Wekiva River and Rock Springs Run Pollutant Load Reduction Goals

Report to the Florida Department of Environmental Protection

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Executive Summary

The Wekiva Parkway and Protection Act of 2004 (Chapter 369, Part III, FS) required the St. Johns River Water Management District (SJRWMD) to develop Pollutant Load Reduction Goals (PLRGs) for the Wekiva Study Area (WSA, Figure 1). The major spring-fed ecosystems within the WSA are Wekiwa Springs, the Wekiva River, Rock Springs, and Rock Springs Run. It is for these systems that the SJRWMD developed PLRG recommendations. PLRGs are the reductions in pollutant loadings needed to meet water quality standards or goals. The development of a PLRG is a four-step process: 1) determine the nature and degree of impairment, 2) identify the causative pollutant(s), 3) determine the acceptable concentration of each causative pollutant, and 4) determine the reduction in loading required to achieve the acceptable concentration of each causative pollutant.

The SJRWMD designed a project to develop multiple lines of evidence for the PLRG: relevant information in the scientific literature; biological, chemical, and physical data for the Wekiva River and Rock Springs Run and reference (less impacted) streams; mesocosm studies in the Wekiva River and Rock Springs Run and reference streams; and data for other spring-fed streams in Florida. Two reference streams were used to aid the assessment of impairment: Alexander Spring Creek Run and Juniper Creek (Figure 2). This work indicates potential impairment of the Wekiva River and Rock Springs Run in terms of ecosystem processes, overgrowth of periphytic algae, dominance of the periphyton by Cyanobacteria (blue-green algae), and toxic effects on larvae of nitrate-sensitive aquatic organisms. Two causative pollutants create these potential effects: nitrate and total phosphorus (TP).

Two water quality standards apply to these effects: nutrients and toxicity. The standard for nutrients requires that they not cause an imbalance in flora and fauna (Chapter 62-302.530[48][b], FAC), such as algal blooms, changes in algal species richness or taxonomic composition, or presence of nuisance algal mats. State and Federal water quality standards require that any pollutant shall not be present at toxic levels (Chapter 62-302.530[62], FAC). Using these standards, there are several lines of evidence that the concentrations of nitrate and TP in the Wekiva River and Rock Springs Run are too high:

1) They are higher than in the reference streams and other less-impacted Florida springs and spring-run streams;
2) They are higher than historical data for springs and spring-run stream;
3) Various measures of ecosystem metabolism are altered in the Wekiva River and Rock Springs Run, as compared to the reference streams and these changes are correlated with higher concentrations of nitrate and TP;
4) In laboratory studies the growth of filamentous Cyanobacteria is accelerated by nitrate;
5) In field studies of other springs, the abundance and growth of epiphytes was correlated with TP;

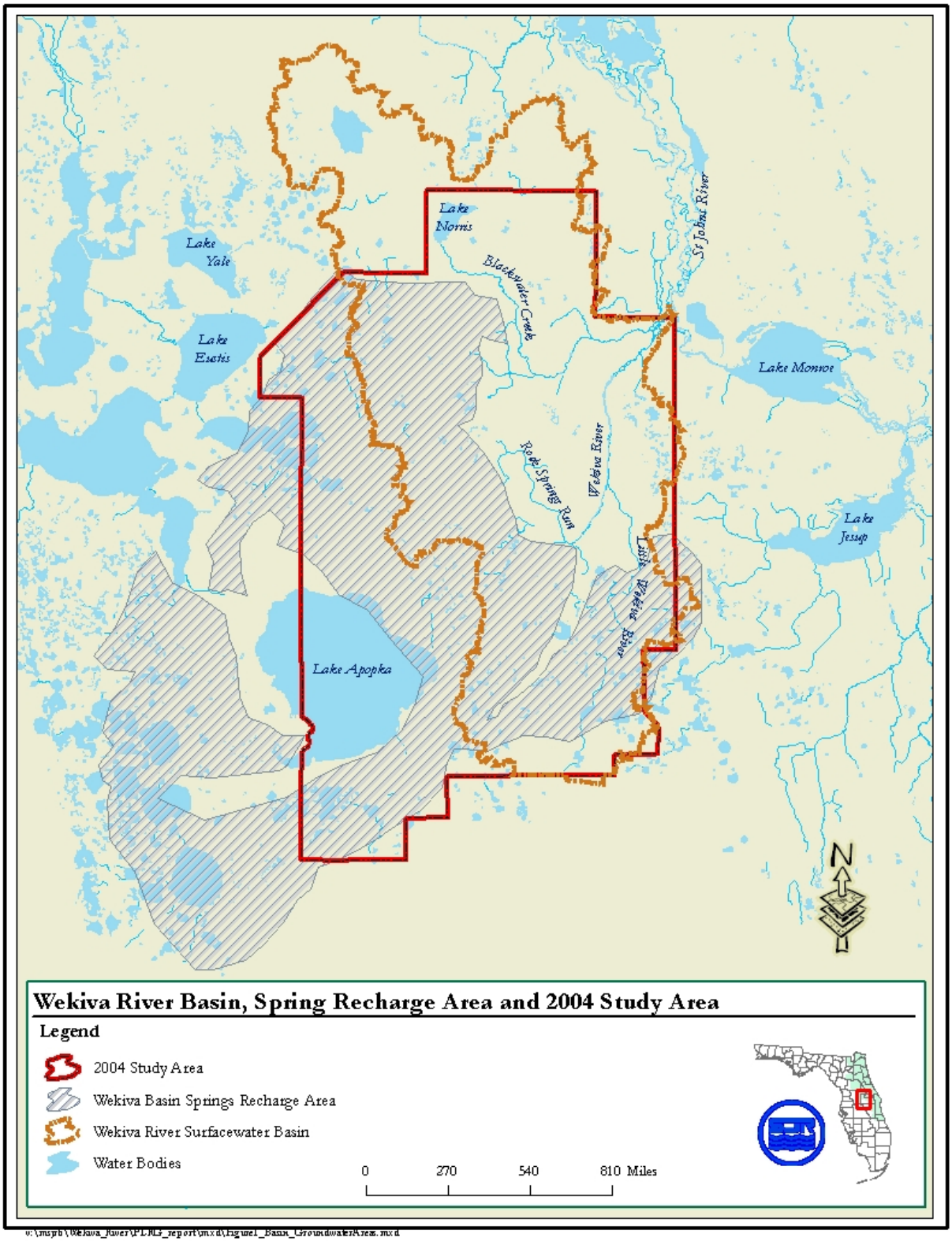

Figure 1 (Executive Summary). The Wekiva River basin, spring recharge area, and 2004 Wekiva Study Area. Source: SJRWMD data.

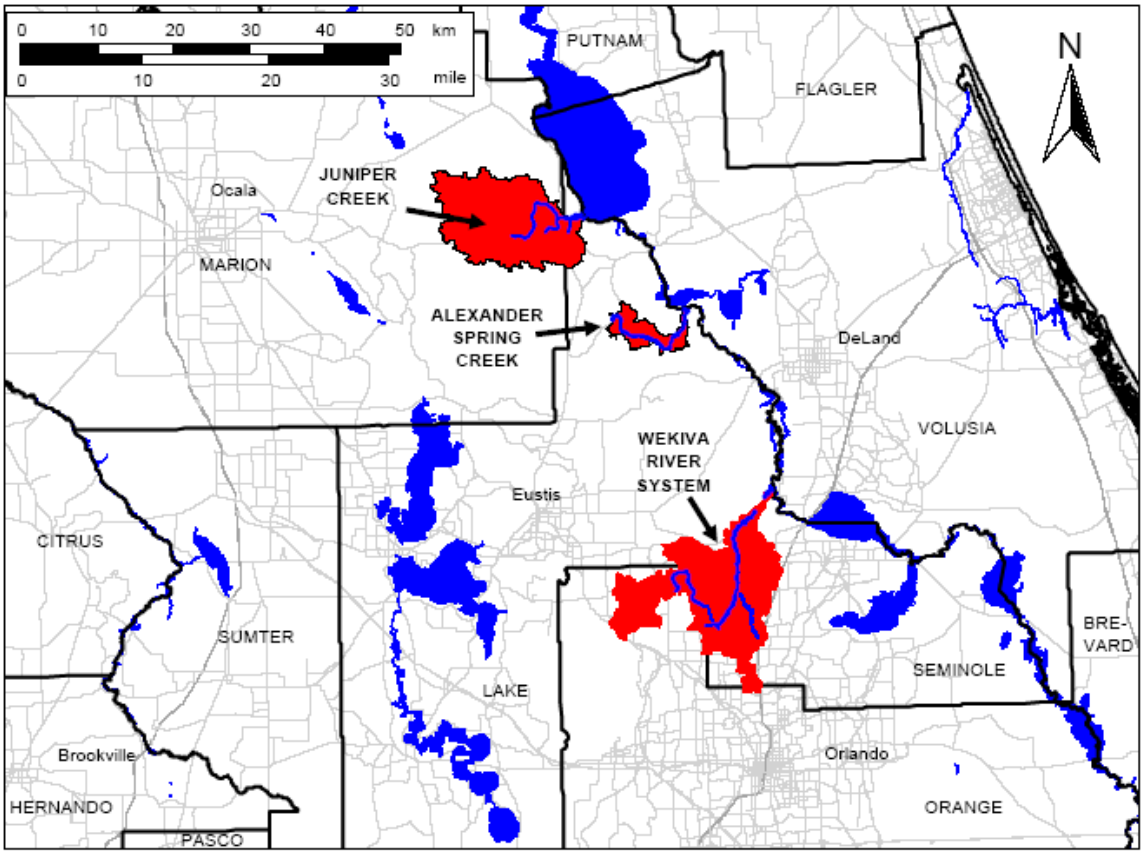

Figure 2 (Executive Summary). Location map showing the Wekiva River System (including the Wekiva River and Rock Springs Run) and the two reference spring-run streams; Alexander Spring Creek and Juniper Creek. Source: WSI, 2005 (Appendix C).

6) In the Wekiva River and Rock Springs Run , the relative abundance of Cyanobacteria and Chlorophyta (algae which are generally considered "nuisance" taxa) was higher in sites with higher TP;
7) Data from studies reported in the scientific literature indicate that nitrate is toxic to larvae of sensitive aquatic insects and amphibians at concentrations that have occurred in the Wekiva River and Rock Springs Run . Nitrate concentrations in the Wekiva River and Rock Springs Run have commonly exceeded estimated no-effects levels for these nitrate-sensitive aquatic organisms.

These observations lead to a variety of potential target concentrations for nutrients (Tables 1 and 2; Figures 3 and 4).

To reduce the potential for violation of water quality standards, the SJRWMD recommends that mean concentrations of nitrate and TP be reduced to 216 µg/L nitrate and 59 µg/L total phosphorus in the Wekiva River and 221 µg/L nitrate and 61 µg/L total phosphorus in Rock Springs Run. These concentrations include a margin-of-safety and were derived using statistical techniques that ensure a very low probability of exceeding thresholds that promote excessive or nuisance algal growth.

Impairment was also demonstrated for total coliform bacteria, which exceeded the state water quality standard. The SJRWMD recommends the state water quality standard of < 2,400 colonies/100 ml as the target concentration for total coliform bacteria.

In order to calculate PLRGs as percent reductions, pollutant concentrations were assumed to vary in direct proportion to the variation in pollutant loads. Thus, percent load reductions were assumed equivalent to the required percent reduction in concentrations:

$$PLRG(\%) = [(cmc - tmc) / cmc] \times 100,$$

Where cmc is the current mean concentration of the pollutant and tmc is the target mean concentration of the pollutant. This method yields load reductions for nitrate and TP ranging from 44 – 89% (Table 3). Reductions in total coliform counts were calculated based on EPA's percent-reduction method (Lehmensiek, 2005).

Spatial and temporal trends were considered in the calculation of PLRGs. Where there was a decreasing temporal trend, the cmc only reflected the recent period when there was no significant trend (i.e. data extending back from the present to that time when a non-significant trend became statistically significant). Spatial trends were also examined (from headspring to confluence with the next downstream system), and where appropriate, concentration reductions were applied to specific segments of each spring-run stream or to the entire stream.

Table 1 (Executive Summary). Potential nitrate-nitrite (NOx) concentration targets based on various lines of investigation.

Reference	Basis for Target	NOx (µg/L)	Statistic
Ecosystem metabolism in the Wekiva River and Rock Springs Run (WSI 2005)	Comparison to metabolism in less-impacted spring-run streams (Juniper & Alexander)	100 - 200	Threshold
	Comparison to other springs in SJRWMD	200	Median
Nitrate toxicity to aquatic animals (Mattson et al. 2005)	90% probability of ≤1,400 µg/L (lowest toxicity threshold for caddisflies)		
	Wekiwa Spring	1,200	Mean
	Rock Spring	1,240	Mean
	New thresholds after application of uncertainty factors	125 - 140	Threshold
	90% probability of <125 µg/L (lowest threshold with uncertainty factor):		
	Wekiwa Spring	108	Mean
	Rock Spring	111	Mean
Rainbow River algal bioassays (Cowell and Dawes 2004)	*Lyngbya wollei* biomass	300 – 600	Threshold
	90% probability of ≤ threshold of 250 µg/L:		
	Wekiva River	216	Mean
	Rock Springs Run	221	Mean
Suwannee River periphytic algae and nitrate levels (Hornsby et al. 2000)	Algal biomass	200 - 300	Threshold
	Algal cell density	300	Threshold
Nutrients in Florida springs (WSI and DEP databases)	130 Florida springs, including impacted springs	480	Median
	Juniper Spring, Fern Hammock Spring	81, 90	Median
	Alexander Spring	51	Median
Nutrients in less-impacted spring-run streams in Florida (STORET database)	Juniper Creek	80	Median
	Alexander Spring Creek	50	Median
	Wacissa River	60	Median
Nutrients in undeveloped streams In the United States (Binkley et al., 2004; Clark et al. 2000)	Forested stream basins in the southeastern U.S.	180	Mean
	Undeveloped watersheds in the U.S.	87	Median
EPA proposed TMDL for Wekiwa Spring and Rock Springs Run (USEPA 2005)	Comparison to Juniper Spring	110	Threshold
FDEP wastewater treatment criteria in the Wekiva Study Area (FDEP 2004)	Comparison to less-impacted Florida springs	200	Threshold

Table 2 (Executive Summary). Potential total phosphorus (TP) concentration targets based on various lines of investigation.

Reference	Basis for Target	TP (µg/L)	Statistic
Ecosystem metabolism in the Wekiva River and Rock Springs Run (WSI 2005)	Comparison to metabolism in less-impacted spring-run streams (Juniper & Alexander) Comparison to springs in SJRWMD	50-80 50	Threshold Median
% Cyanobacteria and Chlorophyta in attached algae in Wekiva River and Rock Springs Run (analysis of data from GreenWater Labs 2005)	90% probability of ≤ 90 µg /L (threshold for increased levels of cyanobacteria and chlorophyta in attached algal community): Wekiva River Rock Springs Run	 59 61	 Mean Mean
Mapping and monitoring of submerged aquatic vegetation in the Ichetucknee River headsprings (PBS&J 2004)	Epiphytic algal biomass	55	Threshold
Phosphorus in selected Florida springs in the 1950s (Odum 1953)	Springs outside of phosphatic areas Springs within phosphatic areas	45 61	Mean Mean
Nutrients in Florida springs (WSI and DEP databases)	130 Florida springs, including impacted springs Juniper Spring, Fern Hammock Spring Alexander Spring	40 34, 31 44	Median Median Median
Nutrients in less-impacted spring-run streams in Florida (STORET database)	Juniper Creek Alexander Spring Creek Wacissa River	23 44 44	Median Median Median
Nutrients in undeveloped streams in the United States (Clark et al. 2000)	Undeveloped watersheds in the U.S.	22	Median

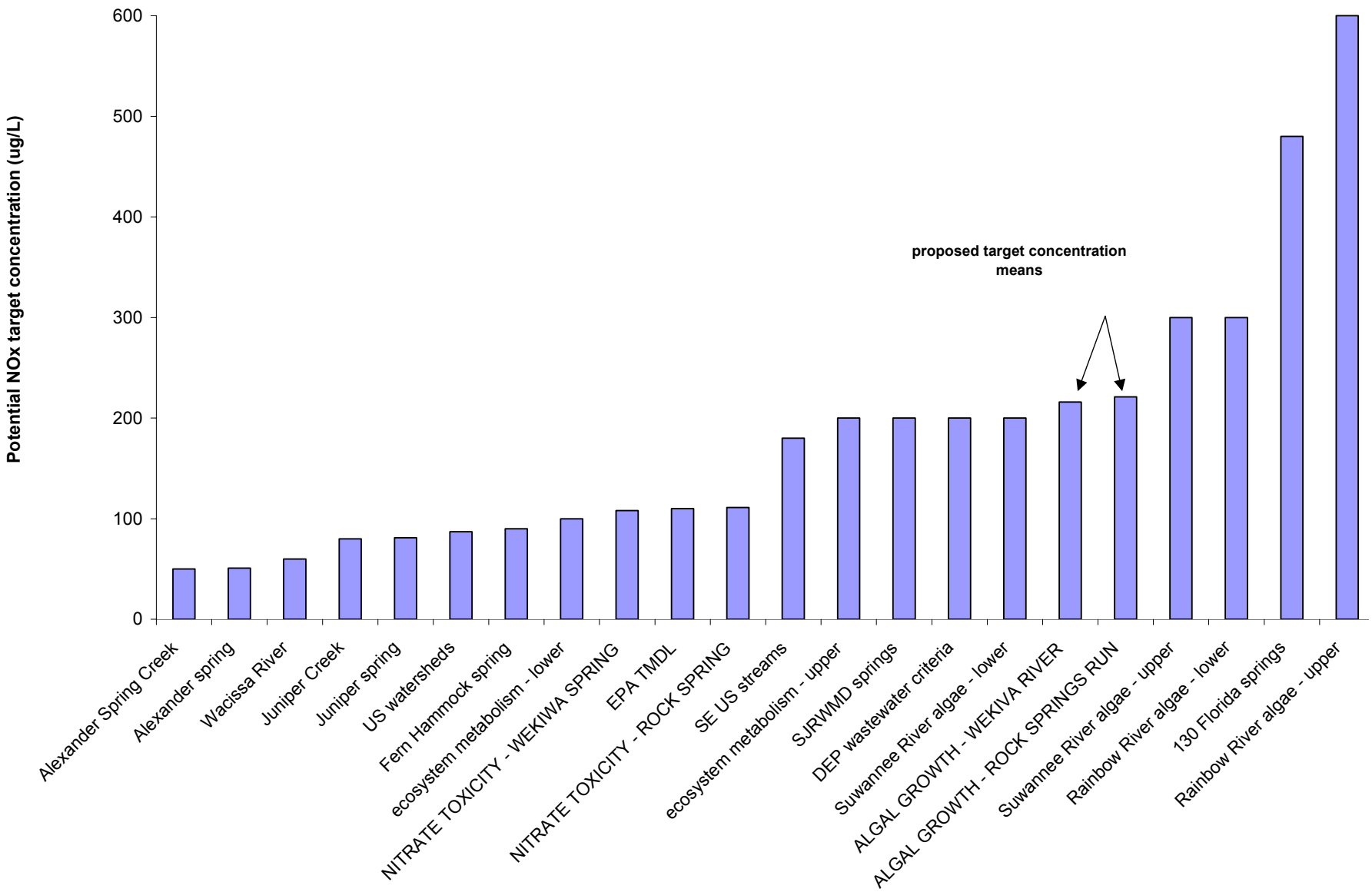

Figure 3 (Executive Summary). Potential and proposed nitrate targets based on Table 1.

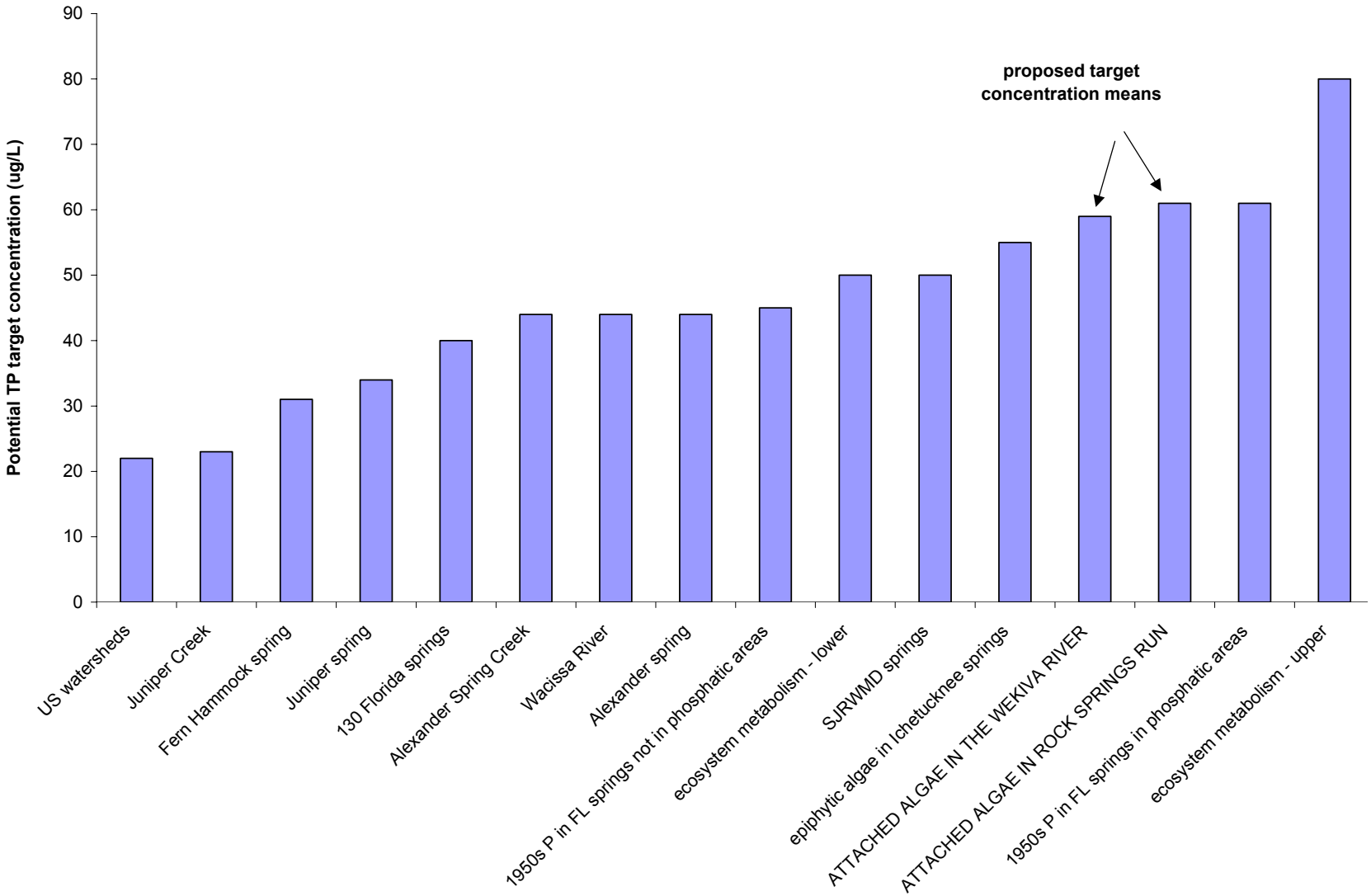

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Table 3 (Executive Summary). Recommended percent reductions in loading of nitrate, TP, and total coliform bacteria for the Wekiva River and Rock Springs Run.

	Nitrate	Total Phosphorus	Total Coliform Bacteria
Wekiwa Spring	82%	- - -	- - -
Upper Wekiva River (to Little Wekiva River)	69%	50%	49%
Lower Wekiva River (to Blackwater Creek)	36%	50%	30%
Rock Spring	85%	- - -	- - -
Rock Springs Run	52%	29%	50%

The recommended PLRGs are based on the best information available within the time frame required by the Wekiva Parkway and Protection Act. There was insufficient time to delineate seasonal and yearly fluctuations in biological conditions. Algal surveys and ecosystem metabolism studies in the Wekiva River and Rock Springs Run were conducted when there were significant impacts from the unusually strong hurricane season of 2004. Sediments had been eroded and deposited in new areas, vegetation had been buried and removed by scouring, and water quality was atypical. In addition to the problems associated with the short time frame for the work, an understanding of the influence of nutrient concentrations on the structure and function of spring-fed streams is still developing. These ecosystems have not been extensively studied, and much additional research is needed before they are as well understood as are lakes and wetlands. The potential for nitrate toxicity is also poorly known. Additional research is needed to decrease the uncertainty associated with the recommended PLRGs.

In recognition of the numerous sources of uncertainty, these PLRG recommendations should be considered provisional. Large safety margins were employed to ensure that the PLRGs will be protective. Additional research may allow these safety margins to be reduced, resulting in higher concentration targets than those currently proposed. This will reduce the pollutant load reductions required to meet these higher targets.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFDW	-	ash free dry weight
cfs	-	cubic feet per second
EOG	-	Executive Office of the Governor
FAC	-	Florida Administrative Code
FCREPA	-	Florida Committee on Rare and Endangered Plants and Animals
FDEP	-	Florida Department of Environmental Protection
FNAI	-	Florida Natural Areas Inventory
FS	-	Florida Statutes
g	-	grams
IWR	-	Impaired Waters Rule
m^2	-	square meters
mi^2	-	square miles
MFL	-	Minimum Flows and Levels
mg/L	-	milligrams per liter
mgd	-	million gallons per day
MSJRB	-	Middle St. Johns River Basin
MSL	-	mean sea level
NOx	-	Nitrate-nitrite (NO_3/NO_2) – nitrogen
N	-	Nitrogen
P	-	Phosphorus
PLRG	-	Pollutant Load Reduction Goal
SCI	-	Stream Condition Index
SJRWMD	-	St. Johns River Water Management District
SR	-	State Road
SWFWMD	-	Southwest Florida Water Management District
SWIM	-	Surface Water Improvement and Management
TMDL	-	Total Maximum Daily Load
TP	-	Total Phosphorus
USEPA	-	U.S. Environmental Protection Agency
WBID	-	Water Body Identification
WQI	-	Water Quality Index
WRBCC	-	Wekiva River Basin Coordinating Committee
WSA	-	Wekiva Study Area

1 INTRODUCTION

The Wekiva River, its main tributaries (Rocks Springs Run, Little Wekiva River, and Blackwater Creek) and their 30 contributing groundwater springs (Figure 1-1) are resources of regional and statewide significance (Wekiva River Basin Coordinating Committee, 2004). Public conservation lands in the Wekiva River basin are some of the last remaining large natural areas in central Florida, a rapidly urbanizing region. The Wekiva River and its primary upstream tributary, Rock Springs Run, are classified by the Florida Natural Areas Inventory as spring-run streams and are considered imperiled in Florida.

1.1 Wekiva River Protection Area

Efforts to protect the Wekiva River basin began in 1988 when Governor Bob Martinez appointed the Wekiva River Task Force to recommend strategies to protect the Wekiva River basin (EOG #88-26). As a result of this group's work, the Florida Legislature passed the Wekiva River Protection Act (Chapter 369, Part II, Florida Statutes [FS]). The purpose of this Act was to protect the ground and surface water resources of the Wekiva River basin through establishment of a "Wekiva River Protection Area" within which local governments were required to meet additional criteria in their comprehensive land-use plans (established in the statute). The Legislature also amended the Water Resources Act (Chapter 373, Florida Statutes [FS]) to require development of Minimum Flows and Levels (MFL) for the river and development of a scientifically defensible buffer adjacent to the river and its tributaries (Chapter 373.415, FS). The Wekiva River Protection Act of 1988 also required development of basin-specific criteria for surface water management permits issued in the basin. Basin-specific criteria addressed drawdown of surface water, erosion control, riparian habitat protection zones, and local government authorization within the Wekiva River Protection Area.

1.2 Wekiva Parkway and Protection Act

In 2002, Governor Jeb Bush appointed the Wekiva Basin Area Task Force (EOG #2002-259) to make recommendations on the best route for a limited-access expressway to connect State Road (SR) 429 and Interstate 4 in Seminole and Orange Counties. The Task Force was directed to make protection of the Wekiva River ecosystem a priority. This group submitted a report to the Governor in January 2003. Governor Bush then appointed the Wekiva River Basin Coordinating Committee (WRBCC) to expand on the Task Force recommendations and develop implementation strategies (EOG #2003-112).

As a result of the recommendations of the WRBCC, the Florida Legislature passed the Wekiva Parkway and Protection Act in 2004 (Chapter 369, Part III, FS). One element instructed the St. Johns River Water Management District (SJRWMD) to develop Pollutant Load Reduction Goals (PLRGs) for the Wekiva Study Area:

Figure 1-1. The Wekiva River system showing major tributaries and 30 contributing springs.

"By December 1, 2005, the St. Johns River Water Management District shall establish pollution load reduction goals for the Wekiva Study Area to assist the Department of Environmental Protection in adopting total maximum daily loads for impaired waters within the Wekiva Study Area by December 1, 2006" (Chapter 369.318 [8], FS)

The WRBCC identified the Wekiva River and its primary upstream tributary, Rock Springs Run, as high-priority for protection. Consequently, SJRWMD focused its initial efforts, beginning in the summer of 2004, on development of PLRGs for these two important spring-run streams. This report and its recommendations were prepared to address the PLRG requirements of the Wekiva Parkway and Protection Act.

1.3 Other Protective Designations

1.3.1 Surface Water Improvement and Management Program

The Wekiva River basin is part of SJRWMD's Surface Water Improvement and Management (SWIM) Program for the Middle St. Johns River Basin. The primary goal of the SWIM program is protection and restoration of aquatic resources of the Middle St. Johns River Basin (SJRWMD, 2002). Specific goals set forth in the Middle Basin SWIM plan include:

- To preserve natural and functional components of the ecosystem while restoring, where feasible, such conditions to the degraded portions of the system;
- To preserve, or where necessary restore, the quantity and quality of water necessary to support thriving biological communities, containing appropriate diversities of native species within the riverine and lacustrine systems of the St. Johns River Middle Basin;
- To pursue the development and implementation of stormwater management plans.

Developing PLRGs for the Wekiva River and Rock Springs Run implements goals stated in the Middle St. Johns River Basin SWIM Plan.

1.3.2 Outstanding Florida Waters

The Wekiva River is designated an Outstanding Florida Water (OFW; Chapter 62-302.700, Florida Administrative Code [FAC]). This designation is conferred on water bodies within state and federal conservation areas and that have exceptional recreational or ecological significance (Chapter 62-302.700 [5], FAC). An important rule requirement is that discharges to OFWs cause no degradation of water quality (Chapter 62-302.700[1], FAC).

1.3.3 Aquatic Preserve

The Wekiva River is in the Wekiva River Aquatic Preserve, first designated in June 1975 by the Florida Legislature. The Preserve includes the Wekiva River, Rock Springs

Run, portions of the Little Wekiva River and Blackwater Creek, and a portion of the Middle St. Johns River (added in 1985). Aquatic Preserves are areas of submerged land with exceptional biological, aesthetic, and scientific value (Chapter 258.36, FS). They are established and managed "for the purpose of being preserved in an essentially natural or existing condition so that their aesthetic, biological and scientific values may endure for the enjoyment of future generations" (Chapter 18-20.001 [2], FAC).

1.3.4 National Wild and Scenic River

Most recently, the Wekiva River and portions of its major tributaries were designated Florida's third National Wild and Scenic River system (U.S. House of Representatives Bill H.R. 3155). This is a federal designation applied to rivers considered worthy of protection due to their ecological and aesthetic attributes and recreational value. The Wild and Scenic designation imposes additional requirements for federal activity that may affect the river and is an additional designation that recognizes the environmental and recreational value of this river system.

1.4 Pollutant Load Reduction Goals

Pollutant Load Reduction Goals are defined as "the estimated numeric reductions in pollutant loadings needed to preserve or restore designated uses of receiving bodies of water and maintain water quality consistent with applicable state water quality standards" (Chapter 62-40.210 [20], FAC). The legal basis for PLRGs is found in state law.

- Chapter 373.016 (FS) indicates that it is state policy to "minimize degradation of water resources caused by the discharge of stormwater; and to preserve natural resources, fish, and wildlife . . ."

- The State Water Resource Implementation Rule (Chapter 62-40, FAC) indicates that it is state policy to "Restore and protect the quality of ground and surface water by solving current problems and ensuring high quality treatment for stormwater and wastewater." (Chapter 62-40.310 [2][a], FAC).

PLRGs are part of the Surface Water Improvement and Management (SWIM) planning process. They may also be developed as part of a watershed management plan or may be adopted as part of a basin-specific rule (Chapter 62-40.430 [5][d], FAC). For the Wekiva River and Rock Springs Run, PLRGs were developed as required by the Wekiva Parkway and Protection Act.

The PLRG process involves several steps:

1. Determine the nature and extent of impairments, if any.

Collect and analyze data to determine if the stream's designated-use is impaired because of a violation of water-quality standards and/or because of an imbalance of flora and fauna.

2. Identify the causative pollutants, if any.

Assess the degree to which pollutant(s) such as nutrients are the cause of impairment. Impairments may stem from factors other than pollutants, such as altered hydrology, physical damage to biota, exotic species, species losses, and altered bathymetry. Impairments such as these cannot be addressed by PLRGs.

3. Determine concentration of causative pollutants that will not result in impairments.

Identify concentrations of pollutants that are safely below the levels associated with impairment.

4. Calculate necessary pollutant load reductions.

Relate acceptable pollutant targets to pollutant concentrations, and where feasible calculate pollutant load reductions needed to meet the target concentration.

2 WEKIVA RIVER SYSTEM DESCRIPTION

The Wekiva River Study Area ("WSA"; Figure 2-1) was delineated by the WRBCC (2004) and encompasses 473 square miles. The word Wekiva (alternate spelling Wekiwa – which is applied to the spring itself) derives from the Seminole/Creek for "spring" or "spring of water" (Morris 1995). Human use of the river dates back about 12,000 years before present (Weisman 1993) when small groups of hunter-gatherers obtained freshwater, game, and fish from the river and its headspring, called Wekiwa Spring. Over the past century the river floodplain has served as a source of timber, and its springs as a respite for their "healing waters", with various resorts and spas nearby. The Wekiva River and Rock Springs Run and their headsprings currently provide a variety of recreational opportunities including canoeing, swimming, snorkeling, tubing, boating, and fishing.

2.1 Physiography and Geology

Physiography. The area that includes the Wekiva River surface water basin and "springshed" (the groundwater contributing area; Figure 2-1) lies within portions of the Marion Upland, Orlando Ridge, and Osceola Plain physiographic regions (Schmidt 1997). Land elevations range from a high of 175 feet above mean sea level (MSL) in the western part of the region to a low of 10 feet above MSL at the confluence of the Wekiva River and Blackwater Creek (WSI 2004). Five marine terraces in the region were formed by sediment deposition and reworking during periods of higher sea level (Schmidt 1997). Wekiwa Spring and Rock Springs appear to emerge at the base of the Penholloway Terrace, which exhibits about 40 feet of relief. In the western and southern portions of the region, the land is a series of high (>75 feet above MSL) terraces and ridges with well-draining sandy soils. In the eastern and northeastern portions of the region, land elevations are generally $\leq$ 25 feet above MSL with poorly draining wetland and flatwoods soils.

The region also lies within the Southern Coastal Plain ecoregion (Berndt et al. 1996) and encompasses two stream-type subecoregions (Griffith et al. 1994); the Eastern Florida Flatwoods and Central Florida Ridges and Uplands. The Eastern Flatwoods subregion is characterized by variable soils, ranging from moderately draining sandy soils of the flatwoods to poorly draining clay or muck soils of wetlands. The Central Ridges subregion is characterized by deep, moderate- to well-draining sands supporting sandhill, scrubby flatwoods, or scrub ecosystems.

Geology and Hydrogeology. The Wekiva River basin and springshed lie in a karst-influenced landscape. The top of the limestone unit bearing the Floridan Aquifer ('Floridan') lies 50 to 100 feet beneath land surface (Osburn et al. 2002). A generalized hydrogeologic framework of the region is presented in Table 2-1. This region of the SJRWMD is where the Floridan is at or near land surface (Osburn, et al. 2002). Many of the lakes in the region were likely formed from solution (sinkhole) processes. The karst nature of the area means that there is a high degree of interconnection between surface water and groundwater.

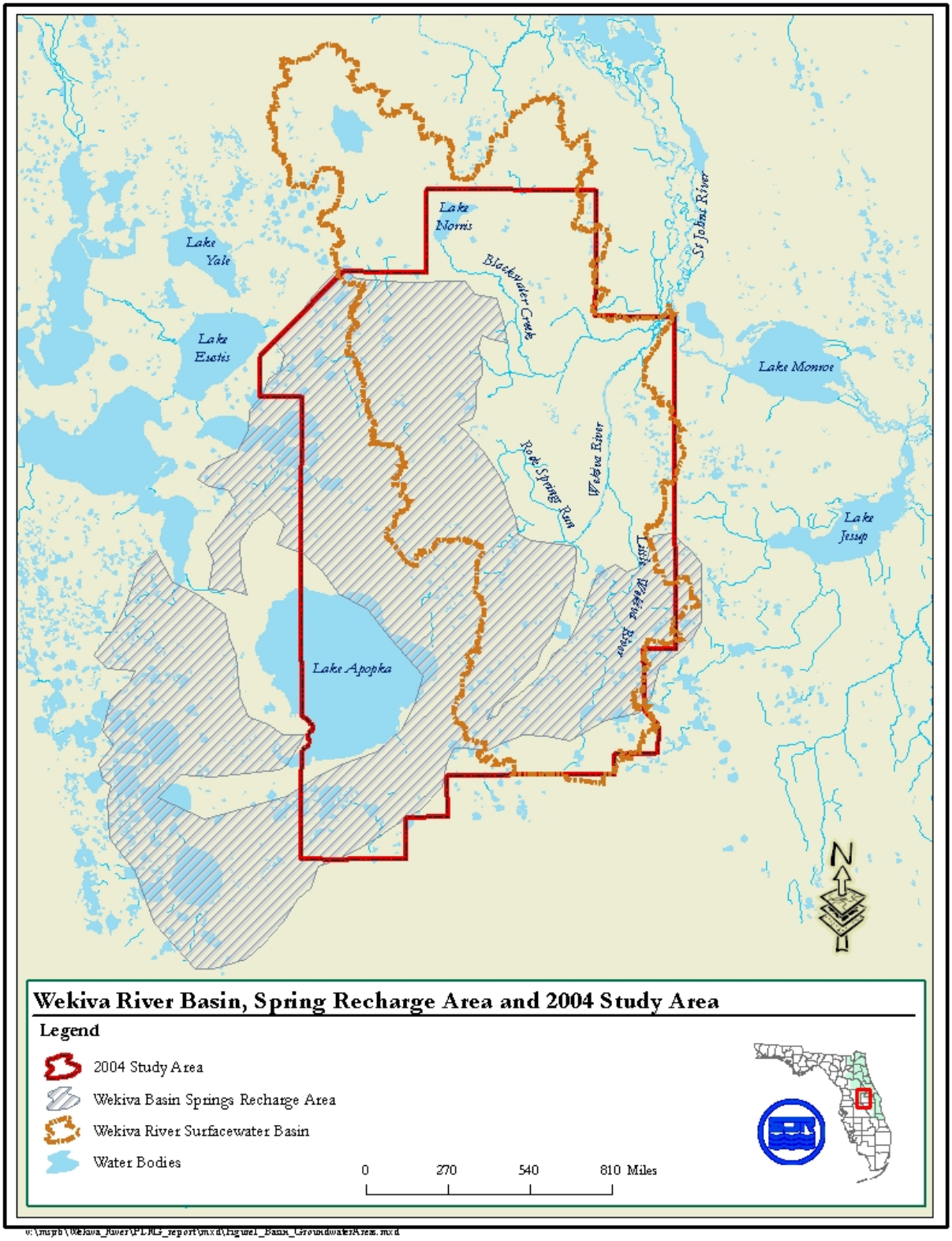


Figure 2-1. The Wekiva River basin, spring recharge area, and 2004 Wekiva Study Area. Source: SJRWMD data.

Table 2-1. Hydrogeologic framework for the Wekiva region (adapted from Osburn et al. 2002).

Hydrogeologic Unit	Epoch	Stratigraphic Unit
Surficial Aquifer System	Holocene and Pleistocene	Surficial sands and marine terrace deposits
Intermediate Aquifer System (or intermediate confining unit)	Pliocene	Undifferentiated deposits
	Miocene	Hawthorne Group
Floridan Aquifer System	Oligocene	Suwannee Limestone
	Eocene	Ocala Limestone
		Avon Park Formation
		Oldsmar Formation

The Floridan Aquifer is the main water source for springs that discharge to the Wekiva River and its tributaries (Toth and Fortich 2002; Osburn et al. 2002). Figure 2-2 shows the potentiometric surface of the Floridan Aquifer in the Wekiva region in 2002. Water flow is perpendicular to the contours of the potentiometric surface. The principal areas of rainfall recharge to the Floridan are in the western and southern portions of the region (Osburn et al. 2002), with recharge of up to 12" of rainfall annually. Much of the lengths of the Wekiva River and Rock Springs Run lie within the discharge zone of the Floridan Aquifer, resulting in a predominance of spring flow in these streams.

Water quality of the Floridan Aquifer in the Wekiva region is generally hard and high in dissolved calcium bicarbonate, reflecting the limestone matrix of the aquifer. Toth and Fortich (2002) identified areas of the Floridan aquifer in the region with elevated levels of nitrate, which they defined as >0.2 mg/L nitrate-nitrogen. Other sources (e.g., Scott et al. 2004 and references therein) define "natural background" for nitrate in the Floridan Aquifer as $\leq$0.05 mg/L.

2.2 Climate and Hydrology

Climate Characteristics. Climate in the region is subtropical. Mean annual air temperature is 72 degrees F, ranging from an average monthly high of 90-95 degrees F during the summer (August/September) to an average monthly low of 59-60 degrees F in winter (December/January). Rainfall across the region averages 51.5 inches annually (WSI 2004). The highest annual rainfall in the period of record is 75 inches and the lowest annual total is 30 inches (WSI 2004). The majority of the rainfall occurs between June and September in association with convectional thunderstorms. Highest monthly total rainfall in the region is about 7-8 inches, typically in August, and lowest is about 2-3 inches in April (Fernald and Purdum, 1998). WSI (2004) found no apparent long-term temporal trend in rainfall based on data from seven stations in or near the Wekiva River.

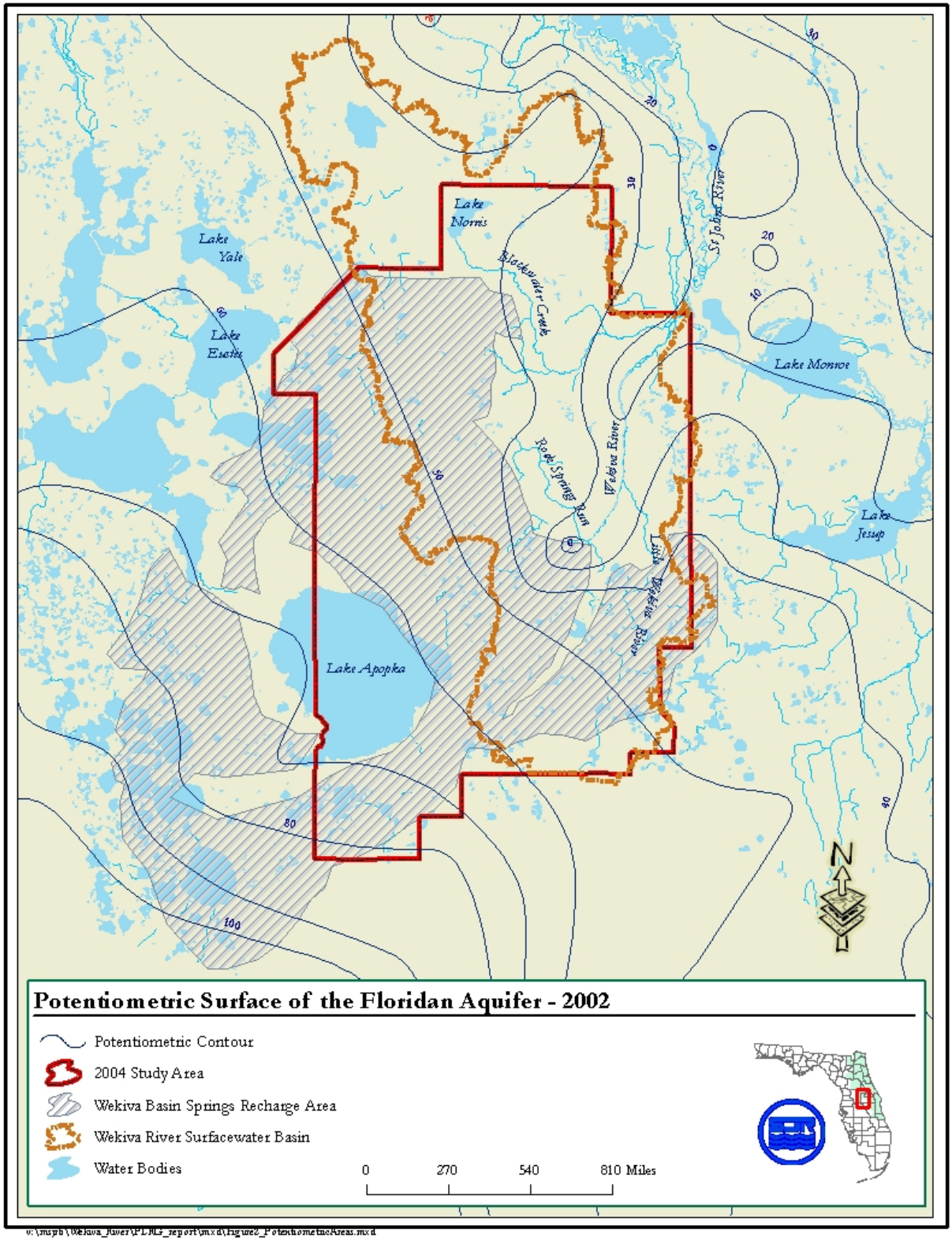


Figure 2-2. Potentiometric surface of the Floridan Aquifer in the Wekiva Study Area. Source: SJRWMD data.

Hydrology of the Wekiva River and Rock Springs Run . Stream flows in the Wekiva River basin are derived from surface drainage from the watershed and groundwater inflow from the Floridan Aquifer. Location of springs and stream flow-gaging stations in the basin are shown in Figure 2-3. A summary of stream-flow characteristics for the Wekiva River and Rock Springs Run are shown in Table 2-2.

Spring inflow appears to account for a majority of base flow in the Wekiva River. Thirty springs have been identified in the Wekiva River basin (Figure 2-3). Mean flows in these springs range from 67.1 cfs (Wekiwa Spring) to <1cfs in a number of the smaller springs. All appear to be fed by the Floridan Aquifer (Toth and Fortich 2002; WSI 2004). Average flow of Wekiwa Spring, Rock Spring and Miami Spring total about 135 cfs (Hupalo et al. 1994). Using the 2-year/30-day low flow of 202 cfs as typical base flow in the river at SR 46 (10 miles downstream of Wekiwa Spring), spring flow represents at least 67% of the base flow of the Wekiva River. This figure is probably low because it does not include groundwater inflow from other springs and other base flow sources. FDEP (2003) stated that spring inflow accounted for 64% of the base flow of the Wekiva River. Because of the predominance of spring flow in these streams, water quality in the springs exerts a major influence on water quality in the spring-run streams.

Three tropical storm systems (Hurricanes Charley, Frances, and Jeanne) crossed the Wekiva basin in 2004, increasing flows in the Wekiva River (Figure 2-4) and Rock Springs Run. This caused atypically high flows and resulted in scouring of vegetation, higher water color due to leaching of tannins from the floodplain forests, and transfer of sediment.

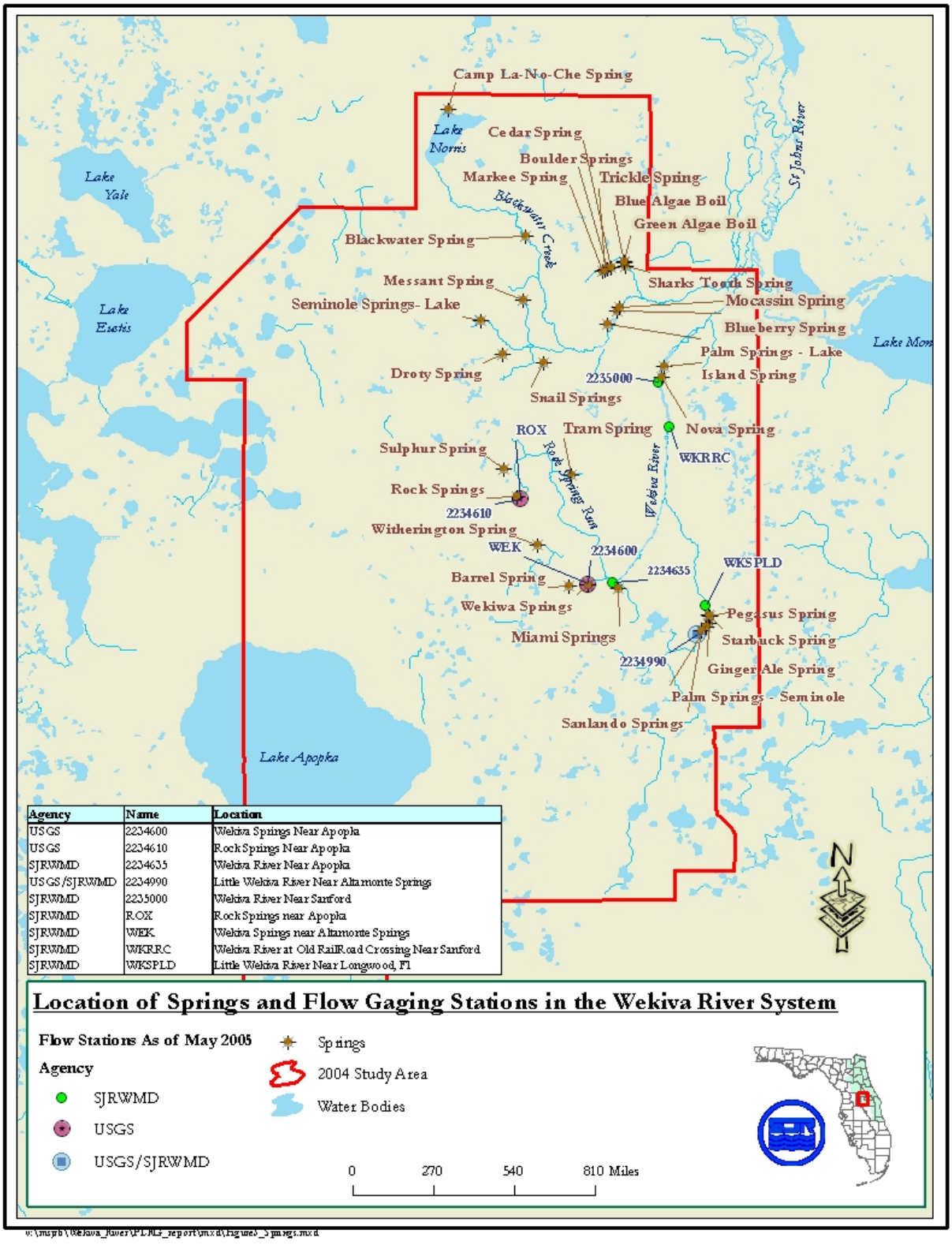
Table 2-2. Summary of stream-flow characteristics for the Wekiva River and Rock Springs Run.

	Mean Flow (cfs)	**Median Flow (cfs)**	**Minimum Flow (cfs)**	**Maximum Flow (cfs)**
Wekiva River (at State Road 46)	290.7	253	105	2,060
Rock Springs (in Kelly Park)	60.1	59.2	48.2	72.1

2.3 Water Quality – Description, Status, and Trends

2.3.1 Water Quality Description

The Wekiva River and Rock Springs Run are hardwater streams with relatively high conductivity and alkalinity, indicating water rich in dissolved minerals (Table 2.3). Color increases downstream in the Wekiva River and Rock Springs Run due to inflow of surface water from the adjacent drainage area. During the course of these studies,



Agency	Name	Location
USGS	2234600	Wekiva Springs Near Apopka
USGS	2234610	Rock Springs Near Apopka
SJRWMD	2234635	Wekiva River Near Apopka
USGS/SJRWMD	2234990	Little Wekiva River Near Altamonte Springs
SJRWMD	2235000	Wekiva River Near Sanford
SJRWMD	ROX	Rock Springs near Apopka
SJRWMD	WEK	Wekiva Springs near Altamonte Springs
SJRWMD	WKRRC	Wekiva River at Old RailRoad Crossing Near Sanford
SJRWMD	WKSPLD	Little Wekiva River Near Longwood, Fl

Figure 2-3. Location of springs and flow gaging stations in the Wekiva River system.

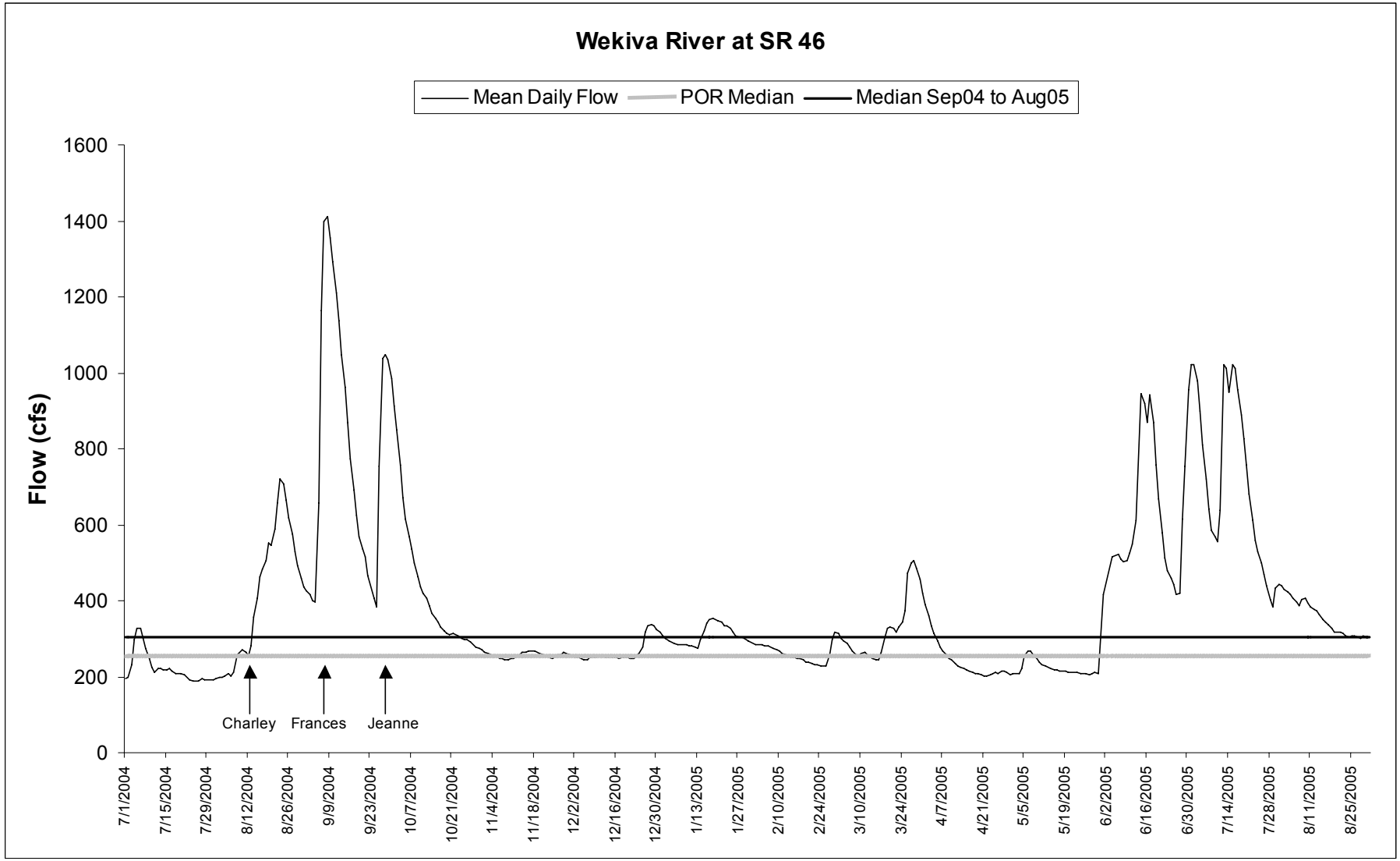


Figure 2-4. Mean daily flows in the Wekiva River prior to and during the studies conducted for the PLRG effort, showing median flows for the period of record (1935-2005), for the study period (Sept. 2004 to Aug. 2005), and dates of passage of hurricanes.

Table 2-3. Summary of water quality data from the Wekiva River and Rock Springs Run. Values are means of available data for the period of record indicated. Source: WSI 2004. e = estimated by adding TKN and NOx-N.

Analyte	**Wekiva River @ SR 46**	**Rock Springs Run above Wekiva River**
Period of Record	*1954-2003*	*1973-2003*
Conductivity (µmhos/cm)	624	244
pH (units)	7.42	7.31
Alkalinity (mg/L as $CaCO_3$)	94.9	86.6
Color (pcu)	61.5	203
Turbidity (NTU)	3.34	1.60
Dissolved O_2 (mg/L)	7.10	5.84
Total Organic Carbon (mg/L)	8.31	21.9
Total Nitrogen (mg/L)	1.25	1.68 e
Total Kjeldahl Nitrogen (mg/L)	0.632	0.896
NO_3/NO_2-N (mg/L)	0.578	0.784
Ammonia (mg/L)	0.045	0.047
Orthophosphorus (mg/L)	0.108	0.084
Total Phosphorus (mg/L)	0.141	0.118
Chlorophyll a - corrected (µg/L)	1.70	2.90
Fecal Coliform (#/100ml)	100	54.2
Total Coliform (#/100 ml)	1,351	1,649

water levels were high and subsequently color was high due to contribution of tannins from the floodplain forests. Nitrate levels in the headsprings are relatively high (1.4-1.5 mg/L) but decline downstream, probably due to a combination of dilution and biological uptake (WSI 2004). Rock Springs Run exhibits higher color and total organic carbon than the Wekiva River.

2.3.2 Water Quality Status and Trends

FDEP Bioassessment. FDEP conducted habitat assessments, water quality sampling, and macroinvertebrate and algal assessments for the Wekiva River and Rock Springs Run in 1999 as part of their Statewide Stream Bioassessment Program (FDEP 2000). Results indicated nitrate enrichment in both streams because nitrate concentrations exceeded those found in 95% of other Florida streams. Ammonia, total Kjeldahl nitrogen and total phosphorus levels approximated the statewide stream median.

Habitat Assessment scores at all sites in both streams fell within the optimum range for peninsular streams. Macroinvertebrate Stream Condition Index scores were all in the good or excellent range based on reference levels for peninsular streams (FDEP 2000). Average Algal Growth Potential (AGP) scores exceeded the “problem threshold”,

indicating that nutrient levels were high enough to potentially support high levels of algal growth in both streams.

SJRWMD Water Quality Analysis. In 2004, SJRWMD staff analyzed water quality status and trends for the Wekiva River and Rock Springs Run using data from stations located in the spring-run streams. Water quality variables examined were water clarity (turbidity or Secchi depth), bacteria (total and fecal coliform), oxygen demand, dissolved oxygen levels, and nutrients. Water quality in the Wekiva River and Rock Springs Run was also compared to about 50 other springs in the SJRWMD.

For both the Wekiva River and Rock Springs Run, nitrate (NOx), and total phosphorus (TP) were high relative to springs in the SJRWMD, status was poor for nitrate and total coliform bacteria (based on FDEP criteria), and there was a degrading trend in total coliform bacteria in both streams (Table 2-4). Since the Outstanding Florida Waters designation for both streams, total coliform bacteria levels had degraded (=increased). For Rock Springs Run, nitrate had also degraded since OFW designation.

Table 2-4. Results of SJRWMD 2004 water quality analyses.

	Nitrate	**Total Phosphorus**	**Total Coliform Bacteria**
Wekiva River	high relative to springs in SJRWMD poor status	high relative to springs in SJRWMD	poor status degraded since OFW designation degrading trend
Rock Springs Run	high levels relative to springs in SJRWMD poor status degraded since OFW designation	high relative to springs in SJRWMD	poor status degraded since OFW designation degrading trend

SJRWMD staff conducted additional statistical analyses of water quality trends in 2005 with a more comprehensive data set than used in 2004. Total phosphorus decreased in both the Wekiva River and Rock Springs Run since 1974 (Figures 2-5 and 2-6), with decreases in both wet and dry seasons. Nitrate concentration decreased in the Wekiva River since 1984 (Figure 2-5) due to wet season decreases. Nitrate did not decrease in Rock Springs Run since 1984 (Figure 2-6) except during the wet season.

There were statistically significant decreasing downstream trends in nitrate concentration in both the Wekiva River and Rock Springs Run (Figures 2-7 and 2-8), which was evident in both the wet and dry seasons. These decreasing downstream trends in nitrate are partly due to dilution, but they also suggest that a considerable fraction of the nitrate load from the headsprings is being assimilated in the spring-run streams, with lesser amounts exported downstream to the St. Johns River. There was no downstream trend in total phosphorus in either stream (Figures 2-7 and 2-8), although Rock Springs Run showed an increasing downstream trend in total phosphorus during the wet season.

2.3.3 Water Quality Issues

Nitrate concentrations are elevated in many springs throughout Florida due to urban and agricultural development in the spring recharge areas (Florida Springs Task Force 2000; Scott et al. 2004; Osburn et al. 2002; Toth and Fortich 2002). Consequently, spring-run streams receive unnaturally high loads of nitrate, causing concern about potential impacts to aquatic flora and fauna. Recent observations of large amounts of algal growth in springs and spring-run streams, and perceptions that large amounts of algae constitute a “nuisance,” have led to speculation that elevated nitrate levels cause excessive algae growth, with possible detrimental impacts associated with this algal growth.

As a result of these concerns, the Wekiva Parkway and Protection Act directed FDEP to study and, if appropriate, initiate rulemaking for enhanced water quality and central wastewater treatment standards to achieve nitrogen reductions in surface water and groundwater. The Florida Department of Health was directed to study the effects of on-site waste disposal systems in the Wekiva Study Area, and if necessary to institute rulemaking to develop criteria to reduce nitrogen loading to surface and ground water from on-site systems. For these reasons, SJRWMD emphasized investigations into nitrates and algae growth in the PLRG development process.

2.4 Ecological Overview

Natural Community Types. Large portions of the Wekiva River basin are public conservation lands containing high quality natural communities. These are listed here and briefly described in Appendix A, using the Florida Natural Areas Inventory (FNAI) classification system (FNAI and FDNR 1990). Figure 2-9 shows natural community types based on the Florida Land Use, Cover and Forms Classification System (FLUCFCS). Natural community types include:

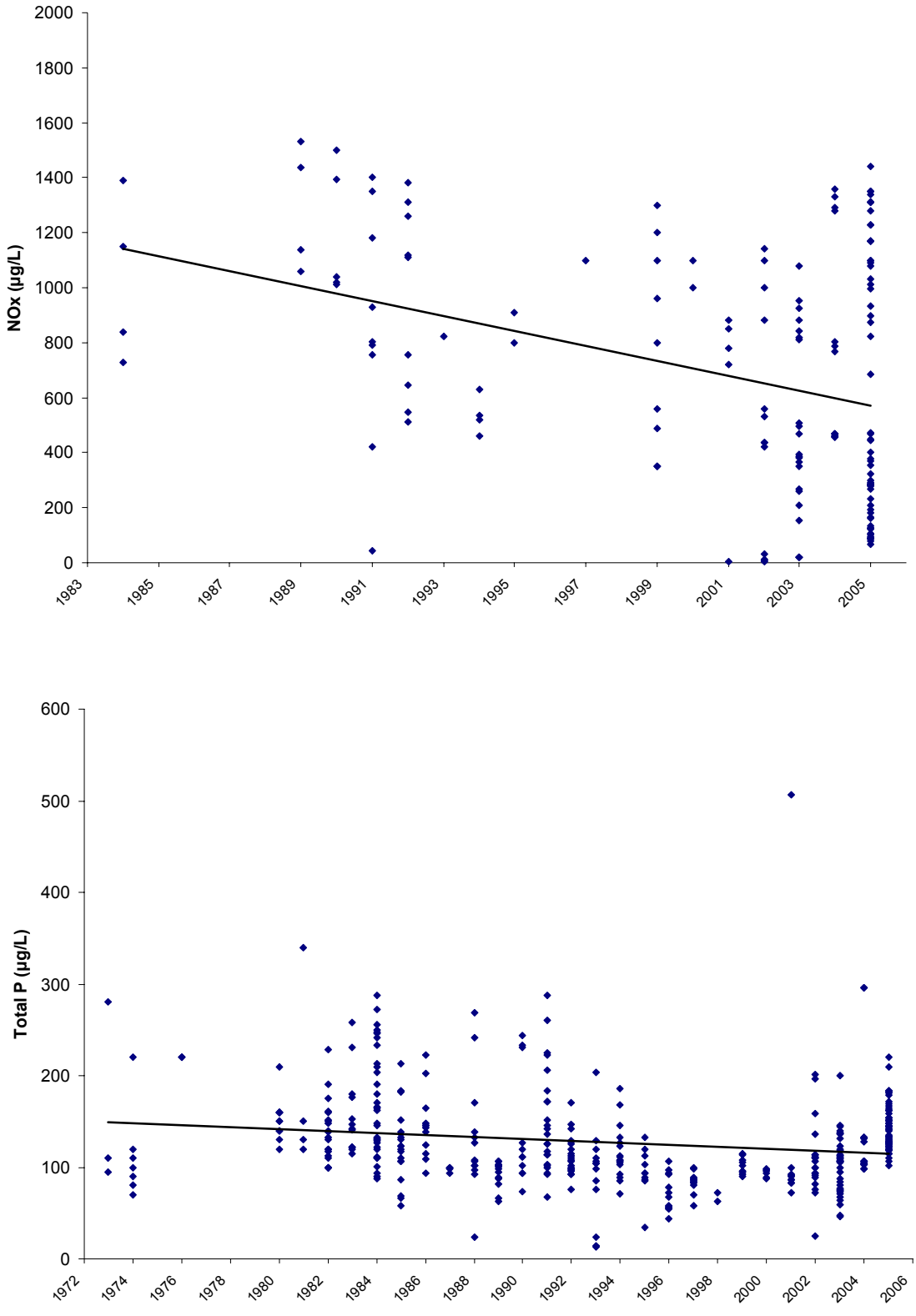


Figure 2-5. Temporal trends in nitrate and total phosphorus in the Wekiva River for the period of record. Line indicates statistically significant decreasing trend.

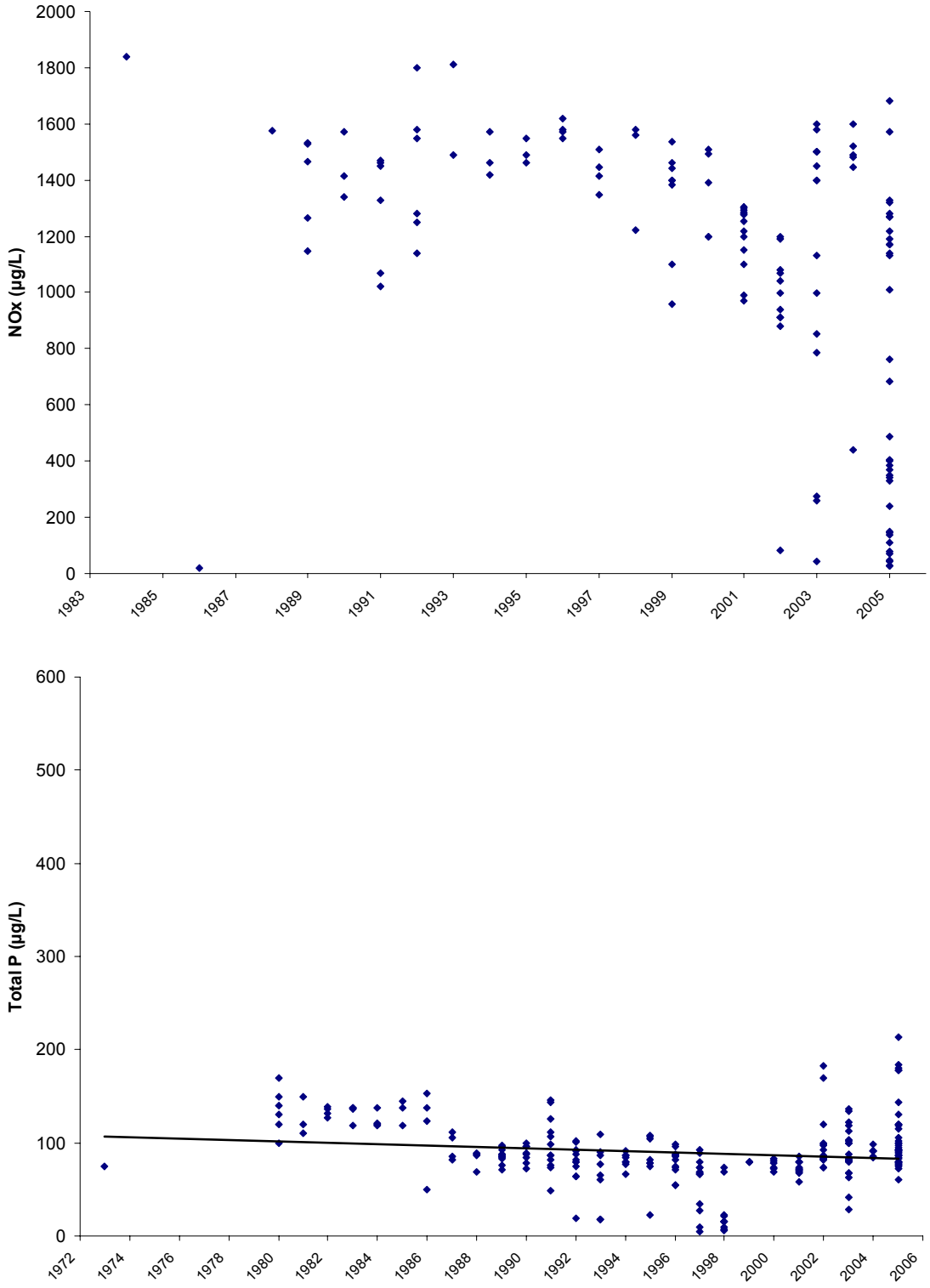
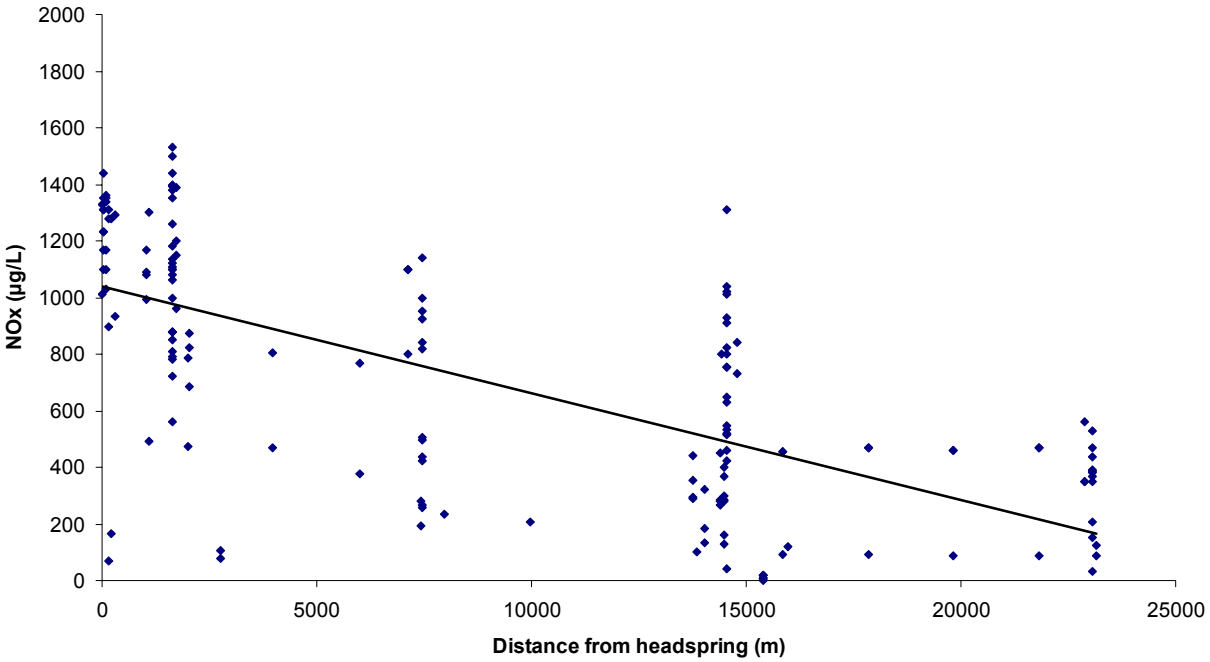


Figure 2-6. Temporal trends in nitrate and total phosphorus in Rock Springs Run for the period of record. Line indicates statistically significant decreasing trend.



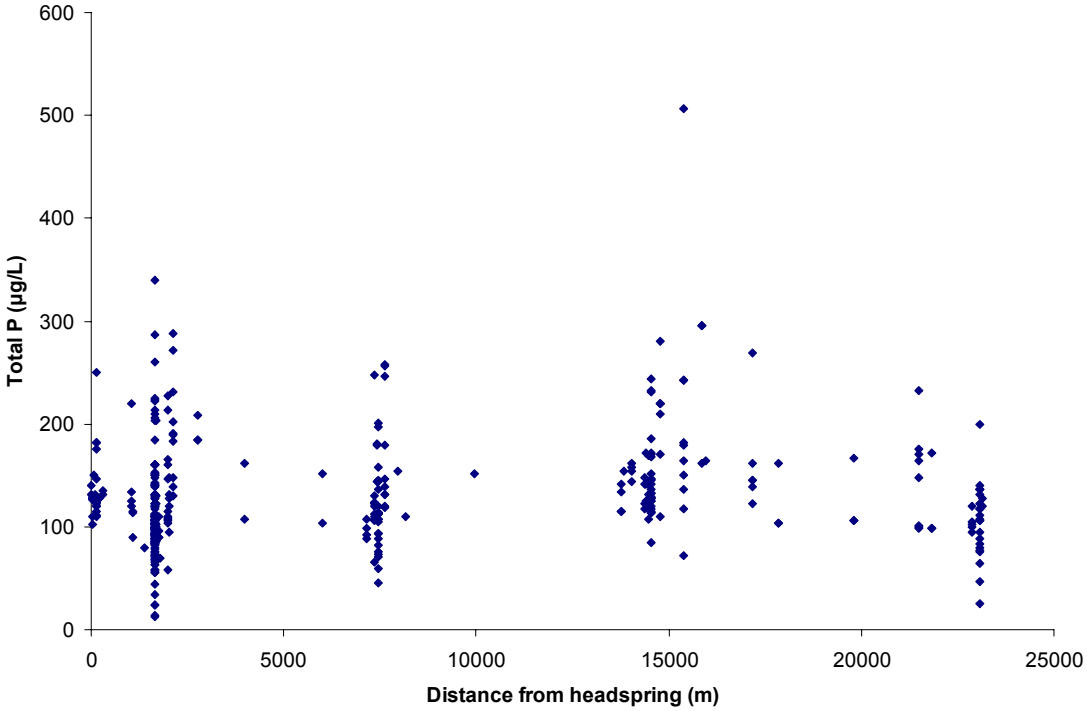
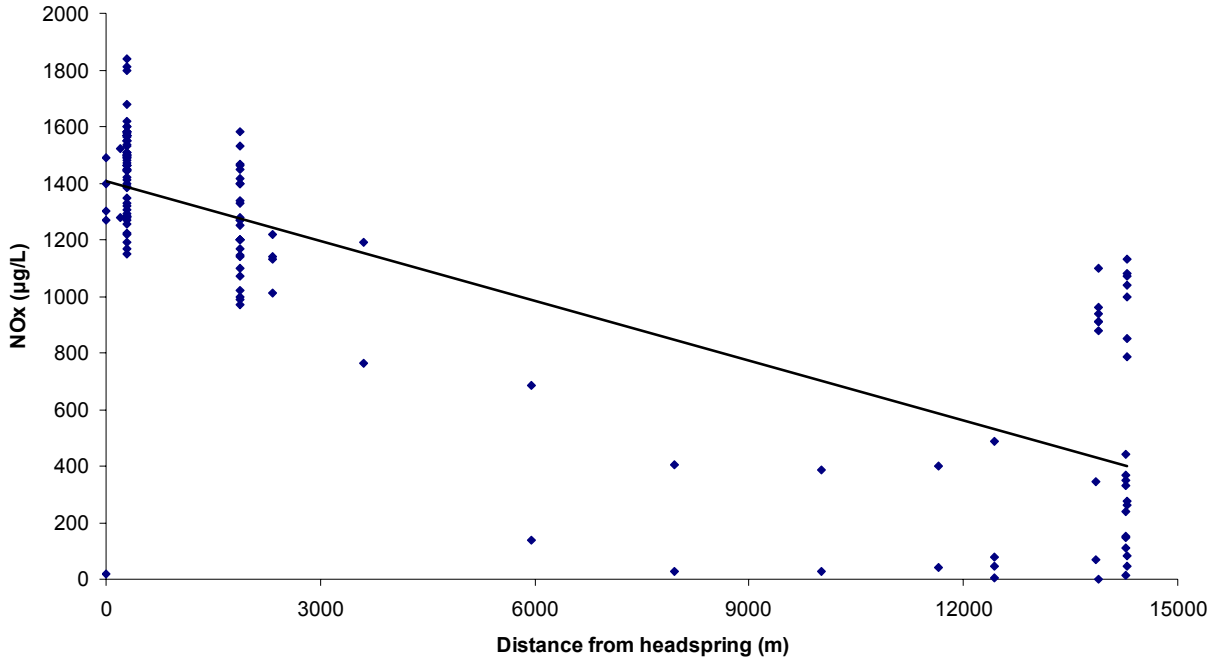


Figure 2-7. Spatial trends in nitrate and total phosphorus in the Wekiva River for the period of record. Line indicates statistically significant decreasing trend.



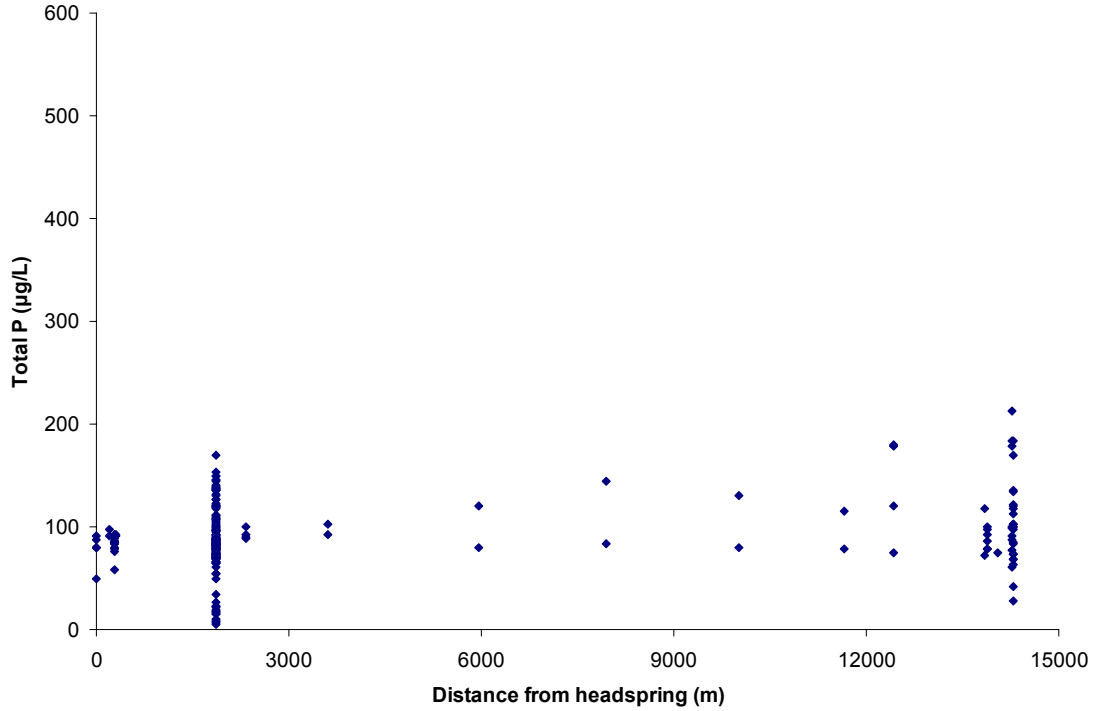


Figure 2-8. Spatial trends in nitrate and total phosphorus in Rock Springs Run for the period of record. Line indicates statistically significant decreasing trend

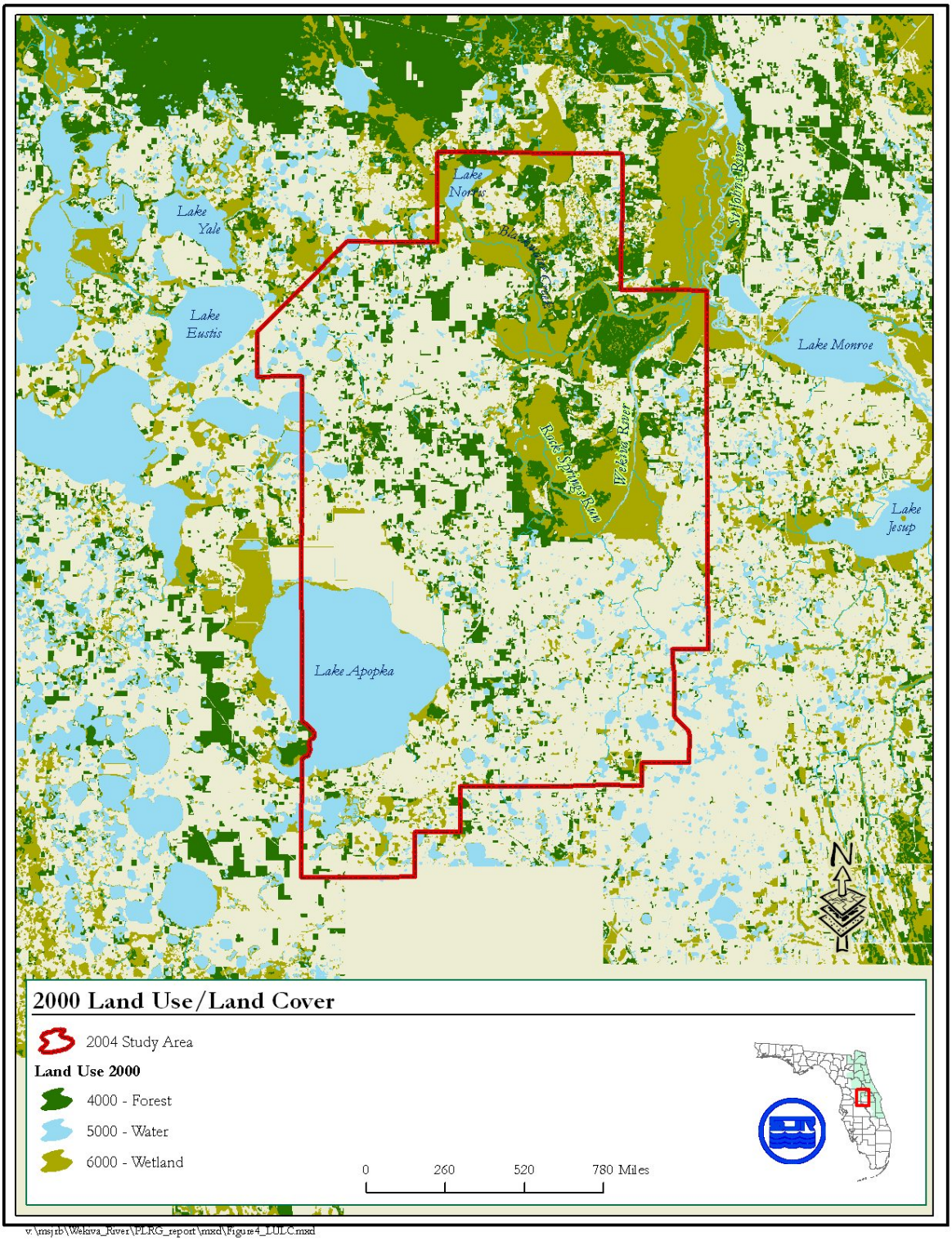


Figure 2-9. 2000 land use and land cover, showing forest and wetland areas in the Wekiva Study area.

Upland Communities (FLUCFCS '4000 – Forest')
Mesic Flatwoods
Scrubby Flatwoods
Sandhill
Scrub
Xeric hammock.
Upland hardwood or Upland mixed forest

Wetland Communities (FLUCFCS '6000 – Wetland')
Wet flatwoods
Floodplain swamp
Hydric hammock
Baygall
Freshwater marsh

Aquatic Communities (FLUCFCS '5000 – Water')
Spring-run stream
Blackwater stream
Clastic upland lake
Sandhill upland lake

Aquatic Habitats. Aquatic habitats in the Wekiva River and Rock Springs Run were described in FDNR (1987), Hupalo, et al. (1994) and the National Park Service (1999). Overall, there have been few detailed biological studies of these two spring-run streams, and currently there is no regular program of biological monitoring.

One of the principal aquatic habitats of the Wekiva River and Rock Springs Run are beds of submerged aquatic vegetation (SAV), primarily dominated by eelgrass, *Vallisneria americana* (WSI 2004; Canfield and Hoyer 1988). Other taxa of SAV present include spring-tape (*Sagittaria kurziana*), Brazilian elodea (*Egeria densa*), hydrilla (*Hydrilla verticillata*), variable-leaf milfoil (*Myriophyllum heterophyllum*), and sago pondweed (*Potamogeton pectinatus*). Associated with the SAV is a community of epiphytic algae growing attached to the leaves, which is a natural component of this habitat (Whitford 1956; Odum 1957). SAV beds provide important fish and macroinvertebrate habitat. Warren, et al. (2000) conducted macroinvertebrate surveys in SAV beds in the Wekiva River and found 127 taxa of invertebrates in these habitats. VanGenechten (1999) similarly found that SAV beds supported high fish densities compared to other habitats in the Wekiva River.

Submerged wood debris, generally referred to as "snag habitat", is a second important aquatic habitat. Studies in other southeastern coastal plain streams have documented the importance of wood snag habitat to macroinvertebrates and fishes (Benke et al. 1984; Benke et al. 1985). Warren et al. (2000) found a total of 163 taxa of macroinvertebrates on snag habitat in the Wekiva River. Many of these taxa are important components of the diet of redbreast and spotted sunfish (Benke et al. 1985), two important sportfish on the river.

Bare sediment (mud or sand) is a third major aquatic habitat type in the streams, and supports a diverse assemblage of macroinvertebrates. Warren et al. (2000) found highest total invertebrate taxa richness in this habitat in the Wekiva River (166 taxa). Invertebrate densities (#/m^2) were also high in this habitat. A number of fish taxa (catfish, sucker, and minnows) generally prefer to forage on bare sediments as opposed to vegetated habitats.

Areas of floating and emergent aquatic vegetation are a fourth aquatic habitat. Areas of floating vegetation (primarily pennywort, *Hydrocotyle* spp.) support diverse macroinvertebrate and abundant fish populations (Warren et al. 2000). However other areas of this habitat, particularly monospecific beds of cattail (*Typha* sp.), are poor habitat for invertebrates and fish.

Aquatic Fauna. Major groups of fauna on the Wekiva River and Rock Springs Run are benthic macroinvertebrates, fishes, herpetofauna (reptiles and amphibians) birds and mammals. Some of these taxa are, or tend to be, most associated with spring-run streams (Table 2-5).

Benthic macroinvertebrates include aquatic insects, mollusks, worms and crustaceans associated with aquatic habitats. Warren et al. (2000) collected a total of 268 invertebrate taxa in the Wekiva River, in 39 major taxonomic groups. Generally, the non-biting midges (Chironomidae) dominated the invertebrate diversity and abundance in most habitats. Mayflies (Ephemeroptera), caddisflies (Trichoptera), aquatic beetles (Coleoptera) and amphipods were the other abundant groups in the river. Eight taxa of hydrobiid snails (a group most frequently associated with springs and spring-run streams, with many endemics) were collected in this survey.

A total of 51 species of fishes are known to occur in the river. Dominant taxa, by abundance, include sunfish, shiners, and killifish (Walsh and Williams 2003; VanGenechten 1999; Canfield and Hoyer 1988). VanGenechten (1999) determined that mats of floating vegetation and SAV beds constituted some of the best fish habitat in the Wekiva River in terms of fish taxa richness or abundance. Water depth and velocity appeared to be more important than water temperature and dissolved oxygen in explaining fish community structure. VanGenechten (1999) compared his fish data to those collected by Canfield and Hoyer (1988) about 10 years earlier and found no major changes in fish communities of the Wekiva River.

We found few quantitative studies of other vertebrates (herpetofauna, birds and mammals) on the Wekiva River or Rock Springs Run. Aquatic Preserve staff have recently begun coordinating bird surveys in conjunction with volunteers (D. Shelley, Wekiva River Aquatic Preserve, personal communication).

Species of Conservation Interest. Four federally-listed species occur in the basin along with many state-listed species and other rare and endemic species (Table 2-6). Additionally, searches for ivory-billed woodpeckers from 1987-1992 included the Wekiva

Table 2-5. Taxa primarily associated with, or that reach high abundance in, spring-run streams. Adapted from Simons (1990) and Mattson et al. (1995). All taxa listed here are known to occur in the Wekiva River basin except (?), which are likely to occur in the basin.

		Spring-run Stream "Best Habitat"	**Spring-run Stream "Good Habitat"**
Plants			
Eelgrass	*Vallisneria americana*		XX
Springtape	*Sagittaria kurziana*	XX	
Chara	*Chara* spp.		XX
Invertebrates			
Siltsnails	Hydrobiidae (most freshwater taxa)	XX	
River horn snails	*Elimia* spp.	XX	
Apple snail	*Pomacea paludosa*		XX
Grass shrimp	*Palaemonetes paludosus*		XX
Mayfly	*Stenacron* spp.		XX
Mayfly	*Tricorythodes albilineatus*		XX
Aquatic butterfly	*Paraponyx* sp.		XX
Spiral-cased caddisfly (?)	*Helicopsyche* spp.	XX	
Fishes			
Longnose gar	*Lepisosteus osseus*	XX	
Florida gar	*Lepisosteus platyrhincus*	XX	
Golden shiner	*Notemigonus chrysoleucas*		XX
Redeye chub (?)	*Notropis harperi*	XX	
Coastal shiner	*Notropis petersoni*	XX	
Sailfin shiner	*Pteronotropis hypselopterus*	XX	
Channel catfish	*Ictalurus punctatus*	XX	
Seminole killifish	*Fundulus seminolis*	XX	
White catfish	*Ameiurus catus*	XX	

Table 2-5. Continued.

TAXON		Spring run "Best Habitat"	Spring run "Good Habitat"
Bluefin killifish	*Lucania goodei*		XX
Bluegill sunfish	*Lepomis macrochirus*		XX
Redear sunfish	*Lepomis microlophus*	XX	
Spotted sunfish	*Lepomis punctatus*	XX	
Amphibians			
River Frog (?)	*Rana heckscheri*	XX	
Reptiles			
American alligator	*Alligator mississippiensis*		XX
Florida snapping turtle	*Chelydra serpentina osceola*	XX	
Stinkpot	*Sternotherus odoratus*		XX
Loggerhead musk turtle	*Sternotherus minor minor*	XX	
Florida red-bellied turtle	*Pseudemys nelsoni*	XX	
Brown water snake	*Nerodia taxispilota*	XX	
Rainbow snake	*Farancia erytrogramma erytrogramma*	XX	
Birds			
Great blue heron	*Ardea herodias*		XX
Great egret	*Casmerodius albus*		XX
Little blue heron	*Egretta caerulea*		XX
Limpkin	*Aramus guarauna*	XX	
Wood duck	*Aix sponsa*		XX
Swallow-tailed kite	*Elanoides forficatus*		XX
Red-shouldered hawk	*Buteo lineatus*		XX
Barred owl	*Strix varia*		XX
Belted kingfisher	*Ceryle alcyon*	XX	

Table 2-5. Continued.

TAXON		Spring run "Best Habitat"	Spring run "Good Habitat"
Acadian flycatcher	*Empidonax virescens*		XX
Prothonotary warbler	*Protonotaria citrea*	XX	
Mammals			
Southeastern myotis (?)	*Myotis austroriparius*	XX	
Red bat	*Lasiurus borealis*	XX	
Seminole bat	*Lasiurus seminolus*		XX
Evening bat	*Nycticeius humeralis*	XX	
Florida manatee	*Trichechus manatus latirostris*		XX

Table 2-6. Listed and endemic taxa largely dependent upon aquatic and wetland habitats that occur in the Wekiva River system. U.S. = species officially listed under the Endangered Species Act; Florida = species listed by the State of Florida; FNAI = species listed by the Florida Natural Areas Inventory; FCREPA = species listed by the Florida Committee on Rare and Endangered Plants and Animals. See bottom of table for definitions of status designations.

TAXON		Endemic	U.S.	Florida	FNAI	FCREPA
Plants						
Needle palm	*Rhapidophyllum hystrix*			T		
Cardinal flower	*Lobelia cardinalis*			T		
Hand fern	*Ophioglossum palmatum*			E	S2	
Star anise	*Illicium parviflorum*	Y (?)		E	S2	
Invertebrates						
Wekiva springs hydrobe	*Aphaostracon monas*	Y			S1	T
Wekiva siltsnail	*Cincinnatia wekiwae*	Y			S1	
Rock springs siltsnail	*Cincinnatia petrifons*	Y				
Sanlando siltsnail	*Cincinnatia ponderosa* (extinct?)	Y			S1	
Seminole siltsnail	*Cincinnatia vanhyningi*	Y			S1	
Rock springs horn snail	*Elimia vanhyningiana*	Y				
Orlando cave crayfish	*Procambarus acherontis*	Y			S1	T
S.E. spinyleg dragonfly	*Dromogomphus armatus*				S3	R
Everglades sprite	*Nehalennia pallidula*	Y				SSC
Microcaddisfly	*Orthotrichia instabilis*					T
Triaenode caddisfly	*Triaenodes furcella*					T
Fishes						
Bluenose shiner	*Pteronotropis welaka*	Y		SSC		SSC
Reptiles						
American alligator	*Alligator mississippiensis*		T	SSC		

Table 2-6. Continued.

TAXON		Endemic	U.S.	Florida	FNAI	FCREPA
Birds						
Little blue heron	*Egretta caerulea*			SSC		SSC
Snowy egret	*Egretta thula*			SSC	S3	SSC
Great egret	*Ardea alba*					SSC
Tricolored heron	*Egretta tricolor*			SSC		SSC
Reddish egret	*Egretta rufescens*			SSC	S2	R
Limpkin	*Aramus guarauna*			SSC	S3	SSC
Yellow-crowned night heron	*Nyctanassa violacea*				S3	SSC
Black-crowned night heron	*Nycticorax nycticorax*				S3	SSC
White ibis	*Eudocimus alba*			SSC		SSC
Glossy ibis	*Plegadis falcinellus*				S3	SSC
Wood stork	*Mycteria americana*		E	E	S2	E
Florida sandhill crane	*Grus canadensis pratensis*	Y		T	S2/S3	T
Swallow-tailed kite	*Elanoides forficatus*				S2	T
Peregrine falcon	*Falco peregrinus*			E	S2	E
S. E. American kestrel	*Falco sparverius paulus*			T	S3	T
Bald eagle	*Haliaeetus leucocephalus*		T	T	S3	T
Mammals						
Florida black bear	*Ursus americanus floridanus*	Y		T	S2	T
Florida manatee	*Trichechus manatus latirostris*	Y	E	E	S2	E

E=Endangered; T=Threatened; SSC=Species of Special Concern; R=Rare; S1=critically imperilled in Florida because of extreme rarity or because of extreme vulnerability to extinction due to some natural or man-made factor; S2=imperilled in Florida because of rarity or because of vulnerability to extinction due to some natural or man-made factor; S3=either very rare and local in Florida or found locally in a restricted range or vulnerable to extinction from other factors.

River floodplain because these swamp forests were considered to be potential habitat for this endangered species (Jackson, 1996). In many cases, the water quality and habitat requirements of species of conservation interest are poorly understood in Florida, so the data do not exist to incorporate the needs of these taxa into this phase of PLRG development.

Another relevant conservation issue is the documented global decline in amphibian diversity (Stuart et al. 2004; Sparling et al. 2000). In many regions of the world, amphibian species are disappearing or their range is dramatically declining. Related to this is an apparent increase in the incidence of deformities in amphibians (Sparling et al. 2000). Mechanisms postulated for these include increasing levels of ultraviolet radiation due to degradation of the ozone layer, increased infestation of amphibian populations by parasites, toxicity from pesticides and other chemicals, and toxicity from nitrate due to fertilizer use (Marco et al. 1999; Rouse et al. 1999).

2.5 Surrounding Land Use

Current and past land use in the surface water drainage areas of the Wekiva River and Rock Springs Run were analyzed by WSI (2004). More intensive development (urban, suburban, and transportation) increased by about 350% between 1973 and 2000 (Table 2-7), with much of the change occurring between 1973 and 1990. Nitrogen isotope analyses conducted by SJRWMD to evaluate sources contributing nitrates to Wekiwa Spring and Rock Springs indicated a combination of organic (wastewater, manure, etc.) and inorganic (fertilizer) sources, attributed largely to urban development in the spring recharge area (Toth and Fortich 2002). Although high nitrate concentrations were measured in the Floridan Aquifer beneath agricultural lands in the western part of the contributing area, Toth and Fortich believed that leachate from those agricultural lands was not influencing nitrate levels in Wekiwa Spring and Rock Springs.

Table 2-7. Urban and developed land use in the surface drainage area of the Wekiva River and Rock Springs Run. Source: WSI 2004 (Appendix B).

LAND USE (acres)	**1973**	**1990**	**1995**	**2000**
Urban (including residential, commercial, & industrial)	4,390	15,010	16,090	17,492
Transportation & Utilities (roads, powerlines, water supply, sewage, and generating facilities)	42.5	483	526	612
Total drainage area	59,280	59,280	59,280	59,280
% urban and built up land	7.5%	26.1%	28.0%	30.5%

3 DISTRICT STUDIES CONDUCTED FOR PLRG DEVELOPMENT

Beginning in 2004, after passage of the Wekiva Parkway and Protection Act, SJRWMD contracted with private consultants to conduct investigations that would contribute to PLRG development for the Wekiva River and Rock Springs Run. District staff also reviewed scientific literature and analyzed water quality data. Information from these various lines of investigation was used to develop the pollutant concentration targets and related reductions recommended in this report. Following are brief descriptions of the objectives and methods of these concurrent efforts. Details can be found in the appendices.

3.1 Ecosystem Metabolism in the Wekiva River, Rock Springs Run, and in Reference Spring-run Streams

Wetland Solutions Inc. (WSI) was contracted by SJRWMD in summer 2004 to compile and summarize existing data and information for the Wekiva River and Rock Springs Run and to develop a work plan for rapid PLRG development. WSI's 2004 Work Plan Report is in Appendix B.

The purpose of the work plan was to provide a scientifically based approach for verifying whether nutrients are elevated in the Wekiva River and Rock Springs Run, and to document nutrient impacts, if any, on ecosystem metabolism of these spring-run streams. Work plan methods included:

1. Review and analysis of existing information on the Wekiva River and Rock Springs Run and similar reference spring-run streams to characterize a baseline for the streams' designated uses
2. Review of existing information and planning of focused studies to link specific nutrients to impaired conditions
3. Implementation of those studies and analysis of resulting data
4. Identification of nutrient reductions necessary to preserve or restore the Wekiva River and Rock Springs Run to an unimpaired condition.

Two "reference" spring-run streams were recommended to help determine background conditions for the Wekiva River and Rock Springs Run. These were Juniper Creek and Alexander Springs Creek, both less impacted, low-nutrient spring-run streams in nearby Ocala National Forest.

WSI was then contracted in fall 2004 to implement the Wekiva PLRG work plan. Impairment was evaluated by measuring ecosystem metabolism in upstream and downstream segments of the Wekiva River and Rock Springs Run and in comparable segments in Juniper Creek and Alexander Springs Creek, the two less impacted, reference spring-run streams in nearby Ocala National Forest. Tasks included:

1. Reconnaissance of the four spring-run streams
2. Water and nutrient mass-balance estimation for the four spring-run streams

3. Detailed ecological evaluation under conditions of differing nutrient availability in segments in the Wekiva River, Rock Springs Run, Juniper Creek and Alexander Spring Creek
4. Collection of ecosystem-level data (physical environment, water quality, plant communities, gross primary productivity, net primary productivity, ecological efficiency)
5. Analysis and interpretation of data to evaluate impairment

To identify pollutants of concern, ecosystem metabolism data from the Wekiva River and Rock Springs Run were compared to the reference streams to determine whether, and to what extent, nutrients affected ecosystem function. Water quality spatial trends were examined and compared to ecosystem data to look for onset of impairment. Nutrient concentrations and loads in the Wekiva River and Rock Springs Run were also compared to data from other Florida springs.

Existing pollutant loadings were estimated for the four spring-run streams . This analysis also considered assimilation rates of nutrients and used the two reference streams to determine acceptable nutrient targets. Existing pollutant loads causing impairment were determined by calculation of water and nutrient mass balances. Overall nutrient mass balance loads and assimilation rates were estimated for the Wekiva River, Rock Springs Run, Alexander Springs Creek, and Juniper Creek. Diffuse runoff and nutrient loading rates for land use mapped in the year 2000 were used to estimate external contributions. Spring flows and nutrient concentrations were used to estimate groundwater loads. Upstream-downstream load changes were used to estimate assimilation rates in each stream reach.

The relationship between pollutant loading rates and in-stream nutrient concentrations was determined using a simplified regression model relating nutrient mass loading rates to in-stream nutrient concentrations. This model includes estimated water and associated nutrient inputs from springs, non-point source runoff, tributaries, and from atmospheric inputs. Nutrient transformation rates were estimated from published reaction rates. Necessary pollutant load reduction was estimated as the difference between the existing pollutant load and the estimated load that will result in meeting the in-stream nutrient target, the concentration at which no impairment is likely to occur. Nutrient PLRGs were recommended for nitrate and total phosphorus, nutrient forms for which impairment is already occurring or for which impairment is considered to be likely in light of increasing trends in pollutant loading rates. Results of this work are presented in the pertinent sections of the PLRG Development chapter. Details on Wetland Solutions' 2005 work can be found in Appendix C.

3.2 Attached Algae in the Wekiva River and Rock Springs Run

GreenWater Labs Inc. was contracted to assess the distribution, composition and biomass of attached algae and to characterize habitats of attached algae in the Wekiva River and Rock Springs Run. A visual survey was conducted of attached algae in the Wekiva River and Rock Springs Run in 2004. Attached algae species composition,

density and biomass were analyzed from 15 sites in Wekiwa Spring and the Wekiva River and 9 sites from Rock Springs and Rock Springs Run in winter 2004/05 and summer 2005. Algae were described and collected from various substrates (vegetation, rocks, and wood) at regular intervals along the streams. Algae growing on the sediment surface were not sampled. Field water quality parameters were measured concurrent with algal sampling, and water quality samples were collected for laboratory analysis. Results of this work are presented in the pertinent sections of the PLRG Development chapter. Details on this work can be found in GreenWater's report in Appendix D.

3.3 SJRWMD Review of Literature and Data

SJRWMD staff conducted additional reviews of the scientific literature and analysis of available data to augment the contracted PLRG development work described above. Objectives and methods are summarized here. Results will be summarized in the upcoming PLRG Development chapter. Details for most of these efforts can be found in the appendices. Those not included in the Appendices can be obtained via the internet (URL links provided in the Literature Cited section) or are available from the scientific literature.

3.3.1 Nitrate Toxicity to Aquatic Animals

SJRWMD staff (Mattson et al. 2005) conducted a review of the scientific literature on nitrate toxicity to determine threshold levels of nitrate that have been demonstrated (experimentally or with field surveys) to cause adverse lethal or sub-lethal effects to aquatic animals. Toxicity values gleaned from the literature were in most cases derived from short-term acute laboratory assays. Uncertainty factors are a means of accounting for various sources of uncertainty, extrapolation from short-term laboratory results to long-term effects in the field, from one species to others, and from lethal thresholds to sublethal thresholds (Newman and Unger 2003). Uncertainty factors were applied to the literature-derived toxicity values to estimate protective threshold concentrations for nitrate. Details on this literature review and data analysis can be found in Appendix E.

3.3.2 Coliform Bacteria Impairment

SJRWMD staff (Lehmensiek 2005) analyzed water quality data collected by Orange County from 1997 through 2005 to determine if the Wekiva River and Rock Springs Run were impaired for total and fecal coliform bacteria levels according to numeric criteria in the Impaired Waters Rule (Chapter 62-303, FAC). Reductions in total coliform counts were calculated based on EPA's percent-reduction method. Details on this coliform assessment can be found in Appendix F.

3.3.3 Total Phosphorus Thresholds for Attached Algae Growth

SJRWMD conducted additional analysis of the attached algae data collected by GreenWater Labs (2005) in the Wekiva River and Rock Springs Run to evaluate whether there was a relationship between phosphorus and the occurrence and

proportion of algae generally considered to be “nuisance” taxa. These are primarily taxa in the Cyanobacteria and green algae (Chlorophyta). This additional analysis was prompted by the findings in the Upper St. Johns River basin (Keenan et al. 2003), which found that increased phosphorus accounted for increased biovolume of Cyanobacteria. The analysis is described in Appendix G

3.3.4 Rainbow River Algal Bioassays

The University of South Florida (Cowell and Dawes 2004) conducted laboratory assays for the Southwest Florida Water Management District (SWFWMD), examining nitrate levels and growth of the cyanobacterium, *Lyngbya wollei,* from the Rainbow River, a spring-run stream in western Marion County.

3.3.5 Suwannee River Algae and Nutrients

The Suwannee River Water Management District (Hornsby et al 2000) collected long-term (3 -10 years) quarterly data on periphyton in the Suwannee River and its major tributaries, concurrent with water chemistry sampling. These data were analyzed to evaluate relationships between algal abundance (as cell density and ash-free dry weight biomass) and nitrate. Relevant excerpts from their report are found in Appendix H.

3.3.6 Nutrients in Less-Impacted Spring-Run Streams and in 130 Florida Springs

Existing nitrate and total phosphorus data were retrieved from STORET for three Florida spring-run streams (Juniper Creek, Alexander Springs Creek, Wacissa River) considered to be less-impacted due to minimal urban and/or agricultural development in their springsheds, and for 130 Florida springs, including impacted springs. These data were analyzed and compared to the Wekiva River and Rock Springs Run. Results of these analyses are in Appendix I.

3.3.7 Nutrients in Undeveloped Streams in the United States

Clark et al. (2000) analyzed various forms of nitrogen and phosphorus and their yields from 85 sites representing relatively undeveloped watersheds in the continental U.S. Their data came from various U.S. Geological Survey water quality assessment programs conducted between 1990-1995. Binkley et al. (2004) extracted data from the published literature on nitrogen and phosphorus concentrations in 300 streams draining largely forested watersheds in the U.S. They examined regional and nationwide spatial trends in water quality using these data.

3.3.8 Nitrate Targets for EPA’s TMDL

The U.S. Environmental Protection Agency (USEPA 2005) issued a final Total Maximum Daily Load (TMDL) for nitrate in the Wekiwa Spring and Rock Springs Run in December 2005, as required by a Consent Decree. The TMDL was based on comparison with Juniper Spring, a less-impacted lower-nutrient spring-run stream in

Ocala National Forest. A target concentration was selected based on the 90th percentile level of nitrate for Juniper Spring. The URL link to this report is listed in the Literature Cited section.

3.3.9 Total Phosphorus and Epiphytic Algae in Ichetucknee Springs

A contractor for Suwannee River Water Management District sampled epiphytic algae and water quality in headsprings contributing to the Ichetucknee River, a spring-run stream in Columbia County, Florida (PBS&J 2004). The relationship between nitrogen and phosphorus and algal biomass (as mg chlorophyll a per gram wet weight of host plant) was examined. Relevant excerpts from the final report from this effort are in Appendix J.

3.3.10 Phosphorus in Florida Springs in the 1950's

The University of Florida (Odum 1953) collected phosphorus data from a variety of surface and ground waters in Florida (including springs) in the early 1950's prior to more intensive agricultural and urban land use changes in many springsheds. These data were evaluated to determine potential historic or background conditions of phosphorus in springs.

3.3.11 Nitrate Targets for FDEP's Wastewater Treatment Criteria

FDEP (2004) proposed a nitrate concentration target for development of enhanced central wastewater treatment standards and criteria for the Wekiva Study Area, as mandated by the Wekiva Parkway and Protection Act. This target was based on comparison with nitrate levels in less developed spring-run streams such as Juniper Creek, Alexander Springs Creek, and Silver Glen Run (C. Ferraro, FDEP Central District, personal communication; R. Drew, FDEP Tallahassee, personal communication). The URL link to this report is listed in the Literature Cited section.

4 PLRG DEVELOPMENT

To briefly reiterate, the steps followed in this PLRG development process are:

1. Identify the nature and extent of impairments, if any;
2. Identify causative pollutants, if any;
3. Determine acceptable concentrations of causative pollutants;
4. Calculate necessary pollutant load reductions.

The various investigations described in Chapter 3 each contributed to one or more of these steps. Key results of these investigations are briefly summarized in the following sections. Detailed reports for most of these efforts are in the Appendices. Prior to presentation of the findings, however, is a discussion of issues involved in identifying impairment and in defining nuisance algae.

4.1 Determining Impairment

Surface-water quality in Florida is managed by assigning "designated uses" (Chapter 62-302.530, FAC). The Wekiva River and Rock Springs Run have a designated use of Class III, meaning they are managed for "recreation, propagation of a healthy, well-balanced population of fish and wildlife". A water body must meet a set of water quality standards specific to its designated use. If it does not meet those standards, it is considered impaired. Chapter 62-303, FAC (Identification of Impaired Surface Waters) establishes the criteria by which the State of Florida identifies impaired water bodies. An impaired water is defined in this rule as:

"a water body or water body segment that does not meet its applicable water quality standards as set forth in Chapters 62-302 and 62-4, FAC, as determined by the methodology in Part III of this chapter, due in whole or in part to discharges of pollutants from point or nonpoint sources." (Chapter 62-303.200[6], FAC)

Water bodies are placed on FDEP's Verified List of Impaired Waters if:

- any of the water quality criteria listed in Chapter 62-302, FAC have exceedances surpassing a threshold (based on eligible data) with at least a 90% level of confidence that the actual exceedance frequency is $\geq$10%;
- the water body fails a bioassessment, conducted using one of the department-approved methods (SCI, BioRecon, or LCI);
- acute or chronic toxicity is determined;
- a determination is made that there is a violation of the narrative nutrient criterion in the Class III water quality standards. For streams, this determination is made if: (1) algal mats are present in sufficient quantities to "pose a nuisance" or "hinder reproduction of a threatened or endangered species", and/or (2) annual mean chlorophyll-a levels are >20 µg/L or have increased by more than 50% over "historical values" for "at least two consecutive years". The rule also notes, however, that "Other information indicating an imbalance of flora or fauna due to

nutrient enrichment, including, but not limited to, algal blooms, excessive macrophyte growth, decrease in the distribution (either in density or areal coverage) of seagrasses or other submerged aquatic vegetation, changes in algal species richness, and excessive diel oxygen swings, shall also be considered." (Chapter 62-303.350[1], FAC);

- the water body was subject to swimming area closures due to exceedance of primary contact bacteriological quality;
- the water body is under a fish or shellfish consumption advisory;
- the water body is used as a source of drinking water and exceedances of human health-based water quality criteria are demonstrated.

Water bodies placed on this Verified List of Impaired Waters are then subject to the development of Total Maximum Daily Loads (TMDLs).

4.1.1 FDEP Assessment of Impairment

FDEP conducted a water quality assessment of the Wekiva River and its tributaries as part of its process to identify impaired water bodies in the Middle St. Johns River Basin (MSJRB). FDEP is required by the federal Clean Water Act to develop and implement TMDLs for these water bodies to reduce or eliminate impairment caused by pollution. The assessment of the MSJRB (FDEP 2003) considered water quality, biological and fish tissue data collected between 1991 and 2000. Water quality criteria analyzed were metals, chlorophyll-a, dissolved oxygen (DO), fecal and total coliforms, pH and unionized ammonia. Additional information from the FDEP Bioassessment program and fish tissue data/consumption advisories were also considered. See the FDEP website (link listed in Literature Cited) for a copy of the MSJRB Assessment Report. Based on their criteria and analysis, FDEP does not consider the Wekiva River and Rock Springs Run to be impaired for any constituent.

4.1.2 SJRWMD Analysis of Impairment

Impairment has to be scientifically demonstrated and causal pollutants identified before PLRGs can be developed. Consequently SJRWMD work focused on determining if the Wekiva River and Rock Springs Run are impaired according to criteria not considered by FDEP in their standard water-quality assessments described above. The broad range of issues that were considered in making a determination of impairment are listed in Table 4-1.

Consideration of numeric water quality criteria is relatively straightforward – if numeric criteria are violated due to anthropogenic effects, then there is impairment. Consideration of ecological factors (e.g., ecosystem processes and biological communities) can be more difficult, particularly since the state standard for nutrients is narrative (Chapter 62-302.530 (48): "In no case shall nutrient concentrations of a body of water be altered as to cause an imbalance in natural populations of aquatic flora and fauna." In some instances, such as impacts on populations of a listed species, there is a clear legal threshold that permits a finding of imbalance and impairment. In other

Table 4-1. Issues that were considered in determining impairment of the Wekiva River and Rock Springs Run.

Water Quality	Comparison to Class III standards Comparison to "typical values" for other spring-run streams (or to reference spring-run systems) Evaluate against OFW standard (i.e., degrading trends) Toxicity to animals
Ecosystem Processes (production, respiration, etc.)	Imbalance considerations (what's "natural" for a spring-run stream?) Important limiting nutrients/nutrient thresholds for algal production Stream metabolism Comparison to other spring-run systems
Habitats/Communities/Populations	Habitat alterations due to algal growth Invertebrate and or fish community impacts Aquatic macrophyte communities (aquatic plant management) Impacts on listed species Disruption by non-native species Changes in taxa composition of algal community (increased proportion of "undesirable" taxa)
Recreation/Aesthetics	"Nuisance" algae (interference with recreational use; odors; visual impacts) Fishery impacts
Human Health	Coliform levels/Swim area closures Algal toxicity/allergic reactions
Hydrology	Potential changes in flows and levels (frequency, duration, magnitude) Interactions with established MFL for the Wekiva River

cases (alterations in species composition of algal or benthic communities, impacts on sportfish habitat), a scientific judgment regarding what constitutes a balanced biota must be made. Florida law defines the natural background condition as "the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered water body or on historical pre-alteration data." (Chapter 62-302.200[15], FAC). Assuming that the natural background condition maintained a balanced biota, the determination of nutrient impairment can be based on comparisons to historical data predating impacts or to the biota of similar water bodies that are unimpacted (reference water bodies).

Because data pre-dating anthropogenic effects are generally lacking for many aquatic ecosystems, a current approach towards assessing anthropogenic effects is to define a "reference" condition using minimally impacted, similar systems for a particular region (Hughes 1995; Bunn et al. 1999). The reference condition is generally interpreted to mean the condition of the system prior to human development of the landscape, and is assumed to represent optimal "biological integrity" or "ecosystem health" (Hughes 1995). Karr (1991), citing some of his earlier work, defines biological integrity as:

"the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat of the region. "

He defines ecological health as:

(a biological system) ". . . can be considered healthy when its inherent potential is realized, its condition is stable, its capacity for self-repair when perturbed is preserved, and minimal external support for management is needed."

In a "reference" approach, deviation from the reference condition is inferred as impairment, including the above considerations regarding biological integrity and ecological health.

For the Wekiva River system, water quality or ecological degradation that can be demonstrated to have occurred since 1979 (the baseline year for evaluating the non-degradation standard for OFWs) would constitute a violation of the no degradation standard in Chapter 62-302.700 [1], FAC and also may be considered impairment.

Florida water quality standards also prohibit the presence of "Substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, plants, or animals" (Chapter 62-302.530 [62], FAC). Because nitrate can be toxic to aquatic organisms, our investigation included an assessment of the potential for nitrate toxicity and an analysis of concentrations that would result in minimal or no toxicity effects.

4.2 Defining Nuisance Algae

For purposes of this report, periphyton refers to the community of attached organisms, on submerged surfaces. This community includes microscopic algae (diatoms, green algae, blue-green bacteria and euglenophytes), as well as bacteria, protozoa, and microscopic animals embedded in a polysaccharide matrix (Lock et al. 1984). This community has been variously described as a "biofilm" or "benthic turf". The periphyton can also include filamentous macrophytic algae or macroalgae. These species are macroscopic (easily visible), primarily filamentous green (Chlorophyta) and yellow-green (Xanthophyceae) algae and Cyanobacteria. They may form thick benthic or floating mats and may become nuisance species. In this report, growth of periphyton and growth/occurrence of filamentous "nuisance algae" are both considered. While some amount of periphyton growth is ecologically beneficial (due to increased food resources and additional habitat), excessive periphyton growth, especially of the filamentous macroalgae, can inhibit the growth of beneficial species of submersed aquatic vegetation (SAV), can have detrimental effects on faunal habitat, and/or can constitute an aesthetic nuisance. A determination of the level of periphyton that is harmful was beyond the scope of this work and is not available in the scientific literature. To reduce the potential for harmful levels of periphyton, we looked for inflection points between the growth potential of periphyton (at species and community levels) and levels of nitrate and total phosphorus. By limiting concentrations to levels below these points excessive growth of periphyton should be prevented.

The perception of "nuisance" algae (primarily the filamentous macroalgae in the Cyanobacteria and Chlorophyta) and its possible link to elevated nitrate levels is of relevance in this PLRG analysis. Florida's Impaired Waters Rule (Chapter 62-303.200, FAC) defines "nuisance species" as:

". . . species of flora or fauna whose noxious characteristics or presence in sufficient number, biomass, or areal extent may reasonably be expected to prevent, or unreasonably interfere with, a designated use of those waters."

The scientific literature generally defines "nuisance algae" in reference to interference with human uses; e.g., decreasing water flow, clogging water intakes, or interfering with recreational uses (Dodds and Welch 2000; Lembi 2003). Welch et al. (1988) considered a chlorophyll-a standing crop of >150 mg/m^2 (which equated to a cover of about 20% filamentous macroalgae) as a nuisance level in northern rocky streams. They interpreted nuisance to mean "aesthetically displeasing and interfere(s) with foot travel by fishermen." Large mats of filamentous algae (Cyanobacteria and Chlorophyta) are also a aesthetic nuisance in that anaerobic decomposition of dead filaments within the mats produces a characteristic "sewage" or "septic" odor.

To date, a determination of what constitutes a "nuisance level" of algae in Florida springs or spring-run streams has not been made. Based on the definition of nuisance species for a Class III water body, per the Impaired Waters Rule, algal growth that interferes with recreational uses or causes ecological changes which affect "health or

balance" of fish or wildlife populations could be considered a nuisance, and thus an impairment of the water body.

One algal group of major concern in Florida springs is the filamentous Cyanobacteria, primarily in the genus *Lyngbya*. With increased nutrient loading to a water body, it is frequently the Cyanobacteria that respond most prolifically (Komárek 2003; Brönmark and Hansson 1998), exhibiting large increases in abundance and excluding other algal taxa. Increase in *Lyngbya* biomass is a management issue in many Florida springs (Burns, unpublished paper; Stevenson et al. 2004). *Lyngbya*, and other Cyanobacteria, produce toxins that may be associated with skin reactions (dermatitis) and respiratory distress (Burns, unpublished paper; Komárek 2003). In some instances the allergic reaction may be severe enough to result in anaphylactic shock. The toxins may also have ecological impacts, but these have received much less attention than the human health effects. Large mats (= blooms) of filamentous Cyanobacteria may also adversely affect macroinvertebrate and fish habitat, water quality, and SAV.

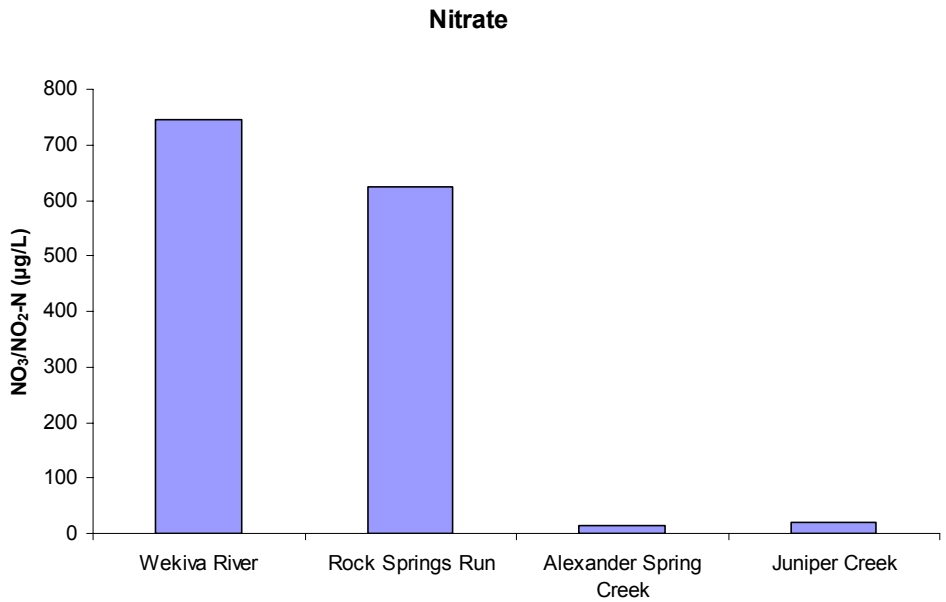
4.3 Results of PLRG Investigations

4.3.1 Ecosystem Metabolism in the Wekiva River, Rock Springs Run, and in Reference Spring-run Streams

Impairment. Data collected by WSI during 9 months in 2004-2005 demonstrated that nitrate and total phosphorus concentrations were elevated in the Wekiva River and Rock Springs Run compared to Juniper Creek and Alexander Spring Creek (WSI, 2005; Figure 4-1). Mass loading of total inorganic nitrogen (TIN) was higher in upstream segments of the Wekiva River and Rock Springs Run than in the Juniper and Alexander segments. Measures of ecosystem metabolism (gross primary productivity, net primary productivity, and ecological efficiency) were consistently lower in the Wekiva River and Rock Springs Run than in the two reference streams (Figure 4-2). High nutrient loading in the Wekiva River and Rock Springs Run appears to be causing disruption of ecosystem function in these aquatic ecosystems, evidenced by reductions in productivity and ecological efficiency (WSI 2005).

