**	**Biomass per area (kg/ha)**	**Fish Density (n/ha)**
Atlantic Needlefish	*Strongylura marina*			1	3			3	**7**	279.4	38.1	0.0505	0.35	0.03	0.6
Black Crappie	*Pomoxis nigromaculatus*	3	2	2		3	4	3	**17**	177.8	139.7	0.0952	1.62	0.15	1.6
Blackbanded Darter	*Percina nigrofasciata*		5	1			10	14	**30**	76.2	38.1	0.0042	0.12	0.01	2.8
Bluefin Killifish	*Lucania goodei*	25		45		4			**74**	31.8	25.4	0.0005	0.04	0.00	6.8
Bluegill	*Lepomis macrochirus*	11	9	34	31	25	13	23	**146**	101.6	101.6	0.0225	3.28	0.30	13.5
Brown Darter	*Etheostoma edwini*			1					**1**	38.1	19.1	0.0005	0.00	0.00	0.1
Coastal Shiner	*Notropis petersoni*			6		90	80	135	**311**	38.1	25.4	0.0007	0.21	0.02	28.7
Dollar Sunfish	*Lepomis marginatus*			2	2	2	2	2	**10**	88.9	76.2	0.0124	0.12	0.01	0.9
Golden Shiner	*Notemigonus crysoleucas*	1			20	1	18	4	**44**	152.4	76.2	0.0351	1.54	0.14	4.1
Gulf Pipe Fish	*Syngnathus scovelli*	1							**1**	101.6	12.7	0.0020	0.00	0.00	0.1
Hog Choker	*Trinectes maculatus*							2	**2**	50.8	50.8	0.0027	0.01	0.00	0.2
Lake Chubsucker	*Erimyzon sucetta*	2	20	33	35	18	25	14	**147**	304.8	228.6	0.4745	69.75	6.43	13.5
Large Mouth Bass	*Micropterus salmoides*	20	77	39	61	30	11	28	**266**	254.0	152.4	0.2090	55.60	5.12	24.5
Least Killifish	*Heterandria formosa*			1					**1**	25.4	19.1	0.0002	0.00	0.00	0.1
Longnose Gar	*Lepisosteus osseus*					1	1	1	**3**	711.2	279.4	3.0526	9.16	0.84	0.3
Mosquito Fish	*Gambusia holbrooki*	115	120		20	10			**265**	38.1	25.4	0.0007	0.18	0.02	24.4
Mountain Mullet	*Agonostomus monticola*		2						**2**	177.8	101.6	0.0659	0.13	0.01	0.2
Redbreast Sunfish	*Lepomis auritus*	302	803	576	1,182	543	829	1,071	**5,306**	101.6	95.3	0.0208	110.55	10.19	488.9
Redear Sunfish	*Lepomis microlophus*	3	1	22	41	2	2	5	**76**	152.4	127.0	0.0634	4.82	0.44	7.0
Redeyed Chubsucker	*Notropis harperi*	1,425	565	350	450	1,100	160	295	**4,345**	30.5	38.1	0.0007	3.10	0.29	400.3
Sailfin Molly	*Poecilia latipinna*	10							**10**	50.8	38.1	0.0019	0.02	0.00	0.9
Sailfin Shiner	*Pteronotropis metallicus*	75	90	40		25	20	20	**270**	38.1	38.1	0.0011	0.30	0.03	24.9
Seminole Killifish	*Fundulus seminolis*	6	31	15	16	8	3	13	**92**	114.3	63.5	0.0163	1.50	0.14	8.5
Spotted Sucker	*Minytrema melanops*	2	3	3	43	60	33	49	**193**	457.2	304.8	1.4434	278.58	25.67	17.8
Spotted Sunfish	*Lepomis punctatus*	59	46	34	58	27	18	50	**292**	127.0	114.3	0.0395	11.54	1.06	26.9
Eastern Starhead Minnow	*Fundulus escambiae*							6	**6**	76.2	25.4	0.0026	0.02	0.00	0.6
Striped Mullet	*Mugil cephalus*		6	28	302	33	21	10	**400**	457.2	228.6	1.0348	413.90	38.14	36.9
Suwannee Bass	*Micropterus notius*		4	7	1	8	2	4	**26**	304.8	177.8	0.3548	9.22	0.85	2.4
Total	**28**	**2,060**	**1,784**	**1,240**	**2,265**	**1,990**	**1,252**	**1,752**	**12,343**				**975.66**	**89.90**	**1,137.3**

Sampled Area (ha)	10.85

Notes

Segment 1 from north canoe launch to Blue Spring; Segment 2 from Blue Spring to Mission Springs;
Segment 3 from Mission Springs to Devil's Spring; Segment 4 from Devil's Spring to Millpond Spring; Segment 5 from Millpond Spring to mid-point tube launch;
Segment 6 from mid-point tube launch to Dampier's Landing; Segment 7 from Dampier's Landing to 29.95631 / -82.78081.

Ichetucknee Springs (Columbia Co.) Fish Species Composition
July 14, 2009



- Atlantic needlefish
- black crappie
- blackbanded darter
- bluefin killifish
- bluegill
- brown darter
- coastal shiner
- dollar sunfish
- golden shiner
- Gulf pipe fish
- hog choker
- lake chubsucker
- large mouth bass
- least killifish
- longnose gar
- mosquito fish
- mountain mullet
- redbreast sunfish
- redear sunfish
- redeyed chubsucker
- sailfin molly
- sailfin shiner
- Seminole killifish
- spotted sucker
- spotted sunfish
- eastern starhead minnow
- striped mullet
- Suwannee bass

APPENDIX K

Results of visual fish survey from Jackson Blue Springs (Jackson Co.) during January 12 to 14, 2009.

		Estimated Field Observations					Estimated Fish Measurements					
Common Name	**Scientific Name**	**1/12/2009**	**1/13/2009**	**1/14/2009**	**Average**	**Std. Dev.**	**Length (mm)**	**Girth (mm)**	**Weight (kg)**	**Biomass (kg)**	**Biomass per area (kg/ha)**	**Fish Density (n/ha)**
SPRING POOL												
Eastern Mosquitofish	*Gambusia holbrooki*	-	30	80	36.7	40.4	38.1	25.4	0.0007	0.03	0.06	89.8
Largemouth Bass	*Micropterus salmoides*	52	39	54	48.3	8.1	254.0	152.4	0.2090	10.10	24.76	118.4
Dusky Shiner	*Notropis cummingsae*	20	-	40	30.0	14.1	152.4	76.2	0.0351	1.05	2.58	73.5
Sunfish sp.*	*Lepomis sp.* *	866	1,044	1,006	972.0	93.7	152.4	203.2	0.1092	106.12	260.04	2,381.7
Total	**7**	**938**	**1,113**	**1,180**	**1,087.0**	**125.0**				**117.31**	**287.43**	**2,663.5**
SPRING RUN												
bluegill	*Lepomis macrochirus*				X							
eastern mosquitofish	*Gambusia holbrooki*				X							
grass carp	*Ctenopharyngodon idella*				X							
largemouth bass	*Micropterus salmoides*				X							
redear sunfish	*Lepomis microlophus*				X							
spotted sunfish	*Lepomis punctatus*				X							
Total	**6**											

Unable to quantify the fish community due to large size of Spring Run

Location	Sampled Area (ha)
Spring Pool	0.4081
Spring Run	10.33

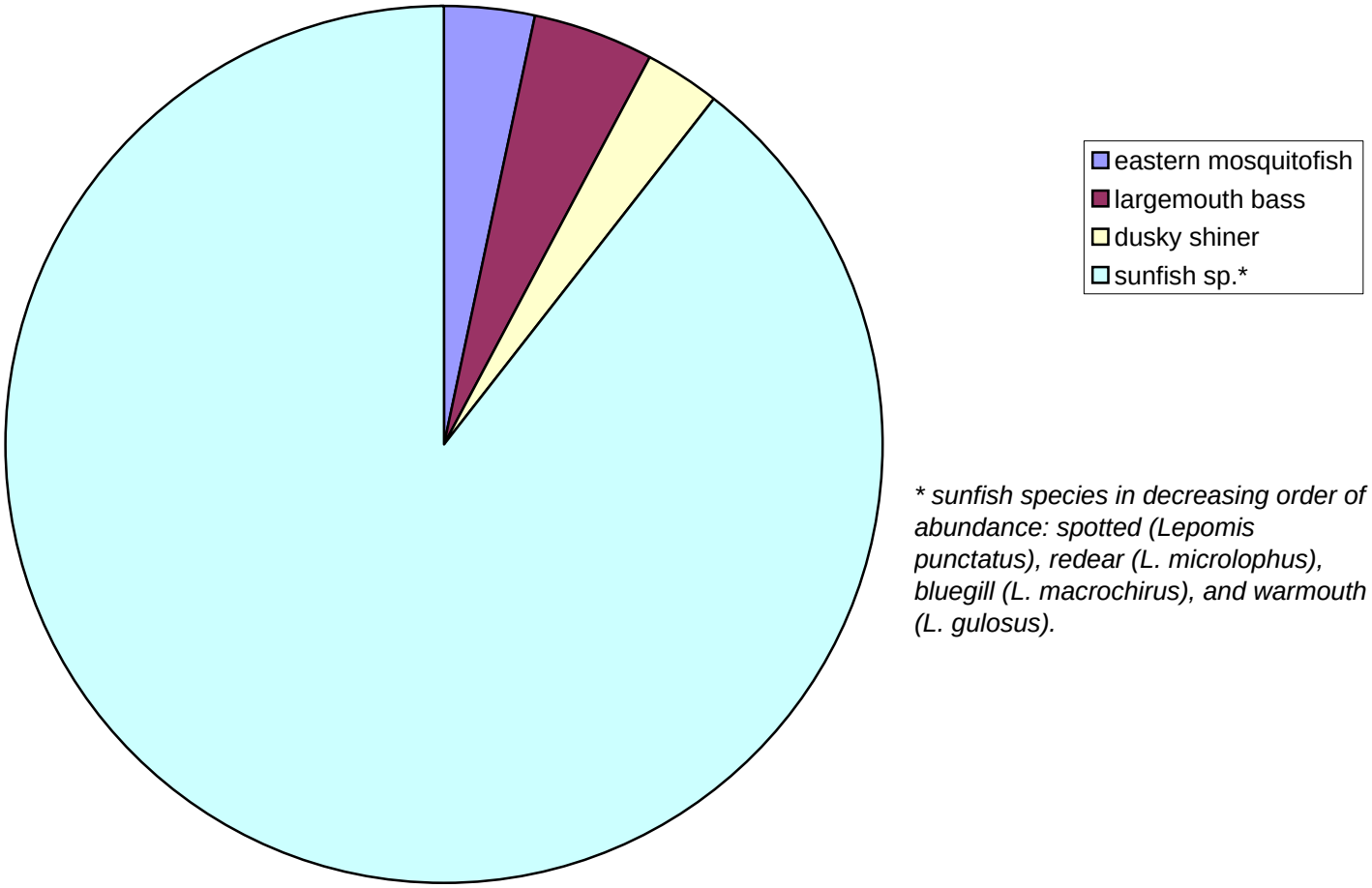
Notes

Length and girth values derived from estimates from Ichetucknee 09 fish survey when available, and otherwise from Silver River fish survey 09

"shiner sp." estimated from golden shiner, silver 09

** sunfish species in decreasing order of abundance: spotted, redear, bluegill, and warmouth.*

Jackson Blue Springs (Jackson Co.) Fish Species Composition
Average Spring Pool (January 12, 2009)



** sunfish species in decreasing order of abundance: spotted (Lepomis punctatus), redear (L. microlophus), bluegill (L. macrochirus), and warmouth (L. gulosus).*

APPENDIX K

Results of visual fish surveys (snorkel/SCUBA) from Madison Blue Springs (Madison Co.) on December 1, 2008 and January 2, 2008.

		Estimated Field Observations						Estimated Fish Measurements							
Common Name	**Scientific Name**	**12/1/2008**	**12/10/2008**	**1/2/2009**	**1/6/2009**	**Average**	**Std. Dev.**	**Length (in)**	**Girth (in)**	**Length (mm)**	**Girth (mm)**	**Weight (kg)**	**Biomass (kg)**	**Biomass per area (kg/ha)**	**Fish Density (n/ha)**
SPRING POOL															
Brook silverside	*Labidesthes sicculus*	80		15	X	47.5	46.0	3	1	76.2	25.4	0.0026	0.12	2.80	1,076.7
Eastern Mosquitofish	*Gambusia holbrooki*	12		35		23.5	16.3	1.5	1	38.1	25.4	0.0007	0.02	0.36	532.7
Hogchoker	*Trinectes maculatus*	-		4		2.0	2.8	2.0	2.0	50.8	50.8	0.0027	0.01	0.12	45.3
Largemouth Bass	*Micropterus salmoides*	13		15	X	14.0	1.4	10.0	6.0	254.0	152.4	0.2090	2.93	66.33	317.3
Longnose Gar	*Lepisosteus osseus*	-	X	-		-	-	28.0	11.0	711.2	279.4	3.0526	---	---	---
Ironcolor Shiner	*Notropis chalybaeus*	560		180	X	370.0	268.7	1.5	1.5	38.1	38.1	0.0011	0.40	9.18	8,386.9
Spotted sucker	*Minytrema melanops*	2		-		1.0	1.4	18.0	12.0	457.2	304.8	1.4434	1.44	32.72	22.7
Striped Mullet	*Mugil cephalus*	11		-	X	5.5	7.8	18.0	9.0	457.2	228.6	1.0348	5.69	129.00	124.7
Redbreast Sunfish	*Lepomis auritus*	79		170	X	124.5	64.3	6	8	152.4	203.2	0.1092	13.59	308.12	2,822.1
Total	**9**	**757**		**419**		**588.0**	**239.0**						**24.20**	**548.64**	**13,328.4**
SPRING RUN															
Eastern Mosquitofish	*Gambusia holbrooki*	X		-		-	---	1.5	1	38.1	25.4	0.0007	-	-	-
Hogchoker	*Trinectes maculatus*			1		1.0	---	2.0	2.0	50.8	50.8	0.0027	0.00	0.04	15.8
Ironcolor Shiner	*Notropis chalybaeus*	X		60	X	60.0	---	1.5	1.5	38.1	38.1	0.0011	0.07	1.04	946.1
Largemouth Bass	*Micropterus salmoides*	X		3	X	3.0	---	10.0	6.0	254.0	152.4	0.2090	0.63	9.89	47.3
Longnose Gar *	*Lepisosteus osseus*		X	-	X	-	---	28.0	11.0	711.2	279.4	3.0526	-	-	-
Striped Mullet	*Mugil cephalus*	X		-	X	-	---	18.0	9.0	457.2	228.6	1.0348	-	-	-
Redbreast Sunfish	*Lepomis auritus*	X		90	X	90.0	---	6	8	152.4	203.2	0.1092	9.83	154.94	1,419.1
Total	**7**			**154**		**154.0**	---						**10.52**	**165.91**	**2,428.3**

Location	Sampled Area (ha)
Spring Pool	0.0441
Spring Run	0.0634

Notes

Unable to attempt fish count on Dec. 2, due to tannic waters and poor visibility from the Withlacoochee River flooding the spring.

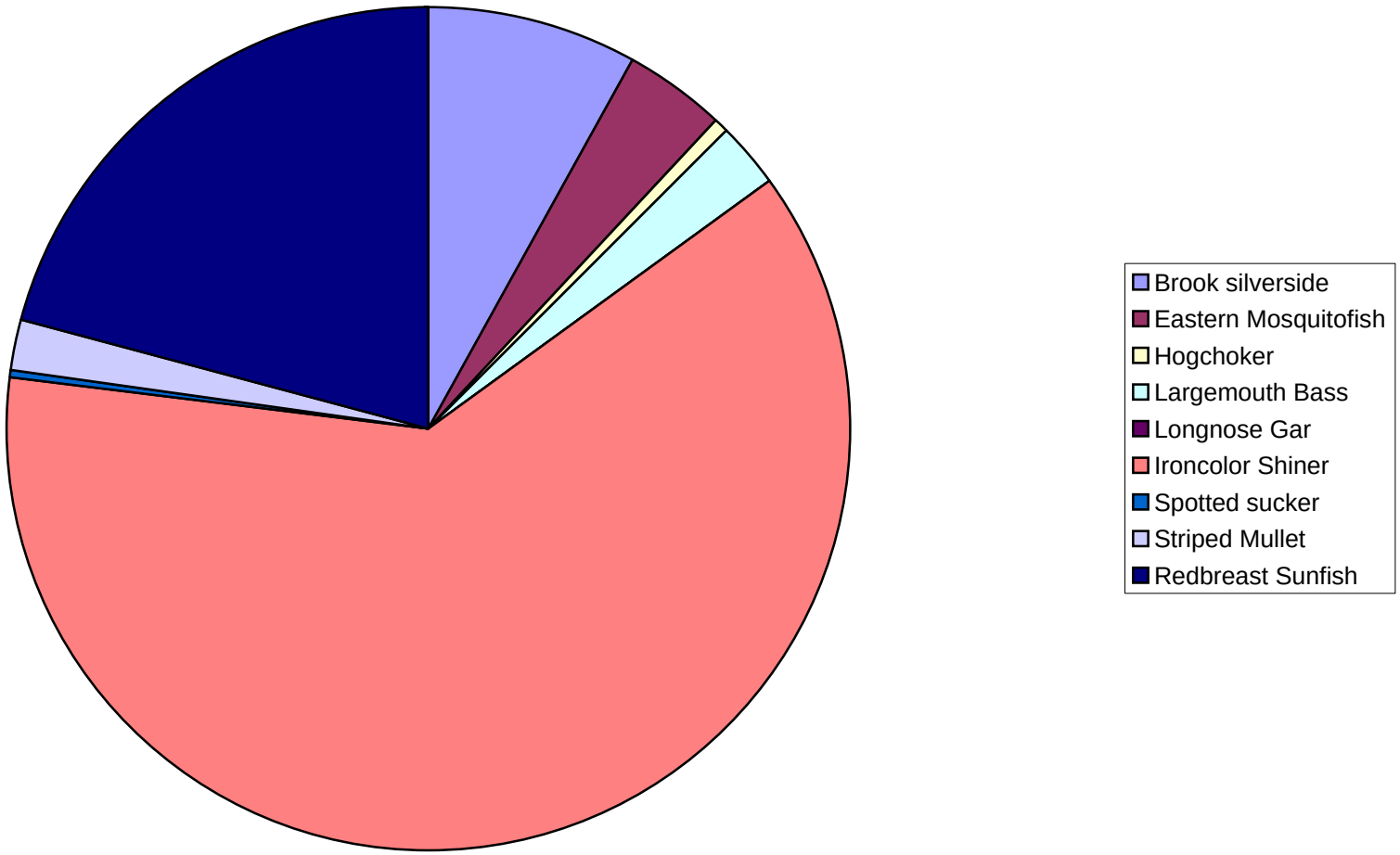
Left spring on day two due to flood conditions

mostly appear to be redbreast (but also spotted, bluegill, and dollar), about half the sunfish were 2" and not identifiable to species

* Seen in pool/run, surface gulping air on 12/10/08 (flooded conditions)

On 12/1/08 and 12/10/08, unable to attempt to quantify the fish in the spring run due to tannic waters and poor visibility from Withlacoochee River flooding.

Madison Blue Springs (Madison Co.) Fish Species Composition
Average Spring Pool (December 2008)



APPENDIX K

Results from snorkel fish count at Manatee Springs on August 3, 2009.

		Estimated Field Observations			Estimated Fish Measurements					
Common Name	**Scientific Name**	**Pool to MS-2**	**MS-2 to MS-3**	**Total**	**Length (mm)**	**Girth (mm)**	**Weight (kg)**	**Biomass (kg)**	**Biomass per area (kg/ha)**	**Fish Density (n/ha)**
Bluefin Killifish	*Lucania goodei*	498	785	**1,283**	31.8	25.4	0.0005	0.62	0.94	1,954.7
Eastern Mosquitofish	*Gambusia holbrooki*	15	-	**15**	31.8	25.4	0.0005	0.01	0.01	22.9
Golden Shiner	*Notemigonus crysoleucas*	190	25	**215**	101.6	50.8	0.0101	2.16	3.30	327.6
Hogchoker	*Trinectes maculatus*	3	78	**81**	50.8	50.8	0.0027	0.22	0.33	123.4
Largemouth Bass	*Micropterus salmoides*	8	38	**46**	304.8	203.2	0.4140	19.05	29.02	70.1
Red-Ear Sunfish	*Lepomis microlophus*	-	31	**31**	304.8	355.6	0.7911	24.52	37.36	47.2
Shiner*	*Notropis sp.*	2,155	2,510	**4,665**	50.8	25.4	0.0012	5.55	8.46	7,107.5
Spotted Sucker	*Minytrema melanops*	41	166	**207**	457.2	254.0	1.1689	241.96	368.65	315.4
Striped Mullet	*Mugil cephalus*	77	647	**724**	457.2	203.2	0.9029	653.72	995.99	1,103.1
Sunfish*	*Lepomis sp.*	232	276	**508**	101.6	152.4	0.0359	18.23	27.78	774.0
Total	**10**	**3,219**	**4,556**	**7,775**				**966.04**	**1,471.84**	**11,845.8**

Sampled Area (ha)	0.6564

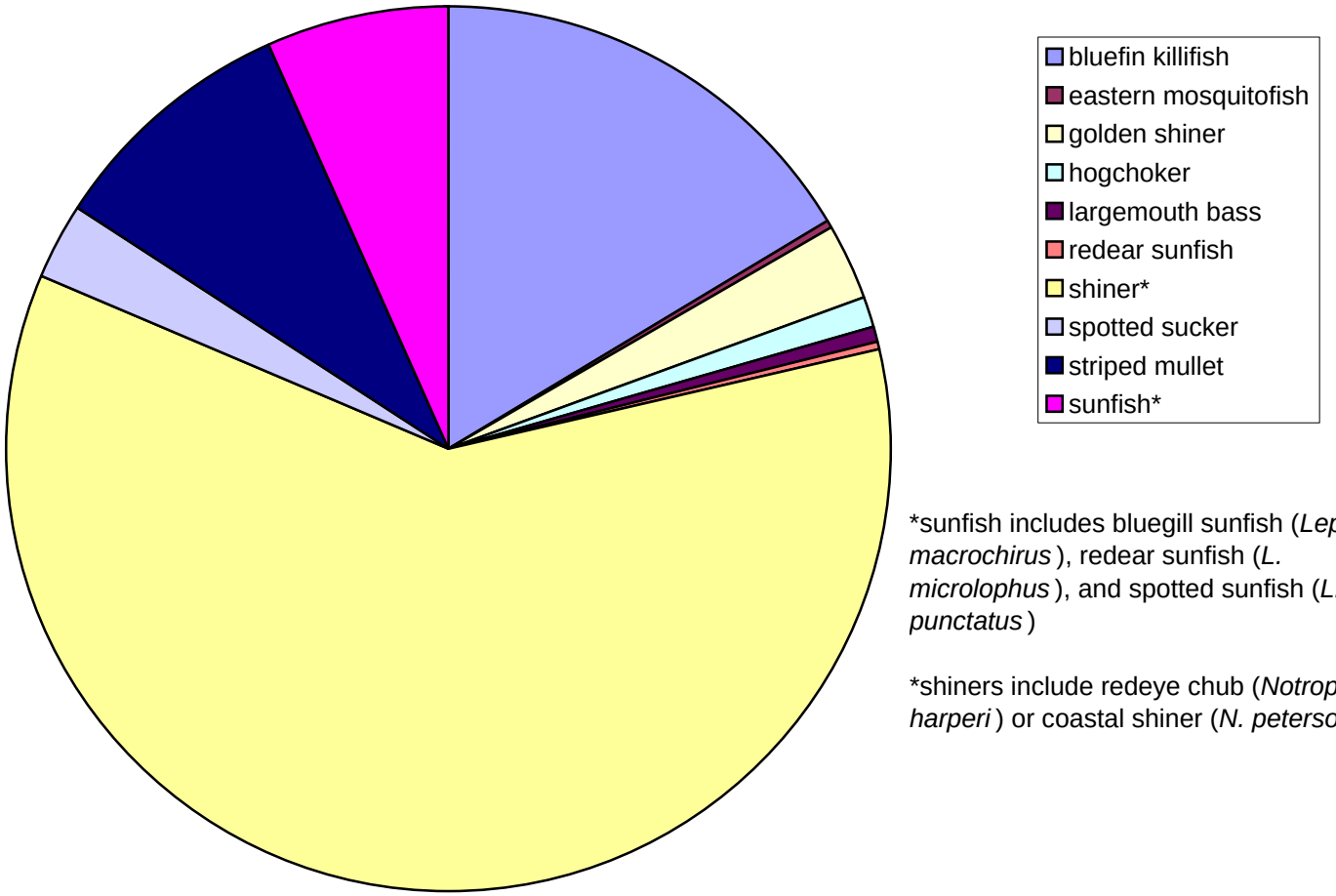
Notes

*sunfish observed in descending order of abundance: redbreast sunfish (L. auritus), bluegill sunfish (*Lepomis macrochirus*), and spotted sunfish (*L. punctatus*)

*shiners include redeye chub (*Notropis harperi*) and coastal shiner (*Notropis petersoni*).

hogchockers were very abundant, could easily be 1 per square meter on average.

Manatee Springs (Levy Co.) Fish Species Composition
August 3, 2009



*sunfish includes bluegill sunfish (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), and spotted sunfish (*L. punctatus*)

*shiners include redeye chub (*Notropis harperi*) or coastal shiner (*N. petersoni*).

APPENDIX K

Results from snorkel fish counts at Ponce de Leon Springs for September 8-11, 2009.

Common Name	Scientific Name	Estimated Field Observations 9/8/2009	9/9/2009	9/10/2009	9/11/2009	Average	Std. Dev.	Estimated Fish Measurements Length (mm)	Girth (mm)	Weight (kg)	Biomass (kg)	Biomass per area (kg/ha)	Fish Density (n/ha)
SPRING POOL													
Redfin Pickerel	*Esox americanus*	X	2		1	1.5	0.7	203.2	50.8	0.0382	0.06	0.36	9.4
Chain Pickerel	*Esox niger*		2	X	3	2.5	0.7	406.4	152.4	0.5161	1.29	8.09	15.7
Coastal Darter	*Etheostoma colorosum*		1		3	2.0	1.4	38.1	12.7	0.0003	0.00	0.00	12.5
Eastern Mosquitofish	*Gambusia holbrooki*		50		35	42.5	10.6	31.8	12.7	0.0002	0.01	0.06	266.5
Brook Silverside	*Labidesthes sicculus*		5		15	10.0	7.1	76.2	12.7	0.0012	0.01	0.07	62.7
Redbreast Sunfish	*Lepomis auritus*	X	64	X	59	61.5	3.5	101.6	127.0	0.0291	1.79	11.21	385.6
Bluegill Sunfish	*Lepomis macrochirus*	X	46	X	42	44.0	2.8	101.6	127.0	0.0291	1.28	8.02	275.9
Redear Sunfish	*Lepomis microlophus*		31		28	29.5	2.1	101.6	127.0	0.0291	0.86	5.38	185.0
Spotted Sunfish	*Lepomis punctatus*	X	12	X	11	11.5	0.7	101.6	127.0	0.0291	0.33	2.10	72.1
Largemouth Bass	*Micropterus salmoides*	X	46	X	37	41.5	6.4	203.2	101.6	0.0851	3.53	22.15	260.2
Redeye Chub	*Notropis harperi*	X	1,780	X	1,250	1,515	375	38.1	20.3	0.0005	0.80	5.02	9,498.4
Weed Shiner	*Notropis texanus*	X	400	X	400	400.0	-	63.5	22.9	0.0016	0.65	4.06	2,507.8
Blackbanded Darter	*Percina nigrofasciata*		4		2	3.0	1.4	76.2	25.4	0.0026	0.01	0.05	18.8
Total	**13**	**-**	**2,443**	**-**	**1,886**	**2,165**	**393.9**				**10.62**	**66.56**	**13,570.5**
SPRING RUN													
Redfin Pickerel	*Esox americanus*		1	X	-	0.5	0.7	152.4	50.8	0.0220	0.01	0.06	2.7
Chain Pickerel	*Esox niger*		2	X	1	1.5	0.7	355.6	152.4	0.3992	0.60	3.20	8.0
Coastal Darter	*Etheostoma colorosum*		15	X	6	10.5	6.4	38.1	12.7	0.0003	0.00	0.02	56.2
Redbreast Sunfish	*Lepomis auritus*	X	8	X	4	6.0	2.8	101.6	127.0	0.0291	0.17	0.93	32.1
Bluegill Sunfish	*Lepomis macrochirus*	X	5	X	3	4.0	1.4	101.6	127.0	0.0291	0.12	0.62	21.4
Spotted Sunfish	*Lepomis punctatus*	X	5	X	3	4.0	1.4	101.6	127.0	0.0291	0.12	0.62	21.4
Largemouth Bass	*Micropterus salmoides*	X	2	X	2	2.0	-	203.2	101.6	0.0851	0.17	0.91	10.7
Redeye Chub	*Notropis harperi*	X	495	X	550	522.5	38.9	38.1	20.3	0.0005	0.28	1.48	2,795.6
Weed Shiner	*Notropis texanus*	X	55	X	100	77.5	31.8	63.5	22.9	0.0016	0.13	0.67	414.7
Blackbanded Darter	*Percina nigrofasciata*		1		-	0.5	0.7	76.2	25.4	0.0026	0.00	0.01	2.7
Total	**10**		**589**	**-**	**669**	**629.0**	**56.6**				**1.59**	**8.52**	**3,365.4**

Location	Sampled Area (ha)
Spring Pool	0.1595
Spring Run	0.1869

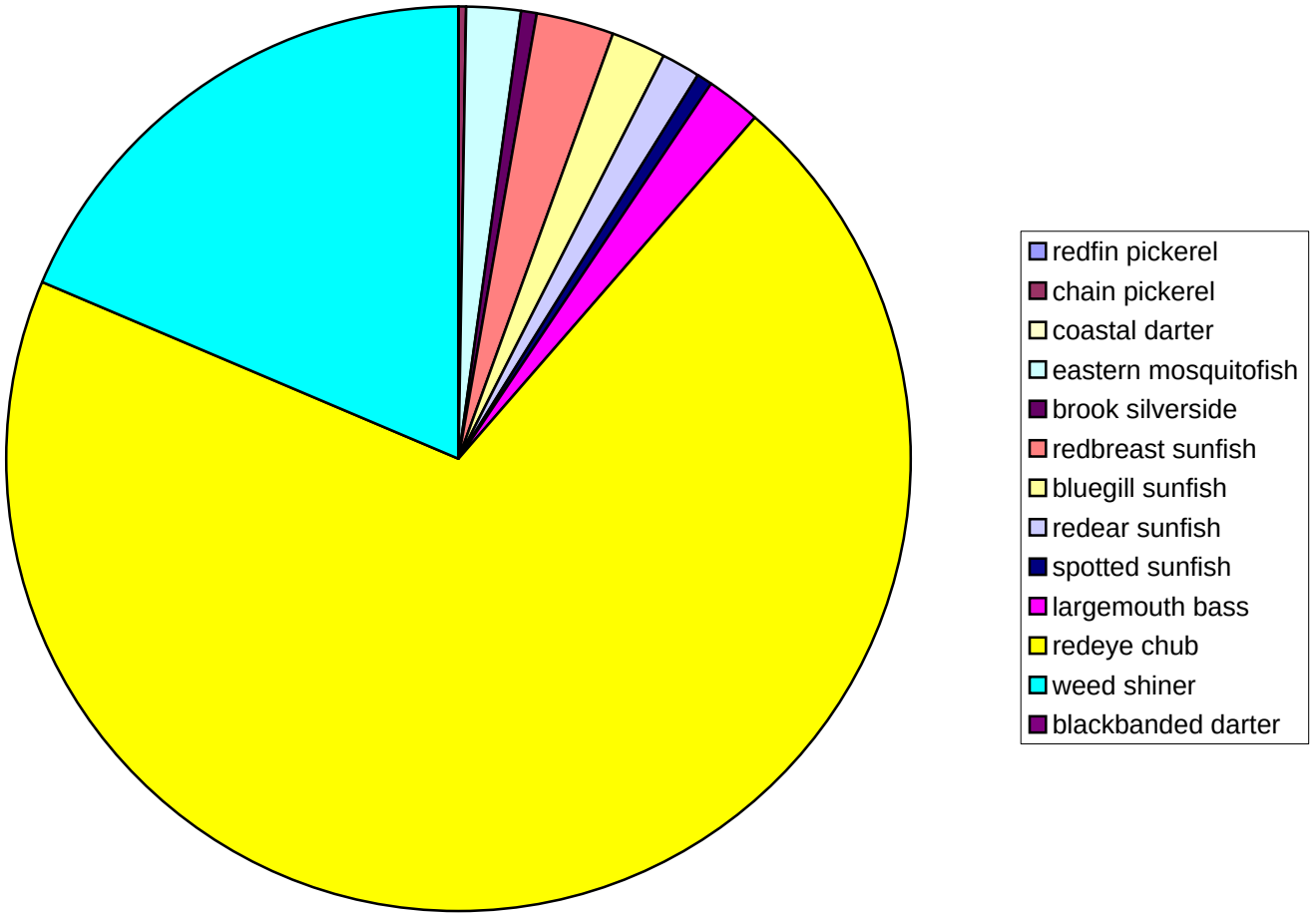
Notes

Spring Pool - sunfish observed in descending order of abundance: redbreast sunfish (*Lepomis auritus*), bluegill sunfish (*L. macrochirus*), redear sunfish (*L. microlophus*), and spotted sunfish (*L. punctatus*).

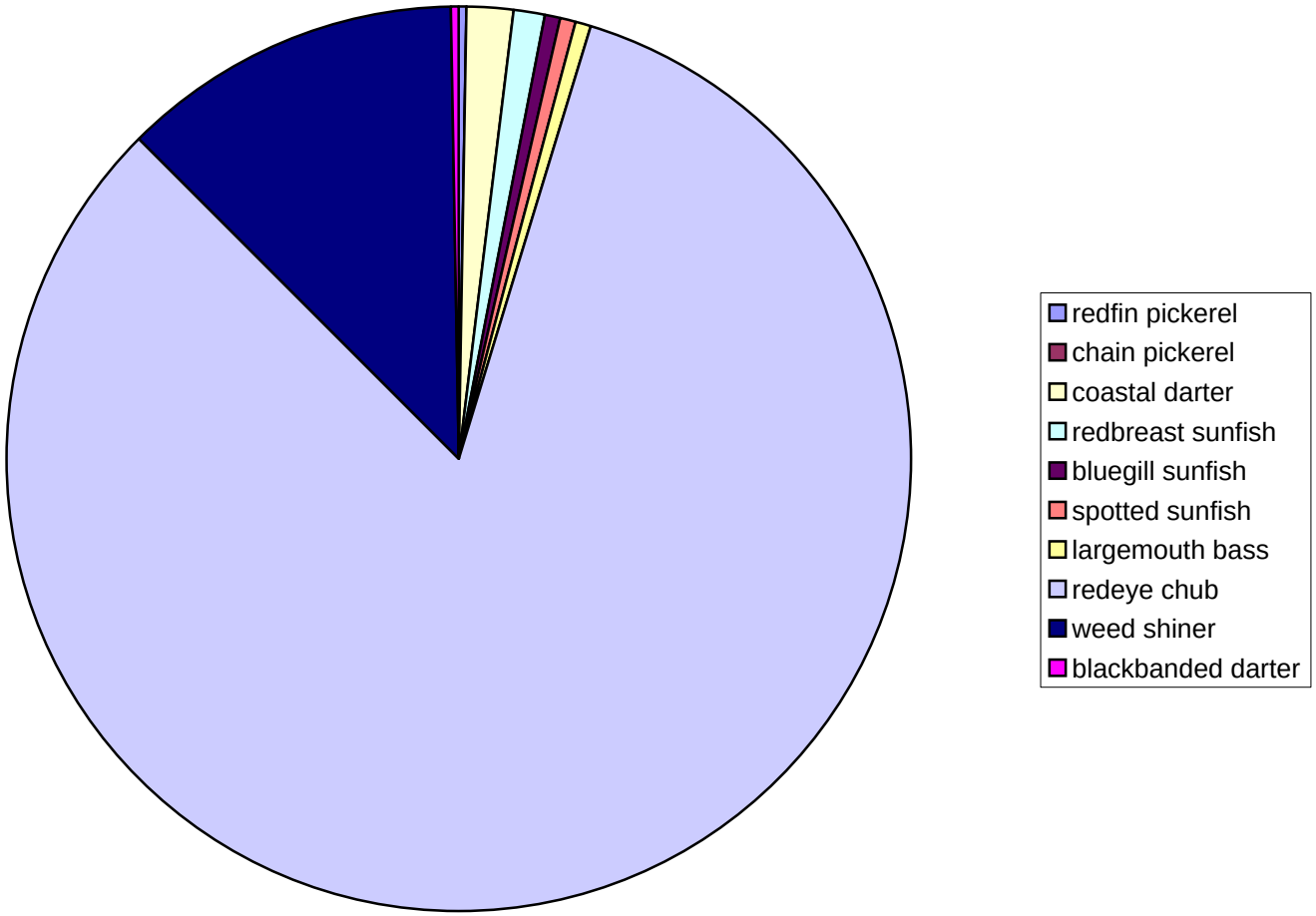
Spring Run - *Etheostoma colorosum* was more abundant in lower 30 m of spring (about 1 per m^2), than count suggests.

Spring Run - Observed a juvenile river horse or sucker (3") in lower run, unknown and not counted.

Ponce de Leon Springs (Holmes Co.) Average Fish Species Composition
Spring Pool September 9 & 11, 2009



Ponce de Leon Springs (Holmes Co.) Average Fish Species Composition
Spring Run September 9 & 11, 2009



APPENDIX K

Results from snorkel fish count at Rainbow Springs, Fl June 9, 2009

Common Name	Scientific Name	Estimated Field Observations: Pool to RS-2	RS-2 to RS-3	Total	Estimated Fish Measurements: Length (mm)	Girth (mm)	Weight (kg)	Biomass (kg)	Biomass per area (kg/ha)	Fish Density (n/ha)
JUNE 8, 2009										
Atlantic Needlefish	*Strongylura marina*	-	1	1	304.8	25.4	0.0373	0.04	0.01	0.2
Bluefin Killifish	*Lucania goodei*	149	7	156	38.1	25.4	0.0007	0.11	0.02	31.0
Bowfin	*Amia Calva*	12	5	17	736.6	254.0	2.9247	49.72	9.89	3.4
Chain Pickerel	*Esox niger*	1	-	1	609.6	228.6	1.7993	1.80	0.36	0.2
Eastern Mosquitofish	*Gambusia holbrooki*	50	50	100	25.4	25.4	0.0003	0.03	0.01	19.9
Gizzard Shad	*Dorosoma cepedianum*	-	8	8	355.6	254.0	0.7209	5.77	1.15	1.6
Lake Chubsucker	*Erimyzon sucetta*	53	1	54	406.4	279.4	1.0406	56.19	11.17	10.7
Largemouth Bass	*Micropterus salmoides*	258	161	419	203.2	152.4	0.1361	57.02	11.34	83.3
Longnose Gar	*Lepisosteus osseus*	2	-	2	990.6	304.8	6.3844	12.77	2.54	0.4
Seminole Killifish	*Fundulus seminolis*	254	299	553	139.7	101.6	0.0414	22.90	4.55	110.0
Shiner*	*Notropis sp.*	67	7	74	38.1	25.4	0.0007	0.05	0.01	14.7
Silverside*		1,095	2,745	3,840	50.8	12.7	0.0005	2.05	0.41	763.6
Sunfish*	*Lepomis sp.*	2,354	2,814	5,168	114.3	203.2	0.0628	324.50	64.53	1,027.7
Total	**13**	**4,295**	**6,098**	**10,393**				**532.95**	**105.98**	**2,066.7**

Common Name	Scientific Name	Estimated Field Observations: Pool to RS-1	RS-1 to RS-2	RS-2 to RS-3	Total	Estimated Fish Measurements: Length (mm)	Girth (mm)	Weight (kg)	Biomass (kg)	Biomass per area (kg/ha)	Fish Density (n/ha)
JUNE 9, 2009											
Bluefin Killifish	*Lucania goodei*	35	8	8	51	38.1	25.4	0.0007	0.03	0.01	10.1
Bowfin	*Amia Calva*	1	6	1	8	609.6	254.0	2.0325	16.26	3.23	1.6
Chain Pickerel	*Esox niger*	1	-	1	2	609.6	228.6	1.7993	3.60	0.72	0.4
Eastern Mosquitofish	*Gambusia holbrooki*	50	50	50	150	25.4	25.4	0.0003	0.05	0.01	29.8
Gizzard Shad	*Dorosoma cepedianum*	-	23	43	66	355.6	254.0	0.7209	47.58	9.46	13.1
Golden Shiner	*Notemigonus crysoleucas*	3	33	-	36	203.2	152.4	0.1361	4.90	0.97	7.2
Lake Chubsucker	*Erimyzon sucetta*	1	64	7	72	406.4	279.4	1.0406	74.93	14.90	14.3
Largemouth Bass	*Micropterus salmoides*	69	234	202	505	203.2	152.4	0.1361	68.73	13.67	100.4
Longnose Gar	*Lepisosteus osseus*	-	10	3	13	990.6	304.8	6.3844	83.00	16.50	2.6
Seminole Killifish	*Fundulus seminolis*	73	174	258	505	139.7	101.6	0.0414	20.92	4.16	100.4
Silverside*		575	735	1,305	2,615	50.8	12.7	0.0005	1.40	0.28	520.0
Sunfish*	*Lepomis sp.*	926	1,452	2,209	4,587	114.3	203.2	0.0628	288.02	57.27	912.2
Total	**12**	**1,734**	**2,789**	**4,087**	**8,610**				**609.40**	**121.18**	**1,712.2**

Sampled Area (ha)	5.029

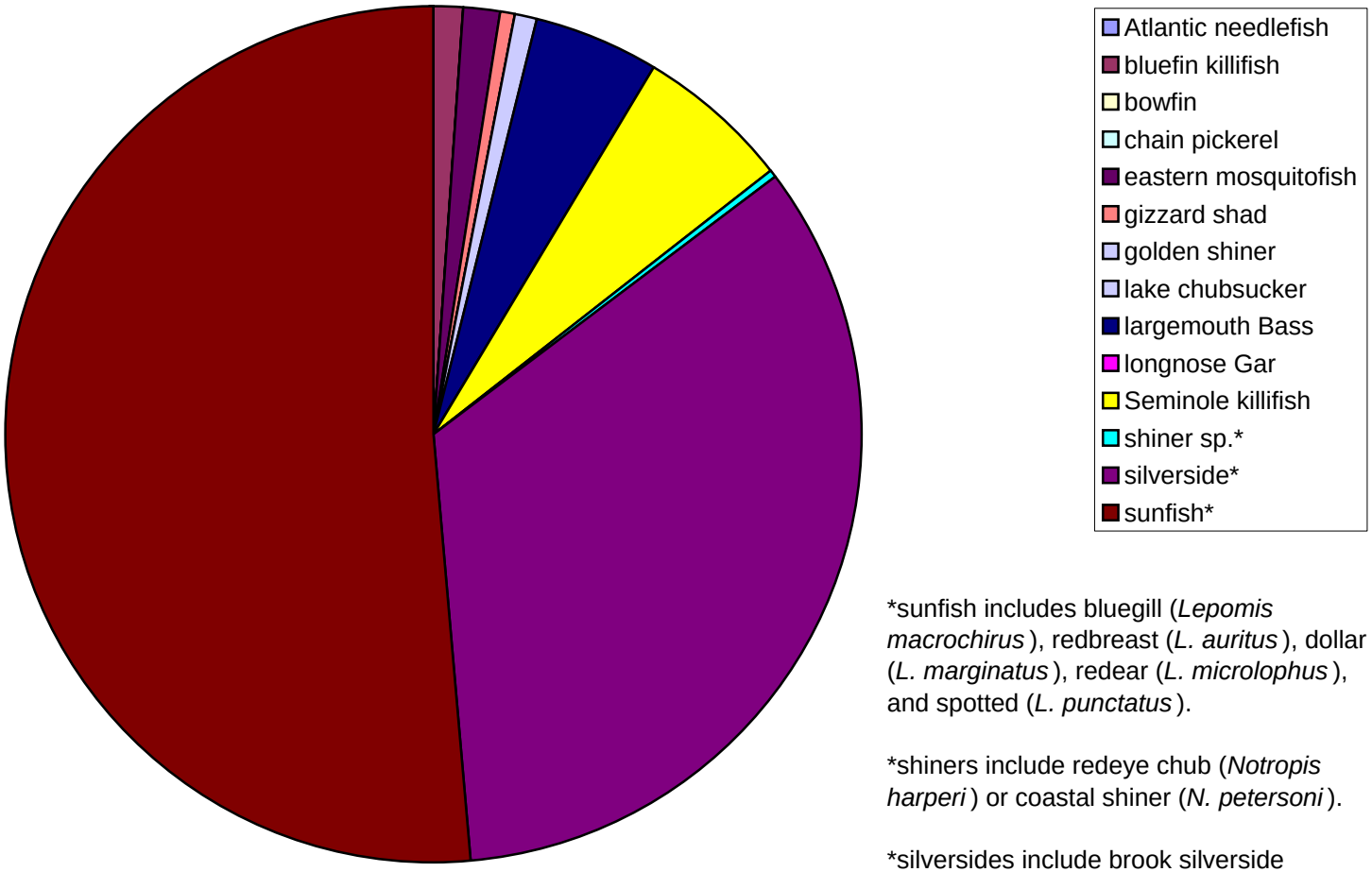
Notes

*sunfish includes bluegill sunfish (*Lepomis macrochirus*), redbreast sunfish (*L. auritus*), dollar sunfish (*L. marginatus*), redear sunfish (*L. microlophus*), and spotted sunfish (*L. punctatus*)

*shiners include redeye chub (*Notropis harperi*) or coastal shiner (*Notropis petersoni*).

*silversides include brook silverside (*Labidesthes sicculus*) and inland silverside (*Menidia beryllina*).

Rainbow Springs (Marion Co.) Fish Species Composition
Average Spring Pool and Run (June 8 and 9, 2009)



*sunfish includes bluegill (*Lepomis macrochirus*), redbreast (*L. auritus*), dollar (*L. marginatus*), redear (*L. microlophus*), and spotted (*L. punctatus*).

*shiners include redeye chub (*Notropis harperi*) or coastal shiner (*N. petersoni*).

*silversides include brook silverside (*Labidesthes sicculus*) and inland silverside (*Menidia beryllina*).

APPENDIX K

Summary of fish species, with estimated biomass and density from a snorkel surveys at Silver Springs on May 5, 2009 and May 7, 2009.

		Estimated Field Observations							Estimated Fish Measurements					
Common Name	**Scientific Name**	**Seg. 1**	**Seg. 2**	**Seg. 3**	**Seg. 4**	**Seg. 5**	**Seg. 6**	**Total**	**Length (mm)**	**Girth (mm)**	**Weight (kg)**	**Biomass (kg)**	**Biomass per area (kg/ha)**	**Fish Density (n/ha)**
MAY 5, 2009														
Bowfin	*Amia calva*	15	24	21	19	14	15	108	609.6	254.0	2.0325	219.5	27.65	13.6
Chubsucker	*Erimyzon sucetta*	1	38	61	82	56	71	309	355.6	279.4	0.8050	248.7	31.33	38.9
Chain pickerel	*Esox niger*	3	3	7		4	2	19	609.6	228.6	1.7993	34.2	4.31	2.4
Eastern Mosquitofish *	*Gambusia holbrooki*							1,175	38.1	25.4	0.0007	0.8	0.10	148.0
Least Killifish *	*Heterandria formosa*							1,175	25.4	19.1	0.0002	0.3	0.03	148.0
Channel Catfish	*Ictalurus punctatus*			1				1	609.6	254.0	2.0325	2.0	0.26	0.1
Brook Silverside	*Labidesthes sicculus*					3		3	76.2	25.4	0.0026	0.0	0.00	0.4
Longnose Gar	*Lepisosteus osseus*	1	11	-	13	18	1	44	1,066.8	304.8	7.3622	323.9	40.80	5.5
Florida Gar	*Lepisosteus platyrhincus*	9	58	84	3	28		182	508.0	152.4	0.7927	144.3	18.17	22.9
Sunfish**	*Lepomis sp.*	255	472	529	554	330	322	2,462	152.4	203.2	0.1092	268.8	33.86	310.1
Bluefin killifish *	*Lucania goodei*							1,175	31.8	25.4	0.0005	0.6	0.07	148.0
Rainwater Killifish	*Lucania parva*	89	230	665	188	5	20	1,197	38.1	25.4	0.0007	0.8	0.10	150.8
Largemouth Bass	*Micropterus salmoides*	103	146	170	128	52	48	647	304.8	152.4	0.2968	192.0	24.19	81.5
Striped Mullet	*Mugil cephalus*		27					27	508.0	228.6	1.2671	34.2	4.31	3.4
Golden Shiner	*Notemigonus crysoleucas*						44	44	152.4	76.2	0.0351	1.5	0.19	5.5
Red Eye Chub	*Notropis harperi*			60	170	40	50	320	88.9	38.1	0.0056	1.8	0.23	40.3
Blue Tilapia	*Oreochromis aurea*			2				2	406.4	355.6	1.3756	2.8	0.35	0.3
Blackbanded Darter	*Percina nigrofasciata*				3			3	88.9	38.1	0.0056	0.0	0.00	0.4
Sailfin Molly *	Poecilia latipinna							1,175	63.5	50.8	0.0041	4.8	0.60	148.0
Vermiculated Sailfin Catfish	*Pterygoplichthys disjunctivus*		11	3	4			18	508.0	228.6	1.2671	22.8	2.87	2.3
Total	**20**	**476**	**1,020**	**1,603**	**1,164**	**550**	**573**	**10,086**				**1,503.9**	**189.4**	**1,270.3**
MAY 7, 2009														
Brown Bullhead	*Ameiurus nebulosus*			1				1	304.8	203.2	0.4140	0.4	0.05	0.1
Bowfin	*Amia calva*	27	27	35	22	16	20	146	609.6	254.0	2.0325	296.7	37.38	18.4
Okefenokee pygmy sunfish	*Elassoma okefenokee*					1		1	25.4	25.4	0.0003	0.0	0.00	0.1
Chubsucker	*Erimyzon sucetta*	14	14	44	98	141	109	420	355.6	279.4	0.8050	338.1	42.58	52.9
Chain pickerel	*Esox niger*	5	5	5	2	1	5	22	609.6	228.6	1.7993	39.6	4.99	2.8
Eastern Mosquitofish *	*Gambusia holbrooki*							1,175	38.1	25.4	0.0007	0.8	0.10	148.0
Least Killifish *	*Heterandria formosa*							1,175	25.4	19.1	0.0002	0.3	0.03	148.0
Longnose Gar	*Lepisosteus osseus*	4	4	2	8	18	2	37	1,066.8	304.8	7.3622	272.4	34.31	4.7
Florida Gar	*Lepisosteus platyrhincus*	36	36	61	1			134	508.0	152.4	0.7927	106.2	13.38	16.9
Sunfish **	*Lepomis sp.*	386	386	670	581	373	376	2,772	152.4	203.2	0.1092	302.7	38.12	349.1
Bluefin killifish *	*Lucania goodei*							1,175	31.8	25.4	0.0005	0.6	0.07	148.0
Rainwater Killifish	*Lucania parva*	140	140	593	320	302	205	1,700	38.1	25.4	0.0007	1.2	0.15	214.1
Largemouth Bass	*Micropterus salmoides*	147	147	222	125		63	704	304.8	152.4	0.2968	209.0	26.32	88.7
Striped Mullet	*Mugil cephalus*	5	5					10	508.0	228.6	1.2671	12.7	1.60	1.3
Golden Shiner	*Notemigonus crysoleucas*						43	43	152.4	76.2	0.0351	1.5	0.19	5.4
Red Eye Chub	*Notropis harperi*	91	91	270	260		100	811	76.2	38.1	0.0042	3.4	0.42	102.1
Blue tilapia	*Oreochromis aurea*	4	4	1	1			9	406.4	355.6	1.3756	12.4	1.56	1.1
Blackbanded Darter	*Percina nigrofasciata*				3			3	88.9	38.1	0.0056	0.0	0.00	0.4
Sailfin Molly *	*Poecilia latipinna*							1,175	63.5	50.8	0.0041	4.8	0.60	148.0
Vermiculated Sailfin Catfish	*Pterygoplichthys disjunctivus*	2	2	2	4			10	508.0	228.6	1.2671	12.7	1.60	1.3
Total	**20**	**859**		**1,906**	**1,425**	**852**	**923**	**11,523**				**1,615.3**	**203.4**	**1,451.3**

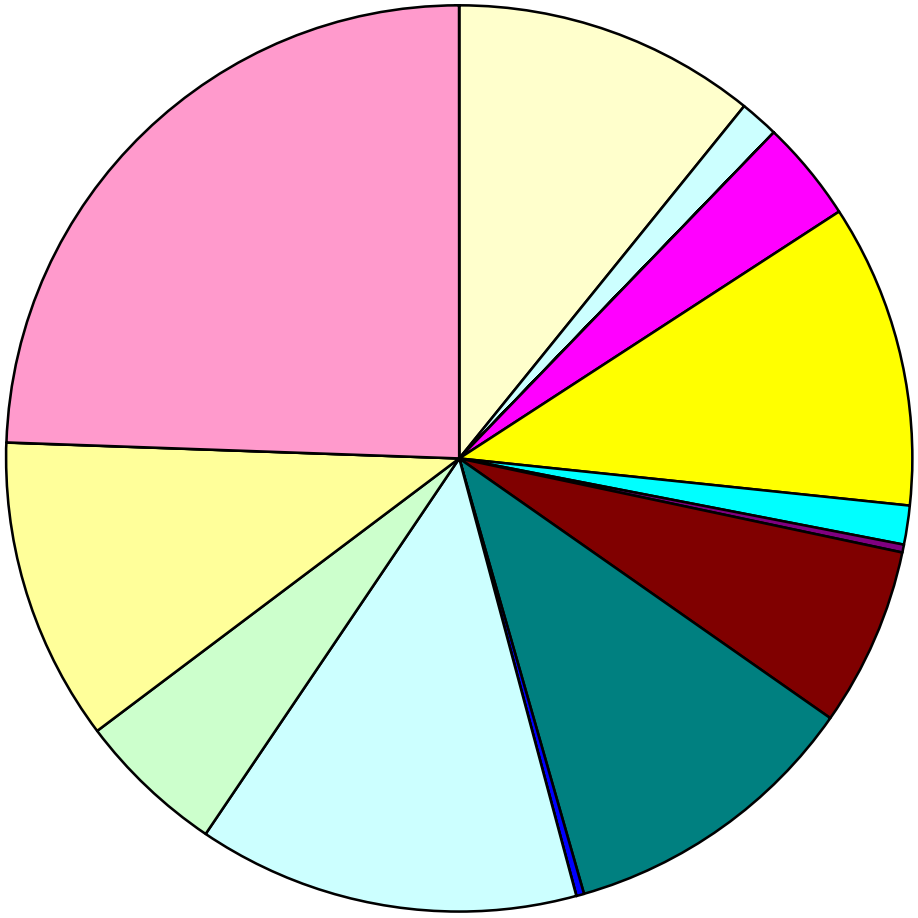
Sampled Area (ha)	7.94

Notes

* Sunfish includes Bluegill (Lepomis macrochirus), Redbreast (L. auritus), Dollar (L. marginatus), Redear (L. microlophus), and Spotted (L. punctatus)

** estimated 0.5 fish per linear meter of shoreline (Sections 2 - 6 = 1,100 m along north shore and 1,250 m along south shore).

Silver Springs (Marion Co.) Fish Species Composition
Pool and Run Average (May 5 and 7, 2009)



- Blackbanded Darter
- Blue tilapia
- Bluefin killifish
- Bowfin
- Brown Bullhead
- Brook Silverside
- Brown Bullhead
- Chain pickerel
- Channel Catfish
- Chubsucker
- Eastern Mosquitofish
- Florida Gar
- Golden Shiner
- Largemouth Bass
- Least Killifish
- Longnose Gar
- Okefenokee pygmy sunfish
- Rainwater Killifish
- Red Eye Chub
- Sailfin Molly
- Striped Mullet
- Sunfish*
- Vermiculated Sailfin Catfish

* sunfish species in decreasing order of abundance: spotted (*Lepomis punctatus*), redear (*L. microlophus*), bluegill (*L. macrochirus*), and redbreast (*L. auritus*).

APPENDIX K

Results of visual fish survey from Silver Glen Springs (Marion Co.) during February 16, 17, and 18, 2009.

		Estimated Field Observations					Estimated Fish Measurements					
Common Name	Scientific Name	2/16/2009	2/17/2009	2/18/2009	Average	Std. Dev.	Length (mm)	Girth (mm)	Weight (kg)	Biomass (kg)	Biomass per area (kg/ha)	Fish Density (n/ha)
SPRING POOL												
Blue Tilapia	*Oreochromis aurea*	454	X	340	397.0	80.6	406.4	381.0	1.4899	591.5	2,421.9	1,625.6
Crevalle Jack	*Caranx hippos*	120	X	100	110.0	14.1	457.2	406.4	2.0135	221.5	906.9	450.4
Eastern Mosquitofish	*Gambusia holbrooki*	40	X	80	60.0	28.3	38.1	25.4	0.0007	0.0	0.2	245.7
Ladyfish	*Elops saurus*	1,500	X	1,800	1,650.0	212.1	457.2	177.8	0.7737	1,276.6	5,227.0	6,756.2
Largemouth Bass	*Micropterus salmoides*	31	X	198	114.5	118.1	254.0	152.4	0.2090	23.9	98.0	468.8
Rainwater Killifish	*Lucania parva*	200	X	1,400	800.0	848.5	38.1	25.4	0.0007	0.5	2.2	3,275.7
Florida gar	*Lepisosteus platyrhincus*	18	X	16	17.0	1.4	457.2	152.4	0.6473	11.0	45.1	69.6
Striped Bass	*Morone saxatilis*	2	X	2	2.0	-	508.0	304.8	1.7676	3.5	14.5	8.2
Striped Mullet	*Mugil cephalus*	20	X	4	12.0	11.3	457.2	228.6	1.0348	12.4	50.8	49.1
Sunfish*	*Lepomis spp.*	208	X	480	344.0	192.3	152.4	203.2	0.1092	37.6	153.8	1,408.6
Total	**10**	**2,593**		**4,420**	**3,506.5**	**1,291.9**				**666.0**	**2,726.9**	**7,073.5**
SPRING RUN												
Atlantic Stingray	*Dasyatis sabina*	3		X	3.0	-	254.0	406.4	0.6502	2.0	0.5	0.8
Blue Tilapia	*Oreochromis aurea*	126	X	X	126.0	-	406.4	381.0	1.4899	187.7	52.4	35.2
Gulf Pipefish	*Syngnathus scovelli*	1			1.0	-	76.2	12.7	0.0012	0.0	0.0	0.3
Largemouth Bass	*Micropterus salmoides*	154	X	X	154.0	-	254.0	152.4	0.2090	32.2	9.0	43.0
Rainwater Killifish	*Lucania parva*	1,040	X	X	1,040.0	-	38.1	25.4	0.0007	0.7	0.2	290.2
Seminole Killifish	*Fundulus seminolis*	8			8.0	-	114.3	63.5	0.0163	0.1	0.0	2.2
Shiner sp.	*Notropis sp.*	15			15.0	-	38.1	38.1	0.0011	0.0	0.0	4.2
Striped Mullet	*Mugil cephalus*	46	X	X	46.0	-	457.2	228.6	1.0348	47.6	13.3	12.8
Sunfish*	*Lepomis spp.*	615	X	X	615.0	-	152.4	203.2	0.1092	67.1	18.7	171.6
Vermiculated Sailfin Catfish	*Pterygoplichthys disjunctivus*	3		X	3.0	-	457.2	228.6	1.0348	3.1	0.9	0.8
Total	**10**	**2,011**			**2,011.0**	**-**				**338.6**	**94.5**	**560.3**

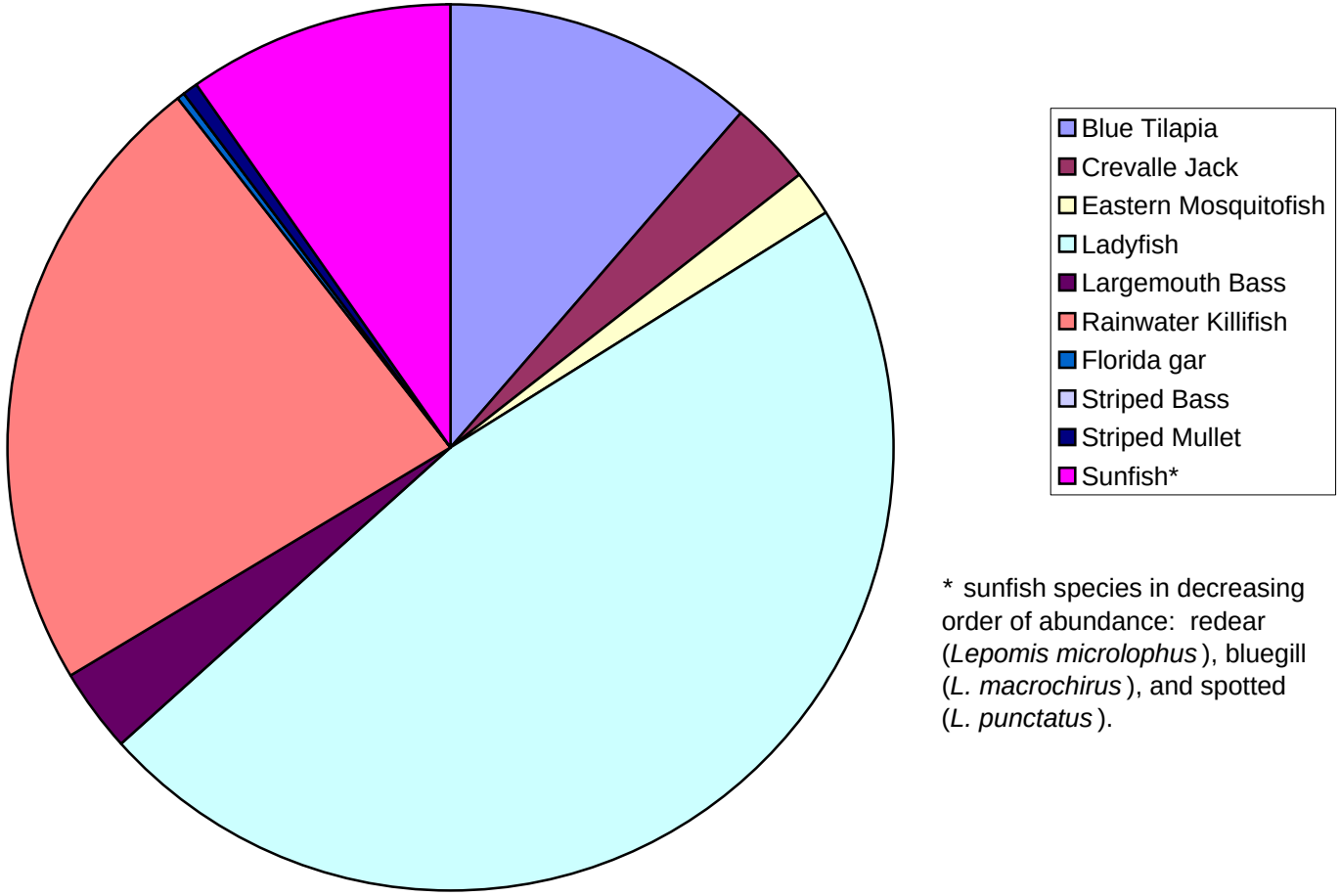
Location	Sampled Area (ha)
Spring Pool	0.2442
Spring Run	3.5836

Notes

sunfish sp and shiner sp values based on Ich 09 fish survey estimates for sailfin shiner

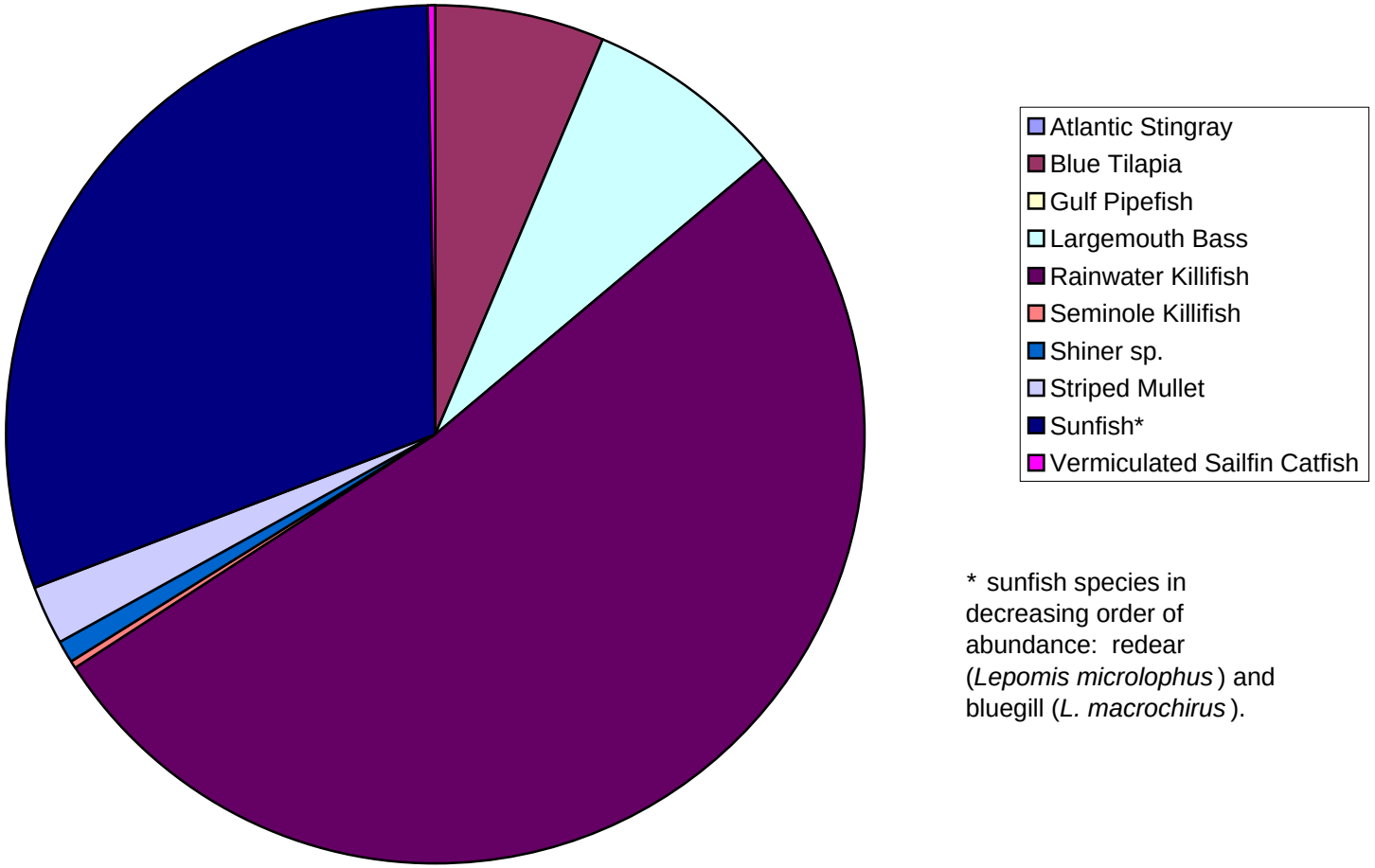
** Sunfish abundance (most to least) = redear, bluegill, and spotted.*

Silver Glen Springs (Marion Co.) Fish Species Composition
Average Spring Pool (February 16 and 18, 2009)



* sunfish species in decreasing order of abundance: redear (*Lepomis microlophus*), bluegill (*L. macrochirus*), and spotted (*L. punctatus*).

Silver Glen Springs (Marion Co.) Fish Species Composition
Spring Run (February 16, 2009)



* sunfish species in decreasing order of abundance: redear (*Lepomis microlophus*) and bluegill (*L. macrochirus*).

APPENDIX K

Results of visual fish surveys from Wakulla Springs (Wakulla Co.) spring run on April 13 - 16, 2009.

Common Name	Scientific Name	Observed
Eastern Mosquitofish	*Gambusia holbrooki*	X
Longnose Gar	*Lepisosteus osseus*	X
Sunfish	*Lepomis spp.*	X
Largemouth Bass	*Micropterus salmoides*	X
Striped Mullet	*Mugil cephalus*	X
	Total Count	**5 spp.**

Notes

No entry into water permitted outside of swimming area.

Fish seen from boats and docks.

Water in pool and run was tannin stained from flood conditions.

APPENDIX K

Results of visual fish survey from Weeki Wachee Springs (Hernando Co.) during March 9, 10, 11, and 12, 2009

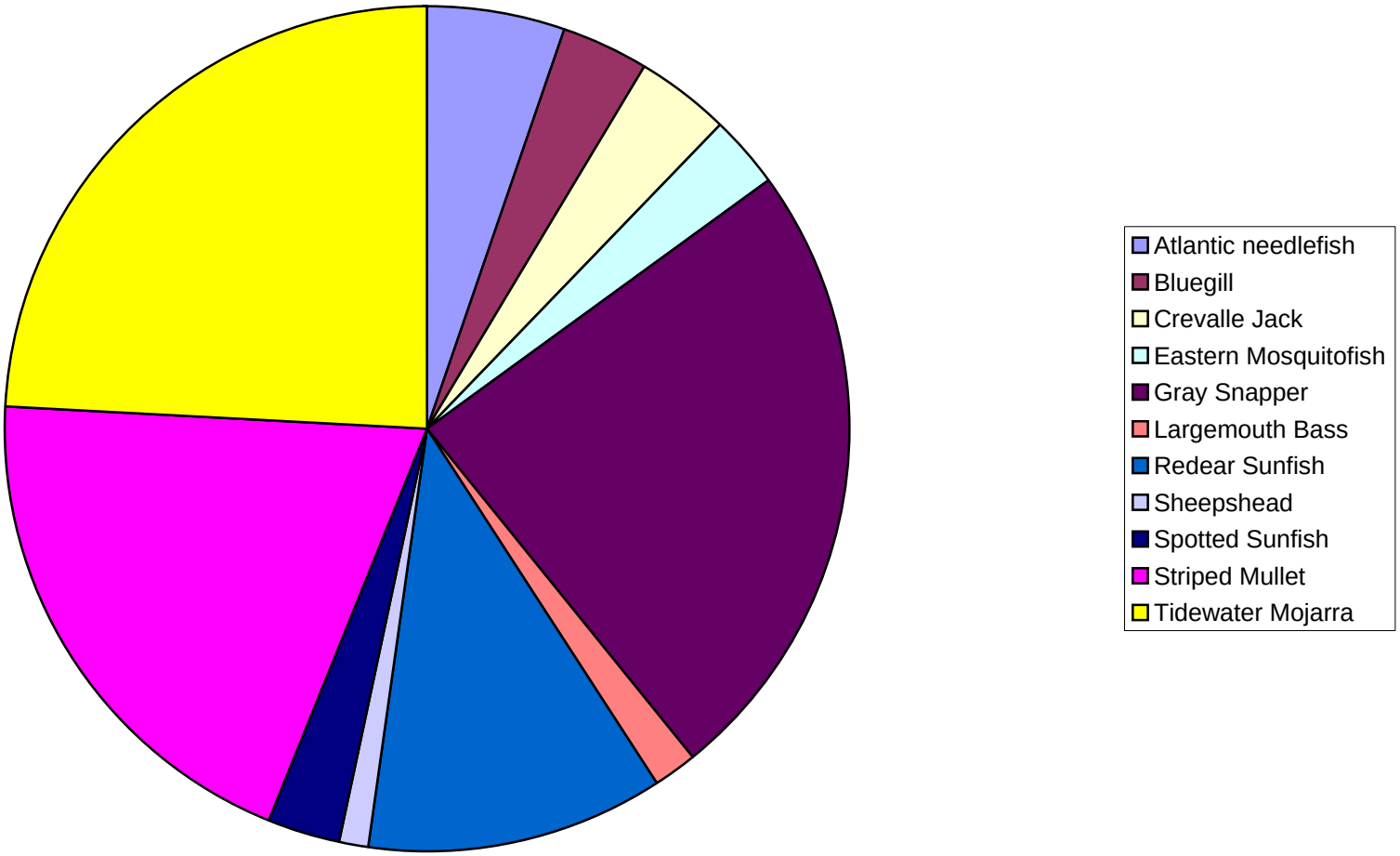
		Estimated Field Observations						Estimated Fish Measurements							
Common Name	Scientific Name	3/9/2009	3/10/2009	3/11/2009	3/12/2009	Average	Std. Dev.	Length (in)	Girth (in)	Length (mm)	Girth (mm)	Weight (kg)	Biomass (kg)	Biomass per area (kg/ha)	Fish Density (n/ha)
SPRING POOL															
Atlantic needlefish	*Strongylura marina*	45	52	X	X	48.5	4.9	11	1.5	279.4	38.1	0.0505	2.45	12.70	251.4
Bluegill	*Lepomis macrochirus*	19	46	X	X	32.5	19.1	6	8	152.4	203.2	0.1092	3.55	18.39	168.5
Crevalle Jack	*Caranx hippos*	30	35	X	X	32.5	3.5	10	12	254.0	304.8	0.4661	15.15	78.53	168.5
Eastern Mosquitofish	*Gambusia holbrooki*	24	30	X	X	27.0	4.2	1.5	1	38.1	25.4	0.0007	0.02	0.10	140.0
Gray Snapper	*Lutjanus griseus*	268	186	X	X	227.0	58.0	10	6	254.0	152.4	0.2090	47.45	245.98	1,176.8
Largemouth Bass	*Micropterus salmoides*	18	12	X	X	15.0	4.2	10	6	254.0	152.4	0.2090	3.14	16.25	77.8
Redear Sunfish	*Lepomis microlophus*	114	99	X	X	106.5	10.6	6	8	152.4	203.2	0.1092	11.63	60.28	552.1
Sheepshead	*Archosargus probatocephalus*	8	11	X	X	9.5	2.1	7	10	177.8	254.0	0.1901	1.81	9.36	49.2
Spotted Sunfish	*Lepomis punctatus*	24	29	X	X	26.5	3.5	5	4.5	127.0	114.3	0.0395	1.05	5.43	137.4
Striped Mullet	*Mugil cephalus*	154	218	X	X	186.0	45.3	16	8	406.4	203.2	0.7199	133.91	694.17	964.2
Tidewater Mojarra	*Eucinostomus harangulus*	153	298	X	X	225.5	102.5	3	4	76.2	101.6	0.0129	2.91	15.09	1,169.0
Total	**11**	**857**	**1,016**			**936.5**	**112.4**						**223.05**	**1,156.29**	**4,854.8**
SPRING RUN - BELOW SLIDES TO WWS-2															
Atlantic needlefish	*Strongylura marina*	1				1.0	-	11	1.5	279.4	38.1	0.0505	0.05	0.11	2.2
Bluegill	*Lepomis macrochirus*	11				11.0	-	4	4	101.6	101.6	0.0225	0.25	0.53	23.7
Gray Snapper	*Lutjanus griseus*	16				16.0	-	10	6	254.0	152.4	0.2090	3.34	7.22	34.5
Largemouth Bass	*Micropterus salmoides*	2				2.0	-	10	6	254.0	152.4	0.2090	0.42	0.90	4.3
Striped Mullet	*Mugil cephalus*	39				39.0	-	16	8	406.4	203.2	0.7199	28.08	60.58	84.1
Tidewater Mojarra	*Eucinostomus harangulus*	46				46.0	-	3	4	76.2	101.6	0.0129	0.59	1.28	99.2
Total	**6**	**115**				**115.0**	**-**						**32.73**	**70.62**	**248.1**
SPRING RUN - WWS-2 TO WWS-3															
Atlantic needlefish	*Strongylura marina*	X	280	X	X	280.0	-	11	1.5	279.4	38.1	0.0505	14.14	9.53	188.7
Bluegill	*Lepomis macrochirus*	X	137	X	X	137.0	-	4	4	101.6	101.6	0.0225	3.08	2.07	92.3
Eastern Mosquitofish	*Gambusia holbrooki*	X	90	X	X	90.0	-	1.5	1	38.1	25.4	0.0007	0.06	0.04	60.6
Largemouth Bass	*Micropterus salmoides*	X	247	X	X	247.0	-	10	6	254.0	152.4	0.2090	51.63	34.79	166.4
Rainwater Killifish	*Lucania parva*	X	6	X	X	6.0	-	1.5	1	38.1	25.4	0.0007	0.00	0.00	4.0
Redear Sunfish	*Lepomis microlophus*	X	113	X	X	113.0	-	6	8	152.4	203.2	0.1092	12.34	8.31	76.1
Sailfin Molly	*Poecilia latipinna*	X	4			4.0	-	2	1.5	50.8	38.1	0.0019	0.01	0.01	2.7
Seminole Killifish	*Fundulus seminolis*		129			129.0	-	4.5	2.5	114.3	63.5	0.0163	2.11	1.42	86.9
Shiner sp.	*Notropis sp.*		550	X	X	550.0	-	6	3	152.4	76.2	0.0351	19.30	13.01	370.6
Spotted Sunfish	*Lepomis punctatus*	X	249	X	X	249.0	-	5	4.5	127.0	114.3	0.0395	9.84	6.63	167.8
Striped Mullet	*Mugil cephalus*	X	424	X	X	424.0	-	16	8	406.4	203.2	0.7199	305.25	205.66	285.7
Tidewater Mojarra	*Eucinostomus harangulus*	X	1,118	X	X	1,118.0	-	3	4	76.2	101.6	0.0129	14.44	9.73	753.3
Total	**12**		**3,347**			**3,347.0**	**-**						**432.19**	**291.19**	**2,255.1**

Location	Sampled Area (ha)
Spring Pool	0.1929
Spring Run (Upper)	0.4635
Spring Run (Lower)	1.4842

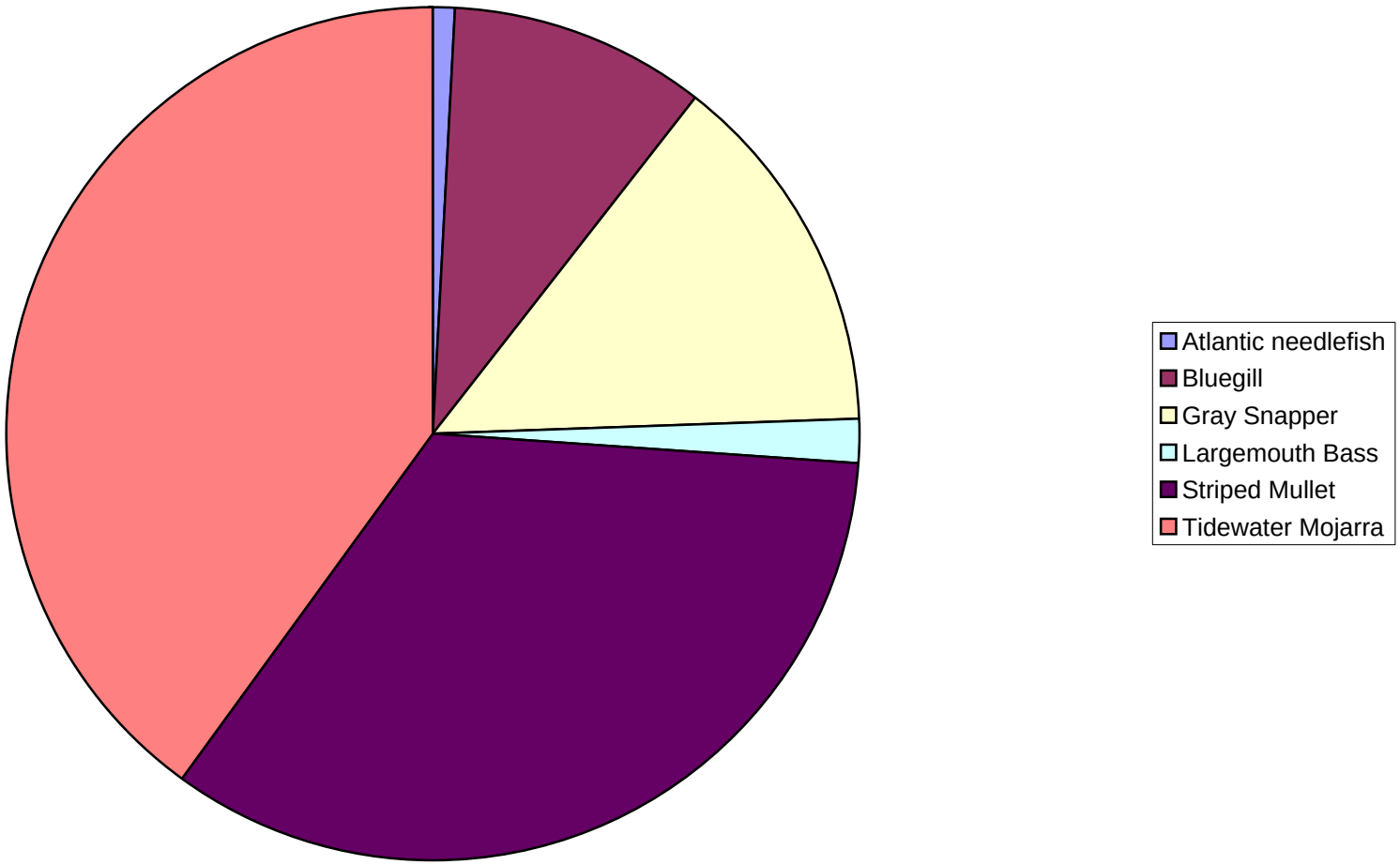
Notes

snorkel surveys of pool (to lower slides, includes Buccaneer Bay)
snorkel surveys of pool by SN on 3/9/09
snorkel survey of pool by SN on 3/10/09
snorkel surveys of upper run (below slides to WWS-2) by RK on 3/9/09
snorkel surveys of run (from WWS-2 to WWS-3) by RK and SN on 3/10/09
mosquito fish count is estimated

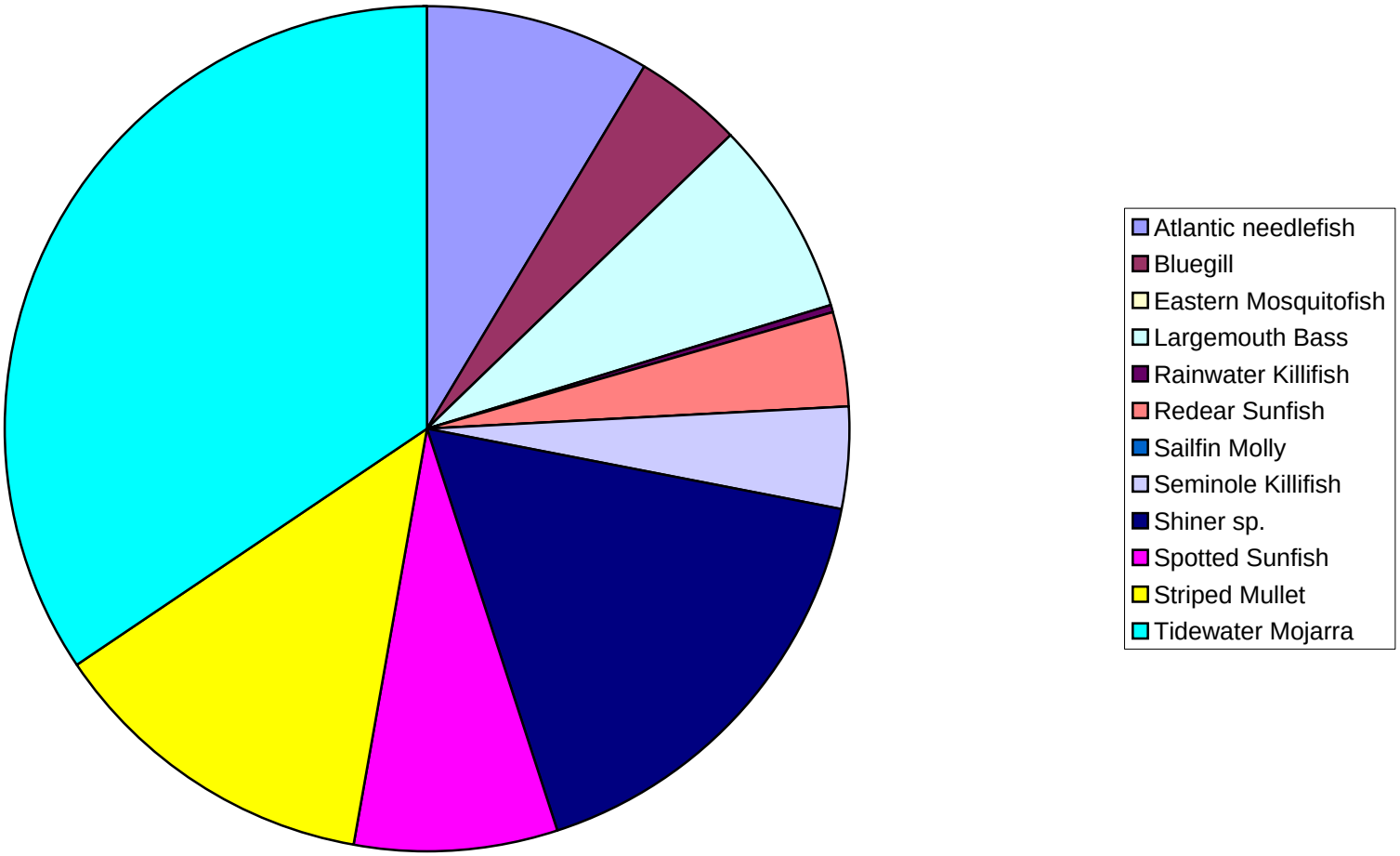
Weeki Wachee Springs (Hernando Co.) Fish Species Composition
Average Spring Pool (March 9 and 10, 2009)



Weeki Wachee Springs (Hernando Co.) Fish Species Composition
Upper Spring Run (March 9, 2009)



Weeki Wachee Springs (Hernando Co.) Fish Species Composition
Spring Run (March 10, 2009)



Appendix L

Macrofauna

Appendix L
Listing of bird species by location.

Group	Location	Scientific Name	Common Name
Bird	Both	*Agelaius phoeniceus*	Red-winged Blackbird
		Aix sponsa	Wood Duck
		Anhinga anhinga	Anhinga
		Ardea alba	Great Egret
		Ardea herodias	Great Blue Heron
		Buteo lineatus	Red-shouldered Hawk
		Butorides virescens	Green Heron
		Cairina moschata	Muscovy Duck
		Chaetura pelagica	Chimney Swift
		Corvus ossifragus	Fish Crow
		Eudocimus albus	American White Ibis
		Fulica americana	American Coot
		Gallinula chloropus	Common Moorhen
		Hirundo rustica	Barn Swallow
		Megaceryle alcyon	Belted Kingfisher
		Melanerpes carolinus	Red-bellied Woodpecker
		Mimus polyglottos	Northern Mockingbird
		Pandion haliaetus	Osprey
		Phalacrocorax auritus	Double-crested Cormorant
		Protonotaria citrea	Prothonotary Warbler
		Quiscalus major	Boat-tailed Grackle
	Pool	*Ardea alba*	Great Egret
		Bombycilla cedrorum	Cedar Waxwing
		Buteo lineatus	Red-shouldered Hawk
		Butorides virescens	Green Heron
		Cardinalis cardinalis	Northern Cardinal
		Charadrius vociferus	Killdeer
		Coragyps atratus	American Black Vulture
		Corvus brachyrhynchos	American Crow
		Corvus ossifragus	Fish Crow
		Cyanocitta cristata	Blue Jay
		Dumetella carolinensis	Gray Catbird
		Emberizidae	Sparrow
		Eudocimus albus	American White Ibis
		Melanerpes carolinus	Red-bellied Woodpecker
		Myiarchus crinitus	Great Crested Flycatcher
		Podilymbus podiceps	Pied-billed Grebe
		Quiscalus quiscula	Common Grackle
		Zenaida macroura	Mourning Dove

Appendix L
Listing of bird species by location.

Group	Location	Scientific Name	Common Name
	Run	*Agelaius phoeniceus*	Red-winged Blackbird
		Aix sponsa	Wood Duck
		Anas fulvigula	Mottled Duck
		Anhinga anhinga	Anhinga
		Aramus guarauna	Limpkin
		Ardea alba	Great Egret
		Ardea herodias	Great Blue Heron
		Baeolophus bicolor	Tufted Titmouse
		Buteo jamaicensis	Red-tailed Hawk
		Buteo lineatus	Red-shouldered Hawk
		Butorides virescens	Green Heron
		Cardinalis cardinalis	Northern Cardinal
		Cathartes aura	Turkey Vulture
		Chaetura pelagica	Chimney Swift
		Colaptes auratus	Northern Flicker
		Coragyps atratus	American Black Vulture
		Corvus ossifragus	Fish Crow
		Cyanocitta cristata	Blue Jay
		Dendroica coronata	Yellow-rumped Warbler
		Dryocopus pileatus	Pileated Woodpecker
		Dumetella carolinensis	Gray Catbird
		Egretta caerulea	Little Blue Heron
		Egretta thula	Snowy Egret
		Egretta tricolor	Tricolored Heron
		Elanoides forficatus	Swallow-tailed Kite
		Eudocimus albus	American White Ibis
		Fulica americana	American Coot
		Gallinula chloropus	Common Moorhen
		Haliaeetus leucocephalus	Bald Eagle
		Ictinia mississippiensis	Mississippi Kite
		Ixobrychus exilis	Least Bittern
		Larus delawarensis	Ring-billed Gull
		Megaceryle alcyon	Belted Kingfisher
		Melanerpes carolinus	Red-bellied Woodpecker
		Meleagris gallopavo	Wild Turkey
		Mergus serrator	Red-breasted Merganser
		Mimus polyglottos	Northern Mockingbird
		Mycteria americana	Wood Stork
		Myiarchus crinitus	Great Crested Flycatcher
		Nyctanassa violacea	Yellow-crowned Night Heron
		Nycticorax violaceus	Yellow-crowned Night Heron
		Pandion haliaetus	Osprey
		Parula americana	Northern Parula
		Phalacrocorax auritus	Double-crested Cormorant
		Picoides pubescens	Downy Woodpecker
		Platalea ajaja	Roseate Spoonbill
		Podilymbus podiceps	Pied-billed Grebe
		Poecile carolinensis	Carolina Chickadee
		Polioptila caerulea	Blue-gray Gnatcatcher
		Porzana carolina	Sora Rail
		Progne subis	Purple Martin
		Sayornis phoebe	Eastern Phoebe
		Strix varia	Barred Owl
		Tachycineta bicolor	Tree Swallow
		Thryothorus ludovicianus	Carolina Wren
		Turdus migratorius	American Robin
	Uplands	*Meleagris gallopavo*	Wild Turkey
		Passerina cyanea	Indigo Bunting

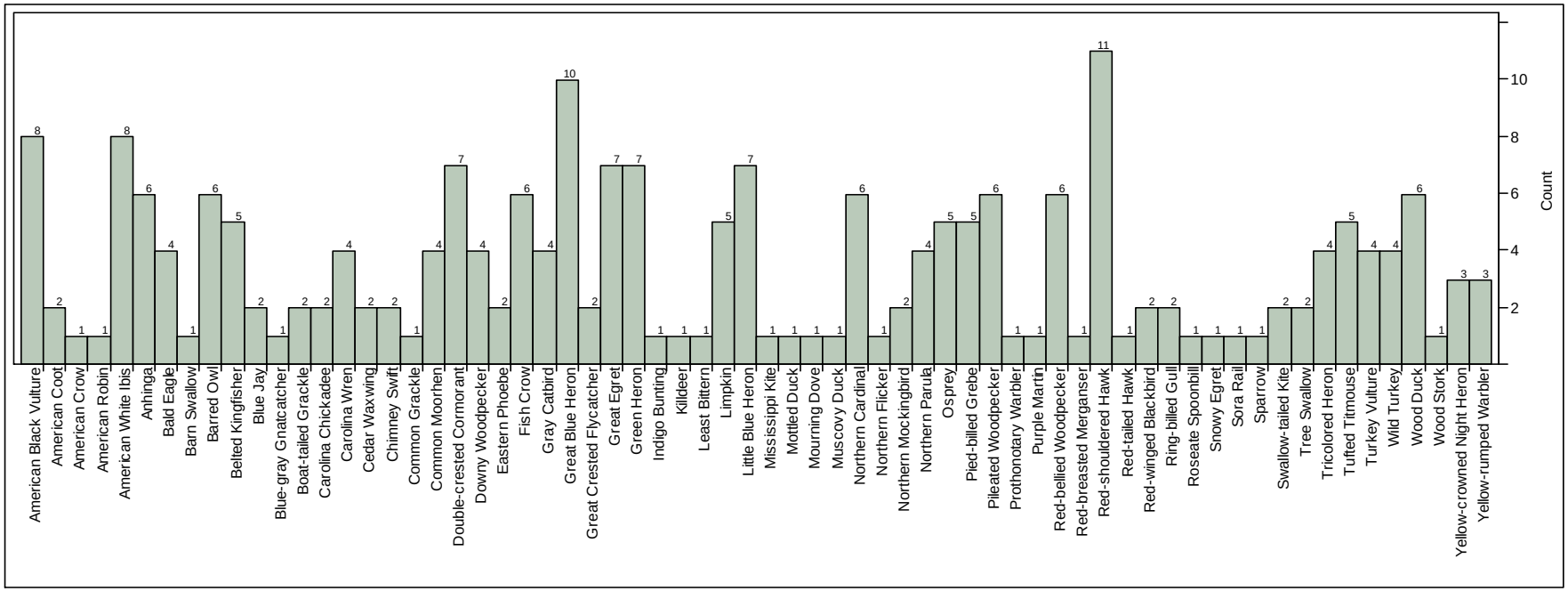
Appendix L
Listing of amphibian, crustacean, mammal, and reptile species by location.

Group	Location	Scientific Name	Common Name
Amphibian	Pool	*Hyla cinerea*	*green tree frog*
		Rana catesbeiana	*bull frog*
	Run	*Rana grylio*	*pig frog*
Crustacean	Pool	*Procambarus spiculifer*	*crayfish*
	Run	*Procambarus sp.*	*crayfish*
Mammal	Both	*Procyon lotor*	*raccoon*
		Sciurus carolinensis	*eastern gray squirrel*
		Trichechus manatus latirostrus	*Florida manatee*
	Pool	*Dasypus novemcinctus*	*nine-banded armadillo*
		Felis catus	*house cat*
		Odocoileus virginianus	*white-tailed deer*
		Procyon lotor	*raccoon*
		Sciurus carolinensis	*eastern gray squirrel*
	Run	*Lontra canadensis*	*North American river otter*
		Macaca mulatta	*rhesus macaque*
		Procyon lotor	*raccoon*
		Sciurus carolinensis	*eastern gray squirrel*
		Sus scrofa	*wild boar*
	Uplands	*Dasypus novemcinctus*	*nine-banded armadillo*
		Odocoileus virginianus	*white-tailed deer*
		Sciurus carolinensis	*eastern gray squirrel*
Reptile	Both	*Alligator mississippiensis*	*American alligator*
		Anolis carolinensis	*Carolina anole*
		Anolis sagrei	*brown anole*
		Eumeces inexpectatus	*southeastern five-lined skink*
		Pseudemys concinna suwanniensis	*Suwannee cooter*
		Pseudemys floridana floridana	*Florida cooter*
		Pseudemys nelsoni	*Florida red-bellied turtle*
		Sternotherus minor minor	*loggerhead musk turtle*
	Pool	*Anolis carolinensis*	*Carolina anole*
		Anolis sagrei	*brown anole*
		Apalone ferox	*Florida softshell*
		Graptemys barbouri	*Barbour's map turtle*
		Nerodia erythrogaster erythrogaster	*red-bellied water snake*
		Nerodia taxispilota	*brown water snake*
		Pseudemys floridana floridana	*Florida cooter*
		Sternotherus minor minor	*loggerhead musk turtle*
		Sternotherus odoratus	*common musk turtle*
	Run	*Alligator mississippiensis*	*American alligator*
		Anolis carolinensis	*Carolina anole*
		Apalone ferox	*Florida softshell*
		Caretta caretta	*loggerhead sea turtle*
		Chelydra serpentina	*snapping turtle*
		Eumeces fasciatus	*five-lined skink*
		Nerodia fasciata pictiventris	*Florida banded water snake*
		Nerodia taxispilota	*brown water snake*
		Pseudemys concinna suwanniensis	*Suwannee cooter*
		Pseudemys floridana floridana	*Florida cooter*
		Pseudemys nelsoni	*Florida red-bellied turtle*
		Sternotherus minor minor	*loggerhead musk turtle*
		Sternotherus odoratus	*common musk turtle*
		Trachemys scripta	*yellow-bellied slider*
	Uplands	*Elaphe obsoleta spiloides*	*gray rat snake*

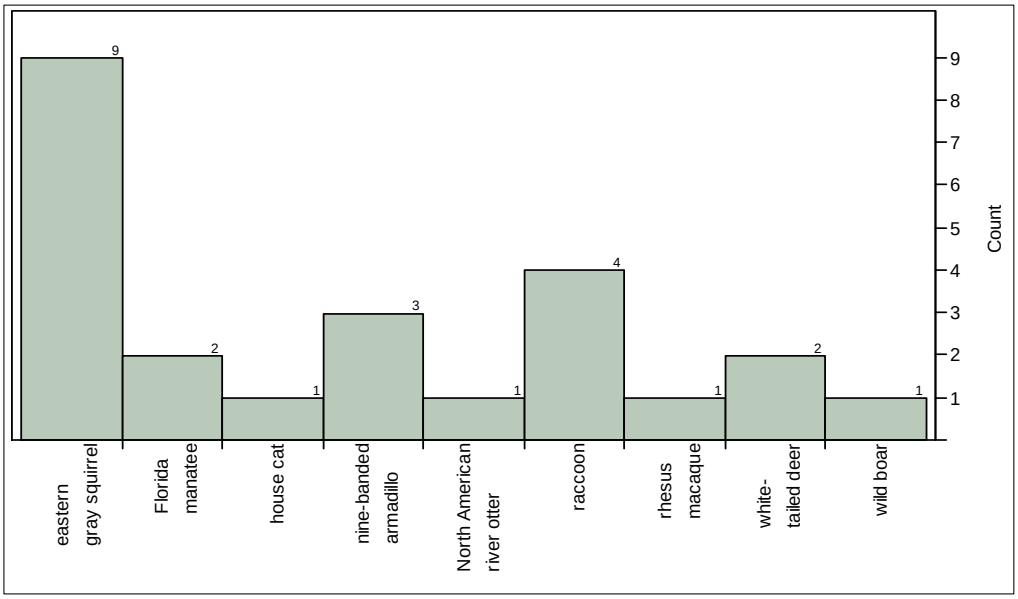
Appendix L
The number of species by group and spring.

Spring	Group	N Rows
De Leon	Bird	20
	Mammal	2
	Reptile	1
Homosassa	Bird	10
	Mammal	2
	Reptile	2
Ichetucknee	Bird	16
	Mammal	4
	Reptile	5
	Crustacean	1
Jackson Blue	Bird	26
	Crustacean	1
	Mammal	2
	Reptile	2
Madison Blue	Bird	2
	Mammal	1
	Reptile	2
Manatee	Bird	10
	Mammal	3
	Reptile	9
Ponce de Leon	Bird	3
	Crustacean	1
	Reptile	3
Rainbow	Amphibian	2
	Bird	21
	Reptile	5
Silver	Amphibian	1
	Bird	23
	Mammal	3
	Reptile	8
Silver Glen	Bird	22
	Mammal	4
	Reptile	5
Wakulla	Bird	42
	Mammal	2
	Reptile	6
Weeki Wachee	Bird	26
	Mammal	1
	Reptile	5

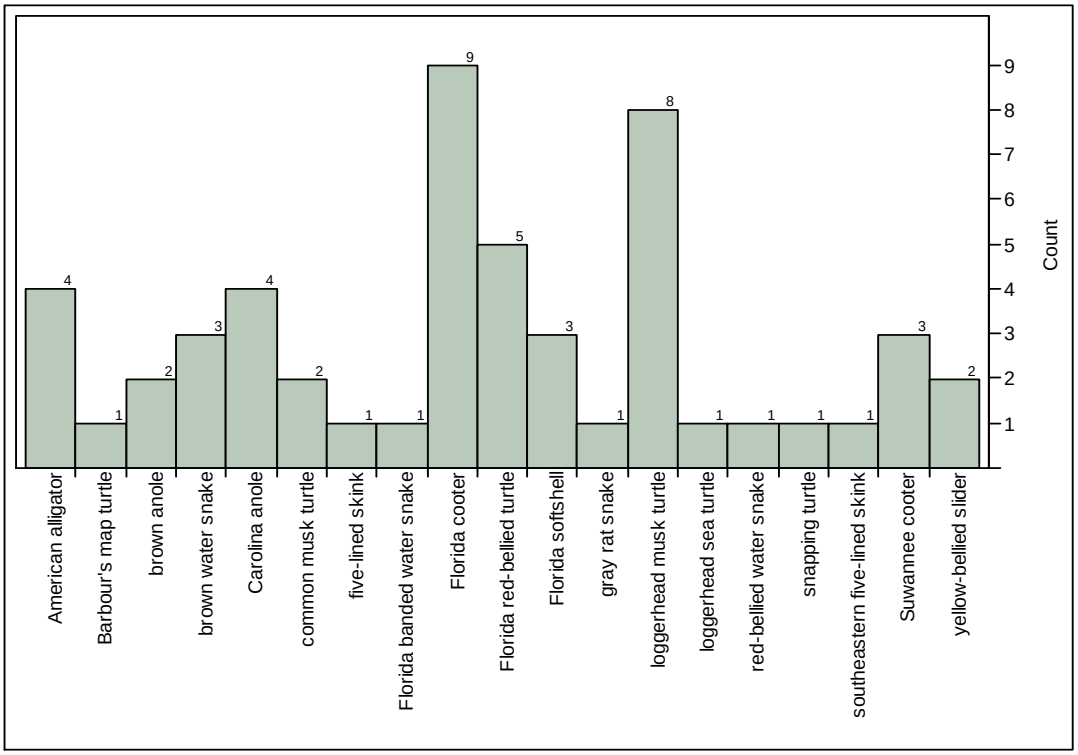
Appendix L
The number of springs that each species was observed at.



Appendix L
The number of springs that each species was observed at.



Appendix L
The number of springs that each species was observed at.



APPENDIX L

De Leon Springs (Volusia Co.) macrofauna observations made from October 6 to 9, 2008.

Group	Common Name	Scientific Name	Location*
Bird (20 spp.)	Anhinga	*Anhinga anhinga*	Both
	Limpkin	*Aramus guarauna*	Run
	Great Egret	*Ardea alba*	Pool
	Great Blue Heron	*Ardea herodias*	Run
	Red-shouldered Hawk	*Buteo lineatus*	Run
	Green Heron	*Butorides virescens*	Run
	Northern Cardinal	*Cardinalis cardinalis*	Run
	American Black Vulture	*Coragyps atratus*	Run
	Fish Crow	*Corvus ossifragus*	Both
	Pileated Woodpecker	*Dryocopus pileatus*	Run
	Little Blue Heron	*Egretta caerulea*	Run
	Tricolored Heron	*Egretta tricolor*	Run
	Common Moorhen	*Gallinula chloropus*	Run
	Bald Eagle	*Haliaeetus leucocephalus*	Run
	Belted Kingfisher	*Megaceryle alcyon*	Run
	Yellow-crowned Night Heron	*Nyctanassa violacea*	Run
	Osprey	*Pandion haliaetus*	Run
	Double-crested Cormorant	*Phalacrocorax auritus*	Run
	Pied-billed Grebe	*Podilymbus podiceps*	Run
	Boat-tailed Grackle	*Quiscalus major*	Both
Mammal (2 spp.)	house cat	*Felis catus*	Pool
	eastern gray squirrel	*Sciurus carolinensis*	Both
Reptile (1 spp.)	Florida cooter	*Pseudemys floridana floridana*	Run

* Location of observation, Run = spring run, Pool = spring pool, or Both.

APPENDIX L

Homosassa Springs (Citrus Co.) macrofauna observations made from November 3 to 6, 2008.

Group	Common Name	Scientific Name	Location*
Bird (10 spp.)	American Black Vulture	*Coragyps atratus*	Run[1]
	American White Ibis	*Eudocimus albus*	Run[1]
	Anhinga	*Anhinga anhinga*	Run
	Double-crested Cormorant	*Phalacrocorax auritus*	Run
	Gray Catbird	*Dumetella carolinensis*	Pool
	Great Blue Heron	*Ardea herodias*	Both
	Great Egret	*Ardea alba*	Both[1]
	Little Blue Heron	*Egretta caerulea*	Run
	Osprey	*Pandion haliaetus*	Run
	Wood Duck	*Aix sponsa*	Both
Mammal (2 spp.)	Florida manatee	*Trichechus manatus latirostrus*	Both[2]
	eastern gray squirrel	*Sciurus carolinensis*	Both
Reptile (2 spp.)	Florida cooter	*Pseudemys floridana floridana*	Run
	loggerhead sea turtle	*Caretta caretta*	Run [3]

* Location of observation, Run = spring run, Pool = spring pool, or Both.

[1] These birds were also observed feeding and roosting in the captive bird exhibit.

[2] Manatees in the spring pool were captive, manatees in the spring run were wild animals.

[3] Observed by others



Picture taken by visitor the week after WSI sampling.

APPENDIX L

Ichetucknee Springs (Columbia Co.) macrofauna observations made during July 6 to 14, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location***	**7/6/09**	**7/7/09**	**7/9/09**	**7/14/09**
Bird (16 spp.)	American White Ibis	*Eudocimus albus*	Run	9	18	16	16
	Barred Owl	*Strix varia*	Run	1			1
	Great Blue Heron	*Ardea herodias*	Run	1	1		1
	Great Egret	*Ardea alba*	Run	3	6	3	13
	Green Heron	*Butorides virescens*	Run			1	
	Limpkin	*Aramus guarauna*	Run	2	1	1	X
	Little Blue Heron	*Egretta caerulea*	Run	1		2	
	Osprey	*Pandion haliaetus*	Run				1
	Mississippi Kite	*Ictinia mississippiensis*	Run	2			
	Red-bellied Woodpecker	*Melanerpes carolinus*	Run		1		
	Red-shouldered Hawk	*Buteo lineatus*	Run	1			
	Roseate Spoonbill	*Platalea ajaja*	Run	1	1	1	2
	Snowy Egret	*Egretta thula*	Run	2			
	Wild Turkey	*Meleagris gallopavo*	tram road			2	
	Wood Duck	*Aix sponsa*	Run	4	10	13	6
	Wood Stork	*Mycteria americana*	Run	3	8	11	7
Mammal (4 spp.)	wild boar	*Sus scrofa*	Run	8			
	nine-banded armadillo	*Dasypus novemcinctus*	tram road			1	
	raccoon	*Procyon lotor*	Run	1			
	eastern gray squirrel	*Sciurus carolinensis*	Both	X		X	
Reptile (5 spp.)	Suwannee cooter	*Pseudemys concinna suwanniensis*	Run	X	X	X	X
	yellow-bellied slider	*Trachemys scripta*	Run	X	X		X
	Florida red-bellied turtle	*Pseudemys nelsoni*	Run				X
	loggerhead musk turtle	*Sternotherus minor minor*	Run	X	X	X	24
	brown watersnake	*Nerodia taxispilota*	Run		1		
Crustacean (1 spp.)	crayfish	*Procambarus sp.*	Run				

* Location of observation, Run = spring run, Pool = spring pool, or Both.

APPENDIX L

Jackson Blue Springs (Jackson Co.) macrofauna observations made from January 12 to 15, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location***	**1/12/09**	**1/13/09**	**1/14/09**	**1/15/09**
Bird (26 spp.)	Great Egret	*Ardea alba*	Run	1		1	
	Great Blue Heron	*Ardea herodias*	Run				2
	Tufted Titmouse	*Baeolophus bicolor*	Run			1	
	Cedar Waxwing	*Bombycilla cedrorum*	Pool			35	
	Red-tailed Hawk	*Buteo jamaicensis*	Run			1	
	Red-shouldered Hawk	*Buteo lineatus*	Run	1	1	3	1
	Green Heron	*Butorides virescens*	Run	1			
	Turkey Vulture [1]	*Cathartes aura*	Run	15	12	3	20
	Northern Flicker	*Colaptes auratus*	Run			1	
	American Black Vulture [1]	*Coragyps atratus*	Run	125	160	80	104
	Fish Crow	*Corvus ossifragus*	Run	3	1	1	
	Blue Jay	*Cyanocitta cristata*	Run		2		
	Yellow-rumped Warbler	*Dendroica coronata*	Run			1	
	Pileated Woodpecker	*Dryocopus pileatus*	Run	1	1	1	
	American Coot	*Fulica americana*	Run	1	1	1	1
	Ring-billed Gull	*Larus delawarensis*	Run	1		3	2
	Belted Kingfisher	*Megaceryle alcyon*	Run	1	1	1	1
	Red-bellied Woodpecker	*Melanerpes carolinus*	Run			2	
	Double-crested Cormorant [1]	*Phalacrocorax auritus*	Run	118	30	1	23
	Pied-billed Grebe	*Podilymbus podiceps*	Run	2	1		
	Carolina Chickadee	*Poecile carolinensis*	Run			1	
	Blue-gray Gnatcatcher	*Polioptila caerulea*	Run			2	
	Eastern Phoebe	*Sayornis phoebe*	Run			1	
	Barred Owl	*Strix varia*	Run			1	
	Carolina Wren	*Thryothorus ludovicianus*	Run			1	
	American Robin	*Turdus migratorius*	Run			30	
Mammal (2 spp.)	North American river otter [2]	*Lontra canadensis*	Run				1
	raccoon	Procyon lotor	Pool		1		
Reptile (2 spp.) [3]	Florida cooter	*Pseudemys floridana floridana*	Run	2	17	3	2
	loggerhead musk turtle	*Sternotherus minor minor*	Run	1	4	2	
Crustacean (1 spp.)	crayfish	*Procambarus spiculifer*	Pool	2	1	6	

* Location of observation, Run = spring run, Pool = spring pool, or Both.

[1] using cypress trees along run as day and night roosts

[2] tracks observed in sand around pool

[3] The tops of much of the Vallisneria in spring pool has been grazed I think by turtles

APPENDIX L

Madison Blue Springs (Madison Co.) macrofauna observations made from December 1 to 2, 2008 and January 2, 2009.

Group	Common Name	Scientific Name	Location*
Bird (2 spp.)	Red-shouldered Hawk	*Buteo lineatus*	Pool
	American Crow	*Corvus brachyrhynchos*	Pool
Mammal (1 spp.)	eastern gray squirrel	*Sciurus carolinensis*	Both
Reptile (2 spp.)	Florida cooter	*Pseudemys floridana floridana*	Run
	loggerhead musk turtle	*Sternotherus minor minor*	Both

* Location of observation, Run = spring run, Pool = spring pool, or Both.

APPENDIX L

Manatee Springs (Levy Co.) macrofauna observations made August 3 to 6, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location**	**8/3/09**	**8/4/09**	**8/5/09**	**8/6/09**
Bird (10 spp.)	Limpkin	*Aramus guarauna*	Run	1			
	Red-shouldered Hawk	*Buteo lineatus*	Run			1	
	Green Heron	*Butorides virescens*	Both	2	2	1	1
	Turkey Vulture	*Cathartes aura*	Run	X		25	
	American Black Vulture	*Coragyps atratus*	Run	X			
	Pileated Woodpecker	*Dryocopus pileatus*	Run	1			
	American White Ibis	*Eudocimus albus*	Both	1	1	1	1
	Wild Turkey	*Meleagris gallopavo*	Uplands [1]			2	
	Barred Owl	*Strix varia*	Run			1	
	Carolina Wren	*Thryothorus ludovicianus*	Run		1	1	
Reptile (9 spp.)	Carolina anole	*Anolis carolinensis*	Run		1		
	brown anole	*Anolis sagrei*	Pool	1	2	1	
	gray rat snake	*Elaphe obsoleta spiloides*	Uplands [1]	1			
	five-lined skink	*Eumeces fasciatus*	Run		1		
	red-bellied water snake	*Nerodia erythrogaster erythrogaster*	Pool		1	1	
	brown water snake	*Nerodia taxispilota*	Pool			1	
	Suwannee cooter	*Pseudemys concinna suwanniensis*	Both	43	21	10	X
	Florida red-bellied turtle	*Pseudemys nelsoni*	Run	X	X	X	X
	loggerhead musk turtle	*Sternotherus minor minor*	Both	8	7	X	X
Mammal (3 spp.)	nine-banded armadillo	*Dasypus novemcinctus*	Uplands [1]		1		
	white-tailed deer	*Odocoileus virginianus*	Uplands [1]	6	9		
	eastern gray squirrel	*Sciurus carolinensis*	Uplands [1]	2	2	1	3

* Location of observation, Run = spring run, Pool = spring pool, or Both.

[1] Observed along serice roads

APPENDIX L

Ponce de Leon Springs (Holmes Co.) macrofauna observations made September 8 to 11, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location**	**9/8/09**	**9/9/09**	**9/10/09**	**9/11/09**
Bird (3 spp.)	Red-shouldered Hawk	*Buteo lineatus*	Run	1	2	2	
	Blue Jay	*Cyanocitta cristata*	Pool	3			
	Tufted Titmouse	*Baeolophus bicolor*	Run	1			
Reptile (3 spp.)	Florida cooter	*Pseudemys florida*	Pool	2	3	1	6
	loggerhead musk turtle	*Sternotherus minor minor*	Both	3	1		
	southeastern five-lined skink	*Eumeces inexpectatus*	Both		1	1	
Crustacean (1 spp.)	crayfish	*Procambarus sp.*	Run		2	2	

* Location of observation, Run = spring run, Pool = spring pool, or Both.

APPENDIX L

Rainbow Springs (Marion Co.) macrofauna observations made June 8 to 11, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location**	**6/8/09**	**6/9/09**	**6/10/09**	**6/11/09**
Bird (21 spp.)	Wood Duck	*Aix sponsa*	Run	12	2	2	8
	Pied-billed Grebe	*Podilymbus podiceps*	Run	1			
	Red-shouldered Hawk	*Buteo lineatus*	Run	1		1	
	Northern Parula	*Parula americana*	Run	X	X		
	Swallow-tailed Kite	*Elanoides forficatus*	Run	1		2	
	Downy Woodpecker	*Picoides pubescens*	Run	X			
	Tricolored Heron	*Egretta tricolor*	Run	2			
	Common Moorhen	*Gallinula chloropus*	Run	7	1	3	1
	Northern Cardinal	*Cardinalis cardinalis*	Run	X	X		
	Fish Crow	*Corvus ossifragus*	Both	1	X		
	American White Ibis	*Eudocimus albus*	Run	2	1	6	
	Little Blue Heron	*Egretta caerulea*	Run			4	1
	Red-bellied Woodpecker	*Melanerpes carolinus*	Run	5	X	X	
	Anhinga	*Anhinga anhinga*	Run	10	15	10	5
	Double-crested Cormorant	*Phalacrocorax auritus*	Run	7	9	5	13
	Great Egret	*Ardea alba*	Run	1		1	1
	Great Blue Heron	*Ardea herodias*	Run				1
	Red-winged Blackbird	*Agelaius phoeniceus*	Run				3
	Purple Martin	*Progne subis*	Run		X		
	Carolina Wren	*Thryothorus ludovicianus*	Run		X		
	American Black Vulture	*Coragyps atratus*	Run		2	3	
Reptile (5 spp.)	American alligator	*Alligator mississippiensis*	Run		1		2
	Florida softshell	*Apalone ferox*	Run	2	1		
	common musk turtle	*Sternotherus odoratus*	Run	3			
	Suwannee cooter	*Pseudemys concinna suwanniensis*	Run	12	27	6	6
	loggerhead musk turtle	*Sternotherus minor minor*	Run	9	8		2
Amphibian (2 spp.)	green tree frog	*Hyla cineria*	Pool		X	X	
	bull frog	*Rana catesbeiana*	Pool	X	X		

* Location of observation, Run = spring run, Pool = spring pool, or Both.

APPENDIX L

Silver Glen Springs (Marion Co.) macrofauna observations made from February 16 to 19, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location***	**2/16/09**	**2/17/09**	**2/18/09**	**2/19/09**
Bird (22 spp.)	Anhinga	*Anhinga anhinga*	Run	2	3	2	2
	Great Blue Heron	*Ardea herodias*	Both	2	2	4	1
	Red-shouldered Hawk	*Buteo lineatus*	Run	1		3	
	Northern Cardinal	*Cardinalis cardinalis*	Run		2		2
	Turkey Vulture	*Cathartes aura*	Run	3	13	1	5
	American Black Vulture	*Coragyps atratus*	Run	8	3	2	2
	Fish Crow	*Corvus ossifragus*	Run		2		
	Yellow-rumped Warbler	*Dendroica coronata*	Run				2
	Pileated Woodpecker	*Dryocopus pileatus*	Run		1		
	Gray Catbird	*Dumetella carolinensis*	Pool		1		
	American White Ibis	*Eudocimus albus*	Run		4		
	Bald Eagle	*Haliaeetus leucocephalus*	Run	1	1		1
	Ring-billed Gull	*Larus delawarensis*	Run		1		1
	Belted Kingfisher	*Megaceryle alcyon*	Run	1	2	1	1
	Red-bellied Woodpecker	*Melanerpes carolinus*	Run		1		1
	Wild Turkey	*Meleagris gallopavo*	Run			6	
	Osprey	*Pandion haliaetus*	Run	1	1		
	Double-crested Cormorant	*Phalacrocorax auritus*	Both	1	1	1	4
	Downy Woodpecker	*Picoides pubescens*	Run	1			
	Pied-billed Grebe	*Podilymbus podiceps*	Pool	1	2		1
	Eastern Phoebe	*Sayornis phoebe*	Run			1	
	Tree Swallow	*Tachycineta bicolor*	Run		5		
Mammal (4 spp.)	nine-banded armadillo	*Dasypus novemcinctus*	Pool		1		
	white-tailed deer	*Odocoileus virginianus*	Pool				2
	raccoon	*Procyon lotor*	Both	2	1	2	1
	eastern gray squirrel	*Sciurus carolinensis*	Pool				2
Reptile (5 spp.)	American alligator	*Alligator mississippiensis*	Run		2	1	
	Carolina anole	*Anolis carolinensis*	Both		2		
	Florida red-bellied turtle	*Pseudemys nelsoni*	Run		5		
	Florida cooter	*Pseudemys floridana floridana*	Run		2		
	loggerhead musk turtle	*Sternotherus minor minor*	Pool	1			

* Location of observation, Run = spring run, Pool = spring pool, or Both.

APPENDIX L

Silver Springs (Marion Co.) macrofauna observations made May 4, 5, 7, and 8, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location**	**5/4/09**	**5/5/09**	**5/7/09**	**5/9/09**
Bird (23 spp.)	Wood Duck	*Aix sponsa*	Run	X	X	X	X
	Anhinga	*Anhinga anhinga*	Both	X	X	X	X
	Limpkin	*Aramus guarauna*	Run		X		
	Great Blue Heron	*Ardea herodias*	Run	X	X	X	X
	Tufted Titmouse	*Baeolophus bicolor*	Run			X	
	Red-shouldered Hawk	*Buteo lineatus*	Run	X	X	X	X
	Green Heron	*Butorides virescens*	Run	X	X	X	X
	Northern Cardinal	*Cardinalis cardinalis*	Run		X		
	Turkey Vulture	*Cathartes aura*	Run	X			
	Chimney Swift	*Chaetura pelagica*	Run	X			
	Fish Crow	*Corvus ossifragus*	Run	X	X		
	Pileated Woodpecker	*Dryocopus pileatus*	Run	X			
	Little Blue Heron	*Egretta caerulea*	Run	X	X	X	X
	Swallow-tailed Kite	*Elanoides forficatus*	Run	X		X	
	American White Ibis	*Eudocimus albus*	Run	X	X	X	
	Common Moorhen	*Gallinula chloropus*	Run	X	X	X	X
	Great Crested Flycatcher	*Myiarchus crinitus*	Run			X	
	Yellow-crowned Night Heron	*Nyctanassa violacea*	Run		X		
	Northern Parula	*Parula americana*	Run	X			
	Double-crested Cormorant	*Phalacrocorax auritus*	Run	X	X	X	X
	Downy Woodpecker	*Picoides pubescens*	Run	X			
	Barred Owl	*Strix varia*	Run		X		
	Carolina Wren	*Thryothorus ludovicianus*	Run	X			
Mammal (3 spp.)	rhesus macaque	*Macaca mulatta*	Run		5	10	15
	raccoon	*Procyon lotor*	Run			1	
	eastern gray squirrel	*Sciurus carolinensis*	Run				1
Reptile (8 spp.)	American alligator	*Alligator mississippiensis*	Both	X	6	6	X
	Carolina anole	*Anolis carolinensis*	Run			1	
	Florida softshell	*Apalone ferox*	Run		2	1	
	snapping turtle	*Chelydra serpentina*	Run			2	
	Florida banded water snake	*Nerodia fasciata pictiventris*	Run	1			
	Florida cooter	*Pseudemys floridana floridana*	Both	X	42	58	X
	Florida red-bellied turtle	*Pseudemys nelsoni*	Run	X	X	X	
	loggerhead musk turtle	*Sternotherus minor minor*	Run	1			
Amphibian (1 spp.)	pig frog	*Rana grylio*	Run	X			

* Location of observation, Run = spring run, Pool = spring pool, or Both.

APPENDIX L

Wakulla Springs (Wakulla Co.) macrofauna observations made from April 13 to 16, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location***	**4/13/09**	**4/14/09**	**4/15/09**	**4/16/09**
Bird (42 spp.)	Red-winged Blackbird	*Agelaius phoeniceus*	Both	1	6	X	X
	Wood Duck	*Aix sponsa*	Run		2		
	Anhinga	*Anhinga anhinga*	Both	4	4	X	X
	Great Egret	*Ardea alba*	Run	3	X		
	Great Blue Heron	*Ardea herodias*	Run		3		
	Tufted Titmouse	*Baeolophus bicolor*	Run			X	
	Cedar Waxwing	*Bombycilla cedrorum*	Pool				X
	Red-shouldered Hawk	*Buteo lineatus*	Run	1	1		
	Green Heron	*Butorides virescens*	Pool	X	1	X	
	Northern Cardinal	*Cardinalis cardinalis*	Pool				X
	Chimney Swift	*Chaetura pelagica*	Both		X	X	
	American Black Vulture	*Coragyps atratus*	Pool			X	
	Fish Crow	*Corvus ossifragus*	Pool	X	3	X	
	Pileated Woodpecker	*Dryocopus pileatus*	Run			X	
	Gray Catbird	*Dumetella carolinensis*	Pool				X
	Little Blue Heron	*Egretta caerulea*	Run		1	X	
	Tricolored Heron	*Egretta tricolor*	Run	1	2	X	X
	American White Ibis	*Eudocimus albus*	Pool		X		
	American Coot	*Fulica americana*	Both	5	1	X	X
	Common Moorhen	*Gallinula chloropus*	Both	1	4	X	X
	Bald Eagle	*Haliaeetus leucocephalus*	Run		1		
	Barn Swallow	*Hirundo rustica*	Both	8	6	X	X
	Least Bittern	*Ixobrychus exilis*	Run	1		X	
	Belted Kingfisher	*Megaceryle alcyon*	Both		1		
	Red-bellied Woodpecker	*Melanerpes carolinus*	Pool				X
	Wild Turkey	*Meleagris gallopavo*	Pool[1]			X	
	Northern Mockingbird	*Mimus polyglottos*	Both		1	X	
	Great Crested Flycatcher	*Myiarchus crinitus*	Pool		1		
	Yellow-crowned Night Heron	*Nyctanassa violacea*	Run	2	X	X	
	Osprey	*Pandion haliaetus*	Both	1	3	X	X
	Northern Parula	*Parula americana*	Run	1	4		
	Indigo Bunting	*Passerina cyanea*	Pool[1]				X
	Double-crested Cormorant	*Phalacrocorax auritus*	Both	1	1	X	
	Pied-billed Grebe	*Podilymbus podiceps*	Pool		1	X	
	Carolina Chickadee	*Poecile carolinensis*	Run		1	X	

APPENDIX L

Wakulla Springs (Wakulla Co.) macrofauna observations made from April 13 to 16, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location***	**4/13/09**	**4/14/09**	**4/15/09**	**4/16/09**
Bird (cont.)	Sora Rail	*Porzana carolina*	Run	1	X	X	
	Prothonotary Warbler	*Protonotaria citrea*	Both	1		X	X
	Boat-tailed Grackle	*Quiscalus major*	Both		X	X	X
	Common Grackle	*Quiscalus quiscula*	Pool		10		
	Barred Owl	*Strix varia*	Run		X		
	Tree Swallow	*Tachycineta bicolor*	Run	15			
	Mourning Dove	*Zenaida macroura*	Pool			X	X
Mammal (2 spp.)	eastern gray squirrel	*Sciurus carolinensis*	Pool	X		2	
	Florida manatee	*Trichechus manatus latirostrus*	Both		2		X
Reptile (6 spp.)	American alligator	*Alligator mississippiensis*	Both	9	8	15	
	Carolina anole	*Anolis carolinensis*	Pool		X	X	X
	Barbour's map turtle	*Graptemys barbouri*	Pool		X		
	brown water snake	*Nerodia taxispilota*	Pool		2	2	
	Florida cooter	*Pseudemys floridana floridana*	Both	X	X	9	
	yellow-bellied slider	*Trachemys scripta*	Run			X	

* Location of observation, Run = spring run, Pool = spring pool, or Both.

[1] These birds observed near lodge on upland side.

APPENDIX L

Weeki Wachee Springs (Hernando Co.) macrofauna observations made from March 9 to 12, 2009.

				Counts			
Group	**Common Name**	**Scientific Name**	**Location***	**3/9/09**	**3/10/09**	**3/11/09**	**3/12/09**
Bird (26 spp.)	Wood Duck	*Aix sponsa*	Run	2	1		
	Mottled Duck	*Anas fulvigula*	Run	2	2	2	
	Limpkin	*Aramus guarauna*	Run				1
	Great Egret	*Ardea alba*	Pool		1		
	Great Blue Heron	*Ardea herodias*	Both	2	1	2	2
	Tufted Titmouse	*Baeolophus bicolor*	Run				2
	Red-shouldered Hawk	*Buteo lineatus*	Both	1			
	Green Heron	*Butorides virescens*	Run				1
	Muscovy Duck	*Cairina moschata*	Both			2	2
	Northern Cardinal	*Cardinalis cardinalis*	Run		1		1
	Killdeer	*Charadrius vociferus*	Pool	1			
	American Black Vulture	*Coragyps atratus*	Run			2	
	Yellow-rumped Warbler	*Dendroica coronata*	Run	1			2
	Gray Catbird	*Dumetella carolinensis*	Run	1			2
	Little Blue Heron	*Egretta caerulea*	Run	1	2		1
	Tricolored Heron	*Egretta tricolor*	Run		1		
	Sparrow	*Emberizidae*	Pool				5
	American White Ibis	*Eudocimus albus*	Both		2		1
	Bald Eagle	*Haliaeetus leucocephalus*	Run	2	2		
	Belted Kingfisher	*Megaceryle alcyon*	Run			1	1
	Red-bellied Woodpecker	*Melanerpes carolinus*	Both	1			
	Red-breasted Merganser	*Mergus serrator*	Run	1			
	Northern Mockingbird	*Mimus polyglottos*	Run		1		
	Northern parula	*Parula americana*	Run	2	2	1	
	Downy Woodpecker	*Picoides pubescens*	Run		1		
	Barred Owl	*Strix varia*	Run		1		
Mammal (1 spp.)	eastern gray squirrel	*Sciurus carolinensis*	Both	X	X	X	
Reptile (5 spp.)	brown anole	*Anolis sagrei*	Both	2	1		
	Florida softshell	*Apalone ferox*	Pool	6	3		
	Florida red-bellied turtle	*Pseudemys nelsoni*	Both	4	1		
	Florida cooter	*Pseudemys floridana floridana*	Both	9	11		
	common musk turtle	*Sternotherus odoratus*	Pool		2		

* Location of observation, Run = spring run, Pool = spring pool, or Both.

Appendix M

Human Use

APPENDIX M

De Leon Springs (Volusia Co.) counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			10/6/2008	10/7/2008	10/8/2008	10/9/2008	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	1.3	4.0	1.3	2.3	2.2	0.32	1.15
		Bathing	1.0	1.8	0.5	2.8	1.5	0.24	0.86
		Snorkeling	0.0	1.8	0.0	0.8	0.6	0.09	0.33
		Swimming	7.8	4.3	9.5	4.3	6.4	0.90	3.29
		SCUBA	1.8	0.5	0.0	4.8	1.8	0.30	1.10
	Out of Water	Sitting	14.5	1.8	7.0	18.3	10.4	1.66	6.28
		Walking	17.0	23.8	27.3	25.5	23.4	3.36	12.72
		Sunbathing	0.0	7.0	0.5	3.5	2.8	0.40	1.51
	In Water		11.8	12.3	11.3	14.8	12.5	1.85	6.72
	Out of Water		31.5	32.5	34.8	47.3	36.5	5.42	20.50
Spring Run	In Water	Canoeing	0.0	0.0	1.8	1.0	0.7	0.09	0.04
		Power-boating	0.8	0.8	0.0	0.0	0.4	0.05	0.02
		Fishing	0.5	0.8	1.3	0.0	0.6	0.08	0.03
	In Water		1.3	1.5	3.0	1.0	1.7	0.23	0.09
Entire Spring			44.5	46.3	49.0	63.0	50.7	7.50	27.31

Note(s):

Hours of Observations:	28.5	6.3	7.8	9.0	5.5
Spring Pool Wetted Area (ha):	0.2752				
Spring Pool Upland Area (ha):	0.2644				
Spring Run Area (ha):	2.5665				



APPENDIX M
Observational area for human use surveys made at De Leon Springs State Park defined by dashed line.

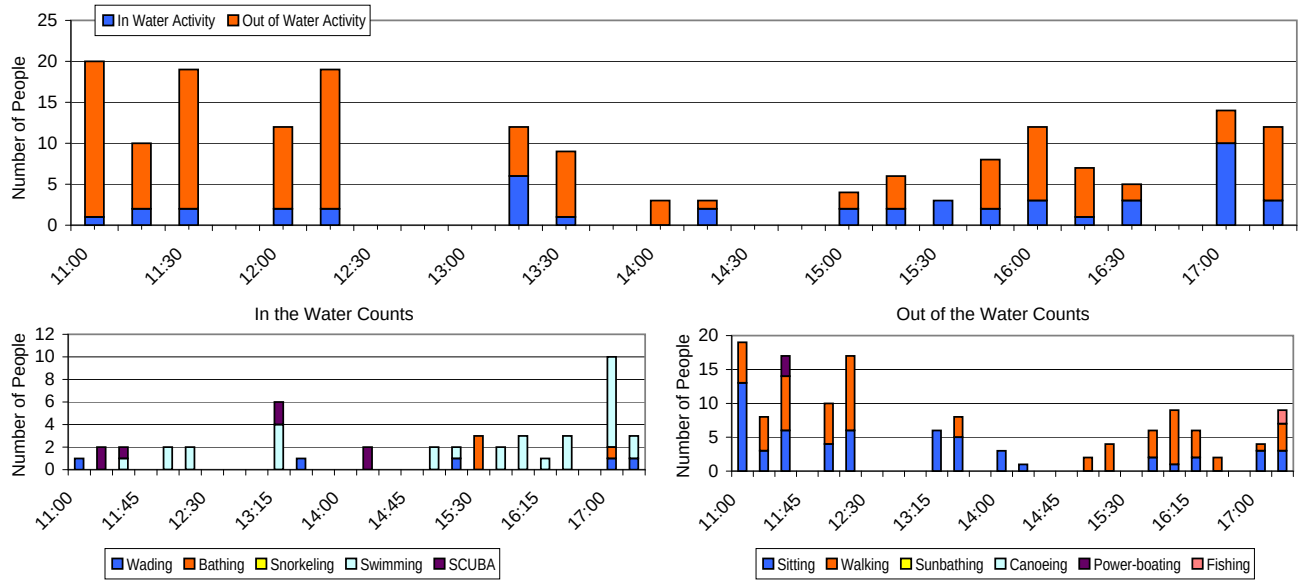
Human Use Actvity Summary

Site DeLeon Springs **Date** 10/6/2008 **Survey Period** 11:00 17:15

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
11:00	1					1	13	6					19
11:15					2	2	3	5					8
11:30				1	1	2	6	8			3		17
11:45						0							0
12:00				2		2	4	6					10
12:15				2		2	6	11					17
12:30						0							0
12:45						0							0
13:00						0							0
13:15				4	2	6	6						6
13:30	1					1	5	3					8
13:45						0							0
14:00						0	3						3
14:15					2	2	1						1
14:30						0							0
14:45						0							0
15:00				2		2		2					2
15:15	1			1		2		4					4
15:30		3				3							0
15:45				2		2	2	4					6
16:00				3		3	1	8					9
16:15				1		1	2	4					6
16:30				3		3		2					2
16:45						0							0
17:00	1	1		8		10	3	1					4
17:15	1			2		3	3	4				2	9
Person-Hrs	1.25	1.00	0.00	7.75	1.75	11.75	14.50	17.00	0.00	0.00	0.75	0.50	32.75
Percentage	10.6%	8.5%	0.0%	66.0%	14.9%	100.0%	44.3%	51.9%	0.0%	0.0%	2.3%	1.5%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Mostly sunny day.
Observational counts were made of people engaging in various activities in the swimming/spring run area De Leon Springs State Park. The swimming area is the concrete bordered spring pool. The surrounding area under observation included the sidewalk, platforms, and seating benches around the swim area, the area from the restuarant to the museum, and the spring run.

Average Time Interval (hrs): 0.25



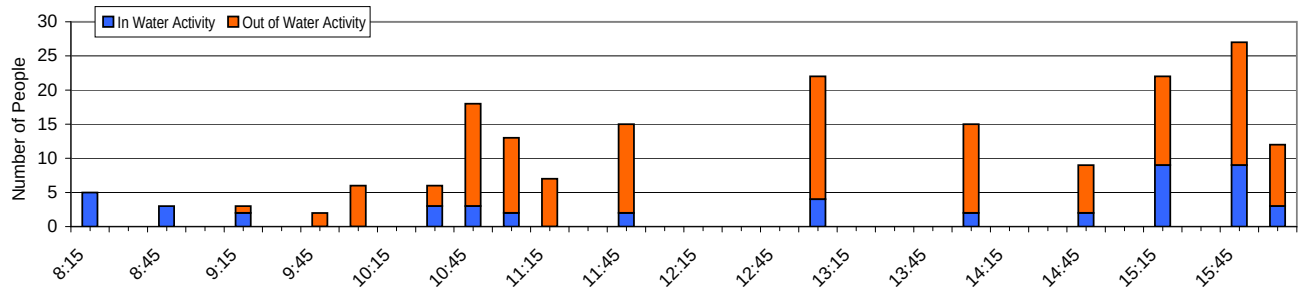
Human Use Actvity Summary

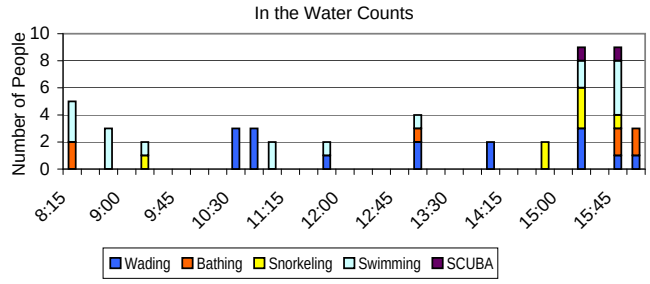
Site DeLeon Springs **Date** 10/7/2008 **Survey Period** 8:15 16:00

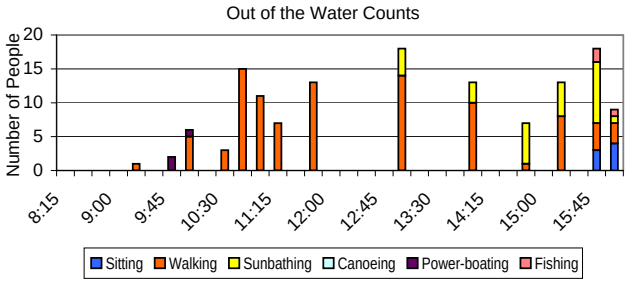
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:15		2		3		5							0
8:30						0							0
8:45				3		3							0
9:00						0							0
9:15			1	1		2		1					1
9:30						0							0
9:45						0					2		2
10:00						0		5			1		6
10:15						0							0
10:30	3					3		3					3
10:45	3					3		15					15
11:00				2		2		11					11
11:15						0		7					7
11:30						0							0
11:45	1			1		2		13					13
12:00						0							0
12:15						0							0
12:30						0							0
12:45						0							0
13:00	2	1		1		4		14	4				18
13:15						0							0
13:30						0							0
13:45						0							0
14:00	2					2		10	3				13
14:15						0							0
14:30						0							0
14:45			2			2		1	6				7
15:00						0							0
15:15	3		3	2	1	9		8	5				13
15:30						0							0
15:45	1	2	1	4	1	9	3	4	9			2	18
16:00	1	2				3	4	3	1			1	9
Person-Hrs	4.00	1.75	1.75	4.25	0.50	12.25	1.75	23.75	7.00	0.00	0.75	0.75	34.00
Percentage	32.7%	14.3%	14.3%	34.7%	4.1%	100.0%	5.1%	69.9%	20.6%	0.0%	2.2%	2.2%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Mostly cloudy day.
Observational counts were made of people engaging in various activities in the swimming/spring run area De Leon Springs State Park. The swimming area is the concrete bordered spring pool. The surrounding area under observation included the sidewalk, platforms, and seating benches around the swim area, the area from the restuarant to the museum, and the spring run.

Average Time Interval (hrs): 0.25







Human Use Actvity Summary

Site DeLeon Springs **Date** 10/8/2008 **Survey Period** 8:00 17:00

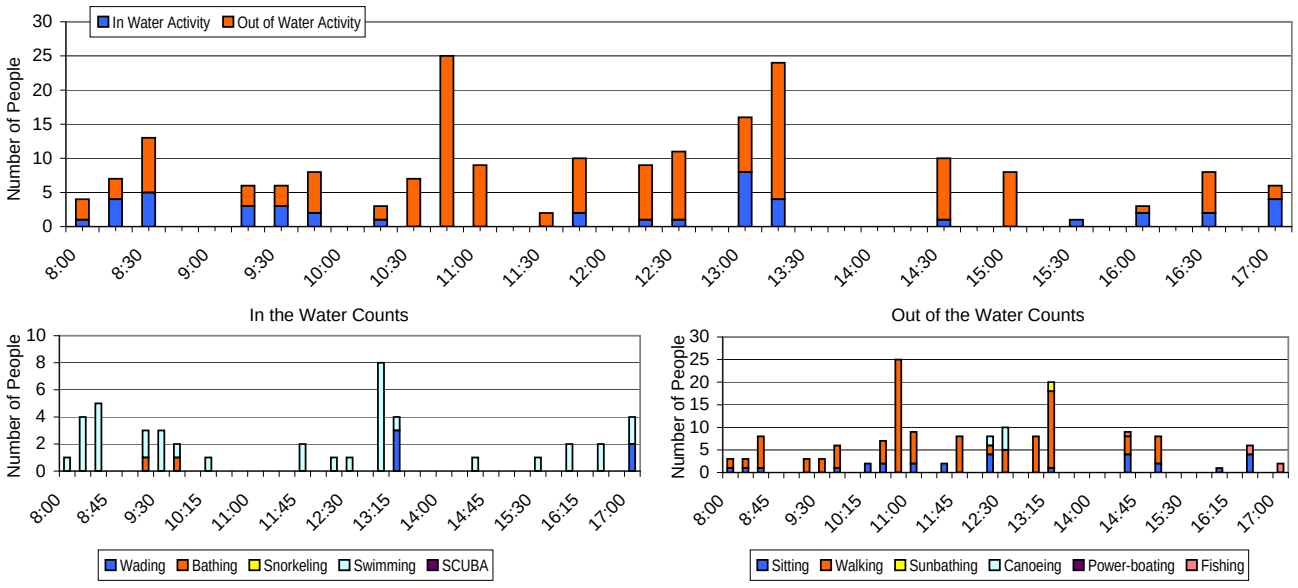
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00				1		1	1	2					3
8:15				4		4	1	2					3
8:30				5		5	1	7					8
8:45						0							0
9:00						0							0
9:15		1		2		3		3					3
9:30				3		3		3					3
9:45		1		1		2	1	5					6
10:00						0							0
10:15				1		1	2						2
10:30						0	2	5					7
10:45						0		25					25
11:00						0	2	7					9
11:15						0							0
11:30						0	2						2
11:45				2		2		8					8
12:00						0							0
12:15				1		1	4	2		2			8
12:30				1		1		5		5			10
12:45						0							0
13:00				8		8		8					8
13:15	3			1		4	1	17	2				20
13:30						0							0
13:45						0							0
14:00						0							0
14:15						0							0
14:30				1		1	4	4				1	9
14:45						0							0
15:00						0	2	6					8
15:15						0							0
15:30				1		1							0
15:45						0							0
16:00				2		2	1						1
16:15						0							0
16:30				2		2	4					2	6
16:45						0							0
17:00	2			2		4						2	2
Person-Hrs	1.25	0.50	0.00	9.50	0.00	11.25	7.00	27.25	0.50	1.75	0.00	1.25	37.75
Percentage	11.1%	4.4%	0.0%	84.4%	0.0%	100.0%	18.5%	72.2%	1.3%	4.6%	0.0%	3.3%	100.0%

Note(s):

"Wading" is waist deep, "Bathing" is chest deep. Overcast and drizzly day. Started raining at 11:00 to 11:20; 12:10 to 12:40; and 15:30 to 16:10.

Observational counts were made of people engaging in various activities in the swimming/spring run area De Leon Springs State Park. The swimming area is the concrete bordered spring pool. The surrounding area under observation included the sidewalk, platforms, and seating benches around the swim area, the area from the restuarant to the museum, and the spring run.

Average Time Interval (hrs): 0.25



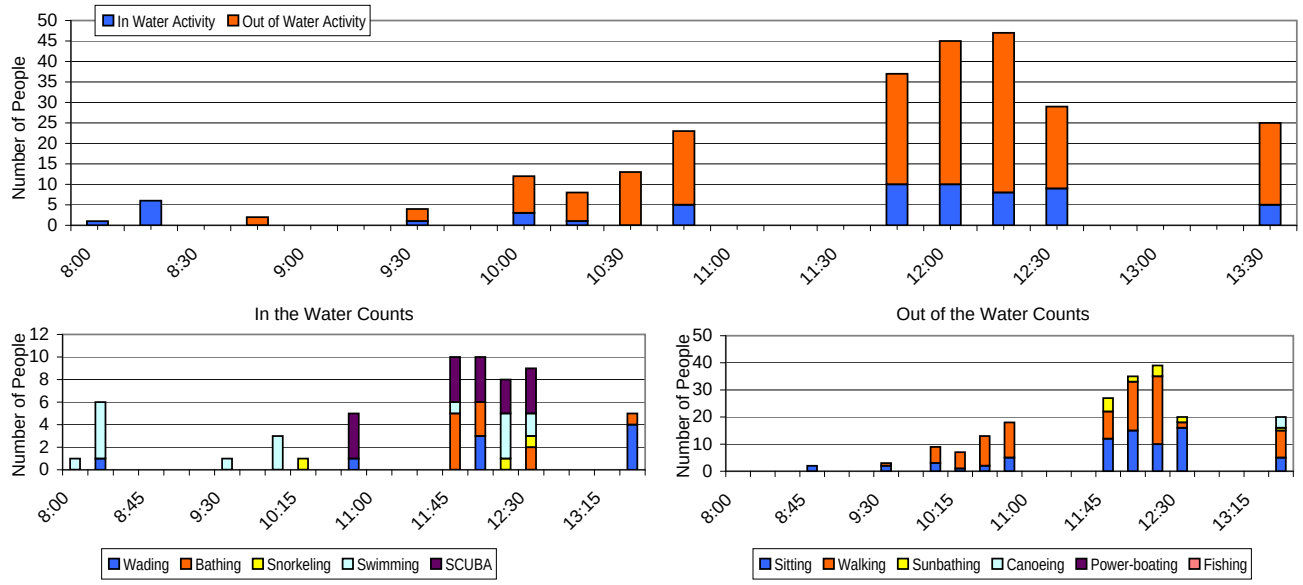
Human Use Actvity Summary

Site DeLeon Springs **Date** 10/9/2008 **Survey Period** 8:00 13:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Canoeing**	**Power-boating**	**Fishing**	**Total**
8:00				1		1							0
8:15	1			5		6							0
8:30						0							0
8:45						0	2						2
9:00						0							0
9:15						0							0
9:30				1		1	2	1					3
9:45						0							0
10:00				3		3	3	6					9
10:15			1			1	1	6					7
10:30						0	2	11					13
10:45	1				4	5	5	13					18
11:00						0							0
11:15						0							0
11:30						0							0
11:45		5		1	4	10	12	10	5				27
12:00	3	3			4	10	15	18	2				35
12:15			1	4	3	8	10	25	4				39
12:30		2	1	2	4	9	16	2	2				20
12:45						0							0
13:00						0							0
13:15						0							0
13:30	4	1				5	5	10	1	4			20
Person-Hrs	2.25	2.75	0.75	4.25	4.75	14.75	18.25	25.50	3.50	1.00	0.00	0.00	48.25
Percentage	15.3%	18.6%	5.1%	28.8%	32.2%	100.0%	37.8%	52.8%	7.3%	2.1%	0.0%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Sunny day.
Observational counts were made of people engaging in various activities in the swimming/spring run area De Leon Springs State Park. The swimming area is the concrete bordered spring pool. The surrounding area under observation included the sidewalk, platforms, and seating benches around the swim area, the area from the restuarant to the museum, and the spring run.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary - Period of Record Average

Site DeLeon Springs **Date** 10/6/2009 - 10/9/2008 **Survey Period** 8:00 18:00

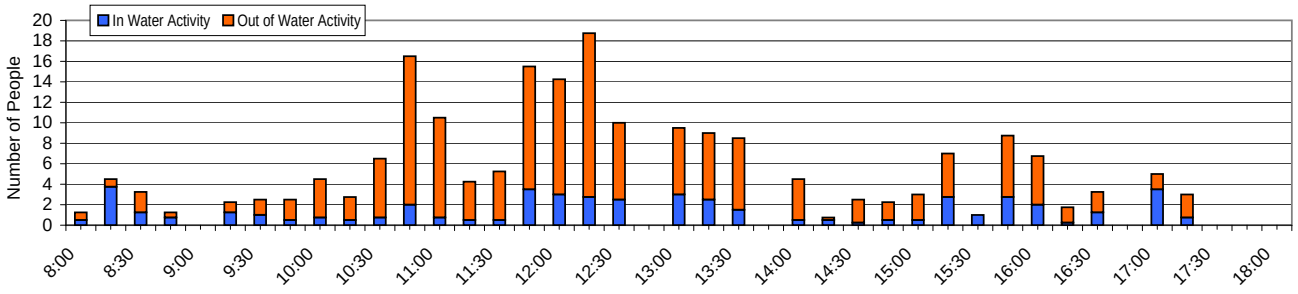
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00	0	0	0	1	0	1	0	1	0	0	0	0	1
8:15	0	1	0	3	0	4	0	1	0	0	0	0	1
8:30	0	0	0	1	0	1	0	2	0	0	0	0	2
8:45	0	0	0	1	0	1	1	0	0	0	0	0	1
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	1	0	1	0	1	0	0	0	0	1
9:30	0	0	0	1	0	1	1	1	0	0	0	0	2
9:45	0	0	0	0	0	1	0	1	0	0	1	0	2
10:00	0	0	0	1	0	1	1	3	0	0	0	0	4
10:15	0	0	0	0	0	1	1	2	0	0	0	0	2
10:30	1	0	0	0	0	1	1	5	0	0	0	0	6
10:45	1	0	0	0	1	2	1	13	0	0	0	0	15
11:00	0	0	0	1	0	1	4	6	0	0	0	0	10
11:15	0	0	0	0	1	1	1	3	0	0	0	0	4
11:30	0	0	0	0	0	1	2	2	0	0	1	0	5
11:45	0	1	0	1	1	4	3	8	1	0	0	0	12
12:00	1	1	0	1	1	3	5	6	1	0	0	0	11
12:15	0	0	0	2	1	3	5	10	1	1	0	0	16
12:30	0	1	0	1	1	3	4	2	1	1	0	0	8
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	1	0	0	2	0	3	0	6	1	0	0	0	7
13:15	1	0	0	1	1	3	2	4	1	0	0	0	7
13:30	1	0	0	0	0	2	3	3	0	1	0	0	7
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	1	0	0	0	0	1	1	3	1	0	0	0	4
14:15	0	0	0	0	1	1	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	1	1	0	0	0	0	2
14:45	0	0	1	0	0	1	0	0	2	0	0	0	2
15:00	0	0	0	1	0	1	1	2	0	0	0	0	3
15:15	1	0	1	1	0	3	0	3	1	0	0	0	4
15:30	0	1	0	0	0	1	0	0	0	0	0	0	0
15:45	0	1	0	2	0	3	1	2	2	0	0	1	6
16:00	0	1	0	1	0	2	2	3	0	0	0	0	5
16:15	0	0	0	0	0	0	1	1	0	0	0	0	2
16:30	0	0	0	1	0	1	1	1	0	0	0	1	2
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	1	0	0	3	0	4	1	0	0	0	0	1	2
17:15	0	0	0	1	0	1	1	1	0	0	0	1	2
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Person-Hrs	2.19	1.50	0.63	6.44	1.75	12.50	10.38	23.38	2.75	0.69	0.38	0.63	38.19
Percentage	17.5%	12.0%	5.0%	51.5%	14.0%	100.0%	27.2%	61.2%	7.2%	1.8%	1.0%	1.6%	100.0%

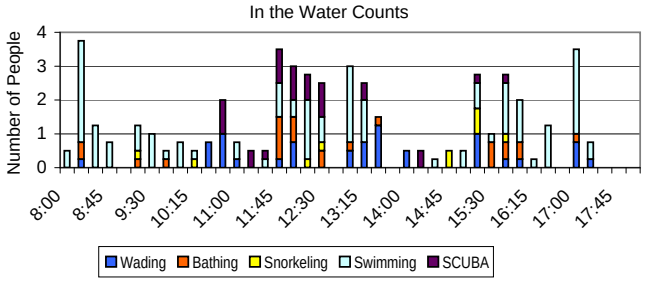
Note(s):

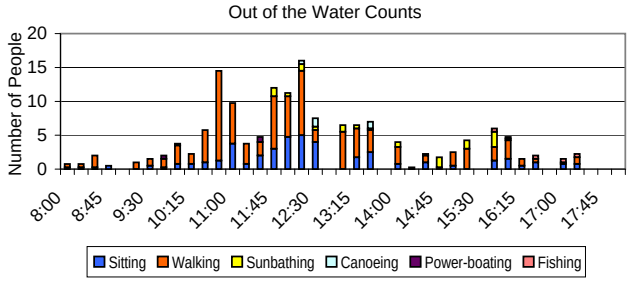
"Wading" is waist deep, "Bathing" is chest deep.

Observational counts were made of people engaging in various activities in the swimming/spring run area De Leon Springs State Park. The swimming area is the concrete bordered spring pool. The surrounding area under observation included the sidewalk, platforms, and seating benches around the swim area, the area from the restuarant to the museum, and the spring run.

Average Time Interval (hrs): 0.25







APPENDIX M

Homosassa Springs (Citrus Co.) counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			11/3/2008	11/4/2008	11/5/2008	11/6/2008	Person-Hrs	# People	People/ha
Spring Pool	In Water	Wading	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Bathing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Snorkeling	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Swimming	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		SCUBA	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Out of Water	Viewing*	111.5	118.0	94.0	136.5	115.0	11.50	1.69
	In Water		0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Out of Water		111.5	118.0	94.0	136.5	115.0	11.50	1.69
Spring Run	In Water	Canoeing	0.0	0.5	0.0	0.0	0.1	0.01	0.02
		Power-boating	1.5	3.0	2.0	1.0	1.9	0.19	0.30
		Fishing	0.5	0.0	0.0	0.5	0.3	0.03	0.04
	In Water		2.0	3.5	2.0	1.5	2.3	0.23	0.36
Entire Spring			113.5	121.5	96.0	138.0	117.3	11.73	2.05

Note(s):

Hours of Observations:	40.0	10.0	10.0	10.0	10.0
Spring Pool Wetted Area (m^2):	0.5068				
Park Upland Area (m^2):	6.7859				
Spring Run Area (m^2):	0.6251				

* Counts from FDEP park entry numbers



APPENDIX M
Observational areas of human use at Homosassa Springs State Park defined by dashed line.

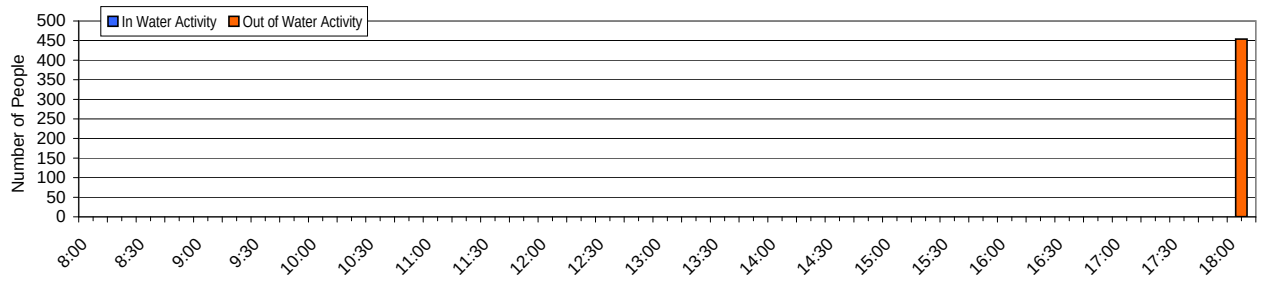
Human Use Actvity Summary

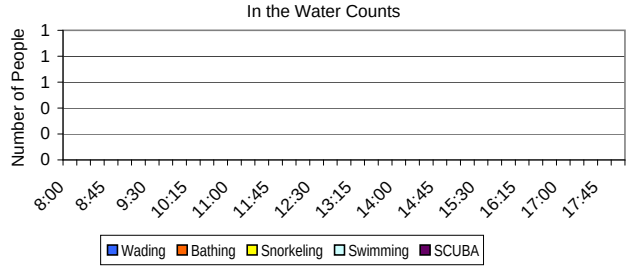
Site Homosassa Springs **Date** 11/3/2008 **Survey Period** 8:00 18:00

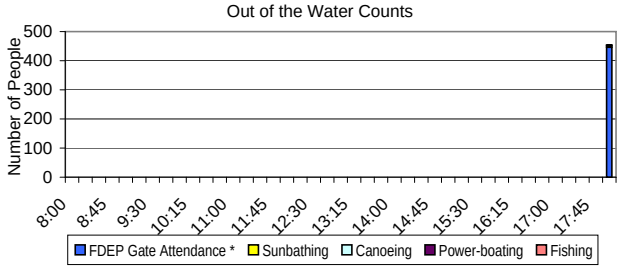
	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0						0
8:15						0						0
8:30						0						0
8:45						0						0
9:00						0						0
9:15						0						0
9:30						0						0
9:45						0						0
10:00						0						0
10:15						0						0
10:30						0						0
10:45						0						0
11:00						0						0
11:15						0						0
11:30						0						0
11:45						0						0
12:00						0						0
12:15						0						0
12:30						0						0
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45						0						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
17:15						0						0
17:30						0						0
17:45						0						0
18:00						0	446			6	2	454
Total	0	0	0	0	0	0	446	0	0	6	2	454
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	111.50	0.00	0.00	1.50	0.50	113.50
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	98.2%	0.0%	0.0%	1.3%	0.4%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep.
FDEP gate attendance records for the spring pool/run area of Homosassa Springs State Park. There is no swimming in the spring pool. The area under observation included the sidewalks, seating platforms, and seating benches around the pool/run area, as well as the spring run.

Average Time Interval (hrs): 0.25







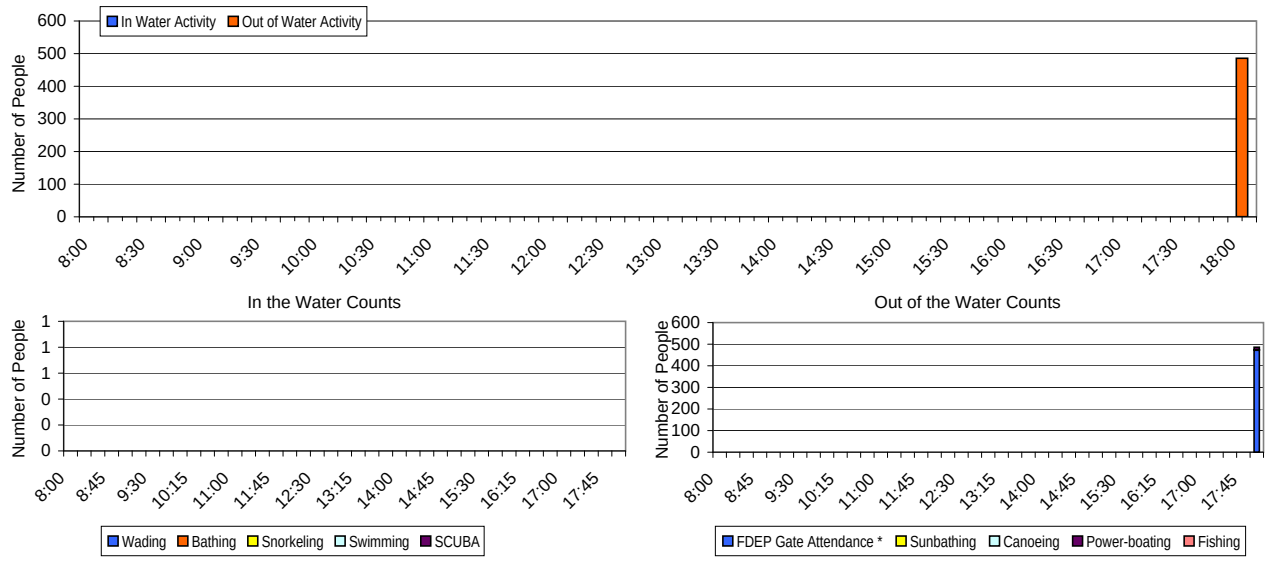
Human Use Actvity Summary

Site Homosassa Springs **Date** 11/4/2008 **Survey Period** 8:00 18:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0						0
8:15						0						0
8:30						0						0
8:45						0						0
9:00						0						0
9:15						0						0
9:30						0						0
9:45						0						0
10:00						0						0
10:15						0						0
10:30						0						0
10:45						0						0
11:00						0						0
11:15						0						0
11:30						0						0
11:45						0						0
12:00						0						0
12:15						0						0
12:30						0						0
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45						0						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
17:15						0						0
17:30						0						0
17:45						0						0
18:00						0	472		2	12		486
Total	0	0	0	0	0	0	472	0	2	12	0	486
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	118.00	0.00	0.50	3.00	0.00	121.50
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	97.1%	0.0%	0.4%	2.5%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep.
FDEP gate attendance records for the spring pool/run area of Homosassa Springs State Park. There is no swimming in the spring pool. The area under observation included the sidewalks, seating platforms, and seating benches around the pool/run area, as well as the spring run.

Average Time Interval (hrs): 0.25



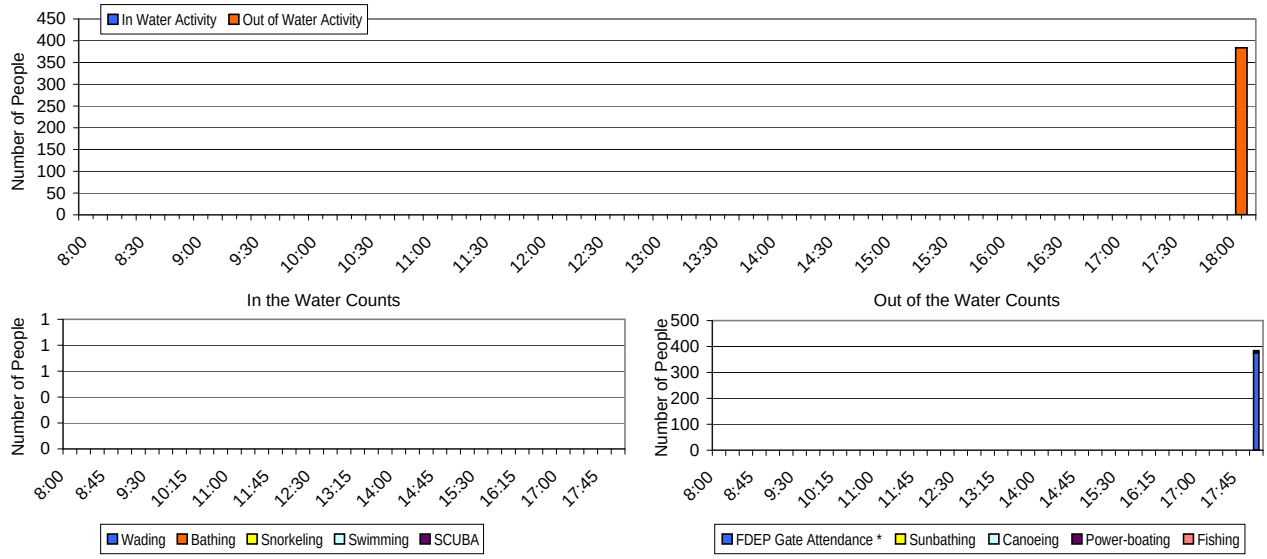
Human Use Actvity Summary

Site Homosassa Springs **Date** 11/5/2008 **Survey Period** 8:00 18:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0						0
8:15						0						0
8:30						0						0
8:45						0						0
9:00						0						0
9:15						0						0
9:30						0						0
9:45						0						0
10:00						0						0
10:15						0						0
10:30						0						0
10:45						0						0
11:00						0						0
11:15						0						0
11:30						0						0
11:45						0						0
12:00						0						0
12:15						0						0
12:30						0						0
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45						0						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
17:15						0						0
17:30						0						0
17:45						0						0
18:00						0	376			8		384
Total	0	0	0	0	0	0	376	0	0	8	0	384
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	94.00	0.00	0.00	2.00	0.00	96.00
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	97.9%	0.0%	0.0%	2.1%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep.
FDEP gate attendance records for the spring pool/run area of Homosassa Springs State Park. There is no swimming in the spring pool. The area under observation included the sidewalks, seating platforms, and seating benches around the pool/run area, as well as the spring run.

Average Time Interval (hrs): 0.25



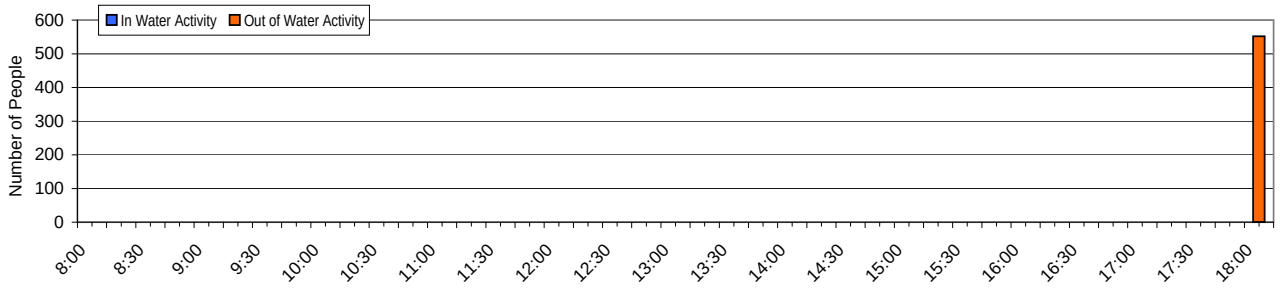
Human Use Actvity Summary

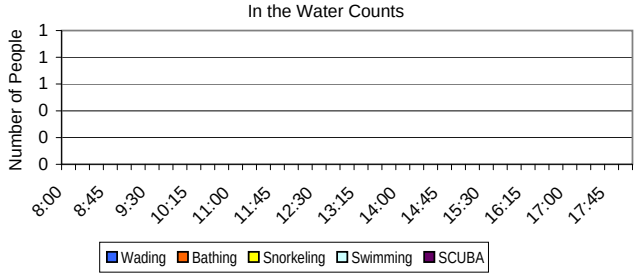
Site Homosassa Springs **Date** 11/6/2008 **Survey Period** 8:00 18:00

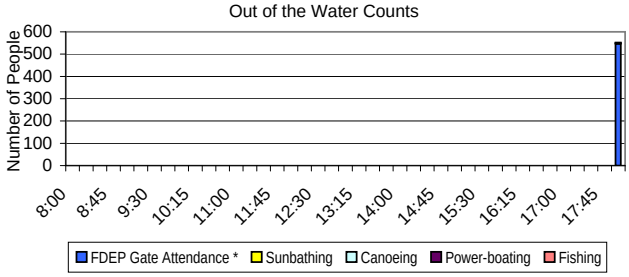
	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0						0
8:15						0						0
8:30						0						0
8:45						0						0
9:00						0						0
9:15						0						0
9:30						0						0
9:45						0						0
10:00						0						0
10:15						0						0
10:30						0						0
10:45						0						0
11:00						0						0
11:15						0						0
11:30						0						0
11:45						0						0
12:00						0						0
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14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45						0						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
17:15						0						0
17:30						0						0
17:45						0						0
18:00						0	546			4	2	552
Total	0	0	0	0	0	0	546	0	0	4	2	552
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	136.50	0.00	0.00	1.00	0.50	138.00
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	98.9%	0.0%	0.0%	0.7%	0.4%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep.
FDEP gate attendance records for the spring pool/run area of Homosassa Springs State Park. There is no swimming in the spring pool. The area under observation included the sidewalks, seating platforms, and seating benches around the pool/run area, as well as the spring run.

Average Time Interval (hrs): 0.25







Human Use Actvity Summary - Period of Record Average

Site Homosassa Springs **Date** 11/3/2008 - 11/6/2008 **Survey Period** 8:00 18:00

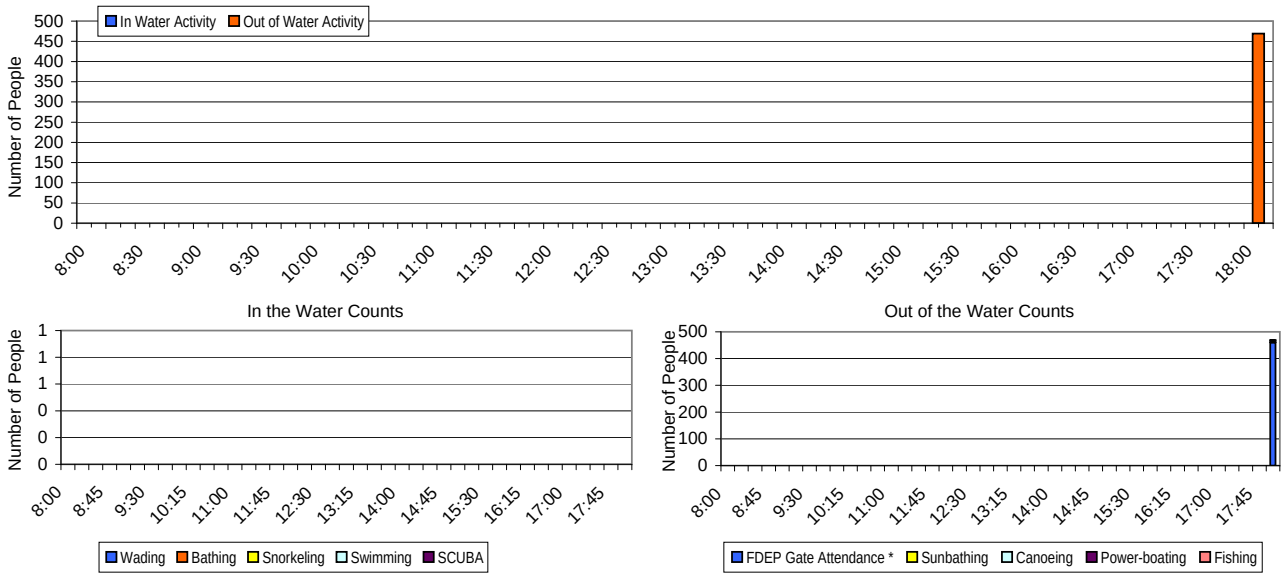
	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0
9:00	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	0	0	0	0	0	0	0	0	0
9:30	0	0	0	0	0	0	0	0	0	0	0	0
9:45	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	460	0	1	8	1	469
Total	0	0	0	0	0	0	460	0	1	8	1	469
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	115.00	0.00	0.13	1.88	0.25	117.25
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	98.1%	0.0%	0.1%	1.6%	0.2%	100.0%

Note(s):

"Wading" is waist deep, "Bathing" is chest deep.

Observational counts were made of people engaging in various activities in the swimming/spring run area De Leon Springs State Park. The swimming area is the concrete bordered spring pool. The surrounding area under observation included the sidewalk, platforms, and seating benches around the swim area, the area from the restuarant to the museum, and the spring run.

Average Time Interval (hrs): 0.25



APPENDIX M

Ichetucknee Springs counts of human use by location, activity, category, and date.

		Person-Hrs					Average		Average Person-Hrs		Average # People	
		Final Take-out Point (US 27)	Midpoint Dock	Main Pool	Upstream Tube Launch Dock	Spring Run						
Category	Activity	7/6/2009	7/7/2009	7/9/2009	7/9/2009	7/14/2009	Person-Hrs	# People	Pool	Run	Pool	Run
In Water	Wading	0.0	0.0	12.0	0.0	0.0	2.4	0.51	12.0	0.0	2.5	0.0
	Tubing	44.0	66.8	0.0	18.5	88.8	43.6	6.78	0.0	54.5	0.0	8.5
	Bathing	0.0	0.0	12.0	0.0	0.0	2.4	0.51	12.0	0.0	2.5	0.0
	Snorkeling	0.3	3.5	5.5	0.0	0.3	1.9	0.35	5.5	1.0	1.2	0.1
	Swimming	0.0	3.5	0.0	0.0	3.3	1.4	0.22	0.0	1.7	0.0	0.3
	SCUBA	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0
Out of Water	Sitting / Walking	0.5	1.5	20.3	1.0	0.3	4.7	0.95	20.3	0.8	4.3	0.1
	Sunbathing	0.0	0.0	0.5	0.0	0.0	0.1	0.02	0.5	0.0	0.1	0.0
	Canoe / Kayak	2.3	1.5	0.0	0.0	0.8	0.9	0.12	0.0	1.1	0.0	0.2
	Tubers	29.8	0.0	0.0	0.0	1.5	6.3	0.72	0.0	7.8	0.0	0.9
	Observing	0.0	0.0	0.0	0.3	0.0	0.1	0.01	0.0	0.1	0.0	0.0
	Other	1.8	0.0	0.0	0.0	0.0	0.4	0.04	0.0	0.4	0.0	0.0
In Water		44.3	73.8	29.5	18.5	92.3	52	8.36	29.5	57.2	6.2	8.9
Out of Water		34.3	3.0	20.8	1.3	2.5	12	1.86	20.8	10.3	4.4	1.2

Note(s):

Hours of Observations:	31.8	9.0	7.0	4.8	5.5	5.5

Human Use Actvity Summary

Site Ichetucknee Springs - Final Take-out Point (US 27) **Date** 7/6/2009 **Survey Period** 9:00 18:00

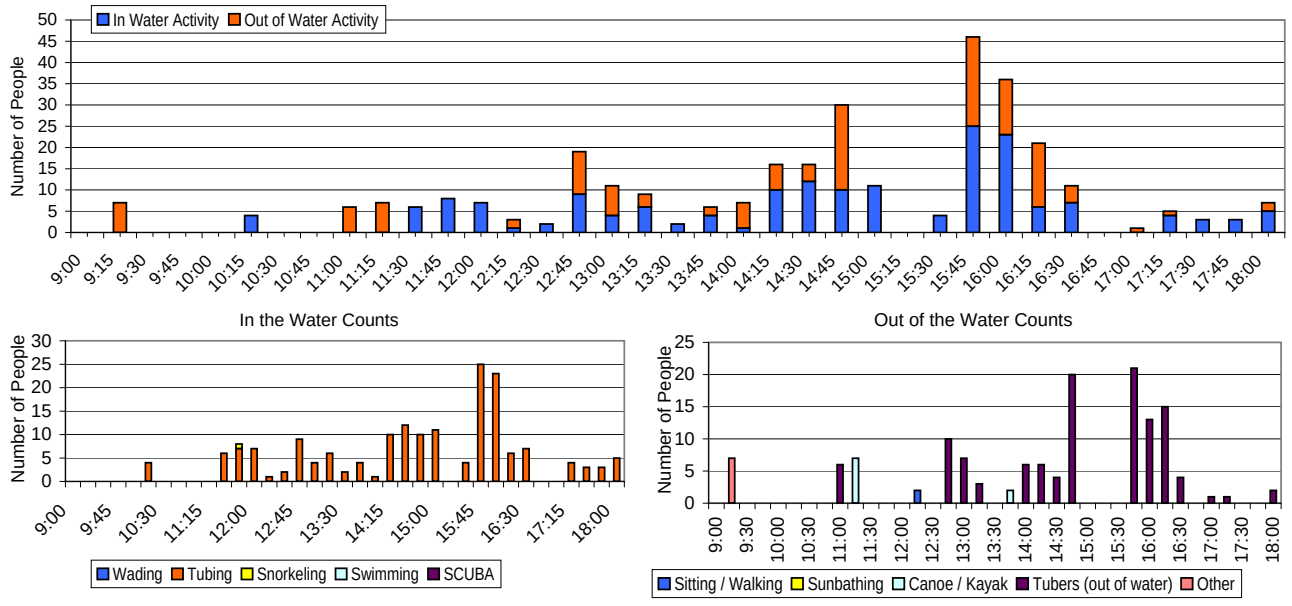
	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Tubing	Snorkeling	Swimming	SCUBA	Total	Sitting / Walking	Sunbathing	Canoe / Kayak	Tubers (out of water)	Other	Total
9:00						0						0
9:15						0					7	7
9:30						0						0
9:45						0						0
10:00						0						0
10:15		4				4						0
10:30						0						0
10:45						0						0
11:00						0				6		6
11:15						0			7			7
11:30		6				6						0
11:45		7	1			8						0
12:00		7				7						0
12:15		1				1	2					2
12:30		2				2						0
12:45		9				9				10		10
13:00		4				4				7		7
13:15		6				6				3		3
13:30		2				2						0
13:45		4				4			2			2
14:00		1				1				6		6
14:15		10				10				6		6
14:30		12				12				4		4
14:45		10				10				20		20
15:00		11				11						0
15:15						0						0
15:30		4				4						0
15:45		25				25				21		21
16:00		23				23				13		13
16:15		6				6				15		15
16:30		7				7				4		4
16:45						0						0
17:00						0				1		1
17:15		4				4				1		1
17:30		3				3						0
17:45		3				3						0
18:00		5				5				2		2
Person-Hrs	0.00	44.00	0.25	0.00	0.00	44.25	0.50	0.00	2.25	29.75	1.75	34.25
Percentage	0.0%	99.4%	0.6%	0.0%	0.0%	100.0%	1.5%	0.0%	6.6%	86.9%	5.1%	100.0%

Note(s):

Others - 7 state workers cleaning the dock

Observational counts were made of people engaging in various activities at the Final Take-out and immediate surrounding area of the Itchetucknee Springs State Park. The area under observation consisted of the exit ramp and the grassy and paved areas at the edge of the river and immediately adjacent to exit ramp. In water activities are recorded as the activity visitors were engaged in prior to exit, since the observation area was a take-out location.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

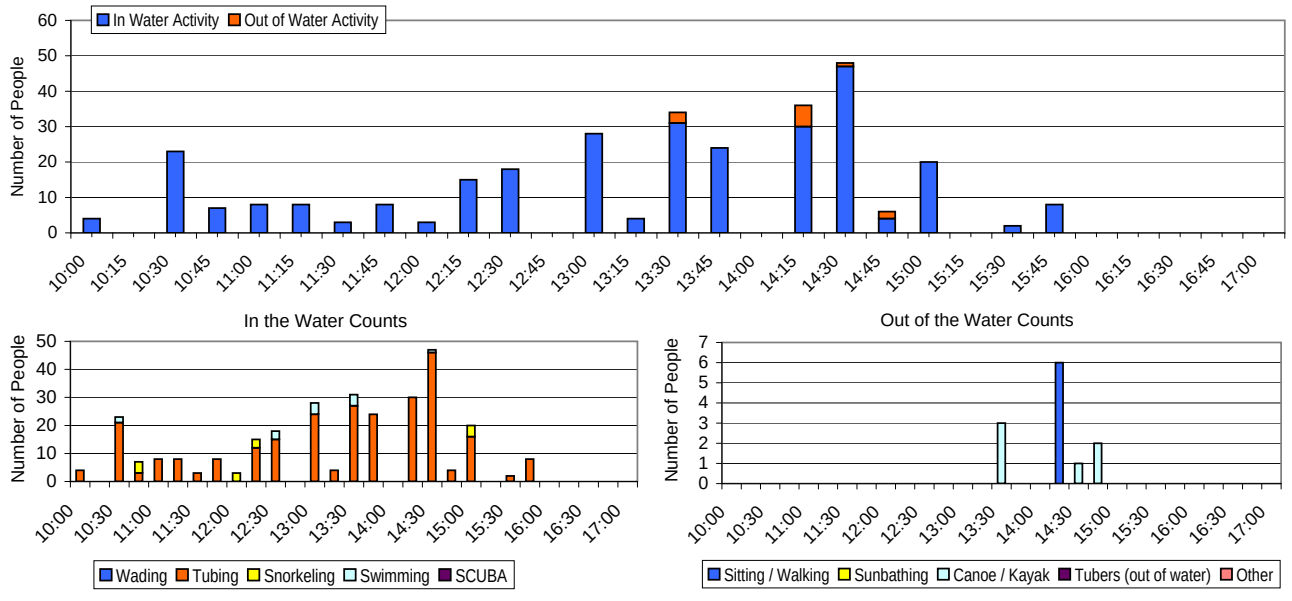
Site Ichetucknee Springs - Midpoint Dock **Date** 7/7/2009 **Survey Period** 10:00 17:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Tubing	Snorkeling	Swimming	SCUBA	Total	Sitting / Walking	Sunbathing	Canoe / Kayak	Tubers (out of water)	Other	Total
10:00		4				4						0
10:15						0						0
10:30		21		2		23						0
10:45		3	4			7						0
11:00		8				8						0
11:15		8				8						0
11:30		3				3						0
11:45		8				8						0
12:00			3			3						0
12:15		12	3			15						0
12:30		15		3		18						0
12:45						0						0
13:00		24		4		28						0
13:15		4				4						0
13:30		27		4		31			3			3
13:45		24				24						0
14:00						0						0
14:15		30				30	6					6
14:30		46		1		47			1			1
14:45		4				4			2			2
15:00		16	4			20						0
15:15						0						0
15:30		2				2						0
15:45		8				8						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
Person-Hrs	0.00	66.75	3.50	3.50	0.00	73.75	1.50	0.00	1.50	0.00	0.00	3.00
Percentage	0.0%	90.5%	4.7%	4.7%	0.0%	100.0%	50.0%	0.0%	50.0%	0.0%	0.0%	100.0%

Note(s):

Observational counts were made of people engaging in various activities around the Midpoint Launch-Off dock of the Itchetucknee Springs State Park. The area under observation consisted of the entry ramp and the portion of the the river immediately adjacent to the dock and within sight. Persons were counted when they entered and exited the water to/from the dock, and recorded based on their activity. Persons were also counted as they floated past the dock and recorded according to the activity in which they were engaged. The data provide total numbers of people observed within a particular 15 minute time span. This methodology differs from the typical 15 minute snapshot used during other human use surveys.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

Site Ichetucknee Springs - Main Boil **Date** 7/9/2009 **Survey Period** 11:00 15:45

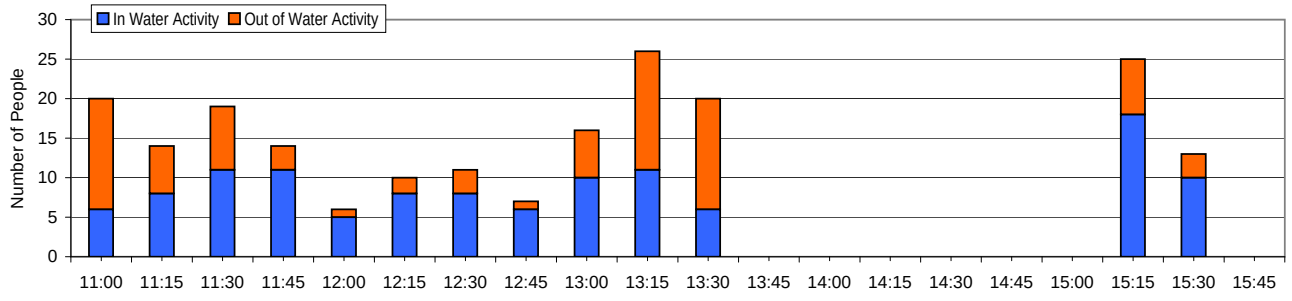
	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting / Walking	Sunbathing	Canoe / Kayak	Tubers (out of water)	Other	Total
11:00	4	1	1			6	14					14
11:15	4	3	1			8	6					6
11:30	2	6	3			11	7	1				8
11:45	4	5	2			11	2	1				3
12:00	1	3	1			5	1					1
12:15	6		2			8	2					2
12:30	1	7				8	3					3
12:45	2	2	2			6	1					1
13:00	4	2	4			10	6					6
13:15	8	2	1			11	15					15
13:30	4	1	1			6	14					14
13:45						0						0
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15	5	13				18	7					7
15:30	3	3	4			10	3					3
15:45						0						0
Person-Hrs	12.00	12.00	5.50	0.00	0.00	29.50	20.25	0.50	0.00	0.00	0.00	20.75
Percentage	40.7%	40.7%	18.6%	0.0%	0.0%	100.0%	97.6%	2.4%	0.0%	0.0%	0.0%	100.0%

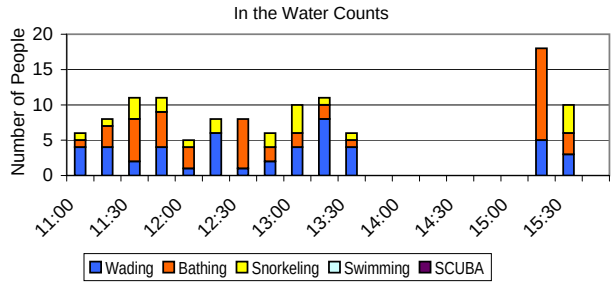
Note(s):

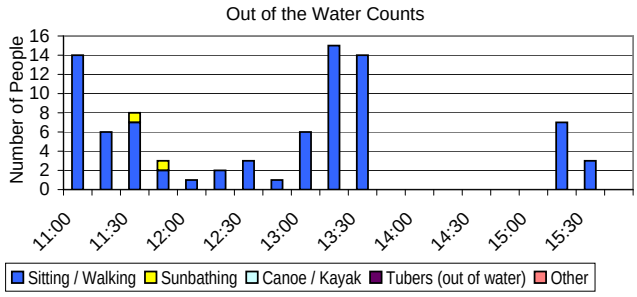
"Wading" is waist deep, "Bathing" is chest deep. Rain event lasted from 14:00 to 15:30.

Observational counts were made of people engaging in various activities around the Main Boil Swim Area of the Itchetucknee Springs State Park. The area under observation consisted of the surrounding concrete resting area and the adjacent pool.

Average Time Interval (hrs): 0.25







Human Use Actvity Summary

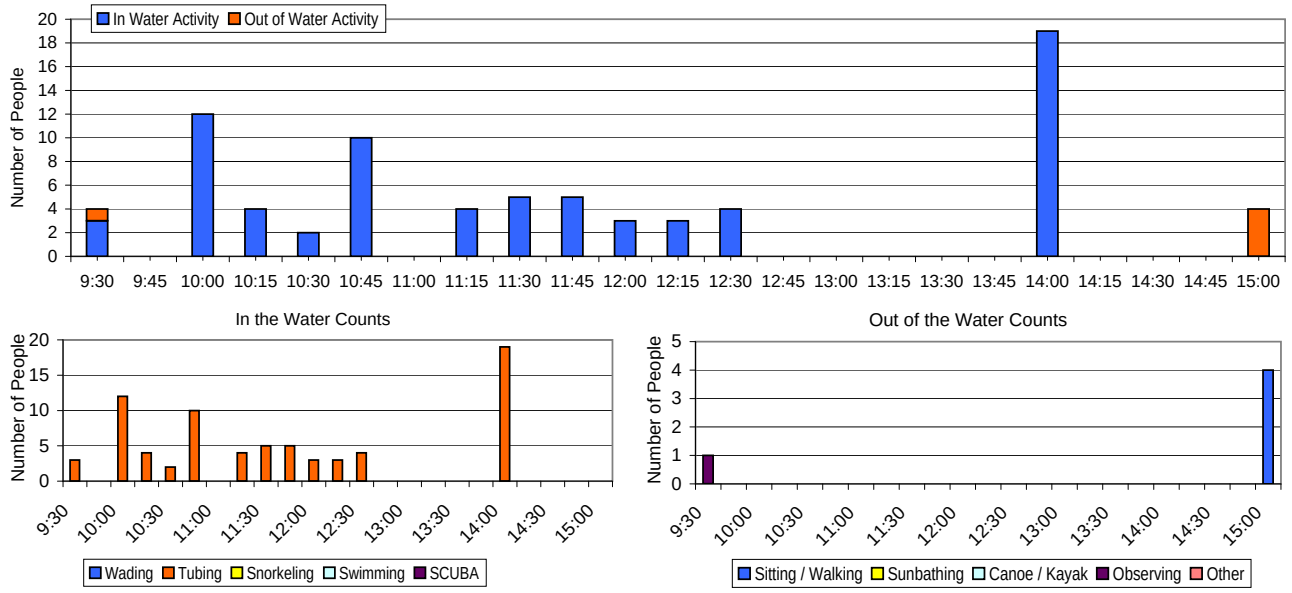
Site Ichetucknee Springs - Upstream Tube Launch Dock **Date** 7/9/2009 **Survey Period** 9:30 15:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Tubing	Snorkeling	Swimming	SCUBA	Total	Sitting / Walking	Sunbathing	Canoe / Kayak	Observing	Other	Total
9:30		3				3				1		1
9:45						0						0
10:00		12				12						0
10:15		4				4						0
10:30		2				2						0
10:45		10				10						0
11:00						0						0
11:15		4				4						0
11:30		5				5						0
11:45		5				5						0
12:00		3				3						0
12:15		3				3						0
12:30		4				4						0
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00		19				19						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0	4					4
Person-Hrs	0.00	18.50	0.00	0.00	0.00	18.50	1.00	0.00	0.00	0.25	0.00	1.25
Percentage	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	80.0%	0.0%	0.0%	20.0%	0.0%	100.0%

Note(s): Entry gate to dock was locked at 15:12, eliminating access to patrons.

Observational counts were made of people engaging in various activities around the Upstream tube launch dock of the Itchetucknee Springs State Park. The area under observation consisted of the entry ramp and the portion of the the spring run immediately adjacent to the dock and within sight. Persons were counted when they entered the water from the dock, and recorded based on their activity . The 15 Minute snapshots provide total numbers of people seen within one minute of each time span (10:15, 10:30, etc.).There are no counts for visitors exiting the river, as this observation location was not a designated take-out point.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

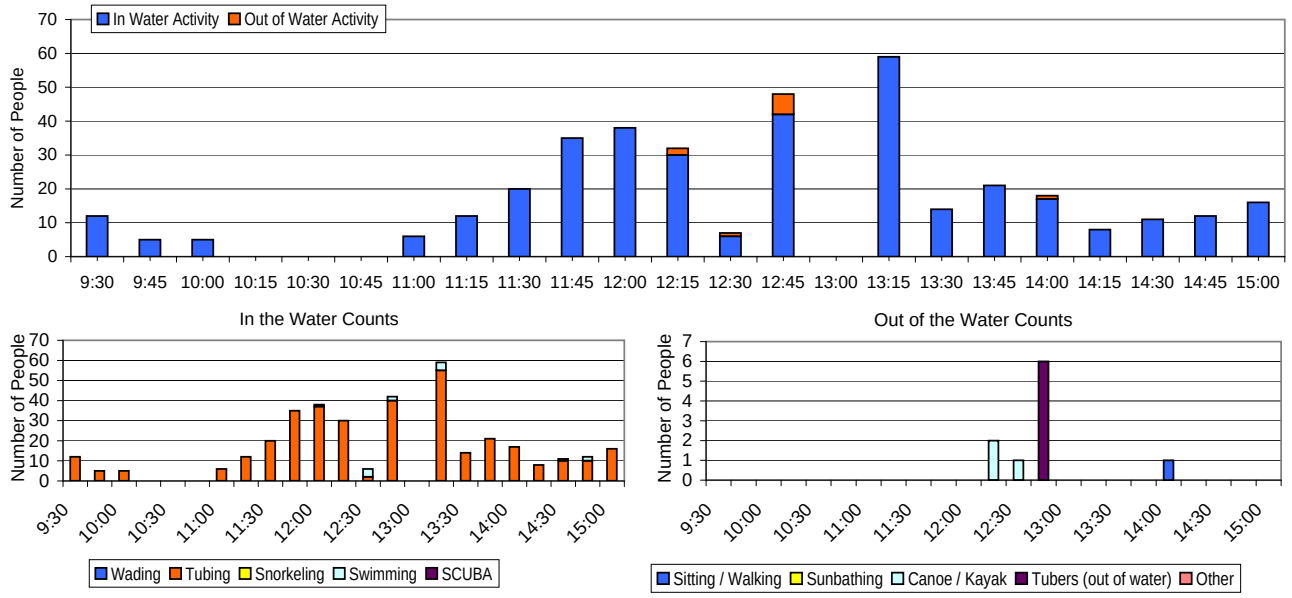
Site Ichetucknee Springs - Spring Run **Date** 7/14/2009 **Survey Period** 9:30 15:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Tubing	Snorkeling	Swimming	SCUBA	Total	Sitting / Walking	Sunbathing	Canoe / Kayak	Tubers (out of water)	Other	Total
9:30		12				12						0
9:45		5				5						0
10:00		5				5						0
10:15		0				0						0
10:30		0				0						0
10:45						0						0
11:00		6				6						0
11:15		12				12						0
11:30		20				20						0
11:45		35				35						0
12:00		37		1		38						0
12:15		30				30			2			2
12:30		2		4		6			1			1
12:45		40		2		42				6		6
13:00						0						0
13:15		55		4		59						0
13:30		14				14						0
13:45		21				21						0
14:00		17				17	1					1
14:15		8				8						0
14:30		10	1			11						0
14:45		10		2		12						0
15:00		16				16						0
Person-Hrs	0.00	88.75	0.25	3.25	0.00	92.25	0.25	0.00	0.75	1.50	0.00	2.50
Percentage	0.0%	96.2%	0.3%	3.5%	0.0%	100.0%	10.0%	0.0%	30.0%	60.0%	0.0%	100.0%

Note(s):

Observational counts were made by a recorder traveling downstream in canoe of people engaging in various activities along the length of the Spring run. Observations began at the Upstream tube-launch dock and ended just before the final take out dock near US-27.

Average Time Interval (hrs): 0.25



APPENDIX M

Jackson Blue Springs (Jackson Co.) counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			1/12/2009	1/13/2009	1/14/2009	1/15/2009	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Bathing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Snorkeling	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Swimming	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		SCUBA	4.5	15.0	4.5	10.3	8.6	0.29	0.71
	Out of Water	Sitting	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Walking	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Sunbathing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	In Water		4.5	15.0	4.5	10.3	8.6	0.29	0.71
	Out of Water		0.0	0.0	0.0	0.0	0.0	0.00	0.00
Spring Run	In Water	Canoeing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Power-boating	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Fishing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	In Water		0.0	0.0	0.0	0.0	0.0	0.00	0.00
Entire Spring			4.5	15.0	4.5	10.3	8.6	0.29	0.71

Note(s):

Hours of Observations:	29.5	5.5	10.0	9.0	5.0
Spring Pool Wetted Area (ha):	0.4081				
Spring Pool Upland Area (ha):	1.2033				
Spring Run Area (ha):	10.332				



APPENDIX M
Observational area for human use surveys made at Jackson Blue Springs Recreational Area defined by dashed line.

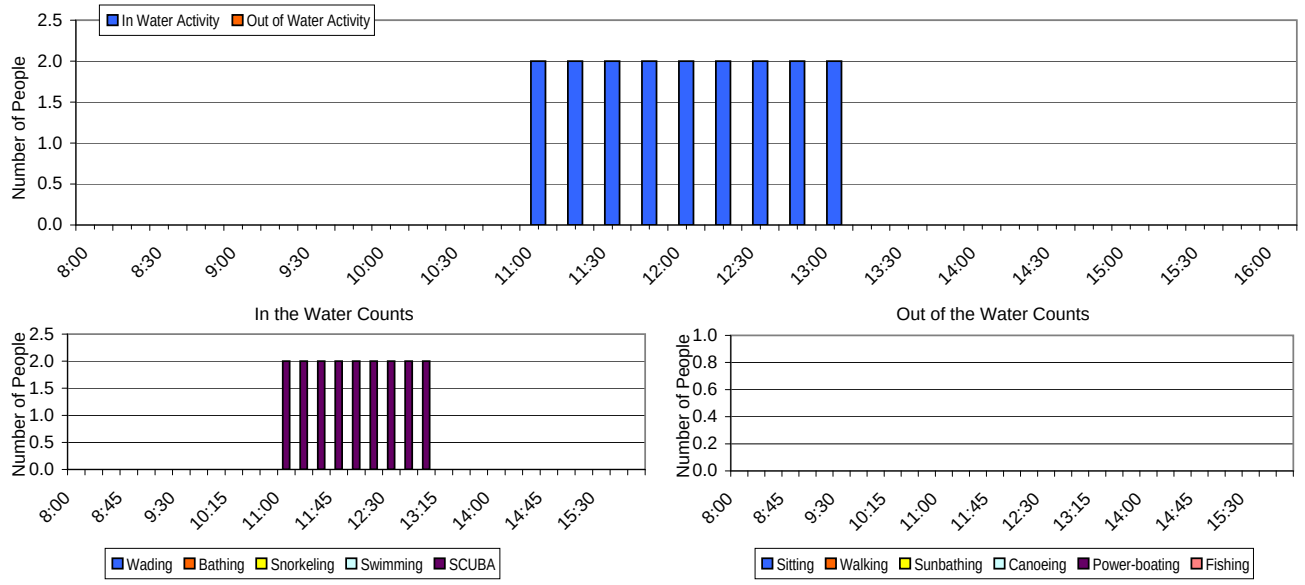
Human Use Actvity Summary

Site Jackson Blue Springs **Date** 1/12/2009 **Survey Period** 10:30 16:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0							0
8:15						0							0
8:30						0							0
8:45						0							0
9:00						0							0
9:15						0							0
9:30						0							0
9:45						0							0
10:00						0							0
10:15						0							0
10:30						0							0
10:45						0							0
11:00					2	2							0
11:15					2	2							0
11:30					2	2							0
11:45					2	2							0
12:00					2	2							0
12:15					2	2							0
12:30					2	2							0
12:45					2	2							0
13:00					2	2							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00						0							0
14:15						0							0
14:30						0							0
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
Person-Hrs	0.00	0.00	0.00	0.00	4.50	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percentage	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Mostly sunny day.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Jackson Blue Springs Recreational Area. The swimming area is the spring pool. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (Merritt's Mill Pond).

Average Time Interval (hrs): 0.25



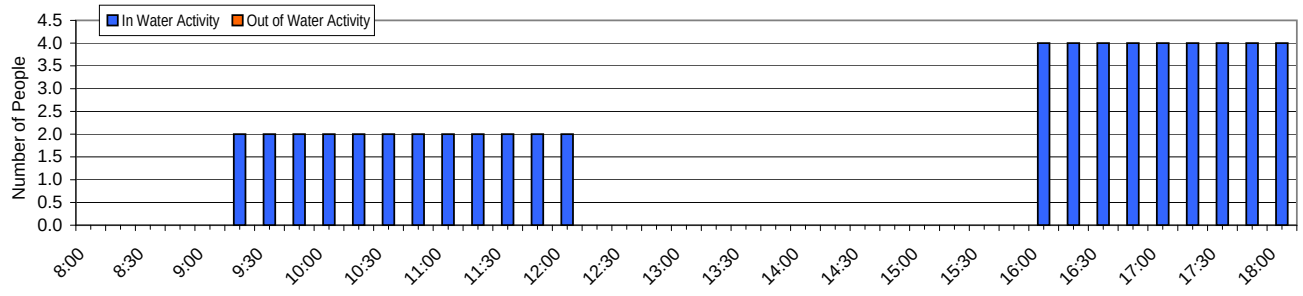
Human Use Actvity Summary

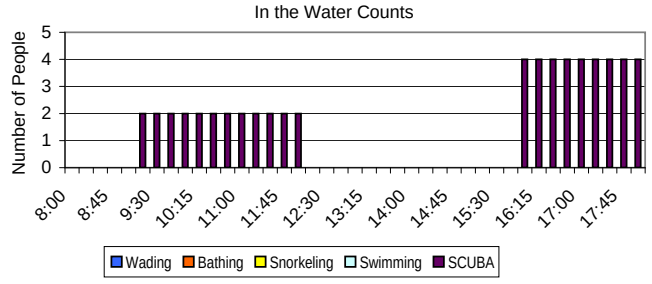
Site Jackson Blue Springs **Date** 1/13/2009 **Survey Period** 8:00 18:00

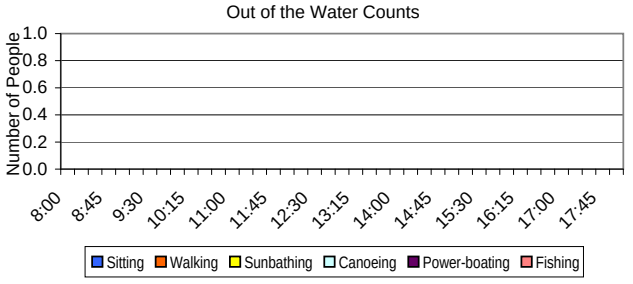
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0							0
8:15						0							0
8:30						0							0
8:45						0							0
9:00						0							0
9:15					2	2							0
9:30					2	2							0
9:45					2	2							0
10:00					2	2							0
10:15					2	2							0
10:30					2	2							0
10:45					2	2							0
11:00					2	2							0
11:15					2	2							0
11:30					2	2							0
11:45					2	2							0
12:00					2	2							0
12:15						0							0
12:30						0							0
12:45						0							0
13:00						0							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00						0							0
14:15						0							0
14:30						0							0
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00					4	4							0
16:15					4	4							0
16:30					4	4							0
16:45					4	4							0
17:00					4	4							0
17:15					4	4							0
17:30					4	4							0
17:45					4	4							0
18:00					4	4							0
Person-Hrs	0.00	0.00	0.00	0.00	15.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percentage	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Note(s):
"Wading" is waist deep, "Bathing" is chest deep.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Jackson Blue Springs Recreational Area. The swimming area is the spring pool. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (Merritt's Mill Pond).

Average Time Interval (hrs): 0.25







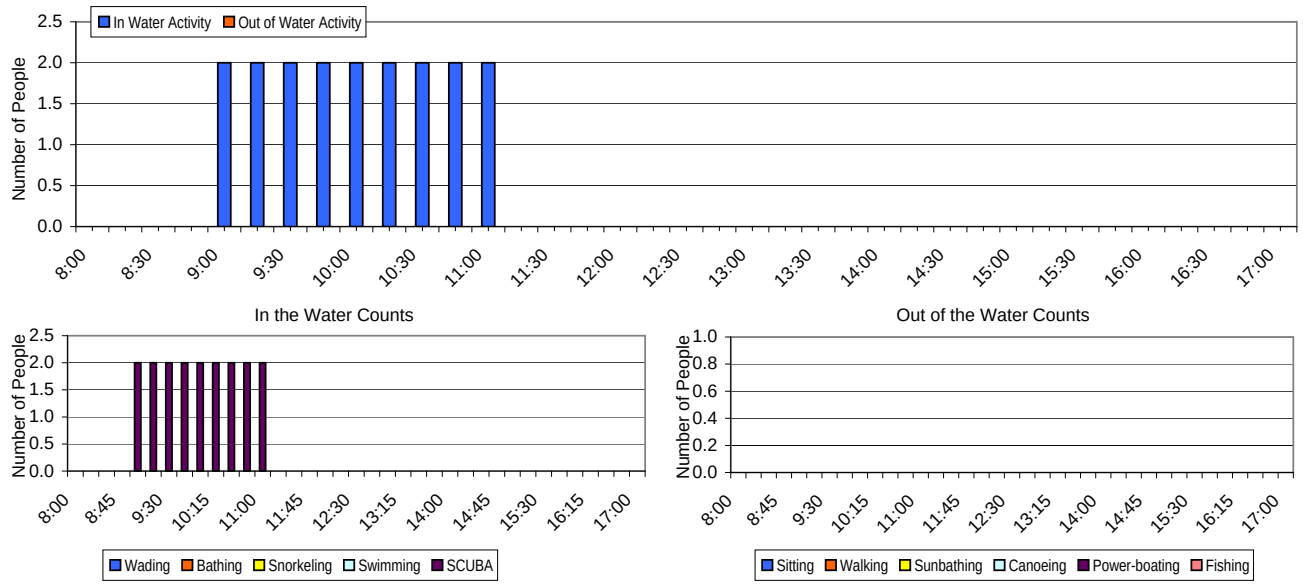
Human Use Actvity Summary

Site Jackson Blue Springs **Date** 1/14/2009 **Survey Period** 8:00 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0							0
8:15						0							0
8:30						0							0
8:45						0							0
9:00					2	2							0
9:15					2	2							0
9:30					2	2							0
9:45					2	2							0
10:00					2	2							0
10:15					2	2							0
10:30					2	2							0
10:45					2	2							0
11:00					2	2							0
11:15						0							0
11:30						0							0
11:45						0							0
12:00						0							0
12:15						0							0
12:30						0							0
12:45						0							0
13:00						0							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00						0							0
14:15						0							0
14:30						0							0
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
16:15						0							0
16:30						0							0
16:45						0							0
17:00						0							0
Person-Hrs	0.00	0.00	0.00	0.00	4.50	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percentage	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Note(s):
"Wading" is waist deep, "Bathing" is chest deep.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Jackson Blue Springs Recreational Area. The swimming area is the spring pool. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (Merritt's Mill Pond).

Average Time Interval (hrs): 0.25



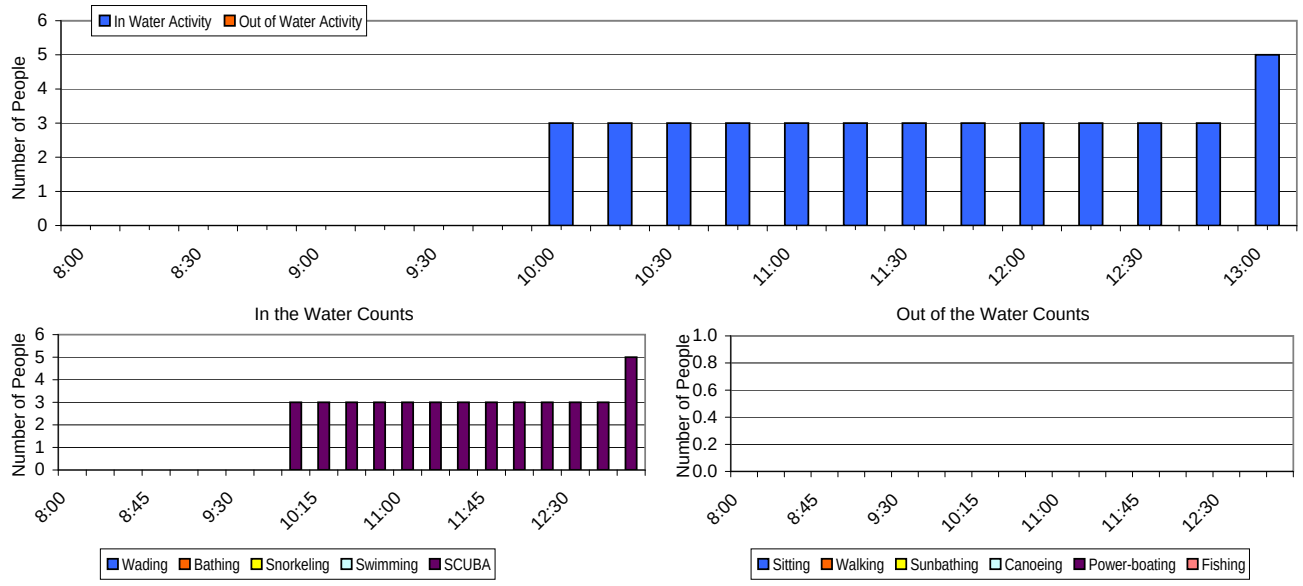
Human Use Actvity Summary

Site Jackson Blue Springs **Date** 1/15/2009 **Survey Period** 8:00 13:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0							0
8:15						0							0
8:30						0							0
8:45						0							0
9:00						0							0
9:15						0							0
9:30						0							0
9:45						0							0
10:00					3	3							0
10:15					3	3							0
10:30					3	3							0
10:45					3	3							0
11:00					3	3							0
11:15					3	3							0
11:30					3	3							0
11:45					3	3							0
12:00					3	3							0
12:15					3	3							0
12:30					3	3							0
12:45					3	3							0
13:00					5	5							0
Person-Hrs	0.00	0.00	0.00	0.00	10.25	10.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percentage	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Note(s):
"Wading" is waist deep, "Bathing" is chest deep.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Jackson Blue Springs Recreational Area. The swimming area is the spring pool. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (Merritt's Mill Pond).

Average Time Interval (hrs): 0.25



Human Use Actvity Summary - Period of Record Average

Site Jackson Blue Springs **Date** 1/12/2009 - 1/15/2009 **Survey Period** 8:00 18:00

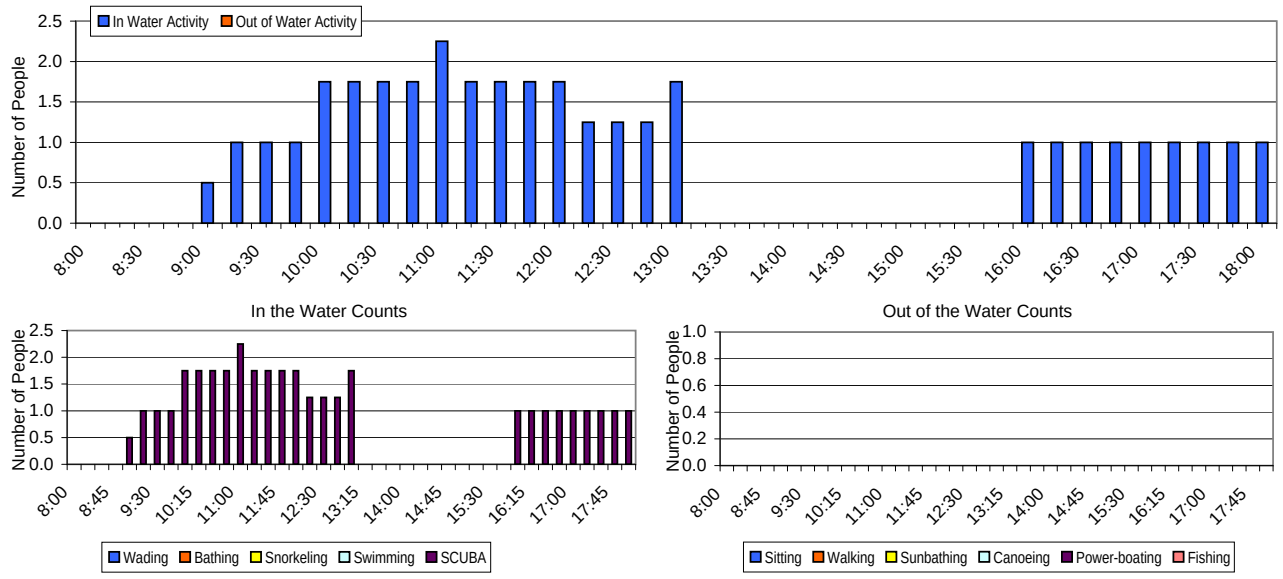
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	0	0	0	0	1	1	0	0	0	0	0	0	0
9:15	0	0	0	0	1	1	0	0	0	0	0	0	0
9:30	0	0	0	0	1	1	0	0	0	0	0	0	0
9:45	0	0	0	0	1	1	0	0	0	0	0	0	0
10:00	0	0	0	0	2	2	0	0	0	0	0	0	0
10:15	0	0	0	0	2	2	0	0	0	0	0	0	0
10:30	0	0	0	0	2	2	0	0	0	0	0	0	0
10:45	0	0	0	0	2	2	0	0	0	0	0	0	0
11:00	0	0	0	0	2	2	0	0	0	0	0	0	0
11:15	0	0	0	0	2	2	0	0	0	0	0	0	0
11:30	0	0	0	0	2	2	0	0	0	0	0	0	0
11:45	0	0	0	0	2	2	0	0	0	0	0	0	0
12:00	0	0	0	0	2	2	0	0	0	0	0	0	0
12:15	0	0	0	0	1	1	0	0	0	0	0	0	0
12:30	0	0	0	0	1	1	0	0	0	0	0	0	0
12:45	0	0	0	0	1	1	0	0	0	0	0	0	0
13:00	0	0	0	0	2	2	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	1	1	0	0	0	0	0	0	0
16:15	0	0	0	0	1	1	0	0	0	0	0	0	0
16:30	0	0	0	0	1	1	0	0	0	0	0	0	0
16:45	0	0	0	0	1	1	0	0	0	0	0	0	0
17:00	0	0	0	0	1	1	0	0	0	0	0	0	0
17:15	0	0	0	0	1	1	0	0	0	0	0	0	0
17:30	0	0	0	0	1	1	0	0	0	0	0	0	0
17:45	0	0	0	0	1	1	0	0	0	0	0	0	0
18:00	0	0	0	0	1	1	0	0	0	0	0	0	0
Total	0	0	0	0	34	34	0	0	0	0	0	0	0
Person-Hrs	0.00	0.00	0.00	0.00	8.56	8.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percentage	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Note(s):

"Wading" is waist deep, "Bathing" is chest deep.

Observational counts were made of people engaging in various activities in the swimming/spring run area of Jackson Blue Springs Recreational Area. The swimming area is the spring pool. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (Merritt's Mill Pond).

Average Time Interval (hrs): 0.25



APPENDIX M

Madison Blue Springs (Madison Co.) counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs		Average		
			12/1/2008	12/2/2008	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	0	0	0.0	0.00	0.00
		Bathing	0	0	0.0	0.00	0.00
		Snorkeling	0	0	0.0	0.00	0.00
		Swimming	0	0	0.0	0.00	0.00
		SCUBA	19	0	9.3	1.32	29.95
	Out of Water	Sitting	0	0	0.0	0.00	0.00
		Walking	0	1	0.5	0.07	0.10
		Sunbathing	0	0	0.0	0.00	0.00
	In Water		18.5	0	9.3	1.32	29.95
	Out of Water		0	1	0.5	0.07	0.10
Spring Run	In Water	Canoeing	0	1	0.5	0.07	1.13
		Power-boating	0	0	0.0	0.00	0.00
		Fishing	0	0	0.0	0.00	0.00
	In Water		0	1	0.5	0.07	1.13
Entire Spring			18.5	2	10.3	1.46	31.18

Note(s):

Hours of Observations:	14.0	7.0	7.0
Spring Pool Wetted Area (ha):	0.0441		
Spring Pool Upland Area (ha):	0.7176		
Spring Run Area (ha):	0.0634		



APPENDIX M
Observational area for human use surveys made at Madison Blue Springs State Park defined by dashed line.

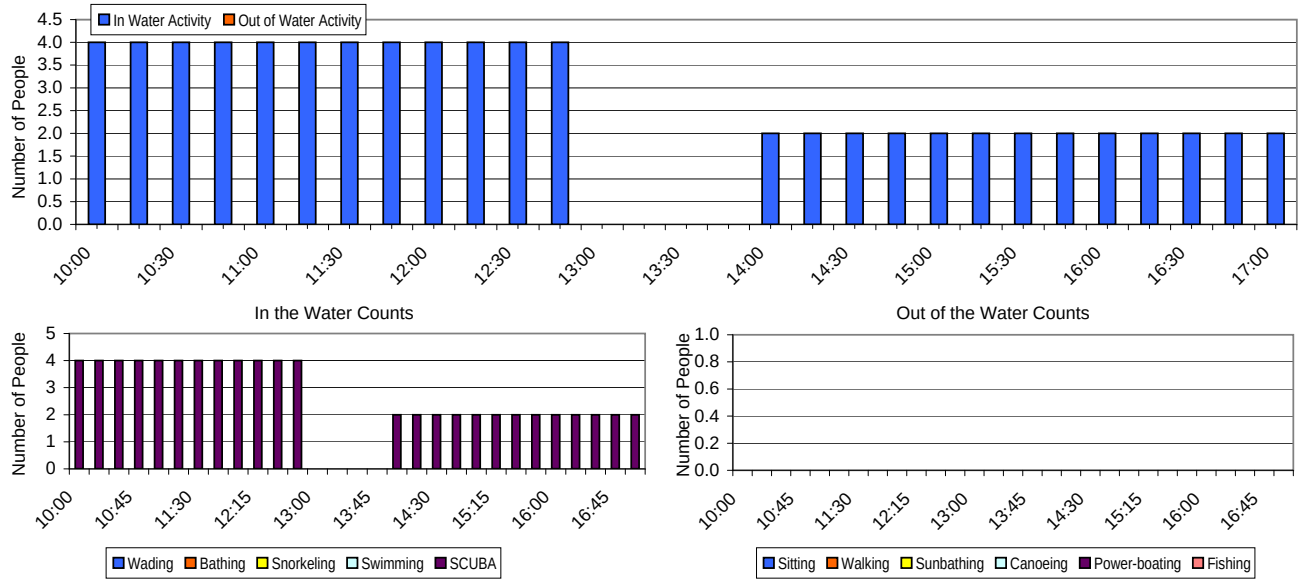
Human Use Actvity Summary

Site Madison Blue Springs **Date** 12/1/2008 **Survey Period** 10:00 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
10:00					4	4							0
10:15					4	4							0
10:30					4	4							0
10:45					4	4							0
11:00					4	4							0
11:15					4	4							0
11:30					4	4							0
11:45					4	4							0
12:00					4	4							0
12:15					4	4							0
12:30					4	4							0
12:45					4	4							0
13:00						0							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00					2	2							0
14:15					2	2							0
14:30					2	2							0
14:45					2	2							0
15:00					2	2							0
15:15					2	2							0
15:30					2	2							0
15:45					2	2							0
16:00					2	2							0
16:15					2	2							0
16:30					2	2							0
16:45					2	2							0
17:00					2	2							0
Person-Hrs	0.00	0.00	0.00	0.00	18.50	18.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percentage	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Mostly sunny day.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Madison Blue Springs State Park. The swimming area is the spring pool. The surrounding area under observation included the walkways and seating benches around the swim area, and the spring run.

Average Time Interval (hrs): 0.25



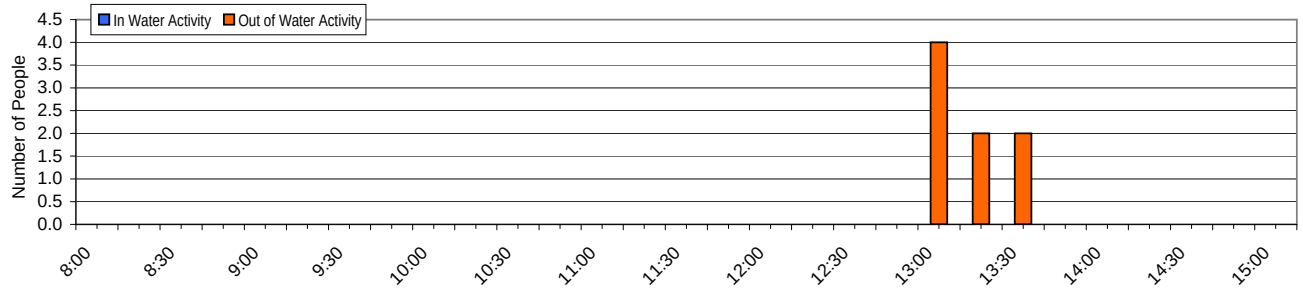
Human Use Actvity Summary

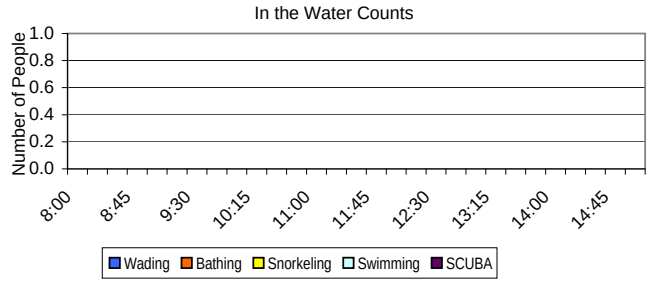
Site Madison Blue Springs **Date** 12/2/2008 **Survey Period** 8:00 15:00

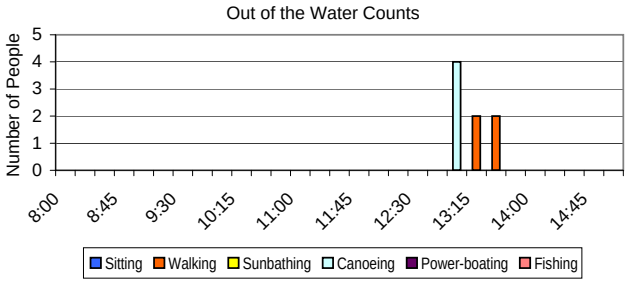
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Canoeing**	**Power-boating**	**Fishing**	**Total**
8:00						0							0
8:15						0							0
8:30						0							0
8:45						0							0
9:00						0							0
9:15						0							0
9:30						0							0
9:45						0							0
10:00						0							0
10:15						0							0
10:30						0							0
10:45						0							0
11:00						0							0
11:15						0							0
11:30						0							0
11:45						0							0
12:00						0							0
12:15						0							0
12:30						0							0
12:45						0							0
13:00						0				4			4
13:15						0		2					2
13:30						0		2					2
13:45						0							0
14:00						0							0
14:15						0							0
14:30						0							0
14:45						0							0
15:00						0							0
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	2.00
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.0%	50.0%	0.0%	50.0%	0.0%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Mostly cloudy day.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Madison Blue Springs State Park. The swimming area is the spring pool. The surrounding area under observation included the walkways and seating benches around the swim area, and the spring run.

Average Time Interval (hrs): 0.25







Human Use Actvity Summary - Period of Record Average

Site Madison Blue Springs **Date** 12/1/2008 - 12/2/2008 **Survey Period** 8:00 15:00

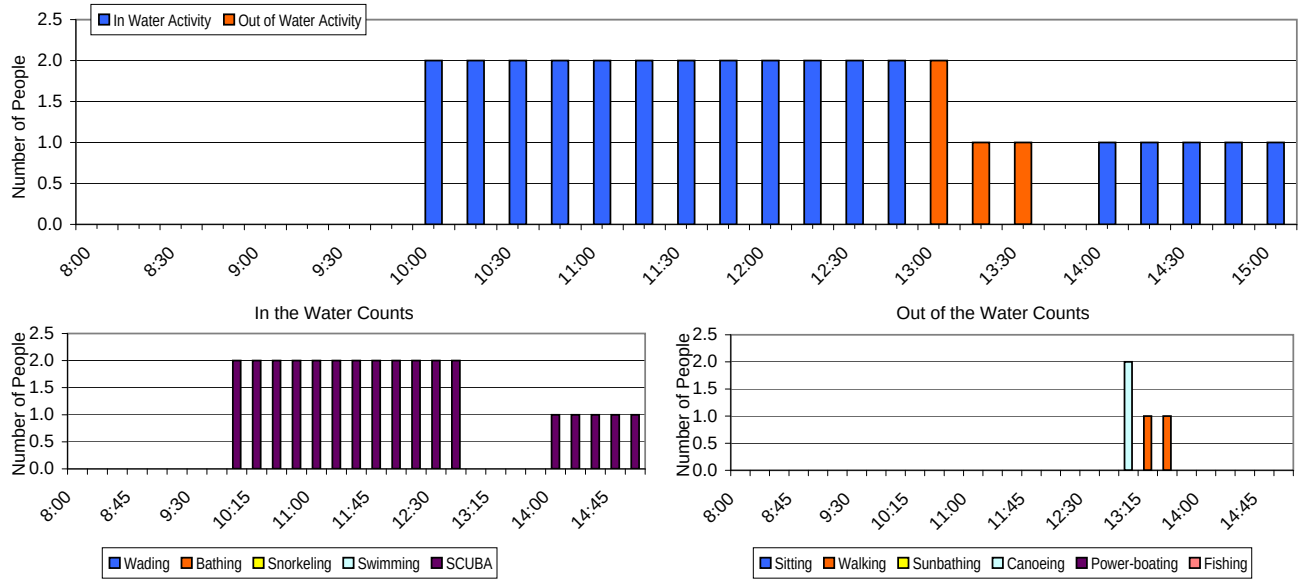
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	2	2	0	0	0	0	0	0	0
10:15	0	0	0	0	2	2	0	0	0	0	0	0	0
10:30	0	0	0	0	2	2	0	0	0	0	0	0	0
10:45	0	0	0	0	2	2	0	0	0	0	0	0	0
11:00	0	0	0	0	2	2	0	0	0	0	0	0	0
11:15	0	0	0	0	2	2	0	0	0	0	0	0	0
11:30	0	0	0	0	2	2	0	0	0	0	0	0	0
11:45	0	0	0	0	2	2	0	0	0	0	0	0	0
12:00	0	0	0	0	2	2	0	0	0	0	0	0	0
12:15	0	0	0	0	2	2	0	0	0	0	0	0	0
12:30	0	0	0	0	2	2	0	0	0	0	0	0	0
12:45	0	0	0	0	2	2	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	2	0	0	2
13:15	0	0	0	0	0	0	0	1	0	0	0	0	1
13:30	0	0	0	0	0	0	0	1	0	0	0	0	1
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	1	1	0	0	0	0	0	0	0
14:15	0	0	0	0	1	1	0	0	0	0	0	0	0
14:30	0	0	0	0	1	1	0	0	0	0	0	0	0
14:45	0	0	0	0	1	1	0	0	0	0	0	0	0
15:00	0	0	0	0	1	1	0	0	0	0	0	0	0
Person-Hrs	0.00	0.00	0.00	0.00	9.25	9.25	0.00	0.50	0.00	0.50	0.00	0.00	1.00
Percentage	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	0.0%	50.0%	0.0%	50.0%	0.0%	0.0%	100.0%

Note(s):

"Wading" is waist deep, "Bathing" is chest deep.

Observational counts were made of people engaging in various activities in the swimming/spring run area De Leon Springs State Park. The swimming area is the concrete bordered spring pool. The surrounding area under observation included the sidewalk, platforms, and seating benches around the swim area, the area from the restuarant to the museum, and the spring run.

Average Time Interval (hrs): 0.25



APPENDIX M

Manatee Springs (Levy Co.) counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			8/3/2008	8/4/2009	8/5/2009	8/6/2009	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Floating	6.8	1.5	4.3	3.5	4.0	0.54	2.05
		Snorkeling	12.3	3.3	11.0	1.8	7.1	0.93	3.53
		Swimming	20.8	12.3	29.3	18.5	20.2	2.70	10.31
		SCUBA	0.0	1.5	1.5	0.0	0.8	0.10	0.37
	Out of Water	Sitting/Walking	41.8	28.8	66.5	41.5	44.6	5.97	21.72
	In Water		39.8	18.5	46.0	23.8	32.0	4.26	16.27
	Out of Water		41.8	28.8	66.5	41.5	44.6	5.97	21.72
Spring Run	In Water	Canoe/ Kayak	1.5	14.0	6.3	6.8	7.1	0.96	1.80
		Power-boating	0.0	0.0	0.5	0.0	0.1	0.02	0.03
		Fishing	0.0	0.0	0.0	0.8	0.2	0.03	0.05
	In Water		1.5	14.0	6.8	7.5	7.4	1.01	1.88
Entire Spring			83.0	61.3	119.3	72.8	84.1	11.23	39.86

Note(s):

Hours of Observations:	29.8	7.5	7.5	8.0	6.8
Spring Pool Wetted Area (ha):	0.2618				
Spring Pool Upland Area (ha):	0.2747				
Spring Run Area (ha):	0.5352				



APPENDIX M
Observational areas of human use at Manatee Springs State Park defined by dashed line.

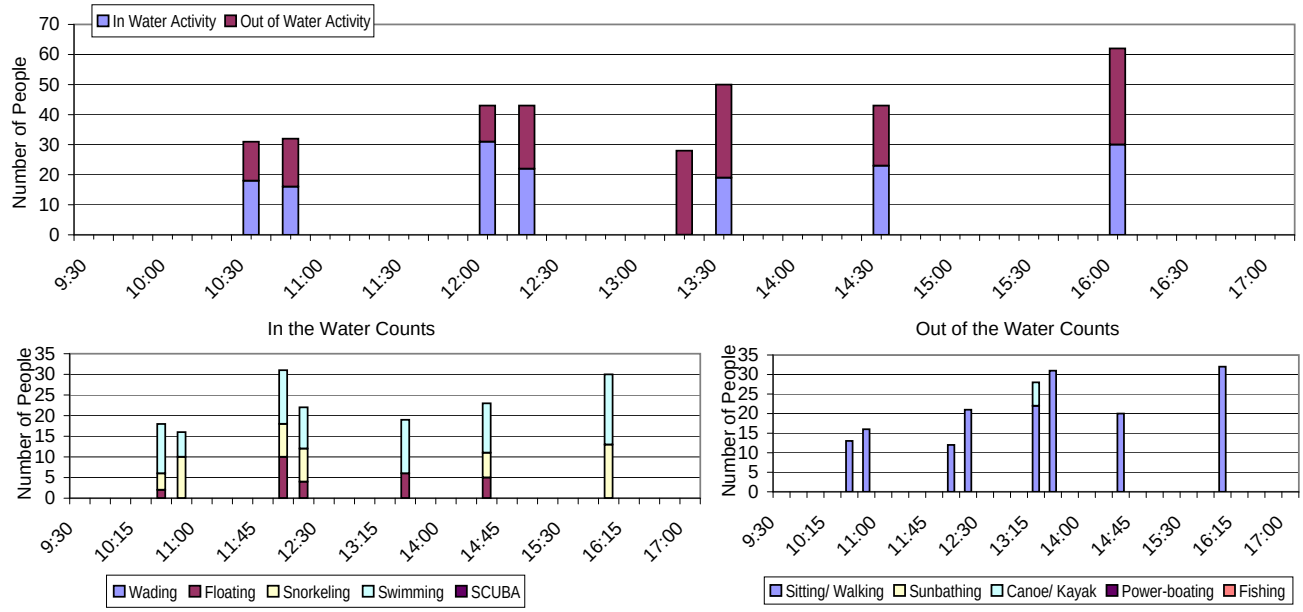
Human Use Actvity Summary

Site Manatee Springs **Date** 8/3/2008 **Survey Period** 9:30 17:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:30						0						0
9:45						0						0
10:00						0						0
10:15						0						0
10:30		2	4	12		18	13					13
10:45			10	6		16	16					16
11:00						0						0
11:15						0						0
11:30						0						0
11:45						0						0
12:00		10	8	13		31	12					12
12:15		4	8	10		22	21					21
12:30						0						0
12:45						0						0
13:00						0						0
13:15						0	22		6			28
13:30		6		13		19	31					31
13:45						0						0
14:00						0						0
14:15						0						0
14:30		5	6	12		23	20					20
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45						0						0
16:00			13	17		30	32					32
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
Person-Hrs	0.00	6.75	12.25	20.75	0.00	39.75	41.75	0.00	1.50	0.00	0.00	43.25
Percentage	0.0%	17.0%	30.8%	52.2%	0.0%	100.0%	96.5%	0.0%	3.5%	0.0%	0.0%	100.0%

Note(s):

Average Time Interval (hrs): 0.25



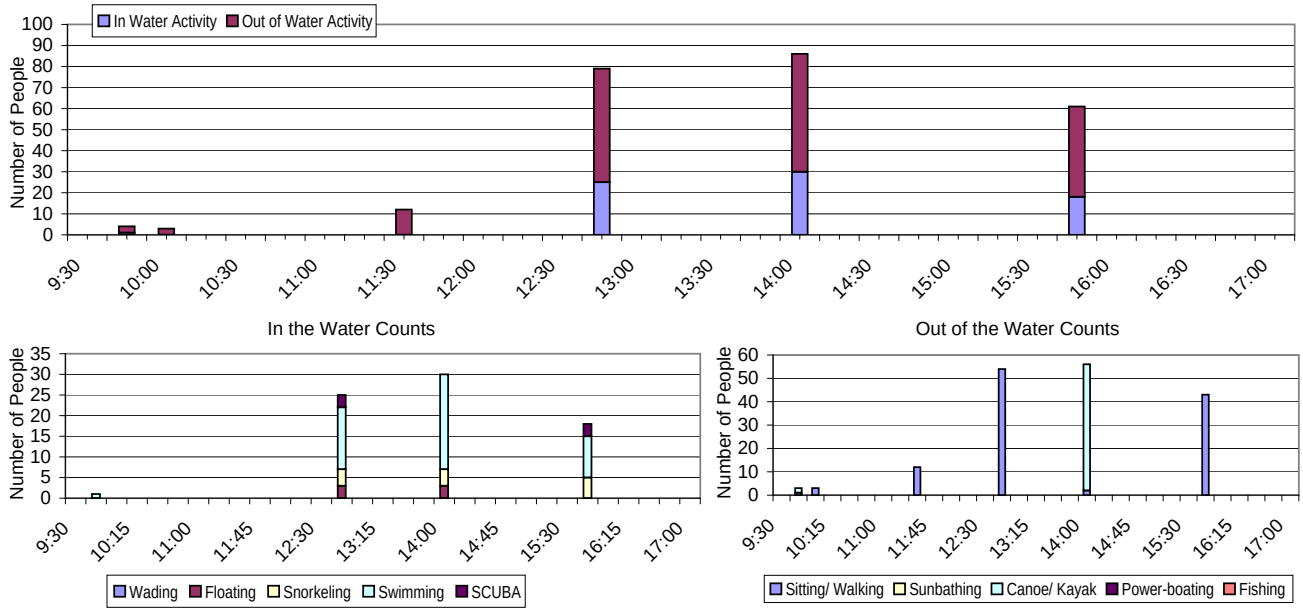
Human Use Actvity Summary

Site Manatee Springs **Date** 8/4/2009 **Survey Period** 9:30 17:00

Time	Numbers of People											
	In Water Activity						Out of Water Activity					
	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:30						0						0
9:45				1		1	1		2			3
10:00						0	3					3
10:15						0						0
10:30						0						0
10:45						0						0
11:00						0						0
11:15						0						0
11:30						0	12					12
11:45						0						0
12:00						0						0
12:15						0						0
12:30						0						0
12:45		3	4	15	3	25	54					54
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00		3	4	23		30	2		54			56
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45			5	10	3	18	43					43
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
Person-Hrs	0.00	1.50	3.25	12.25	1.50	18.50	28.75	0.00	14.00	0.00	0.00	42.75
Percentage	0.0%	8.1%	17.6%	66.2%	8.1%	100.0%	67.3%	0.0%	32.7%	0.0%	0.0%	100.0%

Note(s):

Average Time Interval (hrs): 0.25



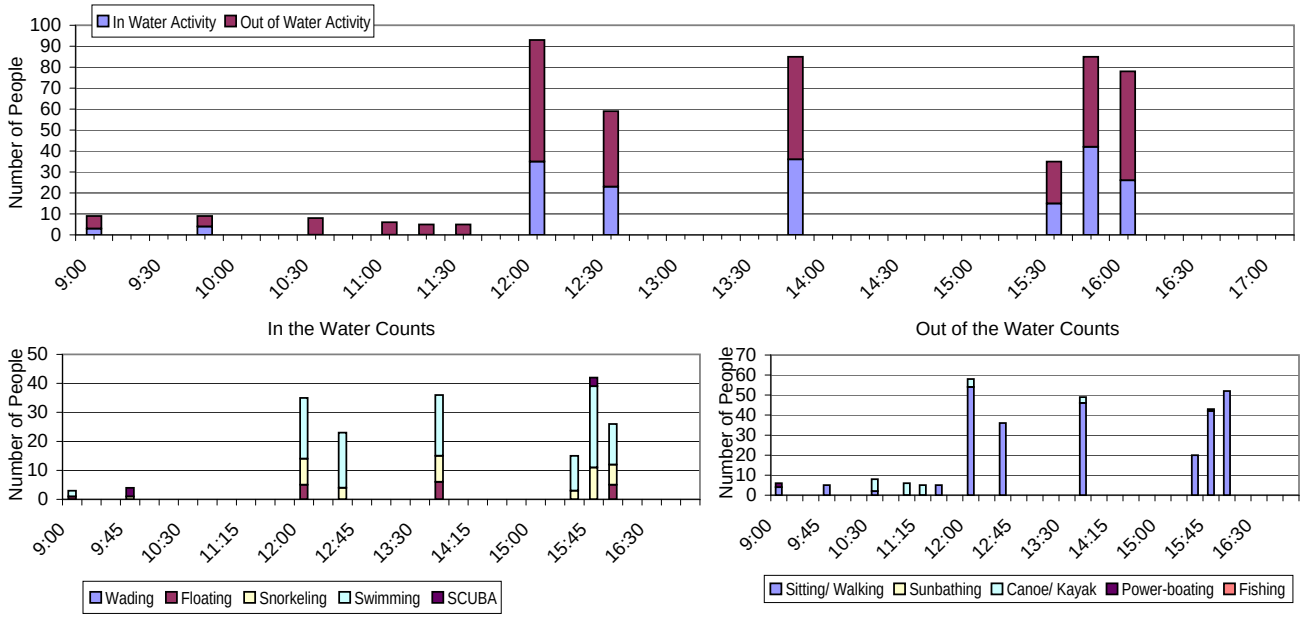
Human Use Actvity Summary

Site Manatee Springs **Date** 8/5/2009 **Survey Period** 9:00 17:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:00		1		2		3	4			2		6
9:15						0						0
9:30						0						0
9:45			1		3	4	5					5
10:00						0						0
10:15						0						0
10:30						0	2		6			8
10:45						0						0
11:00						0			6			6
11:15						0			5			5
11:30						0	5					5
11:45						0						0
12:00		5	9	21		35	54		4			58
12:15						0						0
12:30			4	19		23	36					36
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45		6	9	21		36	46		3			49
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30			3	12		15	20					20
15:45			11	28	3	42	42		1			43
16:00		5	7	14		26	52					52
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
Person-Hrs	0.00	4.25	11.00	29.25	1.50	46.00	66.50	0.00	6.25	0.50	0.00	73.25
Percentage	0.0%	9.2%	23.9%	63.6%	3.3%	100.0%	90.8%	0.0%	8.5%	0.7%	0.0%	100.0%

Note(s):
motor boating -likely research team

Average Time Interval (hrs): 0.25



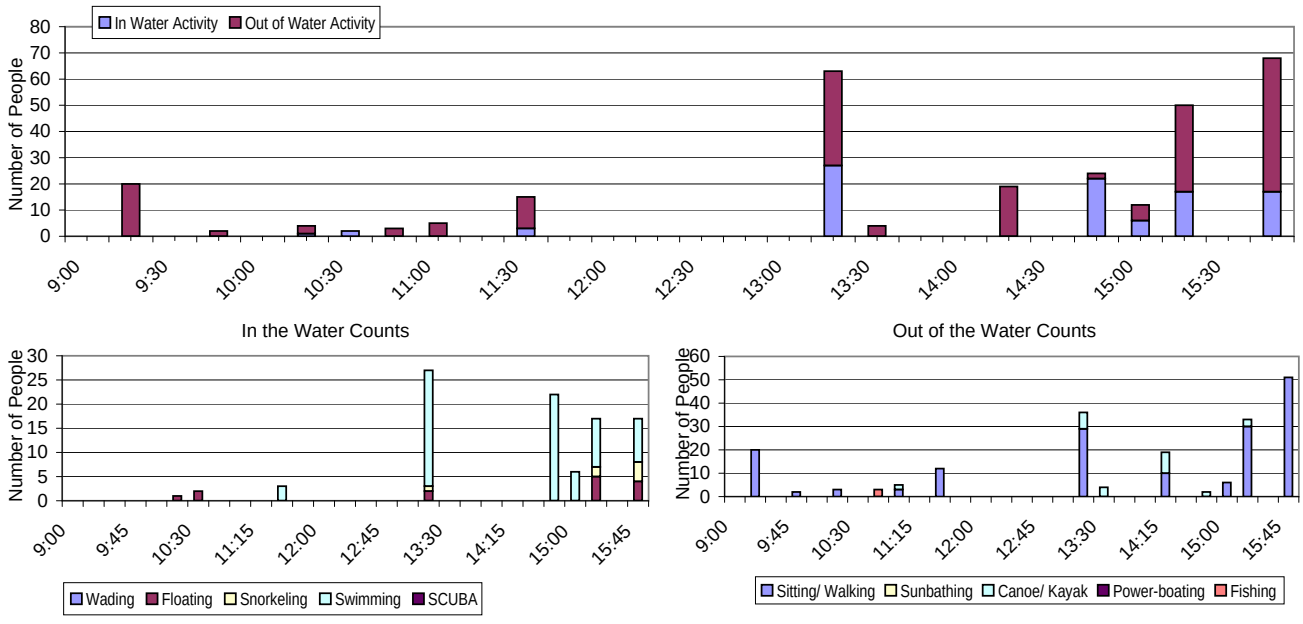
Human Use Actvity Summary

Site Manatee Springs **Date** 8/6/2009 **Survey Period** 9:00 15:45

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:00						0						0
9:15						0	20					20
9:30						0						0
9:45						0	2					2
10:00						0						0
10:15		1				1	3					3
10:30		2				2						0
10:45						0					3	3
11:00						0	3		2			5
11:15						0						0
11:30				3		3	12					12
11:45						0						0
12:00						0						0
12:15						0						0
12:30						0						0
12:45						0						0
13:00						0						0
13:15		2	1	24		27	29		7			36
13:30						0			4			4
13:45						0						0
14:00						0						0
14:15						0	10		9			19
14:30						0						0
14:45				22		22			2			2
15:00				6		6	6					6
15:15		5	2	10		17	30		3			33
15:30						0						0
15:45		4	4	9		17	51					51
Person-Hrs	0.00	3.50	1.75	18.50	0.00	23.75	41.50	0.00	6.75	0.00	0.75	49.00
Percentage	0.0%	14.7%	7.4%	77.9%	0.0%	100.0%	84.7%	0.0%	13.8%	0.0%	1.5%	100.0%

Note(s):
Sitting/Walking includes 15 people playing on the swing set/jungle gym in upland area (09:15)

Average Time Interval (hrs): 0.25



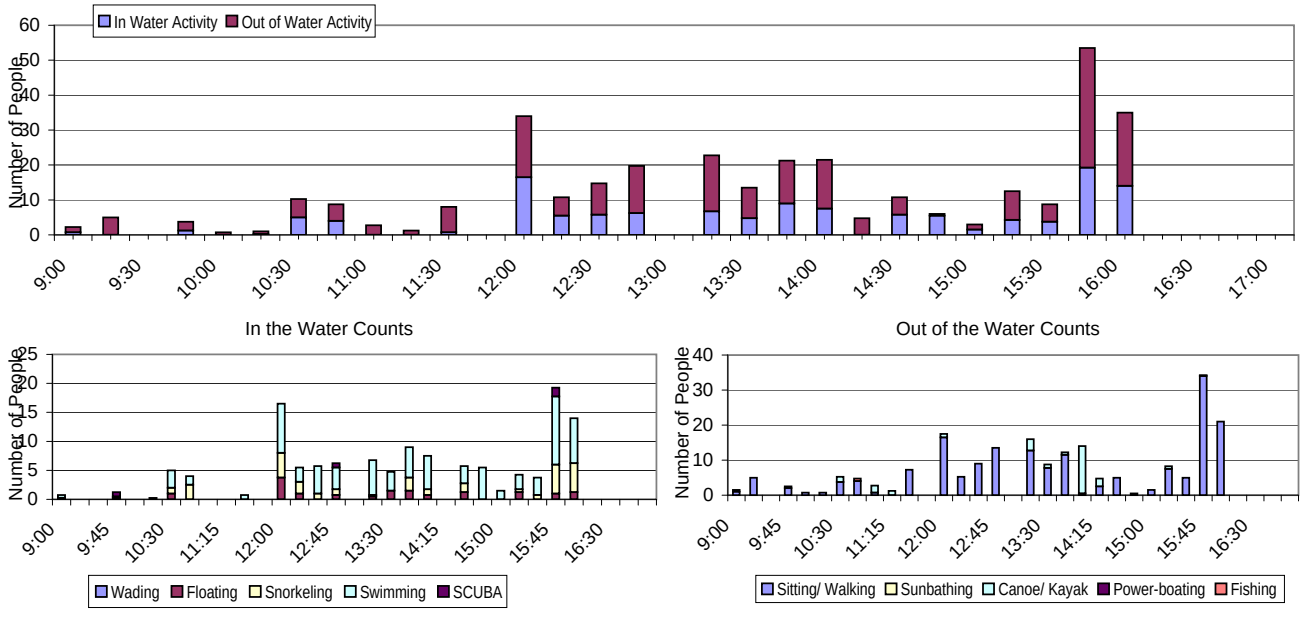
Human Use Actvity Summary - Period of Record Average

Site Manatee Springs **Date** 8/3/2009 - 8/6/2009 **Survey Period** 9:00 17:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:00	0	0	0	1	0	1	1	0	0	1	0	2
9:15	0	0	0	0	0	0	5	0	0	0	0	5
9:30	0	0	0	0	0	0	0	0	0	0	0	0
9:45	0	0	0	0	1	1	2	0	1	0	0	3
10:00	0	0	0	0	0	0	1	0	0	0	0	1
10:15	0	0	0	0	0	0	1	0	0	0	0	1
10:30	0	1	1	3	0	5	4	0	2	0	0	5
10:45	0	0	3	2	0	4	4	0	0	0	1	5
11:00	0	0	0	0	0	0	1	0	2	0	0	3
11:15	0	0	0	0	0	0	0	0	1	0	0	1
11:30	0	0	0	1	0	1	7	0	0	0	0	7
11:45	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	4	4	9	0	17	17	0	1	0	0	18
12:15	0	1	2	3	0	6	5	0	0	0	0	5
12:30	0	0	1	5	0	6	9	0	0	0	0	9
12:45	0	1	1	4	1	6	14	0	0	0	0	14
13:00	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	1	0	6	0	7	13	0	3	0	0	16
13:30	0	2	0	3	0	5	8	0	1	0	0	9
13:45	0	2	2	5	0	9	12	0	1	0	0	12
14:00	0	1	1	6	0	8	1	0	14	0	0	14
14:15	0	0	0	0	0	0	3	0	2	0	0	5
14:30	0	1	2	3	0	6	5	0	0	0	0	5
14:45	0	0	0	6	0	6	0	0	1	0	0	1
15:00	0	0	0	2	0	2	2	0	0	0	0	2
15:15	0	1	1	3	0	4	8	0	1	0	0	8
15:30	0	0	1	3	0	4	5	0	0	0	0	5
15:45	0	1	5	12	2	19	34	0	0	0	0	34
16:00	0	1	5	8	0	14	21	0	0	0	0	21
16:15	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0
Person-Hrs	0.00	4.00	7.06	20.19	0.75	32.00	44.63	0.00	7.13	0.13	0.19	52.06
Percentage	0.0%	12.5%	22.1%	63.1%	2.3%	100.0%	85.7%	0.0%	13.7%	0.2%	0.4%	100.0%

Note(s):

Average Time Interval (hrs): 0.25



APPENDIX M

Ponce de Leon Springs (Holmes Co.) counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			9/8/2009	9/9/2009	9/10/2009	9/11/2009	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	1.0	3.3	1.8	0.0	1.5	0.19	1.18
		Floating	0.0	0.0	1.0	0.0	0.3	0.03	0.20
		Snorkeling	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Swimming	4.3	5.3	6.3	0.0	3.9	0.49	3.09
		SCUBA	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Out of Water	Sitting	1.3	7.5	0.0	0.0	2.2	0.27	0.78
		Walking	0.5	4.3	6.5	1.0	3.1	0.38	1.10
		Sunbathing	2.5	5.5	1.8	0.0	2.4	0.30	0.87
	In Water		5.3	8.5	9.0	0.0	5.7	0.71	4.46
	Out of Water		4.3	17.3	8.3	1.0	7.7	0.96	2.75
Spring Run	In Water	Canoeing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Power-boating	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Fishing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	In Water		0.0	0.0	0.0	0.0	0.0	0.00	0.00
Entire Spring			9.5	25.8	17.3	1.0	13.4	1.67	7.21

Note(s):

Hours of Observations:	32.0	8.0	8.0	8.0	8.0
Spring Pool Wetted Area (ha):	0.1595				
Spring Pool Upland Area (ha):	0.3490				
Spring Run Area (ha):	0.1869				



APPENDIX M
Observational areas of human use at Ponce de Leon Springs State Park defined by dashed line.

Human Use Actvity Summary

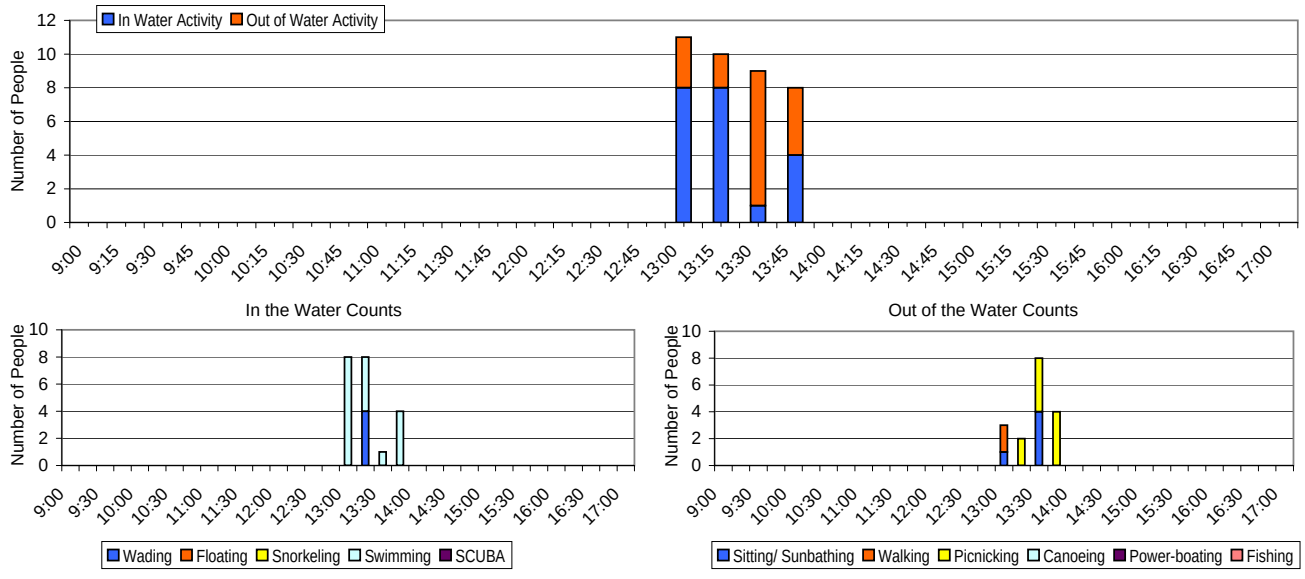
Site Ponce de Leon Springs **Date** 9/8/2009 **Survey Period** 9:00 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Sunbathing	Walking	Picnicking	Canoeing	Power-boating	Fishing	Total
9:00						0							0
9:15						0							0
9:30						0							0
9:45						0							0
10:00						0							0
10:15						0							0
10:30						0							0
10:45						0							0
11:00						0							0
11:15						0							0
11:30						0							0
11:45						0							0
12:00						0							0
12:15						0							0
12:30						0							0
12:45						0							0
13:00				8		8	1	2					3
13:15	4			4		8			2				2
13:30				1		1	4		4				8
13:45				4		4			4				4
14:00						0							0
14:15						0							0
14:30						0							0
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
16:15						0							0
16:30						0							0
16:45						0							0
17:00						0							0
Person-Hrs	1.00	0.00	0.00	4.25	0.00	5.25	1.25	0.50	2.50	0.00	0.00	0.00	4.25
Percentage	19.0%	0.0%	0.0%	81.0%	0.0%	100.0%	29.4%	11.8%	58.8%	0.0%	0.0%	0.0%	100.0%

Note(s):

Observational counts were made of people engaging in various activities in the swimming/spring run area of Ponce de Leon Springs State Park. The swimming area is the spring pool; wading, floating, and fishing take place in the spring run. The surrounding area under observation included the sidewalks, picnic tables, and areas adjacent to the swim area; nature trails circle both sides of the spring run.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

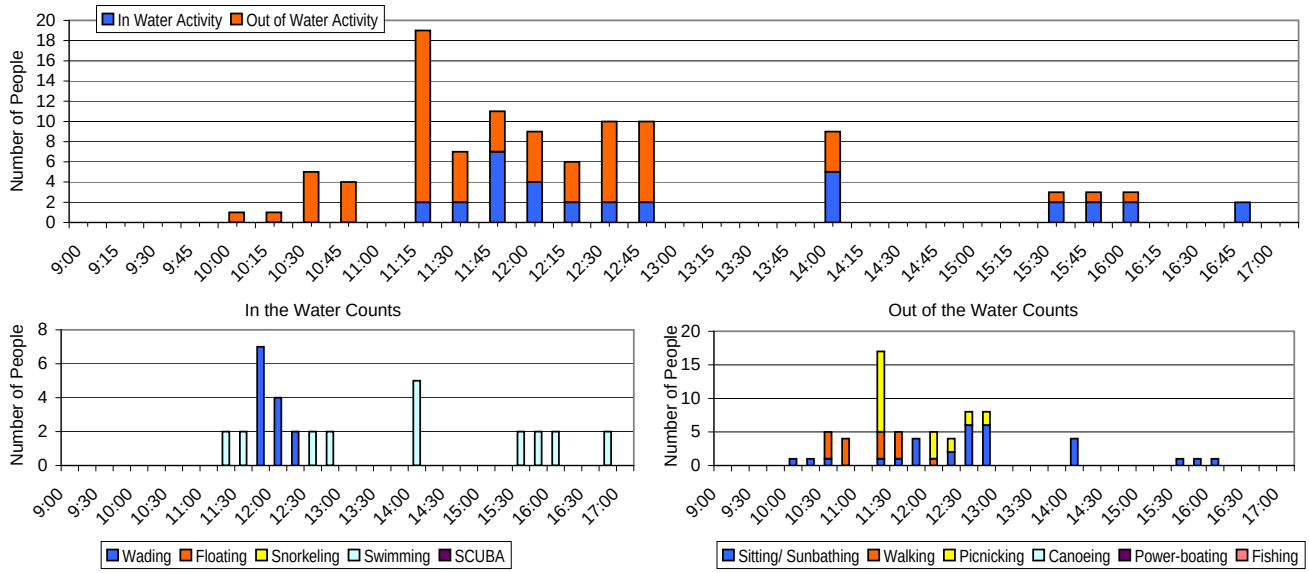
Site Ponce de Leon Springs **Date** 9/9/2009 **Survey Period** 9:00 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Sunbathing	Walking	Picnicking	Canoeing	Power-boating	Fishing	Total
9:00						0							0
9:15						0							0
9:30						0							0
9:45						0							0
10:00						0	1						1
10:15						0	1						1
10:30						0	1	4					5
10:45						0		4					4
11:00						0							0
11:15				2		2	1	4	12				17
11:30				2		2	1	4					5
11:45	7					7	4						4
12:00	4					4		1	4				5
12:15	2					2	2		2				4
12:30				2		2	6		2				8
12:45				2		2	6		2				8
13:00						0							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00				5		5	4						4
14:15						0							0
14:30						0							0
14:45						0							0
15:00						0							0
15:15						0							0
15:30				2		2	1						1
15:45				2		2	1						1
16:00				2		2	1						1
16:15						0							0
16:30						0							0
16:45				2		2							0
17:00						0							0
Person-Hrs	3.25	0.00	0.00	5.25	0.00	8.50	7.50	4.25	5.50	0.00	0.00	0.00	17.25
Percentage	38.2%	0.0%	0.0%	61.8%	0.0%	100.0%	43.5%	24.6%	31.9%	0.0%	0.0%	0.0%	100.0%

Note(s):

Observational counts were made of people engaging in various activities in the swimming/spring run area of Ponce de Leon Springs State Park. The swimming area is the spring pool; wading, floating, and fishing take place in the spring run. The surrounding area under observation included the sidewalks, picnic tables, and areas adjacent to the swim area; nature trails circle both sides of the spring run.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

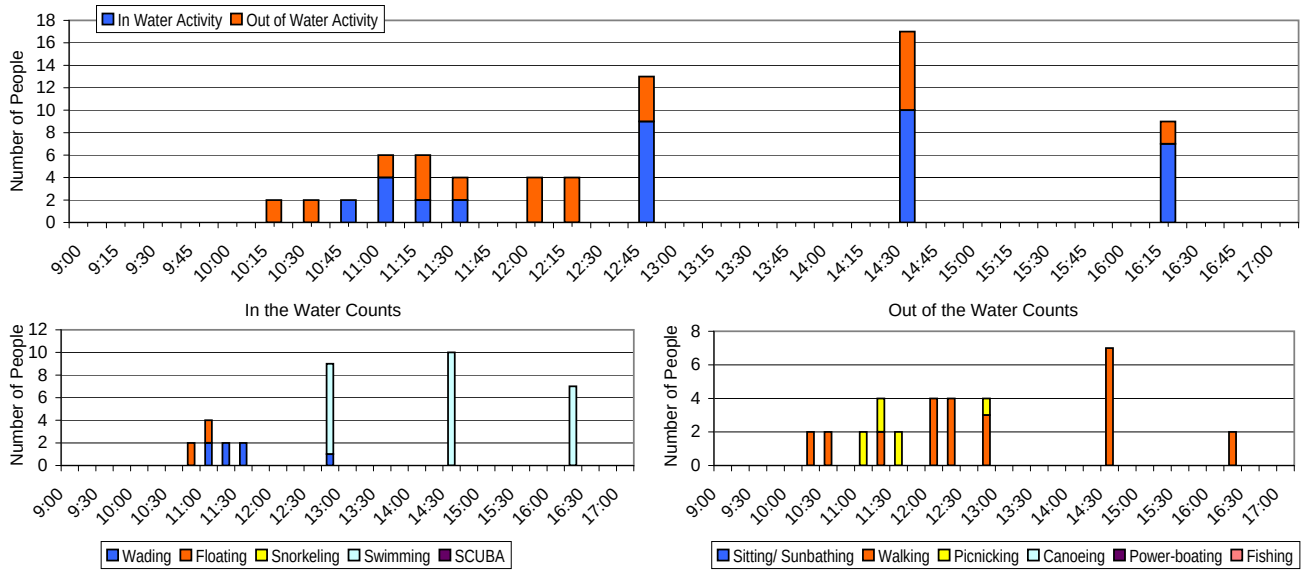
Site Ponce de Leon Springs **Date** 9/10/2009 **Survey Period** 9:00 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Sunbathing	Walking	Picnicking	Canoeing	Power-boating	Fishing	Total
9:00						0							0
9:15						0							0
9:30						0							0
9:45						0							0
10:00						0							0
10:15						0		2					2
10:30						0		2					2
10:45		2				2							0
11:00	2	2				4			2				2
11:15	2					2		2	2				4
11:30	2					2			2				2
11:45						0							0
12:00						0		4					4
12:15						0		4					4
12:30						0							0
12:45	1			8		9		3	1				4
13:00						0							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00						0							0
14:15						0							0
14:30				10		10		7					7
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
16:15				7		7		2					2
16:30						0							0
16:45						0							0
17:00						0							0
Person-Hrs	1.75	1.00	0.00	6.25	0.00	9.00	0.00	6.50	1.75	0.00	0.00	0.00	8.25
Percentage	19.4%	11.1%	0.0%	69.4%	0.0%	100.0%	0.0%	78.8%	21.2%	0.0%	0.0%	0.0%	100.0%

Note(s):

Observational counts were made of people engaging in various activities in the swimming/spring run area of Ponce de Leon Springs State Park. The swimming area is the spring pool; wading, floating, and fishing take place in the spring run. The surrounding area under observation included the sidewalks, picnic tables, and areas adjacent to the swim area; nature trails circle both sides of the spring run.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

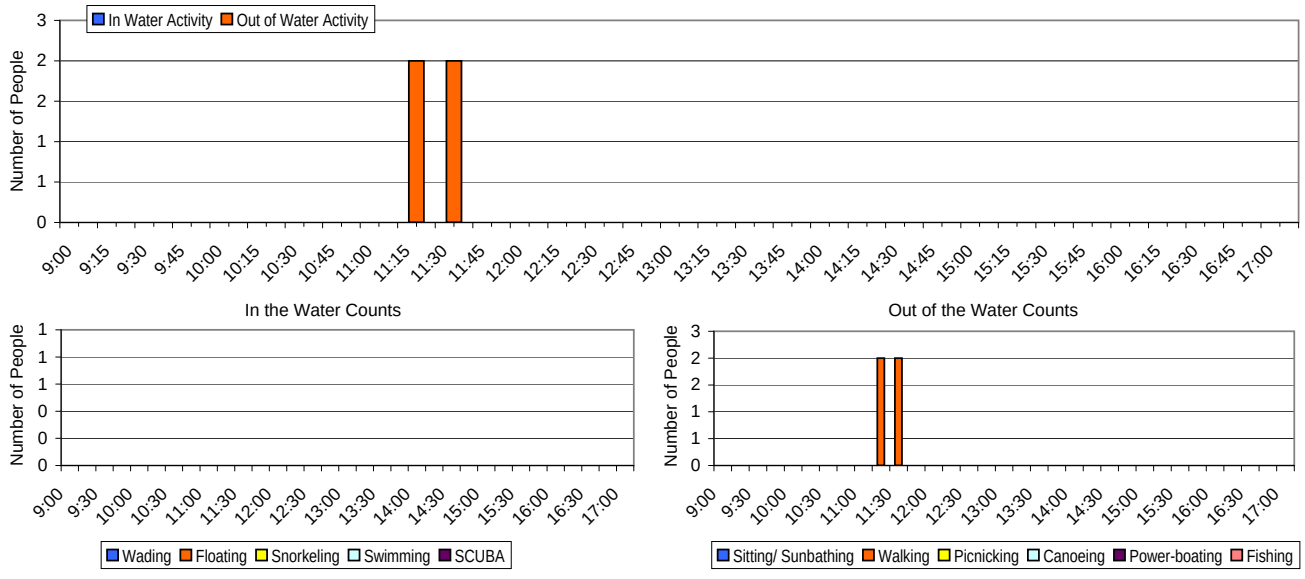
Site Ponce de Leon Springs **Date** 9/11/2009 **Survey Period** 9:00 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Sunbathing	Walking	Picnicking	Canoeing	Power-boating	Fishing	Total
9:00						0							0
9:15						0							0
9:30						0							0
9:45						0							0
10:00						0							0
10:15						0							0
10:30						0							0
10:45						0							0
11:00						0							0
11:15						0		2					2
11:30						0		2					2
11:45						0							0
12:00						0							0
12:15						0							0
12:30						0							0
12:45						0							0
13:00						0							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00						0							0
14:15						0							0
14:30						0							0
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
16:15						0							0
16:30						0							0
16:45						0							0
17:00						0							0
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note(s):

Observational counts were made of people engaging in various activities in the swimming/spring run area of Ponce de Leon Springs State Park. The swimming area is the spring pool; wading, floating, and fishing take place in the spring run. The surrounding area under observation included the sidewalks, picnic tables, and areas adjacent to the swim area; nature trails circle both sides of the spring run.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary - Period of Record Average

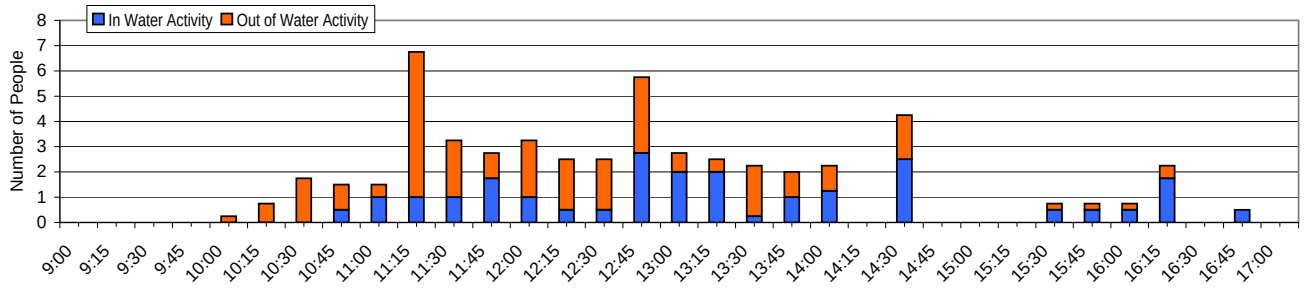
Site DeLeon Springs **Date** 10/6/2009 - 10/9/2008 **Survey Period** 9:00 17:00

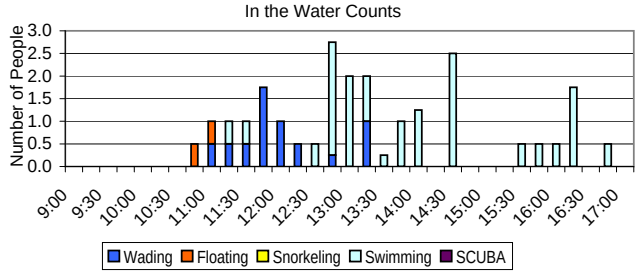
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Floating	Snorkeling	Swimming	SCUBA	Total	Sitting/ Sunbathing	Walking	Picnicking	Canoeing	Power-boating	Fishing	Total
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	1	0	0	0	0	1
10:30	0	0	0	0	0	0	0	2	0	0	0	0	2
10:45	0	1	0	0	0	1	0	1	0	0	0	0	1
11:00	1	1	0	0	0	1	0	0	1	0	0	0	1
11:15	1	0	0	1	0	1	0	2	4	0	0	0	6
11:30	1	0	0	1	0	1	0	2	1	0	0	0	2
11:45	2	0	0	0	0	2	1	0	0	0	0	0	1
12:00	1	0	0	0	0	1	0	1	1	0	0	0	2
12:15	1	0	0	0	0	1	1	1	1	0	0	0	2
12:30	0	0	0	1	0	1	2	0	1	0	0	0	2
12:45	0	0	0	3	0	3	2	1	1	0	0	0	3
13:00	0	0	0	2	0	2	0	1	0	0	0	0	1
13:15	1	0	0	1	0	2	0	0	1	0	0	0	1
13:30	0	0	0	0	0	0	1	0	1	0	0	0	2
13:45	0	0	0	1	0	1	0	0	1	0	0	0	1
14:00	0	0	0	1	0	1	1	0	0	0	0	0	1
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	3	0	3	0	2	0	0	0	0	2
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	1	0	1	0	0	0	0	0	0	0
15:45	0	0	0	1	0	1	0	0	0	0	0	0	0
16:00	0	0	0	1	0	1	0	0	0	0	0	0	0
16:15	0	0	0	2	0	2	0	1	0	0	0	0	1
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	1	0	1	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Person-Hrs	1.50	0.25	0.00	3.94	0.00	5.69	2.19	3.06	2.44	0.00	0.00	0.00	7.69
Percentage	26.4%	4.4%	0.0%	69.2%	0.0%	100.0%	28.5%	39.8%	31.7%	0.0%	0.0%	0.0%	100.0%

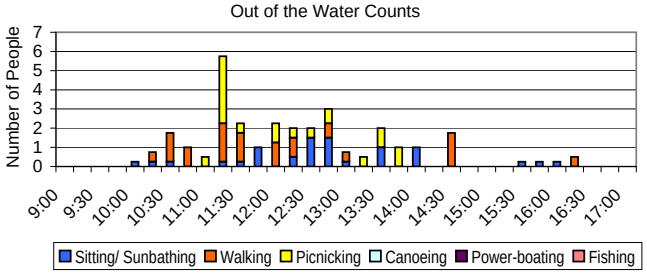
Note(s):

Observational counts were made of people engaging in various activities in the swimming/spring run area of Ponce de Leon Springs State Park. The swimming area is the spring pool; wading, floating, and fishing take place in the spring run. The surrounding area under observation included the sidewalks, picnic tables, and areas adjacent to the swim area; nature trails circle both sides of the spring run.

Average Time Interval (hrs): 0.25







APPENDIX M

Rainbow Springs counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			6/8/2009	6/9/2009	6/10/2009	6/11/2009	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	0.5	0.0	3.8	0.0	1.1	0.15	0.29
		Bathing	0.0	0.0	10.8	0.0	2.7	0.38	0.76
		Snorkeling	0.5	1.5	0.0	3.3	1.3	0.18	0.35
		Swimming	25.8	45.0	29.5	28.3	32.1	4.18	8.31
		Floating	0.3	13.8	13.5	5.8	8.3	1.12	2.23
	Out of Water	Sitting	37.0	56.8	47.5	62.3	50.9	6.72	14.01
		Walking	1.5	5.3	7.0	1.0	3.7	0.49	1.02
		Sunbathing	5.3	7.8	8.0	0.0	5.3	0.67	1.40
	In Water		27.0	60.3	57.5	37.3	45.5	6.02	11.95
	Out of Water		43.8	69.8	62.5	63.3	59.8	7.89	16.44
Spring Run	In Water	Canoe/ Kayak	22.8	39.8	27.0	37.0	31.6	4.16	0.83
		Power-boating	9.5	15.3	14.5	4.5	10.9	1.42	0.28
		Fishing	1.5	2.5	1.3	0.0	1.3	0.16	0.03
	In Water		33.8	57.5	42.8	41.5	43.9	5.74	1.14
Entire Spring			104.5	187.5	162.8	142.0	149.2	19.65	29.54

Note(s):

Hours of Observations:	31.0	9.0	8.0	7.0	7.0
Spring Pool Wetted Area (ha):	0.5033				
Spring Pool Upland Area (ha):	0.4796				
Spring Run Area (ha):	5.029				



APPENDIX M
Observational areas of human use at Rainbow Springs State Park defined by dashed line.

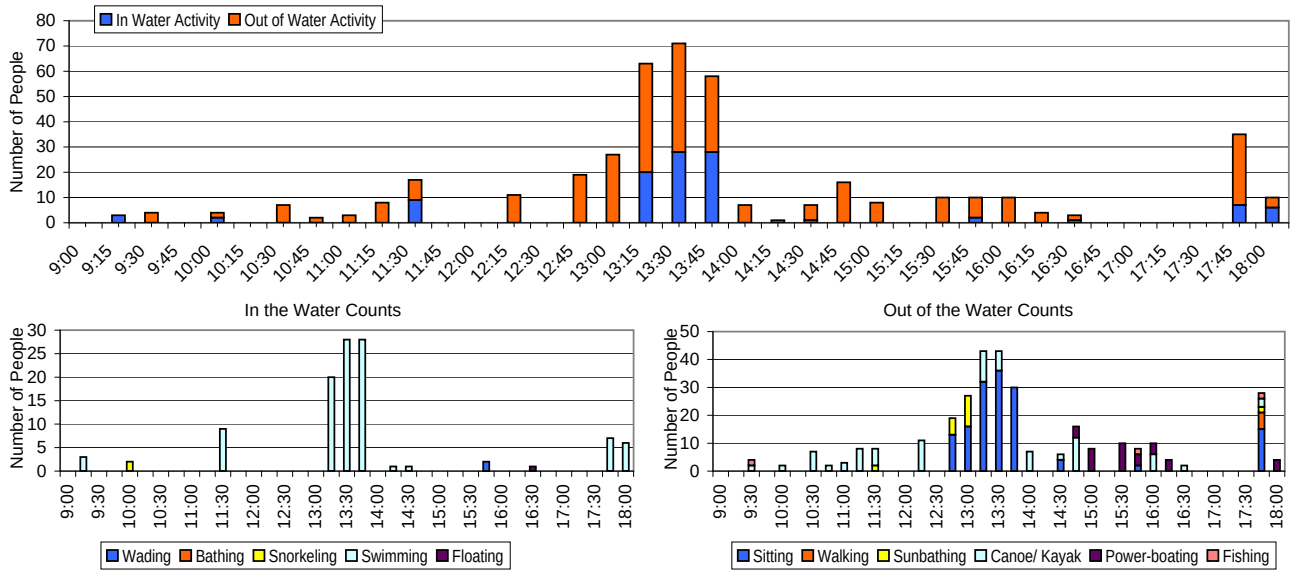
Human Use Actvity Summary

Site Rainbow Springs **Date** 6/8/2009 **Survey Period** 9:00 18:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	Floating	Total	Sitting	Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:00						0							0
9:15				3		3							0
9:30						0				2		2	4
9:45						0							0
10:00			2			2				2			2
10:15						0							0
10:30						0				7			7
10:45						0				2			2
11:00						0				3			3
11:15						0				8			8
11:30				9		9			2	6			8
11:45						0							0
12:00						0							0
12:15						0				11			11
12:30						0							0
12:45						0	13		6				19
13:00						0	16		11				27
13:15				20		20	32			11			43
13:30				28		28	36			7			43
13:45				28		28	30						30
14:00						0				7			7
14:15				1		1							0
14:30				1		1	4			2			6
14:45						0				12	4		16
15:00						0					8		8
15:15						0							0
15:30						0					10		10
15:45	2					2	2				4	2	8
16:00						0				6	4		10
16:15						0					4		4
16:30					1	1				2			2
16:45						0							0
17:00						0							0
17:15						0							0
17:30						0							0
17:45				7		7	15	6	2	3		2	28
18:00				6		6					4		4
Person-Hrs	0.50	0.00	0.50	25.75	0.25	27.00	37.00	1.50	5.25	22.75	9.50	1.50	77.50
Percentage	1.9%	0.0%	1.9%	95.4%	0.9%	100.0%	47.7%	1.9%	6.8%	29.4%	12.3%	1.9%	100.0%

Note(s):
Visual survey records for the spring pool/run area of Rainbow Springs State Park.

Average Time Interval (hrs): 0.25



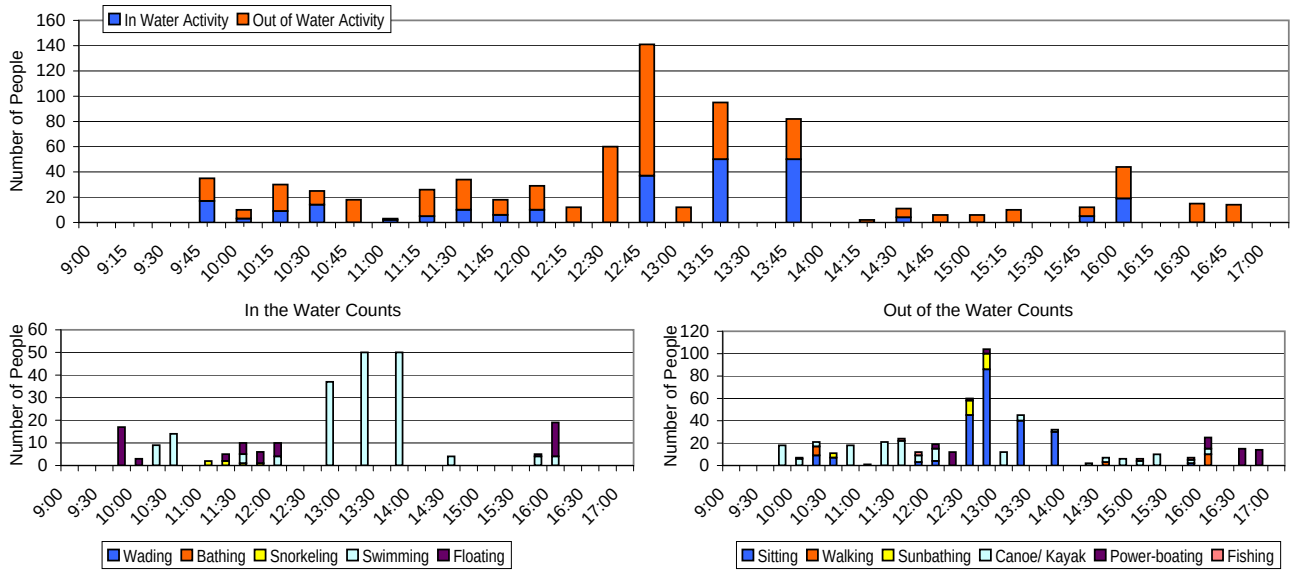
Human Use Actvity Summary

Site DeLeon Springs **Date** 6/9/2009 **Survey Period** 9:00 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	Floating	Total	Sitting	Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:00						0							0
9:15						0							0
9:30						0							0
9:45					17	17				18			18
10:00					3	3				6		1	7
10:15				9		9	9	8		4			21
10:30				14		14	7		4				11
10:45						0				18			18
11:00			2			2	1						1
11:15			2		3	5				21			21
11:30			1	4	5	10				22		2	24
11:45			1		5	6	3			6		3	12
12:00				4	6	10	4			11	4		19
12:15						0					12		12
12:30						0	45		13		2		60
12:45				37		37	86		14		4		104
13:00						0				12			12
13:15				50		50	40			5			45
13:30						0							0
13:45				50		50	30			2			32
14:00						0							0
14:15						0				2			2
14:30				4		4		3		4			7
14:45						0				6			6
15:00						0				4		2	6
15:15						0				10			10
15:30						0							0
15:45				4	1	5	2			3		2	7
16:00				4	15	19		10		5	10		25
16:15						0							0
16:30						0					15		15
16:45						0					14		14
17:00						0							0
Person-Hrs	0.00	0.00	1.50	45.00	13.75	60.25	56.75	5.25	7.75	39.75	15.25	2.50	127.25
Percentage	0.0%	0.0%	2.5%	74.7%	22.8%	100.0%	44.6%	4.1%	6.1%	31.2%	12.0%	2.0%	100.0%

Note(s):

Average Time Interval (hrs): 0.25



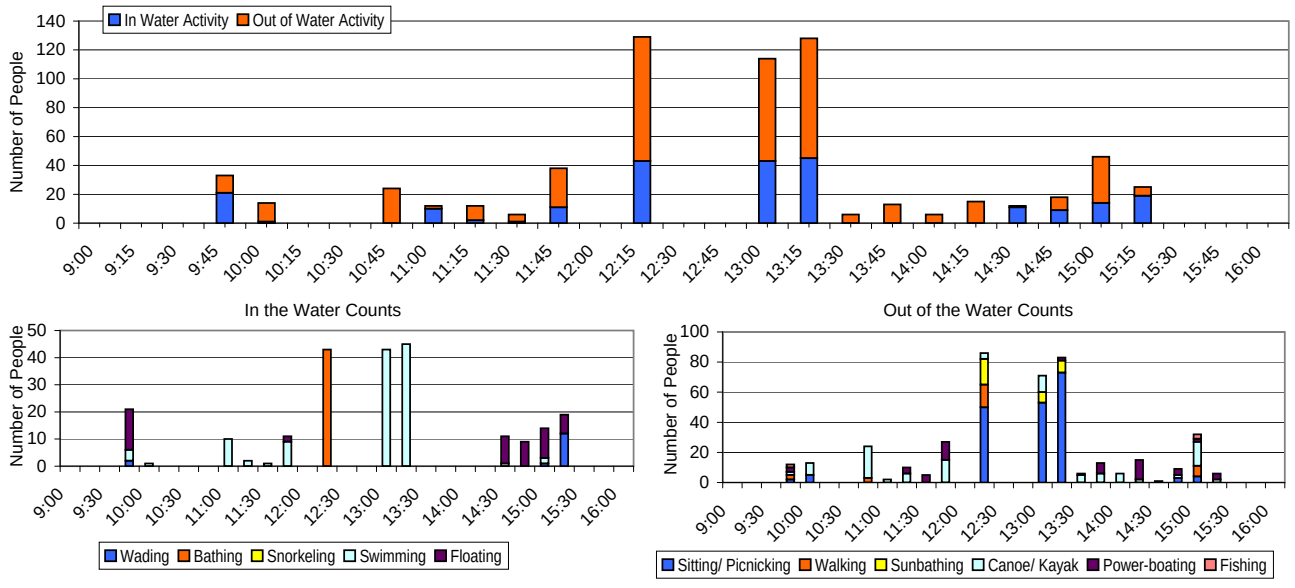
Human Use Actvity Summary

Site DeLeon Springs **Date** 6/10/2009 **Survey Period** 9:00 16:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	Floating	Total	Sitting/ Picnicking	Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:00						0							0
9:15						0							0
9:30						0							0
9:45	2			4	15	21	2	3		2	3	2	12
10:00				1		1	5			8			13
10:15						0							0
10:30						0							0
10:45						0		3		21			24
11:00				10		10				2			2
11:15				2		2				6	4		10
11:30				1		1					5		5
11:45				9	2	11				15	12		27
12:00						0							0
12:15		43				43	50	15	17	4			86
12:30						0							0
12:45						0							0
13:00				43		43	53		7	11			71
13:15				45		45	73		8		2		83
13:30						0				5	1		6
13:45						0				6	7		13
14:00						0				6			6
14:15						0				2	13		15
14:30				1	10	11					1		1
14:45					9	9	3			2	4		9
15:00	1			2	11	14	4	7		16	2	3	32
15:15	12				7	19				2	4		6
15:30						0							0
15:45						0							0
16:00						0							0
Person-Hrs	3.75	10.75	0.00	29.50	13.50	57.50	47.50	7.00	8.00	27.00	14.50	1.25	105.25
Percentage	6.5%	18.7%	0.0%	51.3%	23.5%	100.0%	45.1%	6.7%	7.6%	25.7%	13.8%	1.2%	100.0%

Note(s):

Average Time Interval (hrs): 0.25



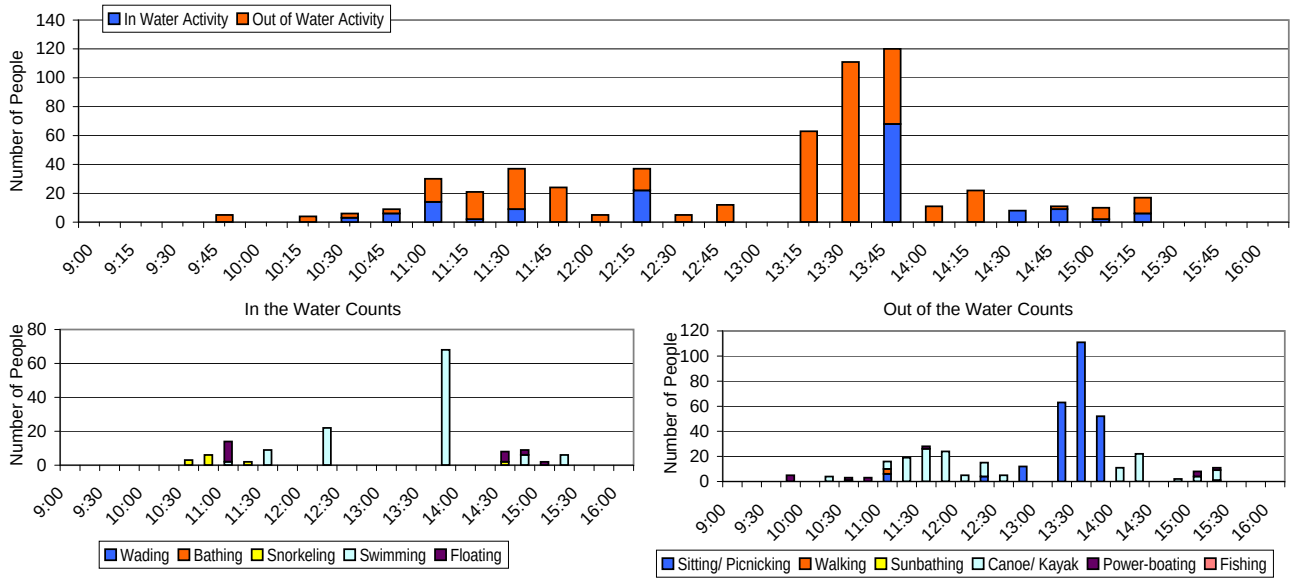
Human Use Actvity Summary

Site DeLeon Springs **Date** 6/11/2009 **Survey Period** 9:00 16:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	Floating	Total	Sitting/ Picnicking	Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:00						0							0
9:15						0							0
9:30						0							0
9:45						0					5		5
10:00						0							0
10:15						0				4			4
10:30			3			3				1	2		3
10:45			6			6					3		3
11:00				2	12	14	6	4		6			16
11:15			2			2				19			19
11:30				9		9				26	2		28
11:45						0				24			24
12:00						0				5			5
12:15				22		22	4			11			15
12:30						0				5			5
12:45						0	12						12
13:00						0							0
13:15						0	63						63
13:30						0	111						111
13:45				68		68	52						52
14:00						0				11			11
14:15						0				22			22
14:30			2		6	8							0
14:45				6	3	9				2			2
15:00					2	2				4	4		8
15:15				6		6	1			8	2		11
15:30						0							0
15:45						0							0
16:00						0							0
Person-Hrs	0.00	0.00	3.25	28.25	5.75	37.25	62.25	1.00	0.00	37.00	4.50	0.00	104.75
Percentage	0.0%	0.0%	8.7%	75.8%	15.4%	100.0%	59.4%	1.0%	0.0%	35.3%	4.3%	0.0%	100.0%

Note(s):

Average Time Interval (hrs): 0.25



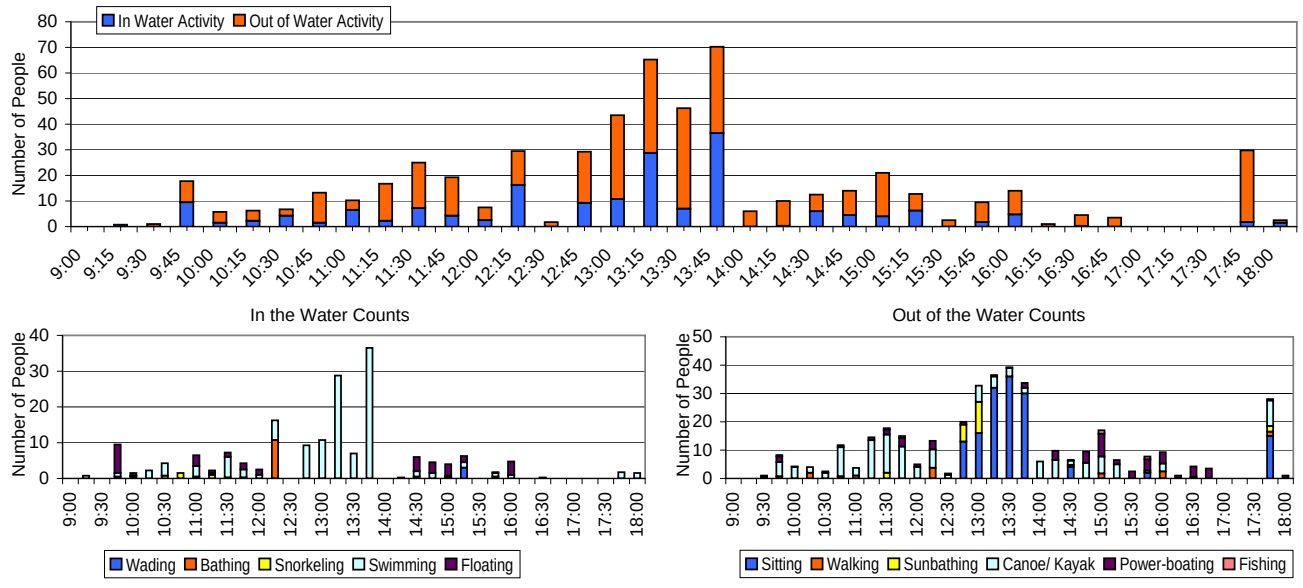
Human Use Actvity Summary - Period of Record Average

Site Rainbow Springs **Date** 6/8/2009 - 6/11/2009 **Survey Period** 9:00 18:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	Floating	Total	Sitting	Walking	Sunbathing	Canoe/ Kayak	Power-boating	Fishing	Total
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	1	0	1	0	0	0	0	0	0	0
9:30	0	0	0	0	0	0	0	0	0	1	0	1	1
9:45	1	0	0	1	8	10	0	1	0	5	2	1	8
10:00	0	0	1	0	1	2	0	0	0	4	0	0	4
10:15	0	0	0	2	0	2	0	2	0	2	0	0	4
10:30	0	0	1	4	0	4	0	0	0	2	1	0	3
10:45	0	0	2	0	0	2	0	1	0	10	1	0	12
11:00	0	0	1	3	3	7	0	1	0	3	0	0	4
11:15	0	0	1	1	1	2	0	0	0	14	1	0	15
11:30	0	0	0	6	1	7	0	0	2	14	2	1	18
11:45	0	0	0	2	2	4	0	0	0	11	3	1	15
12:00	0	0	0	1	2	3	0	0	0	4	1	0	5
12:15	0	11	0	6	0	16	0	4	0	7	3	0	13
12:30	0	0	0	0	0	0	0	0	0	1	1	0	2
12:45	0	0	0	9	0	9	13	0	6	0	1	0	20
13:00	0	0	0	11	0	11	16	0	11	6	0	0	33
13:15	0	0	0	29	0	29	32	0	0	4	1	0	37
13:30	0	0	0	7	0	7	36	0	0	3	0	0	39
13:45	0	0	0	37	0	37	30	0	0	2	2	0	34
14:00	0	0	0	0	0	0	0	0	0	6	0	0	6
14:15	0	0	0	0	0	0	0	0	0	7	3	0	10
14:30	0	0	1	2	4	6	4	1	0	2	0	0	7
14:45	0	0	0	2	3	5	0	0	0	6	4	0	10
15:00	0	0	0	1	3	4	0	2	0	6	8	1	17
15:15	3	0	0	2	2	6	0	0	0	5	2	0	7
15:30	0	0	0	0	0	0	0	0	0	0	3	0	3
15:45	1	0	0	1	0	2	2	0	0	1	4	1	8
16:00	0	0	0	1	4	5	0	3	0	3	4	0	9
16:15	0	0	0	0	0	0	0	0	0	0	1	0	1
16:30	0	0	0	0	0	0	0	0	0	1	4	0	4
16:45	0	0	0	0	0	0	0	0	0	0	4	0	4
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	2	0	2	15	2	2	9	0	1	28
18:00	0	0	0	2	0	2	0	0	0	0	1	0	1
Person-Hrs	1.06	2.69	1.31	32.13	8.31	45.50	37.00	3.69	5.25	33.69	13.44	1.31	94.38
Percentage	2.3%	5.9%	2.9%	70.6%	18.3%	100.0%	39.2%	3.9%	5.6%	35.7%	14.2%	1.4%	100.0%

Note(s):

Average Time Interval (hrs): 0.25



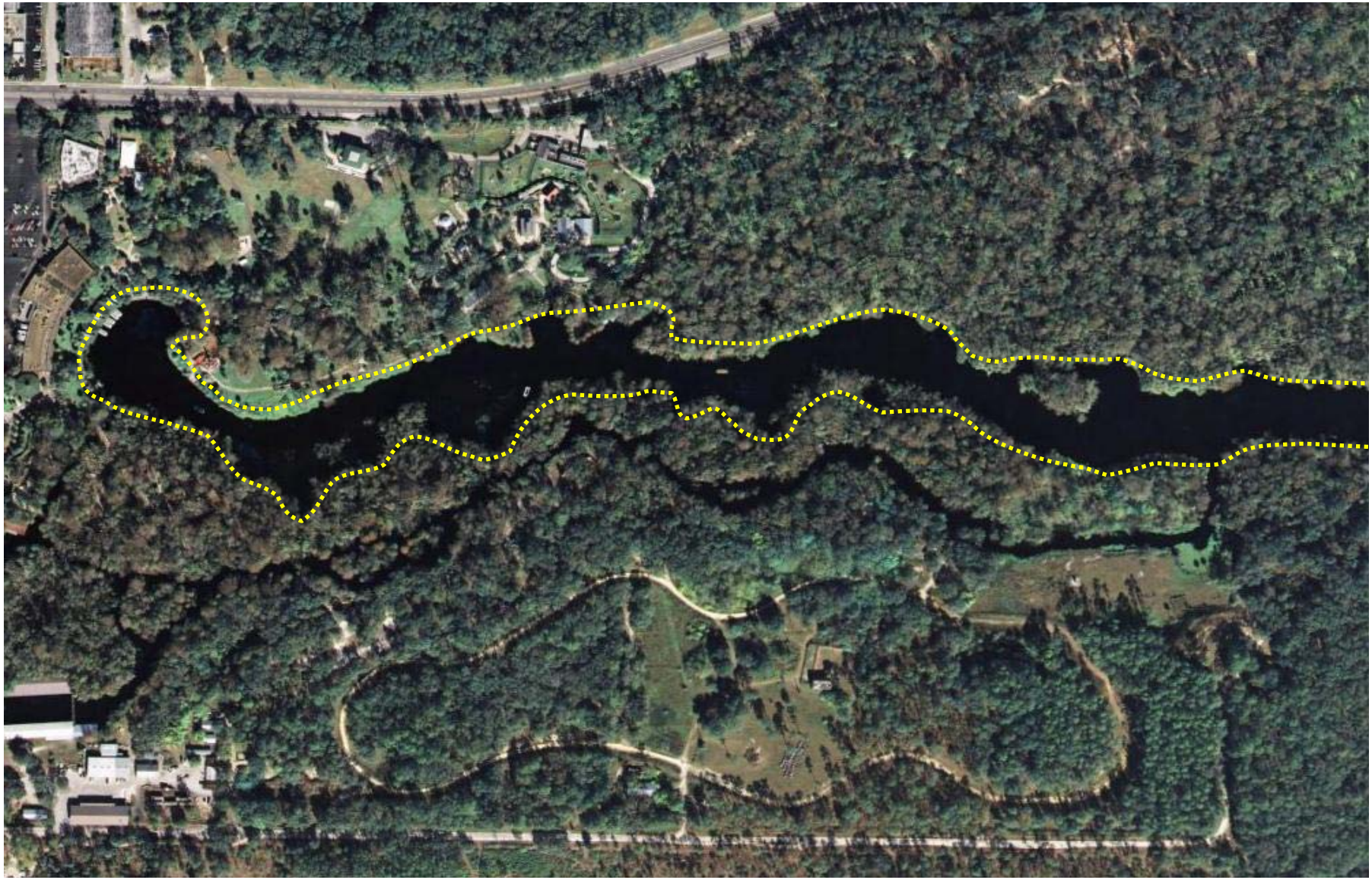
APPENDIX M

Silver Springs (Marion Co.) statistics of human use (in person hours) by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			5/4/2009	5/5/2009	5/7/2009	5/8/2009	Person-Hrs	# People	# People/ha
Spring Pool & Spring Run	In Water	Glass-bottom boat	16.3	20.0	27.5	116.3	45.0	13.57	1.72
		Kayaking-Canoeing	8.8	3.3	1.0	1.0	3.5	0.77	0.10
		Power-boating	3.5	3.3	2.0	1.8	2.6	0.58	0.07
		Jungle Cruise Boat	30.0	25.0	34.8	71.8	40.4	10.87	1.38
	In Water		58.5	51.5	65.3	190.8	91.5	25.80	3.26

Note(s):

Hours of Observations:	19.0	4.3	6.8	5.3	2.8
Spring Pool Wetted Area (ha):	0.564				
Spring Run Area (ha):	7.340				



APPENDIX M
Observational areas of human use at Silver Springs defined by dashed line.

Human Use Actvity Summary

Site Silver Springs **Date** 5/4/2009 **Survey Period** 12:30 16:45

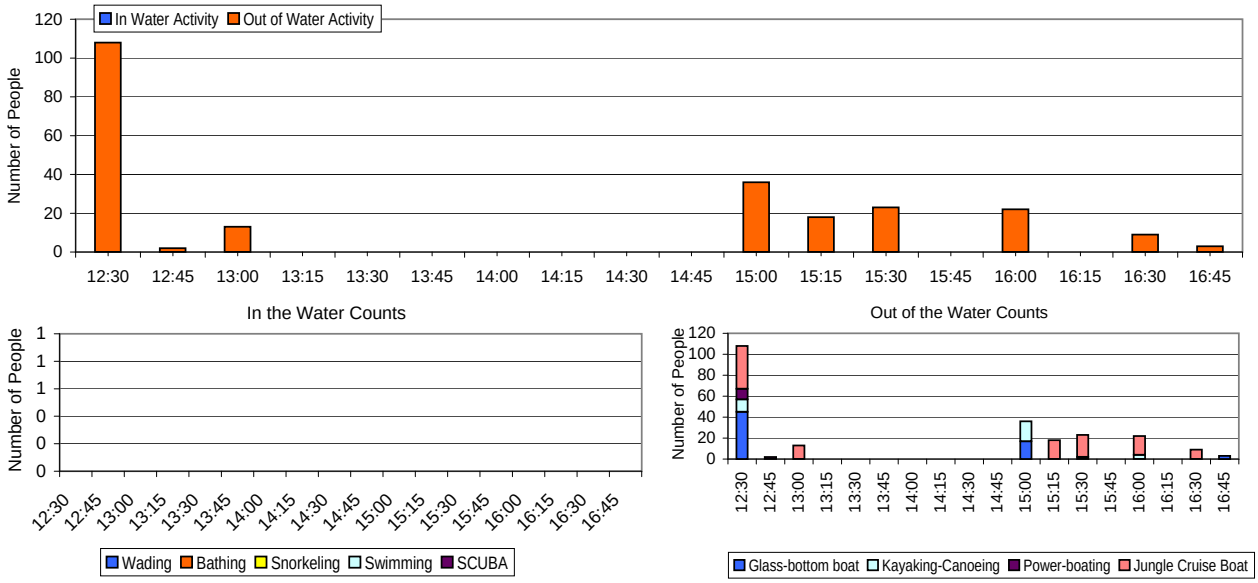
	Numbers of People										
	In Water Activity						Out of Water Activity				
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Glass-bottom boat**	**Kayaking-Canoeing**	**Power-boating**	**Jungle Cruise Boat**	**Total**
12:30						0	45	12	10	41	108
12:45						0			2		2
13:00						0				13	13
13:15						0					0
13:30						0					0
13:45						0					0
14:00						0					0
14:15						0					0
14:30						0					0
14:45						0					0
15:00						0	17	19			36
15:15						0				18	18
15:30						0			2	21	23
15:45						0					0
16:00						0		4		18	22
16:15						0					0
16:30						0				9	9
16:45						0	3				3
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	16.25	8.75	3.50	30.00	58.50
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	27.8%	15.0%	6.0%	51.3%	100.0%

Note(s):

Only total numbers presented.

Visual survey records for the spring pool/run area of Silver Springs State Park. There is no swimming in the spring vent or along the length of the spring run. The survey includes estimated numbers of visitors touring with glass bottomed boats or jungle cruise boats, and power-boating or kayaking/canoing recreationally.

Average Time Interval (hrs): 0.25



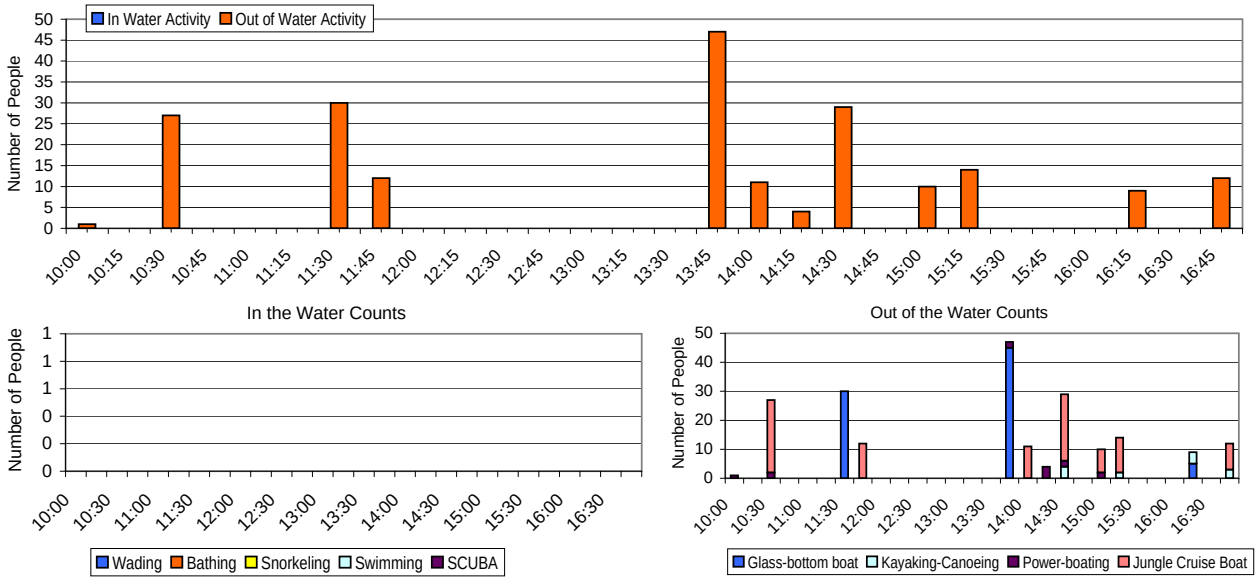
Human Use Actvity Summary

Site Silver Springs **Date** 5/5/2009 **Survey Period** 10:00 16:45

	Numbers of People										
	In Water Activity						Out of Water Activity				
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Glass-bottom boat	Kayaking-Canoeing	Power-boating	Jungle Cruise Boat	Total
10:00						0			1		1
10:15						0					0
10:30						0			2	25	27
10:45						0					0
11:00						0					0
11:15						0					0
11:30						0	30				30
11:45						0				12	12
12:00						0					0
12:15						0					0
12:30						0					0
12:45						0					0
13:00						0					0
13:15						0					0
13:30						0					0
13:45						0	45		2		47
14:00						0				11	11
14:15						0			4		4
14:30						0		4	2	23	29
14:45						0					0
15:00						0			2	8	10
15:15						0		2		12	14
15:30						0					0
15:45						0					0
16:00						0					0
16:15						0	5	4			9
16:30						0					0
16:45						0		3		9	12
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	20.00	3.25	3.25	25.00	51.50
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	38.8%	6.3%	6.3%	48.5%	100.0%

Note(s):
Only total numbers presented.
Visual survey records for the spring pool/run area of Silver Springs State Park. There is no swimming in the spring vent or along the length of the spring run. The survey includes estimated numbers of visitors touring with glass bottomed boats or jungle cruise boats, and power-boating or kayaking/canoing recreationally.

Average Time Interval (hrs): 0.25



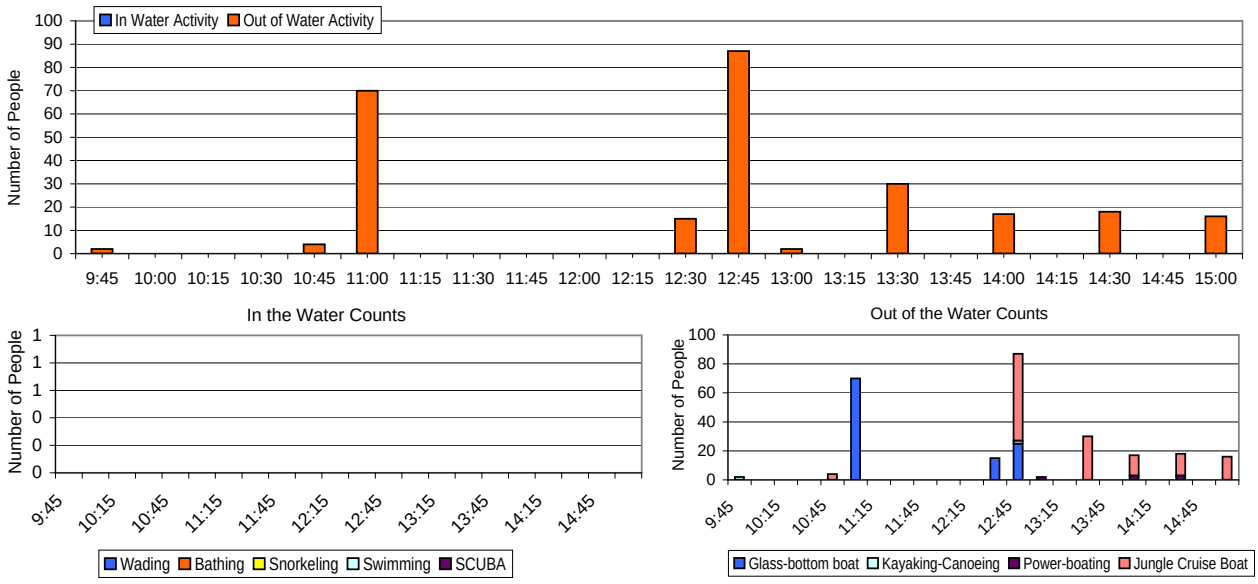
Human Use Actvity Summary

Site Silver Springs **Date** 5/7/2009 **Survey Period** 9:45 15:00

	Numbers of People										
	In Water Activity						Out of Water Activity				
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Glass-bottom boat	Kayaking-Canoeing	Power-boating	Jungle Cruise Boat	Total
9:45						0		2			2
10:00						0					0
10:15						0					0
10:30						0					0
10:45						0				4	4
11:00						0	70				70
11:15						0					0
11:30						0					0
11:45						0					0
12:00						0					0
12:15						0					0
12:30						0	15				15
12:45						0	25	2		60	87
13:00						0			2		2
13:15						0					0
13:30						0				30	30
13:45						0					0
14:00						0			3	14	17
14:15						0					0
14:30						0			3	15	18
14:45						0					0
15:00						0				16	16
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	27.50	1.00	2.00	34.75	65.25
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	42.1%	1.5%	3.1%	53.3%	100.0%

Note(s):
Only total numbers presented.
Visual survey records for the spring pool/run area of Silver Springs State Park. There is no swimming in the spring vent or along the length of the spring run. The survey includes estimated numbers of visitors touring with glass bottomed boats or jungle cruise boats, and power-boating or kayaking/canoing recreationally.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

Site Silver Springs **Date** 5/8/2009 **Survey Period** 9:45 12:30

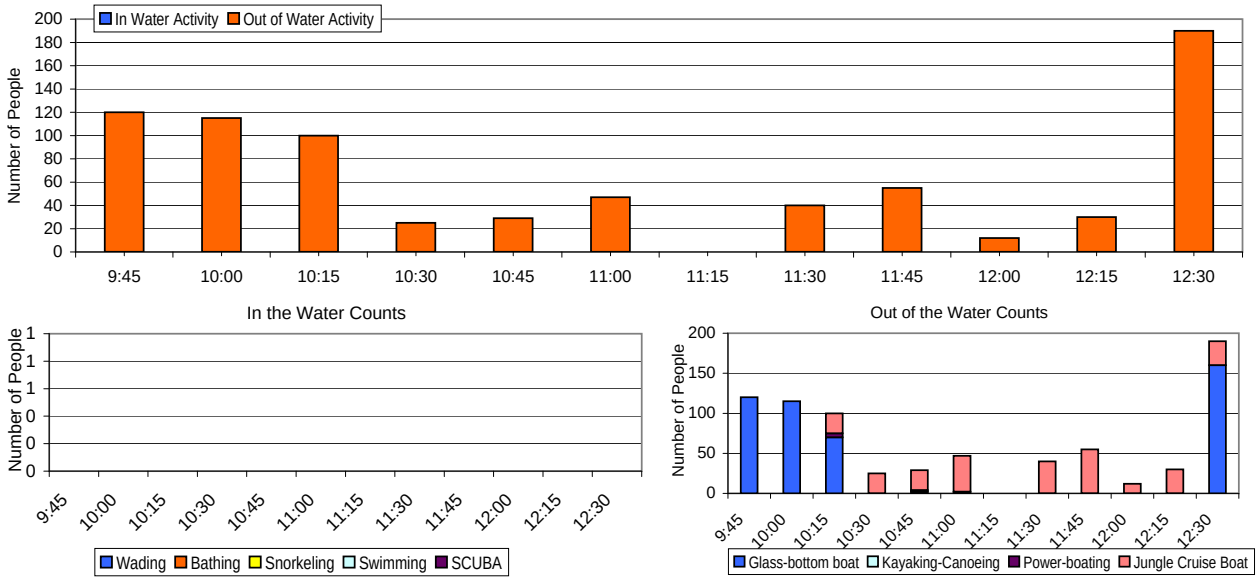
	Numbers of People										
	In Water Activity						Out of Water Activity				
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Glass-bottom boat**	**Kayaking-Canoeing**	**Power-boating**	**Jungle Cruise Boat**	**Total**
9:45						0	120				120
10:00						0	115				115
10:15						0	70		5	25	100
10:30						0				25	25
10:45						0		2	2	25	29
11:00						0		2		45	47
11:15						0					0
11:30						0				40	40
11:45						0				55	55
12:00						0				12	12
12:15						0				30	30
12:30						0	160			30	190
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	116.25	1.00	1.75	71.75	190.75
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	60.9%	0.5%	0.9%	37.6%	100.0%

Note(s):

Only total numbers presented.