WSI (2005) noted other impacts to the Wekiva River and Rock Springs Run that could contribute to degradation and imbalances in flora and fauna. These impacts included high erosion rates in the contributing watershed, flow reduction due to increasing groundwater withdrawals, high-intensity aquatic plant management efforts, and recreation-related disturbance.

Nutrient Target Concentrations. Wetland Solutions (WSI 2005) recommended nutrient concentration targets for the Wekiva River and Rock Springs Run calculated to avoid degradation of aquatic ecological structure and function. These were based on evaluation of ecosystem metabolism data and water quality data for 130 Florida springs. Ecosystem metabolism data suggested an NOx target of 100 – 200 µg/L. About half of the 130 Florida springs had mean NOx concentrations greater than 500 µg/L and mean



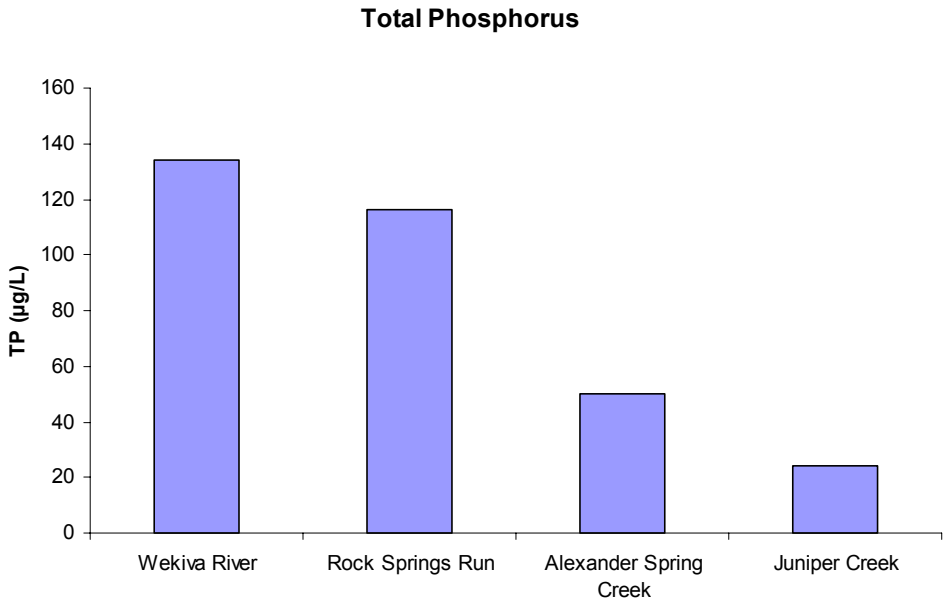
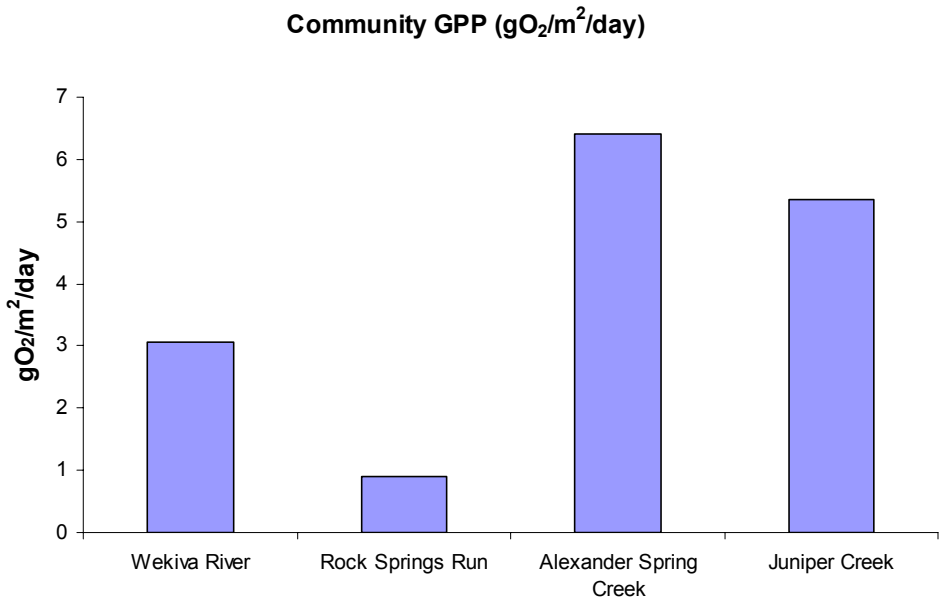


Figure 4-1. Mean nitrate and total phosphorus concentrations in intensive-study segments of the Wekiva River, Rock Springs Run, Alexander Spring Creek and Juniper Creek (from WSI 2005).



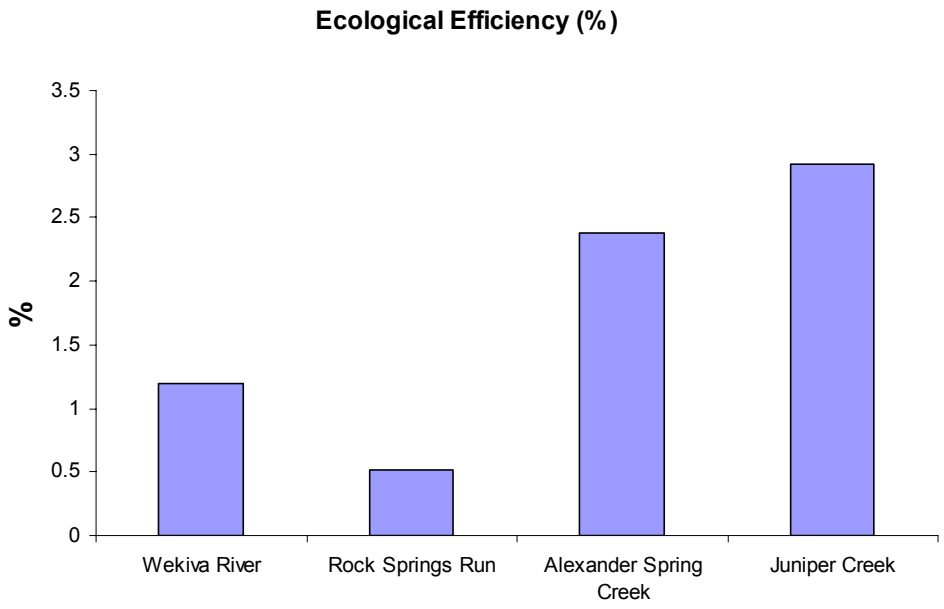


Figure 4-2. Mean gross primary productivity and ecological efficiency in the Wekiva River, Rock Springs Run, Alexander Spring Creek, and Juniper Creek (from WSI 2005).

TP concentrations greater than 50 µg/L. Based on these lines of evidence, WSI calculated PLRGs for target concentrations of 100 µg/L NOx and 50 µg/L TP.

PLRGs. Preliminary NOx and TP load reductions necessary to meet these concentration targets were calculated using simple linear models relating nutrient loading rates and in-stream nutrient concentrations for downstream points in each stream. These model relationships were weak and would need to be improved through additional data collection. Load reductions of 67% NOx would be required to meet the 100 µg/L NOx target at a downstream point in the Wekiva River. A TP load reduction of 76% would be required to meet the 50 µg/L TP target at a downstream point in the Wekiva River.

See Appendix C for Wetland Solutions' detailed methodology and data.

4.3.2 Attached Algae in the Wekiva River and Rock Springs Run

The highest biomass of attached algae was found at sites in and around the springs for both Wekiva River (WR) and Rock Springs Run (RSR). Diatoms were the dominant algal group in terms of biomass and diversity at the majority of sites (GreenWater Labs 2005). Filamentous Cyanobacteria (particularly *Lyngbya wollei* and *Phormidium*) were most abundant in terms of biomass at sampling sites nearest the headsprings, although the thin cyanophyte filament *Heteroleibleinia* was important at some downstream sites.

Cyanobacteria comprised a greater percentage of total biovolume in summer than in winter (GreenWater Labs 2005). Chlorophyta (particularly *Spirogyra*, *Mougeotia* and *Cladophora glomerata*) were most abundant in terms of biomass at the sites nearer the headsprings although accumulations of filamentous green algae (*Cladophora glomerata* and *Oedogonium*) were observed in the wide, shallow section of the Wekiva River upstream of the SR46 bridge. The filamentous red alga *Batrachospermum* was found in both the WR and RSR, but was more abundant and at a higher percentage of sites in the WR. The filamentous xanthophyte *Vaucheria* was more abundant in WR and RSR than indicated by this study. The sampling method excluded benthic mats, of which some extensive ones composed of *Vaucheria* were present at times in both systems. Ash free dry weight (AFDW) and chlorophyll-a were both higher at sites nearer the headsprings on both spring-run streams. See Appendix D for details.

4.3.3 Nitrate Toxicity to Aquatic Animals

Camargo and Ward (1995) estimated safe levels of nitrate for two species of caddisflies based on 96 h LC50s. Using multifactor probit analysis they extrapolated from the acute LC50 concentrations to estimate "safe concentrations" for chronic exposure for early instar larvae: 1,400 ug/L for the genus *Hydropsyche* and 2,400 ug/L for the genus *Cheumatopysche*. Both genera occur in the Wekiva River (Warren et al. 2000). Mosquitofish, which also occur in the Wekiva River (Warren et al. 2000), have exhibited adverse sublethal effects at nitrate levels of 4,000 µg/L and above (Edwards et al. 2004; Edwards 2005). Selected frog genera in Canada (*Rana* sp. and *Pseudacris* sp.) showed

adverse sublethal effects at nitrate levels as low as 2,500 µg/L (Hecnar, 1995). Representatives of these frog genera are present in the Wekiva River and Rock Springs Run (*Rana* spp.) and its adjacent floodplain (*Pseudacris* spp). Many of the experimental studies were conducted over the larval lifetime of an animal (e.g., frogs from egg to adult).

Figure 4-3 illustrates the reported toxicity thresholds for different aquatic animals relative to nitrate concentrations in the Wekiva River and Rock Springs Run. Maximum nitrate concentrations recorded through 2005 for the Wekiva River and Rock Springs Run were 1,500 and 1,800 µg/L, respectively. These concentrations may be toxic to at least one genus of caddisfly found in the Wekiva River and Rock Springs Run. An increase in maximum nitrate of 1000 µg/L (67%) for the Wekiva River and 700 µg/L (39%) in Rock Springs Run would meet or exceed toxicity thresholds for other caddisflies and for certain frogs.

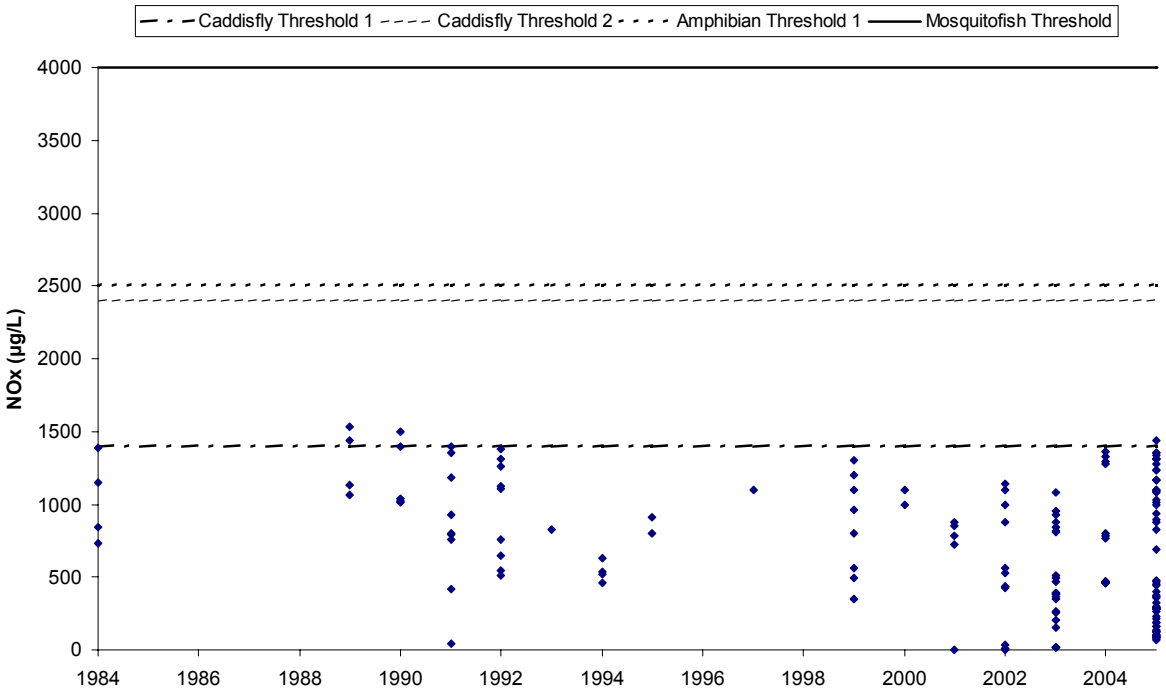
Derivation of a protective nitrate concentration requires consideration of the sources of uncertainty inherent in the limitations of the data derived from short-term, acute toxicity assays. The USEPA (1995a; 1995b), USFWS (2003), and USFWS et al. (2001) have employed up to four uncertainty factors to set protective exposure limits for toxic contaminants:

1) an interspecies uncertainty factor (UF_A);
2) an exposure duration uncertainty factor (subchronic to chronic: UF_S);
3) an exposure endpoint uncertainty factor (UF_L) – equivalent to a concentration between the "Lowest Observed Effect Level" (LOEL) and the "No Observed Effect Level" (NOEL), and;
4) an intraspecific uncertainty factor (UF_I).

These factors were applied to the lowest nitrate toxicity thresholds derived from the literature review for caddisflies (1,400 µg/L) and amphibians (2,500 µg/L). Application of uncertainty factors yielded concentration thresholds of 140 and 125 µg/L, respectively. Detailed description of this procedure is in Appendix E.

A statistical approach was developed to take the nitrate toxicity thresholds derived from application of uncertainty factors and use them to determine what a new mean nitrate level would be if the threshold were set at the upper end of the population of nitrate data. Nitrate data from the headspring regions of the Wekiva River and Rock Springs Run were used since these were the highest levels (Section 2.3) and thus potentially the most toxic. In order to use this statistical approach, the data must approximate a normal distribution or be transformed to conform to a normal distribution. The existing nitrate data from Wekiwa and Rock Springs met this requirement by deleting a very few outlier values from the dataset. From an ecologically conservative standpoint, the threshold criterion were set at the upper end of the population distribution, at the 90 % probability level, in order to build in an explicit margin of safety. Using this as a starting point, the new mean nitrate concentration was calculated based on the probability of a

Wekiva River



Rock Springs Run

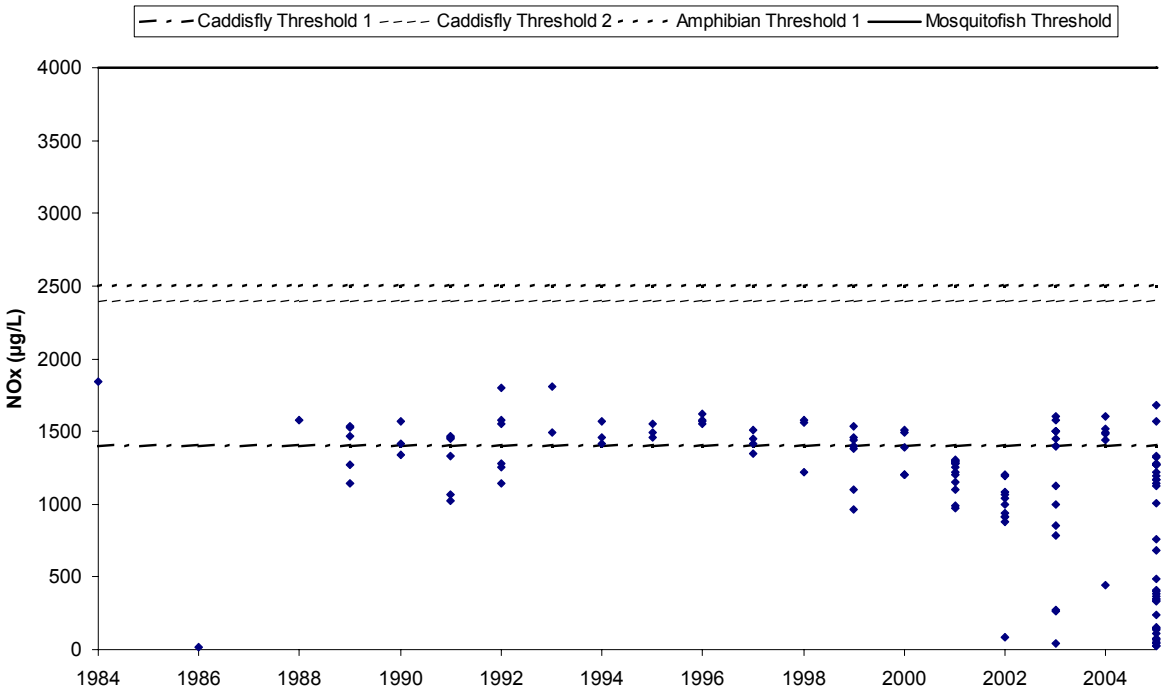


Figure 4-3. Nitrate concentration in the Wekiva River and Rock Springs Run, showing selected toxicity thresholds for aquatic insects, amphibians, and mosquitofish. Source: SJRWMD data analysis and literature review (Mattson et al. 2005).

randomly collected water sample having a nitrate concentration at or less than the specific threshold. To determine the target mean nitrate concentration:

$$M + Z\ score * S = threshold\ concentration \qquad \text{(Equation 1)}$$

M is the target mean nitrate concentration, S is the standard deviation of the target population distribution, and the Z score is the normal deviate associated with the probability assigned (these are obtained from standard tables in most statistics textbooks). This equation enables calculation of the percentage of samples in the new population which will have nitrate concentrations at or less than the established threshold target.

Since S is unknown for the new population distribution, the coefficient of variation (CV) of the existing population (= the existing data) multiplied by the mean can substitute for S in the equation:

$$M + (Z\ score)(CV \times M) = threshold\ target \qquad \text{(Equation 2)}$$

CV is the Coefficient of Variation of the existing population distribution. This assumes that the population variance will vary in proportion to the mean with the coefficient of proportionality being the CV. As such, the CV will be the same for the existing and new distributions of data. To obtain the new target population mean, Equation 2 was solved for M:

$$M = threshold\ concentration/[Z\ score * CV * (1+Z)] \qquad \text{(Equation 3)}$$

For consideration, the threshold selected was a nitrate level of 125 µg/L at a probability of 90% (i.e., 90% of the time, nitrate must be $\leq$125 µg/L). This was the threshold determined by applying uncertainty factors to the lowest amphibian threshold of 2,500 µg/L NOx. Using the statistical methodology described above, the new population mean nitrate/nitrite nitrogen concentrations were 108 µg/L in the Wekiva River and 111 µg/L in Rock Springs Run. These are the suggested nitrate targets in each spring run based on toxicity considerations.

Results of SJRWMD's nitrate toxicity literature review and the application of uncertainty factors are in Appendix E.

4.3.4 Coliform Bacteria Impairment

An analysis of recent data indicates that the Wekiva River and Rock Springs Run are impaired for total coliform bacteria according to criteria in Florida's Impaired Waters Rule. The Class III standard of "no exceedance of 2,400 units/100ml at any time" was used to evaluate total coliform bacteria exceedances Since 1997, the upstream segment of the Wekiva River has exceeded the standard 40% of the time, the downstream segment 45% of the time, and Rock Springs Run 43% of the time. Additionally, the swim area in Kelly Park, at the headwaters of Rock Springs Run, was

closed five times between 2000 and 2005 because of exceedance of primary contact bacteriological standards. The Wekiva River and Rock Springs Run are not impaired for fecal coliform bacteria. For details of SJRWMD's coliform analysis, see Appendix F.

4.3.5 Total Phosphorus Thresholds for Attached Algae Growth

Although the study by GreenWater Labs (2005) sampled algae from a limited range of habitat types, these data can be used in an algae-based water quality assessment (Potapova and Charles 2005). Analysis of the attached algal data from the Wekiva River and Rock Springs Run indicated that % Cyanobacteria in the algal community (by biovolume) was positively correlated with total phosphorus (TP) and % Chlorophyta was not significantly correlated with TP. Graphical analysis of the data indicated that above TP concentrations of 90 µg/L, increased amounts of both Cyanobacteria and Chlorophyta were present in the algal community (Figure 4-4). The statistical procedure described in Section 4.3.3. on nitrate toxicity, was used to calculate a mean TP concentration for the Wekiva River and for Rock Springs Run by setting a threshold of maintaining TP levels $\leq$90 µg/L with a probability of 90%. This probability was selected to be ecologically protective.

Mean TP resulting from this analysis was 59 µg/L for the Wekiva River and 61 µg/L for Rock Springs Run. Results of these analyses are summarized in Appendix G.

4.3.6 Rainbow River Algal Bioassays

Cowell and Dawes (2004) performed laboratory assays of nitrate concentration and growth of *Lyngbya wollei* from the Rainbow River and found a nitrate threshold of 300-600 µg/L, above which growth of *Lyngbya* was significantly higher They recommended a reduction to <300 µg/L nitrate would be necessary to reduce growth of *Lyngbya* in the Rainbow River. A threshold nitrate target concentration of 250 µg/L was selected largely based on this scientific data and recommendation.

4.3.7 Suwannee River Algae and Nutrients

Long-term periphyton and water quality data collected on the Suwannee River (Hornsby et al. 2000) with glass-slide settling racks (periphytometers) indicate that periphyton biomass and abundance increase at threshold concentrations of 200 - 300 µg/L nitrate (Figure 4-5). This lends support to the threshold of 250 µg/L nitrate indicated in the Section above. An upper threshold of about 600 µg/L nitrate appears to be evident, above which nitrate is evidently not limiting to algal growth. Much of the length of the Suwannee is heavily influenced by spring inflow, and the algal communities appear to be generally similar in composition to those in the Wekiva River and Rock Springs Run. Therefore, the Suwannee results are considered applicable to the Wekiva River and Rock Springs Run. See Appendix H for details of the Suwannee River work.

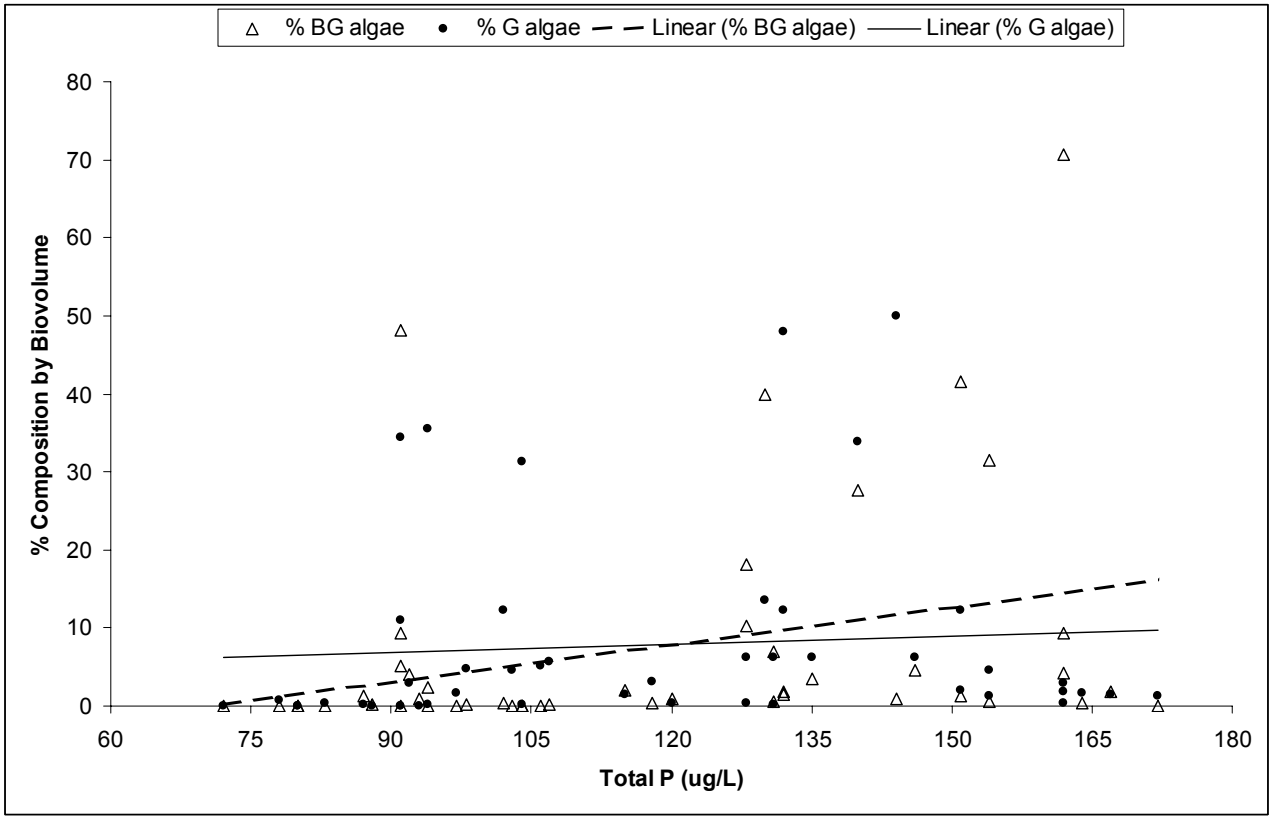


Figure 4-4. Plot of percent Cyanobacteria (= ”BG algae”) and Chlorophyta (= ”G algae”) versus total phosphorus concentrations in the attached algal community in the Wekiva River and Rock Springs Run. Data from GreenWater Labs (2005) survey.

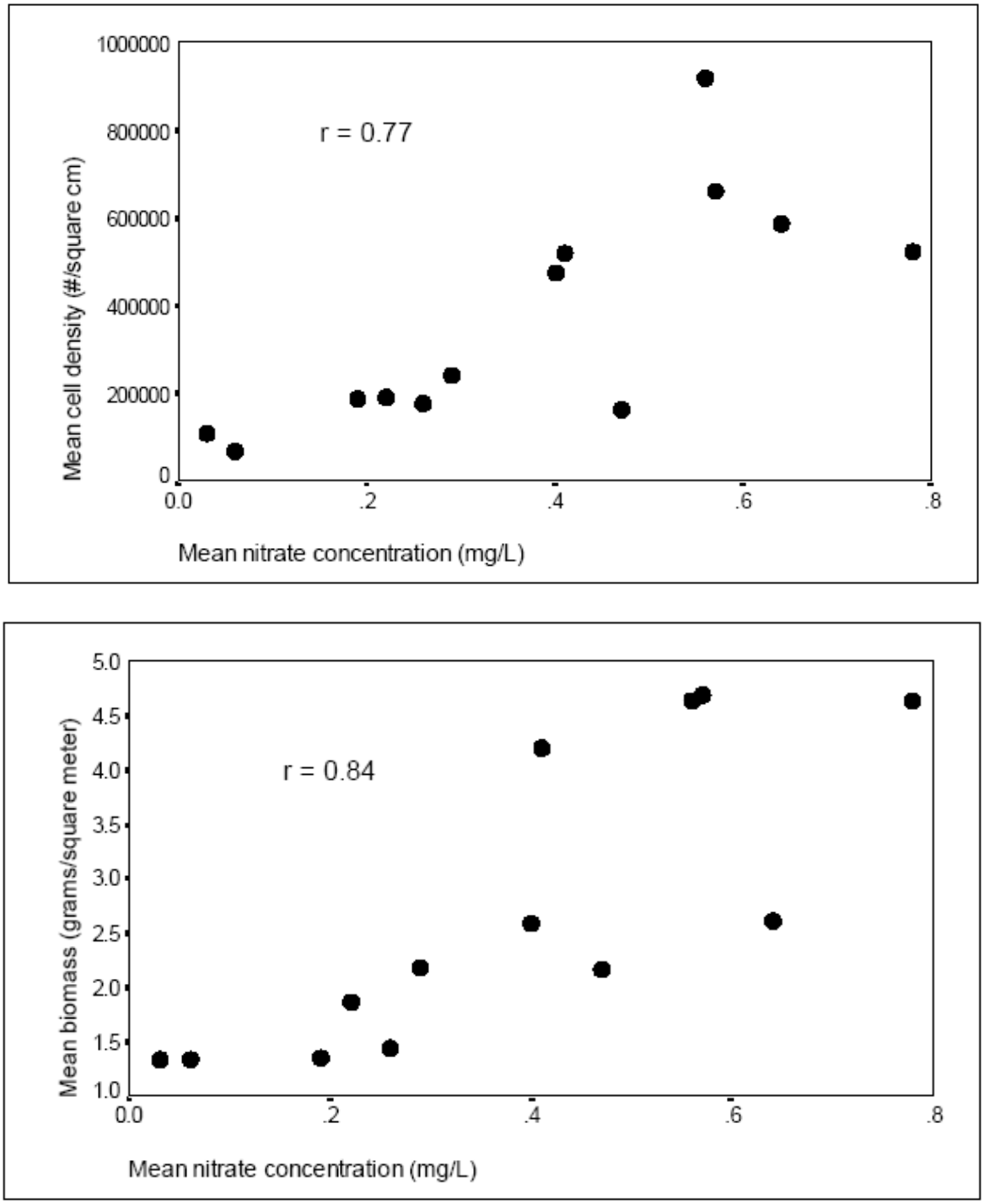


Figure 4-5. Plots showing relationships between mean nitrate concentration and mean periphyton cell density and biomass from long term monitoring stations on the Suwannee River. Source: Hornsby et al. (2000)

4.3.8 Nutrients in Less-Impacted Spring-Run Streams and in 130 Florida Springs

Median nitrate concentrations in three less-impacted Florida spring-run streams (Alexander Springs Creek, Juniper Creek, Wacissa River) were all <100 µg/L. Median total phosphorus concentrations in these streams were all <50 µg/L (Appendix I).

Median nitrate concentration in 130 Florida springs, including springs known to be impacted by elevated nitrate loading, was 480 µg/L and median total phosphorus was 40 µg/L. Median nitrate/total phosphorus levels in Alexander Spring were 51/44 µg/L, in Juniper Spring 81/34 µg/L and in Fern Hammock Spring 90/31 µg/L. These correspond to the results reported above for less impacted spring runs (i.e., nitrate <100 µg/L and total phosphorus <50 µg/L).

Data are summarized in Appendix I.

4.3.9 Nutrients in Undeveloped Streams in the United States

Median nitrate concentrations in streams draining undeveloped watersheds nationwide were 87 µg/L (Clark et al. 2000). Median total phosphorus levels in these streams nationwide were 22 µg/L. In forested watersheds in the southeastern U.S. (Binkley et al. 2004) mean nitrate levels were 180 µg/L and median levels were 50 µg/L. Nationwide, mean nitrate levels in these forested watersheds were 310 µg/L, with a nationwide median of 150 µg/L nitrate. Phosphate levels (whether this was PO_4 or PO_4-P was not specified in the paper) in the southeastern U.S. from these forested watersheds showed a mean of 14 µg/L and a median of 7 µg/L (Binkley et al. 2004).

4.3.10 Nitrate Targets for EPA's TMDL

The US Environmental Protection Agency defined a target concentration of 110 µg/L NOx for Wekiwa Spring and Rock Springs based on the 90th percentile of nitrate concentration in Juniper Spring. Using this concentration target, USEPA proposed a 91-95% reduction in nitrogen load to restore Wekiwa Spring and Rock Springs to natural background conditions. A TMDL for total phosphorus was not established by EPA.

4.3.11 Total Phosphorus and Epiphytic Algae in Ichetucknee Springs

No significant relationships were observed between biomass of epiphytic algae in springs of the Ichetucknee River and nitrate or total nitrogen (PBS&J 2004). Algal biomass was positively correlated with both total phosphorus and soluble reactive phosphorus (SRP), which were almost identical in these springs. Epiphytic algal biomass notably increased above a threshold of about 50-55 µg/L SRP or TP (PBS&J 2004). Results and excerpts from this report are in Appendix J.

4.3.12 Phosphorus in Florida Springs in the 1950's

Historic levels of phosphorus in Florida springs were identified by using data from Odum (1953). Springs within "phosphatic regions" (regions underlain with phosphorus-rich geologic strata) had a mean TP concentration of 61 µg/L (Odum 1953). Florida springs outside of phosphatic regions had a mean TP concentration of 45 µg/L. Odum's map suggests the Wekiva River is outside of the phosphatic region, although the phosphorus-rich Hawthorn Formation is present in the Wekiva study area (Section 2.1). The concentrations from these earlier periods likely reflect conditions closer to the natural background condition.

4.3.13 Nitrate Targets for FDEP's Wastewater Treatment Criteria

FDEP proposed a target nitrate level of 200 µg/L NOx for Wekiwa Spring (FDEP 2004). This was based on NOx levels exhibited by less-impacted reference springs such as Juniper and Alexander.

4.4 Evidence of Impairment and Causative Pollutants

4.4.1 Nutrients - Imbalance of Flora and Fauna

Several lines of evidence indicate that the Wekiva River and Rock Springs Run are impaired due to an imbalance of flora and fauna caused by enrichment with nitrate and total phosphorus:

- Gross and net primary productivity and ecological efficiency are lower than in less-impacted spring-run streams (Juniper Creek and Alexander Spring Creek). This indicates an "imbalance in natural populations of flora and fauna" as prohibited by Chapter 62-302.530[48b], FAC These effects are correlated with nutrient concentrations;

- Laboratory and field studies indicate that present concentrations of nitrate and total phosphorus create the potential for high biomass and productivity of periphyton and potentially nuisance algal species, especially Cyanobacteria, again, constituting an imbalance of flora and fauna.

4.4.2 Nitrate - Potential for chronic toxicity

- Nitrate concentrations have been demonstrated to exceed nitrate toxicity thresholds for sensitive aquatic insects and frogs as prohibited by Chapter 62-302.530[62], FAC

4.4.3 Nutrients - Non-compliance with OFW designation

- The high concentrations of nitrate and total phosphorus indicate anthropogenic enrichment that is not in compliance with part of the narrative nutrient standard (Chapter 62-302.530[48a], FAC); and is not permissible in OFWs (Chapter 62-4.242[2], FAC);

- One analysis indicated there has been an increase in nitrate concentrations in Rock Springs Run since the stream was designated an Outstanding Florida Water. This is prohibited by Chapter 62-4.242[2].

4.4.4 Total Coliform Impairment

The Wekiva River and Rock Springs Run are impaired for total coliform bacteria based on the following evidence:

- greater than 40% exceedance of the 2,400 counts/100 ml impairment criterion in the Impaired Waters Rule;

- swim area closures in Kelly Park (Rock Springs Run);

- increasing levels of coliform bacteria (i.e., a degrading trend in water quality) since OFW designation, a violation of the OFW Rule.

4.5 Pollutant Target Concentrations

4.5.1 Nutrients

Potential nutrient concentration targets for PLRG development were discussed above (Section 4.3) and are summarized in Tables 4-2 (nitrate) and 4-3 (total phosphorus). These findings from multiple lines of investigation (Tables 4-2 and 4-3) were collectively considered to arrive at targets for nitrate and total phosphorus.

4.5.2 Nitrate

SJRWMD proposes mean target concentrations of **216 µg/L NOx** for the Wekiva River and **221 µg/L NOx** for Rock Springs Run. These mean nitrate targets will.

- maintain nitrate levels $\leq$250 µg/L at a probability of 90% in order to limit excessive accumulation of periphyton biomass and limit growth of potential nuisance species of macroalgae such as *Lyngbya*;
- restore ecological efficiency to that found in less-impacted spring-run streams;
- maintain nitrate concentrations at levels that would be minimally toxic to aquatic fauna. The proposed mean concentrations are reduced by a factor of 11 to 12 for the lowest observed amphibian toxicity threshold and by a factor of about 6

Table 4-2. Potential nitrate-nitrite (NOx) concentration targets based on various lines of investigation.

Reference	Basis for Target	NOx (µg/L)	Statistic
Ecosystem metabolism in the Wekiva River and Rock Springs Run (WSI 2005)	Comparison to metabolism in less-impacted spring-run streams (Juniper & Alexander)	100 - 200	Threshold
	Comparison to other springs in SJRWMD	200	Median
Nitrate toxicity to aquatic animals (Mattson et al. 2005)	90% probability of ≤1,400 µg/L (lowest toxicity threshold for caddisflies)		
	Wekiwa Spring	1,200	Mean
	Rock Spring	1,240	Mean
	New thresholds after application of uncertainty factors	125 - 140	Threshold
	90% probability of <125 µg/L (lowest threshold with uncertainty factor):		
	Wekiwa Spring	108	Mean
	Rock Spring	111	Mean
Rainbow River algal bioassays (Cowell and Dawes 2004)	*Lyngbya wollei* biomass	300 – 600	Threshold
	90% probability of ≤ threshold of 250 µg/L:		
	Wekiva River	216	Mean
	Rock Springs Run	221	Mean
Suwannee River periphytic algae and nitrate levels (Hornsby et al. 2000)	Algal biomass	200 - 300	Threshold
	Algal cell density	300	Threshold
Nutrients in Florida springs (WSI and DEP databases)	130 Florida springs, including impacted springs	480	Median
	Juniper Spring, Fern Hammock Spring	81, 90	Median
	Alexander Spring	51	Median
Nutrients in less-impacted spring-run streams in Florida (STORET database)	Juniper Creek	80	Median
	Alexander Spring Creek	50	Median
	Wacissa River	60	Median
Nutrients in undeveloped streams In the United States (Binkley et al., 2004; Clark et al. 2000)	Forested stream basins in the southeastern U.S.	180	Mean
	Undeveloped watersheds in the U.S.	87	Median
EPA proposed TMDL for Wekiwa Spring and Rock Springs Run (USEPA 2005)	Comparison to Juniper Spring	110	Threshold
FDEP wastewater treatment criteria in the Wekiva Study Area (FDEP 2004)	Comparison to less-impacted Florida springs	200	Threshold

Table 4-3. Potential total phosphorus (TP) concentration targets based on various lines of investigation.

Reference	Basis for Target	TP (µg/L)	Statistic
Ecosystem metabolism in the Wekiva River and Rock Springs Run (WSI 2005)	Comparison to metabolism in less-impacted spring-run streams (Juniper & Alexander) Comparison to springs in SJRWMD	50-80 50	Threshold Median
% Cyanobacteria and Chlorophyta in attached algae in Wekiva River and Rock Springs Run (analysis of data from GreenWater Labs 2005)	90% probability of ≤ 90 µg /L (threshold for increased levels of cyanobacteria and chlorophyta in attached algal community): Wekiva River Rock Springs Run	 59 61	 Mean Mean
Mapping and monitoring of submerged aquatic vegetation in the Ichetucknee River headsprings (PBS&J 2004)	Epiphytic algal biomass	55	Threshold
Phosphorus in selected Florida springs in the 1950s (Odum 1953)	Springs outside of phosphatic areas Springs within phosphatic areas	45 61	Mean Mean
Nutrients in Florida springs (WSI and DEP databases)	130 Florida springs, including impacted springs Juniper Spring, Fern Hammock Spring Alexander Spring	40 34, 31 44	Median Median Median
Nutrients in less-impacted spring-run streams in Florida (STORET database)	Juniper Creek Alexander Spring Creek Wacissa River	23 44 44	Median Median Median
Nutrients in undeveloped streams in the United States (Clark et al. 2000)	Undeveloped watersheds in the U.S.	22	Median

- for the estimated no effects threshold of caddisflies as reported in Mattson et al. (2005);
- restore NOx concentrations to that characteristic of less-impacted springs and spring-run streams in Florida and in undeveloped watersheds in the southeastern U.S. and nationwide.

These proposed targets fall within the upper mid-range of the range of possibilities considered in Table 4-2 (Figure 4-6). The Wekiva River and Rock Springs Run targets fall at the 29th percentile for the database of 130 Florida springs assembled by WSI (2005), thus both are in the lower third relative to springs in Florida. Scott et al. (2004) list a nitrate-nitrite measurement of 70 µg/L for Rock Spring in 1946, so the proposed targets are not as low as these springs may have historically been, but should be low enough to protect the ecological integrity of the spring-runs. Toth and Fortich (2002) suggest that levels in springs above 200 ug/L constitute a "problem threshold", and the proposed targets are very close to this level.

4.5.3 Total Phosphorus

Orthophosphate is the analyte most frequently analyzed in groundwater and spring vents (Osburn et al. 2002; Scott et al. 2004). No research appears to have been done in Florida springs to separate the phosphate derived from natural leaching vs. that derived from surficial recharge. Orthophosphate is also rapidly taken up by plants and bacteria, while total phosphorus is less labile. Because of these reasons, SJRWMD made the decision to use total phosphorus (TP). Wastewater treatment and stormwater management are primarily focused on reductions in TP, so any improvements due to load reductions should be measureable by sampling TP in the spring-run streams. SJRWMD proposes mean target concentrations of **59 µg/L TP** for the Wekiva River and **61 µg/L TP** for Rock Springs Run. These mean TP concentration targets will:

- maintain TP concentrations below the threshold for increased growth of Cyanobacteria and green algae (90 µg/L) with a probability of 90%;
- restore ecological efficiency to that found in less-impacted spring-run streams;
- Limit accumulation of epiphytic algal biomass by keeping TP concentrations ~60 µg/L;
- restore TP concentration to that found in Florida springs in the 1950s;
- restore TP concentration to that found in less-impacted springs and spring-run streams in Florida, and in undeveloped watersheds in the southeastern U.S. and nationwide.

The proposed TP targets fall within the upper mid-range of the range of possibilities considered in Table 4-3 (Figure 4-7). The Wekiva River target falls at the 66th percentile for the database of 130 Florida springs assembled by WSI (2005) and Rock Springs Run falls at the 67th percentile, thus both exceed the median TP level relative to springs in Florida. They conform to the potential historic levels of TP found in Florida springs (45-61 µg/L) as reported in Odum (1953), which may be regarded as "natural background". Reference springs in the Ocala National Forest, such as Alexander and

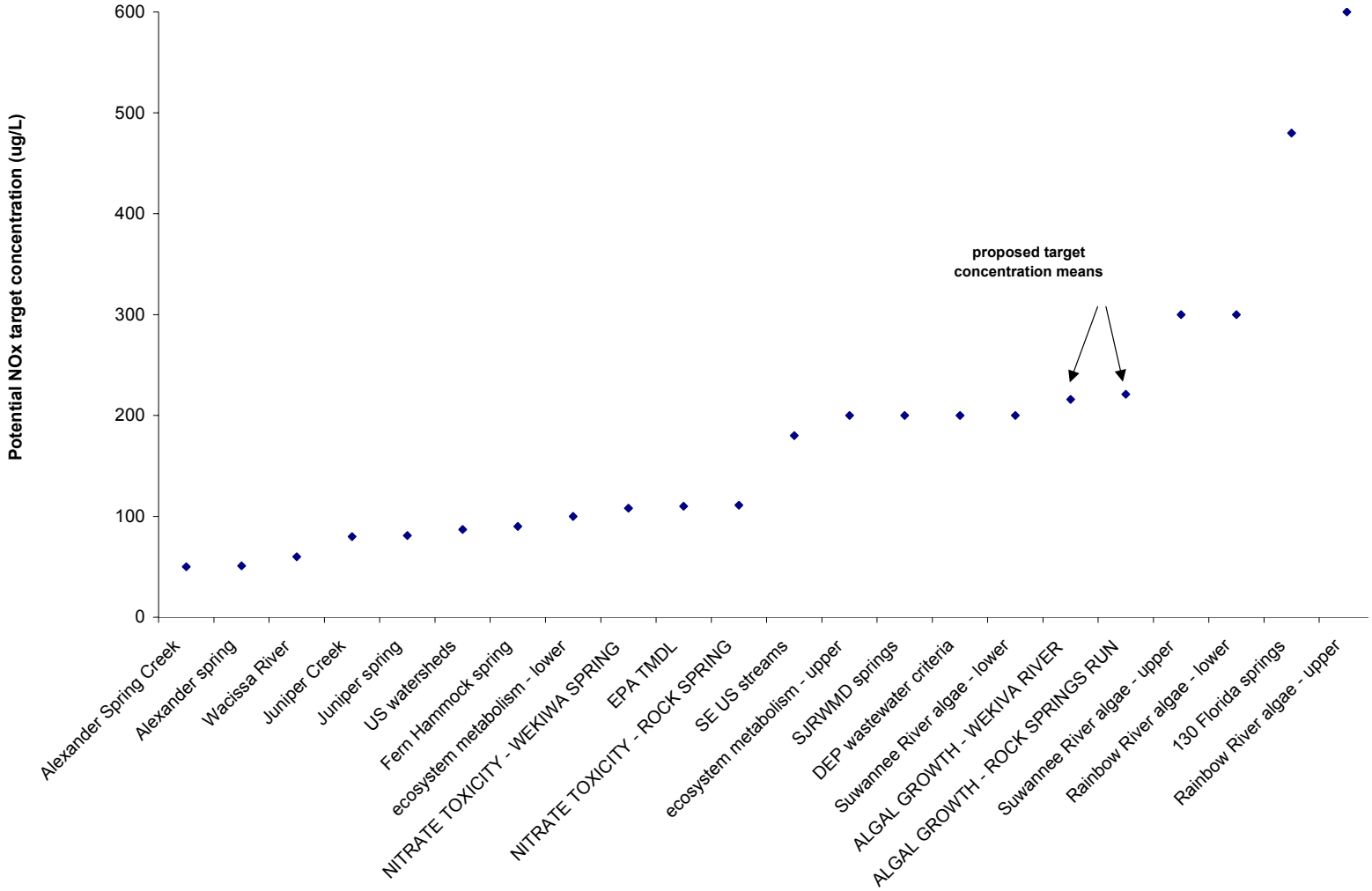
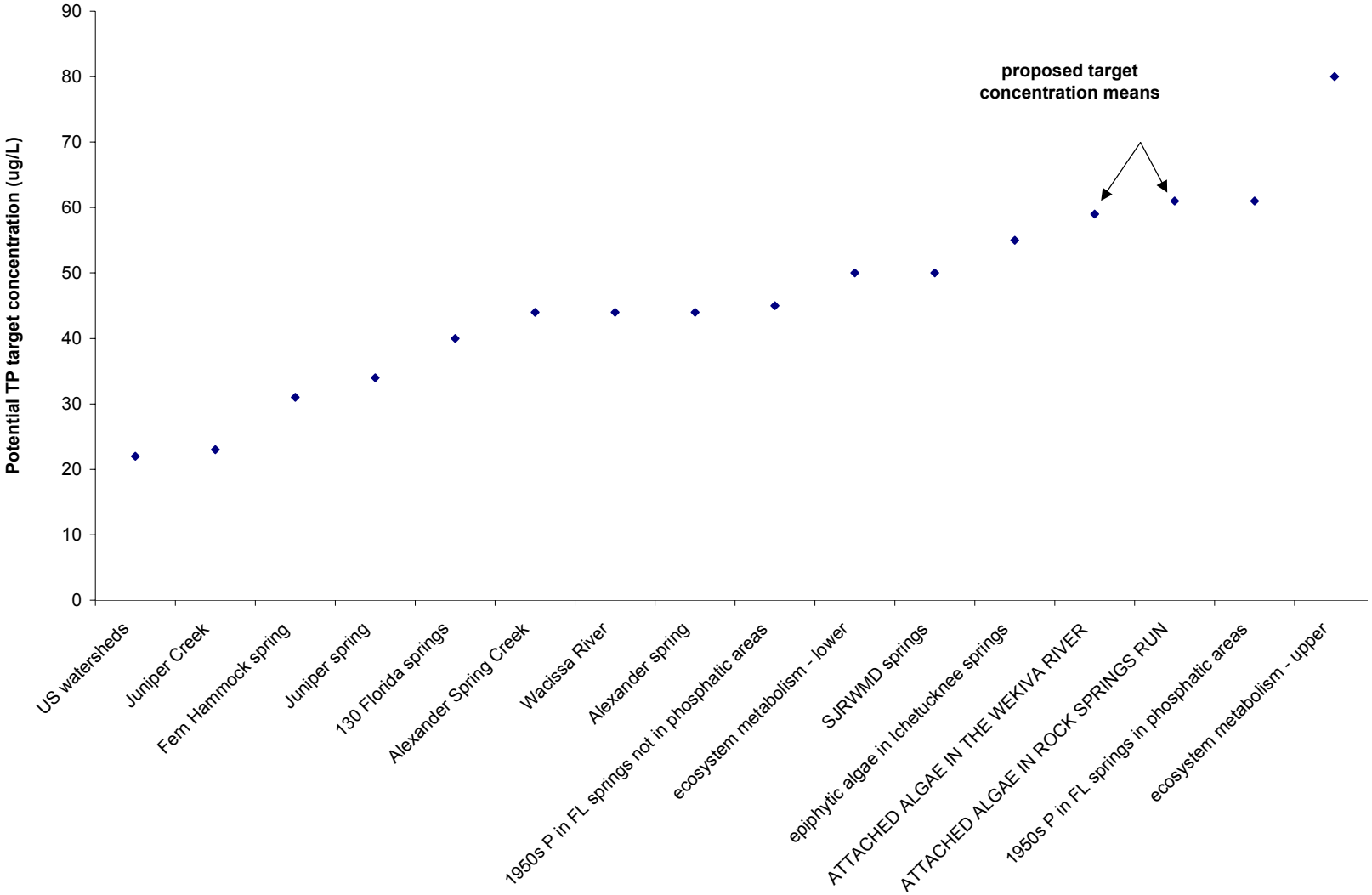


Figure 4-6. Chart showing nitrate concentration targets that were considered and mean concentration targets proposed for the Wekiva River and Rock Springs Run.

Figure 4-7. Chart showing total phosphorus concentration targets that were considered and mean concentration targets



proposed for the Wekiva River and Rock Springs Run.

Juniper also have TP values within or less than this range (40-60 µg/L). Odum (1953) reported TP values of 120-127 µg/L TP for Rock Spring in 1951. This approximates existing concentrations in the spring run (Figure 4-1), indicating either that this is the natural concentration or that anthropogenic TP loading affected the 1951 measurements and has continued, either via groundwater and/or surfacewater inflow. Rock Spring continues to average around 80 µg/L TP and Wekiva Spring 200-600 µg/L (WSI 2004; Osburn et al. 2002), which lie above the apparent natural background levels of TP based on historic data (Odum 1953) and existing reference springs (Alexander and Juniper). It is likely that the TP levels seen in the Wekiva River and Rock Springs Run in part reflect both anthropogenic enrichment and phosphorus leached from geologic deposits in the region.

4.5.4 Total Coliform Bacteria

SJRWMD proposes a not-to-exceed target concentration of **2,400 counts/100 ml total coliform bacteria**, which is the state water-quality standard for Class III waters.

4.6 Pollutant Load Reduction Goals

There are limited data available to calculate nutrient and coliform loading from various sources to the Wekiva River and Rock Springs Run and to relate in-stream concentrations to external loads. Therefore, only reductions in pollutant concentration could be calculated at this time. We assume that pollutant load reductions need to be proportional to pollutant concentration reductions. Throughout the remainder of this document, the percent load reduction is considered equal to the percent concentration reduction.

4.6.1 Nutrients

Nutrient load (concentration) reductions were calculated based on the formula:

$$[(\text{current mean} - \text{target mean}) / \text{current mean}] \times 100 \qquad \text{(Equation 4)}$$

Spatial and temporal trends were considered in development of NOx and TP target concentrations. As appropriate, the required concentration reduction was calculated either for specific segments of each spring-run stream or for the entire stream.

<u>Nitrate</u>

Temporal Trends. Nitrate has significantly decreased in the Wekiva River since 1984 (Figure 2-5). To address the temporal decrease in NOx, a “current condition” data set was created for each segment (see below) that consisted of the most recent and largest data set that showed no significant temporal trend. NOx load reductions were calculated based on the mean of the current condition data for each segment (Table 4-4).

Spatial Trends. Nitrate concentrations significantly decrease from upstream to downstream in the Wekiva River and Rock Springs Run, probably due primarily to assimilation (Figures 2-7 and 2-8). To address the downstream decrease in NOx in calculating load reductions, both spring-run streams were divided into segments (Figure 4-8; Table 4-4) with the headspring as the uppermost segment. The Wekiva River has two downstream segments separated by the confluence of the Little Wekiva River and corresponding to USEPA Water Body Identification (WBID) numbers. Rock Springs Run had one downstream segment consisting of the entire stream. Nitrate load reductions were calculated for each segment to account for the downstream decline in NOx (Table 4-5).

NOx PLRGs - Wekiva River. Based on the proposed mean target concentration of 216 µg/L, nitrate load reductions required to restore the Wekiva River range from 36-82%, with the higher reductions needed in Wekiwa Spring and the Upper Wekiva River (Table 4-5).

NOx PLRGs – Rock Springs Run. Based on the proposed mean target concentration of 221 µg/L, nitrate load reductions required to restore Rock Springs Run range from 52-85%, with the higher reductions needed in Rock Spring (Table 4-5).

<u>Total Phosphorus</u>

Temporal Trends. Total phosphorus significantly decreased over the period of record in both the Wekiva River and Rock Springs Run (Figures 2-5 and 2-6). To address the temporal decrease in TP, a “current condition” data set was created for each spring-run stream that consisted of the most recent and largest data set the showed no significant temporal trend. Total phosphorus load reductions were calculated based mean of the current condition for each spring-run stream (Table 4-5).

Spatial Trends. Total phosphorus showed no spatial trend in the Wekiva River or Rock Springs Run for the period of record (Figures 2-7 and 2-8). Consequently, total phosphorus load reductions were calculated for the entire length of each spring-run stream, with the exception of the headspring portion (Table 4-5).

TP PLRGs - Wekiva River. Based on the proposed mean target concentration of 59 µg/L, the total phosphorus load reduction required to restore the Wekiva River is 50% (Table 4-5).

TP PLRGs - Rock Springs Run. Based on the proposed mean target concentration of 61 µg/L, the total phosphorus load reduction required to restore Rock Springs Run is 29% (Table 4-5).

The PLRGs for total phosphorus are applied to the upper and lower Wekiva River (as defined for nitrate) and the length of Rock Springs Run downstream from the headspring. The PLRGs will not be applied to the headsprings of either spring-run stream at this time due to the uncertainty of how much of the spring TP load is natural

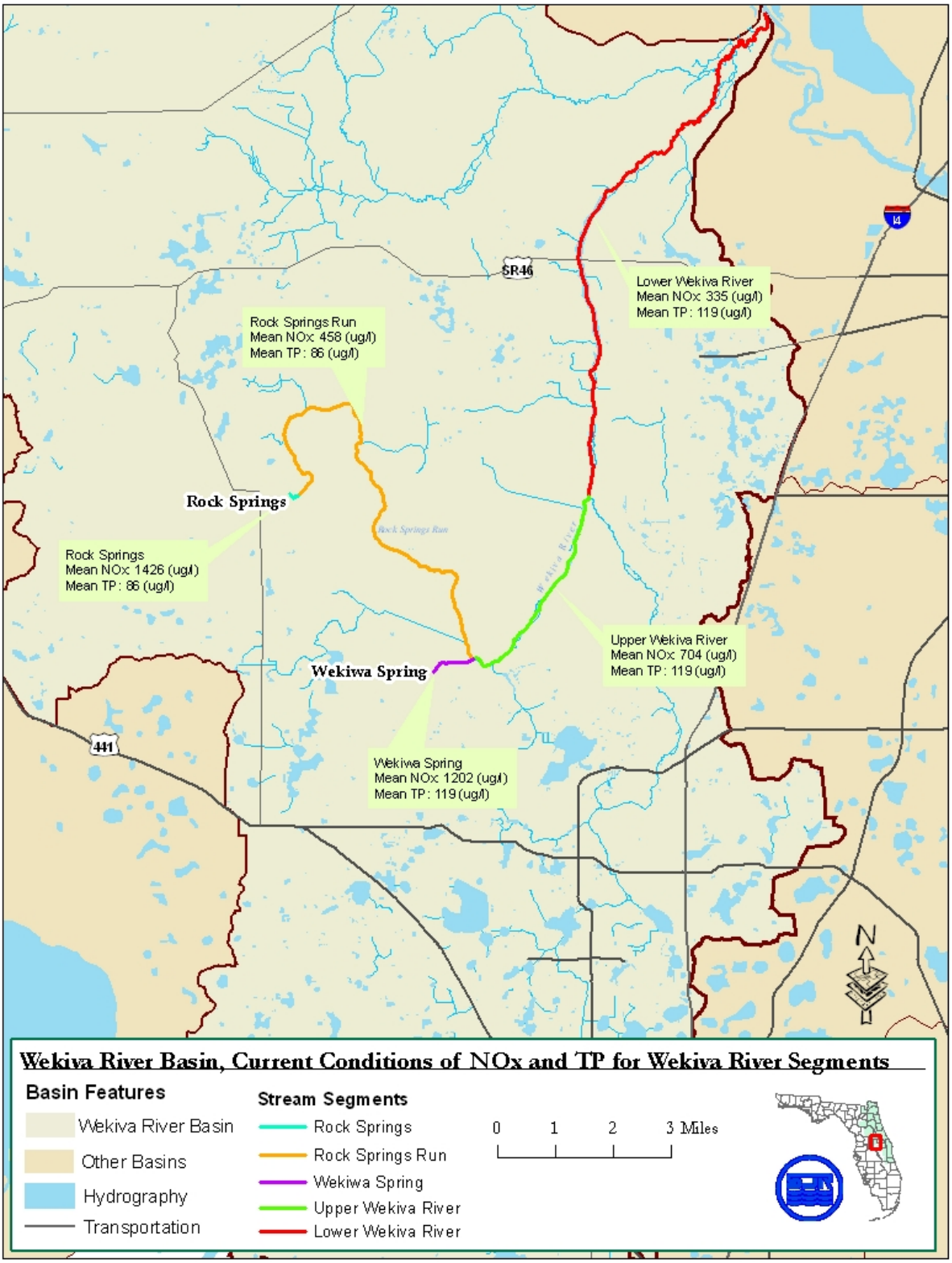


Figure 4-8. Map showing Wekiva River system segments and current conditions for nitrate (NOx) and total phosphorus (TP).

Table 4-4. Segments in the Wekiva River and Rock Springs Run used for determination of nutrient load reductions.

Segment	Distance from Headspring (meters)	USEPA Water Body Identification (WBID)
Wekiwa Spring	0-1,267	2956C
Upper Wekiva River	1,267-7,306	2956
Lower Wekiva River	7,306-23,409	2956A
Rock Spring	0-369	None
Rock Springs Run	369-14,344	2967

Table 4-5. Percent load reduction in nitrate, total phosphorus, and total coliform bacteria required to meet target mean concentrations proposed and applicable water quality standards in the Wekiva River and Rock Springs Run.

	Current Condition Mean Concentration	Target Mean Concentration	% Reduction Required to Meet Target (Concentration & Load)
Nitrate			
Wekiwa Spring	1,202 µg/L	216 µg/L	82%
Upper Wekiva River	704 µg/L	216 µg/L	69%
Lower Wekiva River	335 µg/L	216 µg/L	36%
Rock Spring	1,426 µg/L	221 µg/L	85%
Rock Springs Run	458 µg/L	221 µg/L	52%
Total Phosphorus			
Upper Wekiva River	119 µg/L	59 µg/L	50%
Lower Wekiva River	119 µg/L	59 µg/L	50%
Rock Springs Run	86 µg/L	61 µg/L	29%
Total Coliform		**Class III standard**	
Upper Wekiva River	- - -	2,400 units/100 ml	49%
Lower Wekiva River	- - -	2,400 units/100 ml	30%
Rock Springs Run	- - -	2,400 units/100 ml	50%

vs. anthropogenic. Further work will better separate these two components in the spring inflow.

4.6.2 Total Coliform Bacteria

Coliform concentration reductions were calculated by subtracting the target (2,400 colonies/100 ml) from each data point that equaled or exceeded the target, determining the % reduction needed based on this difference and obtaining the median % reduction for all of the data in two segments in the Wekiva River (upper and lower) and in Rock Springs Run. Details are provided in Appendix F.

Based on the proposed target concentration of 2,400 units/100ml, the total coliform bacteria load reduction required to restore the Upper Wekiva River is 49%, the Lower Wekiva River is 30%, and Rock Springs Run is 50% (Table 4-5).

4.7 Discussion and Conclusions

The Wekiva Parkway and Protection Act of 2004 directed SJRWMD to establish PLRGs for the Wekiva Study Area to assist FDEP in adopting Total Maximum Daily Loads (TMDLs) for impaired waters within the Wekiva Study Area. Consequently, SJRWMD and FDEP staff spent considerable time discussing and reviewing the various lines of evidence for PLRG development. The proposed Pollutant Load Reduction Goals represent the consensus of SJRWMD and FDEP.

SJRWMD acknowledges that there is still considerable uncertainty in the proposed nutrient targets, given the limitations of the data and studies used to derive the targets. The approach taken was to err on the side of resource protection, deriving targets that should be highly protective of what are widely regarded to be two spring-run streams of regional and statewide significance. These nutrient targets are water-body specific; they are intended to apply to the Wekiva River and Rock Springs Run, and may not be applicable to other spring-run systems in the SJRWMD or other areas of the state.

The pollutant concentration reductions proposed here by SJRWMD for nitrate, total phosphorus, and total coliform bacteria are based on the best data and information available within the time frame provided by the Wekiva Parkway and Protection Act. The proposed levels and load reductions should be highly protective but additional work is recommended to address remaining areas of uncertainty. The major areas of uncertainty are:

1. The studies conducted by SJRWMD were necessarily short-term in order to meet the legislative deadline, and covered less than one year. This was an insufficient period of time to reflect the range of natural intra- and inter-annual variation in spring-run streams. This problem was compounded by the fact that, during these studies, hurricanes caused atypical conditions of high water flows, scouring of vegetation, transfer of sediments and atypical water quality conditions.

2. There are no specific state standards, and no general scientific consensus, on criteria for identifying impairment of spring-run streams. Throughout the state there is attention being focused on nitrate, phosphorus and algal growth in springs and spring-runs, yet almost none of these systems are listed for these pollutants on the FDEP Verified List of Impaired Waters. Their characteristics are such that criteria in the Impaired Waters Rule for listing streams based on violations of the Narrative Nutrient Standard do not appear to apply to spring-run streams. Subsequent work will be used to refine the nutrient targets, which will most likely not be any lower than what is currently proposed in this report.

3. The potential for nitrate toxicity needs further study. Fish eggs from some species have shown nitrate toxicity at very low concentrations. These studies used species not native to Florida and there were problems with fungal contamination, so these very low reported nitrate levels were not adopted as thresholds of toxicity. Further toxicological work is needed to confirm that the proposed nitrate target concentrations are protective of the aquatic life of the Wekivia River system.

4. The relationships between periphytic algal growth and nutrient concentrations under varying conditions of current velocity and light are poorly known. These relationships need further study. Criteria for determining what levels of periphyton or macroalgae constitute a “nuisance” level need to be developed.

5. The inhibitory effects of periphyton on SAV growth, and the effects of filamentous algal growth on macroinvertebrate and fish habitat is not understood quantitatively. Further work is needed to delineate the levels of algae associated with adverse impacts on SAV and aquatic fauna.

To address some of the research needs described above, SJRWMD is performing additional work that could result in refinement of nutrient concentration targets and PLRGs for the Wekiva River and Rock Springs Run in the future. The work includes:

- Wetland Solutions is repeating data collection on stream ecosystem metabolism in all four spring-run streams (Wekiva River, Rock Springs Run, Juniper Creek and Alexander Springs Creek) in the fall and winter of 2005/06 to obtain a full year of data collection;

- Post, Buckley, Schue, and Jernigan (PBS&J), in conjunction with the University of North Carolina, are completing evaluation of in-stream surveys of algal communities and nutrients in the Wekiva River and Rock Springs Run, and are performing laboratory assays in mesocosms to determine limiting nutrients and the effects of nutrient reductions on algal growth;

- Staff is reviewing additional scientific literature on nitrate toxicity effects on aquatic animals.

Other research efforts are planned to further define impairment, pollutant impacts, and required reductions to restore and maintain the ecological integrity of these spring-run streams. SJRWMD is developing a five-year work plan for the Wekiva basin that will focus on improving understanding of spring-run stream ecosystems, impairment of spring-run streams, other pollutants of concern (including nutrient forms), and pollutant sources and loadings. These will contribute to future revisions of PLRGs proposed in this report.

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6 APPENDICES

APPENDIX A

Descriptions of Natural Community Types found within the Wekiva River Basin

Adapted from: FDNR 1987; FNAI and FDNR 1990; National Park Service 1999

Upland Communities (FLUCFCS ‘4000 – Forest’)

Mesic Flatwoods. Found on low relief, flat topography. Poorly draining, sandy soils with an underlying organic or clay “hardpan”. Sparse, open canopy of longleaf or slash pine with understory of saw palmetto, gallberry, wax myrtle, St. John’s wort and various grasses and sedges.

Scrubby Flatwoods. On similar topography as Mesic flatwoods but soils are somewhat better-draining, consequently these are a “drier” community type. Vegetation similar to Mesic flatwoods, but canopy and understory may contain various oaks (sand live oak, Chapman’s oak, myrtle oak). Groundcover may include some sandhill plant taxa.

Sandhill. Found on crests of ridges and very well-draining terraces. Soils are deep, well-draining sands. Fire is a major structuring force; historically these communities burned every 2-5 years. Canopy is sparse longleaf pine with occasional upland oaks (turkey oak, sand post oak, bluejack oak) and a diverse groundcover of wiregrass, indian grass, wild indigo, gopher apple, and other grasses, herbs and forbes.

Scrub. Found on relict sand dunes on deep, well-draining sands. Fires are an important natural force. Canopy characterized by dense sand pine or thickets of scrub oak (myrtle oak, Chapman’s oak, sand live oak, runner oak). Heavy shade from sand pine or oak generally results in limited groundcover.

Xeric hammock. An alternate community on relict sand dunes and some ridges. Soils are well-draining sands. Canopy ranges from dense to moderately open and includes sand live oak, live oak, turkey oak, laurel oak or water oak. Understory tends to be dense saw palmetto; more open areas may include sparkleberry, wild olive, American holly, yaupon holly, and winged sumac.

Upland hardwood or Upland mixed forest. Growing in areas with low to moderate relief. Soils sandy to loamy with some organic matter and/or shallow water table or limestone close to land surface. Canopy dense with live oak, southern magnolia, pignut hickory, sweetgum, Florida maple, American hornbeam, hophornbeam, or loblolly pine. Groundcover limited due to heavy shading but may include greenbriers, beautyberry, passion flower, partridgeberry, and other herbs and forbes.

Wetland Communities (FLUCFCS ‘6000 – Wetland’)

Wet flatwoods. Occurs on flat, poorly draining sites with sandy soils. Subject to longer periods of inundation/soil saturation than the Mesic flatwoods community.
Canopy is a sparse to moderate cover of pond pine or slash pine with scattered sweet bay, swamp bay, and/or cabbage palm. Understory and groundcover includes dahoon holly, fetterbush, wax myrtle, buttonbush, titi, gallberry, and diverse cover of wetland sedges, grasses, bloodroot, and ferns.

Floodplain swamp. Brown et al. (1987) referred to this community as “Mixed hardwood swamp”. This is synonymous with the FNAI “Floodplain swamp” community type. Soils tend to be organic mucks or clayey sands, very poorly draining and subject to regular and periodic inundation or saturation. The canopy is a dense cover of bald cypress, swamp tupelo, laurel oak, American elm, blue beech, sweetgum, red maple, and green ash. Understory and groundcover vary based in part on elevation and frequency/duration of inundation and may include dahoon holly, wax myrtle, buttonbush, royal fern, Virginia chain fern, and swamp lily.

Hydric hammock. Brown et al. (1987) also identified this community type in the Wekiva River basin. This wetland forest type appears to be confined to peninsular Florida (Vince et al., 1989). It occurs in areas of low relief with limestone at or near land surface and a high water table. These areas may or may not be inundated by floodwaters on a frequent or prolonged basis but the soils are almost continuously saturated (Brown et al., 1987; Vince et al., 1989). They support the most diverse tree canopy of all forested wetland types in Florida (Brown et al., 1987; Light et al., 2002), consisting of a dense canopy with laurel oak, red maple, swamp bay, sweet bay, sweetgum, cabbage palm, blue beech, red cedar, southern magnolia, water oak, live oak, pop ash, slash pine and other taxa. The understory and ground cover may include wax myrtle, swamp palm, needle palm, dahoon holly, and various ferns.

Baygall. Found at the base of slopes and escarpments where soil water seeps from the ground, maintaining an almost continuously saturated condition in organic, peat soils. Canopy a dense cover of broadleaf evergreens such as sweetbay, swamp bay, loblolly bay, with occasional red maple, pond pine or pond cypress. Understory and groundcover may include fetterbush, Virginia willow, dahoon holly, wax myrtle, chokeberry, and ferns.

Freshwater marsh. Fringing the channels of the Wekiva River and Rock Springs Run and in isolated depressions in flatwoods communities. These wetlands are dominated by a dense cover of herbaceous plants which may include sawgrass, pickerelweed, arrowhead, wild rice, swamp lily, cattail, maidencane, cutgrass, frog’s bit, pennywort, cinnamon fern, bulrush, and sedges.

Aquatic Communities (FLUCFCS ‘5000 – Water’)

Spring-run Stream (Is this their actual terminology?). The Wekiva River and Rock Springs Ru, are spring-run streams. As noted earlier, these are designated “S2” by FNAI. The hydrology of these systems is generally dominated by groundwater inflow through one or more spring vents. Water quality is generally characterized by high pH, high dissolved mineral content, and high water clarity. Important stream communities are beds of submerged aquatic vegetation, which may include eelgrass, coontail, naiad, macroalgae (filamentous green algae or macroalgae such as Chara or Nitella), and pondweeds. The exotic plant hydrilla can exclude these native taxa, and has done so in many spring-run streamsin Florida. Other important stream habitats are fringing

emergent marshes (with many of the same taxa found in the Freshwater marsh community type) and areas of submerged wood ("snags").

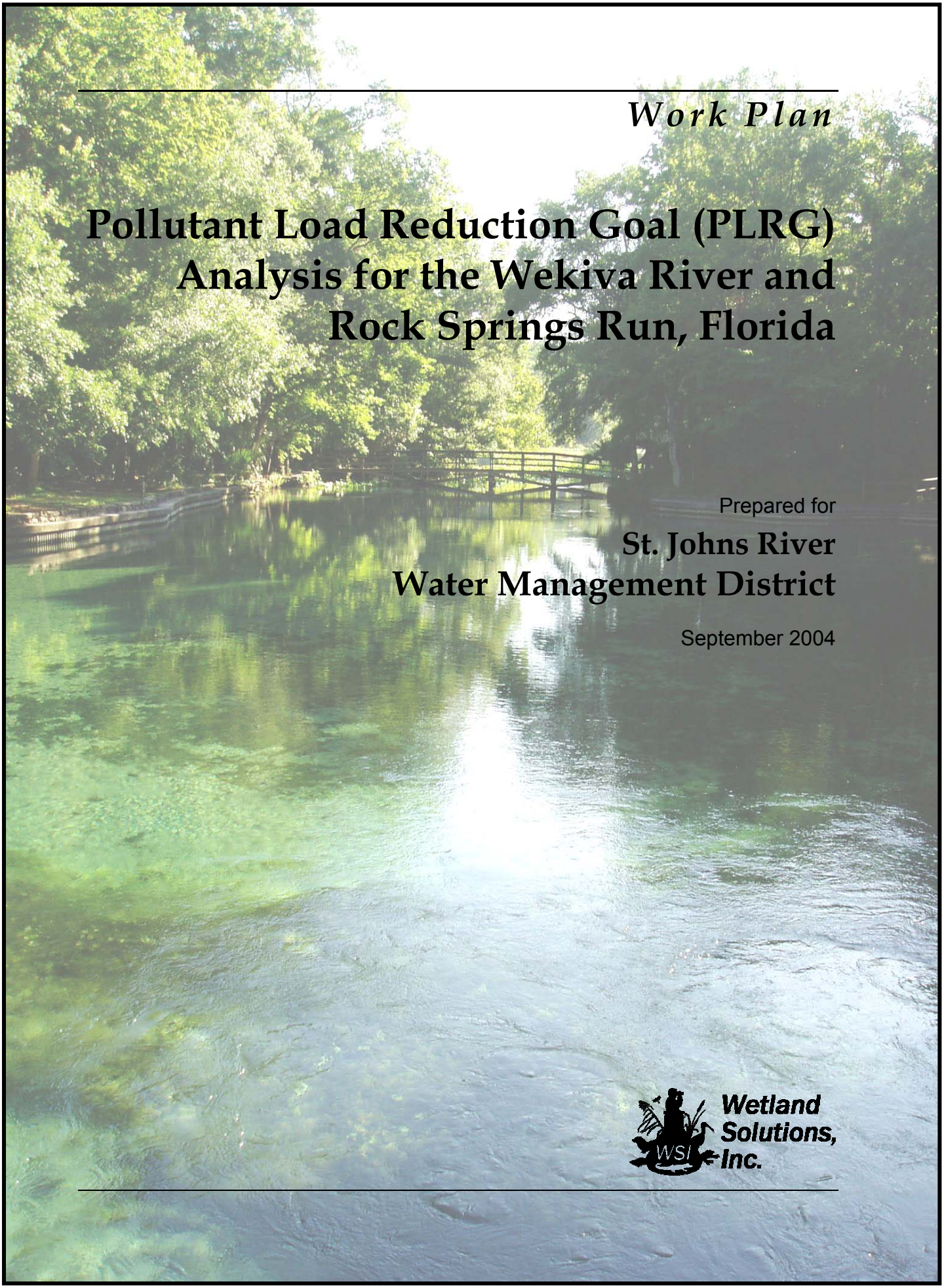
Blackwater Stream. The principal stream of this type is Blackwater Creek, although the upper Little Wekiva River may also be characterized as this stream type. Blackwater streams are also listed as "S2" by FNAI. The hydrology of these streams is maintained by surface water drainage of the surrounding watershed. Under natural conditions, water draining through the sandy soils picks up quantities of tannic and humic compounds from decaying vegetation, giving the water of these streams the characteristic dark "tea color". Water quality is low pH (acidic), low mineral content, and high color. Important stream habitats are areas of woody snag, "debris dams" (accumulations of small twigs and fallen leaves in the stream channel), and root mats along the shoreline.

Clastic upland lake or Sandhill upland lake. The lakes in the Wekiva River basin can all be classified as one of these two types. Clastic upland lakes are shallow to moderately deep, irregularly shaped lake basins. They may have inflowing streams. Where the shorelines are shallow enough, they may be fringed by a freshwater marsh community. Water quality is variable, ranging from clear to colored and neutral to slightly acidic. Bottom substrates may be clay or organic. They may be oligo-mesotrophic to eutrophic, depending upon regional geology and surrounding land use. Sandhill upland lakes are characterized as generally shallow lakes with a round shoreline due to formation by solution processes. They are generally "closed basin" lakes with no inflowing or outflowing streams. Vegetation is a fringe of marsh vegetation along shallow shorelines. Water quality is generally clear and somewhat acidic. The clear water may permit growth of submerged plant communities. Bottom substrates are generally sandy with small amounts of silt. These lakes are typically oligotrophic to oligo-mesotrophic but can be highly modified by surrounding land uses.

APPENDIX B

Work Plan - Pollutant Load Reduction Goal (PLRG) Analysis for the Wekiva River and Rock Springs Run

Final Report from Wetland Solutions, Inc. (2004)



Work Plan

Pollutant Load Reduction Goal (PLRG) Analysis for the Wekiva River and Rock Springs Run, Florida

Prepared for

St. Johns River Water Management District

September 2004

Wetland Solutions, Inc.

Work Plan

Pollutant Load Reduction Goal (PLRG) Analysis for the Wekiva River and Rock Springs Run, Florida

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Executive Summary

The Wekiva Parkway and Protection Act of 2004 requires the St. Johns River Water Management District (SJRWMD) to establish pollutant load reduction goals (PLRGs) for the Wekiva River Study Area by December 1, 2005. At the request of the SJRWMD Wetland Solutions Inc. (WSI) has prepared this work plan for assessment of appropriate PLRGs for two spring runs, the Wekiva River and one important tributary, Rock Springs Run (together referred in this report as the "Wekiva River System") located in Seminole, Orange, and Lake Counties, Florida. This area includes over 90 percent of the Wekiva River and the entire length of Rock Springs Run, for a total stream length of about 36 km (22 miles). The Wekiva River System included in this work plan does not include any of the headwater springs, the Little Wekiva River, and Blackwater Creek and its tributaries Sulfur Run and Seminole Creek or the springs that feed those streams. For the purposes of this work plan, the Little Wekiva River and all headwater springs will be considered as external sources of pollutant loading to the Wekiva River System.

The majority of the surface waters within the Wekiva River System are Class III waters of the state and also Outstanding Florida Waters (OFWs) due to their incorporation within state parks and aquatic preserves. Class III waters have the designated use of: "Recreation, Propagation of a Healthy, Well-Balanced Population of Fish and Wildlife" and specific water quality criteria are included in Section 62-302, F.A.C. to protect these designated uses. PLRGs can be developed for those pollutants that are likely to impair these designated uses, either through an exceedance of one or more specific water quality criteria or through overall degradation and loss of specific uses such as recreation or maintenance of normal fish and wildlife populations.

This work plan focuses on determining whether nutrient loads need to be controlled to meet the regulatory requirement for avoiding "an imbalance in natural populations of aquatic flora and fauna" (Section 62-302.530(48)(b), F.A.C.). Since spring runs are qualitatively and quantitatively different environments than most other surface waters in the state, they have attributes that may not be directly protected by specific water quality criteria. For this reason, protection of their general designated uses is an important additional approach for their preservation or restoration.

The purpose of this work plan is to provide a scientifically-based approach for determining if nutrients, and which forms of nutrients, are of concern in the Wekiva River System and to document their impacts, if any, on the attributes of the Wekiva River aquatic ecosystem. Nutrient concentrations that have either resulted in historic impairment, are currently resulting in continuing impairment, or have the potential to create future impairment if not attenuated, will be identified. This work plan will be augmented by parallel investigations conducted by others concerning the need for nutrient reductions to reduce growths of filamentous algae to a "desirable" level in the Wekiva River System and to determine what, if any, effect nitrate toxicity/impairment may have on amphibian populations in these two spring runs.

The deadline established by the Florida Legislature for completion of this project dictates the appropriate level-of-effort for all project activities. For this reason sampling methods selected for this work plan must be able to identify specific endpoints of impairment. Continuous measurements using remote logging technologies will be desirable to

generate comprehensive and statistically powerful data sets over a wide range of seasonal and climatic conditions within a limited project schedule. Budget constraints will also limit the depth and breadth of sampling. This work plan endeavors to integrate these important practical considerations into a realistic and implementable project that will result in recommended nutrient PLRGs by December 1, 2005.

A considerable body of technical information already exists for the Wekiva River system. A review of this information found that the Wekiva River System is in peril of being "loved to death". Urban development on the northern edge of the greater Orlando metropolitan area has and is continuing to contribute significant pollutant loads to the Wekiva River System, primarily through stormwater runoff and treated effluent discharges into the Little Wekiva River, elevated nitrate nitrogen concentrations in regional groundwater due to fertilizer and septic tanks, and through direct human use of the natural resource through swimming, wading, canoeing, and motor boating in the springs, spring runs, and rivers that comprise the Wekiva River System. In spite of these threats and some apparent degradation in various parts of the overall Wekiva River System, scientific studies to-date have generally determined that the aquatic ecosystem is technically "healthy" based on typical structural indicators of pollution. This finding conflicts with apparent increases in cover by nuisance filamentous algae in some portions of springs and spring runs, high sediment loads and apparent smothering of plant beds, invasion by exotic plant and animal species, downstream increases in fecal coliform bacteria populations, and high levels of human activity, especially on weekends and holidays. It appears that the Wekiva River System has significant capacity to assimilate certain types and loads of pollutants and to cleanse itself enough to maintain some semblance of a moderately healthy natural aquatic ecosystem.

Based on this review of existing studies, it is concluded that a different sort of evaluation needs to be conducted in the Wekiva River System to attempt to detect whether there is or is not an imbalance of the natural aquatic flora and fauna. Relatively sensitive and powerful ecosystem-level measurements of function (ecological processes) are proposed in this work plan to provide a more quantitative basis for interpreting the extensive existing data about populations of aquatic macroinvetebrates and fish in the Wekiva River system. The recommended approach offered in this work plan includes quantification of key ecosystem processes such as gross and net primary productivity, community respiration, community export, and nutrient assimilation by making repeated upstream-downstream measurements of biologically-active chemical and biological variables. While the nutrient assimilation rate of the entire spring runs (referred to as "reaches") will be estimated by this sampling, intensive ecosystem process measurements will be focused on representative smaller stream "segments" in each stream reach that are exposed to differing nutrient concentrations and loads. Two reference spring runs, Juniper Creek and Alexander Springs Run in the nearby Ocala National Forest will also be studied using the same methods employed in the Wekiva River and in Rock Springs Run to provide reference sites that duplicate most of the environmental conditions in the Wekiva River System but without the elevated nutrient levels.

Interpretation of these measurements will be possible through sampling of key physical, chemical, and biological characteristics of these stream segments, allowing development of statistical models that predict responses to key pollutants and stressors that are likely to

affect the Wekiva River System. While demonstration of cause-and-effect in biological systems is difficult at best, predictability can be enhanced through statistical data analysis and development of significant correlations. Comparison of ecological functioning in different parts of the overall Wekiva River System and at reference sites that are subjected to a wide range of nutrient concentrations should allow clarification of the specific role of those stressors and quantification of their mass loads that need to be reduced to protect the Wekiva River System.

The work plan presented in this document is designed to support the SJRWMD with determination of nutrient PLRGs within the Wekiva River System by the mandated December 1, 2005 deadline. Based on contracting being completed no later than November 30, 2004, preliminary field efforts to locate and establish stations and to characterize the physical and biological conditions in all 36 km (22 miles) of the Wekiva River System will be completed by January 15, 2005. Mass balance studies will be conducted continuously in the stream reaches over the six-month period from December 15, 2004 to May 15, 2005. The intensive field sampling effort in the smaller stream segments will cover a period of about eight weeks and be conducted between March 15 and May 15, 2005. Data analysis will be continuous through the length of the project and the draft report will be submitted for review by July 20, 2005. The final report will be delivered to the SJRWMD on September 13, 2005. An estimated budget has been prepared to complete these field and reporting efforts. The total estimated budget for the Wekiva River System PLRG Work Plan is $250,000. A detailed breakdown of this budget by estimated labor hours and materials is provided in the report below.

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Acknowledgements

Wetland Solutions, Inc. (WSI) gratefully acknowledges the following assistance received during this project: Carol Lippincott was the SJRWMD's interim project manager and coordinated all collection and transmittal of existing information to WSI; Troy Keller provided water quality summaries for the Wekiva River System; Deborah Shelley, manager of the Florida Department of Environmental Protection's Wekiva River Aquatic Preserve, participated in the initial site reconnaissance field trip on June 8, 2004; and David Murray and Lou Ley of the Wekiwa River State Park and Ed Lowe of the SJRWMD also assisted with that field trip to the project area. Helpful reviews of the draft work plan were provided by SJRWMD staff, including Bill Osburn and David Toth. This project was completed under Purchase Order PO37314 from the St. Johns River Water Management District.

1.0 Introduction

The Wekiva Parkway and Protection Act of 2004 (Chapter 369 part III, Florida Statutes [F.S.]) requires the St. Johns River Water Management District (SJRWMD) to establish pollutant load reduction goals (PLRGs) for the Wekiva River Study Area by December 1, 2005 (Section 369.318 [9], F.S.). At the request of the SJRWMD, Wetland Solutions Inc. (WSI) has prepared this work plan for assessment of appropriate nutrient PLRGs for the Wekiva River and for Rock Springs Run (Wekiva River System) located in Seminole, Orange, and Lake Counties, Florida.

The Wekiva River Study Area defined in Chapter 369 part III is located in central Florida, just north of the city of Orlando (Figure 1-1). Although the Wekiva River Study Area includes a number of tributaries and their associated springs and watersheds, for the purposes of this work plan, only the portion of the Wekiva River Study Area upstream of its confluence with Blackwater Creek is included. This area is called the Wekiva River System in this report and includes over 90 percent of the Wekiva River and the entire length of Rock Springs Run, for a total stream length of about 36 km (22 miles)(Figure 1-2). The Wekiva River System included in this work plan does not include the nine named springs contributing directly to the upstream ends of the Wekiva River and Rock Springs Run, the Little Wekiva River and associated springs (Sanlando, Palm, Ginger Ale, and Starbuck Springs) above its confluence with the Wekiva River and Blackwater Creek and its tributaries Sulfur Run and Seminole Creek or the springs that feed those streams. Those headwater springs and tributaries will be treated as point source loading points to the Wekiva River System evaluated in this study.

The Water Resource Implementation Rule (Section 62-40.210 [18] Florida Administrative Code [F.A.C.]) defines PLRGs as: “the estimated numeric reductions in pollutant loadings needed to preserve or restore designated uses of receiving bodies of water and maintain water quality consistent with applicable state water quality standards”. PLRGs are intended to address unacceptable pollutant loadings from older stormwater management systems which were constructed before adoption of Chapter 62-25, F.A.C. (Regulation of Stormwater Discharge). PLRGs provide useful information to assist the Florida Department of Environmental Protection (FDEP) with establishment of Total Maximum Daily Loads (TMDLs) used to limit both point- and non-point source discharges to surface waters.

The surface waters within the Wekiva River System are Class III waters of the state and also Outstanding Florida Waters (OFWs) due to their incorporation within State Parks and Aquatic Preserves. Class III waters have the designated use of: “Recreation, Propagation of a Healthy, Well-Balanced Population of Fish and Wildlife” and specific water quality standards or criteria are included in Section 62-302, F.A.C. to protect these designated uses (see Table 1-1 for a summary of Class III water quality criteria). PLRGs can be developed for those pollutants that are likely to impair these designated uses, either through an exceedance of one or more specific water quality criteria or through overall degradation and loss of specific uses such as recreation or maintenance of normal fish and wildlife populations. Since springs and spring runs are qualitatively and quantitatively different environments than most other surface waters in the state (FDEP 2000), they have attributes that may not be directly protected by specific water quality

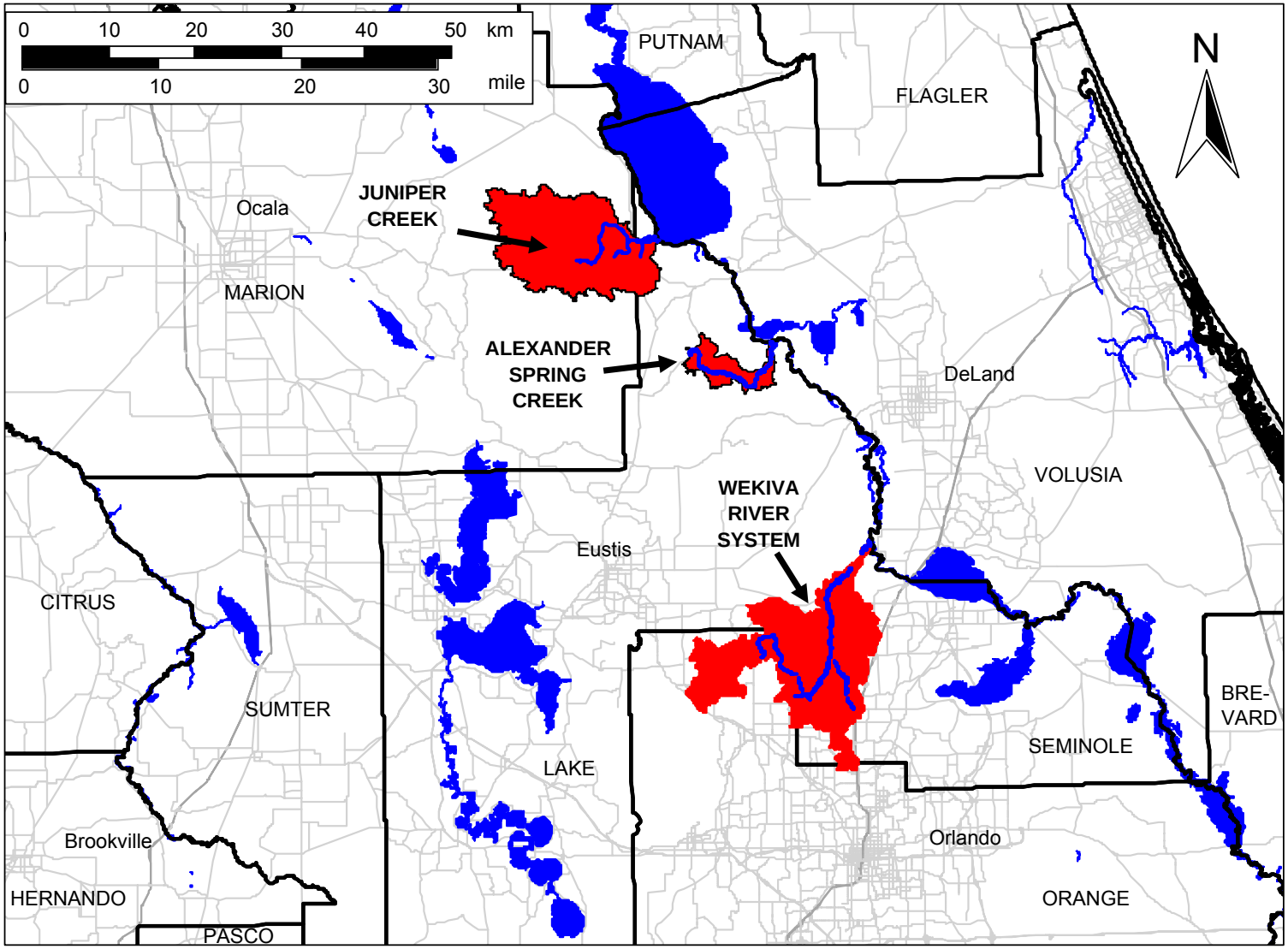


FIGURE 1-1

Source: FGDL

GENERAL LOCATION MAP FOR THE WEKIVA RIVER SYSTEM PROJECT AREA AND REFERENCE SITES - JUNIPER CREEK AND ALEXANDER SPRING CREEK

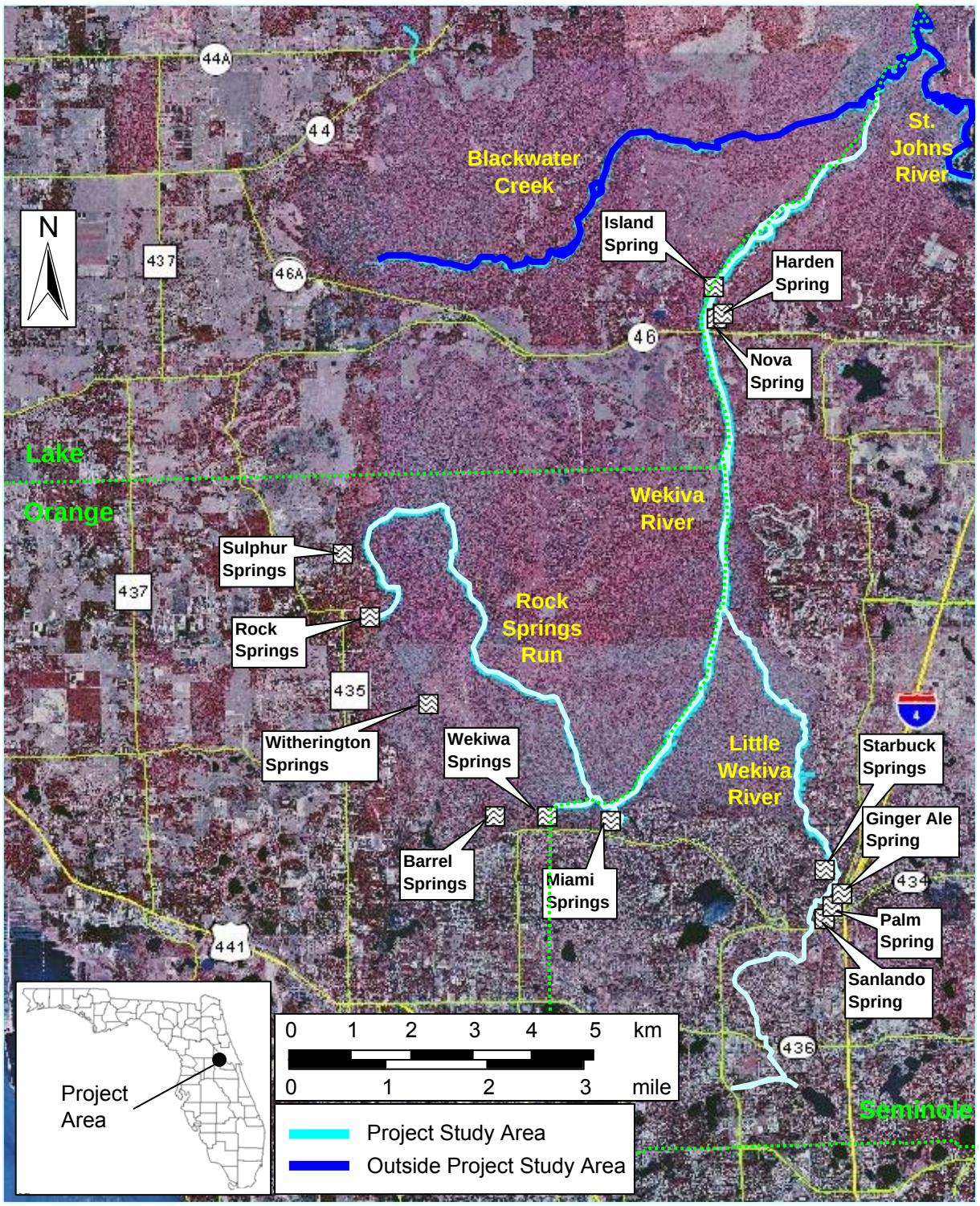


FIGURE 1-2

WEKIVA RIVER SYSTEM PROJECT AREA IDENTIFYING KEY RIVER SEGMENTS AND CONTRIBUTING SPRINGS

TABLE 1-1

Florida Class III Criteria for Surface Water Quality Classifications, 62-302.530 (Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife)

Parameter	Units	Class III: Predominantly Fresh Waters
(1) Alkalinity	Milligrams/L as CaCO3	Shall not be depressed below 20
(2) Aluminum	Milligrams/L	---
(3) Ammonia (un-ionized)	Milligrams/L as NH3	≤ 0.02
(4) Antimony	Micrograms/L	≤ 4,300
(5) (a) Arsenic (total)	Micrograms/L	≤ 50
(5) (b) Arsenic (trivalent)	Micrograms/L measured as total recoverable Arsenic	---
(6) Bacteriological Quality (Fecal Coliform Bacteria)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period.
(7) Bacteriological Quality (Total Coliform Bacteria)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	≤ 1,000 as a monthly average; nor exceed 1,000 in more than 20% of the samples examined during any month; ≤ 2,400 at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period, using either the MPN or MF counts.
(8) Barium	Milligrams/L	---
(9) Benzene	Micrograms/L	≤ 71.28 annual avg.
(10) Beryllium	Micrograms/L	≤ 0.13 annual avg.
(11) Biological Integrity	Percent reduction of Shannon-Weaver Diversity Index	The Index for benthic macroinvertebrates shall not be reduced to less than 75% of established background levels as measured using organisms retained by a U. S. Standard No. 30 sieve and collected and composited from a minimum of three Hester-Dendy type artificial substrate samplers of 0.10 to 0.15 m^2 area each, incubated for a period of four weeks.
(12) BOD (Biochemical Oxygen Demand)		Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class and, in no case, shall it be great enough to produce nuisance conditions.
(13) Boron	Milligrams/L	---
(14) Bromates	Milligrams/L	---
(15) Bromine (free molecular)	Milligrams/L	---
(16) Cadmium	Micrograms/L See Notes (1) and (3).	Cd ≤ e(0.7852[lnH]-3.49)
(17) Carbon tetrachloride	Micrograms/L	≤ 4.42 annual avg.
(18) Chlorides	Milligrams/L	---
(19) Chlorine (total residual)	Milligrams/L	≤ 0.01
(20) (a) Chromium (trivalent)	Micrograms/L measured as total recoverable Chromium See Notes (1) and (3).	Cr (III) ≤ e(0.819[lnH]+0.6848)
(20) (b) Chromium (hexavalent)	Micrograms/L See Note (3).	≤ 11
(21) Chronic Toxicity		(see definition in Section 62-302.200(3), F.A.C. and also see below, "Substances in concentrations which...")
(22) Color, etc. (see also Minimum Criteria, Odor, Phenols, etc.)	Color, odor, and taste producing substances and other deleterious substances, including other chemical compounds attributable to domestic wastes, industrial wastes, and other wastes	---
(23) Conductance, Specific	Micromhos/cm	Shall not be increased more than 50% above background or to 1275, whichever is greater
(24) Copper	Micrograms/L See Notes (1) and (3).	Cu ≤ e(0.8545[lnH]-1.702)
(25) Cyanide	Micrograms/L	≤ 5.2
(26) Definitions (see Section 62-302.200, F.A.C.)		---
(27) Detergents	Milligrams/L	≤ 0.5

TABLE 1-1

Florida Class III Criteria for Surface Water Quality Classifications, 62-302.530 (Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife)

Parameter	Units	Class III: Predominantly Fresh Waters
(28) 1,1-Dichloroeth-ylene (1,1-di-chlo-roethene)	Micrograms/L	≤ 3.2 annual avg.
(29) Dichloromethane (methylene chloride)	Micrograms/L	≤ 1,580 annual avg.
(30) 2,4-Dinitrotolu-ene	Micrograms/L	≤ 9.1 annual avg.
(31) Dissolved Oxygen	Milligrams/L	Shall not be less than 5.0. Normal daily and seasonal fluctuations above these levels shall be maintained.
(32) Dissolved Solids	Milligrams/L	---
(33) Fluorides	Milligrams/L	≤ 10.0
(34) "Free Froms" (see Minimum Criteria in Section 62-302.500, F.A.C.)		---
(35) "General Criteria" (see Section 62-302.510, F.A.C. and individual criteria)		---
(36) (a) Halometh-anes (Total trihalomethanes) (total of bromoform, chlorodibromomethane, dichlorobromome- thane, and chloroform). Individual halomethanes shall not exceed (b)1. to (b)5. below.	Micrograms/L	---
(36) (b) 1. Halometh-anes (individual): Bromoform	Micrograms/L	≤ 360 annual avg.
(36) (b) 2. Halometh-anes (individual): Chlorodibromomethane	Micrograms/L	≤ 34 annual avg.
(36) (b) 3. Halometh-anes (individual): Chloroform	Micrograms/L	≤ 470.8 annual avg.
(36) (b) 4. Halometh-anes (individual): Chloromethane (methyl chloride)	Micrograms/L	≤ 470.8 annual avg.
(36) (b) 5. Halometh-anes (individual): Dichlorobromo-methane	Micrograms/L	≤ 22 annual avg.
(37) Hexachlorobutadiene	Micrograms/L	≤ 49.7 annual avg.
(38) Imbalance (see Nutrients)		---
(39) Iron	Milligrams/L	≤ 1.0
(40) Lead	Micrograms/L See Notes (1) and (3).	Pb ≤ e(1.273 [lnH] -4.705)
(41) Manganese	Milligrams/L	---
(42) Mercury	Micrograms/L	≤ 0.012
(43) Minimum Criteria (see Section 62302. 500, F.A.C.)		---
(44) Mixing Zones (See Section 62-4.246, F.A.C.)		---
(45) Nickel	Micrograms/L See Notes (1) and (3).	Ni ≤ e(0.846[lnH]+0.0584)
(46) Nitrate	Milligrams/L as N	---
(47) Nuisance Species		Substances in concentrations which result in the dominance of nuisance species: none shall be present.
(48) (a) Nutrients		The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter. Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Sections 62-302.300, 62-302.700, and 62-4.242, F.A.C.
(48) (b) Nutrients		In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna.
(49) Odor (also see Color, Minimum Criteria, Phenolic Compounds, etc.)	Threshold odor number	---
(50) (a) Oils and Greases	Milligrams/L	Dissolved or emulsified oils and greases shall not exceed 5.0
(50) (b) Oils and Greases		as to cause taste or odor, or otherwise interfere with the beneficial use of waters.
(51) **Pesticides and Herbicides**		---
(51) (a) 2,4,5-TP	Micrograms/L	---
(51) (b) 2-4-D	Micrograms/L	---
(51) (c) Aldrin	Micrograms/L	≤ .00014 annual avg.; 3.0 max

TABLE 1-1

Florida Class III Criteria for Surface Water Quality Classifications, 62-302.530 (Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife)

Parameter	Units	Class III: Predominantly Fresh Waters
(51) (d) Beta-hexachlorocyclohexane (b-BHC)	Micrograms/L	≤ 0.046 annual avg.
(51) (e) Chlordane	Micrograms/L	≤ 0.00059 annual avg.; 0.0043 max
(51) (f) DDT	Micrograms/L	≤ 0.00059 annual avg.; 0.001 max
(51) (g) Demeton	Micrograms/L	≤ 0.1
(51) (h) Dieldrin	Micrograms/L	≤ 0.00014 annual avg.; 0.0019 max
(51) (i) Endosulfan	Micrograms/L	≤ 0.056
(51) (j) Endrin	Micrograms/L	≤ 0.0023
(51) (k) Guthion	Micrograms/L	≤ 0.01
(51) (l) Heptachlor	Micrograms/L	≤ 0.00021 annual avg.; 0.0038 max
(51) (m) Lindane (g-benzene hexachloride)	Micrograms/L	≤ 0.063 annual avg.; 0.08 max
(51) (n) Malathion	Micrograms/L	≤ 0.1
(51) (o) Methoxychlor	Micrograms/L	≤ 0.03
(51) (p) Mirex	Micrograms/L	≤ 0.001
(51) (q) Parathion	Micrograms/L	≤ 0.04
(51) (r) Toxaphene	Micrograms/L	≤ 0.0002
(52) pH (Class III Waters)	Standard Units	Shall not vary more than one unit above or below natural background of predominantly fresh waters and coastal waters as defined in Section 62-302.520(3)(b), F.A.C. or more than two-tenths unit above or below natural background of open waters as defined in Section 62-302.520(3)(f), F.A.C., provided tha the pH is not lowered to less than 6 units in predominantly fresh waters, or less than 6.5 units in predominantly marine waters, or raised above 8.5 units. If natural background is less than 6 units, or less than 6.5 units in predominantly marine waters, the pH shall not vary below natural background or vary more than one unit above natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit above natural background of open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit below natural background of open waters.
(53)(a) Phenolic Compounds: Total		Phenolic compounds other than those produced by the natural decay of plant material, listed or unlisted, shall not taint the flesh of edible fish or shellfish or produce objectionable taste or odor in a drinking water supply.
(53) (b) Phenolic Compounds: Total	Micrograms/L	1. The total of all chlorinated phenols, and chlorinated cresols, except as set forth in (c) 1. to (c) 4. below, shall not exceed 1.0 unless higher values are shown not to be chronically toxic. Such higher values shall be approved in writing by the Secretary. 2. the compounds listed in (c)1. to (c)6. below shall not exceed the limits specified for each compound.
(53) (c) 1. Phenolic Compound: 2chlorophenol	Micrograms/L	≤ 400 See Note (2).
(53) (c) 2. Phenolic Compound: 2,4-dichlorophenol	Micrograms/L	≤ 790 See Note (2).
(53) (c) 3. Phenolic Compound: Pentachlorophenol	Micrograms/L	≤ 30 max; ≤ 8.2 annual avg; ≤ e(1.005[pH]-5.29)
(53) (c) 4. Phenolic Compound: 2,4,6-trichlorophenol	Micrograms/L	≤ 6.5 annual avg.
(53) (c) 5. Phenolic Compound: 2,4-dinitrophenol	Milligrams/L	≤ 14.26 See Note (2).
(53) (c) 6. Phenolic Compound: Phenol	Milligrams/L	≤ 0.3
(54) Phosphorus (Elemental)	Micrograms/L	---
(55) Phthalate Esters	Micrograms/L	≤ 3.0
(56) Polychlorinated Biphenyls (PCBs)	Micrograms/L	≤ 0.000045 annual avg.; 0.014 max
(57) (a) Polycyclic Aromatic Hydrocarbons (PAHs). Total of: Acenaphthylene; Benzo(a)anthracene; Benzo(a)pyrene; Benzo(b)fluoran-thene; Benzo-(ghi)perylene; Benzo(k)fluoranth-ene; Chrysene; Dibenzo-(a,h)anthra-cene; Indeno(1,2,3-cd)pyrene; and Phenanthrene	Micrograms/L	≤ 0.031annual avg.

TABLE 1-1

Florida Class III Criteria for Surface Water Quality Classifications, 62-302.530 (Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife)

Parameter	Units	Class III: Predominantly Fresh Waters
(57) (b) 1 (Individual PAHs): Acenaphthene	Milligrams/L	≤ 2.7 See Note (2).
(57) (b) 2. (Individual PAHs):	Milligrams/L	≤ 110 See Note (2).
(57) (b) 3. (Individual PAHs): Fluoranthene	Milligrams/L	≤ 0.370 See Note (2).
(57) (b) 4. (Individual PAHs): Fluorene	Milligrams/L	≤ 14 See Note (2).
(57) (b) 5. (Individual PAHs): Pyrene	Milligrams/L	≤ 11 See Note (2).
(58) (a) Radioactive substances (Combined radium 226 and 228)	Picocuries/L	≤ 5
(58) (b) Radioactive substances (Gross alpha particle activity including radium 226, but excluding radon and uranium)	Picocuries/L	≤ 15
(59) Selenium	Micrograms/L	≤ 5.0
(60) Silver	Micrograms/L See Note (3).	≤ 0.07
(61) Specific Conductance (see Conductance, Specific, above)		---
(62) Substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, plants, or animals		None shall be present.
(63) 1,1,2,2-Tetra-chloroethane	Micrograms/L	≤ 10.8 annual avg.
(64) Tetrachloroethyl-ene (1,1,2,2-tetrachlo-roethene)	Micrograms/L	≤ 8.85 annual avg.
(65) Thallium	Micrograms/L	≤ 6.3
(66) Thermal Criteria (See Section 62-302.520)		---
(67) Total Dissolved Gases	Percent of the saturation value for gases at the existing atmospheric and hydrostatic pressures	≤ 110% of saturation
(68) Transparency	Depth of the compensation point for photosynthetic activity	Shall not be reduced by more than 10% as compared to the natural background value.
(69)Trichloroethylene (trichloroethene)	Micrograms/L	≤ 80.7 annual avg.
(70) Turbidity	Nephelometric Turbidity Units (NTU)	≤ 29 above natural
(71) Zinc	Micrograms/L See Notes (1) and (3).	Zn ≤ e(0.8473[lnH]+0.884)

Notes: (1) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is >400 mg/L. (2) This criterion is protective of human health not of aquatic life. (3) For application of dissolved metals criteria see 62-302.500(2)(d), F.A.C.

criteria. For this reason, protection of their general designated uses is an important additional strategy to preserve or restore springs and spring runs.

Existing data summarized in this work plan indicate that nutrients are elevated in both the Wekiva River and in Rock Springs Run due to past and present human activities. It has also been observed that plant communities within these two stream reaches may be altered compared to natural conditions and that growths of filamentous algae are a possible result of these elevated nutrient levels. These conditions have not been adequately measured to-date to allow development of PLRGs for these water bodies. For these reasons the focus of this work plan is to provide quantitative data to support nutrient PLRGs, if they are indeed necessary to protect the designated uses of these aquatic ecosystems. If data collection and analysis supports a finding of nutrient-based imbalance of natural populations of aquatic flora and fauna in the Wekiva River System or of any other Class III water quality criteria, separate PLRGs will be developed for the Wekiva River above Blackwater Creek, for Rock Springs Run, or for both aquatic ecosystems.

The purpose of this work plan is to provide a scientifically-based approach for verifying whether elevated nutrient concentrations are, or are not, a concern in the Wekiva River System and to document any measurable nutrient impacts on ecological attributes of the Wekiva River System. Methods that are recommended in this work plan to accomplish the project goals include review and analysis of existing information and scientific studies of the Wekiva River System and similar reference spring run systems to establish a characterization of the baseline or goal for the system's designated uses of recreation and healthy, well-balanced fish and wildlife populations; review of existing information and development of focused studies to link specific nutrients to impaired conditions; implementation of those studies and analysis of new data collected in those studies; and identification of the necessary level of nutrient reductions necessary to either preserve or restore the Wekiva River System to the reference or baseline condition.

Reference sites will be used to help establish normal conditions in the Wekiva River System. The reference sites that have been selected for this work plan are two similar spring runs in north Orange County and south Marion County: Alexander Springs Run and Juniper Creek, respectively. While no two spring runs are identical, these two systems are relatively close to the Wekiva River System (see Figure 1-1), are used for similar types of recreation, but do not have any signs of significant nutrient enrichment due to past or present human activities.

Nutrients are just one category of pollutants that may be resulting in impairment of the Wekiva River System. They are the focus of this work plan because they are most amenable to PLRG analysis. However, other pollutants and stressors may also be impairing designated uses in the Wekiva River System. Additional parallel and future work efforts may be required to identify and quantify the role of those additional pollutants and stressors on the functioning of the Wekiva River System. Part of this nutrient-focused work plan will be to provide initial observations of other stressors of concern in the ecosystem and to make recommendations concerning additional focused sampling efforts for their documentation and eventual control. Pollutants or stressors that have either resulted in historic impairment, are currently resulting in continuing

impairment, or have the potential to create future impairment if not attenuated, will be identified.

This work plan includes the following sections:

- **Section 1: Introduction** that describes the nature of the problem and the goals and objectives of the project
- **Section 2: Description of the Work Plan Area** that briefly describes the Wekiva River System and the spring run reference sites' location, extent, and surrounding land uses
- **Section 3: Review and Analysis of Existing Information** that provides the basis for current understanding of the effects of nutrients in the Wekiva River System and focuses the direction of future work activities to efficiently identify existing impairment of designated uses with minimal redundancy of sampling efforts
- **Section 4: Work Plan** that describes the proposed project components, their level-of-effort and schedule, the methods to be employed, and the estimated cost of those activities
- **Section 5: Data Analysis and PLRG Development** that provides a preliminary description of the analysis methods that will be employed to summarize the existing and new data and to prepare a defensible nutrient PLRG for the Wekiva River System if warranted

The December 1, 2005 deadline established by the Florida Legislature for completion of this project dictates the appropriate level-of-effort for all project activities. Work on this Work Plan was initiated in late June 2004 and the Work Plan completion date is scheduled to be no later than September 30, 2004. This timeline is necessary to initiate funding for any recommended additional monitoring activities at the beginning of the SJRWMD's 2004/2005 fiscal year in October 2004. Given this schedule and the need to fully analyze all data and develop any recommended nutrient PLRGs by December 1, 2005, there is only a maximum of 6 months available for additional sample collection (December 2004 through about May 2005). Less time than this may be available due to unavoidable funding delays, review of sampling and analysis plans, mobilization of sampling activities, and final PLRG development. For these reasons sampling methods selected for this work plan must be those that are most representative of the specific endpoints of impairment. Sampling methods must be reproducible and must be applicable in reference areas as well as in the Wekiva River System. Continuous measurements using remote logging technologies will be desirable to generate comprehensive and statistically powerful data sets over a wide range of seasonal and climatic conditions within a limited project schedule. Budget constraints will also limit the depth and breadth of sampling. This work plan endeavors to integrate these important practical considerations into a realistic and implementable project that will support the SJRWMD staff with development of recommended nutrient PLRGs by December 1, 2005.

2.0 Description of the Wekiva River System and Spring Run Reference Sites

2.1 General Location

The Wekiva River System is located in central Florida, just north of Orlando and within three counties: Orange, Seminole, and Lake (Figure 2-1). Wekiwa Springs, the primary headwater spring of the Wekiva River, is located in northeast Orange County, approximately 4.8 km (3 miles) northeast of the City of Apopka and 9.6 km (6 miles) northeast of Lake Apopka.

Rock Springs, the primary headwater spring of Rock Springs Run is located about 6.4 km (4 miles) northwest of Wekiwa Springs. Rock Springs Run also receives input from Sulfur Spring and flows north, east, and then southeast for a distance of about 14.2 km (8.8 miles) before joining with Wekiwa Springs Run about 1,065 m (3,500 ft) east of Wekiwa Springs. The Wekiva River flows northeast from this confluence for about 5.9 km (3.7 miles) before it is joined by the Little Wekiva River whose headwaters are in north Orlando.

The Wekiva River flows north and northeast from its confluence with the Little Wekiva River for about 14.4 km (8.9 miles), crossing under SR 46 about 21 km (13 miles) east of Mount Dora and 14.5 km (9 miles) west of Sanford. The Wekiva River receives additional input of dark water at its confluence with Blackwater Creek, about one mile upstream of its confluence with the St. Johns River where it ends. The Wekiva River is the legal boundary between Orange and Seminole Counties to the south and Lake and Seminole Counties in the north.

The two spring run reference sites are located about 32 to 54 km (20 to 33 miles) north of the Wekiva River System in south Marion and north Lake Counties. Juniper Creek receives inflows from Juniper Springs and Fern Hammock Springs and travels for about 9 km (5.6 miles) before entering the southwest corner of Lake George (Figure 2-2). Alexander Springs Creek (Figure 2-3) receives inflow from Alexander Springs and travels for about 17 km (10.5 miles) before entering the St. Johns River near Lake Dexter.

2.2 State-Owned Lands and Designations

Wekiwa Springs State Park and Rock Springs Run State Preserve include about 7,850 ha (19,400 acres) of uplands, wetlands, and aquatic habitats surrounding Wekiwa Springs, Rock Springs, Rock Springs Run, and the southern end of the Wekiva River. The northern reach of the Little Wekiva River, northwest of Altamonte Springs is located within the Wekiva River Buffer Conservation Area. The northern one third of the Wekiva River is located in Seminole State Forest. The Wekiva River State Aquatic Preserve includes the Wekiva River, Rock Springs Run, the lower (north) reach of the Little Wekiva River, and Blackwater Creek. The Wekiva River and Rock Springs Run are listed as Outstanding Florida Waters (OFWs) and protected by special rules applicable to OFWs.

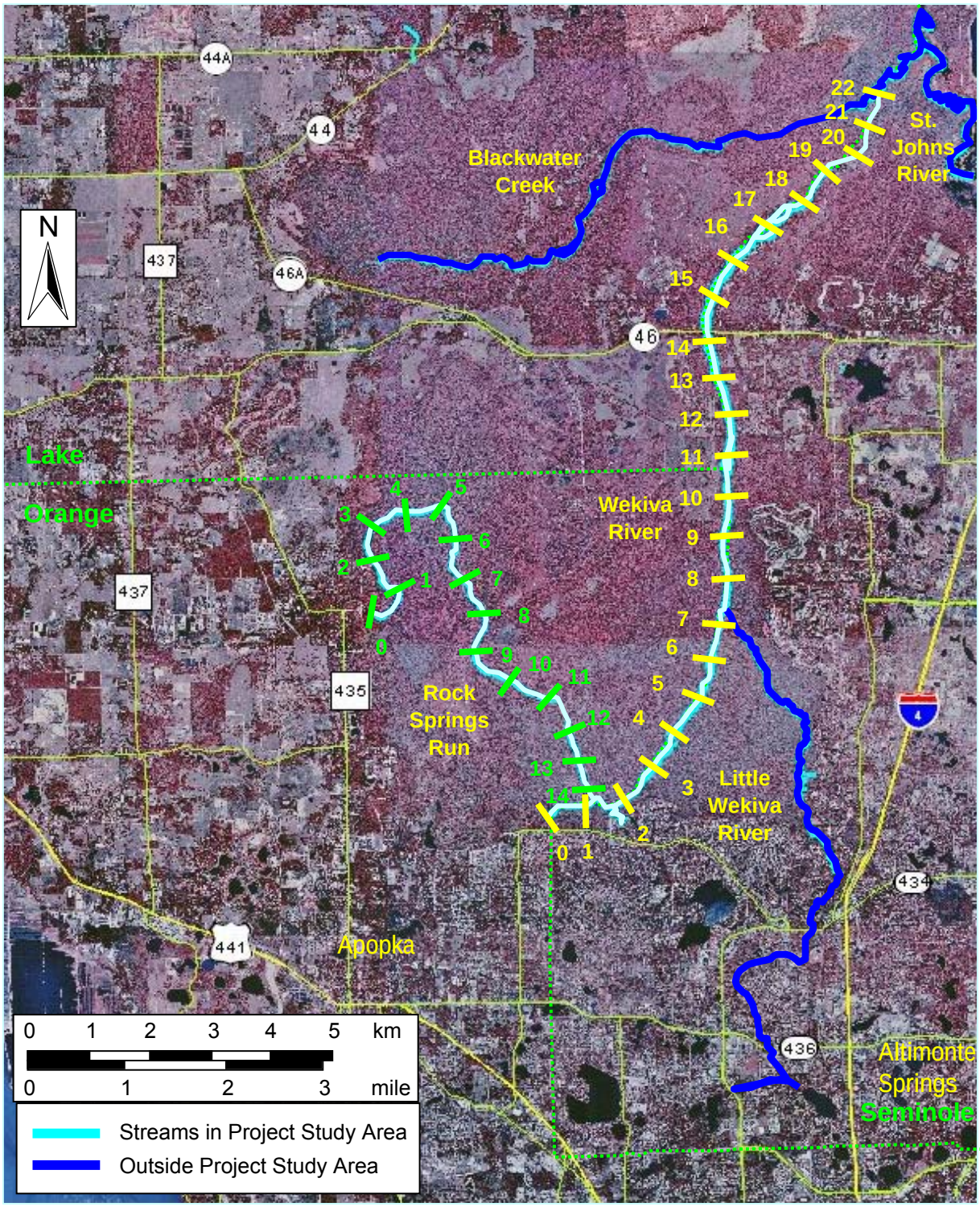


FIGURE 2-1

MAP ILLUSTRATING THE EXTENT OF THE WEKIVA RIVER SYSTEM AND SHOWING APPROXIMATE 1 KM FLOW DISTANCE INTERVALS FOR EACH KEY RIVER SEGMENT

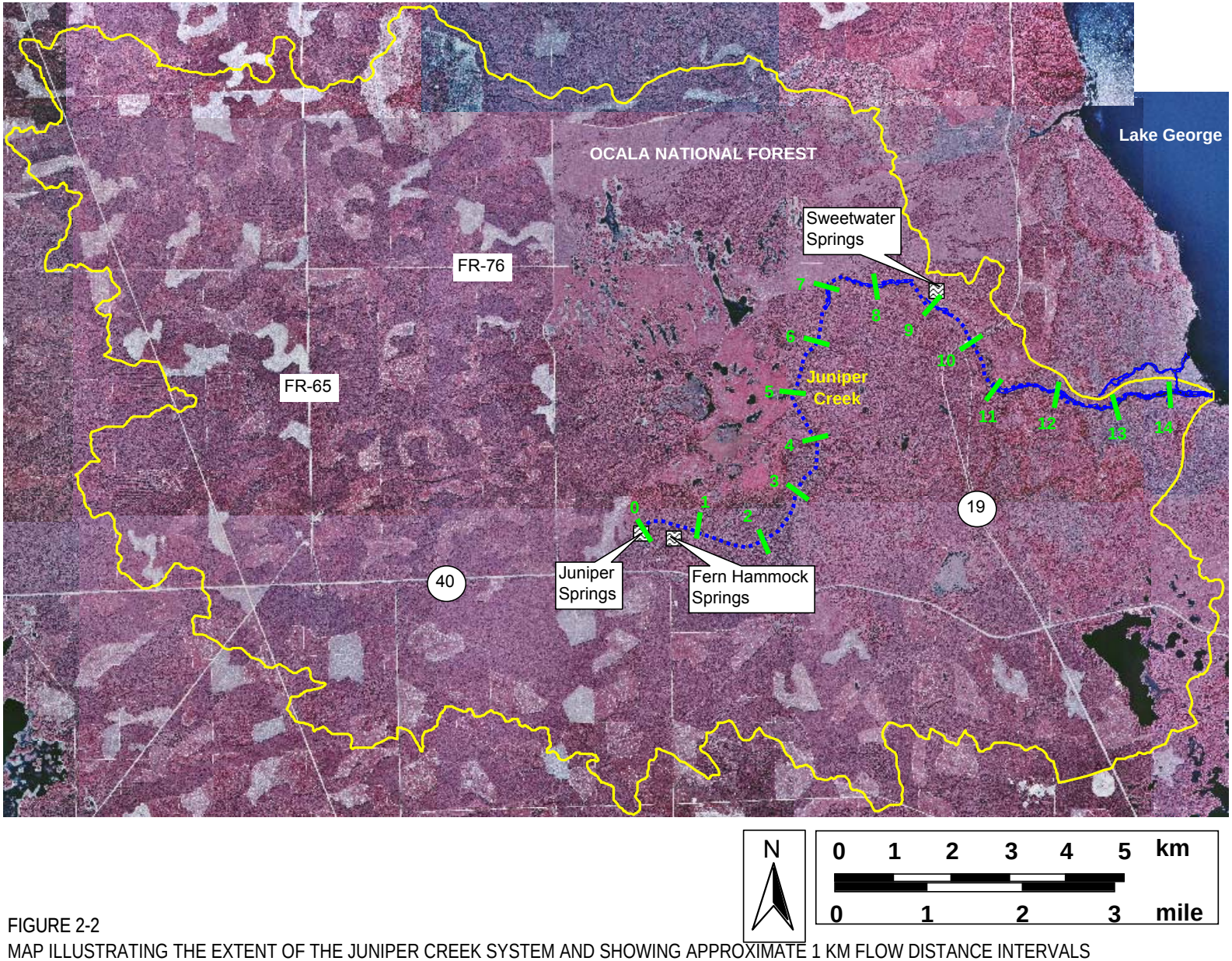


FIGURE 2-2
MAP ILLUSTRATING THE EXTENT OF THE JUNIPER CREEK SYSTEM AND SHOWING APPROXIMATE 1 KM FLOW DISTANCE INTERVALS

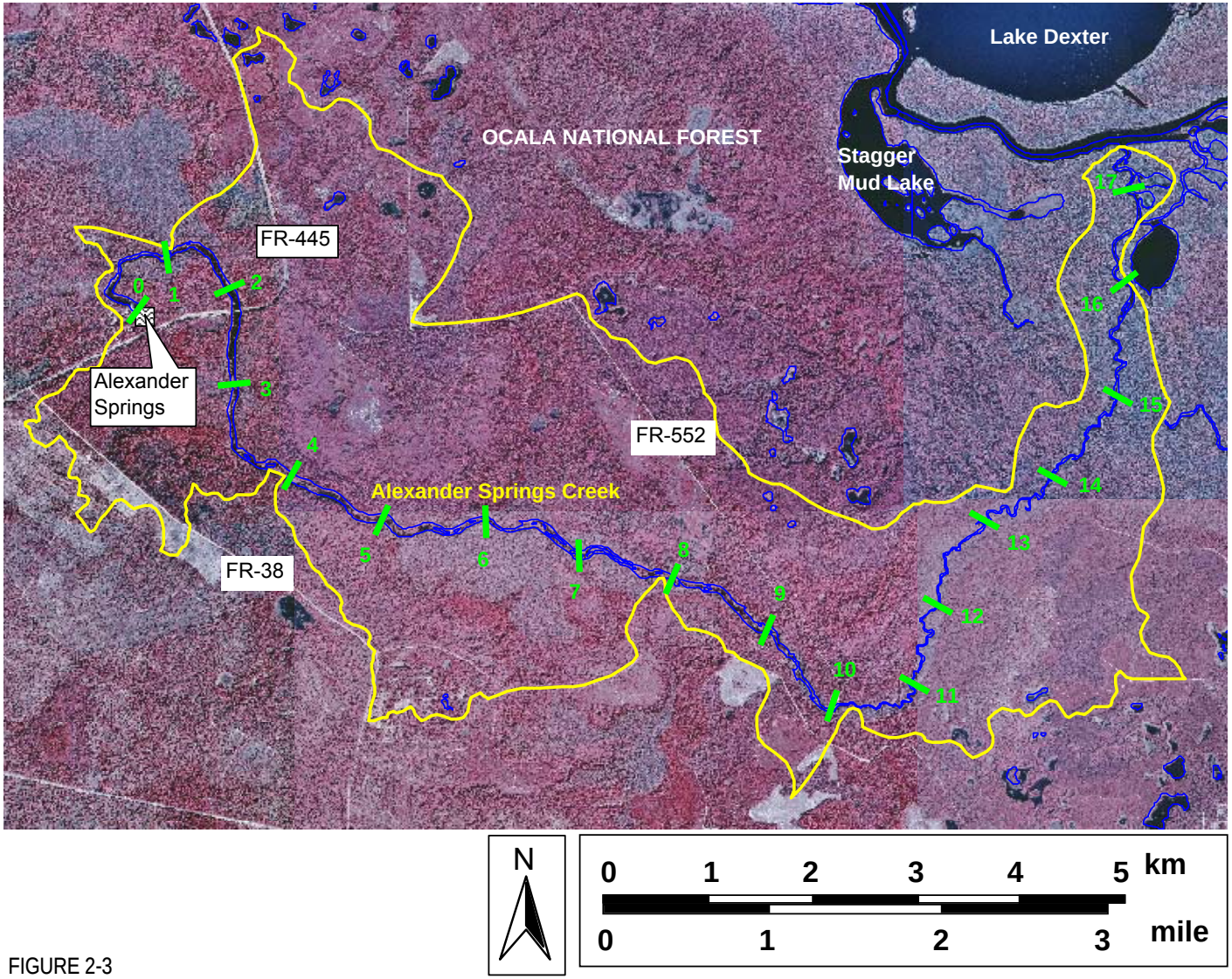


FIGURE 2-3

MAP ILLUSTRATING THE EXTENT OF THE ALEXANDER SPRINGS CREEK SYSTEM AND SHOWING APPROXIMATE 1 KM FLOW DISTANCE INTERVALS

The entire length of the Wekiva River and Rock Springs Run is a State Canoe Trail and is one of the most heavily used in the state of Florida. Attendance at the Wekiwa Springs State Park averages more than 200,000 human-use-days per year (FOWR 1985).

The two reference spring run sites are located within the boundaries of the Ocala National Forest and are also heavily-used recreational sites.

2.3 Watershed Boundaries and Landuse Changes

Topographical maps of the Wekiva River System and surrounding watershed basins are provided in Figures 2-4 and 2-5, respectively. There are five subbasins within the Wekiva River System as defined for this work plan for a total watershed area of about 24,000 ha (59,280 acres). These include:

- Wekiva River Subbasin– 8,680 ha (21,450 acres)
- Rock Springs Run Subbasin – 8,676 ha (21,439 acres)
- Little Wekiva River Subbasin – 3,881 ha (9,591 acres)
- An unnamed subbasin – 587 ha (1,451 acres)
- Lake Gary Outlet Subbasin – 359 ha (886 acres)
- Yankee Lake Outlet – 1,806 ha (4,463 acres)

Ground surface elevations in this watershed range from a high of about 175 ft NGVD29 west of the project area to a low of about 10 ft NGVD29 at the confluence of the Wekiva River and Blackwater Creek. As summarized in Table 2-1 (see Appendix A for greater detail) a large portion of the basin (about 7,700 ha or 19,000 acres) is classified as wetlands by the National Wetlands Inventory (USFWS 1988). Forested wetland areas predominate (6,270 ha [15,495 acres] or about 82 percent of the mapped wetlands) in the headwaters of the Wekiva River and Rock Springs Run and throughout about half of their length. The remaining wetlands in the basin include emergent marsh (407 ha [1,006 acres]), limnetic unconsolidated bottom (lake bottom – 376 ha [929 acres]), palustrine unconsolidated bottom (198 ha [490 acres]), scrub/shrub (136 ha [336 acres]), and aquatic bed (94 ha [232 acres]).

There has been relatively minor change in the mapped area of wetlands in the Wekiva River System watershed since the first land use map prepared by the SJRWMD in 1973 (Figures 2-6 and 2-7 and Appendix B). Overall areas of upland forest and rangeland in the Wekiva River System watershed have also seen relatively minor net changes from 1973 through 2000. The greatest land use conversion in this period for the entire watershed has been from agricultural land to urban and built-up.

Land use changes in the Wekiva River subbasin have primarily resulted in a shift from upland forest and agricultural land in 1973 to urban and built-up land in 2000. The Little Wekiva River subbasin has had an almost complete conversion of uplands formerly in agriculture and upland forest land uses to urban and built-up during this time period, while the Rock Springs Run subbasin has seen the smallest percent land use changes with an apparent shift of some agricultural land to rangeland and upland forest.

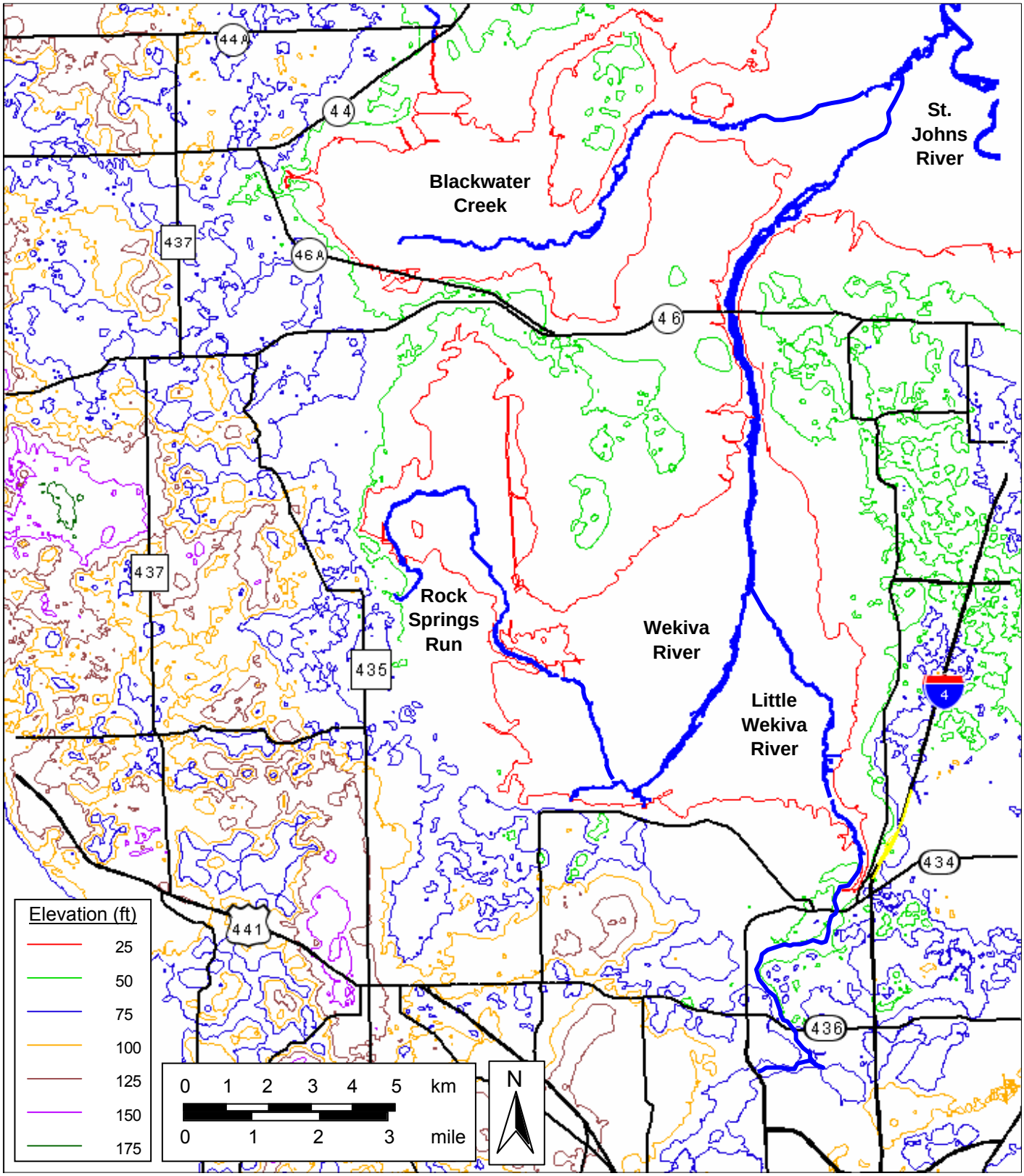


FIGURE 2-4
TOPOGRAPHIC MAP FOR THE WEKIVA RIVER SYSTEM AND SURROUNDING AREAS

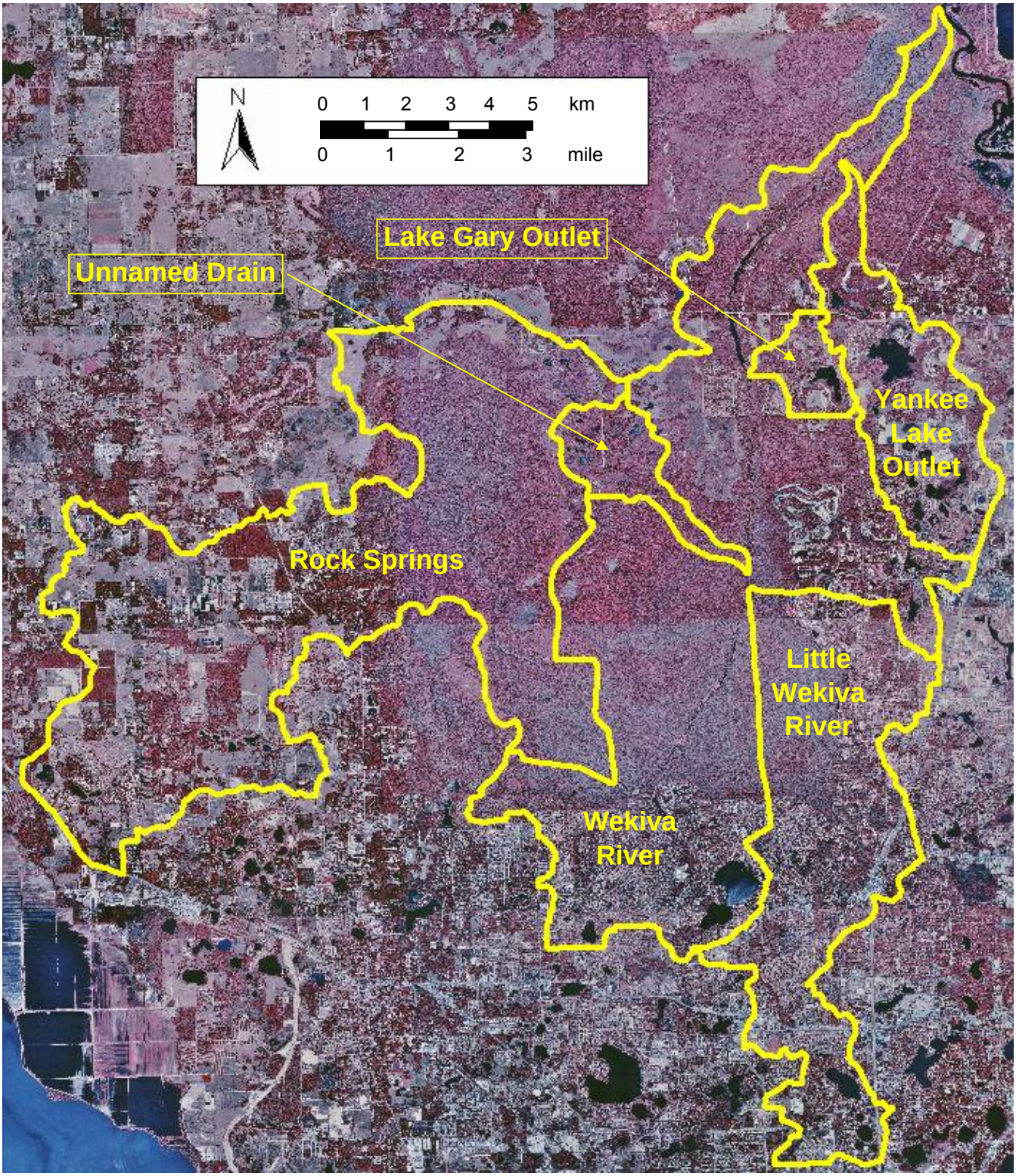


FIGURE 2-5
SURFACE WATER CATCHMENT AREAS FOR THE WEKIVA RIVER SYSTEM AND SURROUNDING AREAS

TABLE 2-1

NATIONAL WETLAND INVENTORY SUMMARY FOR SURFACE WATER BASINS WITHIN THE WEKIVA RIVER SYSTEM AND REFERENCE AREAS (Areas in Acres)

			STUDY AREA							REFERENCE AREA		
System	Subsystem	Class	Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	Total	Juniper Creek	Alexander Spring Creek	Total
Lacustrine	Limnetic	Open Water	---	---	---	---	---	---	0.00	275	---	275
		Unconsolidated Bottom	380	32.7	130	---	83.2	303	929	---	---	0.00
	Littoral	Aquatic Bed	5.82	---	---	---	---	3.53	9.35	58.2	---	58.2
		Open Water	---	---	---	---	---	---	0.00	0.033	---	0.033
Palustrine		Aquatic Bed	27.8	122	12.7	32.6	1.08	36.2	232	227	11.4	239
		Emergent	282	319	74.8	67.8	15.3	248	1,006	844	76.1	920
		Forested	7,095	5,386	2,565	224	21.8	204	15,495	3,730	2,114	5,844
		Open Water	---	---	---	---	---	---	0.00	133	11.8	145
		Scrub/Shrub	116	40.3	5.71	62.6	---	111	336	57.9	76.8	135
		Unconsolidated Bottom	79.6	157	76.5	4.62	30.9	142	490	---	---	0.00
		Unconsolidated Shore	3.86	1.69	---	---	---	---	5.55	---	---	0.00
Riverine	Lower Perennial	Aquatic Bed	4.29	18.3	29.0	---	---	---	51.5	---	12.3	12.3
		Open Water	---	---	---	---	---	---	0.00	49.5	167	217
		Unconsolidated Bottom	366	40.8	18.0	---	0.161	0.311	426	---	---	0.00
Upland			13,089	15,323	6,679	1,059	734	3,415	40,298	41,240	5,701	46,940
No data			0.009	---	---	---	---	0.191	0.200	---	---	0.00
Total			21,450	21,439	9,591	1,451	886	4,463	59,280	46,615	8,170	54,786

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory (Published 1988)

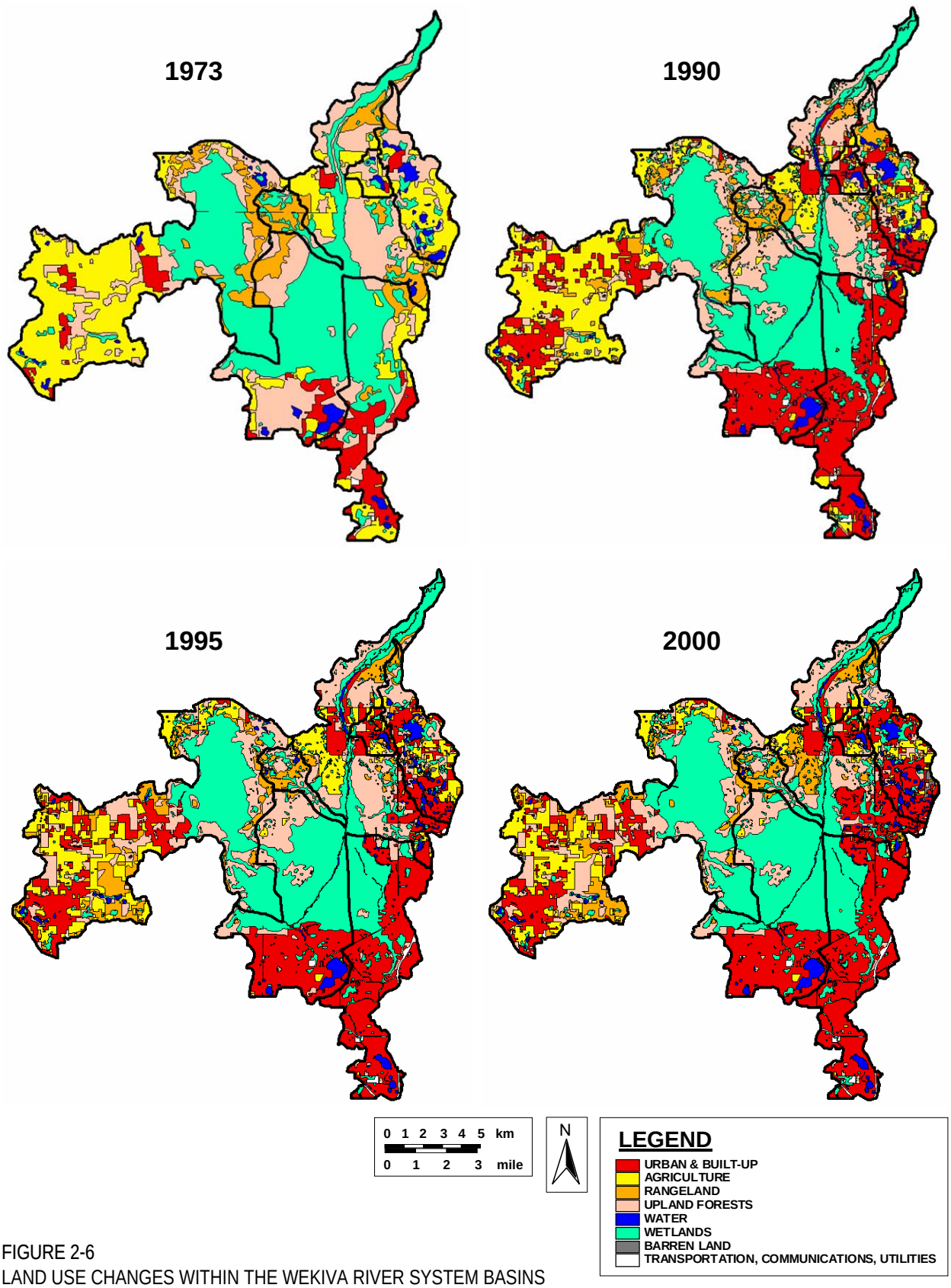


FIGURE 2-6
LAND USE CHANGES WITHIN THE WEKIVA RIVER SYSTEM BASINS

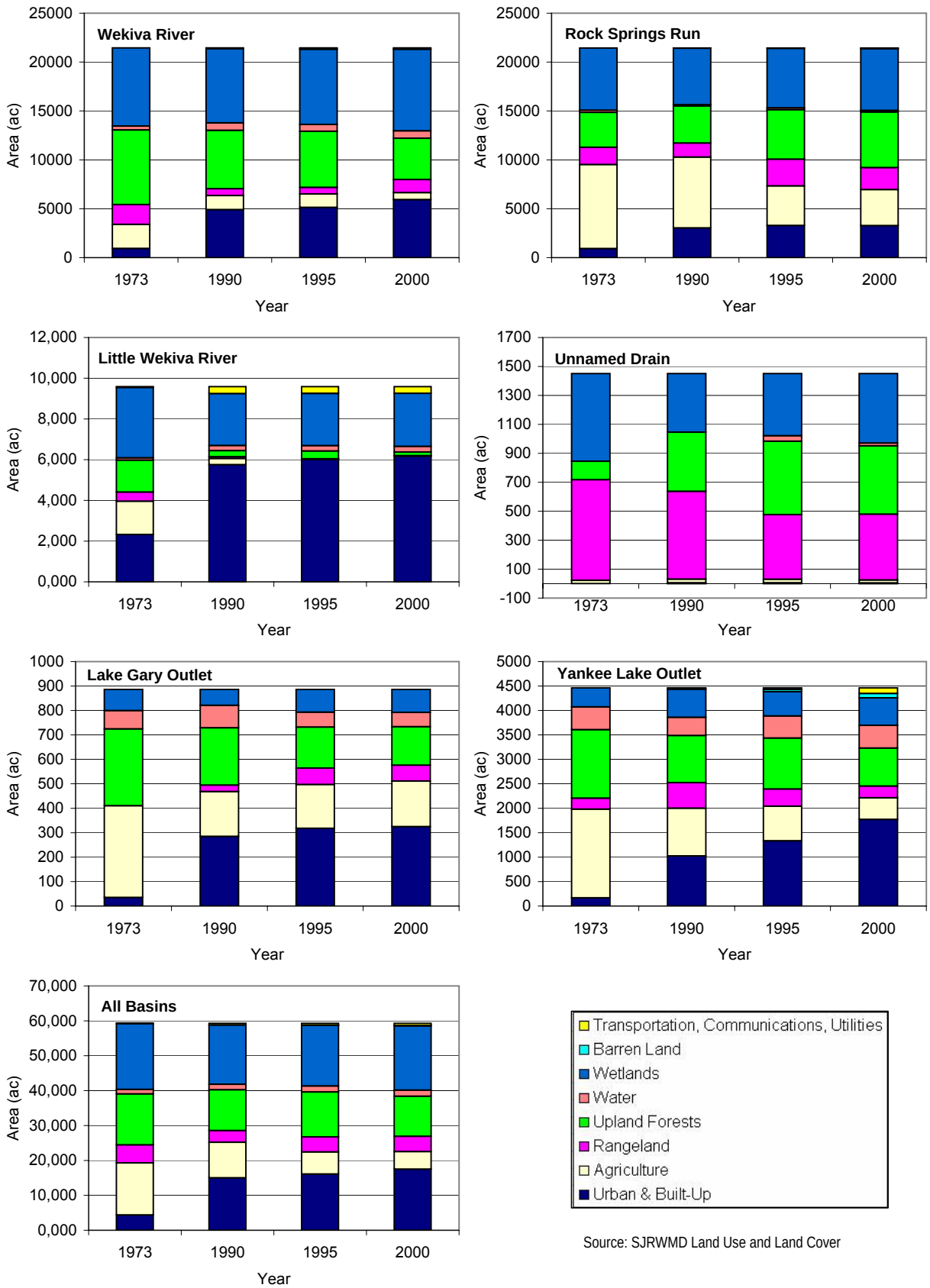


FIGURE 2-7
LAND USE CHANGES SUMMARY BY BASIN IN THE WEKIVA RIVER SYSTEM

Watershed boundaries for the reference spring run systems are illustrated in Figures 2-8 and 2-9. The Juniper Creek watershed includes about 18,852 ha (46,584 ac) while the Alexander Springs Creek watershed basin includes about 3,304 ha (8,164 ac). Wetlands comprise about 2,302 ha (5,689 ac) of the Juniper Creek basin and 1,008 ha (2,491 ac) of the Alexander Springs Creek basin (see Table 2-1 and Appendices A and B). Land use changes at both reference sites in the Ocala National Forest have been relatively minor (Figures 2-10 to 2-12). Dominant land use for both of the reference site watersheds is upland forest (managed pine plantations).

2.4 Rainfall and Discharge Rates

Normal rainfall totals for the Wekiva River System area are 131 cm/yr (51.5 in/yr) (Table 2-2). The period-of-record annual rainfall totals for seven precipitation stations in the vicinity of the project area are illustrated in Figure 2-13. There is no apparent trend in these rainfall amounts within this period. The maximum and minimum annual average rainfall amounts during this period-of-record are typically between 76 and 190 cm/yr (30 and 75 in/yr), respectively.

There are 13 named springs that directly contribute to flows into the Wekiva River in this project area (Table 2-3). It has been demonstrated by several researchers that these springs are all artesian in nature and discharge from the upper portion of the Floridan Aquifer. While most of this groundwater flow enters the system through named springs, some results from leakage between the Florida Aquifer and the surficial aquifer and then enters the rivers and runs as seepage flow.

Time-series and cumulative frequency flow data for selected springs in this area are illustrated in Appendix C and summarized in Table 2-4. Wekiwa Springs had an average flow rate of 1.90 m^3/s (67 cfs) based on data between 1969 and 2003. Rock Springs had an average discharge rate of 1.43 m^3/s (51 cfs) for the period-of-record from 1970 through 2003. Juniper and Fern hammock Springs had a combined average flow rate of 0.6 m^3/s (22.6 cfs). Alexander Springs had an average flow rate of 2.94 m^3/s (104 cfs) based on data collected between 1931 and 2000.

Stream flows are gauged at three locations in the Wekiva River and at two locations in the Little Wekiva River (Figure 2-14 and Appendix D). Stream discharge data are summarized in Table 2-5. Median flow rates at the Wekiva Marina and Old RR Crossing gauging stations on the Wekiva River are 4.13 m^3/s (146 cfs) at the Wekiva Marina (USGS 2234635) and 6.03 m^3/s (213 cfs) further downstream at the Old RR Crossing station (USGS 022349993). Flow downstream at the SR 46 station (USGS 02235000) has been gauged since October 1935. Median flow at this station is 7.14 m^3/s (252 cfs). Maximum and minimum recorded flows at this station are 58.3 and 2.97 m^3/s (2,060 and 105 cfs), respectively.

Flows in the Little Wekiva River are gauged at SR 434 (USGS 02234990) and at Springs Landing Boulevard (USGS 02234998). Median flow increases from the upstream to the downstream stations from 0.59 to 1.61 m^3/s (21 to 57 cfs). Average flow from the Altamonte Springs WWTP to the Little Wekiva River upstream of SR 436 for the period from 1998 through 2004 was 0.050 m^3/s (1.8 cfs).

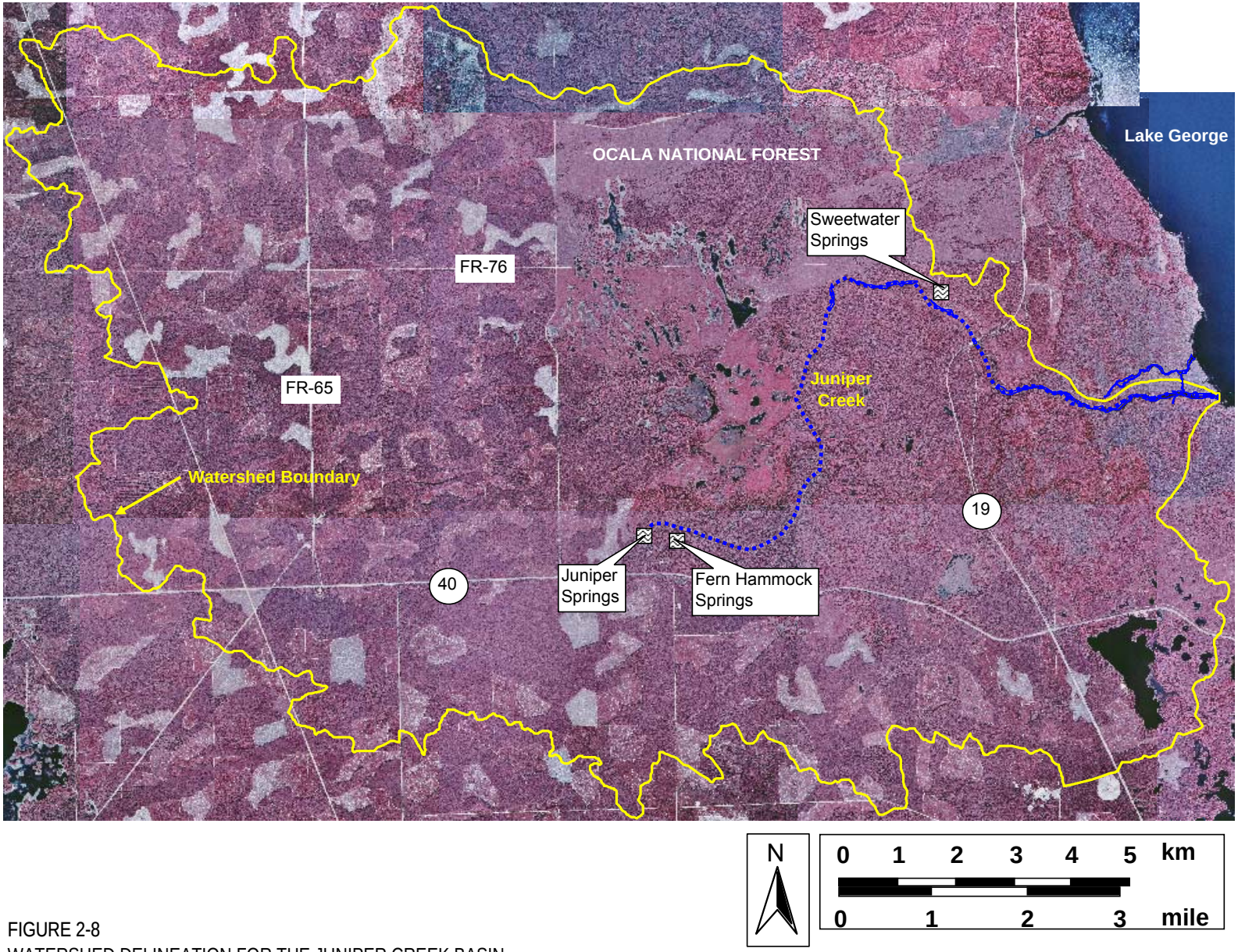


FIGURE 2-8
WATERSHED DELINEATION FOR THE JUNIPER CREEK BASIN

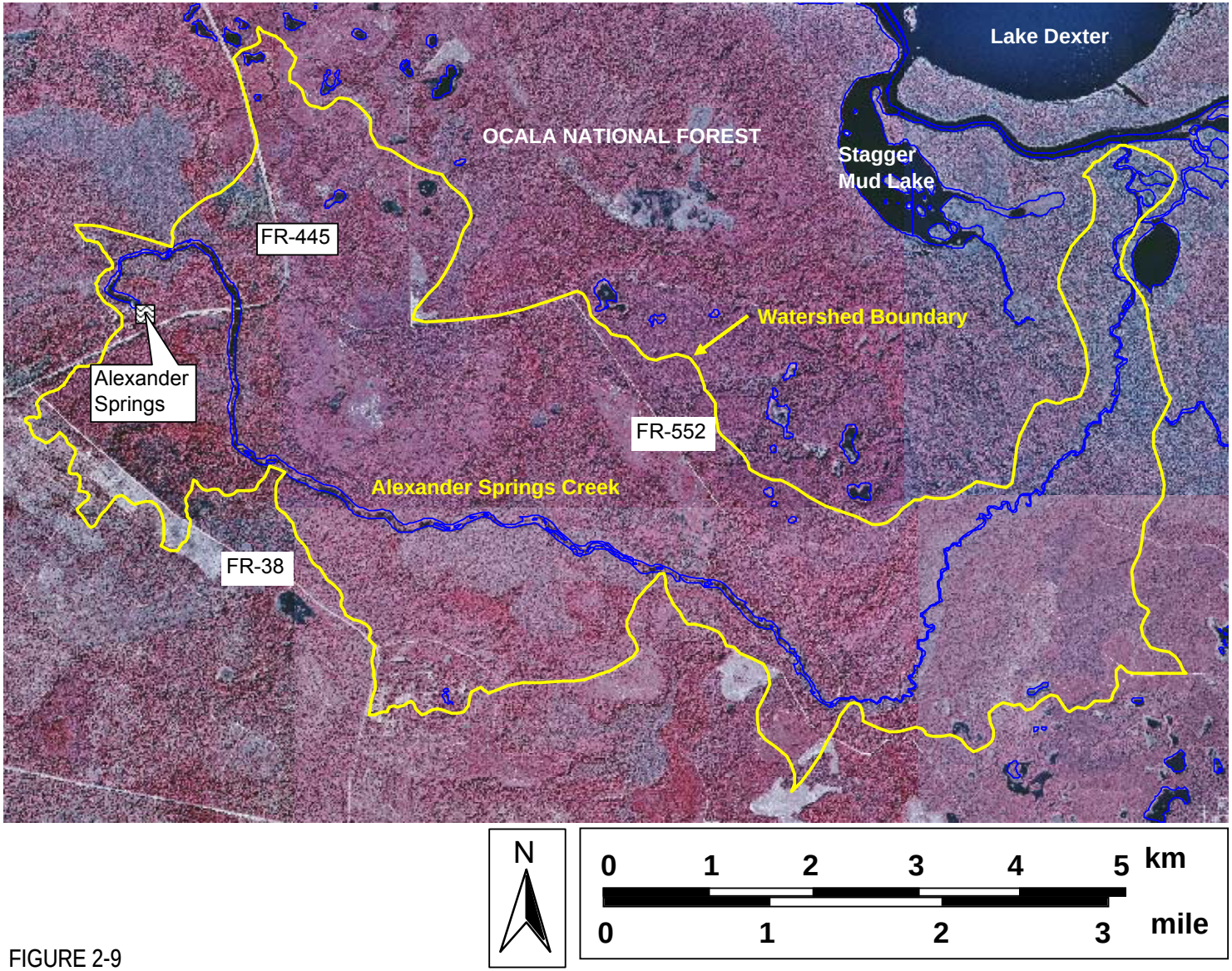


FIGURE 2-9
WATERSHED DELINEATION FOR THE ALEXANDER SPRINGS CREEK BASIN

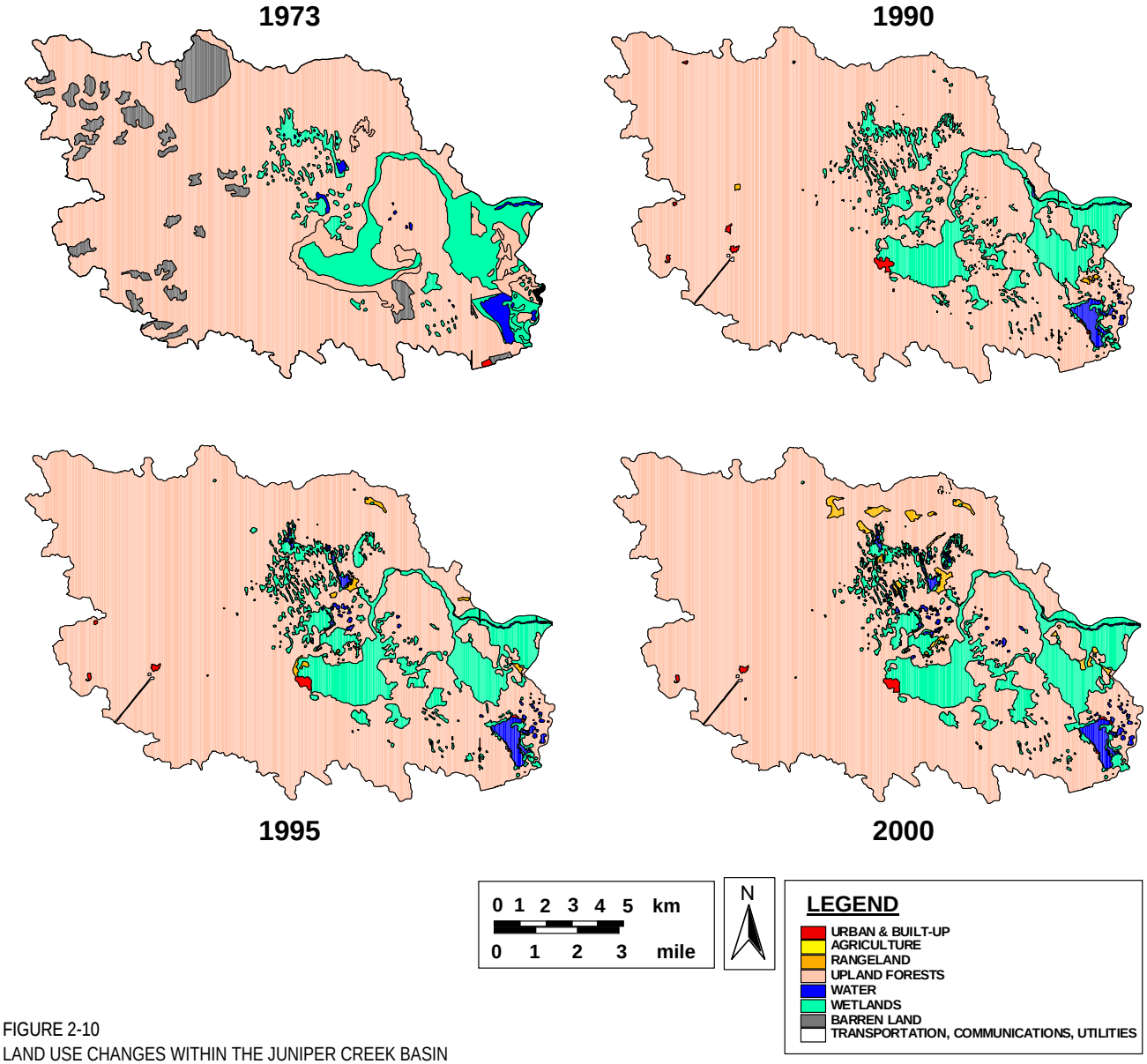


FIGURE 2-10
LAND USE CHANGES WITHIN THE JUNIPER CREEK BASIN

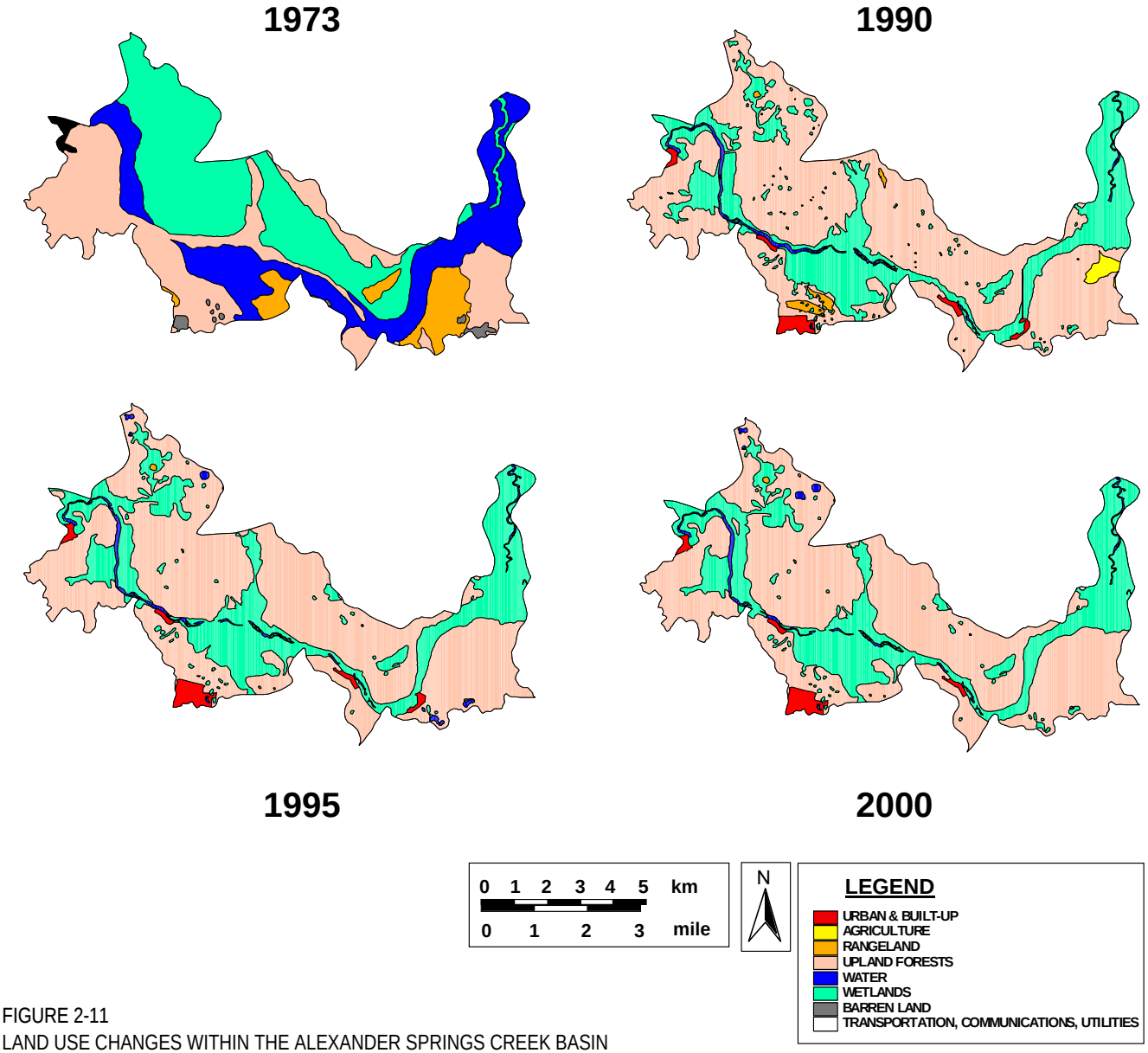
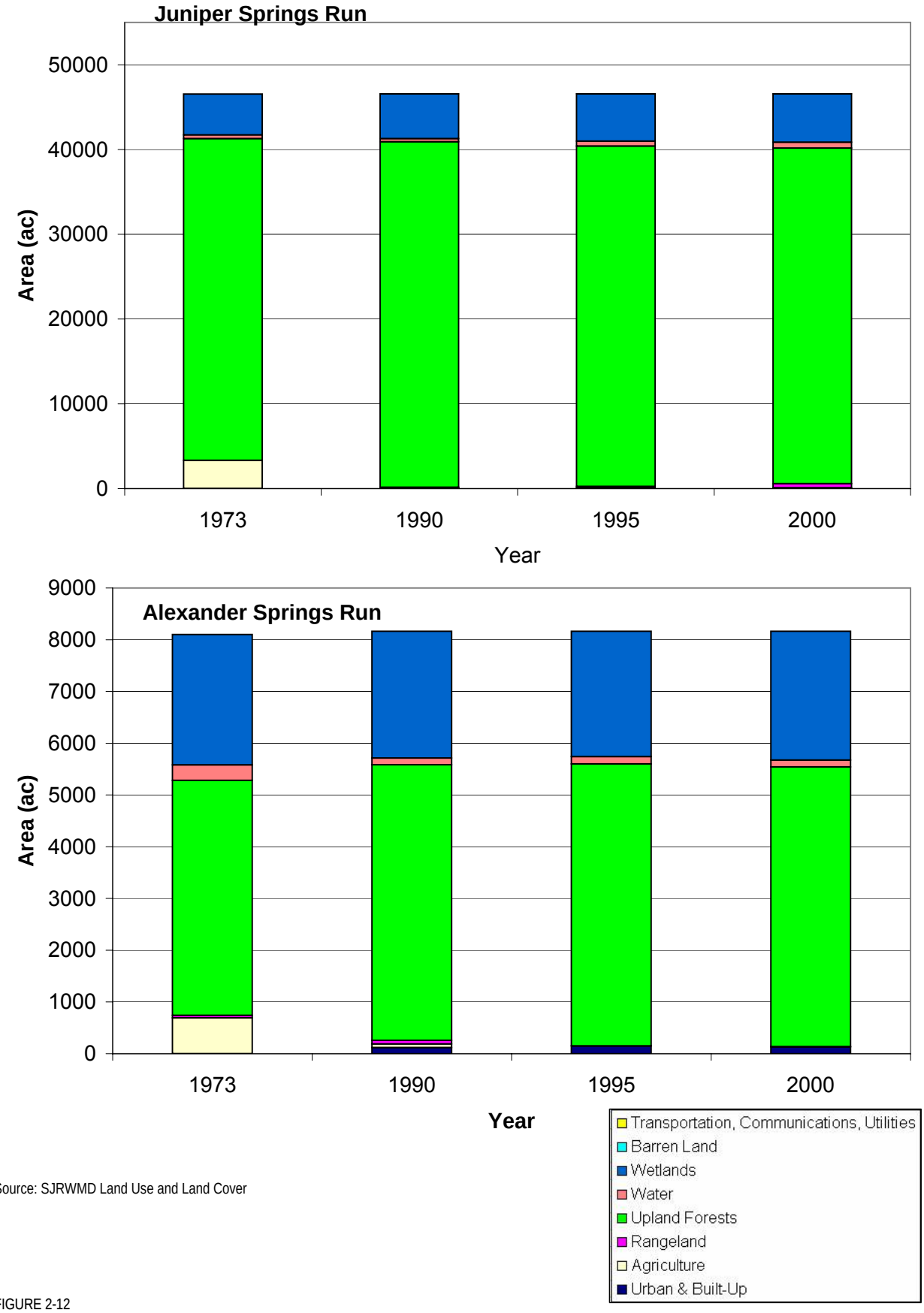


FIGURE 2-11
LAND USE CHANGES WITHIN THE ALEXANDER SPRINGS CREEK BASIN



Source: SJRWMD Land Use and Land Cover

FIGURE 2-12
SUMMARY OF LAND USE CHANGES BY BASIN AT THE JUNIPER CREEK AND ALEXANDER SPRINGS CREEK REFERENCE SITES

TABLE 2-2

RAINFALL SUMMARY FOR STATIONS SURROUNDING THE WEKIVA RIVER SYSTEM PROJECT AREA

COOPID	STATION NAME	POR	Annual Rainfall (inches)					
			Average	Median	Maximum	Minimum	Std Dev	Count
87977	SANFORD EXPERIMENT STN	1949 - 2001	52.34	51.98	74.06	32.74	9.67	53
82827	EUSTIS 2 S	1931 - 1958	49.04	47.95	65.68	35.93	8.00	28
81641	CLERMONT 7 S	1948 - 2001	50.72	50.72	68.09	29.16	9.26	54
86628	ORLANDO WSO MCCOY	1974 - 2001	49.23	49.07	67.85	30.30	8.53	28
86638	ORLANDO WSO AIRPORT	1949 - 1973	50.66	50.93	68.58	40.09	7.95	25
86633	ORLANDO WATER PLANT	1950 - 1958	52.76	50.08	73.93	40.69	9.87	9
82229	DELAND 1 SSE	1931 - 2001	55.70	55.29	81.67	39.94	9.62	71

POR = Period-of-Record

Source: NCDC

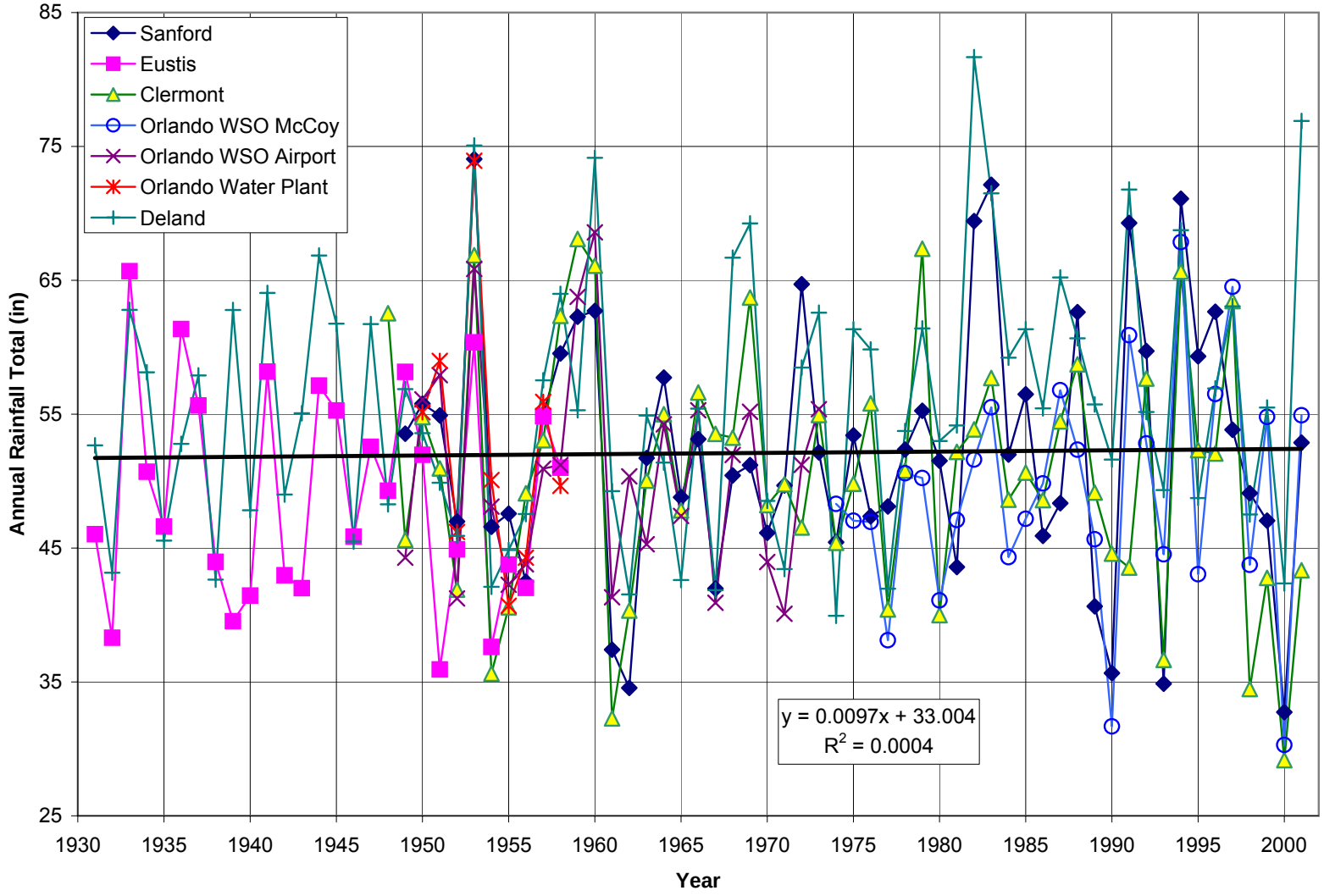


FIGURE 2-13
TIMESERIES OF ANNUAL RAINFALL FROM STATIONS SURROUNDING THE WEKIVA RIVER PROJECT AREA

TABLE 2-3
SPRINGS CONTRIBUTING TO THE WEKIVA RIVER (MINUS BLACKWATER CREEK BASIN) - SORTED BY MAGNITUDE

No.	Spring Name	Location	County	Latitude	Longitude	Magnitude (bold italics = estimate)	Aquifer	Receiving Water Body	Receiving Basin	Ownership	Access	Monitored
1	Sanlando Springs	near Longwood	Seminole	28.68861	-81.39583	2	Floridan Aquifer (Confined)	Little Wekiva River	Little Wekiva River	Private	with permission	Yes
2	Starbuck Spring	near Longwood. Formerly Sheppard Spring	Seminole	28.69667	-81.39111	2	Floridan Aquifer (Confined)	Little Wekiva River	Little Wekiva River	Private	with permission	Yes
3	Rock Springs	near Apopka	Orange	28.75556	-81.49944	2	Floridan Aquifer (Confined)	Rock Springs Run	Rock Springs Run	Public		Yes
4	Wekiwa Springs	near Apopka	Orange	28.71194	-81.46000	2	Floridan Aquifer (Confined)	Wekiva River	Wekiva River	Public		Yes
5	Ginger Ale Springs	Little Wekiwa River	Seminole	28.69250	-81.39167	3	Floridan Aquifer (Confined)	Little Wekiva River	Little Wekiva River	Private	not granted	No
6	Palm Springs - Seminole	near Longwood	Seminole	28.69083	-81.39278	3	Floridan Aquifer (Confined)	Little Wekiva River	Little Wekiva River	Private	with permission	Yes
7	Miami Springs	near Longwood	Seminole	28.71000	-81.44278	3	Floridan Aquifer (Confined)	Wekiva River	Wekiva River	Private	with permission	Yes
8	Island Spring	near Cassia	Seminole	28.82278	-81.41750	3	Floridan Aquifer (Confined)	Wekiva River	Wekiva River	Public	boat	Yes
9	Witherington Spring	near Apopka	Orange	28.73139	-81.48944	3	Floridan Aquifer (Confined)	Mill Creek	Wekiva River?	Public		No
10	Sulphur Spring	formerly Camp Spring - near Apopka	Orange	28.77000	-81.50917	4	Floridan Aquifer (Confined)	Rock Springs Run	Rock Springs Run	Public		No
11	Harden Spring	Wekiva River (Man Made - dug pond)	Seminole	28.82111	-81.41667	4	Floridan Aquifer (Confined)	Wekiva River	Wekiva River	Private	with permission	No
12	Nova Spring	Wekiva River (appears to be man-made due to canal dredging	Seminole	28.81750	-81.41861	4	Floridan Aquifer (Confined)	Wekiva River	Wekiva River	Public	boat	No
13	Barrel Spring	near Apopka	Orange	28.71139	-81.47167	4	Floridan Aquifer (Confined)	Wekiva River?	Wekiva River?	Public		No

Source: SJRWMD (6/2004)

TABLE 2-4

SPRING FLOW SUMMARY FOR SPRINGS WITHIN THE WEKIVA RIVER SYSTEM

Site	Parameter	Units	Period-of-Record		Average	Maximum	Minimum	Std Dev	Count
Barrel Spring	Flow, Inst	cfs	6/19/1995	9/10/1997	0.253	0.310	0.180	0.067	3
Island Spring	Flow, Inst	cfs	5/7/1982	12/19/2003	7.68	10.2	5.39	1.62	16
Miami Springs	Flow	cfs	1/11/2003	10/1/2003	6.37	7.85	5.13	0.705	264
	Flow, Inst	cfs	8/8/1945	2/3/2004	5.04	7.40	2.90	1.02	111
Palm Springs	Flow	cfs	12/21/2002	9/29/2003	6.22	6.76	5.35	0.321	283
	Flow, Inst	cfs	11/12/1941	2/2/2004	6.86	12.0	0.240	2.16	136
Rock Springs	Flow	cfs	5/16/1970	9/29/2003	50.5	73.0	37.0	6.42	1753
	Flow, Inst	cfs	2/5/1931	2/6/2004	58.4	83.2	34.1	7.72	442
Sanlando Springs	Flow	cfs	12/21/2002	9/29/2003	21.2	28.3	10.7	3.98	283
	Flow, Inst	cfs	11/12/1941	2/2/2004	19.6	36.0	8.99	5.05	137
Starbuck Spring	Flow	cfs	12/12/2002	9/29/2003	14.7	19.0	12.9	1.22	292
	Flow, Inst	cfs	7/25/1944	2/3/2004	14.4	21.0	8.30	2.02	130
Sulphur Springs	Flow, Inst	cfs	6/23/1995	6/11/1997	0.620	0.800	0.440	0.255	2
Wekiwa Springs	Flow	cfs	1/30/1969	9/29/2003	67.1	79.0	61.0	3.20	293
	Flow, Inst	cfs	3/8/1932	2/5/2004	67.6	92.0	38.6	7.84	412
Witherington Springs	Flow, Inst	cfs	3/28/1972	5/26/1995	2.30	3.70	1.00	1.35	3
REFERENCE SITES									
Alexander Springs	Flow, Inst	cfs	2/12/1931	6/10/2003	103	202	56.0	18.7	155
Fern Hammock Spring	Flow, Inst	cfs	4/19/1972	9/19/2003	12.2	17.0	9.27	1.52	143
Juniper Springs	Flow, Inst	cfs	11/13/1908	9/19/2003	10.4	16.5	5.60	1.94	139
Sweetwater Springs	Flow, Inst	cfs	11/14/1980	9/19/2003	12.8	23.0	7.12	1.79	133

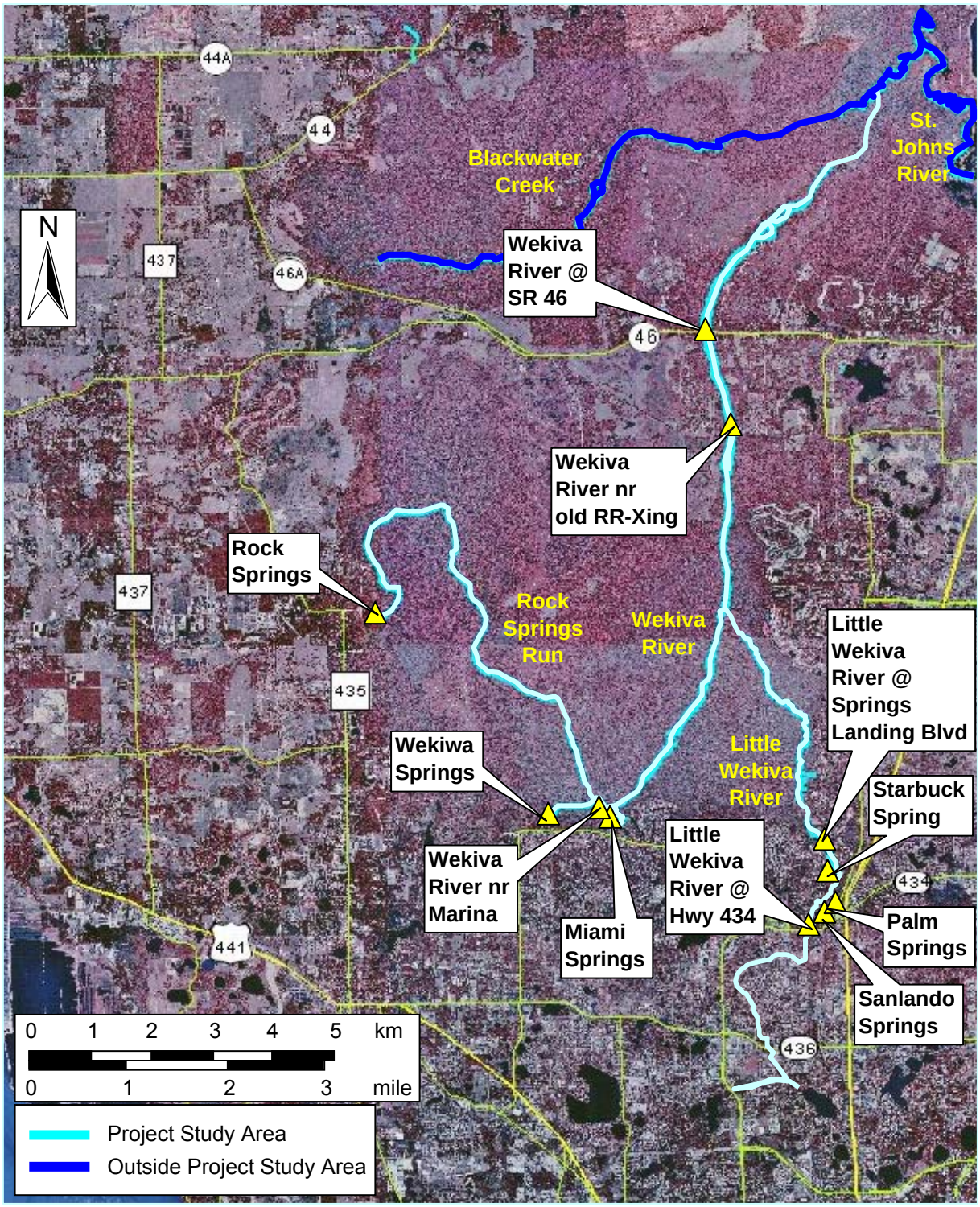


FIGURE 2-14

STREAM AND SPRING FLOW GAUGING STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

TABLE 2-5

FLOW AND STAGE SUMMARY FOR THE STREAMS AND TRIBUTARIES WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA AND REFERENCE SITES

Location	Distance from Main Boil (m) [a]	Period-of-Record		Number	Flow cfs	Flow, Inst cfs	Stage ft MSL
Wekiwa Springs	Main Boil	3/1932	2/2004	556	67.1	67.6	13.2
Wekiva River	1690	5/1961	3/2002	2,434	157	163	12.5
	1940	5/1973	5/1973	1	---	135	---
	8095	5/1973	6/1999	2	---	181	---
	11640	7/1995	3/2002	2,440	251	277	9.42
	14240	10/1931	4/2004	24,881	289	296	7.62
	19470	4/1981	6/1999	2	---	188	---
Rock Spring Run	250	2/1931	2/2004	1,986	50.5	58.5	62.9
	14200	5/1973	6/1999	2	---	56.0	---
Little Wekiva River	0	4/1974	4/1974	1	---	7.80	---
	3040	4/1974	4/1974	1	---	11.0	---
	4540	2/1972	4/2004	10,873	35.2	48.8	24.8
	6680	6/1995	3/2004	2,470	80.0	110	19.6
	14000	5/1973	6/1999	2	---	47.5	---
REFERENCE SITES							
Juniper Creek	0	11/1908	9/2003	154	---	10.4	30.3
Fern Hammock Spring	0	4/1972	9/2003	143	---	12.2	---
Sweetwater Springs	0	11/1980	9/2003	133		12.8	30.6
Alexander Springs Creek	0	2/1931	6/2003	155	---	103	8.81

[a] Little Wekiva River - Distance from Hwy 436

2.5 Existing Water Quality

Existing water quality data for the Wekiva River System were collected from a variety of sources including:

- U.S. Environmental Protection Agency's STORET database
- SJRWMD special studies and internal databases
- U.S. Geological Survey databases
- Florida Department of Environmental Protection databases
- Local government databases

A total of 99 separate water quality sampling locations were identified within the Wekiva River System and at the reference sites (Table 2-6). Many of these stations have differing periods-of-records and differing numbers of samples collected for each parameter. This means that comparisons of averages between stations must be made carefully and with reference to the detailed data and sample counts published in the Appendix E.

Period-of-record water quality data for the principal springs in the Wekiva River System and at the reference sites are summarized in Table 2-7. All of these springs have water quality that is characteristic of the upper Floridan Aquifer; however, water quality recorded in these springs varies by location within the watershed. Headspring area springs in the Wekiva River system have low concentrations of dissolved solids such as chlorides and sulfate, while the downstream springs in the Wekiva River near SR 46 and at Alexander and Sweetwater Springs have elevated levels of these salts. This variation is typical of groundwater in this basin with higher salt levels nearer the St. Johns River.

Mean spring water temperatures ranged from 21.8 to 24.8 °C with relatively minor annual variation in relation to flow rate. Mean dissolved oxygen concentration is low in many of these springs (<1.5 mg/L) with the exception of the Wekiva Falls station which is downstream of the actual spring boil and an artificial waterfall and probably represents re-aerated water. Specific conductance is typically between 239 and 433 µS in the headwater springs and above 1,200 µS in the downstream springs. Hardness is higher in the downstream springs (650 to 880 mg/L as $CaCO_3$) than in the upstream springs (102 to 157 mg/L as $CaCO_3$), but alkalinity is similar in all of the springs (86 to 130 mg/L as $CaCO_3$). Color and turbidity are low in all of the springs. Elevated levels of fecal and total coliforms have been recorded in Wekiwa Springs and Wekiva Falls, and total coliforms were elevated in Sanlando, Palm, and Starbuck Springs.

Nitrate + nitrite N concentrations are elevated in all of the headwater springs near the urban area with average reported concentrations ranging from 0.17 mg/L in Miami Springs to 1.41 mg/L in Wekiwa Springs. Nitrate levels at the reference springs are typically less than 0.1 mg/L. Total P concentrations in the springs nearest the urbanized areas are also elevated. Rock Springs had an average total P concentration of 0.065 mg/L while Sanlando, Palm, Starbuck, and Wekiwa Springs averaged between 0.129 to 0.217 mg/L of total P. With the exception of several elevated concentrations reported from Alexander Springs, the reference site springs had relatively low mean total P concentrations (0.019 to 0.049 mg/L).

TABLE 2-6
SURFACE WATER QUALITY STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT PROJECT AREA AND REFERENCE SITES

MAP ID	Site	Relative Location	Est. Distance from Spring (m)	Agency	Organization Code	Primary Station ID	Station Location Name	Latitude	Longitude	Source
1	Wekiwa Springs	Spring	0	Seminole County	21FLSCES	10000	Wekiva River-Wekiva Springs Boil	28.71278	-81.45972	STORET Legacy
2	Wekiwa Springs	Spring	0	SJRWMD	21FLSJWM	00371831	Wekiva Springs Near Altamonte Springs	28.71253	-81.46003	SJRWMD
3	Wekiwa Springs	Spring	0	USGS	USGS	02234600	Wekiva Springs Near Apopka	28.71194	-81.46000	USGS
4	Wekiwa Springs	Spring	0	FDEP	21FLA	20010430	Wekiva River At Wekiva Springs	28.71319	-81.45972	STORET Legacy
5	Wekiwa Springs	Spring	0	USGS	USGS	284243081273600	Wekiwa Springs	28.71194	-81.46000	USGS
6	Wekiwa Springs	Spring	0	SJRWMD	21FLSJWM	Wekiwa Springs	Wekiwa Springs	28.71194	-81.46000	SJRWMD
7	Wekiva River	Upstream	1065	FDEP	21FLA / 21FLCEN	20010431	Wekiva River 50-m Upstream of Confluence with Rock Spring	28.71439	-81.45056	STORET Legacy / Modern
8	Wekiva River	Internal	1330	FDEP	21FLA	20010432	Wekiva River Downstream of Rock Springs Run	28.71625	-81.44783	STORET Legacy
9	Wekiva River	Internal	1690	Seminole County	21FLSCES	10098	Wekiva River Upstream from Sweetwater Canal	28.71361	-81.44583	STORET Legacy
10	Wekiva River	Internal	1690	USGS	USGS	02234635	Wekiva River Near Apopka	28.71340	-81.44570	USGS
11	Wekiva River	Internal	1690	FDEP	21FLA / 21FLCEN	20010377	Big Wekiva River at Wekiva Marina	28.71336	-81.44525	STORET Legacy / Modern
12	Wekiva River	Internal	1690	FDEP	21FLA	20010433	Wekiva River Upstream of Sweetwater Creek	28.71339	-81.44472	STORET Legacy
13	Wekiva River	Internal	1690	Orange County	21FLORAN	BWB	Wekiva Marina	28.71333	-81.44667	OC / STORET Legacy
14	Wekiva River	Internal	1940	Seminole County	21FLSCES	10117	Wekiva River Downstream from Sweetwater Canal	28.71444	-81.44306	STORET Legacy
15	Wekiva River	Internal	1940	FDEP	21FLA	20010434	Wekiva River Downstream of Sweetwater Creek	28.71411	-81.44311	STORET Legacy
16	Wekiva River	Internal	1940	USGS	USGS	284252081263401	Wekiva River Near Forest City	28.71444	-81.44278	USGS
17	Wekiva River	Internal	7235	Seminole County	21FLSCES	10447	Wekiva River Upstream from Little Wekiva River	28.75444	-81.41806	STORET Legacy
18	Wekiva River	Internal	7235	FDEP	21FLA / 21FLCEN	20010103	Big Wekiva River upstream of Little Wekiva	28.75247	-81.41800	STORET Legacy / Modern
19	Wekiva River	Internal	7235	FDEP	21FLA	20010435	Wekiva R. Upstrm Of Little Wekiva	28.75500	-81.41730	STORET Legacy
20	Wekiva River	Internal	7235	SJRWMD	21FLSJWM	WR-ULW	Wekiva River Upstream of Little Wekiva	28.75500	-81.41730	SJRWMD
21	Wekiva River	Internal	7505	Seminole County	21FLSCES	10466	Wekiva River Downstream from Little Wekiva	28.75611	-81.41806	STORET Legacy
22	Wekiva River	Internal	7505	FDEP	21FLA	20010436	Wekiva River Downstream from Little Wekiva River	28.75653	-81.41667	STORET Legacy
23	Wekiva River	Internal	7820	FDEP	21FLA	20010126	Big Wekiva River Downstream of Little Wekiva	28.75833	-81.41550	STORET Legacy
24	Wekiva River	Internal	8095	USGS	USGS	284539081245701	Wekiva River Near Paola	28.76083	-81.41583	USGS
25	Wekiva River	Internal	11640	USGS	USGS	022349993	Wekiva River at Old RR Crossing Near Sanford	28.79250	-81.41361	USGS
26	Wekiva River	Internal	14240	Seminole County	21FLSCES	10860	Wekiva River Near Bridge at SR 46	28.81333	-81.42083	STORET Legacy
27	Wekiva River	Internal	14240	SJRWMD / USGS	21FLSJWM / USGS	02235000	Wekiva River Near Sanford	28.81490	-81.41950	SJRWMD / USGS
28	Wekiva River	Internal	14240	FDEP	21FLA	20010140	Wekiva River at SR 46	28.81764	-81.41972	STORET Legacy
29	Wekiva River	Internal	14240	Orange County	21FLORAN	BWC	Big Wekiva at SR 46	28.81430	-81.41880	OC / STORET Legacy
30	Wekiva River	Internal	14240	SJRWMD	21FLSJWM	WR46	Wekiva River 50-m Downstream of SR 46	28.81555	-81.41964	SJRWMD
31	Wekiva River	Internal	14240	SJRWMD	21FLSJWM	WRUS46	Wekiva River 100-m Upstream of SR 46	28.81444	-81.41944	STORET Legacy
32	Wekiva River	Internal	16580	Seminole County	21FLSCES	11057	Wekiva River at Katie's Landing	28.83444	-81.40694	STORET Legacy
33	Wekiva River	Downstream	19470	USGS	USGS	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	28.84972	-81.38667	USGS
34	Wekiva River	Downstream	20280	Seminole County	21FLSCES	11417	Wekiva River Upstream from St. Johns River	28.85472	-81.38194	STORET Legacy
35	Wekiva River	Downstream	21890	FDEP	21FLA / 21FLCEN	20010438	Wekiva River Upstream of Blackwater Creek	28.86389	-81.37556	STORET Legacy / Modern
36	Wekiva River	Downstream	21890	SJRWMD	21FLSJWM	WR-UBWC	Wekiva River Upstream of Blackwater Creek	28.86550	-81.37600	SJRWMD
37	Rock Springs	Spring	0	USGS	USGS	284317081234101	Rock Springs	28.75611	-81.50167	USGS
38	Rock Springs	Spring	0	USGS	USGS	284522081300600	Rock Springs	28.75611	-81.50167	USGS
39	Rock Springs Run	Upstream	250	SJRWMD	21FLSJWM	00330830	Rock Springs Near Apopka	28.75567	-81.49921	SJRWMD
40	Rock Springs Run	Upstream	250	USGS	USGS	02234610	Rock Springs Near Apopka	28.75556	-81.49944	USGS
41	Rock Springs Run	Upstream	250	SJRWMD	21FLSJWM	Rock Springs	Rock Springs	28.75567	-81.49921	SJRWMD
42	Rock Springs Run	Internal	1800	Orange County	21FLORAN	BWA	Rock Springs Run at Camp Joy-Southern Baptist	28.76556	-81.50111	OC / STORET Legacy
43	Rock Springs Run	Internal	1800	Orange County	21FLORAN	BWAA	Big Wekiva at Camp Joy Main Flow	28.76556	-81.50111	OC
44	Rock Springs Run	Internal	9300	SJRWMD	21FLSJWM	USJ904	Rock Springs Run Near Mouth	28.74460	-81.47590	SJRWMD
45	Rock Springs Run	Internal	9300	SJRWMD	21FLSJWM	USJ904	Rock Springs Run Near Mouth	28.74444	-81.47611	STORET Legacy
46	Rock Springs Run	Downstream	14200	FDEP	21FLCEN	20010342	Rock Springs Run 50-m Upstream of Wekiva River	28.71910	-81.45010	STORET Modern
47	Rock Springs Run	Downstream	14200	USGS	USGS	284258081270201	Rock Springs Run Near Forest City	28.71611	-81.45056	USGS
48	Rock Springs Run	Downstream	14200	USGS	USGS	284302081270401	Rock Springs Run Near Kelly Park	28.71722	-81.45111	USGS
49	Rock Springs Run	Downstream	14200	SJRWMD	21FLSJWM	RSR-WR	Rock Springs Run Upstream of Wekiva	28.71540	-81.44960	SJRWMD

TABLE 2-6
SURFACE WATER QUALITY STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT PROJECT AREA AND REFERENCE SITES

MAP ID	Site	Relative Location	Est. Distance from Spring (m)	Agency	Organization Code	Primary Station ID	Station Location Name	Latitude	Longitude	Source
50	Witherington Springs	Spring	0	USGS	USGS	02234620	Witherington Springs Near Apopka	28.73139	-81.48944	USGS
51	Witherington Springs	Spring	0	SJRWMD	21FLSJWM	Witherington Spring	Witherington Spring	28.73139	-81.48944	SJRWMD
52	Barrel Spring	Spring	0	SJRWMD	21FLSJWM	00380045	Barrel Spring Near Wekiva Springs	28.71139	-81.47167	SJRWMD
53	Barrel Spring	Spring	0	SJRWMD	21FLSJWM	Barrel Spring	Barrel Spring	28.71139	-81.47167	SJRWMD
54	Sulphur Springs	Spring	0	USGS	USGS	284612081303401	Sulphur Springs Pool	28.77000	-81.50944	USGS
55	Sulphur Springs	Spring	0	SJRWMD	21FLSJWM	Sulphur Spring	Sulphur Spring	28.77000	-81.50944	SJRWMD
56	Sweetwater Crk	Upstream	0	Seminole County	21FLSCES	160043	Sweetwater Creek	28.70750	-81.43750	STORET Legacy
57	Sweetwater Crk	Downstream	1130	Seminole County	21FLSCES	10110	Sweetwater Canal	28.71278	-81.44306	STORET Legacy
58	Miami Springs	Spring	0	SJRWMD	21FLSJWM	00421834	Miami Springs Near Longwood	28.71090	-81.44264	SJRWMD
59	Miami Springs	Spring	0	USGS	USGS	02234650	Miami Springs Near Longwood	28.71000	-81.44278	USGS
60	Miami Springs	Spring	0	SJRWMD	21FLSJWM	Miami Springs	Miami Springs	28.71000	-81.44278	SJRWMD
61	Little Wekiva River	Upstream	0	USGS	USGS	02234945	Little Wekiva River at Forest City	28.66229	-81.41014	USGS
62	Little Wekiva River	Upstream	0	USGS	USGS	02234947	L Wekiva R at St Hwy 436, Forest City	28.66229	-81.41014	USGS
63	Little Wekiva River	Internal	3040	USGS	USGS	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	28.67889	-81.40278	USGS
64	Little Wekiva River	Internal	4540	USGS	USGS	02234990	Little Wekiva River Near Altamonte Springs	28.68694	-81.39722	USGS
65	Little Wekiva River	Internal	6680	USGS	USGS	02234998	Little Wekiva River Near Longwood	28.70194	-81.39222	USGS
66	Little Wekiva River	Internal	6680	FDEP	21FLA	20010429	Little Wekiva River at Springs Landing Rd	28.70278	-81.39222	STORET Legacy
67	Little Wekiva River	Internal	8720	FDEP	21FLA	20010102	Little Wekiva River at Betsy Lane off Delk Road	28.71683	-81.39933	STORET Legacy
68	Little Wekiva River	Internal	8720	FDEP	21FLA	20010139	Little Wekiva R at Ft Bridge N	28.71747	-81.39936	STORET Legacy
69	Little Wekiva River	Downstream	14000	USGS	USGS	284517081245501	Little Wekiva River Near Paola	28.75472	-81.41528	USGS
70	Little Wekiva River	Downstream	14000	Seminole County	21FLSCES	10458	Little Wekiva River-Mouth	28.75500	-81.41528	STORET Legacy
71	Sanlando Springs	Spring	0	SJRWMD	21FLSJWM	00451840	Sanlando Springs nr Longwood	28.68868	-81.39534	SJRWMD
72	Sanlando Springs	Spring	0	USGS	USGS	02234991	Sanlando Springs Near Longwood	28.68861	-81.39583	USGS
73	Sanlando Springs	Spring	0	SJRWMD	21FLSJWM	Sanlando Springs	Sanlando Springs	28.68868	-81.39534	SJRWMD
74	Palm Springs	Spring	0	SJRWMD	21FLSJWM	00441845	Palm Springs nr Longwood	28.69099	-81.39285	SJRWMD
75	Palm Springs	Spring	0	USGS	USGS	02234996	Palm Springs Near Longwood	28.69083	-81.39278	USGS
76	Palm Springs	Spring	0	USGS	USGS	285038081270100	Palm Springs, Seminole State Forest	28.69083	-81.39278	USGS
77	Palm Springs	Spring	0	SJRWMD	21FLSJWM	Palm Springs - Seminole	Palm Springs - Seminole	28.69091	-81.39281	SJRWMD
78	Starbuck Spring	Spring	0	SJRWMD	21FLSJWM	00471851	Starbuck Springs nr Longwood	28.69701	-81.39117	SJRWMD
79	Starbuck Spring	Spring	0	USGS	USGS	02234997	Starbuck Spring Near Longwood	28.69667	-81.39111	USGS
80	Starbuck Spring	Spring	0	SJRWMD	21FLSJWM	Starbuck Spring	Starbuck Spring	28.69701	-81.39117	SJRWMD
81	Wekiva Falls	Spring	800	Seminole County	21FLSCES	10621	Wekiva Falls Canal	28.77778	-81.41806	STORET Legacy
82	Nova Spring	Spring	0	USGS	USGS	284903081250800	Wekiva Branch Spring	28.81750	-81.41889	USGS
83	Island Spring	Spring	0	SJRWMD	21FLSJWM	15790431	Island Spring Near Sanford	28.82278	-81.41750	SJRWMD
84	Island Spring	Spring	0	USGS	USGS	284922081250300	Island Spring Near Sanford	28.82278	-81.41750	USGS
85	Island Spring	Spring	0	SJRWMD	21FLSJWM	Island Spring	Island Spring	28.82278	-81.41750	SJRWMD
86	Alexander Springs	Spring	0	FDEP	21FLA	9670	Alexander Springs	29.081301	-81.575884	STORET Modern;FL STORET
87	Alexander Springs	Spring	0	USGS / SJRWMD	USGS / 21FLSJWM	2236095	Alexander Springs Near Astor, FL	29.081301	-81.575884	USGS / SJRWMD
88	Alexander Springs	Spring	0	SJRWMD	21FLSJWM	Alexander Springs	Alexander Springs	29.081301	-81.575884	SJRWMD
89	Alexander Springs	Upstream	2010	Lake County WRM	21FLLCPC	SWALEXSP445	Alexander Springs Run at CR 445	29.081111	-81.565833	STORET Modern;FL STORET
90	Fern Hammock Spring	Spring	0	USGS / SJRWMD	USGS / 21FLSJWM	2236132	Fern Hammock Spring Near Ocala, FL	29.183573	-81.708195	USGS / SJRWMD
91	Fern Hammock Spring	Spring	0	SJRWMD	21FLSJWM	Fern Hammock Springs	Fern Hammock Springs	29.183573	-81.708195	SJRWMD
92	Juniper Springs	Spring	0		21FLGW	11456	Fern Hammock Springs	29.183573	-81.708195	FL STORET
93	Juniper Springs	Spring	0		21FLGW	11463	Juniper Springs	29.183706	-81.712412	FL STORET
94	Juniper Springs	Spring	0	USGS / SJRWMD	USGS / 21FLSJWM	2236130	Juniper Springs Near Ocala, FL	29.183706	-81.712412	USGS / SJRWMD
95	Juniper Springs	Spring	0	SJRWMD	21FLSJWM	Juniper Springs	Juniper Springs	29.183706	-81.712412	SJRWMD
96	Juniper Springs	Internal	9820	FDEP	21FLA	20010454	Juniper Creek 100 yards upstream of Highway 19	29.213611	-81.655556	STORET Modern;FL STORET
97	Juniper Springs	Downstream	11430		21FLGW	20120	SJC-SS-1026	29.205910	-81.645290	FL STORET
98	Sweetwater Springs	Spring	0	USGS / SJRWMD	USGS / 21FLSJWM	2236147	Sweetwater Springs Near Astor Park			USGS / SJRWMD
99	Sweetwater Springs	Spring	0	SJRWMD	21FLSJWM	Sweetwater Springs	Sweetwater Springs			SJRWMD

TABLE 2-7

WATER QUALITY SUMMARY OF SPRINGS PERIOD-OF-RECORD AVERAGES WITHIN THE WEKIVA RIVER SYSTEM PROJECT PROJECT AREA AND REFERENCE SITES

		SPRING / AVERAGE											REFERENCE SITE / AVERAGE			
PARAMETER	UNITS	Barrel	Island	Miami	Nova	Palm	Rock	Sanlando	Starbuck	Sulphur	Wekiwa	Witherington	Alexander	Fern Hmck	Juniper	Sweetwater
Water Temperature	C	23.3	23.7	24.5	22.9	24.2	23.9	24.1	24.1	24.8	23.7	23.7	23.5	21.8	21.9	23.2
Dissolved Oxygen	%	---	---	---	---	---	26.0	---	---	---	10.2	---	11.0	---	---	---
Dissolved Oxygen	mg/L	---	0.62	2.81	---	0.63	1.46	1.63	0.83	0.00	0.68	1.20	1.82	5.93	6.48	3.42
pH	SU	7.51	7.45	7.53	7.60	7.36	7.52	7.23	7.41	7.89	7.39	7.21	7.65	7.74	7.86	7.44
Specific Conductance	umhos/cm	252	2,806	258	3,350	358	249	328	341	433	284	239	1,079	123	119	3,839
Secchi	m	---	---	---	---	---	---	---	---	---	1.49	---	7.72	---	2.40	---
Color	CPU	---	10.0	2.50	2.50	2.50	4.18	2.92	3.13	2.50	4.97	4.17	1.09	0.00	2.95	0.00
Turbidity	NTU	---	0.127	---	---	2.00	2.50	1.00	1.50	---	2.09	---	0.231	---	0.125	---
Alkalinity	mg/L as CaCO3	97.1	128	110	---	116	89.0	130	119	---	108	95.7	80.9	45.5	43.8	73.0
Chloride, Total	mg/L	9.23	1,754	10.4	830	21.3	9.30	16.4	19.3	7.70	12.3	7.77	243	5.01	5.87	1,108
Fluoride, Total	mg/L	0.248	0.225	0.169	---	0.178	0.143	0.174	0.196	---	0.160	0.188	0.127	0.071	0.070	0.120
Hardness	mg/L as CaCO3	---	880	102	650	180	107	125	135	220	110	108	182	48.5	54.0	510
Silica, Total	mg/L	6.32	5.40	4.38	---	4.55	5.08	4.27	4.65	---	5.09	5.78	5.14	5.14	5.21	4.78
Sulfate, Total	mg/L	21.1	488	9.80	350	28.4	19.2	11.3	22.9	110	16.0	11.2	63.2	6.87	7.64	265
Carbon, Dissolved Organic	mg/L	---	0.715	0.510	---	0.440	0.335	0.675	0.405	---	0.535	---	---	---	---	---
Carbon, Total Organic	mg/L	---	1.65	0.205	---	0.375	0.662	3.58	0.450	---	0.827	---	1.44	0.700	0.798	0.700
Ammonia Nitrogen	mg/L	---	0.234	0.016	---	0.068	0.068	0.161	0.028	---	0.024	---	0.020	---	0.014	---
Nitrate+Nitrite Nitrogen	mg/L	0.049	0.007	0.166	---	0.665	1.45	0.523	0.392	---	1.41	0.377	0.051	0.080	0.080	0.044
Organic Nitrogen	mg/L	---	---	---	---	0.450	0.603	0.243	0.165	---	0.238	---	0.005	---	---	---
Total Kjeldahl Nitrogen	mg/L	---	0.558	0.061	---	0.107	0.131	0.406	0.151	0.10	0.154	---	0.093	---	0.030	---
Total Nitrogen	mg/L	---	---	---	---	---	---	0.790	---	---	0.710	---	0.030	---	---	---
Unionized Ammonia	mg/L	---	---	---	---	---	---	---	---	---	0.0006	---	---	---	---	---
Biochemical Oxygen Demand, 5 Day	mg/L	---	---	---	---	---	---	0.200	---	---	0.387	---	0.400	---	---	---
Chemical Oxygen Demand	mg/L	---	---	---	---	---	---	---	---	---	2.12	---	---	---	---	---
Orthophosphorus	mg/L	0.037	0.072	0.107	---	0.116	0.076	0.162	0.145	0.030	0.108	0.145	0.049	0.027	0.028	0.024
Total Phosphorus	mg/L	---	---	0.110	---	0.129	0.079	0.174	0.159	0.030	0.217	---	0.046	---	0.029	0.019
Total Dissolved Solids	mg/L	148	3,539	150	2,080	209	146	191	194	266	163	139	580	70.6	68.5	2,188
Fec Col / Fec Strp	---	---	---	---	---	---	---	---	---	---	0.079	---	---	---	---	---
Fecal Coliform	#/100ml	---	---	---	---	0.00	---	2.00	0.00	---	56.5	---	1.00	---	44.5	---
Total Coliform	#/100ml	---	---	---	---	96.5	---	268	40.0	---	131	---	6.70	---	---	---
Aluminum, Total	µg/L	---	---	---	---	---	---	---	---	---	---	---	15.0	---	10.0	---
Arsenic, Total	µg/L	---	---	---	---	0.00	---	0.500	---	---	0.500	---	1.80	---	1.50	---
Barium, Total	µg/L	---	---	---	---	---	---	50.0	---	---	50.0	---	24.6	---	---	---
Cadmium, Total	µg/L	---	---	---	---	---	---	---	---	---	1.40	---	0.375	---	0.250	---
Calcium, Total	mg/L	31.4	227	35.1	---	39.8	30.3	42.9	41.5	---	37.8	29.6	45.9	12.5	12.3	105
Chromium, Total	µg/L	---	---	---	---	---	---	10.0	---	---	3.56	---	2.64	---	1.00	---
Cobalt, Total	µg/L	---	---	---	---	---	---	---	---	---	---	---	0.469	---	0.375	---
Copper, Total	µg/L	---	---	---	---	0.00	---	---	---	---	14.0	---	2.19	---	1.75	---
Iron, Total	µg/L	72.5	0.902	18.6	---	16.3	20.2	13.8	13.8	---	35.6	69.0	25.9	29.0	148	71.1
Lead, Total	µg/L	---	---	---	---	---	---	---	---	---	9.50	---	2.50	---	2.00	---
Magnesium, Total	mg/L	8.85	111	9.44	---	11.8	9.24	12.0	11.9	---	10.9	9.38	20.4	4.66	4.39	60.4
Manganese, Total	µg/L	---	---	---	---	0.00	---	5.00	---	---	3.50	---	1.266	---	0.250	---
Mercury, Total	µg/L	---	---	---	---	---	---	0.250	---	---	0.100	---	0.388	---	---	---
Nickel, Total	µg/L	---	---	---	---	---	---	---	---	---	6.00	---	1.54	---	1.00	---
Potassium, Total	mg/L	1.26	25.3	0.908	---	1.09	1.35	1.67	1.43	---	1.60	1.22	3.90	0.900	0.440	18.1
Selenium, Total	µg/L	---	---	---	---	---	---	0.500	---	---	0.500	---	2.80	---	2.00	---
Silver, Total	µg/L	---	---	---	---	---	---	---	---	---	0.700	---	0.500	---	---	---
Strontium, Total	µg/L	463	5,356	187	---	347	167	86.9	325	---	135	113	729	89.5	75.0	2,337
Zinc, Total	µg/L	---	---	---	---	0.00	---	10.0	---	---	71.5	---	1.88	---	1.000	---
Start Date		6/1995	5/1982	10/1960	8/1996	4/1956	2/1931	4/1956	7/1944	1/1997	4/1956	10/1960	2/1931	4/1972	11/1908	11/1980
End Date		9/1997	9/2003	5/2004	8/1996	5/2004	5/2004	5/2004	5/2004	8/1999	5/2004	5/2000	1/2004	9/2003	9/2003	9/2003
Number of Sample Events		5	12	73	1	96	176	94	91	2	184	14	198	142	206	128

Note(s):

Half of detection limit was used to calculate averages when reported below laboratory detection limit

Due to the small amount of data from the Rock Spring main boil, the averages were calcuated using stations located in the upper 250-m

None of the trace metals that have been sampled in these springs show elevated concentrations.

Stream water quality data are summarized in Tables 2-8 to 2-11. For summary purposes water quality data from stream stations have been grouped by location and by distance from headwater areas (Figures 2-15 through 2-21). Water quality stations on the mainstem of the Wekiva River range from the Wekiwa Springs mainboil area (0 m) to a point just upstream of the river's confluence with Blackwater Creek at about 21,900 m (13.6 miles) downstream (Figures 2-15 to 2-19). Water quality stations summarized for Rock Springs Run (Figure 2-18) range from the main boil at Rock Springs (0 m) to just above the confluence with Wekiwa Springs Run at 14,200 m (8.8 miles). Stations in the Little Wekiva River (Figure 2-19) range from SR 436 (0 m) to just above the confluence with the Wekiva River at 14,000 m (8.7 miles). Stations in Juniper Creek extend from the spring boils to CR 19 at about 10 km (6.1 miles). There are no downstream stations in Alexander Springs Creek except at forest road 445 at about 2,010 m (1.2 miles).

Average dissolved oxygen concentration increases in the Wekiva River from a low of <1.0 mg/L in the spring boils to >5.0 mg/l by 1,690 m (1.04 miles) downstream (Table 2-8). Average dissolved oxygen concentrations remain above the Class III standard of 5 mg/L at all stations further downstream; however, concentrations rise to near 100 percent saturation at about 16,500 m and then decline with distance downstream to about 60 to 70 percent saturation near 20,000 m (12.4 miles) and the confluence with Blackwater Creek. Other water quality variables that consistently increase from upstream to downstream in the Wekiva River include: color, pH, specific conductance, total dissolved solids, hardness, and fecal and total coliforms. The average concentration of nitrate+nitrite N declines from upstream to downstream, indicating a net assimilation of this nutrient. There is no consistent trend from upstream to downstream for concentrations of ammonia N or for total P.

Dissolved oxygen concentrations in Rock Springs Run increase from less than 1 mg/L in the spring boils to >5 mg/L by 1,800 m (1.1 miles) downstream (Table 2-9). Specific conductance, total dissolved solids, and hardness concentrations in this stream remain fairly constant with distance downstream, indicating that any groundwater or surface water inputs are of similar water quality. Color consistently increases from upstream to downstream in Rock Springs Run, indicating the influence of the surrounding swamp forest on the stream's water quality. Organic P (the difference between total P and ortho-P in Table 2-9) also increased downstream and may reflect this increasing contribution of swamp water to the stream. Nitrate+nitrite N concentrations show a consistent decline between upstream and downstream water quality stations. Total and fecal coliform counts were elevated at all stations downstream from the spring area. This is another possible indicator of swamp water inputs but may also indicate pollution from human use activities in the spring run.

Water quality data for the Little Wekiva River are summarized in Table 2-10. Dissolved oxygen percent saturation and concentration remains relatively low in this system in the urbanized area but increases slightly downstream in the natural area. There is little change in conservative water quality variables such as specific conductance, color, chlorides, and hardness between upstream and downstream water quality stations.

TABLE 2-8
WEKIVA RIVER AVERAGE WATER QUALITY SUMMARY BY DISTANCE FROM WEKIWA SPRINGS

		Approximate Distance Downstream (m)													
PARAMETER	UNITS	Main Boil	1,065	1,330	1,690	1,940	7,235	7,505	7,820	8,095	14,240	16,580	19,470	20,280	21,890
Water Temperature	C	23.7	23.0	22.3	21.9	22.1	21.5	22.4	17.4	23.0	22.7	24.5	23.0	21.7	21.0
Dissolved Oxygen	%	10.2	36.2	41.5	54.7	58.1	61.1	62.5	70.4	---	74.7	119	---	62.4	70.9
Dissolved Oxygen	mg/L	0.679	3.10	3.67	5.06	5.14	4.92	5.51	6.83	---	7.10	10.0	8.50	5.68	5.76
Color	CPU	4.97	2.50	---	56.9	10.0	251	---	20.0	15.0	61.5	---	10.0	---	93.2
pH	SU	7.39	7.66	---	7.26	7.26	7.26	7.12	7.28	7.60	7.42	8.01	8.40	6.92	7.44
Secchi	m	1.49	---	---	3.10	1.76	1.02	1.13	0.800	---	1.01	0.674	---	1.46	1.22
Specific Conductance	umhos/cm	284	265	---	286	256	295	273	314	260	624	722	1,460	704	799
Turbidity	NTU	2.09	7.81	12.5	2.86	3.07	2.52	3.16	1.50	3.00	3.34	1.26	---	1.57	2.58
Total Dissolved Solids	mg/L	163	---	---	307	1,750	691	3,613	---	153	283	372	484	---	488
Total Suspended Solids	mg/L	---	---	---	101	---	3.33	---	---	---	62.0	---	---	---	2.73
Alkalinity	mg/L as CaCO3	108	141	151	97.9	104	102	104	145	95.0	94.9	97.8	99.0	88.3	111
Chloride, Total	mg/L	12.3	13.5	---	27.0	9.56	18.8	16.2	18.0	13.0	30.8	130	150	63.6	156
Fluoride, Total	mg/L	0.160	---	---	---	---	---	---	---	---	---	---	---	---	---
Hardness	mg/L as CaCO3	110	---	---	133	120	146	---	---	120	138	---	210	---	209
Silica, Total	mg/L	5.09	---	---	---	---	---	---	---	---	3.22	---	---	---	---
Sulfate, Total	mg/L	16.0	22.5	---	36.8	17.0	33.9	---	24.0	18.0	39.4	---	73.0	---	77.0
Carbon, Dissolved Organic	mg/L	0.535	---	---	---	---	18.0	---	---	---	6.24	---	---	---	12.0
Carbon, Total Organic	mg/L	0.827	---	---	1.20	---	19.8	---	---	---	8.31	---	---	---	12.9
Ammonia Nitrogen	mg/L	0.024	0.008	---	0.079	0.054	0.024	0.036	0.029	0.020	0.045	0.065	---	0.062	0.022
Nitrate+Nitrite Nitrogen	mg/L	1.41	0.895	---	1.10	---	0.738	---	0.980	---	0.578	---	---	---	0.355
Organic Nitrogen	mg/L	0.238	---	---	0.724	0.501	0.614	0.563	---	0.220	0.573	0.630	---	0.878	---
Total Kjeldahl Nitrogen	mg/L	0.154	0.240	0.290	0.494	0.257	0.674	0.581	0.210	---	0.632	0.544	---	0.571	0.588
Total Nitrogen	mg/L	0.710	---	---	1.46	---	---	---	---	---	1.25	---	---	---	---
Unionized Ammonia	mg/L	0.0006	---	---	0.001	0.0002	0.0002	0.0001	0.0002	---	0.002	0.019	---	0.0004	---
Biochemical Oxygen Demand, 5 Day	mg/L	0.387	1.10	1.50	1.82	0.441	0.906	0.700	---	---	1.97	1.20	---	0.683	---
Carbonaceous Biochemical Oxygen Demand, 5 Day	mg/L	---	---	---	2.04	---	---	---	---	---	2.27	---	---	---	---
Chemical Oxygen Demand	mg/L	2.12	---	---	7.08	7.28	9.52	7.38	---	---	21.6	9.82	---	19.6	---
Orthophosphorus	mg/L	0.108	0.115	---	0.090	0.070	0.095	---	0.108	0.090	0.108	---	---	---	0.096
Total Phosphorus	mg/L	0.217	0.090	0.080	0.115	0.133	0.127	0.173	0.120	0.110	0.141	0.311	---	0.149	0.118
Fec Col / Fec Strp	---	0.079	0.103	0.650	1.16	1.25	0.400	0.440	---	---	1.33	---	---	---	0.435
Fecal Coliform	#/100ml	56.5	36.0	52.0	113	529	195	4,365	74.0	---	100	142	---	508	100
Total Coliform	#/100ml	131	600	60.0	946	498	385	491	300	---	1,351	80.0	---	168	150
Chlorophyll-a Corr	µg/L	---	---	---	1.23	---	1.20	---	0.400	---	1.70	---	---	---	---
Chlorophyll-b	µg/L	---	---	---	0.957	---	---	---	---	---	0.757	---	---	---	---
Chlorophyll-c Corr	µg/L	---	---	---	2.25	---	---	---	---	---	2.85	---	---	---	---
Pheophytin-a	µg/L	---	---	---	1.54	---	1.15	---	1.64	---	2.44	---	---	---	---
Aluminum, Total	µg/L	---	---	---	162	---	---	---	---	---	107	---	---	---	---
Arsenic, Total	µg/L	0.500	---	---	10.0	---	---	---	---	---	3.91	---	---	---	---
Barium, Total	µg/L	50.0	---	---	24.1	---	---	---	---	---	13.7	---	---	---	---
Cadmium, Total	µg/L	1.40	---	---	1.20	1.45	1.35	1.35	---	---	3.77	3.00	---	2.10	---
Calcium, Total	mg/L	37.8	---	---	---	---	40.1	---	---	---	40.0	---	---	---	57.8
Chromium, Total	µg/L	3.56	---	---	1.98	1.13	1.40	2.50	---	---	1.15	2.00	---	1.63	---
Cobalt, Total	µg/L	---	---	---	4.56	---	---	---	---	---	4.78	---	---	---	---
Copper, Total	µg/L	14.0	---	---	7.05	22.0	10.0	11.5	---	---	4.75	10.0	---	16.5	---
Iron, Total	µg/L	35.6	---	---	99.7	90.0	256	98.0	---	---	113	63.0	---	179	149
Lead, Total	µg/L	9.50	---	---	4.71	6.50	7.00	11.5	---	---	1.90	4.00	---	9.50	---
Magnesium, Total	mg/L	10.9	---	---	350	---	10.9	---	---	---	11.4	---	---	---	18.5
Manganese, Total	µg/L	3.50	---	---	5.62	4.00	3.00	6.00	---	---	6.01	---	---	11.0	---
Mercury, Total	µg/L	0.100	---	---	0.100	---	---	---	---	---	0.100	---	---	---	---
Nickel, Total	µg/L	6.00	---	---	13.3	6.00	6.00	7.00	---	---	7.52	---	---	9.00	---
Potassium, Total	mg/L	1.60	---	---	4.33	---	---	---	---	---	2.57	---	---	---	---
Selenium, Total	µg/L	0.500	---	---	4.21	---	---	---	---	---	2.01	---	---	---	---
Silver, Total	µg/L	0.700	---	---	1.49	1.50	2.45	3.00	---	---	0.984	2.00	---	2.50	---
Strontium, Total	µg/L	135	---	---	---	---	---	---	---	---	475	---	---	---	---
Zinc, Total	µg/L	71.5	---	---	111	61.0	59.0	59.0	---	---	8.91	---	---	87.0	---
Alachlor, Dissolved	µg/L	---	---	---	0.001	---	---	---	---	---	---	---	---	---	---
Atrazine, Dissolved	µg/L	---	---	---	0.006	---	---	---	---	---	---	---	---	---	---
Diazinon, Dissolved	µg/L	---	---	---	0.002	---	---	---	---	---	---	---	---	---	---
Dieldrin, Dissolved	µg/L	---	---	---	0.001	---	---	---	---	---	---	---	---	---	---
Lindane, Dissolved	µg/L	---	---	---	0.002	---	---	---	---	---	---	---	---	---	---
Start Date		4/1956	8/1973	8/1973	7/1963	5/1973	8/1973	8/1973	1/1997	5/1973	5/1954	11/1983	4/1981	1/1982	1/1974
End Date		5/2004	9/1999	3/1974	7/2003	5/1988	7/2003	5/1988	1/1997	5/1973	9/2003	5/1988	4/1981	5/1988	7/2003
Number of Sample Events		184	5	3	130	20	32	18	1	1	275	13	1	10	15

Note: half of detection limit was used to calculate averages when reported below laboratory detection limit

TABLE 2-9
ROCK SPRINGS RUN AVERAGE WATER QUALITY SUMMARY BY DISTANCE DOWNSTREAM

		Approximate Distance Downstream (m)			
PARAMETER	UNITS	≤ 250	1,800	9,300	14,200
Water Temperature	C	23.9	22.0	23.4	21.9
Dissolved Oxygen	%	26.0	62.2	92.5	---
Dissolved Oxygen	mg/L	1.46	5.66	8.07	5.84
pH	SU	7.52	7.32	6.87	7.31
Specific Conductance	umhos/cm	249	253	320	244
Secchi	m	---	3.84	0.667	0.644
Color	CPU	4.18	19.0	36.7	203
Turbidity	NTU	2.50	1.49	3.17	1.60
Total Dissolved Solids	mg/L	---	130	---	277
Total Suspended Solids	mg/L	---	81.6	---	3.34
Alkalinity	mg/L as CaCO3	89.0	86.8	---	86.6
Chloride, Total	mg/L	9.30	11.3	---	10.9
Fluoride, Total	mg/L	0.143	---	---	---
Hardness	mg/L as CaCO3	107	114	---	134
Silica, Total	mg/L	5.08	---	---	---
Sulfate, Total	mg/L	19.2	32.8	---	32.5
Carbon, Dissolved Organic	mg/L	0.335	---	---	21.1
Carbon, Total Organic	mg/L	0.662	---	---	21.9
Ammonia Nitrogen	mg/L	0.068	0.068	---	0.047
Nitrate+Nitrite Nitrogen	mg/L	1.45	1.26	---	0.784
Organic Nitrogen	mg/L	0.603	0.394	---	0.370
Total Kjeldahl Nitrogen	mg/L	0.131	0.378	---	0.896
Total Nitrogen	mg/L	---	1.42	---	---
Unionized Ammonia	mg/L	---	0.001	---	---
Biochemical Oxygen Demand, 5 Day	mg/L	---	1.89	---	1.80
Carbonaceous Biochemical Oxygen Demand, 5 Day	mg/L	---	1.88	---	---
Orthophosphorus	mg/L	0.076	0.071	---	0.084
Total Phosphorus	mg/L	0.079	0.098	---	0.118
Fec Col / Fec Strp	---	146	1.70	---	---
Fecal Coliform	#/100ml	---	212	1,149	54.2
Total Coliform	#/100ml	---	2,483	---	1,649
Chlorophyll-a Corr	µg/L	---	1.05	1.47	2.90
Chlorophyll-b	µg/L	---	0.838	0.006	---
Chlorophyll-c Corr	µg/L	---	2.39	---	---
Pheophytin-a	µg/L	---	1.10	1.40	8.04
Aluminum, Total	µg/L	---	160	---	---
Arsenic, Total	µg/L	---	9.82	---	---
Barium, Total	µg/L	---	23.1	---	---
Cadmium, Total	µg/L	---	0.450	---	---
Calcium, Total	mg/L	30.3	23.9	---	37.7
Chromium, Total	µg/L	---	2.44	---	---
Cobalt, Total	µg/L	---	4.32	---	---
Copper, Total	µg/L	---	5.91	---	---
Iron, Total	µg/L	20.2	38.7	---	353
Lead, Total	µg/L	---	4.51	---	---
Magnesium, Total	mg/L	9.24	8.83	---	10.1
Manganese, Total	µg/L	---	5.46	---	---
Mercury, Total	µg/L	---	0.100	---	---
Nickel, Total	µg/L	---	31.4	---	---
Potassium, Total	mg/L	1.35	0.500	---	---
Selenium, Total	µg/L	---	3.46	---	---
Silver, Total	µg/L	---	1.26	---	---
Strontium, Total	µg/L	167	---	---	---
Zinc, Total	µg/L	---	22.8	---	---
Start Date		2/1931	1/1980	5/1992	5/1973
End Date		5/2004	10/2003	12/1992	7/2003
Number of Sample Events		176	97	3	18

Note: half of detection limit was used to calculate averages when reported below laboratory detection limit

TABLE 2-10
LITTLE WEKIVA RIVER AVERAGE WATER QUALITY SUMMARY BY DISTANCE FROM HIGHWAY 436

		Approximate Distance from Downstream (m)					
PARAMETER	UNITS	Hwy 436	3,040	4,540	6,680	8,720	14,000
Water Temperature	C	24.6	27.0	24.8	23.8	21.4	22.5
Dissolved Oxygen	%	---	---	59.9	62.7	52.7	64.8
Dissolved Oxygen	mg/L	---	---	4.69	5.28	4.75	5.68
pH	SU	6.56	6.80	7.12	7.20	7.38	7.07
Specific Conductance	umhos/cm	177	232	270	323	250	280
Color	CPU	38.8	10.0	22.3	22.5	25.0	15.0
Secchi	m	---	---	---	1.05	1.20	1.09
Turbidity	NTU	5.50	6.00	6.50	3.55	9.17	1.84
Total Dissolved Solids	mg/L	112	126	158	174	---	2,104
Total Suspended Solids	mg/L	---	---	---	6.00	3.67	---
Alkalinity	mg/L as CaCO3	38.4	97.0	81.4	92.5	97.1	96.2
Chloride, Total	mg/L	14.9	12.0	22.0	20.3	15.1	17.5
Hardness	mg/L as CaCO3	52.4	100	94.8	133	---	120
Sulfate, Total	mg/L	18.9	6.50	14.0	17.4	17.7	15.0
Carbon, Dissolved Organic	mg/L	---	---	10.1	3.10	---	---
Carbon, Total Organic	mg/L	---	---	5.88	---	---	---
Ammonia Nitrogen	mg/L	0.285	0.030	0.078	0.160	0.057	0.024
Nitrate+Nitrite Nitrogen	mg/L	---	---	---	0.770	0.495	---
Organic Nitrogen	mg/L	0.935	0.890	0.857	1.16	0.313	0.609
Total Kjeldahl Nitrogen	mg/L	---	---	0.884	0.360	0.240	0.514
Total Nitrogen	mg/L	1.55	0.930	1.38	---	---	---
Unionized Ammonia	mg/L	---	---	---	0.005	0.0005	0.0002
Biochemical Oxygen Demand, 5 Day	mg/L	---	---	6.05	3.70	1.05	0.479
Chemical Oxygen Demand	mg/L	---	---	---	---	---	10.9
Orthophosphorus	mg/L	0.985	0.480	0.300	0.127	0.301	0.230
Total Phosphorus	mg/L	1.25	0.500	0.363	0.475	0.390	0.304
Fecal Coliform	#/100ml	---	---	1,245	---	81.3	463
Total Coliform	#/100ml	---	---	14,400	---	1,683	410
Chlorophyll-a Corr	µg/L	---	---	---	1.23	1.28	---
Pheophytin-a	µg/L	---	---	---	---	0.770	---
Arsenic, Total	µg/L	---	---	7.50	---	---	---
Cadmium, Total	µg/L	---	---	0.00	---	---	1.90
Chromium, Total	µg/L	---	---	---	---	---	1.50
Copper, Total	µg/L	---	---	5.00	---	---	12.0
Iron, Total	µg/L	---	---	280	---	---	106
Lead, Total	µg/L	---	---	---	---	---	6.00
Manganese, Total	µg/L	---	---	12.5	---	---	7.00
Mercury, Total	µg/L	---	---	0.250	---	---	---
Nickel, Total	µg/L	---	---	---	---	---	6.00
Silver, Total	µg/L	---	---	---	---	---	1.50
Zinc, Total	µg/L	---	---	15.0	---	---	56.0
Alachlor, Dissolved	µg/L	---	---	0.001	---	---	---
Atrazine, Dissolved	µg/L	---	---	0.283	---	---	---
Diazinon, Dissolved	µg/L	---	---	0.071	---	---	---
Dieldrin, Dissolved	µg/L	---	---	0.0009	---	---	---
Lindane, Dissolved	µg/L	---	---	0.002	---	---	---
Start Date		10/1960	4/1974	5/1972	1/1984	1/1971	5/1973
End Date		4/1974	4/1974	6/2003	6/2004	1/1997	5/1988
Number of Sample Events		4	1	57	28	7	17

Note: half of detection limit was used to calculate averages when reported below laboratory detection limit

TABLE 2-11
REFERENCE SITE AVERAGE WATER QUALITY SUMMARY BY DISTANCE DOWNSTREAM

		Approximate Distance from Main Boil (m)						
		Alexander		Juniper			Fern Hmck	Sweetwater
PARAMETER	UNITS	0	2,010	0	9,820	11,430	0	0
Water Temperature	C	23.5	23.2	21.9	22.0	23.6	21.8	23.2
Dissolved Oxygen	mg/L	1.82	4.82	6.48	6.80	6.68	5.93	3.42
Dissolved Oxygen	%	11.0	---	---	---	---	---	---
pH	SU	7.65	7.28	7.86	7.40	7.47	7.74	7.44
Specific Conductance	umhos/cm	1,079	1,002	119	1,670	1,548	123	3,839
Color	CPU	1.09	94.6	2.95	---	100	0.00	0.00
Secchi	m	7.72	0.613	2.40	0.600	0.180	---	---
Turbidity	NTU	0.231	0.358	0.125	1.77	0.850	---	---
Total Dissolved Solids	mg/L	580	---	68.5	---	---	70.6	2,188
Total Suspended Solids	mg/L	2.33	---	2.00	---	2.00	---	---
Alkalinity	mg/L as CaCO3	80.9	72.3	43.8	59.0	---	45.5	73.0
Chloride, Total	mg/L	243	206	5.87	440	390	5.01	1,108
Hardness	mg/L as CaCO3	182	120	54.0	---	---	48.5	510
Sulfate, Total	mg/L	63.2	66.0	7.64	135	110	6.87	265
Carbon, Total Organic	mg/L	1.44	9.82	0.798	---	7.40	0.700	0.700
Fluoride, Total	mg/L	0.127	---	0.070	---	0.110	0.071	0.120
Silica, Total	mg/L	5.14	---	5.21	---	---	5.14	4.78
Ammonia Nitrogen	mg/L	0.020	---	0.014	0.012	0.012	---	---
Nitrate+Nitrite Nitrogen	mg/L	0.051	0.033	0.080	0.007	0.015	0.080	0.044
Organic Nitrogen	mg/L	0.005	---	---	---	---	---	---
Total Kjeldahl Nitrogen	mg/L	0.097	0.527	0.030	0.245	0.400	---	---
Total Nitrogen	mg/L	0.030	0.705	---	---	---	---	---
Biochemical Oxygen Demand, 5 Day	mg/L	0.400	---	---	---	---	---	---
Orthophosphorus	mg/L	0.049	---	0.028	0.040	---	0.027	0.024
Total Phosphorus	mg/L	0.046	0.052	0.029	---	0.029	---	0.019
Fecal Coliform	#/100ml	1.00	217	44.5	159	66.0	---	---
Total Coliform	#/100ml	6.70	763	---	2,038	---	---	---
Pheophytin-a	µg/L	---	---	---	1.65	0.425	---	---
Aluminum, Total	µg/L	20.2	---	10.0	---	---	---	---
Arsenic, Total	µg/L	1.80	---	1.50	---	---	---	---
Barium, Total	µg/L	24.6	---	---	---	---	---	---
Cadmium, Total	µg/L	0.375	---	0.250	---	---	---	---
Calcium, Total	mg/L	45.9	43.2	12.3	---	50.8	12.5	105
Chromium, Total	µg/L	2.64	---	1.00	---	---	---	---
Cobalt, Total	µg/L	0.469	---	0.375	---	---	---	---
Copper, Total	µg/L	2.19	---	1.75	---	---	---	---
Iron, Total	µg/L	25.9	---	148	---	---	29.0	71.1
Lead, Total	µg/L	2.50	---	2.50	---	---	---	---
Magnesium, Total	mg/L	20.4	18.2	4.39	---	27.1	4.66	60.4
Manganese, Total	µg/L	1.27	---	0.250	---	---	---	---
Mercury, Total	µg/L	0.388	---	---	---	---	---	---
Nickel, Total	µg/L	1.54	---	1.00	---	---	---	---
Potassium, Total	mg/L	3.90	3.55	0.440	---	7.00	0.900	18.1
Selenium, Total	µg/L	2.80	---	2.00	---	---	---	---
Silver, Total	µg/L	0.500	---	---	---	---	---	---
Strontium, Total	µg/L	729	---	75.0	---	---	89.5	2,337
Zinc, Total	µg/L	1.88	---	1.00	---	---	---	---

Note: half of detection limit was used to calculate averages when reported below laboratory detection limit