Visual survey records for the spring pool/run area of Silver Springs State Park. There is no swimming in the spring vent or along the length of the spring run. The survey includes estimated numbers of visitors touring with glass bottomed boats or jungle cruise boats, and power-boating or kayaking/canoing recreationally.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary - Period of Record Average

Site Silver Springs **Date** 5/4/2009 - 5/8/2009 **Survey Period** 9:45 16:45

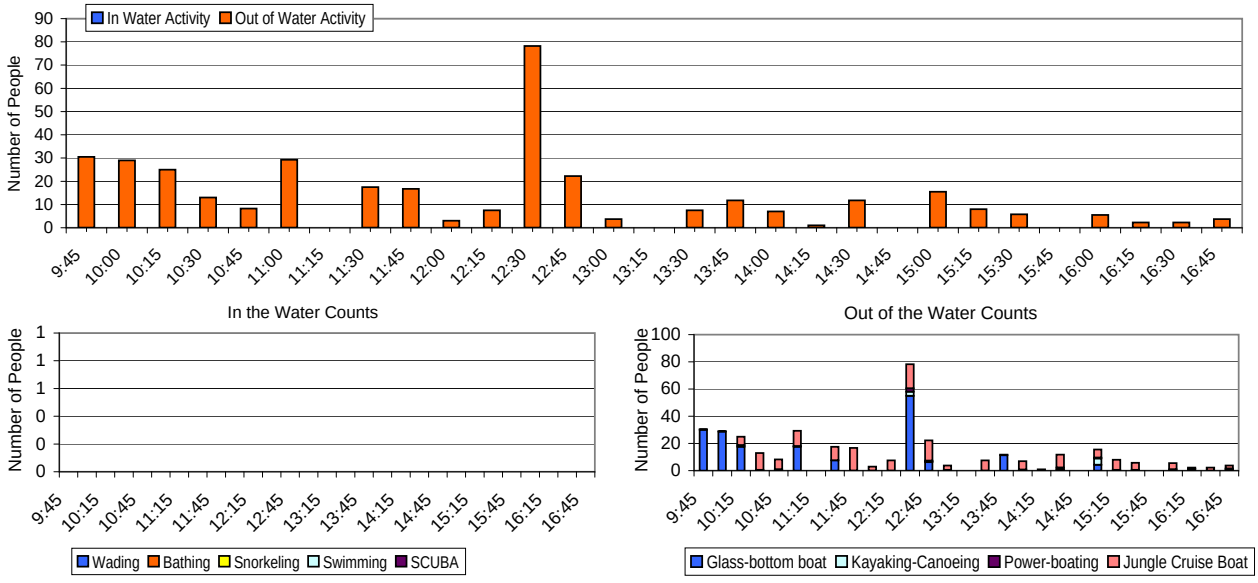
	Numbers of People										
	In Water Activity						Out of Water Activity				
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Glass-bottom boat	Kayaking-Canoeing	Power-boating	Jungle Cruise Boat	Total
9:45	0	0	0	0	0	0	30	1	0	0	31
10:00	0	0	0	0	0	0	29	0	0	0	29
10:15	0	0	0	0	0	0	18	0	1	6	25
10:30	0	0	0	0	0	0	0	0	1	13	13
10:45	0	0	0	0	0	0	0	1	1	7	8
11:00	0	0	0	0	0	0	18	1	0	11	29
11:15	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	8	0	0	10	18
11:45	0	0	0	0	0	0	0	0	0	17	17
12:00	0	0	0	0	0	0	0	0	0	3	3
12:15	0	0	0	0	0	0	0	0	0	8	8
12:30	0	0	0	0	0	0	55	3	3	18	78
12:45	0	0	0	0	0	0	6	1	1	15	22
13:00	0	0	0	0	0	0	0	0	1	3	4
13:15	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	8	8
13:45	0	0	0	0	0	0	11	0	1	0	12
14:00	0	0	0	0	0	0	0	0	1	6	7
14:15	0	0	0	0	0	0	0	0	1	0	1
14:30	0	0	0	0	0	0	0	1	1	10	12
14:45	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	4	5	1	6	16
15:15	0	0	0	0	0	0	0	1	0	8	8
15:30	0	0	0	0	0	0	0	0	1	5	6
15:45	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	1	0	5	6
16:15	0	0	0	0	0	0	1	1	0	0	2
16:30	0	0	0	0	0	0	0	0	0	2	2
16:45	0	0	0	0	0	0	1	1	0	2	4
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	45.00	3.50	2.63	40.38	91.50
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	49.2%	3.8%	2.9%	44.1%	100.0%

Note(s):

Only total numbers presented.

Visual survey records for the spring pool/run area of Silver Springs State Park. There is no swimming in the spring vent or along the length of the spring run. The survey includes estimated numbers of visitors touring with glass bottomed boats or jungle cruise boats, and power-boating or kayaking/canoing recreationally.

Average Time Interval (hrs): 0.25



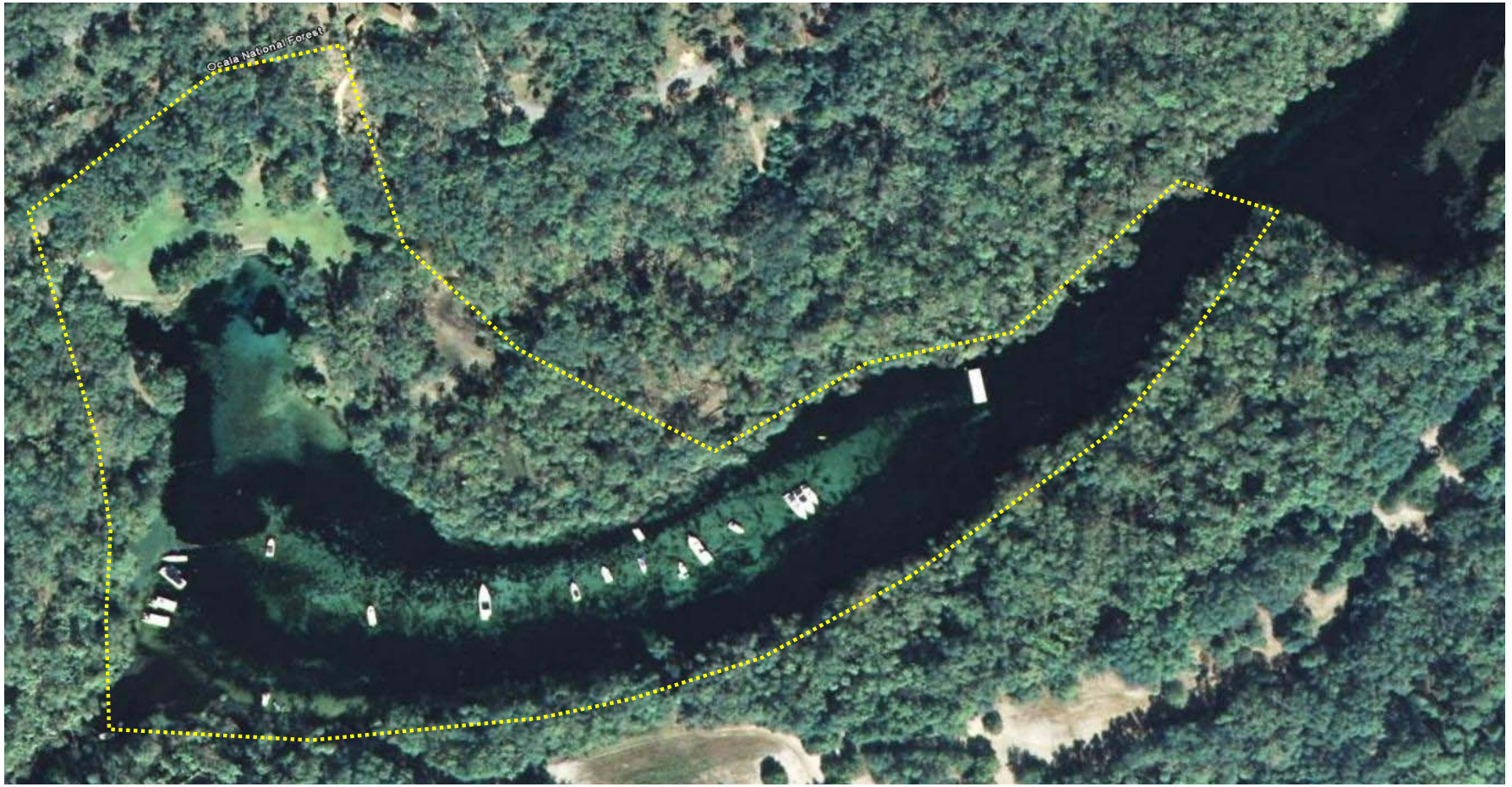
APPENDIX M

Silver Glen Springs (Marion Co.) counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			2/16/2009	2/17/2009	2/18/2009	2/19/2009	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	3.3	1.5	0.3	0.0	1.3	0.18	0.72
		Bathing	0.0	0.0	1.0	0.0	0.3	0.03	0.12
		Snorkeling	0.0	0.5	1.0	0.0	0.4	0.04	0.18
		Swimming	2.5	0.8	1.8	0.0	1.3	0.17	0.69
		SCUBA	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Out of Water	Sitting	2.0	7.0	0.0	0.0	2.3	0.28	0.24
		Walking	2.8	5.3	3.3	5.5	4.2	0.61	0.51
		Sunbathing	5.3	1.5	4.3	0.0	2.8	0.37	0.31
	In Water		5.8	2.8	4.0	0.0	3.1	0.42	1.72
	Out of Water		10.0	13.8	7.5	5.5	9.2	1.26	1.07
Spring Run	In Water	Canoeing	0.0	0.0	2.5	0.0	0.6	0.07	0.02
		Power-boating	4.8	47.8	19.0	31.3	25.7	3.57	1.00
		Fishing	5.8	1.0	0.5	0.3	1.9	0.28	0.08
	In Water		10.5	48.8	22.0	31.5	28.2	3.92	1.09
Entire Spring			26.3	65.3	33.5	37.0	40.5	5.60	3.88

Note(s):

Hours of Observations:	29.0	6.5	8.5	8.5	5.5
Spring Pool Wetted Area (ha):	0.2442				
Spring Pool Upland Area (ha):	1.181				
Spring Run Area (ha):	3.584				



APPENDIX M
Observational area for human use surveys made at Silver Glen Springs Recreational Area defined by dashed line.

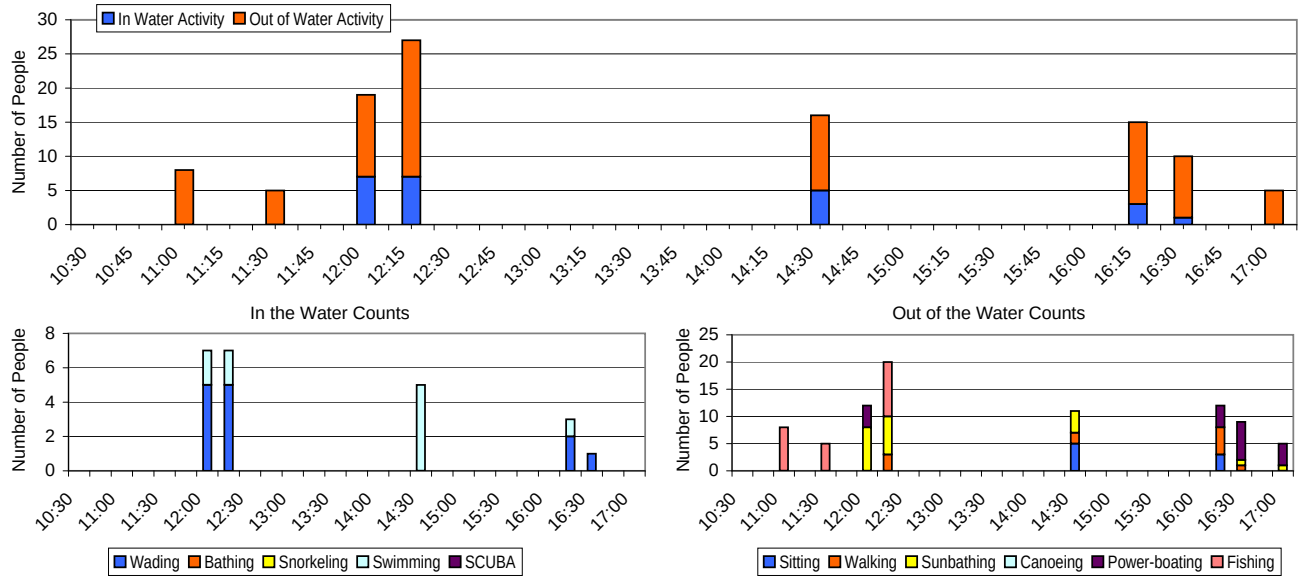
Human Use Actvity Summary

Site Silver Glen Springs **Date** 2/16/2009 **Survey Period** 10:30 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
10:30						0							0
10:45						0							0
11:00						0						8	8
11:15						0							0
11:30						0						5	5
11:45						0							0
12:00	5			2		7			8		4		12
12:15	5			2		7		3	7			10	20
12:30						0							0
12:45						0							0
13:00						0							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00						0							0
14:15						0							0
14:30				5		5	5	2	4				11
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
16:15	2			1		3	3	5			4		12
16:30	1					1		1	1		7		9
16:45						0							0
17:00						0			1		4		5
Person-Hrs	3.25	0.00	0.00	2.50	0.00	5.75	2.00	2.75	5.25	0.00	4.75	5.75	20.50
Percentage	56.5%	0.0%	0.0%	43.5%	0.0%	100.0%	9.8%	13.4%	25.6%	0.0%	23.2%	28.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Sunny day.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Silver Glen Springs Recreational Area. The swimming area is the spring pool and upper run. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (upstream of Juniper Hunt Club).

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

Site Silver Glen Springs **Date** 2/17/2009 **Survey Period** 8:00 16:30

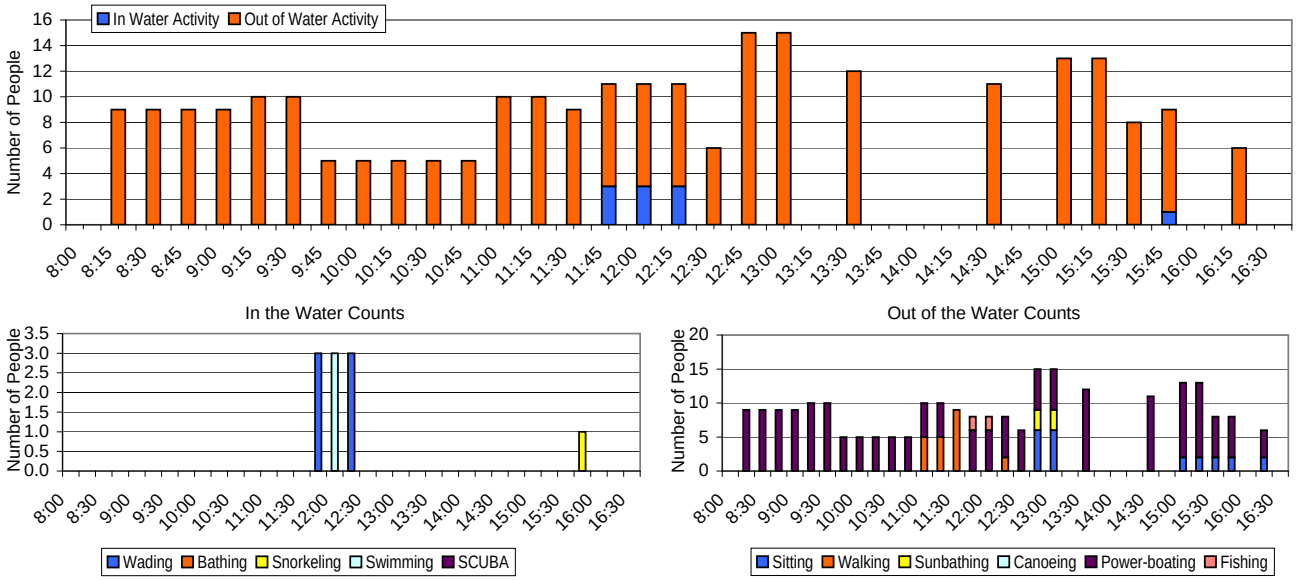
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0							0
8:15						0					9		9
8:30						0					9		9
8:45						0					9		9
9:00						0					9		9
9:15						0					10		10
9:30						0					10		10
9:45						0					5		5
10:00						0					5		5
10:15						0					5		5
10:30						0					5		5
10:45						0					5		5
11:00						0		5			5		10
11:15						0		5			5		10
11:30						0		9					9
11:45	3					3					6	2	8
12:00				3		3					6	2	8
12:15	3					3		2			6		8
12:30						0					6		6
12:45						0	6		3		6		15
13:00						0	6		3		6		15
13:15						0							0
13:30						0					12		12
13:45						0							0
14:00						0							0
14:15						0							0
14:30						0					11		11
14:45						0							0
15:00						0	2				11		13
15:15						0	2				11		13
15:30						0	2				6		8
15:45			1			1	2				6		8
16:00						0							0
16:15						0	2				4		6
16:30						0							0
Person-Hrs	1.50	0.00	0.50	0.75	0.00	2.75	7.00	5.25	1.50	0.00	47.75	1.00	62.50
Percentage	54.5%	0.0%	18.2%	27.3%	0.0%	100.0%	11.2%	8.4%	2.4%	0.0%	76.4%	1.6%	100.0%

Note(s):

"Wading" is waist deep, "Bathing" is chest deep. Sunny day.

Observational counts were made of people engaging in various activities in the swimming/spring run area of Silver Glen Springs Recreational Area. The swimming area is the spring pool and upper run. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (upstream of Juniper Hunt Club).

Average Time Interval (hrs): 0.25



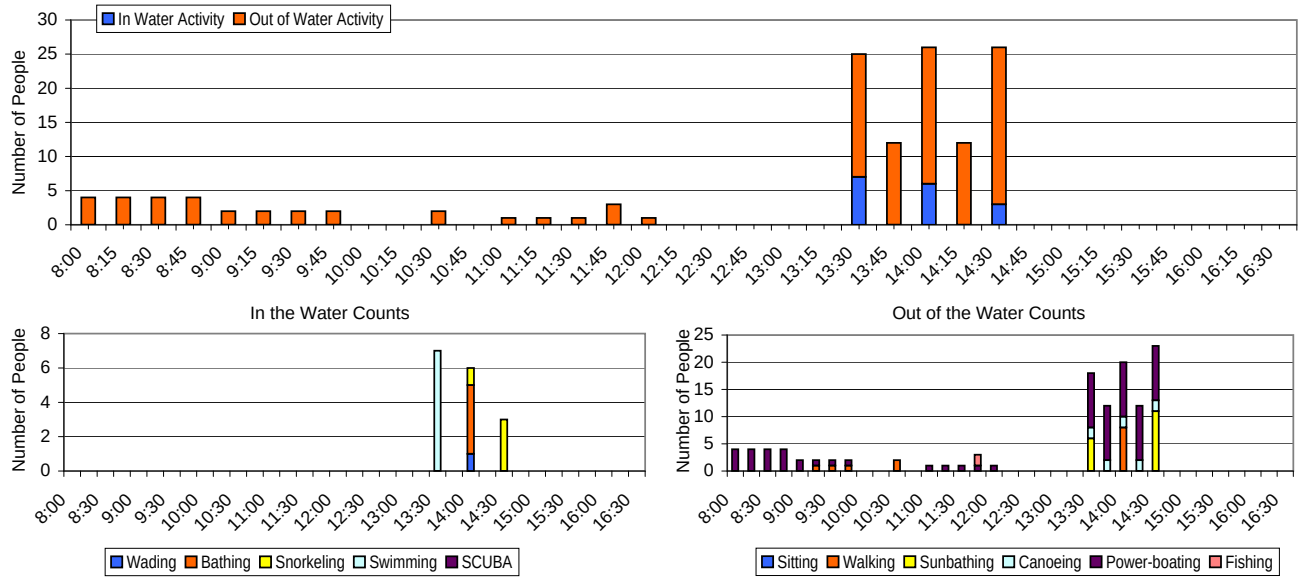
Human Use Actvity Summary

Site Silver Glen Springs **Date** 2/18/2009 **Survey Period** 8:00 16:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0					4		4
8:15						0					4		4
8:30						0					4		4
8:45						0					4		4
9:00						0					2		2
9:15						0		1			1		2
9:30						0		1			1		2
9:45						0		1			1		2
10:00						0							0
10:15						0							0
10:30						0		2					2
10:45						0							0
11:00						0					1		1
11:15						0					1		1
11:30						0					1		1
11:45						0					1	2	3
12:00						0					1		1
12:15						0							0
12:30						0							0
12:45						0							0
13:00						0							0
13:15						0							0
13:30				7		7			6	2	10		18
13:45						0				2	10		12
14:00	1	4	1			6		8		2	10		20
14:15						0				2	10		12
14:30			3			3			11	2	10		23
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
16:15						0							0
16:30						0							0
Person-Hrs	0.25	1.00	1.00	1.75	0.00	4.00	0.00	3.25	4.25	2.50	19.00	0.50	29.50
Percentage	6.3%	25.0%	25.0%	43.8%	0.0%	100.0%	0.0%	11.0%	14.4%	8.5%	64.4%	1.7%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Sunny day.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Silver Glen Springs Recreational Area. The swimming area is the spring pool and upper run. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (upstream of Juniper Hunt Club).

Average Time Interval (hrs): 0.25



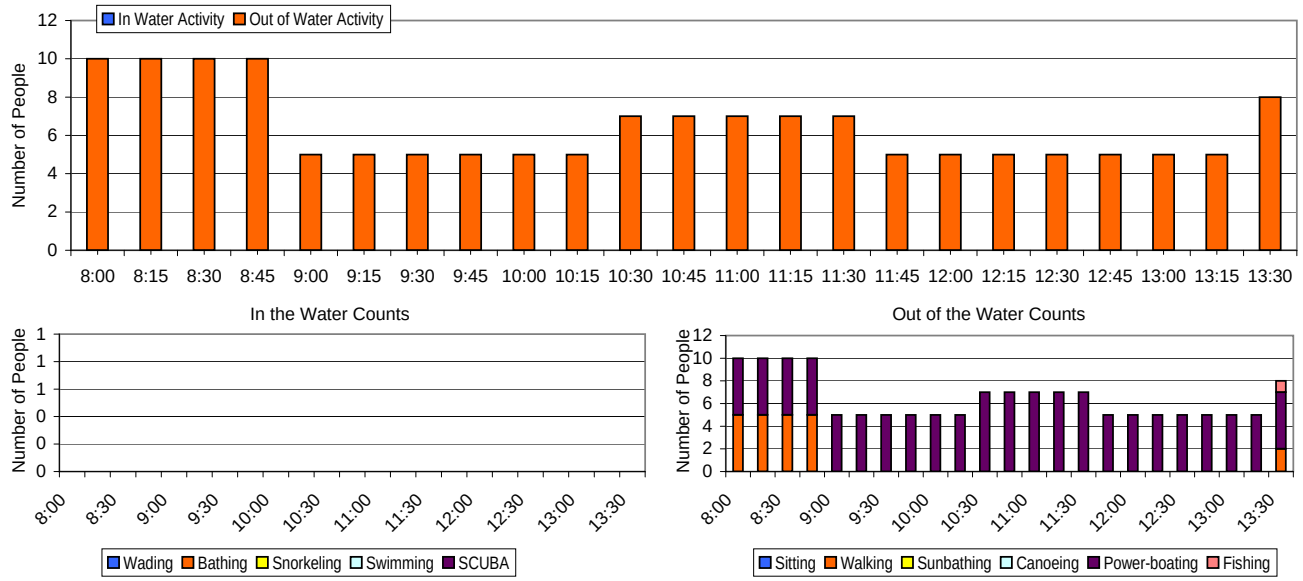
Human Use Actvity Summary

Site Silver Glen Springs **Date** 2/19/2009 **Survey Period** 8:00 13:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00						0		5			5		10
8:15						0		5			5		10
8:30						0		5			5		10
8:45						0		5			5		10
9:00						0					5		5
9:15						0					5		5
9:30						0					5		5
9:45						0					5		5
10:00						0					5		5
10:15						0					5		5
10:30						0					7		7
10:45						0					7		7
11:00						0					7		7
11:15						0					7		7
11:30						0					7		7
11:45						0					5		5
12:00						0					5		5
12:15						0					5		5
12:30						0					5		5
12:45						0					5		5
13:00						0					5		5
13:15						0					5		5
13:30						0		2			5	1	8
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.50	0.00	0.00	31.25	0.25	37.00
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.0%	14.9%	0.0%	0.0%	84.5%	0.7%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. Overcast and drizzly morning.
Observational counts were made of people engaging in various activities in the swimming/spring run area of Silver Glen Springs Recreational Area. The swimming area is the spring pool and upper run. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (upstream of Juniper Hunt Club).

Average Time Interval (hrs): 0.25



Human Use Actvity Summary - Period of Record Average

Site DeLeon Springs **Date** 2/16/2009 - 2/19/2008 **Survey Period** 8:00 18:00

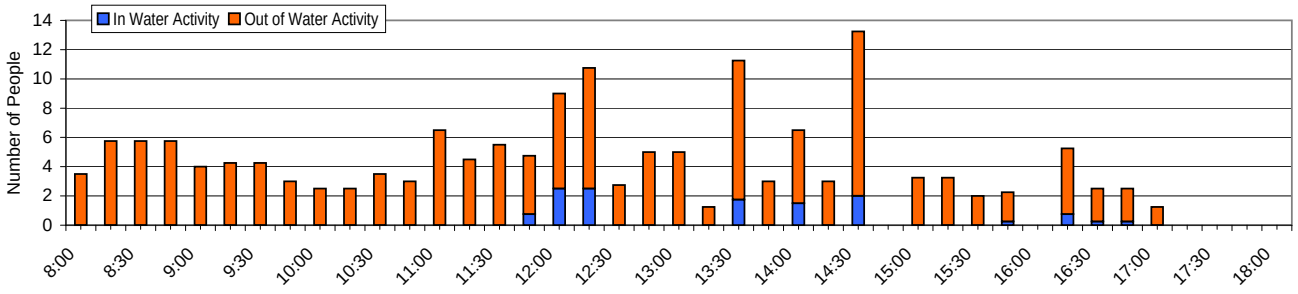
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Canoeing	Power-boating	Fishing	Total
8:00	0	0	0	0	0	0	0	1	0	0	2	0	4
8:15	0	0	0	0	0	0	0	1	0	0	5	0	6
8:30	0	0	0	0	0	0	0	1	0	0	5	0	6
8:45	0	0	0	0	0	0	0	1	0	0	5	0	6
9:00	0	0	0	0	0	0	0	0	0	0	4	0	4
9:15	0	0	0	0	0	0	0	0	0	0	4	0	4
9:30	0	0	0	0	0	0	0	0	0	0	4	0	4
9:45	0	0	0	0	0	0	0	0	0	0	3	0	3
10:00	0	0	0	0	0	0	0	0	0	0	3	0	3
10:15	0	0	0	0	0	0	0	0	0	0	3	0	3
10:30	0	0	0	0	0	0	0	1	0	0	3	0	4
10:45	0	0	0	0	0	0	0	0	0	0	3	0	3
11:00	0	0	0	0	0	0	0	1	0	0	3	2	7
11:15	0	0	0	0	0	0	0	1	0	0	3	0	5
11:30	0	0	0	0	0	0	0	2	0	0	2	1	6
11:45	1	0	0	0	0	1	0	0	0	0	3	1	4
12:00	1	0	0	1	0	3	0	0	2	0	4	1	7
12:15	2	0	0	1	0	3	0	1	2	0	3	3	8
12:30	0	0	0	0	0	0	0	0	0	0	3	0	3
12:45	0	0	0	0	0	0	2	0	1	0	3	0	5
13:00	0	0	0	0	0	0	2	0	1	0	3	0	5
13:15	0	0	0	0	0	0	0	0	0	0	1	0	1
13:30	0	0	0	2	0	2	0	1	2	1	7	0	10
13:45	0	0	0	0	0	0	0	0	0	1	3	0	3
14:00	0	1	0	0	0	2	0	2	0	1	3	0	5
14:15	0	0	0	0	0	0	0	0	0	1	3	0	3
14:30	0	0	1	1	0	2	1	1	4	1	5	0	11
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	1	0	0	0	3	0	3
15:15	0	0	0	0	0	0	1	0	0	0	3	0	3
15:30	0	0	0	0	0	0	1	0	0	0	2	0	2
15:45	0	0	0	0	0	0	1	0	0	0	2	0	2
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	1	0	0	0	0	1	1	1	0	0	2	0	5
16:30	0	0	0	0	0	0	0	0	0	0	2	0	2
16:45	0	0	0	0	0	0	2	0	0	0	1	0	2
17:00	0	0	0	0	0	0	0	0	0	0	1	0	1
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Person-Hrs	1.25	0.25	0.38	1.25	0.00	3.13	2.25	4.19	2.75	0.63	25.69	1.88	37.38
Percentage	40.0%	8.0%	12.0%	40.0%	0.0%	100.0%	6.0%	11.2%	7.4%	1.7%	68.7%	5.0%	100.0%

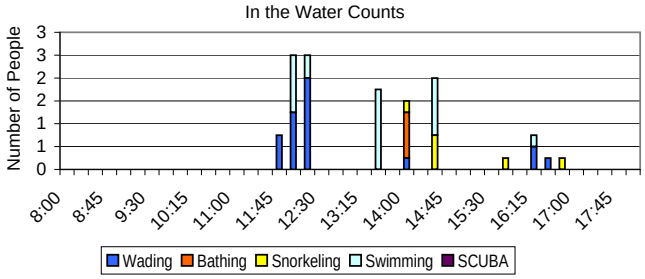
Note(s):

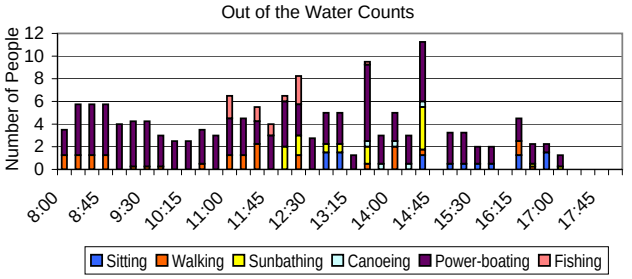
"Wading" is waist deep, "Bathing" is chest deep.

Observational counts were made of people engaging in various activities in the swimming/spring run area of Silver Glen Springs Recreational Area. The swimming area is the spring pool and upper run. The surrounding area under observation included the lands ajacent to the swim area, and the upper spring run (upstream of Juniper Hunt Club).

Average Time Interval (hrs): 0.25







APPENDIX M

Wakulla Springs counts of human use by location, activity, category, and date.

Location	Category	Activity	Person-Hrs				Average		
			4/13/2009	4/14/2009	4/15/2009	4/16/2009	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	0.5	0.0	2.3	1.0	0.9	0.13	0.08
		Bathing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Snorkeling	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Swimming	0.5	0.0	2.8	0.0	0.8	0.09	0.06
		SCUBA	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Out of Water	Sitting	0.0	0.0	7.3	2.5	2.4	0.31	0.23
		Walking	4.0	7.0	13.5	7.0	7.9	1.06	0.79
		Sunbathing	0.0	0.0	9.0	4.8	3.4	0.46	0.34
		Viewing	4.5	13.0	4.8	2.0	6.1	0.77	0.57
	In Water		1.0	0.0	5.0	1.0	1.8	0.23	0.14
	Out of Water		8.5	20.0	34.5	16.3	19.8	2.60	1.92
Spring Run	In Water	Boat Tour	44.5	17.5	27.3	4.8	23.5	3.58	0.59
		Other	0.0	0.5	0.0	0.0	0.1	0.01	0.00
	In Water		44.5	18.0	27.3	4.8	23.6	3.59	0.60
Entire Spring			54.0	38.0	66.8	22.0	45.2	6.42	2.66

Note(s):

Hours of Observations:	30.0	5.0	10.0	10.0	5.0
Spring Pool Wetted Area (ha):	1.569				
Spring Pool Upland Area (ha):	1.353				
Spring Run Area (ha):	6.032				



APPENDIX M
Observational areas of human use at Wakulla Springs defined by dashed line.

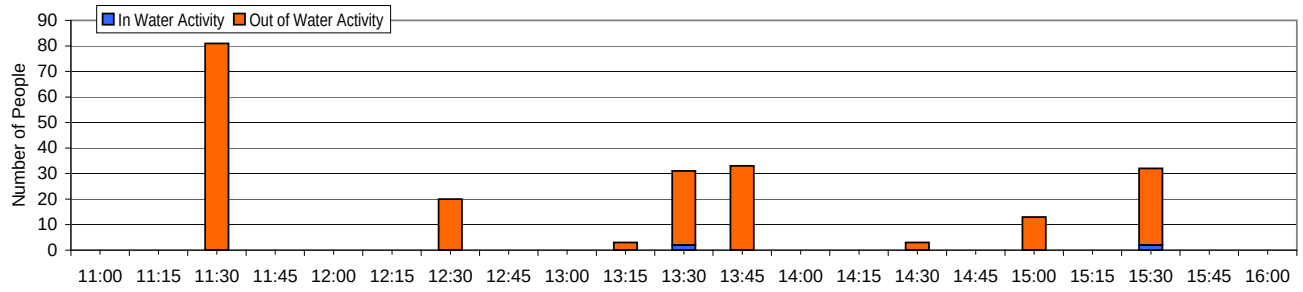
Human Use Actvity Summary

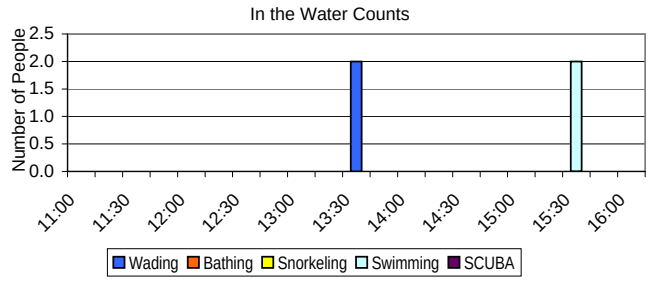
Site Wakulla Springs **Date** 4/13/2009 **Survey Period** 11:00 16:00

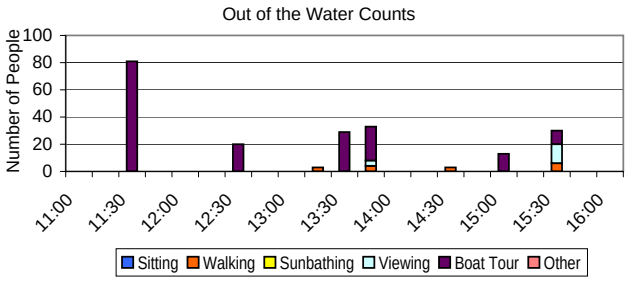
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Viewing**	**Boat Tour**	**Other**	**Total**
11:00						0							0
11:15						0							0
11:30						0					81		81
11:45						0							0
12:00						0							0
12:15						0							0
12:30						0					20		20
12:45						0							0
13:00						0							0
13:15						0		3					3
13:30	2					2					29		29
13:45						0		4		4	25		33
14:00						0							0
14:15						0							0
14:30						0		3					3
14:45						0							0
15:00						0					13		13
15:15						0							0
15:30				2		2		6		14	10		30
15:45						0							0
16:00						0							0
Person-Hrs	0.50	0.00	0.00	0.50	0.00	1.00	0.00	4.00	0.00	4.50	44.50	0.00	53.00
Percentage	50.0%	0.0%	0.0%	50.0%	0.0%	100.0%	0.0%	7.5%	0.0%	8.5%	84.0%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-of-water recreation. Recreational boating in the spring pool or spring run are prohibited. In water recreation is limited to a defined swim area along the south side of the spring pool.

Average Time Interval (hrs): 0.25







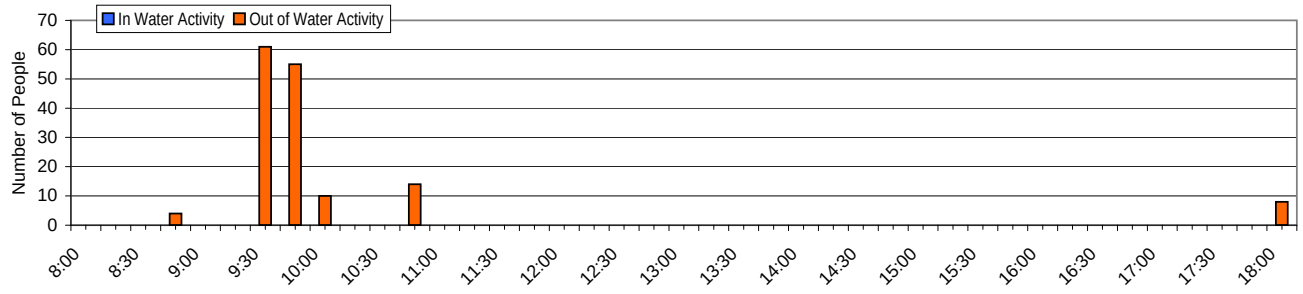
Human Use Actvity Summary

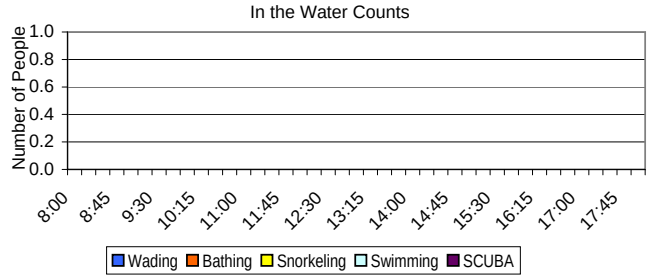
Site Wakulla Springs **Date** 4/14/2009 **Survey Period** 8:00 18:00

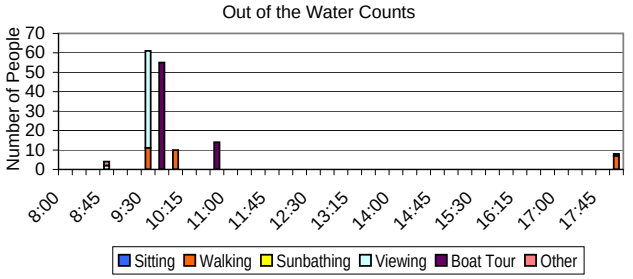
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Viewing**	**Boat Tour**	**Other**	**Total**
8:00						0							0
8:15						0							0
8:30						0							0
8:45						0				2		2	4
9:00						0							0
9:15						0							0
9:30						0		11		50			61
9:45						0					55		55
10:00						0		10					10
10:15						0							0
10:30						0							0
10:45						0					14		14
11:00						0							0
11:15						0							0
11:30						0							0
11:45						0							0
12:00						0							0
12:15						0							0
12:30						0							0
12:45						0							0
13:00						0							0
13:15						0							0
13:30						0							0
13:45						0							0
14:00						0							0
14:15						0							0
14:30						0							0
14:45						0							0
15:00						0							0
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
16:15						0							0
16:30						0							0
16:45						0							0
17:00						0							0
17:15						0							0
17:30						0							0
17:45						0							0
18:00						0		7			1		8
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	0.00	13.00	17.50	0.50	38.00
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.0%	18.4%	0.0%	34.2%	46.1%	1.3%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-of-water recreation. Recreational boating in the spring pool or spring run are prohibited. In water recreation is limited to a defined swim area along the south side of the spring pool.

Average Time Interval (hrs): 0.25







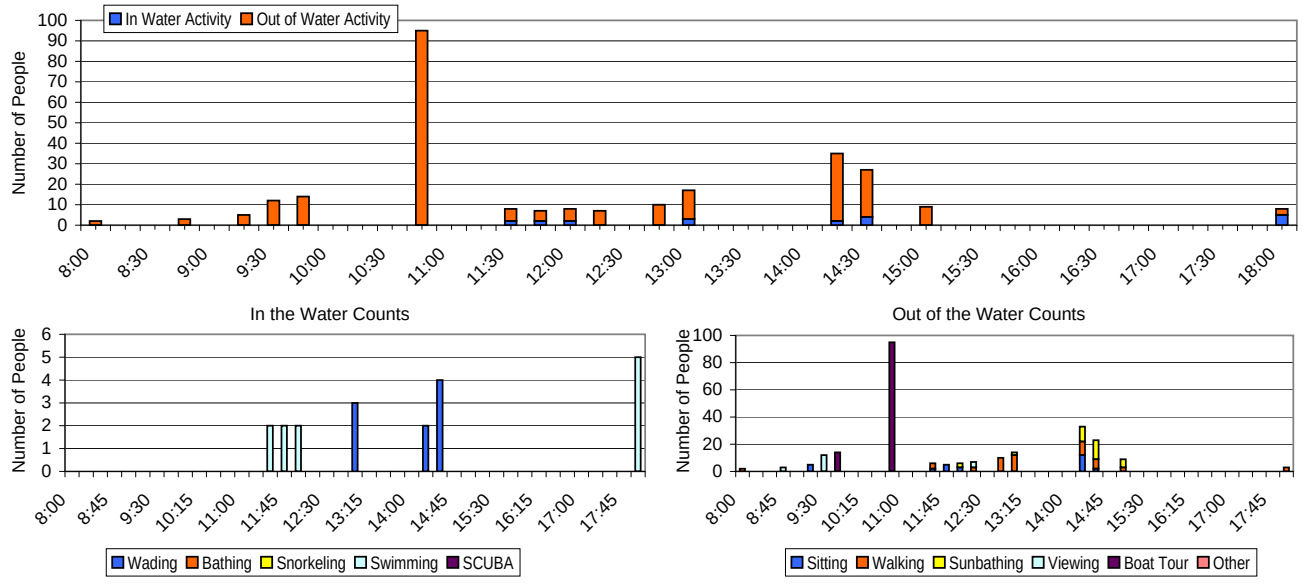
Human Use Actvity Summary

Site Wakulla Springs **Date** 4/15/2009 **Survey Period** 8:00 18:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Viewing**	**Boat Tour**	**Other**	**Total**
8:00						0		2					2
8:15						0							0
8:30						0							0
8:45						0				3			3
9:00						0							0
9:15						0	5						5
9:30						0				12			12
9:45						0					14		14
10:00						0							0
10:15						0							0
10:30						0							0
10:45						0					95		95
11:00						0							0
11:15						0							0
11:30				2		2	2	4					6
11:45				2		2	5						5
12:00				2		2	3		3				6
12:15						0		3		4			7
12:30						0							0
12:45						0		10					10
13:00	3					3		12	2				14
13:15						0							0
13:30						0							0
13:45						0							0
14:00						0							0
14:15	2					2	12	10	11				33
14:30	4					4	2	7	14				23
14:45						0							0
15:00						0		3	6				9
15:15						0							0
15:30						0							0
15:45						0							0
16:00						0							0
16:15						0							0
16:30						0							0
16:45						0							0
17:00						0							0
17:15						0							0
17:30						0							0
17:45						0							0
18:00				5		5		3					3
Person-Hrs	2.25	0.00	0.00	2.75	0.00	5.00	7.25	13.50	9.00	4.75	27.25	0.00	61.75
Percentage	45.0%	0.0%	0.0%	55.0%	0.0%	100.0%	11.7%	21.9%	14.6%	7.7%	44.1%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-of-water recreation. Recreational boating in the spring pool or spring run are prohibited. In water recreation is limited to a defined swim area along the south side of the spring pool.

Average Time Interval (hrs): 0.25



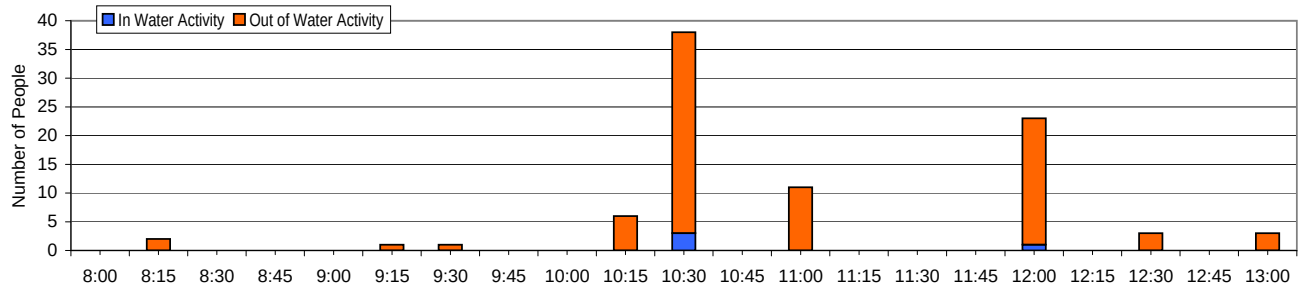
Human Use Actvity Summary

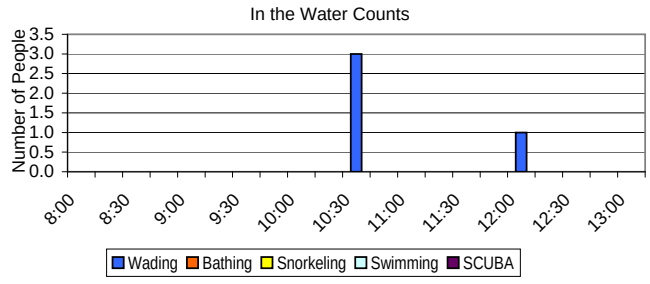
Site Wakulla Springs **Date** 4/16/2009 **Survey Period** 8:00 13:00

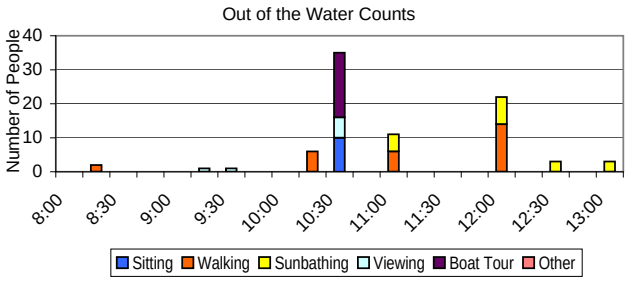
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Viewing**	**Boat Tour**	**Other**	**Total**
8:00						0							0
8:15						0		2					2
8:30						0							0
8:45						0							0
9:00						0							0
9:15						0				1			1
9:30						0				1			1
9:45						0							0
10:00						0							0
10:15						0		6					6
10:30	3					3	10			6	19		35
10:45						0							0
11:00						0		6	5				11
11:15						0							0
11:30						0							0
11:45						0							0
12:00	1					1		14	8				22
12:15						0							0
12:30						0			3				3
12:45						0							0
13:00						0			3				3
Person-Hrs	1.00	0.00	0.00	0.00	0.00	1.00	2.50	7.00	4.75	2.00	4.75	0.00	21.00
Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	11.9%	33.3%	22.6%	9.5%	22.6%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-of-water recreation. Recreational boating in the spring pool or spring run are prohibited. In water recreation is limited to a defined swim area along the south side of the spring pool.

Average Time Interval (hrs): 0.25







Human Use Actvity Summary - Period of Record Average

Site Wakulla Springs **Date** 4/13/2009 - 4/16/2009 **Survey Period** 8:00 18:00

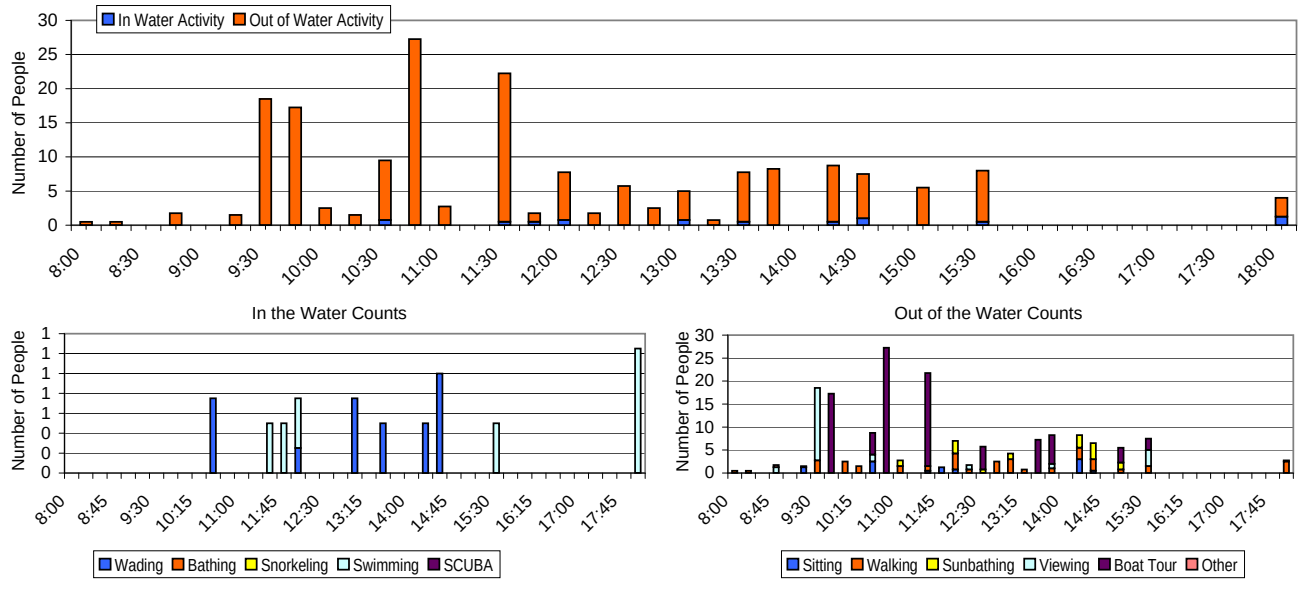
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
8:00	0	0	0	0	0	0	0	1	0	0	0	0	1
8:15	0	0	0	0	0	0	0	1	0	0	0	0	1
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	1	0	1	2
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	0	0	0	1	0	0	0	0	0	2
9:30	0	0	0	0	0	0	0	3	0	16	0	0	19
9:45	0	0	0	0	0	0	0	0	0	0	17	0	17
10:00	0	0	0	0	0	0	0	3	0	0	0	0	3
10:15	0	0	0	0	0	0	0	2	0	0	0	0	2
10:30	1	0	0	0	0	1	3	0	0	2	5	0	9
10:45	0	0	0	0	0	0	0	0	0	0	27	0	27
11:00	0	0	0	0	0	0	0	2	1	0	0	0	3
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	1	0	1	1	1	0	0	20	0	22
11:45	0	0	0	1	0	1	1	0	0	0	0	0	1
12:00	0	0	0	1	0	1	1	4	3	0	0	0	7
12:15	0	0	0	0	0	0	0	1	0	1	0	0	2
12:30	0	0	0	0	0	0	0	0	1	0	5	0	6
12:45	0	0	0	0	0	0	0	3	0	0	0	0	3
13:00	1	0	0	0	0	1	0	3	1	0	0	0	4
13:15	0	0	0	0	0	0	0	1	0	0	0	0	1
13:30	1	0	0	0	0	1	0	0	0	0	7	0	7
13:45	0	0	0	0	0	0	0	1	0	1	6	0	8
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	1	0	0	0	0	1	3	3	3	0	0	0	8
14:30	1	0	0	0	0	1	1	3	4	0	0	0	7
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	1	2	0	3	0	6
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	1	0	1	0	2	0	4	3	0	8
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	1	0	1	0	3	0	0	0	0	3
Person-Hrs	0.94	0.00	0.00	0.81	0.00	1.75	2.44	7.88	3.44	6.06	23.50	0.13	43.44
Percentage	53.6%	0.0%	0.0%	46.4%	0.0%	100.0%	5.6%	18.1%	7.9%	14.0%	54.1%	0.3%	100.0%

Note(s):

"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats

Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-of-water recreation. Recreational boating in the spring pool or spring run are prohibited. In water recreation is limited to a defined swim area along the south side of the spring pool.

Average Time Interval (hrs): 0.25



APPENDIX M

Wakulla Springs counts of human use by location, activity, category, and date.

			# Person/ha												Average	
			1/19/2009	1/25/2009	2/26/2009	2/28/2009	3/29/2009	3/31/2009	4/26/2009	4/30/2009	5/29/2009	5/31/2009	6/28/2009	6/30/2009		
Location	Category	Activity	Weekday	Weekend	Weekday	Weekend	Weekend	Weekday	Weekend	Weekday	Weekday	Weekend	Weekend	Weekday	Weekday	Weekend
Spring Pool	In Water	Wading	0.12	0.02	0.11	0.08	1.28	0.41	8.14	0.71	3.42	12.99	21.92	7.33	2.02	7.40
		Bathing	0.00	0.00	0.00	0.00	0.00	0.17	5.32	0.13	1.86	11.04	26.59	9.84	2.00	7.16
		Snorkeling	0.06	0.00	0.00	0.00	0.11	0.00	0.74	0.00	0.05	0.60	2.15	3.74	0.64	0.60
		Swimming	0.06	0.00	0.00	0.04	7.56	0.87	6.03	0.69	3.80	8.49	8.58	5.48	1.82	5.12
		SCUBA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Out of Water	Sitting	0.24	0.58	0.65	1.32	5.31	1.01	17.34	3.81	5.62	29.39	47.62	11.48	3.80	16.93
		Walking	4.10	2.90	4.67	9.29	18.09	7.66	24.65	8.63	20.31	37.75	54.27	22.20	11.26	24.49
		Sunbathing	0.00	0.00	0.00	0.00	5.04	0.00	14.07	1.36	1.51	19.78	13.71	4.34	1.20	8.77
		Viewing	0.00	4.28	4.91	8.78	18.88	8.33	35.68	10.53	92.85	54.10	62.31	32.75	24.90	30.67
	In Water		0.2	0.0	0.1	0.1	8.9	1.4	20.2	1.5	9.1	33.1	59.2	26.4	6.47	20.28
	Out of Water		4.3	7.8	10.2	19.4	47.3	17.0	91.8	24.3	120.3	141.0	177.9	70.8	41.16	80.86
Spring Run	In Water	Boat Tour	2.68	1.96	4.25	4.57	3.37	3.90	6.08	6.78	5.49	7.65	2.13	5.80	4.82	4.29
		Other	0.17	0.00	0.00	0.12	0.11	0.43	1.16	0.03	0.14	1.34	1.04	0.15	0.15	0.63
	In Water		2.8	2.0	4.3	4.7	3.5	4.3	7.2	6.8	5.6	9.0	3.2	5.9	4.97	4.92
Entire Spring			7.4	9.7	14.6	24.2	59.7	22.8	119.2	32.7	135.1	183.1	240.3	103.1	52.61	106.06

Note(s):

Hours of Observations:		5.5	9.5	8.5	8.0	7.0	5.5	6.5	6.3	6.3	4.0	6.0	7.5
Spring Pool Wetted Area (ha):	1.569											
Spring Pool Upland Area (ha):	1.353											
Spring Run Area (ha):	6.032											

APPENDIX M

Wakulla Springs counts of human use by location, activity, category, and date.

			Person-Hrs												Average		
			1/19/2009	1/25/2009	2/26/2009	2/28/2009	3/29/2009	3/31/2009	4/26/2009	4/30/2009	5/29/2009	5/31/2009	6/28/2009	6/30/2009			
Location	Category	Activity	Weekday	Weekend	Weekday	Weekend	Weekend	Weekday	Weekend	Weekday	Weekday	Weekend	Weekend	Weekday	Person-Hrs	# People	# People/ha
Spring Pool	In Water	Wading	1.0	0.3	1.5	1.0	14.0	3.5	83.0	7.0	33.5	81.5	206.3	86.3	43.2	7.39	4.71
		Bathing	0.0	0.0	0.0	0.0	0.0	1.5	54.3	1.3	18.3	69.3	250.3	115.8	42.5	7.18	4.58
		Snorkeling	0.5	0.0	0.0	0.0	1.3	0.0	7.5	0.0	0.5	3.8	20.3	44.0	6.5	0.97	0.62
		Swimming	0.5	0.0	0.0	0.5	83.0	7.5	61.5	6.8	37.3	53.3	80.8	64.5	33.0	5.44	3.47
		SCUBA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Out of Water	Sitting	1.8	7.5	7.5	14.3	50.3	7.5	152.5	32.3	47.5	159.0	386.5	116.5	81.9	14.02	10.36
		Walking	30.5	37.3	53.8	100.5	171.3	57.0	216.8	73.0	171.8	204.3	440.5	225.3	148.5	24.18	17.88
		Sunbathing	0.0	0.0	0.0	0.0	47.8	0.0	123.8	11.5	12.8	107.0	111.3	44.0	38.2	6.74	4.98
		Viewing	0.0	55.0	56.5	95.0	178.8	62.0	313.8	89.0	785.0	292.8	505.8	332.3	230.5	37.58	27.78
	In Water		2.0	0.3	1.5	1.5	98.3	12.5	206.3	15.0	89.5	207.8	557.5	310.5	125.2	20.98	13.38
	Out of Water		32.3	99.8	117.8	209.8	448.0	126.5	806.8	205.8	1,017.0	763.0	1,444.0	718.0	499.0	82.53	61.01
Spring Run	In Water	Boat Tour	88.8	112.5	218.0	220.5	142.5	129.5	238.5	255.8	207.0	184.5	77.0	262.3	178.1	27.48	4.56
		Other	5.5	0.3	0.0	6.0	4.8	14.3	45.5	1.0	5.3	32.3	37.8	6.8	13.3	2.36	0.39
	In Water		94.3	112.8	218.0	226.5	147.3	143.8	284.0	256.8	212.3	216.8	114.8	269.0	191.3	29.84	4.95
Entire Spring			128.5	212.8	337.3	437.8	693.5	282.8	1,297.0	477.5	1,318.8	1,187.5	2,116.3	1,297.5	815.6	133.35	79.33

Note(s):

Hours of Observations:		5.5	9.5	8.5	8.0	7.0	5.5	6.5	6.3	6.3	4.0	6.0	7.5
Spring Pool Wetted Area (ha):	1.569											
Spring Pool Upland Area (ha):	1.353											
Spring Run Area (ha):	6.032											

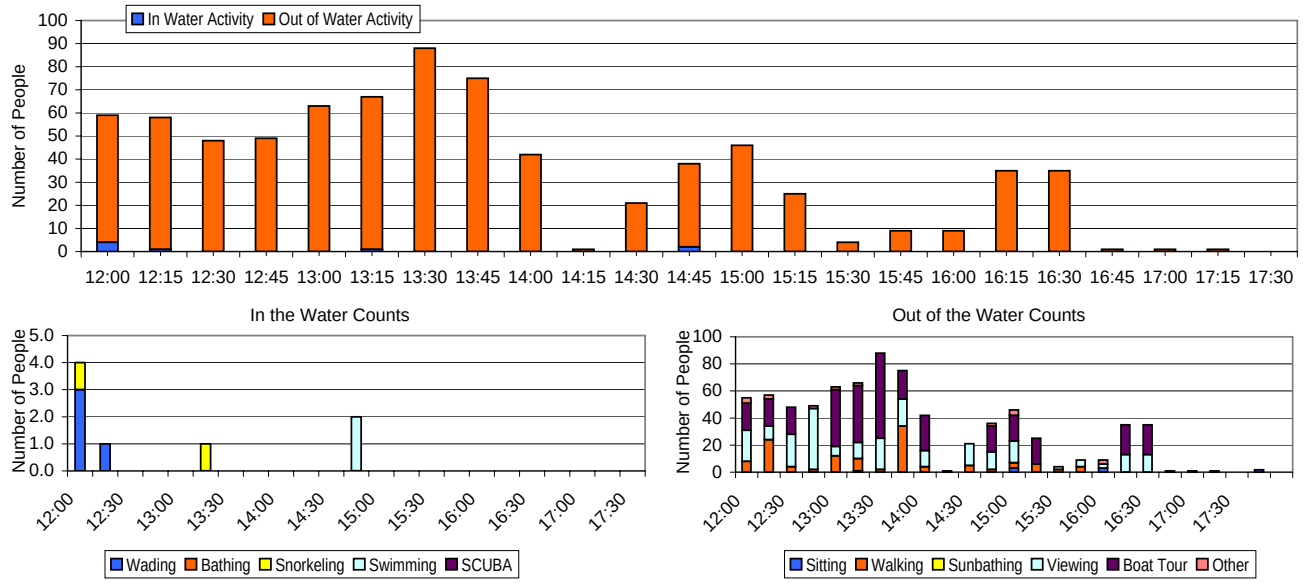
Human Use Actvity Summary

Site Wakulla Springs **Date** 1_19_2009 **Survey Period** 12:00 17:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
12:00	3	0	1	0	0	4	0	8	0	23	20	4	55
12:15	1	0	0	0	0	1	0	24	0	10	20	3	57
12:30	0	0	0	0	0	0	0	4	0	24	20	0	48
12:45	0	0	0	0	0	0	0	2	0	45	0	2	49
13:00	0	0	0	0	0	0	0	12	0	7	42	2	63
13:15	0	0	1	0	0	1	1	9	0	12	42	2	66
13:30	0	0	0	0	0	0	0	2	0	23	63	0	88
13:45	0	0	0	0	0	0	0	34	0	20	21	0	75
14:00	0	0	0	0	0	0	0	4	0	12	26	0	42
14:15	0	0	0	0	0	0	0	0	0	1	0	0	1
14:30	0	0	0	0	0	0	0	5	0	16	0	0	21
14:45	0	0	0	2	0	2	0	2	0	13	19	2	36
15:00	0	0	0	0	0	0	3	4	0	16	19	4	46
15:15	0	0	0	0	0	0	0	6	0	0	19	0	25
15:30	0	0	0	0	0	0	0	2	0	2	0	0	4
15:45	0	0	0	0	0	0	0	4	0	5	0	0	9
16:00	0	0	0	0	0	0	3	0	0	3	0	3	9
16:15	0	0	0	0	0	0	0	0	0	13	22	0	35
16:30	0	0	0	0	0	0	0	0	0	13	22	0	35
16:45	0	0	0	0	0	0	0	0	0	1	0	0	1
17:00	0	0	0	0	0	0	0	0	0	1	0	0	1
17:15	0	0	0	0	0	0	0	0	0	1	0	0	1
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Person-Hrs	1.00	0.00	0.50	0.50	0.00	2.00	1.75	30.50	0.00	65.25	88.75	5.50	191.75
Percentage	50.0%	0.0%	25.0%	25.0%	0.0%	100.0%	0.9%	15.9%	0.0%	34.0%	46.3%	2.9%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



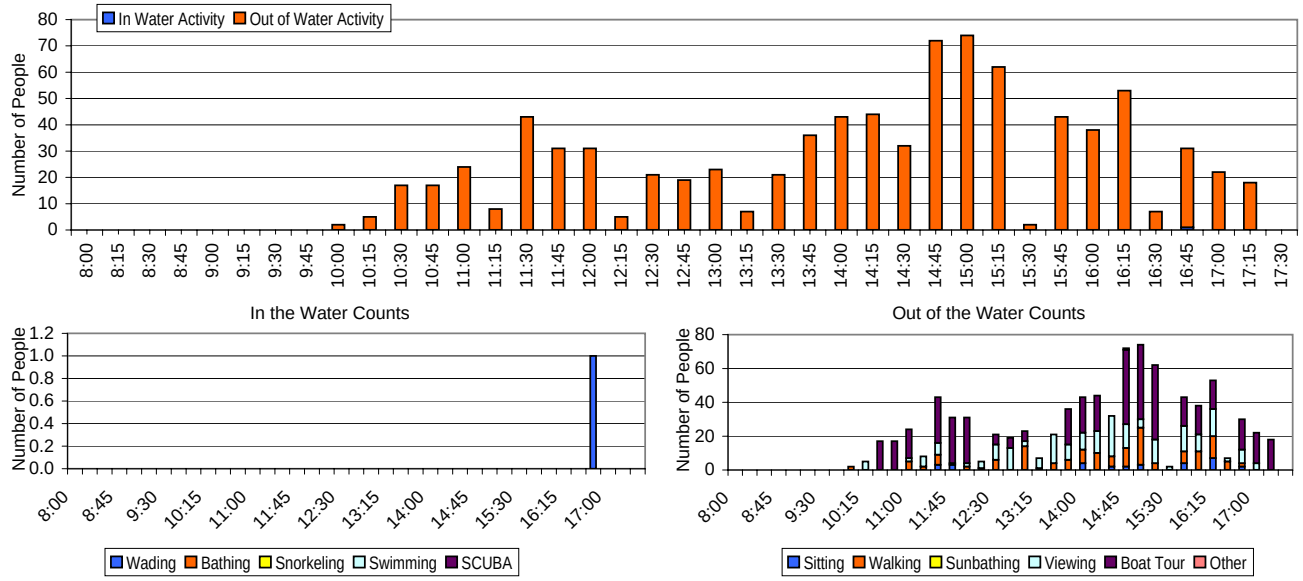
Human Use Actvity Summary

Site Wakulla Springs **Date** 1_25_2009 **Survey Period** 8:00 17:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	2	0	0	0	0	2
10:15	0	0	0	0	0	0	0	0	0	5	0	0	5
10:30	0	0	0	0	0	0	0	0	0	0	17	0	17
10:45	0	0	0	0	0	0	0	0	0	0	17	0	17
11:00	0	0	0	0	0	0	0	5	0	2	17	0	24
11:15	0	0	0	0	0	0	0	2	0	6	0	0	8
11:30	0	0	0	0	0	0	3	6	0	7	27	0	43
11:45	0	0	0	0	0	0	3	1	0	0	27	0	31
12:00	0	0	0	0	0	0	0	2	0	2	27	0	31
12:15	0	0	0	0	0	0	0	1	0	4	0	0	5
12:30	0	0	0	0	0	0	0	6	0	9	6	0	21
12:45	0	0	0	0	0	0	0	0	0	13	6	0	19
13:00	0	0	0	0	0	0	0	14	0	3	6	0	23
13:15	0	0	0	0	0	0	0	1	0	6	0	0	7
13:30	0	0	0	0	0	0	0	4	0	17	0	0	21
13:45	0	0	0	0	0	0	0	6	0	9	21	0	36
14:00	0	0	0	0	0	0	4	8	0	10	21	0	43
14:15	0	0	0	0	0	0	0	10	0	13	21	0	44
14:30	0	0	0	0	0	0	2	6	0	24	0	0	32
14:45	0	0	0	0	0	0	2	11	0	14	44	1	72
15:00	0	0	0	0	0	0	3	22	0	5	44	0	74
15:15	0	0	0	0	0	0	0	4	0	14	44	0	62
15:30	0	0	0	0	0	0	0	0	0	2	0	0	2
15:45	0	0	0	0	0	0	4	7	0	15	17	0	43
16:00	0	0	0	0	0	0	0	11	0	10	17	0	38
16:15	0	0	0	0	0	0	7	13	0	16	17	0	53
16:30	0	0	0	0	0	0	0	5	0	2	0	0	7
16:45	1	0	0	0	0	1	2	2	0	8	18	0	30
17:00	0	0	0	0	0	0	0	0	0	4	18	0	22
17:15	0	0	0	0	0	0	0	0	0	0	18	0	18
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Person-Hrs	0.25	0.00	0.00	0.00	0.00	0.25	7.50	37.25	0.00	55.00	112.50	0.25	212.50
Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	3.5%	17.5%	0.0%	25.9%	52.9%	0.1%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



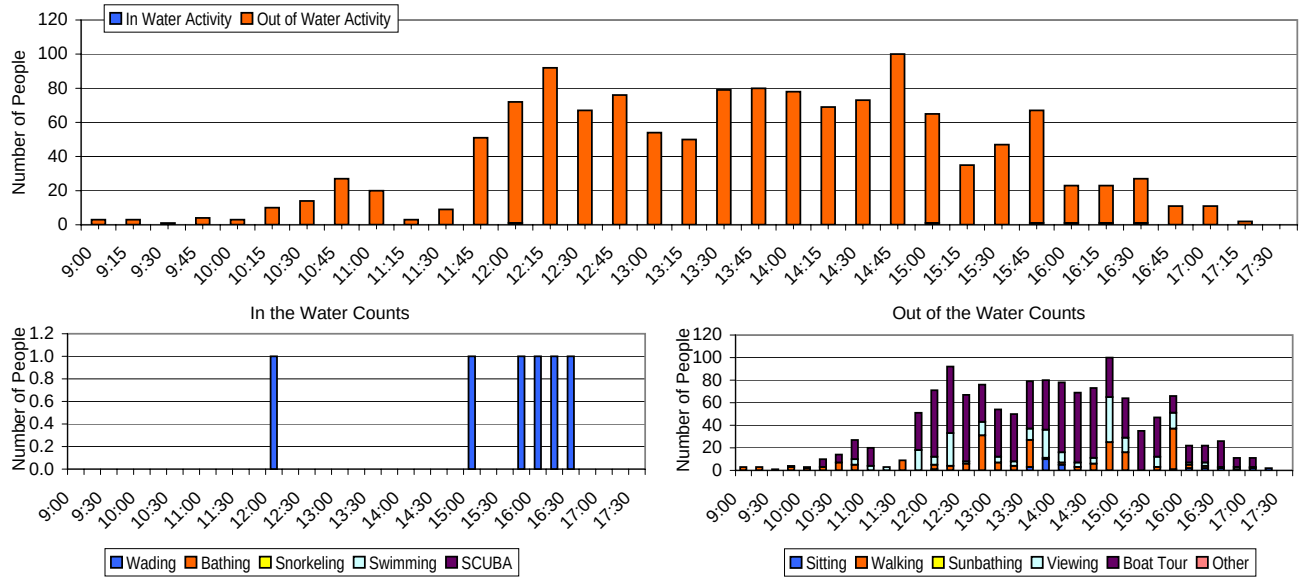
Human Use Actvity Summary

Site Wakulla Springs **Date** 2_26_2009 **Survey Period** 9:00 17:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
9:00	0	0	0	0	0	0	0	3	0	0	0	0	3
9:15	0	0	0	0	0	0	0	3	0	0	0	0	3
9:30	0	0	0	0	0	0	0	1	0	0	0	0	1
9:45	0	0	0	0	0	0	0	3	0	0	1	0	4
10:00	0	0	0	0	0	0	0	2	0	0	1	0	3
10:15	0	0	0	0	0	0	0	3	0	0	7	0	10
10:30	0	0	0	0	0	0	0	7	0	0	7	0	14
10:45	0	0	0	0	0	0	0	5	0	5	17	0	27
11:00	0	0	0	0	0	0	0	0	0	4	16	0	20
11:15	0	0	0	0	0	0	0	0	0	3	0	0	3
11:30	0	0	0	0	0	0	0	9	0	0	0	0	9
11:45	0	0	0	0	0	0	0	0	0	18	33	0	51
12:00	1	0	0	0	0	1	1	4	0	7	59	0	71
12:15	0	0	0	0	0	0	0	4	0	29	59	0	92
12:30	0	0	0	0	0	0	0	6	0	2	59	0	67
12:45	0	0	0	0	0	0	0	31	0	12	33	0	76
13:00	0	0	0	0	0	0	0	7	0	5	42	0	54
13:15	0	0	0	0	0	0	0	4	0	4	42	0	50
13:30	0	0	0	0	0	0	3	24	0	10	42	0	79
13:45	0	0	0	0	0	0	10	1	0	25	44	0	80
14:00	0	0	0	0	0	0	5	2	0	9	62	0	78
14:15	0	0	0	0	0	0	0	3	0	4	62	0	69
14:30	0	0	0	0	0	0	0	6	0	5	62	0	73
14:45	0	0	0	0	0	0	0	25	0	40	35	0	100
15:00	1	0	0	0	0	1	0	16	0	13	35	0	64
15:15	0	0	0	0	0	0	0	0	0	0	35	0	35
15:30	0	0	0	0	0	0	0	3	0	9	35	0	47
15:45	1	0	0	0	0	1	1	36	0	14	15	0	66
16:00	1	0	0	0	0	1	2	3	0	2	15	0	22
16:15	1	0	0	0	0	1	2	2	0	3	15	0	22
16:30	1	0	0	0	0	1	2	0	0	1	23	0	26
16:45	0	0	0	0	0	0	0	1	0	2	8	0	11
17:00	0	0	0	0	0	0	2	1	0	0	8	0	11
17:15	0	0	0	0	0	0	2	0	0	0	0	0	2
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Person-Hrs	1.50	0.00	0.00	0.00	0.00	1.50	7.50	53.75	0.00	56.50	218.00	0.00	335.75
Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	2.2%	16.0%	0.0%	16.8%	64.9%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



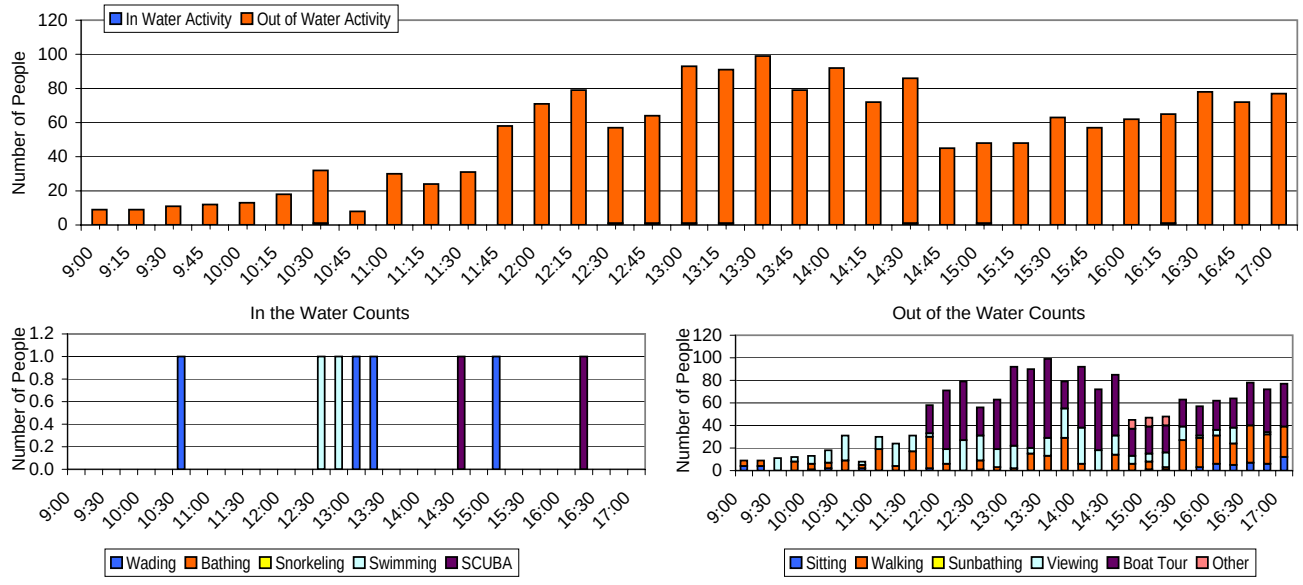
Human Use Actvity Summary

Site Wakulla Springs **Date** 2_28_2009 **Survey Period** 9:00 17:00

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
9:00	0	0	0	0	0	0	4	5	0.00	0	0	0	9
9:15	0	0	0	0	0	0	4	5	0.00	0	0	0	9
9:30	0	0	0	0	0	0	0	0	0.00	11	0	0	11
9:45	0	0	0	0	0	0	0	8	0.00	4	0	0	12
10:00	0	0	0	0	0	0	1	5	0.00	7	0	0	13
10:15	0	0	0	0	0	0	2	5	0.00	11	0	0	18
10:30	1	0	0	0	0	1	0	9	0.00	22	0	0	31
10:45	0	0	0	0	0	0	2	3	0.00	3	0	0	8
11:00	0	0	0	0	0	0	0	19	0.00	11	0	0	30
11:15	0	0	0	0	0	0	0	4	0.00	20	0	0	24
11:30	0	0	0	0	0	0	0	17	0.00	14	0	0	31
11:45	0	0	0	0	0	0	2	28	0.00	3	25	0	58
12:00	0	0	0	0	0	0	0	6	0.00	13	52	0	71
12:15	0	0	0	0	0	0	0	0	0.00	27	52	0	79
12:30	0	0	0	1	0	1	1	8	0.00	22	25	0	56
12:45	0	0	0	1	0	1	0	3	0.00	16	44	0	63
13:00	1	0	0	0	0	1	0	2	0.00	20	70	0	92
13:15	1	0	0	0	0	1	0	15	0.00	5	70	0	90
13:30	0	0	0	0	0	0	0	13	0.00	16	70	0	99
13:45	0	0	0	0	0	0	0	29	0.00	26	24	0	79
14:00	0	0	0	0	0	0	0	6	0.00	32	54	0	92
14:15	0	0	0	0	0	0	0	0	0.00	18	54	0	72
14:30	0	0	0	0	1	1	0	14	0.00	17	54	0	85
14:45	0	0	0	0	0	0	0	6	0.00	7	24	8	45
15:00	1	0	0	0	0	1	1	7	0.00	7	24	8	47
15:15	0	0	0	0	0	0	1	2	0.00	13	24	8	48
15:30	0	0	0	0	0	0	0	27	0.00	12	24	0	63
15:45	0	0	0	0	0	0	3	26	0.00	2	26	0	57
16:00	0	0	0	0	0	0	6	25	0.00	5	26	0	62
16:15	0	0	0	0	1	1	5	19	0.00	14	26	0	64
16:30	0	0	0	0	0	0	7	33	0.00	0	38	0	78
16:45	0	0	0	0	0	0	6	26	0.00	2	38	0	72
17:00	0	0	0	0	0	0	12	27	0.00	0	38	0	77
Person-Hrs	1.00	0.00	0.00	0.50	0.50	2.00	14.25	100.50	0.00	95.00	220.50	6.00	436.25
Percentage	50.0%	0.0%	0.0%	25.0%	25.0%	100.0%	3.3%	23.0%	0.0%	21.8%	50.5%	1.4%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



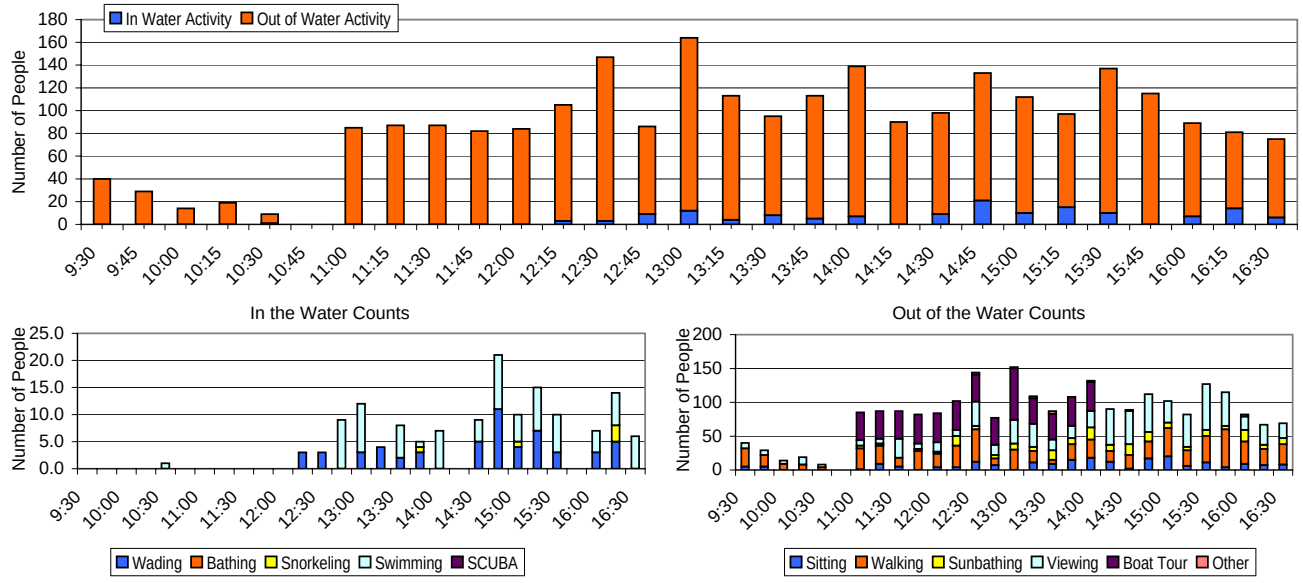
Human Use Actvity Summary

Site Wakulla Springs **Date** 3_29_2009 **Survey Period** 9:30 16:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
9:30	0	0	0	0	0	0	5	27	0	8	0	0	40
9:45	0	0	0	0	0	0	5	17	0	7	0	0	29
10:00	0	0	0	0	0	0	0	9	0	5	0	0	14
10:15	0	0	0	0	0	0	0	8	0	11	0	0	19
10:30	0	0	0	1	0	1	0	4	0	4	0	0	8
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	1	31	4	8	41	0	85
11:15	0	0	0	0	0	0	9	27	3	7	41	0	87
11:30	0	0	0	0	0	0	5	13	0	28	41	0	87
11:45	0	0	0	0	0	0	0	28	3	8	43	0	82
12:00	0	0	0	0	0	0	4	20	3	14	43	0	84
12:15	3	0	0	0	0	3	4	32	14	9	43	0	102
12:30	3	0	0	0	0	3	12	48	5	36	40	3	144
12:45	0	0	0	9	0	9	7	10	5	15	40	0	77
13:00	3	0	0	9	0	12	0	30	9	35	76	2	152
13:15	4	0	0	0	0	4	11	17	6	34	38	3	109
13:30	2	0	0	6	0	8	9	6	14	16	38	4	87
13:45	3	0	1	1	0	5	15	23	9	18	43	0	108
14:00	0	0	0	7	0	7	18	27	18	24	43	2	132
14:15	0	0	0	0	0	0	12	16	9	53	0	0	90
14:30	5	0	0	4	0	9	2	20	16	49	0	2	89
14:45	11	0	0	10	0	21	17	25	14	56	0	0	112
15:00	4	0	1	5	0	10	20	42	8	32	0	0	102
15:15	7	0	0	8	0	15	6	23	5	48	0	0	82
15:30	3	0	0	7	0	10	11	39	9	68	0	0	127
15:45	0	0	0	0	0	0	4	56	5	50	0	0	115
16:00	3	0	0	4	0	7	9	33	17	20	0	3	82
16:15	5	0	3	6	0	14	7	24	6	30	0	0	67
16:30	0	0	0	6	0	6	8	30	9	22	0	0	69
Person-Hrs	14.00	0.00	1.25	20.75	0.00	36.00	50.25	171.25	47.75	178.75	142.50	4.75	595.25
Percentage	38.9%	0.0%	3.5%	57.6%	0.0%	100.0%	8.4%	28.8%	8.0%	30.0%	23.9%	0.8%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



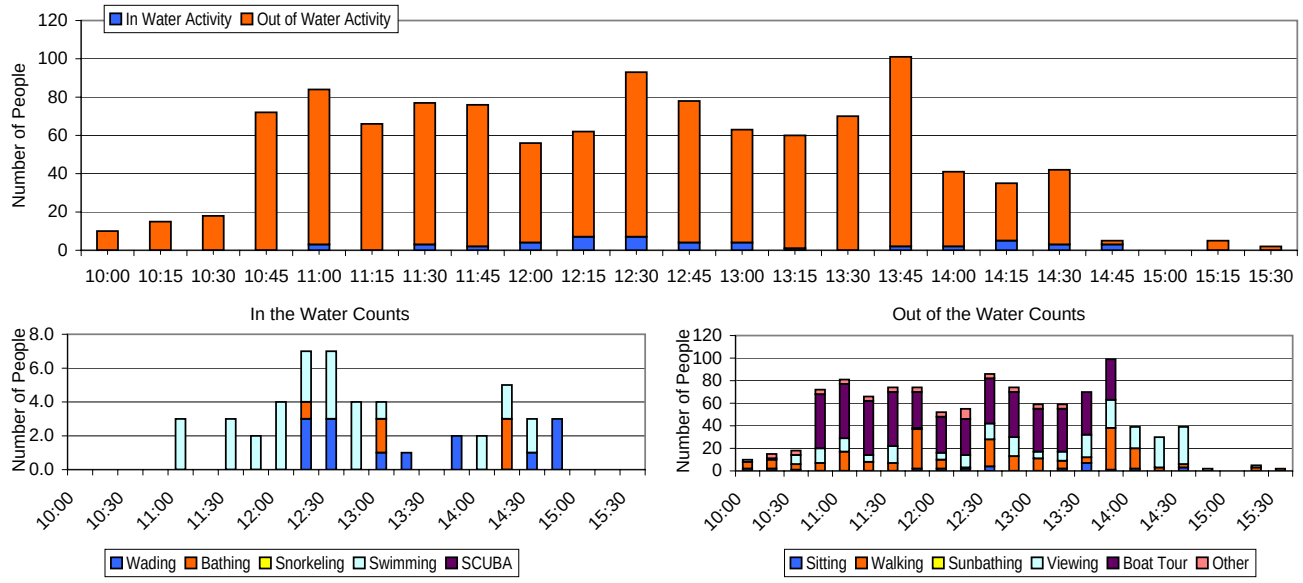
Human Use Actvity Summary

Site Wakulla Springs **Date** 3_31_2009 **Survey Period** 10:00 15:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Viewing**	**Boat Tour**	**Other**	**Total**
10:00	0	0	0	0	0	0	2	6	0	2	0	0	10
10:15	0	0	0	0	0	0	2	8	0	1	0	4	15
10:30	0	0	0	0	0	0	1	5	0	8	0	4	18
10:45	0	0	0	0	0	0	0	7	0	13	48	4	72
11:00	0	0	0	3	0	3	0	17	0	12	48	4	81
11:15	0	0	0	0	0	0	0	8	0	6	48	4	66
11:30	0	0	0	3	0	3	0	7	0	15	48	4	74
11:45	0	0	0	2	0	2	2	35	0	1	32	4	74
12:00	0	0	0	4	0	4	2	8	0	6	32	4	52
12:15	3	1	0	3	0	7	2	1	0	11	32	9	55
12:30	3	0	0	4	0	7	4	24	0	14	40	4	86
12:45	0	0	0	4	0	4	0	13	0	17	40	4	74
13:00	1	2	0	1	0	4	0	11	0	6	38	4	59
13:15	1	0	0	0	0	1	2	7	0	8	38	4	59
13:30	0	0	0	0	0	0	7	5	0	20	38	0	70
13:45	2	0	0	0	0	2	1	37	0	25	36	0	99
14:00	0	0	0	2	0	2	2	18	0	19	0	0	39
14:15	0	3	0	2	0	5	0	3	0	27	0	0	30
14:30	1	0	0	2	0	3	3	3	0	33	0	0	39
14:45	3	0	0	0	0	3	0	0	0	2	0	0	2
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	3	0	2	0	0	5
15:30	0	0	0	0	0	0	0	2	0	0	0	0	2
Person-Hrs	3.50	1.50	0.00	7.50	0.00	12.50	7.50	57.00	0.00	62.00	129.50	14.25	270.25
Percentage	28.0%	12.0%	0.0%	60.0%	0.0%	100.0%	2.8%	21.1%	0.0%	22.9%	47.9%	5.3%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

Site Wakulla Springs **Date** 4_26_2009 **Survey Period** 11:00 17:30

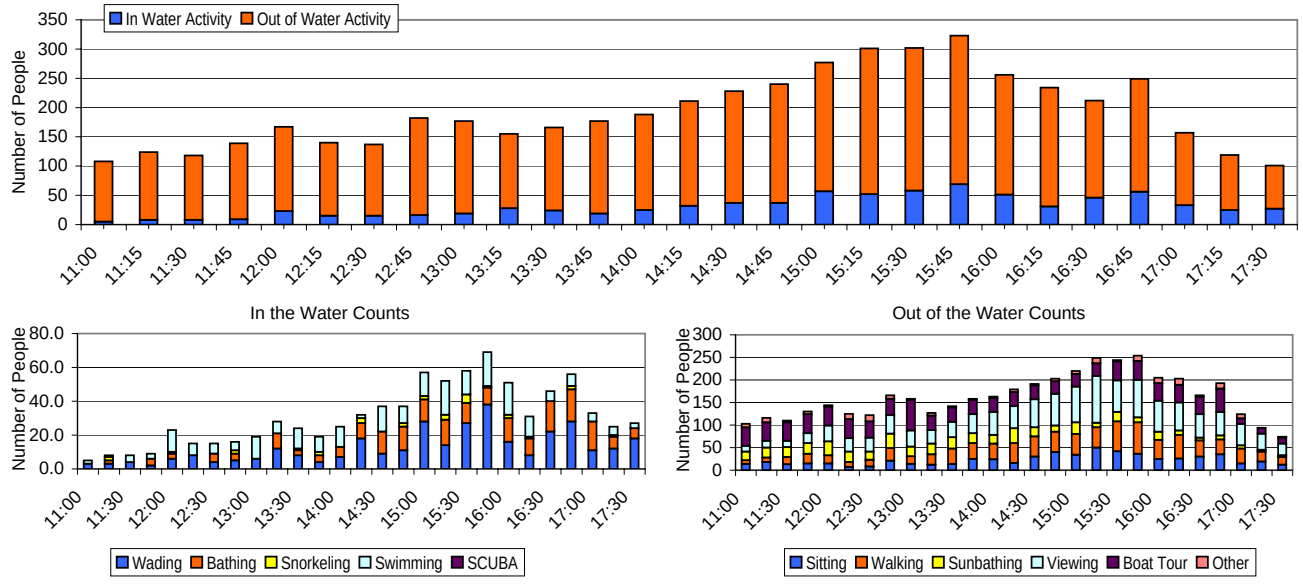
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
11:00	3	0	0	2	0	5	14	8	19	13	41	8	103
11:15	3	2	2	1	0	8	18	10	22	15	41	10	116
11:30	4	0	0	4	0	8	13	16	22	14	41	4	110
11:45	2	4	0	3	0	9	15	21	24	22	42	6	130
12:00	6	3	1	13	0	23	15	18	31	35	42	3	144
12:15	8	0	0	7	0	15	7	11	23	30	42	12	125
12:30	4	5	0	6	0	15	8	15	18	31	36	14	122
12:45	5	4	2	5	0	16	21	28	32	41	36	8	166
13:00	6	0	0	13	0	19	14	17	21	36	68	2	158
13:15	12	9	0	7	0	28	12	23	24	30	32	6	127
13:30	8	3	1	12	0	24	14	34	25	34	32	3	142
13:45	4	4	2	9	0	19	25	35	22	42	32	2	158
14:00	7	6	0	12	0	25	24	35	19	51	31	3	163
14:15	18	9	3	2	0	32	16	44	33	49	31	6	179
14:30	9	13	0	15	0	37	30	45	20	62	31	3	191
14:45	11	14	2	10	0	37	40	45	14	70	28	6	203
15:00	28	13	2	14	0	57	34	46	26	79	28	7	220
15:15	14	15	3	20	0	52	50	45	10	104	28	12	249
15:30	27	12	5	14	0	58	42	66	21	70	42	3	244
15:45	38	10	1	20	0	69	36	70	11	83	42	12	254
16:00	16	14	2	19	0	51	25	42	18	69	39	12	205
16:15	8	10	1	12	0	31	26	52	10	62	39	14	203
16:30	22	18	0	6	0	46	30	36	6	52	39	3	166
16:45	28	19	2	7	0	56	35	33	9	52	52	12	193
17:00	11	17	0	5	0	33	15	33	7	47	13	9	124
17:15	12	7	1	5	0	25	19	22	4	36	13	0	94
17:30	18	6	0	3	0	27	12	17	4	26	13	2	74
Person-Hrs	83.00	54.25	7.50	61.50	0.00	206.25	152.50	216.75	123.75	313.75	238.50	45.50	1,090.75
Percentage	40.2%	26.3%	3.6%	29.8%	0.0%	100.0%	14.0%	19.9%	11.3%	28.8%	21.9%	4.2%	100.0%

Note(s):

"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats

Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



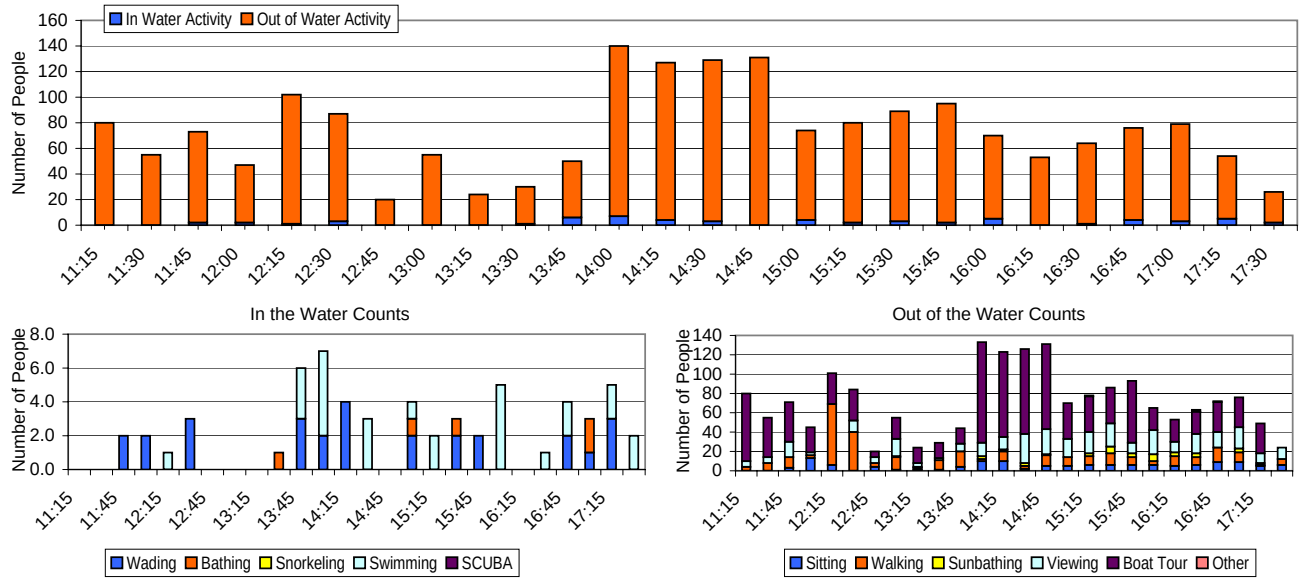
Human Use Actvity Summary

Site Wakulla Springs **Date** 4_30_2009 **Survey Period** 11:15 17:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
11:15	0	0	0	0	0	0	0	4	0	6	70	0	80
11:30	0	0	0	0	0	0	0	8	0	6	41	0	55
11:45	2	0	0	0	0	2	3	11	0	16	41	0	71
12:00	2	0	0	0	0	2	13	3	0	3	26	0	45
12:15	0	0	0	1	0	1	6	63	0	0	32	0	101
12:30	3	0	0	0	0	3	0	40	0	12	32	0	84
12:45	0	0	0	0	0	0	4	4	0	6	6	0	20
13:00	0	0	0	0	0	0	1	13	1	18	22	0	55
13:15	0	0	0	0	0	0	1	2	1	4	16	0	24
13:30	0	1	0	0	0	1	1	10	0	2	16	0	29
13:45	3	0	0	3	0	6	4	16	0	8	16	0	44
14:00	2	0	0	5	0	7	10	2	3	14	104	0	133
14:15	4	0	0	0	0	4	10	10	2	13	88	0	123
14:30	0	0	0	3	0	3	2	3	3	30	88	0	126
14:45	0	0	0	0	0	0	5	11	1	26	88	0	131
15:00	2	1	0	1	0	4	5	9	0	19	37	0	70
15:15	0	0	0	2	0	2	6	9	3	22	37	1	78
15:30	2	1	0	0	0	3	6	12	7	24	37	0	86
15:45	2	0	0	0	0	2	6	8	4	11	64	0	93
16:00	0	0	0	5	0	5	6	4	7	25	23	0	65
16:15	0	0	0	0	0	0	5	10	4	11	23	0	53
16:30	0	0	0	1	0	1	6	8	4	20	23	2	63
16:45	2	0	0	2	0	4	9	15	0	16	31	1	72
17:00	1	2	0	0	0	3	9	10	4	22	31	0	76
17:15	3	0	0	2	0	5	5	1	2	10	31	0	49
17:30	0	0	0	2	0	2	6	6	0	12	0	0	24
Person-Hrs	7.00	1.25	0.00	6.75	0.00	15.00	32.25	73.00	11.50	89.00	255.75	1.00	462.50
Percentage	46.7%	8.3%	0.0%	45.0%	0.0%	100.0%	7.0%	15.8%	2.5%	19.2%	55.3%	0.2%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



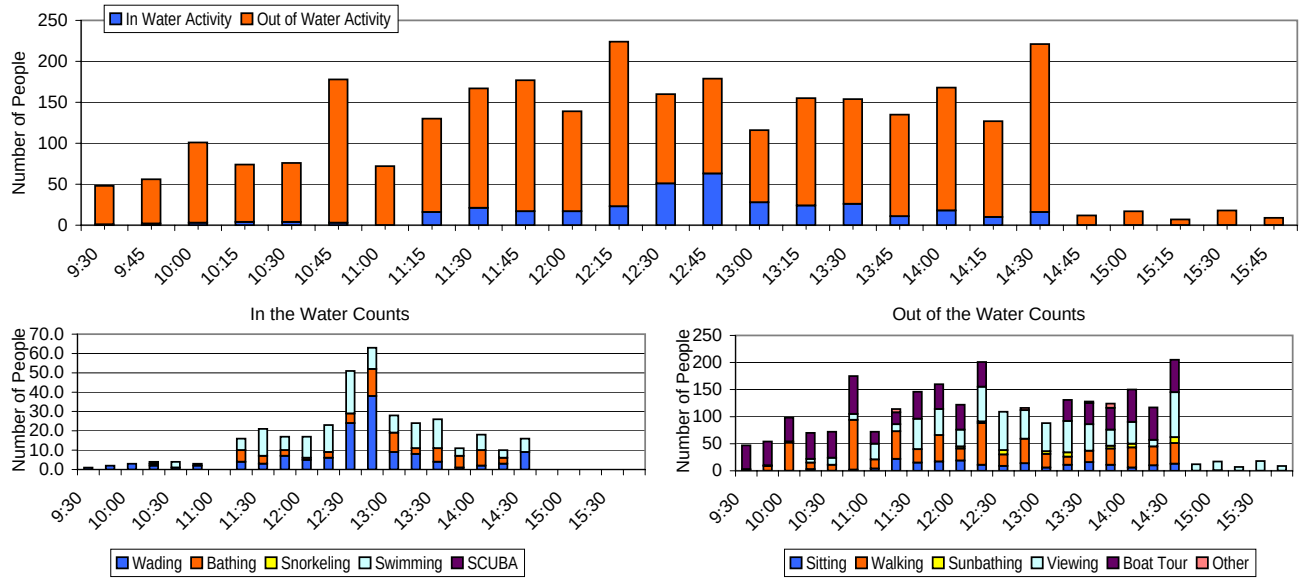
Human Use Actvity Summary

Site Wakulla Springs **Date** 5_29_2009 **Survey Period** 9:30 15:45

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Viewing**	**Boat Tour**	**Other**	**Total**
9:30	1	0	0	0	0	1	1	2	0	0	44	0	47
9:45	2	0	0	0	0	2	0	9	0	1	44	0	54
10:00	3	0	0	0	0	3	0	52	0	2	44	0	98
10:15	2	0	1	1	0	4	3	12	0	7	48	0	70
10:30	1	0	0	3	0	4	0	11	0	13	48	0	72
10:45	2	0	1	0	0	3	2	92	0	11	70	0	175
11:00	0	0	0	0	0	0	4	17	0	29	22	0	72
11:15	4	6	0	6	0	16	22	51	0	13	22	6	114
11:30	3	4	0	14	0	21	15	25	0	56	50	0	146
11:45	7	3	0	7	0	17	17	49	0	48	46	0	160
12:00	5	1	0	11	0	17	19	22	4	31	46	0	122
12:15	6	3	0	14	0	23	11	77	3	64	46	0	201
12:30	24	5	0	22	0	51	9	21	8	71	0	0	109
12:45	38	14	0	11	0	63	14	45	0	53	0	4	116
13:00	9	10	0	9	0	28	6	25	5	52	0	0	88
13:15	8	3	0	13	0	24	11	15	8	58	39	0	131
13:30	4	7	0	15	0	26	16	21	0	49	39	3	128
13:45	1	6	0	4	0	11	11	30	5	30	40	8	124
14:00	2	8	0	8	0	18	6	37	7	40	60	0	150
14:15	3	3	0	4	0	10	10	35	0	12	60	0	117
14:30	9	0	0	7	0	16	13	38	11	83	60	0	205
14:45	0	0	0	0	0	0	0	0	0	12	0	0	12
15:00	0	0	0	0	0	0	0	1	0	16	0	0	17
15:15	0	0	0	0	0	0	0	0	0	7	0	0	7
15:30	0	0	0	0	0	0	0	0	0	18	0	0	18
15:45	0	0	0	0	0	0	0	0	0	9	0	0	9
Person-Hrs	33.50	18.25	0.50	37.25	0.00	89.50	47.50	171.75	12.75	196.25	207.00	5.25	640.50
Percentage	37.4%	20.4%	0.6%	41.6%	0.0%	100.0%	7.4%	26.8%	2.0%	30.6%	32.3%	0.8%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o
Time that the swim area was closed due to lightning shown in red.

Average Time Interval (hrs): 0.25



Human Use Actvity Summary

Site Wakulla Springs **Date** 5_31_2009 **Survey Period** 11:00 15:00

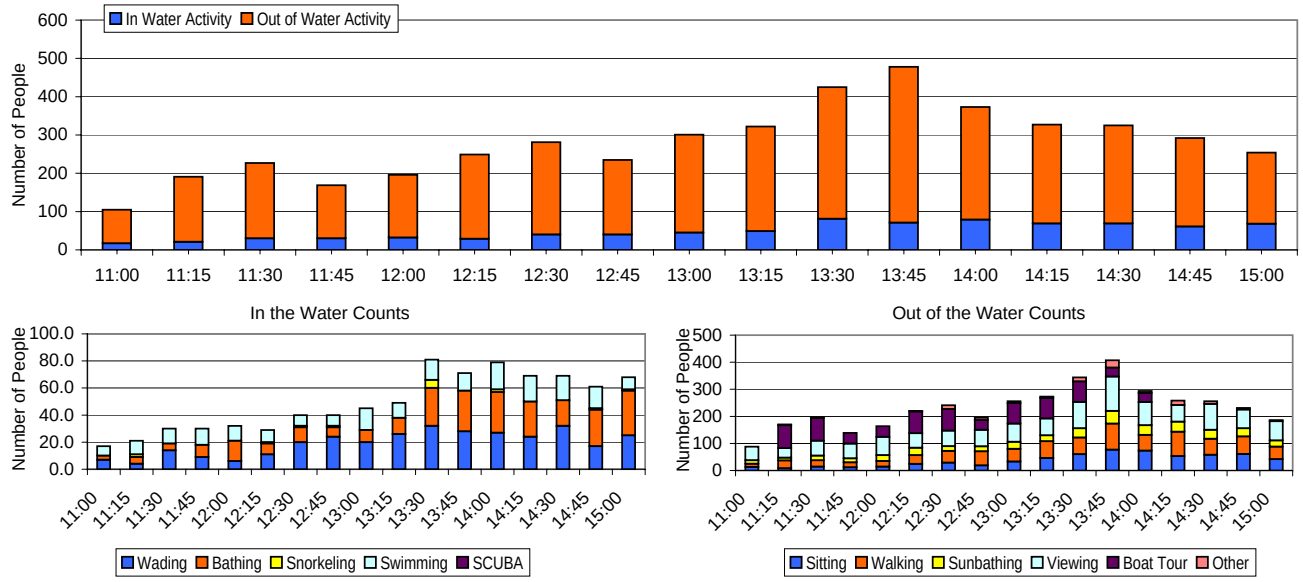
	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Viewing**	**Boat Tour**	**Other**	**Total**
11:00	7	3	0	7	0	17	13	12	13	50	0	0	88
11:15	4	5	2	10	0	21	8	29	10	36	84	3	170
11:30	14	5	0	11	0	30	14	24	17	55	84	3	197
11:45	9	9	0	12	0	30	12	18	15	54	40	0	139
12:00	6	15	0	11	0	32	14	21	22	67	40	0	164
12:15	11	8	1	9	0	29	24	33	27	54	80	2	220
12:30	20	11	1	8	0	40	29	43	18	57	80	14	241
12:45	24	7	1	8	0	40	19	52	18	61	36	9	195
13:00	20	9	0	16	0	45	33	47	26	67	76	7	256
13:15	26	12	0	11	0	49	46	62	22	62	76	5	273
13:30	32	28	6	15	0	81	60	62	34	97	76	15	344
13:45	28	30	0	13	0	71	77	96	47	127	33	27	407
14:00	27	30	2	20	0	79	73	58	36	86	33	8	294
14:15	24	26	0	19	0	69	53	90	37	62	0	16	258
14:30	32	19	0	18	0	69	58	59	33	96	0	10	256
14:45	17	27	1	16	0	61	61	65	30	69	0	6	231
15:00	25	33	1	9	0	68	42	46	23	71	0	4	186
Person-Hrs	81.50	69.25	3.75	53.25	0.00	207.75	159.00	204.25	107.00	292.75	184.50	32.25	979.75
Percentage	39.2%	33.3%	1.8%	25.6%	0.0%	100.0%	16.2%	20.8%	10.9%	29.9%	18.8%	3.3%	100.0%

Note(s):

"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats

Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



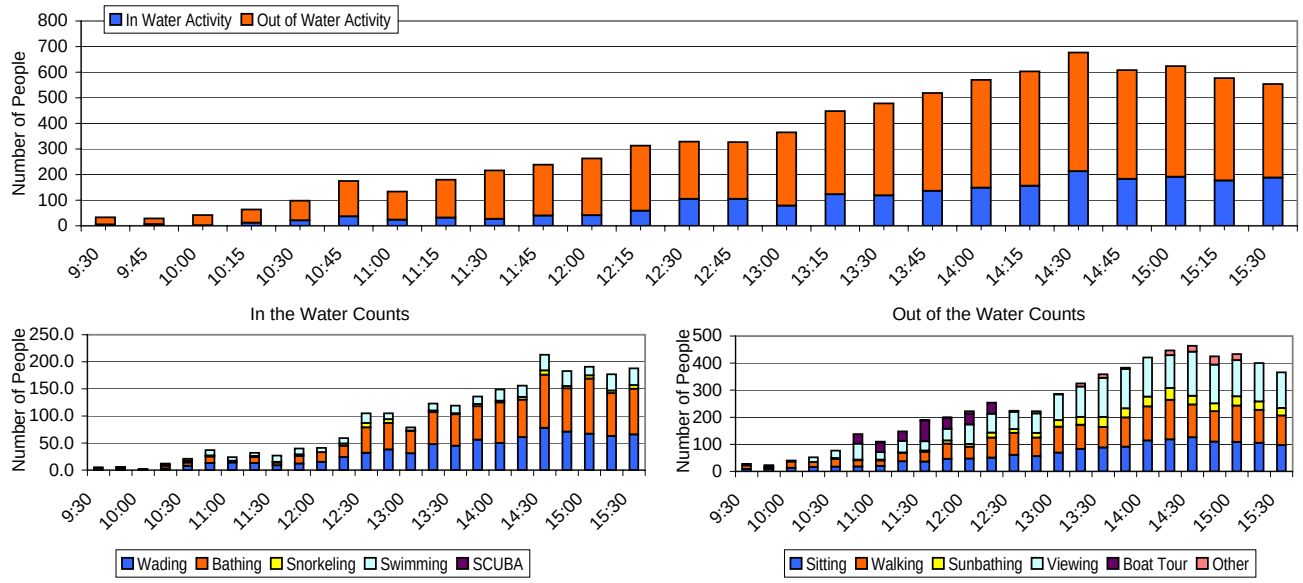
Human Use Actvity Summary

Site Wakulla Springs **Date** 6_28_2009 **Survey Period** 9:30 15:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	**Wading**	**Bathing**	**Snorkeling**	**Swimming**	**SCUBA**	**Total**	**Sitting**	**Walking**	**Sunbathing**	**Viewing**	**Boat Tour**	**Other**	**Total**
9:30	4	1	0	0	0	5	9	13	0	6	0	0	28
9:45	3	2	0	1	0	6	9	6	1	7	0	0	23
10:00	1	0	1	0	0	2	13	23	0	4	0	0	40
10:15	3	5	2	2	0	12	16	18	0	18	0	0	52
10:30	8	6	3	4	0	21	17	29	3	28	0	0	77
10:45	13	12	2	10	0	37	18	23	2	59	36	0	138
11:00	14	3	0	7	0	24	20	20	3	28	36	3	110
11:15	13	11	2	6	0	32	37	31	2	42	36	0	148
11:30	9	5	1	12	0	27	36	36	5	34	77	1	189
11:45	12	14	3	11	0	40	46	56	12	43	41	1	199
12:00	15	18	0	8	0	41	47	44	10	72	41	8	222
12:15	24	21	4	10	0	59	51	74	18	70	41	0	254
12:30	32	47	8	18	0	105	61	81	14	64	0	4	224
12:45	38	49	7	11	0	105	56	69	17	72	0	8	222
13:00	31	41	1	6	0	79	69	96	24	95	0	2	286
13:15	48	59	3	13	0	123	83	89	29	112	0	12	325
13:30	45	58	2	14	0	119	88	76	37	144	0	14	359
13:45	56	62	4	14	0	136	91	108	34	145	0	5	383
14:00	50	75	3	21	0	149	114	126	36	145	0	0	421
14:15	61	69	5	21	0	156	118	146	44	121	0	18	447
14:30	78	98	8	29	0	213	126	121	32	163	0	22	464
14:45	71	80	4	28	0	183	110	112	29	143	0	31	425
15:00	67	102	6	16	0	191	109	134	34	134	0	22	433
15:15	63	79	5	30	0	177	105	122	31	142	0	0	400
15:30	66	84	7	31	0	188	97	109	28	132	0	0	366
Person-Hrs	206.25	250.25	20.25	80.75	0.00	557.50	386.50	440.50	111.25	505.75	77.00	37.75	1,558.75
Percentage	37.0%	44.9%	3.6%	14.5%	0.0%	100.0%	24.8%	28.3%	7.1%	32.4%	4.9%	2.4%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



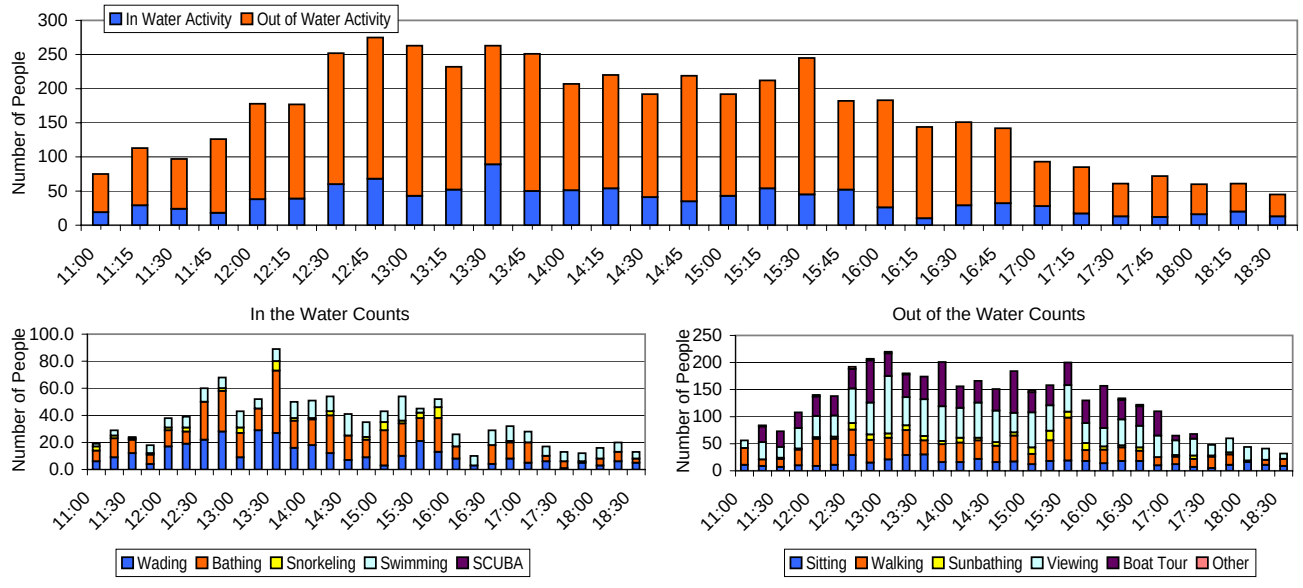
Human Use Actvity Summary

Site Wakulla Springs **Date** 6_30_2009 **Survey Period** 11:00 18:30

	Numbers of People												
	In Water Activity						Out of Water Activity						
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	Sitting	Walking	Sunbathing	Viewing	Boat Tour	Other	Total
11:00	6	8	3	2	0	19	11	31	0	14	0	0	56
11:15	9	14	2	4	0	29	9	12	0	32	29	2	84
11:30	12	10	1	1	0	24	7	15	2	20	29	0	73
11:45	4	7	1	6	0	18	10	29	2	38	29	0	108
12:00	17	12	2	7	0	38	9	50	3	39	36	3	140
12:15	19	9	3	8	0	39	11	48	4	39	36	0	138
12:30	22	28	0	10	0	60	29	47	12	64	36	4	192
12:45	28	30	2	8	0	68	15	42	10	59	78	3	207
13:00	9	18	4	12	0	43	21	40	8	106	42	3	220
13:15	29	16	0	7	0	52	29	46	9	52	42	2	180
13:30	27	46	7	9	0	89	30	26	8	68	42	0	174
13:45	16	20	2	12	0	50	16	33	6	64	82	0	201
14:00	18	19	1	13	0	51	16	36	9	55	40	0	156
14:15	12	28	3	11	0	54	22	34	5	65	40	0	166
14:30	7	18	0	16	0	41	16	30	7	58	40	0	151
14:45	9	13	2	11	0	35	17	48	6	36	77	0	184
15:00	3	26	6	8	0	43	12	19	12	65	37	4	149
15:15	10	24	2	18	0	54	18	38	18	47	37	0	158
15:30	21	17	4	3	0	45	19	79	11	49	42	0	200
15:45	13	25	8	6	0	52	18	20	13	37	42	0	130
16:00	8	9	0	9	0	26	14	25	6	34	78	0	157
16:15	3	0	0	7	0	10	18	25	4	48	36	3	134
16:30	4	14	0	11	0	29	18	19	6	40	36	3	122
16:45	8	12	1	11	0	32	10	15	0	40	45	0	110
17:00	5	15	0	8	0	28	12	14	3	27	9	0	65
17:15	6	4	0	7	0	17	7	15	6	31	9	0	68
17:30	1	5	0	7	0	13	5	21	2	20	0	0	48
17:45	5	1	0	6	0	12	11	19	4	26	0	0	60
18:00	3	5	0	8	0	16	16	3	0	25	0	0	44
18:15	6	7	0	7	0	20	11	9	0	21	0	0	41
18:30	5	3	0	5	0	13	9	13	0	10	0	0	32
Person-Hrs	86.25	115.75	13.50	64.50	0.00	280.00	116.50	225.25	44.00	332.25	262.25	6.75	987.00
Percentage	30.8%	41.3%	4.8%	23.0%	0.0%	100.0%	11.8%	22.8%	4.5%	33.7%	26.6%	0.7%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. 'Other' includes staff in FDEP boats
Visual survey records for the spring pool/run area of Wakulla State Park; including the estimated numbers of visitors participating in either in-water or out-o

Average Time Interval (hrs): 0.25



APPENDIX M

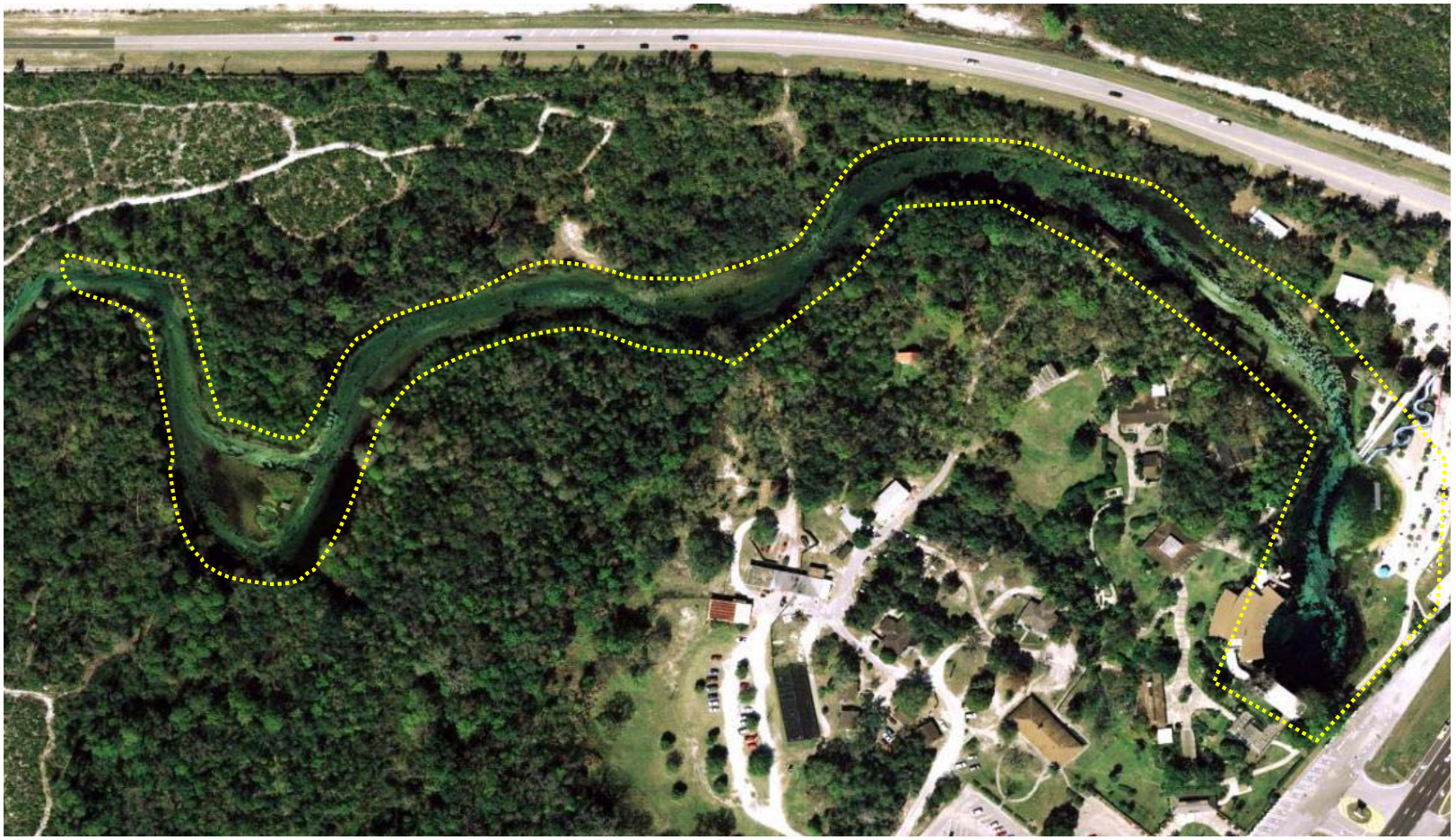
Weeki Wachee Springs (Hernando Co.) counts of human use by location, activity, category, and date

Location	Category	Activity	Person-Hrs				Average		
			3/9/2009	3/10/2009	3/11/2009	3/12/2009	Person-Hrs	# People	People/ha
Spring Pool	In Water	Wading	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Bathing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Snorkeling	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		Swimming	0.0	0.0	0.0	0.0	0.0	0.00	0.00
		SCUBA	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Out of Water	Viewing*	48.8	80.8	115.3	59.8	76.1	8.46	2.39
	In Water		0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Out of Water		48.8	80.8	115.3	59.8	76.1	8.46	2.39
Spring Run	In Water	Kayaking-Canoeing	0.0	4.5	15.5	9.5	7.4	0.82	0.42
		Power-boating	0.0	0.0	1.0	0.0	0.3	0.03	0.01
		Fishing	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	In Water		0.0	4.5	16.5	9.5	7.6	0.85	0.43
Entire Spring			48.8	85.3	131.8	69.3	83.8	9.31	2.82

Note(s):

Hours of Observations:	36.0	9.0	9.0	9.0	9.0
Spring Pool Wetted Area (ha):	0.1929				
Park Upland Area (ha):	3.5392				
Spring Run Area (ha):	1.9477				

* Counts from FDEP park entry numbers



Appendix M
Observational areas of human use at Weeki Wachee Springs State Park defined by dashed line.

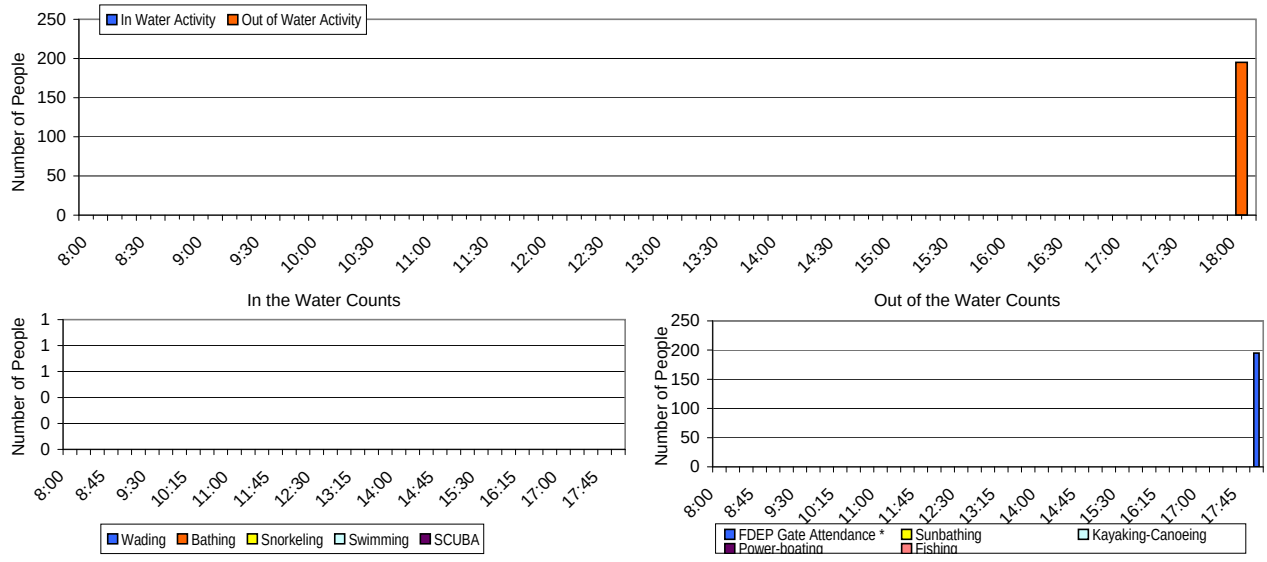
Human Use Actvity Summary

Site Weeki Wachee Springs **Date** 3/9/2009 **Survey Period** 8:00 18:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Kayaking-Canoeing	Power-boating	Fishing	Total
8:00						0						0
8:15						0						0
8:30						0						0
8:45						0						0
9:00						0						0
9:15						0						0
9:30						0						0
9:45						0						0
10:00						0						0
10:15						0						0
10:30						0						0
10:45						0						0
11:00						0						0
11:15						0						0
11:30						0						0
11:45						0						0
12:00						0						0
12:15						0						0
12:30						0						0
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45						0						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
17:15						0						0
17:30						0						0
17:45						0						0
18:00						0	195					195
Total	0	0	0	0	0	0	195	0	0	0	0	195
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	48.75	0.00	0.00	0.00	0.00	48.75
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. The park runs seven Jungle Criuse boat runs per day.
FDEP gate attendance records for the spring pool/run area of Weeki Wachee Springs State Park. There is no swimming in the spring vent, the lower spring pool is part of the "Buccanneer Bay" water park.

Average Time Interval (hrs): 0.25



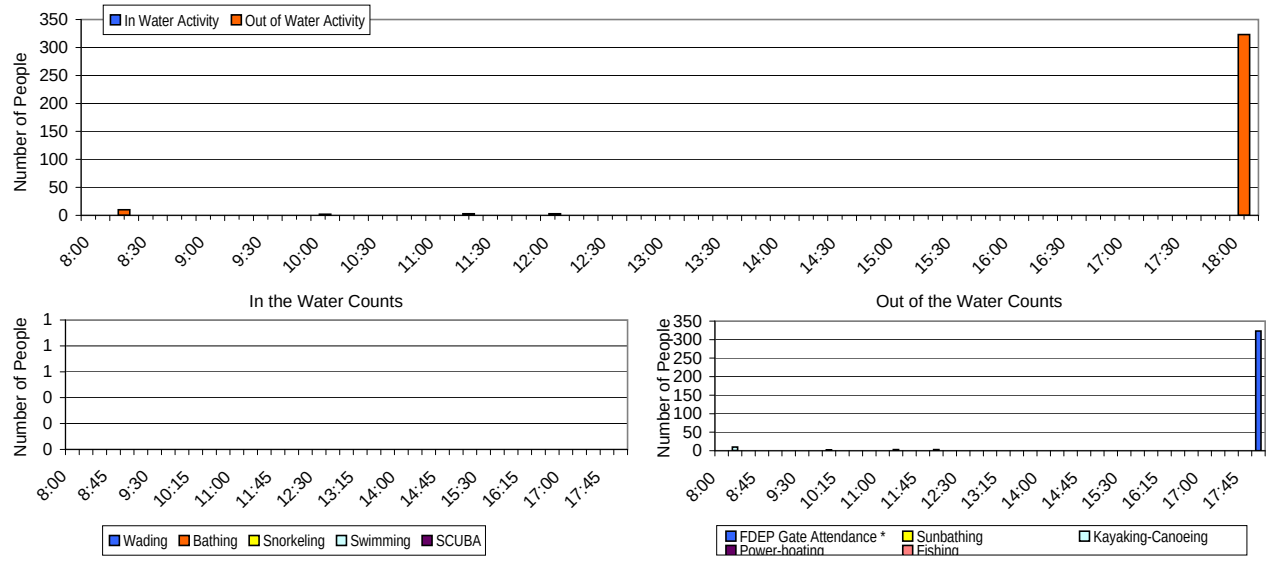
Human Use Actvity Summary

Site Weeki Wachee Springs **Date** 3/10/2009 **Survey Period** 8:00 18:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Kayaking-Canoeing	Power-boating	Fishing	Total
8:00						0						0
8:15						0			10			10
8:30						0						0
8:45						0						0
9:00						0						0
9:15						0						0
9:30						0						0
9:45						0						0
10:00						0			2			2
10:15						0						0
10:30						0						0
10:45						0						0
11:00						0						0
11:15						0			3			3
11:30						0						0
11:45						0						0
12:00						0			3			3
12:15						0						0
12:30						0						0
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45						0						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
17:15						0						0
17:30						0						0
17:45						0						0
18:00						0	323					323
Total	0	0	0	0	0	0	323	0	18	0	0	341
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	80.75	0.00	4.50	0.00	0.00	85.25
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	94.7%	0.0%	5.3%	0.0%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. The park runs seven Jungle Criuse boat runs per day.
FDEP gate attendance records for the spring pool/run area of Weeki Wachee Springs State Park. There is no swimming in the spring vent, the lower spring pool is part of the "Buccaneer Bay" water park.

Average Time Interval (hrs): 0.25



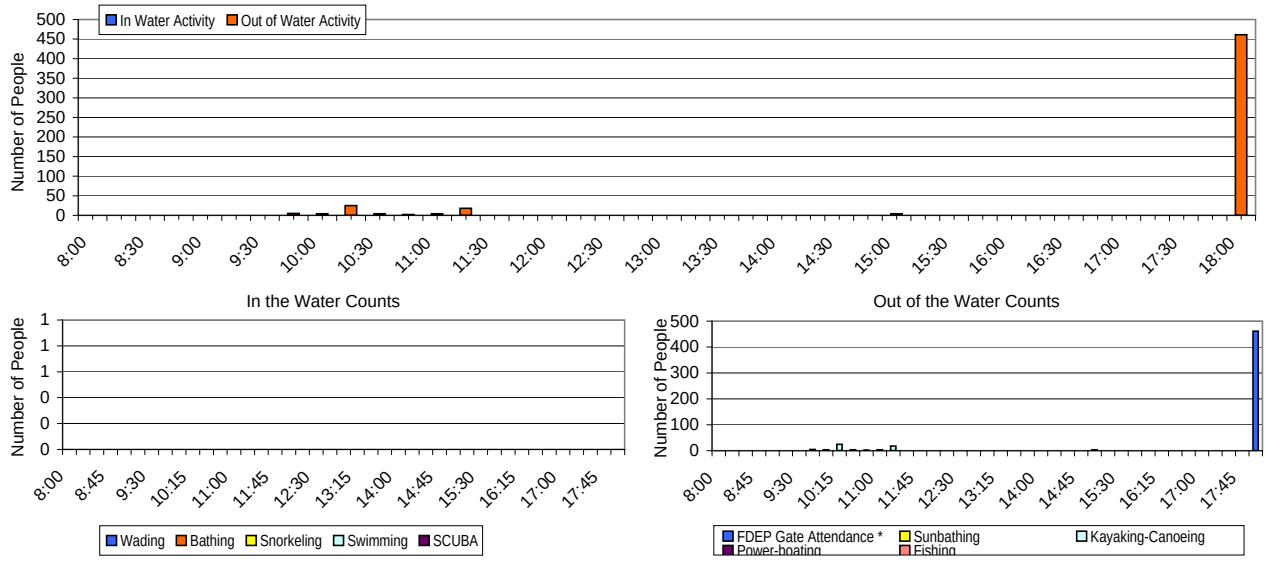
Human Use Actvity Summary

Site Weeki Wachee Springs **Date** 3/11/2009 **Survey Period** 8:00 18:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Kayaking-Canoeing	Power-boating	Fishing	Total
8:00						0						0
8:15						0						0
8:30						0						0
8:45						0						0
9:00						0						0
9:15						0						0
9:30						0						0
9:45						0			5			5
10:00						0			4			4
10:15						0			25			25
10:30						0			4			4
10:45						0			2			2
11:00						0			4			4
11:15						0			18			18
11:30						0						0
11:45						0						0
12:00						0						0
12:15						0						0
12:30						0						0
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0				4		4
15:15						0						0
15:30						0						0
15:45						0						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
17:15						0						0
17:30						0						0
17:45						0						0
18:00						0	461					461
Total	0	0	0	0	0	0	461	0	62	4	0	527
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	115.25	0.00	15.50	1.00	0.00	131.75
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	87.5%	0.0%	11.8%	0.8%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. The park runs seven Jungle Criuse boat runs per day.
FDEP gate attendance records for the spring pool/run area of Weeki Wachee Springs State Park. There is no swimming in the spring vent, the lower spring pool is part of the "Buccanneer Bay" water park.

Average Time Interval (hrs): 0.25



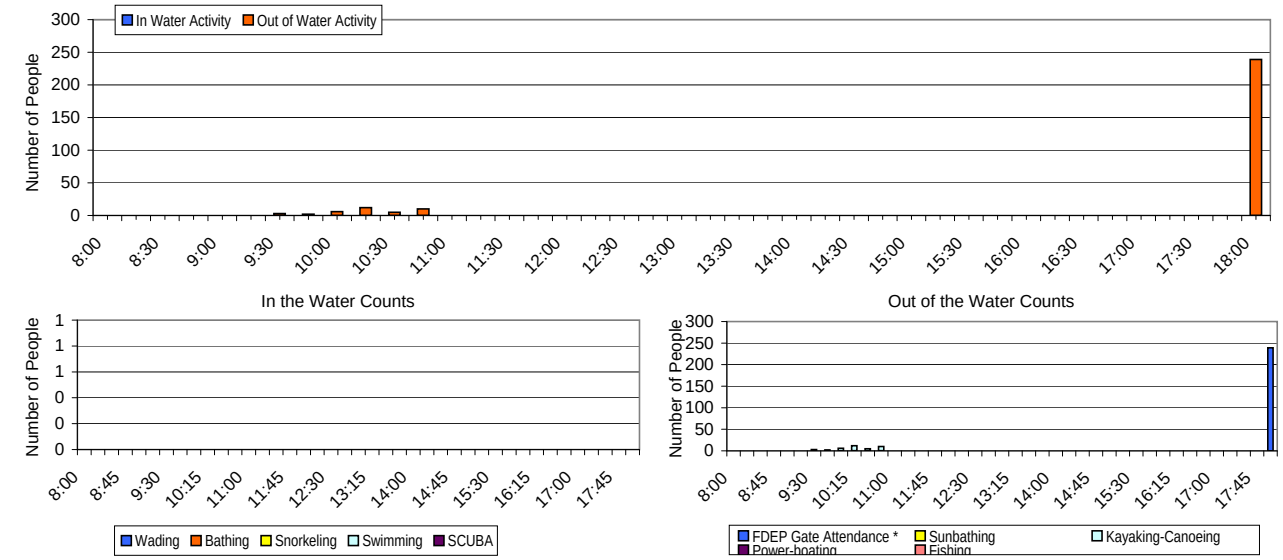
Human Use Actvity Summary

Site Weeki Wachee Springs **Date** 3/12/2009 **Survey Period** 8:00 18:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Kayaking-Canoeing	Power-boating	Fishing	Total
8:00						0						0
8:15						0						0
8:30						0						0
8:45						0						0
9:00						0						0
9:15						0						0
9:30						0			3			3
9:45						0			2			2
10:00						0			6			6
10:15						0			12			12
10:30						0			5			5
10:45						0			10			10
11:00						0						0
11:15						0						0
11:30						0						0
11:45						0						0
12:00						0						0
12:15						0						0
12:30						0						0
12:45						0						0
13:00						0						0
13:15						0						0
13:30						0						0
13:45						0						0
14:00						0						0
14:15						0						0
14:30						0						0
14:45						0						0
15:00						0						0
15:15						0						0
15:30						0						0
15:45						0						0
16:00						0						0
16:15						0						0
16:30						0						0
16:45						0						0
17:00						0						0
17:15						0						0
17:30						0						0
17:45						0						0
18:00						0	239					239
Total	0	0	0	0	0	0	239	0	38	0	0	277
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	59.75	0.00	9.50	0.00	0.00	69.25
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	86.3%	0.0%	13.7%	0.0%	0.0%	100.0%

Note(s):
"Wading" is waist deep, "Bathing" is chest deep. The park runs seven Jungle Criuse boat runs per day.
FDEP gate attendance records for the spring pool/run area of Weeki Wachee Springs State Park. There is no swimming in the spring vent, the lower spring pool is part of the "Buccanneer Bay" water park.

Average Time Interval (hrs): 0.25



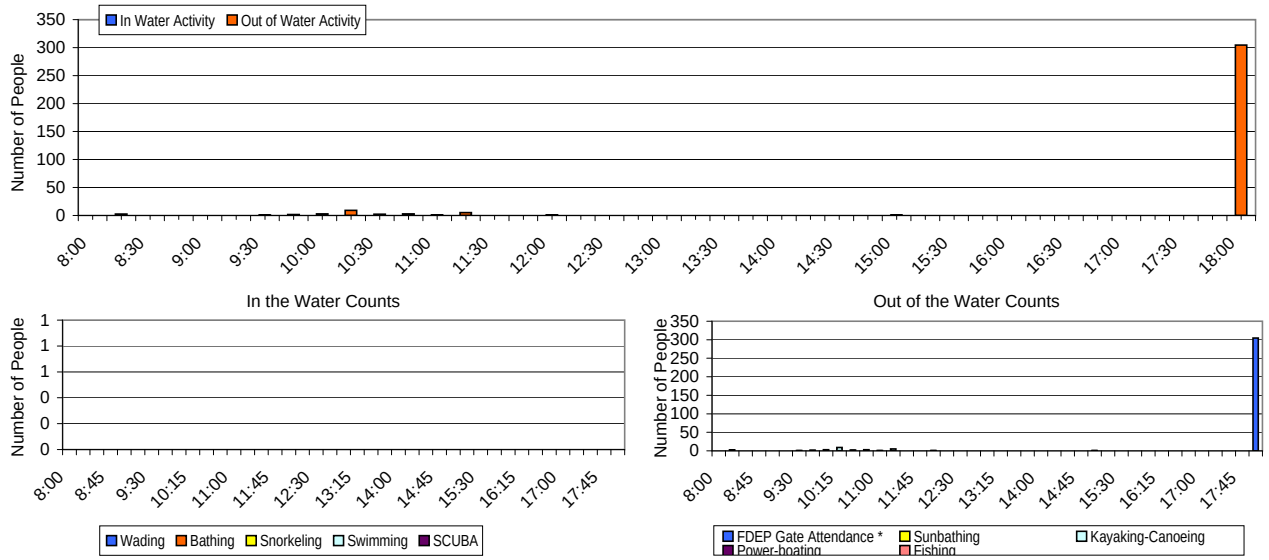
Human Use Actvity Summary - Period of Record Average

Site Weeki Wachee Springs **Date** 03/09/2009 - 03/12/2009 **Survey Period** 8:00 18:00

	Numbers of People											
	In Water Activity						Out of Water Activity					
Time	Wading	Bathing	Snorkeling	Swimming	SCUBA	Total	FDEP Gate Attendance *	Sunbathing	Kayaking-Canoeing	Power-boating	Fishing	Total
8:00	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	3	0	0	3
8:30	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0
9:00	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	0	0	0	0	0	0	0	0	0
9:30	0	0	0	0	0	0	0	0	1	0	0	1
9:45	0	0	0	0	0	0	0	0	2	0	0	2
10:00	0	0	0	0	0	0	0	0	3	0	0	3
10:15	0	0	0	0	0	0	0	0	9	0	0	9
10:30	0	0	0	0	0	0	0	0	2	0	0	2
10:45	0	0	0	0	0	0	0	0	3	0	0	3
11:00	0	0	0	0	0	0	0	0	1	0	0	1
11:15	0	0	0	0	0	0	0	0	5	0	0	5
11:30	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	1	0	0	1
12:15	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	1	0	1
15:15	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	305	0	0	0	0	305
Total	0	0	0	0	0	0	305	0	30	1	0	335
Person-Hrs	0.00	0.00	0.00	0.00	0.00	0.00	76.13	0.00	7.38	0.25	0.00	83.75
Percentage	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	90.9%	0.0%	8.8%	0.3%	0.0%	100.0%

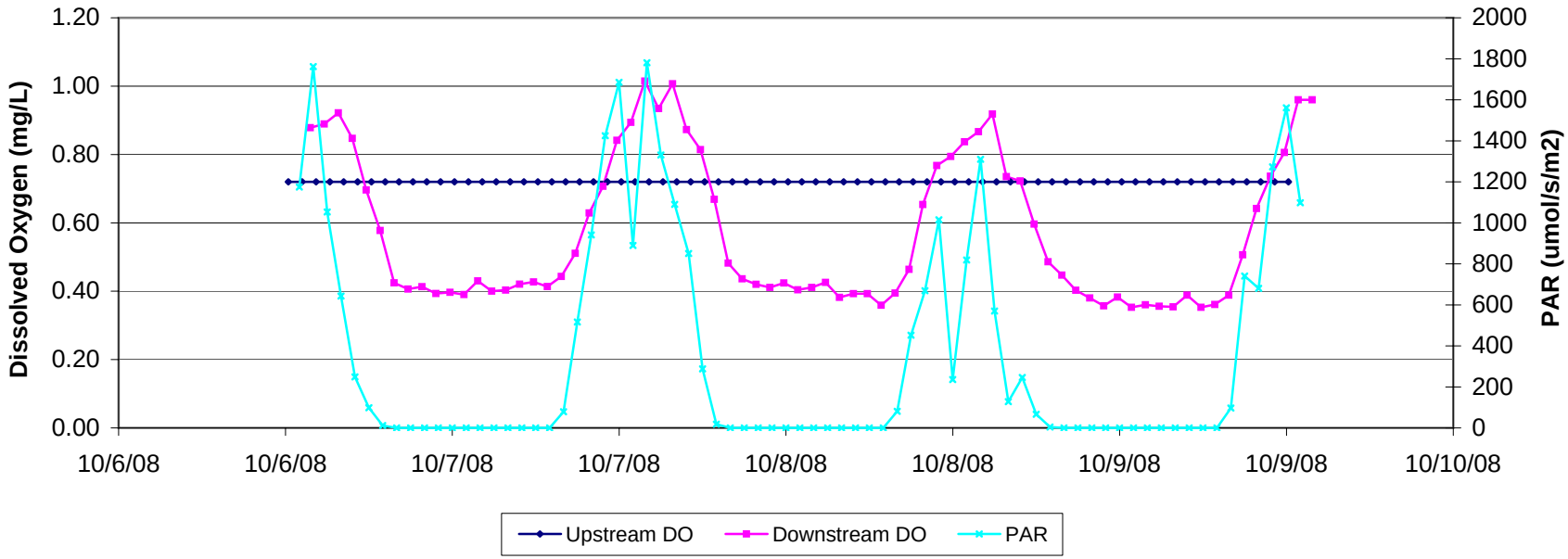
Note(s):
"Wading" is waist deep, "Bathing" is chest deep. The park runs seven Jungle Criuse boat runs per day.
FDEP gate attendance records for the spring pool/run area of Weeki Wachee Springs State Park. There is no swimming in the spring vent, the lower spring pool is part of the "Buccanneer Bay" water park.

Average Time Interval (hrs): 0.25



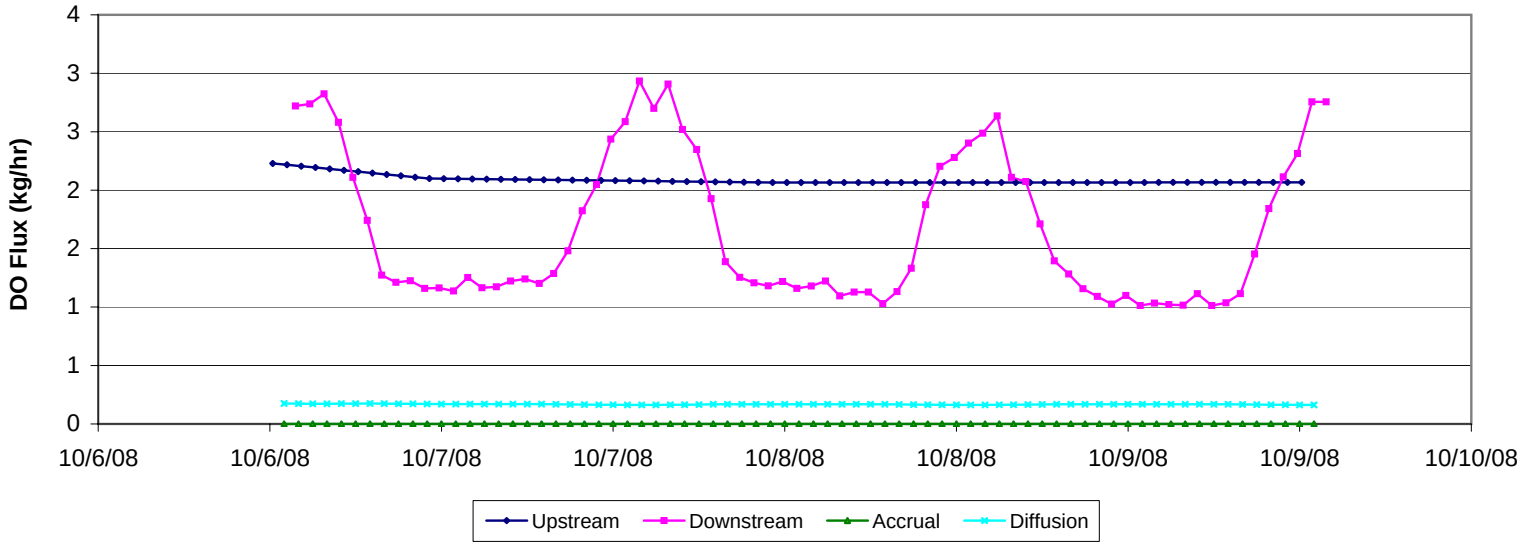
Appendix N

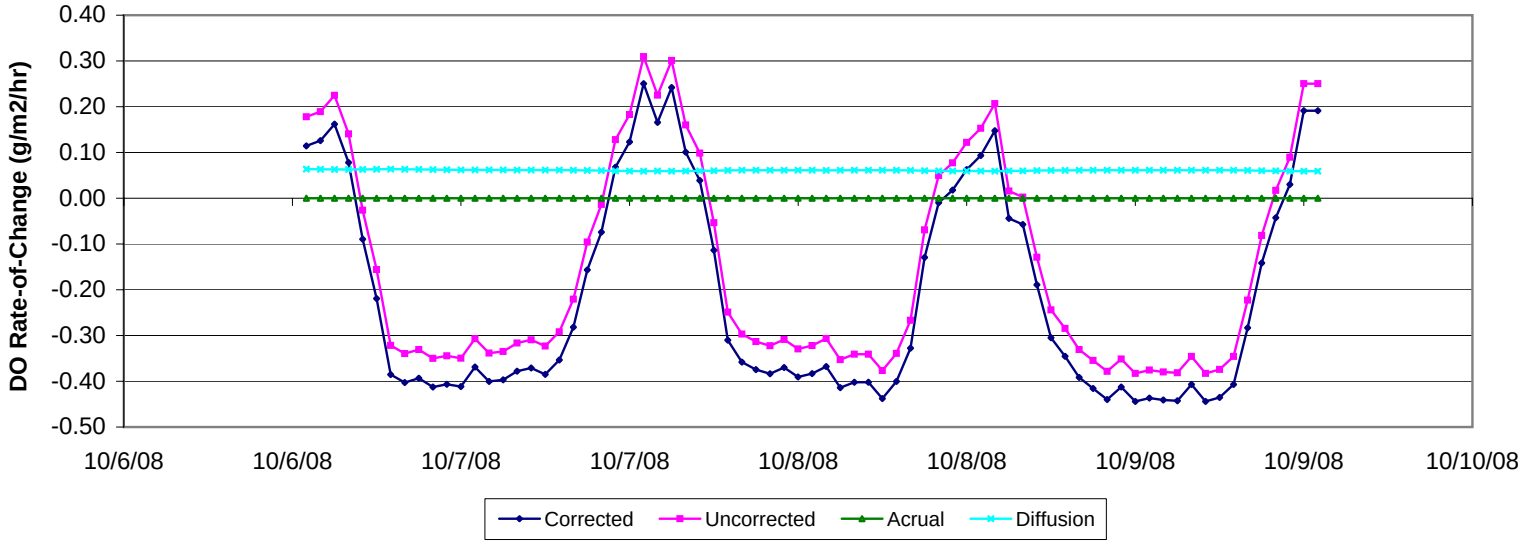
Ecosystem Metabolism Parameters



APPENDIX N

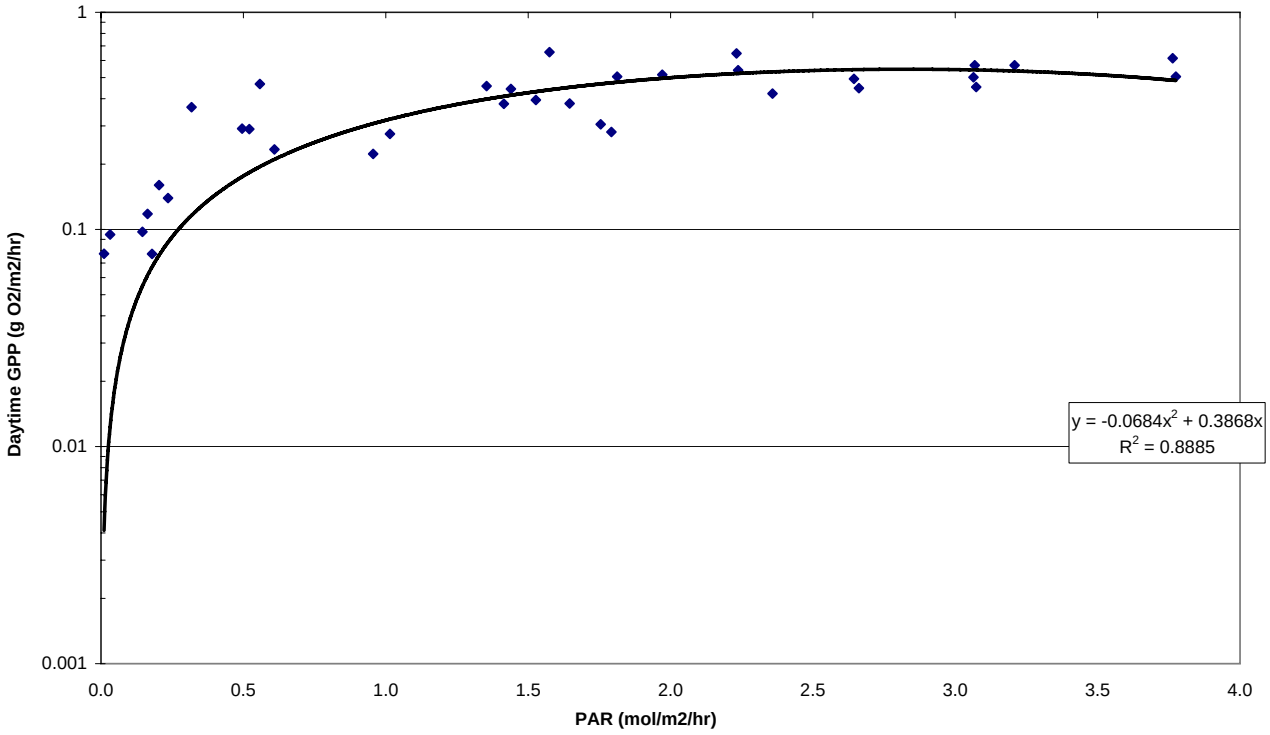
VOLUISA DELEON SPRING - MAIN BOIL TO STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

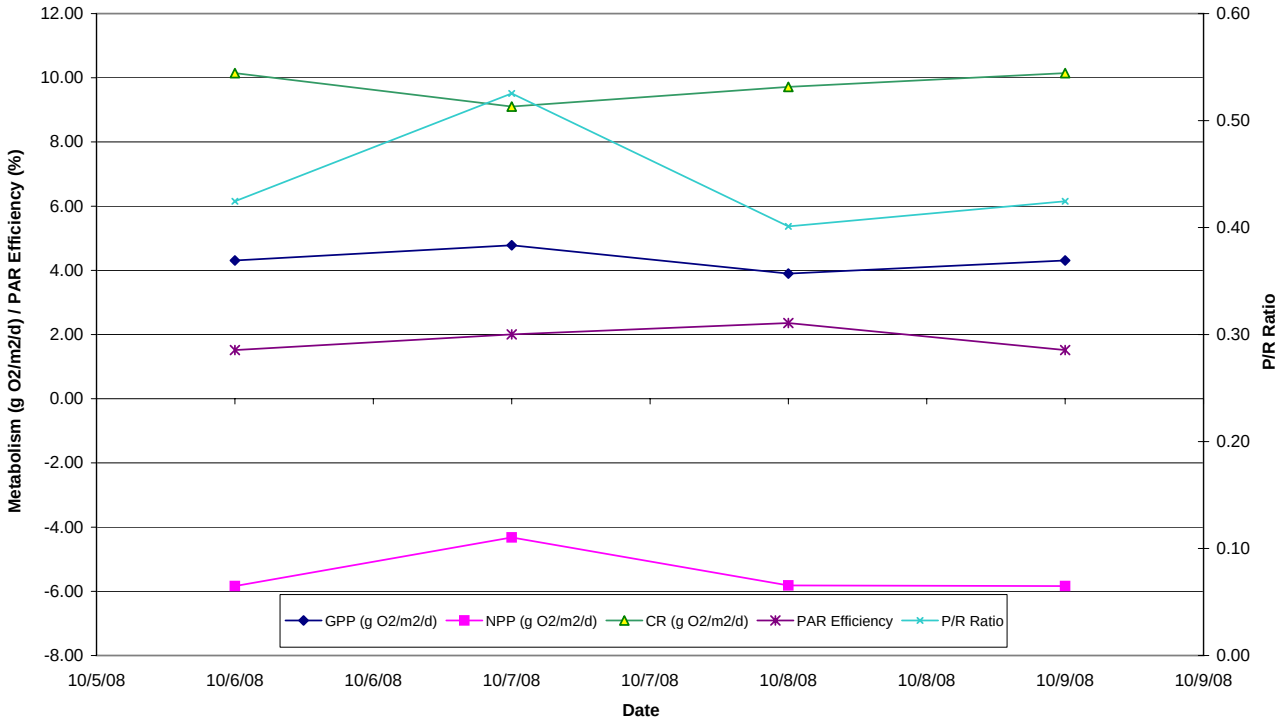




APPENDIX N

VOLUISA DELEON SPRING - MAIN BOIL TO STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





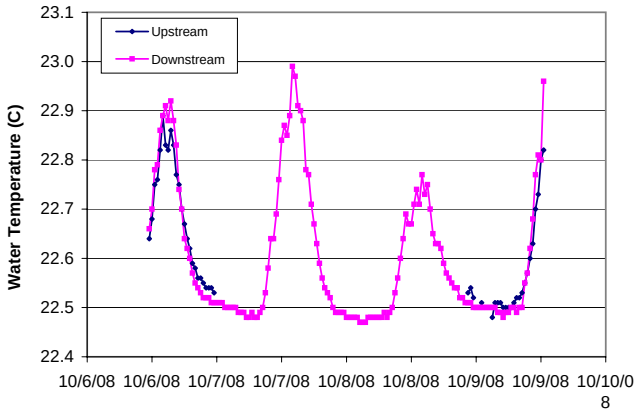
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	4.32	-5.45	9.78	0.44	1.85
Max	4.78	-4.32	10.15	0.53	2.36
Min	3.90	-5.84	9.10	0.40	1.52

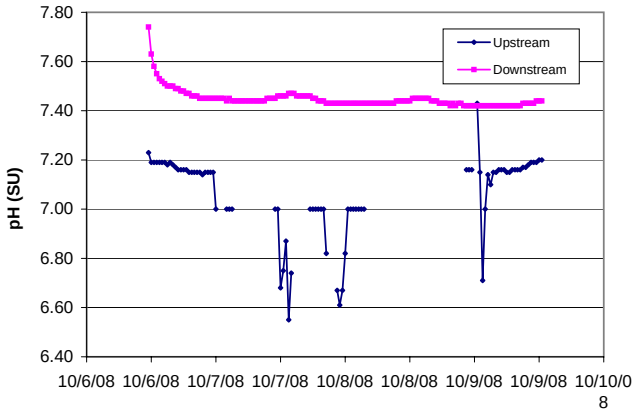
APPENDIX N

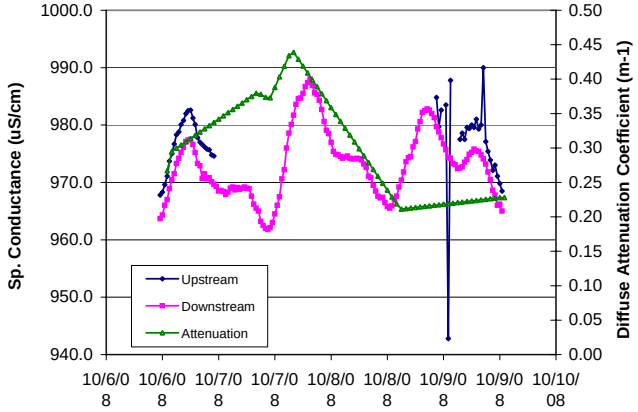
VOLUISA DELEON SPRING - MAIN BOIL TO STN 2 METABOLISM ESTIMATES

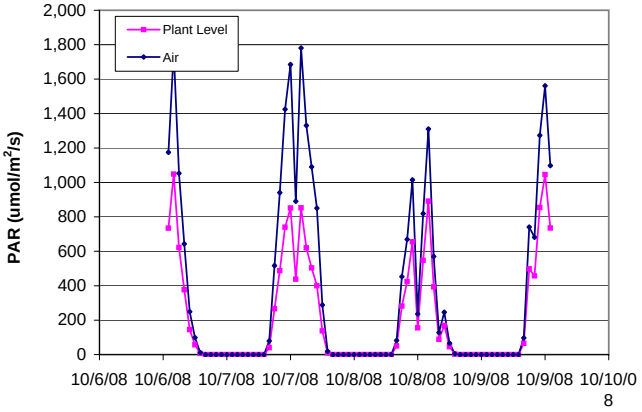
APPENDIX N

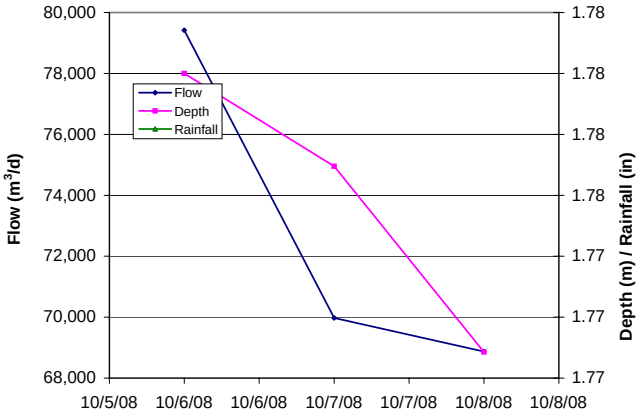
VOLUISA DELEON SPRING - MAIN BOIL TO STN 2 METABOLISM SUMMARY



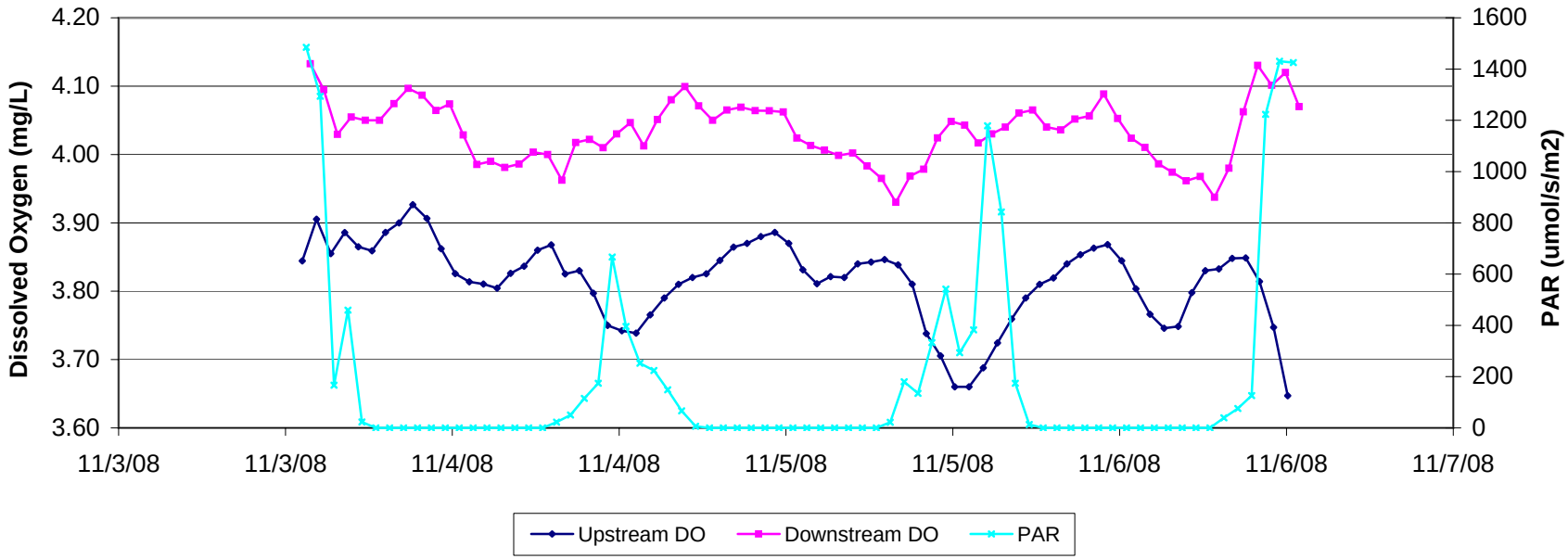






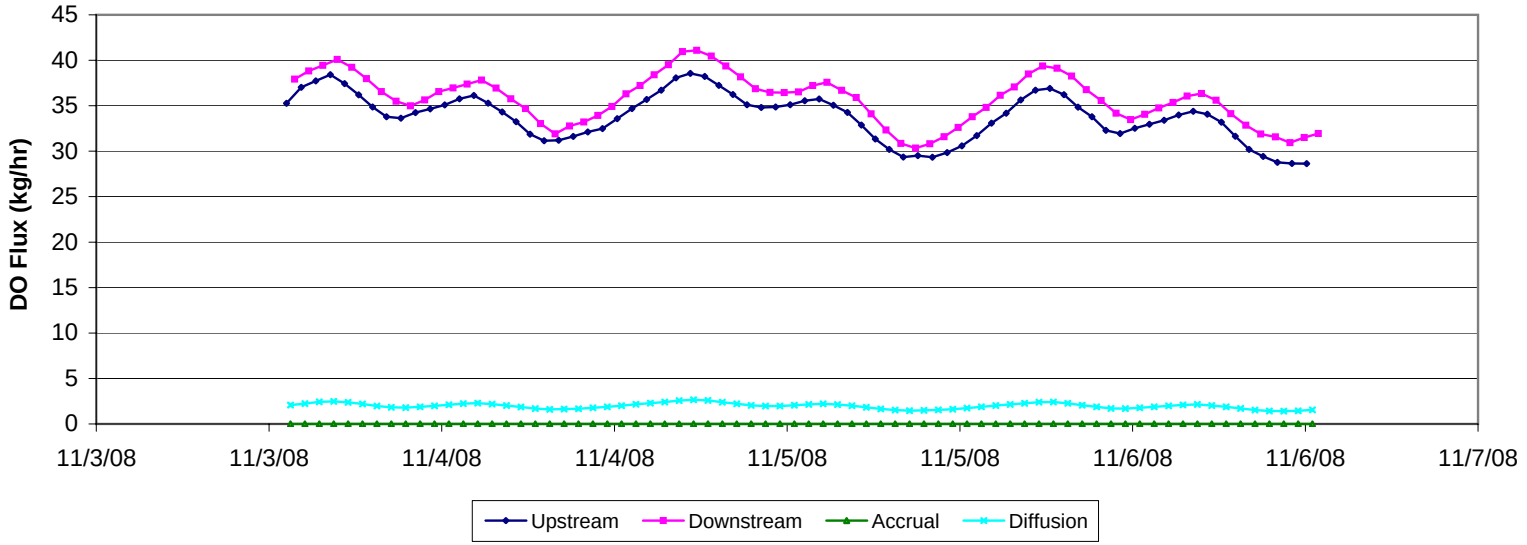


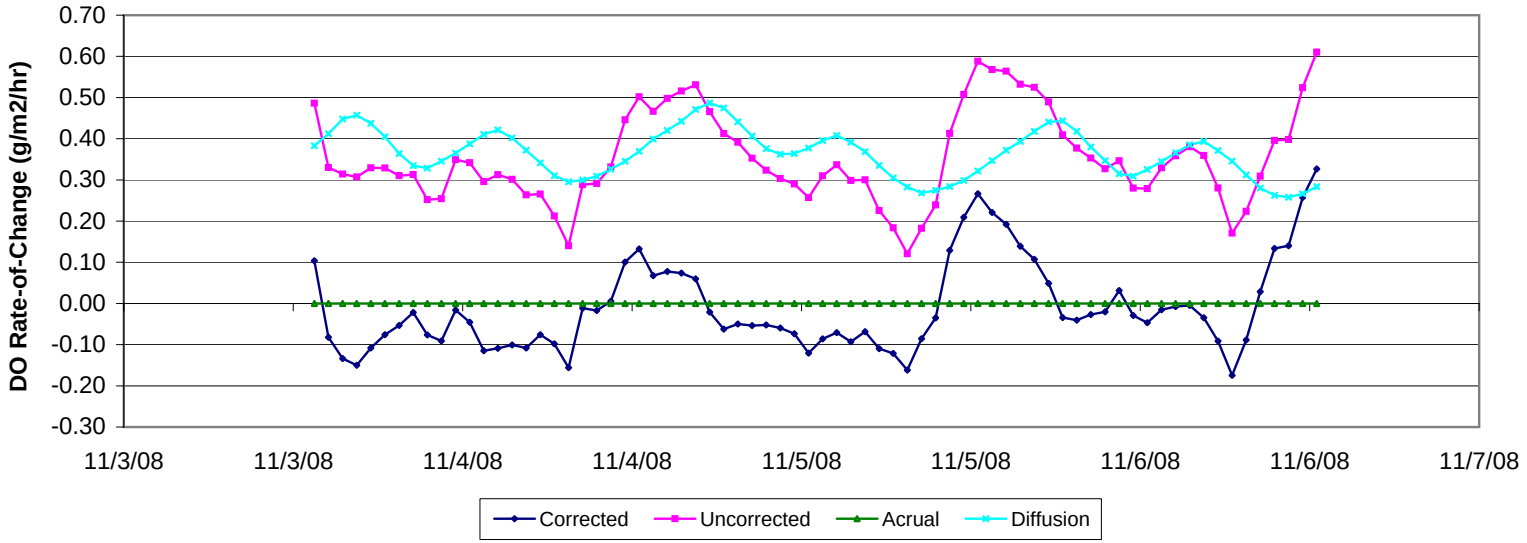
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	0.72	0.72	0.72	148
down		0.57	0.34	1.03	147
Wtr Temp - up	C	22.6	22.5	22.9	49
down		22.6	22.5	23.0	147
pH - up	SU	7.07	6.55	7.43	82
down		7.45	7.42	7.74	147
SpCond - up	uS/cm	977	943	990	49
down		973	962	988	147
Flow - up	m^3/d	72,753	68,871	79,416	3
Depth	m	1.78	1.77	1.78	3
Rainfall Total	in		0		
PAR - air	$umol/m^2/s$	365	0.0	2,218	438
plant		215	0.0	1049	73
DO rate chng	$g/m^2/hr$				
corr		-0.216	-0.444	0.250	73
uncorr		-0.155	-0.383	0.310	73



APPENDIX N

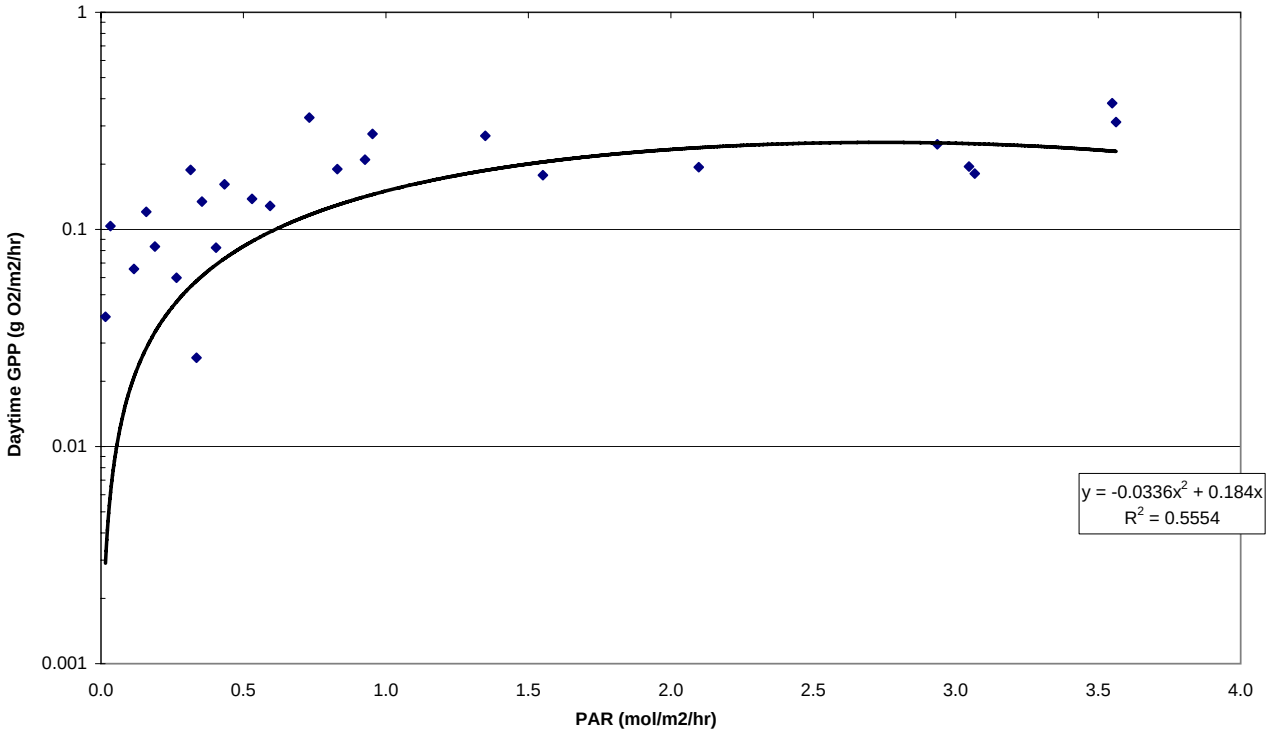
HOMOSASSA SPRING - MAIN BOIL TO STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

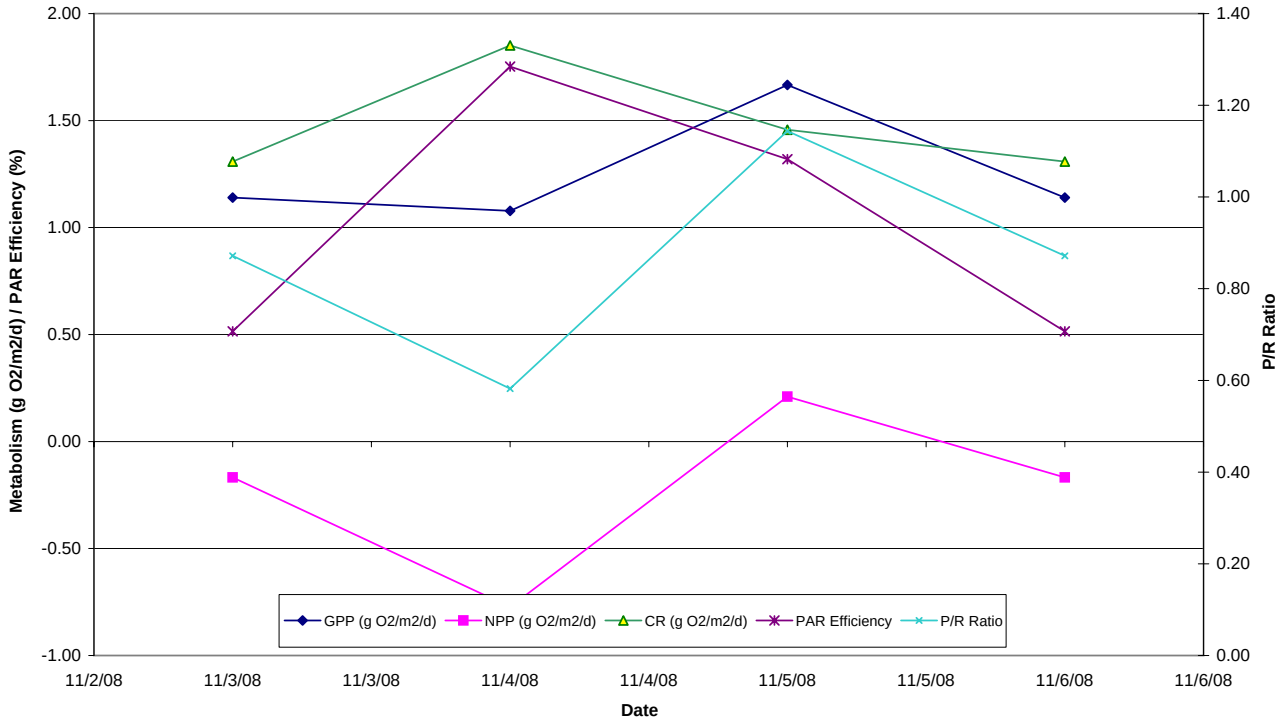




APPENDIX N

HOMOSASSA SPRING - MAIN BOIL TO STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





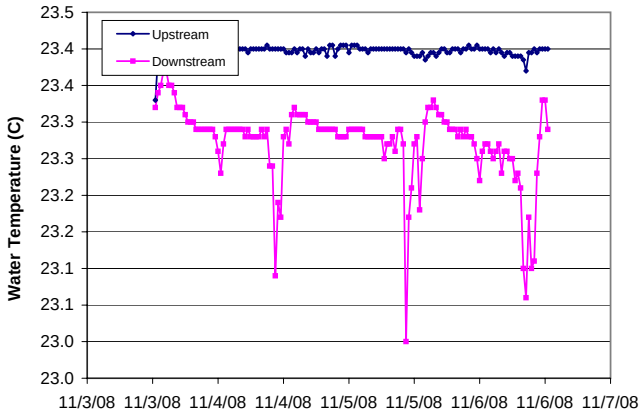
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	1.26	-0.23	1.48	0.87	1.03
Max	1.67	0.21	1.85	1.14	1.75
Min	1.08	-0.77	1.31	0.58	0.52

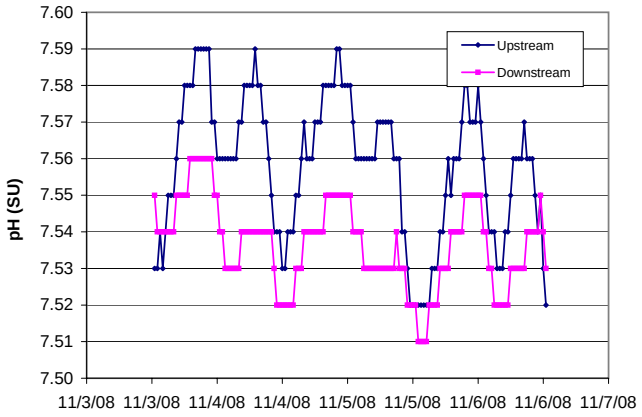
APPENDIX N

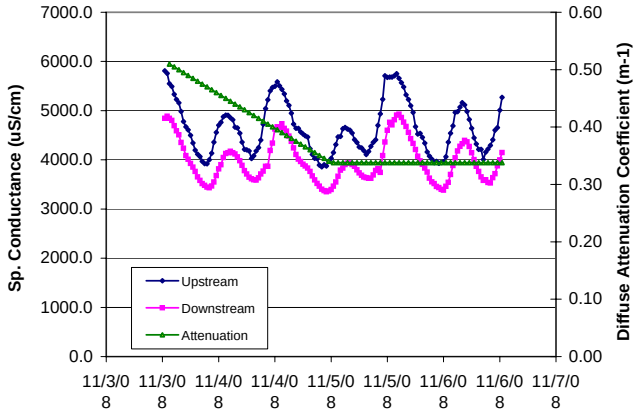
HOMOSASSA SPRING - MAIN BOIL TO STN 2 METABOLISM ESTIMATES

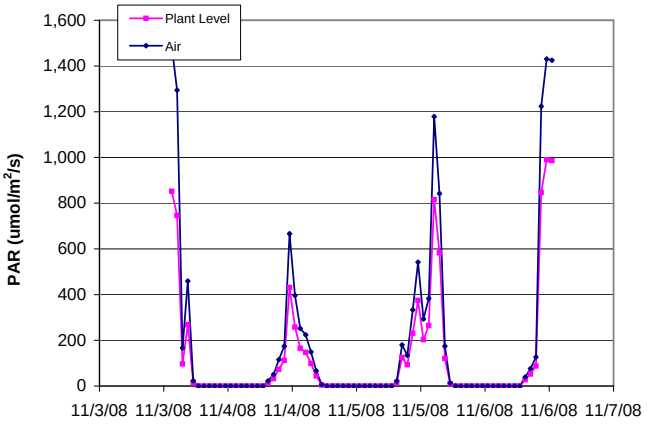
APPENDIX N

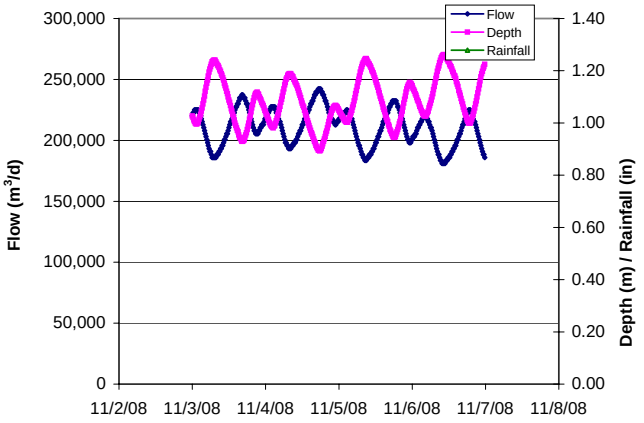
HOMOSASSA SPRING - MAIN BOIL TO STN 2 METABOLISM SUMMARY



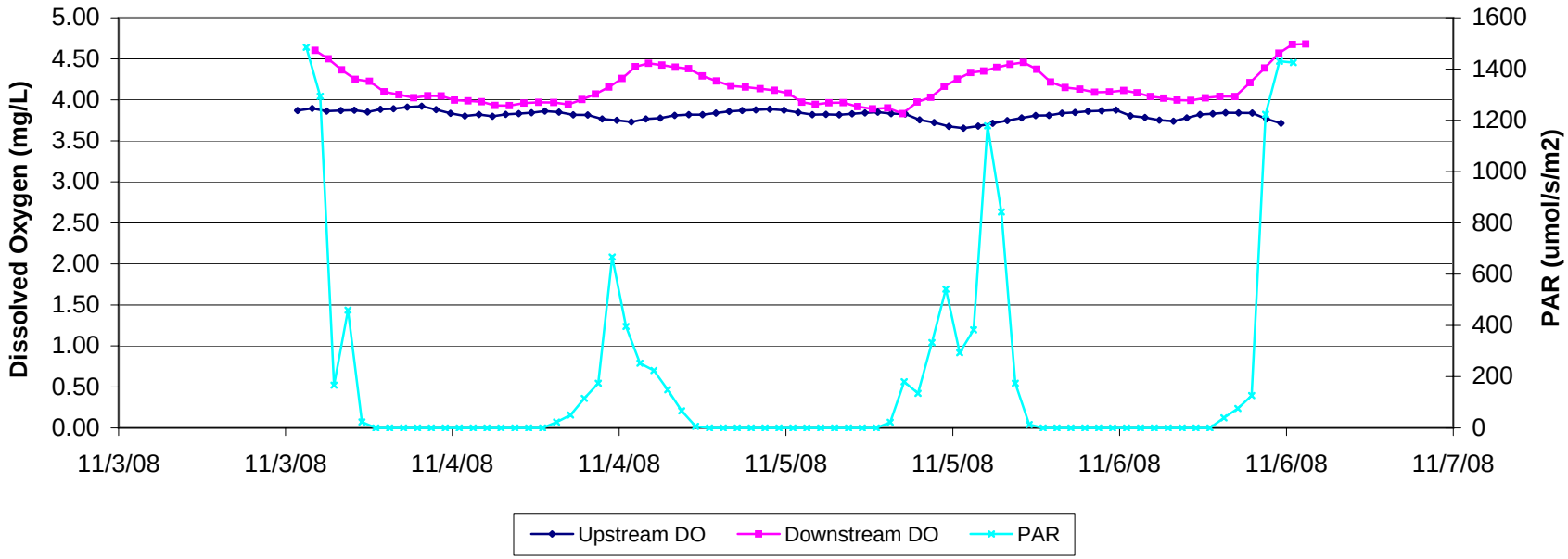






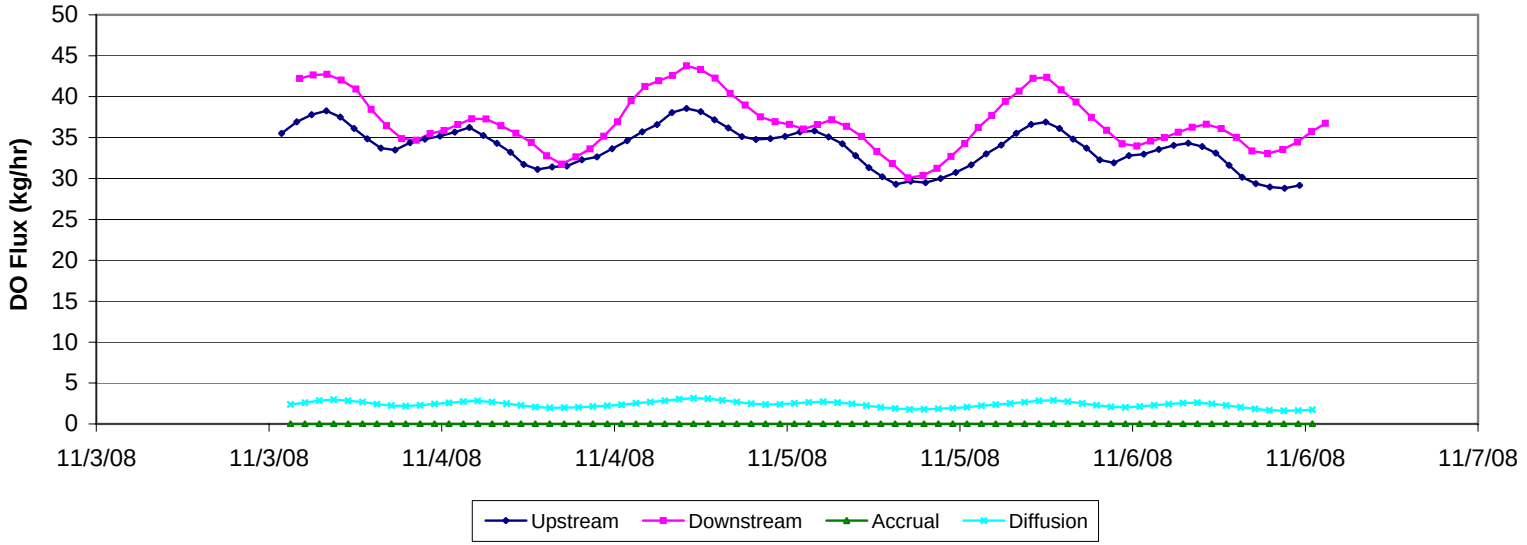


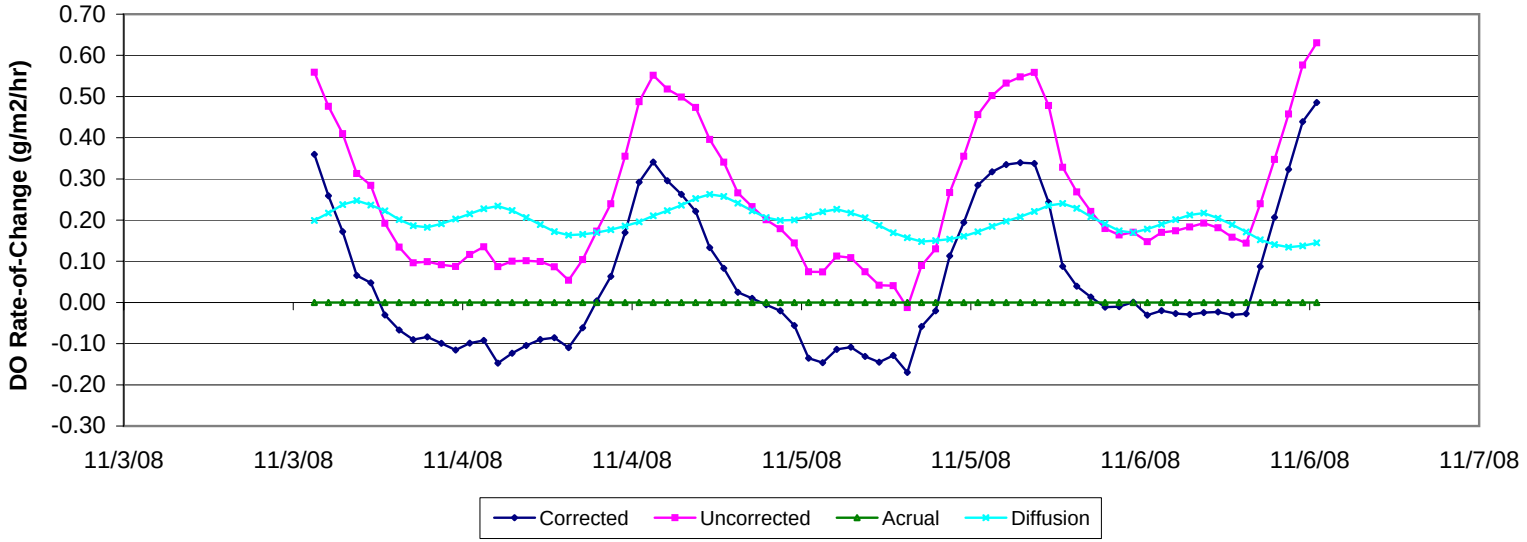
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.81	3.59	3.94	144
down		4.04	3.91	4.31	145
Wtr Temp - up	C	23.4	23.3	23.4	145
down		23.3	23.0	23.4	145
pH - up	SU	7.56	7.52	7.59	145
down		7.54	7.51	7.56	145
SpCond - up	uS/cm	4640	3857	5808	145
down		3970	3352	4928	145
Flow - up	m^3/d	210,992	181,047	242,211	384
Depth	m	1.08	0.89	1.26	384
Rainfall Total	in		0		
PAR - air	$umol/m^2/s$	157	0.0	1,498	833
plant		127	0.0	990	72
DO rate chng	$g/m^2/hr$				
corr		-0.010	-0.175	0.327	72
uncorr		0.354	0.121	0.610	72



APPENDIX N

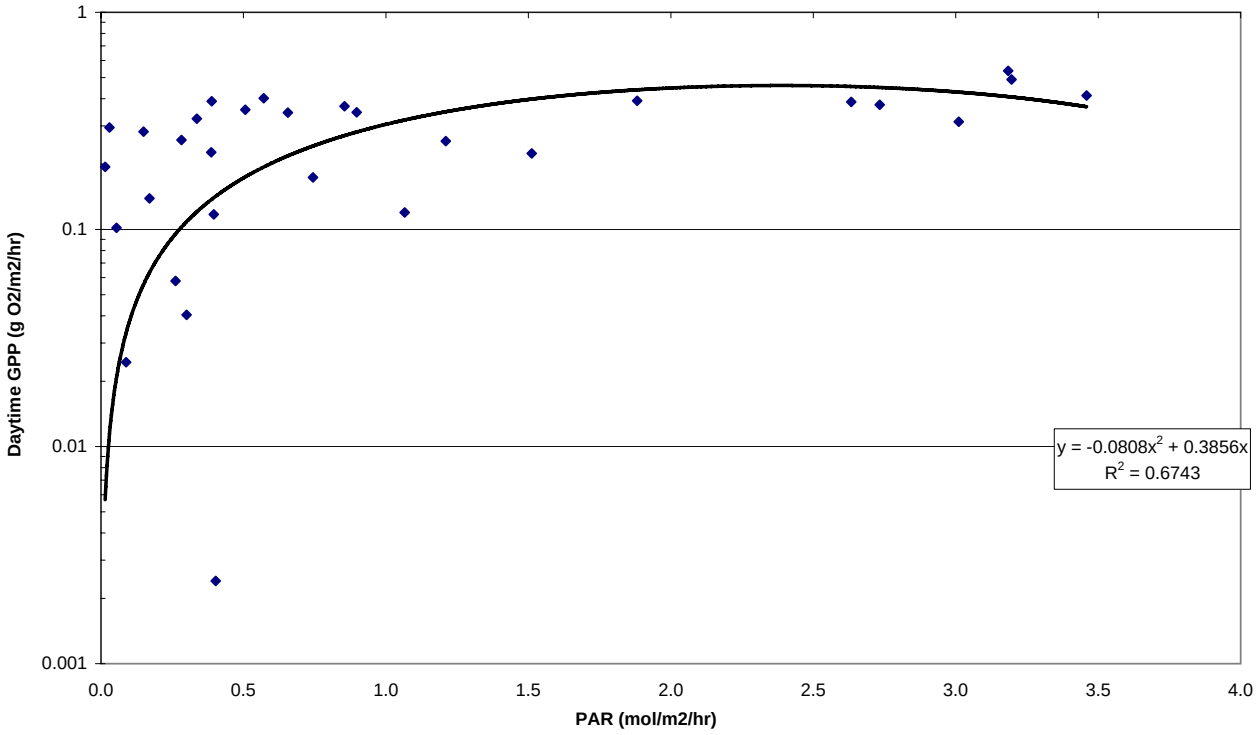
HOMOSASSA SPRING - MAIN BOIL TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

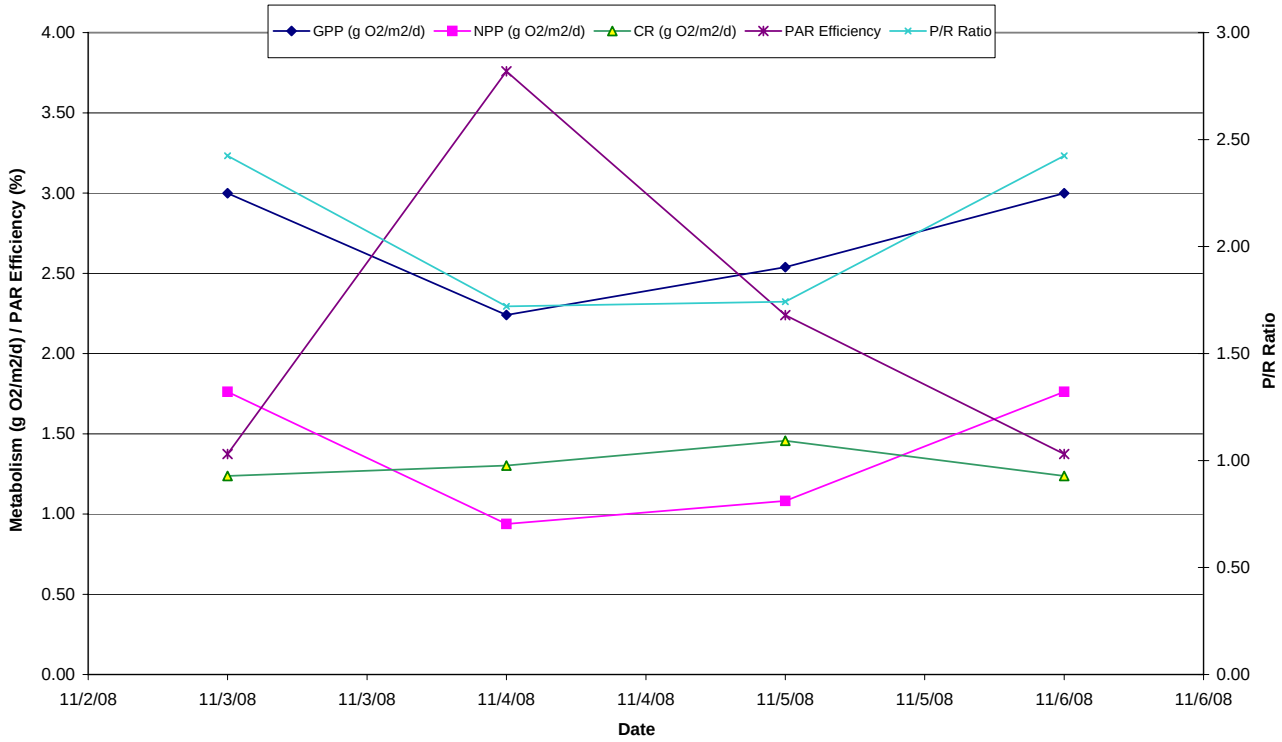




APPENDIX N

HOMOSASSA SPRING - MAIN BOIL TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





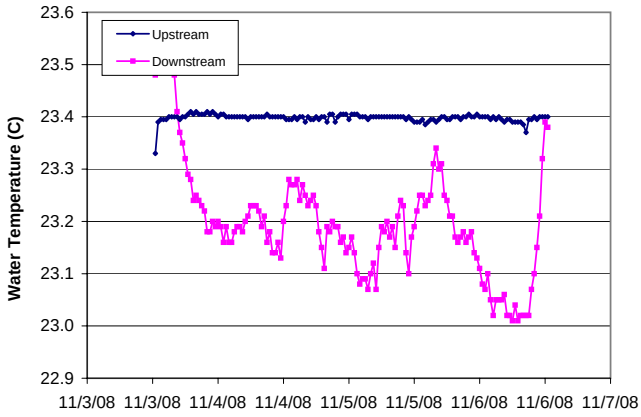
APPENDIX N

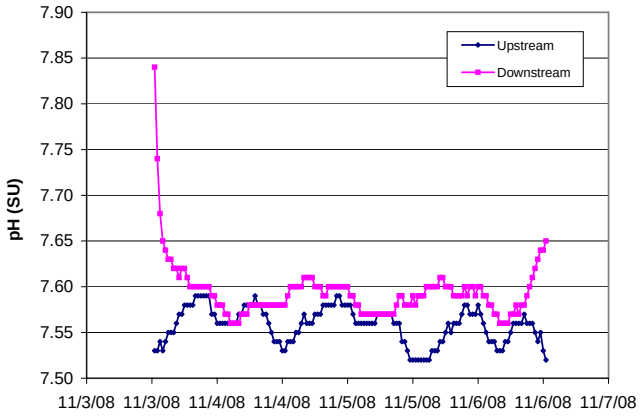
HOMOSASSA SPRING - MAIN BOIL TO STN 3 METABOLISM ESTIMATES

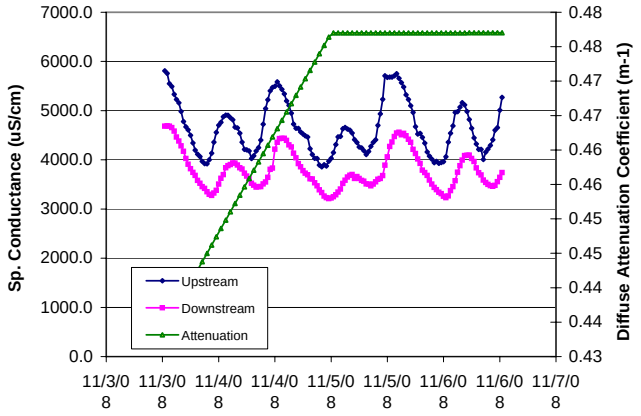
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	2.69	1.39	1.31	2.08	2.19
Max	3.00	1.76	1.46	2.42	3.76
Min	2.24	0.94	1.24	1.72	1.37

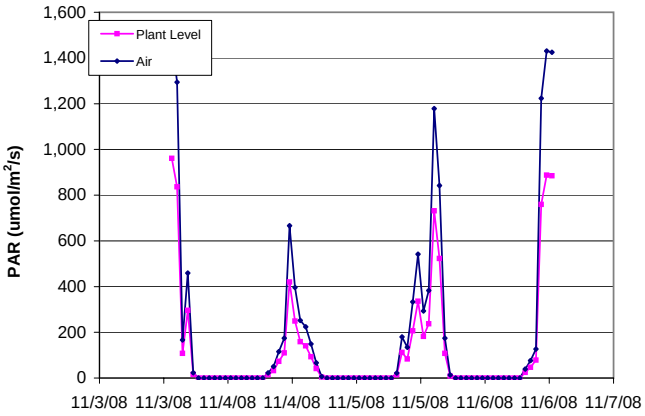
APPENDIX N

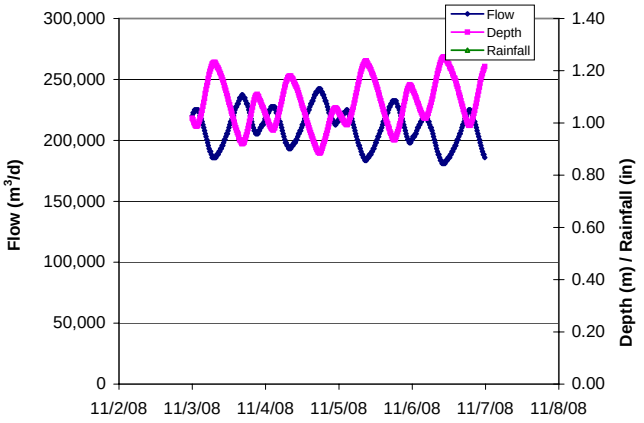
HOMOSASSA SPRING - MAIN BOIL TO STN 3 METABOLISM SUMMARY



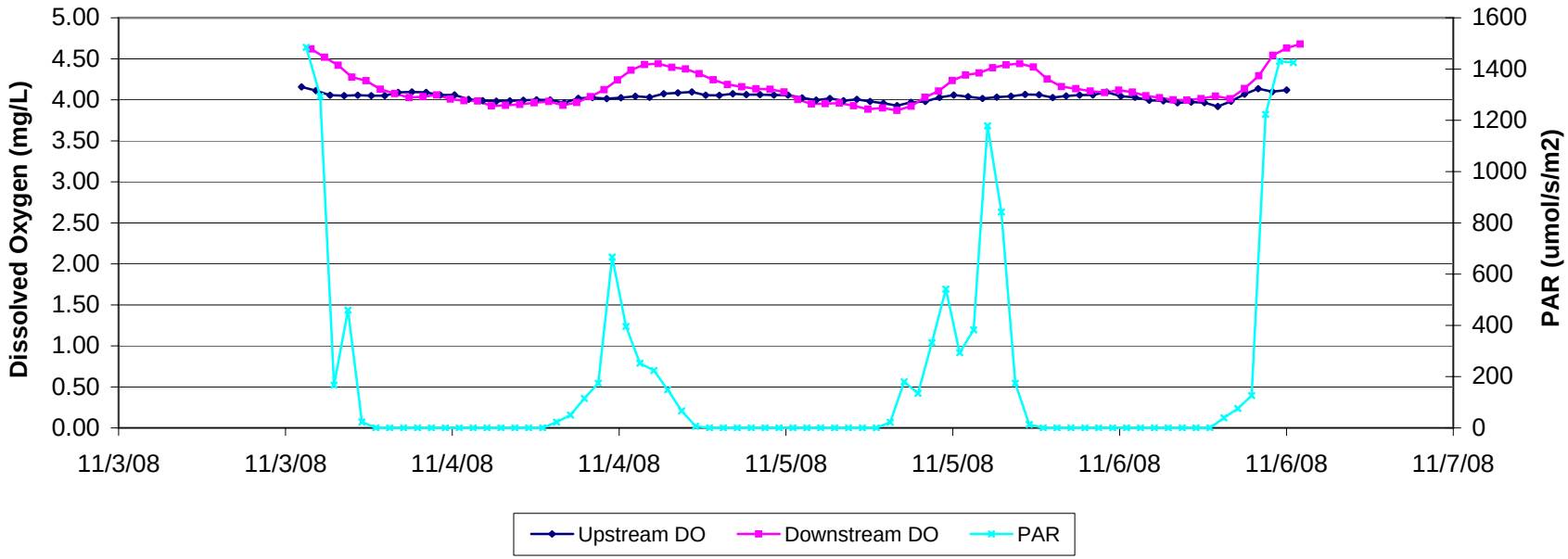






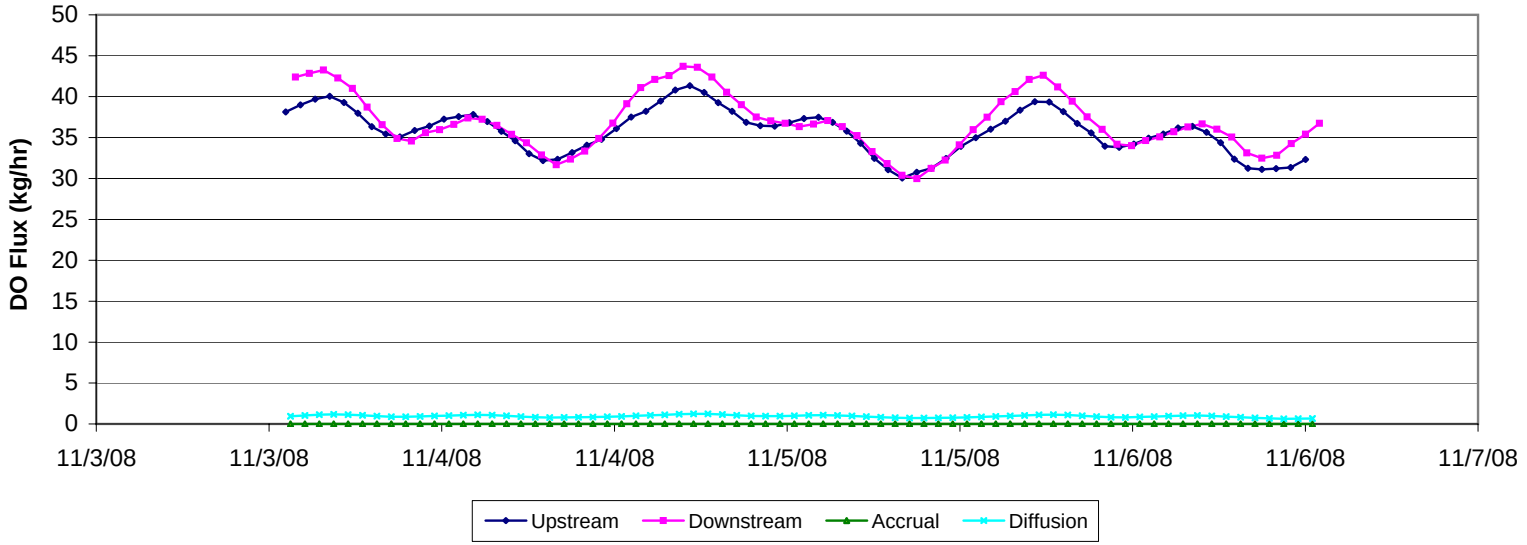


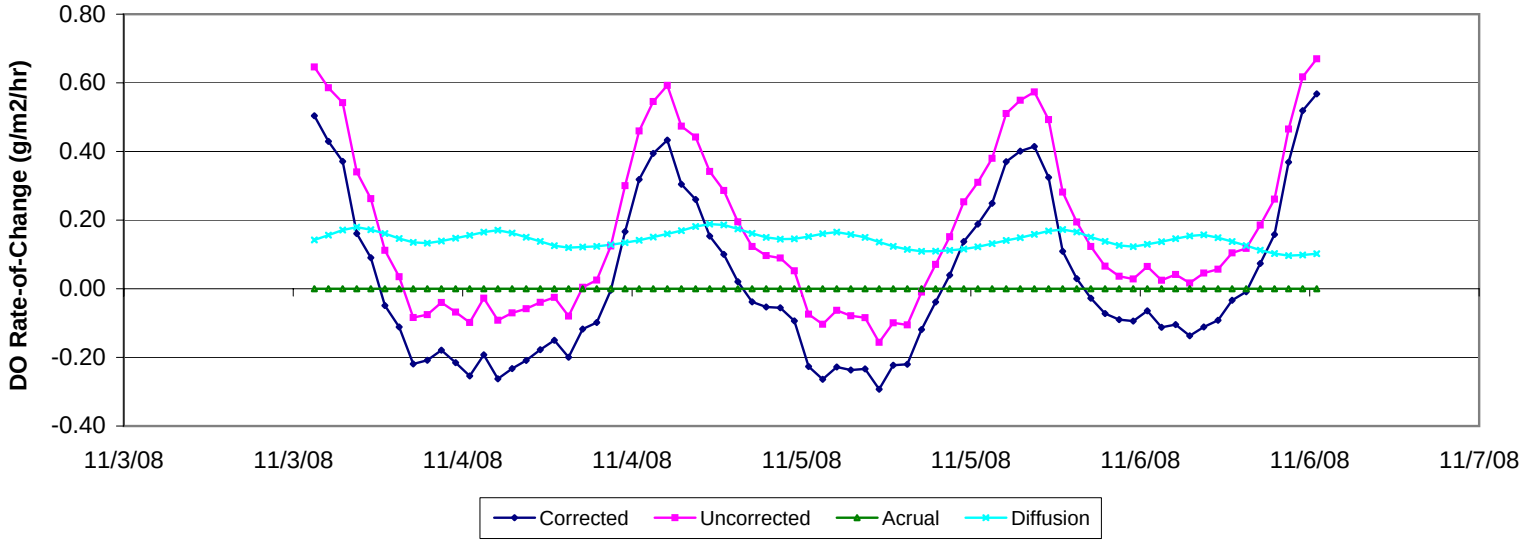
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.82	3.59	3.94	145
down		4.15	3.82	4.76	145
Wtr Temp - up	C	23.4	23.3	23.4	145
down		23.2	23.0	23.6	145
pH - up	SU	7.56	7.52	7.59	145
down		7.59	7.56	7.84	145
SpCond - up	uS/cm	4640	3857	5808	145
down		3783	3210	4689	145
Flow - up	m^3/d	210,992	181,047	242,211	384
Depth	m	1.07	0.88	1.25	384
Rainfall Total	in		0		
PAR - air	umol/m^2/s	157	0.0	1,498	833
plant		122	0.0	961	72
DO rate chng	g/m^2/hr				
corr		0.053	-0.170	0.486	72
uncorr		0.251	-0.012	0.630	72



APPENDIX N

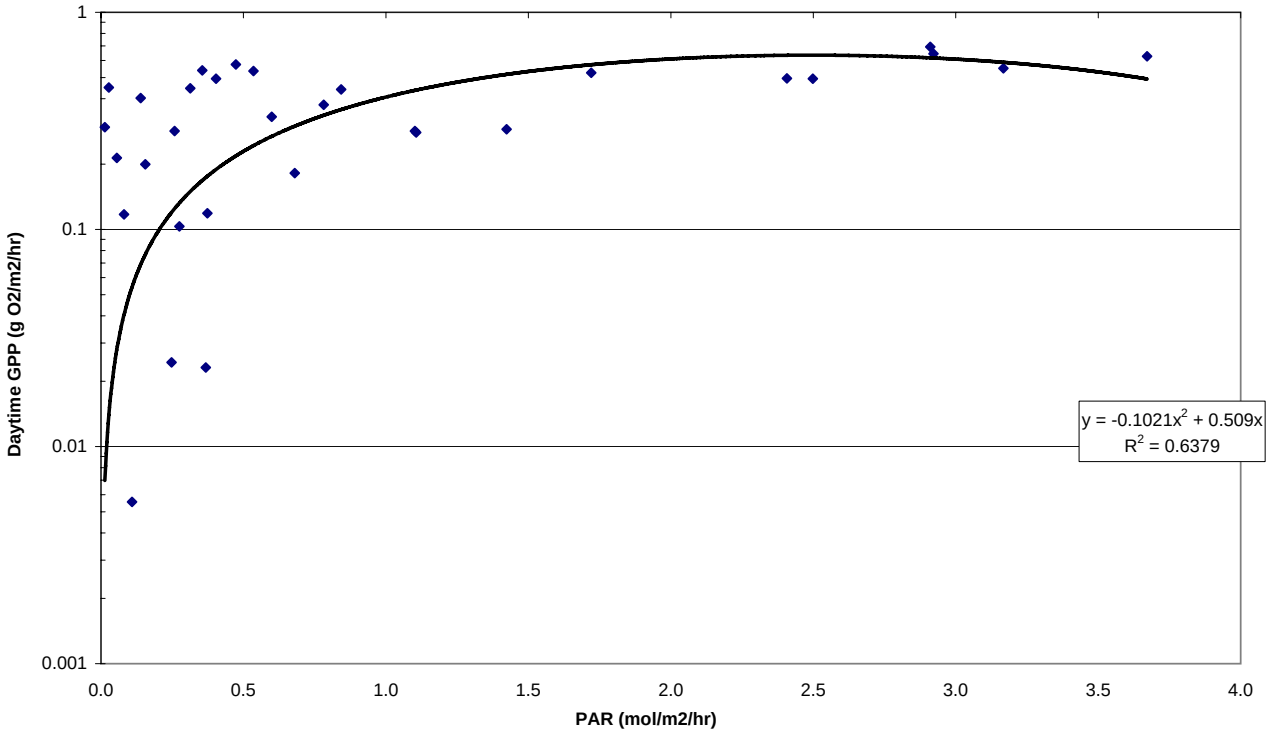
HOMOSASSA SPRING - STN 2 TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

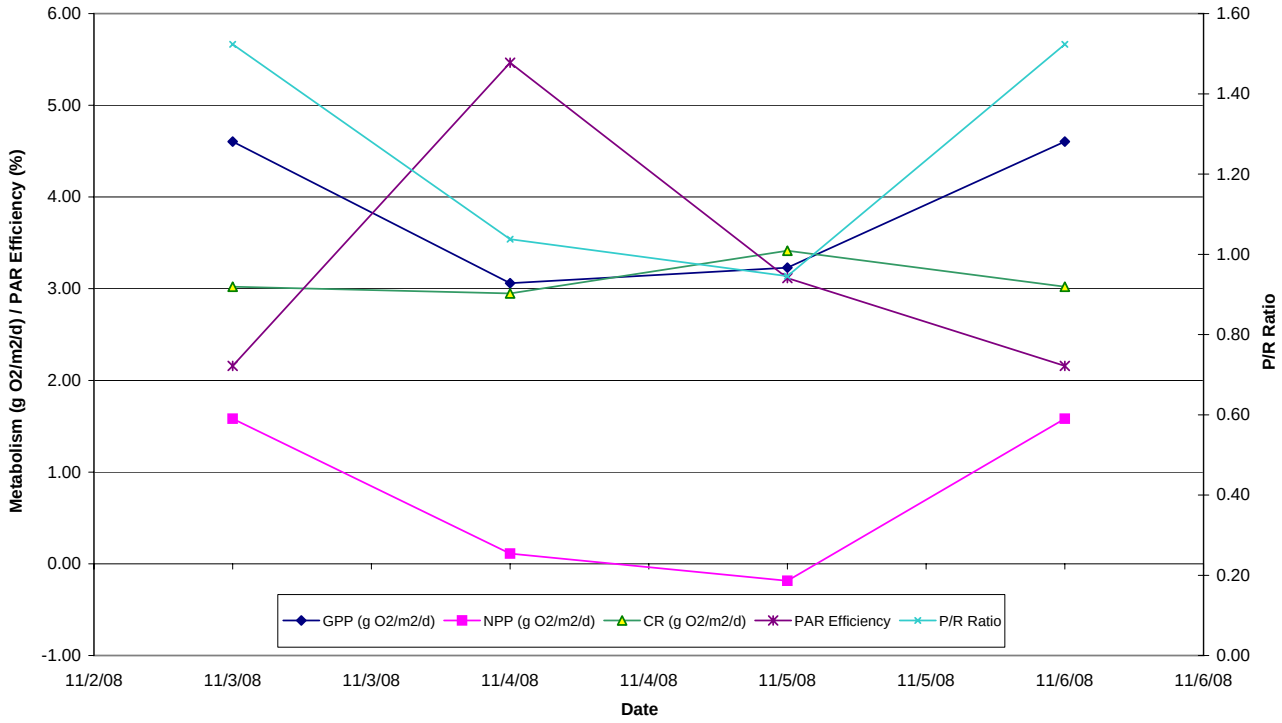




APPENDIX N

HOMOSASSA SPRING - STN 2 TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





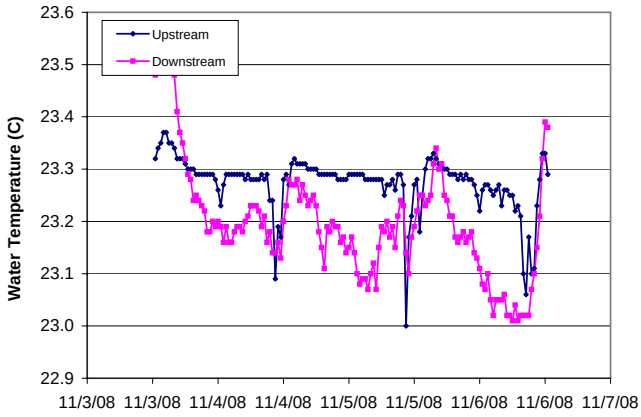
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	3.87	0.77	3.10	1.26	3.22
Max	4.60	1.58	3.41	1.52	5.46
Min	3.06	-0.19	2.95	0.95	2.16

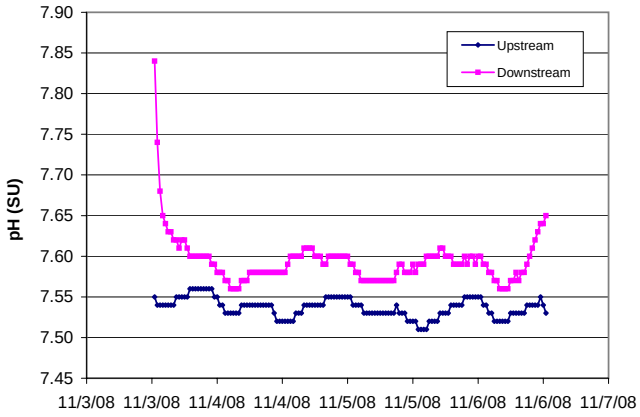
APPENDIX N

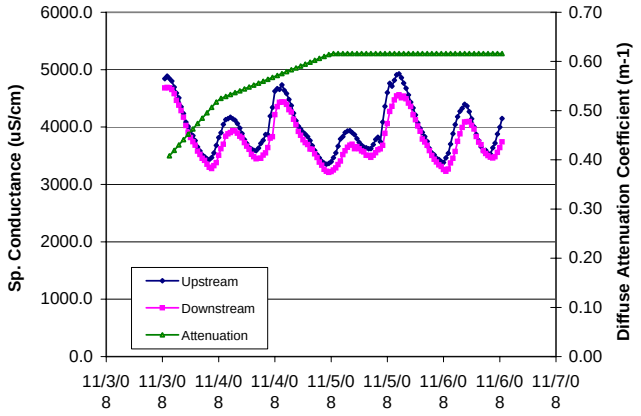
HOMOSASSA SPRING - STN 2 TO STN 3 METABOLISM ESTIMATES

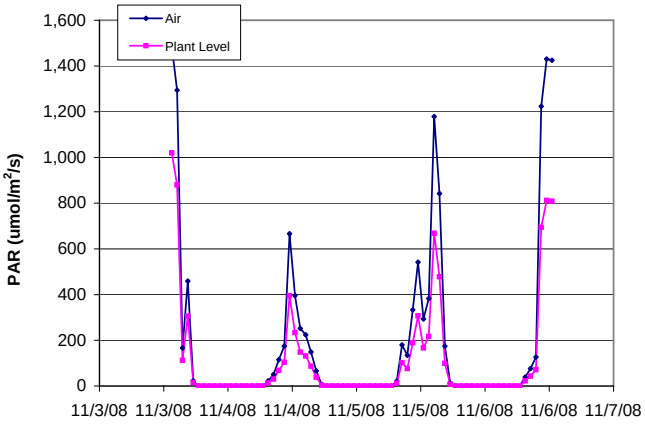
APPENDIX N

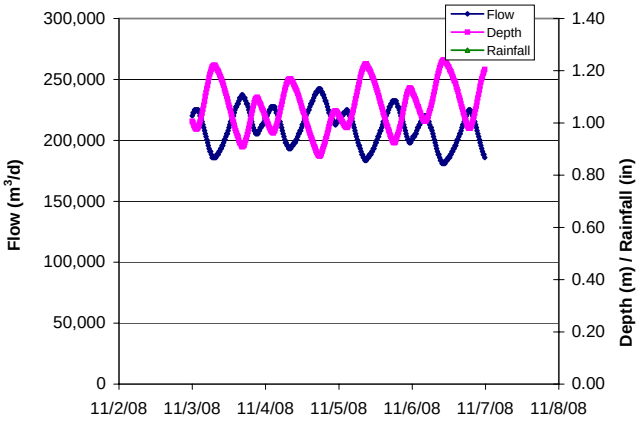
HOMOSASSA SPRING - STN 2 TO STN 3 METABOLISM SUMMARY



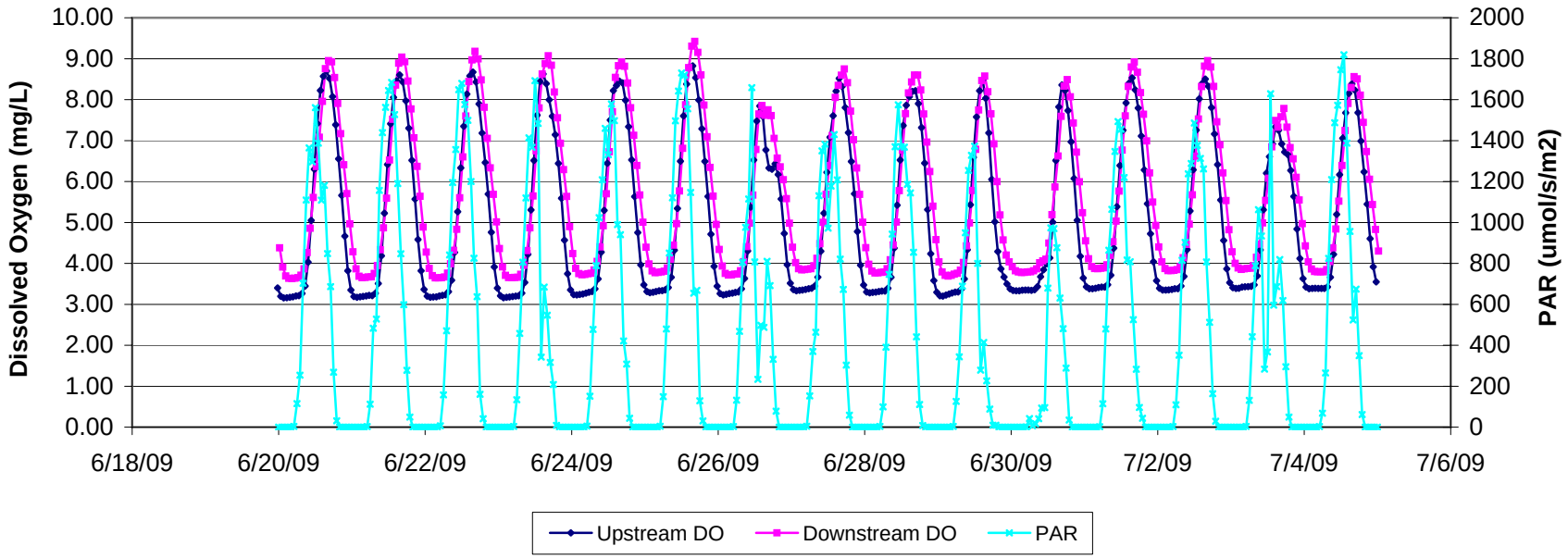






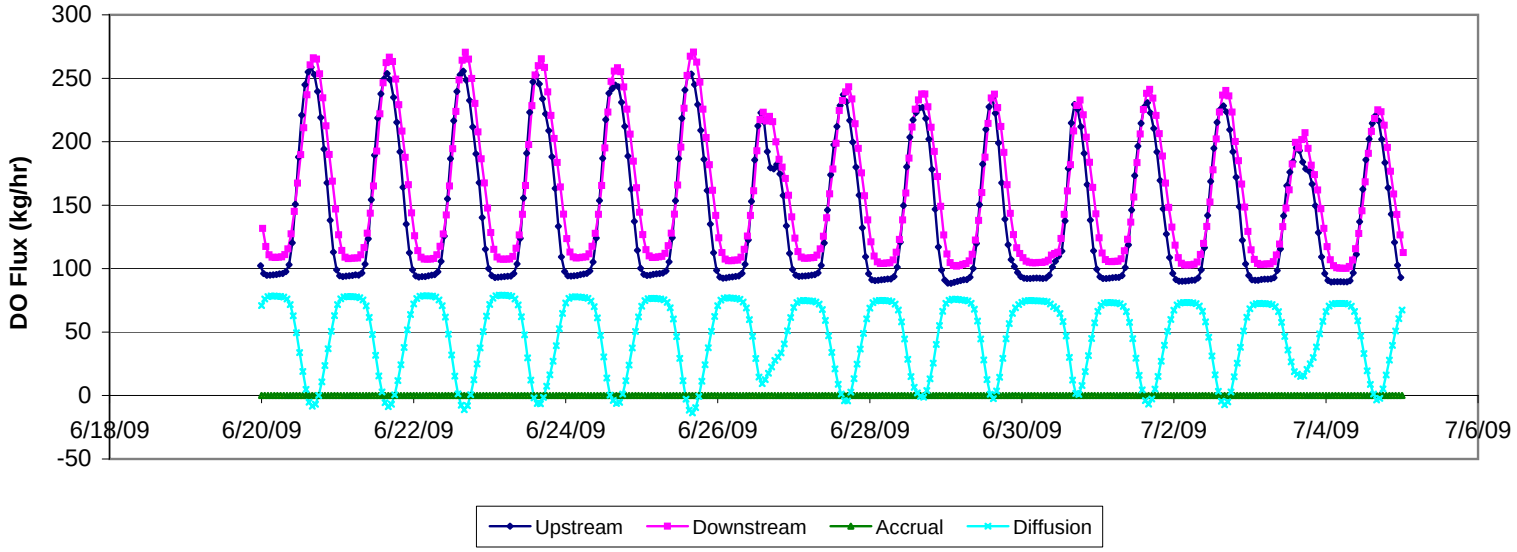


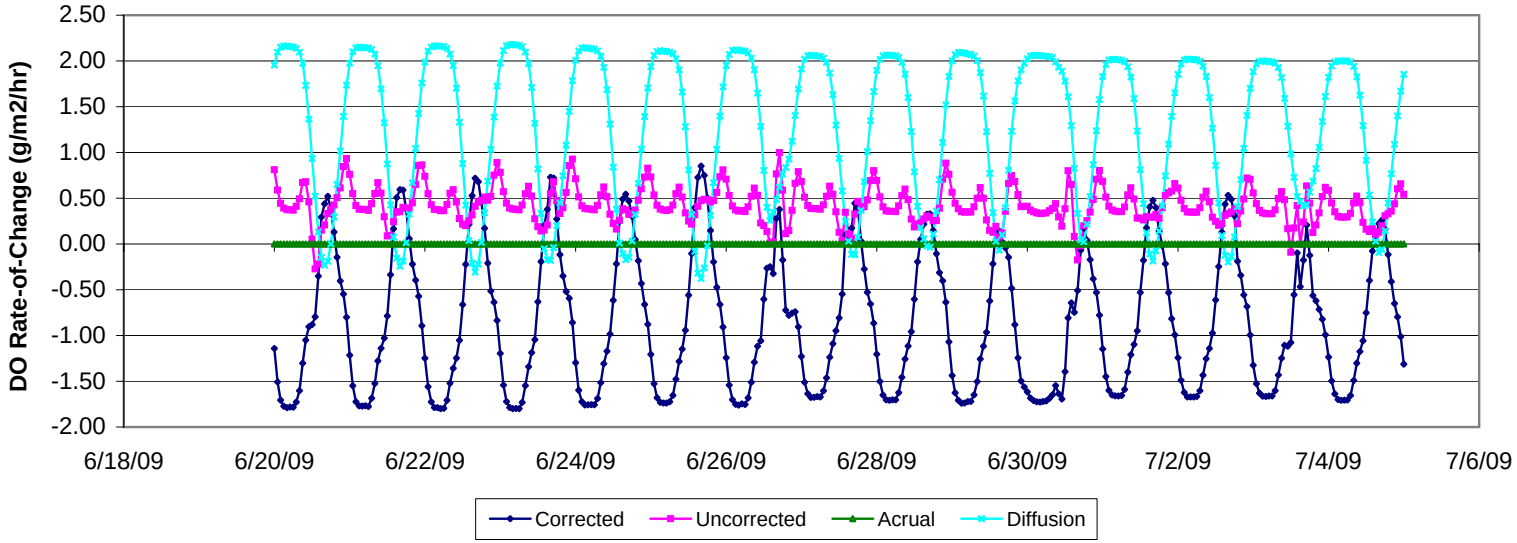
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	4.04	3.91	4.31	145
down		4.15	3.82	4.76	145
Wtr Temp - up	C	23.3	23.0	23.4	145
down		23.2	23.0	23.6	145
pH - up	SU	7.54	7.51	7.56	145
down		7.59	7.56	7.84	145
SpCond - up	uS/cm	3970	3352	4928	145
down		3783	3210	4689	145
Flow - up	m^3/d	210,992	181,047	242,211	384
Depth	m	1.06	0.87	1.24	384
Rainfall Total	in		0		
PAR - air	$umol/m^2/s$	157	0.0	1,498	833
plant		116	0.0	1020	72
DO rate chng	$g/m^2/hr$				
corr		0.021	-0.293	0.568	72
uncorr		0.164	-0.156	0.670	72



APPENDIX N

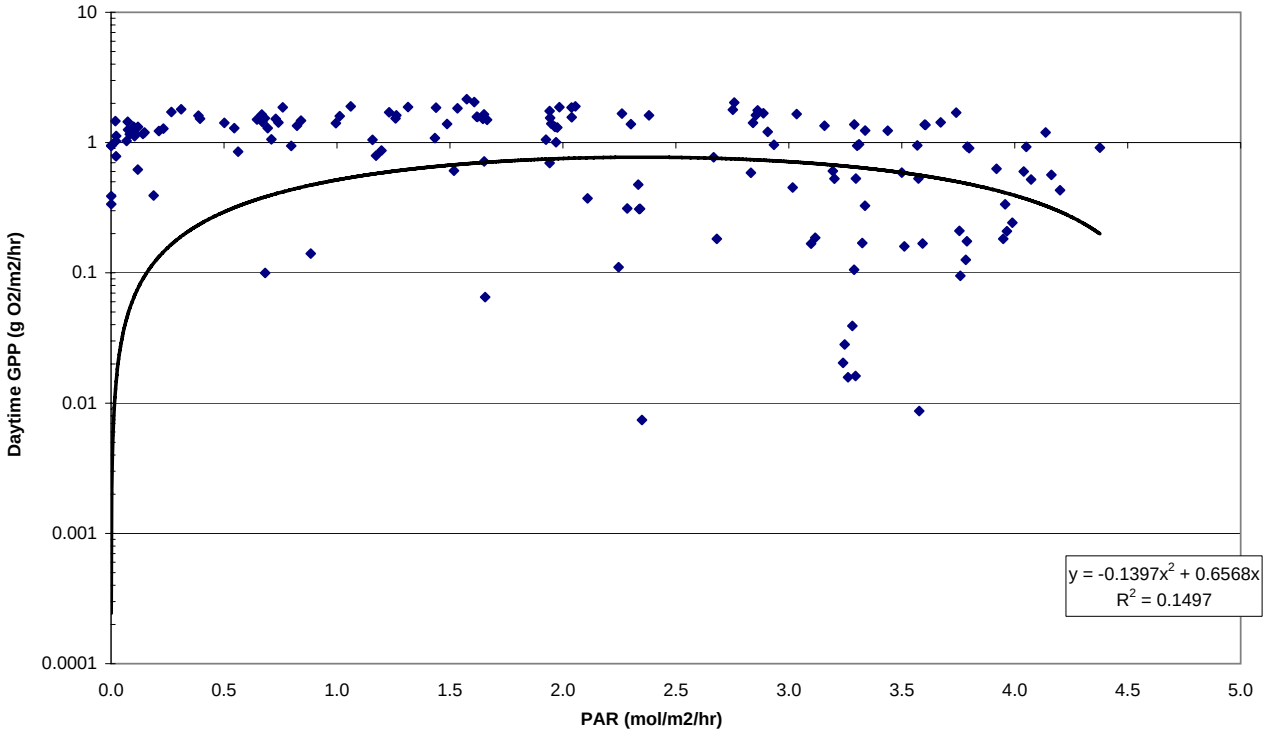
ICHETUCKNEE RIVER - DL to US 27 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

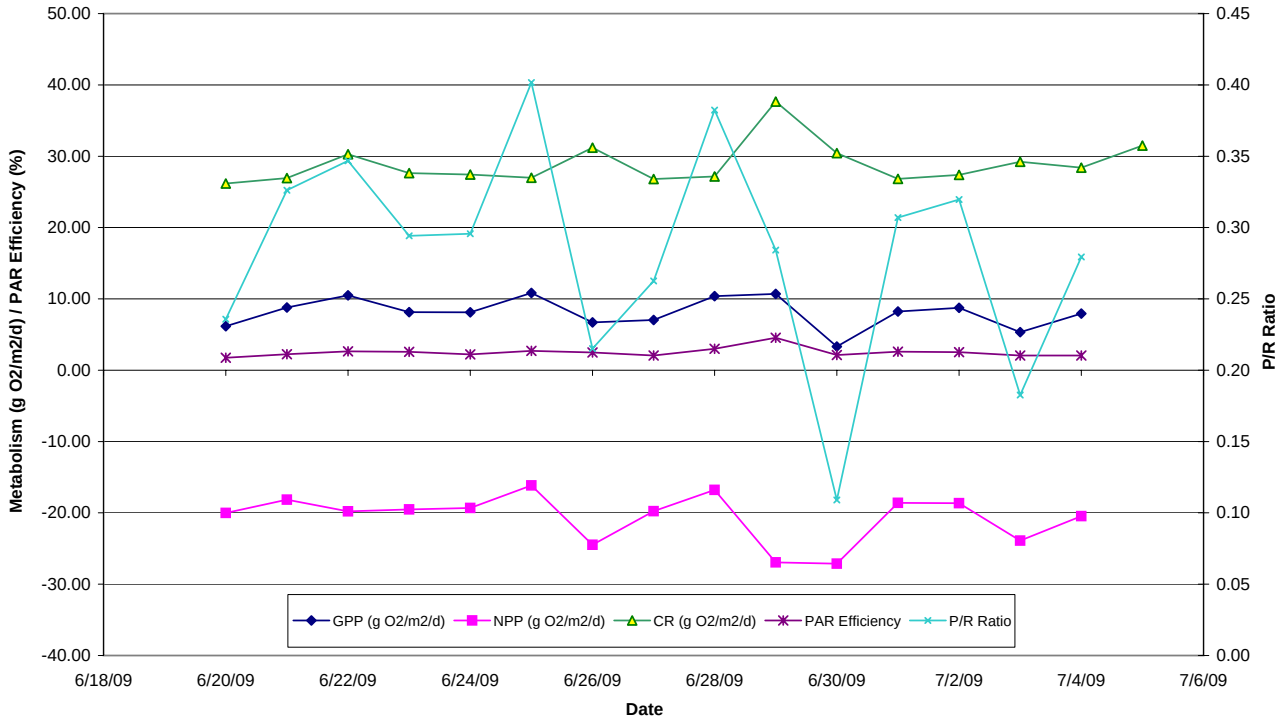




APPENDIX N

ICHETUCKNEE RIVER - DL to US 27 DISSOLVED OXYGEN FLUX / RATE OF CHANGE



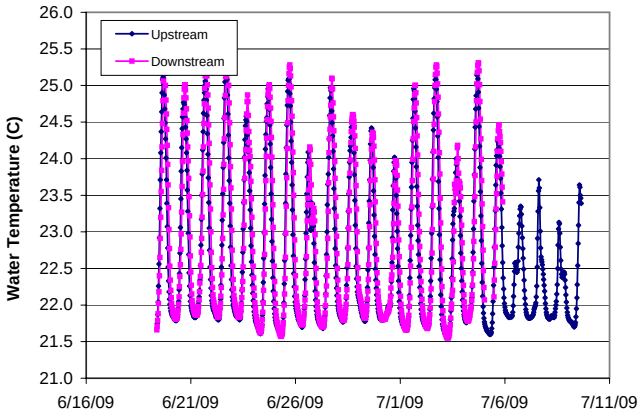


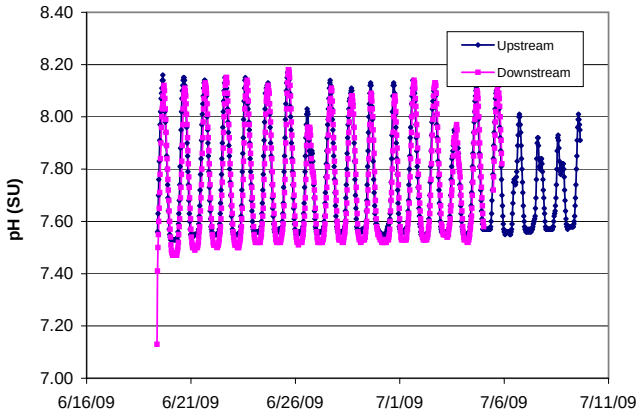
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	8.07	-20.64	28.88	0.28	2.51
Max	10.84	-16.15	37.66	0.40	4.55
Min	3.32	-27.13	26.17	0.11	1.74

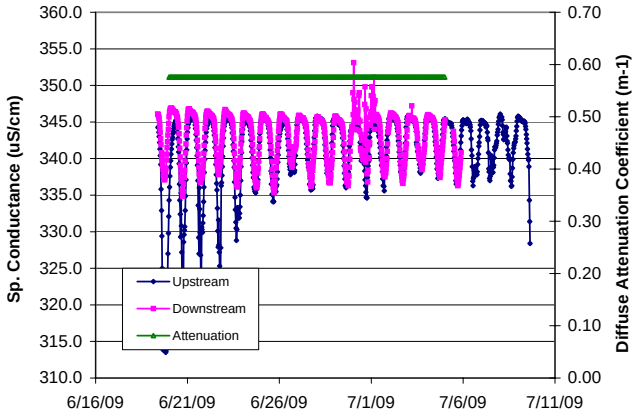
APPENDIX N
ICHETUCKNEE RIVER - DL to US 27 METABOLISM ESTIMATES

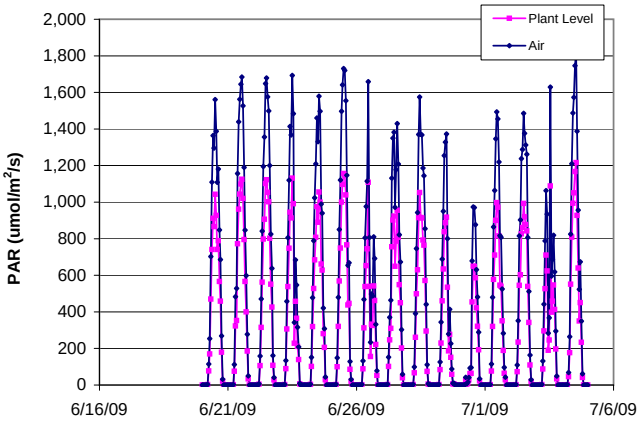
APPENDIX N

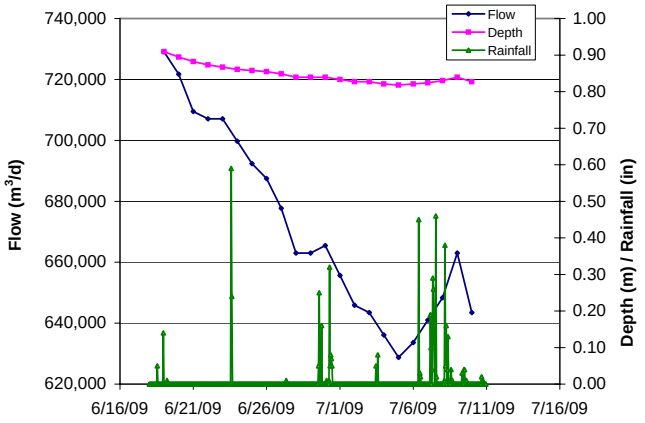
ICHETUCKNEE RIVER - DL to US 27 METABOLISM SUMMARY



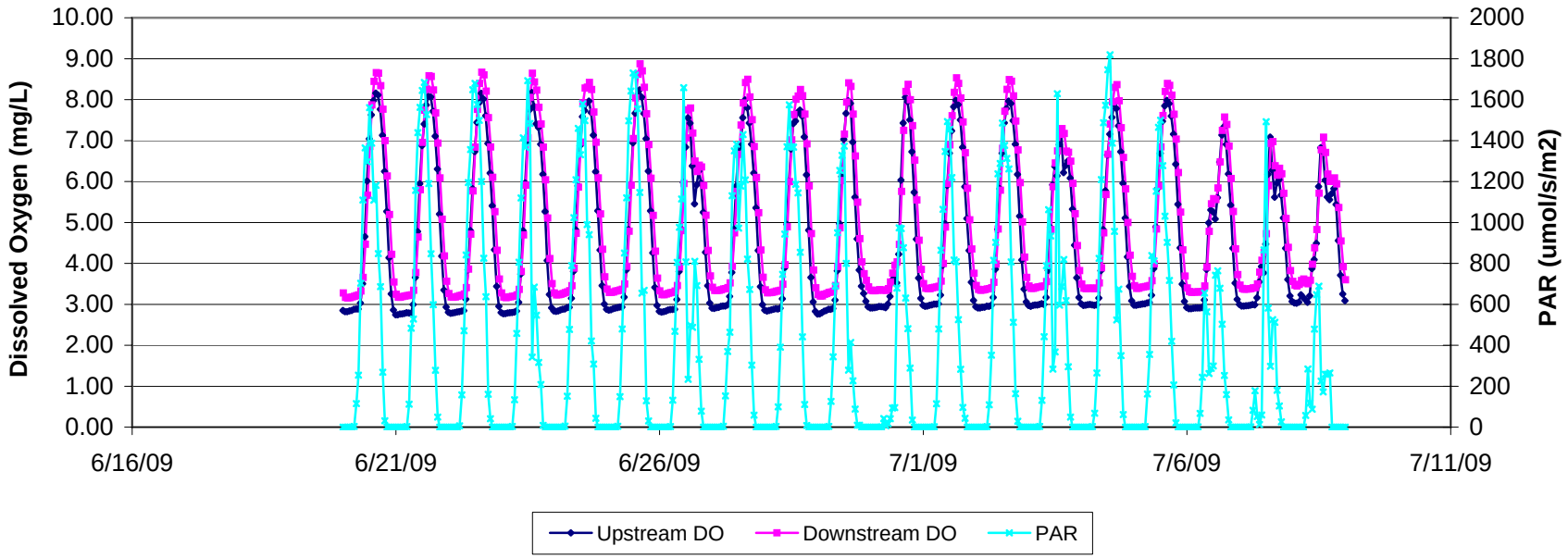






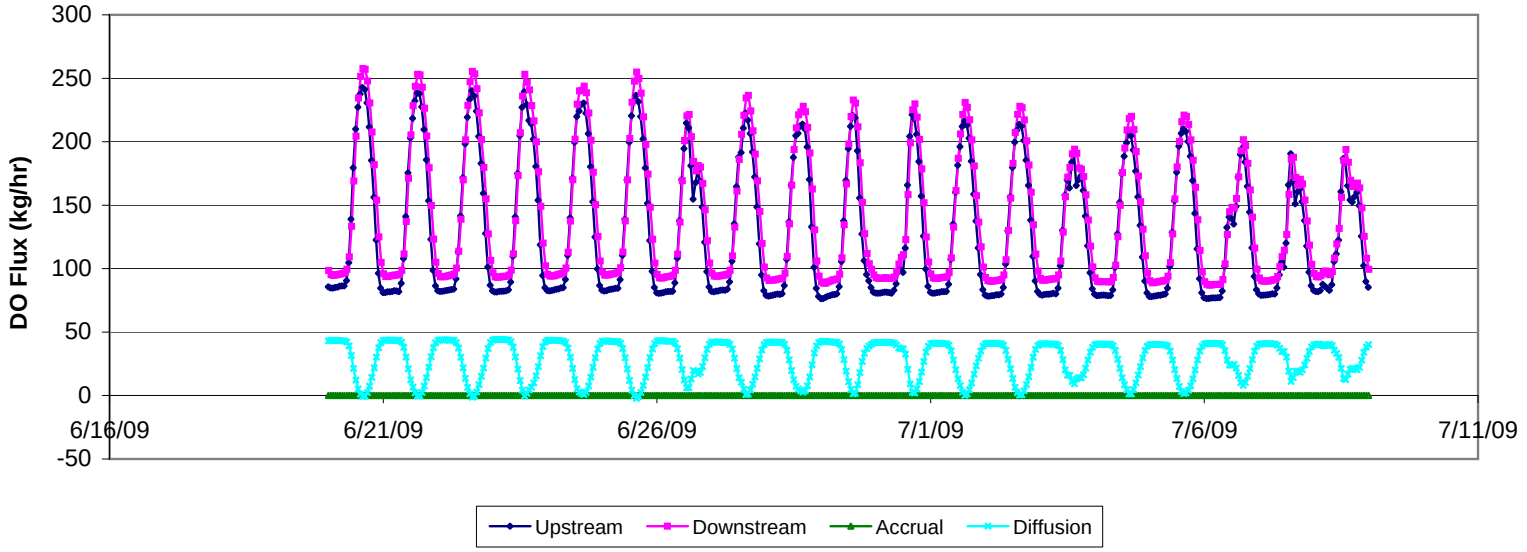


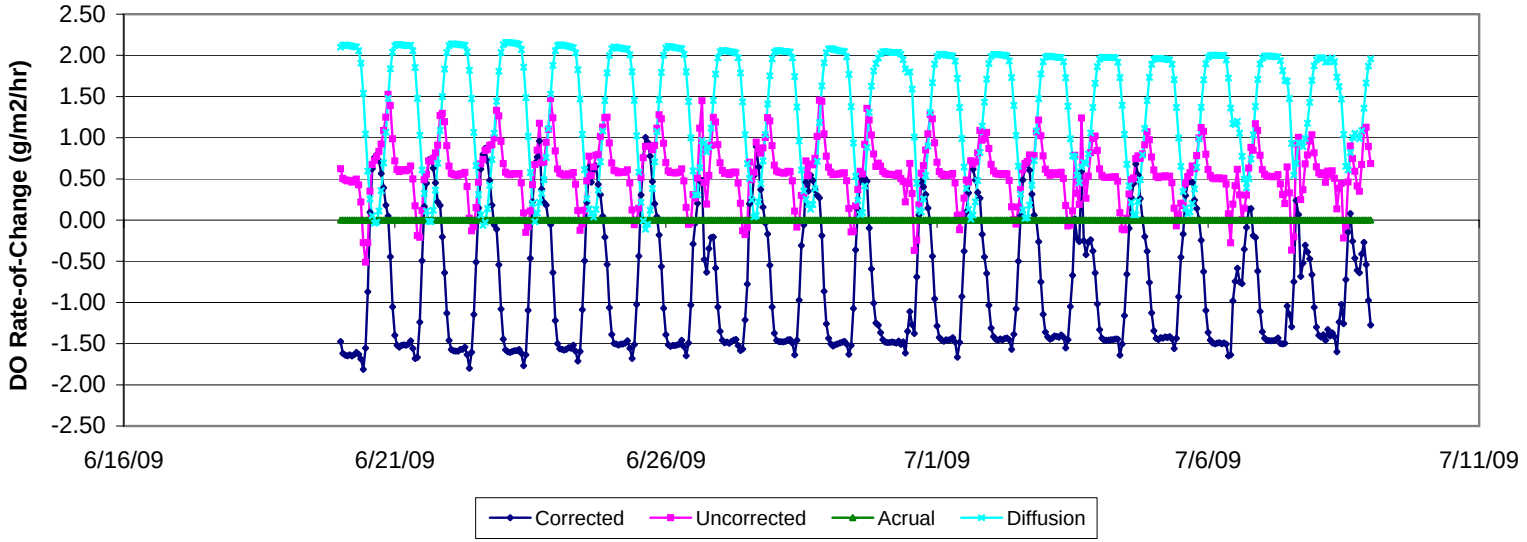
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	5.12	3.15	8.88	973
down		5.78	3.62	9.43	773
Wtr Temp - up	C	22.7	21.6	25.3	973
down		22.9	21.6	25.4	773
pH - up	SU	7.74	7.53	8.17	973
down		7.73	7.13	8.18	773
SpCond - up	uS/cm	341	314	346	973
down		343	335	353	773
Flow - up	m^3/d	671,029	628,770	729,080	22
Depth	m	0.85	0.82	0.91	22
Rainfall Total	in		5.27		
PAR - air	umol/m^2/s	409	0.0	1,819	552
plant		303	0.0	1216	361
DO rate chng	g/m^2/hr				
corr		-0.864	-1.799	0.851	361
uncorr		0.416	-0.273	0.998	361



APPENDIX N

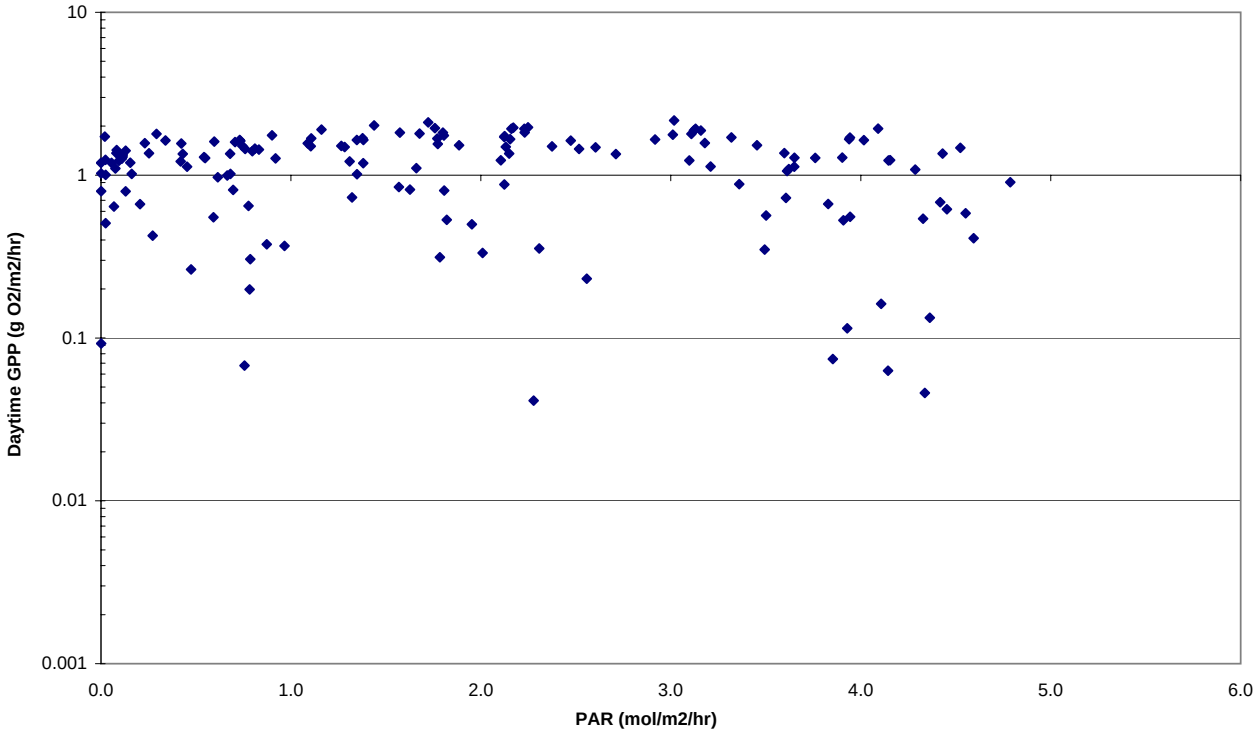
ICHETUCKNEE RIVER - MID to DL UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

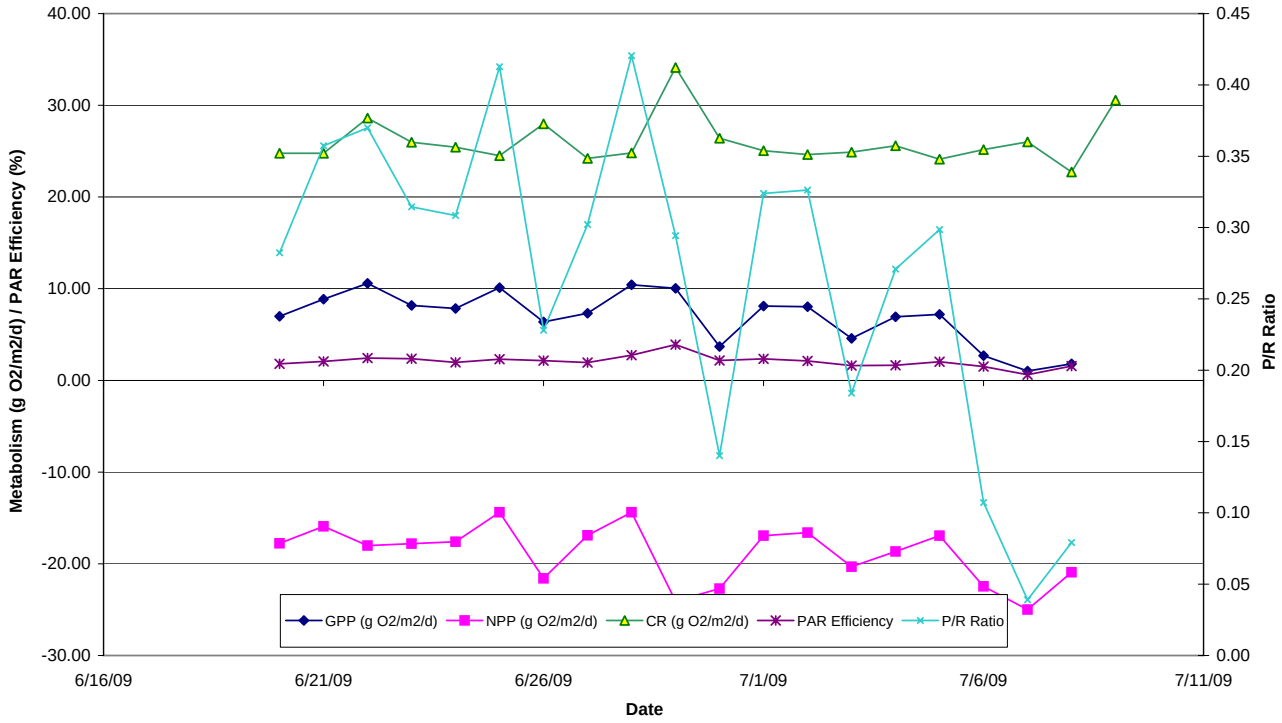




APPENDIX N

ICHETUCKNEE RIVER - MID to DL DISSOLVED OXYGEN FLUX / RATE OF CHANGE



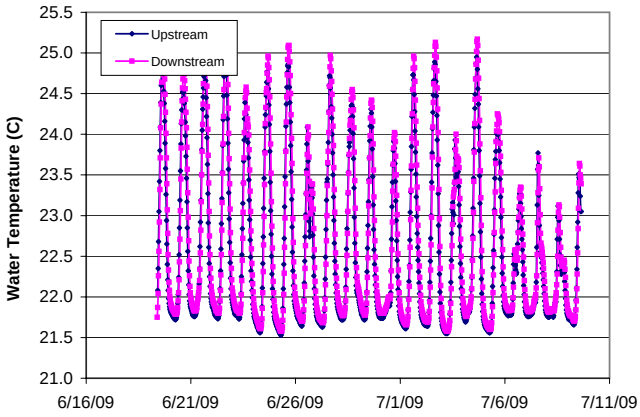


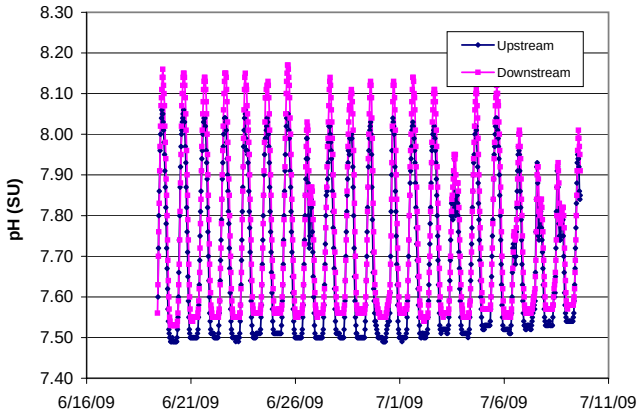
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	6.88	-18.89	26.02	0.27	2.07
Max	10.58	-14.38	34.12	0.42	3.90
Min	1.02	-24.99	22.72	0.04	0.63

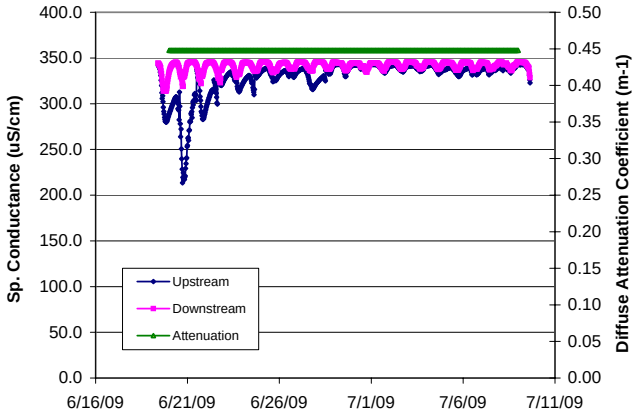
APPENDIX N
ICHETUCKNEE RIVER - MID to DL METABOLISM ESTIMATES

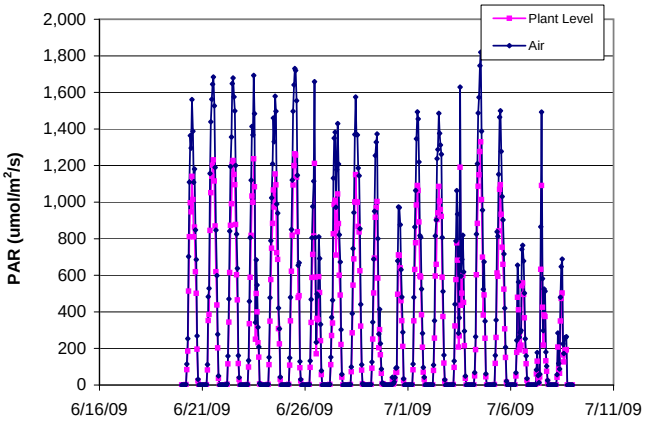
APPENDIX N

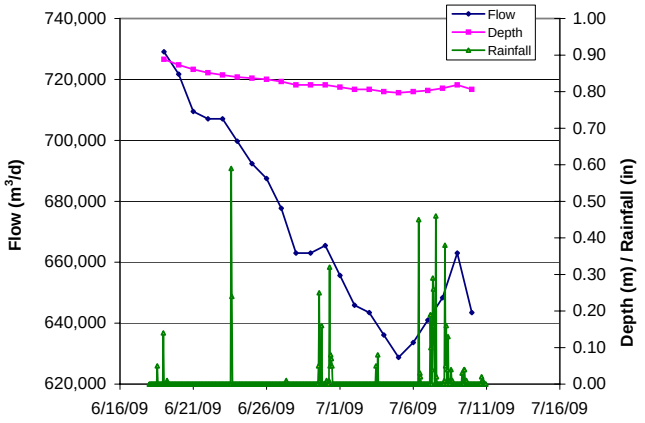
ICHETUCKNEE RIVER - MID to DL METABOLISM SUMMARY



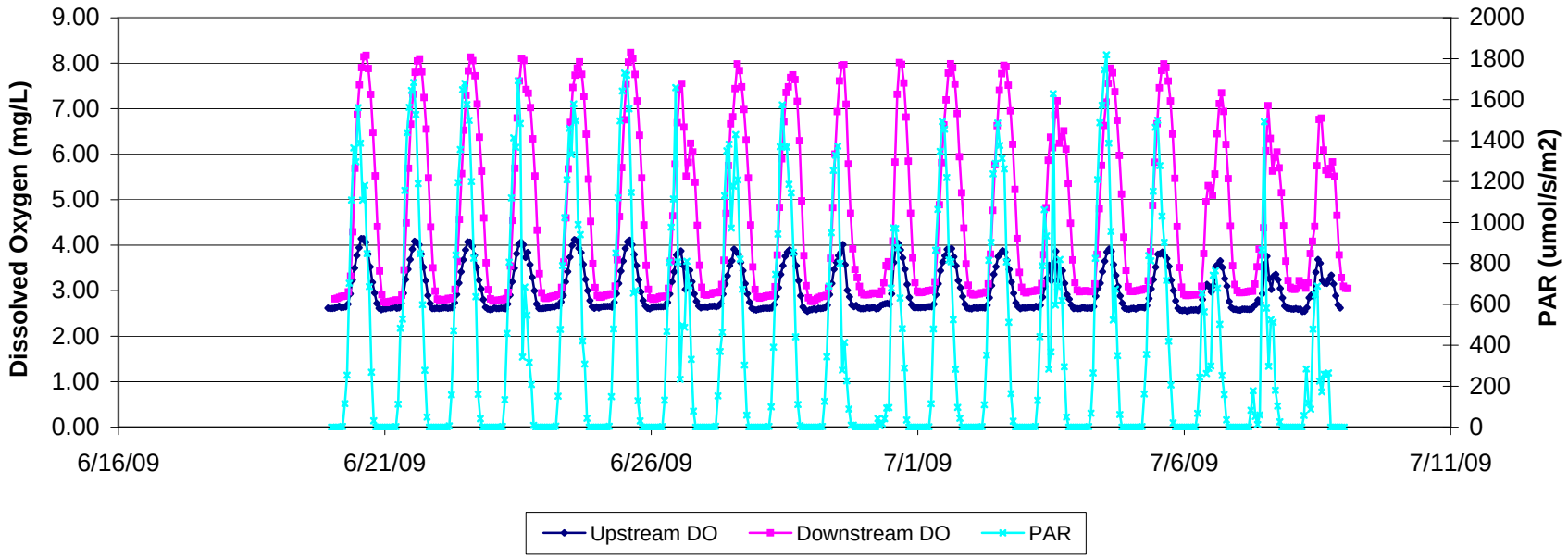






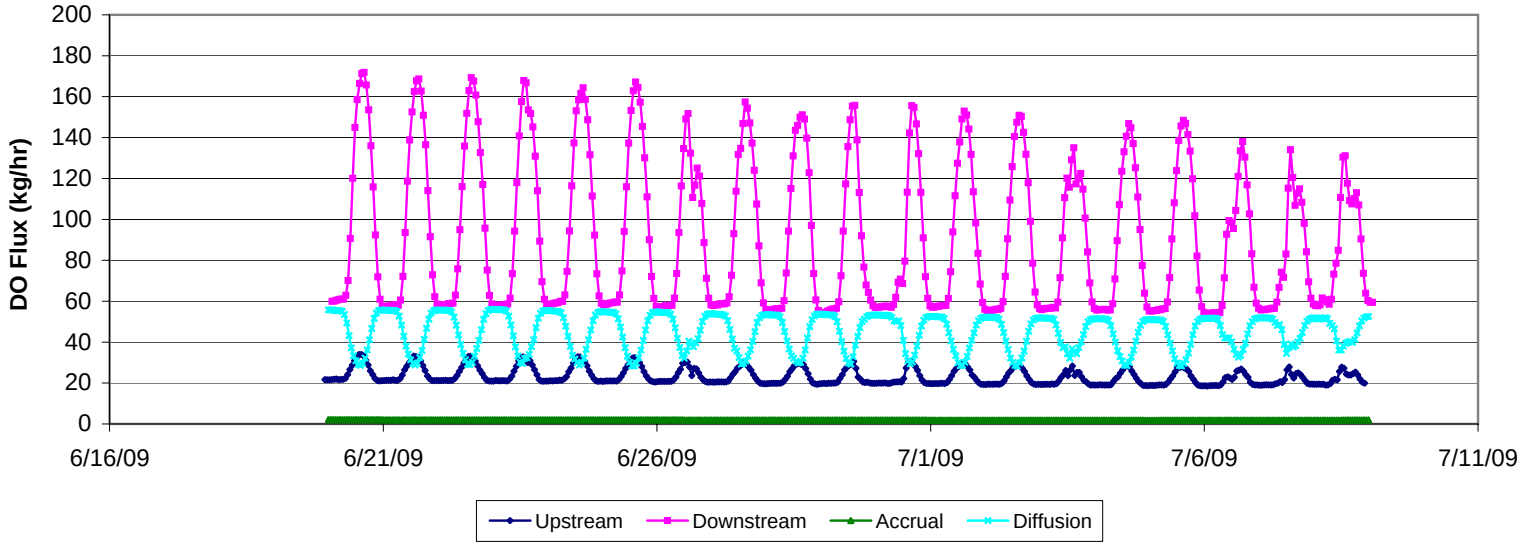


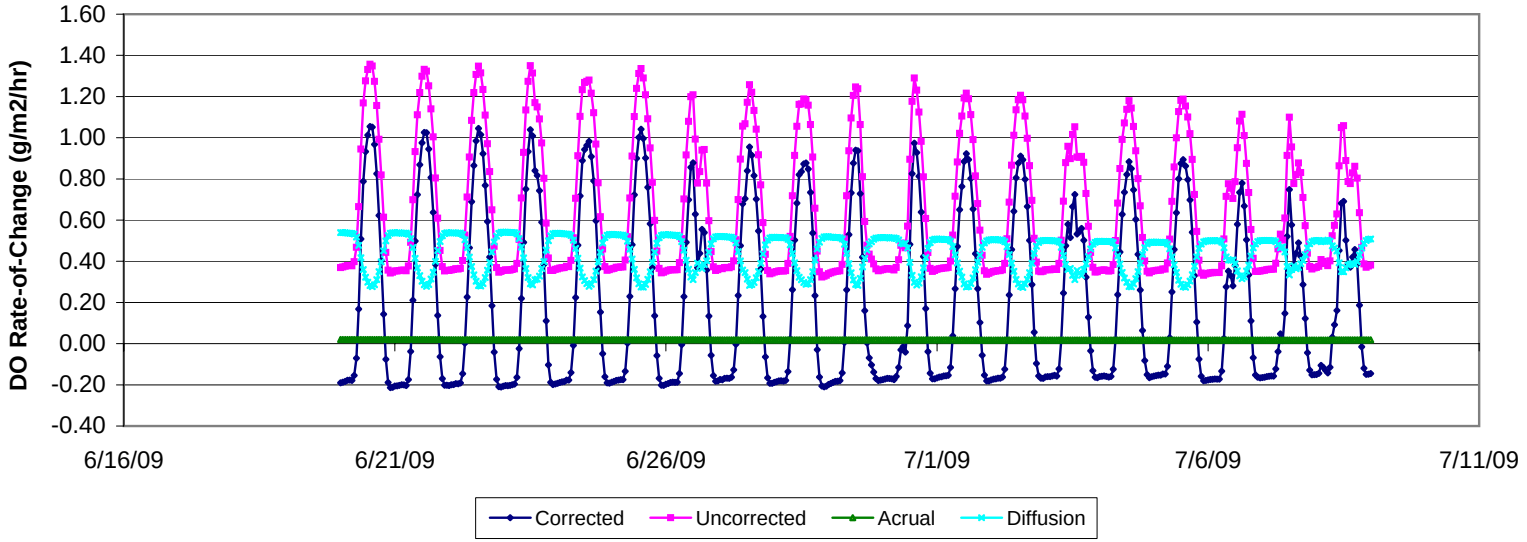
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	4.70	2.73	8.31	972
down		5.12	3.15	8.88	973
Wtr Temp - up	C	22.5	21.5	25.0	972
down		22.7	21.6	25.3	973
pH - up	SU	7.68	7.49	8.06	972
down		7.74	7.53	8.17	973
SpCond - up	uS/cm	329	213	344	972
down		341	314	346	973
Flow - up	m^3/d	671,029	628,770	729,080	22
Depth	m	0.83	0.80	0.89	22
Rainfall Total	in		5.27		
PAR - air	$umol/m^2/s$	424	0.0	1,888	768
plant		302	0.0	1330	457
DO rate chng	$g/m^2/hr$				
corr		-0.789	-1.813	1.004	457
uncorr		0.581	-0.510	1.526	457



APPENDIX N

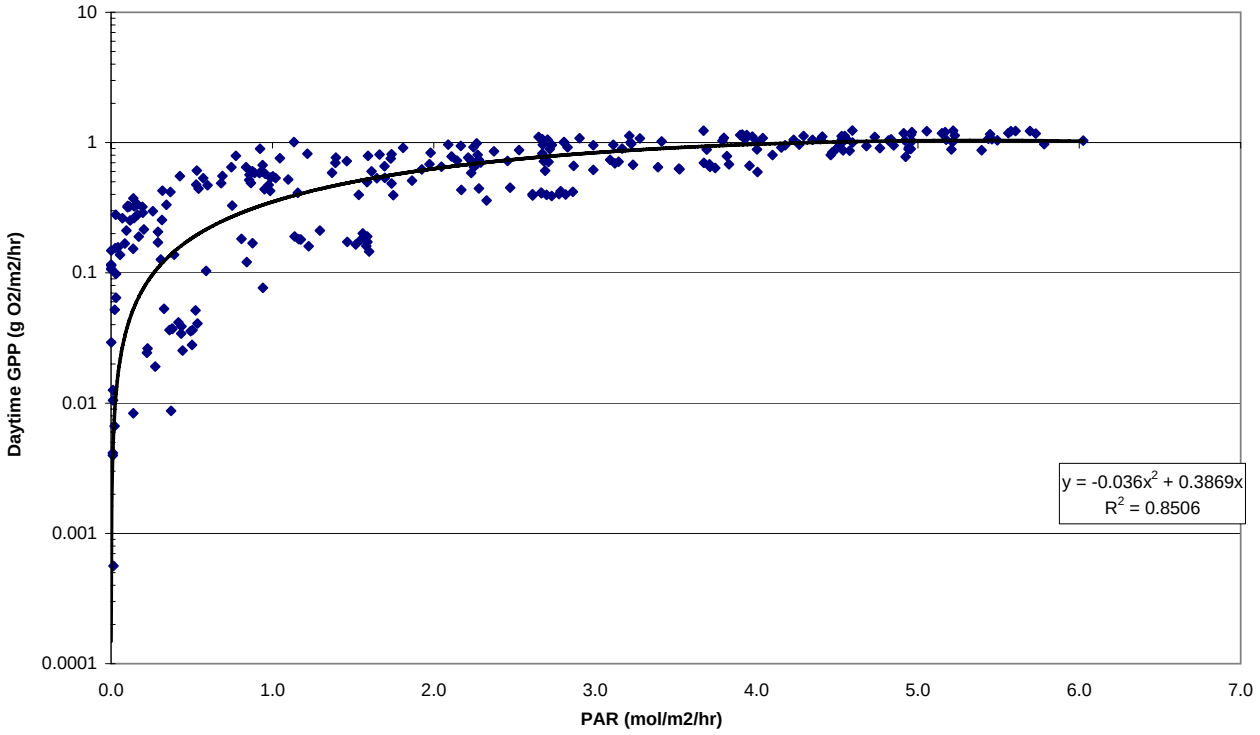
ICHETUCKNEE RIVER - UP to MID UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

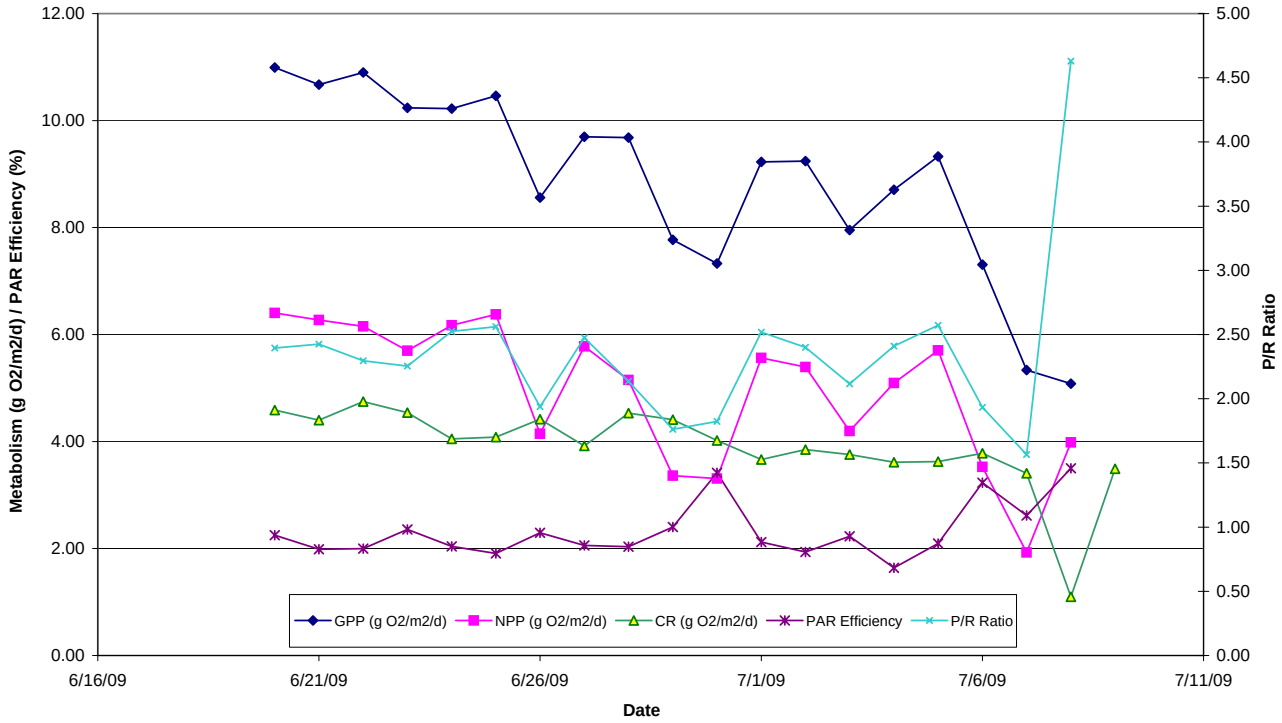




APPENDIX N

ICHETUCKNEE RIVER - UP to MID DISSOLVED OXYGEN FLUX / RATE OF CHANGE



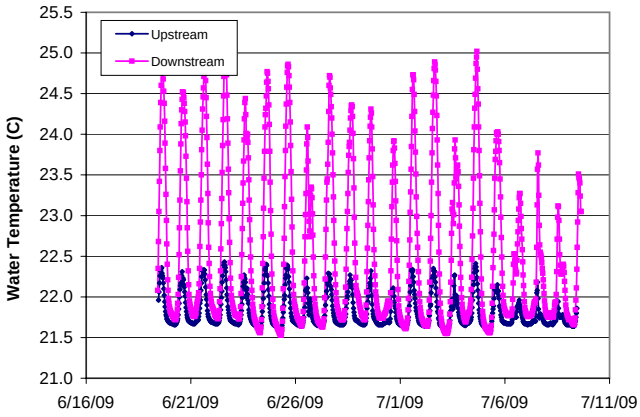


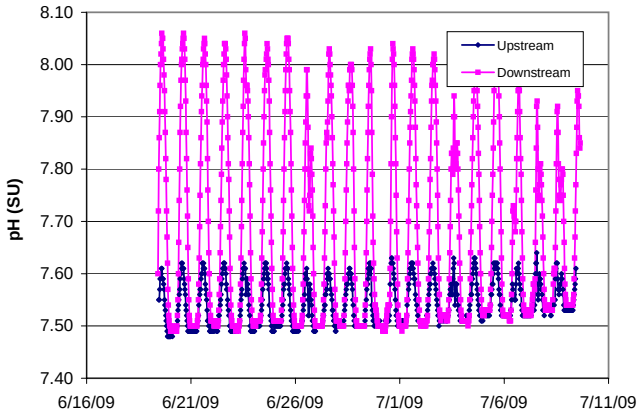
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	8.88	4.96	3.90	2.35	2.32
Max	10.99	6.40	4.75	4.63	3.50
Min	5.08	1.93	1.10	1.57	1.64

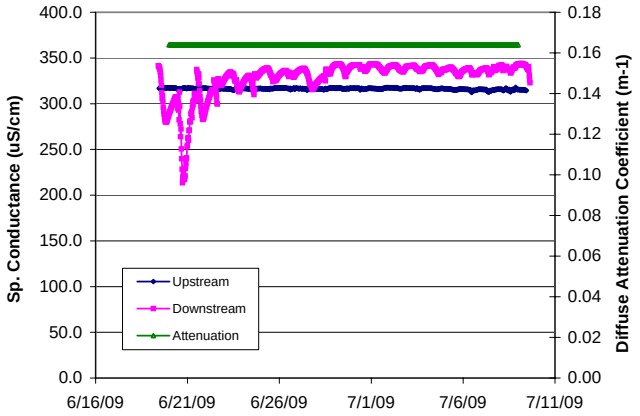
APPENDIX N
ICHETUCKNEE RIVER - UP to MID METABOLISM ESTIMATES

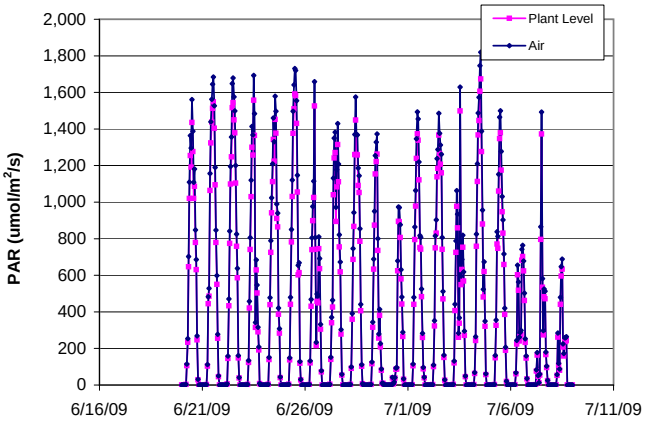
APPENDIX N

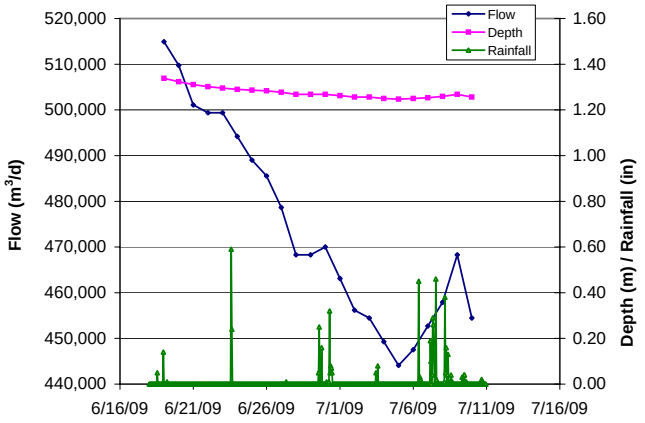
ICHETUCKNEE RIVER - UP to MID METABOLISM SUMMARY



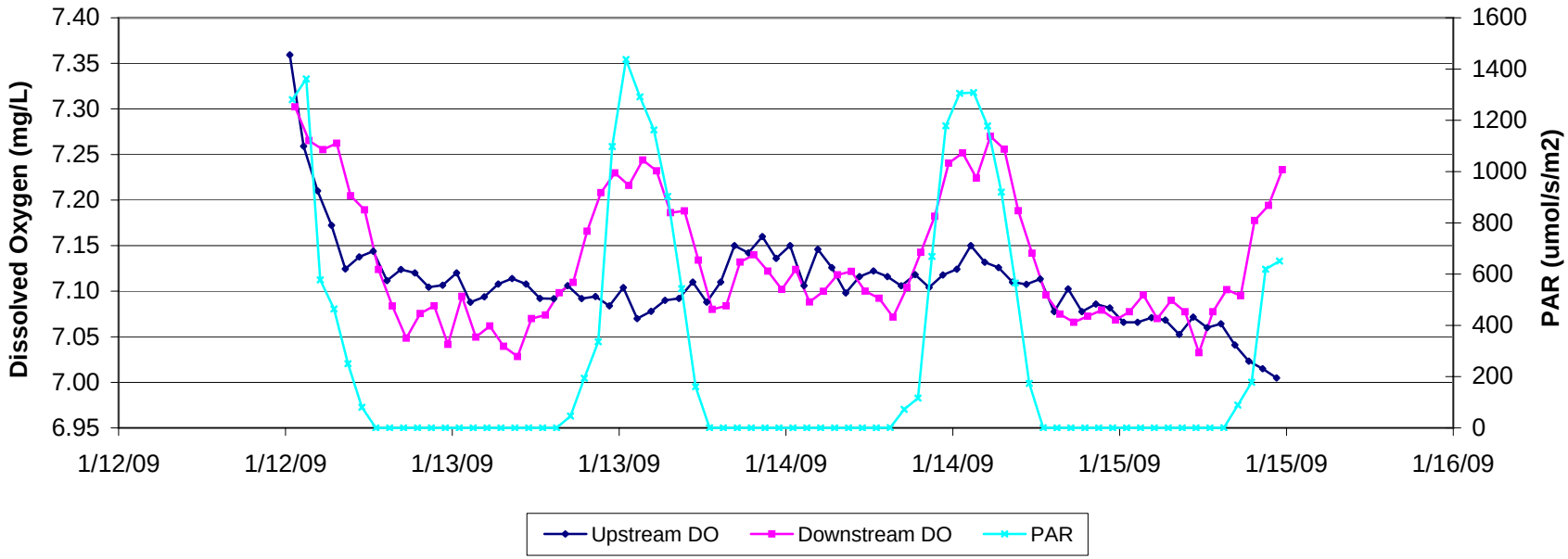






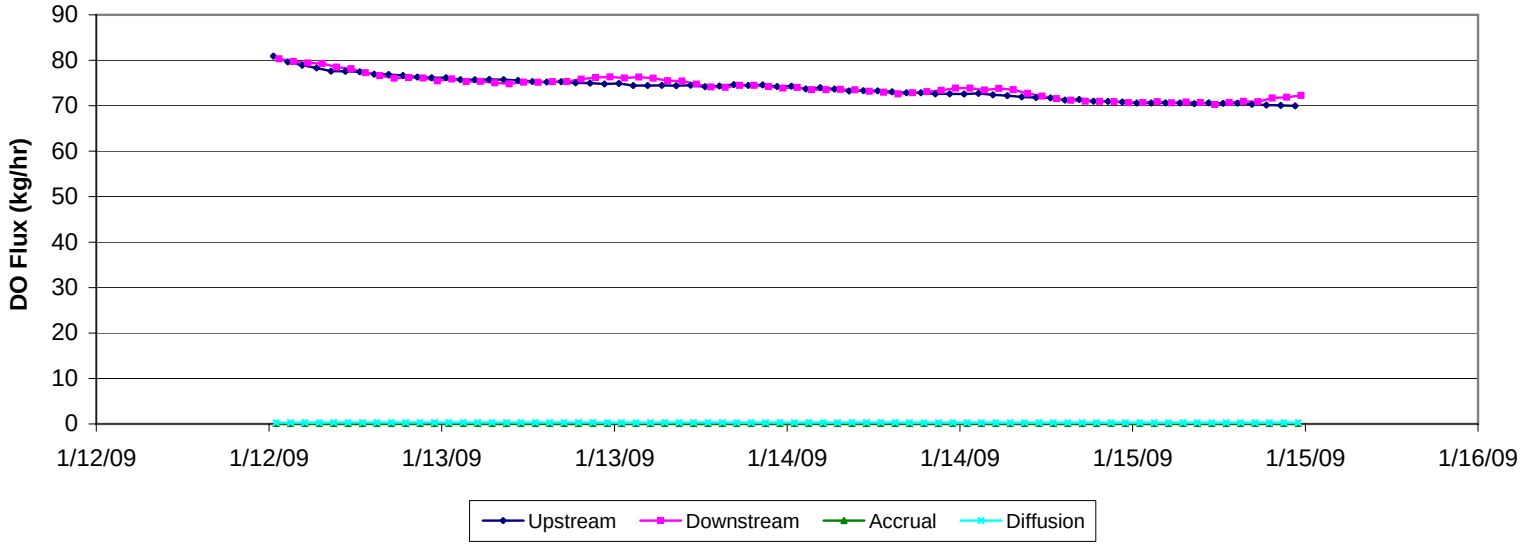


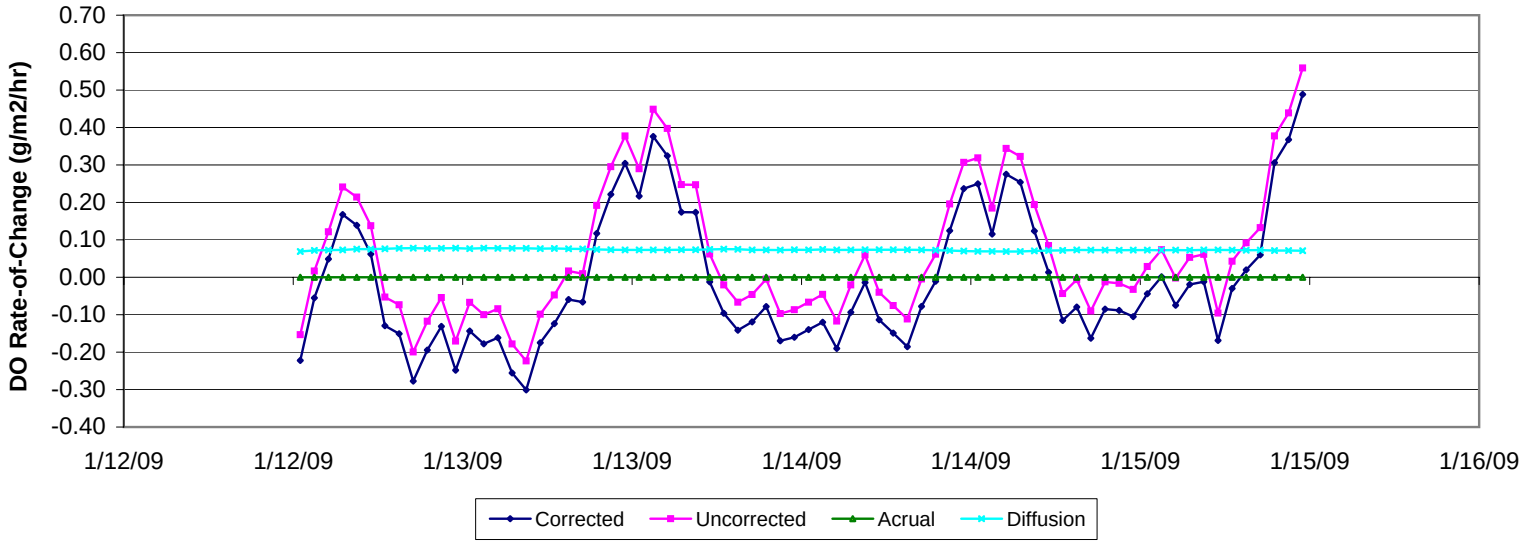
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.04	2.53	4.21	960
down		4.70	2.73	8.31	972
Wtr Temp - up	C	21.8	21.6	22.4	960
down		22.5	21.5	25.0	972
pH - up	SU	7.54	7.48	7.64	960
down		7.68	7.49	8.06	972
SpCond - up	uS/cm	316	312	318	960
down		329	213	344	972
Flow - up	m^3/d	473,930	444,083	514,929	22
Depth	m	1.28	1.25	1.34	22
Rainfall Total	in		5.27		
PAR - air	$umol/m^2/s$	424	0.0	1,888	768
plant		380	0.0	1673	457
DO rate chng	$g/m^2/hr$				
corr		0.207	-0.214	1.054	457
uncorr		0.661	0.324	1.357	457



APPENDIX N

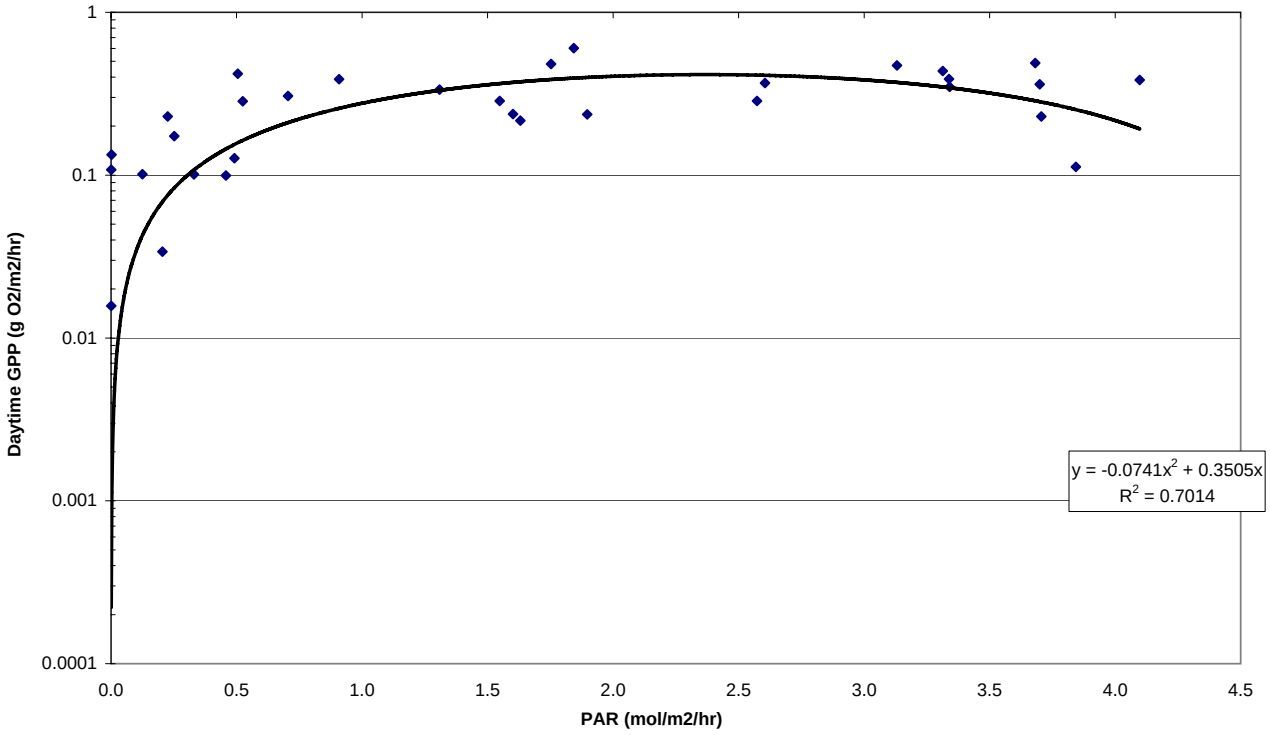
JACKSON BLUE SPRING - MAIN BOIL TO STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

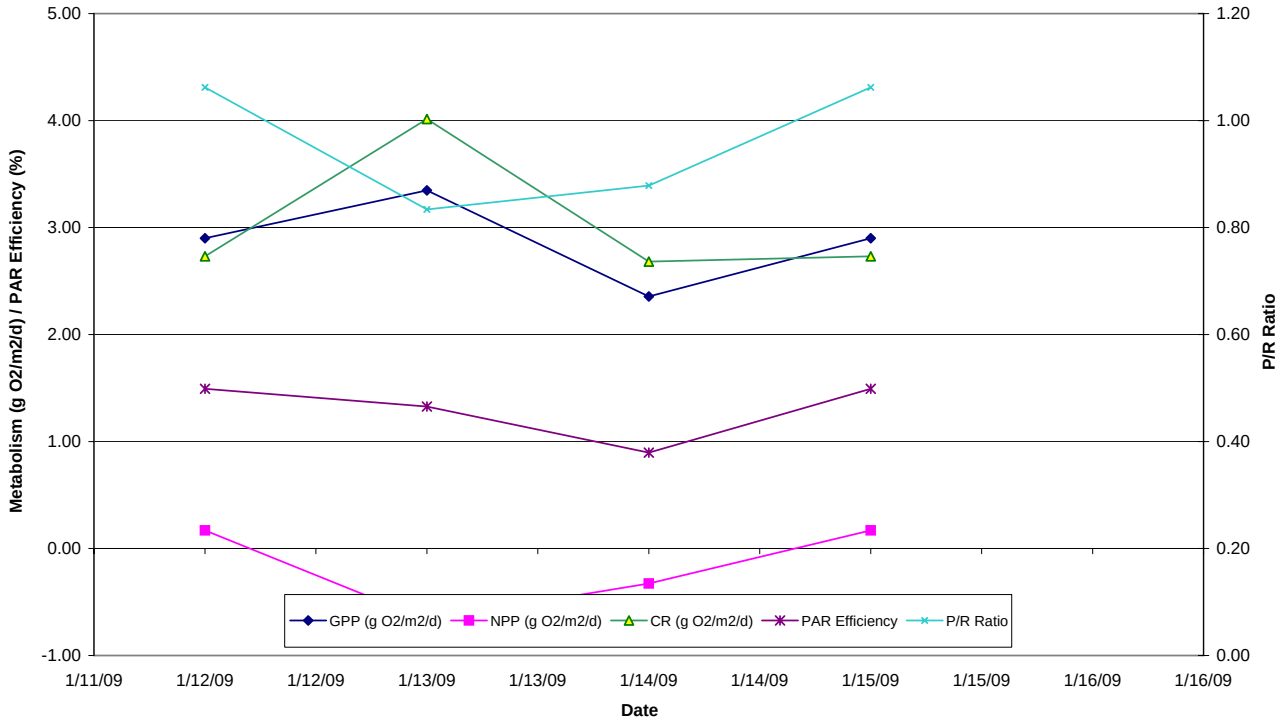




APPENDIX N

JACKSON BLUE SPRING - MAIN BOIL TO STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE



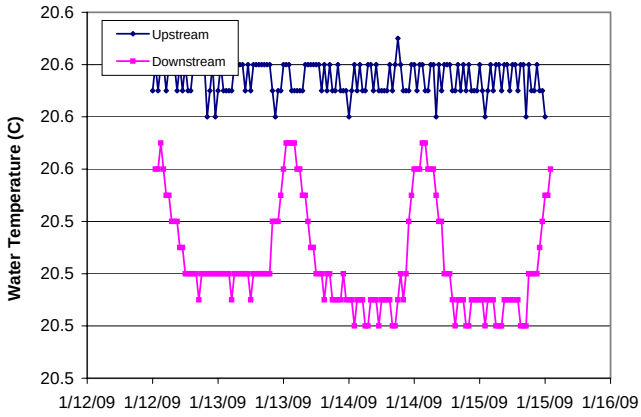


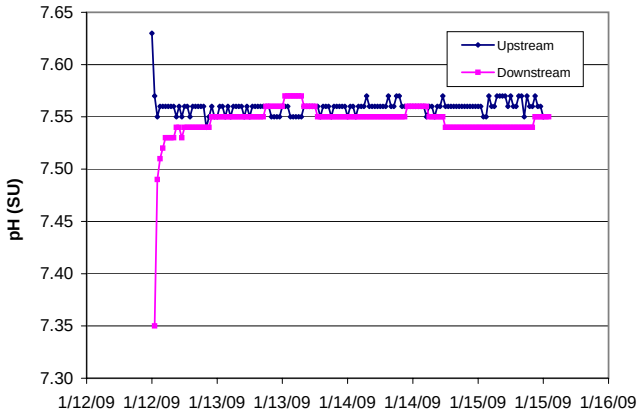
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	2.88	-0.16	3.04	0.96	1.30
Max	3.35	0.17	4.02	1.06	1.49
Min	2.36	-0.67	2.68	0.83	0.90

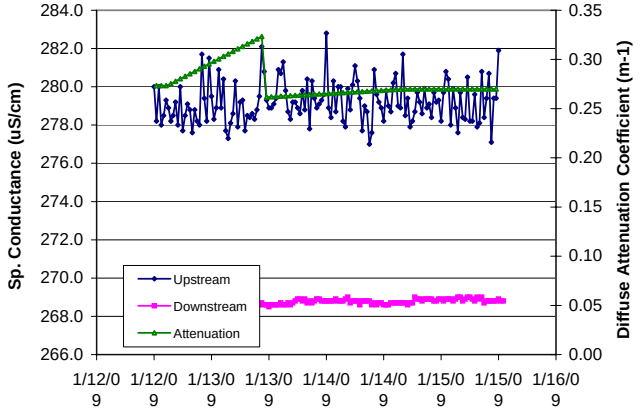
APPENDIX N
JACKSON BLUE SPRING - MAIN BOIL TO STN 2 METABOLISM ESTIMATES

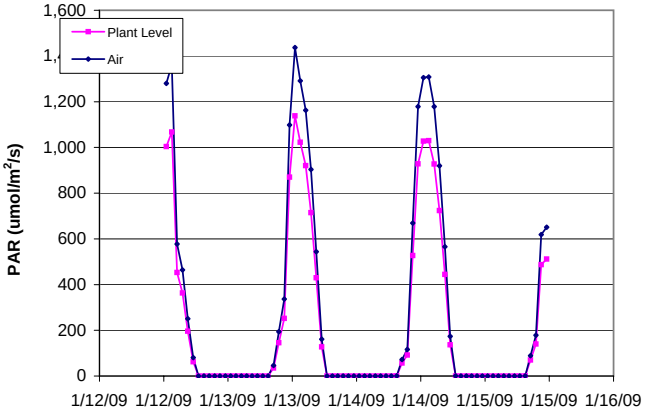
APPENDIX N

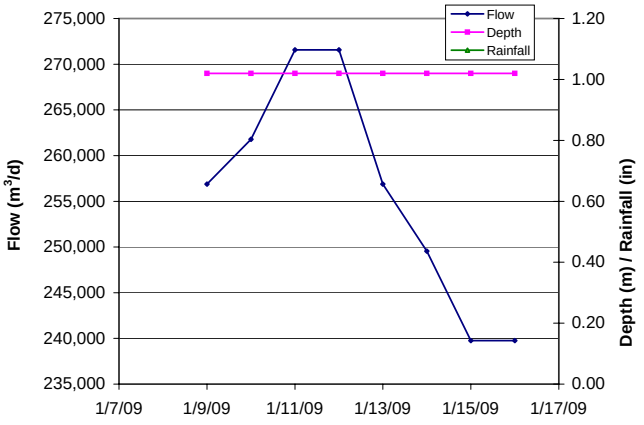
JACKSON BLUE SPRING - MAIN BOIL TO STN 2 METABOLISM SUMMARY



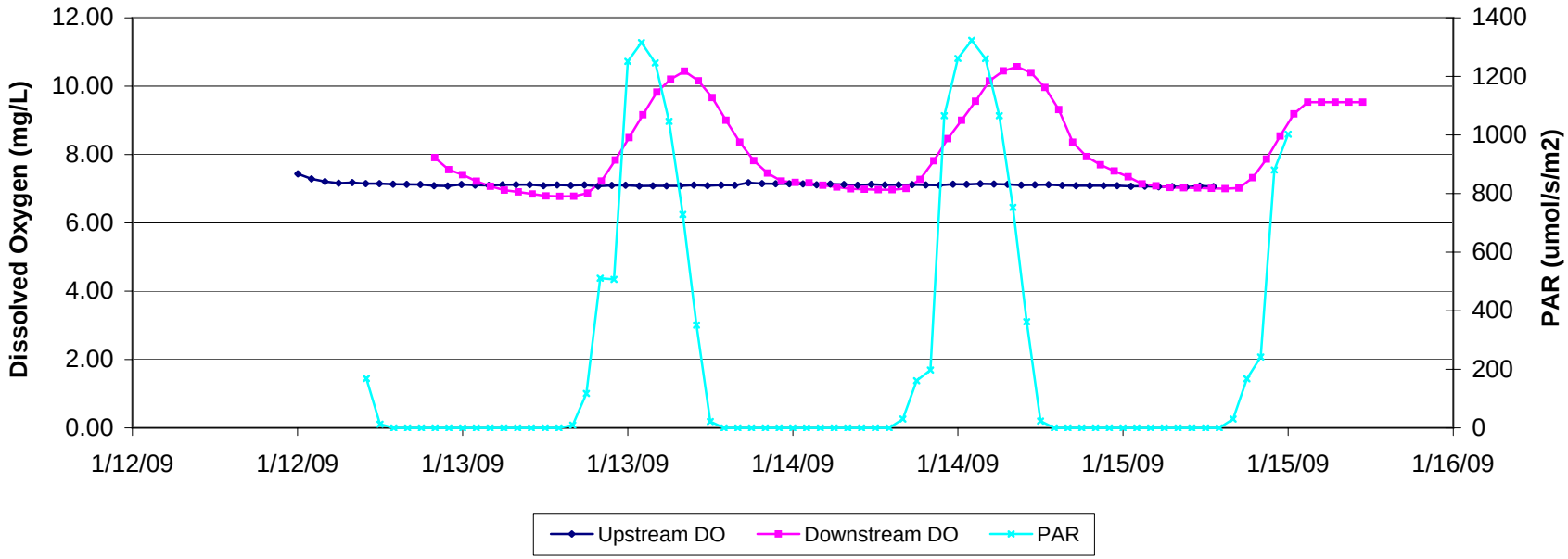






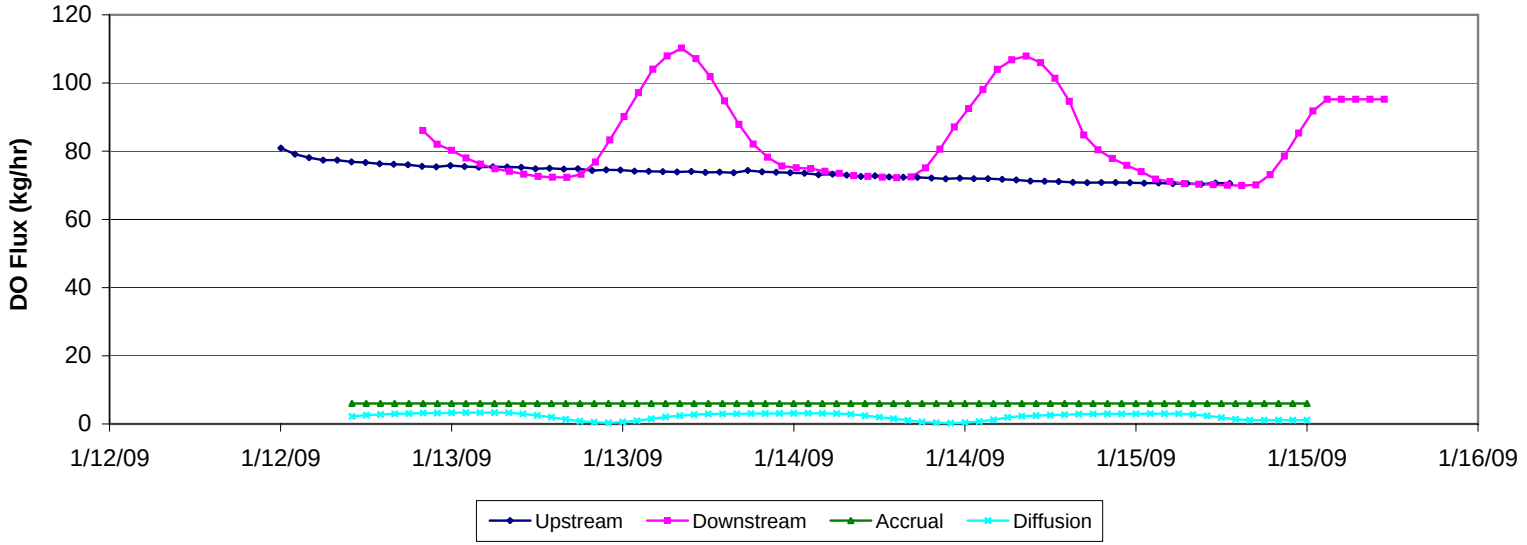


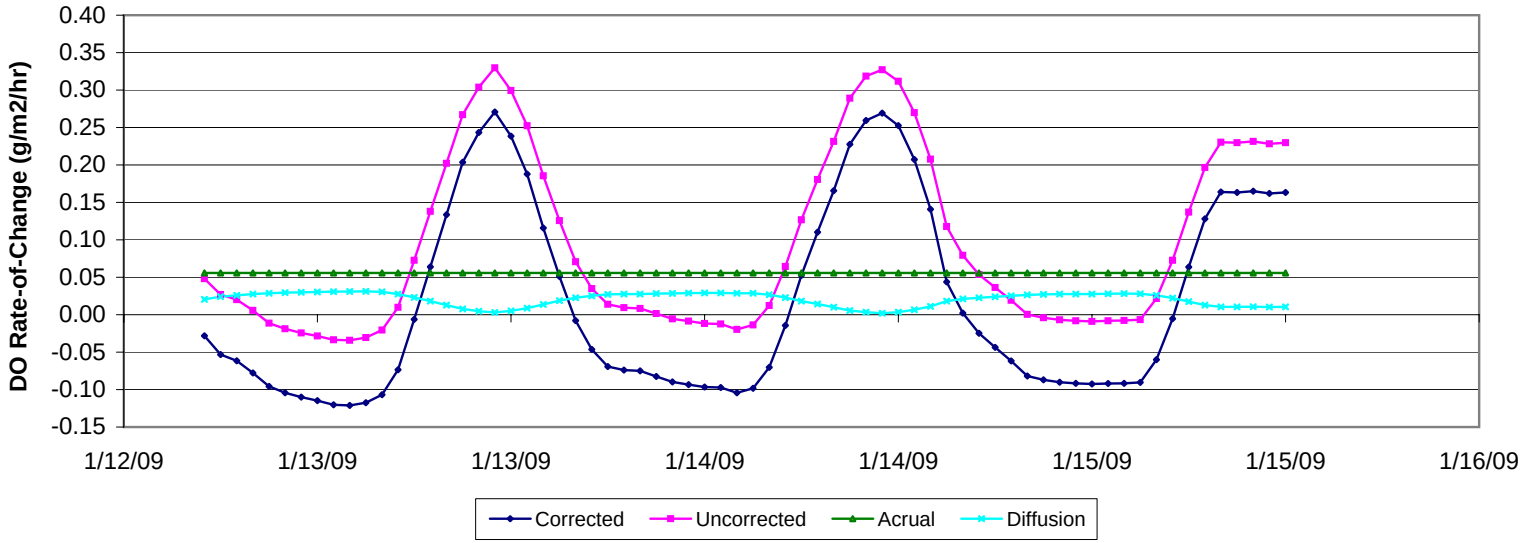
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	7.11	6.97	7.44	145
down		7.14	7.01	7.31	146
Wtr Temp - up	C	20.6	20.6	20.6	145
down		20.5	20.5	20.6	146
pH - up	SU	7.56	7.54	7.63	145
down		7.55	7.35	7.57	146
SpCond - up	uS/cm	279	277	283	145
down		269	268	269	146
Flow - up	m^3/d	255,973	239,764	271,570	8
Depth	m	1.02	1.02	1.02	8
Rainfall Total	in		0		
PAR - air	$umol/m^2/s$	279	0.0	1,437	288
plant		221	0.0	1138	72
DO rate chng	$g/m^2/hr$				
corr		-0.011	-0.301	0.488	72
uncorr		0.063	-0.224	0.559	72



APPENDIX N

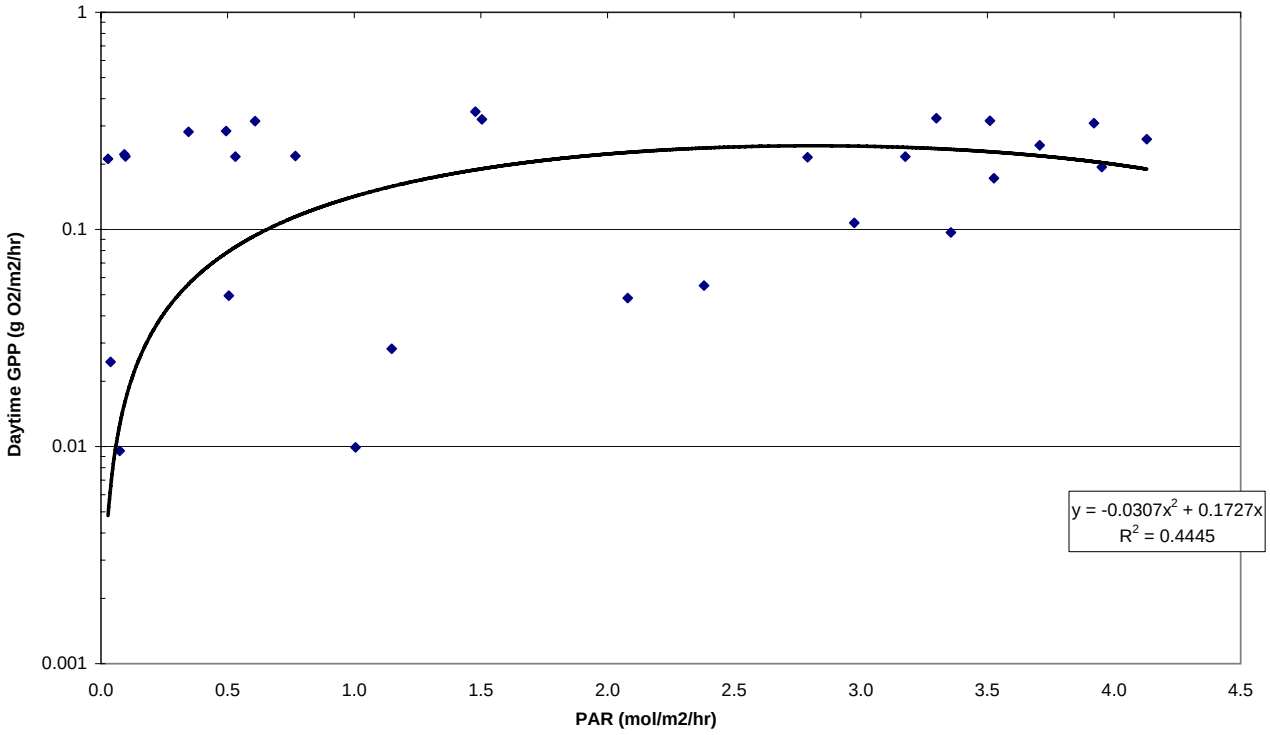
JACKSON BLUE SPRING - MAIN BOIL TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

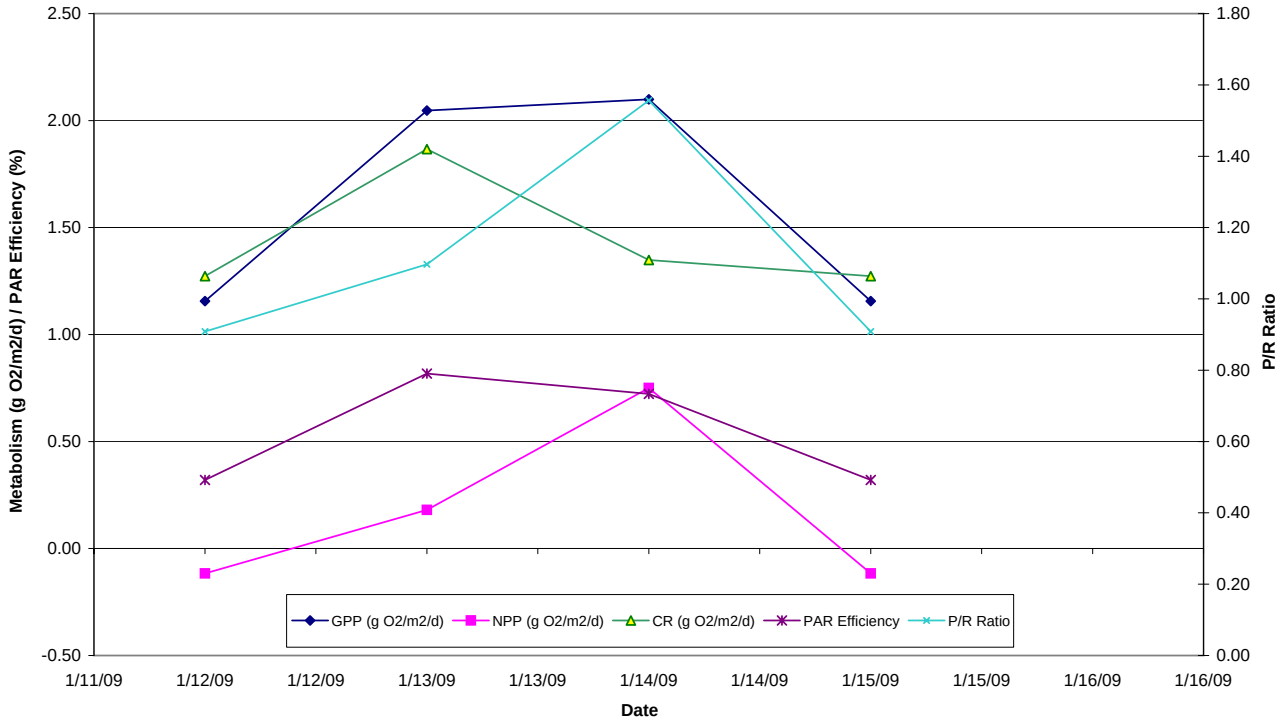




APPENDIX N

JACKSON BLUE SPRING - MAIN BOIL TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE