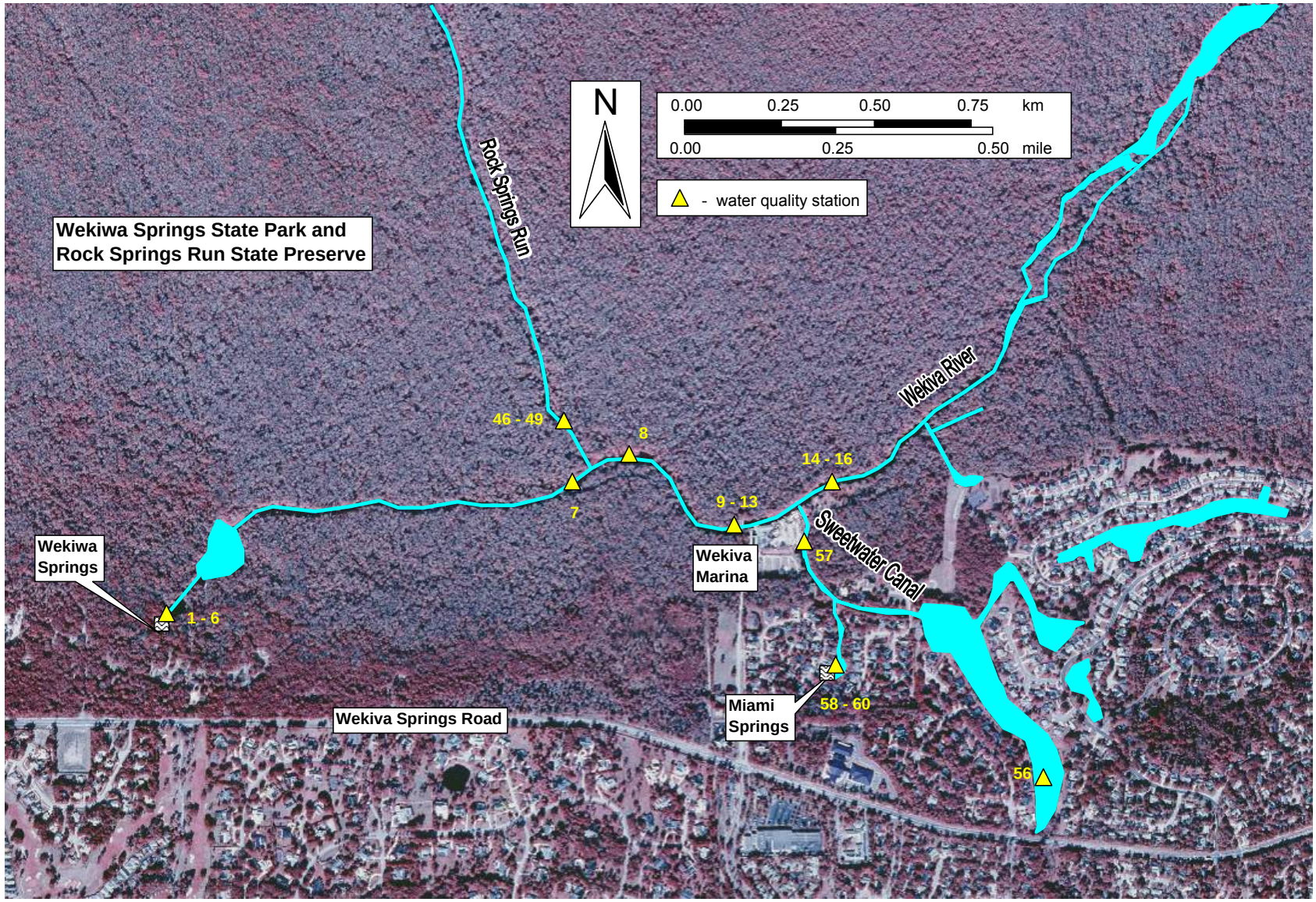


FIGURE 2-15
WATER QUALITY STATIONS IN WEKIWA SPRINGS, WEKIVA RIVER, AND SWEETWATER CANAL

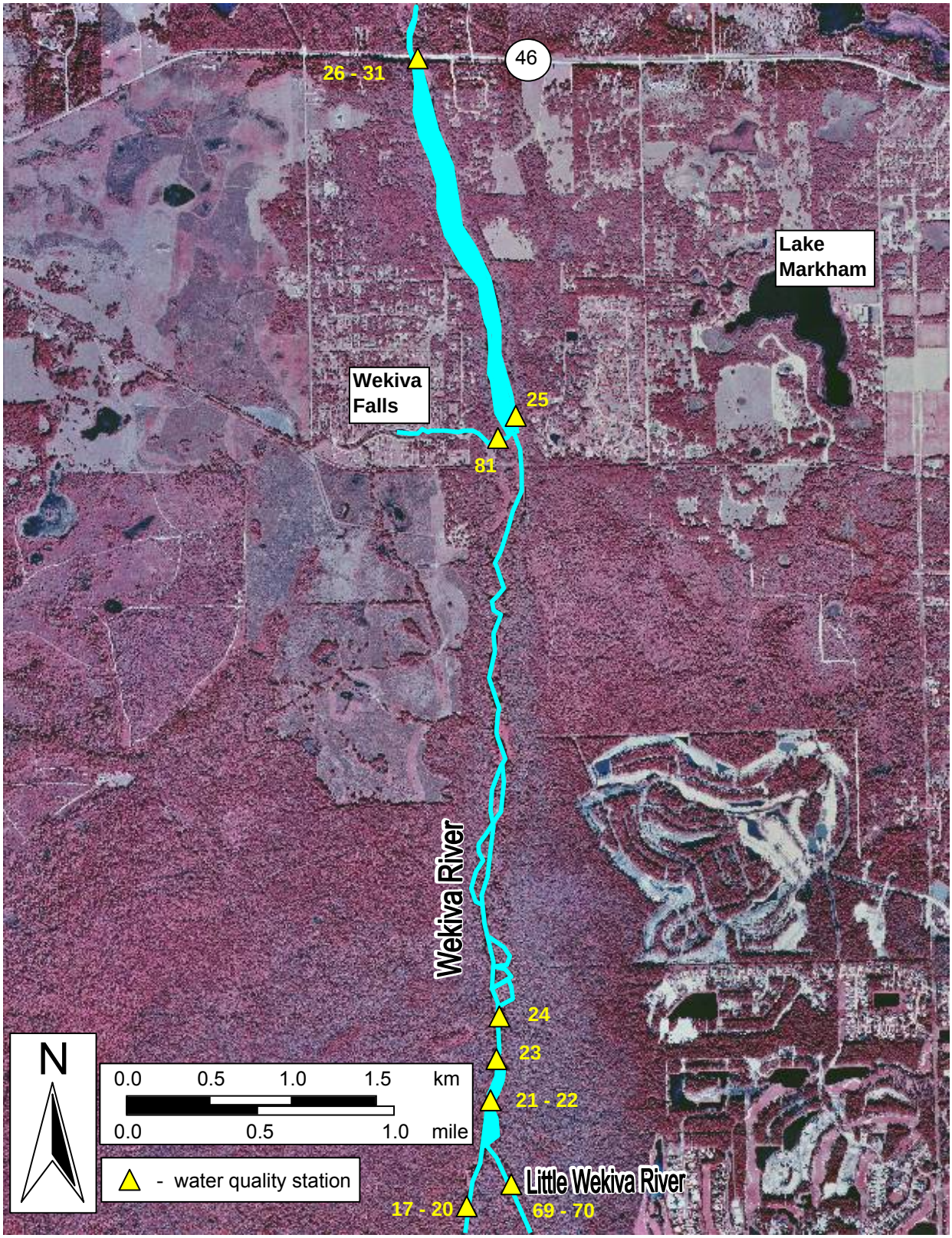


FIGURE 2-16
WATER QUALITY STATIONS IN THE WEKIVA RIVER BETWEEN LITTLE WEKIVA RIVER AND SR 46

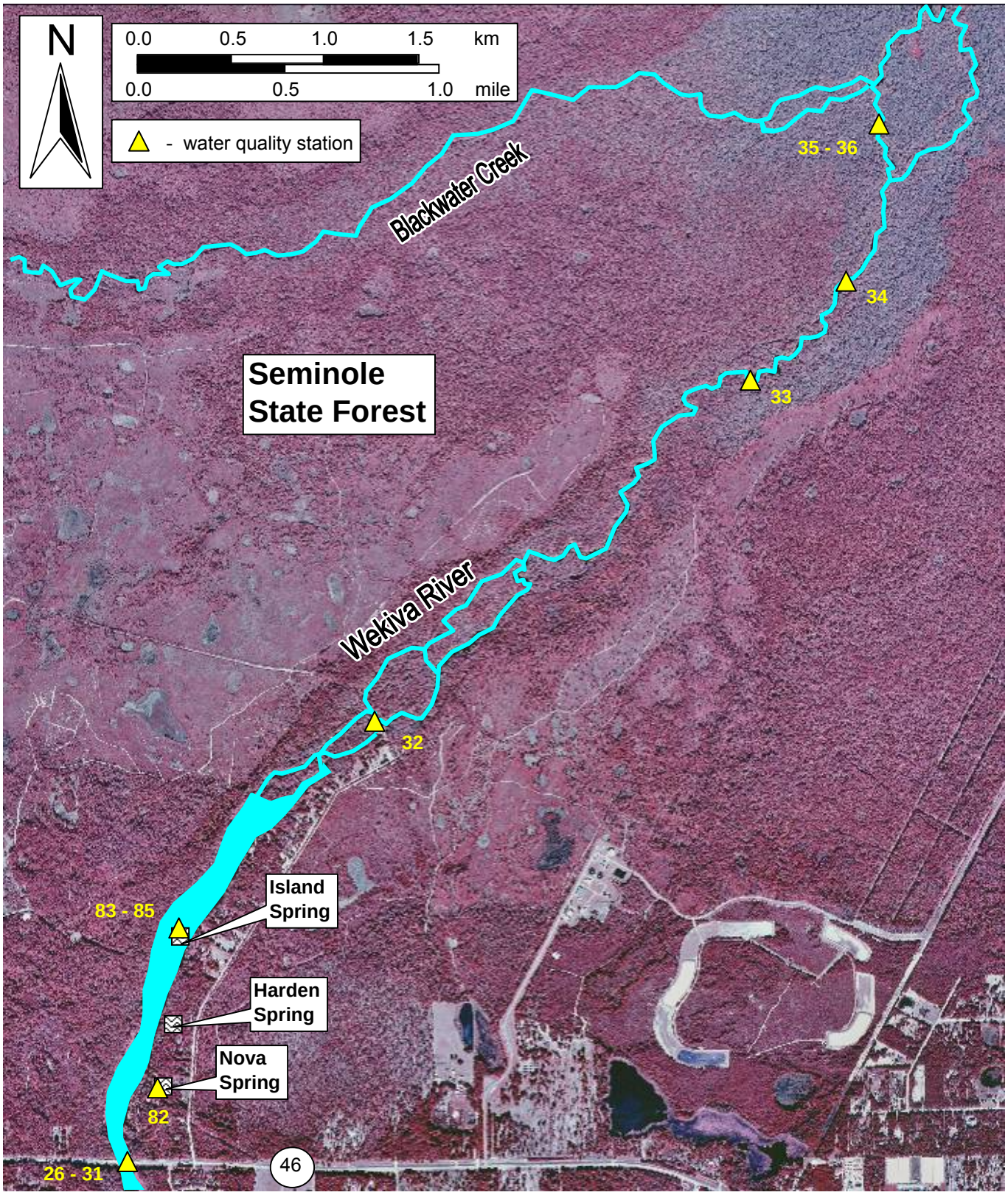


FIGURE 2-17
WATER QUALITY STATIONS IN THE WEKIVA RIVER BETWEEN SR 46 AND BLACKWATER CREEK

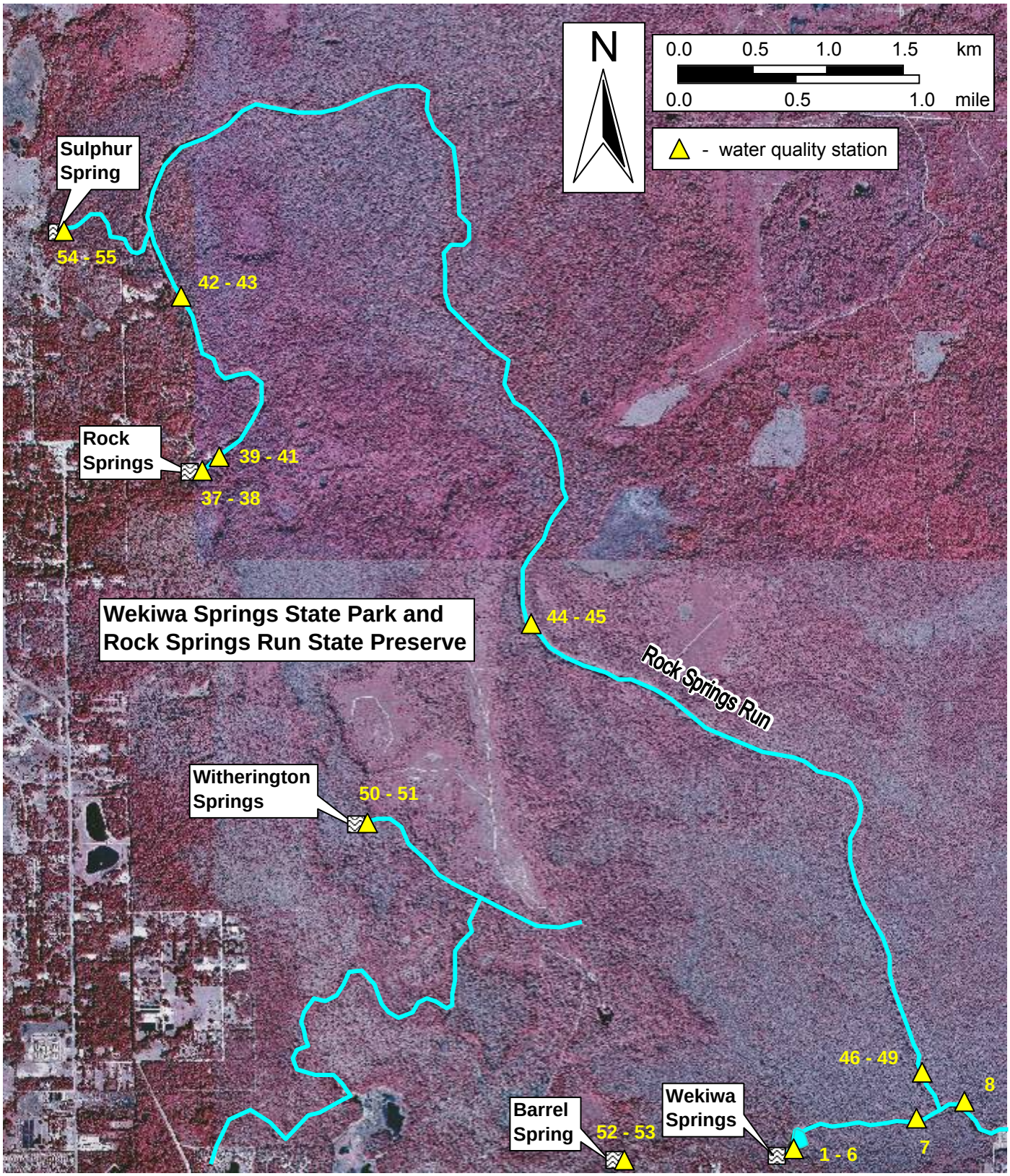


FIGURE 2-18

WATER QUALITY STATIONS IN ROCK SPRINGS, ROCK SPRINGS RUN, AND SURROUNDING AREA

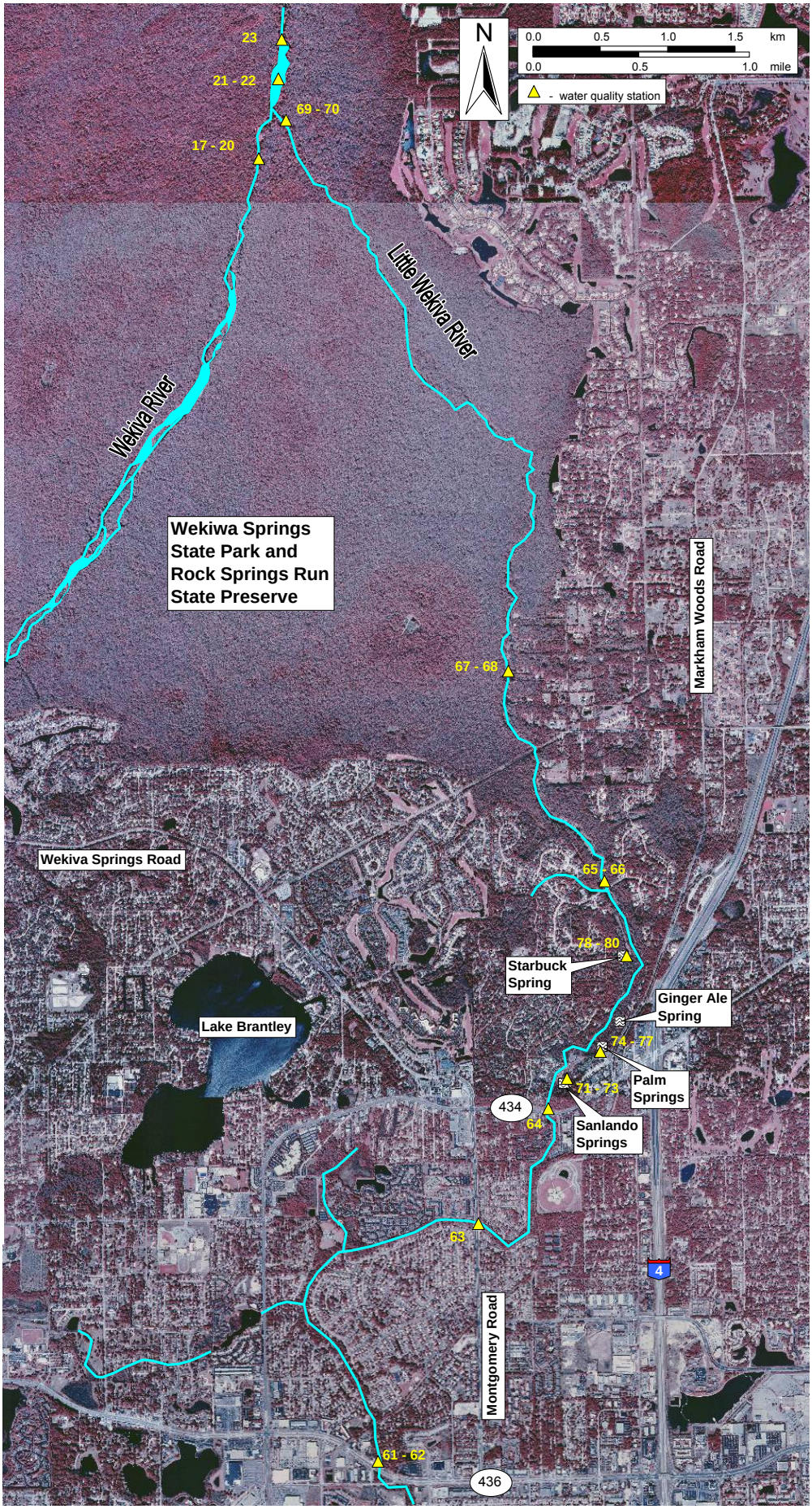


FIGURE 2-19
WATER QUALITY STATIONS IN THE LITTLE WEKIVA RIVER

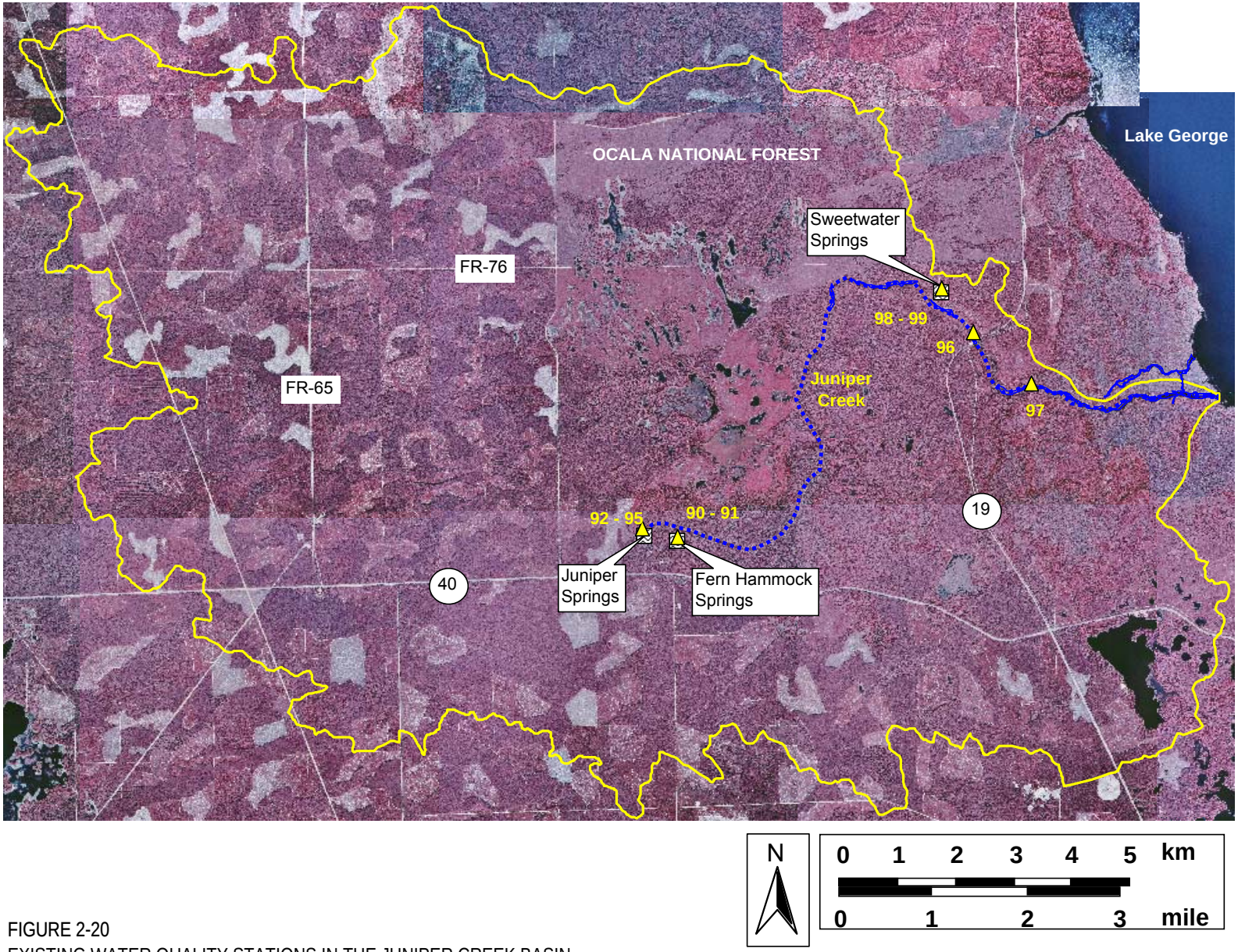


FIGURE 2-20
EXISTING WATER QUALITY STATIONS IN THE JUNIPER CREEK BASIN

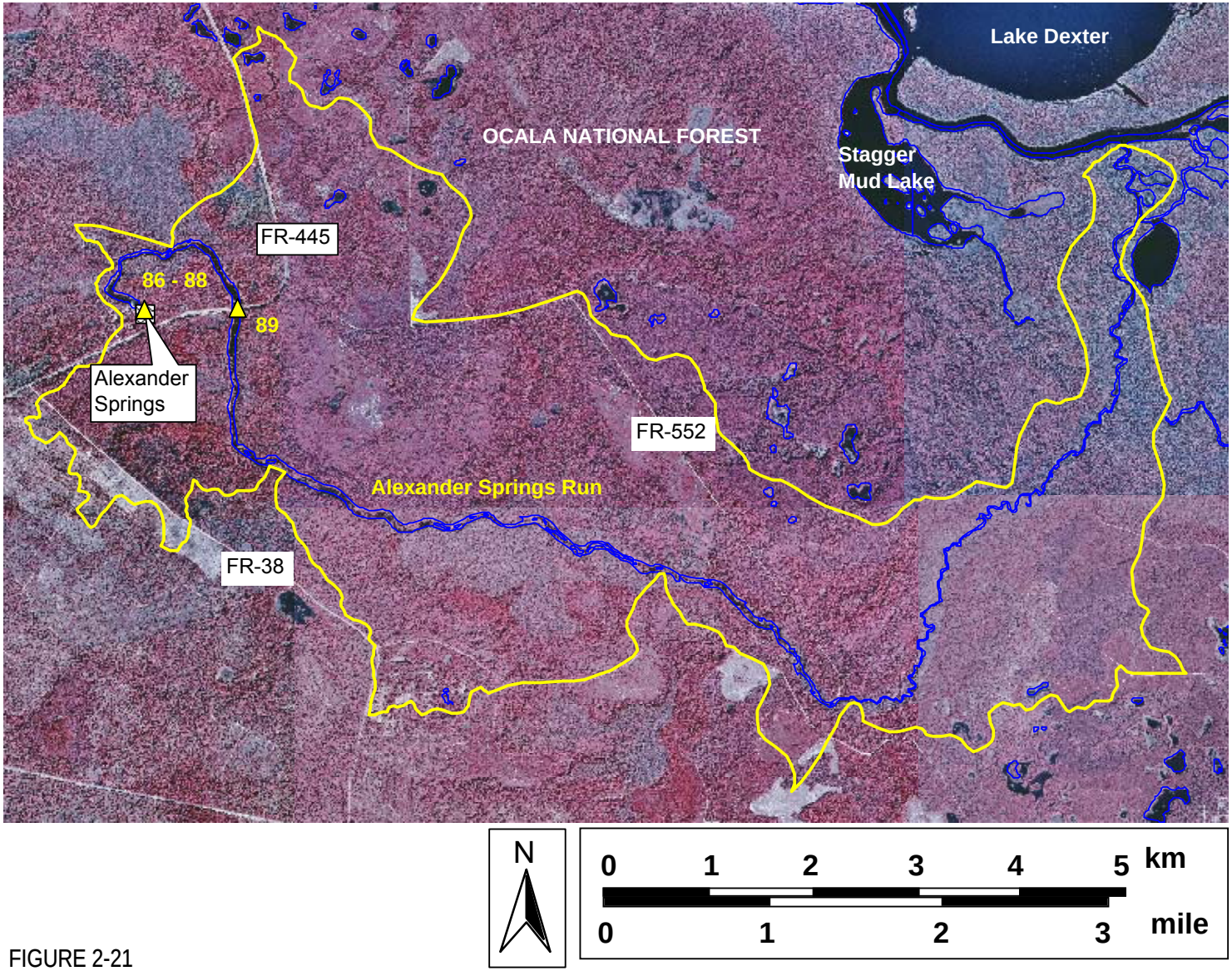


FIGURE 2-21
ALEXANDER SPRINGS CREEK BASIN EXISTING WATER QUALITY STATIONS

Average ammonia N, total P, biochemical oxygen demand, and coliform (fecal and total) concentrations are elevated at the SR 436 station and generally decrease downstream. Nitrate+nitrite N concentrations are elevated at two stations.

Water quality in the reference spring run sites are summarized in Table 2-11. Dissolved oxygen is reportedly high at Juniper Springs and Fern Hammock Springs. These elevated levels may indicate a non-representative sampling point following flow over an outlet weir. Color increases substantially downstream from these springs in response to surface water inputs from adjacent wetlands. Chlorides and conductivity also increase in Juniper Creek, apparently in response to elevated concentrations in nearby Lake George. Nitrate nitrogen concentrations decrease downstream at both reference sites, apparently in response to natural assimilation rates.

3.0 Review of Existing Relevant Studies Pertaining to Nutrients in the Wekiva River System, Florida

3.1 Introduction

This section of the work plan provides a brief summary of the published information of importance to understanding the effects of nutrient conditions within the Wekiva River System. Existing on-going discharge and water quality monitoring efforts are also summarized. This information review supports the need for additional work efforts necessary to establish nutrient PLRGs for the project area. More in-depth analyses of these and many other published datasets about the Wekiva River System will be completed during the second phase of this project to better define and quantify nutrient impairment and resulting environmental impacts.

3.2 Groundwater Nitrate and Travel-Time Studies (Toth 1999; Toth and Fortich 2002)

The SJRWMD studied water quality and stable isotope levels in 17 springs in the St. Johns River watershed basin (Toth 1999). Second-magnitude springs (0.28 to 2.8 m^3/s [10 to 100 cfs] average discharge) that were studied included Wekiwa, Rock, Sanlando, and Starbuck Springs. Palm Springs (a third-magnitude spring, 0.028 0.28 m^3/s [1 to 10 cfs]) was also studied. Wells in the study area were also sampled. In addition to a variety of water quality variables, the selected springs and wells were also sampled for stable and radioactive isotopes to allow analysis of groundwater origin and age. Water quality was found to be highly variable in the springs that were sampled. Water quality was also measured in the springs and adjacent wells. All springs were found to be discharging groundwater from the Upper Floridan Aquifer.

The flow system in this zone was found to be shallow to deep for all of these springs. Water discharging from two of the major springs in the Wekiva River System had the following estimated mean ages: Wekiwa Springs – 17.1 ± 0.5 yr and Rock Springs – 19.8 ± 0.5 yr. Nitrate (dissolved) concentrations ranged from about 0.46 in Starbuck Spring to 1.94 mg/L in Wekiwa Spring. Other water quality variables were fairly consistent between the different springs sampled in the Wekiva River Basin. Temperature varied from 23.7 °C in Wekiwa Springs to 24.6 °C in several of the other springs. Specific conductance ranged from a low of 238 µS in Rock Springs to 376 µS in Starbuck Spring. Dissolved calcium ranged from 29 mg/L in Rock Springs to 40 to 41 mg/L in the rest of the springs. Total dissolved solids ranged from a low of 138 mg/L in Rock Springs to 179 mg/L in Sanlando and Starbuck Springs. These values for fairly conservative dissolved solids are quite different than those measured in many of the other springs and spring groups through the SJRWMD.

Toth (1999) concluded that nitrate N concentrations above 0.2 mg/L are indicative of pollution sources in the springshed of these springs. Elevated nitrate N concentrations in Wekiwa, Sanlando, and Starbuck Springs were determined to be largely due to groundwater contamination by animal waste and/or human sewage discharges. The elevated nitrate N concentration was attributed to contamination by animal waste/sewage with a fraction of nitrates derived from soil organic N. Elevated nitrate N concentrations

in Rock Springs are probably the result of contamination by fertilizers and soil organic N. The presence of elevated nitrate levels in spring water suggests a shallow to intermediate flow system in the Upper Zone of the Floridan Aquifer.

Toth and Fortich (2002) continued the SJRWMD's evaluation of nitrate in springs in the Wekiva River Basin. The concentration of nitrate N appeared to increase during the period-of-record to a maximum of about 2.0 mg/l in 1995 and has been declining since that time (1.3 mg/L in 1999). A total of 50 additional sites in the Wekiva River Basin were sampled for groundwater nitrate N concentrations for this study. Highest concentrations were detected to the west of Lake Apopka; however, the data indicated that the areas of highest nitrate N concentrations probably do not contribute to the nitrate discharging at Wekiwa Springs. Land use changes between 1973 and 1990 suggest that this elevated nitrate is probably derived from septic tanks and lawn fertilizer applications. The source of these inputs was determined to be the high-rate recharge areas just south and southwest of the spring. Declining nitrate N concentrations may be due to the construction of a wastewater treatment facility in Seminole County in 1973 or to an increasing fraction of the spring discharge from the deeper part of the aquifer.

3.3 Proposed Flood Management Plan for the Little Wekiva River Basin and Water Quality Conditions (Rao et al. 1989; 1991)

Beginning in 1982, the SJRWMD conducted a two-part flood management study in the watershed of the Little Wekiva River (Rao *et al.* 1989; 1991). The Little Wekiva River watershed basin includes about 109 km^2 (42 mi^2) and nine major tributaries. This area was divided into 75 contributing subbasins. Phase 1 of the study (Rao *et al.* 1989) determined flood elevations and flood prone area in the basin. Phase 2 of the study (Rao *et al.* 1991) analyzed damages, major problem areas in the basin, and proposed flood protection alternatives for each problem area. Environmental conditions, water quality, and wetland loss were also evaluated in this phase.

The water quality review found that the upper (south) Little Wekiva River system had relatively low dissolved oxygen concentrations (<5.0 mg/L) and elevated levels of biochemical oxygen demand (BOD), nutrients, turbidity, coliforms, and trace metals. Erosion and resulting sediment loading were observed to be at least partially responsible for these degraded water quality conditions. The river was found to be highly influenced by urban stormwater runoff. Sewage treatment plant discharges immediately south of SR 436 and contamination by septic tank leachate throughout the basin were additional identified sources of pollution to the river. Water quality (dissolved oxygen, BOD, and turbidity) generally improved with travel distance downstream. Nitrogen and phosphorus concentrations were especially elevated at the SR 436 station and showed significant reduction downstream of the Sanlando Spring system.

The Little Wekiva River watershed basin lost an estimated 48 percent (2,000 acres) of its wetlands between 1947 and the time of this study due primarily to urban development. This land use conversion contributed to the observed flood control and water quality problems in the watershed.

3.4 Impacts of Nutrients (Canfield and Hoyer 1988)

Canfield and Hoyer (1988) assessed the nutrient assimilative capacity of the Little Wekiva River in 1984 – 1987 for the Altamonte Springs Department of Public Works. The project was designed to assess the effects of wastewater discharges from the Altamonte Springs Regional Wastewater Treatment Plant (WWTP), the Weathersfield Sewage Treatment Plant (STP), and the Hi-Acres Citrus processing plant on stream hydrology, water quality, and biology. The primary goal of the project was to determine if there was a relationship between stream nutrient conditions and the abundance of exotic aquatic macrophytes in the stream.

The three WWTPs were found to contribute about 13 percent of the entire flow in the Little Wekiva River (Altamonte Springs WWTP – 6 percent, Weathersfield STP – 1 percent, and Hi-Acres – 6 percent). Above SR 434 these discharges represented about 48 percent of the average streamflow. Nutrient levels in the Little Wekiva River are elevated as a result of the WWTP discharges. At the time of Canfield and Hoyer's study the WWTP discharges contributed about 40 percent of the TN and TP in the lower Little Wekiva River. Nuisance plant growths in the Little Wekiva River were not linked to this nutrient enrichment. A review of aerial photographs from the 1940s indicated that the Little Wekiva River was blocked by aquatic macrophytes before the beginning of discharges from the WWTPs.

Aquatic macrophyte abundance was found to be highly related to shading by streamback vegetation. Average aquatic macrophyte wet weight standing crops were measured as 1,767 g/m^2. Nutrient enrichment was found to be stimulating the fish productivity of streams. Total fish populations measured in the Little Wekiva River averaged 5.5 g/m^2 and harvestable fish stock was estimated as 2.7 g/m^2. Erosion in the upper Little Wekiva River was found to be impacting populations of aquatic plants. Aquatic plant beds are scoured or buried by moving sand. Deeper areas are filled in and rooted emergent macrophytes are invading portions of the channel on shallow sand bars. Streambank erosion is being accelerated by human activities that remove natural streambank vegetation.

3.5 General Faunal Studies (VanGenechten 1999; Warren et al. 2000; FDEP 2000)

Intensive studies of aquatic macroinvertebrate and fish populations in the Wekiva River System were conducted by VanGenenechten (1999) and Warren *et al.* (2000) in 1997. FDEP (2000) has conducted numerous stream bioassessments of the Wekiva River including the collection of water quality and macroinvertebrate data.

Spring and fall macroinvertebrate sampling was conducted in five dominant habitat types: bare sediments, snags, floating mats, eelgrass (*Vallisneria americana*) beds, and spatterdock (*Nuphar luteum*) beds (Warren *et al.* 2000). This sampling indicated a high macroinvertebrate species diversity (268 individual taxa in 39 major taxonomic groups) and relatively even distribution of these organisms between the differing stream habitats sampled. Bare sediments, snags, and floating mats had overall higher species richness (157 to 166 taxa), diversity (3.62 to 3.82 units), and population densities (25,501 to 33,486 organisms/m^2) than eelgrass beds (127 taxa, 3.26 unit diversity, and 20,614

org/m^2) and spatterdock beds (76 taxa, 3.07 diversity, and 3,774 org/m^2). High diversity was indicative of the high degree of habitat complexity, adequate and diverse food resources, abundant nutrients, and good water quality. The author's concluded that based on these results for aquatic macroinvertebrate populations, the aquatic habitat in the Wekiva River System is healthy but moderately eutrophic. The author's also concluded that significant reduction in flows and/or levels in the Wekiva River System are likely to result in significant changes to these invertebrate populations, especially in downstream, shallow-water areas currently dominated by eelgrass.

VanGenechten (1999) and Warren *et al.* (2000) also studied fish populations in the Wekiva River System in four habitat types: eelgrass beds, spatterdock beds, pennywort (*Hydrocotyle* sp.), and unvegetated areas. Spring and fall sampling was conducted in 1997 using throw traps for smaller fish and blocknet-electrofishing for larger fish. A total of 40 fish species were collected in the Wekiva River System. Highest densities (40 to 78 fish/m^2) were recorded in the pennywort beds, followed by lower population numbers in eelgrass beds, spatterdock beds, and unvegetated areas. Pennywort areas were dominated by livebearers (Poeciliidae) while eelgrass beds were dominated by sunfish species (Centrarchidae). Spatterdock beds were dominated by minnows (Cyprinidae) and killifishes (Fundulidae). Pennywort beds had the highest mean species richness (4.4 to 6.6 species/m^2) while eelgrass beds had the highest fish biomass (up to 51 g/m^2). Dissolved oxygen concentrations and water temperature were not significant factors for determining fish distribution in this study since these water quality measures were not very different between sampling stations.

Plant communities were sampled for percent cover and biomass as part of fish sampling. Percent cover by plant community averaged for both sampling periods were: pennywort – 85 percent, spatterdock – 35 percent, and eelgrass – 85 percent. Wet weight plant biomass in these samples averaged: pennywort – 3,503 g/m^2, spatterdock – 900 g/m^2, and eelgrass – 2,513 g/m^2.

Warren *et al.* (2000) compared their results to the study of the Wekiva and Little Wekiva Rivers by Canfield and Hoyer (1988) and to 17 other Florida streams in 1985-1987 and found no major change or variation from those historical records.

An ecological assessment of the Wekiva River was conducted by the Florida Department of Environmental Protection (FDEP) in January and September 1999 (FDEP 2000). Biological, physical, chemical, and wildlife habitat information were collected and reported for seven stations within the Wekiva River System discussed in this work plan. These stations were located in the main channel of the Wekiva River (4 stations), in Rock Springs Run, in the Little Wekiva River, and in the outlet channel from Yankee Lake. Biological data included samples of benthic macroinvertebrates from natural substrates, phytoplankton from the water column, chlorophyll *a*, and algal growth potential (AGP) using *Selenastrum capricornutum*. Chemical variables that were measured included temperature, pH, dissolved oxygen, specific conductance, ammonia N, nitrate+nitrite N, total kjeldahl N (TKN), and total phosphorus (TP). Physical variables included water depth and secchi depth.

These measures were used to calculate a variety of habitat metrics to characterize the health of the Wekiva River aquatic habitats and indicated that habitat quality was high at

all stations sampled (FDEP 2000). All of the sampling stations in the Wekiva River, Little Wekiva River, and Rock Springs Run had habitat scores of 131 points or more, placing them in the optimal range. Stream Condition Index (SCI) scores based on macroinvertebrate populations at these stations were all in the “Excellent” range.

The largest potential habitat problem identified by FDEP was smothering from sand and silt. Nitrate N enrichment was noted at all of the water quality stations with the exception of the Yankee Lake outlet channel. Nitrate N concentrations at the upper Wekiva River Sites, including Rock Springs Run, exceeded 95 percent of other Florida stream levels. TP was slightly elevated in the Little Wekiva River compared to other Florida streams. Ammonia N and TKN were lower at these sites than in 50 percent of other Florida streams. Algal growth potential results exceeded the 5 mg dry weight/L “problem threshold” at all of the upstream Wekiva River sampling locations and in the Little Wekiva River.

4.0 Wekiva River System Work Plan

4.1 Introduction

The Wekiva River System PLRG Work Plan is designed to assess the relationship between nutrients and existing ecological conditions in the Wekiva River System and at reference sites that are subject to lower levels of nutrient enrichment from human activities. This plan is by necessity a compromise between thoroughness and practicality. As with any work plan, both schedule and budget considerations constrain the possible level-of-effort.

The Wekiva River System Work Plan schedule is constrained by the requirements of the Wekiva Parkway and Protection Act of 2004. PLRGs for the Wekiva River System are to be established by December 1, 2005. A proposed schedule to allow use of data collected as a result of this work plan to help the SJRWMD staff meet this deadline is as follows:

- September 30, 2004 – final work plan completed
- November 30, 2004 – contracts in place to start field work
- December 15, 2004 – field sampling started
- May 15, 2005 – field sampling completed
- July 20, 2005 – data analysis and draft report completed
- September 13, 2005 – final report completed
- December 1, 2005 – District comprehensive final PLRG report completed

Approximately 151 days (5 months) are available for the field sampling efforts. This available sampling period extends from the beginning of winter through the end of spring or early summer. Mass balance studies will be conducted continuously over these five months (six monthly sampling events). Intensive stream segment studies will be conducted for about eight weeks during the spring season. This schedule leaves about 66 days for analysis of any final water quality and biological samples, data analysis, and report drafting. This schedule also allows about 78 days for PLRG development and documentation between submittal of the final work plan report and submittal of the recommended PLRGs to the legislature on December 1, 2005.

Budget is a second constraint. A tentative planning-level budget target of $250,000 (Carol Lippincott, personal communication) was used to guide the level-of-effort in the Wekiva River System PLRG Work Plan described below. A planning-level cost estimate for the work was prepared and is presented to document estimated costs.

4.2 Wekiva River System PLRG Work Plan Overview

The proposed Wekiva River System PLRG Work Plan includes focused field work in critical and/or representative areas in the Wekiva River, Rock Springs Run, and the two reference sites, Juniper Creek and Alexander Springs Run. Three general types of field sampling activities are included in the work plan:

- Continuous meteorological sampling at four existing and upgraded base stations
- Nutrient mass balance and assimilation sampling at upstream and downstream locations in each stream reach as well as overall stream characterization
- Intensive ecosystem sampling of representative stream segments (each segment approximately 1 km [3,280 ft] in length) exposed to varying nutrient levels

Sampling will be conducted at differing frequencies for different variables. Methods to be employed in each of these sampling efforts are described in detail below. Table 4.1 provides a summary of all of the sampling efforts, their duration, and frequency.

Sampling methods are intended to obtain valid data within budget and schedule limitations. Standard methods are not available for all metrics listed below. While all of these methods have been employed for similar studies, actual methods may vary based on constraints encountered in the field.

The following metrics will be quantified in the project area and in the stream segments listed above:

- Physical Environment
    - Precipitation (four existing stations) daily
    - Air temperature (four existing stations) hourly
    - Insolation and photosynthetically active radiation (new station near the Wekiva River) hourly
    - Stream discharge (water level and flow) daily at mass balance stations
    - Underwater light transmission (photosynthetically active radiation) at each stream segment twice during a single four-week period
    - Representative channel cross sections (width and depth profile) once in each stream segment and at all new discharge sites
    - Stream profiles (centerline depth profile) once in each stream reach
    - Velocity profiles (discharge) at stream segments once
    - Sediment texture and chemical composition (sand/silt/clay, % organic matter, phosphorus, nitrogen) once at each stream segment
    - Oxygen diffusion rate (floating dome method) replicated measurements at each of the six stream segments
- Water Quality
    - Field variables (water temperature, pH, dissolved oxygen, specific conductance) monthly at mass balance stations and hourly for four weeks at stream segment upstream and downstream stations
    - Cations (calcium, magnesium, silica, sodium) monthly at mass balance stations and twice at each stream segment

TABLE 4-1
SUMMARY OF DETAILED WEKIVA RIVER SYSTEM NUTRIENT PLRG WORK PLAN

		Mass Balance Stations									Stream Segments							
Parameter	**Weather Station[1]**	**WR-MB1**	**WR-MB2**	**RSR-MB1**	**RSR-MB2**	**LWR-MB1**	**ASC-MB1**	**ASC-MB2**	**JC-MB1**	**JC-MB2**	**WR-SEG1**	**WR-SEG2**	**RSR-SEG1**	**RSR-SEG2**	**ASC-SEG1**	**ASC-SEG2**	**JC-SEG1**	**JC-SEG2**
Physical																		
Precipitation	D																	
Air Temperature	H																	
Total Solar Radiation	H																	
Photosynthetically Active Radiation	H																	
Stream Discharge		D	D	D	D*	D	D*	D*	D*	D*								
Light Transmission (underwater)											T	T	T	T	T	T	T	T
Oxygen Diffusion (floating dome)											T	T	T	T	T	T	T	T
Channel Cross Sections											O	O	O	O	O	O	O	O
Stream Centerline Depth Profiles		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Bathymetry/Volume											O	O	O	O	O	O	O	O
Velocity Profiles											O	O	O	O	O	O	O	O
Sediment Texture											O	O	O	O	O	O	O	O
Water Quality																		
Water Temperature		M	M	M	M	M*	M	M*	M	M*	C*	C*	C*	C*	C*	C*	C*	C*
pH		M	M	M	M	M*	M	M*	M	M*	C*	C*	C*	C*	C*	C*	C*	C*
Dissolved Oxygen		M	M	M	M	M*	M	M*	M	M*	C*	C*	C*	C*	C*	C*	C*	C*
Specific Conductance		M	M	M	M	M*	M	M*	M	M*	C*	C*	C*	C*	C*	C*	C*	C*
Total Dissolved Solids		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Turbidity		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Five Day Biochemical Oxygen Demand		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Chloride		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Sodium		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Calcium		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Magnesium		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Silica		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Sulfate		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Iron		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Alkalinity		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Kjeldahl Nitrogen		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Nitrate+Nitrite Nitrogen		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Ammonia Nitrogen		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Soluble Reactive Phosphorus		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Dissolved Phosphorus		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Phosphorus		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Suspended Solids		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Volatile Suspended Solids		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Color		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Carbon		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Dissolved Carbon		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Ecosystem-Level Metrics																		
Community Metabolism											C*	C*	C*	C*	C*	C*	C*	C*
Pollutant Assimilation Rates (N and P)		M*	M*	M*	M*	M*	M*	M*	M*	M*								
Community Export											O	O	O	O	O	O	O	O
Aquatic Vegetation																		
Percent Cover/Dominant Species											O	O	O	O	O	O	O	O
Stream Mesocosm Plant Metabolism											O	O	O	O	O	O	O	O

Notes:
[1]existing weather stations will be used for rainfall and air temperature data collection; one new solar radiation station will be established
H = hourly
D = daily by others
D* = daily for this project
C* = continuous (hourly) upstream and downstream for 4-weeks during one seasonal sampling event
T = two times (beginning and end of a single 4-week seasonal sampling event) at the downstream station only
T* = two times (beginning and end of a single 4-week seasonal sampling event) at upstream and downstream stations
M = monthly by others for six events (December 15, 2004 - May 15, 2005)
M* = monthly for this project for six events (December 15, 2004 - May 15, 2005)
O = once during the project

  - Anions (chlorides, sulfate, alkalinity) monthly at mass balance stations and twice at each stream segment
  - Nutrients (total kjeldahl nitrogen, nitrate+nitrite nitrogen, ammonia nitrogen, soluble reactive P, total dissolved P, total P) monthly at mass balance stations and twice at each stream segment
  - Miscellaneous (five-day biochemical oxygen demand, color, total suspended solids, volatile suspended solids, dissolved organic carbon, total dissolved solids, turbidity, total organic carbon, silica, iron) monthly at mass balance stations and twice at each stream segment
- Ecosystem Level Metrics
  - Community metabolism (gross primary productivity, net primary productivity, community respiration, P/R ratio, ecological efficiency) at each stream segment daily for four weeks
  - Nutrient assimilation rates (stream reach upstream/downstream changes in concentrations of nitrogen and phosphorus) between mass balance stations monthly for six months
  - Community export (suspended solids and floating macrophytes) at stream segments once
- Aquatic Vegetation
  - Percent cover and dominant species by functional group (floating aquatic, submerged aquatic, emergent, filamentous algae, benthic algae) at ten transects in each stream segment once during the project period
  - Stream mesocosms for quantification of the metabolic activity of specific aquatic plant dominants including eelgrass and filamentous algae at stream segments once during the project period

The recommended frequency of sampling for the above metrics is based on the estimated level-of-effort for each metric and its assumed temporal variability. Table 4-1 summarizes this proposed sampling plan. Individual sampling methods are described below.

4.2.1 Meteorological Sampling

Meteorological sampling will be continuous (daily) from December 2004 through May 2005.

4.2.1.1 Precipitation

Precipitation will be continuously recorded in the vicinity of the four streams using existing monitoring devices. These rainfall data will be utilized to provide a real-time summary of rainfall contributions to the Wekiva River System and the reference stream reaches during the course of this project. Precipitation data from other local stations will also be reviewed and summarized. Published rainfall nutrient concentrations will be used

in conjunction with precipitation data to estimate atmospheric nutrient inputs to each stream reach..

4.2.1.2 Air Temperature

Air temperature will be continuously measured and recorded in the vicinity of each of the four stream reaches using existing weather stations.

4.2.1.3 Insolation and PAR

Total incident solar radiation (insolation) and photosynthetically active radiation (PAR) are important because of the role they play in driving community metabolism (primary productivity and respiration). Primary productivity is directly related to the amount of sunlight that reaches the aquatic ecosystem. Therefore, higher productivity will often occur on days when the sun is not obscured by clouds. Measurements of the amount of sunlight will be made with LI-COR light sensors models LI-190SA (pyranometer) and LI-200SA (PAR). Data collected by these light sensors will be recorded using a LI-1400 data logger that can then be downloaded to a computer and output to an Excel spreadsheet and Access database. The data logger takes readings every minute and then averages to output integrated hourly data. The light sensors will be installed in an area free of shading at the Wekiwa River State Park or at a site to be determined nearer the center of the overall project area.

4.2.2 Stream Reach Mass Balance and Nutrient Assimilation Sampling

Water and nutrient mass balances will be estimated for each of the four stream reaches during the five-month duration of this project. These nutrient mass balances will be interpreted in the light of a general environmental characterization of each stream reach between the upstream and downstream monitoring points. These mass balance studies will focus on upstream and downstream sampling stations by collection of continuous flow records and monthly (six events) water quality sampling data. Mass balance studies will be conducted over a five-month period starting in mid-December 2004 and extending through mid-May 2005. Upstream and downstream water levels and discharge rates will be measured continuously (daily) while water quality variables at these mass balance stations will be measured monthly. Nutrient assimilation rates will be calculated for each of the four stream reaches based on this five-month data collection period.

There are a total of nine mass balance stations planned for this project:

- WR-MB1 – Wekiva River discharge and water quality monitoring station located at the downstream end of the main boil at Wekiwa Springs (USGS WEK)
- WR-MB2 – Wekiva River at SR 46 bridge (USGS 2235000)
- RSR-MB1 – Rock Springs Run at the downstream pedestrian bridge in Kelly Park (USGS ROX)
- RSR-MB2 – Rock Springs just upstream of its confluence with the Wekiva River
- LWR-MB1 – Little Wekiva River at Springs Landing Road (USGS WRSPLD)
- JC-MB1 – Juniper Creek upstream at outlet of Juniper Springs (USGS JUN) above its confluence with Fern Hammock Springs

- JC-MB2 – Juniper Creek downstream at CR 19
- ASC-MB1 – Alexander Springs Creek upstream at Forest Road 445 (SJRWMD ALX)
- ASC-MB2 – Alexander Springs Creek downstream at Forest Road 552

Several of these proposed stations overlap with existing water level and flow gauging stations. Table 4-2 summarizes these stations, including their names and locations, the responsible agency for maintenance and monitoring, and the monitoring frequency.

Three of these stations currently have continuous water level and discharge measurements and monthly water quality:

- WR-MB1
- WR-MB2
- RSR-MB1

One of these stations has continuous water level and discharge measurements but no routine water quality:

- LWR-MB1

Three stations have monthly water quality but do not have continuous water level or discharge readings:

- RSR-MB2
- JC-MB1
- ASC-MB1

Two stations have neither discharge nor water quality data:

- JC-MB2
- ASC-MB2

Continuous discharge and/or monthly water quality sampling will be added to these stations as needed to allow development of monthly water and nutrient loads at each upstream and downstream location. In addition there are a few other monitoring points in these streams where continuous or intermittent data are also available.

4.2.2.1 Water Stage and Discharge

Continuous water stage and stream discharge rates are currently measured and reported from a total of three of the eight mass balance stations. The five remaining stations will be upgraded by addition of USA Infinities water level recorders and data loggers or equivalent and with a fixed staff gauge. Datum elevations will be determined by the SJRWMD survey group. New discharge stations will be rated by measurement of stage and associated discharge on at least five occasions during the project period.

TABLE 4-2

DESCRIPTION OF THE MASS BALANCE STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT PROJECT AREA AND REFERENCE SITES

Work Plan Station	Existing Station Name	Agency	Latitude	Longitude	Monitoring Type / Existing Frequency		
					Discharge	Wtr Level	Wtr Quality
WR-MB1	WEK	USGS	28.71194	-81.46000	C	C	M
WR-MB2	2235000	USGS	28.81500	-81.41944	C	C	M
RSR-MB1	ROX	USGS	28.75556	-81.49917	C	C	M
RSR-MB2	RSR-UWR	SJRWMD	28.71543	-81.44972	New	New	M
LWR-MB1	WKSPLD	USGS	28.70194	-81.39220	C	C	New
JC-MB1	JUN	USGS/SJRWMD	29.18500	-81.71139	SA	Q	M
JC-MB2			29.21338	-81.65451	New	New	New
ASC-MB1	ALX	USGS/SJRWMD	29.08139	-81.57667	Q	Q	M
ASC-MB2			29.04548	-81.50848	New	New	New

C = Continuous
M = Monthly
Q = Quarterly
SA = Semi-Annual
New = this study

4.2.2.2 Pollutant Assimilation Rates

Assimilation rates for nutrients (total, organic, ammonia, and nitrate-nitrite N and total, total dissolved, and soluble reactive P) will be determined for each of the four stream reaches based on upstream-downstream nutrient concentration and load changes during the five-month sampling period. Results from the upstream and downstream samples will be used in concert with the water mass balance and estimated nominal hydraulic residence time and with the estimated stream area and volume information within each stream reach to estimate net pollutant assimilation rates based on wetted area ($kg/m^2/yr$) and on water volume ($kg/m^3/yr$). Land use areas combined with literature unit pollutant loading rates will be used to estimate non-point source pollutant loads to each river segment. Atmospheric nutrient input rates will be estimated from the literature. A total water and nutrient budget for each river segment will be estimated based on this information.

4.2.2.3 Stream Reach Reconnaissance

Each of the four stream reaches will be inventoried between the upstream and downstream mass balance stations once during the project. This reconnaissance will gather the following types of data to characterize the overall environmental conditions within the stream reach:

- Centerline orientation, depth, and width – water depth will be measured at 500 m (1,640 ft) intervals along each stream reach and each point will be approximately located with a hand-held GPS unit, channel width will be rapidly estimated at each point with a range finder
- Photo-log – five digital photographs will be taken at each sampling point described above with five photos at each station – upstream, downstream, right shore, left shore, and overhead canopy
- Plant community characterization – the plant community at each sampling point will be rapidly assessed for species dominants, percent cover, and canopy cover (over the stream channel)
- Water quality – field variables will be collected at each sampling point

In addition to this characterization sampling, one important goal of this site reconnaissance is to locate suitable stream segments for the intensive ecological sampling described below.

4.2.3 Stream Segment Intensive Ecological Sampling

A total of six stream segments will be intensively sampled during this project. Upstream and downstream stream segments will be sampled in the Wekiva River and in Rock Springs Run (Figure 4-1) and a single segment will be sampled in Juniper Creek (Figure 4-2) and in Alexander Springs Creek (Figure 4-3). Methods for this ecological sampling are described below.

Water quality and ecosystem-level variables in each of the six stream segments will be measured during a four week intensive sampling period. This sampling event will roughly correspond to an annual period of moderate incident radiation (spring). Water quality field variables will be measured continuously (hourly) upstream and downstream

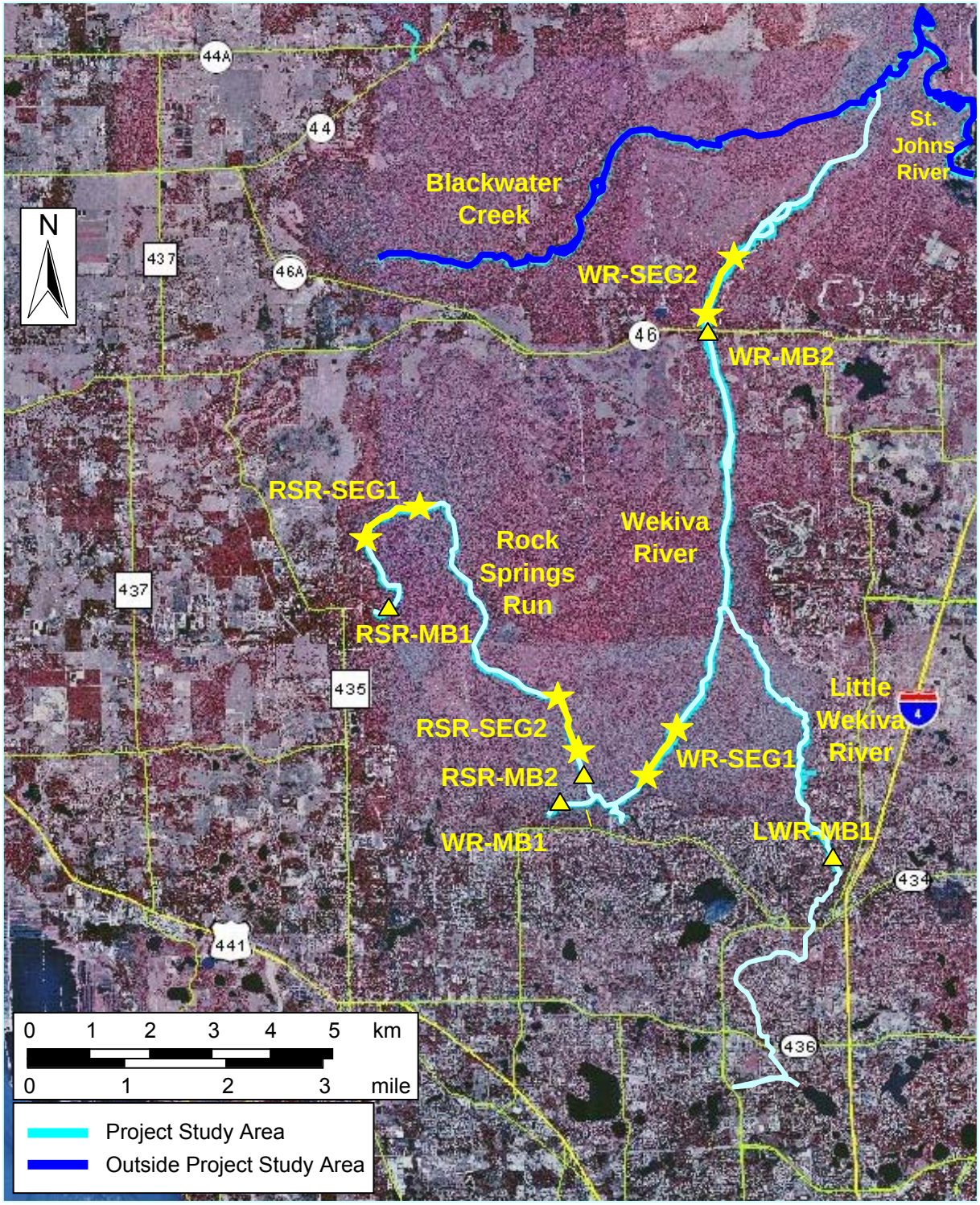


FIGURE 4-1

STREAM NUTRIENT MASS BALANCE AND ECOSYSTEM METABOLISM SAMPLING SITES WITHIN THE WEKIVA RIVER SYSTEM

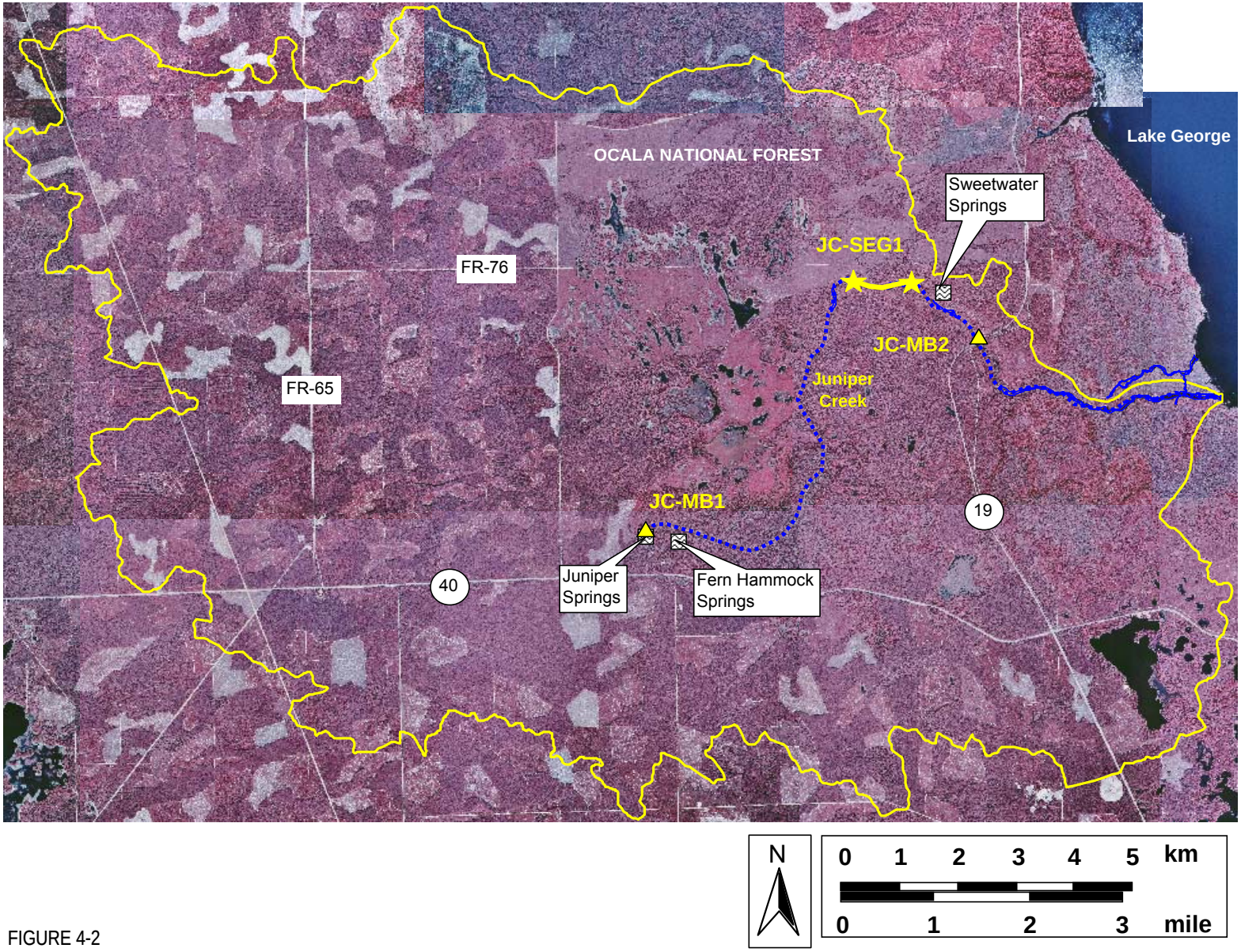


FIGURE 4-2
STREAM NUTRIENT MASS BALANCE AND ECOSYSTEM METABOLISM SAMPLING SITES WITHIN JUNIPER CREEK

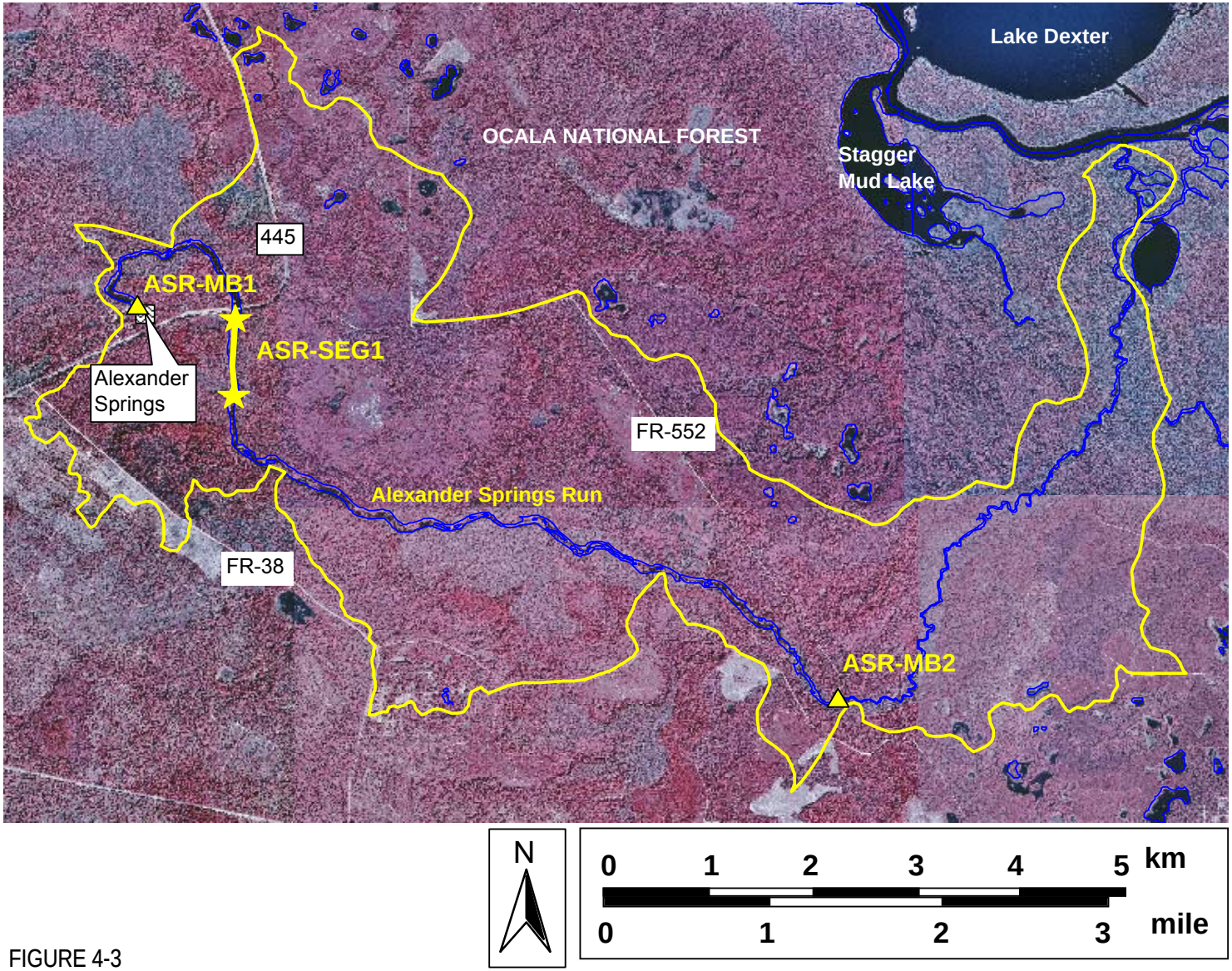


FIGURE 4-3
STREAM NUTRIENT MASS BALANCE AND ECOSYSTEM METABOLISM SAMPLING SITES WITHIN ALEXANDER SPRINGS CREEK

in each stream segment for about four weeks during these events and will allow replication of daily estimates of ecosystem-level metabolism during the sampling period.

Certain physical and biological conditions such as stream segment morphometry, sediment characteristics, stream segment flows, and plant community percent cover will only be measured one time during the project period.

Stream segments will be selected for detailed upstream-downstream sampling from the two principal water bodies in the project area: Wekiva River and Rock Springs Run (one upstream and one downstream segment in each) and at one stream segment each in the two reference sites, Juniper Creek and Alexander Springs Creek. Specific stations and stream segments for detailed sampling efforts will be selected based on their location with respect to nutrient concentrations, based on accessibility for sampling, and to provide representative and comparable unshaded aquatic habitats typical of the Wekiva River System. These six stream segments will be selected during an initial stream reconnaissance effort.

Six stream segments will be selected for upstream and downstream studies. These stream segments will all be relatively wide areas of each stream and characterized by minimal canopy shading effects and well-developed aquatic and wetland plant communities. Each stream segment will be approximately 1 km (3,280 feet) in total length, subject to actual field conditions. Initial field measurements taken during site reconnaissance will be used to determine the actual required segment length needed to detect significant upstream/downstream changes in dissolved oxygen.

These six stream segments will be identified as follows:

- WR-SEG1 – Wekiwa River upstream between the Rock Springs Run and Little Wekiva River confluences.
- WR-SEG2 – Wekiva River downstream near the SR 46 bridge and upstream of Island Spring
- RSR-SEG1 – Rock Springs Run upstream below the Kings Landing canoe livery canal
- RSR-SEG2 – Rock Springs Run downstream and just up from its confluence with the Wekiva River
- JC-SEG1 – a representative stream segment in Juniper Creek
- ASC-SEG1 – a representative stream segment in Alexander Springs Creek

4.2.3.1 Station Establishment

The upstream and downstream ends of each stream segment will be semi-permanently marked with steel rebar and PVC tubing. A staff gauge will be installed at the downstream end of each stream segment. Datum elevations for these gauges will be determined by the SJRWMD survey group.

An anchoring site will be installed at the upstream and downstream ends of each stream segment for rapid deployment and recovery of submersible data recording sondes.

4.2.3.2 Cross-Sections and Segment Surface Area and Volume

Ten channel cross sections will be made at approximately 100 m (328 ft) intervals along each of the six stream segments. A tape measure will be pulled from shoreline to shoreline perpendicular to flow direction at each of these ten cross sections. Water depth along each cross section will be determined at 10 m (33 ft) intervals along the length of these cross sections with a pocket rod and recorded.

Information concerning the approximate wetted surface area and volume of each stream segment is important in assessing hydraulic residence time, pollutant assimilation rates, community metabolism, and the quantitative extent of plant and animal communities. A bathymetric map will be prepared for each stream segment by use of the stream cross sections and profiles measured above.

4.2.3.3 Plant Community Characterization and Mapping

Aquatic plant communities in each stream segment will be approximately mapped once during this project. Vegetative cover will be documented on each of the cross sections described above by the line intercept method. Any plants observed over or under the tape measure will be identified and their linear distance recorded. Plant coverage between these transects will be interpolated from these line intercept data and from general field observations. Dominant macrophyte plant species will be noted for each cover unit. Filamentous benthic algae will be included as a cover type and periphyton cover on macrophytes will be noted as a descriptor.

4.2.3.4 Discharge Estimates

Discharge will be estimated one time in the general vicinity of the upstream and downstream end of each stream segment. The purpose of these measurements is to determine if there are any significant water gains or losses in the stream segment and to determine overall incremental flow increases downstream or upstream of the continuous flow monitoring stations.

Current velocities will be measured at 0.2 and 0.8 depths at each of the stream cross section sampling intervals by use of a Marsh-McBirney Flo-Mate 2000-51 portable flowmeter. These velocities will also be used to estimate the stream discharge at each stream segment sampling station.

4.2.3.5 Sediment Texture

Sediment samples will be collected at five of the ten sampling transects. Sediment will be collected using a stainless steel soil sampling spoon or a Ponar Dredge in deeper areas. Sediment samples from each transect will be composited from at least five points and analyzed by a soil testing facility for texture (percent sand/silt/clay), percent organic matter, and for total nitrogen, total phosphorus, and total carbon.

4.2.3.6 Light Transmission

Underwater light transmission will be measured at the downstream end of each stream segment at the beginning and end of the four week sampling period by use of underwater LI-COR light sensors (pyranometer and spherical PAR). These sensors will be mounted on an underwater weighted frame and light readings will be manually recorded at one-foot intervals of depth from the surface to the bottom of the water body in an unshaded location. Light extinction coefficients will be calculated from these data. These extinction

coefficients will be used with information about stream depth in each stream segment and the continuous insolation and PAR measurements described above to estimate the total amount of useable light reaching the submerged plant communities.

4.2.3.7 Oxygen Diffusion

Oxygen diffusion rates will be quantified by use of the floating dome method of McKeller (1975). In this method a floating dome of known volume is placed on the surface of the water and is evacuated with pure nitrogen gas. The dome has two valves installed in the top, one to release air, and one to admit nitrogen. An oxygen sensor is suspended from a hook on the inside of the dome and is used to measure the internal increase in oxygen within the dome for a period of time after it is fully evacuated with nitrogen gas. At least two measurements of oxygen diffusion will be made in each stream segment during the period of the field sampling project. Current velocity and water depth will be recorded during each diffusion measurement. These data will be used to develop a correlation between these variables to allow extrapolation of diffusion rates to each stream segment for that sampling period.

4.2.3.8 Water Quality

Water quality assessment of the stream segments are of particular importance for this project. Field measurements during each sampling event and at each sampling station will include temperature, pH, dissolved oxygen, oxygen percent saturation, conductivity, and specific conductance. All field water quality sampling will be conducted with an In Situ Troll-9000 sonde or equivalent.

A Florida-certified analytical laboratory will be used for all other water quality analyses. Table 4-3 provides a list of all of the analyses proposed for the Wekiva River System PLRG project and the methods to be used for those analyses. All water quality samples will be collected as surface “grabs”. A rinsed water collection bottle will be used to dip water samples from about 30 cm (one ft) below the water surface and used to fill preserved sample bottles. Samples will be collected at both the upstream and downstream ends of each stream segment station twice, with one set of samples collected at the beginning of the four-week sampling period and the second set of samples collected at the end of the four-week period. This sampling strategy will result in a total of four water quality samples being collected at each stream segment during the field sampling project.

In Situ Troll-9000 data-loggers (or equivalent) will be continuously deployed at the upstream and downstream ends of each stream segment for a period of four weeks twice during the project period. These data sondes will automatically record and store hourly readings for water temperature, dissolved oxygen, oxygen percent saturation, pH, and specific conductance. The In Situ Troll-9000 data sondes will be camouflaged and anchored in areas at least 1 m deep with the measuring membrane just above the top of any submerged vegetation and at least 1 m below the average water surface. The data sonde will be retrieved by a skindiver and re-calibrated at the end of each sampling period.

TABLE 4-3
SUMMARY OF ANALYTICAL METHODS

Parameter	Analytical Method	Reporting Limit	Units
Total Dissolved Solids	EPA 160.1	2	mg/L
Turbidity	EPA 180.1	1	NTU
Calcium	EPA 6010	0.014	mg/L
Magnesium	EPA 6010	0.0074	mg/L
Silica	EPA 6010	0.0024	mg/L
Sulphate	EPA 375.4	1.4	mg/L
Alkalinity	EPA 310.1	5	mg/L
Total Kjeldahl Nitrogen	EPA 351.2	0.048	mg/L
Nitrate+Nitrite Nitrogen	EPA 353.2	0.015	mg/L
Ammonia Nitrogen	EPA 350.1	0.026	mg/L
Soluble Reactive Phosphorus	EPA 365.2	0.015	mg/L
Total Dissolved Phosphorus	EPA 365.2	0.015	mg/L
Total Phosphorus	EPA 365.4	0.02	mg/L
Total Suspended Solids	EPA 160.2	2	mg/L
Arsenic	EPA 6010	0.007	mg/L
Cadmium	EPA 6010	0.00021	mg/L
Chromium	EPA 6010	0.00016	mg/L
Copper	EPA 6010	0.0071	mg/L
Lead	EPA 6010	0.00092	mg/L
Iron	EPA 6010	0.016	mg/L
Mercury	EPA 7470	0.000014	mg/L
Zinc	EPA 6010	0.0072	mg/L
Atrazine	EPA 525.2	0.00006	mg/L
Simazine	EPA 525.2	0.00007	mg/L
DDT	EPA 8081	0.000013	mg/L
Diazinon	EPA 8141	*locating lab*	mg/L
Color	E110.2	5	color units
Five-Day Biochemical Oxygen Demand	SM52102B	2	mg/L
Total Carbon	TBD	TBD	mg/L
Dissolved Organic Carbon	TBD	TBD	mg/L

1 All methods for environmental waters from Methods for Chemical Analysis of Water and Wastes, EPA-600-79-020, Revised March 1983, and /or Standard Methods for the Examination of Water and Wastewater, 18th Edition,
TBD = to be determined

4.2.3.9 Ecosystem Metabolism

Ecosystem metabolism will be estimated in the stream segments using the upstream/downstream dissolved oxygen change method pioneered by H.T. Odum (1956; 1960) and Odum and Hoskins (1957). Hourly upstream/downstream dissolved oxygen data recorded by the In Situ Troll 9000 data sondes will be used to estimate ecosystem metabolism. Upstream data will be shifted by the estimated travel time between the upstream and downstream stream segment stations and an oxygen-rate-of-change curve will be prepared. This curve will be corrected for atmospheric diffusion based on measured percent oxygen saturation and oxygen diffusion rates corrected for water depth and velocity. Gross primary productivity is estimated as the entire area under the oxygen rate-of-change curve. Community respiration is estimated as the average nighttime oxygen rate-of-change. Net primary productivity is equal to the difference between these two estimates. Ecological efficiency is equal to the rate of gross primary productivity divided by the incident PAR during a specified time interval.

4.2.4.10 Community Export

Community export will be quantified with two sampling methods. Export of larger macrophytes and masses of filamentous algae will be estimated with suspended horizontal traps anchored perpendicular to the flow direction. Three traps will be deployed in each stream segment station for a period of one to two days. Collected plants will be sorted by dominant species and wet weights will be obtained in the field. Representative subsamples will be retained for percent solids analysis in the laboratory.

Smaller suspended material will be sampled using a plankton net suspended in the current at mid-depth. The mesh size on the plankton net will be 153 µm. Samples from the net at a known stream velocity and for a known time will be rinsed into a sample bottle and returned to the laboratory for wet, dry, and ash-free dry weight analyses.

4.2.4.11 Stream Mesocosm Sampling

Stream mesocosms based on the methods of Knight (1980, 1983) utilized at the Silver River in Marion County, Florida will be used to provide replicated plant-specific estimates of metabolic activity (Figure 4-4). Nine acrylic tubes (stream mesocosms) 5.1 cm (2 in) in diameter and approximately 3 m (10 ft) long will be suspended in the water column at the downstream end of each stream segment once during the spring season sampling period. Two submerged plant species will be placed in each of three replicate stream mesocosms with leaves and roots of *Vallisneria americana* (eelgrass) placed in three tubes, and masses of filamentous algae in three tubes. Screens will be used to contain the plants in each tube during the period of measurement. Three of the stream mesocosms will not have any plants and will serve as replicate controls.

These nine stream mesocosms will be suspended from a floating rack so they are below the water surface and aligned parallel to the direction of flow. An automated sampling manifold and tubing will be attached to the upstream end of this rack and individually to the downstream end of each mesocosm to allow remote sampling of the inflow and outflow water masses on an intermittent basis. Typical sampling will allow upstream and downstream measurement of dissolved oxygen, pH, and temperature within each tube hourly for about four to six hours of the daylight period. The mesocosms will then be enclosed in an opaque cover and upstream-downstream oxygen changes will be measured

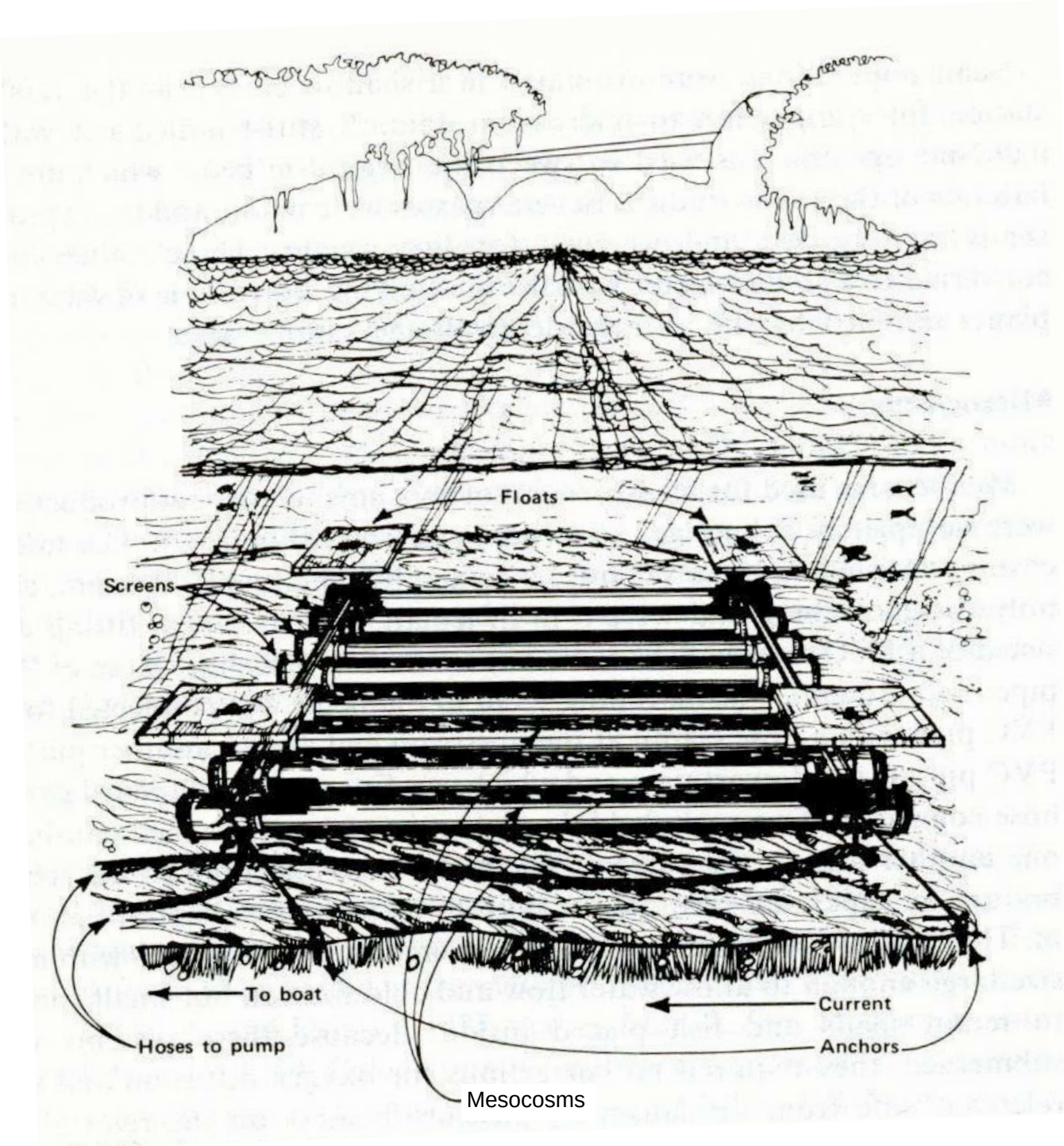


FIGURE 4-4

EXPERIMENTAL DESIGN FOR FLOW-THROUGH STREAM MESOCOSMS (KNIGHT 1983)

for an additional one to two hours. At the end of this data collection period the contents of the six plant-filled mesocosms will be emptied into sample bags and the plants will be returned to the laboratory for dry weight and ash-free dry weight analysis.

This mesocosm sampling will allow quantification of the gross and net primary productivity and the nighttime (dark period) community respiration for these individual plant species under varying conditions of nutrient enrichment. No diffusion correction is required for these measurements since the stream mesocosms will be fully submerged and not influenced by atmospheric oxygen exchanges. Productivity and respiration estimates will be normalized by measured light intensity and by plant dry weight biomass.

4.3 Cost Estimate

A preliminary cost estimate has been prepared for the proposed Wekiva River System PLRG Work Plan. Table 4-4 provides the estimated costs based on normal environmental consultant labor rates, direct expenses, and professional judgment of the authors about the time needed to complete various project activities. The total estimated budget for this work plan is $250,000. This estimated cost can be roughly divided into $165,300 for labor (2,117 hours) and $84,700 for expenses. Direct expenses include about $11,200 for travel, $51,800 for equipment rental/purchase, and $19,900 for laboratory analytical services.

TABLE 4-4

ESTIMATED BUDGET FOR EXECUTION OF THE WEKIVA RIVER SYSTEM PLRG WORK PLAN

	Labor		Expenses					
Task	Hours	Total	Travel	Shipping	Equipment	Laboratory	Total	Total
Task 1 - Meetings and Project Management	160	$16,100	$380	$0	$0	$0	$380	$16,480
Task 2 - Mobilization / Station Setup / Segment Characterizatior	482	$38,270	$3,720	$450	$42,488	$2,310	$48,968	$87,238
Task 3 - Discharge Station Setup (5 stations)	246	$16,080	$1,940	$150	$4,350	$0	$6,440	$22,520
Task 4 - Mass Balance Sampling	144	$9,720	$2,160	$750	$0	$7,410	$10,320	$20,040
Task 5 - Spring Sampling	280	$17,360	$2,300	$444	$0	$7,880	$10,624	$27,984
Task 6 - Mesocosm Study	346	$28,310	$660	$50	$5,000	$2,268	$7,978	$36,288
Task 7 - Data Analysis	210	$16,200	$0	$0	$0	$0	$0	$16,200
Task 8 - Report Preparation	249	$23,250	$0	$0	$0	$0	$0	$23,250
Total	2,117	$165,290	$11,160	$1,844	$51,838	$19,868	$84,710	$250,000

Note: horizontal and vertical survey of monitoring stations to be completed by others

5.0 Data Analysis and PLRG Development

5.1 Introduction

Analysis of existing and new data relevant to the Wekiva River System will continue in parallel with the field sampling efforts described above in Section 4.0. The purpose of this analysis is the careful and thorough documentation of nutrient loads acting on the Wekiva River System and the detection of any significant impacts associated with those nutrients. This section of the work plan provides some preliminary thoughts concerning that data analysis effort. It is likely that the methods used for this analysis will continue to be developed and refined as additional data become available throughout the period of this project.

This project will develop PLRGs for both the Wekiva River and for Rock Springs Run, if needed. PLRGs will be estimated for any nutrient forms that are at or above levels that are shown to impair existing beneficial uses in these two aquatic ecosystems. There are four steps planned for this PLRG development process:

1. Identify biological impairments
2. Identify pollutants or stressors of concern
3. Estimate acceptable pollutant concentration targets
4. Quantify current pollutant loadings
5. Characterize the relationship between pollutant loading rates and pollutant concentrations
6. Calculate necessary pollutant load reductions in terms of concentrations

A general discussion of proposed activities included within each of these steps is provided as follows.

5.2 Identification of Impairment

The work plan outlined in Section 4 above is designed to quantify the existing ecological structure and functioning of the Wekiva River System, including specified stream reaches and segments in the Wekiva River and Rock Springs Run. This quantification will allow comparison between differing parts of the overall system, comparison to control or reference sites with lower levels of nutrient inputs, and development of correlations between independent and dependent variables. Analysis of variance will be helpful for understanding the relative importance of each forcing function for determination of ecological function. For example, overall aquatic productivity is a function of sunlight, nutrients, water clarity, and the density and cover of submerged plant communities. The work plan outlined above will provide a fairly detailed response surface for these variables over the project period-of-record. These data can be used to document the expected aquatic productivity under the most favorable, natural conditions of adequate light and moderate nutrient conditions.

Data from Rock Springs Run can be contrasted to data from Wekiwa Springs Run or the lower Wekiva River downstream of the inputs from the Little Wekiva River to factor out the effects of higher nitrate or phosphorus inputs known to occur in those systems. A

perfect control site is probably not available in the project area. However, existing similar data from other Florida spring runs such as the Silver and Rainbow Rivers and from reference sites at Alexander Springs Run and Juniper Creek will be utilized as a benchmark for comparison.

Water quality data will be compared to relevant water quality Class III criteria to provide a direct measure of impairment. Any water quality exceedances due to natural conditions should be explainable based on the upstream-downstream sampling design. For example, low dissolved oxygen values near spring boils are a natural phenomenon when low oxygen ground waters emerge to the surface. Natural re-aeration rapidly raises these dissolved oxygen levels in the absence of excessive pollution. Estimation of dissolved oxygen re-aeration rates at various locations within the Wekiva River System will allow an analysis of how this natural re-aeration is being affected by internal and external sources of organic matter. If nutrient levels are elevating rates of algal production and deposition of reduced organic matter, then dissolved oxygen levels may be depressed below natural levels.

Nitrate assimilation rates within each of the four stream segments will also be estimated by this work plan. This is an important service that these spring runs are providing that helps to protect the downstream water quality of the St. Johns River, but at some cost to the existing ecological balance within the aquatic system. Nutrient assimilation rates may be impaired by multiple stressors acting within the aquatic ecosystem. If higher nitrate assimilation rates are detected in the Wekiva River and Rock Springs Run stream reaches compared to the reference sites, this finding in concert with increased rates of primary productivity may be a convincing sign of impairment.

It is considered likely that any impairment detected in the Wekiva River System is a cumulative response to multiple pollutants and physical stressors. For this reason it may not be possible to conclusively prove a cause-and-effect relationship between specific pollutants and specific indicators of impairment. It is more likely that any impairment of the natural system that is documented will be assignable to a variety of likely pollutants/stressors. A conceptual system model will need to be prepared to illustrate the state-of-the-art understanding of causative pathways between pollutant stressors and the structure and function of the aquatic ecosystem. At best this assignment of responsibility between specific pollutants and impairment will indicate an estimated percent contribution by each of the multiple causative factors. Analysis of variance will be helpful in documenting the statistical strength of any significant correlations that are discovered.

5.3 Identify Pollutants and Stressors of Concern

Existing and new water quality data from the Wekiva River System will be examined for quantification of historic and current nutrient concentrations and loads. Water quality at upstream stations (below spring boils and the stream segments nearer urban and built-up areas) will be compared to ambient water quality data from other Florida streams to detect any nutrients with concentrations that are above normal values. Regression analysis will be used to determine if there are temporal trends of increasing or decreasing levels of nutrient enrichment. Nutrients may have been released at higher concentrations or loads in the past and may still be resulting in lingering sources of impairment to the

existing river system. This lag-time response is especially likely due to historic levels of ground water contamination and the observed long travel times before this water enters the Wekiva River and Rock Springs Run through the upstream spring boils.

Water quality data collected from upstream and downstream mass balance stations will be examined and compared to data from the stream segment stations to look for significant differences that may document inputs or assimilation of identified pollutants. For example, pollutants loads from the Altamonte Springs WWTP upstream in the Little Wekiva River contribute to elevated nitrogen and phosphorus levels within the mid-section of that river. Downstream data may or may not indicate that those loads are fully assimilated or that they are causing and contributing to impairment of important biological and aesthetic functions.

Nutrient loads from the surrounding watershed basins to the Wekiva River System will be estimated. Existing and historic land use data will be used in connection with published unit nutrient loading rates, event-mean pollutant concentrations, and average rainfall amounts to estimate the non-point source inputs of particulate and dissolved nutrients into each of the streams at various locations. These estimated pollutant loads will be compared to the actual water quality data measured in the streams to help allocate internal versus external sources of these potential pollutants.

5.4 Estimate Acceptable Pollutant Concentration Target

If specific nutrients are shown to be singly or in combination resulting in impairment of designated beneficial uses of either the Wekiva River or Rock Springs Run aquatic ecosystems, the level of each pollutant that is causing impairment will be estimated using the regression models described above. For example, if nitrate is found to be directly correlated with ecosystem gross primary productivity and that the relationship is significant over a range of concentrations and productivity levels that span the scale from reference sites to eutrophic sites, then this regression model will be used to estimate the nitrate concentration below which there is no significant impairment in terms of an imbalance in natural populations of aquatic flora and fauna.

5.5 Estimation of Existing Pollutant Loads Causing Impairment

Nutrient loads and concentrations acting on the Wekiva River System will be quantified or estimated as part of the proposed work plan described in Section 4 above. For nutrients, overall mass balance estimates of loads and assimilation rates will be estimated for the specific stream reaches in the Wekiva River, Rock Springs Run, Alexander Springs Creek, and Juniper Creek. For any nutrients found to be correlated with impairment the actual concentration or level will be estimated that no longer would result in statistically significant (measurable) impairment. This level will be the target concentration that has no significant impact on achieving the designated beneficial uses of the aquatic ecosystems. Existing self-cleansing processes such as nutrient assimilation and plant re-growth will be factored into this estimation of acceptable nutrient concentrations.

5.6 Relationship between Pollutant Loading Rates and In-Stream Concentrations

A simplified stream model will be constructed to relate nutrient mass loading rates to in-stream nutrient concentrations. This model will only include as much complexity as can be supported from readily available information. This model may include estimated water and associated nutrient inputs from springs, non-point source runoff, tributaries (such as the Little Wekiva River), and from atmospheric inputs (wet and dry deposition). Nutrient transformations may be included using published reaction rates. If adequate rate constants for nutrient conversions are not available, this model may only be able to estimate the relationship between mass loads and concentrations for total nitrogen and total phosphorus.

5.7 Estimation of Necessary Pollutant Load Reduction

Nutrient PLRGs for the Wekiva River and Rock Springs Run will be estimated as the difference between the existing or anticipated future pollutant load and the estimated load that will result in in-stream nutrient concentrations at which no impairment is likely to occur. Nutrient PLRGs will be recommended for any nutrient forms for which impairment is already occurring or for which impairment is considered to be likely in light to existing increasing trends in pollutant loading rates.

The final report from this project will list specific nutrients (if any) that are impairing the ecological conditions within the Wekiva River System. It will also document the impaired designated uses of these water bodies (if any).

The Wekiva River and its principal tributaries are an important and possibly fragile natural resource in central Florida. While the Wekiva River System's natural beauty has attracted development of the surrounding uplands and the attention of thousands of loving recreationalists, this attraction could prove chronically or acutely harmful if unchecked. The Wekiva River System Nutrient PLRG Work Plan will provide an improved factual basis for quantifying this potentially damaging relationship between humans and the natural environment occupying this region.

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Appendix A

National Wetland Inventory Data for the Wekiva River System and Reference Sites

APPENIDX A1

NATIONAL WETLAND INVENTORY SUMMARY FOR SURFACE WATER BASINS WITHIN THE WEKIVA RIVER SYSTEM

	BASIN (Areas in Acres)						
ATTRIBUTE	Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	Total
LACUSTRINE							
LIMNETIC							
L1UBH	373	32.7	124	---	80.3	303	913
L1UBHx	7.71	---	5.87	---	2.94	0.282	16.8
LITTORAL							
L2AB3H	5.82	---	---	---	---	3.53	9.35
PALUSTRINE							
AQUATIC BED							
PAB3H	23.6	115	5.22	32.6	1.08	35.4	213
PAB3Hx	---	---	3.27	---	---	---	3.27
PAB4F	---	0.427	---	---	---	---	0.427
PAB4G	---	0.838	---	---	---	---	0.838
PAB4H	3.50	5.43	0.612	---	---	0.623	10.2
PAB4Hx	0.732	---	3.58	---	---	0.166	4.48
EMERGENT							
PEM1A	6.65	26.5	---	---	---	17.5	50.7
PEM1Ad	27.5	---	---	---	---	---	27.5
PEM1C	89.7	64.0	17.7	23.6	1.22	39.1	235
PEM1Cd	18.3	---	---	---	---	---	18.3
PEM1F	126	153	57.1	20.4	14.1	158	528
PEM1Fx	0.965	0.175	---	---	---	1.41	2.55
PEM1G	12.9	75.2	---	23.9	---	31.6	144
PFO1/3A	---	69.1	---	---	---	---	69.1
PFO1/3C	122	1,718	113	13.1	5.74	42.8	2,015
PFO1/4A	347	355	4.73	12.0	---	---	719
PFO1/4C	614	133	27.5	21.9	---	17.2	814
PFO1A	4.99	30.6	29.8	4.66	---	10.0	80.2
PFO1Ad	---	---	1.35	---	---	---	1.35
PFO1C	1,232	150	604	---	16.1	32.8	2,034
PFO2/3C	44.3	10.9	---	---	---	15.0	70.3
PFO3B	16.9	---	19.0	---	---	---	35.9
PFO3C	8.52	13.4	21.0	4.19	---	---	47.1
PFO3Cd	0.827	---	---	---	---	---	0.827
PFO4A	5.18	188	11.0	---	---	---	204
PFO4B	10.1	---	---	---	---	---	10.1
PFO4C	14.4	17.6	---	---	---	---	32.0
PFO6C	4,456	2,623	1,684	167	---	64.6	8,995
PFO6F	65.6	---	0.547	---	---	7.82	74.0
PFO7A	32.6	---	17.5	---	0.012	0.098	50.2
PFO7B	91.5	63.9	14.4	---	---	---	170
PFO7C	28.7	14.1	16.5	0.760	---	13.5	73.6
SCRUB/SHRUB							
PSS1/3C	---	---	2.44	8.31	---	15.2	26.0
PSS1/3F	---	---	---	---	---	39.3	39.3
PSS1C	35.3	5.83	1.73	1.06	---	11.3	55.2
PSS1F	13.1	6.69	1.55	30.4	---	28.9	80.6
PSS3/1C	6.27	---	---	---	---	---	6.27
PSS3B	61.6	5.48	---	---	---	1.41	68.5
PSS3C	---	22.3	---	22.8	---	14.2	59.3
PSS7C	---	---	---	---	---	0.838	0.838
UNCONSOLIDATED BOTTOM							
PUBF	---	---	---	---	---	1.18	1.18
PUBH	37.0	132	21.6	1.28	30.6	115	338
PUBHh	---	---	1.02	---	---	0.829	1.84
PUBHx	42.6	24.1	53.8	3.34	0.281	24.7	149
UNCONSOLIDATED SHORE							
PUSCx	3.86	1.69	---	---	---	---	5.55
RIVERINE							
R2AB3Hx	---	---	26.0	---	---	---	26.0
R2AB4H	4.29	18.3	2.99	---	---	---	25.5
R2UBH	363	40.8	18.0	---	0.161	0.311	422
R2UBHx	3.49	---	---	---	---	---	3.49
U	13,089	15,323	6,679	1,059	734	3,415	40,298
UNKNOWN							
no data	0.009	---	---	---	---	0.191	0.200
Total	21,450	21,439	9,591	1,451	886	4,463	59,280

Source: SJRWMD National Wetland Inventory

APPENIDX A2

NATIONAL WETLAND INVENTORY SUMMARY FOR SURFACE WATER BASINS WITHIN THE REFERENCE BASINS

	SITE	
ATTRIBUTE	JUNIPER	ALEXANDER
LACUSTRINE		
LIMNETIC		
L1OWH	275	---
LITTORAL		
L2AB3H	58.2	---
L2OWH	0.033	---
PALUSTRINE		
AQUATIC BED		
PAB3/EM1H	31.4	0.718
PAB3H	196	10.7
EMERGENT		
PEM/FO1C	2.95	---
PEM/SS1C	7.21	---
PEM/SS1F	13.6	---
PEM1/SS3C	3.45	---
PEM1A	189	2.40
PEM1C	52.8	7.47
PEM1Ch	10.0	---
PEM1F	510	66.2
PEM1G	14.6	---
PEM1H	40.2	---
PFO1/3A	12.1	---
PFO1/4A	80.7	---
PFO1A	---	20.3
PFO1C	---	37.3
PFO3/4A	4.58	---
PFO3/4C	256	237
PFO3/6C	196	---
PFO3C	---	37.5
PFO3F	35.9	---
PFO4/3A	231	---
PFO4/3C	1.14	8.98
PFO4A	125	---
PFO4C	161	---
PFO6/3C	300	31.0
PFO6/3F	1,476	1,668
PFO6/7C	788	---
PFO6C	6.91	---
PFO6F	---	63.2
PFO7/1C	56.8	10.5
OPEN WATER		
POW/EM1H	21.5	10.0
POWH	112	1.77
SCRUB/SHRUB		
PSS1/3A	26.5	---
PSS1/3C	3.73	---
PSS1/3F	14.2	---
PSS1/FO4A	10.3	---
PSS3C	2.48	3.41
PSS3F	---	73.4
PSS7F	0.745	---
RIVERINE		
R2AB3H	---	12.3
R2OW/AB3H	49.4	137
R2OWH	0.100	30.3
UPLAND		
U	41,240	5,701
Total	46,615	8,170

Source: SJRWMD National Wetland Inventory

Appendix B

Historic Land Use Data for the Wekiva River System, Contributing Watershed, and Reference Sites

APPENDIX B-1
1973 LAND USE SUMMARY

LAND USE	BASIN (Areas in Acres) Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	Total
URBAN & BUILT-UP							
Industrial	---	---	5.00	---	---	---	5.00
Mining	---	30.9	14.7	---	---	---	45.6
Open Land	155	73.5	387	---	---	146	761
Recreation	7.18	---	137	---	---	---	144
Residential High Density	---	---	69.2	---	---	---	69.2
Residential Low Density	218	786	167	---	34.8	20.8	1,226
Residential Medium Density	560	37.6	1,542	---	---	---	2,139
TOTAL	940	927.8	2,321	---	34.8	167	4,390
AGRICULTURE							
Citrus Groves	494	6,783	660	---	186	1,778	9,901
Clear-cut Areas	567	13.9	---	0.925	---	---	582
Confined Feeding	---	295	---	---	---	---	295
Improved Pasture	1,390	1,506	933	21.1	190	35.5	4,076
Nurseries & Special Crops	---	0.001	---	---	---	---	0.001
Planted Pine	9.19	0.825	43.5	---	---	---	53.5
TOTAL	2,461	8,599	1,637	22.1	375	1,814	14,907
RANGELAND							
Grassy Scrub	2,028	1,759	455	696	---	227	5,164
TOTAL	2,028	1,759	455	696	---	227	5,164
UPLAND FORESTS							
Mesic Hammock	521	250	117	---	---	823	1,711
Pine Flatwood	6,308	1,839	462	78.6	4.92	397	9,089
Sand Pine Scrub	---	---	---	---	---	---	0.00
Sandhill Communities	800	1,479	982	48.6	309	100	3,720
Xeric Hammock	---	---	---	---	---	81.5	81.5
TOTAL	7,629	3,568	1,561	127	314	1,402	14,602
WATER							
Lakes & Ponds	403	221	116	---	74.8	464	1,280
Rivers	1.18	---	---	---	---	---	1.18
TOTAL	404	221	116	---	74.8	464	1,281
WETLANDS							
Cypress Dome	2.86	---	---	---	---	---	2.86
Fresh Water Marsh	166	224	134	30.5	46.1	329	929
Hardwood Swamp (Riverine	7,067	5,936	3,067	392	---	1.62	16,464
Hydric Hammock	423	202	249	183	40.6	59.5	1,157
Riverine Cypress	330	---	---	---	---	---	330
Wet Prairies	---	---	7.96	---	---	---	7.96
TOTAL	7,989	6,362	3,458	606	86.7	390	18,891
BARREN LAND							
Borrow Pit	---	3.04	---	---	---	---	3.04
TOTAL	---	3.04	---	---	---	---	3.04
TRANSPORTATION, COMMUNICATIONS, UTILITIES							
Utilities & Communication	---	---	42.5	---	---	---	42.5
TOTAL	---	---	42.5	---	---	---	42.5
Total	21,450	21,439	9,591	1,451	0,886	4,463	59,280

Source: SJRWMD Land Use and Land Cover (1973)

APPENDIX B-2
1990 LAND USE SUMMARY

LAND USE	LUCODE	BASIN (Areas in Acres) Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	Total
URBAN & BUILT-UP	1000							
Residential, low density - less than 2 dwelling units/acre	1100	1,009	1,420	1,731	---	278	383	4,822
Fixed single family units (low density)	1110	95.7	111	---	5.71	---	---	213
Residential, medium density - 2-5 dwelling units/acre	1200	2,662	763	2,217	---	4.21	203	5,849
Fixed single family units (medium density)	1210	227	---	---	---	---	---	227
Mobile home units (medium density)	1220	---	---	---	---	---	8.47	8.47
Residential, high density - 6 or more dwelling units/acre	1300	155	125	599	---	---	73.3	952
Mixed units (fixed and mobile home, high density)	1350	50.5	---	---	---	---	---	50.5
Commercial and services	1400	96.6	25.9	524	---	---	5.70	652
Industrial	1500	10.6	---	---	---	---	26.2	36.8
Food processing	1510	---	11.7	---	---	---	---	11.7
Other light industrial	1550	---	28.0	58.9	---	---	---	86.9
Other heavy industrial	1560	---	---	22.5	---	---	---	22.5
Clays	1611	---	56.6	---	---	---	---	56.6
Sand & gravel pits (must be active)	1620	---	---	5.46	---	---	42.1	47.6
Holding ponds	1660	---	---	1.46	---	---	---	1.46
Abandoned lands	1670	---	70.8	16.9	---	---	---	87.7
Institutional	1700	39.4	22.2	99.5	---	---	---	161
Recreational	1800	14.5	16.3	43.0	---	---	16.7	90.5
Golf courses	1820	378	167	127	---	---	141	813
Parks and zoos	1850	8.17	68.3	---	---	---	---	76.5
Open land	1900	93.8	---	70.1	---	---	77.7	241
Inactive land with street pattern but no structures	1920	66.4	146	239	---	2.57	48.8	502
TOTAL		4,907	3,032	5,755	5.71	285	1,026	15,010
AGRICULTURE	2000							
Cropland and pastureland	2100	---	51.2	---	---	---	---	51.2
Improved pastures (monocult, planted forage crops)	2110	303	670	7.87	---	44.6	203	1,228
Unimproved pastures	2120	18.5	722	133	---	0.366	6.01	880
Woodland pastures	2130	104	286	---	---	31.0	---	421
Row crops	2140	---	---	---	---	---	5.48	5.48
Field crops	2150	856	148	---	24.9	30.4	---	1,060
Mixed crop	2160	---	213	---	---	---	---	213
Citrus groves	2210	54.5	400	10.1	---	1.80	458	924
Abandoned tree crops	2240	---	613	---	---	---	12.9	626
Feeding operations	2300	---	8.15	---	---	---	---	8.15
Cattle feeding operations	2310	---	7.11	---	---	---	---	7.11
Nurseries and vineyards	2400	---	7.77	---	---	---	---	7.77
Tree nurseries	2410	---	5.21	---	---	---	---	5.21
Ornamentals	2430	27.9	920	24.2	---	---	15.7	988
Horse farms	2510	13.1	272	---	---	---	---	285
Other open lands - rural	2600	---	29.8	---	---	---	---	29.8
Fallow cropland	2610	63.7	2,901	128	---	75.0	274	3,442
TOTAL		1,441	7,254	304	24.9	183	975	10,182
RANGELAND	3000							
Herbaceous range	3100	22.5	8.35	3.22	---	26.8	---	60.8
Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub oak)	3200	219	510	8.13	25.5	---	179	942
Mixed rangeland	3300	452	916	71.6	581	---	344	2,365
TOTAL		693	1,435	83.0	607	26.8	523	3,368
UPLAND FORESTS	4000							
Pine flatwoods	4110	2,542	1,894	48.1	124	17.7	227	4,854
Longleaf pine - xeric oak	4120	455	274	8.93	14.0	---	147	900
Sand pine	4130	164	398	---	---	---	---	562
Upland hardwood forests	4200	5.81	33.6	---	---	---	---	39.4
Upland mixed coniferous/hardwood	4340	1,043	1,198	121	271	198	481	3,311
Tree plantations	4400	1,503	---	124	---	18.4	97.9	1,744
Forest regeneration	4430	269	---	---	---	---	10.6	279
TOTAL		5,981	3,798	302	409	234	964	11,688
WATER	5000							
Streams and waterways	5100	318	37.3	20.5	---	---	---	376
Lakes	5200	83.7	52.8	128	---	89.2	324	677
Reservoirs - pits, retention ponds, dams	5300	304	17.3	1.60	---	---	11.5	334
Reservoirs less than 10 acres	5340	46.3	20.4	99.9	---	2.83	37.8	207
TOTAL		751	128	250	---	92.0	374	1,594

APPENDIX B-2
1990 LAND USE SUMMARY

LAND USE	LUCODE	BASIN (Areas in Acres)						Total
		Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	
WETLANDS	6000							
Bay swamp (if distinct)	6110	7.92	102	---	31.0	---	20.5	162
River/lake swamp (bottomland, may include cypress)	6150	4,678	4,624	1,979	---	---	12.3	11,294
Wetland coniferous forests	6200	16.4	32.7	---	---	---	---	49.1
Cypress (if distinct as in domes or pure stands)	6210	8.77	3.94	1.30	0.517	---	0.425	14.9
Wetland forested mixed	6300	2,371	470	464	218	27.5	112	3,662
Freshwater marshes	6410	198	309	63.1	92.2	13.3	159	835
Wet prairies	6430	74.9	106	1.40	4.90	16.5	34.1	238
Emergent aquatic vegetation	6440	105	36.0	6.36	0.393	2.84	73.7	224
Mixed scrub-shrub wetland	6460	131	80.2	32.8	57.9	4.98	163	470
unknown	6640	---	---	2.92	---	---	---	2.92
TOTAL		7,591	5,764	2,552	404	65.2	575	16,952
BARREN LAND	7000							
Disturbed land	7400	---	3.18	---	---	---	---	3.18
TOTAL		---	3.18	---	---	---	---	3.18
TRANSPORTATION, COMMUNICATIONS, UTILITIES	8000							
Roads and highways (divided 4-lanes with medians)	8140	14.2	15.0	203	---	---	21.2	253
Oil, water, or gas long distance transmission lines	8170	---	10.8	---	---	---	---	10.8
Electrical power facilities	8310	0.777	---	3.46	---	---	---	4.24
Electrical power transmission lines	8320	42.4	---	63.2	---	---	---	106
Water supply plants	8330	26.4	---	16.9	---	---	---	43.3
Sewage treatment	8340	---	---	59.3	---	---	6.11	65.4
TOTAL		83.8	25.8	346	---	---	27.4	483
UNKNOWN								
No Data	0	---	---	0.002	---	---	---	0.002
TOTAL		---	---	0.002	---	---	---	0.002
Total		21,450	21,439	9,591	1,451	886	4,463	59,280

Source: SJRWMD Land Use and Land Cover (1990)

APPENDIX B-3
1995 LAND USE SUMMARY

LAND USE	LUCODE	BASIN (Areas in Acres) Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	Total
URBAN & BUILT-UP	1000							
Residential, low density - less than 2 dwelling units/acre	1100	806	1,883	526	5.34	254	602	4,076
Residential, medium density - 2-5 dwelling units/acre	1200	3,470	647	3,363	---	52.6	227	7,760
Commercial and services	1400	71.0	8.47	630	---	---	42.8	753
Other light industrial	1550	---	10.7	56.4	---	---	13.0	80.1
Clays	1611	---	51.3	---	---	---	---	51.3
Sand & gravel pits	1620	---	9.55	4.48	---	---	---	14.0
Abandoned lands	1670	---	70.4	---	---	---	---	70.4
Institutional	1700	61.7	22.8	85.8	---	---	41.5	212
Recreational	1800	119	18.4	50.5	---	11.8	49.3	249
Golf courses	1820	274	157	250	---	---	128	810
Parks and zoos	1850	---	121	---	---	---	---	121
Open land	1900	40.4	104	248	---	---	39.2	431
Inactive land with street pattern but no structures	1920	61.3	57.7	26.2	---	---	106	251
TOTAL		5,130	3,290	6,012	5.34	318	1,334	16,090
AGRICULTURE	2000							
Improved pastures (monocult, planted forage crops)	2110	149	1,462	4.87	---	58.6	30.4	1,705
Unimproved pastures	2120	---	119	---	---	---	6.01	125
Woodland pastures	2130	0.594	52.7	---	---	31.2	---	84.5
Row crops	2140	---	---	---	---	---	12.5	12.5
Field crops	2150	1,099	415	0.116	25.0	18.0	210	1,768
Citrus groves	2210	23.8	204	---	---	38.3	23.8	290
Abandoned tree crops	2240	66.6	442	---	---	28.2	360	897
Poultry feeding operations	2320	---	---	---	---	---	---	0.00
Nurseries and vineyards	2400	---	---	---	---	---	---	0.00
Tree nurseries	2410	---	6.35	---	---	---	---	6.35
Ornamentals	2430	37.1	988	5.35	---	5.16	19.6	1,055
Shade ferns	2431	---	---	---	---	---	---	0.00
Hammock ferns	2432	---	---	---	---	---	---	0.00
Floriculture	2450	---	6.35	---	---	---	---	6.35
Specialty farms	2500	---	---	---	---	---	---	0.00
Horse farms	2510	6.59	284	---	---	---	---	291
Fallow cropland	2610	---	58.7	---	---	---	44.0	103
TOTAL		1,383	4,041	10.3	25.0	180	707	6,346
RANGELAND	3000							
Herbaceous range	3100	169	985	11.1	220	35.5	63.5	1,484
TOTAL		677	2,734	18.6	446	67	353	4,296
UPLAND FORESTS	4000							
Pine flatwoods	4110	2,553	1,612	14.3	216	---	148	4,543
Longleaf pine - xeric oak	4120	468	182	6.89	---	58.0	46.7	761
Sand pine	4130	268	468	36.3	---	---	---	772
Upland hardwood forests	4200	0.932	44.0	20.5	---	6.73	22.6	94.7
Xeric oak	4210	62.6	---	45.8	---	86.9	37.8	233
Coniferous pine	4410	652	129	55.4	36.9	---	171	1,044
Forest regeneration	4430	344	717	11.1	---	---	216	1,288
TOTAL		5,732	5,070	387	507	168	1,040	12,904
WATER	5000							
Streams and waterways	5100	226	5.31	15.9	---	0.076	0.077	248
Lakes	5200	368	155	148	37.8	60.7	367	1,137
Reservoirs - pits, retention ponds, dams	5300	21.5	---	---	---	---	19.8	41.2
Reservoirs less than 10 acres	5340	78.0	18.2	96.8	---	---	66.1	259
TOTAL		694	178	261	37.8	60.8	453	1,685
WETLANDS	6000							
Bay swamp (if distinct)	6110	76.4	2,949	46.1	12.1	---	5.66	3,089
River/lake swamp (bottomland, may include cypress)	6150	5,415	1,183	1,789	58.3	30.7	1.20	8,476
Mixed wetland hardwoods	6170	84.7	---	133	---	---	---	218
Wetland coniferous forests	6200	13.2	68.3	5.65	---	---	8.80	95.9
Cypress (if distinct as in domes or pure stands)	6210	1.88	---	0.953	---	---	0.229	3.06
Wetland forested mixed	6300	1,693	1,362	480	198	---	135	3,868
Freshwater marshes	6410	228	248	68.7	65.1	23.4	144	778
Emergent aquatic vegetation	6440	77.2	52.1	6.52	---	39.0	75.7	251
TOTAL		7,702	6,085	2,560	429	93.1	499	17,369

APPENDIX B-3
1995 LAND USE SUMMARY

LAND USE	LUCODE	BASIN (Areas in Acres)						Total
		Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	
BARREN LAND	7000							
Sand other than beaches	7200	---	---	---	---	---	---	0.00
Rural land in transition without positive indicators of intended activity	7410	9.00	4.45	6.87	---	---	44.2	64.5
Borrow areas - associated with nearby fill areas for construction	7420	---	---	---	---	---	---	0.00
Spoil areas	7430	---	---	---	---	---	---	0.00
TOTAL		9.00	4.45	6.87	---	---	44.2	65
TRANSPORTATION, COMMUNICATIONS, UTILITIES	8000							
Airports	8110	---	---	---	---	---	---	0.00
Roads and highways (divided 4-lanes with medians)	8140	43.9	21.4	212	---	---	14.3	291
Communications	8200	---	---	---	---	---	3.13	3.13
Electrical power facilities	8310	1.22	---	5.13	---	---	1.43	7.77
Electrical power transmission lines	8320	35.5	---	45.8	---	---	0.373	81.6
Water supply plants	8330	---	15.8	19.2	---	---	4.70	39.6
Sewage treatment	8340	42.1	---	52.0	---	---	8.73	103
TOTAL		123	37.2	334	---	---	32.6	526
Total		21,450	21,439	9,591	1,451	886	4,463	59,280

Source: SJRWMD Land Use and Land Cover (1995)

APPENDIX B-4
2000 LAND USE SUMMARY

LAND USE	LUCODE	BASIN (Areas in Acres) Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	Total
URBAN & BUILT-UP	1000							
Residential, low density - less than 2 dwelling units/acre	1100	777	1,438	526	4.76	209	428	3,382
Rural residential	1180	---	227	---	---	---	55.8	283
Low density under construction	1190	---	54.1	---	---	---	---	54.1
Residential, medium density - 2-5 dwelling units/acre	1200	3,684	564	3,421	---	116	618	8,402
Medium density under construction	1290	405	---	55.6	---	---	203	664
Residential, high density - 6 or more dwelling units/acre	1300	223	238	831	---	---	117	1,408
High density under construction	1390	---	12.9	---	---	---	5.16	18.1
Commercial and services	1400	115	8.47	708	---	---	77.7	909
Cemeteries	1480	---	---	7.89	---	---	---	7.89
Other light industrial	1550	---	---	61.4	---	---	13.0	74.4
Extractive	1600	13.2	3.03	---	---	---	---	16.2
Clays	1611	---	51.3	---	---	---	---	51.3
Sand & gravel pits (must be active)	1620	---	9.55	---	---	---	---	9.55
Abandoned mining lands	1670	---	66.8	---	---	---	---	66.8
Institutional	1700	61.4	22.8	85.0	---	---	43.5	213
Recreational	1800	71.2	15.7	54.9	---	---	29.5	171
Golf courses	1820	566	312	331	---	---	162	1,371
Marinas & fish camps	1840	5.61	---	---	---	---	---	5.61
Community recreational facilities	1860	2.05	---	3.20	---	---	9.48	14.7
Open land	1900	8.88	254	90.7	---	---	---	354
Inactive land with street pattern but no structures	1920	6.08	---	---	---	---	9.84	15.9
TOTAL		5,938	3,277	6,175	4.76	325	1,771	17,492
AGRICULTURE	2000							
Improved pastures (monocult, planted forage crops)	2110	164	1,609	4.87	---	61.5	138	1,977
Unimproved pastures	2120	17.5	148	---	---	---	50.6	216
Woodland pastures	2130	0.594	173	---	---	31.2	9.87	215
Row crops	2140	---	---	---	---	---	5.70	5.70
Field crops	2150	383	286	0.116	20.4	29.8	66.8	786
Tree crops	2200	---	7.43	---	---	---	---	7.43
Citrus groves	2210	38.1	103	---	---	36.1	5.05	183
Abandoned tree crops	2240	61.0	69.6	---	---	18.5	105	254
Cattle feeding operations	2310	---	2.85	---	---	---	---	2.85
Nurseries and vineyards	2400	---	---	---	---	3.77	1.81	5.58
Tree nurseries	2410	---	---	---	---	---	7.78	7.78
Ornamentals	2430	37.1	966	5.36	---	5.16	38.3	1,052
Shade ferns	2431	---	25.8	---	---	---	---	25.8
Floriculture	2450	---	6.35	---	---	---	---	6.35
Horse farms	2510	7.10	285	---	---	---	---	292
Fallow cropland	2610	---	---	---	---	---	11.9	11.9
TOTAL		708	3,682	10.3	20.4	186	441	5,048
RANGELAND	3000							
Herbaceous upland nonforested	3100	192	1,073	9.94	228	33.6	29.5	1,566
Shrub and brushland (wax myrtle or saw palmetto, occasionally scru	3200	892	569	---	13.3	20.3	62.6	1,557
Mixed upland nonforested	3300	248	612	4.20	213	11.4	148	1,236
TOTAL		1,331	2,254	14.1	454	65.3	240	4,359
UPLAND FORESTS	4000							
Pine flatwoods	4110	1,894	1,649	10.1	215	---	107	3,875
Longleaf pine - xeric oak	4120	421	156	---	---	53.4	46.7	677
Sand pine	4130	549	342	11.6	---	---	---	903
Upland hardwood forests	4200	0.932	65.7	23.5	---	4.61	19.1	114
Xeric oak	4210	56.7	79.3	---	---	82.8	33.0	252
Upland mixed coniferous/hardwood	4340	658	2,113	125	220	16.5	270	3,403
Coniferous pine	4410	276	924	---	37.0	---	129	1,366
Forest regeneration	4430	378	349	---	---	---	172	899
TOTAL		4,233	5,678	171	472	157	778	11,488

APPENDIX B-4
2000 LAND USE SUMMARY

LAND USE	LUCODE	BASIN (Areas in Acres) Wekiva River	Rock Springs Run	Little Wekiva River	Unnamed Drain	Lake Gary Outlet	Yankee Lake Outlet	Total
WATER	5000							
Streams and waterways	5100	222	12.2	15.9	---	0.076	0.077	251
Lakes	5200	373	133	150	10.00	58.5	306	1,031
Open water within a freshwater marsh / Marshy Lakes	5250	---	1.24	---	9.59	---	8.06	18.9
Reservoirs - pits, retention ponds, dams	5300	164	19.0	114	---	---	153	449
Major springs	5500	---	---	0.933	---	---	---	0.933
TOTAL		759	166	281	19.6	58.5	467	1,750
WETLANDS	6000							
Bay swamp (if distinct)	6110	84.1	21.1	21.3	9.61	---	8.82	145
Mixed wetland hardwoods	6170	5,794	4,386	2,161	256	30.7	63.6	12,691
Cypress	6210	406	0.645	0.953	---	---	0.229	408
Hydric pine flatwoods	6250	609	148	19.1	31.1	---	26.9	834
Wetland forested mixed	6300	1,037	1,204	223	4.45	---	68.3	2,536
Freshwater marshes	6410	221	298	78.9	79.4	42.6	148	867
Wet prairies	6430	31.8	92.3	---	0.508	---	23.4	148
Emergent aquatic vegetation	6440	86.0	32.6	5.58	---	20.6	95.7	241
Mixed scrub-shrub wetland	6460	81.9	138	97.0	98.4	---	126	541
TOTAL		8,351	6,319	2,606	480	93.9	561	18,412
BARREN LAND	7000							
Disturbed land	7400	---	12.1	---	---	---	---	12.1
Rural land in transition without positive indicators of intended activity	7410	3.02	14.1	---	---	---	90.6	108
TOTAL		3.02	26.2	---	---	---	90.6	120
TRANSPORTATION, COMMUNICATIONS, UTILITIES	8000							
Roads and highways (divided 4-lanes with medians)	8140	48.3	21.4	220	---	---	58.6	348
Communications	8200	---	---	---	---	---	2.43	2.43
Electrical power facilities	8310	1.22	---	5.13	---	---	1.43	7.77
Electrical power transmission lines	8320	35.5	---	45.8	---	---	3.06	84.3
Water supply plants	8330	---	15.8	19.2	---	---	4.64	39.6
Sewage treatment	8340	42.1	---	43.5	---	---	8.73	94.3
Treatment ponds (non-sewage)	8360	---	---	---	---	---	35.4	35.4
TOTAL		127	37.2	333	---	---	114	612
Total		21,450	21,440	9,591	1,451	886	4,463	59,281

Source: SJRWMD Land Use and Land Cover (2000)

APPENDIX B-5
1973 LAND USE SUMMARY

LAND USE	BASIN (Areas in Acres) Juniper	Alexander	Total
URBAN & BUILT-UP			
Institutional	20.8	---	20.8
TOTAL	20.8	0.00	20.8
AGRICULTURE			
Clear-cut Areas	2,943	324	3,267
Planted Pine	373	369	742
TOTAL	3,316	693	4,010
RANGELAND			
Grassy Scrub	---	46.7	46.7
TOTAL	0.00	46.7	46.7
UPLAND FORESTS			
Mesic Hammock	1,574	64.1	1,639
Pine Flatwood	77.3	2,749	2,826
Sand Pine Scrub	36,302	1,432	37,733
Sandhill Communities	---	296	296
TOTAL	37,953	4,541	42,494
WATER			
Lakes & Ponds	403	12.0	415
Rivers	40.2	288	328
TOTAL	443	300	743
WETLANDS			
Cypress Dome	38.6	---	38.6
Fresh Water Marsh	1,113	32.7	1,146
Hardwood Swamp (Riverine	3,625	2,488	6,113
Wet Prairies	33.0	---	33.0
TOTAL	4,810	2,520	7,330
BARREN LAND			
TOTAL	0.00	0.00	0.00
TRANSPORTATION, COMMUNICATIONS, UTILITIES			
TOTAL	0.00	0.00	0.00
NOT IDENTIFIED			
TOTAL	40.1	63.2	103
Total	46,584	8,164	54,748

Source: SJRWMD Land Use and Land Cover (1973)

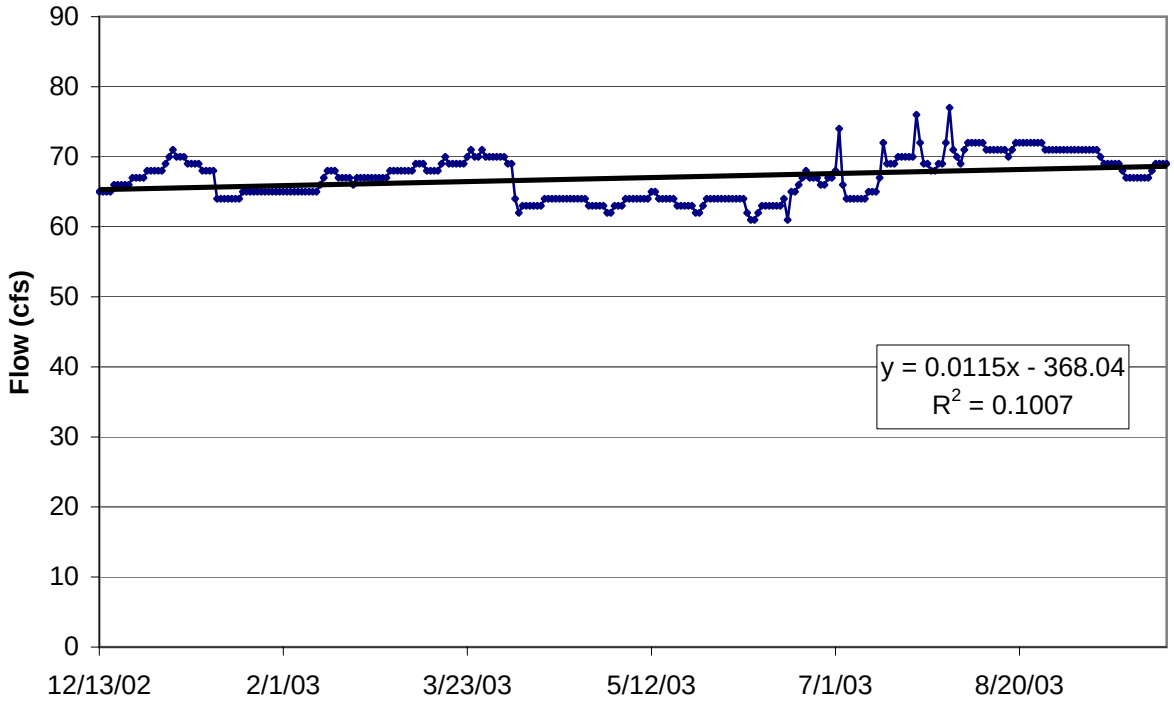
APPENDIX B-6
REFERENCE SITE LAND USE SUMMARY - 1990, 1995, 2000

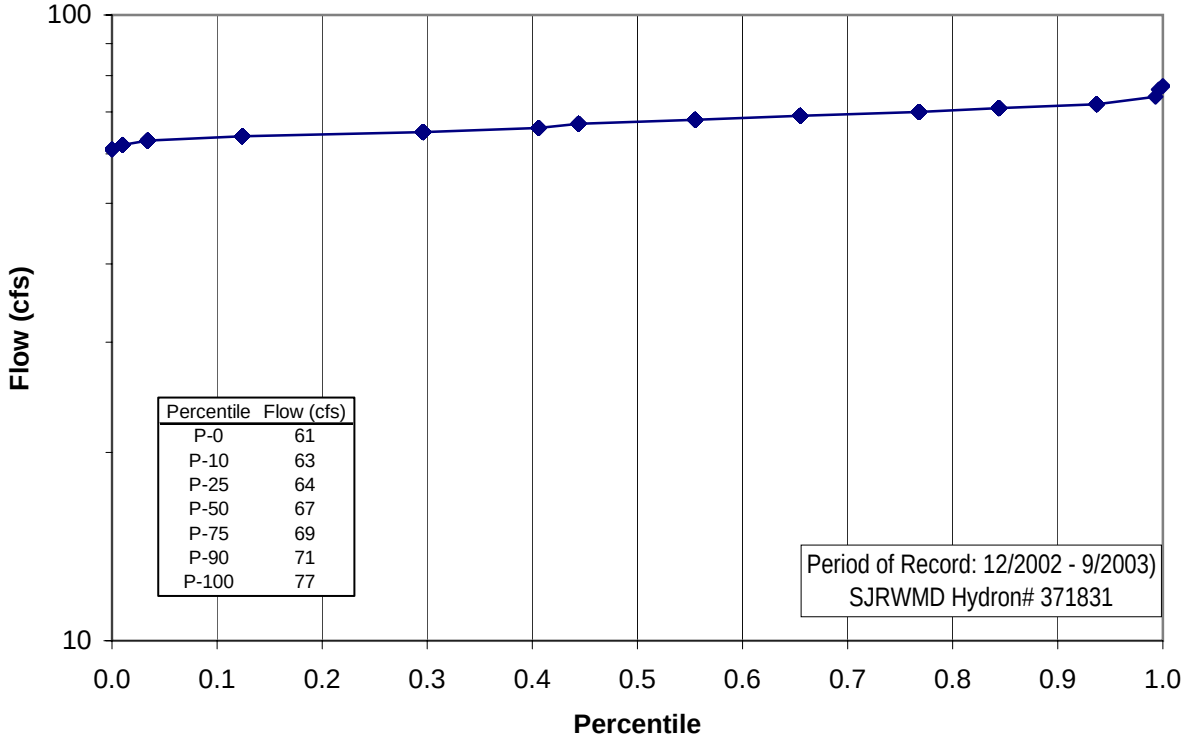
		BASIN (Areas in Acres)					
		Juniper			Alexander		
LAND USE	LUCODE	1990	1995	2000	1990	1995	2000
URBAN & BUILT-UP	1000						
Residential, low density - less than 2 dwelling units/acre	1100	---	5.12	2.14	---	130	115
Fixed Single Family Units	1110	11.4	---	---	42.2	---	---
Mixed units (fixed and mobile home, low density)	1130	---	---	---	62.2	---	---
Commercial and services	1400	62.6	---	---	14.5	---	---
Other light industrial	1550	---	1.04	1.04	---	---	---
Clays	1611	46.6	31.3	26.5	---	---	---
Military	1730	1.50	---	---	---	---	---
Recreational	1800	---	55.4	---	---	17.4	17.4
Marinas & fish camps	1840	---	6.16	6.16	---	---	---
Parks and Zoos	1850	---	---	62.8	---	---	---
TOTAL		122	99.1	98.6	119	148	132
AGRICULTURE	2000						
Improved pastures (monocult, planted forage crops)	2110	---	---	---	68.2	---	---
TOTAL		0.00	0.00	0.00	68.2	0.00	0.00
RANGELAND	3000						
Shrub and brushland (wax myrtle or saw palmetto, occasionally scru	3200	36.7	116	488	43.0	4.03	4.03
Mixed upland nonforested	3300	---	40.6	---	27.2	---	---
TOTAL		36.7	157	488	70.2	4.03	4.03
UPLAND FORESTS	4000						
Upland Coniferous Forests	4100	1.66	---	---	---	---	---
Pine flatwoods	4110	449	4,090	3,802	786	1,786	1,955
Longleaf pine - xeric oak	4120	14.6	264	243	443	390	926
Sand pine	4130	31,010	18.0	15.8	3,365	1,713	408
Upland hardwood forests	4200	---	1,122	---	---	---	---
Upland mixed coniferous/hardwood	4340	1,138	1,260	1,070	353	327	394
Coniferous pine	4410	---	23,325	22,440	---	550	949
Forest regeneration	4430	8,152	10,079	12,005	379	682	773
TOTAL		40,765	40,157	39,576	5,326	5,448	5,406
WATER	5000						
Streams and waterways	5100	48.9	50.9	51.4	129	114	109
Lakes	5200	319	522	588	---	24.4	11.6
Open water within a freshwater marsh / Marshy Lakes	5250	---	---	67.3	---	---	7.09
Reservoirs - pits, retention ponds, dams	5300	---	---	---	---	---	1.12
Reservoirs less than 10 acres	5340	1.23	---	---	1.44	1.12	---
Major springs	5500	0.098	---	---	---	2.27	2.27
TOTAL		369	573	707	130	141	131
WETLANDS	6000						
Bay swamp (if distinct)	6110	36.4	75.3	---	204	368	273
Streams and Lake Swamps (bottomland)	6150	2,700	390	---	1,616	1,037	---
Mixed wetland hardwoods	6170	---	---	3,226	---	15.9	1,769
Wetland coniferous forests	6200	220	71.7	---	---	12.0	---
Cypress	6210	15.4	---	31.1	1.32	1.63	1.63
Pond pine	6220	---	78.7	259	---	---	---
Hydric pine flatwoods	6250	---	---	655	---	---	12.0
Wetland forested mixed	6300	902	3,579	459	477	857	272
Freshwater marshes	6410	632	497	238	80.4	68.8	71.0
Wet prairies	6430	401	421	388	7.11	---	3.71
Emergent aquatic vegetation	6440	56.1	167	176	33.4	41.3	44.6
Mixed scrub-shrub wetland	6460	307	293	258	31.5	20.6	44.5
TOTAL		5,269	5,573	5,689	2,451	2,423	2,491
BARREN LAND	7000						
Rural land in transition without positive indicators of intended activity	7410	---	1.86	1.86	---	---	---
TOTAL		0.00	1.86	1.86	0.00	0.00	0.00
TRANSPORTATION, COMMUNICATIONS, UTILITIES	8000						
Communications	8200	21.2	2.48	2.48	---	---	---
Electrical power transmission lines	8320	---	20.4	20.4	---	---	---
TOTAL		21.2	22.9	22.9	0.00	0.00	0.00
NOT IDENTIFIED							
TOTAL		0.00	0.00	1.04	0.33	0.00	0.00
Total		46,584	46,584	46,585	8,164	8,164	8,164

Source: SJRWMD Land Use and Land Cover (1990, 1995, 2000)

Appendix C

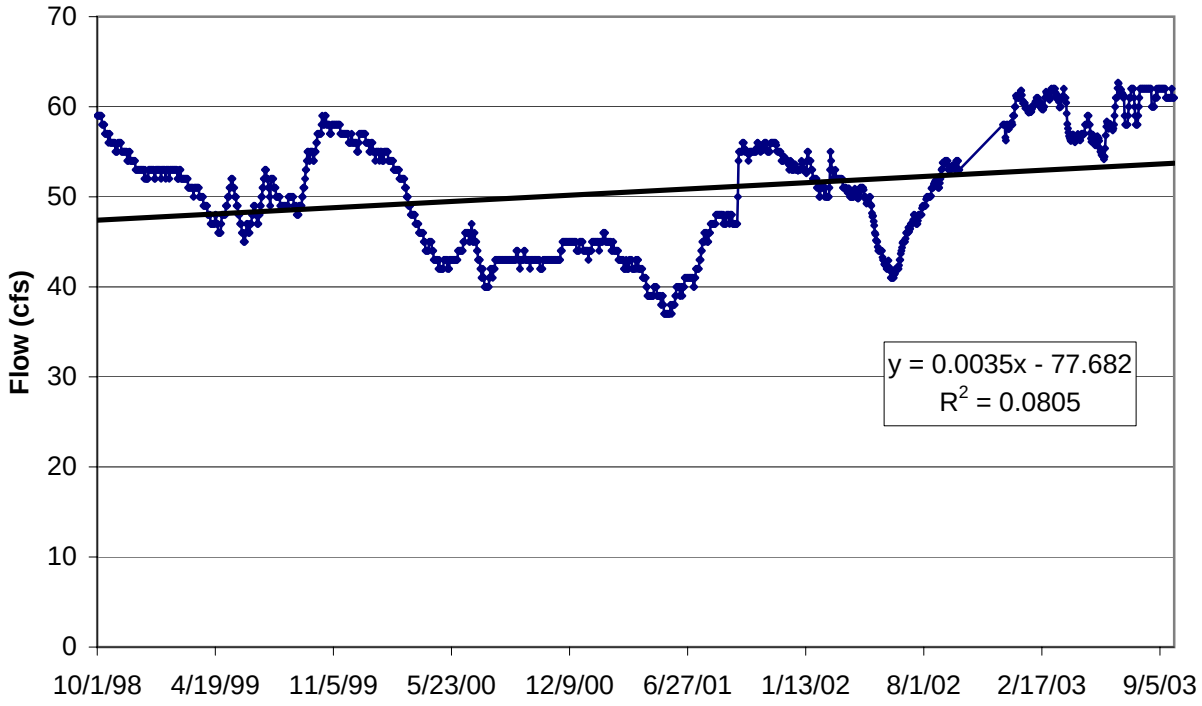
Detailed Flow Time Series and Cumulative Frequency Curves for Springs in the Wekiva River System

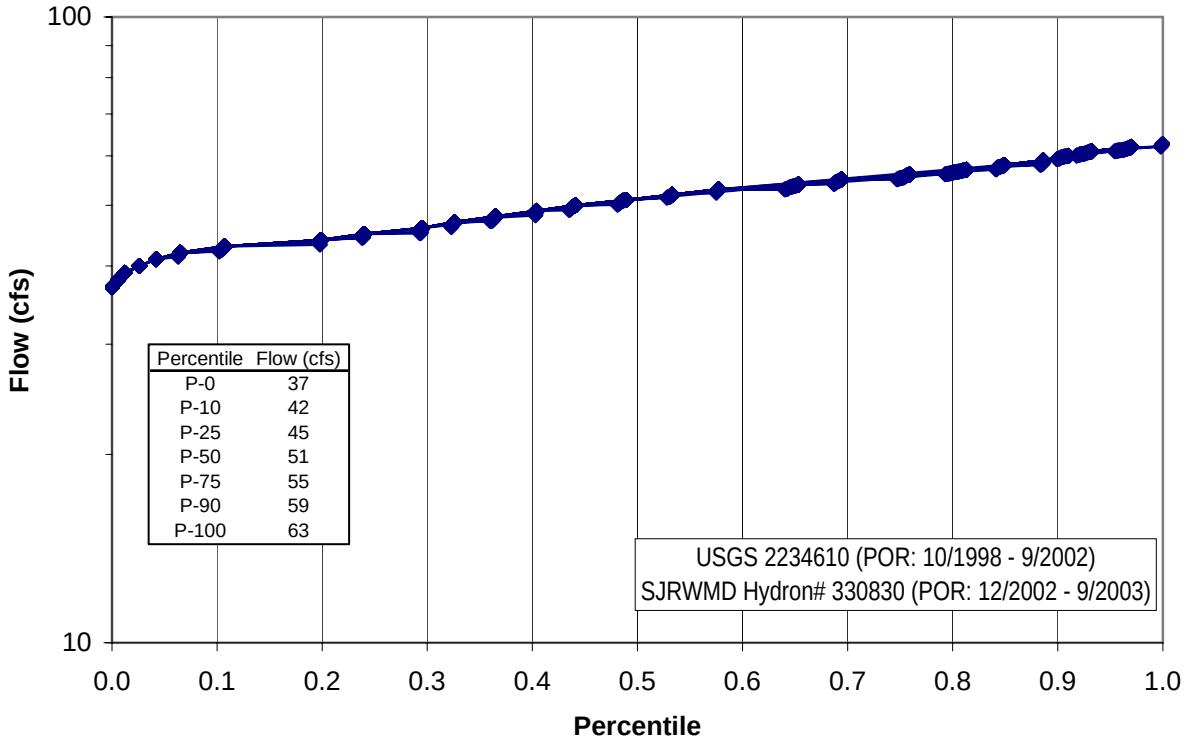




APPENDIX C-1

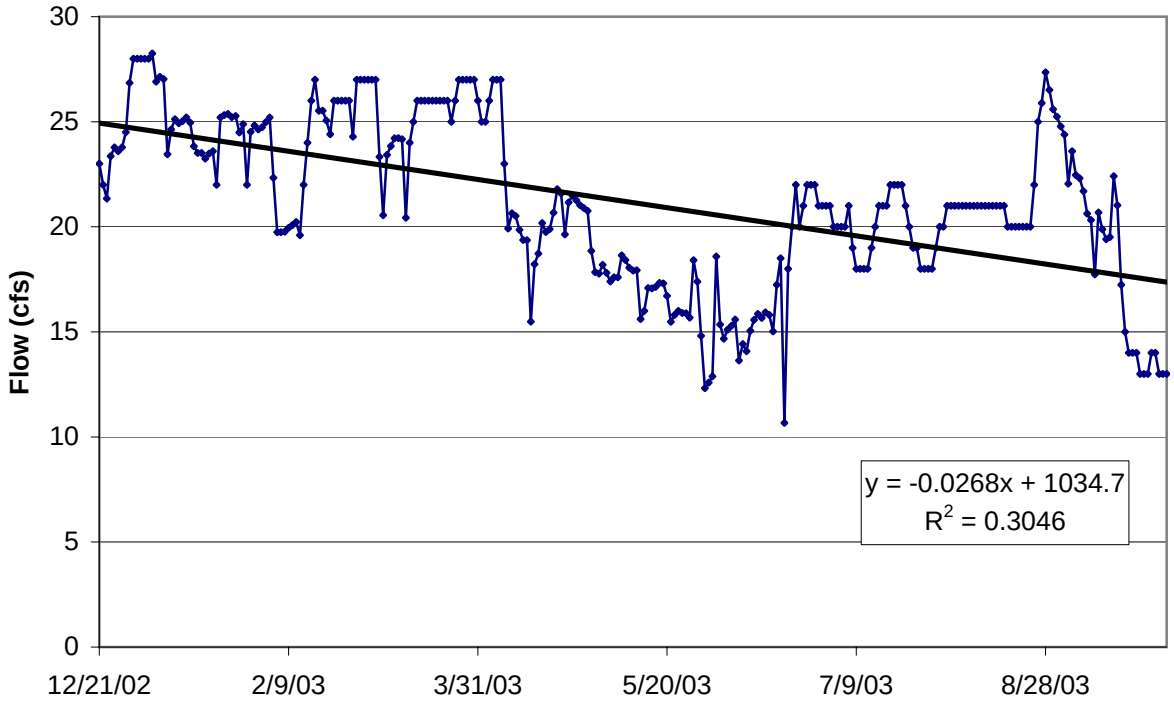
FLOW TIME SERIES AND FREQUENCY CURVE FOR WEKIWA SPRINGS

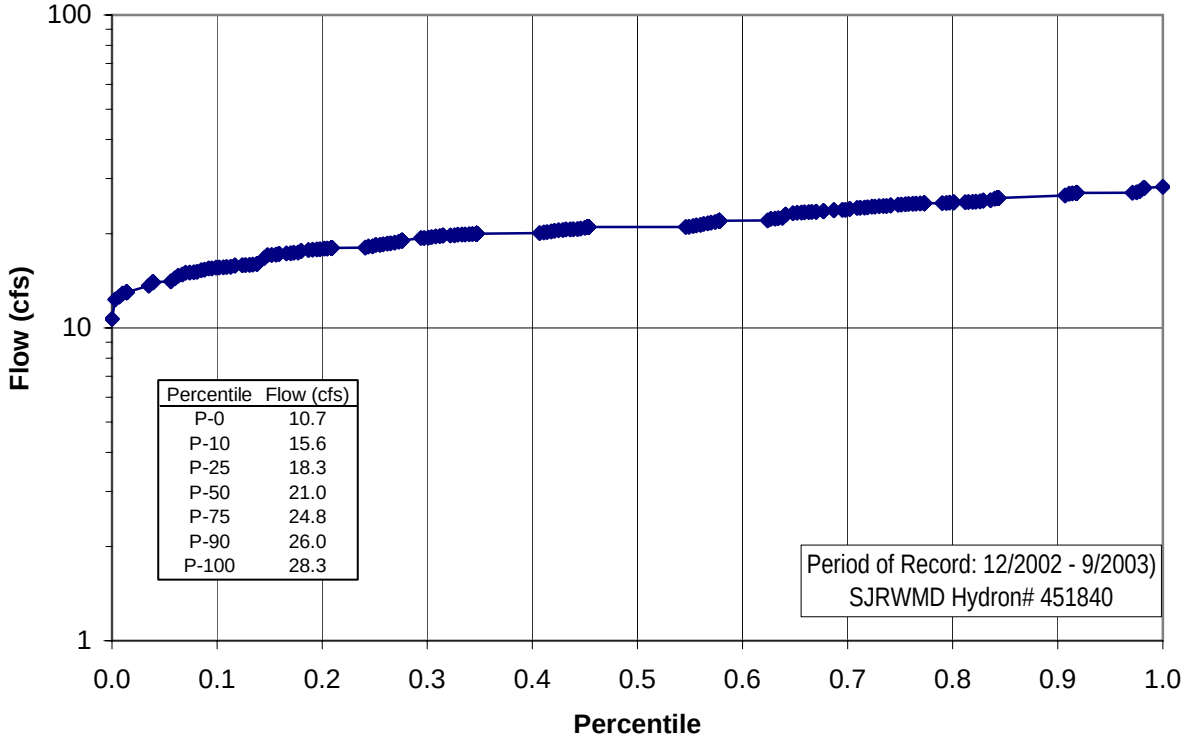




APPENDIX C-2

FLOW TIME SERIES AND FREQUENCY CURVE FOR ROCK SPRINGS

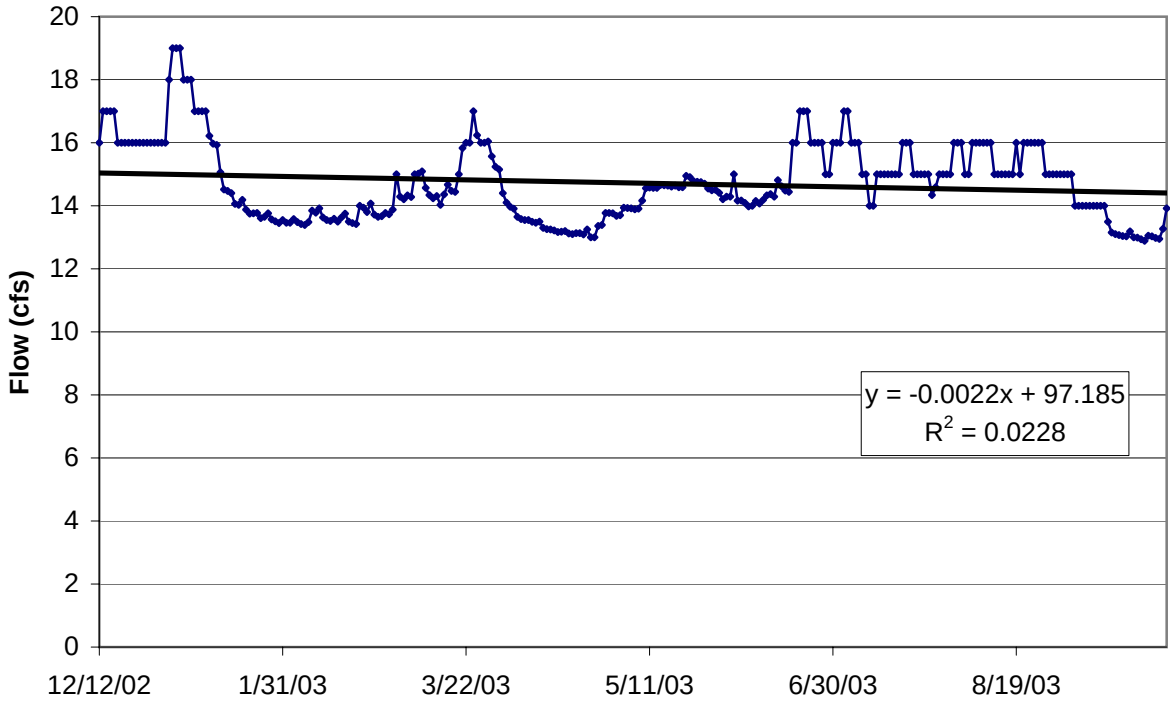


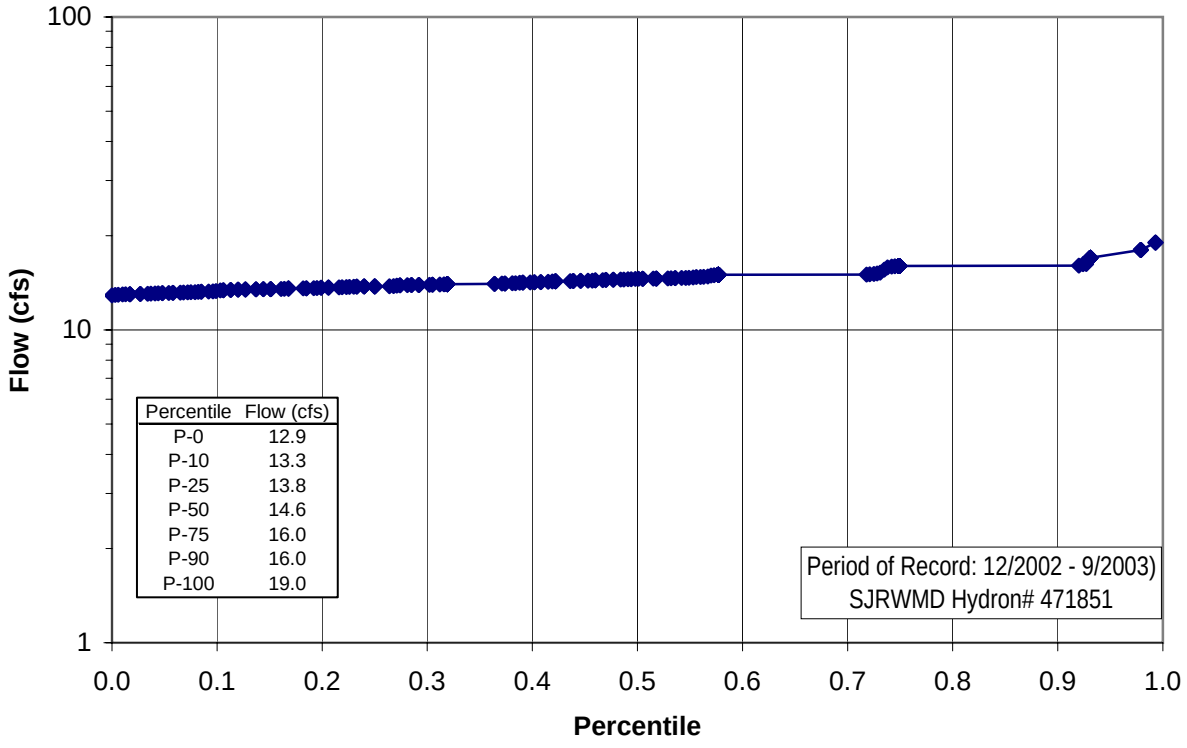


Percentile	Flow (cfs)
P-0	10.7
P-10	15.6
P-25	18.3
P-50	21.0
P-75	24.8
P-90	26.0
P-100	28.3

APPENDIX C-3

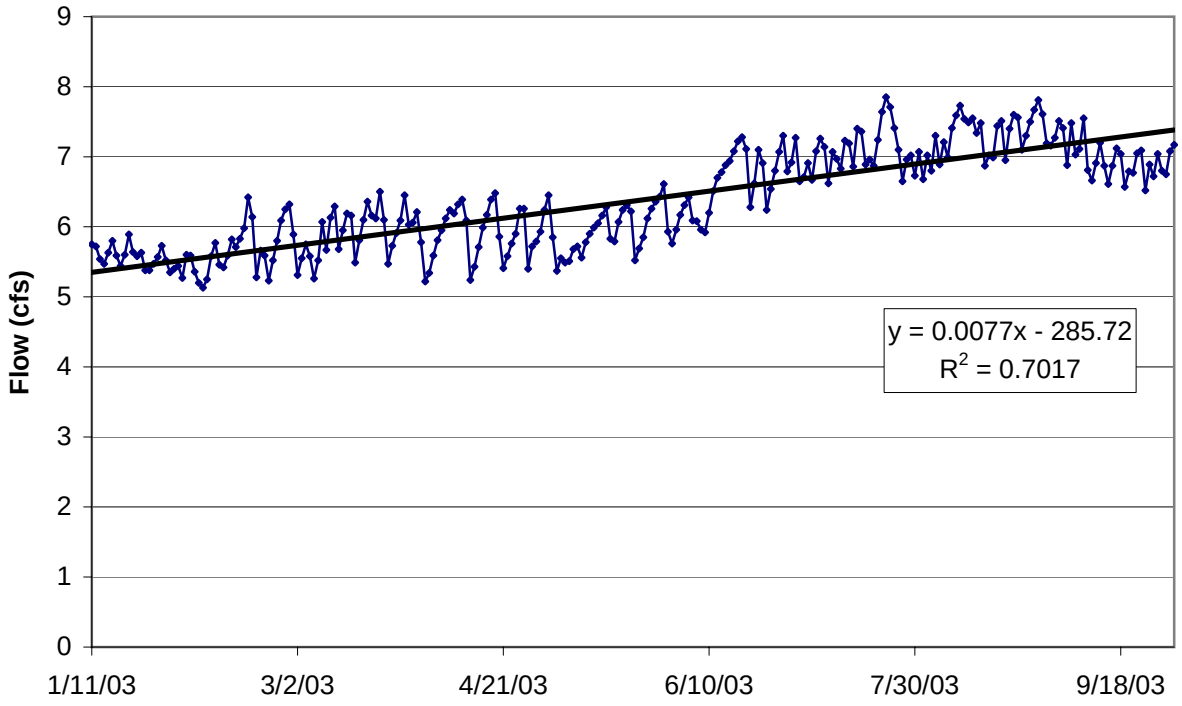
FLOW TIME SERIES AND FREQUENCY CURVE FOR SANLANDO SPRINGS

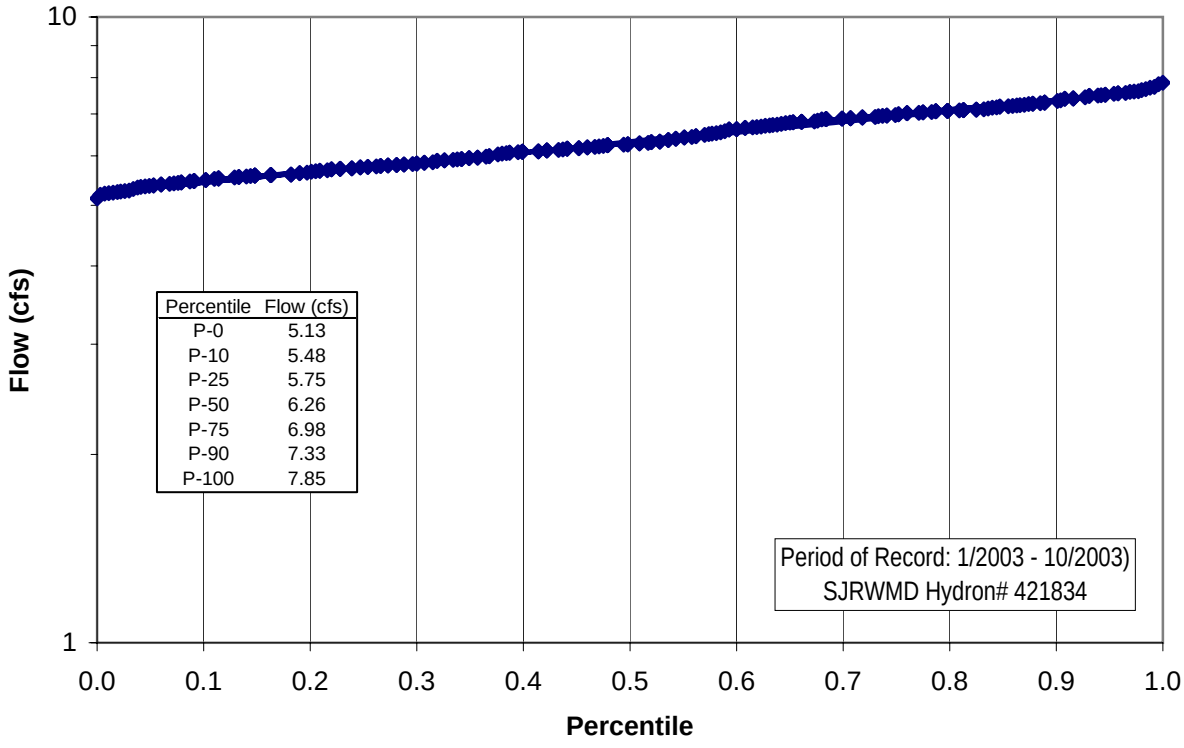




APPENDIX C-4

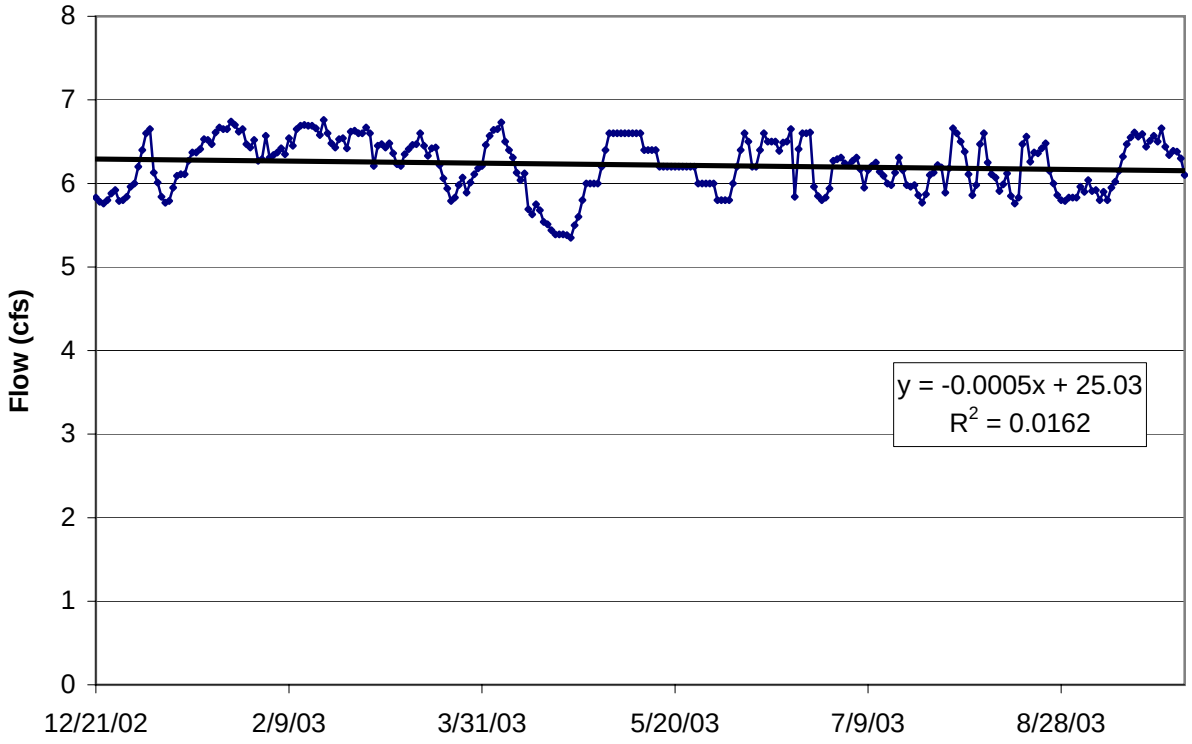
FLOW TIME SERIES AND FREQUENCY CURVE FOR STARBUCK SPRINGS

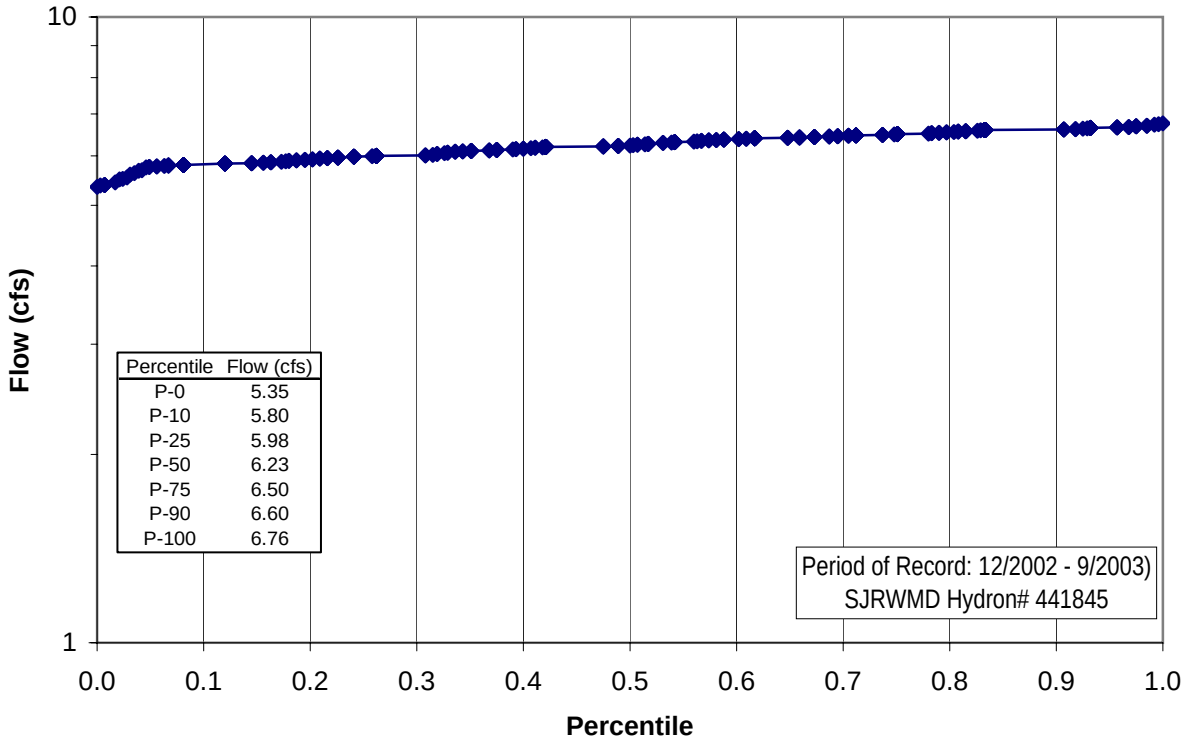




APPENDIX C-5

FLOW TIME SERIES AND FREQUENCY CURVE FOR MIAMI SPRINGS



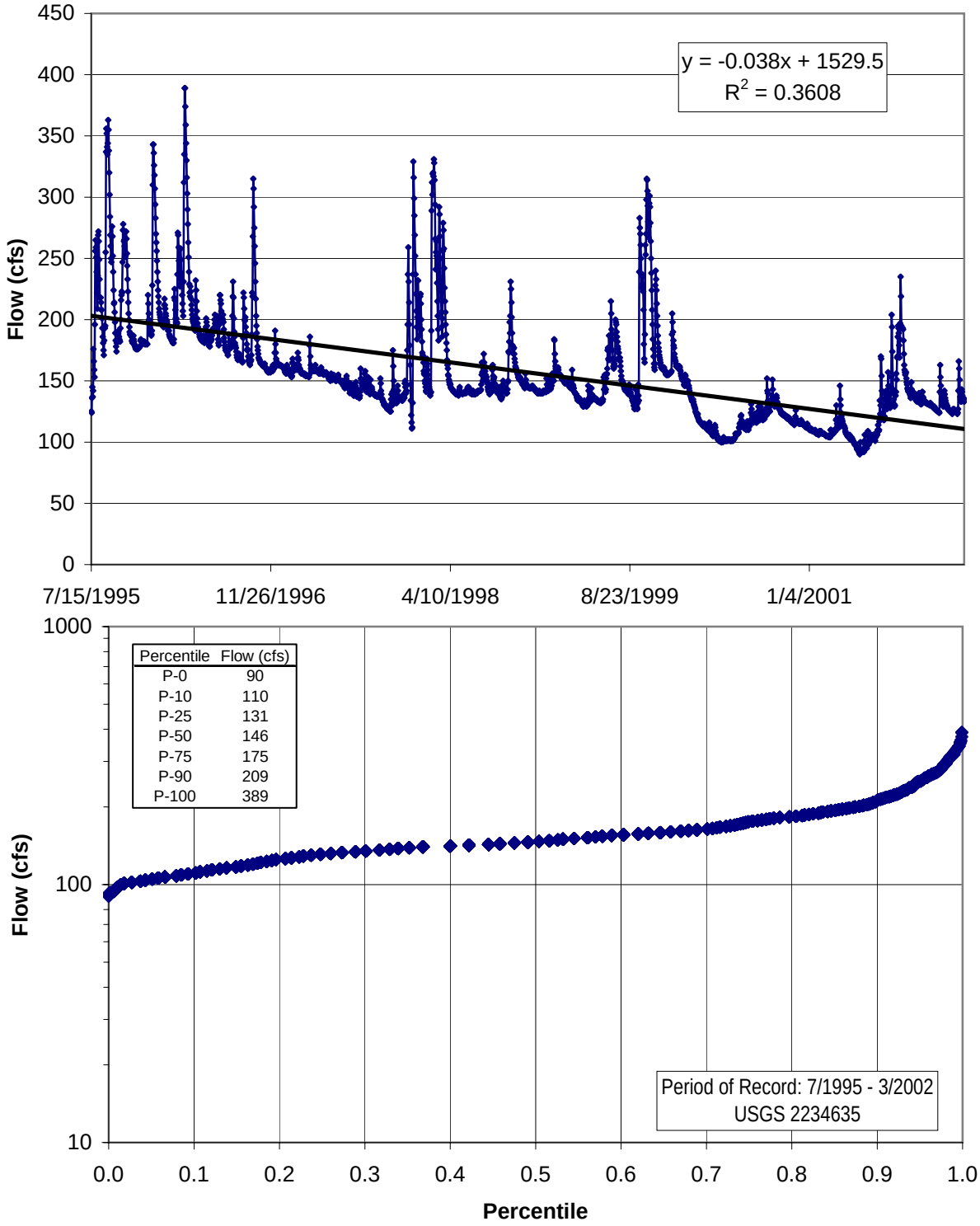


APPENDIX C-6

FLOW TIME SERIES AND FREQUENCY CURVE FOR PALM SPRINGS

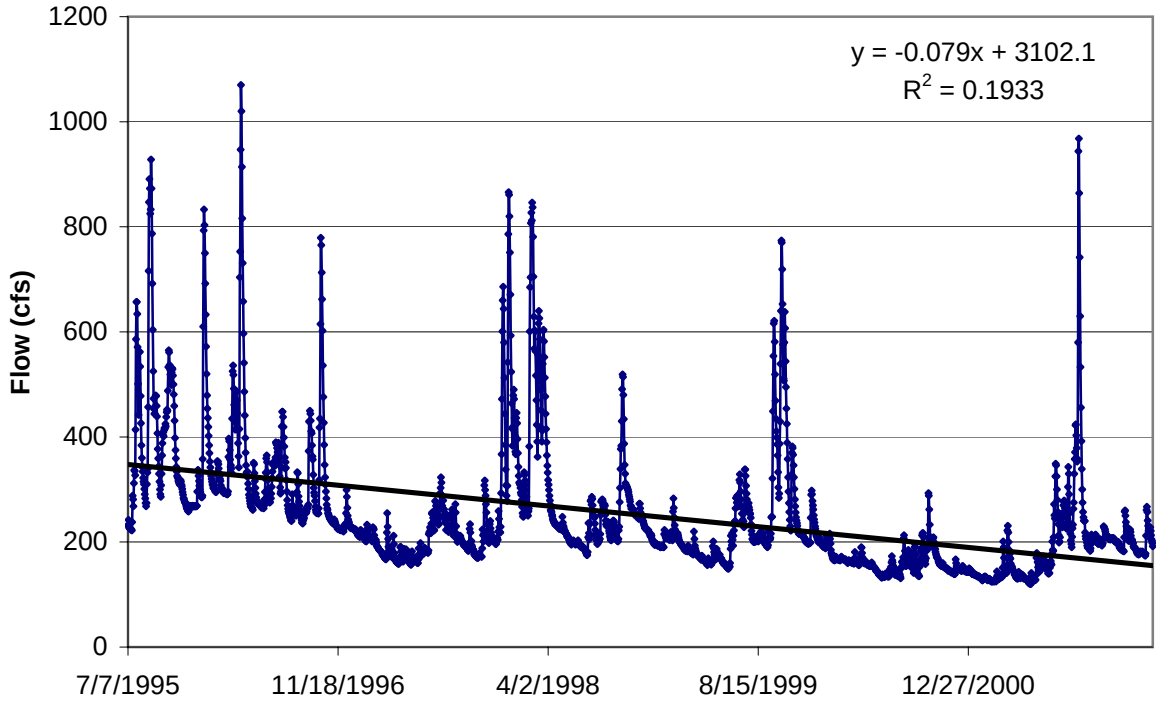
Appendix D

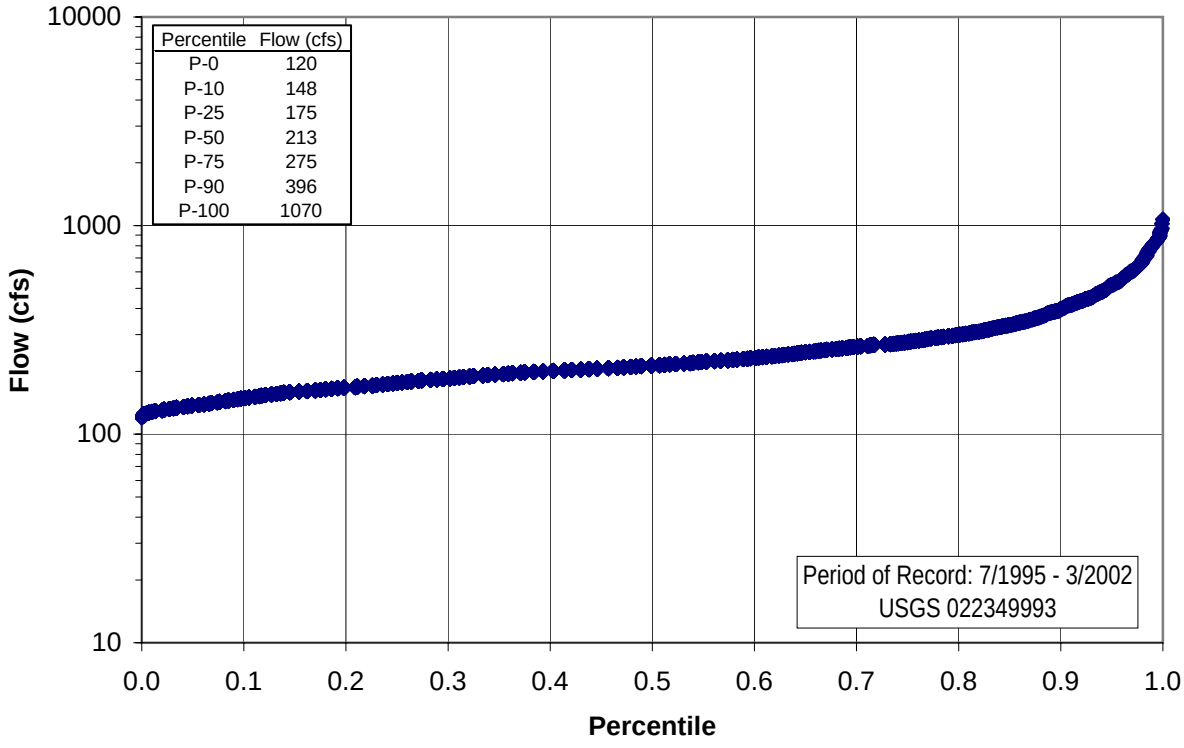
Detailed Flow Time Series and Cumulative Frequency Curves for Stream Stations in the Wekiva River System



APPENDIX D-1

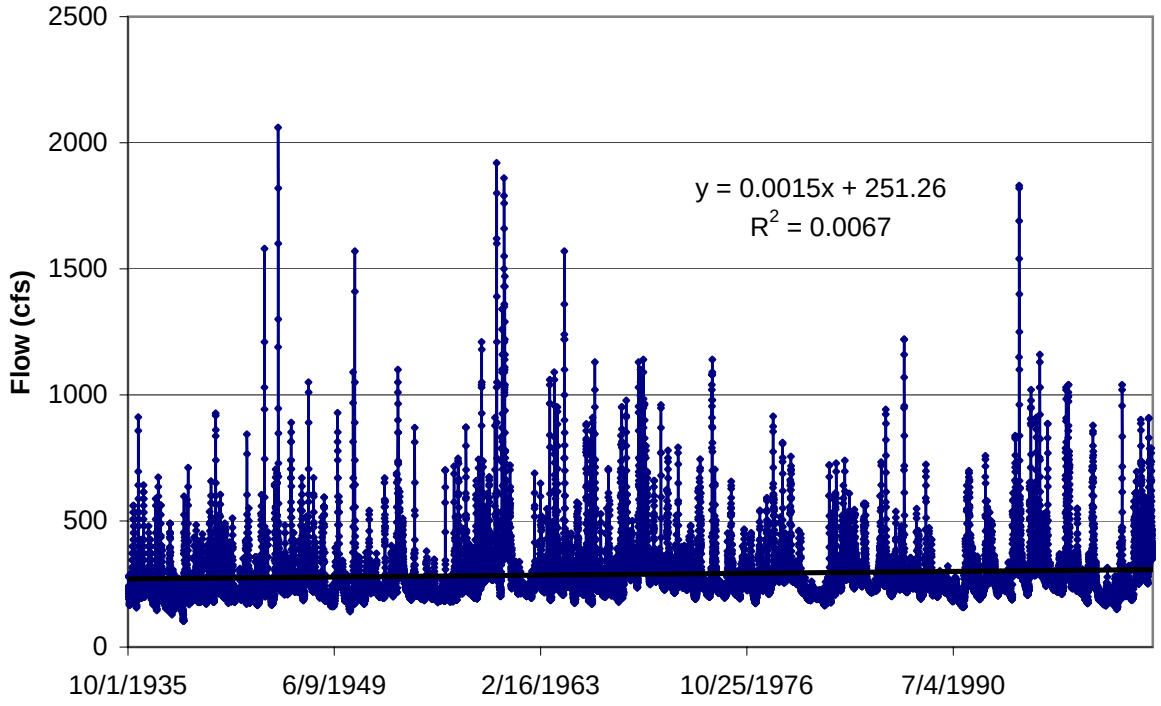
FLOW TIME SERIES AND FREQUENCY CURVE FOR WEKIVA RIVER NEAR WEKIVA MARINA

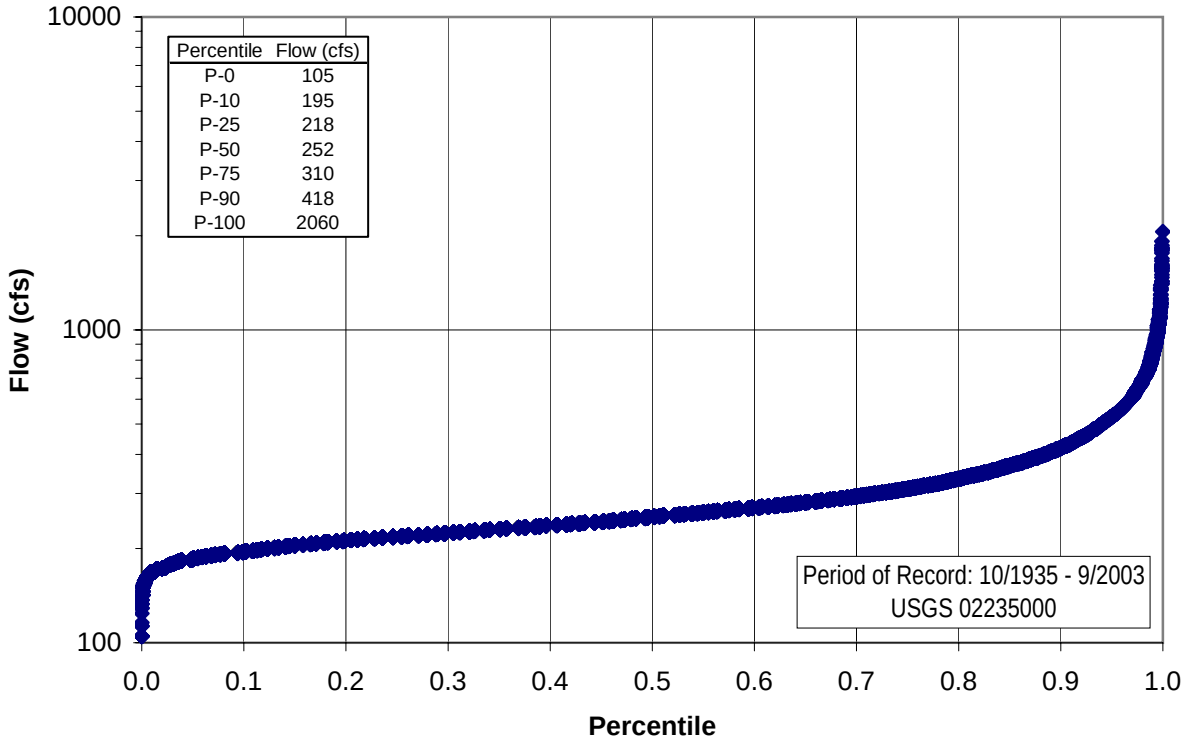




APPENDIX D-2

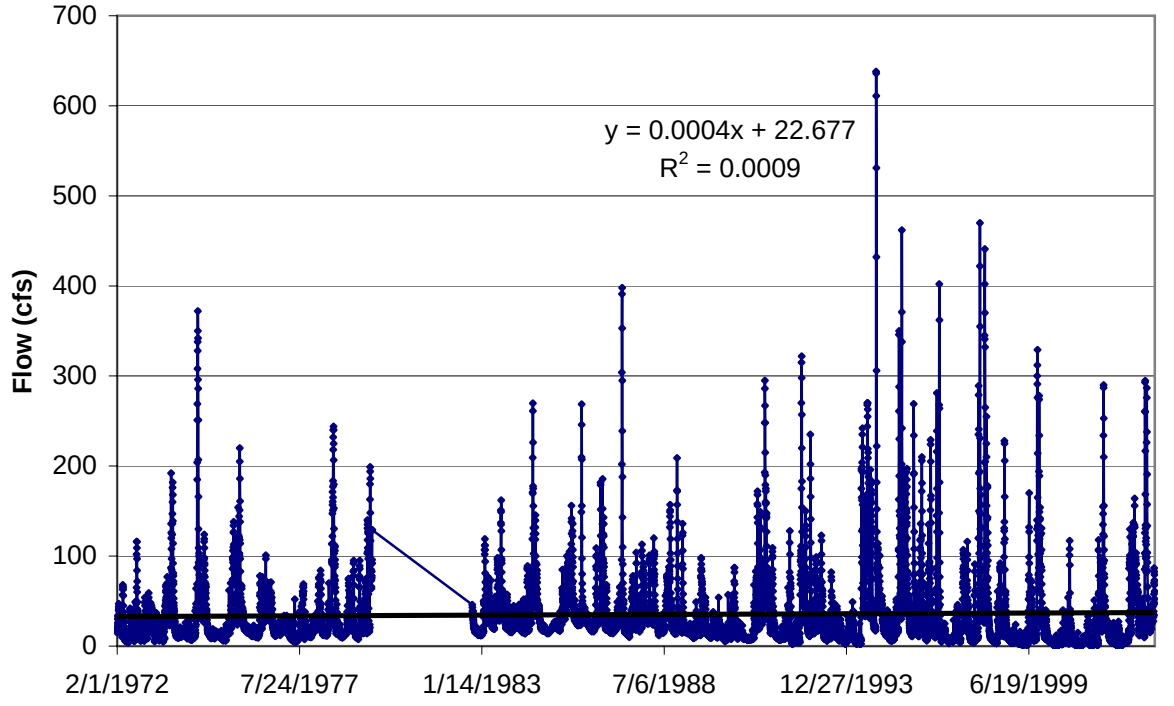
FLOW TIME SERIES AND FREQUENCY CURVE FOR WEKIVA RIVER AT OLD RR CROSSING

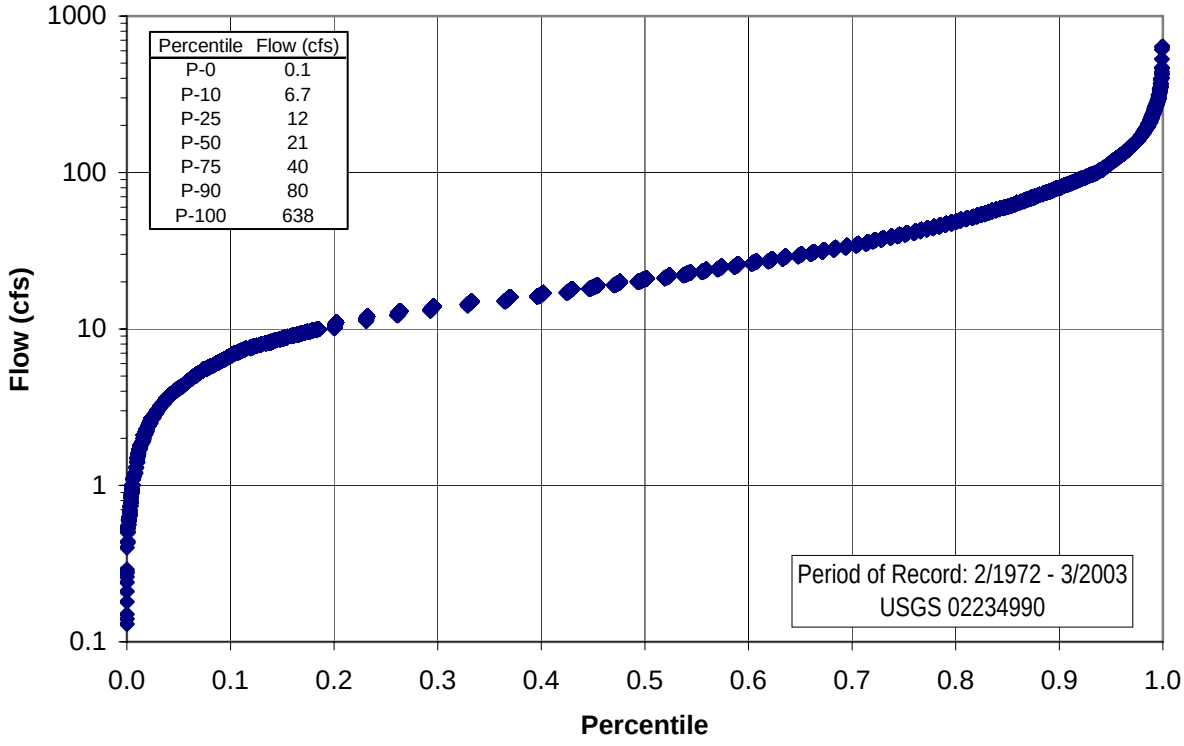




APPENDIX D-3

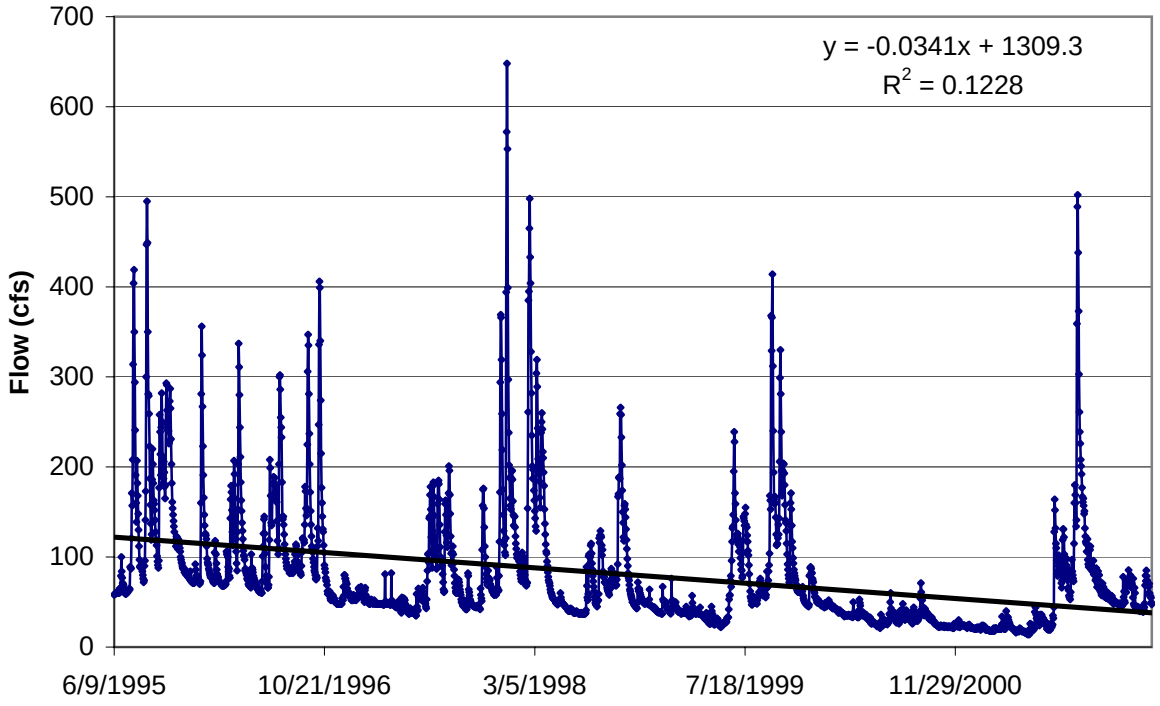
FLOW TIME SERIES AND FREQUENCY CURVE FOR WEKIVA RIVER AT SR 46

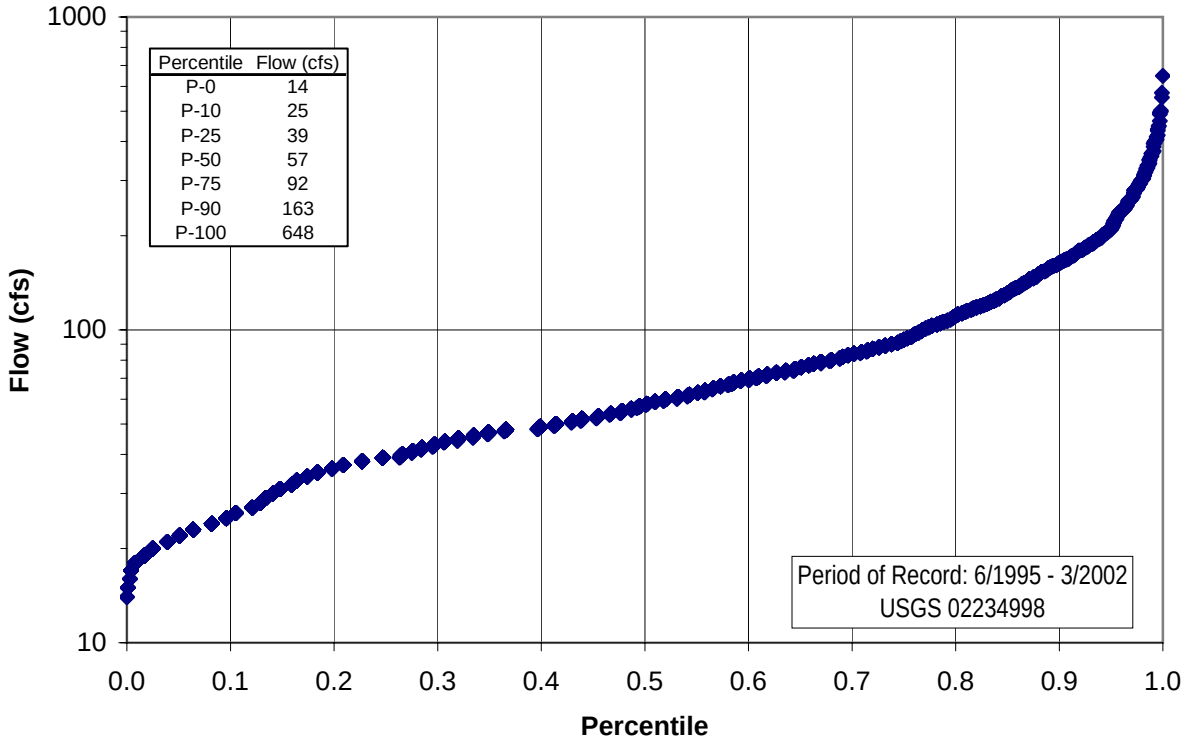




APPENDIX D-4

FLOW TIME SERIES AND FREQUENCY CURVE FOR LITTLE WEKIVA RIVER AT HWY 434





APPENDIX D-5

FLOW TIME SERIES AND FREQUENCY CURVE FOR LITTLE WEKIVA RIVER AT SPRINGS LANDING BLVD

Appendix E

Detailed Historic Water Quality Data from the Wekiva River System

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	3/20/1984	BACTERIOLOGICAL	Fecal Coliform	#/100ml	66.7	0.00	190	107	3
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	50.2	10.0	180	72.8	5
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	%	7.08	5.68	9.41	1.60	8
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.578	0.300	0.800	0.164	9
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	103	93.5	110	4.26	10
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	10.5	8.37	11.9	1.43	5
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	1.40	0.800	2.00	0.849	2
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	1.13	0.250	2.00	1.24	2
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	14.0	9.00	19.0	7.07	2
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	18.0	15.0	21.0	4.24	2
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	14.0	2.00	26.0	17.0	2
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	2.00	2.00	2.00	---	1
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	6.00	6.00	6.00	---	1
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	0.800	0.600	1.00	0.283	2
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	103	103	103	---	1
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.027	0.00	0.070	0.029	7
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.251	0.210	0.370	0.056	7
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	7/16/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.209	0.085	0.430	0.152	4
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/14/1985	NITROGEN	Unionized Ammonia	mg/L	0.0006	0.00	0.001	0.0006	4
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.267	0.00	0.500	0.169	7
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	2.12	0.00	3.50	1.45	5
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.146	0.110	0.250	0.045	10
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	PHYSICAL	pH	SU	7.12	5.80	7.80	0.765	6
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	1.49	0.800	2.50	0.677	7
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	255	230	302	21.0	11
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	PHYSICAL	Turbidity	NTU	0.689	0.080	5.50	1.60	11
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	10/14/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	7.50	3.00	12.0	6.36	2
1	Wekiwa Springs	Spring	0	10000	Wekiva River-Wekiva Springs Boil	1/7/1982	5/18/1988	TEMPERATURE	Water Temperature	C	23.1	22.0	24.0	0.641	8
2	Wekiwa Springs	Spring	0	371831	Wekiva Springs nr Altamonte Springs	12/13/2002	9/29/2003	FLOW	Flow	cfs	67.0	61.0	77.0	3.06	291
2	Wekiwa Springs	Spring	0	371831	Wekiva Springs nr Altamonte Springs	3/20/1984	2/5/2004	FLOW	Flow, Inst	cfs	67.4	38.6	89.9	7.46	99
2	Wekiwa Springs	Spring	0	371831	Wekiva Springs nr Altamonte Springs	10/31/2002	2/5/2004	PHYSICAL	Stage	ft	13.3	13.0	13.7	0.270	9
2	Wekiwa Springs	Spring	0	371831	Wekiva Springs nr Altamonte Springs	10/31/2002	2/5/2004	PHYSICAL	Stage	ft MSL	13.2	12.9	13.7	0.270	9
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	9/2/1977	BACTERIOLOGICAL	Total Coliform	#/100ml	6.00	6.00	6.00	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/21/1969	5/6/1971	DISSOLVED OXYGEN	Dissolved Oxygen	%	13.3	6.00	18.0	6.43	3
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/21/1969	9/17/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.650	0.050	1.60	0.656	9
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	1/30/1969	5/15/1970	FLOW	Flow	cfs	79.0	79.0	79.0	0.00	2
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	3/8/1932	9/23/2003	FLOW	Flow, Inst	cfs	67.7	51.6	92.0	7.96	313
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/27/1956	9/2/1977	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	95.7	72.0	102	6.86	18
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/27/1956	5/22/2001	GENERAL INORGANIC	Chloride, Total	mg/L	10.2	7.00	14.0	2.05	22
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/27/1956	5/22/2001	GENERAL INORGANIC	Hardness	mg/L as CaCO3	110	1.00	150	27.8	22
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/27/1956	5/22/2001	GENERAL INORGANIC	Sulfate, Total	mg/L	12.9	6.00	18.0	3.01	22
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/11/1972	5/22/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.667	0.00	2.00	1.15	3
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	9/2/1977	METAL	Arsenic, Total	µg/L	0.500	0.500	0.500	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	2/1/1985	METAL	Barium, Total	µg/L	50.0	50.0	50.0	0.00	2
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	2/1/1985	METAL	Chromium, Total	µg/L	6.00	2.00	10.0	5.66	2
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	9/2/1977	METAL	Iron, Total	µg/L	100	100	100	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	2/1/1985	METAL	Lead, Total	µg/L	0.500	0.500	0.500	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	9/2/1977	METAL	Manganese, Total	µg/L	5.00	5.00	5.00	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/11/1972	2/1/1985	METAL	Mercury, Total	µg/L	0.100	0.00	0.250	0.132	3
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	9/2/1977	METAL	Selenium, Total	µg/L	0.500	0.500	0.500	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	2/1/1985	2/1/1985	METAL	Silver, Total	µg/L	0.500	0.500	0.500	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	9/2/1977	METAL	Zinc, Total	µg/L	40.0	40.0	40.0	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/11/1972	9/2/1977	NITROGEN	Ammonia Nitrogen	mg/L	0.010	0.00	0.020	0.014	2
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	9/2/1977	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.630	0.630	0.630	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	5/15/1970	9/2/1977	NITROGEN	Organic Nitrogen	mg/L	0.215	0.030	0.600	0.264	4
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	5/22/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.093	0.080	0.100	0.012	3
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	9/2/1977	9/2/1977	NITROGEN	Total Nitrogen	mg/L	0.710	0.710	0.710	---	1
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/11/1972	9/2/1977	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.600	0.200	1.00	0.566	2
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/11/1972	5/22/2001	PHOSPHORUS	Orthophosphorus	mg/L	0.103	0.100	0.110	0.005	4
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/11/1972	5/22/2001	PHOSPHORUS	Total Phosphorus	mg/L	0.110	0.100	0.120	0.008	4
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/27/1956	5/19/1993	PHYSICAL	Color	CPU	4.97	0.00	10.0	3.35	18
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/27/1956	9/17/2001	PHYSICAL	pH	SU	7.46	6.50	8.30	0.361	33
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/27/1956	9/17/2001	PHYSICAL	Specific Conductance	umhos/cm	270	192	333	35.3	50
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	10/16/1968	9/23/2003	PHYSICAL	Stage	ft	11.6	1.68	14.2	2.94	116
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	2/1/1985	8/10/1999	PHYSICAL	Stage	ft MSL	13.1	12.9	13.4	0.246	3
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	5/15/1970	9/2/1977	PHYSICAL	Turbidity	NTU	0.750	0.00	1.00	0.500	4
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	11/25/1959	5/22/2001	SOLID	Total Dissolved Solids	mg/L	152	101	190	20.6	19
3	Wekiwa Springs	Spring	0	2234600	Wekiva Springs Nr Apopka	4/27/1956	9/17/2001	TEMPERATURE	Water Temperature	C	23.7	22.0	25.5	0.551	101
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fec Col / Fec Strp	---	0.079	0.079	0.079	---	1
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	26.0	26.0	26.0	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	8/31/1973	8/31/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	660	660	660	---	1
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	18.1	10.3	25.9	11.0	2
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	1.55	0.900	2.20	0.919	2
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	3/4/1974	3/4/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	201	201	201	---	1
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	3/4/1974	3/4/1974	GENERAL INORGANIC	Chloride, Total	mg/L	11.5	11.5	11.5	---	1
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	3/4/1974	3/4/1974	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.230	0.230	0.230	---	1
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	8/31/1973	8/31/1973	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.800	0.800	0.800	---	1
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	3/4/1974	3/4/1974	PHYSICAL	pH	SU	7.60	7.60	7.60	---	1
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	3/4/1974	3/4/1974	PHYSICAL	Specific Conductance	umhos/cm	185	185	185	---	1
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	8/31/1973	3/4/1974	PHYSICAL	Turbidity	NTU	12.5	12.5	12.5	0.00	2
4	Wekiwa Springs	Spring	0	20010430	Wekiva River At Wekiva Springs	8/31/1973	3/4/1974	TEMPERATURE	Water Temperature	C	23.7	23.4	24.0	0.424	2
5	Wekiwa Springs	Spring	0	284243081273600	Wekiwa Springs	8/10/1999	8/10/1999	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.100	0.100	0.100	---	1
5	Wekiwa Springs	Spring	0	284243081273600	Wekiwa Springs	8/10/1999	8/10/1999	PHYSICAL	pH	SU	7.60	7.60	7.60	---	1
5	Wekiwa Springs	Spring	0	284243081273600	Wekiwa Springs	8/10/1999	8/10/1999	PHYSICAL	Specific Conductance	umhos/cm	330	330	330	---	1
5	Wekiwa Springs	Spring	0	284243081273600	Wekiwa Springs	8/10/1999	8/10/1999	PHYSICAL	Stage	ft MSL	13.4	13.4	13.4	---	1
5	Wekiwa Springs	Spring	0	284243081273600	Wekiwa Springs	8/10/1999	8/10/1999	TEMPERATURE	Water Temperature	C	23.6	23.6	23.6	---	1
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/27/1956	5/13/2004	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	111	72.0	140	11.5	75
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/27/1956	5/13/2004	GENERAL INORGANIC	Chloride, Total	mg/L	13.0	7.00	27.0	2.81	82
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	1/12/1994	8/12/2003	GENERAL INORGANIC	Fluoride, Total	mg/L	0.160	0.120	0.210	0.021	40
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	7/23/1987	7/16/2002	GENERAL INORGANIC	Silica, Total	mg/L	5.09	4.00	14.0	1.91	46
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/27/1956	5/13/2004	GENERAL INORGANIC	Sulfate, Total	mg/L	16.8	6.00	21.0	3.26	82
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	2/26/2001	2/26/2001	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	0.535	0.535	0.535	---	1
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/11/1972	2/26/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.896	0.00	2.30	0.843	7
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	7/7/1992	5/13/2004	METAL	Calcium, Total	mg/L	37.8	25.6	45.0	3.46	46
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	9/2/1977	11/18/2003	METAL	Iron, Total	µg/L	34.4	2.56	100	30.5	24
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	7/7/1992	5/13/2004	METAL	Magnesium, Total	mg/L	10.9	7.65	12.0	0.788	46
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	7/7/1992	5/13/2004	METAL	Potassium, Total	mg/L	1.60	1.30	2.49	0.232	46
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	7/7/1992	8/12/2003	METAL	Strontium, Total	µg/L	135	92.0	189	16.2	42
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	2/26/2001	2/26/2001	NITROGEN	Ammonia Nitrogen	mg/L	0.031	0.031	0.031	---	1
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	9/2/1977	5/13/2004	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	1.43	0.630	2.00	0.326	51
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	2/26/2001	2/26/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.042	0.042	0.042	---	1
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/11/1972	5/13/2004	PHOSPHORUS	Orthophosphorus	mg/L	0.108	0.059	0.148	0.017	42
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/11/1972	5/13/2004	PHOSPHORUS	Total Phosphorus	mg/L	0.360	0.100	2.04	0.679	8
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/27/1956	5/13/2004	PHYSICAL	pH	SU	7.37	6.13	8.22	0.308	85
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/27/1956	5/13/2004	PHYSICAL	Specific Conductance	umhos/cm	293	192	398	36.9	115
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	11/25/1959	5/13/2004	SOLID	Total Dissolved Solids	mg/L	170	101	217	20.6	75
6	Wekiwa Springs	Spring	0	Wekiwa Springs	Wekiwa Springs	4/27/1956	5/13/2004	TEMPERATURE	Water Temperature	C	23.7	22.0	25.5	0.490	159
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fec Col / Fec Strp	---	0.103	0.103	0.103	---	1
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	36.0	36.0	36.0	---	1
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	8/31/1973	8/31/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	600	600	600	---	1
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	36.2	27.1	41.4	7.96	3
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	8/31/1973	9/13/1999	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	3.10	2.30	3.60	0.570	5
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	1/21/1974	9/13/1999	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	141	104	225	56.2	4
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	3/4/1974	9/13/1999	GENERAL INORGANIC	Chloride, Total	mg/L	13.5	11.4	15.0	1.86	3
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	1/11/1999	9/13/1999	GENERAL INORGANIC	Sulfate, Total	mg/L	22.5	21.0	24.0	2.12	2
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	1/11/1999	9/13/1999	NITROGEN	Ammonia Nitrogen	mg/L	0.008	0.005	0.011	0.004	2
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	1/11/1999	9/13/1999	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.895	0.490	1.30	0.573	2
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	1/21/1974	9/13/1999	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.240	0.140	0.390	0.119	4
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	8/31/1973	8/31/1973	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.10	1.10	1.10	---	1
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	1/11/1999	9/13/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.115	0.110	0.120	0.004	4
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	1/21/1974	1/21/1974	PHOSPHORUS	Total Phosphorus	mg/L	0.090	0.090	0.090	---	1
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	9/13/1999	9/13/1999	PHYSICAL	Color	CPU	2.50	2.50	2.50	---	1
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	3/4/1974	9/13/1999	PHYSICAL	pH	SU	7.66	7.50	7.80	0.114	5
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	3/4/1974	9/13/1999	PHYSICAL	Specific Conductance	umhos/cm	265	184	317	70.9	3
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	8/31/1973	9/13/1999	PHYSICAL	Turbidity	NTU	7.81	0.650	12.5	6.42	5
7	Wekiva River	Upstream	1065	20010431	Wekiva River 50 m upstream of confluence with Rock Springs	8/31/1973	9/13/1999	TEMPERATURE	Water Temperature	C	23.0	21.6	23.8	0.860	5
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fec Col / Fec Strp	---	0.650	0.650	0.650	---	1
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	52.0	52.0	52.0	---	1
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	8/31/1973	8/31/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	60.0	60.0	60.0	---	1
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	41.5	38.9	44.8	3.02	3
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	3.67	3.50	3.90	0.208	3
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	1/21/1974	3/4/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	151	101	201	71.1	2
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	1/21/1974	1/21/1974	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.290	0.290	0.290	---	1
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	8/31/1973	8/31/1973	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.50	1.50	1.50	---	1
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	1/21/1974	1/21/1974	PHOSPHORUS	Total Phosphorus	mg/L	0.080	0.080	0.080	---	1
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	8/31/1973	3/4/1974	PHYSICAL	Turbidity	NTU	12.5	12.5	12.5	0.00	3
8	Wekiva River	Internal	1330	20010432	Wekiva River Downstream of Rock Springs Run	8/31/1973	3/4/1974	TEMPERATURE	Water Temperature	C	22.3	21.0	23.5	1.26	3
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	3/17/1986	BACTERIOLOGICAL	Fecal Coliform	#/100ml	182	28.0	933	304	8
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	367	228	545	124	6
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	%	60.3	47.7	111	16.6	12

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.36	4.20	10.2	1.52	13
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	96.3	91.7	105	4.21	10
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	10.1	7.87	13.1	1.88	5
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	1.95	0.900	3.00	1.48	2
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	1.13	0.250	2.00	1.24	2
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	17.0	11.0	23.0	8.49	2
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	79.0	55.0	103	33.9	2
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	6.00	3.00	9.00	4.24	2
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	3.00	3.00	3.00	---	1
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	6.00	6.00	6.00	---	1
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	3.00	1.00	5.00	2.83	2
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	93.0	93.0	93.0	---	1
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.046	0.00	0.080	0.025	7
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.563	0.250	0.970	0.295	7
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	7/16/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.364	0.270	0.470	0.083	4
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Unionized Ammonia	mg/L	0.0003	0.00	0.0007	0.0003	5
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.543	0.100	1.35	0.459	7
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	7.08	0.00	14.0	5.39	5
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.109	0.069	0.203	0.037	10
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	pH	SU	6.91	6.10	7.50	0.511	10
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	1.69	1.30	2.00	0.206	10
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	265	195	320	33.9	11
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Turbidity	NTU	1.59	0.450	6.00	2.07	11
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	10/8/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	2,202	5.00	6,000	3,303	3
9	Wekiva River	Internal	1690	10098	Wekiva River Upstream from Sweetwater Canal	1/7/1982	3/17/1986	TEMPERATURE	Water Temperature	C	21.5	19.0	24.0	1.42	12
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	9/6/2000	4/22/2003	DISSOLVED OXYGEN	Dissolved Oxygen	%	62.3	50.0	71.0	10.1	4
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	4/22/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.44	4.20	6.30	0.910	5
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/15/1995	3/11/2002	FLOW	Flow	cfs	157	90.0	389	44.4	2432
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	5/25/1961	3/13/2002	FLOW	Flow, Inst	cfs	163	98.3	349	48.8	52
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/24/1963	9/6/2000	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	98.3	98.0	99.0	0.577	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/24/1963	4/22/2003	GENERAL INORGANIC	Chloride, Total	mg/L	12.4	11.0	14.0	1.47	5
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/24/1963	4/22/2003	GENERAL INORGANIC	Hardness	mg/L as CaCO3	134	130	150	8.94	5
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/24/1963	4/22/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	20.4	12.8	32.0	7.14	5
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	1.20	0.800	1.70	0.458	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	4/12/2000	NITROGEN	Organic Nitrogen	mg/L	0.280	0.280	0.280	---	1
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.233	0.100	0.300	0.115	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	NITROGEN	Total Nitrogen	mg/L	1.35	1.20	1.50	0.212	2
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	PESTICIDE	Alachlor, Dissolved	µg/L	0.001	0.001	0.001	0.00	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	PESTICIDE	Atrazine, Dissolved	µg/L	0.006	0.004	0.008	0.002	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	PESTICIDE	Diazinon, Dissolved	µg/L	0.002	0.001	0.003	0.0009	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	PESTICIDE	Dieldrin, Dissolved	µg/L	0.001	0.0005	0.003	0.001	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	PESTICIDE	Lindane, Dissolved	µg/L	0.002	0.002	0.002	0.00	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	PHOSPHORUS	Orthophosphorus	mg/L	0.090	0.080	0.100	0.010	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	2/5/2001	PHOSPHORUS	Total Phosphorus	mg/L	0.097	0.070	0.120	0.025	3
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/24/1963	7/24/1963	PHYSICAL	Color	CPU	60.0	60.0	60.0	---	1
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/24/1963	4/22/2003	PHYSICAL	pH	SU	7.54	7.10	8.00	0.321	9
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/24/1963	4/22/2003	PHYSICAL	Specific Conductance	umhos/cm	291	261	301	15.2	6
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	5/25/1961	3/13/2002	PHYSICAL	Stage	ft	2.54	2.10	14.5	0.457	2422
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	5/25/1961	3/13/2002	PHYSICAL	Stage	ft MSL	12.5	12.0	24.4	0.457	2422
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	7/24/1963	2/5/2001	SOLID	Total Dissolved Solids	mg/L	178	169	187	8.04	4
10	Wekiva River	Internal	1690	2234635	Wekiva River Near Apopka	4/12/2000	4/22/2003	TEMPERATURE	Water Temperature	C	21.8	19.1	24.1	2.07	5
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	2/12/1992	BIOLOGICAL	Chlorophyll-a Corr	µg/L	0.083	0.00	0.250	0.144	3
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	2/12/1992	2/12/1992	BIOLOGICAL	Pheophytin-a	µg/L	0.250	0.250	0.250	---	1
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	2/12/1992	DISSOLVED OXYGEN	Dissolved Oxygen	%	60.1	49.4	70.0	10.3	3
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.44	4.30	6.40	0.961	5
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	75.4	0.00	102	42.7	5
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	GENERAL INORGANIC	Chloride, Total	mg/L	12.5	9.90	15.0	2.12	4
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	GENERAL INORGANIC	Sulfate, Total	mg/L	24.8	21.0	29.0	3.86	4
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	7/3/1984	9/13/1999	NITROGEN	Ammonia Nitrogen	mg/L	0.043	0.005	0.110	0.058	3
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	1.18	0.960	1.39	0.177	4
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	7/3/1984	7/3/1984	NITROGEN	Organic Nitrogen	mg/L	0.680	0.680	0.680	---	1
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.297	0.180	0.520	0.193	3
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	7/3/1984	7/3/1984	NITROGEN	Unionized Ammonia	mg/L	0.003	0.003	0.003	---	1
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	7/3/1984	2/12/1992	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	2.39	0.570	4.20	2.57	2
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/11/1999	9/13/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.095	0.090	0.100	0.005	3
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	7/3/1984	PHOSPHORUS	Total Phosphorus	mg/L	0.100	0.090	0.110	0.014	2
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	PHYSICAL	Color	CPU	19.3	0.00	50.0	22.1	4
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	PHYSICAL	pH	SU	6.77	0.00	8.00	2.58	9
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	2/12/1992	PHYSICAL	Secchi	m	1.20	0.900	1.80	0.520	3
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	PHYSICAL	Specific Conductance	umhos/cm	282	258	318	21.9	6

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	PHYSICAL	Turbidity	NTU	0.950	0.00	2.20	0.873	5
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	2/12/1992	SOLID	Total Suspended Solids	mg/L	2.67	1.00	5.00	2.08	3
11	Wekiva River	Internal	1690	20010377	Big Wekiva River at Wekiva Marina	1/10/1984	9/13/1999	TEMPERATURE	Water Temperature	C	21.4	18.4	24.0	2.36	5
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fec Col / Fec Strp	---	0.600	0.600	0.600	---	1
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	60.0	60.0	60.0	---	1
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	8/31/1973	8/31/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	80.0	80.0	80.0	---	1
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	42.9	33.0	50.6	9.02	3
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	3.77	2.90	4.30	0.757	3
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	1/21/1974	3/4/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	149	96.1	202	75.0	2
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	3/4/1974	3/4/1974	GENERAL INORGANIC	Chloride, Total	mg/L	1,100	1,100	1,100	---	1
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	1/21/1974	3/4/1974	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.350	0.350	0.350	0.00	2
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	8/31/1973	8/31/1973	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	2.10	2.10	2.10	---	1
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	1/21/1974	1/21/1974	PHOSPHORUS	Total Phosphorus	mg/L	0.070	0.070	0.070	---	1
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	3/4/1974	3/4/1974	PHYSICAL	pH	SU	7.80	7.80	7.80	---	1
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	3/4/1974	3/4/1974	PHYSICAL	Specific Conductance	umhos/cm	179	179	179	---	1
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	8/31/1973	3/4/1974	PHYSICAL	Turbidity	NTU	12.5	12.5	12.5	0.00	2
12	Wekiva River	Internal	1690	20010433	Wekiva River Upstream of Sweetwater Creek	8/31/1973	3/4/1974	TEMPERATURE	Water Temperature	C	22.0	20.0	24.0	2.00	3
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	2/25/1997	BACTERIOLOGICAL	Fec Col / Fec Strp	---	1.17	0.125	7.89	1.37	61
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	4/7/2003	BACTERIOLOGICAL	Fecal Coliform	#/100ml	107	1.00	660	140	82
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	4/7/2003	BACTERIOLOGICAL	Total Coliform	#/100ml	997	10.0	8,600	1,516	85
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	4/7/2003	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.27	0.00	12.2	1.91	86
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	4/7/2003	BIOLOGICAL	Chlorophyll-b	µg/L	0.957	0.00	12.0	1.81	86
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	4/7/2003	BIOLOGICAL	Chlorophyll-c Corr	µg/L	2.25	0.00	18.2	4.24	45
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	4/7/2003	BIOLOGICAL	Pheophytin-a	µg/L	1.56	0.00	23.2	2.94	86
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	2/25/1997	DISSOLVED OXYGEN	Dissolved Oxygen	%	53.6	26.0	116	14.3	72
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.01	2.50	11.5	1.51	90
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	98.2	22.0	149	17.9	92
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	GENERAL INORGANIC	Chloride, Total	mg/L	10.8	0.400	17.0	4.86	53
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	GENERAL INORGANIC	Hardness	mg/L as CaCO3	133	2.50	270	34.5	58
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/28/1991	7/29/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	39.4	0.500	217	51.5	49
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	METAL	Aluminum, Total	µg/L	162	12.5	500	160	30
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/29/1992	7/29/2003	METAL	Arsenic, Total	µg/L	10.0	2.50	12.5	4.28	22
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	2/25/1997	7/29/2003	METAL	Barium, Total	µg/L	24.1	10.0	25.0	3.64	17
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	METAL	Cadmium, Total	µg/L	1.15	0.150	20.0	3.71	28
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	METAL	Chromium, Total	µg/L	2.05	0.010	5.00	1.26	26
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	2/25/1997	7/29/2003	METAL	Cobalt, Total	µg/L	4.56	0.650	5.00	1.28	18
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	METAL	Copper, Total	µg/L	6.45	0.020	55.0	10.5	33
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	METAL	Iron, Total	µg/L	101	0.180	760	176	31
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	METAL	Lead, Total	µg/L	4.63	0.250	60.0	10.3	32
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	2/14/1995	2/14/1995	METAL	Magnesium, Total	mg/L	350	350	350	---	1
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	METAL	Manganese, Total	µg/L	5.72	0.100	25.0	4.90	26
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	11/28/2000	7/29/2003	METAL	Mercury, Total	µg/L	0.100	0.100	0.100	0.0000	11
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	METAL	Nickel, Total	µg/L	13.6	0.500	25.0	6.14	30
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	2/14/1995	7/8/1996	METAL	Potassium, Total	mg/L	4.33	2.50	8.00	3.18	3
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	7/22/1991	7/29/2003	METAL	Selenium, Total	µg/L	4.21	0.112	9.00	2.31	21
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	2/25/1997	7/29/2003	METAL	Silver, Total	µg/L	1.32	0.015	1.50	0.437	18
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	2/14/1995	7/29/2003	METAL	Zinc, Total	µg/L	113	0.450	500	210	14
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	NITROGEN	Ammonia Nitrogen	mg/L	0.083	0.005	0.930	0.114	91
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	1.09	0.560	1.53	0.264	26
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	NITROGEN	Organic Nitrogen	mg/L	0.758	0.010	11.1	1.62	47
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	4/2/1980	7/29/2003	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.519	0.010	2.01	0.420	91
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	4/2/1980	7/29/2003	NITROGEN	Total Nitrogen	mg/L	1.47	0.320	2.60	0.499	51
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	2/25/1997	NITROGEN	Unionized Ammonia	mg/L	0.001	0.00	0.008	0.002	67
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	2/25/1997	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.93	0.200	7.70	1.50	71
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	OXYGEN DEMAND	Carbonaceous Biochemical Oxygen Demand, 5 Day	mg/L	2.04	0.200	7.70	1.71	45
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	5/6/1987	7/29/2003	PHOSPHORUS	Orthophosphorus	mg/L	0.089	0.013	0.260	0.036	55
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	PHOSPHORUS	Total Phosphorus	mg/L	0.117	0.024	0.340	0.045	120
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	4/11/1990	7/29/2003	PHYSICAL	Color	CPU	61.0	2.00	360	80.4	36
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	PHYSICAL	pH	SU	7.31	5.60	8.10	0.481	90
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	8/23/1994	7/29/2003	PHYSICAL	Secchi	m	3.87	0.200	71.0	13.7	26
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	PHYSICAL	Specific Conductance	umhos/cm	290	125	500	54.4	90
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	PHYSICAL	Turbidity	NTU	2.91	0.200	67.0	8.31	100
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	7/18/1990	7/29/2003	SOLID	Total Dissolved Solids	mg/L	174	5.00	470	81.6	39
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/24/1989	7/29/2003	SOLID	Total Suspended Solids	mg/L	104	0.00	495	114	99
13	Wekiva River	Internal	1690	BWB	Wekiva Marina	1/2/1980	7/29/2003	TEMPERATURE	Water Temperature	C	22.0	12.0	31.6	3.76	90
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	3/17/1986	BACTERIOLOGICAL	Fecal Coliform	#/100ml	579	30.0	2,960	991	8
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	582	230	1,710	634	5
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	%	61.6	47.7	109	18.1	11
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.43	4.20	10.0	1.68	12
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	96.5	92.5	105	4.03	10

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	9.50	8.37	10.9	0.917	5
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	1.45	0.900	2.00	0.778	2
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	1.13	0.250	2.00	1.24	2
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	22.0	14.0	30.0	11.3	2
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	90.0	66.0	114	33.9	2
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	6.50	4.00	9.00	3.54	2
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	4.00	4.00	4.00	---	1
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	6.00	6.00	6.00	---	1
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	1.50	1.00	2.00	0.707	2
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	61.0	61.0	61.0	---	1
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.057	0.00	0.200	0.071	7
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.530	0.210	0.930	0.307	7
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	7/16/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.268	0.120	0.440	0.135	4
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Unionized Ammonia	mg/L	0.0002	0.00	0.0005	0.0002	5
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.290	0.00	1.00	0.351	7
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	7.28	1.90	13.6	4.84	5
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.137	0.058	0.228	0.053	10
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	pH	SU	7.15	6.50	7.60	0.350	10
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	1.76	1.10	2.40	0.366	10
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	264	225	320	29.2	11
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Turbidity	NTU	1.27	0.430	8.20	2.31	11
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	8/10/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	2,287	260	6,000	3,220	3
14	Wekiva River	Internal	1940	10117	Wekiva River Downstream from Sweetwater Canal	1/7/1982	3/17/1986	TEMPERATURE	Water Temperature	C	21.9	20.0	24.0	1.28	11
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fec Col / Fec Strp	---	1.25	1.25	1.25	---	1
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	125	125	125	---	1
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	8/31/1973	8/31/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	80.0	80.0	80.0	---	1
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	45.2	37.5	50.0	6.77	3
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	4.00	3.30	4.60	0.656	3
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	1/21/1974	3/4/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	149	96.8	200	73.1	2
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	3/4/1974	3/4/1974	GENERAL INORGANIC	Chloride, Total	mg/L	11.4	11.4	11.4	---	1
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	1/21/1974	3/4/1974	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.235	0.180	0.290	0.078	2
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	8/31/1973	8/31/1973	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.50	1.50	1.50	---	1
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	3/4/1974	3/4/1974	PHYSICAL	pH	SU	7.90	7.90	7.90	---	1
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	3/4/1974	3/4/1974	PHYSICAL	Specific Conductance	umhos/cm	180	180	180	---	1
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	1/21/1974	3/4/1974	PHYSICAL	Turbidity	NTU	12.5	12.5	12.5	0.00	2
15	Wekiva River	Internal	1940	20010434	Wekiva River Downstream of Sweetwater Creek	8/31/1973	3/4/1974	TEMPERATURE	Water Temperature	C	21.9	20.0	24.0	2.00	3
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	FLOW	Flow, Inst	cfs	135	135	135	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	95.0	95.0	95.0	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	GENERAL INORGANIC	Chloride, Total	mg/L	8.00	8.00	8.00	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	GENERAL INORGANIC	Hardness	mg/L as CaCO3	120	120	120	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	GENERAL INORGANIC	Sulfate, Total	mg/L	17.0	17.0	17.0	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	NITROGEN	Ammonia Nitrogen	mg/L	0.030	0.030	0.030	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	NITROGEN	Organic Nitrogen	mg/L	0.300	0.300	0.300	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	PHOSPHORUS	Orthophosphorus	mg/L	0.070	0.070	0.070	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	PHOSPHORUS	Total Phosphorus	mg/L	0.095	0.095	0.095	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	PHYSICAL	Color	CPU	10.0	10.0	10.0	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	PHYSICAL	pH	SU	7.70	7.70	7.70	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	PHYSICAL	Specific Conductance	umhos/cm	250	250	250	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	PHYSICAL	Turbidity	NTU	4.00	4.00	4.00	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	SOLID	Total Dissolved Solids	mg/L	139	139	139	---	1
16	Wekiva River	Internal	1940	284252081263401	Wekiva River Near Forest City	5/10/1973	5/10/1973	TEMPERATURE	Water Temperature	C	24.0	24.0	24.0	---	1
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	3/17/1986	BACTERIOLOGICAL	Fecal Coliform	#/100ml	228	10.0	796	273	9
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	405	150	605	167	7
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	%	61.9	44.3	81.5	9.49	12
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.54	3.90	7.50	0.905	13
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	95.8	90.2	105	4.30	10
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	16.0	11.8	27.3	5.74	6
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	1.35	0.700	2.00	0.919	2
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	1.40	0.800	2.00	0.849	2
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	10.0	7.00	13.0	4.24	2
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	99.0	93.0	105	8.49	2
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	7.00	5.00	9.00	2.83	2
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	3.00	3.00	3.00	---	1
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	6.00	6.00	6.00	---	1
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	2.45	0.900	4.00	2.19	2
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	59.0	59.0	59.0	---	1
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.026	0.00	0.090	0.038	7
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.614	0.320	0.880	0.217	7
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	7/16/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.382	0.310	0.500	0.085	4
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	3/17/1986	NITROGEN	Unionized Ammonia	mg/L	0.0002	0.00	0.0007	0.0003	5

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.593	0.00	1.40	0.474	7
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	9.52	1.90	23.9	8.58	5
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.124	0.066	0.247	0.047	10
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	5/18/1988	PHYSICAL	pH	SU	7.17	6.60	7.60	0.410	10
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	1.28	0.900	1.65	0.270	10
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	290	249	338	38.5	11
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	5/18/1988	PHYSICAL	Turbidity	NTU	1.11	0.200	2.70	0.786	11
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	8/10/1980	3/19/1986	SOLID	Total Dissolved Solids	mg/L	2,197	250	6,000	3,294	3
17	Wekiva River	Internal	7235	10447	Wekiva River Upstream from Little Wekiva River	1/7/1982	3/17/1986	TEMPERATURE	Water Temperature	C	21.5	17.0	25.0	2.26	12
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	1/13/1997	BACTERIOLOGICAL	Fecal Coliform	#/100ml	50.0	50.0	50.0	---	1
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	1/13/1997	BACTERIOLOGICAL	Total Coliform	#/100ml	550	550	550	---	1
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	1/13/1997	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.20	1.20	1.20	---	1
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	1/13/1997	BIOLOGICAL	Pheophytin-a	µg/L	1.15	1.15	1.15	---	1
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	1/13/1997	DISSOLVED OXYGEN	Dissolved Oxygen	%	75.6	75.6	75.6	---	1
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.93	4.20	7.18	1.55	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	102	90.0	111	10.7	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	GENERAL INORGANIC	Chloride, Total	mg/L	14.3	13.0	16.0	1.53	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	GENERAL INORGANIC	Sulfate, Total	mg/L	24.0	21.0	29.0	4.36	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	NITROGEN	Ammonia Nitrogen	mg/L	0.014	0.012	0.016	0.002	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	1.00	0.800	1.10	0.173	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.223	0.190	0.260	0.035	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	1/13/1997	NITROGEN	Unionized Ammonia	mg/L	0.0001	0.0001	0.0001	---	1
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.100	0.089	0.110	0.009	5
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	1/13/1997	PHOSPHORUS	Total Phosphorus	mg/L	0.098	0.098	0.098	---	1
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	PHYSICAL	Color	CPU	11.3	2.50	20.0	12.4	2
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	PHYSICAL	pH	SU	7.54	7.31	7.90	0.228	5
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	1/13/1997	PHYSICAL	Secchi	m	0.700	0.700	0.700	---	1
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	PHYSICAL	Specific Conductance	umhos/cm	292	274	311	18.5	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	PHYSICAL	Turbidity	NTU	1.96	0.570	2.70	1.20	3
18	Wekiva River	Internal	7235	20010103	Big Wekiva River upstream of Little Wekiva	1/13/1997	9/13/1999	TEMPERATURE	Water Temperature	C	19.4	15.5	24.8	4.82	3
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fec Col / Fec Strp	---	0.400	0.400	0.400	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	40.0	40.0	40.0	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	8/31/1973	8/31/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	80.0	80.0	80.0	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	49.6	45.6	53.6	5.66	2
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	4.30	4.10	4.50	0.283	2
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	3/4/1974	3/4/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	201	201	201	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	3/4/1974	3/4/1974	GENERAL INORGANIC	Chloride, Total	mg/L	11.0	11.0	11.0	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	3/4/1974	3/4/1974	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.280	0.280	0.280	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	8/31/1973	8/31/1973	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	3.10	3.10	3.10	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	3/4/1974	3/4/1974	PHYSICAL	pH	SU	7.60	7.60	7.60	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	3/4/1974	3/4/1974	PHYSICAL	Specific Conductance	umhos/cm	179	179	179	---	1
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	8/31/1973	3/4/1974	PHYSICAL	Turbidity	NTU	12.5	12.5	12.5	0.00	2
19	Wekiva River	Internal	7235	20010435	Wekiva R. Upstrm Of Little Wekiv	8/31/1973	3/4/1974	TEMPERATURE	Water Temperature	C	23.0	20.8	25.2	3.11	2
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	4.02	2.13	5.72	1.35	11
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	99.7	78.0	112	12.1	11
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	GENERAL INORGANIC	Chloride, Total	mg/L	22.0	14.6	38.4	8.13	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	GENERAL INORGANIC	Hardness	mg/L as CaCO3	146	134	156	7.12	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	36.4	19.6	73.4	18.1	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	18.0	0.116	35.8	12.8	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	GENERAL ORGANIC	Carbon, Total Organic	mg/L	19.8	2.73	39.3	13.5	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	METAL	Calcium, Total	mg/L	40.1	36.9	43.8	2.02	11
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	METAL	Iron, Total	µg/L	282	81.5	670	206	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	METAL	Magnesium, Total	mg/L	10.9	10.2	11.8	0.519	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	NITROGEN	Ammonia Nitrogen	mg/L	0.026	0.0005	0.069	0.023	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.672	0.259	1.14	0.306	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.917	0.330	2.01	0.529	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	PHOSPHORUS	Orthophosphorus	mg/L	0.094	0.046	0.123	0.023	22
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	PHOSPHORUS	Total Phosphorus	mg/L	0.131	0.059	0.201	0.044	11
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	PHYSICAL	Color	CPU	294	15.0	1,500	452	11
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	PHYSICAL	pH	SU	7.18	6.67	7.43	0.271	10
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	PHYSICAL	Secchi	m	0.787	0.400	1.21	0.227	10
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	PHYSICAL	Specific Conductance	umhos/cm	311	281	386	27.9	11
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	PHYSICAL	Turbidity	NTU	2.29	0.500	3.60	1.12	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	SOLID	Total Dissolved Solids	mg/L	315	174	1,443	357	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	SOLID	Total Suspended Solids	mg/L	3.33	0.00	7.00	2.64	12
20	Wekiva River	Internal	7235	WR-ULW	Wekiva River Upstream of Little Wekiva	10/2/2002	7/8/2003	TEMPERATURE	Water Temperature	C	21.8	13.6	26.5	4.03	11
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	BACTERIOLOGICAL	Fecal Coliform	#/100ml	4,905	10.0	38,000	13,374	8
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	458	190	965	277	6
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	%	63.2	46.0	83.7	9.68	11
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.57	4.00	7.70	0.948	12

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	94.7	85.9	103	4.87	10
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	10/8/1985	GENERAL INORGANIC	Chloride, Total	mg/L	17.3	13.0	26.1	5.33	5
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	1.35	0.700	2.00	0.919	2
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	2.50	1.00	4.00	2.12	2
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	11.5	10.0	13.0	2.12	2
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	98.0	83.0	113	21.2	2
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	11.5	1.00	22.0	14.8	2
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	6.00	6.00	6.00	---	1
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	7.00	7.00	7.00	---	1
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	3.00	2.00	4.00	1.41	2
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	59.0	59.0	59.0	---	1
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.036	0.00	0.080	0.036	7
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.563	0.330	0.830	0.211	7
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	7/16/1984	11/27/1984	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.548	0.370	0.850	0.263	3
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	NITROGEN	Unionized Ammonia	mg/L	0.0001	0.00	0.0004	0.0002	5
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.443	0.00	0.950	0.321	7
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	7.38	1.80	14.7	5.13	5
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.173	0.119	0.258	0.058	10
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	5/18/1988	PHYSICAL	pH	SU	7.07	5.90	7.60	0.546	10
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	1.13	0.750	1.50	0.286	10
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	PHYSICAL	Specific Conductance	umhos/cm	283	225	336	38.7	10
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	PHYSICAL	Turbidity	NTU	1.29	0.560	2.60	0.770	10
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	8/10/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	3,613	340	9,999	5,531	3
21	Wekiva River	Internal	7505	10466	Wekiva River Downstream from Little Wekiva	1/7/1982	3/17/1986	TEMPERATURE	Water Temperature	C	22.2	19.0	25.5	1.98	11
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fec Col / Fec Strp	---	0.440	0.440	0.440	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	8/31/1973	8/31/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	44.0	44.0	44.0	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	8/31/1973	8/31/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	690	690	690	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	59.0	53.6	64.5	7.69	2
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	8/31/1973	3/4/1974	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.15	4.50	5.80	0.919	2
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	3/4/1974	3/4/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	199	199	199	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	3/4/1974	3/4/1974	GENERAL INORGANIC	Chloride, Total	mg/L	10.9	10.9	10.9	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	3/4/1974	3/4/1974	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.680	0.680	0.680	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	8/31/1973	8/31/1973	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	2.50	2.50	2.50	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	3/4/1974	3/4/1974	PHYSICAL	pH	SU	7.60	7.60	7.60	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	3/4/1974	3/4/1974	PHYSICAL	Specific Conductance	umhos/cm	179	179	179	---	1
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	8/31/1973	3/4/1974	PHYSICAL	Turbidity	NTU	12.5	12.5	12.5	0.00	2
22	Wekiva River	Internal	7505	20010436	Wekiva River Downstream from Little Wekiva River	8/31/1973	3/4/1974	TEMPERATURE	Water Temperature	C	23.1	21.0	25.1	2.90	2
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	BACTERIOLOGICAL	Fecal Coliform	#/100ml	74.0	74.0	74.0	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	BACTERIOLOGICAL	Total Coliform	#/100ml	300	300	300	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	BIOLOGICAL	Chlorophyll-a Corr	µg/L	0.400	0.400	0.400	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	BIOLOGICAL	Pheophytin-a	µg/L	1.64	1.64	1.64	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	DISSOLVED OXYGEN	Dissolved Oxygen	%	70.4	70.4	70.4	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	6.83	6.83	6.83	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	145	145	145	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	GENERAL INORGANIC	Chloride, Total	mg/L	18.0	18.0	18.0	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	24.0	24.0	24.0	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	NITROGEN	Ammonia Nitrogen	mg/L	0.029	0.029	0.029	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.980	0.980	0.980	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.210	0.210	0.210	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	NITROGEN	Unionized Ammonia	mg/L	0.0002	0.0002	0.0002	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	PHOSPHORUS	Orthophosphorus	mg/L	0.108	0.108	0.108	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	PHOSPHORUS	Total Phosphorus	mg/L	0.120	0.120	0.120	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	PHYSICAL	Color	CPU	20.0	20.0	20.0	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	PHYSICAL	pH	SU	7.28	7.28	7.28	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	PHYSICAL	Secchi	m	0.800	0.800	0.800	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	PHYSICAL	Specific Conductance	umhos/cm	314	314	314	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	PHYSICAL	Turbidity	NTU	1.50	1.50	1.50	---	1
23	Wekiva River	Internal	7820	20010126	Big Wekiva River Downstream of Little Wekiva	1/13/1997	1/13/1997	TEMPERATURE	Water Temperature	C	17.4	17.4	17.4	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	6/8/1999	FLOW	Flow, Inst	cfs	181	172	189	12.0	2
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	95.0	95.0	95.0	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	GENERAL INORGANIC	Chloride, Total	mg/L	13.0	13.0	13.0	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	GENERAL INORGANIC	Hardness	mg/L as CaCO3	120	120	120	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	GENERAL INORGANIC	Sulfate, Total	mg/L	18.0	18.0	18.0	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	NITROGEN	Ammonia Nitrogen	mg/L	0.020	0.020	0.020	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	NITROGEN	Organic Nitrogen	mg/L	0.220	0.220	0.220	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	PHOSPHORUS	Orthophosphorus	mg/L	0.090	0.090	0.090	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	PHOSPHORUS	Total Phosphorus	mg/L	0.110	0.110	0.110	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	PHYSICAL	Color	CPU	15.0	15.0	15.0	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	PHYSICAL	pH	SU	7.60	7.60	7.60	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	PHYSICAL	Specific Conductance	umhos/cm	260	260	260	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	PHYSICAL	Turbidity	NTU	3.00	3.00	3.00	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	SOLID	Total Dissolved Solids	mg/L	153	153	153	---	1
24	Wekiva River	Internal	8095	284539081245701	Wekiva River Nea Paola	5/10/1973	5/10/1973	TEMPERATURE	Water Temperature	C	23.0	23.0	23.0	---	1
25	Wekiva River	Internal	11640	22349993	Wekiva River at Old RR Crossing Near Sanford	7/7/1995	3/11/2002	FLOW	Flow	cfs	251	120	1,070	127	2440
25	Wekiva River	Internal	11640	22349993	Wekiva River at Old RR Crossing Near Sanford	7/10/1995	3/7/2002	FLOW	Flow, Inst	cfs	277	132	855	168	51
25	Wekiva River	Internal	11640	22349993	Wekiva River at Old RR Crossing Near Sanford	7/8/1995	3/11/2002	PHYSICAL	Stage	ft	2.67	1.99	21.9	0.561	2425
25	Wekiva River	Internal	11640	22349993	Wekiva River at Old RR Crossing Near Sanford	7/8/1995	3/11/2002	PHYSICAL	Stage	ft MSL	9.42	8.74	28.6	0.561	2425
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	9/25/1984	BACTERIOLOGICAL	Fecal Coliform	#/100ml	81.2	5.00	205	82.8	6
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	142	60.0	188	49.6	5
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	10/8/1985	DISSOLVED OXYGEN	Dissolved Oxygen	%	120	67.0	162	26.5	10
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	10.4	5.90	12.6	2.03	11
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	10/8/1985	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	97.8	92.2	106	4.79	8
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	36.1	18.7	59.6	17.3	4
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	1.35	0.700	2.00	0.919	2
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	1.50	1.00	2.00	0.707	2
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	11.5	9.00	14.0	3.54	2
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	60.0	53.0	67.0	9.90	2
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	5.50	1.00	10.0	6.36	2
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	3.00	3.00	3.00	---	1
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	6.00	6.00	6.00	---	1
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	1.80	0.600	3.00	1.70	2
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	78.0	78.0	78.0	---	1
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	10/8/1985	NITROGEN	Ammonia Nitrogen	mg/L	0.033	0.00	0.120	0.047	6
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	10/8/1985	NITROGEN	Organic Nitrogen	mg/L	0.568	0.310	0.960	0.235	6
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	9/25/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.445	0.320	0.690	0.212	3
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	10/8/1985	NITROGEN	Unionized Ammonia	mg/L	0.005	0.00	0.014	0.006	4
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.540	0.200	0.700	0.230	5
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	21.6	6.10	60.3	25.9	4
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.177	0.117	0.242	0.046	8
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	5/18/1988	PHYSICAL	pH	SU	7.98	7.20	8.70	0.550	8
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	0.975	0.600	1.70	0.358	8
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	383	257	690	133	9
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	5/18/1988	PHYSICAL	Turbidity	NTU	2.35	0.740	13.0	4.01	9
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	8/10/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	2,220	210	6,000	3,276	3
26	Wekiva River	Internal	14240	10860	Wekiva River near Bridge at SR46	1/7/1982	10/8/1985	TEMPERATURE	Water Temperature	C	23.8	19.0	29.0	2.81	10
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	1/31/1996	BACTERIOLOGICAL	Fecal Coliform	#/100ml	35.8	3.00	80.0	33.1	4
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	7/19/1995	1/31/1996	BACTERIOLOGICAL	Total Coliform	#/100ml	1,247	40.0	2,400	1,181	3
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.45	0.00	6.55	1.65	47
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	BIOLOGICAL	Chlorophyll-b	µg/L	0.333	0.00	2.21	0.538	47
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	BIOLOGICAL	Pheophytin-a	µg/L	3.17	0.00	26.4	5.05	47
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/8/1967	8/27/2002	DISSOLVED OXYGEN	Dissolved Oxygen	%	91.5	42.0	136	28.0	10
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/8/1967	9/11/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	7.79	3.25	11.8	2.27	64
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	10/1/1935	9/30/2003	FLOW	Flow	cfs	289	105	2,060	129	24862
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	10/9/1931	4/6/2004	FLOW	Flow, Inst	cfs	296	27.0	1,850	170	644
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/17/1954	9/11/2003	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	92.8	52.2	131	15.3	81
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/17/1954	9/11/2003	GENERAL INORGANIC	Chloride, Total	mg/L	35.8	10.0	112	20.0	94
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/17/1954	9/11/2003	GENERAL INORGANIC	Hardness	mg/L as CaCO3	141	57.0	227	28.4	80
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	5/24/1995	GENERAL INORGANIC	Silica, Total	mg/L	1.29	1.29	1.29	---	1
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/17/1954	9/11/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	37.2	15.0	104	19.6	90
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	3/2/2000	8/27/2002	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	6.24	2.10	29.0	7.92	12
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	GENERAL ORGANIC	Carbon, Total Organic	mg/L	8.71	0.120	39.0	9.40	55
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	11/19/1998	9/11/2003	METAL	Aluminum, Total	µg/L	68.4	12.2	221	52.2	30
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	11/19/1998	9/11/2003	METAL	Arsenic, Total	µg/L	0.910	0.015	4.79	0.945	30
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	11/19/1998	9/11/2003	METAL	Barium, Total	µg/L	9.83	0.069	15.7	2.87	38
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	11/19/1998	9/11/2003	METAL	Cadmium, Total	µg/L	0.070	0.0005	0.860	0.162	30
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	METAL	Calcium, Total	mg/L	41.4	28.7	64.1	6.34	55
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	11/19/1998	9/11/2003	METAL	Chromium, Total	µg/L	0.474	0.002	4.06	0.711	30
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	METAL	Copper, Total	µg/L	0.989	0.0005	6.00	1.36	47
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	METAL	Iron, Total	µg/L	136	0.00	776	178	59
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	METAL	Lead, Total	µg/L	0.399	0.00	2.22	0.499	47
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	METAL	Magnesium, Total	mg/L	11.7	8.28	16.3	1.57	54
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	11/19/1998	9/11/2003	METAL	Manganese, Total	µg/L	5.09	0.080	13.4	3.86	30
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	11/19/1998	9/11/2003	METAL	Nickel, Total	µg/L	4.30	0.055	69.1	12.6	30
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	METAL	Potassium, Total	mg/L	2.05	1.27	6.02	0.670	47
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	11/19/1998	9/11/2003	METAL	Selenium, Total	µg/L	0.645	0.025	3.60	0.913	30
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	3/2/2000	8/15/2001	METAL	Strontium, Total	µg/L	475	440	580	44.7	8
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	METAL	Zinc, Total	µg/L	3.06	0.0005	25.0	5.52	47
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/10/1973	9/11/2003	NITROGEN	Ammonia Nitrogen	mg/L	0.016	0.0005	0.053	0.011	60
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.445	0.078	0.734	0.176	55
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/16/1970	8/27/2002	NITROGEN	Organic Nitrogen	mg/L	0.626	0.200	1.50	0.518	5

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.588	0.170	1.71	0.429	51
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	2/14/2002	8/27/2002	NITROGEN	Total Nitrogen	mg/L	1.10	0.540	1.80	0.643	3
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/10/1973	9/11/2003	PHOSPHORUS	Orthophosphorus	mg/L	0.088	0.033	0.130	0.020	56
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/10/1973	9/11/2003	PHOSPHORUS	Total Phosphorus	mg/L	0.110	0.004	0.197	0.031	53
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/17/1954	9/11/2003	PHYSICAL	Color	CPU	59.5	0.00	600	89.8	89
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/17/1954	9/11/2003	PHYSICAL	pH	SU	7.46	5.80	8.70	0.536	101
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	PHYSICAL	Secchi	m	1.00	0.100	1.80	0.336	23
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/17/1954	9/11/2003	PHYSICAL	Specific Conductance	umhos/cm	375	228	699	101	95
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	1/6/1932	4/6/2004	PHYSICAL	Stage	ft	2.66	1.56	7.35	0.551	24440
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	1/6/1932	4/6/2004	PHYSICAL	Stage	ft MSL	7.62	6.52	12.3	0.551	24440
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/16/1970	9/11/2003	PHYSICAL	Turbidity	NTU	1.67	0.250	8.20	1.44	62
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	6/11/1965	9/11/2003	SOLID	Total Dissolved Solids	mg/L	235	136	385	58.4	81
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/24/1995	9/11/2003	SOLID	Total Suspended Solids	mg/L	4.76	0.500	18.0	3.81	59
27	Wekiva River	Internal	14240	2235000	Wekiva River Near Sanford	5/17/1954	9/11/2003	TEMPERATURE	Water Temperature	C	23.6	11.7	76.0	5.96	126
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	4/9/1974	4/9/1974	BACTERIOLOGICAL	Fec Col / Fec Strp	---	0.500	0.500	0.500	---	1
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	2/26/1974	3/30/1976	BACTERIOLOGICAL	Fecal Coliform	#/100ml	3.33	0.00	10.0	5.77	3
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	3/30/1976	BACTERIOLOGICAL	Total Coliform	#/100ml	459	21.0	1,600	628	7
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/10/1984	7/3/1984	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.67	0.00	3.33	2.35	2
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	DISSOLVED OXYGEN	Dissolved Oxygen	%	93.7	19.1	193	50.2	11
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	8.29	1.60	15.6	4.04	11
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	110	78.0	201	45.1	11
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	GENERAL INORGANIC	Chloride, Total	mg/L	21.1	9.90	35.0	8.84	11
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	4/9/1974	4/9/1974	GENERAL INORGANIC	Hardness	mg/L as CaCO3	55.0	55.0	55.0	---	1
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	2/26/1974	7/3/1984	GENERAL INORGANIC	Sulfate, Total	mg/L	25.5	20.0	31.0	5.32	4
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	NITROGEN	Ammonia Nitrogen	mg/L	0.073	0.00	0.170	0.053	8
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/10/1984	7/3/1984	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.785	0.730	0.840	0.078	2
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	NITROGEN	Organic Nitrogen	mg/L	0.425	0.230	0.930	0.225	8
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	3/5/1974	1/10/1984	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.663	0.440	0.960	0.268	3
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	NITROGEN	Unionized Ammonia	mg/L	0.003	0.00	0.009	0.003	8
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.00	0.400	1.70	0.454	8
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	10/31/1972	3/30/1976	PHOSPHORUS	Orthophosphorus	mg/L	0.160	0.100	0.220	0.041	6
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	8/7/1973	7/3/1984	PHOSPHORUS	Total Phosphorus	mg/L	0.202	0.110	0.280	0.057	6
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	PHYSICAL	Color	CPU	45.0	15.0	120	32.3	9
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	PHYSICAL	pH	SU	7.81	7.10	9.00	0.464	15
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/10/1984	7/3/1984	PHYSICAL	Secchi	m	1.15	0.600	1.70	0.778	2
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	PHYSICAL	Specific Conductance	umhos/cm	288	192	370	58.1	12
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	PHYSICAL	Turbidity	NTU	8.56	0.100	12.5	5.52	11
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	SOLID	Total Suspended Solids	mg/L	5.44	2.00	9.00	2.88	9
28	Wekiva River	Internal	14240	20010140	Wekiva River at SR46	1/12/1971	7/3/1984	TEMPERATURE	Water Temperature	C	21.6	13.5	27.0	4.14	11
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	2/25/1997	BACTERIOLOGICAL	Fec Col / Fec Strp	---	1.34	0.003	35.0	4.44	63
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	BACTERIOLOGICAL	Fecal Coliform	#/100ml	108	4.00	900	162	82
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	BACTERIOLOGICAL	Total Coliform	#/100ml	1,504	10.0	16,700	2,577	82
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.91	0.00	11.9	2.28	77
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	BIOLOGICAL	Chlorophyll-b	µg/L	1.19	0.00	17.3	2.28	79
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	BIOLOGICAL	Chlorophyll-c Corr	µg/L	2.85	0.00	19.0	4.59	39
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	BIOLOGICAL	Pheophytin-a	µg/L	2.24	0.00	22.5	3.41	84
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	2/25/1997	DISSOLVED OXYGEN	Dissolved Oxygen	%	60.5	15.7	100	16.9	65
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.70	1.60	12.3	1.96	84
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	93.7	26.4	157	22.1	82
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	GENERAL INORGANIC	Chloride, Total	mg/L	21.3	0.600	63.7	15.9	43
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	GENERAL INORGANIC	Hardness	mg/L as CaCO3	135	2.50	241	34.2	57
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/28/1991	7/18/2002	GENERAL INORGANIC	Sulfate, Total	mg/L	47.7	1.40	214	54.6	44
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	METAL	Aluminum, Total	µg/L	151	0.100	500	155	27
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/29/1992	7/18/2002	METAL	Arsenic, Total	µg/L	10.4	2.50	12.5	4.19	19
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	2/25/1997	7/18/2002	METAL	Barium, Total	µg/L	23.5	2.50	25.0	5.81	15
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	METAL	Cadmium, Total	µg/L	10.0	0.150	250	48.9	26
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	2/14/1995	2/25/1997	METAL	Calcium, Total	mg/L	38.1	29.9	54.0	11.0	4
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	METAL	Chromium, Total	µg/L	2.20	0.250	5.00	1.38	25
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	2/25/1997	7/18/2002	METAL	Cobalt, Total	µg/L	4.78	1.50	5.00	0.875	16
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	METAL	Copper, Total	µg/L	12.3	0.025	180	34.0	28
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	METAL	Iron, Total	µg/L	70.8	0.180	500	113	28
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	METAL	Lead, Total	µg/L	4.66	1.00	50.0	8.99	28
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	2/14/1995	2/25/1997	METAL	Magnesium, Total	mg/L	11.0	8.61	13.8	2.52	4
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	METAL	Manganese, Total	µg/L	7.11	1.50	25.0	5.88	23
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	11/28/2000	7/18/2002	METAL	Mercury, Total	µg/L	0.100	0.100	0.100	0.0000	9
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	METAL	Nickel, Total	µg/L	14.8	1.50	25.0	5.43	26
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	2/25/1997	2/25/1997	METAL	Potassium, Total	mg/L	1.70	1.70	1.70	---	1
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	7/22/1991	7/18/2002	METAL	Selenium, Total	µg/L	4.06	0.009	21.0	4.29	20
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	2/25/1997	7/18/2002	METAL	Silver, Total	µg/L	1.34	0.015	1.50	0.434	16
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	2/14/1995	7/18/2002	METAL	Zinc, Total	µg/L	8.66	0.026	15.0	4.16	13