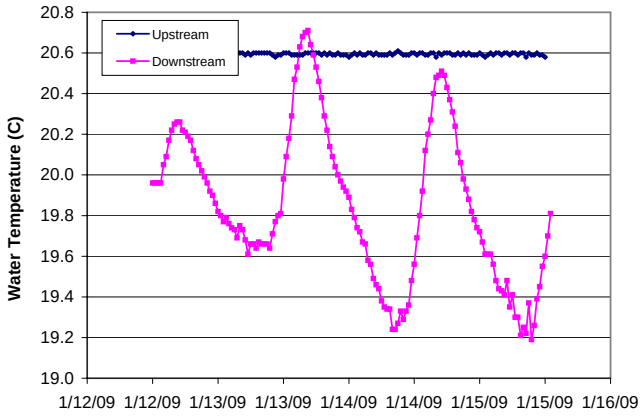


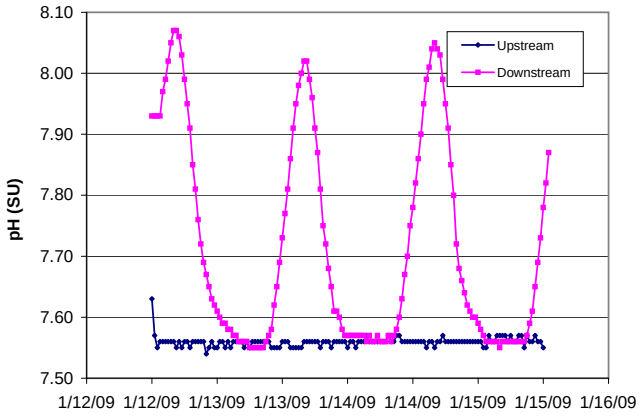
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	1.61	0.17	1.44	1.12	0.55
Max	2.10	0.75	1.87	1.56	0.82
Min	1.16	-0.12	1.27	0.91	0.32

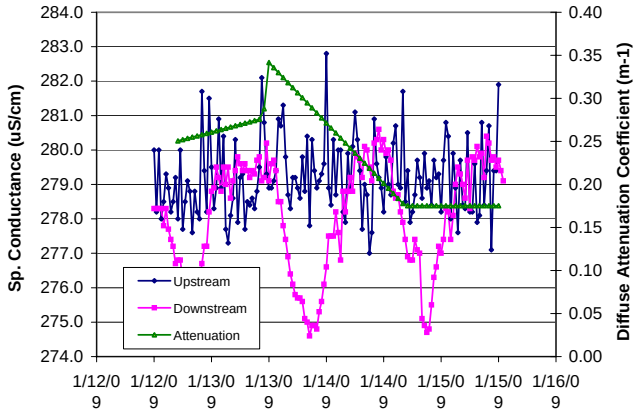
APPENDIX N
JACKSON BLUE SPRING - MAIN BOIL TO STN 3 METABOLISM ESTIMATES

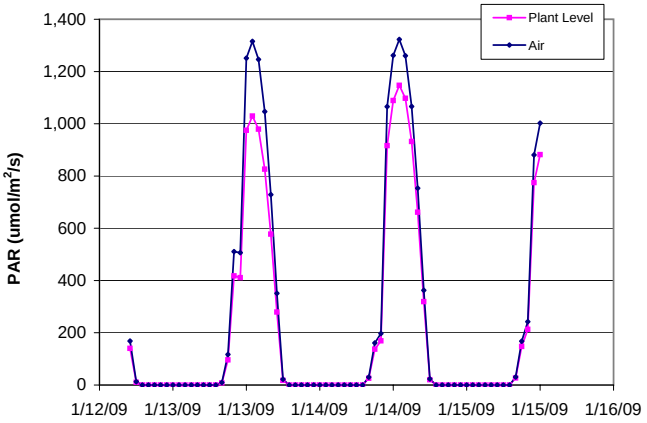
APPENDIX N

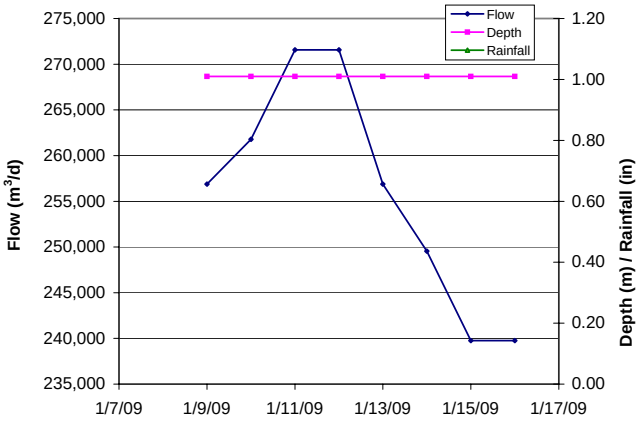
JACKSON BLUE SPRING - MAIN BOIL TO STN 3 METABOLISM SUMMARY



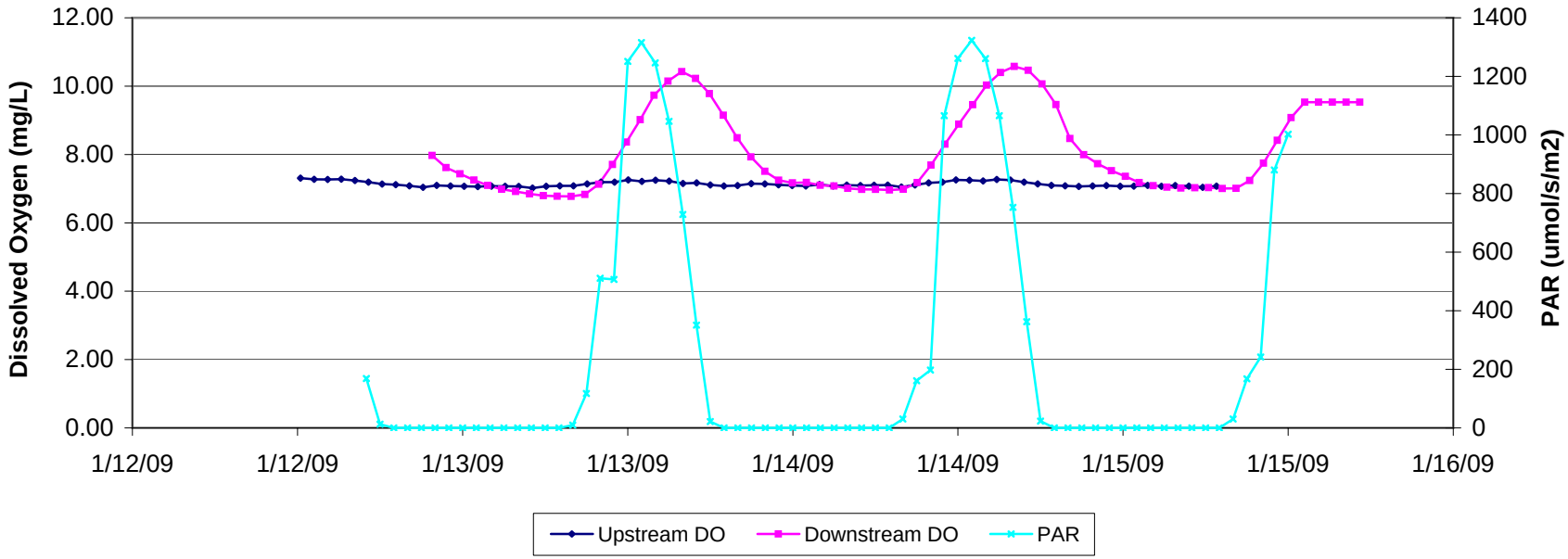






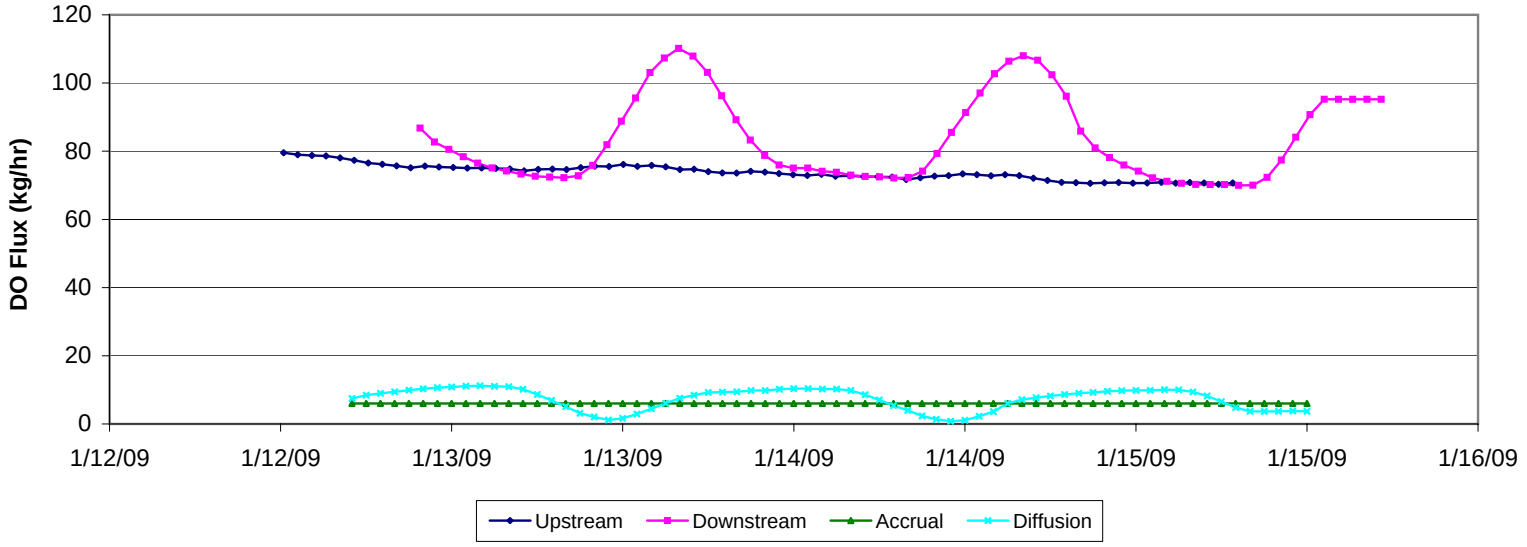


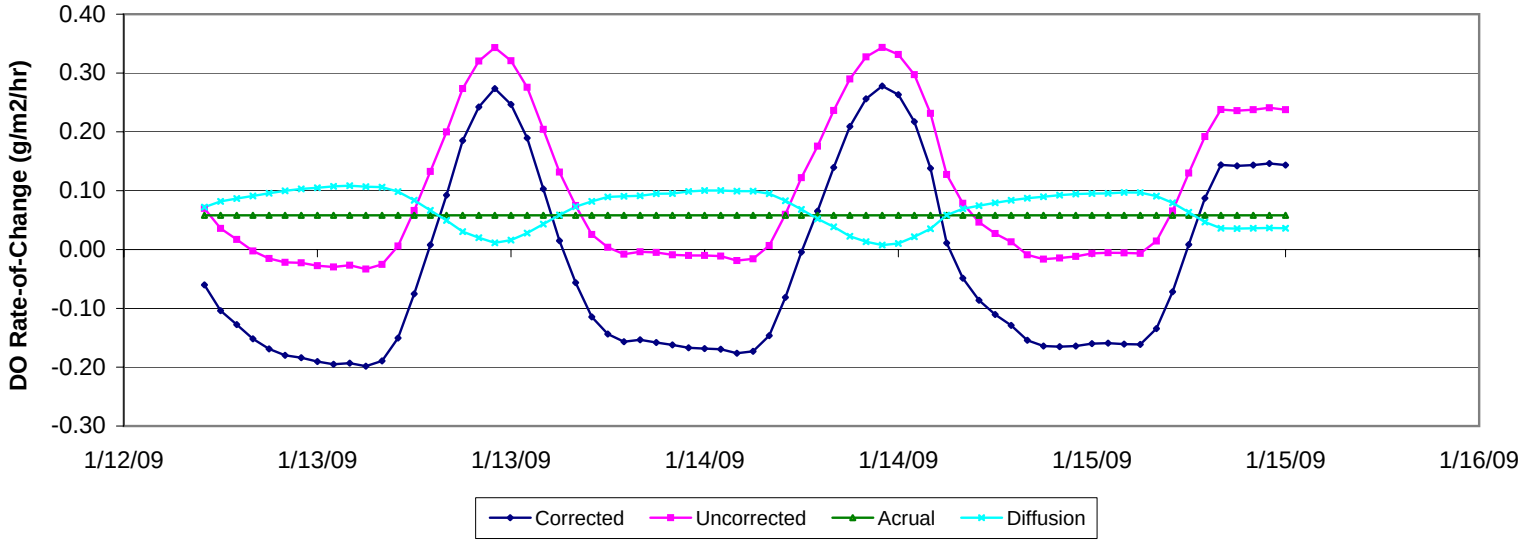
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	7.11	6.97	7.44	145
down		8.23	6.75	10.70	147
Wtr Temp - up	C	20.6	20.6	20.6	145
down		19.9	19.2	20.7	147
pH - up	SU	7.56	7.54	7.63	145
down		7.72	7.55	8.07	147
SpCond - up	uS/cm	279	277	283	145
down		278	275	281	147
Flow - up	m^3/d	255,973	239,764	271,570	8
Depth	m	1.01	1.01	1.01	8
Rainfall Total	in		0		
PAR - air	umol/m^2/s	279	0.0	1,437	288
plant		211	0.0	1147	68
DO rate chng	g/m^2/hr				
corr		0.017	-0.121	0.271	68
uncorr		0.093	-0.034	0.330	68



APPENDIX N

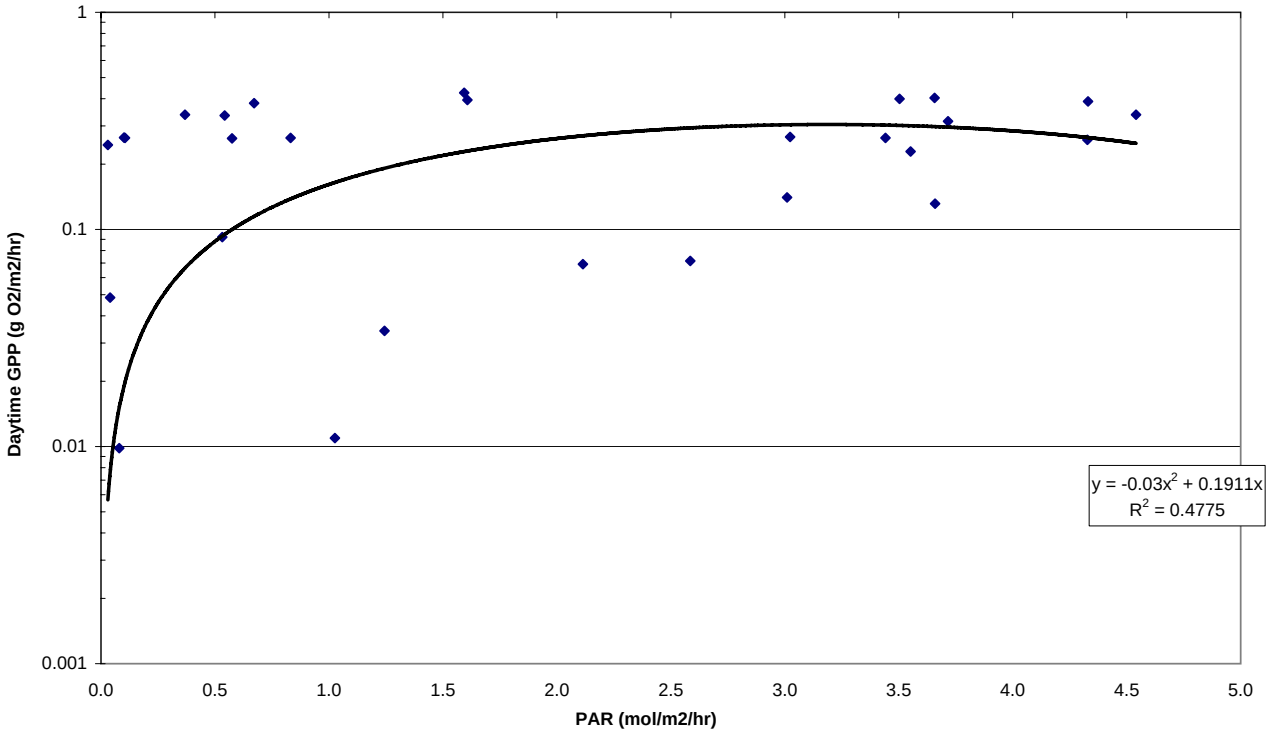
JACKSON BLUE SPRING - STN 2 TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

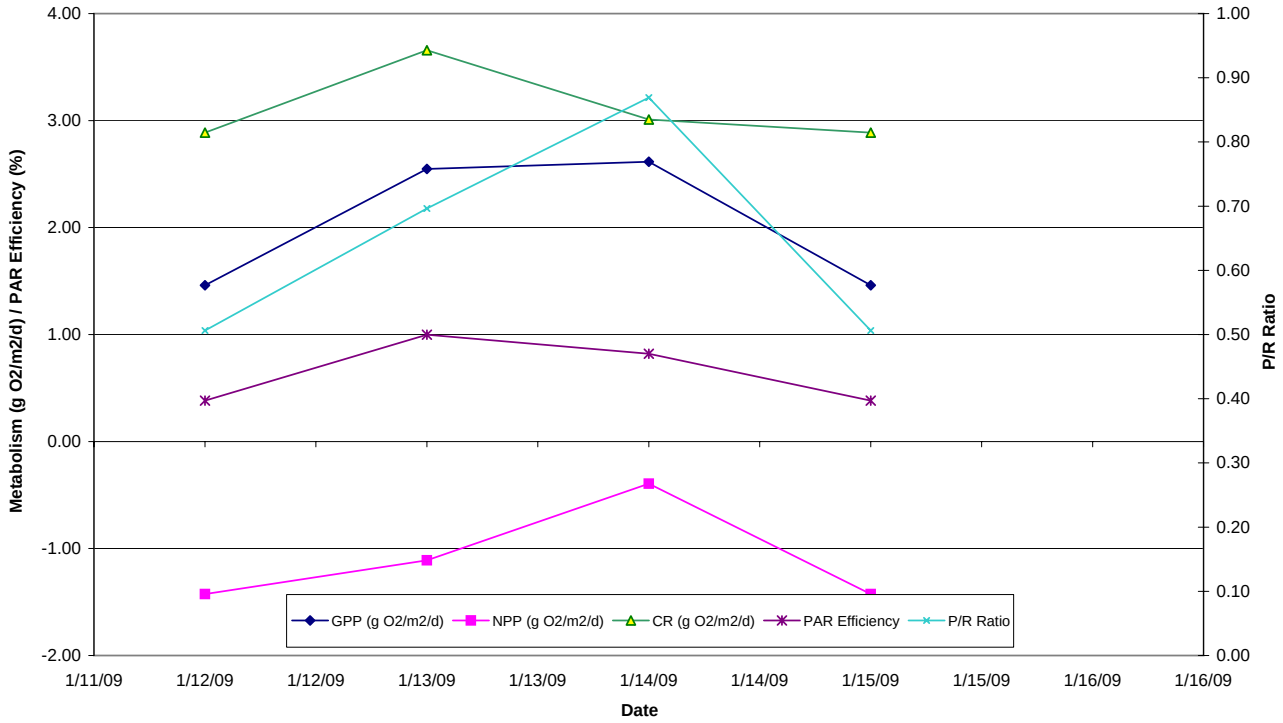




APPENDIX N

JACKSON BLUE SPRING - STN 2 TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





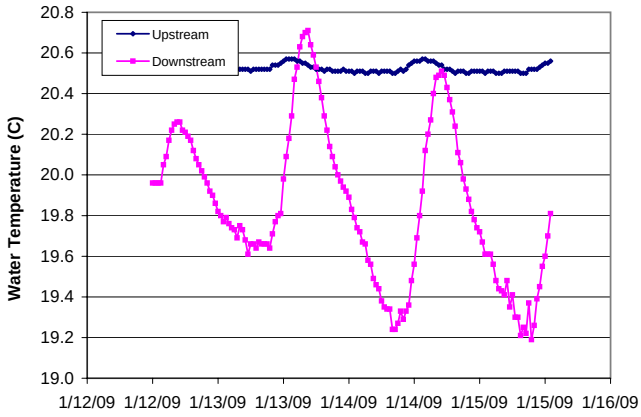
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	2.02	-1.09	3.11	0.64	0.65
Max	2.62	-0.39	3.66	0.87	1.00
Min	1.46	-1.43	2.89	0.51	0.38

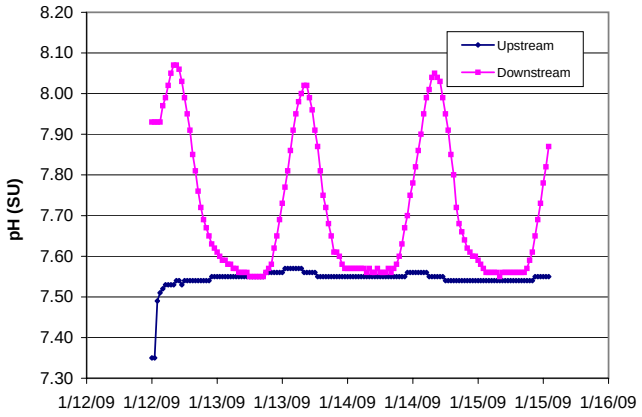
APPENDIX N

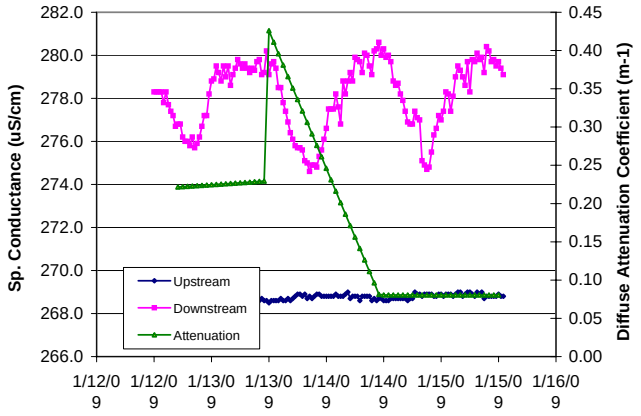
JACKSON BLUE SPRING - STN 2 TO STN 3 METABOLISM ESTIMATES

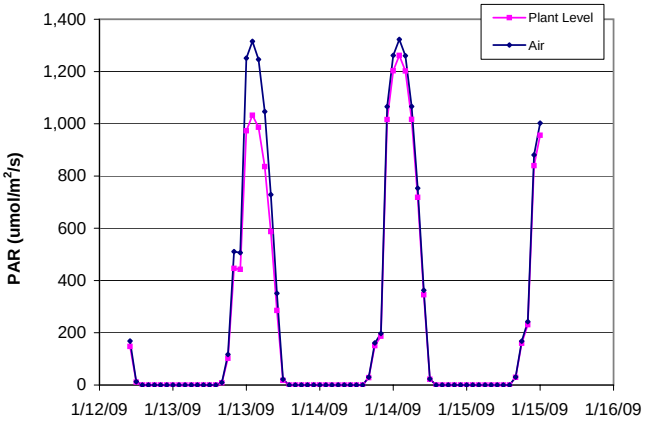
APPENDIX N

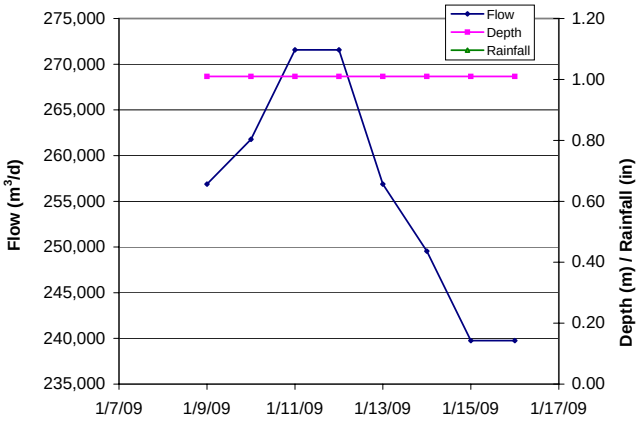
JACKSON BLUE SPRING - STN 2 TO STN 3 METABOLISM SUMMARY



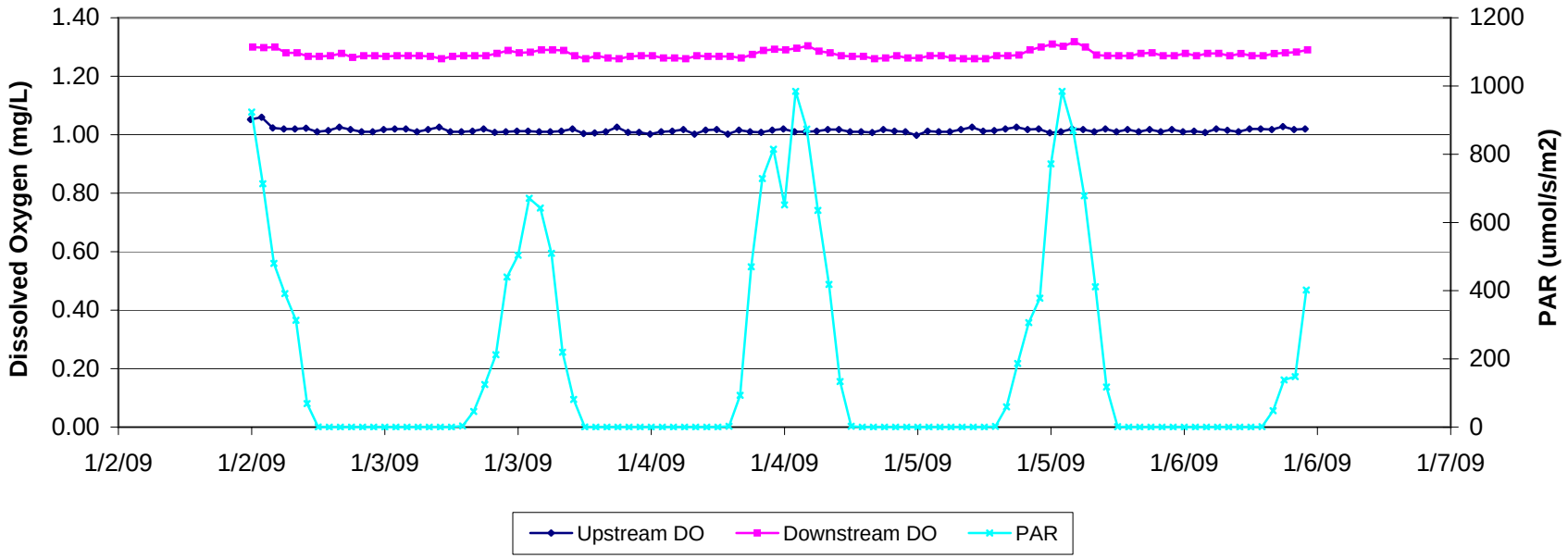






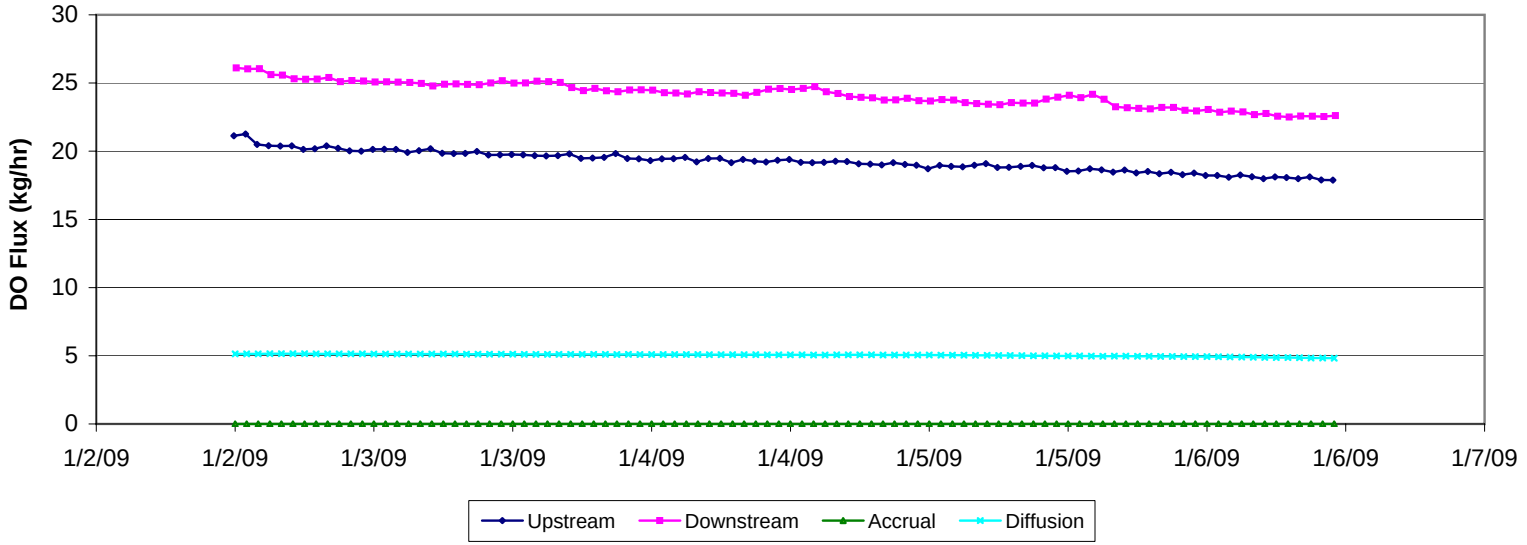


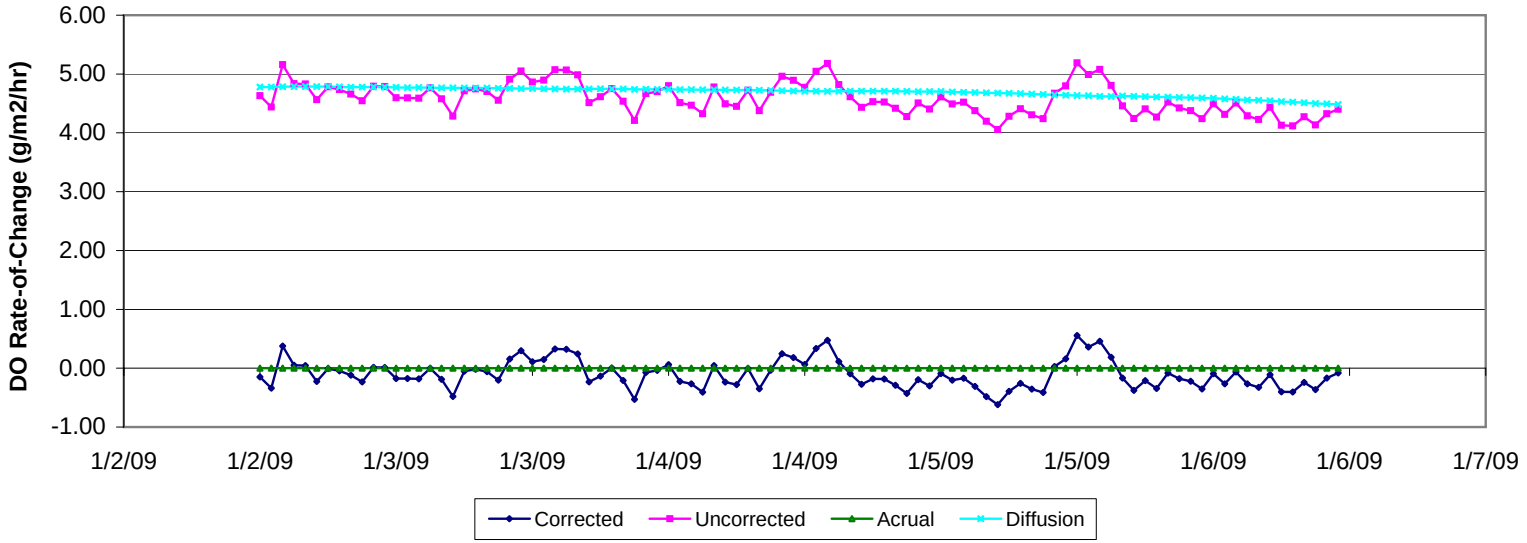
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	7.14	7.01	7.31	147
down		8.23	6.75	10.70	147
Wtr Temp - up	C	20.5	20.5	20.6	147
down		19.9	19.2	20.7	147
pH - up	SU	7.54	7.35	7.57	147
down		7.72	7.55	8.07	147
SpCond - up	uS/cm	269	268	269	147
down		278	275	281	147
Flow - up	m^3/d	255,973	239,764	271,570	8
Depth	m	1.01	1.01	1.01	8
Rainfall Total	in		0		
PAR - air	$umol/m^2/s$	279	0.0	1,437	288
plant		224	0.0	1261	68
DO rate chng	$g/m^2/hr$				
corr		-0.034	-0.198	0.278	68
uncorr		0.095	-0.033	0.344	68



APPENDIX N

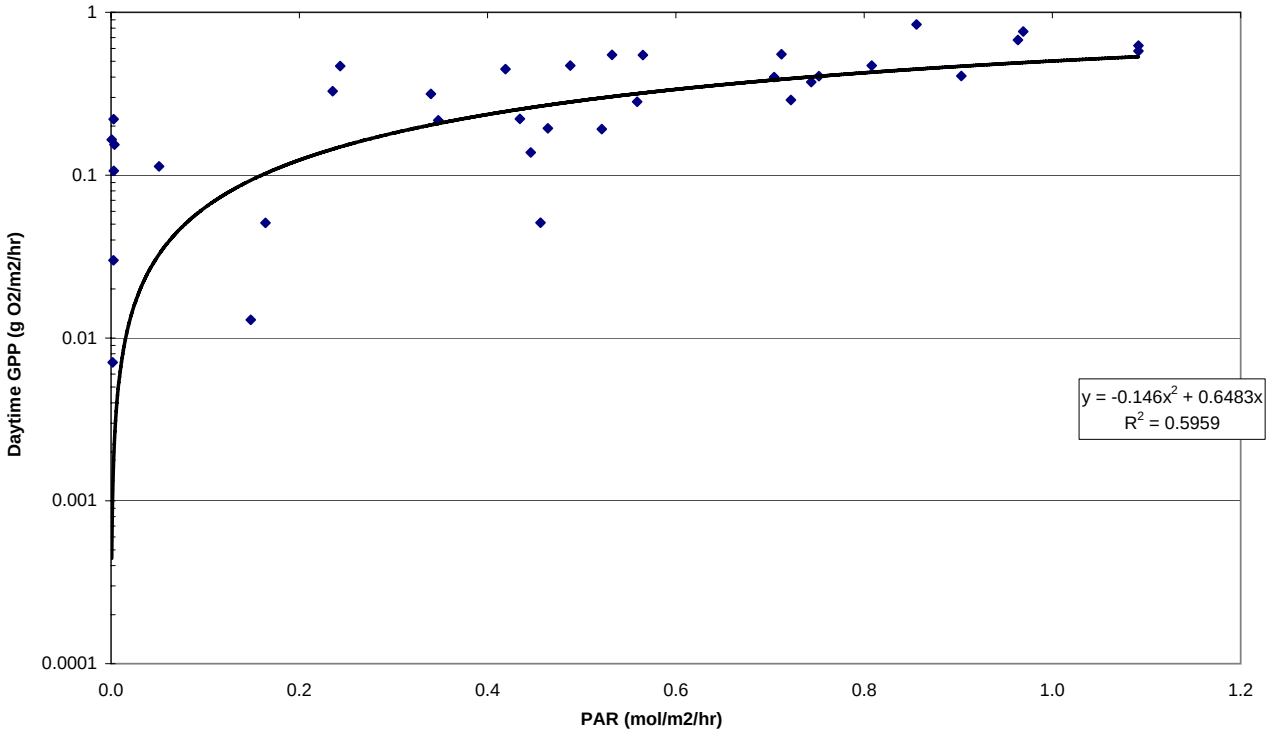
MADISON BLUE SPRING - MAIN BOIL TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

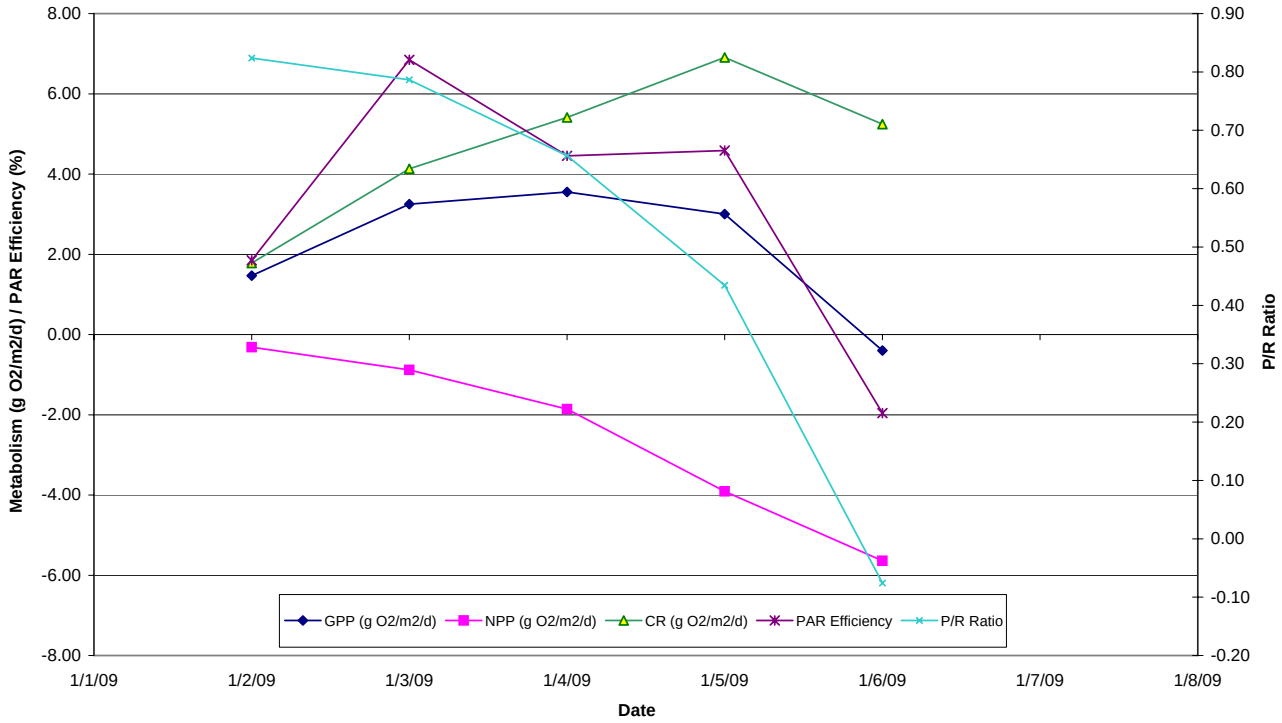




APPENDIX N

MADISON BLUE SPRING - MAIN BOIL TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





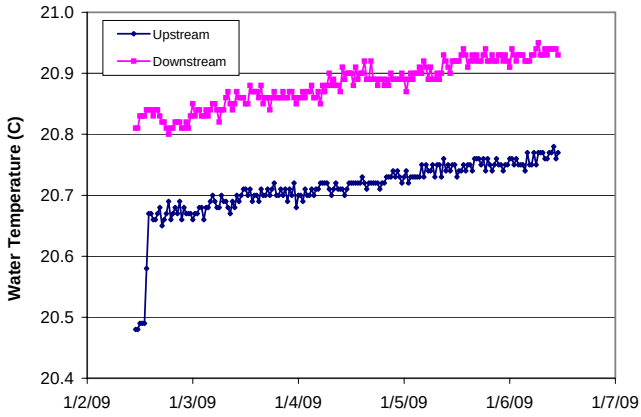
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	2.18	-2.52	4.70	0.53	3.16
Max	3.55	-0.31	6.91	0.82	6.85
Min	-0.40	-5.64	1.78	-0.08	-1.96

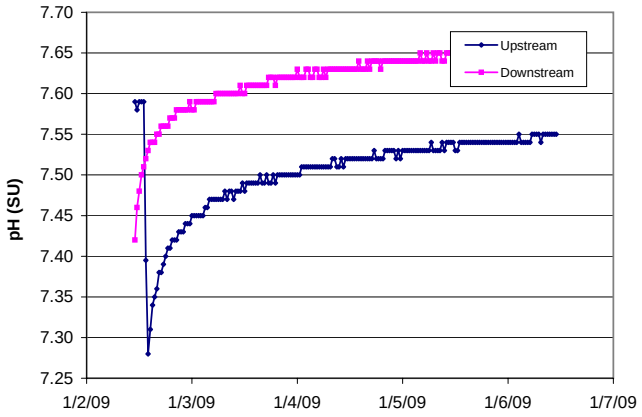
APPENDIX N

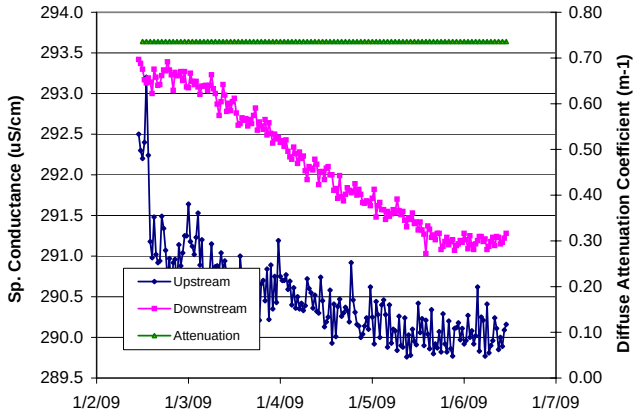
MADISON BLUE SPRING - MAIN BOIL TO STN 3 METABOLISM ESTIMATES

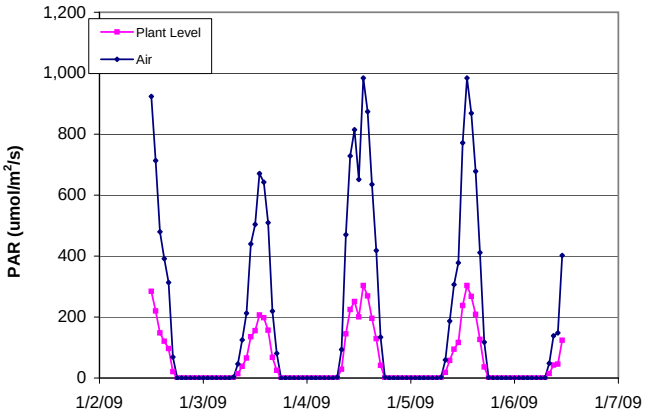
APPENDIX N

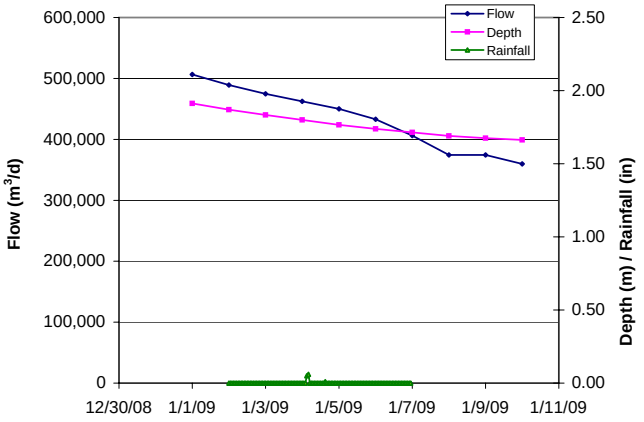
MADISON BLUE SPRING - MAIN BOIL TO STN 3 METABOLISM SUMMARY



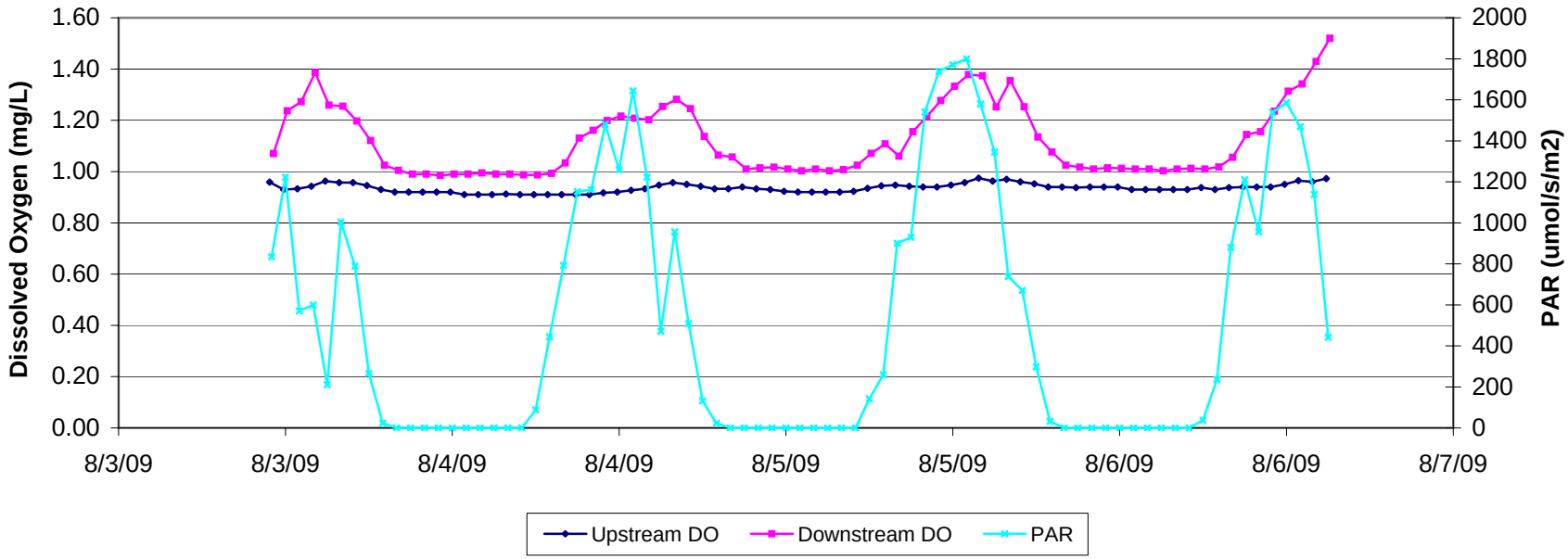






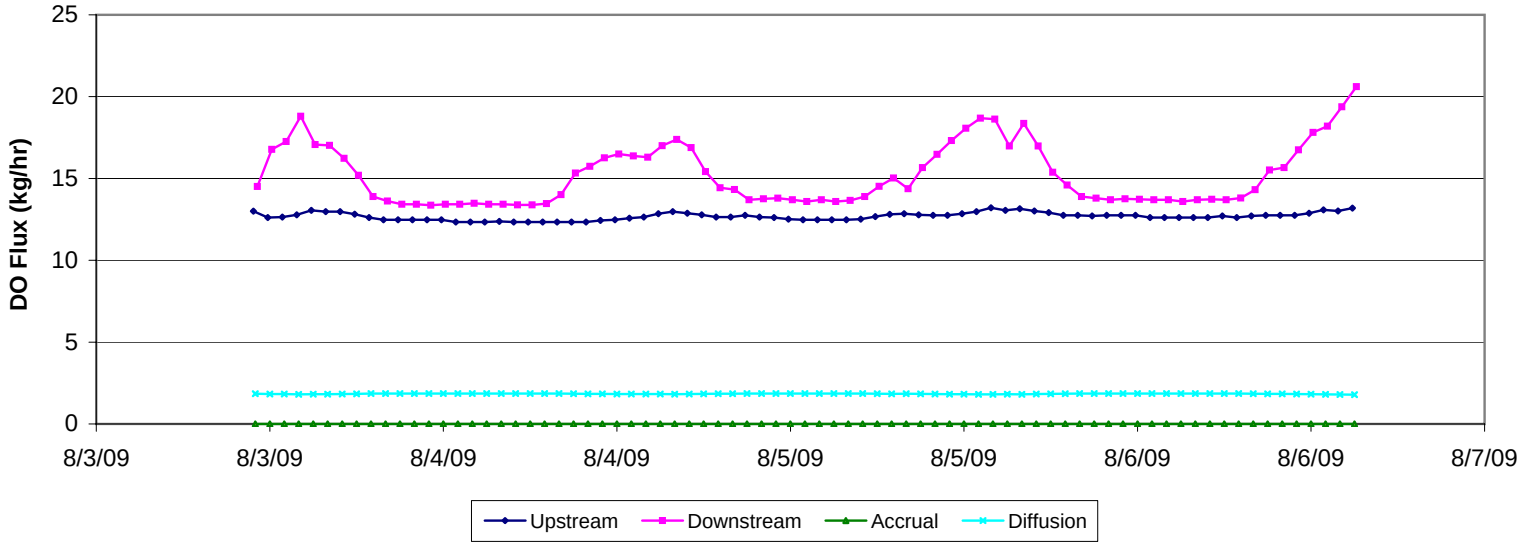


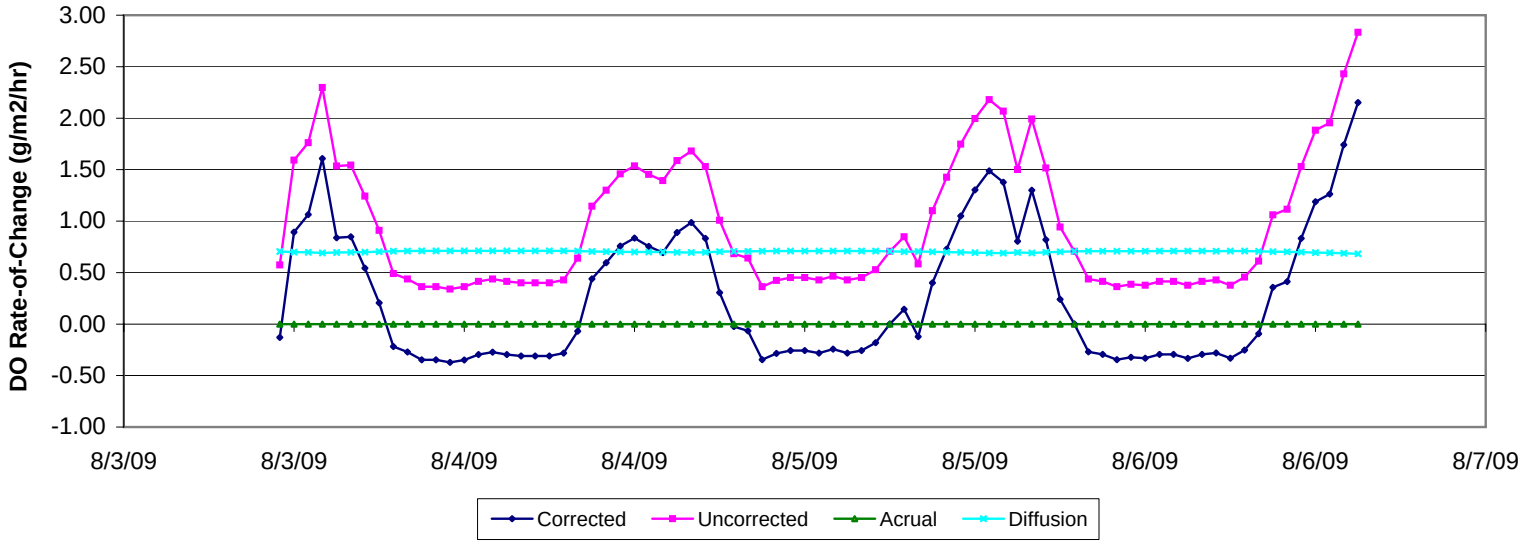
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	1.01	0.99	1.06	193
down		1.28	1.26	1.32	193
Wtr Temp - up	C	20.7	20.5	20.8	193
down		20.9	20.8	21.0	193
pH - up	SU	7.50	7.28	7.59	193
down		7.62	7.42	7.66	193
SpCond - up	uS/cm	290	290	293	193
down		292	291	293	193
Flow - up	m^3/d	433,044	359,647	506,441	10
Depth	m	1.77	1.66	1.91	10
Rainfall Total	in		0.12		
PAR - air	umol/m^2/s	175	0.0	0,984	120
plant		57	0.0	303	96
DO rate chng	g/m^2/hr				
corr		-0.107	-0.619	0.555	96
uncorr		4.587	4.056	5.191	96



APPENDIX N

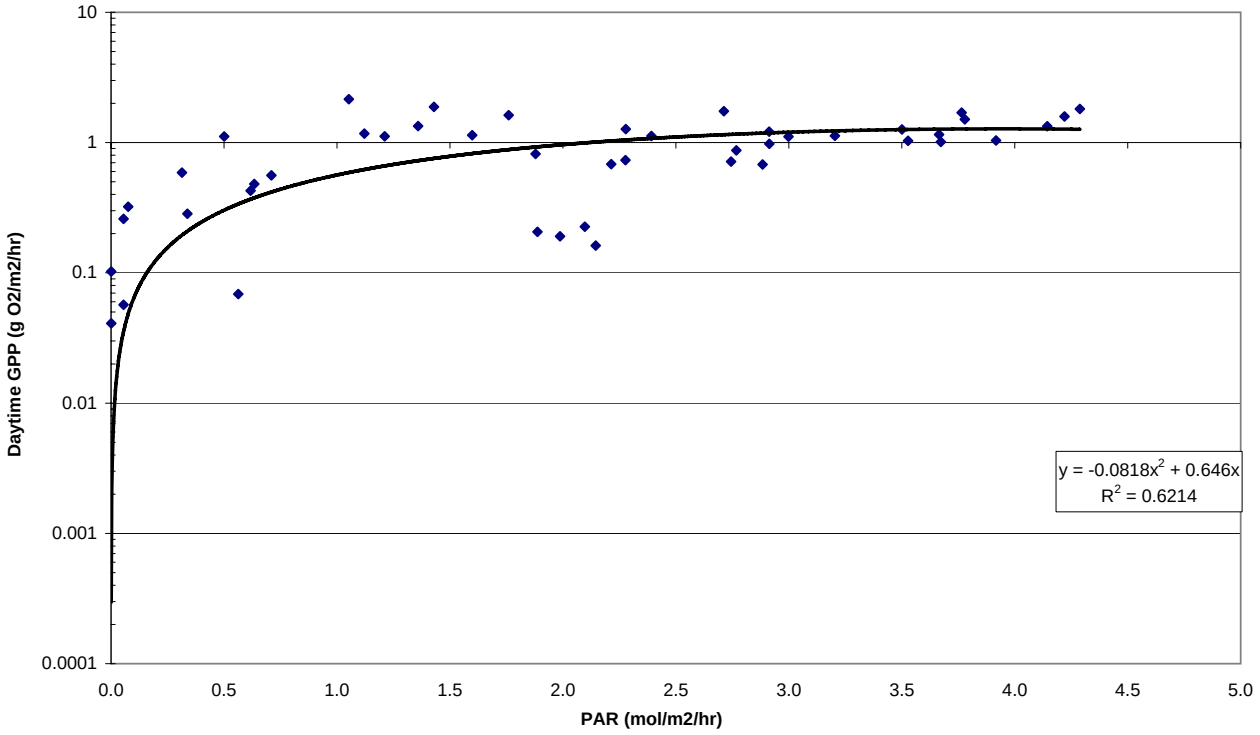
MANATEE SPRING - MB to STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

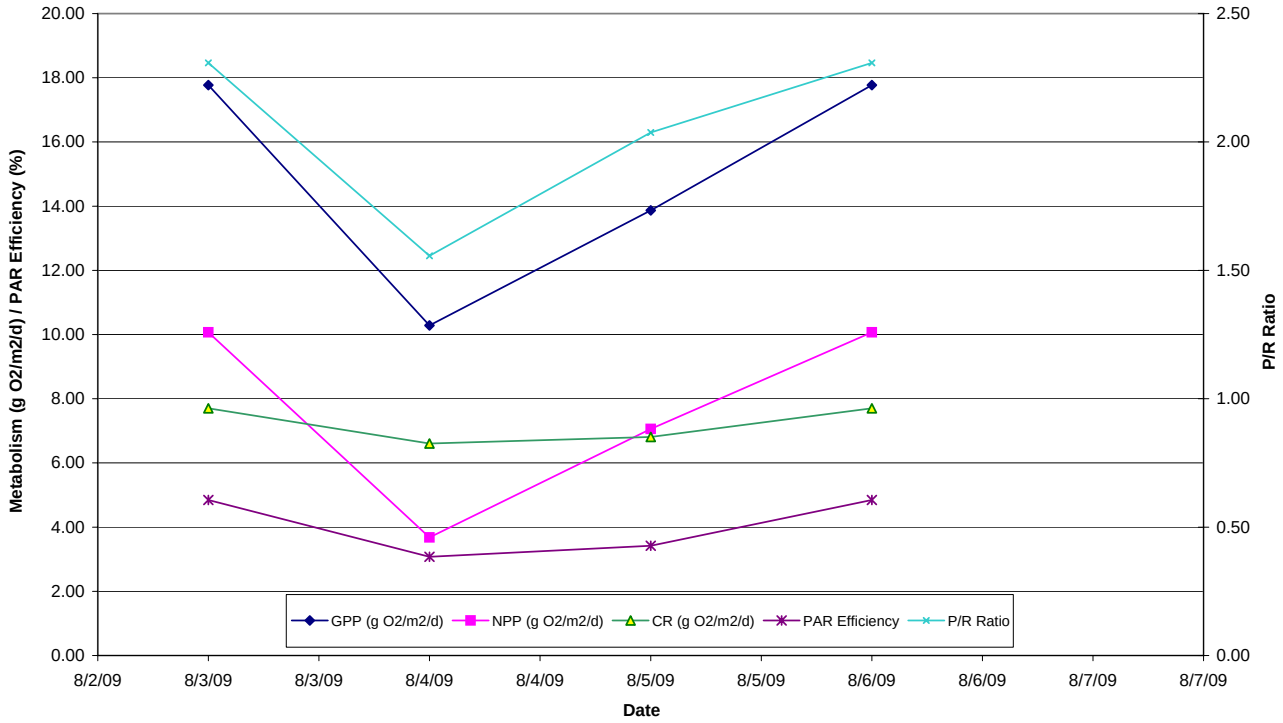




APPENDIX N

MANATEE SPRING - MB to STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





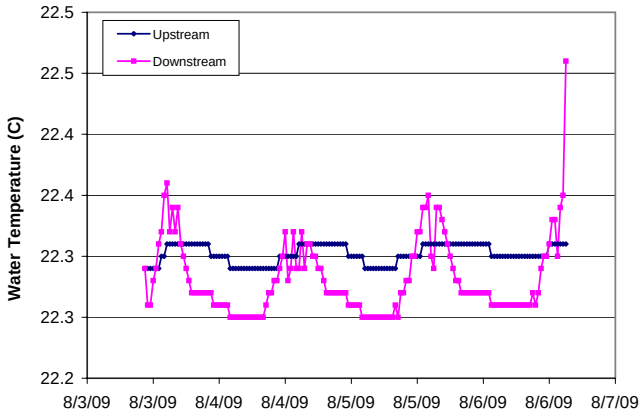
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	14.92	7.72	7.20	2.05	4.05
Max	17.77	10.07	7.70	2.31	4.85
Min	10.28	3.68	6.61	1.56	3.07

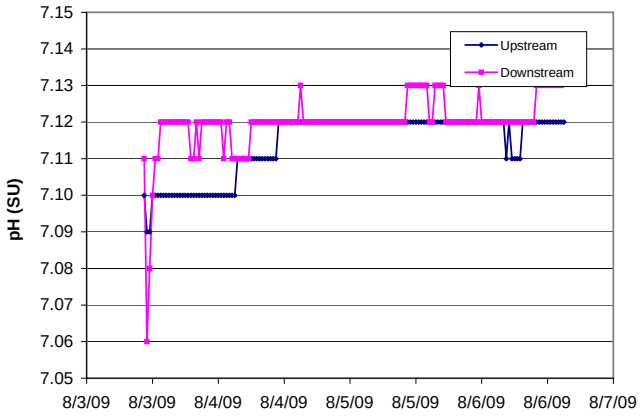
APPENDIX N

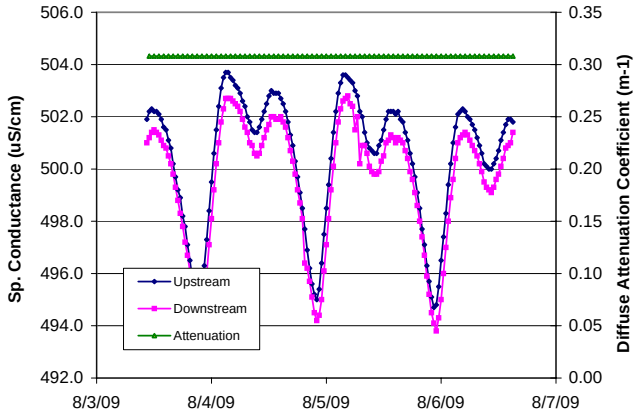
MANATEE SPRING - MB to STN 2 METABOLISM ESTIMATES

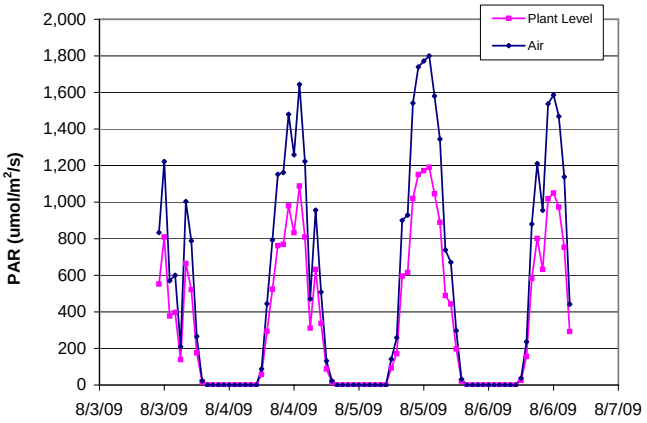
APPENDIX N

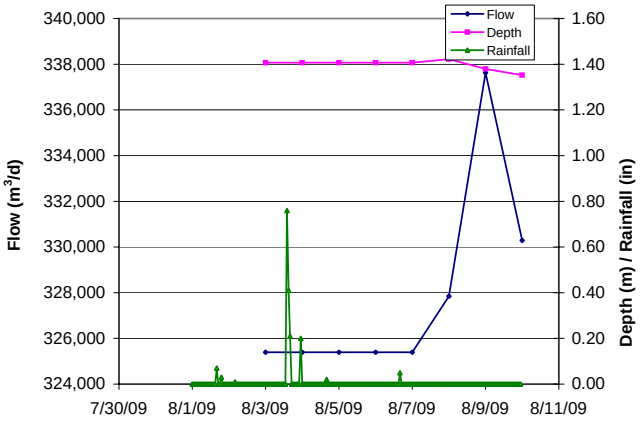
MANATEE SPRING - MB to STN 2 METABOLISM SUMMARY



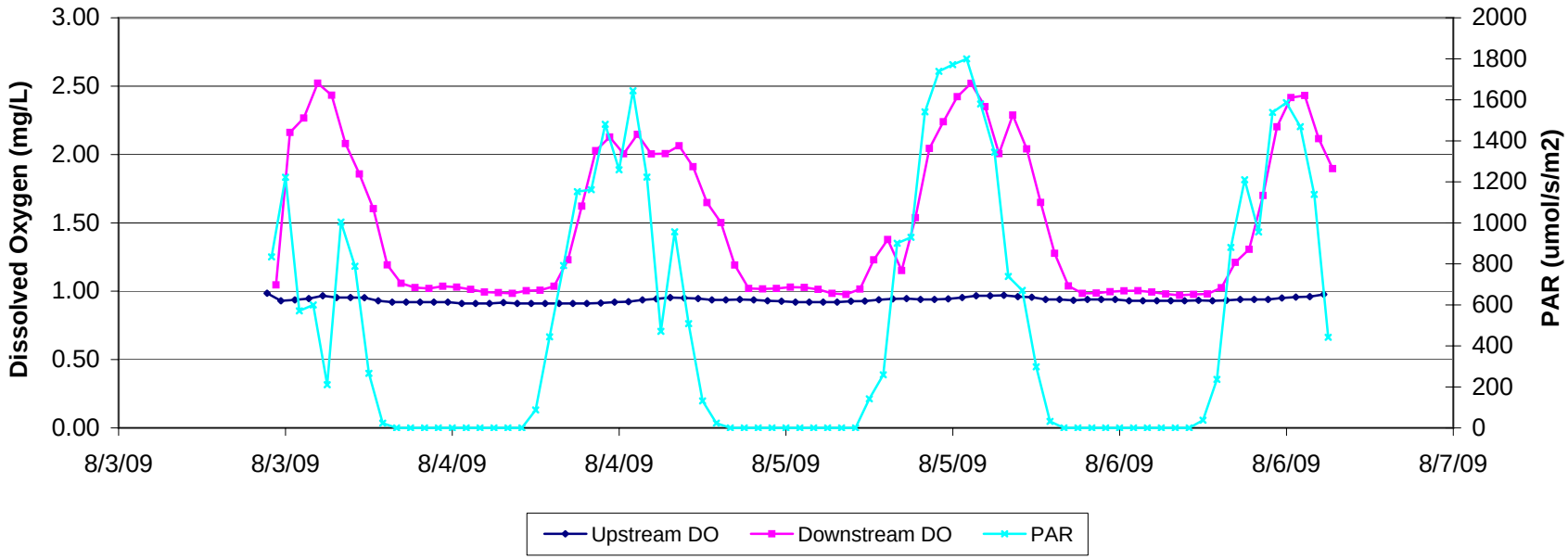






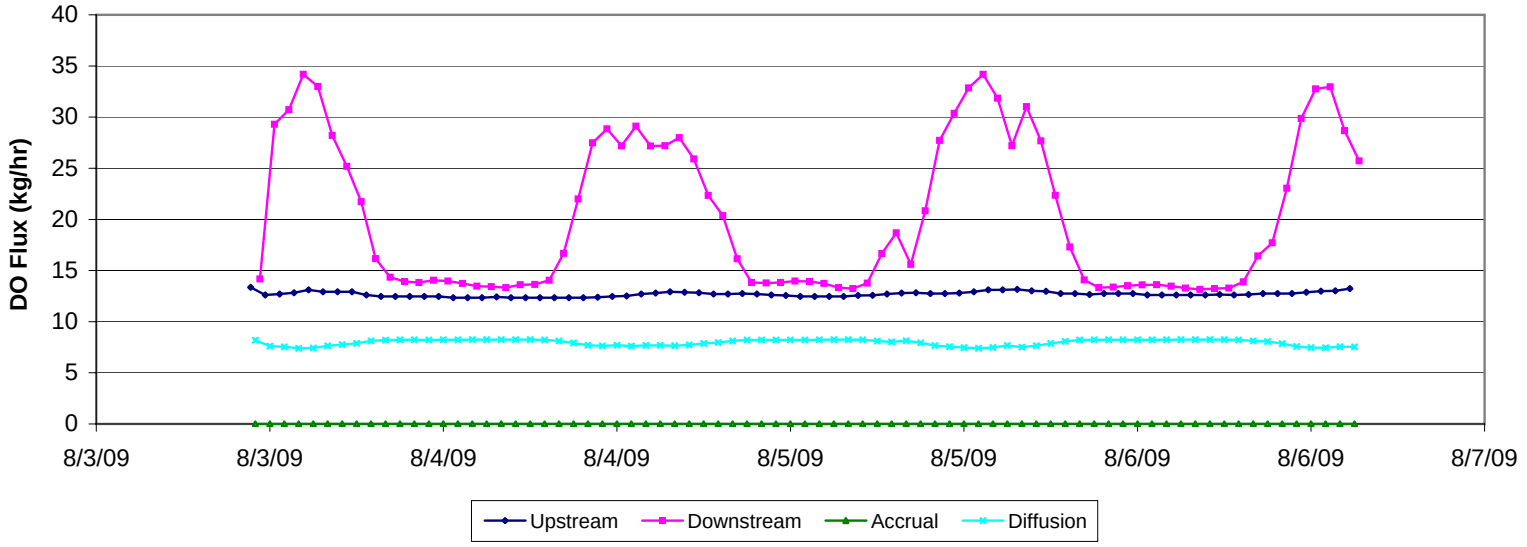


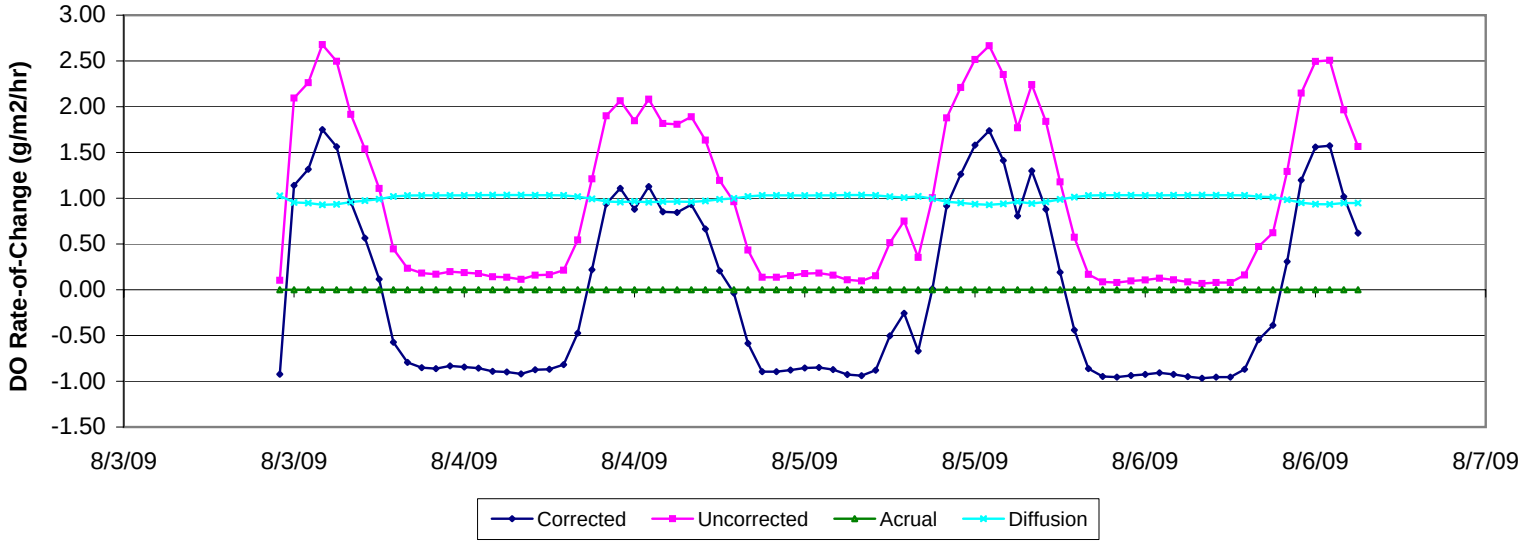
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	0.94	0.91	1.01	154
down		1.12	0.98	1.52	154
Wtr Temp - up	C	22.3	22.3	22.3	154
down		22.3	22.3	22.5	154
pH - up	SU	7.11	7.09	7.12	154
down		7.12	7.06	7.14	154
SpCond - up	uS/cm	500	495	504	154
down		500	494	503	154
Flow - up	m^3/d	327,841	325,395	337,627	8
Depth	m	1.40	1.35	1.42	8
Rainfall Total	in		1.76		
PAR - air	$umol/m^2/s$	477	0.0	1,892	216
plant		345	0.0	1191	77
DO rate chng	$g/m^2/hr$				
corr		0.262	-0.372	2.151	77
uncorr		0.965	0.339	2.834	77



APPENDIX N

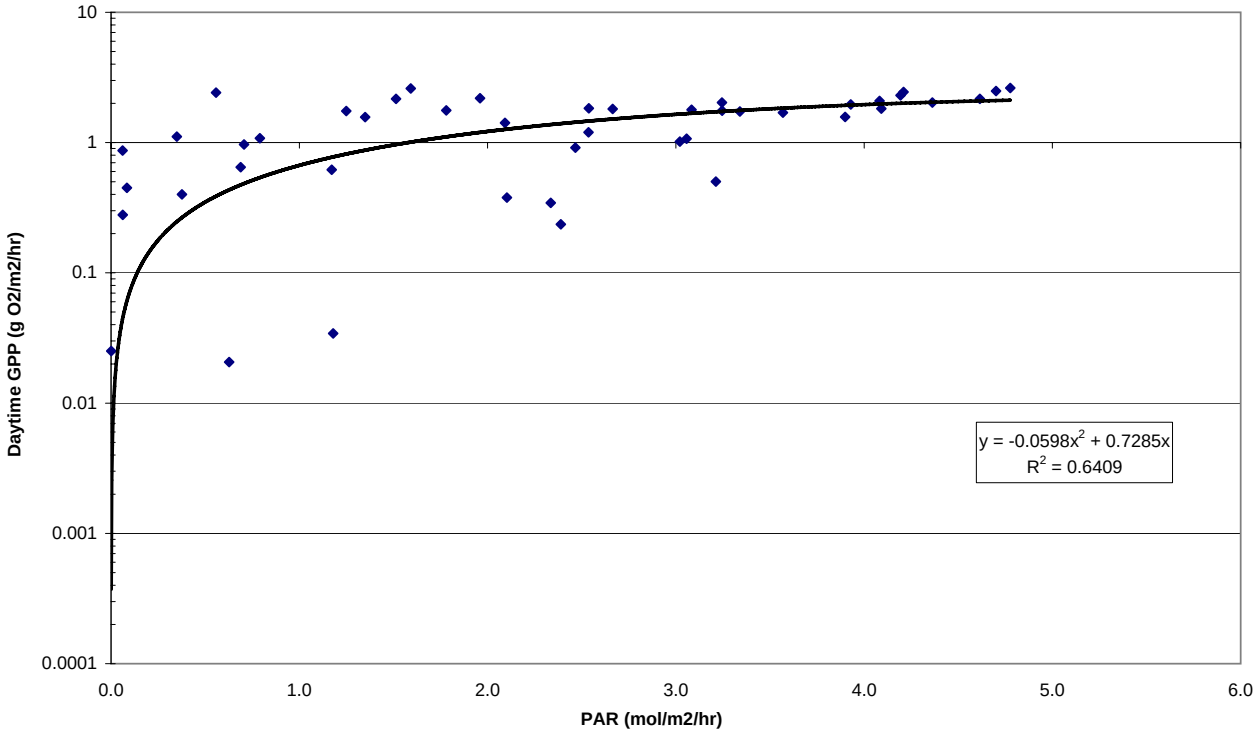
MANATEE SPRING - MB to STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

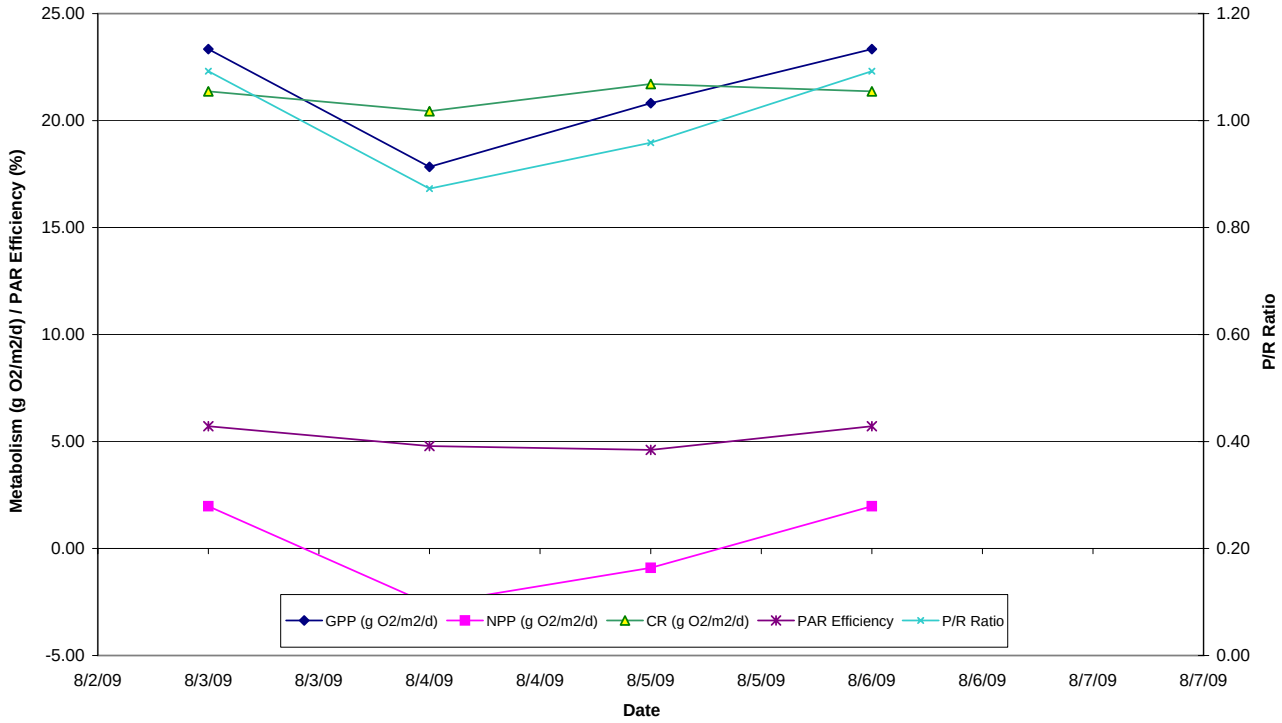




APPENDIX N

MANATEE SPRING - MB to STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE



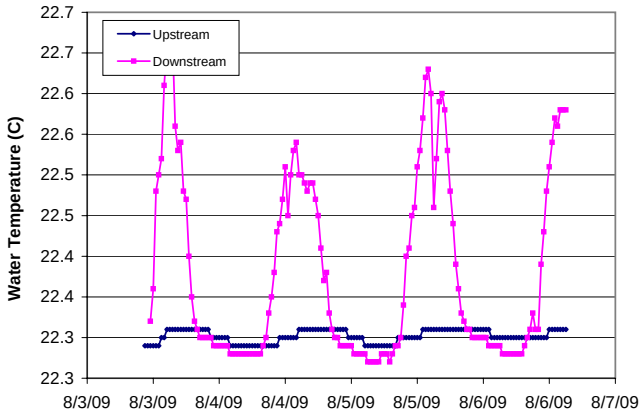


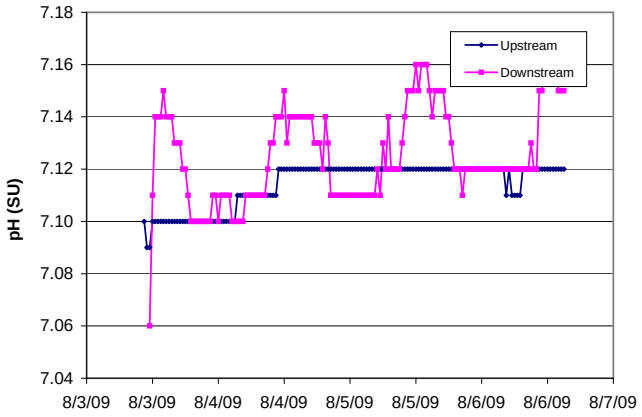
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	21.33	0.11	21.22	1.00	5.21
Max	23.34	1.97	21.71	1.09	5.71
Min	17.84	-2.60	20.44	0.87	4.61

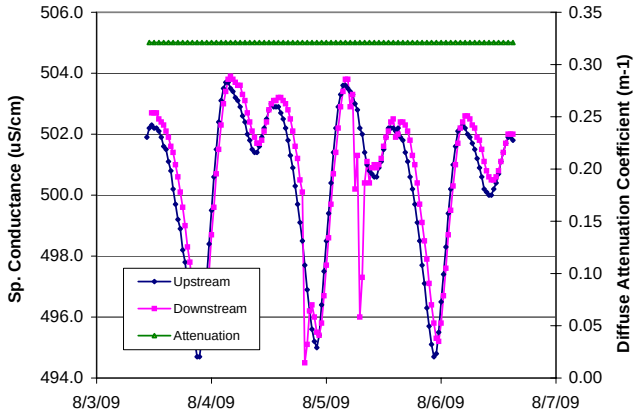
APPENDIX N
MANATEE SPRING - MB to STN 3 METABOLISM ESTIMATES

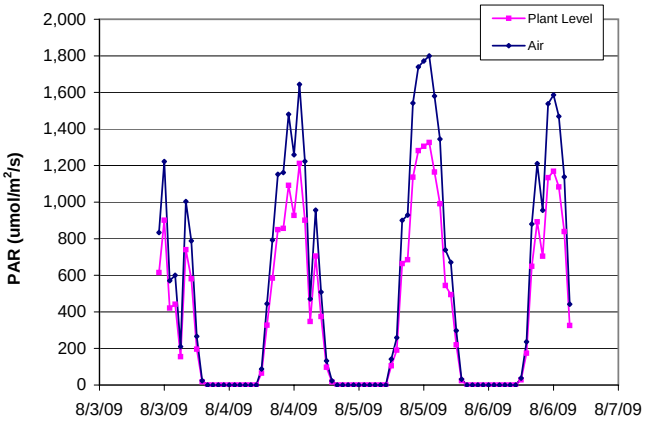
APPENDIX N

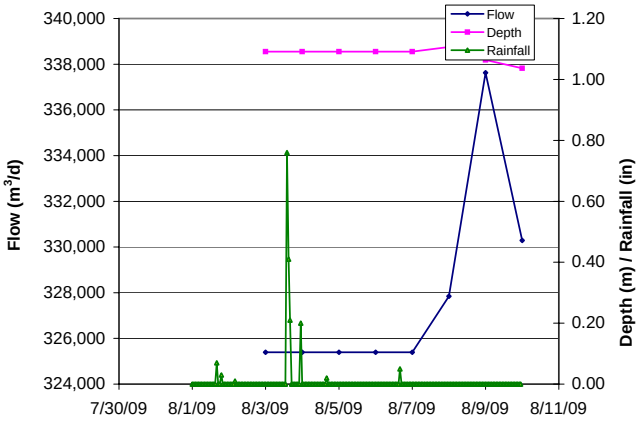
MANATEE SPRING - MB to STN 3 METABOLISM SUMMARY



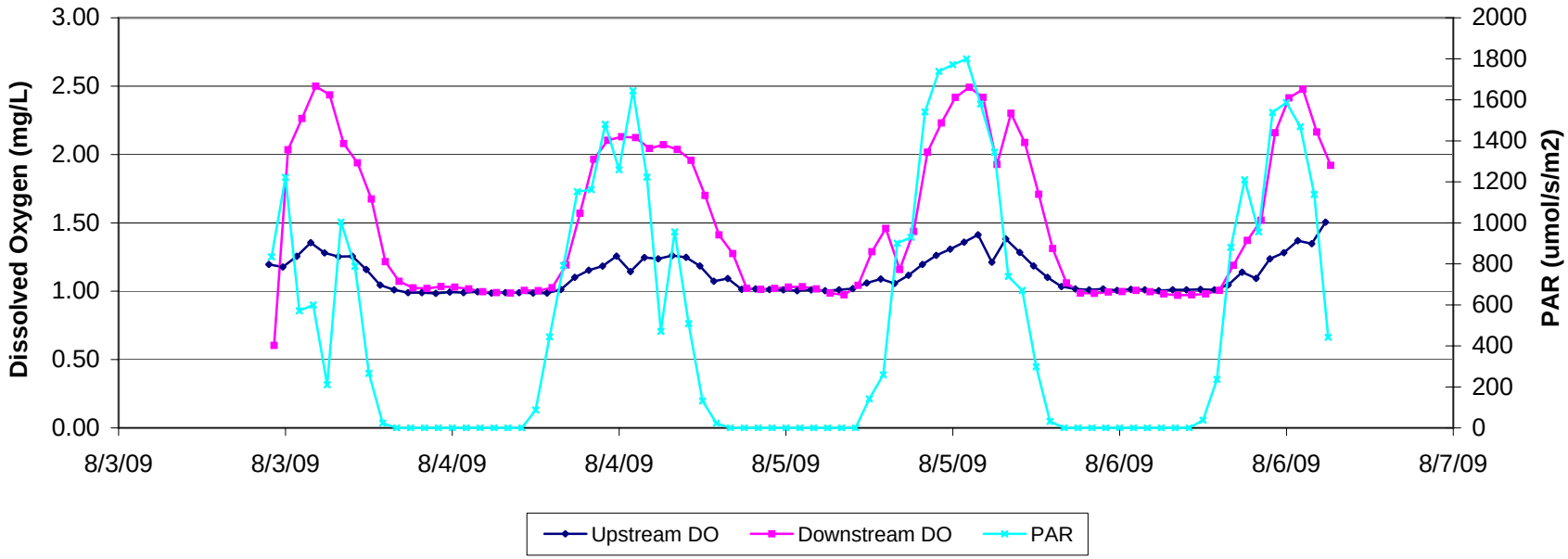






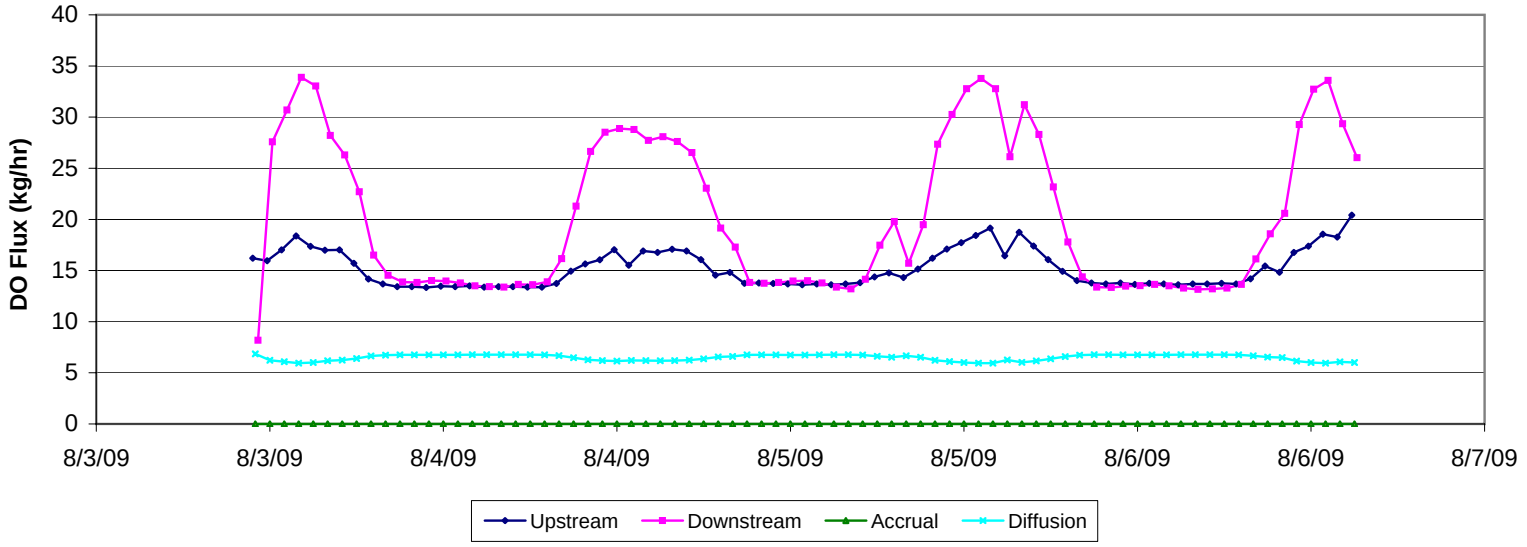


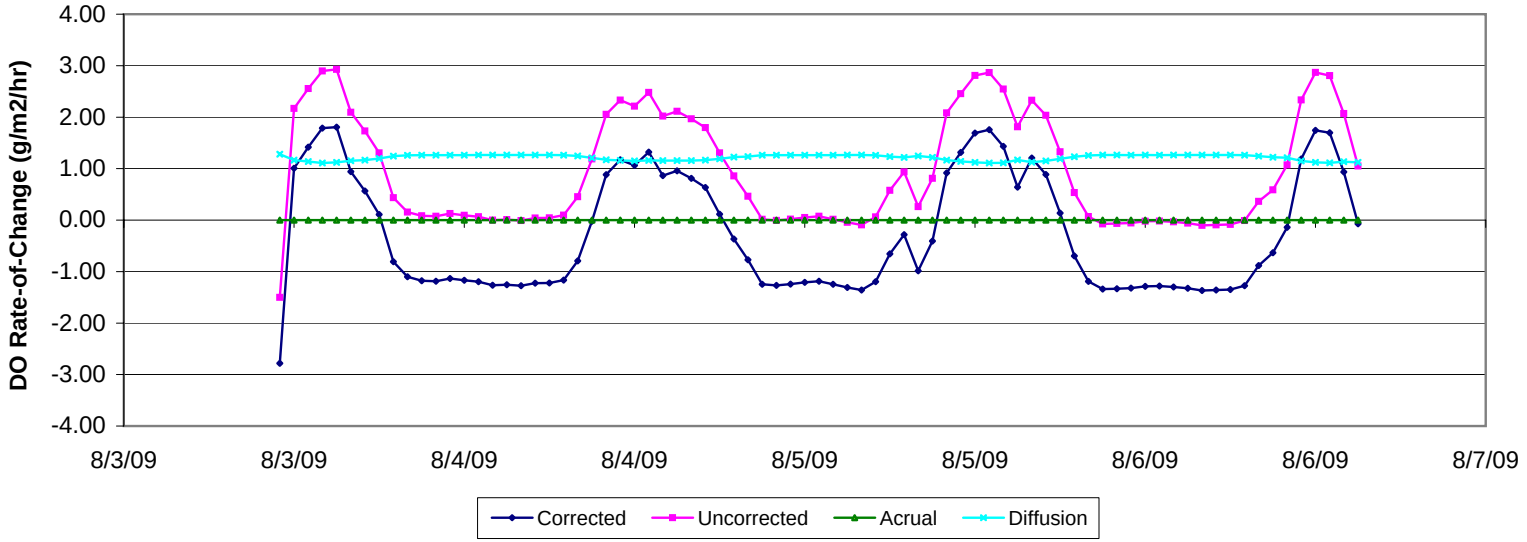
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	0.94	0.91	1.01	154
down		1.50	0.97	2.56	152
Wtr Temp - up	C	22.3	22.3	22.3	154
down		22.4	22.3	22.7	152
pH - up	SU	7.11	7.09	7.12	154
down		7.13	7.06	7.16	152
SpCond - up	uS/cm	500	495	504	154
down		501	495	504	152
Flow - up	m^3/d	327,841	325,395	337,627	8
Depth	m	1.08	1.04	1.11	8
Rainfall Total	in		1.76		
PAR - air	umol/m^2/s	477	0.0	1,892	216
plant		384	0.0	1327	77
DO rate chng	g/m^2/hr				
corr		-0.043	-0.966	1.751	77
uncorr		0.955	0.068	2.679	77



APPENDIX N

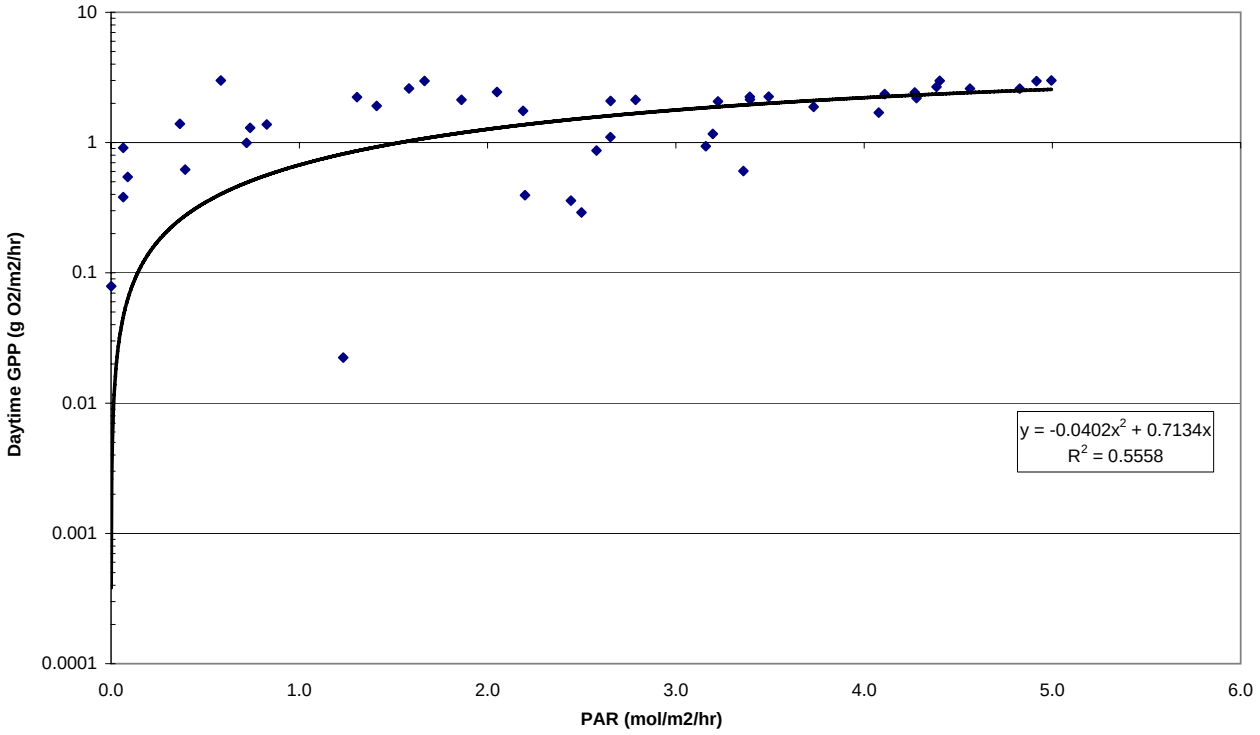
MANATEE SPRING - STN 2 to STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

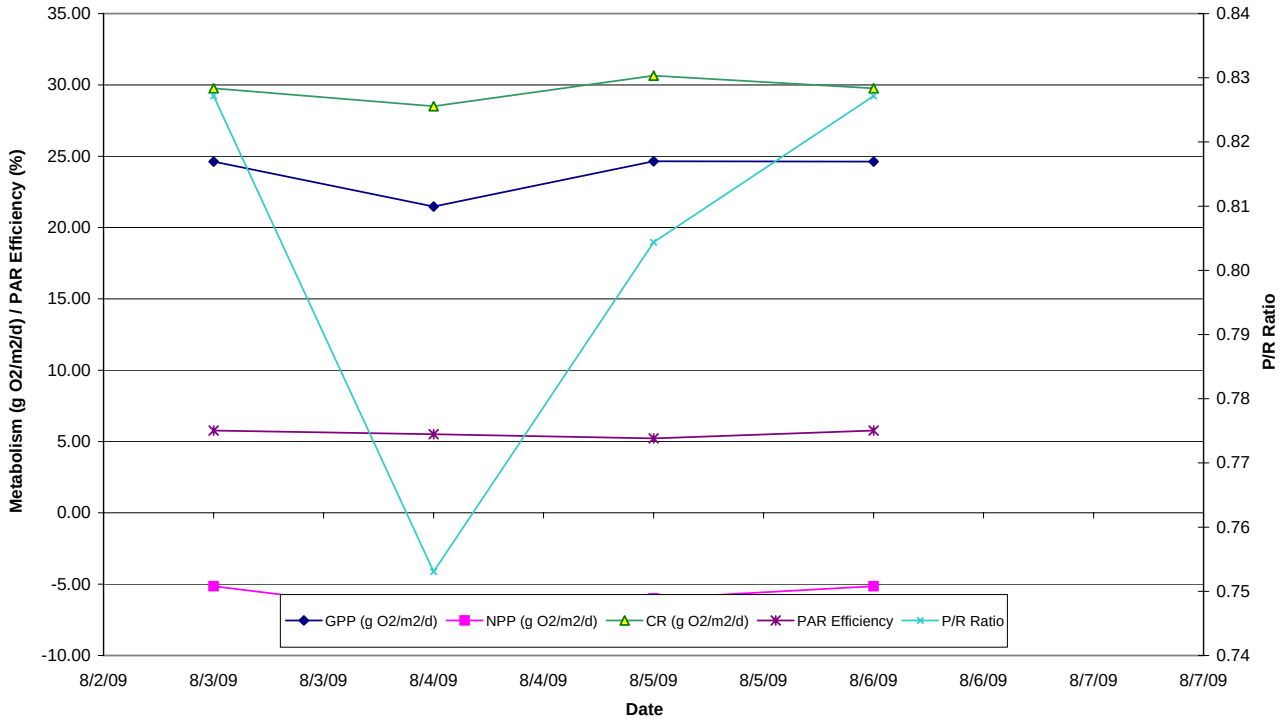




APPENDIX N

MANATEE SPRING - STN 2 to STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





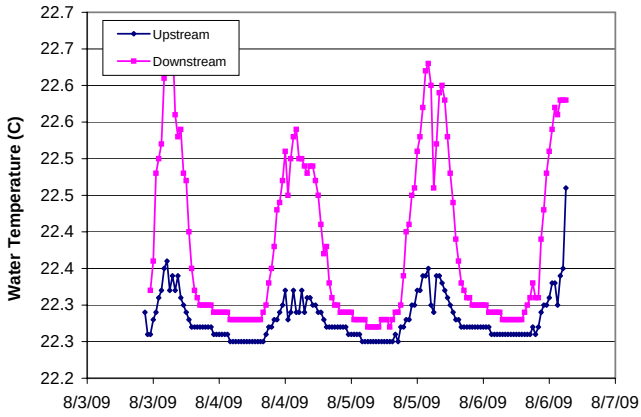
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	23.84	-5.83	29.67	0.80	5.56
Max	24.65	-5.14	30.65	0.83	5.76
Min	21.47	-7.04	28.51	0.75	5.22

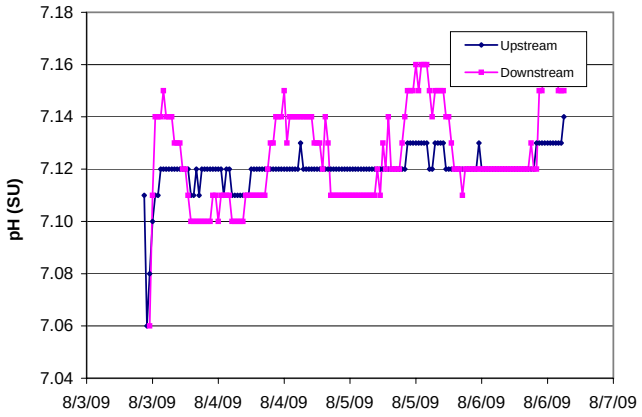
APPENDIX N

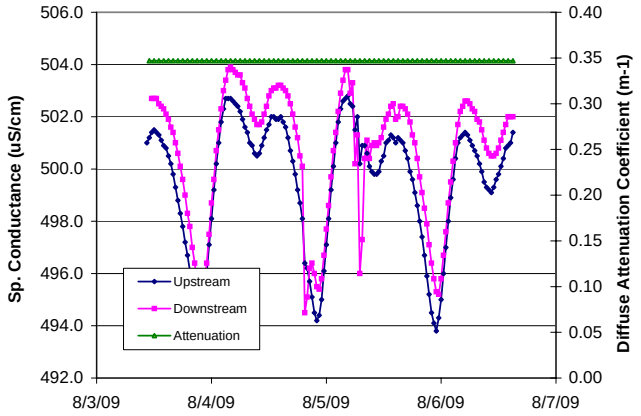
MANATEE SPRING - STN 2 to STN 3 METABOLISM ESTIMATES

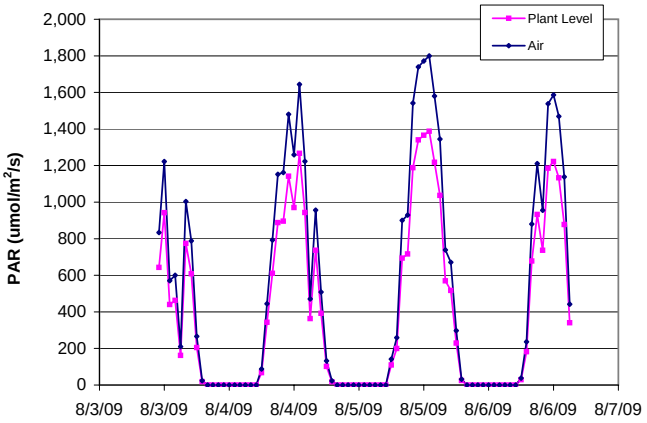
APPENDIX N

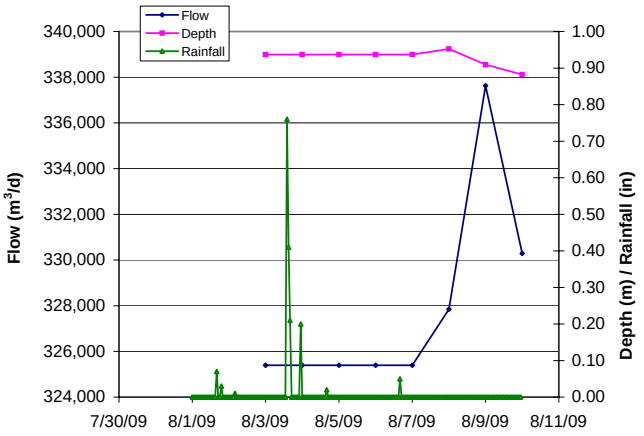
MANATEE SPRING - STN 2 to STN 3 METABOLISM SUMMARY



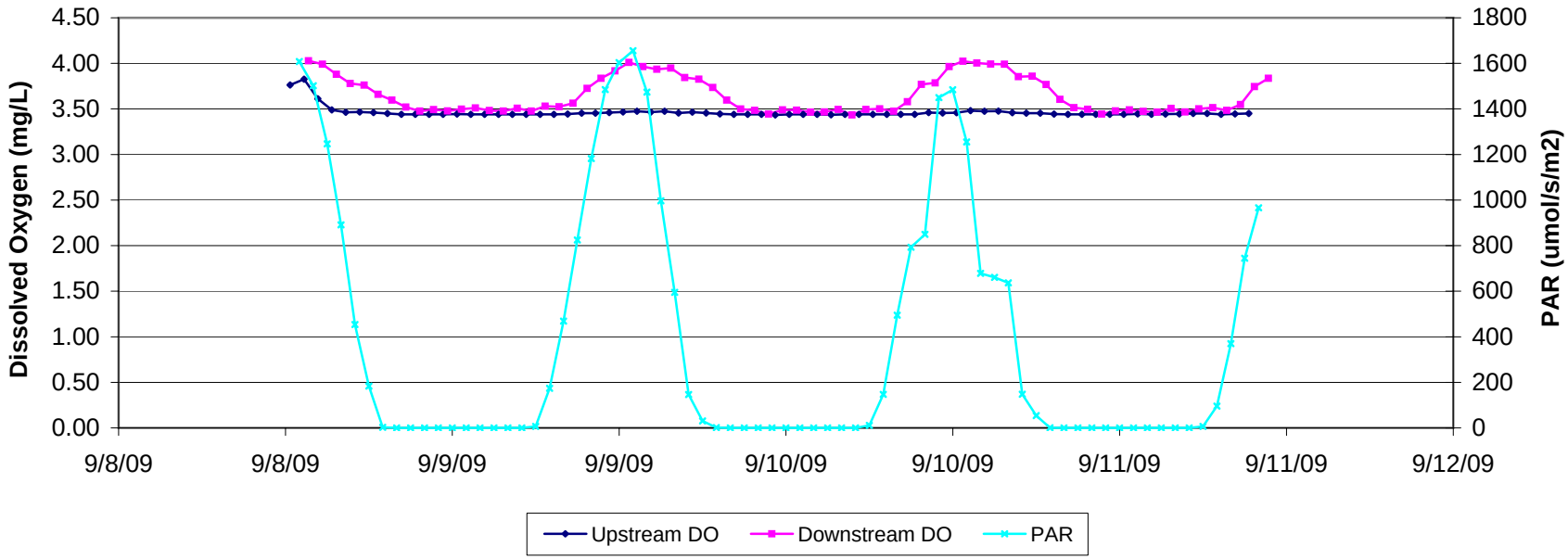






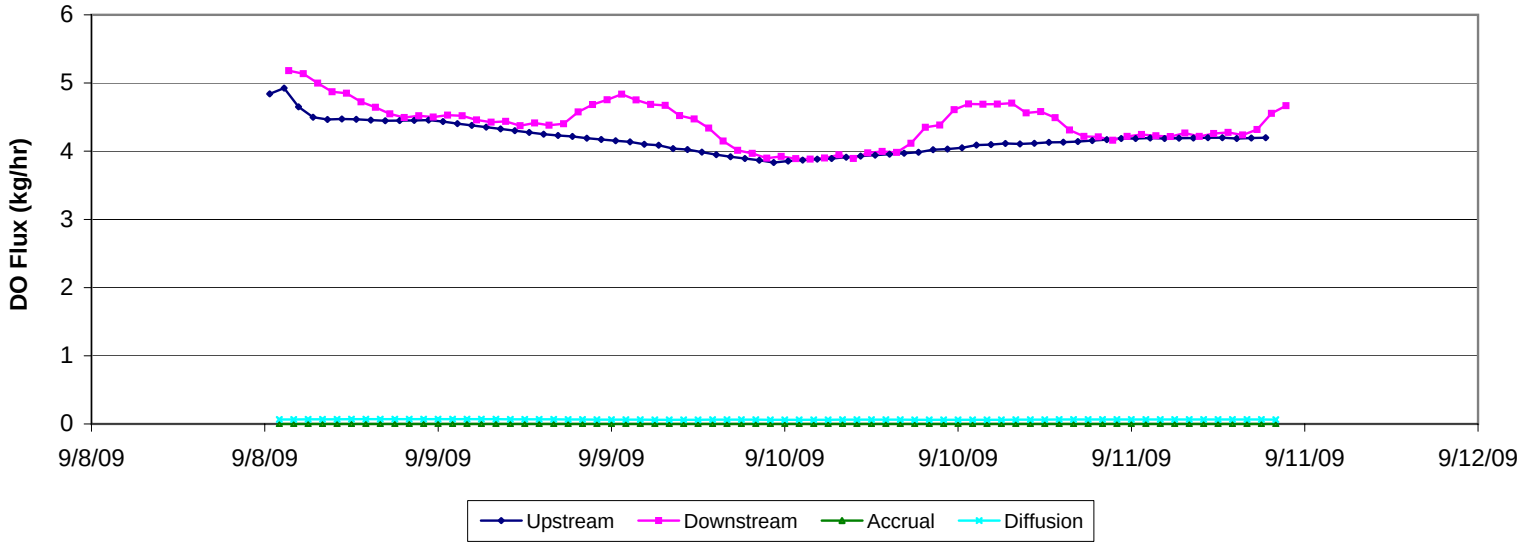


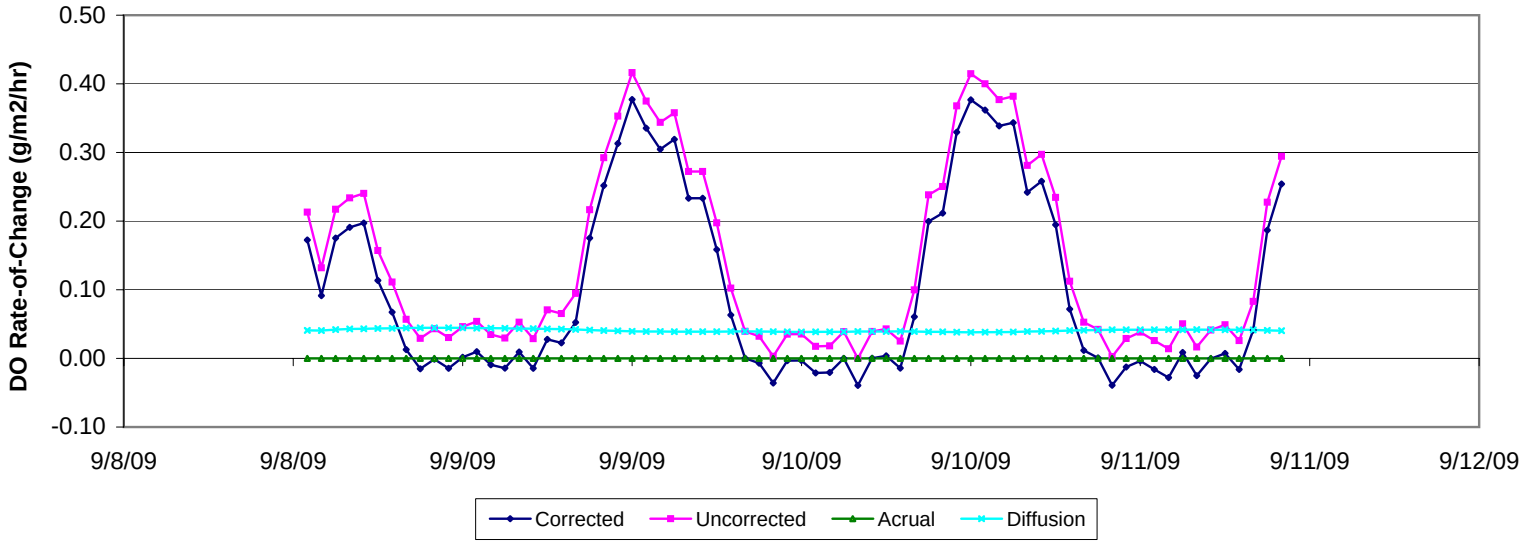
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	1.12	0.98	1.52	154
down		1.50	0.97	2.56	152
Wtr Temp - up	C	22.3	22.3	22.5	154
down		22.4	22.3	22.7	152
pH - up	SU	7.12	7.06	7.14	154
down		7.13	7.06	7.16	152
SpCond - up	uS/cm	500	494	503	154
down		501	495	504	152
Flow - up	m^3/d	327,841	325,395	337,627	8
Depth	m	0.93	0.88	0.95	8
Rainfall Total	in		1.76		
PAR - air	$umol/m^2/s$	477	0.0	1,892	216
plant		401	0.0	1387	77
DO rate chng	$g/m^2/hr$				
corr		-0.268	-2.782	1.806	77
uncorr		0.944	-1.502	2.927	77



APPENDIX N

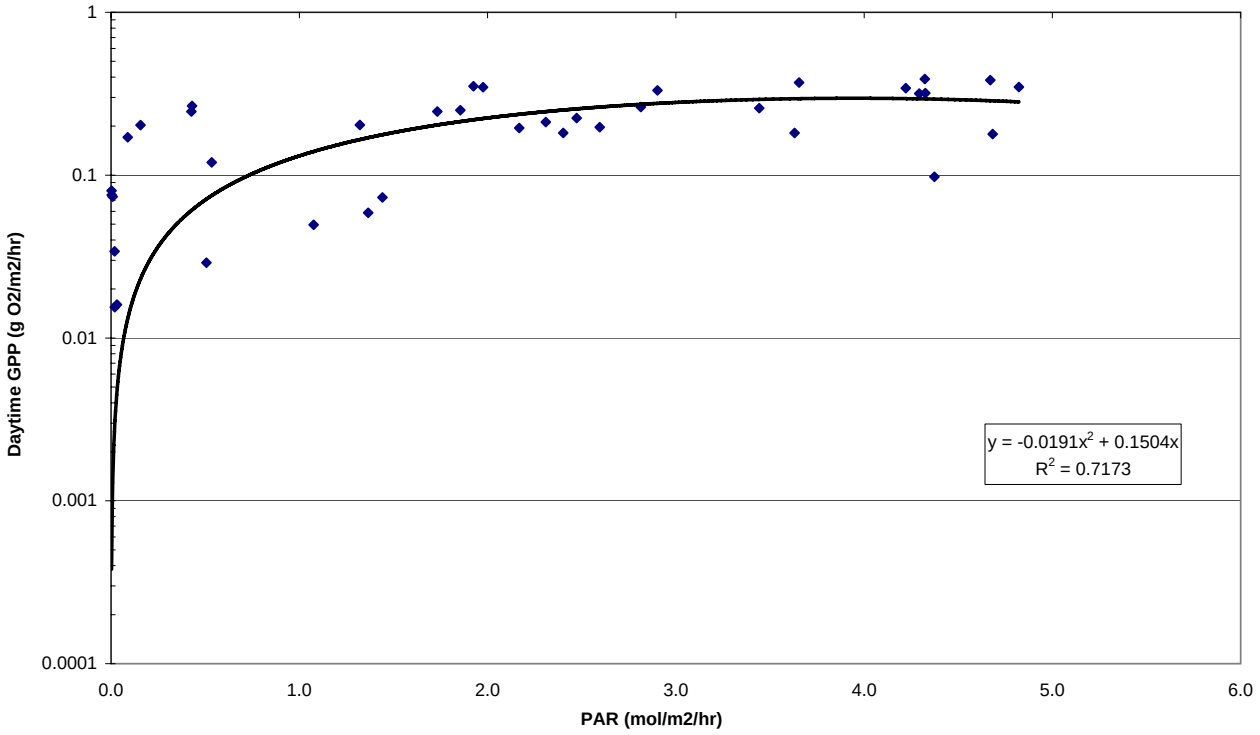
PONCE DELEON SPRING - MB to STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

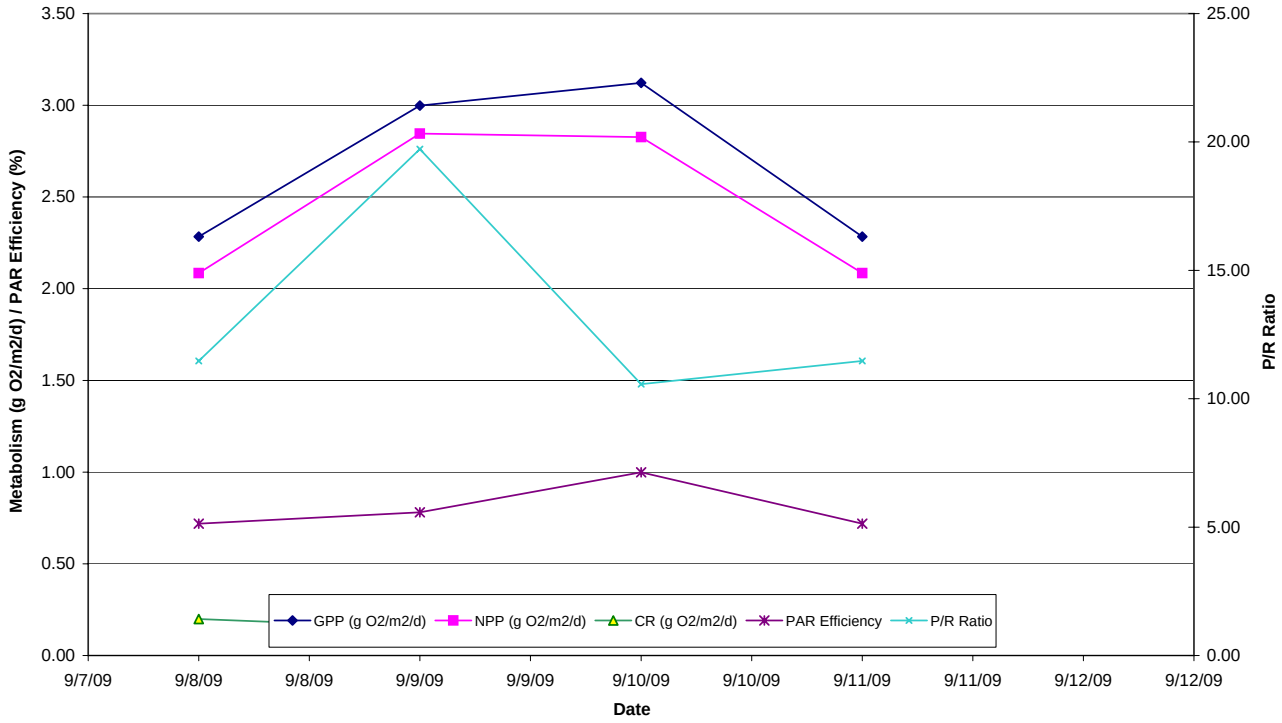




APPENDIX N

PONCE DELEON SPRING - MB to STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE



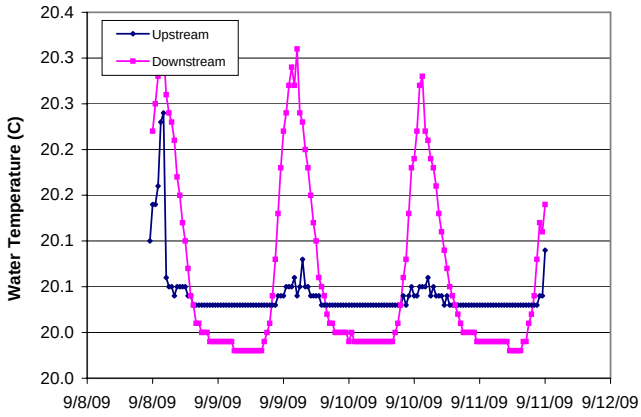


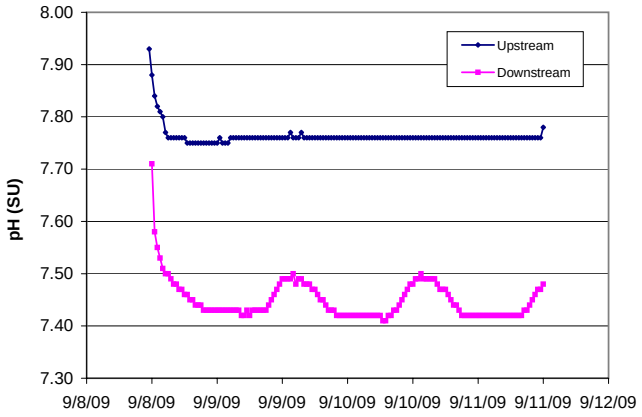
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	2.67	2.46	0.21	13.31	0.80
Max	3.12	2.85	0.30	19.72	1.00
Min	2.28	2.08	0.15	10.57	0.72

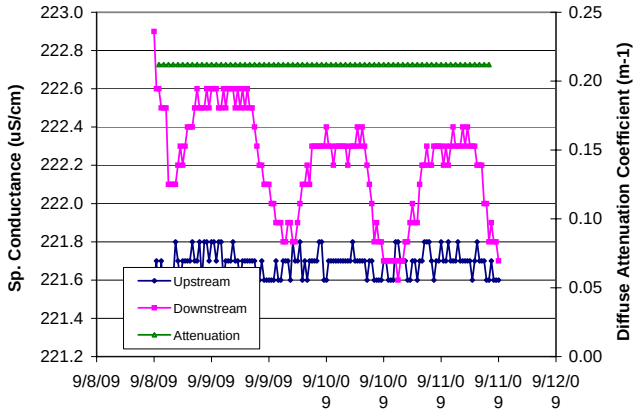
APPENDIX N
PONCE DELEON SPRING - MB to STN 2 METABOLISM ESTIMATES

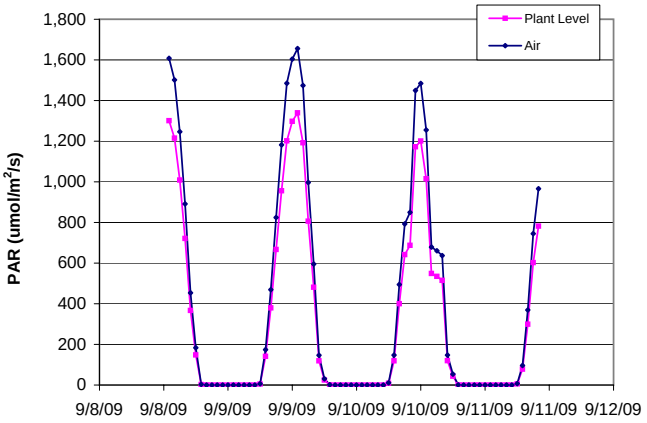
APPENDIX N

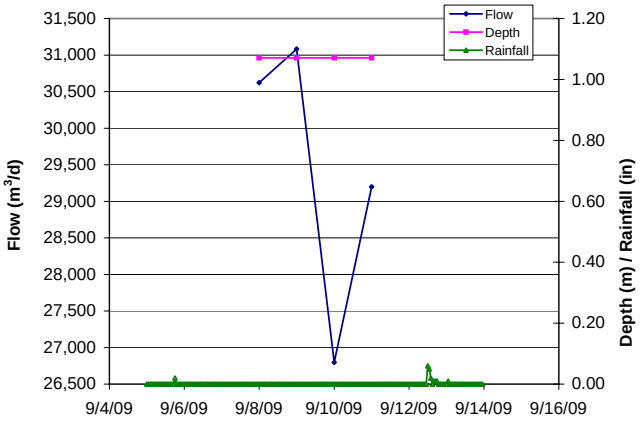
PONCE DELEON SPRING - MB to STN 2 METABOLISM SUMMARY



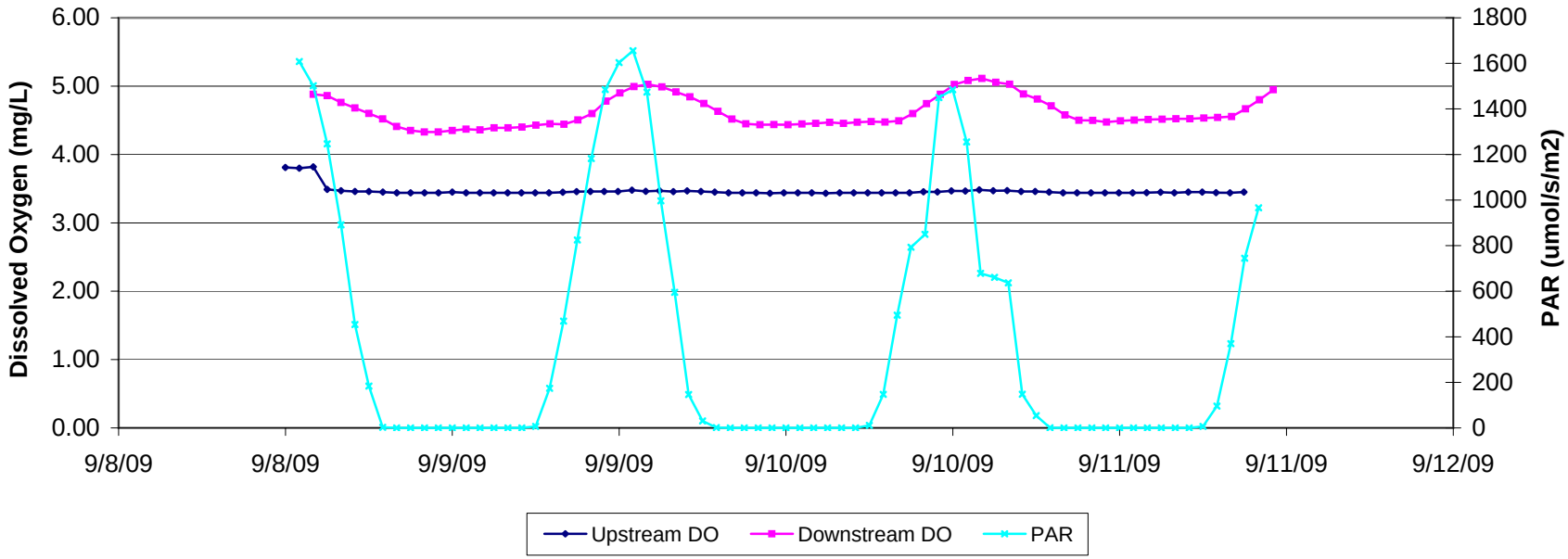






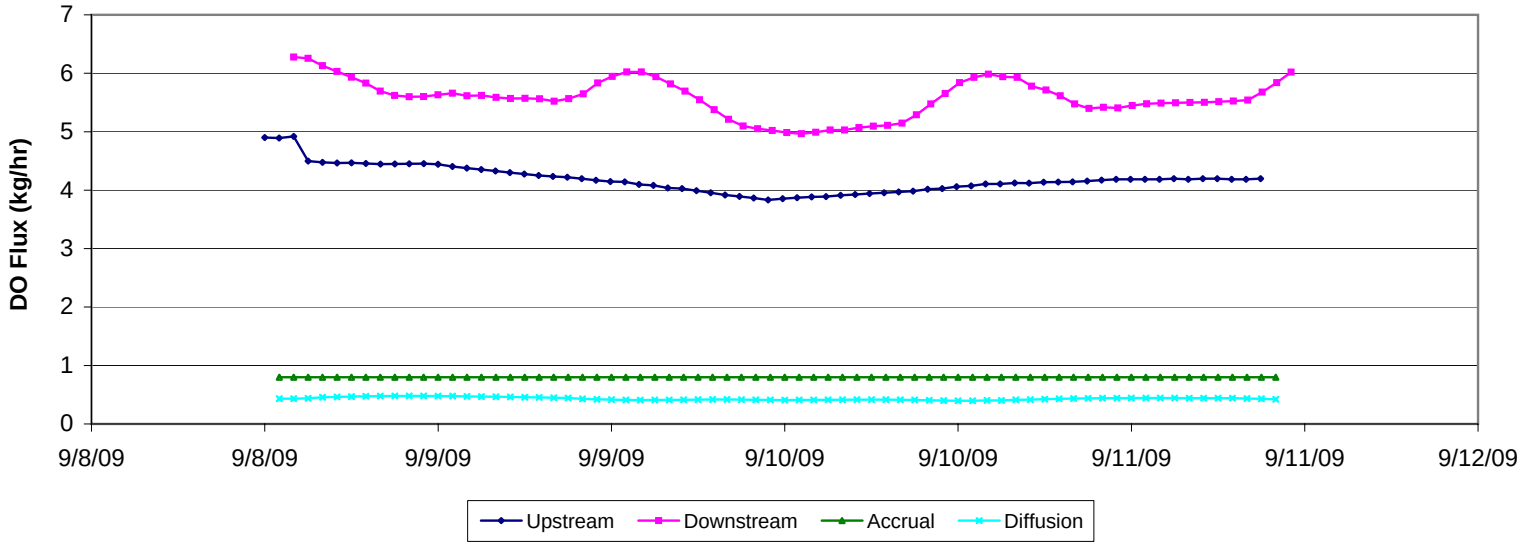


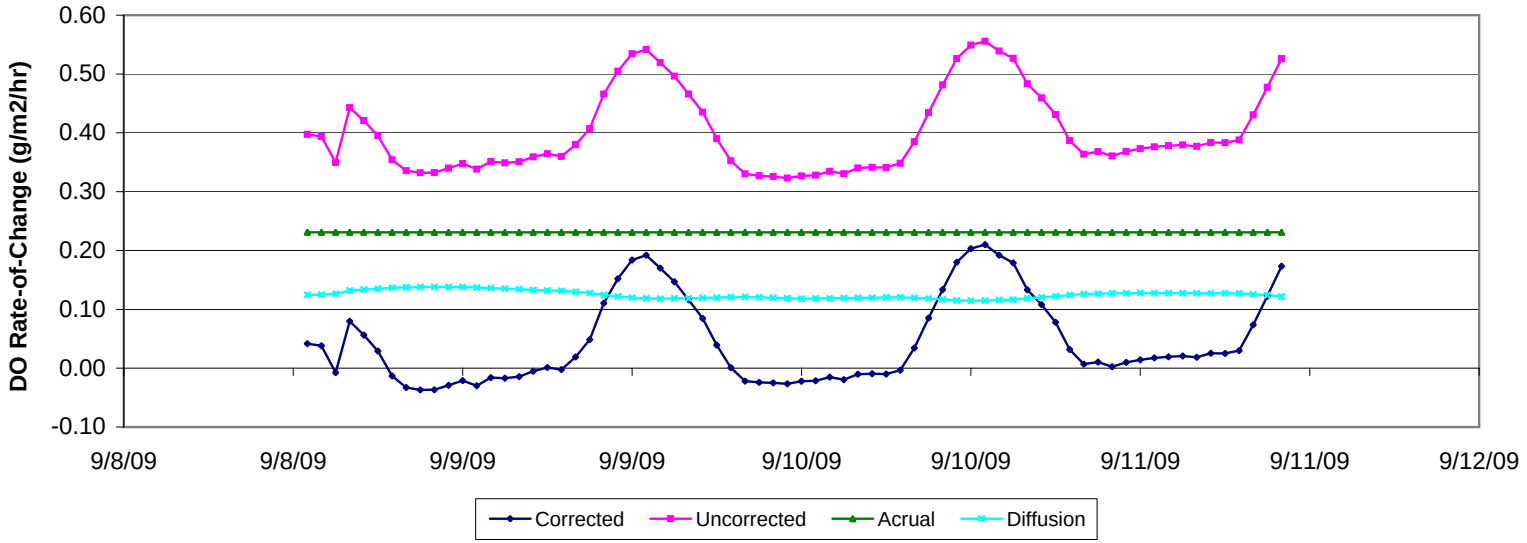
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.47	3.43	3.84	146
down		3.66	3.41	4.17	145
Wtr Temp - up	C	20.0	20.0	20.2	146
down		20.1	20.0	20.3	145
pH - up	SU	7.76	7.75	7.93	146
down		7.45	7.41	7.71	145
SpCond - up	uS/cm	222	221	222	146
down		222	222	223	145
Flow - up	m^3/d	29,425	26,798	31,083	4
Depth	m	1.07	1.07	1.07	4
Rainfall Total	in		0.19		
PAR - air	$umol/m^2/s$	358	0.0	1,656	216
plant		316	0.0	1339	70
DO rate chng	$g/m^2/hr$				
corr		0.101	-0.039	0.377	70
uncorr		0.142	0.000	0.416	70



APPENDIX N

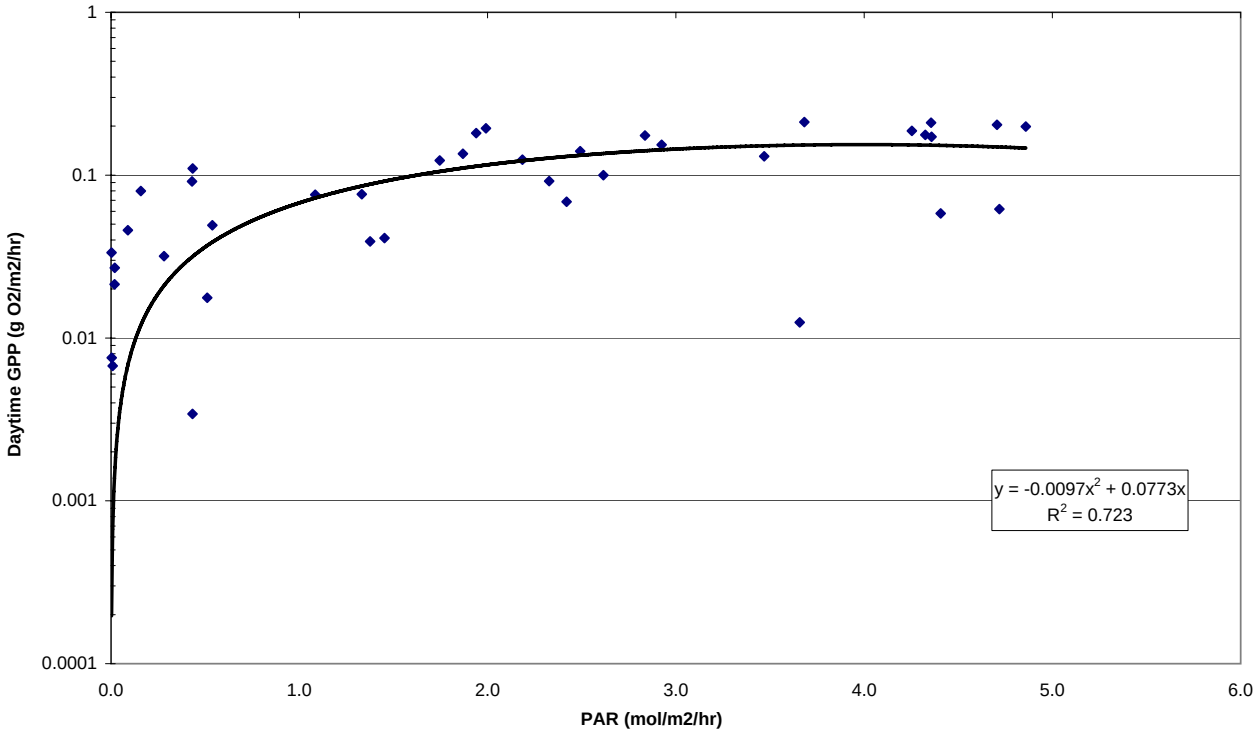
PONCE DELEON SPRING - MB to STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

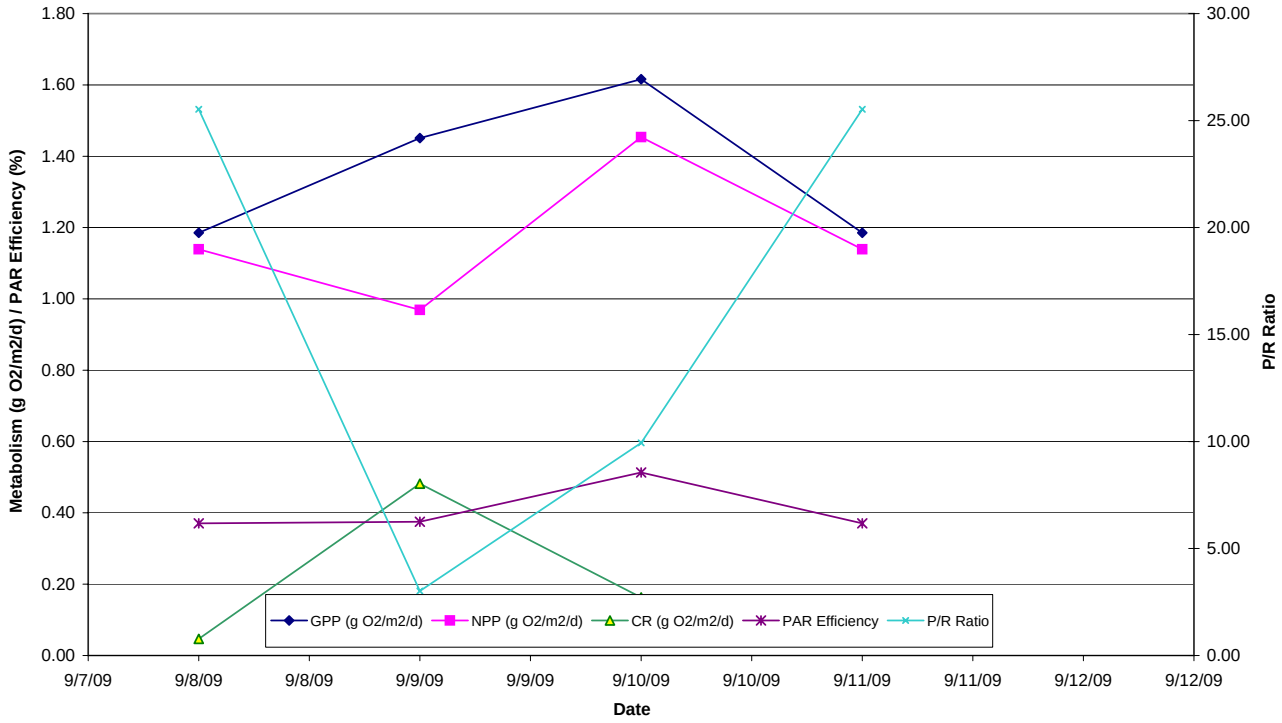




APPENDIX N

PONCE DELEON SPRING - MB to STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





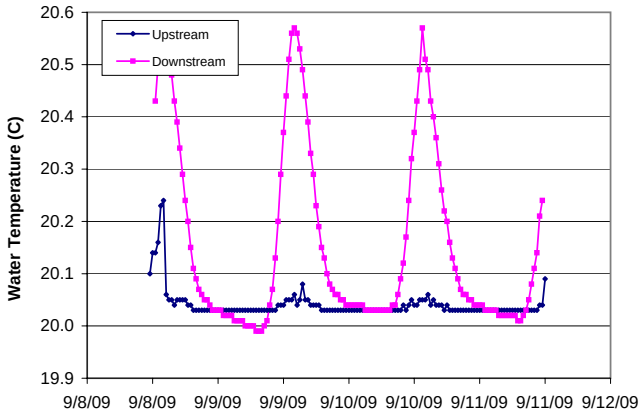
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	1.36	1.18	0.18	16.00	0.41
Max	1.62	1.45	0.48	25.53	0.51
Min	1.19	0.97	0.05	3.01	0.37

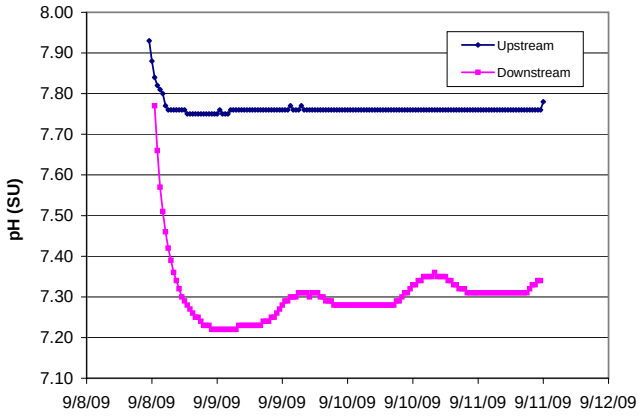
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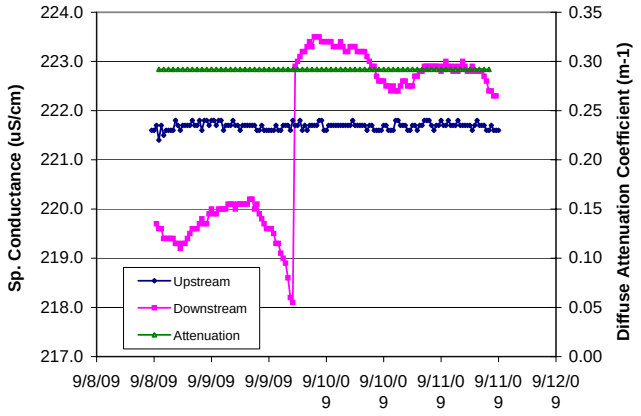
PONCE DELEON SPRING - MB to STN 3 METABOLISM ESTIMATES

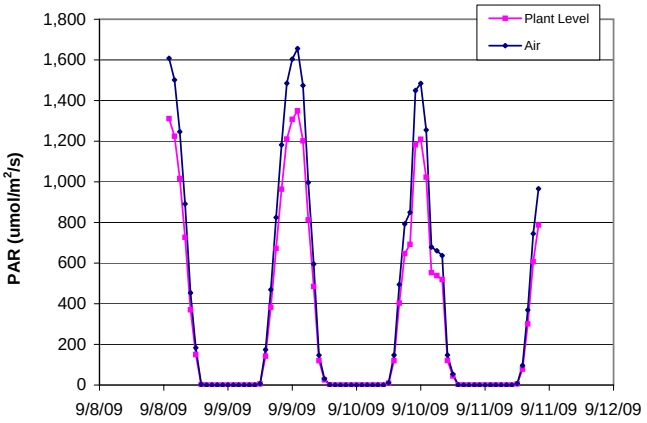
APPENDIX N

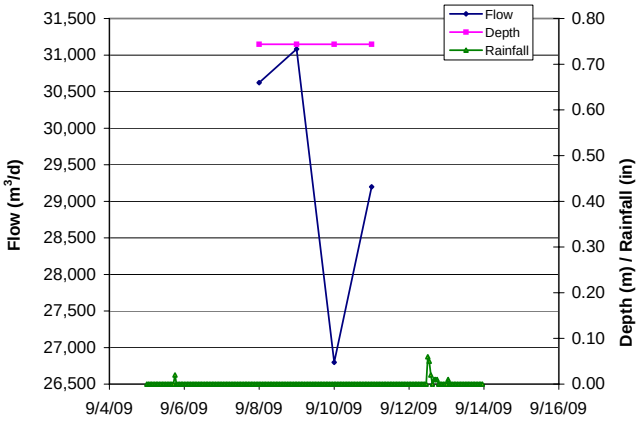
PONCE DELEON SPRING - MB to STN 3 METABOLISM SUMMARY



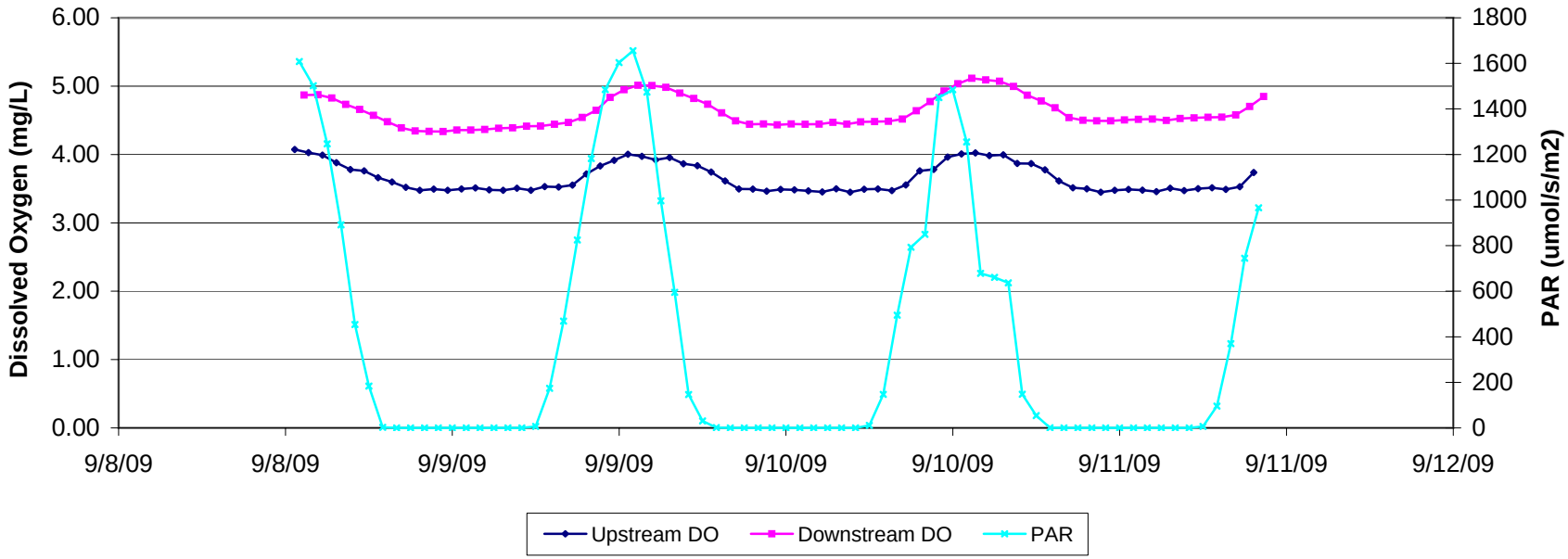






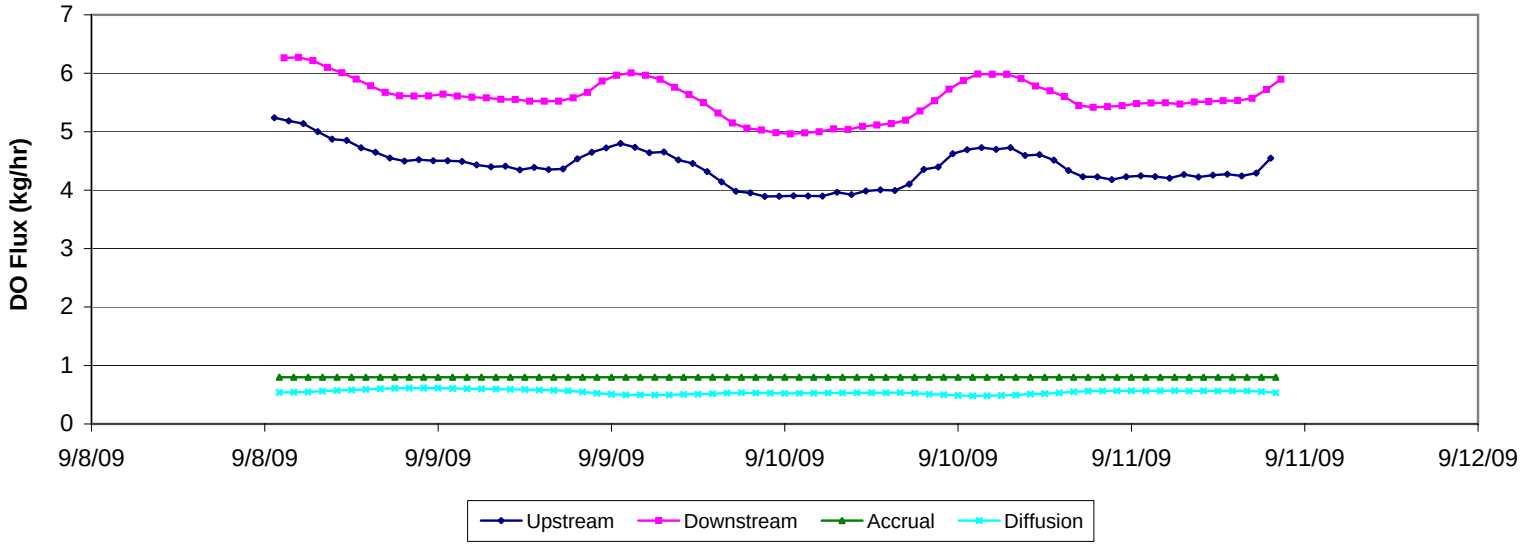


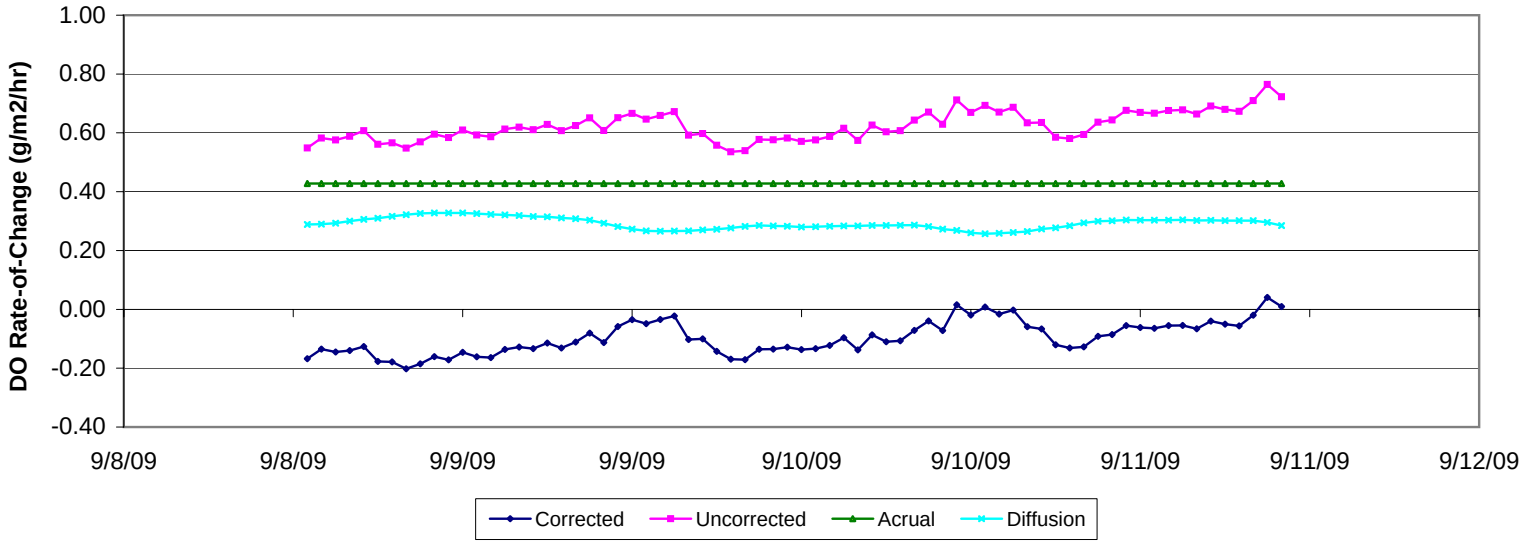
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.47	3.43	3.84	146
down		4.63	4.33	5.13	143
Wtr Temp - up	C	20.0	20.0	20.2	146
down		20.2	20.0	20.6	143
pH - up	SU	7.76	7.75	7.93	146
down		7.30	7.22	7.77	143
SpCond - up	uS/cm	222	221	222	146
down		222	218	224	143
Flow - up	m^3/d	29,425	26,798	31,083	4
Depth	m	0.74	0.74	0.74	4
Rainfall Total	in		0.19		
PAR - air	$umol/m^2/s$	358	0.0	1,656	216
plant		319	0.0	1350	70
DO rate chng	$g/m^2/hr$				
corr		0.045	-0.037	0.210	70
uncorr		0.401	0.323	0.556	70



APPENDIX N

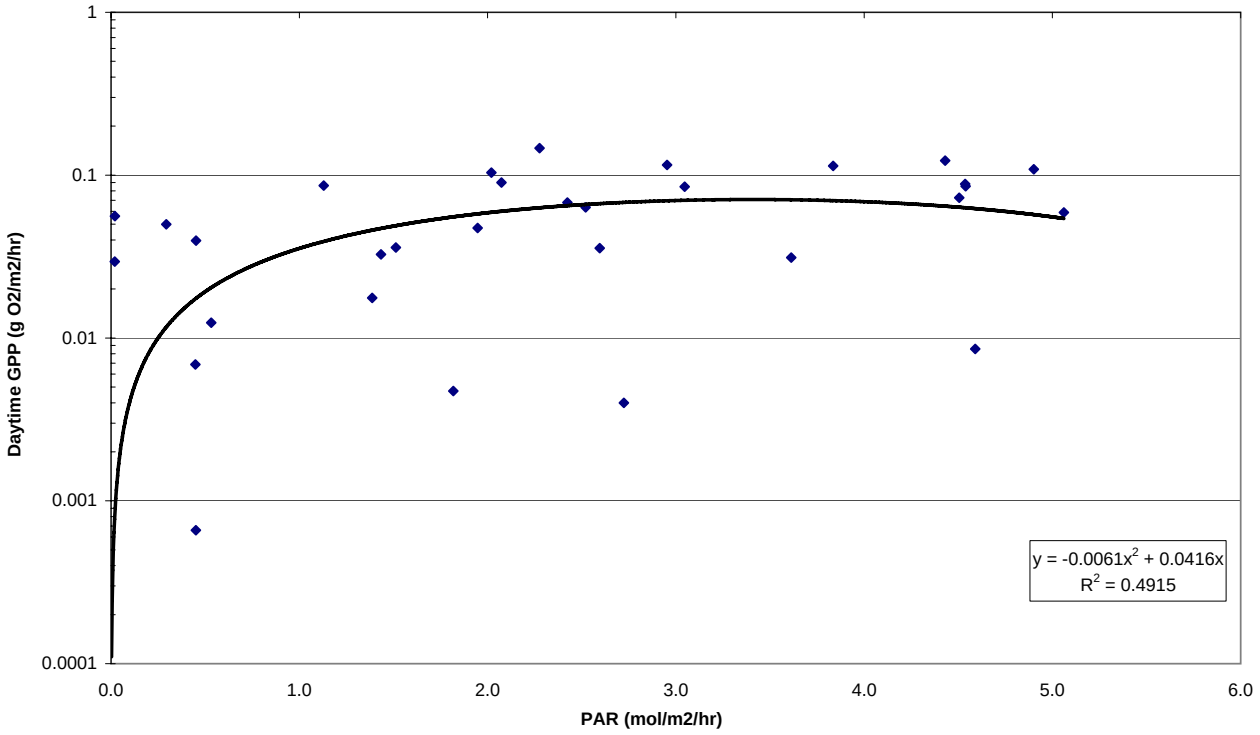
PONCE DELEON SPRING - STN 2 to STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

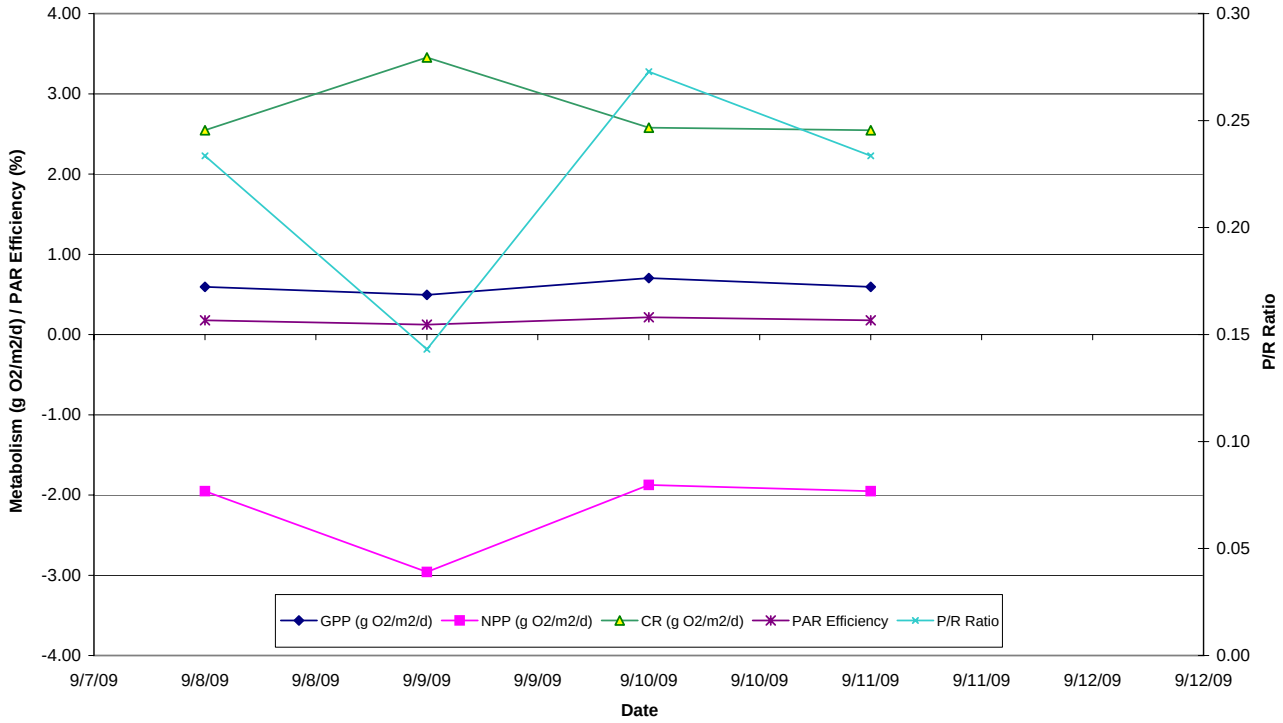




APPENDIX N

PONCE DELEON SPRING - STN 2 to STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





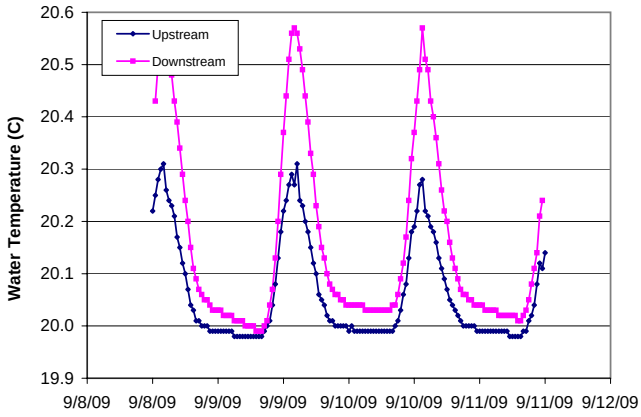
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	0.60	-2.18	2.78	0.22	0.17
Max	0.70	-1.87	3.45	0.27	0.21
Min	0.49	-2.96	2.55	0.14	0.12

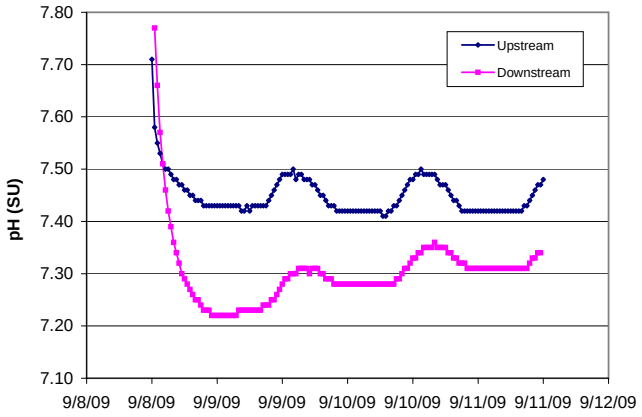
APPENDIX N

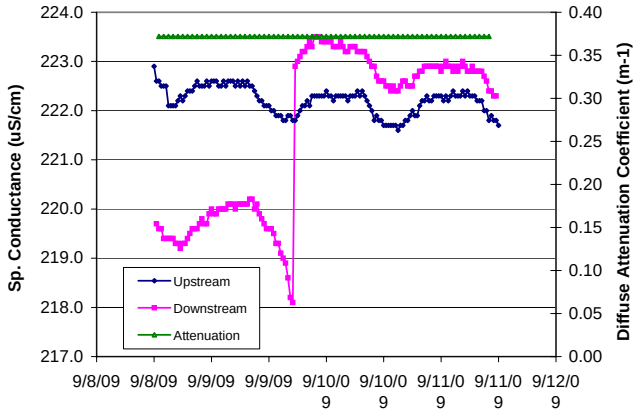
PONCE DELEON SPRING - STN 2 to STN 3 METABOLISM ESTIMATES

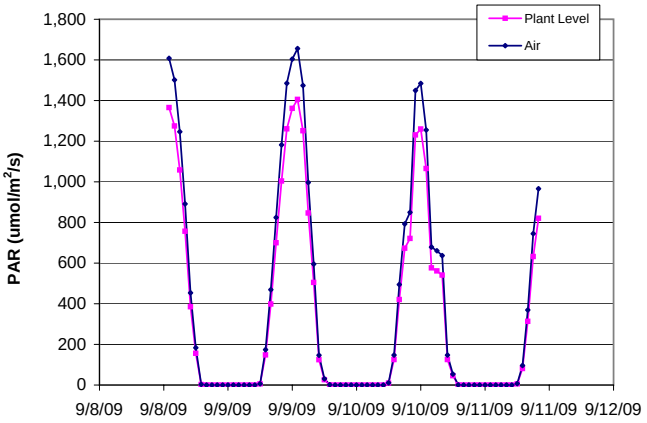
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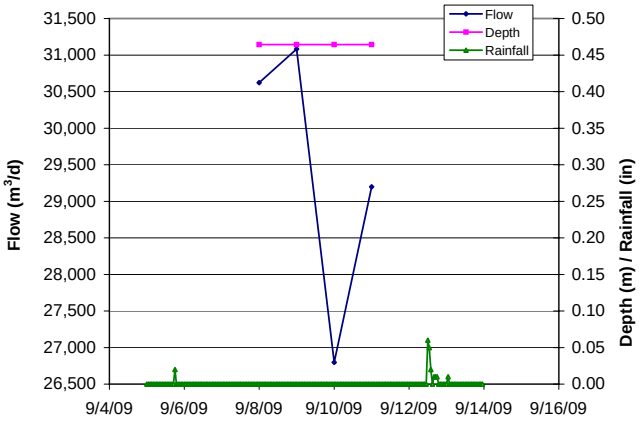
PONCE DELEON SPRING - STN 2 to STN 3 METABOLISM SUMMARY



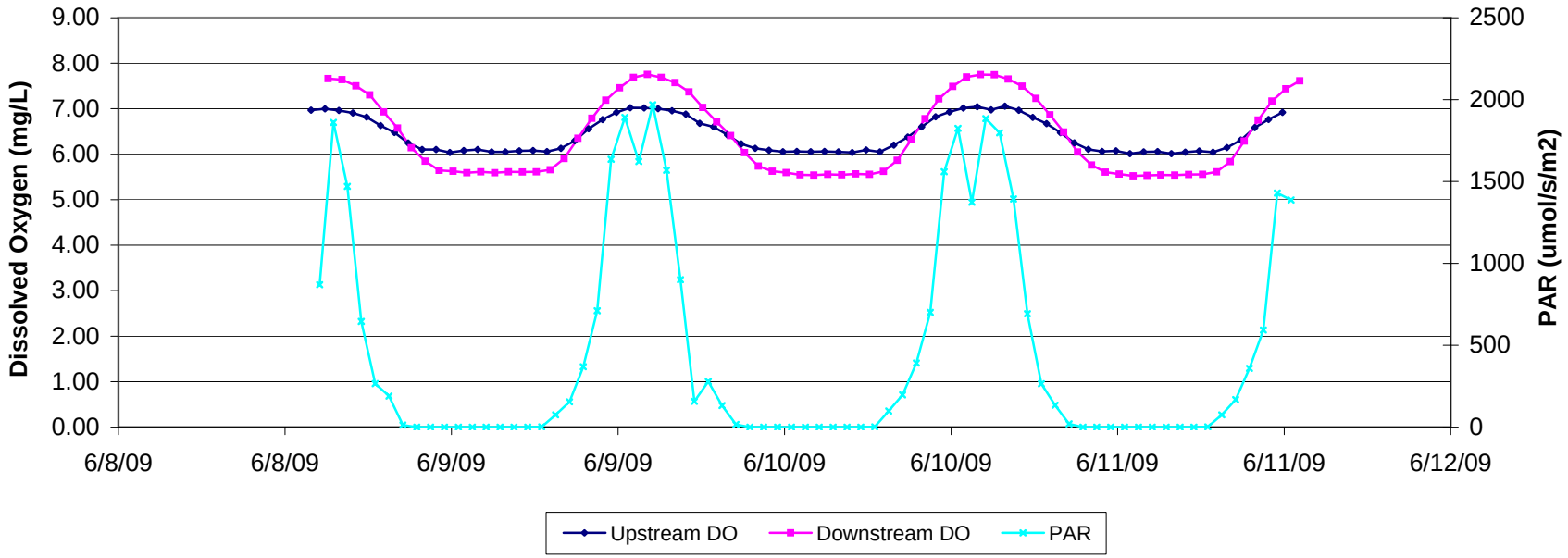






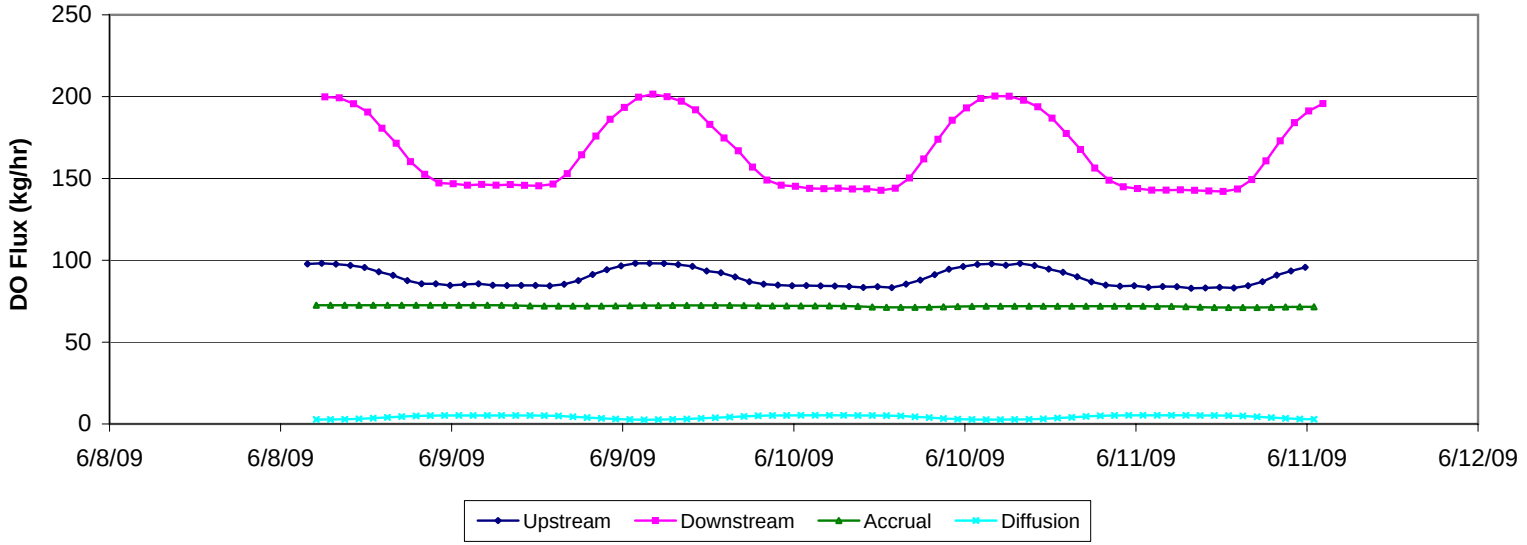


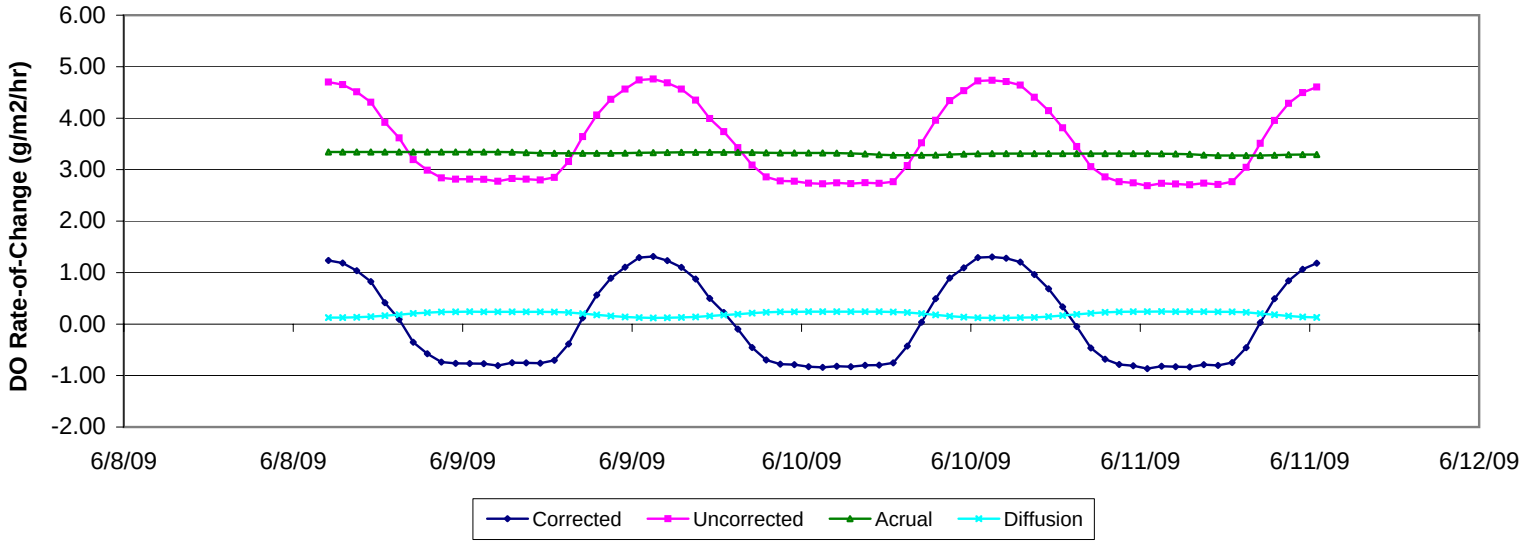
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.66	3.41	4.17	145
down		4.63	4.33	5.13	143
Wtr Temp - up	C	20.1	20.0	20.3	145
down		20.2	20.0	20.6	143
pH - up	SU	7.45	7.41	7.71	145
down		7.30	7.22	7.77	143
SpCond - up	uS/cm	222	222	223	145
down		222	218	224	143
Flow - up	m^3/d	29,425	26,798	31,083	4
Depth	m	0.46	0.46	0.46	4
Rainfall Total	in		0.19		
PAR - air	$umol/m^2/s$	358	0.0	1,656	216
plant		332	0.0	1406	70
DO rate chng	$g/m^2/hr$				
corr		-0.097	-0.202	0.040	70
uncorr		0.623	0.535	0.764	70



APPENDIX N

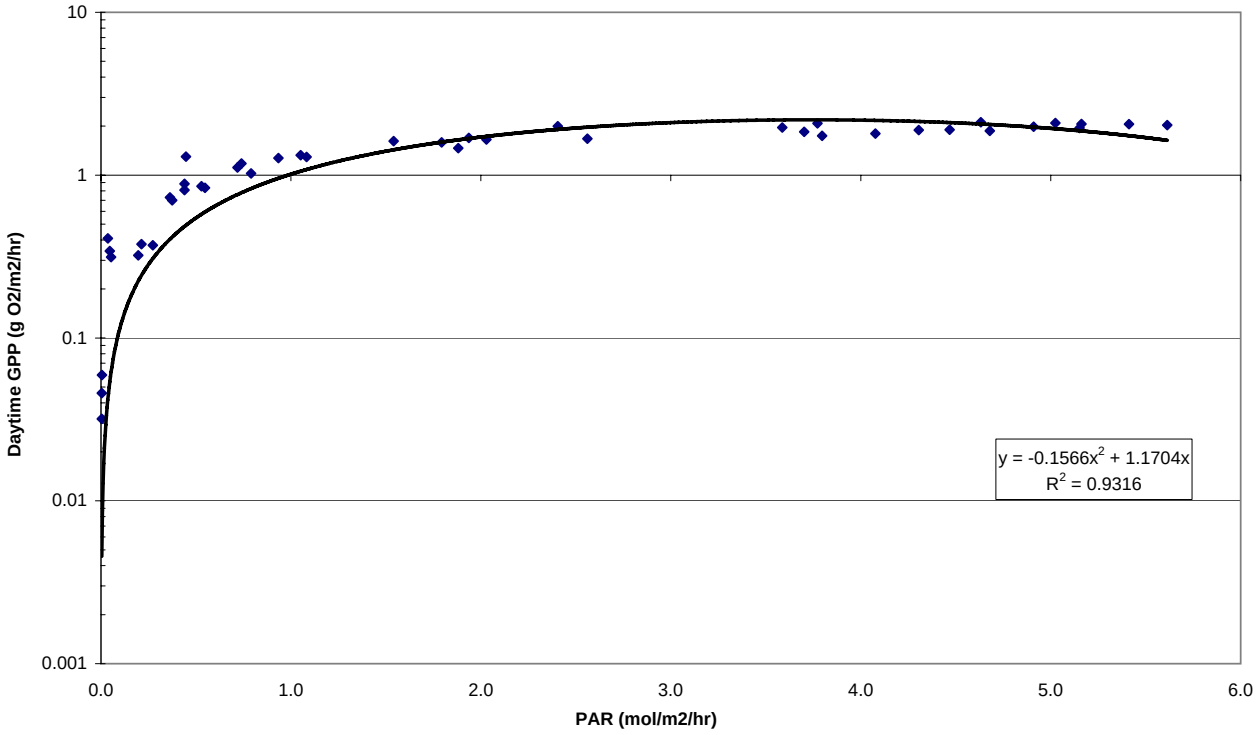
RAINBOW SPRINGS - MAIN BOIL TO STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

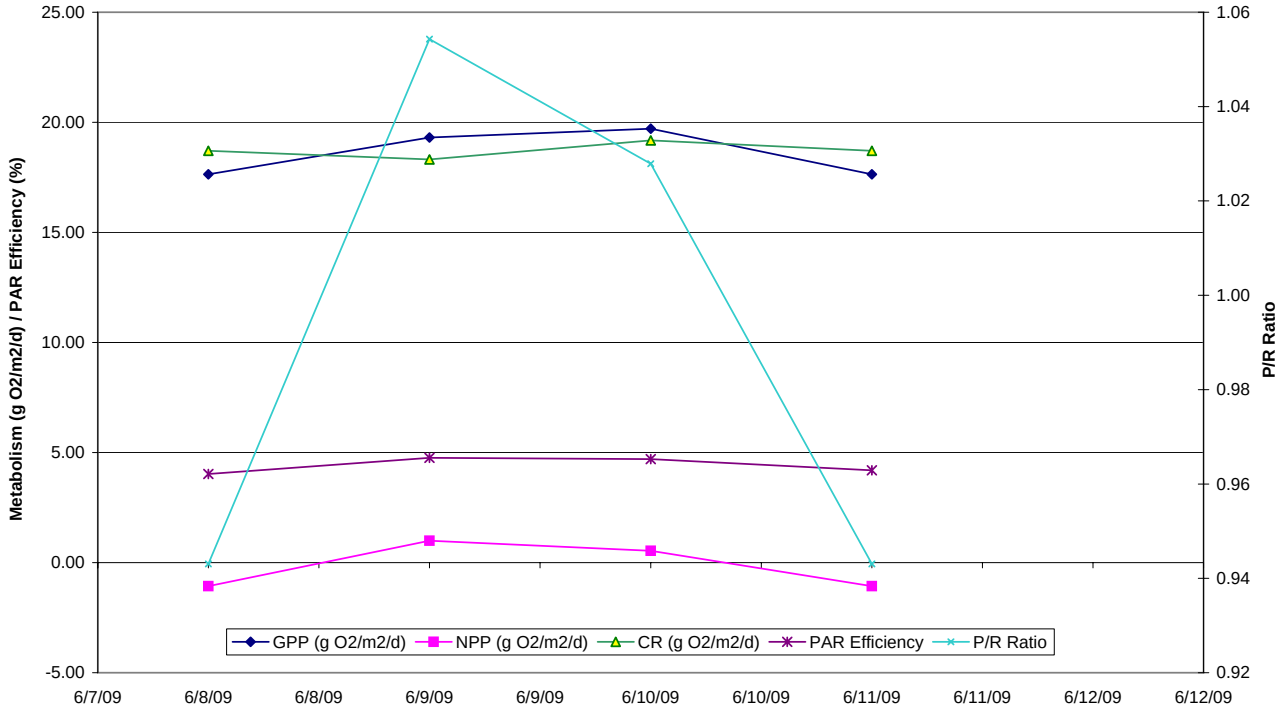




APPENDIX N

RAINBOW SPRINGS - MAIN BOIL TO STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





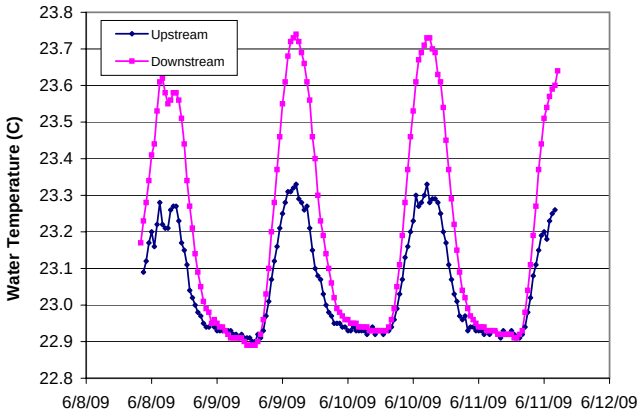
Stats	GPP (g $O_2/m^2/d$)	NPP (g $O_2/m^2/d$)	CR (g $O_2/m^2/d$)	P/R ratio	PAR Eff. (%)
Avg	18.58	-0.15	18.73	0.99	4.42
Max	19.71	0.99	19.18	1.05	4.76
Min	17.64	-1.06	18.31	0.94	4.03

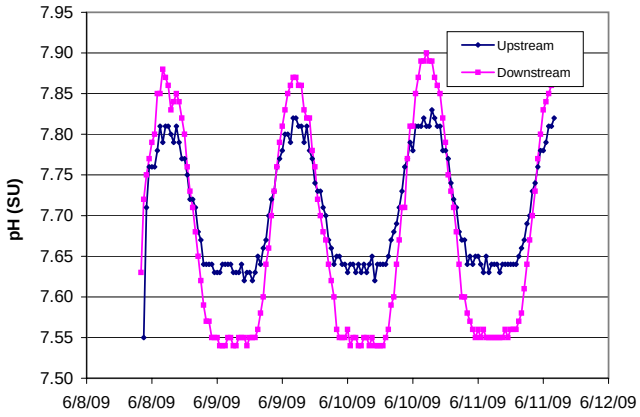
APPENDIX N

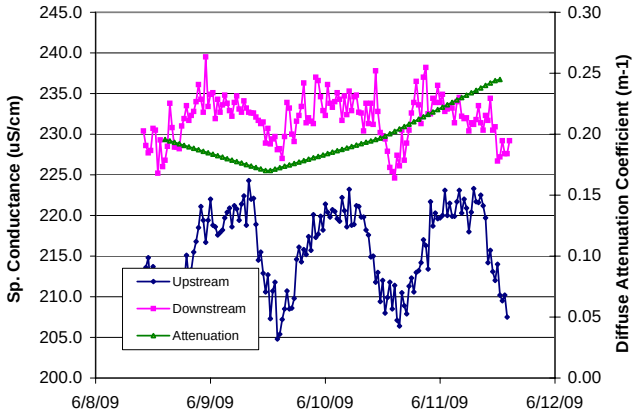
RAINBOW SPRINGS - MAIN BOIL TO STN 2 METABOLISM ESTIMATES

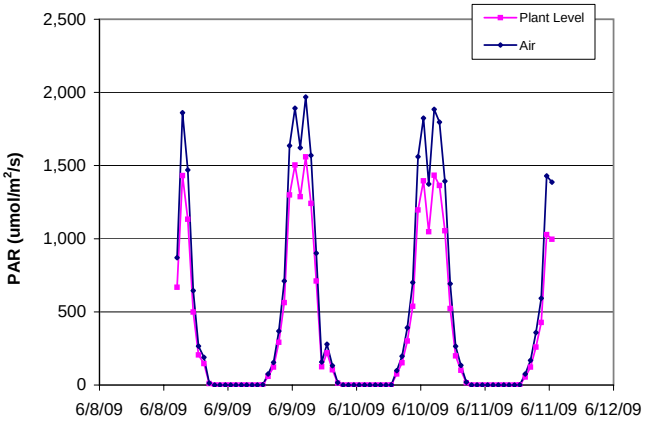
APPENDIX N

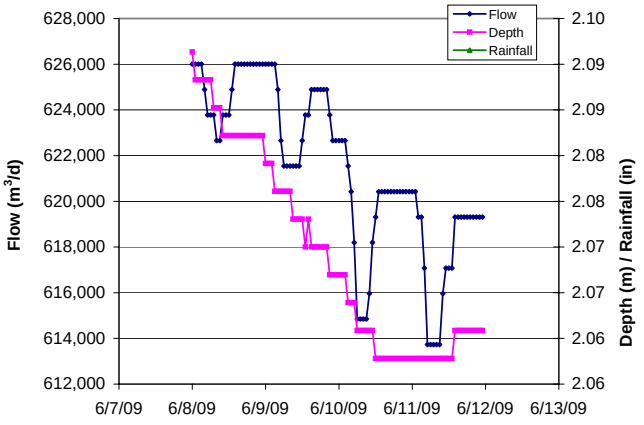
RAINBOW SPRINGS - MAIN BOIL TO STN 2 METABOLISM SUMMARY



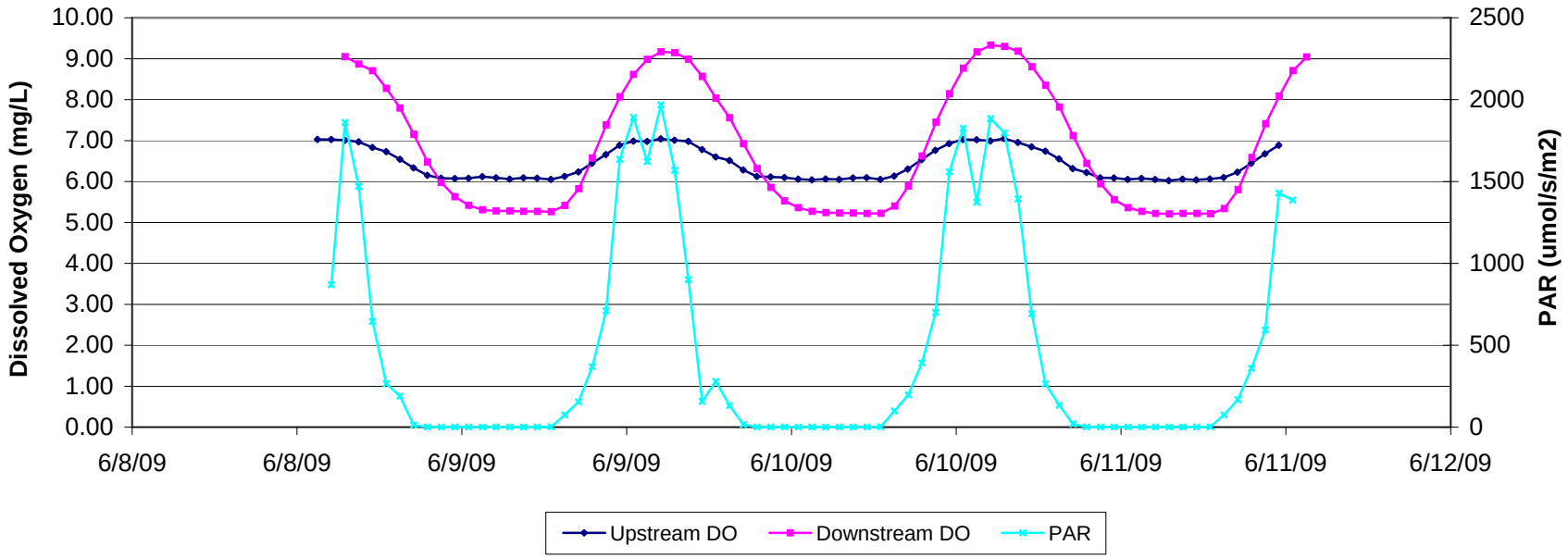






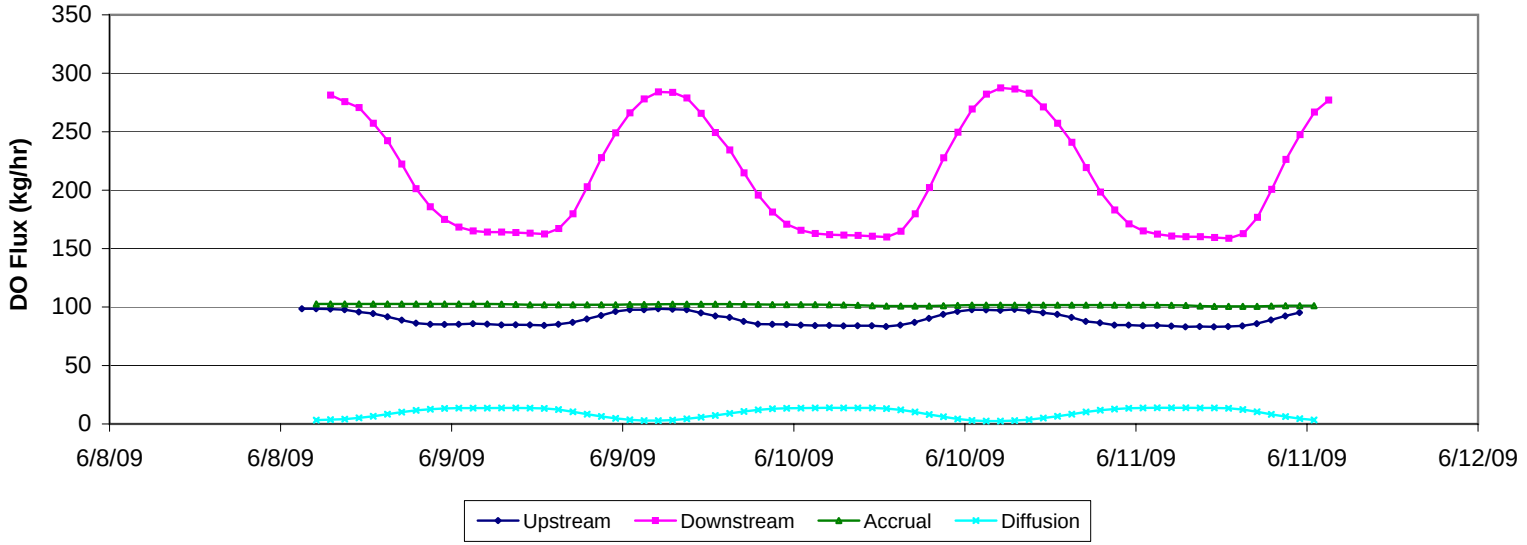


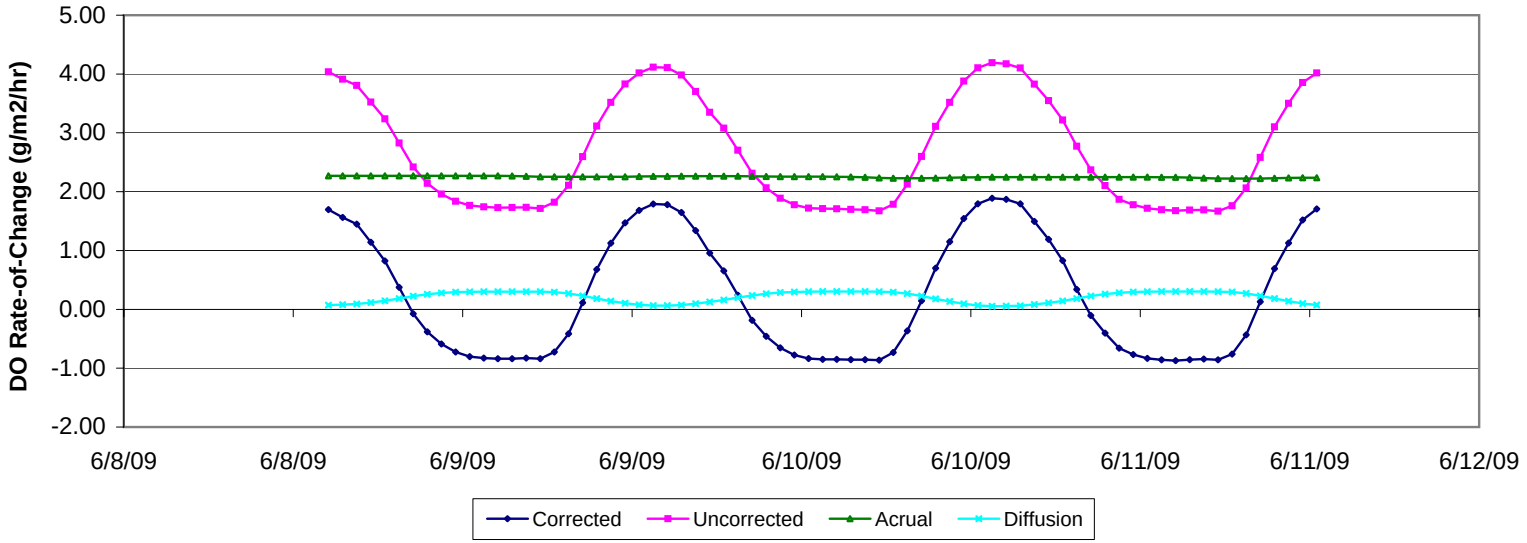
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	6.46	6.00	7.06	153
down		6.49	5.51	7.77	154
Wtr Temp - up	C	23.1	22.9	23.3	152
down		23.2	22.9	23.7	154
pH - up	SU	7.71	7.55	7.83	152
down		7.68	7.54	7.90	154
SpCond - up	uS/cm	216	205	224	152
down		232	225	240	154
Flow - up	m^3/d	621,485	613,732	626,006	96
Depth	m	2.07	2.06	2.09	96
Rainfall Total	in		0		
PAR - air	umol/m^2/s	528	0.0	2,003	302
plant		359	0.0	1559	71
DO rate chng	g/m^2/hr				
corr		0.017	-0.866	1.312	71
uncorr		3.527	2.688	4.761	71



APPENDIX N

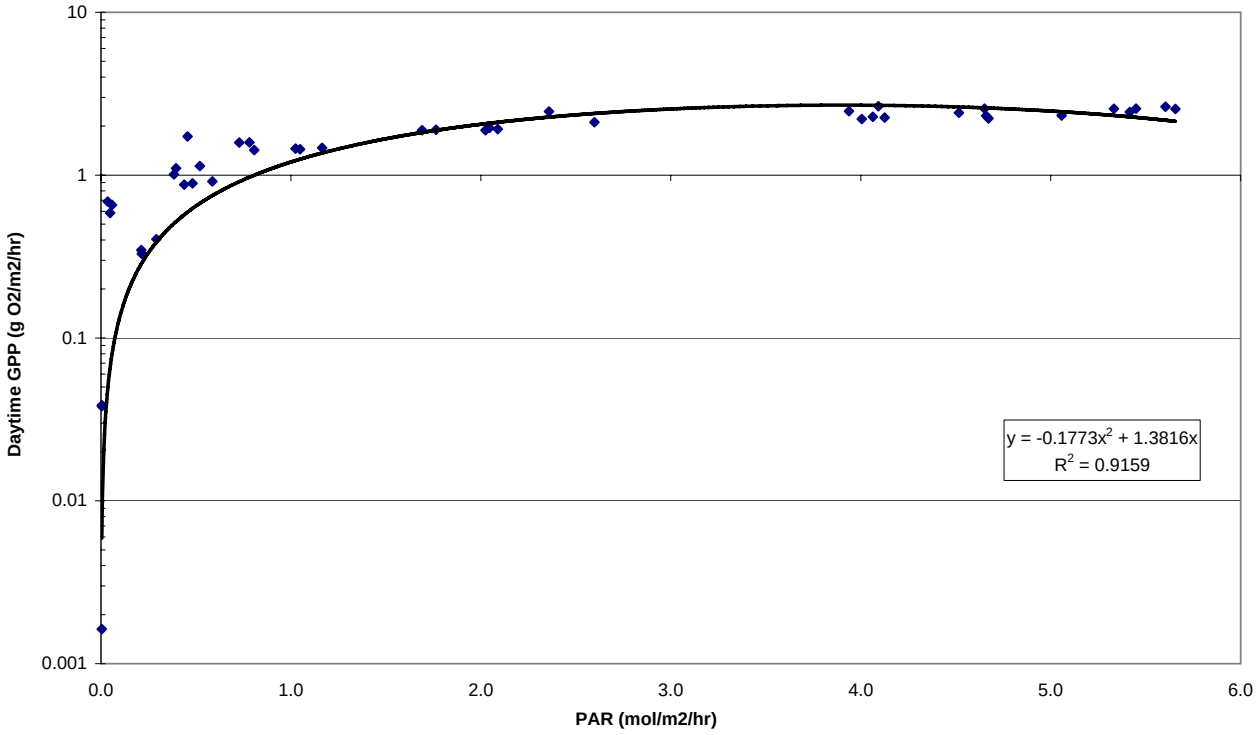
RAINBOW SPRINGS - MAIN BOIL TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

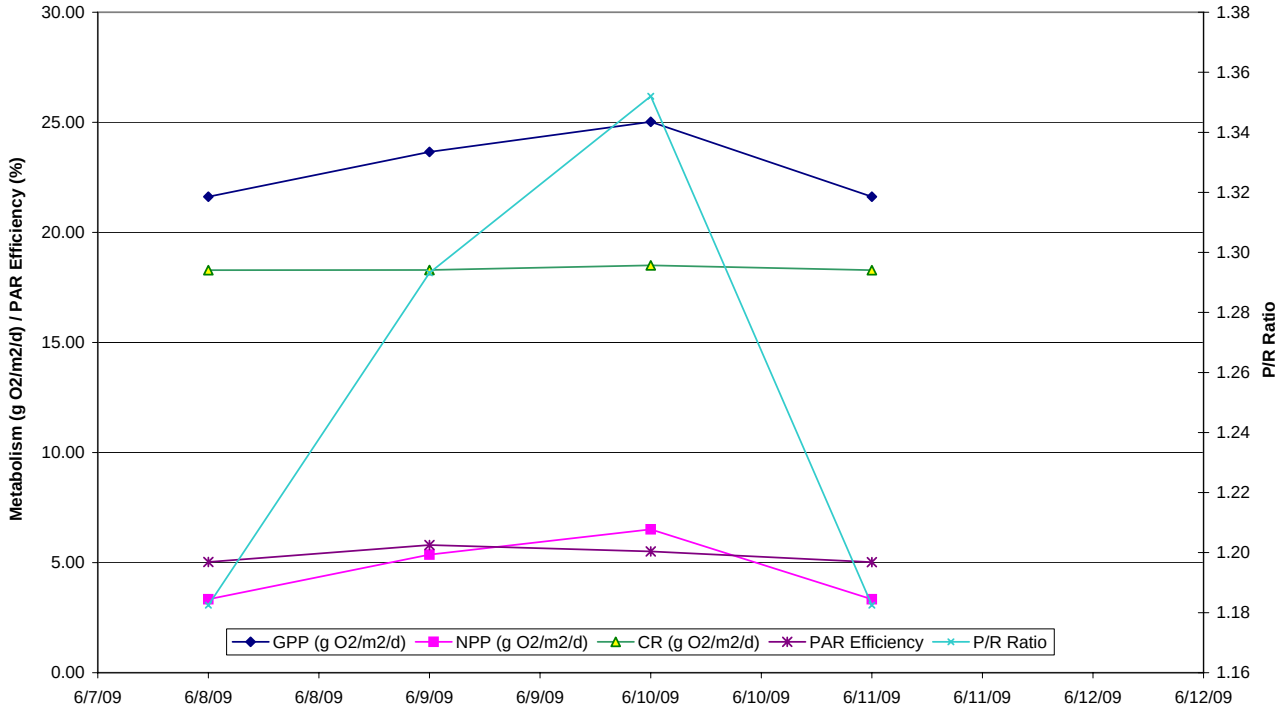




APPENDIX N

RAINBOW SPRINGS - MAIN BOIL TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





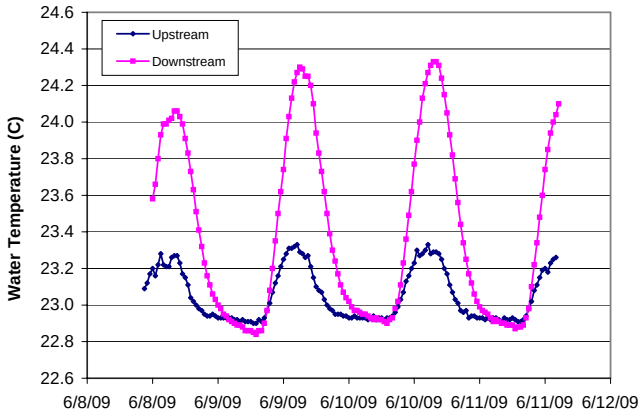
Stats	GPP (g $O_2/m^2/d$)	NPP (g $O_2/m^2/d$)	CR (g $O_2/m^2/d$)	P/R ratio	PAR Eff. (%)
Avg	22.98	4.64	18.34	1.25	5.34
Max	25.02	6.51	18.51	1.35	5.80
Min	21.62	3.34	18.28	1.18	5.02

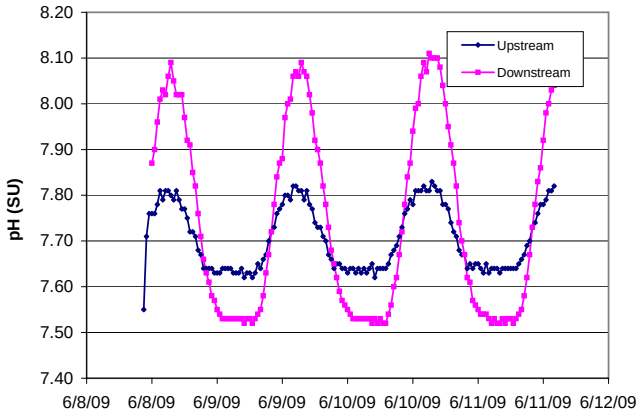
APPENDIX N

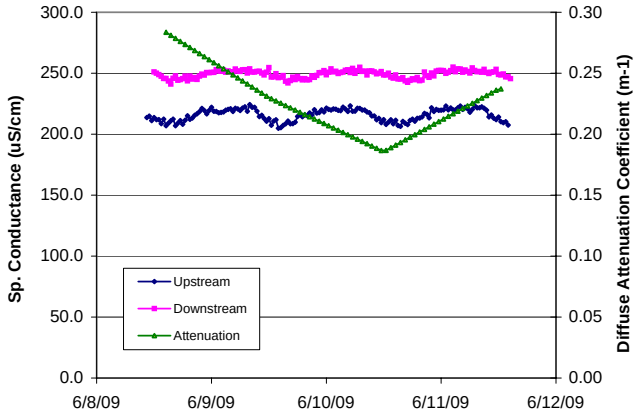
RAINBOW SPRINGS - MAIN BOIL TO STN 3 METABOLISM ESTIMATES

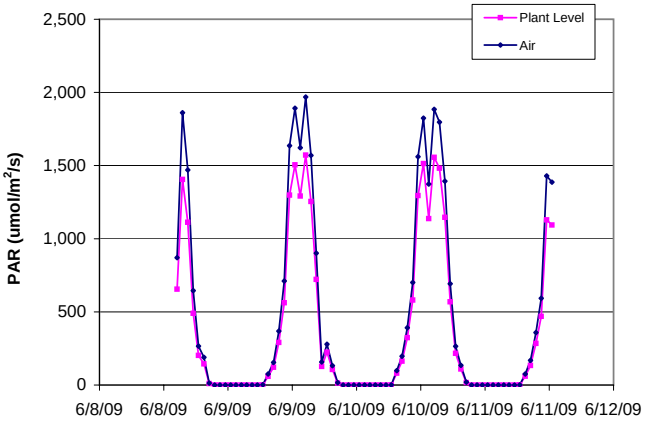
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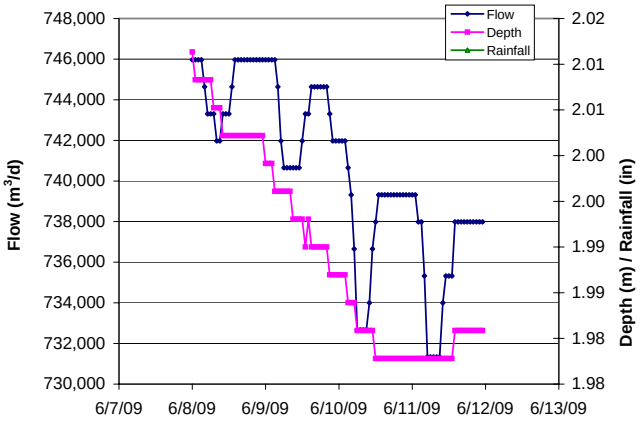
RAINBOW SPRINGS - MAIN BOIL TO STN 3 METABOLISM SUMMARY



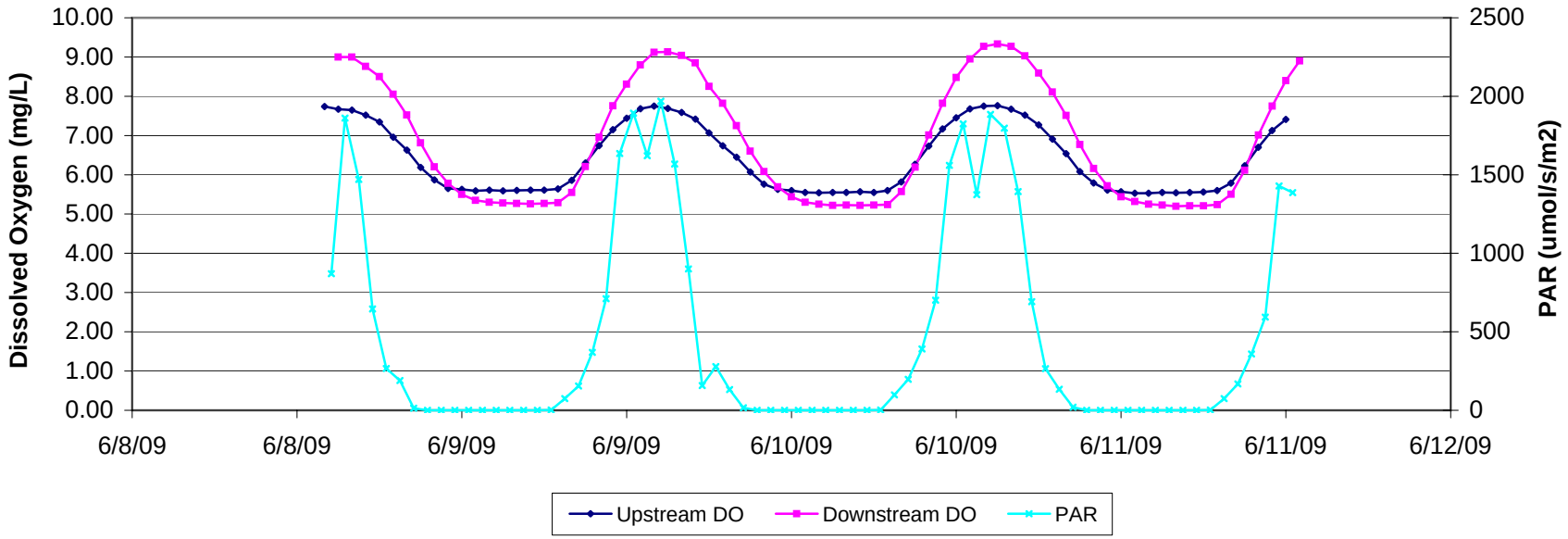






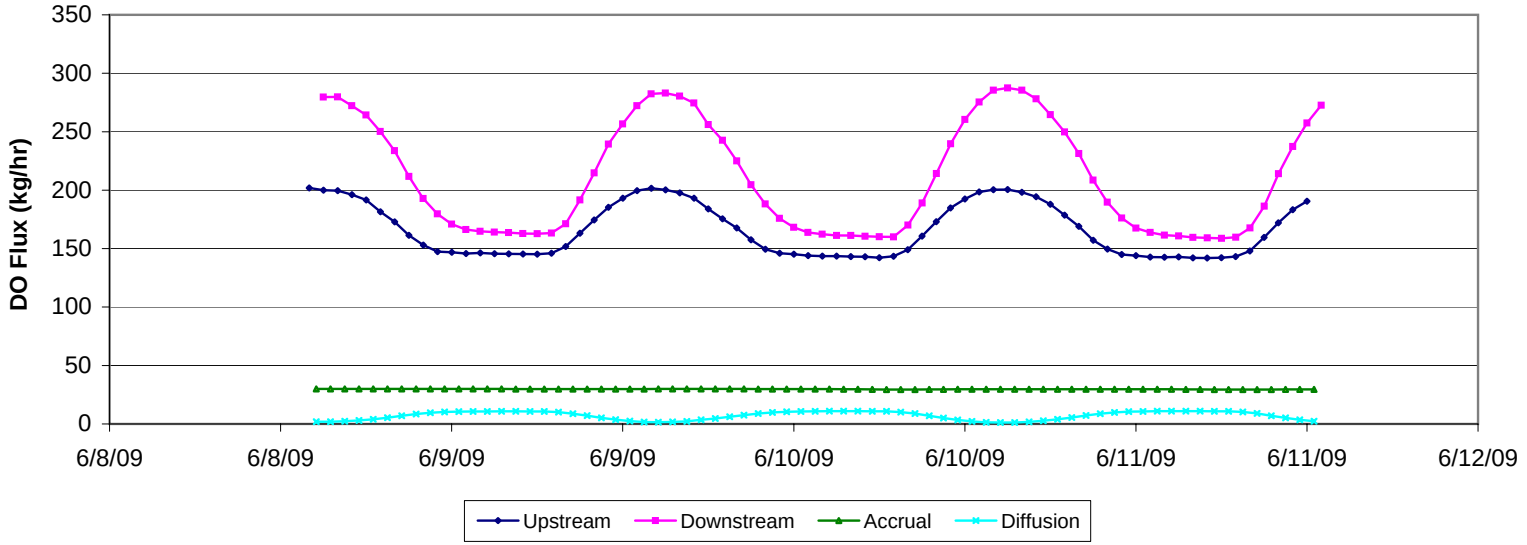


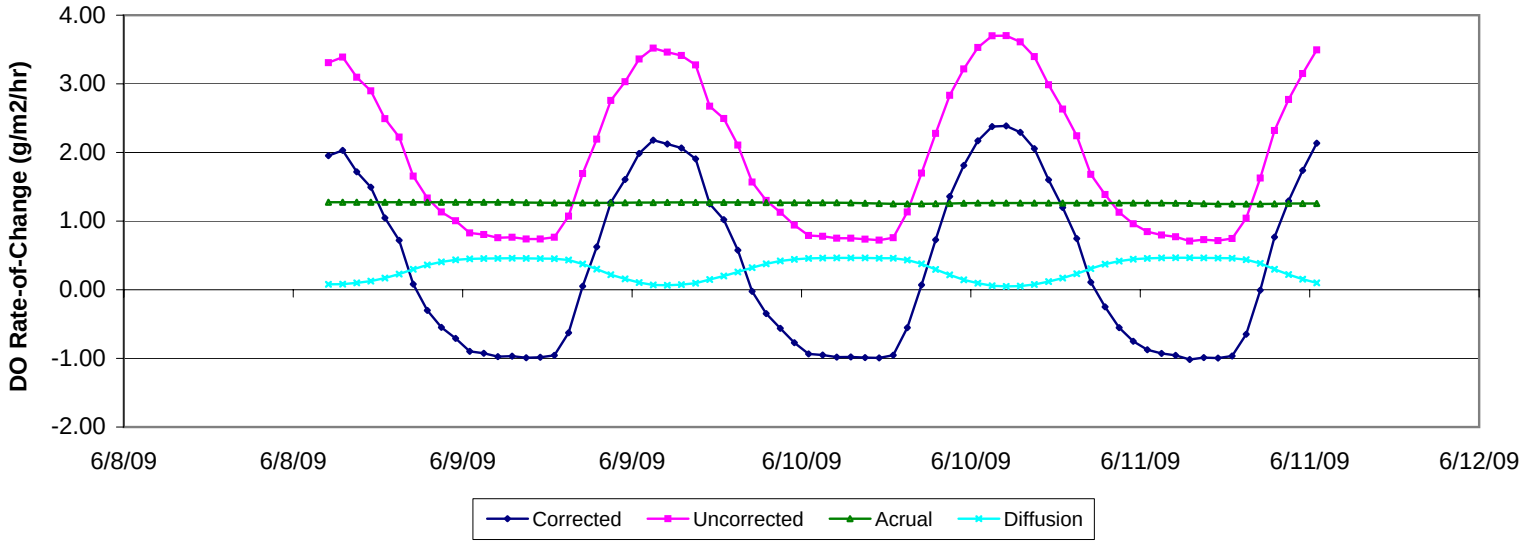
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	6.46	6.00	7.06	153
down		6.94	5.20	9.33	150
Wtr Temp - up	C	23.1	22.9	23.3	152
down		23.4	22.8	24.3	150
pH - up	SU	7.71	7.55	7.83	152
down		7.75	7.52	8.11	150
SpCond - up	uS/cm	216	205	224	152
down		249	241	255	150
Flow - up	m^3/d	740,579	731,340	745,967	96
Depth	m	1.99	1.98	2.01	96
Rainfall Total	in		0		
PAR - air	umol/m^2/s	528	0.0	2,003	302
plant		374	0.0	1571	71
DO rate chng	g/m^2/hr				
corr		0.226	-0.872	1.890	71
uncorr		2.683	1.669	4.192	71



APPENDIX N

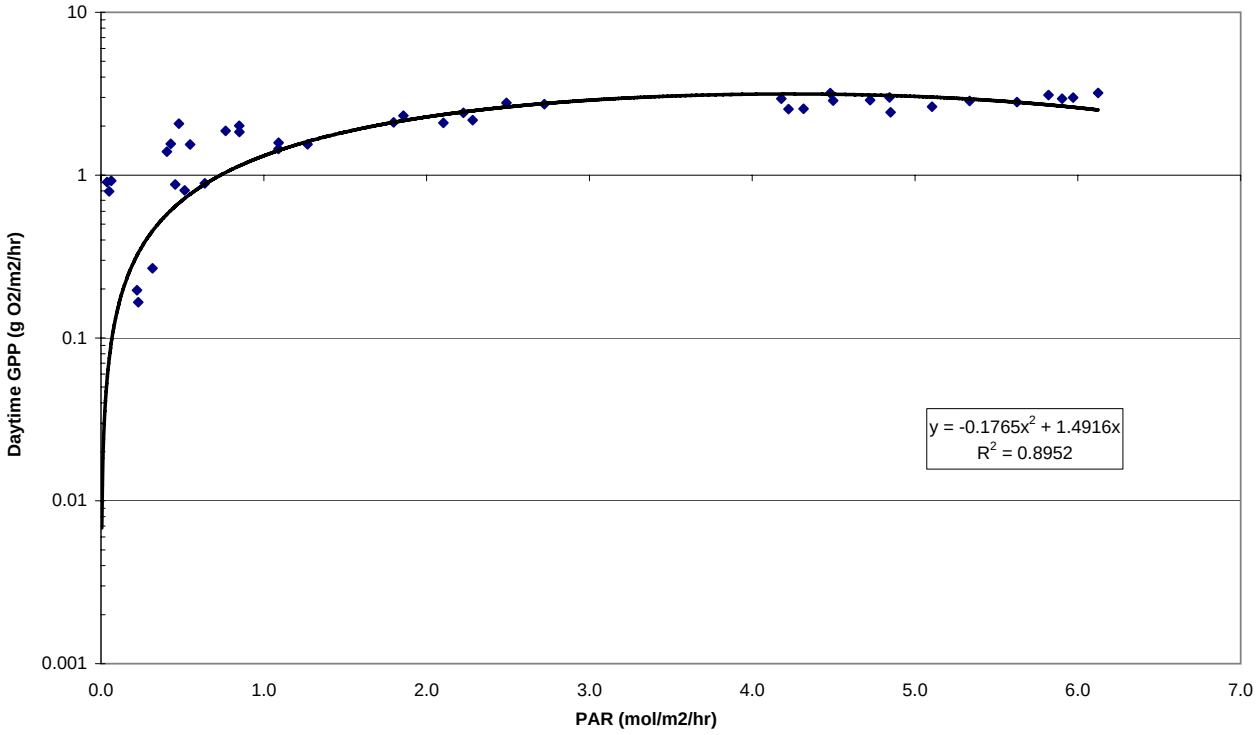
RAINBOW SPRINGS - STN 2 TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

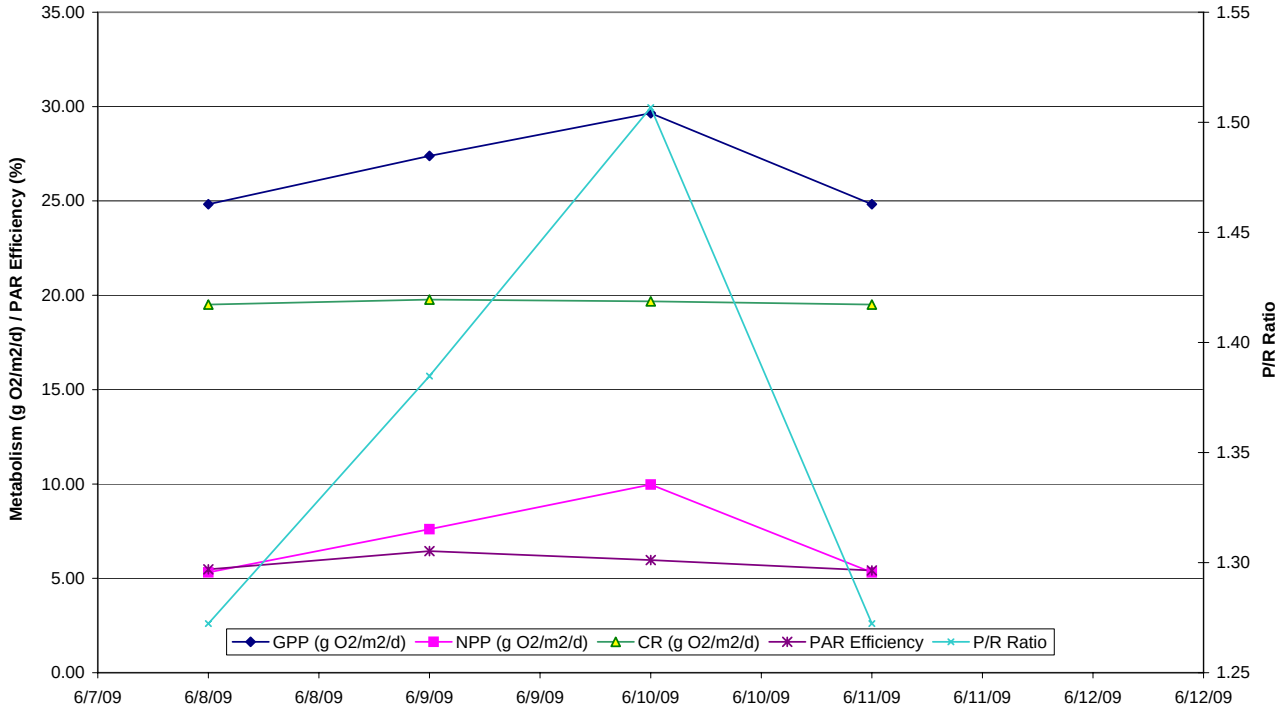




APPENDIX N

RAINBOW SPRINGS - STN 2 TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





Date

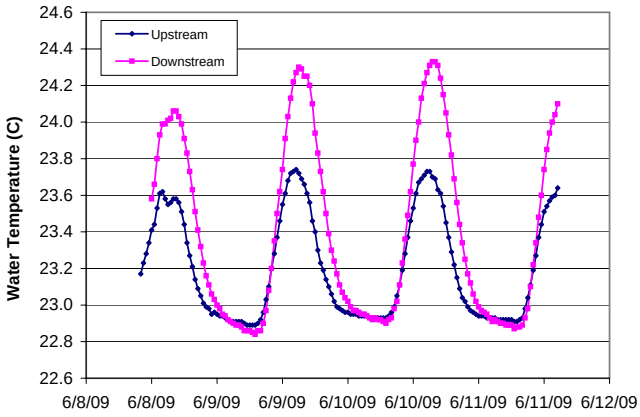
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	26.67	7.05	19.62	1.36	5.83
Max	29.65	9.97	19.78	1.51	6.44
Min	24.82	5.31	19.51	1.27	5.42

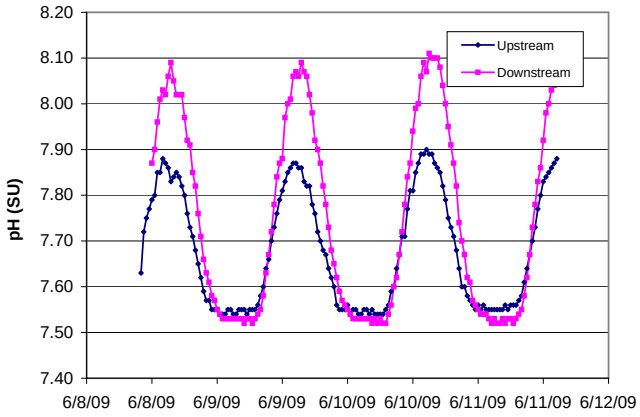
APPENDIX N

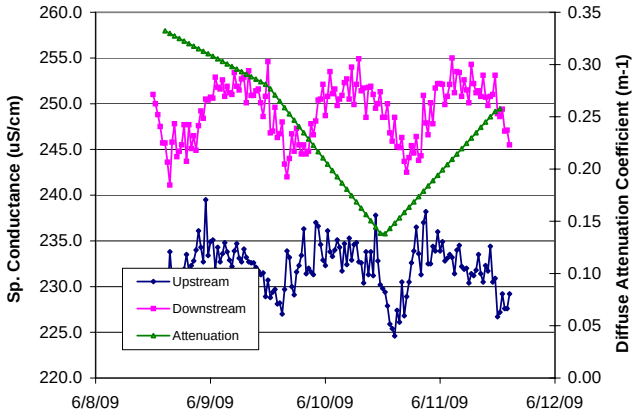
RAINBOW SPRINGS - STN 2 TO STN 3 METABOLISM ESTIMATES

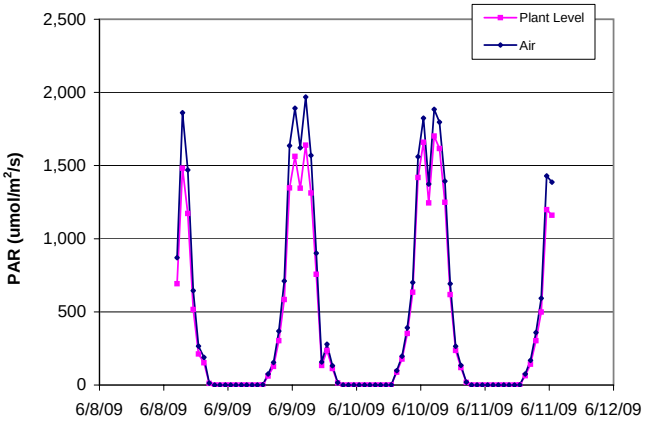
APPENDIX N

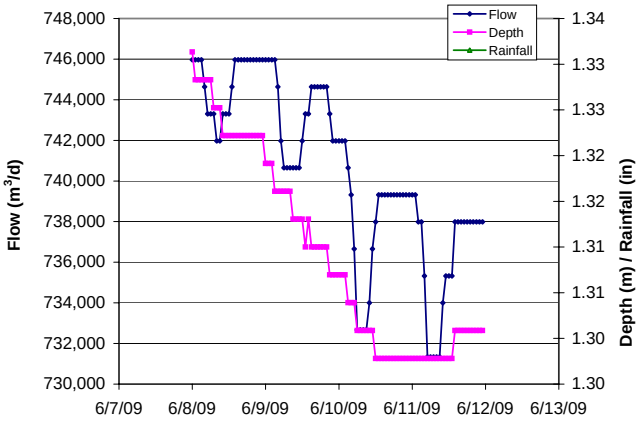
RAINBOW SPRINGS - STN 2 TO STN 3 METABOLISM SUMMARY



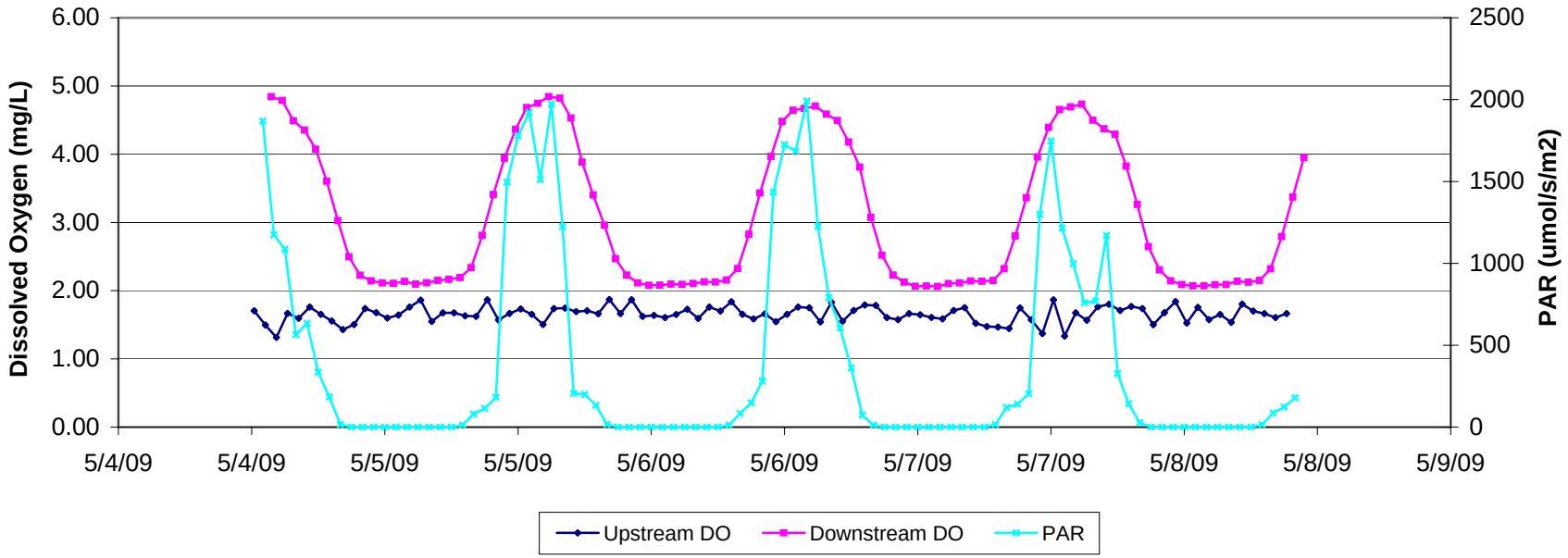






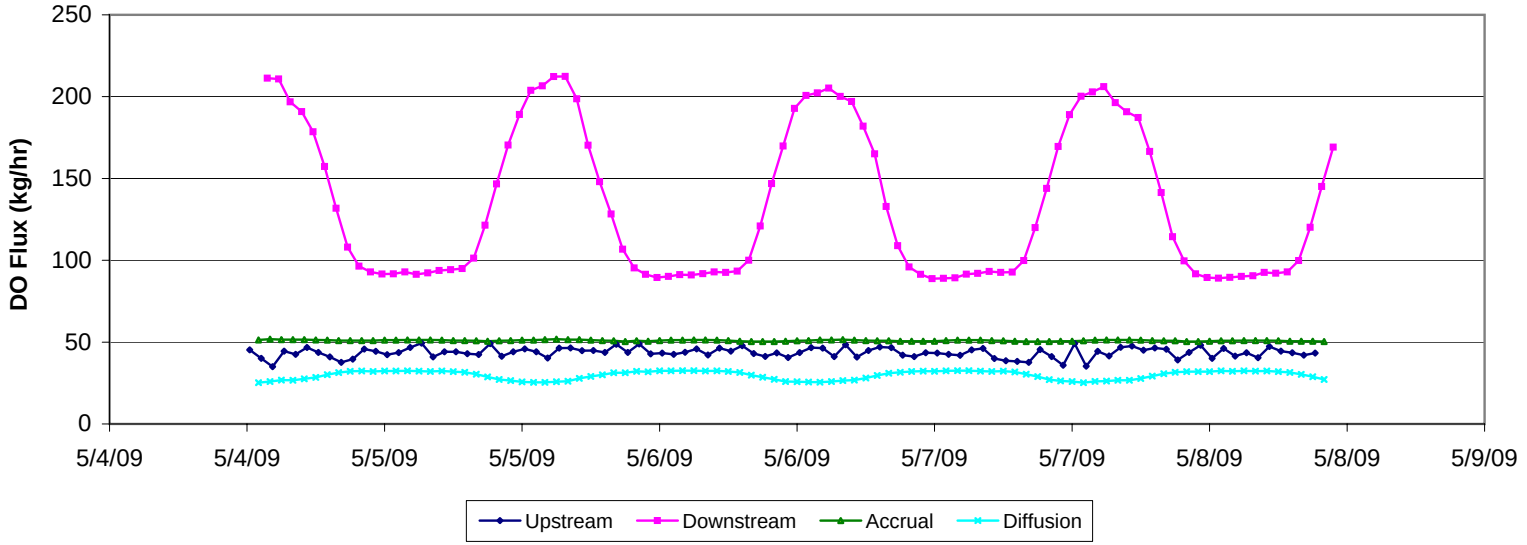


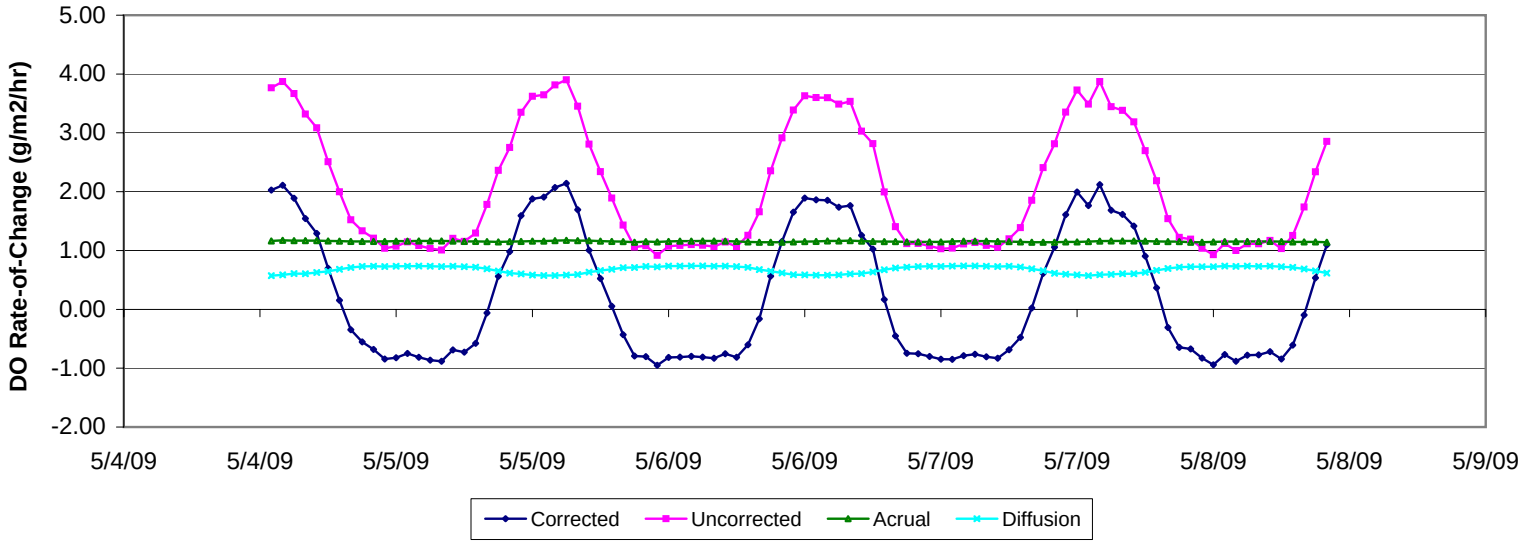
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	6.49	5.51	7.77	154
down		6.94	5.20	9.33	150
Wtr Temp - up	C	23.2	22.9	23.7	154
down		23.4	22.8	24.3	150
pH - up	SU	7.68	7.54	7.90	154
down		7.75	7.52	8.11	150
SpCond - up	uS/cm	232	225	240	154
down		249	241	255	150
Flow - up	m^3/d	740,579	731,340	745,967	96
Depth	m	1.31	1.30	1.33	96
Rainfall Total	in		0		
PAR - air	umol/m^2/s	528	0.0	2,003	302
plant		398	0.0	1701	71
DO rate chng	g/m^2/hr				
corr		0.334	-1.017	2.387	71
uncorr		1.902	0.708	3.701	71



APPENDIX N

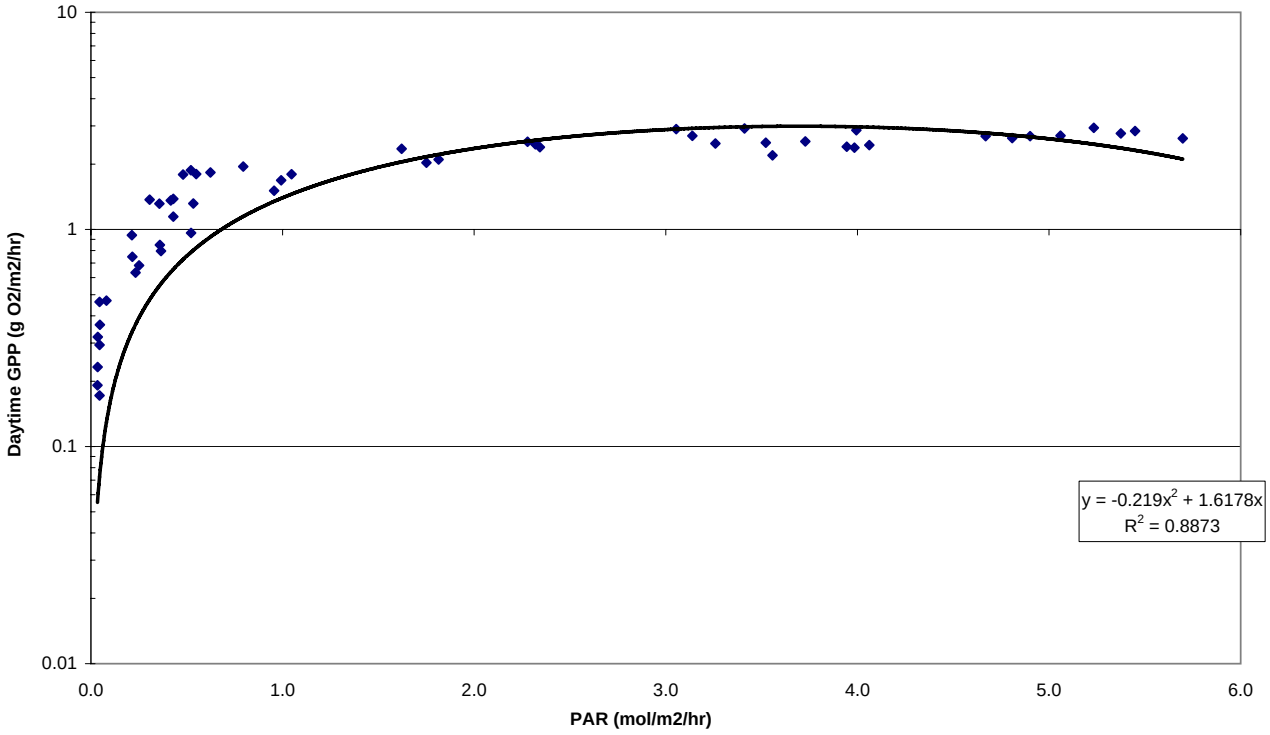
SILVER SPRING RUN - MAIN BOIL TO STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

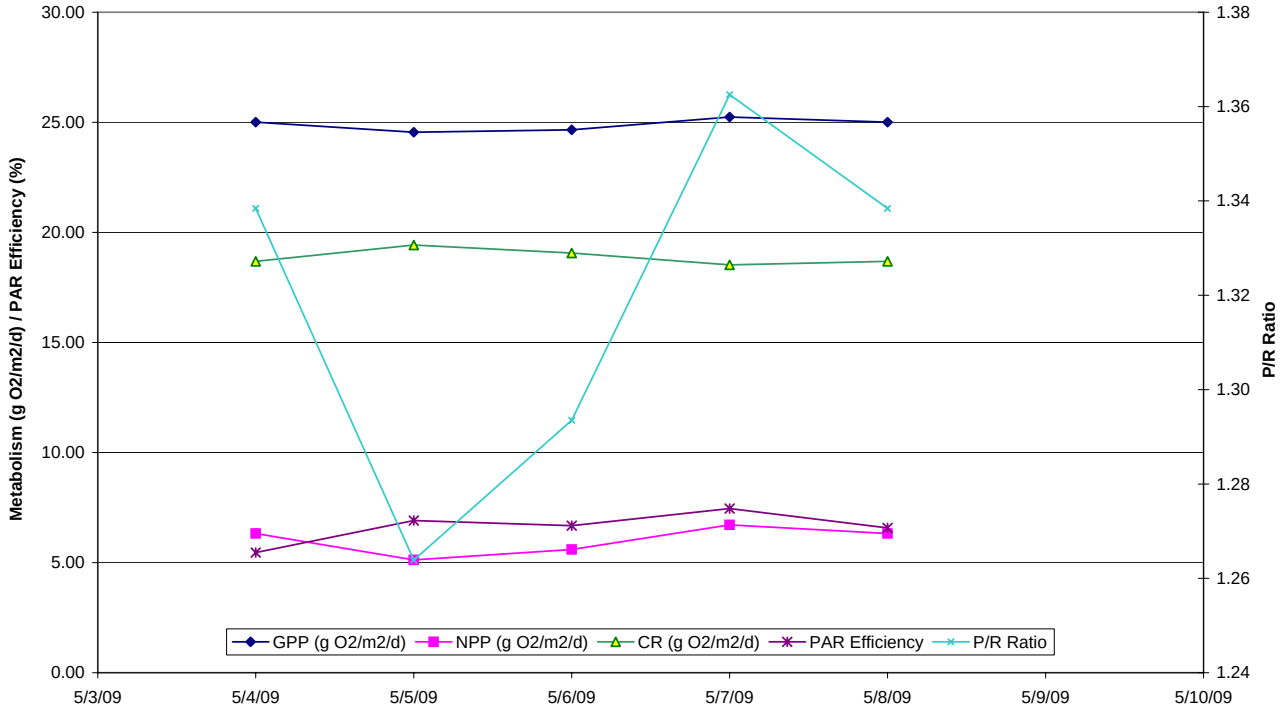




APPENDIX N

SILVER SPRING RUN - MAIN BOIL TO STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





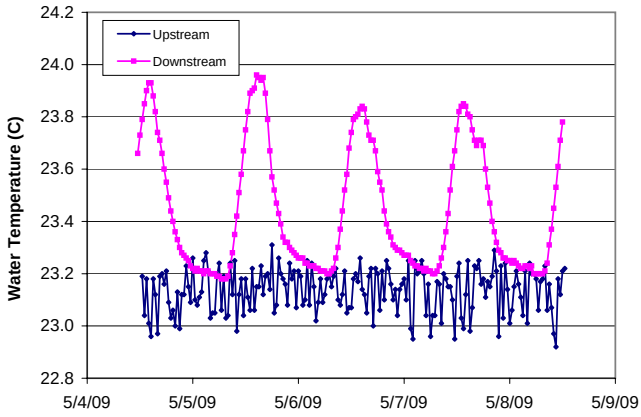
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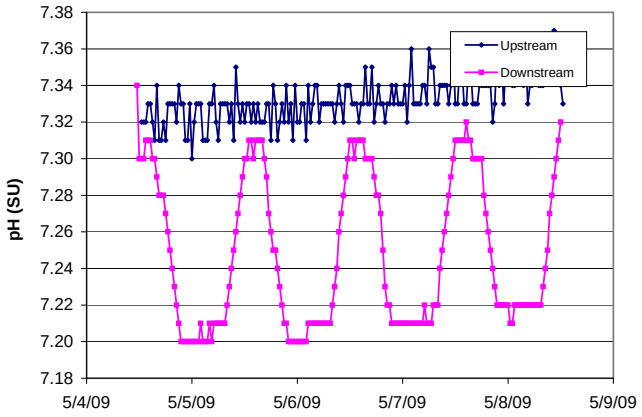
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	24.89	6.02	18.88	1.32	6.62
Max	25.24	6.72	19.43	1.36	7.46
Min	24.55	5.13	18.52	1.26	5.46

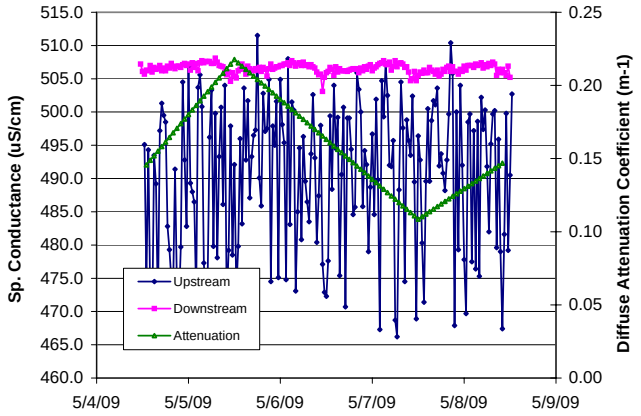
APPENDIX N
SILVER SPRING RUN - MAIN BOIL TO STN 2 METABOLISM ESTIMATES

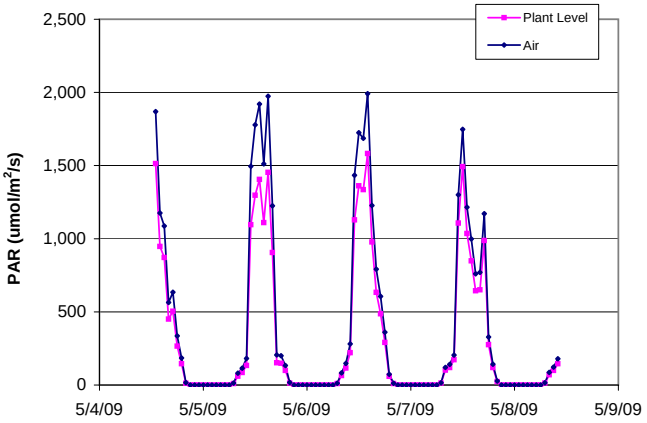
APPENDIX N

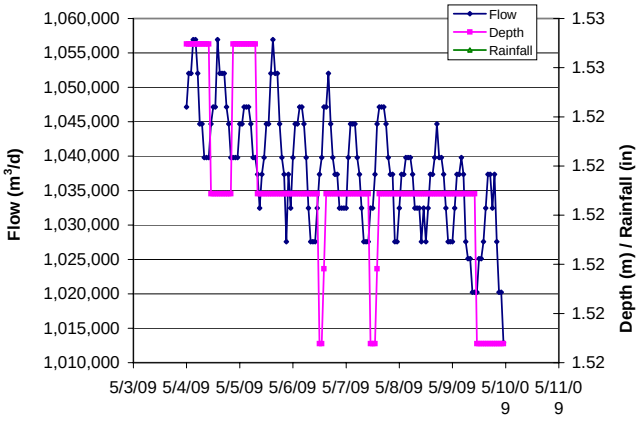
SILVER SPRING RUN - MAIN BOIL TO STN 2 METABOLISM SUMMARY



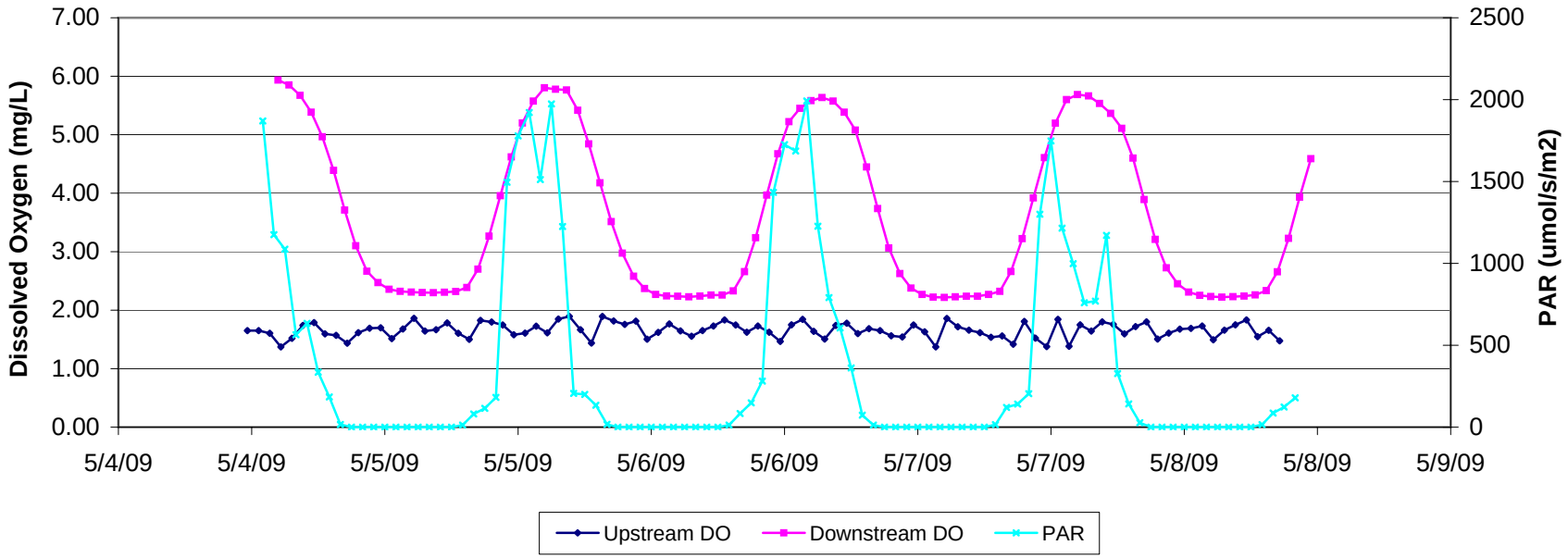






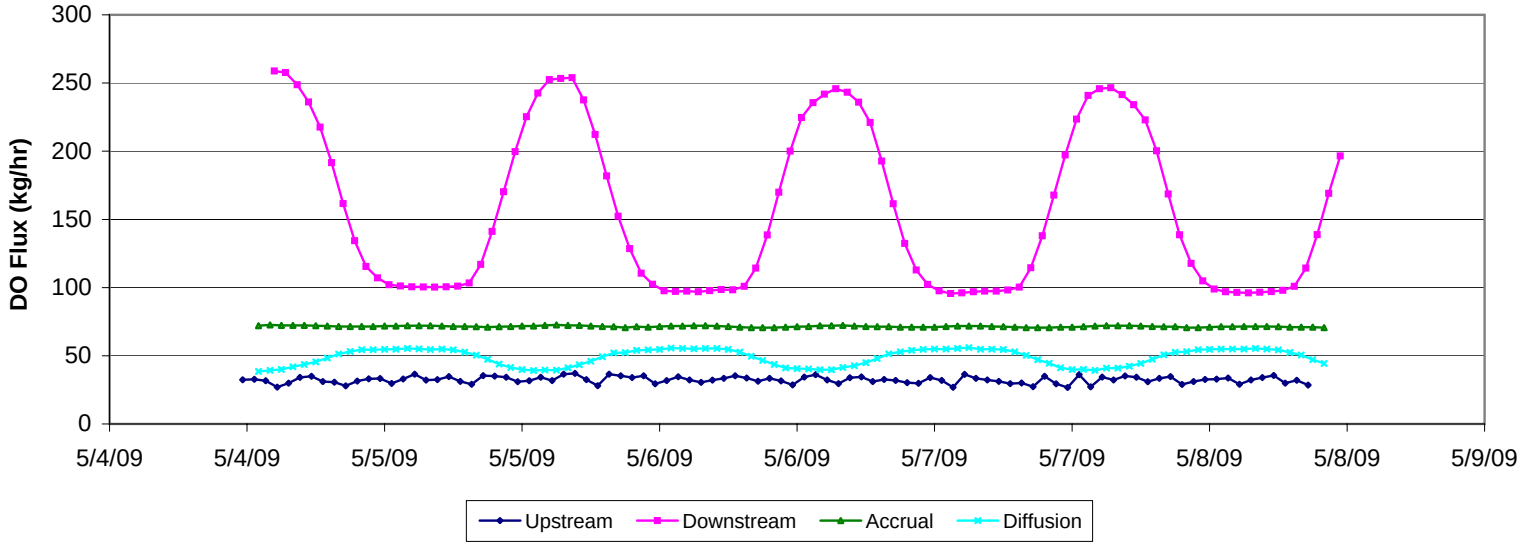


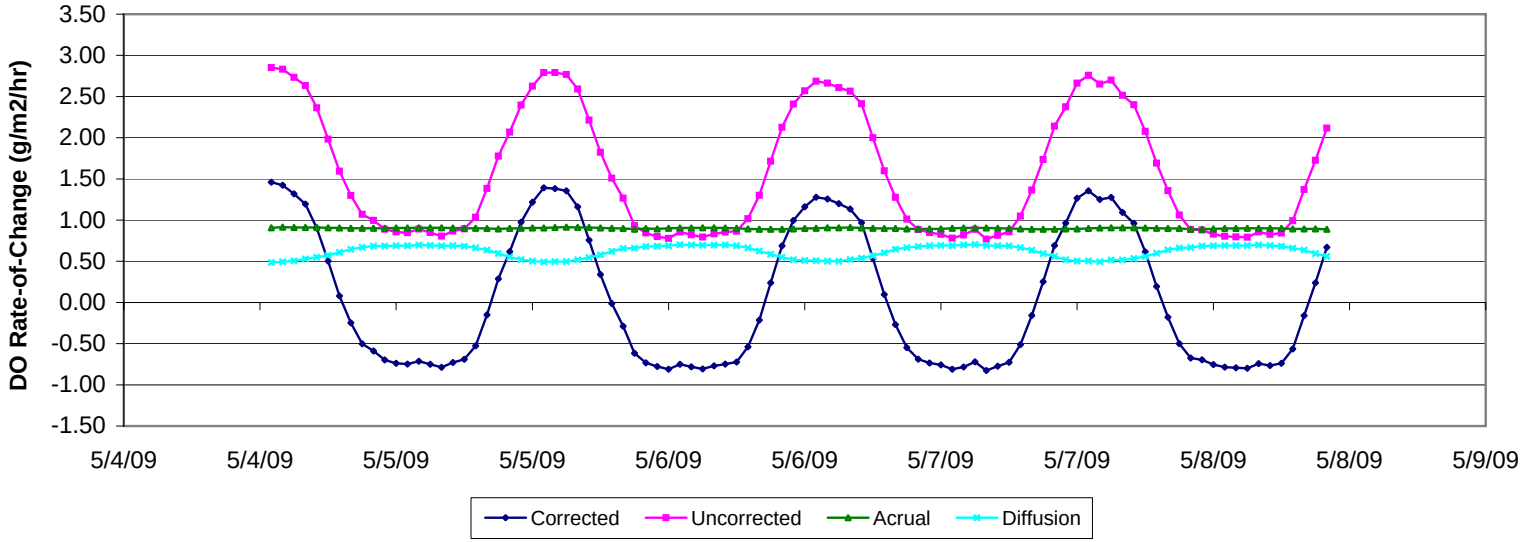
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	1.65	1.20	2.00	196
down		3.13	2.04	4.87	194
Wtr Temp - up	C	23.1	22.9	23.3	193
down		23.4	23.2	24.0	194
pH - up	SU	7.33	7.30	7.37	193
down		7.25	7.20	7.34	194
SpCond - up	uS/cm	490	466	512	193
down		507	503	508	194
Flow - up	m^3/d	1,038,334	1,012,882	1,056,921	144
Depth	m	1.52	1.52	1.53	144
Rainfall Total	in		0		
PAR - air	umol/m^2/s	446	0.0	2,099	392
plant		307	0.0	1583	94
DO rate chng	g/m^2/hr				
corr		0.215	-0.951	2.143	94
uncorr		2.045	0.919	3.902	94



APPENDIX N

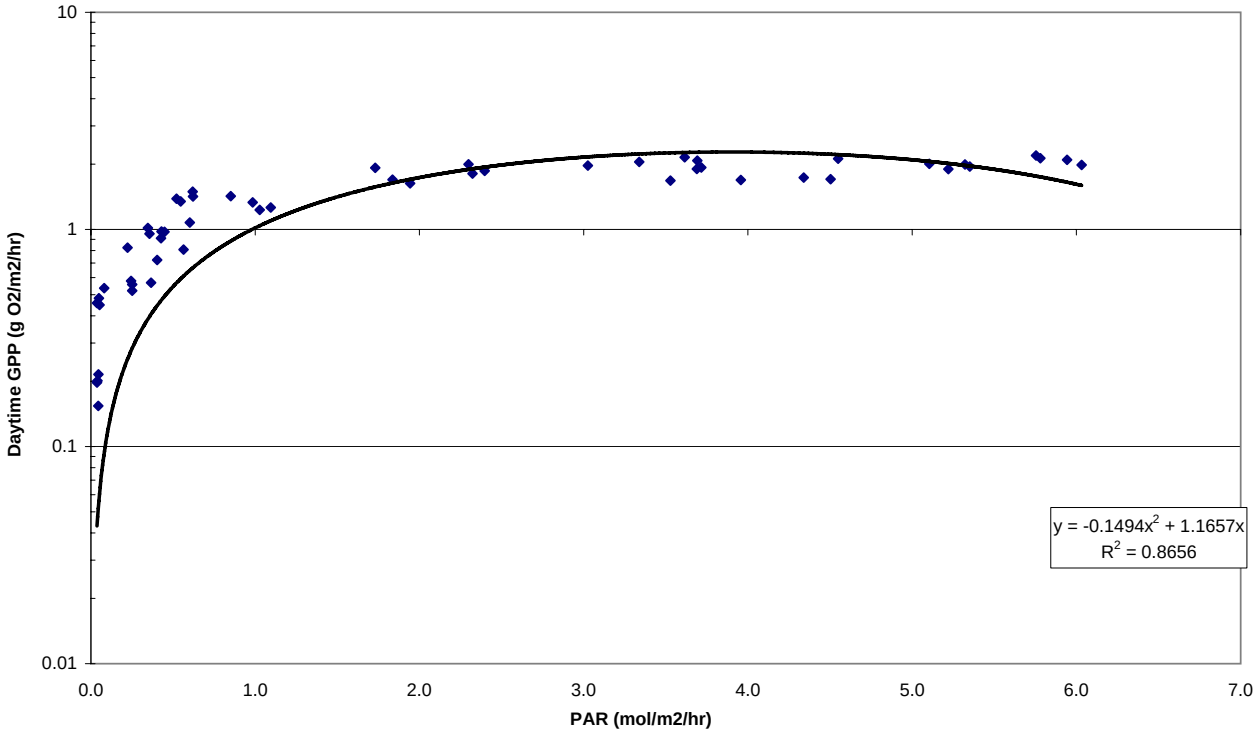
SILVER SPRING RUN - MAIN BOIL TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

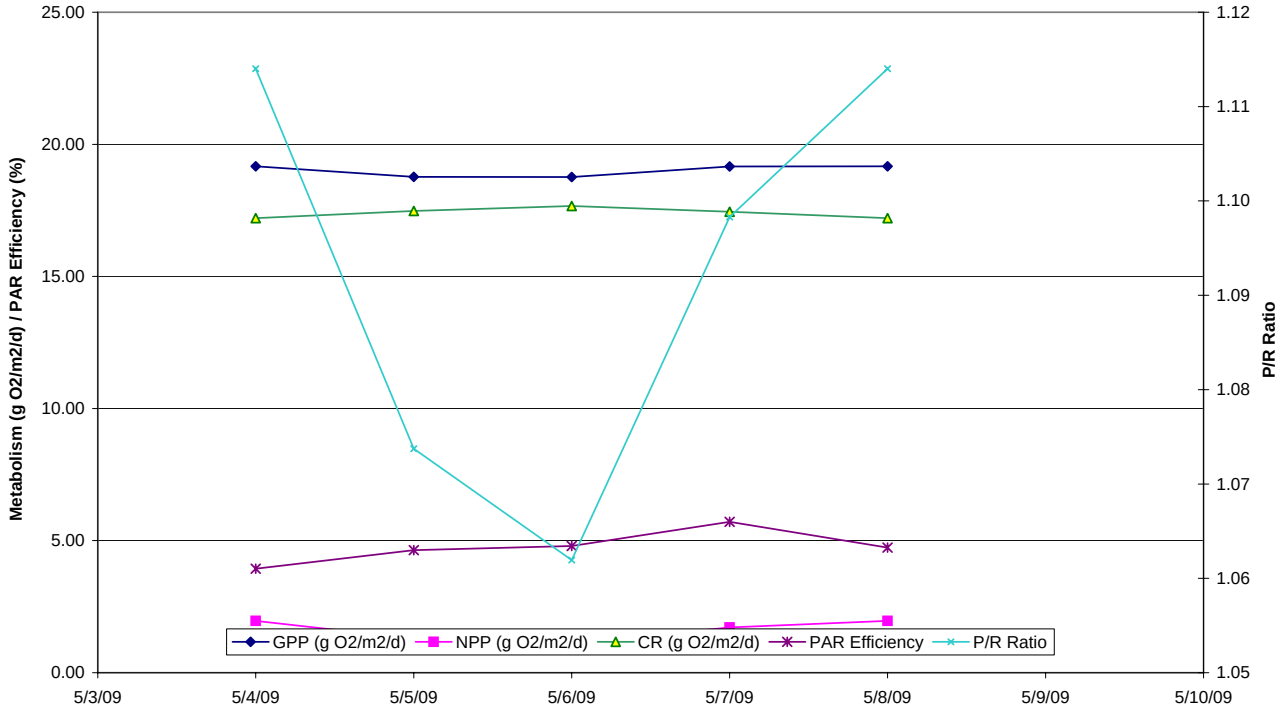




APPENDIX N

SILVER SPRING RUN - MAIN BOIL TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





Date

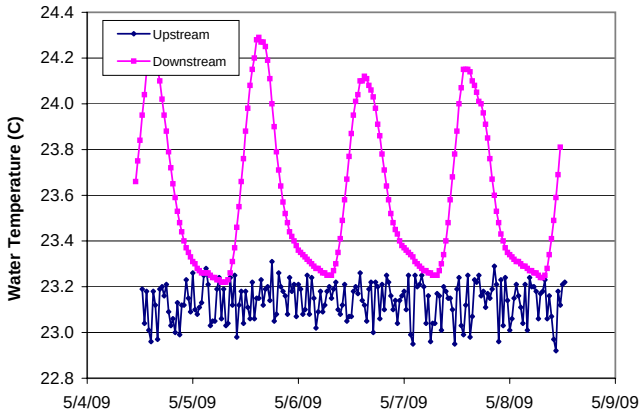
Stats	GPP (g $O_2/m^2/d$)	NPP (g $O_2/m^2/d$)	CR (g $O_2/m^2/d$)	P/R ratio	PAR Eff. (%)
Avg	19.00	1.60	17.40	1.09	4.76
Max	19.17	1.96	17.67	1.11	5.71
Min	18.76	1.09	17.20	1.06	3.93

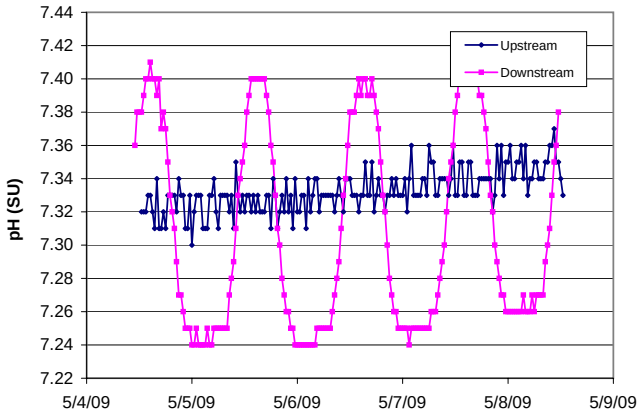
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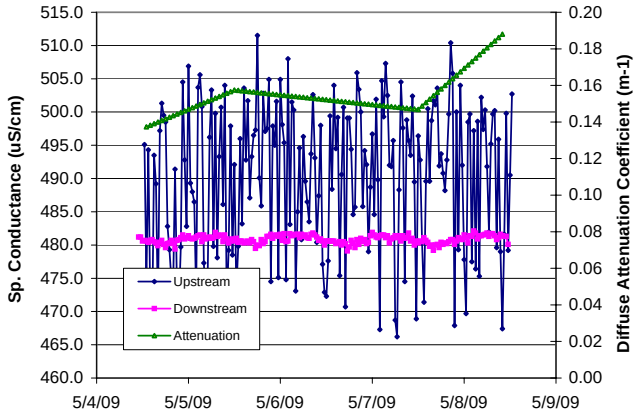
SILVER SPRING RUN - MAIN BOIL TO STN 3 METABOLISM ESTIMATES

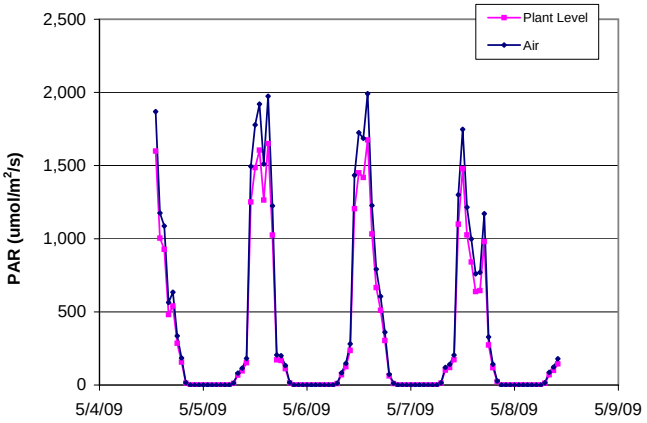
APPENDIX N

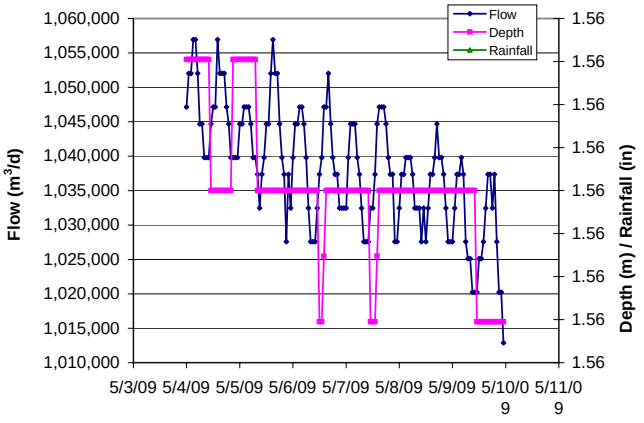
SILVER SPRING RUN - MAIN BOIL TO STN 3 METABOLISM SUMMARY



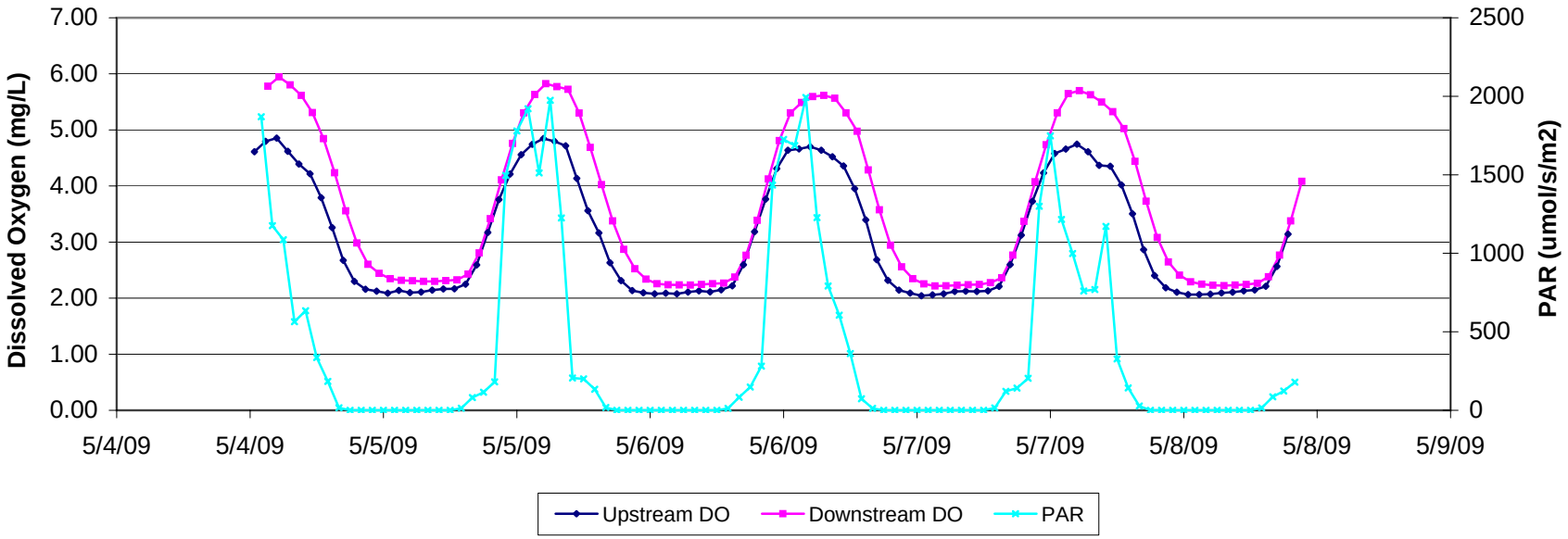






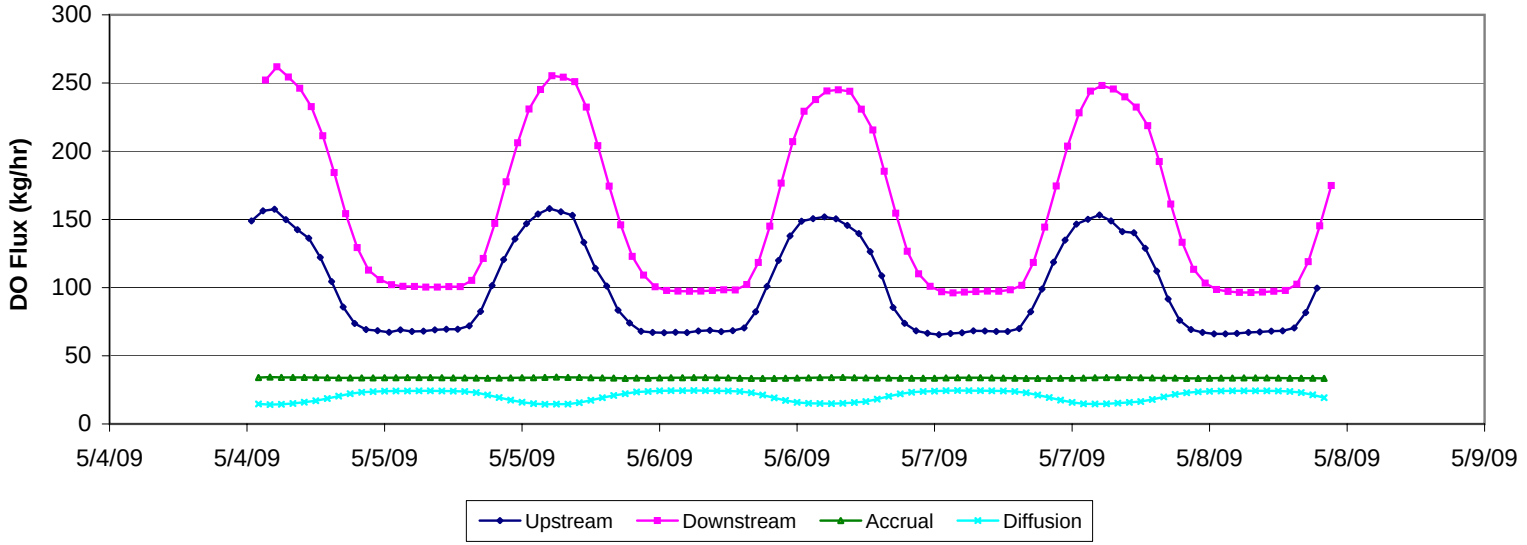


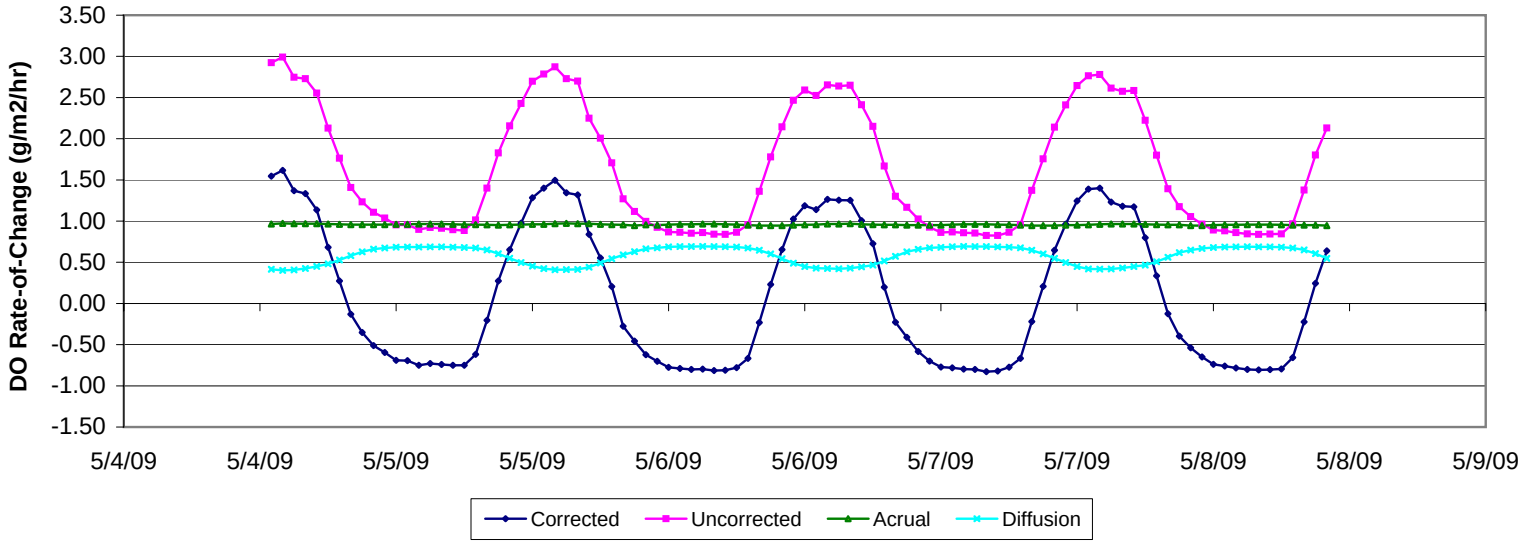
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	1.65	1.20	2.00	196
down		3.64	2.21	5.95	194
Wtr Temp - up	C	23.1	22.9	23.3	193
down		23.6	23.2	24.3	194
pH - up	SU	7.33	7.30	7.37	193
down		7.31	7.24	7.42	194
SpCond - up	uS/cm	490	466	512	193
down		481	479	482	194
Flow - up	m^3/d	1,038,334	1,012,882	1,056,921	144
Depth	m	1.56	1.56	1.56	144
Rainfall Total	in		0		
PAR - air	umol/m^2/s	446	0.0	2,099	392
plant		327	0.0	1676	94
DO rate chng	g/m^2/hr				
corr		0.041	-0.827	1.460	94
uncorr		1.557	0.769	2.852	94



APPENDIX N

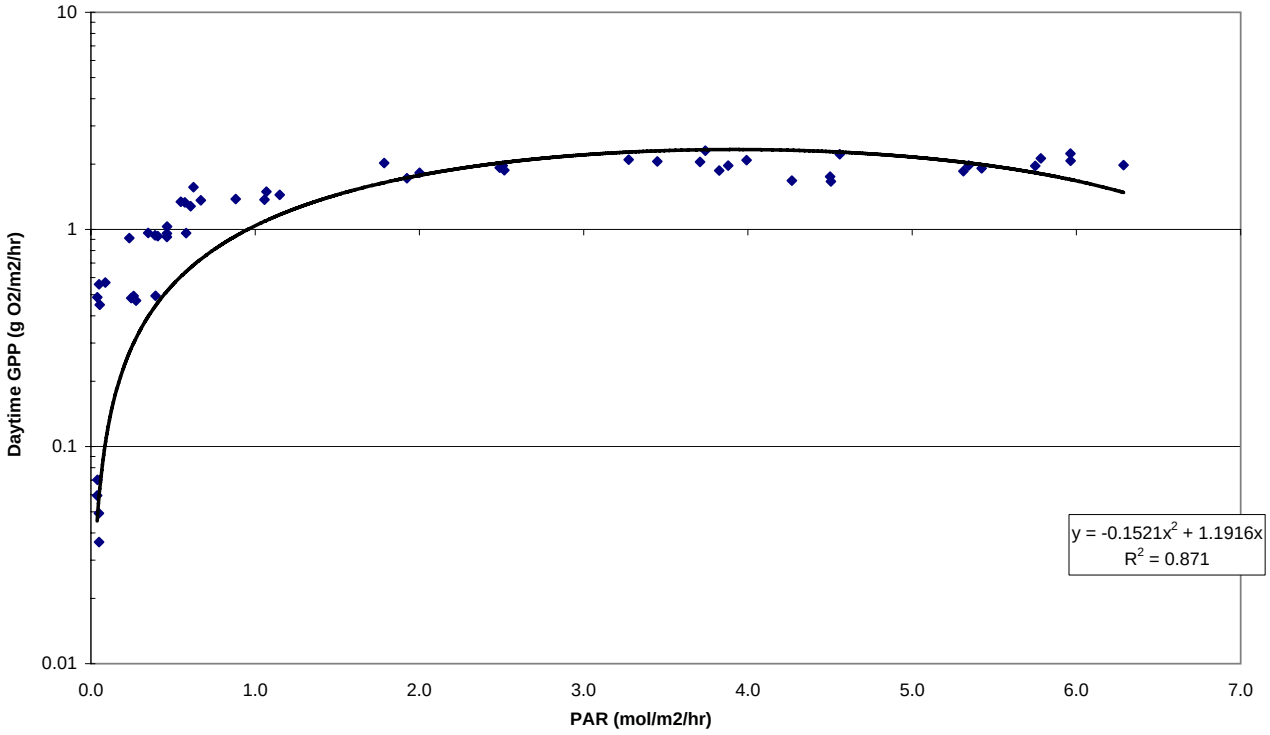
SILVER SPRING RUN - STATION 2 TO 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

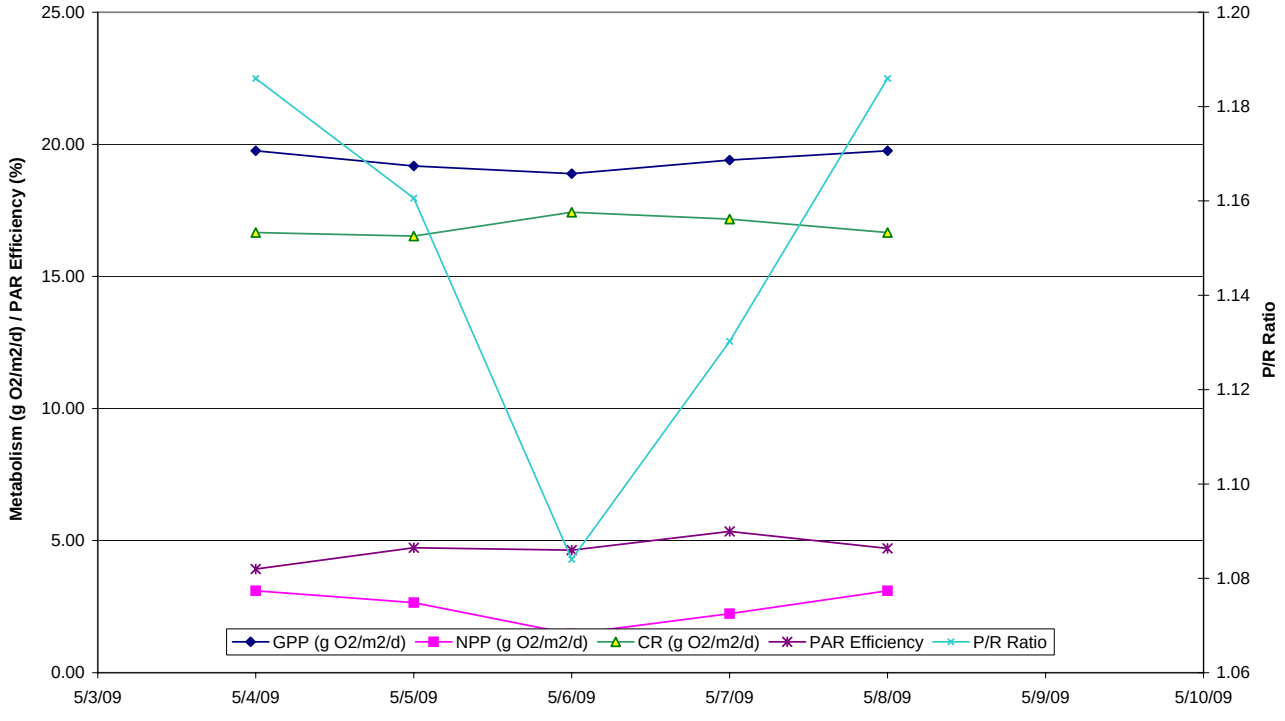




APPENDIX N

SILVER SPRING RUN - STATION 2 TO 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





Date

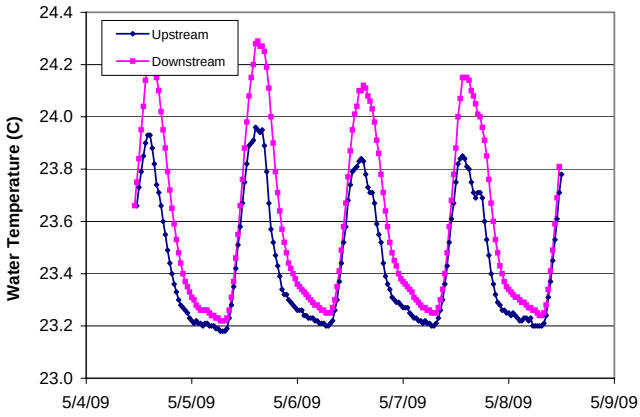
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	19.40	2.51	16.89	1.15	4.67
Max	19.76	3.10	17.43	1.19	5.35
Min	18.89	1.46	16.53	1.08	3.93

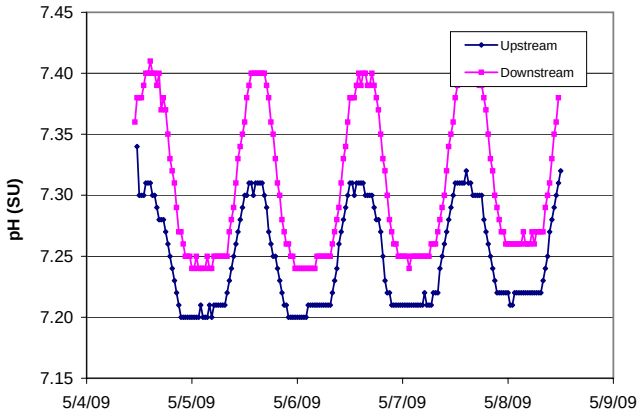
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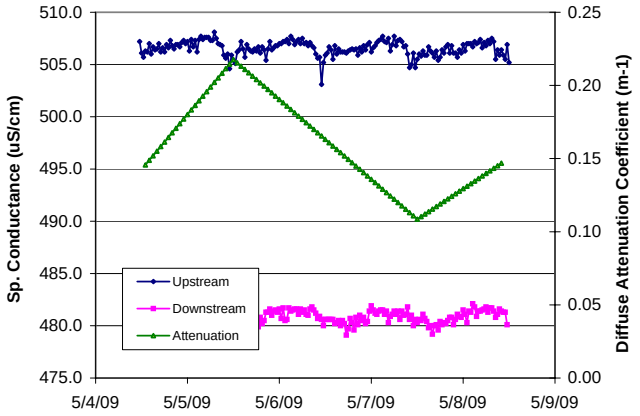
SILVER SPRING RUN - STATION 2 TO 3 METABOLISM ESTIMATES

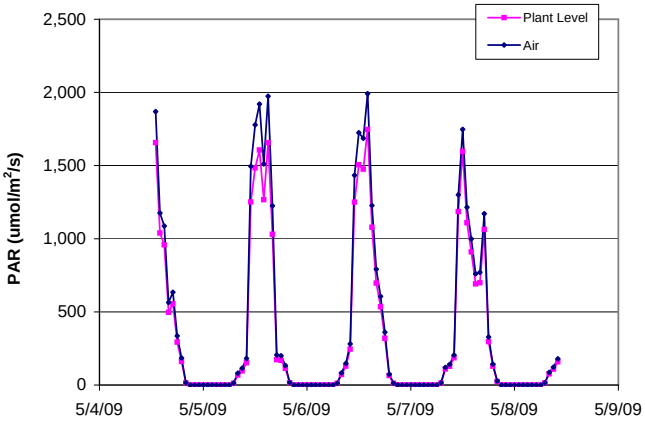
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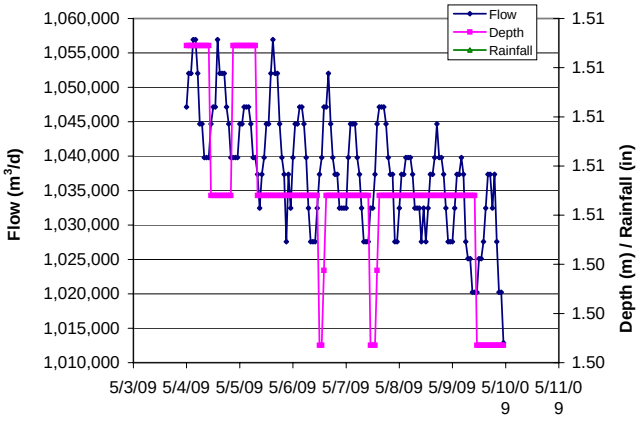
SILVER SPRING RUN - STATION 2 TO 3 METABOLISM SUMMARY



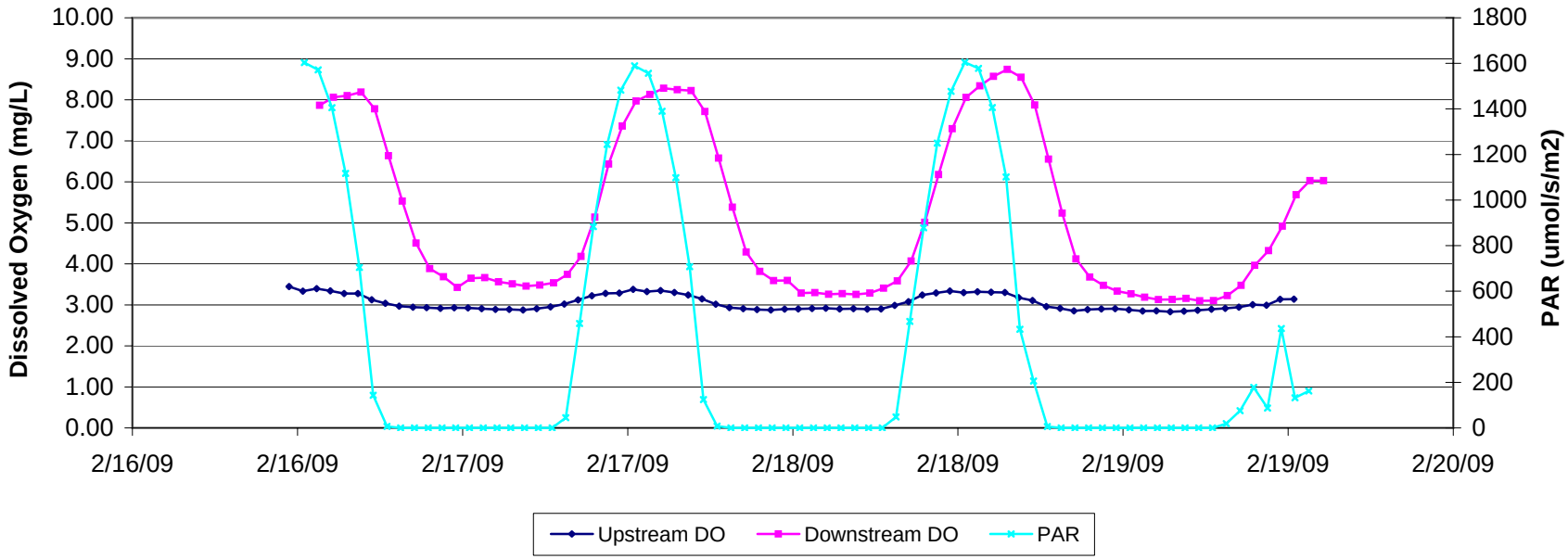






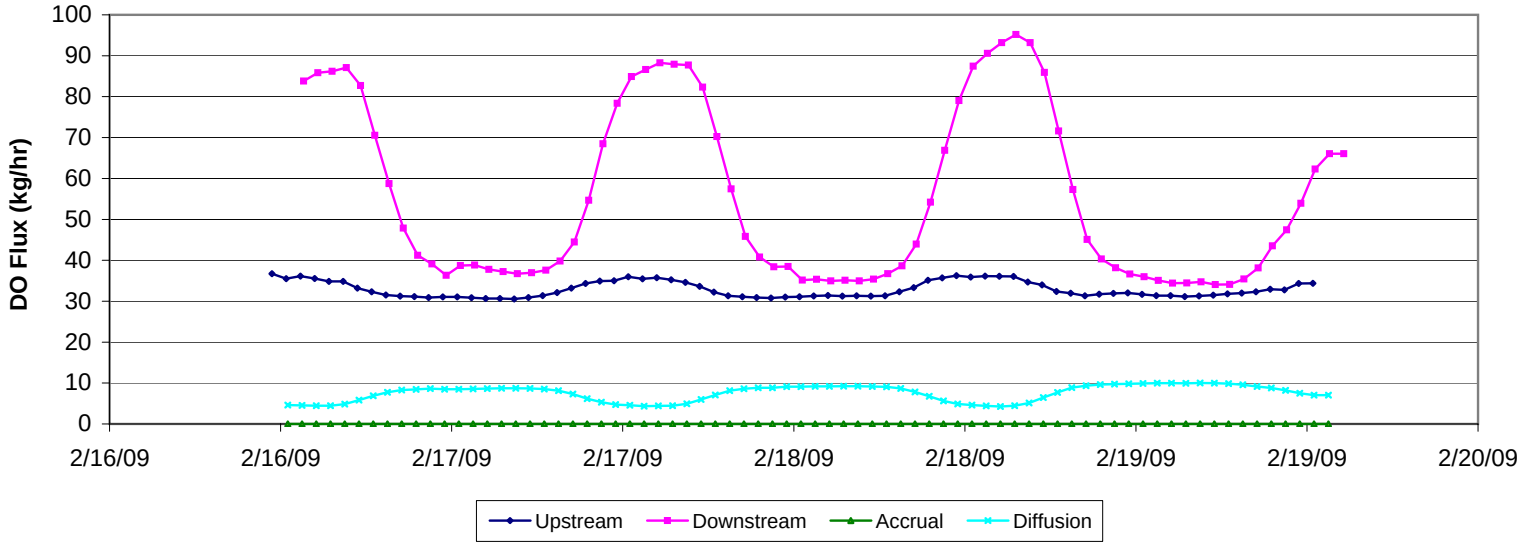


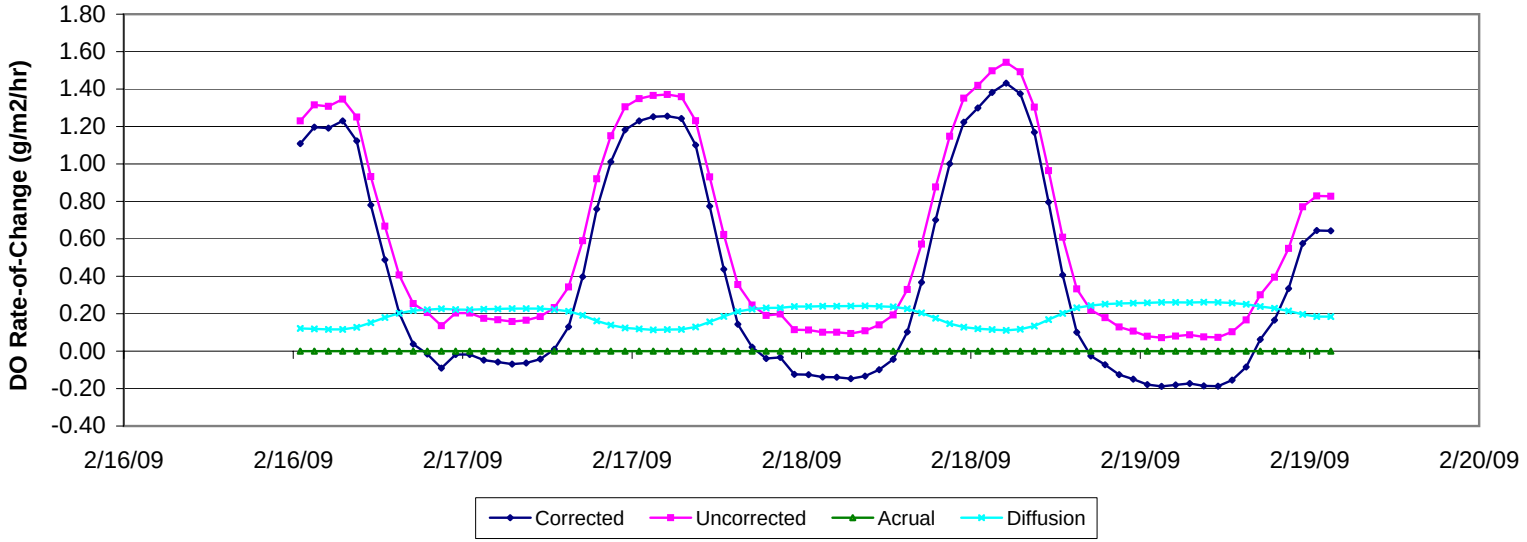
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.13	2.04	4.87	194
down		3.64	2.21	5.95	194
Wtr Temp - up	C	23.4	23.2	24.0	194
down		23.6	23.2	24.3	194
pH - up	SU	7.25	7.20	7.34	194
down		7.31	7.24	7.42	194
SpCond - up	uS/cm	507	503	508	194
down		481	479	482	194
Flow - up	m^3/d	1,038,334	1,012,882	1,056,921	144
Depth	m	1.51	1.50	1.51	144
Rainfall Total	in		0		
PAR - air	umol/m^2/s	446	0.0	2,099	392
plant		339	0.0	1746	94
DO rate chng	g/m^2/hr				
corr		0.077	-0.827	1.615	94
uncorr		1.615	0.824	2.991	94



APPENDIX N

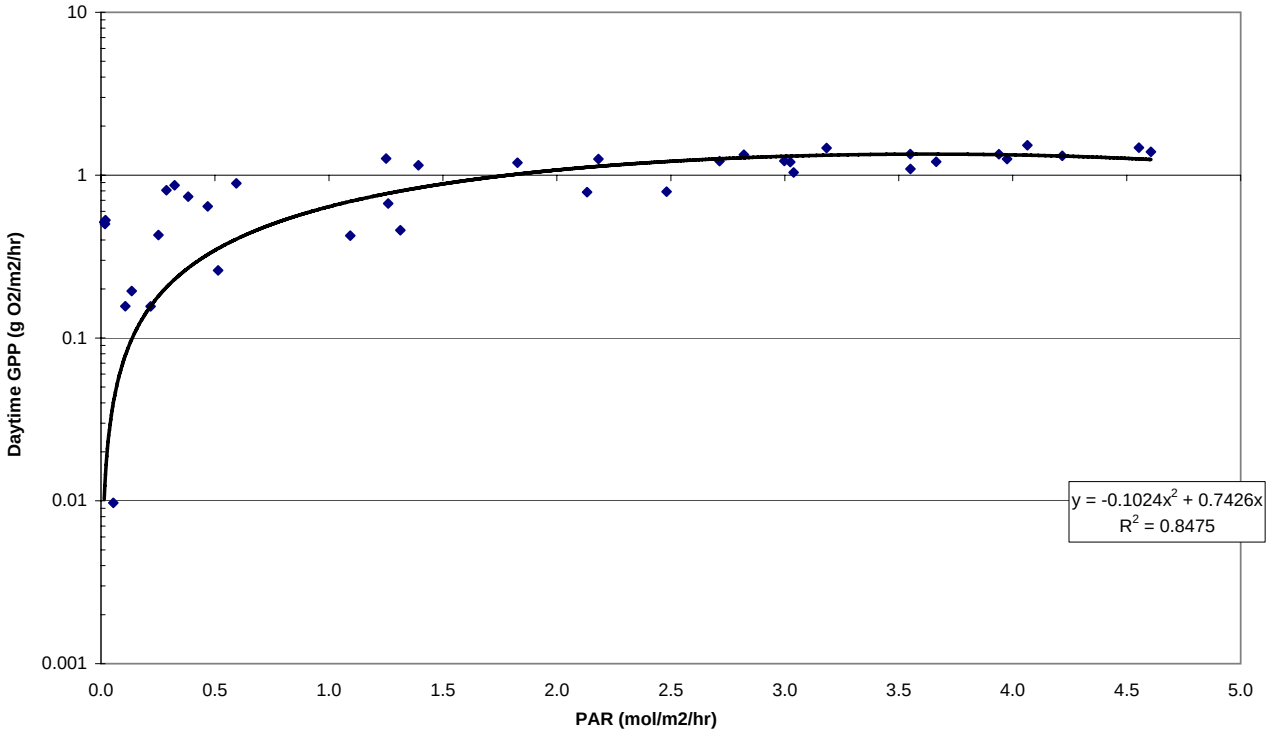
SILVER GLEN SPRING - MAIN BOIL TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

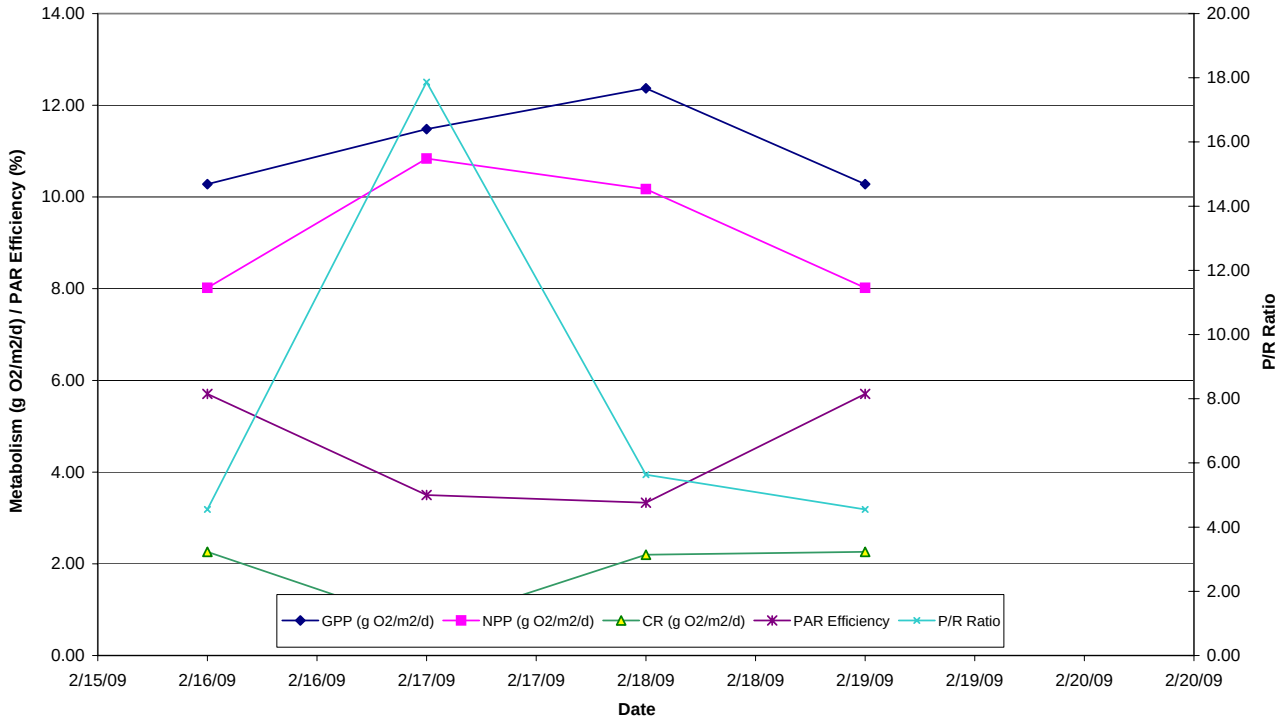




APPENDIX N

SILVER GLEN SPRING - MAIN BOIL TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





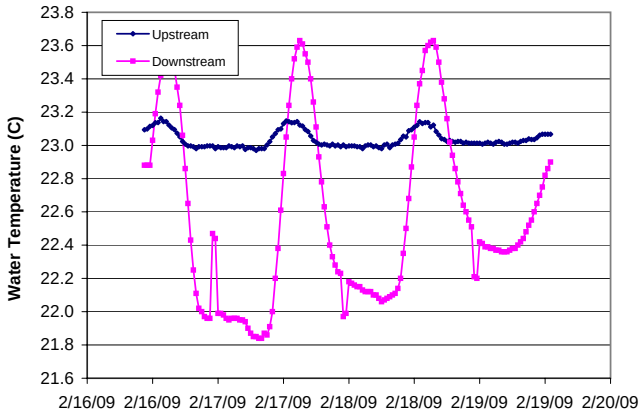
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	11.10	9.26	1.84	8.15	4.56
Max	12.37	10.84	2.26	17.87	5.70
Min	10.28	8.02	0.64	4.55	3.33

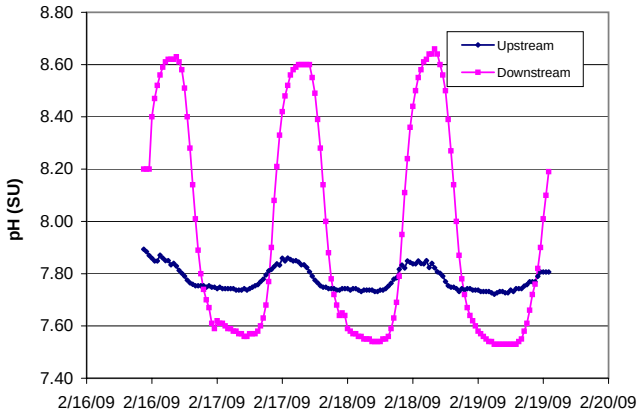
APPENDIX N

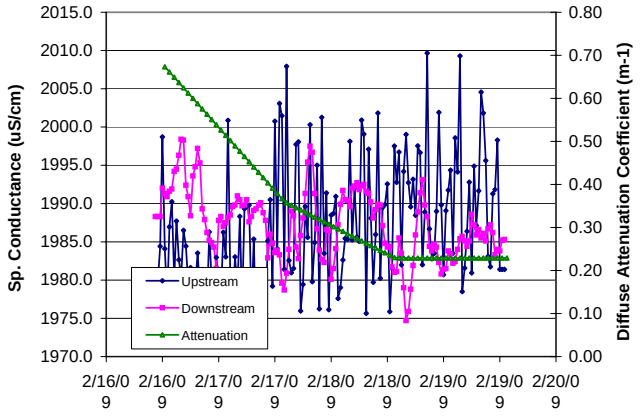
SILVER GLEN SPRING - MAIN BOIL TO STN 3 METABOLISM ESTIMATES

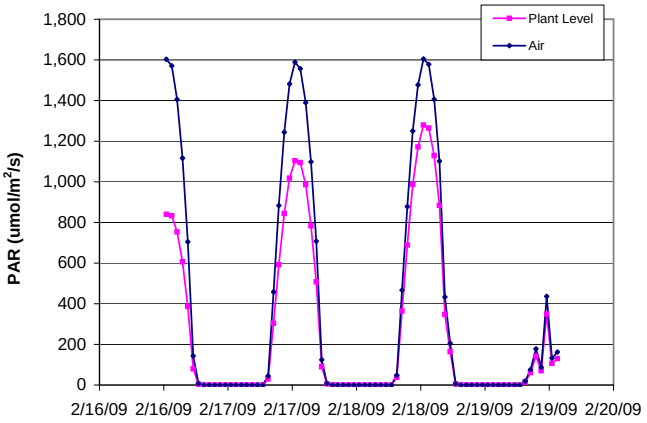
APPENDIX N

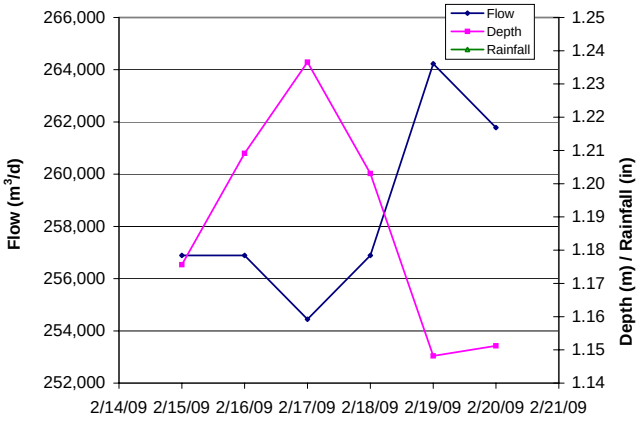
SILVER GLEN SPRING - MAIN BOIL TO STN 3 METABOLISM SUMMARY



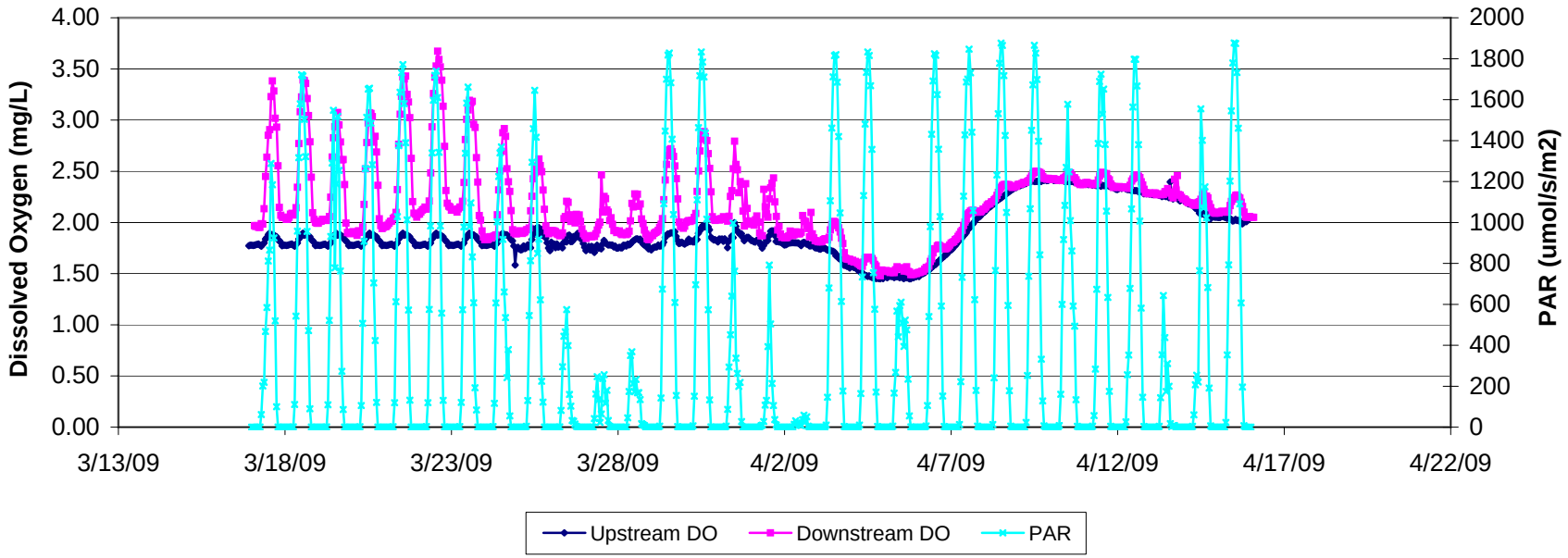






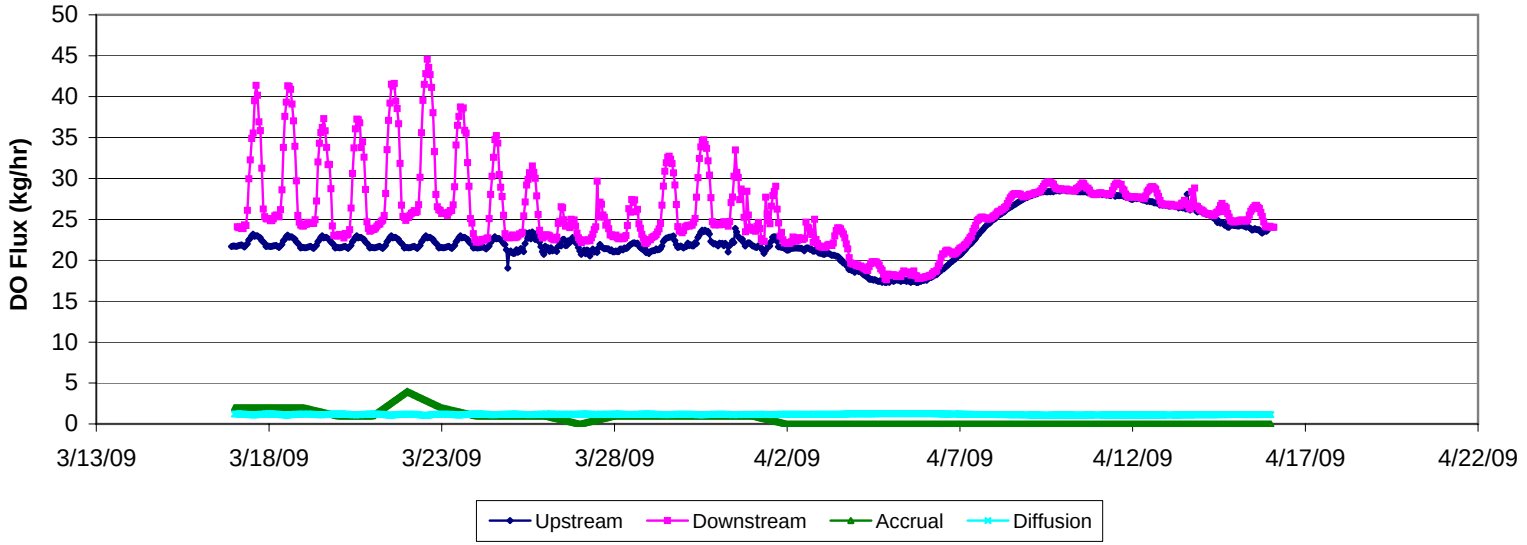


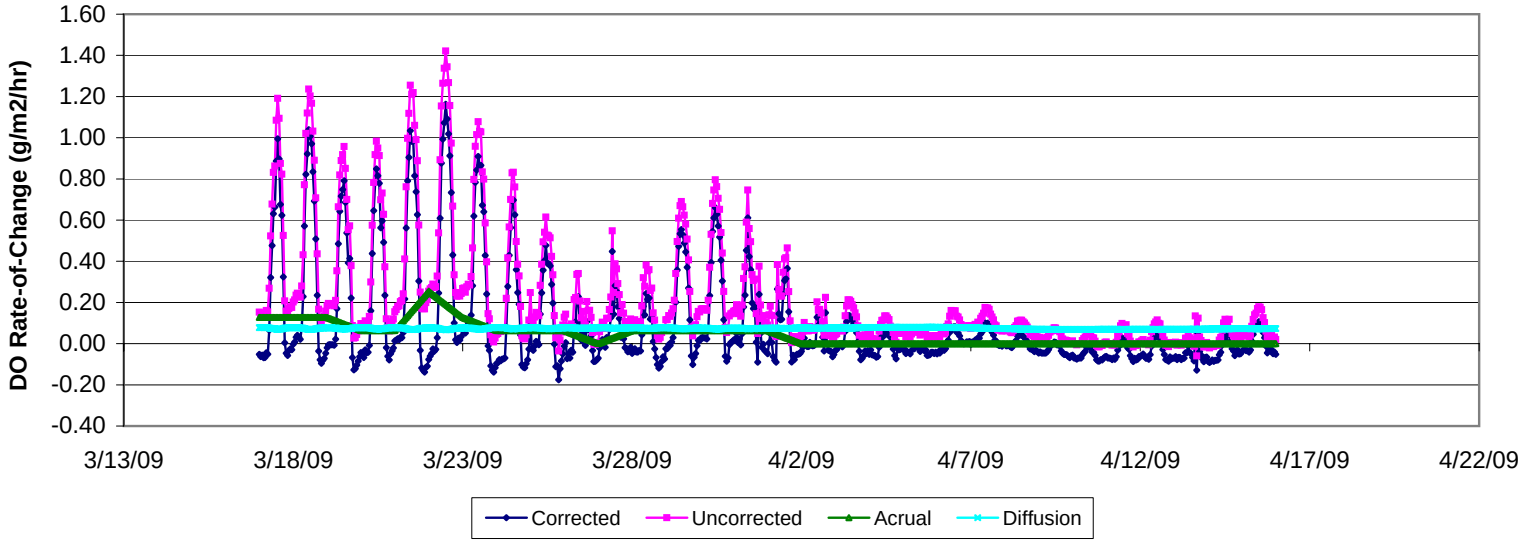
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.06	2.83	3.55	150
down		5.20	3.09	8.90	150
Wtr Temp - up	C	23.0	23.0	23.2	150
down		22.6	21.8	23.6	150
pH - up	SU	7.78	7.72	7.89	150
down		7.96	7.53	8.66	150
SpCond - up	uS/cm	1987	1973	2010	150
down		1987	1975	1998	150
Flow - up	m^3/d	258,522	254,444	264,230	6
Depth	m	1.19	1.15	1.24	6
Rainfall Total	in		0		
PAR - air	$umol/m^2/s$	405	0.0	1,619	298
plant		271	0.0	1279	74
DO rate chng	$g/m^2/hr$				
corr		0.391	-0.188	1.432	74
uncorr		0.588	0.072	1.543	74



APPENDIX N

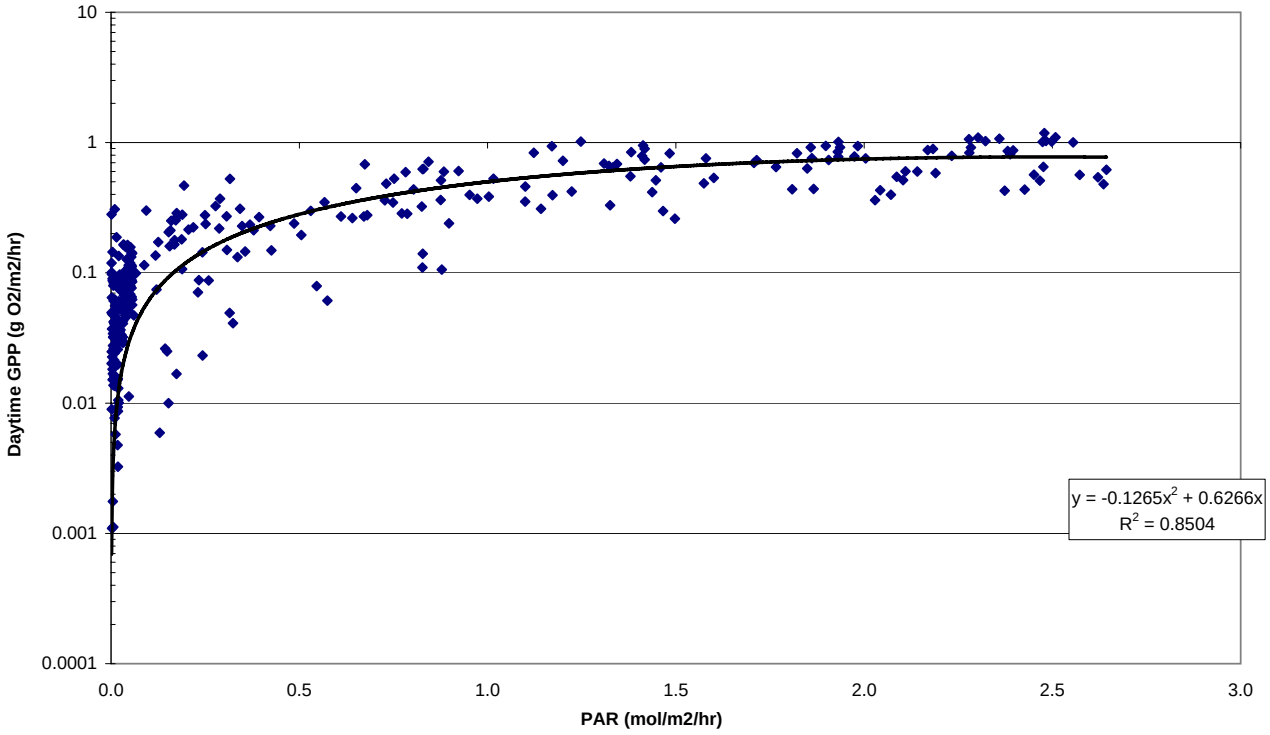
WAKULLA SPRING - MAIN BOIL TO STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