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	NITROGEN	Ammonia Nitrogen	mg/L	0.072	0.005	0.410	0.075	84
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.645	0.080	1.20	0.327	27
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	NITROGEN	Organic Nitrogen	mg/L	0.593	0.010	1.90	0.499	46
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.667	0.050	3.40	0.546	87
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	10/26/1981	7/18/2002	NITROGEN	Total Nitrogen	mg/L	1.26	0.550	2.30	0.398	40
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	2/25/1997	NITROGEN	Unionized Ammonia	mg/L	0.001	0.00	0.005	0.001	62
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	2/25/1997	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	2.33	0.00	6.90	1.48	62
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	OXYGEN DEMAND	Carbonaceous Biochemical Oxygen Demand, 5 Day	mg/L	2.27	0.700	6.90	1.61	36
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	5/6/1987	7/18/2002	PHOSPHORUS	Orthophosphorus	mg/L	0.123	0.024	0.377	0.067	54
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	PHOSPHORUS	Total Phosphorus	mg/L	0.148	0.010	0.414	0.070	114
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	4/11/1990	7/18/2002	PHYSICAL	Color	CPU	73.3	10.0	400	88.7	29
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	PHYSICAL	pH	SU	7.24	5.50	8.10	0.523	86
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	8/23/1994	7/18/2002	PHYSICAL	Secchi	m	1.01	0.300	2.00	0.483	25
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	2/6/1980	7/18/2002	PHYSICAL	Specific Conductance	umhos/cm	359	59.0	2,900	310	80
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	PHYSICAL	Turbidity	NTU	4.30	0.100	57.0	9.56	88
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	7/18/1990	7/18/2002	SOLID	Total Dissolved Solids	mg/L	261	25.0	2,469	398	34
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/24/1989	7/18/2002	SOLID	Total Suspended Solids	mg/L	119	0.500	501	133	88
29	Wekiva River	Internal	14240	BWC	Big Wekiva at Highway 46	1/2/1980	7/18/2002	TEMPERATURE	Water Temperature	C	21.2	7.50	27.2	4.67	85
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	1/30/1991	3/9/1995	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.30	0.00	3.74	0.988	19
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	1/30/1991	3/9/1995	BIOLOGICAL	Chlorophyll-b	µg/L	0.088	0.00	0.622	0.187	19
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	1/30/1991	3/9/1995	BIOLOGICAL	Pheophytin-a	µg/L	1.30	0.00	4.01	1.17	19
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	8.06	4.20	12.6	2.19	16
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	1/30/1991	3/9/1995	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	96.9	38.0	121	17.9	19
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	11/20/1990	3/9/1995	GENERAL INORGANIC	Chloride, Total	mg/L	32.1	16.0	109	22.3	20
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	3/19/1991	3/9/1995	GENERAL INORGANIC	Hardness	mg/L as CaCO3	136	86.0	210	31.9	10
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	7/30/1991	1/30/1992	GENERAL INORGANIC	Silica, Total	mg/L	3.50	2.00	4.00	1.00	4
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	1/30/1991	3/9/1995	GENERAL INORGANIC	Sulfate, Total	mg/L	33.9	18.0	105	21.6	19
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	GENERAL ORGANIC	Carbon, Total Organic	mg/L	7.63	2.50	31.5	7.03	17
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/6/1992	3/9/1995	METAL	Arsenic, Total	µg/L	0.589	0.00	2.00	0.578	10
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Cadmium, Total	µg/L	0.155	0.00	0.350	0.128	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Calcium, Total	mg/L	34.2	17.0	48.0	8.17	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Chromium, Total	µg/L	0.542	0.00	1.10	0.438	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Copper, Total	µg/L	1.02	0.00	3.00	1.07	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Iron, Total	µg/L	115	21.0	396	115	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Lead, Total	µg/L	0.825	0.00	4.00	1.24	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Magnesium, Total	mg/L	10.1	7.40	12.9	1.48	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	8/5/1992	METAL	Manganese, Total	µg/L	7.68	2.50	16.7	6.23	4
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Nickel, Total	µg/L	0.508	0.00	2.10	0.661	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Potassium, Total	mg/L	4.74	1.50	34.5	9.39	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	12/6/1993	3/9/1995	METAL	Silver, Total	µg/L	0.059	0.00	0.300	0.110	8
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	METAL	Zinc, Total	µg/L	25.8	5.00	56.0	14.2	12
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	11/20/1990	3/9/1995	NITROGEN	Ammonia Nitrogen	mg/L	0.017	0.00	0.044	0.011	22
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	11/20/1990	3/9/1995	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.822	0.042	2.77	0.538	20
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	11/20/1990	3/9/1995	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.634	0.150	2.17	0.484	22
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	11/20/1990	5/21/1991	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.520	0.300	0.800	0.192	5
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	3/19/1991	3/9/1995	PHOSPHORUS	Orthophosphorus	mg/L	0.108	0.071	0.140	0.018	18
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	11/20/1990	3/9/1995	PHOSPHORUS	Total Phosphorus	mg/L	0.153	0.085	0.244	0.040	22
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	3/19/1991	3/9/1995	PHYSICAL	Color	CPU	65.3	15.0	400	94.2	17
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	PHYSICAL	pH	SU	7.48	6.60	8.50	0.518	17
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	8/5/1992	3/9/1995	PHYSICAL	Secchi	m	1.09	0.100	2.08	0.639	6
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	11/20/1990	3/9/1995	PHYSICAL	Specific Conductance	umhos/cm	3,076	289	19,810	6,793	21
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	8/5/1992	8/5/1992	PHYSICAL	Stage	ft	2.15	2.15	2.15	---	1
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	11/20/1990	3/9/1995	PHYSICAL	Turbidity	NTU	2.10	0.560	6.40	1.49	22
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	3/19/1991	3/9/1995	SOLID	Total Dissolved Solids	mg/L	225	162	462	74.3	18
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	3/19/1991	3/9/1995	SOLID	Total Suspended Solids	mg/L	3.11	0.00	9.00	2.49	18
30	Wekiva River	Internal	14240	WR46	Wekiva River 50 meters downstream of SR 46	5/21/1991	3/9/1995	TEMPERATURE	Water Temperature	C	23.7	15.7	28.8	3.82	17
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	BIOLOGICAL	Chlorophyll-a Corr	µg/L	3.61	1.07	6.15	3.59	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	BIOLOGICAL	Chlorophyll-b	µg/L	0.00	0.00	0.00	0.00	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	BIOLOGICAL	Pheophytin-a	µg/L	4.91	0.615	9.20	6.07	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	DISSOLVED OXYGEN	Dissolved Oxygen	%	120	112	127	10.6	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	11.3	10.5	12.1	1.13	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	106	104	108	2.83	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	GENERAL INORGANIC	Chloride, Total	mg/L	28.5	22.0	35.0	9.19	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	GENERAL INORGANIC	Hardness	mg/L as CaCO3	146	146	146	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	11/13/1991	11/13/1991	GENERAL INORGANIC	Silica, Total	mg/L	4.00	4.00	4.00	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	GENERAL INORGANIC	Sulfate, Total	mg/L	34.0	24.0	44.0	14.1	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	GENERAL ORGANIC	Carbon, Total Organic	mg/L	3.17	2.93	3.40	0.332	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Cadmium, Total	µg/L	0.250	0.250	0.250	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Calcium, Total	mg/L	40.0	40.0	40.0	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Chromium, Total	µg/L	2.00	2.00	2.00	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Copper, Total	µg/L	1.00	1.00	1.00	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Iron, Total	µg/L	73.0	73.0	73.0	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Lead, Total	µg/L	1.00	1.00	1.00	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Magnesium, Total	mg/L	11.2	11.2	11.2	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Manganese, Total	µg/L	5.00	5.00	5.00	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Nickel, Total	µg/L	1.00	1.00	1.00	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Potassium, Total	mg/L	1.80	1.80	1.80	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	METAL	Zinc, Total	µg/L	16.0	16.0	16.0	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	NITROGEN	Ammonia Nitrogen	mg/L	0.008	0.003	0.013	0.007	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	3/12/1991	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.802	0.802	0.802	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.415	0.250	0.580	0.233	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	NITROGEN	Unionized Ammonia	mg/L	0.0003	0.0001	0.0004	0.0002	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	PHOSPHORUS	Orthophosphorus	mg/L	0.132	0.125	0.139	0.010	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	PHOSPHORUS	Total Phosphorus	mg/L	0.157	0.142	0.172	0.021	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	PHYSICAL	Color	CPU	20.0	15.0	25.0	7.07	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	PHYSICAL	pH	SU	7.90	7.80	8.00	0.141	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	PHYSICAL	Specific Conductance	umhos/cm	375	340	410	49.5	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	11/13/1991	11/13/1991	PHYSICAL	Turbidity	NTU	1.20	1.20	1.20	---	1
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	SOLID	Total Dissolved Solids	mg/L	224	163	284	85.6	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	SOLID	Total Suspended Solids	mg/L	26.5	1.00	52.0	36.1	2
31	Wekiva River	Internal	14240	WRUS46	Wekiva River 100 M Upstream Of Sr 46	3/12/1991	11/13/1991	TEMPERATURE	Water Temperature	C	18.9	18.3	19.4	0.778	2
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	11/17/1983	3/17/1986	BACTERIOLOGICAL	Fecal Coliform	#/100ml	142	50.0	310	120	4
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	11/17/1983	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	80.0	30.0	135	48.5	4
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	11/17/1983	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	%	119	79.9	155	26.1	8
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	11/17/1983	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	10.0	6.70	11.8	1.70	9
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	3/20/1984	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	97.8	88.8	110	7.23	7
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	3/20/1984	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	130	85.0	154	32.0	4
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/17/1984	7/17/1984	METAL	Cadmium, Total	µg/L	3.00	3.00	3.00	---	1
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/17/1984	7/17/1984	METAL	Chromium, Total	µg/L	2.00	2.00	2.00	---	1
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/17/1984	7/17/1984	METAL	Copper, Total	µg/L	10.0	10.0	10.0	---	1
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/17/1984	7/17/1984	METAL	Iron, Total	µg/L	63.0	63.0	63.0	---	1
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/17/1984	7/17/1984	METAL	Lead, Total	µg/L	4.00	4.00	4.00	---	1
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/17/1984	7/17/1984	METAL	Silver, Total	µg/L	2.00	2.00	2.00	---	1
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	3/20/1984	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.065	0.00	0.110	0.047	4
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	3/20/1984	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.630	0.370	0.960	0.287	4
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/16/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.544	0.294	0.860	0.277	4
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	5/14/1985	3/17/1986	NITROGEN	Unionized Ammonia	mg/L	0.019	0.0004	0.057	0.033	3
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/16/1984	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.20	0.700	1.45	0.344	4
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	9.82	5.20	13.6	3.39	5
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	3/20/1984	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.311	0.123	1.19	0.392	7
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/16/1984	5/18/1988	PHYSICAL	pH	SU	8.01	7.00	9.50	0.884	7
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	7/16/1984	5/18/1988	PHYSICAL	Secchi	m	0.674	0.500	1.00	0.206	7
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	3/20/1984	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	722	143	1,000	289	8
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	3/20/1984	5/18/1988	PHYSICAL	Turbidity	NTU	1.26	0.680	2.52	0.645	8
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	8/10/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	372	146	600	227	3
32	Wekiva River	Internal	16580	11057	Wekiva River at Katie's Landing	11/17/1983	3/17/1986	TEMPERATURE	Water Temperature	C	24.5	19.0	30.0	3.45	8
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	8.50	8.50	8.50	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	6/8/1999	FLOW	Flow, Inst	cfs	188	183	193	7.07	2
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	99.0	99.0	99.0	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	GENERAL INORGANIC	Chloride, Total	mg/L	150	150	150	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	GENERAL INORGANIC	Hardness	mg/L as CaCO3	210	210	210	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	GENERAL INORGANIC	Sulfate, Total	mg/L	73.0	73.0	73.0	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	PHYSICAL	Color	CPU	10.0	10.0	10.0	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	PHYSICAL	pH	SU	8.40	8.40	8.40	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	PHYSICAL	Specific Conductance	umhos/cm	1,460	1,460	1,460	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	SOLID	Total Dissolved Solids	mg/L	484	484	484	---	1
33	Wekiva River	Downstream	19470	285059081231200	Wekiva River 1.6 Mi Above Blackwater Creek Near Debary	4/7/1981	4/7/1981	TEMPERATURE	Water Temperature	C	23.0	23.0	23.0	---	1
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	3/17/1986	BACTERIOLOGICAL	Fecal Coliform	#/100ml	508	20.0	2,460	971	6
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	168	30.0	440	189	4
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	%	62.4	42.0	86.4	13.2	7
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.68	3.70	8.20	1.27	8
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	88.3	68.5	101	11.4	8
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	63.6	12.3	111	53.7	4
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	2.10	1.20	3.00	1.27	2
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	1.63	0.250	3.00	1.94	2
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	16.5	10.0	23.0	9.19	2
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	179	119	239	84.9	2
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	9.50	3.00	16.0	9.19	2
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	11.0	11.0	11.0	---	1
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	9.00	9.00	9.00	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	2.50	2.00	3.00	0.707	2
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	87.0	87.0	87.0	---	1
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.062	0.030	0.100	0.028	5
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.878	0.560	1.21	0.269	5
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	7/16/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.571	0.250	1.08	0.361	4
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	9/21/1983	NITROGEN	Unionized Ammonia	mg/L	0.0004	0.00	0.0007	0.0004	3
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.683	0.400	1.38	0.467	4
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	3/20/1984	11/27/1984	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	19.6	11.2	31.5	8.91	4
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.149	0.099	0.233	0.047	8
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	PHYSICAL	pH	SU	6.92	5.90	7.30	0.576	5
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	1.46	0.700	2.80	0.717	8
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	704	570	800	85.7	9
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	PHYSICAL	Turbidity	NTU	1.57	0.570	2.80	0.913	9
34	Wekiva River	Downstream	20280	11417	Wekiva River Upstream from St. Johns River	1/7/1982	5/18/1988	TEMPERATURE	Water Temperature	C	21.7	18.0	25.0	2.75	7
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	4/9/1974	4/9/1974	BACTERIOLOGICAL	Fec Col / Fec Strp	---	0.435	0.435	0.435	---	1
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	4/9/1974	4/9/1974	BACTERIOLOGICAL	Fecal Coliform	#/100ml	100	100	100	---	1
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	4/9/1974	4/9/1974	BACTERIOLOGICAL	Total Coliform	#/100ml	150	150	150	---	1
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/19/1974	4/9/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	70.9	67.8	76.8	5.09	3
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/19/1974	9/13/1999	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	6.68	6.10	7.40	0.497	5
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/19/1974	9/13/1999	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	144	102	201	51.6	5
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	3/5/1974	9/13/1999	GENERAL INORGANIC	Chloride, Total	mg/L	156	150	170	9.64	4
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	4/9/1974	4/9/1974	GENERAL INORGANIC	Hardness	mg/L as CaCO3	91.0	91.0	91.0	---	1
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/11/1999	9/13/1999	GENERAL INORGANIC	Sulfate, Total	mg/L	78.0	72.0	84.0	8.49	2
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/11/1999	9/13/1999	NITROGEN	Ammonia Nitrogen	mg/L	0.028	0.005	0.050	0.032	2
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/11/1999	9/13/1999	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.455	0.350	0.560	0.148	2
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/19/1974	9/13/1999	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.658	0.380	1.40	0.425	5
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/11/1999	9/13/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.102	0.095	0.110	0.005	6
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/19/1974	4/9/1974	PHOSPHORUS	Total Phosphorus	mg/L	0.110	0.100	0.120	0.014	2
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	9/13/1999	9/13/1999	PHYSICAL	Color	CPU	5.00	5.00	5.00	---	1
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	3/5/1974	9/13/1999	PHYSICAL	pH	SU	7.68	7.50	7.80	0.126	4
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/19/1974	9/13/1999	PHYSICAL	Specific Conductance	umhos/cm	697	625	756	64.4	5
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/19/1974	9/13/1999	PHYSICAL	Turbidity	NTU	5.37	0.450	12.5	6.51	5
35	Wekiva River	Downstream	21890	20010438	Wekiva River Upstream of Blackwater Creek	1/19/1974	9/13/1999	TEMPERATURE	Water Temperature	C	20.5	14.8	26.4	4.14	5
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.35	4.10	7.83	1.01	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	96.0	70.0	116	14.1	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	GENERAL INORGANIC	Chloride, Total	mg/L	156	82.5	205	35.1	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	GENERAL INORGANIC	Hardness	mg/L as CaCO3	220	174	248	24.4	10
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	76.9	64.7	91.2	8.07	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	12.0	1.86	25.7	7.54	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	GENERAL ORGANIC	Carbon, Total Organic	mg/L	12.9	4.06	28.3	7.70	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	METAL	Calcium, Total	mg/L	57.8	47.9	63.6	5.17	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	METAL	Iron, Total	µg/L	149	87.5	338	86.4	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	METAL	Magnesium, Total	mg/L	18.5	13.3	21.6	2.62	10
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	NITROGEN	Ammonia Nitrogen	mg/L	0.021	0.0005	0.050	0.018	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.336	0.031	0.530	0.147	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.556	0.300	1.11	0.260	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	PHOSPHORUS	Orthophosphorus	mg/L	0.094	0.025	0.137	0.027	19
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	PHOSPHORUS	Total Phosphorus	mg/L	0.120	0.064	0.200	0.037	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	PHYSICAL	Color	CPU	102	35.0	200	52.9	10
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	PHYSICAL	pH	SU	7.36	6.99	7.56	0.163	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	PHYSICAL	Secchi	m	1.22	0.620	1.72	0.319	10
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	PHYSICAL	Specific Conductance	umhos/cm	845	538	1,014	139	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	PHYSICAL	Turbidity	NTU	1.31	0.500	2.30	0.686	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	SOLID	Total Dissolved Solids	mg/L	488	368	628	74.6	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	SOLID	Total Suspended Solids	mg/L	2.73	0.00	6.00	2.52	11
36	Wekiva River	Downstream	21890	WR-UBWC	Wekiva River upstream of Blackwater Creek	10/17/2002	7/16/2003	TEMPERATURE	Water Temperature	C	21.2	12.6	26.1	4.44	10
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	GENERAL INORGANIC	Chloride, Total	mg/L	110	110	110	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	GENERAL INORGANIC	Hardness	mg/L as CaCO3	240	240	240	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	GENERAL INORGANIC	Sulfate, Total	mg/L	120	120	120	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.130	0.130	0.130	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.010	0.010	0.010	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	NITROGEN	Organic Nitrogen	mg/L	0.190	0.190	0.190	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.320	0.320	0.320	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	PHOSPHORUS	Orthophosphorus	mg/L	0.020	0.020	0.020	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	PHOSPHORUS	Total Phosphorus	mg/L	0.050	0.050	0.050	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	PHYSICAL	Color	CPU	2.50	2.50	2.50	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	PHYSICAL	pH	SU	7.85	7.80	7.90	0.071	2
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	PHYSICAL	Specific Conductance	umhos/cm	750	750	750	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	SOLID	Total Dissolved Solids	mg/L	498	498	498	---	1
37	Rock Springs	Spring	0	284317081234101	Rock Springs	10/22/1986	10/22/1986	TEMPERATURE	Water Temperature	C	23.5	23.5	23.5	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
38	Rock Springs	Spring	0	284522081300600	Rock Springs	5/22/2001	5/22/2001	DISSOLVED OXYGEN	Dissolved Oxygen	%	1.00	1.00	1.00	---	1
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	9/17/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.083	0.050	0.100	0.029	3
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	7/14/1999	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	86.0	86.0	86.0	---	1
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	5/22/2001	GENERAL INORGANIC	Chloride, Total	mg/L	7.85	7.80	7.90	0.071	2
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	5/22/2001	GENERAL INORGANIC	Hardness	mg/L as CaCO3	115	110	120	7.07	2
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	5/22/2001	GENERAL INORGANIC	Sulfate, Total	mg/L	17.5	17.0	18.0	0.707	2
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	7/14/1999	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.200	0.200	0.200	---	1
38	Rock Springs	Spring	0	284522081300600	Rock Springs	5/22/2001	5/22/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.100	0.100	0.100	---	1
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	5/22/2001	PHOSPHORUS	Orthophosphorus	mg/L	0.080	0.080	0.080	0.00	2
38	Rock Springs	Spring	0	284522081300600	Rock Springs	5/22/2001	5/22/2001	PHOSPHORUS	Total Phosphorus	mg/L	0.080	0.080	0.080	---	1
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	9/17/2001	PHYSICAL	pH	SU	7.52	6.30	8.20	0.726	5
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	9/17/2001	PHYSICAL	Specific Conductance	umhos/cm	258	254	264	5.13	3
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	5/22/2001	SOLID	Total Dissolved Solids	mg/L	149	147	150	2.12	2
38	Rock Springs	Spring	0	284522081300600	Rock Springs	7/14/1999	9/17/2001	TEMPERATURE	Water Temperature	C	23.8	23.7	23.8	0.058	3
39	Rock Springs Run	Upstream	250	330830	Rock Springs nr Apopka	12/13/2002	9/29/2003	FLOW	Flow	cfs	59.5	54.2	62.7	2.13	291
39	Rock Springs Run	Upstream	250	330830	Rock Springs nr Apopka	3/19/1984	2/6/2004	FLOW	Flow, Inst	cfs	56.3	34.1	71.1	6.18	101
39	Rock Springs Run	Upstream	250	330830	Rock Springs nr Apopka	11/1/2002	2/6/2004	PHYSICAL	Stage	ft	2.59	2.52	2.73	0.067	9
39	Rock Springs Run	Upstream	250	330830	Rock Springs nr Apopka	11/1/2002	2/6/2004	PHYSICAL	Stage	ft MSL	26.2	26.1	26.3	0.067	9
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/21/1969	5/6/1971	DISSOLVED OXYGEN	Dissolved Oxygen	%	32.3	20.0	48.0	11.8	4
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/21/1969	2/27/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	1.98	0.200	4.00	1.27	8
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	5/16/1970	9/30/2002	FLOW	Flow	cfs	48.7	37.0	73.0	5.38	1462
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	2/5/1931	9/23/2003	FLOW	Flow, Inst	cfs	59.1	36.4	83.2	8.01	339
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/26/1956	11/8/1971	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	88.5	66.0	165	19.0	20
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/26/1956	4/21/1997	GENERAL INORGANIC	Chloride, Total	mg/L	7.17	5.00	9.00	1.10	23
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/26/1956	5/25/1995	GENERAL INORGANIC	Hardness	mg/L as CaCO3	100	10.0	110	20.7	22
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/26/1956	4/21/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	17.4	16.0	20.0	1.08	23
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	5/16/1970	5/6/1971	NITROGEN	Organic Nitrogen	mg/L	0.810	0.020	1.60	1.12	2
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	8/16/1999	8/16/1999	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.100	0.100	0.100	---	1
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	8/16/1999	8/16/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.080	0.080	0.080	---	1
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	8/16/1999	8/16/1999	PHOSPHORUS	Total Phosphorus	mg/L	0.080	0.080	0.080	---	1
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/26/1956	5/20/1993	PHYSICAL	Color	CPU	4.26	0.00	10.0	3.90	21
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/26/1956	2/27/2001	PHYSICAL	pH	SU	7.48	6.40	8.20	0.420	32
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	4/26/1956	2/27/2001	PHYSICAL	Specific Conductance	umhos/cm	241	210	289	18.6	49
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	11/24/1959	9/23/2003	PHYSICAL	Stage	ft	36.2	1.43	52.4	14.8	412
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	11/24/1959	9/23/2003	PHYSICAL	Stage	ft MSL	63.7	26.0	80.0	14.9	413
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	5/16/1970	5/6/1971	PHYSICAL	Turbidity	NTU	2.50	0.00	5.00	3.54	2
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	10/17/1960	5/25/1995	SOLID	Total Dissolved Solids	mg/L	132	13.0	168	29.0	21
40	Rock Springs Run	Upstream	250	2234610	Rock Springs Near Apopka	2/5/1931	2/27/2001	TEMPERATURE	Water Temperature	C	23.9	21.5	28.5	0.853	108
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	4/26/1956	5/13/2004	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	89.2	66.0	117	6.30	74
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	4/26/1956	5/13/2004	GENERAL INORGANIC	Chloride, Total	mg/L	8.70	5.00	24.0	2.48	82
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	1/12/1994	8/12/2003	GENERAL INORGANIC	Fluoride, Total	mg/L	0.143	0.100	0.176	0.019	38
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	7/14/1987	7/16/2002	GENERAL INORGANIC	Silica, Total	mg/L	5.08	4.00	14.0	1.73	46
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	4/26/1956	5/13/2004	GENERAL INORGANIC	Sulfate, Total	mg/L	18.5	15.0	24.0	1.99	82
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	2/27/2001	2/27/2001	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	0.335	0.335	0.335	---	1
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	7/10/1990	2/27/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.778	0.310	1.60	0.571	4
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	7/7/1992	5/13/2004	METAL	Calcium, Total	mg/L	30.3	26.0	37.4	1.78	45
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	7/20/1993	11/18/2003	METAL	Iron, Total	µg/L	20.2	0.650	213	51.7	19
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	7/7/1992	5/13/2004	METAL	Magnesium, Total	mg/L	9.24	8.00	11.0	0.502	45
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	7/7/1992	5/13/2004	METAL	Potassium, Total	mg/L	1.35	1.05	1.93	0.202	44
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	7/7/1992	8/12/2003	METAL	Strontium, Total	µg/L	167	122	188	14.5	41
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	2/27/2001	2/27/2001	NITROGEN	Ammonia Nitrogen	mg/L	0.005	0.005	0.005	---	1
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	6/12/1984	5/13/2004	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	1.48	1.15	1.84	0.148	49
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	2/27/2001	2/27/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.004	0.004	0.004	---	1
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	11/22/1994	5/13/2004	PHOSPHORUS	Orthophosphorus	mg/L	0.077	0.042	0.094	0.012	38
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	8/16/1999	5/13/2004	PHOSPHORUS	Total Phosphorus	mg/L	0.084	0.080	0.088	0.003	5
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	4/26/1956	5/13/2004	PHYSICAL	pH	SU	7.54	6.40	8.20	0.313	87
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	4/26/1956	5/13/2004	PHYSICAL	Specific Conductance	umhos/cm	247	210	356	19.7	110
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	10/17/1960	5/13/2004	SOLID	Total Dissolved Solids	mg/L	146	118	289	21.5	74
41	Rock Springs Run	Upstream	250	Rock Springs	Rock Springs	2/5/1931	5/13/2004	TEMPERATURE	Water Temperature	C	23.8	21.5	28.5	0.718	168
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	2/25/1997	BACTERIOLOGICAL	Fec Col / Fec Strp	---	1.70	0.033	15.0	2.26	67
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	BACTERIOLOGICAL	Fecal Coliform	#/100ml	216	1.00	910	217	82
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	BACTERIOLOGICAL	Total Coliform	#/100ml	2,363	10.0	16,700	3,156	80
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.07	0.00	5.00	0.974	80
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	BIOLOGICAL	Chlorophyll-b	µg/L	0.859	0.00	7.60	1.38	84
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	BIOLOGICAL	Chlorophyll-c Corr	µg/L	2.54	0.00	19.4	4.48	42
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	BIOLOGICAL	Pheophytin-a	µg/L	1.12	0.00	6.90	1.47	84
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	11/30/1998	DISSOLVED OXYGEN	Dissolved Oxygen	%	62.2	22.6	126	15.1	73
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.74	2.40	11.4	1.51	86
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	86.4	3.00	138	18.7	87
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	GENERAL INORGANIC	Chloride, Total	mg/L	11.6	6.00	24.8	4.97	39

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	GENERAL INORGANIC	Hardness	mg/L as CaCO3	114	2.50	176	25.4	47
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/28/1991	4/7/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	34.1	10.3	160	41.7	38
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	METAL	Aluminum, Total	µg/L	184	12.5	500	165	26
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/29/1992	4/7/2003	METAL	Arsenic, Total	µg/L	9.56	2.50	12.5	4.70	17
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	2/25/1997	4/7/2003	METAL	Barium, Total	µg/L	25.0	25.0	25.0	0.00	12
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	METAL	Cadmium, Total	µg/L	0.439	0.050	2.90	0.558	23
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	2/25/1997	2/25/1997	METAL	Calcium, Total	mg/L	23.9	23.9	23.9	---	1
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	METAL	Chromium, Total	µg/L	2.58	0.250	10.0	2.19	22
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	2/25/1997	4/7/2003	METAL	Cobalt, Total	µg/L	4.73	1.50	5.00	0.971	13
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	METAL	Copper, Total	µg/L	6.62	0.023	30.6	8.49	26
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	METAL	Iron, Total	µg/L	39.8	0.130	310	59.0	25
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	METAL	Lead, Total	µg/L	4.71	0.091	40.0	7.68	26
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	2/25/1997	2/25/1997	METAL	Magnesium, Total	mg/L	8.83	8.83	8.83	---	1
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	METAL	Manganese, Total	µg/L	6.23	1.50	25.0	4.79	20
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	11/28/2000	4/7/2003	METAL	Mercury, Total	µg/L	0.100	0.100	0.100	0.0000	6
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	METAL	Nickel, Total	µg/L	36.3	1.50	500	98.9	24
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	2/25/1997	2/25/1997	METAL	Potassium, Total	mg/L	0.500	0.500	0.500	---	1
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	7/22/1991	4/7/2003	METAL	Selenium, Total	µg/L	3.51	0.116	8.00	1.93	17
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	2/25/1997	4/7/2003	METAL	Silver, Total	µg/L	1.31	0.016	1.50	0.477	13
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	2/25/1997	4/7/2003	METAL	Zinc, Total	µg/L	35.8	5.00	208	75.9	7
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	NITROGEN	Ammonia Nitrogen	mg/L	0.071	0.005	0.820	0.097	84
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	1.26	0.970	1.58	0.177	21
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	5/10/1989	4/7/2003	NITROGEN	Organic Nitrogen	mg/L	0.419	0.010	1.54	0.372	46
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	4/2/1980	4/7/2003	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.390	0.005	1.65	0.325	85
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	4/2/1980	4/7/2003	NITROGEN	Total Nitrogen	mg/L	1.47	0.230	2.69	0.542	39
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	11/30/1998	NITROGEN	Unionized Ammonia	mg/L	0.001	0.00	0.007	0.001	69
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	11/30/1998	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.89	0.050	8.70	1.32	71
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	OXYGEN DEMAND	Carbonaceous Biochemical Oxygen Demand, 5 Day	mg/L	1.97	0.050	8.70	1.61	42
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	5/6/1987	4/7/2003	PHOSPHORUS	Orthophosphorus	mg/L	0.070	0.003	0.112	0.026	56
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	PHOSPHORUS	Total Phosphorus	mg/L	0.098	0.010	0.359	0.046	107
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	4/11/1990	4/7/2003	PHYSICAL	Color	CPU	19.0	2.50	100	23.0	30
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	PHYSICAL	pH	SU	7.36	5.96	8.20	0.418	87
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	8/23/1994	4/7/2003	PHYSICAL	Secchi	m	1.31	0.500	3.00	0.680	24
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	PHYSICAL	Specific Conductance	umhos/cm	254	145	350	37.8	87
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	PHYSICAL	Turbidity	NTU	1.53	0.200	12.7	2.62	92
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	7/18/1990	4/7/2003	SOLID	Total Dissolved Solids	mg/L	128	5.00	198	45.2	39
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/24/1989	4/7/2003	SOLID	Total Suspended Solids	mg/L	81.5	0.200	232	86.4	91
42	Rock Springs Run	Internal	1800	BWA	Rock Springs Run at Camp Joy-Southern Baptist	1/2/1980	4/7/2003	TEMPERATURE	Water Temperature	C	21.9	12.0	28.0	2.90	85
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	1/13/2003	BACTERIOLOGICAL	Fecal Coliform	#/100ml	85.3	30.0	126	49.7	3
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	1/13/2003	BACTERIOLOGICAL	Total Coliform	#/100ml	5,677	330	8,700	4,644	3
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	1/13/2003	BIOLOGICAL	Chlorophyll-a Corr	µg/L	0.517	0.250	0.700	0.236	3
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	1/13/2003	BIOLOGICAL	Chlorophyll-b	µg/L	0.250	0.250	0.250	0.00	3
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	1/13/2003	BIOLOGICAL	Chlorophyll-c Corr	µg/L	0.250	0.250	0.250	0.00	3
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	1/13/2003	BIOLOGICAL	Pheophytin-a	µg/L	0.483	0.250	0.700	0.225	3
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	3.87	2.25	4.91	1.27	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	95.7	93.0	98.2	2.48	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	GENERAL INORGANIC	Chloride, Total	mg/L	8.72	6.64	10.6	1.79	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	GENERAL INORGANIC	Hardness	mg/L as CaCO3	109	107	111	1.52	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	20.3	15.1	25.4	4.26	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Aluminum, Total	µg/L	37.4	12.0	50.0	17.9	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Arsenic, Total	µg/L	10.7	8.00	12.5	2.46	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Barium, Total	µg/L	18.4	8.10	25.0	8.99	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Cadmium, Total	µg/L	0.500	0.500	0.500	0.00	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Chromium, Total	µg/L	1.82	0.800	2.50	0.931	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Cobalt, Total	µg/L	3.26	0.650	5.00	2.38	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Copper, Total	µg/L	2.17	1.05	2.50	0.632	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Iron, Total	µg/L	33.2	3.80	100	38.4	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Lead, Total	µg/L	3.50	2.50	5.00	1.37	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Manganese, Total	µg/L	2.41	0.040	5.00	2.42	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	METAL	Mercury, Total	µg/L	0.100	0.100	0.100	0.00	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Nickel, Total	µg/L	7.70	0.500	12.5	6.57	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Selenium, Total	µg/L	3.30	0.750	5.00	2.33	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Silver, Total	µg/L	1.15	0.550	1.50	0.482	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	10/13/2003	METAL	Zinc, Total	µg/L	4.68	0.450	7.50	3.86	5
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	NITROGEN	Ammonia Nitrogen	mg/L	0.012	0.005	0.020	0.006	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	1.26	1.00	1.45	0.206	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	NITROGEN	Organic Nitrogen	mg/L	0.105	0.010	0.210	0.082	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.131	0.094	0.230	0.066	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	NITROGEN	Total Nitrogen	mg/L	0.973	0.094	1.40	0.594	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	OXYGEN DEMAND	Carbonaceous Biochemical Oxygen Demand, 5 Day	mg/L	1.00	1.00	1.00	0.00	4

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	PHOSPHORUS	Orthophosphorus	mg/L	0.082	0.080	0.083	0.001	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	PHOSPHORUS	Total Phosphorus	mg/L	0.083	0.082	0.084	0.0008	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	PHYSICAL	Color	CPU	18.8	2.50	60.0	27.7	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	PHYSICAL	pH	SU	6.48	5.72	7.27	0.673	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	PHYSICAL	Secchi	m	19.0	1.00	71.0	34.7	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	PHYSICAL	Specific Conductance	umhos/cm	236	230	242	5.35	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	PHYSICAL	Turbidity	NTU	0.550	0.050	1.40	0.615	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	SOLID	Total Dissolved Solids	mg/L	156	147	166	8.66	4
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	SOLID	Total Suspended Solids	mg/L	82.4	0.500	180	87.8	8
43	Rock Springs Run	Internal	1800	BWAA	Big Wekiva at Camp Joy main flow	7/18/2002	7/29/2003	TEMPERATURE	Water Temperature	C	24.2	23.4	25.7	1.08	4
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	9/23/1992	12/7/1992	BACTERIOLOGICAL	Fecal Coliform	#/100ml	1,149	198	2,100	1,345	2
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.47	0.267	2.41	1.10	4
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	BIOLOGICAL	Chlorophyll-b	µg/L	0.006	0.00	0.018	0.010	3
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	BIOLOGICAL	Pheophytin-a	µg/L	1.40	0.508	2.27	0.720	4
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	DISSOLVED OXYGEN	Dissolved Oxygen	%	92.5	88.3	95.2	3.67	3
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	8.07	7.70	8.30	0.287	4
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	Color	CPU	36.7	5.00	100	54.8	3
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	pH	SU	6.87	6.30	7.60	0.666	3
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	Secchi	m	0.667	0.500	1.00	0.289	3
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	Specific Conductance	umhos/cm	320	260	420	87.2	3
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	Turbidity	NTU	3.17	1.60	5.80	2.29	3
44	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	TEMPERATURE	Water Temperature	C	23.4	19.1	25.7	3.75	3
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	9/23/1992	12/7/1992	BACTERIOLOGICAL	Fecal Coliform	#/100ml	1,149	198	2,100	1,345	2
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.47	0.267	2.41	1.10	4
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	BIOLOGICAL	Chlorophyll-b	µg/L	0.006	0.00	0.018	0.010	3
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	BIOLOGICAL	Pheophytin-a	µg/L	1.40	0.508	2.27	0.720	4
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	DISSOLVED OXYGEN	Dissolved Oxygen	%	92.5	88.3	95.2	3.67	3
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	8.07	7.70	8.30	0.287	4
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	Color	CPU	36.7	5.00	100	54.8	3
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	pH	SU	6.87	6.30	7.60	0.666	3
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	Secchi	m	0.667	0.500	1.00	0.289	3
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	Specific Conductance	umhos/cm	320	260	420	87.2	3
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	PHYSICAL	Turbidity	NTU	3.17	1.60	5.80	2.29	3
45	Rock Springs Run	Internal	9300	USJ904	Rock Springs Run Near Mouth	5/20/1992	12/7/1992	TEMPERATURE	Water Temperature	C	23.4	19.1	25.7	3.75	3
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	3/18/2002	10/22/2002	BACTERIOLOGICAL	Fecal Coliform	#/100ml	54.2	15.0	152	56.6	5
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	3/18/2002	10/22/2002	BACTERIOLOGICAL	Total Coliform	#/100ml	1,649	210	5,300	2,117	5
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	6/4/2002	10/22/2002	BIOLOGICAL	Chlorophyll-a Corr	µg/L	2.90	2.90	2.90	---	1
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	3/18/2002	10/22/2002	BIOLOGICAL	Pheophytin-a	µg/L	8.04	2.70	14.6	5.53	5
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	6.48	1.23	8.70	2.45	7
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	89.0	60.0	99.9	13.5	7
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	9/13/1999	GENERAL INORGANIC	Chloride, Total	mg/L	8.90	8.70	9.10	0.283	2
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	4/23/2002	GENERAL INORGANIC	Sulfate, Total	mg/L	23.7	20.0	30.0	5.51	3
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	NITROGEN	Ammonia Nitrogen	mg/L	0.065	0.005	0.350	0.126	7
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.950	0.880	1.10	0.078	6
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.754	0.150	3.50	1.24	7
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	3/18/2002	10/22/2002	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.80	1.00	2.60	1.13	2
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	9/13/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.082	0.079	0.090	0.005	4
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	3/18/2002	10/22/2002	PHOSPHORUS	Total Phosphorus	mg/L	0.131	0.086	0.280	0.083	5
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	9/13/1999	10/22/2002	PHYSICAL	Color	CPU	178	5.00	700	280	6
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	PHYSICAL	pH	SU	7.52	6.57	7.84	0.411	8
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	PHYSICAL	Specific Conductance	umhos/cm	225	0.290	283	100	7
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	PHYSICAL	Turbidity	NTU	1.97	0.200	5.60	1.80	7
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	3/18/2002	10/22/2002	SOLID	Total Suspended Solids	mg/L	4.20	1.50	8.60	2.72	5
46	Rock Springs Run	Downstream	14200	20010342	Rock Springs Run 50 meters upstream of Wekiva River	1/11/1999	10/22/2002	TEMPERATURE	Water Temperature	C	23.7	15.5	26.9	3.74	7
47	Rock Springs Run	Downstream	14200	284258081270201	Rock Springs Run Nea Forest City	6/8/1999	6/8/1999	FLOW	Flow, Inst	cfs	48.0	48.0	48.0	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	FLOW	Flow, Inst	cfs	64.0	64.0	64.0	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	89.0	89.0	89.0	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	GENERAL INORGANIC	Chloride, Total	mg/L	8.00	8.00	8.00	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	GENERAL INORGANIC	Hardness	mg/L as CaCO3	110	110	110	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	GENERAL INORGANIC	Sulfate, Total	mg/L	22.0	22.0	22.0	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	NITROGEN	Ammonia Nitrogen	mg/L	0.020	0.020	0.020	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	NITROGEN	Organic Nitrogen	mg/L	0.370	0.370	0.370	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	PHOSPHORUS	Orthophosphorus	mg/L	0.070	0.070	0.070	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	PHOSPHORUS	Total Phosphorus	mg/L	0.075	0.075	0.075	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	PHYSICAL	Color	CPU	15.0	15.0	15.0	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	PHYSICAL	pH	SU	7.60	7.60	7.60	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	PHYSICAL	Specific Conductance	umhos/cm	245	245	245	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	PHYSICAL	Turbidity	NTU	4.00	4.00	4.00	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	SOLID	Total Dissolved Solids	mg/L	141	141	141	---	1
48	Rock Springs Run	Downstream	14200	284302081270401	Rock Springs Run Nea Kelly Park	5/10/1973	5/10/1973	TEMPERATURE	Water Temperature	C	25.0	25.0	25.0	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.42	2.13	7.15	1.69	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	84.9	48.0	100	15.5	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	GENERAL INORGANIC	Chloride, Total	mg/L	11.5	8.40	17.4	2.91	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	GENERAL INORGANIC	Hardness	mg/L as CaCO3	136	118	147	9.60	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	35.9	10.8	74.4	20.8	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	21.1	0.00	52.7	17.1	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	GENERAL ORGANIC	Carbon, Total Organic	mg/L	21.9	0.200	59.5	18.6	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	METAL	Calcium, Total	mg/L	37.7	31.8	41.7	3.18	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	METAL	Iron, Total	µg/L	353	77.3	1,040	304	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	METAL	Magnesium, Total	mg/L	10.1	9.22	10.9	0.607	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	NITROGEN	Ammonia Nitrogen	mg/L	0.039	0.0005	0.250	0.072	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.693	0.044	1.13	0.434	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.987	0.190	2.76	0.713	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	PHOSPHORUS	Orthophosphorus	mg/L	0.085	0.028	0.123	0.026	20
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	PHOSPHORUS	Total Phosphorus	mg/L	0.115	0.042	0.183	0.041	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	PHYSICAL	Color	CPU	234	25.0	1,000	293	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	PHYSICAL	pH	SU	7.11	6.59	7.44	0.353	10
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	PHYSICAL	Secchi	m	0.644	0.300	0.800	0.157	10
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	PHYSICAL	Specific Conductance	umhos/cm	257	228	290	21.4	10
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	PHYSICAL	Turbidity	NTU	1.15	0.200	1.80	0.508	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	SOLID	Total Dissolved Solids	mg/L	290	141	1,214	313	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	SOLID	Total Suspended Solids	mg/L	2.95	0.500	16.0	4.50	11
49	Rock Springs Run	Downstream	14200	RSR-WR	Rock Springs Run Upstream of Wekiva	10/2/2002	7/8/2003	TEMPERATURE	Water Temperature	C	20.4	11.4	25.8	4.54	10
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	5/19/1993	5/19/1993	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	1.20	1.20	1.20	---	1
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	3/28/1972	5/26/1995	FLOW	Flow, Inst	cfs	2.30	1.00	3.70	1.35	3
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	10/19/1960	3/28/1972	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	92.5	89.0	96.0	4.95	2
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	10/19/1960	5/26/1995	GENERAL INORGANIC	Chloride, Total	mg/L	7.53	7.00	7.90	0.386	4
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	10/19/1960	5/26/1995	GENERAL INORGANIC	Hardness	mg/L as CaCO3	108	100	110	5.00	4
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	10/19/1960	5/26/1995	GENERAL INORGANIC	Sulfate, Total	mg/L	10.6	9.60	12.0	1.10	4
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	10/19/1960	5/19/1993	PHYSICAL	Color	CPU	4.17	2.50	5.00	1.44	3
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	10/19/1960	5/26/1995	PHYSICAL	pH	SU	7.43	6.90	7.90	0.427	4
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	10/19/1960	5/26/1995	PHYSICAL	Specific Conductance	umhos/cm	233	219	242	10.6	4
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	3/28/1972	5/26/1995	SOLID	Total Dissolved Solids	mg/L	139	136	142	3.06	3
50	Witherington Springs	Spring	0	2234620	Witherington Springs Nr Apopka	10/19/1960	5/26/1995	TEMPERATURE	Water Temperature	C	23.7	23.4	23.9	0.263	4
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	10/19/1960	5/17/2000	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	96.3	89.0	104	4.69	11
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	10/19/1960	5/17/2000	GENERAL INORGANIC	Chloride, Total	mg/L	7.85	7.00	10.0	0.776	12
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	GENERAL INORGANIC	Fluoride, Total	mg/L	0.188	0.169	0.210	0.012	9
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	GENERAL INORGANIC	Silica, Total	mg/L	5.78	4.99	10.0	1.60	9
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	10/19/1960	5/17/2000	GENERAL INORGANIC	Sulfate, Total	mg/L	11.4	9.06	15.0	1.93	13
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	METAL	Calcium, Total	mg/L	29.6	27.0	36.7	2.92	9
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	METAL	Iron, Total	µg/L	69.0	7.80	113	44.2	4
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	METAL	Magnesium, Total	mg/L	9.38	8.70	10.5	0.586	9
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	METAL	Potassium, Total	mg/L	1.22	1.00	1.70	0.256	7
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	METAL	Strontium, Total	µg/L	113	90.0	189	30.4	9
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.377	0.087	0.699	0.211	9
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	6/19/1995	5/17/2000	PHOSPHORUS	Orthophosphorus	mg/L	0.145	0.095	0.190	0.033	9
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	10/19/1960	5/17/2000	PHYSICAL	pH	SU	7.14	6.78	7.60	0.257	12
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	10/19/1960	5/17/2000	PHYSICAL	Specific Conductance	umhos/cm	241	219	276	13.1	14
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	3/28/1972	5/17/2000	SOLID	Total Dissolved Solids	mg/L	139	126	156	8.87	12
51	Witherington Springs	Spring	0	Witherington Spring	Witherington Spring	10/19/1960	5/17/2000	TEMPERATURE	Water Temperature	C	23.8	23.3	25.0	0.453	14
52	Barrel Spring	Spring	0	380045	Barrel Spring nr Wekiva Springs	6/19/1995	9/10/1997	FLOW	Flow, Inst	cfs	0.253	0.180	0.310	0.067	3
52	Barrel Spring	Spring	0	380045	Barrel Spring nr Wekiva Springs	6/19/1995	9/10/1997	PHYSICAL	Stage	ft	-0.67	-0.83	-0.42	0.199	4
52	Barrel Spring	Spring	0	380045	Barrel Spring nr Wekiva Springs	6/19/1995	9/10/1997	PHYSICAL	Stage	ft MSL	7.08	6.92	7.33	0.199	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	97.1	94.0	100	2.53	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	GENERAL INORGANIC	Chloride, Total	mg/L	9.23	8.00	11.0	1.26	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	GENERAL INORGANIC	Fluoride, Total	mg/L	0.248	0.240	0.260	0.010	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	GENERAL INORGANIC	Silica, Total	mg/L	6.32	5.00	10.0	2.46	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	21.1	19.4	23.0	1.46	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	METAL	Calcium, Total	mg/L	31.4	29.7	32.0	1.14	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	5/21/1996	METAL	Iron, Total	µg/L	72.5	54.0	91.0	26.2	2
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	METAL	Magnesium, Total	mg/L	8.85	8.31	9.10	0.365	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	METAL	Potassium, Total	mg/L	1.26	1.18	1.40	0.121	3
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	METAL	Strontium, Total	µg/L	463	455	472	7.13	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.049	0.040	0.061	0.009	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/20/1995	9/10/1997	PHOSPHORUS	Orthophosphorus	mg/L	0.037	0.030	0.041	0.005	4
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/19/1995	9/10/1997	PHYSICAL	pH	SU	7.51	7.23	7.73	0.228	5
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/19/1995	9/10/1997	PHYSICAL	Specific Conductance	umhos/cm	252	245	256	4.49	5
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	5/21/1996	9/10/1997	SOLID	Total Dissolved Solids	mg/L	148	145	151	3.06	3
53	Barrel Spring	Spring	0	Barrel Spring	Barrel Spring	6/19/1995	9/10/1997	TEMPERATURE	Water Temperature	C	23.3	21.7	26.0	1.81	5
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	8/16/1999	8/16/1999	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.00	0.00	0.00	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	6/23/1995	6/11/1997	FLOW	Flow, Inst	cfs	0.620	0.440	0.800	0.255	2
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	1/14/1997	1/14/1997	GENERAL INORGANIC	Chloride, Total	mg/L	7.70	7.70	7.70	---	1
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	1/14/1997	1/14/1997	GENERAL INORGANIC	Hardness	mg/L as CaCO3	220	220	220	---	1
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	1/14/1997	1/14/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	110	110	110	---	1
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	8/16/1999	8/16/1999	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.100	0.100	0.100	---	1
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	8/16/1999	8/16/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.030	0.030	0.030	---	1
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	8/16/1999	8/16/1999	PHOSPHORUS	Total Phosphorus	mg/L	0.030	0.030	0.030	---	1
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	1/14/1997	1/14/1997	PHYSICAL	Color	CPU	2.50	2.50	2.50	---	1
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	1/14/1997	8/16/1999	PHYSICAL	pH	SU	7.90	7.80	8.00	0.141	2
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	1/14/1997	8/16/1999	PHYSICAL	Specific Conductance	umhos/cm	433	420	446	18.4	2
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	1/14/1997	1/14/1997	SOLID	Total Dissolved Solids	mg/L	266	266	266	---	1
54	Sulphur Springs	Spring	0	284612081303401	Sulphur Springs Pool	1/14/1997	8/16/1999	TEMPERATURE	Water Temperature	C	24.8	24.7	24.8	0.071	2
55	Sulphur Springs	Spring	0	Sulphur Spring	Sulphur Spring	1/14/1997	1/14/1997	GENERAL INORGANIC	Chloride, Total	mg/L	7.70	7.70	7.70	---	1
55	Sulphur Springs	Spring	0	Sulphur Spring	Sulphur Spring	1/14/1997	1/14/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	110	110	110	---	1
55	Sulphur Springs	Spring	0	Sulphur Spring	Sulphur Spring	8/16/1999	8/16/1999	PHOSPHORUS	Total Phosphorus	mg/L	0.030	0.030	0.030	---	1
55	Sulphur Springs	Spring	0	Sulphur Spring	Sulphur Spring	1/14/1997	8/16/1999	PHYSICAL	pH	SU	7.88	7.76	8.00	0.170	2
55	Sulphur Springs	Spring	0	Sulphur Spring	Sulphur Spring	1/14/1997	8/16/1999	PHYSICAL	Specific Conductance	umhos/cm	433	420	446	18.4	2
55	Sulphur Springs	Spring	0	Sulphur Spring	Sulphur Spring	1/14/1997	1/14/1997	SOLID	Total Dissolved Solids	mg/L	266	266	266	---	1
55	Sulphur Springs	Spring	0	Sulphur Spring	Sulphur Spring	1/14/1997	8/16/1999	TEMPERATURE	Water Temperature	C	24.8	24.7	24.8	0.071	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	DISSOLVED OXYGEN	Dissolved Oxygen	%	36.4	19.1	53.6	24.4	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	3.50	1.80	5.20	2.40	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	92.7	84.3	101	11.8	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	4/16/1984	4/16/1984	GENERAL INORGANIC	Chloride, Total	mg/L	27.9	27.9	27.9	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Cadmium, Total	µg/L	1.00	1.00	1.00	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Calcium, Total	mg/L	45.0	45.0	45.0	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Chromium, Total	µg/L	3.00	3.00	3.00	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Copper, Total	µg/L	15.0	15.0	15.0	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Iron, Total	µg/L	521	521	521	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Lead, Total	µg/L	9.00	9.00	9.00	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Manganese, Total	µg/L	62.0	62.0	62.0	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Nickel, Total	µg/L	10.0	10.0	10.0	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Silver, Total	µg/L	5.00	5.00	5.00	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	METAL	Zinc, Total	µg/L	346	346	346	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	NITROGEN	Ammonia Nitrogen	mg/L	0.825	0.810	0.840	0.021	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	NITROGEN	Organic Nitrogen	mg/L	1.70	1.64	1.75	0.078	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	NITROGEN	Unionized Ammonia	mg/L	0.0004	0.0004	0.0004	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	4/16/1984	4/16/1984	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	3.70	3.70	3.70	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	100	91.5	109	12.4	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	PHOSPHORUS	Total Phosphorus	mg/L	1.84	0.787	2.90	1.49	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	10/26/1983	PHYSICAL	pH	SU	6.10	6.10	6.10	---	1
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	PHYSICAL	Specific Conductance	umhos/cm	368	336	400	45.3	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	PHYSICAL	Turbidity	NTU	0.950	0.800	1.10	0.212	2
56	Sweetwater Crk	Upstream	0	160043	Sweetwater Creek	10/26/1983	4/16/1984	TEMPERATURE	Water Temperature	C	18.0	17.0	19.0	1.41	2
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	3/17/1986	BACTERIOLOGICAL	Fecal Coliform	#/100ml	856	120	3,080	1,036	8
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	503	200	1,470	544	5
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	%	44.9	29.8	106	20.4	12
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	3.95	2.50	9.20	1.71	13
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	92.0	70.2	99.3	8.44	10
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	10.1	9.47	10.9	0.693	5
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	1.85	0.700	3.00	1.63	2
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	1.13	0.250	2.00	1.24	2
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	23.0	20.0	26.0	4.24	2
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	74.0	67.0	81.0	9.90	2
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	31.0	3.00	59.0	39.6	2
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	3.00	3.00	3.00	---	1
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	4.00	4.00	4.00	---	1
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	3.00	1.00	5.00	2.83	2
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	169	169	169	---	1
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.056	0.00	0.150	0.052	7
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.287	0.090	0.540	0.170	7
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	7/16/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.325	0.130	0.560	0.185	4
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	3/17/1986	NITROGEN	Unionized Ammonia	mg/L	0.0004	0.00	0.001	0.0005	6
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.919	0.300	1.85	0.511	7
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	4.14	1.40	6.90	2.22	5
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.197	0.130	0.288	0.053	10
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	pH	SU	7.09	6.50	7.60	0.356	11
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	1.16	0.600	2.00	0.450	9
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	229	210	259	16.3	11
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	5/18/1988	PHYSICAL	Turbidity	NTU	3.35	0.330	30.0	8.85	11
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	8/10/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	963	590	1,700	638	3

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
57	Sweetwater Crk	Downstream	1130	10110	Sweetwater Canal	1/7/1982	3/17/1986	TEMPERATURE	Water Temperature	C	22.6	19.0	25.0	1.74	12
58	Miami Springs	Spring	0	421834	Miami Springs nr Longwood	1/11/2003	10/1/2003	FLOW	Flow	cfs	6.37	5.13	7.85	0.705	264
58	Miami Springs	Spring	0	421834	Miami Springs nr Longwood	6/17/1993	2/3/2004	FLOW	Flow, Inst	cfs	5.31	3.71	7.28	1.06	19
58	Miami Springs	Spring	0	421834	Miami Springs nr Longwood	6/17/1993	11/12/2001	PHYSICAL	Stage	ft	-1.35	-1.89	-0.49	0.392	14
58	Miami Springs	Spring	0	421834	Miami Springs nr Longwood	6/17/1993	11/12/2001	PHYSICAL	Stage	ft MSL	19.7	19.2	20.6	0.392	14
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	5/17/1993	1/18/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	3.90	0.600	7.20	4.67	2
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	8/8/1945	9/23/2003	FLOW	Flow, Inst	cfs	4.99	2.90	7.40	1.01	92
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	10/17/1960	3/28/1972	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	84.0	81.0	87.0	4.24	2
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	10/17/1960	4/21/1997	GENERAL INORGANIC	Chloride, Total	mg/L	8.70	5.50	11.0	2.33	5
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	10/17/1960	5/26/1995	GENERAL INORGANIC	Hardness	mg/L as CaCO3	102	86.0	120	15.5	4
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	10/17/1960	4/21/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	7.22	4.80	9.50	1.97	5
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	10/17/1960	5/17/1993	PHYSICAL	Color	CPU	2.50	0.00	5.00	2.50	3
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	10/17/1960	1/18/2001	PHYSICAL	pH	SU	7.60	5.80	8.30	0.711	12
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	10/17/1960	1/18/2001	PHYSICAL	Specific Conductance	umhos/cm	245	184	280	26.5	17
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	5/21/1992	9/23/2003	PHYSICAL	Stage	ft	12.4	1.75	15.5	5.60	10
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	3/28/1972	5/26/1995	SOLID	Total Dissolved Solids	mg/L	135	120	148	14.0	3
59	Miami Springs	Spring	0	2234650	Miami Springs Near Longwood	10/17/1960	1/18/2001	TEMPERATURE	Water Temperature	C	24.6	23.5	27.5	0.720	42
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	1/18/2001	1/18/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.620	0.620	0.620	---	1
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	10/17/1960	5/13/2004	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	111	81.0	125	7.71	34
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	10/17/1960	5/13/2004	GENERAL INORGANIC	Chloride, Total	mg/L	10.6	5.50	13.0	1.39	36
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	9/30/1993	8/12/2003	GENERAL INORGANIC	Fluoride, Total	mg/L	0.169	0.150	0.200	0.018	29
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	9/30/1993	7/16/2002	GENERAL INORGANIC	Silica, Total	mg/L	4.38	3.91	8.00	0.821	23
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	10/17/1960	5/13/2004	GENERAL INORGANIC	Sulfate, Total	mg/L	10.1	3.00	17.0	2.38	37
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	1/18/2001	1/18/2001	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	0.510	0.510	0.510	---	1
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	1/18/2001	1/18/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.205	0.205	0.205	---	1
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	9/30/1993	5/13/2004	METAL	Calcium, Total	mg/L	35.1	28.0	37.4	2.06	32
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	6/20/1995	11/18/2003	METAL	Iron, Total	µg/L	18.6	1.35	93.0	26.7	20
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	9/30/1993	5/13/2004	METAL	Magnesium, Total	mg/L	9.44	8.45	10.1	0.483	32
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	9/30/1993	5/13/2004	METAL	Potassium, Total	mg/L	0.908	0.453	1.41	0.339	27
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	9/30/1993	8/12/2003	METAL	Strontium, Total	µg/L	187	160	231	14.8	29
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	1/18/2001	1/18/2001	NITROGEN	Ammonia Nitrogen	mg/L	0.016	0.016	0.016	---	1
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	9/30/1993	5/13/2004	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.166	0.009	0.540	0.141	31
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	1/18/2001	1/18/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.061	0.061	0.061	---	1
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	6/20/1995	5/13/2004	PHOSPHORUS	Orthophosphorus	mg/L	0.107	0.056	0.230	0.033	31
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	1/18/2001	5/13/2004	PHOSPHORUS	Total Phosphorus	mg/L	0.110	0.099	0.130	0.014	4
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	10/17/1960	5/13/2004	PHYSICAL	pH	SU	7.50	5.80	8.30	0.413	40
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	10/17/1960	5/13/2004	PHYSICAL	Specific Conductance	umhos/cm	263	184	297	21.4	52
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	3/28/1972	5/13/2004	SOLID	Total Dissolved Solids	mg/L	152	120	194	14.7	33
60	Miami Springs	Spring	0	Miami Springs	Miami Springs	10/17/1960	5/13/2004	TEMPERATURE	Water Temperature	C	24.4	22.8	27.5	0.658	72
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	4/25/1974	4/25/1974	FLOW	Flow, Inst	cfs	3.60	3.60	3.60	---	1
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	23.5	11.0	56.0	21.7	4
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	GENERAL INORGANIC	Chloride, Total	mg/L	15.8	9.50	24.0	7.42	3
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	GENERAL INORGANIC	Hardness	mg/L as CaCO3	43.5	20.0	63.0	18.1	4
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	GENERAL INORGANIC	Sulfate, Total	mg/L	23.5	6.40	43.0	18.4	3
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	4/25/1974	4/25/1974	NITROGEN	Ammonia Nitrogen	mg/L	0.420	0.420	0.420	---	1
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	4/25/1974	4/25/1974	NITROGEN	Organic Nitrogen	mg/L	0.900	0.900	0.900	---	1
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	4/25/1974	4/25/1974	NITROGEN	Total Nitrogen	mg/L	1.80	1.80	1.80	---	1
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	4/25/1974	4/25/1974	PHOSPHORUS	Orthophosphorus	mg/L	1.60	1.60	1.60	---	1
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	4/25/1974	4/25/1974	PHOSPHORUS	Total Phosphorus	mg/L	2.00	2.00	2.00	---	1
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	PHYSICAL	Color	CPU	48.3	5.00	110	54.8	3
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	PHYSICAL	pH	SU	6.65	6.50	6.80	0.129	4
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	PHYSICAL	Specific Conductance	umhos/cm	164	78.0	244	68.1	4
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	4/25/1974	4/25/1974	PHYSICAL	Stage	ft	14.3	14.3	14.3	---	1
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	4/25/1974	4/25/1974	PHYSICAL	Turbidity	NTU	5.00	5.00	5.00	---	1
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	SOLID	Total Dissolved Solids	mg/L	109	77.0	141	45.3	2
61	Little Wekiva River	Upstream	0	2234945	Little Wekiva River at Forest City	10/19/1960	4/25/1974	TEMPERATURE	Water Temperature	C	23.9	19.5	26.1	3.81	3
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	FLOW	Flow, Inst	cfs	12.0	12.0	12.0	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	98.0	98.0	98.0	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	GENERAL INORGANIC	Chloride, Total	mg/L	12.0	12.0	12.0	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	GENERAL INORGANIC	Hardness	mg/L as CaCO3	88.0	88.0	88.0	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	GENERAL INORGANIC	Sulfate, Total	mg/L	5.10	5.10	5.10	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	NITROGEN	Ammonia Nitrogen	mg/L	0.150	0.150	0.150	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	NITROGEN	Organic Nitrogen	mg/L	0.970	0.970	0.970	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	NITROGEN	Total Nitrogen	mg/L	1.30	1.30	1.30	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	PHOSPHORUS	Orthophosphorus	mg/L	0.370	0.370	0.370	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	PHOSPHORUS	Total Phosphorus	mg/L	0.500	0.500	0.500	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	PHYSICAL	Color	CPU	10.0	10.0	10.0	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	PHYSICAL	pH	SU	6.20	6.20	6.20	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	PHYSICAL	Specific Conductance	umhos/cm	228	228	228	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	PHYSICAL	Stage	ft	14.3	14.3	14.3	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	PHYSICAL	Turbidity	NTU	6.00	6.00	6.00	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	SOLID	Total Dissolved Solids	mg/L	119	119	119	---	1
62	Little Wekiva River	Upstream	0	2234947	L Wekiva R at St Hwy 436, Forest City	4/25/1974	4/25/1974	TEMPERATURE	Water Temperature	C	26.5	26.5	26.5	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	FLOW	Flow, Inst	cfs	11.0	11.0	11.0	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	97.0	97.0	97.0	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	GENERAL INORGANIC	Chloride, Total	mg/L	12.0	12.0	12.0	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	GENERAL INORGANIC	Hardness	mg/L as CaCO3	100	100	100	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	GENERAL INORGANIC	Sulfate, Total	mg/L	6.50	6.50	6.50	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	NITROGEN	Ammonia Nitrogen	mg/L	0.030	0.030	0.030	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	NITROGEN	Organic Nitrogen	mg/L	0.890	0.890	0.890	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	NITROGEN	Total Nitrogen	mg/L	0.930	0.930	0.930	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	PHOSPHORUS	Orthophosphorus	mg/L	0.480	0.480	0.480	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	PHOSPHORUS	Total Phosphorus	mg/L	0.500	0.500	0.500	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	PHYSICAL	Color	CPU	10.0	10.0	10.0	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	PHYSICAL	pH	SU	6.80	6.80	6.80	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	PHYSICAL	Specific Conductance	umhos/cm	232	232	232	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	PHYSICAL	Stage	ft	2.94	2.94	2.94	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	PHYSICAL	Turbidity	NTU	6.00	6.00	6.00	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	SOLID	Total Dissolved Solids	mg/L	126	126	126	---	1
63	Little Wekiva River	Internal	3040	284044081241000	L Wekiva River at Montgomery Rd Near Altamonte Springs	4/25/1974	4/25/1974	TEMPERATURE	Water Temperature	C	27.0	27.0	27.0	---	1
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	1,245	400	2,090	1,195	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	14,400	4,800	24,000	13,576	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	6/16/2003	DISSOLVED OXYGEN	Dissolved Oxygen	%	59.9	10.0	97.0	27.0	8
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	6/16/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	4.69	0.600	8.90	2.83	9
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	2/1/1972	3/31/2003	FLOW	Flow	cfs	35.2	0.130	638	44.3	10287
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	2/4/1972	4/5/2004	FLOW	Flow, Inst	cfs	48.8	1.20	721	78.8	332
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	8/29/2000	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	81.4	67.0	95.0	10.2	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	2/14/2001	GENERAL INORGANIC	Chloride, Total	mg/L	22.0	13.0	52.0	12.6	9
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	2/14/2001	GENERAL INORGANIC	Hardness	mg/L as CaCO3	94.8	61.0	140	21.7	9
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	2/14/2001	GENERAL INORGANIC	Sulfate, Total	mg/L	14.0	6.40	30.0	7.50	9
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	4/28/1994	6/15/1994	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	10.1	9.10	11.0	1.34	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	2/14/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	5.88	0.00	9.80	3.61	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	METAL	Arsenic, Total	µg/L	7.50	5.00	10.0	3.54	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	METAL	Cadmium, Total	µg/L	0.00	0.00	0.00	---	1
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	METAL	Copper, Total	µg/L	5.00	0.00	10.0	7.07	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	METAL	Iron, Total	µg/L	280	220	340	84.9	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	METAL	Manganese, Total	µg/L	12.5	5.00	20.0	10.6	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/17/1973	5/17/1973	METAL	Mercury, Total	µg/L	0.250	0.250	0.250	---	1
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	METAL	Zinc, Total	µg/L	15.0	10.0	20.0	7.07	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	4/25/1974	NITROGEN	Ammonia Nitrogen	mg/L	0.078	0.030	0.190	0.075	4
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	2/14/2001	NITROGEN	Organic Nitrogen	mg/L	0.857	0.440	1.40	0.331	9
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	4/28/1994	2/14/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.884	0.500	1.50	0.411	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	4/25/1974	2/14/2001	NITROGEN	Total Nitrogen	mg/L	1.38	0.910	2.70	0.741	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	5/17/1973	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	6.05	3.70	8.40	3.32	2
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	4/28/1994	2/14/2001	PESTICIDE	Alachlor, Dissolved	µg/L	0.001	0.001	0.001	0.0000	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	4/28/1994	2/14/2001	PESTICIDE	Atrazine, Dissolved	µg/L	0.283	0.048	0.716	0.271	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	4/28/1994	2/14/2001	PESTICIDE	Diazinon, Dissolved	µg/L	0.071	0.008	0.206	0.081	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	4/28/1994	2/14/2001	PESTICIDE	Dieldrin, Dissolved	µg/L	0.0009	0.0005	0.003	0.0009	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	4/28/1994	2/14/2001	PESTICIDE	Lindane, Dissolved	µg/L	0.002	0.002	0.002	0.0000	5
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	2/14/2001	PHOSPHORUS	Orthophosphorus	mg/L	0.300	0.010	0.650	0.239	9
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	2/14/2001	PHOSPHORUS	Total Phosphorus	mg/L	0.363	0.110	0.730	0.231	9
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	4/25/1974	PHYSICAL	Color	CPU	22.3	9.00	30.0	9.14	4
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	6/16/2003	PHYSICAL	pH	SU	7.12	6.60	7.60	0.282	18
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	6/16/2003	PHYSICAL	Specific Conductance	umhos/cm	270	171	453	79.2	13
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	2/1/1972	4/5/2004	PHYSICAL	Stage	ft	24.8	0.600	29.9	1.11	10947
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	4/25/1974	PHYSICAL	Turbidity	NTU	6.50	4.00	10.0	3.00	4
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	2/14/2001	SOLID	Total Dissolved Solids	mg/L	158	113	273	49.2	9
64	Little Wekiva River	Internal	4540	2234990	Little Wekiva River Near Altamonte Springs, Fl	5/2/1972	6/16/2003	TEMPERATURE	Water Temperature	C	24.8	15.5	30.0	3.46	57
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	5/21/2002	6/2/2004	DISSOLVED OXYGEN	Dissolved Oxygen	%	63.6	40.0	103	13.3	25
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	10/2/2002	6/2/2004	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.36	3.30	9.20	1.22	24
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	6/9/1995	3/11/2002	FLOW	Flow	cfs	80.0	14.0	648	69.3	2468
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	6/13/1995	3/3/2004	FLOW	Flow, Inst	cfs	110	23.0	480	111	55
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	3/17/2003	4/2/2004	GENERAL INORGANIC	Chloride, Total	mg/L	20.6	0.100	26.1	5.88	16
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	3/17/2003	3/3/2004	GENERAL INORGANIC	Hardness	mg/L as CaCO3	133	95.0	160	19.5	15
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	5/21/2002	4/2/2004	GENERAL INORGANIC	Sulfate, Total	mg/L	17.3	0.100	23.8	4.69	22
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	5/21/2002	5/21/2002	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	3.10	3.10	3.10	---	1
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	4/22/2003	4/21/2004	PHOSPHORUS	Orthophosphorus	mg/L	0.127	0.010	0.200	0.045	16
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	5/21/2002	6/2/2004	PHYSICAL	pH	SU	7.14	6.70	7.50	0.196	26
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	5/21/2002	6/2/2004	PHYSICAL	Specific Conductance	umhos/cm	327	251	375	35.0	25
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	6/10/1995	3/12/2002	PHYSICAL	Stage	ft	19.6	18.1	22.2	0.806	2492

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	3/17/2003	3/17/2003	SOLID	Total Dissolved Solids	mg/L	174	174	174	---	1
65	Little Wekiva River	Internal	6680	2234998	Little Wekiva River Near Longwood, Fl	5/21/2002	6/2/2004	TEMPERATURE	Water Temperature	C	23.8	20.2	27.6	1.90	25
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.23	0.310	2.14	1.29	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	DISSOLVED OXYGEN	Dissolved Oxygen	%	50.8	44.3	57.3	9.19	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	4.30	3.90	4.70	0.566	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	92.5	83.0	102	13.4	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	GENERAL INORGANIC	Chloride, Total	mg/L	17.5	17.0	18.0	0.707	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	GENERAL INORGANIC	Sulfate, Total	mg/L	18.5	18.0	19.0	0.707	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	7/3/1984	7/3/1984	NITROGEN	Ammonia Nitrogen	mg/L	0.160	0.160	0.160	---	1
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.770	0.700	0.840	0.099	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	7/3/1984	7/3/1984	NITROGEN	Organic Nitrogen	mg/L	1.16	1.16	1.16	---	1
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	1/10/1984	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.360	0.360	0.360	---	1
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	7/3/1984	7/3/1984	NITROGEN	Unionized Ammonia	mg/L	0.005	0.005	0.005	---	1
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	7/3/1984	7/3/1984	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	3.70	3.70	3.70	---	1
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	PHOSPHORUS	Total Phosphorus	mg/L	0.475	0.460	0.490	0.021	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	PHYSICAL	Color	CPU	22.5	15.0	30.0	10.6	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	PHYSICAL	pH	SU	7.58	7.40	7.70	0.150	4
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	PHYSICAL	Secchi	m	1.05	0.900	1.20	0.212	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	PHYSICAL	Specific Conductance	umhos/cm	282	266	298	22.6	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	PHYSICAL	Turbidity	NTU	3.55	2.30	4.80	1.77	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	SOLID	Total Suspended Solids	mg/L	6.00	4.00	8.00	2.83	2
66	Little Wekiva River	Internal	6680	20010429	Little Wekiva River at Springs Landing Rd	1/10/1984	7/3/1984	TEMPERATURE	Water Temperature	C	24.0	22.0	26.0	2.83	2
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	BACTERIOLOGICAL	Fecal Coliform	#/100ml	154	154	154	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	BACTERIOLOGICAL	Total Coliform	#/100ml	950	950	950	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	BIOLOGICAL	Chlorophyll-a Corr	µg/L	1.28	1.27	1.28	0.007	2
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	BIOLOGICAL	Pheophytin-a	µg/L	0.770	0.500	1.04	0.382	2
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	DISSOLVED OXYGEN	Dissolved Oxygen	%	63.4	63.4	63.4	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.83	5.83	5.83	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	134	134	134	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	GENERAL INORGANIC	Chloride, Total	mg/L	19.0	19.0	19.0	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	20.0	20.0	20.0	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	NITROGEN	Ammonia Nitrogen	mg/L	0.026	0.026	0.026	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.495	0.490	0.500	0.007	2
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.240	0.220	0.260	0.028	2
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	NITROGEN	Unionized Ammonia	mg/L	0.0002	0.0002	0.0002	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	PHOSPHORUS	Orthophosphorus	mg/L	0.165	0.165	0.165	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	PHOSPHORUS	Total Phosphorus	mg/L	0.170	0.170	0.170	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	PHYSICAL	Color	CPU	10.0	10.0	10.0	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	PHYSICAL	pH	SU	7.22	7.22	7.22	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	PHYSICAL	Secchi	m	1.20	1.20	1.20	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	PHYSICAL	Specific Conductance	umhos/cm	318	318	318	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	PHYSICAL	Turbidity	NTU	0.700	0.700	0.700	---	1
67	Little Wekiva River	Internal	8720	20010102	Little Wekiva River at Betsy Lane off Delk Road	1/13/1997	1/13/1997	TEMPERATURE	Water Temperature	C	20.2	20.2	20.2	---	1
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	3/30/1971	2/26/1974	BACTERIOLOGICAL	Fecal Coliform	#/100ml	45.0	20.0	70.0	35.4	2
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	BACTERIOLOGICAL	Total Coliform	#/100ml	1,805	170	7,200	2,774	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	DISSOLVED OXYGEN	Dissolved Oxygen	%	51.0	17.6	85.4	23.0	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	4.57	1.50	7.00	1.97	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	91.0	72.0	113	14.1	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	GENERAL INORGANIC	Chloride, Total	mg/L	14.5	13.0	17.0	1.38	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	3/30/1971	2/26/1974	GENERAL INORGANIC	Sulfate, Total	mg/L	16.5	16.0	17.0	0.707	2
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	NITROGEN	Ammonia Nitrogen	mg/L	0.062	0.00	0.110	0.046	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	NITROGEN	Organic Nitrogen	mg/L	0.313	0.120	0.470	0.127	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	NITROGEN	Unionized Ammonia	mg/L	0.0006	0.00	0.002	0.0006	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	1.05	0.500	1.60	0.362	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	3/30/1971	2/26/1974	PHOSPHORUS	Orthophosphorus	mg/L	0.328	0.230	0.540	0.127	5
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	3/30/1971	2/26/1974	PHOSPHORUS	Total Phosphorus	mg/L	0.463	0.340	0.560	0.112	3
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	PHYSICAL	Color	CPU	27.5	10.0	60.0	18.1	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	PHYSICAL	pH	SU	7.40	7.10	7.80	0.183	10
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	PHYSICAL	Specific Conductance	umhos/cm	239	233	252	7.10	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	PHYSICAL	Turbidity	NTU	10.6	1.00	12.5	4.69	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	SOLID	Total Suspended Solids	mg/L	3.67	1.00	7.00	2.16	6
68	Little Wekiva River	Internal	8720	20010139	Lit Wekiva R at Ft Bridge N	1/12/1971	2/26/1974	TEMPERATURE	Water Temperature	C	21.6	17.3	26.0	3.17	6
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	6/8/1999	FLOW	Flow, Inst	cfs	47.5	37.0	58.0	14.8	2
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	98.0	98.0	98.0	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	GENERAL INORGANIC	Chloride, Total	mg/L	13.0	13.0	13.0	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	GENERAL INORGANIC	Hardness	mg/L as CaCO3	120	120	120	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	GENERAL INORGANIC	Sulfate, Total	mg/L	15.0	15.0	15.0	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	NITROGEN	Ammonia Nitrogen	mg/L	0.020	0.020	0.020	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	NITROGEN	Organic Nitrogen	mg/L	0.300	0.300	0.300	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	PHOSPHORUS	Orthophosphorus	mg/L	0.230	0.230	0.230	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	PHOSPHORUS	Total Phosphorus	mg/L	0.260	0.260	0.260	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	PHYSICAL	Color	CPU	15.0	15.0	15.0	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	PHYSICAL	pH	SU	7.60	7.60	7.60	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	PHYSICAL	Specific Conductance	umhos/cm	260	260	260	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	PHYSICAL	Turbidity	NTU	6.00	6.00	6.00	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	SOLID	Total Dissolved Solids	mg/L	146	146	146	---	1
69	Little Wekiva River	Downstream	14000	284517081245501	Little Wekiva River Nea Paola	5/10/1973	5/10/1973	TEMPERATURE	Water Temperature	C	23.5	23.5	23.5	---	1
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	3/17/1986	BACTERIOLOGICAL	Fecal Coliform	#/100ml	463	5.00	1,700	632	6
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	410	238	680	191	5
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	%	64.8	47.1	98.9	13.6	11
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	5/18/1988	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.68	4.10	8.60	1.18	12
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	96.0	78.4	109	9.50	10
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	5/18/1988	GENERAL INORGANIC	Chloride, Total	mg/L	18.3	16.0	21.4	1.83	6
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	1.90	0.800	3.00	1.56	2
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	1.50	1.00	2.00	0.707	2
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	12.0	10.0	14.0	2.83	2
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	106	90.0	121	21.9	2
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	6.00	5.00	7.00	1.41	2
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	7.00	7.00	7.00	---	1
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	6.00	6.00	6.00	---	1
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	1.50	1.00	2.00	0.707	2
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	56.0	56.0	56.0	---	1
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.024	0.00	0.080	0.030	7
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.653	0.420	0.970	0.205	7
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	7/16/1984	5/18/1988	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.514	0.350	0.750	0.171	4
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	5/4/1982	3/17/1986	NITROGEN	Unionized Ammonia	mg/L	0.0002	0.00	0.0005	0.0002	4
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	5/18/1988	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.479	0.200	1.00	0.277	7
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	10.9	7.00	16.0	3.52	5
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	5/18/1988	PHOSPHORUS	Total Phosphorus	mg/L	0.308	0.141	0.613	0.135	10
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	5/4/1982	5/18/1988	PHYSICAL	pH	SU	7.01	6.35	7.50	0.473	9
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	5/18/1988	PHYSICAL	Secchi	m	1.09	0.600	1.50	0.300	10
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	5/18/1988	PHYSICAL	Specific Conductance	umhos/cm	282	200	339	41.4	11
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	5/18/1988	PHYSICAL	Turbidity	NTU	1.46	0.850	2.30	0.529	11
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	8/10/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	2,757	570	6,000	2,865	3
70	Little Wekiva River	Downstream	14000	10458	Little Wekiva River-Mouth	1/7/1982	3/17/1986	TEMPERATURE	Water Temperature	C	22.4	20.0	25.5	1.80	11
71	Sanlando Springs	Spring	0	451840	Sanlando Springs nr Longwood	12/21/2002	9/29/2003	FLOW	Flow	cfs	21.2	10.7	28.3	3.98	283
71	Sanlando Springs	Spring	0	451840	Sanlando Springs nr Longwood	6/17/1993	2/2/2004	FLOW	Flow, Inst	cfs	18.6	8.99	27.2	4.47	21
71	Sanlando Springs	Spring	0	451840	Sanlando Springs nr Longwood	9/29/1993	7/10/2001	PHYSICAL	Stage	ft	-0.51	-0.98	0.610	0.444	12
71	Sanlando Springs	Spring	0	451840	Sanlando Springs nr Longwood	9/29/1993	7/10/2001	PHYSICAL	Stage	ft MSL	27.0	26.5	28.1	0.444	12
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/2/1972	5/17/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	2.00	0.00	4.00	2.83	2
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/2/1972	9/5/1977	BACTERIOLOGICAL	Total Coliform	#/100ml	268	88.0	525	229	3
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/17/1973	2/26/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	1.63	0.700	2.70	1.01	3
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	11/12/1941	9/23/2003	FLOW	Flow, Inst	cfs	19.8	10.0	36.0	5.15	116
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	4/27/1956	9/5/1977	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	101	85.0	110	9.46	5
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	4/27/1956	4/17/1997	GENERAL INORGANIC	Chloride, Total	mg/L	12.3	8.50	17.0	3.49	8
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	4/27/1956	5/25/1995	GENERAL INORGANIC	Hardness	mg/L as CaCO3	125	97.0	160	22.9	7
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	4/27/1956	4/17/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	9.18	0.00	12.0	3.98	8
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	GENERAL ORGANIC	Carbon, Total Organic	mg/L	5.00	5.00	5.00	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	METAL	Arsenic, Total	µg/L	0.500	0.500	0.500	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	METAL	Barium, Total	µg/L	50.0	50.0	50.0	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	METAL	Chromium, Total	µg/L	10.0	10.0	10.0	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	METAL	Iron, Total	µg/L	50.0	50.0	50.0	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	METAL	Manganese, Total	µg/L	5.00	5.00	5.00	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	METAL	Mercury, Total	µg/L	0.250	0.250	0.250	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	METAL	Selenium, Total	µg/L	0.500	0.500	0.500	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	METAL	Zinc, Total	µg/L	10.0	10.0	10.0	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/2/1972	9/5/1977	NITROGEN	Ammonia Nitrogen	mg/L	0.157	0.110	0.250	0.081	3
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.250	0.250	0.250	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/2/1972	9/5/1977	NITROGEN	Organic Nitrogen	mg/L	0.243	0.150	0.290	0.081	3
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.540	0.540	0.540	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	NITROGEN	Total Nitrogen	mg/L	0.790	0.790	0.790	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	9/5/1977	9/5/1977	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.200	0.200	0.200	---	1
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/2/1972	9/5/1977	PHOSPHORUS	Orthophosphorus	mg/L	0.150	0.140	0.160	0.010	3
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/2/1972	9/5/1977	PHOSPHORUS	Total Phosphorus	mg/L	0.157	0.150	0.160	0.006	3
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	4/27/1956	5/24/1993	PHYSICAL	Color	CPU	2.92	0.00	5.00	2.46	6
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	4/27/1956	2/26/2001	PHYSICAL	pH	SU	7.33	5.60	8.10	0.593	15
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	4/27/1956	2/26/2001	PHYSICAL	Specific Conductance	umhos/cm	305	211	374	46.0	19
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/3/1982	9/23/2003	PHYSICAL	Stage	ft	25.5	1.27	27.8	5.14	25
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/2/1972	9/5/1977	PHYSICAL	Turbidity	NTU	1.00	0.00	2.00	1.00	3
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	5/2/1972	5/25/1995	SOLID	Total Dissolved Solids	mg/L	172	146	198	22.8	5

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
72	Sanlando Springs	Spring	0	2234991	Sanlando Springs Near Longwood Fla	4/27/1956	2/26/2001	TEMPERATURE	Water Temperature	C	24.1	21.5	28.5	0.847	65
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	4/27/1956	5/13/2004	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	134	85.0	146	14.6	36
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	4/27/1956	5/13/2004	GENERAL INORGANIC	Chloride, Total	mg/L	17.3	8.50	21.0	3.26	39
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/29/1993	8/12/2003	GENERAL INORGANIC	Fluoride, Total	mg/L	0.174	0.150	0.200	0.015	29
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/29/1993	7/16/2002	GENERAL INORGANIC	Silica, Total	mg/L	4.27	3.91	7.00	0.633	22
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	4/27/1956	5/13/2004	GENERAL INORGANIC	Sulfate, Total	mg/L	11.7	0.00	19.0	2.82	40
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	2/26/2001	2/26/2001	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	0.675	0.675	0.675	---	1
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/5/1977	2/26/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	2.87	0.745	5.00	3.01	2
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/29/1993	5/13/2004	METAL	Calcium, Total	mg/L	42.9	37.0	46.1	1.99	31
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/5/1977	11/18/2003	METAL	Iron, Total	µg/L	11.9	-0.20	63.0	16.5	19
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/29/1993	5/13/2004	METAL	Magnesium, Total	mg/L	12.0	10.9	12.9	0.557	31
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/29/1993	5/13/2004	METAL	Potassium, Total	mg/L	1.67	1.50	2.10	0.131	31
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/29/1993	8/12/2003	METAL	Strontium, Total	µg/L	86.9	60.0	94.4	7.09	28
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	2/26/2001	2/26/2001	NITROGEN	Ammonia Nitrogen	mg/L	0.174	0.174	0.174	---	1
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	9/5/1977	5/13/2004	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.532	0.225	1.20	0.240	31
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	2/26/2001	2/26/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.271	0.271	0.271	---	1
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	5/2/1972	5/13/2004	PHOSPHORUS	Orthophosphorus	mg/L	0.163	0.105	0.228	0.025	34
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	5/2/1972	5/13/2004	PHOSPHORUS	Total Phosphorus	mg/L	0.180	0.150	0.212	0.023	8
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	4/27/1956	5/13/2004	PHYSICAL	pH	SU	7.20	5.60	8.10	0.420	42
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	4/27/1956	5/13/2004	PHYSICAL	Specific Conductance	umhos/cm	336	211	378	37.9	53
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	5/2/1972	5/13/2004	SOLID	Total Dissolved Solids	mg/L	194	146	230	17.8	35
73	Sanlando Springs	Spring	0	Sanlando Springs	Sanlando Springs	4/27/1956	5/13/2004	TEMPERATURE	Water Temperature	C	24.2	21.5	28.5	0.783	93
74	Palm Springs	Spring	0	441845	Palm Springs nr Longwood	12/21/2002	9/29/2003	FLOW	Flow	cfs	6.22	5.35	6.76	0.321	283
74	Palm Springs	Spring	0	441845	Palm Springs nr Longwood	6/2/1993	2/2/2004	FLOW	Flow, Inst	cfs	5.96	4.51	6.92	0.705	22
74	Palm Springs	Spring	0	441845	Palm Springs nr Longwood	6/2/1993	11/12/2001	PHYSICAL	Stage	ft	0.291	-2.94	5.64	3.06	14
74	Palm Springs	Spring	0	441845	Palm Springs nr Longwood	6/2/1993	11/12/2001	PHYSICAL	Stage	ft MSL	17.2	13.9	22.5	3.06	14
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/17/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	0.00	0.00	0.00	0.00	2
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/17/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	96.5	43.0	150	75.7	2
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/17/1973	2/26/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.633	0.500	0.800	0.153	3
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	11/12/1941	9/22/2003	FLOW	Flow, Inst	cfs	7.15	2.80	12.0	2.14	112
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	4/27/1956	5/17/1973	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	99.3	89.0	105	7.04	4
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	4/27/1956	5/25/1995	GENERAL INORGANIC	Chloride, Total	mg/L	10.8	7.50	15.0	3.01	6
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	4/27/1956	5/25/1995	GENERAL INORGANIC	Hardness	mg/L as CaCO3	128	110	150	14.7	6
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	4/27/1956	5/25/1995	GENERAL INORGANIC	Sulfate, Total	mg/L	17.0	12.0	23.0	4.20	6
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/2/1972	METAL	Arsenic, Total	µg/L	0.00	0.00	0.00	---	1
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/2/1972	METAL	Copper, Total	µg/L	0.00	0.00	0.00	---	1
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/2/1972	METAL	Iron, Total	µg/L	20.0	20.0	20.0	---	1
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/2/1972	METAL	Manganese, Total	µg/L	0.00	0.00	0.00	---	1
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/2/1972	METAL	Zinc, Total	µg/L	0.00	0.00	0.00	---	1
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/17/1973	NITROGEN	Ammonia Nitrogen	mg/L	0.065	0.060	0.070	0.007	2
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/17/1973	NITROGEN	Organic Nitrogen	mg/L	0.450	0.130	0.770	0.453	2
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/17/1973	PHOSPHORUS	Orthophosphorus	mg/L	0.120	0.120	0.120	0.00	2
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/17/1973	PHOSPHORUS	Total Phosphorus	mg/L	0.135	0.130	0.140	0.007	2
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	4/27/1956	5/25/1993	PHYSICAL	Color	CPU	2.50	0.00	5.00	2.50	5
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	4/27/1956	2/26/2001	PHYSICAL	pH	SU	7.44	5.90	8.40	0.674	13
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	4/27/1956	2/26/2001	PHYSICAL	Specific Conductance	umhos/cm	303	221	348	37.9	19
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	9/22/2003	PHYSICAL	Stage	ft	23.1	21.18	24.83	0.86	40
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	5/2/1972	5/17/1973	PHYSICAL	Turbidity	NTU	2.00	0.00	4.00	2.83	2
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	10/18/1960	5/25/1995	SOLID	Total Dissolved Solids	mg/L	166	130	211	31.9	5
75	Palm Springs	Spring	0	2234996	Palm Springs Near Longwood Fla	4/27/1956	2/26/2001	TEMPERATURE	Water Temperature	C	24.1	23.0	26.5	0.558	64
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	5/17/2001	FLOW	Flow, Inst	cfs	0.385	0.240	0.530	0.205	2
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	6/11/1997	GENERAL INORGANIC	Chloride, Total	mg/L	320	320	320	---	1
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	6/11/1997	GENERAL INORGANIC	Hardness	mg/L as CaCO3	490	490	490	---	1
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	6/11/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	320	320	320	---	1
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	6/11/1997	PHYSICAL	Color	CPU	2.50	2.50	2.50	---	1
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	6/11/1997	PHYSICAL	pH	SU	7.90	7.80	8.00	0.141	2
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	5/17/2001	PHYSICAL	Specific Conductance	umhos/cm	1,795	1,790	1,800	7.07	2
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	6/11/1997	SOLID	Total Dissolved Solids	mg/L	1,130	1,130	1,130	---	1
76	Palm Springs	Spring	0	285038081270100	Palm Springs, Seminole State Forest	6/11/1997	5/17/2001	TEMPERATURE	Water Temperature	C	26.8	26.1	27.4	0.919	2
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	4/27/1956	5/13/2004	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	118	89.0	126	7.48	36
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	4/27/1956	5/13/2004	GENERAL INORGANIC	Chloride, Total	mg/L	14.9	7.50	18.0	2.39	37
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	9/29/1993	8/12/2003	GENERAL INORGANIC	Fluoride, Total	mg/L	0.178	0.160	0.200	0.013	29
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	9/29/1993	7/16/2002	GENERAL INORGANIC	Silica, Total	mg/L	4.55	3.98	8.00	0.819	22
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	4/27/1956	5/13/2004	GENERAL INORGANIC	Sulfate, Total	mg/L	22.5	12.0	27.0	3.31	38
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	2/26/2001	2/26/2001	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	0.440	0.440	0.440	---	1
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	2/26/2001	2/26/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.375	0.375	0.375	---	1
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	9/29/1993	5/13/2004	METAL	Calcium, Total	mg/L	39.8	30.1	43.4	2.65	31
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	5/2/1972	11/18/2003	METAL	Iron, Total	µg/L	16.1	1.10	69.8	19.4	20
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	9/29/1993	5/13/2004	METAL	Magnesium, Total	mg/L	11.8	8.66	13.1	0.827	31
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	9/29/1993	5/13/2004	METAL	Potassium, Total	mg/L	1.09	0.252	1.76	0.310	29

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	9/29/1993	8/12/2003	METAL	Strontium, Total	µg/L	347	245	380	32.3	28
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	2/26/2001	2/26/2001	NITROGEN	Ammonia Nitrogen	mg/L	0.073	0.073	0.073	---	1
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	9/29/1993	5/13/2004	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.665	0.488	0.930	0.125	30
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	2/26/2001	2/26/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.107	0.107	0.107	---	1
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	5/2/1972	5/13/2004	PHOSPHORUS	Orthophosphorus	mg/L	0.116	0.059	0.231	0.031	33
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	5/2/1972	5/13/2004	PHOSPHORUS	Total Phosphorus	mg/L	0.127	0.116	0.140	0.008	7
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	4/27/1956	5/13/2004	PHYSICAL	pH	SU	7.31	5.90	8.40	0.433	41
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	4/27/1956	5/13/2004	PHYSICAL	Specific Conductance	umhos/cm	324	221	359	29.2	53
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	10/18/1960	5/13/2004	SOLID	Total Dissolved Solids	mg/L	189	130	284	24.9	35
77	Palm Springs	Spring	0	Palm Springs - Seminole	Palm Springs - Seminole	4/27/1956	5/13/2004	TEMPERATURE	Water Temperature	C	24.2	23.0	26.5	0.536	93
78	Starbuck Spring	Spring	0	471851	Starbuck Springs nr Longwood	12/12/2002	9/29/2003	FLOW	Flow	cfs	14.7	12.9	19.0	1.22	292
78	Starbuck Spring	Spring	0	471851	Starbuck Springs nr Longwood	6/17/1993	2/3/2004	FLOW	Flow, Inst	cfs	14.1	11.5	17.5	1.51	22
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/2/1972	5/17/1973	BACTERIOLOGICAL	Fecal Coliform	#/100ml	0.00	0.00	0.00	0.00	2
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/2/1972	5/17/1973	BACTERIOLOGICAL	Total Coliform	#/100ml	40.0	5.00	75.0	49.5	2
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/17/1973	3/1/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.800	0.600	0.900	0.173	3
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	7/25/1944	9/22/2003	FLOW	Flow, Inst	cfs	14.4	8.30	21.0	2.11	108
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	7/25/1944	5/17/1973	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	105	98.0	116	7.72	4
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	7/25/1944	4/17/1997	GENERAL INORGANIC	Chloride, Total	mg/L	15.7	12.0	21.0	4.07	7
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	7/25/1944	5/25/1995	GENERAL INORGANIC	Hardness	mg/L as CaCO3	135	120	160	16.4	6
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	7/25/1944	4/17/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	18.3	12.0	24.0	4.64	7
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/2/1972	5/17/1973	NITROGEN	Ammonia Nitrogen	mg/L	0.025	0.020	0.030	0.007	2
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/2/1972	5/17/1973	NITROGEN	Organic Nitrogen	mg/L	0.165	0.070	0.260	0.134	2
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/2/1972	5/17/1973	PHOSPHORUS	Orthophosphorus	mg/L	0.145	0.140	0.150	0.007	2
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/2/1972	5/17/1973	PHOSPHORUS	Total Phosphorus	mg/L	0.150	0.140	0.160	0.014	2
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	10/18/1960	5/25/1993	PHYSICAL	Color	CPU	3.13	0.00	5.00	2.39	4
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	10/18/1960	3/1/2001	PHYSICAL	pH	SU	7.45	6.40	8.00	0.414	13
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	10/18/1960	3/1/2001	PHYSICAL	Specific Conductance	umhos/cm	325	257	376	38.5	17
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/3/1982	9/22/2003	PHYSICAL	Stage	ft	21.2	19.5	24.2	1.21	27
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	5/2/1972	5/17/1973	PHYSICAL	Turbidity	NTU	1.50	1.00	2.00	0.707	2
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	10/18/1960	5/25/1995	SOLID	Total Dissolved Solids	mg/L	172	148	208	26.4	5
79	Starbuck Spring	Spring	0	2234997	Starbuck Spring Near Longwood Fla	7/25/1944	3/1/2001	TEMPERATURE	Water Temperature	C	24.0	23.0	26.5	0.518	61
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	3/1/2001	3/1/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.910	0.910	0.910	---	1
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	7/25/1944	5/13/2004	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	121	98.0	129	6.90	35
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	7/25/1944	5/13/2004	GENERAL INORGANIC	Chloride, Total	mg/L	19.9	12.0	23.8	2.97	38
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	9/30/1993	8/12/2003	GENERAL INORGANIC	Fluoride, Total	mg/L	0.196	0.170	0.221	0.011	29
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	9/30/1993	7/16/2002	GENERAL INORGANIC	Silica, Total	mg/L	4.65	4.00	8.00	0.802	22
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	7/25/1944	5/13/2004	GENERAL INORGANIC	Sulfate, Total	mg/L	23.7	12.0	28.0	3.59	39
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	3/1/2001	3/1/2001	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	0.405	0.405	0.405	---	1
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	3/1/2001	3/1/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.450	0.450	0.450	---	1
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	9/30/1993	5/13/2004	METAL	Calcium, Total	mg/L	41.5	35.0	44.6	2.04	31
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	6/20/1995	11/18/2003	METAL	Iron, Total	µg/L	13.8	1.70	77.0	20.2	18
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	9/30/1993	5/13/2004	METAL	Magnesium, Total	mg/L	11.9	10.7	12.7	0.546	31
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	9/30/1993	5/13/2004	METAL	Potassium, Total	mg/L	1.43	1.18	2.10	0.191	31
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	9/30/1993	8/12/2003	METAL	Strontium, Total	µg/L	325	233	360	27.7	28
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	3/1/2001	3/1/2001	NITROGEN	Ammonia Nitrogen	mg/L	0.033	0.033	0.033	---	1
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	9/30/1993	5/13/2004	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.392	0.129	0.652	0.131	30
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	3/1/2001	3/1/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.151	0.151	0.151	---	1
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	5/2/1972	5/13/2004	PHOSPHORUS	Orthophosphorus	mg/L	0.145	0.116	0.191	0.017	33
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	5/2/1972	5/13/2004	PHOSPHORUS	Total Phosphorus	mg/L	0.162	0.140	0.184	0.013	7
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	10/18/1960	5/13/2004	PHYSICAL	pH	SU	7.40	6.40	8.00	0.279	41
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	10/18/1960	5/13/2004	PHYSICAL	Specific Conductance	umhos/cm	347	257	380	28.6	51
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	10/18/1960	5/13/2004	SOLID	Total Dissolved Solids	mg/L	197	148	250	18.8	35
80	Starbuck Spring	Spring	0	Starbuck Spring	Starbuck Spring	7/25/1944	5/13/2004	TEMPERATURE	Water Temperature	C	24.1	22.8	26.5	0.501	90
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	9/25/1984	BACTERIOLOGICAL	Fecal Coliform	#/100ml	129	20.0	470	192	5
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	9/25/1984	BACTERIOLOGICAL	Total Coliform	#/100ml	247	50.0	375	117	6
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	%	76.3	66.7	93.4	9.12	9
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	3/17/1986	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	6.50	5.80	8.20	0.775	9
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	103	90.0	110	5.68	9
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	3/20/1984	10/8/1985	GENERAL INORGANIC	Chloride, Total	mg/L	296	287	312	13.9	3
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	7/17/1984	METAL	Cadmium, Total	µg/L	2.90	1.80	4.00	1.56	2
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	7/17/1984	METAL	Chromium, Total	µg/L	4.00	3.00	5.00	1.41	2
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	7/17/1984	METAL	Copper, Total	µg/L	13.5	12.0	15.0	2.12	2
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	7/17/1984	METAL	Iron, Total	µg/L	101	66.0	135	48.8	2
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	7/17/1984	METAL	Lead, Total	µg/L	11.5	3.00	20.0	12.0	2
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	9/21/1983	METAL	Manganese, Total	µg/L	3.00	3.00	3.00	---	1
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	9/21/1983	METAL	Nickel, Total	µg/L	10.0	10.0	10.0	---	1
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	7/17/1984	METAL	Silver, Total	µg/L	4.50	4.00	5.00	0.707	2
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	9/21/1983	METAL	Zinc, Total	µg/L	71.0	71.0	71.0	---	1
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	NITROGEN	Ammonia Nitrogen	mg/L	0.068	0.00	0.110	0.040	6
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	NITROGEN	Organic Nitrogen	mg/L	0.338	0.030	0.740	0.320	6

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	7/16/1984	11/27/1984	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.174	0.131	0.200	0.037	3
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	NITROGEN	Unionized Ammonia	mg/L	0.0008	0.00	0.001	0.0006	4
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.420	0.100	0.800	0.251	5
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	3/20/1984	5/14/1985	OXYGEN DEMAND	Chemical Oxygen Demand	mg/L	5.88	1.50	11.6	3.66	5
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	PHOSPHORUS	Total Phosphorus	mg/L	0.086	0.030	0.272	0.085	8
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	PHYSICAL	pH	SU	7.44	7.00	7.90	0.362	8
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	9/21/1983	3/17/1986	PHYSICAL	Secchi	m	1.31	1.00	1.60	0.234	7
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	PHYSICAL	Specific Conductance	umhos/cm	1,190	143	1,510	543	9
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	PHYSICAL	Turbidity	NTU	1.02	0.710	1.90	0.377	9
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	8/10/1985	3/19/1986	SOLID	Total Dissolved Solids	mg/L	642	600	727	73.3	3
81	Wekiva Falls	Spring	800	10621	Wekiva Falls Canal	5/4/1982	3/17/1986	TEMPERATURE	Water Temperature	C	24.3	22.5	26.0	1.18	10
82	Nova Spring	Spring	0	284903081250800	Wekiva Branch Spring	8/16/1996	8/16/1996	GENERAL INORGANIC	Chloride, Total	mg/L	830	830	830	---	1
82	Nova Spring	Spring	0	284903081250800	Wekiva Branch Spring	8/16/1996	8/16/1996	GENERAL INORGANIC	Hardness	mg/L as CaCO3	650	650	650	---	1
82	Nova Spring	Spring	0	284903081250800	Wekiva Branch Spring	8/16/1996	8/16/1996	GENERAL INORGANIC	Sulfate, Total	mg/L	350	350	350	---	1
82	Nova Spring	Spring	0	284903081250800	Wekiva Branch Spring	8/16/1996	8/16/1996	PHYSICAL	Color	CPU	2.50	2.50	2.50	---	1
82	Nova Spring	Spring	0	284903081250800	Wekiva Branch Spring	8/16/1996	8/16/1996	PHYSICAL	pH	SU	7.60	7.60	7.60	---	1
82	Nova Spring	Spring	0	284903081250800	Wekiva Branch Spring	8/16/1996	8/16/1996	PHYSICAL	Specific Conductance	umhos/cm	3,350	3,350	3,350	---	1
82	Nova Spring	Spring	0	284903081250800	Wekiva Branch Spring	8/16/1996	8/16/1996	SOLID	Total Dissolved Solids	mg/L	2,080	2,080	2,080	---	1
82	Nova Spring	Spring	0	284903081250800	Wekiva Branch Spring	8/16/1996	8/16/1996	TEMPERATURE	Water Temperature	C	22.9	22.9	22.9	---	1
83	Island Spring	Spring	0	15790431	Island Spring Near Sanford	3/22/2001	12/19/2003	FLOW	Flow, Inst	cfs	8.10	5.39	10.2	1.67	12
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	3/22/2001	3/22/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.600	0.600	0.600	---	1
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	8/14/1997	FLOW	Flow, Inst	cfs	6.40	6.10	6.60	0.216	4
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	8/12/1996	GENERAL INORGANIC	Chloride, Total	mg/L	1,550	1,200	1,900	495	2
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	8/12/1996	GENERAL INORGANIC	Hardness	mg/L as CaCO3	880	790	970	127	2
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	8/12/1996	GENERAL INORGANIC	Sulfate, Total	mg/L	430	350	510	113	2
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	5/7/1982	PHYSICAL	Color	CPU	10.0	10.0	10.0	---	1
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	3/22/2001	PHYSICAL	pH	SU	7.45	6.80	7.80	0.451	4
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	3/22/2001	PHYSICAL	Specific Conductance	umhos/cm	3,631	542	5,850	2,759	3
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	8/12/1996	SOLID	Total Dissolved Solids	mg/L	3,420	2,680	4,160	1,047	2
84	Island Spring	Spring	0	284922081250300	Island Spring Near Sanford	5/7/1982	3/22/2001	TEMPERATURE	Water Temperature	C	23.9	23.6	24.0	0.231	3
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	3/22/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	0.630	0.630	0.630	---	1
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	128	124	132	2.29	10
85	Island Spring	Spring	0	Island Spring	Island Spring	5/7/1982	9/23/2003	GENERAL INORGANIC	Chloride, Total	mg/L	1,788	1,200	2,098	262	12
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	GENERAL INORGANIC	Fluoride, Total	mg/L	0.225	0.200	0.248	0.018	10
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/18/2002	GENERAL INORGANIC	Silica, Total	mg/L	5.40	5.03	5.61	0.193	7
85	Island Spring	Spring	0	Island Spring	Island Spring	5/7/1982	9/23/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	498	350	580	66.0	12
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	3/22/2001	GENERAL ORGANIC	Carbon, Dissolved Organic	mg/L	0.715	0.715	0.715	---	1
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	3/22/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	1.65	1.65	1.65	---	1
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	METAL	Calcium, Total	mg/L	227	199	250	17.1	9
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	METAL	Iron, Total	µg/L	0.902	0.164	1.60	0.510	9
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	METAL	Magnesium, Total	mg/L	111	93.3	125	11.5	9
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	METAL	Potassium, Total	mg/L	25.3	21.6	28.0	2.33	9
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	METAL	Strontium, Total	µg/L	5,356	4,828	5,830	350	9
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	3/22/2001	NITROGEN	Ammonia Nitrogen	mg/L	0.234	0.234	0.234	---	1
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.007	0.001	0.010	0.004	7
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	3/22/2001	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.558	0.558	0.558	---	1
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	9/23/2003	PHOSPHORUS	Orthophosphorus	mg/L	0.072	0.061	0.090	0.009	10
85	Island Spring	Spring	0	Island Spring	Island Spring	3/22/2001	3/22/2001	PHOSPHORUS	Total Phosphorus	mg/L	0.506	0.506	0.506	---	1
85	Island Spring	Spring	0	Island Spring	Island Spring	5/7/1982	9/23/2003	PHYSICAL	pH	SU	7.45	6.75	9.31	0.705	11
85	Island Spring	Spring	0	Island Spring	Island Spring	5/7/1982	9/23/2003	PHYSICAL	Specific Conductance	umhos/cm	2,629	6.48	6,380	2,674	14
85	Island Spring	Spring	0	Island Spring	Island Spring	9/19/2001	9/19/2001	PHYSICAL	Turbidity	NTU	0.127	0.127	0.127	---	1
85	Island Spring	Spring	0	Island Spring	Island Spring	5/7/1982	9/23/2003	SOLID	Total Dissolved Solids	mg/L	3,559	333	4,500	1,152	12
85	Island Spring	Spring	0	Island Spring	Island Spring	5/7/1982	6/25/2003	TEMPERATURE	Water Temperature	C	23.6	22.3	24.1	0.514	11
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	BACTERIOLOGICAL	Fecal Coliform	#/100ml	1.00	1.00	1.00	0.00	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	BACTERIOLOGICAL	Total Coliform	#/100ml	4.11	1.00	20.0	6.66	9
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	1.10	0.940	1.54	0.183	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	GENERAL INORGANIC	Chloride, Total	mg/L	243	230	270	12.2	9
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	GENERAL INORGANIC	Fluoride, Total	mg/L	0.122	0.110	0.140	0.009	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	GENERAL INORGANIC	Sulfate, Total	mg/L	63.4	61.0	68.0	2.11	11
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.500	0.500	0.500	0.00	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Aluminum, Total	µg/L	12.8	3.50	37.5	16.5	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Arsenic, Total	µg/L	2.13	1.50	3.00	0.750	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/29/2002	10/21/2003	METAL	Barium, Total	µg/L	7.63	6.60	8.20	0.896	3
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Cadmium, Total	µg/L	0.344	0.250	0.375	0.063	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	METAL	Calcium, Total	mg/L	47.8	41.3	66.6	7.13	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Chromium, Total	µg/L	0.963	0.350	1.50	0.471	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Cobalt, Total	µg/L	0.469	0.375	0.500	0.063	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Copper, Total	µg/L	2.19	1.25	3.00	0.747	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Iron, Total	µg/L	9.00	3.50	17.5	5.97	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Lead, Total	µg/L	2.50	2.50	2.50	0.00	4

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	METAL	Magnesium, Total	mg/L	20.3	19.4	21.2	0.582	11
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Manganese, Total	µg/L	0.333	0.250	0.580	0.165	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Nickel, Total	µg/L	1.54	0.750	3.15	1.09	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	METAL	Potassium, Total	mg/L	3.79	3.40	4.20	0.226	9
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Selenium, Total	µg/L	3.38	2.00	4.00	0.946	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Strontium, Total	µg/L	743	708	786	35.2	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/21/2003	METAL	Zinc, Total	µg/L	1.88	1.00	2.50	0.629	4
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	NITROGEN	Ammonia Nitrogen	mg/L	0.011	0.005	0.041	0.012	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.050	0.040	0.059	0.006	11
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.109	0.030	0.190	0.052	11
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	10/24/2001	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.100	0.100	0.100	---	1
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/29/2002	PHOSPHORUS	Total Phosphorus	mg/L	0.044	0.041	0.048	0.004	3
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	PHYSICAL	Color	CPU	0.00	0.00	0.00	0.00	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	PHYSICAL	pH	SU	7.65	7.32	7.87	0.194	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	PHYSICAL	Secchi	m	7.72	6.50	11.8	1.50	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	PHYSICAL	Specific Conductance	umhos/cm	1,040	723	1,160	94.9	20
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	PHYSICAL	Turbidity	NTU	0.178	0.025	0.900	0.269	10
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	SOLID	Total Suspended Solids	mg/L	2.33	2.00	4.00	0.778	12
86	Alexander Springs	Spring	0	9670	Alexander Springs	10/24/2001	1/15/2004	TEMPERATURE	Water Temperature	C	23.6	22.9	24.6	0.482	10
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	9/2/1977	BACTERIOLOGICAL	Total Coliform	#/100ml	30.0	30.0	30.0	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	4/14/1972	DISSOLVED OXYGEN	Dissolved Oxygen	%	11.0	11.0	11.0	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	3/1/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	2.37	0.800	5.70	1.33	13
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	6/22/1967	9/22/1994	FLOW	Flow	cfs	85.5	0.00	114	57.0	4
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	2/12/1931	6/10/2003	FLOW	Flow, Inst	cfs	103	56.0	202	18.7	155
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/23/1956	9/2/1977	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	84.8	75.0	115	17.0	5
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/23/1956	1/25/1985	GENERAL INORGANIC	Chloride, Total	mg/L	231	169	312	37.0	9
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/23/1956	10/30/1980	GENERAL INORGANIC	Hardness	mg/L as CaCO3	182	160	210	18.3	6
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/23/1956	1/25/1985	GENERAL INORGANIC	Sulfate, Total	mg/L	59.0	52.0	62.0	3.32	7
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	9/2/1977	GENERAL ORGANIC	Carbon, Total Organic	mg/L	4.00	3.00	5.00	1.41	2
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	9/2/1977	METAL	Aluminum, Total	µg/L	50.0	50.0	50.0	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	9/2/1977	METAL	Arsenic, Total	µg/L	0.500	0.500	0.500	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	1/25/1985	METAL	Barium, Total	µg/L	50.0	50.0	50.0	0.00	2
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	1/25/1985	METAL	Cadmium, Total	µg/L	0.500	0.500	0.500	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	1/25/1985	METAL	Chromium, Total	µg/L	6.00	2.00	10.0	5.66	2
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	9/2/1977	METAL	Iron, Total	µg/L	50.0	50.0	50.0	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	9/2/1977	METAL	Manganese, Total	µg/L	5.00	5.00	5.00	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	4/15/1985	METAL	Mercury, Total	µg/L	0.388	0.00	1.20	0.551	4
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	9/2/1977	METAL	Selenium, Total	µg/L	0.500	0.500	0.500	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	1/25/1985	1/25/1985	METAL	Silver, Total	µg/L	0.500	0.500	0.500	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	1/25/1985	NITROGEN	Ammonia Nitrogen	mg/L	0.050	0.010	0.130	0.069	3
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	1/25/1985	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.040	0.020	0.060	0.028	2
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	9/2/1977	NITROGEN	Organic Nitrogen	mg/L	0.005	0.00	0.010	0.007	2
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	1/25/1985	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.030	0.010	0.050	0.028	2
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	9/2/1977	9/2/1977	NITROGEN	Total Nitrogen	mg/L	0.030	0.030	0.030	---	1
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	9/2/1977	OXYGEN DEMAND	Biochemical Oxygen Demand, 5 Day	mg/L	0.550	0.100	1.00	0.636	2
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	1/25/1985	PHOSPHORUS	Orthophosphorus	mg/L	0.043	0.040	0.050	0.006	3
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	1/25/1985	PHOSPHORUS	Total Phosphorus	mg/L	0.047	0.040	0.060	0.012	3
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/23/1956	1/25/1985	PHYSICAL	Color	CPU	2.64	0.00	5.00	2.36	7
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/23/1956	3/1/2001	PHYSICAL	pH	SU	7.61	5.50	8.20	0.590	19
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/23/1956	3/1/2001	PHYSICAL	Specific Conductance	umhos/cm	1,069	813	1,240	89.7	25
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	10/30/1980	9/17/2002	PHYSICAL	Stage	ft	10.5	10.1	11.2	0.215	51
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	5/2/1979	2/10/1998	PHYSICAL	Stage	ft MSL	8.81	7.43	11.0	1.23	26
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	4/14/1972	9/2/1977	PHYSICAL	Turbidity	NTU	0.500	0.00	1.00	0.707	2
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	6/22/1967	1/25/1985	SOLID	Total Dissolved Solids	mg/L	566	525	602	31.3	5
87	Alexander Springs	Spring	0	2236095	Alexander Springs Near Astor, FL	11/16/1960	3/1/2001	TEMPERATURE	Water Temperature	C	23.4	22.5	24.0	0.477	37
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	4/23/1956	3/20/2000	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	80.4	73.0	115	6.23	40
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	4/23/1956	3/20/2000	GENERAL INORGANIC	Chloride, Total	mg/L	246	169	333	29.7	46
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	1/20/1994	3/20/2000	GENERAL INORGANIC	Fluoride, Total	mg/L	0.129	0.090	0.250	0.030	22
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	3/23/1987	3/20/2000	GENERAL INORGANIC	Silica, Total	mg/L	5.14	3.00	12.0	2.28	32
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	4/23/1956	3/20/2000	GENERAL INORGANIC	Sulfate, Total	mg/L	63.8	51.0	81.9	6.72	43
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	4/14/1972	7/5/1994	GENERAL ORGANIC	Carbon, Total Organic	mg/L	2.49	0.460	5.00	1.97	4
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	1/18/1993	3/20/2000	METAL	Calcium, Total	mg/L	45.0	41.0	48.8	2.20	22
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	9/2/1977	7/5/1994	METAL	Iron, Total	µg/L	40.3	20.0	51.0	17.6	3
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	7/6/1992	3/20/2000	METAL	Magnesium, Total	mg/L	20.4	19.0	22.0	0.955	24
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	7/6/1992	3/20/2000	METAL	Potassium, Total	mg/L	3.95	3.20	4.64	0.368	24
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	7/6/1992	3/20/2000	METAL	Strontium, Total	µg/L	726	408	894	99.2	24
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	9/2/1977	3/20/2000	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.052	0.020	0.096	0.015	33
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	4/14/1972	3/20/2000	PHOSPHORUS	Orthophosphorus	mg/L	0.050	0.040	0.076	0.008	22
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	4/14/1972	1/25/1985	PHOSPHORUS	Total Phosphorus	mg/L	0.047	0.040	0.060	0.012	3
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	4/23/1956	3/20/2000	PHYSICAL	pH	SU	7.66	6.90	8.20	0.277	50

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	4/23/1956	3/20/2000	PHYSICAL	Specific Conductance	umhos/cm	1,095	813	1,650	128	64
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	6/22/1967	3/20/2000	SOLID	Total Dissolved Solids	mg/L	582	502	698	44.4	39
88	Alexander Springs	Spring	0	Alexander Springs	Alexander Springs	11/16/1960	3/20/2000	TEMPERATURE	Water Temperature	C	23.5	22.0	26.0	0.630	76
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	BACTERIOLOGICAL	Fecal Coliform	#/100ml	217	40.0	719	262	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	BACTERIOLOGICAL	Total Coliform	#/100ml	763	90.0	2,400	880	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	4.82	2.50	7.40	2.11	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	72.3	40.3	83.0	16.2	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	GENERAL INORGANIC	Chloride, Total	mg/L	206	76.5	274	80.7	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	9/9/2002	9/9/2002	GENERAL INORGANIC	Hardness	mg/L as CaCO3	120	120	120	---	1
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	8/28/2001	GENERAL INORGANIC	Sulfate, Total	mg/L	66.0	54.6	72.1	7.41	5
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	8/28/2001	GENERAL ORGANIC	Carbon, Total Organic	mg/L	9.82	1.00	41.2	17.6	5
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	METAL	Calcium, Total	mg/L	43.2	27.5	50.6	8.12	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	METAL	Magnesium, Total	mg/L	18.2	12.6	22.6	3.98	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	METAL	Potassium, Total	mg/L	3.55	2.18	4.91	0.973	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.033	0.005	0.060	0.018	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.527	0.240	0.970	0.310	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	1/25/2001	9/9/2002	NITROGEN	Total Nitrogen	mg/L	0.705	0.380	1.00	0.293	4
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	PHOSPHORUS	Total Phosphorus	mg/L	0.052	0.030	0.100	0.025	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	PHYSICAL	Color	CPU	94.6	0.500	300	141	7
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	PHYSICAL	pH	SU	7.28	6.27	8.08	0.541	11
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	8/28/2001	PHYSICAL	Secchi	m	0.613	0.400	0.800	0.193	4
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	PHYSICAL	Specific Conductance	umhos/cm	1,002	637	1,221	224	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	PHYSICAL	Turbidity	NTU	0.358	0.300	0.550	0.102	6
89	Alexander Springs	Upstream	2010	SWALEXSP445	Alexander Springs Run at CR 445	2/22/2000	9/9/2002	TEMPERATURE	Water Temperature	C	23.2	19.0	26.1	2.47	6
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	6/2/1983	1/16/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.93	5.40	6.30	0.328	8
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/19/1972	9/19/2003	FLOW	Flow, Inst	cfs	12.2	9.27	17.0	1.52	143
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/28/1972	4/28/1972	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	43.0	43.0	43.0	---	1
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/28/1972	11/13/1980	GENERAL INORGANIC	Chloride, Total	mg/L	4.15	4.00	4.30	0.212	2
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/28/1972	11/13/1980	GENERAL INORGANIC	Hardness	mg/L as CaCO3	48.5	48.0	49.0	0.707	2
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/28/1972	11/13/1980	GENERAL INORGANIC	Sulfate, Total	mg/L	5.65	5.20	6.10	0.636	2
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/28/1972	11/13/1980	PHYSICAL	Color	CPU	0.00	0.00	0.00	0.00	2
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/28/1972	1/16/2001	PHYSICAL	pH	SU	7.45	5.20	8.50	1.04	11
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/28/1972	1/16/2001	PHYSICAL	Specific Conductance	umhos/cm	128	107	180	19.9	15
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	9/24/1985	9/19/2003	PHYSICAL	Stage	ft	19.6	1.74	30.5	8.86	37
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/28/1972	11/13/1980	SOLID	Total Dissolved Solids	mg/L	60.5	58.0	63.0	3.54	2
90	Fern Hammock Sprin	Spring	0	2236132	Fern Hammock Spring Near Ocala, FL	4/19/1972	1/16/2001	TEMPERATURE	Water Temperature	C	22.1	21.3	23.0	0.506	17
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	4/28/1972	3/21/2000	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	45.5	37.0	83.0	6.88	36
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	4/28/1972	3/21/2000	GENERAL INORGANIC	Chloride, Total	mg/L	5.06	3.00	11.7	1.84	36
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	1/16/1989	3/21/2000	GENERAL INORGANIC	Fluoride, Total	mg/L	0.071	0.060	0.090	0.007	24
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	4/7/1987	3/21/2000	GENERAL INORGANIC	Silica, Total	mg/L	5.14	3.87	13.0	2.59	34
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	4/28/1972	3/21/2000	GENERAL INORGANIC	Sulfate, Total	mg/L	6.94	3.00	20.0	3.43	38
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	7/30/1990	7/30/1990	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.700	0.700	0.700	---	1
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	7/6/1992	3/21/2000	METAL	Calcium, Total	mg/L	12.5	11.0	15.9	1.22	26
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	7/14/1993	7/6/1994	METAL	Iron, Total	µg/L	29.0	19.0	39.0	14.1	2
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	7/6/1992	3/21/2000	METAL	Magnesium, Total	mg/L	4.66	4.00	6.47	0.508	26
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	7/12/1995	7/12/1995	METAL	Potassium, Total	mg/L	0.900	0.900	0.900	---	1
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	1/18/1993	3/21/2000	METAL	Strontium, Total	µg/L	89.5	53.0	211	37.1	25
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	7/7/1988	3/21/2000	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.080	0.009	0.127	0.020	33
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	11/14/1994	3/21/2000	PHOSPHORUS	Orthophosphorus	mg/L	0.027	0.019	0.109	0.019	21
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	4/28/1972	3/21/2000	PHYSICAL	pH	SU	7.80	5.14	8.50	0.731	46
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	4/28/1972	3/21/2000	PHYSICAL	Specific Conductance	umhos/cm	121	60.0	244	25.1	56
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	4/28/1972	3/21/2000	SOLID	Total Dissolved Solids	mg/L	71.2	49.0	152	18.7	36
91	Fern Hammock Sprin	Spring	0	Fern Hammock Springs	Fern Hammock Springs	4/19/1972	3/21/2000	TEMPERATURE	Water Temperature	C	21.8	20.4	23.0	0.543	58
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	BACTERIOLOGICAL	Fecal Coliform	#/100ml	88.0	88.0	88.0	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	5.84	5.84	5.84	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	GENERAL INORGANIC	Chloride, Total	mg/L	4.00	4.00	4.00	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	GENERAL INORGANIC	Fluoride, Total	mg/L	0.071	0.071	0.071	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	GENERAL INORGANIC	Sulfate, Total	mg/L	5.80	5.80	5.80	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.500	0.500	0.500	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Aluminum, Total	µg/L	10.0	10.0	10.0	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Arsenic, Total	µg/L	1.50	1.50	1.50	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Cadmium, Total	µg/L	0.250	0.250	0.250	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Calcium, Total	mg/L	12.4	12.4	12.4	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Chromium, Total	µg/L	1.00	1.00	1.00	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Cobalt, Total	µg/L	0.375	0.375	0.375	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Copper, Total	µg/L	1.75	1.75	1.75	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Iron, Total	µg/L	17.5	17.5	17.5	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Lead, Total	µg/L	2.50	2.50	2.50	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Magnesium, Total	mg/L	4.40	4.40	4.40	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Manganese, Total	µg/L	0.250	0.250	0.250	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Nickel, Total	µg/L	1.00	1.00	1.00	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Potassium, Total	mg/L	0.260	0.260	0.260	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Selenium, Total	µg/L	2.00	2.00	2.00	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Strontium, Total	µg/L	75.5	75.5	75.5	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	METAL	Zinc, Total	µg/L	1.00	1.00	1.00	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	NITROGEN	Ammonia Nitrogen	mg/L	0.015	0.015	0.015	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.090	0.090	0.090	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.030	0.030	0.030	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	PHYSICAL	Color	CPU	0.00	0.00	0.00	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	PHYSICAL	pH	SU	7.73	7.73	7.73	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	PHYSICAL	Secchi	m	1.20	1.20	1.20	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	PHYSICAL	Specific Conductance	umhos/cm	118	116	120	2.83	2
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	PHYSICAL	Turbidity	NTU	0.150	0.150	0.150	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	SOLID	Total Suspended Solids	mg/L	2.00	2.00	2.00	---	1
92	Juniper Springs	Spring	0	11456	Fern Hammock Springs	1/30/2002	1/30/2002	TEMPERATURE	Water Temperature	C	22.1	22.1	22.1	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	BACTERIOLOGICAL	Fecal Coliform	#/100ml	1.00	1.00	1.00	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	6.24	6.24	6.24	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	GENERAL INORGANIC	Chloride, Total	mg/L	4.00	4.00	4.00	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	GENERAL INORGANIC	Fluoride, Total	mg/L	0.069	0.069	0.069	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	GENERAL INORGANIC	Sulfate, Total	mg/L	5.60	5.60	5.60	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.500	0.500	0.500	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Aluminum, Total	µg/L	10.0	10.0	10.0	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Arsenic, Total	µg/L	1.50	1.50	1.50	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Cadmium, Total	µg/L	0.250	0.250	0.250	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Calcium, Total	mg/L	12.8	12.8	12.8	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Chromium, Total	µg/L	1.00	1.00	1.00	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Cobalt, Total	µg/L	0.375	0.375	0.375	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Copper, Total	µg/L	1.75	1.75	1.75	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Iron, Total	µg/L	17.5	17.5	17.5	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Lead, Total	µg/L	2.50	2.50	2.50	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Magnesium, Total	mg/L	4.40	4.40	4.40	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Manganese, Total	µg/L	0.250	0.250	0.250	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Nickel, Total	µg/L	1.00	1.00	1.00	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Potassium, Total	mg/L	0.260	0.260	0.260	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Selenium, Total	µg/L	2.00	2.00	2.00	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Strontium, Total	µg/L	78.4	78.4	78.4	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	METAL	Zinc, Total	µg/L	1.00	1.00	1.00	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	NITROGEN	Ammonia Nitrogen	mg/L	0.012	0.012	0.012	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.084	0.084	0.084	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.030	0.030	0.030	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	PHYSICAL	Color	CPU	0.00	0.00	0.00	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	PHYSICAL	pH	SU	8.03	8.03	8.03	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	PHYSICAL	Secchi	m	3.60	3.60	3.60	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	PHYSICAL	Specific Conductance	umhos/cm	118	115	120	3.54	2
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	PHYSICAL	Turbidity	NTU	0.100	0.100	0.100	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	SOLID	Total Suspended Solids	mg/L	2.00	2.00	2.00	---	1
93	Juniper Springs	Spring	0	11463	Juniper Springs	1/30/2002	1/30/2002	TEMPERATURE	Water Temperature	C	22.0	22.0	22.0	---	1
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	11/13/1908	2/27/2001	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	6.58	6.00	7.40	0.418	9
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	11/13/1908	9/19/2003	FLOW	Flow, Inst	cfs	10.4	5.60	16.5	1.93	154
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	4/23/1956	4/28/1972	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	41.7	21.0	63.0	12.5	7
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	4/23/1956	1/15/1997	GENERAL INORGANIC	Chloride, Total	mg/L	9.41	3.50	50.0	15.2	9
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	4/23/1956	11/13/1980	GENERAL INORGANIC	Hardness	mg/L as CaCO3	54.0	52.0	58.0	2.83	7
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	4/23/1956	1/15/1997	GENERAL INORGANIC	Sulfate, Total	mg/L	8.04	5.50	10.0	1.65	9
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	4/23/1956	1/15/1997	PHYSICAL	Color	CPU	3.61	0.00	5.00	2.20	9
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	11/13/1908	2/27/2001	PHYSICAL	pH	SU	7.67	5.80	8.70	0.729	20
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	11/13/1908	2/27/2001	PHYSICAL	Specific Conductance	umhos/cm	118	12.0	159	26.3	22
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	9/26/1984	9/19/2003	PHYSICAL	Stage	ft	30.4	30.0	31.0	0.171	56
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	9/22/1978	9/19/2000	PHYSICAL	Stage	ft MSL	30.3	26.8	30.8	0.479	65
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	3/11/1962	1/15/1997	SOLID	Total Dissolved Solids	mg/L	72.0	66.0	80.0	6.32	4
94	Juniper Springs	Spring	0	2236130	Juniper Springs Near Ocala, FL	11/13/1908	2/27/2001	TEMPERATURE	Water Temperature	C	21.9	20.0	23.0	0.548	21
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	4/23/1956	3/21/2000	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	44.1	21.0	63.0	5.18	45
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	4/23/1956	3/21/2000	GENERAL INORGANIC	Chloride, Total	mg/L	5.23	3.50	13.0	1.99	44
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	1/16/1989	3/21/2000	GENERAL INORGANIC	Fluoride, Total	mg/L	0.070	0.060	0.130	0.014	26
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	4/7/1987	3/21/2000	GENERAL INORGANIC	Silica, Total	mg/L	5.21	3.89	13.0	2.62	35
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	4/23/1956	3/21/2000	GENERAL INORGANIC	Sulfate, Total	mg/L	7.64	4.00	42.0	5.51	47
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	7/26/1990	1/11/1994	GENERAL ORGANIC	Carbon, Total Organic	mg/L	1.10	0.490	1.70	0.856	2
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	7/6/1992	3/21/2000	METAL	Calcium, Total	mg/L	12.2	8.00	14.3	1.21	27
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	7/12/1993	3/20/1996	METAL	Iron, Total	µg/L	213	41.0	680	312	4
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	7/6/1992	3/21/2000	METAL	Magnesium, Total	mg/L	4.39	3.80	5.09	0.311	27
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	7/6/1994	7/6/1994	METAL	Potassium, Total	mg/L	0.800	0.800	0.800	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	7/6/1992	3/21/2000	METAL	Strontium, Total	µg/L	74.9	45.0	107	14.0	26
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	6/11/1984	3/21/2000	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.080	0.065	0.118	0.012	33
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	11/14/1994	3/21/2000	PHOSPHORUS	Orthophosphorus	mg/L	0.028	0.020	0.082	0.012	22
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	4/29/1996	4/29/1996	PHOSPHORUS	Total Phosphorus	mg/L	0.029	0.029	0.029	---	1
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	11/13/1908	3/21/2000	PHYSICAL	pH	SU	7.93	5.80	8.83	0.660	55
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	11/13/1908	3/21/2000	PHYSICAL	Specific Conductance	umhos/cm	120	100	183	15.5	63
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	3/11/1962	3/21/2000	SOLID	Total Dissolved Solids	mg/L	68.1	33.0	94.0	11.0	39
95	Juniper Springs	Spring	0	Juniper Springs	Juniper Springs	11/13/1908	3/21/2000	TEMPERATURE	Water Temperature	C	21.8	20.0	25.1	0.599	64
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	BACTERIOLOGICAL	Fecal Coliform	#/100ml	159	153	164	7.78	2
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	BACTERIOLOGICAL	Total Coliform	#/100ml	2,038	925	3,150	1,573	2
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	3/12/2002	3/12/2002	BIOLOGICAL	Pheophytin-a	µg/L	1.65	1.10	2.20	0.778	2
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	7/19/1999	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	6.80	6.80	6.80	---	1
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	7/19/1999	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	59.0	59.0	59.0	---	1
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	7/19/1999	GENERAL INORGANIC	Chloride, Total	mg/L	440	440	440	---	1
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	GENERAL INORGANIC	Sulfate, Total	mg/L	135	130	140	7.07	2
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	NITROGEN	Ammonia Nitrogen	mg/L	0.012	0.012	0.012	0.00	2
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.007	0.007	0.007	0.00	2
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.245	0.220	0.270	0.035	2
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	7/19/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.040	0.040	0.040	---	1
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	PHYSICAL	pH	SU	7.40	7.10	7.59	0.261	3
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	7/19/1999	PHYSICAL	Secchi	m	0.600	0.600	0.600	---	1
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	PHYSICAL	Specific Conductance	umhos/cm	1,670	1,580	1,760	127	2
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	7/19/1999	PHYSICAL	Turbidity	NTU	1.77	1.77	1.77	---	1
96	Juniper Springs	Internal	9820	20010454	Juniper Creek 100 yards upstream of Highway 19	7/19/1999	3/12/2002	TEMPERATURE	Water Temperature	C	22.0	20.7	23.2	1.77	2
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	BACTERIOLOGICAL	Fecal Coliform	#/100ml	66.0	66.0	66.0	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	BIOLOGICAL	Pheophytin-a	µg/L	0.425	0.425	0.425	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	6.68	6.68	6.68	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	GENERAL INORGANIC	Chloride, Total	mg/L	390	390	390	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	GENERAL INORGANIC	Fluoride, Total	mg/L	0.110	0.110	0.110	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	GENERAL INORGANIC	Sulfate, Total	mg/L	110	110	110	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	GENERAL ORGANIC	Carbon, Total Organic	mg/L	7.40	7.40	7.40	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	METAL	Calcium, Total	mg/L	50.8	50.8	50.8	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	METAL	Magnesium, Total	mg/L	27.1	27.1	27.1	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	METAL	Potassium, Total	mg/L	7.00	7.00	7.00	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	NITROGEN	Ammonia Nitrogen	mg/L	0.012	0.012	0.012	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.015	0.015	0.015	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	NITROGEN	Total Kjeldahl Nitrogen	mg/L	0.400	0.400	0.400	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	PHYSICAL	Color	CPU	100	100	100	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	PHYSICAL	pH	SU	7.47	7.47	7.47	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	PHYSICAL	Secchi	m	0.180	0.180	0.180	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	PHYSICAL	Specific Conductance	umhos/cm	1,548	1,530	1,565	24.7	2
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	PHYSICAL	Turbidity	NTU	0.850	0.850	0.850	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	SOLID	Total Suspended Solids	mg/L	2.00	2.00	2.00	---	1
97	Juniper Springs	Downstream	11430	20120	SJC-SS-1026	8/27/2003	8/27/2003	TEMPERATURE	Water Temperature	C	23.6	23.6	23.6	---	1
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	6/3/1983	5/1/1987	DISSOLVED OXYGEN	Dissolved Oxygen	mg/L	3.42	1.90	9.10	3.18	5
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	9/19/2003	FLOW	Flow, Inst	cfs	12.8	7.12	23.0	1.79	133
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	11/14/1980	GENERAL INORGANIC	Chloride, Total	mg/L	1,100	1,100	1,100	---	1
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	11/14/1980	GENERAL INORGANIC	Hardness	mg/L as CaCO3	510	510	510	---	1
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	11/14/1980	GENERAL INORGANIC	Sulfate, Total	mg/L	280	280	280	---	1
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	11/14/1980	PHYSICAL	Color	CPU	0.00	0.00	0.00	---	1
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	5/22/1998	PHYSICAL	pH	SU	7.28	6.30	8.00	0.636	9
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	5/21/1999	PHYSICAL	Specific Conductance	umhos/cm	3,475	405	4,350	1,445	12
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	9/19/2003	PHYSICAL	Stage	ft	7.48	6.49	8.55	0.551	51
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	11/14/1980	PHYSICAL	Stage	ft MSL	30.6	30.6	30.6	---	1
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	11/14/1980	SOLID	Total Dissolved Solids	mg/L	2,510	2,510	2,510	---	1
98	Sweetwater Springs	Spring	0	2236147	Sweetwater Springs Near Astor Park	11/14/1980	5/21/1999	TEMPERATURE	Water Temperature	C	23.2	22.5	23.5	0.320	13
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	7/19/1985	3/17/2000	GENERAL INORGANIC	Alkalinity	mg/L as CaCO3	73.0	64.0	110	7.03	33
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	11/14/1980	3/17/2000	GENERAL INORGANIC	Chloride, Total	mg/L	1,108	846	2,160	203	36
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	1/18/1994	3/17/2000	GENERAL INORGANIC	Fluoride, Total	mg/L	0.120	0.090	0.138	0.011	24
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	1/29/1988	3/17/2000	GENERAL INORGANIC	Silica, Total	mg/L	4.78	4.00	13.0	1.95	32
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	11/14/1980	3/17/2000	GENERAL INORGANIC	Sulfate, Total	mg/L	264	224	296	17.1	37
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	1/10/1991	1/10/1991	GENERAL ORGANIC	Carbon, Total Organic	mg/L	0.700	0.700	0.700	---	1
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	7/8/1992	3/17/2000	METAL	Calcium, Total	mg/L	105	99.0	116	4.71	27
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	11/15/1994	11/13/1998	METAL	Iron, Total	µg/L	71.1	52.0	116	30.2	4
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	7/8/1992	3/17/2000	METAL	Magnesium, Total	mg/L	60.4	54.5	67.1	3.02	25
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	7/8/1992	3/17/2000	METAL	Potassium, Total	mg/L	18.1	12.9	22.9	1.87	26
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	7/8/1992	3/17/2000	METAL	Strontium, Total	µg/L	2,337	1,714	4,940	540	27
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	1/20/1989	11/12/1999	NITROGEN	Nitrate+Nitrite Nitrogen	mg/L	0.044	0.014	0.143	0.024	32
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	11/15/1994	11/12/1999	PHOSPHORUS	Orthophosphorus	mg/L	0.024	0.017	0.035	0.004	21
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	5/3/1996	5/3/1996	PHOSPHORUS	Total Phosphorus	mg/L	0.019	0.019	0.019	---	1

APPENDIX E

SURFACE WATER QUALITY STATISITICS FOR STATIONS WITHIN THE WEKIVA RIVER SYSTEM PROJECT AREA

STN_ID	SITE	RELATIVE LOCATION	EST DISTANCE FROM SPRING (m)	PRIMARY STATION ID	STATION LOCATION NAME	PERIOD-OF-RECORD		PARAMETER GROUP	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	STDEV	COUNT
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	11/14/1980	11/12/1999	PHYSICAL	pH	SU	7.47	6.30	8.08	0.375	45
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	11/14/1980	11/12/1999	PHYSICAL	Specific Conductance	umhos/cm	3,940	3,306	4,350	267	43
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	11/14/1980	3/17/2000	SOLID	Total Dissolved Solids	mg/L	2,178	2,000	2,510	132	33
99	Sweetwater Springs	Spring	0	Sweetwater Springs	Sweetwater Springs	11/14/1980	11/12/1999	TEMPERATURE	Water Temperature	C	23.2	22.0	24.5	0.353	51

Note: half of detection limit was used to calculate statistics when reported below laboratory detection limit

APPENDIX C

Pollutant Load Reduction Goal (PLRG) Analysis for the Wekiva River and Rock Springs Run, Florida

Final Report from Wetland Solutions Inc. (2005)

Final Report

Pollutant Load Reduction Goal (PLRG) Analysis for the Wekiva River and Rock Springs Run, Florida

Prepared for

St. Johns River Water Management District

October 2005

Wetland Solutions, Inc.

Final Report

Pollutant Load Reduction Goal (PLRG) Analysis for the Wekiva River and Rock Springs Run, Florida

Prepared for

St. Johns River Water Management District

October 2005

Wetland Solutions, Inc.

Executive Summary

The Wekiva Parkway and Protection Act of 2004 requires the St. Johns River Water Management District (SJRWMD) to establish pollutant load reduction goals (PLRGs) for the Wekiva River Study Area by December 1, 2005. At the request of the SJRWMD, Wetland Solutions Inc. (WSI) has conducted an initial assessment to identify appropriate PLRGs with a focus on nutrients for two spring runs, the Wekiva River and one important tributary, Rock Springs Run (together referred to in this report as the "Wekiva River System") located in Seminole, Orange, and Lake Counties, Florida. This area includes over 90 percent of the Wekiva River and the entire length of Rock Springs Run, for a total stream length of about 36 km (22 miles). The Wekiva River System defined for the purposes of this study does not include any of the headwater springs, the Little Wekiva River, and Blackwater Creek and its tributaries Sulfur Run and Seminole Creek or the springs that feed those streams. For the purposes of this PLRG analysis, the Little Wekiva River and all headwater springs are considered as external sources of pollutant loading to the Wekiva River System.

Previous studies of the Wekiva River System have been inconclusive with regards to the need for nutrient load reductions. Although it has been recognized that nutrients are elevated in these spring-fed streams, normal biological indices such as macroinvertebrate species diversity tools and population studies of plants and fish have not been able to demonstrate actual impairment of the flora and fauna inhabiting these streams. This study applied different methods to examination of potential anthropogenic, nutrient-related impacts to these river systems. Ecological and ecosystem-level indices are utilized to examine the structure and functioning of the entire aquatic ecosystems inclusive of all living organisms that fix carbon and process that fixed carbon through the biological flywheel of primary productivity and respiratory metabolism. This community metabolism was measured by the use of techniques that record the activity of the entire ecosystem through its effects upon dissolved oxygen concentrations. Upstream and downstream dissolved oxygen data were collected as well as extensive supporting information concerning sunlight, stream discharge rates, hydraulic residence time, oxygen diffusion rates, plant community composition, pollutant concentrations, mass loading and assimilation rates, and community export rates to fully interpret the community metabolism data.

Two reference sites were chosen for this study and were subjected to all of the same measurements conducted in the Wekiva River System streams. These reference sites, Juniper Creek and Alexander Springs Creek in the Ocala National Forest, are similar to the study streams in many respects but are different in that they are protected from developed land uses in their watershed as a result of their location in the Ocala National Forest. This study confirmed that ambient surface water nutrient concentrations are elevated for nitrate+nitrite nitrogen, total nitrogen, and total phosphorus in the Wekiva River System stream reaches compared to the reference streams located in the Ocala National Forest.

The data collected through the nine-month ecological study described in this report illustrate the complexity of these large aquatic ecosystems. Measurements of ecosystem-level indices do not preclude the normal problems associated with controlling the large number of variables typically present when conducting any field study. Since many forcing functions are at work simultaneously, there are few obvious correlations indicating cause and effect. Also, field measurements are subject to normal error and insufficient replication. Mesocosm studies were included in the sampling plan to help to elucidate the extent of these challenges. These studies found that ecosystem-level measurements could be repeated with promising accuracy within a more controlled environment of one plant species at a time. Community-wide measures are accurate but cannot be exactly repeated due to uncontrollable climatic and natural conditions in river ecosystems. However, mesocosm tests do not provide the important integrative aspect of the in-stream studies.

The most important finding from this study was that ecosystem-level indices were apparently consistently different between the Wekiva River System study streams and the two reference sites. Gross primary productivity, net primary productivity, and ecological efficiency (the effectiveness of the aquatic ecosystem to utilize solar radiation) were consistently higher in the reference streams than in the streams with higher nutrient content. Community respiration rates were not very different between the stream segments but were found to be reduced for the dominant submerged plant species (*Vallisneria americana)* in the *in situ* mesocosms.

Speculation can be made about the basis for these key findings. Common sense dictates increasing plant productivity in response to increasing nutrient concentrations. However spring run ecosystems are eminently adapted to their ambient nutrient conditions. Although higher nutrient levels could be a subsidy in a simple, mono-culture plant community, they may represent an imbalance or stress in the natural order of a complex aquatic ecosystem with a long period of community adaptation and optimization. This is especially true when the system has received other potentially synergistic impacts such as high erosion rates in the contributing watershed, pollutant loads from wastewater treatment facilities, flow reduction due to increasing groundwater withdrawals, high intensity aquatic "weed" management efforts, and recreation-related disturbance.

Florida Class III waters have the designated uses of: "Recreation, Propagation of a Healthy, Well-Balanced Population of Fish and Wildlife" and specific water quality criteria are included in Section 62-302, Florida Administrative Code (F.A.C.) to protect these designated uses. Outstanding Florida Waters (Section 62-302.700, F.A.C.) cannot be degraded relative to a 1979 baseline. PLRGs are developed for those pollutants that are likely to impair these designated uses, either through an exceedance of one or more specific water quality criteria or through overall degradation and loss of specific uses such as recreation or maintenance of normal fish and wildlife populations. Special emphasis was placed on determining whether nutrient loads need to be controlled in the Wekiva River System to meet the regulatory requirement for avoiding "an imbalance in natural populations of aquatic flora and fauna" (Section 62-302.530(48)(b), F.A.C.).

Since spring runs are qualitatively and quantitatively different environments than most other surface waters in the state, they have attributes that may not be directly protected

by specific water quality criteria. For this reason, protection of their general designated uses is an important additional approach for their preservation or restoration. This study determined that concentrations of dissolved oxygen and pH do not always meet Class III criteria in the Wekiva River System. However, these exceedances also occur in other spring-fed streams, including the two reference sites. For this reason those exceedances are concluded to be due to natural, non-abatable conditions. This analysis also concluded that nutrients, both nitrogen and phosphorus, are elevated in the Wekiva River System streams compared to comparable water bodies that are located in less intensively developed watersheds. These increased nutrient concentrations are concluded to be abatable and a range of in-stream nutrient targets are offered for consideration based on the ecosystem-level data collected and reviewed for this study. Based on a model relating nutrient loading rates to in-stream nutrient concentrations, specific nutrient load reductions are proposed to meet the proposed concentration targets.

The deadline established by the Florida Legislature for completion of this project dictated the feasible level-of-effort for all project activities, including data collection, analysis, and presentation. For this reason it is prudent to consider continued monitoring of the most promising ecosystem-level indices utilized in this study. Continuation of seasonal or continuous upstream-downstream oxygen sampling and metabolism estimates is recommended until enough data have been collected to fully document the reproducibility of the results found in this study and to determine the effects of a wider range of environmental variables on the target ecological indices.

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1.0 Introduction

1.1 Project Background

The Wekiva Parkway and Protection Act of 2004 (Chapter 369 part III, Florida Statutes [F.S.]) requires the St. Johns River Water Management District (SJRWMD) to establish pollutant load reduction goals (PLRGs) for the Wekiva River Study Area by December 1, 2005 (Section 369.318 [9], F.S.). At the request of the SJRWMD, Wetland Solutions Inc. (WSI) has conducted ecological studies in the Wekiva River Study Area to provide a scientific basis for proposed nutrient PLRGs for the Wekiva River and for Rock Springs Run (Wekiva River System) located in Seminole, Orange, and Lake Counties, Florida.

The Wekiva River Study Area defined in Chapter 369 part III is located in central Florida, just north of the city of Orlando (**Figure 1-1**). Although the Wekiva River Study Area includes a number of tributaries and their associated springs and watersheds, for the purposes of this project, only the portion of the Wekiva River Study Area upstream of its confluence with Blackwater Creek was included. This area is called the Wekiva River System in this report and includes over 90 percent of the Wekiva River and the entire length of Rock Springs Run, for a total stream length of about 36 km (22 miles) (**Figure 1-2**). The Wekiva River System included in this project did not include the nine named springs contributing directly to the upstream ends of the Wekiva River and Rock Springs Run, the Little Wekiva River and associated springs (Sanlando, Palm, Ginger Ale, and Starbuck Springs) above its confluence with the Wekiva River and Blackwater Creek and its tributaries Sulfur Run and Seminole Creek or the springs that feed those streams. Nutrient inputs contributed from those headwater springs and tributaries are treated as point source loads to the Wekiva River System evaluated in this study.

The Water Resource Implementation Rule (Section 62-40.210 [18] Florida Administrative Code [F.A.C.]) defines PLRGs as: "the estimated numeric reductions in pollutant loadings needed to preserve or restore designated uses of receiving bodies of water and maintain water quality consistent with applicable state water quality standards". PLRGs are intended to address unacceptable pollutant loadings from older stormwater management systems which were constructed before adoption of Chapter 62-25, F.A.C. (Regulation of Stormwater Discharge). PLRGs provide useful information to assist the Florida Department of Environmental Protection (FDEP) with establishment of Total Maximum Daily Loads (TMDLs) used to limit both point- and non-point source discharges to surface waters.

The surface waters within the Wekiva River System are Class III waters of the state and also Outstanding Florida Waters (OFWs) due to their incorporation within State Parks and Aquatic Preserves. Class III waters have the designated use of: "Recreation, Propagation of a Healthy, Well-Balanced Population of Fish and Wildlife" and specific water quality standards or criteria are included in Section 62-302, F.A.C. to protect these designated uses. OFWs receive a higher level of statutory protection in that their water quality cannot be measurably degraded compared to baseline conditions existing in 1979

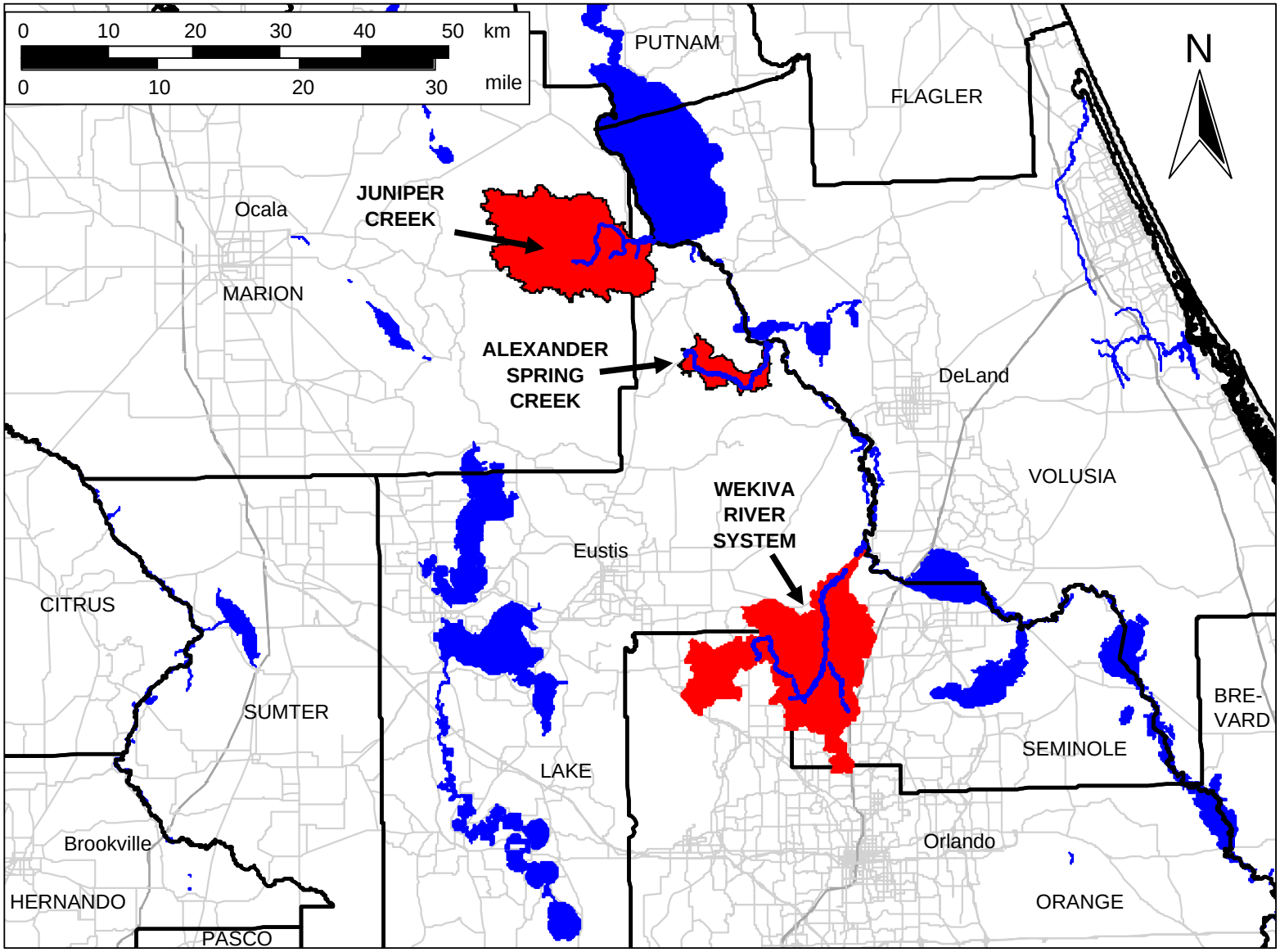


FIGURE 1-1

Source: FGDL

GENERAL LOCATION MAP FOR THE WEKIVA RIVER SYSTEM PROJECT AREA AND REFERENCE SITES - JUNIPER CREEK AND ALEXANDER SPRING CREEK

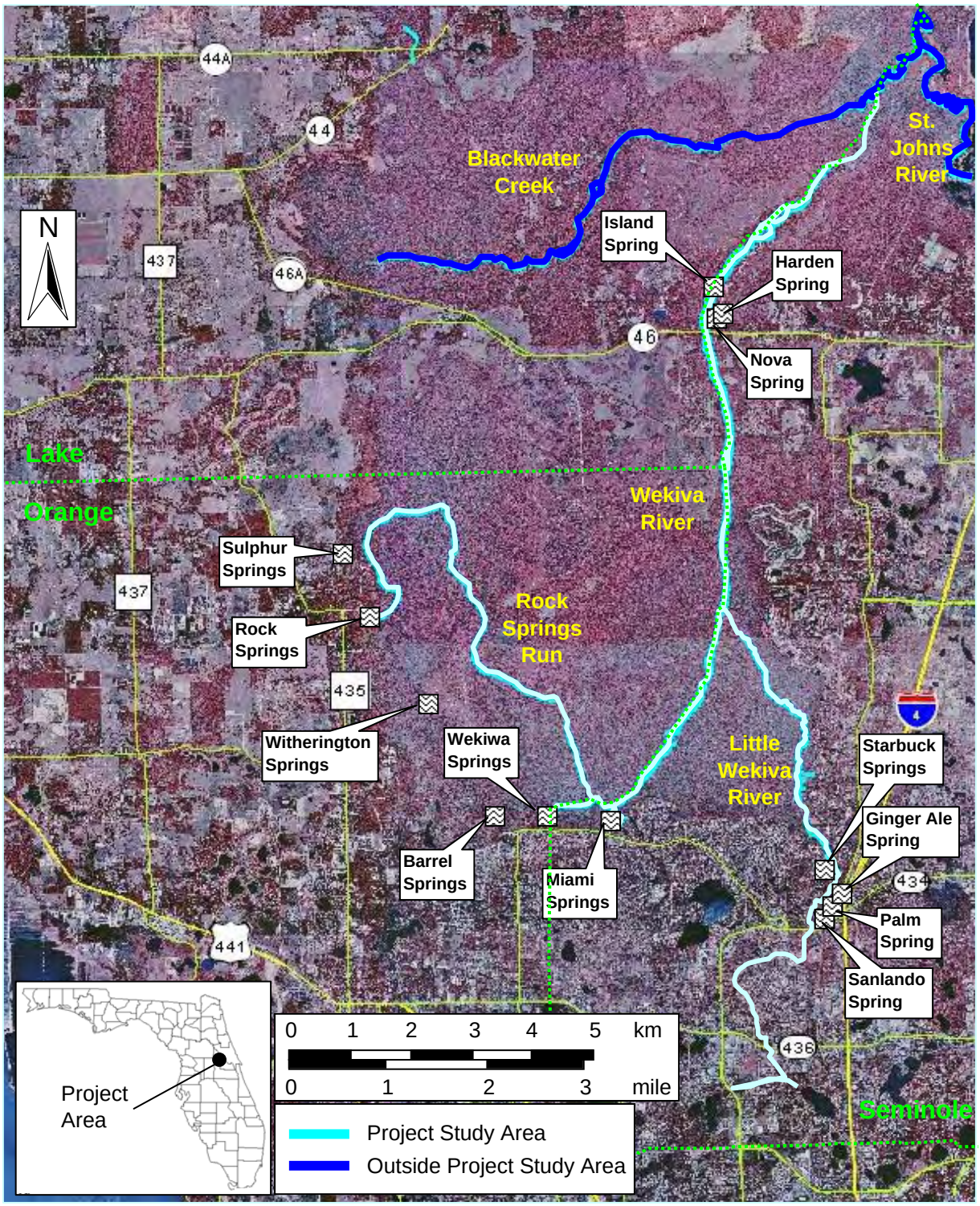


FIGURE 1-2

WEKIVA RIVER SYSTEM PROJECT AREA IDENTIFYING KEY RIVER SEGMENTS AND CONTRIBUTING SPRINGS

(Section 62-302.700, F.A.C.). PLRGs can be developed for those pollutants that are likely to impair designated uses, either through an exceedance of one or more specific water quality criteria or through overall degradation and loss of specific uses such as recreation or maintenance of normal fish and wildlife populations. Since springs and spring runs are qualitatively and quantitatively different environments than most other surface waters in the state (FDEP 2000), they have attributes that may not be directly protected by specific water quality criteria. For this reason, protection of their general designated uses is an important additional strategy to preserve or restore springs and spring runs.

Existing data summarized prior to this study indicated that nutrients are elevated in both the Wekiva River and in Rock Springs Run due to past and present human activities. It has also been observed that plant communities within these two stream reaches may be altered compared to natural conditions and that growths of filamentous algae are a possible result of these elevated nutrient levels. These conditions have not been adequately measured to-date to allow development of PLRGs for these water bodies. For these reasons the focus of this project was to provide quantitative data to support nutrient PLRGs, if they are indeed necessary to protect the designated uses of these aquatic ecosystems.

The purpose of this project was to provide a scientifically-based approach for determining whether elevated nutrient concentrations are, or are not, a concern in the Wekiva River System and to document any measurable nutrient impacts on ecological attributes of the Wekiva River System. Methods that were used to accomplish the project goals included review and analysis of existing information and scientific studies of the Wekiva River System and similar reference spring run systems to establish a characterization of the baseline or goal for the system's designated uses of recreation and healthy, well-balanced fish and wildlife populations; review of existing information and development of focused ecological measures to link specific nutrients to impaired conditions; completion of those studies and analysis of new data collected in those studies; and identification of the necessary level of nutrient reductions necessary to either preserve or restore the Wekiva River System to the reference or baseline condition.

Reference sites were used to help establish normal or pre-development conditions in the Wekiva River System. The reference sites included two similar spring runs in north Orange County and south Marion County: Alexander Springs Creek and Juniper Creek, respectively. While no two spring runs are identical, these two systems are relatively close geographically to the Wekiva River System (see **Figure 1-1**), are used for similar types of recreation, but do not have any signs of significant nutrient enrichment due to past or present human activities.

Nutrients are just one possible category of pollutants and stressors that may be resulting in impairment of the Wekiva River System. They were the focus of this project because they are most amenable to PLRG analysis. However, other pollutants and stressors may also be impairing designated uses in the Wekiva River System. Additional parallel and future work efforts may be required to identify and quantify the role of those additional pollutants and stressors on the functioning of the Wekiva River System. Part of this nutrient-focused project was to provide initial observations of other stressors of concern

in the ecosystem and to make recommendations concerning additional focused sampling efforts for their documentation and eventual control. Pollutants or stressors that have either resulted in historic impairment, are currently resulting in continuing impairment, or have the potential to create future impairment if not attenuated, are considered in this analysis.

1.2 Study Objectives

The Wekiva River System PLRG Study followed a previously-prepared work plan (WSI 2004). The reader is referred to that work plan for a detailed basis for the approach used in this project to assess impairment and to develop recommended nutrient PLRGs for the Wekiva River System, if needed.

The Wekiva River System PLRG Study included the following six objectives:

1. Identify Biological Impairments
2. Identify Pollutants of Concern
3. Determine Concentration Targets for Pollutants of Concern
4. Quantify Current Loadings of Pollutants of Concern
5. Characterize Relationship between Pollutant Loading Rates and Concentrations
6. Calculate Necessary Load Reductions in Terms of Concentrations

A general discussion of the activities conducted to accomplish each of these objectives is provided as follows.

1.2.1 Identification of Biological Impairments

The Wekiva River System PLRG Study was designed to provide quantification of a number of ecosystem-level properties of the target aquatic systems in the Wekiva River and Rock Springs Run, as well as at two relatively unaffected control streams in the Ocala National Forest (Juniper Creek and Alexander Springs Creek). The purpose of this quantification was to allow comparison between upstream and downstream "segments" of each overall river system or "reach", comparison of the relatively higher nutrient streams to control or reference sites with lower levels of nutrient inputs, and development of correlations between independent and dependent variables. Specific work activities included the following:

- Reconnaissance of each stream reach
- Water and nutrient mass balance estimation for each stream reach
- Selection of upstream and downstream segments within the Wekiva River and Rock Spring Run for detailed ecological evaluation under conditions of differing nutrient availability
- Collection of ecosystem data (physical environment, water quality, plant communities, and ecosystem-level metrics)
- Analysis of data
- Interpretation of data

Analysis of variance is used to help understand the relative importance of each forcing function for determination of ecological function.

1.2.2 Identify Pollutants and Stressors of Concern

Existing and new water quality data from the Wekiva River System are examined for quantification of historic and current nutrient concentrations and loads. Statistical analyses are used to determine which forms of nutrients contribute most significantly to ecosystem-level functioning. Historical water quality trends are examined and compared to historical ecosystem data to look for the onset of any observable impairment. Nutrient concentrations and loads in the Wekiva River System Study area are compared to data from other Florida spring-fed rivers to provide a comparison to natural and man-induced conditions.

1.2.3 Estimate Acceptable Pollutant Concentration Target

If specific nutrients are shown to be singly or in combination resulting in impairment of designated beneficial uses of either the Wekiva River or Rock Springs Run aquatic ecosystems, the level of each nutrient that is causing impairment will be estimated using the regression models described above. This analysis takes natural assimilation rates of these nutrients into consideration and uses reference sites to determine acceptable nutrient targets.

1.2.4 Estimation of Existing Pollutant Loads Causing Impairment

Nutrient loads and concentrations acting on the Wekiva River System are estimated by preparation of water and nutrient mass balances. Overall nutrient mass balance loads and assimilation rates are estimated for each individual stream reach and stream segment in the Wekiva River, Rock Springs Run, Alexander Springs Creek, and Juniper Creek. Diffuse runoff and nutrient loading rates for 2000 land uses are used to estimate outside contributions. Spring flows and concentrations are used to estimate groundwater loads. Upstream-downstream load changes are used to estimate assimilation rates in each stream reach.

1.2.5 Relationship between Pollutant Loading Rates and In-Stream Concentrations

A simplified stream model is presented that relates nutrient mass loading rates to in-stream nutrient concentrations. This model includes only as much complexity as can be supported from readily available information. This model includes estimated water and associated nutrient inputs from springs, non-point source runoff, tributaries (such as the Little Wekiva River), and from atmospheric inputs (wet and dry deposition). Nutrient transformation rates are estimated from published reaction rates.

1.2.6 Estimation of Necessary Pollutant Load Reduction

Nutrient PLRGs for the Wekiva River and Rock Springs Run are estimated as the difference between the existing or anticipated future pollutant load and the estimated load that will result in in-stream nutrient concentrations at which no impairment is likely to occur. Nutrient PLRGs are recommended only for nutrient forms for which impairment is already occurring or for which impairment is considered to be likely in light of existing increasing trends in pollutant loading rates.

1.3 Study Methods

The Wekiva River System PLRG Study included collection of a significant amount of new ecological data from the four stream reaches of interest. Detailed study methodologies are described below.

1.3.1 Stream Reach Reconnaissance

The reaches of four spring-fed streams listed in **Table 1-1** were inventoried once at the beginning of the project to characterize environmental conditions in each reach and to locate suitable stream segments for the more detailed ecosystem data collection described below under Stream Segment Selection.

TABLE 1-1
Stream Reaches Studied for the Wekiva River System PLRG Study

SPRING-FED STREAMS	REACH OF INTEREST
Wekiva River	Outlet of Wekiwa Spring to State Road 46
Rock Springs Run	Outlet of Rock Springs at Kelly Park to confluence with the Wekiva River
Juniper Creek	Outlet of Juniper Spring to State Road 19
Alexander Spring Creek	Outlet of Alexander Spring to Forest Road 552

WSI recorded the following data at approximately 500 m (1,640 ft) intervals along each stream reach:

- Centerline orientation & depth, stream width – Coordinates of the centerline at each interval point were recorded with a Garmen Model 76S hand-held Global Positioning System (GPS) unit that is WAAS-enabled. Water depth was measured at the centerline. Channel width was estimated with a Bushnell Yardage Pro range finder.

- Photo log – Five digital photographs were taken at each interval point – upstream, downstream, right shore, left shore, and overhead canopy.

- Plant community characterization – Plant community was rapidly assessed for dominant species, percent cover, and canopy cover over the stream channel.

- Water quality – Field variables (water temperature, pH, dissolved oxygen concentration and percent saturation, and specific conductance) were measured and recorded.

1.3.2 Water and Nutrient Mass-Balance Estimates

Water and nutrient mass-balances were estimated at each of the four stream reaches listed in **Table 1-1** over the approximately nine-month project duration. With noted exceptions, the mass-balance estimates are based on continuous flow (level and discharge) and monthly water quality data collected at upstream and downstream stations in each stream reach.

Mass balance data were collected from mid-December 2004 through August 2005 for nine mass-balance stations. These stations included upstream and downstream points for each of the four stream reaches as well as one major tributary (Little Wekiva River)

entering near the mid-point of the Wekiva River. **Table 1-2** summarizes information for the nine mass-balance sampling stations, including names and locations, responsible agency for maintenance and monitoring, and monitoring frequency. Where useful, available flow and/or water quality data from other monitoring points in the stream reaches were incorporated into this analysis.

1.3.2.1 Water Flow

WSI obtained daily flow (level and discharge) data from the five existing USGS and SJRWMD stations on the Wekiva River, Rock Springs Run, the Little Wekiva River, and Alexander Springs Creek.

WSI upgraded the existing USGS/SJRWMD stations upstream on Juniper Creek and Alexander Springs Creek by installation of USA Infinities water level recorders and data loggers (or equivalent) and fixed staff gauges (if not already present). The SJRWMD survey group measured vertical datum elevations for all new staff gauges.

WSI installed two new downstream stations (Rock Springs Run and Juniper Creek) that contain USA Infinities water level recorders and data loggers (or equivalent) and fixed staff gauges. The SJRWMD survey group measured datum elevations for the new staff gauges. Discharge at these new stations was rated by measurement of stage and associated discharge at least eight times during the project duration.

1.3.2.2 Water Quality

WSI with the assistance of SJRWMD staff obtained water quality data that are collected monthly or quarterly by USGS or SJRWMD at six of the nine mass-balance stations.

WSI sampled water quality from three of the nine mass-balance stations (Lower Wekiva River and downstream on Juniper Creek and Alexander Spring Creek) monthly from December 2004 through May 2005, for a total of 6 events. During the final three months of the field effort, WSI collected water quality data from eight of the nine mass balance stations listed in **Table 1-2**. Water quality sampling at these stations included the parameters and methods listed in **Table 1-3**. Analytical water quality determinations were made by PPB Environmental Services, Inc. in Gainesville, Florida.

1.3.2.3 Contributing Land Use Data

Land use data summarized by the SJRWMD for the year 2000 were utilized for estimating non-point source (diffuse) loads to the stream reaches of interest. **Table 1-4** summarizes these data. The Wekiva River reach has a contributing watershed of about 8,700 ha (21,450 ac). Rock Springs Run has a similar watershed area of about 8,700 ha (21,440 ac). Juniper Creek's contributing watershed is much larger at about 18,900 ha (46,600 ac). Alexander Springs Creek watershed is about 3,300 ha (8,200 ac). Detailed watershed data summaries were provided in an earlier report (WSI 2004).

1.3.2.4 Contributing Loads

Contributing non-point source pollutant loads were estimated based on the 2000 land use data as well as estimated event-mean pollutant concentrations by land use category and runoff coefficients by land use category (**Table 1-5**). Monthly non-point source pollutant loads (kg/month) to each stream reach were estimated by multiplying the monthly total rainfall (m), the event-mean concentration (mg/L), the runoff coefficient

TABLE 1-2

SITES

Work Plan Station	Existing Station Name	Agency	Latitude	Longitude	Monitoring Type / Existing Frequency		
					Discharge	Wtr Level	Wtr Quality
WR-MB1	WEK	USGS	28.71194	-81.46000	C	C	M
WR-MB2	2235000	USGS	28.81500	-81.41944	C	C	M
RSR-MB1	ROX	USGS	28.75556	-81.49917	C	C	M
RSR-MB2	RSR-UWR	SJRWMD	28.71543	-81.44972	New	New	M
LWR-MB1	WKSPLD	USGS	28.70194	-81.39220	C	C	New
JC-MB1	JUN	USGS/SJRWMD	29.18500	-81.71139	SA	Q	M
JC-MB2	---	---	29.21338	-81.65451	New	New	New
ASC-MB1	ALX	USGS/SJRWMD	29.08139	-81.57667	Q	Q	M
ASC-MB2	ALXTRACY	SJRWMD	29.04548	-81.50848	C	C	New

C = Continuous
M = Monthly
Q = Quarterly
SA = Semi-Annual
New = this study

TABLE 1-3
WATER QUALITY CONSTITUENTS TO BE ANALYZED FOR ECOSYSTEM DATA COLLECTION

Parameter	Analytical Method	Reporting Limit	Units
Total Dissolved Solids	EPA 160.1	2	mg/L
Turbidity	EPA 180.1	1	NTU
Calcium	EPA 6010	0.014	mg/L
Magnesium	EPA 6010	0.0074	mg/L
Silica	EPA 6010	0.0024	mg/L
Sulphate	EPA 375.4	1.4	mg/L
Alkalinity	EPA 310.1	5	mg/L
Total Kjeldahl Nitrogen	EPA 351.2	0.048	mg/L
Nitrate+Nitrite Nitrogen	EPA 353.2	0.015	mg/L
Ammonia Nitrogen	EPA 350.1	0.026	mg/L
Soluble Reactive Phosphorus	EPA 365.2	0.015	mg/L
Total Dissolved Phosphorus	EPA 365.2	0.015	mg/L
Total Phosphorus	EPA 365.4	0.02	mg/L
Total Suspended Solids	EPA 160.2	2	mg/L
Arsenic	EPA 6010	0.007	mg/L
Cadmium	EPA 6010	0.00021	mg/L
Chromium	EPA 6010	0.00016	mg/L
Copper	EPA 6010	0.0071	mg/L
Lead	EPA 6010	0.00092	mg/L
Iron	EPA 6010	0.016	mg/L
Mercury	EPA 7470	0.000014	mg/L
Zinc	EPA 6010	0.0072	mg/L
Atrazine	EPA 525.2	0.00006	mg/L
Simazine	EPA 525.2	0.00007	mg/L
DDT	EPA 8081	0.000013	mg/L
Diazinon	EPA 8141	*locating lab*	mg/L
Color	E110.2	5	color units
Five-Day Biochemical Oxygen Demand	SM52102B	2	mg/L
Total Carbon	TBD	TBD	mg/L
Dissolved Organic Carbon	TBD	TBD	mg/L

1 All methods for environmental waters from Methods for Chemical Analysis of Water and Wastes, EPA-600-79-020, Revised March 1983, and /or Standard Methods for the Examination of Water and Wastewater, 18th Edition, Revised
TBD = to be determined

TABLE 1-4

LAND USE SUMMARY FOR THE WEKIVA RIVER SYSTEM AND REFERENCE SITE CONTRIBUTING WATERSHED BASINS (SJRWMD 2000)

		BASIN (Areas in Acres)					
LAND USE	LUCODE	Wekiva River	Rock Springs Run	Little Wekiva River	Juniper Creek	Alexander Springs Creek	Total Area
URBAN & BUILT-UP	1000	5,938	3,277	6,175	98.62	132	15,621
AGRICULTURE	2000	708	3,682	10.3	0.0	0	4,400
RANGELAND	3000	1,331	2,254	14.1	488	4.0	4,092
UPLAND FORESTS	4000	4,233	5,678	171	39576	5406	55,063
WATER	5000	759	166	281	707.1	131.0	2,044
WETLANDS	6000	8,351	6,319	2,606	5689	2491.5	25,457
BARREN LAND	7000	3.02	26.2	0.00	1.86	0.00	0,031
TRANSPORTATION, COMMUNICATIONS, UTILITIES	8000	127	37.2	333	22.89	0.00	0,520
Total		21,450	21,440	9,591	46,584	8,164	107,229

TABLE 1-5

SUMMARY OF WEKIVA RIVER SYSTEM EVENT MEAN POLLUTANT CONCENTRATIONS AND RUNOFF COEFFICIENTS BY LAND USE CATEGORY (SJRWMD 2005)

Land Use	Est. Runoff Coefficient (fraction)	EMC's				
		TP mg/l	DP mg/l	TKN mg/l	NO2/NO3 mg/l	TN mg/l
General Agriculture	0.31	0.344	0.230	1.74	0.580	2.32
Feeding Operations	0.45	6.53	0.230	1.74	0.580	78.2
Nurseries	0.40	0.565	0.230	1.74	0.580	2.30
Pasture	0.36	0.480	0.230	1.74	0.580	2.48
Row Crops	0.40	0.562	0.230	1.74	0.580	2.68
Specialty Farms	0.40	0.493	0.230	1.74	0.580	2.34
Tree Crops	0.31	0.140	0.230	1.74	0.580	2.05
Commercial	0.60	0.290	0.135	1.08	0.670	2.01
Industrial	0.70	0.310	0.166	1.63	0.400	1.79
Institutional	0.60	0.150	0.080	1.24	1.05	2.29
Forest/Open	0.05	0.050	0.004	1.10	0.310	1.25
Very Low Density Residential	0.30	0.177	0.151	1.22	0.470	1.77
Low Density Residential	0.40	0.300	0.298	1.34	0.630	2.29
Medium Density Residential	0.50	0.395	0.397	1.48	0.650	2.36
High Density Residential	0.58	0.490	0.496	1.63	0.670	2.42
Highways	0.80	0.340	0.189	1.61	0.400	2.08
Water	0.75	0.110	0.020	0.600	0.190	1.25
Wetlands	0.75	0.190	0.090	1.10	0.400	1.6

(unitless), the land use category area (m^2), and dividing the product by 1,000 gm/kg. Contributions from all of the different land use categories within the contributing watershed were summed to estimate the total non-point source load.

1.3.3 Stream Segment Selection

After completion of the stream reach reconnaissance described above, WSI and SJRWMD staff selected six stream segments for detailed ecological study. These included two segments (upstream and downstream) each in Wekiva River and in Rock Springs Run (**Figure 1-3**), and one segment each in Juniper Creek (**Figure 1-4**) and in Alexander Spring Creek (**Figure 1-5**).

Criteria used for segment selection included:

- sufficient length to detect significant upstream/downstream changes in dissolved oxygen and possibly nutrient concentrations, approximately 1 km [3,280 ft]
- different nutrient concentrations between upstream & downstream segments within each stream reach
- similar flow rate in upstream / downstream segments between streams
- environmental conditions suitable for high primary productivity (i.e. growth of submerged vascular plants and attached algae)
- presence of native rooted submersed vascular plants
- not subject to active plant management (herbicides or hand/mechanical removal) during the sampling period
- not subject to significant disturbance from recreational users
- reasonably accessible during the sampling period

Each stream segment was semi-permanently marked at the upstream and downstream ends with steel rebar and PVC tubing. The six stream segments were identified as follows:

- WR-SEG1 Wekiva River upstream
- WR-SEG2 Wekiva River downstream
- RSR-SEG1 Rock Springs Run upstream
- RSR-SEG2 Rock Springs Run downstream
- JC-SEG1 a representative stream segment in Juniper Creek
- ASC-SEG1 a representative stream segment in Alexander Spring Creek

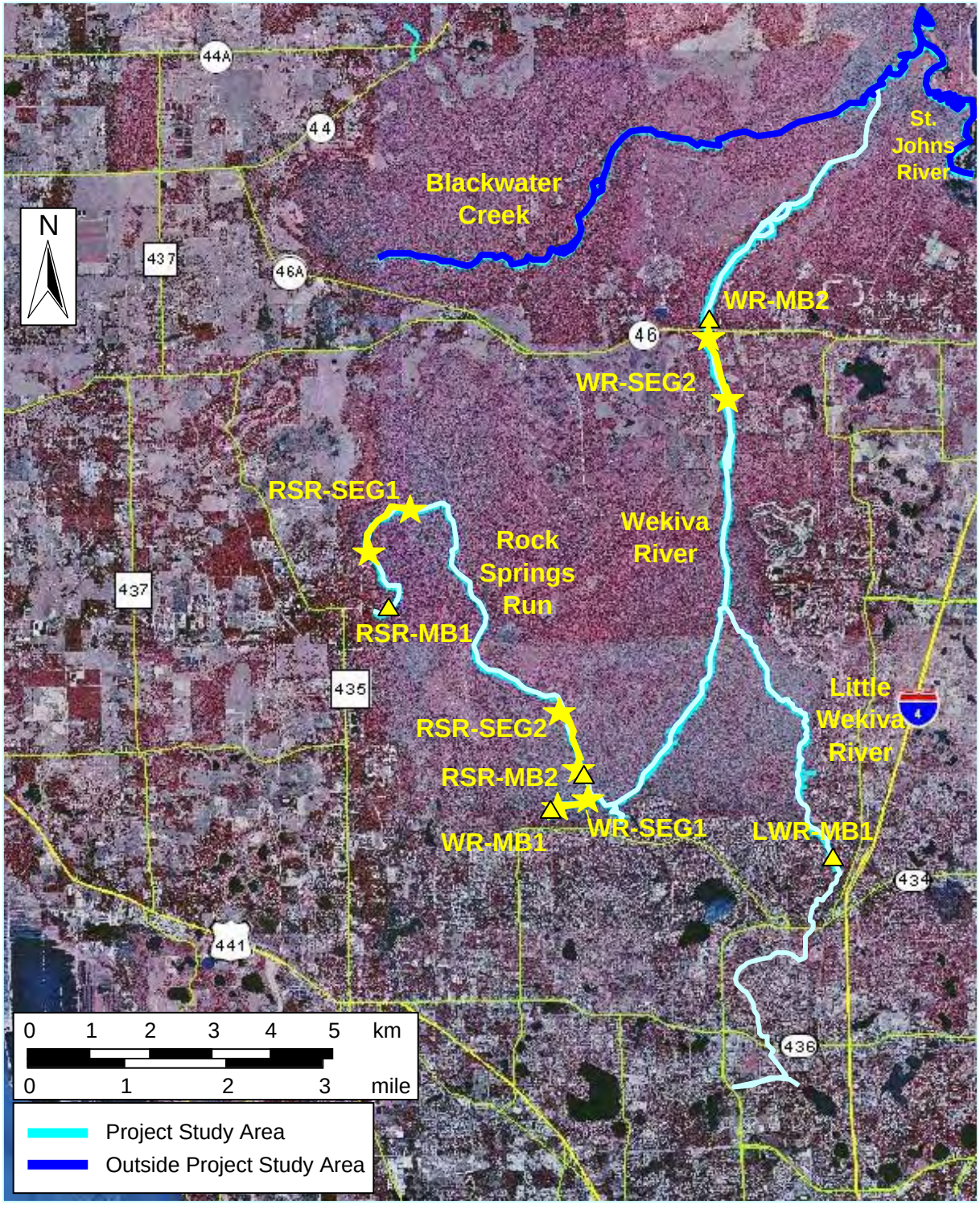


FIGURE 1-3

WEKIVA RIVER AND ROCK SPRINGS RUN STREAM SEGMENTS FOR DETAILED ECOLOGICAL EVALUATION

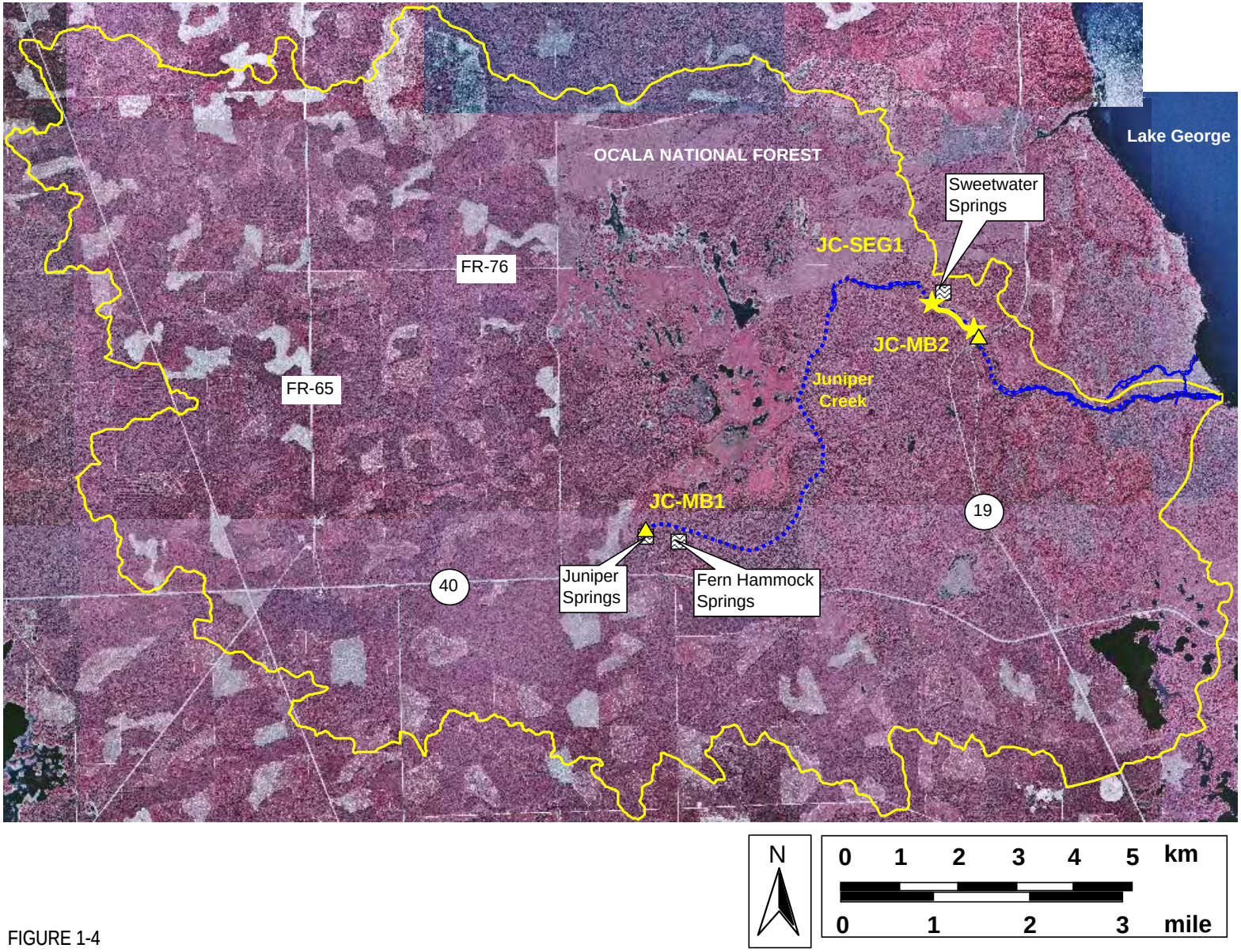


FIGURE 1-4
JUNIPER CREEK STREAM SEGMENT FOR DETAILED ECOLOGICAL EVALUATION

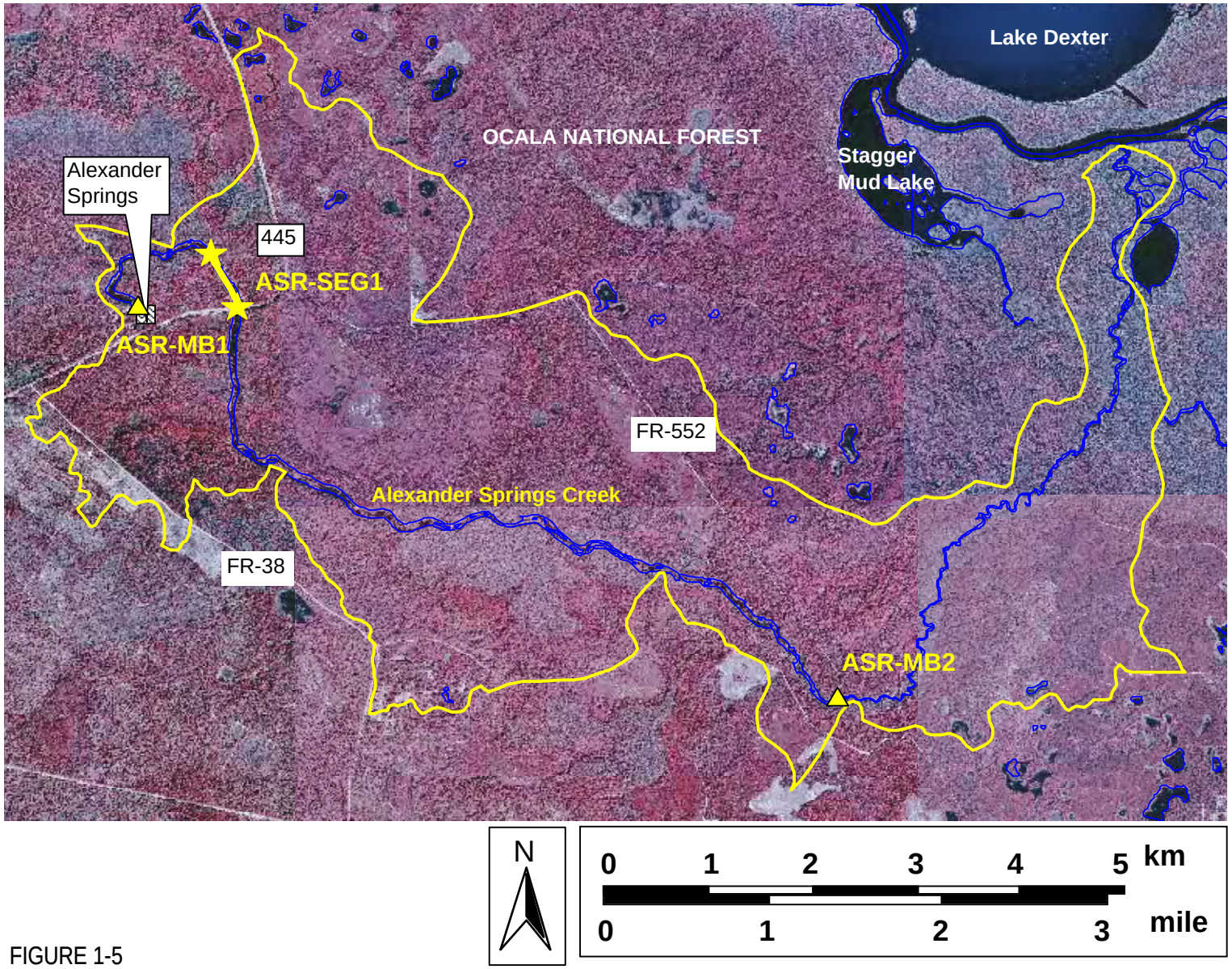


FIGURE 1-5
ALEXANDER SPRINGS CREEK STREAM SEGMENT FOR DETAILED ECOLOGICAL EVALUATION

1.3.4 Ecosystem Data Collection

Ecosystem data were collected for determination of biological impairment from each of the six stream segments over two intensive approximately three-week periods during the project. These sampling events occurred in April-May (spring) and July-August (summer).

Table 1-6 provides a summary of the physical environment, water quality, plant communities, and ecosystem-level metrics that were collected during these two seasonal sampling events. All of the ecological metrics measured in the stream segments are listed and described below:

- Physical Environment
  - Precipitation
  - Air temperature
  - Insolation and photosynthetically active radiation (PAR)
  - Stream discharge (water level and flow) and current velocity
  - Underwater light transmission (PAR)
  - Segment morphometry (cross section, centerline depth and velocity profiles)
  - Sediment texture and chemical composition
  - Oxygen diffusion rate
- Water Quality
  - Field variables (water temperature, pH, dissolved oxygen, specific conductance)
  - Cations (calcium, magnesium, silica, sodium)
  - Anions (chlorides, sulfate, alkalinity)
  - Nutrients (total kjeldahl nitrogen, nitrate+nitrite nitrogen, ammonia nitrogen, soluble reactive P, total dissolved P, total P)
  - Miscellaneous (five-day biochemical oxygen demand, color, total suspended solids, volatile suspended solids, dissolved organic carbon, total dissolved solids, turbidity, total organic carbon, silica, iron)
- Plant Communities
  - Mapping and percent cover of dominant plant species by functional group (floating aquatic, submerged aquatic, emergent, attached algae, benthic algae)

TABLE 1-6
SUMMARY OF DETAILED WEKIVA RIVER SYSTEM NUTRIENT PLRG SAMPLING PLAN

		Mass Balance Stations									Stream Segments							
Parameter	**Weather Station[1]**	**WR-MB1**	**WR-MB2**	**RSR-MB1**	**RSR-MB2**	**LWR-MB1**	**ASC-MB1**	**ASC-MB2**	**JC-MB1**	**JC-MB2**	**WR-SEG1**	**WR-SEG2**	**RSR-SEG1**	**RSR-SEG2**	**ASC-SEG1**	**ASC-SEG2**	**JC-SEG1**	**JC-SEG2**
Physical																		
Precipitation	D																	
Air Temperature	H																	
Total Solar Radiation	H																	
Photosynthetically Active Radiation	H																	
Stream Discharge		D	D	D	D*	D	D*	D*	D*	D*								
Light Transmission (underwater)											T	T	T	T	T	T	T	T
Oxygen Diffusion (floating dome)											T	T	T	T	T	T	T	T
Channel Cross Sections											O	O	O	O	O	O	O	O
Stream Centerline Depth Profiles		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Bathymetry/Volume											O	O	O	O	O	O	O	O
Velocity Profiles											O	O	O	O	O	O	O	O
Sediment Texture											O	O	O	O	O	O	O	O
Water Quality																		
Water Temperature		M	M	M	M	M*	M	M*	M	M*	C*	C*	C*	C*	C*	C*	C*	C*
pH		M	M	M	M	M*	M	M*	M	M*	C*	C*	C*	C*	C*	C*	C*	C*
Dissolved Oxygen		M	M	M	M	M*	M	M*	M	M*	C*	C*	C*	C*	C*	C*	C*	C*
Specific Conductance		M	M	M	M	M*	M	M*	M	M*	C*	C*	C*	C*	C*	C*	C*	C*
Total Dissolved Solids		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Turbidity		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Five Day Biochemical Oxygen Demand		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Chloride		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Sodium		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Calcium		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Magnesium		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Silica		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Sulfate		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Iron		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Alkalinity		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Kjeldahl Nitrogen		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Nitrate+Nitrite Nitrogen		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Ammonia Nitrogen		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Soluble Reactive Phosphorus		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Dissolved Phosphorus		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Phosphorus		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Suspended Solids		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Volatile Suspended Solids		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Color		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Carbon		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Total Dissolved Carbon		M	M	M	M	M*	M	M*	M	M*	T*	T*	T*	T*	T*	T*	T*	T*
Ecosystem-Level Metrics																		
Community Metabolism											C*	C*	C*	C*	C*	C*	C*	C*
Pollutant Assimilation Rates (N and P)		M*	M*	M*	M*	M*	M*	M*	M*	M*								
Community Export											O	O	O	O	O	O	O	O
Aquatic Vegetation																		
Percent Cover/Dominant Species											O	O	O	O	O	O	O	O
Stream Mesocosm Plant Metabolism											O	O	O	O	O	O	O	O

Notes:
[1]existing weather stations will be used for rainfall and air temperature data collection; one new solar radiation station will be established
H = hourly
D = daily by others
D* = daily for this project
C* = continuous (hourly) upstream and downstream for 4-weeks during one seasonal sampling event
T = two times (beginning and end of a single 4-week seasonal sampling event) at the downstream station only
T* = two times (beginning and end of a single 4-week seasonal sampling event) at upstream and downstream stations
M = monthly by others for six events (December 15, 2004 - May 15, 2005)
M* = monthly for this project for six events (December 15, 2004 - May 15, 2005)
O = once during the project

- Ecosystem-Level Metrics
    - Ecosystem metabolism (gross primary productivity, net primary productivity, community respiration, P/R ratio, ecological efficiency)
    - Plant metabolism of selected aquatics such as *Vallisneria americana* and attached algae
    - Nutrient assimilation
    - Community export (floating macrophytes and fine particulate export)

Methods for measurement of these parameters are described below.

1.3.4.1 Precipitation

Continuous rainfall data were collected by use of a USA Infinities tipping bucket rain gauge installed for the duration of the study in Wekiwa Springs State Park (**Figure 1-6**). This recorder was checked for obstructions and logged data were downloaded on at least a monthly basis for the duration of the field sampling effort. In addition, precipitation data from other local stations were collected, reviewed, summarized, and incorporated into analyses as needed.

1.3.4.2 Air Temperature

Continuous air temperature data were collected from existing weather stations in the project area.

1.3.4.3 Insolation and PAR

LI-COR light sensors models LI-190SA (pyranometer) and LI-200SA (PAR) were installed in an open area free of significant shading at Wekiwa River State Park (**Figure 1-7**). Data were recorded using a LI-1400 data logger every minute and averaged to output integrated hourly data. The light sensors were checked monthly and cleaned as necessary and data were downloaded to a computer and output to an Excel spreadsheet and Access database.

1.3.4.4 Stream Discharge and Current Velocity

Stream discharge and velocity were estimated using a portable flow meter (Marsh-McBirney Flo-Mate 2000-51). A tape measure was stretched across the stream channel at each discharge station perpendicular to the flow direction and depth and velocity were measured in at least 15 to 25 even-width segments at each cross section (**Figure 1-8**). For water depths less than 2 feet (60 cm) velocity was measured at a fractional point 0.6 above the stream bottom. For water depths over 2 ft (60 cm) velocity was measured at 0.2 and 0.8 fractions and averaged to get the segment velocity. Each segment velocity was multiplied by the segment width and depth to estimate segment discharge and all of the segment discharges were totaled to get total stream discharge at that station. A staff gauge and recording water level recorder (**Figure 1-9**) were used to assess water stage at the time of each discharge measurement. These data were used to prepare a stage-discharge relationship for each station with multiple discharge determinations.

FIGURE 1-6
USA INFINITIES RECORDING RAIN GAUGE INSTALLED AT WEKIWA SPRINGS STATE PARK

FIGURE 1-7
LI-COR INSOLATION AND PAR SENSORS AND DATA LOGGER INSTALLED AT WEKIWA SPRINGS STATE PARK

FIGURE 1-8
USE OF MARSH-MCBIRNEY FLOW METER TO MEASURE STREAM DISCHARGE

FIGURE 1-9

USA INFINITIES WATER LEVEL RECORDER INSTALLATION AT RSR-MB-2

Stream discharge was measured at the mass balance stations as described above. Discharge was also determined at least once at both the upstream and downstream points for each stream segment during each of the two seasonal intensive ecological monitoring events.

1.3.4.5 Underwater Light Transmission

Underwater light transmission and attenuation were measured by use of an underwater LI-COR photosynthetically active radiation (PAR) light sensor (**Figure 1-10)**. The PAR sensor was attached to an underwater weighted frame and light readings were manually recorded at 0.5 to one-foot (15 to 30 cm) depth intervals from the surface to the stream bottom in an unshaded location. Light extinction (attenuation) coefficients were calculated from these data using the Lambert-Beer equation (Wetzel 2001):

$$I_z = I_o(e^{-kz}) \qquad \text{[Equation 1-1]}$$

Where:

I_z = PAR at depth z

I_o = PAR at the water surface

k = diffuse attenuation coefficient, m^{-1}

z = water depth, m

Percent transmittance (%T) was calculated from these data using the following expression:

$$\%T = 100(e^{-kz}) \qquad \text{[Equation 1-2]}$$

The Birgean Percentile Absorption (BPA) was calculated for a depth of 1 m using the following expression:

$$BPA = 100(I_o - I_z)/I_o \qquad \text{[Equation 1-3]}$$

Light attenuation was measured in association with water color analyses for each stream segment intensive ecological study. Color was in turn correlated with specific conductance within each stream segment so that continuous records of specific conductance throughout the duration of each study could be used to estimate color and available light reaching the submerged plant community.

1.3.4.6 Stream Segment Morphometry

Ten channel cross-sections were measured at approximately 100 m (328 ft) intervals along each of the six stream segments. A tape measure was stretched from shoreline to shoreline perpendicular to flow direction at each of these ten cross sections. Water depth along each cross section was determined at approximately 20 evenly-spaced points along the length of each of these cross sections with a pocket rod and recorded.

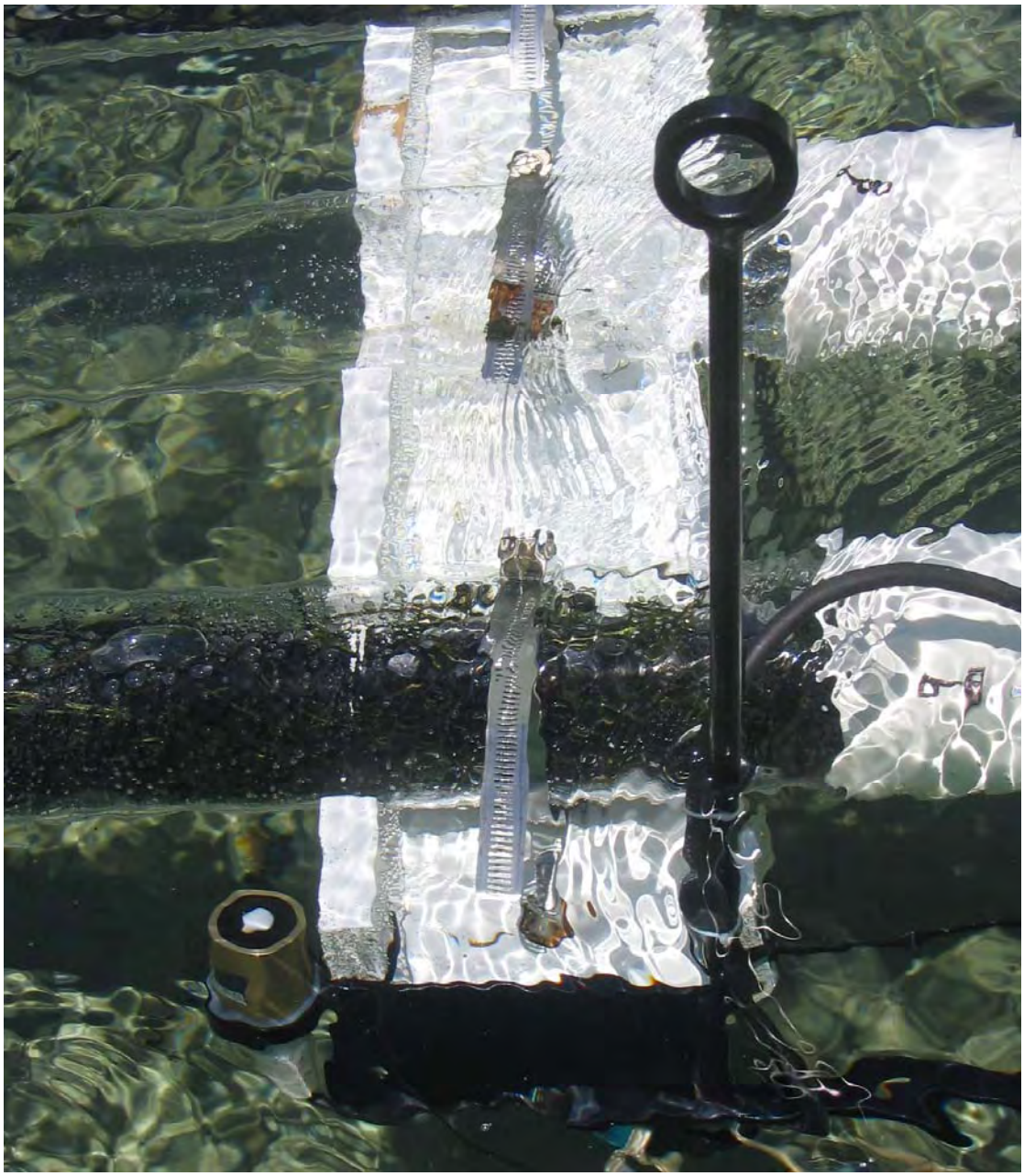


FIGURE 1-10
UNDERWATER LI-COR PAR SENSOR ATTACHED TO STREAM MESOCOSMS

Wetted surface area and volume of each stream segment was estimated based on these channel cross-sections. Nominal hydraulic residence time was estimated for each stream segment based on these estimated water volumes and the upstream and downstream flow estimates.

1.3.4.7 Sediment Texture and Chemical Composition

Sediment samples were collected at five of the ten cross-section transects in each segment. Sediment samples were collected using a stainless steel bucket auger or with a Ponar Dredge in deeper areas with soft sediments. Sediment samples from each transect were composited from at least five points and analyzed by a soil testing laboratory (Midwest Labs in Omaha, Nebraska) for texture (percent sand/silt/clay), percent organic matter, and for total nitrogen, total phosphorus, and total carbon.

1.3.4.8 Oxygen Diffusion Rate

Oxygen diffusion rates were quantified in each stream segment by use of the floating dome method of McKeller (1975). In this method a floating dome of known volume is placed on the surface of the water and is evacuated with pure nitrogen gas (**Figure 1-11**). The dome has two valves installed in the top: one to release air and one to admit nitrogen. An oxygen sensor suspended from a hook on the inside of the dome is used to measure the internal increase in oxygen within the dome for a period of time after it is fully evacuated with nitrogen gas. Oxygen tension in the water under the floating dome was measured and the difference in oxygen saturation in the water and in the dome was used for diffusion rate estimates using the following equation:

$$K = (V)(pO_2)(\text{delta } \%O_2)/((A)(t)(\text{avg } \%O_2 \text{ sat deficit})) \qquad \text{[Equation 1-3]}$$

Where:

K = the area-based oxygen diffusion coefficient at 100% saturation deficit, g $O_2/m^2/hr$

V = volume of oxygen in dome when saturated = volume of dome multiplied by the proportion of oxygen in air (20 percent), mL

pO_2 = density of oxygen corrected to air temperature in the dome, g/mL

delta O_2 = change in oxygen percent saturation in the dome during the measurement, unitless

A = area of water surface covered by the dome, m^2

t = duration of the measurement, hr

Avg $\%O_2$ sat deficit = the average percent saturation deficit between the dome and the water for the duration of the measurement, unitless

Water depth and flow velocity were measured during each diffusion sampling event. Oxygen diffusion rate was estimated at one station in each of the six stream segments on two occasions (spring and summer sampling events). Two replicate diffusion estimates

FIGURE 1-11

FLOATING NITROGEN-FILLED DIFFUSION DOME USED FOR MEASURING REAERATION RATE *IN SITU*

were made during each sampling event. A regression was developed between oxygen diffusion rate and current velocity to allow estimation of changing diffusion rates in response to day-to-day changes in average current velocity in the measurement area.

1.3.4.9 Water Quality

For the seasonal stream segment sampling, field variables (water temperature, dissolved oxygen, oxygen percent saturation, pH, conductivity and specific conductance) were measured using an In Situ Troll-9000 data-loggers (or equivalent) continuously deployed at the upstream and downstream ends of each stream segment for a period of up to three weeks (**Figure 1-12**). These data sondes were programmed to automatically record and store hourly readings. The In Situ Troll-9000 data sondes were camouflaged and anchored in areas at least 0.5 m (20 in) deep with the measuring membrane just above the top of any submerged vegetation and at least 30 cm (12 in) below the average water surface. The data sondes were calibrated using manufacturer's recommendations prior to deployment and were re-calibrated at the end of each sampling period.

Water quality samples were collected twice (beginning and end of three-week study period) during each of the two seasonal sampling events at both the upstream and downstream ends of each stream segment. This sampling strategy resulted in a total of eight water samples collected for each stream segment during the course of this study (2 stations x 2 samples per event x 2 seasonal events).

Water quality samples were collected as surface grabs. A rinsed water collection bottle was used to dip water samples from about 30 cm (1 foot) below the water surface and used to fill preserved sample bottles. Water depth and field parameters were recorded during all water quality sampling events.

Water quality samples were analyzed for the constituents listed in **Table 1-3** by PPB Environmental Services.

1.3.4.10 Plant Community Characterization

Aquatic plant communities in each of the six stream segments were quantified once during this project during the spring sampling event. Vegetative cover was documented on each of the ten stream cross sections in each segment by the line-intercept method. Plants observed over or under the tape measure were identified to species when possible or were categorized according to functional group (floating aquatic, submerged aquatic, emergent, attached algae, benthic algae) and their linear distance was recorded. Dominant macrophyte species within each functional group were noted for each cover unit (discreet line-intercept interval for a functional group). No quantitative plant biomass samples were collected.

1.3.4.11 Ecosystem Metabolism

Ecosystem metabolism was estimated during the two seasonal sampling events in the stream segments using the upstream/downstream dissolved oxygen change method of H.T. Odum (1957a and b; 1960) and Odum and Hoskins (1957). Hourly upstream/downstream dissolved oxygen data recorded by the In Situ Troll 9000 data sondes were used to estimate ecosystem metabolism. Upstream and downstream data were each shifted by one-half of the estimated travel time between the upstream and

FIGURE 1-12

IN SITU TROLL 9000 MULTI-PROBE WATER QUALITY LOGGER SHOWING INSTALLATION IN LOCKING PVC CASE IN ANCHORED MONITORING BUOY

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 depth and 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), P/R ratio, ecological efficiency (EFF). **Figure 1-13** illustrates the calculation of these metabolism measurements based on development of a typical oxygen rate-of-change curve.

Gross primary productivity 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 under the daytime curve in g $O_2/m^2/d$.

Community respiration is the average of the corrected nighttime oxygen rate-of-change values in g $O_2/m^2/d$.

Net primary productivity is equal to the difference between these two estimates (GPP-CR).

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 is equal to the rate of gross primary productivity divided by the incident PAR during a specified time interval. It is an ecosystem-level property that estimates the overall efficiency of an aquatic ecosystem to effectively utilize incident solar radiation, the principal forcing function for autotrophic stream ecosystems. PAR reaching the productive 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 $gO_2/m^2/d$ by $mol/m^2/d$, resulting in units of gO_2/mol. PAR Efficiency is also reported as a percentage using the conversion factors employed by Knight (1980; 1983): 4.22 Kcal/gO_2 and 52.27 Kcal/mole of photons (McCree 1972).

1.3.4.12 Aquatic Plant Metabolism

Stream mesocosms based on the methods of Knight (1980, 1983) originally utilized at the Silver River in Marion County, Florida were used to provide replicated plant-specific estimates of metabolic activity (**Figure 1-14**). Nine acrylic tubes (stream mesocosms) 5.1 cm (2 in) in diameter and approximately 1.83 m (6 ft) long were suspended in the water column within each stream segment once during the spring and summer sampling periods. Two or three submerged plant species were placed in replicate stream mesocosms for each study. Various combinations of the most readily available plant species were utilized for these mesocosm studies including in order of preference:

- *Vallisneria americana* (tape grass)
- Filamentous algae
- *Najas quadalupensis* (southern naiad)

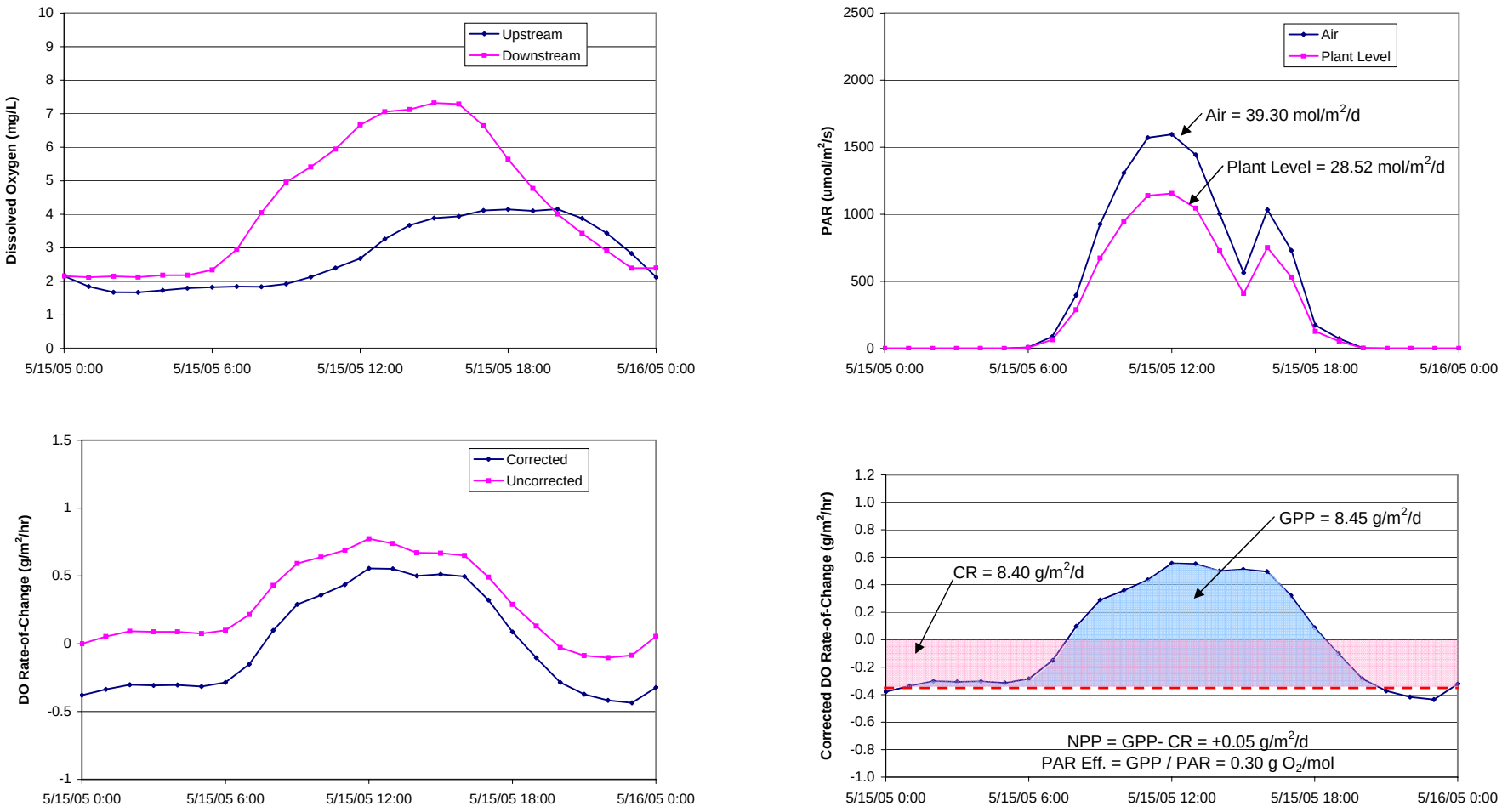


FIGURE 1-13

EXAMPLE CALCULATION OF ECOSYSTEM METABOLISM BASED ON UPSTREAM-DOWNSTREAM DISSOLVED OXYGEN DATA

FIGURE 1-14
STREAM MESOCOSMS FOR MEASURING IN SITU METABOLISM OF SELECTED SUBMERGED AQUATIC PLANTS

- *Ceratophylum demersum* (coontail)
- *Potamogeton pectinatus* (sago pondweed)

Above and below ground portions of the rooted macrophytes were used when available. Freshly collected plants were enclosed in 1-cm plastic mesh screens for installation into the mesocosm tubes (**Figure 1-15**). Two or three replicates were run for each plant species. Two or three mesocosms were reserved as controls with no plants.

Mesocosms were installed in a floating rack just below the water surface and a manifold consisting of ten ball valves was used to regulate water flow to a YSI Model 55 dissolved oxygen meter for measurement of upstream and downstream dissolved oxygen and temperature values throughout a four to six hour period. During each study period, the mesocosms were run in a light mode with no covers and in a dark mode where they were fully covered by black PVC (**Figure 1-16**). At the end of this data collection period the contents of the six plant-filled mesocosms were emptied into sample bags and the plants were returned to the laboratory for wet and dry weight analysis. Plant samples were air dried or dried in a drying oven at 104 ^{o}C. PAR was continually recorded throughout the light period for each mesocosm study by use of the underwater Li-Cor sensor attached to the mesocosm frame (**Figure 1-10**).

The mesocosm sampling was used to quantify the gross and net primary productivity and the nighttime (dark period) community respiration for these individual plant species under varying conditions of nutrient enrichment. No diffusion correction was required for these measurements since the stream mesocosms were fully submerged and not influenced by atmospheric oxygen exchanges. Mesocosm productivity and respiration estimates were normalized by measured light intensity and by plant dry weight biomass.

Mesocosm studies complement the whole stream segment metabolism studies described above. Mesocosm studies can be fully replicated so that statistical comparisons can be made and significance assessed. The stream mesocosms used in this study have the additional advantages of being deployable in the outside environment, under conditions of relatively natural stream flow velocities, temperatures, nutrient and chemical conditions, and solar inputs. The mesocosm treatments were designed to provide clarification of the effects of ambient stream nutrient concentrations on the productivity and respiration of the dominant submerged aquatic plants in the Wekiva River System.

1.3.4.13 Nutrient Assimilation

Nutrient assimilation rates for total nitrogen, nitrate, ammonia, dissolved ortho-phosphate, and total phosphorus were estimated for each of the six stream segments by calculating upstream-downstream concentration changes during each seasonal segment sampling period. Average nutrient mass inputs and outputs were estimated based on average water concentrations and flows over the period of each study. Non-point nutrient inputs from the surrounding watershed feeding each stream segment were estimated from an analysis of the contributing area, the 2000 land use from the SJRWMD, and estimated even mean concentrations and runoff coefficients for each land

FIGURE 1-15
PLASTIC MESH USED TO EASILY INSERT AND REMOVE PLANTS IN STREAM MESOCOSMS

FIGURE 1-16

STREAM MESOCOSMS IN "DARK MODE" COVERED BY BLACK PVC TUBING

use (**Table 1-5**). Nutrient assimilation was estimated as the difference between the sum of the upstream loads (river plus diffuse inputs) and the estimated downstream load. Nutrient assimilation rates are reported on a unit wetted area basis.

1.3.4.14 Community Export

Community export was quantified in each stream segment using two sampling methods which targeted coarse and fine particulate export. Export of larger macrophytes and masses of attached algae was estimated with suspended horizontal traps anchored perpendicular to the flow direction (**Figure 1-17**). Three traps were deployed in each stream segment for four to six hours. Collected plants were sorted in the laboratory by dominant species and wet and dry weights were obtained.

Smaller suspended material was sampled using a plankton net suspended in the current at mid-depth (**Figure 1-18**). The mesh size on the plankton net was 153 µm. Samples collected by the plankton net at a known stream velocity and for a known time were rinsed into a sample bottle and returned to the laboratory for wet, dry, and ash-free dry weight analyses. Particulate samples were ashed at an oven temperature of about 450 ^{o}C.

1.3.5 Data Analysis

1.3.5.1 Within-Segment Comparisons

For each of the six stream segments, appropriate statistical procedures were used to analyze the relative strength of relationships between selected physical, water quality, nutrient assimilation, aquatic plant community, and ecosystem-level variables measured or calculated using the methods described above. These statistical procedures included correlation analyses.

1.3.5.2 Between-Segment Comparisons

Selected physical, water quality, nutrient assimilation, aquatic plant community, and ecosystem-level variables for each of the six stream segments were also compared using to those for other selected stream segments to detect differences between:

- upstream-downstream segments in the Wekiva River
- upstream-downstream segments in Rock Springs Run
- Wekiva River and Rock Springs Run
- Wekiva River and Juniper Creek
- Wekiva River and Alexander Spring Creek
- Rocks Springs Run and Juniper Creek
- Rocks Springs Run and Alexander Spring Creek
- Juniper Creek and Alexander Spring Creek

The primary statistical procedure that was used was correlation analyses.

FIGURE 1-17
TYPICAL FLOATING MACROPHYTE EXPORT TRAP WITH 1 M CAPTURE LENGTH

FIGURE 1-18
PLANKTON NET USED FOR MEASURING THE FINE PARTICULATE EXPORT IN THE WEKIVA PLRG S

2.0 Description of the Wekiva River System and Spring Run Reference Sites

2.1 General Location and Description

The Wekiva River System is located in central Florida, just north of Orlando and within three counties: Orange, Seminole, and Lake (**Figure 2-1**). Wekiwa Springs, the primary headwater spring of the Wekiva River, is located in northeast Orange County, approximately 4.8 km (3 miles) northeast of the City of Apopka and 9.6 km (6 miles) northeast of Lake Apopka.

Rock Springs, the primary headwater spring of Rock Springs Run is located about 6.4 km (4 miles) northwest of Wekiwa Springs. Rock Springs Run also receives input from Sulfur Spring and flows north, east, and then southeast for a distance of about 14.2 km (8.8 miles) before joining with Wekiwa Springs Run about 1,065 m (3,500 ft) east of Wekiwa Springs. The Wekiva River flows northeast from this confluence for about 5.9 km (3.7 miles) before it is joined by the Little Wekiva River whose headwaters are in north Orlando.

The Wekiva River flows north and northeast from its confluence with the Little Wekiva River for about 14.4 km (8.9 miles), crossing under SR 46 about 21 km (13 miles) east of Mount Dora and 14.5 km (9 miles) west of Sanford. The Wekiva River receives additional input of dark water at its confluence with Blackwater Creek, about one mile upstream of its confluence with the St. Johns River where it ends. The Wekiva River is the legal boundary between Orange and Seminole Counties to the south and Lake and Seminole Counties in the north.

The two spring run reference sites are located about 32 to 54 km (20 to 33 miles) north of the Wekiva River System in south Marion and north Lake Counties. Juniper Creek receives inflows from Juniper Springs and Fern Hammock Springs and travels for about 9 km (5.6 miles) before entering the southwest corner of Lake George (**Figure 2-2**). Alexander Springs Creek (**Figure 2-3**) receives inflow from Alexander Springs, Billies Bay Branch, and Nine Mile Creek, and travels for about 17 km (10.5 miles) before entering the St. Johns River near Lake Dexter.

Wekiwa Springs State Park and Rock Springs Run State Preserve include about 7,850 ha (19,400 acres) of uplands, wetlands, and aquatic habitats surrounding Wekiwa Springs, Rock Springs, Rock Springs Run, and the southern end of the Wekiva River. The northern reach of the Little Wekiva River, northwest of Altamonte Springs is located within the Wekiva River Buffer Conservation Area. The northern one third of the Wekiva River is located in Seminole State Forest. The Wekiva River State Aquatic Preserve includes the Wekiva River, Rock Springs Run, the lower (north) reach of the Little Wekiva River, and Blackwater Creek. The Wekiva River and Rock Springs Run are listed as Outstanding Florida Waters (OFWs) and protected by special rules applicable to OFWs.

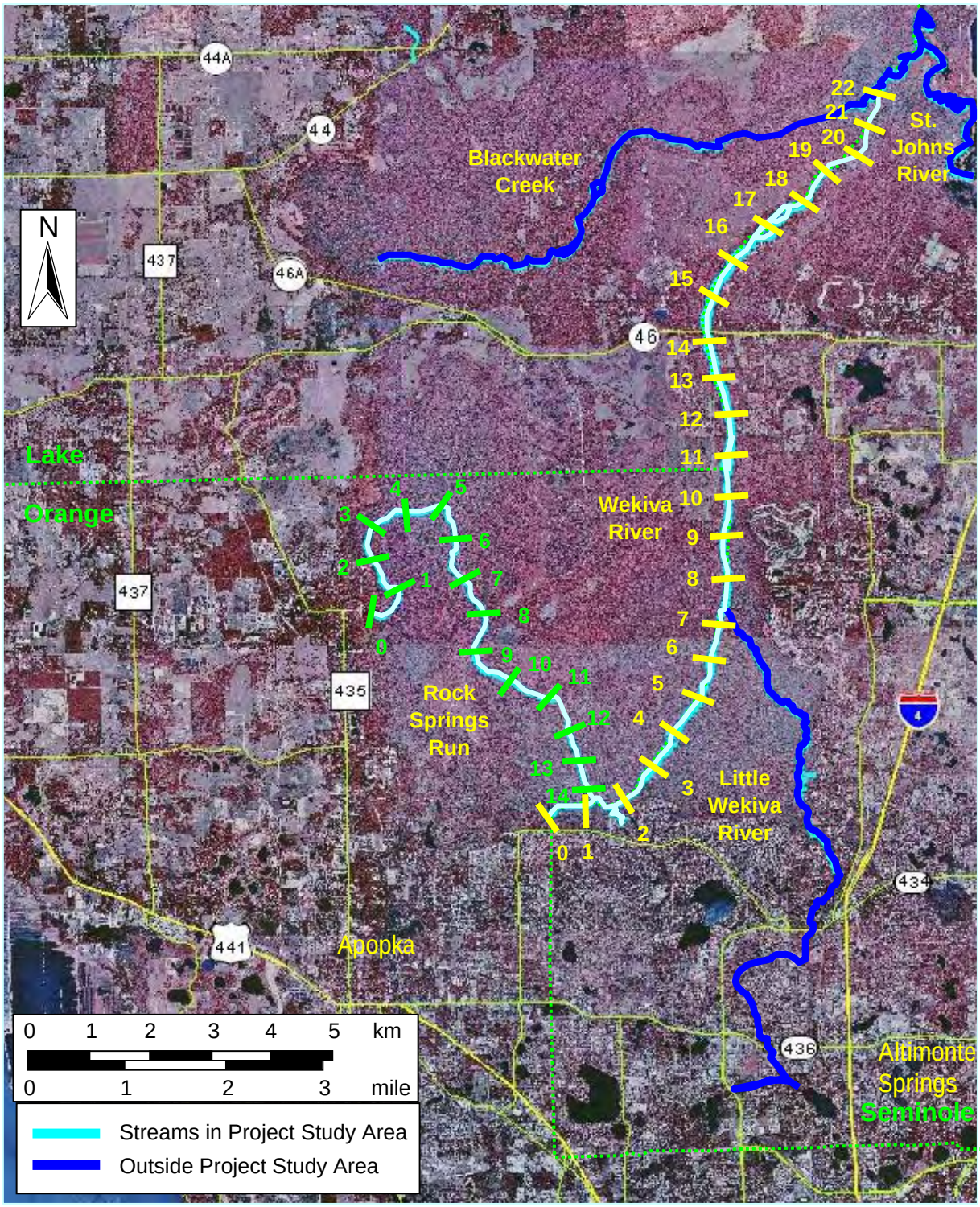


FIGURE 2-1

MAP ILLUSTRATING THE EXTENT OF THE WEKIVA RIVER SYSTEM AND SHOWING APPROXIMATE 1 KM FLOW DISTANCE INTERVALS FOR EACH KEY RIVER SEGMENT

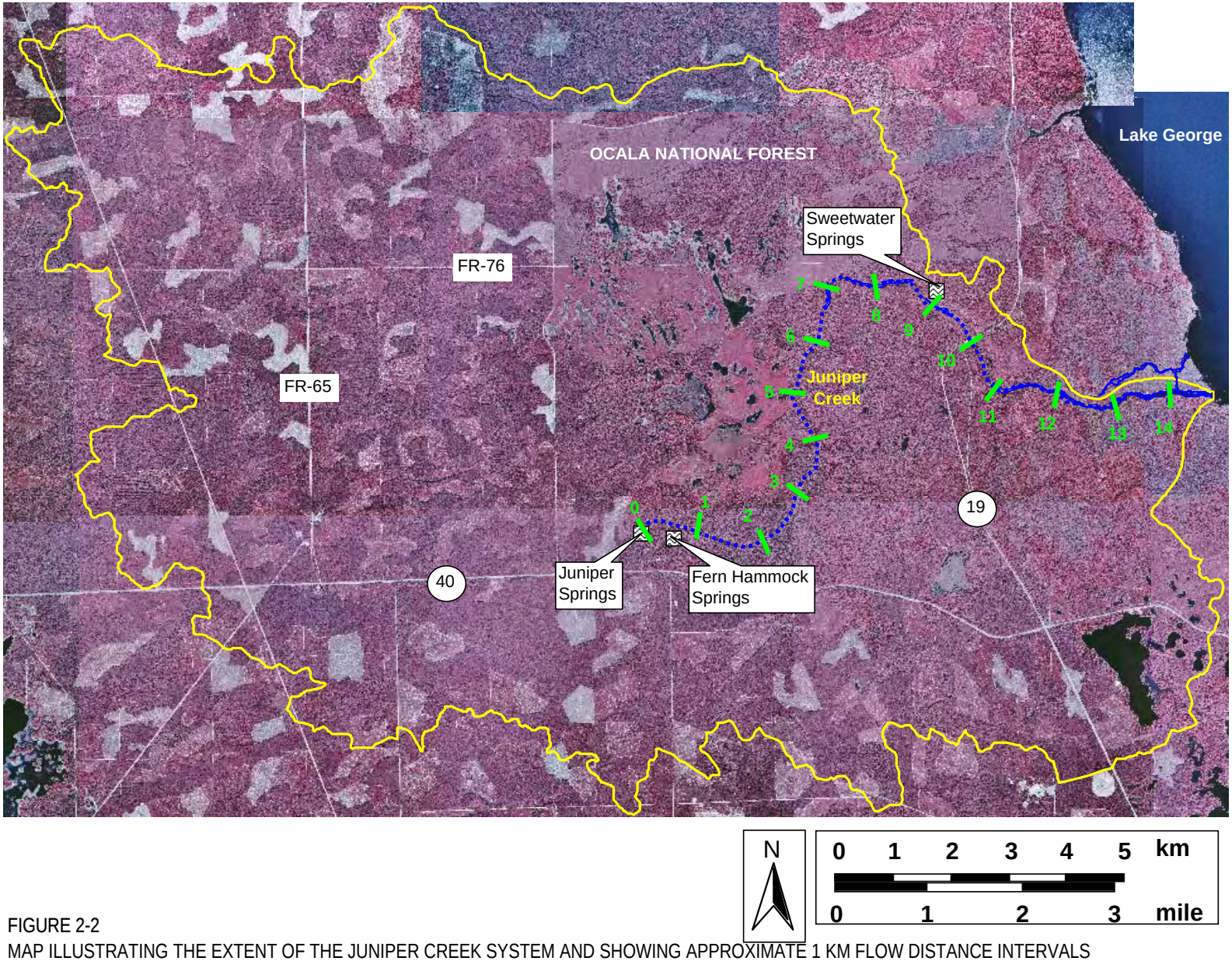


FIGURE 2-2
MAP ILLUSTRATING THE EXTENT OF THE JUNIPER CREEK SYSTEM AND SHOWING APPROXIMATE 1 KM FLOW DISTANCE INTERVALS

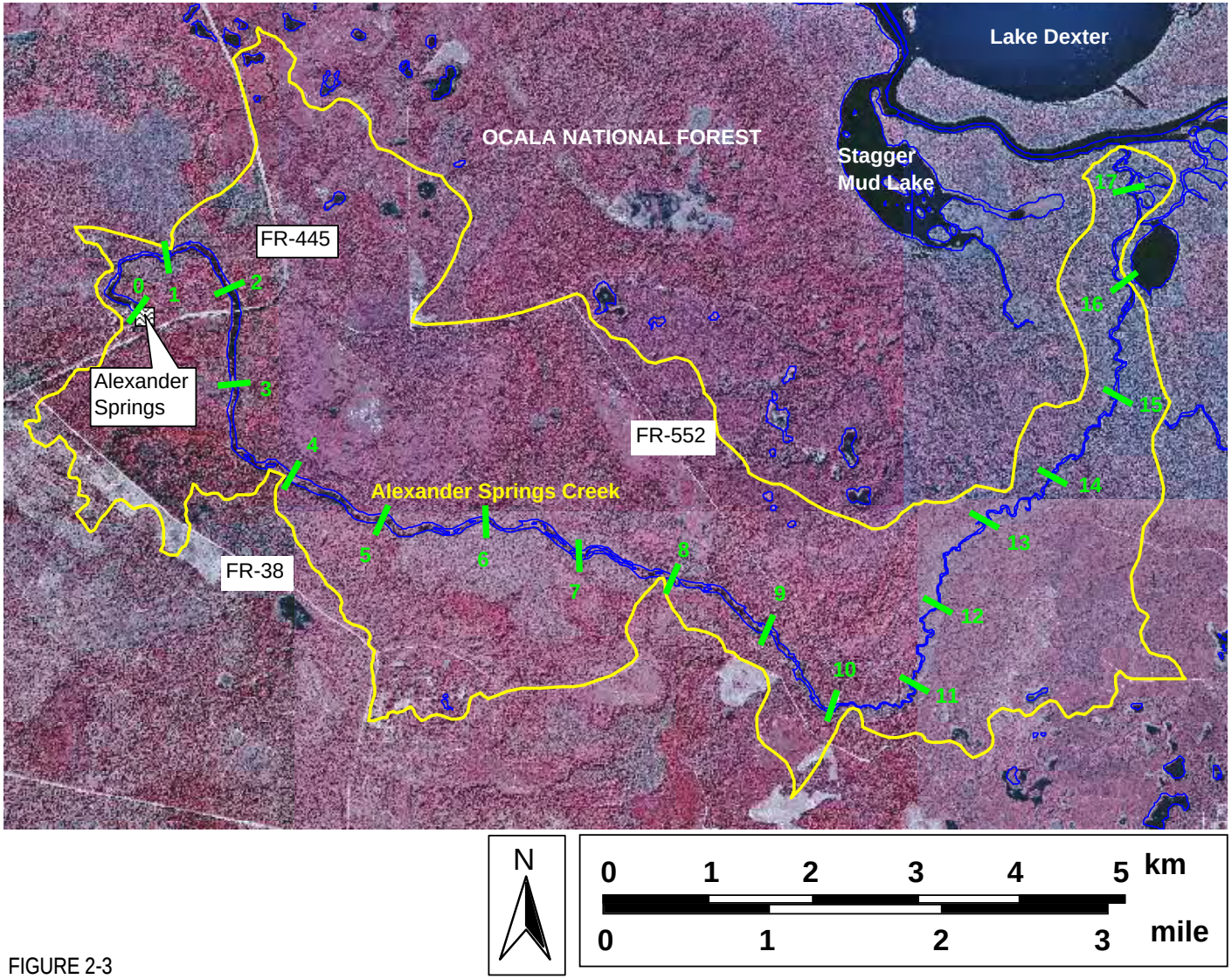


FIGURE 2-3

MAP ILLUSTRATING THE EXTENT OF THE ALEXANDER SPRINGS CREEK SYSTEM AND SHOWING APPROXIMATE 1 KM FLOW DISTANCE INTERVALS

The entire length of the Wekiva River and Rock Springs Run is a State Canoe Trail and is one of the most heavily used in the state of Florida. Attendance at the Wekiwa Springs State Park averages more than 200,000 human-use-days per year (FOWR 1985).

The two reference spring run sites are located within the boundaries of the Ocala National Forest and are also heavily-used recreational sites.

2.2 Stream Reach Reconnaissance Results

2.2.1 Introduction

Four stream reaches were evaluated for this project. Each stream reach was quantitatively characterized to provide an overview of their existing ecological structure. The purpose of this characterization was to allow comparison between study and reference sites, to interpret upstream and downstream data for each reach, and to provide a basis for selecting smaller stream segments for more detailed study. Each of the four stream reaches is described as follows. Detailed data from the stream reach reconnaissance study are provided in **Appendix A**. **Table 2-1** provides a summary comparison of the four stream reaches.

2.2.2 Wekiva River Reach

The location of the Wekiva River Reach is illustrated in **Figure 2-4**. The Wekiva River Reach was inventoried by canoe on January 26, 2005. This reach was approximately 14.5 km (9 mi) in length between the upstream starting point at the bridge just downstream of the Wekiwa Springs swimming area to the SR 46 bridge, and had an average width of 52.4 m (172 ft). The stream width varied from about 20 to 134 m (66 to 440 ft). The nature of the Wekiva River changes substantially within the length of this reach. The upper river is spring-fed but quickly enters a forested swamp and receives a variety of diffuse and point source inflows. During rainy periods these inflows bring colored water of lower hardness into the river and dilute the spring flow. Major tributary inflows include Rock Springs Run at 1.1 km (0.7 mi), the Little Wekiva River at 7.6 km (4.7 mi), and Wekiva Falls (a short spring run) at 12.1 km (7.5 mi). The Wekiva River changes from a canopy-dominated narrow river above the Little Wekiva River to a much wider and open, highly vegetated river downstream to the SR 46 bridge.

The estimated average depth in the Wekiva Stream Reach was 1.14 m (3.7 ft), resulting in an estimated volume of about 866,172 m^3 (1,133,000 cubic yards [cy]). Average flow velocity was estimated as 0.24 m/s (0.79 ft/s). On January 26, 2005 the Wekiva Stream Reach had the following average water quality conditions: water temperature – 17.6 ^oC, pH – 7.5 s.u., dissolved oxygen – 6.2 mg/L, and specific conductance – 316 µS/cm. The light attenuation coefficient, k, averaged 2.25 for this reach, indicating colored water conditions in much of the river on the sampling date. Canopy cover for the Wekiva River Reach was estimated as 4% during this mid-winter sampling event. Floating and emergent macrophyte cover averaged about 32%, while the cover of submerged aquatic plants and benthic algae was estimated as about 42%.

TABLE 2-1

SUMMARY OF WEKIVA PLRG STREAM REACH RECONNAISSANCE DATA COLLECTED FROM JANUARY TO MARCH 2005

Parameter	Wekiva River 1/26/2005	Rock Springs Run 2/23/2005	Juniper Creek 3/8/2005	Alexander Springs Creek 3/9/2005
Width (m)	52.4	28.9	20.2	56.8
Depth (m)	1.14	1.09	1.12	0.83
Velocity (m/s)	0.24	0.24	0.32	0.08
Dissolved Oxygen (mg/L)	6.2	4.8	6.8	5.7
Temperature (oC)	17.6	21.6	20.9	19.7
pH (su)	7.5	7.4	7.5	7.8
Specific Conductance (µS/cm)	316	244	404	868
Light Attenuation Coefficient (k)	2.25	2.14	3.09	2.28
FAP Cover (%)	13	25	11	11
SAV Cover (%)	11	23	37	35
EMA Cover (%)	19	6	14	12
ALG Cover (%)	31	17	15	48
Canopy Cover (%)	4	22	34	7

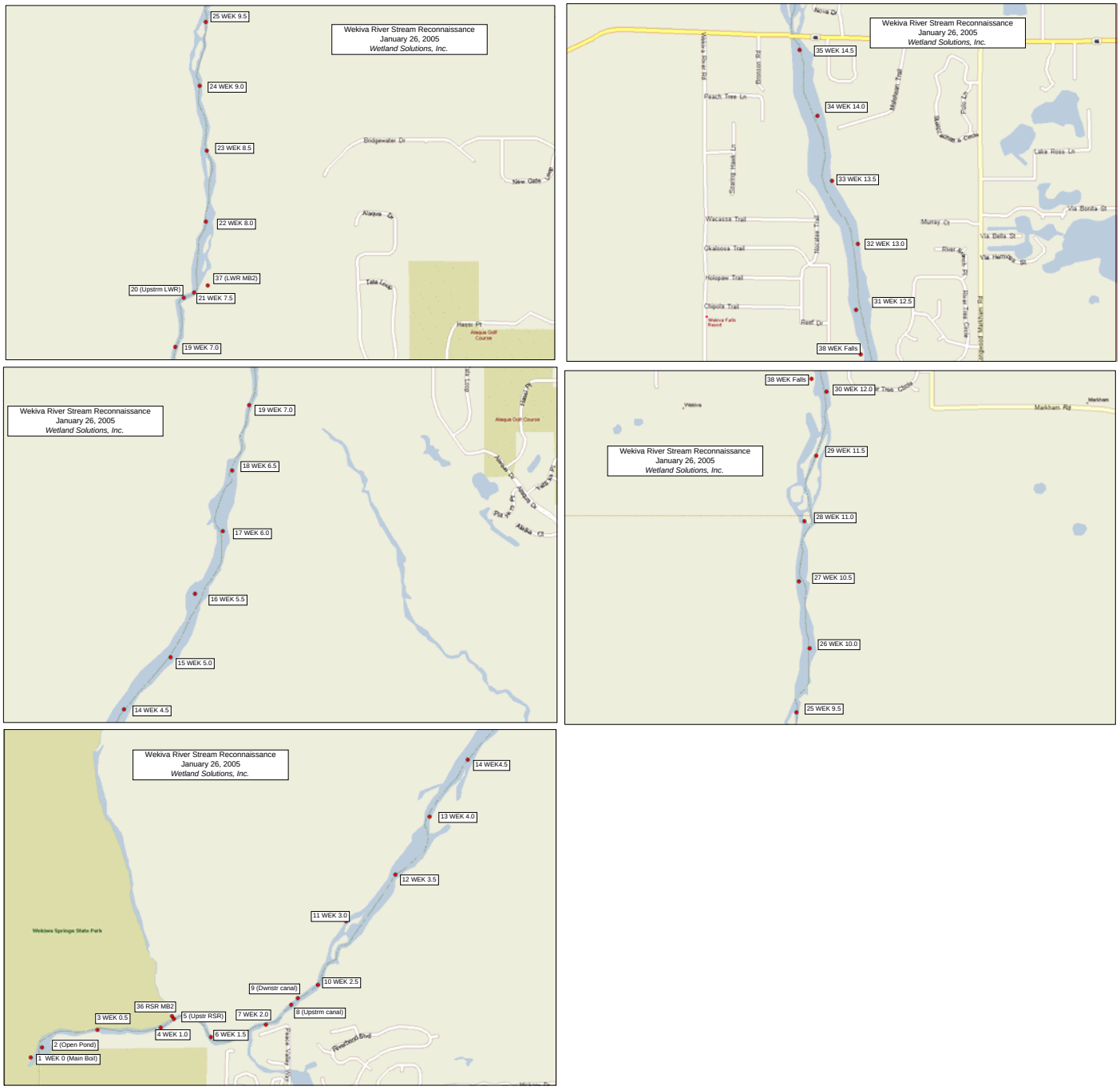


FIGURE 2-4

WEKIVA RIVER STREAM REACH RECONNAISSANCE AREA

2.2.3 Rock Springs Run Reach

The location of the Rock Springs Run Reach is illustrated in **Figure 2-5**. The Rock Springs Run Reach was inventoried by canoe on February 23, 2005. This reach was approximately 13 km (8.1 mi) in length from the starting point at the Kings landing Canal (2.3 km downstream of the head spring) to the confluence with the Wekiva River, and had an average width of 28.9 m (95 ft). The stream width varied from about 12 to 60 m (39 to 197 ft). Rock Springs Run was fairly tannic on the day of the stream reconnaissance study. Colored water inputs occur during rainy periods from the surrounding swamp forest. The majority of Rock Springs Run is narrow and heavily shaded by a canopy forest. However, several areas are wider and dominated by emergent and floating aquatic plants. Occurrence of submerged aquatic vegetation was spotty on the day of this reconnaissance study. Other than some relatively minor inflow ditches and small spring inflows in the upper portion of the reach, there are no significant tributaries that enter Rock Springs Run. The lower part of the run is somewhat deltaic with anastomotic channels meandering off to join the Wekiva River at several spread out points.

The estimated average depth in the Rock Springs Run Reach was 1.09 m (3.6 ft), resulting in an estimated volume of about 409,513 m^3 (535,600 cy). Average flow velocity was estimated as 0.24 m/s (0.79 ft/s). On February 23, 2005 the Rock Springs Run Reach had the following average water quality conditions: water temperature – 21.6 ^oC, pH – 7.4 s.u., dissolved oxygen – 4.8 mg/L, and specific conductance – 244 µS/cm. The light attenuation coefficient, k, averaged 2.14 for this reach, indicating colored water conditions in much of the river on the sampling date. Canopy cover for the Rock Springs Run Reach was estimated as 22% during this late-winter sampling event. Floating and emergent macrophyte cover averaged about 31%, while the cover of submerged aquatic plants and benthic algae was estimated as about 40%.

2.2.4 Juniper Creek Reach

The location of the Juniper Creek Reach is illustrated in **Figure 2-6**. The Juniper Creek Reach was inventoried by canoe on March 8, 2005. This reach was approximately 11 km (6.8 mi) in length from the starting point just below the Juniper Springs Boil to the US 19 bridge, and had an average width of 20.2 m (66 ft). The stream width varied from about 4 to 52 m (13 to 170 ft). Juniper Creek was fairly tannic on the day of the stream reconnaissance study. Colored water inputs occur during rainy periods from the surrounding swamp forest. The majority of Juniper Creek is narrow and heavily shaded by a canopy forest. Downstream areas are wider and characterized by some emergent and floating aquatic plants. Occurrence of submerged aquatic vegetation was spotty on the day of this reconnaissance study. Tributary inflows of importance include a natural stream near the headwaters, the spring flow from Fern Hammock Springs near the headwaters, and a spring inflow from Sweetwater Springs upstream from the US 19 bridge.

The estimated average depth in the Juniper Creek Reach was 1.12 m (3.7 ft), resulting in an estimated volume of about 248,864 m^3 (325,500 cy). Average flow velocity was estimated as 0.32 m/s (1.05 ft/s). On March 8, 2005 the Juniper Creek Reach had the following average water quality conditions: water temperature – 20.9 ^oC, pH – 7.5 s.u.,

FIGURE 2-5

ROCK SPRINGS RUN STREAM REACH RECONNAISSANCE AREA

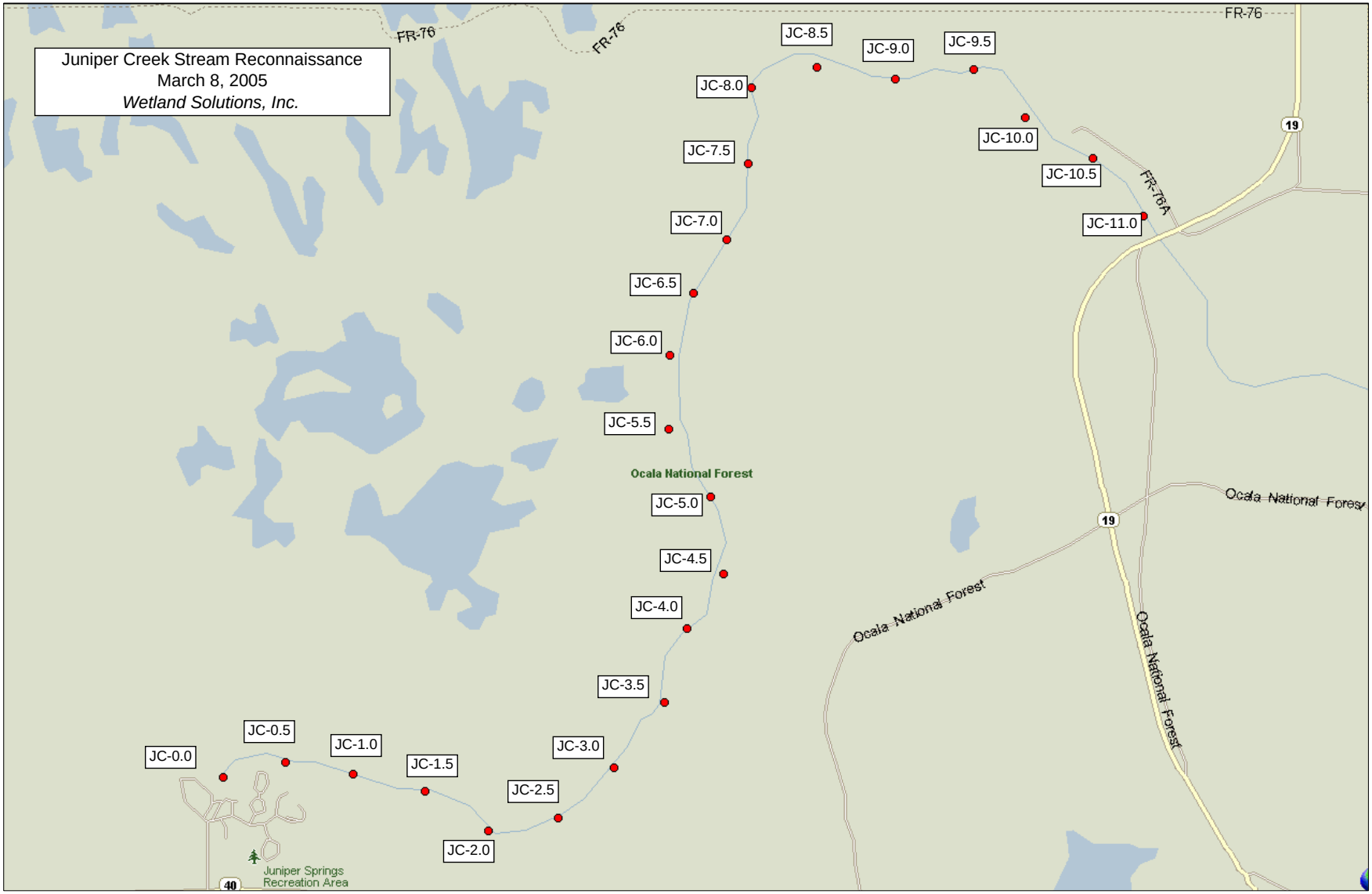


FIGURE 2-6

JUNIPER CREEK STREAM REACH RECONNAISSANCE AREA

dissolved oxygen – 6.8 mg/L, and specific conductance – 404 µS/cm. The light attenuation coefficient, k, averaged 3.09 for this reach, indicating colored water conditions in much of the river on the sampling date. Canopy cover for the Juniper Creek Reach was estimated as 34% during this early-spring sampling event. Floating and emergent macrophyte cover averaged about 25%, while the cover of submerged aquatic plants and benthic algae was estimated as about 52%.

2.2.5 Alexander Springs Creek Reach

The location of the Alexander Springs Creek Reach is illustrated in **Figure 2-7**. The Alexander Springs Creek Reach was inventoried by canoe on March 9, 2005, during a heavy rain storm. This reach was approximately 10.5 km (6.5 mi) in length from the starting point just below the Alexander Springs swimming area to Ocala national Forest Road 552 landing. The Alexander Springs Creek Reach had an average width of 56.8 m (186 ft). The stream width varied from about 18 to 98 m (59 to 321 ft). Alexander Springs Creek was fairly tannic on the day of the stream reconnaissance study. Colored water inputs occur during rainy periods from the surrounding swamp forest. The majority of Alexander Springs Creek is wide, open, and relatively unshaded by the surrounding canopy. Submerged aquatic vegetation (primarily *Vallisneria americana*) is notable in much of the river. Two significant tributaries enter Alexander Springs Creek above the CR 445 bridge: Billies Bay Branch and Nine Mile Creek. The lower part of the run enters a swamp forest and is wider and more influenced by canopy cover.

The estimated average depth in the Alexander Springs Creek Reach was 0.83 m (2.7 ft), resulting in an estimated volume of about 495,012 m^3 (647,400 cy). Average flow velocity was estimated as 0.08 m/s (0.26 ft/s). On March 9, 2005 the Alexander Springs Creek Reach had the following average water quality conditions: water temperature – 19.7 ^oC, pH – 7.8 s.u., dissolved oxygen – 5.7 mg/L, and specific conductance – 868 µS/cm. The light attenuation coefficient, k, averaged 2.28 for this reach, indicating colored water conditions in much of the river on the sampling date. Canopy cover for the Alexander Springs Creek Reach was estimated as 7% during this early spring sampling event. Floating and emergent macrophyte cover averaged about 23%, while the cover of submerged aquatic plants and benthic algae was estimated as about 83%.

2.3 Stream Segment Detailed Characterization Results

2.3.1 Introduction

Six stream segments were selected for detailed ecological study from the stream reaches described above, with two each (upstream and downstream) in Wekiva River and Rock Springs Run (**Figure 2-8**), and one each in Juniper Creek (**Figure 2-9**) and in Alexander Springs Creek (**Figure 2-10**). These segments were selected based on the reach environmental properties described above and in consultation with staff from the SJRWMD. The basic environmental characteristics of the six stream segments are summarized in **Tables 2-2** and **2-3**. Detailed cross-sectional data for these stream segments are provided in **Appendix B**. This section provides additional descriptions of the characteristics of each stream segment.