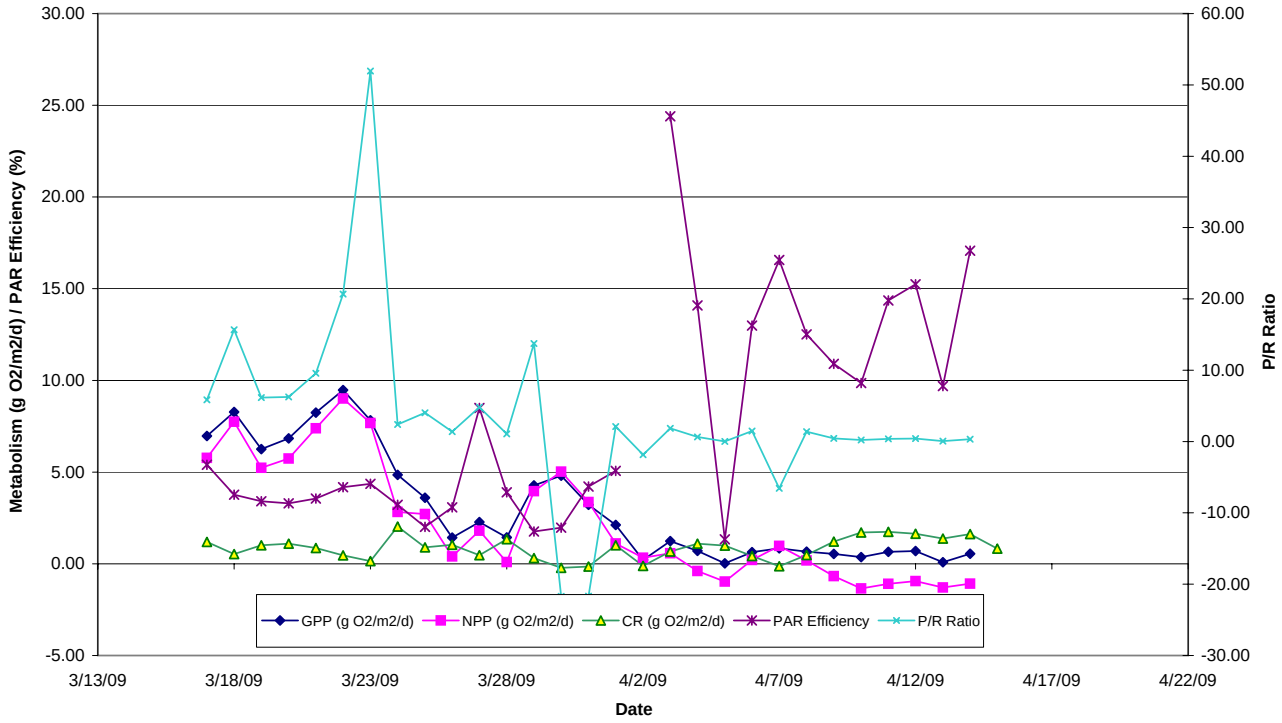




APPENDIX N

WAKULLA SPRING - MAIN BOIL TO STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





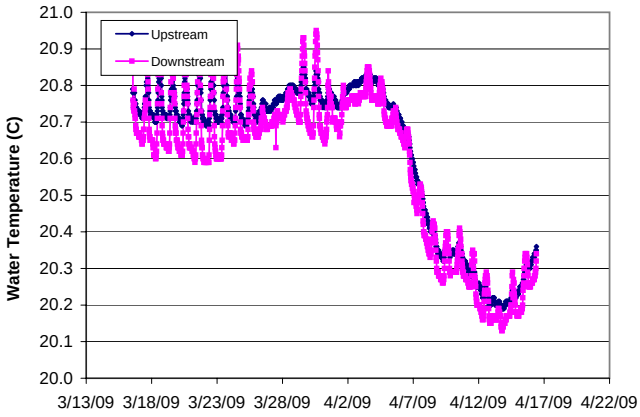
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	3.07	2.22	0.85	3.48	7.88
Max	9.47	9.01	2.03	51.94	24.40
Min	0.02	-1.34	-0.22	-21.71	1.34

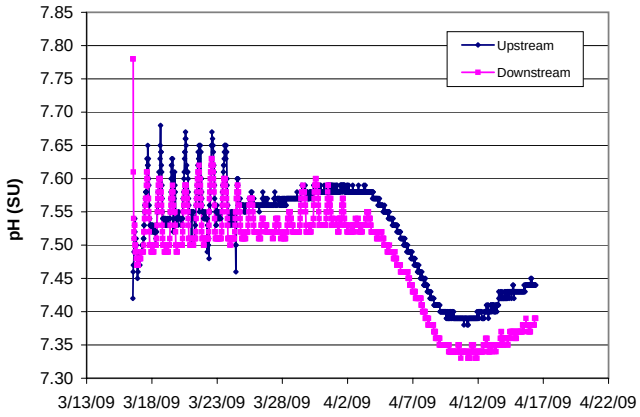
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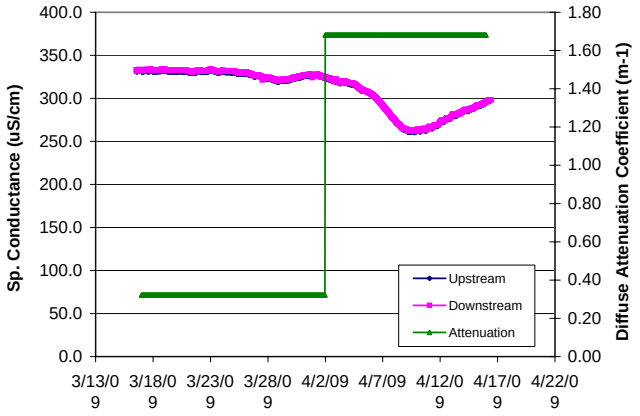
WAKULLA SPRING - MAIN BOIL TO STN 2 METABOLISM ESTIMATES

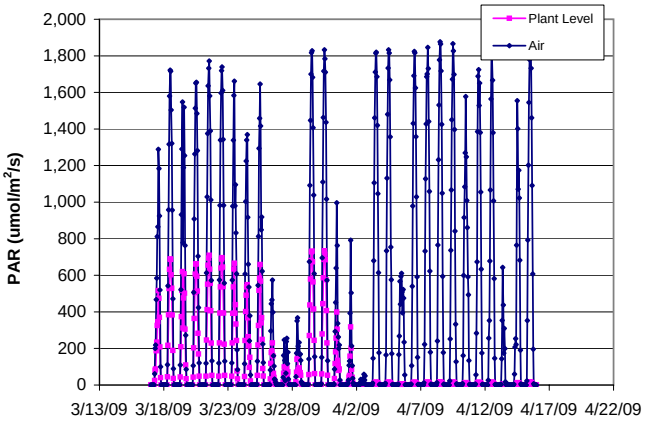
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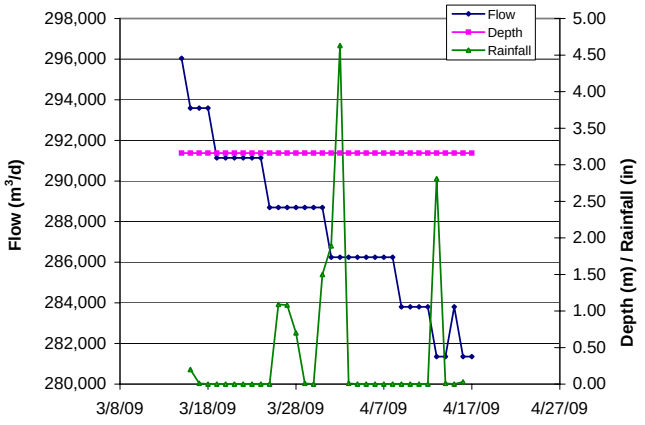
WAKULLA SPRING - MAIN BOIL TO STN 2 METABOLISM SUMMARY



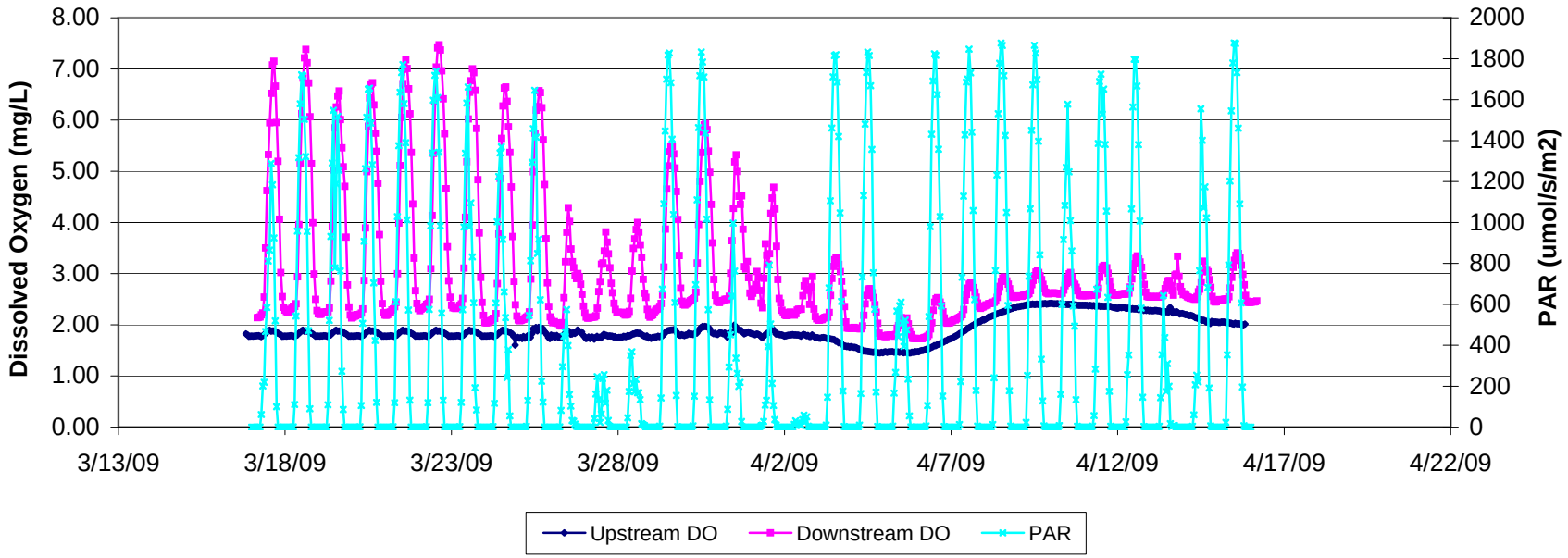






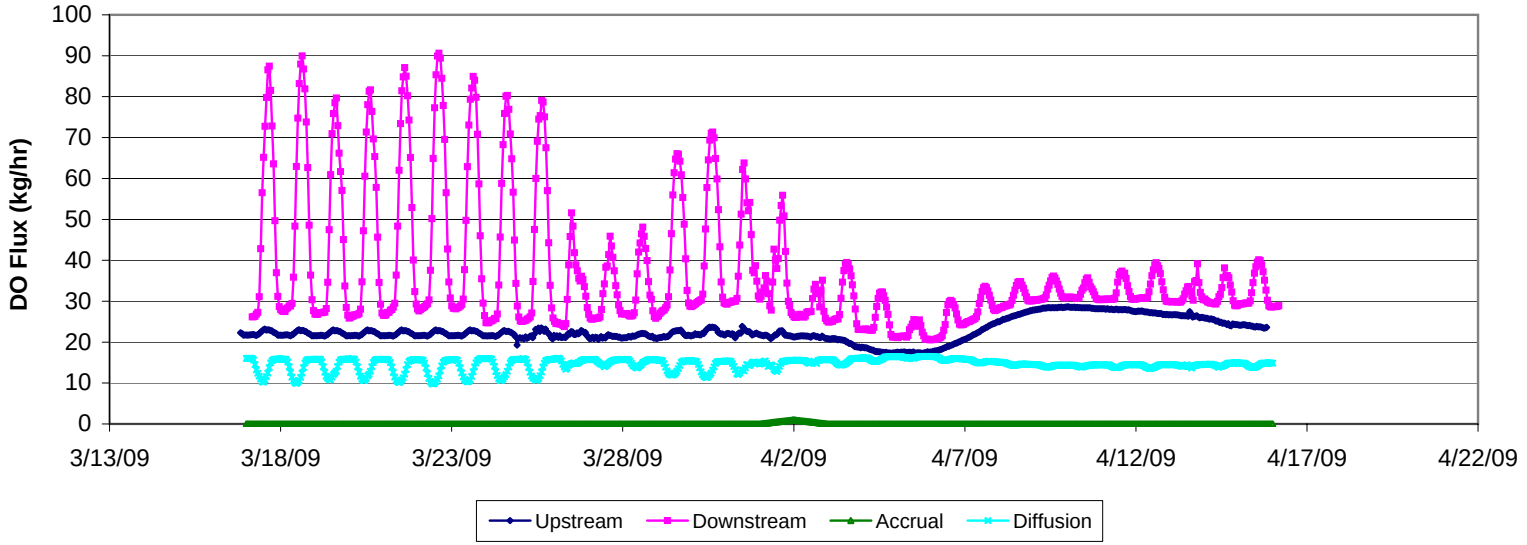


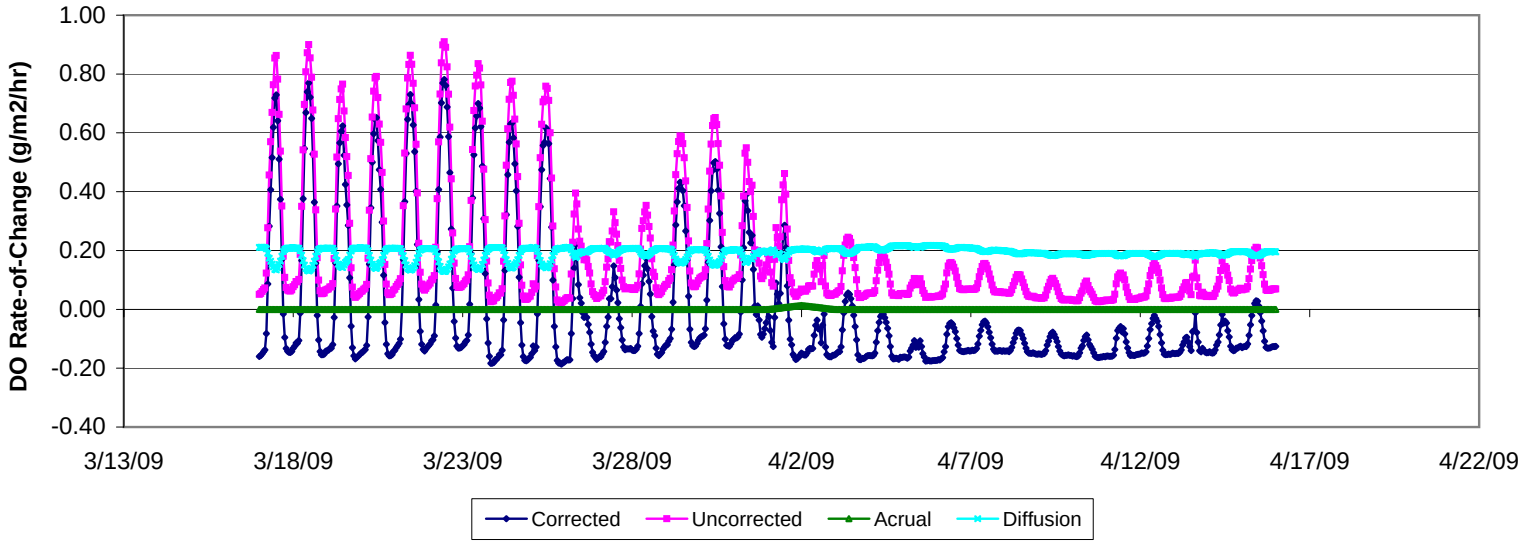
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	1.90	1.45	2.44	1483
down		2.18	1.47	3.68	1483
Wtr Temp - up	C	20.6	20.2	20.9	1483
down		20.6	20.1	21.0	1483
pH - up	SU	7.52	7.38	7.68	1483
down		7.48	7.33	7.78	1483
SpCond - up	uS/cm	309	260	333	1483
down		311	262	334	1483
Flow - up	m^3/d	287,617	281,356	296,036	34
Depth	m	3.16	3.16	3.16	34
Rainfall Total	in		13.97		
PAR - air	$umol/m^2/s$	390	0.0	1,888	768
plant		77	0.0	734	721
DO rate chng	$g/m^2/hr$				
corr		0.090	-0.175	1.162	721
uncorr		0.209	-0.060	1.421	721



APPENDIX N

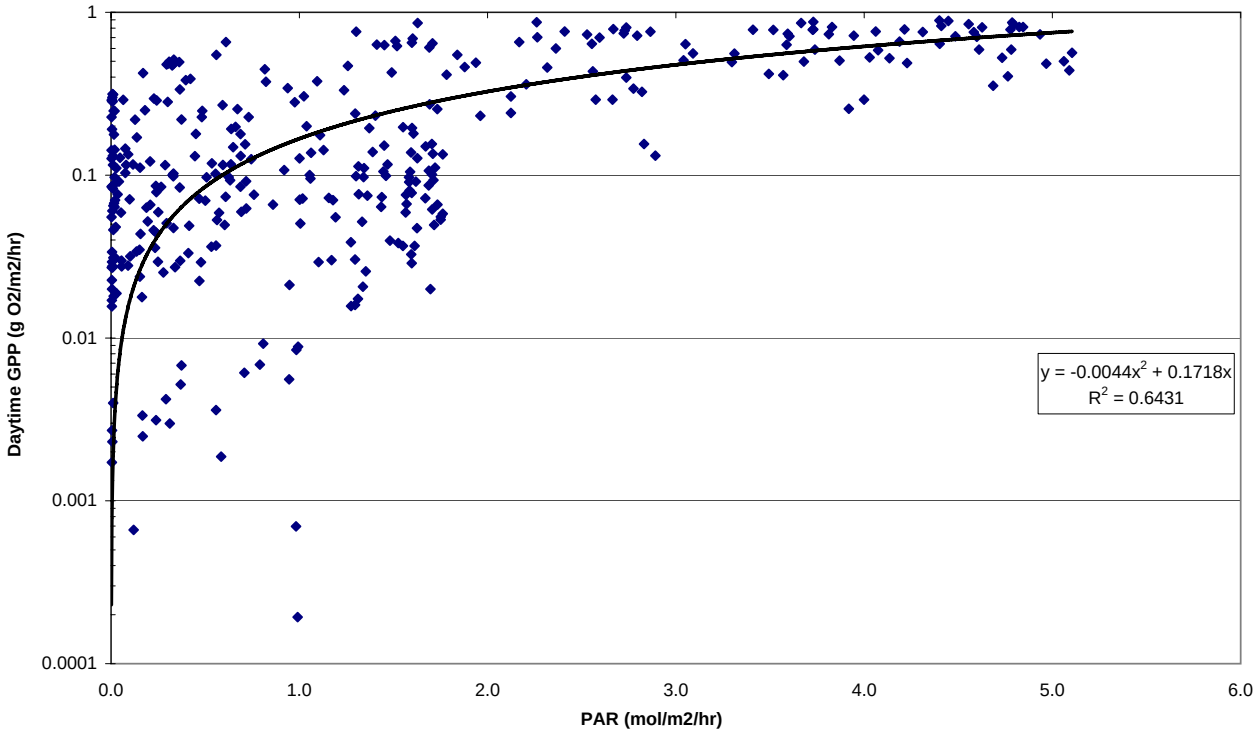
WAKULLA SPRING - MAIN BOIL TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS





APPENDIX N

WAKULLA SPRING - MAIN BOIL TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





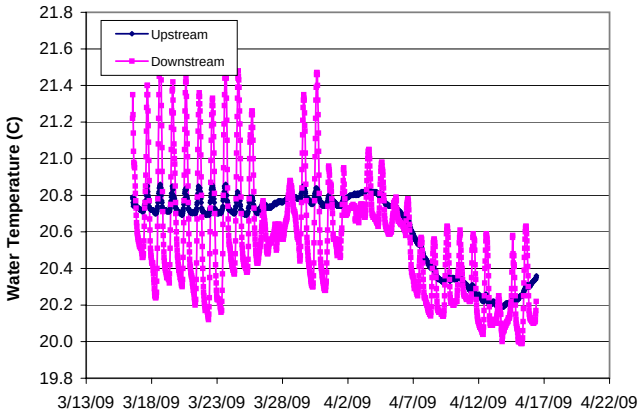
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	3.11	-0.12	3.22	1.07	1.44
Max	7.75	5.25	3.97	3.10	3.62
Min	0.27	-3.70	1.87	0.07	0.33

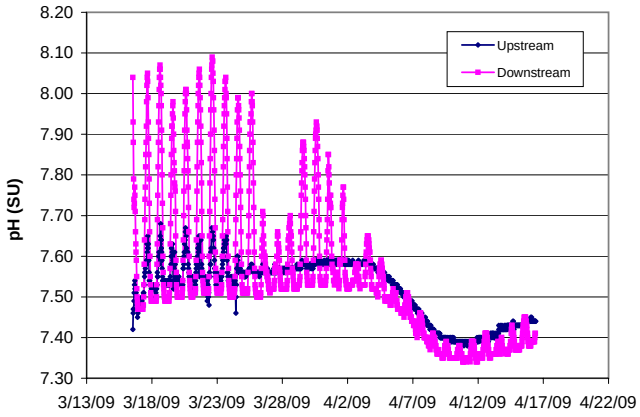
APPENDIX N

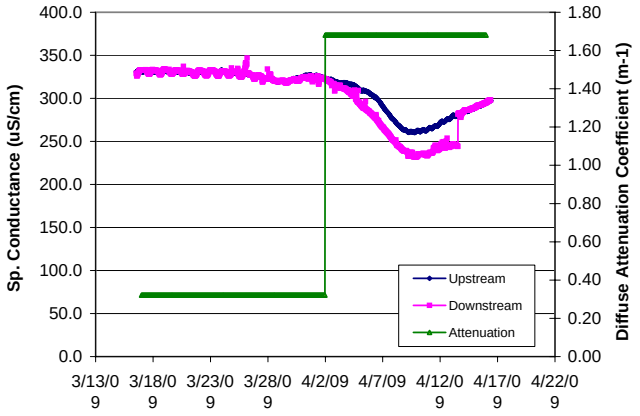
WAKULLA SPRING - MAIN BOIL TO STN 3 METABOLISM ESTIMATES

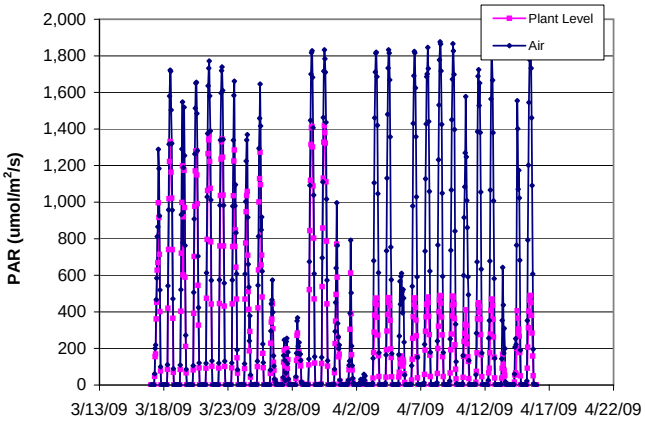
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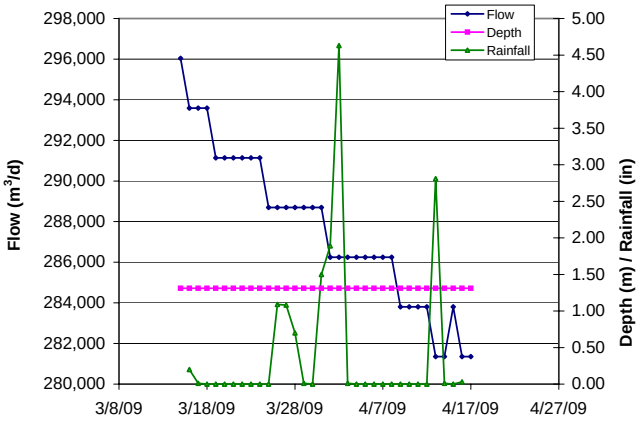
WAKULLA SPRING - MAIN BOIL TO STN 3 METABOLISM SUMMARY



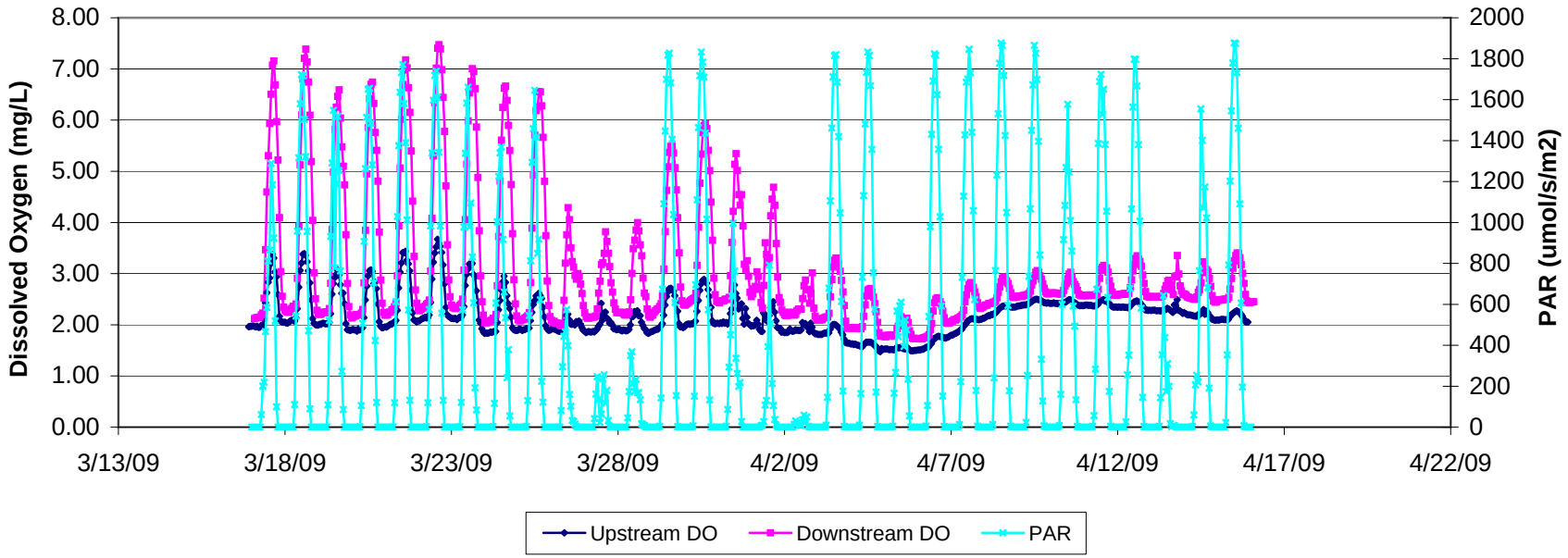






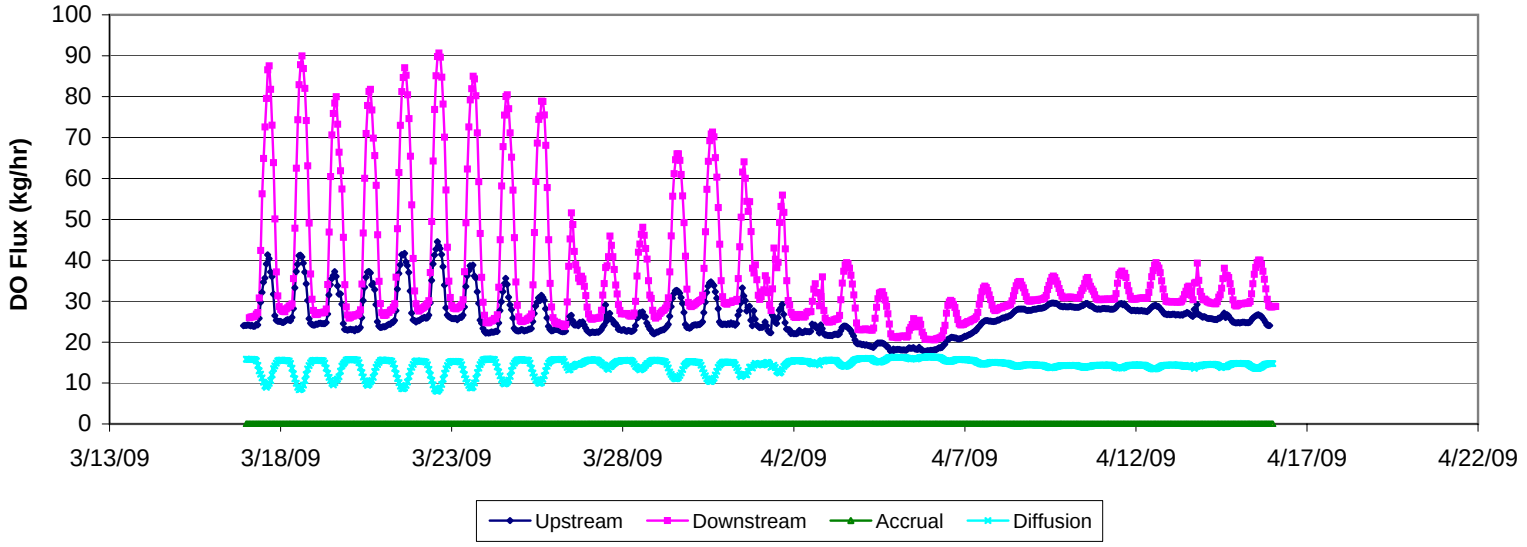


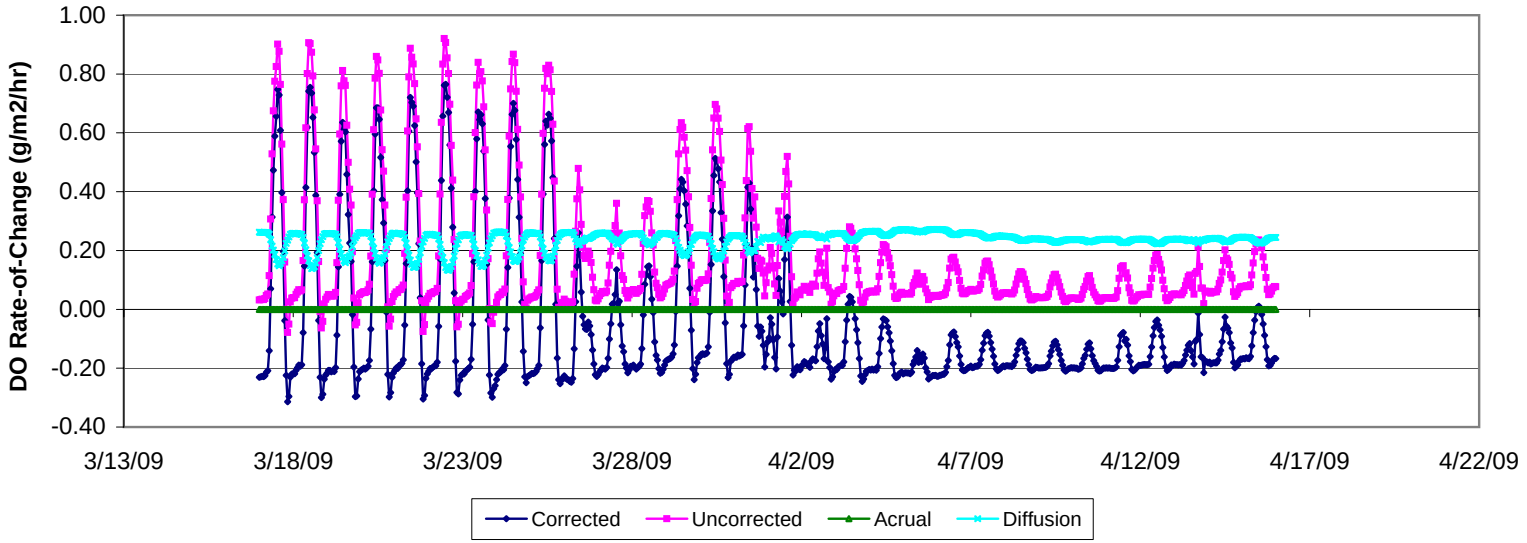
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	1.90	1.45	2.44	1483
down		3.08	1.72	7.48	1482
Wtr Temp - up	C	20.6	20.2	20.9	1483
down		20.5	20.0	21.6	1482
pH - up	SU	7.52	7.38	7.68	1483
down		7.54	7.34	8.09	1482
SpCond - up	uS/cm	309	260	333	1483
down		301	232	347	1482
Flow - up	m^3/d	287,617	281,356	296,036	34
Depth	m	1.31	1.31	1.31	34
Rainfall Total	in		13.97		
PAR - air	umol/m^2/s	390	0.0	1,888	768
plant		199	0.0	1418	721
DO rate chng	g/m^2/hr				
corr		-0.007	-0.186	0.781	721
uncorr		0.185	0.021	0.910	721



APPENDIX N

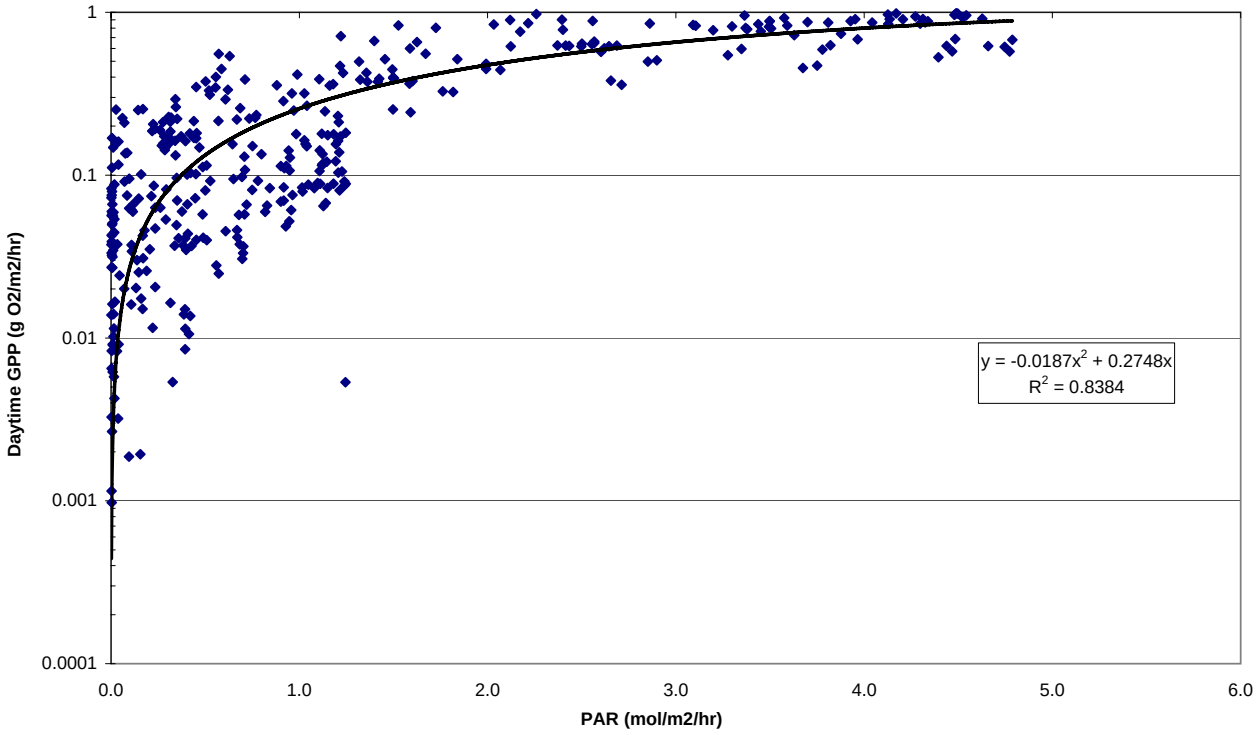
WAKULLA SPRING - STN 2 TO 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

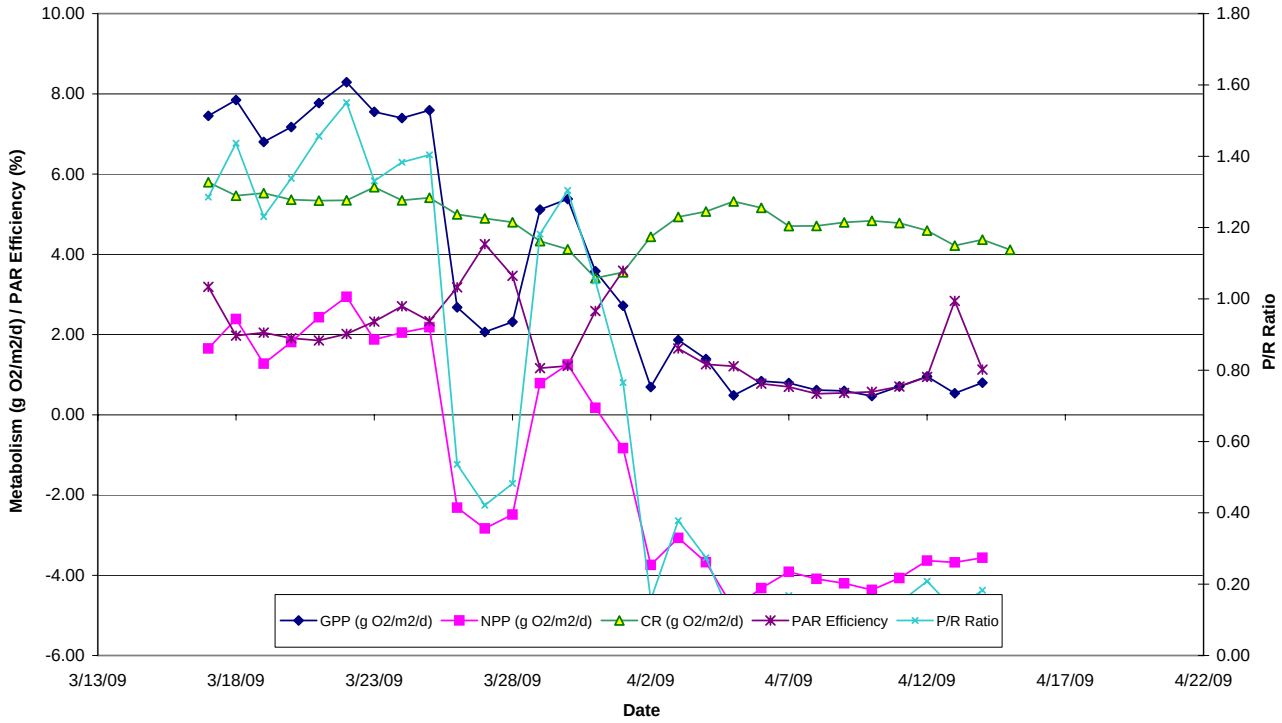




APPENDIX N

WAKULLA SPRING - STN 2 TO 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE



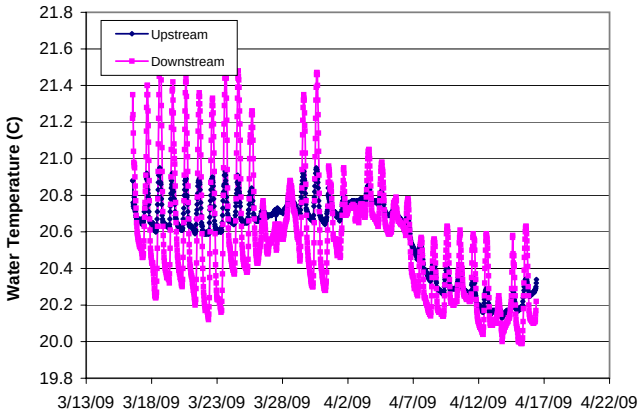


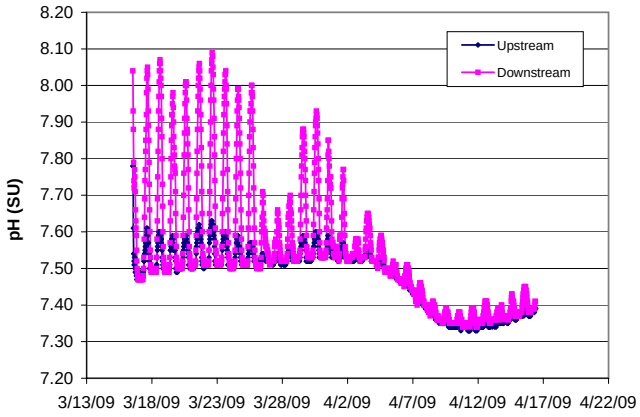
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	3.53	-1.34	4.85	0.70	1.88
Max	8.29	2.94	5.80	1.55	4.25
Min	0.47	-4.83	3.41	0.09	0.52

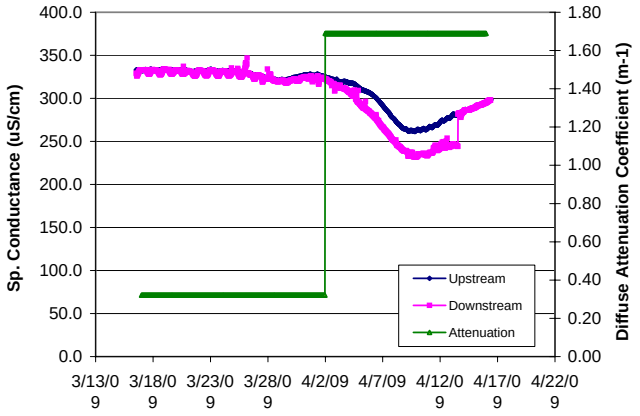
APPENDIX N
WAKULLA SPRING - STN 2 TO 3 METABOLISM ESTIMATES

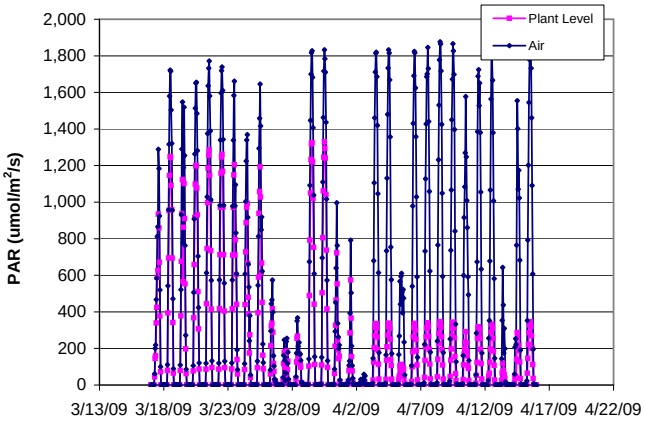
APPENDIX N

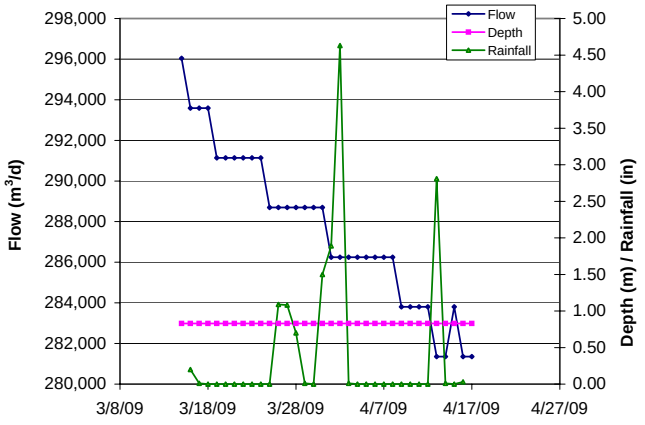
WAKULLA SPRING - STN 2 TO 3 METABOLISM SUMMARY



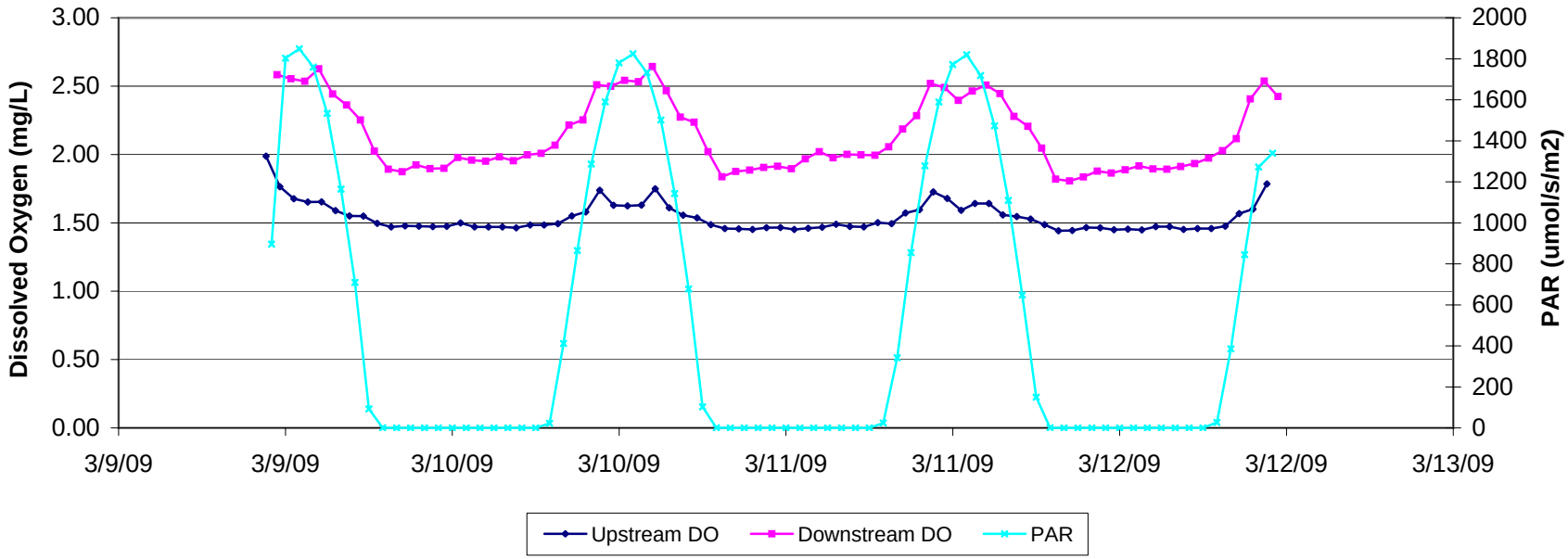






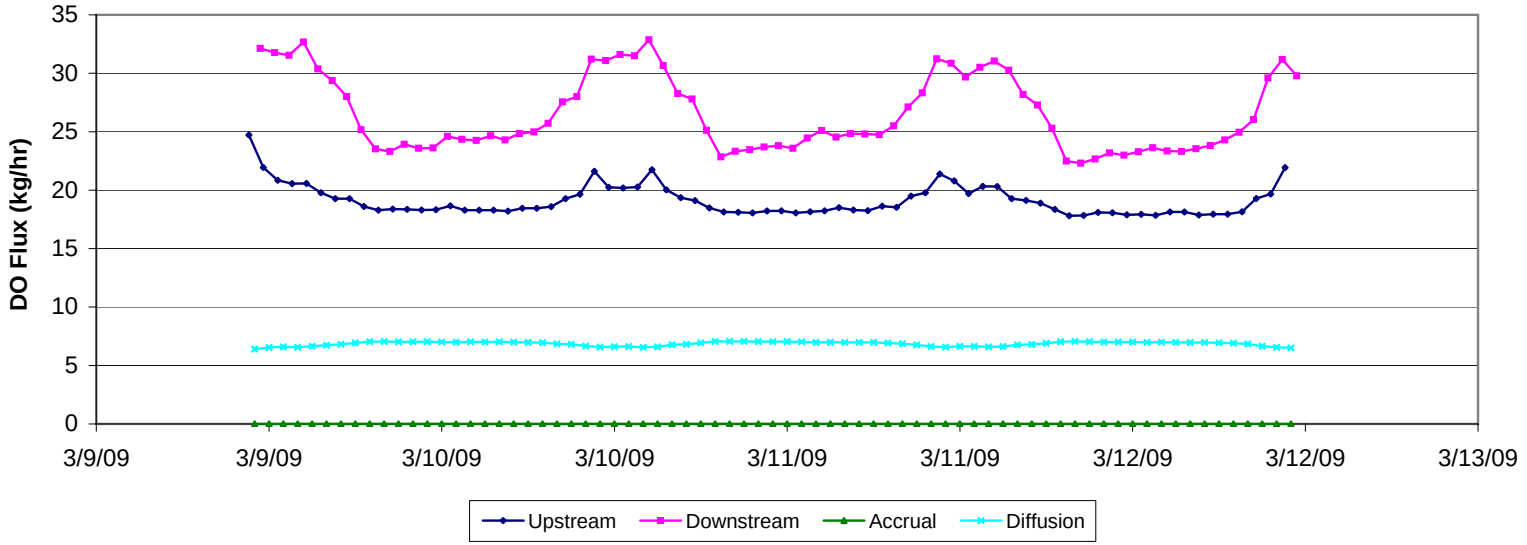


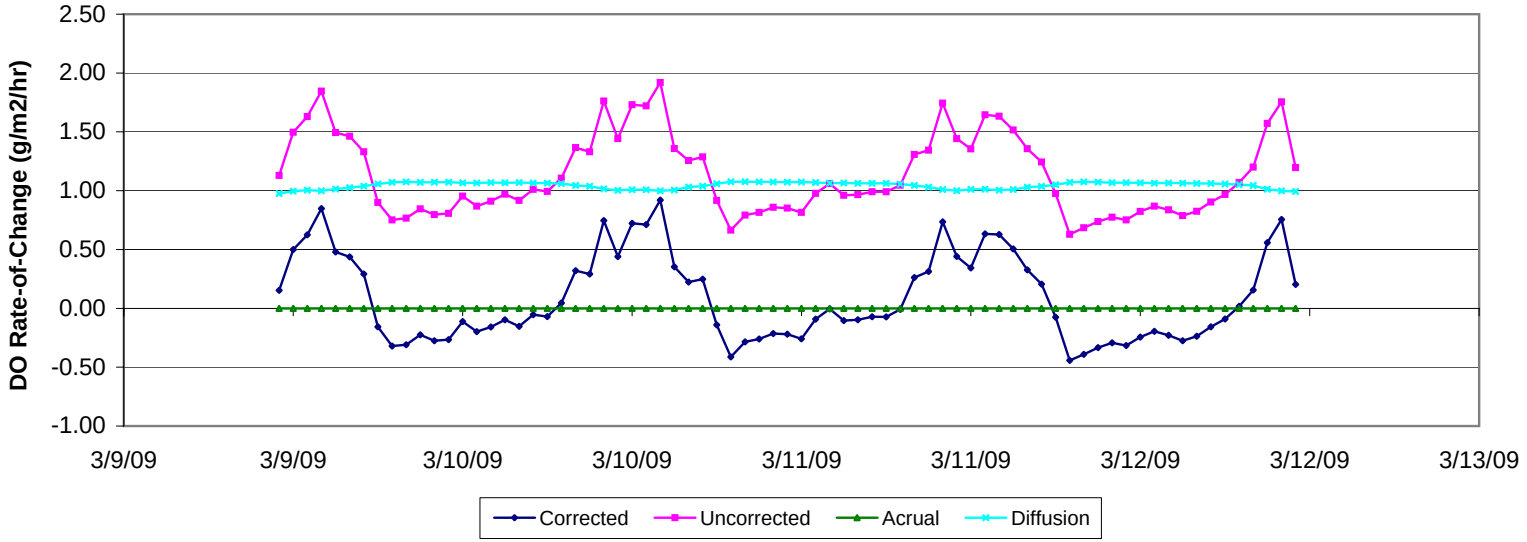
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	2.18	1.47	3.68	1483
down		3.08	1.72	7.48	1482
Wtr Temp - up	C	20.6	20.1	21.0	1483
down		20.5	20.0	21.6	1482
pH - up	SU	7.48	7.33	7.78	1483
down		7.54	7.34	8.09	1482
SpCond - up	uS/cm	311	262	334	1483
down		301	232	347	1482
Flow - up	m^3/d	287,617	281,356	296,036	34
Depth	m	0.83	0.83	0.83	34
Rainfall Total	in		13.97		
PAR - air	umol/m^2/s	390	0.0	1,888	768
plant		174	0.0	1330	721
DO rate chng	g/m^2/hr				
corr		-0.057	-0.314	0.765	721
uncorr		0.178	-0.079	0.920	721



APPENDIX N

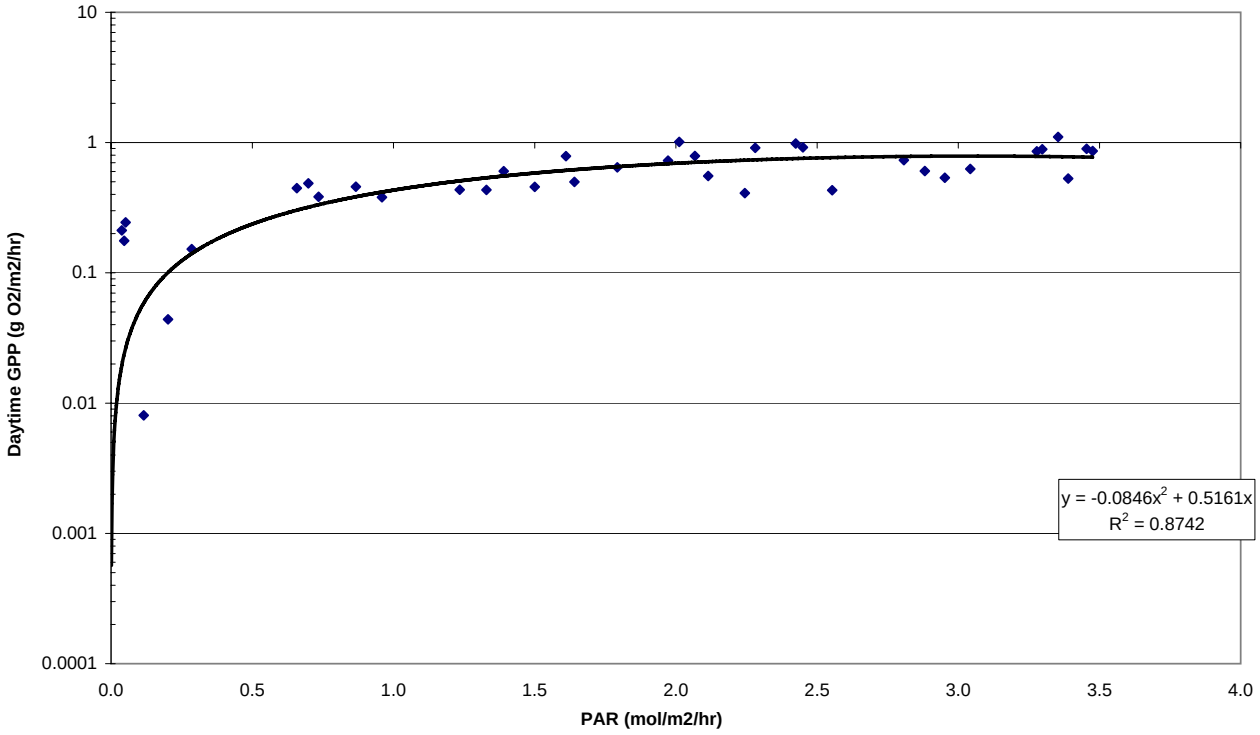
WEEKI WACHEE SPRING - MAIN BOIL TO STN 2 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

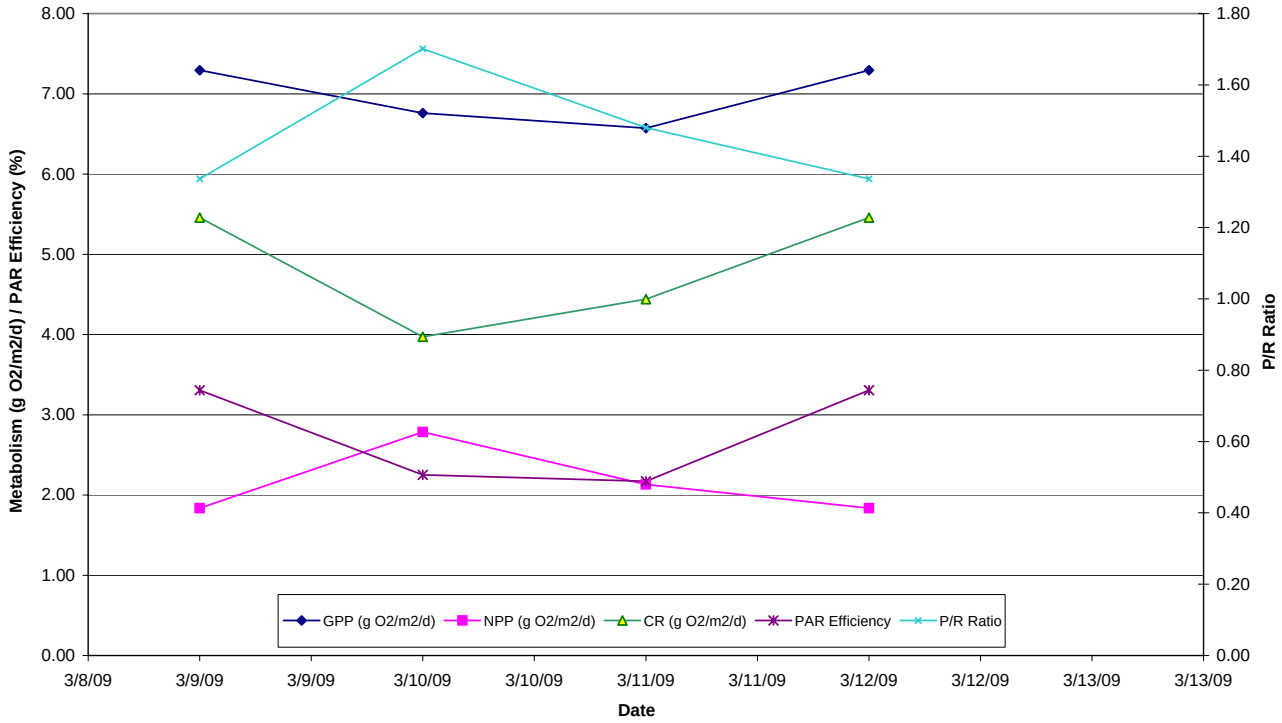




APPENDIX N

WEEKI WACHEE SPRING - MAIN BOIL TO STN 2 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





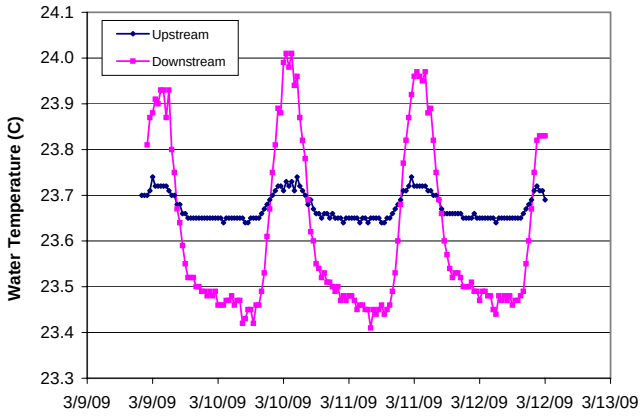
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
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Max	7.29	2.79	5.46	1.70	3.31
Min	6.57	1.84	3.97	1.34	2.17

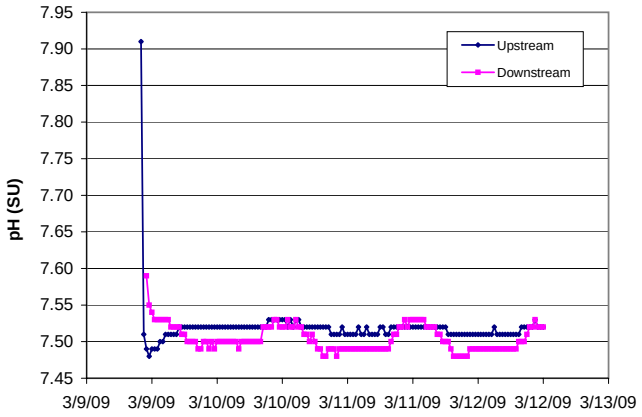
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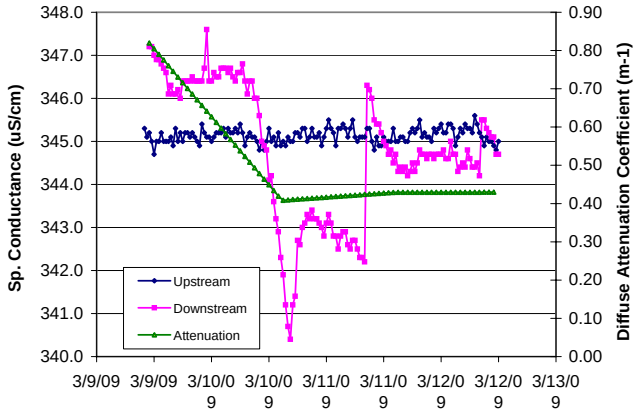
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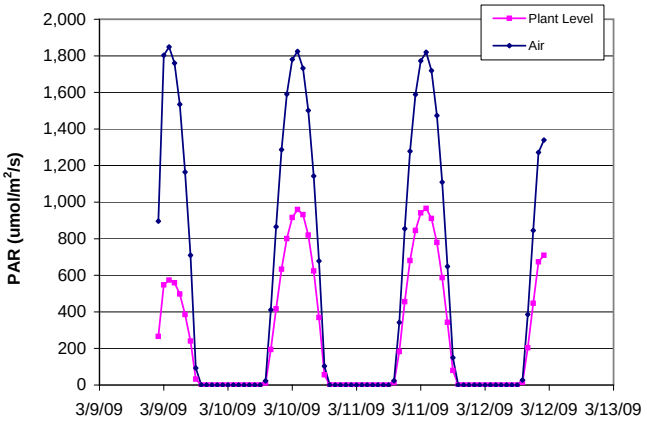
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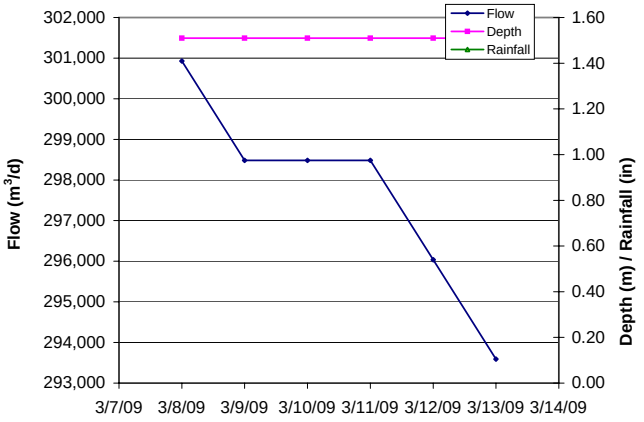
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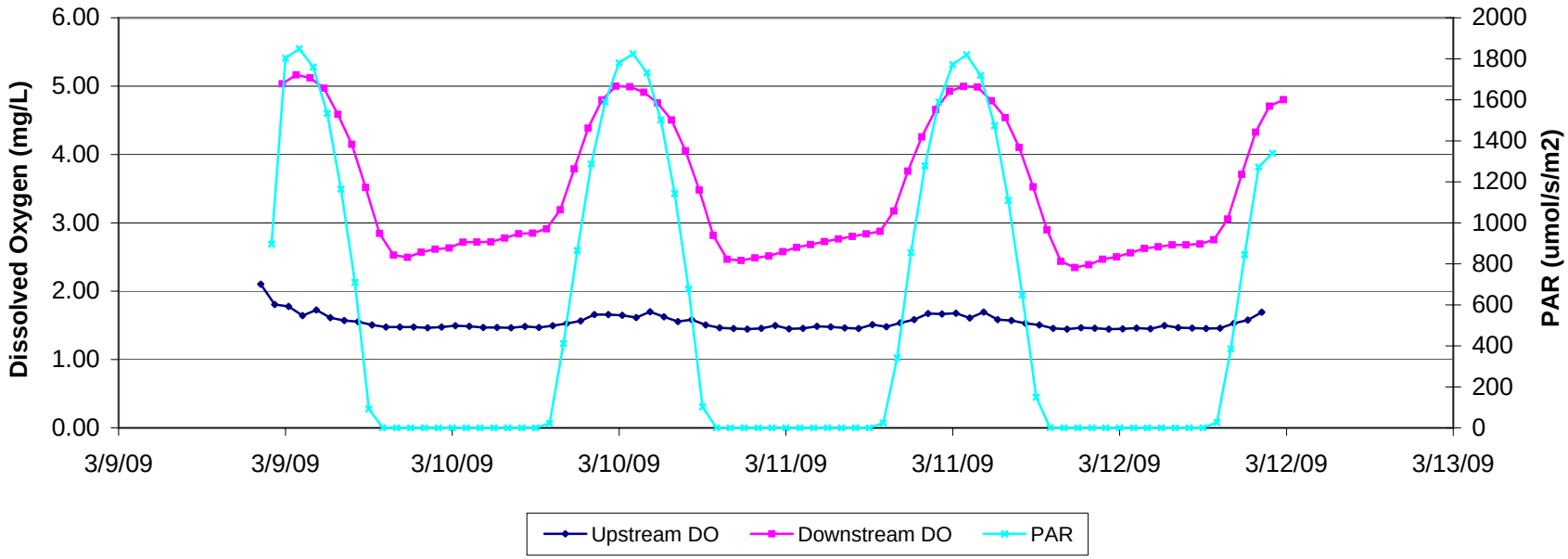






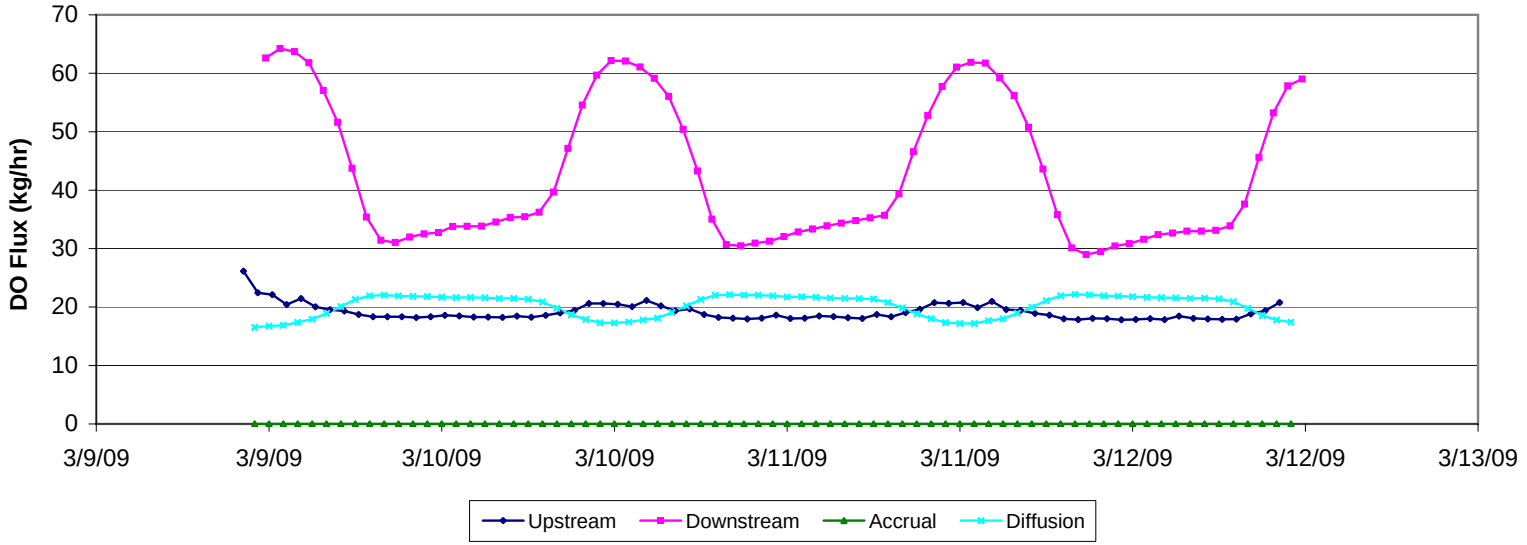


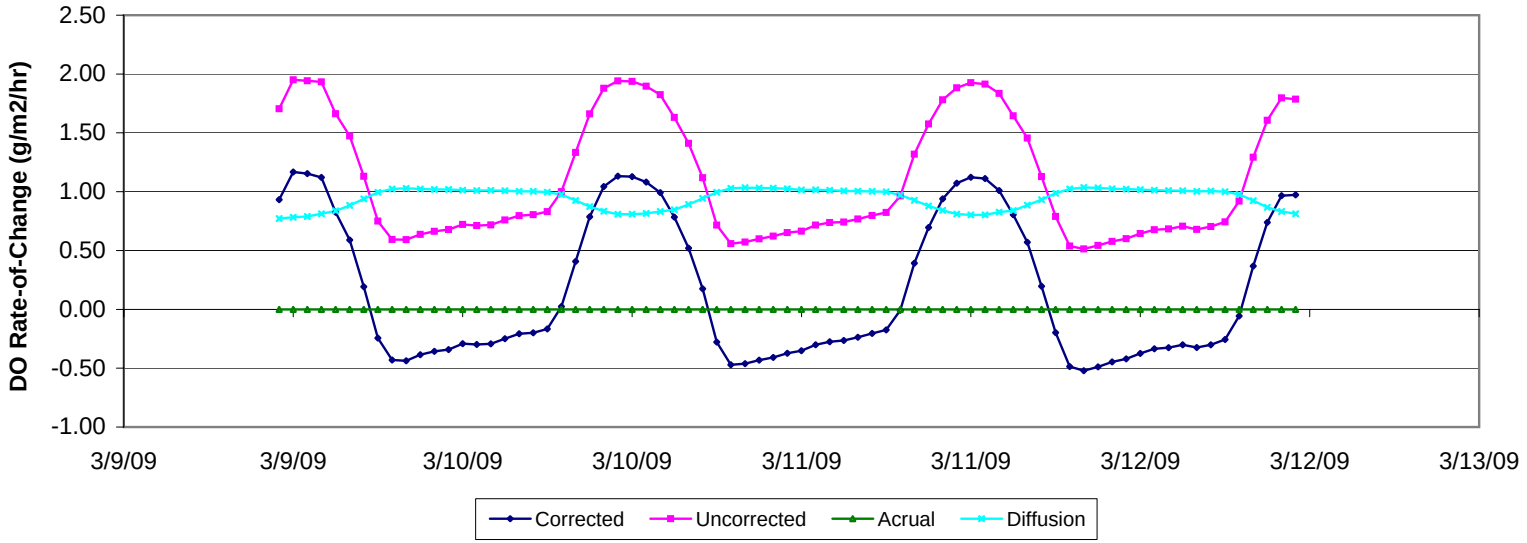
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down		2.14	1.79	2.75	147
Wtr Temp - up	C	23.7	23.6	23.7	149
down		23.6	23.4	24.0	147
pH - up	SU	7.52	7.48	7.91	149
down		7.50	7.48	7.59	147
SpCond - up	uS/cm	345	345	346	149
down		345	340	348	147
Flow - up	m^3/d	297,667	293,589	300,929	6
Depth	m	1.51	1.51	1.51	6
Rainfall Total	in		0		
PAR - air	umol/m^2/s	553	0.0	1,857	297
plant		256	0.0	966	73
DO rate chng	g/m^2/hr				
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uncorr		1.134	0.629	1.919	73



APPENDIX N

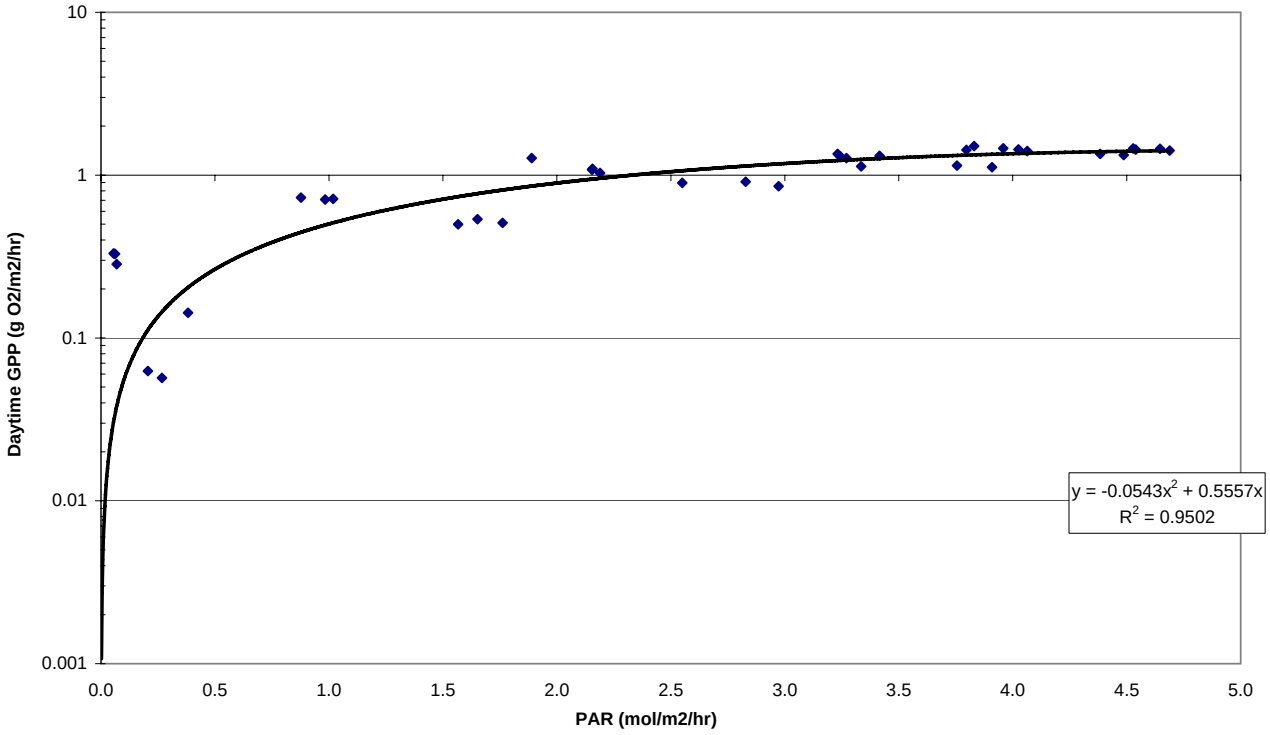
WEEKI WACHEE SPRING - MAIN BOIL TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

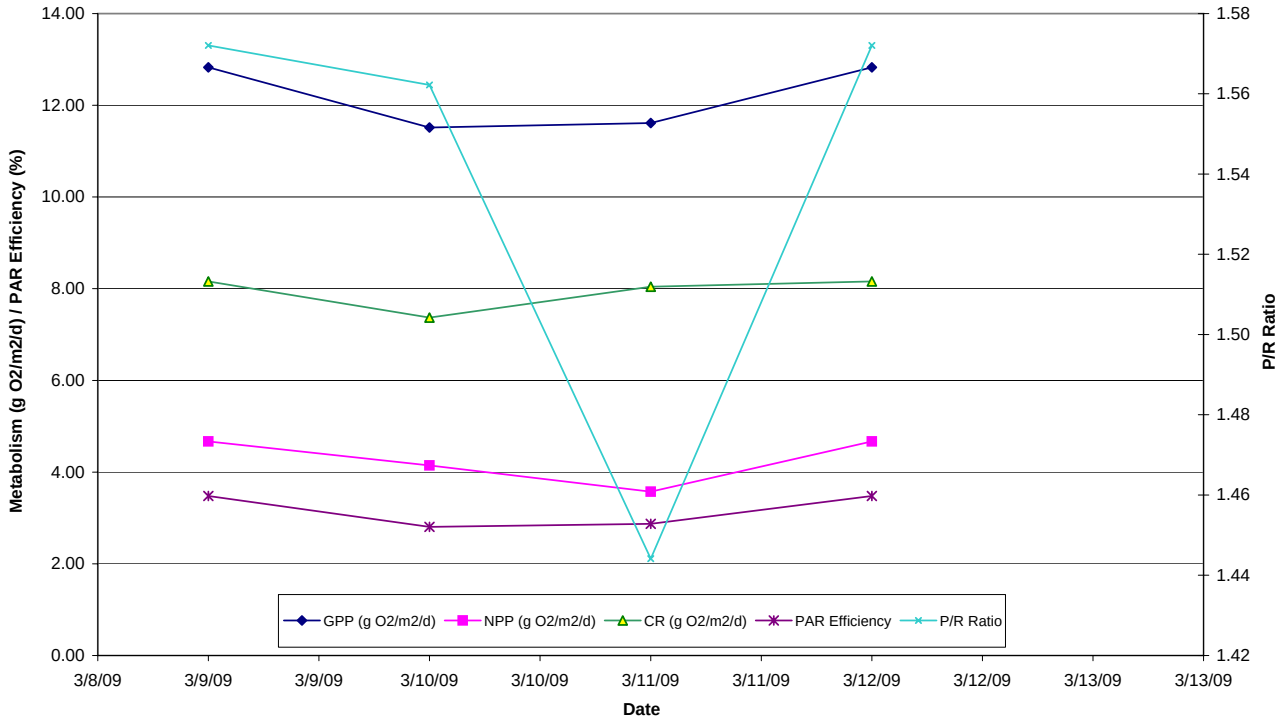




APPENDIX N

WEEKI WACHEE SPRING - MAIN BOIL TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





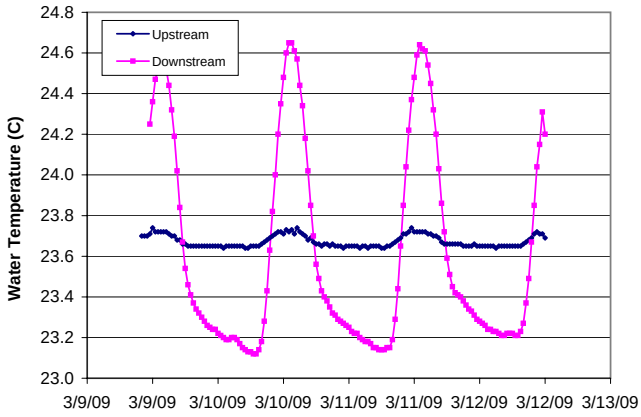
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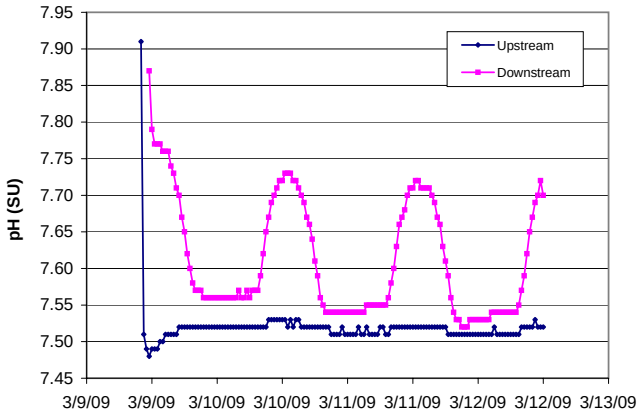
WEEKI WACHEE SPRING - MAIN BOIL TO STN 3 METABOLISM ESTIMATES

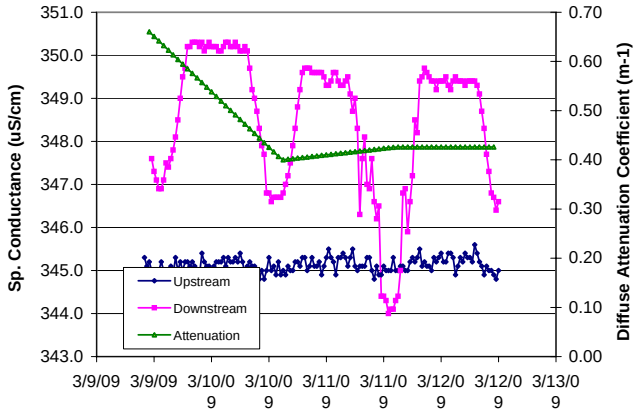
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	12.20	4.26	7.93	1.54	3.16
Max	12.83	4.67	8.16	1.57	3.48
Min	11.52	3.57	7.37	1.44	2.81

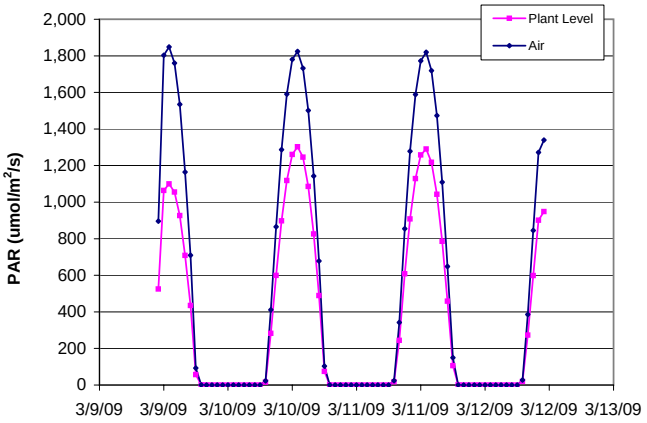
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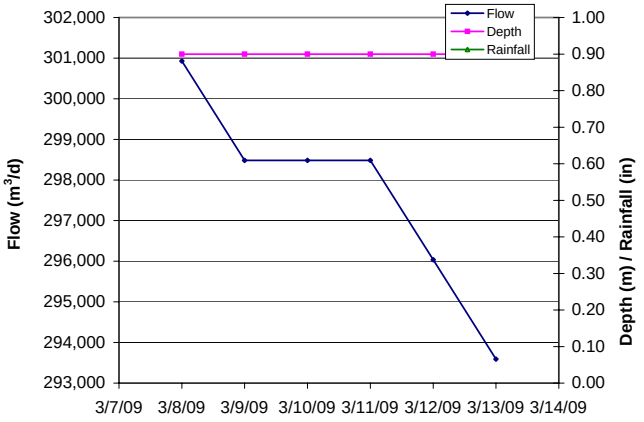
WEEKI WACHEE SPRING - MAIN BOIL TO STN 3 METABOLISM SUMMARY



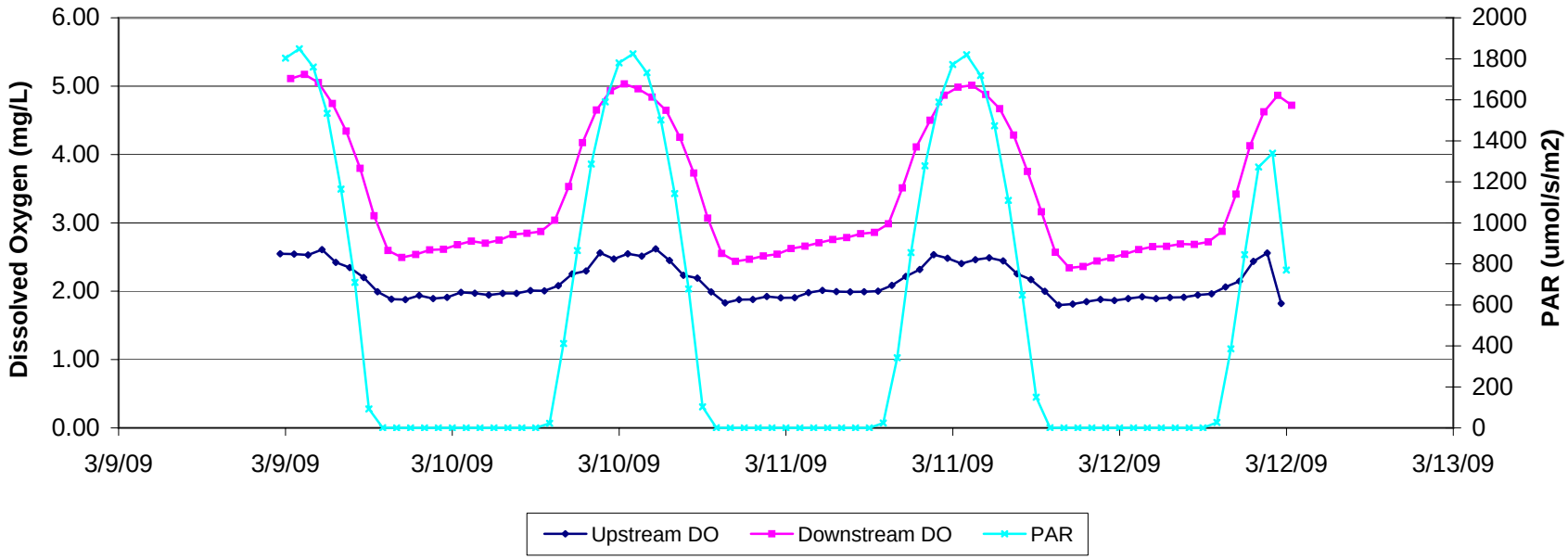






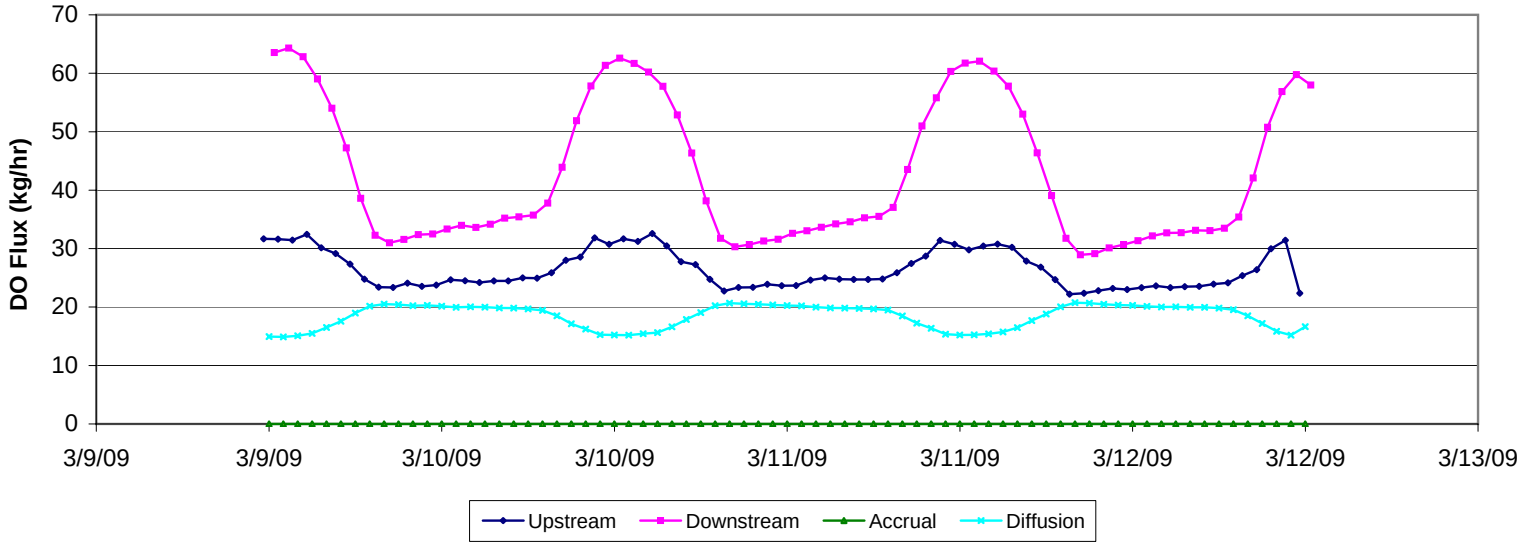


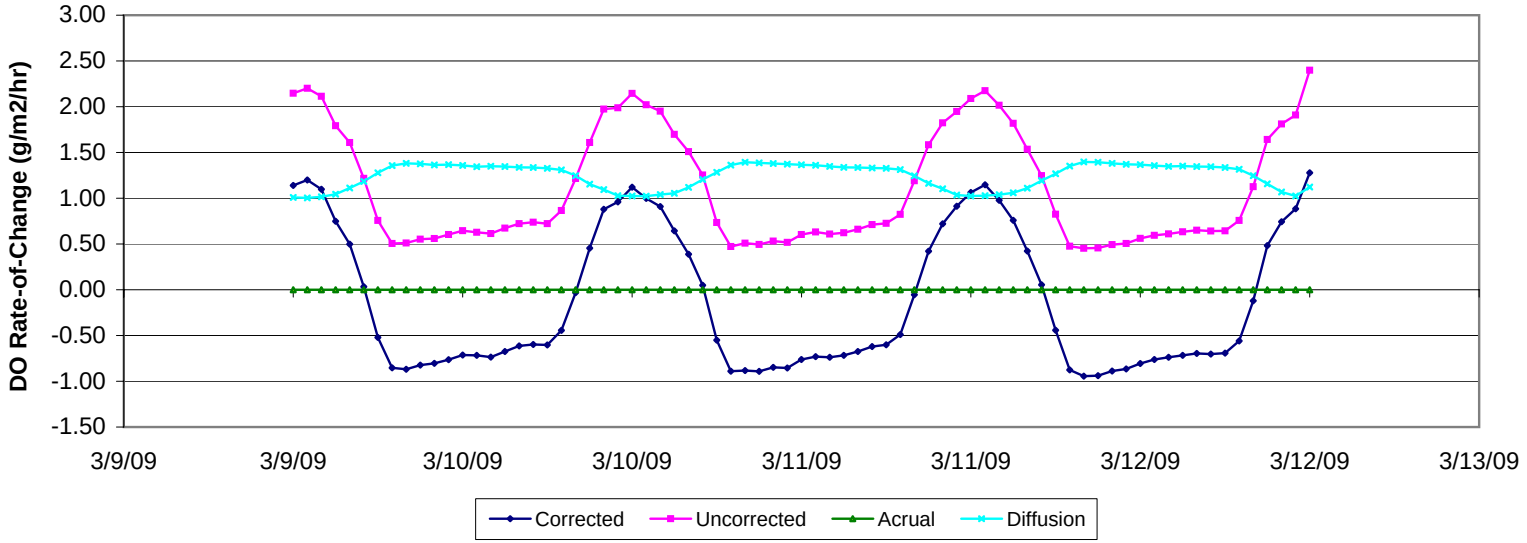
Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	1.55	1.44	2.17	149
down		3.46	2.33	5.20	146
Wtr Temp - up	C	23.7	23.6	23.7	149
down		23.6	23.1	24.7	146
pH - up	SU	7.52	7.48	7.91	149
down		7.61	7.52	7.87	146
SpCond - up	uS/cm	345	345	346	149
down		348	344	350	146
Flow - up	m^3/d	297,667	293,589	300,929	6
Depth	m	0.90	0.90	0.90	6
Rainfall Total	in		0		
PAR - air	umol/m^2/s	553	0.0	1,857	297
plant		368	0.0	1302	73
DO rate chng	g/m^2/hr				
corr		0.165	-0.522	1.168	73
uncorr		1.108	0.514	1.951	73



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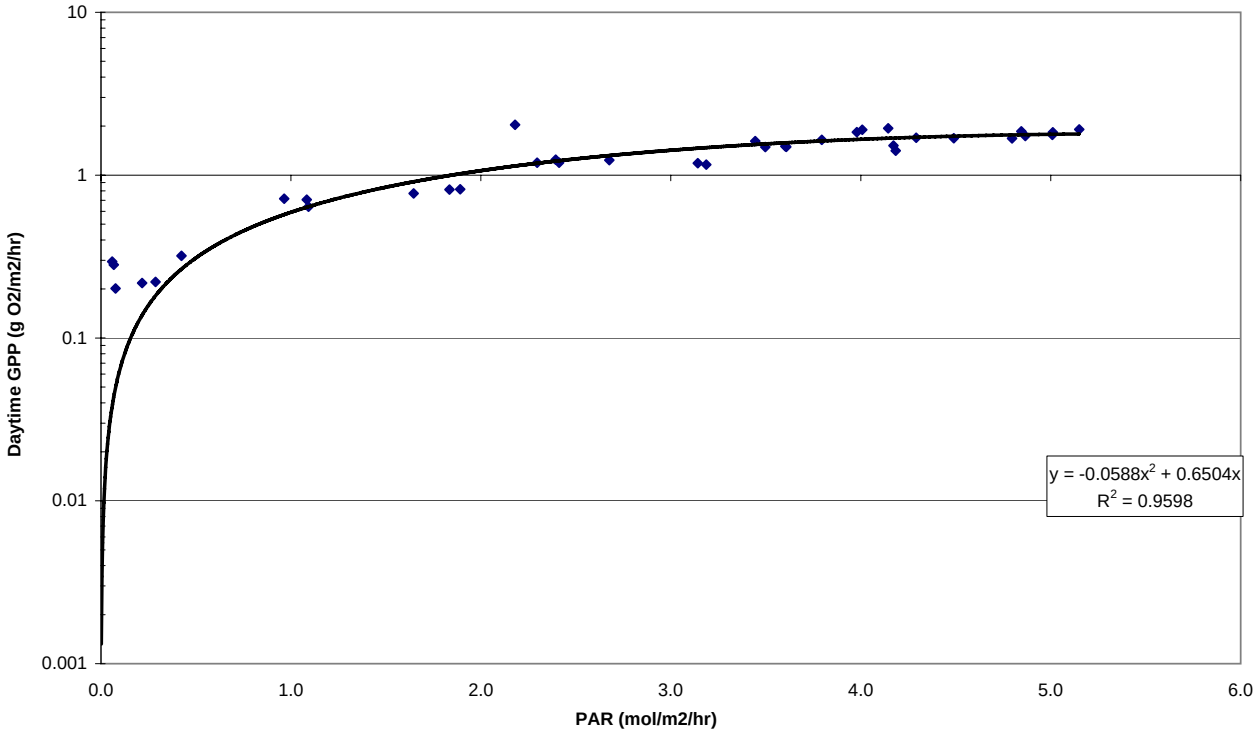
WEEKI WACHEE SPRING - STN 2 TO STN 3 UPSTREAM / DOWNSTREAM DISSOLVED OXYGEN MEASUREMENTS

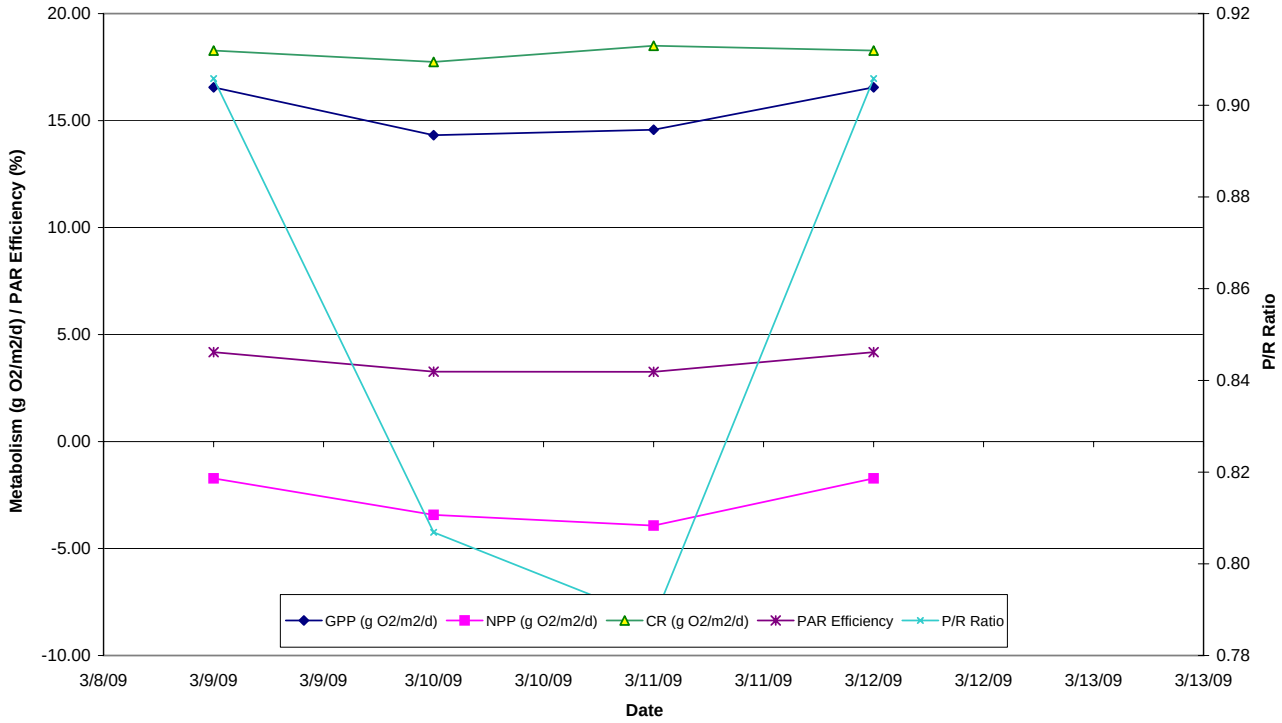




APPENDIX N

WEEKI WACHEE SPRING - STN 2 TO STN 3 DISSOLVED OXYGEN FLUX / RATE OF CHANGE





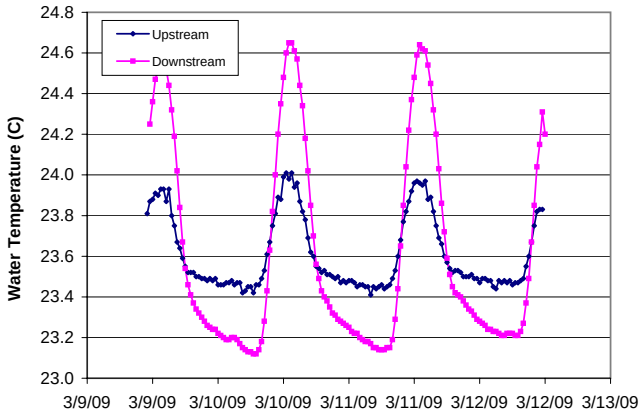
Stats	GPP	NPP	CR	P/R	PAR Eff.
	($g\ O_2/m^2/d$)			ratio	(%)
Avg	15.50	-2.70	18.20	0.85	3.72
Max	16.55	-1.72	18.50	0.91	4.18
Min	14.31	-3.92	17.74	0.79	3.26

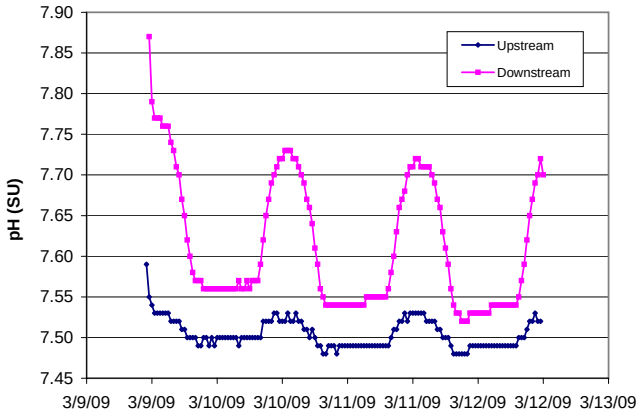
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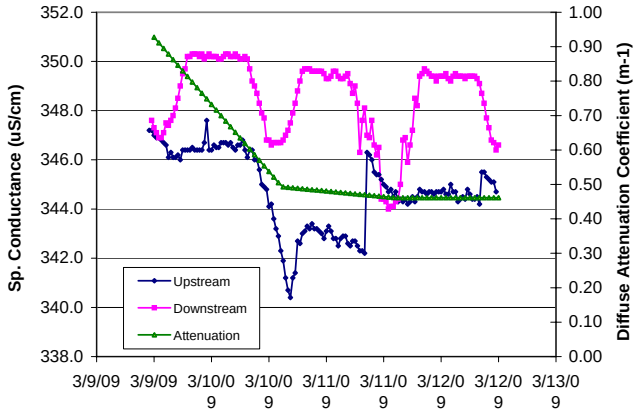
WEEKI WACHEE SPRING - STN 2 TO STN 3 METABOLISM ESTIMATES

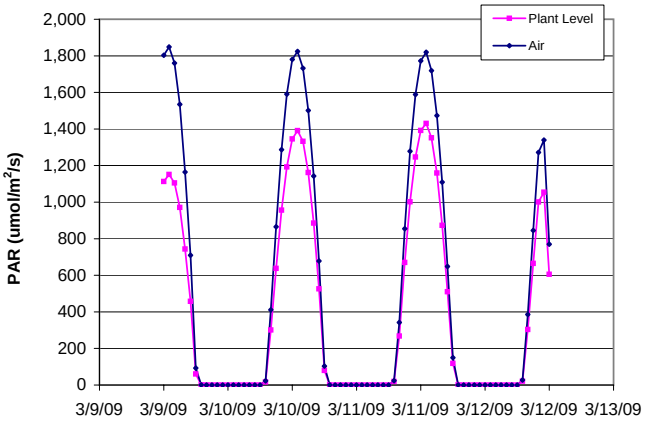
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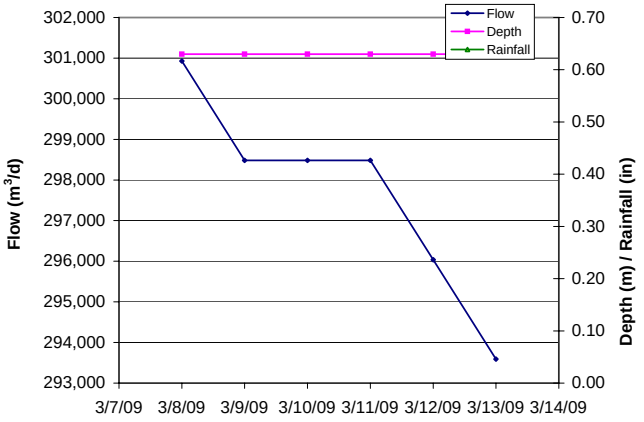
WEEKI WACHEE SPRING - STN 2 TO STN 3 METABOLISM SUMMARY











Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	2.14	1.79	2.75	146
down		3.46	2.33	5.20	146
Wtr Temp - up	C	23.6	23.4	24.0	146
down		23.6	23.1	24.7	146
pH - up	SU	7.50	7.48	7.59	146
down		7.61	7.52	7.87	146
SpCond - up	uS/cm	345	340	348	146
down		348	344	350	146
Flow - up	m^3/d	297,667	293,589	300,929	6
Depth	m	0.63	0.63	0.63	6
Rainfall Total	in		0		
PAR - air	umol/m^2/s	553	0.0	1,857	297
plant		399	0.0	1430	73
DO rate chng	g/m^2/hr				
corr		-0.135	-0.944	1.278	73
uncorr		1.107	0.453	2.399	73

Appendix O

Summary of data for De Leon Springs



Summary of Existing Data - De Leon Springs (Volusia Co.)

Prepared by

Wetland Solutions, Inc.

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Cover photo: Underwater view of De Leon Springs pool entry stairs with a school of golden shiner (*Notemigonus crysoleucas*) swimming above (S.K. Notestein, 10/06/08).

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Table 4 Macroinvertebrate richness and community measures for De Leon Springs 2003/2004 (from Phelps *et al*. 2006).

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Table 6 Results of FDEP fish survey of De Leon Springs run (Spring Garden Lake, Volusia County) conducted on May 9, 2007.

Table 7 A summary of water resource values, the flow condition used for their evaluation, and the results of the MFL review (from ATM 2008).

Summary of Existing Springs Data

This report summarizes known existing physical, chemical, and biological data for De Leon Springs (Volusia County). These data were collected from sources such as the St. Johns River Water Management District (SJRWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

De Leon Springs State Park

Physical address

De Leon Springs State Park; 601 Ponce De Leon Blvd.; De Leon Springs, Florida 32130; Phone: 386-985-4212; latitude/longitude: 29.132298°, -81.360859°; park website: http://www.floridastateparks.org/deleonsprings/default.cfm .

Driving Directions

Take US Hwy 17 North from Deland for approximately 10 km (6 mi). Turn left onto Ponce De Leon Blvd and travel approximately 0.6 km (1 mi) to the park entrance (**Figure 1**).

General

The name applied to this spring has several variations, most commonly referred to as either De Leon Springs or Ponce De Leon Springs. We utilize the name "De Leon Springs", as it reflects the established name of the park by the FDEP/FPS. This second magnitude spring has a long history of human usage as evidenced by the presence of several Native American earthen mounds. In the late 19th century, the springs were developed as a natural health spa and are presently administered by the FDEP/FPS. The park facilities are well developed and include a restaurant, museum, and boat ramp (**Figure 2**). Visitor parking is limited to approximately 250 spaces which are commonly filled to capacity. This

site is used as a popular regional swimming destination, as well as for SCUBA instruction, and general outdoor recreation. There is a single main vent near the center of the spring pool, and a group of smaller spring vents are located several hundred feet downstream of the spring pool.

Physical

De Leon Springs is a second magnitude spring with a semicircular pool of about 58 m (190 ft) in width. Several springs are found on the property; however the principal spring vent is enclosed in a semicircular pool approximately 61 m (200 ft) in diameter. The pool is fully enclosed by a concrete wall and walkway. Spring discharge emanates from a cavern near the central part of the pool resulting in a visible surface boil. The lands immediately surrounding the pool are maintained as open grass, scattered trees, as well as a bathhouse and other structures. Spring water discharges through three outlets along the west concrete wall: the majority passing through a concrete weir (with about a 0.6 m drop in elevation) onto a rock waterfall feature, a small portion through a concrete channel leading past an inoperative water wheel, and a variable amount through a discharge pipe with a control valve.

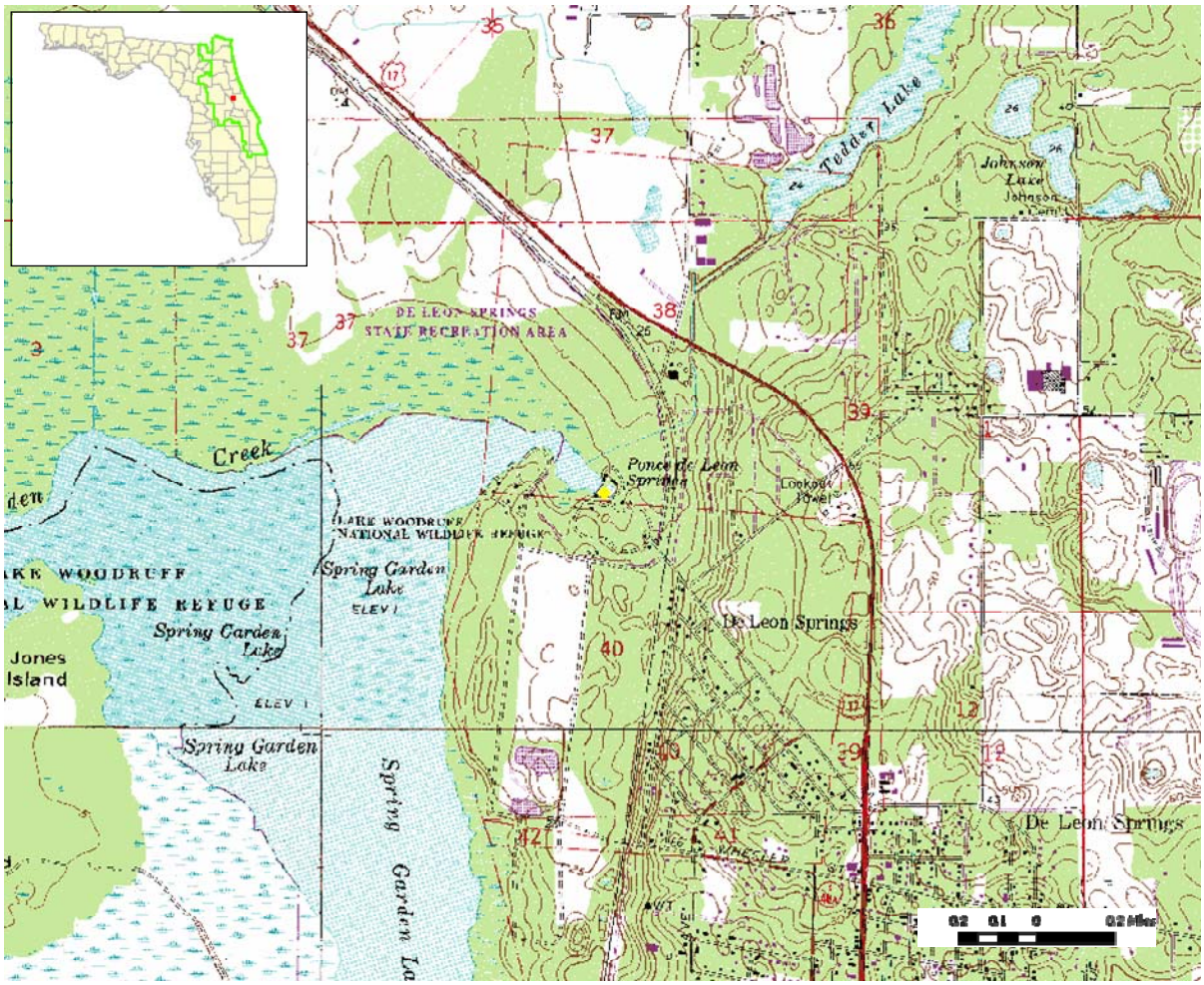


FIGURE 1
De Leon Springs location in Volusia County.

De Leon Springs discharge empties into a wide spring run (a lobe of Spring Garden Lake). During the reconnaissance visit, the spring run resembled a lake with dimensions about 122 m (400 ft) wide and 305 m (1000 ft) long and was not recognizable as a typical spring run. There was no obvious flow path of water or incised sediment channel, accumulations of floating plants were abundant, water clarity was poor due to organic particles, phytoplankton, and tannins, and deep organic sediments were noted. The spring run connects to a chain of three lakes (Spring Garden, Woodruff, and Dexter), before ultimately joining with the St. Johns River.

De Leon Springs are located within the 2,990 ha (7,390 ac) Spring Garden Creek sub-basin, a component of the Lake Woodruff Unit in the Lake George Basin (Adamus *et al.* 1997). The Lake Woodruff Unit encompasses the middle portion of the St. Johns River, as well as nearby lakes Spring Garden, Woodruff, and Dexter (**Figure 3**).

The De Leon Spring recharge area is approximately 186.5 km^2 (72 mi^2) with major infiltration zones found to the east of the spring group in the urbanized area around US Highway 17 (**Figure 3**). The capture zone boundary was determined by Epting (2006) and suggests that the majority of recharge comes from the sand hills of the Crescent City-DeLand Ridge. The De Leon springshed has also been estimated at 28 km^2 (10.8 mi^2) by Walsh *et al.* (2009).

De Leon Springs is located within the Central Lakes District, a region of active sinkhole development with solution basins, sand hill karst, and internal drainage combining to make this the principle recharge area of the Floridan Aquifer (Brooks 1981). The physiographic region of De Leon Springs can be further subdivided into the Crescent City-DeLand Ridge physiographic subunit. This subunit is characterized by sand hills with typical elevations between 24 m (80 ft) and 30.5 m (100 ft), thick sand soils, and Plio-Pleistocene sands and shells resting directly upon the Floridan Aquifer (Brooks 1981).

A bathymetric survey of the spring run (spillway downstream of weir to park boundary) conducted during May 2008 revealed extensive organic material underlies this area (Kimberly-Horn and Associates 2008). The estimated thickness of this material ranged from 0.3 m (1 ft) to 0.61 m (2 ft) along the shoreline of the spillway to 4.6 m (15 ft) within the central portion of the spillway. The accumulation of organic sediments in this area was attributed to the limited flushing of the run (Kimberly-Horn and Associates 2008).



FIGURE 2
De Leon Springs State Park facilities and attractions (from FDEP).

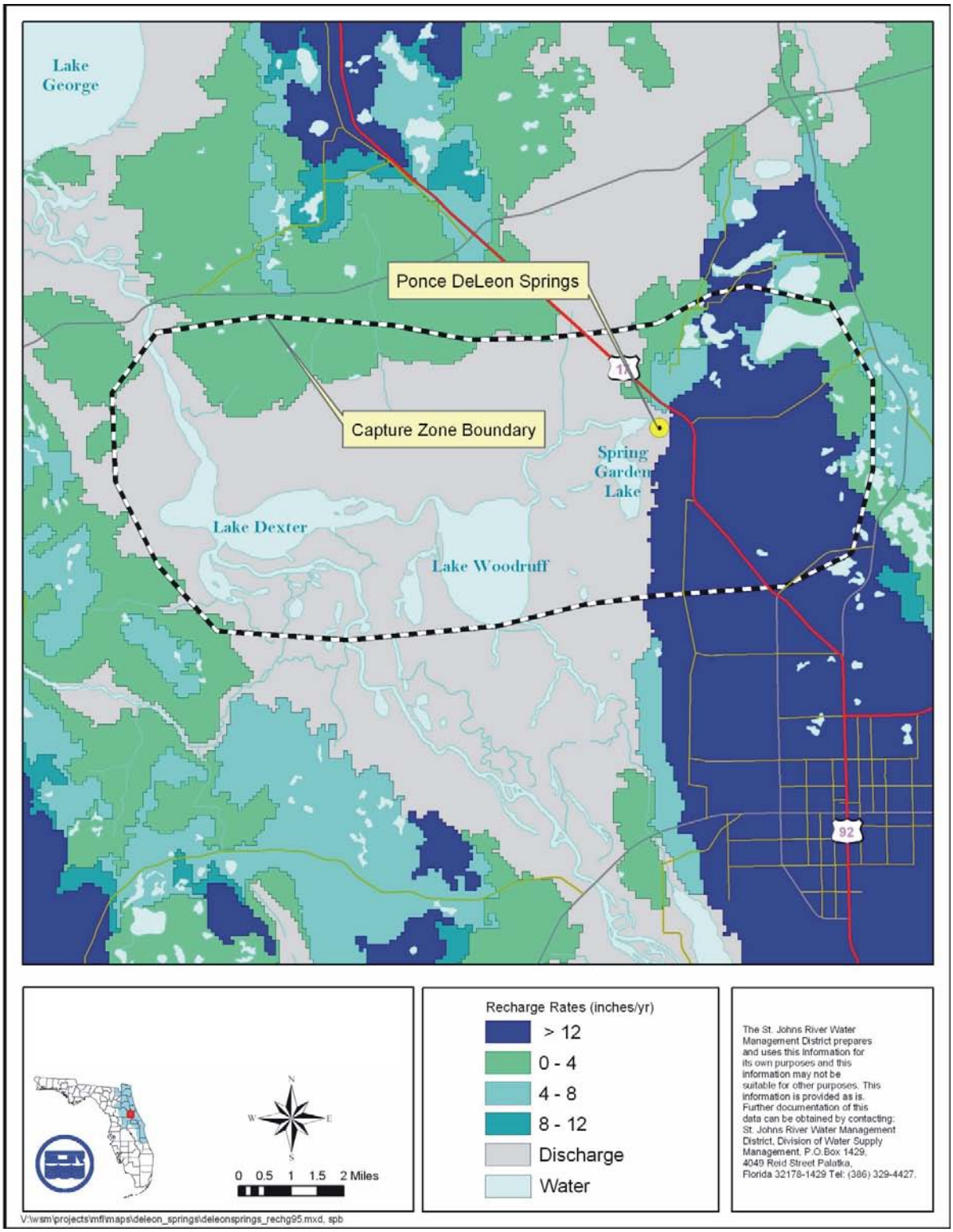


FIGURE 3
Estimated springshed and recharge rates (inches/yr) for the De Leon (aka Ponce de Leon) Springs capture zone (from Epting 2006).

Study Area

The project study area is principally defined as the spring pool (**Figure 4).** The project area includes the spring run, but as Epting (2006) notes, water levels along the spring run are maintained by the hydrology of the St. Johns River, not spring flows. Correspondingly, the effluent of De Leon Springs does not contribute towards the formation of a classic spring run: directional stream flow is not apparent, organic sediments are not transported downstream, water residence times appear long, and water clarity is poor.



FIGURE 4
An aerial view of De Leon Springs and adjacent park facilities, with study area defined by dashed lines.

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of De Leon Springs are given in **Table 1** below.

TABLE 1
Source information for the historical De Leon Springs data described in this report.

Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
21FLCEN	Florida Department of Environmental Protection	20010721	Deleon Springs @ Main Boil	29.134378	-81.362778
21FLGW	FL Dept. of Environmental Protection	11390	Ponce De Leon Springs-Vol	29.134280	-81.362748
21FLVEMD	Volusa County Environmental Health Lab (Florida)	VC-080	Deleon Springs	29.133889	-81.363056
USGS	USGS	2236110	Ponce De Leon Springs Near De Land, FL	29.133888	-81.363056
SJRWMD	St. Johns River Water Management District	301897	Ponce De Leon Springs at De Land, FL	29.133991	-81.362898

Discharge and Stage

This analysis utilized discharge data for De Leon Springs between February 1929 and August 2008 (USGS data). Over this entire period-of-record (POR) the average spring discharge was 27.5 cubic feet per second (cfs) with a range in values between 12.2 to 44.3 cfs (**Figure 5**). These values correspond to historical discharge measurement reported by Rosenau *et al*. (1977), who reported an average discharge of 30.8 cfs (min. of 20 cfs and max. of 42 cfs) for the time period between 1929 and 1975.

The discharge of De Leon Springs has been modeled as a function of water level measurements from a nearby Floridian aquifer well (L-0045) (Intera 2007). Using moving average well water levels (8-, 48- and 52-week), and moving average spring discharge values (12-, 48-, and 52-week), approximately 57% of the variation in spring discharge was determined by the ground water levels of the modeled well (Intera 2007).

The stage of De Leon Springs is artificially modified by the retaining wall/weir which surrounds the spring pool. This weir structure maintains spring pool water levels at approximately three feet above those of spring garden lake. The effects of these elevated water levels on spring discharge are unknown.

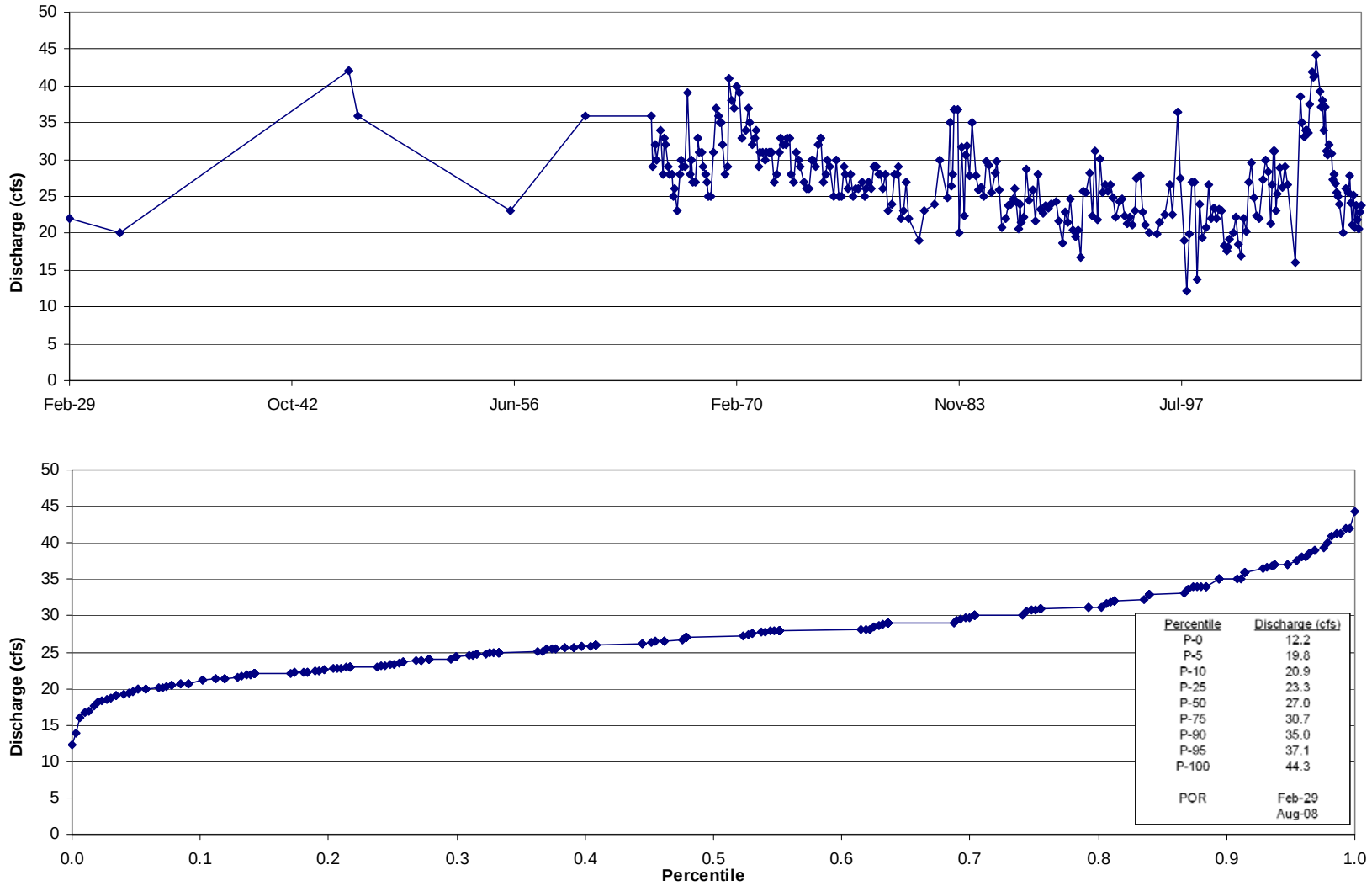


FIGURE 5
Monthly average discharge time series and frequency curve for De Leon Springs.

Water Quality

Water quality data for De Leon Springs are available from as early as April 1956 to as recent as May 2008. The numbers of samples collected were highly variable between parameters, ranging from 1 to over 400 records. Water quality at De Leon Springs has principally been sampled by the U.S. Geological Survey (from 1956 to 1990, with periodic field measurements at other times since 1932) and the St. Johns River Water Management District (SJRWMD, from 1984 to 2005). Currently the SJRWMD samples De Leon spring four times per year (SJRWMD 2008). **Table 2** provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. De Leon Springs POR averages (1932 to 2008) for several key parameters and the numbers of samples in parenthesis are:

- Water temperature – 23.1 °C (n = 420)
- Dissolved oxygen – 1.37 mg/L (n = 68)
- pH – 7.52 (n = 159)
- Specific conductance – 738 µS/cm (n = 437)
- Turbidity – 0.568 NTU (n = 37)
- Color – 4.02 CPU (n = 51)
- Total chloride – 126 mg/L (n = 350)
- Sulfate –26.4 mg/L (n = 148)
- Nitrate+nitrite nitrogen – 0.798 mg/L (n = 128)
- Total phosphorus – 0.087 mg/L (n = 73)

The estimated age of water discharging from De Leon Springs has been reported (SJRWMD 2008) based on the concentration of various elemental isotopes (tritium, delta carbon-13, and carbon-14 in samples collected during May 1995 and tritium and helium-3 from July 1995). Based on measures of tritium concentration, the water is believed to be less than 42 years old. Based on the ratio of tritium/helium-3, the age of discharge water was estimated at 28.6 years. De Leon Springs had a delta carbon-13 value of 7.96 parts per thousand and a carbon-14 concentration of 35% modern carbon, both of which may have resulted from the mixing of Upper and Lower Floridan aquifer water, and suggest that the age of water discharged from De Leon Springs may be less than that suggested by tritium measures.

Water quality field parameters (temperature, conductance, dissolved oxygen, and pH) were measured in the spring pool and spring run areas during a reconnaissance trip on July 29, 2008. These parameters were measured on the upstream side of the weir and also via a boat from the waterfall feature and continuing through the spring run into the confluence of Spring Lake (see **Figure 6** for sampling locations). Water discharging from the spring vent had elevated conductivity (~ 700 µS/cm), low dissolved oxygen (< 7% or 0.60 mg/L), and slightly alkaline pH (**Figure 7**). Water in the spring pool had good clarity with a light blue apparent color.

TABLE 2
Summary of water quality data for De Leon Springs.

			Decade Average								POR Statistics					Period of Record	
PARAMETER GROUP	PARAMETER	UNITS	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
BACTERIOLOGICAL	Enterococci	#/100ml									6.45	6.45	1.00	40.0	11.4	11	1/30/02	11/2/06
	FC	#/100ml									1.67	1.67	0.500	5.00	0.984	23	1/30/02	12/5/07
	TC	#/100ml									7.07	7.07	1.00	60.0	15.2	15	7/20/04	10/25/07
BIOLOGICAL	Chl-a corr	µg/L									0.610	0.610	0.275	2.10	0.467	23	1/10/07	12/18/07
	Pheo-a	µg/L									0.567	0.567	0.120	1.10	0.404	23	1/10/07	12/18/07
DISSOLVED OXYGEN	DO	%					29.7	27.0			28.0	28.1	13.0	40.0	10.9	9	5/8/67	9/12/06
	DO	mg/L					2.60	2.35	1.54		1.22	1.37	0.170	6.70	1.12	68	5/8/67	12/18/07
FLOW	Flow	cfs					31.3	30.0			15.9	28.0	15.9	33.0	6.85	5	10/3/67	7/20/04
	Flow-Inst	cfs	22.0	20.0	39.0	23.0	30.6	29.6	26.2	23.3	27.9	27.5	12.2	44.3	5.49	319	2/11/29	8/13/08
GENERAL INORGANIC	Alk	mg/L as CaCO3				104	105	101	112	118	120	115	24.9	184	14.9	105	4/18/56	5/21/08
	Cl-T	mg/L				66.0	131	104	114	159	152	126	2.30	272	42.7	350	4/18/56	5/21/08
	F-T	mg/L							0.120	0.096	0.099	0.098	0.067	0.120	0.009	46	1/11/89	10/25/07
	Hardness	mg/L as CaCO3				130	152	109				138	15.0	200	40.9	14	4/18/56	3/2/72
	Si-D	mg/L				5.60	6.91	6.42	7.50		6.88	6.72	5.60	8.00	0.491	33	4/18/56	2/28/01
	Si-T	mg/L							6.80	3.48	3.52	3.86	3.00	10.0	1.51	45	3/23/87	7/16/02
	SO4	mg/L				12.0	20.1	18.7	23.6	28.0	28.3	26.4	2.30	43.0	7.52	148	4/18/56	5/21/08
GENERAL ORGANIC	TOC	mg/L						0.00		1.29	1.35	1.29	0.00	2.00	0.422	52	4/12/72	12/18/07
METAL	Al-T	µg/L									15.2	15.2	2.50	37.5	17.0	6	1/30/02	4/12/05
	As-T	µg/L									1.54	1.54	0.570	3.00	1.00	13	1/30/02	7/16/07
	Ba-T	µg/L									22.0	22.0	18.9	27.2	3.60	4	10/19/04	4/12/05
	Cd-T	µg/L									0.144	0.144	0.010	0.250	0.120	13	1/30/02	7/16/07
	Ca-D	mg/L				40.0	43.9	41.0	46.4	49.0	49.6	46.0	32.1	57.0	5.13	56	4/18/56	10/25/07
	Ca-T	mg/L								52.2	52.7	52.6	31.2	103	6.26	113	1/18/93	5/21/08
	Cr-T	µg/L									1.35	1.35	0.500	4.30	1.20	8	1/30/02	3/21/07
	Co-T	µg/L									0.792	0.792	0.375	1.00	0.323	6	1/30/02	4/12/05
	Cu-T	µg/L									1.21	1.21	0.100	2.50	0.988	13	1/30/02	7/16/07
	Fe-T	µg/L								35.6	66.1	57.6	2.50	544	125	18	7/6/92	3/21/07
	Pb-T	µg/L									1.32	1.32	0.100	2.50	1.19	13	1/30/02	7/16/07
	Mg-D	mg/L				6.80	10.1	9.70	11.8	12.5	11.9	11.0	3.70	18.1	2.98	57	4/18/56	10/25/07
	Mg-T	mg/L								14.1	13.4	13.6	7.60	20.3	2.41	114	7/6/92	5/21/08
	Mn-T	µg/L									3.16	3.16	1.10	7.10	2.16	7	1/30/02	4/12/05
	Hg-T	µg/L						0.00				0.00	0.00	0.00		1	4/12/72	4/12/72
	Ni-T	µg/L									1.07	1.07	0.550	2.00	0.408	8	1/30/02	3/21/07
	K-T	mg/L								4.41	4.30	4.33	0.460	6.80	0.864	109	7/6/92	5/21/08
	Se-T	µg/L									3.00	3.00	2.00	4.00	0.957	7	1/30/02	4/12/05
	Ag-T	µg/L									0.013	0.013	0.013	0.013	0.0000	6	2/28/07	7/16/07
	NA-D	mg/L				40.0	67.0	61.3	62.5	79.5	63.8	67.1	1.60	135	26.5	57	4/18/56	10/25/07
	NA-T	mg/L									82.8	82.8	50.5	158	26.2	42	1/30/02	12/18/07
	SR-T	µg/L								359	375	367	44.9	553	86.4	46	7/6/92	4/12/05
	Zn-T	µg/L									1.16	1.16	0.750	1.50	0.297	8	1/30/02	3/21/07

TABLE 2 (CONTINUED)
Summary of water quality data for De Leon Springs.

PARAMETER GROUP	PARAMETER	UNITS	Decade Average									POR Statistics					Period of Record	
			1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
NITROGEN	NH4-N	mg/L						0.140			0.072	0.073	0.005	0.150	0.036	56	4/12/72	12/18/07
	NOx-N	mg/L							0.688	0.915	0.769	0.798	0.010	1.40	0.279	128	6/12/84	5/21/08
	NO3-N	mg/L						0.070				0.070	0.050	0.090	0.023	4	3/2/72	4/12/72
	NO2-N	mg/L						0.007				0.007	0.003	0.010	0.005	2	3/2/72	4/12/72
	OrgN	mg/L						0.133				0.133	0.090	0.240	0.072	4	5/14/70	4/12/72
	TKN	mg/L									0.250	0.250	0.030	0.440	0.090	52	2/28/01	12/18/07
	TKN-D	mg/L									0.257	0.257	0.030	0.450	0.120	9	2/28/01	10/25/07
OXYGEN DEMAND	BOD5	mg/L						0.200			0.848	0.825	0.100	3.80	0.905	28	4/12/72	12/18/07
	cBOD5	mg/L									0.100	0.100	0.100	0.100		1	2/12/02	2/12/02
PESTICIDE	Alachlor-D	µg/L									0.005	0.005	0.005	0.005	0.00	2	5/12/04	8/23/04
	Atrazine-D	µg/L									0.007	0.007	0.007	0.007	0.00	2	5/12/04	8/23/04
	Diazinon-D	µg/L									0.005	0.005	0.005	0.005	0.00	2	5/12/04	8/23/04
	Dieldrin-D	µg/L									0.009	0.009	0.009	0.009	0.00	2	5/12/04	8/23/04
	Lindane-D	µg/L									0.004	0.004	0.004	0.004	0.00	2	5/12/04	8/23/04
PHOSPHORUS	OrthoP	mg/L						0.038		0.054	0.048	0.049	0.024	0.065	0.007	98	4/12/72	5/21/08
	TDP	mg/L								0.017	0.047	0.044	0.017	0.060	0.013	11	5/31/95	10/25/07
	TP	mg/L						0.035		0.049	0.089	0.087	0.028	2.60	0.298	73	4/12/72	5/21/08
PHYSICAL	Color	CPU				5.00	3.00	5.00			4.16	4.02	0.00	10.0	2.37	51	4/18/56	12/18/07
	Depth	m									3.19	3.19	0.500	10.7	3.57	38	1/30/02	12/18/07
	pH	SU				7.70	7.58	7.37	7.63	7.43	7.53	7.52	6.80	8.40	0.298	159	4/18/56	5/21/08
	Secchi	m									5.21	5.21	0.700	8.80	3.70	30	1/30/02	12/18/07
	SpCond	umhos/cm				438	669	579	624	775	986	738	180	12,100	713	437	4/18/56	5/21/08
	Stage	ft					4.42	4.30	4.15	2.49	3.98	4.03	0.00	4.68	1.21	858	11/12/64	5/14/08
	Turb	NTU						1.50			0.455	0.568	0.025	2.00	0.420	37	5/14/70	12/5/07
SOLID	TDS	mg/L					328	329	340	444	411	401	117	620	92.3	128	11/2/60	5/21/08
	TSS	mg/L									2.03	2.03	0.750	4.00	0.480	25	1/30/02	12/5/07
TEMPERATURE	Air Temp	C						27.6	26.3			27.0	20.5	35.5	3.81	14	10/4/78	10/7/80
	Wtr Temp	C	23.5	23.0	23.0	23.1	23.5	22.9	22.7	22.7		23.1	19.9	25.0	0.604	420	3/7/32	5/21/08

Water quality field parameters were also measured at the outflow location from the spring pool. Values for these parameters were observed to be markedly distinct from those measured in the spring pool. For example, water temperature in the pool was 22.6 °C, while just below the weir structure; water temperature was 24.8 °C (**Figure 8**). Similarly, dissolved oxygen in the pool was 0.8 mg/L, while just below the weir structure; dissolved oxygen was 8.4 mg/L (**Figure 8**). These observations support the concept that the spring run of De Leon Springs is a branch of Spring Garden Lake. In the remainder of the spring run or spillway area, conductivity increased slightly (there are smaller spring vents which are reported to contribute water), dissolved oxygen rose substantially (> 60% or 5.5 mg/L), pH correspondingly increased, and water clarity dropped (~ 4 foot Secchi disk visibility) due to tannins, phytoplankton, and organic particulates (**Figure 8**).



FIGURE 6
Image of De Leon Springs (Volusia Co.) and receiving waters; red icon and path indicate sampling points during reconnaissance trip on July 29, 2008.

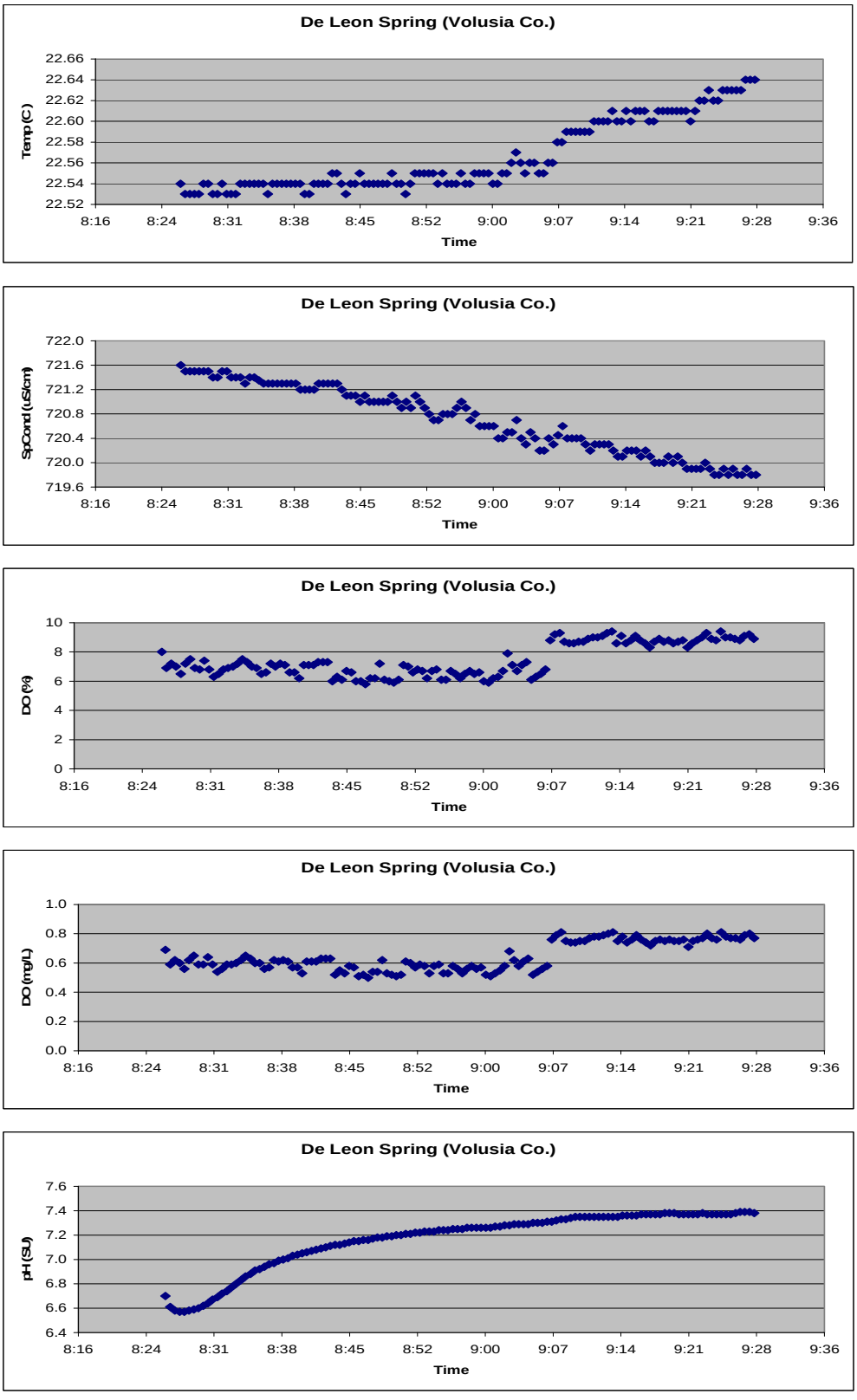
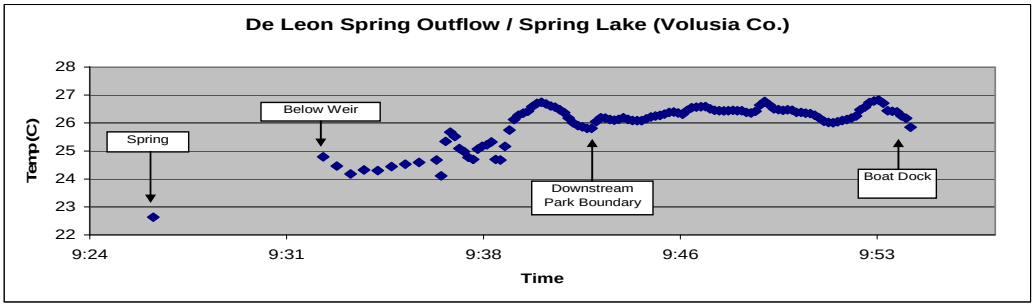
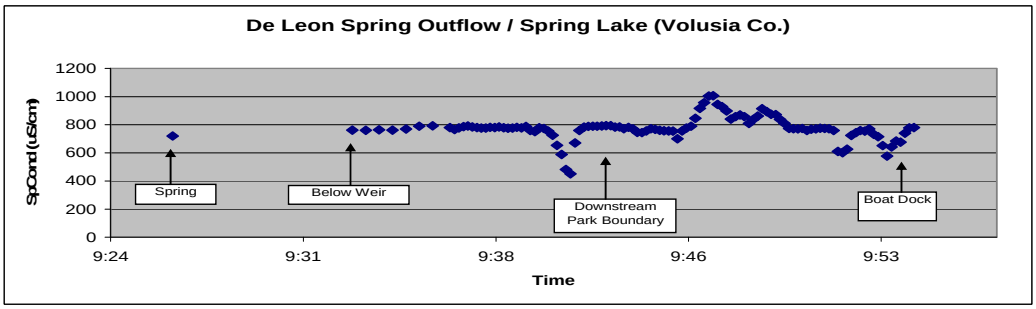
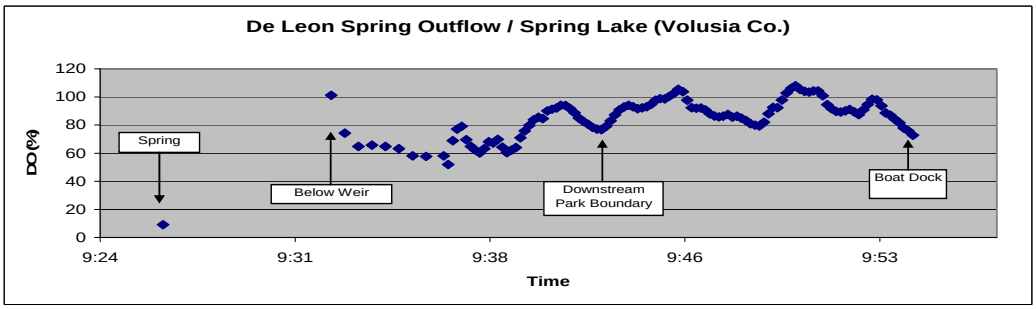
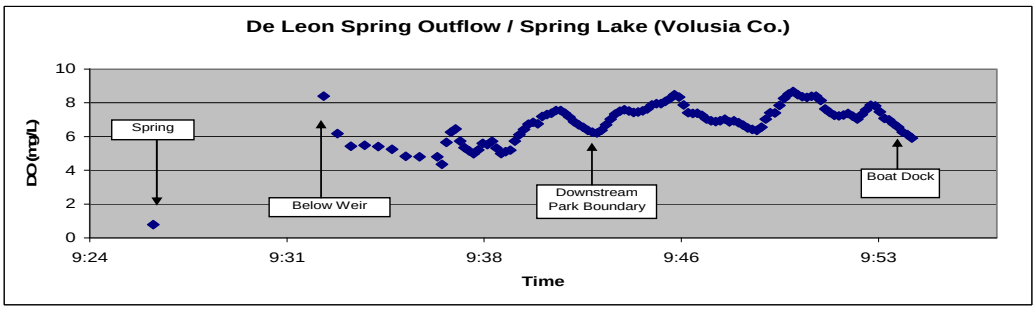


FIGURE 7
Field parameters measured at the De Leon Springs (Volusia Co.) pool on July 26, 2008.









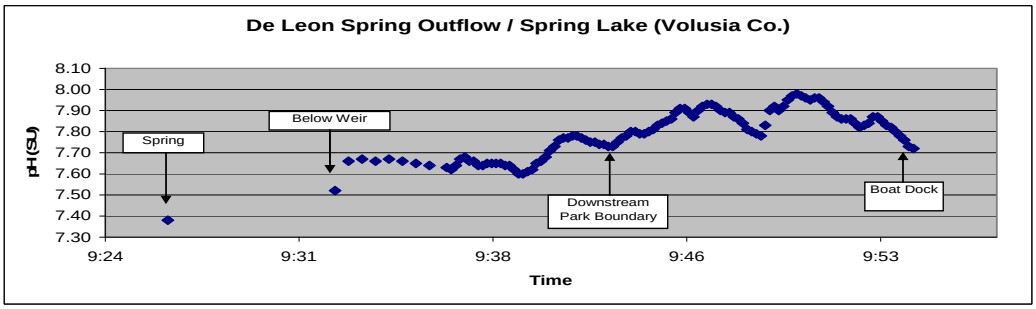


FIGURE 8
Field parameters measured from the spring run/Spring Garden Lake (Volusia Co.) on July 26, 2008.

Biological

Vegetation

Woodruff (1993) noted aquatic vegetation at De Leon Springs during a 1992 survey. Only one species was noted in the pool, sago pondweed (*Potamogeton pectinatus*). In the run, tape grass (*Vallisneria americana*), hydrilla (*Hydrilla verticillata*), coontail (*Ceratophyllum demersum*), elodea (*Elodea canadensis*), water lettuce (*Pistia stratiotes*), and water hyacinth (*Eichhornia crassipes*) were noted.

A survey of the flora and fauna of De Leon Springs State Park was conducted in 2005 by staff with the Florida Natural Areas Inventory (FNAI) (Davis and Herring 2005). This survey took place around the spring pool, within approximately one-half mile of the lands surrounding the spring run to Spring Garden Lake, and within the open water area of the spring run. Findings from this survey did not reveal any significant submersed aquatic vegetation within the spring pool or run (abundant emergent and floating aquatic vegetation noted in the spring run), and reported three rare upland plant species (**Table 3**).

TABLE 3
Species list of rare, endemic, or exotic flora and fauna observed during May 2005 (from Davis and Herring 2005).

Common Name	Scientific Name	FNAI Global/State Ranks	Federal Status	State Status	Location
Plants					
angle-pod	*Matelea gonocarpos*	N/N	N	LT	hydric hammock
hooded pitcher-plant	*Sarracenia minor*	N/N	N	LT	edge of dome swamp
star anise	*Illicium parviflorum**	G2/S2	N	LE	hydric hammock
Animals(Fish)					
suckermouth catfish	*Pterygoplichys* sp.**	N/A	N	N	spring run-open water
Animals (Reptiles)					
American alligator	*Alligator mississippiensis*	G5/S4	LT(S/A)	LS	spring run
Animals (Birds)					
little blue heron	*Egretta caerulea*	G5/S4	N	LS	spring run
snowy egret	*Egretta thula*	G5/S3	N	LS	spring run
limpkin	*Aramus guarauna*	G5/S3	N	LS	spring run
osprey	*Pandion haliaetus*	G5/S4	N	LS††	foraging, over spring run

* = endemic to Florida.
** = exotic species
†† = State listed as Special Concern Species in Monroe County only.
N = Not listed.
N/A = Not Applicable.

During the reconnaissance trip, submersed aquatic vegetation within the De Leon Spring pool was minimal and limited to sparse filamentous algae growing attached to rock substrates and small clumps of hydrilla (*Hydrilla verticillata*) near the walls. The limited amount of vegetation is not unexpected due to the heavy recreational usage of the pool, the predominance of rocky substrate unsuitable for plant rooting, and the active removal of submersed aquatic vegetation by park volunteers (which are directed to focus on hydrilla). Downstream of the waterfall feature several small beds of tape grass (*Vallisneria americana*) were observed, as well as patches of hydrilla (*Hydrilla verticillata*), and floating mats of filamentous algae, water hyacinth (*Eichhornia crassipes*), and water lettuce (*Pistia stratiotes*).

Macroinvertebrates

Museum records for De Leon Springs have been examined for the occurrence of rare or endemic snails and two unusual species were noted: *Aphaostracon* species (exact identity undetermined) and *Tryonia aequicostata*, (endemic to the St. Johns River basin) (Shelton 2005). Both snails are members of the Hydrobiidae family, which is known for its high degree of endemism as many members of this family are endemic to single springs (Shelton 2005). Woodruff (1993) collected three types in the pool: Hydrobiidae, *Elimia vanhyningiana*, and *Hebetancylus excentricus*; and two species in the run: *Pomacea paludosa* and *Planorbella trivolvis intertexta*.

Mussels were surveyed from the western shore of the spring run in 2002 (Walsh and Williams 2003) and the authors reported collecting reported collecting *Corbicula fluminea* (a non-indigenous Asian clam) as well as the empty shells of five native species.

A detailed survey of macroinvertebrates at De Leon Springs was made by Phelps *et al.* (2006) during the winter, spring, and summer seasons of 2003/2004. In total, over forty two

thousand macroinvertebrates, representing 45 taxa, were collected via ponar and sweep net sampling gear (Phelps *et al.* 2006). Richness (number of families) of EPT taxa (Ephemeroptera + Plecoptera + Trichoptera) ranged from 0 in the spring to 3 in summer; while richness of ETO taxa (Ephemeroptera + Trichoptera + Odonata) varied from 1 in the spring to 7 in the summer (**Table 4**). Amphipods, dipterans, and gastropods commonly dominated the sample collections (**Table 4**, Phelps *et al*. 2006). Woodruff (1993) collected crustaceans at De Leon Springs including *Hyalella azteca* in the pool, and *Procambarus sp*. and *Palaeomonetes paludosus* in the run.

Beginning in March 2001, FDEP EcoSummary sampling at De Leon Springs has occurred up to four times per year (FDEP 2008). These events have not sampled for invertebrates however, instead focusing on water chemistry, bacteria, and periphyton composition.

TABLE 4
Macroinvertebrate richness and community measures for De Leon Springs 2003/2004 (from Phelps *et al*. 2006).

	Winter	Spring	Summer	Combined
Taxon Richness (total # taxa)	15	11	18	45
Total Abundance	8,944	7,425	22,275	38,644
EPTr (# taxa)	1	0	3	4
EPT (# individuals)	56	0	56	112
Odonata (# taxa)	2	1	4	5
ETOr (# taxa)	3	1	7	9
ETO (# individuals)	225	56	169	350
Florida Index	--	--	--	4
Dominant Taxon	Amphipoda	Amphipoda	Amphipoda	Amphipoda
Percent Dominant Taxon	77.4	75	81.3	79
Percent Diptera	4.4	10.6	.8	3.5
Percent Odonata	1.9	.8	.5	.9
Amphipoda excluded				
Total Abundance	2,025	1,856	4,163	8,044
Dominant Taxon	Gastropoda	Diptera	Gastropoda	Gastropoda
Percent Dominant Taxon	52.8	42.5	48.6	45
Percent Diptera	19.5	42.5	4.1	16.8
Percent Odonata	8.3	3	2.7	4.1

Macro fauna

A 1992 fish survey of De Leon Springs resulted in eight species collected (Woodruff 1993). A comprehensive fish survey in the spring run area of De Leon Springs was conducted in 2002 using electrofishing and seine net gear by the USGS (Walsh and Williams 2003). This 2002 sampling resulted in 28 species of fish, including marine and exotic species. Phelps et al. (2006) reviewed the species represented in the Florida Museum of Natural History (FLMNH), and in comparison with the Walsh and Williams (2003) study, reported a total of 31 species of fishes have been identified from De Leon Springs (**Table 5**). This list does not include two exotic armored catfish, the brown hoplo (*Hoplosternum littorale*) and the sailfin catfish, (*Pterygoplichthys disjunctivus*), which have been observed by others (Davis and Herring 2005, Phelps *et al*. 2006) and are species known to be expanding their distribution in the St. Johns River drainage. Collectively, it appears that 33 species of fish have been observed or collected from the spring run portion of De Leon Springs.

A visual fish survey was conducted in Spring Garden Lake by FDEP/FPS staff on May 9, 2007 which observed 21 species of fish, as well as 5 species of amphibians, 4 species of reptiles, and 10 types of invertebrates (personal communication from park biologist Graham Williams, see **Table 6**). These fish species observed were consistent with those reported by Phelps et al. (2006), except for the sailfin catfish (*Pterygoplichthys disjunctivus*), which had not been reported prior to 2005.

During the reconnaissance trip made July 29, 2008; the only fish observed in the spring pool were several juvenile largemouth bass (*Micropterus salmoides*). These juvenile fish likely gained access to the spring pool by swimming upstream in the concrete flume that supplies the water wheel. In the spring run numerous sunfish (*Lepomis spp*.) were observed.

Manatees

De Leon Springs run is utilized as a warm water refuge by St. Johns River manatees. Twenty-five manatees were documented in the spring run during the winter of 2006 and park staff report that smaller groups have been observed before (Taylor 2006). Manatees are prevented from accessing the spring pool by the concrete weir which separates the spring pool and run area. Food resources, including water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*) are available for manatees in the spring run area.

TABLE 5
Species list of fish collected from De Leon Spring by Walsh and Williams (2003) and from Florida Museum of Natural History records (from Phelps *et al.* 2006).

Family	Species	USGS		FLMNH ichthyological collection	
		Number of specimens	Percent composition	Number of specimens	Percent of material
Dasyatidae	*Dasyatis sabina*	3	0.4	--	--
Lepisosteidae	*Lepisosteus osseus*	1	.1	--	--
Amiidae	*Amia calva*	1	.1	--	--
Anguillidae	*Anguilla rostrata*	3	.4	--	--
Clupeidae	*Dorosoma cepedianum*	2	.3	--	--
Cyprinidae	*Notemigonus crysoleucas*	17	2.5	2	3.2
Catostomidae	*Erimyzon sucetta*	29	4.3	--	--
Ictaluridae	*Ameiurus natalis*	1	.1	--	--
	Noturus leptacanthus	--	--	1	1.6
Esocidae	*Esox niger*	1	.1	--	--
Mugilidae	*Mugil cephalus*	15	2.2	--	--
Belonidae	*Strongylura marina*	2	.3	--	--
Fundulidae	*Fundulus chrysotus*	3	.4	--	--
	Fundulus rubrifrons	--	--	3	4.8
	Fundulus seminolis	12	1.8	8	12.7
	Lucania goodei	49	7.3	20	31.7
	Lucania parva	42	6.3	1	1.6
Poeciliidae	*Gambusia holbrooki*	69	10.3	--	--
	Heterandria formosa	22	3.3	--	--
	Poecilia latipinna	15	2.2	--	--
Centrarchidae	*Enneacanthus gloriosus*	1	.1	4	6.3
	Lepomis auritus	11	1.6	5	7.9
	Lepomis gulosus	9	1.3	4	6.3
	Lepomis macrochirus	196	29.3	5	7.9
	Lepomis microlophus	69	10.3	7	11.1
	Lepomis punctatus	9	1.3	--	--
	Micropterus salmoides	76	11.4	1	1.6
	Pomoxis nigromaculatus	5	.7	1	1.6
Percidae	*Etheostoma fusiforme*	5	.7	--	--
Cichlidae	*Oreochromis aureus**	1	.1	--	--
Achiridae	*Trinectes maculatus*	--	--	1	1.6
	Total number of species	**28**		**14**	
	Total number of specimens	**669**		**63**	

*nonindigenous species

TABLE 6
Results of FDEP fish survey of De Leon Springs run (Spring Garden Lake, Volusia County) conducted on May 9, 2007.

Group	Common Name	Scientific Name
Fishes	Vermiculated Sailfin Catfish*	*Pterygoplichthys disjunctivus*
	Brown Hoplo*	*Hoplosternum littorale*
	Oscar*	*Astronotus ocellaus*
	Blue Tilapia*	*Oreochromis aureus*
	Sailfin Molly	*Peocilia latipinna*
	Golden Topminnow	*Fundulus chrysotus*
	Eastern Mosquitofish	*Gambusia holbrooki*
	Redear Sunfish	*Lepomis microlophus*
	Warmouth	*Lepomis gulosus*
	Bluespotted Sunfish	*Enneacanthus gloriosus*
	Least Killifish	*Heterandria formosa*
	Bowfin	*Amia calva*
	Taillight Shiner	*Notropis maculates*
	Bluegill	*Lepomis macrochirus*
	Largemouth Bass	*Micropterus salmoides*
	Striped Mullet	*Mugil cephalus*
	Redbreast Sunfish	*Lepomis auritus*
	Longear Sunfish	*Lepomis megalotis*
	Florida Gar	*Lepisosteus platyrhincus*
	Atlantic Stingray	*Dasyatis sabina*
	Shiner	*Notropis* sp.
Amphibians	Southern Leopard Frog	*Rana sphenocephala*
	Greater Siren	*Siren lacertina*
	Peninsula Newt	*Notophthalmus viridescens piaropicola*
	Pig Frog	*Rana grylio*
	Squirrel Treefrog	*Hyla squirella*
Reptiles	Florida Redbellied Turtle	*Pseudemys nelsoni*
	Peninsula Cooter	*Pseudemys floridana peninsularis*
	Loggerhead Musk Turtle	*Sternotherus minor*
	Three-striped Mud Turtle	*Kinosternon bauri*
Macroinvertebrates	Crayfish	*Procambarus* sp.
	Ram's Horn Snail	*Planorbella* sp.
	Predacious Diving Beetle	*Cybister* sp.
	Water Scorpion	*Ranatra fuscus*
	Eastern Grass Shrimp	*Palaemonetes paludosus*
	Florida Apple Snail	*Pomacea paludosa*
	Whirligig Beetles	*Gyrinus* sp.
	Creeping Waterbug	*Pelocoris* sp.
	Midge Larva	Diptera
	Dragonfly Naiad	Odonata

* = Exotic

Ecosystem Functions

There was no record found that De Leon Springs has ever been measured for ecosystem or plant productivity.

Human-Use Attendance and Activities

Recreational activities at De Leon Springs include swimming, boating, fishing, hiking, canoeing, paddleboat rentals, and SCUBA diving. Within the spring pool only swimming and SCUBA diving are allowed. As a state park, monthly and annual statistics of human attendance are available for De Leon Springs (**Figure 9**). This park does not have overnight usage and the annual attendance values represent day use only. Maximum usage slightly exceeds 250 thousand visitors a year and is likely limited by available visitor parking. Maximum monthly usage occurs during the summer, reflecting this springs usage as a popular swimming location.

A detailed analysis of De Leon Springs visitor profiles and their resulting economic impact has been conducted for the time period between 1990 and 2002 (Bonn 2004). Highlights from this study reveal that approximately 44% of visitors had not been to the spring before, the average party size was 3.7 persons (62% non-county residents), and average daily expenditures per party were $43.50 (Bonn 2004). Extrapolated against average visitation numbers, Bonn (2004) estimated the annual economic impact was $2,185,440, with 36 full/part time jobs created, and $425,600 in wages created.

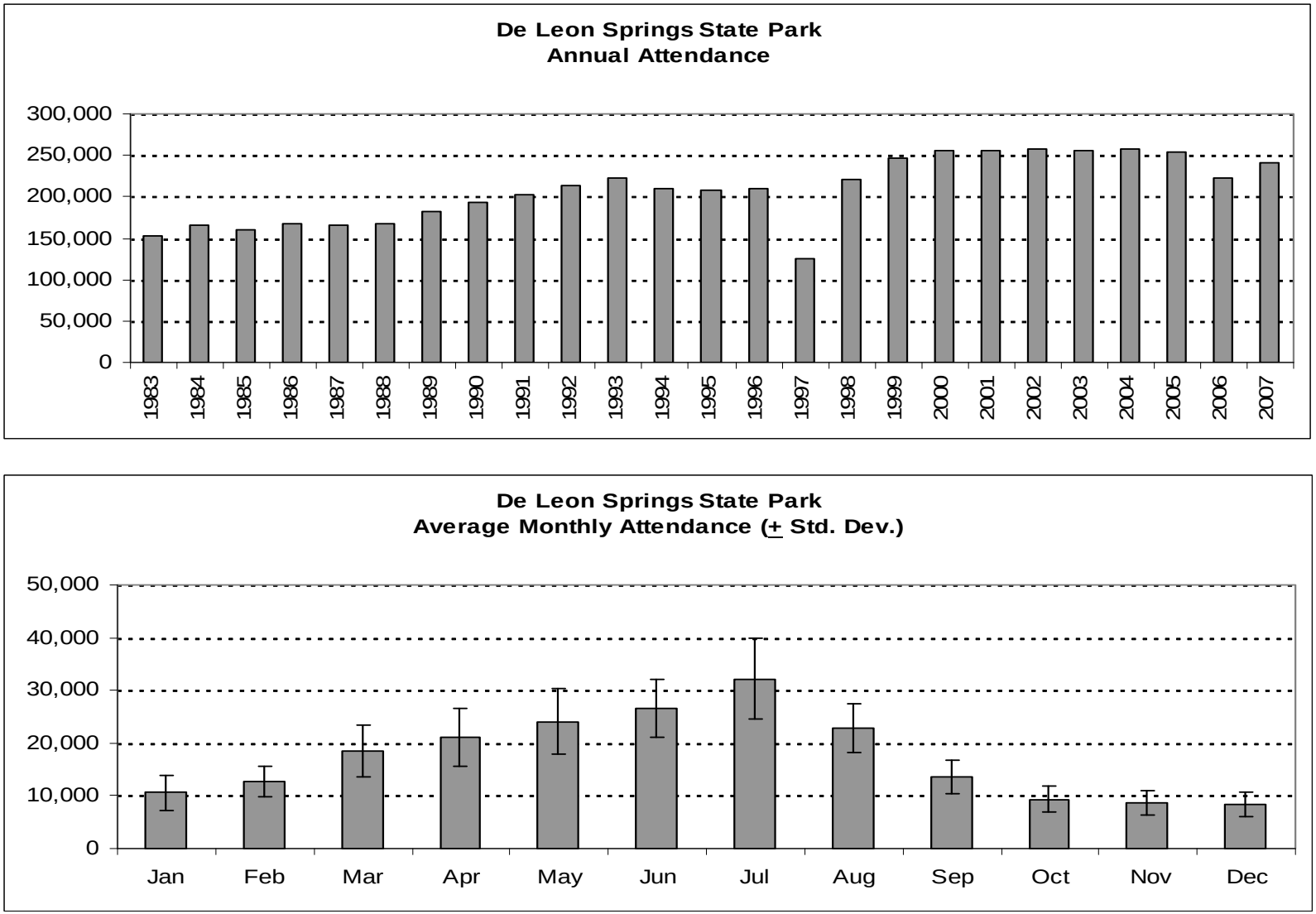


FIGURE 9
Annual and monthly park attendance statistics for De Leon Springs (Volusia Co.) (FDEP data).

Minimum Flow and Levels and Water Resource Values

An analysis of the proposed MFL for De Leon Springs has recently been completed for the SJRWMD (ATM 2008). Results of this evaluative study suggest that the proposed MFL of 25.5 cubic feet per second (cfs) will be protective of all relevant water resource values (WRVs) (**Table 7**). This MFL represents an approximate 4 percent reduction in the existing average flow for the spring, which the report lists as 26.6 cfs. The MFL value of 25.5 cfs (minimum average flow) proposed by SJRWMD was based on maintaining acceptable swimming conditions as defined by the Florida Department of Health (FDOH) public health criteria (Chapter 64E-9.013, F.A.C.) through dilution and flushing of the spring pool to minimize water-born bacteria and pathogens. The MFL was derived using a water quality model incorporating spring discharge (Intera 2007) and daily average annual attendance to predict *Enterococcus* (a specific pathogen of concern) concentrations. To avoid an unacceptable increase in the number of violation days of FDOH water quality standards for swimming, SJRWMD technical staff determined that a four percent reduction in the existing average flow of 26.6 cfs (Epting 2006) to 25.5 cfs (the proposed MFL) was adequate.

The WRV evaluations of the proposed MFL were made using event-based analysis of the return intervals (*i.e.*, frequency of occurrence) of flow and water depth conditions between the proposed MFL conditions and baseline conditions (i.e., long-term average conditions) and individual WRVs were viewed to be protected if the frequency of occurrence of undesirable conditions/events did not vary from long-term conditions at unacceptable levels (**Table 7**).

In regard to minimum levels of De Leon Springs, the water depth in the spring pool is independent of spring discharge. This is because the entire spring pool is enclosed (and

impounded) by a concrete retaining walkway with outflow through a fixed-height weir (and flume to water wheel) and an adjustable gate valve. For these reasons, water levels in the spring pool are relatively constant and independent of spring discharge. Water depths within the spring run are set by Spring Garden Lake and in turn the St. Johns River, therefore spring discharge does not influence spring run water levels.

TABLE 7
A summary of water resource values, the flow condition used for their evaluation, and the results of the MFL review (from ATM 2008).

Water Resource Value	Flow Condition Evaluated to Determine if WRV Protected	MFLs Regime Protective/ Not Protective
1. Recreation in and on the Water	Low flow	Protective
2. Fish and Wildlife Habitats and the Passage of Fish	Low flow	Protective
3. Estuarine Resources	(None required)	Protective
4. Transfer of Detrital Material	High flow	Protective
5. Maintenance of Freshwater Storage and Supply	(None Required)	Protective
6. Aesthetic and Scenic Attributes	Low flow	Protective
7. Filtration and Absorption of Nutrients and Other Pollutants	Low flow	Protective
8. Sediment Loads	High Flow	Protective
9. Water Quality	Low flow	Protective
10. Navigation	(None required)	Protective

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Appendix P

Summary of data for Homosassa Springs



Summary of Existing Data - Homosassa Springs (Citrus Co.)

Prepared by

Wetland Solutions, Inc.

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Cover photo: A congregation of gray snapper (*Lutjanus griseus*) near a vent of Homosassa Springs (S.K. Notestein, 11/05/08).

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Table 5 A Summary of the Direct Economic Impact of Ichetucknee; Wakulla; Homosassa and Volusia Blue Spring State Parks on the Local Economy during 2002 (from Bonn and Bell 2003).

Summary of Existing Springs Data

This report summarizes known and existing physical, chemical, and biological data for Homosassa Springs (Citrus County). These data were collected from sources such as the Southwest Florida Water Management District (SWFWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Homosassa Springs and Homosassa Springs Wildlife State Park

Physical address

Homosassa Springs Wildlife State Park; 4150 S. Sun coast Blvd.; Homosassa, Florida 34446; Phone: 352-628-5343; latitude/longitude: 28.799569 °, -82.587525 °; park website: http://www.floridastateparks.org/homosassasprings/default.cfm .

Driving Directions

Homosassa Springs Wildlife State Park is comprised of two physical properties located in the city of Homosassa Springs (Citrus County), approximately 121 km (75 mi) north of Tampa and 145 km (90 mi) northwest of Orlando (**Figure 1**). The visitor center, restaurant, gift shop, and administrative offices are adjacent to US19. The actual springs, as well as wildlife exhibits and underwater observatory (fish bowl) are located at the west portion of the park. From US 19 go west on Halls River Road, go south on Fish Bowl Drive, arrive at the park entrance. The park provides transportation from the visitor center on US 19 to springs are also provided by the park via tram or boat ride.

General

This first magnitude spring complex has a long history of human usage and is presently administered by the FDEP/FPS. The park facilities are split between two locations, the first, adjacent to US 19, includes a restaurant, gift shop, and administrative offices. The second facility is located about 0.6 km (1 mi) west and includes the spring vent, an underwater observation platform (the fish bowl), as well as numerous animal and nature exhibits. This site is a popular destination for wildlife viewing, nature park programs, and general tourism. Homosassa Springs Wildlife State Park does not allow in-water recreation within park property. Swimming takes place outside the park, in the Homosassa River and in the limited spring run downstream of the park footbridge. Access to this swim area can be made from boats launched on the Homosassa River.

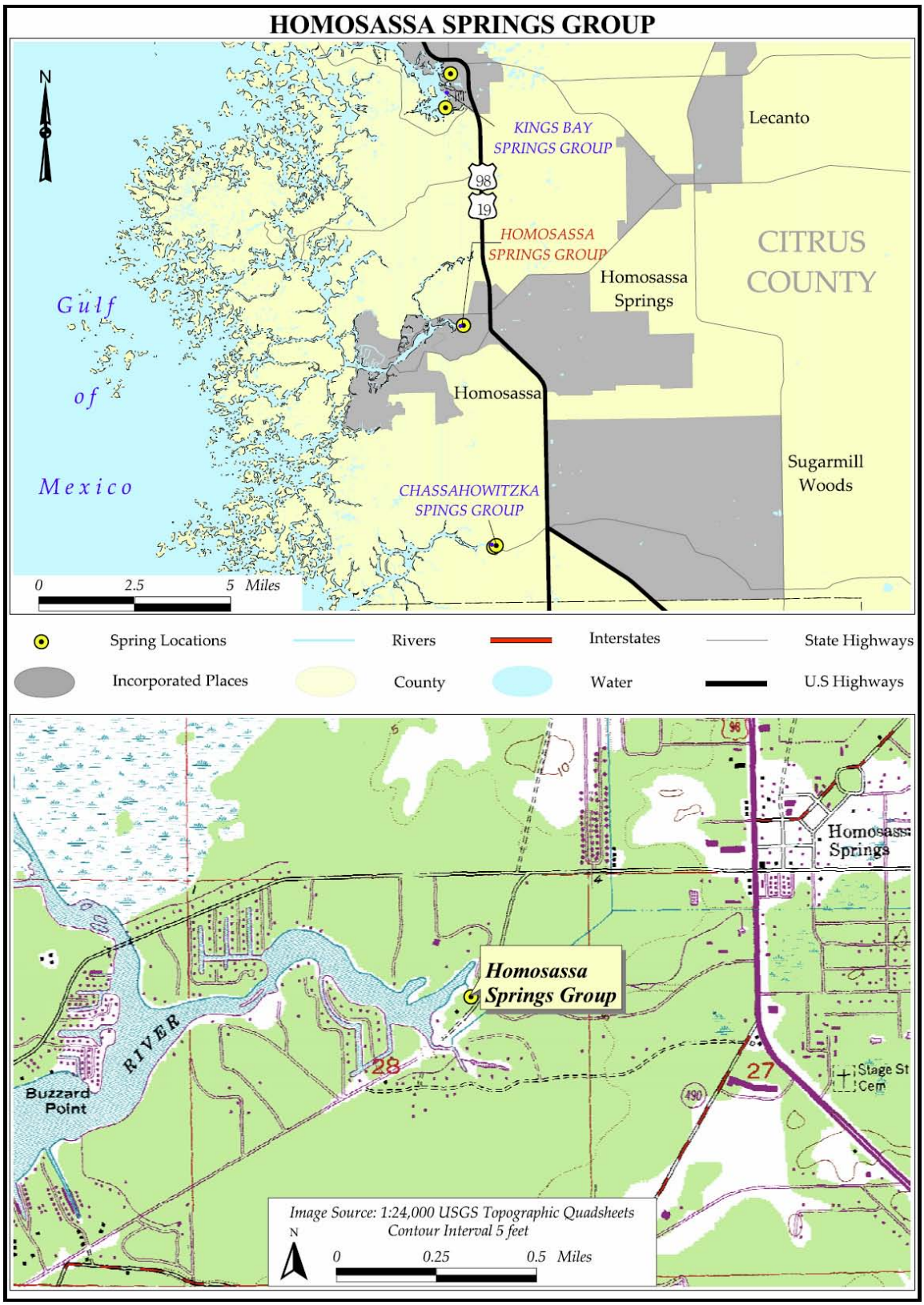


FIGURE 1
Homosassa Springs location (from Scott *et al*. 2002).

Physical

The Homosassa Springs group is located just southwest of the intersection of SR 409 and US 19 in western Citrus County, Fl. The main spring consists of 3 vents and there are ten or more additional springs dispersed over the surrounding of 10.4 km^2 (4 mi^2) area.

The Homosassa Springs watershed is bounded by ground-water divides instead of topographic divides, as the principle drainage is through ground-water flow in the Upper Floridan aquifer (**Figure 2**, Knochenmus and Yobbi 2001).The Homosassa Springs watershed includes four physiographic regions: Coastal Swamps, Gulf Coastal Lowlands, Brooksville Ridge, and Tsala Apopka Plain (**Figure 3**, Knockenmus and Yobbi 2001). The main springs are located in the Coastal Swamps region, which extends two to five miles inland from the Gulf of Mexico, has elevations less than 10-ft, and is predominated by wetlands and poorly drained soils overlying karst geology (Brooks 1981).

Observations of the physical conditions in the spring boil and run area were made during the reconnaissance trip in the fall of 2008. The semicircular spring pool is approximately 200 feet wide, has a conical vent about 40 feet deep, and has rocky substrate consistent with the region's karst geology. The spring is a group of three feeder vents which have tubing installed to facilitate water chemistry sampling (Karst Environmental Services 1992). **Figure 4** shows the springs in the Homosassa Springs group as identified by the SWFWMD (Champion and Starks, 2001).

The lands immediately surrounding the spring are hardwood/coastal wetland, but many portions have been extensively developed for residential and commercial use. The spring run is surrounded by a variety of park attractions and runs about 400 feet downstream to a footbridge. Below this footbridge there a metal barrier system (bars on 9

inch center) which prevent human or manatee passage (Manatees are kept in the spring pool/run for rehabilitation and education). Below the foot bridge the spring run feeds into the Homosassa River, along with spring flow from nearby springs, and further downstream, surface drainage from the Halls River. The spring run sediments appear to be primarily limestone and coarse sands.

The temporal and spatial hydrology of Homosassa Springs has been investigated using data from ground-water levels in the Upper Floridan aquifer, surface-water stage, spring flow, and specific conductance of spring water (Knockenmus and Yobbi 2001). This study revealed that Upper Floridan aquifer water levels control the magnitude of daily mean spring flow; that tidal influences from the Gulf of Mexico, impact the diel range and duration of spring pool stage (and instantaneous spring discharge); and that seasonal and stochastic rainfall patterns strongly influence ground-water levels and resulting average spring discharge (Knockenmus and Yobbi 2001).

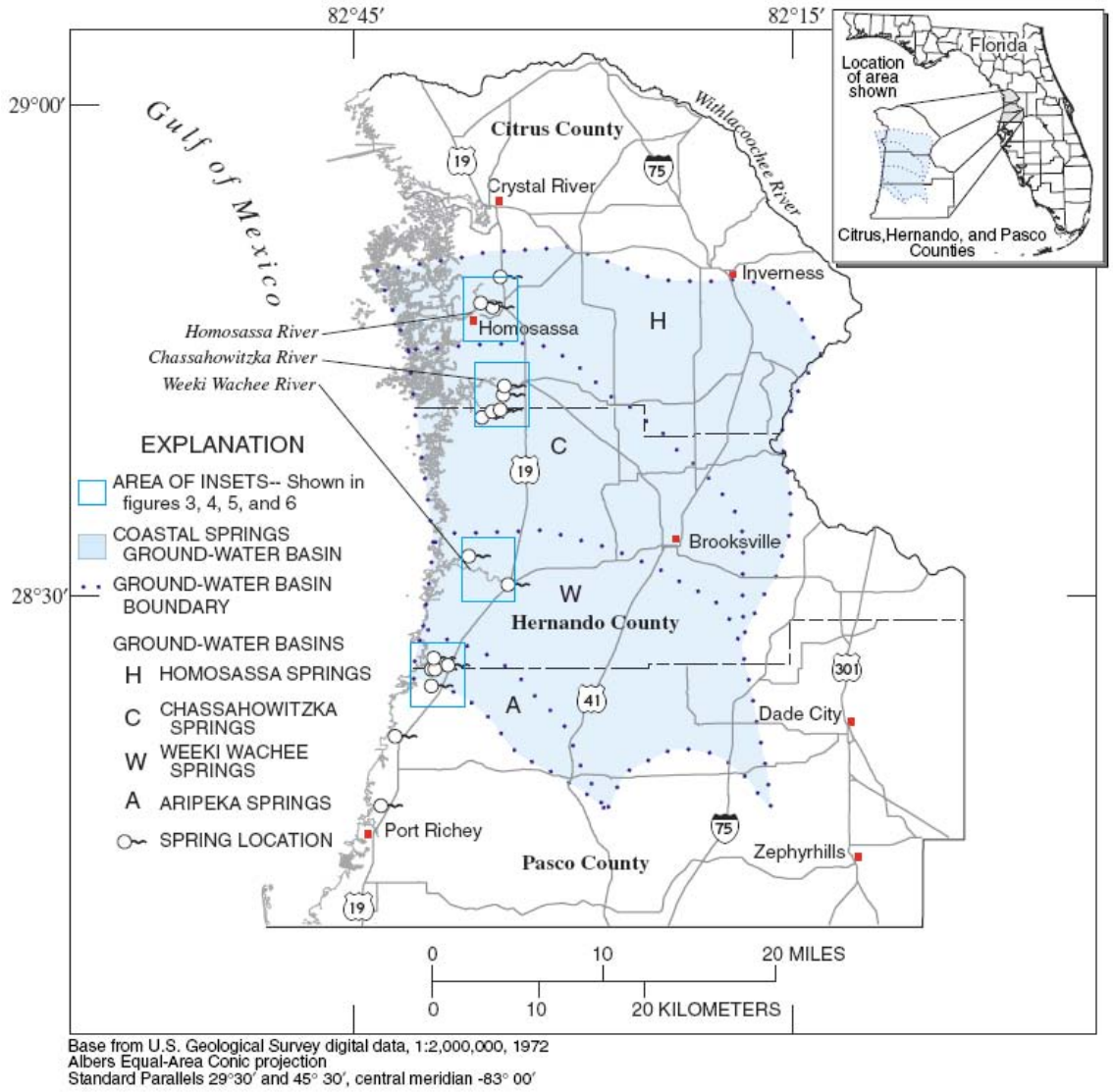


FIGURE 2
The Coastal Springs Ground-Water Basin showing Homosassa Springs basin boundaries (from Knochenmus and Yobbi 2001).

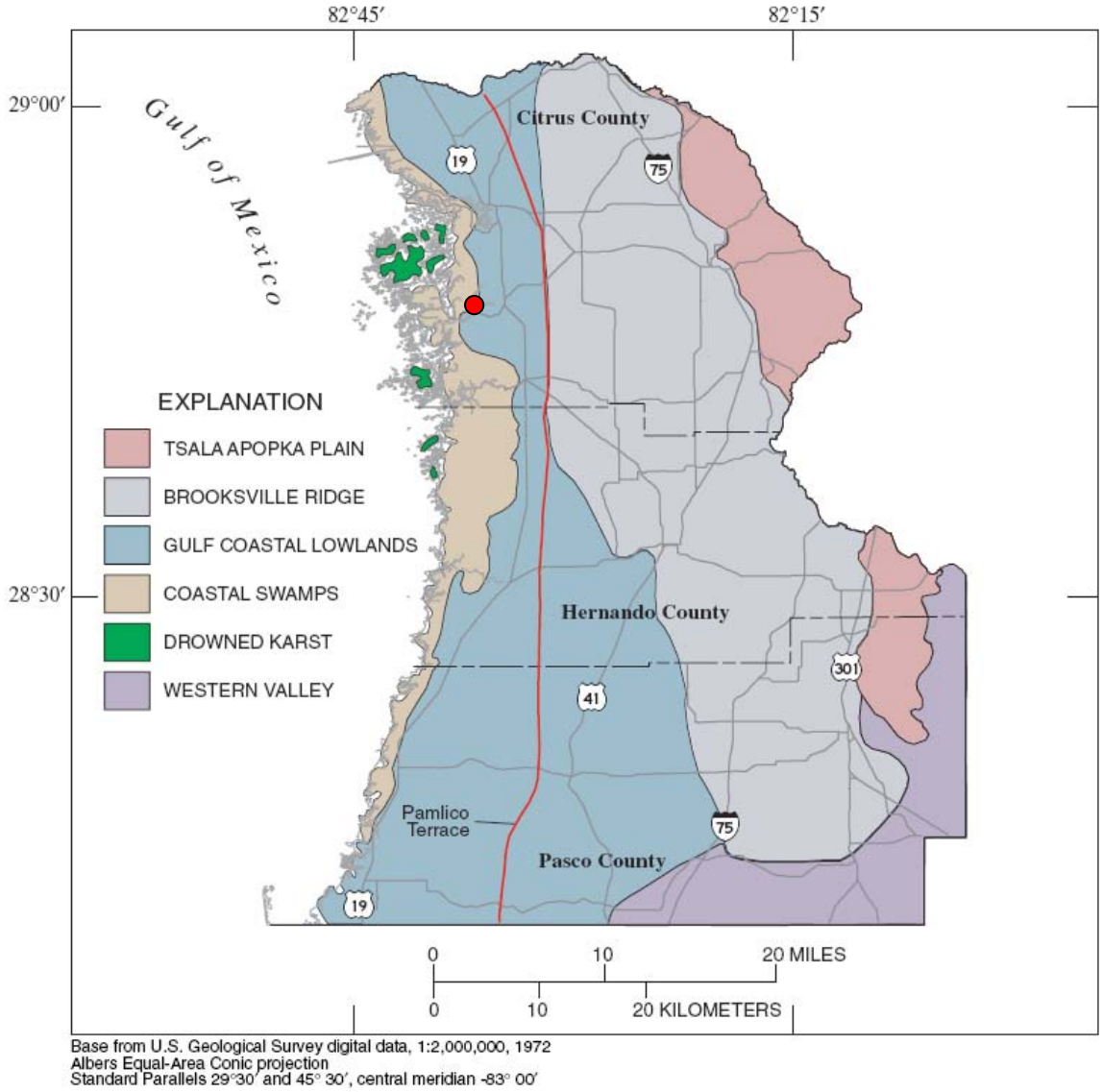


FIGURE 3
The underlying geology of the region, red circle indicates the locations of Homosassa Springs (from Knochenmus and Yobbi 2001).

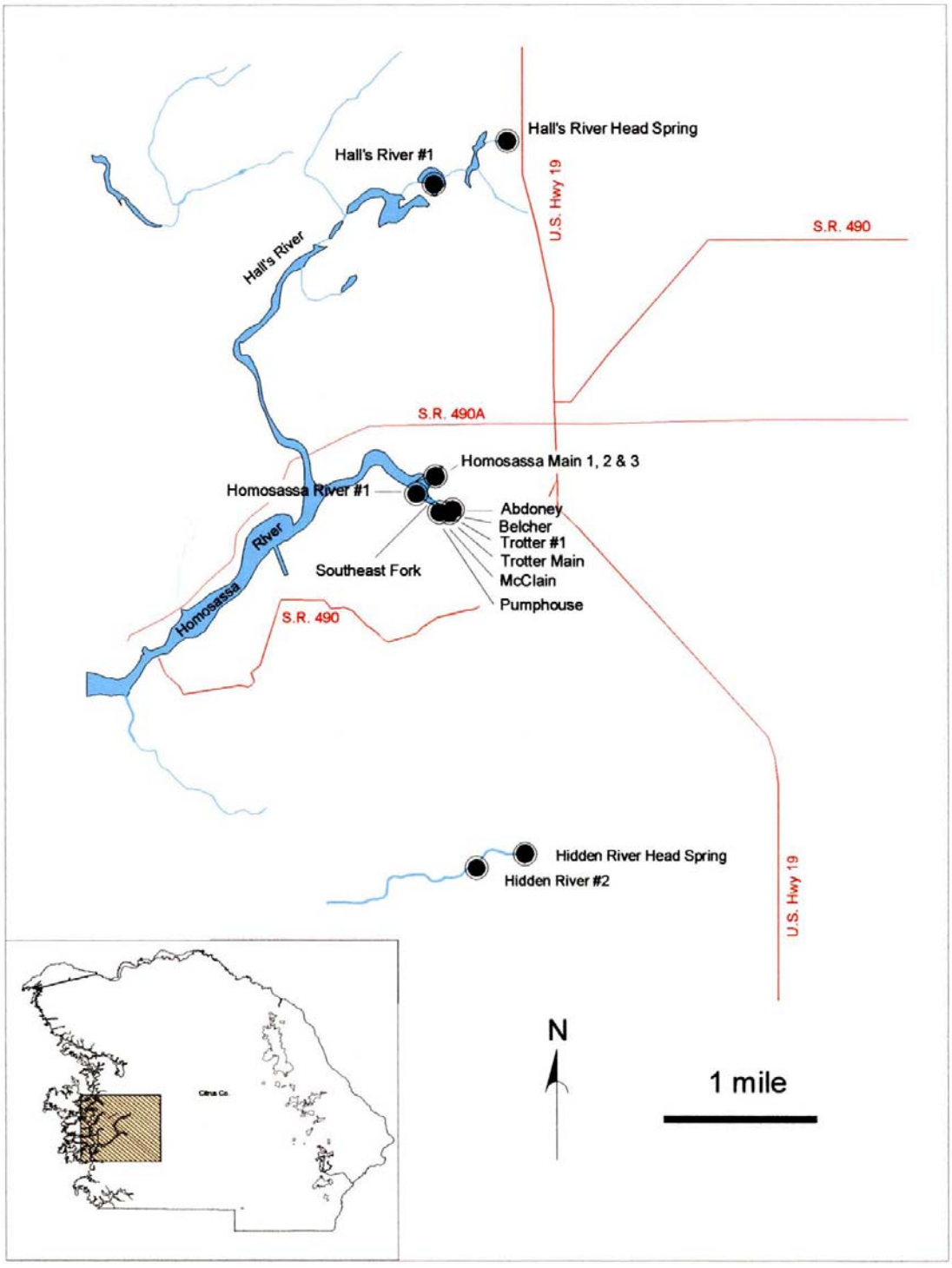


FIGURE 4
Illustration of the Homosassa Springs group and neighboring springs (from Champion and Starks 2001).

Limited physical data is available for Homosassa Springs and the short spring run. Karst Environmental Services (1992) conducted a hydrogeological study of the Homosassa Springs in 1991-1992. The study conducted water and sediment sampling, sediment quantity was estimated, and the cave system of the spring was explored, mapped and photographed (Karst Environmental Services 1992).

Comprehensive reports on the Homosassa River have been completed based on physical, chemical, and biological data collected between 1998 and 2005 (Frazer *et al.* 2001, 2006). However, these reports focus on the Homosassa River downstream of the spring run, and as such, describe conditions in the river rather than the spring pool or spring run.

Study Area

The project study area is defined as the spring boil and spring run going downstream to the footbridge. **Figure 5** shows an approximation of the study area and existing water quality sampling locations. Note that the footbridge located approximately 120 m (394 ft) downstream of the headspring includes an underwater barrier to prevent captive manatees from escaping.

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Homosassa Springs are given in **Table 1** below. Station locations are identified on **Figure 5** as well.

Discharge and Stage

Infrequent discharge data for Homosassa Springs are available as early as October 1930, with more frequent data collection beginning in 1966 to September 2008 (USGS 2008). Over this entire period-of-record (POR) the average spring discharge was 95.7 cubic feet per second (cfs) and observed values ranged from approximately 68 to 280 cfs (**Figure 6**).

Stage data at Homosassa Springs are available for the period from August 4, 1965 to September 2008 (USGS 2008). Gage height at the Homosassa Springs gauge (located just downstream of the footbridge) is variable due to the connection of the Homosassa River with the Gulf of Mexico (**Figure 7**). Since 1996, the mean gage height is 2.98 ft and the values range from 0.34 to 5.72 ft.

TABLE 1
Source information for the Homosassa Springs historical data described in this report.

Station	Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
Main Boil	21FLGW	FL Dept. of Environmental Protection	9705	Homosassa #1	28.799074	-82.588525
Main Boil	21FLGW	FL Dept. of Environmental Protection	9704	Homosassa #2	28.799069	-82.588552
Main Boil	21FLGW	FL Dept. of Environmental Protection	9706	Homosassa #3	28.799064	-82.588522
Main Boil	USGS	USGS	2310676	Head Spring Run At Homosassa River FL	28.799722	-82.588333
Spring Run (38m)	21FLGW	FL Dept. of Environmental Protection	21380	Homosassa Spring Run Flo 259 775 0	28.799538	-82.588407
Spring Run (145m)	USGS	USGS	2310678	Homosassa Springs at Homosassa Springs FL	28.799445	-82.588889
Spring Run (185m)	21FLTPA	FL Dept. of Environmental Protection	24040021	TP34 - Homosassa River	28.799389	-82.589472

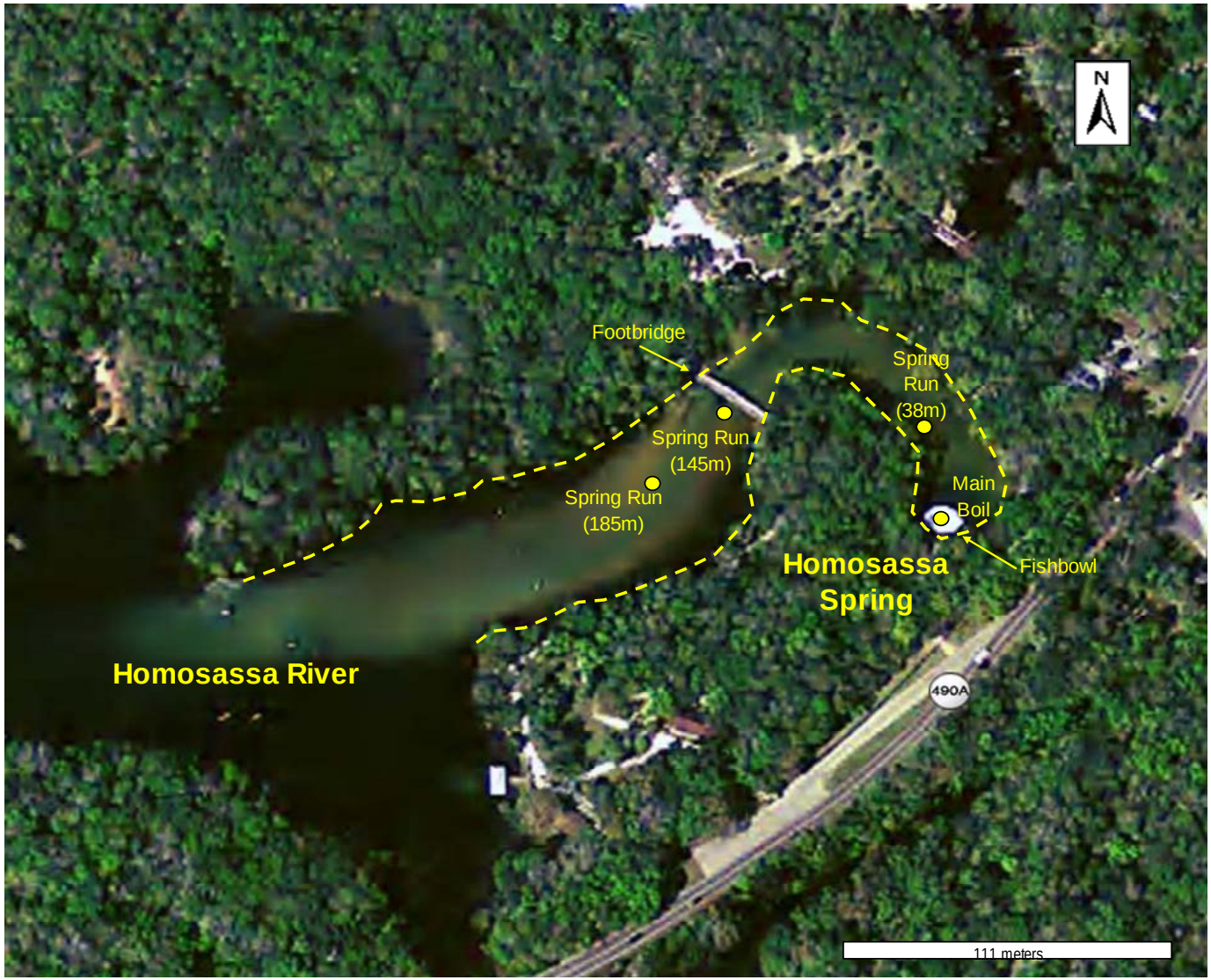


FIGURE 5
Overhead view of the Homosassa Springs group illustrating the study area, water quality stations, and the Homosassa River.

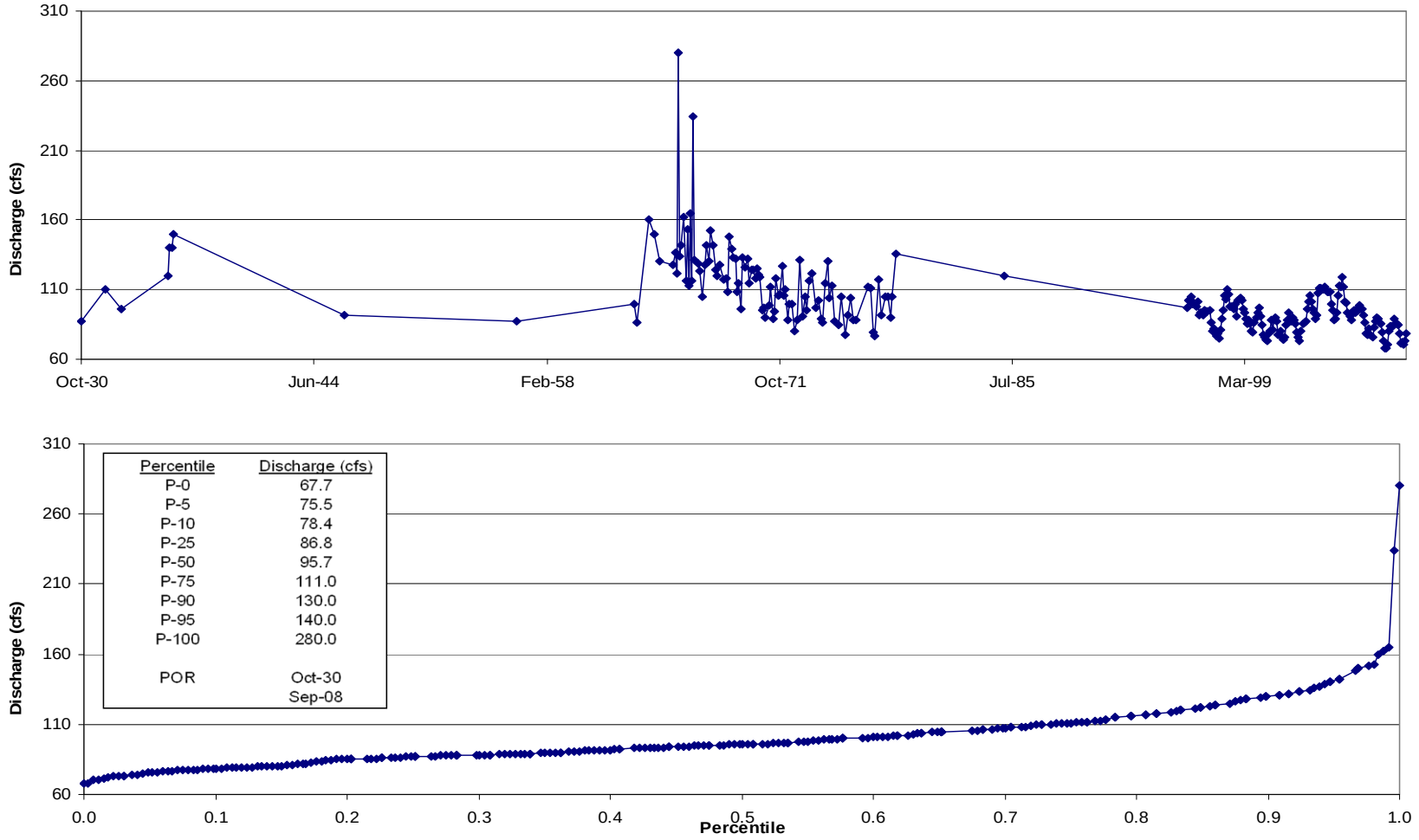


FIGURE 6
Monthly average discharge time series and frequency curve for Homosassa Springs.

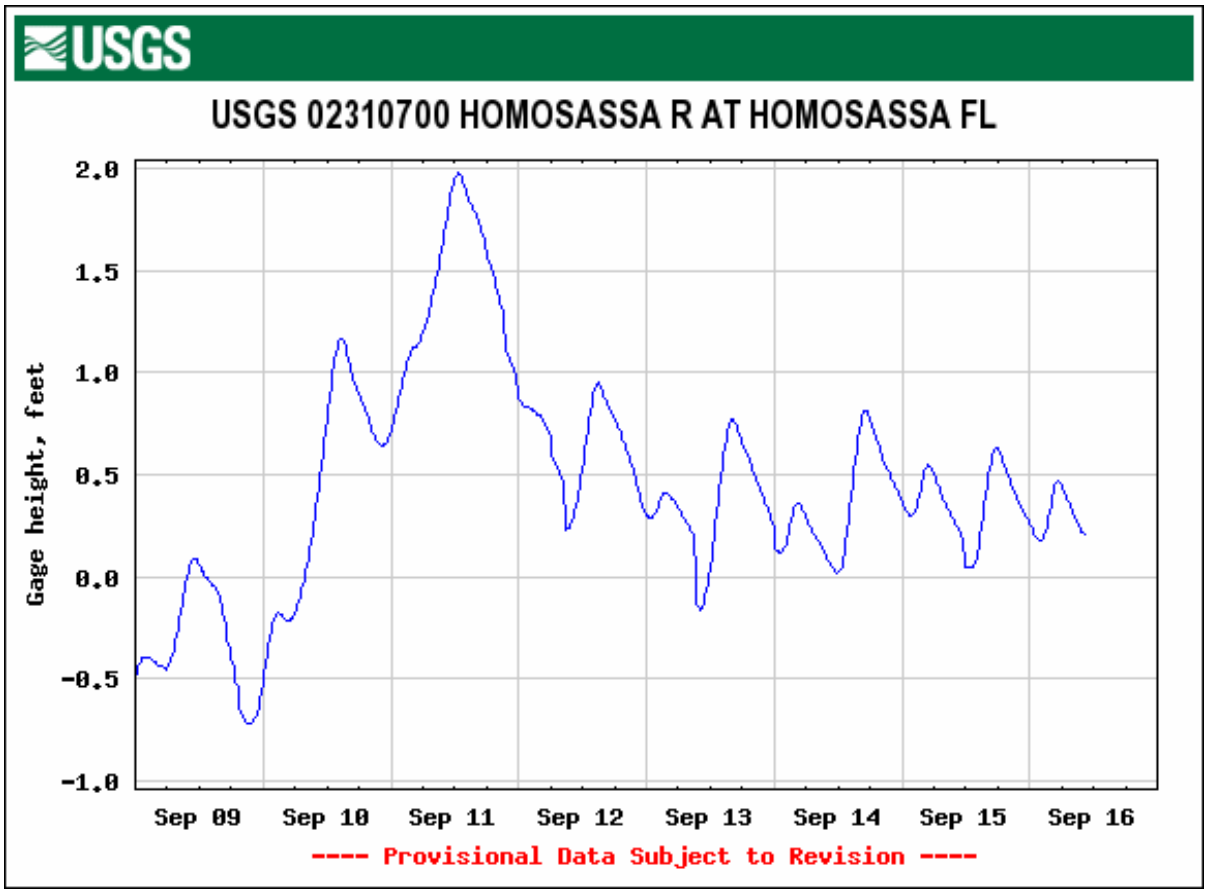


FIGURE 7
Example of gage height variation due to Gulf of Mexico tidal cycles, data from September 2008 (USGS 2008).

Water Quality

Water quality data for Homosassa Springs are available from as early as May 1956 to as recent as June 2008. The numbers of samples collected were highly variable between parameters, ranging from 1 to over 1,400 records. In addition, samples have been collected from the main boil, from the spring run at 38-m downstream, and from the spring run at 145-m downstream from the boil. **Table 2** provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Homosassa main boil POR averages for several key parameters and the numbers of samples in parenthesis are:

- Water temperature – 23.1 °C (n = 63)
- Dissolved oxygen – 3.86 mg/L (n = 63)
- pH – 7.53 SU (n = 65)
- Specific conductance – 4,097 umhos/cm (n = 128)
- Turbidity – 1.30 NTU (n = 63)
- Color – 5.25 CPU (n= 20)
- Total chloride – 1,171 mg/L (n = 80)
- Sulfate –165 mg/L (n = 80)
- Nitrate+nitrite nitrogen – 0.523 mg/L (n = 78)
- Total phosphorus – 0.080 mg/L (n = 78)

The trend of increasing nitrate-nitrogen concentrations in the water discharged from Homosassa Springs (and other regional springs) has been investigated by the Southwest

Florida Water Management District (Jones *et al*. 1997). Results of this study indicate that the dominant source of nitrate is inorganic, resulting from the residential and commercial application of fertilizers within the springshed (Jones *et al*. 1997). Efforts to control flooding and non-point nutrient sources within the Homosassa basin have been undertaken by the Southwest Water Management District through a series of watershed action management plans (Jones, Edmunds and Associates 2002).

In 2005, Florida Department of Environmental Protection noted a number of observed water quality trends (FDEP 2005) Nitrate concentrations in Homosassa Springs had risen from approximately 0.05 mg/L (Rosenau *et al*. 1977) to between 0.14 and 0.42 mg/L (Champion *et al*. 2001).

This rise in nitrates parallels similar rises observed in springs around the state (FDEP 2005). However, in a recent thesis, Strong (2004) did not find a statistically significant trend in nitrate concentrations in Homosassa Springs, but did note significant increases in specific conductivity (2,590 µS/cm @ 25 °C to 4,486 µS/cm @ 25 °C) and hardness (360 mg/L CaCO3 to 612 mg/L $CaCO_3$).

Another water quality concern at Homosassa Springs has been elevated coliform and fecal coliform concentrations in the spring run. Fecal bacterial concentrations (total and fecal coliforms, *Clostridium perfringens*, and *enterococci*) were measured as relative indicators of fecal contamination during 1997 and 1998 at a variety of locations in the park (Griffin *et al*. 2000). The highest concentrations of all fecal indicators were found at a station downstream of the animal holding pens while lowest concentrations of fecal indicators were observed in spring vents (Griffin *et al*. 2000). These results suggest that animal (indigenous and captive) and not human sources were contributing to the microbial water quality (Griffin *et al*. 2000).

As of 2005, the park had spent $1.1 million making improvements to reduce the fecal loading in the spring. Briefly, these improvements included removing animals and attractions from the property and connecting the park's wastewater discharge to the Citrus County wastewater treatment facility (FDEP 2005)

Park managers are also aware of substantial erosion and sedimentation problems within the springs and spring run. Eroded sediment, including limestone and pea gravel, from the park's pedestrian trails has been documented in some of the spring vents. Likewise, organic matter from the park's many captive animals, particularly the hippopotamus, may have accumulated. FDEP suggests that this sedimentation may have reduced flow from the affected springs. The park has made a significant ongoing effort to remove old trails and replace them with elevated boardwalks to reduce upland erosion (FDEP 2005) and a sedimentation removal project was conducted in 2006-07 throughout the spring pool, spring run, and Mitten Cove (Richard Owen, personal communication).

TABLE 2
Summary of water quality data for Homosassa Springs.

				Decade Average								Statistics						
GROUP DESC	PARAMETER	UNITS	Station	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
BACTERIOLOGICAL	EColi	#/100ml	Main Boil								1.00	1.00	1.00	1.00	0.00	6	10/16/01	1/30/02
	Enterococci	#/100ml	Main Boil								2.33	2.33	2.00	6.00	1.03	18	8/1/05	11/15/06
			Spring Run (38 m)								25.0	25.0	1.00	110	25.4	29	8/2/05	12/4/07
	FC	#/100ml	Main Boil								1.46	1.46	1.00	10.0	1.19	63	10/16/01	11/1/07
			Spring Run (38 m)								34.0	34.0	2.00	276	56.4	29	8/2/05	12/4/07
			Spring Run (145 m)					200				200	200	200		1	6/4/75	6/4/75
			Spring Run (185 m)							1,180		1,180	660	1,700	735	2	7/30/97	2/3/98
	TC	#/100ml	Main Boil								10.3	10.3	1.00	320	41.6	60	10/16/01	11/1/07
			Spring Run (145 m)					13,000				13,000	13,000	13,000		1	6/4/75	6/4/75
			Spring Run (185 m)							2,710		2,710	1,020	4,400	2,390	2	7/30/97	2/3/98
BIOLOGICAL	Chl-a corr	µg/L	Spring Run (38 m)								0.427	0.427	0.275	1.20	0.164	29	8/2/05	12/4/07
	Pheo-a	µg/L	Spring Run (38 m)								0.596	0.596	0.120	0.950	0.259	29	8/2/05	12/4/07
DISSOLVED OXYGEN	DO	%	Spring Run (145 m)				55.7	64.0				60.9	49.0	88.0	13.1	8	6/5/67	9/19/72
	DO	mg/L	Main Boil								3.86	3.86	1.78	5.52	0.593	63	10/16/01	11/1/07
			Spring Run (38 m)								4.87	4.87	4.15	6.29	0.483	58	8/2/05	12/4/07
			Spring Run (145 m)				4.63	6.64	4.47			6.40	2.40	42.0	5.18	52	6/5/67	10/18/88
			Spring Run (185 m)							4.79		4.79	4.05	5.52	1.04	2	7/30/97	2/3/98
FLOW	Flow	cfs	Spring Run (145 m)				122	114		92.8	89.0	90.2	34.0	141	13.6	4,579	5/19/66	9/8/08
	Flow-Inst	cfs	Spring Run (145 m)	120	92.0	87.0	135	104	120			116	77.0	280	27.9	112	10/9/30	1/29/85
GENERAL INORGANIC	Alk	mg/L as CaCO3	Main Boil				108				114	114	103	125	5.06	44	3/26/64	11/1/07
			Spring Run (145 m)			112	108	108	107			108	101	118	4.06	16	5/1/56	10/18/88
	Cl-T	mg/L	Main Boil				1,052				1,174	1,171	54.0	2,500	643	80	3/26/64	11/1/07
			Spring Run (38 m)								1,067	1,067	690	1,500	223	29	8/2/05	12/4/07
			Spring Run (145 m)			680	722	784	927			778	240	1,100	171	55	5/1/56	10/18/88
	F-T	mg/L	Main Boil								0.139	0.139	0.100	0.170	0.017	42	10/16/01	11/1/07
	Hardness	mg/L as CaCO3	Main Boil				510					510	140	880	523	2	3/26/64	3/27/64
			Spring Run (145 m)			360	351	350	387			358	260	480	62.2	17	5/1/56	10/18/88
	Si-D	mg/L	Main Boil				6.00					6.00	4.70	7.30	1.84	2	3/26/64	3/27/64
			Spring Run (145 m)			8.10	8.15	7.19	8.17			7.79	1.80	8.50	1.49	19	5/1/56	10/18/88
	SO4	mg/L	Main Boil				146				165	165	11.0	350	88.3	80	3/26/64	11/1/07
			Spring Run (38 m)								152	152	100	210	31.1	29	8/2/05	12/4/07
			Spring Run (145 m)			95.0	101	101	130			106	75.0	150	22.3	17	5/1/56	10/18/88
GENERAL ORGANIC	TOC	mg/L	Main Boil								1.03	1.03	0.500	2.90	0.576	63	10/16/01	11/1/07
			Spring Run (38 m)								0.814	0.814	0.500	7.20	1.25	29	8/2/05	12/4/07
			Spring Run (145 m)					3.00				3.00	0.00	19.0	5.30	16	9/30/70	5/10/78
METAL	Ag-T	µg/L	Spring Run (145 m)						0.500			0.500	0.500	0.500		1	1/29/85	1/29/85
	Al-T	µg/L	Main Boil								10.7	10.7	2.50	37.5	13.9	15	10/16/01	4/15/04
	As-T	µg/L	Main Boil								3.26	3.26	1.50	8.00	1.77	15	10/16/01	4/15/04
	Ba-T	µg/L	Main Boil								3.89	3.89	1.00	5.80	1.45	12	10/7/02	4/15/04
			Spring Run (145 m)						50.0			50.0	50.0	50.0		1	1/29/85	1/29/85
	Ca-D	mg/L	Main Boil				66.0				65.0	65.1	36.8	95.2	15.7	47	3/26/64	11/1/07
			Spring Run (145 m)			54.0	52.1	53.0	57.0			53.4	44.0	65.0	5.50	17	5/1/56	10/18/88
	Ca-T	mg/L	Main Boil								68.3	68.3	37.4	340	34.8	78	10/16/01	11/1/07
			Spring Run (38 m)								63.1	63.1	51.4	74.0	5.79	29	8/2/05	12/4/07
	Cd-T	µg/L	Main Boil								0.364	0.364	0.250	0.840	0.166	15	10/16/01	4/15/04
			Spring Run (145 m)					0.00				0.00	0.00	0.00		1	4/21/72	1/29/85
	Co-T	µg/L	Main Boil								0.575	0.575	0.375	1.00	0.226	15	10/16/01	4/15/04
			Spring Run (145 m)					0.00				0.00	0.00	0.00		1	4/21/72	4/21/72

TABLE 2 (CONTINUED)
Summary of water quality data for Homosassa Springs.

				Decade Average								Statistics					Period of Record	
GROUP DESC	PARAMETER	UNITS	Station	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
METAL	Cr-T	µg/L	Main Boil								1.48	1.48	1.00	3.80	0.819	15	10/16/01	4/15/04
			Spring Run (145 m)						1.00			1.00	1.00	1.00		1	1/29/85	1/29/85
	Cu-T	µg/L	Main Boil								1.95	1.95	1.00	3.00	0.775	15	10/16/01	4/15/04
			Spring Run (145 m)					0.00				0.00	0.00	0.00		1	4/21/72	1/29/85
	Fe-T	µg/L	Main Boil								372	372	33.0	1,890	482	15	10/16/01	4/15/04
			Spring Run (145 m)					10.0				10.0	10.0	10.0		1	4/21/72	4/21/72
	Hg-T	µg/L	Spring Run (145 m)					0.00	1.15			0.767	0.00	2.00	1.08	3	4/21/72	4/11/85
	K-T	mg/L	Main Boil								22.8	22.8	4.20	45.5	12.1	78	10/16/01	11/1/07
			Spring Run (38 m)								20.3	20.3	13.3	27.9	3.87	29	8/2/05	12/4/07
	Mg-D	mg/L	Main Boil				74.4				85.4	84.9	9.70	161	41.2	47	3/26/64	11/1/07
			Spring Run (145 m)			56.0	53.4	54.8	60.0			55.1	35.0	86.0	13.6	17	5/1/56	10/18/88
	Mg-T	mg/L	Main Boil								82.3	82.3	20.2	161	40.7	78	10/16/01	11/1/07
			Spring Run (38 m)								74.7	74.7	51.2	98.5	12.9	29	8/2/05	12/4/07
	Mn-T	µg/L	Main Boil								14.3	14.3	1.10	83.1	21.1	15	10/16/01	4/15/04
			Spring Run (145 m)					0.00				0.00	0.00	0.00		1	4/21/72	4/21/72
	NA-D	mg/L	Main Boil				544				664	659	3.70	1,280	349	47	3/26/64	11/1/07
			Spring Run (145 m)				388	400	517			416	292	600	97.3	16	11/10/60	10/18/88
	NA-T	mg/L	Main Boil								602	602	118	1,100	341	36	8/1/05	11/15/06
			Spring Run (38 m)								570	570	371	778	111	29	8/2/05	12/4/07
	Ni-T	µg/L	Main Boil								1.26	1.26	0.750	3.85	0.756	15	10/16/01	4/15/04
	Pb-T	µg/L	Main Boil								2.50	2.50	2.50	2.50	0.00	15	10/16/01	4/15/04
			Spring Run (145 m)					0.00				0.00	0.00	0.00		1	4/21/72	1/29/85
	Se-T	µg/L	Main Boil								3.30	3.30	2.00	4.00	0.775	15	10/16/01	4/15/04
	SR-T	µg/L	Main Boil								757	757	221	1,210	357	15	10/16/01	4/15/04
	Zn-T	µg/L	Main Boil								2.53	2.53	1.00	6.10	1.28	15	10/16/01	4/15/04
			Spring Run (145 m)					10.0				10.0	10.0	10.0		1	4/21/72	4/21/72
NITROGEN	NH4-N	mg/L	Main Boil								0.016	0.016	0.005	0.035	0.010	78	10/16/01	11/1/07
			Spring Run (38 m)								0.018	0.018	0.005	0.032	0.007	29	8/2/05	12/4/07
			Spring Run (145 m)					0.033	0.030			0.032	0.00	0.050	0.019	5	4/21/72	1/29/85
	NO2-N	mg/L	Spring Run (145 m)					0.004	0.005			0.004	0.00	0.005	0.002	6	4/21/72	1/29/85
	NO3-N	mg/L	Spring Run (145 m)					0.204				0.204	0.020	0.310	0.117	5	4/21/72	6/4/75
	NOx-N	mg/L	Main Boil								0.523	0.523	0.180	0.630	0.055	78	10/16/01	11/1/07
			Spring Run (38 m)								0.523	0.523	0.490	0.600	0.029	29	8/2/05	12/4/07
			Spring Run (145 m)						0.305			0.305	0.270	0.340	0.049	2	1/29/85	6/7/88
	OrgN	mg/L	Spring Run (145 m)					0.164	0.120			0.157	0.050	0.420	0.148	6	6/1/70	1/29/85
	TKN-D	mg/L	Main Boil								0.169	0.169	0.030	0.310	0.068	45	10/16/01	11/1/07
	TKN	mg/L	Main Boil								0.155	0.155	0.040	0.730	0.090	78	10/16/01	11/1/07
			Spring Run (38 m)								0.136	0.136	0.040	0.220	0.048	29	8/2/05	12/4/07
			Spring Run (145 m)						0.150			0.150	0.150	0.150		1	1/29/85	1/29/85
	TN	mg/L	Spring Run (145 m)						0.420			0.420	0.420	0.420		1	1/29/85	1/29/85
OXYGEN DEMAND	BOD5	mg/L	Spring Run (145 m)					0.269				0.269	0.00	0.900	0.263	13	4/21/72	5/10/78
	cBOD5	mg/L	Main Boil								0.767	0.767	0.680	0.860	0.090	3	10/16/01	10/16/01
			Spring Run (185 m)							2.00		2.00	2.00	2.00	0.00	2	7/30/97	2/3/98
	COD	mg/L	Spring Run (145 m)					6.00				6.00	6.00	6.00		1	6/4/75	6/4/75

TABLE 2 (CONTINUED)
Summary of water quality data for Homosassa Springs.

GROUP DESC	PARAMETER	UNITS	Station	Decade Average								Statistics					Period of Record	
				1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
PHOSPHORUS	OrthoP	mg/L	Main Boil								0.015	0.015	0.008	0.023	0.003	63	10/16/01	11/1/07
			Spring Run (38 m)								0.019	0.019	0.016	0.023	0.002	29	8/2/05	12/4/07
			Spring Run (145 m)					0.017	0.020			0.018	0.010	0.020	0.005	4	4/21/72	1/29/85
	TDP	mg/L	Main Boil								0.019	0.019	0.008	0.040	0.007	42	10/16/01	11/1/07
	TP	mg/L	Main Boil								0.080	0.080	0.004	4.50	0.507	78	10/16/01	11/1/07
			Spring Run (38 m)								0.025	0.025	0.019	0.032	0.003	29	8/2/05	12/4/07
			Spring Run (145 m)					0.040	0.045			0.042	0.025	0.060	0.017	5	4/21/72	6/7/88
PHYSICAL	Color	CPU	Main Boil				12.5				4.44	5.25	0.00	20.0	5.50	20	3/26/64	11/15/06
			Spring Run (38 m)								3.28	3.28	0.00	10.0	3.07	29	8/2/05	12/4/07
			Spring Run (145 m)			3.00	3.13	5.00	2.50			3.70	0.00	10.0	3.38	15	5/1/56	1/29/85
			Spring Run (185 m)							12.5		12.5	7.00	18.0	7.78	2	7/30/97	2/3/98
	Depth	m	Main Boil								19.7	19.7	18.8	20.4	0.808	3	10/16/01	10/16/01
			Spring Run (38 m)								0.734	0.734	0.200	1.10	0.253	86	8/2/05	12/4/07
			Spring Run (185 m)							1.50		1.50	1.50	1.50	0.00	2	7/30/97	2/3/98
	ORP	mV	Main Boil								224	224	163	276	38.8	6	1/30/02	4/11/02
			Spring Run (145 m)						225			225	176	274	69.3	2	6/7/88	10/18/88
	pH	SU	Main Boil				7.45				7.53	7.53	7.10	7.81	0.139	65	3/26/64	11/1/07
			Spring Run (38 m)								7.49	7.49	7.30	8.00	0.127	58	8/2/05	12/4/07
			Spring Run (145 m)			8.20	7.40	7.67	7.65			7.60	6.90	8.20	0.317	26	5/1/56	10/18/88
			Spring Run (185 m)							7.27		7.27	7.16	7.37	0.148	2	7/30/97	2/3/98
	Secchi	m	Main Boil								19.7	19.7	18.8	20.4	0.808	3	10/16/01	11/1/07
			Spring Run (38 m)								0.842	0.842	0.400	1.10	0.163	56	8/2/05	12/4/07
			Spring Run (185 m)							1.50		1.50	1.50	1.50	0.00	2	7/30/97	2/3/98
	SpCond (Max)	umhos/cm	Spring Run (145 m)								4,409	4,409	2,810	22,300	1,115	1,442	11/2/88	6/27/08
	SpCond (Min)	umhos/cm	Spring Run (145 m)								2,966	2,966	1,160	5,150	599	1,439	11/2/88	6/27/08
	SpCond	umhos/cm	Main Boil				3,499				4,106	4,097	317	12,200	2,139	128	3/26/64	11/1/07
			Spring Run (38 m)								3,702	3,702	2,530	5,060	655	87	8/2/05	12/4/07
			Spring Run (145 m)			2,590	2,605	2,798	3,245			4,247	2,988	305	5,550	870	78	5/1/56	6/9/08
			Spring Run (185 m)							3,910		3,910	3,910	3,910		1	7/30/97	7/30/97
	Stage	ft	Main Boil								1.56	1.56	0.900	3.40	1.04	5	8/2/05	11/1/07
			Spring Run (38 m)								2.68	2.68	-1.11	3.70	1.00	45	9/7/05	12/4/07
			Spring Run (145 m)				9.71	9.45	4.61	3.85	2.97	3.41	0.340	37.8	2.29	4,618	8/4/65	9/8/08
	Turb	NTU	Main Boil								1.30	1.30	0.150	7.20	1.16	63	10/16/01	11/1/07
			Spring Run (38 m)								0.653	0.653	0.300	1.20	0.236	29	8/2/05	12/4/07
			Spring Run (145 m)					2.00				2.00	0.00	4.00	1.83	4	6/1/70	9/19/72
			Spring Run (185 m)							0.900		0.900	0.900	0.900	0.00	2	7/30/97	2/3/98
SOLID	TDS	mg/L	Main Boil								2,183	2,183	484	4,080	1,065	63	10/16/01	11/1/07
			Spring Run (38 m)								1,984	1,984	1,310	3,860	528	29	8/2/05	12/4/07
			Spring Run (145 m)			1,530	1,410	1,353	1,917			1,573	1,130	2,130	332	9	5/1/56	10/18/88
	TSS	mg/L	Main Boil								2.41	2.41	2.00	15.0	1.77	63	10/16/01	11/1/07
			Spring Run (38 m)								2.10	2.10	2.00	5.00	0.557	29	8/2/05	12/4/07
			Spring Run (185 m)							1.00		1.00	1.00	1.00	0.00	2	7/30/97	2/3/98
TEMPERATURE	Wtr Temp (Max)	C	Spring Run (145 m)								23.4	23.4	23.2	25.8	0.121	1,440	11/2/88	6/27/08
	Wtr Temp (Min)	C	Spring Run (145 m)								23.2	23.2	22.8	23.4	0.098	1,439	11/2/88	6/27/08
	Wtr Temp	C	Main Boil								23.1	23.1	2.50	25.0	2.71	63	10/16/01	11/1/07
			Spring Run (38 m)								23.3	23.3	23.0	23.5	0.122	58	8/2/05	12/4/07
			Spring Run (145 m)			23.3	22.9	23.6	23.5		23.4	23.4	20.0	25.5	1.02	101	5/1/56	6/9/08
			Spring Run (185 m)							23.3		23.3	23.2	23.4	0.141	2	7/30/97	2/3/98

Measurements of water chemistry field parameters (temperature, conductance, dissolved oxygen, and pH) in the spring boil and run areas were made during the reconnaissance trip. Field parameters were measured from the northern side of the observation platform above the spring vent and on the upstream side of the foot bridge approximately 122 m (400 ft) downstream (**Figure 8**). Temperature above the spring vent was typical of groundwater, at approximately 23 °C, and increased slightly with distance downstream (see **Figure 9**). Specific conductance at Homosassa Springs was elevated (~ 4,500 µS/cm) in comparison to most Florida springs; yet consistent with a coastal spring whose source water is mixing with marine waters. Within the spring run, vertical stratification of salinity and dissolved oxygen was observed. Dissolved oxygen concentrations from the spring vents approximately 3.5 mg/L (or 40% saturated), and at the downstream footbridge reached a maximum of about 4.3 mg/L (50% saturated). These dissolved oxygen values were measured between 12:00 and 13:00 under heavy cloud cover. Higher dissolved oxygen concentrations are to be expected during afternoon hours on days without cloud cover. Field measured pH values varied slightly among sampling locations, averaging about 7.6 standard units throughout the spring run (**Figure 9**).



FIGURE 8
Image of Homosassa Springs pool and run, red icons indicate August 13, 2008 sampling locations.

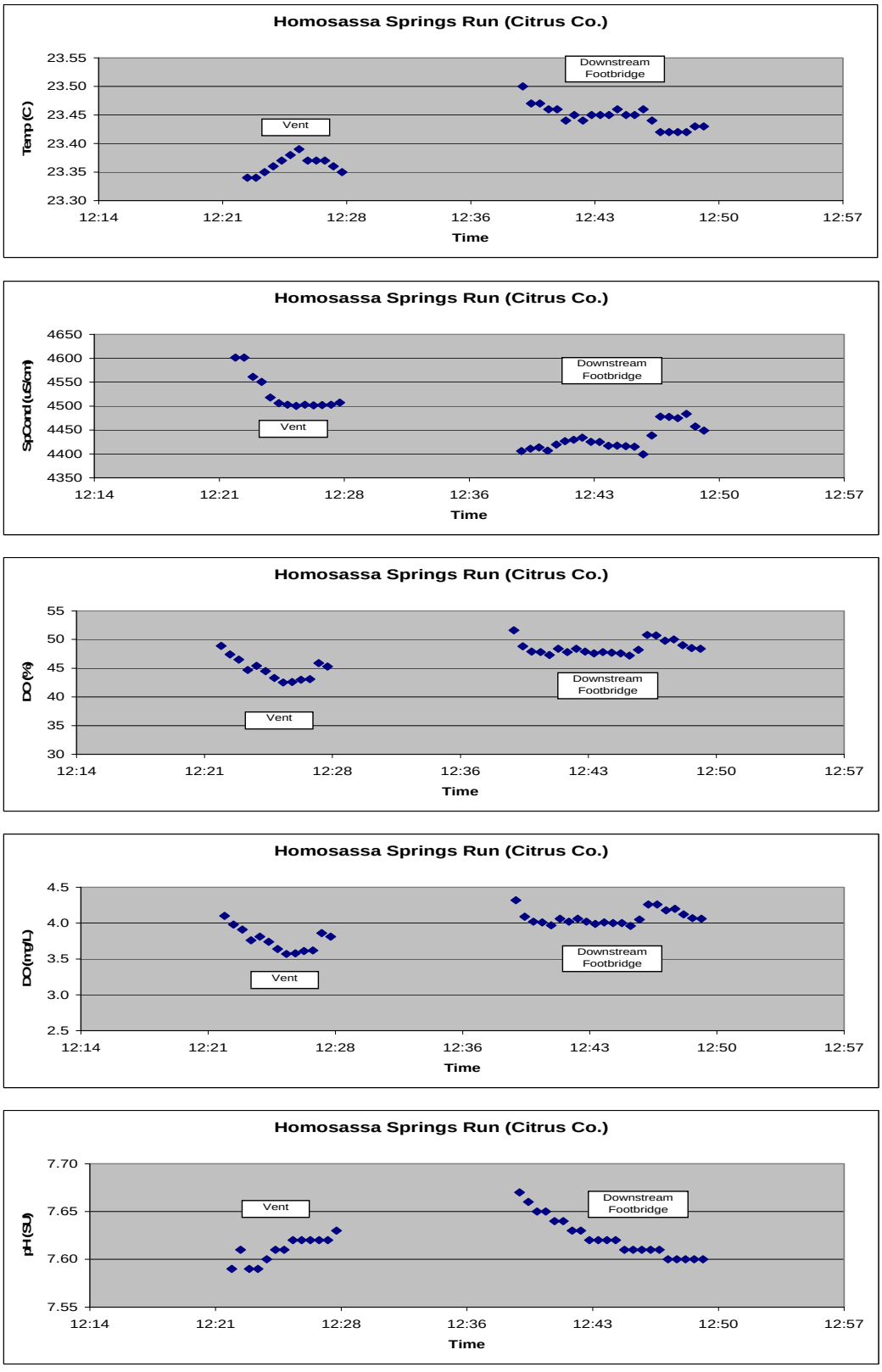


FIGURE 9
Field parameters by location and time for Homosassa Springs on August 13, 2008.

Biological

Vegetation

In 1956, Sloan found the submerged aquatic vegetation (SAV) communities of Homosassa Springs and the Homosassa River to consist primarily of tape grass, *Vallisneria neotropicalis* (*V. americana*), Sago pondweed, *Potamogeton pectinatus*, and southern naiad, *Najas guadalupensis* in the upper reaches with Sargassum seaweed, *Sargassum* sp. taking over 4.5 miles downstream as the river approaches the Gulf of Mexico. SAV covered 30% of the bottom in the spring pool, 50% of the bottom 0.2 mi downstream, 40-50% .07 mi downstream and reached a maximum of 70% 1.5 mi downstream. From that point, the percent cover slowly decreased to 5-10% as the river approaches the Gulf of Mexico (Sloan 1956).

Around this same time period, a study of algal communities in a variety of Florida spring was made (Whitford 1956). He described the attached algal community of Homosassa (and other oligohaline Florida springs) as being composed of *Cladophora* spp., *Cocconeis* spp., and *Enteromorpha* spp. Whitford's paper provides a listing of algae species found in several Florida springs.

Odum studied Homosassa Springs as part of a primary productivity investigation in 1957. **Figure 10** shows a sketch of the spring pool and spring run from his field notes which notes the location and species of SAV present. Odum observed the same SAV species as Sloan, but does not give a quantitative estimate of percent cover. However, his sketch suggests substantial SAV abundance in the upper spring run.

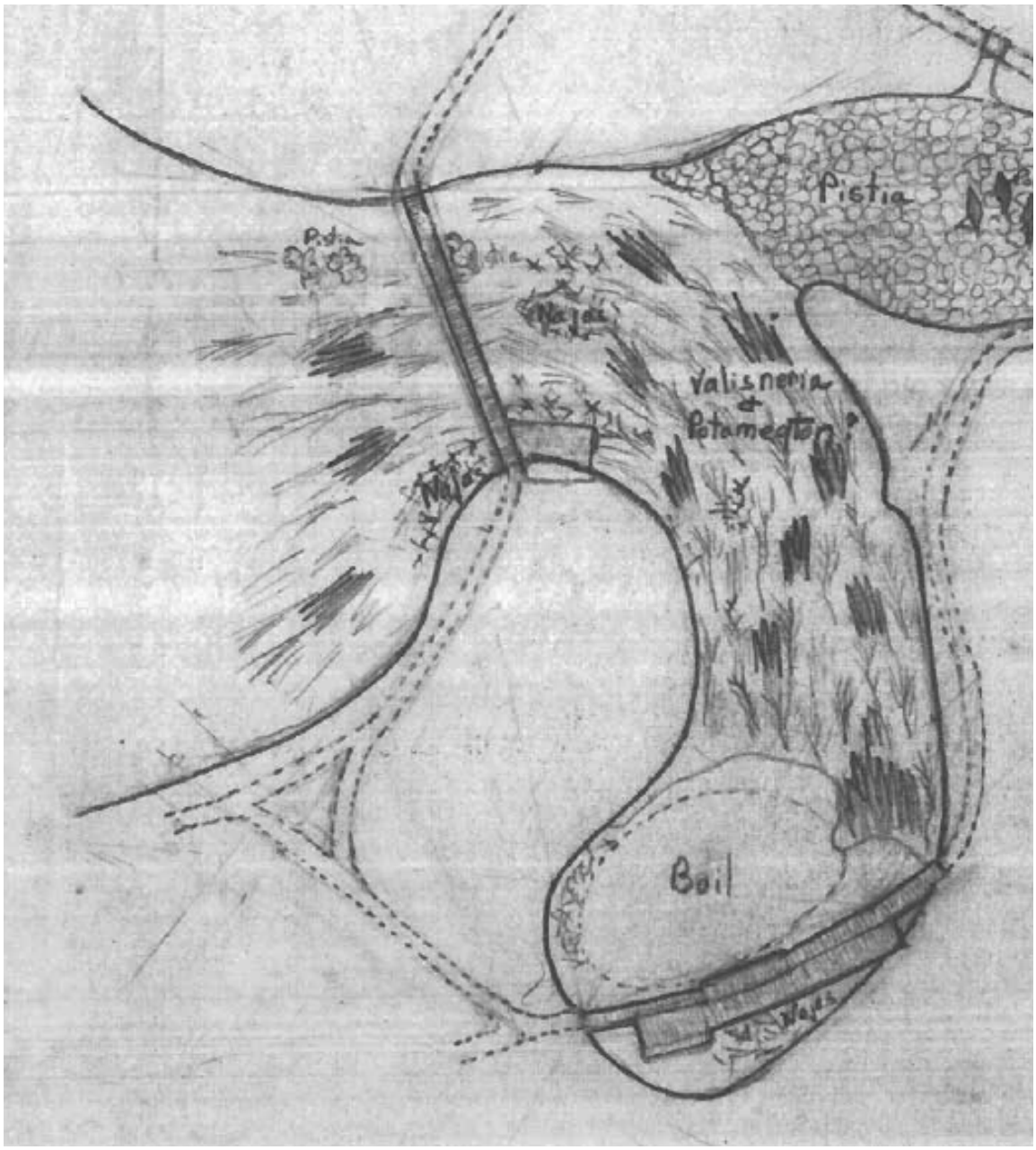


FIGURE 10
Sketch of Homosassa Springs and the submersed aquatic vegetation as noted by H.T. Odum in 1955 (from Munch *et al.* 2005).

Historic (1956-1957) SAV coverage estimates are in sharp contrast to modern (1998-2005) estimates of SAV abundance, specifically in the degree that SAV abundance has been reduced in the spring run and Homosassa River.

A visual demonstration of this trend can be shown by comparing **Figure 10** (above) to **Figure 11**, an aerial photograph taken by H. Means; in which SAV is absent from the upper spring run (Scott *et al*. 2004). For many years the managers of the park (including FDEP) have kept captive manatees in the upper reach of the spring run (FDEP 2005). This high density and year-round presence of manatees in this section of the spring run have likely contributed to the absence of SAV noted in modern times.



FIGURE 11
Aerial photograph of Homosassa Springs taken in 2004 by H. Means (from Scott *et al.* 2004).

A more quantitative analysis of the reduction in SAV in the Homosassa River (below the spring run) has been presented as part of a study of five Springs Coast rivers in Florida (Frazer *et al*. 2001). Frazer *et al*. (2001) reported that the Homosassa River wet weight SAV biomass was 0.8 kg in 1998, 1.0 in 1999 and fell to 0.4 kg in 2000. The authors of the report suggest that the abundance of SAV vegetation in the Homosassa is at least partially influenced by the volume of freshwater discharge from the spring and the corresponding degree of saltwater intrusion from the Gulf of Mexico. Support for the importance of salinity in structuring the SAV community of the Homosassa River is presented by Hoyer *et al*. (2004) who concluded that salinity and light availability were determined to be the major factors affecting the distribution and abundance of SAV.

Also notable for the Homosassa River is the apparent change in SAV species composition from tape grass, *Vallisneria americana*, Sago pondweed, *Potamogeton pectinatus*, and southern naiad, *Najas guadalupensis* in 1956 (Sloan 1956) to *Lyngbya* sp., *Eurasian milfoil*, Myriophyllum *spicatum*, *Chaetomorpha* sp., and southern naiad, *Najas guadalupensis* in 2001 (Frazer *et al*. 2001.)

Further studies of the Homosassa River reveal that declines in SAV abundance have continued through the 2003-2005 time period (Frazer *et al*. 2006). In this follow up project, Frazer *et al*. noted declines in the frequency of occurrence for the majority SAV species, and that the most common species southern naiad (*Najas guadalupensis*) was only observed in approximately 24% of the sampled locations (**Table 3**).

TABLE 3
The frequency of occurrence (% of stations sampled) of SAV for the Homosassa River by time period and their corresponding differences (from Frazer *et al*. 2006).

SPECIES	1998 – 2000 FREQUENCY OF OCCURRENCE (%)	2003 – 2005 FREQUENCY OF OCCURRENCE (%)	PERCENTAGE CHANGE
Ceratophyllum demersum	6.7	2.3	-65
Chara sp.	0.3	0.0	-100
Filamentous algae	51.0	24.0	-53
Gracilaria sp.	3.7	2.0	-45
Hydrilla verticillata	4.0	2.7	-33
Myriophyllum spicatum	43.0	14.0	-67
Najas guadalupensis	39.7	23.7	-40
None	27.7	56.3	104
Potamogeton pusillus	6.3	9.3	47
Ruppia maritima	1.7	2.3	40
Vallisneria americana	6.0	2.0	-67

Collectively the historic and modern observations of the Homosassa spring run and Homosassa River suggest that a decline in SAV has occurred in both locations within this ecosystem.

Observations of the aquatic plant community in the spring boil and run area were made during the reconnaissance trip of August 13, 2008. Submersed aquatic vegetation (SAV) within the Homosassa Springs pool was limited to minimal amounts of filamentous algae. Below the park footbridge, filamentous algae were more abundant, but still relatively sparse. The lack of SAV in the spring pool/upper run is expected given the continual presence of captive manatees in this small area, rocky substrate, and elevated salinity.

Macroinvertebrates

The aquatic macroinvertebrates of Homosassa Springs and River were characterized in 1956 by Sloan, in a study comparing the aquatic insect communities of the Homosassa and Weeki Wachee Rivers. Sloan (1956) provides a description of the distribution of aquatic macroinvertebrates (by order) that were collected; which will prove useful as a comparison

of species distributions from emergence traps deployed at this spring as part of the current study. The aquatic macroinvertebrate orders reported by Sloan (1956) were: Ephemeroptera, Odonata, Hemiptera, Trichoptera, Coleoptera, and Diptera.

Sloan (1956) found that population distributions varied by insect order, but that the number of species found was highest 322 meters (1,056 ft) downstream of the headspring and declined gradually along the river as it approached the Gulf (**Figure 12**).

Other macroinvertebrate data for Homosassa Springs are available from a study of aquatic crustaceans in 17 Florida parks (Franz 2002). From Homosassa Springs, in the lower spring run, downstream of the park boundary (footbridge?), several crustaceans were collected: Crayfish (*Procambarus paeninsulanus*), shrimp (*Palaemonetes* sp.), amphipods (*Gammarus*), and an isopod (unidentified marine species).

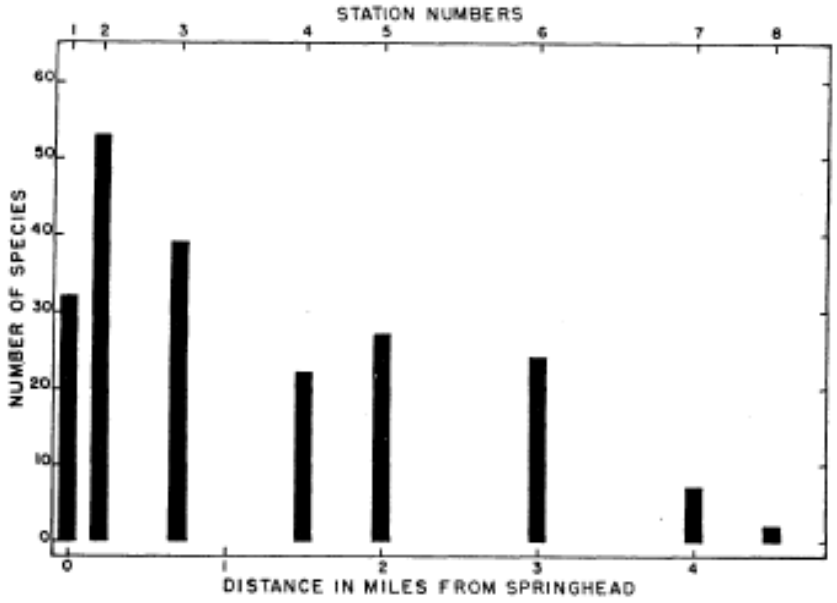


FIGURE 12
The number of species of aquatic insects collected as a function of distance from the headspring (from Sloan 1956).

Macro fauna

Marine fish congregate in the boil of Homosassa Springs and contribute towards relatively high fish diversity at this spring (Walsh and Williams 2003). Walsh and Williams (2003) conducted electrofishing downstream of the park footbridge (**Figure 13**) in October 2002 and collected a total of 556 fish representing 34 species (**Table 4**). By comparing their list of fish to previous collections from Herald and Strickland (1949), an estimated minimum of 47 species of freshwater, diadromous, and eurhyaline marine fishes have been collected from Homosassa Springs in and near the spring (Walsh and Williams 2002).

Observations of the fish community in the spring boil and run area were made during the reconnaissance trip of August 13, 2008. The Homosassa spring pool is a well known location to observe congregations of marine fish and we observed 5 species of fish including several sheepshead (*Archosargus probatocephalus*), about 40 common snook (*Centropomus undecimalis*), a dozen of striped mullet (*Mugil cephalus*), about 30 Crevalle jack (*Caranx hippos*), and about a dozen Red Drum (*Sciaenops ocellatus*).

Mussels

Walsh and Williams (2003) did not collect or observe any mussels (including the exotic and widespread Asian clam, *Corbicula fluminea*) in the run downstream of the footbridge to the southwest boundary of the wildlife park (see Figure 32 for sampling locations). It was speculated that the absence of freshwater mussels in Homosassa Springs was due to tidal influence and associated salinity effects present in this system (Walsh and Williams 2003)

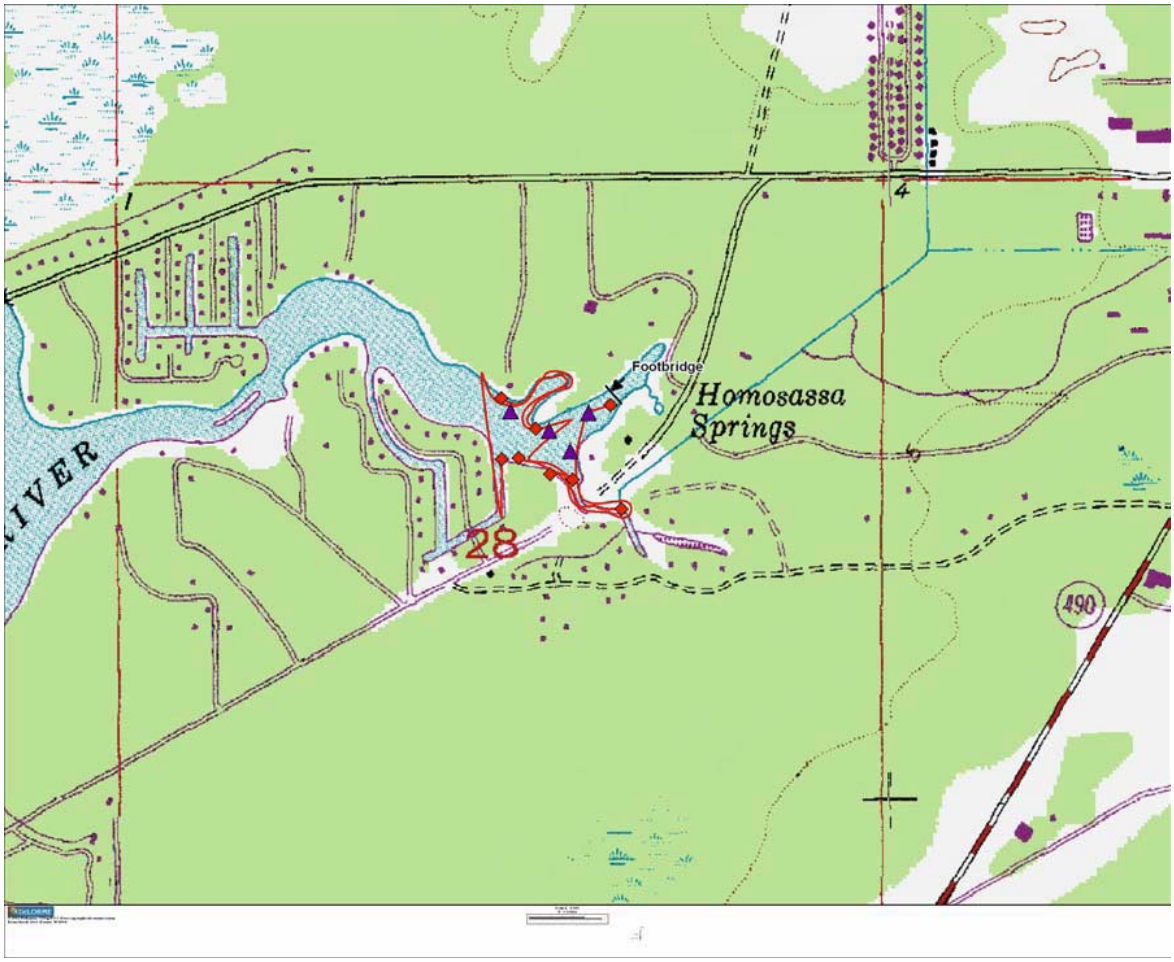


FIGURE 13
The area sampled for fishes (diamonds and lines; electrofishing) and mussels (triangles) below the Homosassa Springs Wildlife State Park (from Walsh and Williams 2003).

TABLE 4
A listing of fish collected nearby Homosassa Springs Wildlife State Park during October 2002 and those provisionally reported (X) by Herald and Strickland (1949) (from Walsh and Williams 2003).

Family	Species	USGS		Herald & Strickland (1949)
		N	Relative Abundance (%)	
Carcharhinidae	unidentified shark	---	---	X
Dasyatidae	*Dasyatis sabina*	---	---	X
Acipenseridae	*Acipenser oxyrhincus desotoi*	---	---	X
Lepisosteidae	*Lepisosteus osseus*	1	0.2	X
	Lepisosteus platyrhincus	15	2.7	---
Megalopidae	*Megalops atlanticus*	---	---	X
Anguillidae	*Anguilla rostrata*	3	0.5	---
Cyprinidae	*Notemigonus chrysoleucas*	---	---	X
	Notropis harperi	1	0.2	X
	Notropis petersoni	3	0.5	---
Catostomidae	*Erimyzon sucetta*	---	---	X
Ictaluridae	*Ameiurus natalis*	1	0.2	X
	Noturus gyrinus	1	0.2	---
Ariidae	*Ariopsis felis*	---	---	X
	Bagre marinus	---	---	X
Mugilidae	*Mugil cephalus*	35	6.3	X
	Mugil curema	---	---	X
Atherinopsidae	*Menidia beryllina*	7	1.3	---
Belonidae	*Strongylura marina*	6	1.1	X
Fundulidae	*Fundulus confluentus*	5	0.9	---
	Fundulus seminolis	3	0.5	---
	Lucania goodei	12	2.2	X
	Lucania parva	46	8.3	X
Poeciliidae	*Gambusia holbrooki*	26	4.7	X
	Heterandria formosa	2	0.4	X
	Poecilia latipinna	17	3.1	X
Cyprinodontidae	*Cyprinodon variegatus*	---	---	X
Centropomidae	*Centropomus undecimalis*	12	2.2	X
Centrarchidae	*Lepomis gulosus*	3	0.5	X
	Lepomis macrochirus	34	6.1	X
	Lepomis microlophus	8	1.4	X
	Lepomis punctatus	48	8.6	X
	Micropterus salmoides	38	6.8	X
Echeneidae	*Echeneis naucrates*	1	0.2	X
Carangidae	*Caranx hippos*	3	0.5	X
Lutjanidae	*Lutjanus apodus*	---	---	X
	Lutjanus griseus	33	5.9	X
Gerreidae	*Eucinostomus harengulus*	171	30.8	X
Sparidae	*Archosargus probatocephalus*	2	0.4	X
	Lagodon rhomboides	2	0.4	X
Sciaenidae	*Cynoscion nebulosus*	---	---	X
	Pogonias chromis	2	0.4	---
	Sciaenops ocellatus	---	---	X
Elassomatidae	*Elassoma okefenokee*	1	0.2	---
Gobiidae	*Ctenogobius* sp.	1	0.2	---
	Microgobius gulosus	3	0.5	---
Achiridae	*Trinectes maculatus*	10	1.8	---
	Total number of species	**34**		**35**
	Total number of specimens	**556**		

Manatees

Homosassa Springs State Wildlife Park has an active manatee rehabilitation program which utilizes the spring pool and upper run to shelter and contain individuals. Observations of the spring boil and run area were made during the reconnaissance trip of August 13, 2008. During this event, six adult manatees were reported to be held in this spring pool enclosure and we observed several manatees in this area. Downstream of the park footbridge, wild manatees are known to congregate during the winter for the thermal refuge provided by the spring effluent. Concern over the fencing (under the foot bridge) which precludes wild manatee access to the main spring pool have been raised in a review of Florida springs and their accessibility to manatees seeking thermal refuge (Taylor 2006). During winter periods manatees congregate in deeper portions of the spring run (**Figure 14**, Taylor 2006).

Ecosystem Functions

Homosassa Springs is one of 11 spring systems that Odum documented ecosystem productivity of in a 1957 publication (Odum 1957b). In the study, Odum calculated net primary production on the basis of oxygen production per square meter per day as a function of light intensity. **Figure 15** shows the extraordinary production efficiency of Homosassa springs as compared to other Florida springs. As an explanation for this elevated productivity, Odum (1957b) suggested that the waste products from the large numbers of fish continuously present in the main boil could provide nutrients to the downstream autotrophic community.

Based on field parameters (temperature, conductance, dissolved oxygen, and pH) measured in the spring boil and spring run during the reconnaissance trip of August 13, 2008, this spring is suitable for measuring ecosystem metabolism based on changes in

dissolved oxygen following discharge from the spring vent. Complicating factors may include the tidal nature of the Homosassa River.



FIGURE 14
Locations and approximate numbers of manatees documented during 30 monitoring days from November 2005 through March 2006 (from Taylor 2006).

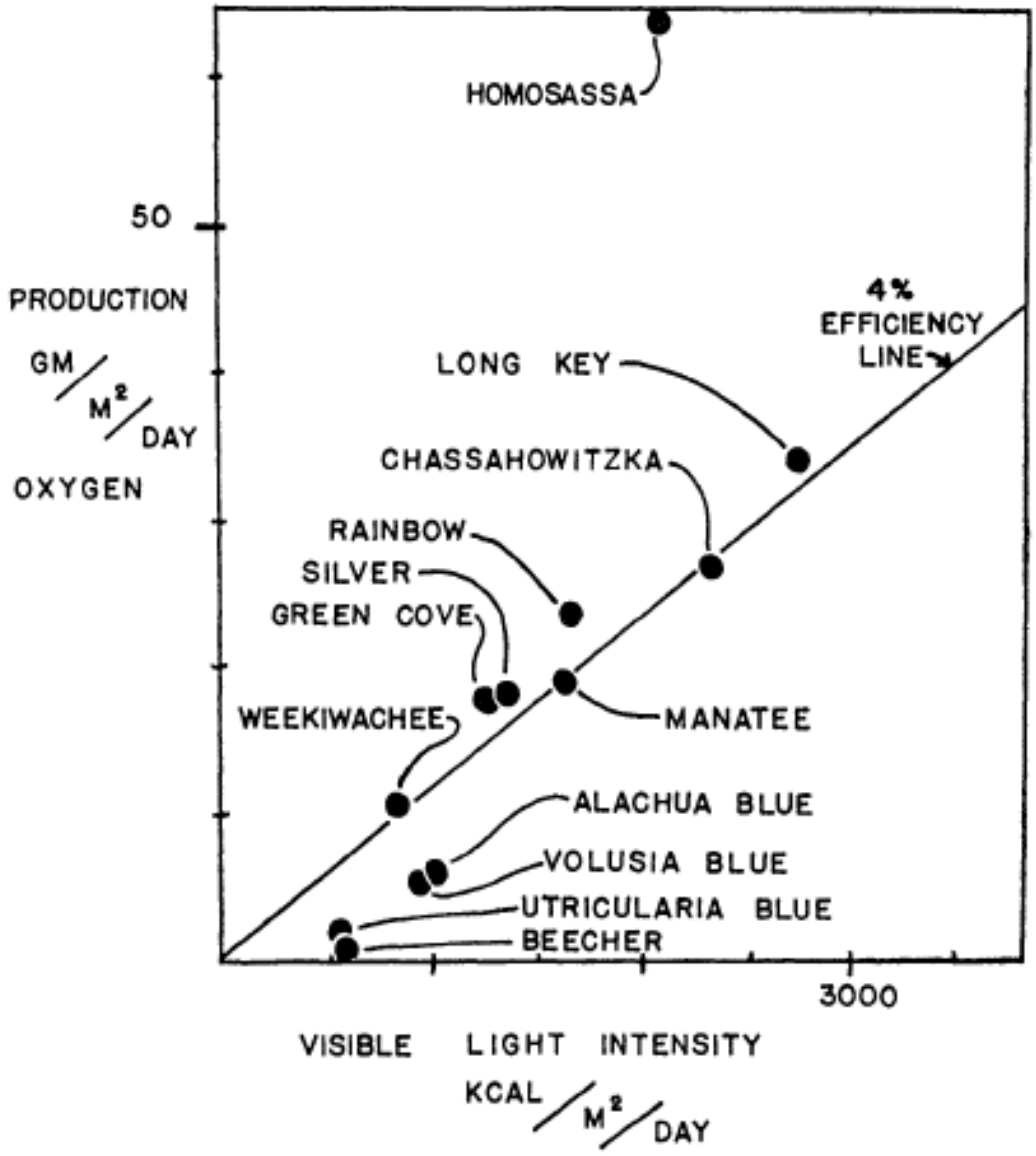


FIGURE 15
Gross primary production on an area basis as a function of visible light intensity reaching the level of submersed aquatic vegetation (from Odum, 1957b).

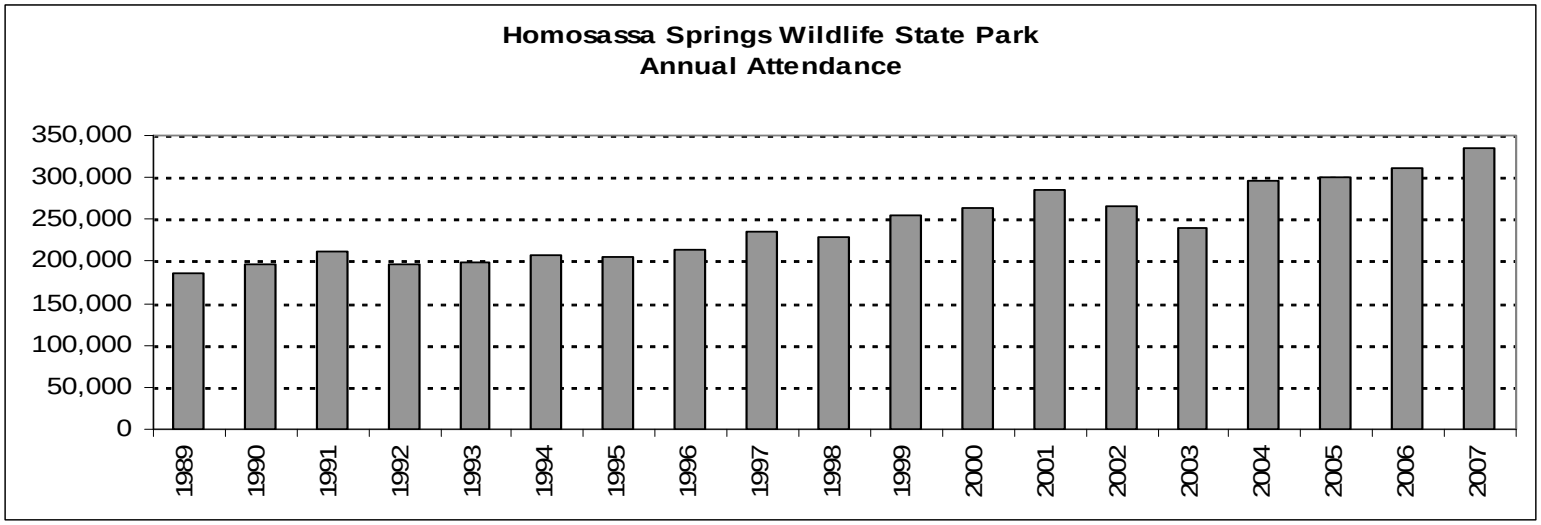
Human-Use Attendance and Activities

Unique tourism opportunities at Homosassa State Wildlife Park include the ability to observe manatees year round because of the rehabilitation facilities for these animals. As a state park, daily attendance records are maintained and annual and monthly statistics are shown in **Figure 16**. This park does not have overnight usage and the annual attendance values represent day use only. Maximum annual attendance was observed in 2007 with over 334 thousand visitors. Annual visitation does not appear to have leveled off, suggesting that a limiting factor (such as parking) has not been reached for this park (**Figure 16**). Mean monthly attendance peaks in March, a probable consequence of winter tourism and the fact that the park does not allow swimming.

Detailed assessments of human attendance and the economic impact of tourism at Homosassa State Wildlife Park have been conducted by Bonn and Bell (2003). The study was commissioned by FDEP/FPS and included Ichetucknee, Wakulla, and Volusia Blue Springs state parks as well. Key findings from the Bonn and Bell (2003) study reveal there were over 200 thousand visitors in 1992 and nearly 266 thousand visitors in 2002, representing a 33% increase over that 11 year period. Park attendance is seasonal with a peak from February through April, coinciding with the winter tourist season for Florida. The economic impact of visitors to Homosassa Springs totaled and estimated $13.6 million in 2002; despite spending per visitor party and per person day at relatively low rates for this park (**Table 5**).

Minimum Flow and Levels

Minimum Flow and Levels (MFLs) for Homosassa Springs (and the Homosassa River) are being developed by the Southwest Florida Water Management District (SWFWMD). The draft MFL is scheduled to be completed in 2009.



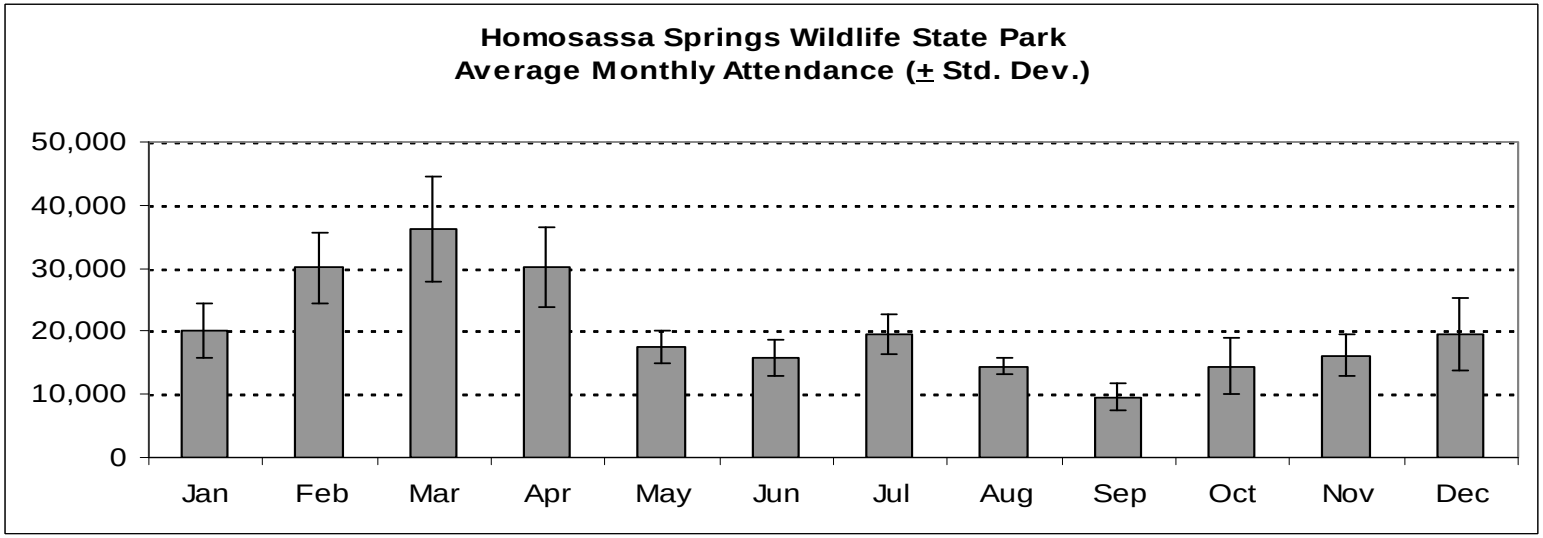


FIGURE 16
Annual and monthly park attendance statistics for Homosassa Springs (FDEP data).

TABLE 5
Summary of the direct economic impact of Ichetucknee; Wakulla; Homosassa and Volusia Blue Spring State Parks on the local economy during 2002 (from Bonn and Bell 2003).

Springs	Ichetucknee	Wakulla	Homosassa	Blue	Average Per Spring
Spending Expenditures (Mil $)	22.7	22.2	13.6	10.0	17.13
Spend Per Party Day ($)	215	409	90	61	193.75
Spend Per Person Day ($)	34	89	25	19	45.50
Spending (Mil $)					
Hotel & Motel	4.1	15.3	5.5	5.6	7.63
Condos	1.5	1.8	0.1	0.9	1.08
Friends/Family	12.3	4.3	4.3	1.2	5.53
Campers	3.2	0.1	2.6	1.5	1.85
Day	1.6	0.7	1.1	0.8	1.05
Spending by Category (Mil $)					
Lodging	1.44	4.01	3.43	5.67	3.64
Restaurants	3.86	3.42	1.87	0.94	2.52
Groceries	1.76	2.11	0.13	0	1.00
Fees	4.34	1.21	4.22	0.69	2.62
Evening Enter	2.31	2.51	2.36	1.26	2.11
Transportation	2.95	1.47	0.32	0.34	1.27
Shopping	3.75	3.56	1.08	0.95	2.34
All other	2.27	3.99	0.11	0.15	1.63
Wages & Salaries (Mil $)	5.09	4.33	3.13	2.38	3.73
Employment	311	347	206	174	259.50
Other Characteristics					
Party Size	6.4	4.6	3.6	3.3	4.48
Length of Stay	2.7	2.1	3.3	2.6	2.68
Attendance	188,845	180,793	265,977	337,356	243,243
Visitors	169,962	126,555	169,962	219,282	171,441
Residents	18,883	54,238	96,015	118,074	71,802
Percent Visitors (%)	90	70	64	65	70.48

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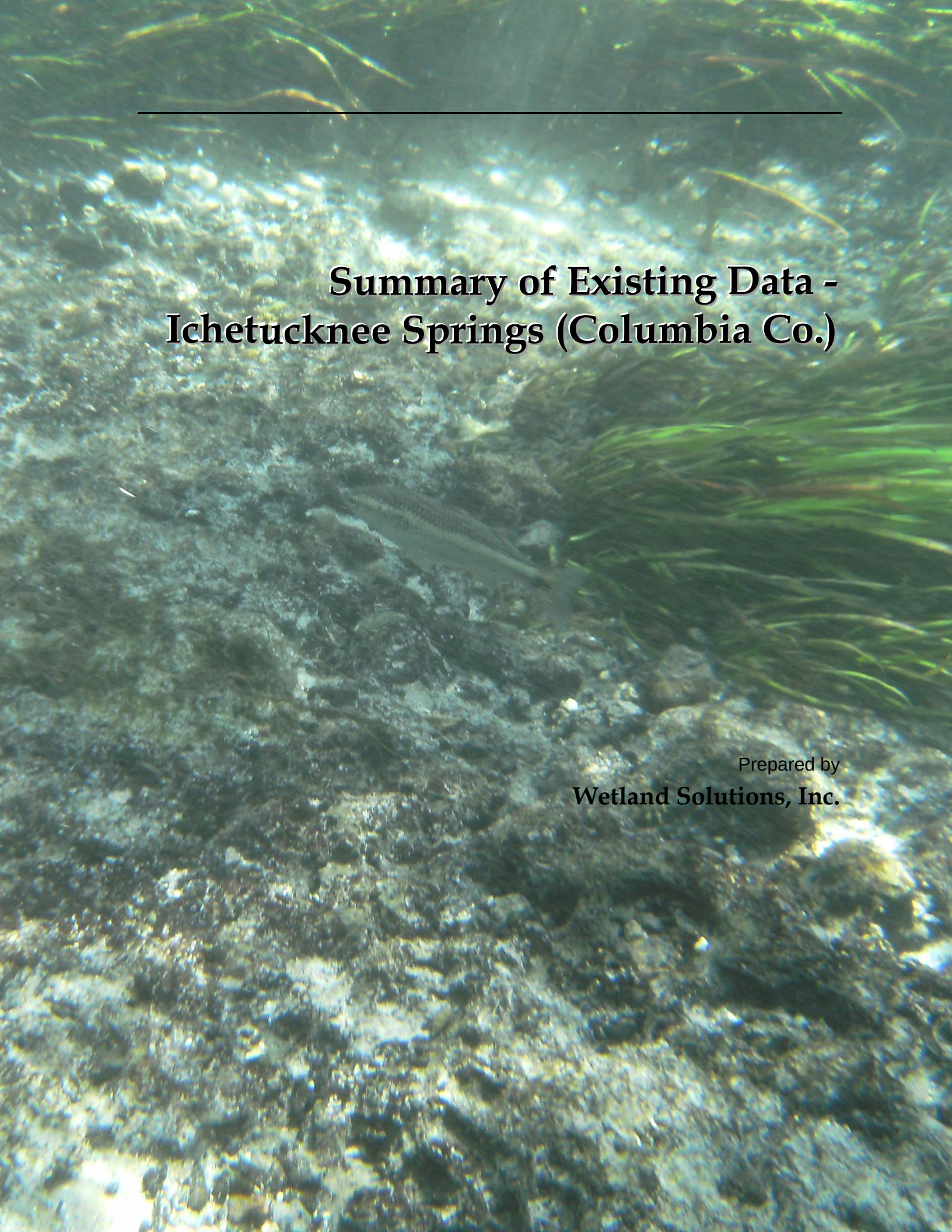
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Appendix Q

Summary of data for Ichetucknee Springs



Summary of Existing Data - Ichetucknee Springs (Columbia Co.)

Prepared by

Wetland Solutions, Inc.

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Cover photo: A mountain mullet (*Agonostomus monticola*) swimming upstream in the Ichetucknee River just downstream of the confluence with Blue Hole Spring (S.K. Notestein, 07/14/09).

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Summary of Existing Springs Data

This section summarizes existing physical, chemical, and biological data for Ichetucknee Springs. These data were collected from sources such as the Suwannee River Water Management District (SRWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Ichetucknee Springs State Park

Physical Address

Ichetucknee Springs State Park (ISSP); 12087 S.W. US Hwy 27; Fort White, Florida 32038; Phone: 386-497-4690; latitude/longitude: 29.985994°, -82.760140°; park website: http://www.floridastateparks.org/ichetuckneesprings/default.cfm .

Driving Directions

To reach the main (south) park entrance, take US 27 north to Ft. White and stay on US 27 north approximately 6.4 km (4 mi) to the South Park Entrance (**Figure 1**). The park has a north entry point as well, from Ft. White, take US 47 north to CR 238, and go west to the north park entrance (phone: 386-497-1216).

General

This first magnitude spring complex and resulting river have a long history of human usage. Twenty three archeological sites have been identified spanning the entire range of Florida's pre-history, from Paleo-Indian (12,000 BC - 6,500 BC) to the Weeden Island culture (A.D. 200 - A.D. 1000), with the park recorded in the Florida Master Site File as the Ichetucknee River Archaeological Zone (FDEP 2000a). Remains of a mission from the Spanish period have been discovered along the river (see Deagan 1972 and Weisman 1991),

and phosphate mining on the uplands along the Ichetucknee River occurred during the late 1800s.

The park property of about 923 ha (2,280 ac) was acquired by the state in 1970, and the head spring is a designated National Natural Landmark by the U. S. Department of the Interior. The ISSP is administered by the FDEP/FPS for public outdoor recreation, and provides a popular swimming and tubing destination. Waters within the ISSP are designated as Outstanding Florida Waters, are also classified as Class III waters, but the site is not a designated aquatic preserve (FDEP 2000a). The park facilities are well developed and include boardwalks, paths, pavilions, playgrounds, restrooms, and concessions (**Figure 2**). This site is a regionally popular tubing destination; and visitors can also participate in picnicking, snorkeling, canoeing, swimming, hiking, and wildlife viewing.

The Ichetucknee River travels south and then southwest for approximately 9 km (5.5 mi) before joining the Santa Fe River and ultimately the Suwannee River (**Figure 1**). There are no dams or locks downstream of the Ichetucknee River.

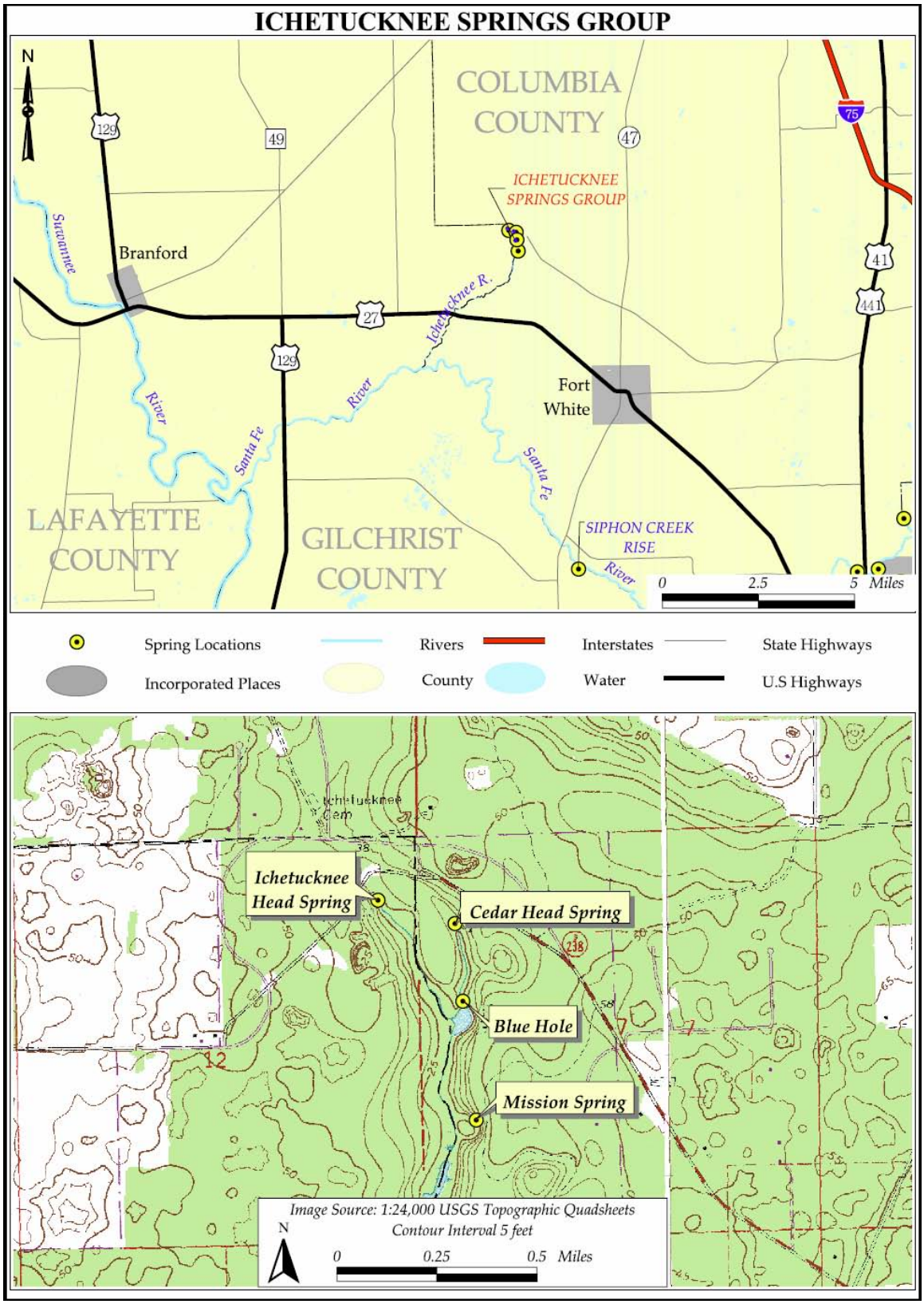


FIGURE 1
Ichetucknee Springs geographic location (from Scott *et al*. 2002).

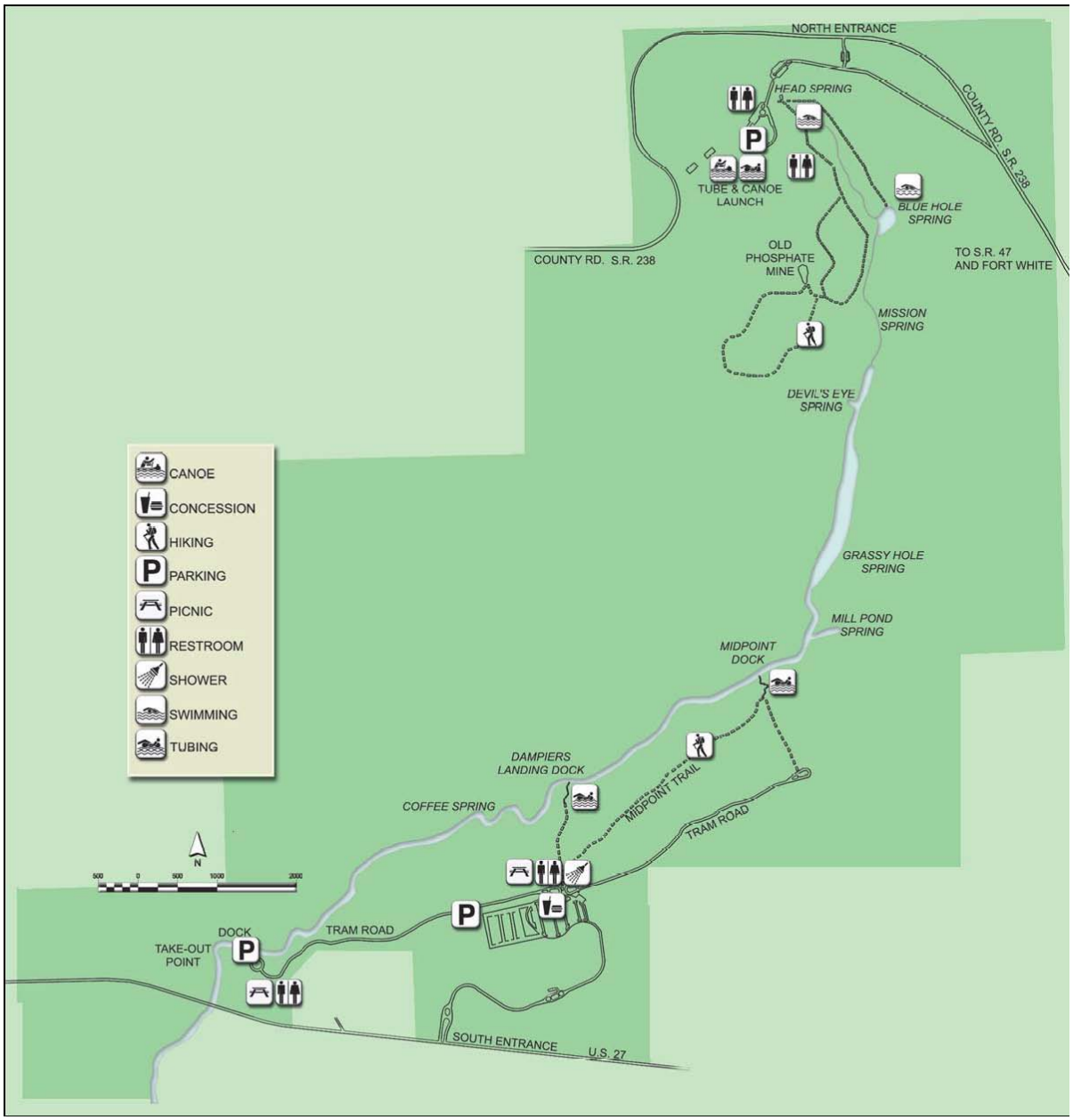


FIGURE 2
Ichetucknee Springs State Park map (from FDEP).

Physical

There are nine named springs and several other smaller, unnamed springs which collectively form the Ichetucknee Springs System (ISS) (**Figure 3**). The named springs from headspring going downstream are: Ichetucknee (headspring), Cedar Head, Blue Hole, Mission Group (Roaring and Singing), Devil's Eye, Grassy Hole, Mill Pond, and Coffee. Of these named springs, Blue Hole has the largest discharge. The unnamed springs along the river are estimated to contribute about 19 percent of the total river flow (Skiles *et al.* 1991).

The headspring forms a pool approximately 22.9 m (75 ft) by 32 m (105 ft), with depths to about 9.1 m (30 ft) (**Figure 4**). Restoration of this spring vent (completed in 1999) resulted in the removal of 35.2 m^3 (46 cubic yards of concrete, rubble, and scrap metals debris and 30.6 m^3 40 cubic yards of sand, gravel, and other sediments (FDEP 2000a). Cedar Head Spring is located approximately 304.8 m (1,000 ft) southeast of the headspring, with two vents that form a pool approximately 9.1 m (30 ft) wide and 1.5 m (5 ft) deep, and discharges to the south through a 106.7 m (350 ft) run that connects into the pool of Blue Hole Spring (FDEP 2000a). Blue Hole Spring (also known as Jug Spring) has a pool about 25.9 m (85 ft) by 38.1 m (125 ft) in size, a vent that opens at a depth of about 2.1 m (7 ft) and continues down to about 9.8 m (32 ft), where it extends horizontally into a cave system. The Blue Spring run is about 61 m (200 ft) and joins the Ichetucknee River on the east side about 549 m (1,800 ft) downstream of the Headspring (FDEP 2000a). Mission Springs Group includes eight vents with a maximum depth of 1.5 m (5 ft) that are located about 457 m (1,500 ft) downstream of Blue Hole Spring on the east side of the river. The two named springs in this group, Roaring and Singing, are located along the base of limestone outcroppings to the east of the river. The resulting spring runs are about 61 m (200 ft) and 30.5 m (100 ft) in

length. The other spring vent included in this group is located slightly to the south and discharges directly to the bottom of the river (FDEP 2000a).

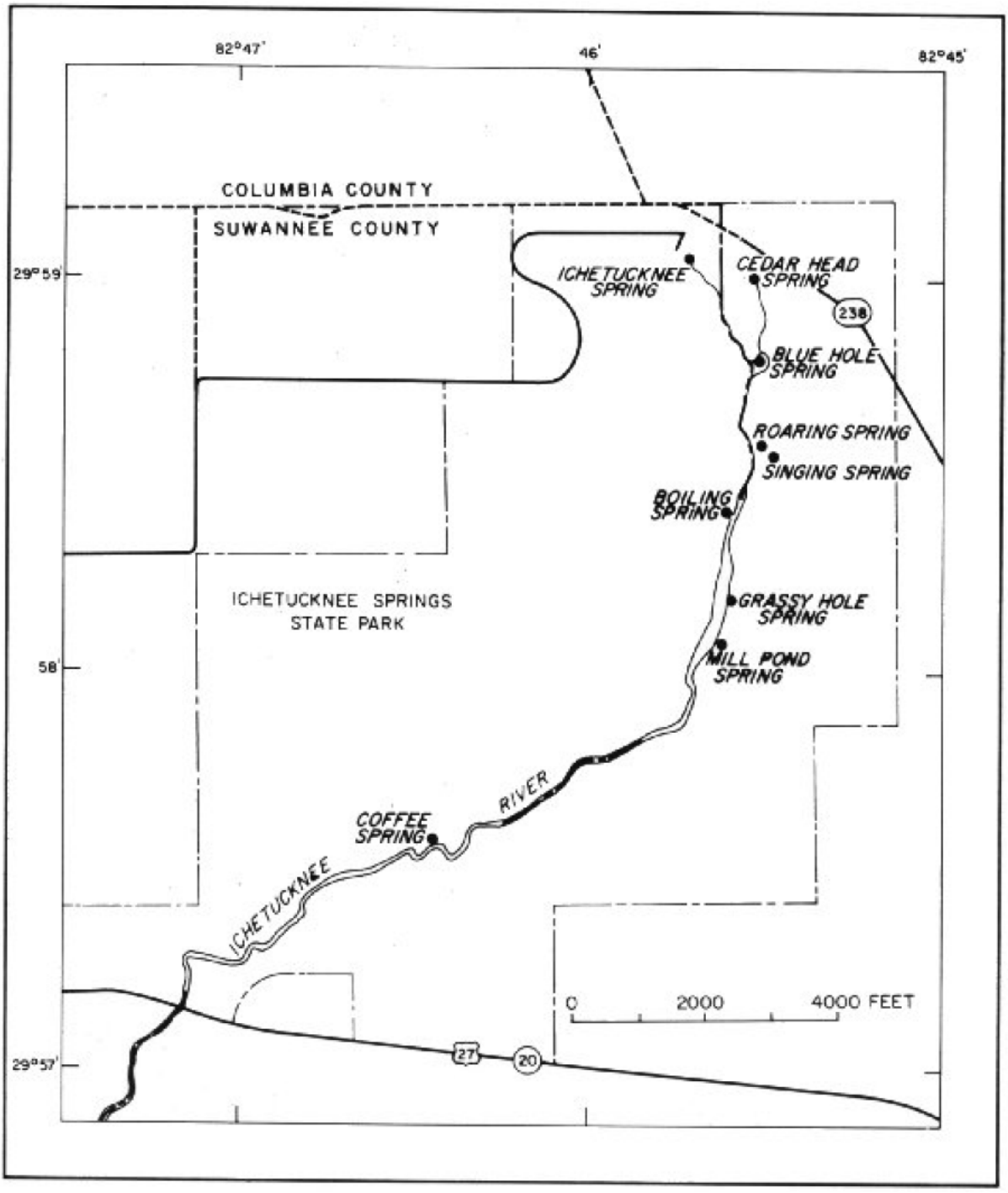


FIGURE 3
Map of the Ichetucknee Springs System (from Rosenau *et al.* 1977).



FIGURE 4
Picture of the Ichetucknee Headspring (by T. Scott from Scott *et al.* 2002).

Devil's Eye Spring (also known as Boiling Spring), is located about 259 m (850 ft) south of the Mission Springs Group on the west side of the river. The spring pool is about 18.3 m (60 ft) by 36.6 m (120 ft), has depths to about 3 m (10 ft), and forms a run which travels about 12.2 m (40 ft) to the river. Grassy Hole Spring is located 411 m (1,350 ft) downstream from Devil's Eye Spring on the east side of the river. The pool is about 3.7 m (12 ft) wide and 0.6 m (2 ft) deep with two vents which flow about 49 m (160 ft) into the wide rice marsh area of the river (FDEP 2000a). About 244 m (800 ft) downstream from Grassy Hole on the east side of the river; Mill Pond Spring forms a shallow pool about 15.2 m (50 ft) by 30.5 m (100 ft) in size, with a maximum depth of 1.5 m (5 ft). There are three boils present (the pool was modified in the 1800's to funnel water to power a mill) and the resulting run flows

southwest about 137 m (450 ft) to the river. Coffee Spring (the last named spring) is located about 1.6 km (1 mi) downstream from Mill Pond Spring about 9 m (30 ft) west the river at the base of a limestone outcrop, where it discharges over a rock ledge into the river (FDEP 2000a).

The Ichetucknee River is in total about 8.9 km (5.5 mi) long at which point it joins the Santa Fe River, which joins the Suwannee River and ultimately goes to tide. The run travels through park property for about 5.1 km (3.2 mi) during which it travels through undeveloped riparian lands. The Ichetucknee River has widths of about 6.1 m (20 ft) above Blue Spring, and then widens to about 18.3 m (60 ft) for most of its length, except for a half mile section below Devils Spring known as the rice marsh, where widths approach several hundred feet. Based on the spatial mapping analyses for the river by Kurz *et al.* (2004), the vast majority of the river is less than 2 m deep. Just over 50% of the river area (75,000 m^2) is less than 1 m (3.3 ft) deep, with a slightly smaller area (62,000 m^2) between 1 m (3.3 ft) and 2 m (6.6 ft) deep. The 2 to 3 meter interval is small (5,000 m^2, less then 5%) and occurs in the area known as the rice marsh and the lower reaches.

Within the Ichetucknee Springs State Park (ISSP) elevations range from less than 6.1 m (20 ft) mean sea level (MSL) along the floodplain to over 18.3 m (60 ft) MSL in the southeastern corner (FDEP 2000a). Manmade alterations to the landscape of the ISSP include roads, tramways, and multiple phosphate pits and settling ponds. The phosphate mining operations at ISSP occurred in two phases: the phosphate boom era of the late 1800s and early 1900s and again during the 1950s when old pits were revisited to reclaim colloidal phosphate residues, during which time the settling ponds were constructed (Doig 1992).

Physiography

The Ichetucknee River is in the physiographic region called the Gulf Coastal Lowlands, a region characterized by karst topography and elevations less than 30.5 m (100 ft) above MSL. Most of the springshed is found in the Northern Highlands physiographic province north of the ISS (**Figure 5**). The Ichetucknee Trace occurs north of the ISS in the southern portion of the Northern Highlands physiographic region and terminates at a topographic break known as the Cody Escarpment, which separates the Northern Highlands and the Gulf Coastal Lowlands regions (Puri and Vernon 1964).

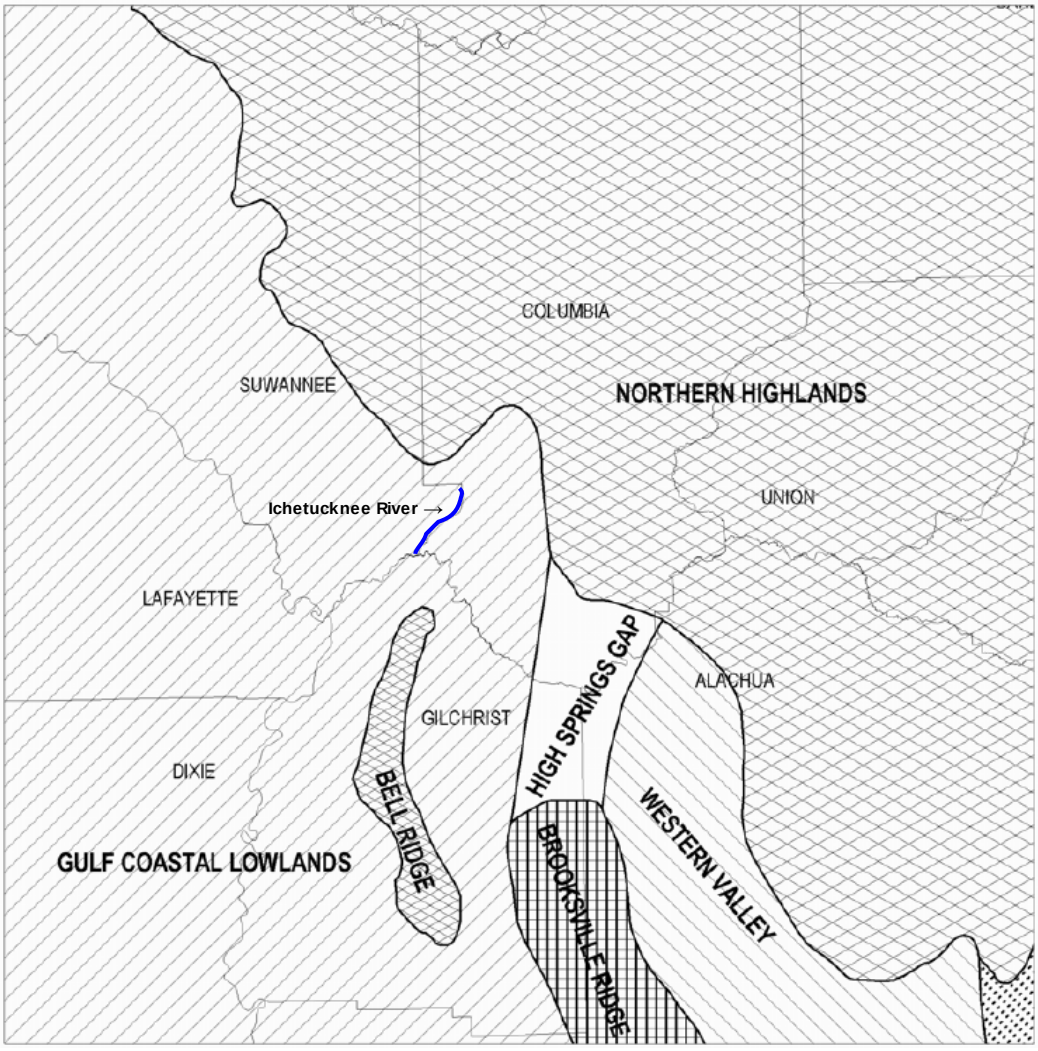


FIGURE 5
Physiographic regions surrounding Ichetucknee Springs (from Butt and Murphy 2003).

The Northern Highlands are distinguished by a thick layer of unconsolidated sediments which overly the limestone bedrock. Overlying sediments are made up of undifferentiated sediments and the Hawthorn Group which in conjunction with the karst, leads to a well defined system of streams and sinks (Butt and Murphy 2003).

The Gulf Coastal Lowlands are highly favorable to sinkhole formation and stream capture, and as such, contain multiple sink, creek, and spring features including: Black Sink, Lime Sink, Dyal Sink, Clay Hole Creek, Cannon Creek, Cannon Sink, Rose Creek, the Rose Creek Cave System, and the Ichetucknee Spring System (Butt and Murphy 2003). The Gulf Coastal Lowlands are characterized by a limestone terrain with a relatively thin layer of surficial sands and clays, resulting in the exposure of limestone in many places (strikingly at the Ichetucknee Headspring, Mission Springs, and multiple locations along the river). Examinations of aerial photography of this area reveal multiple collapsed sinkholes that are connected by surficial drainage features. It appears that the trace of the Ichetucknee River follows a relict stream bed that had Rose and Clay Hole Creeks as its headwaters; however, intervening sinkhole formation is intercepting and redirecting the streamflow to the river to groundwater (Butt and Murphy 2003).

Geology

The ISSP geology is dominated by the Ocala Platform, a broad structure which trends northwest to southeast. Sediments younger than the Eocene-aged Ocala Group Limestones, the Suwannee Limestone and the Hawthorn Formation, were removed during the Miocene period through erosion processes and subsequent deposition has resulted in a thin veneer of undifferentiated sediments. As a result, the underlying Floridan aquifer is unconfined and

in combined with fractures formed during Ocala Platform formation, direct flow paths for groundwater and surface water infiltration are common (Butt and Murphy 2003).

Hydrogeology

The topographic features define the hydrology of both the Northern Highlands and the Gulf Coastal Lowlands regions. Found within the Northern Highlands are well-organized streams and scattered sinkholes. Within the Gulf Coastal Lowlands stream patterns are disorganized, and all drainage is internal to the karst features. The ISS is entirely underlain by the Floridan aquifer, which is unconfined and lacking a surficial or intermediate aquifer due to the thin layer of undifferentiated sediments over the Eocene Ocala Limestone Group.

Karst Environmental Services, Inc. (KES) conducted qualitative dye trace studies of sinkholes located within Clay Hole Creek Trace from May through September 2003 (Butt and Murphy 2003). The Clay Hole Creek Trace is a relic stream valley located southwest of Lake City, Florida in Columbia County and approximately 9 miles northeast of Ichetucknee Springs. Dye tracers were released into Dyal and Black Sinks on the first day of the study, and waters in local wells, the down gradient subterranean Rose Creek Cave System, and in the Ichetucknee Springs Group were sampled for the next four months. The dye tracers from both release sites were eventually recovered in the Rose Creek Cave System within 26 to 34 days of initial release and by Day 65 at three of the Ichetucknee Springs: Mission Spring, Blue Hole Spring, and Devil's Eye Spring. No dye was detected at the Ichetucknee Head Spring, Cedar Head Spring, Mill Pond Spring, and Grassy Hole Spring. This study concluded that there is a direct hydraulic connection between sinkholes southwest of Lake City and a portion of the Ichetucknee System. Of additional interest in this study and a previous dye tracer study (KES unpublished) was the absence of an observed connection

between the Lake City sinkholes and the Ichetucknee Head Spring. This may indicate that there may be differing springsheds responsible for providing water to the various springs in the Ichetucknee System.

Springshed

The Ichetucknee springshed is located north, northeast, and east of ISSP and largely follows the geographic boundaries of the lower two-thirds of Columbia County (with Lake City at its center), with small portions overlapping Suwannee, Baker, and Union Counties. The springshed size has been variously estimated at 1,606 km^2 (620 mi^2) by Hunn and Slack (1983) and at about 1,036 km^2 (400 mi^2) by Sepũlveda *et al*. (2006). The latter estimate was based on 94 ground water-level measurements of the potentiometric surface of the Upper Floridan aquifer made on September 9-10, 2003 by Suwannee River Water Management District (SRWMD) personnel. The findings by Sepũlveda *et al*. (2006) were utilized to produce a springshed map (**Figure 6**) by the SRWMD (2008). The pieziometric surface of the Ichetucknee Springs Basin in September 2003 ranged from about 17.7 m (58 ft) MSL at the northeast corner of the basin to about 4.9 m (16 ft) MSL at the point where the Ichetucknee River crosses under US 27. The Ichetucknee falls within the USGS defined Santa Fe River Hydrologic Unit of the larger Suwannee River basin (Seaber *et al*. 1987).

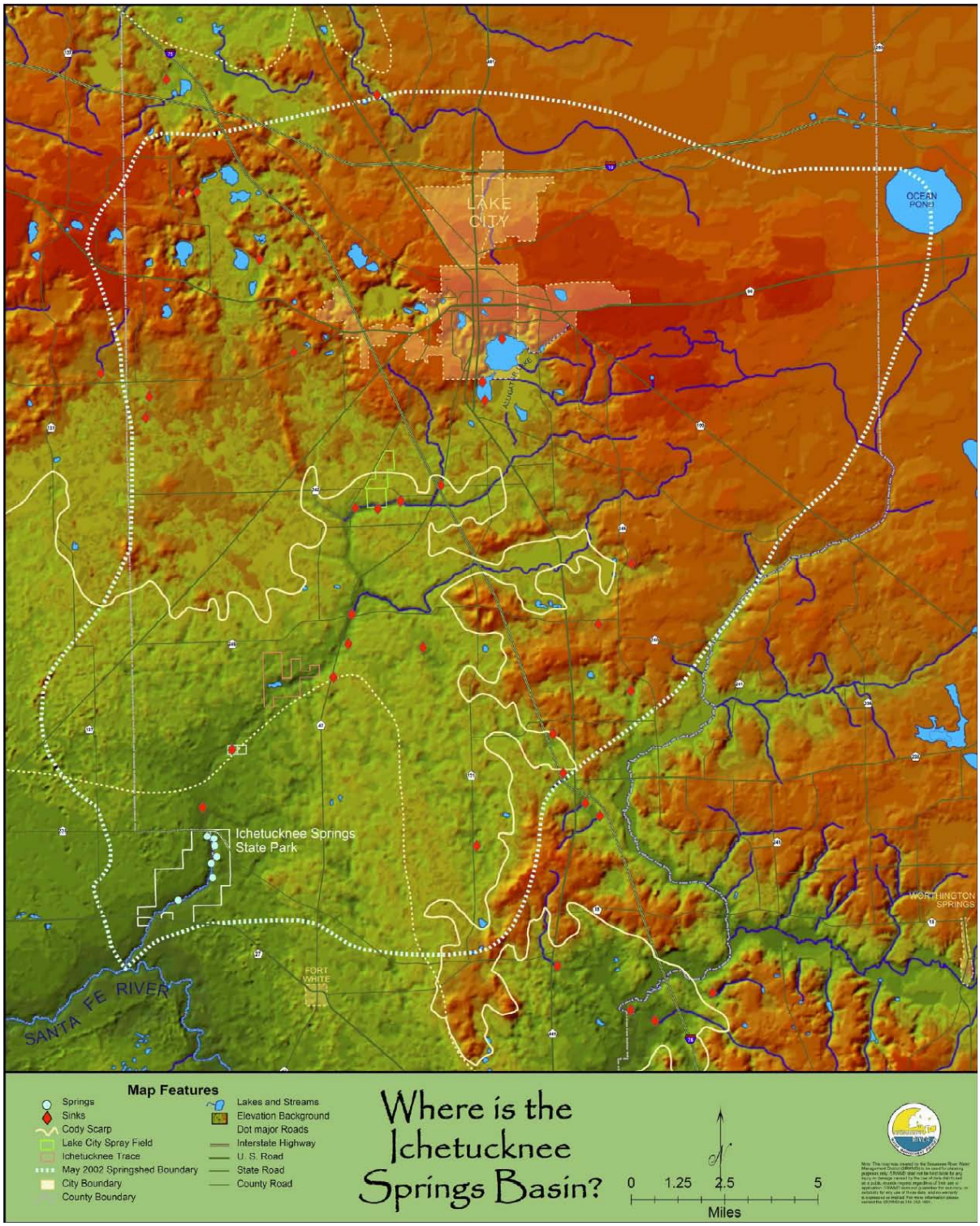


FIGURE 6
Map of the Ichetucknee Springs System springshed, showing the potentiometric surface of the upper Floridan Aquifer during September 2003 (from SRWMD).

Springshed Land Use

In the mid-1990s, land uses in the Ichetucknee Springs Basin were predominantly agricultural (47%), forest (34%), urban (9%), and wetland (7%, **Figure 7**). Although more recent land use data were not available for this review, it is assumed that during the past decade, land uses in the springshed have continued converting from agriculture and forestry to urban. Sources within the Ichetucknee springshed that have the ability to reduce downstream water quality include Lake City wastewater sprayfields, various agricultural operations, and numerous sinks and creeks which receive untreated stormwater run-off.

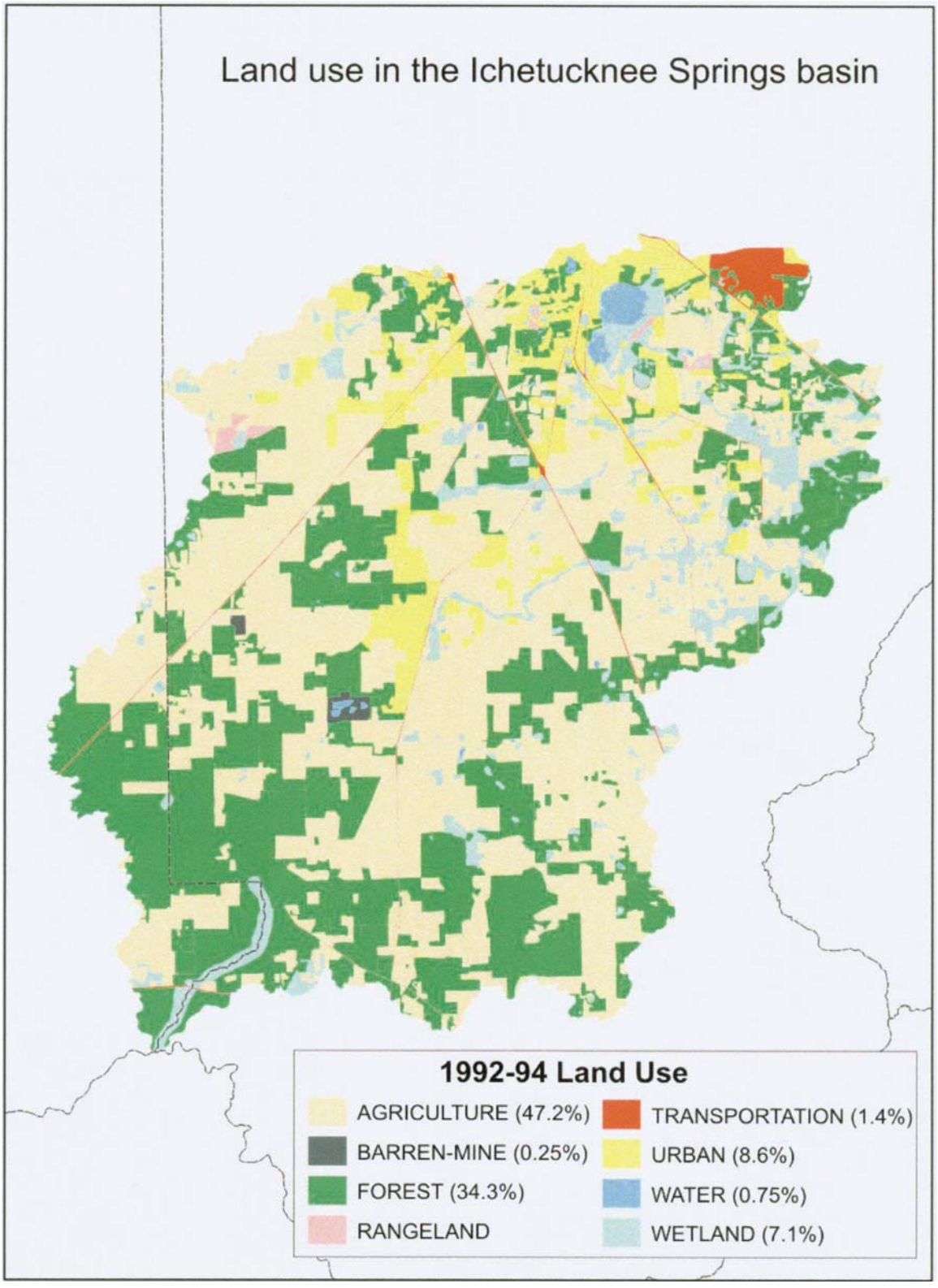


FIGURE 7
Map of land use within the Ichetucknee springshed (from Brian Katz, USGS 2005).

Study Area

The project study area for Ichetucknee Springs System focused on the upper 3.2 miles (5.1 km) of the Ichetucknee River. Study segments are defined by the sonde locations and resulted in: an upper segment (below the confluence of Blue Spring to the mid-point tube launch) and a lower segment (mid-point tube launch to the US 2 take out). **Figure 8** shows an approximation of the study area and data sonde locations are indicated by red icons.

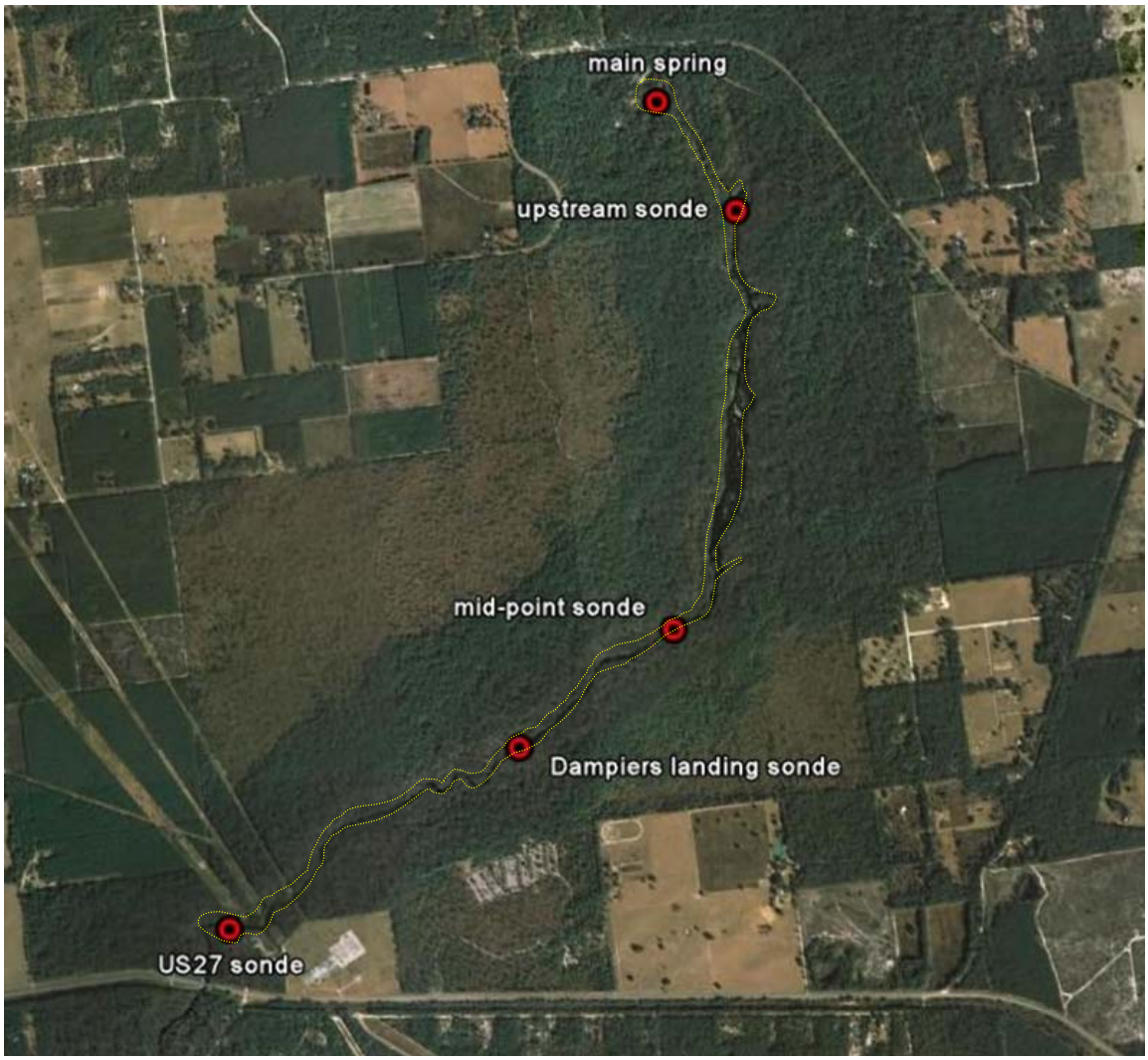


FIGURE 8
The study area for the Ichetucknee Springs System (with data sonde locations as red icons).

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of the Ichetucknee Springs System are given in **Table 1** below.

TABLE 1
Source information for the Ichetucknee Springs System historical water quality data described in this report.

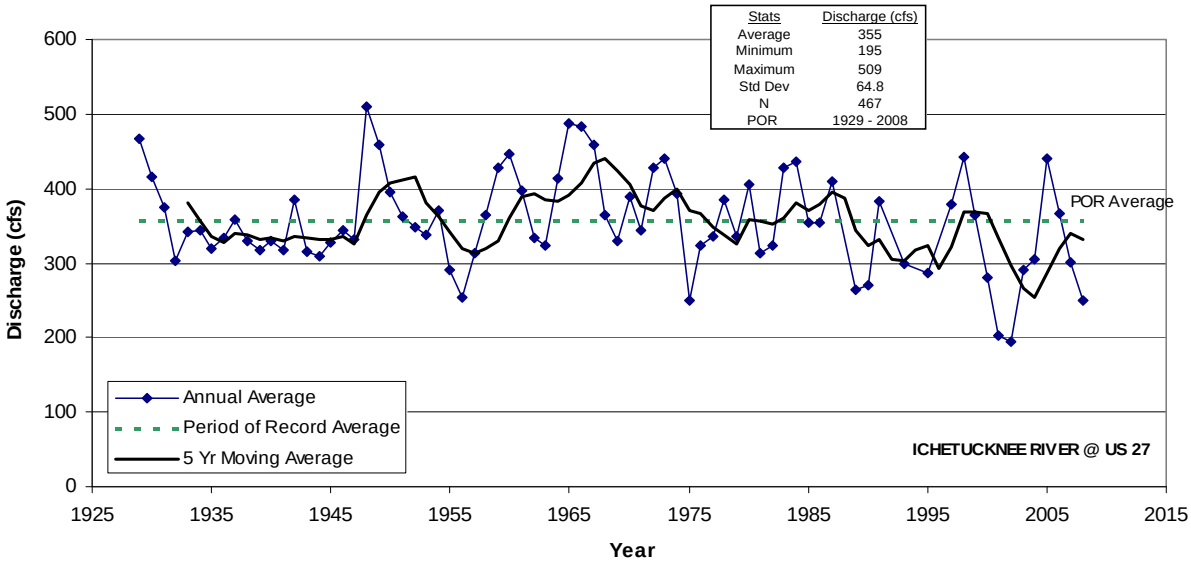
Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
21FLSUW	FLASTORET	ICH010C1	Ichetucknee River .2 Mi North Of Bridge	29.95444	-82.78417
USGS	USGS	2322700	Ichetucknee R @ Hwy27 Nr Hildreth, Fl	29.95250	-82.78611
21FLA	FDEP	21030050	Ichetucknee R At Us Hwy 27	29.95345	-82.78568
21FLGW	FDEP	10787	Coffee Springs	29.95917	-82.77528
21FLSUW	FLASTORET	ICH008C1	Coffee Springs	29.95917	-82.77556
21FLA	FDEP	21030104	Coffee Spring In Ichetucknee Spgs State Pk	29.95931	-82.77541
21FLA	FDEP	21030123	Ichetucknee River At Dampiers Landing	29.96050	-82.77100
21FLGW	FDEP	10786	Mill Pond Spring	29.96639	-82.76000
21FLSUW	FLASTORET	ICH005C1	Mill Pond Spring Vent	29.96639	-82.76000
21FLA	FDEP	21030103	Mill Pond Spring In Ichetucknee Spgs State Pk	29.96641	-82.76017
21FLKWAT	FLASTORET	COL-IC-RIVER-1	Columbia-Ichetucknee River-1-1	29.95253	-82.78617
21FLA	FDEP	21030081	Devils Eye Spring In Ichetucknee Spgs State Pk	29.97322	-82.76006
21FLGW	FDEP	10788	Devils Eye Spring	29.97333	-82.76028
21FLSUW	FLASTORET	ICH004C1	Devils Eye Spring Vent	29.97333	-82.76028
21FLA	FDEP	21030080	Mission Spring In Ichetucknee Spgs State Pk	29.97611	-82.75778
21FLSUW	FLASTORET	ICH003C1	Mission Spring Vent	29.97611	-82.75778
21FLGW	FDEP	9714	Mission Spring	29.97621	-82.75788
21FLGW	FDEP	10443	SRB-LS-1023 Unknown	29.97716	-82.75926
21FLGW	FDEP	10784	Grassy Hole Spring	29.96778	-82.75972
21FLGW	FDEP	10448	SRB-LS-1071 Unnamed Stream	29.97894	-82.75916
21FLA	FDEP	21030079	Ichetucknee R ~ 100M South Cedar Head Run	29.97922	-82.75888
21FLSUW	FLASTORET	ICH002C1	Blue Hole Spring Vent	29.98028	-82.75861
21FLSUW	FLASTORET	COL1105041	Blue Hole	29.98052	-82.75802
21FLGW	FDEP	9743	Blue Hole Spring Vent	29.98053	-82.75844
21FLSUW	FLASTORET	ICH007C1	Grassy Hole	29.96806	-82.75972
21FLA	FDEP	21030051	Grassy Hole Spring Ichetucknee	29.96825	-82.75980
21FLA	FDEP	21030064	Cedar Head Run - Ichetucknee	29.98116	-82.75973
21FLWQSP	FLASTORET	CLB188GS	Cedar Head Run In Itchitucknee State Park (WBID 3519X)	29.98126	-82.75846
21FLGW	FDEP	9742	Cedar Head Spring	29.98328	-82.75869
21FLA	FDEP	21030132	Blue Hole @ Ichetucknee State Park	29.98355	-82.75869
21FLSUW	FLASTORET	ICH001C1	Ichetucknee Head Spring	29.98389	-82.76194
USGS	USGS	2322685	Ichetucknee Head Spring Nr Hildreth, Fl	29.98389	-82.76194
21FLA	FDEP	21030131	Ichetucknee Head Spring	29.98414	-82.76184
21FLGW	FDEP	9713	Ichetucknee Spring Main	29.98419	-82.76187
USGS	USGS	2322698	Ichetucknee Dampier's Landing	29.96028	-82.77222

Discharge and Stage

Historical instantaneous discharge measures from the bridge at US 27 are reported by Rosenau *et al.* (1977). Spanning the time period of 1917 to 1975, these measures ranged from a minimum of 241 cfs (January 28, 1956) to a maximum of 578 cfs (April 29, 1948); with an average discharge of 361 cfs (1917-1975) (**Figure 9**). Other measures of discharge include a value of 186 cfs (October 3, 2001) by Scott *et al.* 2002.

Discharge and stage have been intensively measured at multiple locations (most named springs, Dampier's landing, and US 27) of the Ichetucknee Springs System beginning in February 2002 through USGS, SRWMD, and FDEP cooperative action. An example of relative differences in discharge between springs is shown in a time-series graph of discharge between 2002 and 2004 (**Figure 9**). Expanding upon the USGS discharge data, a discharge time series from 2002 through 2009 illustrates the variability of discharge in this spring system (**Figure 10**). Over this period-of-record, median discharge at US 27 was 291 cfs, annual mean discharge was 323 cfs, minimum daily mean was 124 cfs, and maximum peak discharge was 563 cfs.

Corresponding stage measures have been collected by USGS from February 2002 to the present. During this time period, gage height at the headspring ranged from 0.5 to 5.1 feet, with a median value of 1.5 feet. At the US 27 station, gage height ranged from a low of 14.5 feet to a high of 26.7 feet (April 17, 2005), with a median values 15.1 feet (NGVD 1929). Period-of-record stage data are shown in **Figure 11** for the Headspring, Dampier's landing, and US 27 stations. Detailed descriptive statistics of the discharge and stage data for the Ichetucknee, Cedar Head, Blue Hole, Mission, Mill Pond, Dampier's landing, and US 27 are presented in **Table 2**.



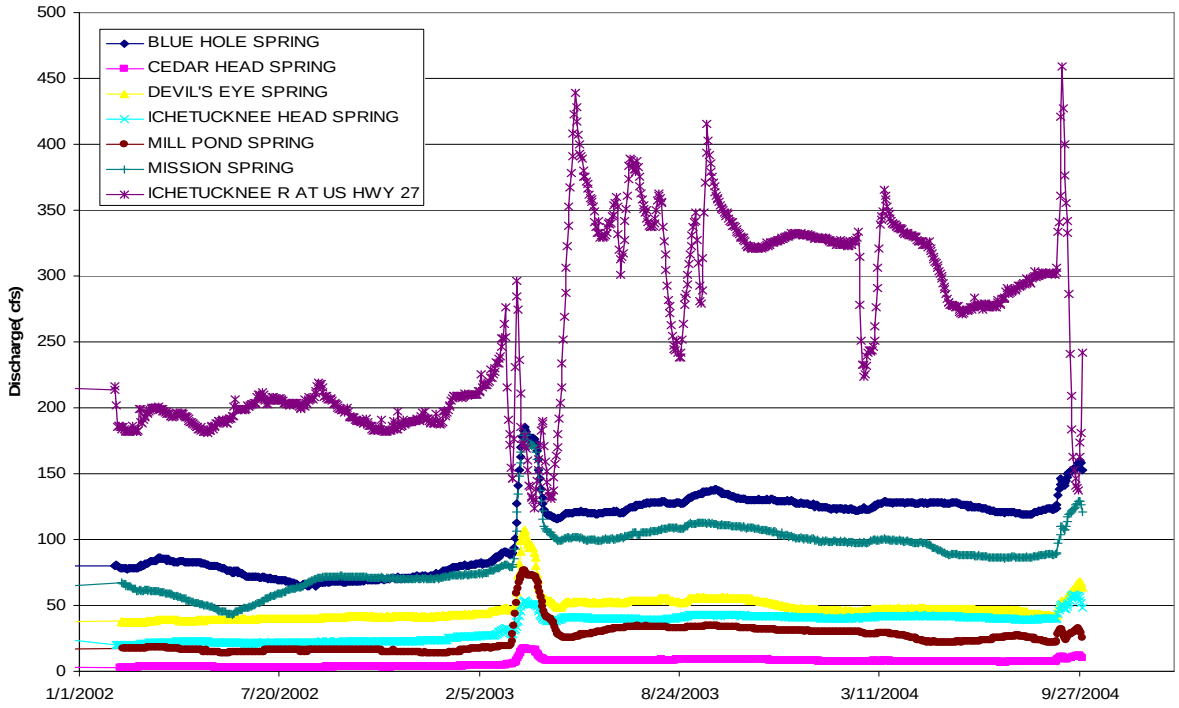
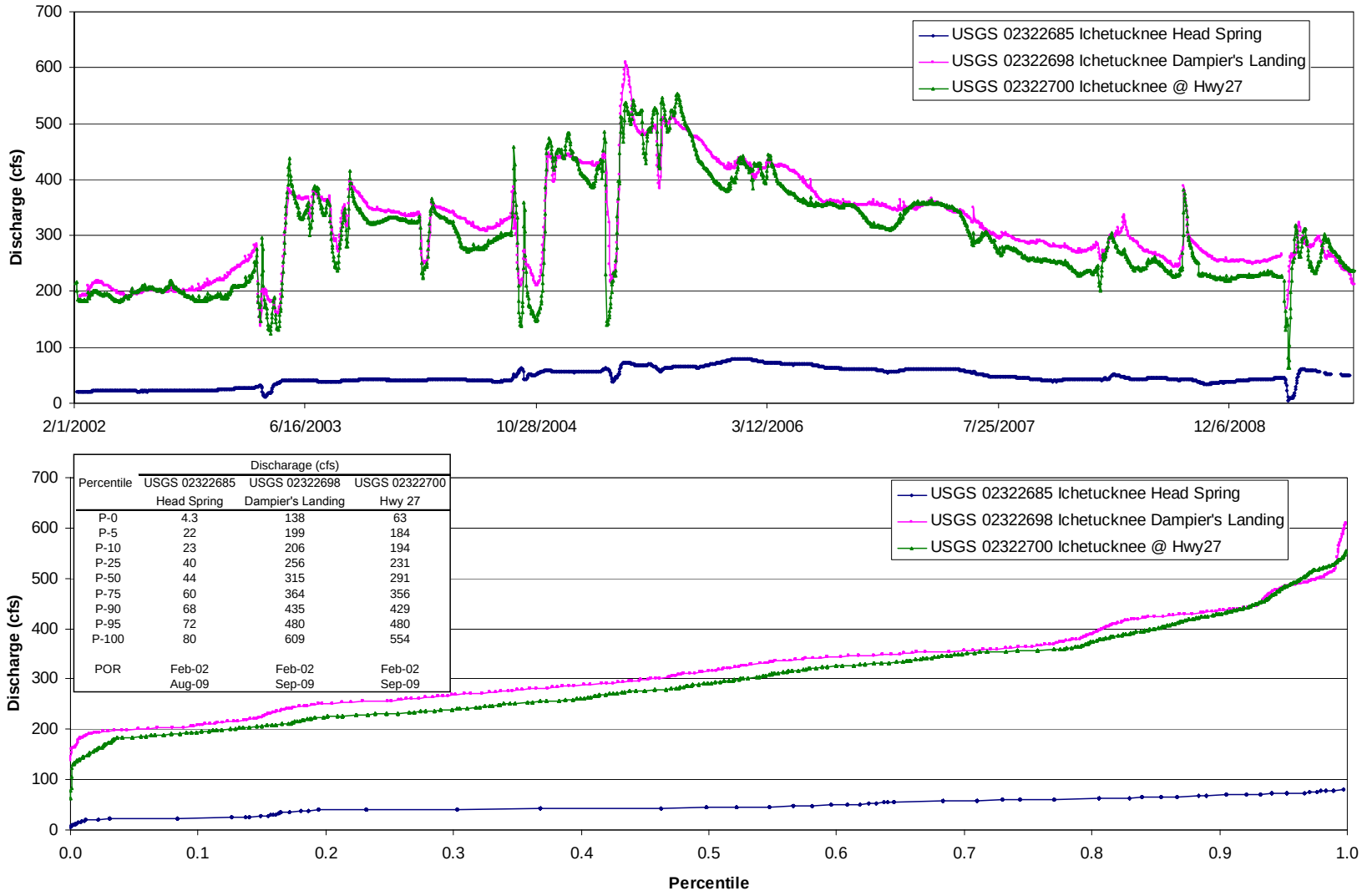
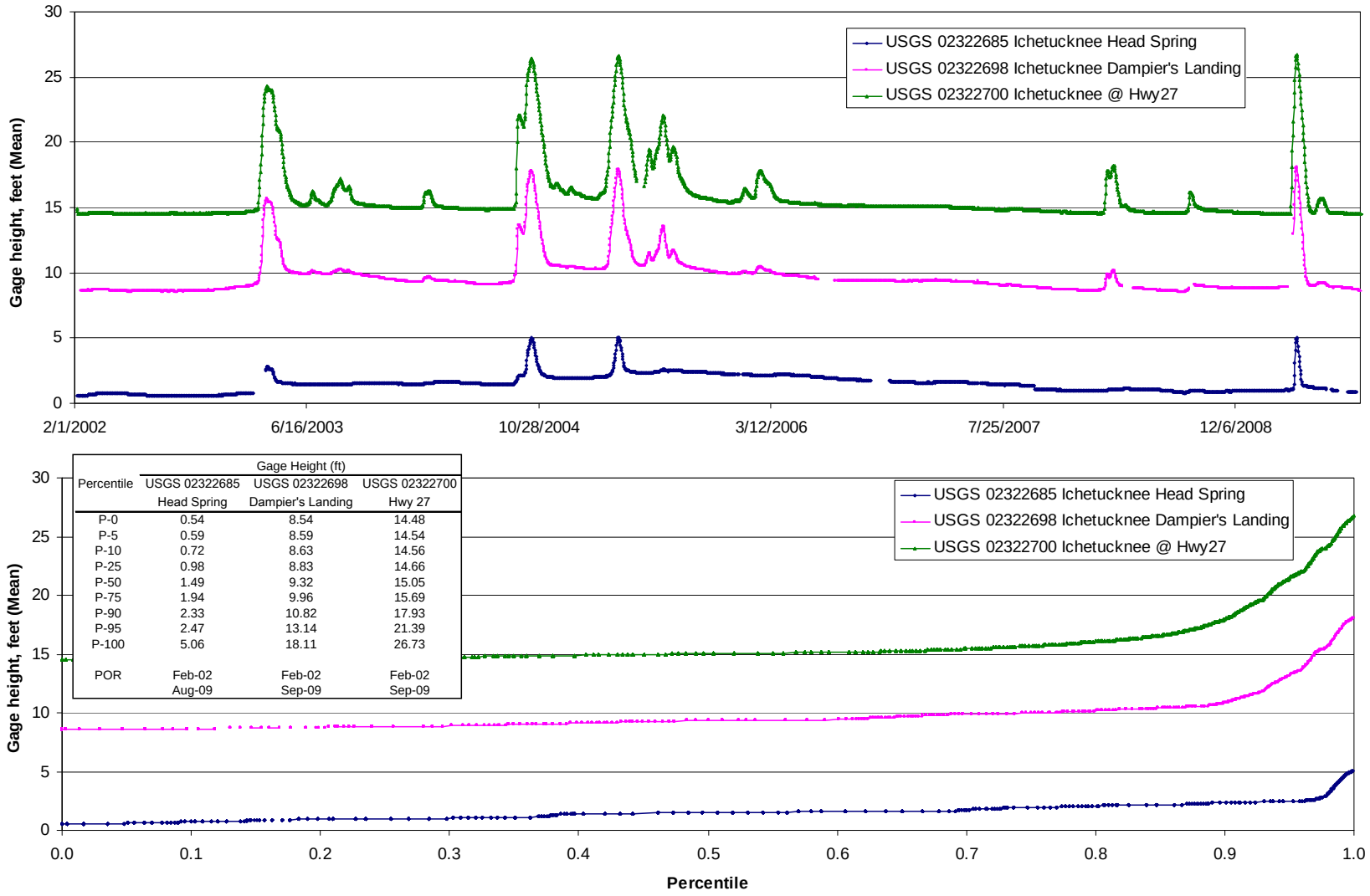


FIGURE 9
Annual average discharge period-of-record time series for US 27 station (top), and recent detailed discharge time series for key springs (bottom) of the Ichetucknee Springs System (USGS 2009).



Percentile	Discharge (cfs) USGS 02322685 Head Spring	USGS 02322698 Dampier's Landing	USGS 02322700 Hwy 27
P-0	4.3	138	63
P-5	22	199	184
P-10	23	206	194
P-25	40	256	231
P-50	44	315	291
P-75	60	364	356
P-90	68	435	429
P-95	72	480	480
P-100	80	609	554
POR	Feb-02 Aug-09	Feb-02 Sep-09	Feb-02 Sep-09

FIGURE 10
Daily average discharge time series and frequency curve for the Ichetucknee River (USGS 2009).



Percentile	Gage Height (ft) USGS 02322685 Head Spring	USGS 02322698 Dampier's Landing	USGS 02322700 Hwy 27
P-0	0.54	8.54	14.48
P-5	0.59	8.59	14.54
P-10	0.72	8.63	14.56
P-25	0.98	8.83	14.66
P-50	1.49	9.32	15.05
P-75	1.94	9.96	15.69
P-90	2.33	10.82	17.93
P-95	2.47	13.14	21.39
P-100	5.06	18.11	26.73
POR	Feb-02 Aug-09	Feb-02 Sep-09	Feb-02 Sep-09

FIGURE 11
Daily average gage height time series and frequency curve for the Ichetucknee River (USGS 2009).

TABLE 2
Summary statistics for the discharge (cfs) and stage (ft) of the Ichetucknee Springs System (USGS 2009).

02322685 ICHETUCKNEE HEAD SPRING NEAR HILDRETH, FL—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 2002 - 2008	
Annual total	18,755		15,831			
Annual mean	51.4		43.3		50.3	
Highest annual mean					69.8	2006
Lowest annual mean					31.4	2003
Highest daily mean	62	Mar 22	51	Mar 30	80	Jan 9, 2006
Lowest daily mean	39	Nov 19	38	Sep 30	12	Mar 20, 2003
Annual seven-day minimum	40	Nov 14	39	Sep 24	13	Mar 18, 2003
Maximum peak flow			51	Mar 29	80	Jan 9, 2006
Maximum peak stage			1.13	Oct 2	5.08	Apr 17, 2005
Instantaneous low flow			38	Sep 29	12	Mar 19, 2003
Annual runoff (ac-ft)	37,200		31,400		36,440	
10 percent exceeds	61		46		69	
50 percent exceeds	49		43		47	
90 percent exceeds	41		40		39	

02322687 CEDAR HEAD SPRING NEAR HILDRETH, FL—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 2002 - 2008	
Annual total	2,126.7		1,777.2			
Annual mean	5.83		4.86		7.76	
Highest annual mean					10.6	2006
Lowest annual mean					4.86	2008
Highest daily mean	7.3	May 22	6.3	Sep 10	15	Sep 21, 2005
Lowest daily mean	4.4	Nov 13	3.3	Aug 11	2.7	Jul 19, 2002
Annual seven-day minimum	4.4	Nov 13	3.4	Aug 13	2.8	Jul 14, 2002
Maximum peak flow			7.1	Aug 29	15	Sep 20, 2005
Maximum peak stage			9.37	Aug 29	12.90	Apr 17, 2005
Instantaneous low flow			3.2	Aug 17	2.7	Jul 18, 2002
Annual runoff (ac-ft)	4,220		3,530		5,620	
10 percent exceeds	6.9		5.4		12	
50 percent exceeds	5.8		4.9		7.5	
90 percent exceeds	4.8		3.9		4.5	

02322688 BLUE HOLE SPRING NEAR HILDRETH, FL—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 2002 - 2008	
Annual total	39,430		36,707			
Annual mean	108		100		134	
Highest annual mean					197	2005
Lowest annual mean					99.6	2003
Highest daily mean	117	Jan 13	119	Apr 7	294	May 3, 2005
Lowest daily mean	99	Oct 9	91	Mar 5	61	Mar 21, 2003
Annual seven-day minimum	99	Dec 22	91	Jun 21	62	Mar 18, 2003
Maximum peak flow			122	Aug 29	296	May 3, 2005
Maximum peak stage			2.11	Aug 29	6.40	Apr 17, 2005
Instantaneous low flow			90	Jun 9	58	Mar 21, 2003
Annual runoff (ac-ft)	78,210		72,810		96,800	
10 percent exceeds	114		109		193	
50 percent exceeds	109		99		124	
90 percent exceeds	100		93		93	

02322691 MISSION SPRINGS COMPLEX NEAR HILDRETH, FL—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 2002 - 2008	
Annual total	31,711		31,680			
Annual mean	86.9		86.6		95.1	
Highest annual mean					117	2005
Lowest annual mean					84.5	2007
Highest daily mean	92	Jan 13	100	Apr 6	165	May 3, 2005
Lowest daily mean	79	Jun 26	69	Aug 21	33	Mar 21, 2003
Annual seven-day minimum	80	Jun 22	70	Aug 16	34	Mar 17, 2003
Maximum peak flow			101	Apr 6	169	May 3, 2005
Maximum peak stage			21.46	Aug 29	26.14	Apr 17, 2005
Instantaneous low flow			69	Aug 17	31	Mar 21, 2003
Annual runoff (ac-ft)	62,900		62,840		68,860	
10 percent exceeds	91		92		118	
50 percent exceeds	87		87		91	
90 percent exceeds	81		80		75	

TABLE 2 (CONTINUED)
Summary statistics for the discharge (cfs) and stage (ft) of the Ichetucknee Springs System (USGS 2009).

02322695 MILL POND SPRING NEAR HILDRETH, FL—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 2002 - 2008	
Annual total	9,383		8,720			
Annual mean	25.7		23.8		28.8	
Highest annual mean					38.3	2005
Lowest annual mean					23.8	2008
Highest daily mean	32	Mar 16	29	Mar 9	57	May 17, 2005
Lowest daily mean	22	Jun 17	17	Jan 29	5.6	Apr 16, 2005
Annual seven-day minimum	22	Sep 9	20	Jan 28	6.2	Apr 13, 2005
Maximum peak flow			30	Mar 9	58	May 17, 2005
Maximum peak stage			1.35	Mar 17	7.83	Apr 17, 2005
Instantaneous low flow			16	Jan 29	5.6	Apr 16, 2005
Annual runoff (ac-ft)	18,610		17,300		20,870	
10 percent exceeds	30		27		40	
50 percent exceeds	24		23		28	
90 percent exceeds	23		22		19	

02322698 ICHETUCKNEE RIVER AT DAMPIER'S LANDING NEAR HILDRETH, FL—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 2002 - 2008	
Annual total	115,483		102,755			
Annual mean	316		281		342	
Highest annual mean					425	2005
Lowest annual mean					273	2003
Highest daily mean	366	Mar 2	389	Aug 30	609	May 9, 2005
Lowest daily mean	275	Dec 26	243	Aug 10	138	Mar 11, 2003
Annual seven-day minimum	275	Dec 25	244	Aug 6	156	Mar 7, 2003
Maximum peak flow			336	Apr 8	613	May 8, 2005
Maximum peak stage			10.19	Mar 20	17.95	Apr 17, 2005
Instantaneous low flow			243	Aug 9	137	Mar 11, 2003
Annual runoff (ac-ft)	229,100		203,800		247,400	
Annual runoff (cfsm)	1.52		1.35		1.64	
Annual runoff (inches)	20.65		18.38		22.31	
10 percent exceeds	355		301		441	
50 percent exceeds	308		279		343	
90 percent exceeds	281		258		243	

02322700 ICHETUCKNEE RIVER AT HIGHWAY 27 NEAR HILDRETH, FL—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 2002 - 2008	
Annual total	109,781		92,690			
Annual mean	301		253		323	
Highest annual mean					417	2005
Lowest annual mean					253	2008
Highest daily mean	363	Mar 2	381	Aug 30	554	Aug 29, 2005
Lowest daily mean	241	Dec 29	200	Mar 1	124	Apr 1, 2003
Annual seven-day minimum	243	Dec 25	215	Feb 27	132	Mar 28, 2003
Maximum peak flow			416	Aug 30	563	Apr 30, 2005
Maximum peak stage			18.24	Mar 19	26.60	Apr 17, 2005
Instantaneous low flow			191	Mar 1	113	Mar 31, 2003
Annual runoff (ac-ft)	217,800		183,900		234,100	
Annual runoff (cfsm)	1.41		1.19		1.52	
Annual runoff (inches)	19.17		16.19		20.61	
10 percent exceeds	357		279		441	
50 percent exceeds	290		251		325	
90 percent exceeds	252		232		209	

Water Quality

Water quality data for the Ichetucknee Springs System are available from as early as 1946 by Rosenau *et al.* (1977); however STORET data (USGS and FDEP data) primarily spans from the 1990s to 2008. Among water chemistry parameters, the numbers of samples collected ranges from 1 to 432 records, with most samples collected near US 27. These data are summarized in **Table 3** which provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Data from the main spring and Ichetucknee River at US 27 POR averages for several key parameters (with the number of samples) are:

Ichetucknee Main Spring

- Water temperature – 21.7°C (n = 72)
- Dissolved oxygen – 4.26 mg/L (n = 72)
- pH – 7.43 SU (n = 72)
- Specific conductance – 323 umhos/cm (n = 123)
- Turbidity – 0.274 NTU (n = 57)
- Color – 2.85 CPU (n= 50)
- Total chloride – 4.14 mg/L (n = 80)
- Sulfate – 8.26 mg/L (n = 80)
- Nitrate+nitrite nitrogen – 0.777 mg/L (n = 82)
- Total phosphorus – 0.027 mg/L (n = 70)

Ichetucknee River at US 27

- Water temperature – 21.6°C (n = 225)
- Dissolved oxygen – 5.88 mg/L (n = 225)
- pH – 7.56 SU (n = 225)
- Specific conductance – 310 umhos/cm (n = 432)
- Turbidity – 0.386 NTU (n = 204)
- Color – 9.96 CPU (n= 174)
- Total chloride – 5.85 mg/L (n = 196)
- Sulfate – 11.9 mg/L (n = 195)
- Nitrate+nitrite nitrogen – 0.492 mg/L (n = 214)
- Total phosphorus – 0.066 mg/L (1990 average)

TABLE 3
Ichetucknee Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade					POR Statistics					Period of Record	
				1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
BACTERIOLOGICAL	Enterococci	#/100ml	mBoil					5.81	5.81	1.00	42.0	10.1	21	Oct-01	Oct-06
			Cedar Head					40.7	40.7	24.0	56.0	16.0	3	Oct-01	Aug-02
			Blue Hole					8.60	8.60	1.00	80.0	19.2	20	Oct-01	Oct-06
			Springrun					52.0	52.0	42.0	62.0	14.1	2	Jun-01	Jun-01
			Mission					1.75	1.75	1.00	2.00	0.452	12	Oct-01	Oct-06
			Devils Eye					1.00	1.00	1.00	1.00	0.00	2	Jun-02	Aug-02
			Grassy Hole					1.00	1.00	1.00	1.00	0.00	2	Jun-02	Aug-02
			Mill Pond					5.58	5.58	1.00	42.0	11.5	12	Jun-02	Oct-06
			Coffee					17.5	17.5	1.00	34.0	23.3	2	Jun-02	Aug-02
	EColi	#/100ml	mBoil					1.00	1.00	1.00	1.00		1	Oct-01	Oct-01
			Cedar Head					2.00	2.00	2.00	2.00		1	Oct-01	Oct-01
			Blue Hole					1.00	1.00	1.00	1.00		1	Oct-01	Oct-01
			Springrun					49.0	49.0	20.0	78.0	41.0	2	Jun-01	Jun-01
			Mission					1.00	1.00	1.00	1.00		1	Oct-01	Oct-01
	FC	#/100ml	mBoil				16.9	7.89	10.0	0.00	85.0	22.4	46	Nov-91	Oct-06
			Cedar Head					7.00	7.00	2.00	12.0	7.07	2	Oct-01	Jun-02
			Blue Hole				14.2	31.8	27.3	0.500	480	83.2	39	Dec-91	Oct-06
			Springrun					40.0	40.0	20.0	57.0	15.6	4	Mar-00	Jun-01
			Mission				0.500	11.6	7.99	0.00	200	34.5	34	Nov-91	Oct-06
			Devils Eye				0.955	40.1	21.4	0.00	270	62.5	23	Nov-91	Sep-02
			Grassy Hole					7.25	7.25	0.00	80.0	22.9	12	Dec-01	Sep-02
			Mill Pond				0.625	12.0	8.07	0.00	190	32.0	35	Oct-91	Oct-06
			Springrun DL					420	420	420	420		1	Jul-01	Jul-01
			Coffee					26.2	26.2	0.00	332	91.9	13	Dec-01	Apr-06
			US27				118	42.0	115	0.500	800	176	25	Feb-90	Apr-06
	TC	#/100ml	mBoil				38.4	26.1	29.0	0.00	240	48.7	46	Nov-91	Oct-06
			Cedar Head					20.0	20.0	20.0	20.0		1	Oct-01	Oct-01
			Blue Hole				50.8	43.7	45.5	1.00	480	89.1	40	Dec-91	Oct-06
			Springrun					155	155	150	160	7.07	2	Jun-01	Jun-01
			Mission				2.27	16.8	11.9	0.00	250	43.9	33	Nov-91	Oct-06
			Devils Eye				5.59	67.0	37.6	0.00	290	77.9	23	Nov-91	Sep-02
			Grassy Hole					59.8	59.8	0.00	570	163	12	Feb-01	Sep-02
			Mill Pond				7.63	33.8	24.5	0.00	270	53.3	34	Oct-91	Oct-06
			Springrun DL					3,000	3,000	3,000	3,000		1	Jul-01	Jul-01
			Coffee					419	419	0.00	3,200	993	12	Feb-01	Sep-02
			US27				295		295	2.00	940	288	25	Feb-90	Dec-99
BIOLOGICAL	Chl-a corr	µg/L	mBoil					0.368	0.368	0.250	0.480	0.081	18	Feb-01	Mar-08
			Cedar Head					0.425	0.425	0.425	0.425	0.000	11	Jan-06	Nov-06
			Cedar Head_run					0.230	0.230	0.050	0.500	0.246	5	Apr-05	Jan-06
			Blue Hole					9.03	9.03	0.250	17.8	12.4	2	Feb-01	Feb-01
			Springrun					0.500	0.500	0.500	0.500	0.00	2	Jun-01	Jun-01
			Mission					0.338	0.338	0.250	0.425	0.124	2	Feb-01	Apr-06
			Devils Eye					0.250	0.250	0.250	0.250		1	Feb-01	Feb-01
			Grassy Hole					0.250	0.250	0.250	0.250		1	Feb-01	Feb-01
			Mill Pond					0.338	0.338	0.250	0.425	0.124	2	Feb-01	Apr-06
			Coffee					0.338	0.338	0.250	0.425	0.124	2	Feb-01	Apr-06
			US27					0.425	0.425	0.425	0.425		1	Apr-06	Apr-06
	Chl-b	µg/L	mBoil					1.20	1.20	1.20	1.20		1	Feb-01	Feb-01
			Blue Hole					0.250	0.250	0.250	0.250	0.00	2	Feb-01	Feb-01
			Mission					0.250	0.250	0.250	0.250		1	Feb-01	Feb-01
			Devils Eye					1.40	1.40	1.40	1.40		1	Feb-01	Feb-01
			Grassy Hole					1.90	1.90	1.90	1.90		1	Feb-01	Feb-01
			Mill Pond					8.20	8.20	8.20	8.20		1	Feb-01	Feb-01
			Coffee					0.250	0.250	0.250	0.250		1	Feb-01	Feb-01
	Chl-c corr	µg/L	mBoil					0.250	0.250	0.250	0.250		1	Feb-01	Feb-01
			Blue Hole					0.475	0.475	0.250	0.700	0.318	2	Feb-01	Feb-01
			Mission					0.250	0.250	0.250	0.250		1	Feb-01	Feb-01
			Devils Eye					5.30	5.30	5.30	5.30		1	Feb-01	Feb-01
			Grassy Hole					0.250	0.250	0.250	0.250		1	Feb-01	Feb-01
			Mill Pond					5.70	5.70	5.70	5.70		1	Feb-01	Feb-01
			Coffee					6.40	6.40	6.40	6.40		1	Feb-01	Feb-01
	Pheo-a	µg/L	mBoil					0.532	0.532	0.120	0.850	0.306	18	Feb-01	Mar-08
			Cedar Head					0.750	0.750	0.750	0.750	0.00	11	Jan-06	Nov-06
			Blue Hole					2.90	2.90	0.500	5.30	3.39	2	Feb-01	Feb-01
			Springrun					0.500	0.500	0.500	0.500	0.00	2	Jun-01	Jun-01
			Mission					0.625	0.625	0.500	0.750	0.177	2	Feb-01	Apr-06
			Devils Eye					4.50	4.50	4.50	4.50		1	Feb-01	Feb-01
			Grassy Hole					0.500	0.500	0.500	0.500		1	Feb-01	Feb-01
			Mill Pond					11.4	11.4	0.750	22.0	15.0	2	Feb-01	Apr-06
			Coffee					0.625	0.625	0.500	0.750	0.177	2	Feb-01	Apr-06
			US27					0.625	0.625	0.500	0.750	0.177	2	Sep-00	Apr-06

TABLE 3 (CONTINUED)
Ichetucknee Springs water quality table for the period-of-record.

				Decade					POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
DISSOLVED OXYGEN	DO	%	mBoil					58.7	58.7	31.0	117	15.9	20	Dec-05	Mar-08
			Cedar Head					36.4	36.4	29.0	67.0	11.9	12	Dec-05	Nov-06
			Springrun					46.3	46.3	41.5	51.0	6.72	2	Mar-00	Apr-06
			Mission					8.00	8.00	8.00	8.00		1	Apr-06	Apr-06
			Devils Eye					16.8	16.8	16.8	16.8		1	Apr-06	Apr-06
			Grassy Hole					12.0	12.0	12.0	12.0		1	Apr-06	Apr-06
			Mill Pond					11.3	11.3	7.60	15.0	5.23	2	Apr-06	May-06
			Springrun DL					79.9	79.9	59.0	106	23.8	3	Jul-01	May-06
			Coffee					32.4	32.4	32.4	32.4		1	Apr-06	Apr-06
			US27					83.6	83.6	65.0	113	25.6	3	Sep-03	Apr-06
	DO	mg/L	mBoil				4.47	4.19	4.26	1.80	10.2	1.12	72	Oct-91	Mar-08
			Cedar Head					3.25	3.25	2.50	6.10	1.06	13	Oct-01	Nov-06
			Cedar Head_run					4.27	4.27	3.84	4.55	0.244	8	Apr-05	Jan-06
			Blue Hole				2.41	1.77	1.95	1.26	2.76	0.400	42	Nov-91	Oct-06
			Springrun					4.59	4.59	3.67	5.57	0.778	4	Mar-00	Apr-06
			Mission				0.325	0.526	0.459	0.100	1.80	0.340	36	Oct-91	Oct-06
			Devils Eye				0.531	0.556	0.543	0.100	3.40	0.739	26	Oct-91	Apr-06
			Grassy Hole				1.60	0.404	0.489	0.100	1.80	0.564	14	Jun-98	Apr-06
			Mill Pond				0.433	0.641	0.574	0.100	2.61	0.586	37	Nov-91	Oct-06
			Springrun DL					8.00	8.00	6.50	9.11	1.35	3	Jul-01	May-06
			Coffee				3.60	1.77	1.90	1.20	3.60	0.607	14	Jun-98	Apr-06
			US27			5.07	5.35	6.43	5.88	1.70	9.70	1.56	225	Feb-89	Mar-08
FLOW	Flow	cfs	mBoil		45.7	51.4		47.1	47.1	4.30	80.0	15.4	2707	Jul-75	Aug-09
			Blue Hole				106	80.0	88.7	80.0	106	15.1	3	Jun-98	Feb-01
			Mission					50.0	50.0	50.0	50.0		1	Feb-01	Feb-01
			Devils Eye				60.0	35.0	47.5	35.0	60.0	17.7	2	Jun-98	Feb-01
			Grassy Hole				10.0	3.00	6.50	3.00	10.0	4.95	2	Jun-98	Feb-01
			Mill Pond				23.1	15.0	19.0	15.0	23.1	5.69	2	Jun-98	Feb-01
			Springrun DL				298	320	320	138	609	84.4	2737	Aug-93	Sep-09
			Coffee				2.83	3.00	2.92	2.83	3.00	0.120	2	Jun-98	Feb-01
			US27	416	375	360	394	312	313	124	554	94.1	2428	May-66	Jul-08
	Velocity	ft/s	mBoil					0.180	0.180	0.100	0.300	0.084	5	Mar-06	Oct-06
			Cedar Head					0.400	0.400	0.100	0.600	0.173	7	Dec-05	Oct-06
			Springrun					1.50	1.50	1.50	1.50		1	Mar-00	Mar-00
			Mill Pond					0.750	0.750	0.750	0.750		1	May-06	May-06
			Springrun DL					0.500	0.500	0.500	0.500	0.00	2	Jul-01	May-06
			US27					0.967	0.967	0.900	1.00	0.058	3	Jun-03	Dec-03
GENERAL INORGANIC	Alk	mg/L as CaCO3	mBoil				134	144	142	48.0	156	21.9	22	Nov-91	Sep-02
			Blue Hole					135	135	125	139	4.58	12	Feb-01	Sep-02
			Mission				122	139	137	122	147	6.33	13	Nov-91	Sep-02
			Devils Eye				124	140	138	124	145	5.51	13	Nov-91	Sep-02
			Grassy Hole					137	137	100	147	12.5	12	Feb-01	Sep-02
			Mill Pond				129	138	138	129	146	5.95	13	Nov-91	Sep-02
			Coffee					129	129	122	133	3.06	12	Feb-01	Sep-02
			US27				139	147	143	14.0	159	13.0	202	Feb-90	Mar-08
	Cl-T	mg/L	mBoil				4.19	4.13	4.14	3.50	5.00	0.278	80	Nov-91	Nov-06
			Cedar Head					4.74	4.74	3.90	5.10	0.406	12	Oct-01	Nov-06
			Blue Hole				4.93	4.82	4.84	4.00	6.50	0.391	58	Dec-91	Oct-06
			Springrun					4.10	4.10	3.80	4.30	0.216	4	Mar-00	Jun-01
			Mission				5.67	5.80	5.77	5.00	6.60	0.327	46	Nov-91	Oct-06
			Devils Eye				6.27	6.44	6.36	4.90	7.50	0.513	23	Nov-91	Sep-02
			Grassy Hole					7.07	7.07	6.60	8.10	0.410	12	Feb-01	Sep-02
			Mill Pond				8.43	7.59	7.80	6.80	9.20	0.595	47	Oct-91	Oct-06
			Coffee					3.58	3.58	3.10	4.60	0.415	13	Feb-01	Apr-06
			US27				5.71	5.98	5.85	0.00	13.2	1.54	196	Feb-90	Mar-08
	Si-T	mg/L	mBoil					7.22	7.22	3.41	16.0	3.49	30	Dec-01	Sep-02
			Blue Hole					10.4	10.4	4.37	21.2	5.23	20	Dec-01	Sep-02
			Mission					10.4	10.4	0.147	20.9	5.75	22	Dec-01	Sep-02
			Devils Eye					11.2	11.2	0.212	23.4	6.31	22	Dec-01	Sep-02
			Grassy Hole					14.3	14.3	5.61	29.5	6.88	22	Dec-01	Sep-02
			Mill Pond					13.5	13.5	6.44	31.1	6.68	22	Dec-01	Sep-02
			Coffee					6.38	6.38	3.00	13.7	3.12	22	Dec-01	Sep-02
			US27					5.59	5.59	4.32	13.0	2.11	55	Oct-02	Mar-08
	SO4	mg/L	mBoil				8.34	8.25	8.26	0.00	10.4	1.12	80	Nov-91	Nov-06
			Cedar Head					4.76	4.76	4.50	5.40	0.294	12	Oct-01	Nov-06
			Blue Hole				4.82	5.34	5.25	3.20	28.0	3.28	58	Dec-91	Oct-06
			Springrun					6.50	6.50	5.80	8.40	1.27	4	Mar-00	Jun-01
			Mission				5.32	7.54	7.01	4.30	10.2	1.58	46	Nov-91	Oct-06
			Devils Eye				10.6	16.5	13.7	5.10	19.6	3.78	23	Nov-91	Sep-02
			Grassy Hole					23.9	23.9	19.5	27.1	1.80	12	Feb-01	Sep-02
			Mill Pond				27.5	26.9	27.0	19.0	37.0	4.64	47	Oct-91	Oct-06
			Coffee					8.90	8.90	7.40	10.0	0.639	13	Feb-01	Apr-06
			US27				11.6	12.2	11.9	5.40	25.0	2.86	195	Feb-90	Mar-08

TABLE 3 (CONTINUED)
Ichetucknee Springs water quality table for the period-of-record.

				Decade					POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
GENERAL ORGANIC	TOC	mg/L	mBoil				2.10	0.495	0.660	0.00	5.00	0.925	68	Nov-91	Nov-06
			Cedar Head					0.500	0.500	0.500	0.500	0.00	12	Oct-01	Nov-06
			Cedar Head_run					1.76	1.76	0.500	3.54	1.25	5	Apr-05	Jan-06
			Blue Hole					0.780	0.780	0.00	9.40	1.58	40	Feb-01	Oct-06
			Springrun					0.500	0.500	0.500	0.500	0.00	2	Jun-01	Jun-01
			Mission				4.10	0.544	0.646	0.00	4.10	1.05	35	Nov-91	Oct-06
			Devils Eye				4.10	1.08	1.20	0.00	9.40	2.41	24	Nov-91	Sep-02
			Grassy Hole					0.733	0.733	0.00	4.00	0.980	23	Feb-01	Sep-02
			Mill Pond				2.70	0.803	0.905	0.200	4.40	1.03	37	Oct-91	Oct-06
			Coffee					0.340	0.340	0.00	4.00	0.831	24	Feb-01	Apr-06
			US27				2.14	2.71	2.42	0.00	54.0	4.45	203	Feb-90	Mar-08
METAL	Al-T	µg/L	mBoil					7.24	7.24	1.50	37.5	10.0	13	Oct-01	Apr-05
			Cedar Head					37.5	37.5	37.5	37.5		1	Oct-01	Oct-01
			Blue Hole					5.73	5.73	1.50	37.5	9.60	13	Oct-01	Apr-05
			Mission					9.50	9.50	2.50	37.5	15.7	5	Oct-01	Apr-05
			Mill Pond					4.22	4.22	2.50	8.60	2.73	6	Oct-04	Apr-05
	As-T	µg/L	mBoil					2.39	2.39	1.50	4.50	0.836	14	Oct-01	Apr-05
			Cedar Head					1.50	1.50	1.50	1.50	0.00	2	Oct-01	Oct-01
			Blue Hole					2.39	2.39	1.50	4.50	0.836	14	Oct-01	Apr-05
			Mission					2.33	2.33	1.50	3.00	0.683	6	Oct-01	Apr-06
			Mill Pond					2.75	2.75	2.50	3.00	0.274	6	Oct-04	Apr-06
	Ba-T	µg/L	mBoil					3.68	3.68	2.40	4.40	0.569	12	Oct-02	Apr-05
			Blue Hole					4.19	4.19	3.10	4.90	0.476	12	Oct-02	Apr-05
			Mission					4.55	4.55	4.00	5.00	0.464	5	Apr-05	Apr-06
			Mill Pond					5.31	5.31	5.00	5.80	0.306	7	Oct-04	Apr-06
			Coffee					2.57	2.57	2.57	2.57		1	Apr-06	Apr-06
			US27					4.45	4.45	4.45	4.45		1	Apr-06	Apr-06
	Cd-T	µg/L	mBoil					0.286	0.286	0.250	0.375	0.059	14	Oct-01	Apr-05
			Cedar Head					0.375	0.375	0.375	0.375	0.00	2	Oct-01	Oct-01
			Blue Hole					0.286	0.286	0.250	0.375	0.059	14	Oct-01	Apr-05
			Mission					0.254	0.254	0.025	0.375	0.117	7	Oct-01	Apr-06
			Mill Pond					0.218	0.218	0.025	0.250	0.085	7	Oct-04	Apr-06
			Coffee					0.025	0.025	0.025	0.025		1	Apr-06	Apr-06
			US27					0.025	0.025	0.025	0.025		1	Apr-06	Apr-06
	Ca-T	mg/L	mBoil				53.4	58.5	57.5	47.4	78.2	4.85	80	Nov-91	Nov-06
			Cedar Head					55.6	55.6	51.2	58.5	2.05	12	Oct-01	Nov-06
			Blue Hole				50.4	53.8	53.2	46.5	82.2	4.98	58	Dec-91	Oct-06
			Springrun					55.2	55.2	53.9	56.5	1.84	2	Jun-01	Jun-01
			Mission				47.8	52.3	51.2	45.5	59.5	3.47	46	Nov-91	Oct-06
			Devils Eye				49.7	53.5	51.7	47.2	59.4	3.41	23	Nov-91	Sep-02
			Grassy Hole					56.2	56.2	44.9	64.0	6.18	12	Feb-01	Sep-02
			Mill Pond				52.7	56.2	55.3	45.1	65.9	3.61	47	Oct-91	Oct-06
			Coffee					52.9	52.9	46.5	70.4	6.43	13	Feb-01	Apr-06
			US27				49.1	53.5	51.3	10.4	90.3	5.80	196	Feb-90	Mar-08
	Cr-T	µg/L	mBoil					1.03	1.03	0.250	2.30	0.473	14	Oct-01	Apr-05
			Cedar Head					0.300	0.300	0.250	0.350	0.071	2	Oct-01	Oct-01
			Blue Hole					0.936	0.936	0.250	1.50	0.301	14	Oct-01	Apr-05
			Mission					0.800	0.800	0.250	1.00	0.343	7	Oct-01	Apr-06
			Mill Pond					1.00	1.00	1.00	1.00	0.00	7	Oct-04	Apr-06
			Coffee					1.00	1.00	1.00	1.00		1	Apr-06	Apr-06
			US27					1.00	1.00	1.00	1.00		1	Apr-06	Apr-06
	Co-T	µg/L	mBoil					0.644	0.644	0.250	1.00	0.322	13	Oct-01	Apr-05
			Cedar Head					0.375	0.375	0.375	0.375		1	Oct-01	Oct-01
			Blue Hole					0.644	0.644	0.250	1.00	0.322	13	Oct-01	Apr-05
			Mission					0.875	0.875	0.375	1.00	0.280	5	Oct-01	Apr-05
			Mill Pond					1.00	1.00	1.00	1.00	0.00	6	Oct-04	Apr-05
	Cu-T	µg/L	mBoil					2.04	2.04	1.00	4.00	0.903	14	Oct-01	Apr-05
			Cedar Head					1.25	1.25	1.25	1.25	0.00	2	Oct-01	Oct-01
			Blue Hole					2.04	2.04	1.00	4.00	0.912	14	Oct-01	Apr-05
			Mission					2.05	2.05	0.125	4.40	1.39	7	Oct-01	Apr-06
			Mill Pond					1.81	1.81	0.125	3.05	0.968	7	Oct-04	Apr-06
			Coffee					0.125	0.125	0.125	0.125		1	Apr-06	Apr-06
			US27					0.125	0.125	0.125	0.125		1	Apr-06	Apr-06
	Fe-T	µg/L	mBoil					11.2	11.2	2.50	72.0	17.9	14	Oct-01	Apr-05
			Cedar Head					13.8	13.8	10.0	17.5	5.30	2	Oct-01	Oct-01
			Blue Hole					7.12	7.12	2.50	17.5	4.52	14	Oct-01	Apr-05
			Mission					6.79	6.79	2.50	17.5	5.35	7	Oct-01	Apr-06
			Mill Pond					3.93	3.93	2.50	5.00	1.34	7	Oct-04	Apr-06
			Coffee					5.00	5.00	5.00	5.00		1	Apr-06	Apr-06
			US27					56.0	56.0	56.0	56.0		1	Apr-06	Apr-06

TABLE 3 (CONTINUED)
Ichetucknee Springs water quality table for the period-of-record.

				Decade					POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
	Pb-T	µg/L	mBoil					2.18	2.18	0.013	3.50	0.966	14	Oct-01	Apr-05
			Cedar Head					2.25	2.25	2.00	2.50	0.354	2	Oct-01	Oct-01
			Blue Hole					2.18	2.18	0.013	3.50	0.966	14	Oct-01	Apr-05
			Mission					2.08	2.08	0.038	2.50	0.918	7	Oct-01	Apr-06
			Mill Pond					2.15	2.15	0.038	2.50	0.931	7	Oct-04	Apr-06
			Coffee					0.038	0.038	0.038	0.038		1	Apr-06	Apr-06
			US27					0.038	0.038	0.038	0.038		1	Apr-06	Apr-06
	Mg-T	mg/L	mBoil				5.49	6.09	5.97	4.90	8.60	0.495	80	Nov-91	Nov-06
			Cedar Head					5.27	5.27	5.00	5.60	0.183	12	Oct-01	Nov-06
			Blue Hole				5.06	5.25	5.22	4.50	8.50	0.589	58	Dec-91	Oct-06
			Springrun					5.60	5.60	5.30	5.90	0.424	2	Jun-01	Jun-01
			Mission				5.54	6.43	6.21	5.20	7.70	0.631	46	Nov-91	Oct-06
			Devils Eye				6.95	8.48	7.74	4.80	9.50	1.07	23	Nov-91	Sep-02
			Grassy Hole					9.75	9.75	7.40	11.5	1.10	12	Feb-01	Sep-02
			Mill Pond				9.14	9.25	9.22	0.00	12.2	1.55	47	Oct-91	Oct-06
			Coffee					5.24	5.24	4.30	7.20	0.696	13	Feb-01	Apr-06
			US27				6.21	6.64	6.43	0.600	8.70	0.808	196	Feb-90	Mar-08
	Mn-T	µg/L	mBoil					0.291	0.291	0.125	1.20	0.267	14	Oct-01	Apr-05
			Cedar Head					0.250	0.250	0.250	0.250	0.00	2	Oct-01	Oct-01
			Blue Hole					0.223	0.223	0.125	0.250	0.053	14	Oct-01	Apr-05
			Mission					0.583	0.583	0.250	1.30	0.517	6	Oct-01	Apr-06
			Mill Pond					0.622	0.622	0.250	1.00	0.317	6	Oct-04	Apr-06
			Coffee					0.050	0.050	0.050	0.050		1	Apr-06	Apr-06
			US27					0.700	0.700	0.700	0.700		1	Apr-06	Apr-06
	Ni-T	µg/L	mBoil					1.05	1.05	0.500	2.00	0.356	14	Oct-01	Apr-05
			Cedar Head					0.750	0.750	0.750	0.750	0.00	2	Oct-01	Oct-01
			Blue Hole					1.05	1.05	0.500	2.00	0.356	14	Oct-01	Apr-05
			Mission					0.857	0.857	0.500	1.00	0.197	7	Oct-01	Apr-06
			Mill Pond					1.00	1.00	1.00	1.00	0.00	6	Oct-04	Apr-06
			Coffee					0.500	0.500	0.500	0.500		1	Apr-06	Apr-06
	K-T	mg/L	mBoil				0.250	0.127	0.155	0.00	0.900	0.116	70	Nov-91	Nov-06
			Cedar Head					0.326	0.326	0.220	0.400	0.065	9	Oct-01	Nov-06
			Blue Hole				0.250	0.338	0.323	0.050	0.510	0.093	58	Dec-91	Oct-06
			Springrun					0.195	0.195	0.140	0.250	0.078	2	Jun-01	Jun-01
			Mission				0.282	0.460	0.418	0.050	0.600	0.121	46	Nov-91	Oct-06
			Devils Eye				0.327	0.446	0.389	0.050	0.600	0.149	23	Nov-91	Sep-02
			Grassy Hole					0.504	0.504	0.050	0.800	0.184	12	Feb-01	Sep-02
			Mill Pond				0.379	0.540	0.499	0.050	0.710	0.140	47	Oct-91	Oct-06
			Coffee					0.133	0.133	0.050	0.200	0.062	12	Feb-01	Apr-06
			US27				1.48	0.369	0.915	0.00	98.8	7.07	194	Feb-90	Mar-08
	Se-T	µg/L	mBoil					4.32	4.32	2.00	10.0	2.34	14	Oct-01	Apr-05
			Cedar Head					2.00	2.00	2.00	2.00	0.00	2	Oct-01	Oct-01
			Blue Hole					4.21	4.21	2.00	8.50	2.08	14	Oct-01	Apr-05
			Mission					3.17	3.17	2.00	4.00	0.931	6	Oct-01	Apr-06
			Mill Pond					3.67	3.67	3.50	4.00	0.258	6	Oct-04	Apr-06
	SR-T	µg/L	mBoil					162	162	147	173	8.46	13	Oct-01	Apr-05
			Cedar Head					105	105	105	105		1	Oct-01	Oct-01
			Blue Hole					90.2	90.2	76.0	107	8.14	13	Oct-01	Apr-05
			Mission					121	121	107	133	10.5	5	Oct-01	Apr-05
			Mill Pond					283	283	264	306	15.4	6	Oct-04	Apr-05
	Zn-T	µg/L	mBoil					2.86	2.86	1.00	8.90	2.29	14	Oct-01	Apr-05
			Cedar Head					2.50	2.50	2.50	2.50	0.00	2	Oct-01	Oct-01
			Blue Hole					3.47	3.47	1.00	17.0	4.37	14	Oct-01	Apr-05
			Mission					1.64	1.64	1.00	2.50	0.627	7	Oct-01	Apr-06
			Mill Pond					1.29	1.29	1.00	1.50	0.267	7	Oct-04	Apr-06
			Coffee					1.50	1.50	1.50	1.50		1	Apr-06	Apr-06
			US27					1.50	1.50	1.50	1.50		1	Apr-06	Apr-06
NITROGEN	NH4-N	mg/L	mBoil				0.011	0.006	0.007	0.00	0.053	0.006	81	Nov-91	Nov-06
			Cedar Head					0.006	0.006	0.005	0.011	0.002	14	Oct-01	Nov-06
			Cedar Head_run					0.005	0.005	0.005	0.005	0.0000	5	Apr-05	Jan-06
			Blue Hole				0.006	0.007	0.007	0.00	0.080	0.010	58	Dec-91	Oct-06
			Springrun					0.009	0.009	0.005	0.016	0.005	4	Mar-00	Jun-01
			Mission				0.011	0.005	0.007	0.00	0.065	0.009	46	Nov-91	Oct-06
			Devils Eye				0.005	0.005	0.005	0.00	0.010	0.004	23	Nov-91	Sep-02
			Grassy Hole					0.005	0.005	0.00	0.010	0.005	12	Feb-01	Sep-02
			Mill Pond				0.006	0.005	0.006	0.00	0.013	0.003	47	Oct-91	Oct-06
			Coffee					0.005	0.005	0.00	0.010	0.005	13	Feb-01	Apr-06
			US27				0.011	0.026	0.018	0.00	0.090	0.017	195	Feb-90	Apr-07

TABLE 3 (CONTINUED)
Ichetucknee Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade					POR Statistics					Period of Record	
				1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
	NOx-N	mg/L	mBoil				0.760	0.781	0.777	0.660	0.880	0.053	82	Nov-91	Nov-06
			Cedar Head					0.796	0.796	0.720	0.890	0.047	14	Oct-01	Nov-06
			Cedar Head_run					0.714	0.714	0.700	0.730	0.015	5	Apr-05	Jan-06
			Blue Hole				0.656	0.670	0.668	0.040	0.990	0.123	59	Dec-91	Oct-06
			Springrun					0.788	0.788	0.720	0.820	0.046	4	Mar-00	Jun-01
			Mission				0.500	0.523	0.517	0.370	0.660	0.070	46	Nov-91	Oct-06
			Devils Eye				0.533	0.448	0.491	0.390	0.730	0.093	24	Nov-91	Sep-02
			Grassy Hole				0.500	0.403	0.410	0.360	0.560	0.058	13	Jun-98	Sep-02
			Mill Pond				0.355	0.390	0.380	0.200	0.560	0.081	48	Oct-91	Oct-06
			Coffee				0.710	0.506	0.521	0.420	0.710	0.071	14	Jun-98	Apr-06
			US27				0.496	0.488	0.492	0.230	0.750	0.099	214	Feb-90	Mar-08
	NO3-N	mg/L	US27				0.451		0.451	0.330	0.550	0.060	20	Feb-90	Sep-02
	NO2-N	mg/L	US27				0.050		0.050	0.050	0.050	0.0000	20	Feb-90	Sep-91
	TKN	mg/L	mBoil				0.096	0.044	0.054	0.00	0.780	0.087	80	Nov-91	Nov-06
			Cedar Head					0.047	0.047	0.030	0.080	0.018	14	Oct-01	Nov-06
			Cedar Head_run					0.074	0.074	0.030	0.180	0.067	5	Apr-05	Jan-06
			Blue Hole				0.091	0.043	0.051	0.00	0.280	0.045	58	Dec-91	Oct-06
			Springrun					0.030	0.030	0.030	0.030	0.00	4	Mar-00	Jun-01
			Mission				0.064	0.047	0.051	0.00	0.200	0.043	46	Nov-91	Oct-06
			Devils Eye				0.064	0.067	0.065	0.00	0.230	0.060	23	Nov-91	Sep-02
			Grassy Hole					0.083	0.083	0.00	0.400	0.117	12	Feb-01	Sep-02
			Mill Pond				0.073	0.048	0.054	0.00	0.240	0.042	47	Oct-91	Oct-06
			Coffee					0.044	0.044	0.00	0.210	0.053	13	Feb-01	Apr-06
			US27				0.095	0.177	0.136	0.00	2.32	0.202	203	Feb-90	Mar-08
OXYGEN DEMAND	BOD5	mg/L	mBoil					0.592	0.592	0.100	2.00	0.851	12	Oct-01	Mar-08
			Cedar Head					0.813	0.813	0.100	2.00	0.983	8	Oct-01	Nov-06
			Blue Hole					0.100	0.100	0.100	0.100		1	Oct-01	Oct-01
			Springrun					0.500	0.500	0.500	0.500	0.00	2	Mar-00	Mar-00
			Mission					0.100	0.100	0.100	0.100		1	Oct-01	Apr-06
			US27				1.20		1.20	0.500	6.10	1.31	20	Feb-90	Apr-06
PHOSPHORUS	OrthoP	mg/L	mBoil				0.022	0.022	0.022	0.008	0.031	0.003	62	Nov-91	Nov-06
			Cedar Head					0.041	0.041	0.027	0.046	0.005	13	Oct-01	Nov-06
			Blue Hole				0.047	0.047	0.047	0.037	0.057	0.005	40	Dec-91	Oct-06
			Springrun					0.020	0.020	0.011	0.028	0.012	2	Jun-01	Jun-01
			Mission				0.059	0.059	0.059	0.048	0.075	0.006	35	Nov-91	Oct-06
			Devils Eye				0.057	0.062	0.059	0.043	0.074	0.006	23	Nov-91	Sep-02
			Grassy Hole					0.060	0.060	0.051	0.073	0.006	12	Feb-01	Sep-02
			Mill Pond				0.059	0.057	0.058	0.021	0.073	0.008	36	Oct-91	Oct-06
			Coffee					0.030	0.030	0.025	0.051	0.007	13	Feb-01	Apr-06
			US27				0.046	0.038	0.042	0.002	0.147	0.015	198	Feb-90	Apr-07
	TP	mg/L	mBoil				0.031	0.026	0.027	0.010	0.055	0.008	70	Nov-91	Nov-06
			Cedar Head					0.034	0.034	0.033	0.034	0.0007	2	Oct-01	Nov-06
			Cedar Head_run					0.028	0.028	0.020	0.030	0.004	5	Apr-05	Jan-06
			Blue Hole				0.059	0.050	0.051	0.041	0.087	0.010	58	Dec-91	Oct-06
			Springrun					0.025	0.025	0.019	0.030	0.008	2	Mar-00	Jun-01
			Mission				0.088	0.058	0.065	0.048	0.265	0.032	45	Nov-91	Oct-06
			Devils Eye				0.088	0.062	0.074	0.050	0.276	0.046	23	Nov-91	Sep-02
			Grassy Hole					0.060	0.060	0.051	0.078	0.008	12	Feb-01	Sep-02
			Mill Pond				0.090	0.058	0.066	0.051	0.269	0.032	46	Oct-91	Oct-06
			Coffee					0.028	0.028	0.022	0.040	0.005	12	Feb-01	Apr-06
			US27				0.066	1.57	0.815	0.021	54.0	6.19	207	Feb-90	Mar-08
PHYSICAL	Color	CPU	mBoil				5.00	2.61	2.85	0.00	7.50	2.42	50	Apr-98	Nov-06
			Cedar Head					3.64	3.64	0.00	7.50	2.05	11	Oct-01	Nov-06
			Cedar Head_run					5.00	5.00	2.50	10.0	3.06	5	Apr-05	Jan-06
			Blue Hole					2.17	2.17	0.00	5.00	2.52	30	Feb-01	Oct-06
			Springrun					2.50	2.50	0.00	5.00	2.89	4	Mar-00	Jun-01
			Mission					3.23	3.23	0.00	10.0	2.81	24	Feb-01	Oct-06
			Devils Eye					5.00	5.00	5.00	5.00	0.00	12	Feb-01	Sep-02
			Grassy Hole					5.00	5.00	5.00	5.00	0.00	12	Feb-01	Sep-02
			Mill Pond					2.81	2.81	0.00	5.00	2.48	24	Feb-01	Oct-06
			Coffee					4.81	4.81	2.50	5.00	0.693	13	Feb-01	Apr-06
			US27				16.1	5.50	9.96	0.500	750	56.5	174	Feb-90	Mar-08
	Depth	m	mBoil				1.12	3.86	3.10	0.800	11.7	2.58	61	Oct-91	Mar-08
			Cedar Head					1.98	1.98	1.50	2.20	0.204	12	Oct-01	Nov-06
			Blue Hole				1.95	10.9	7.69	0.800	13.8	4.45	31	Nov-91	Oct-06
			Springrun					0.950	0.950	0.900	1.00	0.071	2	Jun-01	Jun-01
			Mission				1.40	1.29	1.34	0.750	3.50	0.550	27	Oct-91	Oct-06
			Devils Eye				1.15	3.65	2.29	0.700	4.00	1.31	22	Oct-91	Sep-02
			Grassy Hole					0.332	0.332	0.250	0.450	0.068	11	Dec-01	Sep-02
			Mill Pond				1.00	1.21	1.13	0.450	2.10	0.406	27	Nov-91	Oct-06
			Springrun DL					1.00	1.00	1.00	1.00		1	May-06	May-06
			Coffee					0.182	0.182	0.100	0.250	0.046	11	Dec-01	Sep-02
			US27			0.908	1.18	1.45	1.30	0.500	4.00	0.506	207	Feb-89	Mar-08

TABLE 3 (CONTINUED)
Ichetucknee Springs water quality table for the period-of-record.

				Decade					POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
	pH	SU	mBoil				7.34	7.45	7.43	6.76	7.91	0.186	72	Oct-91	Mar-08
			Cedar Head					7.49	7.49	7.37	7.68	0.102	13	Oct-01	Nov-06
			Cedar Head_run					7.51	7.51	7.26	7.70	0.150	8	Apr-05	Jan-06
			Blue Hole				7.48	7.47	7.47	7.00	7.77	0.163	43	Nov-91	Oct-06
			Springrun					7.56	7.56	7.25	7.70	0.208	4	Mar-00	Apr-06
			Mission				7.49	7.43	7.45	7.17	7.94	0.178	37	Oct-91	Oct-06
			Devils Eye				7.48	7.46	7.47	7.12	7.86	0.171	26	Oct-91	Apr-06
			Grassy Hole				7.63	7.48	7.49	7.16	7.80	0.158	14	Jun-98	Apr-06
			Mill Pond				7.51	7.42	7.45	7.09	7.84	0.186	37	Nov-91	Oct-06
			Springrun DL					7.82	7.82	7.76	7.87	0.056	3	Jul-01	May-06
			Coffee				7.13	7.57	7.54	7.13	7.92	0.185	14	Jun-98	Apr-06
			US27			7.34	7.49	7.64	7.56	6.02	8.34	0.408	225	Feb-89	Mar-08
	Secchi	m	mBoil				1.20	3.08	2.91	0.800	6.90	2.12	43	Nov-91	Mar-08
			Cedar Head					2.01	2.01	1.50	2.40	0.227	13	Oct-01	Nov-06
			Cedar Head_run					0.450	0.450	0.00	0.900	0.636	2	Jul-05	Jan-06
			Blue Hole				2.20	11.1	9.49	2.00	13.2	3.85	22	Nov-91	Oct-06
			Springrun					1.03	1.03	0.900	1.20	0.153	3	Mar-00	Jun-01
			Mission				1.53	1.29	1.35	0.300	3.50	0.718	15	Nov-91	Oct-06
			Devils Eye				1.14		1.14	1.10	1.25	0.075	4	Nov-91	Feb-92
			Mill Pond				0.517	1.21	1.07	0.450	2.10	0.542	15	Dec-91	Oct-06
			Springrun DL					0.800	0.800	0.600	1.00	0.283	2	Jul-01	May-06
			US27			0.908	1.31	1.16	1.22	0.500	4.00	0.830	43	Feb-89	Oct-07
	SpCond	umhos/cm	mBoil				319	325	323	290	590	35.8	123	Oct-91	Mar-08
			Cedar Head					309	309	286	325	11.1	14	Oct-01	Nov-06
			Cedar Head_run					331	331	324	339	5	8	Apr-05	Jan-06
			Blue Hole				293	309	304	171	545	53.9	84	Nov-91	Oct-06
			Springrun					309	309	283	334	15.7	8	Mar-00	Apr-06
			Mission				292	313	306	265	558	43.3	70	Oct-91	Oct-06
			Devils Eye				310	349	329	273	625	59.2	50	Oct-91	Apr-06
			Grassy Hole				313	363	359	302	624	72.2	27	Jun-98	Apr-06
			Mill Pond				347	370	362	297	675	55.6	73	Oct-91	Oct-06
			Springrun DL					323	323	317	330	6.51	3	Jul-01	May-06
			Coffee				241	296	292	226	584	80.9	27	Jun-98	Apr-06
			US27			288	309	312	310	270	378	14.8	432	Feb-89	Mar-08
	Stage	ft	mBoil					1.52	1.52	0.540	5.06	0.689	2637	Feb-02	Aug-09
			Blue Hole					2.90	2.90	1.58	6.36	1.03	17	Oct-02	Oct-06
			Mission					22.2	22.2	21.7	23.0	0.394	9	Jul-04	Oct-06
			Mill Pond					9.05	9.05	1.24	20.3	8.61	9	Jul-04	Jul-06
			Dampier					9.73	9.73	8.54	18.1	1.56	2675	Feb-02	Sep-09
			US27		15.34	16.01	16.59	15.88	15.89	14.49	26.58	2.20	2383	Jan-76	Jul-08
	Stage	ft MSL	mBoil					0.647	0.647	0.580	0.760	0.071	15	Dec-01	Sep-02
			Blue Hole					1.66	1.66	1.55	1.73	0.074	10	Dec-01	Sep-02
			Mission					20.9	20.9	20.9	21.0	0.030	11	Dec-01	Sep-02
			Devils Eye					8.15	8.15	8.05	8.24	0.073	8	Feb-02	Sep-02
			Grassy Hole					14.1	14.1	14.0	14.1	0.024	11	Dec-01	Sep-02
			Mill Pond					1.28	1.28	1.25	1.30	0.022	11	Dec-01	Sep-02
			US27			15.7	16.8	15.3	16.1	0.960	25.2	3.23	204	Feb-89	Apr-07
	Turb	NTU	mBoil				0.288	0.270	0.274	0.025	2.70	0.376	57	Nov-91	Nov-06
			Cedar Head					0.189	0.189	0.025	0.450	0.135	11	Oct-01	Nov-06
			Cedar Head_run					0.380	0.380	0.290	0.450	0.082	3	Apr-05	Jan-06
			Blue Hole				0.190	0.214	0.210	0.025	1.40	0.238	36	Dec-91	Oct-06
			Springrun					0.100	0.100	0.100	0.100	0.00	4	Mar-00	Jun-01
			Mission				0.210	0.152	0.165	0.025	0.550	0.123	31	Nov-91	Oct-06
			Devils Eye				0.231	0.104	0.151	0.050	0.410	0.102	19	Nov-91	Sep-02
			Grassy Hole					0.124	0.124	0.040	0.300	0.082	12	Feb-01	Sep-02
			Mill Pond				0.230	0.211	0.216	0.025	1.50	0.265	32	Oct-91	Oct-06
			Coffee					0.165	0.165	0.050	0.550	0.133	13	Feb-01	Apr-06
			US27				0.305	0.468	0.386	0.010	6.45	0.515	204	Feb-90	Mar-08
SOLID	TDS	mg/L	mBoil				170	183	182	158	210	12.7	43	Apr-98	Nov-06
			Cedar Head					172	172	156	189	13.7	4	Oct-01	Nov-06
			Blue Hole					174	174	149	203	13.9	30	Feb-01	Oct-06
			Springrun					177	177	175	179	2.83	2	Jun-01	Jun-01
			Mission					178	178	151	222	16.7	24	Feb-01	Oct-06
			Devils Eye					213	213	170	242	19.8	12	Feb-01	Sep-02
			Grassy Hole					233	233	208	270	18.8	12	Feb-01	Sep-02
			Mill Pond					219	219	168	282	27.6	24	Feb-01	Oct-06
			Coffee					174	174	132	196	16.9	13	Feb-01	Apr-06
			US27				180	191	186	108	289	23.7	192	Feb-90	Mar-08

TABLE 3 (CONTINUED)
Ichetucknee Springs water quality table for the period-of-record.

				Decade					POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
	TSS	mg/L	mBoil				1.29	1.73	1.65	0.00	2.00	0.694	42	Nov-91	Nov-06
			Cedar Head					2.00	2.00	2.00	2.00	0.00	12	Oct-01	Nov-06
			Blue Hole					1.59	1.59	0.00	2.00	0.781	22	Feb-01	Oct-06
			Springrun					1.25	1.25	1.00	2.00	0.463	8	Mar-00	Jun-01
			Mission				2.00	1.63	1.68	0.00	2.00	0.728	17	Nov-91	Oct-06
			Devils Eye				2.00	0.167	0.900	0.00	2.00	1.02	5	Nov-91	Feb-02
			Grassy Hole					0.167	0.167	0.00	0.500	0.289	3	Feb-01	Feb-02
			Mill Pond				2.00	1.53	1.58	0.00	2.00	0.809	18	Nov-91	Oct-06
			Coffee					0.625	0.625	0.00	2.00	0.946	4	Feb-01	Apr-06
			US27				20.6	0.875	16.4	0.00	210	49.4	151	Feb-90	Apr-06
TEMPERATURE	Wtr Temp	C	mBoil				21.3	21.8	21.7	20.1	22.8	0.378	72	Oct-91	Mar-08
			Cedar Head					21.7	21.7	21.6	21.9	0.104	13	Oct-01	Nov-06
			Cedar Head_run					21.5	21.5	20.6	21.9	0.441	8	Apr-05	Jan-06
			Blue Hole				21.1	21.7	21.6	20.0	22.5	0.431	43	Nov-91	Oct-06
			Springrun					22.1	22.1	21.5	22.6	0.458	4	Mar-00	Apr-06
			Mission				21.3	22.0	21.8	21.0	24.3	0.683	36	Oct-91	Oct-06
			Devils Eye				21.4	21.7	21.5	21.1	21.9	0.213	26	Oct-91	Apr-06
			Grassy Hole				21.6	21.7	21.7	21.5	21.8	0.085	14	Jun-98	Apr-06
			Mill Pond				21.5	21.9	21.7	21.2	22.4	0.284	37	Nov-91	Oct-06
			Springrun DL					22.9	22.9	22.4	23.6	0.612	3	Jul-01	May-06
			Coffee				21.7	21.7	21.7	21.5	21.7	0.064	14	Jun-98	Apr-06
			US27			21.4	21.5	21.7	21.6	18.0	24.0	1.11	225	Feb-89	Mar-08

While many water quality measures such as temperature, solids, and color are relatively constant in these springs, there are notable differences between key spring vents. In the Ichetucknee Springs Group there are significant and consistent differences in dissolved oxygen, specific conductance, and nitrate-nitrite nitrogen concentrations between spring vents. The Ichetucknee Spring has an average dissolved oxygen concentration of 4.3 mg/L, while Blue Hole Spring averages 2.0 mg/L, Mission Spring averages 0.46 mg/L, Devil's Eye Spring averages 0.54 mg/L, and Mill Pond averages 0.57 mg/L. Specific conductance averages 323 µS/cm at Ichetucknee Spring, 304 µS/cm at Blue Hole, 306 µS/cm at Mission Springs, 329 µS/cm at Devil's Eye Spring, and 362 µS/cm at Mill Pond Springs. Nitrate+nitrite nitrogen concentrations average 0.78 mg/L at Ichetucknee Spring, 0.67 mg/L at Blue Hole Spring, 0.52 mg/L at Mission Spring, 0.49 mg/L at Devil's Eye Spring, and 0.38 mg/L at Mill Pond Spring.

Nitrate concentrations between the many springs which supply the Ichetucknee Springs System, appear to show a pattern of decreasing nitrate concentrations from north to south. Nitrate concentrations appear to be increasing over the period-of-record, as average nitrate concentrations at the Ichetucknee headspring have been observed to

increase from 0.36 mg/L to 0.77 mg/L (Strong 2004). Rosenau *et al*. (1977) reported the following rising historic nitrate-nitrogen concentrations: 1946 - 0.23 mg/L and 1975 - 0.43 mg/L. Comparing nitrate concentrations for Ichetucknee Spring (headspring) over the 1966 to 2007 period-of-record, there appears to be a general trend of increase (**Figure 12**). Total phosphorus in the various spring vents currently averages between 0.027 and 0.074 mg/L. Rosenau *et al*. (1977) reported a total phosphorus concentration of 0.05 mg/L. These observations are consistent with the geology of the karst springshed.

Katz and Hornsby (1998) estimated sources and travel times for groundwater discharged at Blue Hole Spring. Nitrate-nitrogen stable isotope data suggest the primary sources of nitrate were a combination of inorganic fertilizers and organic animal wastes. The estimated mean residence time (age) of water discharging at Blue Hole was 24 years.

To compare how several of the major springs of the Ichetucknee System relate to other Florida springs, mean nitrate and mean total phosphorus concentrations are plotted in **Figures 13** and **14**, respectively. Nitrate concentrations in the Ichetucknee Springs System are elevated compared to springs located in undeveloped areas of north and central Florida (**Figure 13**) and compared to published historic data (Rosenau *et al*. 1977). Concentrations of total phosphorus are still relatively low (**Figure 14**).

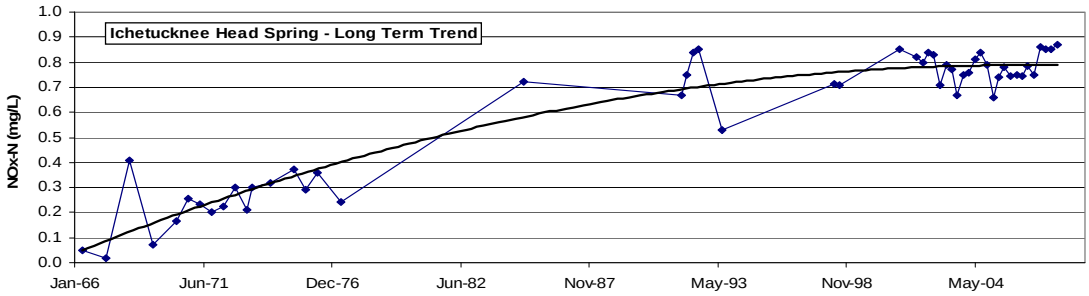


FIGURE 12
Period-of-record (1966 to 2007) nitrate concentrations for Ichetucknee Springs (headspring).

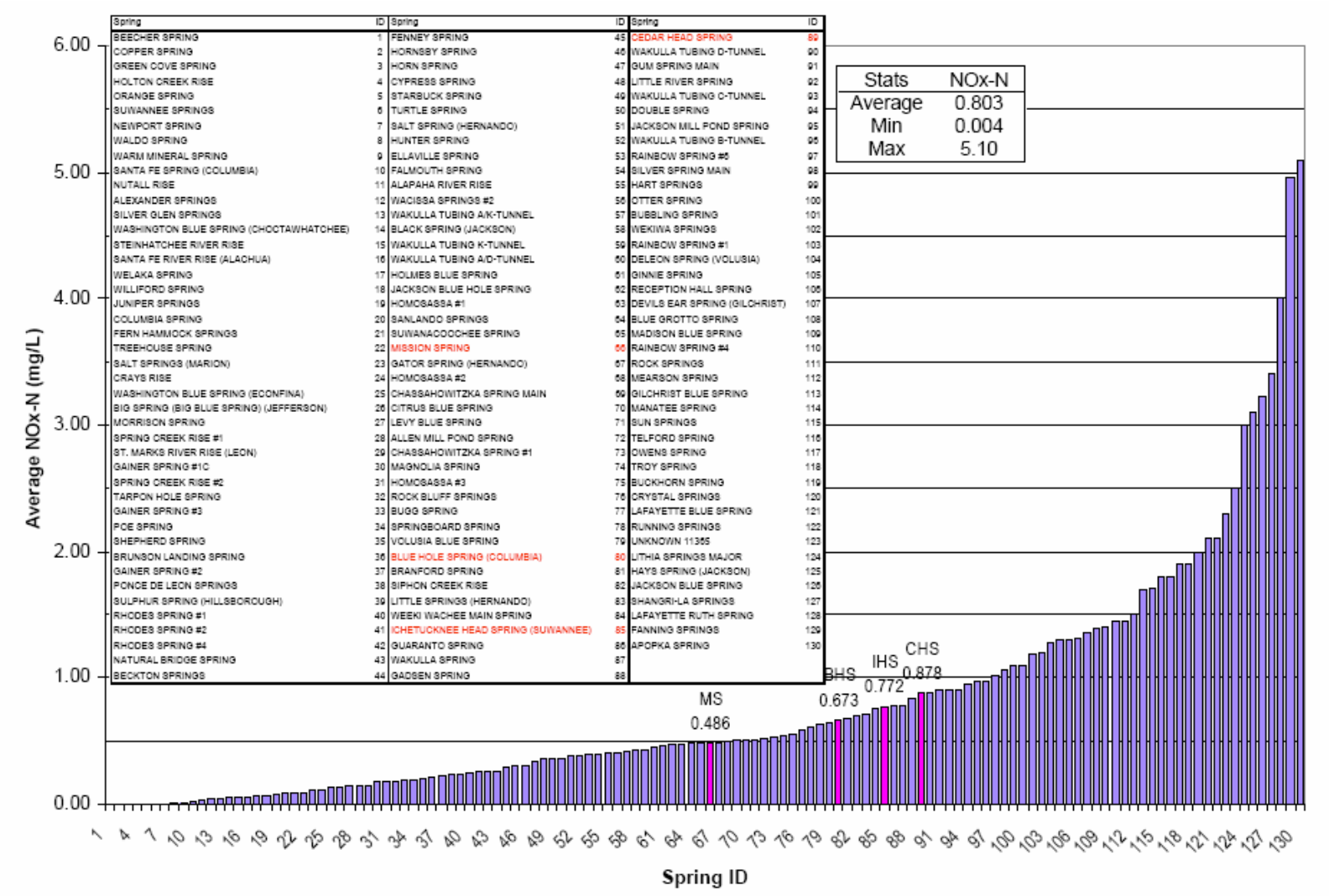


FIGURE 13
Average NOx-N concentrations for representative Florida springs and for key Springs in the Ichetucknee System.

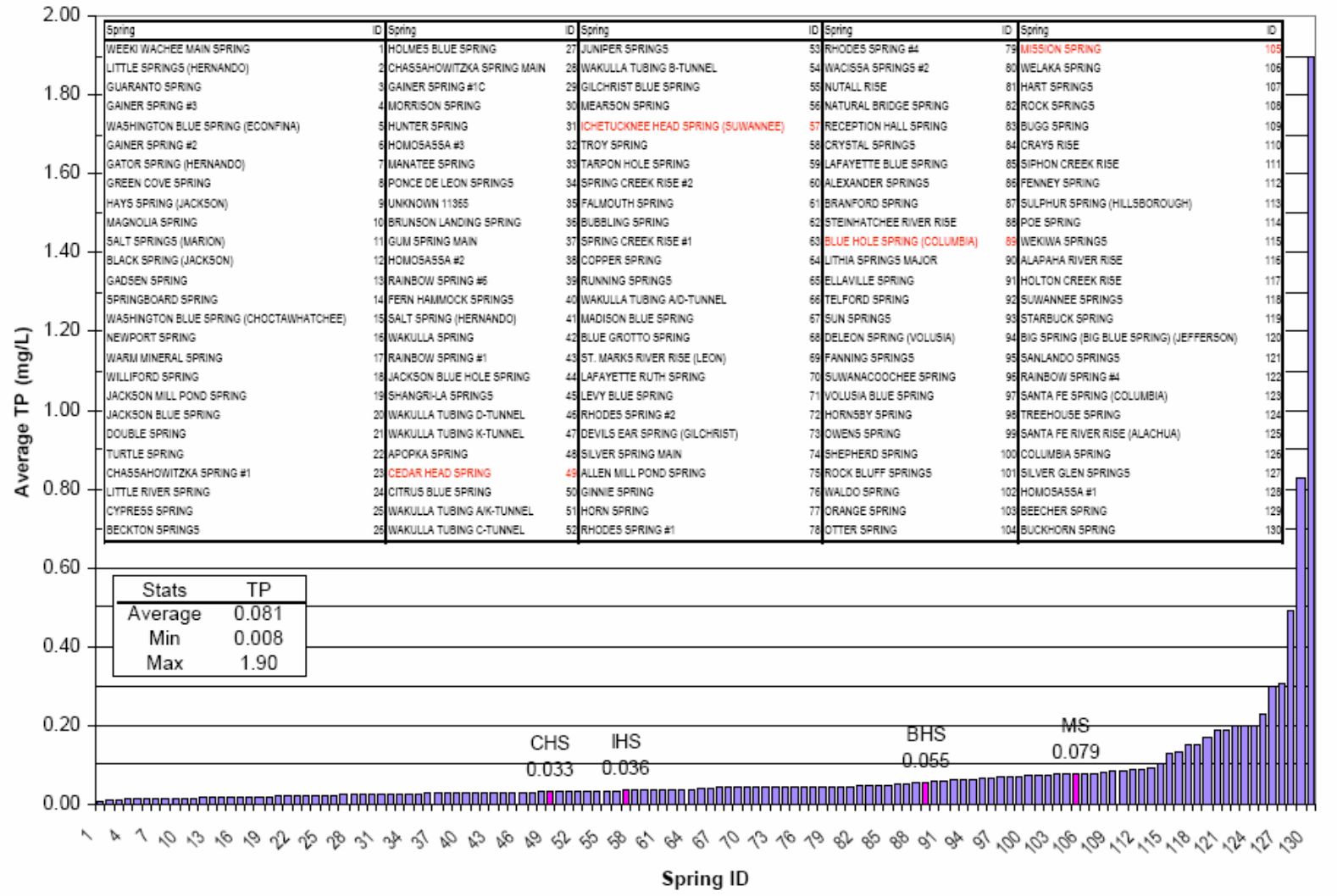


FIGURE 14
Average TP concentration for representative Florida springs and for key springs in the Ichetucknee System.

During site reconnaissance of the Ichetucknee Springs System on Monday July 28, 2008 the northern reach of the Ichetucknee River and several of the springs feeding it were visited between 10:00 and 12:00 (**Figure 15**). Temperature along the sampling path gradually increased with distance downstream of spring vents (**Figure 16**). Specific conductance was approximately 300 µS/cm along the spring run, with variation noted around spring vents (**Figure 16**). Dissolved oxygen concentrations increased with distance downstream of spring vents (**Figure 16**). Field measured pH values from the spring run were less than 7.5 standard units (**Figure 16**). Trends in field parameters along the spring run were affected by feeder springs with variable inputs.

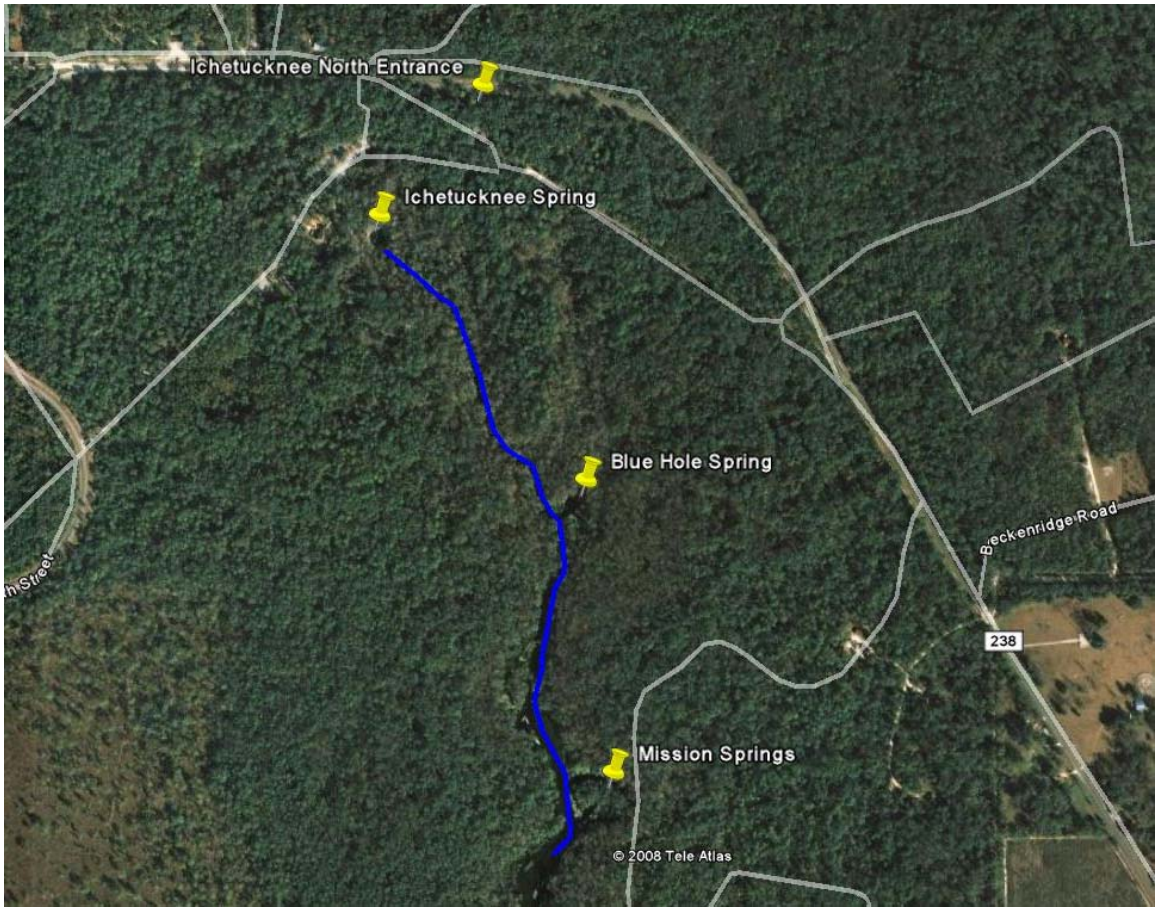
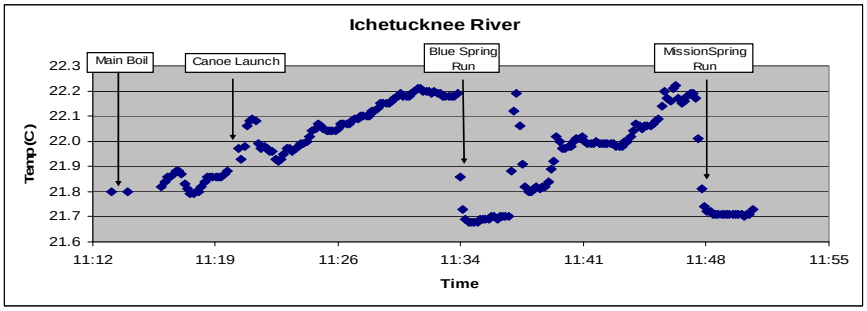
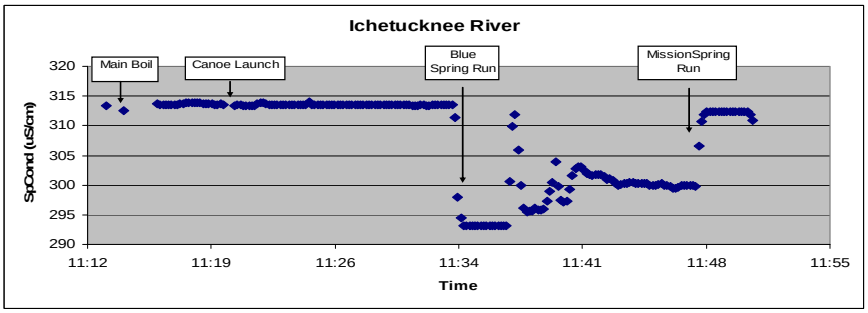
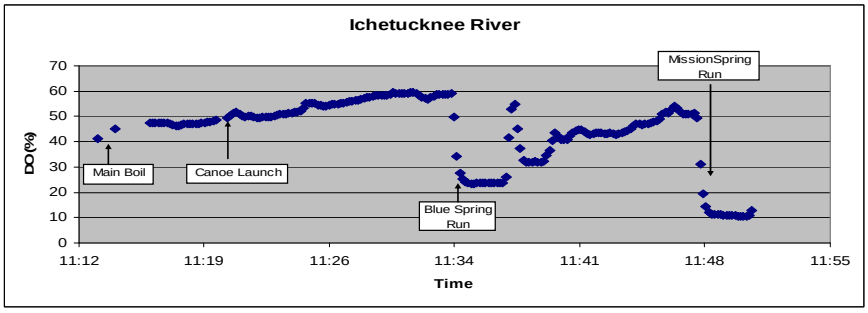
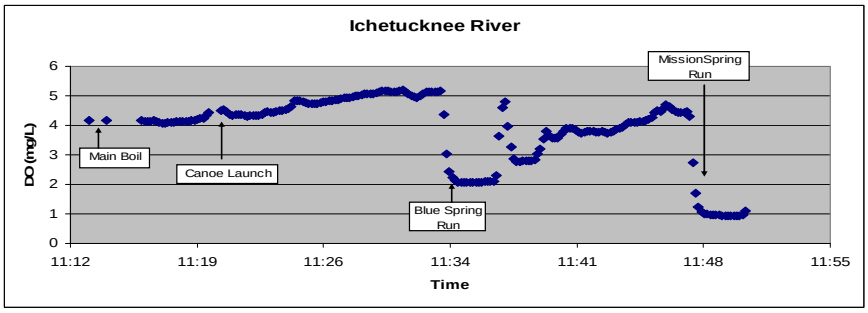


FIGURE 15
Image of Ichetucknee Springs with blue path indicating the reconnaissance sampling locations on July 28, 2008.









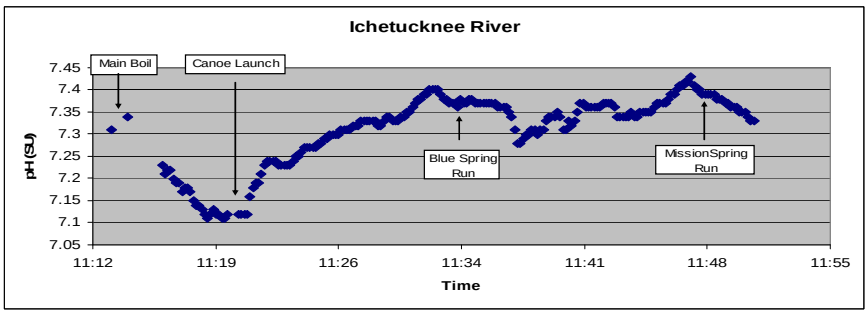


FIGURE 16
Field parameters by location and time for the Ichetucknee River on July 28, 2008.

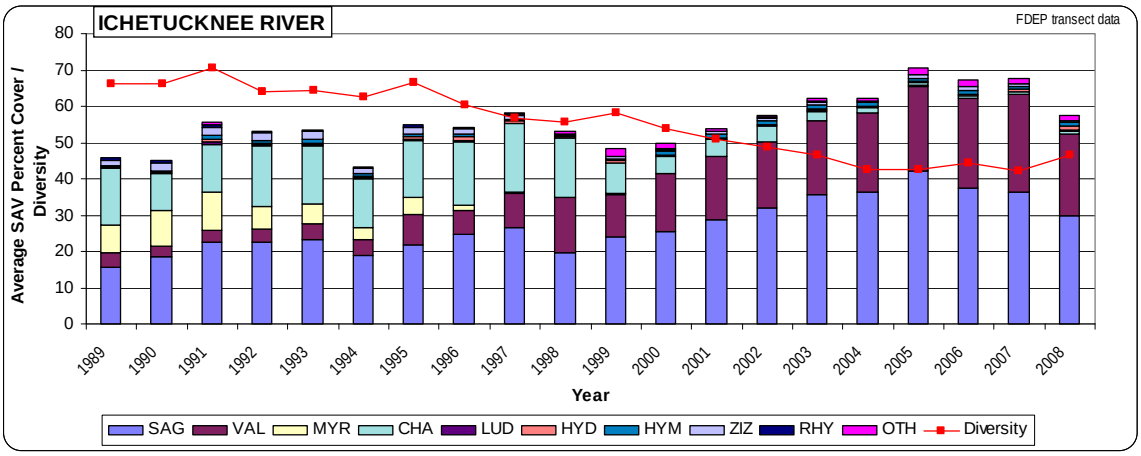
Biological

Vegetation

During a reconnaissance trip made on July 28, 2008, the submersed aquatic vegetation (SAV) of the upper 1 km (0.6 mi) of the spring run were qualitatively noted. In the Ichetucknee Spring (headspring), swimming and wading use are highest and contribute to largely un-vegetated quartz sand substrates, especially where depths allow wading. SAV was limited to small beds of red ludwigia (*Ludwigia repens*). Downstream of the swimming area, emergent and submersed aquatic vegetation include wild rice (*Zizania aquatica*), water hemlock (*Cicuta maculata*), water chestnut (*Trapa natans*), red ludwigia, and strap-leaf sagittaria (*Sagittaria kurziana*). Blue Hole Spring has substantially less recreation and corresponding higher levels of SAV, comprised almost exclusively of dense growths of strap-leaf sagittaria. Mission Springs run is closed to recreation and has correspondingly high abundance of strap-leaf sagittaria, however, the leaves of these plants are heavily covered in periphytic growths of what appear to be a variety of green algae, cyanobacteria, and possibly other photosynthetic bacteria (purple). The spring run has dense riparian vegetation, is narrowest downstream of the Ichetucknee Spring, widens and deepens after being joined by the Blue Hole Spring, and continues to increase in discharge as other springs feed into the river. SAV in the Ichetucknee River is dominated by strap-leaf sagittaria; other observed species in this section include wild rice, musk grass (*Chara sp.*), tape grass (*Vallisneria americana*), water chestnut, and red Ludwigia. In the river, filamentous algae are most abundant in lower velocity regions particularly adjacent to spring inputs. In shallow portions of the river, mid-stream exclusion of SAV was observed, presumably the result of recreational trampling.

The SAV of the Ichetucknee Springs System was first quantitatively sampled in 1977-78 as part of a Master's Thesis to determine the types and amount of recreational usage that the aquatic vegetation could sustain without irreversible damage (DuToit 1979). This study produced detailed maps of SAV, quantified loss rates of SAV based on recreation type, and examined fish and invertebrate change as well. This study helped to define the daily limits of recreational use for the Ichetucknee System.

Staff members of the ISSP perform a SAV survey at multiple transects (currently 17) along the Ichetucknee River twice a year, before and after the intensive summer recreation period. These surveys are designed to monitor SAV abundance in relation to recreational impacts and the results from 1989 to 2008 are shown in **Figure 17**. During this period-of-record, strap-leaf sagittaria and tape grass have become the dominant two species of SAV, while musk grass and overall SAV diversity appear to be declining.



SAG = *Sagittaria kurziana*
VAL = *Valisineria americana*
MYR = *Myriophyllum heterophyllum*
CHA = Chara (prob.) *zeylonica*
LUD = *Ludwigia repens*
HYD = *Hydrocotyle* (prob.) *umbellata*
HYM = *Hymenocallis rotata*
ZIZ = *Zizania aquatica*
RHY = *Rhynchospora sp* . or *Carex sp.*
OTH = Others

FIGURE 17
Average submersed aquatic vegetation (SAV) cover and diversity for Ichetucknee River (FDEP data).

A floristic inventory of the Ichetucknee Springs State Park, including the spring habitats, was conducted between 1991 and 1993 (Herring and Judd 1995). Plant communities were characterized by quantitative methods and general field observations and in total, 604 species of vascular plants and 60 species of bryophytes were collected (Herring and Judd 1995). SAV occurrence lists for Mission and Mill Pond Springs were produced by Woodruff (1993) as well.

The Ichetucknee River SAV was surveyed by Canfield and Hoyer (1988) as part of a 17 Florida stream study to examine relationships between aquatic macrophyte abundance and nutrient enrichment. Mean aquatic macrophyte standing stock in the Ichetucknee River was reported to be 3.6 kg fresh weight/m^2 with a range of seasonal values from 2.5 to 4.7 kg/m^2. Canfield and Hoyer (1988) observed that macrophyte abundance was significantly negatively correlated with canopy coverage (positively correlated with light availability), was not correlated with nitrogen or phosphorus availability, and substrate type, water depth, and current velocity were all found to affect aquatic macrophyte abundance. The authors also measured nutrient export rates and macrophyte tissue nutrient levels in the Ichetucknee River. These calculations indicated that only 0.7 to 0.8% of the annual nitrogen load in the water column would provide the entire nitrogen content of SAV standing stock. Based on these calculations, the authors concluded that most aquatic macrophytes are dependent upon nutrient uptake through their roots and that further reducing nutrient concentrations in the surface water would not result in a concomitant reduction in macrophyte biomass (Canfield and Hoyer 1988).

The most detailed modern study of the Ichetucknee SAV community was conducted in 2003 and 2004 by Kurz *et al*. (2004). During both survey years, the Ichetucknee System was dominated by the following species of submersed and emergent aquatic vegetation: strap-leaf sagittaria (*Sagittaria kurziana*), wild rice (*Zizania aquatica*), tape grass (*Vallisneria americana*), musk grass (*Chara sp*.), milfoil (*Myriophyllum heterophyllum*), red ludwigia (*Ludwigia repens*), and pennywort (*Hydrocotyle sp*., **Figure 18**). In 2003, approximately 78% of the Ichetucknee River bottom surface area is covered by SAV and in 2004 the estimated amount was 2 % less. Based on a comparison to the 1979 study by DuToit (1979), SAV coverage has increased by 9.3 ha (23 ac) or 353% in a 24 year period. The authors reported that both on a long-term basis and based on summer declines during the peak recreational season, observations indicate that control of recreational use is a key factor in SAV abundance in the Ichetucknee River and that recreational impacts on SAV abundance are especially acute during low water level conditions caused by long-term drought conditions Kurz *et al*. (2004).

Above ground SAV biomass in the Ichetucknee River was measured at 31 transects and found to average about 4.6 kg wet weight/m^2 (range 2.4 to 8.0 kg/m^2) and SAV biomass generally increased with distance downstream, while periphyton (epiphytic algae) populations were greater in areas downstream of feeder springs Kurz *et al*. (2004).

Maps of the Ichetucknee River SAV community were produced for 2003, with portions re-mapped in 2004, and a change analysis between years (see **Figure 19**). Maps by reach were also produced for depth, flow, and riparian shading.

The impact of periphyton abundance on SAV growth was investigated by Politano (2008); who hypothesized that low dissolved oxygen concentrations near spring vents

lowers the abundance of primary grazers and, consequently, macrophytes in these areas of low stream velocity accumulate more periphyton and grow more slowly than vegetation in more oxygenated, swiftly flowing portions of the Ichetucknee Springs System. Following characterization of the abiotic environment and the macrophyte community of the Ichetucknee Springs System did support the proposed pattern. A four-week translocation experiment was carried out where strap-leaf sagittaria (*Sagittaria kurziana*), were relocated to several river and spring locations to evaluate site specific differences in the rate of periphyton accumulation and potential effects on macrophyte growth. Periphyton accumulation was enhanced in feeder spring areas, however, there were no detectable effects on macrophyte growth probably due to the short duration of the study (Politano 2008).

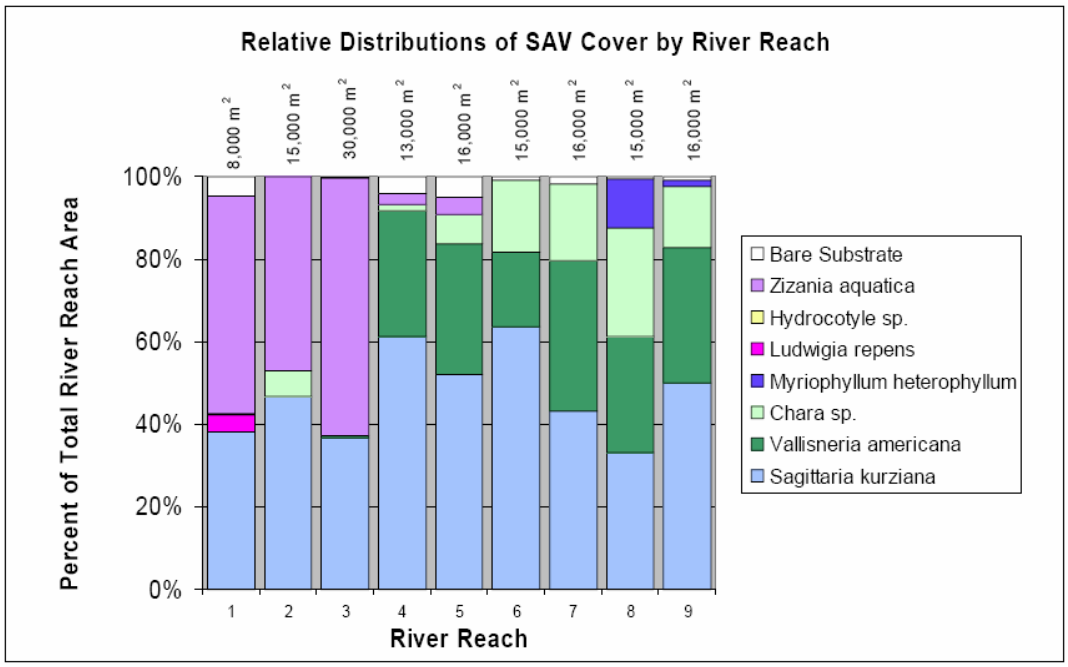


FIGURE 18
Percent of total river area (m^2) by river reach and plant species (from Kurz *et al.* 2004).

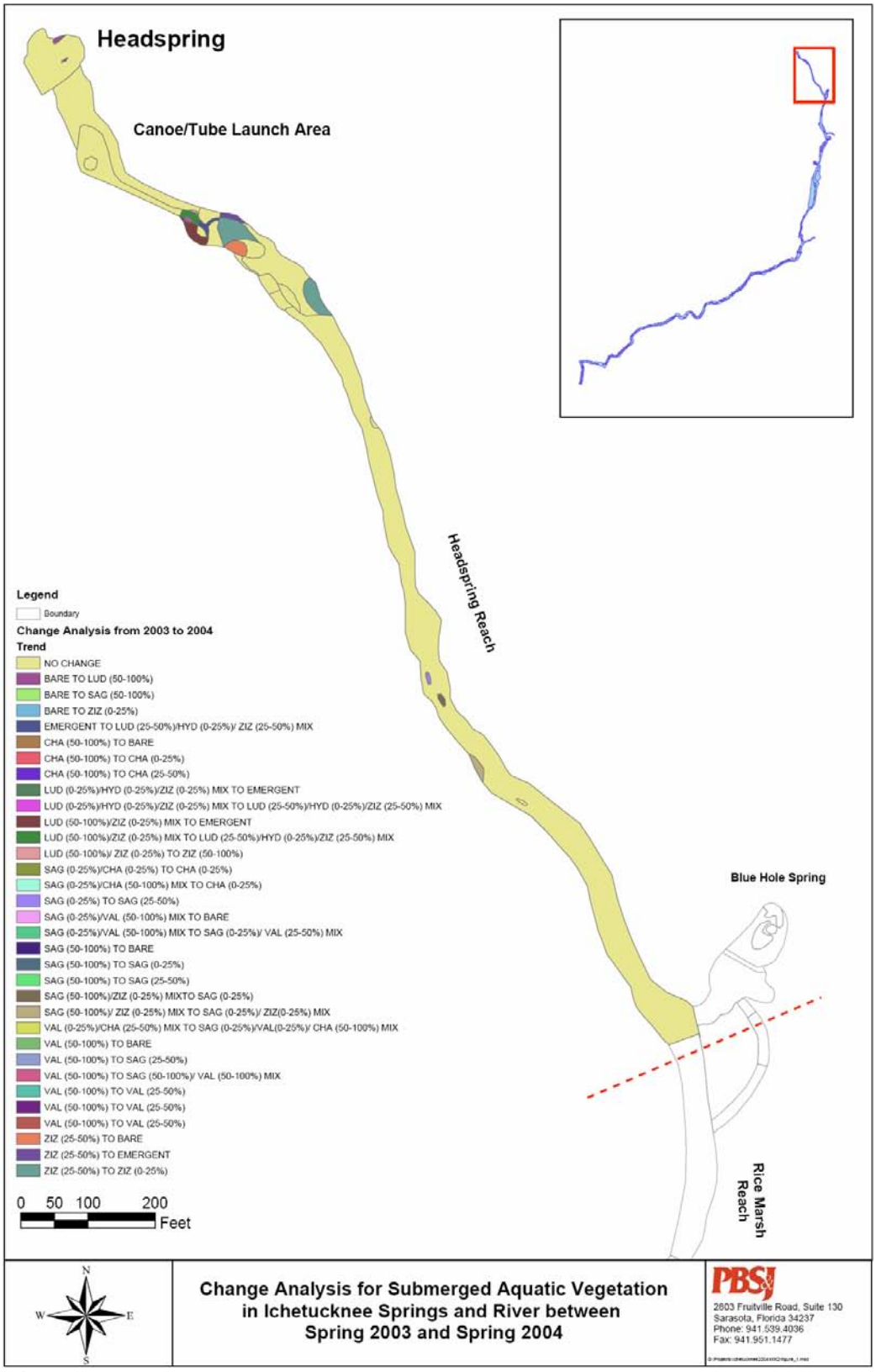


FIGURE 19
Change analysis between 2003 and 2004 for aquatic vegetation in Ichetucknee River (from Kurz *et al.* 2004).

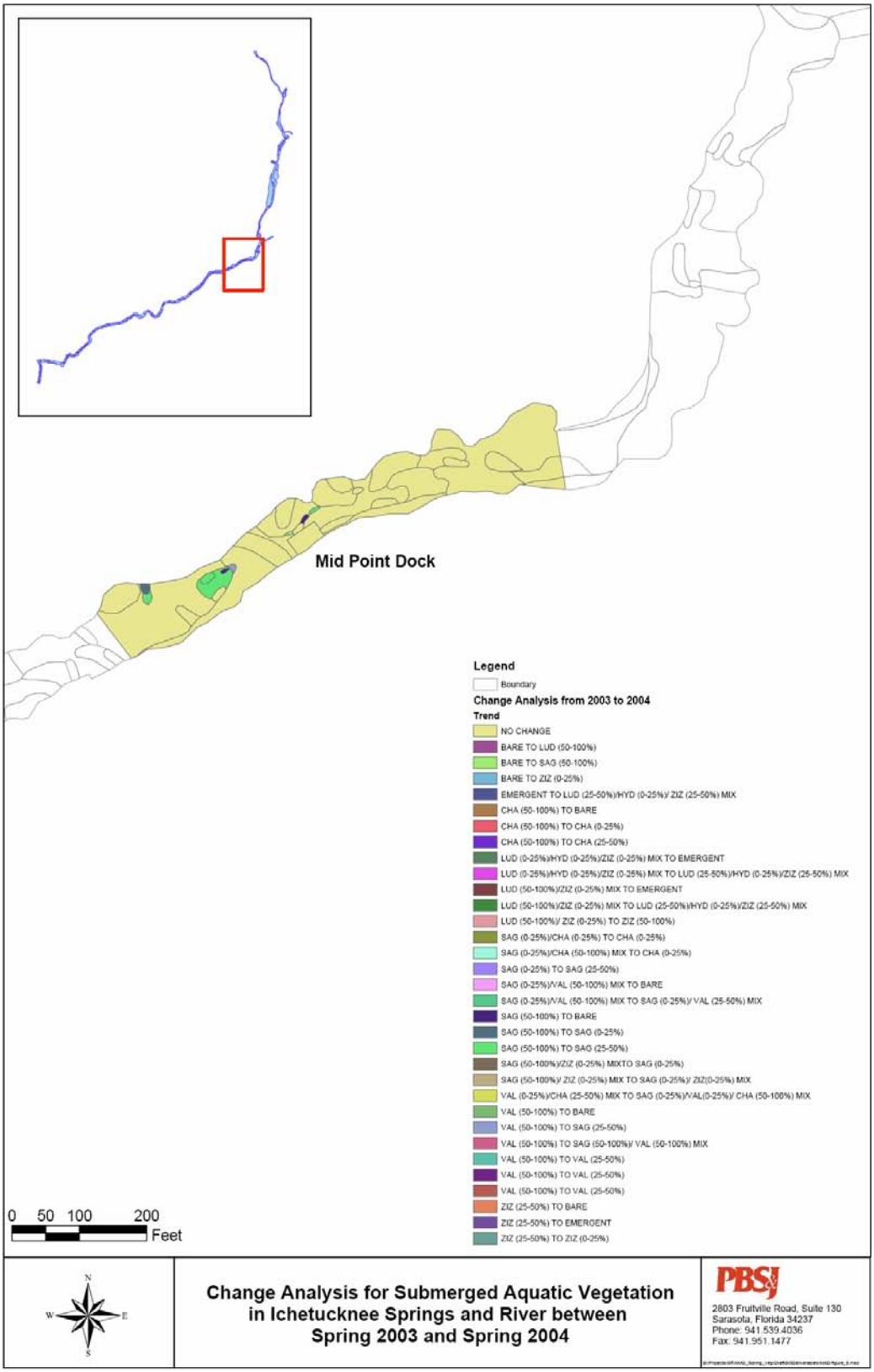


FIGURE 19 (CONTINUED)
Change analysis between 2003 and 2004 for aquatic vegetation in Ichetucknee River (from Kurz *et al.* 2004).

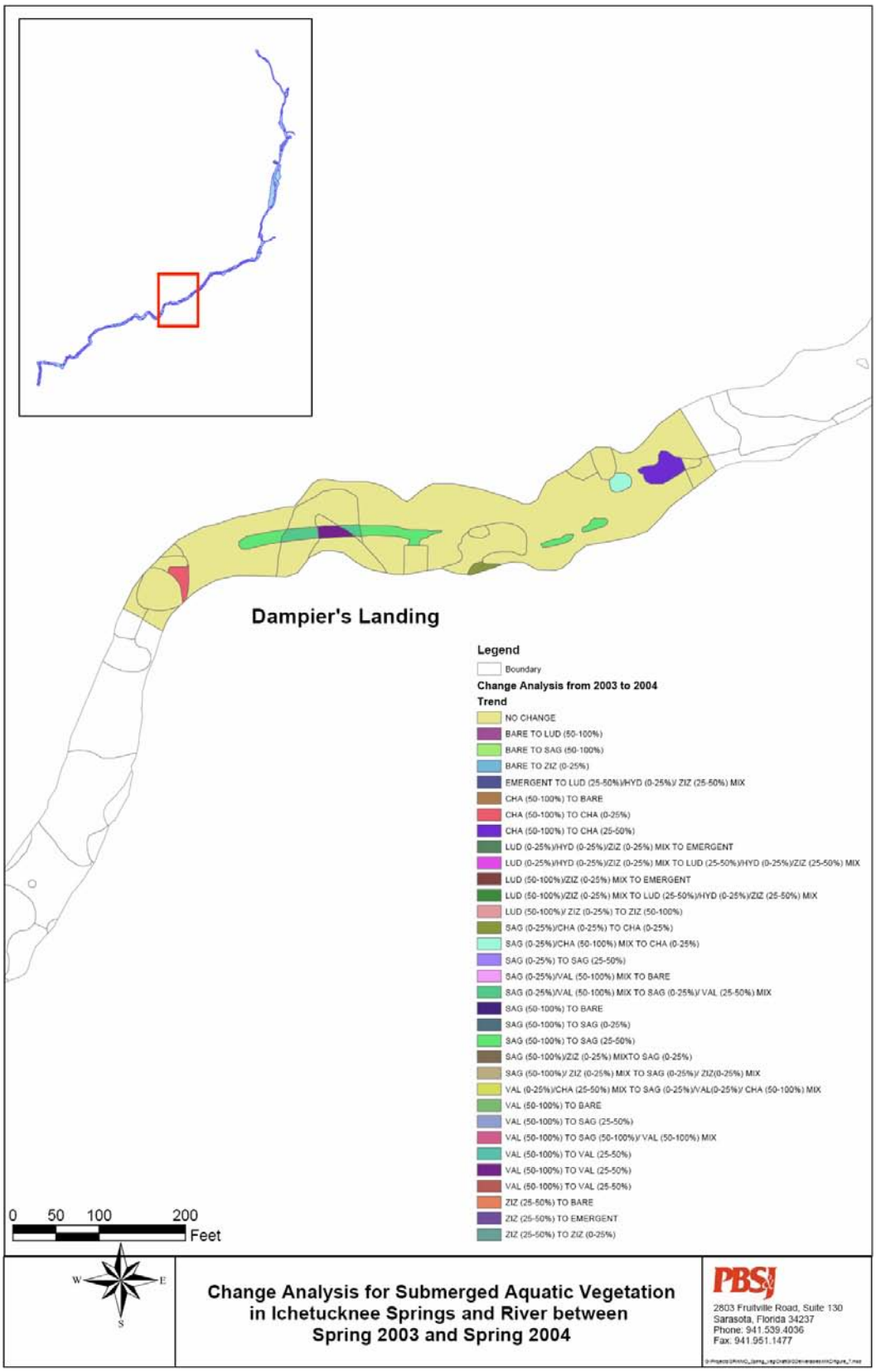


FIGURE 19 (CONTINUED)
Change analysis between 2003 and 2004 for aquatic vegetation in Ichetucknee River (from Kurz *et al.* 2004).

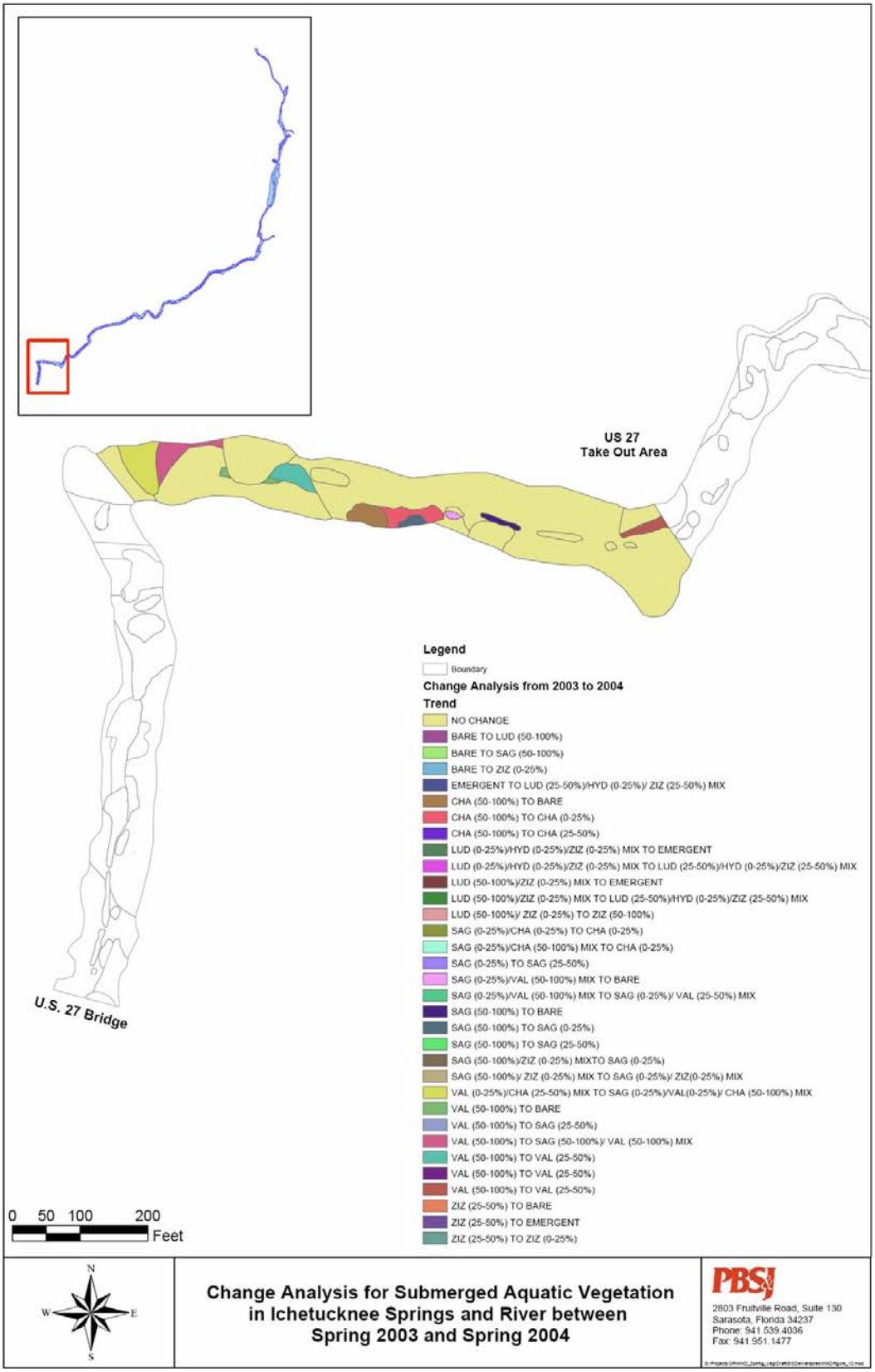


FIGURE 19 (CONTINUED)
Change analysis between 2003 and 2004 for aquatic vegetation in Ichetucknee River (from Kurz *et al.* 2004).

The filamentous algae community of Ichetucknee Springs System was surveyed by Stevenson *et al.* (2007) at eight stations including a monthly time series from May 2005 to April 2006 (**Figure 20**). Results of this survey reveal that macroalgae abundance can vary widely and the authors noted that *Lyngbya* was the most common filamentous algae species (Stevenson *et al.* 2007).

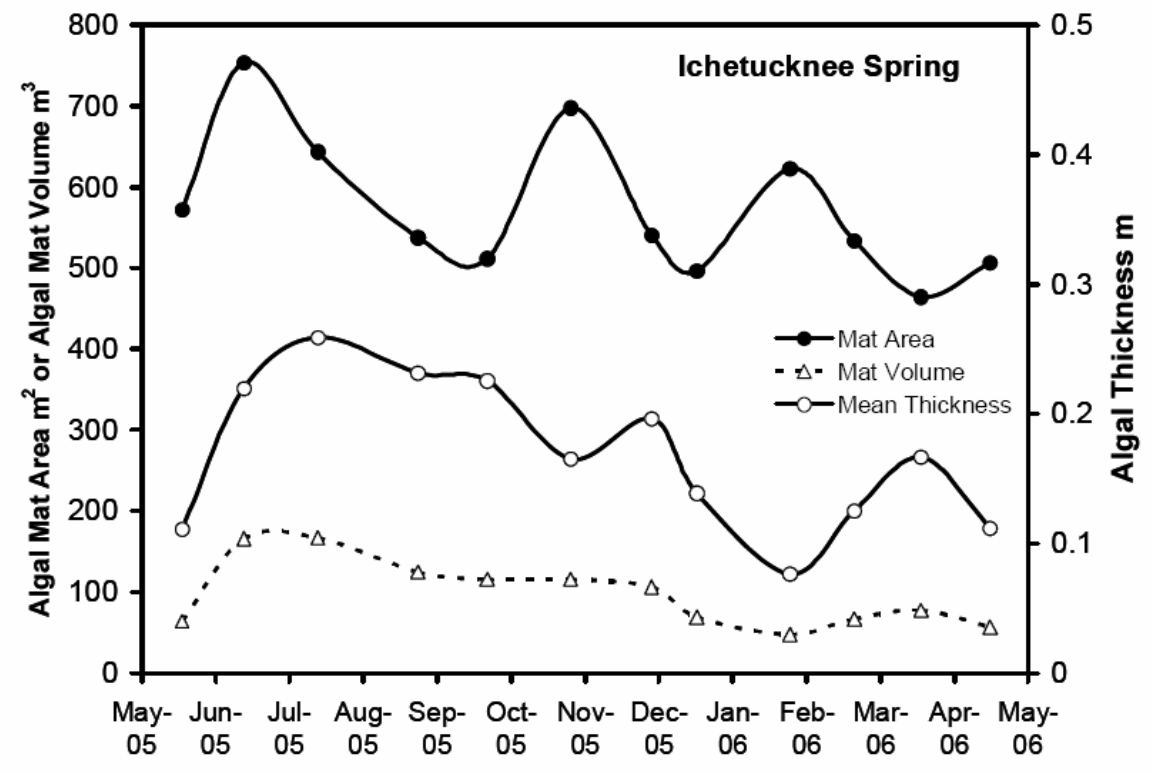


FIGURE 20
Variation in area and thickness of spring bottom covered by Lyngbya-dominated algae (Stevenson *et al.* 2007).

Epiphytic growth on SAV (*i.e.*, periphyton) has been studied by different researchers. Kurz et al. (2004), Steigerwalt (2005), Dormsjo (2008), and Politano (2008) all note periphyton abundance. Among these researchers, higher periphyton abundance was typically noted within the feeder spring pool and run. The differences were attributed to lower dissolved oxygen concentrations, lower stream velocities, and reduced grazer abundance in the feeder springs relative to the Ichetucknee River (Politano 2008).

Non-indigenous aquatic plants in the Ichetucknee Springs System appear to be limited to water lettuce (*Pistia stratiotes*). Currently, water lettuce abundance within the ISSP is minimal, entirely due to hand-removal efforts of volunteers and park staff. Between September 2000 and May 2008, volunteers and staff removed approximately 59 acres of water lettuce (FDEP 2008a). Commonly occurring in other spring systems, hydrilla (*Hydrilla verticillata*) and Eurasian milfoil (*Myriophyllum spicatum*) have not been introduced to the Ichetucknee Springs System, probably because of the lack of power boat introductions.

Sediments

The sediments of the Ichetucknee River were semi-quantitatively characterized in 2003 and 2004 as part of aquatic vegetation monitoring by Kurz *et al.* (2004, **Figure 21**). In 2003, the sediment type "mud" was most common, with "sand" being the next most common. In 2004, the category "sand" had replaced "mud" as the most common. Both of these sediment types are conducive to SAV colonization and growth.

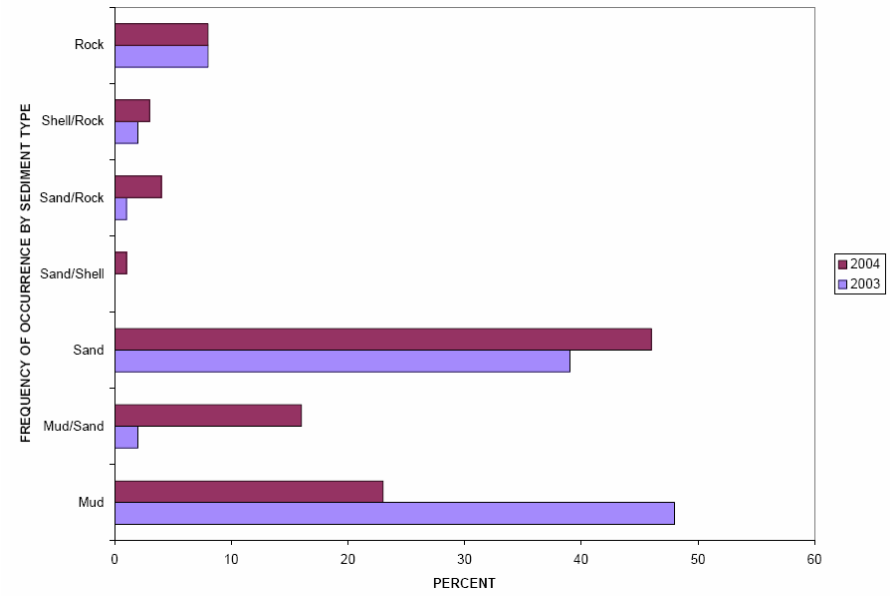


FIGURE 21
Frequency of occurrence of sediment types for the Ichetucknee River (from Kurz *et al.* 2004).

Macroinvertebrates

The Florida Department of Environmental Protection (FDEP) has been conducting investigations of macroinvertebrate populations (bioassessments) and multiple chemical and biological measures (EcoSummaries) in the Ichetucknee River as early as 1975 (FDEP 1997, 2000b, 2001a, 2001b, 2002a, 2002b, 2002c, 2003a, 2003b, 2003c, 2003d, 2004a, 2004b, 2004c, 2004d, 2005, 2006a, 2006b, 2006c, 2007a, 2007b, 2007c, and 2007d). The 1997 report concluded that overall stream health had improved during the POR since 1975, possibly due to improved management of the resource through control of recreational use. A 2008 report summarized EcoSummary data from 2000 and later, noting habitat assessment was consistently optimal, total number of invertebrate taxa ranged from 15 to 43, number of sensitive taxa ranged from one to six, and Stream Condition Index (SCI) scores were typically in the healthy range (prior to June 2004 SCI > 21 is healthy, after June 2004 re-calibration SCI > 34 is healthy, **Figure 22**, FDEP 2008b).

SAV-associated macroinvertebrate sampling was conducted throughout the Ichetucknee River concurrently with the SAV mapping effort of Kurz *et al*. (2004). Macroinvertebrates were sampled at 31, evenly distributed stations along the Ichetucknee River, beginning at the headsprings down to the US 27 bridge. Samples were collected from the leaves of SAV and a total of 47 species of aquatic macroinvertebrates were identified in the Ichetucknee River. Chironomids (midges) dominated the macroinvertebrate community (92% of the individual organisms), followed by Hydracarina (4.3%), Petrophilla (1.2%), Hydroptila (0.7%), and Oxyethira (0.5%). Macroinvertebrate density and species richness were both correlated with periphyton biomass but not correlated with flow velocity, SAV species, or SAV biomass.

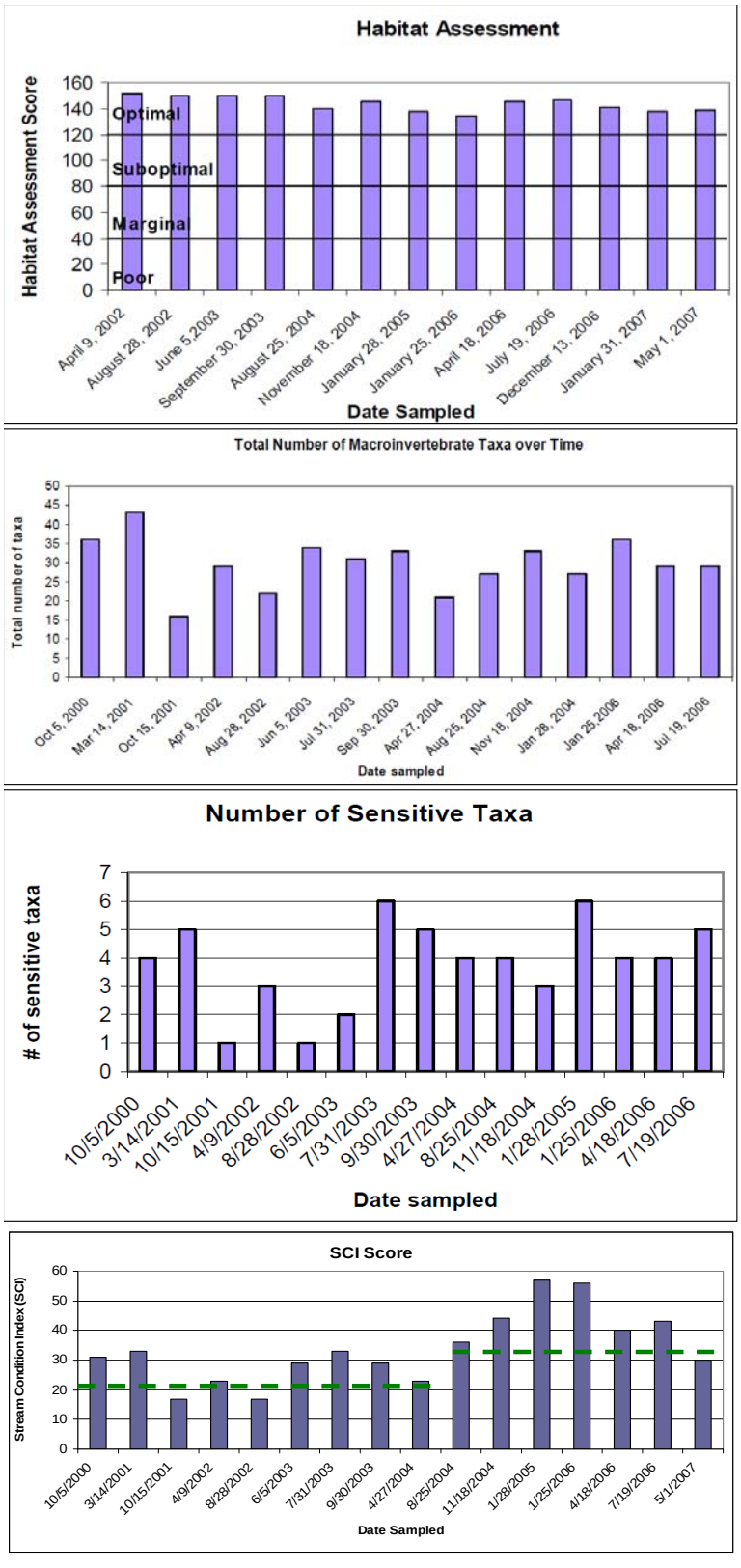


FIGURE 22
Time series of habitat assessment scores, total number of aquatic macroinvertebrate taxa, total number of sensitive taxa, and stream condition index scores for Ichetucknee Springs (FDEP 2008b).

Several major springs as well as the river near US27 were sampled for crustaceans on May 22, 2002 by staff from the Florida Museum of Natural History (Franz 2002). Crustaceans collected were the freshwater shrimp (*Palaemonetes paludosa*), amphipods (*Hyalella sp*. and *Gammarus* sp.), and crayfish *(Cambarellus schmitti, Procambarus paeninsulanus,* and *P. spiculifer*). Woodruff (1993) made crustacean collections at Mill Pond and Mission Springs, reporting amphipods (*Crangonyx* and *Hyalella* sp.), isopods (*Asellus* sp.), and decapods (*Palaemonetes paludosa* and *Procambarus spiculifer*).

Walsh and Williams (2003) sampled for bivalves in the upper, middle, and lower reaches of the spring run which resulted in the collection of a total of seven mussel species (**Table 4**), including dead valves of the non-indigenous Asian clam (*Corbicula fluminea*). The most abundant native unionid mussel was the variable spike (*Elliptio icterina*) and all other species were relatively rare. The authors speculated that the very low overall mussel abundance in the park may be due to unsuitable substrate. Upstream areas of the Ichetucknee River generally have hard rock or rubble bottom overlain by sand or silt, and downstream areas where the riparian canopy is heavily shaded have a substrate that is dominated by soft, flocculent organic detritus; neither of which substrates provide the ideal habitat for mussels (Walsh and Williams 2003).

TABLE 4
The number and percent of mussels collected from the Ichetucknee River (from Walsh and Williams 2003).

Species	Common Name	N	%
Corbicula fluminea	Asian clam	>1	>0.8
Elliptio icterina	variable spike	91	77.1
Toxolasma paulus	iridescent lilliput	9	7.6
Uniomerus carolinianus	Florida pondhorn	1	0.8
Villosa vibex	southern rainbow	5	4.2
Villosa villosa	downy rainbow	5	4.2
Villosa lienosa	little spectaclecase	6	5.1
	Total number of specimens	**118**	

Steigerwalt (2005) reported on the effects of current velocity and other environmental factors on the distribution, abundance, and diversity of populations of aquatic macroinvertebrates in the Ichetucknee River above US 27 and within the confines of the ISSP. Macroinvertebrate populations on submerged woody debris (snags) were collected from three river segments: the headspring reach, the rice marsh reach, and the floodplain reach (**Table 5**). Snags were sampled along a gradient of current velocities and their macroinvertebrate populations were removed by scraping. Average species richness was similar between reaches (29 to 36 species per sample) and species richness was also similar between reaches (0.69 to 0.77), with the resulting macroinvertebrate species diversity averaged 3.61 over the entire study area and varied only slightly between reaches (3.48 to 3.72, **Table 6**). The abundance and species diversity of aquatic macroinvertebrates on woody snags was found to increase with distance downstream. Statistical analyses indicated that overall macroinvertebrate density could be predicted based on epiphyton biomass, dissolved oxygen, and canopy cover. Current velocity was also important for explaining the biomass of some macroinvertebrate groups, especially the stoneflies (Trichoptera) and the mayflies (Ephemeroptera). Steigerwalt (2005) concluded that current velocity may be most important to spring run macroinvertebrate fauna due to its effects on replenishing dissolved oxygen in areas of low concentrations (near spring boils).

Steigerwalt (2005) observed that invertebrates most likely to be affected by reductions in current velocity include filterers and species with high dissolved oxygen preferences. Maintaining current velocities at levels that support more sensitive species provides for maintenance of existing invertebrate communities.

TABLE 5
Mean densities (#/m²) and coefficients of variation (cv) of major groups of invertebrates associated with snags within the Ichetucknee River during Spring 2004 (from Steigerwalt 2005). Dominant taxa (>5% relative abundance) are marked in bold, dash indicates taxon not collected and reaches with the same letter are not significantly different (Kruskal-Wallis test with Dunn's multiple comparison).

		Reach		
	Study Area mean (cv) n=24	Headspring mean (cv) n=6	Ricemarsh mean (cv) n=7	Floodplain mean (cv) n=11
Hydrozoa	1 (3.39)	——— [a]	2 [a] (2.65)	1 [a] (3.32)
Turbellaria	120 (3.02)	4 [a] (2.45)	326 [a] (1.93)	52 [a] (2.79)
Nemertea	107 (1.60)	112 [a] (1.12)	166 [a] (1.64)	66 [a] (1.53)
Tardigrada	35 (4.26)	——— [a]	121 [b] (2.26)	——— [a]
Nematoda	137 (1.17)	90 [a] (1.22)	205 [a] (0.84)	119 [a] (1.47)
Aphanoneura	1 (4.90)	——— [a]	5 [a] (2.65)	——— [a]
Oligochaeta	664 (1.94)	661 [a] (0.82)	1240 [a] (1.84)	298 [a] (1.40)
Hirudinia	61 (4.90)	——— [a]	210 [a] (2.65)	——— [a]
Gastropoda	682 (3.34)	18 [a] (1.16)	**2030 [b] (2.00)**	186 [a] (2.53)
Amphipoda	**3470 (2.05)**	450 [a] (1.20)	**11000 [b] (0.91)**	337 [a] (2.16)
Isopoda	52 (4.20)	3 [a] (2.45)	176 [a] (2.25)	——— [a]
Aquatic Acari	**2230 (1.20)**	**1450 [a] (0.55)**	**2590 [a] (0.64)**	2420 [a] (1.54)
Collembola	2 (4.90)	——— [a]	6 [a] (2.65)	——— [a]
Ephemeroptera	413 (0.99)	139 [a] (1.21)	397 [b] (0.48)	574 [b] (0.92)
Anisoptera	1 (4.90)	——— [a]	——— [a]	1 [a] (3.32)
Zygoptera	8 (2.89)	——— [a]	12 [a] (1.43)	9 [a] (3.32)
Hemiptera	2 (3.66)	2 [a] (2.45)	5 [a] (2.65)	——— [a]
Megaloptera	2 (3.75)	——— [a]	——— [a]	4 [a] (2.49)
Trichoptera	**13300 (1.94)**	**3360 [a] (0.34)**	**5770 [ab] (0.82)**	**23400 [b] (1.53)**
Lepidoptera	56 (1.40)	91 [a] (0.71)	4 [b] (2.65)	71 [a] (1.35)
Coleoptera	292 (2.39)	53 [a] (2.32)	19 [a] (1.84)	597 [b] (1.61)
Ceratopogonidae	506 (3.52)	88 [ab] (1.19)	1620 [a] (1.97)	28 [b] (1.75)
Chironomidae	**17700 (2.01)**	**8730 [ab] (0.49)**	**6950 [a] (0.39)**	**29500 [b] (1.74)**
Empididae	665 (0.80)	417 [a] (0.61)	303 [a] (1.22)	1030 [b] (0.50)
Ephydridae	2 (4.90)	——— [a]	——— [a]	5 [a] (3.32)
Simuliidae	31 (2.63)	19 [a] (2.45)	——— [a]	56 [a] (1.97)
Stratiomyidae	1 (4.90)	——— [a]	2 (2.65)	——— [a]

TABLE 6
Means and coefficients of variation (cv) of total invertebrates and selected descriptors of invertebrate community quality associated with snags within the Ichetucknee River during Spring 2004 (from Steigerwalt 2005). Reaches with the same letter are not significantly different (Kruskal-Wallis test with Dunn's multiple comparison).

		Reach		
	Study Area mean (cv) n=24	Headspring mean (cv) n=6	Ricemarsh mean (cv) n=7	Floodplain mean (cv) n=11
Total Invertebrates (#/m^2)	40500 (1.56)	15700 [a] (0.34)	33100 [b] (0.52)	58800 [b] (1.54)
Taxa Richness	33 (0.19)	29 [a] (0.10)	33 [a] (0.14)	36 [a] (0.22)
Evenness	0.72 (0.09)	0.77 [a] (0.06)	0.69 [a] (0.09)	0.71 [a] (0.10)
Diversity	3.61 (0.08)	3.72 [a] (0.07)	3.48 [a] (0.08)	3.64 [a] (0.09)

Gastropod utilization of the Ichetucknee was studied by Dormsjo (2008) who investigated the hypothesis that reduced grazer abundances near spring vents results in reduced grazing pressure and facilitates proliferation of periphyton in these low dissolved oxygen areas. Among gastropods (>300 µm) within the Ichetucknee River and Singing, Devil's, and Mill Pond Springs, Dormsjo (2008) found *Elimia floridensis* most common in the river and *Planorbella scalaris* most common in the springs (**Table 7**).

Dormsjo (2008) then carried out a manipulative experiment involving *Elimia floridensis* and their ability to graze epiphytic algal growths on glass Petri dishes. Although these gastropods were able to reduce the rate of periphyton accumulation relative to controls; in the feeder springs snails suffered substantial mortality (~50%) and were not able to significantly reduce periphyton relative to controls. These finding suggest that the absence of top-down controls, such as grazing, may be responsible for the higher amounts of periphyton and macroalgae observed in the feeder springs of the Ichetucknee Springs System (and other Florida springs ecosystems).

TABLE 7
Listing of gastropod species (with total number of individuals and percent of total abundance) within the Ichetucknee River and Singing, Devil's Eye, and Mill Pond Springs (from Dormsjo 2008).

Location	Species	Total Number of Individuals	% of Total Abundance
River	*Elimia floridensis*	251	85.7
	Pomacea paludosa	8	2.7
	Lioplax pilsbryi	2	0.7
	Notogillia wetherbyi	29	9.9
	Hydrobiidae	0	0.0
	Planorbella scalaris	1	0.3
	Tarebia granifera	2	0.7
Spring	*Elimia floridensis*	27	9.7
	Pomacea paludosa	0	0.0
	Lioplax pilsbryi	0	0.0
	Notogillia wetherbyi	10	3.6
	Hydrobiidae	13	4.7
	Planorbella scalaris	227	81.9
	Tarebia granifera	0	0.0

Macro fauna

A variety of aquatic turtle species are found in the Ichetucknee Springs System and multiple researchers have published their findings, including: Marchand (1942) who made the earliest scientific observations of the Ichetucknee aquatic turtle community, Iverson (1977) for geographic variation of loggerhead musk turtles (*Sternotherus minor*), Iverson (1978) for study of the reproductive cycle of female loggerhead musk turtles (*S. minor*), and Meylan and Chapin (2008) who documented the turtle fauna as it existed in 2007 and tested the hypothesis that turtle numbers have declined in Ichetucknee Springs State Park since biologists began making observations there 70 years ago.

Meylan and Chapin's (2008) comprehensive study of Ichetucknee River turtles was conducted over four days in March and October 2007. These four sampling events resulted in capture of 535 turtles of seven species (**Table 8**). Loggerhead musk turtles (*Sternotherus minor*) were the most frequently captured species followed by Suwannee cooters (*Pseudemys concinna*), yellow-bellied sliders (*Trachemys scripta*), common musk

turtles (*S. odoratus*), Florida red-bellied turtles (*P. nelsoni*), common snapping turtles (*Chelydra serpentina*), and Florida softshell (*Apalone ferox*).

In the Meylan and Chapin (2008) study, a total of 392 different individual turtles (> 55 mm carapace length) were tagged with uniquely numbered PIT tags allowing population estimates to be made for the most abundant species (**Table 9**). Mark-recapture efforts by Meylan and Chapin (2008) produced an estimate of approximately 11,700 (± 6,600) loggerhead musk turtles (*S. minor*), 141 (± 70) yellow-bellied slider (*T. scripta*), 137 (± 47) Suwannee cooter (*P. concinna*), and 104 (± 59) common musk turtle (*S. odoratus*). Less common species of aquatic turtle were not recaptured in sufficient numbers to estimate their populations. However, capture data indicate that at least 19 individual common musk turtles (*S. odoratus*), four individual snapping turtles (*C. serpentina*), and one Florida softshell turtle (A. ferox) were found in the Ichetucknee River during sampling. Because nearly 400 turtles have been marked with PIT tags, future population studies have a substantial amount of demographic data to expand upon.

TABLE 8
Mark-recapture data for turtles encountered during four sampling sessions at Ichetucknee Springs State Park in March and October 2007 (from Meylan and Chapin 2008).

Species	total number captured 03/22/07	number marked 03/22/07	total number captured 03/23/07	number of recaptures 03/23/07	number of new marks 03/23/07	total marks available after 03/23/07	total number captured 10/29/07	number of recaptures 10/29/07	number marked 10/29/07	total number captured 10/30/07	number of recaptures 10/30/07	number of new marks 10/30/07	total marks available after 10/30/07
Florida softshell *Apalone ferox*	0	0	0	0	0	0	0	0	0	1	0	1	1
loggerhead musk turtle [1] *Sternotherus minor*	43	39	65	0	45	84	70	1	44	141	1	94	222
common musk turtle *Sternotherus odoratus*	3	3	5	0	5	8	2	0	2	11	1	9	19
yellow-bellied slider *Trachemys scripta*	15	15	15	1	14	29	17	5	12	22	3	19	60
Suwannee cooter *Pseudemys concinna*	44	43	33	10	23	66	13	7	6	17	9	8	79
red-bellied cooter *Pseudemys nelsoni*	1	1	2	1	1	2	1	1	0	1	0	1	3
snapping turtle *Chelydra serpentina*	1	1	1	0	1	2	1	0	1	1	0	1	4
Totals	**114**		**123**			**194**	**104**			**194**			**392**

[1] > 55 mm carapace length

TABLE 9
Population estimates for the four most common aquatic turtles captured in the Ichetucknee River (from Meylan and Chapin 2008).

Species	individuals marked on 22 March	recaptures made on 23 March	total captures on 23 March	Population Estimate	95% CI	individuals marked on 29 October	recaptures made on 30 October	total captures on 30 October	Population Estimate	95% CI	individuals marked on 22 and 23 March	recaptures made on 29 and 30 October	total captures on 29 and 30 October	Population Estimate	95% CI
S. minor [1]	39	0	45	*n/a*	*n/a*	45	1	94	4,230	2,393	84	1	139	11,676	6,606
S. odoratus	3	0	5	*n/a*	*n/a*	2	0	10	*n/a*	*n/a*	8	1	13	104	59
P. concinna	43	10	33	142	62	13	3	17	74	45	66	13	27	137	47
T. scripta	15	1	15	225	127	17	0	22	*n/a*	*n/a*	29	8	39	141	70

[1] > 55 mm carapace length

During the July 2008 reconnaissance of the Ichetucknee Springs System numerous fish were observed in the river including: several varieties of sunfish (*Lepomis* sp.), Suwannee (*Micropterus notius*) and largemouth bass (*M. salmoides*), lake chubsucker (*Erimyzon sucetta*), shiners (Cyprinidae), and stripped mullet (*Mugil cephalus*).

Aspects of the Ichetucknee Springs System fish community have been sampled as part of several University of Florida theses. Woodruff (1993) produced a species list for Mill Pond and Mission Springs with 6 and 5 species, respectively.

A study by Bayster (1996) examined the distribution and relative abundance of fish along a dissolved oxygen gradient in Mission Springs and the behavioral and physiological response of the dominant species, eastern mosquitofish (*Gambusia holbrooki*), to the hypoxic conditions. A combination of field studies to quantify seasonal and spatial variation in dissolved oxygen and fish distribution in the spring run and laboratory studies on two groups of mosquitofish from different parts of the gradient were used to examine variation in behavioral and physiological traits related to oxygen uptake. Mosquitofish from both groups of the oxygen gradient used aquatic surface respiration, and although thresholds for aquatic surface respiration were lower in the fish from the boil, the metabolic rate and critical oxygen tension did not differ between the two groups (Bayster 1996). While the critical oxygen tension (which averaged 26.96 mm Hg) was higher than expected, the metabolic rates of both groups fell below the standard curve for freshwater and cyprinodontoid fishes and below the mean metabolic rate for other mosquitofish populations (Bayster 1996). It appears that the use of surface respiration and a low metabolic rate by mosquitofish facilitates their utilization of spring ecosystems with very low dissolved oxygen concentrations.

Walsh and Williams (2003) collected fish from the Ichetucknee River within the ISSP and also summarized the Florida Museum of Natural History (FLMNH) fish collections. Based on their review of museum data, a total of 31 species of 22 genera and 14 families of fishes had previously been collected. Utilizing electrofishing and seining techniques, Walsh and Williams (2003) collected a total of 28 species of 24 genera and 15 families from the Ichetucknee River upstream of US27. Walsh and Williams (2003) noted that fish biomass was dominated by suckers (lake chubsucker, *Erimyzon sucetta*, and spotted sucker, *Minytrema melanops*), sunfishes, and basses; and numerically dominated by redeye chub (*Notropis harperi*), mosquitofish (*Gambusia holbrooki*), bluefin killifish (*Lucania goodei*), least killifish (*Heterandria formosa*), and various sunfish (*Lepomis*) species. A listing of fish species for Ichetucknee Springs is provided **Table 10** (from Walsh and Williams 2003).

TABLE 10
Fishes collected in Ichetucknee Springs State Park (number of specimens and relative abundance), and material in the FLMNH ichthyologic collection (number of specimens and percent of material, from Walsh and Williams 2003).

Family	Species	USGS		FLMNH Material	
		N	Relative Abundance (%)	Specimens	%
Lepisosteidae	*Lepisosteus osseus**	>1	---	---	---
Amiidae	*Amia calva*	4	0.3	---	---
Anguillidae	*Anguilla rostrata*	1	0.1	3	0.2
Cyprinidae	*Notropis harperi*	587	44.9	843	48.6
	Notropis petersoni	1	0.1	31	1.8
	Pteronotropis hypselopterus	16	1.2	99	5.7
Catostomidae	*Erimyzon sucetta*	71	5.4	1	0.1
	Minytrema melanops	41	3.1	1	0.1
Ictaluridae	*Ameiurus natalis*	26	2.0	6	0.3
	Noturus gyrinus	2	0.2	30	1.7
	Noturus leptacanthus	---	---	4	0.2
Esocidae	*Esox americanus*	4	0.3	6	0.3
Aphredoderidae	*Aphredoderus sayanus*	4	0.3	16	0.9
Mugilidae	*Agonostomus monticola**	>1	---	---	---
	*Mugil cephalus**	>1	---	---	---
Belonidae	*Strongylura marina*	---	---	1	0.1
Fundulidae	*Fundulus escambiae*	1	0.1	6	0.3
	Fundulus seminolis	17	1.3	12	0.7
	Lucania goodei	78	6.0	204	11.8
Poeciliidae	*Gambusia holbrooki*	119	9.1	79	4.6
	Heterandria formosa	41	3.1	177	10.2
	Poecilia latipinna	48	3.7	48	2.8
Syngnathidae	*Syngnathus scovelli*	10	0.8	13	0.7
Centrarchidae	*Lepomis auritus*	68	5.2	13	0.7
	Lepomis gulosus	---	---	1	0.1
	Lepomis macrochirus	8	0.6	1	0.1
	Lepomis marginatus	1	0.1	---	---
	Lepomis microlophus	4	0.3	---	---
	Lepomis punctatus	87	6.7	17	1.0
	Micropterus notius	47	3.6	11	0.6
	Micropterus salmoides	17	1.3	5	0.3
	Pomoxis nigromaculatus	1	0.1	---	---
Percidae	*Etheostoma edwini*	3	0.2	72	4.1
	Percina nigrofasciata	---	---	7	0.4
Elassomatidae	*Elassoma evergladei*	---	---	1	0.1
	Elassoma okefenokee	1	0.1	8	0.5
	Elassoma zonatum	---	---	17	1.0
Achiridae	*Trinectes maculatus*	---	---	3	0.2
	Total number of species	**31**		**31**	
	Total number of specimens	**1308**		**1736**	

*observed independently of this survey (see text).

Manatees

Manatee utilization of the Ichetucknee Springs System occurs infrequently, in low numbers of one to three individuals, and principally in the last decade. A sighting by ISSP staff of one manatee occurred in March 2005 (Taylor 2006). Although no downstream dams or locks occur downstream of this system in the Santa Fe and Suwannee Rivers, there is reportedly a natural geologic formation on the lower Ichetucknee River, which during low water periods may serve as an upstream barrier to manatees. In addition, the distance from the Gulf of Mexico is substantial as manatees must travel about 60 miles up the Suwannee River and 11.3 km (7 mi) up the Santa Fe River to reach the Ichetucknee River.

As Taylor (2006) reports, historical data on manatee use of the Ichetucknee Springs System is absent, except for recovered manatee fossils from the Santa Fe River (Laist and Reynolds 2005). FWC has documented one perinatal manatee mortality in 1999 and one undetermined mortality 2007 from the Gilchrist County portion of the Suwannee River (FWC manatee mortality database).

Ecosystem Functions

Based on field parameters (temperature, conductance, dissolved oxygen, and pH) measured in the spring pool and spring run during the reconnaissance trip of July 28, 2008, the Ichetucknee Springs System is suitable for measuring ecosystem metabolism based on changes in dissolved oxygen. During our reconnaissance, average DO concentrations at the spring vents were approximately 3.5, 2.0, and 1.0 mg/L in Ichetucknee, Blue Hole, and Roaring Springs, respectively. In the main spring run, DO increased to approximately 5 mg/L within 457 m (1,500 ft) downstream of Mission Springs. These values were measured early in the day in full sunlight summer

conditions, and daily maximal DO concentrations are likely to be observed between 16:00 to 18:00 hours. Metabolism estimates in the Ichetucknee River will need to incorporate multiple, variable inputs for spring water with differing ambient DO concentrations.

Human-Use Attendance and Activities

Recreational activities at Ichetucknee Springs include swimming, tubing and rafting, canoeing and kayaking, picnicking, and hiking. As a state park, complete annual statistics of human attendance are available between 1993 and 2008. Peak total annual attendance occurred in 1983 and 1999, each slightly more than 201 thousand people, and peak seasonal use occurs in summer months with 70% of visitation occurs (**Figure 23**).

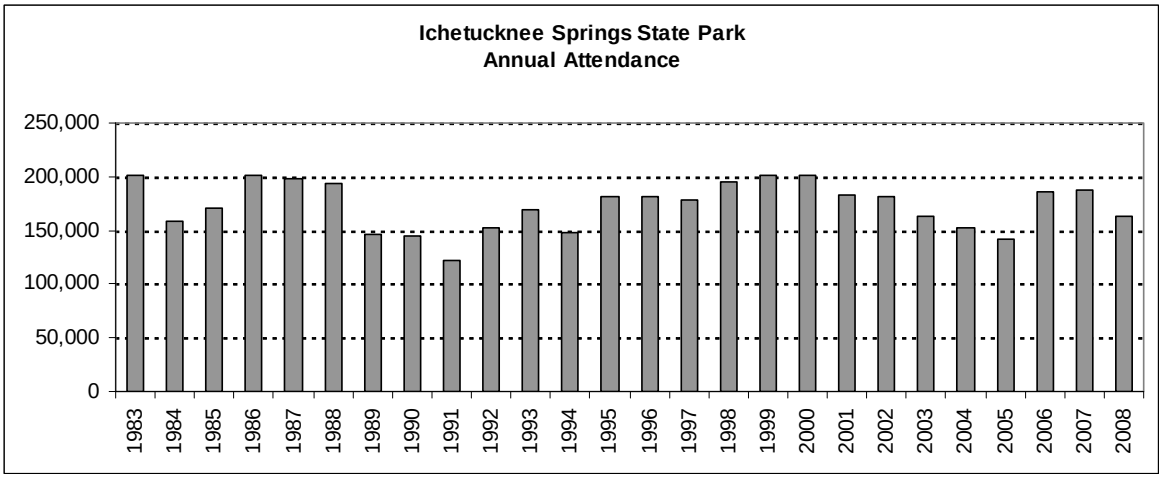
A student research project by Paulauskas (2001) examined the experience of recreationalists using the Ichetucknee River in relation to their perceptions of crowding. Results were derived from 320 respondent surveys conducted on site between May and June 2000. Findings indicate that the majority of users were highly satisfied and that an inverse relationship between crowding and overall satisfaction ratings exists. During heavy weekend use, between 50% and 65% of the respondents rated the river as crowded; yet perceptions of social carrying capacity did not appear to be exceeded when visitor numbers reach the park's ecological carrying capacity (Paulauskas 2001).

An economic analysis of four springs located in Florida state parks, Ichetucknee, Wakulla, Homosassa, and Volusia Blue was conducted by Bonn and Bell (2003). No effort was made to quantify the value of the natural services these systems provide; rather, the focus of this report is on the economic impact to the surrounding areas and the characteristics of visitor usage. Attendance data spanned 1992 to 2002, and

documented increasing annual visitation trends. Spending per visitor was second highest for Ichetucknee, with 2002 totals at $22 million. In terms of wages and salaries, Ichetucknee Springs generated the most wages $5.09 million (Bonn and Bell 2003). In general, springs attracted visitors in a party size between 4-5 individuals whom spend about 2-3 days per visit. This study illustrates that the specific type of recreation (and other expenditure opportunities) a spring has determines its economic impact and that generalized economic valuations are not possible. Of note, Bonn and Bell (2003) ascribe the decline in Volusia Blue attendance to "The decrease [in attendance] is consistent with the economic model, which asserts that increasing environmental problems are related to a decline in economic activity as measured by park attendance." This is relevant when considering the impact that nitrate pollution, declining spring discharge rates, eutrophication, and other environmental changes may play on economics.

Minimum Flows and Levels

The Suwannee River Water Management District (SRWMD) plans to establish minimum flows and levels for the Ichetucknee group, which is within the lower Santa Fe River Basin, during 2010. The upper Santa Fe River Basin MFL was adopted in 2008 (SRWMD 2009).



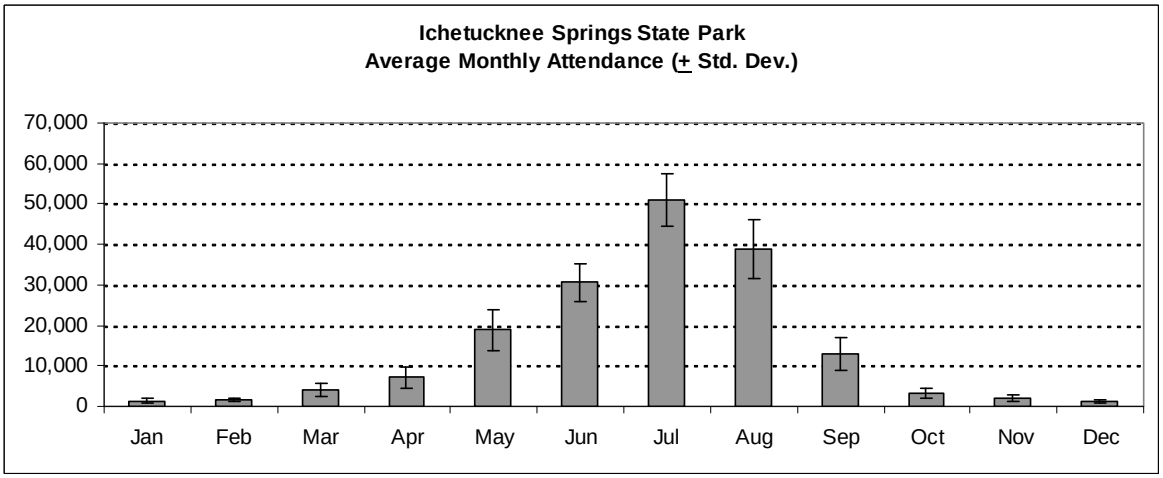


FIGURE 23
Ichetucknee Springs State Park annual and monthly attendance data.

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Appendix R

Summary of data for Jackson Blue Springs

Summary of Existing Data - Jackson Blue Springs (Jackson Co.)

Prepared by

Wetland Solutions, Inc.



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Cover photo: Underwater view of Jackson Blue Springs 50 m downstream of the pool showing luxuriant growths of coontail (*Ceratophyllum demersum*) and tape grass (*Vallisneria americana*); inset: an example of the large crayfish (*Procambarus sp.*, 13 cm carapace), which frequent the retaining wall of the swim area (S.K. Notestein, 01/12/09).

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Table 7 A listing of fish in the Florida museum of Natural History (FLMNH) ichthyologic collection from Merritt's Mill Pond and Spring Creek (from Walsh and Williams 2003).

Summary of Existing Springs Data

This report summarizes known existing physical, chemical, and biological data for Jackson Blue Springs (Jackson County). These data were collected from sources such as the Northwest Florida Water Management District (NWFWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Jackson Blue Springs Recreational Area

Physical Address

Blue Springs Recreational Area; Lola Davis Lane; Marianna, Florida 32448; Phone: 850-718-0437; latitude / longitude: 30.790797°, -85.139916°; park website: http://www.jacksoncountyfl.com/blue_springs.htm .

Driving Directions

Jackson Blue Spring is approximately 16 km (6 mi) east of the town of Marianna in the Florida panhandle (**Figure 1**). From Highway 90 in Marianna, go north on State Road 71. After about 1.6 km (1 mi), Blue Spring Road forks off to the right. Go about 4.8 km (3 mi) and the entrance to Blue Spring Recreational Area is on the right.

General

Jackson Blue Spring is the largest of several nearby spring systems which include: Twin Cave, Hole in the Wall, Shangri-la, and Gator Hole, all of which collectively supply water to Merritt's Mill Pond. This reservoir is formed by a dam at Highway 90 creating an approximately 6.4 km (4 mi) long reservoir with area reported to be 81.7 ha (202 ac). The Jackson Blue Spring property is owned by the Northwest Florida Water Management

District and managed by Jackson County Parks & Recycling Department as the Blue Spring Recreational Area. The park facilities include restrooms, a playground, and pavilions. The site can also be accessed from downstream via public boat ramps. This site is a popular regional swimming destination, with a beach area, diving platform, slides, and boat docks. Recreational usage is highest during summer months and the park is currently only open on a daily basis between Memorial and Labor Day holidays. The site does allow year round scuba diving and is a popular cave diving destination. Scuba divers must get permission from and pay a fee to the Jackson County Sheriff's office to dive in the spring. Jackson Blue should be distinguished from another Jackson County spring, ***Blue Hole Spring***, a second magnitude spring within the Florida Caverns State Park.

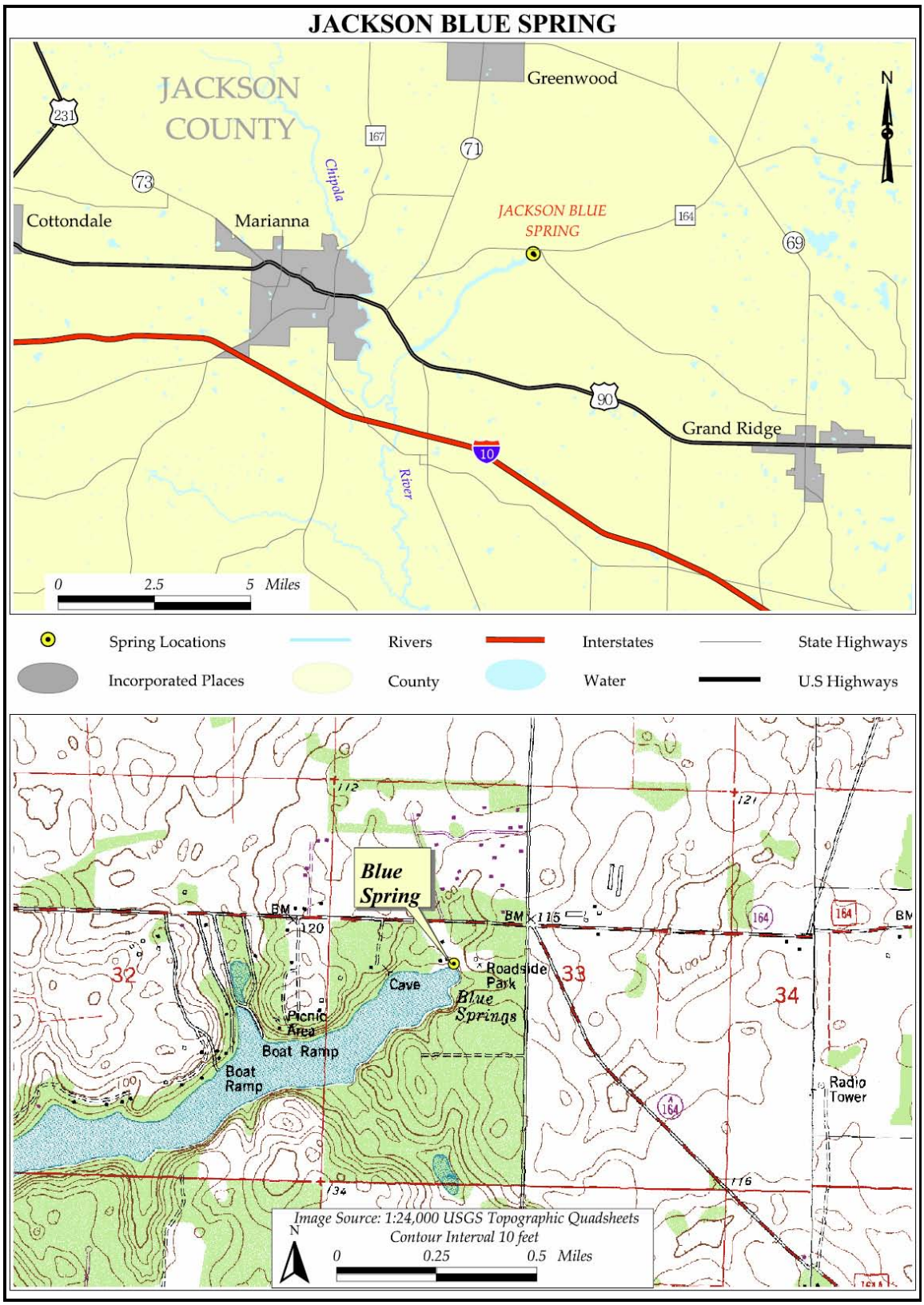


FIGURE 1
Jackson Blue Spring location (from Scott *et al.* 2002).

Physical

Hilly lands surround the spring pool, and include open grass areas, scattered trees, parking areas, and recreational structures. The semicircular pool is approximately 76 m (250 ft) in diameter and partially enclosed by a concrete wall and swim platform along the northern edge. Immediately downstream of the spring pool, a wire fence delineates swimming and boating areas. Spring discharge emanates from a substantial cavern that is approximately 2.4 m (8 ft) high by 9 m (30 ft) wide near the northern part of the pool at a depth of about 4.6 m (15 ft) (**Figure 2**). The cave system is extensive and over 4,877 m (16,000 ft) have been surveyed (Florida Caves Website).

Quartz white sand underlies the spring pool and run, the springs vents reveal the underlying karst geology. Jackson Blue Spring effectively forms the headwaters of Merritt's Mill Pond. The spring run (Merritt's Mill Pond) is wide at over 90 m (300 ft), bordered by cypress trees along the banks, and in places along the northern shore, limestone bluffs are visible (**Figure 3**). Mill Pond water level and outflow is controlled by a structure at Highway 90, reportedly originally constructed to aid in the generation of electricity for a neighboring ice plant. The spring run subsequently discharges to the Chipola River, the Apalachicola River, and ultimately the Gulf of Mexico.

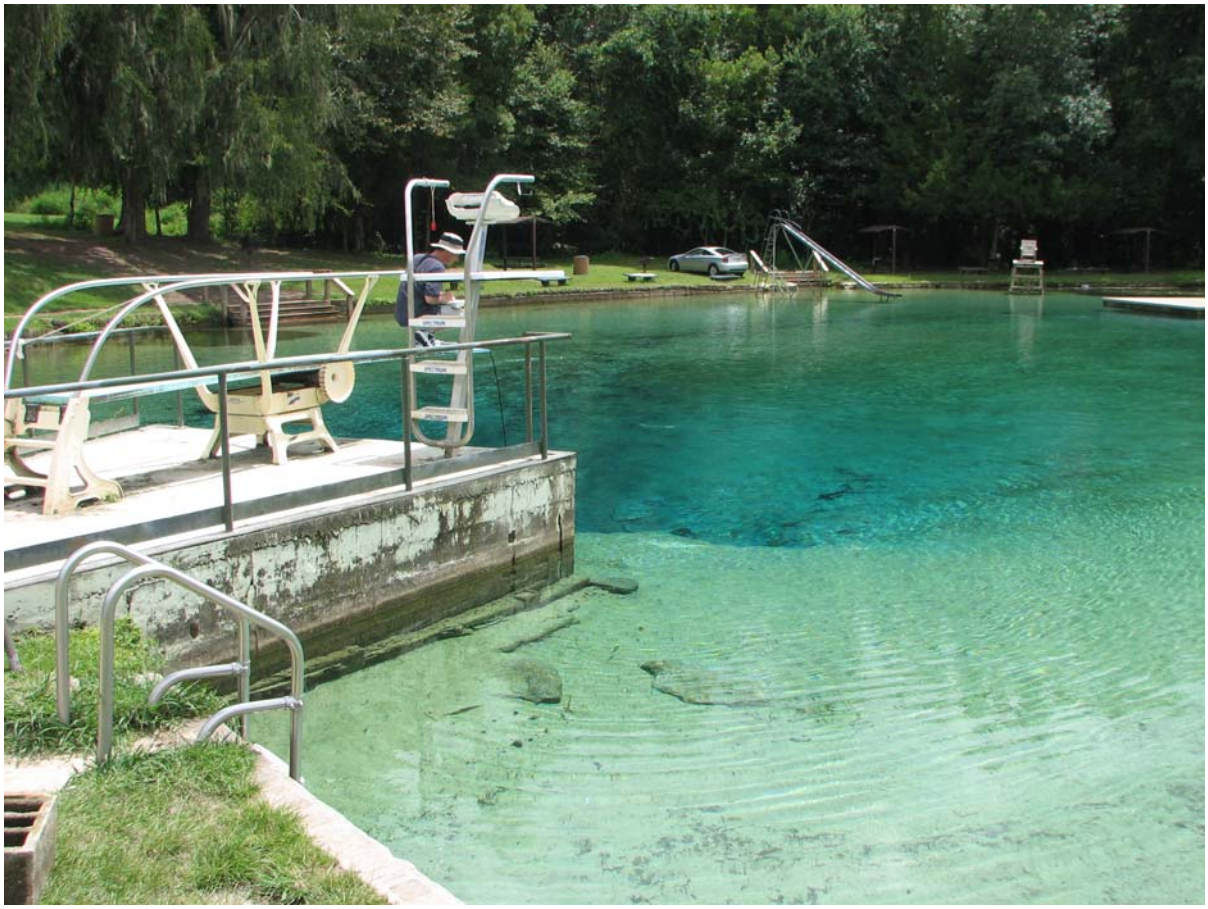


FIGURE 2
Photo of Jackson Blue Spring from the western bank of the pool, the vent is below the diving platform (R.L. Knight 08/18/08).

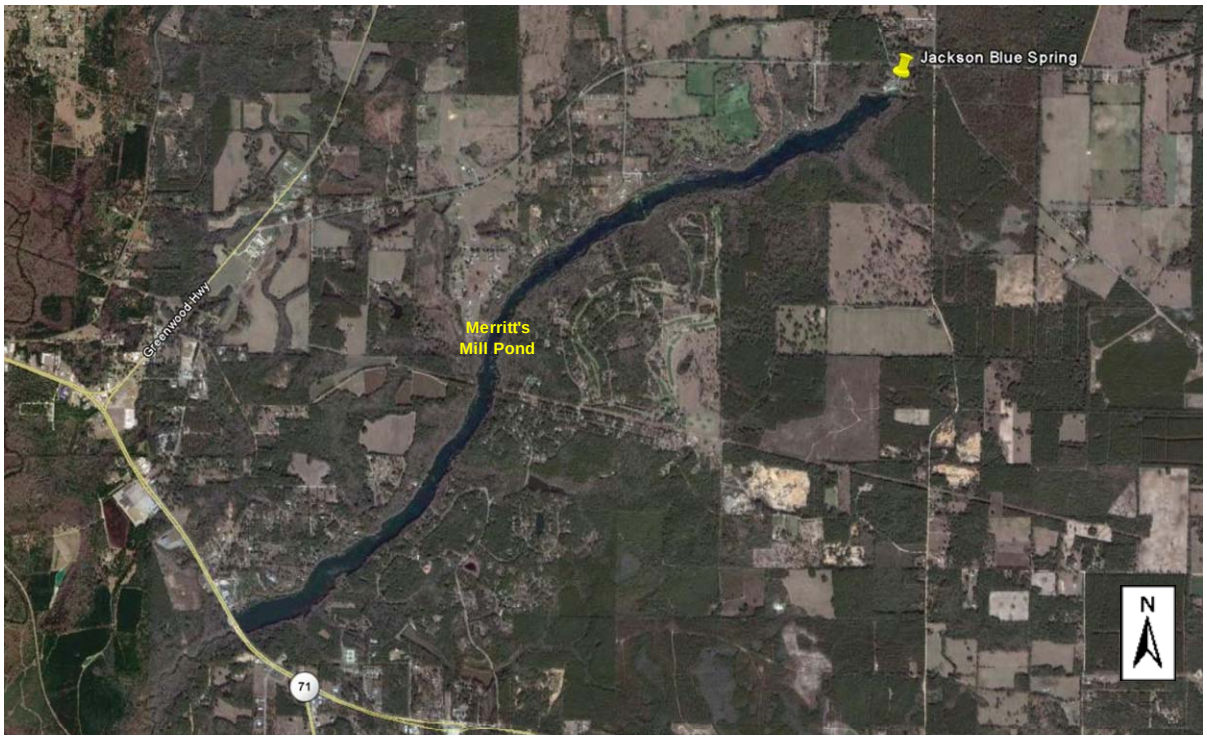


FIGURE 3
Jackson Blue Spring site map, the spring run is impounded and also known as Merritt's Mill Pond.

Hydrogeology

The geology of the region has been described by Barrios and DeFosset (2006). Underlying Jackson Blue Spring is the Dougherty Karst Plain District, a feature which encompasses the northern portions of Bay and Calhoun counties, all of Jackson County and most of Washington and Holmes counties. Within the Dougherty Karst Plain the Floridan Aquifer is recharged through the leaky confinement of the Intermediate System and discharges to surface springs and rivers. Due to the semi-confined nature of the Floridan Aquifer across the Dougherty Karst Plain, a large amount of local groundwater recharge occurs and creates the potential for Floridan Aquifer contamination from activities occurring on the land surface (Barrios and DeFosset 2006).

Within the confines of Jackson County, the Floridan Aquifer is comprised of three components, the Chattahoochee Formation, the undifferentiated Marianna/Suwannee Limestone, and the Ocala Limestone (Scott 1993, **Figure 4**). In north Jackson County, where it is composed of the Ocala Limestone only (Moore 1955), the Floridan Aquifer has a thickness of approximately 100 feet. In south Jackson County, the Floridan reaches to approximately 500 feet in thickness with the addition of the Marianna, Suwannee, and Chattahoochee geologic formations (Barrios and DeFosset 2006).

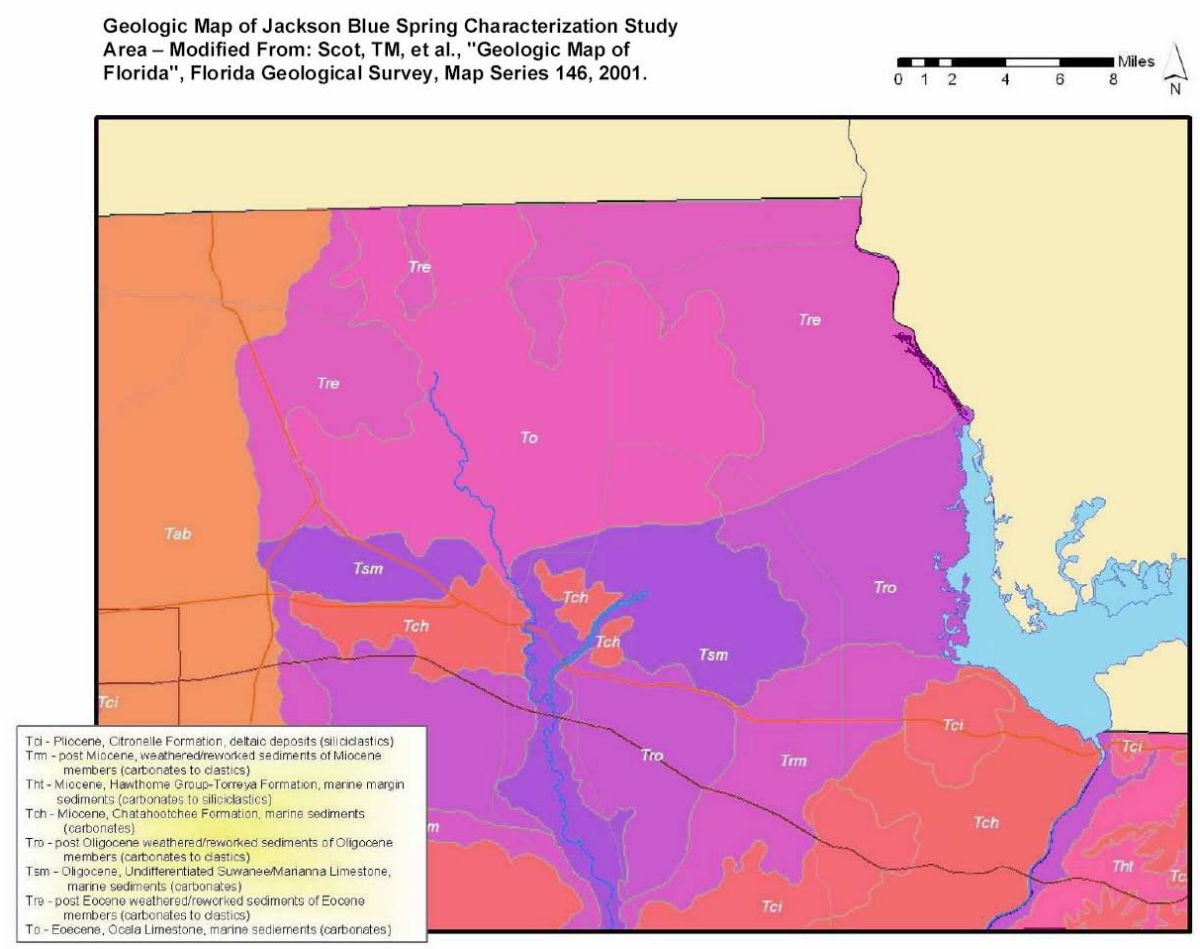


FIGURE 4
Geologic map of the vicinity of Jackson Blue Spring (from Barrios and DeFosset 2006).

Springshed

A potentiometric surface map, as well as the springshed of the Jackson Blue Spring has been delineated by the Northwest Florida Water Management District. During May 2002, district staff conducted a round of water level measurements from 91 existing Floridan Aquifer wells in northeast Jackson County (Chelette *et al.* 2002). A second springshed map has been built based on data from 77 wells sampled during February and March 2007, and is presented in **Figure 5**. It should be remembered that the springshed delineation may expand or contract based on variation in rainfall, groundwater recharge, and groundwater withdrawal rates (Chelette *et al.* 2002).

Springshed Land Use

Utilizing the 2002 Jackson Blue Springshed delineation, land use in the area was classified from existing GIS land use coverage derived from 1994-1995 digital ortho-quads (Chelette *et al.* 2002). The springshed land use was dominated by agriculture (50 %) and upland forests (44 %, **Table 1** and **Figure 6**). The authors also noted that there are at least 67 wells used for agricultural irrigation and there are 56 known Storage Tank and Petroleum Contamination/Cleanup Monitoring (STCM) program sites in the in the springshed capture zone (Chelette *et al.* 2002).

TABLE 1
Land use categories and areas of the Jackson Blue Spring (Jackson County) springshed (from Chelette *et al.* 2002).

Category	Acres	Percent of Total Capture Zone	Percent of Total County Area
Agriculture	35,193	50.46	16
Barren Land	17	0.02	3
Commercial & Services	67	0.10	4
Industrial	105	0.15	8
Institutional	31	0.04	2
Open Land	0	0	0
Recreational	0	0	0
Residential	2,131	3.06	11
Transportation, Communication & Utilities	101	0.14	2
Upland Forests	30,913	44.33	11
Water	173	0.25	1
Wetlands	1,010	1.45	2

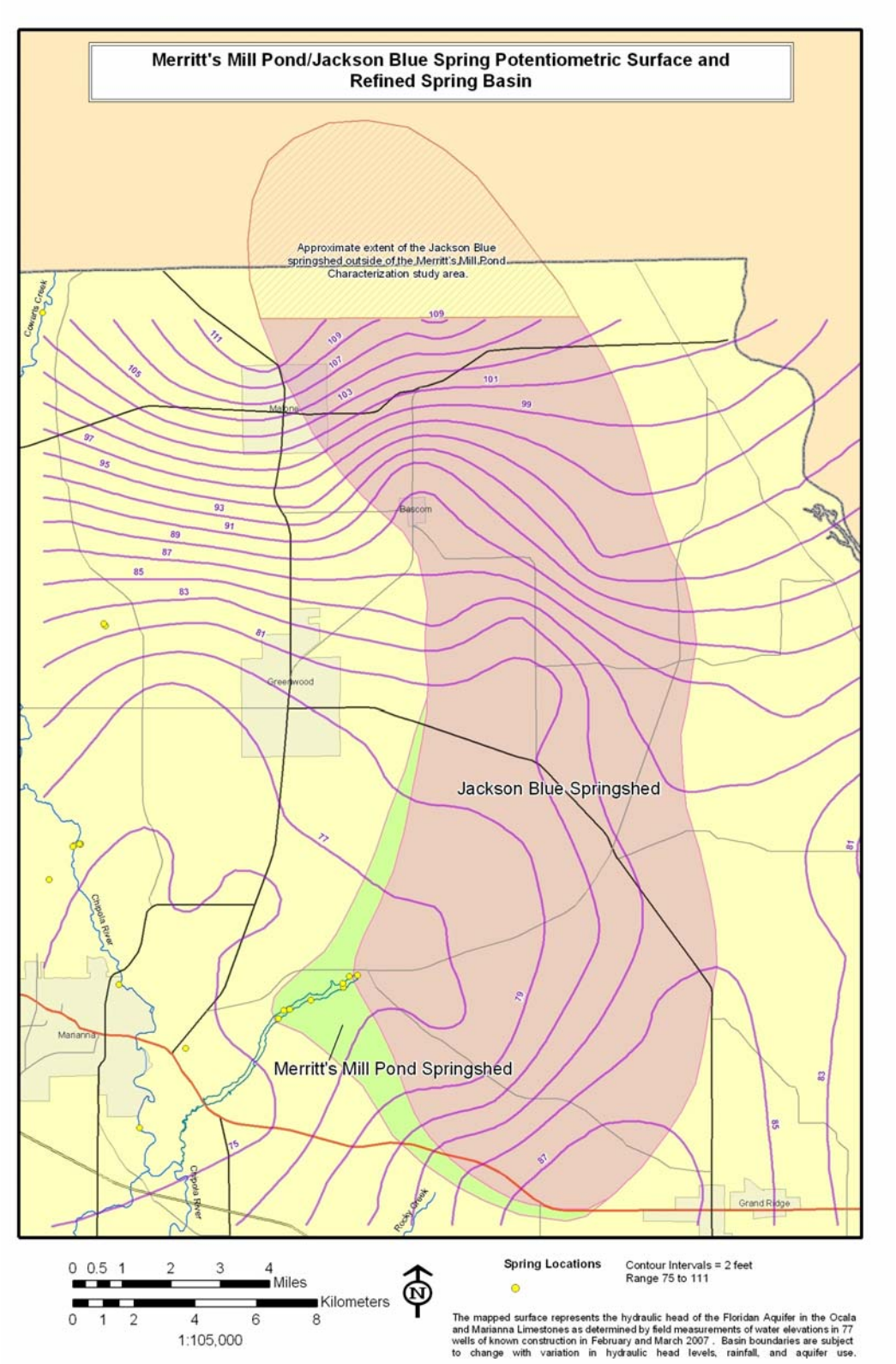


FIGURE 5
The springshed delineation of Jackson Blue Spring based on data collected from 77 wells during February and March 2007 (NWFWMD).

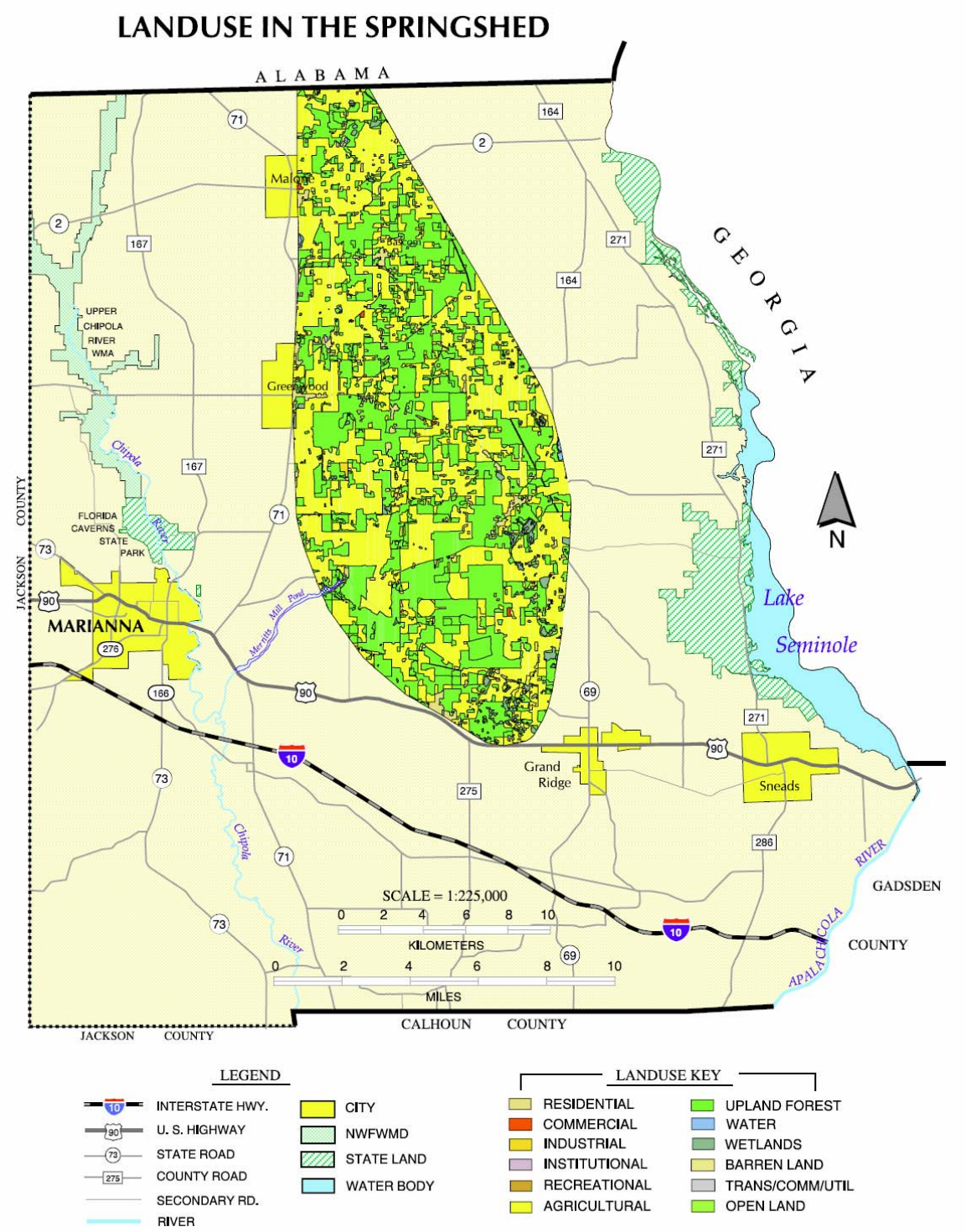


FIGURE 6
Land use within the Jackson Blue Springshed based on 1994-1995 digital ortho-quads (from Chelette *et al*. 2002).

Jackson Blue spring currently exhibits elevated nitrate-nitrogen concentrations and the application of nitrogen via commercial fertilizer use in the springshed was estimated using sales data from the Florida Department of Agriculture and Consumer Services (DACS) by Chelette *et al.* 2002, (**Table 2**). Three assumptions were made to estimate the nitrogen load applied to the springshed: 1) commercial fertilizer sold in Jackson County represents the total used in the county; 2) all agricultural land received the same application rate; and 3) the proportion of agricultural land in the springshed as a percentage of the county total has not changed with time (Chelette *et al.* 2002). According to DACS sales data, nitrogen applications in Jackson County, and likely within the springshed, appear to be decreasing (**Figure 7**).

TABLE 2
Estimated nitrogen loading to the Jackson Blue springshed from DACS fertilizer records (from Chelette *et al.* 2002).

year	N (tons)	year	N (tons)	year	N (tons)
1974	1208	1984	1340	1993	849
1975	967	1985	1211	1994	**ND**
1976	1170	1986	1015	1995	611
1977	1525	1987	879	1996	**ND**
1978	1325	1988	1054	1997	555
1979	1510	1989	1526	1998	**ND**
1980	1330	1990	2970	1999	279
1981	1636	1991	**ND**	2000	307
1982	1344	1992	**ND**	2001	456
1983	1277				

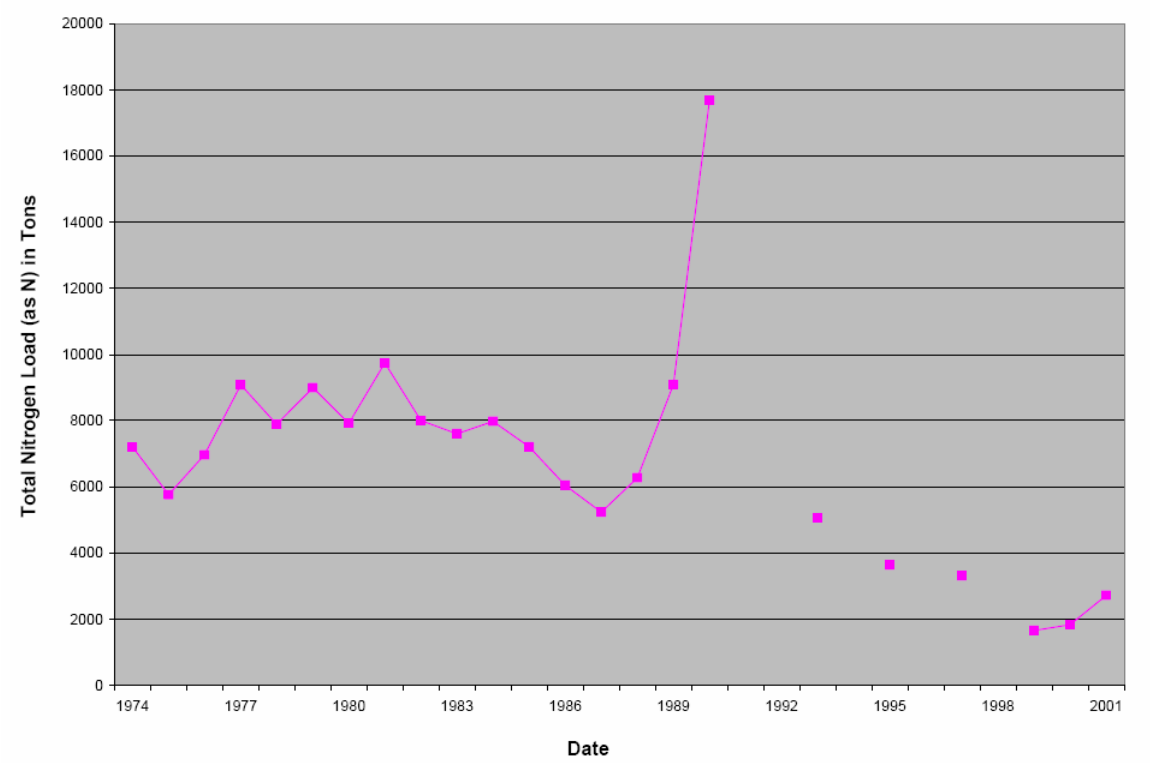


FIGURE 7
Estimated nitrogen sales for Jackson County between 1974 and 2001 based on DACS data (from Chelette *et al*. 2002).

Study Area

The project study area is defined as the spring pool and upper 1 km of the spring run (Merritt's Mill Pond) going downstream to the impoundment at Highway 90. **Figure 8** shows an approximation of the study area.

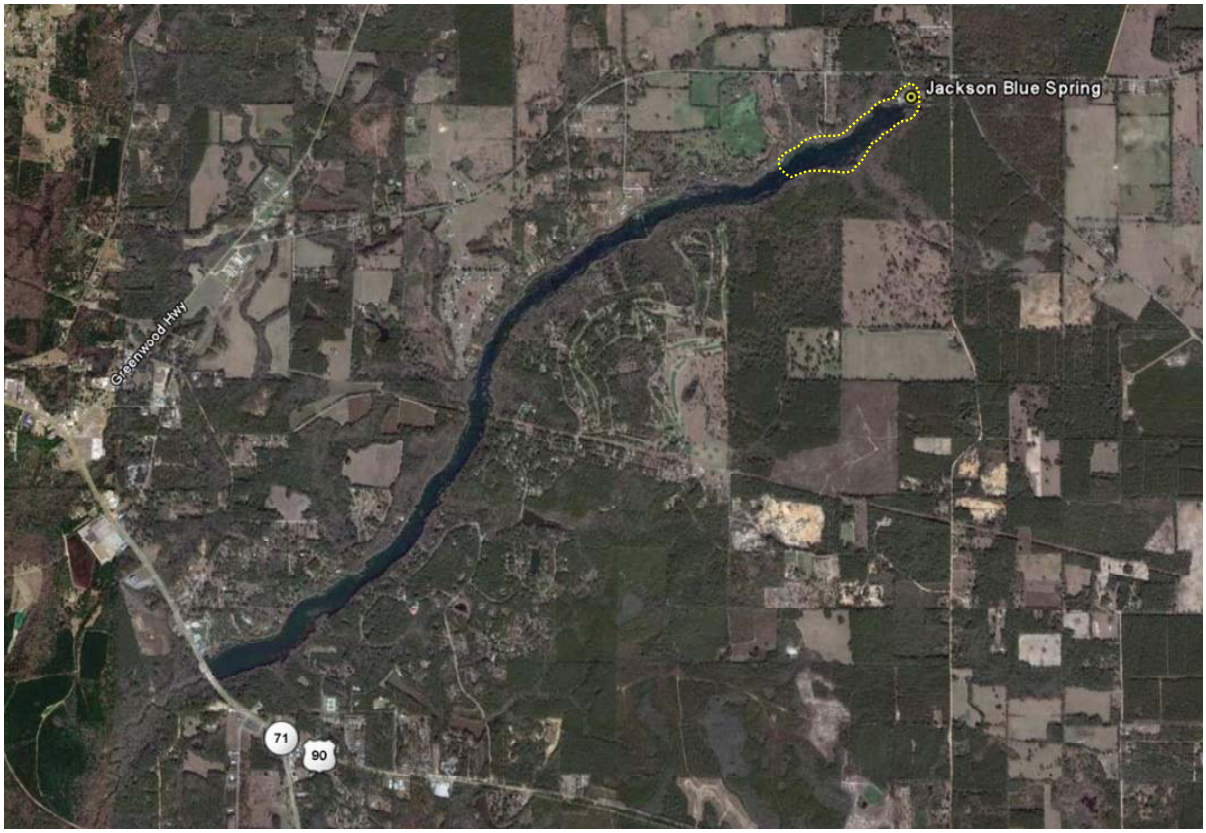


FIGURE 8
Study area for Jackson Blue Spring, the final downstream extent to be sampled in the spring run to be determined.

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Jackson Blue Spring are given in **Table 3** below.

TABLE 3
Source information for the Jackson Blue Spring historical water quality data described in this report.

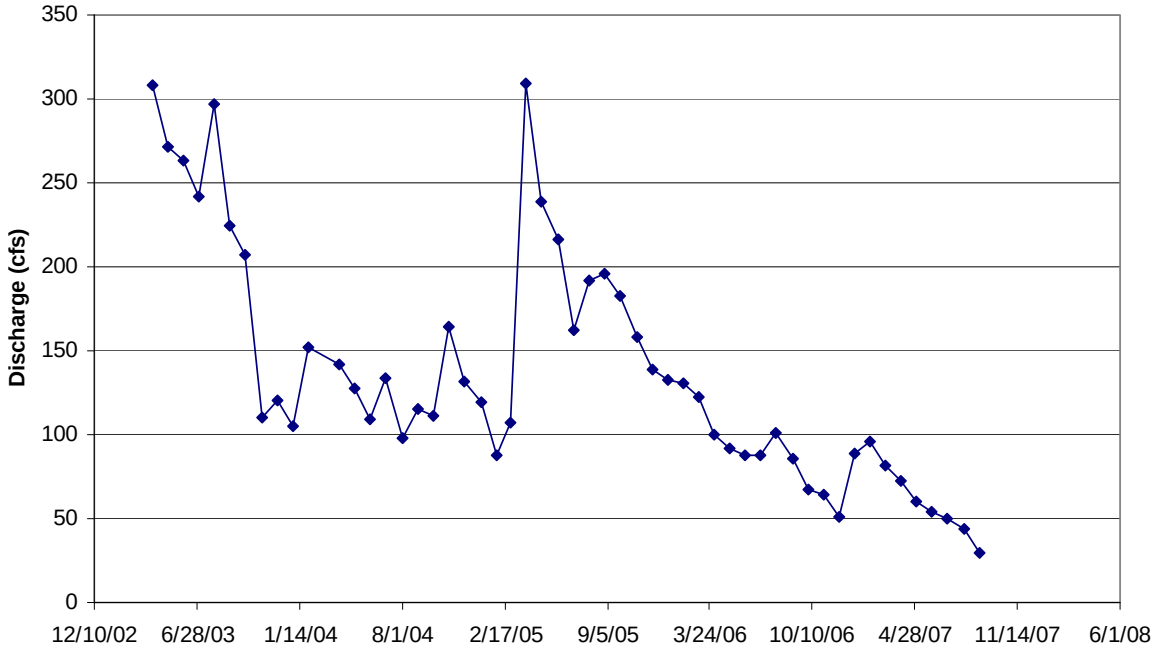
Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
21FLGW	FL Dept. of Environmental Protection	9674	Blue Spring (Jackson)	30.790515	-85.140088
USGS	USGS	2358795	Jackson Blue Spring	30.790278	-85.140833
21FLGW	FL Dept. of Environmental Protection	19510	Shangri-La Springs (800 ft from Main Boil)	30.790166	-85.142885
21FLGW	FL Dept. of Environmental Protection	10605	NWB-LL-1026 Merritt's Mil (1500 ft from Main Boil)	30.787602	-85.144725

Discharge and Stage

Historical discharge data for Jackson Blue Spring are reported by Rosenau *et al.* (1977), with 20 sporadic measurements spanning the time period of 1918 to 1973. Discharge values (made at the fence just downstream of the main spring pool) ranged from 56 cfs (December 22, 1934) to 265 cfs (May 20, 1942). Other measures of discharge include a value of 52 cfs (January 7, 2002) and 43 cfs (April 8, 2002) by Chelette *et al.* 2002. The US Geological Survey has a station which monitors discharge and stage (station # 02358795) with daily records mostly available between April 2003 and September 2007 (USGS 2007a). Spring flow is affected by Merritt's Mill Pond stage at all times according to USGS (2007a) reports. As an impoundment, the water stage in the spring pool and run are also dependent on the Highway 90 control structures. **Table 4** and **Figures 9** and **10** illustrate the variability of discharge and stage at this spring system.

TABLE 4
Summary statistics for the discharge and stage of Jackson Blue Spring (from USGS 2007).

SUMMARY STATISTICS						
	Calendar Year 2006		Water Year 2007		Water Years 2003 - 2007	
Annual mean	93.5		63.1		117	
Highest annual mean					170	2005
Lowest annual mean					63.1	2007
Highest daily mean	139	Mar 6	118	Feb 2	448	Apr 17, 2005
Lowest daily mean	44	Dec 19	23	Sep 30	23	Sep 30, 2007
Annual seven-day minimum	45	Dec 15	27	Sep 24	27	Sep 24, 2007
Maximum peak flow			120	Jan 16	493	Apr 11, 2005
Maximum peak stage			13.29	Feb 25	14.42	Apr 11, 2005
Instantaneous low flow			21	Sep 30	21	Sep 30, 2007
10 percent exceeds	133		91		204	
50 percent exceeds	93		61		101	
90 percent exceeds	60		41		51	



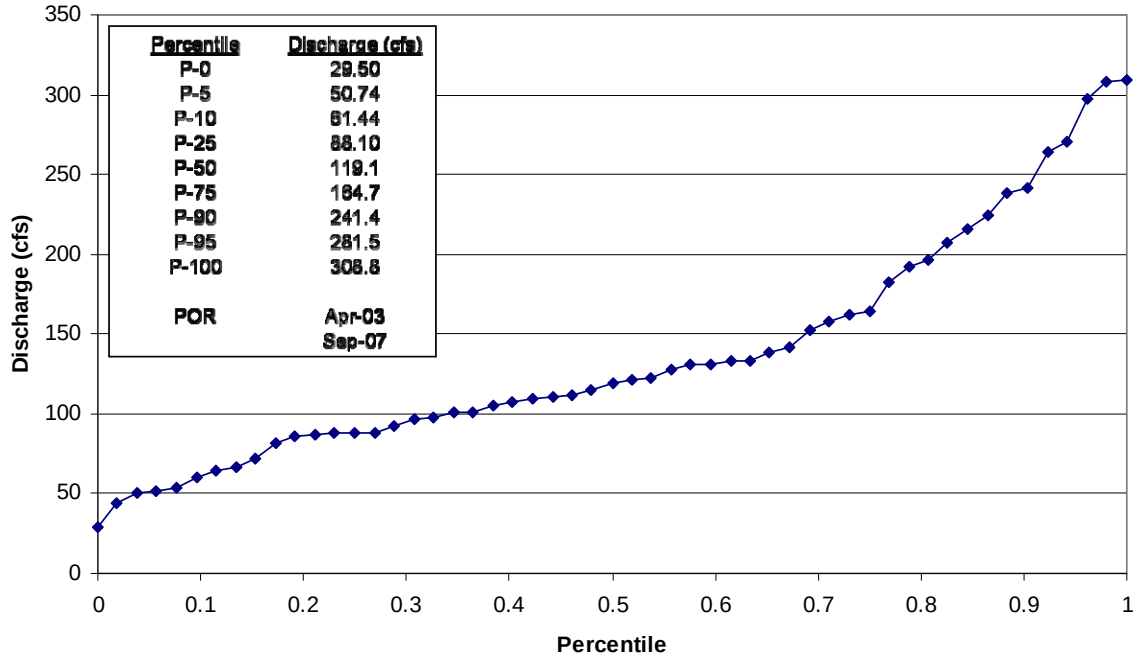


FIGURE 9
Monthly average discharge time series and frequency curve for Jackson Blue Spring.

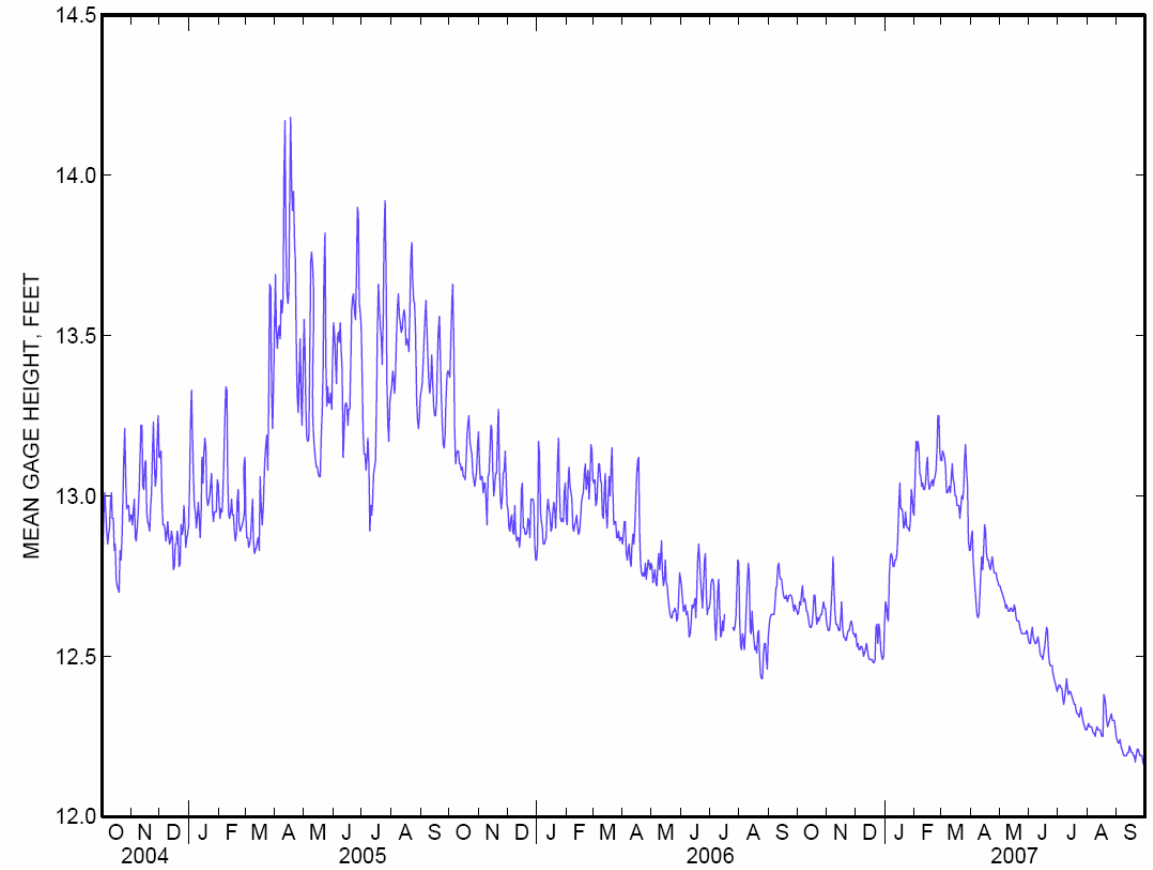


FIGURE 10
Jackson Blue Spring water stage time series (from USGS 2007).

Water Quality

Water chemistry sampling of 29 groundwater wells in the springshed of Jackson Blue was conducted during October 2004 by the NWFWMD (Barrios and DeFosset 2006). These data are provided in **Table 5** and serve as the most recent groundwater chemistry values available for this spring system. Additional analysis of these water chemistry data includes the use of Principle Component Analysis, Component Score Deviation, and Hierarchical Cluster Analysis and their report should be referenced for interpretation and discussion (Barrios and DeFosset 2007).

Surface water quality data for Jackson Blue Spring are available from as early as December 1960 to as recent as September 2007 from STORET (USGS and FDEP data).

Among water chemistry parameters, the numbers of samples collected ranged from 1 to 56 records, with most samples collected from the main pool. These data are summarized in **Table 6** which provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Elevated nitrate concentrations and relatively high dissolved oxygen values are conspicuous. Jackson Blue Spring POR averages for several key parameters (with number of samples) are:

- Water temperature – 20.7 °C (n = 36)
- Dissolved oxygen – 7.33 mg/L (n = 36)
- pH – 7.51 SU (n = 39)
- Specific conductance – 248 umhos/cm (n = 71)
- Turbidity – 0.162 NTU (n = 33)
- Color – 0.6 CPU (n= 24)
- Total chloride – 4.12 mg/L (n = 56)
- Sulfate – 1.12 mg/L (n = 56)
- Nitrate+nitrite nitrogen – 3.24 mg/L (n = 51)
- Total phosphorus – 0.021 mg/L (n = 52)

TABLE 5
Jackson Blue Spring springshed groundwater quality table from samples collected October 6 to 21, 2004 (from Barrios and DeFosset 2007).

Parameter	n	Mean	Median	St. Dev.
Water Temperature	29	21.0	20.9	0.4
Specific Conductance	29	237	231	64
Dissolved Oxygen	29	7.41	8.30	2.43
pH	29	7.38	7.39	0.19
Alkalinity, Total	29	105	104	36
Ammonia*	29	0.015	0.010	0.021
TKN*	29	0.066	0.060	0.030
Nitrate-Nitrite, Total	29	2.55	2.40	1.80
Phosphorus, Total	29	0.021	0.016	0.020
Orthophosphate, Dissolved	29	0.016	0.015	0.006
Calcium, Total	29	43.8	41.8	14.0
Magnesium, Total	29	2.2	1.0	2.8
Sodium, Total	29	1.82	1.76	0.39
Potassium, Total	29	0.28	0.24	0.11
Chloride, Total	29	3.8	3.5	1.1
Sulfate, Total	29	1.11	0.71	1.76
Fluoride, Total	29	0.059	0.050	0.016
TDS	29	143	138	35

TABLE 6
Jackson Blue Spring water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade				POR Statistics					Period of Record	
				1960	1970	1980	2000	Average	Min	Max	StDev	N		
BACTERIOLOGICAL	EColi	#/100ml	Main Boil				1.00	1.00	1.00	1.00	0.00	4	9/27/01	1/7/02
			1500ft				1.00	1.00	1.00	1.00	---	1	6/27/01	6/27/01
	Enterococci	#/100ml	Main Boil				2.12	2.12	0.500	10.0	2.02	21	9/27/01	11/27/06
			Shangri-La				1.00	1.00	1.00	1.00	---	1	6/30/03	6/30/03
			1500ft				1.00	1.00	1.00	1.00	---	1	6/27/01	6/27/01
	FC	#/100ml	Main Boil				1.70	1.70	0.500	6.00	1.24	32	9/27/01	11/27/06
			Shangri-La				1.00	1.00	1.00	1.00	---	1	6/30/03	6/30/03
			1500ft				1.00	1.00	1.00	1.00	---	1	6/27/01	6/27/01
	TC	#/100ml	Main Boil				7.03	7.03	1.00	26.0	6.70	30	9/27/01	11/27/06
			1500ft				1.00	1.00	1.00	1.00	---	1	6/27/01	6/27/01
BIOLOGICAL	Chl-a corr	µg/L	1500ft				0.500	0.500	0.500	0.500	---	1	6/27/01	6/27/01
	Pheo-a	µg/L	1500ft				0.500	0.500	0.500	0.500	---	1	6/27/01	6/27/01
DISSOLVED OXYGEN	DO	%	Main Boil		86.0		113	95.0	86.0	113	15.6	3	4/19/72	7/30/07
	DO	mg/L	Main Boil		7.80	7.00	7.31	7.33	5.89	10.3	0.919	36	4/19/72	7/30/07
			Shangri-La				6.26	6.26	6.26	6.26	---	1	6/30/03	6/30/03
			1500ft				8.82	8.82	8.80	8.84	0.028	2	6/27/01	6/27/01
FLOW	Flow	cfs	Main Boil				134	134	23.0	448	72.8	1,528	4/24/03	9/30/07
	Flow-Inst	cfs	Main Boil			180		180	180	180	---	1	2/13/85	2/13/85
GENERAL INORGANIC	Alk	mg/L as Ca	Main Boil	96.0	98.0		111	108	96.0	115	5.73	12	12/6/60	4/5/04
	Cl-T	mg/L	Main Boil	2.00	2.50	3.20	4.21	4.12	2.00	4.60	0.456	56	12/6/60	7/30/07
			Shangri-La				4.30	4.30	4.30	4.30	---	1	6/30/03	6/30/03
			1500ft				3.80	3.80	3.80	3.80	---	1	6/27/01	6/27/01
	CO2	mg/L	Main Boil	4.70	12.0	5.00		7.23	4.70	12.0	4.13	3	12/6/60	2/13/85
	F-D	mg/L	Main Boil	0.100	0.100	0.100	0.063	0.070	0.035	0.100	0.025	16	12/6/60	7/30/07
	F-T	mg/L	Main Boil				0.052	0.052	0.036	0.066	0.008	10	9/27/01	4/5/04
	Hardness	mg/L as Ca	Main Boil	97.0	100	110	120	111	97.0	120	10.6	6	12/6/60	7/30/07
	Si-D	mg/L	Main Boil	5.30	6.00	6.60	6.44	6.20	5.30	6.60	0.487	6	12/6/60	7/30/07
	SO4	mg/L	Main Boil	0.800	0.00	0.100	1.16	1.12	0.00	1.40	0.249	56	12/6/60	7/30/07
			Shangri-La				1.20	1.20	1.20	1.20	---	1	6/30/03	6/30/03
			1500ft				1.10	1.10	1.10	1.10	---	1	6/27/01	6/27/01
GENERAL ORGANIC	DOC	mg/L	Main Boil				0.600	0.600	0.300	0.800	0.265	3	10/25/01	7/30/07
	TOC	mg/L	Main Boil		0.00		0.913	0.885	0.00	4.60	0.992	33	4/19/72	11/27/06
			Shangri-La				0.500	0.500	0.500	0.500	---	1	6/30/03	6/30/03
			1500ft				0.500	0.500	0.500	0.500	---	1	6/27/01	6/27/01

TABLE 6 (CONTINUED)
Jackson Blue Spring water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade				POR Statistics					Period of Record	
				1960	1970	1980	2000	Average	Min	Max	StDev	N		
METAL	Ag-T	µg/L	Main Boil			1.00		1.00	1.00	1.00	---	1	2/13/85	2/13/85
	Al-T	µg/L	Main Boil				10.1	10.1	1.50	75.0	18.2	18	9/27/01	4/28/05
			Shangri-La				5.00	5.00	5.00	5.00	---	1	6/30/03	6/30/03
	As-T	µg/L	Main Boil		10.0		3.16	3.50	1.50	10.0	2.18	20	4/19/72	4/28/05
			Shangri-La				2.75	2.75	2.00	3.50	1.06	2	6/30/03	6/30/03
	Ba-T	µg/L	Main Boil			100	5.41	11.0	4.30	100	23.0	17	2/13/85	4/28/05
	Ca-D	mg/L	Main Boil	37.0	37.0	41.0	44.8	43.6	37.0	46.9	2.94	17	12/6/60	7/30/07
	Ca-T	mg/L	Main Boil				45.8	45.8	41.4	49.3	1.85	51	9/27/01	11/27/06
			Shangri-La				52.2	52.2	51.0	53.4	1.70	2	6/30/03	6/30/03
			1500ft				45.7	45.7	45.7	45.7	---	1	6/27/01	6/27/01
	Cd-T	µg/L	Main Boil			1.00	0.395	0.425	0.250	1.00	0.238	20	2/13/85	4/28/05
			Shangri-La				0.250	0.250	0.250	0.250	0.00	2	6/30/03	6/30/03
	Co-T	µg/L	Main Boil				0.913	0.913	0.250	3.30	0.732	18	9/27/01	4/28/05
			Shangri-La				1.00	1.00	1.00	1.00	---	1	6/30/03	6/30/03
	Cr-T	µg/L	Main Boil			1.00	1.27	1.26	0.250	3.00	0.646	20	2/13/85	4/28/05
			Shangri-La				1.00	1.00	1.00	1.00	0.00	2	6/30/03	6/30/03
	Cu-T	µg/L	Main Boil			1.00	2.50	2.43	1.00	6.00	1.40	20	2/13/85	4/28/05
			Shangri-La				2.00	2.00	1.50	2.50	0.707	2	6/30/03	6/30/03
	Fe-T	µg/L	Main Boil				7.79	7.79	2.50	25.0	5.72	19	9/27/01	4/28/05
			Shangri-La				6.25	6.25	5.00	7.50	1.77	2	6/30/03	6/30/03
	Hg-T	µg/L	Main Boil			0.100		0.100	0.100	0.100	---	1	2/13/85	2/13/85
	K-D	mg/L	Main Boil	0.200	0.200	0.300	0.295	0.284	0.200	0.320	0.034	17	12/6/60	7/30/07
	K-T	mg/L	Main Boil				0.306	0.306	0.250	0.380	0.027	51	9/27/01	11/27/06
			Shangri-La				0.290	0.290	0.290	0.290	0.00	2	6/30/03	6/30/03
			1500ft				0.270	0.270	0.270	0.270	---	1	6/27/01	6/27/01
	Mg-D	mg/L	Main Boil	1.10	2.10	1.70	2.22	2.12	1.10	2.50	0.309	17	12/6/60	7/30/07
	Mg-T	mg/L	Main Boil				2.25	2.25	2.04	2.50	0.112	51	9/27/01	11/27/06
			Shangri-La				1.80	1.80	1.80	1.80	0.00	2	6/30/03	6/30/03
			1500ft				2.00	2.00	2.00	2.00	---	1	6/27/01	6/27/01
	Mn-T	µg/L	Main Boil				0.866	0.866	0.100	8.50	1.89	19	9/27/01	4/28/05
			Shangri-La				0.313	0.313	0.125	0.500	0.265	2	6/30/03	6/30/03
	NA-D	mg/L	Main Boil	1.80	1.60	1.60	1.68	1.68	1.40	1.90	0.130	17	12/6/60	7/30/07
	NA-T	%	Main Boil	4.00	3.00	3.00	3.00	3.17	3.00	4.00	0.408	6	12/6/60	7/30/07
	NA-T	mg/L	Main Boil				1.77	1.77	1.40	2.10	0.156	41	9/27/01	11/27/06
			Shangri-La				1.69	1.69	1.50	1.87	0.262	2	6/30/03	6/30/03
			1500ft				1.70	1.70	1.70	1.70	---	1	6/27/01	6/27/01

TABLE 6 (CONTINUED)
Jackson Blue Spring water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade				POR Statistics					Period of Record	
				1960	1970	1980	2000	Average	Min	Max	StDev	N		
METAL	Ni-T	µg/L	Main Boil				1.38	1.38	0.500	3.00	0.674	19	9/27/01	4/28/05
			Shangri-La				1.00	1.00	1.00	1.00	0.00	2	6/30/03	6/30/03
	Pb-T	µg/L	Main Boil			1.00	2.90	2.80	0.038	5.00	1.55	20	2/13/85	4/28/05
			Shangri-La				4.25	4.25	2.50	6.00	2.47	2	6/30/03	6/30/03
	SAR	ratio	Main Boil	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.0000	6	12/6/60	7/30/07
	Se-T	µg/L	Main Boil				4.21	4.21	1.75	8.00	1.80	19	9/27/01	4/28/05
			Shangri-La				5.75	5.75	4.00	7.50	2.47	2	6/30/03	6/30/03
	SR-D	µg/L	Main Boil		40.0	60.0	37.2	41.5	33.0	60.0	9.41	6	4/19/72	4/5/04
	SR-T	µg/L	Main Boil				36.1	36.1	32.0	39.0	2.08	18	9/27/01	4/28/05
			Shangri-La				39.0	39.0	39.0	39.0	---	1	6/30/03	6/30/03
	Zn-T	µg/L	Main Boil				3.16	3.16	0.500	6.30	1.81	19	9/27/01	4/28/05
			Shangri-La				1.50	1.50	1.50	1.50	0.00	2	6/30/03	6/30/03
NITROGEN	NH4-N	mg/L	Main Boil		0.010	0.010	0.009	0.009	0.005	0.080	0.011	52	4/19/72	11/27/06
			Shangri-La				0.005	0.005	0.005	0.005	---	1	6/30/03	6/30/03
			1500ft				0.018	0.018	0.018	0.018	---	1	6/27/01	6/27/01
	NO2-N	mg/L	Main Boil			0.010		0.010	0.010	0.010	---	1	2/13/85	2/13/85
	NO3-N	mg/L	Main Boil		1.00			1.00	1.00	1.00	---	1	4/19/72	4/19/72
	NOx-N	mg/L	Main Boil			2.10	3.26	3.24	2.10	3.70	0.235	51	2/13/85	11/27/06
			Shangri-La				3.40	3.40	3.40	3.40	---	1	6/30/03	6/30/03
			1500ft				3.10	3.10	3.10	3.10	---	1	6/27/01	6/27/01
	NOx-N-D	mg/L	Main Boil				2.96	2.96	0.500	3.50	0.754	13	9/27/01	7/30/07
	OrgN	mg/L	Main Boil		0.160	0.210		0.185	0.160	0.210	0.035	2	4/19/72	2/13/85
	TKN	mg/L	Main Boil			0.220	0.048	0.051	0.030	0.220	0.035	52	2/13/85	11/27/06
			Shangri-La				0.030	0.030	0.030	0.030	0.00	2	6/30/03	6/30/03
			1500ft				0.030	0.030	0.030	0.030	---	1	6/27/01	6/27/01
	TKN-D	mg/L	Main Boil				0.083	0.083	0.060	0.200	0.052	13	9/27/01	4/5/04
	TN	mg/L	Main Boil			2.30		2.30	2.30	2.30	---	1	2/13/85	2/13/85
OXYGEN DEMAND	BOD5	mg/L	Main Boil		0.00		0.100	0.050	0.00	0.100	0.071	2	4/19/72	9/27/01
			Shangri-La				0.100	0.100	0.100	0.100	---	1	6/30/03	6/30/03
	cBOD5	mg/L	Main Boil				0.200	0.200	0.200	0.200	---	1	9/27/01	9/27/01
PESTICIDE	Atrazine-D	µg/L	Main Boil				0.040	0.040	0.040	0.040	---	1	7/30/07	7/30/07

TABLE 6 (CONTINUED)
Jackson Blue Spring water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade				POR Statistics					Period of Record	
				1960	1970	1980	2000	Average	Min	Max	StDev	N		
PHOSPHORUS	OrthoP	mg/L	Main Boil		0.020	0.020	0.018	0.018	0.010	0.022	0.003	37	4/19/72	7/30/07
			Shangri-La				0.021	0.021	0.021	0.021	---	1	6/30/03	6/30/03
			1500ft				0.014	0.014	0.014	0.014	---	1	6/27/01	6/27/01
	PO4-T	mg/L as PO4	Main Boil				0.039	0.039	0.031	0.055	0.014	3	10/25/01	7/30/07
	TDP	mg/L	Main Boil				0.022	0.022	0.018	0.028	0.004	10	9/27/01	4/5/04
	TP	mg/L	Main Boil		0.020	0.020	0.021	0.021	0.008	0.029	0.004	52	4/19/72	11/27/06
			Shangri-La				0.034	0.034	0.032	0.035	0.002	2	6/30/03	6/30/03
			1500ft				0.014	0.014	0.014	0.014	---	1	6/27/01	6/27/01
PHYSICAL	Alk-D	mg/L as CaCO3	Main Boil				109	109	109	109	---	1	7/30/07	7/30/07
	Color	CPU	Main Boil	5.00	0.00	5.00	0.238	0.625	0.00	5.00	1.69	24	12/6/60	11/27/06
			Shangri-La				0.00	0.00	0.00	0.00	---	1	6/30/03	6/30/03
			1500ft				0.00	0.00	0.00	0.00	---	1	6/27/01	6/27/01
	Depth	m	Main Boil				6.94	6.94	4.00	21.3	4.32	15	9/27/01	11/27/06
			Shangri-La				2.30	2.30	2.30	2.30	---	1	6/30/03	6/30/03
			1500ft				2.30	2.30	2.30	2.30	---	1	6/27/01	6/27/01
	pH	SU	Main Boil	7.60	7.35	7.45	7.52	7.51	7.17	8.06	0.219	39	12/6/60	7/30/07
			Shangri-La				7.54	7.54	7.54	7.54	---	1	6/30/03	6/30/03
			1500ft				7.71	7.71	7.70	7.72	0.014	2	6/27/01	6/27/01
	Secchi	m	Main Boil				5.62	5.62	3.50	22.8	3.17	32	9/27/01	11/27/06
			Shangri-La				2.30	2.30	2.30	2.30	---	1	6/30/03	6/30/03
			1500ft				2.30	2.30	2.30	2.30	---	1	6/27/01	6/27/01
	SpCond	umhos/cm	Main Boil	197	214	224	250	248	197	270	12.6	71	12/6/60	7/30/07
			Shangri-La				269	269	263	275	8.49	2	6/30/03	6/30/03
			1500ft				245	245	242	250	4.16	3	6/27/01	6/27/01
	Turb	NTU	Main Boil		0.00		0.167	0.162	0.00	1.70	0.281	33	4/19/72	11/27/06
			Shangri-La				0.050	0.050	0.050	0.050	---	1	6/30/03	6/30/03
			1500ft				0.050	0.050	0.050	0.050	---	1	6/27/01	6/27/01
SOLID	TDS	mg/L	Main Boil	108	113	130	146	143	108	173	13.5	40	12/6/60	7/30/07
			Shangri-La				168	168	168	168	---	1	6/30/03	6/30/03
			1500ft				145	145	145	145	---	1	6/27/01	6/27/01
	TSS	mg/L	Main Boil				4.00	4.00	4.00	4.00	0.00	32	9/27/01	11/27/06
			Shangri-La				4.00	4.00	4.00	4.00	---	1	6/30/03	6/30/03
			1500ft				4.00	4.00	4.00	4.00	---	1	6/27/01	6/27/01
TEMPERATURE	Air Temp	C	Main Boil				31.5	31.5	31.5	31.5	---	1	7/30/07	7/30/07
	Wtr Temp	C	Main Boil		20.5	22.0	20.7	20.7	20.1	22.0	0.369	36	4/19/72	7/30/07
			Shangri-La				20.9	20.9	20.9	20.9	---	1	6/30/03	6/30/03
			1500ft				21.9	21.9	21.5	22.3	0.523	2	6/27/01	6/27/01

Ground water nitrate-nitrogen concentrations in the Jackson Blue springshed have been investigated by the Northwest Florida Water Management District (Barrios and DeFosset 2006). Results indicate that groundwater nitrate concentrations are variable and frequently elevated within the springshed (**Figure 11**). An analysis by Strong (2004) found a significant increase in nitrate concentrations at Jackson Blue Spring, with average nitrate-nitrogen concentrations from 1980-1989 being 1.29 mg/L and increasing to an average value of 3.30 mg/L between the 1990-2003 time interval.

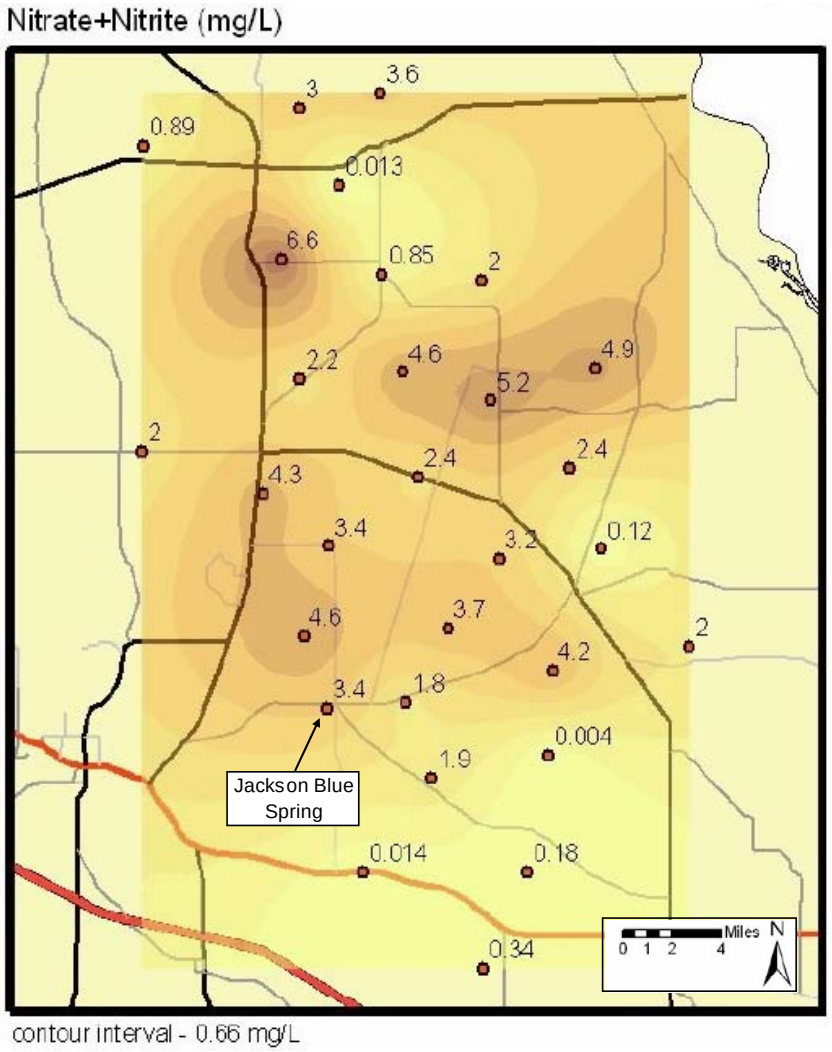


FIGURE 11
Jackson County groundwater nitrate-nitrogen concentrations (mg/L) from samples collected October 6 to 21, 2004 (from Barrios and DeFosset 2007).

During site reconnaissance on August 18, 2008 between 13:00 and 15:00, field parameters were measured from above the vent of Jackson Blue Spring and along a path in the spring run from the wire fence downstream to the buoys which identify the idle only zone for boats (**Figure 12**). Water in the spring pool and run was clear and had a pleasing apparent blue color. Water temperature from the spring vent was about 20.5 ° C, cooler than the 22 to 23 ° C observed in many peninsular springs (**Figure 13**). Specific conductance from the main vent was 255 µS/cm, with variation downstream including the area adjacent to Shangri-la Springs which had slightly greater values. Dissolved oxygen concentrations from the vent were approximately 7 mg/L (80 % saturated), a value greater than the other springs surveyed in this project. These oxygen values are consistent with those reported by Scott *et al*. 2002 in FGS bulletin 85 which listed a value of 7.26 mg/L in 2001. Dissolved oxygen concentrations increased with distance downstream to approximately 10 mg/L (112 % saturated) by the idle speed buoys (**Figure 14**). Along the sampling path, higher dissolved oxygen values were measured in areas that had topped-out submersed aquatic vegetation. Field measured pH values at the vent were approximately 7.8 standard units, and ranged from about 7.6 to 8.0 standard units in the spring run (**Figure 14**).

Shangri-la Spring water quality was similar to the main spring vent, with slightly higher conductivity and pH, while temperature and dissolved oxygen concentrations were relatively similar between spring vents (**Figure 14**).

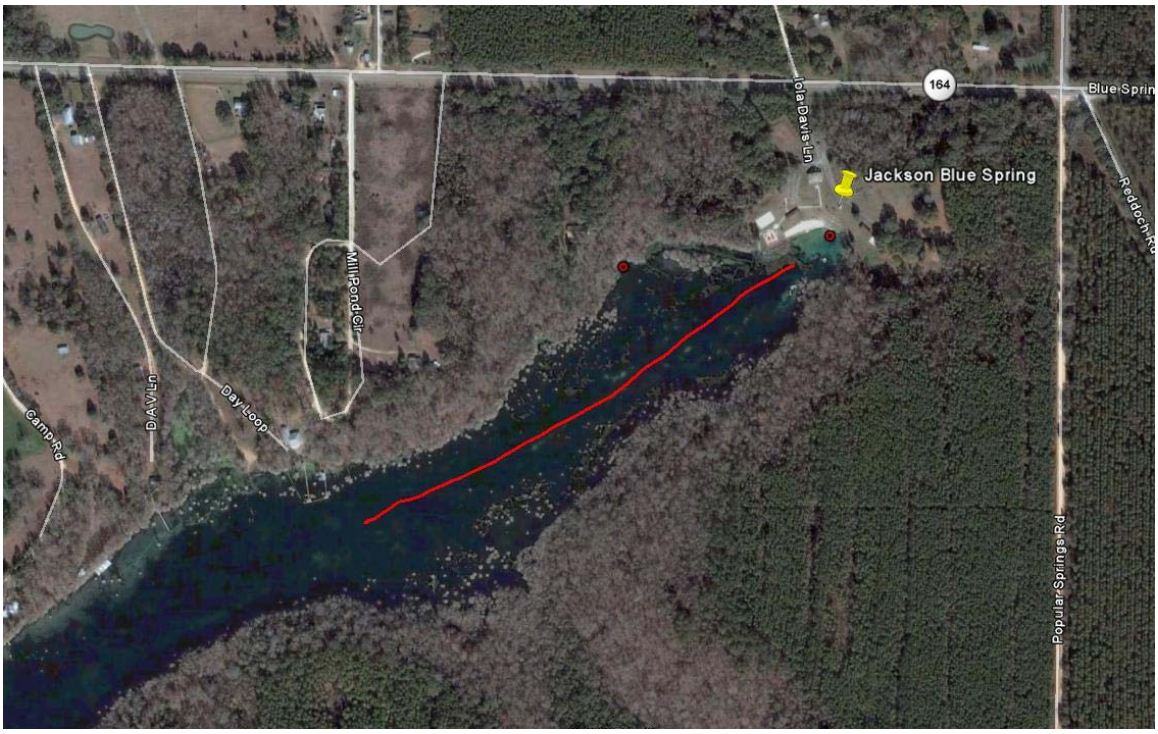


FIGURE 12
Image of Jackson Blue Spring and Merritt's Mill Pond, red icons and path indicate sampling points.

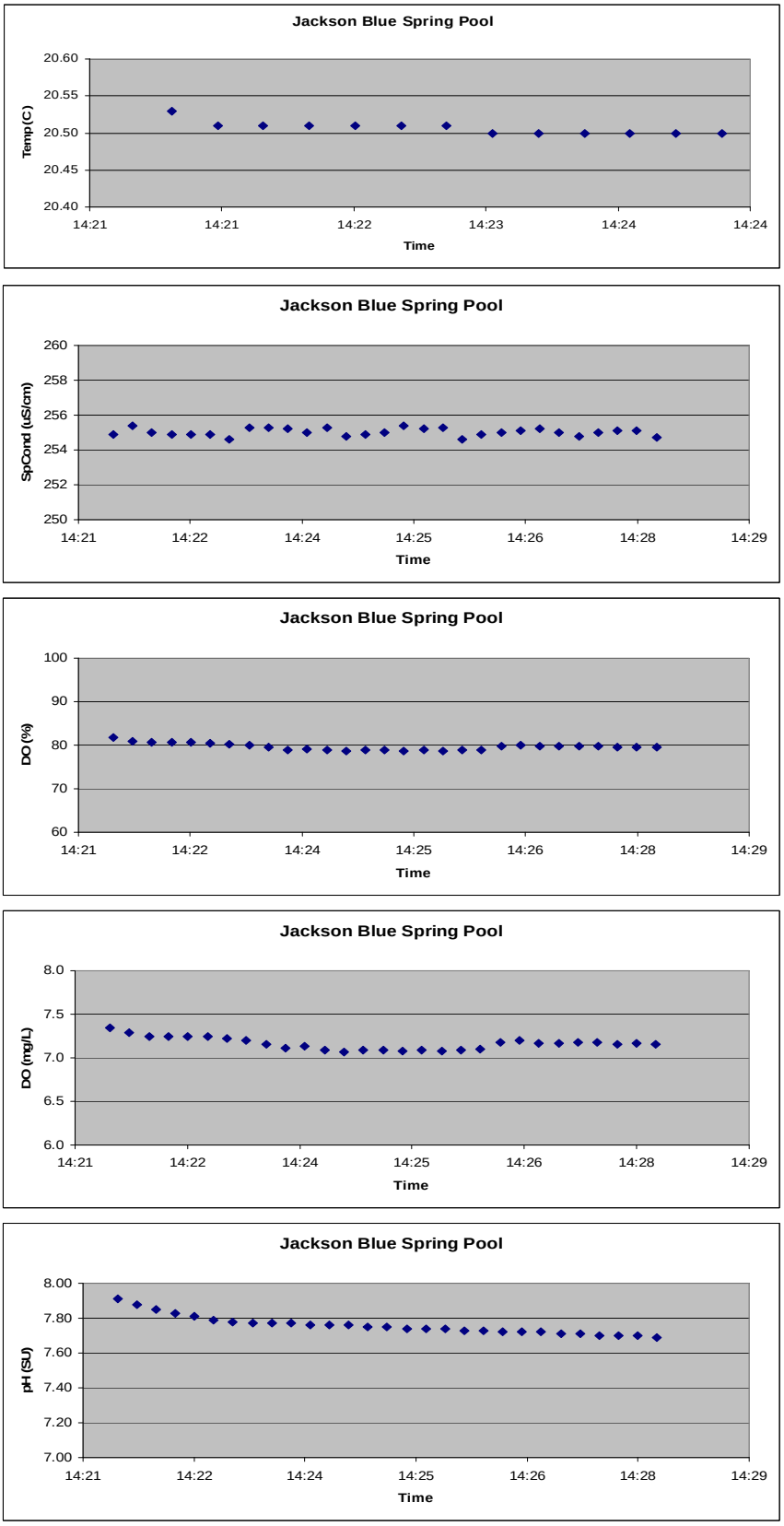
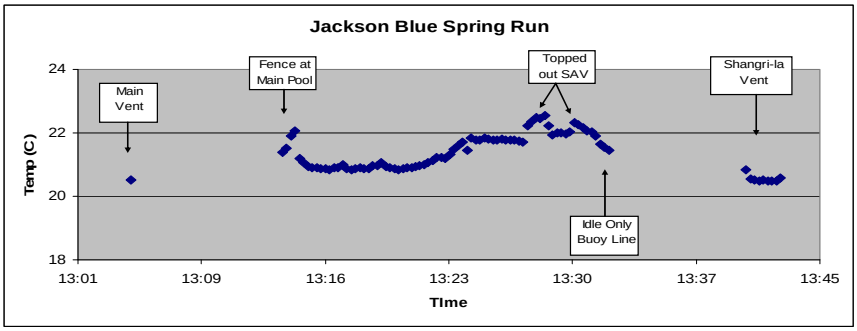
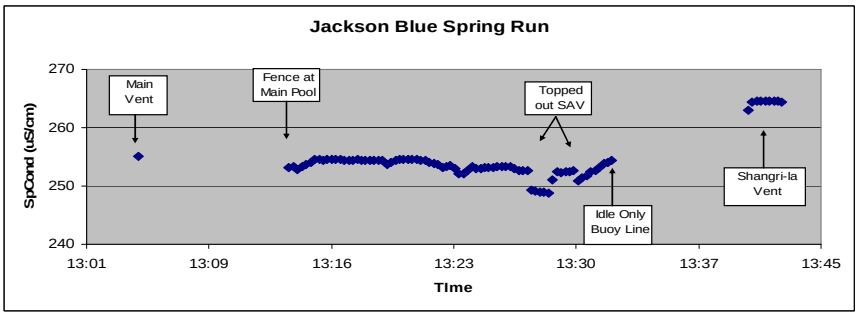
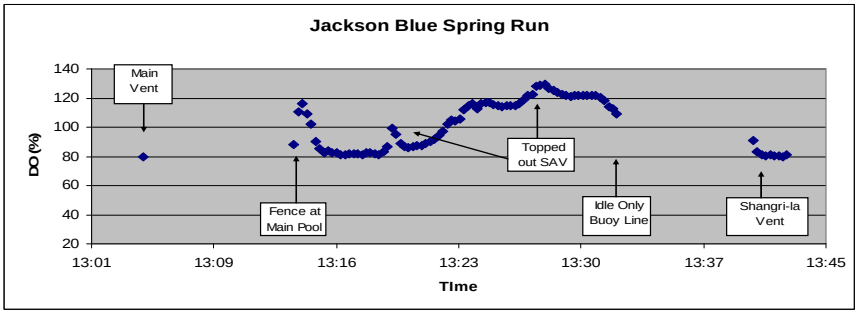
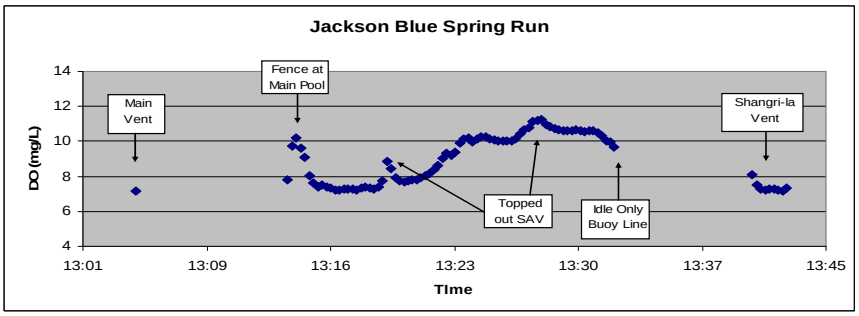


FIGURE 13
Field parameters measured from the pool of Jackson Blue Spring on August 18, 2008.









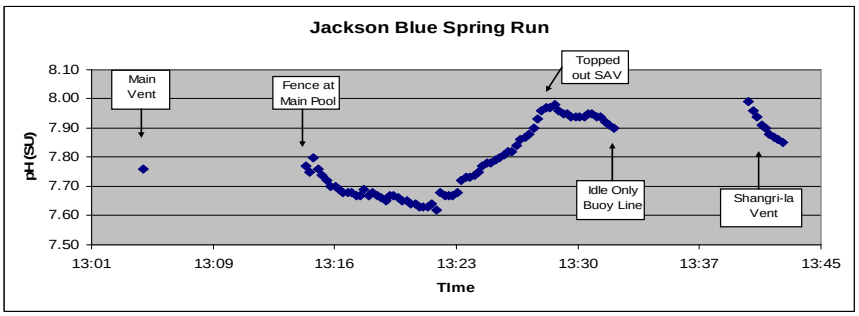


FIGURE 14
Field parameters measured from the run (Merritt's Mill Pond) of Jackson Blue Spring on August 18, 2008.

Biological

Vegetation

During the site visit made on August 18, 2008 submersed aquatic vegetation (SAV) within the spring pool and swim area was largely absent except around the downstream edge where tape grass (*Vallisneria americana*) and coontail (*Ceratophyllum demersum*) were present. A bed of cattail (*Typha spp*.) was growing from the shoreline between the swim area and boat docks. Downstream of the fence that separates the pool and run areas, coontail becomes very abundant, particularly outside of the main boat channel and along the sides on the spring run (**Figure 15**). In these areas, the percent area coverage of SAV appeared to be 75 %, with much of the coontail growing to the surface, and percent volume inhabited by submersed aquatic vegetation likely exceeded 50 % as well. This site had the most abundant growths of coontail that the authors have ever observed. Previous anecdotal reports of hydrilla (*Hydrilla verticillata*) or common waterweed (*Egeria densa*) infestations in the spring run may have been misidentifications of coontail. Beds of tape grass were also present in the spring run, but at a substantially lesser abundance than coontail. Very little periphyton or filamentous algal growths were observed in the spring, spring run, or attached to the SAV.

The absence of SAV in the first 100 m of the spring run was previously noted by FDEP Springs Initiative samplers who noted that despite very high nitrate levels (over 3.0 mg/L); there were minimal nuisance algae or plants in the upper run (FDEP 2002a). To investigate the possibility of chemicals in the spring inhibiting vegetative growth, two samples each were collected from the sediments and the water column. Analysis of the water and sediment samples from Jackson Blue Springs resulted in the detection of one herbicide. Hexazinone was detected in the water column at both water sites at concentrations below the practical quantification limit, 0.037 and 0.038 µg/L, respectively. No other herbicides/pesticides were

detected in the water or sediment samples. Hexazinone (trade name Velpar) is an herbicide used to control grasses and broadleaf and woody plants in agriculture. Hexazinone is a known and pervasive groundwater contaminant, due to its high water solubility, but at the measured concentrations, the FDEP report suggested it was "probably not the reason for reduced algae and plant growth in Jackson Blue Springs. [And suggested that] Previous physical removal of vegetative material in the swimming area or phosphorus limitation are possible" explanations for the absence of SAV in this portion of Jackson Blue Spring (FDEP 2002a).

Aquatic plants in Jackson Blue Springs run (Merritt's Millpond) have been managed by the state through herbicide applications. It has been reported that Aquathol, was used to treat hydrilla in Merritt's Mill Pond in 1996, 1998, 1999, 2000, and 2001 at concentrations of 2-3 ppm for 48 hour periods (personal communication with Jess Van Dyke from Franz 2002). During the 2006-2007 fiscal period, one acre of floating aquatic plants were treated and the same amount is projected for the 2007-2008 fiscal period (FDEP 2007).

The macroalgae of Jackson Blue Spring was surveyed during April 19 and September 24, 2008 as part of a multi-spring project by Stevenson *et al*. (2007). In the pool area, macroalgae coverage was 25.9% with a thickness of 6.6 cm (2.6 in) during April and coverage was 16% with a thickness of 11.6 cm (4.6 in) in September. The dominant species was Spirogyra sp., although another green algae species, *Rhizoclonium heiroglyphicum*, and diatoms were also noted. Submersed aquatic vegetation was also sampled, with April and September coverage being 58% and 52%, respectively. The dominant SAV species for the two sampling events was coontail, averaging 38% coverage, followed by tape grass at 23%, hydrilla and southern naiad (*Najas guadalupensis*) at 2% each (Stevenson *et al.* 2007).



FIGURE 15
A northeast-facing photograph of Jackson Blue Spring (Merritt's Mill Pond), downstream of the pool showing the abundance of topped-out coontail (R.L. Knight 08/18/08).

Macroinvertebrates

Jackson Blue Spring was sampled for crustaceans on June 12, 2002 by staff from the Florida Museum of Natural History (Franz 2002). In the main spring and run, no crayfishes were collected, only a few freshwater shrimp (*Palaemonetes paludosa*) and numerous amphipods (*Hyalella sp*.). At Spring Creek Park (below the dam at Highway 90) two species of crayfish (*Procambarus paeninsulanus* and *P. spiculifer*) were collected (Franz 2002).

In the document authored by Franz (2002), it was reported from anecdotal accounts of the park manager (Mr. Sims) that there were large numbers of crayfish in spring pool immediately following refilling of the spring run after dam reconstruction, but the apparent numbers of

crayfish have decreased each year since this observation. This reduction in crayfish abundance may be related to the consistently elevated water levels in the reservoir.

The Dougherty Plain Cave Crayfish (*Cambarus (Jugicambarus) cryptodytes*) has been collected from the cave systems of Jackson County (Walsh 2001). Although this crustacean's usage of Jackson Blue Spring is uncertain, the spring run and associated feeder springs and cave systems are potential habitat of regional importance to this rare crayfish.

Bivalves (mussels) were surveyed on June 6, 2002 in the main pool area of Blue Spring, at the eastern end of Merritt's Mill pond, and in Spring Creek just downstream of the mill dam at Highway 90 by Walsh and Williams (2003). Upstream of the dam, only the non-indigenous Asian clam (*Corbicula fluminea*) was present, although uncommon while this clam was very abundant below the dam. Downstream of the dam, at the Spring Creek site, seven native species of *Elliptio* were common to abundant including: elephantear (*Elliptio crassidens*), variable spike (*Elliptio icterina*), southern fatmucket (*Lampsilis straminea*), Florida pondhorn (*Uniomerus carolinianus*), little spectaclecase (*Villosa lienosa*), southern rainbow (*V. vibex*), and downy rainbow (*V. villosa*).

Merritt's Mill Pond was sampled once on August 5, 2002 as part of the FDEP EcoSummary program. Invertebrate stream condition index (SCI) values were not listed in this report, instead the lake condition index (LCI) was reported with a value of 41.5 (FDEP 2002b). Based on the Panhandle West Bioregion, this score is a "good" value (FDEP 2002b).

Macro fauna

The Georgia blind salamander (*Haideotriton wallacei*) has reportedly been collected from the cave systems associated with Jackson Blue Spring and nearby Shangri-La Spring. It is possible

that the nearby Florida Caverns State Park (with a Blue Spring as well) may represent the actual collection location of this amphibian.

During the site visit on August 18, 2008 by WSI; fish observed included large mouth bass (*Micropterus salmoides*) and sunfish (*Lepomis sp.*), with neither species seen in great abundance or large size. Anecdotal reports indicate that grass carp (*Ctenopharyngodon idella*) have been introduced in the reservoir to aid in the control submersed aquatic vegetation, and are reported to congregate around the spring vent in the winter months. Fishing is permitted in the spring run (Merritt's Mill Pond).

Walsh and Williams (2003) reported on fishes represented in the Florida Museum of Natural History (FLMNH) ichthyologic collection from Merritt's Mill Pond and Spring Creek immediately downstream from the dam at Highway 90 (none of the museum material was from the main spring pool). A total of 29 species of 20 genera and 12 families were recorded from the aforementioned reaches (**Table 7**). The majority of specimens represented two species, brook silverside (*Labidesthes sicculus*) and eastern mosquitofish (*Gambusia holbrooki*), with six species of cyprinids, primarily dusky shiner (*Notropis cummingsae*) and bluefin killifish (*Lucania goodei*) comprising an additional 14%, and seven species of centrarchids, primarily spotted sunfish intergrades (*Lepomis miniatus x punctatus*) another 10% of the total (Walsh and Williams 2003).

Manatees

Jackson Blue Spring is not accessible to manatees due to the dam at Highway 90. Regardless of the dam, the northern panhandle location likely makes this spring outside the normal range of manatees. In addition, manatees attempting to utilize this spring would have to first navigate the Apalachicola and the Chipola Rivers, a combined distance of more than 120 km (75 mi) inland from the Gulf of Mexico.

TABLE 7
A listing of fish in the Florida museum of Natural History (FLMNH) ichthyologic collection from Merritt's Mill Pond and Spring Creek (from Walsh and Williams 2003).

Family	Species	FLMNH	
		N	%
Lepisosteidae	*Lepisosteus osseus*	2	0.3
Clupeidae	*Dorosoma petenense*	14	2.3
Cyprinidae	*Cyprinella venusta*	1	0.2
	Cyprinus carpio	2	0.3
	Notropis cummingsae	48	7.9
	Notropis harperi	17	2.8
	Notropis petersoni	17	2.8
	Notropis texanus	1	0.2
Catostomidae	*Erimyzon sucetta*	7	1.1
	Minytrema melanops	2	0.3
Ictaluridae	*Noturus gyrinus*	3	0.5
	Noturus leptacanthus	1	0.2
Esocidae	*Esox niger*	1	0.2
Atherinopsidae	*Labidesthes sicculus*	208	34.2
Fundulidae	*Fundulus escambiae*	2	0.3
	Lucania goodei	46	7.6
Poeciliidae	*Gambusia holbrooki*	130	21.3
	Heterandria formosa	1	0.2
Centrarchidae	*Centrarchus macropterus*	4	0.7
	Lepomis auritus	7	1.1
	Lepomis gulosus	5	0.8
	Lepomis macrochirus	7	1.1
	Lepomis microlophus	3	0.5
	Lepomis miniatus x *punctatus*	31	5.1
	Micropterus salmoides	3	0.5
Percidae	*Etheostoma edwini*	24	3.9
	Etheostoma fusiforme	4	0.7
	Percina nigrofasciata	15	2.5
Elassomatidae	*Elassoma okefenokee*	3	0.5
	Total Number of Species	**29**	
	Total Number of Specimens	**609**	

Ecosystem Functions

Based on field parameters (temperature, conductance, dissolved oxygen, and pH) measured in the spring pool and spring run during the reconnaissance trip of August 18, 2008 (**Figures 13** and **14)**, this spring is suitable for measuring ecosystem metabolism based on changes in dissolved oxygen following discharge from the spring vent. Complicating factors may include the impounded water levels of the spring run with the resulting increase in water residence time as well as the multiple spring vents within Merritt's Mill Pond.

Human-Use Attendance and Activities

Recreational activities at Jackson Blue Springs include swimming, boating, fishing, picnicking, and cave diving. As a Jackson County park (Blue Springs Recreational Area), annual statistics of human attendance are available for a limited time period. For the 2006-2007 season, park attendance was reported to be approximately 26,000; and for the 2007-2008 season park attendance was reported to be 27,739 (Park Director Chuck Hatcher, personal communication). This park does not have overnight usage and the annual attendance values represent day use only. The park is open daily during the summer season, the remainder of the year the park is accessible to SCUBA divers by arrangement. The park can be accessed from the boat ramps along the spring run as well and some amount of year-round recreation may be attributed to this source.

Minimum Flow and Levels

Jackson Blue Spring was placed on the Northwest Florida Water Management District (NWWMD) MFL priority list for 2008. As of this report, the MFL adoption date has been changed to 2012 due to the need for additional data and model analysis to quantify uncertainty (NWFWMD 2009).

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Appendix S

Summary of data for Madison Blue Spring



Summary of Existing Data - Madison Blue Spring (Madison Co.)

Prepared by

Wetland Solutions, Inc.

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Cover photo: Underwater view of Madison Blue Springs pool with two largemouth bass (*Micropterus salmoides*) swimming along the rock wall (S.K. Notestein, 01/02/09).

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Figure 2 Madison Blue Spring cave map (from Karst Environmental Services).

Figure 3 Madison Blue Spring site map.

Figure 4 Photo of Madison Blue Spring from the southern bank of the pool, the vent is at the base of the rock wall to the left.

Figure 5 Physiographic regions of Madison Blue Spring (from Hoenstine 1986).

Figure 6 Hydrologic conditions of the Floridan Aquifer in the Suwannee River Water Management District; red dot indicates Madison Blue Spring (from Upchurch *et al*. 2007).

Figure 7 Monthly average discharge time series and frequency curve for Madison Blue Spring.

Figure 8 Example of Madison Blue Spring gage height variation due to the Withlacoochee River, data from August / September 2008 (USGS 2008).

Figure 9 Trends detected in springs monitored as part of the SRWMD Water Assessment Regional Network (from Upchurch *et al*. 2007).

Figure 10 Image of Madison Blue Spring, red icons indicate sampling locations on July 28, 2008.

Figure 11 Field parameters by location and time for Madison Blue Spring on July 28, 2008.

Figure 12 Underwater photo of Madison Blue Spring, showing the sparse benthic filamentous algae in the upper spring run April 27, 2008.

Figure 13 Underwater photo of Madison Blue Spring, showing a largemouth bass and sunfish in the spring pool area April 27, 2008.

Figure 14 Annual and monthly park attendance statistics for Madison Blue Spring (FDEP data).

List of Tables

Table 1 Source information for the Madison Blue Spring historical water quality data described in this report.

Table 2 Summary of water quality data for Madison Blue Spring.

Table 3 Madison Blue Spring fish survey on April 27, 2008.

Summary of Existing Springs Data

This report summarizes known existing physical, chemical, and biological data for Madison Blue Spring (Madison County). These data were collected from sources such as the Suwannee River Water Management District (SRWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Madison Blue Spring State Park

Physical address

Madison Blue Spring State Park; 8300 N.E. State Road 6; Lee, Florida 32059; Phone: 850-971-5003; latitude/longitude: 30.480500°, -83.244386°; park website: http://www.floridastateparks.org/madison/ .

Driving Directions

Madison Blue Spring is approximately 16 km (10 mi) east of Madison on the west bank of the Withlacoochee (north) River (**Figure 1**). From the town of Madison, go east on SR 6 towards the Withlacoochee River. Turn south on the west side of the bridge at the park sign. The spring is approximately 150 m (500 ft) south of the highway.

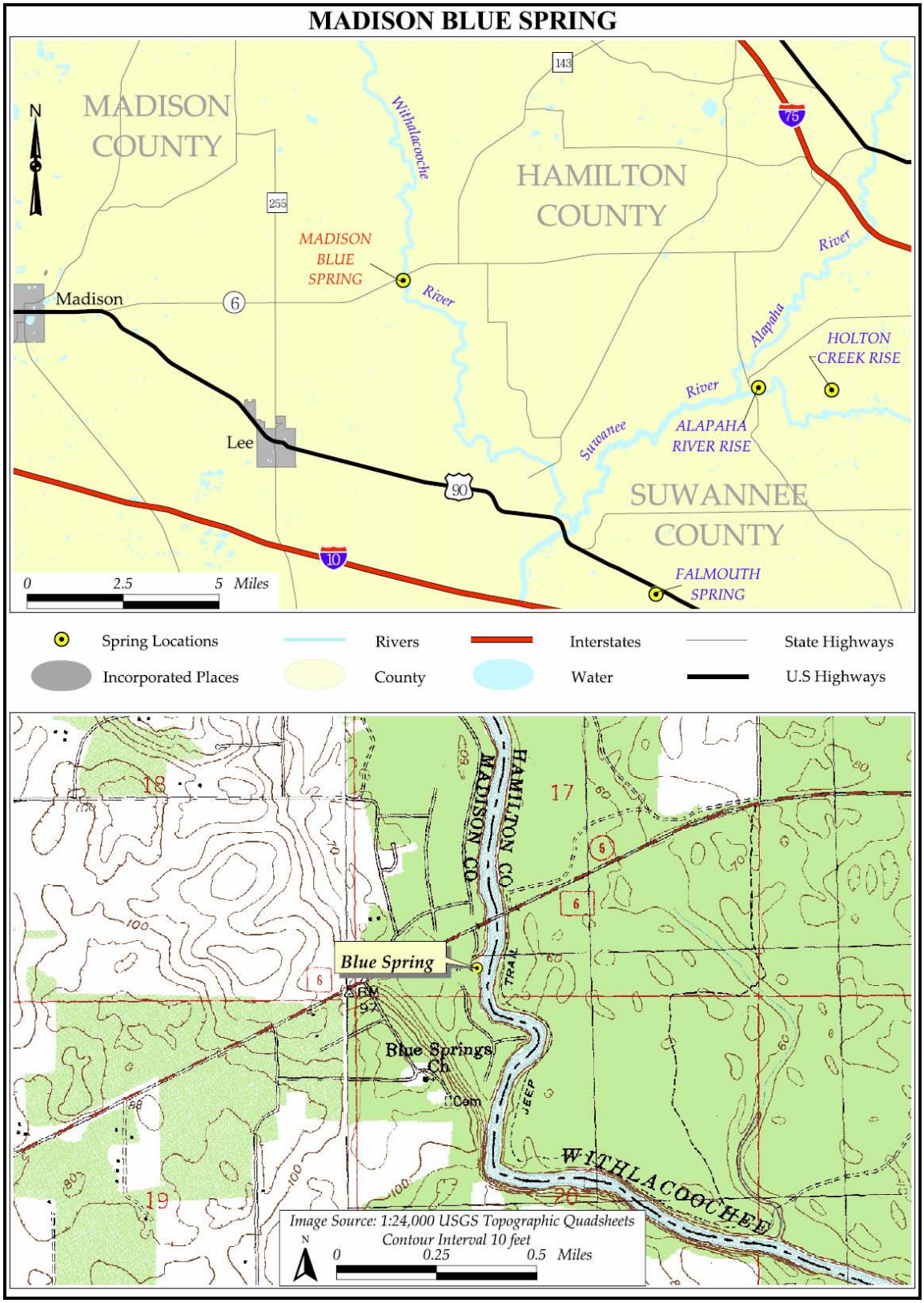


FIGURE 1
Madison Blue Spring location (from Scott *et al.* 2002).

General

Madison Blue Spring is classified as a first magnitude spring and has recently been acquired by the FDEP/FPS along with 16 ha (40 ac) of surrounding lands. Park facilities include a pay station, bathrooms, pavilions, and picnic tables available for day use with parking limited to approximately 100 vehicles. Madison Blue Spring is a popular local swimming destination, with peak usage between May through September, during which time maximum daily usage can approach 1,500 persons a day (Park Ranger Myra Carter, personal communication). Another important recreational draw to this spring is the opportunity to cave dive; however, scuba diving is restricted to certified cavern/cave divers (no solo or open water divers). Several thousand feet of this cave system have been mapped (**Figure 2**).

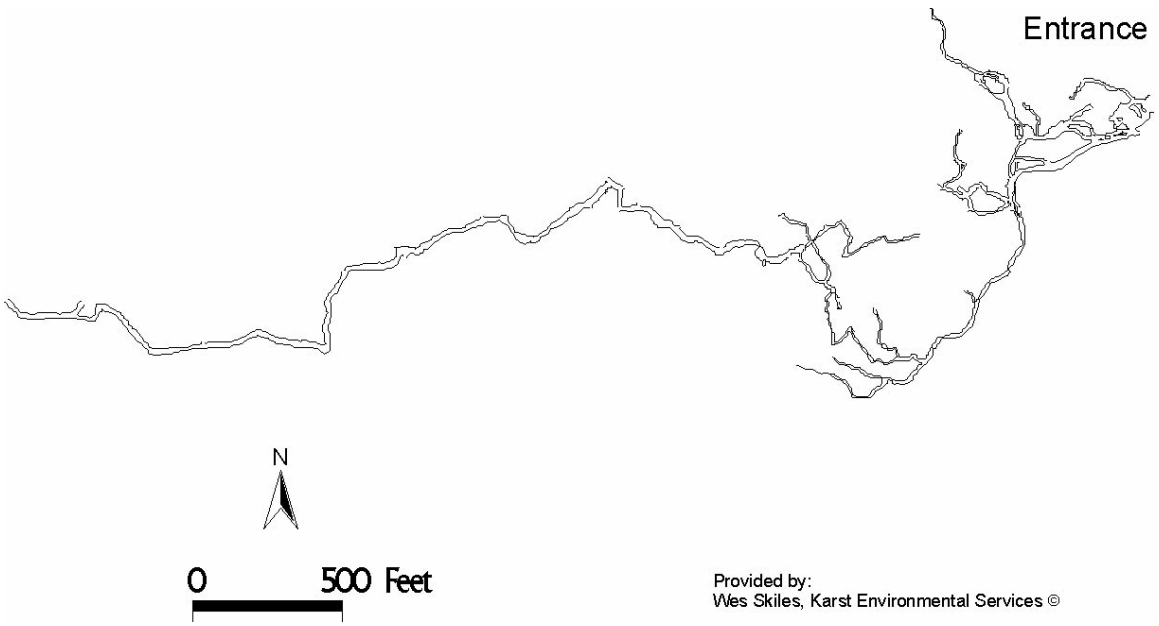


FIGURE 2
Madison Blue Spring cave map (from Karst Environmental Services).

Physical

Madison Blue Spring is located approximately 150 m (500 ft) south of SR 6 along the western bank of the Withlacoochee (north) River in Madison County (**Figure 3**). The aerial view in **Figure 3** shows the spring during Withlacoochee River flood stage, with tannin colored river water overlying the spring run and pool. River stage is highly variable and may rise more than 6 m (20 ft) during flood events.

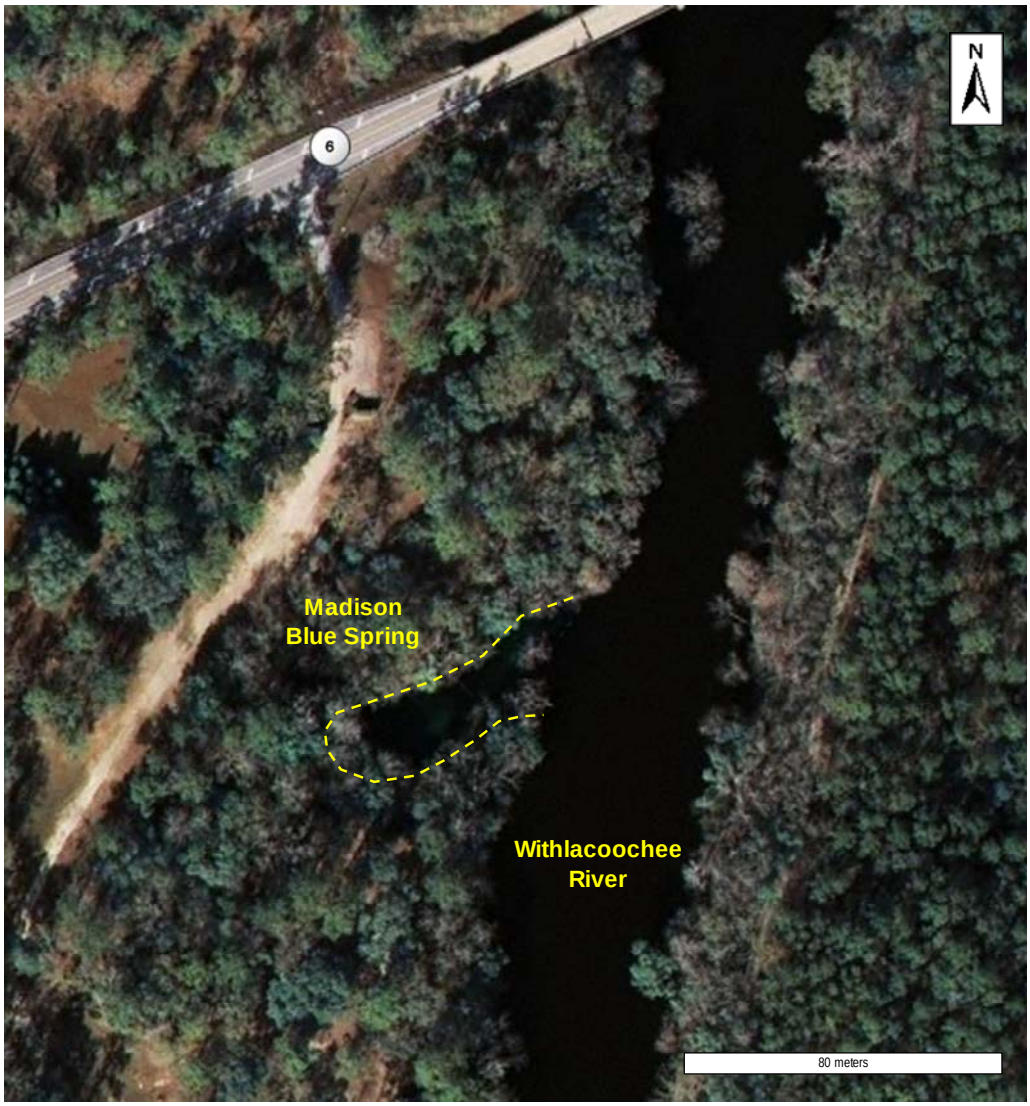


FIGURE 3
Madison Blue Spring site map.

Despite the potential for riverine flooding, Madison Blue Spring is a captivating first magnitude spring (**Figure 4**). Numerous sinkhole depressions including at least one with ground water access and connectivity to the main spring vent are found on the property. The spring is situated on the west bank of the Withlacoochee River (north) and is located in the Withlacoochee basin of the Suwannee River Water Management District. The spring pool is circular and approximately 24.4 m (80 ft) in diameter. The spring discharges from a large karst fissure at approximately 9.1 m (30 ft) of depth during typical river stage. Along the western side of the spring pool, the limestone walls are oriented vertically. The remains of wooden decking used as scuba platforms are present near the spring vent. Large limestone rocks are visible near the vent. Between the vent and the spring run, deposits of quartz sands are maintained at an approximate 45° slope. Allochthonous debris from the riparian vegetation is mixed with sediments here. The spring run travels easterly for approximately 46 m (150 ft) at which point it joins the Withlacoochee River (north). At typical river stage, the spring run is approximately 6.1 m (20 ft) wide, 1 m (3.3 ft) deep, and has rapid water movement. The spring run sediments are corresponding composed of large rocks and gravel, transitioning to finer gravel and sands as stream velocity is reduced by the confluence of the Withlacoochee River.

The lands surrounding Madison Blue Spring are contained within the Tallahassee Hills/Valdosta Limesink Ecoregion of the Southeastern Plains. The area is underlain by Oligocene and Eocene age limestone deposits. Madison County has two major physiographic regions, the Northern Highlands (where the spring is located) and the Coastal Lowlands separated by a southward facing escarpment commonly referred to as the Cody Scarp (**Figure 5**, Hoenstine 1986). The Tallahassee (Red) Hills physiographic region

has clayey sands which have weathered to a reddish soil, and reach elevations on nearly 250-ft (Brooks 1981). These hills have been created through stream erosion and subsurface dissolution (Hoenstine 1986). The Coastal Lowlands began south of the Cody Scarp and continues to the border of Taylor and Lafayette Counties. Rivers in these lowlands include the Suwannee, Withlacoochee, and Aucilla. Madison Blue Spring is located in the unconfined portion between Madison and Hamilton Counties which has become exposed through surface water erosion and geologic dissolution (**Figure 6**). Springs are abundant along these riverine unconfined areas.



FIGURE 4
Photo of Madison Blue Spring from the southern bank of the pool, the vent is at the base of the rock wall to the left.

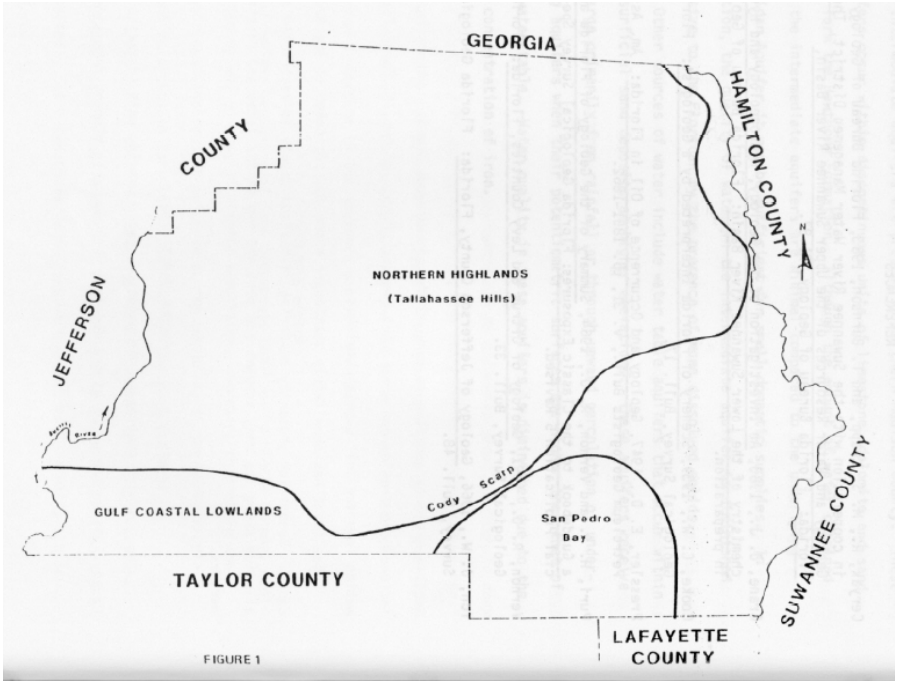


FIGURE 5
The physiographic regions of Madison County (from Hoenstine 1986).

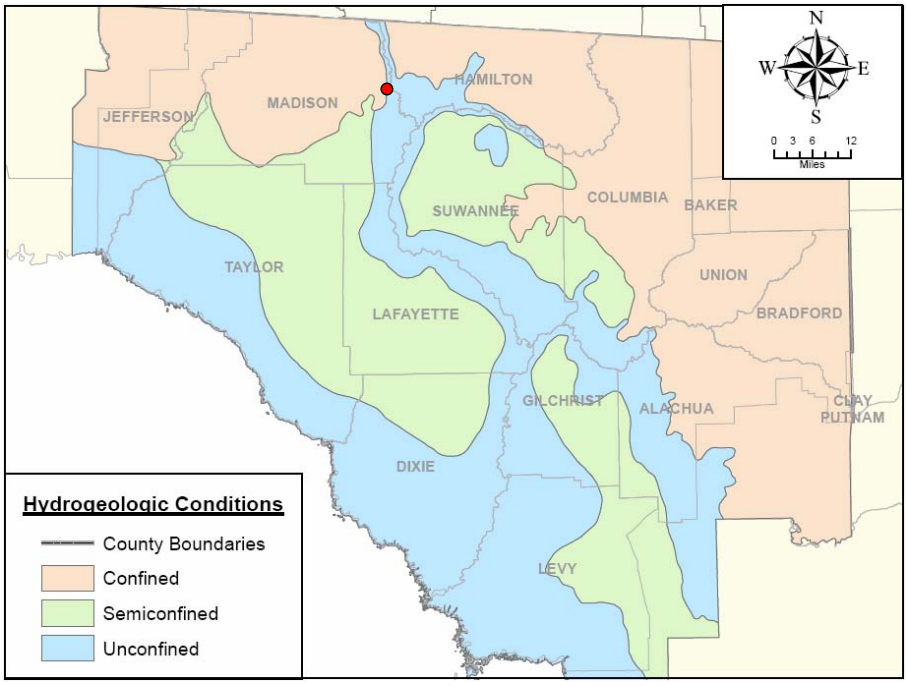


FIGURE 6
Hydrologic conditions of the Floridan Aquifer in the Suwannee River Water Management District; red dot indicates Madison Blue Spring (from Upchurch *et al.* 2007).

Study Area

The project study area is defined as the spring boil and spring run going downstream to the Withlacoochee River. **Figure 3** shows an approximation of the study area.

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Madison Blue Spring are given in **Table 1** below.

TABLE 1
Source information for the Madison Blue Spring historical water quality data described in this report.

Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
21FLGW	FL Dept. of Environmental Protection	9672	Madison Blue Spring	30.480436	-83.244363
21FLSUW	Suwannee River Water Management District	BLM010C1	Blue Spring nr Madison	30.480278	-83.244444
USGS	USGS	2319302	Madison Blue Spring nr Blue Springs, Fl	30.480278	-83.244440

Discharge and Stage

Infrequent discharge data for Madison Blue Spring are available as early as November 1973, with more frequent data collection beginning in October 2001 and continuing through June 2008 (USGS 2008). Over this entire period-of-record (POR) the average spring discharge was 85.9 cubic feet per second (cfs) and observed values ranged from approximately -74 to 408 cfs (**Figure 7**). Discharge estimates are computed from a water-current meter and when the Withlacoochee River floods, water can back up into the spring run producing negative velocities and discharges. Instantaneous discharge has been measured by the Florida Geological Survey (Rosenau *et al*. 1977, Scott *et al.* 2002) seven times between 1932 and 2001, with an average of 109 cfs (ranging from 75 to 145 cfs).

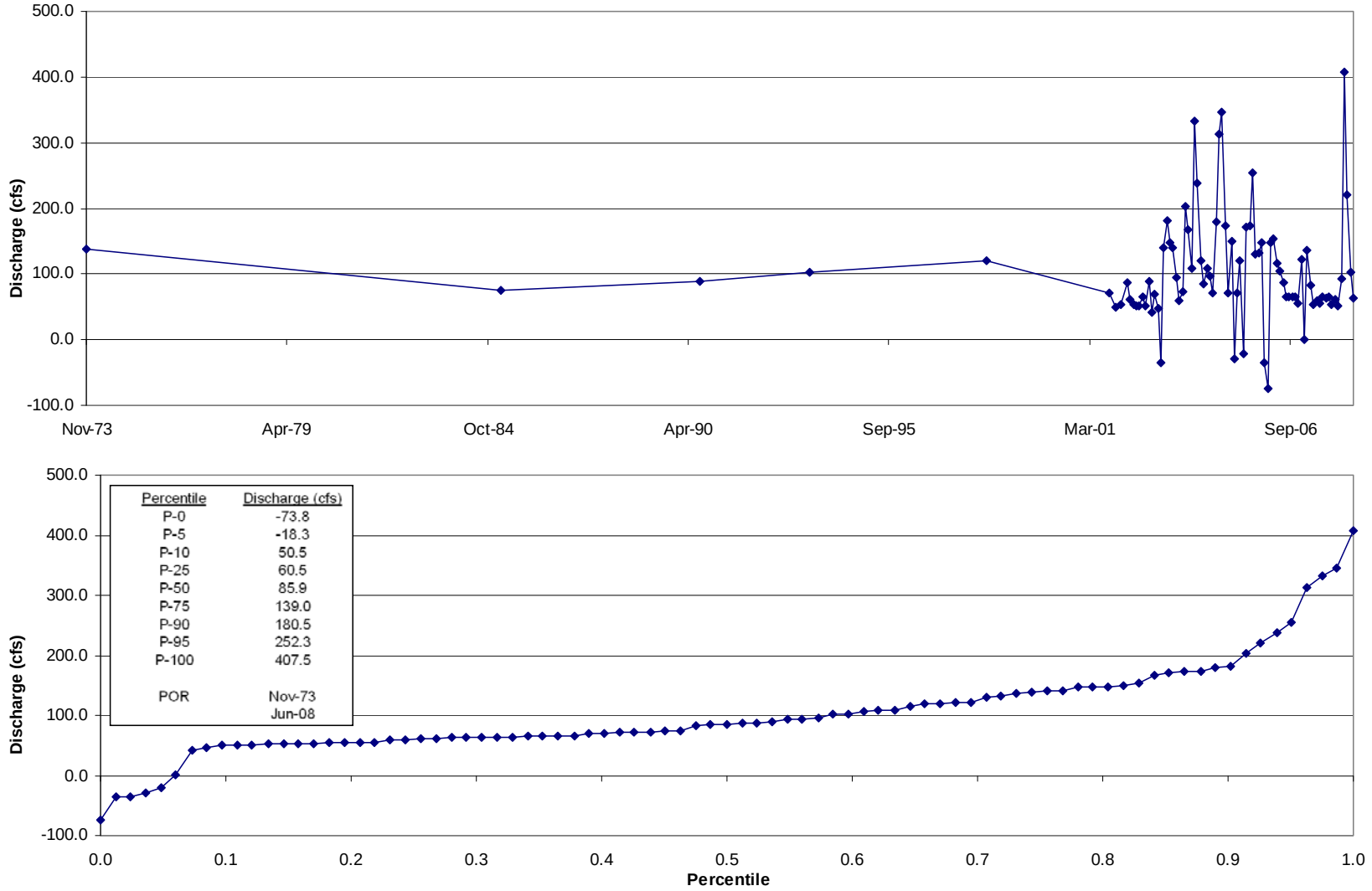


FIGURE 7
Monthly average discharge time series and frequency curve for Madison Blue Spring.

As noted above, water levels in Madison Blue Spring are influenced by the stage of the Withlacoochee River. Between 2002 and 2007, monthly mean gage heights have ranged between about 8 ft to nearly 27 ft (Land-surface elevation 48 feet above sea level NGVD29, USGS 2008). An example of the rapid change in water levels at Madison Blue Spring is shown in **Figure 8** below.

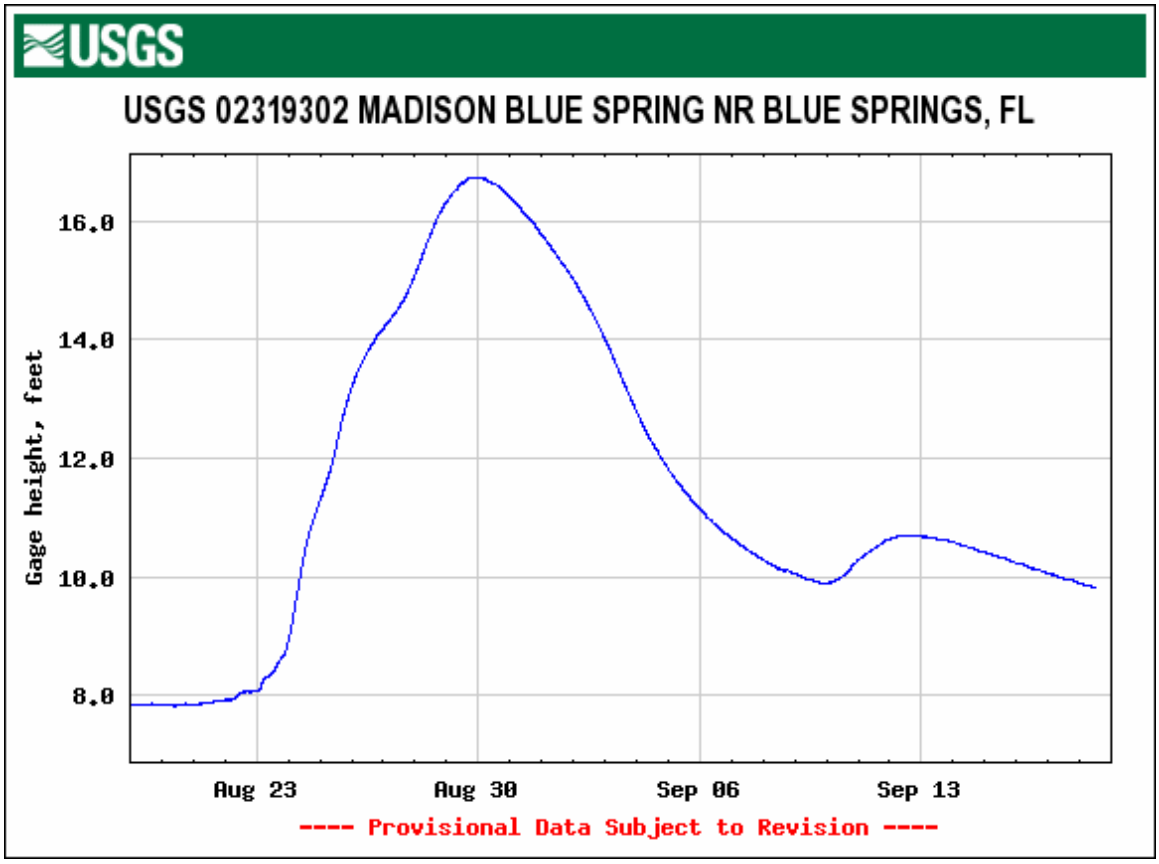


FIGURE 8
Example of Madison Blue Spring gage height variation due to the Withlacoochee River, data from August / September 2008 (USGS 2008).

Water Quality

Water quality data for Madison Blue Spring are available from as early as April 1956 to as recent as February 2008 (USGS 2008). The numbers of samples collected were highly variable between parameters, ranging from 1 to over 177 records. Samples appear to have been collected solely from the main boil. **Table 2** provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Madison Blue Spring POR averages for several key parameters and the numbers of samples in parenthesis are:

- Water temperature – 21.4 °C (n = 93)
- Dissolved oxygen – 1.99 mg/L (n = 81)
- pH – 7.58 SU (n = 96)
- Specific conductance – 266 umhos/cm (n = 177)
- Turbidity – 0.74 NTU (n = 82)
- Color – 8.43 CPU (n= 78)
- Total chloride – 5.73 mg/L (n = 97)
- Sulfate –13.8 mg/L (n = 97)
- Nitrate+nitrite nitrogen – 1.4 mg/L (n = 96)
- Total phosphorus – 0.05 mg/L (n = 95)

TABLE 2
Summary of water quality data for Madison Blue Spring.

			Decade Average						Statistics					Period of Record	
PARAMETER GROUP	PARAMETER	UNITS	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
BACTERIOLOGICAL	Enterococci	#/100ml						2.43	2.43	2.00	5.00	1.13	7	4/8/04	10/16/06
	EColi	#/100ml						6.00	6.00	6.00	6.00		1	10/2/01	10/2/01
	FC	#/100ml						13.8	13.8	0.00	120	30.0	36	10/2/01	10/15/07
	TC	#/100ml						35.6	35.6	0.00	240	50.8	36	10/2/01	10/15/07
DISSOLVED OXYGEN	DO	%			28.0				28.0	28.0	28.0		1	11/6/73	11/6/73
	DO	mg/L			2.50	1.50	2.37	1.98	1.99	0.800	7.15	0.961	81	11/6/73	2/26/08
FLOW	Flow	cfs					120	110	110	32.5	231	48.2	27	6/15/98	10/4/06
	Flow-Inst	cfs			138	75.0	95.5		101	75.0	138	27.2	4	11/6/73	8/9/93
GENERAL INORGANIC	Alk	mg/L as CaCO3	117	118	121			120	120	6.00	162	15.5	80	4/24/56	2/26/08
	Cl-T	mg/L	5.50	4.00	4.00	5.00	3.90	5.81	5.73	2.50	13.0	1.16	97	4/24/56	2/26/08
	F-T	mg/L						0.153	0.153	0.140	0.170	0.010	11	10/2/01	10/15/07
	Hardness	mg/L as CaCO3	130	130	140	130	140		135	130	140	5.48	6	4/24/56	8/9/93
	Si-D	mg/L	10.0	9.10	9.40	9.40	9.50		9.48	9.10	10.0	0.299	6	4/24/56	8/9/93
	Si-T	mg/L						4.90	4.90	3.20	15.8	2.13	43	10/24/02	2/26/08
	SO4	mg/L	12.0	9.60	11.0	13.0	13.0	13.9	13.8	4.47	83.6	7.52	97	4/24/56	2/26/08
GENERAL ORGANIC	DOC	mg/L					0.500		0.500	0.500	0.500		1	8/9/93	8/9/93
	TOC	mg/L			0.00			1.29	1.28	0.00	15.8	1.77	138	11/6/73	2/26/08
METAL	Al-T	µg/L						19.5	19.5	7.70	37.5	10.2	7	10/2/01	4/8/04
	As-T	µg/L						3.29	3.29	1.50	7.00	1.95	7	10/2/01	4/8/04
	Ba-T	µg/L				100		3.87	17.6	2.40	100	36.4	7	3/7/85	4/8/04
	Cd-T	µg/L				1.00		0.321	0.406	0.250	1.00	0.257	8	3/7/85	4/8/04
	Ca-D	mg/L	40.0	41.0	40.0	40.0	42.5	42.3	41.9	39.4	43.5	1.32	17	4/24/56	10/15/07
	Ca-T	mg/L						41.4	41.4	2.91	73.1	5.99	91	10/2/01	2/26/08
	Cr-T	µg/L				1.00		1.07	1.06	1.00	1.50	0.177	8	3/7/85	4/8/04
	Co-T	µg/L						0.732	0.732	0.375	1.00	0.274	7	11/6/73	4/8/04
	Cu-T	µg/L				1.00		1.93	1.81	1.00	4.00	1.13	8	11/6/73	4/8/04
	Fe-T	µg/L						14.9	14.9	5.00	23.0	6.70	7	10/2/01	4/8/04
	Pb-T	µg/L				1.00		3.14	2.88	1.00	6.00	1.43	8	11/6/73	4/8/04
	Mg-D	mg/L	8.00	7.20	10.0	8.00	8.20	8.44	8.38	7.20	10.0	0.651	17	4/24/56	10/15/07
	Mg-T	mg/L						8.36	8.36	1.36	12.1	1.04	91	10/2/01	2/26/08
	Mn-T	µg/L						2.00	2.00	0.680	4.40	1.33	7	10/2/01	4/8/04
	Hg-T	µg/L				0.100			0.100	0.100	0.100		1	3/7/85	3/7/85
	Ni-T	µg/L						1.18	1.18	0.750	2.00	0.426	7	10/2/01	4/8/04
	K-T	mg/L						0.580	0.580	0.200	3.00	0.422	91	10/2/01	2/26/08
	Se-T	µg/L						3.82	3.82	1.75	7.50	1.80	7	10/2/01	4/8/04
	Ag-T	µg/L				1.00			1.00	1.00	1.00		1	3/7/85	3/7/85
	NA-D	mg/L	2.80	2.60	2.90	2.80	2.95	3.51	3.27	2.60	4.70	0.690	17	4/24/56	10/15/07
	NA-T	mg/L						4.11	4.11	2.60	35.4	3.70	80	10/23/01	2/26/08
	SR-T	µg/L						54.7	54.7	50.0	65.4	5.88	7	10/2/01	4/8/04
	Zn-T	µg/L						2.71	2.71	1.00	8.00	2.45	7	10/2/01	4/8/04
NITROGEN	NH4-N	mg/L			0.010	0.060	0.010	0.043	0.042	0.00	0.235	0.042	87	11/6/73	10/15/07
	NOx-N	mg/L				1.00	1.46	1.40	1.40	0.107	2.00	0.309	96	3/7/85	2/26/08
	NO3-N	mg/L			0.520				0.520	0.520	0.520		1	11/6/73	9/10/02
	NO2-N	mg/L			0.006	0.010	0.010		0.009	0.006	0.010	0.002	3	11/6/73	8/13/90
	OrgN	mg/L			1.20	0.040			0.620	0.040	1.20	0.820	2	11/6/73	3/7/85
	TKN	mg/L				0.100	0.200	0.176	0.176	0.030	0.890	0.166	93	3/7/85	2/26/08
	TKN-D	mg/L					0.200	0.064	0.075	0.030	0.200	0.053	12	8/9/93	10/15/07
	TN	mg/L			1.70	1.10			1.40	1.10	1.70	0.424	2	11/6/73	3/7/85
OXYGEN DEMAND	BOD5	mg/L			0.700				0.700	0.700	0.700		1	11/6/73	11/6/73
	cBOD5	mg/L						0.290	0.290	0.290	0.290		1	10/2/01	10/2/01
PESTICIDE	Alachlor-D	µg/L					0.002		0.002	0.002	0.002		1	8/9/93	8/9/93
	Atrazine-D	µg/L					0.001		0.001	0.001	0.001		1	8/9/93	8/9/93
	Diazinon-D	µg/L					0.002		0.002	0.002	0.002		1	8/9/93	8/9/93
	Dieldrin-D	µg/L					0.001		0.001	0.001	0.001		1	8/9/93	8/9/93
	Lindane-D	µg/L					0.004		0.004	0.004	0.004		1	8/9/93	8/9/93
PHOSPHORUS	OrthoP	mg/L			0.030	0.040	0.035	0.035	0.035	0.019	0.056	0.009	83	11/6/73	10/15/07
	TDP	mg/L					0.030	0.043	0.042	0.030	0.057	0.007	12	8/9/93	10/15/07
	TP	mg/L			0.035	0.040	0.035	0.050	0.050	0.009	0.140	0.017	95	11/6/73	2/26/08
PHYSICAL	Color	CPU	10.0	0.00	5.00	5.00	5.00	8.66	8.43	0.00	160	18.7	78	4/24/56	2/26/08
	Depth	m						7.59	7.59	1.08	9.63	1.25	74	10/2/01	2/26/08
	pH	SU	7.90	7.70	7.70	7.70	7.76	7.56	7.58	7.02	8.01	0.176	96	4/24/56	2/26/08
	Secchi	m						6.68	6.68	0.500	9.10	2.24	26	10/2/01	2/26/08
	SpCond	umhos/cm	260	257	261	267	271	266	266	0.045	309	47.6	177	4/24/56	2/26/08
	Stage	ft						9.47	9.47	8.12	12.6	1.50	14	10/24/02	10/15/07
	Stage	ft MSL						8.74	8.74	1.89	12.5	2.52	61	11/12/01	4/19/07
	Turb	NTU			4.00			0.734	0.774	0.00	27.3	3.03	82	11/6/73	2/26/08
SOLID	TDS	mg/L		163	155	140	162	166	165	86.0	324	25.4	89	11/15/60	2/26/08
	TSS	mg/L						1.52	1.52	0.00	2.00	0.823	25	10/2/01	10/15/07
TEMPERATURE	Wtr Temp	C		21.1	21.0	21.0	21.1	20.9	21.4	16.6	70.0	5.12	93	4/24/56	2/26/08

A trend of increasing nitrate-nitrogen concentrations in the water discharged from Madison Blue Spring (and other regional springs, **Figure 9**) has been investigated by the Suwannee River Water Management District (SRWMD 2004) and other researchers (Upchurch *et al.* 2007). Results of these studies indicate that a mixture of nitrogen sources, including inorganic fertilizer, organic animal waste, and to a degree, atmospheric deposition, contribute to this increasing groundwater nitrogen trend (Upchurch *et al.* 2007). In a time series analysis of water quality data, Upchurch *et al.* (2007) reported that approximately 47% of the increasing trend in nitrate concentrations could be explained by the date of sampling (51 samples). Analysis by Strong (2004) also found a significant increase in nitrate concentrations at Madison Blue Spring.

Measurements of water chemistry field parameters (temperature, conductance, dissolved oxygen, and pH) in the spring boil and run areas were made during the reconnaissance trip of July 28, 2008. Field parameters were measured from the main boil, approximately mid-way downstream the spring run, and at the lower spring run (**Figure 10)**. Water temperatures above the spring vent was typical of groundwater at this latitude at approximately 21 °C, and increased slightly with distance downstream (**Figure 11**). Specific conductance was approximately 275 umhos/cm in the spring pool and increased marginally downstream (**Figure 11**). Dissolved oxygen concentrations from the spring vent approximately 1.2 mg/L (or 14% saturated), and at the lower spring run had increased to about 1.6 mg/L (17% saturated) (**Figure 11**). Field measured pH values varied slightly among sampling locations, averaging about 7.6 standard units throughout the spring run (**Figure 11**). The apparent color of the spring boil at the time of sampling could be described as a pleasing blue.

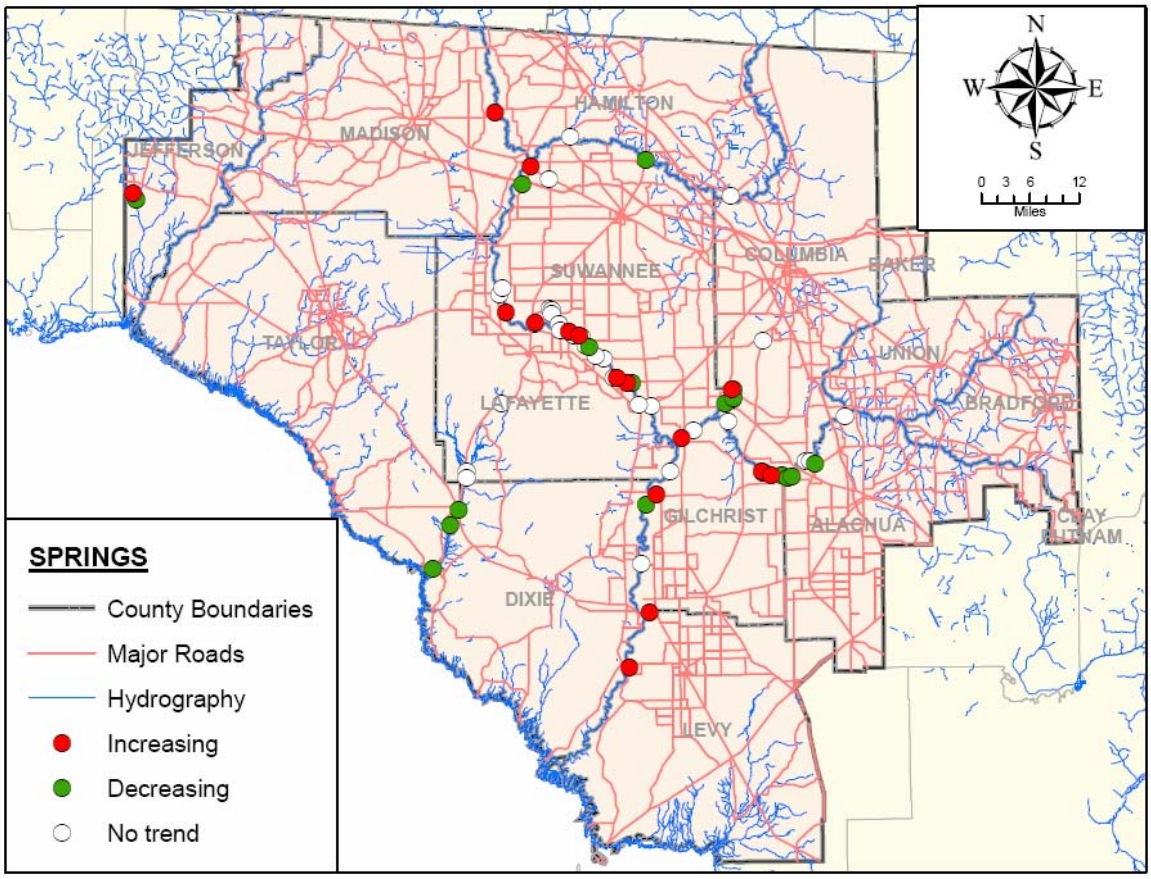


FIGURE 9
Trends detected in springs monitored as part of the SRWMD Water Assessment Regional Network (from Upchurch *et al.* 2007).

Although the Madison Blue spring run is short with minimal aquatic vegetation; slight downstream increases in dissolved oxygen (DO) were evident and afford the opportunity to estimate ecosystem metabolism based on these changes. During our reconnaissance, average DO concentrations at the spring vent were roughly 1.2 mg/L and increased to approximately 1.6 mg/L within 46 m (150 ft) downstream. These values were measured early in morning sunlight conditions, and slightly higher downstream DO concentrations are likely to be observed between 16:00 to 18:00 hours on days without cloud cover.

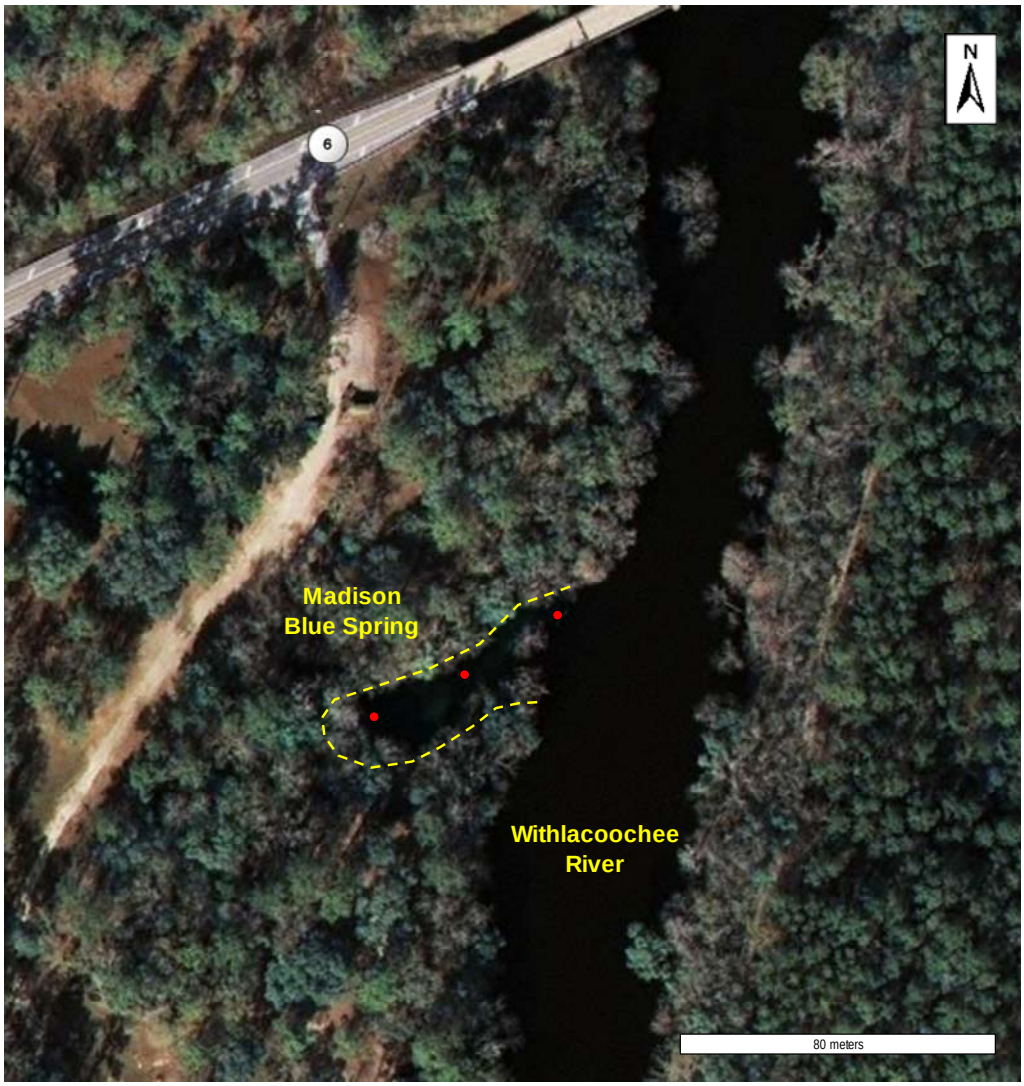
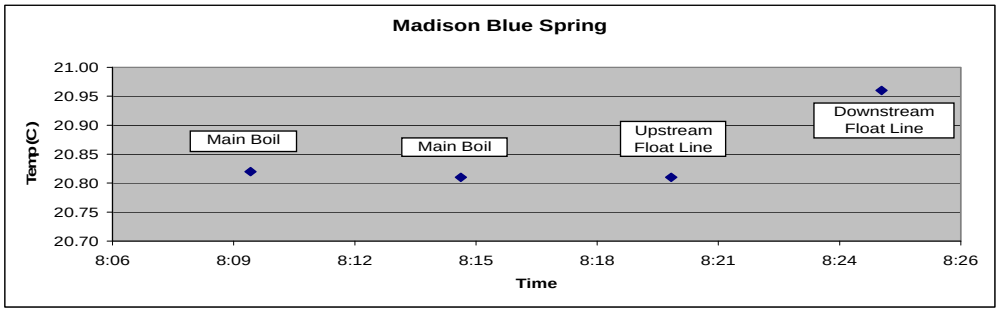
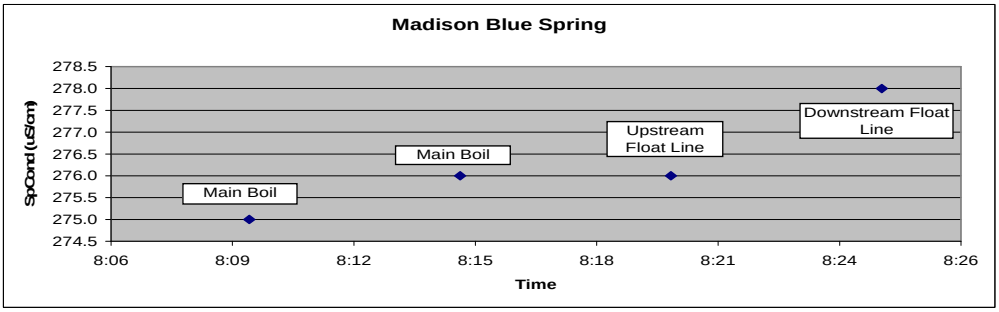
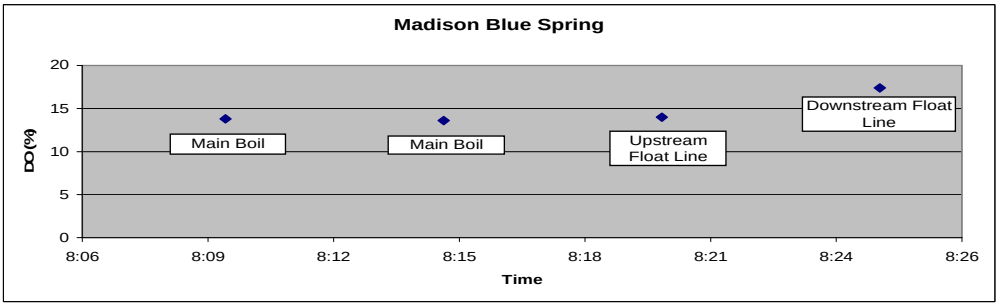
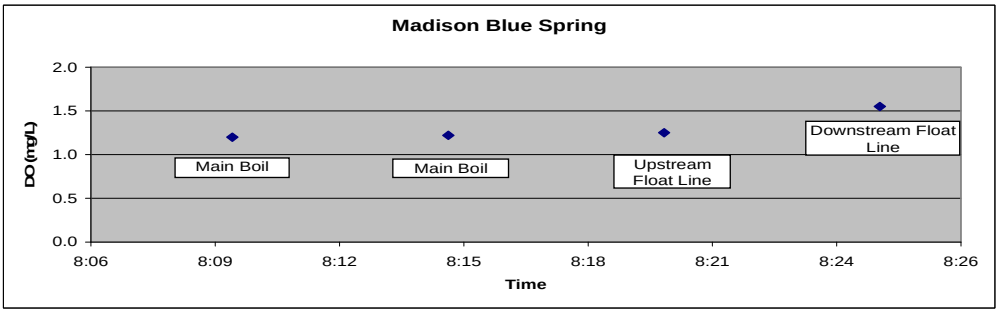


FIGURE 10
Image of Madison Blue Spring, red icons indicate sampling locations on July 28, 2008.









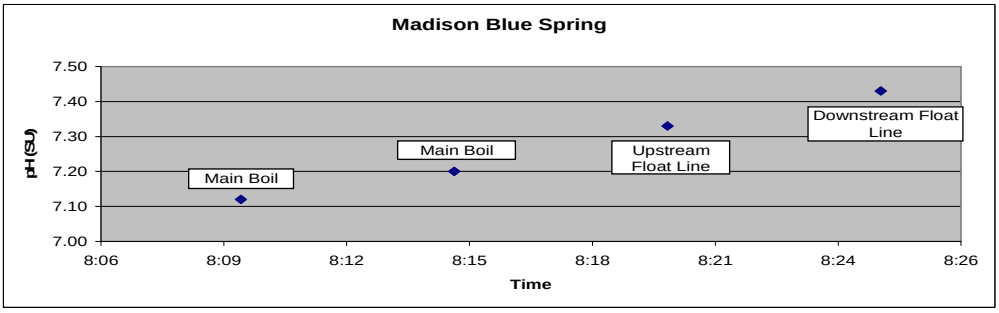


FIGURE 11
Field parameters by location and time for Madison Blue Spring on July 28, 2008.

Biological

Vegetation

There appears to have been only one investigation, by Stevenson *et al.* (2007) of the aquatic vegetation for Madison Blue Spring. This study involved two sampling dates, September 29, 2003 and July 26, 2006, for the purpose of quantifying the macroalgae community and what environmental factors were correlated with the algae in the spring. During the fall sampling event the authors noted that macroalgae covered 69% of the spring benthos with an average depth of 6.3 cm (2.5 in). The macroalgae observed included *Vaucheria sp*. (69%), *Spirogyra sp*. (30%), *Oscillatoria sp*. (12 %), and diatoms (4%). The only reported macrophyte was an aquatic moss (e.g. *Fontinalis sp*.) with an estimated coverage of 3.7% of the spring (Stevenson *et al.* 2007).

During the site visit, submersed aquatic vegetation was limited to sparse filamentous algae growing on the sediments, and attached to submersed wood and rock substrates (**Figure 12**). Periphyton appears to be composed of green algae, cyanobacteria, and diatoms. Park ranger Myra Carter reported that no aquatic weeds had been observed in the past two years in the spring; however, following river flood events, water hyacinth (*Eichhornia crassipes*) can be deposited in the spring boil.



FIGURE 12
Underwater photo of Madison Blue Spring, showing the sparse benthic filamentous algae in the upper spring run April 27, 2008.

Macroinvertebrates

In a publication by Franz *et al*. (1994), Madison Blue Spring was reported to support a troglobitic crayfish, the pallid cave crayfish (*Procambarus pallidus*), and two species of cave amphipods, the Florida cave amphipod (*Crangonyx grandimanus*) and Hobb's cave amphipod (*Crangonyx hobbsi*). However, a subsequent report by Franz (2002) in which the aquatic crustaceans from 17 Florida parks were investigated, did not include Madison Blue Spring.

Mattson *et al.* (1995) collected macroinvertebrates and periphyton from the nearby Withlacoochee River (and other spring-fed streams of north central Florida) and noted that increases in benthic invertebrate species richness and higher proportions of periphytic diatoms were associated with spring inputs.

The best examination of the benthic macroinvertebrate community for Madison Blue Spring has been undertaken by Biological Research Associates (BRA) as part of the biological monitoring component of the Environmental Monitoring Plan issued by the Suwannee River Water Management District (SRWMD) water use permit to Nestlé Waters North America, Inc. At least six biological monitoring events (using methodology similar to FDEP SCI) have been conducted; with three events in November 2003, May 2004, and May 2005 serving as baseline conditions (prior to permitted withdrawal of groundwater in July 2005); and three monitoring events in November 2005, May 2006, and November 2006 (Campbell and Durbin 2007).

Within the solution tunnels of Madison Blue Spring, between 3 and 46 cave crayfish and 3 and 95 cave amphipods (believed to be the species identified by Franz *et al*. 1994) were observed during each of the six monitoring events. Within the spring pool and run, benthic

macroinvertebrates and *Elimia* snails have been monitored as well. The number of *Elimia* snails collected from the spring pool and run ranged from 51 in May 2005 to 173 in May 2006. During 2006 sampling, the two most common macroinvertebrate species collected were the amphipods *Gammarus tigrinus* and *Hyalella azteca* (Campbell and Durbin 2007).

Stream condition Index (SCI) metrics have been calculated as part of BRA monitoring efforts at Madison Blue Spring. SCI overall scores have ranged from 7.56 (very poor) to 27.97 (poor) in the pool and run portions.

Macro fauna

Limited published data exist for the fish community of Madison Blue Spring. Campbell and Durbin (2007) report both yellow bullhead (*Ameiurus natalis*) and more commonly, white catfish (*Ameiurus catus*) occupying the cavern and associated solution tunnels of the spring, with total numbers of specimens ranging from 26 in May 2005 to 178 in October 2003.

During a site visit made on April 27, 2008, a visual fish survey was conducted of the spring pool and run (S.K. Notestein). Four different species of fish were observed with an estimated total of 18 individuals (**Table 3**). The largemouth bass observed appeared to have relatively poor condition (**Figure 13**).

TABLE 3
Madison Blue Spring fish survey on April 27, 2008.

common name	scientific name	total estimated #
striped mullet	*Mugil cephalus*	8
largemouth bass	*Micropterus salmoides*	1
bluegill	*Lepomis macrochirus*	4
redbreast sunfish	*Lepomis auritus*	5
Totals	**4 species**	**18 individuals**



FIGURE 13
Underwater photo of Madison Blue Spring, showing a largemouth bass and sunfish in the spring pool area on April 27, 2008.

During the July 28, 2008 site visit, relatively few fish were observed: two largemouth bass (*Micropterus salmoides*), up to a dozen smaller sunfish (*Lepomis sp*.), and where the spring run joined the river, a small school of unknown minnow sized fish.

Manatees

Madison Blue Spring is not known to be utilized by manatees, likely due to the long distance upstream from the Gulf of Mexico and shallow shoals along the Withlacoochee River (north).

Ecosystem Functions

Based on field parameters (temperature, conductance, dissolved oxygen, and pH, **Figure 11**) measured in the spring boil and spring run during the reconnaissance trip of July 28, 2008, this spring is suitable for measuring ecosystem metabolism based on changes in dissolved oxygen following discharge from the spring vent. Complicating factors may include the variable water levels of the Withlacoochee River and the possibility of spring flooding.

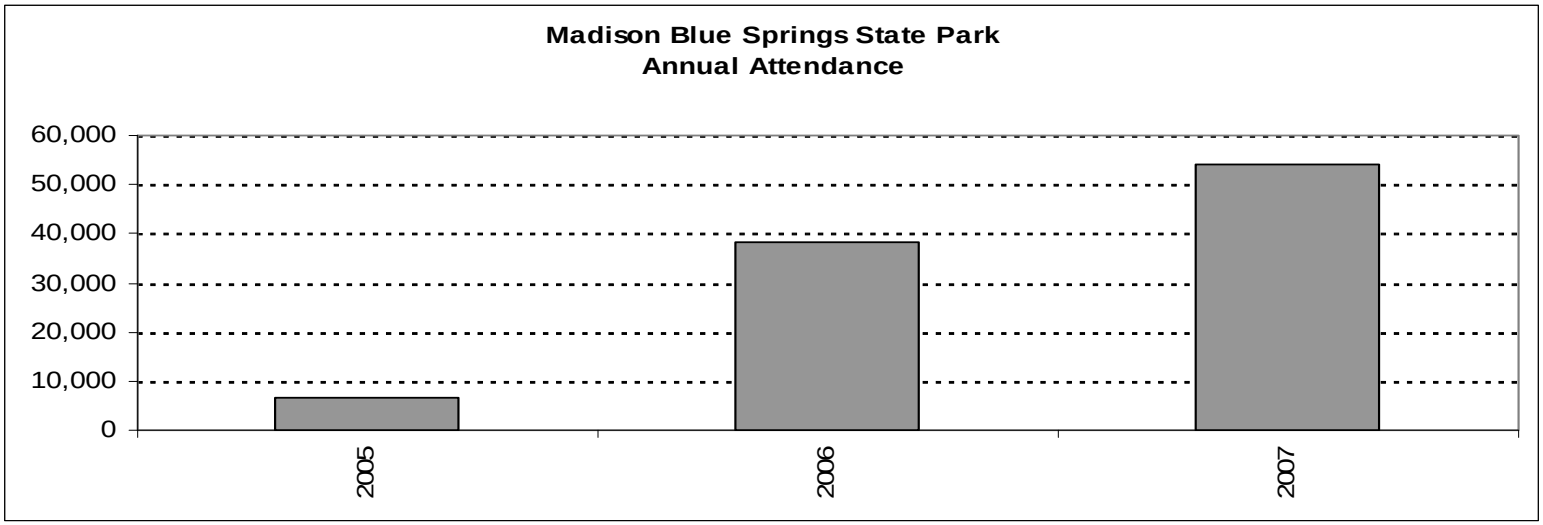
Human-Use Attendance and Activities

Recreational activities at Madison Blue Springs include swimming, fishing, picnicking, and cave diving. The park can be accessed from the Withlacoochee River as well. As a state park, monthly and annual statistics of human attendance are available for Madison Blue Springs (**Figure 14**). Park attendance records are only available from the recent time period, as the park has recently been acquired by FDEP/FPS from private parties. This park does not have overnight usage and the annual attendance values represent day use only. Maximum annual attendance slightly exceeded 54 thousand visitors during 2007 and based on the available data, annual attendance appears to be increasing. Maximum monthly usage occurs during the summer, reflecting this springs usage as a popular swimming location (**Figure 14**).

Minimum Flow and Levels

Minimum Flow and Levels (MFLs) for Madison Blue Spring have been adopted by the Suwannee River Water Management District (SRWMD) in 2005. The MFL established minimum surface water flows and levels at which further withdrawals would be significantly harmful to the water resources or ecology (WRA 2004). The MFL establishes: (1) The minimum surface water flow for Madison Blue Spring is 70 cubic feet per second

(cfs) for a flow duration frequency of 90 percent when the stage of the Withlacoochee River measured at the Pinetta gauge is 55.0 feet (NGVD) or less. (2) If the surface water flows from Madison Blue Spring are reduced below the levels established in paragraph (1) above, withdrawals will be significantly harmful to the water resources or ecology (WRA 2004). This MFL is based on: (a) A stage of 55.0 feet (NGVD) at the Pinetta gauge will serve as a modeling boundary condition and (b) The surface water flow for Madison Blue Spring shall not be caused to be reduced to a predicted flow of 70 cfs or less for a flow duration frequency of less than 90 percent as determined by the Flow Duration Curve for the Madison Blue Spring discharge over the historic period (WRA 2004).



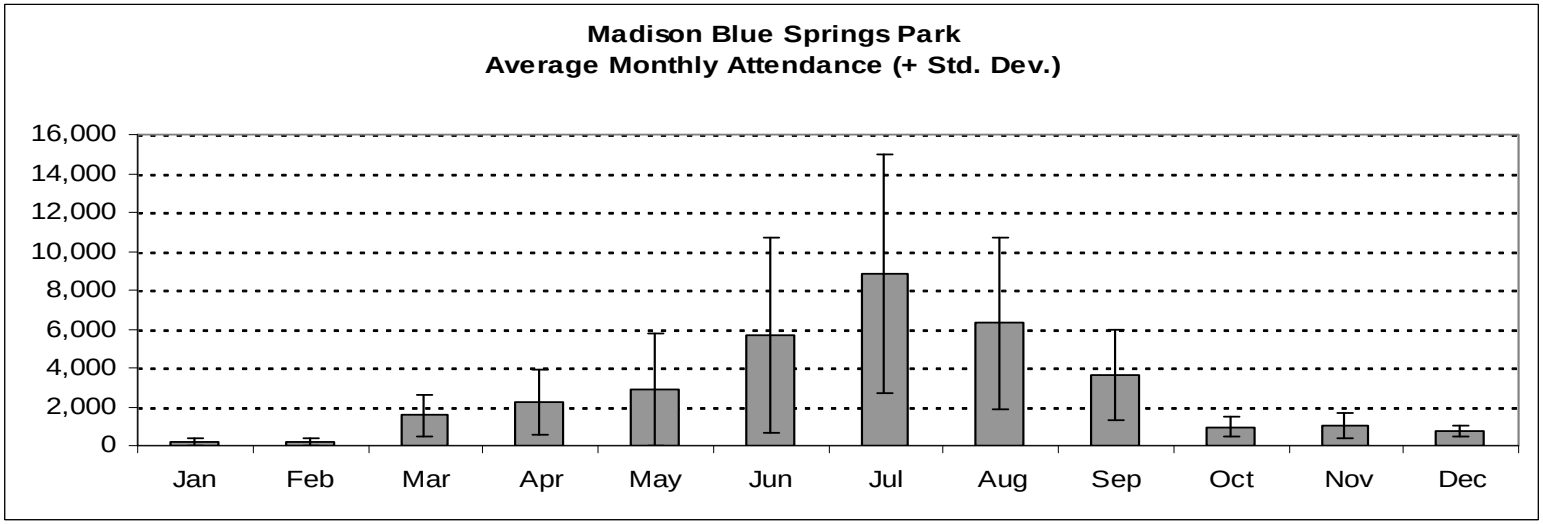


FIGURE 14
Annual and monthly park attendance statistics for Madison Blue Spring (FDEP data).

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Appendix T

Summary of data for Manatee Springs



Summary of Existing Data - Manatee Springs (Levy Co.)

Prepared by

Wetland Solutions, Inc.

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Table 4 Fishes collected in Manatee Springs State Park (number of specimens and relative abundance), and material in the FLMNH ichthyologic collection, including historical specimens from the spring run (number of specimens and percent of material), (from (Walsh and Williams 2003).

Table 5 The ten water resource values (WRVs) which were considered for the establishment of the Manatee Springs minimum flow and level (MFL) (from SRWMD 2005).

Summary of Existing Springs Data

This section summarizes existing physical, chemical, and biological data for Manatee Springs. These data were collected from sources such as the Suwannee River Water Management District (SRWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Manatee Springs State Park

Physical Address

Manatee Springs State Park (MSSP); 11650 N.W. 115th St.; Chiefland, Florida 32626; Phone: 352-493-6072 latitude/longitude: 29.49140°, -82.96627°; park website: http://www.floridastateparks.org/manateesprings/default.cfm .

Driving Directions

Manatee Springs is approximately 11 km (7 mi) west of Chiefland within Manatee Springs State Park. Starting at US 19/27 in Chiefland, travel west on SR 320 to the park entrance (**Figure 1**). Boat access from the Suwannee River is also possible via the boardwalk along the south-side of the spring run.

General

Manatee Springs is situated in a hardwood hammock about 32 km (20 mi) northeast of the Gulf of Mexico along the eastern bank of the Suwannee River. This first magnitude spring has a long history of human usage. Earliest evidence of human utilization includes an extensive aboriginal site of the Weedon Island culture (A.D. 200 - A.D. 1000), as well as more recent activities including moonshine and turpentine operations, which were discovered during park development (FDEP 2004a).

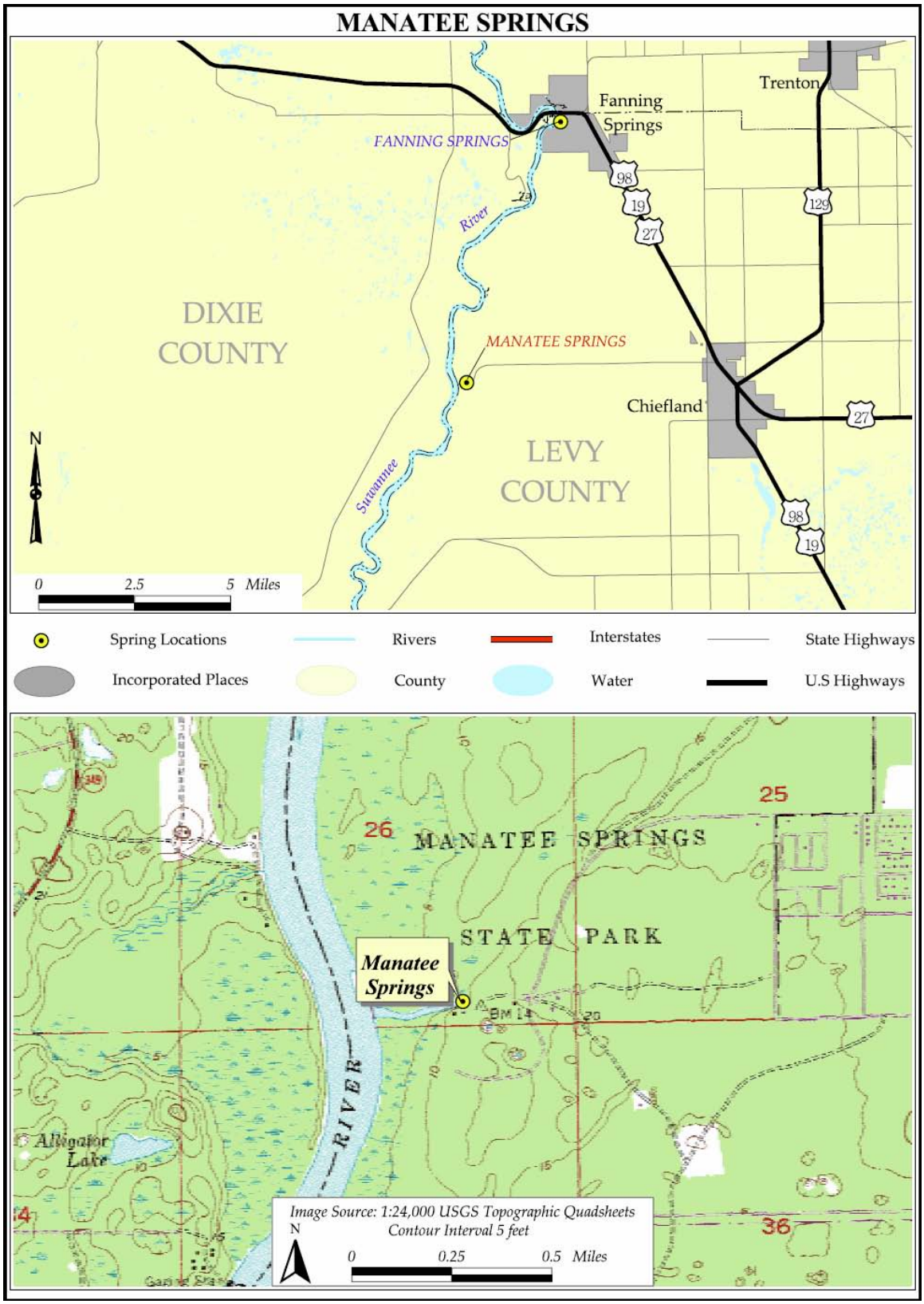


FIGURE 1
Manatee Springs geographic location (from Scott *et al*. 2002).

Manatee Springs State Park lands were first acquired by the state in 1949, making it the first spring ecosystem managed by the Florida Park Service (FPS), with designation as a National Natural Landmark in 1971 (FDEP 2004a). As of 2004, the park contained approximately 989 ha (2,443 ac) parts of which are components of the Florida Greenways and Trails System, and the Great Florida Birding Trail. Waters within MSSP (as well as the Suwannee River) are designated as Outstanding Florida Waters and surface waters are classified as Class 3 water (FDEP 2004a).

The MSSP is administered by the FDEP/FPS for public outdoor recreation and conservation. The park facilities are well developed and include campsites, boardwalks, hiking trails, pavilions, playgrounds, restrooms, and concessions (**Figure 2**). This site is a popular recreational destination where visitors can participate in swimming, snorkeling, cave diving, canoeing, picnicking, hiking, camping, and wildlife viewing.

Swimming and other in-water recreation is allowed in the spring pool and upper spring run area. Diving within the extensive cave system is allowed and an extensive network has been mapped to date. The spring run travels west for approximately 380 m (1,250 ft) at which point it joins the Suwannee River (**Figure 2**). Within the spring run, non-motorized water craft can be operated when manatees are not present. Motorized watercrafts are prohibited from the spring run, but a dock on the Suwannee River allows these vessels to dock and passengers to walk to the park along a boardwalk. There are no dams or locks downstream of the Manatee Springs, facilitating the access of fish and wildlife to the spring.

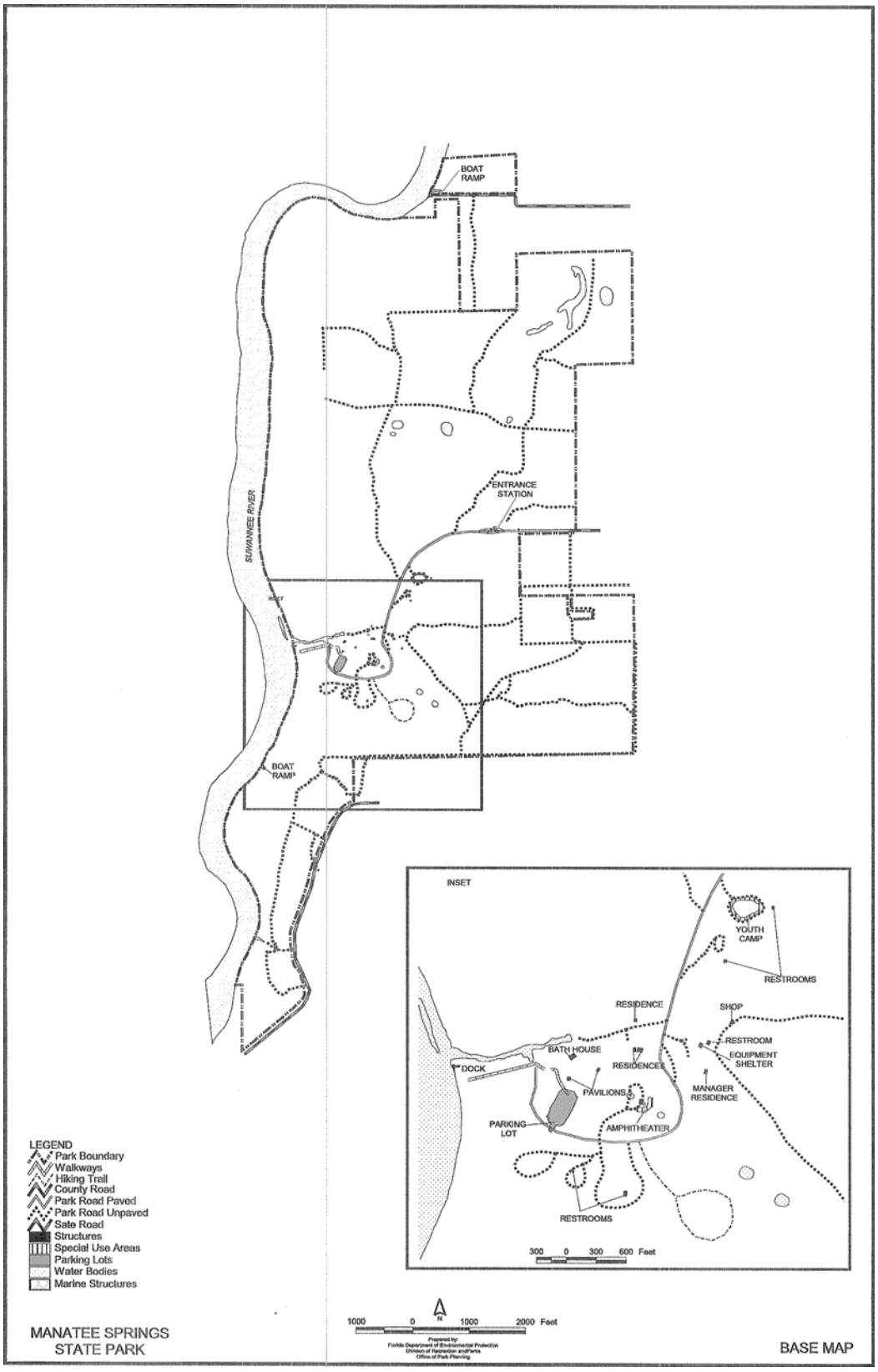


FIGURE 2
Manatee Springs State Park map (from FDEP 2004a).

Manatee Springs has two historical descriptions which may provide the earliest written accounts of any Florida spring. The first account was made by William Bartram in 1774 during his travels through Florida. His description is unique:

> "We now ascend the crystal stream; the current swift; we entered the grand fountain, the expansive circular basin. The ebullition is astonishing, and continual, though its greatest force of fury intermits, regularly, for the space of thirty seconds of time: the waters appear of a lucid sea green colour, in some measure owing to the reflection of the leaves above: the ebullition is perpendicular upwards, from a vast ragged orifice through a bed of rocks, a great depth below the common surface of the basin, throwing up particles or pieces of white shells, which subside with the waters at the moment of intermission, gently settling down round about the orifice, forming a vast funnel. At those moments when the waters rush upwards, the surface of the basin immediately over the orifice is greatly swollen or raised a considerable height; and then it is impossible to keep the boat or any other floating vessel over the fountain; but the ebullition quickly subsides; yet, before the surface becomes quite even, the fountain vomits up the waters again, and so on perpetually." (Travels of William Bartram, edited by Francis Harper, 1958).

A little more than fifty years later, in 1827, John Lee Williams published his observations of Manatee Springs:

> "A little below the Santaffee [Santa Fe River] is the Great Maneto [Manatee] spring. This spring is on the south-east side of the Suwannee River, below the Santaffee, at the foot of the Upland hills; the basin is circular, fifty yards in diameter, of a bluish green colour, but perfectly transparent, and exceedingly deep. It is a kind of jet, emitting the waters with great force for nearly half a minute, and then subsiding for the same length of time; the stream, issuing from the fountain, is forty or fifty feet wide and very deep, it abounds in fish and alligators; and the Indians state that the maneto, or seacow, used to resort to it. This is nearly the size of the Chapola Big spring."
> (*The Territory of Florida*, University of Florida Press 1962)

These two descriptions provide a glimpse of the historic conditions of Manatee Springs and except for the magnitude of discharge, are generally similar to the conditions found at Manatee Springs today.

Physical

There is one main spring vent which discharges groundwater at Manatee Springs (**Figure 3**). The vent is conical and forms a spring pool approximately 18 m (60 ft) from north to south, 23 m (75 ft) from west to east. Along the south side of the pool, a limestone shelf about 1 m below the water surface extends from the concrete seawall and stairs that lead to the spring pool. Just beyond the shelf, a limestone wall drops to the spring vent with maximum depth of about 8 m (26 ft). The south side of the pool is extensively modified to facilitate recreation and reduce erosion. The north side of the spring pool has a natural cypress swamp community. The spring run is relatively undeveloped, except for a small landing area for canoes and kayaks and a boardwalk along the southern side which leads to the Suwannee River. The cave system is extensive (**Figure 4**) and connected to numerous sinks. During the winter of 1994, cave divers Jarrod Jablonski and Todd Kincaid traveled 3,375 m (11,073 ft) through the Manatee Springs system to an upstream siphon (GUE 2009). A notable component of the cave system is "Catfish Hotel," a large sinkhole, approximately 105 m (345 ft) southeast of the main spring pool, which maintains clear water under a covering of duckweeds (*Lemna sp*.).



FIGURE 3
Picture of Manatee Springs pool from the south entry stairs; note limestone shelf in foreground, tidal water marks along the cypress trees, and the appealing blue color of the pool.

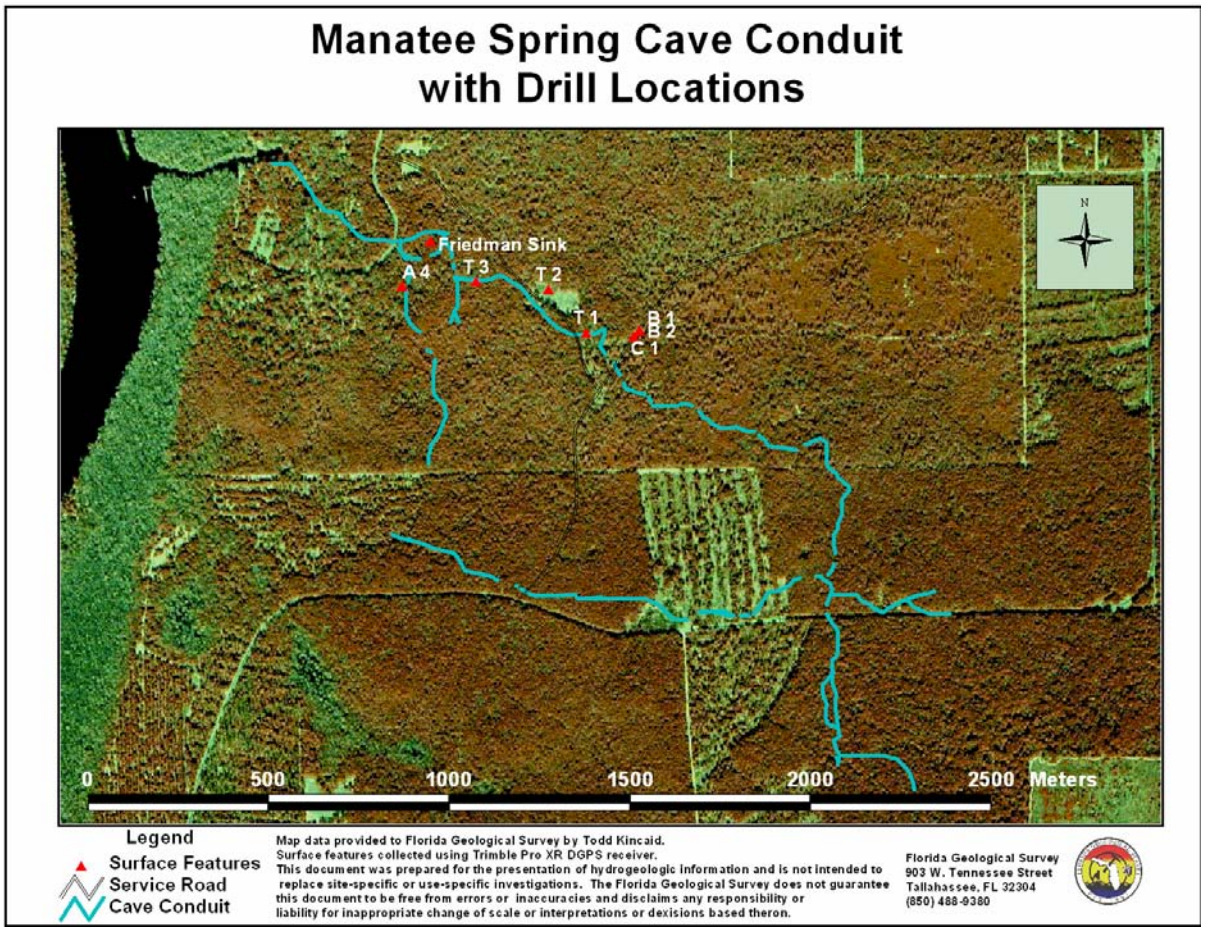


FIGURE 4
Manatee Springs cave system (from FGS).

Manatee Springs run travels about 380 m (1,250 ft) west before joining the Suwannee River on its journey to the Gulf of Mexico. The spring run traverses a tidal hardwood swamp of cypress, tupelo, ash, and persimmon trees. Typical widths are about 20 m (65 ft), with a maximum of about 40 m (130 ft) at the canoe launch. Bathymetry of the spring run was mapped in June 2005 by the Florida Geological Survey (FGS, **Figure 5**). Average spring run depths are less than 0.9 m (3 ft); with the shallowest points identified just downstream of the canoe launch along the southern bank of the spring run bank and below the spring pool, also along the southern bank. Shallow areas were attributed to deposition of sediments from upstream swimming activities (FDEP 2005a).

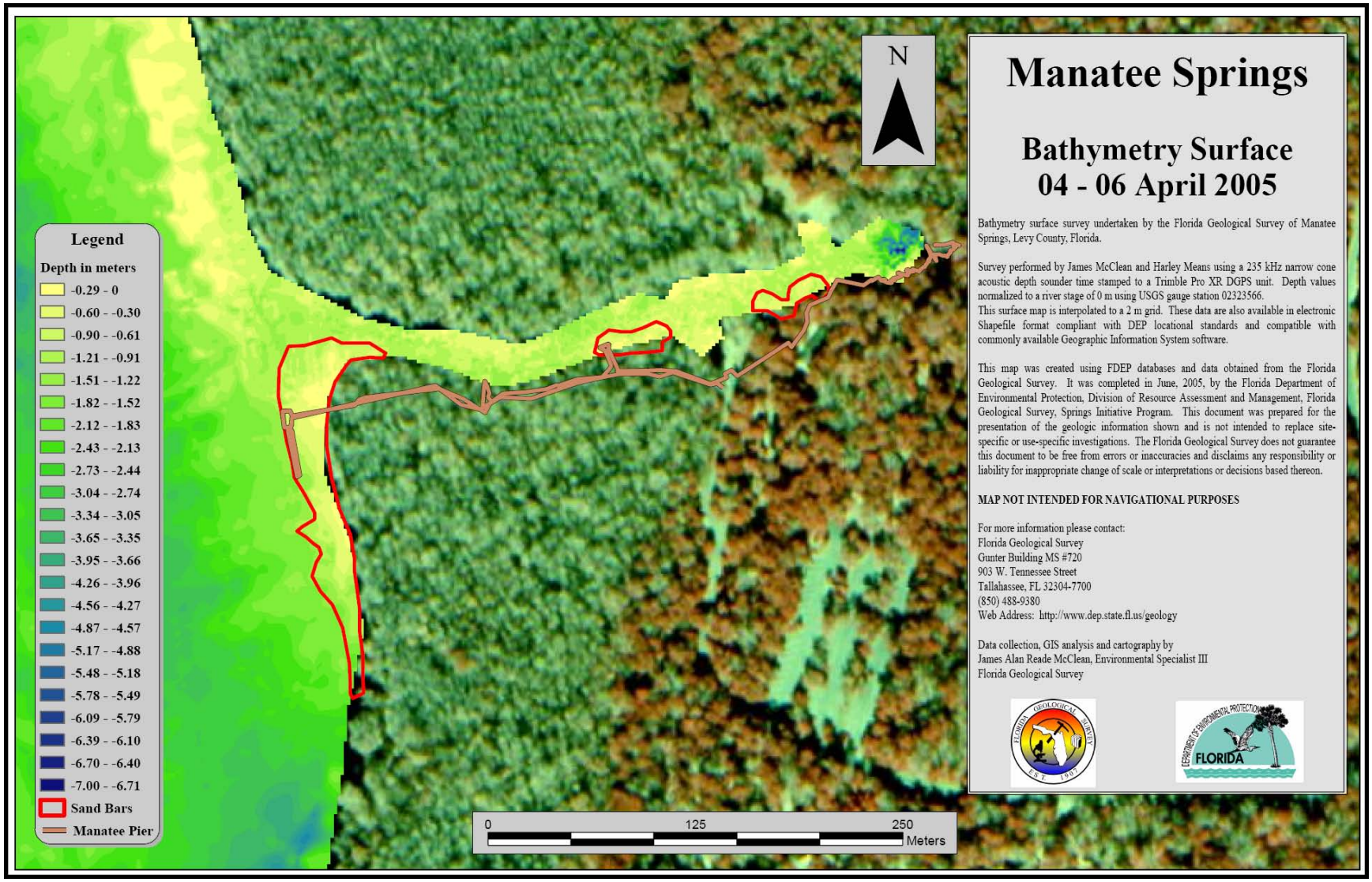


FIGURE 5
Bathymetry surface of Manatee Springs and the adjacent Suwannee River showing identified sand bars (from FDEP 2005a).

Physiography

Manatee Springs is located in the physiographic region called the Gulf Coastal Lowlands, a region characterized by karst topography and elevations less than 100 feet above means sea level (MSL). The Gulf Coastal Lowlands have a limestone terrain with a relatively thin layer of surficial sands and clays, resulting in the exposure of limestone in many places and contains multiple sink, creek, and spring features (Fernald and Purdum 1998). Within Manatee Springs State Park there are extensive karst features which have become exposed due to sediment erosion.

Geology

The MSSP geology is dominated by the Eocene-aged Ocala Group Limestone (Puri and Vernon 1964). Younger sediments from the Hawthorne Group (Miocene-aged) and undifferentiated sediments of Pleistocene/Holocene age are located to the west and east, but have largely been removed through erosion processes (**Figure 6**). Resultantly, the underlying Floridan aquifer is unconfined and direct flow paths for groundwater and surface water infiltration are common.

Hydrogeology

The surface water features in the eastern and southwestern portions of the Manatee springshed serve as hydrologic boundaries (Upchurch *et al.* (2005). Within the Manatee springshed, streams and lakes are generally absent due to the karst drainage system in the Floridan aquifer. An exception is Shacklefoot Pond which is classified as a swamp lake (FDEP 2004a). The recharge to the Floridan aquifer is rapid as Hawthorn Group sediments are generally absent, limestone is at or near land surface, and the sandy soils that mantle the limestone are generally well drained and porous (SRWMD 2005).

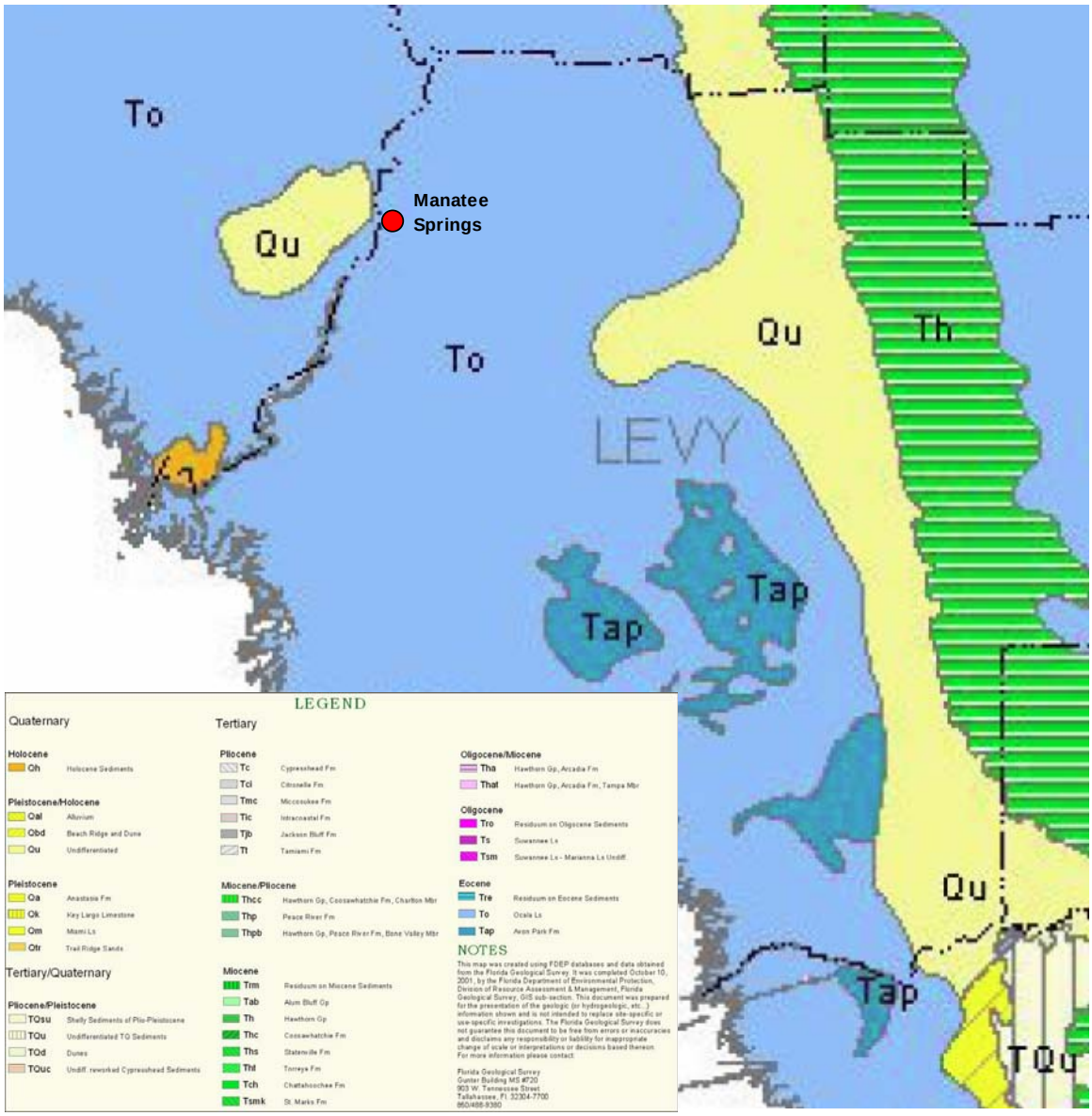


FIGURE 6
Underlying geology of Manatee Springs (adapted from Scott *et al*. 2001).

Ground water transmissivity is relatively rapid within the conduits and passages of the Manatee springshed. Rates of one mile per day were measured in dye-trace studies in nearby Ichetucknee Springs (Butt and Murphy 2003). Katz *et al.* (1999) estimated the age of waters discharged from Manatee Springs using chlorofluorocarbons (CFC's) tracers. These CFC's are derived from aerosol propellants and refrigerants that have dissolved in precipitation and subsequently been entrained in groundwater. A

significant portion of the waters discharged from Manatee Springs are estimated to range from 17 to 30 years of age (Katz *et al.* 1999). The water discharging from Manatee Springs likely contains a mix of older water, but the findings of Katz *et al.* (1999) clearly indicates that movement of water through the aquifer is dynamic and rapid. As a result, the potential for dilution and abatement of contaminants derived from watershed activities is likely to be minimal and the springs are vulnerable to contamination (SRWMD 2005).

Springshed

An example of the potentiometric surface of the Floridan aquifer in the Lower Suwannee River/Manatee/Fanning springshed study area is shown in **Figure 7**. The size of this springshed is estimated to be about 31 square miles (8,100 ha or 20,000 ac). The springshed delineation was achieved by geostatistically analyzing water level data from about 100 monitor wells within western Gilchrist and Levy counties. Based on potentiometric surface elevations in the study area, an "average" groundwater basin boundary between the Manatee and Fanning springsheds was drawn by Upchurch and Champion (2004). On the potentiometric surface map, areas where the contour lines are widely spaced reflect areas where the Floridan aquifer is highly permeable. This includes the karst region immediately east of the Suwannee River which extends eastward to Trenton and Chiefland (Upchurch *et al*. 2005).

Given that springshed boundaries change in response to water levels in the Floridan aquifer (and corresponding changes in potentiometric surface elevations), the eastern edge of the springshed could be approximated by the 20-foot isopleths (SRWMD 2005). An expanded springshed is presented in **Figure 8** based on a 2006 FGS committee

decision (Greenhalgh 2008). This springshed includes a greater area to the east to include the regional groundwater divide in the center of the Waccasassa Flats.

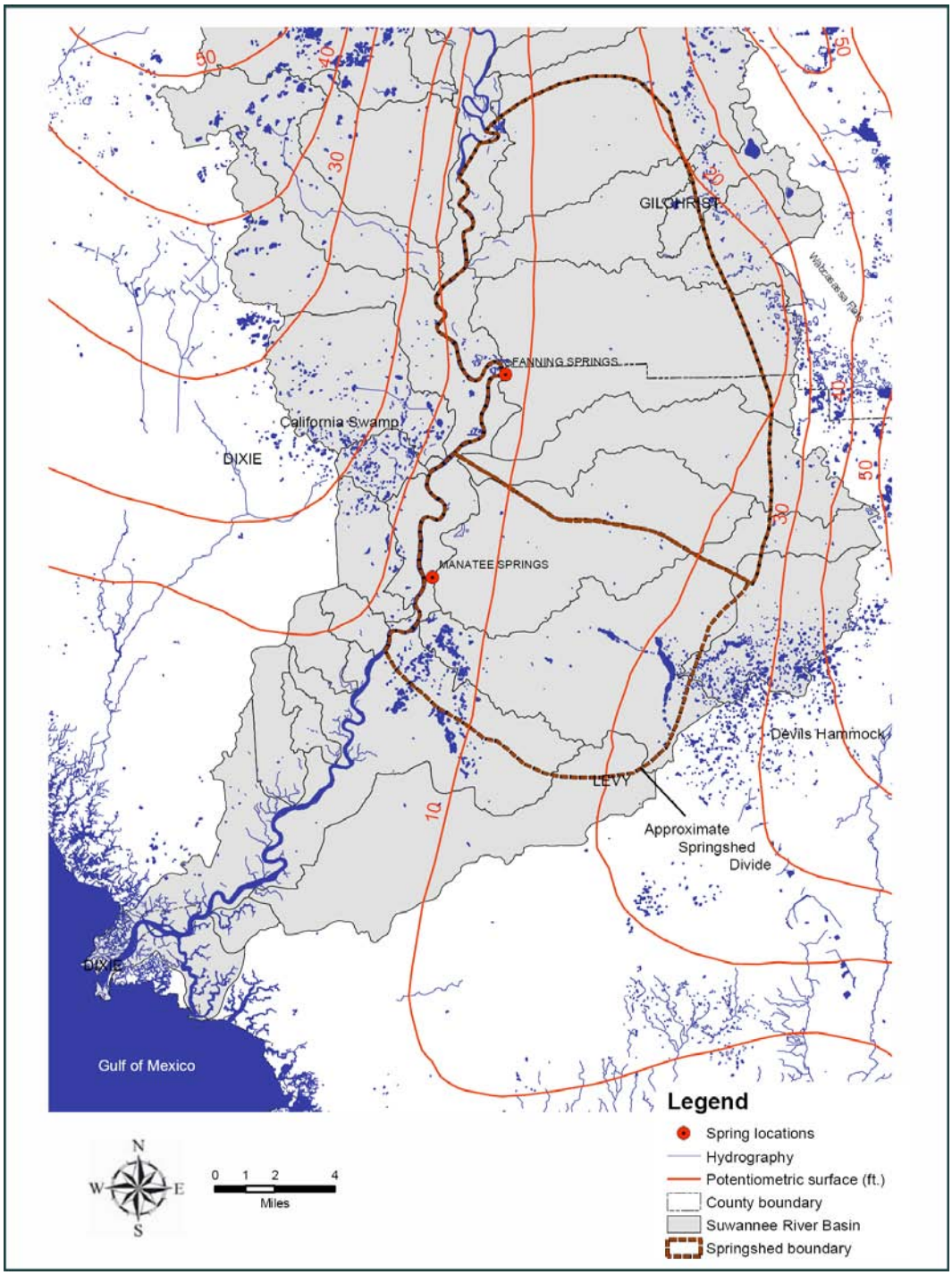


FIGURE 7
Map of the Manatee Springs and Fanning springshed, showing the potentiometric surface of the upper Floridan Aquifer during May 1995 (from SRWMD 2005).

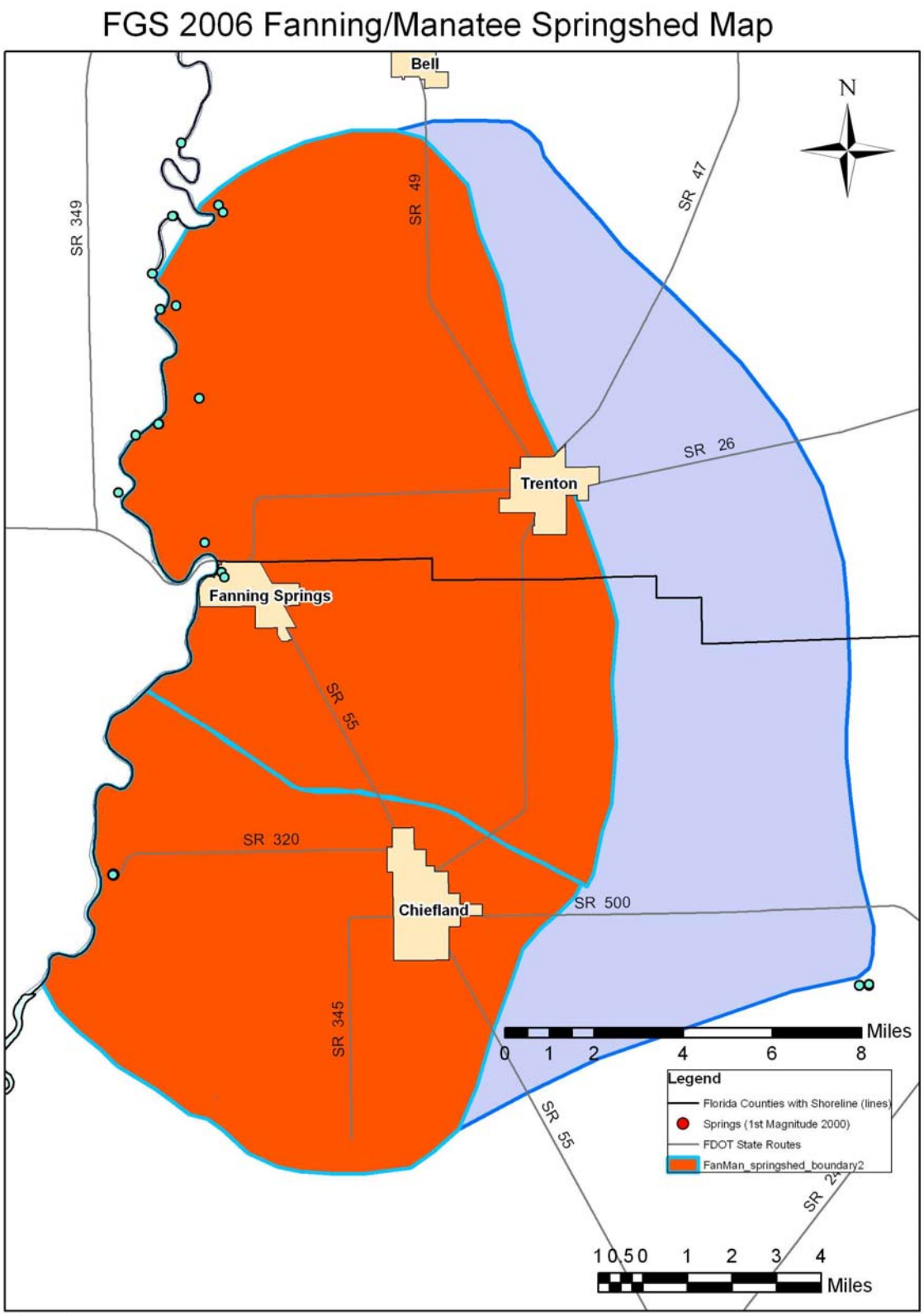


FIGURE 8
Map of the Manatee and Fanning springsheds (orange) with additional potential contributing area (gray) to the east based 2006 potentiometric data (from Upchurch and Champion 2004).

Springshed Land Use

Land use estimates for the Manatee springshed were presented by Katz (2004) for both 1977 and 1993 with the following values (1977 values within parenthesis): total agriculture- 22% (14%), forest- 43% (59%), urban- 6.6% (0.2%), water/wetlands- 28% (25%), and other- 0.4% (1.8%). Of the agriculture category in 1993, 42% was estimated to be cropland, a type of land use frequently identified as the prime source of nitrate contamination in groundwater (Katz 2004). Other sources within the Manatee springshed that have the ability to reduce downstream groundwater quality include wastewater sprayfields, dairies, and numerous sinks and creeks which receive untreated stormwater run-off from the city of Chiefland.

Aerial photography from 2004 for the estimated Manatee springshed reveals the amount of agriculture which occurs therein (**Figure 10**). For the year 2004, land use classifications within the Manatee springshed support the conclusion that agricultural land uses have continued to increase and forested land uses have declined (**Figure 10**).

A Florida Department of Health (FDOH) study in Manatee Springs State Park looked at how quickly and far effluent and total nitrogen (TN) from conventional OWTS moves in a karst environment (FDOH 2004). The study reported that effluent tracers moved at rates between one to 280 feet per day horizontally with minimal TN concentration abatement in the effluent plume. The use of advanced treatment septic systems at MSSP includes a Hydro-action Nutrient Reducing Treatment System installed in 2004 at the Magnolia II campground which exhibited TN reduction ranging from 60% to 88% and a Micro-fast Nutrient Reducing Treatment System installed in 2009 at the Hickory Campground which exhibited TN reduction ranging from 22% to 75% (FDOH 2009).

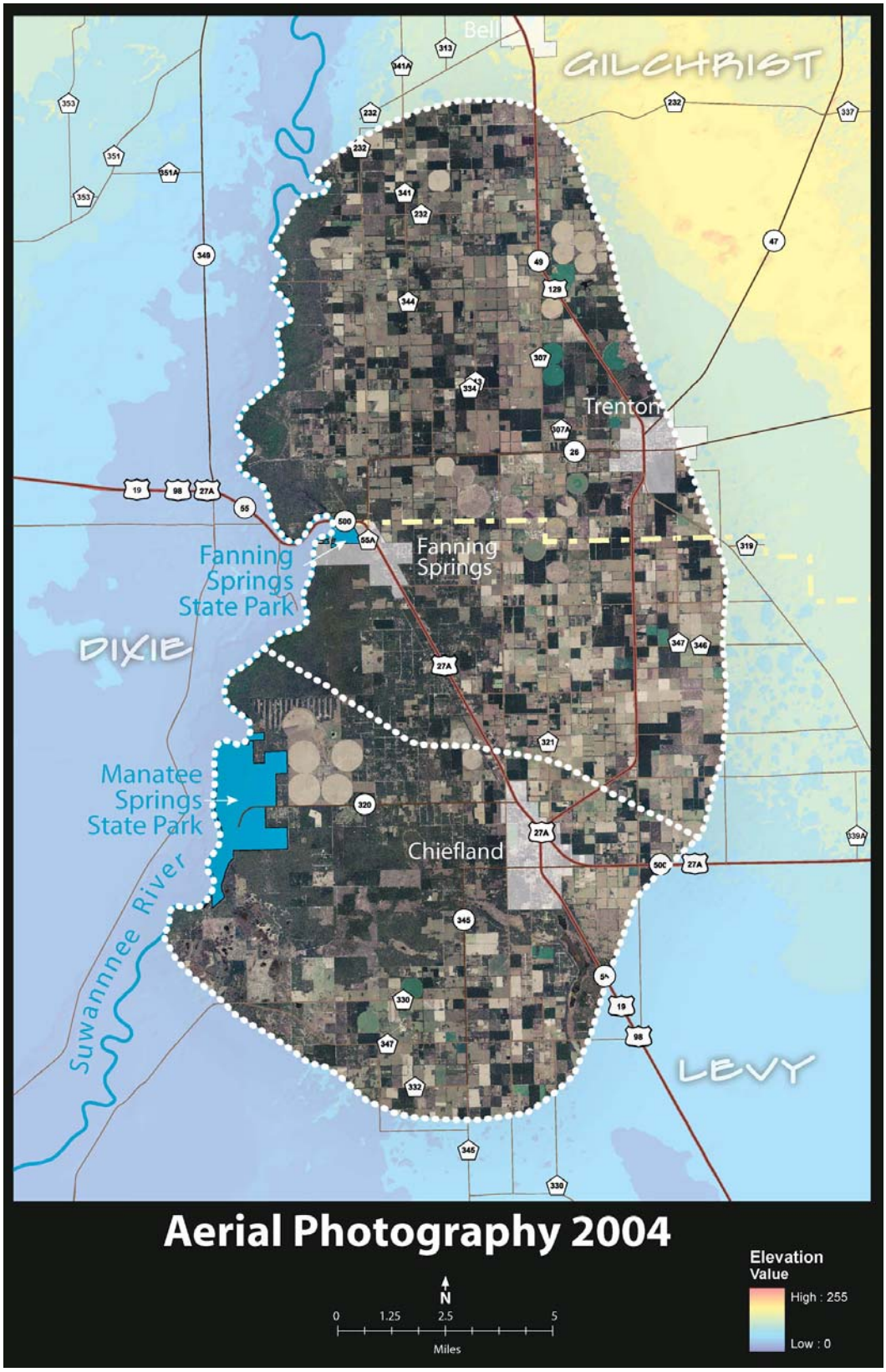


FIGURE 9
Aerial photography of lands within the Manatee and Fanning springsheds (from SRWMD).

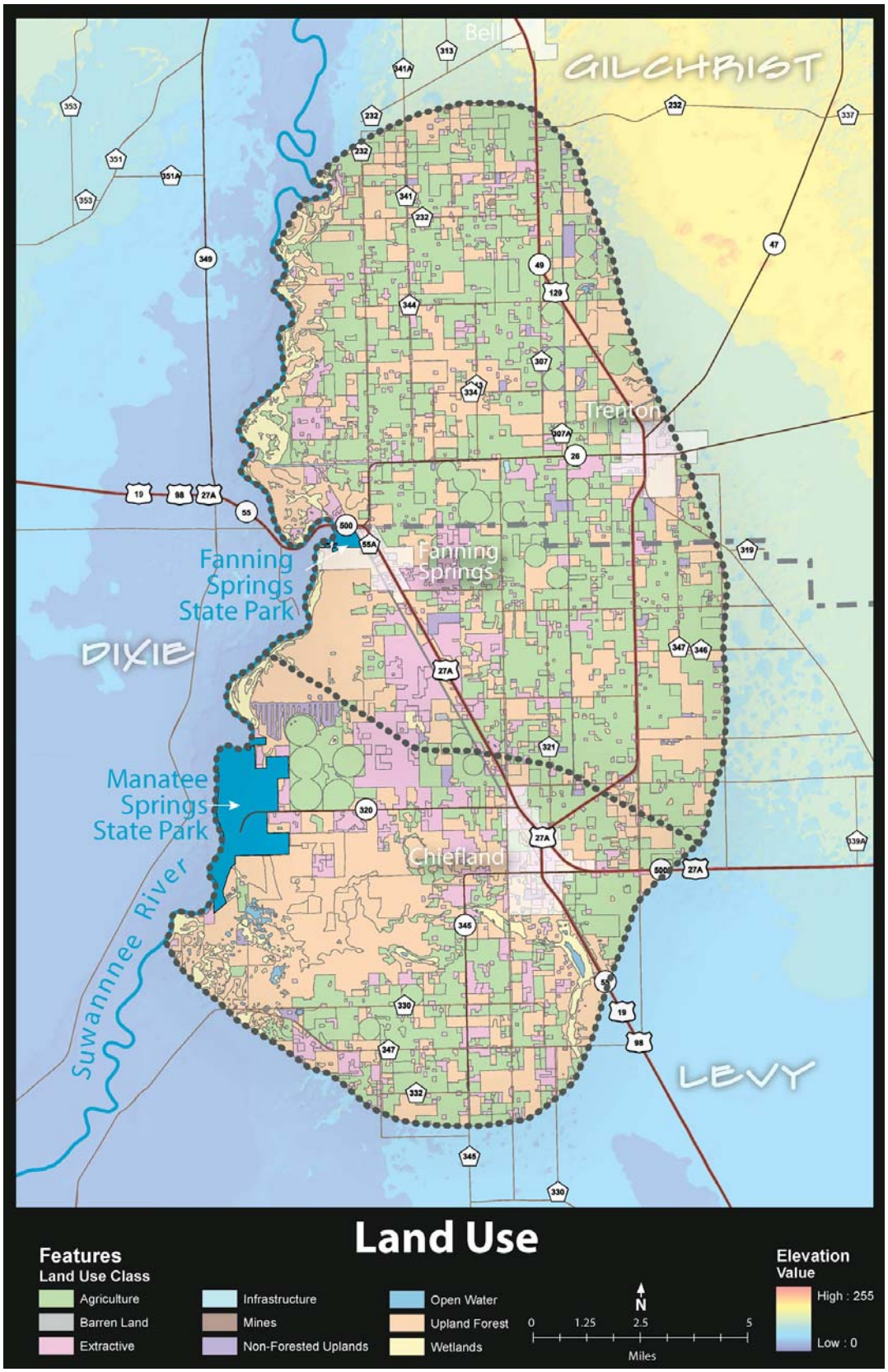


FIGURE 10
Map of land use within the Manatee and Fanning springsheds (from SRWMD).

Study Area

The project study area for Manatee Springs included the entire spring pool and run, as well as the uplands immediately to the south of the spring were substantial human use occurs. **Figure 11** shows an approximation of the study area and data sonde locations are indicated by red icons. Two study segments are defined by the sonde locations and resulted in: an upper segment (MS-1 to MS-2) and a lower segment (MS-2 to MS-3).



FIGURE 11
The study area for Manatee Springs (with data sonde locations as red icons).

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Manatee Springs are given in **Table 1** below.

TABLE 1
Source information for Manatee Springs historical water quality data described in this report.

Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
USGS	USGS	2323566	Manatee Spring Near Cheifland, FL	29.489445	-82.976945
21FLKWAT	Florida Lakewatch	LEV-MA-PRINGS-1	Levy-Manatee Springs-1-1	29.489550	-82.976750
21FLKWAT	Florida Lakewatch	LEV-MA-PRINGS-2	Levy-Manatee Springs-2-2	29.489383	-82.978017
21FLGW	FDEP	21020061	Manatee Springs State Park	29.489650	-82.976845
21FLSUW	SRWMD	9683	Manatee Spring	29.489501	-82.976872
21FLBRA	Biological Research Associates	MAN010C1	Manatee Springs	29.489167	-82.976945
21FLBRA	Biological Research Associates	3422R-A	3422R - Manatee Springs	29.489567	-82.976742

Discharge and Stage

Historical discharge measures have been made sporadically beginning in 1932 by the US Geological Survey (USGS). Discharge from the spring has ranged from 110 cfs (April 27, 1956) to 268 cfs, based on 19 observations from 1932 to 2004. Discharge measured on October 23, 2001 by Scott *et al.* (2002) was 154 cfs. Based on these historical discharge measures (manually collected), the calculated period-of-record median discharge for Manatee Springs is 204 cfs and the average discharge is 189 cfs (SRWMD 2005).

Beginning in January 2001, measures of stage and discharge were automated through instrumentation. The automated discharge readings are computed from a continuous velocity record obtained from an acoustic velocity meter (AVM). The USGS stream gage is located near the downstream portion of the swimming area, on the south side of the run (Station # 02323566). The Suwannee River affects both stage and discharge estimates because of tidal and flood variations. River water can back up into the spring run during flood-stage periods producing negative velocities and discharges.

Based on the 2001 to 2008 USGS published values, the annual mean discharge is 153 cfs, the median discharge was 138 cfs, lowest daily mean value was 2.0 cfs (April 5, 2005), and the highest daily mean was 546 cfs (October 14, 2004, **Table 2**). The continuous discharge data illustrates the variability of these parameters for this spring system. A time-series graph and frequency curve graph of AVM discharge estimates between 2001 and 2008 is presented in **Figure 11.**

Corresponding stage measures have been collected by the USGS. During the 2001 and 2008 time-period, average daily gage height ranged from -0.72 to 10.15 ft, with an median value of 1.61 ft (NGVD 1929). During this time period, a maximum stage of 10.15 ft was recorded on April 20, 2009. A time-series graph and frequency curve graph of stage estimates between 2001 and 2008 is presented in **Figure 11**.

Given that the discharge of Manatee Springs is partially a function of Suwannee River stage (SRWMD 2005), the period-of-record (March 1992 to September 2009) stage data from the confluence of Manatee Springs and the Suwannee River (SRWMD station 02323567) is shown in **Figure 12**. Stage at this location ranged from -0.93 ft (January 3, 2008) to 12.75 ft (March 27, 1998), with an average value of 2.68 ft, and a median value of 2.13 ft (NGVD 1929; station # 02323567; SRWMD 2009). Flood stage is greater than 10 ft.

TABLE 2
Summary statistics of Manatee Springs discharge (cfs) from 2001 to 2008 (USGS 2009).

02323566 MANATEE SPRING NEAR CHIEFLAND, FL—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 2001 - 2008	
Annual mean	114		151		153	
Highest annual mean					234	2005
Lowest annual mean					98.3	2002
Highest daily mean	192	Feb 19	505	Sep 2	546	Oct 14, 2004
Lowest daily mean	15	May 16	30	Jul 21	2.0	Apr 5, 2005
Annual seven-day minimum	36	Aug 22	51	Jul 15	20	Apr 4, 2005
Maximum peak flow					668	Oct 15, 2004
Maximum peak stage			5.16	Mar 8	10.10	Apr 20, 2005
10 percent exceeds	166		274		248	
50 percent exceeds	110		127		138	
90 percent exceeds	72		73		86	

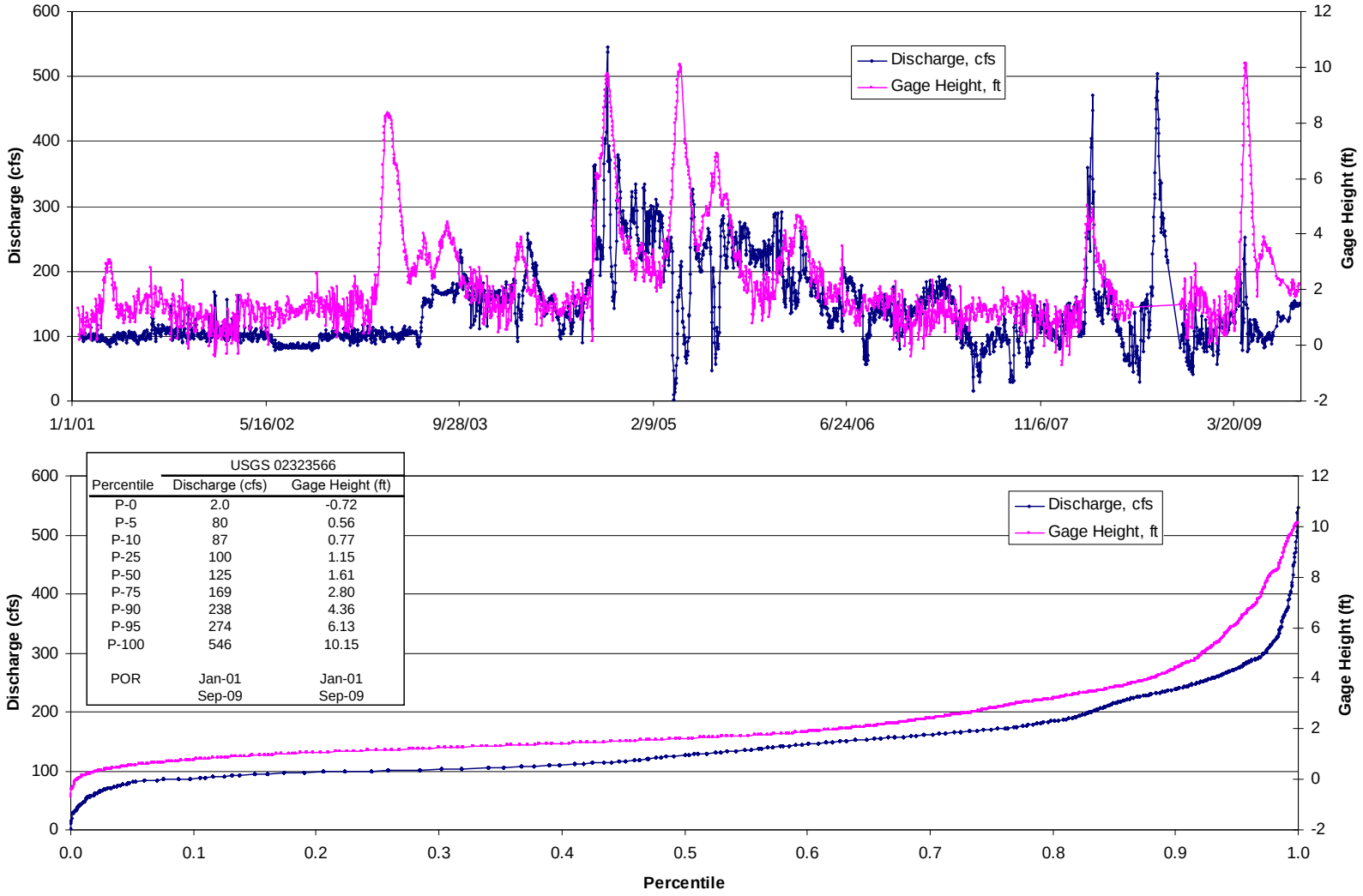


FIGURE 11
Daily average discharge and gage height time series (top) and frequency curve (bottom) for Manatee Springs (USGS data).

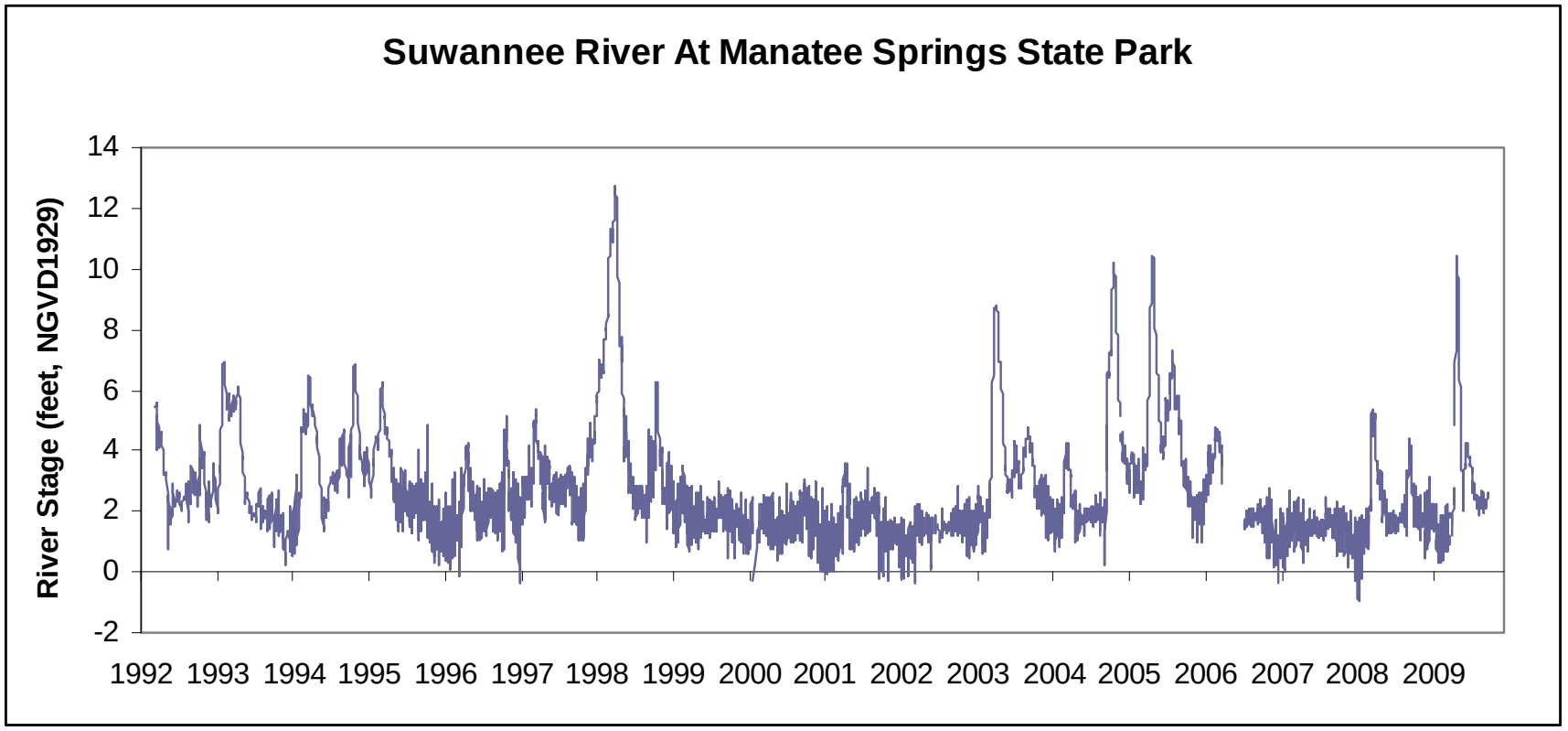


FIGURE 12
Stage time series (1992 to 2009) for the Suwannee River at Manatee Springs (station # 02323567; SRWMD 2009).

Water Quality

Water quality data for Manatee Springs are available from as early as 1946 by Rosenau *et al.* (1977); however STORET data (USGS and FDEP data) primarily spans the 1990s to 2008. Among water chemistry parameters, the numbers of samples collected ranges from 1 to 1,683 records, with most samples collected from the spring pool. These data are summarized in **Table 3** which provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Manatee Springs average values for several key parameters (with the number of samples) are:

- Water temperature – 22.1 °C (n = 1,683)
- Dissolved oxygen – 1.69 mg/L (n = 184)
- pH – 7.24 SU (n = 191)
- Specific conductance – 465 umhos/cm (n = 339)
- Turbidity – 0.418 NTU (n = 167)
- Color – 4.39 CPU (n= 169)
- Total chloride – 8.21 mg/L (n = 202)
- Sulfate – 33.3 mg/L (n = 197)
- Nitrate+nitrite nitrogen – 1.73 mg/L (n = 201)
- Total phosphorus – 0.033 mg/L (n = 202)

TABLE 3
Manatee Springs water quality table for the period-of-record.

				Decade						POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
BACTERIOLOGICAL	EColi	#/100ml	mBoil						10.2	10.2	0.500	150	28.3	27	Oct-01	Jan-07
	Enterococci	#/100ml	mBoil						6.00	6.00	1.00	46.0	9.95	20	Oct-01	Oct-06
	FC	#/100ml	mBoil					8.33	135	127	0.00	2,000	397	45	Jun-96	Oct-06
	TC	#/100ml	mBoil					26.7	393	376	0.00	4,900	715	66	Jun-96	Dec-06
BIOLOGICAL	Chl-a corr	µg/L	mBoil						0.600	0.600	0.350	1.80	0.306	28	Jun-01	Jan-07
	Chl-b	µg/L	mBoil						1.19	1.19	1.18	1.20	0.014	2	Jun-01	Jun-01
	Pheo-a	µg/L	mBoil						1.83	1.83	0.500	7.00	1.85	26	Mar-06	Jan-07
DISSOLVED OXYGEN	DO	%	mBoil			17.0				17.0	17.0	17.0	0.00	2	Apr-72	Apr-72
	DO	mg/L	mBoil			1.50		1.45	1.72	1.69	0.900	7.64	0.599	184	Apr-72	Mar-08
FLOW	Flow	cfs	mBoil					158	145	145	2.00	546	65.6	3080	Mar-32	Sep-09
	Flow-Inst	cfs	mBoil				209	125		167	125	209	59.4	2	Jan-85	Aug-90
	Velocity	ft/s	mBoil						40.5	40.5	0.00	178	52.1	2435	Mar-32	Jul-08
GENERAL INORGANIC	Alk	mg/L as CaCO3	mBoil	176	128	174		188	198	197	0.500	217	25.2	152	Apr-56	Mar-08
	Cl-T	mg/L	mBoil	6.50	5.00	4.00	7.60	7.35	8.35	8.21	0.015	14.0	1.42	202	Apr-56	Mar-08
	CO2	mg/L	mBoil	3.40	4.00	3.40	46.0	12.0		13.8	3.40	46.0	18.4	5	Apr-56	Aug-90
	F-D	mg/L	mBoil	0.200	0.300	0.200	0.100	0.100	0.100	0.133	0.100	0.300	0.065	12	Apr-56	Oct-02
	Hardness	mg/L as CaCO3	mBoil	220	180	210	230	225	240	228	180	290	25.3	12	Apr-56	Oct-02
	Si-D	mg/L	mBoil	6.10	5.50	5.00	5.60	5.65	5.73	5.66	5.00	6.10	0.261	12	Apr-56	Oct-02
	Si-T	mg/L	mBoil						3.09	3.09	0.008	6.90	1.23	59	Oct-02	Mar-08
	SO4	mg/L	mBoil	22.0	23.0	25.0	25.0	31.2	33.7	33.3	0.030	87.0	7.31	197	Apr-56	Mar-08
GENERAL ORGANIC	DOC	mg/L	mBoil					0.100	0.633	0.557	0.100	0.900	0.264	7	Aug-98	Oct-02
	TOC	mg/L	mBoil			0.00		7.91	2.53	2.95	0.00	41.0	4.54	279	Apr-72	Mar-08
METAL	Ag-T	µg/L	mBoil				1.00		0.125	0.160	0.125	1.00	0.175	25	Jan-85	Jan-07
	Al-T	µg/L	mBoil						6.32	6.32	1.50	37.5	10.4	11	Oct-01	Apr-05
	As-D	µg/L	mBoil			0.00	1.00			0.500	0.00	1.00	0.707	2	Apr-72	Jan-85
	As-T	µg/L	mBoil						1.42	1.42	0.300	4.50	0.934	36	Oct-01	Jan-07
	Ba-T	µg/L	mBoil				100		5.77	14.3	4.50	100	28.4	11	Jan-85	Apr-05
	Ca-D	mg/L	mBoil	74.0	53.0	74.0	81.0	81.5	85.7	79.9	53.0	102	11.1	12	Apr-56	Oct-02
	Ca-T	mg/L	mBoil					73.4	86.5	85.7	0.160	110	11.5	185	Aug-95	Mar-08
	Cd-D	µg/L	mBoil			0.00				0.00	0.00	0.00		1	Apr-72	Apr-72
	Cd-T	µg/L	mBoil						0.128	0.128	0.013	0.375	0.120	36	Jan-85	Jan-07
	Co-D	µg/L	mBoil			0.00				0.00	0.00	0.00		1	Apr-72	Apr-72
	Co-T	µg/L	mBoil						0.693	0.693	0.250	1.00	0.323	11	Oct-01	Apr-05
	Cr-T	µg/L	mBoil				1.00		0.758	0.764	0.250	2.20	0.382	37	Jan-85	Jan-07
	Cu-D	µg/L	mBoil			0.00				0.00	0.00	0.00		1	Apr-72	Apr-72
	Cu-T	µg/L	mBoil						1.02	1.02	0.195	4.00	1.01	36	Jan-85	Jan-07
	Fe-D	µg/L	mBoil			0.00				0.00	0.00	0.00		1	Apr-72	Apr-72
	Fe-T	µg/L	mBoil						33.6	33.6	2.50	90.0	20.8	36	Oct-01	Jan-07
	Hg-T	µg/L	mBoil			0.00	0.200			0.100	0.00	0.200	0.141	2	Apr-72	Jan-85
	K-D	mg/L	mBoil	0.200	0.00	0.200	0.600	0.850	1.30	0.875	0.00	2.70	0.694	12	Apr-56	Oct-02
	K-T	mg/L	mBoil					0.917	1.14	1.13	0.030	1.63	0.254	183	Aug-95	Mar-08
	Mg-D	mg/L	mBoil	7.70	1.00	5.20	5.60	5.80	6.60	5.89	1.00	9.60	1.97	12	Apr-56	Oct-02
	Mg-T	mg/L	mBoil					5.40	6.44	6.37	0.010	8.80	0.923	185	Aug-95	Mar-08

TABLE 3 (CONTINUED)
Manatee Springs water quality table for the period-of-record.

				Decade						POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
METAL	Mn-D	µg/L	mBoil			0.00				0.00	0.00	0.00		1	Apr-72	Apr-72
	Mn-T	µg/L	mBoil						0.870	0.870	0.250	1.90	0.576	12	Oct-01	Apr-05
	NA-D	mg/L	mBoil	3.10	2.70	3.00	3.50	3.60	3.95	3.60	2.70	4.90	0.554	12	Apr-56	Oct-02
	NA-T	%	mBoil	3.00	4.00	3.00	3.00	3.00	3.00	3.08	3.00	4.00	0.289	12	Apr-56	Oct-02
	Ni-T	µg/L	mBoil						0.439	0.439	0.075	2.00	0.478	36	Oct-01	Jan-07
	Pb-D	µg/L	mBoil			0.00				0.00	0.00	0.00		1	Apr-72	Apr-72
	Pb-T	µg/L	mBoil				1.00		1.07	1.07	0.013	6.00	1.55	37	Jan-85	Jan-07
	SAR	ratio	mBoil	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.0000	12	Apr-56	Oct-02
	Se-D	µg/L	mBoil				1.00			1.00	1.00	1.00		1	Jan-85	Jan-85
	Se-T	µg/L	mBoil						4.25	4.25	2.00	7.50	1.92	12	Oct-01	Apr-05
	SR-D	µg/L	mBoil			100	280	220	270	240	100	490	124	7	Apr-72	Oct-02
	SR-T	µg/L	mBoil						196	196	163	231	21.8	11	Oct-01	Apr-05
	Zn-D	µg/L	mBoil			10.0				10.0	10.0	10.0		1	Apr-72	Apr-72
	Zn-T	µg/L	mBoil						4.02	4.02	0.500	18.0	3.16	36	Oct-01	Jan-07
NITROGEN	NH4-N	mg/L	mBoil			0.010	0.020	0.016	0.019	0.019	0.00	0.090	0.018	158	Apr-72	Apr-07
	NO2-N	mg/L	mBoil			0.00	0.010	0.010		0.007	0.00	0.010	0.006	3	Apr-72	Aug-90
	NO3-N	mg/L	mBoil			0.600				0.600	0.600	0.600		1	Apr-72	Sep-02
	NOx-N	mg/L	mBoil				1.60	1.48	1.75	1.73	0.002	5.70	0.440	201	Jan-85	Mar-08
	NOx-N-D	mg/L	mBoil					1.70	2.00	1.96	1.50	4.00	0.909	7	Aug-98	Oct-02
	OrgN	mg/L	mBoil			0.190	0.180			0.185	0.180	0.190	0.007	2	Apr-72	Jan-85
	TKN	mg/L	mBoil				0.200	0.092	0.288	0.272	0.00	17.8	1.53	189	Jan-85	Mar-08
	TKN-D	mg/L	mBoil					0.200	0.200	0.200	0.200	0.200	0.0000	7	Aug-98	Oct-02
	TN	mg/L	SpringRun_115m						1.40	1.40	1.14	1.60	0.159	9	Nov-01	Aug-02
	TN	mg/L	mBoil				1.80		1.43	1.47	0.97	1.80	0.260	10	Jan-85	Aug-02
OXYGEN DEMAND	BOD5	mg/L	mBoil			0.100			0.965	0.933	0.100	1.00	0.240	27	Apr-72	Jan-07
PESTICIDE	Diazinon-D	µg/L	mBoil						0.500	0.500	0.500	0.500		1	Oct-02	Oct-02
PHOSPHORUS	OrthoP	mg/L	mBoil			0.020	0.030	0.021	0.021	0.021	0.004	0.085	0.008	148	Apr-72	Apr-07
	OrthoP	mg/L as PO4	mBoil					0.061	0.077	0.074	0.061	0.123	0.024	7	Aug-98	Oct-02
	PO4-T	mg/L as PO4	mBoil			0.055	0.092	0.061		0.069	0.055	0.092	0.020	3	Apr-72	Aug-90
	TP	mg/L	SpringRun_115m						0.025	0.025	0.021	0.034	0.005	9	Nov-01	Aug-02
	TP	mg/L	mBoil			0.020	0.030	0.032	0.033	0.033	0.003	0.120	0.015	202	Apr-72	Mar-08
PHYSICAL	Color	CPU	mBoil	5.00	0.00	0.00	5.00	5.00	4.40	4.39	0.00	25.0	2.34	169	Apr-56	Mar-08
	Depth	m	mBoil					4.63	3.04	3.22	0.600	15.0	2.81	169	Aug-95	Mar-08
	pH	SU	mBoil	8.00	7.80	7.75	7.30	7.25	7.22	7.24	6.70	8.14	0.192	191	Apr-56	Mar-08
	Secchi	m	mBoil					1.50	7.42	7.16	0.700	15.0	3.22	23	Dec-98	Oct-07
	SpCond	umhos/cm	mBoil	390	354	413	432	450	468	465	354	528	22	339	Apr-56	Mar-08
	Stage	ft	mBoil						2.22	2.22	-0.69	10.2	1.77	2930	May-98	Sep-09
	Stage	ft MSL	mBoil					1.99	1.93	1.93	-0.04	6.59	1.16	126	Jun-96	Apr-07
	Turb	NTU	mBoil			1.00		0.448	0.412	0.418	0.015	15.4	1.21	167	Apr-72	Mar-08
SOLID	TDS	mg/L	mBoil	226	202	228	247	268	274	272	1.50	362	38.2	185	Apr-56	Mar-08
	TSS	mg/L	mBoil					1.25	1.92	1.83	0.00	6.00	1.55	89	Aug-95	Jan-07
TEMPERATURE	Wtr Temp	C	mBoil	73.0	22.2	22.0	22.0	22.0	22.1	22.1	18.5	73.0	1.29	1683	Apr-56	Mar-08

Factors which influence the water chemistry of Manatee Springs include flooding by the Suwannee River. To illustrate this, a graph of water temperature is shown in Figure 13. Lower than typical water temperature values indicate flooding events, several of which are noted to have occurred in the limited time period of continuous temperature data available (USGS 2009).

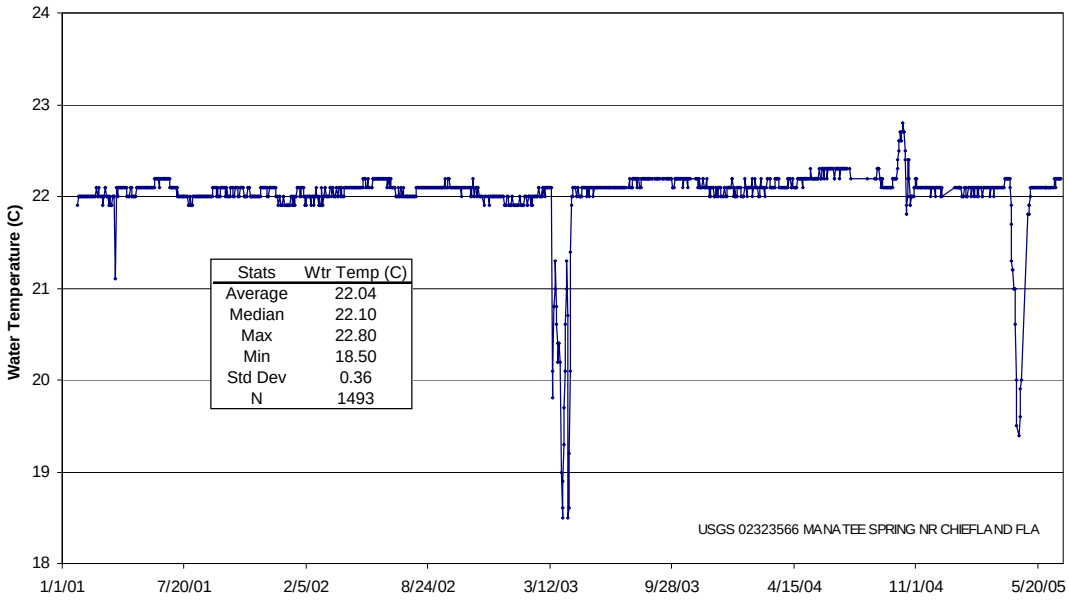


FIGURE 13
Daily average water temperature for Manatee Springs (USGS data).

Nitrate in many springs within the Suwannee River Basin have shown patterns of increasing concentrations, and Manatee Springs is no exception (Katz 2004). Nitrate concentrations appear to be increasing over the period-of-record, as average nitrate concentrations at Manatee Springs have been observed to increase from 0.24 mg/L to 1.53 mg/L, (Strong 2004). Hornsby and Ceryak (1998) reported the following rising historic nitrate-nitrogen concentrations: 1946 - 0.37 mg/L, 1956 - 0.40 mg/L, and 1960 – 0.60 mg/L (from Rosenau *et al*. 1977); with values above 1.0 mg/L from 1980 forward.

Sampling by Scott *et al.* (2002) in October 2001 resulted in a nitrate concentration of 1.7 mg/L.

Trends for a variety of water chemistry parameters were explored by McKinney (2008), who examined data from a 1995 to 2008 time-period of intensive SRWMD monitoring. Significant increasing trends during this time-period were observed for nitrate (**Figure 14**), conductivity (**Figure 15**), total alkalinity (**Figure 16**), potassium, magnesium, sodium, calcium, and chloride concentrations (McKinney 2008).

Data for total phosphorus concentrations at Manatee Springs are less readily available. Rosenau *et al*. (1977) did not report total phosphorus concentrations, while Scott *et al.* (2002) reported a value of 0.025 mg/L. SRWMD monitoring between 1995 and 2008 observed total phosphorus concentrations to range between less than 0.01 to 0.07 mg/L, with an average value of about 0.04 mg/L. McKinney (2008) plotted total phosphorus concentrations between the 1995 to 2008 time-period, and observed no significant trend (**Figure 17**). This observation is consistent with other spring systems, and may suggest that phosphorus is bound in the soil and/or geological matrix preventing dissolution in groundwater.

To compare Manatee Springs to other Florida springs, mean nitrate and mean total phosphorus concentrations are plotted in **Figures 18** and **19**, respectively. Nitrate concentrations in the Manatee Springs System are elevated compared to springs located in undeveloped areas of north and central Florida (**Figure 18**) and compared to published historic data (Rosenau *et al*. 1977). Concentrations of total phosphorus are relatively low in comparison other Florida spring systems (**Figure 19**).

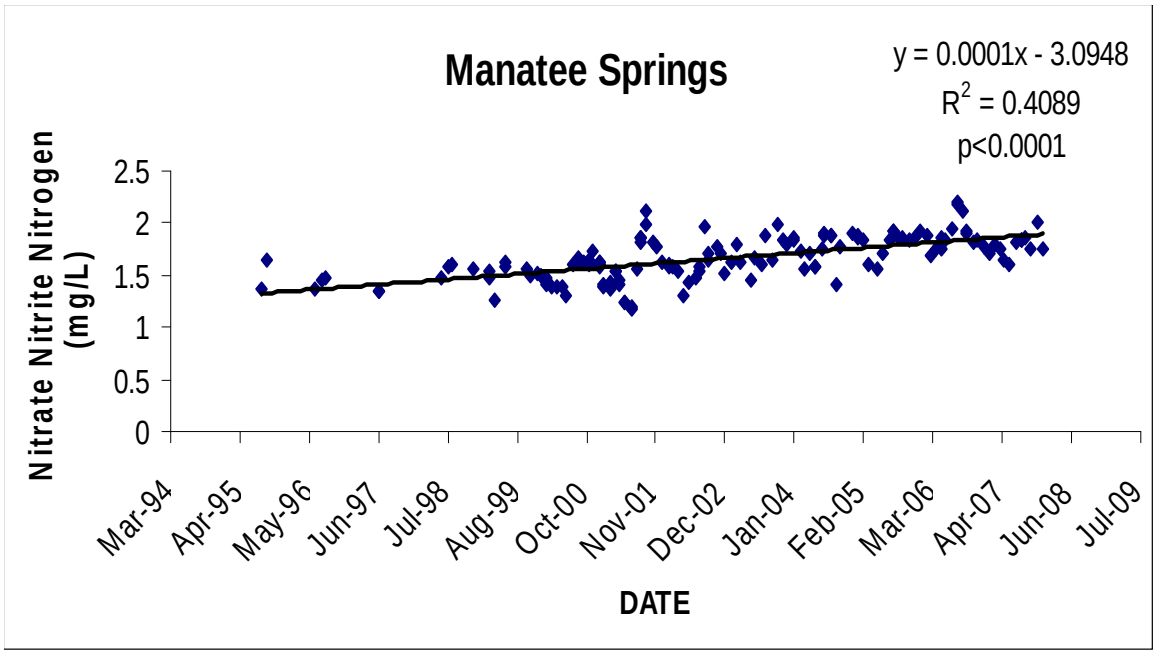


FIGURE 14
Manatee Springs nitrate concentration (mg/L) between the 1995 to 2008 time-period (from McKinney 2008).

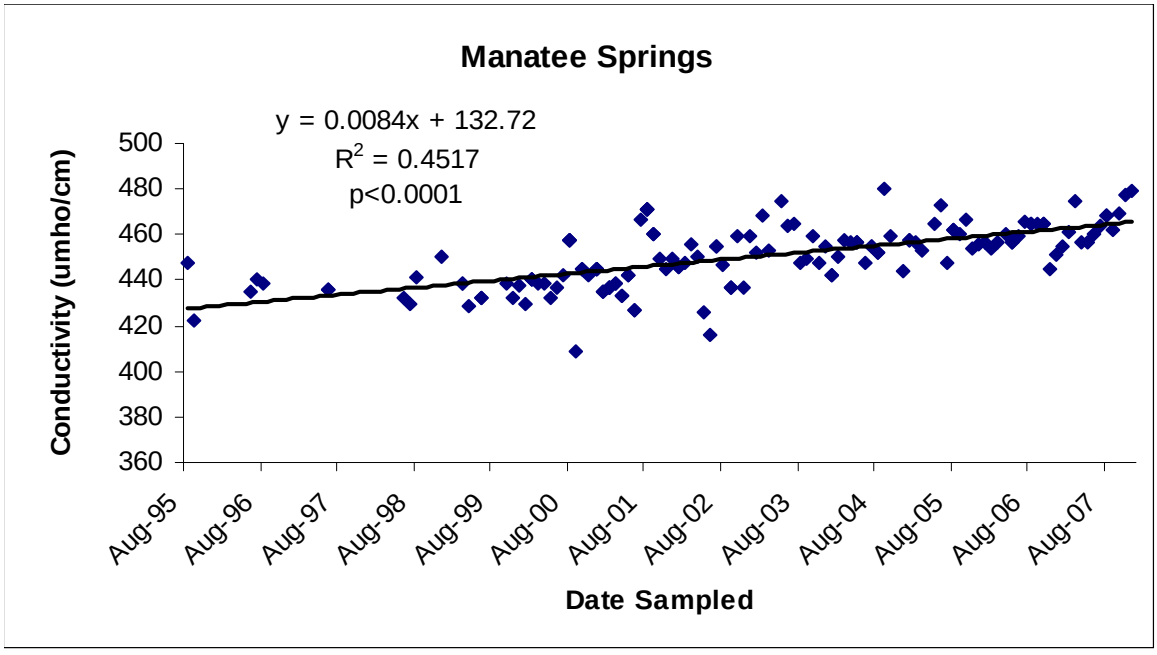


FIGURE 15
Manatee Springs conductivity (umhos/cm) between the 1995 to 2008 time-period (from McKinney 2008).

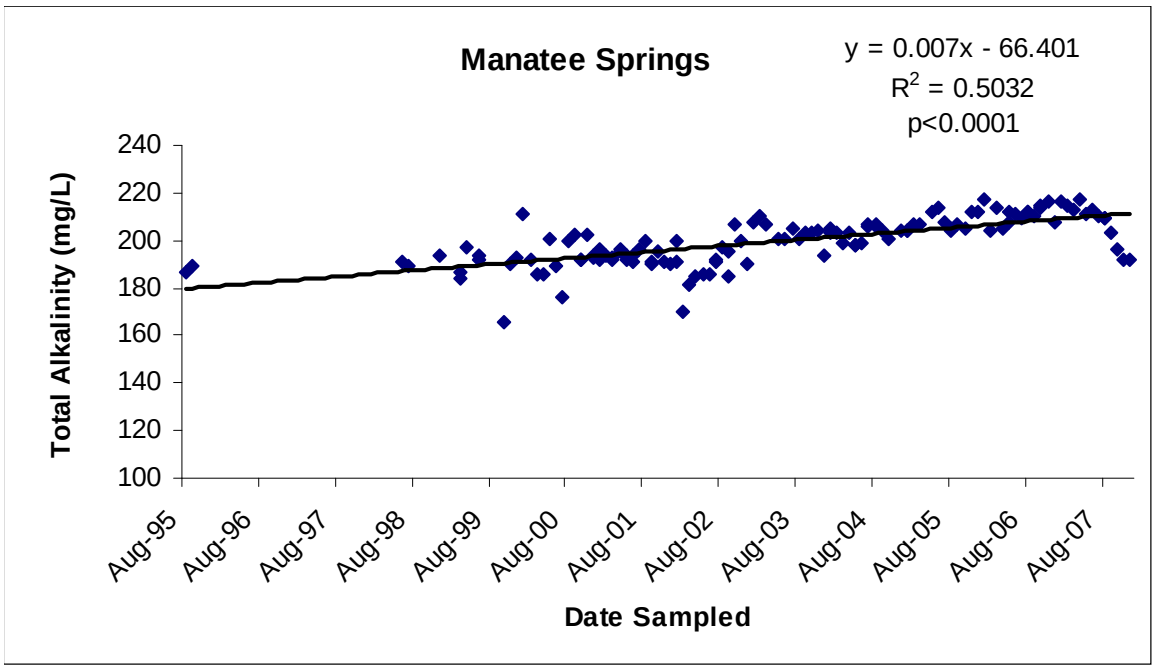


FIGURE 16
Manatee Springs total alkalinity concentration (mg/L) between the 1995 to 2008 time-period (from McKinney 2008).

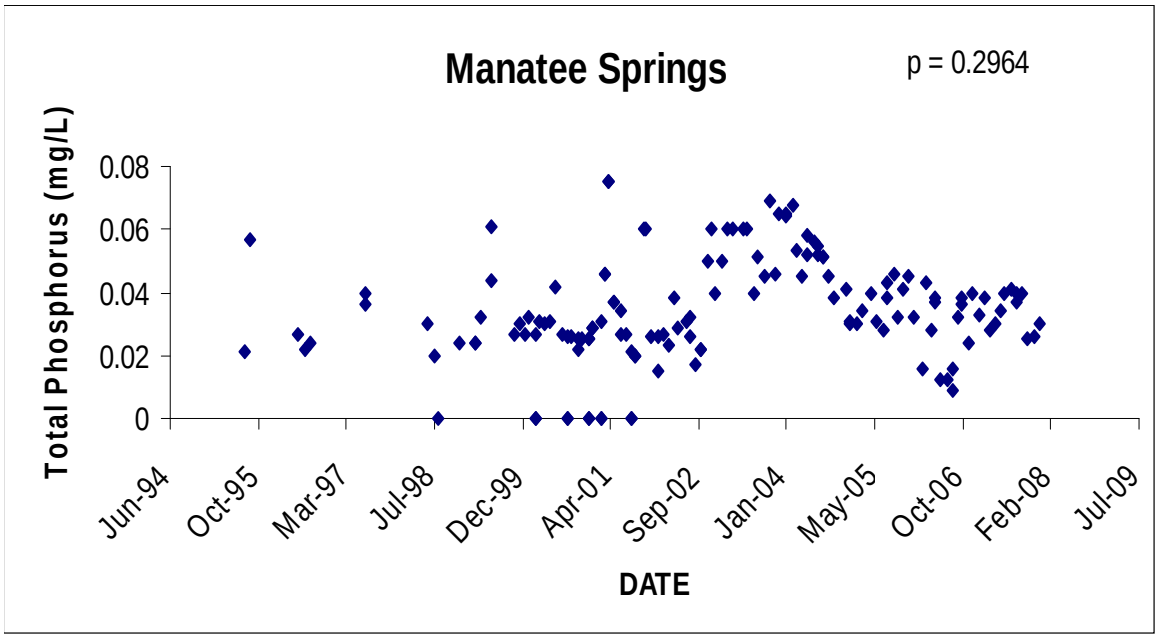


FIGURE 17
Manatee Springs total phosphorus concentration (mg/L) between the 1995 to 2008 time-period (from McKinney 2008).

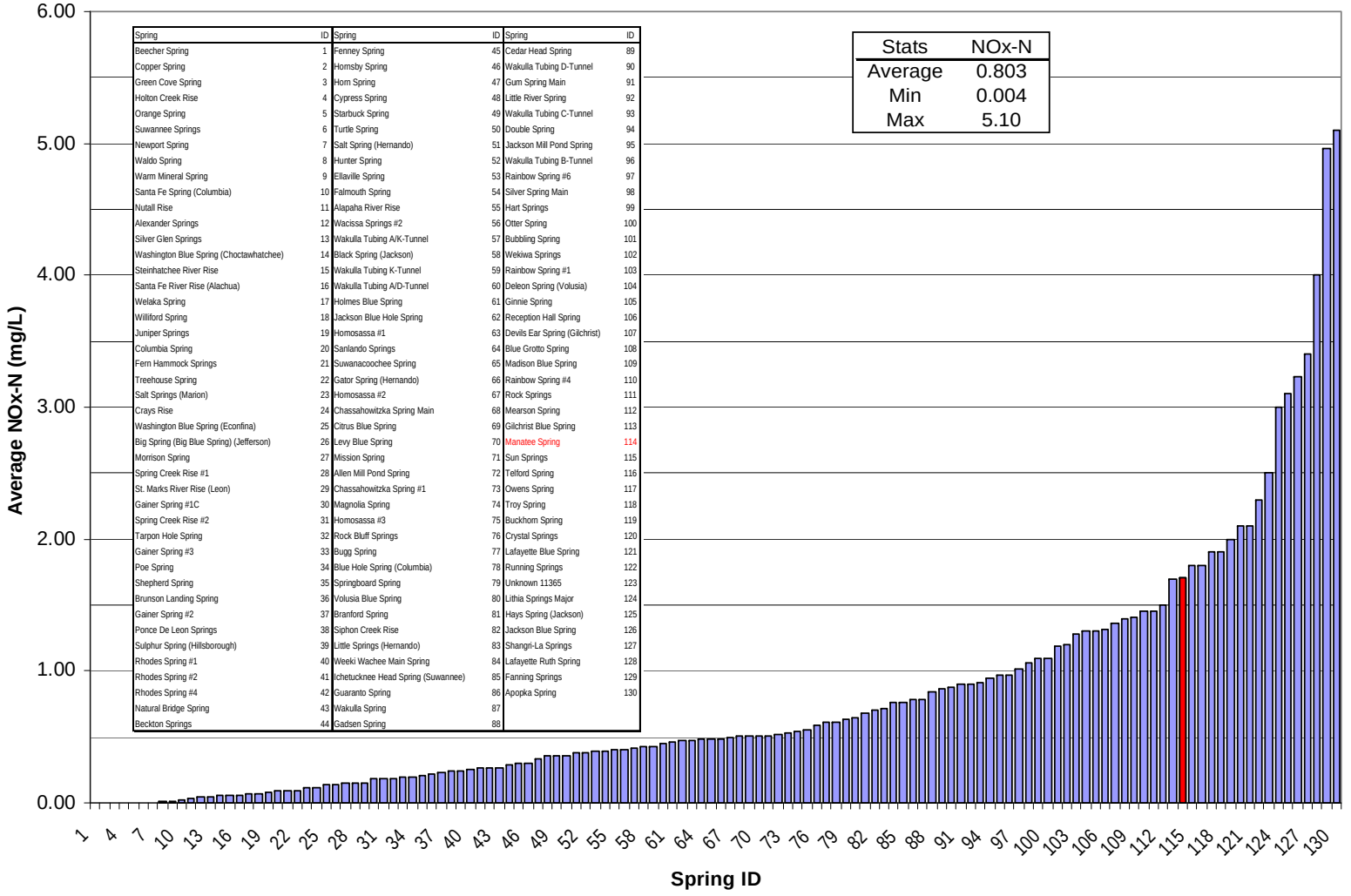
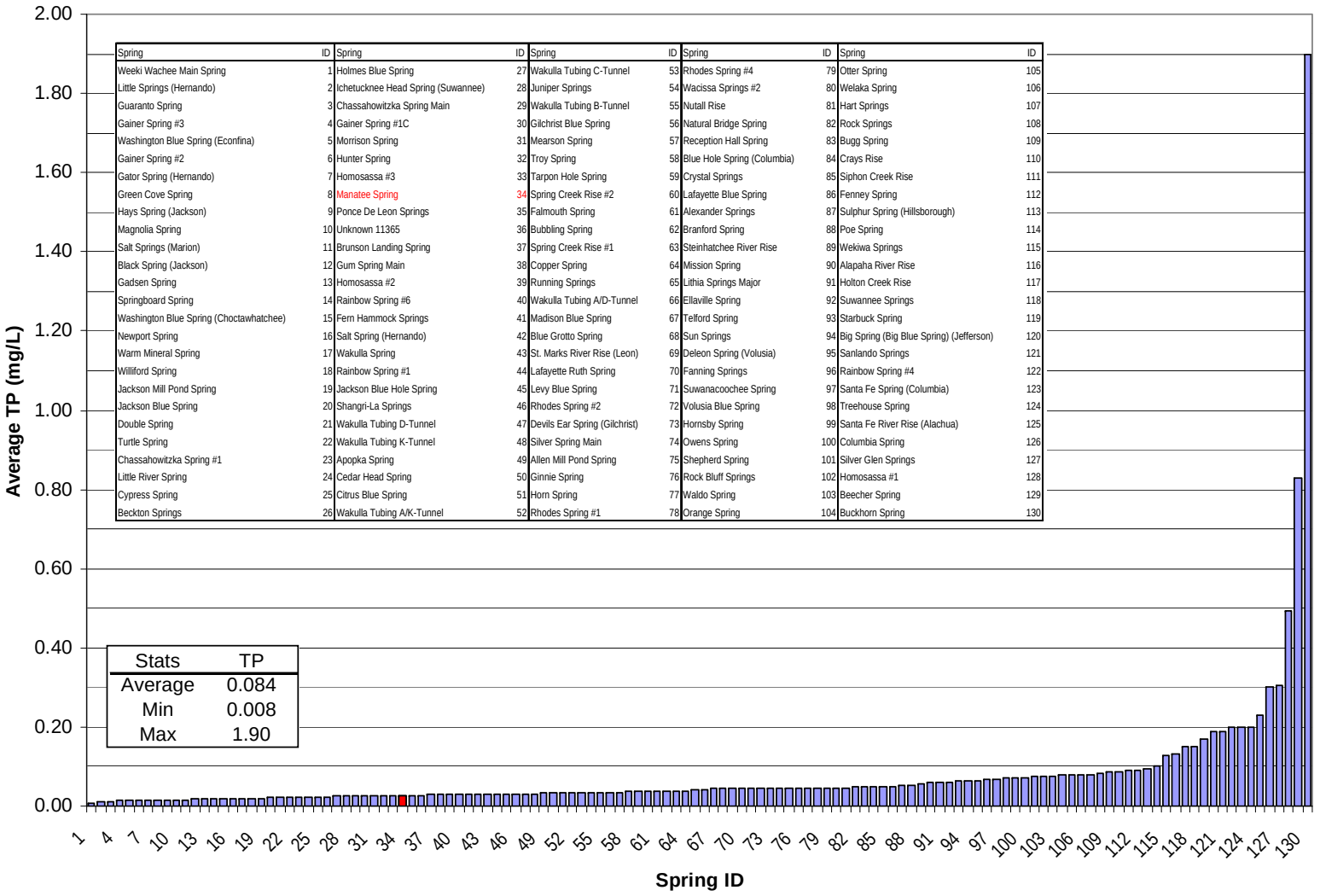


FIGURE 18
Average nitrate+nitrite nitrogen (NO_X-N) concentrations for Manatee Springs in relation to other Florida springs.



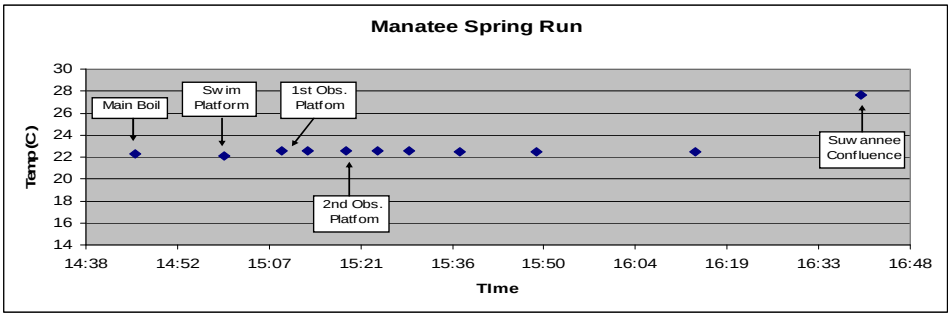
Spring	ID	Spring	ID	Spring	ID	Spring	ID	Spring	ID
Weeki Wachee Main Spring	1	Holmes Blue Spring	27	Wakulla Tubing C-Tunnel	53	Rhodes Spring #4	79	Otter Spring	105
Little Springs (Hernando)	2	Ichetucknee Head Spring (Suwannee)	28	Juniper Springs	54	Wacissa Springs #2	80	Welaka Spring	106
Guaranto Spring	3	Chassahowitzka Spring Main	29	Wakulla Tubing B-Tunnel	55	Nutall Rise	81	Hart Springs	107
Gainer Spring #3	4	Gainer Spring #1C	30	Gilchrist Blue Spring	56	Natural Bridge Spring	82	Rock Springs	108
Washington Blue Spring (Econfina)	5	Morrison Spring	31	Mearson Spring	57	Reception Hall Spring	83	Bugg Spring	109
Gainer Spring #2	6	Hunter Spring	32	Troy Spring	58	Blue Hole Spring (Columbia)	84	Crays Rise	110
Gator Spring (Hernando)	7	Homosassa #3	33	Tarpon Hole Spring	59	Crystal Springs	85	Siphon Creek Rise	111
Green Cove Spring	8	Manatee Spring	34	Spring Creek Rise #2	60	Lafayette Blue Spring	86	Fenney Spring	112
Hays Spring (Jackson)	9	Ponce De Leon Springs	35	Falmouth Spring	61	Alexander Springs	87	Sulphur Spring (Hillsborough)	113
Magnolia Spring	10	Unknown 11365	36	Bubbling Spring	62	Branford Spring	88	Poe Spring	114
Salt Springs (Marion)	11	Brunson Landing Spring	37	Spring Creek Rise #1	63	Steinhatchee River Rise	89	Wekiwa Springs	115
Black Spring (Jackson)	12	Gum Spring Main	38	Copper Spring	64	Mission Spring	90	Alapaha River Rise	116
Gadsen Spring	13	Homosassa #2	39	Running Springs	65	Lithia Springs Major	91	Holton Creek Rise	117
Springboard Spring	14	Rainbow Spring #6	40	Wakulla Tubing A/D-Tunnel	66	Ellaville Spring	92	Suwannee Springs	118
Washington Blue Spring (Choctawhatchee)	15	Fern Hammock Springs	41	Madison Blue Spring	67	Telford Spring	93	Starbuck Spring	119
Newport Spring	16	Salt Spring (Hernando)	42	Blue Grotto Spring	68	Sun Springs	94	Big Spring (Big Blue Spring) (Jefferson)	120
Warm Mineral Spring	17	Wakulla Spring	43	St. Marks River Rise (Leon)	69	Deleon Spring (Volusia)	95	Sanlando Springs	121
Williford Spring	18	Rainbow Spring #1	44	Lafayette Ruth Spring	70	Fanning Springs	96	Rainbow Spring #4	122
Jackson Mill Pond Spring	19	Jackson Blue Hole Spring	45	Levy Blue Spring	71	Suwanacoochee Spring	97	Santa Fe Spring (Columbia)	123
Jackson Blue Spring	20	Shangri-La Springs	46	Rhodes Spring #2	72	Volusia Blue Spring	98	Treehouse Spring	124
Double Spring	21	Wakulla Tubing D-Tunnel	47	Devils Ear Spring (Gilchrist)	73	Hornsby Spring	99	Santa Fe River Rise (Alachua)	125
Turtle Spring	22	Wakulla Tubing K-Tunnel	48	Silver Spring Main	74	Owens Spring	100	Columbia Spring	126
Chassahowitzka Spring #1	23	Apopka Spring	49	Allen Mill Pond Spring	75	Shepherd Spring	101	Silver Glen Springs	127
Little River Spring	24	Cedar Head Spring	50	Ginnie Spring	76	Rock Bluff Springs	102	Homosassa #1	128
Cypress Spring	25	Citrus Blue Spring	51	Horn Spring	77	Waldo Spring	103	Beecher Spring	129
Beckton Springs	26	Wakulla Tubing A/K-Tunnel	52	Rhodes Spring #1	78	Orange Spring	104	Buckhorn Spring	130

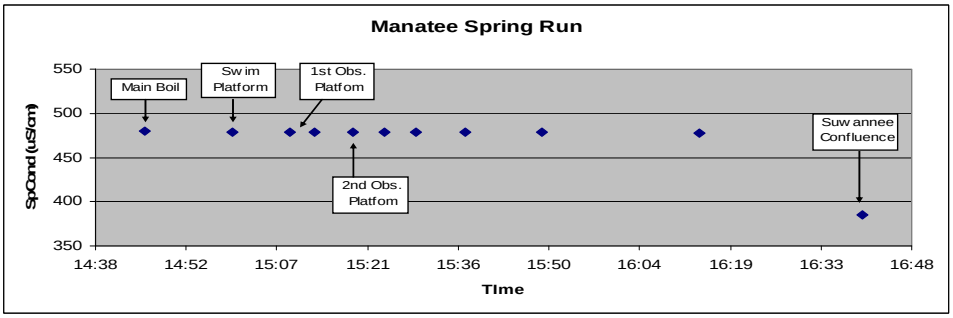
FIGURE 19
Average total phosphorus (TP) concentrations for Manatee Springs in relation to other Florida springs.

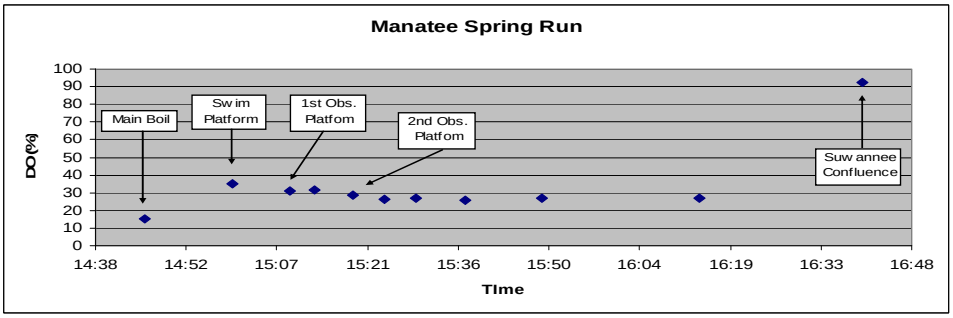
During site reconnaissance of Manatee Springs on Monday July 28, 2008 the spring pool, three locations of the spring run, and the boat dock in the Suwannee River were visited between 14:00 and 17:00 (**Figure 20**). Temperature along the sampling path was stable in the pool and run, before increasing at the Suwannee River (**Figure 21**). Specific conductance was about 480 µS/cm along the spring run, with a decrease at the Suwannee River confluence (**Figure 21**). Dissolved oxygen concentrations and pH values increased downstream of the spring pool (**Figure 21**).

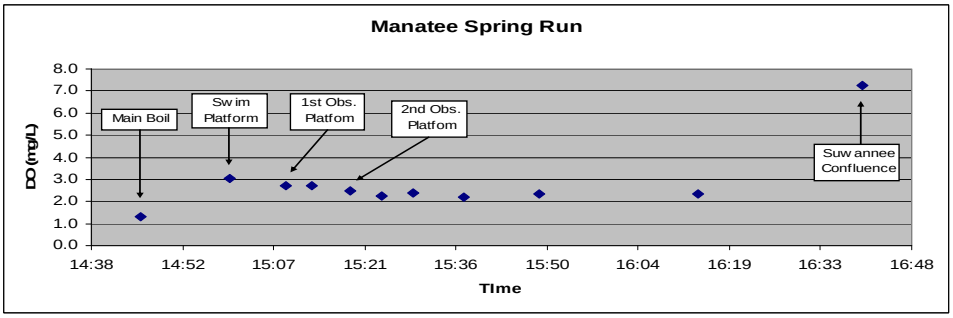


FIGURE 20
Image of Manatee Springs with red icons indicating the field parameter sampling locations on July 28, 2008.









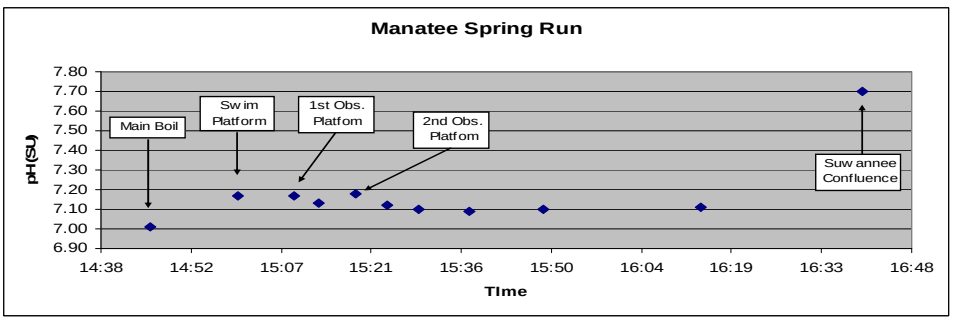


FIGURE 21
Field parameters by location and time for Manatee Springs on July 28, 2008.

Biological

Vegetation

During a reconnaissance trip made on July 28, 2008, the submersed aquatic vegetation (SAV) in Manatee Springs was limited to a few very small beds of tape grass (*Vallisneria americana*) near the boil and filamentous algae. Downstream of the swimming area, filamentous algae coverage ranged from sparse to abundant over the sediments. Tufts of periphyton were present on most of the submersed rock and wood substrates.

As a state park, the aquatic vegetation in Manatee Springs has been observed for the past three decades, and most intensively due to the presence of hydrilla (*Hydrilla verticillata*). The chronology of hydrilla colonization in Manatee Springs has been compiled by Joe Hinkle (FWC, Hinkle 2009). Hydrilla was first discovered growing at the park boat ramp in December 1974, during which time no funds were available for treatment. By 1976, the coverage of hydrilla had increased to one acre and a hand-removal program was instituted. In 1977, hydrilla coverage had increased to an estimated 0.81 ha (2 ac or 30% coverage of the spring run) and hand removal was still being utilized. In 1978 and 1979, chemical treatment of 3.4 ha (8.5 ac) and 2.4 ha (six ac) respectively, were treated around the spring mouth, both of which were non-effective in control. In 1980, a concentrated application of herbicide was made (150 lbs/acre) to 0.4 ha (1 ac) in the spring run. This resulted in a strong kill on hydrilla. By 1982, dense coverage of hydrilla at the mouth of the spring run resulted in 4.5 ha (11 ac) being treated with Diquat and Cutrine. In 1983, an annual harvesting program for the spring run was initiated using a mechanical plant harvester (**Figure 22**).



FIGURE 22
Image of the aquatic vegetation harvester used for hydrilla control in Manatee Springs during 1986 (from Hinkle 2009).

During 1984, high water from a flooded Suwannee River made control unnecessary. Harvesting continued from 1985 through 1990, often in conjunction with herbicide applications. During this time period aquatic plant surveys were also conducted. The 1983 and 1986 surveys indicated that although hydrilla was the dominant plant, strap-leaf sagittaria (*Sagittaria kurziana*), tape grass (*Vallisneria americana*), fanwort (*Cabomba caroliniana*), ludwigia (*Ludwigia sp.*), and several emergent species were also present. A 1989 map showing the distribution of SAV reveals that hydrilla was abundant throughout the spring run and into the Suwannee River (**Figure 23**). By 1994, SAV abundance in Manatee Springs was reduced and limited to hydrilla and fanwort. In 1998, regionally heavy rainfall caused the Suwannee River to flood for an extended period of time. The resulting tannin-stained water conditions in the spring run appeared to have reduced light availability for SAV causing a major loss of both native and non-indigenous plant species. About this same time manatee utilization of the lower Suwannee River and Manatee Springs was observed to be increasing. These two factors appear to have contributed to the decline of SAV in Manatee Springs. Since 2003, the dominant SAV has been filamentous algae.

Stevenson *et al.* (2007) identified the dominant filamentous algae in Manatee Springs as *Vaucheria geminata*, a yellow-green (Xanthophyceae) filamentous alga. Although *Vaucheria* is a native and widespread filamentous alga, it appears to have increased in abundance in many of Florida's spring systems. Thin patches of *Vaucheria geminata* growing on the rocks and on the sloping sides in the pool of Manatee Springs during the fall and winter months of 1971 and 1972 and the spring months of 1972 were observed by Davis and Gworek (1973). Of note, all *Vaucheria* collections were parasitized by the rotifer, *Proales werneckii*, which may provide some degree biological control for this algal species (Davis and Gworek 1973).



FIGURE 23
The distribution of aquatic vegetation in Manatee Springs in 1989 (from Hinkle 2009).

An investigation into the loss of SAV within Manatee Springs was conducted by Smith and Mezich (2004). These authors reported that in the fall of 2000, a group of up to 22 manatees entered the spring and consumed much of the vegetation in the run over a 10 day period. To explore the hypothesis that manatees were over-grazing SAV within this system, the authors planted tape grass propagules in the spring run and enclosed a portion of them with wire cages to prevent manatee grazing. After sustained manatee grazing in the spring run was observed, tape grass shoot counts were significantly reduced (by 95%) in the un-caged controls when compared to caged tape grass (Smith and Mezich 2004). The authors of the study noted that other factors such as SAV grazing by grass carp (*Ctenopharyngodon idella*) and filamentous algal overgrowth from increasing nutrient loads have also contributed to the loss of desirable SAV in Manatee Springs.

A detailed study of the Manatee Springs SAV community was conducted in 2003 by Kurz *et al*. (2003). This study found only sparse patches of strap-leaf sagittaria, mainly at the periphery of the headsprings and approximately 1% coverage in the spring run. Kurz *et al*. (2003) concluded that SAV in Manatee Springs and spring run appear to be affected by both long term and seasonal changes in water quality (highly tannic waters from the Suwannee River) and grazing by manatees.

In 2005 and 2006, as part of a multi-spring algal study conducted by Stevenson *et al.* (2007), the algal community of Manatee Springs was surveyed. Filamentous algal mats were found to be thickest at Manatee Springs, in the range of 50 to 60 cm, and largely composed of *Vaucheria sp*. Sampling included periods of dark water inundation from the Suwannee River, in the late spring and early summer of 2005, during which time macroalgal coverage varied from near zero and a period of clear spring water in the fall and winter of 2006 during which time macroalgal coverage increased to about 3,500 m^2. Correspondingly, mean thickness varied from 3 to 18 cm and gross volume ranged from near zero to 518 m^3 (**Figure 24**). Sampling by Stevenson *et al*. 2007 in the spring pool found four types of filamentous algae, with % cover in parenthesis: *Vaucheria sp*. (91.4%), *Dichotomosiphon sp*. (2.5%), *Oscillatoria sp*. (1.2%), and *Lyngbya sp*. (1.2%).

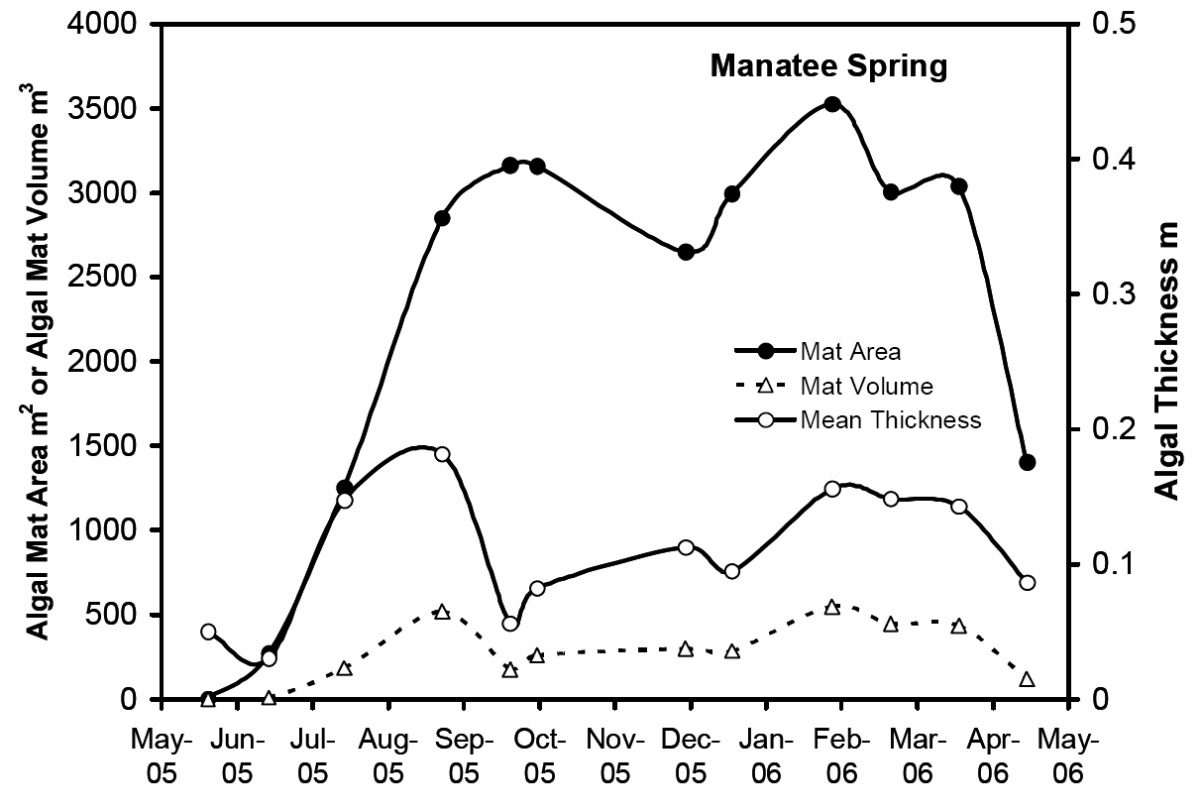


FIGURE 24
Variation in the area, thickness, and volume of filamentous algal mats in Manatee Springs (from Stevenson *et al.* 2007).

Macroinvertebrates

The Florida Department of Environmental Protection (FDEP) has been conducting investigations of macroinvertebrate populations with multiple chemical and biological measures (EcoSummary) in Manatee Springs as early as October 2000 and continuing to-date with up to four events per calendar year (FDEP 2000, 2001a, 2001b, 2002a, 2002b, 2002c, 2003a, 2003b, 2003c, 2003d, 2004b, 2004c, 2004d, 2004e, 2005b, 2006a, 2006b, 2006c, 2006d, 2007a, 2007b, 2007c, and 2007d. Habitat Assessment and Stream Condition Index (SCI) data for much of this time-period (October 12, 2000 to May 14, 2007) have been summarized in a 2008 report (FDEP 2008). Despite habitat assessment in the sub-optimal to optimal range,

seventeen out of eighteen SCI samples indicated impaired biological conditions at Manatee Springs (**Figure 25**, FDEP 2008). The impaired SCI rating was attributed to the low dissolved oxygen concentrations, marginally elevated specific conductance, and lack of habitat. The low dissolved oxygen and elevated specific conductance are natural conditions of Manatee Springs; however, specific conductivity does show a significant increasing trend (**Figure 15**). The number of sensitive macroinvertebrate taxa has remained very low over the period-of-record, averaging 1 sensitive taxon; while the total macroinvertebrates have ranged from 13 to 30 taxa (**Figure 25**).

Manatee Springs was surveyed in 1992 for aquatic plant and animal communities by Woodruff (1993). Findings included 9 types/species of gastropods (snails): *Elimia floridensis*, *Viviparus georgianus*, *Tarebia granifera*, Hydrobiidae, *Physella sp*. *Physella cubensis*, *Hebetancylus excentricus*, *Planorbella trivolvis intertexta*, and *Laevapex fuscus*. Woodruff (1993) reported amphipods (*Crangonyx sp*. and *Hyalella azteca*), isopods (*Asellus sp*.), and decapods of *Procambarus paludosus* and unidentified *Procambarus sp*. Woodruff (1993) also made benthic core collections within *Sagittaria kurziana* beds at Manatee Springs and noted the dominance of oligochaetes (segmented worms) among ten samples (**Figure 26**). Manatee Springs was sampled for crustaceans on May 21, 2002 by staff from the Florida Museum of Natural History (Franz 2002). In the spring pool amphipods (*Hyalella sp*.) were collected, while in the spring run both amphipods and crayfish (*Procambarus sp*.) were collected.

At least three troglobitic invertebrates are known to inhabit the Manatee Springs cave system (FDEP 2004a). These include two crayfish, the light-fleeing cave crayfish (*Procambarus lucifugus*) and the north Florida spider cave crayfish (*Troglocambarus maclanei*), and an amphipod, Hobb's cave amphipod (*Crangonyx hobbsi*).

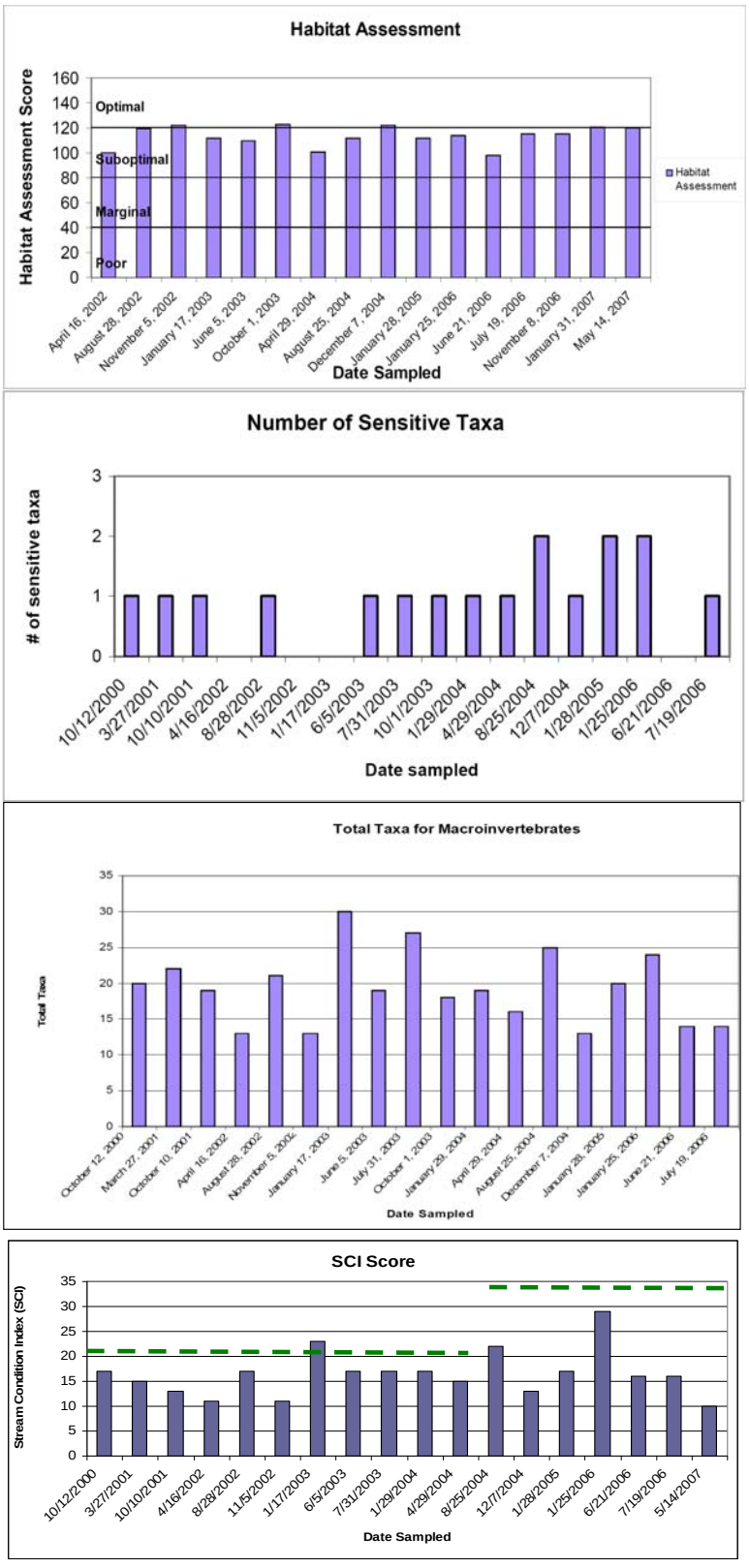


FIGURE 25
Time-series of habitat assessment, number of sensitive taxa, total number of macroinvertebrate taxa, and stream condition index (SCI) values for Manatee Springs (from FDEP 2008).

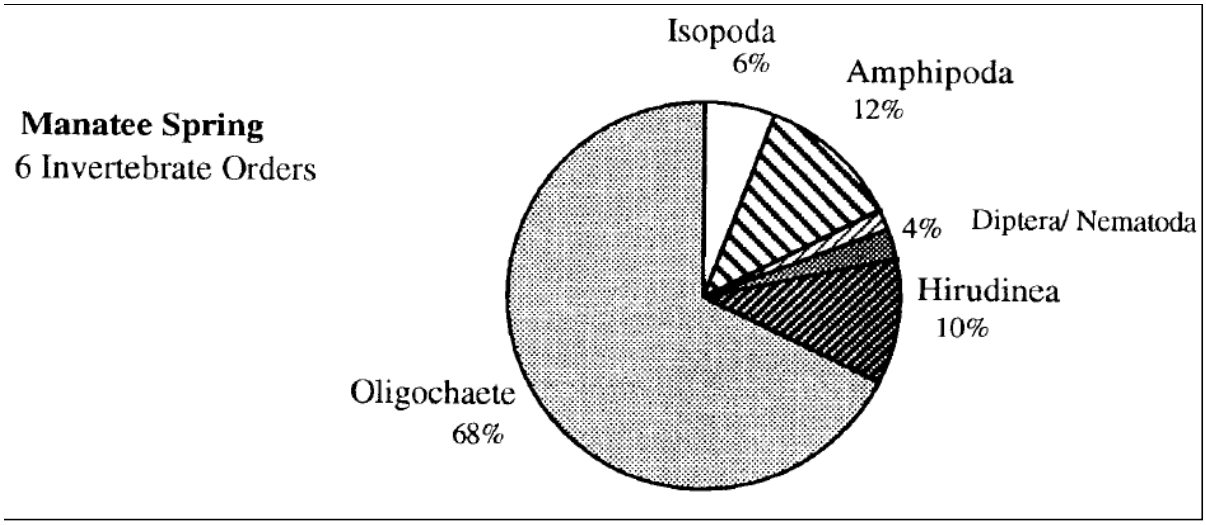


FIGURE 26
Benthic core analyses of ten samples from vegetated substrate in Manatee Springs (from Woodruff 1993).

Walsh and Williams (2003) sampled for bivalves at sites on the north and south shore of the spring pool and along reaches of the spring run to its confluence with the Suwannee River. No mussels were collected in the pool area or along most of the spring run, consistent with the findings of Woodruff (1993). Adjacent to the confluence of the spring run and river Walsh and Williams (2003) collected the following species of unionid mussels (living and /or dead valves): variable spike (*Elliptio icteriana*), iridescent lilliput (*Toxolasma paulus*), downy rainbow (*Villosa villosa*), and the non-indigenous Asiatic clam (*Corbicula fluminea*). It was noted that in sampled portions of the spring run the substrate was comprised of soft, flocculent organic detritus overlain by filamentous algae and does not generally provide suitable habitat for mussels. However, Woodruff (1993) noted that bivalves, which feed primarily on plankton and suspended detritus, are more characteristic of surface water lotic systems, and were not collected at any of his sample sites in 1992.

Macro fauna

A variety of turtle species have been documented from Manatee Springs by the park service with aquatic species including: Florida snapping turtle (*Chelydra serpentina osceola*), mud turtles (*Kinosternon sp.*), alligator snapping turtle (*Macroclemys temminckii*), Suwannee cooter (*Pseudemys concinna suwanniensis*), Florida red-belly turtle (*Pseudemys nelsoni*), stinkpot (*Sternotherus odoratus*), and Florida softshell (*Apalone ferox*). However, no scientific studies of the turtle community have been conducted at this system.

During the July 28, 2008 reconnaissance of Manatee Springs numerous fish were observed. In the main pool, the fish assemblage observed was limited to sunfish (*Lepomis sp.*) and bluefin killifish (*Lucania goodei*). In the spring run, small schools of lake chubsucker (*Erimyzon sucetta*) and stripped mullet (*Mugil cephalus*) were observed grazing the benthos.

The Manatee Springs fish community was sampled as part of a multi-spring survey conducted in 1992 (Woodruff 1993) which resulted in a total of 25 species collected. The fish species collected by Woodruff were similar to collections made a decade later, with the exception of two species: golden shiner (*Notemigonus crysoleucas*) and yellow bullhead (*Ameiurus natalis*).

Walsh and Williams (2003) collected fish from Manatee Springs and also summarized the Florida Museum of Natural History (FLMNH) fish collections from this system. Based on their review of museum voucher specimens, a total of 23 species of 15 genera and 10 families were collected from Manatee Springs (**Table 4**).

Utilizing electrofishing and seining techniques, Walsh and Williams (2003) collected a total of 22 species of 16 genera and 11 families (**Table 4**) from throughout the spring run to the mouth at the Suwannee River and noted two other species of catfish, brown bullhead

(*Ameiurus nebulosus*) and spotted bullhead (*Ameiurus serracanthus*) in the large sink near the head springs known as "Catfish Hotel." Walsh and Williams (2003) noted their sampling was dominated in abundance by bluefin killifish (*Lucania goodei*, 32.4%), redbreast sunfish (*Lepomis auritus*, 17.6%), spotted sunfish (*L. punctatus*, 13.3%), and redeye chub (*Notropis harperi*, 9.1%). Based on the species collected by Woodruff (1993), Walsh and Williams (2003), and those represented in the FLMNH collection, a minimum of at least 35 species have been recorded from the spring, spring run, and large sink ("Catfish Hotel") adjacent to the main boil. This number does not include grass carp (*Ctenopharyngodon idella*) which have been observed by park staff feeding in the spring run.

TABLE 4
Fishes collected in Manatee Springs State Park (number of specimens and relative abundance), and material in the FLMNH ichthyologic collection (number of specimens and percent of material, from Walsh and Williams 2003).

Family	Species	USGS		FLMNH Material	
		N	Relative Abundance (%)	Specimens	%
Lepisosteidae	*Lepisosteus platyrhincus*	7	1.5	---	---
Amiidae	*Amia calva*	9	1.9	1	0.2
Cyprinidae	*Notropis harperi*	44	9.1	132	29.5
	Notropis maculatus	1	0.2	---	---
	Notropis petersoni	15	3.1	4	0.9
Catostomidae	*Erimyzon sucetta*	1	0.2	3	0.7
	Minytrema melanops	1	0.2	1	0.2
Ictaluridae	*Noturus gyrinus*	1	0.2	---	---
Aphredoderidae	*Aphredoderus sayanus*	---	---	6	1.3
Mugilidae	*Mugil cephalus*	2	0.4	---	---
Fundulidae	*Fundulus seminolis*	5	1.0	---	---
	Lucania goodei	156	32.4	78	17.4
Poeciliidae	*Gambusia holbrooki*	30	6.2	17	3.8
	Heterandria formosa	1	0.2	3	0.7
	Poecilia latipinna	4	0.8	---	---
Centrarchidae	*Enneacanthus gloriosus*	---	---	3	0.7
	Lepomis auritus	85	17.6	6	1.3
	Lepomis gulosus	2	0.4	6	1.3
	Lepomis macrochirus	10	2.1	3	0.7
	Lepomis microlophus	3	0.6	4	0.9
	Lepomis punctatus	64	13.3	18	4.0
	Micropterus notius	---	---	1	0.2
	Micropterus salmoides	13	2.7	7	1.6
	Pomoxis nigromaculatus	---	---	2	0.4
Percidae	*Etheostoma edwini*	---	---	2	0.4
	Etheostoma fusiforme	---	---	8	1.8
Elassomatidae	*Elassoma okefenokee*	6	1.2	128	28.6
	Elassoma zonatum	---	---	7	1.6
Achiridae	*Trinectes maculatus*	22	4.6	8	1.8
	Total number of species	**22**		**23**	
	Total number of specimens	**482**		**448**	

Manatees

Manatee utilization at Manatee Springs was reported by Bartram in 1774 (Harper 1958). After this date, their geographic range appears to have been dramatically reduced to a core population in southeast and southwest Florida. This decrease in manatee numbers can likely be attributed to the expansion of settlers within the state who utilized manatees for food. Evidence for this assertion is provided by John Lee Williams observations made over two decades in the early nineteenth century. His writings on the subject are found under his description of Florida's fish (p. 100, Williams 1962): "*This is a shy fish* [sic] *and is mostly confined to the grassy bays and particularly to the deep springs on the coast. They feed on grass and are considered excellent food. Their ribs are used for ivory. They are usually shot while feeding near the shore.*"

As the range of the Florida manatee has expanded, utilization of the lower Suwannee River has also increased. Powell and Rathbun (1984) reported that Manatee Springs was modestly used by manatees over the past century, before increasing in the 1970's as a temporary thermal refuge in the spring and fall. Manatee Springs is a designated secondary refuge for manatees (Warm Water Task Force 2004), as it appears to provide refuge most often during the late fall and late winter when manatees are dispersed from the main wintering refuges (Langtimm *et al.* 2003). Utilization of Manatee Springs as a thermal refuge primarily occurs in the lower spring run and the confluence of the Suwannee River (Langtimm *et al*. 2003). Manatees are less common within the spring run and pool possibly due to shallow water depths, lack of forage, human disturbance, and possibly current velocity (Langtimm *et al*. 2003).

A July 1976 sighting may represent the first modern verified manatee within Manatee Springs and 21 individual manatees have been documented at this spring; although most of these individuals use Crystal or Homosassa Rivers as their primary winter refuges (Langtimm *et al*. 2003). MSSP staff has recorded manatee sightings since 1993, however these observations do not distinguish between individual and do not represent the actual size of the manatee population using the spring (**Figure 27**). Peak periods of manatee sightings are December-March in any given year, supporting assertions that the primary purpose of the spring is warm-water refuge (**Figure 28**). A maximum count of 32 animals using the spring and adjacent river in March 2001 was made by MSSP staff following a late-season cold front (Langtimm *et al*. 2003).

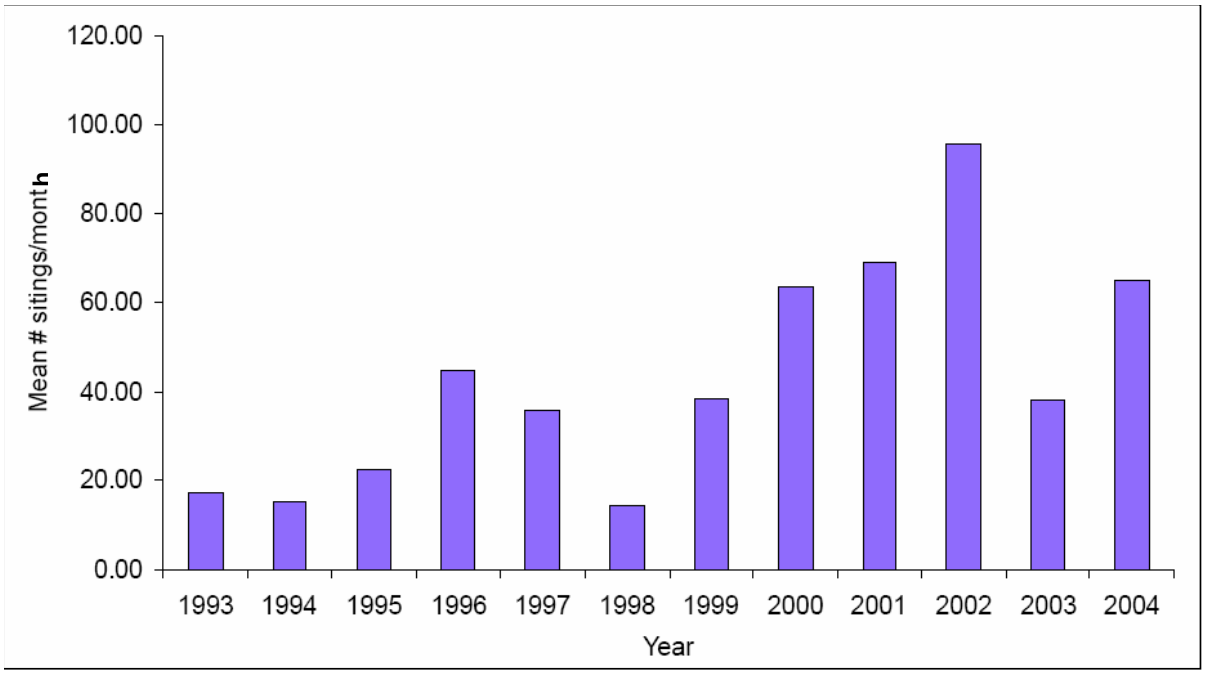


FIGURE 27
Mean number of manatee sightings by month from 1993 to 2004 at Manatee Springs (from SRWMD 2005).

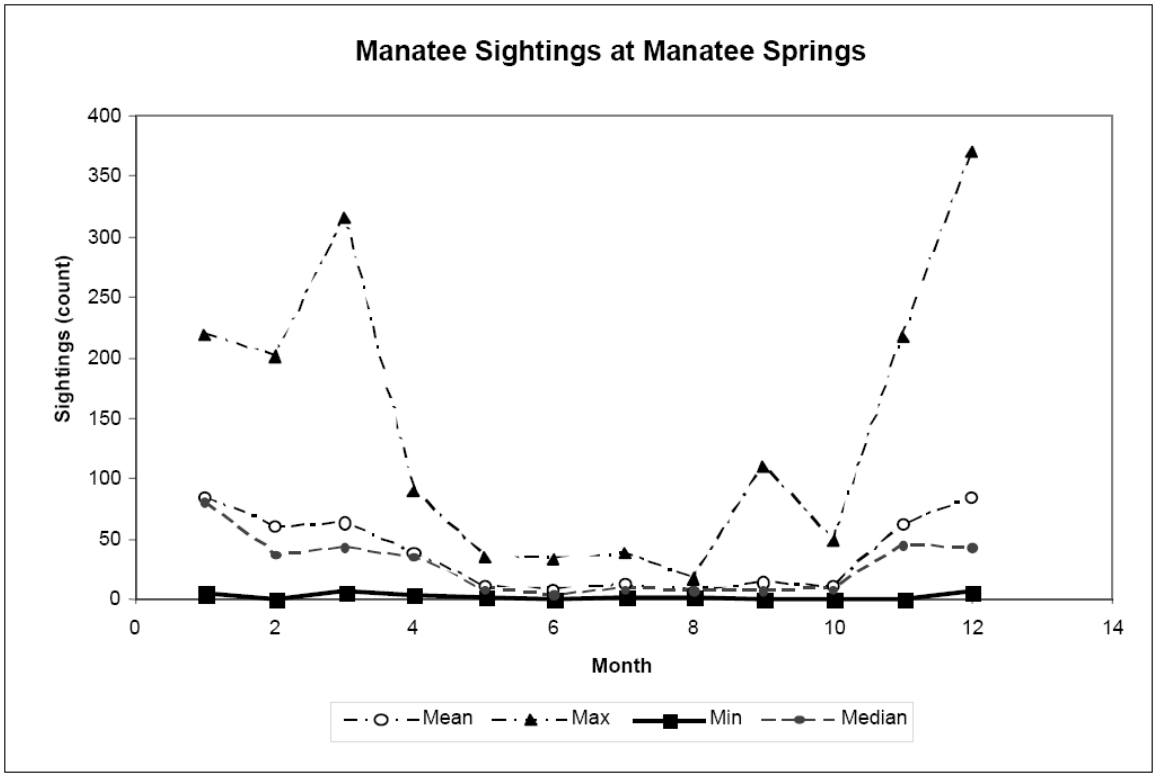


FIGURE 28
Manatee sighting statistics by month at Manatee Springs for 1993 to 2004 data (from SRWMD 2005).

Taylor (2006) designated Manatee Springs as having accessibility issues due to shoals in the spring run and bathymetry surveys conducted in 2005 did identify several shallow sills (< 1 m) which could preclude manatee access. Dredging to remove sediment in these portions of the spring run has been identified by MSSP as a possible management option (FDEP 2004a). Other threats to manatees at this spring include reduced spring flow, deteriorating water quality, and degraded habitat in the form of lack of desirable forage (Taylor 2006).

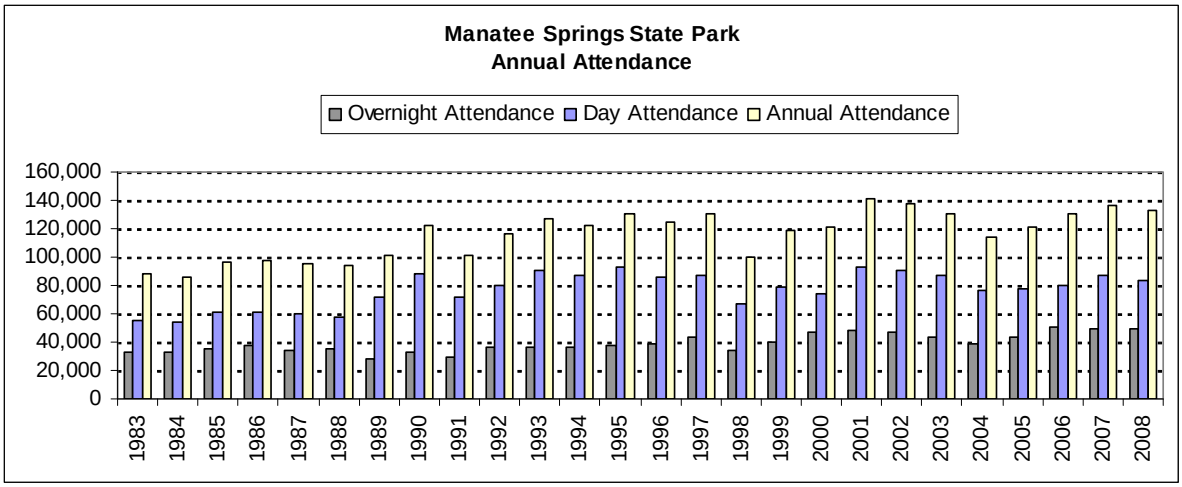
Ecosystem Functions

A historical estimate of primary production was made at Manatee Springs near the mouth of the spring run during August 15, 1955 (Odum 1957). On that date, gross primary production was estimated to be 19.4 g $O_2/m^2/d$. The primary production in Manatee Springs was a function of the light available for the system, as was the case for the other springs in Odum's study.

Based on field parameters (temperature, conductance, dissolved oxygen, and pH) measured in the spring pool and spring run during the reconnaissance trip of July 28, 2008, the Manatee Springs System is suitable for measuring ecosystem metabolism based on changes in dissolved oxygen (see **Figure 21**). During our reconnaissance, average DO concentrations at the spring pool were approximately 1.5 mg/L. In the main spring run, DO rose to approximately 3 mg/L in a relatively short distance. These values were measured in the afternoon under cloudy conditions, and daily maximal DO concentrations are likely to be observed between 16:00 to 18:00 hours.

Human-Use Attendance and Activities

Recreational activities at Manatee Springs include swimming, snorkeling, diving, canoeing and kayaking, picnicking, and hiking. As a state park, complete annual statistics of human attendance are available between 1983 and 2008. Peak total annual attendance occurred in 2001, with slightly more than 140 thousand people, of which about 66% was from day use only and 34% included overnight use. Peak seasonal use occurs between the months of May to August when about 48% of visitation occurs (**Figure 29**).



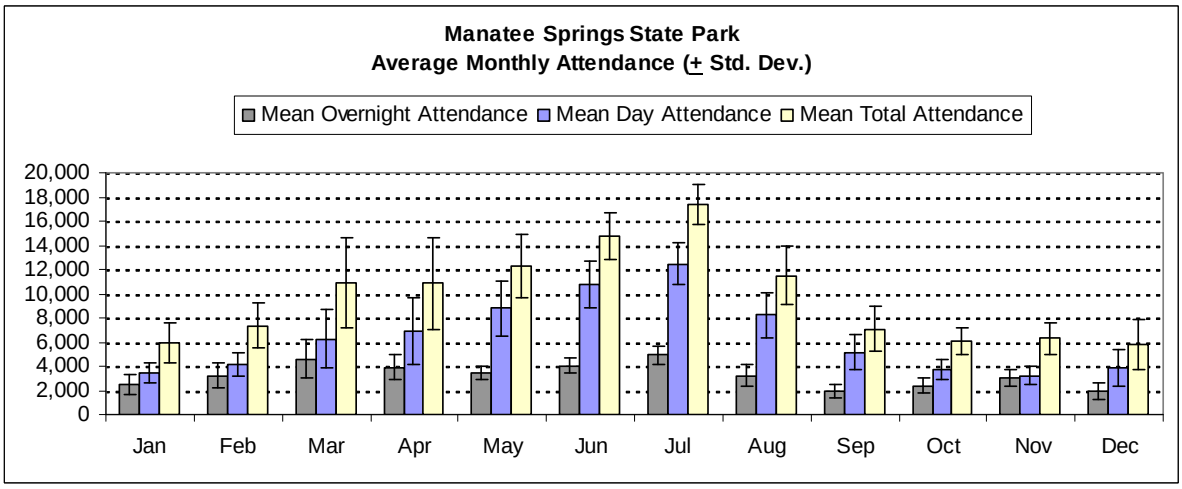


FIGURE 29
Manatee Springs State Park annual and monthly attendance data.

Data for MSSP, fiscal year 2006/2007, was utilized to estimate the economic impact of this park (FDEP 2007e). Findings reveal that 134,110 people utilized the park during this time period, among which 74% were non-local visitors, which in turn generated approximately $5.8 million dollars in local revenue, and supported the creation of 123 jobs (FDEP 2007e). Estimates such as this, reveal the importance of state parks on local economy and provide added incentive towards the maintenance of high environmental quality within parks.

Minimum Flows and Levels

A minimum flow regime (MFR) has been adopted by the SRWMD for Manatee Springs. An important consideration of this MFR was maintaining the protection of fish and wildlife habitats (and the passage of fish), and specifically, the protection of warm water habitat for manatees between November and April (**Table 5**). As stated in the MFL technical document (SRWMD 2005): "*To avoid a significantly adverse impact to the thermal refuge for manatee at Manatee Spring a minimum spring flow of 130 cfs during cold season (November–April) is recommended. This flow is based on modeling of the relationships of river and spring discharge during the cold season (November–April). In addition, throughout the year, the historic flow regime will not* [be] *reduced by more than 10%. This is based on evaluation of the relationship of spring discharge to river stage, avoidance of significant adverse impact to the recreation and aesthetic values of the spring, manatee thermal refuge in the cold season (Nov-Apr) and available water in the springshed.*"

The Manatee Springs MFL is unusual in that it potentially specifies multiple and conflicting discharge values (*i.e.*, 130 cfs between November to April and/or 90% of historical flow regime throughout the year). The period-of-record median discharge for Manatee Springs is 204 cfs and the average discharge is 189 cfs (SRWMD 2005). Based on simple math, it would appear that the median and average flow (for any future year) should not be reduced below 183.6 cfs and 170.1 cfs, respectively. The minimum flow of 130 cfs represents approximately 64% and 69% of the median and average discharge, respectively. It would appear that if a minimum flow value of 130 cfs did occur during the five month manatee protection time period, it would likely prevent the annual goal of not reducing flow more than 10% of period-of-record median or average discharge values.

TABLE 5
The ten water resource values (WRVs) which were considered for the establishment of the Manatee Springs minimum flow and level (MFL) (from SRWMD 2005).

ECOLOGIC & HUMAN USE VALUE	IS VALUE APPLICABLE TO WATER BODY?	REQUIREMENTS TO AVOID SIGNIFICANTLY ADVERSE IMPACT	DOES RECOMMENDED MFL ADDRESS VALUE?
Recreation in and on the water	Yes	Full pool that minimizes "dark water" intrusion from river	Yes
Fish and wildlife habitats and the passage of fish	Yes	130 cfs during cold season to maintain thermal refuge	Yes
Estuarine resources	Yes	Maintain acceptable flows to river in dry period to avoid significant adverse impacts	Yes
Transfer of detrital material	No	NA	NA
Maintenance of freshwater storage and supply	Yes	Availability of water for future use	Yes
Aesthetic and scenic attributes	Yes	Full pool that minimizes "dark water" intrusion from river	Yes
Filtration and absorption of nutrients and other pollutants	No	NA	NA
Sediment loads	No	NA	NA
Water quality	No	NA	NA
Navigation	No	NA	NA

Blue shading indicates limiting (most sensitive to flow reduction) value

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Appendix U

Summary of data for Ponce de Leon Springs



Summary of Existing Data - Ponce de Leon Springs (Holmes Co.)

Prepared by

Wetland Solutions, Inc.

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Cover photo: Underwater view of Ponce de Leon Springs pool with Illinois pondweed (*Potamogeton illinoensis)* and southern naiad (*Najas guadalupensis)* growing along bottom while redeye chub (*Notropis harperi)* and weed shiners (*N. texanus)* swim above (S.K. Notestein, 09/10/09).

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Summary of Existing Springs Data

This report summarizes known and existing physical, chemical, and biological data for Ponce de Leon Springs (Holmes County). These data were collected from the Northwest Florida Water Management District (NWFWMD), the U.S. Geological Survey (USGS), the Florida Department of Environmental Protection (FDEP), and technical reports.

Ponce de Leon Springs State Park

Physical Address

Ponce de Leon Springs State Park; 2860 Ponce de Leon Springs Road; Ponce de Leon, Florida 32455; Phone: 850-836-4281; latitude/longitude: 30.722792°, -85.929947°; park website: http://www.floridastateparks.org/poncedeleonsprings/default.cfm .

Driving Directions

Ponce de Leon Springs are located within the Ponce de Leon State Park in the town of Ponce de Leon in Holmes County. From I-10 exit at SR 81 and travel north for 1.6 km (1 mi), turn east on US 90 and travel 1 km (0.6 mi) to the intersection with CR 181A, and then travel south 1 km (0.6 mi) on CR 181A to the park entrance on the right (**Figure 1**).

General

Named in reference to the Spanish explorer Juan Ponce de Leon, there is no evidence that this spring (or any) were visited during his 1513 exploration of Florida. The legend of his search for a Fountain of Youth began decades after his death and likely provided a background for naming this (and other) springs with a tourism appealing name. Ponce de Leon Springs is a smaller second magnitude spring system whose spring run discharges into Sandy Creek, which in turn flows south into the Choctawhatchee River.

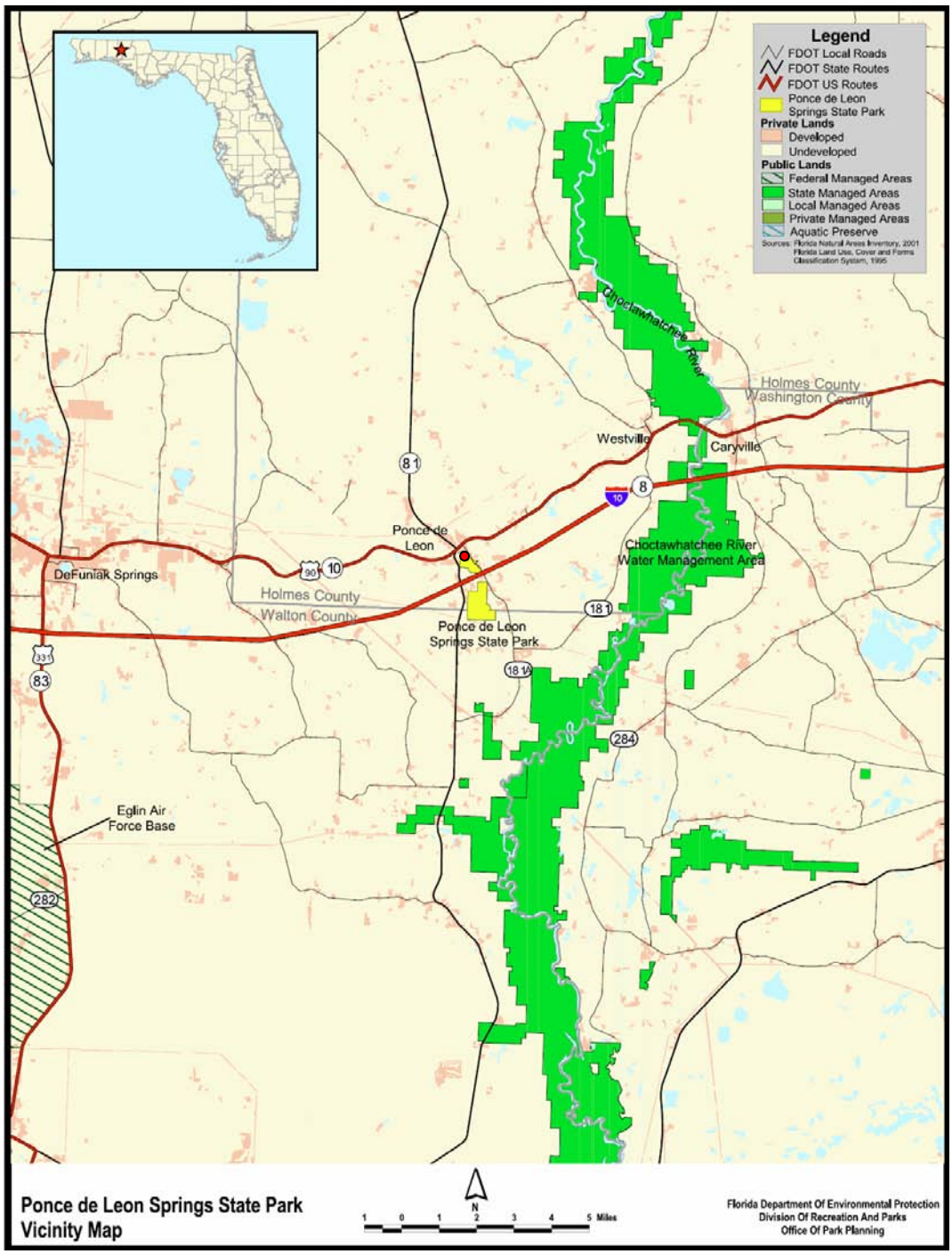


FIGURE 1
Geographic location of Ponce de Leon Springs in Holmes County (from FDEP 2004a).

Ponce de Leon Springs State Park lands were acquired by the state in 1970. The park contains approximately 420 acres, parts of which are components of the Florida Greenways and Trails System and the Great Florida Birding Trail, while the waters are

designated as Outstanding Florida Waters and as Class 3 waters (FDEP 2004a). The park is administered by the FDEP/FPS for public outdoor recreation and conservation. Facilities are well developed and include hiking trails, pavilions, picnic and grilling stations, and restrooms. This site is a popular recreational destination where visitors can participate in swimming, snorkeling, fishing, picnicking, hiking, and nature study.

Physical

All but the western shoreline of the spring pool has been stabilized with concrete and limestone and a concrete weir serves to raise and maintain water elevation in the pool. Downstream of the weir, the sand-bottomed spring run travels about 170 m (560 ft) to Sandy Creek, an alluvial stream which carries a heavy sediment load and is subject to seasonal flooding.. Sandy Creek passes closely to the western side of the spring and during high stage conditions will overflow its banks and flood the entire spring system. Flooding events can occur multiple times throughout the year and frequently deposit large amounts of sand (FDEP Ranger Aaron Miller, personal communication).

Two vents discharge water to the spring pool (**Figures 2** and **3**). However, a third vent noted by Rosenau *et al.* (1977) along the west edge of the pool, was not discharging during 2008 and 2009 site visits. The pool is elliptical shaped and measures about 32 m (105 ft) north to south and 34 m (111 ft) east to west. A wooden retaining wall was built around the spring in 1926 to prevent erosion by the private owners. It was replaced by a concrete wall in 1953 and modified in 1983 to encircle most of the pool while including a small weir which controls pool water levels. Quartz sands cover the bottom of the pool, with the vents exposing karst geology. The spring run is small and winds through a hardwood flood plain before joining Sandy Creek.



FIGURE 2
Ponce de Leon Springs pool facing northeast with main vent shown (September 8, 2009).

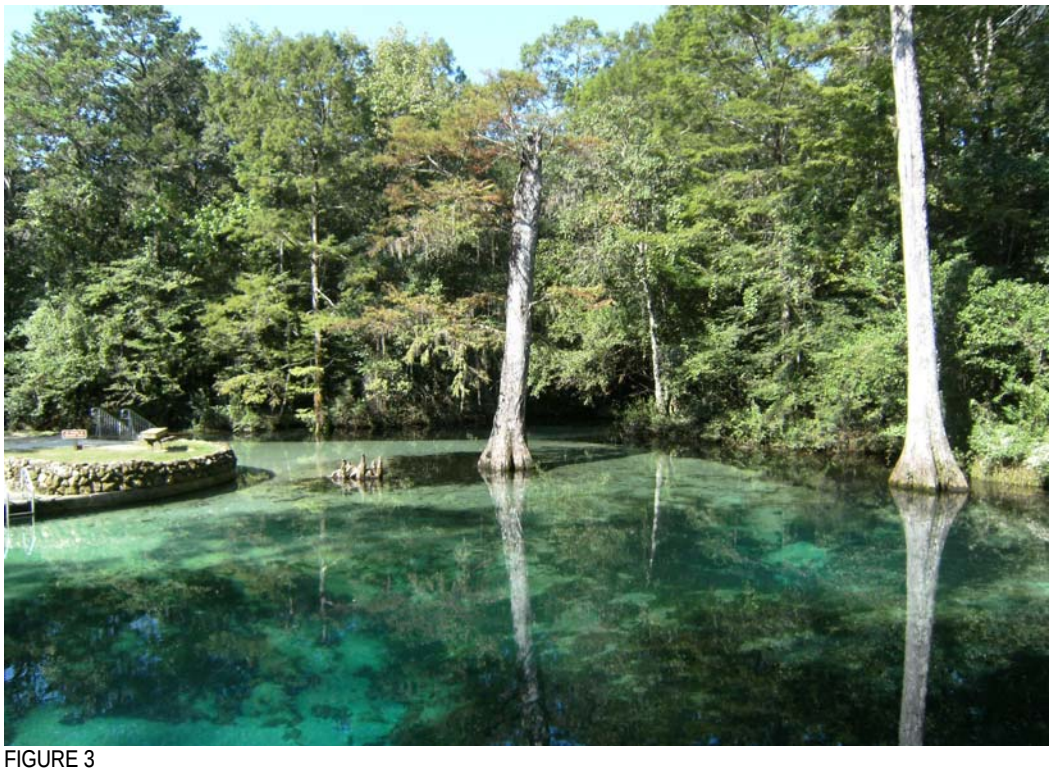


FIGURE 3
Ponce de Leon Springs pool facing southwest, main vent lower left and minor vent lower right (September 8, 2009).

The depth throughout the pool averages approximately 1.5 m (5 ft) deep, but it measures nearly 4.9 m (16.0 ft) deep over the main vent. There are two cypress trees growing in the spring pool north and west of the main vent, which reveal the historical shoreline of the pool. Spring water discharges over a weir designed to raise and maintain water levels in the spring pool. A boardwalk over the weir leads to hiking trails to the south and west of the spring which lead through a forested area associated with the floodplain of Sandy Creek.

The cavern system of Ponce de Leon Springs was explored in May 2003 as part of an inventory of cave-dwelling life in Florida's spring systems (Morris 2006). During this time, the larger vent was obscured by re-suspended sand driven by a vigorous discharge while the minor vent was almost entirely clogged by sand. Inside, a small cavern with a sand floor drops to a depth of 7.3 m (24 ft) revealing a little vent hidden by blowing sand.

Physiography

Ponce de Leon Springs overlies the Dougherty Karst Plain District which encompasses the northern portions of Bay and Calhoun counties, all of Jackson County, most of Washington and Holmes counties, and portions of Walton County (Puri and Vernon 1964, **Figure 4**). The region is now more commonly known as the Marianna Lowlands (Pratt *et al.* 1996). Elevations range from 46 m (150 ft) to 23 m (75 ft) above mean sea level. The physiography is defined by low elevations and wetlands, which were created by erosion and dissolution activity in the karst plain. The karst is well drained, contains many sinkholes (both visible and hidden paleosinks), resulting in a lack of defined surface drainage patterns (Pratt *et al.* 1996).

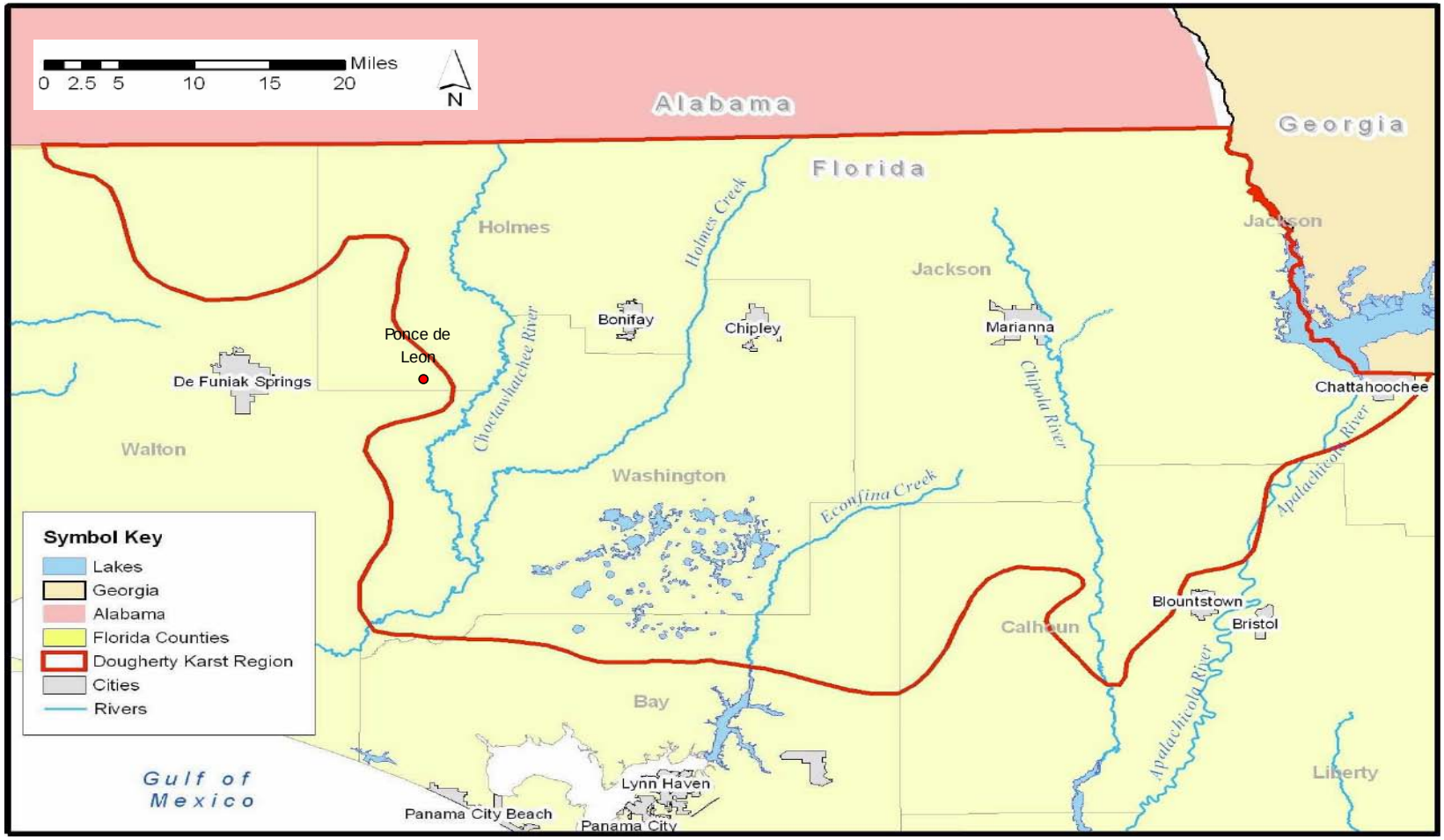


FIGURE 4
Illustration of the Dougherty Karst Region in Florida (from Barrios 2005).

Geology

Underlying Ponce de Leon Springs the geology is dominated by the Miocene-aged limestone of the Alum Bluff Group (Scott *et al.* 2001, **Figure 5**). To the west Citronelle Formation of the Pliocene/Pleistocene is found, while to the east, as a result of erosion from the Choctawhatchee River, Holocene aged Quaternary Alluvium is found (Scott *et al.* 2001). The underlying Floridan aquifer is relatively thin, semi-confined, and direct flow paths for groundwater and surface water infiltrations are common.

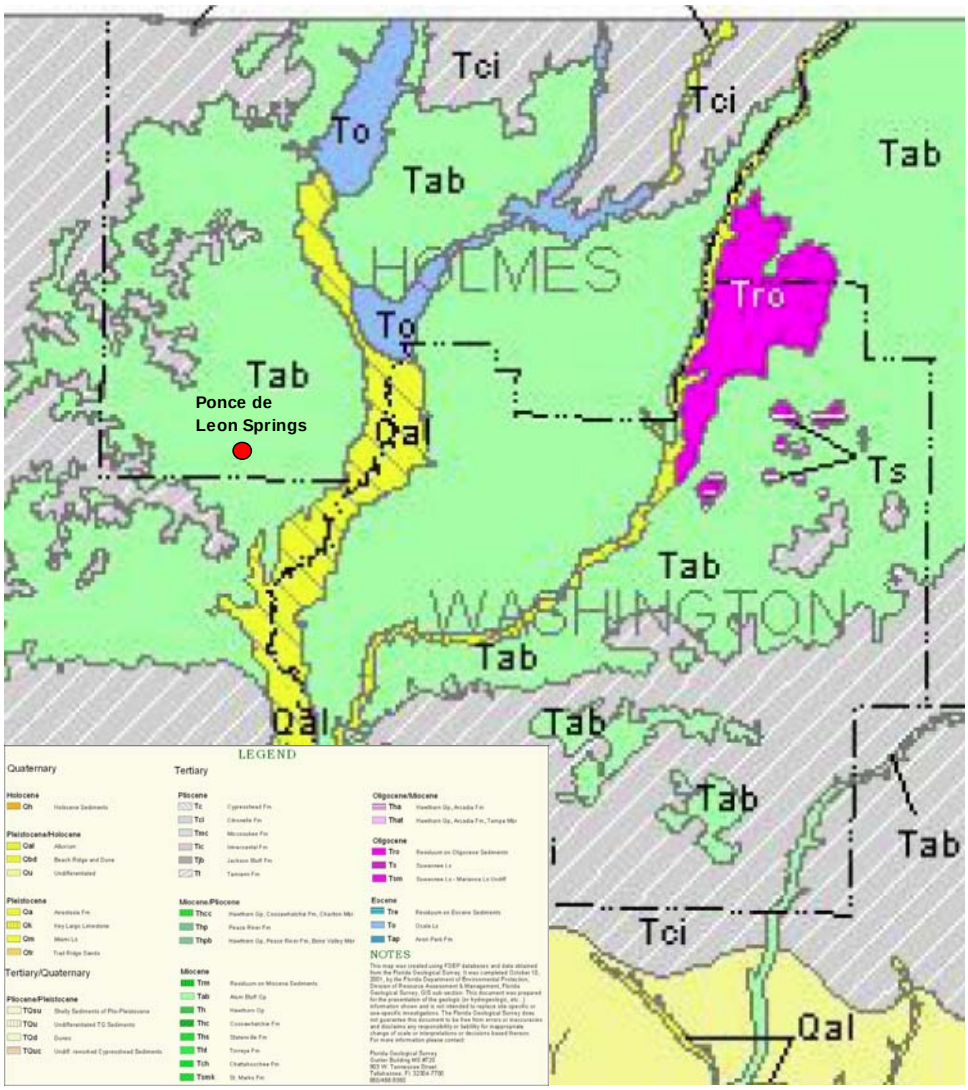


FIGURE 5
Underlying geology of Ponce de Leon Springs (adapted from Scott *et al.* 2001).

Hydrogeology

In Holmes and the adjacent Walton and Washington counties, the Floridan Aquifer is comprised of the Chattahoochee Formation, the undifferentiated Marianna/Suwannee Limestone, and the Ocala Limestone (Green *et al.* 2002). The Floridan Aquifer in the study area includes Eocene to Miocene age carbonate formations and the elevation at the top of the aquifer and its thickness can vary considerably (DeFosset and Barrios 2006). In this region, the Floridan Aquifer is relatively narrow, with a thickness of about 46 m (150 ft) near the Alabama border, where it is composed of Ocala Limestone (Moore 1955). Southward, the Floridan Aquifer increases in thickness with the addition of the younger Marianna, Suwannee, and Chattahoochee Formations to approximately 213 m (700 ft) (DeFosset and Barrios 2006).

Similar to other spring rich portions of the state, the Floridan Aquifer is recharged by rainfall through the leaky confinement of a thin and inconsistent Intermediate System composed of the Alum Bluff Formation which thickens to the south and west. The Alum Bluff is composed of sands, clays, and shell beds. The potentiometric surface suggests that ground water recharge to the aquifer moves regionally in a northwest to southeast direction (DeFosset and Barrios 2006).

In this area, ground water moving through the Floridan Aquifer discharges from several distinct springs: Morrison Spring, Ponce de Leon Spring, Vortex Spring, and Holmes Blue Spring. Specific conductance measurements taken by NWFWMD staff during base flow conditions demonstrate that the Floridan Aquifer also discharges to West Pittman Creek, Reedy Creek, Sandy Creek, Bruce Creek, and the Choctawhatchee River (DeFosset and Barrios 2006).

Springshed

The springshed for Ponce de Leon Springs has not been delineated. However, regional scale potentiometric surface maps suggest that groundwater travels from the northwest to the southeast (**Figure 6**). The springshed contributing to nearby Morrison Spring lies within an area to the northwest encompassing southwest Holmes County and east-central to northeast Walton County. Within this general area, three second or third magnitude springs exist: Ponce de Leon Spring, Vortex Spring, and Holmes Blue Spring. It is likely that the springshed for Ponce de Leon falls within this same region and a conceptualized springshed is shown in **Figure 7**. Estimated springshed and potentiometric surface maps are subject to change under different hydrologic conditions.

Springshed Land Use

Land use estimates for Ponce de Leon Springs have not been published. Within the springshed estimated in **Figure 7**, there are a variety of anthropogenic land use activities with the potential to reduce water quality. These include single family homes with onsite sewage treatment systems, roads, and small scale urbanization. However, the majority of the lands are upland forest, floodplain forest, or pasture. Large scale agriculture (row crops or center-pivot operations) and intensive dairy operations are lacking in the areas surrounding Ponce de Leon Springs. Relatively low groundwater nitrate concentrations, currently averaging about 0.25 mg/L, support the assumption that springshed land use has only moderately impacted this spring. By way of comparison, springs with more pristine springsheds typically exhibit nitrate concentrations less than 0.1 mg/L.

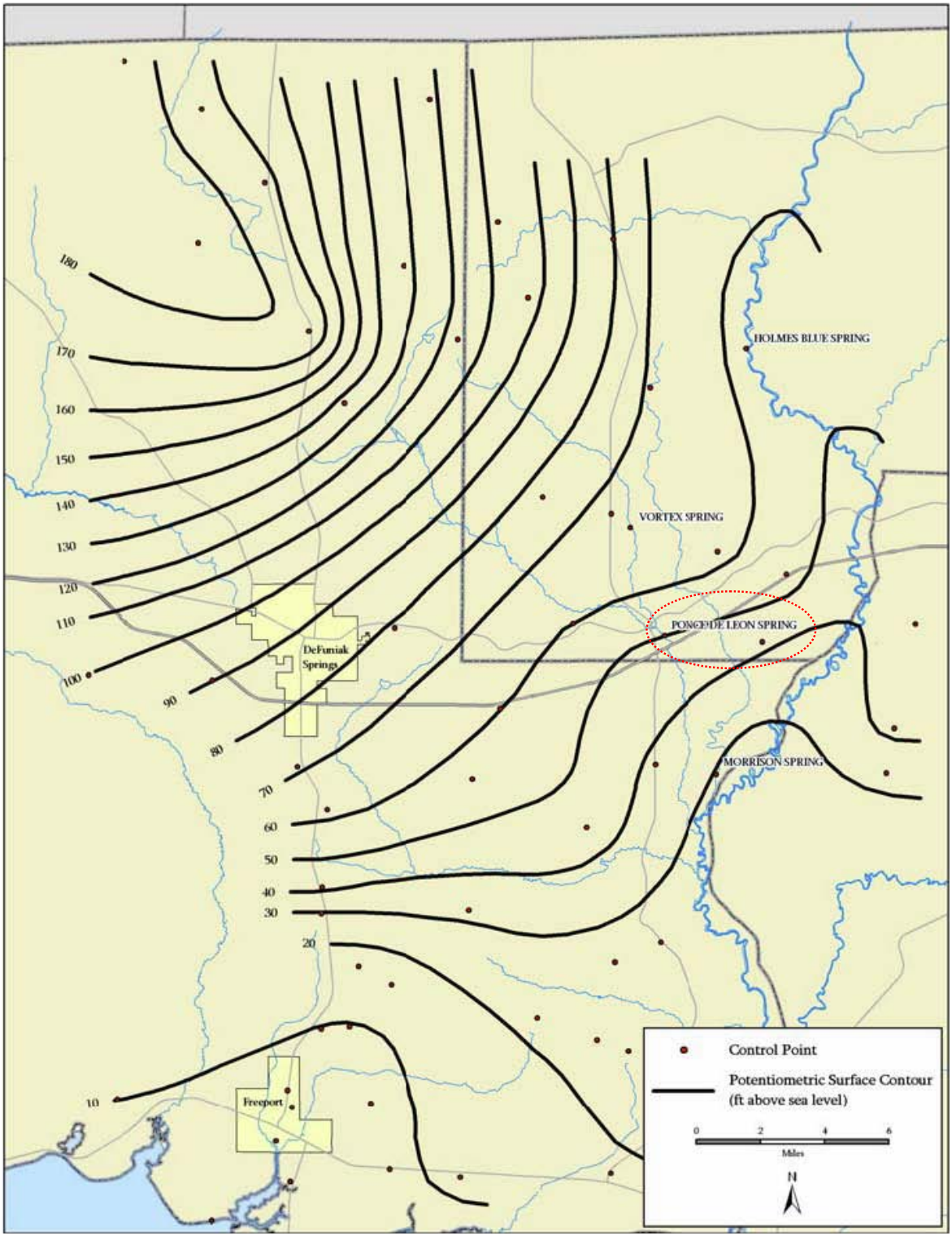


FIGURE 6
Regional groundwater potentiometric surface map (from DeFosset and Barrios 2006).

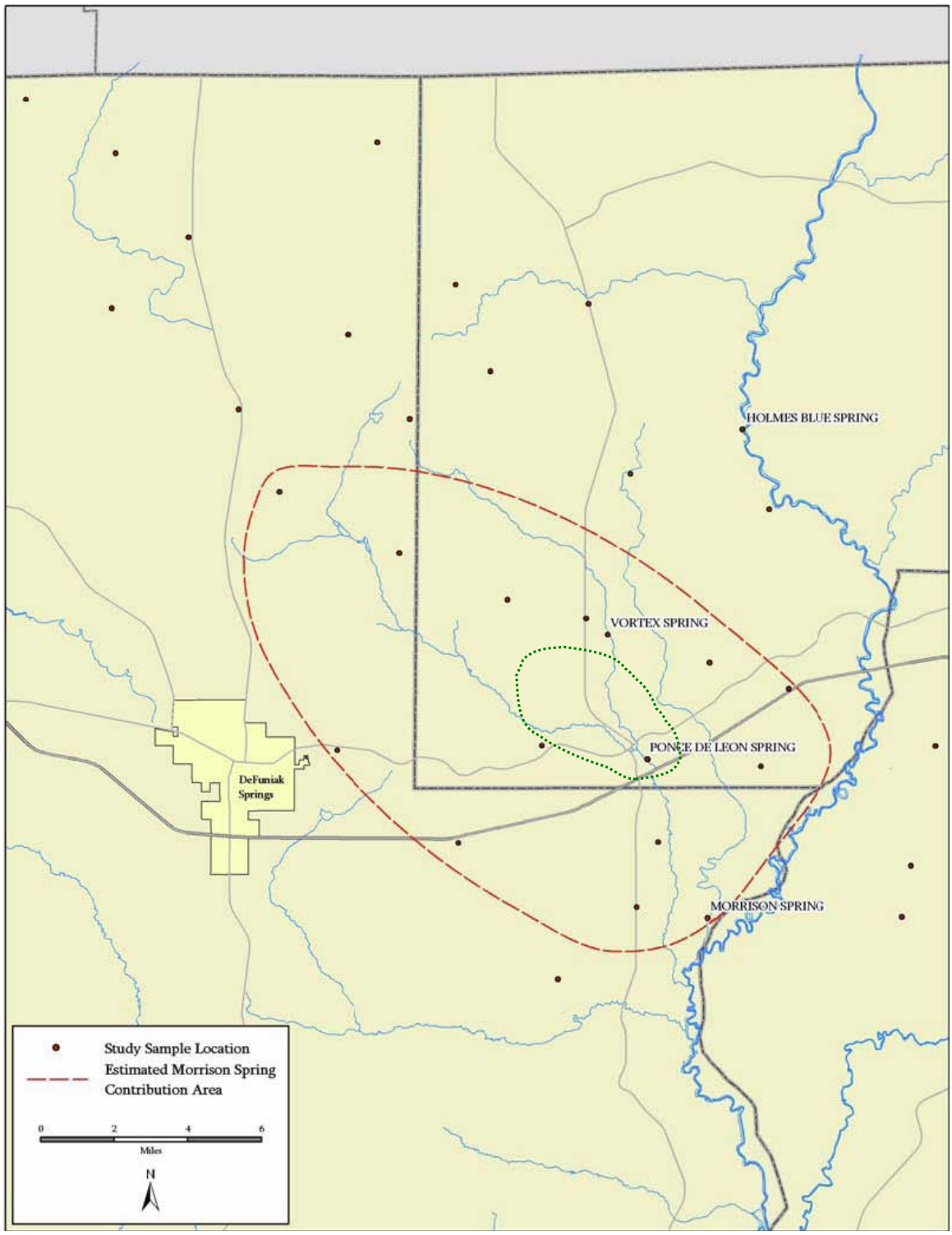


FIGURE 7
Estimated Morrison Spring contribution area (red dash) and Ponce de Leon Springs (green dash) (adapted from DeFosset and Barrios 2006).

Study Area

The project study area for Ponce de Leon Springs included the entire spring pool and run, as well as the uplands immediately to the north, south, and east of the spring where substantial human use occurs. **Figure 8** shows an approximation of the study area and data sonde locations are indicated by red icons. Two study segments are defined by the sonde locations and resulted in: an upper segment (PDL-1 to PDL-2) and a lower segment (PDL-2 to PDL-3).



FIGURE 8
The study area for Ponce de Leon Springs (with data sonde locations as red icons).

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Ponce de Leon Springs are given in **Table 1** below.

TABLE 1
Source information for Ponce de Leon Springs historical water quality data described in this report.

Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
21FLGW	FDEP	11486	Ponce De Leon Springs	30.7212018	-85.9306852
21FLPNS	FDEP	304315808555504	Ponce De Leon Spring	30.7210557	-85.9306669
USGS	USGS	2365710	Ponce De Leon Spring at Ponce De Leon, FL	30.7205557	-85.9305557
USGS	USGS	Springrun	Ponce De Leon Springs	30.7212018	-85.9306852
FDEP	FDEP	Ponce De Leon_50m	100 Meter Reach 50 Meters South of the Headspring	30.7212018	-85.9306852

Discharge and Stage

There is no automated measurement equipment at Ponce de Leon Springs, however several discharge measurements have been reported. Rosenau *et al.* (1977) reported values of 20.7 cfs (May 20, 1942), 18.1 cfs (December 9, 1946), and 18.8 (April 19, 1972). On June 28, 2002 a value of 8.83 cfs was measured by Scott *et al.* 2004. On January 12, 2005 a value of 11.3 cfs was measured (Barrios 2005). Stage in the spring pool is controlled by a weir, resulting in rather stable water elevations except during times of flooding by Sandy Creek. The water level in the spring run is influenced by the water stage of Sandy Creek.

Water Quality

Water quality data for Ponce de Leon Springs are available from as early as 1927 by Rosenau *et al.* (1977); however STORET data (USGS and FDEP data) primarily spans the 1970s to 2008. Among these water chemistry parameters, the numbers of samples collected ranges from 1 to 21 records, with most samples collected from the spring run.

These data (STORET) are summarized in **Table 2** which provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Other historical water quality data are presented in **Table 3** from the Florida Geological Survey. Ponce de Leon Springs pool average water quality values for several key parameters (with the number of samples) are:

- Water temperature – 20.2 °C (n = 5)
- Dissolved oxygen 4.3 mg/L (n = 5)
- pH – 7.71 SU (n = 5)
- Specific conductance – 205 umhos/cm (n = 6)
- Turbidity – 0.025 NTU (n = 1)
- Color – 0.0 CPU (n= 1)
- Total chloride – 2.3 mg/L (n = 1)
- Sulfate – 2.3 mg/L (n = 1)
- Nitrate+nitrite nitrogen – 0.24 mg/L (n = 1)
- Total phosphorus – 0.025 mg/L (n = 2)

TABLE 2
Ponce de Leon Springs water quality table for the period-of-record (STORET data).

				Decade			POR Statistics					
PARAMETER GROUP	PARAMETER	UNITS	STATION	1940	1970	2000	Average	Min	Max	StDev	N	Period of Record
BACTERIOLOGICAL	EColi	#/100ml	Spring Run			6.14	6.14	1.00	28.0	7.23	21	Oct-00 May-07
	Enterococci	#/100ml	mBoil			1.00	1.00	1.00	1.00		1	Feb-02 Feb-02
	Enterococci	#/100ml	Spring Run			15.6	15.6	1.00	62.0	18.9	21	Oct-00 May-07
	FC	#/100ml	mBoil			1.00	1.00	1.00	1.00		1	Feb-02 Feb-02
	FC	#/100ml	Spring Run			5.90	5.90	1.00	33.0	7.70	21	Oct-00 May-07
	TC	#/100ml	Spring Run			63.1	63.1	1.00	220	52.9	21	Oct-00 May-07
DISSOLVED OXYGEN	DO	%	mBoil			49.8	49.8	45.9	53.1	2.99	4	Feb-08 Jun-08
	DO	mg/L	mBoil			4.30	4.30	3.44	4.83	0.539	5	Feb-02 Jun-08
FLOW	Flow	cfs	Spring Run	19.4	18.9	9.96	16.5	8.61	20.7	4.61	7	May-42 Jan-05
GENERAL INORGANIC	Alk	mg/L as CaCO3	Spring Run		104		104	104	104		1	Apr-72 Apr-72
	Cl-T	mg/L	mBoil			2.30	2.30	2.30	2.30		1	Feb-02 Feb-02
	Cl-T	mg/L	Spring Run		3.00		3.00	3.00	3.00		1	Apr-72 Apr-72
	CO2	mg/L	Spring Run		32.0		32.0	32.0	32.0		1	Apr-72 Apr-72
	F-D	mg/L	Spring Run		0.100		0.100	0.100	0.100		1	Apr-72 Apr-72
	Hardness	mg/L as CaCO3	Spring Run		110		110	110	110		1	Apr-72 Apr-72
	Si-D	mg/L	Spring Run		8.20		8.20	8.20	8.20		1	Apr-72 Apr-72
	SO4	mg/L	mBoil			2.30	2.30	2.30	2.30		1	Feb-02 Feb-02
	SO4	mg/L	Spring Run		2.00		2.00	2.00	2.00		1	Apr-72 Apr-72
GENERAL ORGANIC	TOC	mg/L	mBoil			0.500	0.500	0.500	0.500		1	Feb-02 Feb-02
METAL	Al-T	µg/L	mBoil			37.5	37.5	37.5	37.5		1	Feb-02 Feb-02
	As-T	µg/L	mBoil			1.50	1.50	1.50	1.50	0.00	2	Feb-02 Feb-02
	Ca-D	mg/L	Spring Run		30.0		30.0	30.0	30.0		1	Apr-72 Apr-72
	Ca-T	mg/L	mBoil			31.7	31.7	31.2	32.1	0.636	2	Feb-02 Feb-02
	Cd-T	µg/L	mBoil			0.250	0.250	0.250	0.250	0.00	2	Feb-02 Feb-02
	Co-T	µg/L	mBoil			0.375	0.375	0.375	0.375		1	Feb-02 Feb-02
	Cr-T	µg/L	mBoil			1.00	1.00	1.00	1.00	0.00	2	Feb-02 Feb-02
	Cu-T	µg/L	mBoil			1.75	1.75	1.75	1.75	0.00	2	Feb-02 Feb-02
	Fe-T	µg/L	mBoil			73.8	73.8	17.5	130	79.5	2	Feb-02 Feb-02
	K-D	mg/L	Spring Run		0.400		0.400	0.400	0.400		1	Apr-72 Apr-72
	K-T	mg/L	mBoil			0.470	0.470	0.460	0.480	0.014	2	Feb-02 Feb-02
	Mg-D	mg/L	Spring Run		7.40		7.40	7.40	7.40		1	Apr-72 Apr-72
	Mg-T	mg/L	mBoil			7.70	7.70	7.60	7.80	0.141	2	Feb-02 Feb-02
	Mn-T	µg/L	mBoil			0.675	0.675	0.250	1.10	0.601	2	Feb-02 Feb-02
	NA-D	mg/L	Spring Run		1.60		1.60	1.60	1.60		1	Apr-72 Apr-72
	NA-T	%	Spring Run		3.00		3.00	3.00	3.00		1	Apr-72 Apr-72
	Ni-T	µg/L	mBoil			1.00	1.00	1.00	1.00	0.00	2	Feb-02 Feb-02
	Pb-T	µg/L	mBoil			2.00	2.00	1.50	2.50	0.707	2	Feb-02 Feb-02
	SAR	ratio	Spring Run		0.100		0.100	0.100	0.100		1	Apr-72 Apr-72
	Se-T	µg/L	mBoil			2.00	2.00	2.00	2.00	0.00	2	Feb-02 Feb-02
	SR-D	µg/L	Spring Run		40.0		40.0	40.0	40.0		1	Apr-72 Apr-72
	SR-T	µg/L	mBoil			44.9	44.9	44.9	44.9		1	Feb-02 Feb-02
	Zn-T	µg/L	mBoil			0.875	0.875	0.750	1.00	0.177	2	Feb-02 Feb-02
NITROGEN	NH4-N	mg/L	mBoil			0.005	0.005	0.005	0.005		1	Feb-02 Feb-02
	NH4-N	mg/L	Spring Run			0.009	0.009	0.005	0.026	0.007	21	Oct-00 May-07
	NO2-N	mg/L	Spring Run		0.00		0.00	0.00	0.00		1	Apr-72 Apr-72
	NO3-N	mg/L	Spring Run		0.100		0.100	0.100	0.100		1	Apr-72 Apr-72
	NOx-N	mg/L	mBoil			0.240	0.240	0.240	0.240		1	Feb-02 Feb-02
	NOx-N	mg/L	Spring Run			0.254	0.254	0.230	0.330	0.024	21	Oct-00 May-07
	TKN	mg/L	mBoil			0.030	0.030	0.030	0.030	0.00	2	Feb-02 Feb-02
	TKN	mg/L	Spring Run			0.038	0.038	0.030	0.080	0.016	21	Oct-00 May-07
OXYGEN DEMAND	BOD5	mg/L	mBoil			0.100	0.100	0.100	0.100		1	Feb-02 Feb-02
PHOSPHORUS	OrthoP	mg/L	mBoil			0.024	0.024	0.024	0.024		1	Feb-02 Feb-02
	TP	mg/L	mBoil			0.025	0.025	0.022	0.028	0.004	2	Feb-02 Feb-02
	TP	mg/L	Spring Run			0.029	0.029	0.010	0.056	0.012	21	Oct-00 May-07
PHYSICAL	Color	CPU	mBoil			0.00	0.00	0.00	0.00		1	Feb-02 Feb-02
	Color	CPU	Spring Run		0.00		0.00	0.00	0.00		1	Apr-72 Apr-72
	Depth	m	mBoil			4.90	4.90	4.90	4.90		1	Feb-02 Feb-02
	pH	SU	mBoil			7.71	7.71	7.53	7.85	0.147	5	Feb-02 Jun-08
	pH	SU	Spring Run		6.80		6.80	6.80	6.80		1	Apr-72 Apr-72
	Secchi	m	mBoil			1.57	1.57	0.574	4.90	1.87	5	Feb-02 Jun-08
	SpCond	umhos/cm	mBoil			205	205	180	216	13.1	6	Feb-02 Jun-08
	SpCond	umhos/cm	Spring Run		208		208	208	208		1	Apr-72 Apr-72
	Turb	NTU	mBoil			0.025	0.025	0.025	0.025		1	Feb-02 Feb-02
SOLID	TDS	mg/L	mBoil			117	117	117	117		1	Feb-02 Feb-02
	TDS	mg/L	Spring Run		119		119	118	120	1.41	2	Apr-72 Apr-72
	TSS	mg/L	mBoil			2.00	2.00	2.00	2.00		1	Feb-02 Feb-02
TEMPERATURE	Wtr Temp	C	mBoil			20.2	20.2	19.9	20.4	0.228	5	Feb-02 Jun-08
	Wtr Temp	C	Spring Run		20.5		20.5	20.5	20.5	0.00	2	Apr-72 Apr-72

TABLE 3
Historical Ponce de Leon Springs water quality table (from Scott *et al*. 2004).

Analytes	1927	1972	2002	
			Dissolved	Total
Field Measures				
Temperature	-	20.5	19.88	
DO	-	-	3.44	
pH	-	6.8	7.53	
Sp. Cond.	-	-	180	
Lab Analytes				
BOD	-	-	-	0.2U
Turbidity	-	-	-	0.05U
Color	-	0	-	5U
Alkalinity	-	100	-	107
Sp. Cond.	-	208	200.0	-
TDS	-	118	-	117.0
TSS	-	-	-	4U
Cl	2.6	3.0	-	2.3I
SO_4	3.8	2.0	-	2.3
F	-	0.1	-	0.067I
Nutrients				
TOC	-	-	-	1U
$NO_3 + NO_2$ as N	-	0.14	-	0.24
NH_3 as N	-	-	-	0.01U
TKN	-	-	0.06U	0.06U
P	-	-	0.022	0.028
PO_4	-	-	0.024	-
NO_3	-	0.6	-	-
Metals				
Ca	30	30	32.1A	31.2
K	0.4	0.4	0.48A	0.46
Na	1.9	1.6	1.6I	1.4I
Mg	9.2	7.4	7.8A	7.6
Al	-	-	-	75U
As	-	-	3U	3U
B	-	-	-	15U
Cd	-	-	0.5U	0.5U
Co	-	-	-	0.75U
Cr	-	-	2U	2U
Cu	-	-	3.5U	3.5U
Fe	0.27	-	35U	130I
Mn	-	-	0.5I	1.1I
Ni	-	-	4U	4U
Pb	-	-	3U	5U
Ra-226	-	-	-	0.2U
Ra-228	-	-	-	1.5
Se	-	-	4U	4U
Sn	-	-	-	10U
Sr	-	40	-	44.9
Zn	-	-	1.5U	2U

A=Average value U,K=Compound not detected, value shown is the method detection limit
I=Value is less than practical quantitation limit J=Est value Q=Exceeding holding time limit

Nitrate concentrations for many springs within the NWFWMD have shown patterns of increasing nitrate concentrations, due to land-use activities which have been shown to affect groundwater contamination (Chelette *et al*. 2002). From the available records, nitrate concentrations do appear to have increased slightly over the period-of-record at Ponce de Leon Springs as well. Earliest available nitrate data at Ponce de Leon Springs report a value of 0.14 mg/L from an April 19, 1972 measurement (Rosenau *et al*. 1977). In October 4, 2000 a value of 0.23 mg/L was reported (FDEP 2000) and in October 26, 2007 a value of 0.24 mg/L was reported (FDEP 2007b).

Trends for nitrate and total phosphorus concentrations between 2000 and 2007 are shown in **Figures 9** and **10** (FDEP 2008). These data do not suggest any trend in these parameters over this period-of-time.

To compare Ponce de Leon Springs to other Florida springs, mean nitrate and mean total phosphorus concentrations are plotted in **Figures 11** and **12**, respectively. Nitrate concentrations in Ponce de Leon Springs are low compared to most other Florida springs (**Figure 11**). Concentrations of total phosphorus at Ponce de Leon Springs are relatively low in comparison to other Florida spring systems as well (**Figure 12**).

Groundwater sampling in the region which includes Ponce de Leon Springs was utilized to produce multiple isopleths by parameter (**Figures 13, 14, 15**, and **16**). Water chemistry data were utilized from thirty-two ground water samples collected from wells and karst features throughout region during the fall of 2005 (DeFosset and Barrios 2006).

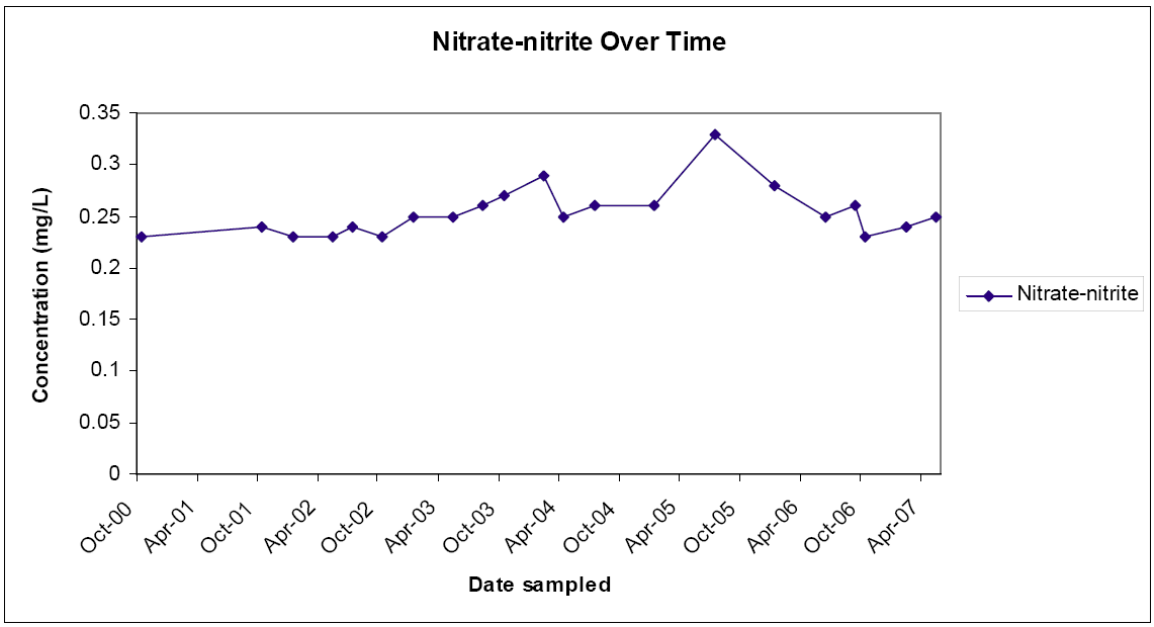


FIGURE 9
Time series (2000 to 2007) for NOX-nitrogen concentrations at Ponce de Leon Springs (FDEP 2008).

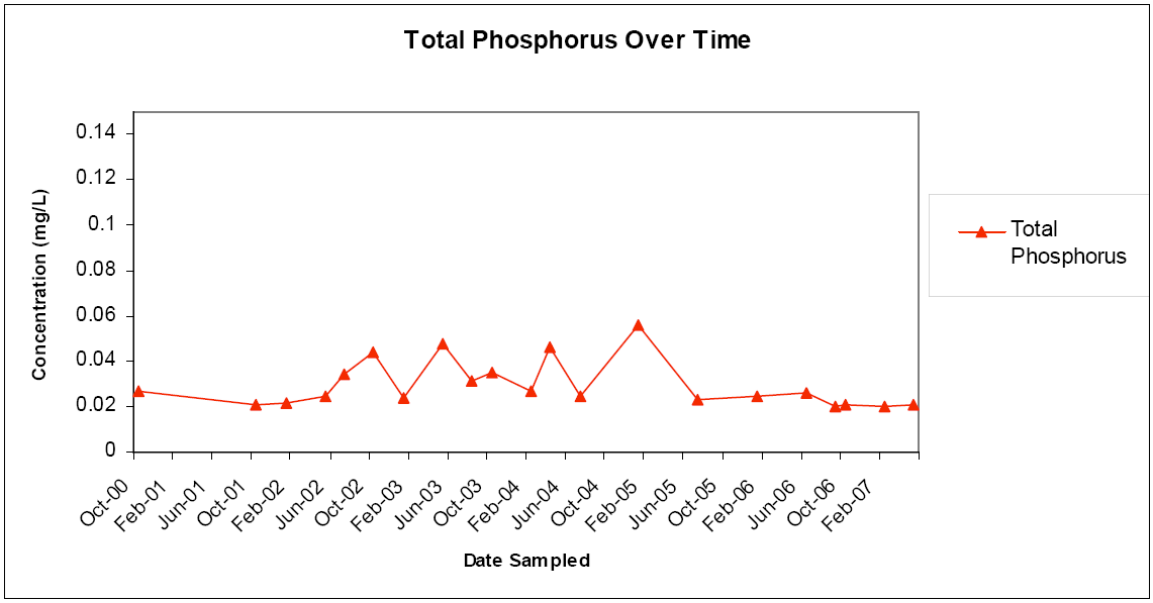


FIGURE 10
Time series (2000 to 2007) for total phosphorus concentrations at Ponce de Leon Springs (FDEP 2008).

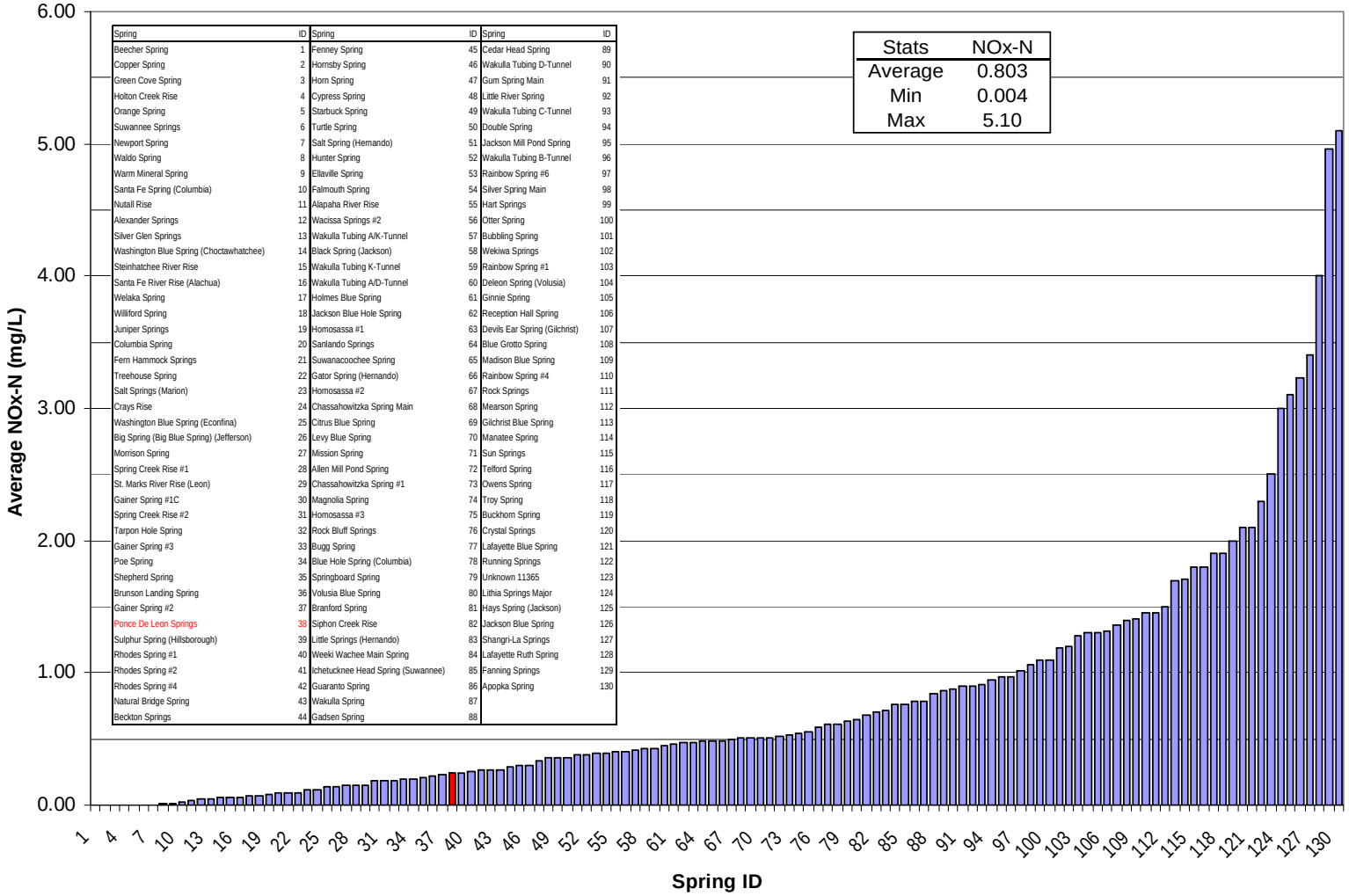
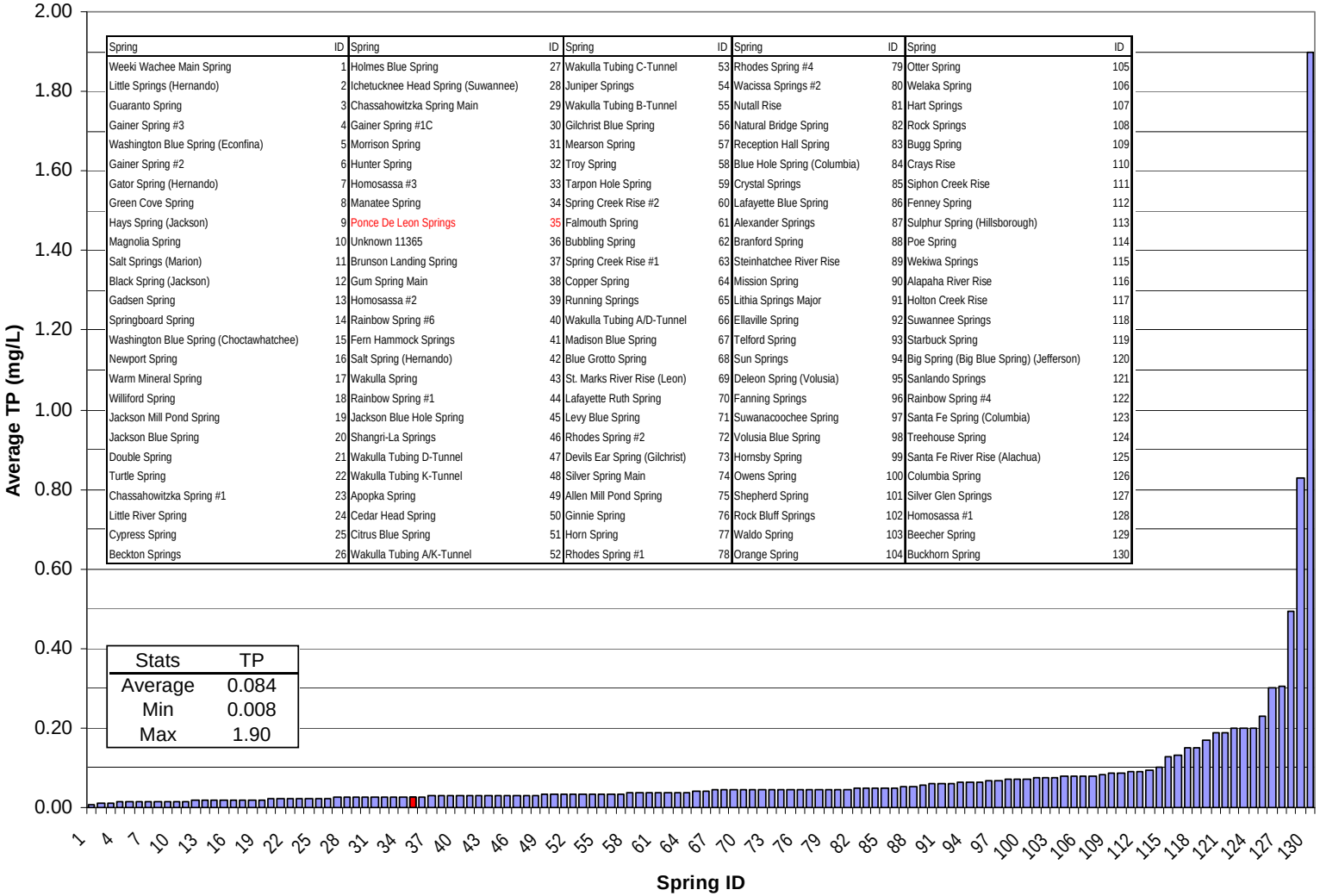


FIGURE 11
Average nitrate+nitrite nitrogen (NO_X-N) concentrations for Ponce de Leon Springs in relation to other Florida springs.



Spring	ID	Spring	ID	Spring	ID	Spring	ID	Spring	ID
Weeki Wachee Main Spring	1	Holmes Blue Spring	27	Wakulla Tubing C-Tunnel	53	Rhodes Spring #4	79	Otter Spring	105
Little Springs (Hernando)	2	Ichetucknee Head Spring (Suwannee)	28	Juniper Springs	54	Wacissa Springs #2	80	Welaka Spring	106
Guaranto Spring	3	Chassahowitzka Spring Main	29	Wakulla Tubing B-Tunnel	55	Nutall Rise	81	Hart Springs	107
Gainer Spring #3	4	Gainer Spring #1C	30	Gilchrist Blue Spring	56	Natural Bridge Spring	82	Rock Springs	108
Washington Blue Spring (Econfina)	5	Morrison Spring	31	Mearson Spring	57	Reception Hall Spring	83	Bugg Spring	109
Gainer Spring #2	6	Hunter Spring	32	Troy Spring	58	Blue Hole Spring (Columbia)	84	Crays Rise	110
Gator Spring (Hernando)	7	Homosassa #3	33	Tarpon Hole Spring	59	Crystal Springs	85	Siphon Creek Rise	111
Green Cove Spring	8	Manatee Spring	34	Spring Creek Rise #2	60	Lafayette Blue Spring	86	Fenney Spring	112
Hays Spring (Jackson)	9	Ponce De Leon Springs	35	Falmouth Spring	61	Alexander Springs	87	Sulphur Spring (Hillsborough)	113
Magnolia Spring	10	Unknown 11365	36	Bubbling Spring	62	Branford Spring	88	Poe Spring	114
Salt Springs (Marion)	11	Brunson Landing Spring	37	Spring Creek Rise #1	63	Steinhatchee River Rise	89	Wekiwa Springs	115
Black Spring (Jackson)	12	Gum Spring Main	38	Copper Spring	64	Mission Spring	90	Alapaha River Rise	116
Gadsen Spring	13	Homosassa #2	39	Running Springs	65	Lithia Springs Major	91	Holton Creek Rise	117
Springboard Spring	14	Rainbow Spring #6	40	Wakulla Tubing A/D-Tunnel	66	Ellaville Spring	92	Suwannee Springs	118
Washington Blue Spring (Choctawhatchee)	15	Fern Hammock Springs	41	Madison Blue Spring	67	Telford Spring	93	Starbuck Spring	119
Newport Spring	16	Salt Spring (Hernando)	42	Blue Grotto Spring	68	Sun Springs	94	Big Spring (Big Blue Spring) (Jefferson)	120
Warm Mineral Spring	17	Wakulla Spring	43	St. Marks River Rise (Leon)	69	Deleon Spring (Volusia)	95	Sanlando Springs	121
Williford Spring	18	Rainbow Spring #1	44	Lafayette Ruth Spring	70	Fanning Springs	96	Rainbow Spring #4	122
Jackson Mill Pond Spring	19	Jackson Blue Hole Spring	45	Levy Blue Spring	71	Suwanacoochee Spring	97	Santa Fe Spring (Columbia)	123
Jackson Blue Spring	20	Shangri-La Springs	46	Rhodes Spring #2	72	Volusia Blue Spring	98	Treehouse Spring	124
Double Spring	21	Wakulla Tubing D-Tunnel	47	Devils Ear Spring (Gilchrist)	73	Hornsby Spring	99	Santa Fe River Rise (Alachua)	125
Turtle Spring	22	Wakulla Tubing K-Tunnel	48	Silver Spring Main	74	Owens Spring	100	Columbia Spring	126
Chassahowitzka Spring #1	23	Apopka Spring	49	Allen Mill Pond Spring	75	Shepherd Spring	101	Silver Glen Springs	127
Little River Spring	24	Cedar Head Spring	50	Ginnie Spring	76	Rock Bluff Springs	102	Homosassa #1	128
Cypress Spring	25	Citrus Blue Spring	51	Horn Spring	77	Waldo Spring	103	Beecher Spring	129
Beckton Springs	26	Wakulla Tubing A/K-Tunnel	52	Rhodes Spring #1	78	Orange Spring	104	Buckhorn Spring	130

FIGURE 12
Average total phosphorus (TP) concentrations for Ponce de Leon Springs in relation to other Florida springs.

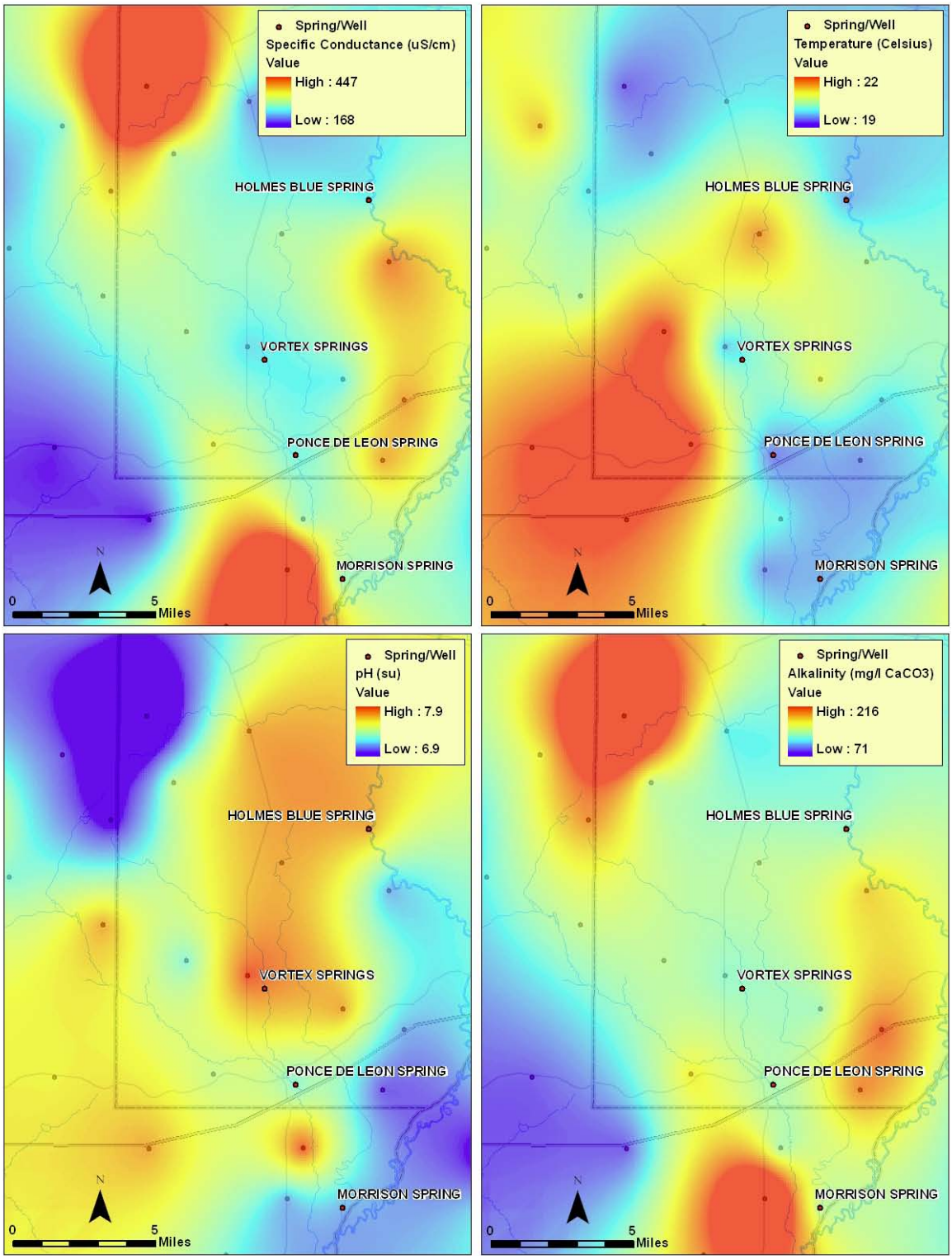


FIGURE 13
Regional groundwater isopleths for specific conductance, temperature, pH, and alkalinity (from DeFosset and Barrios 2006).

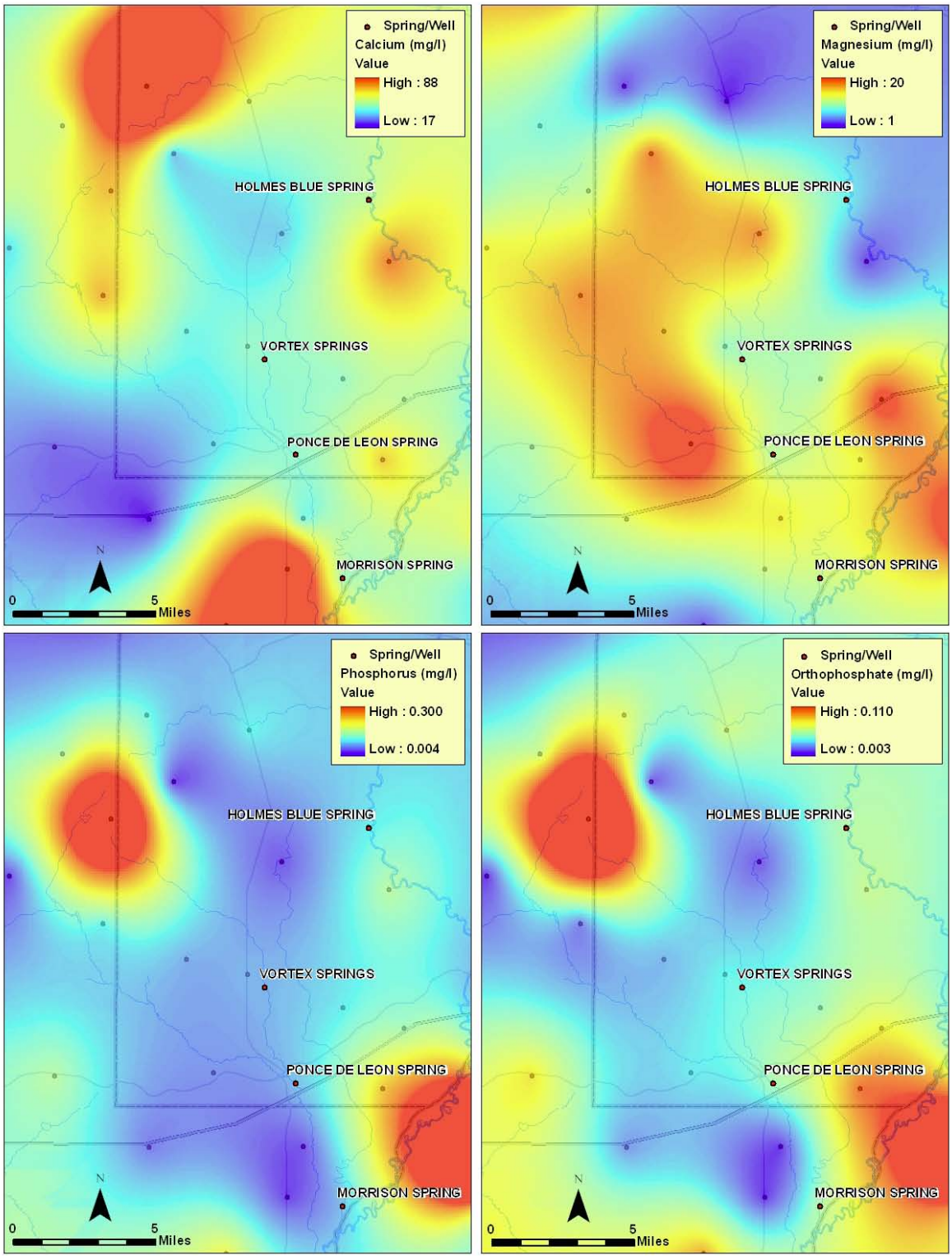


FIGURE 14
Regional groundwater isopleths for calcium, magnesium, phosphorus, and orthophosphate (from DeFosset and Barrios 2006).

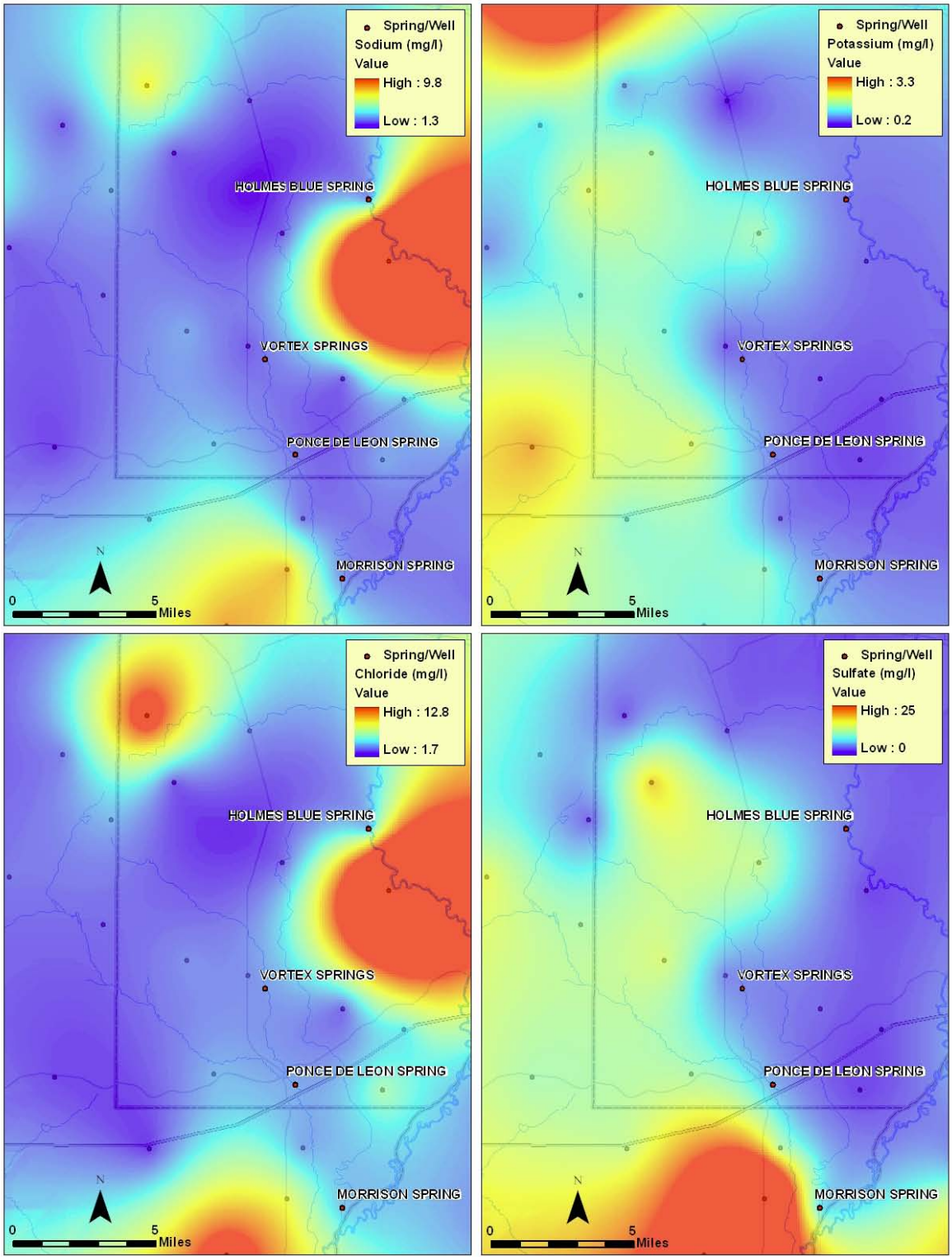


FIGURE 15
Regional groundwater isopleths for sodium, potassium, chloride, and sulfate (from DeFosset and Barrios 2006).

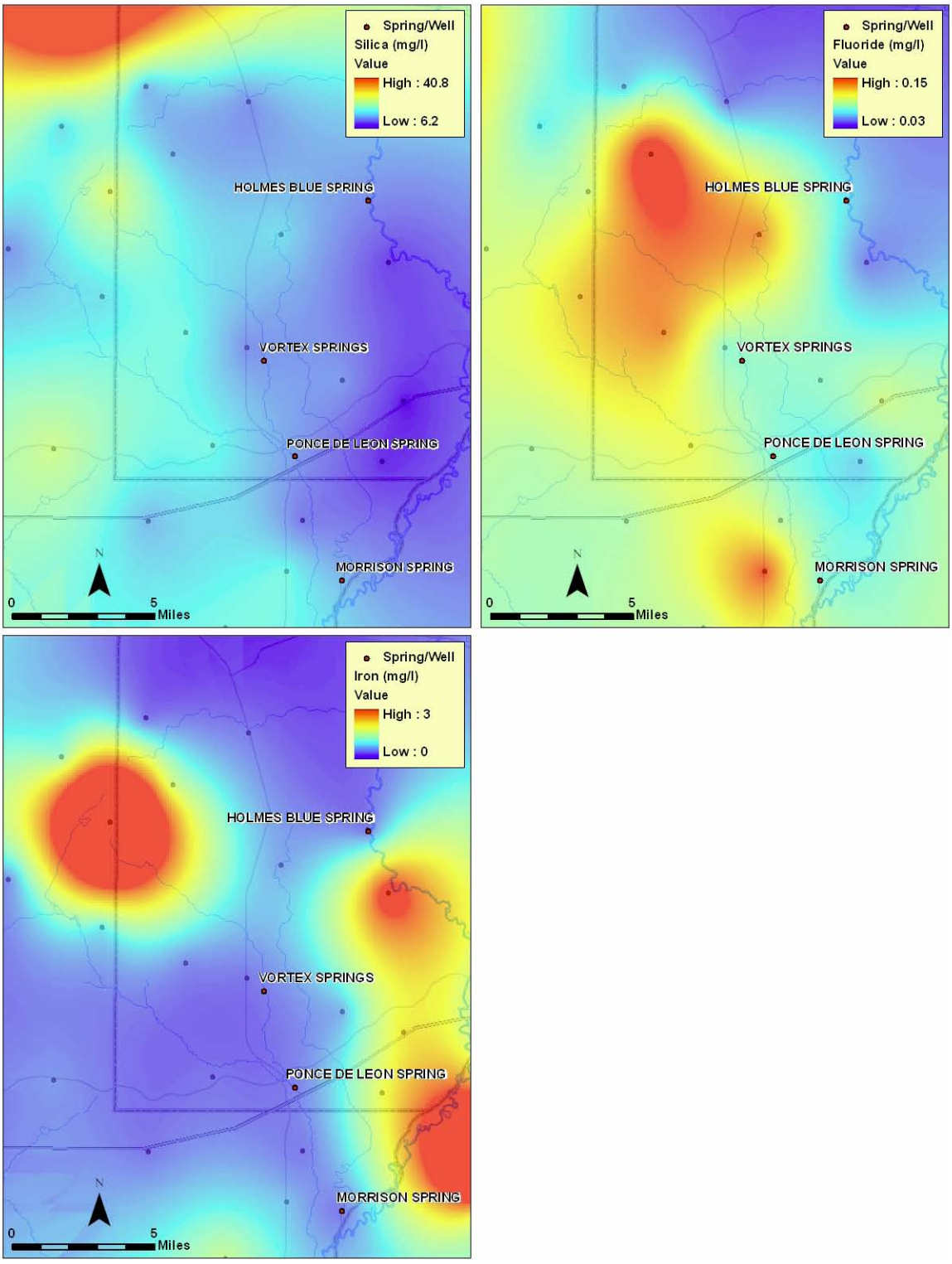
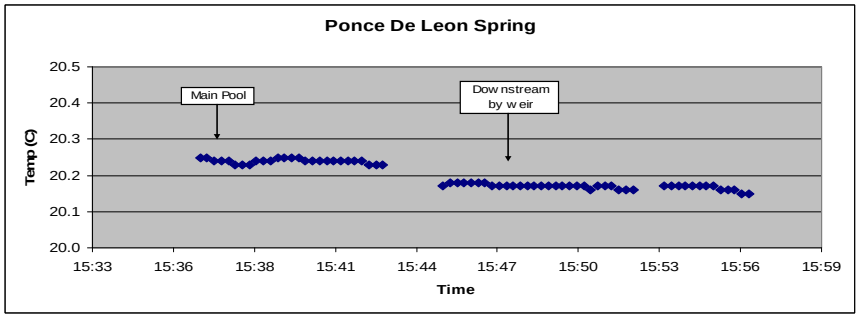


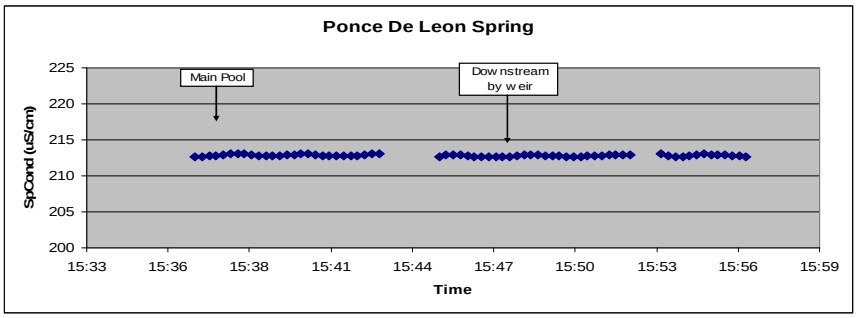
FIGURE 16
Regional groundwater isopleths for silica, fluoride, and iron (from DeFosset and Barrios 2006).

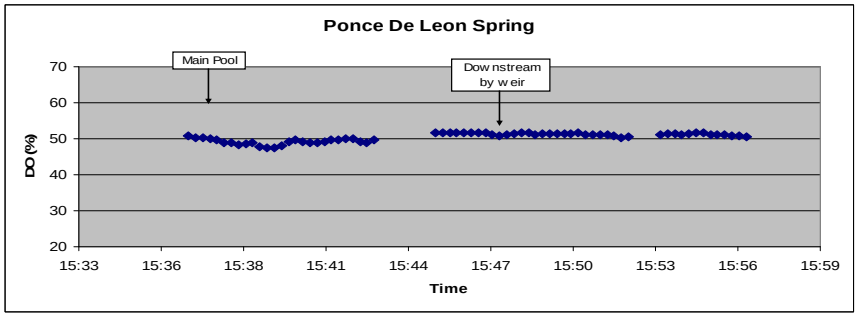
During site reconnaissance of Ponce de Leon Springs on Monday August 18, 2008 field parameters were measured adjacent to the main vent and upstream of the weir between 15:30 and 16:00 CST (**Figure 17**). Water clarity was good and the spring pool had an apparent blue color. Water temperature was approximately 20.2 °C in the spring pool and only slightly different downstream (**Figure 18**). Specific conductivity was similar at both locations, averaging about 212 µS/cm (**Figure 18**). Dissolved oxygen concentrations near the main vent were roughly 4.5 mg/L (50 % saturated) and increased to 4.7 mg/L (52 % saturated) at the downstream measurement location (**Figure 18**). It is likely that higher dissolved oxygen concentrations could be observed during afternoons under clear skies. In addition the aquatic plant community in the spring pool and run are reported to increase during the fall and winter when in water recreation levels are low.

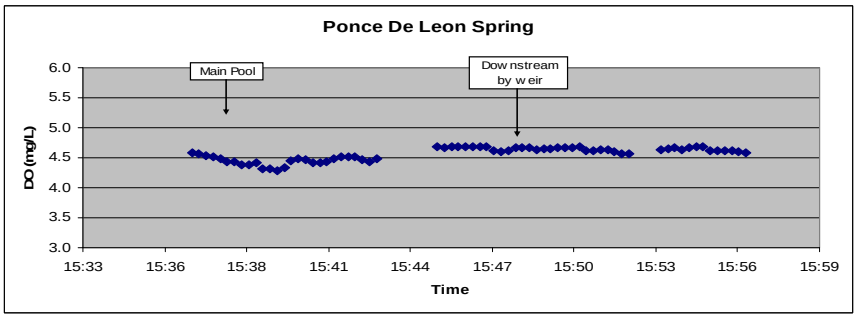


FIGURE 17
Image of Ponce de Leon Springs with red icons indicating the field parameter sampling locations on August 18, 2008.









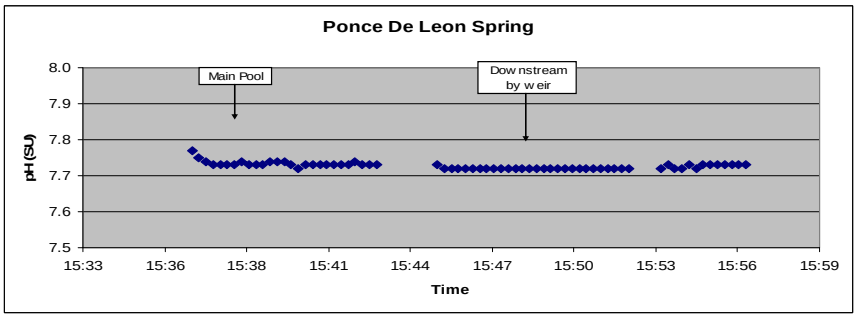


FIGURE 18
Field Parameters by location and time for Ponce de Leon Springs on August 18, 2008.

Biological

Vegetation

In a 2002 visit to characterize the water chemistry of Ponce de Leon Springs it was noted that the pool had sparse aquatic vegetation with thick patches of algae present on the bottom (Scott *et al.* 2004). During April 26, 2003 and September 22, 2003 the pool of Ponce de Leon Springs was surveyed for aquatic plants and algae by Stevenson *et al.* (2007). They reported that in the pool area, algae covered 12.3% of the bottom with an average thickness of 8.6 cm during the spring visit; while algae covered 17.3% of the bottom with a average thickness of 7.6 cm during the fall visit (Stevenson *et al.* 2007). The species encountered during the survey were mostly *Hydrodictyon sp*., followed by *Spirogyra sp*., and *Cladophora glomerata*. Aquatic vascular plant coverage was reported as 16% in the spring and 19.8% in the fall, with species in order of decreasing dominance being: muskgrass (*Chara sp*.), ludwigia (*Ludwigia sp*.), moss (*Brachelyma sp*.), pondweed (*Potamogeton sp*.), and southern naiad (*Najas guadalupensis*).

During site reconnaissance of Ponce de Leon Springs on Monday August 18, 2008, submersed aquatic vegetation within the Ponce De Leon Spring pool was limited to sparse filamentous algae, southern naiad (*Najas guadalupensis*), Illinois pondweed (*Potamogeton illinoensis*), red ludwigia (*Ludwigia repens*), and the macroalgae muskgrass (*Chara sp*.). It was reported that aquatic plants increase in abundance following the end of the summer recreational period (FDEP Ranger Jacob Strickland, personal communication).

Macroinvertebrates

The Florida Department of Environmental Protection (FDEP) has been conducting investigations of macroinvertebrate populations with multiple chemical and biological

measures (EcoSummary) in Ponce de Leon Springs as early as October 2000 and continuing to-date with up to two events per calendar year (FDEP 2000, 2001, 2002a, 2002b, 2003a, 2003b, 2004b, 2006a, 2006b, 2007a, and 2007b. Habitat Assessment and Stream Condition Index (SCI) data for much of this time-period (October 4, 2000 to May 10, 2007) have been summarized in a 2008 report (FDEP 2008). Habitat assessments were typically in the optimal range, the number of sensitive taxa ranged from 2 to 6, and the number of total taxa ranged from 15 to 28 (**Figure 19**, FDEP 2008). Stream condition index (SCI) values have typically been below the healthy rating *i.e.*, greater than 21 before June 2004 and greater than 34 following recalibration of the SCI rating system (**Figure 19**, FDEP 2008). The impaired SCI ratings have been attributed to the low dissolved oxygen concentrations which are typical of groundwater fed systems. Repeated flooding from Sandy Creek and intensive human use are likely factors in the lower SCI rating of this spring system.

The pool and run of Ponce de Leon Springs (and the confluence of Sandy Creek) was sampled for gastropod and bivalve mollusks on November 4, 2001 (Miller and Thompson 2001). They noted greatest abundance and diversity in the mollusk fauna was in the spring run, while Sandy Creek had very low diversity immediately above the confluence of the run. Six mollusk species were collected by Miller and Thompson 2001), and are listed below. Ovate campeloma (*Campeloma geniculum*) was moderately common buried in silt along the edge of the run, but was not found in the spring pool. The stately elimia (*Elimia dickinsoni*) was common in the spring pool, and extremely abundant in the run on sand and woody substrates. The possible new species of graphite elimia (*Elimia cf. "curvicostata"*) was extremely abundant in and on the sand or silt/sand substrates of the spring run, but sparse in the pool.

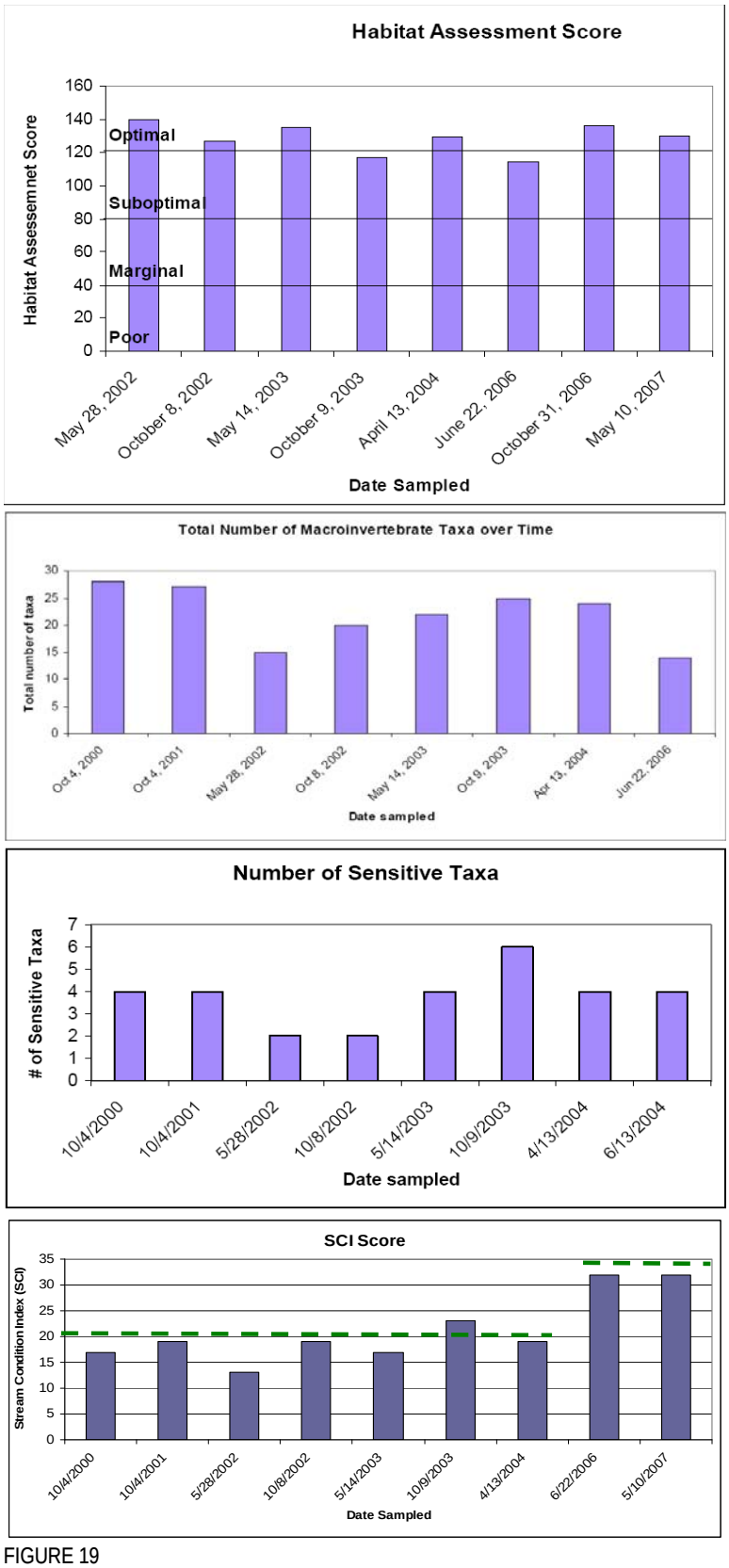


FIGURE 19
Time series of habitat assessment, number of sensitive taxa, total number of macroinvertebrate taxa, and stream condition index (SCI) values for Ponce de Leon Springs (from FDEP 2008).

The alligator siltsnail (*Notogillia wetherbyi*) was sparse in the spring pool, but abundant in the spring run, and most commonly found buried just beneath the surface of sand in areas of moderate current. A new species of siltsnail (*Spilochlamys sp*.) was found sparsely around the edges of the spring pool in quiet water on tree rootlets and dead submerged leaves, and abundantly in the spring run in quiet zones along the margin in silt substrates. Miller and Thompson (2001) reported this species to be known only from Ponce le Leon Springs that differs from other members of this genus found along Holmes Creek in Holmes County by its larger size and stouter shell configuration. Lastly, despite a concerted effort to collect Physidae, Ancylidae, and Planorbidae snails, only a single juvenile *Physella sp*. (small air-breathing snails) shell was found among dead leaves along the margin of the spring run. At the confluence of Sandy Creek, three species were collected: the ovate campeloma (*Campeloma geniculum*), the graphite elimia (*Elimia cf. "curvicostata"*), and the Asian clam (*Corbicula fluminea*).

Walsh and Williams (2003) found no bivalves in Ponce de Leon Spring pool or run, but did collect three species of unionids from Sandy Creek in the area near the mouth of the spring run: variable spike (*Elliptio icterina*), little spectaclecase (*Villosa lienosa*), and southern rainbow (*V. vibex*). They also observed dead valves of the non-indigenous Asian clam (*Corbicula fluminea*).

Ponce de Leon Springs was sampled for crustaceans on May 15, 2002 by staff from the Florida Museum of Natural History (Franz 2002). Within the spring pool and run four species of crayfish were collected: *Procambarus spiculifer*, *P. versutus*, *P. leonensis*, and an odd crayfish in the subgenus Pennides (possibly *Procambarus suttkusi*, an endemic to upper Holmes Creek). The shrimp (*Palaemonetes paludosa*) was also collected. Troglobitic

invertebrates were searched for in the cavern of Ponce de Leon Springs by Morris (2006), but no obligate cave-dwelling organisms were found, only a crayfish, *Procambarus versutus*.

Macro fauna

Several aquatic turtle species are listed from the Ponce de Leon Springs park management plan including: common snapping turtle (*Chelydra serpentina*), alligator snapping turtle (*Macroclemys temminckii*), and Florida cooter (*Pseudemys floridana*). However, no scientific studies of the turtle community have been conducted at this system. During a survey for crustaceans by Franz (2002), a loggerhead musk turtle (*Sternotherus minor*) and a dwarf salamander (*Eurycea quadridigitata*) were observed.

A study of the fishes utilizing Ponce de Leon Springs was made on July 25, 2002 by Walsh and Williams (2003). In addition, a review of material from the Florida Museum of Natural History (FLMNH) ichthyologic collection was made. No fish specimens from Ponce de Leon Springs were represented in the FLMNH collection; however 21 species were represented in material from the neighboring streams, Blue Creek and Sandy Creek (**Table 4**). While the weir at Ponce de Leon Springs precludes fish from entering the pool through the run, the regular flooding by Sandy Creek provides a re-occurring mechanism for the introduction of fish to the pool.

Sampling efforts by Walsh and Williams (2003) was limited to seining in the run below the weir and areas in Sandy Creek near the mouth of the spring run. A total of 11 species were collected (**Table 4**) and were numerically dominated by two species of minnows, redeye chub (*Notropis harperi*) and weed shiner (*Notropis texanus*).

During the August 18, 2008 reconnaissance of Ponce de Leon Springs fish observed included members of the sunfish family (*Lepomis sp*.) and several largemouth bass (*Micropterus salmoides*). Park staff reported that common carp (*Cyprinus carpio*) and American eels (*Anguilla rostrata*) are occasionally observed (FDEP Ranger Jacob Strickland, personal communication) and Morris (2006) reported two American eels (*Anguilla rostrata*) and two redeye chubs (*Notropis harperi*) were present in the cavern during his survey.

TABLE 4
Fishes collected in Ponce de Leon Springs State Park (number of specimens and relative abundance), and material in the FLMNH ichthyologic collection (number of specimens and percent of material), (from Walsh and Williams 2003).

Family	Species	USGS		FLMNH Material	
		N	Relative Abundance (%)	Specimens	%
Anguillidae	*Anguilla rostrata*	---	---	1	0.2
Clupeidae	*Dorosoma petenense*	---	---	1	0.2
Cyprinidae	*Notropis harperi*	276	76.9	---	---
	Cyprinella venusta	---	---	124	25.2
	Hybopsis cf. *winchelli*	---	---	2	0.4
	Notropis texanus	58	16.2	56	11.4
	Notropis buccatus	---	---	12	2.4
	Opsopoeodus emiliae	---	---	6	1.2
	Pteronotropis grandipinnis	---	---	32	6.5
Catostomidae	*Moxostoma poecilurum*	---	---	1	0.2
Ictaluridae	*Noturus gyrinus*	---	---	5	1.0
Esocidae	*Esox americanus*	---	---	2	0.4
Aphredoderidae	*Aphredoderus sayanus*	1	0.3	4	0.8
Atherinopsidae	*Labidesthes sicculus*	---	---	180	36.5
Fundulidae	*Fundulus olivaceus*	---	---	9	1.8
Poeciliidae	*Gambusia holbrooki*	3	0.8	40	8.1
Centrarchidae	*Lepomis auritus*	3	0.8	---	---
	Lepomis gulosus	---	---	2	0.4
	Lepomis macrochirus	8	2.2	---	---
	Lepomis megalotis	1	0.3	---	---
	Lepomis miniatus x *punctatus*	3	0.8	---	---
	Micropterus salmoides	3	0.8	---	---
Percidae	*Etheostoma colorosum*	---	---	2	0.4
	Etheostoma edwini	1	0.3	1	0.2
	Percina nigrofasciata	2	0.6	3	0.6
Elassomatidae	*Elassoma zonatum*	---	---	7	1.4
	Elassoma okefenokee	---	---	3	0.6
	Total Number of Species	**11**		**21**	
	Total Number of Specimens	**359**		**493**	

Manatees

Manatee utilization at Ponce de Leon Springs is not possible; the spring run is too shallow (average depth < 1 m) and a weir prevents access to the spring pool. Although the spring has surface water connections to the Gulf of Mexico, the distance is great; Sandy Creek travels approximately 23 km (14 mi) before joining the Choctawhatchee River, which travels 66 km (41 mi) to Choctawhatchee Bay, and another 42 km (26 mi) to the inlet at Destin. Manatees in the Choctawhatchee Bay or River during cold seasons would be subject to cold stress mortality, as indicated by the Manatee Mortality Database, which has records of four animal deaths in the bordering Okaloosa and Walton Counties between 1990 and 2006 (FWC 2009).

Ecosystem Functions

Based on field parameters (temperature, conductance, dissolved oxygen, and pH) measured in the spring pool and spring run during the reconnaissance trip of August 18, 2008, the Ponce de Leon Springs System is suitable for measuring ecosystem metabolism based on changes in dissolved oxygen (see **Figure 18**). Dissolved oxygen concentrations near the main vent were roughly 4.5 mg/L (50 % saturated) and increased to 4.7 mg/L (52 % saturated) at the downstream measurement location. This small increase in oxygen concentration was likely due to the short distance between measurement points (about 100 feet) and the low light levels due to imminent rain conditions. It is likely that higher dissolved oxygen concentrations could be observed during afternoons under clear skies. In addition the aquatic plant community in the spring pool and run are reported to increase during the fall and winter when in water recreation levels are low. This site should be suitable for metabolism estimates using changes in dissolved oxygen measured at two points.

Human-Use Attendance and Activities

Recreational activities at Ponce de Leon Springs include swimming, snorkeling, fishing, picnicking, hiking, and nature study. As a state park, complete annual statistics of human attendance are available between 1983 and 2008. Peak annual attendance occurred in 1990, with nearly 58 thousand people, followed by an annual low of about 13 thousand people in 1994, and gradually increasing to about 51 thousand people in 2008. Peak seasonal use occurs in July and about 58% of visitation occurs during the summer months of June, July, and August (**Figure 20**).

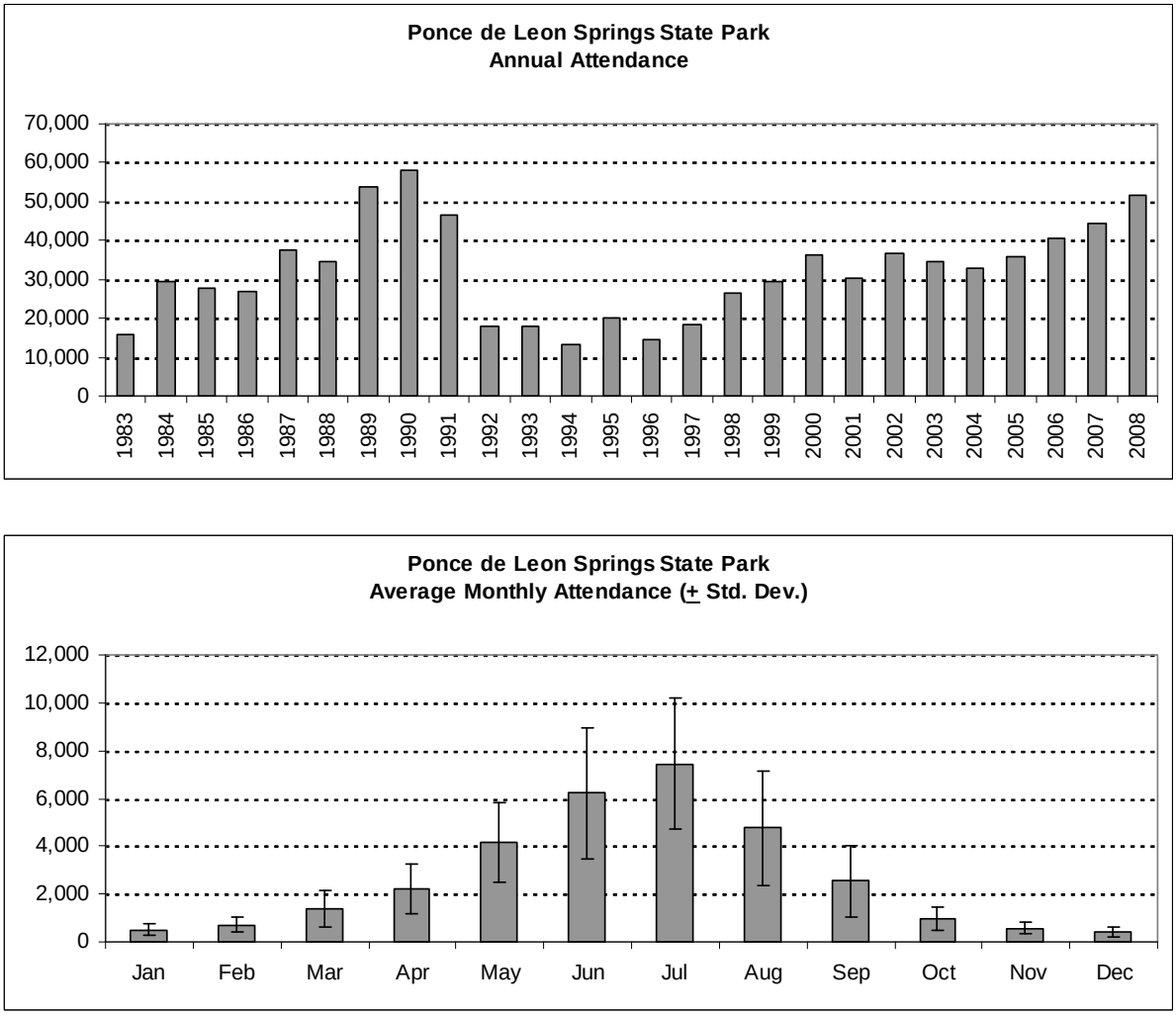


FIGURE 20
Ponce de Leon Springs State Park annual and monthly attendance data.

Visitor entry data for Ponce de Leon Springs State Park, fiscal year 2006/2007, was utilized to estimate the economic impact of this park (FDEP 2007c). Findings reveal that 39,681 people utilized the park during this time period, among which 74% were attributed to non-local visitors, which in turn generated approximately $1.7 million dollars in local revenue, and supported the creation of 40 jobs (FDEP 2007c). This estimate reveals the importance of this state park to the local economy and provides added incentive towards the maintenance of high environmental quality within parks.

Minimum Flows and Levels

An annual priority list for minimum flows and levels (MFL) scheduling of first order magnitude springs (and second magnitude springs within state or federally-owned conservation lands) is a requirement of Chapter 373.042, F.S. As Ponce de Leon is a second magnitude spring within a state park, an MFL will be scheduled by the NWFWMD at a future date. Scheduling for the establishment of springs MFLs is commensurate with existing or potential threats to spring flow from consumptive uses (NWFWMD 2009). Threats to Ponce de Leon Spring from consumptive use currently appear to be low. The nearby Morrison Spring (Walton Co.) has been scheduled for MFL adoption in 2015; while Jackson Blue Spring (Jackson Co.) and Wakulla Springs (Wakulla Co.), both of which were scheduled for MFL adoption in 2008, have been changed to 2012 due to the need for additional data and model analysis to quantify uncertainty (NWFWMD 2009).

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Appendix V

Summary of data for Rainbow Springs



Summary of Existing Data - Rainbow Springs (Marion Co.)

Prepared by

Wetland Solutions, Inc.

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Cover photo: Underwater view of Rainbow Springs run with largemouth bass (*Micropterus salmoides*) and spotted sunfish (*Lepomis punctatus*) swimming above beds of strap-leaf sagittaria (*Sagittaria kurziana*) (S.K. Notestein, 06/09/09).

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Summary of Existing Springs Data

This report summarizes known existing physical, chemical, and biological data for Rainbow Springs (Marion County). These data were collected from sources such as the Southwest Florida Water Management District (SWFWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Rainbow Springs State Park

Physical Address

Rainbow Springs State Park; 19158 S.W. 81st Pl. Rd.; Dunnellon, Florida 34432; Phone: 352-465-8555; latitude/longitude: 29.102500°, -82.437500°; park website: http://www.floridastateparks.org/rainbowsprings/ .

Driving Directions

From I-75, exit onto State Road 40 and drive west until it dead ends at U.S. 41. Turn left, the park entrance is on the left-hand side of the road. From Tampa, take U.S. 41, north and drive through the town of Dunnellon. The park is located on the right-hand side of the road, approximately 4 km (2.5 mi) north of Dunnellon (**Figure 1**).

The campground (18185 S.W. 94th Street - Dunnellon, FL 34432; 352-465-8550) is separate from the headsprings day use area and is located 4 km (2.5 mi) north of C.R. 484 off of S.W. 180th Avenue or 4 km (2.5 mi) south of Highway 40 off of S.W. 180th Avenue. The park campground has recently been extensively renovated.

General

This first magnitude spring complex has a long history of human usage (from the 1930s through the 1970s, it was a privately-owned attraction) and is presently administered by the FDEP/FPS. The entire Rainbow River was designated as a Registered Natural Landmark in 1972, an Aquatic Preserve in 1986, and an Outstanding Florida Waterway in 1987. In 1989 the Southwest Florida Water Management District (SWFWMD) adopted the Rainbow River as a surface water improvement and management (SWIM) water body. The state purchased the original area that was the Rainbow Springs Attraction in 1990. Volunteers cleared the overgrown park and opened the park on weekends to the public and the Florida Park Service officially opened Rainbow Springs State Park on a full time basis on March 9, 1995. The park facilities are well developed and include gardens, camping, pavilions, tubing and canoe rentals; the overnight camping area is currently undergoing restoration (**Figure 2**). This site is a regionally popular swimming, SCUBA, and tubing destination. Rainbow River is also utilized by the Marion County Parks and Recreation Department, at the K.P. Hole county park, where floats, canoes, kayaks, and boat launching are available.

Rainbow Springs forms the headwaters of the Rainbow River which is nearly 10 km (6 mi) long and merges with the Withlacoochee River (south) at Dunnellon. From there, the Withlacoochee River travels west and ultimately discharges into the Gulf of Mexico at Yankeetown, Florida.

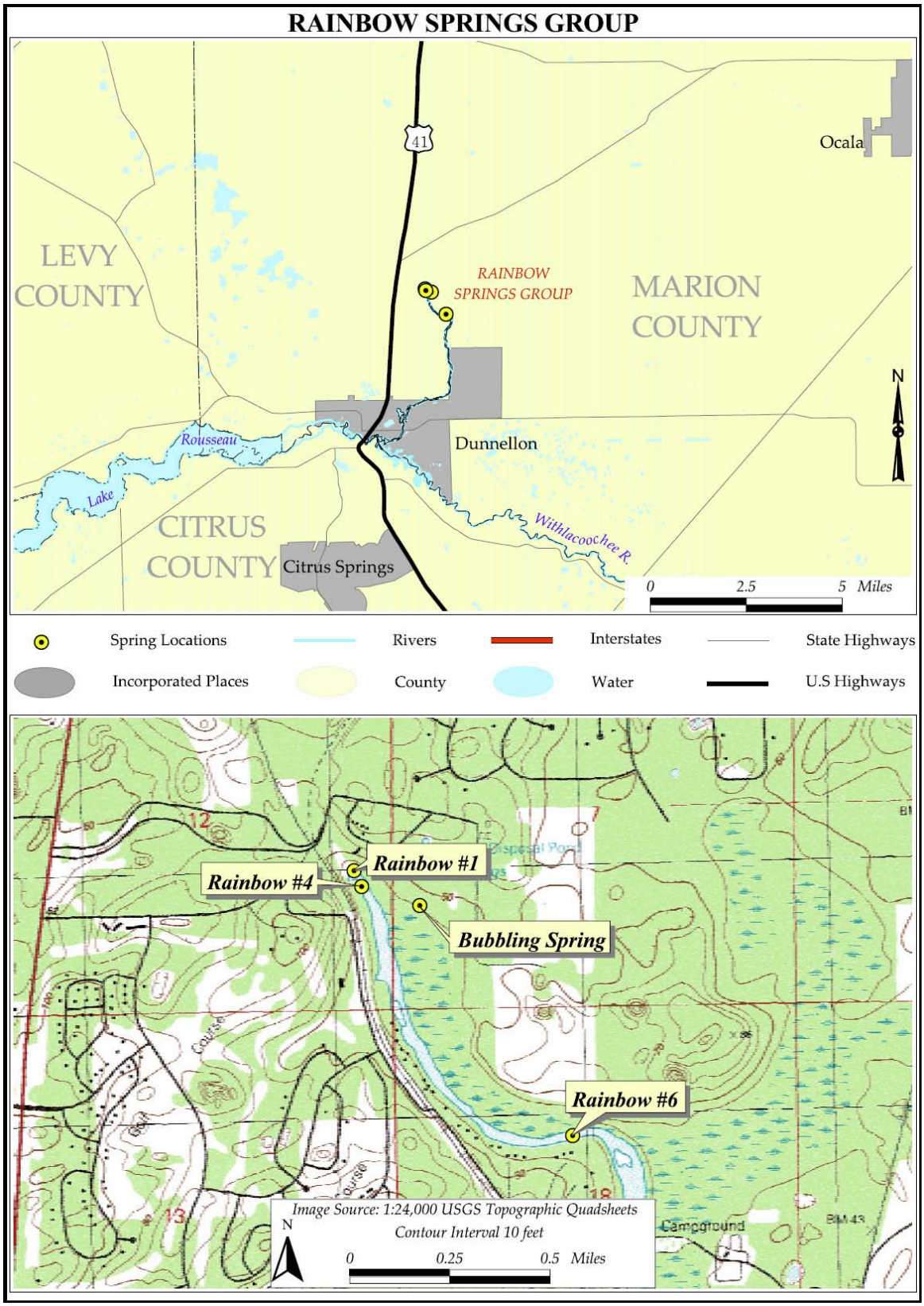


FIGURE 1
Rainbow Springs geographic location (from Scott *et al.* 2002).

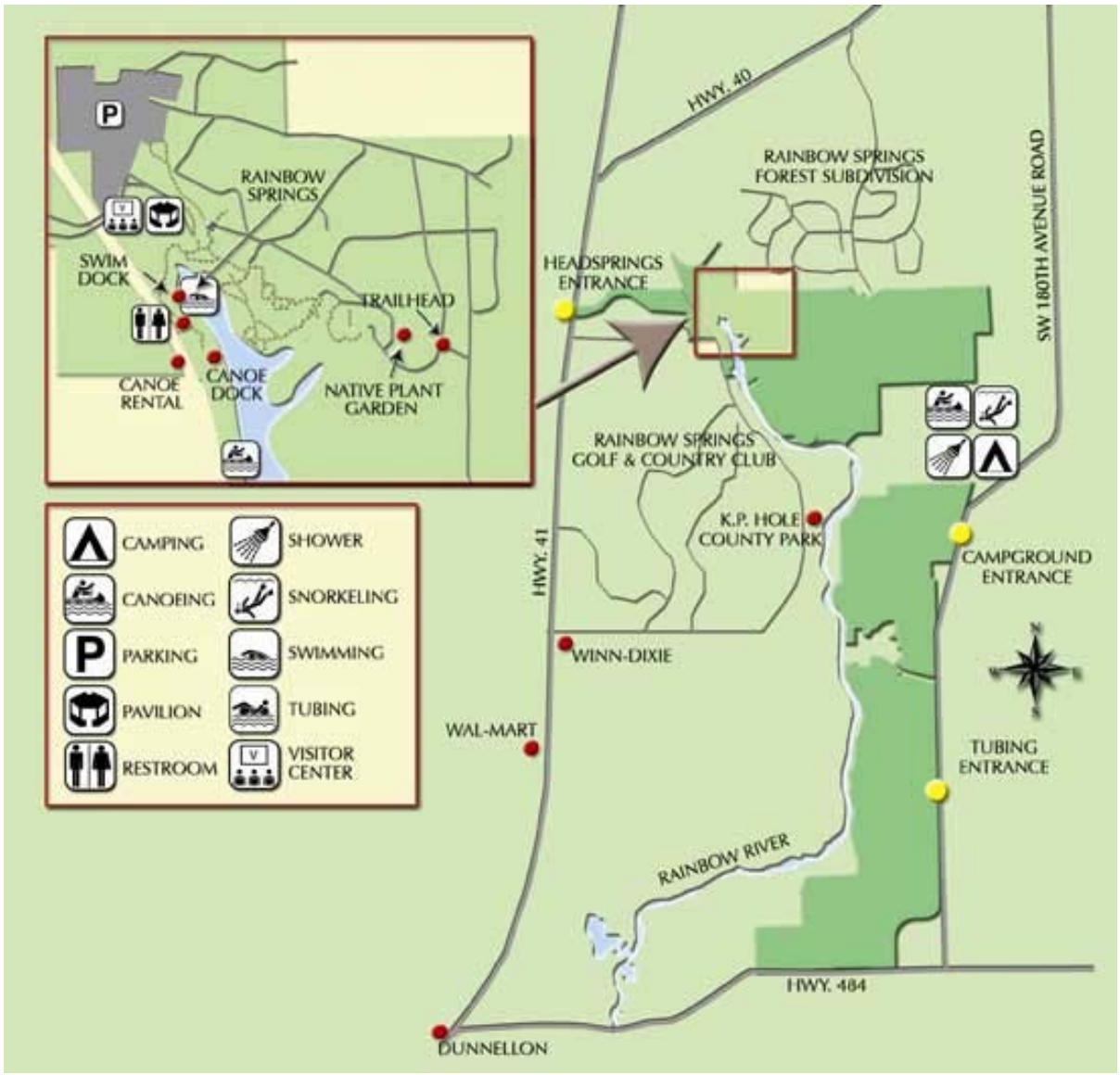


FIGURE 2
Map of Rainbow Springs State Park (from FDEP).

Physical

Rainbow Springs begins as a collection of vents distributed around the spring pool, *e.g.*, Bridge Seep North, Rainbow Springs #1, Rainbow Springs #4, Bubbling Spring, Rainbow Springs #6 (**Figure 3**). These multiple springs create the main spring pool area which is semicircular and approximately 107 m (350 ft) in diameter and approaching 3 m (10 ft) in depth. Spring vents are generally surrounded by karst geology and lack navigable caverns; there are numerous smaller sand boils around the pool as well. The pool is partially enclosed by a concrete wall and swim entry dock. A central component of the spring pool is the defined swim area overlying bare quartz sand (**Figure 4**). The lands immediately surrounding the pool are hilly and maintained as open grass, scattered trees, and park buildings.

The spring run is approximately 46 m (150 ft) wide and travels for roughly 9.2 km (5.7 mi) before joining the Withlacoochee River (south) near the town of Dunnellon. Along the spring run, which is also known as Blue Run or Rainbow River, there are numerous springs which discharge into the river bed through conduits in the underlying karst. During mapping of the aquatic vegetation in Rainbow River, 87 unique spring vents were identified (SWFWMD 2007). About 1.6 km (1 mi) south of the head spring area, a spring-fed tributary (Indian Creek) joins the Rainbow River. The lands along the eastern banks of the spring run are primarily undeveloped, in contrast to the western banks which are largely developed as residential properties. Quartz sand derived from Miocene and Pliocene marine deposits makes up the majority of sediments in the spring and run (GARI 2007). In portions of the spring run the underlying karst geology is visible, particularly around the spring vents.

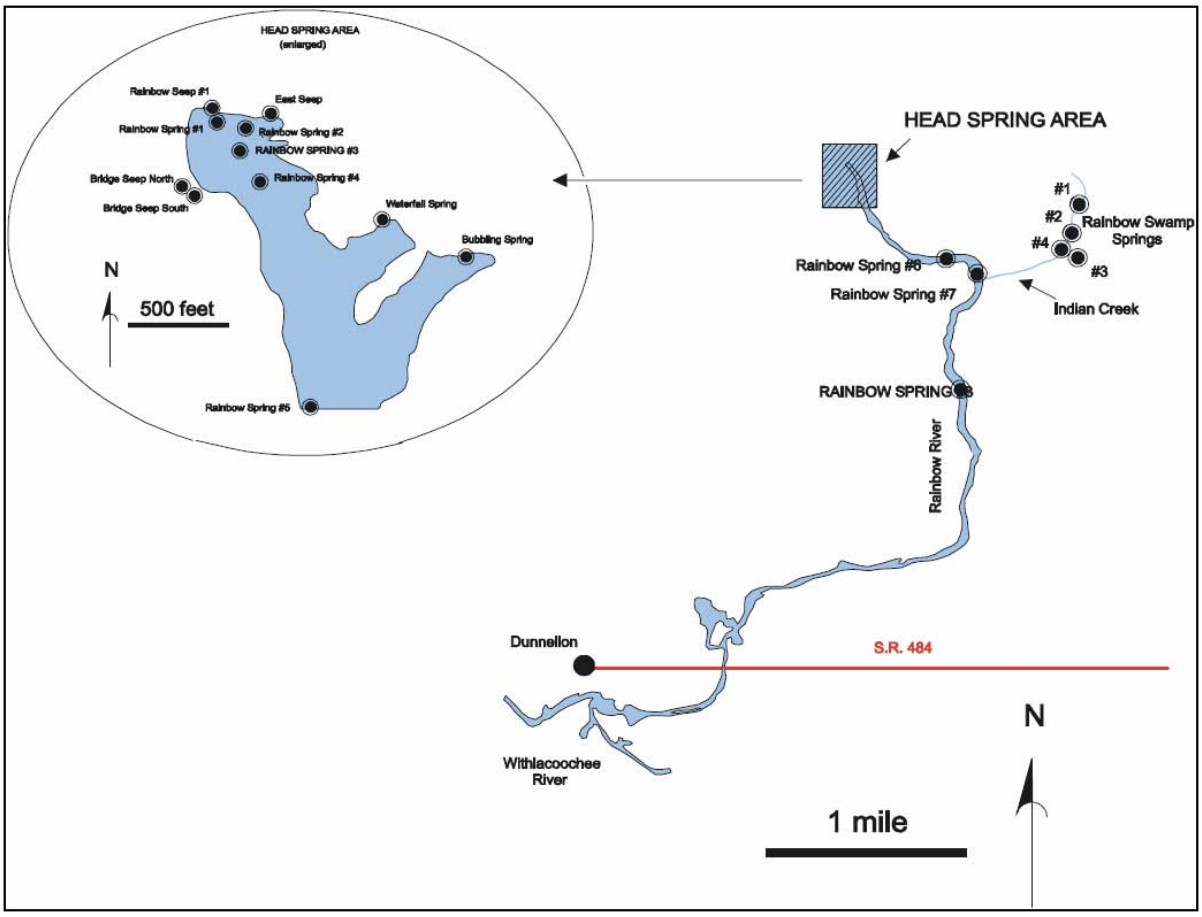


FIGURE 3
Graphic of the Rainbow Springs Group showing the locations of major springs (from Jones *et al.*1996).



FIGURE 4
South facing photograph of Rainbow Springs pool (swim area on right) continuing on to the spring run (from SWFWMD 2008).

Physiography

Based on the underlying sediments and topographic relief Marion County has been divided into eleven physiographic provinces: Central Valley, Marion Upland, Mount Dora Ridge, the Fairfield, Ocala, Martel, and Belleview Hills, Brooksville Ridge, Cotton Plant Ridge, Western Valley, and Sumter Upland (White 1970). Rainbow Springs overlies karst terrain that is generally rolling and spotted with lakes. The elevation ranges from 15 to 30.5 m (50 to 100 ft) above mean sea level. The Brooksville Ridge is underlain by a thin veneer of unconsolidated quartz sand that becomes increasingly clayey with depth. Soils in upland and flat settings range from moderately well drained to very poorly drained. These soils support mostly pine flatwoods, mixed hardwood forests, and riverine swamps. Geologic incision and drainage is carried out by the Withlacoochee River and its tributary the Rainbow River.

Geology

The geology of Marion County consists of Pliocene to Recent age sands overlying Cretaceous and Tertiary clays and carbonates which were sequentially deposited in shallow seas during interglacial periods (SWFWMD 1987, **Figure 5**). Clastic rocks and sediments which overlie limestone units are Miocene age and younger. The unconsolidated Holocene and Pleistocene age sediments consist of sand, clay, peat and marl. The Holocene sediments are mostly alluvial lake and windblown deposits, while the Pleistocene units are marine sediments from former shoreline terraces (MacNeil 1950).

Rainbow River overlies an area where the Ocala Limestones are relatively close to the surface and contains deposits of limestone and dolostones with shell fragments of marine origin. Avon Park limestone underlies the Ocala Limestone formation with the two units

together comprising the Floridan Aquifer. Historical phosphate mining operations can be found on both sides of the Rainbow River

The Hawthorn Formation, which outcrops near Rainbow Springs and ranges from a meter to over 76 m (250 ft) thick, consists of an upper part made up of shallow marine sand mixed with layers of clay and clayey sand and a lower unit comprised of permeable limestone and dolostones (SWFWMD 1987). The upper portion acts as a confining unit to the Floridan Aquifer, although where the Rainbow River crosses the exposed Hawthorn formation limestone numerous spring vents can be found.

Hydrogeology

Rainfall within Marion County not lost to surface drainage and evapotranspiration, percolates through the surficial unconsolidated material or enters into sinkholes to recharge the Floridan Aquifer. The internal drainage route generally follows the potentiometric surface of the pressurized limestone units making up the Aquifer and eventually, the water reappears at points of major discharge, such a Marion County's three first order springs - Rainbow, Silver, and Silver Glen Springs. Faulkner (1973) reported that most of the groundwater to Rainbow Springs is derived from the Ocala Limestone in the upper 30.5 m (100 ft) of the Floridan Aquifer, a water zone with rapid flow rates and relatively short residence times.

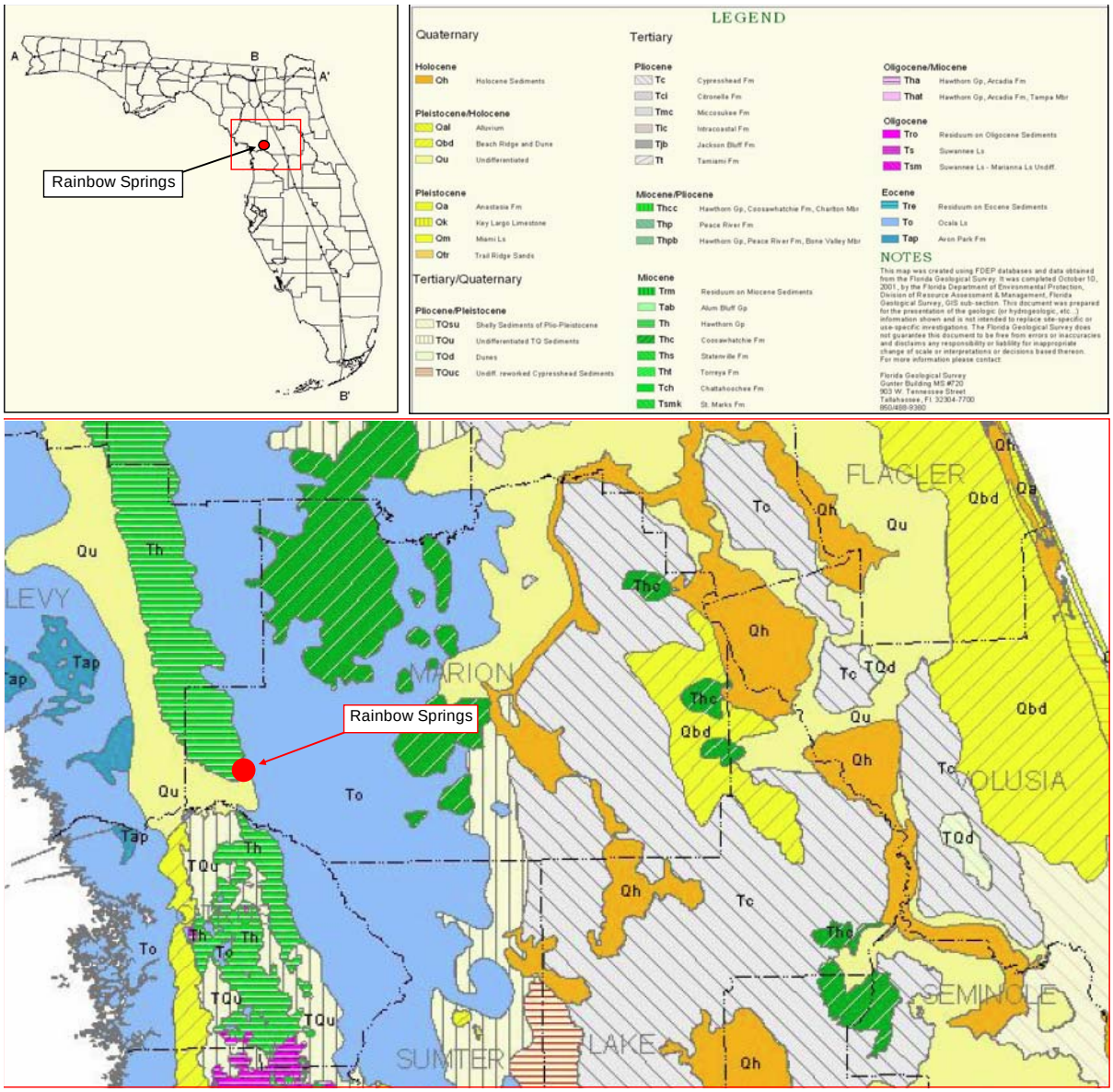


FIGURE 5
Geologic map of Rainbow Springs (adapted from Scott *et al*. 2001).

Springshed

The springshed for Rainbow Springs includes portions of Alachua, Levy, and Marion Counties. The Rainbow River watershed boundary lies within the USGS defined Withlacoochee Hydrologic Unit (Seaber et al. 1987, Foose 2000) and is approximately 189 km^2 (73 mi^2 or 46,700 ac, FGS 2007). However the vast majority of water discharged from the Rainbow River (97 to 99%) results from groundwater rather than surficial inputs (WAR 1991). Several estimates of the groundwater recharge area have been made; Faulkner (1973) reported the total Rainbow Springs groundwater basin having an area of approximately 1,671 km^2 (645 mi^2 or 412,798 ac), while Jones *et al*. (1996) reported the immediate recharge area was approximately 906 km^2 (350 mi^2 or 224,000 ac). Based on Florida Geological Survey delineations (FGS 2007), the Rainbow Springs springshed is estimated to be 1,909 km^2 (737 mi^2 or 471,700 ac, **Figure 6**). These areas are larger than previous estimates made by Faulkner (1973) and Jones *et al.* (1996).

Springshed Land Use

Utilizing USGS photography and SWFWMD GIS data, the land uses within the Rainbow River watershed have changed significantly between 1944 and 1999 (**Figures 7** and **8**, respectively). Land uses and cover types have transitioned from a dominance of forested uplands to those of agriculture to urban uses (Jones *et al*. 1996, SWFWMD 2004). Residential and commercial land uses have increased from 26 ha (64 ac) in 1944 to 2,894 ha (7,151 ac) in 1999, with an additional 4,188 ha (10,349 ac) platted for development (SWFWMD 2004). Agricultural lands increased from 3,017 ha (7,454 ac) in 1944 to 7,454 ha (18,418 ac) in 1999, while forested lands decreased from 14,961 to 3,893 ha (36,969 to 9,620 ac) during the same time period (SWFWMD 2004). Land uses within the springshed are expected to have followed the same trends observed in the river watershed.

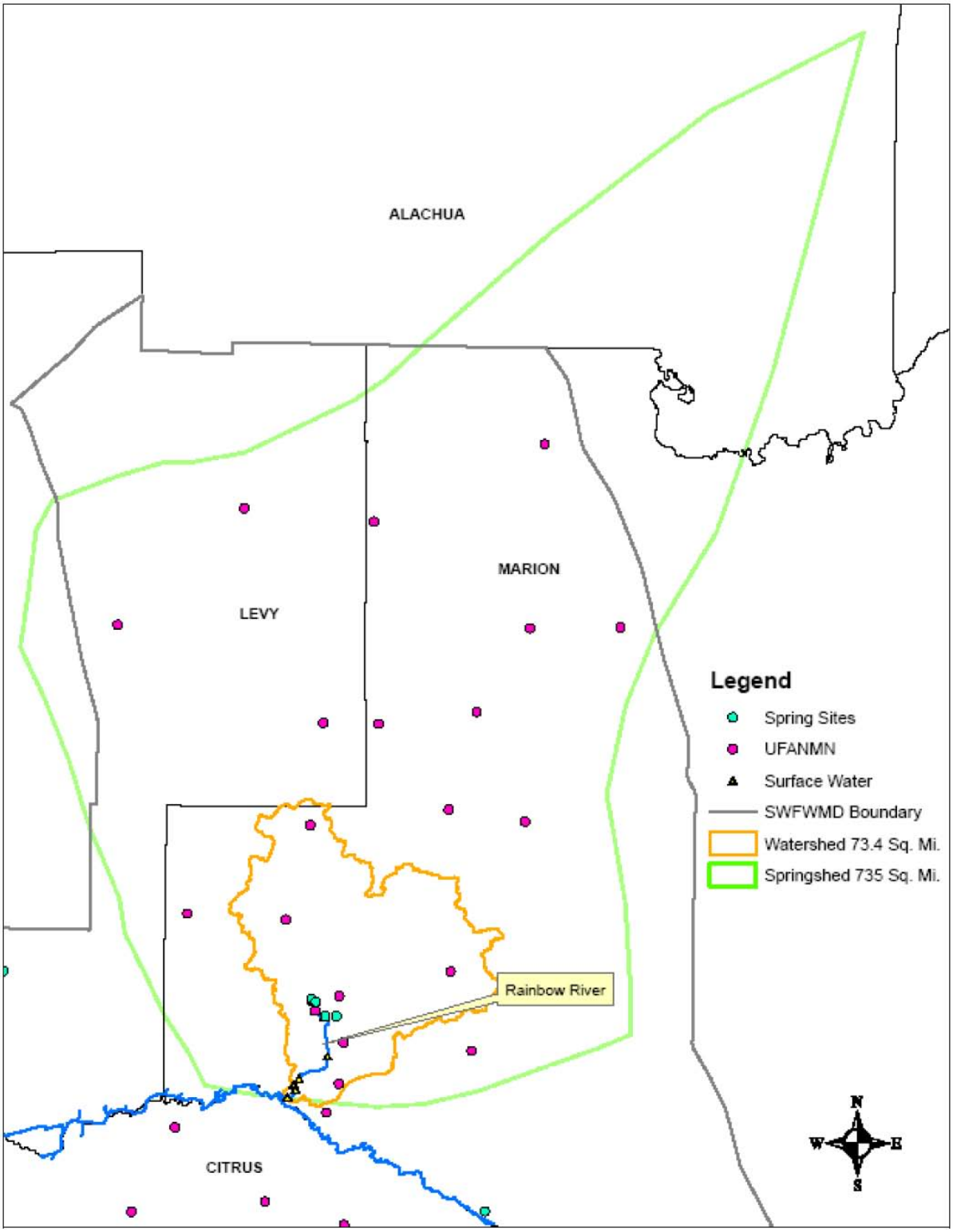


FIGURE 6
The watershed and springshed delineation of Rainbow Springs (from SWFWMD 2008).

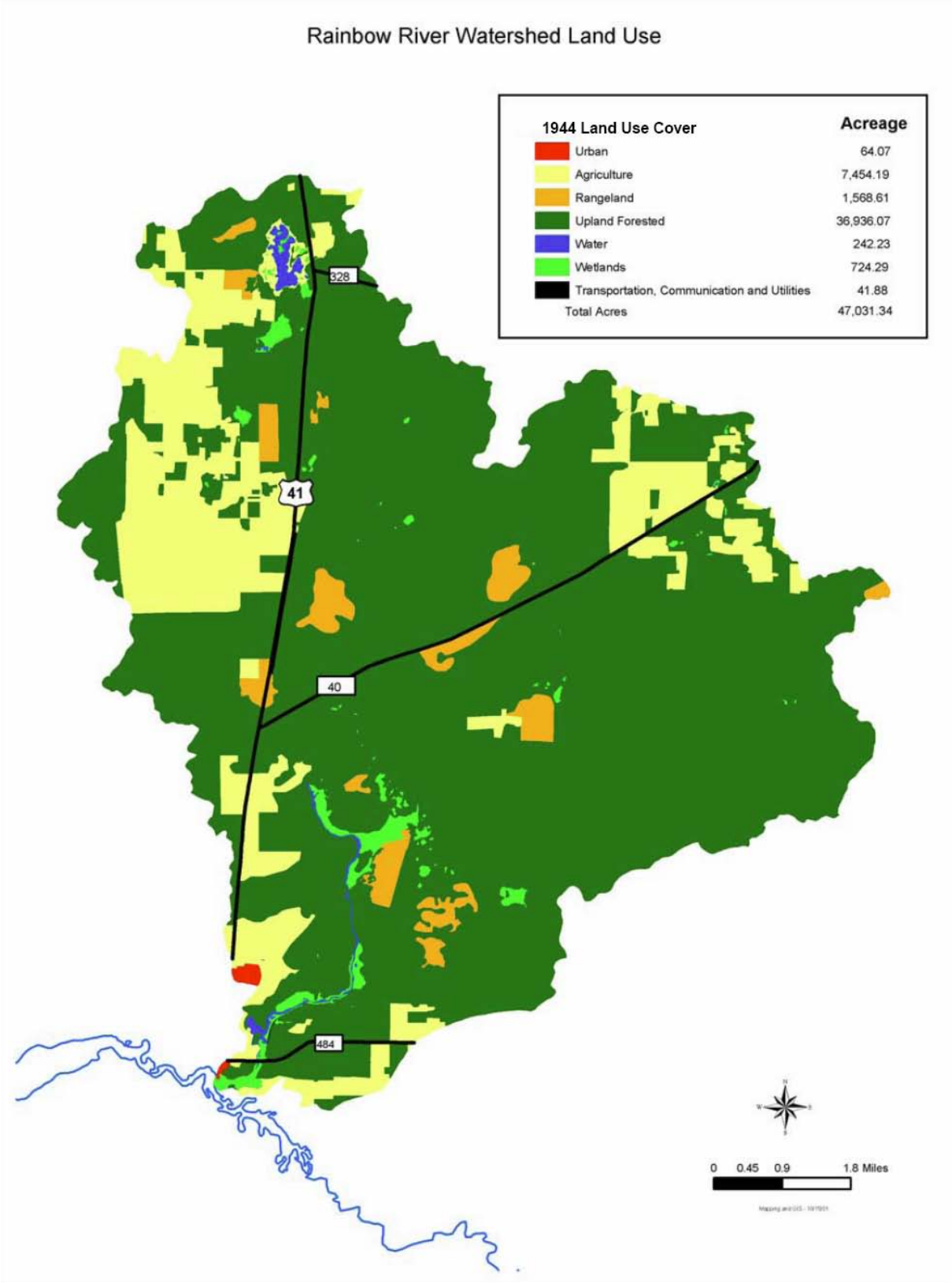


FIGURE 7
Land use in the Rainbow River watershed in 1944 (from SWFWMD 2004).

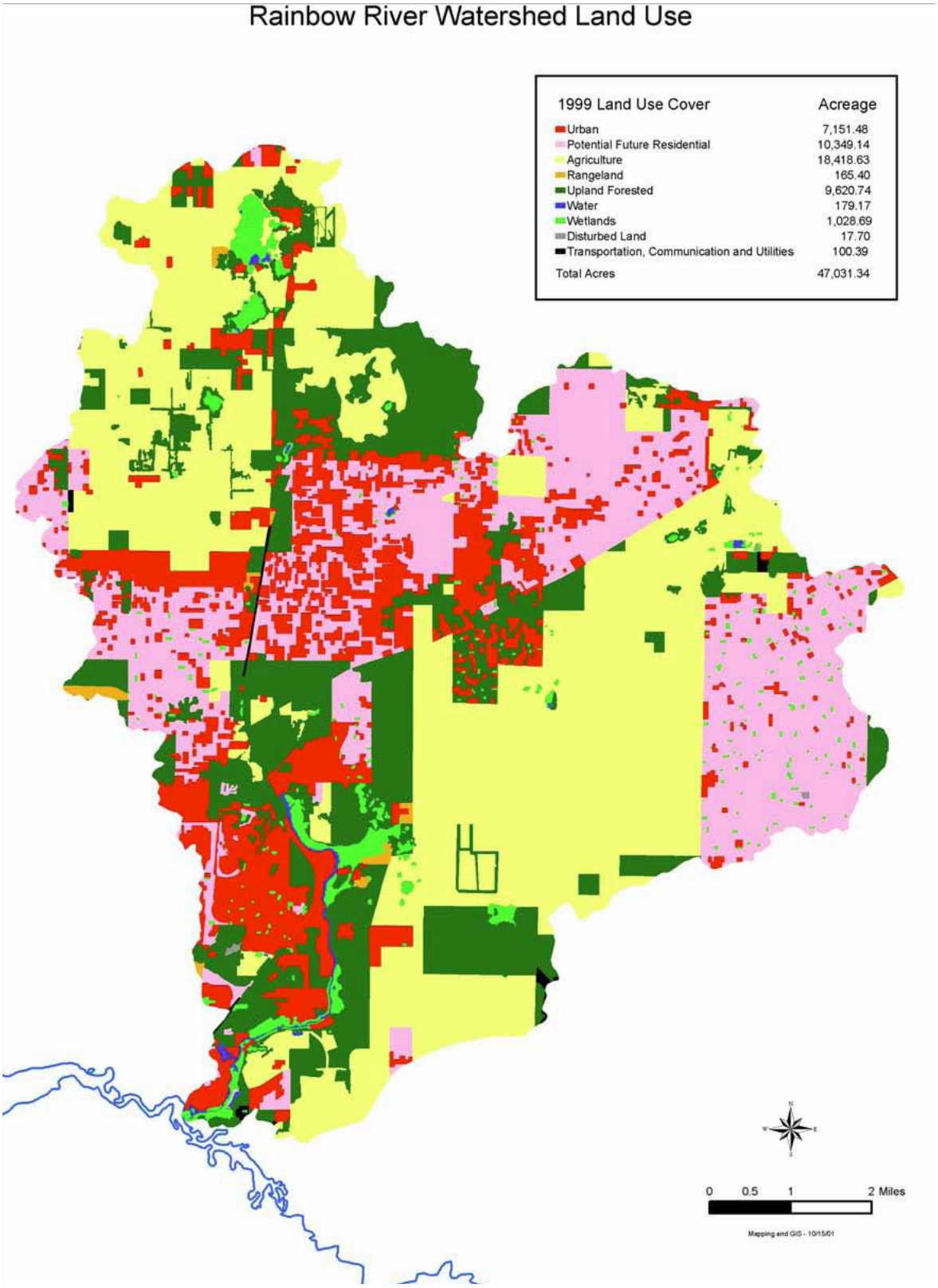


FIGURE 8
Land use in the Rainbow River watershed in 1999 (from SWFWMD 2004).

Study Area

The project study area for Rainbow Springs is defined as the spring pool and the upper 1.1 km (0.7 mi) of the spring run. **Figure 9** shows an approximation of the study area and data sonde locations are indicated by red icons.



FIGURE 9
The study area for Rainbow Springs (with data sonde locations as red icons).

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Rainbow Springs are given in **Table 1** below.

TABLE 1
Source information for the Rainbow Springs historical water quality data described in this report.

Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
21FLA	Florida Department of Environmental Protection	23010404	WITHLACOOCHEE R. BASIN/DUNNELLON/FRESHWATER	29.049639	-82.448195
21FLA	FDEP	23010409	RAINBOW RIVER/DUNNELLON/FRESHWATER REF SITE	29.092806	-82.426195
21FLA	FDEP	23010441	WITHLACOOCHEE R. BASIN/DUNNELLON/FRESHWATER	29.101944	-82.437778
21FLA	Florida Department of Environmental Protection	BUBBLING SPRING	FL Springs Initiative	29.101238	-82.434848
21FLA	Florida Department of Environmental Protection	RAINBOW SPRING #1	FL Springs Initiative	29.102476	-82.437466
21FLA	Florida Department of Environmental Protection	RAINBOW SPRING #4	FL Springs Initiative	29.101908	-82.437159
21FLA	Florida Department of Environmental Protection	RAINBOW SPRING #6	FL Springs Initiative	29.092808	-82.428565
21FLBRA	Florida Department of Environmental Protection	1320A-A	1320A - Rainbow Springs #1 - inside Rainbow Springs	29.102231	-82.437886
21FLGW	Florida Department of Environmental Protection	9699	BUBBLING SPRING	29.101238	-82.434848
21FLGW	Florida Department of Environmental Protection	9700	RAINBOW #1	29.102476	-82.437466
21FLGW	Florida Department of Environmental Protection	9701	RAINBOW #4	29.101908	-82.437159
21FLGW	Florida Department of Environmental Protection	9702	RAINBOW #6	29.092808	-82.428565
21FLGW	Florida Department of Environmental Protection	17967	SWA-LR-1031 RAINBOW RIVER	29.081018	-82.428821
21FLKWAT	Florida Lake Watch	MAR-RA-RIVER-1	Marion-Rainbow River-1-1	29.103000	-82.437000
21FLKWAT	Florida Lake Watch	MAR-RA-RIVER-2	Marion-Rainbow River-2-2	29.087333	-82.428833
21FLKWAT	Florida Lake Watch	MAR-RA-RIVER-3	Marion-Rainbow River-3-3	29.050000	-82.447833
21FLTPA	Florida Department of Environmental Protection	23010404	TP23 - BLUE RUN/RAINBOW RIVER	29.049639	-82.448195
21FLTPA	Florida Department of Environmental Protection	23010409	TP33 - RAINBOW RIVER	29.092806	-82.426195
21FLTPA	Florida Department of Environmental Protection	23010441	TP129 - RAINBOW SPRING	29.101944	-82.437778
21FLTPA	Florida Department of Environmental Protection	29051718225386	TP249-Blue Run	29.088083	-82.427389
21FLTPA	Florida Department of Environmental Protection	29052808225344	TP247-Blue Run	29.091111	-82.426222
21FLTPA	Florida Department of Environmental Protection	29053408225445	TP248-Blue Run	29.092778	-82.429028
21FLWQSP	FDEP	MRN504LR	Rainbow River at state park campground (WBID 1320)	29.089038	-82.426285
USGS	USGS	2313092	USGS 02313092 RAINBOW NUMBER 1 SPRING NEAR DUNNELLON, FL.	29.102500	-82.437500
USGS	USGS	2313093	USGS 02313093 RAINBOW NUMBER 4 SPRING NEAR DUNNELLON, FL.	29.101944	-82.437222
USGS	USGS	2313094	USGS 02313094 RAINBOW BUBBLING SPRING NEAR DUNNELLON, FL.	29.101111	-82.434736
USGS	USGS	2313096	USGS 02313096 RAINBOW NUMBER 6 SPRING NEAR DUNNELLON, FL	29.092778	-82.428611
USGS	USGS	2313100	USGS 02313100 RAINBOW SPRINGS NEAR DUNNELLON, FL	29.102222	-82.437778

Discharge and Stage

Rainbow Springs has a wide range in discharge values (which are typically measured approximately five miles downstream, at SR 484 near Dunnellon). Historical instantaneous discharges reported by Rosenau *et al.* (1977) ranged from a minimum of 487 cfs (October 3, 1932) to a maximum of 1,230 cfs (October 12, 1964); with an average discharge of 763 cfs (1965-1974). Other measures of discharge include a value of 634 cfs (October 23, 2001) by Scott *et al.* 2002.

The US Geological Survey computes discharge of the Rainbow River (station # 02313100) based on the relation between discharge measurements (made 0.25 mi upstream of SR 484) and artesian pressure at a well near the head springs (well # 290514082270701, USGS 2008). The resulting USGS discharge measurements include an annual mean value of 688 cfs (1965 to 2008), a minimum annual mean of 521 cfs from 2001, and a maximum annual mean of 897 cfs from 1970 (USGS 2008). **Table 2** and **Figure 10** illustrates the variability of discharge at this spring system (USGS 2008).

Stage values for Rainbow Springs have been collected by USGS from a location near the head springs. Water-stage was instrument recorded between 1933 and 1969, since April 1971 the non-recording gage has only been read during discharge measurements. A maximum observed stage of 5.90 ft (NGVD 1929) was observed on April 6, 1960 (USGS 2008).

TABLE 2
Summary statistics for the discharge (cfs) and stage (ft) of Rainbow River (near Dunnellon, from USGS 2008).

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 1965 - 2008	
Annual total	209,814		220,035			
Annual mean	575		601		688	
Highest annual mean					897	1970
Lowest annual mean					521	2001
Highest daily mean	611	Mar 4	758	Sep 9	1,060	Sep 19, 1988
Lowest daily mean	545	Jul 9,13	554	Jun 7,8	[a]470	Jun 18, 2001
Annual seven-day minimum	546	Jul 8	556	Jun 4	473	Jun 15, 2001
Maximum peak flow					[d]1,230	Oct 12, 1964
Maximum peak stage			[c]3.13	Aug 29	[b]5.90	Apr 6, 1960
Instantaneous low flow			548	Jun 7	460	Jun 7, 2000
10 percent exceeds	597		660		845	
50 percent exceeds	574		584		672	
90 percent exceeds	554		564		564	

[a] Jun 18, 19, Jul 9, 2001
[b] Observed
[c] Observed at spring pool
[d] Measured

The variation in discharge among the Rainbow Springs group (and other springs) appears to be climatologically influenced. Evidence for this is shown in **Figure 11** which illustrates discharge for both Rainbow and Weeki Wachee Springs by monthly average and by annual average (Champion and Starks 2001). Lowest discharge values for both spring systems are observed in June and highest discharge values are observed in October, a response which likely corresponds to typical rainfall patterns in central Florida. In turn, annual average discharge data between these two spring systems are similar and suggests that rainfall inputs broadly control spring discharge rates (**Figure 11**).

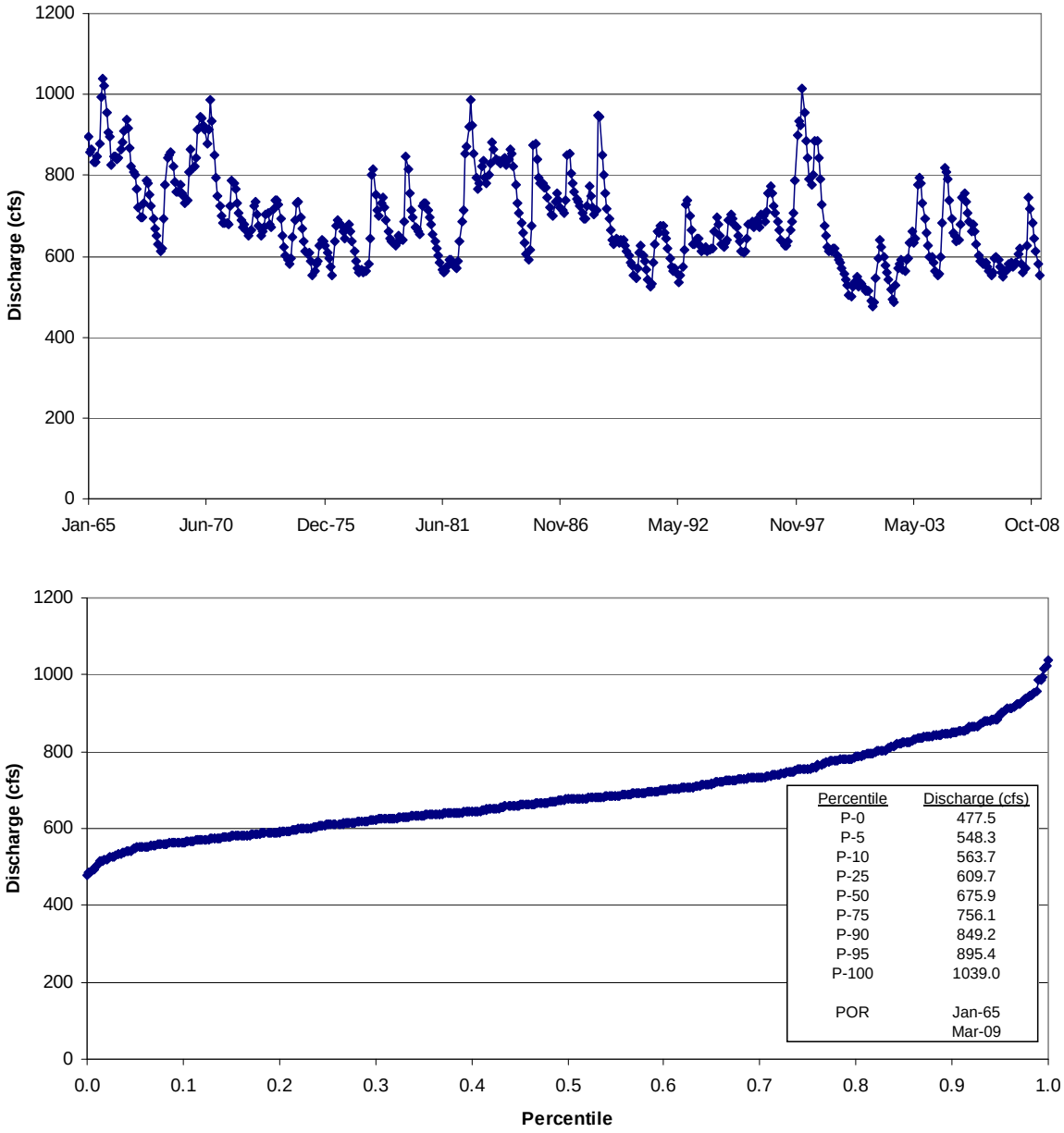
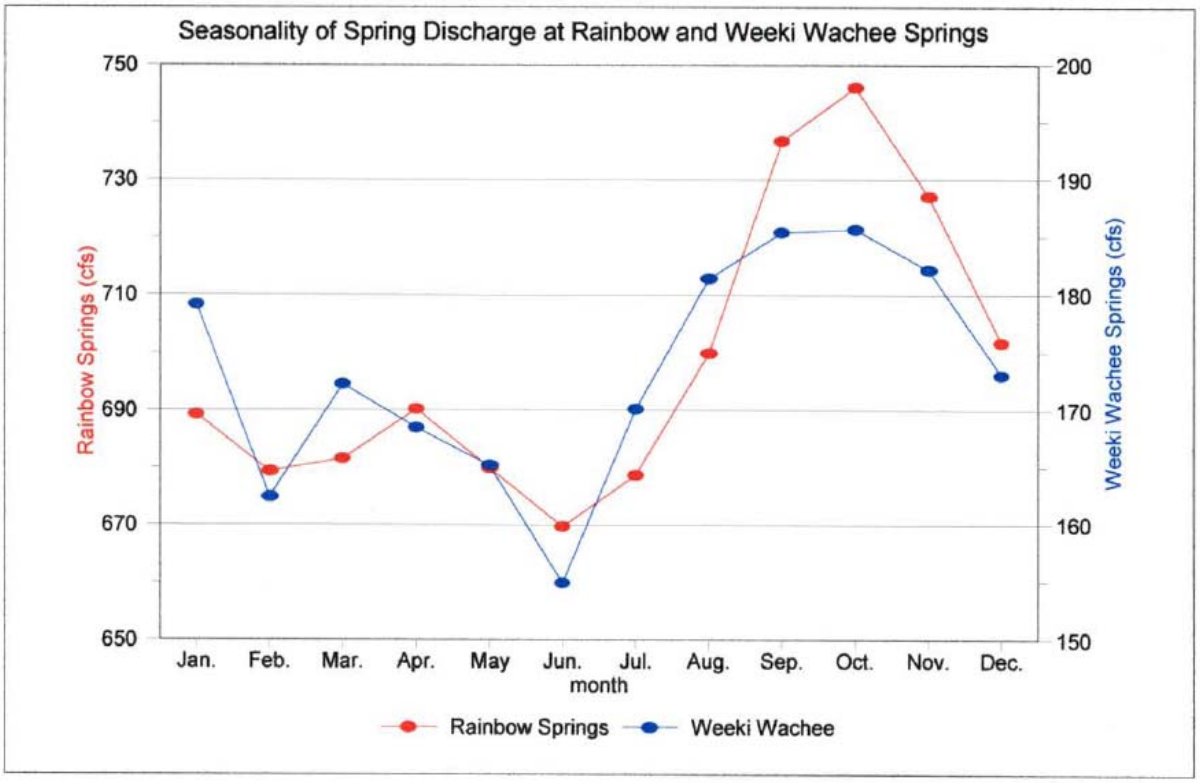


FIGURE 10
Monthly average discharge time series and frequency curve for Rainbow River.



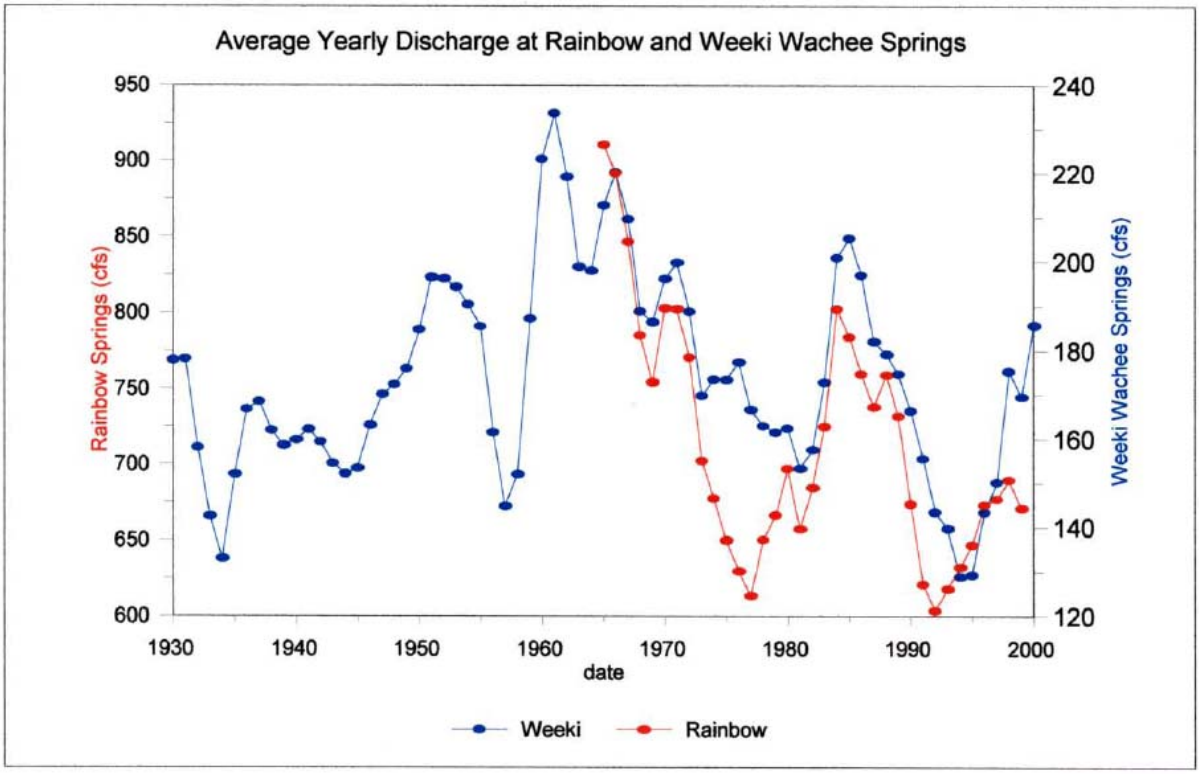


FIGURE 11
Monthly and annual fluctuations in Rainbow and Weeki Wachee Springs discharge from1930 to1997 (from Champion and Starks 2001).

Water Quality

Water quality data for Rainbow Springs are available from as early as 1927 by Rosenau *et al.* (1977); however STORET data (USGS and FDEP data) primarily spans from the 1950s to as recent as March 2009. Among water chemistry parameters, the numbers of samples collected ranges from 1 to 202 records, with most samples collected from the main pool. These data are summarized in **Table 3** which provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Rainbow Springs (main boil) POR averages for several key parameters (with the number of samples) are:

- Water temperature – 23.3 °C (n = 178)
- Dissolved oxygen – 6.87 mg/L (n = 89)
- pH – 7.84 SU (n = 138)
- Specific conductance – 144 umhos/cm (n = 202)
- Turbidity – 0.617 NTU (n = 60)
- Color – 3.54 CPU (n= 128)
- Total chloride – 3.51 mg/L (n = 128)
- Sulfate – 5.24 mg/L (n = 64)
- Nitrate+nitrite nitrogen – 0.482 mg/L (n = 53 only through 1999)
- Total phosphorus – 0.036 mg/L (n = 70)

TABLE 3
Rainbow Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
BACTERIOLOGICAL	EColi	#/100ml	Spring 1											1.51	1.51	0.500	4.10	1.08	10	10/23/2001	10/17/2006
			Spring 4											1.00	1.00	1.00	1.00	0.00	4	10/23/2001	1/23/2002
			Bubbling Spring											1.00	1.00	1.00	1.00	0.00	2	10/23/2001	10/23/2001
			Spring 6											1.00	1.00	1.00	1.00	0.00	2	10/23/2001	10/23/2001
	Enterococci	#/100ml	Spring 1											1.48	1.48	1.00	2.00	0.512	21	10/23/2001	10/24/2006
			Spring 4											1.57	1.57	1.00	4.00	0.746	21	10/23/2001	10/24/2006
			Bubbling Spring											1.65	1.65	1.00	4.00	0.745	20	10/23/2001	10/24/2006
			Spring 6											6.55	6.55	1.00	70.0	15.8	20	10/23/2001	10/24/2006
			Spring Run (mid)											22.0	22.0	22.0	22.0		1	5/28/2003	5/28/2003
	FC	#/100ml	Main Boil								0.00				0.00	0.00	0.00	0.00	6	1/17/1975	11/18/1975
			Spring 1											1.49	1.49	1.00	2.00	0.505	55	10/23/2001	4/30/2008
			Spring 4											1.49	1.49	1.00	2.00	0.505	55	10/23/2001	4/30/2008
			Bridge Seep											5.10	5.10	1.00	30.0	8.71	20	3/1/2004	12/6/2004
			Bubbling Spring											1.62	1.62	1.00	4.00	0.686	53	10/23/2001	4/30/2008
			Spring 6											1.94	1.94	1.00	6.00	1.35	53	10/23/2001	4/30/2008
			Spring Run (mid)											34.4	34.4	1.00	160	50.3	16	11/27/2000	12/13/2006
			Spring Run (SR 484)											106	106	1.00	450	182	10	3/1/2004	12/15/2004
	TC	#/100ml	Main Boil							420	110				140	0.00	640	155	21	5/16/1969	5/20/1977
			Spring 1											124	124	0.500	2,400	440	59	10/23/2001	4/30/2008
			Spring 4											4.75	4.75	1.00	18.0	6.07	53	10/23/2001	4/30/2008
			Bridge Seep											60.6	60.6	1.00	230	67.8	20	3/1/2004	12/6/2004
			Bubbling Spring											5.10	5.10	1.00	70.0	13.4	51	10/23/2001	4/30/2008
			Spring 6											7.98	7.98	1.00	48.0	13.3	51	10/23/2001	4/30/2008
			Spring Run (mid)											67.3	67.3	1.00	280	93.0	15	11/27/2000	12/13/2006
			Spring Run (SR 484)											103	103	1.00	220	91.0	10	3/1/2004	12/15/2004
BIOLOGICAL	Chl-a corr	µg/L	Spring 1											1.70	1.70	0.500	7.10	2.66	6	5/3/2006	10/17/2006
			Bridge Seep											0.491	0.491	0.425	1.10	0.198	22	3/1/2004	12/6/2004
			Spring Run (mid)											0.511	0.511	0.425	1.60	0.282	17	5/28/2003	1/9/2006
			Spring Run (SR 484)											3.08	3.08	0.850	12.0	4.70	10	3/1/2004	12/6/2004
	Pheo-a	µg/L	Spring 1											19.6	19.6	0.500	100	39.5	6	5/3/2006	10/17/2006
			Bridge Seep											0.391	0.391	0.00	0.480	0.128	22	3/1/2004	12/6/2004
			Spring Run (mid)											0.429	0.429	0.425	0.480	0.015	13	5/28/2003	11/1/2004
			Spring Run (SR 484)											0.770	0.770	0.450	0.850	0.169	10	3/1/2004	12/6/2004
DISSOLVED OXYGEN	DO	%	Main Boil							82.8	75.5	67.0			75.3	49.0	91.0	9.40	35	5/17/1967	6/29/1982
			Bridge Seep											88.0	88.0	5.40	125	26.9	26	3/1/2004	12/6/2004
			Spring Run (mid)											97.3	97.3	84.2	120	12.9	16	3/1/2004	12/12/2006
			Spring Run (SR 484)											93.1	93.1	66.3	131	21.9	12	3/1/2004	12/15/2004
	DO	mg/L	Main Boil							7.10	6.33	7.16	7.18		6.87	4.20	12.3	1.01	89	5/17/1967	9/2/1999
			Spring 1											6.60	6.60	5.68	7.75	0.344	59	10/23/2001	4/30/2008
			Spring 4											5.11	5.11	4.00	6.01	0.318	55	10/23/2001	4/30/2008
			Bridge Seep											7.52	7.52	0.440	10.6	2.31	26	3/1/2004	12/6/2004
			Bubbling Spring											4.60	4.60	3.94	7.38	0.712	55	10/23/2001	4/30/2008
			Spring 6											5.89	5.89	4.75	7.19	0.553	55	10/23/2001	4/30/2008
			Spring Run (mid)										6.73	7.89	7.75	6.45	10.2	1.11	33	3/16/1998	12/12/2006
			Spring Run (SR 484)											8.17	8.17	5.64	11.4	1.93	12	3/1/2004	12/15/2004
FLOW	Flow	cfs	Main Boil							809	690	735	667	606	691	470	1,060	110	16181	1/1/1965	3/25/2009
			Bubbling Spring											26.3	26.3	26.3	26.3		1	7/29/2004	7/29/2004
	Flow-Inst	cfs	Main Boil	782	738	838	692	720	717	784	675	734	708		714	487	1,230	107	531	12/24/1904	9/2/1999
			Spring 1											163	163	22.0	254	114	5	8/8/2006	8/22/2007
			Spring 4											169	169	105	261	70.5	5	8/8/2006	8/22/2007
			Bubbling Spring											17.1	17.1	11.0	26.3	5.51	6	7/29/2004	8/22/2007
			Spring 6											317	317	307	326	7.23	5	8/8/2006	8/22/2007

TABLE 3 (CONTINUED)
Rainbow Springs water quality table for the period-of-record continued.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
GENERAL INORGANIC	Alk	mg/L as Ca	Main Boil						114	70.1	56.2	70.0			62.8	47.0	114	20.0	34	5/2/1956	5/29/1981
			Spring 1											57.4	57.4	0.500	67.0	10.3	39	10/23/2001	4/30/2008
			Spring 4											115	115	107	125	4.62	33	10/23/2001	4/30/2008
			Bubbling Spring											155	155	147	166	5.57	32	10/23/2001	4/30/2008
			Spring 6											118	118	104	134	6.84	32	10/23/2001	4/30/2008
	Cl-T	mg/L	Main Boil						5.50	3.58	3.27	3.45	3.87		3.51	1.60	8.00	0.874	128	5/2/1956	9/2/1999
			Spring 1											4.28	4.28	0.036	5.20	0.595	79	10/23/2001	4/30/2008
			Spring 4											5.04	5.04	4.20	5.90	0.340	73	10/23/2001	4/30/2008
			Bridge Seep											3.85	3.85	3.50	4.10	0.187	22	3/1/2004	12/6/2004
			Bubbling Spring											5.92	5.92	5.20	6.60	0.312	70	10/23/2001	4/30/2008
			Spring 6											6.83	6.83	4.80	8.00	0.658	70	10/23/2001	4/30/2008
			Spring Run (mid)											5.35	5.35	4.90	5.80	0.276	13	5/28/2003	11/1/2004
			Spring Run (SR 484)											5.56	5.56	5.20	5.90	0.255	10	3/1/2004	12/6/2004
	CO2	mg/L	Main Boil						8.90	5.31	1.80	2.81	16.9		6.50	0.100	151	20.6	63	5/2/1956	9/2/1999
	F-D	mg/L	Main Boil							0.144	0.157	0.126	0.100		0.127	0.00	0.300	0.061	62	11/9/1960	9/2/1999
			Spring 1											0.088	0.088	0.072	0.120	0.009	33	10/23/2001	4/30/2008
			Spring 4											0.117	0.117	0.094	0.150	0.010	33	10/23/2001	4/30/2008
			Bubbling Spring											0.131	0.131	0.050	0.150	0.018	32	10/23/2001	4/30/2008
			Spring 6											0.129	0.129	0.110	0.150	0.010	32	10/23/2001	4/30/2008
	F-T	mg/L	Spring 1											0.087	0.087	0.050	0.110	0.011	33	10/23/2001	4/30/2008
			Spring 4											0.116	0.116	0.097	0.140	0.009	33	10/23/2001	4/30/2008
			Bubbling Spring											0.133	0.133	0.110	0.160	0.011	32	10/23/2001	4/30/2008
			Spring 6											0.129	0.129	0.110	0.150	0.011	32	10/23/2001	4/30/2008
	Hardness	mg/L as Ca	Main Boil						130	74.7	65.8	69.5	72.3		70.5	44.0	170	20.0	128	5/2/1956	9/2/1999
	Si-D	mg/L	Main Boil						6.20	13.6	6.80	6.66	6.70		7.65	5.50	66.0	7.31	66	5/2/1956	9/2/1999
	SO4	mg/L	Main Boil						18.0	6.13	5.00	5.01	4.61		5.24	2.40	18.0	3.16	64	5/2/1956	9/2/1999
			Spring 1											4.72	4.72	0.030	5.20	0.590	79	10/23/2001	4/30/2008
			Spring 4											5.05	5.05	4.50	6.00	0.246	73	10/23/2001	4/30/2008
			Bridge Seep											4.39	4.39	4.10	4.60	0.179	24	3/1/2004	12/6/2004
			Bubbling Spring											8.59	8.59	7.60	10.0	0.604	70	10/23/2001	4/30/2008
			Spring 6											35.5	35.5	8.30	46.0	8.89	70	10/23/2001	4/30/2008
			Spring Run (mid)											12.0	12.0	7.40	16.0	3.11	16	5/28/2003	11/1/2004
			Spring Run (SR 484)											14.4	14.4	14.0	15.0	0.516	10	3/1/2004	12/6/2004
GENERAL ORGANIC	TOC	mg/L	Main Boil							3.00	3.88	0.763	1.85		2.42	0.00	33.0	6.09	61	9/19/1968	9/2/1999
			Spring 1											0.543	0.543	0.150	3.30	0.375	61	10/23/2001	4/30/2008
			Spring 4											0.625	0.625	0.500	6.00	0.762	55	10/23/2001	4/30/2008
			Bridge Seep											0.600	0.600	0.500	1.10	0.218	22	3/1/2004	12/6/2004
			Bubbling Spring											0.700	0.700	0.500	7.90	1.05	53	10/23/2001	4/30/2008
			Spring 6											0.632	0.632	0.500	4.70	0.620	53	10/23/2001	4/30/2008
			Spring Run (mid)											0.542	0.542	0.500	1.21	0.172	17	5/28/2003	1/9/2006
			Spring Run (SR 484)											6.30	6.30	1.00	26.0	10.4	10	3/1/2004	12/6/2004
METAL	Ag-T	µg/L	Main Boil									1.00			1.00	1.00	1.00		1	1/17/1985	1/17/1985
	Al-T	µg/L	Main Boil								75.0	8.33	23.1		27.5	0.00	100	31.6	27	5/2/1970	9/2/1999
			Spring 1											6.37	6.37	1.50	37.5	9.96	23	10/23/2001	4/21/2005
			Spring 4											6.07	6.07	1.50	37.5	9.97	23	10/23/2001	4/21/2005
			Bubbling Spring											6.07	6.07	1.50	37.5	9.97	23	10/23/2001	4/21/2005
			Spring 6											6.07	6.07	1.50	37.5	9.97	23	10/23/2001	4/21/2005
	As-T	µg/L	Main Boil								1.33	0.938	1.00		1.05	0.00	4.00	0.532	43	8/29/1972	9/2/1999
			Spring 1											2.40	2.40	1.50	3.00	0.608	24	10/23/2001	4/21/2005
			Spring 4											2.40	2.40	1.50	3.00	0.608	24	10/23/2001	4/21/2005
			Bubbling Spring											2.69	2.69	1.50	6.00	1.19	24	10/23/2001	4/21/2005
			Spring 6											2.40	2.40	1.50	3.00	0.608	24	10/23/2001	4/21/2005

TABLE 3 (CONTINUED)
Rainbow Springs water quality table for the period-of-record continued.

				Decade											POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
METAL	Ba-T	µg/L	Main Boil									100			100	100	100		1	1/17/1985	1/17/1985
			Spring 1											0.948	0.948	0.250	1.50	0.308	21	10/9/2002	4/21/2005
			Spring 4											1.27	1.27	0.250	2.10	0.506	21	10/9/2002	4/21/2005
			Bubbling Spring											1.75	1.75	0.560	2.50	0.623	21	10/9/2002	4/21/2005
			Spring 6											1.89	1.89	0.870	2.90	0.765	21	10/9/2002	4/21/2005
	Ca-D	mg/L	Main Boil						43.0	25.7	20.0	22.3	23.1		22.5	14.0	43.0	7.88	72	5/2/1956	9/2/1999
			Spring 1											22.6	22.6	17.7	25.9	1.66	34	10/23/2001	4/30/2008
			Spring 4											42.8	42.8	38.4	45.5	1.95	34	10/23/2001	4/30/2008
			Bubbling Spring											58.5	58.5	54.1	66.2	2.29	33	10/23/2001	4/30/2008
			Spring 6											53.4	53.4	39.5	61.4	5.52	33	10/23/2001	4/30/2008
	Ca-T	mg/L	Spring 1											21.9	21.9	0.080	25.0	2.90	80	10/23/2001	4/30/2008
			Spring 4											42.7	42.7	38.1	67.4	3.69	74	10/23/2001	4/30/2008
			Bridge Seep											19.4	19.4	18.4	24.2	1.60	22	3/1/2004	12/6/2004
			Bubbling Spring											58.4	58.4	49.6	66.5	2.68	71	10/23/2001	4/30/2008
			Spring 6											53.3	53.3	38.1	61.5	5.24	71	10/23/2001	4/30/2008
			Spring Run (mid)											42.8	42.8	41.4	44.1	0.826	13	5/28/2003	11/1/2004
			Spring Run (SR 484)											43.1	43.1	42.3	44.9	0.987	10	3/1/2004	12/6/2004
	Cd-T	µg/L	Main Boil								1.33	0.889	1.06		1.03	0.00	2.00	0.490	30	5/16/1972	9/2/1999
			Spring 1											0.276	0.276	0.250	0.375	0.052	24	10/23/2001	4/21/2005
			Spring 4											0.276	0.276	0.250	0.375	0.052	24	10/23/2001	4/21/2005
			Bubbling Spring											0.276	0.276	0.250	0.375	0.052	24	10/23/2001	4/21/2005
			Spring 6											0.276	0.276	0.250	0.375	0.052	24	10/23/2001	4/21/2005
	Co-T	µg/L	Main Boil								0.00				0.00	0.00	0.00	0.00	2	5/16/1972	8/29/1972
			Spring 1											0.717	0.717	0.250	1.00	0.311	23	10/23/2001	4/21/2005
			Spring 4											0.717	0.717	0.250	1.00	0.311	23	10/23/2001	4/21/2005
			Bubbling Spring											0.861	0.861	0.250	4.30	0.809	23	10/23/2001	4/21/2005
			Spring 6											0.717	0.717	0.250	1.00	0.311	23	10/23/2001	4/21/2005
	Cr-T	µg/L	Main Boil								6.67	2.00			5.50	0.00	20.0	9.71	4	5/2/1970	1/17/1985
			Spring 1											0.983	0.983	0.250	1.50	0.254	24	10/23/2001	4/21/2005
			Spring 4											1.18	1.18	0.250	2.20	0.529	24	10/23/2001	4/21/2005
			Bubbling Spring											1.35	1.35	0.250	2.60	0.715	24	10/23/2001	4/21/2005
			Spring 6											0.983	0.983	0.250	1.50	0.254	24	10/23/2001	4/21/2005
	Cu-T	µg/L	Main Boil								20.0				20.0	0.00	40.0	28.3	2	5/16/1972	1/17/1985
			Spring 1											2.01	2.01	1.00	3.00	0.690	24	10/23/2001	4/21/2005
			Spring 4											2.01	2.01	1.00	3.00	0.690	24	10/23/2001	4/21/2005
			Bubbling Spring											2.18	2.18	1.00	5.20	0.930	24	10/23/2001	4/21/2005
			Spring 6											2.01	2.01	1.00	3.00	0.690	24	10/23/2001	4/21/2005
	Fe-T	µg/L	Main Boil								35.5	50.0	13.9		33.3	3.00	190	37.8	42	5/16/1972	9/2/1999
			Spring 1											7.74	7.74	2.50	34.0	7.23	24	10/23/2001	4/21/2005
			Spring 4											6.44	6.44	2.50	17.5	4.66	24	10/23/2001	4/21/2005
			Bubbling Spring											6.44	6.44	2.50	17.5	4.66	24	10/23/2001	4/21/2005
			Spring 6											6.44	6.44	2.50	17.5	4.66	24	10/23/2001	4/21/2005
	Hg-T	µg/L	Main Boil								0.375	0.129	0.144		0.211	0.00	0.500	0.187	38	5/18/1971	5/25/1995
	K-D	mg/L	Main Boil						0.100	0.178	0.187	0.158	0.197		0.179	0.00	1.00	0.160	64	5/2/1956	9/2/1999
			Spring 1											0.138	0.138	0.075	0.310	0.044	34	10/23/2001	4/30/2008
			Spring 4											0.138	0.138	0.075	0.190	0.027	34	10/23/2001	4/30/2008
			Bubbling Spring											0.181	0.181	0.140	0.230	0.024	33	10/23/2001	4/30/2008
			Spring 6											0.293	0.293	0.150	0.540	0.070	33	10/23/2001	4/30/2008
	K-T	mg/L	Spring 1											0.117	0.117	0.038	0.190	0.026	80	10/23/2001	4/30/2008
			Spring 4											0.126	0.126	0.055	0.190	0.027	74	10/23/2001	4/30/2008
			Bridge Seep											0.146	0.146	0.110	0.210	0.030	22	3/1/2004	12/6/2004
			Bubbling Spring											0.168	0.168	0.075	0.310	0.031	71	10/23/2001	4/30/2008
			Spring 6											0.280	0.280	0.140	0.360	0.054	71	10/23/2001	4/30/2008
			Spring Run (mid)											0.168	0.168	0.140	0.200	0.019	13	5/28/2003	11/1/2004
			Spring Run (SR 484)											0.204	0.204	0.180	0.280	0.040	10	3/1/2004	12/6/2004

TABLE 3 (CONTINUED)
Rainbow Springs water quality table for the period-of-record continued.

				Decade										POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record
METAL	Mg-D	mg/L	Main Boil						4.50	3.02	3.32	3.41	3.45		3.36	0.00	5.50	0.756	72	5/2/1956 9/2/1999
			Spring 1											3.67	3.67	2.90	4.20	0.251	34	10/23/2001 4/30/2008
			Spring 4											5.17	5.17	4.50	5.70	0.248	34	10/23/2001 4/30/2008
			Bubbling Spring											6.32	6.32	5.80	7.20	0.247	33	10/23/2001 4/30/2008
			Spring 6											6.60	6.60	4.90	7.50	0.691	33	10/23/2001 4/30/2008
	Mg-T	mg/L	Spring 1											3.55	3.55	0.050	4.00	0.460	80	10/23/2001 4/30/2008
			Spring 4											5.12	5.12	4.50	5.70	0.265	74	10/23/2001 4/30/2008
			Bridge Seep											3.28	3.28	3.10	3.80	0.189	22	3/1/2004 12/6/2004
			Bubbling Spring											6.33	6.33	5.50	6.90	0.275	71	10/23/2001 4/30/2008
			Spring 6											6.61	6.61	4.80	7.50	0.640	71	10/23/2001 4/30/2008
			Spring Run (mid)											5.25	5.25	5.10	5.50	0.133	13	5/28/2003 11/1/2004
			Spring Run (SR 484)											5.20	5.20	5.00	5.40	0.149	10	3/1/2004 12/6/2004
	Mn-T	µg/L	Main Boil								10.9	10.6	3.35		7.89	0.00	30.0	5.75	44	5/16/1972 9/2/1999
			Spring 1											0.234	0.234	0.125	0.250	0.042	24	10/23/2001 4/21/2005
			Spring 4											0.234	0.234	0.125	0.250	0.042	24	10/23/2001 4/21/2005
			Bubbling Spring											0.553	0.553	0.125	7.90	1.57	24	10/23/2001 4/21/2005
			Spring 6											0.234	0.234	0.125	0.250	0.042	24	10/23/2001 4/21/2005
	NA-D	mg/L	Main Boil						2.80	2.14	2.25	2.18	2.42		2.28	0.600	3.40	0.456	64	5/2/1956 9/2/1999
			Spring 1											2.60	2.60	2.00	3.30	0.304	34	10/23/2001 4/30/2008
			Spring 4											2.83	2.83	2.30	3.40	0.248	34	10/23/2001 4/30/2008
			Bubbling Spring											3.25	3.25	2.70	3.70	0.235	33	10/23/2001 4/30/2008
			Spring 6											3.90	3.90	2.78	4.60	0.505	33	10/23/2001 4/30/2008
	Na-T	%	Main Boil						5.00	5.78	6.93	6.68	7.17		6.73	2.00	11.0	1.53	62	5/2/1956 9/2/1999
	Na-T	mg/L	Spring 1											2.48	2.48	0.250	3.30	0.411	47	10/23/2001 10/24/2006
			Spring 4											2.77	2.77	2.20	3.40	0.237	41	10/23/2001 10/24/2006
			Bridge Seep											2.57	2.57	2.28	4.10	0.513	22	3/1/2004 12/6/2004
			Bubbling Spring											3.19	3.19	2.60	3.70	0.239	39	10/23/2001 10/24/2006
			Spring 6											3.86	3.86	2.78	4.60	0.398	39	10/23/2001 10/24/2006
			Spring Run (mid)											3.03	3.03	2.81	3.22	0.117	13	5/28/2003 11/1/2004
			Spring Run (SR 484)											3.24	3.24	3.09	3.60	0.197	10	3/1/2004 12/6/2004
	Ni-T	µg/L	Main Boil									1.20	1.07		1.10	1.00	2.00	0.288	23	5/14/1974 9/2/1999
			Spring 1											1.02	1.02	0.500	1.50	0.207	24	10/23/2001 4/21/2005
			Spring 4											1.02	1.02	0.500	1.50	0.207	24	10/23/2001 4/21/2005
			Bubbling Spring											1.02	1.02	0.500	1.50	0.207	24	10/23/2001 4/21/2005
			Spring 6											1.19	1.19	0.500	2.00	0.425	24	10/23/2001 4/21/2005
	Pb-T	µg/L	Main Boil								2.00	3.88	1.57		2.26	1.00	7.00	1.79	28	8/29/1972 9/2/1999
			Spring 1											1.97	1.97	0.013	2.50	1.02	24	10/23/2001 4/21/2005
			Spring 4											1.97	1.97	0.027	2.50	1.02	24	10/23/2001 4/21/2005
			Bubbling Spring											1.97	1.97	0.013	2.50	1.02	24	10/23/2001 4/21/2005
			Spring 6											1.97	1.97	0.013	2.50	1.02	24	10/23/2001 4/21/2005
	SAR	ratio	Main Boil						0.100	0.089	0.113	0.100	0.105		0.103	0.00	0.200	0.025	64	5/2/1956 9/2/1999
	Se-T	µg/L	Spring 1											3.63	3.63	2.00	7.50	1.09	24	10/23/2001 4/21/2005
			Spring 4											3.63	3.63	2.00	7.50	1.09	24	10/23/2001 4/21/2005
			Bubbling Spring											3.63	3.63	2.00	7.50	1.09	24	10/23/2001 4/21/2005
			Spring 6											3.63	3.63	2.00	7.50	1.09	24	10/23/2001 4/21/2005
	Sr-D	µg/L	Main Boil							60.0	88.7	94.2	79.3		86.6	0.00	400	64.3	55	5/17/1967 9/2/1999
			Spring 1											54.2	54.2	47.0	59.8	4.32	9	10/9/2002 4/21/2005
			Spring 4											87.0	87.0	81.0	96.2	5.12	9	10/9/2002 4/21/2005
			Bubbling Spring											165	165	153	176	9.15	9	10/9/2002 4/21/2005
			Spring 6											308	308	118	455	152	9	10/9/2002 4/21/2005
	Sr-T	µg/L	Spring 1											54.0	54.0	44.0	60.0	4.79	23	10/23/2001 4/21/2005
			Spring 4											88.1	88.1	81.0	98.4	5.89	23	10/23/2001 4/21/2005
			Bubbling Spring											165	165	153	189	11.9	23	10/23/2001 4/21/2005
			Spring 6											352	352	116	503	138	23	10/23/2001 4/21/2005
	Zn-T	µg/L	Main Boil								15.0				15.0	0.00	30.0	21.2	2	5/16/1972 8/29/1972
			Spring 1											2.53	2.53	1.00	6.10	1.55	24	10/23/2001 4/21/2005
			Spring 4											3.13	3.13	1.00	8.90	2.49	24	10/23/2001 4/21/2005
			Bubbling Spring											2.78	2.78	0.500	8.60	2.31	24	10/23/2001 4/21/2005
			Spring 6											2.78	2.78	1.00	7.80	2.04	24	10/23/2001 4/21/2005

TABLE 3 (CONTINUED)
Rainbow Springs water quality table for the period-of-record continued.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade 1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	POR Statistics Average	Min	Max	StDev	N	Period of Record	
NITROGEN	NH4-N	mg/L	Main Boil							0.003	0.021	0.025	0.017		0.020	0.00	0.110	0.016	65	9/19/1968	9/2/1999
			Spring 1											0.006	0.006	0.005	0.025	0.003	73	10/23/2001	4/30/2008
			Spring 4											0.007	0.007	0.005	0.034	0.005	73	10/23/2001	4/30/2008
			Bridge Seep											0.005	0.005	0.005	0.010	0.001	22	3/1/2004	12/6/2004
			Bubbling Spring											0.006	0.006	0.005	0.018	0.003	70	10/23/2001	4/30/2008
			Spring 6											0.005	0.005	0.005	0.011	0.001	70	10/23/2001	4/30/2008
			Spring Run (mid)											0.006	0.006	0.005	0.016	0.003	17	5/28/2003	1/9/2006
			Spring Run (SR 484)											0.015	0.015	0.010	0.022	0.006	10	3/1/2004	12/6/2004
	NO2-N	mg/L	Main Boil							0.005	0.008	0.011	0.010		0.009	0.00	0.060	0.008	69	7/29/1968	9/2/1999
	NO3-N	mg/L	Main Boil						0.040	0.180	0.252	0.310			0.235	0.00	0.630	0.140	47	5/2/1956	6/11/1987
	NOx-N	mg/L	Main Boil								0.226	0.463	0.704		0.482	0.010	1.10	0.294	53	9/17/1974	9/2/1999
			Spring 1											1.44	1.44	0.013	2.10	0.328	78	10/23/2001	4/30/2008
			Spring 4											1.55	1.55	1.30	1.90	0.181	73	10/23/2001	4/30/2008
			Bridge Seep											1.06	1.06	0.980	1.20	0.068	22	3/1/2004	12/6/2004
			Bubbling Spring											1.32	1.32	1.10	1.60	0.147	70	10/23/2001	4/30/2008
			Spring 6											1.10	1.10	0.880	1.50	0.118	70	10/23/2001	4/30/2008
			Spring Run (mid)											1.19	1.19	1.10	1.32	0.049	17	5/28/2003	1/9/2006
			Spring Run (SR 484)											1.06	1.06	0.980	1.20	0.088	10	3/1/2004	12/6/2004
	NOx-N-D	mg/L	Spring 1											1.54	1.54	1.10	2.10	0.315	33	10/23/2001	4/30/2008
			Spring 4											1.58	1.58	1.30	1.90	0.187	33	10/23/2001	4/30/2008
			Bubbling Spring											1.32	1.32	0.00	1.60	0.286	32	10/23/2001	4/30/2008
			Spring 6											1.14	1.14	0.880	1.40	0.131	32	10/23/2001	4/30/2008
	OrgN	mg/L	Main Boil							0.043	0.112	0.128	0.355		0.135	0.00	0.490	0.140	40	9/19/1968	4/26/1994
	TKN	mg/L	Main Boil								0.106	0.155	0.237		0.172	0.010	0.500	0.116	52	9/17/1974	9/2/1999
			Spring 1											0.040	0.040	0.030	0.110	0.017	80	10/23/2001	4/30/2008
			Spring 4											0.037	0.037	0.030	0.093	0.013	74	10/23/2001	4/30/2008
			Bridge Seep											0.034	0.034	0.030	0.070	0.012	22	3/1/2004	12/6/2004
			Bubbling Spring											0.036	0.036	0.030	0.083	0.010	71	10/23/2001	4/30/2008
			Spring 6											0.036	0.036	0.030	0.075	0.009	71	10/23/2001	4/30/2008
			Spring Run (mid)											0.039	0.039	0.030	0.140	0.029	17	5/28/2003	1/9/2006
			Spring Run (SR 484)											0.083	0.083	0.060	0.120	0.023	10	3/1/2004	12/6/2004
	TKN-D	mg/L	Spring 1											0.039	0.039	0.030	0.075	0.013	34	10/23/2001	4/30/2008
			Spring 4											0.036	0.036	0.030	0.060	0.009	34	10/23/2001	4/30/2008
			Bubbling Spring											0.041	0.041	0.00	0.120	0.022	33	10/23/2001	4/30/2008
			Spring 6											0.039	0.039	0.030	0.075	0.013	33	10/23/2001	4/30/2008
	TN	mg/L	Main Boil							0.350	0.363	0.496	1.06		0.462	0.190	1.50	0.256	41	9/19/1968	4/26/1994
OXYGEN DEMAND	BOD5	mg/L	Main Boil							0.300	0.296	0.280			0.294	0.00	1.20	0.272	31	5/16/1969	8/10/1983
			Spring 1											0.871	0.871	0.100	1.00	0.340	7	10/23/2001	10/17/2006
			Spring 4											0.100	0.100	0.100	0.100		1	10/23/2001	10/23/2001
			Bubbling Spring											0.100	0.100	0.100	0.100		1	10/23/2001	10/23/2001
			Spring 6											0.100	0.100	0.100	0.100		1	10/23/2001	10/23/2001
	cBOD5	mg/L	Spring 1											0.100	0.100	0.100	0.100		1	10/23/2001	10/23/2001
			Spring 4											0.100	0.100	0.100	0.100		1	10/23/2001	10/23/2001
			Bridge Seep											0.396	0.396	0.100	1.00	0.363	22	3/1/2004	12/6/2004
			Bubbling Spring											0.100	0.100	0.100	0.100		1	10/23/2001	10/23/2001
			Spring 6											0.100	0.100	0.100	0.100		1	10/23/2001	10/23/2001
			Spring Run (mid)										2.00	0.414	0.613	0.100	2.00	0.837	16	3/16/1998	11/1/2004
			Spring Run (SR 484)											0.386	0.386	0.200	0.760	0.208	10	3/1/2004	12/6/2004

TABLE 3 (CONTINUED)
Rainbow Springs water quality table for the period-of-record continued.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade											POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
PHOSPHORUS	OrthoP	mg/L	Main Boil							0.018	0.030	0.031	0.028		0.028	0.00	0.060	0.009	73	3/21/1963	9/2/1999
			Spring 1											0.028	0.028	0.022	0.034	0.003	55	10/23/2001	4/30/2008
			Spring 4											0.033	0.033	0.028	0.041	0.003	55	10/23/2001	4/30/2008
			Bridge Seep											0.030	0.030	0.030	0.031	0.0004	22	3/1/2004	12/6/2004
			Bubbling Spring											0.036	0.036	0.030	0.040	0.002	53	10/23/2001	4/30/2008
			Spring 6											0.028	0.028	0.022	0.036	0.003	53	10/23/2001	4/30/2008
			Spring Run (mid)											0.031	0.031	0.030	0.032	0.0009	13	5/28/2003	11/1/2004
			Spring Run (SR 484)											0.032	0.032	0.026	0.040	0.005	10	3/1/2004	12/6/2004
	PO4-T	mg/L as PO4	Main Boil							0.053	0.108				0.073	0.00	0.190	0.055	14	3/21/1963	9/17/1971
	TDP	mg/L	Spring 1											0.029	0.029	0.024	0.046	0.004	33	10/23/2001	4/30/2008
			Spring 4											0.033	0.033	0.028	0.041	0.003	33	10/23/2001	4/30/2008
			Bubbling Spring											0.037	0.037	0.030	0.047	0.004	32	10/23/2001	4/30/2008
			Spring 6											0.030	0.030	0.025	0.043	0.003	32	10/23/2001	4/30/2008
	TP	mg/L	Main Boil							0.022	0.033	0.044	0.035		0.036	0.010	0.110	0.017	70	7/29/1968	9/2/1999
			Spring 1											0.035	0.035	0.010	0.380	0.040	79	10/23/2001	4/30/2008
			Spring 4											0.113	0.113	0.029	2.50	0.383	73	10/23/2001	4/30/2008
			Bridge Seep											0.030	0.030	0.010	0.050	0.015	22	3/1/2004	12/6/2004
			Bubbling Spring											0.037	0.037	0.031	0.050	0.004	70	10/23/2001	4/30/2008
			Spring 6											0.030	0.030	0.025	0.043	0.003	70	10/23/2001	4/30/2008
			Spring Run (mid)											0.032	0.032	0.00	0.070	0.010	71	9/8/2002	3/23/2006
			Spring Run (SR 484)											0.043	0.043	0.00	0.080	0.017	50	9/8/2002	3/24/2006
PHYSICAL	Color	CPU	Main Boil						13.0	4.00	2.46	3.42	5.00		3.54	0.00	75.0	7.01	128	5/2/1956	9/2/1999
			Spring 1											1.57	1.57	0.00	10.0	2.51	27	10/23/2001	10/24/2006
			Spring 4											1.19	1.19	0.00	10.0	2.69	21	10/23/2001	10/24/2006
			Bridge Seep											2.73	2.73	2.50	5.00	0.736	22	3/1/2004	12/6/2004
			Bubbling Spring											1.25	1.25	0.00	10.0	2.75	20	10/23/2001	10/24/2006
			Spring 6											0.500	0.500	0.00	5.00	1.54	20	10/23/2001	10/24/2006
			Spring Run (mid)										5.00	3.55	3.69	0.00	10.0	2.03	21	3/16/1998	1/9/2006
			Spring Run (SR 484)											6.00	6.00	5.00	10.0	2.11	10	3/1/2004	12/6/2004
	Depth	m	Spring 1											3.15	3.15	2.00	4.30	0.708	14	10/23/2001	10/24/2006
			Spring 4											3.50	3.50	2.60	4.50	0.539	11	10/23/2001	10/24/2006
			Bridge Seep											1.88	1.88	1.00	3.00	0.433	26	3/1/2004	12/6/2004
			Bubbling Spring											0.955	0.955	0.700	1.30	0.185	11	10/23/2001	10/24/2006
			Spring 6											5.35	5.35	4.80	6.30	0.443	11	10/23/2001	10/24/2006
			Spring Run (mid)										1.50	1.67	1.64	0.200	5.40	1.15	23	3/16/1998	12/12/2006
			Spring Run (SR 484)											0.833	0.833	0.500	1.50	0.350	12	3/1/2004	12/15/2004
	ORP	mV	Spring 1											313	313	252	374	86.7	2	1/23/2002	4/15/2002
			Spring 4											317	317	257	378	85.4	2	1/23/2002	4/15/2002
			Bubbling Spring											329	329	267	390	86.7	2	1/23/2002	4/15/2002
			Spring 6											333	333	271	395	87.0	2	1/23/2002	4/15/2002

TABLE 3 (CONTINUED)
Rainbow Springs water quality table for the period-of-record continued.

				Decade											POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
PHYSICAL	pH	SU	Main Boil						7.40	7.42	7.99	7.96	7.73		7.84	5.80	9.00	0.564	138	5/2/1956	9/2/1999
			Spring 1											8.05	8.05	7.50	8.70	0.222	59	10/23/2001	4/30/2008
			Spring 4											7.58	7.58	7.30	8.18	0.172	55	10/23/2001	4/30/2008
			Bridge Seep											8.20	8.20	6.93	8.53	0.386	26	3/1/2004	12/6/2004
			Bubbling Spring											7.36	7.36	7.10	7.96	0.163	55	10/23/2001	4/30/2008
			Spring 6											7.49	7.49	7.20	7.75	0.160	55	10/23/2001	4/30/2008
			Spring Run (mid)										7.35	7.80	7.74	7.33	8.20	0.233	33	3/16/1998	12/12/2006
			Spring Run (SR 484)											7.81	7.81	7.66	8.10	0.208	12	3/1/2004	12/15/2004
	Secchi	m	Spring 1											3.05	3.05	1.90	4.30	0.836	36	10/23/2001	4/30/2008
			Spring 4											3.24	3.24	2.60	3.70	0.254	35	10/23/2001	4/30/2008
			Bridge Seep											1.74	1.74	0.200	3.00	0.626	26	3/1/2004	12/6/2004
			Bubbling Spring											0.977	0.977	0.300	2.20	0.306	35	10/23/2001	4/30/2008
			Spring 6											5.21	5.21	4.30	5.90	0.350	35	10/23/2001	4/30/2008
			Spring Run (mid)										1.50	1.72	1.69	0.00	5.40	1.23	25	3/16/1998	12/12/2006
			Spring Run (SR 484)											0.833	0.833	0.500	1.50	0.350	12	3/1/2004	12/15/2004
	SpCond	umhos/cm	Main Boil						253	150	132	143	150		144	60.0	328	40.3	202	5/2/1956	9/2/1999
			Spring 1											151	151	133	173	9.41	114	10/23/2001	4/30/2008
			Spring 4											253	253	160	276	12.8	110	10/23/2001	4/30/2008
			Bridge Seep											141	141	129	184	14.9	26	3/1/2004	12/6/2004
			Bubbling Spring											335	335	314	366	10.8	108	10/23/2001	4/30/2008
			Spring 6											324	324	234	369	29.2	111	10/23/2001	4/30/2008
			Spring Run (mid)										230	1,444	1,301	225	35,624	6,065	34	3/16/1998	12/12/2006
			Spring Run (SR 484)											263	263	258	269	3.89	12	3/1/2004	12/15/2004
	Turb	NTU	Main Boil							2.50	0.578	0.464			0.617	0.00	4.00	0.695	60	7/16/1969	7/31/1987
			Spring 1											0.091	0.091	0.025	0.600	0.077	61	10/23/2001	4/30/2008
			Spring 4											0.151	0.151	0.025	1.60	0.291	55	10/23/2001	4/30/2008
			Bridge Seep											0.159	0.159	0.050	0.400	0.100	22	3/1/2004	12/6/2004
			Bubbling Spring											0.103	0.103	0.025	0.300	0.062	53	10/23/2001	4/30/2008
			Spring 6											0.092	0.092	0.025	0.400	0.069	53	10/23/2001	4/30/2008
			Spring Run (mid)										0.200	0.214	0.213	0.100	1.00	0.199	21	3/16/1998	1/9/2006
			Spring Run (SR 484)											0.320	0.320	0.200	0.500	0.118	10	3/1/2004	12/6/2004
SOLID	TDS	mg/L	Main Boil						148	87.9	80.4	80.7	84.1		83.1	39.0	160	23.3	120	5/2/1956	9/2/1999
			Spring 1											81.7	81.7	2.50	102	13.3	61	10/23/2001	4/30/2008
			Spring 4											137	137	127	156	5.66	55	10/23/2001	4/30/2008
			Bridge Seep											80.7	80.7	70.0	97.0	7.73	22	3/1/2004	12/6/2004
			Bubbling Spring											182	182	155	200	8.80	53	10/23/2001	4/30/2008
			Spring 6											185	185	125	215	20.5	53	10/23/2001	4/30/2008
			Spring Run (mid)											146	146	135	164	6.87	13	5/28/2003	11/1/2004
			Spring Run (SR 484)											149	149	139	168	10.5	10	3/1/2004	12/6/2004
	TSS	mg/L	Spring 1											2.05	2.05	2.00	2.50	0.150	61	10/23/2001	4/30/2008
			Spring 4											2.07	2.07	2.00	4.00	0.378	55	10/23/2001	4/30/2008
			Bridge Seep											2.00	2.00	2.00	2.00	0.00	22	3/1/2004	12/6/2004
			Bubbling Spring											2.00	2.00	2.00	2.00	0.00	53	10/23/2001	4/30/2008
			Spring 6											2.00	2.00	2.00	2.00	0.00	53	10/23/2001	4/30/2008
			Spring Run (mid)										1.00	1.87	1.76	1.00	2.00	0.437	17	3/16/1998	11/1/2004
			Spring Run (SR 484)											4.00	4.00	4.00	4.00	0.00	10	3/1/2004	12/6/2004
TEMPERATURE	Air Temp	C	Main Boil									31.2			31.2	31.2	31.2		1	4/13/1989	4/13/1989
	Wtr Temp	C	Main Boil							23.4	23.2	23.2	23.2		23.3	20.0	25.5	0.635	178	11/9/1960	9/2/1999
			Spring 1											23.3	23.3	20.0	24.2	0.543	62	10/23/2001	4/30/2008
			Spring 4											23.1	23.1	20.2	23.8	0.535	58	10/23/2001	4/30/2008
			Bridge Seep											23.5	23.5	23.1	26.2	0.813	26	3/1/2004	12/6/2004
			Bubbling Spring											22.9	22.9	22.0	23.5	0.279	56	10/23/2001	4/30/2008
			Spring 6											23.5	23.5	22.2	26.0	0.604	60	10/23/2001	4/30/2008
			Spring Run (mid)										22.5	22.9	22.9	19.1	23.9	0.866	33	3/16/1998	12/12/2006
			Spring Run (SR 484)											22.1	22.1	19.0	23.7	1.64	12	3/1/2004	12/15/2004

Rainbow Springs has experienced a significant increase in nitrate concentrations over the past four decades (SWFWMD 2008). Nitrate concentrations (NO_3 as N) measured from the main pool during May 1974 were 0.16 mg/L (Rosenau *et al.* 1977). Recent nitrate concentrations at the Rainbow Springs complex are consistently above 1.6 mg/L, and on several occasions approaching 2.0 mg/L (SWFWMD 2008). Water samples (spring pool) collected by the SWFWMD Water Quality Monitoring Program from 1994 to 2008 illustrate this trend of increasing nitrate concentrations (**Figure 12**).

The source of nitrates delivered to the Rainbow Springs and River has been investigated by Jones *et al.* (1996) and inorganic fertilizer (via agricultural application) was implicated as the dominant source. Current sources of nitrate loading also include residential and golf course fertilizers as well as septic systems due to current land use (SWFWMD 2004). To date, SWFWMD monitoring has not detected any priority pollutants (*e.g.*, cyanide, mercury, heavy metals, pesticides, and volatile organic compounds) from spring vent samples (SWFWMD 2008).

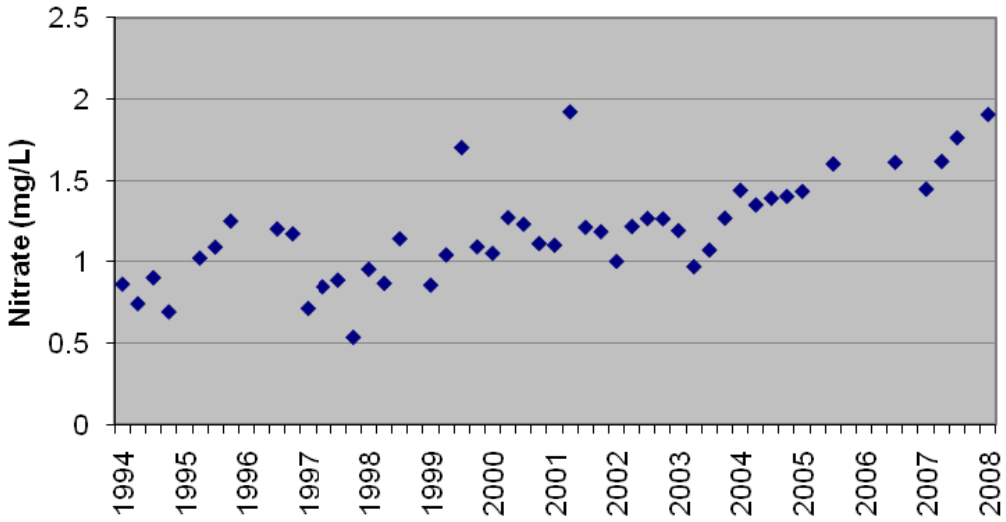


FIGURE 12
Rainbow Springs (RS#1) nitrate time series graph from 1994 to 2008 (from SWFWMD 2004).

During site reconnaissance of Rainbow Springs on the morning of August 13, 2008, field parameters were measured from the spring run starting at the State Park canoe launch and continuing downstream for approximately 3.5 km of the spring run (**Figure 13**). Temperature along the sampling path gradually increased with distance downstream and averaged about 23 ° C (**Figure 14**). Specific conductance was approximately 275 µS/cm along the spring run, with variation noted about certain spring vents (**Figure 14**). Dissolved oxygen concentrations increased with distance downstream to a maximum observed approximately 6 mg/L (70 % saturated, **Figure 14**). Field measured pH values from the spring run were about 7.5 standard units (**Figure 14**). Trends in field parameters along the spring run were masked due to the number of feeder springs, each with variable inputs.

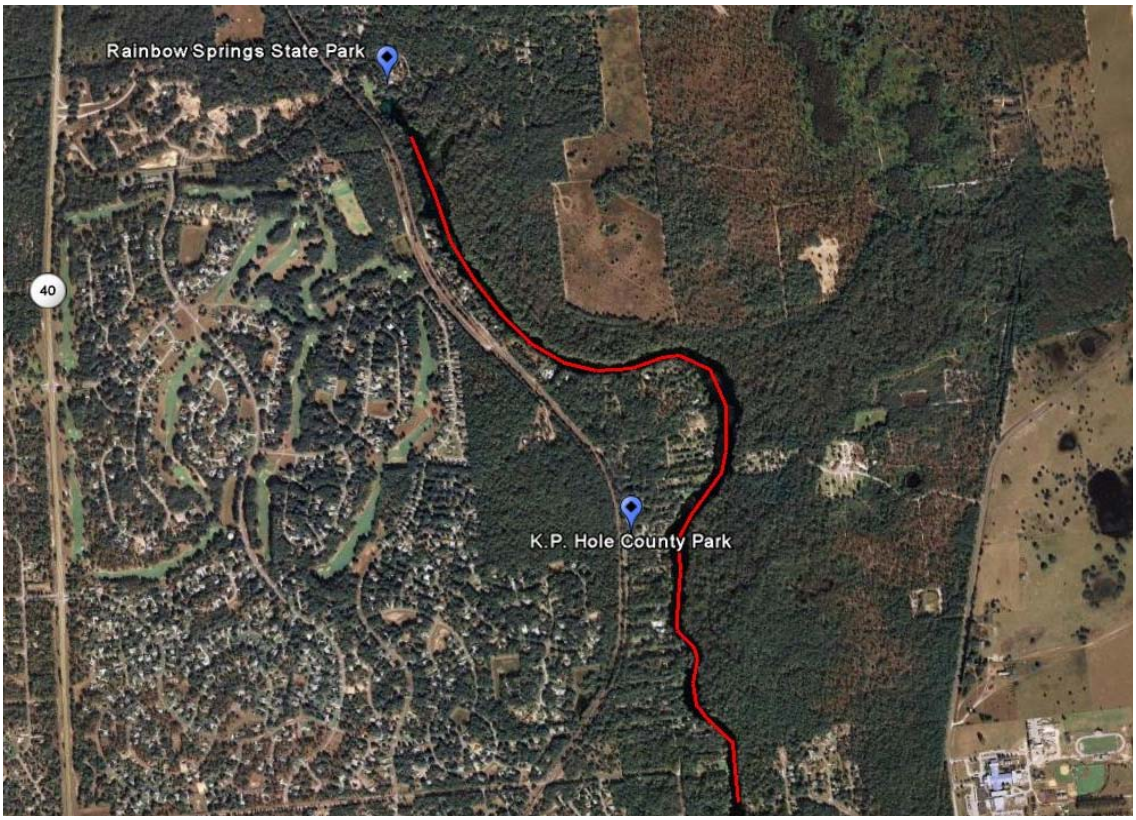


FIGURE 13
Image of Rainbow Springs with red path indicating the reconnaissance sampling locations on August 13, 2008.

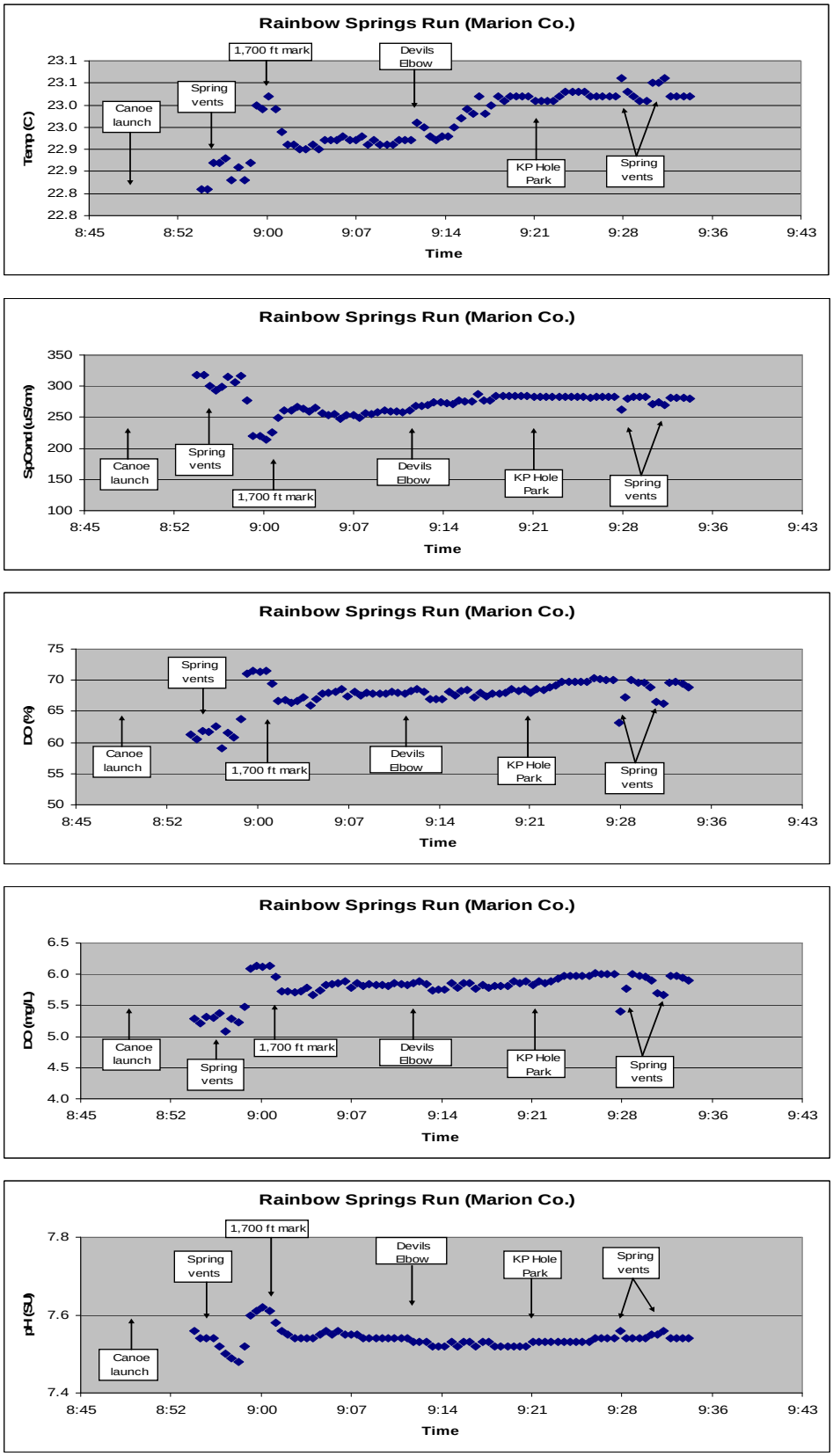


FIGURE 14
Field parameters measured at Rainbow Springs run on August 13, 2008.

Biological

Vegetation

During a reconnaissance trip made on August 13, 2008, the submersed aquatic vegetation (SAV) of the spring pool and upper 1.5 km (0.9 mi) of the spring run were qualitatively noted. Within the Rainbow Springs pool, SAV was confined to areas outside of the designated swimming zone, with strap-leaved sagittaria (*Sagittaria kurziana*) and Illinois pondweed (*Potamogeton illinoensis*) being the most common. Similarly, SAV was excluded in portions of the spring run, especially just below the aquatic preserve sign (1,700 m downstream), where recreational boats commonly anchor and in areas with rocky substrate. The percent area coverage of submersed aquatic vegetation was approximately 80 % in the upper 3.5 km (2.2 mi) of the spring run. SAV species in the spring run from most to least common were: strap-leaved sagittaria (*Sagittaria kurziana*), Illinois pondweed (*Potamogeton illinoensis*), tape grass (*Vallisneria americana*), bladderwort (*Utricularia sp.*), red ludwigia (*Ludwigia repens*), hydrilla (*Hydrilla verticillata*), and coontail (*Ceratophyllum demersum*). Hydrilla gradually becomes more common with distance downstream in this system. Benthic algae were observed growing on some sediments as well as small clumps of floating filamentous algae, but neither type of algae was abundant in the upper spring run. In the spring pool and upper spring run, emergent aquatic plants are common, with Egyptian paspalidium (*Paspalidium geminatum*) being the dominant species in these areas.

Rainbow River (downstream to Dunnellon) has been surveyed for submersed aquatic vegetation (SAV) in 1991, 1996, 2000, and 2005. For the 2005 survey, the primary objectives were to produce a GIS map of emergent and submerged aquatic vegetation and to conduct an analysis of change in SAV coverage relative to previous surveys (SWFWMD 2007). The project resulted in thorough and detailed distribution maps of SAV by species.

Findings from the 2005 SAV survey identified strap-leaved sagittaria, hydrilla, and tape grass as the three most common species in the Rainbow River (as well as for all mapping efforts in the previous 20 years); while coontail, southern naiad (*Najas guadalupensis*), and musk grass (*Chara sp*.) were observed to vary between the fourth and fifth most abundant species (SWFWMD 2007). The percent coverage of the most common SAV species, strap-leaved sagittaria, appears to have remained relatively constant during the 1996 to 2005 time period (0.3% change); while the other common species have all slightly increased coverage: hydrilla (2.6%), tape grass (1.6%), and southern naiad (1.6%, **Table 4**). The areas of bare substrate in the Rainbow River were also noted, and between the 1996 to 2005 time periods there was a decrease in bare substrate (2.9%, **Table 4**). In addition, other important landmarks along the Rainbow River during the 2005 sampling were noted: there were 238 docks on the river, 87 spring vents of varying size were identified, and of the 21.6 km (13.4 ac) of shoreline mapped, 18% was classified as hardened (SWFWMD 2007). Vegetation maps of the upper kilometer of the Rainbow Springs and River for 2005 for the four most common and the seven less common SAV species (as well as emergent vegetation and bare zones) are presented in **Figures 15** and **16**, respectively (from SWFWMD 2007). The SWFWMD (2007) vegetation report also contains detailed SAV maps for the Rainbow River (to Dunnellon) for each of the surveyed time periods as well as detailed change analyses and discussions by species between the 1996, 2000, and 2005 time periods.

Non-indigenous aquatic plants (primarily hydrilla) in Rainbow River have been managed by the state through a variety of herbicide applications. During the 2006-2007 fiscal period, 7.3 ha (18 ac) of floating aquatic plants and 17 ha (42 ac) of hydrilla were treated (FDEP 2007a). Based on the SAV mapping and change analyses completed through 2005, the SAV community

within the Rainbow River appears to be relatively stable and suggests that current management techniques are sufficient in controlling hydrilla abundance (SWFWMD 2008). The effort of FDEP personnel to reduce the abundance of hydrilla within the pool and upper spring run of Rainbow Springs appears to have been especially successful.

During April 4, and November 12, 2003 the filamentous algae community of Rainbow Springs was surveyed by Stevenson *et al.* (2007) who concluded that elevated nutrient concentrations were contributing to the abundance of filamentous algae observed. At the headsprings area, filamentous algae coverage was 40.7% with a thickness of 3.4 cm (1.3 in) in April and coverage was 24.7% with a thickness of 6.1 cm (2.4 in) in November. The average algal species percent cover during these sampling periods was 19.8% *Lyngbya sp.*, 8% diatoms, and 6.8% *Aphanothece sp*. (the tiny, ball-like structures observable in the swim area).

TABLE 4
The percent cover of SAV species and bare substrate in the Rainbow River during 1996, 2000, and 2005 surveys (from SWFWMD 2007).

SUBMERGED VEGETATION	1996 Percent Cover	2000 Percent Cover	2005 Percent Cover	96-'00 Change in % Cover	00-'05 Change in % Cover	96-'05 Change in % Cover
Ceratophyllum demersum	1.9%	1.1%	2.0%	-0.8%	0.9%	0.1%
Chara sp.	1.0%	1.5%	0.7%	0.5%	-0.8%	-0.3%
Hydrilla verticillata	16.2%	17.5%	18.8%	1.3%	1.3%	2.6%
Ludwigia repens	0.04%	0.05%	0.18%	0.01%	0.14%	0.14%
Myriophyllum sp.	0.01%	0.01%	0.01%	0.01%	-0.01%	0.00%
Najas quadalupensis	1.8%	0.7%	3.4%	-1.1%	2.7%	1.6%
Nasturtium sp.	0.002%	0%	0.01%	-0.002%	0%	0.00%
Potamogeton illinoensis	0.4%	0.5%	0.5%	0.1%	0.0%	0.1%
Sagittaria kurziana	35.7%	34.9%	35.4%	-0.8%	0.5%	-0.3%
Utricularia sp.	0.7%	0.1%	0.9%	-0.6%	0.8%	0.2%
Vallisneria americana	4.3%	4.1%	5.9%	-0.2%	1.8%	1.6%
Total bare substrate	7.6%	11.3%	4.7%	3.7%	-6.6%	-2.9%

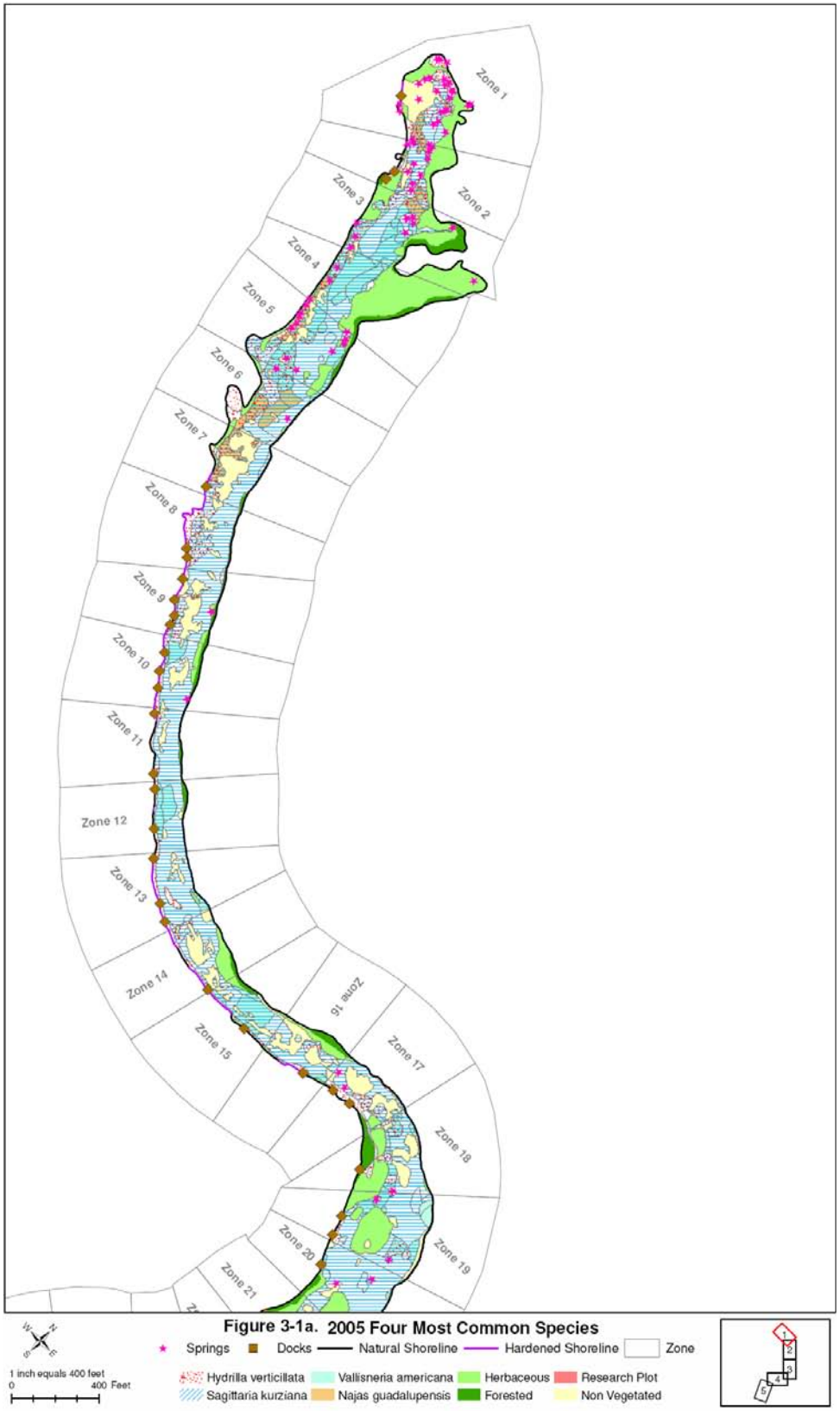


FIGURE 15
Map of 2005 vegetation for the four most common submersed species as well as emergent vegetation and bare zones (from SWFWMD 2007).

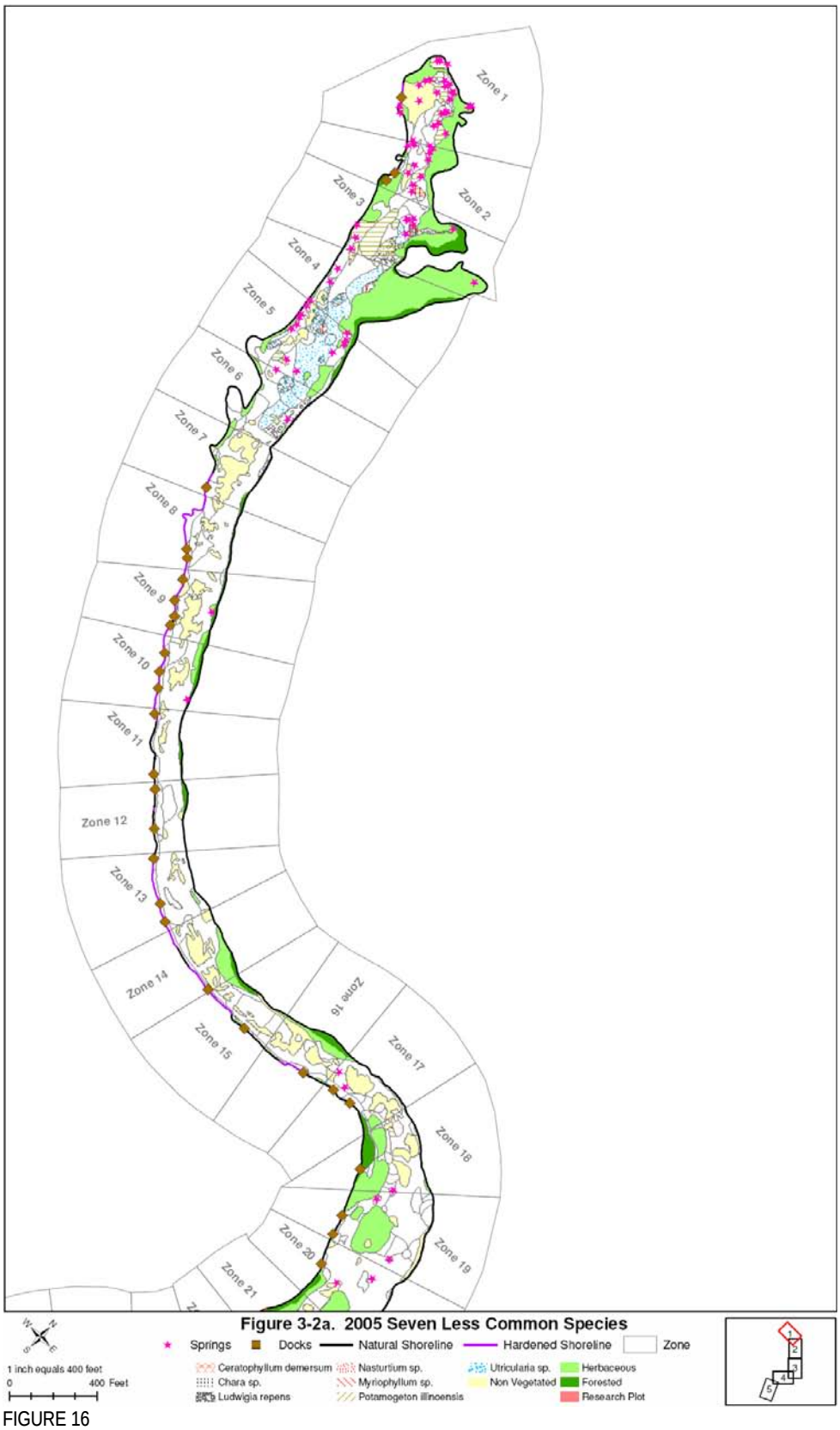


FIGURE 16
Map of 2005 vegetation for the seven less common submersed species as well as emergent vegetation and bare zones (from SWFWMD 2007).

Sediments

The sediments of Rainbow River have been characterized in terms of their importance to aquatic vegetation and nutrient cycling. Two comprehensive studies have been completed, the first conducted in 1990 by Water and Air Research (1991) focused on detecting heavy metals and organic toxins associated with the discharge of treated waste water effluent. The results of the study indicated that previous discharges by waste water treatment plants did not appear to have contributed to the deposition of heavy metals within the sediments and that the concentrations of all the organic toxins analyzed were below laboratory detection limits (Water and Air Research 1991).

The second investigation of Rainbow River sediments was completed in 2007 with the goal of delineating the type and distribution of the sediments within the Rainbow River (GARI 2007). Sediment types, sediment distribution, sources of sediment, and sediment biological communities were examined through the collection of 130 sediment cores along the river from the headspring complex to the confluence with the Withlacoochee River (**Figure 17**). Findings determined that Rainbow River was dominated by medium to fine sands although sediments in the lower portion of the river were nutrient enriched by phosphate containing soils and organic debris (GARI 2007). Organic and phosphorus enriched sediments may be correlated with the presence of hydrilla, both of which appear to increase in the lower Rainbow River (SWFWMD 2008).

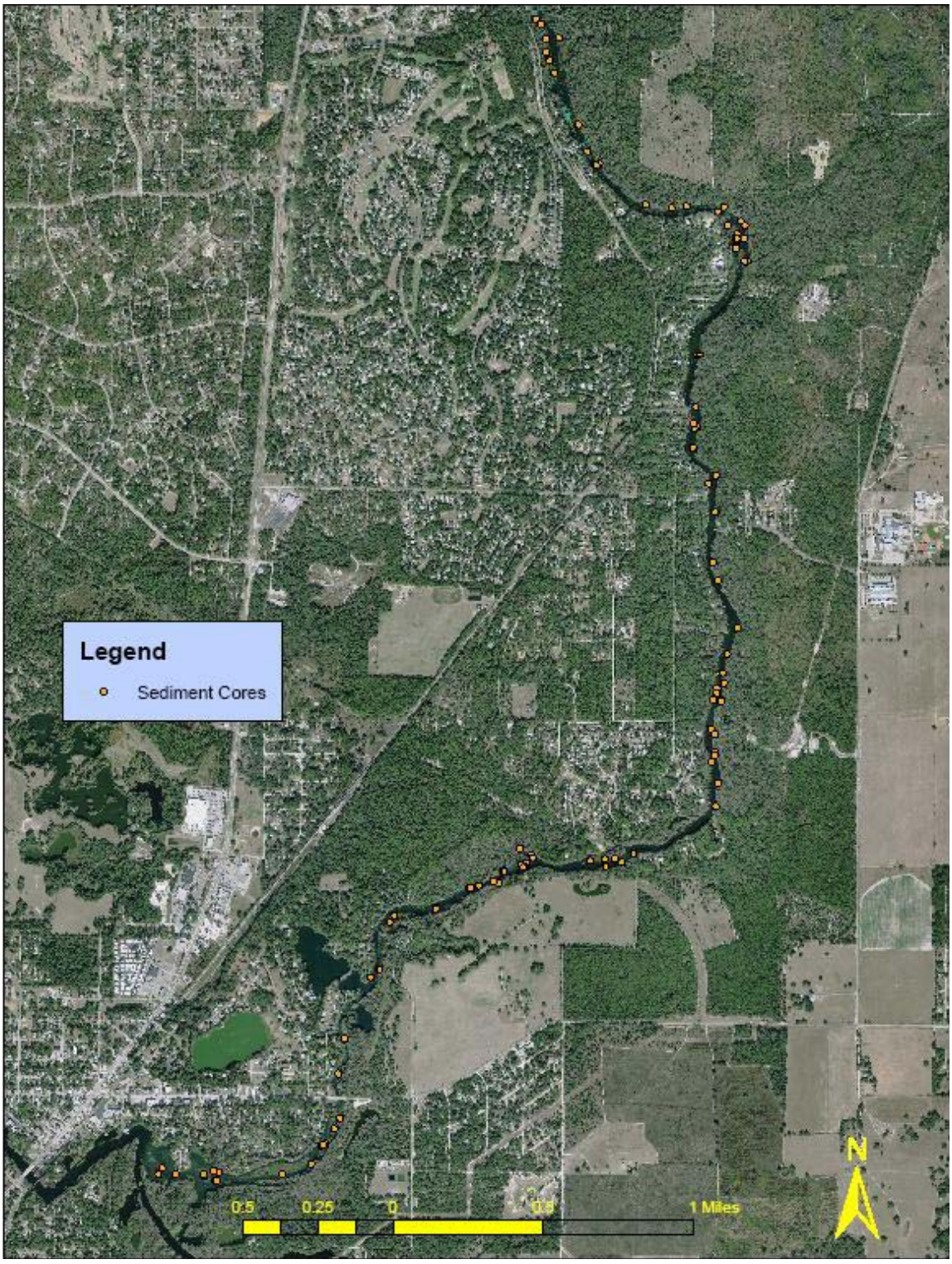


FIGURE 17
Map of benthic core locations used to characterize the sediments of Rainbow River (from SWFWMD 2008).

Macroinvertebrates

Several of the major springs surrounding the pool area were sampled for crustaceans on June 6, 2002 by staff from the Florida Museum of Natural History (Franz 2002). Crustaceans collected were the freshwater shrimp (*Palaemonetes paludosa*), amphipods (*Hyalella sp*.), and crayfish (*Procambarus fallax*). Other crayfish species which have been documented for Marion County, and therefore may inhabit the Rainbow Springs system, include: *Procambarus franzi, P. geodytes, P. lucifugus, P. paeninsulanus,* and *Troglocambarus maclanei* (Franz 2002).

Walsh and Williams (2003) surveyed mussels in the upper spring run (above KP Hole Park) at four locations, resulting in two species: an unidentified spike mussel (*Elliptio sp*.; 78%) and Florida pondhorn (*Uniomerus carolinianus*; 22 %). In the sampled locations, no specimens of the non-indigenous Asian clam (*Corbicula fluminea*) were observed or collected (Walsh and Williams 2003).

During the 2007 sediment survey of Rainbow River, mollusks collected in benthic cores were reported (GARI 2007). Seven species/types of mollusk were encountered from core samples (**Table 5**), with their relative abundance from most to least common being: quilted melania (*Tarebia granifera)*, banded mystery snail (*Viviparus georgianus)*, an unidentified spike (*Elliptio sp*.), Asian clam (*Corbicula fluminea)*, Mesa rams horn (*Planorbella scalaris)*, rams horn snails (Planorbidae), and apple snails (*Pomacea sp*.).

TABLE 5
The frequency of occurrence of mollusks collected from Rainbow River sediment cores during 2007 (from GARI 2007).

Rank Order*	Species	common name	status	cores context
1	*Tarebia granifera*	quilted melania	non-indigenous	multiple, sandy, rocky, detrital, grassy
2	*Viviparus georgianus*	banded mystery snail	native	multiple, sandy, detrital, grassy
3	*Elliptio sp.*	unidentified spike	native	multiple, sandy, rocky, detrital
4	*Corbicula fluminea*	Asian clam	non-indigenous	multiple, grassy, detrital
5	*Planorbella scalaris*	Mesa Rams-horn	native	multiple, grassy, detrital
6	*Planorbidae*	rams horn snails	native	multiple, grassy, detrital
7	*Pomacea sp.*	apple snails	native	multiple, grassy, detrital

** Rank order denotes frequency of occurrence from all cores, where 1 is the most common and 7 is the least common.*

There have been twelve assessments of the Rainbow Springs macroinvertebrate community (*i.e., EcoSummary*, FDEP 2000, 2001a, 2001b, 2002a, 2002b, 2003a, 2003b, 2004a, 2004b, 2005a, 2007b, and 2007c). The Rainbow River monitoring site is a 100 meter stretch located in the spring run, which begins approximately 100 meters south of the headspring. Over these sampling events, the habitat assessments were consistently in the optimal range, the total number of taxa collected ranged from 16 to 34, and the number of sensitive taxa ranged from one to 5 (**Figure 18**, FDEP 2008). Stream condition index (SCI) values greater than 21 were considered healthy, but after re-calibration in June 2004, values greater than 34 were rated as healthy. SCI values are typically rated as healthy in the system (**Figure 18**, FDEP 2008).

Macro fauna

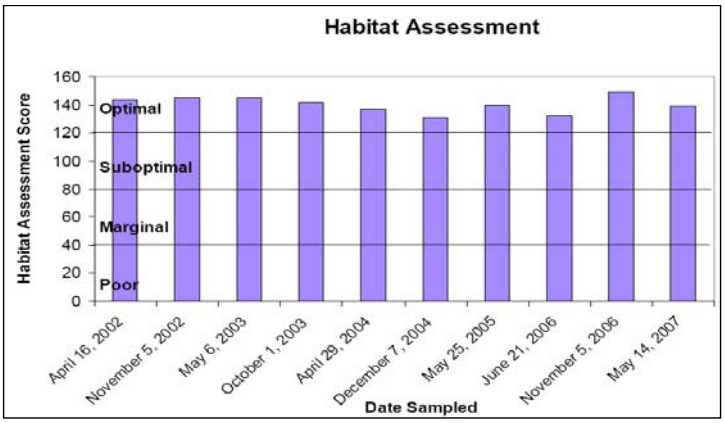
The aquatic turtle community of the Rainbow River is diverse, relatively abundant, and has a history of study including: Marchand 1942, 1945a, 1945b who provided observations of conditions in the early 1940s, Iverson (1977) for geographic variation of loggerhead musk turtles (*Sternotherus minor*), and Giovanetto (1992) who focused on the headsprings area. For one of the more common species, loggerhead musk turtles, the growth rates and age distributions of 482 individuals collected between 1990 and 1992 were reported by Onorata (1996). Results indicated that loggerhead musk turtles of five years age or less comprised approximately 65% of the population and that some of these turtles reach ages of 21 or more years Onorata (1996).

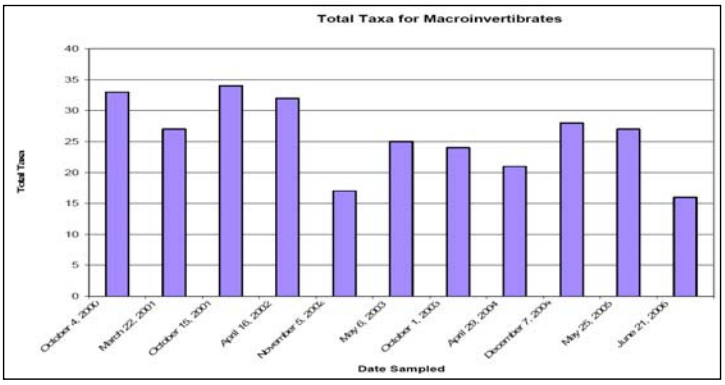
The most comprehensive study of Rainbow River turtles, with data spanning 1990 to 2003 has been conducted by Huestis and Meylan (2004, research continues to-date). Over this time period, 8 species of aquatic turtles have been collected, from most common to least: loggerhead musk turtle (*Sternotherus minor*), eastern river cooter (*Pseudemys concinna)*, Florida cooter (*Pseudemys floridana)*, common musk turtle (*Sternotherus odoratus)*, Florida red-bellied cooter

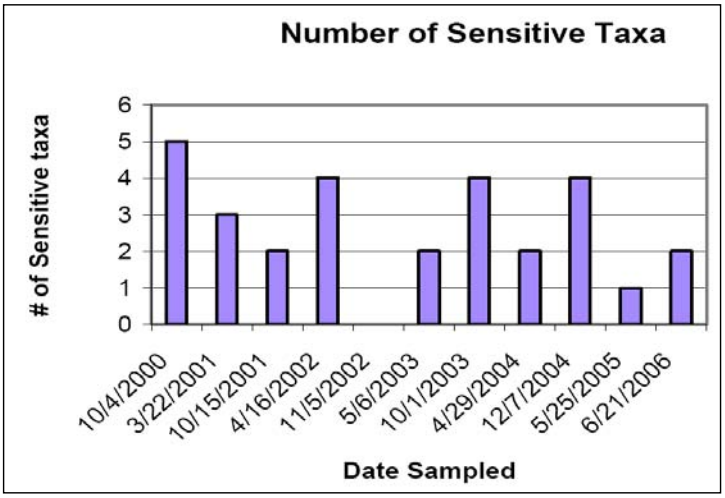
(*Pseudemys nelsoni)*, Florida softshell turtle (*Apalone ferox)*, striped mud turtle (*Kinosternon baurii)*, and chicken turtle (*Deirochelys reticularia*). Huestis and Meylan (2004) reported that there appeared to be a major shift towards smaller species (*e.g.*, musk turtles, **Figure 19**) in comparison to a survey made six decades earlier by Marchand (1942). Particular detail is given to the *Pseudemys sp*. as population estimates, growth rates, sexual dimorphism are described for this group of herbivorous basking turtles (Huestis and Meylan 2004).

During the August 2008 reconnaissance of Rainbow Springs, fish commonly observed included largemouth bass (*Micropterus salmoides*), several species of sunfish (*Lepomis*), and lake chubsucker (*Erimyzon sucetta*), less commonly observed were long nose gar (*Lepisosteus osseus*) and Atlantic Needlefish (*Strongylura marina*). While not observed during that trip, the non-indigenous sailfin catfish (*Pterygoplichthys disjunctivus*) has been observed and collected in limited numbers by park staff.

Rainbow Springs has been sampled for fish by Walsh and Williams (2003); and these researchers also summarized the Florida Museum of Natural History (FLMNH) fish collections. Based on their review of museum data, a total of 19 species of 15 genera and 7 families of fishes had previously been collected. Utilizing electrofishing techniques, Walsh and Williams (2003) collected a total of 20 species of 16 genera and 10 families from the upper spring run area. Electrofishing results of the most common families in descending order of relative abundance were: Poeciliidae (3 species; 39.4%), Centrarchidae (5 species; 24.3%), Fundulidae (2 species; 13.8%), Atherinopsidae (2 species; 8.2%), and Cyprinidae (2 species; 7.7%). Walsh and Williams (2003) noted that fish biomass was dominated by centrarchids and relatively few specimens of lake chubsucker and gizzard shad. A listing of fish species for Rainbow Springs is provided Table 6 (from Walsh and Williams 2003).







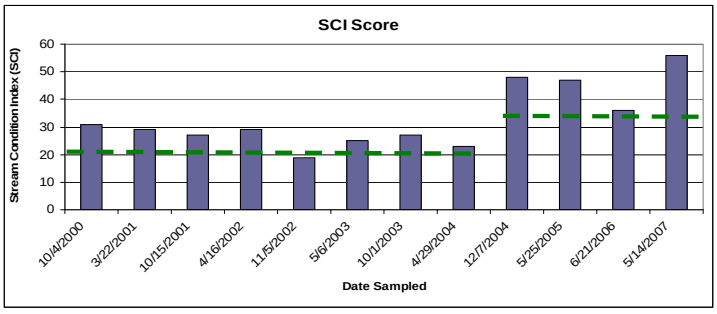


FIGURE 18
Rainbow Springs habitat assessment, total number of macroinvertebrate taxa, number of sensitive invertebrate taxa, and stream condition index (SCI) values (from FDEP 2008).

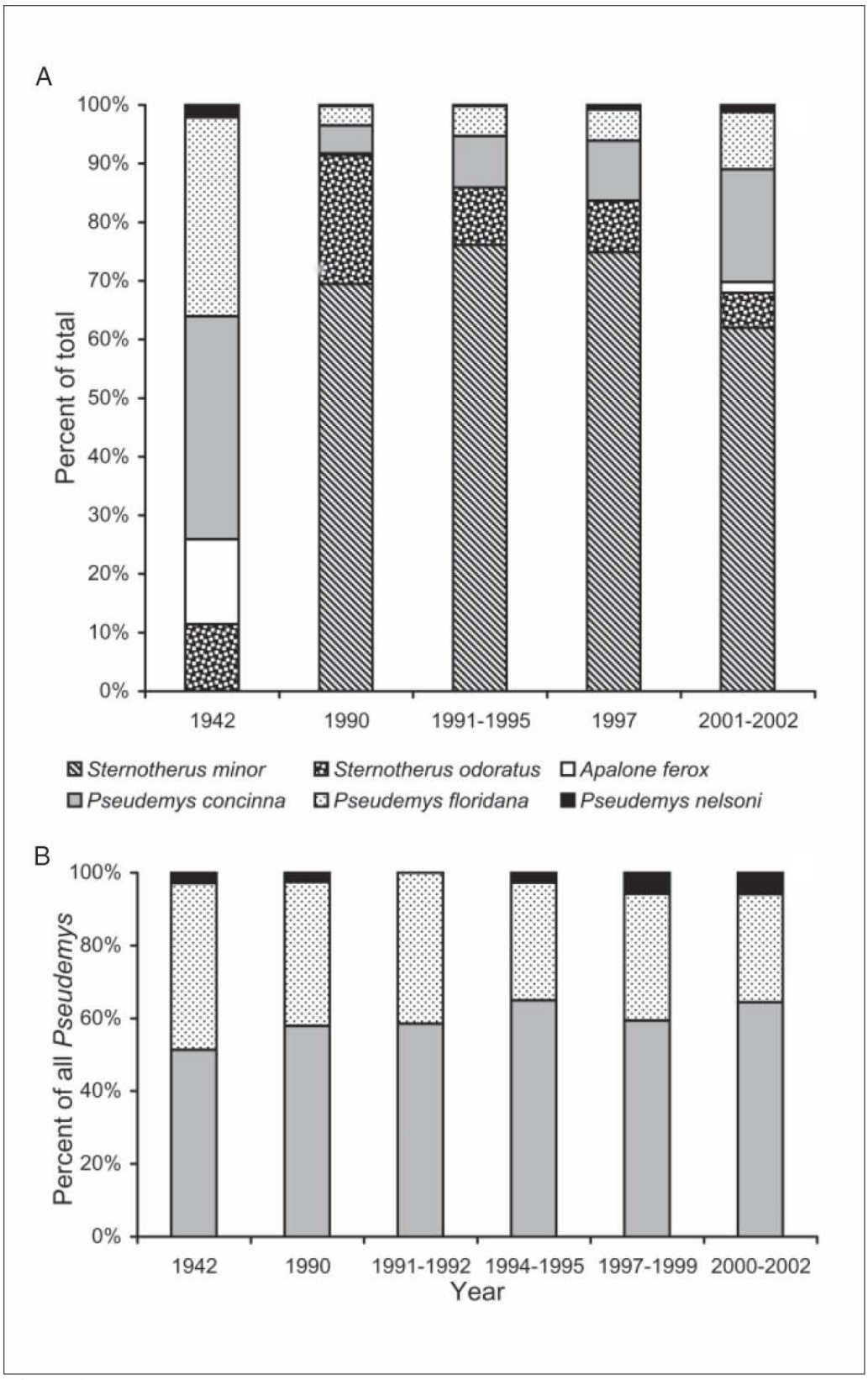


FIGURE 19
Community structure of turtles in Rainbow River, with relative abundance of all turtle species (A) and only Pseudemys sp. (B), rare species not shown (from Huestis and Meylan 2004).

TABLE 6
Fishes collected in Rainbow Springs State Park (number of specimens and relative abundance), and material in the FLMNH ichthyologic collection, including historical specimens from the spring run (number of specimens and percent of material), (from (Walsh and Williams 2003).

Family	Species	USGS		FLMNH Material	
		N	Relative Abundance (%)	Specimens	%
Lepisosteidae	*Lepisosteus platyrhincus*	2	0.5	---	---
Amiidae	*Amia calva*	1	0.3	---	---
Clupeidae	*Dorosoma cepedianum*	10	2.6	---	---
Cyprinidae	*Notemigonus chrysoleucas*	---	---	2	0.3
	Notropis harperi	24	6.1	334	43.3
	Notropis petersoni	6	1.5	6	0.8
Catostomidae	*Erimyzon sucetta*	11	2.8	---	---
Ictaluridae	*Ameiurus natalis*	1	0.3	1	0.1
	Noturus gyrinus	1	0.3	2	0.3
Atherinopsidae	*Labidesthes sicculus*	25	6.4	48	6.2
	Menidia beryllina	7	1.8	26	3.4
Fundulidae	*Fundulus seminolis*	25	6.4	15	1.9
	Jordanella floridae	---	---	1	0.1
	Lucania goodei	29	7.4	208	27.0
Poeciliidae	*Gambusia holbrooki*	115	29.4	18	2.3
	Heterandria formosa	19	4.9	15	1.9
	Poecilia latipinna	20	5.1	36	4.7
Centrarchidae	*Lepomis auritus*	20	5.1	11	1.4
	Lepomis macrochirus	17	4.3	3	0.4
	Lepomis microlophus	2	0.5	1	0.1
	Lepomis punctatus	31	7.9	14	1.8
	Micropterus salmoides	25	6.4	21	2.7
Elassomatidae	*Elassoma okefenokee*	---	---	9	1.2
	Total number of species	**20**		**19**	
	Total number of specimens	**391**		**771**	

Manatees

Although manatee fossils have been recovered from the Withlacoochee River and Rainbow Springs (Laist and Reynolds 2005), the utilization of Rainbow Springs and Rainbow River by manatees is precluded due to downstream barriers on the Withlacoochee River which prevent access. The Withlacoochee River was dammed in the 1920's to provide electric power; and as part of the Cross Florida Barge Canal project, a lock, dam, and bypass facilities were constructed in the town of Inglis during the 1960's and subsequently abandoned in the 1970's (FDEP 2005b). The lock is currently not functional and has not been operational since 1999, eliminating manatee access to the Rainbow River (FDEP 2005b).

A single modern report of a manatee occurrence in the Rainbow River has been reported from December 1976 (Powell and Rathbun 1984, Beeler and O'Shea 1988); presumably this manatee would have traveled through the Inglis lock on the Withlacoochee River to access Lake Rousseau and then Rainbow River. There has been one known manatee mortality at the Inglis lock on July 8, 1986 (Taylor 2006, from FWC manatee mortality database).

Ecosystem Functions

Based on field parameters (temperature, conductance, dissolved oxygen, and pH) measured in the spring pool and spring run during the reconnaissance trip of August 13, 2008, this spring is suitable for measuring ecosystem metabolism based on changes in dissolved oxygen following discharge from the spring vent. The FDEP deployed recording data sondes during August 10 to 24, 2004 at two stations (headsprings and state park sign at 1,700 m). These data revealed diel oxygen curve patterns, however a lack of ancillary data (*e.g.*, spring discharge, water depth, plant depth, and light availability) prevent the accurate usage of these data to calculate primary production rates.

A historic primary productivity estimate of Rainbow Springs was made about 2.1 km downstream of the pool during the summer of 1955 (Odum 1957). Results of that study, indicated gross primary production to be 23.9 g $O_2/m^2/d$. Although a relatively high production value, it was consistent with other spring systems given the amount of available light (Odum 1957).

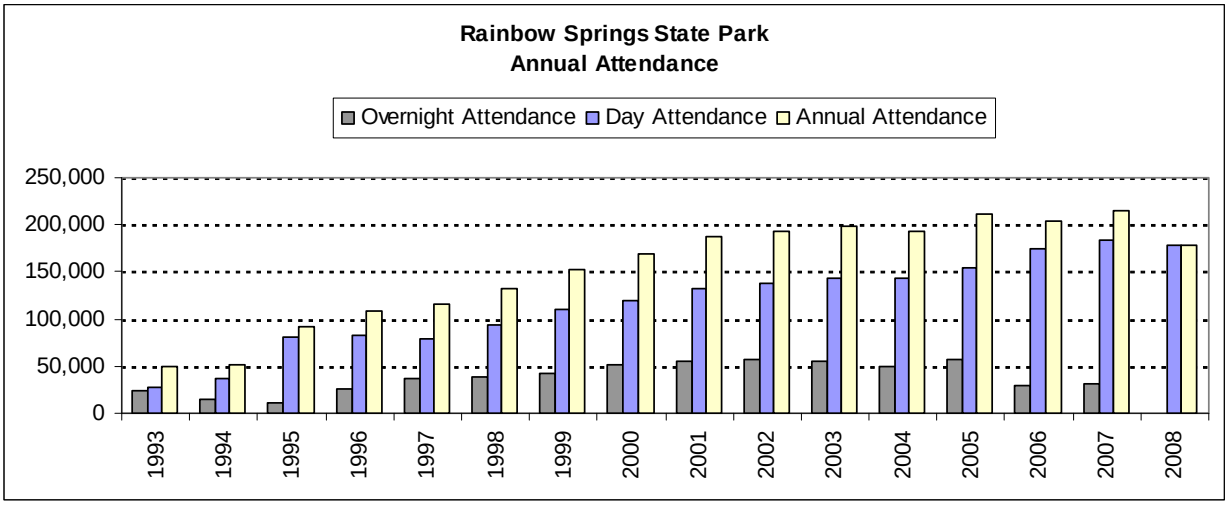
Human-Use Attendance and Activities

Recreational activities at Rainbow Springs include swimming, tubing, canoeing and kayaking, picnicking, and camping. As a state park, complete annual statistics of human attendance are available between 1993 and 2008. Peak total annual attendance occurred in 2007 (slightly more than 215 thousand people) and peak season use occurs in summer months (**Figure 20**).

Rainbow River is also utilized for recreation through the KP Hole Park (Marion Co.) as a tube, canoe and kayak rental site as well as a boat launch point. Recreational boating is popular along the river, and a Marion County ordinance (No. 88-7) has established an idle speed zone along its entire length (SWFWMD 2004).

Minimum Flows and Levels

The SWFWMD is currently in the process of establishing a minimum flow for the Rainbow River with plans for adoption sometime in 2009 (SWFWMD 2008).



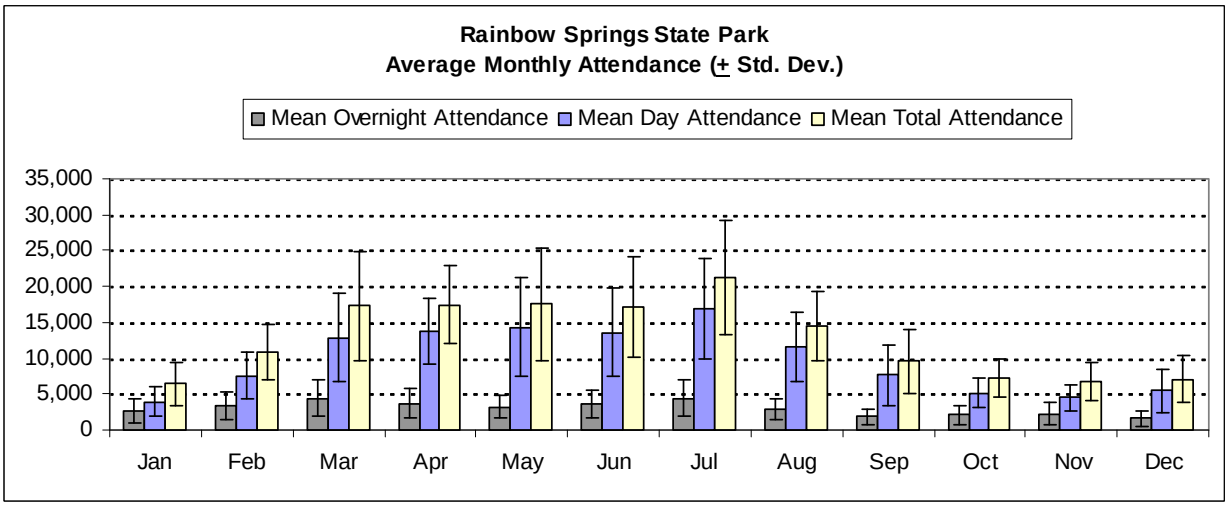


FIGURE 20
Rainbow Springs State Park annual and monthly attendance data.

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Appendix W

Summary of data for Silver Springs



Summary of Existing Data - Silver Springs (Marion Co.)

Prepared by

Wetland Solutions, Inc.

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Table 6 Mean primary producer biomass and biomass by area in Silver Springs as dry weight (DW) and ash-free dry weight (AFDW, from Quinlan *et al.* 2008).

Table 7 Mussels collected in Silver River State Park and the Ocklawaha River at the mouth of the Silver River (from Walsh and Williams 2003).

Table 8 Fishes collected or observed in Silver Springs State Park (Walsh and Williams, 2003), deposited in the Florida Museum of Natural History (FLMNH), and reported (x) by Hubbs and Allen (1943), from Phelps *et al*. (2006).

Table 9 Comparison of biomass estimates (kg live weight/ha) of fishes in the Silver River based on results of visual surveys from Odum (1957), Knight (1980), and Munch *et al.* (2006).

Table 10 Species of birds and reptiles observed (indicated by "+") utilizing the spring run of Silver River, studies by Odum (1957) and Munch *et al*. (2006).

Table 11 Comparison of Silver Springs gross primary productivity estimates (from Munch *et al.* 2006).

Summary of Existing Springs Data

This report summarizes physical, chemical, and biological data for Silver Springs (Marion County). These data were collected from sources such as the St. Johns River Water Management District (SJRWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Silver Springs

Physical address

Silver Springs Nature Park; 5656 E. Silver Springs Blvd.; Silver Springs, FL 34488; Phone: 352-236-2121; latitude/longitude: 29.216012°, -82.052861°. The lands surrounding the Silver Springs Group are developed as a theme park, operated by Palace Entertainment (Newport Beach, CA); theme park website: http://www.silversprings.com/ .

The uplands surrounding the springs are managed as the Silver Springs attraction under lease from the Trustees of the Internal Improvement Trust Fund to Alpha Smart Parks, Incorporated (FDEP 2002a). The spring run (Silver River) is bordered by public lands and includes the Silver River State Park. Silver River State Park; 1425 NE 58th Avenue; Ocala, Florida 34470; Phone: 352-236-7148; latitude/ longitude: 29.201022°, -82.053420°; park website: http://www.floridastateparks.org/Silverriver/ .

Driving Directions

The Silver Springs theme park is located just east of Ocala on S.R. 40. Take exit 352 east from I-75 or exit 268 west from I-95 (**Figure 1**). To access the springs by water, boats can be launched at the boat ramp on SR 40 at the west end of the bridge over the

Ocklawaha River, then go upstream on the Silver River to the springs. Silver River State Park Silver River State Park is located east of Ocala, 0.6 km (1 mi) south of S.R. 40 on S.R. 35. From Interstate 75, take exit 352 onto SR 40 east, about 14.5 km (9 mi) to SR 35.

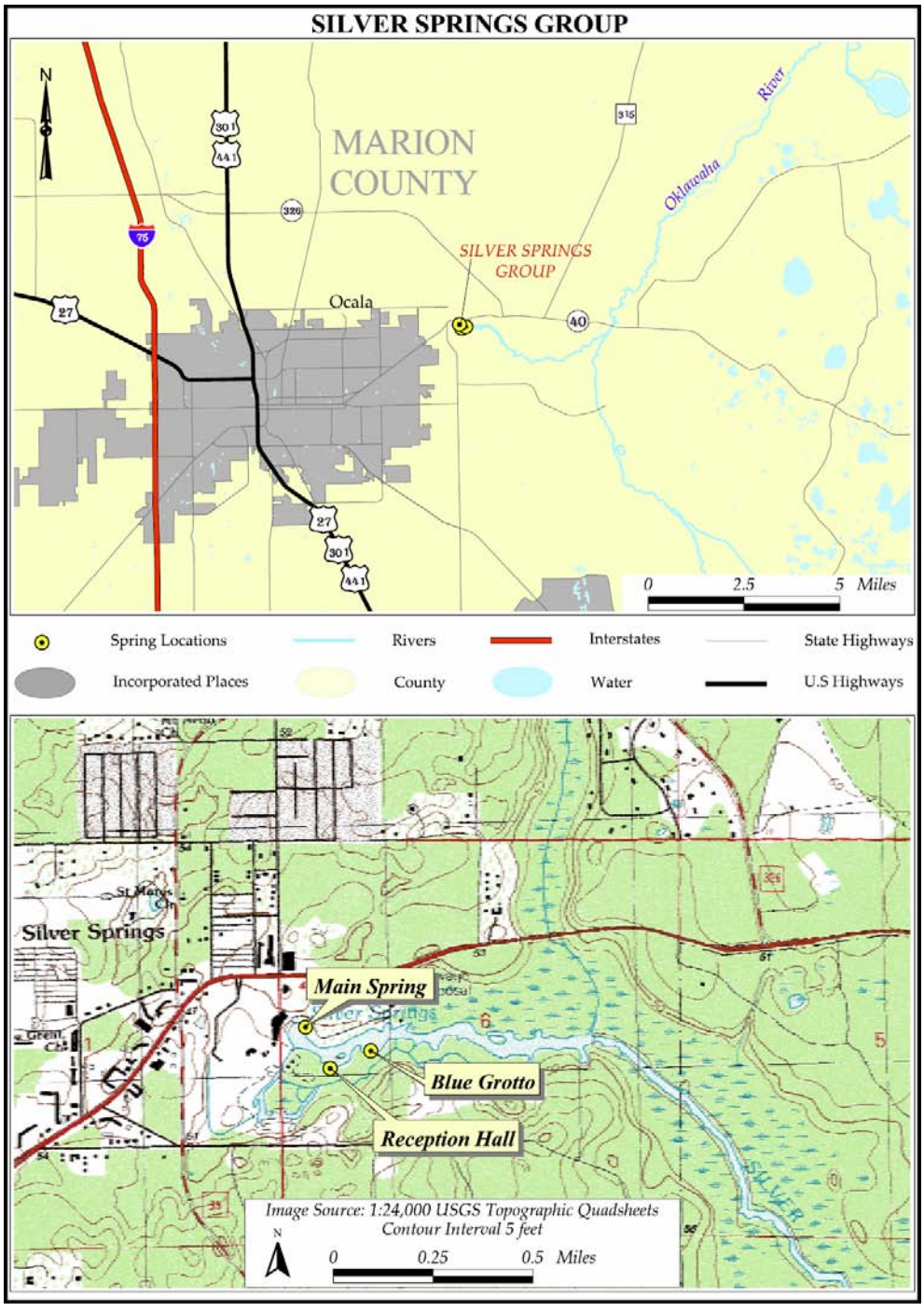


FIGURE 1
Silver Springs geographic location (from Scott *et al.* 2002).

General

The Silver Springs Group is located in Marion County, and represents Florida's largest, most visited, and best studied spring ecosystem. The theme park has a range of animal exhibits, amusement rides, glass-bottom boat tours, and a variety of dining and shopping opportunities. As such, the majority of the land immediately surrounding the spring is highly landscaped and significant areas have been converted to vehicle parking lots. Watercraft access to the springs is only available to boaters who travel up the Silver River, and in water recreation is prohibited within the theme park portion.

The Silver River State Park features a pioneer cracker village and the Silver River Museum and Environmental Education Center (operated in cooperation with the park by the Marion County School District). Silver River State Park visitors can canoe the river, hike or bike on trails, use picnic, pavilion, and playground facilities, or use the full facility campground or 10 luxury cabins.

Physical

Silver Springs collectively refers to the group of springs which form the headwaters of the Silver River. Silver Springs is a group of large vents and smaller springs in the bed and coves of the Silver River. The largest and main spring is Mammoth Spring (also called the Main Spring), whose two vents form the main pool. The larger vent is a horizontal, oval-shaped opening about 1.5 m (5 ft) high and 41 m (135 ft) wide beneath a limestone ledge at approximately 9.1 m (30 ft) depth; with the second vent is in the northwestern part of the main pool (SJRWMD 2008a). The spring pool measures about 91.4 m (300 ft) north to south and 61 m (200 ft) east to west and contains water with a

light blue apparent color. Detailed descriptions of the smaller vents are provided on the SJRWMD springs website (SJRWMD 2008a).

The main vent (Mammoth Spring) provides approximately half the total Silver River discharge, with multiple (at least 24) smaller springs located in the upper 1,220 m (4,000 ft) of the spring run (SJRWMD 2008a, **Figure 2**). The Silver River flows eastward through a hardwood and cypress swamp for approximately 8 km (5 mi) before joining the Ocklawaha River and ultimately the St. Johns River. Depths in the spring run vary between one meter to nearly 24 m (3 to 80 ft) over the deepest spring vent (Bridal Chamber/Abyss). Sand and limestone substrate are observable around some spring vents, but most of the substrate is obscured by benthic algae and submersed aquatic vegetation. The underwater cave system of Mammoth Spring has been partially explored; however the status of cave maps is unknown.

Geology

The underlying geologic formations of Silver Springs, in ascending order from deepest and oldest to shallowest and youngest, are the Avon Park Formation, the Ocala limestone, the Hawthorn Group, and surficial, unconsolidated post-Miocene deposits (Scott *et al.* 2001, **Figure 3**). Surficial deposits are dominated by sand dunes and well sorted fine sand of the Pleistocene and Holocene deposits (Brooks 1981) with underlying Pliocene age material. The area is contained in the Central Lakes division of the Central Lake District; and contains uplifted limestones of the Floridan aquifer below surficial sands, has active sinkhole development, elevations between 60 and 160 feet above mean sea level, and is a significant recharge area of the Floridan aquifer (Brooks 1981).

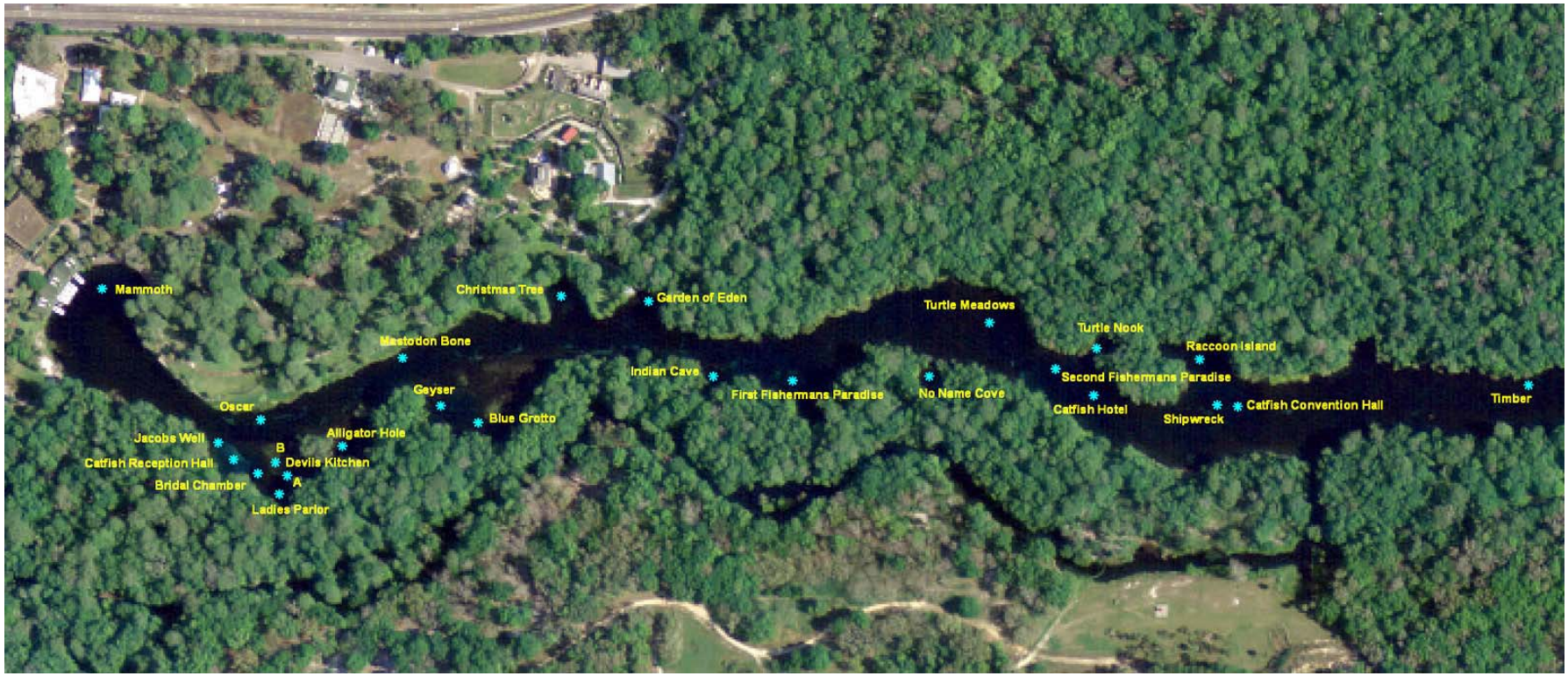


FIGURE 2
Locations of known spring vents on the Silver River (from SJRWMD 2008a).

Hydrogeologic Setting

The hydrogeology of the Silver Springs basin is described in detail by Faulkner (1973). The principal hydrogeologic unit in the Silver Springs springshed is the Upper Floridan Aquifer. In this region, the aquifer is about 91 m (300 ft) thick and occupies the Avon Park Formation and Ocala Limestones. Both formations have high porosity and groundwater flow occurs from both matrix and conduit pathways. Transmissivity, which is a measure of flow, has been calculated for the entire Upper Floridan Aquifer and ranges from 994 to 2,369,000 m^2/d (10,700 to 25,500,000 ft^2/d), with an average value of 185,806 m^2/d (2,000,000 ft^2/d, Faulkner, 1973). Subsequent transmissivity estimates, using three different models, reported average values that ranged from 222,967 to 771,095 m^2/d (2,400,000 to 8,300,000 ft^2/d, Shoemaker *et al.* 2004). These high transmissivity values suggest that relatively rapid transport of ground water occurs in the springshed.

Springshed

Groundwater travel times have been determined from particle tracking to estimate the percentage of spring discharge that has traveled to Silver Springs in a given amount of time from the water source (Shoemaker *et al.* 2004, **Figure 4**). Based on those estimates and using multiple models, about 80 percent of the total discharge of Silver Springs simulated by the north central Florida (NCF) model reaches the spring within 100 years. For the Lake County/Ocala National Forest (LCONF) and the Peninsular Florida (PF) models, about 85 percent of the total discharge of Silver Springs reaches the spring within 100 years (Shoemaker *et al.* 2004, **Figure 5**).

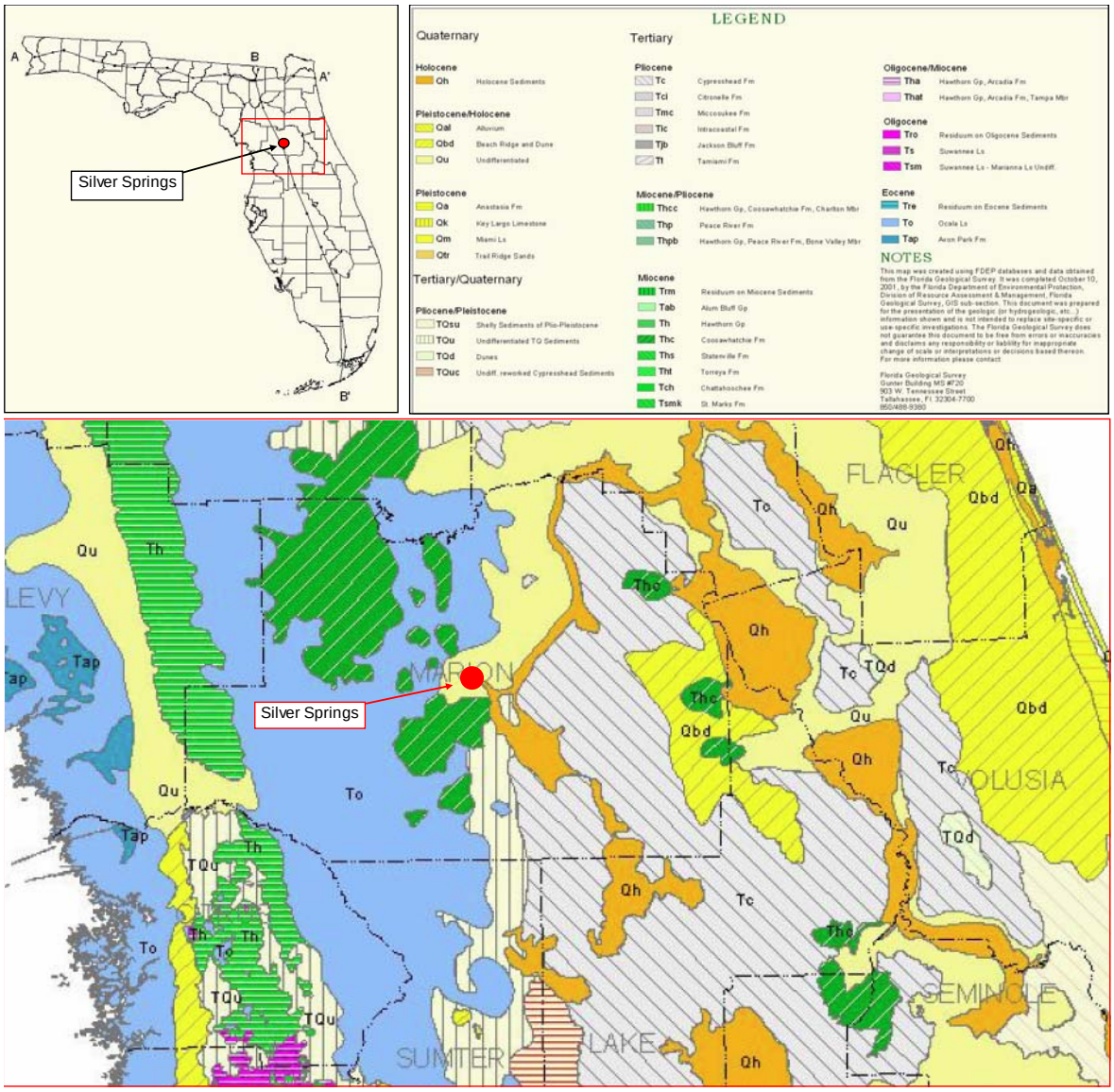


FIGURE 3
Geologic map of Silver Springs (adapted from Scott *et al.* 2001).

The springshed of Silver Springs has been estimated using three different recharge models by Shoemaker *et al.* (2004). Depending on the model employed, the land area contributing recharge to Silver Springs ranged in size from 1,165 to 1,528 km^2 (450 to 590 mi^2, **Figure 5**). By combining the areas of each model, a composite area was generated which encompasses about 1,891 km^2 (730 mi^2 or 467,198 acres). The composite area indicates that although some of the ground water discharging to Silver Springs originates from areas east of the spring, most of the area contributing recharge lies west and south of the spring, an area of generally higher recharge to the Upper Floridan Aquifer than the area east of the spring (Shoemaker *et al.* 2004).

A composite map generated by the SJRWMD illustrates several springshed delineations, with a minimum springshed area of 894 km^2 (345 mi^2) to a maximum of 1,919 km^2 (741 mi^2) for groundwater travel times of up to 100 years (**Figure 6**, Munch *et al.* 2006). Springshed delineations are presented by Phelps (2004) and generally agree with those discussed above.

Phelps (2004) noted that most of the flow to Silver Springs is relatively rapid (Faulkner 1973), and a significant area contributing recharge to the spring falls within a 10-year travel time, as delineated using particle tracking and a computer model of ground-water flow in peninsular Florida (Sepúlveda 2002). Based on the flow model for peninsular Florida (Sepúlveda, 2002), about 17 percent of the flow to Silver Springs is recharged within the 10-year contributing area and about 48 percent within the 30-year contributing area (Shoemaker *et al.* 2004). Utilizing particle tracking simulations, Munch *et al.* (2006) produced springshed delineations of the 2, 10, 100, and 1,000 year capture zones for Silver Springs (**Figure 7**).

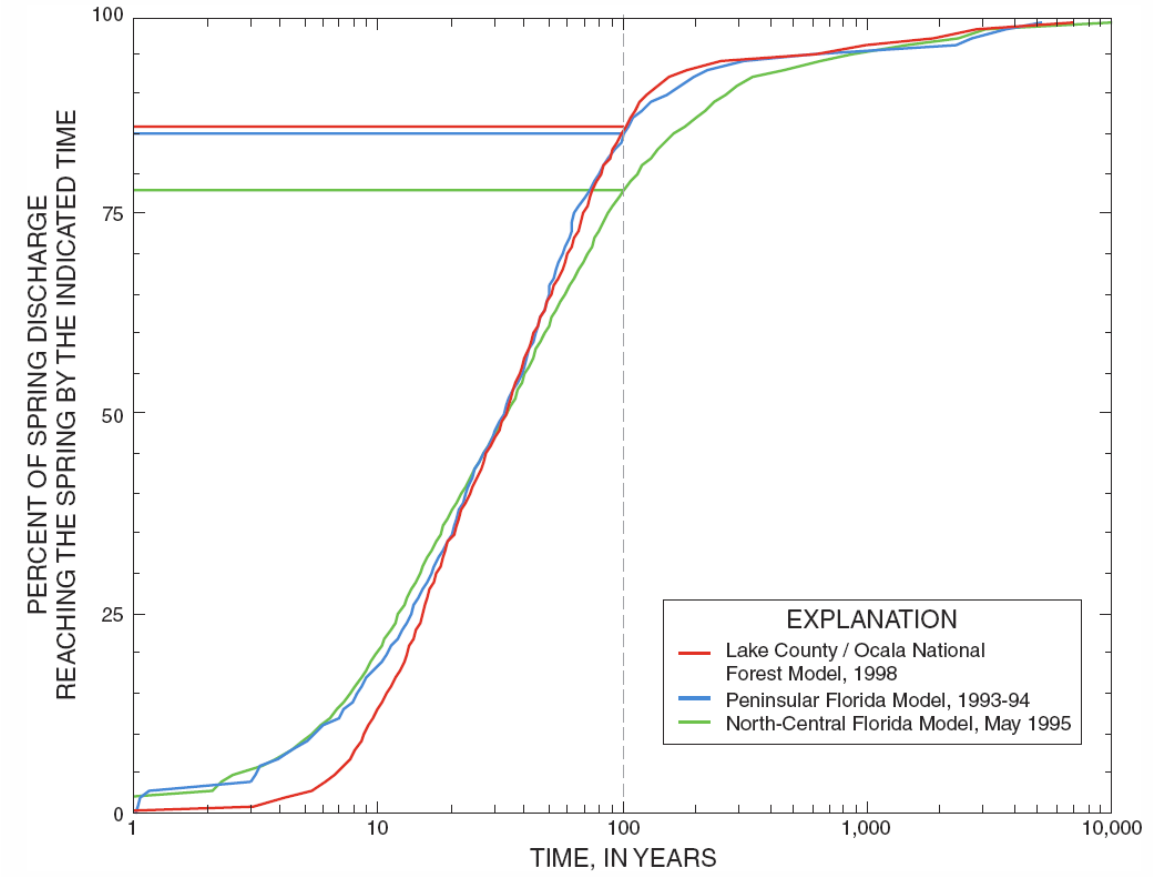


FIGURE 4
Particle travel time as a percentage of total spring discharge to Silver Springs based on average hydrologic conditions of the calibration period (from Shoemaker *et al.* 2004).

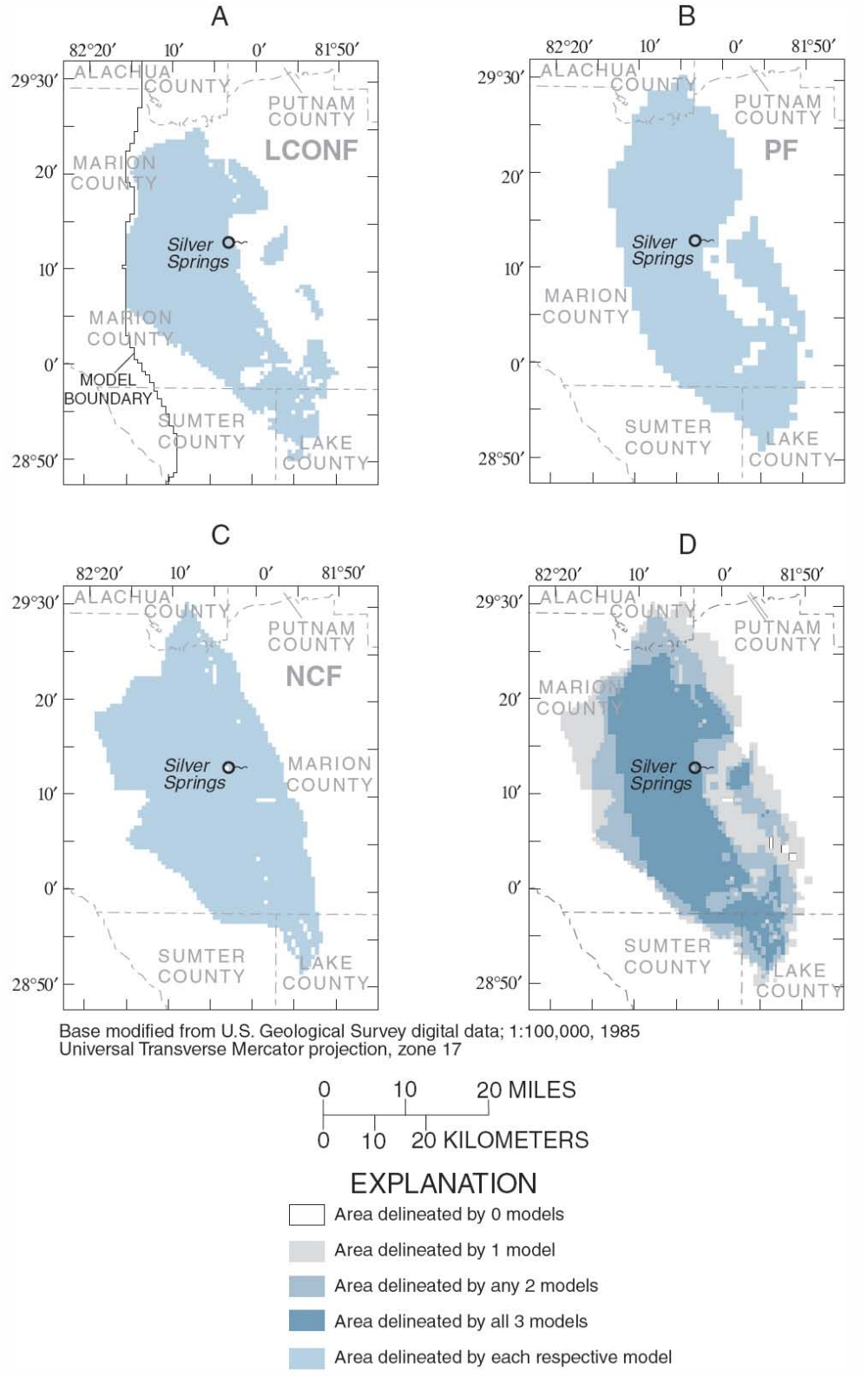


FIGURE 5
Modeled springsheds of Silver Springs based on travel times up to 100 years as simulated by (A) Lake County/Ocala National Forest; (B) Peninsular Florida; (C) North-Central Florida models for the average hydrologic conditions of the calibration period; and (D) composite area of all three models (from Shoemaker *et al.* 2004).

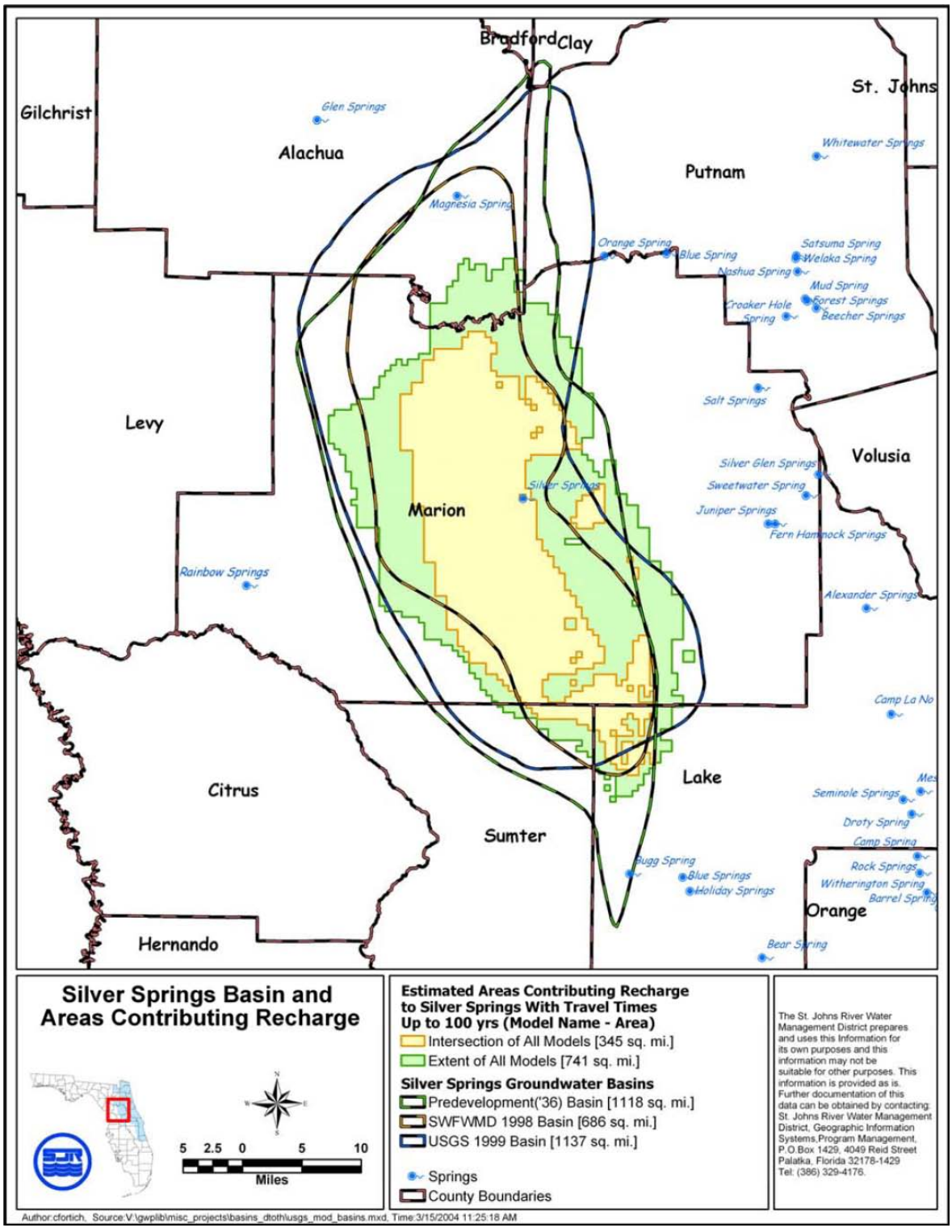


FIGURE 6
Delineations of the Silver Springs springshed (from Munch *et al.* 2006).

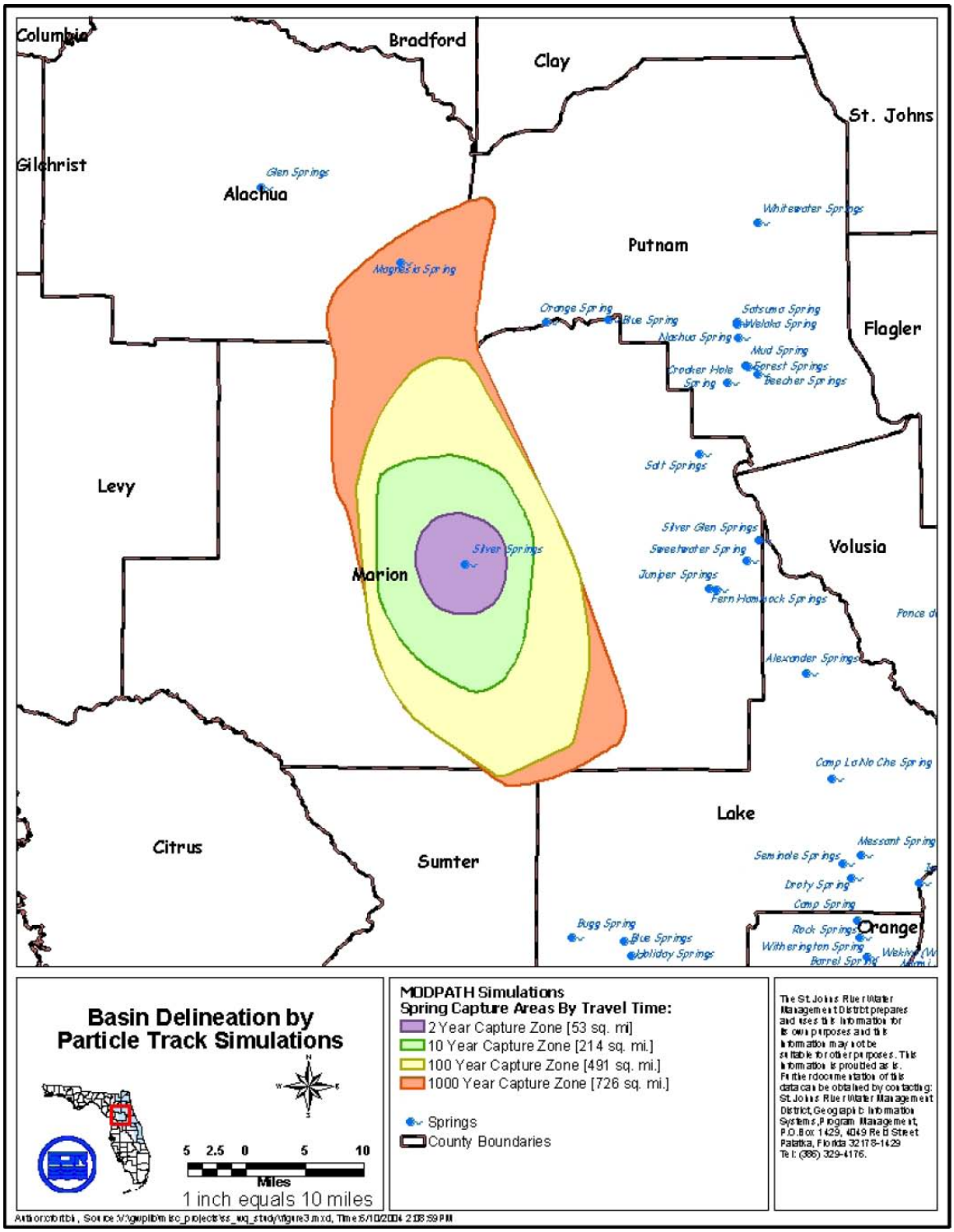


FIGURE 7
Delineations of the Silver Springs springshed capture areas based on particle track simulation (from Munch *et al*. 2006).

Springshed Land Use

Phelps (2004) compared land use changes in the Silver Springs springshed based on 1977 and 1995 GIS land use classifications within the springshed defined by potentiometric water levels. Despite differences in land use detail between these two dates, the estimated urban residential land use in the springshed area increased from about 98 km^2 (38 mi^2) in 1977 to about 425 km^2 (164 mi^2) in 1995 (Phelps 2004, **Figure 8**). Phelps (2004) further examined the springshed within the 10 year capture zone and calculated nitrogen loading from natural and anthropogenic sources.

A detailed examination of the land use changes which have occurred in the two-year capture zone, an area of 13,646 ha (33,720 ac) using aerial images from 1949, 1957, 1964, 1972, 1979, 1989, 1995, and 2005 was performed by Munch *et al.* (2006). In this land use analyses, between 1949 and 1989 the land use/land cover within the Silver Springs two-year capture zone changed from a predominately natural landscape to a more urbanized one (**Figures 8** and **9**). In 1949, the predominant land cover designation was forested and natural vegetative areas, which covered 68% of the area and when included with other natural land covers such as wetlands and open water, the portion of the two-year capture zone covered by natural areas was 74% in 1949 (**Table 14** and **Figure 10**). Conversely, in 1949, urban areas covered only 3.3%, agricultural land covered 9%, and pastures covered 7% of the area (**Table 1** and **Figure 10**).

By 1989, the portion of the area with forested and/or natural land cover had decreased to 38% (all natural land covers declined from 74% to 45%), while urban areas increased to 29% of the study area, and the percentages of land covered by agriculture and pasture remained fairly constant, with declines of 1.5% each (**Figure 10**).

The trend to urbanization within the two-year capture zone continued during the period from 1989 to 2005. During this time period, forested and vegetative areas declined from 38% to 31% (all natural land covers declined from 74% to 36%), and the urban areas increased to 37% of the springshed in 2005 (Munch *et al.* 2006, **Figure 10**).

The north central Florida (NCF) regional groundwater flow model developed by the University of Florida (Motz and Dogan 2004) was used to determine the hydraulic heads and flow field direction to Silver Springs. The calibrated 1995 NCF MODFLOW head distributions and hydrological parameters were applied to the USGS MODPATH particle tracking model to determine the positions and distances of the particles as they are tracked backward from Silver Springs during two years of travel time (Munch *et al.* 2006). Results of the MODPATH particle tracks analyses indicated about 75% of water discharging from Silver Springs originates from this two-year contributing zone, and within this zone, risk designations were determined. Illustrations of nitrogen loading rates are shown in this high risk two-year travel zone for 1949 and 2005 land use/land cover in **Figures 11** and **12**. An increase in the nitrogen loading rate to the Silver Springs group is clearly evident.

Overall, the Silver Springs springshed has changed from a landscape dominated by natural land cover and land use to an area dominated by urban and agricultural land uses. Analysis of aerial photos dating back to 1947 shows a transition from 74% of the springshed with natural land covers, to only 36% with natural land covers by 2005 (Munch *et al.* 2006). This trend correlates with changes observed in the quality and chemistry of water discharged from the Silver Springs group.

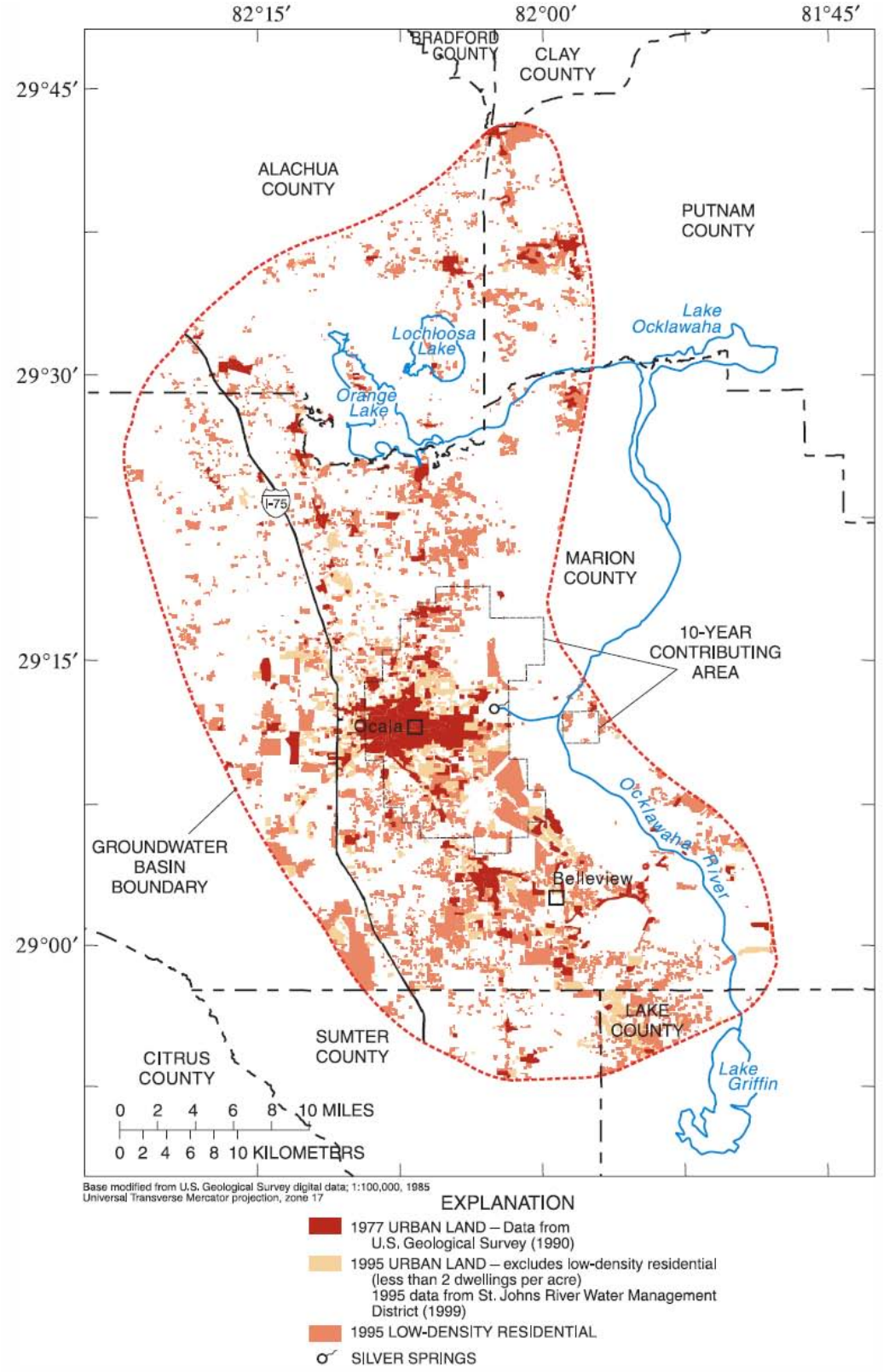


FIGURE 8
Urban and residential land use patterns with 1995 data overlain on 1977 data (from Phelps 2004).

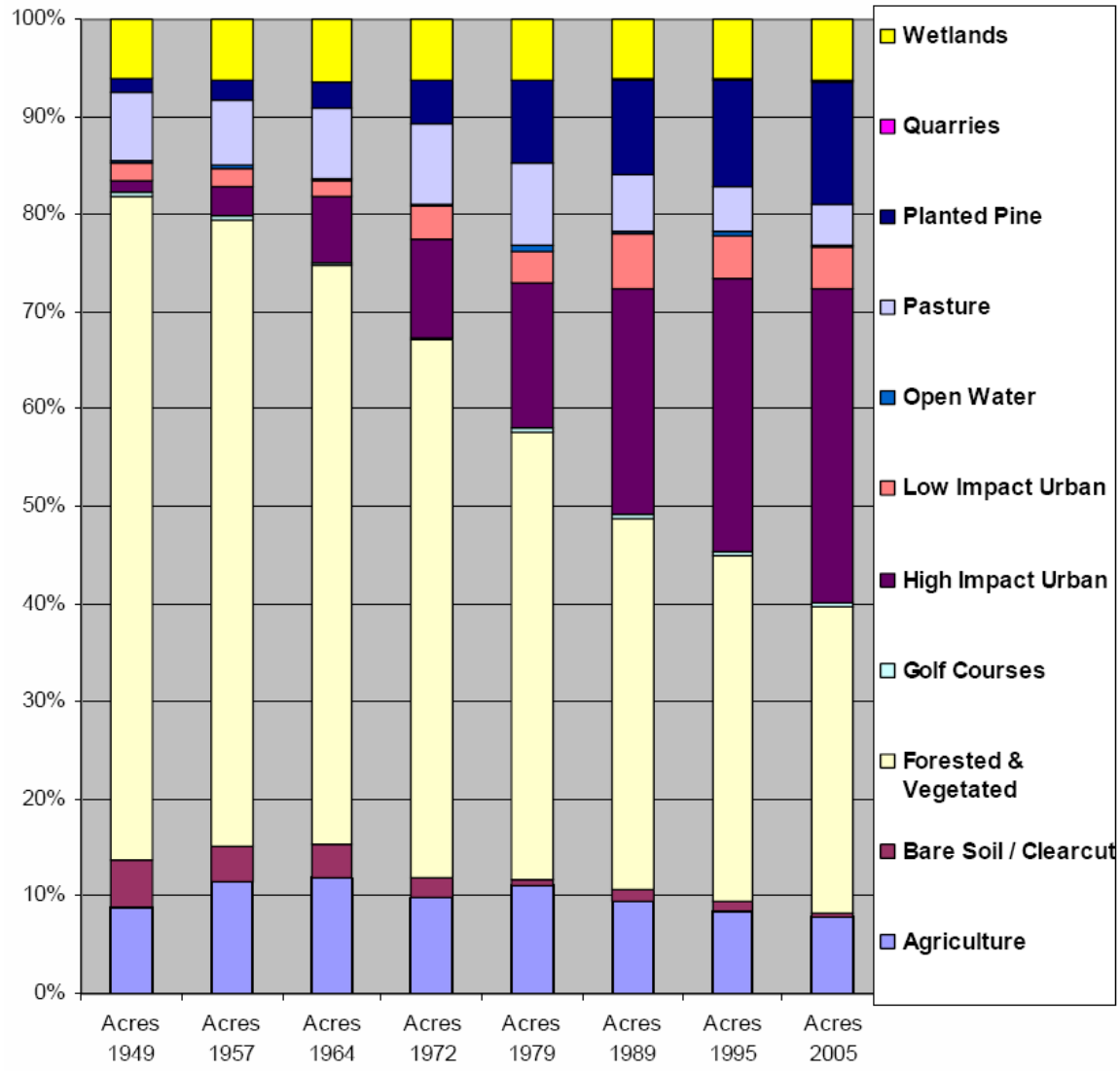


FIGURE 9
Land cover changes from 1949 to 2005 (from Munch *et al.* 2006).

TABLE 1
Table of land covers by acreage, percentage, and cover class for the Silver Springs two-year capture zone (from Munch *et al.* 2006).

Land Cover Class	Acres 1949	Acres 1957	Acres 1964	Acres 1972	Acres 1979	Acres 1989	Acres 1995	Acres 2005
Agriculture	3014.90	3843.75	4020.90	3365.17	3719.25	3168.59	2857.32	2641.24
Bare Soil / Clearcut	1602.99	1271.97	1175.42	648.04	198.18	404.84	362.06	147.08
Forested & Vegetated	23016.22	21701.36	20003.84	18595.16	15517.47	12899.60	11929.89	10595.75
Golf Courses	106.09	106.09	106.09	106.04	138.77	138.17	135.26	138.77
High Impact Urban	433.10	1041.40	2263.53	3418.25	5010.99	7796.68	9445.34	10883.56
Low Impact Urban	569.64	619.88	547.51	1103.91	1142.58	1872.61	1517.46	1420.20
Open Water	66.59	73.84	76.93	78.11	141.62	95.76	106.10	95.04
Pasture	2378.70	2304.22	2436.16	2776.54	2893.78	2001.60	1602.76	1437.29
Planted Pine	492.90	665.57	932.31	1529.30	2866.94	3227.28	3668.74	4197.21
Quarries	0.00	0.00	0.00	11.56	11.56	45.67	55.21	56.64
Wetlands	2039.14	2092.19	2157.57	2088.17	2079.13	2069.47	2040.13	2107.49
Total Acres	33720.27	33720.27	33720.27	33720.27	33720.27	33720.27	33720.27	33720.27

Land Cover - Percentage of Total Area

Land Cover Class	1949	1957	1964	1972	1979	1989	1995	2005
Agriculture	8.94%	11.40%	11.92%	9.98%	11.03%	9.40%	8.47%	7.83%
Bare Soil / Clearcut	4.75%	3.77%	3.49%	1.92%	0.59%	1.20%	1.07%	0.44%
Forested & Vegetated	68.26%	64.36%	59.32%	55.15%	46.02%	38.25%	35.38%	31.42%
Golf Courses	0.31%	0.31%	0.31%	0.31%	0.41%	0.41%	0.40%	0.41%
High Impact Urban	1.28%	3.09%	6.71%	10.14%	14.86%	23.12%	28.01%	32.28%
Low Impact Urban	1.69%	1.84%	1.62%	3.27%	3.39%	5.55%	4.50%	4.21%
Open Water	0.20%	0.22%	0.23%	0.23%	0.42%	0.28%	0.31%	0.28%
Pasture	7.05%	6.83%	7.22%	8.23%	8.58%	5.94%	4.75%	4.26%
Planted Pine	1.46%	1.97%	2.76%	4.54%	8.50%	9.57%	10.88%	12.45%
Quarries	0.00%	0.00%	0.00%	0.03%	0.03%	0.14%	0.16%	0.17%
Wetlands	6.05%	6.20%	6.40%	6.19%	6.17%	6.14%	6.05%	6.25%

Land Cover Class Groups

Class Group	1949	1957	1964	1972	1979	1989	1995	2005
Natural Lands	74.50%	70.78%	65.95%	61.57%	52.60%	44.68%	41.74%	37.95%
Forested & Vegetated	68.26%	64.36%	59.32%	55.15%	46.02%	38.25%	35.38%	31.42%
Wetlds. & Open Water	6.24%	6.42%	6.63%	6.42%	6.59%	6.42%	6.36%	6.53%
Agriculture & Pasture	16.00%	18.23%	19.15%	18.21%	19.61%	15.33%	13.23%	12.10%
Urban	2.97%	4.93%	8.34%	13.41%	18.25%	28.68%	32.51%	36.49%

Natural Lands Includes Forested & Vegetated, Open Water and Wetlands; Urban contains High & Low Impact Urban

Land Cover Class	1949 - 1989 Change in Acres	1949 -1989 Percent Change	1989 - 2005 Change in Acres	1989 - 2005 Percent Change	1949 - 1989 ABS Acres Change	1989 - 2005 ABS Acres Change
Agriculture	153.69	5.10	-527.35	-19.97	153.69	527.35
Bare Soil / Clearcut	-1198.15	-74.74	-257.76	-175.25	1198.15	257.76
Forested & Vegetated	-10108.72	-43.94	-2303.85	-0.44	10108.72	2303.85
Golf Courses	32.08	30.24	0.60	0.44	32.08	0.60
High Impact Urban	7363.58	1700.19	3086.87	28.36	7363.58	3086.87
Low Impact Urban	1302.97	228.73	-452.41	-31.86	1302.97	452.41
Open Water	21.27	28.56	-0.72	-0.76	21.27	0.72
Pasture	-377.10	-15.85	-564.31	-39.26	377.10	564.31
Planted Pine	2734.38	554.76	969.94	23.11	2734.38	969.94
Quarries	45.67	0.00	10.97	19.37	45.67	10.97
Wetlands	30.33	1.49	38.02	1.80	30.33	38.02
			Total Acreage Change		23367.95	8212.81

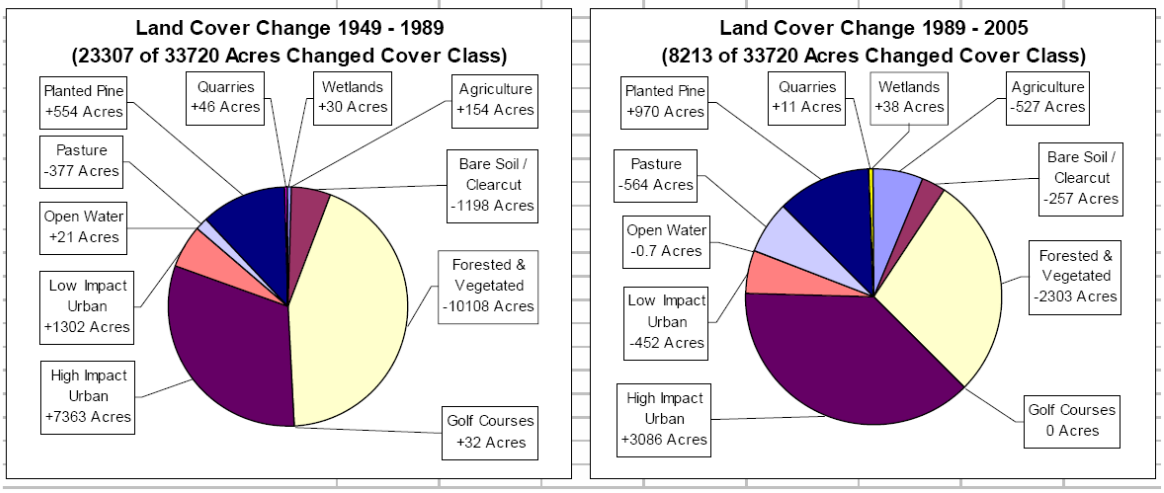


FIGURE 10
Land Cover Change for the 1949 to 1989 and 1989 to 2005 time periods (from Munch *et al.* 2006).

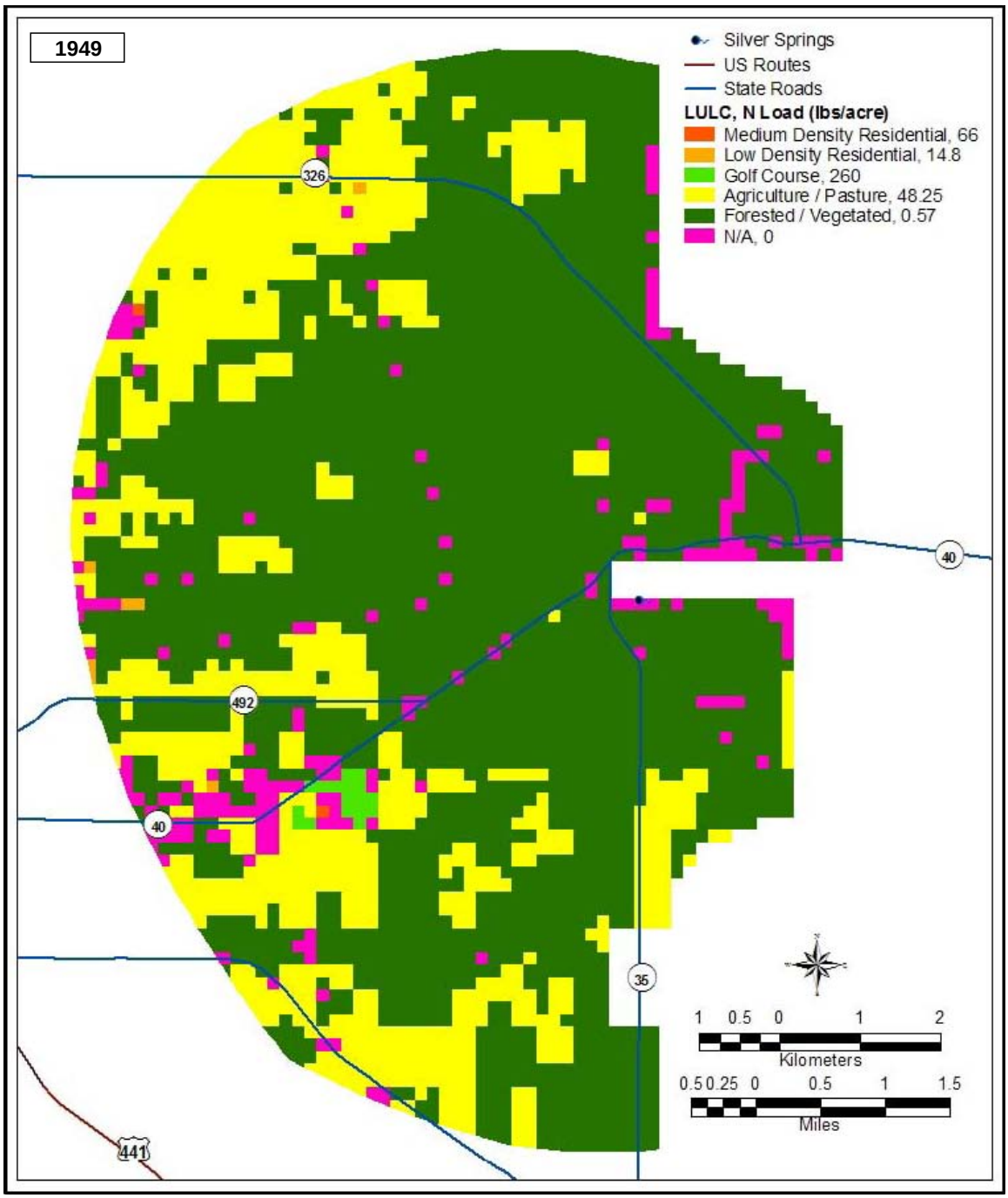


FIGURE 11
Rates of nitrogen loading by land use and land cover classification for 1949 (from Munch *et al.* 2006).

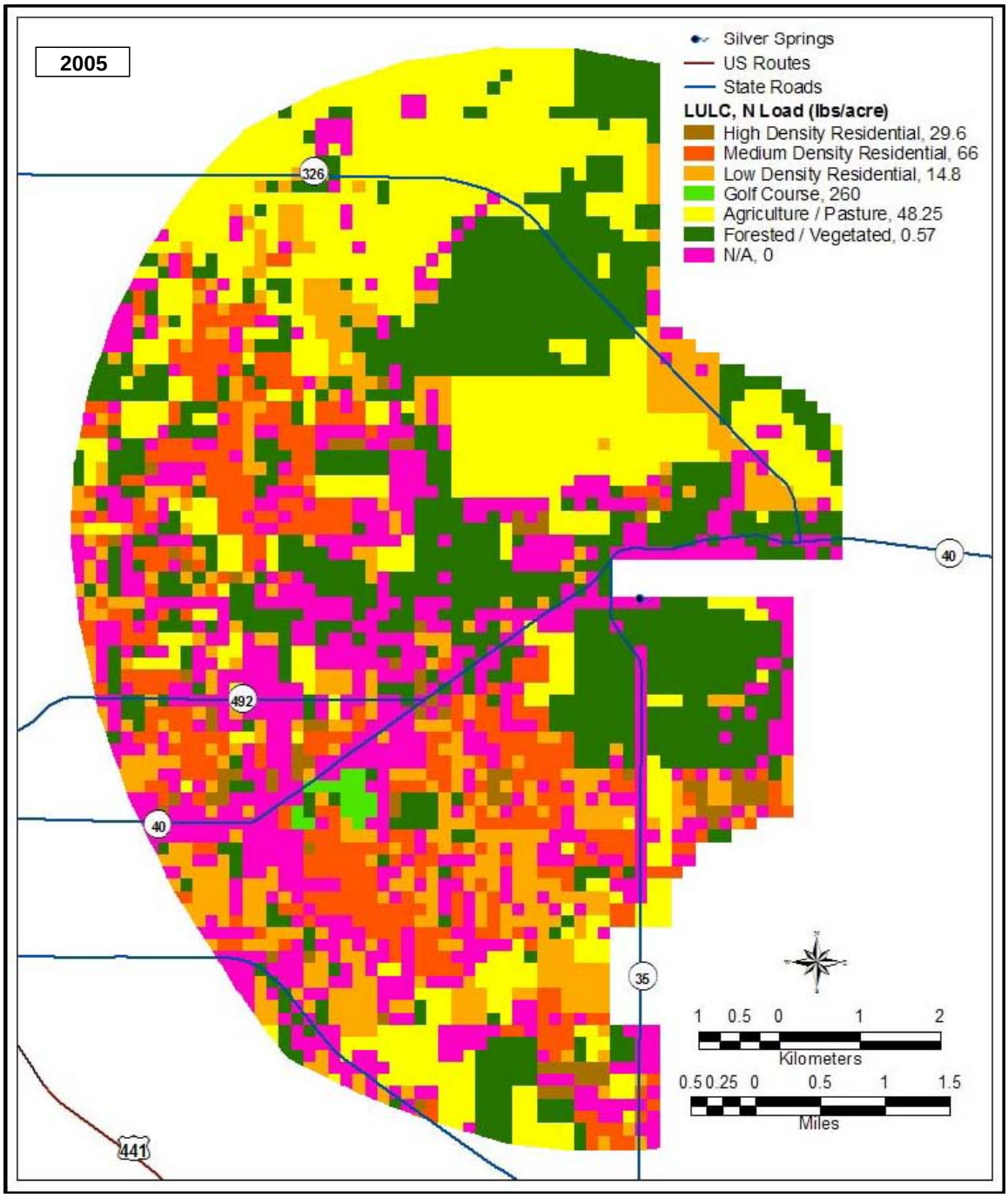


FIGURE 12
Rates of nitrogen loading by land use and land cover classification for 2005 (from Munch *et al.* 2006).

Study Area

The Silver Springs project study area is defined as the spring pool continuing downstream the spring run for approximately 1,200 m **(Figure 13).** This area corresponds to previous ecosystem studies (*e.g.* Odum 1957, Knight 1980, Munch *et al.* 2006).

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Silver Springs are given in **Table 2** below.

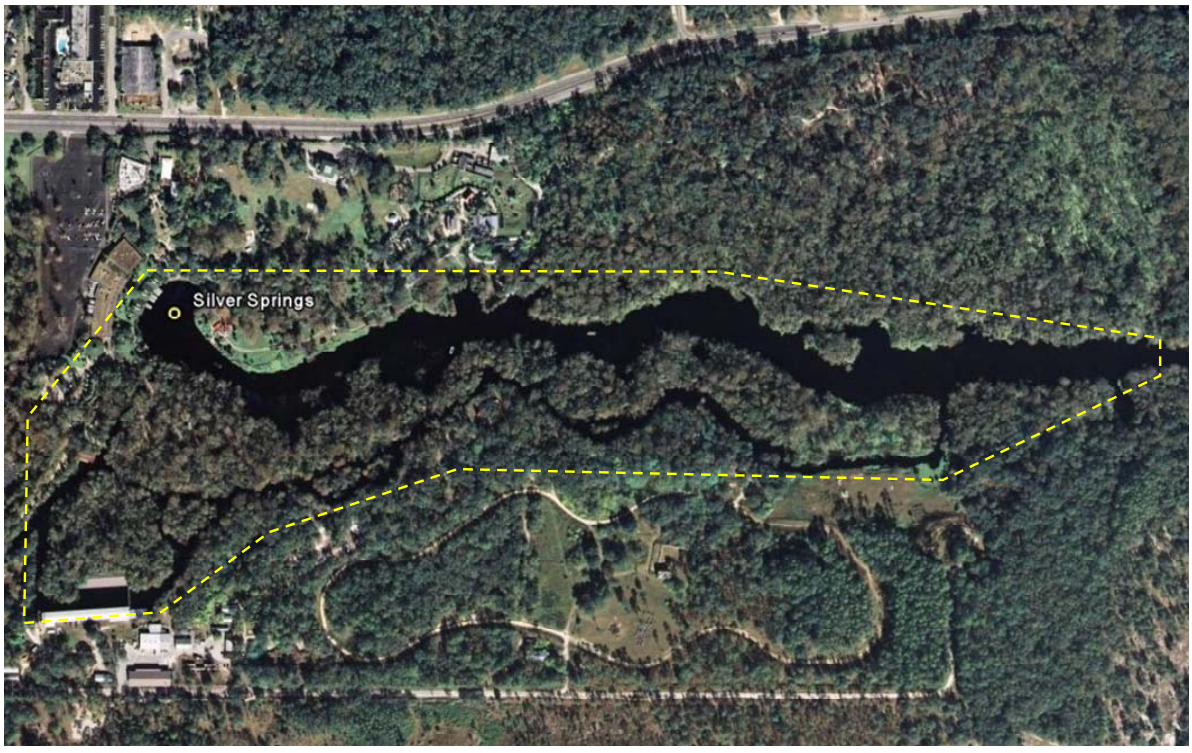


FIGURE 13
The study area for Silver Springs.

TABLE 2
Source information for Silver Springs historical water quality data described in this report.

Org ID	Org Name	Station ID	Station Group	Station Name	Latitude	Longitude
DEP AWQM	DEP AWQM	6925	SilverRvr_MBoil		29.215833	-82.053056
21FLGW	21FLGW	7464	SilverRvr_Okl_up_riv		29.1999	-81.9948
21FLGW	FDEP	9720	SilverRvr_MBoil	SILVER SPRINGS MAIN	29.216206	-82.052631
21FLGW	FDEP	9721	SilverRvr_CRH	RECEPTION HALL	29.214728	-82.051585
21FLGW	FDEP	9722	SilverRvr_BGrotto	BLUE GROTTO	29.21525	-82.049887
USGS	USGS	02239500	SilverRvr_MBoil	SILVER SPRINGS NEAR OCALA, FL	29.212476	-82.053978
USGS	USGS	02239501	SilverRvr_1200m	SILVER RIVER NEAR OCALA, FL	29.214976	-82.0412
USGS	USGS	02239510	SilverRvr_SR_BoatCnl	SILVER RIVER NEAR CONNER, FL	29.211111	-81.990834
21FLA	21FLA	20020007	SilverRvr_350m		29.215111	-82.051389
21FLA	21FLA	20020008	SilverRvr_PPark		29.214833	-82.044861
21FLA	21FLA	20020009	SilverRvr_1000m		29.215222	-82.043056
21FLCEN	FDEP	20020011	SilverRvr_MBoil	Silver Springs at main boil	29.215833	-82.053056
21FLCEN	FDEP	20020154	SilverRvr_SR_US_BoatCnl	Silver River 0.6 miles upstream of boat canal	29.207167	-81.997167
21FLCEN	FDEP	20020155	SilverRvr_SR_DS_YHouse	Silver River downstream of the Yearling shack site	29.202056	-82.020611
21FLA	21FLA	20020156	SilverRvr_Okl_dwn_Riv		29.213444	-81.987306
21FLCEN	FDEP	20020193	SilverRvr_SR_US_BoatCnl	Silver River @ 1.35 miles upstrm of confl w/ boat ramp canal	29.201861	-82.007586
21FLA	21FLA	20020309	SilverRvr_Okl_40		29.214861	-81.986472
21FLCEN	FDEP	20020317	SilverRvr_SR_BoatCnl	Silver Run @ 250M upstream of confluence w/ Boat Ramp Canal	29.209917	-81.993333
21FLCEN	FDEP	20020318	SilverRvr_SR_YHouse	SILVER RIVER AT YEARLING HOUSE	29.203889	-82.028889
21FLCEN	FDEP	20020424	SilverRvr_Okl_up_riv		29.210972	-81.988611
21FLA	21FLA	20020426	SilverRvr_1200m		29.215278	-82.041667
USGS	USGS	291243081592001	SilverRvr_SR_Okl	SILVER SPGS 100 YDS US OF OKLAWAHA RV NR OCALA,FL	29.212199	-81.988698
USGS	USGS	291253082030600	SilverRvr_CRH	SILVER SPRINGS RECEP HALL(ABYSS)AT SILVER SPGS,DEP	29.214976	-82.051478
USGS	USGS	291254082023000	SilverRvr_1200m	SILVER SPRINGS RUN(SSR1)NR SILVER SPRINGS,FL	29.215254	-82.041478
USGS	USGS	291255082024200	SilverRvr_CH	SILVER SPRINGS CATFISH HOTEL 1 NR OCALA, FL	29.215389	-82.045111
USGS	USGS	291255082030000	SilverRvr_BGrotto	SILVER SPRINGS BLUE GROTTO AT SILVER SPGS,FL(DEP)	29.215532	-82.049811
USGS	USGS	291256082022800	SilverRvr_CH	SILVER SPRINGS RUN(SSR3)NR SILVER SPRINGS, FL	29.21581	-82.045367
USGS	USGS	291256082023800	SilverRvr_CCH	SILVER SPGS CATFISH CONVENTION HALL 1 NR OCALA, FL	29.215444	-82.043861
USGS	USGS	291257082025900	SilverRvr_Xmas	SILVER SPRINGS RUN(SSR2)NR SILVER SPRINGS, FL	29.216087	-82.049534
USGS	USGS	291258082030900	SilverRvr_MBoil	SILVER SPRINGS MAIN BOIL AT SILVER SPGS,FL (DEP)	29.216365	-82.052311
USGS	USGS	291258082030901	SilverRvr_MBoil	SILVER SPRINGS MAMMOTH WEST VENT (A) NR OCALA, FL	29.216306	-82.052722
USGS	USGS	291258082030902	SilverRvr_MBoil	SILVER SPRINGS MAMMOTH EAST VENT (B) NR OCALA, FL	29.216167	-82.052667
USGS	USGS	291259082025400	SilverRvr_LostRvrBoil	SILVER SPRINGS LOST RIVER BOIL NR OCALA, FL	29.216278	-82.048194
Knight	Knight	3/4 mile	SilverRvr_1200m			
Knight	Knight	BC	SilverRvr_BC			
UF	UF	BC	SilverRvr_BC			
Knight	Knight	BG	SilverRvr_BGrotto			
UF	UF	BG	SilverRvr_BGrotto			
21FLA	FDEP	BLUE GROTTO SPRING	SilverRvr_BGrotto			
Knight	Knight	CCH	SilverRvr_CCH			
Knight	Knight	CFC	SilverRvr_CRH			
Knight	Knight	CH	SilverRvr_CH			
Knight	Knight	CR	SilverRvr_CRH			
UF	UF	CRC	SilverRvr_CRH			
Knight	Knight	CRH	SilverRvr_CRH			
Knight	Knight	CT	SilverRvr_Xmas			
Knight	Knight	DK	SilverRvr_DKit			
UF	UF	DK	SilverRvr_DKit			
Knight	Knight	FFP	SilverRvr_1stFP			
UF	UF	FPI	SilverRvr_1stFP			
UF	UF	FPII	SilverRvr_2ndFP			
Knight	Knight	GS	SilverRvr_GeyserSp			
Knight	Knight	LP	SilverRvr_LParlor			
UF	UF	LP	SilverRvr_LParlor			
Knight	Knight	MB	SilverRvr_MBoil			
21FLWQSP	FLASTORET	MRN324GS	SilverRvr_SR_US_BoatCnl	Silver Run (WBID 2772)	29.207183	-81.999533
UF	UF	MS	SilverRvr_MBoil			
UF	UF	Okl_dwn_riv	SilverRvr_Okl_dwn_Riv			
UF	UF	Okl_up_riv	SilverRvr_Okl_up_riv			
21FLSJWM	21FLSJWM	ORD	SilverRvr_Okl_40_down_riv		29.2175	-81.985833
21FLA	FDEP	RECEPTION HALL SPRING	SilverRvr_CRH			
Odum	Odum	Reciption Center	SilverRvr_CRH			
Knight	Knight	SG	SilverRvr_SGardens			
21FLSJWM	FLASTORET	SILRV	SilverRvr_SR_BoatCnl	Silver River~90 meters South West of Boat Ramp Canal	29.21005	-81.992083
21FLA	FDEP	SILVER SPRING MAIN	SilverRvr_MBoil			
Knight	Knight	SilverRvr_1200m	SilverRvr_1200m			
Odum	Odum	SilverRvr_1200m	SilverRvr_1200m			
WSI	WSI	SilverRvr_1200m	SilverRvr_1200m			
Odum	Odum	SilverRvr_1stFP	SilverRvr_1stFP			
WSI	WSI	SilverRvr_1stFP	SilverRvr_1stFP			
Odum	Odum	SilverRvr_2ndFP	SilverRvr_2ndFP			
WSI	WSI	SilverRvr_2ndFP	SilverRvr_2ndFP			
WSI	WSI	SilverRvr_BBasin	SilverRvr_BBasin			
Odum	Odum	SilverRvr_BC	SilverRvr_BC			
Odum	Odum	SilverRvr_BGrotto	SilverRvr_BGrotto			
WSI	WSI	SilverRvr_BGrotto	SilverRvr_BGrotto			
WSI	WSI	SilverRvr_Bridge	SilverRvr_Bridge			
WSI	WSI	SilverRvr_CCH	SilverRvr_CCH			
WSI	WSI	SilverRvr_CH	SilverRvr_CH			
WSI	WSI	SilverRvr_CRH	SilverRvr_CRH			
Odum	Odum	SilverRvr_DKit	SilverRvr_DKit			
WSI	WSI	SilverRvr_DKit	SilverRvr_DKit			
WSI	WSI	SilverRvr_GarCove	SilverRvr_GarCove			
Odum	Odum	SilverRvr_LParlor	SilverRvr_LParlor			
WSI	WSI	SilverRvr_LParlor	SilverRvr_LParlor			
Odum	Odum	SilverRvr_MBoil	SilverRvr_MBoil			
Rosenau	Rosenau	SilverRvr_MBoil	SilverRvr_MBoil			
WSI	WSI	SilverRvr_MBoil	SilverRvr_MBoil			
JEA-Biddlecomb	JEA-Biddlecomb	SilverRvr_MBoil_LV	SilverRvr_MBoil_LV			
JEA-Biddlecomb	JEA-Biddlecomb	SilverRvr_MBoil_RV	SilverRvr_MBoil_RV			
WSI	WSI	SilverRvr_Rock	SilverRvr_Rock			
WSI	WSI	SilverRvr_SideRun_In	SilverRvr_SideRun_In			
WSI	WSI	SilverRvr_SideRun_Out	SilverRvr_SideRun_Out			
WSI	WSI	SilverRvr_TMead	SilverRvr_TMead			
Odum	Odum	SilverRvr_Xmas	SilverRvr_Xmas			
WSI	WSI	SilverRvr_Xmas	SilverRvr_Xmas			
UF	UF	SS1	SilverRvr_210m			
UF	UF	SS10	SilverRvr_4800m			
UF	UF	SS11	SilverRvr_5600m			
UF	UF	SS12	SilverRvr_6400m			
UF	UF	SS13	SilverRvr_7200m			
UF	UF	SS2	SilverRvr_400m			
UF	UF	SS3	SilverRvr_800m			
UF	UF	SS4	SilverRvr_1000m			
UF	UF	SS5	SilverRvr_1200m			
UF	UF	SS6	SilverRvr_1600m			
UF	UF	SS7	SilverRvr_2400m			
UF	UF	SS8	SilverRvr_3200m			
UF	UF	SS9	SilverRvr_4000m			
21FLSJWM	FLASTORET	SSR	SilverRvr_SR_Okl	Silver River; 200m upstream of Ocklawaha R.	29.21135	-81.989464
Knight	Knight	TM	SilverRvr_TMead			
UF	UF	XTS	SilverRvr_Xmas			

Discharge and Stage

Earliest discharge measurements at Silver Springs were made by the U.S. Geological Survey in 1906, with approximately 900 measurements to date, mostly after 1932. The majority of discharge measurements from the Silver River have been made about 1,200 m (4,000 ft) below the head of the springs (USGS 2009). Discharge estimates are highly variable at Silver Springs, with the maximum discharge of 1,280 cfs measured in October 1960 and the minimum discharge of 358 cfs measured in June 2001. The mean and median discharges for the period-of-record are 763 and 760 cfs, respectively (Figure 39). Other measures of discharge include a value of 556 cfs (November 15, 2001) by Scott *et al*. 2002.

Continuous discharge in the upper Silver River is estimated from the relationships between stage elevation and water levels in nearby Floridan aquifer wells (USGS 2009). The US Geological Survey has two stations on the upper Silver River; with station # 02239500 monitoring stage at 1,400 ft downstream and station # 02239501 monitoring stage at 3,900 ft downstream (USGS 2009). Discharge data are plotted in **Figure 14** for the available period-of-record.

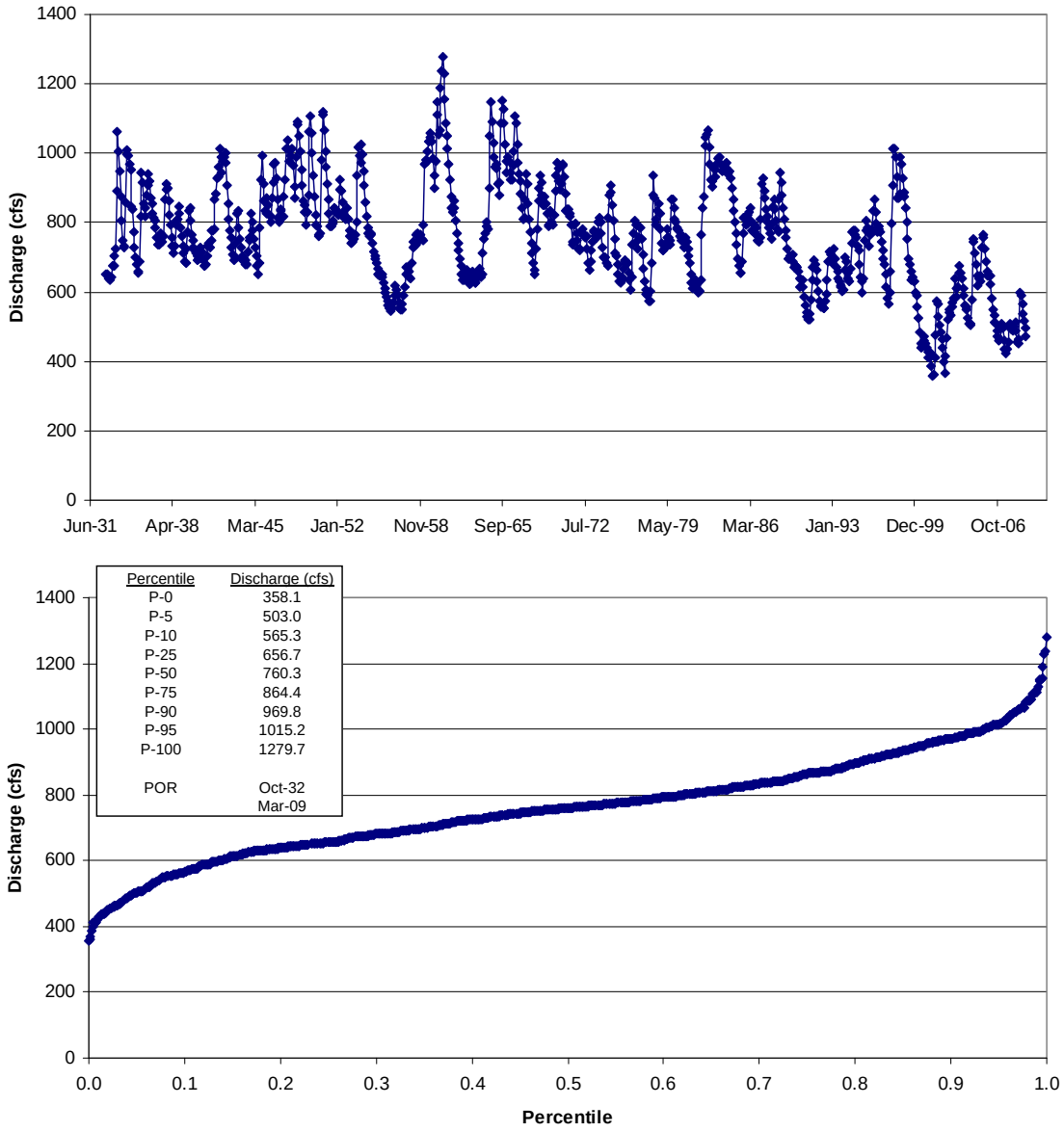


FIGURE 14
Monthly average discharge time series and frequency curve for Silver River.

Water Quality

Water samples were collected from the Main (Mammoth) Spring, the Abyss, and the Blue Grotto of the Silver Springs group during January 2002 and analyzed for the purpose of dating the ground water (Phelps 2004). Estimated age of water from the Main Spring was approximately 27 years for tritium/helium-3 data compared to about 15 years based on sulfur hexafluoride; for the Abyss, the tritium/helium-3 age was about 9 years while the sulfur hexafluoride age was about 8 years; and for the Blue Grotto, tritium/helium-3 age was about 19 years, and the sulfur hexafluoride age was about 6 years (Phelps 2004). It should be noted that the apparent ground-water ages are based on a piston-flow model, which likely does not adequately represent the complex flow system believed to exist in the karst Floridan Aquifer, and may underestimate water ages.

Water quality data for Silver Springs are summarized from December 1907 through May 2008 from STORET (USGS and FDEP data). The numbers of samples collected were highly variable between parameters, ranging from 1 to over 9,000 records. Samples have been collected from numerous locations in the spring group and along the Silver River. **Table 3** provides statistics for the available water quality parameters by location, as well as decadal averages (if available), and the period-of-record (POR) dates.

The Silver Springs main boil POR averages for several key parameters and the numbers of samples in parenthesis are:

- Water temperature – 23.2 °C (n = 7,719)
- Dissolved oxygen – 2.34 mg/L (n = 6,322)
- pH – 7.07 SU (n = 5,036)
- Specific conductance – 427 umhos/cm (n = 4,020)
- Turbidity – 0.417 NTU (n = 1,719)
- Color – 1.87 CPU (n= 2,498)
- Total chloride – 9.88 mg/L (n = 2,711)
- Sulfate – 42.3 mg/L (n = 1,160)
- Nitrate+nitrite nitrogen – 1.00 mg/L (n = 1,030)
- Total phosphorus – 0.044 mg/L (n = 1,379)

TABLE 3
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
BACTERIOLOGICAL	EColi	#/100ml	BGrotto											40.0	40.0	32.0	48.0	8.21	20	11/15/2001	12/19/2001
			CRH											26.5	26.5	1.00	52.0	26.0	24	11/15/2001	12/19/2001
			MBoil											5.25	5.25	1.00	8.00	2.97	56	5/15/2000	12/19/2001
	Enterococci	#/100ml	BGrotto											4.64	4.64	1.00	15.0	4.18	11	4/15/2004	10/26/2006
			CRH											14.8	14.8	1.00	72.0	22.0	11	4/15/2004	10/26/2006
			MBoil											2.00	2.00	2.00	2.00	0.00	11	4/15/2004	10/26/2006
	FC	#/100ml	1200m											76.9	76.9	1.00	440	142	48	2/24/2004	12/9/2004
			BGrotto											21.3	21.3	1.00	100	28.7	198	11/15/2001	4/24/2008
			CRH											3.46	3.46	1.00	16.0	2.93	220	11/15/2001	4/24/2008
			MBoil								7.14			2.46	3.48	0.00	24.0	5.46	483	1/13/1975	4/24/2008
			Okl_40_down_riv										93.2		93.2	27.0	330	94.9	9	1/11/1994	4/25/1995
			Okl_up_riv											67.6	67.6	18.0	98.0	25.5	8	5/24/2000	10/24/2006
			SR_BoatCnl								56.0	24.4	48.0	72.5	51.1	0.00	172	43.3	34	7/6/1976	4/9/2002
			SR_DS_YHouse											71.0	71.0	32.0	93.0	30.3	6	12/18/2001	4/9/2002
			SR_YHouse									65.0		61.3	63.1	0.00	170	50.9	16	1/30/1984	4/9/2002
			Xmas											0.500	0.500	0.500	0.500	0.00	4	5/4/2004	5/4/2004
	TC	#/100ml	1000m							449					449	7.80	2,400	617	70	2/22/1966	8/12/1969
			1200m											131	131	1.00	560	176	48	2/24/2004	12/9/2004
			350m							111					111	1.80	540	129	35	2/22/1966	8/12/1969
			BGrotto											56.0	56.0	1.00	240	72.6	178	11/15/2001	4/24/2008
			CRH											19.6	19.6	1.00	75.0	25.2	208	11/15/2001	4/24/2008
			MBoil							113	145			39.9	97.7	1.00	1,000	183	1141	2/22/1966	4/24/2008
			Okl_40								460				460	380	540	92.4	4	6/15/1971	6/12/1973
			Okl_40_down_riv										3,000		3,000	3,000	3,000		1	1/11/1994	1/11/1994
			Okl_up_riv											302	302	24.0	560	233	8	5/24/2000	10/24/2006
			PPark							361					361	22.0	2,400	595	33	2/22/1966	8/12/1969
			SR_BoatCnl								293	117	550	1,827	856	6.00	4,600	1,212	32	7/6/1976	4/9/2002
			SR_DS_YHouse											1,293	1,293	160	2,600	1,099	6	12/18/2001	4/9/2002
			SR_YHouse									190		1,130	608	17.0	2,200	701	18	1/30/1984	4/9/2002
			Xmas											20.0	20.0	20.0	20.0	0.00	4	5/4/2004	5/4/2004
BIOLOGICAL	Chl-a corr	µg/L	1200m									0.812			0.812	0.160	2.00	0.510	78	1/22/1985	8/30/1988
			MBoil											2.77	2.77	2.77	2.77		1	6/7/2006	6/7/2006
			Okl_40									3.67	5.14		3.85	0.650	12.7	3.52	32	1/23/1985	12/1/1998
			Okl_40_down_riv									4.41	8.29		7.58	0.00	81.9	15.9	44	11/30/1982	12/7/1998
			Okl_dwn_Riv										0.650		0.650	0.650	0.650	0.0000	3	12/1/1998	12/1/1998
			Okl_up_riv									22.7		41.7	23.6	2.78	62.2	14.8	44	1/22/1985	6/27/2006
			SR_BoatCnl									1.94	1.42	1.57	1.80	0.500	8.02	1.88	52	10/5/1982	10/10/2006
			SR_DS_YHouse										0.650	1.44	0.808	0.650	1.44	0.353	5	12/1/1998	10/10/2006
			SR_Okl									0.891	2.41	3.95	3.41	0.00	39.7	8.26	97	11/30/1982	3/20/2008
			SR_US_BoatCnl										0.650	1.39	1.31	0.050	3.21	0.984	19	12/1/1998	10/10/2006
			SR_YHouse									0.927			0.927	0.00	2.36	0.589	40	12/19/1983	9/18/1989
	Chl-b	µg/L	Okl_40_down_riv									0.648	0.478		0.520	0.00	2.60	0.676	48	6/9/1981	12/7/1998
			SR_BoatCnl								0.535	0.278			0.418	0.00	0.960	0.352	22	3/7/1978	3/24/1981
			SR_Okl									0.446	0.029	-0.157	-0.024	-2.93	1.46	0.685	103	11/12/1981	3/20/2008
	Chl-c corr	µg/L	SR_Okl											-0.078	-0.078	-0.608	1.74	0.521	49	2/24/2000	3/20/2008
	Pheo-a	µg/L	1200m									0.958			0.958	0.780	1.24	0.197	24	5/31/1988	8/30/1988
			MBoil											1.10	1.10	1.10	1.10		1	6/7/2006	6/7/2006
			Okl_40									2.18	0.625		1.66	0.500	3.79	1.11	12	6/1/1988	12/1/1998
			Okl_40_down_riv									3.93	6.26		5.68	0.00	68.9	10.9	48	6/9/1981	12/7/1998
			Okl_dwn_Riv										0.750		0.750	0.750	0.750	0.00	3	12/1/1998	12/1/1998
			Okl_up_riv									7.98		1.10	7.00	1.10	13.2	3.93	14	5/31/1988	6/27/2006
			SR_BoatCnl								0.852	0.702	1.14	1.10	0.845	0.00	1.97	0.568	55	3/7/1978	10/10/2006
			SR_DS_YHouse										0.750	1.10	0.820	0.750	1.10	0.157	5	12/1/1998	10/10/2006
			SR_Okl									2.47	1.15	0.350	1.01	-1.11	7.10	1.64	73	11/12/1981	3/20/2008
			SR_US_BoatCnl										0.750	1.10	1.04	0.750	1.10	0.136	12	12/1/1998	10/10/2006
			SR_YHouse									0.694			0.694	0.160	1.06	0.308	16	5/31/1988	9/18/1989

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

				Decade									POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
DISSOLVED OXYGEN	DO	%	1000m							46.8		59.0			47.1	37.7	59.0	5.03	72	3/1/1966	9/5/1984
			1200m							78.0	61.0	63.9		48.4	49.6	30.6	100	12.7	1125	5/7/1968	1/22/2005
			1stFP											40.7	40.7	30.1	55.7	5.99	72	1/29/2004	12/9/2004
			2ndFP											43.8	43.8	30.3	62.8	9.39	51	1/29/2004	12/9/2004
			350m							36.9					36.9	28.2	41.4	3.14	36	3/1/1966	8/12/1969
			BBasin											40.3	40.3	24.3	68.3	12.3	14	2/13/2004	12/9/2004
			BGrotto											42.6	42.6	35.9	53.1	4.85	190	1/29/2004	12/9/2004
			Bridge											29.7	29.7	23.0	38.9	4.21	14	2/13/2004	12/9/2004
			CCH											48.7	48.7	43.1	60.0	9.76	3	12/9/2004	9/6/2007
			CH											47.3	47.3	47.0	47.4	0.231	3	2/13/2004	9/6/2007
			CRH											39.3	39.3	31.8	72.7	8.81	228	1/29/2004	12/9/2004
			DKit											45.7	45.7	33.9	74.4	9.76	68	1/29/2004	12/9/2004
			GarCove											44.9	44.9	44.9	44.9		1	12/9/2004	12/9/2004
			LostRvrBoil											52.0	52.0	52.0	52.0		1	9/6/2007	9/6/2007
			LParlor											43.1	43.1	38.1	50.0	3.03	64	2/13/2004	12/9/2004
			MBoil							28.0	34.7	33.0		26.2	29.3	17.0	78.0	10.3	1634	3/1/1966	9/5/2007
			MBoil_LV										13.7		13.7	12.7	14.5	0.303	514	5/2/1997	5/23/1997
			MBoil_RV										39.2		39.2	38.1	40.7	0.381	514	5/2/1997	5/23/1997
			Okl_40								63.8	54.5	71.1		57.6	34.5	86.2	14.9	40	6/15/1971	12/1/1998
			Okl_40_down_riv									54.3	47.5		49.2	24.8	70.0	10.5	44	6/9/1981	12/7/1998
			Okl_dwn_Riv										62.1		62.1	62.1	62.1	0.0000	3	12/1/1998	12/1/1998
			Okl_up_riv									46.6	34.2		45.7	5.68	70.0	18.2	45	1/22/1985	7/2/1996
			PPark							44.1					44.1	35.3	49.4	4.05	35	3/1/1966	8/12/1969
			Rock											55.7	55.7	55.7	55.7		1	1/29/2004	1/29/2004
			SideRun_In											32.9	32.9	32.9	32.9		1	6/22/2004	6/22/2004
			SideRun_Out											35.6	35.6	35.6	35.6		1	6/22/2004	6/22/2004
			SR_BoatCnl								54.4	58.5	62.1		58.5	41.2	84.1	10.1	98	6/1/1976	9/16/1996
			SR_DS_YHouse										69.2		69.2	69.2	69.2	0.00	2	12/1/1998	12/1/1998
			SR_Okl									56.9	56.6		56.9	50.6	65.5	3.99	22	11/12/1981	1/13/1994
			SR_US_BoatCnl										70.6		70.6	70.6	70.6	0.00	2	12/1/1998	12/1/1998
			SR_YHouse									62.7			62.7	36.8	92.0	13.2	84	10/24/1983	6/20/1989
			TMead											37.8	37.8	28.2	45.5	5.67	44	10/17/2004	12/9/2004
			Xmas											14.8	14.8	7.50	33.3	5.55	76	1/29/2004	12/9/2004
	DO	mg/L	1000m							4.00		4.60		3.90	4.00	2.98	4.93	0.430	86	3/1/1966	1/8/2004
			1200m						3.81	6.80	4.42	5.20		4.13	4.54	2.25	48.4	1.44	9694	12/3/1952	1/22/2005
			1600m											4.35	4.35	3.15	5.84	0.835	7	6/11/2003	1/8/2004
			1stFP						3.87		3.25			3.28	3.32	0.120	4.73	0.763	192	2/25/1954	12/9/2004
			210m											2.97	2.97	2.55	3.36	0.323	7	6/11/2003	1/8/2004
			2400m											4.46	4.46	2.99	5.96	1.02	7	6/11/2003	1/8/2004
			2ndFP						3.48					3.40	3.41	1.83	5.37	0.770	105	2/25/1954	12/9/2004
			3200m											4.53	4.53	3.10	6.39	1.02	7	6/11/2003	1/8/2004
			350m							3.16					3.16	2.40	3.60	0.275	36	3/1/1966	8/12/1969
			4000m											4.58	4.58	3.39	6.38	1.01	7	6/11/2003	1/8/2004
			400m											3.48	3.48	2.74	4.16	0.593	7	6/11/2003	1/8/2004
			4800m											4.72	4.72	3.22	6.67	1.09	7	6/11/2003	1/8/2004
			5600m											4.88	4.88	3.72	6.35	0.826	7	6/11/2003	1/8/2004
			6400m											4.96	4.96	3.54	6.30	0.907	7	6/11/2003	1/8/2004
			7200m											4.52	4.52	2.85	5.90	1.19	7	6/11/2003	1/8/2004
			800m											3.66	3.66	2.91	5.10	0.696	7	6/11/2003	1/8/2004
			BBasin											3.55	3.55	2.08	5.65	1.06	15	2/13/2004	12/9/2004
			BC						4.43		4.22			3.33	3.64	2.43	4.75	0.652	60	2/25/1954	1/8/2004
			BGrotto						4.18		4.14			3.59	3.88	2.77	6.08	0.637	1100	2/18/1954	4/24/2008
			Bridge											2.92	2.92	1.96	7.32	1.29	15	2/13/2004	12/9/2004
			CCH											4.07	4.07	3.65	4.90	0.722	3	12/9/2004	9/6/2007
			CH								3.62			4.85	3.71	2.48	5.70	0.862	82	8/31/1978	9/6/2007
			CRH						3.86		3.53			3.39	3.47	1.85	6.38	0.694	1170	2/25/1954	4/24/2008
			DKit						4.37		4.40			3.63	3.83	2.29	6.28	0.777	168	2/25/1954	12/9/2004
			GarCove											3.84	3.84	3.84	3.84		1	12/9/2004	12/9/2004
			GeyserSp								5.17				5.17	5.17	5.17		1	12/13/1978	12/13/1978
			LostRvrBoil											4.50	4.50	4.50	4.50		1	9/6/2007	9/6/2007
			LParlor						4.32		4.26			3.55	3.95	2.60	5.32	0.558	268	2/25/1954	12/9/2004
			MBoil						2.53	2.41	2.37	3.63	2.63	2.12	2.34	0.050	6.80	0.729	6322	7/1/1952	4/24/2008
			MBoil_LV										1.18		1.18	1.09	1.25	0.027	514	5/2/1997	5/23/1997
			MBoil_RV										3.34		3.34	3.24	3.47	0.034	514	5/2/1997	5/23/1997
			Okl_40								5.40	4.80	5.60		5.10	2.90	7.50	1.24	50	6/15/1971	5/3/1999
			Okl_40_down_riv									4.77	4.17		4.32	2.08	6.55	1.01	44	6/9/1981	12/7/1998
			Okl_dwn_Riv										5.46	4.09	4.72	2.44	6.47	1.18	39	12/1/1998	1/8/2004
			Okl_up_riv									4.36	2.70	2.71	3.60	0.500	7.80	1.88	78	1/22/1985	10/24/2006
			PPark							3.78					3.78	3.00	4.30	0.341	35	3/1/1966	8/12/1969
			Rock											4.80	4.80	4.80	4.80		1	1/29/2004	1/29/2004
			SGardens								4.38				4.38	3.42	5.55	0.584	15	8/31/1978	8/16/1979
			SideRun_In											2.80	2.80	2.80	2.80		1	6/22/2004	6/22/2004
			SideRun_Out											3.07	3.07	3.07	3.07		1	6/22/2004	6/22/2004
			SR_BoatCnl								4.69	5.16	5.33	5.08	5.12	3.50	7.40	0.835	132	6/1/1976	10/10/2006
			SR_DS_YHouse										6.85	4.78	5.78	4.45	8.30	1.23	25	12/1/1998	10/10/2006
			SR_Okl									4.99	5.09	4.58	4.63	1.14	8.98	1.19	180	11/12/1981	3/20/2008
			SR_US_BoatCnl										6.82	5.20	5.44	4.20	8.35	1.21	80	12/1/1998	10/10/2006
			SR_YHouse									5.43		5.02	5.37	3.20	8.00	1.05	100	10/24/1983	8/14/2006
			TMead								3.77			3.22	3.68	2.38	5.75	0.803	268	10/5/1978	12/9/2004
			Xmas						1.46		1.55			1.39	1.47	0.640	4.20	0.636	309	2/25/1954	12/9/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
FLOW	Flow	cfs	1200m				798	838	780	868	762	811	702	537	763	350	1,290	155	27941	10/1/1932	3/30/2009
			MBoil							865	780				835	730	1,110	85.3	300	10/31/1966	9/20/1972
	Flow-Inst	cfs	1200m											593	593	483	766	91.3	11	11/17/2005	11/8/2006
			MBoil	577	674	843	891	898	767	893	728	833	659	440	774	1.80	1,290	193	2513	5/26/1906	5/14/2008
	Velocity	ft/s	1200m											0.688	0.688	0.00	1.34	0.420	108	1/29/2004	2/13/2004
GENERAL INORGANIC	Alk	mg/L as CaCO3	1000m							147		123			135	123	147	13.9	4	8/12/1969	9/5/1984
			1200m						144	157		153		169	158	113	170	12.3	139	2/12/1953	12/9/2004
			350m							160					160	160	160		1	8/12/1969	8/12/1969
			BGrotto											157	157	151	173	4.80	157	11/15/2001	4/24/2008
			CRH											168	168	155	180	6.90	173	11/15/2001	4/24/2008
			MBoil						172	146	165	171		184	168	0.00	203	27.0	863	2/12/1953	4/24/2008
			Okl_40								132	138	173		139	26.0	173	32.1	38	6/15/1971	3/3/1992
			Okl_40_down_riv									135	146		143	113	166	14.7	48	6/9/1981	12/7/1998
			Okl_up_riv									103	95.9		103	77.0	126	14.3	45	1/22/1985	7/2/1996
			PPark							145					145	145	145		1	8/12/1969	8/12/1969
			SR_BoatCnl								123	149	154		144	23.0	164	23.5	88	6/1/1976	9/16/1996
			SR_Okl									138	149	157	152	61.0	179	23.2	96	11/12/1981	8/9/2007
			SR_YHouse									152			152	107	162	11.6	36	1/22/1985	9/18/1989
			Xmas											160	160	160	160	0.00	4	5/4/2004	5/4/2004
	Cl-T	mg/L	1000m							9.08					9.08	6.90	13.0	1.24	76	2/8/1966	8/12/1969
			1200m							9.50		11.7		12.1	11.8	8.00	18.0	2.59	135	5/7/1968	12/9/2004
			350m							9.46					9.46	7.10	12.0	1.11	39	2/8/1966	8/12/1969
			BGrotto											10.1	10.1	8.90	13.0	0.850	219	11/15/2001	4/24/2008
			CH											10.7	10.7	10.0	11.0	0.577	3	1/15/2004	7/14/2004
			CRH											10.3	10.3	8.80	12.0	1.04	243	11/15/2001	4/24/2008
			MBoil	7.70				7.80	12.0	10.0	9.28	10.3	9.83	10.3	9.88	5.00	90.0	6.18	2711	12/16/1907	5/14/2008
			Okl_40								16.5	16.2			16.2	10.0	26.0	5.76	34	4/4/1972	8/31/1988
			Okl_40_down_riv									15.2	12.1		12.9	1.00	36.0	5.99	48	6/9/1981	12/7/1998
			Okl_up_riv									30.9	26.0	29.0	30.4	23.0	38.0	4.38	50	1/22/1985	6/27/2006
			PPark							9.21					9.21	6.90	16.0	1.53	36	2/8/1966	8/12/1969
			SR_BoatCnl								12.0	11.5	9.19	9.43	11.0	8.00	24.0	3.43	98	6/1/1976	3/30/2004
			SR_Okl									10.4	11.0	35.3	29.7	8.00	667	109	107	11/12/1981	3/20/2008
			SR_YHouse									10.9			10.9	8.30	18.0	2.90	36	1/22/1985	9/18/1989
			Xmas											9.88	9.88	9.60	11.0	0.626	5	1/15/2004	5/4/2004
	CO2	mg/L	1200m							4.80				17.0	10.9	4.80	17.0	8.63	2	5/7/1968	1/15/2004
			1stFP						8.73						8.73	7.10	10.6	1.48	16	2/25/1954	5/20/1954
			2ndFP						8.55						8.55	8.30	8.80	0.274	6	5/20/1954	5/20/1954
			BC						9.30						9.30	7.70	10.6	1.38	12	2/25/1954	3/29/1954
			BGrotto						9.15						9.15	8.00	12.1	1.36	60	3/29/1954	5/23/1954
			CH											27.0	27.0	15.0	44.0	15.1	3	1/15/2004	7/14/2004
			CRH						9.94						9.94	7.90	11.7	1.33	60	2/25/1954	5/20/1954
			DKit						8.90						8.90	7.10	10.2	1.08	24	2/25/1954	5/20/1954
			LParlor						8.50						8.50	7.20	9.60	1.02	16	2/25/1954	5/20/1954
			MBoil						9.15	5.93	8.70	24.7	22.1	52.5	11.4	2.00	741	34.2	521	12/1/1952	5/14/2008
			Xmas						6.07					22.0	7.29	5.20	22.0	4.49	13	2/25/1954	1/15/2004
	F-D	mg/L	1200m							0.200					0.200	0.200	0.200		1	5/7/1968	5/7/1968
			BGrotto											0.166	0.166	0.150	0.190	0.011	137	11/15/2001	4/24/2008
			CRH											0.187	0.187	0.150	0.220	0.018	161	11/15/2001	4/24/2008
			MBoil							0.250	0.253	0.200	0.199	0.197	0.219	0.100	0.400	0.058	940	11/10/1960	5/14/2008
	F-T	mg/L	1200m											0.174	0.174	0.150	0.220	0.020	49	1/15/2004	12/9/2004
			BGrotto											0.166	0.166	0.150	0.200	0.015	197	11/15/2001	4/24/2008
			CH											0.200	0.200	0.200	0.200	0.00	3	1/15/2004	7/14/2004
			CRH											0.182	0.182	0.150	0.230	0.024	221	11/15/2001	4/24/2008
			MBoil					0.100						0.188	0.185	0.100	0.250	0.027	367	10/21/1946	4/24/2008
			Okl_up_riv											0.200	0.200	0.200	0.200	0.00	3	5/24/2000	5/24/2000
			SR_BoatCnl								0.175	0.171			0.172	0.160	0.180	0.008	18	6/1/1976	7/19/1983
			Xmas											0.152	0.152	0.140	0.200	0.027	5	1/15/2004	5/4/2004
	Hardness	mg/L as CaCO3	1200m						205	215					208	205	220	5.19	8	2/12/1953	7/18/1968
			MBoil						211	208	212	216	222	229	211	170	340	18.0	1597	2/12/1953	5/14/2008
			Okl_40_down_riv									170	191		184	30.0	275	35.7	54	6/9/1981	12/7/1998
			SR_BoatCnl								162		217		199	84.8	223	42.7	18	5/16/1979	3/21/1995
			SR_Okl									189		212	205	120	293	33.3	98	11/12/1981	9/26/2007
	Si-D	mg/L	1200m							9.20	8.60				8.90	8.60	9.20	0.424	2	5/7/1968	5/27/1971
			MBoil						11.0	10.3	9.93	10.1	10.1	10.2	10.1	8.80	12.0	0.596	802	5/2/1956	5/14/2008
			SR_Okl											10.4	10.4	10.3	10.6	0.119	6	2/24/2000	12/6/2000

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
	Si-T	mg/L	1000m											10.4	10.4	10.1	10.9	0.282	14	6/11/2003	1/8/2004
			1200m											10.3	10.3	10.1	10.6	0.190	42	6/11/2003	1/8/2004
			1600m											10.2	10.2	10.00	10.6	0.211	7	6/11/2003	1/8/2004
			1stFP											10.2	10.2	9.38	11.0	0.587	56	6/11/2003	1/8/2004
			210m											10.5	10.5	10.1	10.9	0.359	7	6/11/2003	1/8/2004
			2400m											10.1	10.1	9.53	10.6	0.349	7	6/11/2003	1/8/2004
			2ndFP											9.88	9.88	9.09	10.8	0.545	42	6/11/2003	1/8/2004
			3200m											10.1	10.1	9.82	10.6	0.271	7	6/11/2003	1/8/2004
			4000m											9.98	9.98	9.48	10.7	0.390	7	6/11/2003	1/8/2004
			400m											10.2	10.2	9.79	10.6	0.287	7	6/11/2003	1/8/2004
			4800m											9.93	9.93	9.33	10.5	0.420	7	6/11/2003	1/8/2004
			5600m											9.88	9.88	9.34	10.5	0.448	7	6/11/2003	1/8/2004
			6400m											9.45	9.45	8.43	10.5	0.782	7	6/11/2003	1/8/2004
			7200m											8.91	8.91	6.67	10.5	1.43	7	6/11/2003	1/8/2004
			800m											10.2	10.2	9.79	10.6	0.268	7	6/11/2003	1/8/2004
			BC											10.4	10.4	9.89	10.8	0.294	42	6/11/2003	1/8/2004
			BGrotto											10.2	10.2	9.63	10.5	0.262	140	6/11/2003	1/8/2004
			CRH											10.4	10.4	9.95	11.0	0.331	168	6/11/2003	1/8/2004
			DKit											10.3	10.3	9.88	10.8	0.273	56	6/11/2003	1/8/2004
			LParlor											10.3	10.3	9.65	10.6	0.336	56	6/11/2003	1/8/2004
			MBoil	13.0				9.20						10.6	10.7	9.20	13.0	0.768	224	12/16/1907	1/8/2004
			Okl_dwn_Riv											8.37	8.37	6.63	10.3	1.46	21	6/11/2003	1/8/2004
			Okl_up_riv											6.57	6.57	4.35	9.76	2.06	21	6/11/2003	1/8/2004
			SR_Okl											10.8	10.8	9.81	12.0	0.819	6	2/24/2000	9/26/2007
			Xmas											8.60	8.60	7.91	9.61	0.504	56	6/11/2003	1/8/2004
	SO4	mg/L	1200m							47.0		51.8		53.8	52.5	44.0	64.0	3.70	134	5/7/1968	12/9/2004
			BGrotto											65.6	65.6	59.0	82.0	6.50	219	11/15/2001	4/24/2008
			CH											47.7	47.7	46.0	49.0	1.53	3	1/15/2004	7/14/2004
			CRH											74.4	74.4	57.0	86.0	4.70	243	11/15/2001	4/24/2008
			MBoil	44.0				34.0	45.0	40.5	41.2	45.0	39.5	43.4	42.3	18.0	65.0	8.97	1160	12/16/1907	5/14/2008
			Okl_40									48.3			48.3	30.0	64.0	8.41	30	8/28/1984	8/31/1988
			Okl_40_down_riv									40.1	42.6		42.0	26.0	63.0	9.00	47	6/9/1981	12/7/1998
			Okl_up_riv									35.4	12.0	12.8	31.8	12.0	77.8	21.0	50	1/22/1985	6/27/2006
			SR_BoatCnl								43.0	50.8	51.5	47.5	49.5	27.0	61.0	5.95	96	6/1/1976	3/30/2004
			SR_Okl									45.5	63.0	149	126	18.1	2,913	476	107	11/12/1981	3/20/2008
			SR_YHouse									51.4			51.4	46.0	56.0	2.15	36	1/22/1985	9/18/1989
			Xmas											30.4	30.4	26.0	48.0	9.84	5	1/15/2004	5/4/2004
GENERAL ORGANIC	DOC	mg/L	CCH											0.400	0.400	0.400	0.400		1	9/6/2007	9/6/2007
			CH											0.300	0.300	0.300	0.300		1	9/6/2007	9/6/2007
			LostRvrBoil											0.300	0.300	0.300	0.300		1	9/6/2007	9/6/2007
			MBoil											0.500	0.500	0.300	0.700	0.283	2	9/5/2007	9/5/2007
			SR_Okl											0.867	0.867	0.220	1.92	0.823	6	2/24/2000	12/6/2000
	TOC	mg/L	1200m											0.400	0.400	0.400	0.400		1	1/15/2004	1/15/2004
			BGrotto											0.546	0.546	0.400	7.10	0.487	189	11/15/2001	4/24/2008
			CH											0.367	0.367	0.300	0.500	0.115	3	1/15/2004	7/14/2004
			CRH											0.534	0.534	0.400	7.70	0.498	209	11/15/2001	4/24/2008
			MBoil							4.00	1.82	0.380	0.053	0.527	1.17	0.00	9.90	1.74	717	9/20/1968	4/24/2008
			Okl_40										3.78		3.78	2.30	7.00	1.72	12	12/1/1998	5/3/1999
			Okl_40_down_riv										6.43		6.43	0.580	16.1	4.96	36	1/11/1994	12/7/1998
			Okl_dwn_Riv										6.05		6.05	2.50	18.0	5.57	18	12/1/1998	5/3/1999
			Okl_up_riv											28.0	28.0	28.0	28.0	0.00	3	5/24/2000	5/24/2000
			SR_BoatCnl								7.50	3.06			4.42	0.500	16.0	5.48	26	3/7/1978	1/4/1983
			SR_DS_YHouse										0.786		0.786	0.500	2.50	0.726	14	12/1/1998	5/3/1999
			SR_Okl										7.60	4.11	4.18	-2.06	33.0	7.78	99	1/13/1994	3/20/2008
			SR_US_BoatCnl										1.00	2.34	1.33	0.500	5.00	1.35	16	12/1/1998	11/15/2005
			Xmas											0.300	0.300	0.300	0.300		1	1/15/2004	1/15/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade											POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
METAL	Ag-T	µg/L	MBoil									0.533			0.533	0.500	1.00	0.129	15	1/17/1985	1/17/1985
			Okl_40_down_riv										0.113		0.113	0.00	0.300	0.100	10	1/11/1994	4/25/1995
			SR_BoatCnl										1.50		1.50	1.50	1.50	0.00	2	9/1/1992	9/1/1992
			SR_Okl											-0.029	-0.029	-0.300	0.223	0.133	28	10/6/2004	3/20/2008
	Al-D	µg/L	BGrotto											3.94	3.94	2.50	9.00	2.52	52	10/30/2002	4/14/2005
			CRH											4.96	4.96	2.50	9.00	2.77	62	10/30/2002	4/14/2005
			MBoil											4.46	4.46	2.50	9.00	2.44	72	10/30/2002	4/14/2005
			SR_BoatCnl										25.0		25.0	25.0	25.0	0.00	2	9/1/1992	9/1/1992
	Al-T	µg/L	BGrotto											14.5	14.5	2.50	37.5	14.4	78	11/15/2001	4/14/2005
			CRH											14.0	14.0	2.50	37.5	14.7	92	11/15/2001	4/14/2005
			MBoil								0.00	5.33	5.33	14.8	11.5	0.00	37.5	13.7	151	5/4/1970	4/14/2005
			Okl_40_down_riv										77.4		77.4	3.71	470	109	26	7/5/1995	12/7/1998
			SR_Okl											27.8	27.8	-2.81	104	25.6	73	10/17/2001	3/20/2008
	As-D	µg/L	BGrotto											2.82	2.82	1.50	5.00	1.24	62	11/15/2001	4/14/2005
			CRH											3.46	3.46	1.50	6.00	1.61	74	11/15/2001	4/14/2005
			MBoil								0.00	0.533		2.42	1.23	0.00	4.00	1.30	176	5/4/1970	4/14/2005
	As-T	µg/L	BGrotto											2.66	2.66	1.50	5.50	1.22	88	11/15/2001	4/14/2005
			CRH											2.67	2.67	1.50	6.00	1.25	104	11/15/2001	4/14/2005
			MBoil								0.793	1.71	0.533	2.63	1.62	0.00	5.50	1.31	345	5/23/1972	4/14/2005
			Okl_40_down_riv										1.50		1.50	0.00	6.21	1.29	36	1/11/1994	12/7/1998
			SR_BoatCnl										10.0		10.0	10.0	10.0	0.00	2	9/1/1992	9/1/1992
			SR_Okl											0.882	0.882	-2.04	3.47	0.969	73	10/17/2001	3/20/2008
	Ba-D	µg/L	BGrotto											4.33	4.33	3.40	5.00	0.559	52	10/30/2002	4/14/2005
			CRH											4.42	4.42	3.80	5.00	0.465	62	10/30/2002	4/14/2005
			MBoil											3.21	3.21	2.00	3.70	0.607	72	10/30/2002	4/14/2005
	Ba-T	µg/L	BGrotto											4.39	4.39	3.40	5.20	0.637	58	10/30/2002	4/14/2005
			CRH											4.50	4.50	3.80	5.40	0.591	68	10/30/2002	4/14/2005
			MBoil									53.3		3.18	11.3	2.00	100	19.2	93	1/17/1985	4/14/2005
			Okl_40_down_riv										8.91		8.91	3.00	20.1	4.50	26	7/5/1995	12/7/1998
			SR_Okl											5.88	5.88	3.60	22.5	3.97	73	10/17/2001	3/20/2008
	Be-T	µg/L	SR_BoatCnl										0.250		0.250	0.250	0.250	0.00	2	9/1/1992	9/1/1992
	Ca-D	mg/L	1200m							68.0					68.0	68.0	68.0		1	5/7/1968	5/7/1968
			BGrotto											73.2	73.2	67.3	82.2	3.24	157	11/15/2001	4/24/2008
			CRH											80.3	80.3	70.8	86.1	4.45	173	11/15/2001	4/24/2008
			MBoil						72.0	67.3	69.0	71.5	73.7	75.9	71.8	48.0	85.9	5.05	1119	5/2/1956	5/14/2008
			Okl_40_down_riv									53.7			53.7	38.0	97.0	24.4	6	6/9/1981	9/6/1984
			SR_Okl									61.5			61.5	40.0	104	22.1	12	11/12/1981	9/6/1984
	Ca-T	mg/L	1200m											71.7	71.7	69.0	75.0	2.02	49	1/15/2004	12/9/2004
			BGrotto											74.6	74.6	67.3	94.2	5.41	219	11/15/2001	4/24/2008
			CH											70.0	70.0	68.0	74.0	3.46	3	1/15/2004	7/14/2004
			CRH											79.8	79.8	71.9	92.4	5.34	243	11/15/2001	4/24/2008
			MBoil	73.0				68.0						76.8	76.4	68.0	87.6	3.17	403	12/16/1907	4/24/2008
			Okl_40_down_riv										59.2		59.2	30.0	77.0	10.8	36	1/11/1994	12/7/1998
			Okl_up_riv											40.3	40.3	40.3	40.3	0.00	3	5/24/2000	5/24/2000
			SR_BoatCnl								49.6				49.6	21.4	66.5	22.0	6	5/16/1979	11/14/1979
			SR_Okl											68.8	68.8	32.5	92.3	10.6	73	10/17/2001	3/20/2008
			Xmas											64.4	64.4	61.0	78.0	7.60	5	1/15/2004	5/4/2004
	Cd-D	µg/L	BGrotto											0.270	0.270	0.250	0.375	0.046	62	11/15/2001	4/14/2005
			CRH											0.270	0.270	0.250	0.375	0.046	74	11/15/2001	4/14/2005
			MBoil								0.00			0.270	0.200	0.00	0.375	0.125	116	5/18/1971	4/14/2005
	Cd-T	µg/L	BGrotto											0.321	0.321	0.250	0.375	0.062	88	11/15/2001	4/14/2005
			CRH											0.322	0.322	0.250	0.375	0.062	104	11/15/2001	4/14/2005
			MBoil								0.853	0.533	0.533	0.323	0.528	0.00	2.00	0.354	255	5/23/1972	4/14/2005
			Okl_40_down_riv										0.416		0.416	0.00	3.60	0.723	36	1/11/1994	12/7/1998
			SR_BoatCnl								4.00	0.200	0.850		2.01	0.150	10.0	3.42	14	5/16/1979	9/1/1992
			SR_Okl											0.035	0.035	-0.500	0.280	0.142	73	10/17/2001	3/20/2008
			SR_YHouse									0.200			0.200	0.100	0.400	0.155	6	1/30/1984	2/17/1986

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
	Co-D	µg/L	BGrotto											0.567	0.567	0.250	1.00	0.374	52	10/30/2002	4/14/2005
			CRH											0.565	0.565	0.250	1.00	0.373	62	10/30/2002	4/14/2005
			MBoil								0.00			0.689	0.570	0.00	1.00	0.372	87	5/18/1971	4/14/2005
	Co-T	µg/L	BGrotto											0.647	0.647	0.375	1.00	0.270	78	11/15/2001	4/14/2005
			CRH											0.641	0.641	0.375	1.00	0.268	92	11/15/2001	4/14/2005
			MBoil								0.00			0.637	0.496	0.00	1.00	0.354	136	5/23/1972	4/14/2005
	Cr-D	µg/L	BGrotto											1.47	1.47	1.00	2.60	0.689	62	11/15/2001	4/14/2005
			CRH											1.44	1.44	1.00	2.50	0.642	74	11/15/2001	4/14/2005
			MBoil											1.00	1.00	1.00	1.00	0.00	86	11/15/2001	4/14/2005
	Cr-T	µg/L	BGrotto											1.84	1.84	1.00	5.00	1.39	88	11/15/2001	4/14/2005
			CRH											1.75	1.75	1.00	5.00	1.30	104	11/15/2001	4/14/2005
			MBoil								3.33	0.533		1.18	1.67	0.00	10.0	2.58	180	5/4/1970	4/14/2005
			Okl_40_down_riv										1.41		1.41	0.001	4.63	0.944	36	1/11/1994	12/7/1998
			SR_BoatCnl								70.0	18.8	5.00		42.1	5.00	100	43.2	12	5/16/1979	1/22/1991
			SR_Okl											1.01	1.01	0.028	8.08	0.948	99	10/17/2001	3/20/2008
			SR_YHouse									12.5			12.5	12.5	12.5	0.00	6	1/30/1984	2/17/1986
	Cu-D	µg/L	BGrotto											1.62	1.62	1.00	2.50	0.637	62	11/15/2001	4/14/2005
			CRH											1.62	1.62	1.00	2.50	0.637	74	11/15/2001	4/14/2005
			MBoil								3.16	0.533	0.533	1.62	2.21	0.00	10.0	3.18	221	5/4/1970	4/14/2005
	Cu-T	µg/L	BGrotto											1.95	1.95	1.00	3.35	0.847	88	11/15/2001	4/14/2005
			CRH											1.95	1.95	1.00	3.35	0.847	104	11/15/2001	4/14/2005
			MBoil								0.00			1.95	1.56	0.00	3.35	1.09	150	5/23/1972	4/14/2005
			Okl_40_down_riv										1.89		1.89	0.00	10.0	2.40	36	1/11/1994	12/7/1998
			SR_BoatCnl								139	10.0	2.50		63.0	2.50	381	135	14	5/16/1979	9/1/1992
			SR_Okl											0.442	0.442	-1.89	3.29	0.951	47	10/17/2001	3/20/2008
			SR_YHouse									14.2			14.2	10.0	20.0	4.65	6	1/30/1984	2/17/1986
	Fe-D	µg/L	1200m							0.00					0.00	0.00	0.00		1	5/7/1968	5/7/1968
			BGrotto											6.53	6.53	2.50	17.5	5.34	62	11/15/2001	4/14/2005
			CRH											7.24	7.24	2.50	17.5	5.04	74	11/15/2001	4/14/2005
			MBoil							0.00	9.79	12.1	10.0	6.57	8.20	0.00	30.0	8.45	431	2/3/1964	4/14/2005
			Okl_40_down_riv									59.5			59.5	10.0	100	31.7	6	6/9/1981	9/6/1984
			SR_Okl									62.2			62.2	20.0	100	30.2	12	11/12/1981	9/6/1984
	Fe-T	µg/L	1200m											8.00	8.00	8.00	8.00		1	1/15/2004	1/15/2004
			BGrotto											11.8	11.8	2.50	30.0	8.98	88	11/15/2001	4/14/2005
			CH											2.67	2.67	2.00	3.00	0.577	3	1/15/2004	7/14/2004
			CRH											11.6	11.6	2.50	27.0	8.27	104	11/15/2001	4/14/2005
			MBoil								29.1	44.0	20.0	9.41	25.3	0.00	120	28.0	360	5/23/1972	4/14/2005
			Okl_40_down_riv										74.8		74.8	0.001	248	75.5	36	1/11/1994	12/7/1998
			SR_BoatCnl								77.0	57.5	4.00		58.3	4.00	100	37.8	12	5/16/1979	9/1/1992
			SR_Okl											32.2	32.2	-1.60	356	60.5	73	10/17/2001	3/20/2008
			Xmas											3.00	3.00	3.00	3.00		1	1/15/2004	1/15/2004
	Hg-D	µg/L	MBoil								0.100				0.100	0.100	0.100	0.0000	15	9/24/1970	9/24/1970
	Hg-T	µg/L	MBoil								0.183	0.086	0.053		0.141	0.00	0.500	0.144	255	5/18/1971	5/30/1991
			SR_BoatCnl								0.110	0.150	0.075		0.111	0.030	0.200	0.064	14	5/16/1979	9/1/1992
			SR_YHouse									0.100			0.100	0.100	0.100	0.0000	6	1/30/1984	2/17/1986
	K-D	mg/L	1200m							0.500					0.500	0.500	0.500		1	5/7/1968	5/7/1968
			BGrotto											0.648	0.648	0.560	0.810	0.053	157	11/15/2001	4/24/2008
			CRH											0.678	0.678	0.590	0.800	0.053	173	11/15/2001	4/24/2008
			MBoil						0.500	1.55	0.540	0.550	0.600	0.595	0.738	0.200	6.00	0.836	984	5/2/1956	5/14/2008
			Okl_40_down_riv									1.40			1.40	0.600	3.30	0.998	6	6/9/1981	9/6/1984
			SR_Okl									0.550			0.550	0.300	1.10	0.275	12	11/12/1981	9/6/1984
	K-T	mg/L	1200m											0.566	0.566	0.060	0.700	0.196	49	1/15/2004	12/9/2004
			BGrotto											0.641	0.641	0.590	0.800	0.034	219	11/15/2001	4/24/2008
			CH											0.667	0.667	0.600	0.800	0.115	3	1/15/2004	7/14/2004
			CRH											0.658	0.658	0.580	0.820	0.043	243	11/15/2001	4/24/2008
			MBoil	9.80				4.00						0.600	1.04	0.510	9.80	1.78	403	12/16/1907	4/24/2008
			Okl_40_down_riv										2.04		2.04	0.700	12.2	2.10	36	1/11/1994	12/7/1998
			Okl_up_riv											7.10	7.10	7.10	7.10	0.00	3	5/24/2000	5/24/2000
			SR_BoatCnl								1.13				1.13	0.650	1.99	0.670	6	5/16/1979	11/14/1979
			SR_Okl											1.06	1.06	-3.57	6.09	1.39	73	10/17/2001	3/20/2008
			Xmas											0.608	0.608	0.600	0.610	0.004	5	1/15/2004	5/4/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
	Mg-D	mg/L	1200m							9.30					9.30	9.30	9.30		1	5/7/1968	5/7/1968
			BGrotto											11.7	11.7	10.5	12.9	0.544	157	11/15/2001	4/24/2008
			CRH											12.4	12.4	10.6	13.3	0.533	173	11/15/2001	4/24/2008
			MBoil						9.40	36.3	9.03	9.33	9.00	9.70	13.7	7.20	96.0	18.1	1119	5/2/1956	5/14/2008
			Okl_40_down_riv									10.9			10.9	8.00	14.2	2.76	6	6/9/1981	9/6/1984
			SR_Okl									9.37			9.37	7.70	11.0	1.36	12	11/12/1981	9/6/1984
	Mg-T	mg/L	1200m											10.0	10.0	9.60	11.0	0.387	49	1/15/2004	12/9/2004
			BGrotto											11.7	11.7	10.5	14.2	0.584	219	11/15/2001	4/24/2008
			CH											9.57	9.57	9.30	10.0	0.379	3	1/15/2004	7/14/2004
			CRH											12.3	12.3	10.6	13.4	0.456	243	11/15/2001	4/24/2008
			MBoil	9.20				9.60						10.0	9.99	8.50	12.1	0.735	403	12/16/1907	4/24/2008
			Okl_40_down_riv										9.90		9.90	8.35	12.4	0.812	36	1/11/1994	12/7/1998
			Okl_up_riv											10.8	10.8	10.8	10.8	0.0000	3	5/24/2000	5/24/2000
			SR_BoatCnl								9.27				9.27	7.62	10.2	1.28	6	5/16/1979	11/14/1979
			SR_Okl											9.90	9.90	7.76	10.8	0.673	73	10/17/2001	3/20/2008
			Xmas											7.52	7.52	6.90	10.0	1.39	5	1/15/2004	5/4/2004
	Mn-D	µg/L	1200m							0.00					0.00	0.00	0.00		1	5/7/1968	5/7/1968
			BGrotto											0.253	0.253	0.125	0.960	0.186	62	11/15/2001	4/14/2005
			CRH											0.230	0.230	0.125	0.500	0.133	74	11/15/2001	4/14/2005
			MBoil							0.00	4.30	5.31	10.0	0.242	3.45	0.00	10.0	3.53	371	5/11/1967	4/14/2005
	Mn-T	µg/L	BGrotto											0.343	0.343	0.250	0.960	0.181	88	11/15/2001	4/14/2005
			CRH											0.279	0.279	0.250	0.500	0.080	104	11/15/2001	4/14/2005
			MBoil								10.7	8.13	10.0	0.283	6.68	0.00	60.0	11.7	360	5/23/1972	4/14/2005
			Okl_40_down_riv										7.76		7.76	0.00	24.5	7.06	26	7/5/1995	12/7/1998
			SR_BoatCnl										0.500		0.500	0.500	0.500	0.00	2	9/1/1992	9/1/1992
			SR_Okl											3.58	3.58	-0.200	45.9	8.14	73	10/17/2001	3/20/2008
	NA-D	mg/L	1200m							5.80					5.80	5.80	5.80		1	5/7/1968	5/7/1968
			BGrotto											6.40	6.40	5.70	7.40	0.357	157	11/15/2001	4/24/2008
			CRH											6.51	6.51	5.80	7.40	0.320	173	11/15/2001	4/24/2008
			MBoil						7.50	23.5	6.03	5.95	5.83	6.31	9.07	4.30	74.0	13.6	984	5/2/1956	5/14/2008
			Okl_40_down_riv									7.03			7.03	6.00	8.90	1.08	6	6/9/1981	9/6/1984
			SR_Okl									6.18			6.18	4.70	7.70	1.07	12	11/12/1981	9/6/1984
	NA-T	%	1200m							6.00					6.00	6.00	6.00		1	5/7/1968	5/7/1968
			MBoil						7.00	10.3	5.93	5.50	5.50	5.81	7.42	4.00	23.0	4.74	477	5/2/1956	5/14/2008
	NA-T	mg/L	1200m											6.42	6.42	6.10	6.80	0.264	49	1/15/2004	12/9/2004
			BGrotto											6.35	6.35	5.40	7.39	0.442	197	11/15/2001	4/24/2008
			CH											6.30	6.30	6.20	6.40	0.100	3	1/15/2004	7/14/2004
			CRH											6.37	6.37	5.70	7.41	0.454	221	11/15/2001	4/24/2008
			MBoil	9.80				1.10						6.14	6.09	0.680	9.80	1.67	381	12/16/1907	4/24/2008
			Okl_40_down_riv										7.08		7.08	4.37	14.5	1.86	36	1/11/1994	12/7/1998
			Okl_up_riv											14.9	14.9	14.9	14.9	0.00	3	5/24/2000	5/24/2000
			SR_BoatCnl								6.27				6.27	5.65	7.37	0.852	6	5/16/1979	11/14/1979
			SR_Okl											7.16	7.16	6.17	13.9	2.01	26	10/17/2001	8/21/2003
			Xmas											5.48	5.48	5.30	6.20	0.402	5	1/15/2004	5/4/2004
	Ni-D	µg/L	BGrotto											0.919	0.919	0.500	1.00	0.185	62	11/15/2001	4/14/2005
			CRH											0.919	0.919	0.500	1.00	0.186	74	11/15/2001	4/14/2005
			MBoil											0.919	0.919	0.500	1.00	0.186	86	11/15/2001	4/14/2005
	Ni-T	µg/L	BGrotto											2.09	2.09	1.00	10.1	2.89	88	11/15/2001	4/14/2005
			CRH											1.09	1.09	1.00	1.50	0.170	104	11/15/2001	4/14/2005
			MBoil								1.07	0.533	0.533	1.09	0.992	0.500	2.00	0.273	180	5/16/1974	4/14/2005
			Okl_40_down_riv										4.40		4.40	0.00	16.7	4.88	36	1/11/1994	12/7/1998
			SR_BoatCnl										2.50		2.50	2.50	2.50	0.00	2	9/1/1992	9/1/1992
			SR_Okl											0.740	0.740	-0.894	4.88	0.915	73	10/17/2001	3/20/2008
	Pb-D	µg/L	BGrotto											2.52	2.52	0.013	5.60	1.62	62	11/15/2001	4/14/2005
			CRH											2.42	2.42	0.013	5.00	1.44	74	11/15/2001	4/14/2005
			MBoil								50.0	1.07	2.00	3.34	16.3	0.00	200	51.6	206	5/4/1970	4/14/2005
	Pb-T	µg/L	BGrotto											2.11	2.11	0.013	2.50	0.843	88	11/15/2001	4/14/2005
			CRH											2.46	2.46	0.013	5.50	1.38	104	11/15/2001	4/14/2005
			MBoil								100	1.24	4.00	2.13	16.1	0.00	200	51.2	210	5/23/1972	4/14/2005
			Okl_40_down_riv										1.54		1.54	0.00	24.0	4.51	36	1/11/1994	12/7/1998
			SR_BoatCnl								10.0	5.45	0.825		6.08	0.650	10.0	3.97	14	5/16/1979	9/1/1992
			SR_Okl											0.016	0.016	-1.52	2.09	0.773	73	10/17/2001	3/20/2008
			SR_YHouse									1.67			1.67	1.00	2.50	0.683	6	1/30/1984	2/17/1986
	SAR	ratio	1200m							0.200					0.200	0.200	0.200		1	5/7/1968	5/7/1968
			MBoil						0.200	0.424	0.193	0.200	0.200	0.200	0.274	0.100	1.40	0.244	477	5/2/1956	5/14/2008
	Se-D	µg/L	BGrotto											3.18	3.18	2.00	4.00	0.742	62	11/15/2001	4/14/2005
			CRH											3.18	3.18	2.00	4.00	0.742	74	11/15/2001	4/14/2005
			MBoil									0.533		3.17	2.78	0.500	4.00	1.17	101	1/17/1985	4/14/2005

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade 1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	POR Statistics Average	Min	Max	StDev	N	Period of Record	
	Se-T	µg/L	BGrotto											4.24	4.24	2.00	13.0	3.43	88	11/15/2001	4/14/2005
			CRH											3.11	3.11	2.00	4.00	0.872	104	11/15/2001	4/14/2005
			MBoil											3.10	3.10	2.00	4.00	0.874	120	11/15/2001	4/14/2005
			Okl_40_down_riv										8.47		8.47	0.00	61.3	14.4	26	7/5/1995	12/7/1998
			SR_BoatCnl										15.0		15.0	15.0	15.0	0.00	2	9/1/1992	9/1/1992
			SR_Okl											-0.314	-0.314	-8.00	3.04	2.24	73	10/17/2001	3/20/2008
	SR-D	µg/L	1200m							660					660	660	660		1	5/7/1968	5/7/1968
			BGrotto											720	720	661	764	37.9	52	10/30/2002	4/14/2005
			CRH											924	924	850	1,020	56.1	62	10/30/2002	4/14/2005
			MBoil							615	593	622	545	563	580	426	800	76.3	664	5/11/1967	5/14/2008
	SR-T	µg/L	1200m											620	620	620	620		1	1/15/2004	1/15/2004
			BGrotto											696	696	661	753	27.1	78	11/15/2001	4/14/2005
			CH											597	597	570	630	30.6	3	1/15/2004	7/14/2004
			CRH											877	877	782	980	73.4	92	11/15/2001	4/14/2005
			MBoil											598	598	426	749	111	106	11/15/2001	4/14/2005
			SR_Okl											397	397	141	626	184	7	10/6/2004	8/8/2005
			Xmas											640	640	640	640		1	1/15/2004	1/15/2004
	Tl-T	µg/L	SR_BoatCnl										25.0		25.0	25.0	25.0	0.00	2	9/1/1992	9/1/1992
	Zn-D	µg/L	BGrotto											3.08	3.08	1.00	11.0	3.54	62	11/15/2001	4/14/2005
			CRH											3.21	3.21	1.00	6.70	1.79	74	11/15/2001	4/14/2005
			MBoil								43.0	80.4	10.0	2.69	38.9	1.00	370	83.7	281	5/4/1970	4/14/2005
	Zn-T	µg/L	BGrotto											2.35	2.35	1.00	4.10	0.776	88	11/15/2001	4/14/2005
			CRH											4.46	4.46	1.00	12.0	4.18	104	11/15/2001	4/14/2005
			MBoil								0.00			2.48	1.99	0.00	7.50	1.35	150	5/23/1972	4/14/2005
			Okl_40_down_riv										11.7		11.7	0.001	100	17.8	36	1/11/1994	12/7/1998
			SR_BoatCnl								82.5	25.5	2.50		43.3	2.50	222	76.2	14	5/16/1979	9/1/1992
			SR_Okl											1.38	1.38	-0.744	5.09	1.36	73	10/17/2001	3/20/2008
			SR_YHouse									6.67			6.67	5.00	10.0	2.58	6	1/30/1984	2/17/1986
NITROGEN	NH3-N	mg/L	1200m									0.001			0.001	0.001	0.001	0.0000	6	4/9/1985	4/9/1985
			MBoil							0.00					0.00	0.00	0.00	0.00	14	11/12/1969	11/12/1969
			Okl_40								0.001	0.0007	0.0003		0.001	0.0003	0.002	0.0007	12	6/15/1971	12/1/1998
			Okl_40_down_riv									0.0006	0.0006		0.0006	0.0001	0.002	0.0004	34	3/5/1984	12/7/1998
			Okl_dwn_Riv										0.0002		0.0002	0.0002	0.0002	0.0000	3	12/1/1998	12/1/1998
			Okl_up_riv									0.003	0.005		0.004	0.003	0.005	0.001	6	4/9/1985	7/2/1996
			SR_BoatCnl								0.0009	0.0005	0.0003		0.0005	0.0001	0.001	0.0004	18	6/1/1976	9/16/1996
			SR_DS_YHouse										0.0002		0.0002	0.0002	0.0002	0.00	2	12/1/1998	12/1/1998
			SR_Okl									0.0003	0.0001		0.0002	0.0001	0.0004	0.0001	8	3/5/1984	1/13/1994
			SR_US_BoatCnl										0.0002		0.0002	0.0002	0.0002	0.00	2	12/1/1998	12/1/1998
			SR_YHouse									0.0009			0.0009	0.0007	0.001	0.0002	4	10/24/1983	4/9/1985
	NH4-N	mg/L	1200m								0.039	0.060		0.013	0.019	0.013	0.060	0.015	55	5/27/1971	12/9/2004
			BGrotto											0.011	0.011	0.005	0.070	0.016	200	11/15/2001	4/24/2008
			CRH											0.008	0.008	0.005	0.029	0.006	220	11/15/2001	4/24/2008
			MBoil							0.00	0.014	0.018	0.009	0.016	0.015	0.00	0.270	0.030	1136	11/12/1969	4/24/2008
			Okl_40								0.110	0.165	0.023		0.114	0.010	0.300	0.111	12	6/15/1971	12/1/1998
			Okl_40_down_riv									0.059	0.108		0.104	0.013	0.598	0.116	39	3/5/1984	12/7/1998
			Okl_dwn_Riv										0.017		0.017	0.017	0.017	0.00	3	12/1/1998	12/1/1998
			Okl_up_riv									0.250	0.300	0.035	0.215	0.034	0.300	0.113	8	4/9/1985	6/27/2006
			SR_BoatCnl								0.075	0.030	0.019	0.009	0.027	0.005	0.080	0.027	24	6/1/1976	8/14/2006
			SR_DS_YHouse										0.005		0.005	0.005	0.005	0.00	4	12/1/1998	12/1/1998
			SR_Okl									0.022		0.042	0.041	-0.002	0.494	0.109	91	3/5/1984	3/20/2008
			SR_US_BoatCnl										0.005	0.009	0.008	0.005	0.030	0.007	17	12/1/1998	8/14/2006
			SR_YHouse									0.030			0.030	0.030	0.030	0.00	4	10/24/1983	4/9/1985
			Xmas											0.013	0.013	0.013	0.013	0.00	4	5/4/2004	5/4/2004
	NO2-N	mg/L	1200m								0.006				0.006	0.006	0.006		1	5/27/1971	5/27/1971
			BGrotto											0.010	0.010	0.010	0.010		1	7/14/2004	7/14/2004
			CRH											0.010	0.010	0.010	0.010		1	7/14/2004	7/14/2004
			MBoil							0.00	0.006	0.006	0.007	0.006	0.006	0.00	0.010	0.003	667	11/12/1969	7/14/2004
			Okl_40								0.017				0.017	0.007	0.025	0.008	6	6/15/1971	6/12/1973
	NO3-N	mg/L	1000m											1.10	1.10	1.01	1.22	0.068	14	6/11/2003	1/8/2004
			1200m							0.470	0.540			1.11	1.08	0.470	1.20	0.142	44	5/7/1968	1/8/2004
			1600m											1.10	1.10	0.986	1.20	0.072	7	6/11/2003	1/8/2004
			1stFP											1.18	1.18	1.05	1.30	0.075	56	6/11/2003	1/8/2004
			210m											1.10	1.10	1.06	1.21	0.051	7	6/11/2003	1/8/2004
			2400m											1.09	1.09	0.981	1.20	0.071	7	6/11/2003	1/8/2004
			2ndFP											1.14	1.14	1.04	1.19	0.048	42	6/11/2003	1/8/2004
			3200m											1.09	1.09	0.956	1.19	0.080	7	6/11/2003	1/8/2004
			4000m											1.08	1.08	0.947	1.18	0.080	7	6/11/2003	1/8/2004
			400m											1.13	1.13	1.04	1.21	0.070	7	6/11/2003	1/8/2004
			4800m											1.08	1.08	0.952	1.21	0.077	7	6/11/2003	1/8/2004
			5600m											1.06	1.06	0.936	1.21	0.084	7	6/11/2003	1/8/2004
			6400m											0.980	0.980	0.673	1.21	0.168	7	6/11/2003	1/8/2004
			7200m											0.845	0.845	0.462	1.21	0.289	7	6/11/2003	1/8/2004
			800m											1.12	1.12	0.962	1.22	0.090	7	6/11/2003	1/8/2004
			BC											1.31	1.31	1.13	1.42	0.094	42	6/11/2003	1/8/2004
			BGrotto											1.33	1.33	1.17	1.48	0.095	140	6/11/2003	1/8/2004
			CRH											1.23	1.23	1.09	1.32	0.081	168	6/11/2003	1/8/2004
			DKit											1.31	1.31	1.13	1.53	0.113	56	6/11/2003	1/8/2004
			LParlor											1.37	1.37	1.20	1.53	0.096	56	6/11/2003	1/8/2004
			MBoil	0.040				0.290		0.357	0.566	0.725	0.905	1.03	0.665	0.040	1.17	0.290	661	12/16/1907	1/8/2004
			Okl_40								0.560				0.560	0.400	0.710	0.139	6	6/15/1971	6/12/1973
			Okl_dwn_Riv											0.703	0.703	0.416	1.05	0.250	21	6/11/2003	1/8/2004
			Okl_up_riv											0.156	0.156	0.054	0.338	0.086	21	6/11/2003	1/8/2004
			Xmas											0.912	0.912	0.809	1.09	0.089	56	6/11/2003	1/8/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
	NOx-N	mg/L	1000m									0.010			0.010	0.010	0.010	0.00	2	9/5/1984	9/5/1984
			1200m									0.820		1.14	0.938	0.680	1.20	0.172	133	1/22/1985	12/9/2004
			BBasin											0.920	0.920	0.920	0.920		1	6/22/2004	6/22/2004
			BGrotto											1.45	1.45	1.30	3.20	0.201	220	11/15/2001	4/24/2008
			Bridge											1.00	1.00	1.00	1.00		1	6/22/2004	6/22/2004
			CH											1.12	1.12	0.960	1.20	0.139	3	1/15/2004	7/14/2004
			CRH											1.39	1.39	1.20	2.60	0.165	244	11/15/2001	4/24/2008
			MBoil								1.04	0.847	0.988	1.02	1.00	0.390	7.10	0.770	1030	9/19/1974	4/24/2008
			Okl_40									0.731	0.913		0.789	0.370	0.990	0.133	44	8/28/1984	5/3/1999
			Okl_40_down_riv									0.635	0.794		0.754	0.324	1.39	0.225	48	6/9/1981	12/7/1998
			Okl_dwn_Riv										0.923		0.923	0.830	1.00	0.058	18	12/1/1998	5/3/1999
			Okl_up_riv									0.186	0.021	0.056	0.163	0.010	0.620	0.171	50	1/22/1985	6/27/2006
			SideRun_Out											0.940	0.940	0.940	0.940		1	6/22/2004	6/22/2004
			SR_BoatCnl								0.478	0.752	0.895	0.985	0.791	0.020	1.27	0.222	110	6/13/1978	8/14/2006
			SR_DS_YHouse										0.993	0.905	0.961	0.670	1.10	0.103	22	12/1/1998	4/9/2002
			SR_Okl									0.764		0.918	0.889	0.030	1.45	0.258	115	11/12/1981	3/20/2008
			SR_US_BoatCnl										0.983	1.14	1.07	0.910	1.20	0.109	27	12/1/1998	8/14/2006
			SR_YHouse									0.807		0.990	0.829	0.620	1.00	0.085	100	10/24/1983	4/9/2002
			Xmas											0.940	0.940	0.900	1.10	0.089	5	1/15/2004	5/4/2004
	NOx-N-D	mg/L	BGrotto											1.40	1.40	1.20	1.80	0.119	137	11/15/2001	4/24/2008
			CCH											1.30	1.30	1.30	1.30		1	9/6/2007	9/6/2007
			CH											1.42	1.42	1.42	1.42		1	9/6/2007	9/6/2007
			CRH											1.35	1.35	1.20	1.90	0.148	161	11/15/2001	4/24/2008
			LostRvrBoil											0.880	0.880	0.880	0.880		1	9/6/2007	9/6/2007
			MBoil											1.04	1.04	0.810	1.40	0.125	261	5/15/2000	5/14/2008
			SR_Okl										0.960	0.950	0.953	0.945	0.961	0.008	8	1/13/1994	12/6/2000
	OrgN	mg/L	1200m								0.170	0.120			0.127	0.120	0.170	0.019	7	5/27/1971	4/9/1985
			MBoil							0.046	0.176	0.103		0.890	0.156	0.00	1.00	0.211	467	9/20/1968	8/14/2002
			Okl_40								0.913	0.560			0.772	0.020	1.97	0.753	10	6/15/1971	4/10/1985
			Okl_up_riv									1.51			1.51	1.51	1.51	0.00	3	4/9/1985	4/9/1985
			SR_BoatCnl								0.840	0.050			0.577	0.050	1.05	0.449	6	6/1/1976	4/10/1985
			SR_YHouse									0.050			0.050	0.050	0.050	0.00	4	10/24/1983	4/9/1985
	TKN	mg/L	1000m									0.610			0.610	0.610	0.610	0.00	2	9/5/1984	9/5/1984
			1200m									0.048		0.039	0.045	0.00	0.140	0.039	126	1/22/1985	12/9/2004
			BGrotto											0.038	0.038	0.024	0.200	0.020	220	11/15/2001	4/24/2008
			CRH											0.037	0.037	0.024	0.200	0.018	244	11/15/2001	4/24/2008
			MBoil								0.075	0.154	0.107	0.088	0.093	0.010	0.900	0.111	1076	9/19/1974	5/14/2008
			Okl_40									0.383	0.289		0.350	0.00	1.28	0.285	40	1/23/1985	5/3/1999
			Okl_40_down_riv									0.997	0.754		0.773	0.00	2.68	0.664	39	3/5/1984	12/7/1998
			Okl_dwn_Riv										0.313		0.313	0.170	0.500	0.124	18	12/1/1998	5/3/1999
			Okl_up_riv									2.16	3.40	2.88	2.31	1.30	3.80	0.674	47	1/22/1985	6/27/2006
			SR_BoatCnl								0.352	0.179	0.105	0.094	0.174	0.00	1.26	0.243	100	3/7/1978	8/14/2006
			SR_DS_YHouse										0.056		0.056	0.030	0.130	0.043	14	12/1/1998	5/3/1999
			SR_Okl									0.297	0.340	0.327	0.326	0.042	2.74	0.609	113	3/5/1984	3/20/2008
			SR_US_BoatCnl										0.067	0.093	0.082	0.030	0.360	0.069	27	12/1/1998	8/14/2006
			SR_YHouse									0.086		0.079	0.086	0.00	0.430	0.075	88	10/24/1983	4/9/2002
			Xmas											1.10	1.10	1.10	1.10	0.00	4	5/4/2004	5/4/2004
	TKN-D	mg/L	BGrotto											0.043	0.043	0.030	0.160	0.022	157	11/15/2001	4/24/2008
			CRH											0.056	0.056	0.030	0.160	0.038	173	11/15/2001	4/24/2008
			MBoil											0.058	0.058	0.030	0.150	0.036	227	5/15/2000	4/24/2008
			Okl_40_down_riv									1.10			1.10	0.480	1.71	0.870	2	3/5/1984	9/6/1984
			SR_Okl									0.370	0.270	0.128	0.205	0.064	0.370	0.113	10	9/6/1984	12/6/2000
	TN	mg/L	1000m											1.19	1.19	1.13	1.28	0.050	14	6/11/2003	1/8/2004
			1200m											1.18	1.18	0.940	1.26	0.078	84	6/11/2003	12/9/2004
			1600m											1.22	1.22	1.15	1.28	0.047	7	6/11/2003	1/8/2004
			1stFP											1.32	1.32	1.18	1.86	0.157	56	6/11/2003	1/8/2004
			210m											1.20	1.20	1.10	1.30	0.060	7	6/11/2003	1/8/2004
			2400m											1.17	1.17	1.12	1.29	0.057	7	6/11/2003	1/8/2004
			2ndFP											1.27	1.27	1.17	1.47	0.077	42	6/11/2003	1/8/2004
			3200m											1.19	1.19	1.11	1.32	0.081	7	6/11/2003	1/8/2004
			4000m											1.18	1.18	1.12	1.28	0.055	7	6/11/2003	1/8/2004
			400m											1.23	1.23	1.16	1.34	0.068	7	6/11/2003	1/8/2004
			4800m											1.19	1.19	1.07	1.29	0.083	7	6/11/2003	1/8/2004
			5600m											1.15	1.15	1.09	1.29	0.072	7	6/11/2003	1/8/2004
			6400m											1.21	1.21	1.07	1.47	0.139	7	6/11/2003	1/8/2004
			7200m											1.35	1.35	1.09	1.63	0.211	7	6/11/2003	1/8/2004
			800m											1.28	1.28	1.12	1.65	0.174	7	6/11/2003	1/8/2004
			BC											1.50	1.50	1.40	1.75	0.092	42	6/11/2003	1/8/2004
			BGrotto											1.45	1.45	1.32	1.56	0.071	140	6/11/2003	1/8/2004
			CRH											1.39	1.39	1.33	1.53	0.051	168	6/11/2003	1/8/2004
			DKit											1.42	1.42	1.35	1.51	0.049	56	6/11/2003	1/8/2004
			LParlor											1.51	1.51	1.41	1.72	0.074	56	6/11/2003	1/8/2004
			MBoil								0.995	0.861		1.24	1.10	0.520	7.10	0.977	644	3/17/1971	6/26/2007
			Okl_dwn_Riv											1.46	1.46	1.32	1.63	0.116	21	6/11/2003	1/8/2004
			Okl_up_riv											2.06	2.06	1.68	2.77	0.317	21	6/11/2003	1/8/2004
			Xmas											1.04	1.04	0.867	1.32	0.140	56	6/11/2003	1/8/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

				Decade										POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record
OXYGEN DEMAND	BOD5	mg/L	1000m							0.800		1.10			0.819	0.300	2.30	0.531	32	3/1/1966 9/5/1984
			1200m									0.377		0.700	0.381	0.00	0.900	0.245	79	1/22/1985 1/15/2004
			350m							0.731					0.731	0.100	1.50	0.417	16	3/1/1966 8/12/1969
			BGrotto											0.109	0.109	0.100	0.200	0.030	11	11/15/2001 7/14/2004
			CH											0.200	0.200	0.100	0.400	0.173	3	1/15/2004 7/14/2004
			CRH											0.115	0.115	0.100	0.300	0.055	13	11/15/2001 7/14/2004
			MBoil							0.631	0.427	0.600		0.129	0.513	0.00	1.60	0.443	645	3/1/1966 6/7/2006
			Okl_40								1.60	0.514	0.466		0.636	0.200	3.00	0.592	48	6/15/1971 5/3/1999
			Okl_40_down_riv									2.03			2.03	1.00	2.90	0.568	9	11/12/1981 6/5/1984
			Okl_dwn_Riv										0.633		0.633	0.500	1.30	0.307	18	12/1/1998 5/3/1999
			Okl_up_riv									2.28			2.28	1.20	3.30	0.592	39	1/22/1985 8/30/1988
			PPark							0.969					0.969	0.200	4.00	0.910	16	3/1/1966 8/12/1969
			SR_BoatCnl								2.10	0.340	0.483	0.350	0.569	0.100	3.60	0.698	54	6/1/1976 10/10/2006
			SR_DS_YHouse										0.500	0.350	0.461	0.350	0.500	0.068	19	12/1/1998 10/10/2006
			SR_Okl									1.07	8,888	0.100	539	-0.100	8,888	2,153	33	11/12/1981 3/20/2008
			SR_US_BoatCnl										0.500	0.350	0.425	0.350	0.500	0.077	24	12/1/1998 10/10/2006
			SR_YHouse									0.324		0.350	0.326	0.200	0.500	0.102	38	1/22/1985 8/14/2006
			Xmas											0.100	0.100	0.100	0.100		1	1/15/2004 1/15/2004
	cBOD5	mg/L	BGrotto											0.100	0.100	0.100	0.100	0.0000	10	11/15/2001 11/15/2001
			CRH											0.100	0.100	0.100	0.100	0.0000	12	11/15/2001 11/15/2001
			MBoil											0.100	0.100	0.100	0.100	0.0000	14	11/15/2001 11/15/2001
	COD	mg/L	1000m							2.83					2.83	0.00	7.60	2.94	30	3/1/1966 8/12/1969
			350m							2.70					2.70	0.00	7.00	2.72	15	3/1/1966 5/6/1969
			MBoil							3.42					3.42	0.00	8.10	2.63	238	3/1/1966 11/12/1969
			Okl_40								10.0				10.0	10.0	10.0	0.00	2	6/12/1973 6/12/1973
			PPark							2.17					2.17	0.00	7.20	2.59	15	3/1/1966 5/6/1969
			SR_BoatCnl								9.73	6.94			7.59	0.00	38.5	13.3	34	5/16/1979 7/19/1983
			SR_YHouse											27.3	27.3	27.3	27.3	0.00	2	11/28/2001 11/28/2001
PESTICIDE	Alachlor-D	µg/L	BGrotto											0.005	0.005	0.005	0.005	0.00	2	4/14/2004 7/14/2004
			CRH											0.005	0.005	0.005	0.005	0.00	2	4/14/2004 7/14/2004
			MBoil											0.005	0.005	0.005	0.005	0.00	2	4/14/2004 7/14/2004
	Atrazine-D	µg/L	BGrotto											0.006	0.006	0.006	0.006	0.00	2	4/14/2004 7/14/2004
			CRH											0.008	0.008	0.008	0.008	0.00	2	4/14/2004 7/14/2004
			MBoil											0.006	0.006	0.005	0.007	0.001	2	4/14/2004 7/14/2004
	Diazinon-D	µg/L	BGrotto											0.232	0.232	0.005	0.500	0.122	13	1/29/2002 7/14/2004
			CCH											0.200	0.200	0.200	0.200		1	9/6/2007 9/6/2007
			CH											0.200	0.200	0.200	0.200		1	9/6/2007 9/6/2007
			CRH											0.234	0.234	0.005	0.500	0.113	15	1/29/2002 7/14/2004
			LostRvrBoil											0.200	0.200	0.200	0.200		1	9/6/2007 9/6/2007
			MBoil											0.247	0.247	0.005	0.500	0.087	34	1/29/2002 9/5/2007
	Dieldrin-D	µg/L	BGrotto											0.009	0.009	0.009	0.009	0.00	2	4/14/2004 7/14/2004
			CRH											0.009	0.009	0.009	0.009	0.00	2	4/14/2004 7/14/2004
			MBoil											0.009	0.009	0.009	0.009	0.00	2	4/14/2004 7/14/2004
	Lindane-D	µg/L	BGrotto											0.004	0.004	0.004	0.004	0.00	2	4/14/2004 7/14/2004
			CRH											0.004	0.004	0.004	0.004	0.00	2	4/14/2004 7/14/2004
			MBoil											0.004	0.004	0.004	0.004	0.00	2	4/14/2004 7/14/2004
PHOSPHORUS	OrthoP	mg/L	1000m											0.043	0.043	0.036	0.051	0.006	14	6/11/2003 1/8/2004
			1200m								0.030			0.043	0.043	0.026	0.074	0.011	92	5/27/1971 12/9/2004
			1600m											0.042	0.042	0.032	0.051	0.007	7	6/11/2003 1/8/2004
			1stFP											0.044	0.044	0.034	0.055	0.006	56	6/11/2003 1/8/2004
			210m											0.046	0.046	0.038	0.058	0.007	7	6/11/2003 1/8/2004
			2400m											0.041	0.041	0.031	0.051	0.007	7	6/11/2003 1/8/2004
			2ndFP											0.044	0.044	0.035	0.054	0.006	42	6/11/2003 1/8/2004
			3200m											0.041	0.041	0.030	0.050	0.007	7	6/11/2003 1/8/2004
			4000m											0.041	0.041	0.033	0.050	0.006	7	6/11/2003 1/8/2004
			400m											0.045	0.045	0.039	0.052	0.005	7	6/11/2003 1/8/2004
			4800m											0.043	0.043	0.031	0.052	0.007	7	6/11/2003 1/8/2004
			5600m											0.042	0.042	0.030	0.051	0.007	7	6/11/2003 1/8/2004
			6400m											0.038	0.038	0.020	0.053	0.011	7	6/11/2003 1/8/2004
			7200m											0.031	0.031	0.014	0.049	0.015	7	6/11/2003 1/8/2004
			800m											0.045	0.045	0.038	0.054	0.007	7	6/11/2003 1/8/2004
			BC											0.044	0.044	0.037	0.054	0.005	42	6/11/2003 1/8/2004
			BGrotto											0.042	0.042	0.030	0.055	0.005	339	11/15/2001 4/24/2008
			CH											0.033	0.033	0.030	0.040	0.006	3	1/15/2004 7/14/2004
			CRH											0.044	0.044	0.034	0.056	0.005	389	11/15/2001 4/24/2008
			DKit											0.044	0.044	0.037	0.053	0.005	56	6/11/2003 1/8/2004
			LParlor											0.043	0.043	0.035	0.052	0.005	56	6/11/2003 1/8/2004
			MBoil							0.035	0.042	0.042	0.040	0.045	0.044	0.010	0.120	0.011	1425	5/11/1967 5/14/2008
			Okl_40								0.035				0.035	0.030	0.040	0.006	4	6/15/1971 6/12/1973
			Okl_40_down_riv									0.042	0.029		0.032	0.005	0.060	0.014	48	6/9/1981 12/7/1998
			Okl_dwn_Riv											0.025	0.025	0.004	0.050	0.016	21	6/11/2003 1/8/2004
			Okl_up_riv											0.013	0.013	0.002	0.032	0.011	24	5/24/2000 1/8/2004
			SR_BoatCnl								0.055			0.030	0.037	0.014	0.080	0.021	14	6/1/1976 10/10/2006
			SR_DS_YHouse											0.022	0.022	0.014	0.037	0.013	3	4/9/2002 10/10/2006
			SR_Okl									0.039	0.039	0.032	0.034	0.009	0.050	0.009	88	11/12/1981 3/20/2008
			SR_US_BoatCnl											0.040	0.040	0.033	0.048	0.005	12	1/25/2006 10/10/2006
			SR_YHouse											0.014	0.014	0.014	0.014	0.00	2	4/9/2002 4/9/2002
			Xmas											0.046	0.046	0.038	0.056	0.006	61	6/11/2003 5/4/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
	PO4-T	mg/L as PO4	1200m								0.090				0.090	0.090	0.090		1	5/27/1971	5/27/1971
			MBoil							0.155	0.122			0.116	0.134	0.070	0.320	0.055	241	3/19/1963	5/14/2008
			Okl_40								0.030		0.047		0.044	0.030	0.060	0.011	12	4/4/1972	5/3/1999
			Okl_dwn_Riv										0.048		0.048	0.032	0.060	0.009	15	1/5/1999	5/3/1999
			SR_BoatCnl										0.041	0.041	0.041	0.034	0.045	0.004	12	3/16/1999	1/23/2002
			SR_DS_YHouse										0.040	0.034	0.038	0.026	0.050	0.007	16	1/5/1999	1/23/2002
			SR_Okl											0.029	0.029	0.015	0.048	0.008	26	10/17/2001	8/21/2003
			SR_US_BoatCnl										0.049		0.049	0.035	0.060	0.008	10	1/5/1999	5/3/1999
			SR_YHouse											0.036	0.036	0.026	0.043	0.006	10	11/28/2001	1/23/2002
	TDP	mg/L	BGrotto											0.041	0.041	0.033	0.049	0.003	147	11/15/2001	4/24/2008
			CRH											0.041	0.041	0.034	0.051	0.004	161	11/15/2001	4/24/2008
			MBoil											0.044	0.044	0.030	0.053	0.005	243	5/15/2000	4/24/2008
			Okl_40_down_riv									0.048			0.048	0.040	0.053	0.007	3	6/10/1982	9/6/1984
			SR_Okl									0.048	0.047	0.036	0.042	0.028	0.051	0.008	12	6/10/1982	12/6/2000
	TP	mg/L	1000m									0.090		0.052	0.057	0.041	0.090	0.016	16	9/5/1984	1/8/2004
			1200m							0.016	0.036	0.041		0.055	0.048	0.016	0.220	0.035	165	5/7/1968	9/14/2004
			1600m											0.053	0.053	0.041	0.069	0.010	7	6/11/2003	1/8/2004
			1stFP											0.059	0.059	0.043	0.115	0.018	56	6/11/2003	1/8/2004
			210m											0.054	0.054	0.043	0.063	0.007	7	6/11/2003	1/8/2004
			2400m											0.051	0.051	0.040	0.065	0.008	7	6/11/2003	1/8/2004
			2ndFP											0.055	0.055	0.041	0.077	0.011	42	6/11/2003	1/8/2004
			3200m											0.053	0.053	0.042	0.065	0.008	7	6/11/2003	1/8/2004
			4000m											0.053	0.053	0.044	0.066	0.008	7	6/11/2003	1/8/2004
			400m											0.049	0.049	0.042	0.060	0.006	7	6/11/2003	1/8/2004
			4800m											0.054	0.054	0.042	0.065	0.008	7	6/11/2003	1/8/2004
			5600m											0.053	0.053	0.044	0.061	0.007	7	6/11/2003	1/8/2004
			6400m											0.052	0.052	0.042	0.065	0.008	7	6/11/2003	1/8/2004
			7200m											0.053	0.053	0.045	0.063	0.007	7	6/11/2003	1/8/2004
			800m											0.053	0.053	0.044	0.066	0.010	7	6/11/2003	1/8/2004
			BC											0.055	0.055	0.040	0.104	0.016	42	6/11/2003	1/8/2004
			BGrotto											0.045	0.045	0.030	0.069	0.008	360	11/15/2001	4/24/2008
			CH											0.030	0.030	0.020	0.040	0.010	3	1/15/2004	7/14/2004
			CRH											0.048	0.048	0.030	0.085	0.010	412	11/15/2001	4/24/2008
			DKit											0.050	0.050	0.042	0.057	0.005	56	6/11/2003	1/8/2004
			LParlor											0.052	0.052	0.039	0.068	0.010	56	6/11/2003	1/8/2004
			MBoil							0.010	0.045	0.050	0.042	0.045	0.044	0.010	0.078	0.013	1379	4/28/1969	5/14/2008
			Okl_40								0.100	0.063	0.039		0.063	0.032	0.270	0.053	36	6/12/1973	12/1/1998
			Okl_40_down_riv									0.070	0.118		0.106	0.038	2.02	0.283	48	6/9/1981	12/7/1998
			Okl_dwn_Riv										0.048	0.052	0.052	0.044	0.063	0.006	24	12/1/1998	1/8/2004
			Okl_up_riv									0.078	0.120	0.065	0.075	0.032	0.140	0.025	71	1/22/1985	6/27/2006
			SR_BoatCnl								0.054	0.046	0.040	0.041	0.045	0.010	0.100	0.015	112	6/1/1976	8/14/2006
			SR_DS_YHouse										0.045	0.045	0.045	0.042	0.049	0.002	12	12/1/1998	4/9/2002
			SR_Okl									0.054	0.051	0.043	0.045	0.020	0.094	0.012	129	11/12/1981	3/20/2008
			SR_US_BoatCnl										0.041	0.040	0.040	0.030	0.058	0.007	17	12/1/1998	8/14/2006
			SR_YHouse									0.043		0.043	0.043	0.020	0.070	0.009	98	10/24/1983	4/9/2002
			Xmas											0.058	0.058	0.022	0.110	0.021	61	6/11/2003	5/4/2004
PHYSICAL	Alk-D	mg/L as CaCO3	CCH											119	119	119	119		1	9/6/2007	9/6/2007
			CH											137	137	137	137		1	9/6/2007	9/6/2007
			LostRvrBoil											170	170	170	170		1	9/6/2007	9/6/2007
			MBoil											202	202	196	207	7.78	2	9/5/2007	9/5/2007
	Color	CPU	1000m							0.385		17.0			0.800	0.00	17.0	2.93	80	2/8/1966	9/5/1984
			1200m							0.00		5.21		2.55	4.17	0.00	10.0	1.79	135	5/7/1968	12/9/2004
			350m							0.128					0.128	0.00	5.00	0.801	39	2/8/1966	8/12/1969
			BGrotto											0.833	0.833	0.00	5.00	1.43	42	11/15/2001	10/26/2006
			CH											5.00	5.00	5.00	5.00	0.00	3	1/15/2004	7/14/2004
			CRH											0.729	0.729	0.00	5.00	1.26	48	11/15/2001	10/26/2006
			MBoil					4.00	8.00	1.12	2.70	1.33	3.44	2.34	1.87	0.00	40.0	3.78	2498	10/21/1946	3/7/2007
			Okl_40								36.7	28.9	5.00		28.8	3.00	160	38.3	38	6/15/1971	3/3/1992
			Okl_40_down_riv									30.0	50.1		45.1	5.00	200	44.5	48	6/9/1981	12/7/1998
			Okl_up_riv									110	80.0	104	107	40.0	280	67.3	55	1/22/1985	10/24/2006
			PPark							0.263					0.263	0.00	5.00	1.13	38	2/8/1966	8/12/1969
			SR_BoatCnl								37.3	8.68	8.18	1.88	12.0	0.00	84.0	18.6	100	6/1/1976	10/10/2006
			SR_DS_YHouse											2.50	2.50	2.50	2.50		1	10/10/2006	10/10/2006
			SR_Okl									10.9	30.0	29.1	23.3	10.0	200	37.2	69	11/12/1981	9/26/2007
			SR_US_BoatCnl											4.22	4.22	2.50	20.0	4.35	16	3/28/2005	10/10/2006
			SR_YHouse									5.05			5.05	0.00	25.0	4.27	88	10/24/1983	9/18/1989
			Xmas											3.00	3.00	2.50	5.00	1.12	5	1/15/2004	5/4/2004
	Cond	umhos/cm	1200m								449			438	448	4.58	488	37.4	1320	8/31/1978	12/9/2004
			1stFP								470			444	455	414	490	22.9	124	8/31/1978	12/9/2004
			2ndFP											429	429	408	467	19.9	51	1/29/2004	12/9/2004
			BBasin											435	435	412	500	25.7	14	2/13/2004	12/9/2004
			BC								462				462	432	492	32.9	6	6/19/1979	7/17/1979
			BGrotto								467			449	462	4.68	505	59.5	700	8/31/1978	12/9/2004
			Bridge											435	435	413	500	27.4	14	2/13/2004	12/9/2004
			CCH								461			389	425	389	461	41.5	4	8/31/1978	12/9/2004
			CH								454			469	455	4.57	521	73.5	84	8/31/1978	2/13/2004
			CRH								534			484	519	430	565	34.8	756	8/31/1978	12/9/2004
			DKit								515			473	485	435	551	34.7	96	3/7/1979	12/9/2004
			GarCove											399	399	399	399		1	12/9/2004	12/9/2004
			GeyserSp								490				490	490	490		1	12/13/1978	12/13/1978
			LParlor								510			462	495	430	539	32.6	196	8/31/1978	12/9/2004
			MBoil								466			444	464	4.62	512	46.6	3878	8/31/1978	12/9/2004
			SGardens								484				484	412	516	30.0	15	8/31/1978	8/16/1979
			SideRun_In											414	414	414	414		1	6/22/2004	6/22/2004
			SideRun_Out											419	419	419	419		1	6/22/2004	6/22/2004
			TMead								467			422	467	4.78	506	50.7	222	10/5/1978	12/9/2004
			Xmas								369			342	361	3.70	421	66.5	240	8/31/1978	12/9/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
	Depth	m	BGrotto											4.29	4.29	0.00	7.70	3.20	29	11/15/2001	10/26/2006
			CRH											4.09	4.09	0.00	9.50	3.31	33	11/15/2001	10/26/2006
			MBoil											6.30	6.30	0.00	11.0	4.87	39	11/15/2001	10/26/2006
			Okl_40_down_riv									6.80	2.87		3.19	1.40	8.20	1.33	36	6/9/1981	12/7/1998
			Okl_up_riv											2.15	2.15	1.50	3.60	0.831	6	1/25/2006	10/24/2006
			SR_BoatCnl										0.800	3.48	2.71	0.800	5.00	1.60	7	3/31/1999	10/10/2006
			SR_DS_YHouse											4.58	4.58	3.10	6.00	1.14	5	1/25/2006	10/10/2006
			SR_Okl									2.20	3.00	3.47	3.46	0.500	7.40	2.18	208	11/12/1981	3/20/2008
			SR_US_BoatCnl											4.09	4.09	2.50	5.60	1.18	8	1/25/2006	10/10/2006
			SR_YHouse											3.60	3.60	2.00	4.20	1.07	4	1/25/2006	8/14/2006
	ORP	mV	1200m						0.432						0.432	0.432	0.432	0.0000	6	5/28/1954	5/28/1954
			MBoil						0.436						0.436	0.436	0.436	0.00	14	5/28/1954	5/28/1954
	pH	SU	1000m							7.53		8.05		7.42	7.54	7.10	8.10	0.207	94	2/8/1966	1/8/2004
			1200m							7.80	6.50	7.77		7.53	6.87	4.58	8.20	0.709	1172	5/7/1968	12/9/2004
			1600m											7.45	7.45	7.28	7.65	0.141	7	6/11/2003	1/8/2004
			1stFP								7.07			7.43	7.34	6.06	7.78	0.284	176	8/31/1978	12/9/2004
			210m											7.35	7.35	7.19	7.69	0.173	7	6/11/2003	1/8/2004
			2400m											7.46	7.46	7.26	7.69	0.155	7	6/11/2003	1/8/2004
			2ndFP											7.45	7.45	7.21	7.70	0.131	93	6/11/2003	12/9/2004
			3200m											7.47	7.47	7.28	7.68	0.153	7	6/11/2003	1/8/2004
			350m							7.47					7.47	7.20	7.80	0.181	38	2/8/1966	8/12/1969
			4000m											7.47	7.47	7.28	7.70	0.158	7	6/11/2003	1/8/2004
			400m											7.36	7.36	7.20	7.69	0.169	7	6/11/2003	1/8/2004
			4800m											7.51	7.51	7.30	7.76	0.177	7	6/11/2003	1/8/2004
			5600m											7.50	7.50	7.31	7.68	0.146	7	6/11/2003	1/8/2004
			6400m											7.53	7.53	7.30	7.78	0.175	7	6/11/2003	1/8/2004
			7200m											7.45	7.45	7.12	7.78	0.220	7	6/11/2003	1/8/2004
			800m											7.41	7.41	7.26	7.74	0.162	7	6/11/2003	1/8/2004
			BBasin											7.44	7.44	7.14	7.81	0.173	15	2/13/2004	12/9/2004
			BC								6.35			7.32	7.25	6.35	7.67	0.279	45	6/19/1979	1/8/2004
			BGrotto								6.77			7.39	7.15	4.94	7.68	0.450	820	8/31/1978	4/24/2008
			Bridge											7.41	7.41	7.19	7.60	0.122	15	2/13/2004	12/9/2004
			CCH								7.12			7.45	7.32	7.12	7.53	0.205	5	8/31/1978	9/6/2007
			CH								6.78			7.38	6.84	4.82	7.63	0.594	54	8/31/1978	9/6/2007
			CRH								6.71			7.33	7.11	5.12	7.74	0.435	918	8/31/1978	4/24/2008
			DKit								6.20			7.40	7.23	5.10	7.72	0.402	144	3/7/1979	12/9/2004
			GarCove											7.53	7.53	7.53	7.53		1	12/9/2004	12/9/2004
			GeyserSp								6.79				6.79	6.79	6.79		1	12/13/1978	12/13/1978
			LostRvrBoil											7.30	7.30	7.30	7.30		1	9/6/2007	9/6/2007
			LParlor								6.82			7.39	7.14	5.92	7.62	0.393	216	8/31/1978	12/9/2004
			MBoil					7.80	7.54	7.50	6.76	7.52	7.77	7.34	7.07	2.30	8.40	0.597	5036	10/21/1946	5/14/2008
			MBoil_LV										7.74		7.74	7.52	7.88	0.089	514	5/2/1997	5/23/1997
			MBoil_RV										7.56		7.56	7.27	7.72	0.118	514	5/2/1997	5/23/1997
			Okl_40								7.67	7.63	7.67		7.64	6.70	8.20	0.294	84	6/15/1971	5/3/1999
			Okl_40_down_riv									7.32	7.11		7.15	6.51	7.80	0.246	43	6/10/1982	12/7/1998
			Okl_dwn_Riv										7.57	7.32	7.44	7.03	8.14	0.256	39	12/1/1998	1/8/2004
			Okl_up_riv									7.41	7.34	7.04	7.30	6.69	8.30	0.290	120	1/22/1985	10/24/2006
			PPark							7.51					7.51	7.30	7.90	0.172	37	2/8/1966	8/12/1969
			SGardens								6.47				6.47	4.88	7.38	0.717	13	8/31/1978	4/15/1979
			SideRun_In											7.24	7.24	7.24	7.24		1	6/22/2004	6/22/2004
			SideRun_Out											7.37	7.37	7.37	7.37		1	6/22/2004	6/22/2004
			SR_BoatCnl								7.68	7.88	7.53	7.44	7.73	6.90	8.90	0.314	202	6/1/1976	10/10/2006
			SR_DS_YHouse										7.65	7.48	7.56	7.40	8.07	0.168	25	12/1/1998	10/10/2006
			SR_Okl									7.38	6.97	7.53	7.51	6.59	7.91	0.207	184	6/10/1982	3/20/2008
			SR_US_BoatCnl										7.71	7.53	7.55	7.30	8.21	0.147	80	12/1/1998	10/10/2006
			SR_YHouse									7.77		7.48	7.74	7.30	8.40	0.206	126	10/24/1983	8/14/2006
			TMead								6.41			7.47	6.42	4.58	7.52	0.531	126	12/13/1978	12/9/2004
			Xmas								6.75			7.50	7.15	4.82	7.81	0.592	241	8/31/1978	12/9/2004
	Secchi	m	1000m									1.30			1.30	1.30	1.30	0.00	2	9/5/1984	9/5/1984
			1200m									2.99		27.5	9.44	2.20	32.1	11.0	114	1/22/1985	10/17/2004
			BGrotto											6.05	6.05	0.00	7.10	1.58	178	11/15/2001	4/24/2008
			CRH											7.00	7.00	0.00	9.50	2.22	196	11/15/2001	4/24/2008
			MBoil											24.5	24.5	0.00	96.0	28.5	294	11/15/2001	4/24/2008
			Okl_40									2.57	3.23		2.78	0.500	6.80	1.43	44	8/28/1984	5/3/1999
			Okl_40_down_riv										2.13		2.13	0.550	3.50	0.866	31	1/11/1994	12/7/1998
			Okl_dwn_Riv										2.83		2.83	2.00	3.80	0.575	18	12/1/1998	5/3/1999
			Okl_up_riv									0.631	0.300	0.589	0.608	0.300	1.00	0.191	60	1/22/1985	10/24/2006
			SR_BoatCnl								3.08	2.98	3.13		3.03	0.800	5.60	1.15	101	5/16/1979	3/31/1999
			SR_DS_YHouse										4.87		4.87	3.20	6.00	1.19	12	12/1/1998	5/3/1999
			SR_Okl										2.33	4.04	4.02	0.400	7.40	2.07	150	1/13/1994	3/20/2008
			SR_US_BoatCnl										5.58	4.20	5.48	4.00	6.30	0.871	13	12/1/1998	11/15/2005
			SR_YHouse									3.11			3.11	0.100	6.00	1.18	90	10/24/1983	9/18/1989
			TMead											36.6	36.6	32.0	40.2	2.85	10	3/26/2004	10/17/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

PARAMETER GROUP	PARAMETER	UNITS	STATION	Decade										POR Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
	SpCond	umhos/cm	1000m							399		405		399	400	374	441	15.3	96	2/8/1966	1/8/2004
			1200m							406	392	416		442	431	376	482	31.6	365	5/7/1968	12/9/2004
			1600m											396	396	379	433	22.5	7	6/11/2003	1/8/2004
			1stFP											437	437	382	496	34.0	128	6/11/2003	12/9/2004
			210m											425	425	406	458	20.4	7	6/11/2003	1/8/2004
			2400m											396	396	378	432	22.5	7	6/11/2003	1/8/2004
			2ndFP											417	417	290	484	41.3	93	6/11/2003	12/9/2004
			3200m											395	395	377	432	22.8	7	6/11/2003	1/8/2004
			350m							408					408	0.00	463	68.8	39	2/8/1966	8/12/1969
			4000m											395	395	375	433	23.2	7	6/11/2003	1/8/2004
			400m											422	422	403	457	21.2	7	6/11/2003	1/8/2004
			4800m											395	395	375	432	23.1	7	6/11/2003	1/8/2004
			5600m											395	395	374	433	23.2	7	6/11/2003	1/8/2004
			6400m											392	392	360	433	26.5	7	6/11/2003	1/8/2004
			7200m											371	371	306	433	47.3	7	6/11/2003	1/8/2004
			800m											403	403	380	435	20.4	7	6/11/2003	1/8/2004
			BBasin											449	449	419	500	25.9	15	2/13/2004	12/9/2004
			BC											442	442	413	477	23.5	42	6/11/2003	1/8/2004
			BGrotto											454	454	387	525	29.9	698	11/15/2001	4/24/2008
			Bridge											451	451	427	500	25.9	15	2/13/2004	12/9/2004
			CCH											387	387	356	402	26.5	3	12/9/2004	9/6/2007
			CH											443	443	369	486	43.0	9	1/15/2004	9/6/2007
			CRH											488	488	399	539	32.3	802	11/15/2001	4/24/2008
			DKit											465	465	419	532	34.1	124	6/11/2003	12/9/2004
			GarCove											413	413	413	413		1	12/9/2004	12/9/2004
			LostRvrBoil											374	374	374	374		1	9/6/2007	9/6/2007
			LParlor											454	454	410	518	33.0	120	6/11/2003	12/9/2004
			MBoil						425	403	419	428	443	453	427	298	538	31.8	4020	5/2/1956	5/14/2008
			MBoil_LV										446		446	440	450	1.77	514	5/2/1997	5/23/1997
			MBoil_RV										487		487	481	490	1.18	514	5/2/1997	5/23/1997
			Okl_40								369	391	412		393	200	472	54.1	72	6/15/1971	5/3/1999
			Okl_40_down_riv									367	415		403	270	467	46.0	45	6/9/1981	12/7/1998
			Okl_dwn_Riv										408	349	376	279	452	50.1	39	12/1/1998	1/8/2004
			Okl_up_riv									335	289	294	321	214	427	45.6	111	1/22/1985	10/24/2006
			PPark							385					385	0.300	443	68.9	37	2/8/1966	8/12/1969
			SideRun_In											427	427	427	427		1	6/22/2004	6/22/2004
			SideRun_Out											432	432	432	432		1	6/22/2004	6/22/2004
			SR_BoatCnl								379	405	421	426	408	320	481	32.0	162	6/1/1976	10/10/2006
			SR_DS_YHouse										415	439	428	380	480	33.3	25	12/1/1998	10/10/2006
			SR_Okl									393	432	434	430	185	477	45.6	199	11/12/1981	3/20/2008
			SR_US_BoatCnl										418	450	445	386	480	17.2	80	12/1/1998	10/10/2006
			SR_YHouse									412		427	413	342	497	25.3	170	10/24/1983	8/14/2006
			TMead											434	434	434	434	0.00	2	12/9/2004	12/9/2004
			Xmas											357	357	306	480	33.5	130	6/11/2003	12/9/2004
	Stage	ft	1200m							1.74	39.3			2.11	2.51	0.960	39.3	3.99	184	7/18/1968	5/14/2008
			BBasin											2.08	2.08	1.01	3.46	1.04	19	2/13/2004	12/9/2004
			BGrotto											7.71	7.71	0.00	10.0	4.31	26	4/9/2002	4/24/2008
			CRH											7.52	7.52	0.00	10.0	4.49	16	4/9/2002	11/8/2007
			MBoil	3.04			2.15	2.11	1.27	1.87	1.25	1.30	1.00	1.22	1.33	-2.4	13.0	1.36	24305	5/26/1906	3/30/2009
			SR_BoatCnl											1.49	1.49	-0.070	5.00	1.07	33	12/8/2003	5/13/2008
			SR_Okl											4.94	4.94	0.650	57.9	12.1	42	8/15/2002	8/9/2007
			MBoil								40.5	47.6			44.1	40.5	47.6	3.60	30	9/27/1978	1/17/1985
	Turb	NTU	1000m							0.236		5.20			0.360	0.00	5.20	0.815	80	2/8/1966	9/5/1984
			1200m							29.0	1.00	0.543		0.105	0.598	0.065	29.0	2.50	135	7/18/1968	12/9/2004
			350m							0.182					0.182	0.00	0.800	0.211	39	2/8/1966	8/12/1969
			BGrotto											0.128	0.128	0.025	0.450	0.116	199	11/15/2001	4/24/2008
			CH											0.143	0.143	0.100	0.170	0.038	3	1/15/2004	7/14/2004
			CRH											0.183	0.183	0.025	0.900	0.242	221	11/15/2001	4/24/2008
			MBoil							0.225	0.800	0.767		0.121	0.417	0.00	4.00	0.617	1719	2/8/1966	4/24/2008
			Okl_40								26.4	1.89	1.09		4.61	0.450	29.3	8.26	50	6/15/1971	5/3/1999
			Okl_40_down_riv									1.85	2.46		2.31	0.100	18.2	3.67	48	6/9/1981	12/7/1998
			Okl_dwn_Riv										1.00		1.00	0.400	1.40	0.394	18	12/1/1998	5/3/1999
			Okl_up_riv									7.02	21.0	7.30	7.89	2.80	21.0	4.08	50	1/22/1985	6/27/2006
			PPark							0.239					0.239	0.00	1.00	0.230	38	2/8/1966	8/12/1969
			SR_BoatCnl								26.1	10.8	1.05	0.211	9.82	0.025	33.0	12.0	104	6/1/1976	10/10/2006
			SR_DS_YHouse										0.371	0.070	0.351	0.070	0.600	0.186	15	12/1/1998	10/10/2006
			SR_Okl									0.727	0.800	1.23	1.12	0.100	8.30	1.69	107	11/12/1981	3/20/2008
			SR_US_BoatCnl										0.400	0.343	0.367	0.025	1.10	0.288	28	12/1/1998	10/10/2006
			SR_YHouse									0.602			0.602	0.00	1.60	0.389	88	10/24/1983	9/18/1989
			Xmas											0.096	0.096	0.065	0.220	0.069	5	1/15/2004	5/4/2004
SOLID	TDS	mg/L	1200m							261				281	280	249	320	18.6	51	5/7/1968	12/9/2004
			BGrotto											270	270	160	305	27.8	198	11/15/2001	4/24/2008
			CH											275	275	271	278	3.51	3	1/15/2004	7/14/2004
			CRH											302	302	268	350	15.8	220	11/15/2001	4/24/2008
			MBoil	274				237	267	264	257	259	265	274	265	183	404	26.8	1566	12/16/1907	5/14/2008
			MBoil_LV										285		285	282	288	1.12	514	5/2/1997	5/23/1997
			MBoil_RV										292		292	31.0	313	71.8	514	5/2/1997	5/23/1997
			Okl_40								280				280	266	294	12.5	6	6/15/1971	6/12/1973
			Okl_40_down_riv									267	246		251	128	405	40.3	48	6/9/1981	12/7/1998
			Okl_up_riv											229	229	229	229	0.00	3	5/24/2000	5/24/2000
			SR_Okl									247	276	259	257	26.3	296	29.6	98	11/12/1981	3/20/2008
			Xmas											241	241	230	286	25.0	5	1/15/2004	5/4/2004
	TSS	mg/L	1000m									5.00			5.00	5.00	5.00	0.00	2	9/5/1984	9/5/1984
			1200m									2.07		1.00	1.68	1.00	3.00	0.823	132	1/22/1985	12/9/2004
			BGrotto											1.98	1.98	1.00	9.00	0.547	198	11/15/2001	4/24/2008
			CRH											2.76	2.76	1.00	12.0	2.51	220	11/15/2001	4/24/2008
			MBoil											1.70	1.70	1.00	2.00	0.457	378	5/15/2000	4/24/2008
			Okl_40								13.7	4.40	1.60		4.73	0.500	29.0	5.71	50	6/15/1971	5/3/1999
			Okl_40_down_riv									6.22	3.91		4.49	0.00	22.0	4.20	48	6/9/1981	12/7/1998
			Okl_dwn_Riv										1.27		1.27	0.500	1.90	0.572	18	12/1/1998	5/3/1999
			Okl_up_riv									13.5		15.0	13.6	4.00	36.0	6.95	45	1/22/1985	5/24/2000
			SR_BoatCnl								5.38	3.10	1.36		3.20	0.00	23.0	3.52	90	6/1/1976	8/9/1994
			SR_DS_YHouse										0.586		0.586	0.500	0.800	0.141	14	12/1/1998	5/3/1999
			SR_Okl									2.67	2.00	3.69	3.45	0.00	16.0	2.89	107	11/12/1981	3/20/2008
			SR_US_BoatCnl										0.800		0.800	0.500	1.30	0.336	12	12/1/1998	5/3/1999
			SR_YHouse									2.42			2.42	1.00	6.00	1.11	38	10/24/1983	9/18/1989
			Xmas											1.00	1.00	1.00	1.00	0.00	4	5/4/2004	5/4/2004

TABLE 3 (CONTINUED)
Silver Springs water quality table for the period-of-record.

				Decade										POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record
TEMPERATURE	Air Temp	C	MBoil									27.6			27.6	23.0	34.0	3.75	75	10/3/1980 6/18/1981
	Wtr Temp	C	1000m							23.7		29.0		23.4	23.8	22.0	29.0	0.998	92	2/8/1966 11/10/2003
			1200m							23.0	23.5	23.6		23.4	23.5	19.1	27.3	0.533	2327	5/7/1968 1/22/2005
			1600m											23.4	23.4	22.7	24.1	0.445	7	1/8/2003 11/10/2003
			1stFP								23.9			23.4	23.6	22.8	24.8	0.404	180	8/31/1978 12/9/2004
			210m											23.3	23.3	23.1	23.6	0.184	7	1/8/2003 11/10/2003
			2400m											23.4	23.4	22.5	24.2	0.530	7	1/8/2003 11/10/2003
			2ndFP											23.4	23.4	22.9	24.1	0.261	93	1/8/2003 12/9/2004
			3200m											23.3	23.3	22.4	24.3	0.615	7	1/8/2003 11/10/2003
			350m							23.6					23.6	22.0	24.5	0.654	39	2/8/1966 8/12/1969
			4000m											23.3	23.3	22.1	24.3	0.684	7	1/8/2003 11/10/2003
			400m											23.4	23.4	23.1	23.6	0.181	7	1/8/2003 11/10/2003
			4800m											23.3	23.3	22.0	24.3	0.769	7	1/8/2003 11/10/2003
			5600m											23.3	23.3	21.9	24.3	0.824	7	1/8/2003 11/10/2003
			6400m											23.4	23.4	21.8	24.7	0.992	7	1/8/2003 11/10/2003
			7200m											24.1	24.1	21.7	26.5	1.69	7	1/8/2003 11/10/2003
			800m											23.4	23.4	23.0	23.6	0.207	7	1/8/2003 11/10/2003
			BBasin											23.2	23.2	22.6	24.1	0.490	15	2/13/2004 12/9/2004
			BC								23.6			23.6	23.6	23.4	23.9	0.120	48	6/19/1979 11/10/2003
			BGrotto								23.4			23.6	23.5	2.90	24.3	2.05	1040	8/31/1978 4/24/2008
			Bridge											23.2	23.2	23.0	23.5	0.149	15	2/13/2004 12/9/2004
			CCH								24.2			23.4	23.7	23.4	24.2	0.422	5	8/31/1978 9/6/2007
			CH								23.7			23.5	23.7	23.1	24.8	0.389	88	8/31/1978 9/6/2007
			CRH								23.9			23.6	23.8	22.9	24.4	0.282	1146	8/31/1978 4/24/2008
			DKit								23.5			23.7	23.6	22.8	24.2	0.234	152	3/7/1979 12/9/2004
			GarCove											23.4	23.4	23.4	23.4		1	12/9/2004 12/9/2004
			GeyserSp								23.6				23.6	23.6	23.6		1	12/13/1978 12/13/1978
			LostRvrBoil											22.9	22.9	22.9	22.9		1	9/6/2007 9/6/2007
			LParlor								23.8			23.6	23.7	23.1	24.2	0.246	252	8/31/1978 12/9/2004
			MBoil						23.1	23.3	23.2	23.6	23.2	23.2	23.2	21.0	27.5	0.518	7719	12/3/1952 5/14/2008
			MBoil_LV										22.7		22.7	22.7	22.7	0.008	514	5/2/1997 5/23/1997
			MBoil_RV										23.3		23.3	23.3	23.3	0.008	514	5/2/1997 5/23/1997
			Okl_40								24.4	22.6	22.3		22.7	20.0	26.5	1.65	50	6/15/1971 5/3/1999
			Okl_40_down_riv									22.7	22.5		22.5	15.6	26.8	2.33	45	6/9/1981 12/7/1998
			Okl_dwn_Riv										22.2	24.6	23.5	20.8	27.7	2.08	39	12/1/1998 11/10/2003
			Okl_up_riv									21.1	28.5	25.4	23.2	9.40	30.5	5.62	78	1/22/1985 10/24/2006
			PPark							23.7					23.7	22.0	24.5	0.671	38	2/8/1966 8/12/1969
			Rock											22.7	22.7	22.7	22.7		1	1/29/2004 1/29/2004
			SGardens								23.6				23.6	23.0	24.3	0.332	15	8/31/1978 8/16/1979
			SideRun_In											23.4	23.4	23.4	23.4		1	6/22/2004 6/22/2004
			SideRun_Out											23.5	23.5	23.5	23.5		1	6/22/2004 6/22/2004
			SR_BoatCnl								23.3	22.8	23.1	23.0	23.0	18.0	25.0	1.22	122	6/1/1976 10/10/2006
			SR_DS_YHouse										23.3	22.9	23.1	21.6	24.1	0.540	25	12/1/1998 10/10/2006
			SR_Okl									22.7	21.5	23.2	23.1	16.8	33.8	1.85	186	11/12/1981 3/20/2008
			SR_US_BoatCnl										22.9	23.1	23.0	21.3	24.8	1.00	80	12/1/1998 10/10/2006
			SR_YHouse									23.3		23.0	23.3	22.0	25.0	0.641	98	10/24/1983 8/14/2006
			TMead								23.4			23.5	23.4	21.3	24.1	0.372	268	10/5/1978 12/9/2004
			Xmas								23.3			23.1	23.2	22.2	25.5	0.401	301	8/31/1978 12/9/2004

Select water chemistry parameters for Silver Springs have been monitored by the St. Johns River Water Management District (SJRWMD 2008a). Nitrate-nitrogen concentrations in the water discharged by Silver Springs indicate that nitrate concentrations have been increasing (**Figure 15**).

The water chemistry of the Silver Springs group has been sampled for numerous projects. Phelps (2004) characterized the chemistry of ground water discharged from the springs group. Phelps *et al.* (2006) characterized the water chemistry (as well as the hydrology and aquatic communities) in that subsequent report. Toth (1999 and 2003) reported on the water quality and isotope concentrations of Silver and other springs in the St. Johns River Water Management District; and the work of Toth and Knowles (to be completed June 2009) involves the determination of the nitrate source (fertilizer versus septic), age of the young fraction of the ground water, and whether organic constituents indicative of anthropogenic activities are present in the ground water of Silver Springs. USGS publication (http://fl.biology.usgs.gov/OFR_2006-1107/Silver_Springs/silver_springs.html) provides review water chemistry at Silver Springs. A comprehensive review of Silver Springs water chemistry and quality is presented in Munch *et al.* (2006).

During a July 29, 2008 site visit field parameters were measured over eight of the largest spring vents, as well as in the spring run down to the USGS gauging station (1,200 m downstream) by boat. Water discharging from individual spring vents exhibited variability in field parameters with specific conductance ranging from approximately 300 to 500 µS/cm, dissolved oxygen ranging from less than 1 to over 4 mg/L, and pH varying around the neutral (7.0) range (**Figure 16**).

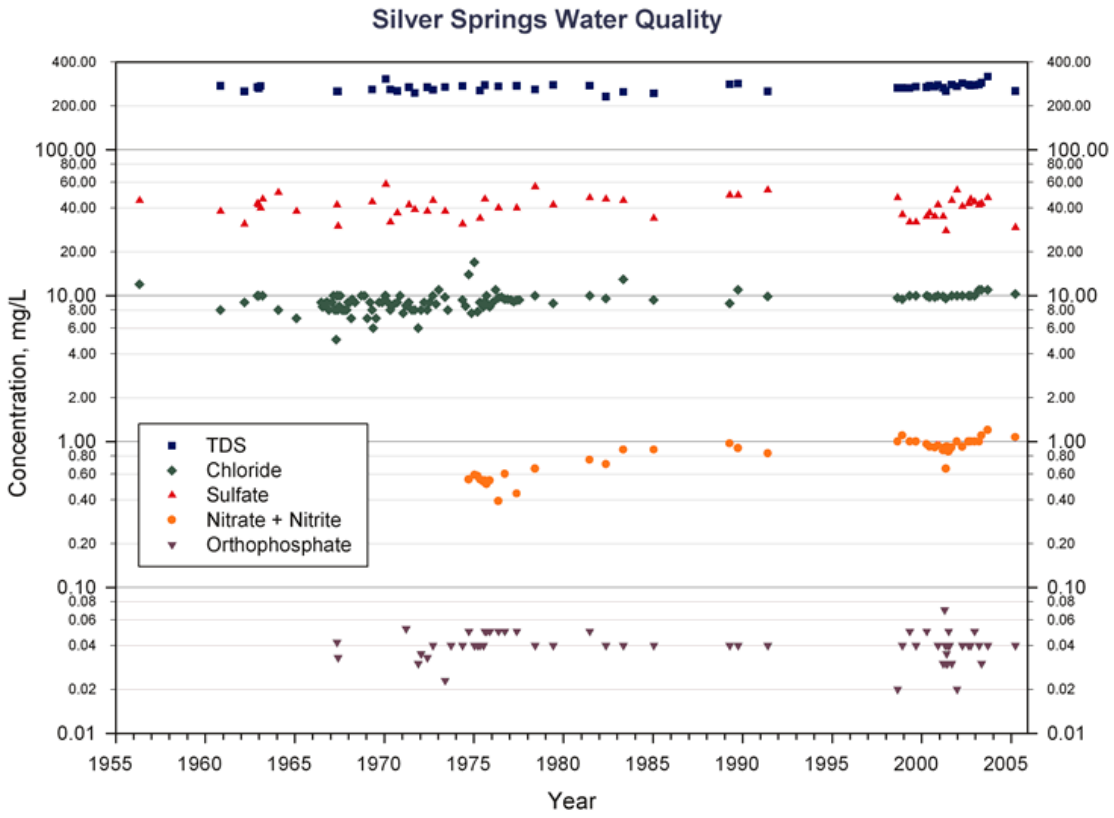
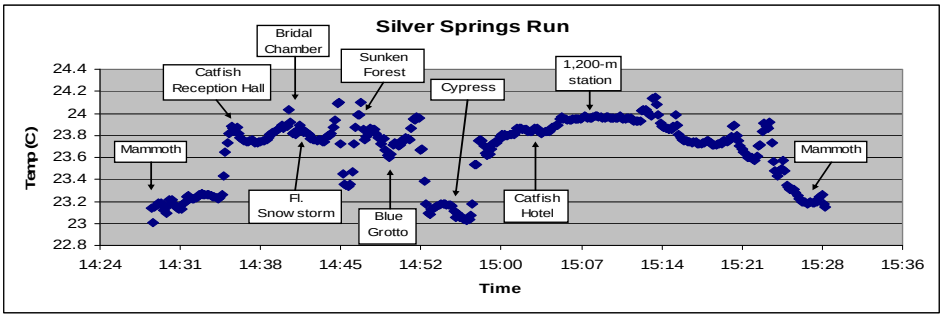
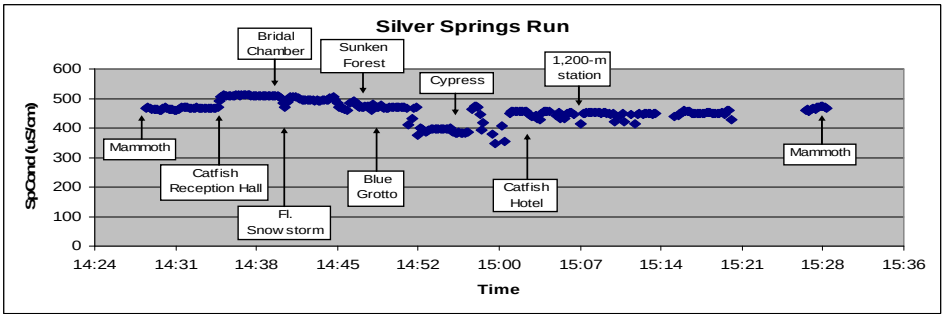
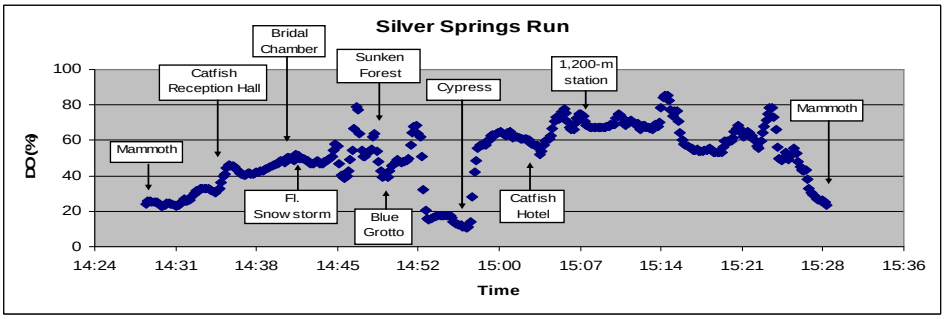


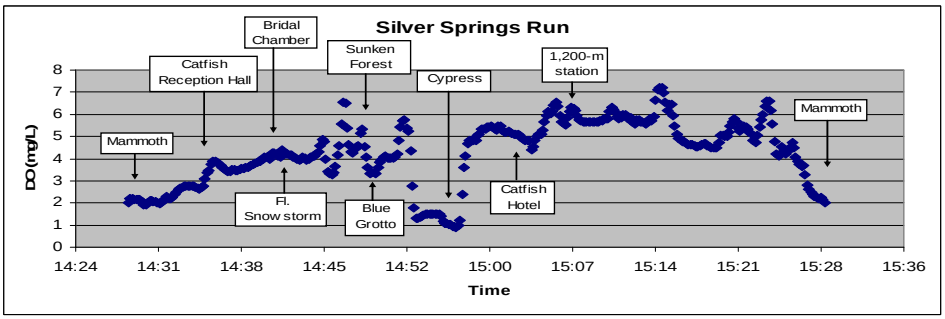
FIGURE 15
Silver Springs water quality values by time and parameter (SJRWMD 2008a).

Downstream increases in dissolved oxygen (DO) were evident in the Silver Springs ecosystem and afford the opportunity to estimate ecosystem metabolism based on these changes. During our reconnaissance, average DO concentrations at the spring vents were roughly 2.5 mg/L and increased to approximately 6.5 mg/L within 4,000 feet downstream (**Figure 16**). These values were measured during early afternoon in cloudy summer conditions, and correspondingly higher DO concentrations are likely to be observed between 16:00 to 18:00 hours on days without cloud cover.









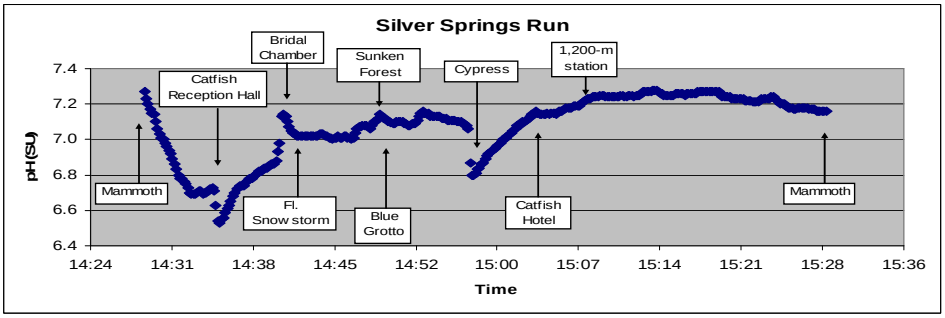


FIGURE 16
Field parameters for Silver Springs run measured on July 29, 2008.

Biological

Vegetation

Submersed aquatic vegetation within the Silver Spring ecosystem as observed on July 29, 2008, was primarily a mix of strap-leaf sagittaria (*Sagittaria kurziana*) and multiple varieties of filamentous algae. Other aquatic vegetation types include the macroalgae muskgrass (*Chara spp.*), and macrophytes tape grass (*Vallisneria americana*) and coontail (*Ceratophyllum demersum*). Epiphytic growths (periphyton) on strap-leaf sagittaria and tape grass were abundant as well. Submersed aquatic vegetation coverage is substantial, but appears to be shifting towards increasing abundance of benthic filamentous algae and epiphytic biofilms. Both Phelps *et al.* (2006) and Stevenson *et al.* (2007) described aspects of the algae community at Silver Springs.

A comprehensive review of the submersed aquatic vegetation (SAV) community at Silver Springs can be found in Munch *et al.* (2006) which includes H.T. Odum data from as early as the 1950's. As part of the Munch *et al.* (2006) research, and subsequently published by Quinlan *et al.* (2008), the spatial and temporal abundance and distribution of above-sediment primary producers (SAV community during 2003/2004) was estimated using a GIS platform and related to historical conditions. Observations reveal that while the macrophyte community was dominated by strap-leaf sagittaria, several other species of submersed, emergent, and floating aquatic macrophytes were also observed (**Table 4**); but all together represented less than five percent of the total macrophyte biomass. Two other species of submersed macrophytes were observed in significant quantities at individual sampling sites, coontail and fanwort (*Cabomba caroliniana)*, but their spatial distribution did not exceed more than 50% of the bottom at sites where they occurred (Quinlan *et al.* 2008). A listing of the dominant algal species

encountered in Silver Springs for both epiphytes (periphyton) and benthic algal mats is provided in **Table 5** (Quinlan *et al*. 2008), however, *Lyngbya sp*. was the dominant benthic algae. Sampling in the headspring during April 3, and November 13, 2003 by Stevenson *et al*. (2007) found that macroalgae coverage was 18.5% and 4.5 cm (1.8 in) thick and 33.3% coverage and 14.6 cm (5.7 in) thick, respectively and dominated by *Lyngbya sp*. and *Vaucheria sp*.

A summary of SAV biomass found that while the strap-leaf sagittaria component of Silver Springs was similar to historic estimates, both epiphyte (periphyton) and benthic algal mat community biomass had increased, particularly in the case of benthic filamentous algae (*e.g. Lyngbya*, **Table 6**).

TABLE 4
Dominant aquatic macrophytes in Silver Springs (from Quinlan *et al.* 2008).

Type	Common Name	Scientific Name
Submersed	Strap-leaf sagittaria	*Sagittaria kurziana*
	Coontail	*Ceratophyllum demersum*
	Fanwort	*Cabomba caroliniana*
	Tape grass	*Vallisneria americana*
	Southern naiad	*Najas guadalupensis*
Floating	Water lettuce	*Pistia stratiotes*
	Spatterdock	*Nuphar luteum*
	Water hyacinth	*Eichhornia crassipes*
	Duckweed	*Lemna minor*
Emergent	Pickerelweed	*Pontederia cordata*
	Water primrose	*Ludwigia octovalvis*
	Cattail	*Typha latifolia*
	Water hemlock	*Cicuta mexicana*
	Wild Taro	*Colocasia esculenta*
	Maidencane	*Panicum hemitomon*

TABLE 5
Dominant algal species encountered in Silver Springs for both periphyton and benthic algal mats (from Quinlan *et al.* 2008).

Dominant algae species present in epiphyton and benthic algae mats by season				
	Spring	Summer	Autumn	Winter
Cyanobacteria				
Lyngbya wollei	+	+‡	+	+
Phormidium spp.	+			
Oscillatoria spp.		+‡	+‡	+‡
Chlorophyta				
Ulothrix spp.	‡			
Cladophora spp.		‡	‡	‡
Mougeotia spp.		‡	‡	
Xanthophyceae				
Vaucheria spp.		+‡	+‡	+‡
Bacillariophyta				
Pennate				
Gomphonema spp.	‡	‡	‡	‡
Cymbella spp.	‡	‡	‡	‡
Synedra ulna	‡	‡	‡	‡
Fragilaria crotonensis	‡			
Fragilaria spp.	‡	‡	‡	‡
Navicula spp.		‡		‡
Centric				
Aulacoseira italica	‡			‡
Aulacoseira varians	‡	‡	‡	‡
Aulacoseira spp.	‡			
Terpsinoe musica	‡		‡	‡
Cocconeis spp.	‡	‡		‡

Species found predominately in the benthic mats are shown with a (+) and epiphyton forms are noted with a (‡). See Guiry and Guiry, 2007 for naming authority.

The spatial distribution of submersed aquatic vegetation during summer and winter sampling periods were estimated using a GIS platform and the resulting maps of SAV, by macrophytes, epiphytes, and benthic macroalgae categories are shown in **Figures 17**, **18**, and **19**, respectively. These figures illustrate that higher biomass is observed during summer periods (compared to winter sampling) for all three SAV community components at Silver Springs.

Overall, Quinlan *et al.* (2008) concluded that the submersed aquatic macrophyte community of Silver Springs appears to have demonstrated resilience to increases in nutrient load. However, the algae community, in the form of epiphytes and benthic algae, has been more responsive to eutrophication as evidenced through an increase in biomass and coverage; and it may be hypothesized that algae biomass increases have not yet reached levels sufficient to displace the macrophyte community (Quinlan *et al.* 2008). The authors also argue for caution in weighing the significance of long-term comparisons of system-wide biomass in light of the considerable spatial heterogeneity in aquatic primary producer communities (Quinlan *et al.* 2008).

TABLE 6
Mean primary producer biomass and biomass by area in Silver Springs as dry weight (DW) and ash-free dry weight (AFDW, from Quinlan *et al.* 2008).

		Summer (2004)	Winter (2003–04)	Odum (1957)
Macrophyte biomass	g AFDW m^{-2}	Area (m^2)	Area (m^2)	
	0–100	13,900	20,500	–
	101–250	12,200	23,400	–
	252–500	27,300	26,900	–
	501–750	21,300	12,500	–
	751–1,000	10,600	4,420	–
	1,000–1,600	2,370	220	–
Mean AFDW (g m^{-2})		403 (267)	342 (255)	–
Mean DW (g m^{-2})		584 (402)	426 (323)	578
Epiphytic algae biomass	g AFDW m^{-2}	Area (m^2)	Area (m^2)	
	0–100	19,500	71,800	–
	101–250	17,100	10,500	–
	252–500	29,800	4,490	–
	501–750	19,200	900	–
	751–1,000	2,200	70	–
	1,000–1,500	90	0	–
Mean AFDW (g m^{-2})		299 (213)	83 (116)	–
Mean DW (g m^{-2})		637 (470)	251 (310)	188
Benthic algae mat biomass	g AFDW m^{-2}	Area (m^2)	Area (m^2)	
	0–100	4,800	30,700	–
	101–200	19,500	26,500	–
	201–300	25,500	16,500	–
	301–400	27,000	8,800	–
	401–500	10,000	4,300	–
	501–657	1,100	1,900	–
Mean AFDW (g m^{-2})		268 (107)	169 (133)	–
Mean DW (g m^{-2})		641 (237)	381 (302)	NA

Standard deviations in parentheses.

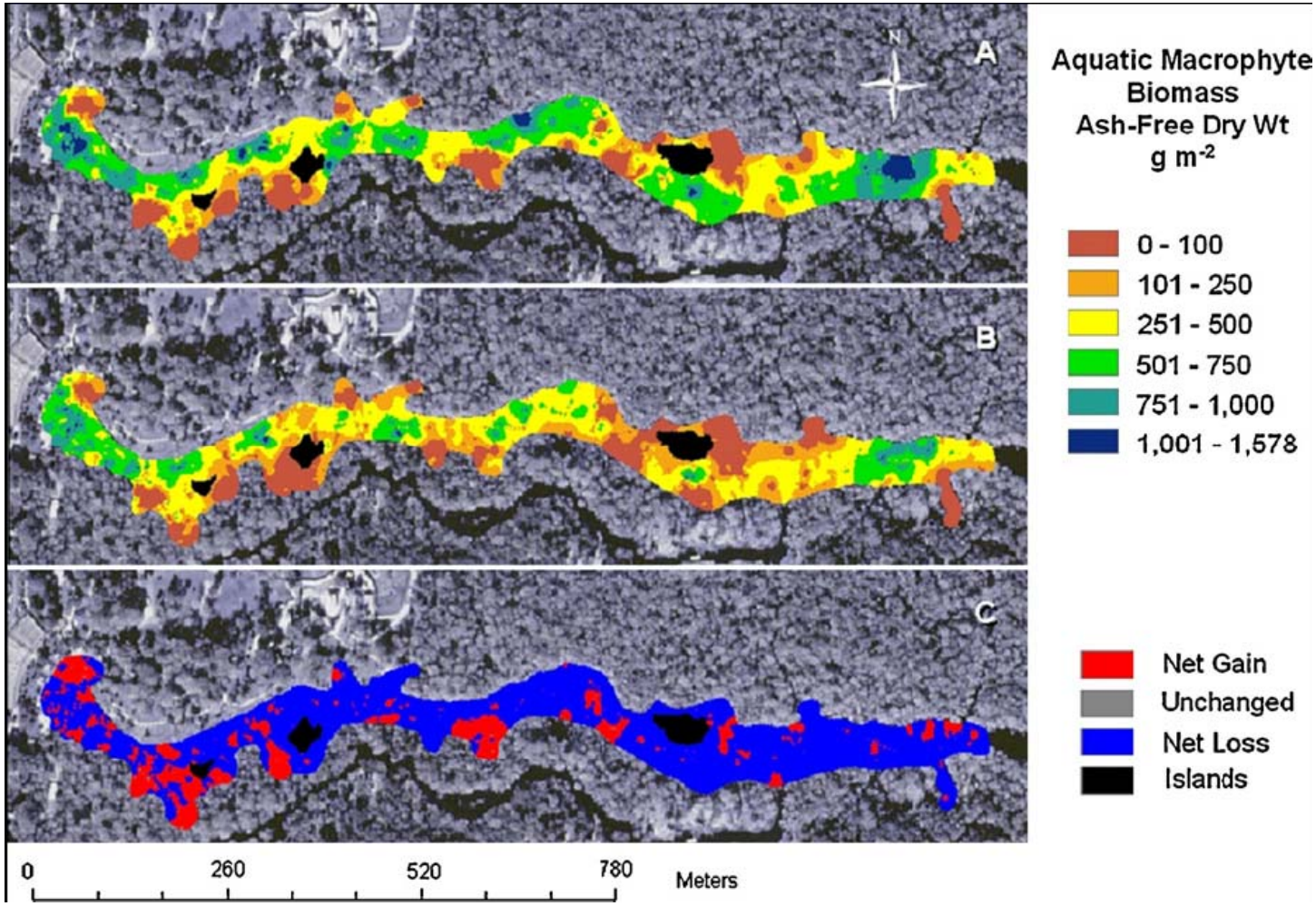


FIGURE 17
Spatial distribution of submerged aquatic macrophytes (g AFDW m 2) for summer 2004 (A), winter 2003–2004 (B) and the overall change in biomass from summer to winter (C) in Silver Springs (from Quinlan *et al*. 2008).

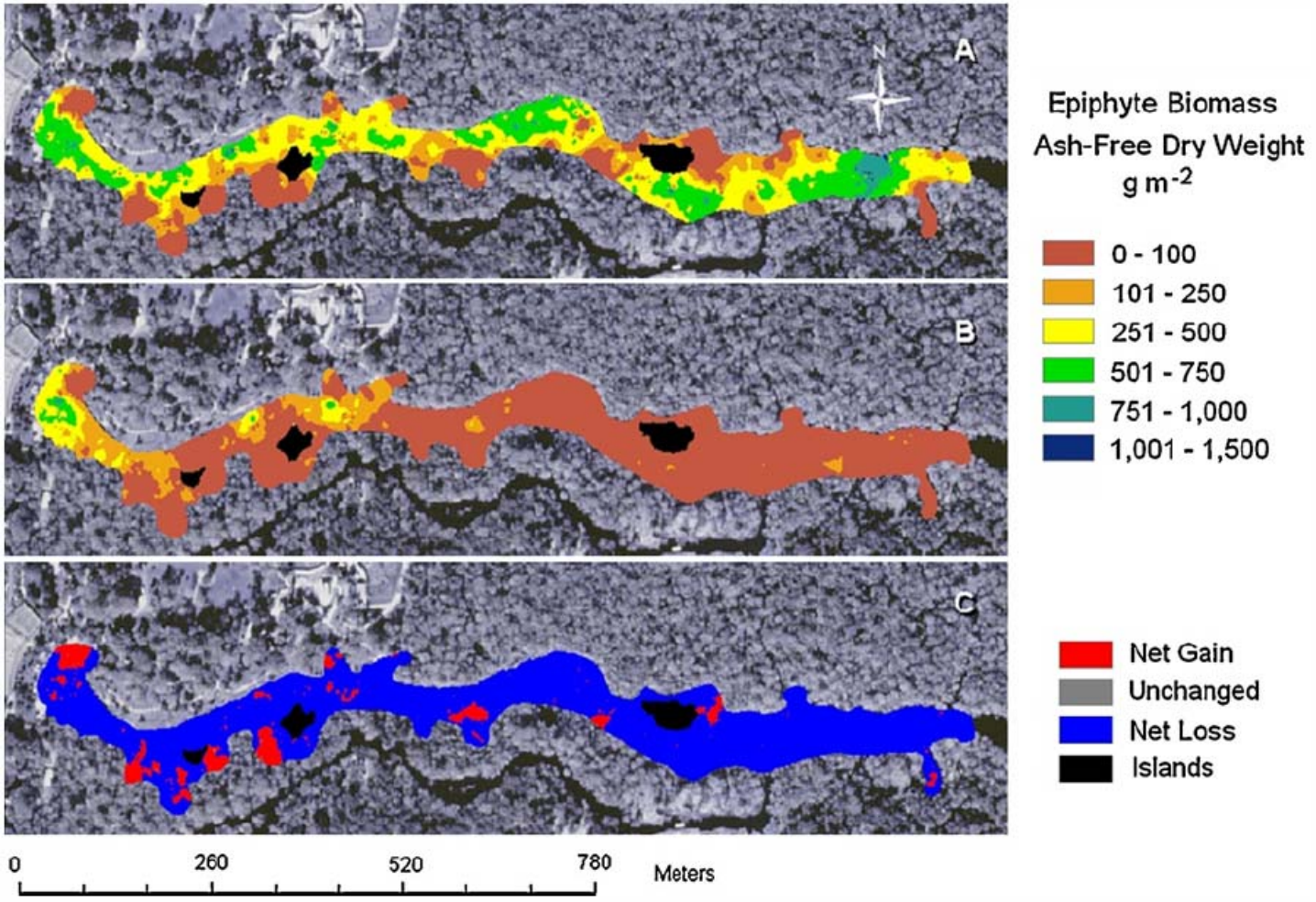


FIGURE 18
Spatial distribution of epiphytic algae (periphyton, g AFDW m 2) for summer 2004 (A), winter 2003–2004 (B) and the overall change in biomass from summer to winter (C) in Silver Springs (from Quinlan *et al.* 2008).

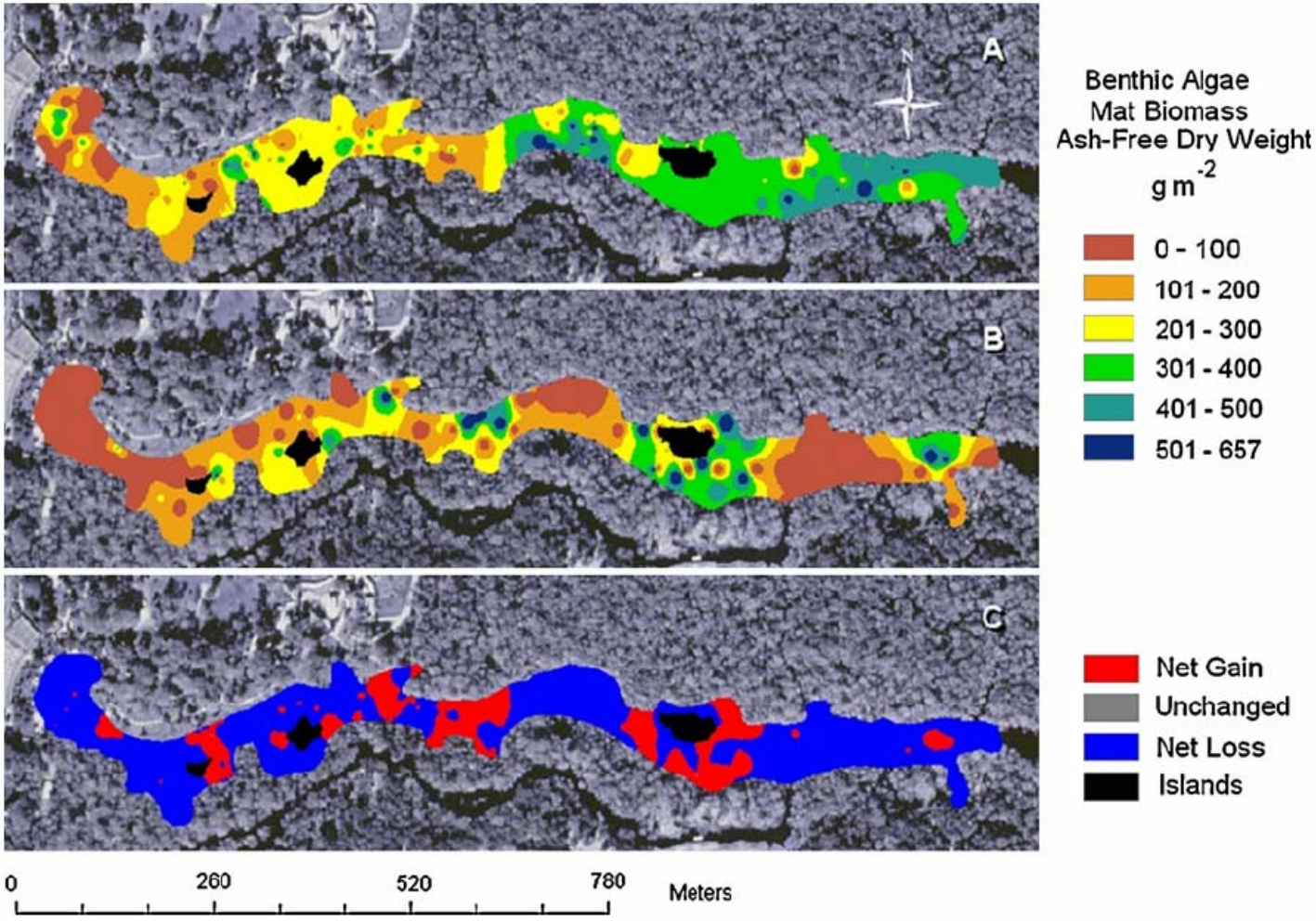


FIGURE 19
Spatial distribution of benthic algae mats (g AFDW m 2) for summer 2004 (A), winter 2003–2004 (B) and the overall change in biomass from summer to winter (C) in Silver Springs (from Quinlan *et al.* 2008).

Macroinvertebrates

The aquatic macroinvertebrates of Silver Springs have been sampled eleven times as part of FDEP EcoSummary activities (FDEP 2002b, 2002c, 2003a, 2003b, 2004a, 2004b, 2005, 2006a, 2006b, 2007a, 2007b). These sampling events take place in a 100 m stretch of the spring run, approximately 200 meters east of the headspring. Over the course of these surveys the habitat assessment scores were consistently in the optimal range, the total number of aquatic macroinvertebrate taxa ranged from 18 to 27, and the number of sensitive aquatic macroinvertebrate taxa ranged from 1 to 3 (**Figure 20**).

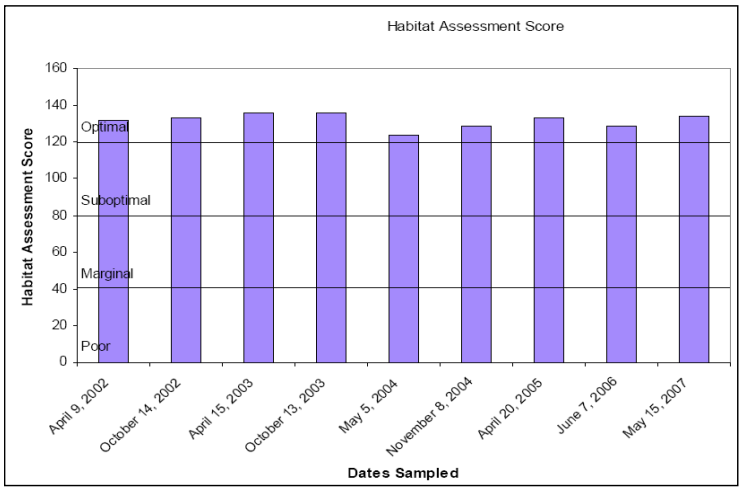
Stream condition index (SCI) scores have been calculated from invertebrate collections during most of the EcoSummary events. The SCI scoring system has undergone revision during its utilization by FDEP. Prior to June 2004, SCI values of 21 or greater produced a healthy SCI rating; while after this date, 34 was the cut-off value for a healthy rating (FDEP 2008). Prior to June 2004, SCI scores ranged from 19 to 27 (> 21 healthy) and after June 2004, SCI scores ranged from 22 to 46 (> 34 healthy, FDEP 2008).

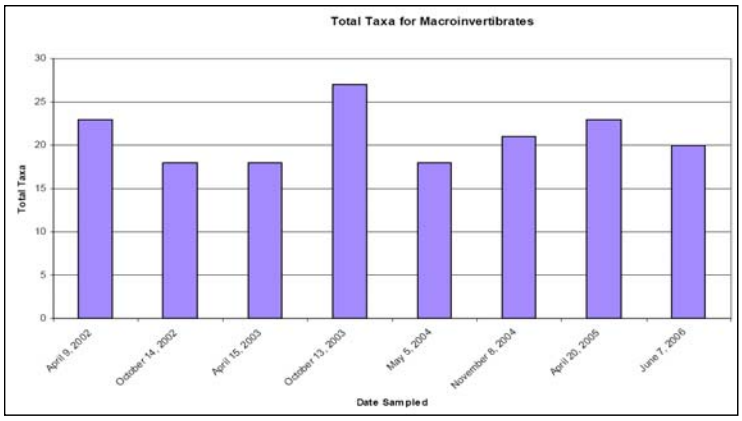
Franz (2002) made a site visit to the Silver Springs (and river) on May 9, 2002 for the purpose of sampling crustaceans. Crayfish (*Procambarus fallax*), freshwater shrimps (*Palaemonetes paludosa*), and amphipods (*Gammarus sp*.) were collected from the spring and run, while burrow chimneys of the crayfish *P. paeninsulanus* and *P. geodytes* were observed along the forested banks of the Silver River (Franz 2002).

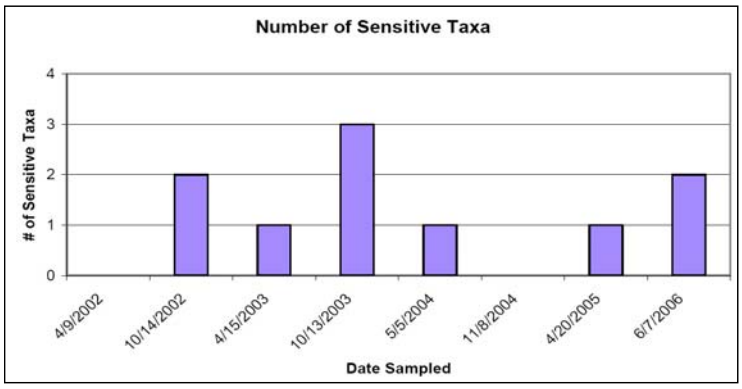
A literature based inventory of rare and endemic snail species utilizing Silver Springs was conducted by Shelton (2006) who found that no rare or endemic snails have been reported from Silver Springs.

Walsh and Williams (2003) surveyed mussels during August 2002 from several locations along the Silver River and at the confluence with the Ocklawaha River. Although mussels were collected from each site, the numbers collected suggest relatively low abundance and included only five species of native unionids as well as the non-indigenous Asian clam (*Corbicula fluminea*, **Table 7**).

FIGURE 20
Time series of habitat assessment scores, total number of aquatic macroinvertebrate taxa, total number of sensitive taxa, and SCI scores (healthy is > 21 prior to 6/04 and > 34 after 6/04) for Silver Springs (from FDEP 2008).







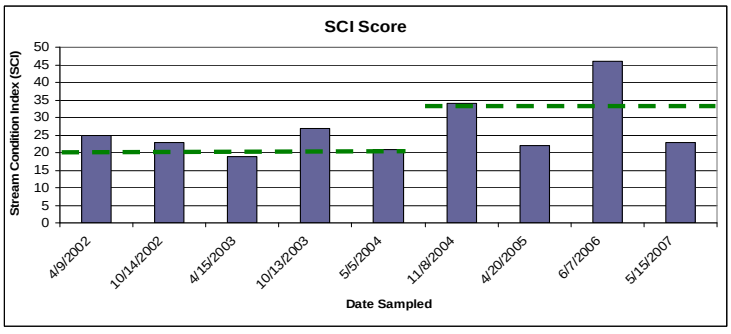


TABLE 7
Mussels collected in Silver River State Park and the Ocklawaha River at the mouth of the Silver River (from Walsh and Williams 2003).

Species	Common name	Number for each subsample	Percent for each subsample
Silver River			
Corbicula fluminea	Asian clam	31	8.8
Elliptio icterina	variable spike	1	.3
Elliptio sp.	unidentified spike	315	89.0
Toxolasma paulus	iridescent lilliput	1	.3
Uniomerus carolinianus	Florida pondhorn	2	.6
Villosa amygdala	Florida rainbow	4	1.1
Total number of specimens		**354**	
Ocklawaha River			
Anodonta couperiana	barrel floater	1	1.1
Corbicula fluminea	Asian clam	14	15.4
Elliptio buckleyi	Florida shiny spike	36	39.6
Elliptio sp.	unidentified spike	1	1.1
Utterbackia imbecillis	paper pondshell	9	9.9
Villosa amygdala	Florida rainbow	30	33.0
Total number of specimens		**91**	

Macro fauna

Fish

A variety of fish were observed in the spring pools and run during the July 29, 2008 site visit; including largemouth bass (*Micropterus salmoides*), several sunfish species (*Lepomis sp.*), white catfish (*Ameiurus catus*), gizzard shad (*Dorosoma cepedianum*), longnose gar (*Lepisosteus osseus*), bowfin (*Amia calva*), lake chubsucker (*Erimyzon sucetta*), blue tilapia (*Oreochromis aurea*), and sailfin catfish (*Pterygoplichthys disjunctivus*).

Silver Springs fish observations include those made by Hubbs and Allen (1943), Odum (1957), Knight (1980), Walsh and Williams (2003), and Munch *et al.* (2006).

Historical perspective is provided by Phelps *et al.* (2006) who noted that based on material housed in the Florida Museum of Natural History and the collections of Walsh and Williams (2003); at least 45 fish species have been documented from the Silver River (**Table 8**). Several fish statistics of note reveal that the most diverse families in the Silver River are centrarchids (8 species), ictalurids (6 species), fundulids (5 species), and cyprinids (4 species); while four species collected by Walsh and Williams (2003) accounted for a combined 45 percent of the sample composition: redeye chub (*Notropis harperi*), mosquitofish (*Gambusia holbrooki*), sailfin molly (*Poecilia latipinna*), and spotted sunfish (*Lepomis punctatus*); and the greatest fish biomass consisted of gar (*Lepisosteus spp.*), lake chubsucker (*Erimyzon sucetta*), and centrarchids (Phelps *et al.* 2006).

In the 50-year retrospective study of Silver Springs (Munch *et al.* 2006), analysis of historic fish biomass suggests an overall reduction has occurred in this system (**Table 9**). Other key findings from the comparative study reveal that catfish and mullet were present in high abundance in Silver Springs fifty years ago and had largely disappeared during Knight's 1978-79 study and also were observed in low abundance in the current study (Munch *et al.* 2006). Knight found gizzard shad to be the most abundant fish species twenty-five years ago whereas the current study found much lower abundance of this species and gizzard shad were not reported by Odum in the 1950s (Munch *et al.* 2006). Overall estimated annual average fish live-weight biomass has declined in Silver Springs since Odum's study in the early 1950s by about 96%; and by 61% since Knight's 1978-79 study (**Table 9**). These declines in total biomass were due to large reductions in a few species (*i.e.*, catfish, mullet, gizzard shad), but other species were found in similar abundance across the fifty-year span (Munch *et al.* 2006).

TABLE 8
Fishes collected or observed in Silver Springs State Park (Walsh and Williams, 2003), deposited in the Florida Museum of Natural History (FLMNH), and reported (x) by Hubbs and Allen (1943), from Phelps *et al.* (2006).

Family	Species	USGS		FLMNH ichthyological collection		Hubbs & Allen (1943)
		Number of specimens	Percent composition	Number of specimens	Percent of material	
Lepisosteidae	*Lepisosteus osseus*	11	1.2	--	--	X
	Lepisosteus platyrhincus	23	2.4	--	--	X
Amiidae	*Amia calva*	3	.3	--	--	X
Anguillidae	*Anguilla rostrata*	5	.5	1	.1	X
Clupeidae	*Dorosoma cepedianum*	10	1.1	--	--	X
	Dorosoma petenese	--	--	--	--	X
Cyprinidae	*Notemigonus crysoleucas*	1	.1	--	--	X
	Notropis harperi	126	13.3	200	22.4	--
	Notropis petersoni	20	2.1	44	4.9	--
	Opsopoeodus emiliae	6	.6	--	--	--
Catostomidae	*Erimyzon sucetta*	19	2.0	--	--	X
Ictaluridae	*Ameiurus catus*	--	--	2	.2	X
	Ameiurus natalis	--	--	1	.1	X
	Ameiurus nebulosus	1	.1	--	--	---
	Ictalurus punctatus	--	--	--	--	X
	Noturus gyrinus	5	.5	3	.3	--
	Noturus leptacanthus	--	--	6	.7	--
Loricariidae*	*Pterygoplichthys disjunctivus*	7	.7	--	--	--
Esocidae	*Esox americanus*	--	--	--	--	X
	Esox niger	2	.2	--	--	X
Aphredoderidae	*Aphredoderus sayanus*	--	--	--	--	X
Mugilidae	*Mugil cephalus*	--	--	--	--	X
Atherinopsidae	*Labidesthes sicculus*	27	2.8	2	.2	X
Belonidae	*Strongylura marina*	--	--	2	.2	X
Fundulidae	*Fundulus chrysotus*	--	--	--	--	X
	Fundulus lineolatus	--	--	--	--	X
	Jordanella floridae	--	--	--	--	X
	Lucania goodei	55	5.8	106	11.9	X
	Lucania parva	68	7.2	258	29.0	X
Poeciliidae	*Gambusia holbrooki*	109	11.5	40	4.5	X
	Heterandria formosa	12	1.3	18	2.0	X
	Poecilia latipinna	95	10.0	99	11.1	X
Centrarchidae	*Lepomis auritus*	30	3.2	11	1.2	X
	Lepomis gulosus	10	1.1	4	.4	X
	Lepomis macrochirus	57	6.0	--	--	X
	Lepomis marginatus	--	--	1	.1	--
	Lepomis microlophus	36	3.8	--	--	X
	Lepomis punctatus	96	10.1	71	8.0	X
	Micropterus salmoides	75	7.9	7	.8	X
	Pomoxis nigromaculatus	--	--	--	--	X
Percidae	*Etheostoma fusiforme*	1	.1	--	--	--
	Percina nigrofasciata	30	3.2	9	1.0	X
Elassomatidae	*Elassoma evergladei*	--	--	--	--	X
	Elassoma okefenokee	8	.8	1	.1	--
Achiridae	*Trinectes maculatus*	--	--	5	.6	X
	Total number of species	**29**		**22**		**35**
	Total number of specimens	**948**		**891**		

*nonindigenous species

TABLE 9
Comparison of biomass estimates (kg live weight/ha) of fishes in the Silver River based on results of visual surveys from Odum (1957), Knight (1980), and Munch *et al.* (2006). Methods used for visual surveys were different among studies. *Anguilla rostrata* was listed as *A. bostoniensis* in Odum (1957). Biomass was derived from grams dry weight per meter ^{2} estimates in Odum (1957) and in Knight (1980) using standard wet weight/dry weight conversion factors (from Munch *et al.* 2006).

Family	Common Name	Scientific Name	Biomass (kg/ha)		
			Odum	Knight	This Study
Amiidae	Bowfin	*Amia calva*		0.58	2.79
Anguillidae	American eel	*Anguilla rostrata*			0.01
Belonidae	Atlantic needlefish	*Strongylura marina*		0.01	
Catostomidae	Lake chubsucker	*Erimyzon sucetta*		1.97	1.10
Centrarchidae	Redbreast sunfish	*Lepomis auritus*			0.26
Centrarchidae	Bluegill	*Lepomis macrochirus*			10.99
Centrarchidae	Redear sunfish	*Lepomis microlophus*			2.42
Centrarchidae	Spotted sunfish	*Lepomis punctatus*			0.04
Centrarchidae	Sunfish sp.	*Lepomis sp.*	47.62	15.56	
Centrarchidae	Largemouth bass	*Micropterus salmoides*	27.14	18.65	11.10
Centrarchidae	Black crappie	*Pomoxis nigromaculatus*		0.02	0.01
Cichlidae	Blue tilapia	*Tilapia aurea*			0.23
Clupeidae	Gizzard shad	*Dorosoma cepedianum*		66.28	2.57
Cyprinidae	Golden shiner	*Notemigonus crysoleucas*		6.32	0.59
Cyprinodontidae	Golden topminnow	*Fundulus chrysotus*			0.00007
Cyprinodontidae	Bluefin killifish	*Lucania goodei*	18.57		0.002
Esocidae	Chain pickerel	*Esox niger*		1.34	2.61
Ictaluridae	Channel catfish	*Ictalurus punctatus*			0.03
Lepisosteidae	Longnose gar	*Lepisosteus osseus*	1.43		2.06
Lepisosteidae	Florida gar	*Lepisosteus platyrhincus*	44.29	1.33	3.52
Mugilidae	Striped mullet	*Mugil cephalus*	266.67	2.57	1.55
Percidae	Swamp darter	*Etheostoma fusiforme*			0.00007
Poeciliidae	Gambusia sp	*Gambusia sp.*	21.43		0.00003
Poeciliidae	Least killifish	*Heterandria formosa*	3.33		0.00003
	Catfish		95.24		
	Shiners		0.95		0.01
TOTAL FISH BIOMASS			526.7	114.6	41.90

Reptiles

During the July 29, 2008 site visit, a variety of aquatic turtles were observed including cooters (*Pseudemys sp.*), loggerhead musk turtles (*Sternotherus minor*), and Florida softshell (*Apalone ferox*). Findings from Munch *et al.* (2006) suggest that the cooters (*Pseudemys sp.*) commonly observed during the early 1950s are still the most commonly observed species, while smaller populations of soft shelled turtles and musk turtles continue to be present. Alligator populations were not estimated by Odum in the 1950s but were estimated at night to have a density of about 3.4/ha by Knight (1980) and in the day at 0.91/ha during the Munch *et al.* (2006) study. See **Table 10** for a listing of the reptile species observed along the Silver River.

Birds

Some historical perspective for Silver Springs birds is provided in Munch *et al.* (2006), as the total species richness for birds (as well as fish and reptiles) were similar in 2004 compared to historical records at the Silver River. However, populations of fish-eating birds such as the double-crested cormorant may have increased at Silver Springs since the 1950s study period (Munch *et al.* 2006). See **Table 10** for a listing of bird species observed along the Silver River.

TABLE 10
Species of birds and reptiles observed (indicated by "+") utilizing the spring run of Silver River, studies by Odum (1957) and Munch *et al.* (2006).

	Common	Species	Odum	This study
Birds	American coot	*Fulica americana*	+	
	Anhinga	*Anhinga anhinga*		+
	Common moorhen	*Gallinula chloropus*	+	+
	Double-crested cormorant	*Phalacrocorax auritus*		+
	Florida mottled duck	*Anas fulvigula*		+
	Grackle	*Quiscalus quiscula*		+
	Great blue heron	*Ardea herodias*	+	+
	Green heron	*Butorides virescens*	+	
	Little blue heron	*Egretta caerulea*	+	+
	Osprey	*Pandion haliaetus*		+
	Pied-billed grebe	*Podilymbus podiceps*		+
	Snowy egret	*Egretta thula*		+
	White ibis	*Eudocimus albus*		+
	Wood duck	*Aix sponsa*		+
Reptiles	Alligator	*Alligator mississippiensis*	+	+
	Common musk turtle	*Sternotheris odoratus*	+	
	Florida cooter	*Pseudemys floridana*	+	+
	Florida red-bellied cooter	*Pseudemys nelsoni*	+	+
	Florida softshell turtle	*Apalone ferox*	+	+
	Loggerhead musk turtle	*Sternotheris minor*	+	
	Snapping turtle	*Chelydra serpentina*	+	+

Manatees

Modern published observations of manatees in this system are rare and include observations in the Silver River by Campbell (1976); by Beeler and O'Shea (1988) at the confluence of the Silver and Ocklawaha Rivers; and by Warr *et al.* (1994) who reported observation of two manatees in the Main Spring in July 1987 by a former director of the Silver Springs attraction.

Silver Springs and the Silver River would appear to provide ideal warm water and feeding habitat for manatees. However, the Silver Springs Group is currently not listed on the Florida Manatee Recovery Team Warm-Water Task Force (WWTF) list of important manatee warm-water sites. This designation is likely the result of inaccessibility to the spring system from the St. Johns River due to the impoundment (Rodman Reservoir) of the connecting Ocklawaha River which became operational in December 1968. There are three artificial structures associated with the Rodman Reservoir: the Rodman Dam, the Buckman Lock, and the Eureka Dam (which was never operationally completed). Access to the lower Ocklawaha River from the St. Johns is blocked by the Rodman Dam, leaving the Buckman Locks as the only manatee access from the St. Johns River to the Rodman Reservoir and ultimately the upper Ocklawaha and Silver Rivers (Taylor 2006).

In addition to preventing upstream access, both the dam and lock systems have been responsible for manatee mortality due to water turbulence at the base of the dam (seven verified manatee deaths from 1974 to 1997 FWC Manatee Mortality Database; Smith 1997); the operation of the dam spillway gates (two manatee deaths documented in August 1995); and four manatee fatalities have been verified at the lock structure (FWC

Manatee Mortality Database, Taylor 2006). Six additional manatee mortalities of undetermined cause have been documented in the vicinity of the Buckman Locks and Rodman dam as well (Taylor 2006).

No manatees were observed during an aerial survey in January 1996 of the Silver River, Ocklawaha River, and Rodman Reservoir (Taylor 2006), suggesting that the Silver Springs system is largely inaccessible to manatees due to the aforementioned structural alterations of the Ocklawaha River.

Ecosystem Functions

Aquatic ecosystem metabolism studies were pioneered by H.T. Odum (1956, 1957) and others (Odum *et al.* 1953) utilizing Silver Springs as a natural study system. Preliminary research in Silver Springs began in 1953, and a progress report by Odum *et al*. (1953) describes the initial results from his measurements of community metabolism. Odum found springs to be ideal experimental units; allowing exploration of community ecology, trophic status, and food webs.

The 1956 publication of *Primary Production in Flowing Waters* by H.T. Odum developed the methods to measure community metabolism as well as the ecological implications these measurements facilitate, *i.e.*, determination of productivity (P), respiration (R), P/R ratios, and heterotrophic versus autotrophic states from a variety of lotic systems. Odum's (1956) results demonstrated that higher productivity can be achieved in flowing waters, that autotrophic and heterotrophic states exist in a gradient, and that primary production and community respiration can be used to characterize communities.

In 1957, Odum published *Trophic structure and productivity of Silver Springs, Florida*. This monograph arguably represents Odum's landmark publication; a major distinction, considering the number and breadth of publications produced in his lifetime. In brief, it is a study of Silver Springs which uses the metric of energy to quantify and qualify the community ecosystem. Rates are presented, often in terms of oxygen or as organic matter produced per unit area and time, rather than just amounts per area. Concepts fundamental to the study of ecology are expounded upon and which in turn, have shaped future ecological paradigms. These include community ecology, food webs, trophic levels, and energy flow. Odum's work in Silver Springs (and other springs) illustrates their value as study sites to test ecological theory given these systems can be individually thermostatic, chemostatic, and biostatic ecological communities in a climax steady state that exhibit seasonally pulsing due to variations in solar inputs. Odum's work in Silver Springs also provides a baseline assessment of the ecosystem, allowing a quantitative comparison to the current state of Silver Springs more than fifty years later (see Munch *et al.* 2006). Key measures from Odum (1957) reveal: community primary production was efficient at 5% of usable light and rates of production are proportional to light intensity with springtime having 2 to 3 times the levels of winter production; most of the production was utilized by respiration; about one third of primary production is due to *Sagittaria* even though this plant community represent about three quarters of the standing biomass; the balance of production was due to the aufwuchs or periphyton community whose abundance was estimated as 2.95 g chlorophyll/m^2 concentrated about 1/3 of the distance from the *Sagittaria* tips; the primary producer community experiences an annual turnover of eight times although apparent stability of gross features constitutes a climax community; nitrate and inorganic phosphorus were found

to be assimilated from the water during both the day and night; and that the nitrogen to phosphorus ratio and rates of utilization suggests that nitrogen is the more limiting nutrient.

An ecosystem-level study of the modern function and community composition of Silver Springs was conducted during 2004-2005 by Munch *et al.* (2006). This comprehensive study of the physical, chemical and biological components of the Silver Springs ecosystem (from the main boil to 1,200 m downstream) had particular emphasis on water quality and measures of ecosystem metabolism as compared to measures of these parameters made 50 years earlier by H.T. Odum and 25 years earlier by R.L. Knight (1980). Findings from Munch *et al.* (2006) reveal that while water chemistry has remained generally stable except for increases in nitrate concentration, declines in water clarity, and possible reductions in dissolved oxygen levels from the main boil; ecosystem metabolism estimates (*i.e.*, Gross Primary Productivity, Net Primary Productivity, Community Respiration, and Ecological Efficiency) appear to have declined from Odum's and Knight's previous estimates. Ecological measurements made Munch *et al.* (2006) resulted in the following observations:

- Annual average gross primary productivity (GPP) declined from about 15.6 grams oxygen per square meter per day (g $O_2/m^2/d$) in the 1950s and late 1970s to about 11.2 g $O_2/m^2/d$ during the Munch *et al.* (2006) study, a decline of about 27% (**Table 11**).

- Community respiration also declined from about 14.8 g $O_2/m^2/d$ during the earlier studies to about 10.9 g $O_2/m^2/d$ during the Munch *et al.* (2006) study, a 26% reduction.

- Resulting net community primary productivity declined from about 1.0 g $O_2/m^2/d$ in the 1950s, to 0.80 g $O_2/m^2/d$ in the late 1970s, to about 0.42 g $O_2/m^2/d$ during the Munch *et al.* (2006) study, a decline of about 59% over the past fifty years.

- The production to respiration (P/R) ratio remained relatively consistent between the three studies, ranging from about 1.11 during Odum's study in the 1950s to about 1.06 during Knight's study in the late 1970s, and 1.06 in the Munch *et al.* (2006) study.

- Ecological efficiency declined from about 1.09 gram of oxygen per mol (g O_2/mol) of Photosynthetically Active Radiation (PAR) during Odum's study to about 0.94 g O_2/mol of PAR during the Munch *et al.* (2006) study, a decline of about 13%.

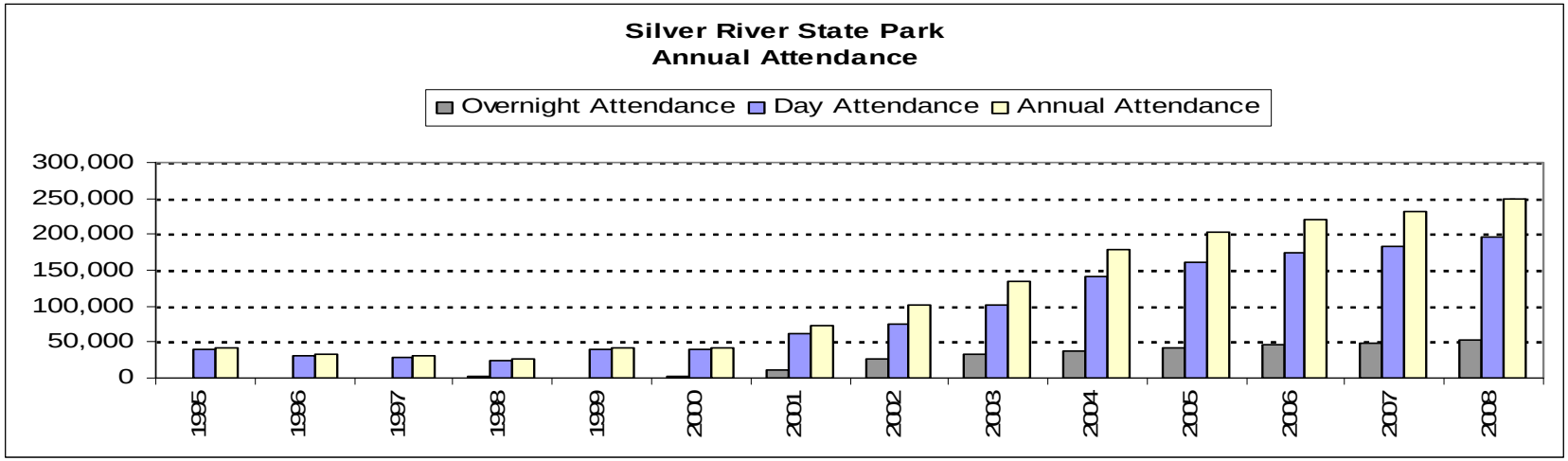
TABLE 11
Comparison of Silver Springs gross primary productivity estimates (from Munch *et al.* 2006).

Odum (1957)		**Knight (1980)**		Munch *et al.* (2006)	
Date	GPP ($gO_2/m^2/d$)	Date	GPP ($gO_2/m^2/d$)	Date	GPP ($gO_2/m^2/d$)
2/19/1953	12.4	8/31/1978	19.3	Feb-04	8.2
3/7/1953	14.0	10/5/1978	13.6	Mar-04	11.4
3/25/1953	17.5	12/13/1978	7.8	Apr-04	13.2
1/7/1954	10.1	3/7/1979	10.7	May-04	13.9
5/23/1954	24.4	4/15/1979	16.8	Jun-04	12.7
7/12/1955	12.1	5/16/1979	23.4	Jul-04	13.6
8/11/1955	19.7	6/19/1979	20.7	Aug-04	12.3
		7/17/1979	11.2	Sep-04	10.9
		8/15/1979	17.1	Oct-04	11.7
				Nov-04	9.8
				Dec-04	8.5
				Jan-05	8.6
				Feb-05	11.1
				Mar-05	10.8
Average	15.7		15.6		11.2

Human-Use Attendance and Activities

The economic impact of Silver Springs (as well as seven other springs in the SJRWMD- Alexander, Apopka, Bugg, Gemini, Green, Ponce de Leon, and Silver Glenn,) was investigated by Bonn (2004) over a 12 month time period to estimate their levels of human visitation and the associated economic impact. Nearly 2,300 surveys were analyzed in the process. Seasonality in spring usage is documented as a key issue, generally the springs experienced peak usage in the spring (Apr-Jun) and then summer periods (Jul-Sep). Overall findings for the eight springs indicated that total annual direct spending by visitors accounted for over $65 million, generated over $13 million in wages, and created over 1,100 jobs. Silver Springs, which has a large theme park associated with the natural springs' environment, accounted for 94% of the total economic impact to the region, while the remainder of the springs contributed only 6%. The Bonn (2004) study illustrates that the money/jobs/economic impact generated by Silver Springs has more to do with its development as a tourist site (with commensurate gate fees and purchase opportunities) rather than simply being Florida's largest spring. While natural areas and the environmental services they provide (not considered in this report) are highly valuable, these valuations are not considered in this report. Also the economic impact generated from the Silver Springs attraction cannot be directly applied to other springs that are operated by governmental agencies.

While attendance records for the Silver Spring theme park are not publicly available, attendance data for the Silver River State Park have been analyzed and are presented in **Figure 21**. These data reveal that total annual attendance has steadily increased since the 1995 opening of the park and that the month of November experiences the highest visitation.



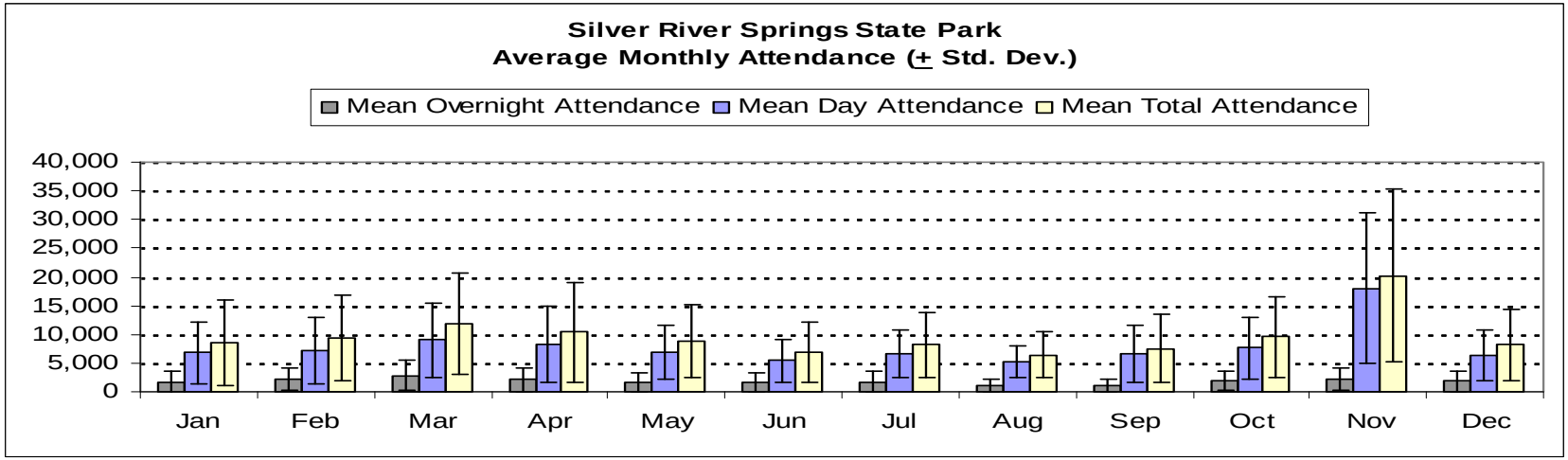


FIGURE 21
Human use statistics for Silver River State Park.

Minimum Flow and Levels

Silver Springs and Silver River have been placed on the St. Johns River Water Management District MFL priority list for 2009 (SJRWMD 2008b). In cooperation with the SJRWMD, the Southwest Florida Water Management District is also conducting an MFL analysis for Silver Springs. As of the date of this report, no MFL has been proposed or adopted for this spring group.

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Appendix X

Summary of data for Silver Glen Springs



Summary of Existing Data - Silver Glen Springs (Marion Co.)

Prepared by

Wetland Solutions, Inc.

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Cover photo: A large school of ladyfish (*Elops saurus*) and Crevalle jack (*Caranx hippos*) circling the main vent of Silver Glen Springs, tape grass (*Vallisneria americana*) and filamentous algae (*Lyngbya sp.*) growing on the bottom, and data sonde housing visible in the middle (S.K. Notestein, 02/18/09).

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Summary of Existing Springs Data

This report summarizes known existing physical, chemical, and biological data for Silver Glen Springs (Marion County). These data were collected from sources such as the St. Johns River Water Management District (SJRWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Silver Glen Springs Recreation Area

Physical address

Silver Glen Springs Recreation Area; Marion County, Florida, 32134; latitude/longitude: 29.247226°, -81.643009°). The spring is administered by the US Forest Service, Lake George Ranger District; 17147 East State Road 40; Silver Springs, Florida, 34488; phone: 352-625-2520; Spring website: http://www.fs.fed.us/r8/florida/ocala/attractions/silverGlenSpringsRecArea.php?p=1.1.3.4 .

Driving Directions

Silver Glen Springs is in the Ocala National Forest approximately 48.3 km (30 mi) northeast of Ocala. At the intersection of SR 40 and CR 326, travel east on SR 40 for approximately 40 km (25 mi), turn north on SR 19 and travel approximately 9.7 km (6 mi) to Silver Glen Springs Recreation Area located on the east side of SR 19. The spring is south of the parking area.

General

This first magnitude spring system is located in the Ocala National Forest adjacent to the border of Marion and Lake Counties (**Figure 1**). Two spring vents comprise the

spring pool and the resulting spring run travels east to Lake George. Operated by private concession, the park facilities are well developed and include rest rooms and picnic facilities. A popular regional swimming and camping destination, the spring run is also accessed by boat via Lake George and the St. Johns River. During summer holidays and weekends hundreds of boats routinely travel into and anchor in the spring run (Pandion Systems, Inc. 2003).

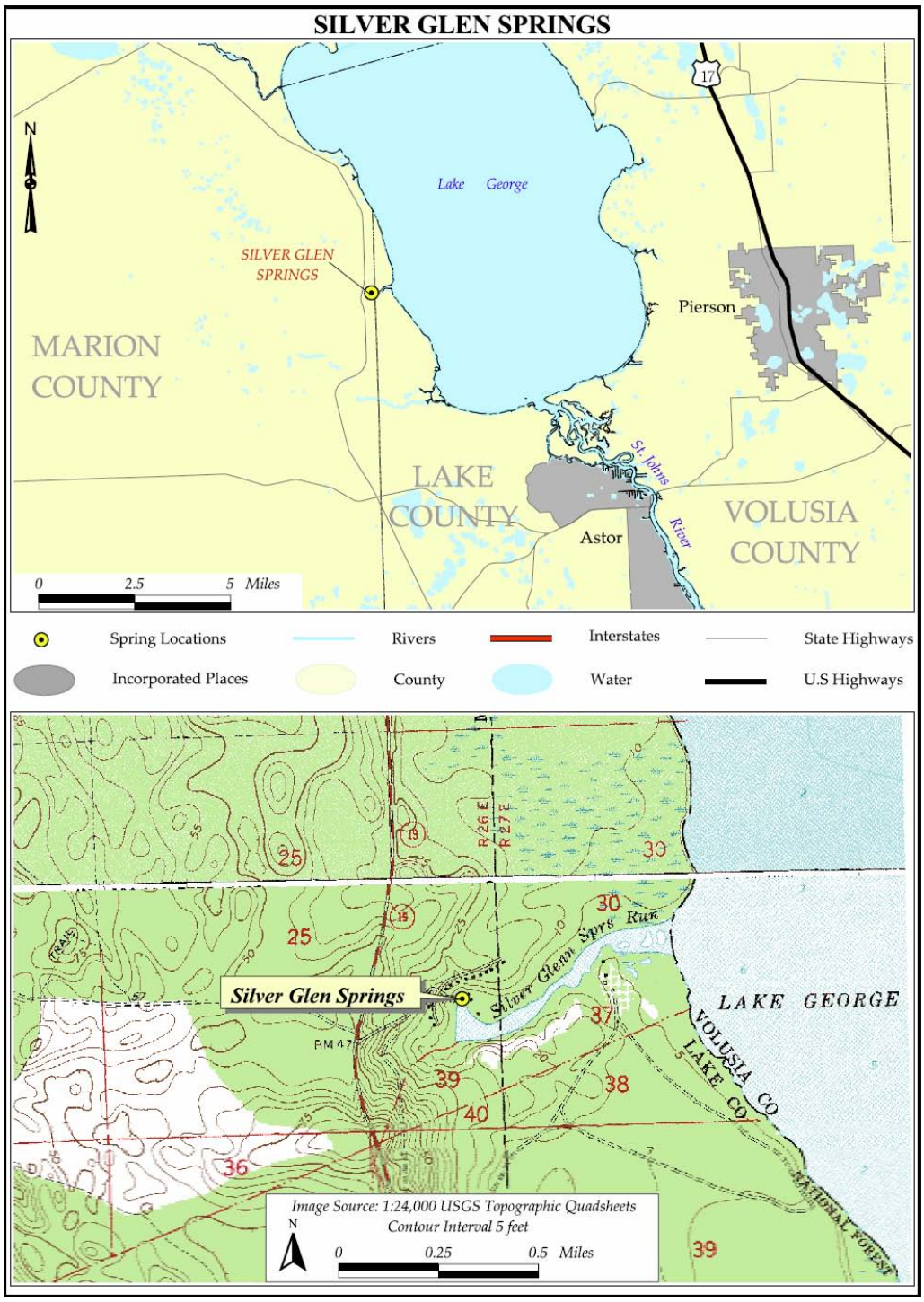


FIGURE 1
Silver Glen Springs location (from Scott *et al.* 2002).

Physical

Silver Glen Springs has two vents and a large combined spring pool with a mostly bare sand bottom. The spring pool is approximately 61 m (200 ft) north to south and 53 m (175 ft) east to west. The depth is 5.5 m (18 ft) at the east vent or "Main spring" which has a conical basin. The second vent, often referred to as "The Well" due to its vertical cylindrical opening into the limestone, is on the southwestern edge of the pool. It is 3.7 m (12 ft) in diameter and approximately 12.2 m (40 ft) deep.

Water is clear and light blue. Large boils occur over both vents. Some patches of submersed aquatic vegetation are in the pool. Two ropes separate the spring pool from boat traffic. Within the main pool, access to "The Well" is maintained as a natural area with recreational access restricted. The spring run ranges from 30 to 60 m (100 to 200 ft) wide, with maximum depths approaching 3.6 m (12 ft), and continues east approximately 1.2 km (0.75 mi) before joining Lake George. The spring pool and upper run are heavily utilized by swimmers and boaters respectively. Resultantly, submersed aquatic vegetation (except filamentous algae which has no need to be rooted to the sediments) has declined in these portions of Silver Glen Springs (**Figures 2** and **3**). The lands around the springs rise to approximately 3.7- 4.6 m (12 to 15 ft) of elevation, where oak, cedar, palm, and pine trees are common, and several large Native American earthen mounds are evident. The underwater cave system at Silver Glen Springs has been extensively mapped. Original cartographic maps of the cave system as well as a color photograph of the largest "room" are displayed in the Silver River State Park museum.



FIGURE 2
Silver Glen Springs circa 1930 photo (anonymous, from Scott *et al*. 2004).



FIGURE 3
Silver Glen Springs pool with "main" spring to the right and "The Well" in the back-center (from Scott *et al*. 2004).

Geology

The geology Silver Glen Springs is dominated by sand dunes and well sorted fine sand of the Pleistocene and Holocene deposits (Brooks 1981) with underlying Pliocene age material (Scott *et al.* 2001) (**Figure 4**). The area is contained in the Ocala Scrub division of the Central Lake District; and contains uplifted limestones of the Floridan aquifer below the surficial sands, has active sinkhole development, and is a significant recharge area of the Floridan aquifer (Brooks 1981).

Hydrogeologic Setting

Shoemaker *et al.* (2004) describe the region containing Silver Glen Springs as mostly underlain by unconsolidated sand and clay sediments that form the surficial aquifer system; followed by less permeable clay and carbonate rocks which form the intermediate confining unit; more permeable carbonate rocks that form the intermediate aquifer system; and a thick sequence of limestone and dolomitic limestone of variable permeability that form the Floridan aquifer system; and low permeability dolomite beds that form the sub-Floridan confining unit, which functions as the base of the fresh ground-water flow system.

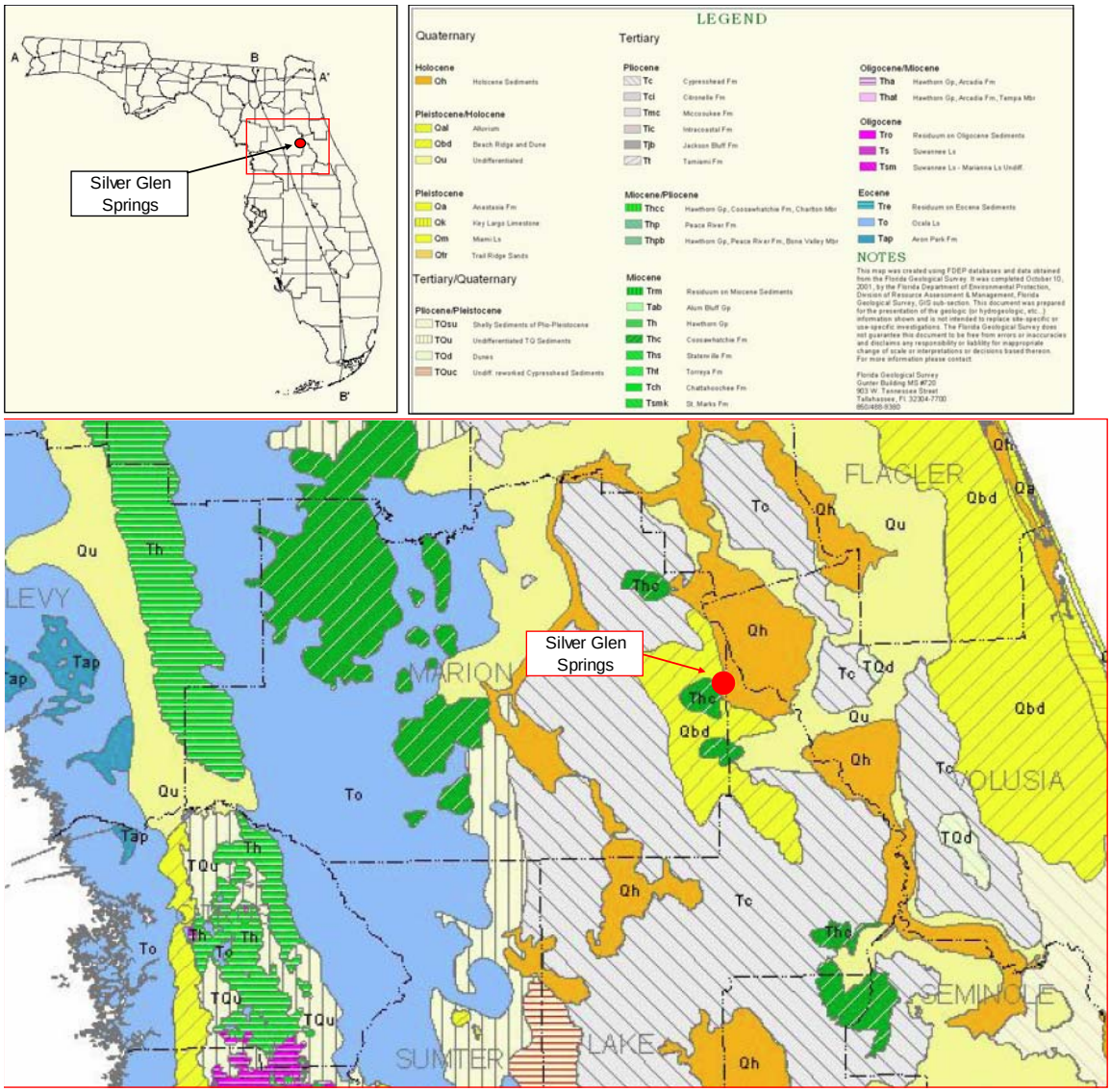


FIGURE 4
Geologic map of Silver Glen Springs (adapted from Scott *et al.* 2001).

Springshed

The springshed of Silver Glen Springs has been estimated using three different recharge models by Shoemaker *et al.* (2004). Depending on the model employed, the land area contributing recharge to Silver Glen Springs ranged in size from 104 to 233 km^2 (40 to 90 mi^2, **Figure 5**). By combining the areas of each model, a composite area was generated which encompasses about 311 km^2 (120 mi^2 or 76,800 ac). This composite area suggests that a portion of the ground water discharged from Silver Glen Springs originates from areas northwest and southeast of the spring, but that most of the area contributing recharge, lies southwest of the spring because the prevailing direction of ground-water flow in the Upper Floridan Aquifer of this area is from southwest to northeast (Shoemaker *et al.* 2004).

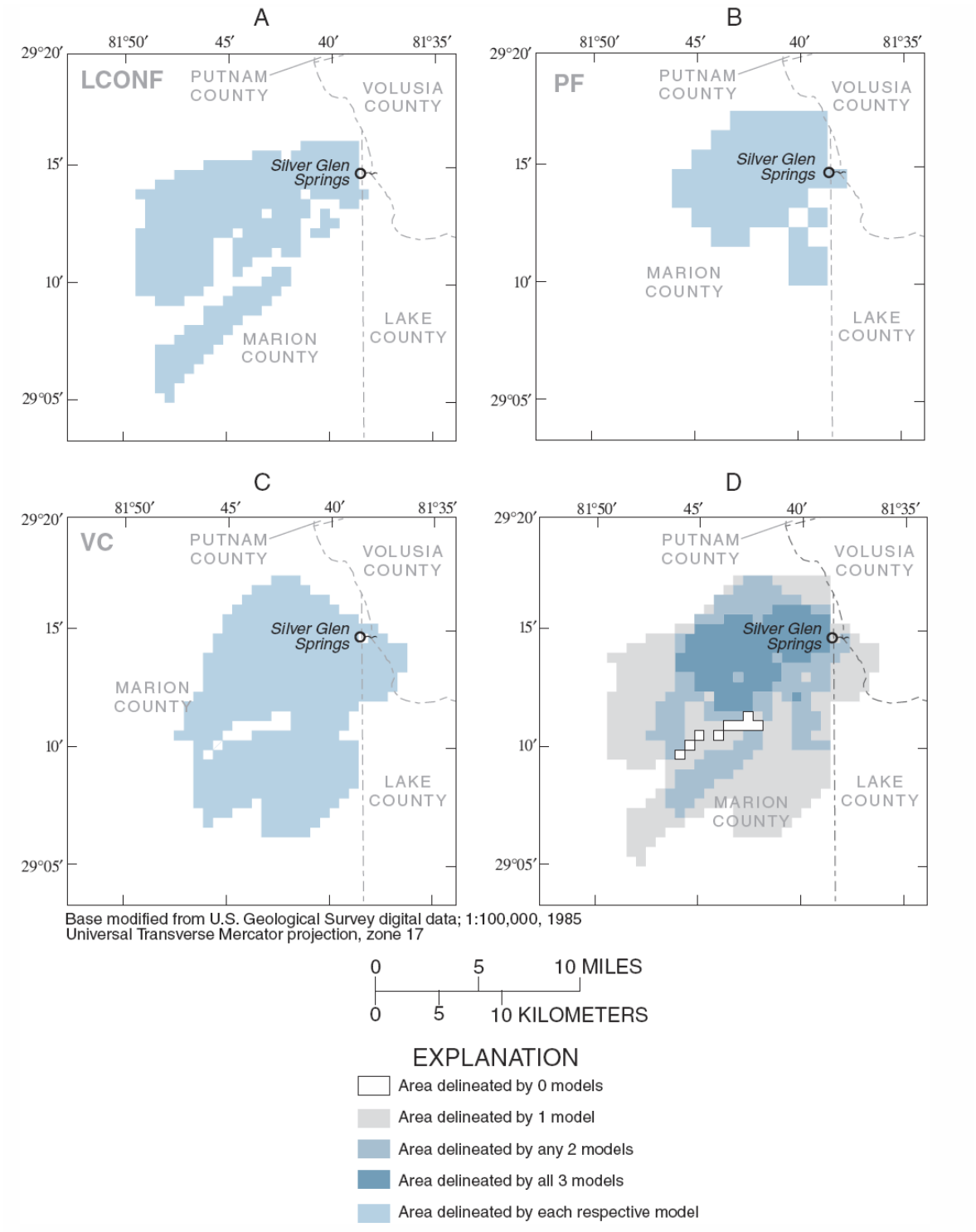


FIGURE 5
Modeled springsheds of Silver Glen Springs based on travel times up to 100 years as simulated by (A) Lake County/Ocala National Forest; (B) Peninsular Florida; (C) North-Central Florida models for the average hydrologic conditions of the calibration period; and (D) composite area of all three models (from Shoemaker *et al.* 2004).

Study Area

The project study area is defined as the spring pool and the upper-half of the spring run. **Figure 6** shows an approximation of the study area.



FIGURE 6
The study area for Silver Glen Springs.

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Silver Glen Springs are given in **Table 1** below.

TABLE 1
Source information for Silver Glen Springs historical water quality data described in this report.

Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
USGS	USGS	2236160	Silver Glen Springs near Salt Springs	29.244444	-81.642778
21FLKWAT	Florida Lakewatch	MAR-SIVERGLEN-1	Marion-Silver Glen-1	29.244861	-81.643250
21FLKWAT	Florida Lakewatch	MAR-SIVERGLEN-2	Marion-Silver Glen-2	29.244861	-81.643250
21FLKWAT	Florida Lakewatch	MAR-SIVERGLEN-3	Marion-Silver Glen-3	29.244861	-81.643250
21FLCEN	Florida Department of Environmental Protection	20010358	Silver Glenn Springs at Main Boil	29.245783	-81.643450
21FLGW	Florida Department of Environmental Protection	9687	Silver Glen Springs	29.245844	-81.643473
21FLCEN	Florida Department of Environmental Protection	20010335	Silver Glenn Springs Run @ Lake George.	29.248361	-81.635061

Discharge and Stage

Historical discharge data for Silver Glen Springs are reported by Rosenau *et al.* (1977), with eleven sporadic measurements spanning the time period of 1931 to 1972, with discharge values ranging from a minimum of 90 cfs (February 7, 1933) to a maximum of 129 cfs (April 12, 1935). Other measures of discharge include a value of 109 cfs (September 13, 2001) by Scott *et al.* 2002. The US Geological Survey has a station which monitors discharge and stage (station # 02236160) with daily records mostly available between November 2002 and December 2008. **Table 2** illustrates the variability of discharge and stage at this spring system (USGS 2006). Discharge data are plotted in **Figure 7** for the available period-of-record.

TABLE 2
Summary statistics for the discharge and stage of Silver Glen Spring (from USGS 2006).

SUMMARY STATISTICS								
	Calendar Year 2005		Water Year 2006		Water Years 2003 - 2006	
Annual total	32,835		35,649			
Annual mean	93.3		97.7		107	
Highest annual mean					118	2003
Lowest annual mean					97.7	2006
Highest daily mean	111	Sep 10	116	Jun 19, 20	132	Dec 1-3, 2002
Lowest daily mean	68	Apr 24	80	Dec 19, 21	68	Apr 24, 2005
Annual seven-day minimum	72	Apr 19	83	Sep 24	72	Apr 19, 2005
Maximum peak stage			3.14	Oct 7	4.68	Sep 26, 2004
10 percent exceeds	105		107		121	
50 percent exceeds	93		98		110	
90 percent exceeds	83		89		90	

Note.--Monthly and annual summary statistics include periods of missing daily discharge record.

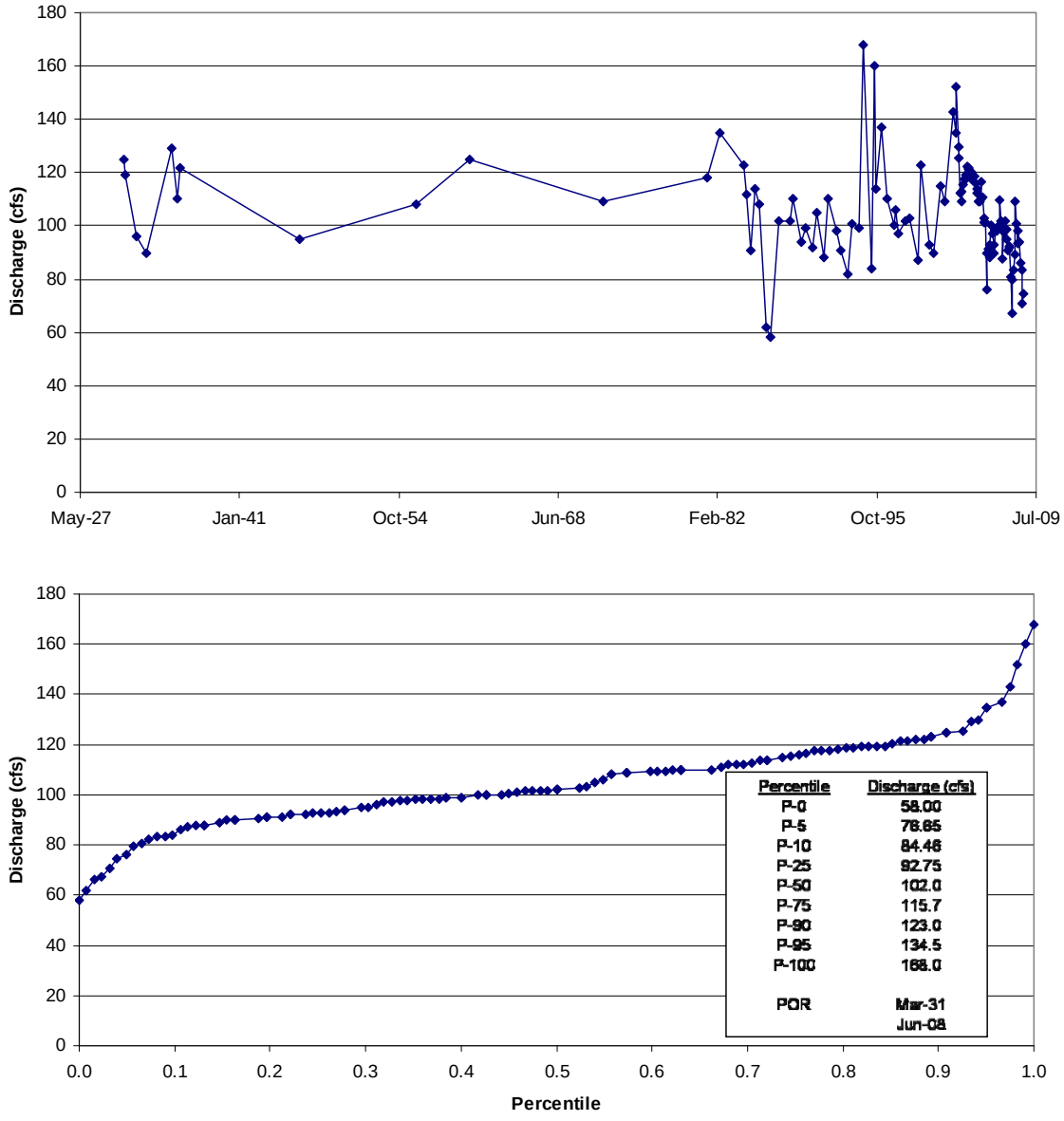


FIGURE 7
Monthly average discharge time series and frequency curve for Silver Glen Springs.

Water Quality

Sporadic water quality data for Silver Glen Springs are summarized from March 1931 through June 2008 from STORET (USGS and FDEP data). The numbers of samples collected were highly variable between parameters, ranging from 1 to 364 records. Samples appear to have been collected solely from the main boil. **Table 3** provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. The Silver Glen Springs POR averages for several key parameters and the numbers of samples in parenthesis are:

- Water temperature – 23.4 °C (n = 22)
- Dissolved oxygen – 2.91 mg/L (n = 22)
- pH – 7.72 SU (n = 22)
- Specific conductance – 1,862 umhos/cm (n = 43)
- Turbidity – 0.125 NTU (n = 16)
- Color – 0.7 CPU (n= 21)
- Total chloride – 449 mg/L (n = 40)
- Sulfate – 169 mg/L (n = 40)
- Nitrate+nitrite nitrogen – 0.05 mg/L (n = 40)
- Total phosphorus – 0.03 mg/L (n = 364)

TABLE 3
Silver Glen Springs water quality table for the period-of-record.

GROUP DESC	PARAMETER	UNITS	Station	Decade Average								Statistics					Period of Record	
				1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
BACTERIOLOGICAL	EColi	#/100ml	Main Boil								1.00	1.00	1.00	1.00	0.00	2	10/25/01	1/29/02
			Lake George								20.0	20.0	4.00	44.0	21.2	3	5/22/01	5/28/01
	Enterococci	#/100ml	Main Boil								4.33	4.33	1.00	46.0	10.2	21	10/25/01	10/25/06
			Lake George								8.67	8.67	2.00	20.0	9.87	3	5/22/01	5/28/01
	FC	#/100ml	Main Boil								1.48	1.48	1.00	2.00	0.512	21	10/25/01	10/25/06
			Lake George								72.3	72.3	8.00	190	102	3	5/22/01	5/28/01
	TC	#/100ml	Main Boil								2.90	2.90	1.00	20.0	4.47	20	10/25/01	10/25/06
			Lake George								1,543	1,543	44.0	4,090	2,217	3	5/22/01	5/28/01
BIOLOGICAL	Pheo-a	µg/L	Spring Run								0.800	0.800	0.100	1.80	0.804	4	1/31/07	10/10/07
DISSOLVED OXYGEN	DO	%	Spring Run					43.0			42.2	42.3	33.0	65.0	10.4	14	4/13/72	10/10/07
	DO	mg/L	Main Boil								2.91	2.91	2.03	4.10	0.45	22	5/22/01	10/25/06
			Spring Run					3.70	4.73		3.55	4.08	2.80	6.20	1.02	32	4/13/72	10/10/07
			Lake George								5.20	5.20	3.56	6.50	1.50	3	5/22/01	5/28/01
FLOW	Flow	cfs	Main Boil								66.4	66.4	66.4	66.4		1	7/21/04	7/21/04
			Spring Run	113	95.0	108	125	109	102	107	102	102	56.0	168	15.1	2048	3/17/31	6/30/08
	Flow-Inst	cfs	Spring Run	113	95.0	108	125	109	102	107	117	110	58.0	168	19.8	68	3/17/31	1/13/05
GENERAL INORGANIC	Alk	mg/L as CaCO3	Spring Run					69.0	66.0			67.5	66.0	69.0	2.12	2	4/13/72	4/16/81
	Cl-T	mg/L	Main Boil								449	449	360	480	26.6	40	10/25/01	10/25/06
			Spring Run					520	460	470		478	420	520	43.5	4	4/13/72	2/4/97
	CO2	mg/L	Spring Run					2.10	5.50	3.40		4.13	2.10	8.40	2.90	4	4/13/72	2/4/97
	F-D	mg/L	Spring Run					0.200	0.350	0.100		0.250	0.100	0.500	0.173	4	4/13/72	2/4/97
	Hardness	mg/L as CaCO3	Spring Run					340	330	340		335	310	350	16.0	8	4/13/72	2/4/97
	Si-D	mg/L	Spring Run					8.80	8.95	8.40		8.78	8.40	9.20	0.330	4	4/13/72	2/4/97
	SO4	mg/L	Main Boil								169	169	150	180	7.36	40	10/25/01	10/25/06
			Spring Run					190	180	180		183	160	200	17.1	4	4/13/72	2/4/97
GENERAL ORGANIC	TOC	mg/L	Main Boil								1.30	1.30	1.30	1.30		1	10/25/01	10/25/06
			Spring Run					5.00				5.00	0.00	15.0	8.66	3	4/13/72	4/13/72
METAL	Ag-T	µg/L	Spring Run					0.00	0.670			0.503	0.00	1.00	0.574	4	4/13/72	1/23/85
	Ba-T	µg/L	Main Boil								6.78	6.78	5.50	7.90	0.698	12	10/29/02	4/13/05
			Spring Run						100			100	100	100	0.00	2	1/23/85	1/23/85
	Ca-D	mg/L	Spring Run					74.0	73.5	74.0		73.8	71.0	76.0	1.91	8	4/13/72	2/4/97
	Ca-T	mg/L	Main Boil								72.2	72.2	61.8	83.4	4.01	41	10/25/01	10/25/06
	Cd-T	µg/L	Spring Run						1.00			1.00	1.00	1.00	0.00	2	1/23/85	1/23/85
	Co-T	µg/L	Main Boil								5.00	5.00	5.00	5.00		1	10/25/01	4/13/05
	Cr-T	µg/L	Spring Run					0.00	1.00			0.667	0.00	1.00	0.577	3	4/13/72	1/23/85
	Fe-T	µg/L	Main Boil								7.60	7.60	7.60	7.60		1	10/25/01	4/13/05
	Hg-T	µg/L	Spring Run					0.00	0.300			0.150	0.00	0.300	0.173	4	4/13/72	1/23/85
	K-D	mg/L	Spring Run					11.0	9.15	8.20		9.38	8.20	11.0	1.29	4	4/13/72	2/4/97
	K-T	mg/L	Main Boil								8.54	8.54	6.70	9.50	0.622	41	10/25/01	10/25/06
	Mg-D	mg/L	Spring Run					38.0	35.5	37.0		36.5	33.0	38.0	2.38	4	4/13/72	2/4/97
	Mg-T	mg/L	Main Boil								35.5	35.5	30.0	38.8	1.90	41	10/25/01	10/25/06
	Mn-T	µg/L	Main Boil								2.90	2.90	0.510	7.50	3.98	3	10/25/01	4/13/05
	NA-D	mg/L	Spring Run					290	250	250		260	230	290	23.9	8	4/13/72	2/4/97
	NA-T	mg/L	Main Boil								248	248	192	285	18.3	41	10/25/01	10/25/06
	NA-T	%	Spring Run					64.0	61.5	61.0		62.0	61.0	64.0	1.41	4	4/13/72	2/4/97
	SAR	ratio	Spring Run					6.80	6.00	5.90		6.18	5.70	6.80	0.486	4	4/13/72	2/4/97
	SR-D	µg/L	Spring Run						1,550	1,400		1,500	1,400	1,600	100	3	4/16/81	2/4/97
	SR-T	µg/L	Main Boil								1,591	1,591	1,450	1,720	98.7	13	10/25/01	4/13/05
	Zn-T	µg/L	Main Boil								2.60	2.60	2.10	3.10	0.707	2	10/25/01	4/13/05

TABLE 3 (CONTINUED)
Silver Glen Springs water quality table for the period-of-record.

				Decade Average								Statistics					Period of Record	
GROUP DESC	PARAMETER	UNITS	Station	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
NITROGEN	NH4-N	mg/L	Main Boil								0.015	0.015	0.011	0.022	0.004	9	10/25/01	10/25/06
			Spring Run					0.030	0.010			0.020	0.010	0.030	0.012	4	4/13/72	1/23/85
			Lake George								0.010	0.010	0.010	0.010		1	5/22/01	5/28/01
	NO2-N	mg/L	Spring Run					0.002	0.010			0.006	0.002	0.010	0.005	4	4/13/72	1/23/85
	NO3-N	mg/L	Spring Run					0.030				0.030	0.030	0.030	0.00	2	4/13/72	4/13/72
	NOx-N	mg/L	Main Boil								0.050	0.050	0.046	0.056	0.002	40	10/25/01	10/25/06
			Spring Run						0.050			0.050	0.050	0.050	0.00	2	1/23/85	1/23/85
			Lake George								0.028	0.028	0.013	0.043	0.021	2	5/22/01	5/28/01
	NOx-N-D	mg/L	Spring Run								0.047	0.047	0.043	0.050	0.005	2	10/19/06	3/15/07
	OrgN	mg/L	Spring Run					0.180	0.040			0.110	0.040	0.180	0.081	4	4/13/72	1/23/85
	TKN	mg/L	Main Boil								0.105	0.105	0.030	0.210	0.054	41	10/25/01	10/25/06
			Spring Run						0.050			0.050	0.050	0.050	0.00	2	1/23/85	1/23/85
			Lake George								0.190	0.190	0.120	0.260	0.099	2	5/22/01	5/28/01
	TN	mg/L	Spring Run						0.200			0.200	0.100	0.400	0.173	3	1/23/85	1/23/85
OXYGEN DEMAND	BOD5	mg/L	Spring Run					0.100				0.100	0.100	0.100	0.00	2	4/13/72	4/13/72
PESTICIDE	Alachlor-D	µg/L	Spring Run								0.005	0.005	0.005	0.005	0.00	2	10/30/06	3/15/07
	Atrazine-D	µg/L	Spring Run								0.007	0.007	0.007	0.007	0.00	2	10/30/06	3/15/07
	Diazinon-D	µg/L	Spring Run								0.070	0.070	0.005	0.200	0.101	6	10/19/06	3/15/07
	Dieldrin-D	µg/L	Spring Run								0.009	0.009	0.009	0.009	0.00	4	10/30/06	3/15/07
PHOSPHORUS	OrthoP	mg/L	Main Boil								0.027	0.027	0.022	0.037	0.003	21	10/25/01	10/25/06
			Spring Run					0.020	0.020			0.020	0.020	0.020	0.00	4	4/13/72	1/23/85
	TP	mg/L	Main Boil							0.022	0.033	0.030	0.000	2.800	0.146	364	2/28/91	10/25/06
			Spring Run					0.030	0.040			0.035	0.019	0.061	0.017	6	4/13/72	1/23/85
PHYSICAL	Color	CPU	Main Boil								0.71	0.71	0.00	5.00	1.79	21	10/25/01	10/25/06
			Spring Run					0.00	2.50	5.00		2.50	0.00	5.00	2.67	8	4/13/72	2/4/97
			Lake George								5.00	5.00	5.00	5.00	0.00	3	5/22/01	5/28/01
	Depth	m	Main Boil								5.21	5.21	4.20	6.30	0.576	12	10/25/01	10/25/06
	pH	SU	Main Boil								7.72	7.72	7.43	7.92	0.124	22	5/22/01	10/25/06
			Spring Run					7.80	7.40	7.75	7.75	7.61	6.20	8.50	0.471	38	4/13/72	10/10/07
			Lake George								7.92	7.92	7.65	8.16	0.230	5	5/22/01	5/28/01
	Secchi	m	Main Boil								4.96	4.96	4.20	5.60	0.382	22	5/22/01	10/25/06
			Lake George								2.87	2.87	1.60	5.00	1.86	3	5/22/01	5/28/01
	SpCond	umhos/cm	Main Boil								1,862	1,862	176	2,050	281	43	5/22/01	10/25/06
			Spring Run					2,200	2,031	1,960	1,926	1,992	1,890	2,200	81.5	52	4/13/72	10/10/07
			Lake George								1,723	1,723	1,670	1,760	47.3	3	5/22/01	5/28/01
	Stage	ft	Spring Run						1.09	1.69	1.39	1.39	0.060	17.2	1.49	2086	3/17/31	6/30/08
	Stage	ft MSL	Spring Run					1.39	1.11	0.823	2.09	1.08	-2.41	5.76	1.20	62	9/27/78	9/19/00
	Turb	NTU	Main Boil								0.125	0.125	0.050	0.350	0.075	16	10/25/01	10/25/06
			Spring Run					0.00			0.014	0.011	0.00	0.100	0.033	9	4/13/72	10/10/07
			Lake George								0.343	0.343	0.070	0.600	0.265	3	5/22/01	5/28/01
SOLID	TDS	mg/L	Main Boil								1,012	1,012	854	1,060	50.7	21	10/25/01	10/25/06
			Spring Run					1,200	1,074	1,120		1,105	975	1,220	96.3	7	4/13/72	2/4/97
	TSS	mg/L	Main Boil								2.00	2.00	2.00	2.00	0.00	21	10/25/01	10/25/06
TEMPERATURE	Wtr Temp	C	Main Boil								23.4	23.4	22.4	24.3	0.455	22	5/22/01	10/25/06
			Spring Run					23.0	23.5	23.1	23.3	23.3	23.0	24.5	0.458	46	4/13/72	10/10/07
			Lake George								23.8	23.8	23.2	24.1	0.471	3	5/22/01	5/28/01

Select water chemistry parameters for Silver Glen Springs are also monitored by the St. Johns River Water Management District (SJRWMD 2008a). Nitrate-nitrogen concentrations in the water discharged by Silver Glen Springs indicate that nitrate concentrations are typically low and do not appear to be increasing (**Figure 8**).

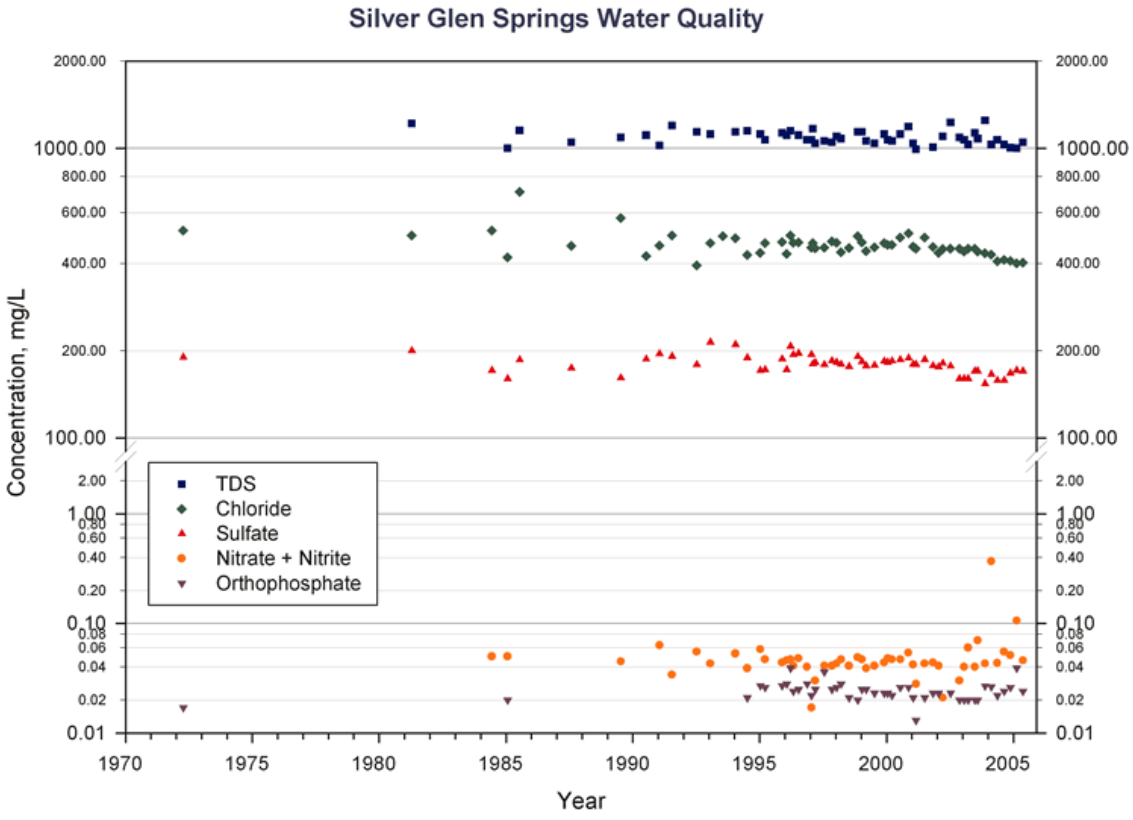


FIGURE 8
Silver Glen Springs water quality values by time and parameter (SJRWMD 2008a).

Field parameters were measured over both of the spring vents, as well as in the spring run to the confluence of Lake George via a boat on July 29, 2008 (**Figure 9**). Water discharging from the spring vents was slightly different (**Figures 10** and **11**), and overall had elevated conductivity (~ 1,900 µS/cm), lower dissolved oxygen values (~ 30 % or 2.70 mg/L), and slightly alkaline pH. The spring pool water had good clarity and a very appealing blue apparent color, likely enhanced by the predominance of white quartz sands. In the spring run, temperature increased slightly, conductivity declined slightly, and dissolved oxygen concentrations increased to over 70 % or 6.0 mg/L, with corresponding pH increases (**Figure 12**).

Downstream increases in dissolved oxygen (DO) were evident in the Silver Glen ecosystem and afford the opportunity to estimate ecosystem metabolism based on these changes (**Figure 12**). During our reconnaissance, average DO concentrations at the spring vent were roughly 3 mg/L and increased to approximately 6 mg/L within 2,000 feet downstream. These values were measured near midday in full sunlight summer conditions, still higher downstream DO concentrations are likely to be observed between 16:00 to 18:00 hours on days without cloud cover.

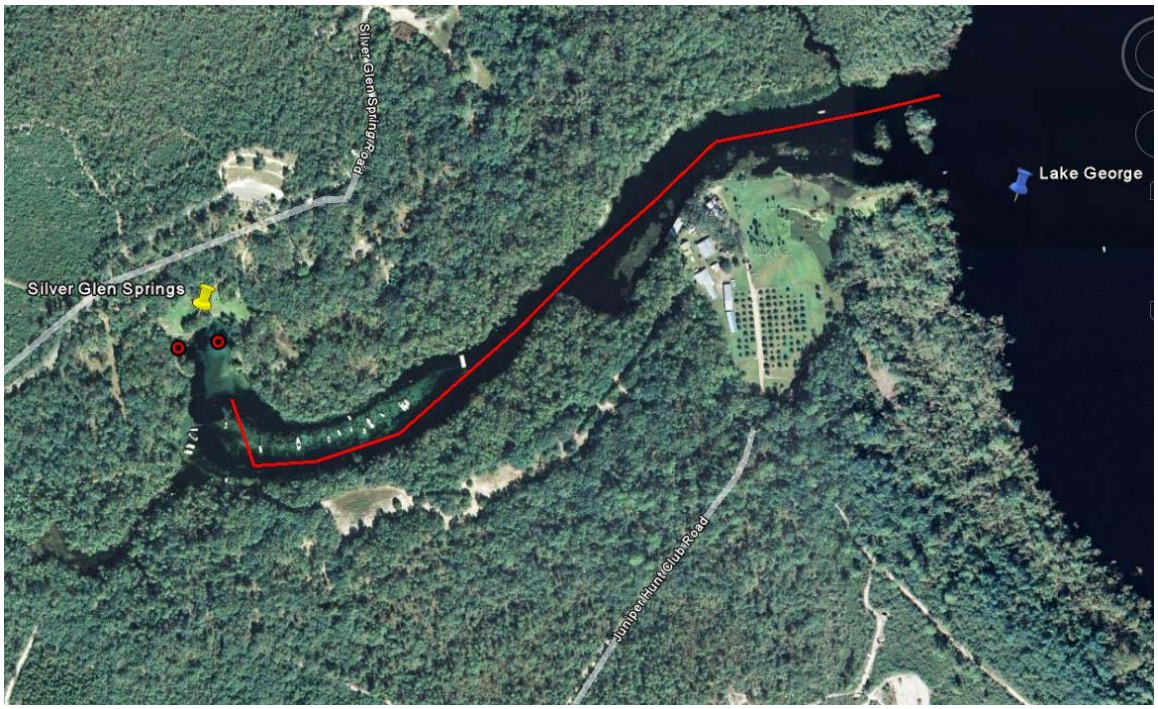


FIGURE 9
Image of Silver Glen Springs showing the location of sampled spring vents (red icons) and the sampling path (red line) taken on July 29, 2008.

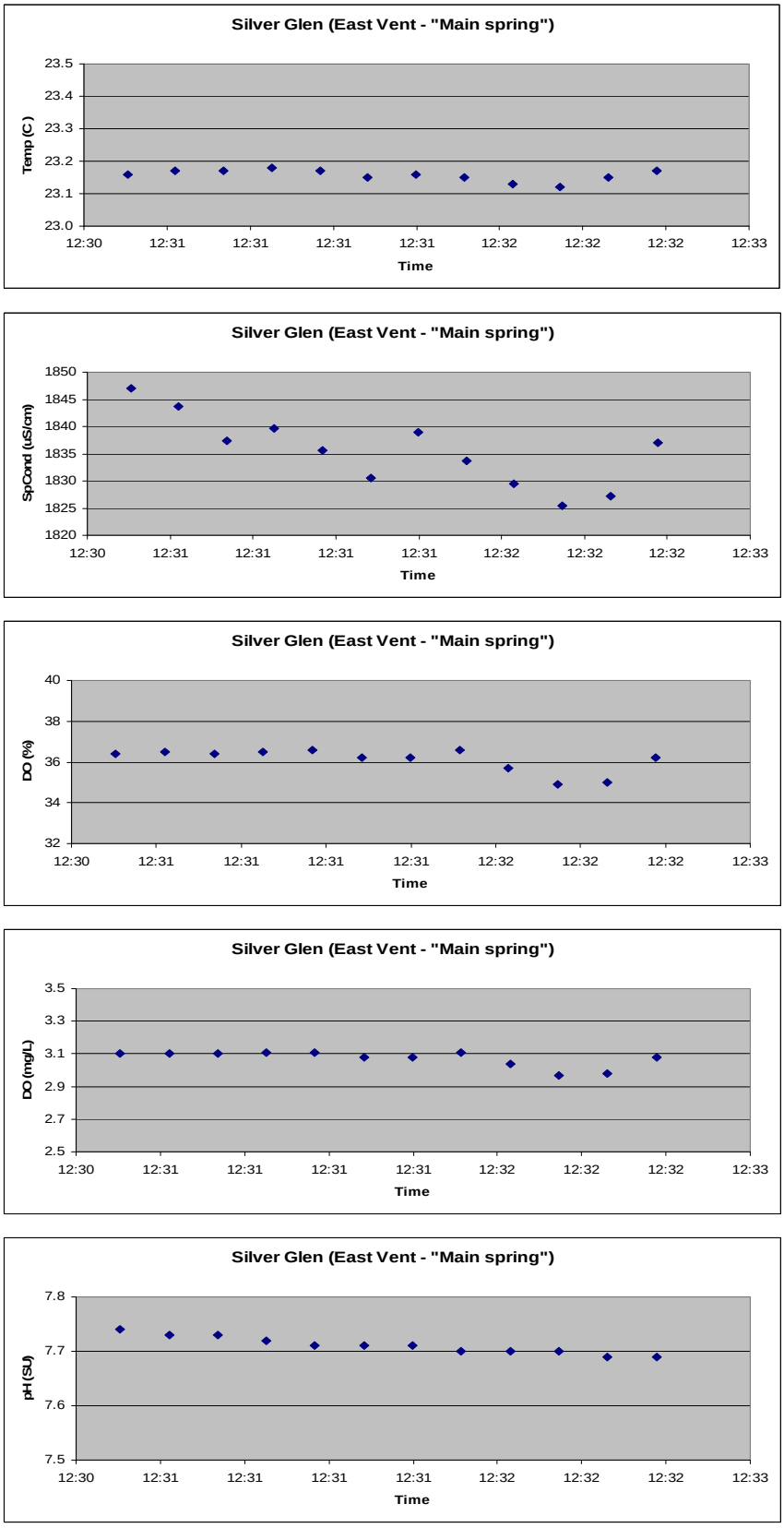


FIGURE 10
Measured field parameters from Silver Glen Springs east vent ("Main spring") on July 29, 2008.

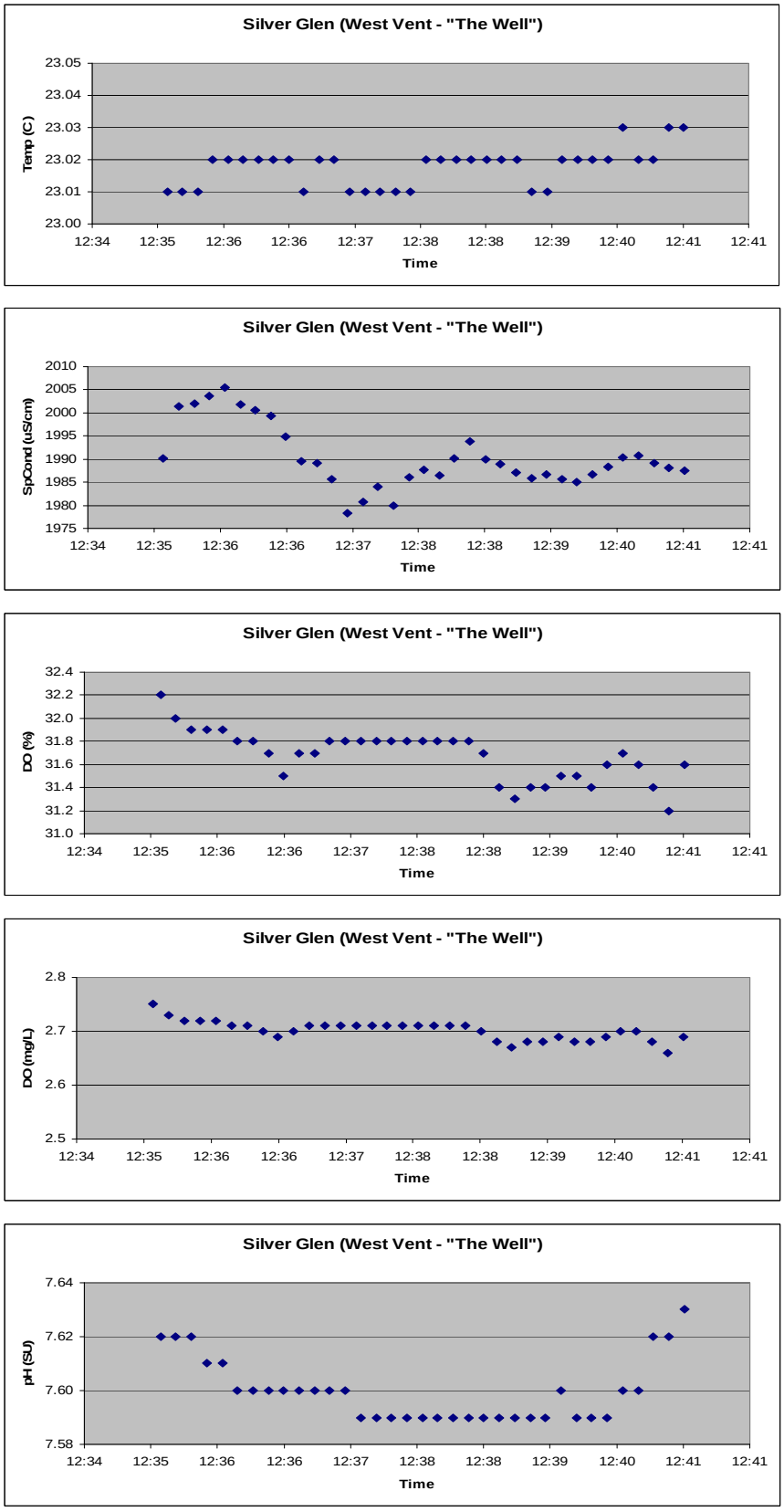
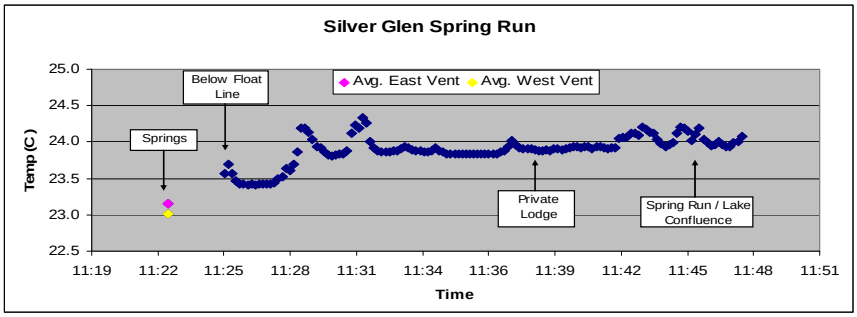
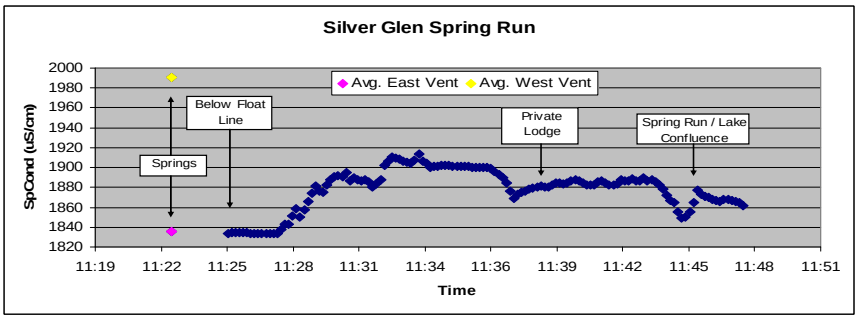
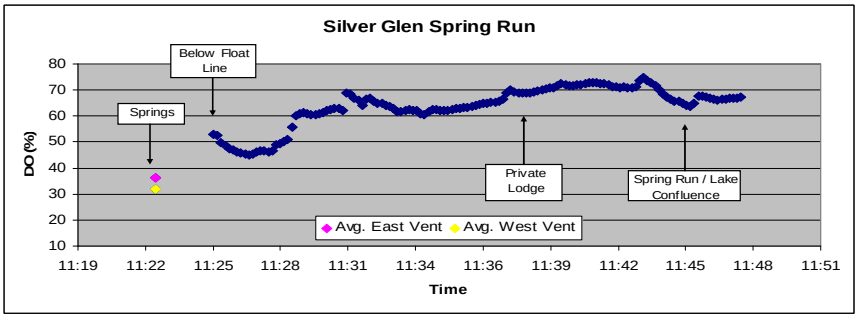
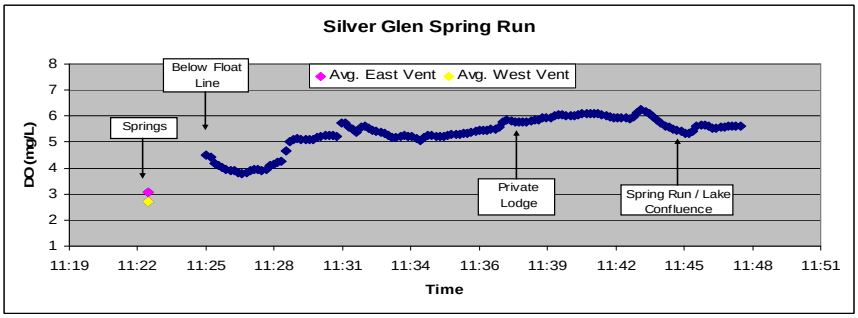


FIGURE 11
Measured field parameters from Silver Glen Springs west vent ("The Well") on July 29, 2008.









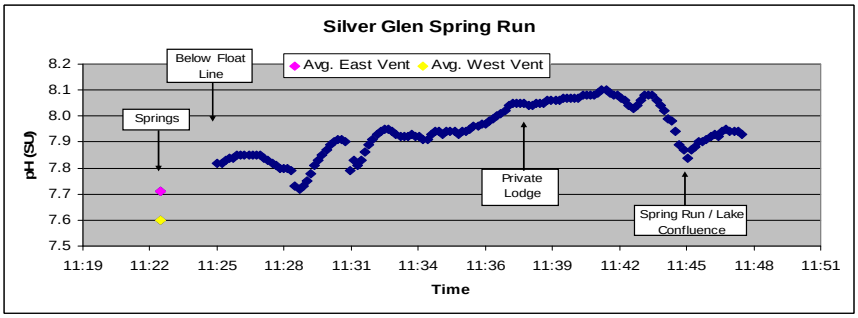


FIGURE 12
Measured field parameters from Silver Glen Springs pool and run on July 29, 2008.

Biological

Vegetation

During a site visit on July 29, 2008 the submersed aquatic vegetation within the Silver Glen spring ecosystem was a mix of filamentous algae and tape grass (*Vallisneria americana*). In areas surrounding the "The Well" vent, plants cover the substrate and grow to the surface. In the main pool and spring run, maximum submersed aquatic vegetation was located in deeper areas were swimmers and boats are presumably not concentrated.

The aquatic vegetation of Silver Glen Springs in 1992 was reported by Woodruff (1993), who noted that hydrilla (*Hydrilla verticillata*) was the dominant submersed plant, while tape grass and southern naiad (*Najas guadalupensis*) were also present.

The most complete investigation into the submersed aquatic vegetation (SAV) of Silver Glen Springs was conducted by Pandion Systems, Inc. (2003); which included a baseline vegetation survey, vegetation re-growth research, estimating the impacts of recreation on SAV, and developing management recommendations. Findings from the January to May 2003 sampling estimated that SAV covered 31%, or 2.7 ha (6.7 ac) of the 8.85 ha (21.88 ac) Silver Glen Spring and Run. SAV species observed included tape grass, water milfoils (*Myriophyllum sp*.), hydrilla, coontail (*Ceratophyllum demersum*), and strap-leaf sagittaria (*Sagittaria kurziana*) (**Figure 13**). Of particular interest in this spring was the presence of non-indigenous hydrilla due to its potential to colonize aquatic habitats. Hydrilla was present in 20.6% (1.8 ha or 4.5 ac) of the run and was noted as the dominant species in 5.2% (0.45 ha or 1.1 ac) of the run (**Figure 14**). Other undesirable aquatic vegetation included benthic filamentous algae which were dominant in 6.8%

(0.61 ha or 1.5 ac) of the run. In areas where algae were particularly abundant, algal mats were sometimes more than 0.61 m (2 ft) thick (Pandion Systems, Inc. 2003).

As part of a multi-spring survey of macroalgae, the pool of Silver Glen Springs was sampled in March 26 and October 30, 2003 for SAV (Stevenson *et al.* 2007). Vascular plants were estimated to cover 27.2% of the pool area during both events and were composed of 22% tape grass, 2.5% hydrilla, 2.5% strap-leaf sagittaria, 2% *Riccia sp*. (an aquatic liverwort), and 1% southern naiad. Macroalgae coverage was 82.7 % with an average thickness of 39.1 cm (15.4 in) during March and coverage was 74.1% with an average thickness of 30.4 cm (12 in) during October (Stevenson *et al.* 2007). Combining both sampling events, the Silver Glen Springs pool macroalgae community was made up of 78.4% *Lyngbya sp.*, 1.9% *Oscillatoria sp.*, and 0.6% *Spirogyra sp.* (Stevenson *et al.* 2007).

Detailed examination of the macroalgal and periphyton communities of Silver Glen Springs was conducted over four quarterly sampling events in 2007 (GreenWater Laboratories 2008). These researchers noted the dominant submersed vascular plant was tape grass, but other species included southern naiad, hydrilla, and horned pondweed (*Zannichellia palustris*), as well as the macroalgae muskgrass (*Chara sp.*). Thick mats (>20cm) of *Lyngbya wollei* were present at the majority of sampled transects as were two other filamentous cyanobacteria, *Oscillatoria sp*. and *Phormidium sp*. The most common green macroalgae were *Oedogonium sp*. and *Cladophora glomerata* and large chain-forming diatoms *Terpsinoe musica* and *Pleurosira laevis* were observed as well (GreenWater Laboratories 2008). Periphyton samples were dominated by cyanobacteria and diatoms in terms of cell numbers and biovolume in all sampling quarters.

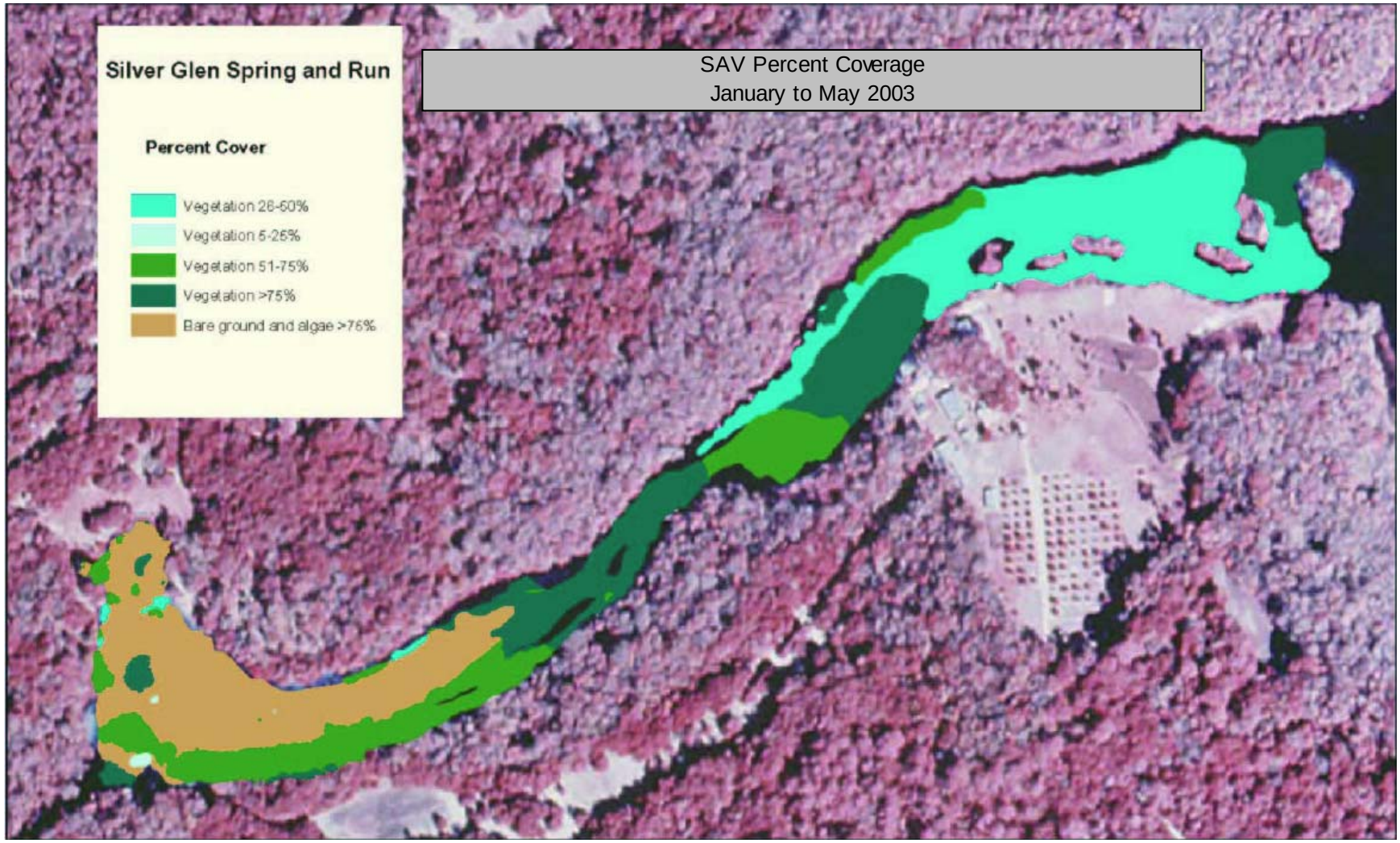


FIGURE 13
Submersed aquatic vegetation (SAV) coverage in Silver Glen Springs during January to May 2003 (from Pandion Systems, Inc. 2003).

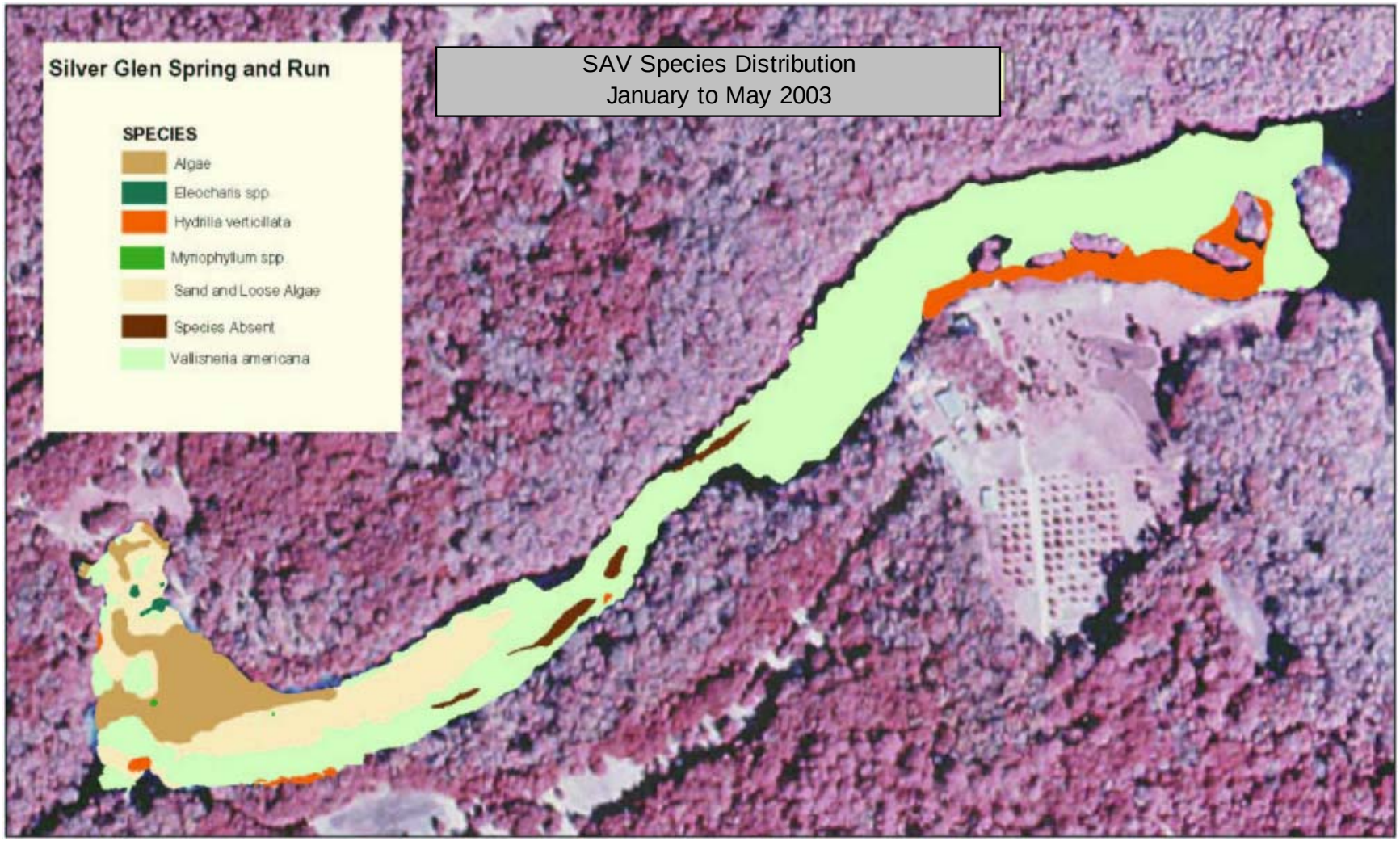


FIGURE 14
Submersed aquatic vegetation (SAV) species distribution in Silver Glen Springs during January to May 2003 (from Pandion Systems, Inc. 2003).

Macroinvertebrates

The benthic macroinvertebrate community of Silver Glen Springs is assessed as part of the FDEP EcoSummary sampling. The monitoring site is a 100 meter reach located in the spring run approximately 100 meters downstream of the headspring. A summary of these sampling events occurring from 2002 through 2007 reveals that the habitat assessment ranges from suboptimal to optimal, the total number of invertebrate taxa ranged from 13 to 32, and the number of sensitive invertebrate taxa never exceeded one (**Figure 15**, FDEP 2008). Stream condition index (SCI) values are also calculated as part of the EcoSummary sampling. Prior to June 2004, a SCI value greater than 21 indicated healthy conditions, following this date, the SCI was re-calibrated and values greater than 34 indicated healthy invertebrate communities. Of eight sampling events only one (or 13%) SCI score was in the healthy range for Silver Glen Springs (**Figure 15**, FDEP 2008).

Based on a literature review of museum records by Shelton (2005), two rare snails have been collected from Silver Glen Springs; *Aphaostracon pycnum* a species endemic to Silver Glen Springs and Alexander Springs, and *Floridobia floridana* a species endemic to the St. Johns River basin.

The crustaceans, mollusks, and benthic invertebrates of Silver Glen Springs were extensively surveyed by Woodruff (1993). Crustacean species collected included the amphipods (scuds) *Crangonyx sp.*, *Gammarus sp.*, and *Hyalella sp.*; isopods (sowbugs) included *Cyathura polita* and *Cassidinidea ocalis*; decapods (crayfish and shrimp) included *Procambarus sp*. and *Palaemonetes paludosus*; and a single mysid (opossum shrimps) *Taphromysis bowmani*. The large freshwater shrimp, *Macrobrachium carcinus*, has anecdotally been reported from Silver Glen Springs as well.

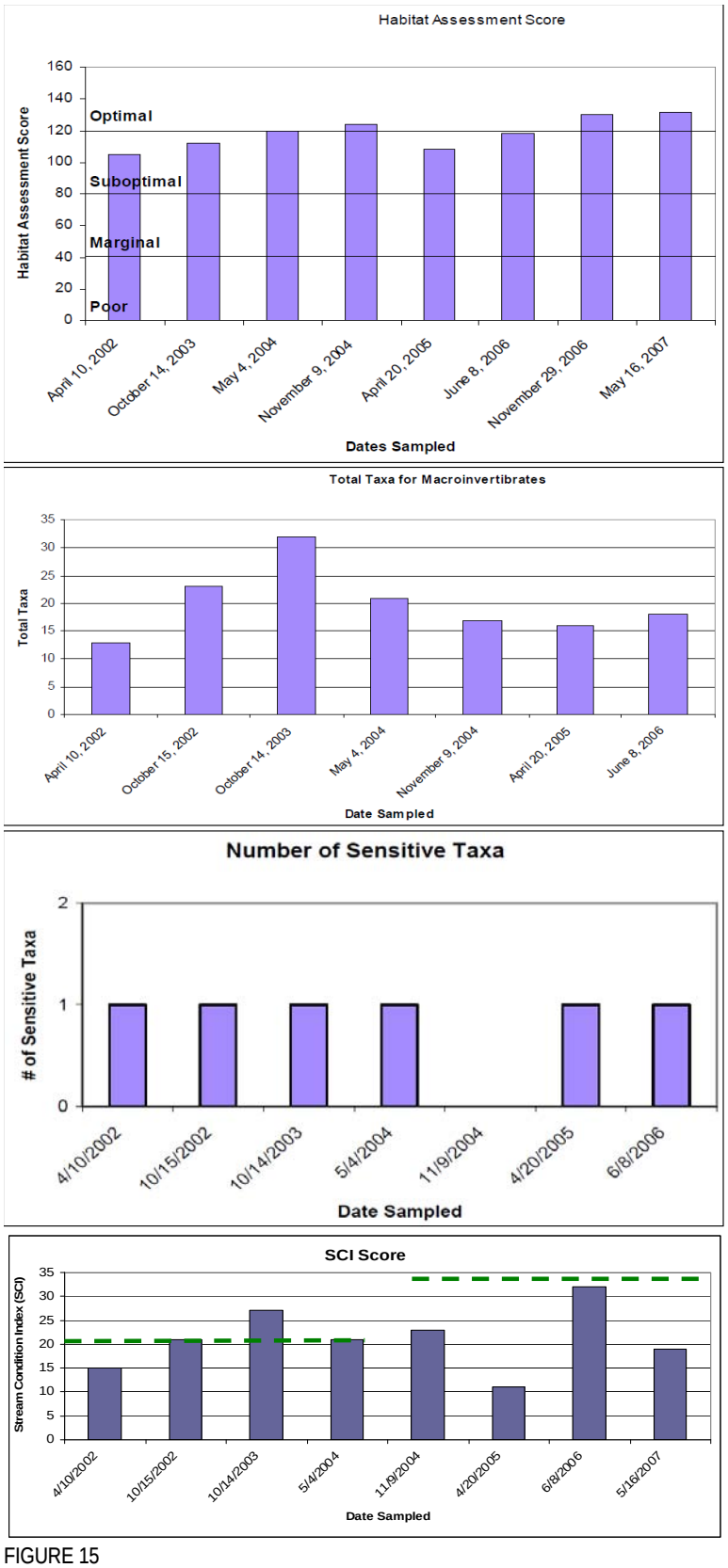


FIGURE 15
Time series of habitat assessment, total number of aquatic macroinvertebrate taxa, number of sensitive aquatic macroinvertebrate taxa, and SCI values for Silver Glen Springs (from FDEP 2008).

Five types of gastropods were documented at Silver Glen Springs by Woodruff (1993). These include members of the Hydrobiidae family, apple snail (*Pomacea paludosa*), goblin elimia (*Elimia vanhyningiana)*, *Gyraulus parvus*, and *Planorbella sp*. Woodruff (1993) also made ten benthic core collections, five from non-vegetated substrate and five from vegetated substrate in Silver Glen Springs. In the non-vegetated substrate oligochaetes (segmented worms) made up 36% of the invertebrates, followed by diptera (fly) larvae (34%), amphipods (14%), isopods (12%), and Hirudinea (leeches) at 4%. In the vegetated substrate, the composition of invertebrates was dominated by amphipods (74%), followed by oligochaetes (17%), diptera (5%), Odonata (dragonfly) and Hirudinea both at 4%. The difference between substrate type was significantly different as well (Woodruff 1993).

Macro fauna

Fish

A variety of fish were observed in the spring pool and run during July 29, 2008, including largemouth bass, several sunfish species, striped mullet, and white catfish. Of particular note were the dozens of fish congregating amongst both spring vents; composed primarily of striped bass (*Morone saxatilis*), many approaching 3 feet in length. Although these anadromous fish spawn in freshwater, they are believed to be attracted to these springs due their cooler water temperatures (compared to Lake George/St. Johns River) and perhaps their elevated conductivity.

The fish community of Silver Glen Springs was assessed through seining and examination of Florida Museum of Natural History (FLMNH) records, with a resulting 19 total species recorded. Five species present in FLMNH records but not collected by Woodruff (1993) included warmouth (*Lepomis gulosus*), golden shiner (*Notemigonus*

crysoleucas), coastal shiner (*Notropis petersoni*), golden topminnow (*Fundulus chrysotus*), and marsh killifish (*Fundulus confluentus*). The fourteen species that were collected by Woodruff (1993) include blue tilapia (*Oreochromis aureus*), Okefenokee pygmy sunfish (*Elassoma okefenokee*), bluegill (*Lepomis macrochirus*), redear (*L. microlophus*), largemouth bass (*Micropterus salmoides*), redeye chub (*Notropis harperi*), bluefin killifish (*Lucania goodei*), rainwater killifish (*Lucania parva*), striped bass (Morone saxatilis), hybrid Sunshine bass (*Morone chrysops x saxatilis*), striped mullet (*Mugil cephalus*), mosquitofish (*Gambusia holbrooki*), least killifish (*Heterandria formosa*), and sailfin molly (*Poecilia latipinna*). Freshwater eels (*Anguilla anguilla*) are anecdotally reported for this system.

A listing of the fish observed in 2003 (Pandion Systems, Inc.) includes schools of striped mullet (*Mugil cephalus*), Crevalle jack (*Caranx hippos*), and ladyfish (*Elops saurus*). The non-indigenous sailfin catfish (*Pterygoplichthys multiradiatus*) was observed; as were blue tilapia, the latter in schools of hundreds of individuals. Florida gar (*Lepisosteus platyrhincus*), largemouth bass, striped bass (*Morone saxatilis*), three species of sunfish (*Lepomis spp.*), killifish (*Fundulus spp.*), mosquitofish, and shiners (*Notropis sp*p.) were seen in the spring pool and run as well (Pandion systems, Inc.). Silver Glen Springs connects to Lake George and the St. Johns River, a diversity of marine species may be expected to utilize this spring system, including Atlantic stingray (*Dasyatis sabina*).

Reptiles

Aquatic turtles utilizing Silver Glen Springs include redbelly turtle (*Pseudemys nelsoni*), peninsula cooter (*Pseudemys floridana peninsularis*), common musk turtle (*Sternotherus odoratus*), and Florida softshell (*Apalone ferox*). American alligators

(*Alligator mississippiensis*) ranging in size from juveniles to six foot individuals utilize the spring run as well (Pandion Systems, Inc. 2003).

Birds

Notable bird observations include great blue heron (*Ardea herodias*), great egret (*Ardea alba*), little blue heron (*Egretta caerulea*), green heron (*Butorides striatus*), double-crested cormorant (*Phalacrocorax auritus*), American anhinga (*Anhinga anhinga*), mallard duck (*Anas platyrhynchos*), purple gallinule (*Porphyrula martinica*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), Coopers hawk (*Accipiter cooperii*), red shouldered hawk (*Buteo lineatus*), black vulture (*Coragyps atratus*) and turkey vulture (*Cathartes aura*) (Pandion Systems, Inc. 2003).

Mammals

Mammal observations included river otter (*Lutra Canadensis*), wild boar (*Sus scrofa*), grey fox (*Urocyon cinereoargenteus*), and eleven manatees (*Trichechus manatus*) were seen using the run during January to March 2003 (Pandion Systems, Inc. 2003).

Manatees

While manatees are known to utilize Silver Glen Springs, particularly during winter months as a thermal refuge, the springs appear to be used by low numbers of manatees. The maximum one day count of seven manatees was documented from January through March 2003 (Pandion Systems, Inc. 2003). Other researchers which have documented manatee usage in Silver Glen Springs include Hartman (1974) who suggested that the spring was used by two to three animals during winter months; and Beeler and O'Shea (1988) who noted one to five manatees in early and late winter. The suitability of this spring system for manatees has been investigated by Taylor (2006) who identified

accessibility issues including a spring run with shallow portions and large numbers of boats. Fortunately, peak recreational usage of Silver Glen Springs occurs during summer months and peak manatee usage occurs during winter months, factors which reduce the potential for conflict.

Ecosystem Functions

Based on field parameters (temperature, conductance, dissolved oxygen, and pH) measured in the spring pool and spring run during the reconnaissance trip of July 29, 2008, Silver Glen Springs are suitable for measuring ecosystem metabolism based on changes in dissolved oxygen. Complicating factors may include surface water inputs to the spring run from wetlands to the west and potential backwater effects from Lake George.

Human-Use Attendance and Activities

Research into recreational usage and the opinions of recreationalists was conducted by Denny and Stein (2001) for the purpose of assessing Silver Glen Springs as a possible candidate for Public Private Ventures (PPVs) by the USDA Forest Service. The goal of PPVs is to combine public land with private sector capital and initiative to improve public recreational experiences. Concessions are currently operated by private parties at Silver Glen Springs and USFS records suggest that approximately 30 thousand people visit this spring annually (**Figure 16).**

Silver Glen is a popular destination, particularly during summer months (**Figure 16)**. Detailed human recreation observations have been made by Pandion Systems, Inc. (2003) with the main types of recreation observed being swimming, fishing and boating. Swimmers utilize both the spring pool and run. Fishing takes place in the spring run

from boats with rod and reel, bow hunting, and cast net gear. A large range of powerboat types and sizes utilize the spring run; including houseboats approaching 60 feet in length which may stay moored in the run for several days to months. Boaters utilized the run every day, but usage levels were dependent on the time of year, time of week, and weather; with peak boating occurring on summer holiday weekends (*e.g.* Memorial Day, Fourth of July, and Labor Day) when approximately 200 boats could be found in the run (**Figure 17**, Pandion Systems, Inc. 2003).

The research by Pandion Systems, Inc. (2003) found that much of Silver Glen Springs Run shows undesirable impacts from recreation (**Figure 18**). In most of the run area the eelgrass exhibited some type of mechanical damage due to contact from boat propellers. Boat anchors caused disturbance to the sediment and damage to the submersed vegetation in the form of drag marks or pits. These observations likely explain the open sand area in the western part of the run where boaters preferred to anchor. Although swimming generally causes little impact on vegetation, wading can result in the trampling of native grasses, and most of the area near the spring pool was devoid of vegetation (Pandion Systems, Inc. 2003).

Minimum Flow and Levels

Silver Glen Spring has been placed on the St. Johns River Water Management District MFL priority list for 2011 (SJRWMD 2008b). As of this report, an MFL has not been adopted for this spring.

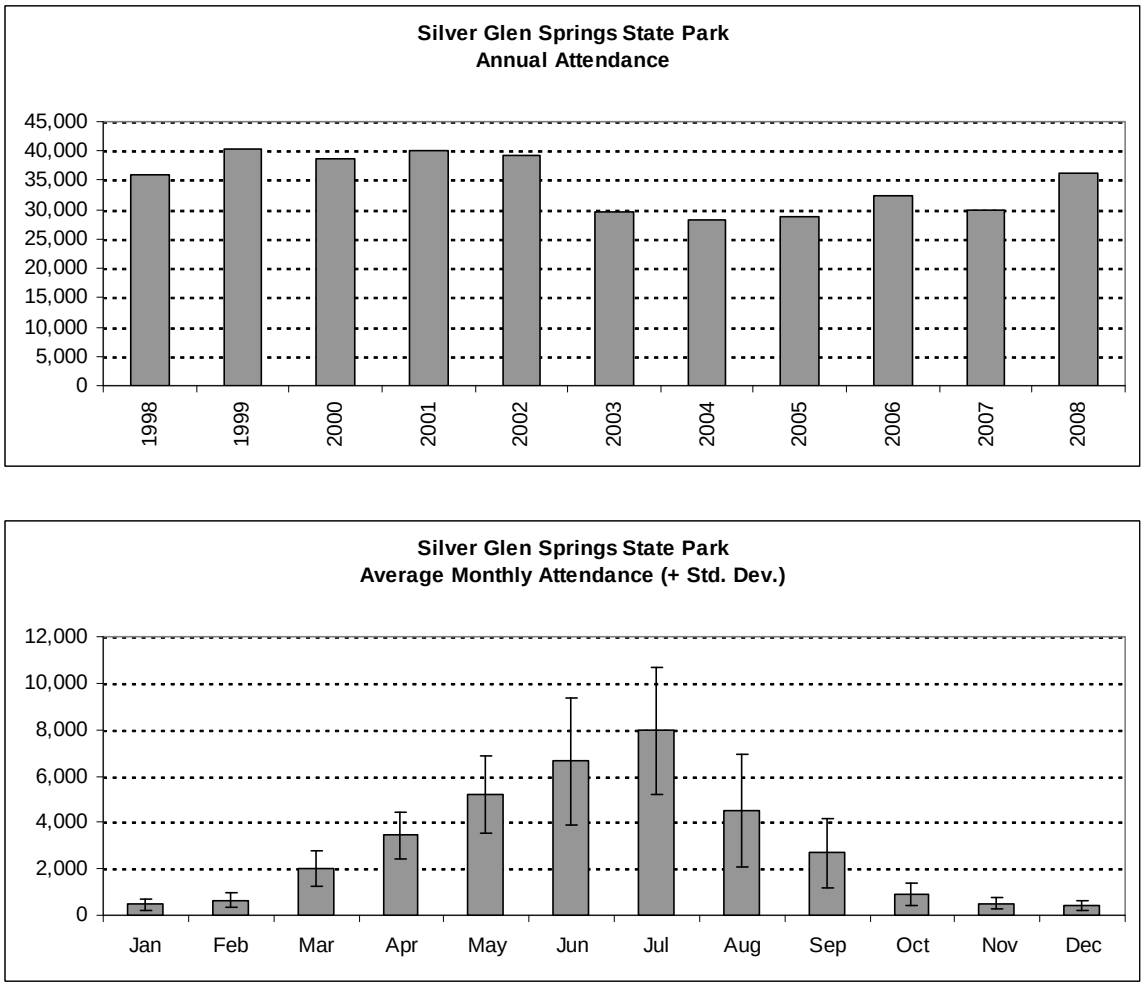


FIGURE 16
Human use statistics for Silver Glen Springs (data from US Forest Service).

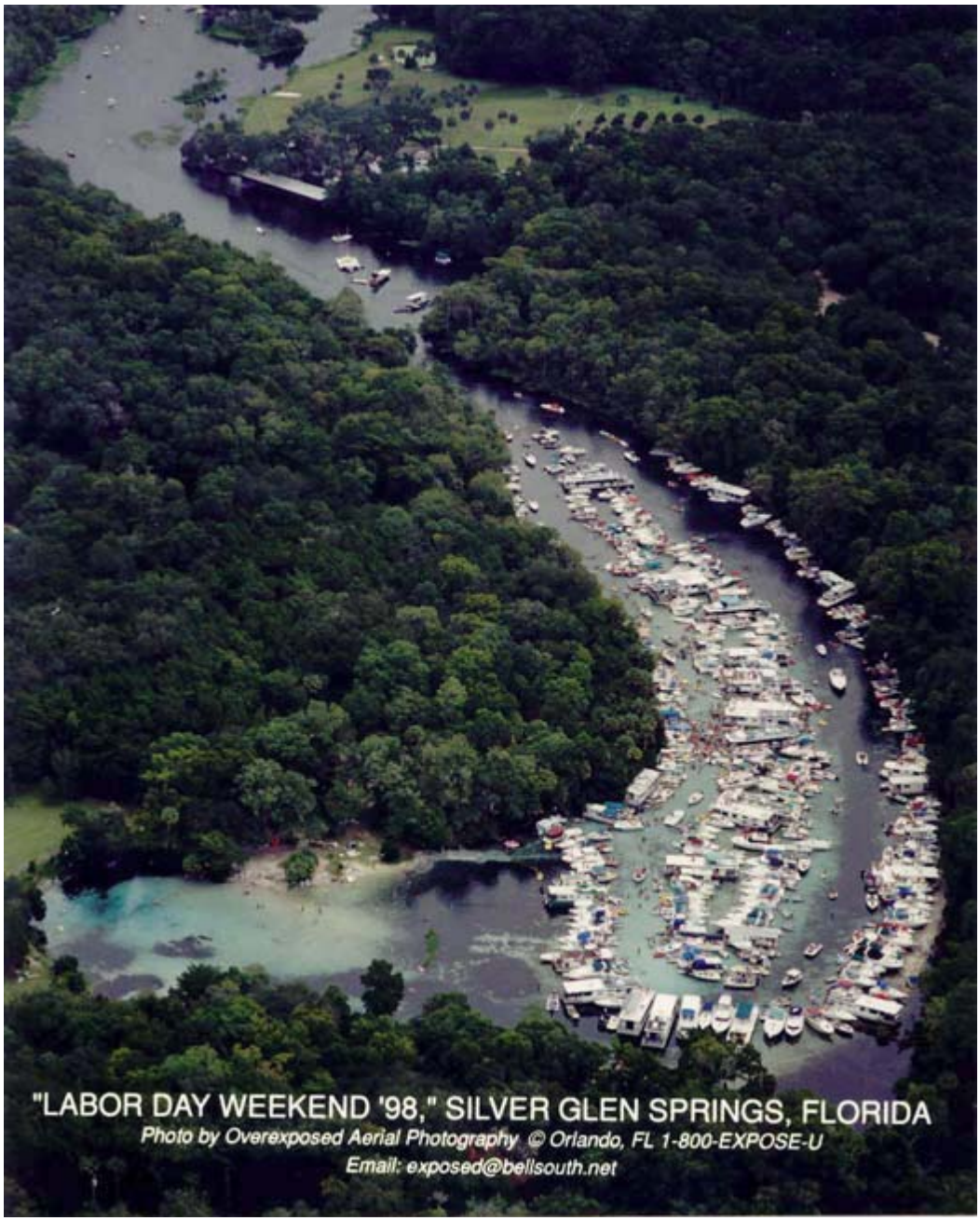


FIGURE 16
Aerial photo of Silver Glen Springs during Labor Day 1998 (from Pandion Systems, Inc. 2003).

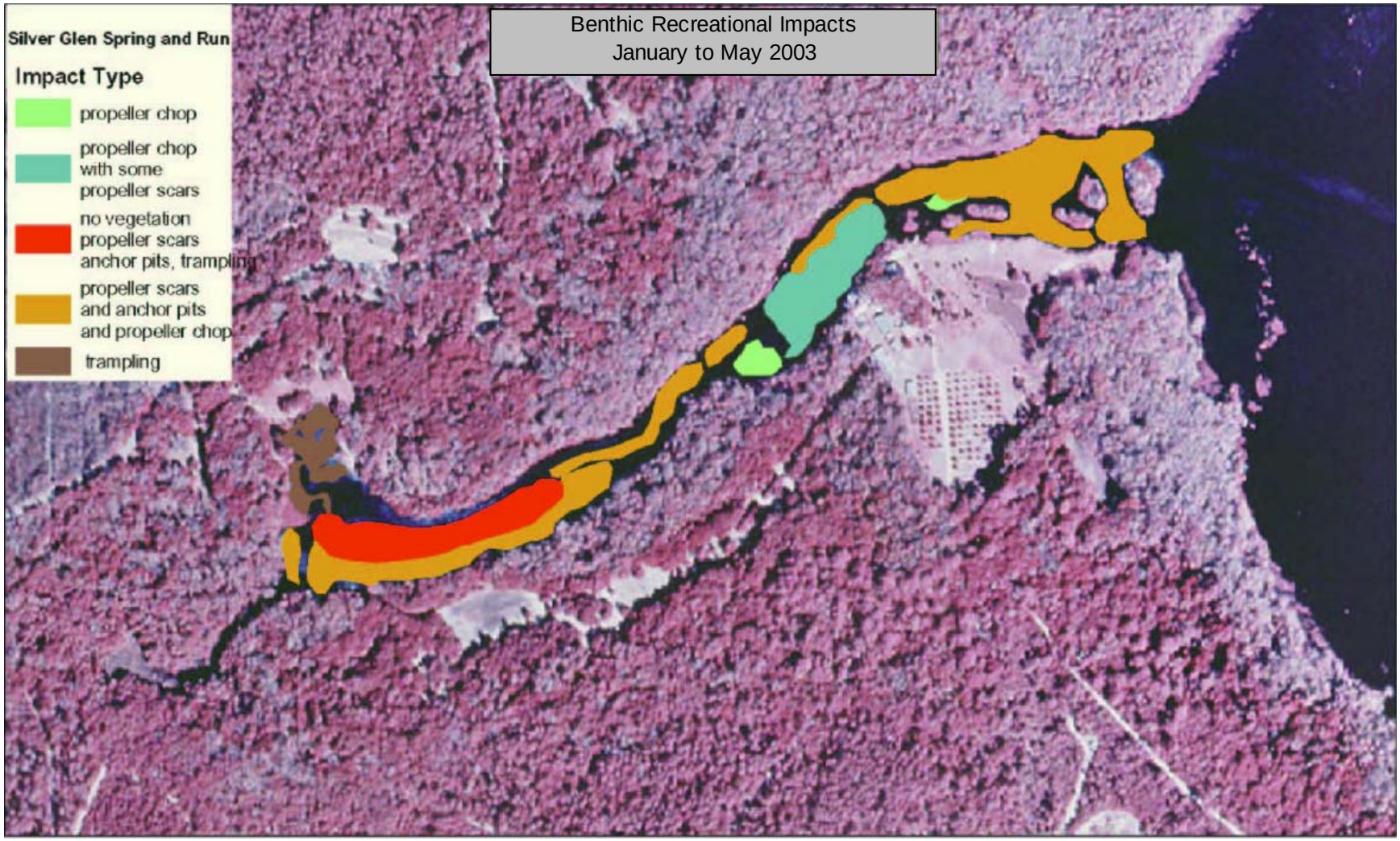


FIGURE 17
The types and location of recreational disturbance to the benthos of Silver Glen Springs (from Pandion Systems, Inc. 2003).

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Appendix Y

Summary of data for Wakulla Springs



Summary of Existing Data - Wakulla Springs (Wakulla Co.)

Prepared by
Wetland Solutions, Inc.

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Cover photo: Two Florida manatees (*Trichechus manatus latirostrus*) relaxing in the pool of Wakulla Springs (S.K. Notestein, 04/14/09).

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Figure 3 Cross sectional view of the main vent at Wakulla Spring, locations of fossil and archeological artifacts from Olsen (1958) and depth profiles by WKKP divers (from Kincaid 1999).

Figure 4 Map of Wakulla Spring cave system showing the local ground water divide which crosses the conduit system and is marked by a broad zone of low ground water velocities. The southern conduits convey ground water toward the Gulf of Mexico while the northern conduits convey ground water to Wakulla spring (from Kincaid 1999).

Figure 5 Regional geologic map of Wakulla Spring (from Chelette *et al*. 2002).

Figure 6 The springshed delineation of Wakulla Springs (from AGI).

Figure 7 Land use within the region supplying groundwater to Wakulla Springs (from Chelette *et al*. 2002).

Figure 8 Wakulla Springs contributory area nitrogen sources (for inventoried sources using 1990-1999 Average N Loading; from Chelette *et al*. 2002).

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Figure 10 Monthly average discharge time series and frequency curve for Wakulla River.

Figure 11 Wakulla River water stage time series (from USGS 2007).

Figure 12 Wakulla Spring nitrate time series (from Chelette *et al.* 2002).

Figure 13 Image of Wakulla Springs with red icons and path indicating the reconnaissance sampling locations on August 18, 2008.

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Figure 15 Wakulla River hydrilla abundance by year (from FDEP 2007).

Figure 16 Time series of habitat assessment, total number of aquatic macroinvertebrate taxa, number of sensitive aquatic macroinvertebrate taxa, and stream condition index (SCI) values for Wakulla Springs (from FDEP 2008).

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Table 3 Wakulla Springs water quality table for the period-of-record.

Table 4 Listing of fishes collected in Wakulla Springs (from Walsh and Williams 2003).

Summary of Existing Springs Data

This report summarizes known existing physical, chemical, and biological data for Wakulla Springs (Wakulla County). These data were collected from sources such as the Northwest Florida Water Management District (NWFWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Edward Ball Wakulla Springs State Park

Physical Address

Edward Ball Wakulla Springs State Park; 550 Wakulla Park Drive; Wakulla Springs, Florida 32327; Phone: 850-926-0700; latitude/longitude: 30.234161°, -84.302161°; park website: http://www.floridastateparks.org/wakullasprings/default.cfm .

Driving Directions

From West I-10 take exit 203 to SR-61 (Thomasville Rd) and go south thru Tallahassee for 16 km (10 mi). Take US-319/SR-61 south for 13 km (8 mi). Turn left onto SR-267 at flashing stop light, park entrance will be on right (**Figure 1**). From Highway 90 in Marianna, go north on State Road 71. After about a 1.6 km (1 mi), Blue Spring Road forks off to the right. Go about 4.8 km (3 mi) and you will see the sign to Blue Spring Recreational Area on the right.

General

One of Florida's largest springs, the site was developed in the 1930s and is presently administered by FDEP/FPS as a state park consisting of approximately 1,214 ha (3,000 ac) (detailed history is provided by Cook in FGS 1998). Wakulla Springs State Park and Lodge

are listed on the Natural Register of Historic Places and are a designated National Natural Landmark. The park facilities are large and include the original lodge with restaurant, museum, and guided river and glass-bottomed boat tours. A swimming beach area, diving platform, and two swim platforms provide in-water recreational opportunities and the spring is a popular regional swimming destination. SCUBA diving at the park is prohibited, although researchers have extensively explored the cave system with over 3,658 m (12,000 ft) mapped. Private boat access is prohibited in the park-managed portion of the spring run (the upper three miles of the spring run). Alligators, turtles, and birds are abundant along the spring run. Historic underwater images may be available as several films were made at Wakulla Spring, including Airport '77, Tarzan's Secret Treasure and sequels of the Creature from the Black Lagoon movie - Return of the Creature and Revenge of the Creature.

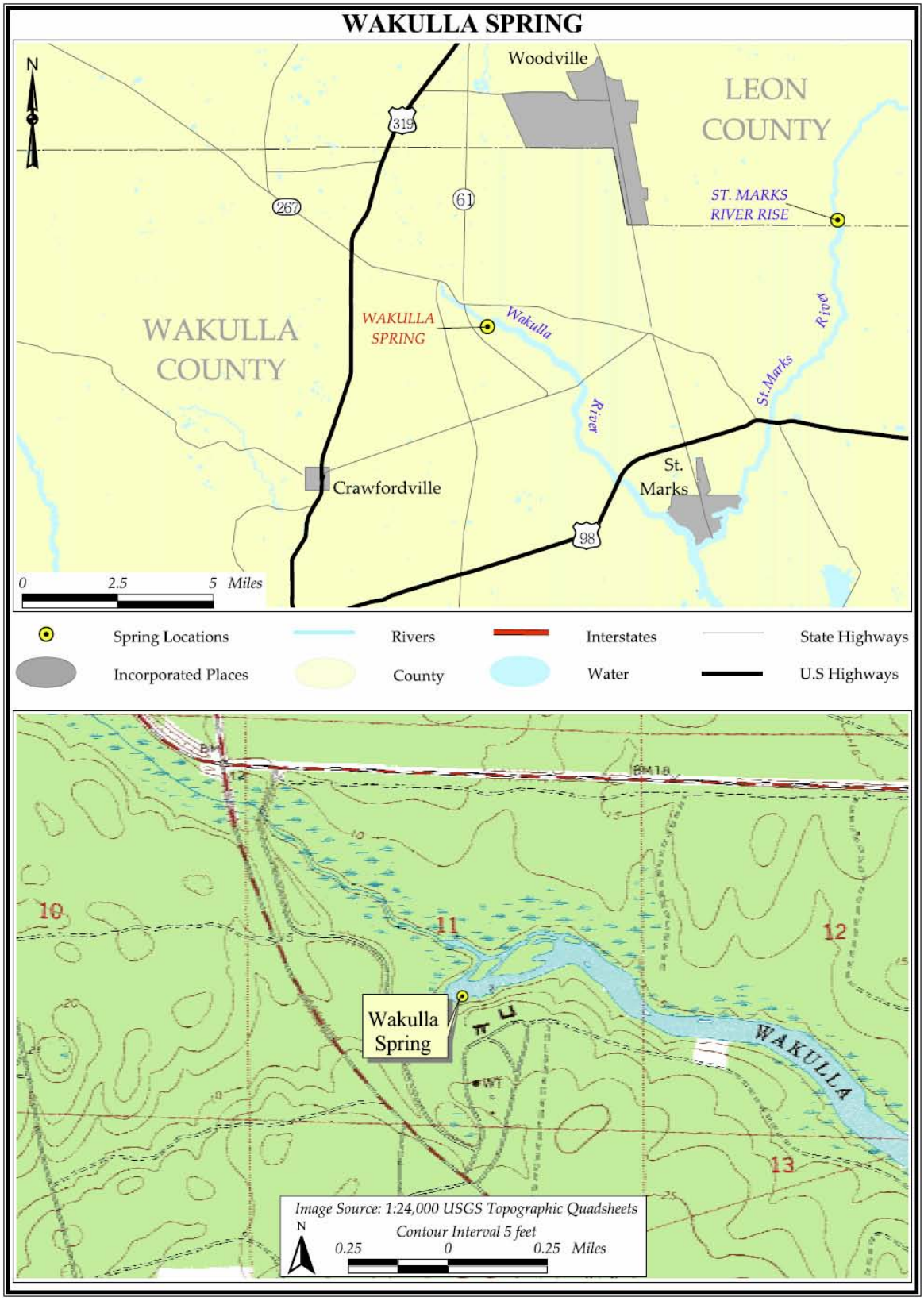


FIGURE 1
Wakulla Spring geographic location (from Scott *et al.* 2002).

Physical

With a circular pool roughly 91 m (300 ft) in diameter, an immense vent opening 15 m (50 ft) by 25 m (82 ft), at a depth of approximately 56 m (185 ft); Wakulla Spring is unusual due its large physical size (**Figure 2**). The Wakulla cave system has been explored for fossil and archeological artifacts (Olsen 1958), a cross sectional view of the entrance illustrates the size of this cave system (**Figure 3**). The cave system of Wakulla Spring has been extensively explored by members of the Woodsville Karst Plain Project. The spring vent derives from a multiple conduit tunnel system whose final extent has yet to be determined (**Figure 4**). This network of feeder tunnels and the karst nature of the region create variable water quality conditions in the spring pool. Water clarity can vary between "air-clear" to tannin stained as a result of source water mixing. A small spring to the northeast, Sally Ward, and its own spring run braid along the northern shore of the main run. The upper 4.8 km (3 mi) of the resulting spring run is about 100 m (330 ft) wide, and ranges in depth between 1 m (3.3 ft) and 3 m (10 ft), and has sandy sediments. In total, the Wakulla River travels southeast for about 14.5 km (9 mi) before joining the St. Marks River. Wakulla Springs lodge is approximately 22.5 km (14 mi) due south of the capital Tallahassee and roughly the same distance from the Gulf of Mexico. As such, its springshed, underground conduits, and spring run are all integrated with the underlying Woodsville Karst Plain.



FIGURE 2
Aerial photo of Wakulla Springs, the vent is left of the diving platform.

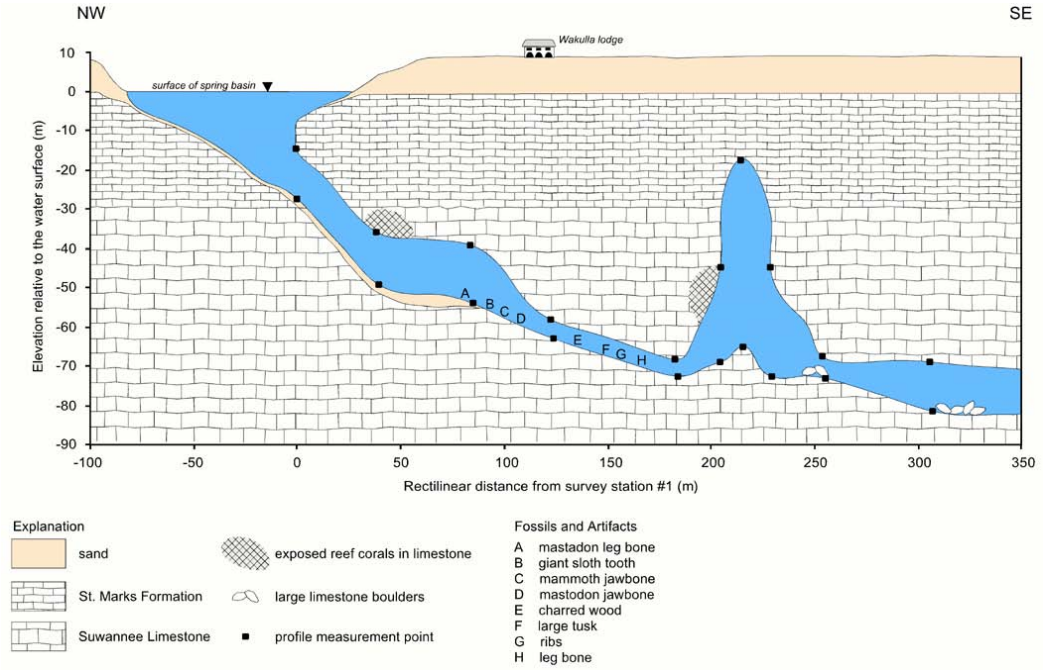


FIGURE 3
Cross sectional view of the main vent at Wakulla Spring, locations of fossil and archeological artifacts from Olsen (1958) and depth profiles by WKKP divers (from Kincaid 1999).

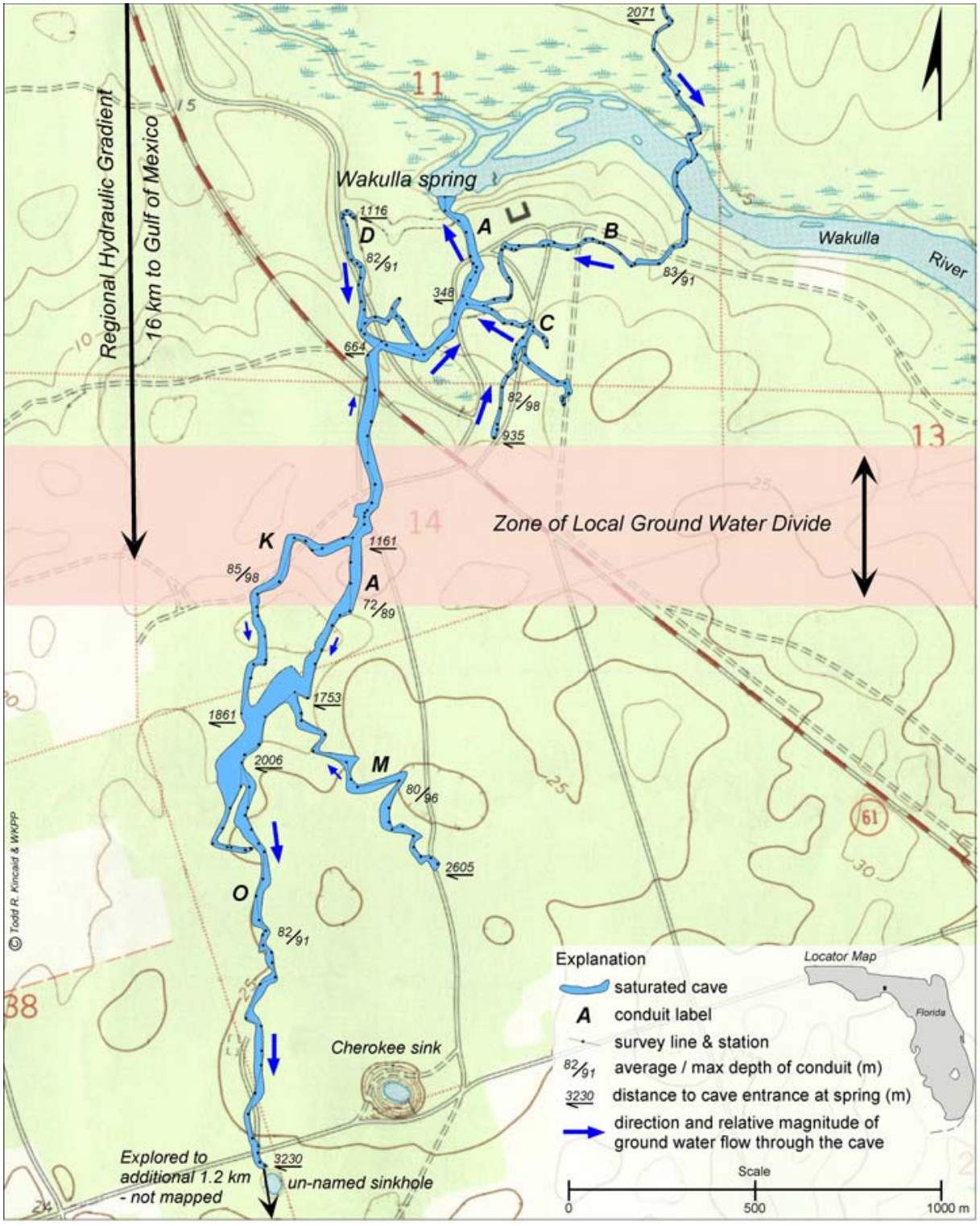


FIGURE 4
Map of Wakulla Spring cave system showing the local ground water divide which crosses the conduit system and is marked by a broad zone of low ground water velocities. The southern conduits convey ground water toward the Gulf of Mexico while the northern conduits convey ground water to Wakulla spring (from Kincaid 1999).

Hydrogeology

Wakulla Spring is located within The Woodville Karst Plain (WKP), a geologic feature which extends from central Wakulla County, eastward through southernmost Jefferson County and around the coastal Big Bend region to the Steinhatchee River in southwestern Taylor County (Schmidt *et al.* 1998). The WKP can be described as a very-gently-seaward-sloping, sandy, swampy sub-zone of the Ocala Karst District geomorphic province which is underlain by shallow, karstic, carbonate bedrock covered by a veneer of undifferentiated Pleistocene sands (Schmidt *et al.* 1998). Land surface elevations typically vary between 0 and 15 m (50 ft) above mean sea level and sinkholes, collapse depressions, disappearing streams and caves are common throughout the region (Schmidt *et al.* 1998). Loosely consolidated sands overlying these karstic features allow rapid infiltration of rainfall, the dominant water supply to the underlying aquifers. Regional surface geological features are shown in **Figure 5** (Chelette *et al.* (2002).

Wakulla Spring is within the St. Marks River Basin, which has four hydrostratigraphic units: the surficial aquifer system, the intermediate aquifer system, the Floridan aquifer system, and the sub-Floridan confining unit. Wakulla Spring represents a natural outflow of the Floridan aquifer. Because of the karstic nature of this region, surface water and ground water mixing can occur as evidenced by the variable water quality observed at Wakulla Springs. Groundwater travels south along existing potentiometric gradients (Rupert 1988) and cave conduits toward the Gulf of Mexico. Notable exceptions to this trend occur within Wakulla Spring cave (and Indian Spring cave) systems because of the well developed conduit system. Detailed knowledge regarding the hydrogeology of Wakulla Springs are available in the compilation reports of Schmidt *et al.* (1998) and Chelette *et al.* (2002).

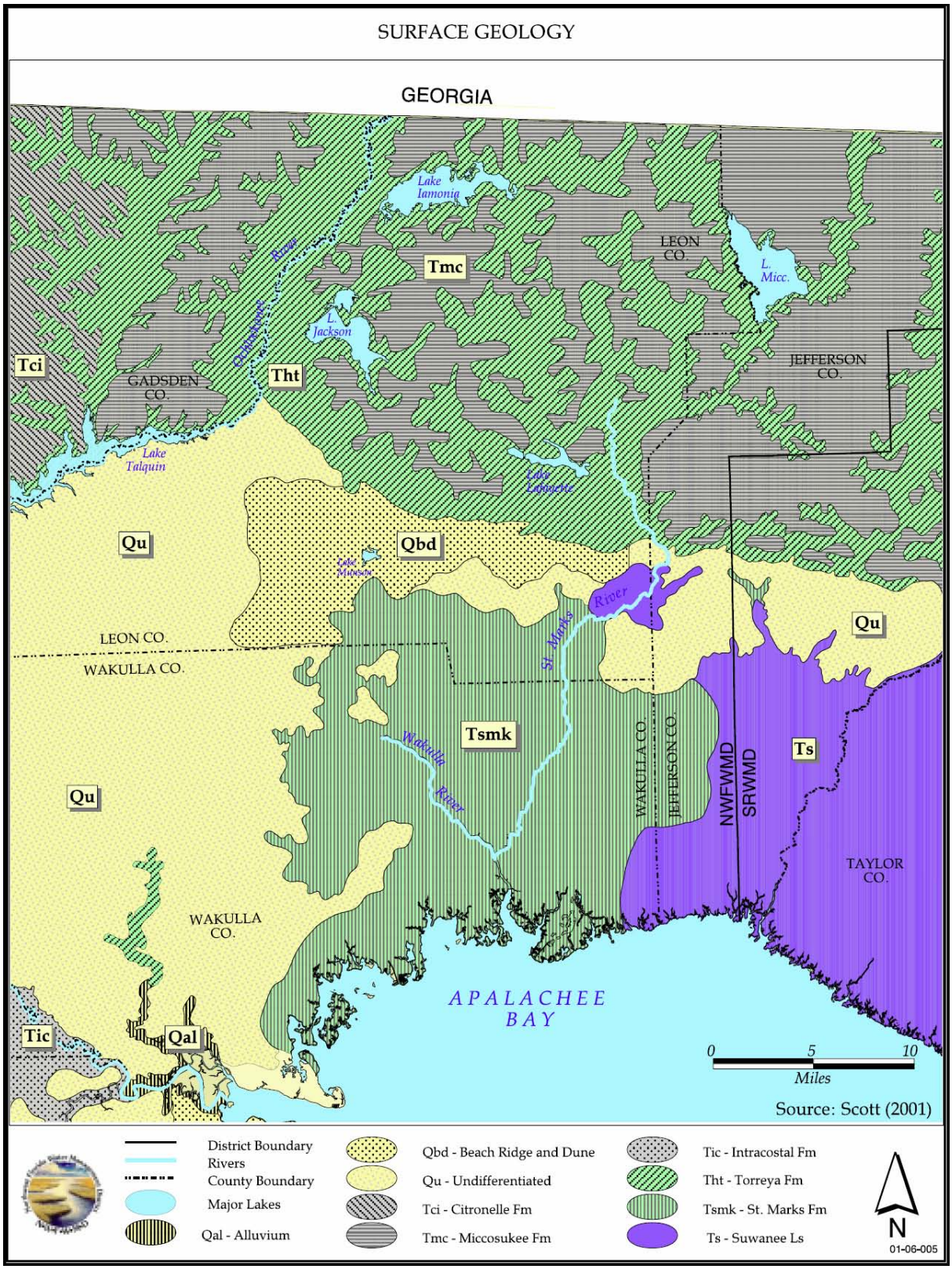


FIGURE 5
Regional geologic map of Wakulla Spring (from Chelette *et al.* 2002).

Springshed

The springshed for Wakulla (and other springs within the Woodville Karst Plain), extends as far north as Mitchell County in southwest Georgia; however, most of Wakulla Springs recharge occurs near the spring and farther north in Leon County (**Figure 6,** Chelette *et al.* 2002). The spring is imbedded in a zone of very high hydraulic conductivity that funnels water to the spring from the northwest, north, and northeast (Chelette *et al.* 2002). A large portion of the Wakulla springshed overlies the region lying north of the Cody Scarp and hence the aquifer lies below relatively impermeable soils. However, potential surface runoff aquifer inputs in this area include the sinkhole lakes Lafayette, Jackson, Iamonia, and Miccosukee and to other open sinkholes (Loper *et al.* 2005).

Springshed Land Use

The city of Tallahassee, suburbanized Leon County and developed portions of Wakulla County overlie the spring capture zone. **Figure 7** illustrates land use within the region.

At the scale of the Wakulla Springs contributory area, waste water treatment facilities (WWTFs) and their residual wastes are estimated to contribute 55% of the nitrogen load applied to the springshed; while atmospheric deposition, on site disposal systems (OSDS), livestock, commercial fertilizer, and sinking streams contribute the remainder (**Figure 8**, Chelette *et al.* 2002).

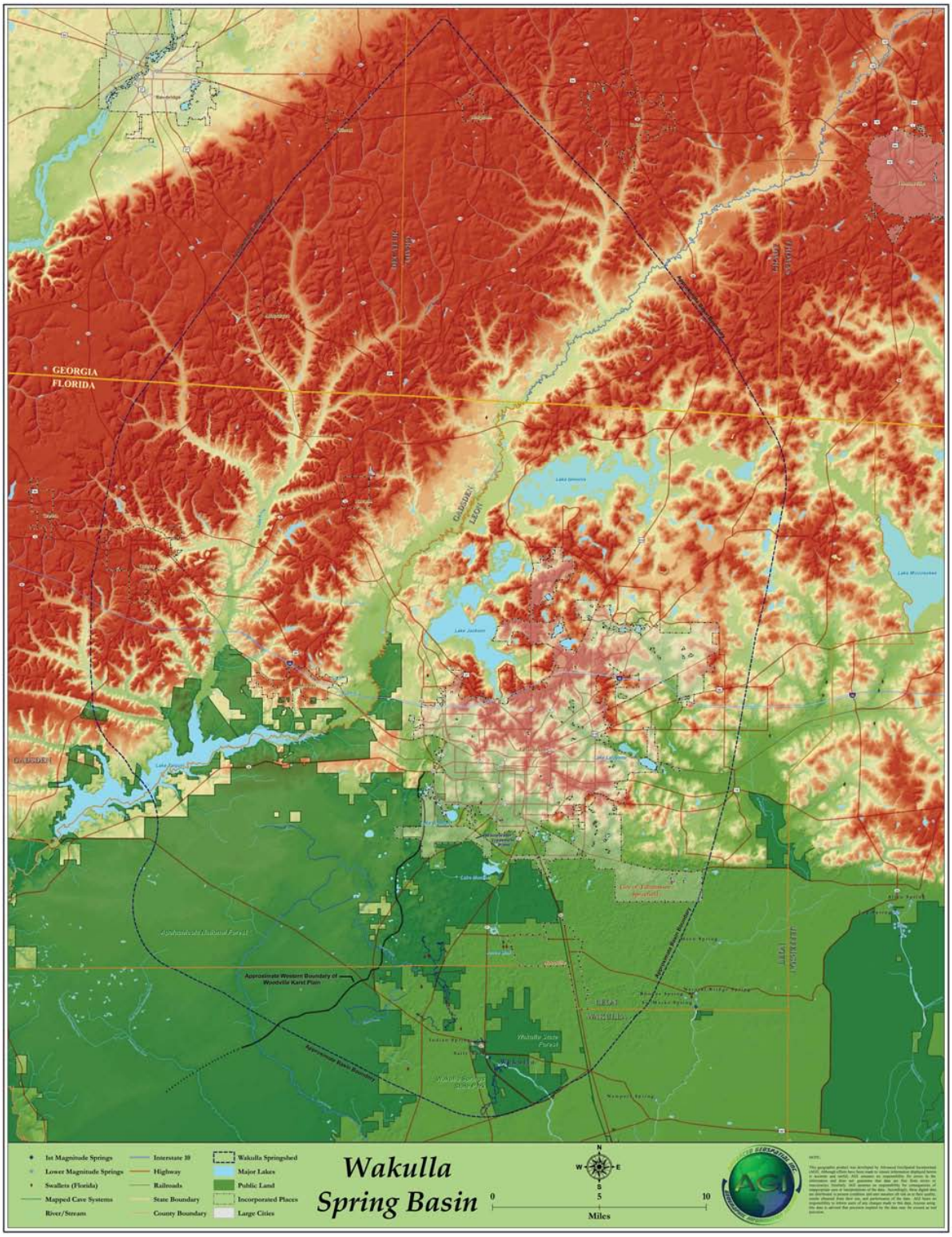


FIGURE 6
The springshed delineation of Wakulla Springs (from AGI).

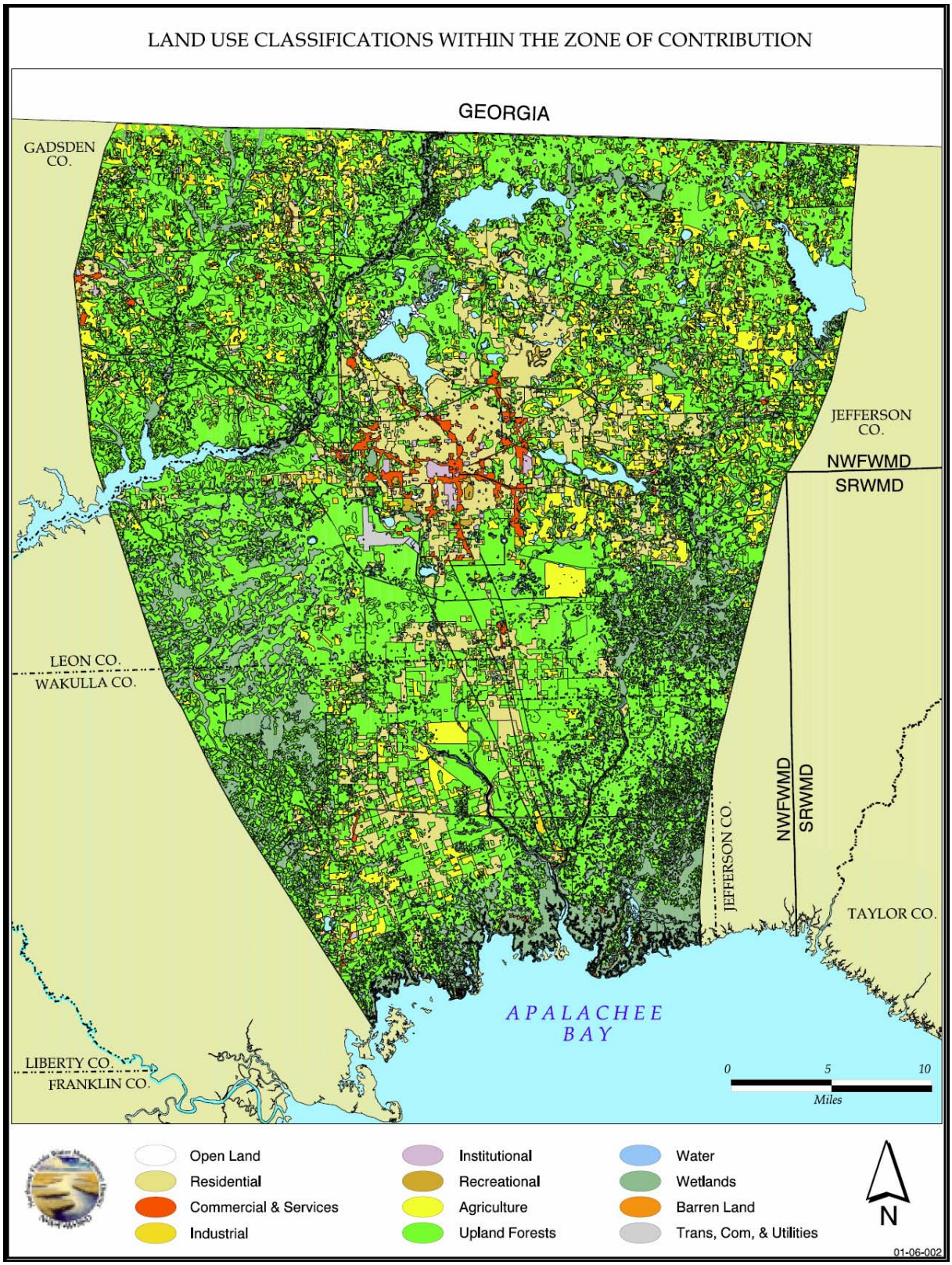


FIGURE 7
Land use within the region supplying groundwater to Wakulla Springs (from Chelette *et al.* 2002).

Source	Average N Load (kg/yr)	Median N Load (kg/yr)	Percent of Total
WWTF Effluent	360,000	345,000	40
Atmospheric Deposition	232,000	229,000	26
WWTF Residuals	130,000	126,000	15
OSDS	56,000	56,000	6
Commercial Fertilizer	60,000	65,000	7
Sinking Streams	33,000	33,000	4
Livestock	14,000	14,000	2
Total	885,000	868,000	100

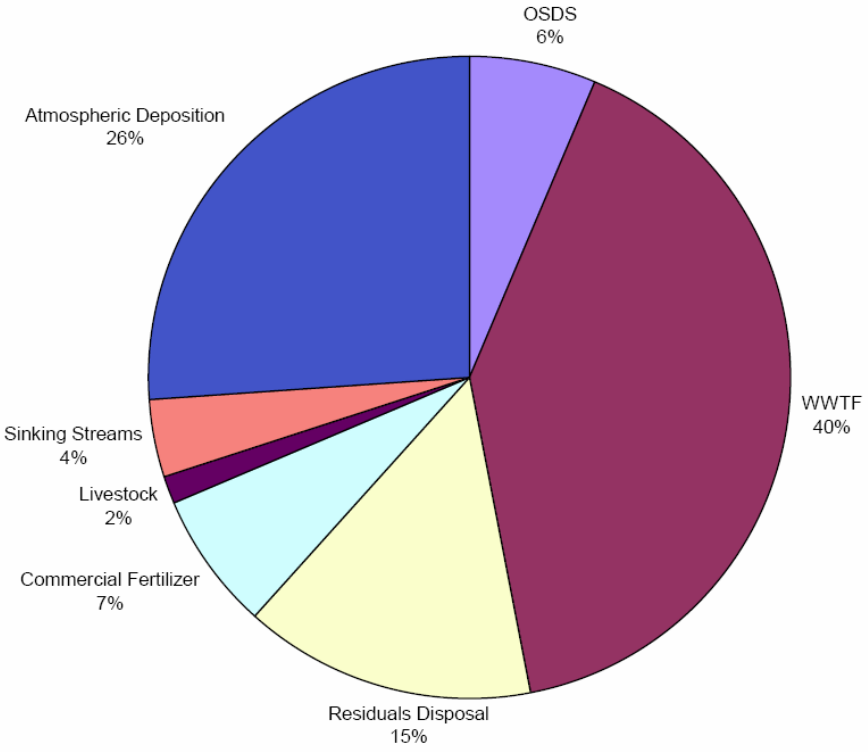


FIGURE 8
Wakulla Springs contributory area nitrogen sources (for inventoried sources using 1990-1999 Average N Loading; from Chelette *et al*. 2002).

Study Area

The project study area is defined as the spring pool and the upper 1 km (0.6 mi)of the spring run. **Figure 9** shows an approximation of the study area.

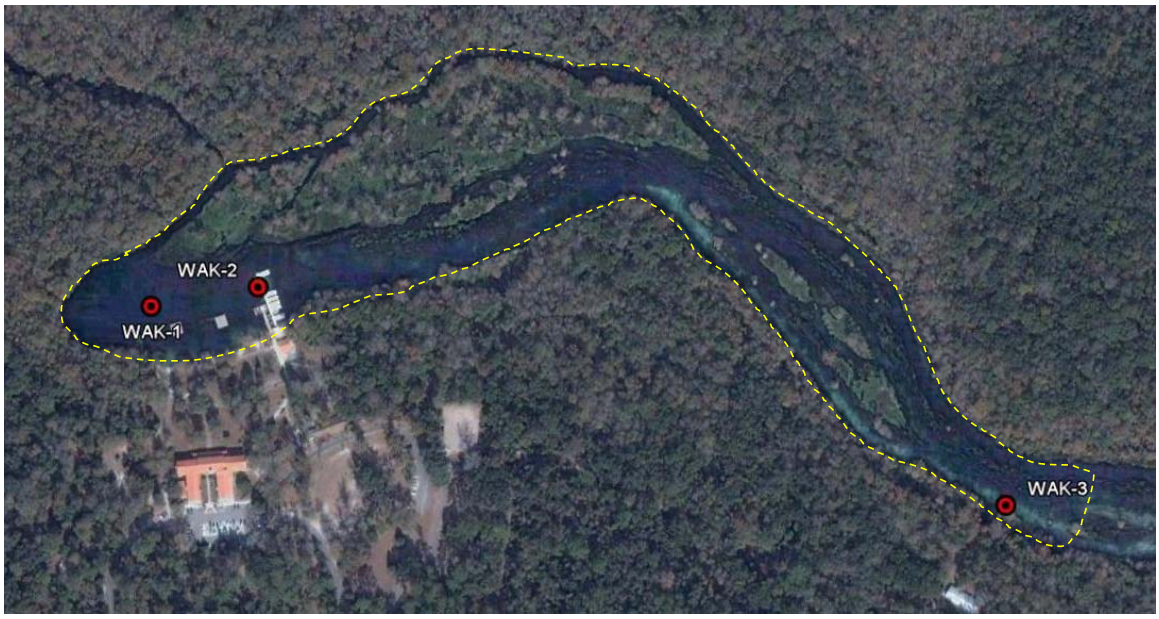


FIGURE 9
Study area for Wakulla Springs (with data sonde locations as red icons).

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the historical description of Wakulla Spring are given in **Table 1** below.

TABLE 1
Source information for the Wakulla Spring historical water quality data described in this report.

Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
21FLA	Florida Department of Environmental Protection	9695	Wakulla Springs	30.23518	-84.30256
21FLA	Florida Department of Environmental Protection	20340	WAKULLA TUBING K-TUNNEL	30.23265	-84.30434
21FLA	Florida Department of Environmental Protection	20381	WAKULLA TUBING A/K-TUNNEL	30.23265	-84.30434
21FLA	Florida Department of Environmental Protection	20387	WAKULLA TUBING D-TUNNEL	30.23265	-84.30434
21FLA	Florida Department of Environmental Protection	20388	WAKULLA TUBING A/D-TUNNEL	30.23265	-84.30434
21FLBRA	Florida Department of Environmental Protection	1006-A	1006 - Wakulla River - 1700m dwnstr of dock	30.23075	-84.28528
21FLBRA	Florida Department of Environmental Protection	1006-B	1006 - Wakulla River - 1300m dwnstr of dock	30.23287	-84.28785
21FLBRA	Florida Department of Environmental Protection	1006-C	1006 - Wakulla River - 300m dwnstr of dock	30.23618	-84.29730
21FLBRA	Florida Department of Environmental Protection	1006X-A	1006X - Wakulla Springs - 70m dwnstr of dock	30.23580	-84.30069
21FLBRA	Florida Department of Environmental Protection	1006X-B	1006X - Wakulla Springs - next to pump house	30.23422	-84.30267
21FLGW	Florida Department of Environmental Protection	20383	WAKULLA TUBING B-TUNNEL W...	30.23356	-84.30208
21FLGW	Florida Department of Environmental Protection	20385	WAKULLA TUBING C-TUNNEL W...	30.23356	-84.30207
21FLGW	Florida Department of Environmental Protection	22848	NW1-LR-2034 WAKULLA RIVER	30.22896	-84.28298
21FLKWAT	Florida Lake Watch	WAK-WA-RIVER-1	Wakulla-Wakulla River-1-1	30.23572	-84.30083
21FLKWAT	Florida Lake Watch	WAK-WA-RIVER-2	Wakulla-Wakulla River-2-2	30.23555	-84.30272
21FLKWAT	Florida Lake Watch	WAK-WA-RIVER-3	Wakulla-Wakulla River-3-3	30.23533	-84.30200
21FLNWFD	Northwest Florida Water Management District	S570	Wakulla River Below Wakul...	30.23444	-84.29528
21FLPNS	Florida Department of Environmental Protection	22030011	WAKULLA SPR AT DOCK	30.23608	-84.30233
21FLWQA	Florida Department of Environmental Protection	301403108417406	Wakulla River at RR Track...	30.23420	-84.29462
21FLWQA	Florida Department of Environmental Protection	301407308418051	Wakulla River at state pa...	30.23536	-84.30141
USGS	USGS	2327000	WAKULLA SPRING NR CRAWFORDVILLE, FL	30.23472	-84.30139
USGS	USGS	2327022	WAKULLA RIVER NEAR CRAWFORDVILLE, FL	30.21369	-84.26152
USGS	USGS	301407084181000	WAKULLA SPRING	30.23528	-84.30278

Discharge and Stage

Wakulla Spring has the largest known range in discharge among Florida springs (Scott *et al.* 2002). Historical discharge data reported by Rosenau *et al.* (1977), ranged from 25.2 cfs (June 18, 1931) to 1,910 cfs (April 11, 1973); with an average discharge of 390cfs (1907-1974). Other measures of discharge include a value of 128.9 cfs (September 27, 2001) by Scott *et al.* 2002. The US Geological Survey has a station downstream of the spring (CR 365 bridge, which includes flow from Sally Ward and McBride Slough) which monitors discharge and stage (station # 02327022) with daily records mostly available between October 2004 and the present. **Table 2** and **Figures 10** and **11** illustrates the variability of discharge and stage at this spring system, some of which is due to tidal influence (USGS 2007).

TABLE 2
Summary statistics for the discharge and stage of Wakulla River (near Crawfordville, from USGS 2007).

SUMMARY STATISTICS

	Calendar Year 2006		Water Year 2007		Water Years 2005 - 2007	
Annual total	220,997		207,985			
Annual mean	605		570		581	
Highest annual mean					591	2006
Lowest annual mean					570	2007
Highest daily mean	913	Jun 13	853	Dec 26	1,760	Jul 11, 2005
Lowest daily mean	249	Apr 14	242	Apr 8	242	Apr 8, 2007
Annual seven-day minimum	263	Apr 11	259	Mar 22	259	Mar 22, 2007
Maximum peak flow			942	Dec 25	2,050	Jul 11, 2005
Maximum peak stage			4.68	Dec 25	9.02	Jul 10, 2005
Instantaneous low flow			59	Mar 31		
Annual runoff (ac-ft)	438,300		412,500		420,600	
10 percent exceeds	758		679		720	
50 percent exceeds	650		614		621	
90 percent exceeds	392		353		370	

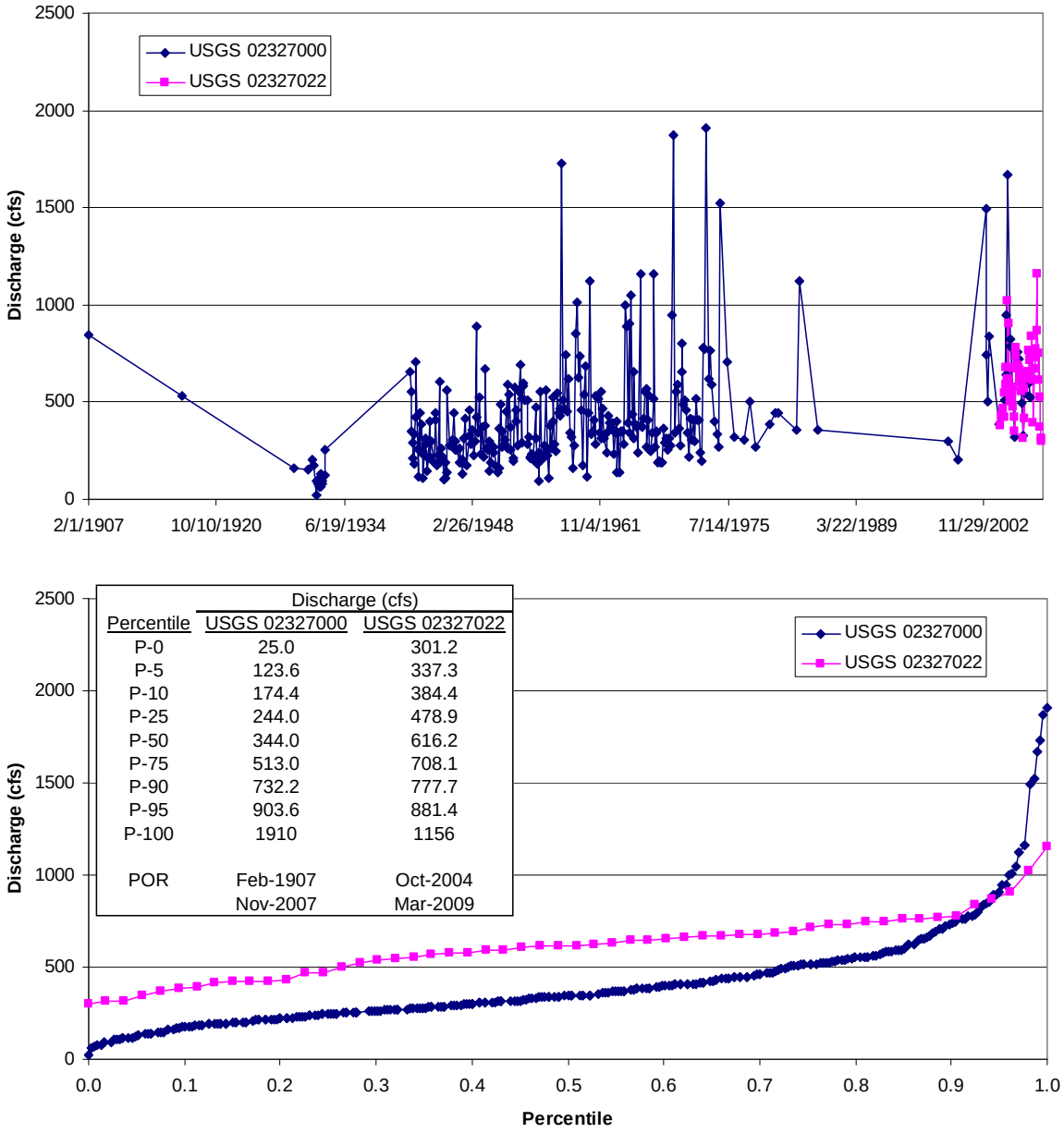


FIGURE 10
Monthly average discharge time series and frequency curve for Wakulla River.

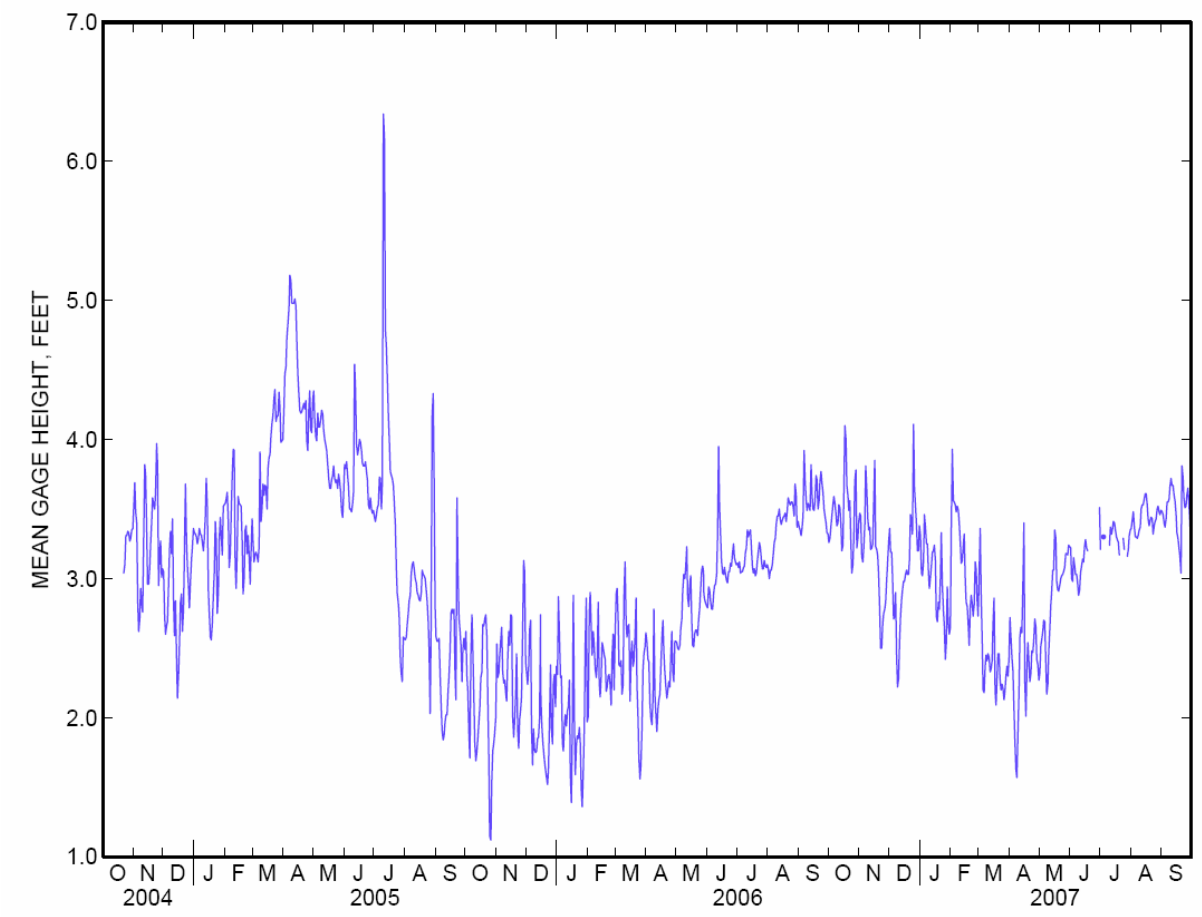


FIGURE 11
Wakulla River water stage time series (from USGS 2007).

Water Quality

Water quality data for Wakulla Spring are available from as early as February 1907 to as recent as May 2008 from STORET (USGS and FDEP data). Among water chemistry parameters, the numbers of samples collected ranged from 1 to 537 records, with most samples collected from the main pool. These data are summarized in **Table 3** which provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Wakulla Spring (main boil) POR averages for several key parameters (with number of samples) are:

- Water temperature – 20.7 °C (n = 149)
- Dissolved oxygen – 2.07 mg/L (n = 131)
- pH – 7.51 SU (n = 146)
- Specific conductance – 308 umhos/cm (n = 248)
- Turbidity – 0.44 NTU (n = 132)
- Color – 4.16 CPU (n= 108)
- Total chloride – 8.43 mg/L (n = 204)
- Sulfate – 10.5 mg/L (n = 197)
- Nitrate+nitrite nitrogen – 0.759 mg/L (n = 175)
- Total phosphorus – 0.03 mg/L (n = 537)

TABLE 3
Wakulla Spring water quality table for the period-of-record.

				Decade											POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
BACTERIOLOGICAL	EColi	#/100ml	Main Boil											27.8	27.8	1.00	190	65.8	8	9/27/2001	11/20/2006
			Spring Run											16.2	16.2	1.00	38.0	12.6	9	11/29/2000	8/23/2006
	Enterococci	#/100ml	Main Boil											2.08	2.08	1.00	18.0	2.47	74	9/27/2001	12/5/2006
			Spring Run											77.1	77.1	1.00	410	113	24	2/28/2000	9/28/2004
	FC	#/100ml	Main Boil											3.75	3.75	1.00	203	19.6	107	9/27/2001	5/27/2008
			Spring Run											124	124	2.00	1,600	256	42	2/28/2000	12/6/2006
	TC	#/100ml	Main Boil											33.8	33.8	1.00	1,800	182	109	9/27/2001	5/27/2008
			Spring Run											367	367	23.0	3,300	633	44	2/28/2000	12/6/2006
BIOLOGICAL	Chl-a corr	µg/L	Main Boil											1.63	1.63	1.00	5.30	1.31	12	4/10/2006	11/28/2006
			Spring Run											1.74	1.74	0.850	6.40	1.33	21	9/28/2004	12/6/2006
	Pheo-a	µg/L	Main Boil											3.68	3.68	1.00	23.0	6.22	12	4/10/2006	11/28/2006
			Spring Run											3.47	3.47	0.850	17.0	3.75	21	9/28/2004	12/6/2006
DISSOLVED OXYGEN	DO	%	Main Boil							53.0	28.6			34.0	34.5	16.0	73.0	18.4	15	6/1/1967	7/13/2006
	DO	mg/L	Main Boil							4.63	2.53	1.30	1.77	1.98	2.07	0.590	6.20	0.879	131	6/1/1967	5/27/2008
			Spring Run											6.25	6.25	2.43	11.4	2.16	45	2/28/2000	12/6/2006
FLOW	Flow	cfs	Main Boil						282	294	386			385	349	188	800	151	13	5/12/1954	8/2/2004
			Spring Run											614	614	182	2,360	214	1621	10/22/2004	3/30/2009
	Flow-Inst	cfs	Main Boil	847	532	163	117	309	393	454	514	519	296	741.82	429	25.0	1,910	305	324	2/1/1907	11/19/2007
	Velocity	ft/s	Spring Run											0.690	0.690	0.220	1.41	0.206	1595	10/22/2004	3/30/2009
GENERAL INORGANIC	Alk	mg/L as CaCO3	Main Boil						121	121	121			137	131	1.00	153	18.1	80	5/12/1954	5/27/2008
			Spring Run											132	132	130	140	3.66	20	4/10/2006	12/6/2006
	Cl-T	mg/L	Main Boil						3.00	6.25	5.85	5.40	8.03	8.91	8.43	0.020	45.0	3.79	204	5/12/1954	5/27/2008
			Spring Run											9.53	9.53	7.40	13.0	2.07	20	4/10/2006	12/6/2006
	CO2	mg/L	Main Boil						9.40	5.53	5.79	5.90			5.88	1.10	30.0	5.46	28	5/12/1954	2/11/1985
	F-D	mg/L	Main Boil						0.200	0.275	0.278	0.200	0.170	0.145	0.199	0.100	0.700	0.096	57	5/12/1954	5/27/2008
	F-T	mg/L	Main Boil											0.141	0.141	0.100	0.160	0.011	41	9/27/2001	5/27/2008
	Hardness	mg/L as CaCO3	Main Boil						140	133	132	140	147	142	135	120	150	7.75	36	5/12/1954	7/13/2006
	Si-D	mg/L	Main Boil						12.0	12.0	10.6	12.0	11.3	10.7	11.0	8.20	13.0	0.881	32	5/12/1954	7/13/2006
	SO4	mg/L	Main Boil						22.0	9.65	10.1	9.40	9.67	10.5	10.5	0.060	22.0	1.70	197	5/12/1954	5/27/2008
			Spring Run											11.2	11.2	9.60	13.0	0.972	20	4/10/2006	12/6/2006
GENERAL ORGANIC	DOC	mg/L	Main Boil										0.133	1.30	0.863	0.100	3.70	1.19	8	7/31/1997	7/13/2006
	TOC	mg/L	Main Boil								4.90			0.954	1.59	0.00	33.0	3.51	125	5/4/1970	5/27/2008
			Spring Run											0.849	0.849	0.110	4.00	0.793	26	2/28/2000	12/6/2006

TABLE 3 (CONTINUED)
Wakulla Spring water quality table for the period-of-record continued.

				Decade										POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record
METAL	Ag-T	µg/L	Main Boil									1.00		0.080	0.157	0.080	1.00	0.266	12	2/11/1985 11/28/2006
	Al-D	µg/L	Main Boil								74.5				74.5	9.00	140	92.6	2	9/2/1970 1/16/1975
	Al-T	µg/L	Main Boil								100			11.2	21.8	0.00	200	38.6	42	5/4/1970 4/25/2005
	As-D	µg/L	Main Boil								2.44	1.00			2.30	0.00	10.0	3.09	10	5/4/1970 2/11/1985
	As-T	µg/L	Main Boil								3.63			3.87	3.84	0.00	22.0	3.25	58	4/25/1972 11/28/2006
	Ba-T	µg/L	Main Boil									100		9.91	12.2	8.20	100	14.4	39	2/11/1985 4/25/2005
	Ca-D	mg/L	Main Boil						39.0	37.5	37.9	39.0	42.3	44.1	41.8	32.0	50.9	3.65	78	5/12/1954 5/27/2008
	Ca-T	mg/L	Main Boil											44.5	44.5	0.160	62.0	4.30	166	9/27/2001 5/27/2008
			Spring Run											44.2	44.2	41.0	49.0	2.28	20	4/10/2006 12/6/2006
	Cd-D	µg/L	Main Boil								0.00				0.00	0.00	0.00	0.00	2	4/28/1971 1/16/1975
	Cd-T	µg/L	Main Boil								1.33	1.00		0.397	0.461	0.00	2.00	0.387	53	4/25/1972 11/28/2006
	Co-D	µg/L	Main Boil								0.00				0.00	0.00	0.00		1	4/28/1971 1/16/1975
	Co-T	µg/L	Main Boil								0.00			1.48	1.40	0.00	2.00	0.697	39	4/25/1972 4/25/2005
	Cr-T	µg/L	Main Boil								3.00	1.00		1.56	1.66	0.00	10.0	1.32	54	5/4/1970 11/28/2006
	Cu-D	µg/L	Main Boil								10.7				10.7	0.00	40.0	15.0	6	5/4/1970 4/28/1977
	Cu-T	µg/L	Main Boil								5.50	1.00		2.76	2.93	0.00	20.0	2.84	54	4/25/1972 11/28/2006
	Fe-D	µg/L	Main Boil						40.0	5.00	29.4				25.5	0.00	210	43.5	22	5/12/1954 4/28/1977
	Fe-T	µg/L	Main Boil						40.0		53.3			20.9	26.1	2.50	260	42.6	60	5/12/1954 11/28/2006
	Hg-D	µg/L	Main Boil								0.500				0.500	0.500	0.500		1	1/16/1975 1/16/1975
	Hg-T	µg/L	Main Boil								0.350	0.200			0.336	0.00	0.500	0.234	11	4/28/1971 2/11/1985
	K-D	mg/L	Main Boil							0.400	0.533	0.600	0.567	0.667	0.598	0.300	1.11	0.143	58	5/19/1966 5/27/2008
	K-T	mg/L	Main Boil											0.605	0.605	0.050	1.19	0.102	166	9/27/2001 5/27/2008
			Spring Run											0.619	0.619	0.520	0.770	0.080	20	4/10/2006 12/6/2006
	Mg-D	mg/L	Main Boil						9.40	9.23	9.03	9.20	9.50	10.2	9.76	7.60	12.0	0.918	78	5/12/1954 5/27/2008
	Mg-T	mg/L	Main Boil											10.2	10.2	0.020	13.9	1.12	166	9/27/2001 5/27/2008
			Spring Run											9.61	9.61	9.00	11.0	0.454	20	4/10/2006 12/6/2006
	Mn-D	µg/L	Main Boil							0.00	8.00				7.06	0.00	20.0	5.88	17	6/1/1967 4/28/1977
	Mn-T	µg/L	Main Boil								14.3			0.710	2.73	0.200	40.0	6.40	47	4/25/1972 4/25/2005
	Mo-D	µg/L	Main Boil								1.00				1.00	1.00	1.00		1	1/16/1975 1/16/1975
	Mo-T	µg/L	Main Boil								1.00				1.00	1.00	1.00		1	6/27/1973 6/27/1973
	NA-D	mg/L	Main Boil						6.00	3.60	4.03	3.60	5.97	6.39	5.49	3.40	23.0	2.95	80	5/12/1954 5/27/2008
	NA-T	%	Main Boil							5.67	6.19	5.00	8.00	7.40	6.45	5.00	9.00	0.971	33	5/19/1966 7/13/2006
	NA-T	mg/L	Main Boil											7.44	7.44	4.94	21.2	4.41	25	2/28/2007 5/27/2008
	Ni-T	µg/L	Main Boil											1.38	1.38	0.180	3.00	0.750	49	6/27/1973 11/28/2006
	Pb-D	µg/L	Main Boil								1.50				1.50	0.00	2.00	1.00	4	5/4/1970 4/28/1977
	Pb-T	µg/L	Main Boil									1.00		2.37	2.35	0.025	5.50	2.16	50	4/25/1972 11/28/2006
	SAR	ratio	Main Boil						0.200	0.100	0.168	0.100	0.200	0.200	0.167	0.100	0.200	0.048	36	5/12/1954 7/13/2006
	Se-D	µg/L	Main Boil									1.00			1.00	1.00	1.00		1	2/11/1985 2/11/1985
	Se-T	µg/L	Main Boil											6.30	6.30	1.75	22.0	3.36	38	9/27/2001 4/25/2005
	SR-D	µg/L	Main Boil							45.0	107	110	86.0		99.3	0.00	160	43.7	19	6/1/1967 10/8/1997
	SR-T	µg/L	Main Boil											95.2	95.2	83.8	109	6.36	40	9/27/2001 4/25/2005
	V-D	µg/L	Main Boil								3.00				3.00	3.00	3.00		1	1/16/1975 1/16/1975
	Zn-D	µg/L	Main Boil								48.2				48.2	20.0	230	61.1	11	5/4/1970 4/28/1977
	Zn-T	µg/L	Main Boil								15.0			4.67	5.45	0.00	20.0	4.56	53	4/25/1972 11/28/2006

TABLE 3 (CONTINUED)
Wakulla Spring water quality table for the period-of-record continued.

				Decade											POR Statistics						
PARAMETER GROUP	PARAMETER	UNITS	STATION	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
NITROGEN	NH4-N	mg/L	Main Boil								0.020	0.020		0.009	0.010	0.00	0.120	0.010	170	9/21/1971	5/27/2008
			Spring Run											0.012	0.012	0.005	0.038	0.006	24	2/28/2000	9/28/2004
	NO2-N	mg/L	Main Boil								0.007	0.010			0.007	0.00	0.020	0.005	19	3/16/1972	2/11/1985
	NO3-N	mg/L	Main Boil								0.259				0.259	0.100	0.330	0.055	18	3/16/1972	4/28/1977
	NOx-N	mg/L	Main Boil								0.283	0.550		0.786	0.759	0.058	9.80	0.719	175	8/28/1974	5/27/2008
			Spring Run											1.33	1.33	0.067	33.0	4.78	46	2/28/2000	12/6/2006
	NOx-N-D	mg/L	Main Boil								0.321		0.837	0.717	0.716	0.321	1.10	0.218	34	6/26/1974	5/27/2008
	OrgN	mg/L	Main Boil								0.149	0.080			0.146	0.00	0.550	0.171	22	5/4/1970	2/11/1985
	TKN	mg/L	Main Boil								0.030	0.100		0.073	0.071	0.010	0.760	0.066	144	8/28/1974	5/27/2008
			Spring Run											0.097	0.097	0.060	0.340	0.055	44	2/28/2000	12/6/2006
	TKN-D	mg/L	Main Boil								0.030		0.200	0.069	0.079	0.030	0.200	0.062	34	6/26/1974	5/27/2008
	TN	mg/L	Main Boil								0.328	0.650	0.814	0.750	0.750	0.00	0,001	0.181	365	5/9/1974	2/27/2006
OXYGEN DEMAND	BOD5	mg/L	Main Boil								0.360			3.29	1.77	0.00	13.0	2.86	29	5/4/1970	11/28/2006
			Spring Run											2.29	2.29	2.00	7.70	1.27	20	4/10/2006	12/6/2006
	COD	mg/L	Main Boil								6.50				6.50	0.00	15.0	5.66	8	4/25/1973	1/16/1975
PESTICIDE	Diazinon-D	µg/L	Main Boil											0.500	0.500	0.500	0.500		1	10/22/2001	10/22/2001
PHOSPHORUS	OrthoP	mg/L	Main Boil						0.030		0.047	0.030	0.033	0.029	0.033	0.012	0.060	0.009	111	5/12/1954	5/27/2008
			Spring Run											0.026	0.026	0.011	0.038	0.006	24	2/28/2000	1/31/2002
	PO4-T	mg/L as PO4	Main Boil							0.070	0.141		0.102	0.094	0.112	0.010	0.190	0.050	17	5/19/1966	7/13/2006
	TDP	mg/L	Main Boil								0.056			0.030	0.032	0.025	0.070	0.008	44	12/21/1973	5/27/2008
	TP	mg/L	Main Boil								0.077	0.050	0.029	0.029	0.030	0.00	0.400	0.018	537	4/25/1972	5/27/2008
			Spring Run											0.033	0.033	0.002	0.093	0.013	46	2/28/2000	12/6/2006
PHYSICAL	Color	CPU	Main Boil							1.25	6.88	5.00		3.75	4.16	0.00	40.0	6.19	108	5/19/1966	12/5/2006
			Spring Run											5.48	5.48	5.00	15.0	2.18	21	9/28/2004	12/6/2006
	Depth	m	Main Boil											39.2	39.2	0.00	92.1	39.5	21	9/27/2001	12/5/2006
			Spring Run											1.29	1.29	0.480	2.25	0.490	19	9/28/2004	12/6/2006
	pH	SU	Main Boil						7.40	7.65	7.73	7.65	7.23	7.46	7.51	6.48	8.30	0.247	146	5/12/1954	5/27/2008
			Spring Run											7.67	7.67	6.30	8.43	0.474	46	2/28/2000	12/6/2006
	Secchi	ft	Main Boil										11.5	10.8	11.0	5.00	20.0	5.19	65	10/29/1996	9/28/2005
	Secchi	m	Main Boil											1.91	1.91	0.00	21.3	5.10	26	7/21/2002	5/27/2008
			Spring Run											0.827	0.827	0.480	1.00	0.300	3	9/28/2004	4/10/2006
	SpCond	umhos/cm	Main Boil						272	266	268	268	275	315	308	211	430	25.7	248	5/12/1954	5/27/2008
			Spring Run											304	304	242	338	18.8	46	2/28/2000	12/6/2006
	Stage	ft	Main Boil		2.95	2.44	2.13	2.73	2.21	2.46	2.18			0.00	2.25	0.00	5.32	0.948	303	2/13/1917	11/29/2007
			Spring Run											3.11	3.11	1.12	6.37	0.685	1598	10/22/2004	3/30/2009
	Turb	NTU	Main Boil								1.57			0.225	0.440	0.00	6.20	0.835	132	9/2/1970	5/27/2008
			Spring Run											0.299	0.299	0.00	0.990	0.217	45	2/28/2000	12/6/2006
SOLID	TDS	mg/L	Main Boil						165	153	155	150	174	174	169	5.00	232	19.2	162	5/12/1954	5/27/2008
			Spring Run											167	167	138	203	12.6	44	2/28/2000	12/6/2006
	TSS	mg/L	Main Boil											3.51	3.51	2.00	23.0	2.16	111	9/27/2001	5/27/2008
			Spring Run											4.95	4.95	4.00	5.00	0.218	21	2/28/2000	12/6/2006
TEMPERATURE	Air Temp	C	Main Boil											25.5	25.5	21.0	30.0	6.36	2	11/3/2005	7/13/2006
	Wtr Temp	C	Main Boil						22.0	22.4	21.0	18.5	21.6	20.6	20.7	16.4	24.0	1.26	149	5/12/1954	5/27/2008
			Spring Run											20.9	20.9	14.2	23.6	1.38	46	2/28/2000	12/6/2006

Wakulla Springs has experienced a significant increase in nitrate concentrations over the past 25 years (**Figure 12**, Chelette *et al.* 2002). Based on data from 1971 through 1977, the median nitrate concentration was 0.26 mg-N/L (n=22), while data from 1989 through 2000, had a median nitrate concentration of 0.89 mg-N/L (n=26), and concentrations appear to have peaked in the early 1990s (Chelette *et al.* 2002).

Based on sampling and isotopic analysis of ground and surface waters from the Woodville Karst Plain, including Wakulla Springs, Fisher Creek, Lost Creek and Munson Slough, water from most sampled wells and from Wakulla Springs had delta 15 N-NO_3 values ranging between 6.8 and 8.9 per mil, indicating that their NO3 originates from a blend of organic and inorganic sources (Katz 2001). Average residence time of ground water discharging from Wakulla Springs was estimated at 38.7 +/-1.07 years using hydrogen to helium isotope ratio age-dating techniques (Katz 2001).

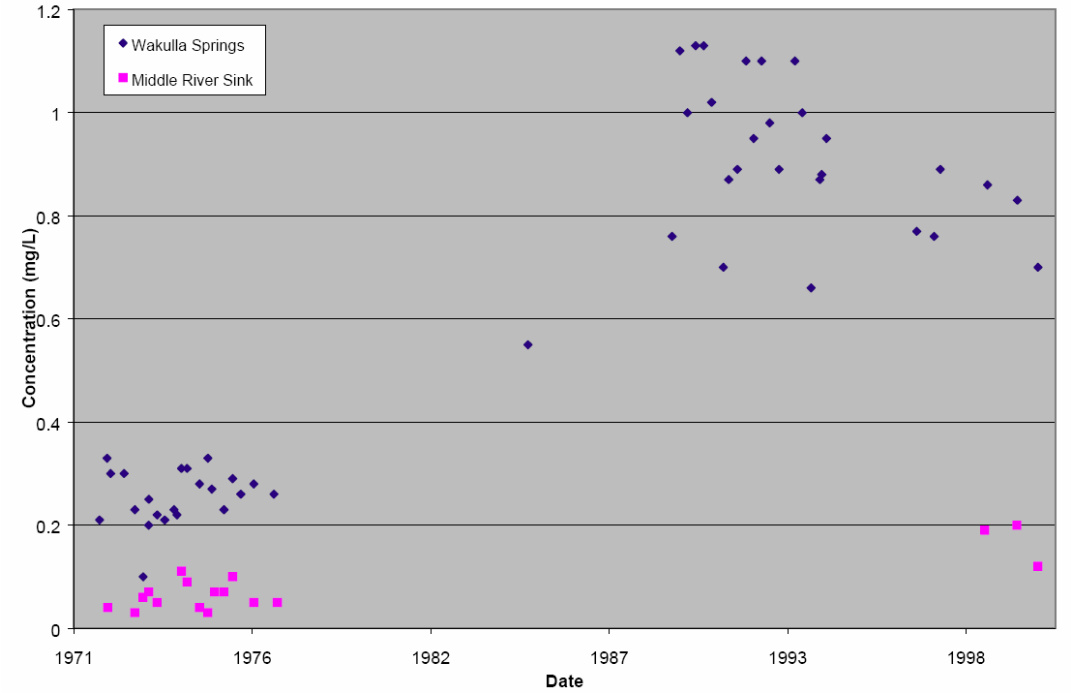


FIGURE 12
Wakulla Spring nitrate timeseries (from Chelette *et al.* 2002).

During site reconnaissance on August 18, 2008 between 8:30 and 10:00, field parameters were measured from above the vent of Wakulla Spring and along the upper 1 km (0.6 mi) of the spring run (**Figure 13**). Temperature over the main boil was about 21 ° C and gradually rose in the spring run (**Figure 14**). Temperatures observed in the lower run of Sally Ward spring were about half a degree (C) higher suggesting a longer travel path from the spring vent. Specific conductance was stable around 510 µS/cm along the spring run, with the exception of the Sally Ward run which had values of about 320 µS/cm (**Figure 14**). Dissolved oxygen concentrations from the main vent were about 1.25 mg/L (15 % saturated) and rose with distance downstream to a maximum observed 2.5 mg/L (28 % saturated, **Figure 14**). Increased dissolved oxygen concentrations were measured at the confluence of the Sally Ward spring run. Field measured pH from the spring vent was about 7 standard units, rising to 7.5 by about 1 mile downstream (**Figure 14**). This increase in pH likely corresponds to aquatic plant metabolism; while pH values from the Sally Ward confluence suggested ground water inputs.

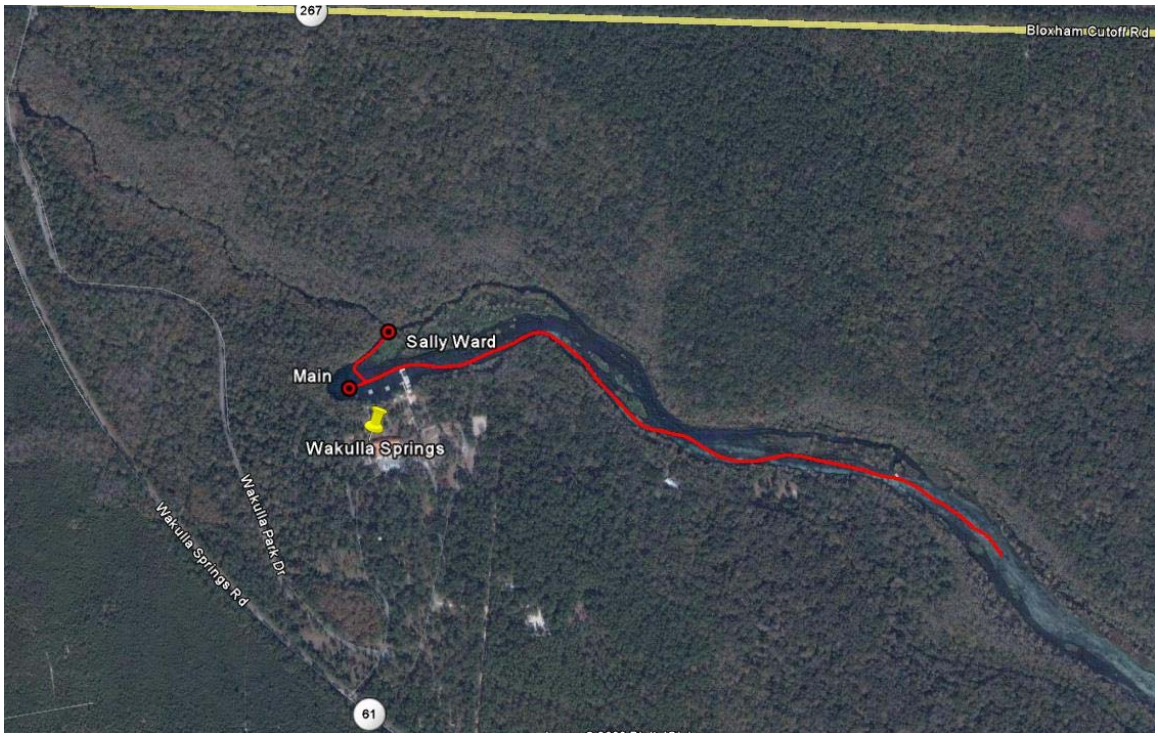
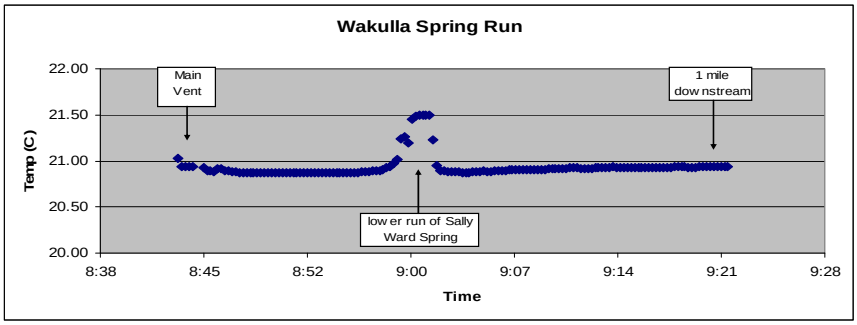
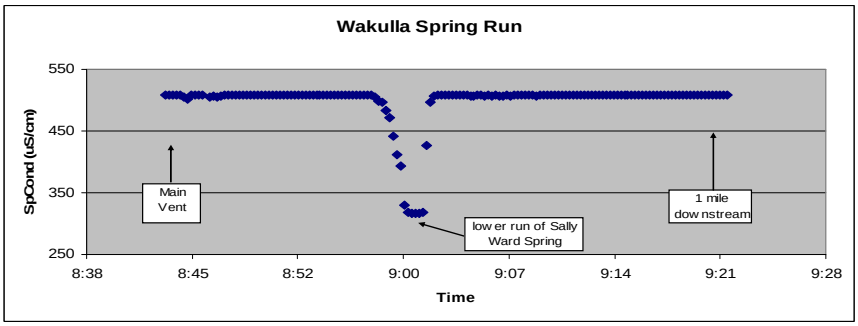
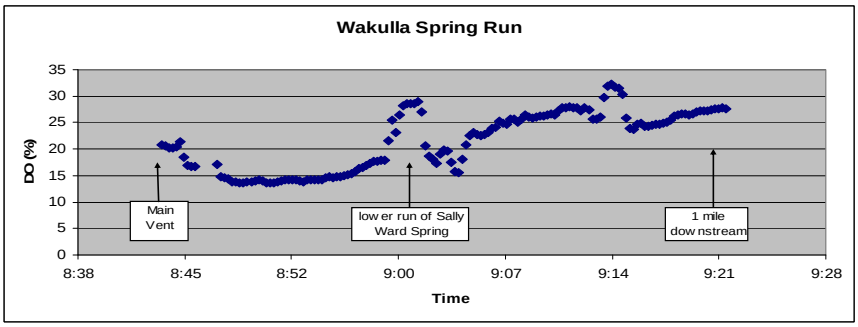
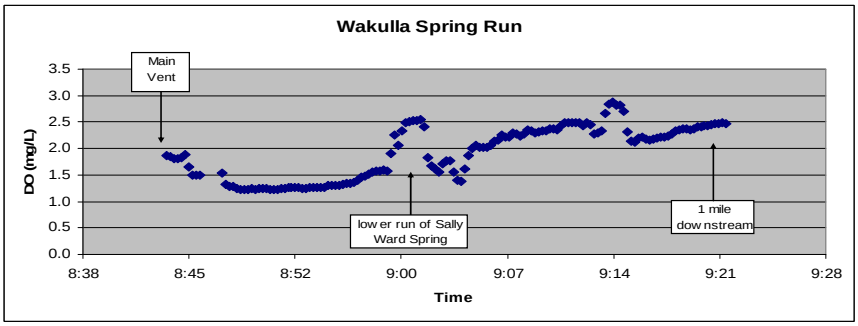


FIGURE 13
Image of Wakulla Springs with red icons and path indicating the reconnaissance sampling locations on August 18, 2008.









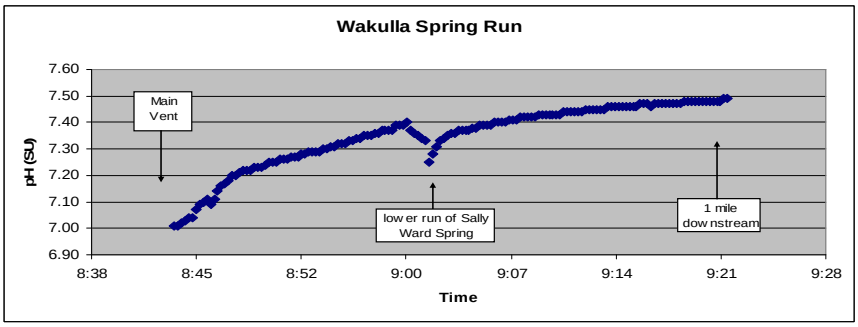


FIGURE 14
Field parameters measured from Wakulla Springs on August 18, 2008.

Biological

Vegetation

As part of a multi-spring macroalgae study, the pool area of Wakulla Springs was sampled during April 8 and October 1, 2003 (Stevenson *et al.* 2007). During April macroalgae coverage was 40.7% with an average thickness of 12.7 cm (5 in), while in October the macroalgal coverage was 50.6% with an average thickness of 8.8 cm (3.5 in). The average percent cover by species for both sampling events was 40.7% *Vaucheria sp.*, 8.7% *Spirogyra sp.*, 7.4% *Hydrodictyon sp.*, 3.1% *Cladophora glomerata*, 1.9% diatoms, and 1.3% *Rhizoclonium heiroglyphicum* (Stevenson *et al.* 2007).

Submersed aquatic vascular plants were also surveyed by Stevenson *et al.* (2007) during these two sampling events. In April coverage of these plants was 51.9%, while in October coverage was 70.4. Average percent occurrence for both sampling events was 56% hydrilla (*Hydrilla verticillata*), 10.5% strap-leaf sagittaria (*Sagittaria kurziana*), and 0.5% southern naiad (*Najas guadalupensis*).

During a reconnaissance trip made on August 18, 2008, the percent area coverage of submersed aquatic vegetation was approximately 50 % in the spring run. The most common plants observed were hydrilla and tape grass (*Vallisneria americana*), while beds of strap leaved sagittaria, Illinois pondweed (*Potamogeton illinoensis*), southern naiad were also seen. Several types of filamentous algae (greens and blue-greens) were observed, commonly entangled with rooted and emergent plant material.

Hydrilla is conspicuously present in Wakulla Springs and although observed in 1983 surveys by FDEP, it was not until the early 1990's that hydrilla abundance had become problematic (**Figure 15**). Aquatic plants in Wakulla Springs run (Wakulla River) have

been managed by the state through a variety of herbicide applications. During the 2006-2007 fiscal period, 75 acres of aquatic plants were treated (predominately hydrilla) and the same amount is projected for the 2007-2008 fiscal period (FDEP 2007).

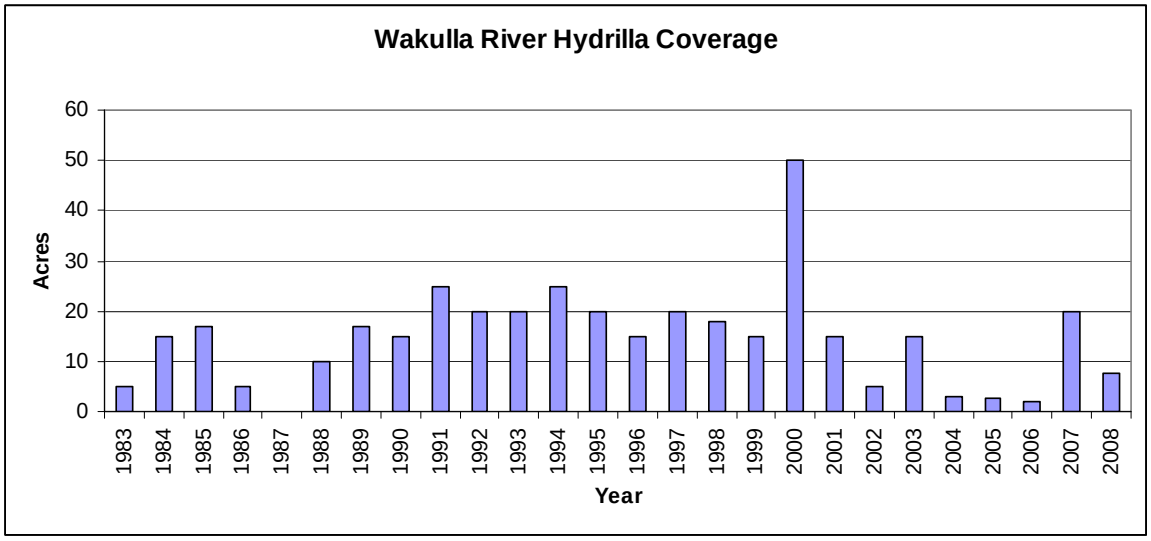


FIGURE 15
Wakulla River hydrilla abundance by year (from FDEP 2007).

Macroinvertebrates

Wakulla River has been sampled up to four times a year since 2000 as part of FDEP EcoSummary sampling (FDEP 2008). The monitoring site is a 100 m stretch located in the spring run, approximately 3.2 km (2 mi) downstream of the headspring. The habitat assessment rating was usually in the optimal range, the total number of invertebrate taxa ranged from 11 to 28, and the total number of sensitive taxa ranged from one to three (**Figure 16**). The stream condition index (SCI) was re-calibrated in June 2004, prior to this date values greater than 21 indicated healthy conditions, while subsequent to re-calibration values greater than 34 indicated healthy conditions. Over the period-of-record, only four out of 27 (or 15%) SCI scores indicated a healthy invertebrate community in Wakulla springs (**Figure 16**).

Wakulla Spring was sampled for crustaceans on May 17-18, 2002 by staff from the Florida Museum of Natural History (Franz 2002). In the main spring and run, freshwater shrimp (*Palaemonetes paludosa*), amphipods (*Hyalella sp.*), and the crayfish (*Procambarus paeninsulanus*) were collected. Franz (2002) lists *Procambarus kilbyi, P. paeninsulanus, P. rogersi, P. orcinus, P. spiculifer, Cambarellus schmitti* as recorded crawfish species for Wakulla County.

Concerns over invertebrate mortality due to aquatic herbicide applications have arisen at Wakulla Springs. In 2005 a study was conducted by FDEP to examine the survival of caged crayfish during herbicide (Aquathol) treatment. Survival of crayfish did not appear to be diminished by herbicide treatments, although the corresponding reduction in spring run dissolved oxygen levels was noted as a possible stressor (FDEP 2005).

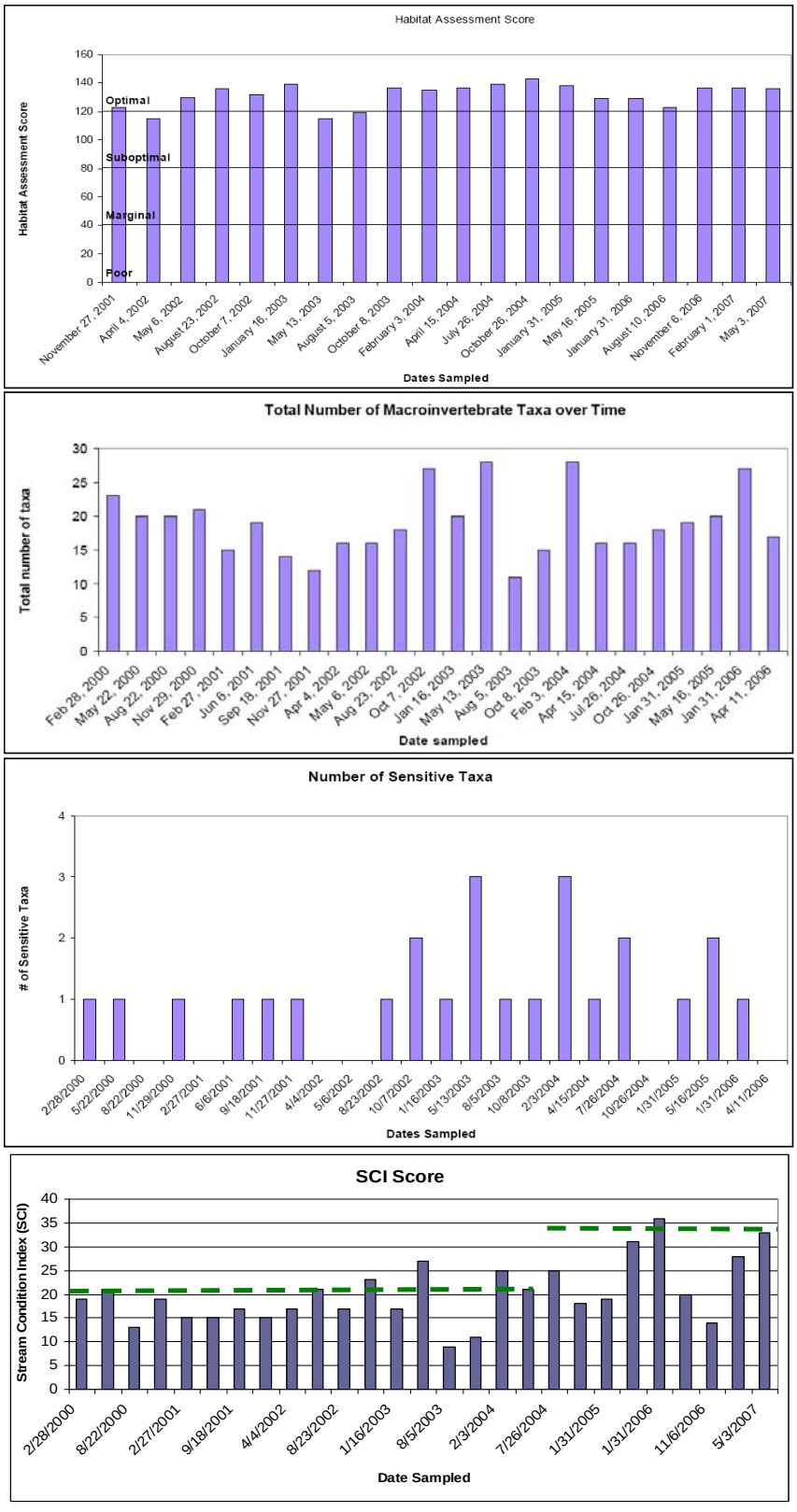


FIGURE 16
Time series of habitat assessment, total number of aquatic macroinvertebrate taxa, number of sensitive aquatic macroinvertebrate taxa, and stream condition index (SCI) values for Wakulla Springs (from FDEP 2008).

Macro fauna

During the site visit on August 18, 2008 by WSI; fish observed included striped mullet (*Mugil cephalus*), lake chub sucker (*Erimyzon sucetta*), largemouth bass (*Micropterus salmoides*), Florida gar (*Lepisosteus platyrhincus*), long nosed gar (*Lepisosteus osseus*), bowfin (*Amia calva*), and several species of sunfish (*Lepomis spp*.). Several river turtles and alligators were observed as well, alligators ranged from 3 to 8 feet in length.

Wakulla Springs have been sampled for fish by Walsh and Williams (2003) who also conducted a review of Florida Museum of Natural History (FLMNH) fish collections. Based on their review of museum data, a total of 43 species of 31 genera and 20 families of fishes had been collected from the headspring, river, and McBride Slough. Utilizing electrofishing techniques, Walsh and Williams (2003) collected a total of 23 species of 21 genera and 13 families from areas near the main spring pool downstream to the vicinity of the mouth of McBride Slough; with the relative abundance of fish dominated by redeye chub (*Notropis harperi*; 28.1%), spotted sunfish (*Lepomis punctatus*; 17.2%), and coastal shiner (*Notropis petersoni*; 15.9%). A listing of fish species for Wakulla Springs is provided **Table 4** (from Walsh and Williams 2003).

Wakulla Springs (and river) have been surveyed as part of the Audubon Christmas bird count beginning in 1947. Twenty aquatic bird species have been documented through this survey, with the five most commonly observed species being American Widgeon (48.7%), American Coot (16.2%), Lesser Scaup (9.6%), White Ibis (5.4%), and Common Moorhen (4.1%). **Figure 17** shows the average number of birds by species for the period-of-record.

Staff members from Wakulla Springs State Park conduct a biannual (winter and summer) survey of the birds, mammals, and reptiles utilizing the Wakulla River. The winter survey is made in late January or early February and the summer survey is made in late July or early August. The survey of the Wakulla River is divided into three segments – the park portion, the middle portion, and the lower portion. The park portion starts at Wakulla Springs and goes to the bridge crossing of State Road 365 (contains park only property), the middle portion starts at the 365 bridge and goes to the U.S. Highway 98 bridge, and the lower portion starts at the 98 bridge and goes to Wakulla River's confluence with the St. Marks River at the San Marcos de Apalache State Historic Site. Each resulting segment is approximately 3 miles in length. Surveys start at 1:00 pm with a staff biologist leading a canoe crew departing at the starting point of each segment of the river (*i.e.*, there are 3 simultaneous survey crews each event). Substantial data exist on the wildlife utilizing Wakulla Springs and River.

Manatees

Manatees are known to utilize Wakulla Spring in relatively low numbers. The current known high manatee count at the spring is 13, documented on 5/13/1996 (FWC – unpublished data, from Taylor 2006). FDEP records indicate that 12 manatees utilized the spring during the 2007 to 2008 winter period. Wakulla Spring is considered a secondary warm-water site by the Florida manatee recovery team and does not appear to have any major accessibility issues at this time despite some relatively shallow areas in the spring run (Taylor 2006).

TABLE 4
Listing of fishes collected in Wakulla Springs (USGS; number of specimens and relative abundance), and material in the FLMNH ichthyologic collection from the spring proper and adjacent reaches (e.g., McBride Slough) of the Wakulla River (% = total percentage of each taxon for all specimens in FLMNH collection for both spring and adjacent reaches combined, from Walsh and Williams 2003).

Family	Species	USGS		FLMNH		
		N	Relative Abundance (%)	Spring	Adjacent	%
Lepisosteidae	*Lepisosteus osseus*	9	0.9	3	---	0.05
	Lepisosteus platyrhincus	4	0.4	---	---	---
Amiidae	*Amia calva*	6	0.6	---	---	---
Anguillidae	*Anguilla rostrata*	8	0.8	9	---	0.15
Cyprinidae	*Notropis cummingsae*	---		355	---	5.84
	Notropis harperi	273	28.1	841	72	15.01
	Notropis petersoni	154	15.9	436	36	7.76
	Opsopoeodus emiliae	---	---	82	---	1.35
	Pteronotropis hypselopterus	1	0.1	252	51	4.98
Catostomidae	*Erimyzon sucetta*	39	4.0	17	1	0.30
	Minytrema melanops	3	0.3	6	---	0.10
Ictaluridae	*Ameiurus catus*	---	---	1	---	0.02
	Noturus gyrinus	---	---	24	2	0.43
	Noturus leptacanthus	---	---	10	---	0.16
Esocidae	*Esox americanus*	---	---	11	4	0.25
	Esox niger	---	---	2	---	0.03
Aphredoderidae	*Aphredoderus sayanus*	18	1.9	69	3	1.18
Mugilidae	*Mugil cephalus*	3	0.3	---	---	---
Atherinopsidae	*Labidesthes sicculus*	4	0.4	195	---	3.21
Belonidae	*Strongylura timucu*	---	---	1	---	0.02
Fundulidae	*Fundulus confluentus*	---	---	28	---	0.46
	Fundulus escambiae	---	---	---	1	0.02
	Fundulus grandis	---	---	1	---	0.02
	Fundulus seminolis	43	4.4	426	---	7.00
	Lucania goodei	78	8.0	734	27	12.51
	Lucania parva	---	---	67	---	1.10
Poeciliidae	*Gambusia holbrooki*	61	6.3	524	22	8.98
	Heterandria formosa	43	4.4	142	32	2.86
	Poecilia latipinna	7	0.7	145	---	2.38
Syngnathidae	*Syngnathus scovelli*	---	---	1	---	0.02
Centrarchidae	*Lepomis auritus*	2	0.2	143	---	2.35
	Lepomis gulosus	---	---	3	---	0.05
	Lepomis marginatus	---	---	5	---	0.08
	Lepomis microlophus	---	---	4	---	0.07
	Lepomis punctatus	167	17.2	188	---	3.09
	Micropterus notius	5	0.5	---	---	---
	Micropterus salmoides	35	3.6	44	1	0.74
Percidae	*Percina nigrofasciata*	---	---	47	---	0.77
Gerreidae	*Eucinostomus argenteus*	---	---	72	---	1.18
Sparidae	*Lagodon rhomboides*	---	---	21	---	0.35
Sciaenidae	*Bairdiella chrysoura*	---	---	8	---	0.13
	Leiostomus xanthurus	---	---	6	---	0.10
Elassomatidae	*Elassoma okefenokee*	5	0.5	500	9	8.37
	Elassoma zonatum	---	---	5	4	0.15
Gobiidae	*Gobiosoma bosc*	---	---	4	---	0.07
	Microgobius gulosus	---	---	1	---	0.02
Achiridae	*Trinectes maculatus*	3	0.3	384	---	6.31
	Total number of species	**23**		**42**	**14**	
	Total number of specimens	**971**		**5817**	**265**	

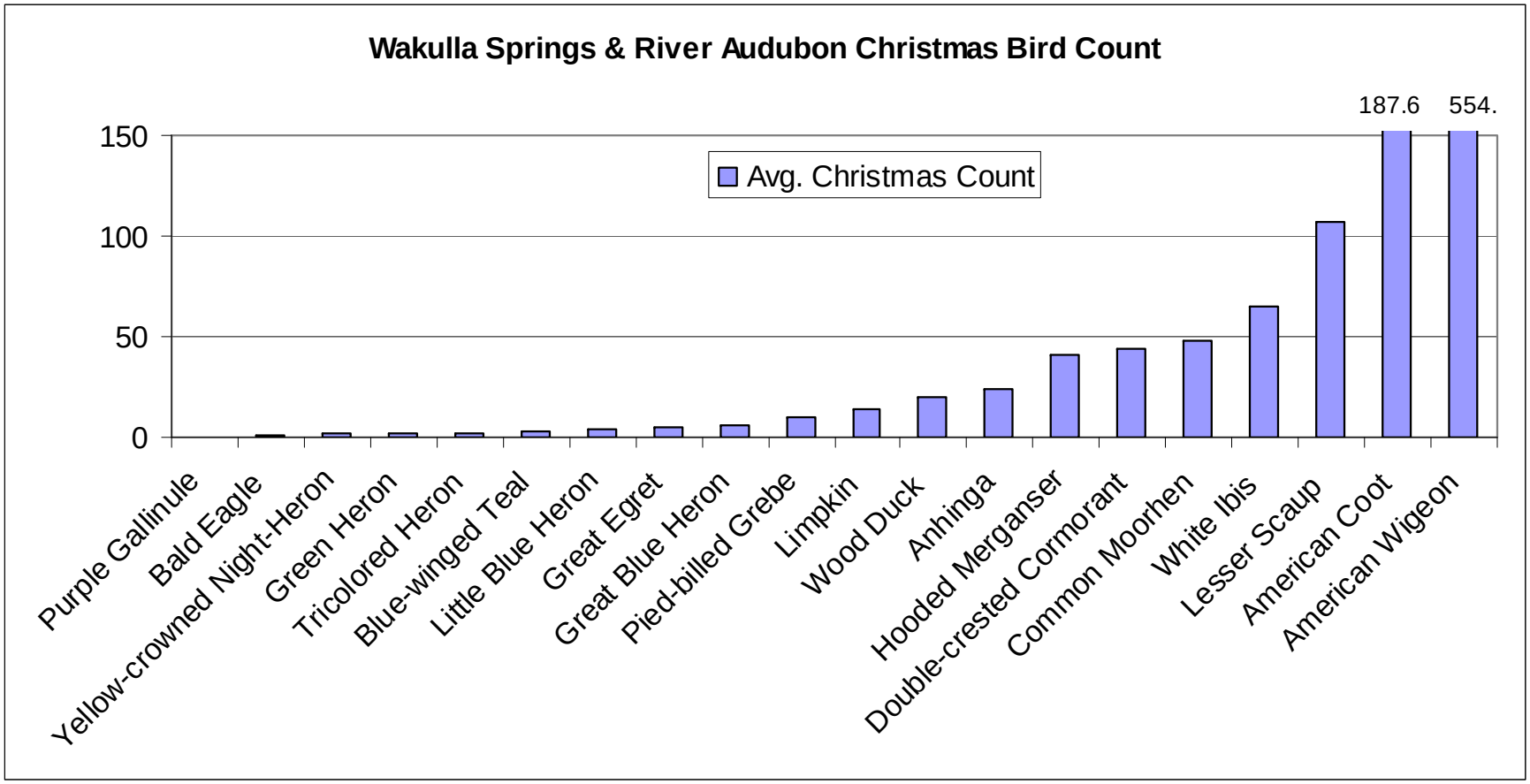


FIGURE 17
Wakulla Springs Audubon Christmas bird count data (average number by species for 1948-2009).

Ecosystem Functions

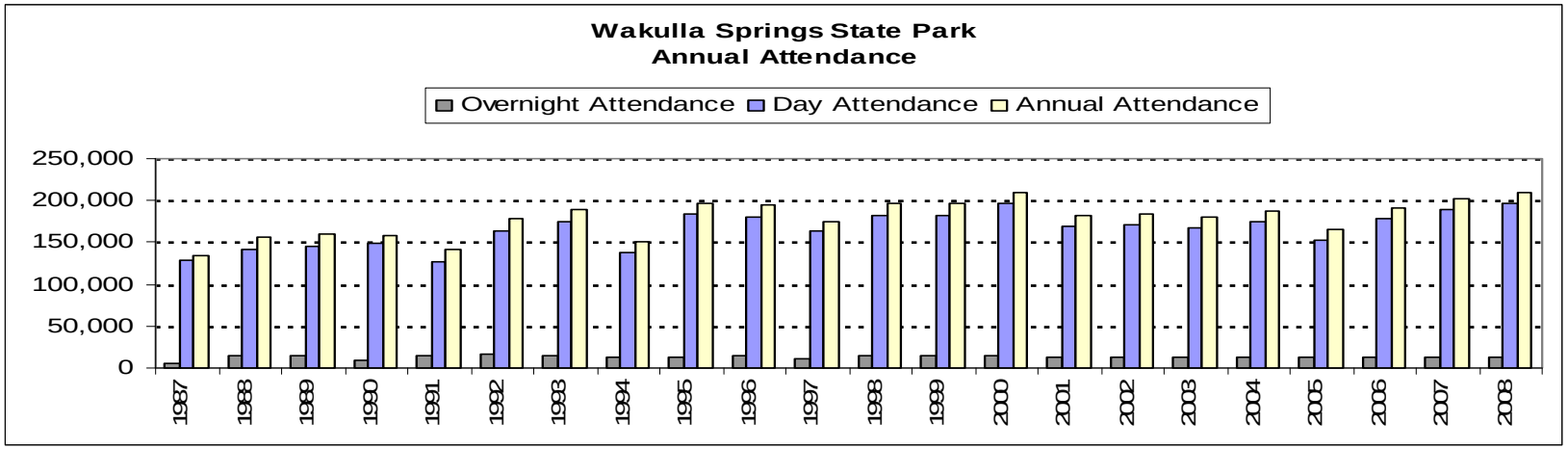
Based on field parameters (temperature, conductance, dissolved oxygen, and pH) measured in the spring pool and spring run during the reconnaissance trip of August 18, 2008, this spring is suitable for measuring ecosystem metabolism based on changes in dissolved oxygen following discharge from the spring vent. The FDEP deployed recording data sondes during April 11 to 15, 2005 at four stations (McBride Slough, near the main pool, near the middle of the spring run, 2.4 km (1.5 mi) downstream, and near the end of the park property boundary of the spring run, 4.8 km (3 mi) downstream. Data collected at the stations revealed diel oxygen curve patterns and were utilized to observe the effects of hydrilla herbicide treatment. These oxygen data are not suitable for ecosystem metabolism estimates due to a lack of corresponding discharge, depth, and light data.

Human-Use Attendance and Activities

Recreational activities at Wakulla Springs include swimming, guided park boat tours, picnicking, and lodging. As a state park, complete annual statistics of human attendance are available between 1987 and 2008. Peak total annual attendance occurred in 2000 (slightly more than 210 thousand people) and peak season use occurs in summer months (**Figure 18**).

Minimum Flow and Levels

Wakulla Spring was placed on the Northwest Florida Water Management District (NWWMD) MFL priority list for 2008. As of the date of this report, no MFL has been adopted for this spring group and the priority list data has been changed to 2012 due to the need for additional data and model analysis to quantify uncertainty (NWFWMD 2009).



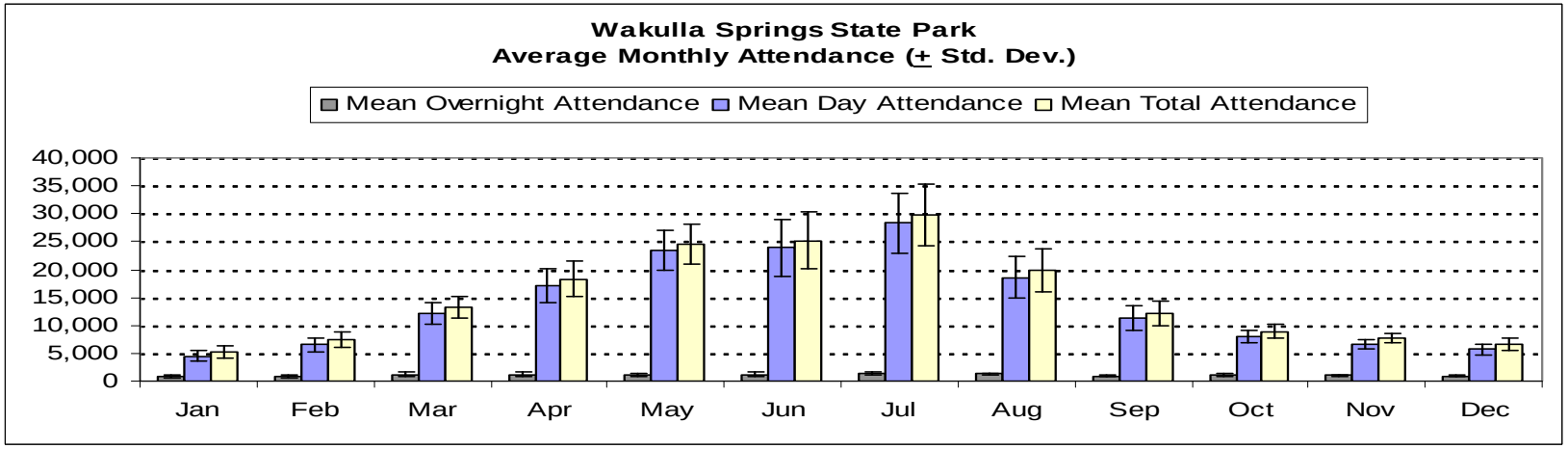


FIGURE 18
Wakulla Springs State Park annual and monthly attendance data.

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Appendix Z

Summary of data for Weeki Wachee Springs



Summary of Existing Data - Weeki Wachee Springs (Hernando Co.)

Prepared by

Wetland Solutions, Inc.

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Table 6 The frequency of occurrence (% of stations sampled) of submersed aquatic vegetation in the Weeki Wachee River. Five stations were sampled along each of 20 river transects (n = 100) during August of each year (from Frazer *et al*. 2006).

Table 7 The frequency of occurrence (% of stations sampled) of submersed aquatic vegetation species in the Weeki Wachee River by time period and their corresponding differences (from Frazer *et al*. 2006).

Table 8 Species composition (percent) of fish collected by electrofishing in the Weeki Wachee River (from SWFWMD 2005).

Table 9 Weeki Wachee minimum flows based on various long-term averages (from Heyl 2008).

Summary of Existing Springs Data

This report summarizes known existing physical, chemical, and biological data for Weeki Wachee Springs (Hernando County). These data were collected from sources such as the Southwest Florida Water Management District (SWFWMD), the U.S. Geological Survey (USGS), and the Florida Department of Environmental Protection (FDEP); as well as through literature searches of journal publications, technical reports, and student dissertations.

Weeki Wachee Springs State Park

Physical address

Weeki Wachee Springs State Park; 6131 Commercial Way; Spring Hill, FL 34606; phone (352) 596-2062; latitude/longitude: 28.517330°, -82.573246°; park website: http://www.floridastateparks.org/weekiwachee/default.cfm .

Driving Directions

Weeki Wachee Springs are located in Hernando County 32.8 km (20.4 mi) south of Homosassa or 8.4 km (5.2 mi) north of Spring Hills, at the intersection of SR 50 and US HWY 19 (**Figure 1**).

General

This first magnitude spring has a long history as a tourist attraction due to the opportunity to view performers dressed as mermaids. The first mermaid show was performed in October 1947. Although the spring was purchased by the City of St. Petersburg as a potential source of drinking water in 1940, it was never utilized for this purpose. Ownership has changed several times in the intervening decades, and in 2001 the springs and surrounding lands were purchased by the SWFWMD with the tourist

attraction continuing operation by private lease. Weeki Wachee Springs and the facilities have recently become a state park administered by the FDEP/FPS (November 1, 2008 was the first day of Weeki Wachee Springs State Park). The park facilities are well developed and include large parking lots, staff housing, animal exhibits, gift shops, and food concessions. The primary recreational inducements to the spring are the underwater viewing chamber and associated mermaid show; a boat tour; and the water park- Buccaneer Bay, which has water slides, swimming, and beaches. Private boats can travel the Weeki Wachee River, but are prohibited from entry into the headsprings pool.

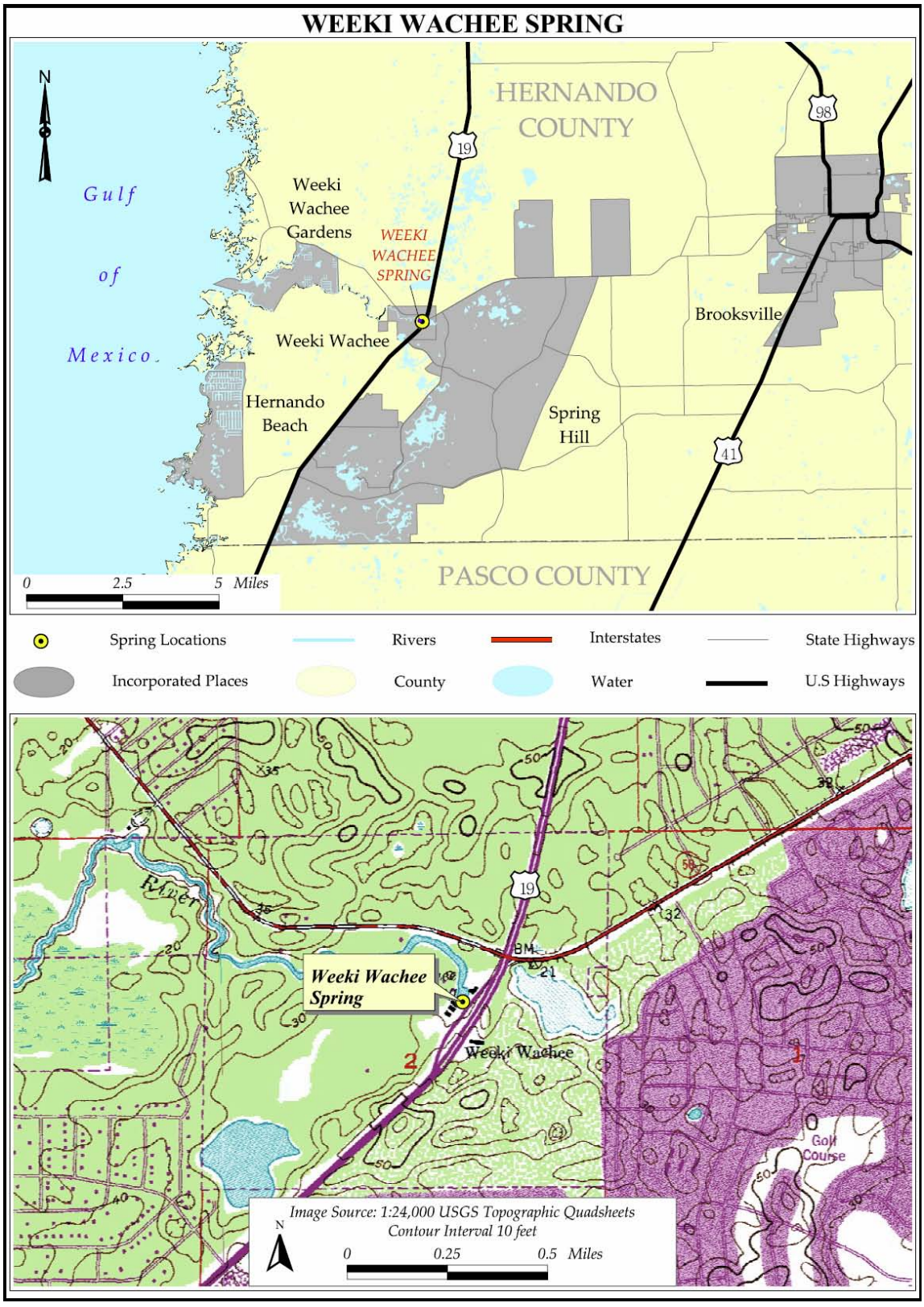


FIGURE 1
Weeki Wachee Springs location (from Scott *et al.* 2002).

Weeki Wachee Spring forms the headwaters of the Weeki Wachee River system which ultimately discharges into the Gulf of Mexico at Bayport, Florida (**Figure 2**). Approximately 1 km (0.6 mi) downstream of the main spring, a smaller spring, Twin Dees Spring, contributes additional groundwater to the river system.

Physical

The nearly circular spring pool is large at approximately 61 m (200 ft) wide, with steeply sloping sides which form a conical vent at a depth of about 15.2 m (50 ft) (**Figure 3**). The spring vent has rocky substrate revealing the region's karst geology, but is covered by quartz sands around the upper sides. A unique feature of Weeki Wachee Springs is the 400 seat underwater theater which allows viewing the spring vent through large windows. Built to facilitate mermaid shows, this feature also allows spectators to appreciate the large spring vent and excellent water clarity (**Figure 4**).

The lands immediately surrounding the spring are mostly developed for various commercial properties. The winding, spring run is extensive but rarely wider than 15.2 m (50 ft); and as a result, riparian canopy cover can be heavy. Sediments in the spring run appear to be primarily coarse sands. The Weeki Wachee River travels westerly for about 11.3 m (7 mi), passing through sandy uplands, and then forested wetlands, and ultimately into a coastal salt marsh where it discharges into the Gulf of Mexico at Bayport. The shoreline of the spring run is relatively undeveloped in the upper portion, residential housing is widespread along the middle and lower reaches though.

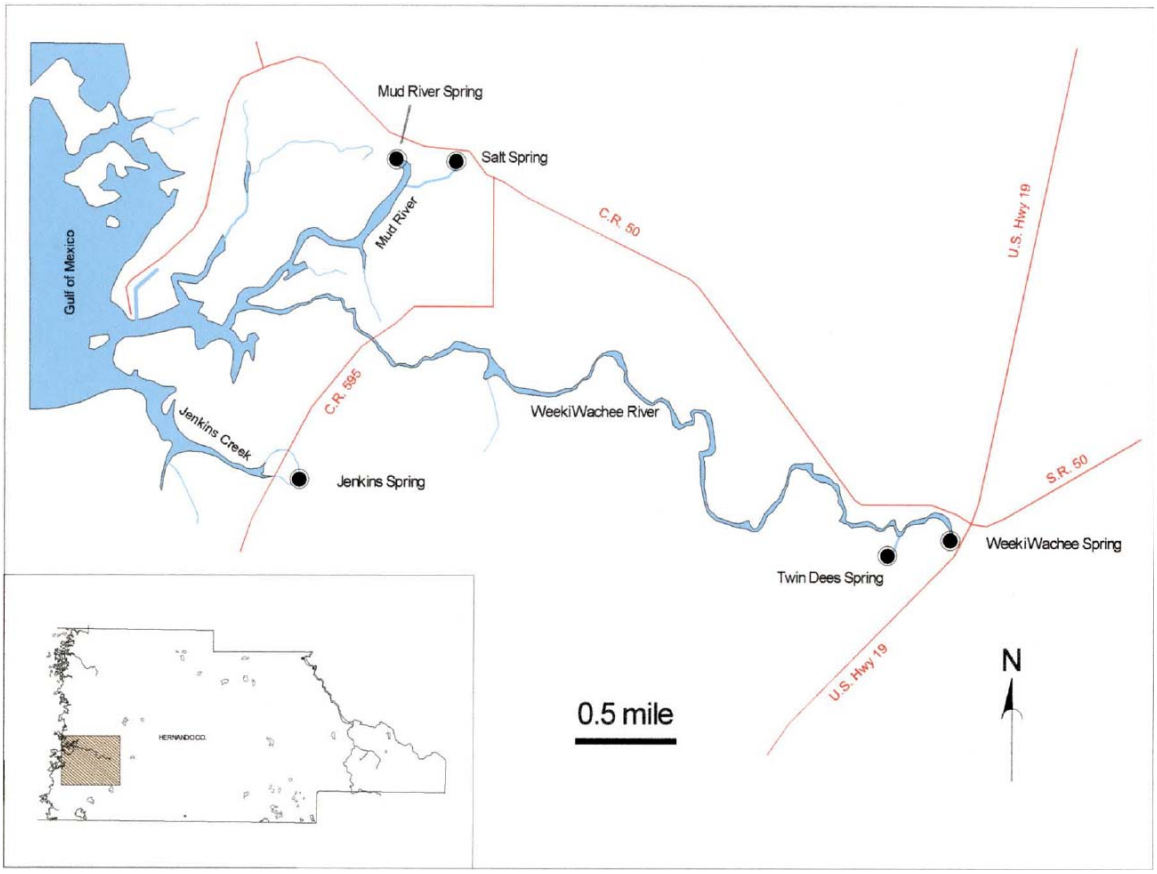


FIGURE 2
Location of Weeki Wachee Spring and other associated springs which contribute to the Weeki Wachee River system (from Champion and Starks 2001).



FIGURE 3
View of Weeki Wachee Springs pool facing north, with Buccaneer Bay in the background (R.L. Knight 08/13/08).

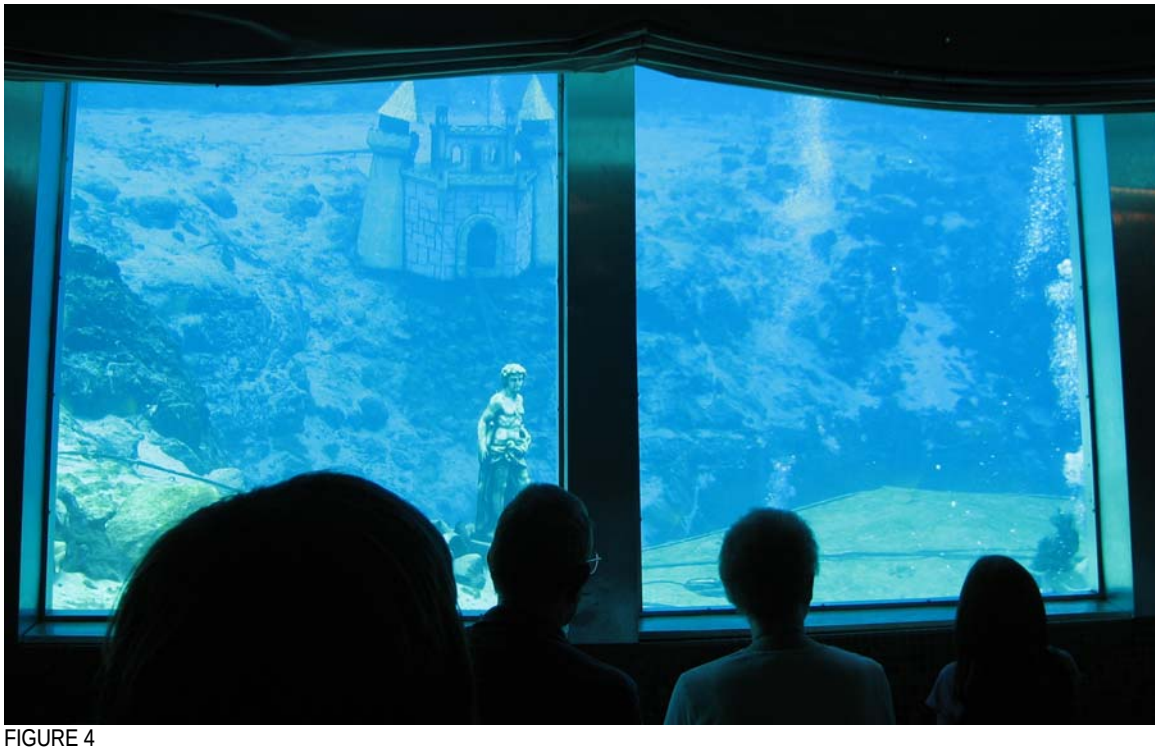


FIGURE 4
View from the Weeki Wachee Springs underwater theater, with show props in the background (R.L. Knight 08/13/08).

Hydrogeology

Weeki Wachee Spring is located in a region commonly referred to as the Springs Coast and a detailed description of this region is provided by Wolfe (1990). The water basin of the Springs Coast is bounded by ground-water divides rather than topographic divides, as the region's principal drainage is by way of ground-water flow within the Upper Floridan aquifer rather than surface water drainages (Knochenmus and Yobbi 2001). Major surface drainage features of the Springs Coast region are the Withlacoochee River, which defines the eastern and northern boundaries and the Pithlachascotee River, along the southern boundary in Pasco County (Wolfe 1990).

The Weeki Wachee Spring originates in the Weeki Wachee Dune Field, a relic dune system with typical elevations of 20 m (65 ft) or less (Brooks 1981). Remaining terrestrial habitats are principally scrub and pine uplands. As the Weeki Wachee River travels west, it passes through the Coastal Strip, comprised of a limestone plain with elevations typically less than three meters. Soils overlying the Coastal Strip are poorly drained, organic, and shallow. Terrestrial habitats in this physiographic region include mixed hardwood forests, flat woods, and ultimately transition into a coastal marsh complex. The physiographic regions of Weeki Wachee are shown in **Figure 5**.

The hydrogeological framework of the Weeki Wachee area includes a discontinuous, siliciclastic surficial aquifer system, a discontinuous, siliciclastic intermediate confining unit, and the thick, mostly carbonate Upper Floridan aquifer. Although substantial saturated siliciclastic deposits are found in the study area, a hydraulically separated and regionally extensive surficial aquifer system does not exist; as the clay confining unit is breached by numerous sinkholes, allowing numerous hydraulic connections between

the aquifers. Geologic units which form the freshwater part of the Upper Floridan aquifer are the Avon Park Formation and Ocala Limestone of Eocene age, and the Suwannee Limestone of Oligocene age (Knochenmus and Yobbi 2001).

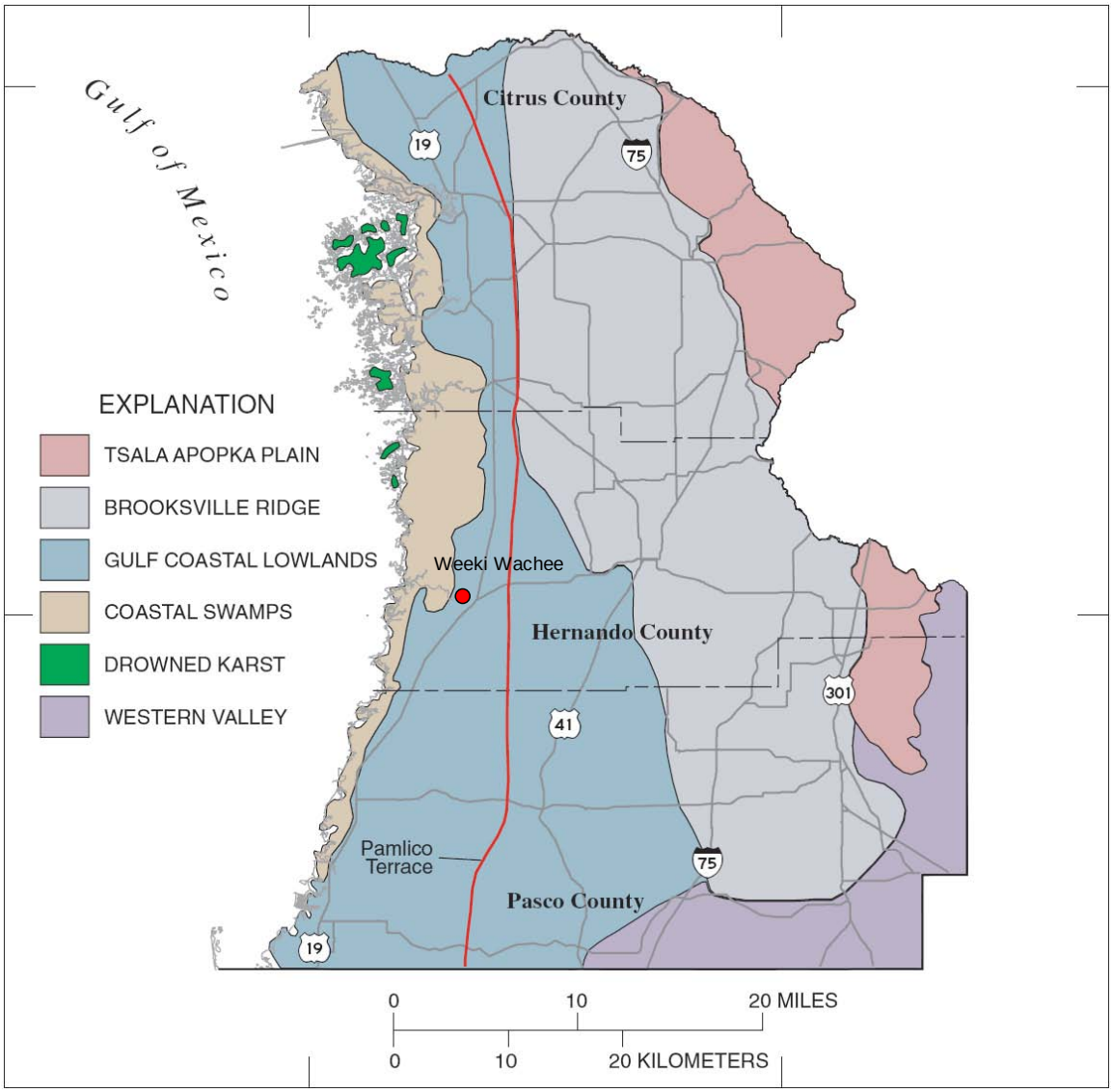


FIGURE 5
Physiographic regions adjacent to Weeki Wachee Springs (from Knochenmus and Yobbi 2001).

Springshed

Both the surface drainage area and the springshed for Weeki Wachee Springs have been delineated, and are approximately 98 km² (38 mi² or 24,320 ac) and 673 km² (260 mi² or 166,400 ac), respectively (Heyl 2008). While the watershed is solely contained within Hernando County, the springshed encompasses large portions of Hernando and Pasco Counties (**Figure 6**).

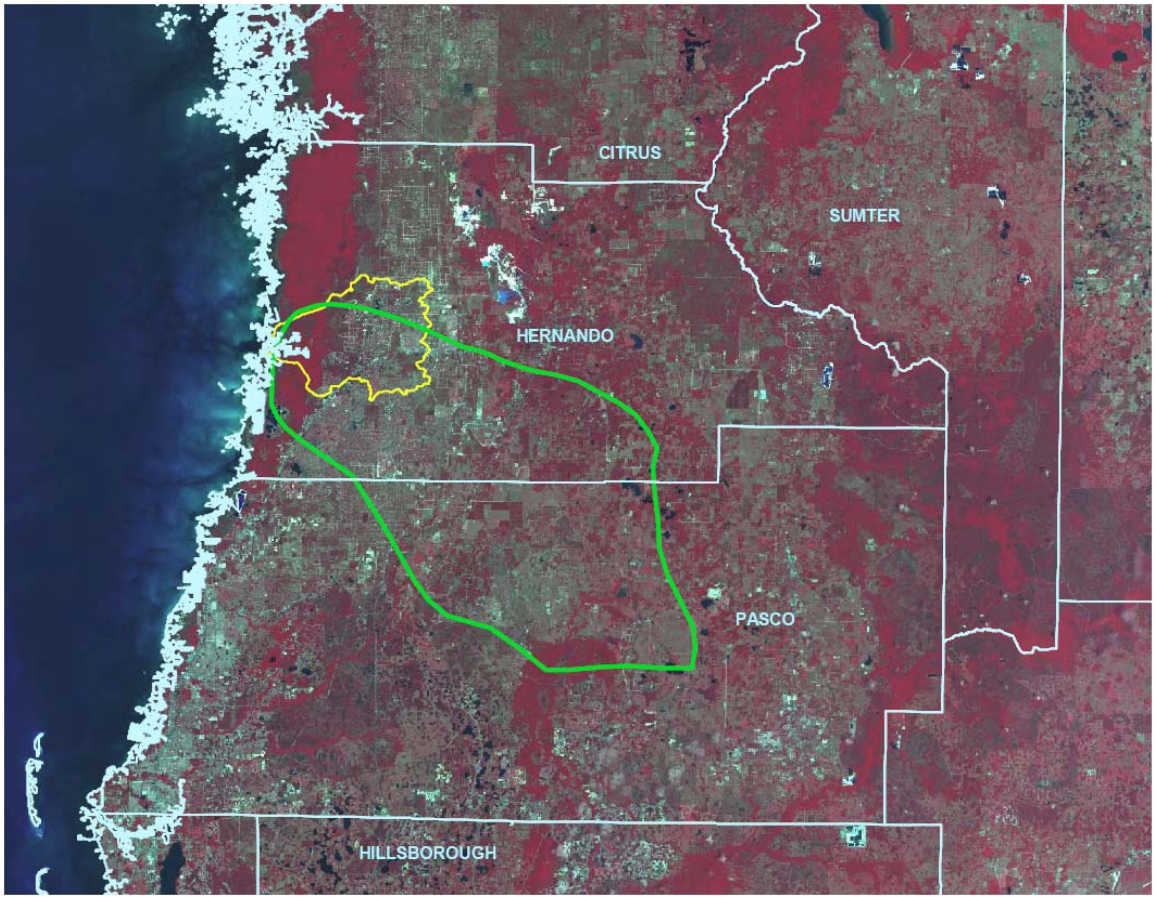


FIGURE 6
The watershed (yellow) and springshed (green) for Weeki Wachee Springs (from Heyl 2008).

Springshed Land Use

Land use for the Weeki Wachee watershed and springshed has been characterized based on 1999 land use maps (Heyl 2008). Based on those data, approximately 43 % of the watershed was urbanized and 27 % of the springshed was urbanized. Other major land use categories within the springshed include agriculture and upland forests. Land use continues to be transformed to urban areas, primarily through the conversion of rangeland and forest habitats and the current percentage of urban lands are likely even greater (**Table 1** and **Figure 7)**.

TABLE 1
Weeki Wachee land use categories (from Heyl 2008).

Springshed Land Use -1999		
	acres	Percent
Citrus	1,779	1%
Mines	415	0%
Nonforested Wetlands	12,234	7%
Other Agriculture	45,342	27%
Rangeland	4,041	2%
Upland Forests	43,004	26%
Urban	44,693	27%
Water	3,564	2%
Wetland Forests	13,223	8%

Watershed Land Use -1999		
	acres	Percent
Citrus	-	0%
Mines	-	0%
Nonforested Wetlands	2,064	8%
Other Agriculture	88	0%
Rangeland	44	0%
Upland Forests	6,965	29%
Urban	10,563	43%
Water	1,044	4%
Wetland Forests	3,574	15%

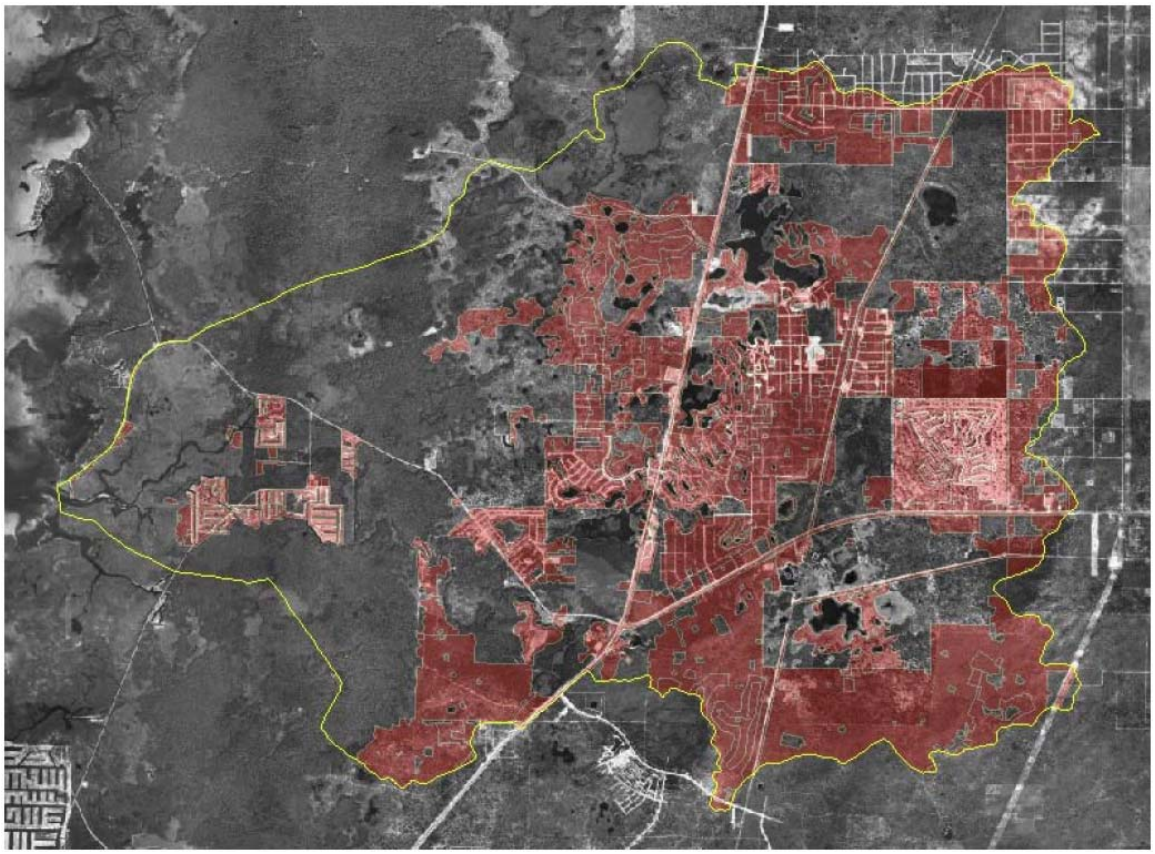


FIGURE 7
Illustration of the Weeki Wachee Springs watershed with urbanized areas in red (from Heyl 2008).

As a consequence of the urbanization of the Weeki Wachee springshed, nitrate-nitrogen concentrations have increased greatly over the past three decades. The trend of increasing nitrate concentrations closely follows human population growth in the springshed (**Figure 8**) suggesting a linkage between these two variables. Research indicates that the origin of the nitrate discharged from this spring is most likely derived from an inorganic source of nitrate, such as inorganic fertilizers applied to residential and golf course turf grass within the springshed (Jones *et al.* 1997).

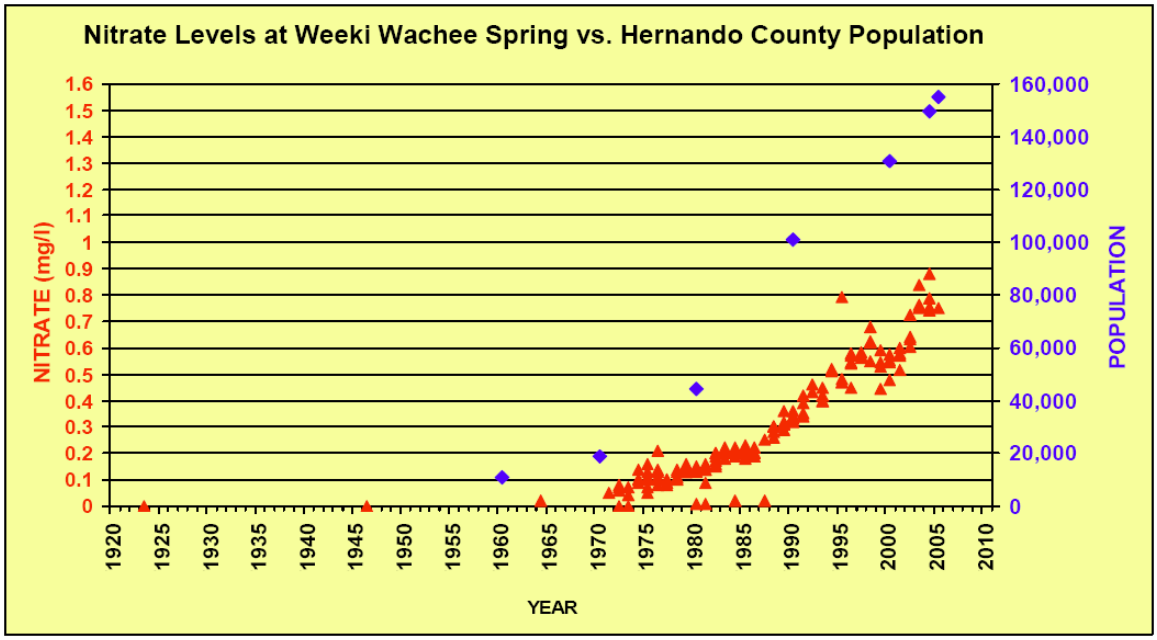


FIGURE 8
Population growth (blue diamonds) in Hernando County, Florida and nitrate-nitrogen concentration (red triangles) at Weeki Wachee Springs from 1923 to 2006 (from SWFWMD).

Study Area

The project study area is defined as beginning in the spring pool and going downstream for approximately 1 km (0.6 mi) in the spring run. **Figure 9** shows an approximation of the study area.

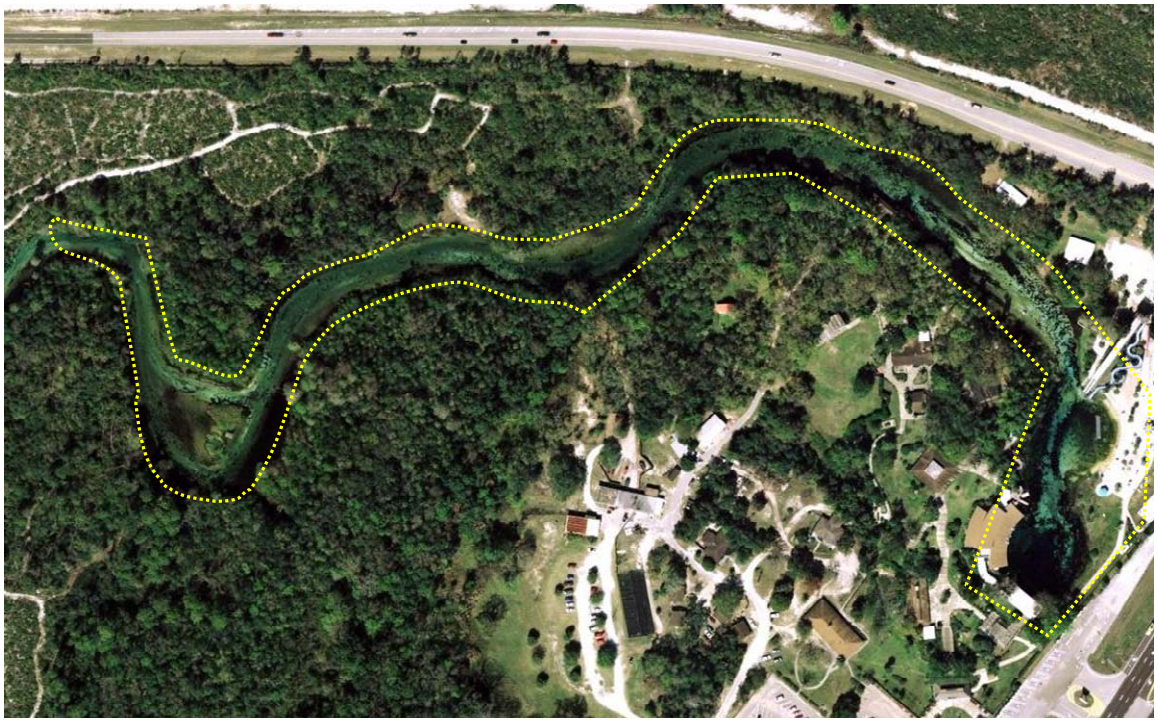


FIGURE 9
Study area for Weeki Wachee Spring.

Meta data (source, station, location, and STORET Origin ID) for the water quality data presented in the background description of Weeki Wachee Spring are given in **Table 2** below.

TABLE 2
Source information for the Weeki Wachee Spring historical water quality data described in this report.

Org ID	Org Name	Station ID	Station Name	Latitude	Longitude
USGS	USGS	2310500	Weeki Wachee Springs Near Brooksville	28.516667	-82.573611
USGS	USGS	2310525	Weeki Wachee Springs Near Brooksville	28.518611	-82.582500
21FLGW	Florida Department of Environmental Protection	3566	Weeki Wachee Springs Near Brooksville	28.518610	-82.582498
21FLGW	Florida Department of Environmental Protection	9716	Weeki Wachee Main	28.517191	-82.573166
21FLPCSW	Southwest Florida Water Management District	FL0050000263700	Weeki Wachee-1	28.518117	-82.573583

Discharge and Stage

Historical discharge data for Weeki Wachee Springs are reported by Rosenau *et al*. (1977), with 364 measurements spanning the time period of 1917 to 1974. Discharge values ranged from 101 cfs (July 24, 1956) to 275 cfs (October 19, 1964) with an average value of 176 cfs during that time period. Recent analysis of the discharge record for Weeki Wachee Springs, as part of the minimum flows and levels (MFL) analysis, indicates that discharge has averaged approximately 174 cfs for the period of record (1935-2004) and 162 cfs for 1984-2004, the baseline period chosen for establishing the MFL, (Heyl 2008). A reduction in average flow was determined to be the result of anthropogenic impacts, principally springshed ground water withdrawals. This reduction has resulted in an estimated 17 cfs decline since 1961 or the equivalent of an eight percent reduction in flow during 2004 (Heyl 2008).

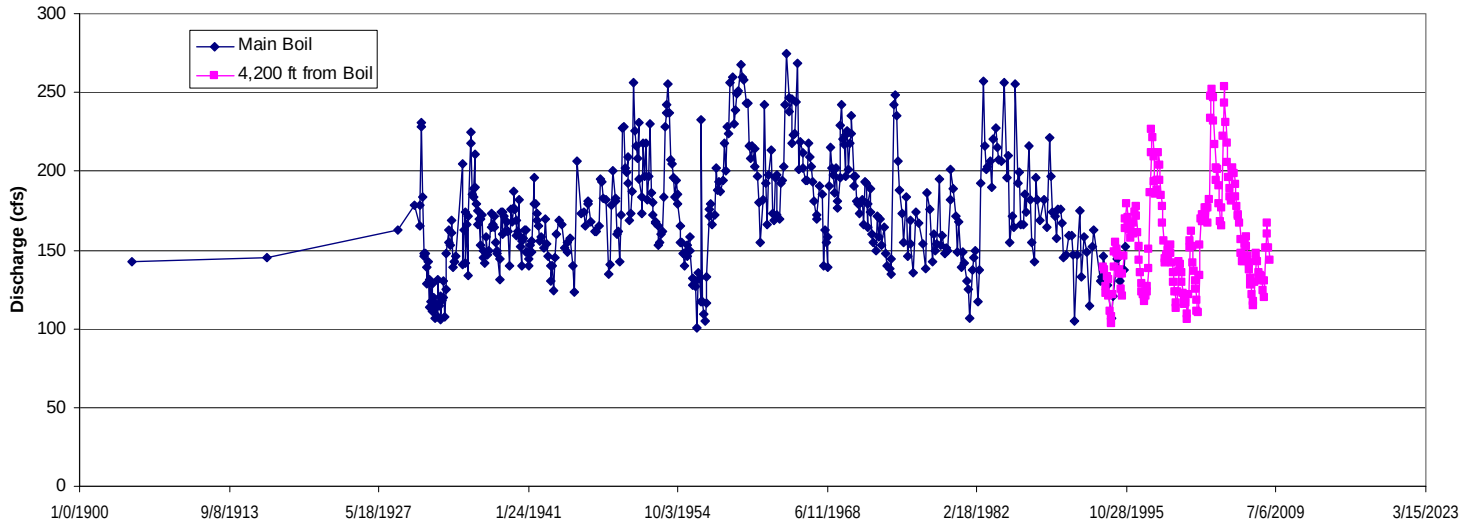
The US Geological Survey (USGS) has a station in the Weeki Wachee River which calculates discharge (station # 02310525) with daily records mostly available between October 1993 and the current time (USGS 2007b). These discharge measurements are made about 1.0 mi downstream from the spring and discharge is computed from a relationship between artesian pressure in a well near Weeki Wachee Springs using maximum daily water level elevation and discharge at the measuring site (USGS 2007b). **Table 3** and **Figure 10** illustrate the variability of discharge at this spring system. Stage data suggest that variations in water level are also related to aquifer levels and stage statistics are also provided in **Table 4**.

Detailed hydrogeological investigations have been made for Weeki Wachee and other springs of Hernando County by Knochenmus and Yobbi (2001). As part of their

research, predictive equations to estimate daily spring flow were developed using ordinary least squares and multiple linear regression techniques. The resulting equations suggest that Weeki Wachee Springs flow (as with other springs of the region) is directly related to ground-water levels in the Upper Floridan aquifer which are in turn affected primarily by the magnitude and timing of springshed rainfall (Knochenmus and Yobbi 2001).

TABLE 3
Summary statistics for recent discharge (cubic feet per second) estimates of Weeki Wachee Spring (from USGS 2007b).

SUMMARY STATISTICS						
	Calendar Year 2006		Water Year 2007		Water Years 1994 - 2007	
Annual total	56,363		49,302			
Annual mean	154		135		159	
Highest annual mean					208	2005
Lowest annual mean					124	1994
Highest daily mean	175	Jan 1	161	Oct 1	257	Oct 13, 2004
Lowest daily mean	141	Jun 11	114	Jul 1	101	Jun 29, 1994
Annual seven-day minimum	141	Aug 19	114	Jul 6	102	Jun 26, 1994
10 percent exceeds	172		154		205	
50 percent exceeds	152		136		152	
90 percent exceeds	143		116		119	



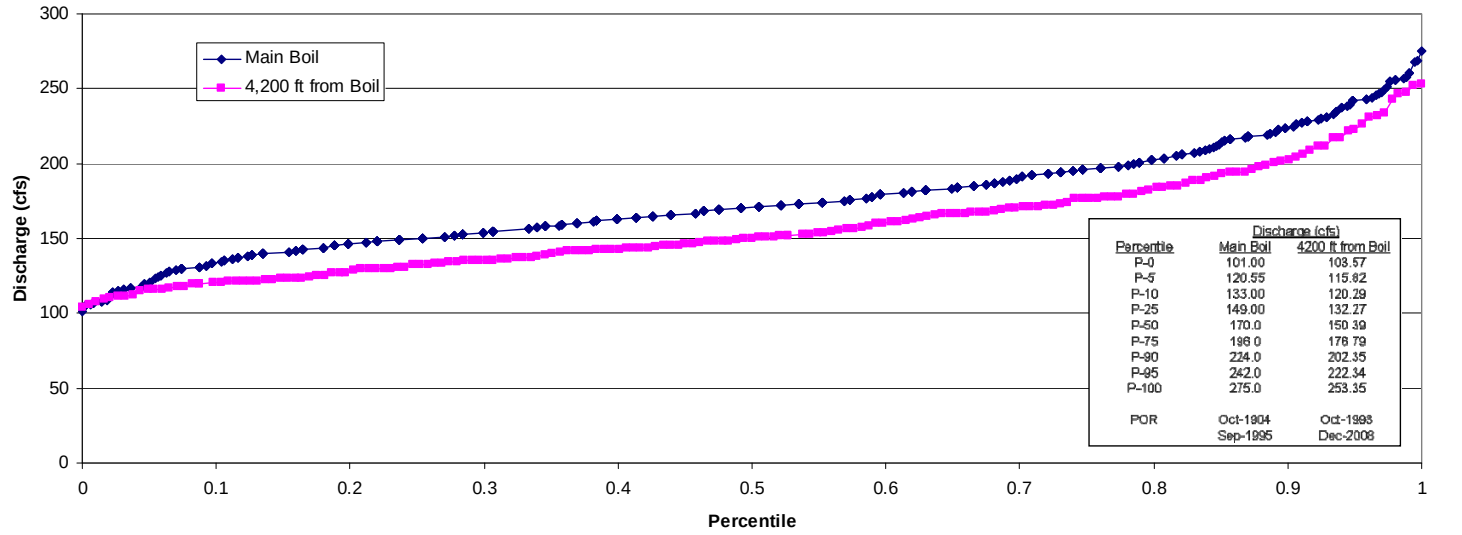


FIGURE 10
Monthly average discharge time series and frequency curve for Weeki Wachee Spring.

Water Quality

As previously discussed, the water chemistry data for Weeki Wachee Spring indicates a dramatic increase in nitrate-nitrogen concentrations. In an analysis of water chemistry trends within Florida springs, Strong (2004) also found a decreasing trend in pH at Weeki Wachee Springs.

Water quality data for Weeki Wachee Springs are summarized from June 1961 through December 2007 from STORET (USGS, FDEP, and SWFWMD data). The numbers of samples collected is highly variable between parameters, ranging from 1 to 271 records. STORET data appear to have been collected from three stations: the main pool, and at stations 350 ft and 4,200 ft downstream. **Table 4** provides statistics for the available water quality parameters, as well as decadal averages (if available), and the period-of-record (POR) dates. Weeki Wachee Springs (main pool) POR averages for several key parameters and the numbers of samples in parenthesis are:

- Water temperature – 23.4°C (n = 246)
- Dissolved oxygen – 2.83 mg/L (n = 213)
- pH – 7.51 SU (n = 222)
- Specific conductance – 289 umhos/cm (n = 271)
- Turbidity – 0.74 NTU (n = 84)
- Color – 2.51 CPU (n= 65)
- Total chloride – 6.81mg/L (n = 89)
- Sulfate – 8.60 mg/L (n = 84)
- Nitrate+nitrite nitrogen – 0.382 mg/L (n = 183)
- Total phosphorus – 0.019 mg/L (n = 200)

TABLE 4
Weeki Wachee Springs water quality table for the period-of-record.

				Decade Average											Statistics						
GROUP DESC	PARAMETER	UNITS	Station	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N	Period of Record	
BACTERIOLOGICAL	EColi	#/100ml	Main Boil											1.00	1.00	1.00	1.00	0.00	2	10/18/2001	1/30/2002
			4200 ft from Boil											519	519	7.00	6,300	1,412	20	1/4/2000	6/5/2001
	Enterococci	#/100ml	Main Boil											2.24	2.24	1.00	18.0	3.65	21	10/18/2001	11/8/2006
			4200 ft from Boil											190	190	4.00	6,800	765	98	1/4/2000	12/4/2007
	FC	#/100ml	Main Boil											1.48	1.48	1.00	2.00	0.512	21	10/18/2001	11/8/2006
			4200 ft from Boil										33.1	240	211	1.00	6,600	833	114	10/5/1998	12/4/2007
	TC	#/100ml	Main Boil											11.2	11.2	1.00	140	31.5	20	10/18/2001	11/8/2006
			4200 ft from Boil										137	1,655	980	1.00	16,000	2,836	36	10/5/1998	6/5/2001
BIOLOGICAL	Chl-a corr	µg/L	4200 ft from Boil										0.500	0.587	0.585	0.275	2.90	0.449	101	11/3/1999	12/4/2007
	Pheo-a	µg/L	4200 ft from Boil										0.500	0.556	0.554	0.00	3.30	0.389	101	11/3/1999	12/4/2007
DISSOLVED OXYGEN	DO	%	Main Boil							37.3	33.5	33.9			33.9	20.0	66.0	9.97	50	5/1/1968	5/5/1983
	DO	mg/L	Main Boil							3.10	3.23	2.90	2.75	1.55	2.83	1.11	7.00	1.14	213	5/1/1968	11/8/2006
			350 ft from Boil										3.24	3.12	3.15	2.10	6.20	0.636	99	8/19/1997	12/11/2006
			4200 ft from Boil										5.21	4.78	4.82	3.13	8.83	0.996	162	10/5/1998	12/4/2007
FLOW	Flow	cfs	Main Boil								182				182	173	193	10.1	3	7/12/1971	6/21/1972
			4200 ft from Boil										154	159	157	101	257	33.4	5573	10/1/1993	12/28/2008
	Flow-Inst	cfs	Main Boil	143	145	163	155	164	182	207	176	180	140		174	101	275	34.9	487	10/31/1904	9/12/1995
	Velocity	ft/s	Main Boil						2.02						2.02	2.02	2.02		1	9/6/1956	9/6/1956
GENERAL INORGANIC	Alk	mg/L as CaCO3	Main Boil							132	129				131	120	139	3.39	27	6/20/1961	10/17/1979
	Cl-T	mg/L	Main Boil							7.88	5.37	5.70	6.32	7.47	6.81	3.00	46.0	4.41	89	6/20/1961	11/8/2006
			4200 ft from Boil										6.81	7.30	7.23	6.10	8.60	0.570	114	10/5/1998	12/4/2007
	Hardness	mg/L as CaCO3	Main Boil							142	141	139	148		142	130	160	6.45	44	6/20/1961	8/17/1994
	Si-D	mg/L	Main Boil							8.27	7.91	8.14	8.10		8.04	7.10	10.0	0.427	60	6/20/1961	8/17/1994
	SO4	mg/L	Main Boil							7.27	7.39	7.48	8.43	9.79	8.60	2.70	14.0	1.74	84	6/20/1961	11/8/2006
			4200 ft from Boil										9.73	9.76	9.76	8.70	11.0	0.540	114	10/5/1998	12/4/2007
GENERAL ORGANIC	TOC	mg/L	Main Boil								3.58	3.13	1.73	0.767	2.26	0.00	22.0	4.39	56	4/28/1971	11/8/2006
			4200 ft from Boil										1.12	0.664	0.728	0.500	8.40	0.923	114	10/5/1998	12/4/2007

TABLE 4 (CONTINUTED)
Weeki Wachee Springs water quality table for the period-of-record.

GROUP DESC	PARAMETER	UNITS	Station	Decade Average										Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
METAL	Ag-T	µg/L	Main Boil									1.00			1.00	1.00	1.00		1	1/31/1985	1/31/1985
	Al-T	µg/L	Main Boil								100	16.7	15.0	6.17	18.0	1.50	100	29.5	20	4/4/1974	4/18/2005
	As-T	µg/L	Main Boil								1.73	1.30	1.00	2.29	1.74	0.00	7.00	1.20	39	5/10/1972	4/18/2005
	Ba-T	µg/L	Main Boil									100		5.60	12.9	4.20	100	26.2	13	1/31/1985	4/18/2005
	Ca-D	mg/L	Main Boil							47.1	46.4	47.2	49.8		47.3	40.0	54.0	2.49	44	6/20/1961	8/17/1994
	Ca-T	mg/L	Main Boil											52.6	52.6	46.5	59.4	2.88	41	10/18/2001	11/8/2006
			4200 ft from Boil										51.6	53.2	53.0	48.3	59.2	2.21	114	10/5/1998	12/4/2007
	Cd-T	µg/L	Main Boil								1.33	1.00	1.00	0.304	0.742	0.00	2.00	0.612	30	5/10/1972	4/18/2005
	Co-T	µg/L	Main Boil								0.00			0.663	0.616	0.00	1.00	0.368	14	5/10/1972	4/18/2005
	Cr-T	µg/L	Main Boil								0.00	1.00	10.0	0.936	1.34	0.00	10.0	2.20	18	6/2/1970	4/18/2005
	Cu-T	µg/L	Main Boil								0.00	1.00	4.00	1.95	1.90	0.00	4.00	1.09	17	5/10/1972	4/18/2005
	Fe-T	µg/L	Main Boil								67.3	88.0	20.0	6.50	46.6	2.50	320	66.2	38	5/10/1972	4/18/2005
	Hg-T	µg/L	Main Boil								0.433	0.100	0.275		0.274	0.00	0.700	0.212	27	4/28/1971	10/22/1992
	K-D	mg/L	Main Boil							0.662	0.321	0.273	0.450		0.427	0.00	5.00	0.728	44	6/20/1961	8/17/1994
	K-T	mg/L	Main Boil											0.332	0.332	0.210	0.410	0.039	41	10/18/2001	11/8/2006
			4200 ft from Boil										0.289	0.325	0.320	0.150	0.590	0.045	114	10/5/1998	12/4/2007
	Mg-D	mg/L	Main Boil							9.43	5.60	5.33	5.42		6.64	3.60	55.0	7.52	44	6/20/1961	8/17/1994
	Mg-T	mg/L	Main Boil											5.95	5.95	5.10	6.80	0.344	41	10/18/2001	11/8/2006
			4200 ft from Boil										5.82	6.11	6.07	5.50	6.80	0.268	114	10/5/1998	12/4/2007
	Mn-T	µg/L	Main Boil								9.00	10.0	10.0	0.223	5.92	0.00	20.0	5.45	36	5/10/1972	4/18/2005
	NA-D	mg/L	Main Boil							4.82	3.37	3.20	3.48		3.77	2.40	27.0	3.61	44	6/20/1961	8/17/1994
	NA-T	%	Main Boil							6.08	5.14	4.91	4.83		5.32	2.00	27.0	3.42	44	6/20/1961	8/17/1994
	NA-T	mg/L	Main Boil											4.33	4.33	3.60	5.50	0.412	41	10/18/2001	11/8/2006
			4200 ft from Boil										3.91	4.31	4.25	3.60	4.99	0.311	114	10/5/1998	12/4/2007
	Ni-T	µg/L	Main Boil								0.00	1.00	1.00	0.982	0.950	0.00	2.00	0.389	25	4/4/1974	4/18/2005
	Pb-T	µg/L	Main Boil								0.00	3.33	1.00	2.11	2.19	0.00	5.00	1.42	24	5/10/1972	4/18/2005
	SAR	ratio	Main Boil							0.162	0.114	0.100	0.100		0.123	0.100	0.900	0.122	44	6/20/1961	8/17/1994
	Se-T	µg/L	Main Boil											4.11	4.11	2.00	10.5	2.27	14	10/18/2001	4/18/2005
	SR-D	µg/L	Main Boil							170	203	225	187		207	100	340	49.5	32	5/1/1968	8/17/1994
	SR-T	µg/L	Main Boil											183	183	174	193	6.10	13	10/18/2001	4/18/2005
	Zn-T	µg/L	Main Boil								0.00		5.00	3.98	3.79	0.00	10.0	2.86	16	5/10/1972	4/18/2005

TABLE 4 (CONTINUTED)
Weeki Wachee Springs water quality table for the period-of-record.

GROUP DESC	PARAMETER	UNITS	Station	Decade Average											Statistics					Period of Record	
				1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	Average	Min	Max	StDev	N		
NITROGEN	NH4-N	mg/L	Main Boil								0.035	0.018	0.014	0.007	0.019	0.00	0.780	0.055	203	7/12/1971	11/8/2006
			4200 ft from Boil										0.006	0.008	0.008	0.005	0.028	0.005	114	10/5/1998	12/4/2007
	NO2-N	mg/L	Main Boil								0.008	0.007	0.010		0.008	0.00	0.010	0.004	161	11/17/1971	9/22/1999
	NO3-N	mg/L	Main Boil								0.092	0.155	0.360		0.128	0.00	0.580	0.091	83	11/17/1971	9/14/1998
	NOx-N	mg/L	Main Boil								0.113	0.201	0.468	0.765	0.382	0.010	0.930	0.254	183	7/31/1974	11/8/2006
			4200 ft from Boil										0.467	0.640	0.615	0.360	0.860	0.129	114	10/5/1998	12/4/2007
	OrgN	mg/L	Main Boil								0.261	0.187	0.257		0.231	0.00	1.80	0.338	96	6/2/1970	9/8/1997
	TKN	mg/L	Main Boil								0.200	0.194	0.208	0.043	0.165	0.00	1.30	0.192	185	7/31/1974	11/8/2006
			4200 ft from Boil										0.032	0.041	0.040	0.030	0.120	0.018	114	10/5/1998	12/4/2007
	TN	mg/L	Main Boil								0.301	0.385	0.643		0.369	0.090	1.50	0.304	81	10/25/1973	9/8/1997
OXYGEN DEMAND	BOD5	mg/L	Main Boil								0.808	0.200		0.760	0.691	0.00	2.40	0.655	16	4/28/1971	10/18/2001
PHOSPHORUS	OrthoP	mg/L	Main Boil								0.014	0.011	0.012	0.006	0.012	0.00	0.150	0.011	180	11/17/1971	11/8/2006
			4200 ft from Boil										0.009	0.009	0.009	0.002	0.023	0.004	114	10/5/1998	12/4/2007
	PO4-T	mg/L as PO4	Main Boil							0.027	0.040				0.037	0.00	0.110	0.025	15	3/8/1963	11/17/1971
	TP	mg/L	Main Boil								0.020	0.023	0.024	0.007	0.019	0.002	0.150	0.015	200	11/17/1971	11/8/2006
			350 ft from Boil										0.009	0.020	0.016	0.004	0.720	0.070	102	7/30/1997	12/11/2006
			4200 ft from Boil										0.010	0.011	0.011	0.004	0.026	0.004	114	10/5/1998	12/4/2007
PHYSICAL	Color	CPU	Main Boil							4.62	1.29	4.09	5.00	0.476	2.51	0.00	15.0	3.02	65	6/20/1961	11/8/2006
			350 ft from Boil										1.50	1.09	1.13	0.00	5.00	1.08	80	5/7/1999	12/11/2006
			4200 ft from Boil										3.44	2.09	2.28	0.00	20.0	4.00	114	10/5/1998	12/4/2007
	Depth	m	Main Boil											29.7	29.7	13.7	45.7	22.6	2	10/18/2001	10/25/2004
			350 ft from Boil										0.877	0.751	0.788	0.250	1.80	0.571	202	7/30/1997	12/11/2006
			4200 ft from Boil										1.77	1.06	1.12	0.300	2.20	0.403	167	10/5/1998	12/4/2007
	pH	SU	Main Boil							7.87	7.48	7.46	7.53	7.51	7.51	5.00	8.70	0.484	222	6/20/1961	11/8/2006
			350 ft from Boil											7.90	7.90	7.33	9.15	0.376	39	12/20/2000	12/11/2006
			4200 ft from Boil										7.78	7.64	7.65	7.14	8.24	0.192	162	10/5/1998	12/4/2007
	Secchi	m	Main Boil											21.7	21.7	13.7	46.0	13.6	5	10/18/2001	2/7/2006
			350 ft from Boil										1.50	1.27	1.34	0.800	1.80	0.245	100	7/30/1997	12/11/2006
			4200 ft from Boil										1.65	1.17	1.20	0.800	2.20	0.286	130	10/5/1998	12/4/2007
	SpCond	umhos/cm	Main Boil							273	277	281	298	318	289	100	423	27.3	271	6/20/1961	11/8/2006
			4200 ft from Boil										299	316	315	239	397	16.3	267	10/5/1998	12/4/2007
	Stage	ft	Main Boil			1.33	1.65	7.00	2.71	2.92	2.35	2.46	1.81	0.866	2.01	-0.200	180	2.20	13852	2/4/1929	7/5/2008
	Stage	ft MSL	Main Boil									3.82	4.89		4.14	1.12	10.7	2.97	10	10/22/1984	9/9/1997
	Stage	ft	4200 ft from Boil										0.00	5.83	5.75	-0.090	9.09	3.39	78	11/3/1999	10/9/2007
	Turb	NTU	Main Boil								0.966	0.750		0.118	0.744	0.00	5.00	0.969	84	2/11/1970	11/8/2006
			4200 ft from Boil										0.400	0.263	0.282	0.025	1.60	0.300	114	10/5/1998	12/4/2007
SOLID	TDS	mg/L	Main Boil							168	158	158	166	174	164	145	257	14.8	105	6/20/1961	11/8/2006
			4200 ft from Boil										166	174	173	119	201	12.3	114	10/5/1998	12/4/2007
	TSS	mg/L	Main Boil											4.00	4.00	4.00	4.00	0.00	21	10/18/2001	11/8/2006
			4200 ft from Boil										4.44	4.11	4.16	4.00	9.00	0.748	114	10/5/1998	12/4/2007
TEMPERATURE	Air Temp	C	Main Boil										25.9		25.9	17.5	34.0	4.85	14	10/16/1990	3/2/1995
	Wtr Temp	C	Main Boil							23.0	23.6	23.4	23.3	23.6	23.4	18.0	27.0	1.13	246	3/16/1962	11/8/2006
			350 ft from Boil										24.1	23.9	23.9	23.0	25.5	0.389	88	7/30/1997	12/17/2004
			4200 ft from Boil										23.7	23.9	23.9	22.1	25.6	0.470	162	10/5/1998	12/4/2007

Water chemistry field parameters were measured on August 13, 2008 from two locations surrounding the main vent and also during the park tour boat trip along the upper spring run (**Figure 11**). Measured temperatures in the spring pool were typical at approximately 23 °C, while specific conductance was approximately 325 µS/cm (**Figure 12**). Dissolved oxygen concentrations from the spring vent were approximately 1.5 mg/L (or 20% saturated) and then gradually rose with distance downstream to a maximum of about 3.5 mg/L (45% saturated, **Figure 12**). It is important to note that while these dissolved oxygen values were measured in the afternoon, ambient conditions included heavy cloud cover. Higher mid-day dissolved oxygen concentrations are to be expected during days without cloud cover. Field measured pH values varied slightly between the spring vent and the run, but averaged near 7.7 standard units (**Figure 12**).



FIGURE 11
Weeki Wachee Springs sampling locations (red icon and line) where field parameters were measured on August 13, 2008.

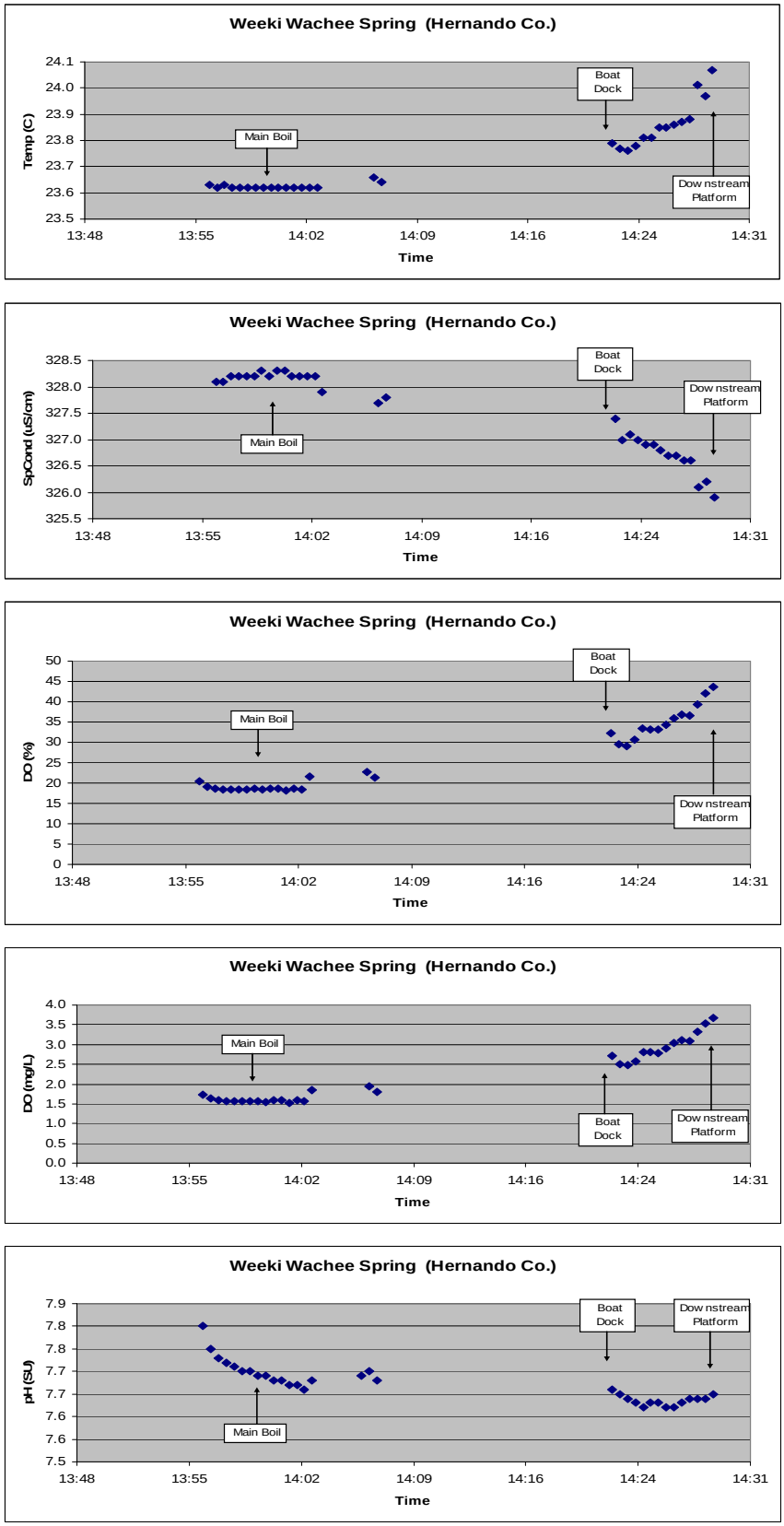


FIGURE 12
Field parameters measured from Weeki Wachee Spring on August 13, 2008.

Biological

Vegetation

During the site visit on August 13, 2008, submersed aquatic vegetation within the Weeki Wachee Spring pool appeared to be dominated by benthic filamentous algae. In the uppermost spring run, strap-leaved sagittaria (*Sagittaria kurziana*) was sparsely present, small beds of the macro algae muskgrass (*Chara sp.*) were seen, and several types of filamentous algae were growing from sediments and underwater structures.

A historical detailed description of the submersed aquatic vegetation (SAV) has been presented by Sloan (1956) as part of an examination of the aquatic insects utilizing Weeki Wachee Springs. Even at this date, SAV was sparsely present in the pool but the dominant species was strap-leaf sagittaria. In the upper 3.2 km (2 mi) of the spring run, the order of dominance by SAV was strap-leaf sagittaria followed by southern naiad (*Najas guadalupensis*). By 9.7 km (6 mi) downstream the order of dominance had switched between these two plants and was maintained until the lower spring run where sago pondweed (*Potamogeton pectinatus*) became dominant, followed by tape grass (*Vallisneria americana*), strap-leaf sagittaria, and southern naiad. Abundance of SAV ranged from 10-15% percent area coverage (PAC) in the spring pool to 45% PAC in the mid-stream area (**Table 5**, Sloan 1956).

Modern assessments, from the 1998 to 2005 time period, of the SAV in the Weeki Wachee system have been made by Frazer *et al.* (2006). This research reveals that while the same historical SAV species can be observed in the spring system, two additional species, the macroalgae muskgrass (*Chara spp.*) and hydrilla (*Hydrilla verticillata*), are now present. Additionally, filamentous algae were the most frequently observed SAV type in five of the six years of monitoring (Frazer *et al.* 2006). In Sloan's 1956 report, filamentous algae in the Weeki

Wachee system are not discussed, and while almost certainly present, this lack of discussion suggests that filamentous algal abundance may have been historically low in this spring system. A listing of the frequency of occurrence by SAV species and year is shown in **Table 6** and a comparison between the 1998-2000 and 2003-2005 time periods is shown in **Table 7**. The environmental factors contributing to the distribution and abundance of the SAV in the Weeki Wachee Springs system were examined by Frazer *et al.* (2001), who reported that riparian shading was negatively correlated with the presence of SAV.

Aquatic plants in the Weeki Wachee Springs run have been managed by the state through herbicide applications, apparently from at least 2002 through the present. The amount of aquatic vegetation treated during the 2002-2003 fiscal period was 0.81 ha (2 ac) of floating plants and 11.3 ha (28 ac) of hydrilla(FDEP 2007). During the 2006-2007 fiscal period, no floating plants were treated while approximately 0.4 ha (1 ac) of cattails and 2.8 ha (7 ac) of hydrilla were treated (FDEP 2007).

The macroalgae community of the Weeki Wachee spring pool area was surveyed on two dates, March 24 and November 5, 2003 as part of a multi-spring macroalgae study (Stevenson *et al.* 2007). During these events, macroalgae in the headspring had 74.1% coverage and a thickness of 28.4 cm (11.28 in) in March and 86.4% coverage and a thickness of 55.1 cm (21.7 in). Average macroalgae species composition for the two sampling events were 52.5% *Lyngbya sp.*, 21.6% *Dichotomosiphon sp.*, 17.3% *Spirogyra sp.*, 9.9% *Oscillatoria sp.*, 9.9% *Hydrodictyon sp.*, 3.7% diatoms, and 1.3% *Audouinella sp.* (Stevenson *et al.* 2007).

The dramatic thickness of macroalgae in the spring pool was addressed by the SWFWMD, who estimated that the Weeki Wachee headspring contained an estimated 6,000 cubic yards of accumulated organic debris and *Lyngbya* biomass. Removal of the sediments and organic

material as well as the planting of tape grass in the headspring and upper river took place in 2008 (SWFWMD 2008).

The submersed aquatic vascular plant community of the Weeki Wachee spring pool area was also surveyed by Stevenson *et al.* (2007). In March they estimated vascular plant coverage to be 1.2% and in November they estimated coverage to be 7.4%, with dominant species being "moss" (*e.g. Fontinalis sp.*), *Ludwigia sp.,* and *Chara sp.* (a macroalgae with plant-like appearance).

TABLE 5
Submersed aquatic plants and environmental features in Weeki Wachee Springs. The abbreviations S. l., N. g., P. p., V. n., and R. m stand for *Sagittaria lorata* (*S. kurziana*) , *Najas guadalupensis*, *Potamogeton pectinatus*, *Vallisneria neotropicalis* (*V. americana*), and *Ruppia maritima*, respectively (from Sloan 1956).

Station and miles from Boil	Dominant Submerged Rooted Aquatics		Bottom Composition	Temperature °C		Current Velocity (Surface of Channel)
	Order of Dominance	Percent Bottom Covered		Extreme Maximum	Extreme Minimum	Feet/Second
W−1 (0).....	S.l. with some epiphytic algae	10-15	White sand covered sparsely with plant detritus	24.0	23.2	Less than 0.01
W−2 (2.0)....	S.l., N.g.	30	From firm white sand to black silt and detritus	25.3	23.3	0.90
W−3 (6.4)....	N.g., S.l.	45	Same type as W−2	26.0	19.0	0.90*
W−4 (8.5)....	N.g., S.l.	30	Same as W−2 except silt lighter in color	28.0	18.0	0.72
W−5 (11.7)...	P.p., V.n., S.l. (drops out in this station), N.g.	15-25	From fine white sand to brown silt	28.0	....	....
W−6 (13.6)...	V.n., P.p., N.g., small amount of R.m.	30-40	Sand mixed with black silt. H_2S odor	30.8	15.7	Less than 0.01

*Average of USGS cross-sectional values.

TABLE 6
The frequency of occurrence (% of stations sampled) of submersed aquatic vegetation in the Weeki Wachee River. Five stations were sampled along each of 20 river transects (n = 100) during August of each year (from Frazer *et al.* 2006).

RIVER	Year	Species	Frequency of Occurrence (%)
WEEKI WACHEE	1998	Chara sp.	0
		Filamentous algae	68
		Hydrilla verticillata	50
		Najas guadalupensis	32
		None	16
		Ruppia maritima	0
		Sagittaria kurziana	11
		Vallisneria americana	7
	1999	Chara sp.	0
		Filamentous algae	73
		Hydrilla verticillata	49
		Najas guadalupensis	39
		None	12
		Ruppia maritima	0
		Sagittaria kurziana	10
		Vallisneria americana	17
	2000	Chara sp.	1
		Filamentous algae	37
		Hydrilla verticillata	41
		Najas guadalupensis	46
		None	22
		Ruppia maritima	0
		Sagittaria kurziana	8
		Vallisneria americana	3
	2003	Chara sp.	5
		Filamentous algae	51
		Hydrilla verticillata	29
		Najas guadalupensis	36
		None	30
		Ruppia maritima	0
		Sagittaria kurziana	5
		Vallisneria americana	4
	2004	Chara sp.	6
		Filamentous algae	54
		Hydrilla verticillata	34
		Najas guadalupensis	53
		None	20
		Ruppia maritima	0
		Sagittaria kurziana	5
		Vallisneria americana	11
	2005	Chara sp.	14
		Filamentous algae	52
		Hydrilla verticillata	32
		Najas guadalupensis	33
		None	28
		Ruppia maritima	1
		Sagittaria kurziana	6
		Vallisneria americana	9

TABLE 7
The frequency of occurrence (% of stations sampled) of submersed aquatic vegetation in the Weeki Wachee River by time period and their corresponding differences (from Frazer *et al.* 2006).

SPECIES	1998 – 2000 FREQUENCY OF OCCURRENCE (%)	2003 – 2005 FREQUENCY OF OCCURRENCE (%)	PERCENTAGE CHANGE
Chara sp.	0.3	8.3	2400
Filamentous algae	59.3	52.3	-12
Hydrilla verticillata	46.7	31.7	-32
Najas guadalupensis	39.0	40.7	4
None	16.7	26.0	56
Ruppia maritima	0.0	0.3	100
Sagittaria kurziana	9.7	5.3	-45
Vallisneria americana	9.0	8.0	-11

Macroinvertebrates

During the site visit on August 13, 2008 by WSI, numerous small snails, similar in appearance to the genus *Elimia*, were observed in the spring run. Several journal publications concern invertebrate species collected from the Weeki Wachee system. Among the invertebrates known to utilize Weeki Wachee Springs is the Lepidoptera *Parargyractis drumalis*. This tiny moth, which has aquatic larvae, is known only from Florida, Weeki Wachee Springs (north of Tampa) south to Fort Lauderdale on the east coast and Sarasota on the west coast (Heppner 1976). Another possible endemic macroinvertebrate of the Weeki Wachee River system is the water strider (Hemiptera), *Metrobates hesperius depilatus*. Nearly 400 individuals were collected on the Weeki Wachee River July 18, 1948, and subsequent examination suggested their status as a distinct sub species (Hussey and Herring 1949).

A detailed examination of the aquatic insect larvae utilizing Weeki Wachee Springs (and Homosassa) has been provided by Sloan (1956) who collected species from the orders Diptera, Ephemeroptera, Trichoptera, Hemiptera, Coleoptera, Lepidoptera, and Odonata. This research was conducted to address the observation that fewer species of aquatic insect larvae are found in spring boil/pool areas than in the associated spring runs (**Figure 13**). A noticeable gradient in dissolved oxygen (low in the spring pool and higher in the spring run) was observed in the

Weeki Wachee system, while a gradient in chloride concentrations was more abbreviated, low chloride in the pool and run, then abruptly increasing at the estuary. By examining the correlation of the spatial distribution of aquatic insects with the physical and chemical environmental factors measured at the collection sites; Sloan (1956) concluded that oxygen and salinity gradients influenced the observed insect distributions. Sloan (1956) also noted similarities between insect fauna of springhead areas and organically polluted waters, suggesting that the similarity may be the result of both environments having low dissolved oxygen concentrations.

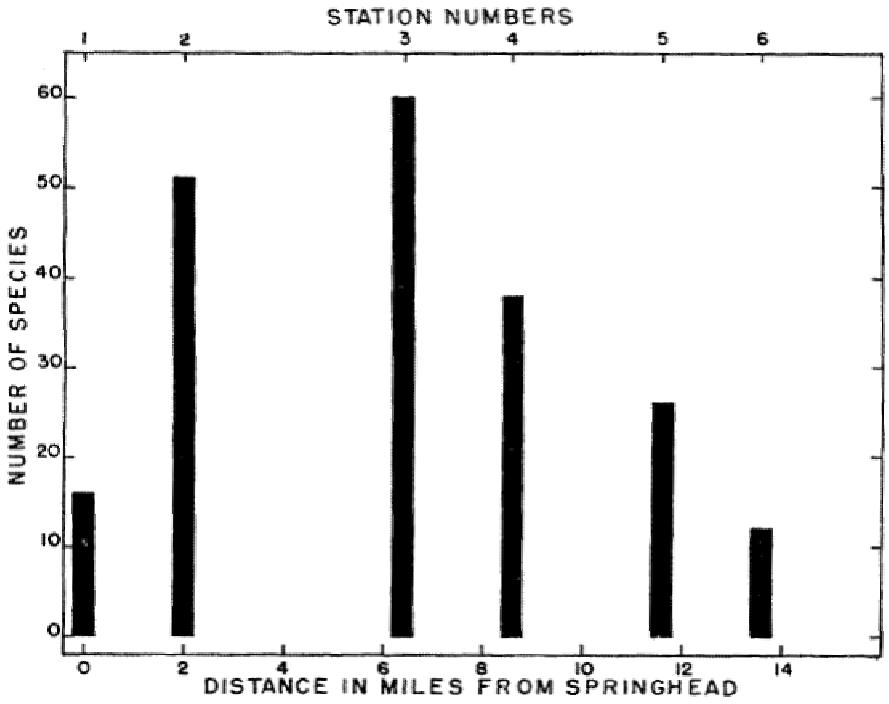


FIGURE 13
The number of aquatic insect larvae collected from Weeki Wachee Springs by location (from Sloan 1956).

More recent investigations of the benthic invertebrates of the Weeki Wachee River have been made during 2005 in which core samplers were used to collect infauna and sweep nets were used to collect epifauna from fifteen transects in the Weeki Wachee River (Janicki Environmental, Inc. 2006). Dominant epifauna taxa were the polychaete *Laeonereis culveri* and

the amphipod *Gammarus mucronatus*; while the dominant epifaunal taxa consisted of amphipods (*Gammarus mucronatus* and *Grandidierella bonnieroides*) and the isopod *Uronmunna reynoldsi* (Janicki Environmental, Inc. 2006).

The only mention of crayfish for the Weeki Wachee Springs system comes from an interesting account of the Twin Dees Springs cave system made during a 1996 dive by Pete Gomez (Floridacaves.com). He noted a "thriving" community of cave crayfish occupying a main cavern ("Middle Earth"). The density of crayfish appeared high, about 3-5 per square ft, as he observed hundreds of small depressions in the silt floor created by the crayfish.

Macro fauna

Fish

During the site visit on August 13, 2008, fish observed included largemouth bass (*Micropterus salmoides*), sunfish (*Lepomis spp.*), and striped mullet (*Mugil cephalus*). Because this spring run discharges into the Gulf of Mexico, marine fish, including Crevalle jack (*Caranx hippos*), gray snapper (*Lutjanus griseus*), sheepshead (*Archosargus probatocephalus*), and Atlantic needlefish (*Strongylura marina*) are common in the spring run, particularly in the lower reaches and during the cold season (personal observations).

As part of the minimum flows and levels evaluation for the Weeki Wachee system, the fish community utilizing the lower Weeki Wachee River was sampled using three types of sampling gear (seine, trawl, and plankton net) during 2004-2005 (Matheson *et al.* 2005). Results of this sampling found that rainwater killifish (*Lucania parva*) were the dominant catch in all three collection types, while dominant plankton net taxa included larval gobies and blennies. Killifish (*Lucania sp.*), pinfish (*Lagodon sp.*) and mojarras (Gerreidae) accounted for 90%of the trawl catch, while the seine gear captured a greater diversity of taxa, with 90% of the catch represented by

killifish, silversides (Atherinopsidae), mojarras, pinfish, sheepshead and sailfin mollies (*Poecilia latipinna*) (Matheson *et al.* 2005).

The Weeki Wachee River has been sampled for fish using electrofishing gear by the FWC on three occasions (1984, 1991, and 2005). Results from this sampling indicate that a total of 20 species have been collected from the river, with a range of 13 to 16 species per sampling event (SWFWMD 2005). The most commonly collected species were centrarchids (sunfish family), see **Table 8** for details

TABLE 8
Species composition (percent) of fish collected by electrofishing in the Weeki Wachee River (from SWFWMD 2005).

	1984	1991	2005
Largemouth bass	25.9	10.6	20.3
Bluegill	6.1	11.6	10.2
Redear sunfish	9.5	3.5	2.5
Spotted sunfish	31.5	56.5	20.3
Warmouth	0.3	3.2	0.0
Florida spotted gar	0.0	1.7	3.4
Lake chubsucker	18.1	5.2	0.0
Brown bullhead	1.3	1.0	0.0
Yellow bullhead	0.3	0.7	0.9
Seminole killifish	0.5	3.2	0.0
Coastal shiner	0.5	0.0	10.3
Mosquitofish	0.0	0.0	6.8
Bluefin killifish	0.0	0.0	4.2
Least killifish	0.0	0.0	5.9
Atlantic needlefish	0.0	0.8	0.8
Striped mullet	0.5	1.0	2.5
Striped mojarra	0.0	1.0	6.8
American eel	5.2	0.0	0.8
Hogchoker	0.3	0.0	1.8
Jack crevalle	0.0	0.0	2.5
Total Species	13	13	16
Fish per minute	3.1	7.2	5.9

Reptiles

During the site visit on August 13, 2008, several Florida cooters (*Pseudemys spp*.) were observed in the spring pool. Cooters are also commonly seen basking in the spring run as well as smaller alligators (personal observations). A non-fatal alligator attack was recorded from the Weeki Wachee spring run in July, 1948; when a male alligator slightly over 9 feet in length, bit the arm and hand of woman swimming alone in the stream (Allen and Neill 1949).

Manatees

Weeki Wachee Springs and the associated river system are available to manatees due to the direct connection to the Gulf of Mexico. However, park staff report that manatees only occasionally visit the headspring pool and the number of manatees observed in the spring run is low compared to nearby coastal spring systems (*e.g.* Crystal and Homosassa Rivers). Aerial surveys conducted by the US Fish and Wildlife Service between 1996 and 2005 reveal that the Weeki Wachee Springs system averaged ten animals per survey during that time period; with the maximum number of manatees counted in the Weeki Wachee being 34 animals on February 13, 2006 (Heyl 2008).

The suitability of the Weeki Wachee Springs system for manatees was investigated by Taylor (2006) who found that anthropogenic use and modification of the spring pool shoreline has resulted in the erosion of beach sand into the spring system. As a result, a shallow shoal near the mouth of the spring pool has developed which would likely prevent manatees from entering the spring pool during low water levels. Similarly, portions of the Weeki Wachee River have shallow riffles and bars due to accumulation of sand which may also limit manatee access (Taylor 2006).

Ecosystem Functions

This spring system was previously by Odum (1957) who estimated metabolism during a one-day sampling event in the spring pool during the summer of 1955. The gross primary production estimate for Weeki Wachee was estimated to be 10.7 g $O_2/m^2/d$ and primary production was observed to be a function of available light (Odum 1957).

This system is suitable for using changes in dissolved oxygen concentration to estimate ecosystem productivity as dissolved oxygen concentrations increased relatively quickly, from 1.5 to 3.5 mg/L, in about 2,000 feet of upper spring run. Although the single main spring vent may reduce variations in water chemistry, there is minor spring input (Twin Dees Springs) in the upper spring run whose inputs will need to be quantified.

Human-Use Attendance and Activities

Weeki Wachee Springs likely represents one of the first spring systems to be developed for tourism purposes, with the first mermaid show being performed there in 1947. Another major milestone in the development of this spring was the 1982 opening of Buccaneer Bay Water Park. The associated structures of the mermaid show and the water park are still in place today and have dramatically altered the appearance of this spring. Today, tourism opportunities at Weeki Wachee Springs include the Mermaid show, a river boat cruise, animal shows, and souvenir and food concessions. In-water recreation opportunities include swimming, water slides, and tubing in a portion of the spring pool area (Buccaneer Bay). Canoes are available for rental and in the past, local dive shops were sporadically permitted to utilize the spring pool for dive classes. The cave system of Weeki Wachee Springs does not appear to have been mapped, although nearby Twin Dees Springs has been mapped. Neither of these spring systems are currently available for cave diving.

In the spring run, fishing and the operation of power boats are permitted, and it is not unusual to see tubers, canoers, and power boaters, particularly during the summer. Along the upper to middle spring run, two public beach type recreation areas are managed by the state (FWC), while in the lower spring run, Hernando County operates a public park (Rogers Park) which has a boat ramp, beach area, playground, cooking, and restroom facilities. At the mouth of the Weeki Wachee River, there is another public property with boat ramps, a fishing pier, picnic, and restroom facilities.

Until November 2008, Weeki Wachee has been operated as a private attraction and attendance figures were not public. During the recent time period, annual visitation numbers range around 200,000 persons a year, and peak visitation occurred in the 1950's and 60's, with close to one million annual visitors. (John Athanason, Marketing Manager, personal communication).

Minimum Flow and Levels

A MFL has recently been adopted for the Weeki Wachee River System by the Southwest Florida Water Management District based on a comprehensive evaluation (Heyl 2008). The proposed MFL for the Weeki Wachee system allows for a 10% reduction in flows that have been corrected for ground water withdrawals. Depending on the method of averaging historic flow data, the minimum flow for the Weeki Wachee River System may range from 128 to 141 cfs (**Table 9**, Heyl 2008).

Additional evaluation of the thermal refuge provided by the Weeki Wachee Springs system has been conducted in which a three-dimensional hydrodynamic model was developed allowing for the projection of the intrusion of the colder, saline waters into the Weeki Wachee River under varying freshwater flows from the spring (ATM 2007). Results of this modeling

indicate that the maximum flow reduction that corresponded to a 15 % (an *a priori* limit) reduction in manatee habitat area/volume was approximately a 5 % reduction in flow (ATM 2007). This analysis also suggests that the available thermal refuge is capable of supporting over 1,300 manatees, a value that is two orders of magnitude above the present manatee utilization of Weeki Wachee Springs.

TABLE 9
Weeki Wachee minimum flows based on various long-term averages (from Heyl 2008).

Criterion	Minimum Flow (cfs)
Minimum 10 yr Moving Average (Based On Annual Average Flows)	141
Minimum 10 yr Moving Average (Based On Annual Median Flows)	131
Minimum 5 yr Moving Average (Based On Annual Average Flows)	136
Minimum 5 yr Moving Average (Based On Annual Median Flows)	128

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