FIGURE 2-7

ALEXANDER SPRINGS CREEK STREAM REACH RECONNAISSANCE AREA

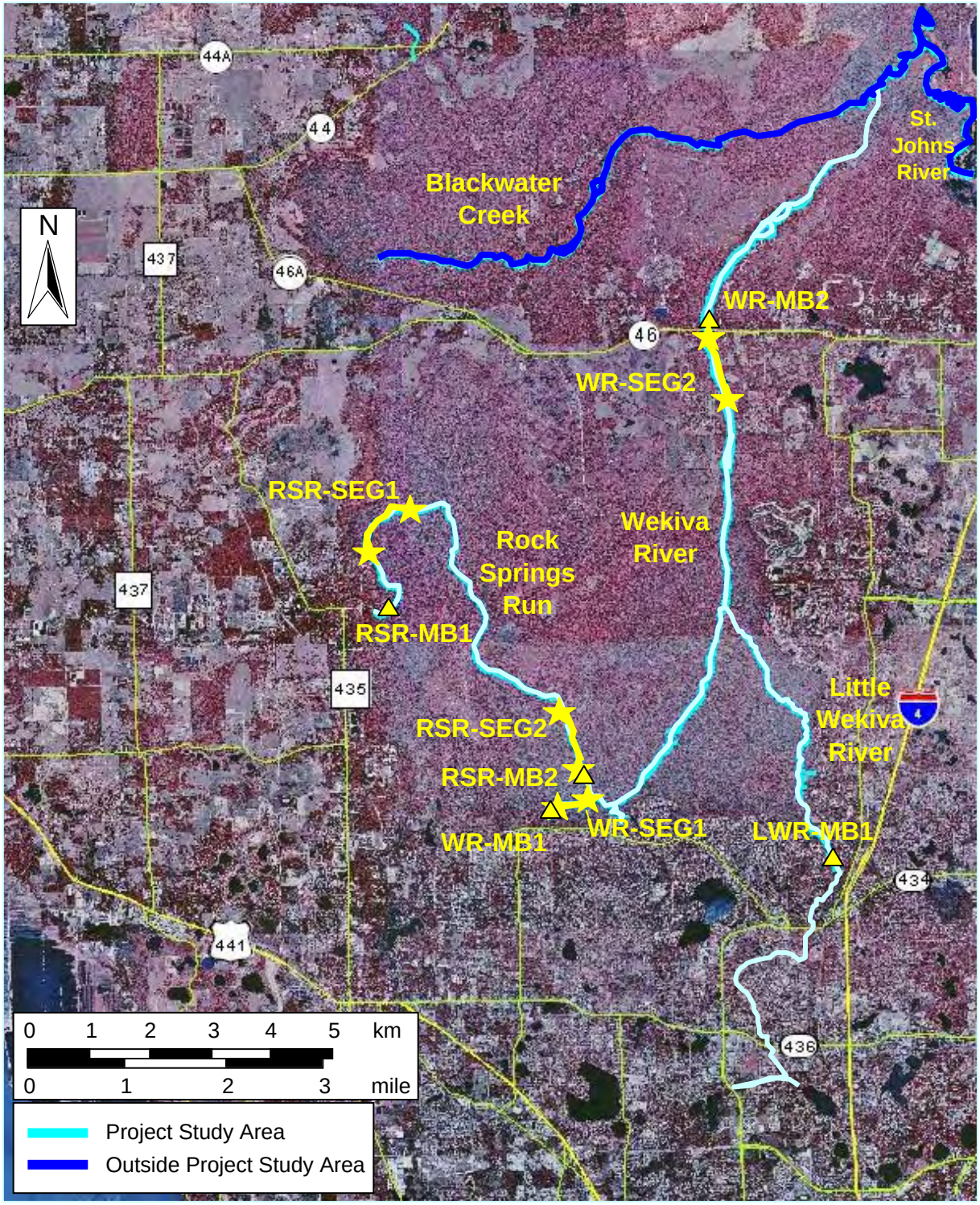


FIGURE 2-8

STREAM NUTRIENT MASS BALANCE AND ECOSYSTEM METABOLISM SAMPLING SITES WITHIN THE WEKIVA RIVER SYSTEM

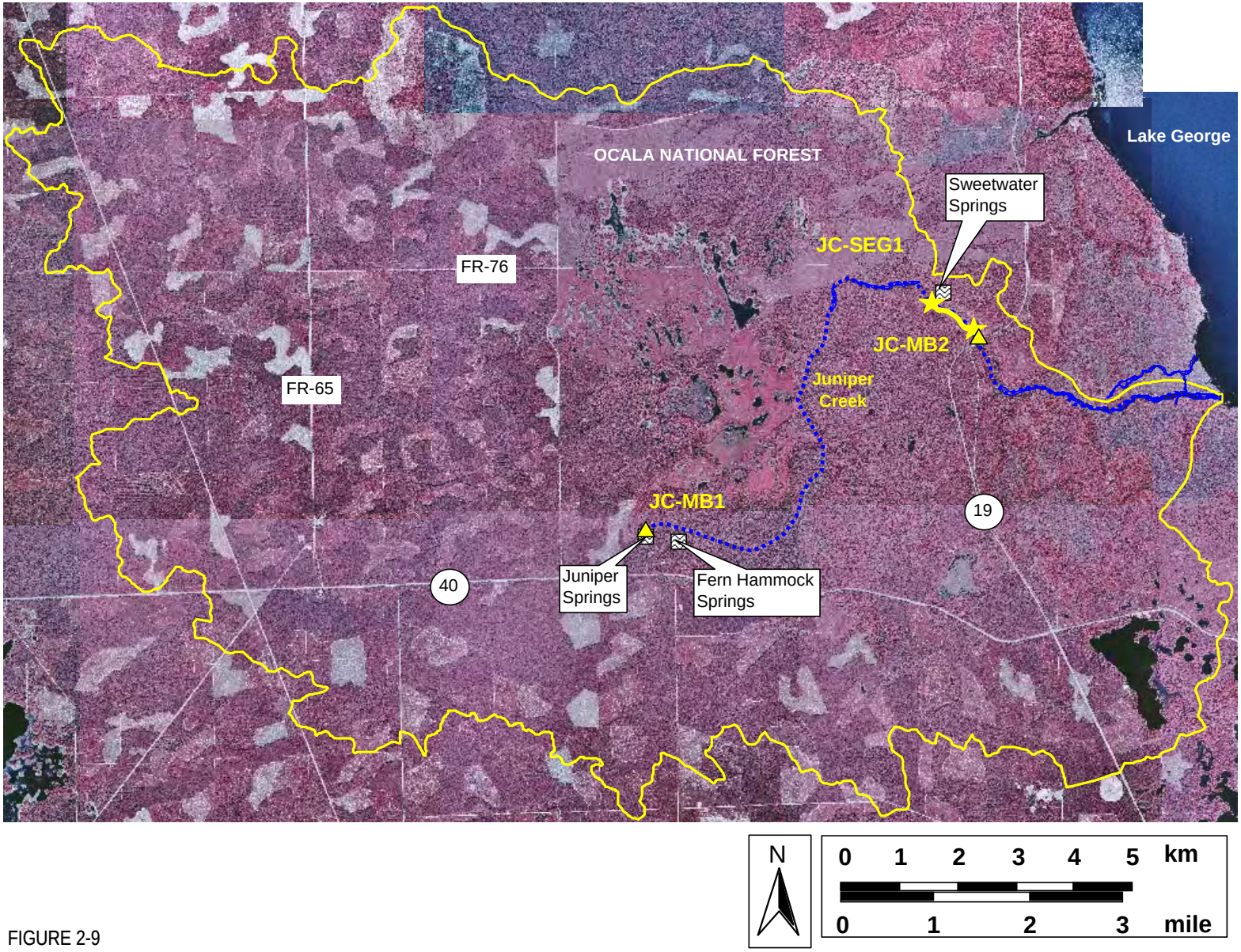


FIGURE 2-9
STREAM NUTRIENT MASS BALANCE AND ECOSYSTEM METABOLISM SAMPLING SITES WITHIN JUNIPER CREEK

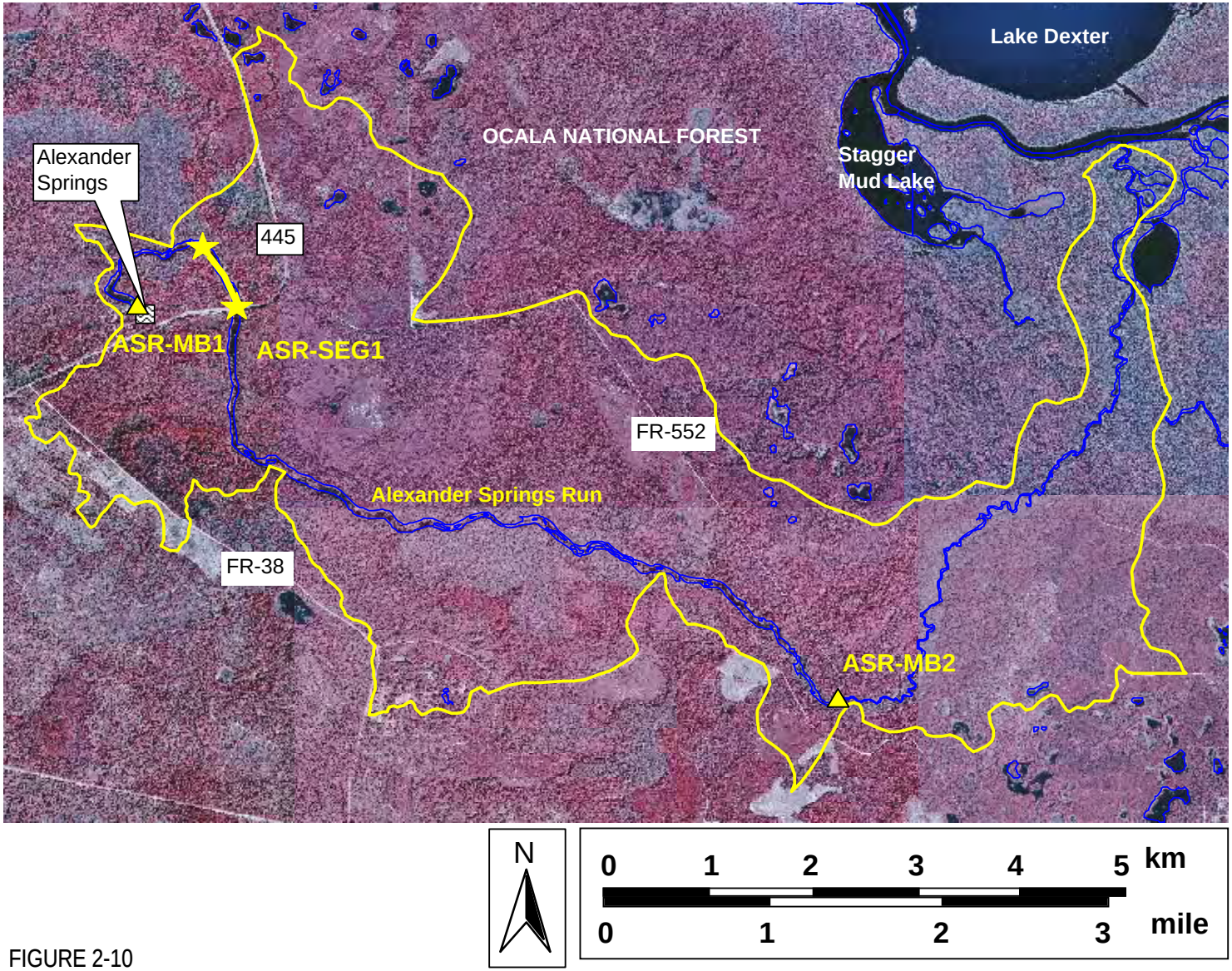


FIGURE 2-10
STREAM NUTRIENT MASS BALANCE AND ECOSYSTEM METABOLISM SAMPLING SITES WITHIN ALEXANDER SPRINGS CREEK

TABLE 2-2

WEKIVA PLRG SEGMENT PHYSICAL CHARACTERISTICS

Segment	Segment Length (m)	Average Channel Width (m)	Average Depth (m)	Est. Area (m^2)	Average Cross-Sectional Area (m^2)	Est. Volume (m^3)
WR SEG 1	1,003	30.9	1.71	33,665	53.0	57,427
WR SEG 2	778	124.2	0.43	98,529	53.9	42,492
RSR SEG 1	824	31.3	0.81	25,381	24.8	20,574
RSR SEG 2	1,277	37.5	0.32	48,018	12.1	15,316
ASC SEG 1	695	60.3	0.61	41,286	36.7	25,318
JC SEG 1	856	10.2	0.84	8,665	8.49	7,306

TABLE 2-3

SUMMARY OF SEDIMENT CHEMISTRY IN WEKIVA RIVER SYSTEM AND REFERENCE SITE SEGMENT CHARACTERIZATION

Segment	Transect	% OM	% Solids	TP (mg/kg DW)	TN % DW	TOC %
ASC1	ASC1-1	3.6	46.7	723	*0.025*	0.84
ASC1	ASC1-3	4.1	48.6	721	0.14	0.99
ASC1	ASC1-5	4.7	58.3	892	0.16	1.31
ASC1	ASC1-7	3.7	46.6	886	0.12	0.86
ASC1	ASC1-9	4.0	46.5	968	0.12	0.9
JC1	JC1-1	0.4	50.0	142	*0.025*	*0.025*
JC1	JC1-3	0.2	66.8	133	*0.025*	*0.025*
JC1	JC1-5	0.3	66.5	75.2	*0.025*	*0.025*
JC1	JC1-7	0.2	72.0	93.5	*0.025*	*0.025*
JC1	JC1-9	0.3	67.9	92.3	*0.025*	*0.025*
WR1	WR1-1	0.7	62.2	9,876	*0.025*	0.27
WR1	WR1-3	15.3	13.4	22,628	1	2.61
WR1	WR1-5	13.5	15.6	20,642	0.91	3.27
WR1	WR1-7	17.0	10.6	25,760	0.9	2.48
WR1	WR1-9	14.9	18.4	29,787	0.64	2.86
WR2	WR2-1	4.3	63.3	497	0.15	1.41
WR2	WR2-3	3.4	64.5	281	0.11	1.15
WR2	WR2-5	3.2	61.5	283	0.09	0.95
WR2	WR2-7	3.1	62.9	263	0.09	1.03
WR2	WR2-9	3.4	63.0	481	0.11	1.14
RSR1	RSR1-1	1.3	73.9	641	*0.025*	0.27
RSR1	RSR1-3	6.3	39.3	863	0.2	1.44
RSR1	RSR1-5	3.5	60.5	379	0.1	1.03
RSR1	RSR1-7	6.9	51.9	665	0.2	2.05
RSR1	RSR1-9	6.4	56.8	154	0.14	2.1
RSR2	RSR2-1	1.0	76.6	75.8	*0.025*	0.34
RSR2	RSR2-3	2.6	59.5	144	*0.025*	0.54
RSR2	RSR2-5	4.8	55.7	183	0.1	1.07
RSR2	RSR2-7	4.5	64.6	130	0.11	1.5
RSR2	RSR2-9	4.7	57.0	148	*0.025*	1.19
Segment Averages						
WR-SEG-1		12.28	24.0	21,739	0.695	2.298
WR-SEG-1 [a]		34.2	23.2	3,112	0.500	8.85
WR-SEG-2		3.48	63.0	361	0.110	1.136
RSR-SEG-1		4.88	56.5	540	0.133	1.378
RSR-SEG-2		3.52	62.7	136	0.057	0.928
ASC-SEG-1		4.02	49.3	838	0.113	0.98
JC-SEG-1		0.28	64.6	107	0.025	0.025

*italics = reported below detection limit (0.5 * detection limit)*

[a] resampled 8/31/05, Average of two labs

2.3.2 Wekiva River Upstream (WR-SEG-1)

WR-SEG-1 is about 1,003 m (3,290 ft) in length, starting at WR-MB-1 at the bridge adjacent to the Wekiwa Springs swimming area, and extending downstream to a heavily-canopied location just upstream of the confluence with Rock Springs Run (**Figure 2-11**). A short spring run quickly opens into a fairly large lagoon (120.6 m in diameter by 2.1 m deep) just below the Wekiwa Springs State Park canoe launch area. The remainder of the channel downstream from this lagoon is about 20 m (66 ft) in width and about 1 m (3.3 ft) deep. The overall average channel width is about 30.9 m (101 ft), the average depth about 1.71 m (5.6 ft), and the estimated wet area for this segment is about 3.37 ha (8.3 ac). The estimated water volume in this segment is 57,427 m^3 (75,100 cy). Segment sediments were generally low in percent solids and high in organic matter (12.3%), total phosphorus (2.2%), and total nitrogen (0.70%). Based on the first round of sampling, total phosphorus concentrations in the sediments were more that 10 times higher in this segment than in any other studied. A second set of sediment samples were collected from this segment on August 31, 2005 for confirmation of the high results. A single sample was prepared as a composite of samples collected on five of the ten transects, split into two identical samples and sent to two labs for analysis. Sediment concentrations of organic matter, total nitrogen, and total phosphorus were still very high compared to all other stream segments, and the two labs provided reasonably consistent results for the split sample.

2.3.3 Wekiva River Downstream (WR-SEG-2)

WR-SEG-2 is about 778 m (2,550 ft) in length, starting downstream of the Wekiva Falls inflow and ending downstream at the SR 46 bridge (**Figure 2-12**). This portion of the river is quite wide with an overall average channel width of about 124.2 m (407 ft) and individual transect widths ranging from 62.9 to 151.5 m (204 to 497 ft). The average segment depth is about 0.43 m (1.4 ft), and the estimated wet area for this segment is about 9.85 ha (24 ac). The estimated water volume in this segment is 42,492 m^3 (55,575 cy). Sediments were relatively low in organic matter and organic carbon, total phosphorus, and total nitrogen. Percent solids were high in these sandy sediments.

2.3.4 Rock Springs Run Upstream (RSR-SEG-1)

RSR-SEG-1 is about 824 m (2,700 ft) in length, starting a short distance below the Kings Landing Canal and extending downstream past a number of private houses into the Wekiwa Springs State park (**Figure 2-13**). Portions of this segment are fairly wide while others are narrow. A dense bed of floating and emergent macrophytes is found along much of the shoreline. Dense beds of *Vallisneria americana* occur in the upper half of the segment. The overall average channel width is about 31.3 m (103 ft), the average depth about 0.81 m (2.6 ft), and the estimated wet area for this segment is about 2.54 ha (6.3 ac). The estimated water volume in this segment is 20,574 m^3 (26,910 cy). This segment had slightly elevated sediment organic matter, organic carbon, phosphorus, and nitrogen. Sediments were a mixture of sands and organic matter.

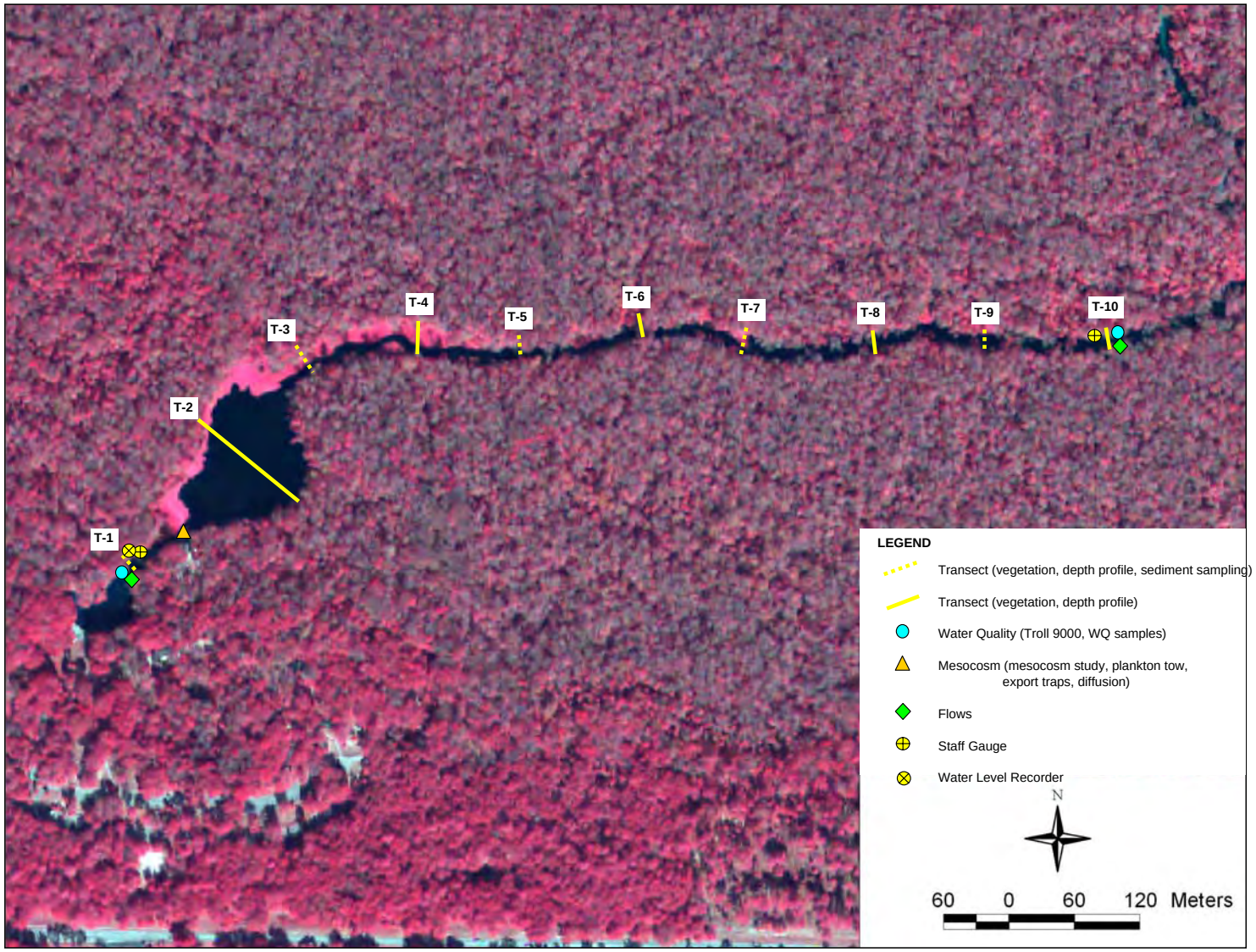


FIGURE 2-11
STREAM SEGMENT MAP FOR WEKIVA RIVER SEGMENT 1

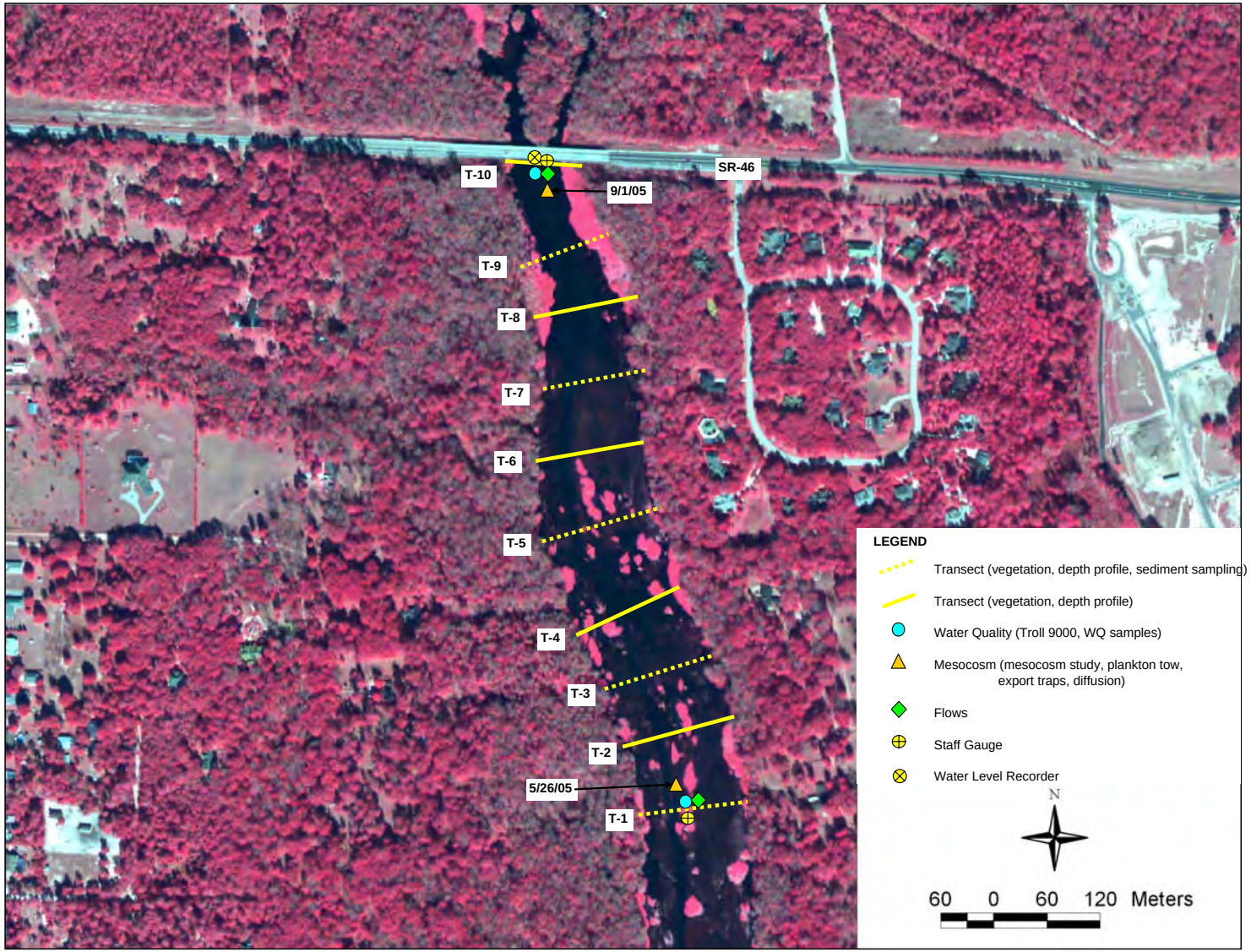


FIGURE 2-12
STREAM SEGMENT MAP FOR WEKIVA RIVER SEGMENT 2

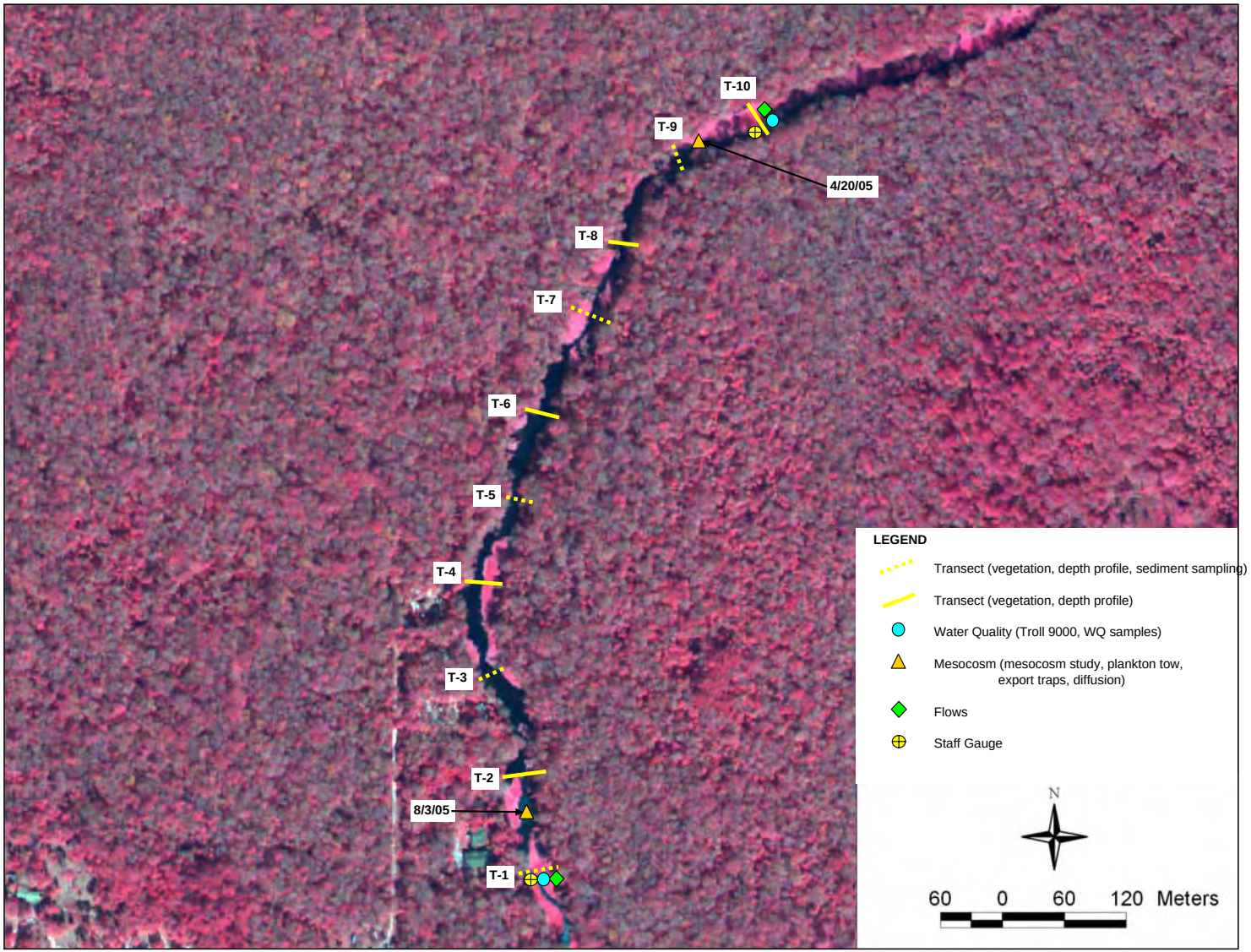


FIGURE 2-13
STREAM SEGMENT MAP FOR ROCK SPRING RUN SEGMENT 1

2.3.5 Rock Springs Run Downstream (RSR-SEG-2)

RSR-SEG-2 is about 1,277 m (4,200 ft) in length and located in the final stretch of Rock Springs Run upstream from the RSR-MB-2 station. This segment includes a mixture of relatively open and closed canopy areas (**Figure 2-14**). Open canopy areas are largely dominated by emergent and floating aquatic plants. There is very little submerged vegetation in this segment. The overall average channel width is about 37.5 m (123 ft), the average depth about 0.32 m (1.0 ft), and the estimated wet area for this segment is about 4.8 ha (11.8 ac). The estimated water volume in this segment is 15,316 m^3 (20,000 cy). This segment is dominated by sandy sediments with relatively low organic matter and carbon content and low nutrient levels.

2.3.6 Juniper Creek (JC-SEG-1)

JC-SEG-1 is about 856 m (2,800 ft) in length, starting above Sweetwater Springs and extending downstream to the US 19 highway bridge (**Figure 2-15**). Although the Juniper Creek channel is relatively narrow in this segment, the area is relatively open with minimal canopy shading and sparse populations of emergent and floating macrophytes. There are limited beds of *Vallisneria americana* and pondweed in this segment. Sweetwater Springs enters the segment about 200 m (650 ft) below the start point. This spring forms a small spring run and has a slightly different water quality than Juniper Creek. The overall average channel width in the Juniper Creek Segment is about 10.2 m (33 ft), the average depth about 0.84 m (2.8 ft), and the estimated wet area for this segment is about 0.87 ha (2.1 ac). The estimated water volume in this segment is 7,306 m^3 (9,600 cy). This segment had the highest fraction of sand and the lowest organic matter and nutrient content of any of the studied segments.

2.3.7 Alexander Springs Creek (ASC-SEG-1)

ASC-SEG-1 is about 695 m (2,300 ft) in length, starting downstream of the head spring and extending downstream to the CR 445 bridge (**Figure 2-16**). This portion of Alexander Springs Creek is quite wide and not significantly influenced by canopy shading. The dominant plant community is composed of *Vallisneria americana* mixed with coontail (*Ceratophyllum demersum*) and with clumps of spatterdock (*Nuphar luteum*), cattails (*Typha* spp.), and other emergent and floating aquatic plants. There are no observable inflows to this stream segment. The overall average channel width is about 60.3 m (198 ft), the average depth about 0.61 m (2.0 ft), and the estimated wet area for this segment is about 4.12 ha (10.2 ac). The estimated water volume in this segment is 25,318 m^3 (33,100 cy). This segment had relatively higher sediment organic matter, carbon, and total phosphorus content.

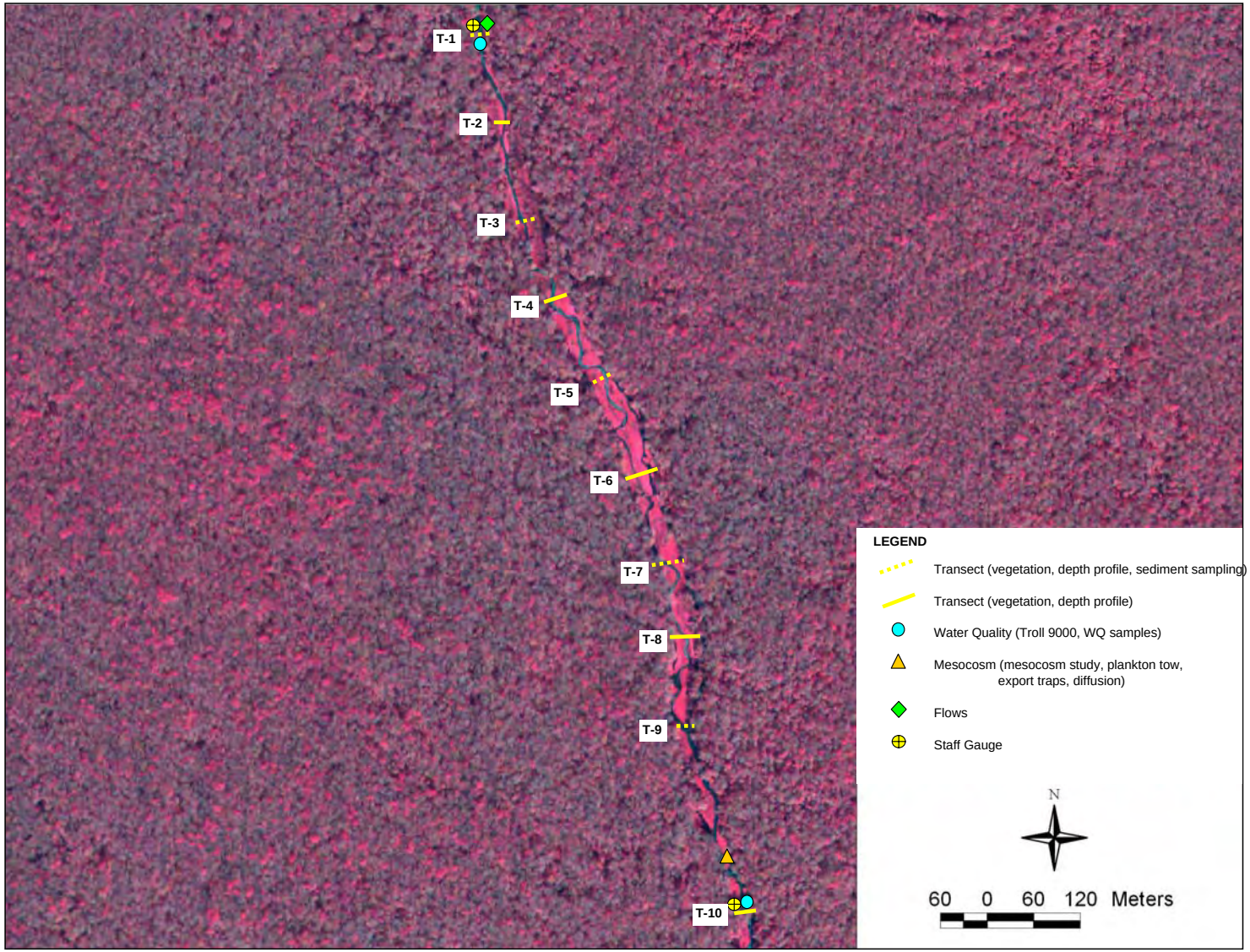


FIGURE 2-14
STREAM SEGMENT MAP FOR ROCK SPRING RUN SEGMENT 2

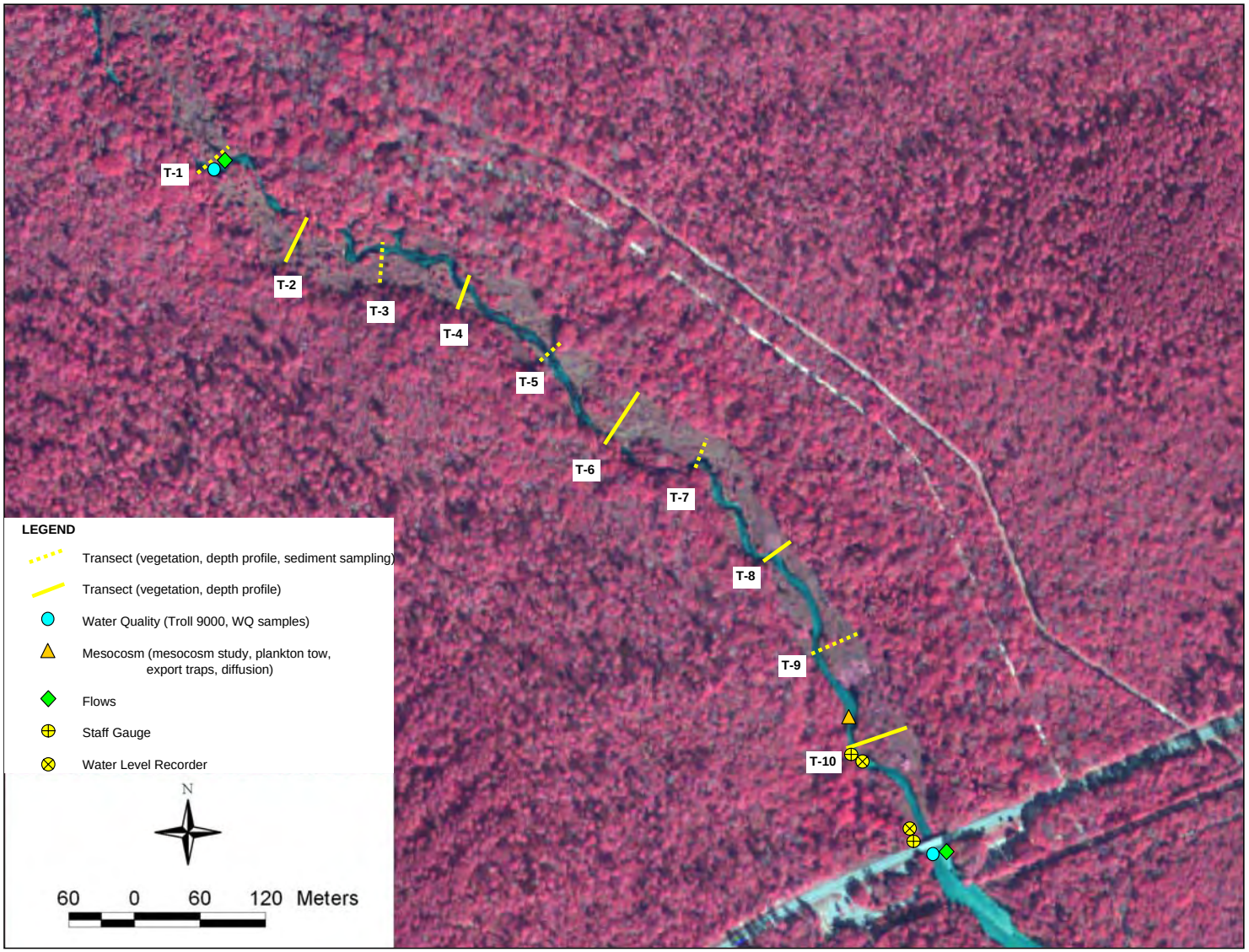


FIGURE 2-15
STREAM SEGMENT MAP FOR JUNIPER CREEK SEGMENT 1

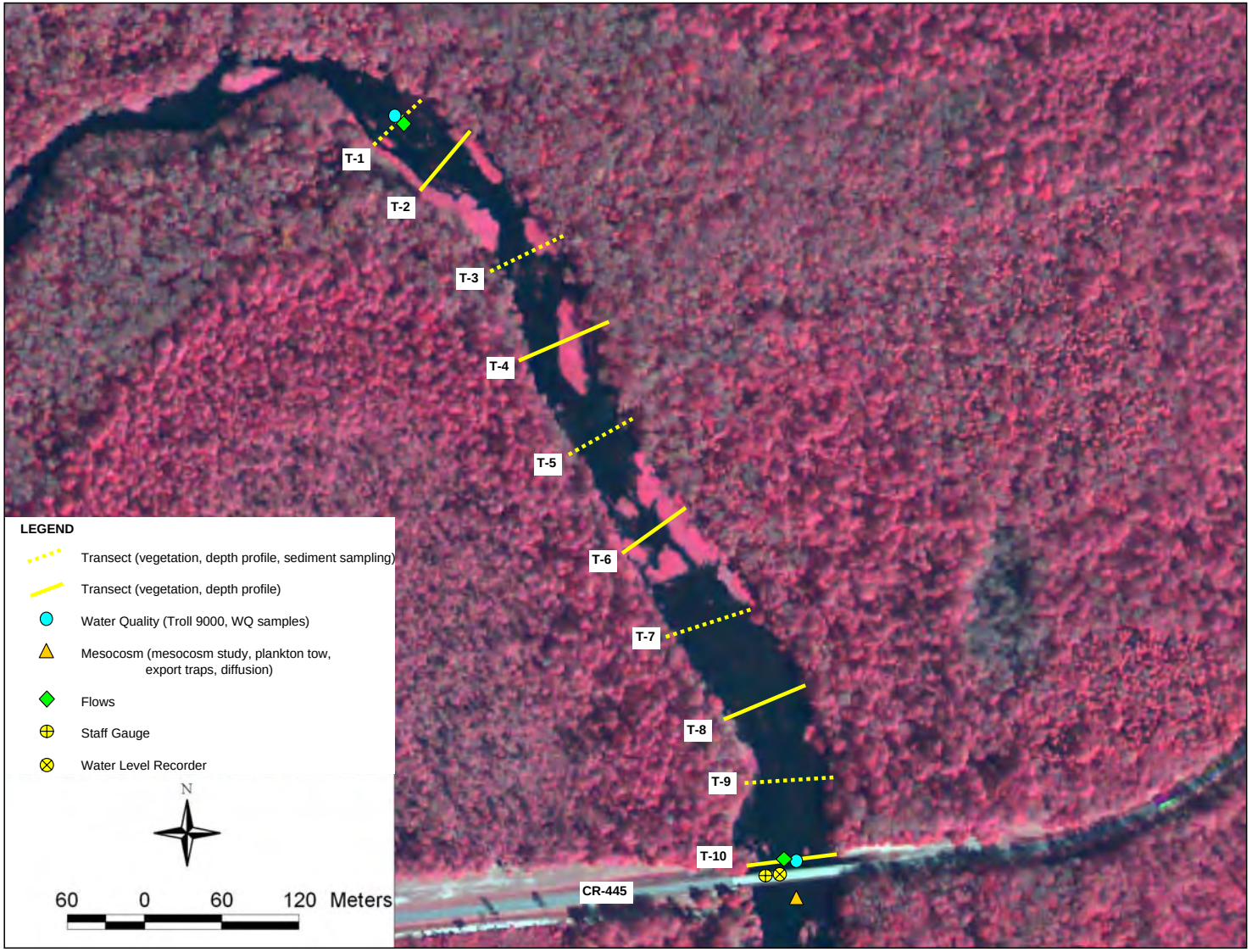


FIGURE 2-16
STREAM SEGMENT MAP FOR ALEXANDER SPRING CREEK RIVER SEGMENT 1

3.0 Summary of Ecological Studies

3.1 Introduction

The Wekiva River System monitoring encompassed an approximately 8.5 month period from mid-December 2004 through September 1, 2005. Detailed ecological studies were conducted in the six stream reaches during two seasons: late spring and late summer 2005. This section describes and summarizes the data collected from these studies.

3.2 Climatological Conditions

Solar and rainfall data are summarized for the study period in **Figure 3-1**.

Average monthly insolation varied from a low of 113 J/s/m^2 in January to high of 242 J/s/m^2 in April. The daily maximum insolation value during this period-of-record was 1,022 J/s/m^2. Photosynthetically active radiation varied from a low monthly average of 229 uE/s/m^2 in January to a maximum monthly average of 475 uE/s/m^2 in April. The maximum recorded daily PAR reading was 2,013 uE/s/m^2 in May 2005.

Approximately 102 cm (40.3 in) of rainfall were recorded during the 8.5 month study period. The lowest monthly average rainfall was recorded in April 2005 (3.1 cm [1.2 in]) and the highest was 30 cm (11.7 in) in June 2005.

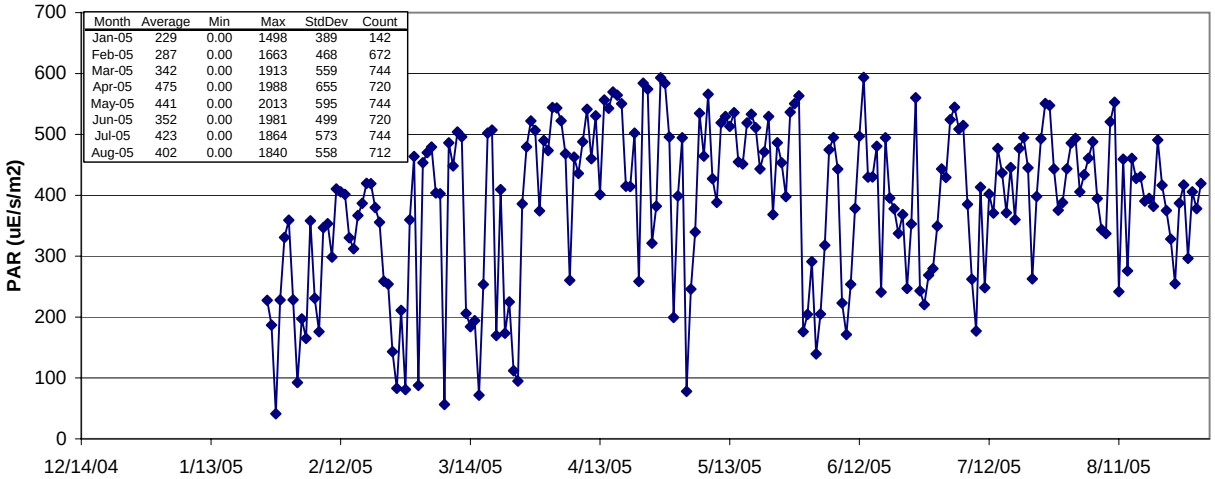
3.3 Hydrology and Flows

3.3.1 Calibration of New Discharge Stations

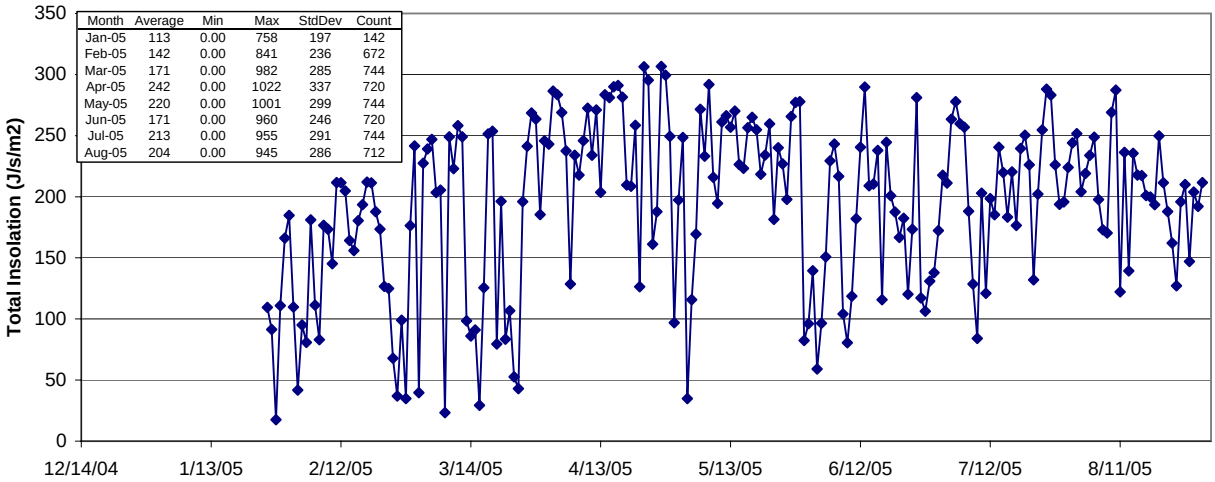
Water level recorders were installed at four new stations during this monitoring effort:

- RSR-MB-2 at the downstream end of Rock Springs Run
- JC-MB-1 at the upstream end of Juniper Creek just below its confluence with the Fern Hammock Spring Run
- JC-MB-2 downstream just above the US 19 bridge
- ASC-MB-1 just below the head spring and swimming area rope

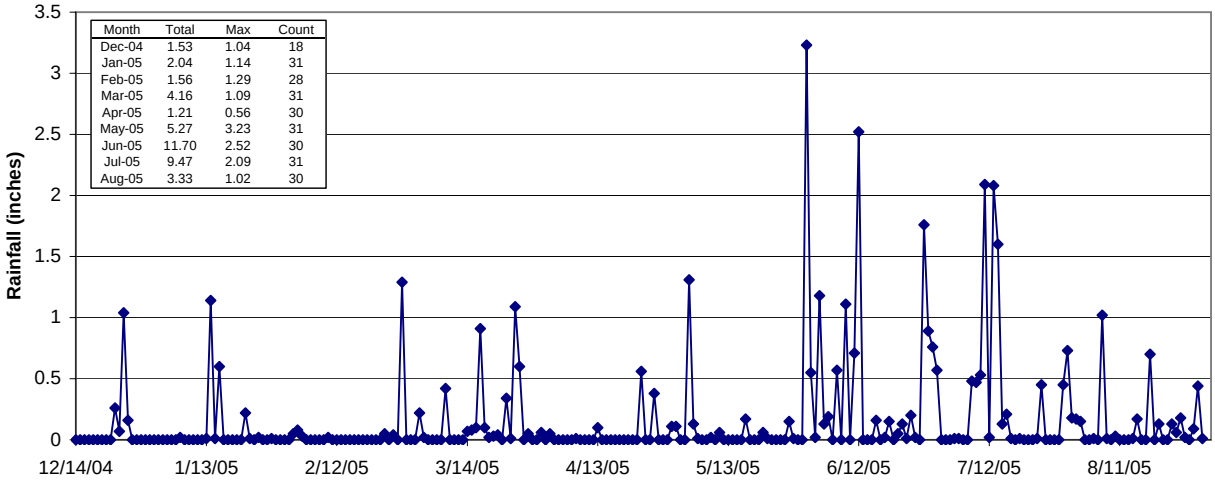
Stage was recorded hourly at these stations. Discharge measurements were made monthly at each station (nine months at the first three and three months at ASC-MB-1). **Figure 3-2** illustrates the observed relationship for each station between stage and discharge. Negative relationships were found between stage and discharge for the two Juniper Creek stations. It is not known if this is due to backwater effects from downstream obstructions or due to measurement error. All flows measured at these stations were within a relatively small range. Positive relationships were found between stage and discharge at the Rock Springs Run downstream station and at the Alexander Springs Creek upstream station. Neither of these regressions had very high R^2 values.



Month	Average	Min	Max	StdDev	Count
Jan-05	229	0.00	1498	389	142
Feb-05	287	0.00	1663	468	672
Mar-05	342	0.00	1913	559	744
Apr-05	475	0.00	1988	655	720
May-05	441	0.00	2013	595	744
Jun-05	352	0.00	1981	499	720
Jul-05	423	0.00	1864	573	744
Aug-05	402	0.00	1840	558	712



Month	Average	Min	Max	StdDev	Count
Jan-05	113	0.00	758	197	142
Feb-05	142	0.00	841	236	672
Mar-05	171	0.00	982	285	744
Apr-05	242	0.00	1022	337	720
May-05	220	0.00	1001	299	744
Jun-05	171	0.00	960	246	720
Jul-05	213	0.00	955	291	744
Aug-05	204	0.00	945	286	712



Month	Total	Max	Count
Dec-04	1.53	1.04	18
Jan-05	2.04	1.14	31
Feb-05	1.56	1.29	28
Mar-05	4.16	1.09	31
Apr-05	1.21	0.56	30
May-05	5.27	3.23	31
Jun-05	11.70	2.52	30
Jul-05	9.47	2.09	31
Aug-05	3.33	1.02	30

FIGURE 3-1
PHOTOSYNTHETICALLY ACTIVE RADIATION, TOTAL SOLAR RADIATION, AND RAINFALL - WEKIVA RIVER PLRG

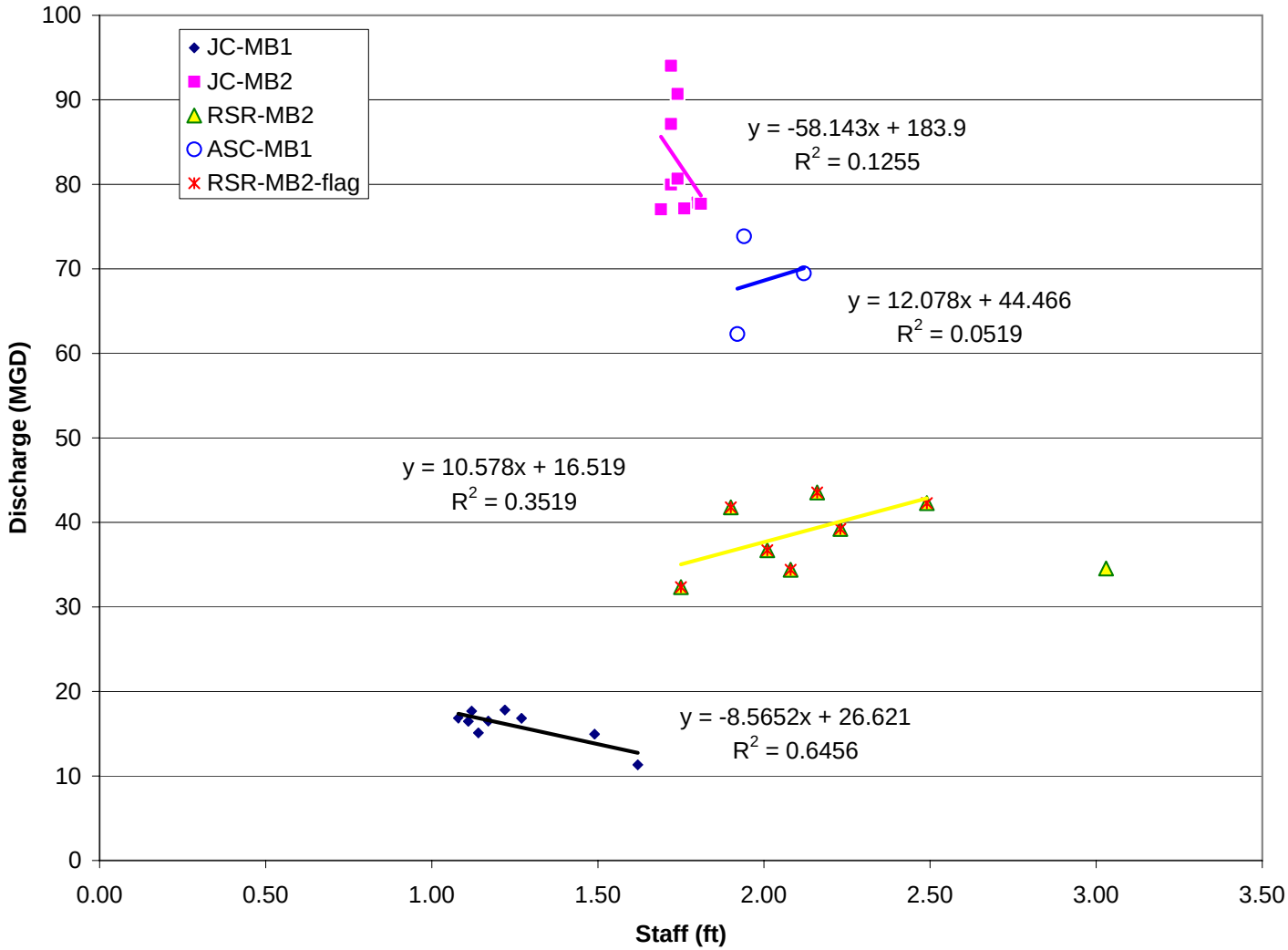


FIGURE 3-2
STAGE DISCHARGE RELATIONSHIPS FOR THE FOUR NEW MASS BALANCE STATIONS

Until additional stage vs. discharge measurements are made at these stations, the regressions in **Figure 3-2** are the best basis for estimating flows from the continuous stage data recorded at these stations.

3.3.2 Stage and Flow Summary

Water level and flow data for the four study stream reaches and the six stream segments are summarized in **Table 3-1**. Detailed hydrological data are provided in **Appendix C**. Data for individual stations are described in more detail below.

Average river stage during the study period decreased from 13.12 ft National Geodetic Vertical Datum (NGVD) at the Wekiwa Springs bridge to 6.57 ft NGVD at the SR 46 bridge. Average flows increased with distance downstream from 1.81 m^3/s (63.8 cfs) at the head spring to 5.27 m^3/s (186 cfs) at the Wekiva Marina, and 10.5 m^3/s (371 cfs) at the SR 46 bridge.

The Little Wekiva River station had an average stage of 24.3 ft NGVD and an average flow of 1.18 m^3/s (41.7 cfs) during this study period.

Rock Springs Run near the head spring had an average stage of 26.5 ft NGVD during the study period while the downstream mass balance station had a stage of 13.0 ft NGVD. Average flow was slightly higher upstream (1.97 m^3/s [69.5 cfs]) than downstream (1.68 m^3/s [59.4 cfs]).

The average stage in Juniper Creek below Fern Hammock Spring was 23.57 ft NGVD while the average water stage downstream near the US 19 bridge was 5.50 ft NGVD. Average flows increased downstream from an estimated 2.61 m^3/s [92.2 cfs] at the JC-MB-1 station to 3.68 m^3/s [130 cfs] at the US 19 bridge station.

Average stage at Alexander Springs was about 12.09 ft NGVD during this period. The recorder installed in June obtained a slightly lower average stage of 10.9 ft NGVD for a shorter sampling interval. The recorded stage at the CR 445 bridge was 11.35 ft NGVD and the average stage downstream at the FR 552 station was 4.96 ft NGVD. There was little flow variation during the study period and only nominal increases with distance downstream. The average recorded flow at the upstream station ranged from 3.06 to 3.34 m3/s [108 to 118 cfs], with an increase to 3.60 cfs [127 cfs] at the CR 445 bridge, and 4.22 m3/s [149 cfs] at the FR 552 landing.

3.3.2 Wekiva River

Stage and flow data for the Wekiva River stations during the study period are illustrated in **Figure 3-3**. Effects of rainfall events are clearly visible on these charts and are magnified with travel distance downstream.

3.3.3 Little Wekiva River

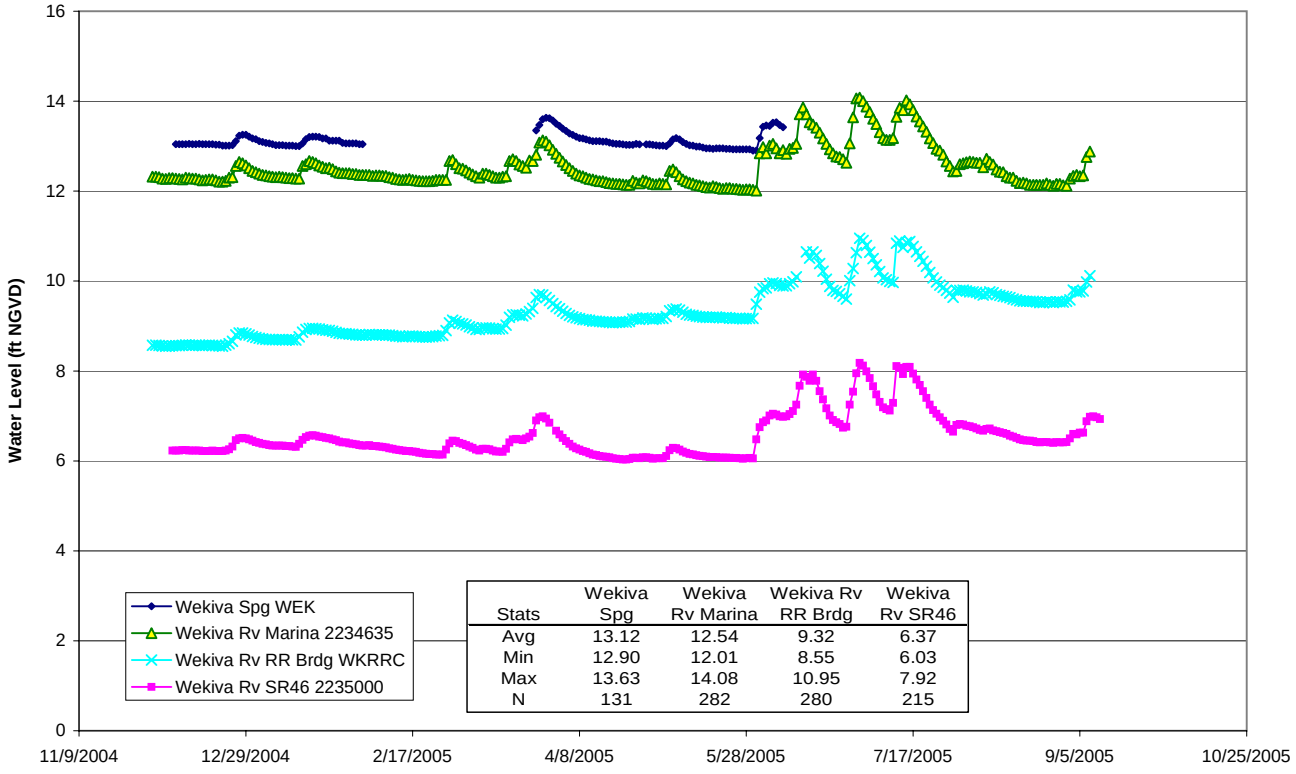
Stage and flow data for the Little Wekiva River stations during the study period are illustrated in **Figure 3-4**. The Little Wekiva River contributed an average of about 11% of the Wekiva River flow measured downstream at SR 46. Discharge is very flashy in response to rainfall events in this urban watershed.

TABLE 3-1

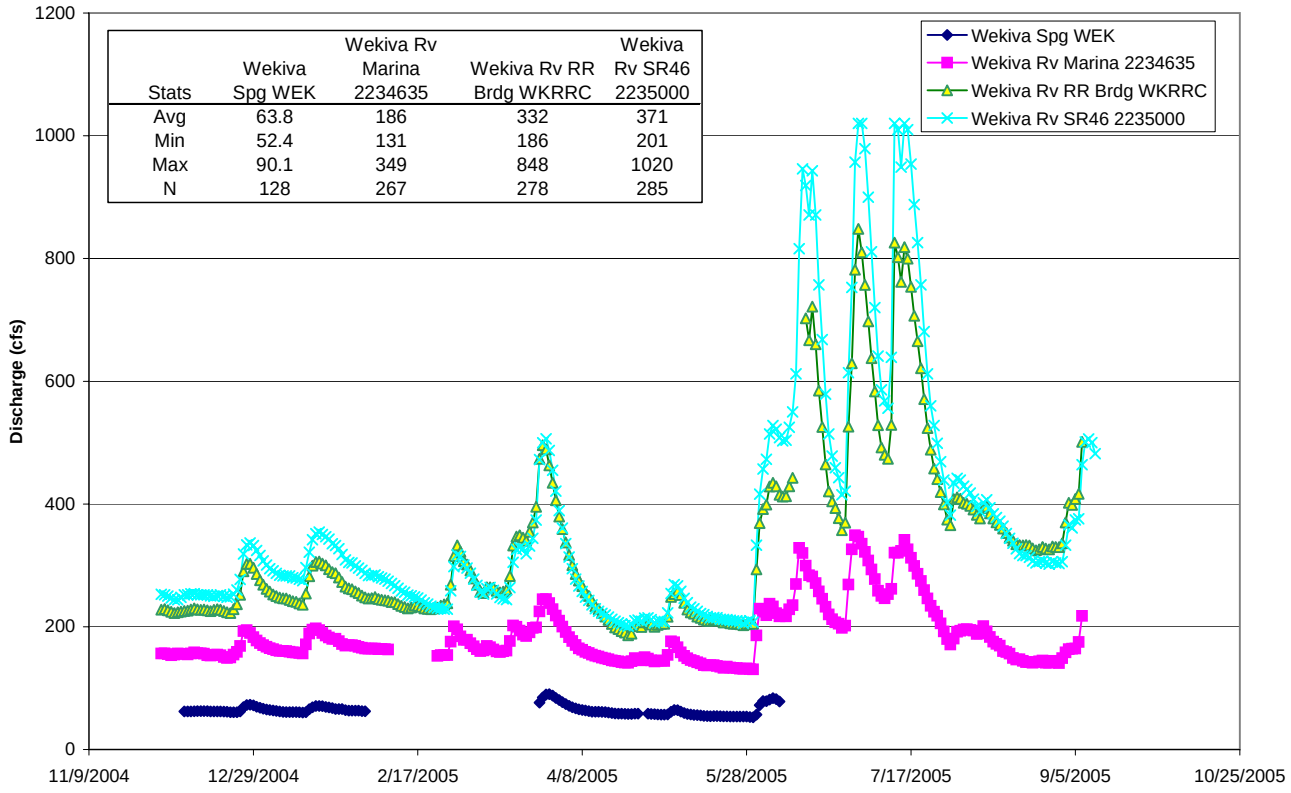
WEKIVA PLRG - STAGE / DISCHARGE SUMMARY FOR STUDY PERIOD

Station Name	Station ID	Stage (ft NGVD)				Discharge (cfs)			
		Avg	Min	Max	N	Avg	Min	Max	N
Wekiva Spg	WEK	13.1	12.9	13.6	131	63.8	52.4	90.1	128
Wekiva Rv Marina	2234635	12.5	12.0	14.1	282	186	131	349	267
Wekiva Rv RR Brdg	WKRRC	9.32	8.55	11.0	280	332	186	848	278
Wekiva Rv SR46	2235000	6.57	6.03	8.18	278	371	201	1,020	285
Rock Spg	ROX	26.5	26.3	26.6	189	69.5	64.6	72.1	186
Rock Spg Run	RSR-MB2	13.0	12.5	14.1	282	59.4	51.5	77.4	282
Juniper Crk	JC-MB1	23.6	23.4	24.1	283	92.2	88.5	102	283
Juniper Crk - SR19	JC-MB2	5.50	5.28	6.25	283	130	62.7	149	283
Alexander Spg	ALX	12.1	11.5	12.3	7	118	104	124	8
Alexander Spg	ASC-MB1	10.9	10.6	11.4	92	108	103	118	92
Alex Spg Run CR445	ALXCR445	11.4	10.6	12.0	174	127	90.9	179	167
Alex Spg Tracy Cnl	ALXTRACY	4.96	4.29	5.45	111	149	113	193	106
Lt Wekiva Rv	2234990	24.3	23.4	27.6	285	41.7	5.41	244	285

ALXCR445 - unknown datum

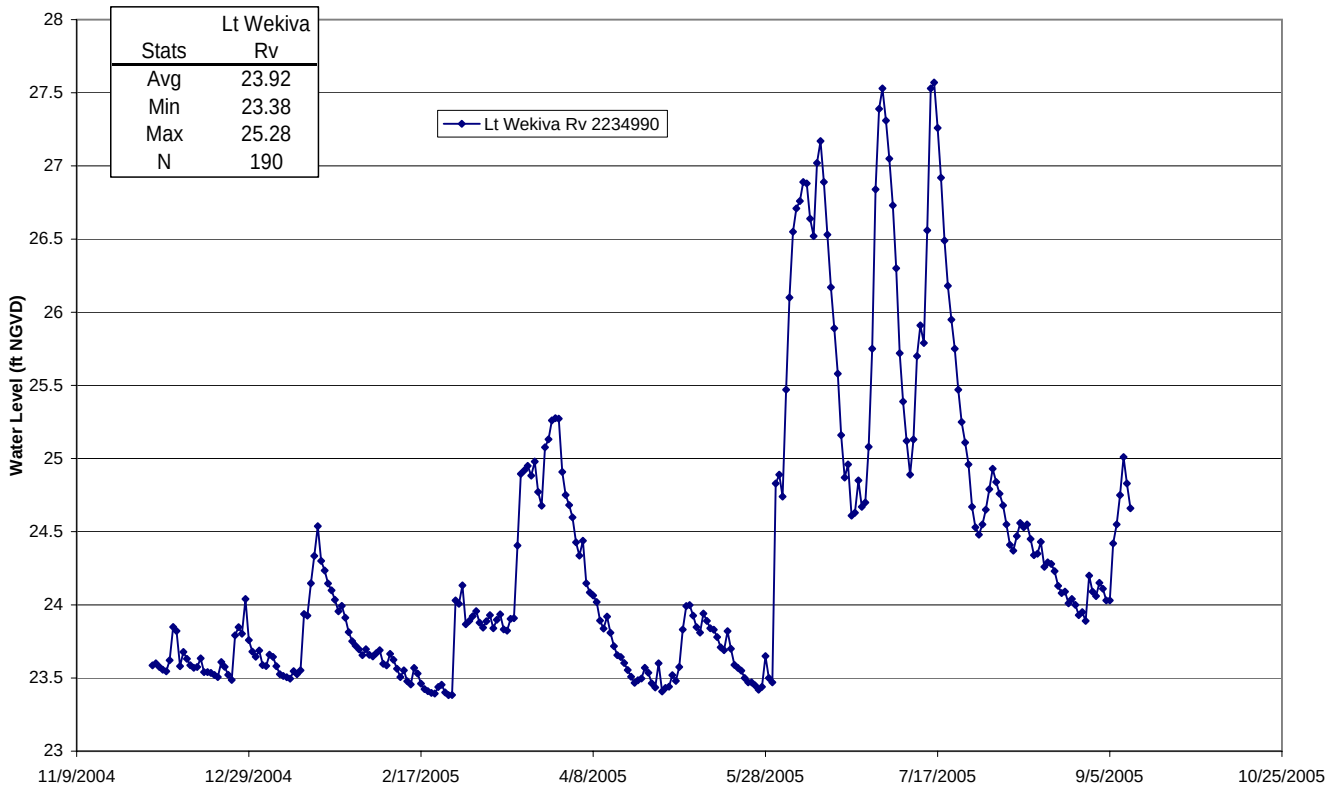


Stats	Wekiva Spg	Wekiva Rv Marina	Wekiva Rv RR Brdg	Wekiva Rv SR46
Avg	13.12	12.54	9.32	6.37
Min	12.90	12.01	8.55	6.03
Max	13.63	14.08	10.95	7.92
N	131	282	280	215



Stats	Wekiva Spg WEK	Wekiva Rv Marina 2234635	Wekiva Rv RR Brdg WKRRC	Wekiva Rv SR46 2235000
Avg	63.8	186	332	371
Min	52.4	131	186	201
Max	90.1	349	848	1020
N	128	267	278	285

FIGURE 3-3
WEKIVA RIVER STAGE AND DISCHARGE MEASUREMENTS DURING THE PLRG STUDY PERIOD



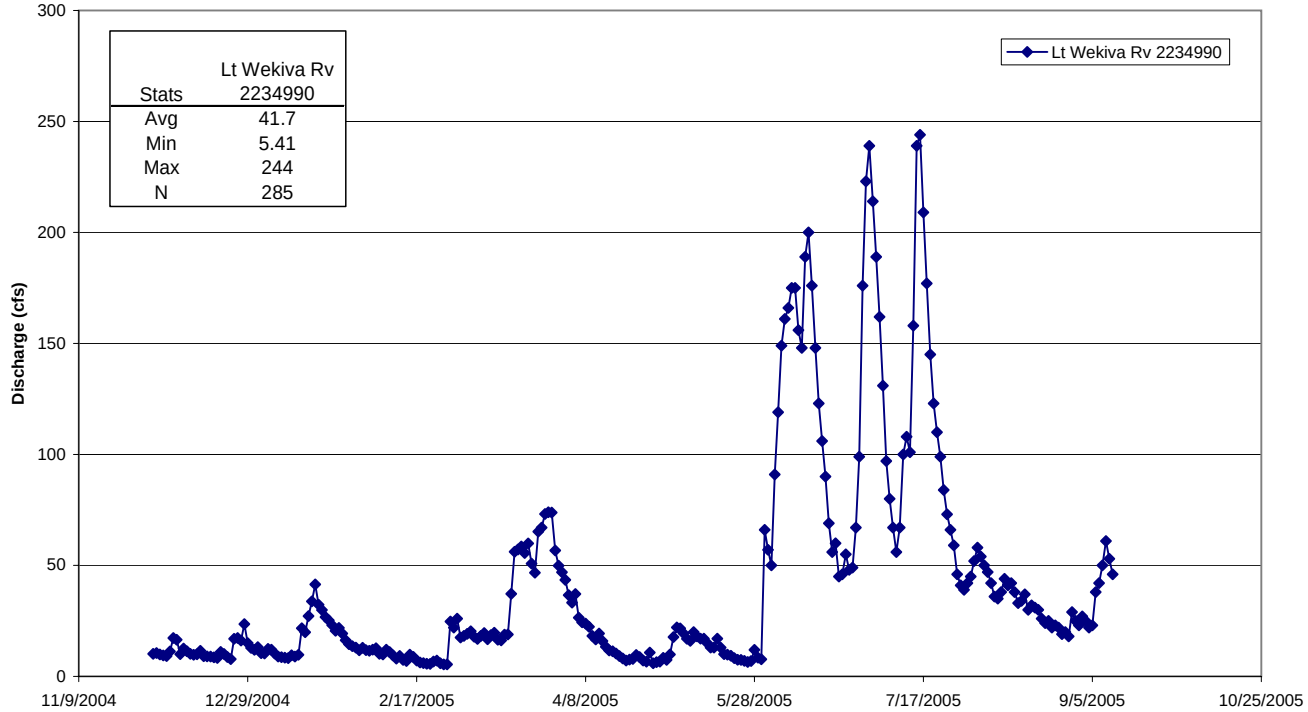


FIGURE 3-4
LITTLE WEKIVA RIVER STAGE AND DISCHARGE MEASUREMENTS DURING THE PLRG STUDY PERIOD

3.3.4 Rock Springs Run

Stage and flow data for the Rock Springs Run stations during the study period are illustrated in **Figure 3-5**. Rock Springs Run contributed an average of about 16% of the Wekiva River flow measured downstream at the SR 46 bridge. Response of stage and discharge is less dramatic in Rock Springs Run's natural watershed compared to the Little Wekiva River (**Figure 3-4**).

3.3.5 Juniper Creek

Stage and flow data for the Juniper Creek stations during the study period are illustrated in **Figure 3-6**. Estimated flows in Juniper Creek were relatively constant compared to the other water bodies.

3.3.6 Alexander Springs Creek

Stage and flow data for the Alexander Springs Creek stations during the study period are illustrated in **Figure 3-7**. Flows in the upper portion of Alexander Springs Creek were relatively constant except for one event in late March 2005. Downstream flows were more responsive to rainfall events but not to the extent observed at Little Wekiva River in the urban watershed.

3.4 Water Quality

Water quality data for all of the mass balance and stream segment stations are combined and summarized in **Table 3-2** by stream reach. Detailed water quality data are provided in **Appendix D**. The section that follows provides additional descriptions of the water quality observed in each of the stream reaches studied in the Wekiva River System and in the reference streams during the study period from mid-December 2004 through August 2005.

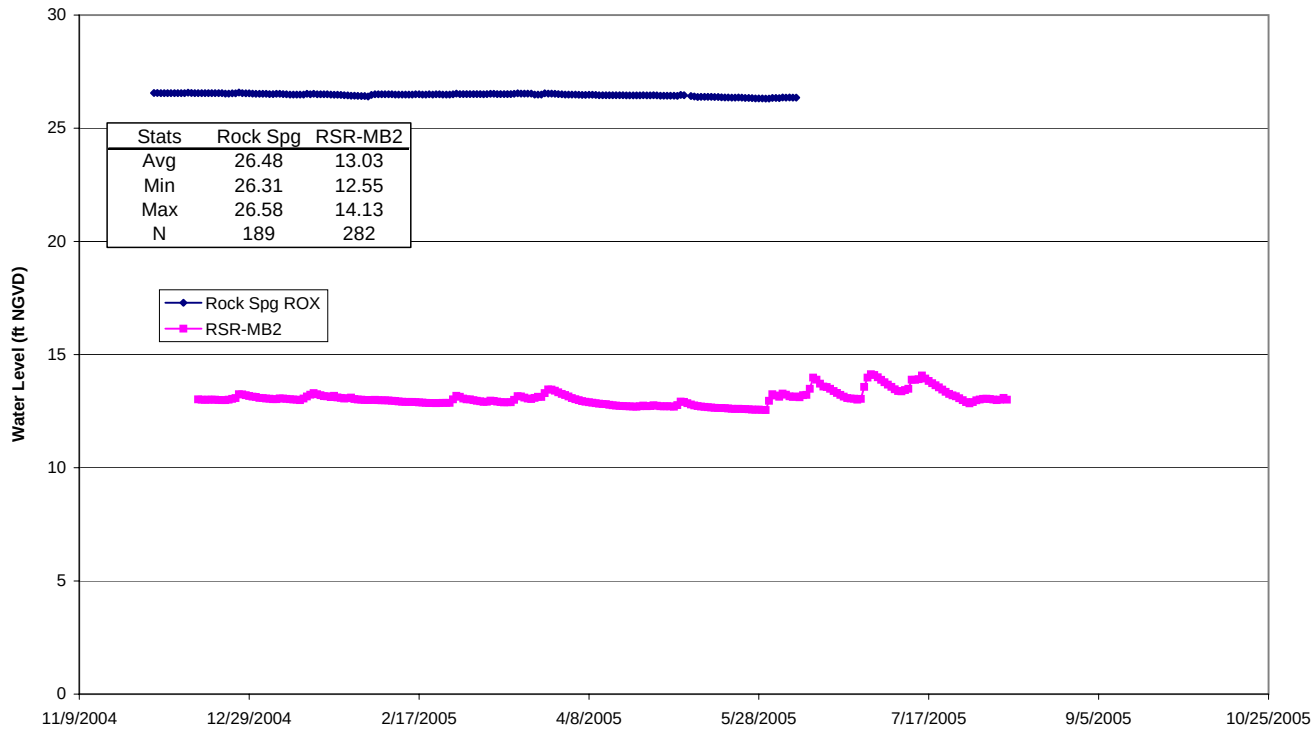
3.4.1 Comparison of Stream Reaches

The data summarized in **Table 3-2** allow a comparison of water quality across the streams of interest.

Average water temperature in all five stream reaches was similar between 23.1 and 24.9 oC. This is not surprising since all of these streams are dominated by spring flow.

The range of average dissolved oxygen concentrations for the streams was more variable with a low of 3.94 mg/L in the Wekiva River and a high of 7.02 mg/L in Juniper Creek. Minimum dissolved oxygen concentrations were much lower in the upper portions of the Wekiva River, Rock Springs Run, and Alexander Springs Creek (0.36 to 1.55 mg/L) compared to Juniper Creek (5.23 mg/L). While the water quality samples for Juniper Creek were collected downstream of the main boil, measurements in the Juniper Springs main boil confirmed that it has an unusually high dissolved oxygen concentration compared to other springs in Florida.

The hydrogen ion concentration measured as pH was relatively similar across these streams with a range of average values from about 7.3 s.u. in Rock Springs run to 7.9 s.u. in Juniper Creek. Minimum and maximum pH values recorded were 6.4 s.u. in Rock Springs Run and 8.9 s.u. in Alexander Springs Creek.



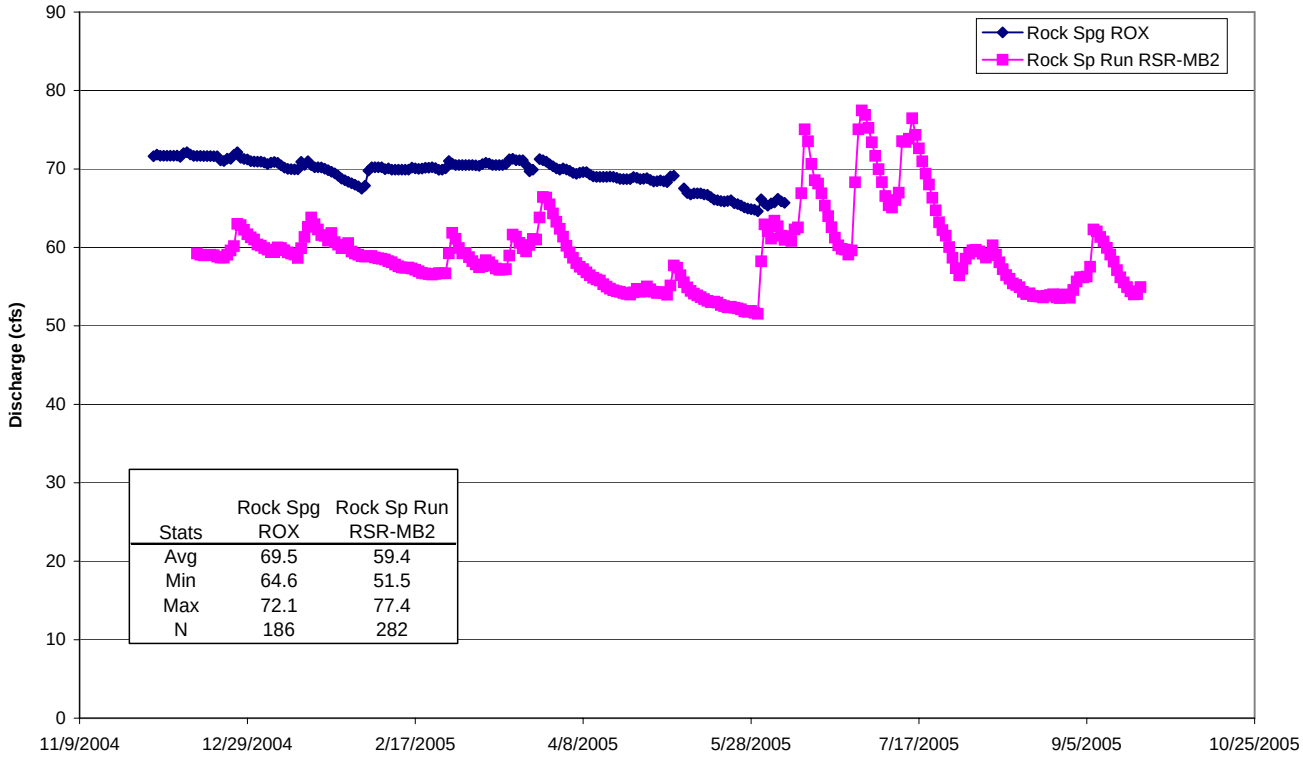
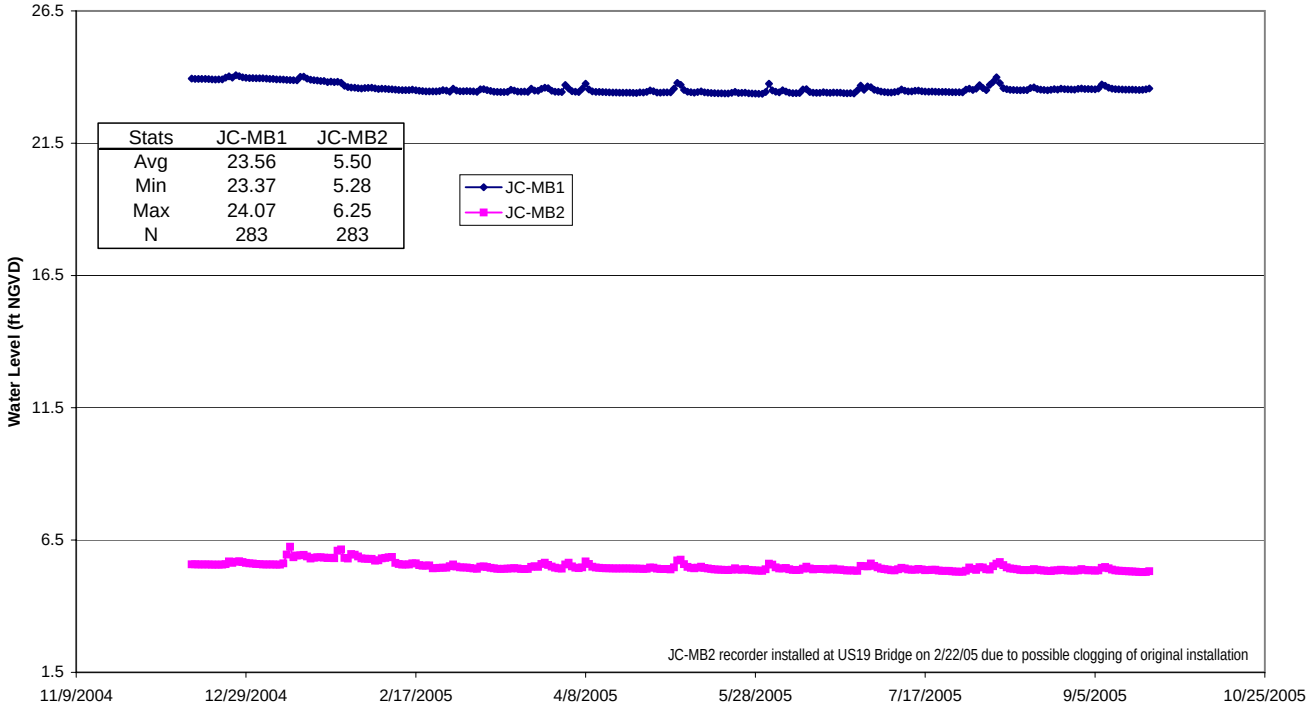


FIGURE 3-5
ROCK SPRINGS RUN STAGE AND DISCHARGE MEASUREMENTS DURING THE PLRG STUDY PERIOD



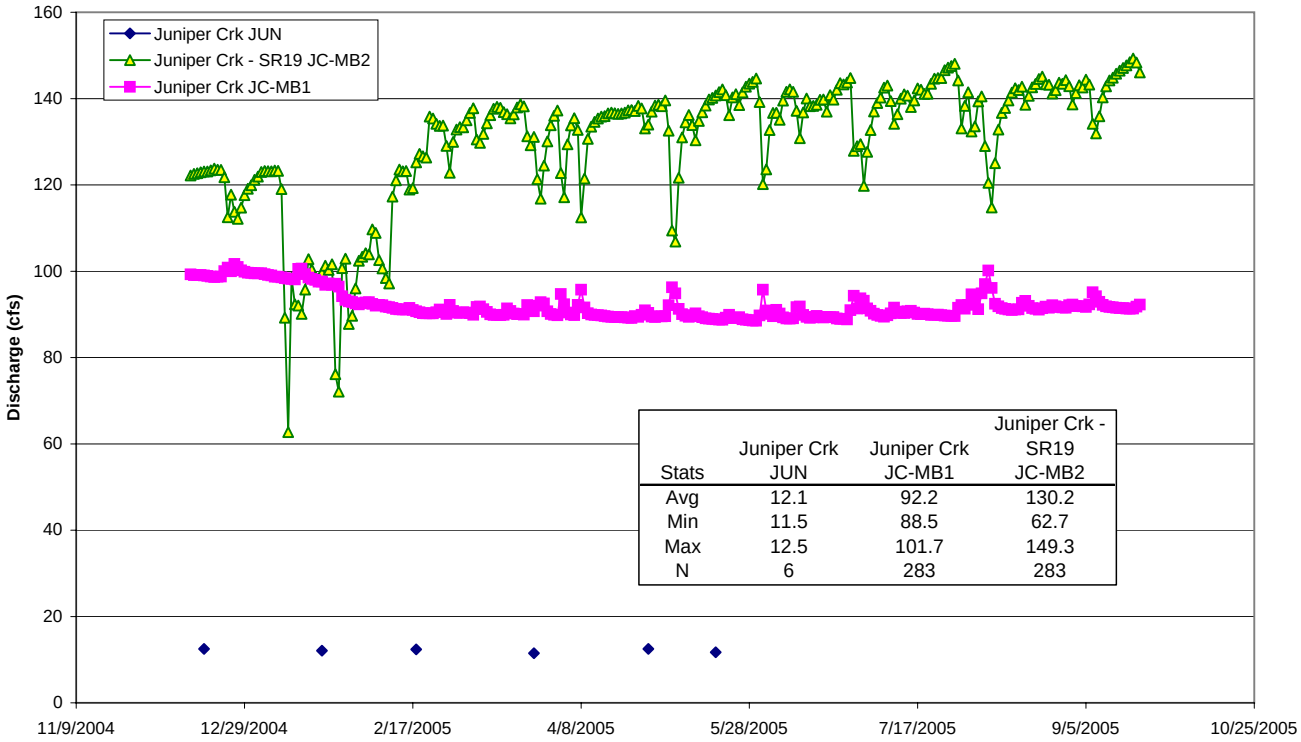
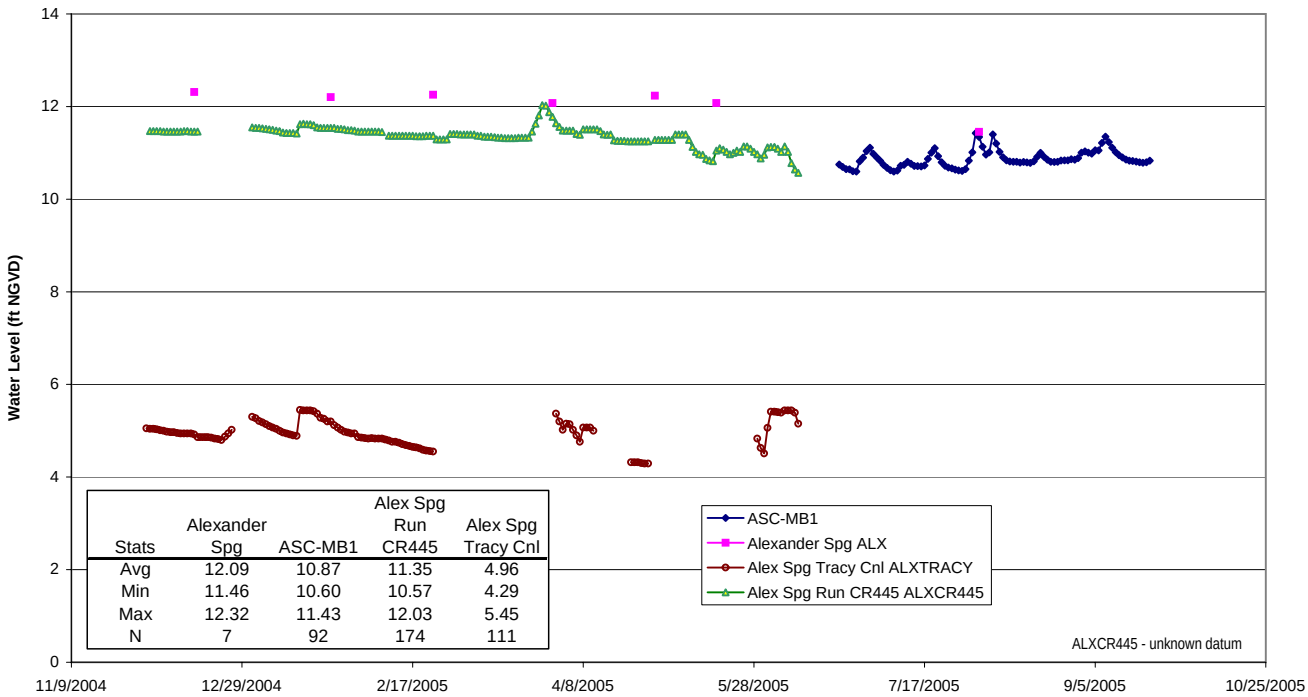
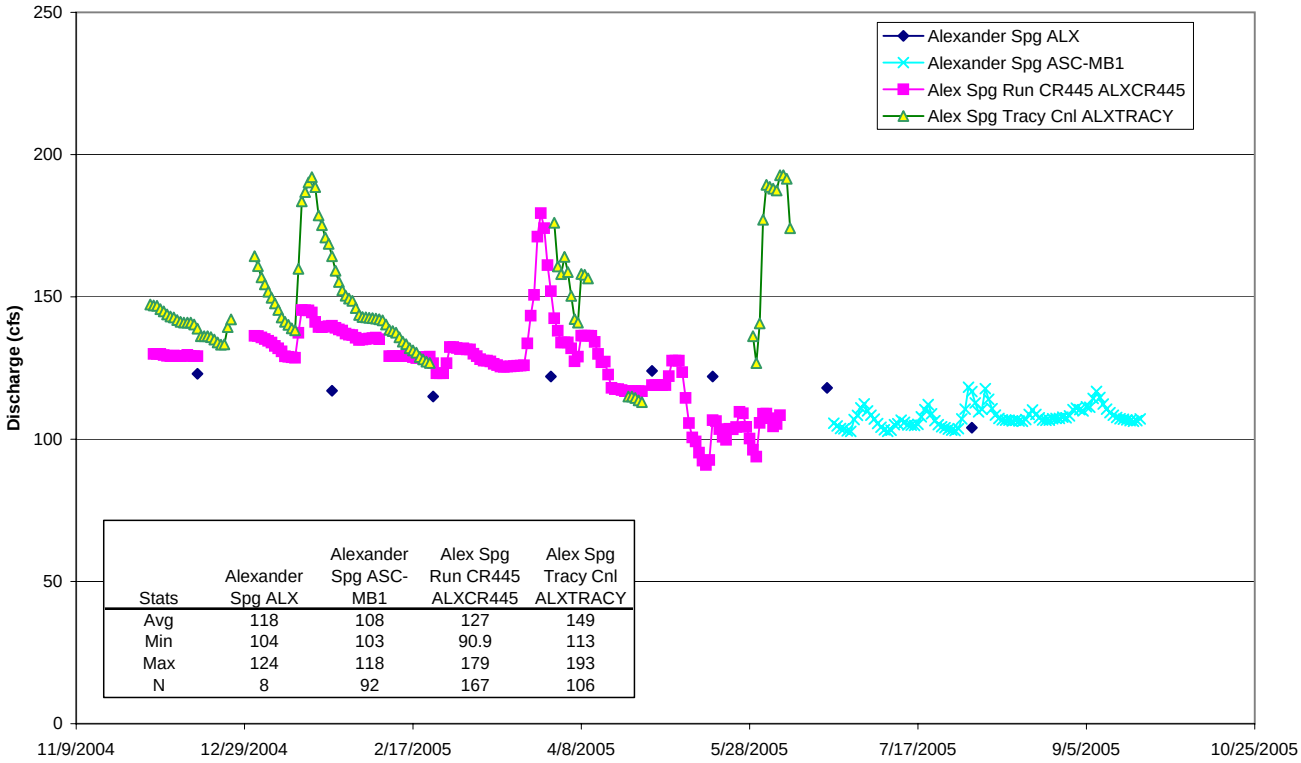


FIGURE 3-6
JUNIPER CREEK STAGE AND DISCHARGE MEASUREMENTS DURING THE PLRG STUDY PERIOD



Stats	Alexander Spg	ASC-MB1	Alex Spg Run CR445	Alex Spg Tracy Cnl
Avg	12.09	10.87	11.35	4.96
Min	11.46	10.60	10.57	4.29
Max	12.32	11.43	12.03	5.45
N	7	92	174	111



Stats	Alexander Spg ALX	Alexander Spg ASC-MB1	Alex Spg Run CR445 ALXCR445	Alex Spg Tracy Cnl ALXTRACY
Avg	118	108	127	149
Min	104	103	90.9	113
Max	124	118	179	193
N	8	92	167	106

FIGURE 3-7
ALEXANDER SPRINGS CREEK STAGE AND DISCHARGE MEASUREMENTS DURING THE PLRG STUDY PERIOD

TABLE 3-2

WATER QUALITY SUMMARIZED BY STREAM REACH - WEKIVA PLRG (DECEMBER 2004 - AUGUST 2005)

			Wekiva River				Rock Spring Run				Little Wekiva River				Alexander Spring Creek				Juniper Creek			
Parameter Group	Parameter	Units	Avg	Max	Min	N	Avg	Max	Min	N	Avg	Max	Min	N	Avg	Max	Min	N	Avg	Max	Min	N
Temperature	Temp	C	24.9	29.5	18.8	31	23.4	28.6	14.8	30	24.8	28.2	21.3	9	24.4	27.5	18.2	22	23.1	25.1	19.2	22
Dissolved Oxygen	DO	%	45.0	144	4.80	26	46.0	93.0	13.8	19	57.1	65.0	47.2	9	58.7	118	18.4	20	82.0	97.8	62.0	20
		mg/L	3.94	11.3	0.360	29	4.22	7.79	1.12	28	4.74	5.46	3.85	9	5.02	9.49	1.55	20	7.02	8.50	5.23	20
Physical	pH	SU	7.51	8.47	7.17	31	7.27	8.03	6.40	30	7.44	7.65	7.16	9	7.71	8.95	6.74	22	7.89	8.63	7.00	22
	Cond	uS/cm	367	520	294	26	250	367	226	19	294	326	245	9	781	1,022	505	20	1,246	1,620	106	20
	Sp Cond	uS/cm	367	509	300	31	251	382	211	30	297	332	231	9	816	1,093	491	22	1,184	1,656	114	22
	Color	cpu	52.8	200	2.50	28	164	600	5.00	28	27.5	50.0	7.50	9	183	1,280	0.00	20	58.5	280	0.00	20
	TURB	ntu	1.37	4.70	0.00	28	1.11	4.10	0.025	28	1.52	3.10	0.400	9	1.45	6.20	0.050	20	0.625	1.40	0.250	20
Oxygen Demand	BOD	mg/L	0.766	2.40	0.050	25	0.665	1.50	0.200	19	1.72	5.60	0.450	9	0.695	4.40	0.150	20	1.24	4.30	0.100	20
Solid	TSS	mg/L	2.75	11.0	0.00	28	1.23	5.00	0.00	28	1.75	5.00	0.00	8	1.68	5.00	0.00	20	1.68	4.00	0.00	20
	TDS	mg/L	231	310	179	30	179	283	125	30	163	202	98.0	9	498	606	339	22	688	969	62.7	22
	VSS	mg/L	3.56	9.00	0.00	25	1.71	5.00	0.00	19	4.89	18.0	0.500	9	3.30	8.00	0.00	20	2.65	6.00	0.500	20
General Inorganic	ALK	mg/L	111	121	89.9	30	90.6	102	80.4	30	105	121	78.5	9	66.4	89.7	42.0	22	51.4	58.6	44.0	22
	Cl -	mg/L	32.3	69.4	13.4	31	11.9	19.5	8.30	30	22.8	27.2	20.9	9	195	265	116	23	280	445	3.50	24
	SILICA	mg/L	10.9	14.4	9.10	25	12.1	19.8	2.51	28	7.67	8.90	5.80	9	10.4	16.1	6.50	20	9.57	11.9	7.60	20
	SO4	mg/L	28.6	49.7	2.22	30	25.3	74.0	0.200	30	19.4	22.5	13.7	9	53.5	69.6	32.7	21	91.7	151	3.85	22
	TC	mg/L	33.9	48.3	6.51	28	32.8	61.0	13.4	28	32.5	39.7	29.0	9	27.8	44.8	19.9	20	17.9	28.6	10.1	20
General Organic	DOC	mg/L	7.57	22.3	0.00	25	16.6	45.0	0.00	28	6.89	10.8	1.88	9	12.0	35.1	0.00	20	4.43	17.1	0.00	20
Nitrogen	NH3	mg/L	0.007	0.059	-0.009	27	0.028	0.150	0.0005	28	0.024	0.051	0.005	9	0.006	0.018	0.002	20	0.005	0.011	0.003	20
	NO2 + NO3	mg/L	0.775	1.44	0.127	31	0.643	1.68	0.006	30	0.539	1.31	0.230	9	0.024	0.142	0.002	23	0.038	0.097	0.006	24
	TKN	mg/L	0.485	1.25	0.050	29	0.687	1.64	0.045	28	0.426	0.730	0.230	8	0.409	1.16	0.050	21	0.217	0.580	0.025	22
	TN	mg/L	1.22	1.75	0.637	29	1.26	1.66	0.757	28	0.869	1.04	0.689	8	0.432	1.18	0.099	21	0.252	0.631	0.070	22
Phosphorus	SRP	mg/L	0.121	0.161	0.096	25	0.100	0.171	0.073	19	0.143	0.216	0.063	9	0.042	0.056	0.003	20	0.016	0.025	0.008	20
	TP/D/SPEC	mg/L	0.124	0.151	0.097	25	0.106	0.176	0.075	19	0.152	0.213	0.085	8	0.052	0.072	0.043	19	0.022	0.034	0.010	19
	TP/T/SPEC	mg/L	0.132	0.220	0.102	30	0.112	0.213	0.061	30	0.171	0.234	0.138	9	0.053	0.095	0.040	22	0.024	0.047	0.008	22
Metal	CA/T/ICP	mg/L	39.9	45.5	35.4	29	34.1	53.5	26.7	30	37.1	44.1	28.3	9	37.0	49.1	23.5	22	42.9	58.8	12.3	22
	FE/T/ICP	ug/L	73.3	338	2.00	26	183	624	4.40	28	81.9	155	28.0	9	113	430	2.20	20	43.4	82.9	13.8	20
	MG/T/ICP	mg/L	11.5	14.0	8.60	29	9.62	13.3	7.51	30	9.16	12.2	5.45	9	16.3	21.3	10.1	22	23.0	33.4	4.22	22
	NA/T/ICP	mg/L	17.6	34.9	8.73	29	5.94	9.57	4.90	21	13.0	17.4	11.5	9	108	134	67.7	22	173	278	2.38	22

Notes:

Statistics calculated using half the detection limit when reported below the detection limit

Specific conductance is quite different between the five streams. The lowest average value of 251 µS/cm was recorded in Rock Springs Run while the highest were recorded in Juniper Creek at 1,184 µS/cm and 816 µS/cm in Alexander Springs Creek. These differences are apparently due to proximity of the reference streams to the St. Johns River and its direct connection with and influence from the Atlantic Ocean. Total dissolved solids, chlorides, sodium, and sulfate showed a pattern in these streams similar to specific conductance.

Color (naturally occurring lignins and tannins from surrounding swamp forest areas) was somewhat elevated in all five of the stream reaches during this relatively wet study period. Average color values ranged from a low of 27.5 cpu in the Little Wekiva River to a high of 183 cpu in Alexander Springs Creek. Minimum color values were quite low (< 7.5cpu) in all streams, especially in the head waters near the head springs. Dissolved organic carbon followed a patter similar to color in these streams with average concentrations recorded between 4.4 and 16.6 mg/L.

Concentrations of particulates as measured by total suspended solids and volatile suspended solids were low in all of the studied streams (all average values less than 2.8 mg/L).

Average alkalinity was highest in the Wekiva River (111 mg/L as $CaCO_3$) and lowest in Juniper Creek (51.4 mg/L as $CaCO_3$). Average calcium concentrations were similar between all streams, with average values ranging from about 34 to 43 mg/L. Average silica concentrations varied from 7.7 to 12.1 mg/L. Iron varied from 43 to 183 mg/L. Average magnesium concentrations varied between 9.2 and 23 mg/L.

Average total nitrogen concentrations were variable between streams with highest values recorded in Rock Springs Run (1.26 mg/L) and the Wekiva River (1.22 mg/L) and lowest concentrations recorded at the two reference sites (Juniper Creek – 0.25 mg/L and Alexander Springs Creek – 0.43 mg/L). Average total nitrogen in the Little Wekiva River was intermediate at 0.87 mg/L. Average organic nitrogen concentrations ranged from 0.21 mg/L in Juniper Creek to 0.66 mg/L in Rock Springs Run. Average ammonia nitrogen was relatively low in the reference streams (0.005 to 0.006 mg/L) and in the Wekiva River (0.007 mg/L) and somewhat elevated in Rock Springs Run (0.028 mg/L) and in the Little Wekiva River (0.024 mg/L). Average nitrate + nitrite nitrogen concentrations were elevated in the Wekiva River (0.78 mg/L), Rock Springs Run (0.64 mg/L), and in the Little Wekiva River 0.54 mg/L), and were much lower in the two reference streams (0.02 mg/L in Alexander Springs Creek and 0.04 in Juniper Creek).

Average total phosphorus concentrations were highest in the Little Wekiva River (0.171 mg/L), the Wekiva River (0.132 mg/L), and in Rock Springs Run (0.112 mg/L), and were lowest in Juniper Creek (0.024 mg/L) and Alexander Springs Creek (0.053 mg/L).

3.4.2 Wekiva River

Table 3-3 summarizes the data from the individual Wekiva River water quality stations for the study period. Detailed data are provided in **Appendix D**. Average water temperature increased downstream from about 23.9 ^{o}C upstream at Wekiwa Spring to 25 to 26 ^{o}C downstream. The average dissolved oxygen concentration and percent saturation increased markedly from 0.45 mg/L (5.4%) at Wekiwa Springs, to 2.1 mg/L

TABLE 3-3

WEKIVA RIVER SEGMENT WATER QUALITY SUMMARY - WEKIVA PLRG (DECEMBER 2004 - AUGUST 2005)

Parameter Group	Parameter	Units	WR-MB1 / SEG1-Up	WR-SEG1-Down	WR-SEG2-Up	WR-MB2 / SEG2-Down
Temperature	Temp	C	23.9	24.9	26.3	25.4
Dissolved Oxygen	DO	%	5.45	25.7	76.7	88.4
		mg/L	0.450	2.11	6.20	6.96
Physical	pH	SU	7.33	7.44	7.67	7.68
	Cond	uS/cm	310	304	472	417
	Sp Cond	uS/cm	321	307	465	402
	Color	cpu	5.83	26.3	70.0	94.5
	TURB	ntu	0.139	0.313	2.18	2.47
Oxygen Demand	BOD	mg/L	0.361	0.588	1.06	1.16
Solid	TSS	mg/L	1.22	2.25	3.25	4.00
	TDS	mg/L	191	196	303	257
	VSS	mg/L	2.33	2.75	3.75	5.25
General Inorganic	ALK	mg/L	120	118	106	102
	Cl -	mg/L	16.0	15.8	61.8	45.4
	SILICA	mg/L	10.4	10.4	10.8	11.6
	SO4	mg/L	21.6	21.3	43.7	32.8
	TC	mg/L	33.0	37.7	37.2	32.1
General Organic	DOC	mg/L	2.04	5.37	9.58	13.9
Nitrogen	NH3	mg/L	0.005	0.005	0.003	0.010
	NO2 + NO3	mg/L	1.26	1.08	0.345	0.291
	TKN	mg/L	0.188	0.273	0.693	0.758
	TN	mg/L	1.43	1.36	1.04	1.05
Phosphorus	SRP	mg/L	0.131	0.125	0.111	0.114
	TP/D/SPEC	mg/L	0.125	0.126	0.123	0.122
	TP/T/SPEC	mg/L	0.126	0.150	0.126	0.133
Metal	CA/T/ICP	mg/L	39.0	38.3	42.4	40.4
	FE/T/ICP	ug/L	4.49	33.7	82.8	140
	MG/T/ICP	mg/L	11.3	11.3	12.6	11.3
	NA/T/ICP	mg/L	9.43	9.33	32.0	24.2

Notes:

Statistics calculated using half the detection limit when reported below the detection limit

(26%) at the downstream end of Segment 1, to 7.0 mg/L (88%) at the SR 46 bridge. Also of note were increases in average concentrations of color, specific conductance, total suspended solids, and other relatively conservative parameters with travel distance downstream. While the concentration of organic nitrogen increased from upstream to downstream, the concentration of nitrate + nitrite nitrogen declined significantly from an average of 1.26 at the head spring to about 0.29 mg/L at SR 46. Average concentrations of total and inorganic phosphorus did not decline over this reach.

3.4.3 Rock Springs Run

Table 3-4 summarizes the data from the individual Rock Springs Run water quality stations for the study period. Detailed data are provided in **Appendix D**. Average water temperature declined slightly with travel distance downstream while dissolved oxygen rose quickly between the station in Kelly Park and the beginning of the upper segment (from 1.5 to 5.6 mg/L) and then stayed relatively constant through the remainder of the reach between 3.2 mg/L (38%) and 5.6 mg/L (68%). Color increased greatly downstream while there was little change in specific conductance. As was observed in the Wekiva River average organic nitrogen concentration increased from upstream to downstream (0.16 to 0.89 mg/L) while nitrate + nitrite nitrogen concentrations decreased from 1.3 to 0.24 mg/L. Total and inorganic phosphorus concentrations both increased with travel distance downstream in Rock Springs run.

3.4.4 Juniper Creek

Table 3-5 summarizes the data from the individual Juniper Creek water quality stations for the study period. Detailed data are provided in **Appendix D**. Average temperature and dissolved oxygen concentrations were relatively constant over the length of this river reach. Average values for specific conductance, color, hydrogen ion, chlorides, sulfate, dissolved carbon, calcium, iron, magnesium, and sodium all increased markedly from upstream to downstream. The average concentration of organic nitrogen increased slightly from upstream to downstream (0.19 to 0.21 mg/L) and nitrate + nitrite nitrogen concentration decreased from 0.08 to 0.02 mg/L. The net effect on the average total nitrogen concentration was no net change 0.27 to 0.26 mg/L. While ortho-phosphorus concentrations dropped some from upstream to downstream (0.023 to 0.015 mg/L) total phosphorus concentration did not show a similar drop (0.024 to 0.023 mg/L).

3.4.5 Alexander Springs Creek

Table 3-6 summarizes the data from the individual Alexander Springs Creek water quality stations for the study period. Detailed data are provided in **Appendix D**. The average water temperature did not change between the upstream and downstream ends of this reach (about 24 ^{o}C). The average dissolved oxygen concentration did increase markedly between the head spring (1.8 mg/l [22%]) and the CR 445 bridge (6.5 mg/L [80%]) and then declined downstream in response to the shaded area above ASC-MB-2. The average specific conductance (1,014 to 695 µS/cm) and chloride (235 to 173 mg/L) concentrations declined with distance downstream as color (7 to 311 cpu) and dissolved organic carbon (0.52 to 18.1 mg/L) increased markedly. These changes are indicative of dilution by rainfall and runoff. The average concentration of total nitrogen increased (0.22 to 0.58 mg/L) in response to this input of dissolved organic nitrogen while average

TABLE 3-4
ROCK SPRING RUN SEGMENT WATER QUALITY SUMMARY - WEKIVA PLRG (DECEMBER 2004 - AUGUST 2005)

Parameter Group	Parameter	Units	RSR-MB1	RSR-SEG1-UP	RSR-SEG1-DOWN	RSR-SEG2-UP	SEG2-DOWN	RSR-MB2
Temperature	Temp	C	24.0	25.0	24.3	24.4	24.9	20.8
Dissolved Oxygen	DO	%	18.2	68.2	57.5	37.6	41.8	---
		mg/L	1.53	5.65	4.82	3.20	3.52	4.98
Physical	pH	SU	7.81	7.70	7.66	6.98	7.11	6.84
	Cond	uS/cm	236	237	235	268	270	---
	Sp Cond	uS/cm	241	239	240	272	273	244
	Color	cpu	8.33	50.0	53.8	258	285	220
	TURB	ntu	0.042	0.588	0.450	1.24	1.80	1.64
Oxygen Demand	BOD	mg/L	0.507	0.590	0.613	0.700	0.875	---
Solid	TSS	mg/L	1.00	0.500	0.750	1.50	2.38	1.22
	TDS	mg/L	146	143	149	207	212	199
	VSS	mg/L	2.00	2.13	1.13	1.38	2.00	---
General Inorganic	ALK	mg/L	92.3	91.0	92.1	89.6	91.1	89.2
	Cl -	mg/L	8.93	9.53	9.38	14.8	14.9	13.2
	SILICA	mg/L	10.7	11.4	11.6	16.5	16.3	9.18
	SO4	mg/L	19.2	19.0	20.3	28.9	28.4	30.8
	TC	mg/L	23.1	28.7	29.3	51.4	50.5	23.3
General Organic	DOC	mg/L	0.507	4.60	5.14	29.3	29.4	21.2
Nitrogen	NH3	mg/L	0.005	0.006	0.005	0.079	0.052	0.022
	NO2 + NO3	mg/L	1.31	1.13	1.06	0.155	0.159	0.238
	TKN	mg/L	0.167	0.219	0.298	1.05	1.08	0.908
	TN	mg/L	1.47	1.36	1.35	1.20	1.24	1.15
Phosphorus	SRP	mg/L	0.084	0.087	0.085	0.114	0.125	---
	TP/D/SPEC	mg/L	0.085	0.088	0.086	0.132	0.132	---
	TP/T/SPEC	mg/L	0.088	0.093	0.095	0.138	0.137	0.121
Metal	CA/T/ICP	mg/L	29.6	29.9	31.9	37.3	37.5	36.4
	FE/T/ICP	ug/L	5.70	41.3	53.0	313	311	250
	MG/T/ICP	mg/L	9.11	9.03	9.52	9.87	9.93	9.97
	NA/T/ICP	mg/L	5.17	5.11	5.27	7.14	7.21	---

Notes:
Statistics calculated using half the detection limit when reported below the detection limit

TABLE 3-5

JUNIPER CREEK SEGMENT WATER QUALITY SUMMARY - WEKIVA PLRG (DECEMBER 2004 - AUGUST 2005)

Parameter Group	Parameter	Units	JC-MB1	JC-SEG1-Up	JC-MB2 / SEG1-Down
Temperature	Temp	C	22.2	23.6	23.2
Dissolved Oxygen	DO	%	78.9	91.1	80.0
		mg/L	6.85	7.75	6.84
Physical	pH	SU	8.38	7.86	7.71
	Cond	uS/cm	109	1,291	1,495
	Sp Cond	uS/cm	116	1,340	1,547
	Color	cpu	5.00	56.3	71.5
	TURB	ntu	0.433	0.575	0.684
Oxygen Demand	BOD	mg/L	0.367	1.99	1.21
Solid	TSS	mg/L	0.833	2.63	1.58
	TDS	mg/L	71.8	764	901
	VSS	mg/L	1.83	3.50	2.58
General Inorganic	ALK	mg/L	44.3	50.8	54.2
	Cl -	mg/L	4.18	320	386
	SILICA	mg/L	9.32	9.70	9.59
	SO4	mg/L	9.22	107	119
	TC	mg/L	11.0	19.2	19.2
General Organic	DOC	mg/L	0.343	4.92	5.22
Nitrogen	NH3	mg/L	0.005	0.005	0.006
	NO2 + NO3	mg/L	0.082	0.017	0.025
	TKN	mg/L	0.191	0.190	0.231
	TN	mg/L	0.271	0.207	0.260
Phosphorus	SRP	mg/L	0.023	0.017	0.015
	TP/D/SPEC	mg/L	0.023	0.021	0.023
	TP/T/SPEC	mg/L	0.029	0.025	0.023
Metal	CA/T/ICP	mg/L	13.2	48.5	52.7
	FE/T/ICP	ug/L	18.8	51.6	46.5
	MG/T/ICP	mg/L	4.70	26.0	29.1
	NA/T/ICP	mg/L	2.56	196	232

Notes:

Statistics calculated using half the detection limit when reported below the detection limit

TABLE 3-6

ALEXANDER SPRINGS CREEK SEGMENT WATER QUALITY SUMMARY - WEKIVA PLRG (DECEMBER 2004 - AUGUST 2005)

Parameter Group	Parameter	Units	ASC-MB1	ASC-SEG1-Up	ASC-SEG1-Down	ASC-MB2
Temperature	Temp	C	23.8	25.4	26.1	23.6
Dissolved Oxygen	DO	%	21.6	58.2	79.9	61.8
		mg/L	1.80	4.76	6.47	5.57
Physical	pH	SU	8.06	7.87	8.12	7.27
	Cond	uS/cm	966	813	865	668
	Sp Cond	uS/cm	1,014	808	852	695
	Color	cpu	6.67	98.8	110	311
	TURB	ntu	0.050	0.403	0.805	2.67
Oxygen Demand	BOD	mg/L	0.217	0.288	0.475	1.13
Solid	TSS	mg/L	0.667	0.500	2.50	2.17
	TDS	mg/L	586	519	531	426
	VSS	mg/L	2.00	3.50	3.60	3.50
General Inorganic	ALK	mg/L	81.2	65.9	68.1	57.7
	Cl -	mg/L	235	195	201	173
	SILICA	mg/L	9.21	10.3	9.73	11.2
	SO4	mg/L	64.7	56.0	57.6	45.7
	TC	mg/L	20.4	26.2	25.8	31.8
General Organic	DOC	mg/L	0.517	9.98	9.05	18.1
Nitrogen	NH3	mg/L	0.005	0.005	0.005	0.007
	NO2 + NO3	mg/L	0.039	0.016	0.012	0.024
	TKN	mg/L	0.177	0.313	0.305	0.559
	TN	mg/L	0.223	0.328	0.317	0.583
Phosphorus	SRP	mg/L	0.051	0.046	0.031	0.043
	TP/D/SPEC	mg/L	0.047	0.049	0.051	0.055
	TP/T/SPEC	mg/L	0.049	0.049	0.051	0.058
Metal	CA/T/ICP	mg/L	44.3	36.7	36.4	33.4
	FE/T/ICP	ug/L	4.50	77.5	65.6	185
	MG/T/ICP	mg/L	19.5	16.4	16.7	14.2
	NA/T/ICP	mg/L	130	108	111	93.4

Notes:

Statistics calculated using half the detection limit when reported below the detection limit

nitrate+nitrite nitrogen concentrations declined from 0.039 to 0.024 mg/L. Average concentrations of total phosphorus increased with distance downstream (0.049 to 0.058 mg/L).

3.5 Plant Communities

Semi-quantitative plant cover estimates for the six stream segments are summarized in **Table 3-7**. These data represent estimates based on difficult field conditions caused by the continued presence of colored water in all of the stream segments throughout the period of this study. Detailed plant community data for all of the transects in each stream segment study area are provided in **Appendix E**.

Benthic algae dominated the estimated submerged vegetation percent cover in the upstream Wekiva River (38%) and Rock Springs Run (20%) stream segments during the late spring of 2005. Downstream segments had lower estimated cover by benthic algae with 7.3% in the Wekiva River and none recorded in Rock Springs Run. Benthic and filamentous algae percent cover estimates were much lower in the reference stream segments with 1.8% in both Juniper Creek and Alexander Springs Creek.

Submerged aquatic vegetation was not observed at the downstream Rock Springs Run stream segment. At the remaining stations the estimated percent cover was lowest in the upper Wekiva River segment at 1.4%, followed by 4.2% in Juniper Creek, 4.5% in the upper segment of Rock Springs Run, 28% in the Wekiva River downstream segment, and 49% in the Alexander Springs Creek segment.

Emergent and floating aquatic plants made up from 9.8 to 17.2% of the plant cover recorded in the Wekiva River segments, and from 21 to 63% of the plant cover recorded in the Rock Springs Run segments. There were also very different proportions of these plant groups in Juniper Creek (2.8%) and in Alexander Springs Creek (28%).

Estimated tree canopy cover varied from 6 to 20% between stream segments with all of the streams having some significant canopy shading flooded areas. Estimated cover for shrubs, subcanopy trees, and vines were all low compared to other plant groups.

In terms of plant community development the upper segments in the Wekiva River and Rock Springs Run were most similar to each other, while the downstream segments of these streams were more similar to the reference sites. The lower segment of the Wekiva River was most similar to the segment in Alexander Springs Creek and the downstream segment of Rock Springs Run was most similar to the Juniper Creek segment.

3.6 Pollutant Mass Balances

3.6.1 Stream Reach Mass Balances

Estimated mass balances for each of the stream reaches are summarized in **Table 3-8**. With the exception of organic nitrogen, the Wekiva River and Rock Springs Run received higher estimated nutrient loads (total phosphorus and nitrate+nitrite nitrogen) than the reference streams. Estimated nutrient assimilation rates were negative in the Wekiva River and in Alexander Springs Creek for total phosphorus and nitrogen but were positive in all four of the streams for nitrate+nitrite nitrogen.

TABLE 3-7

WEKIVA PLRG SUMMARY OF SHRUB / HERBACEOUS PERCENT GROUND COVER

Species	Group	Segment								
		WR 1	WR 2	Average	RSR 1	RSR 2	Average	ASC	JC	Average
Benthic Algae	ALG	35.41		17.70	19.91		9.95	0.57	0.04	0.30
Filamentous Algae	ALG	1.58		0.79	0.29		0.15	1.20		0.60
Floating Algae	ALG	0.74		0.37	0.01		0.01			
Green Fil. Algae - Benthic	ALG								0.63	0.32
Nitella sp.	ALG		7.32	3.66						
Periphyton	ALG								1.15	0.58
Alternanthera philoxeroides	EMA	0.07	4.85	2.46		1.10	0.55			
Bacopa sp.	EMA								0.01	0.01
Cicuta mexicana	EMA	2.90	0.90	1.90	8.71	14.64	11.67	15.77		7.89
Cladium jamaicense	EMA					0.25	0.13	0.10	0.38	0.24
Colocasia esculenta	EMA					10.73	5.36			
Emergent Grass - unidentified	EMA	0.18	0.01	0.09		0.80	0.40	0.03		0.02
Eupatorium capillifolium	EMA		0.01	0.00						
Ferns	EMA	0.50		0.25		0.09	0.05		0.10	0.05
Hibiscus sp.	EMA							0.25		0.13
Juncus sp.	EMA								0.01	0.01
Ludwigia peruviana	EMA		0.24	0.12	0.46		0.23	0.25		0.13
Mikania scandens	EMA	0.72	0.28	0.50	0.01	0.10	0.05	0.51	0.37	0.44
Peltandra virginica	EMA					0.10	0.05			
Pontederia cordata	EMA		0.57	0.28	0.73	5.63	3.18	0.53		0.26
Rumex vertigillatus	EMA					0.85	0.42			
Sagittaria latifolia	EMA					1.19	0.59	0.45		0.22
Saururus cernuus	EMA					0.59	0.30		0.00	0.00
Scirpus sp.	EMA				0.01	0.13	0.07	0.33	0.02	0.17
Sedge	EMA		0.00	0.00	0.05	0.50	0.27	0.25	0.03	0.14
Typha latifolia	EMA		2.28	1.14		0.25	0.12	0.70	0.29	0.49
Urtica dioica	EMA	0.66		0.33	0.04	0.08	0.06			
Zizania sp.	EMA					0.11	0.05			
Azolla caroliniana	FAP		0.27	0.14						
Eichhornia crassipes	FAP	0.54	2.89	1.72		19.55	9.78	2.50	1.32	1.91
Hydrocotyle ranunculoides	FAP	0.54	1.30	0.92		0.25	0.13			
Hydrocotyle umbellata	FAP	1.08	1.76	1.42	5.01	3.20	4.10	4.23	0.14	2.18
Lemna sp.	FAP	0.81	0.63	0.72	1.32	0.25	0.78			
Nuphar lutea	FAP	0.89	1.07	0.98	2.89	3.39	3.14	1.52		0.76
Pistia stratiotes	FAP	0.90	0.18	0.54	1.52		0.76	0.24	0.05	0.15
Salvinia molesta	FAP								0.05	0.03
Ceratophyllum demersum	SAV							0.07		0.03
Najas guadalupensis	SAV	1.45	1.64	1.54					0.04	0.02
Potamogeton sp.	SAV								4.16	2.08
Unknown SAV	SAV		0.04	0.02	0.74		0.37			
Vallisneria americana	SAV		26.19	13.10	3.76		1.88	48.51		24.25
Cephalanthus occidentalis	SHR		0.02	0.01		0.14	0.07			
Itea virginica	SHR				0.00		0.00			
Myrica cerifera	SHR	1.09	0.05	0.57		0.79	0.40	0.08	1.13	0.60
Sambucus canadensis	SHR					0.29	0.15			
Toxicodendron radicans	VINE		0.22	0.11						
Vitus sp.	VINE				0.08		0.04	0.02		0.01
ALG		37.73	7.32	22.52	20.21	0.00	10.11	1.77	1.82	1.80
EMA		5.03	9.13	7.08	10.00	37.11	23.55	19.16	1.22	10.19
FAP		4.77	8.11	6.44	10.73	26.65	18.69	8.50	1.56	5.03
SAV		1.45	27.87	14.66	4.49	0.00	2.25	48.58	4.21	26.39
SHR		1.09	0.07	0.58	0.00	1.22	0.61	0.08	1.13	0.60
VINE		0.00	0.22	0.11	0.08	0.00	0.04	0.02	0.00	0.01
TOTAL		50.07	52.72	51.39	45.52	64.99	55.25	78.10	9.94	44.02

TABLE 3-8

SUMMARY OF ESTIMATED NUTRIENT LOAD REDUCTION RATES IN THE WEKIVA RIVER SYSTEM AND REFERENCE STREAM REACHES - JANUARY-AUGUST 2005

		Inflow	Outflow		Inflow	Outflow	Inflow						Outflow		Removal		
		WR-MB1	WR-MB2	Rainfall	WR-MB1	WR-MB2	WR-MB1	Runoff	RSR	LWR	Total		WR-MB2				
Nutrient	Stream Reach	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
Total Phosphorus	Wekiva River	167,444	783,020	38.7	0.117	0.138	4,758	9,924	4,540	1,949	21,171	1.15	26,259	1.42	-5,089	-0.276	-24.0
	Rock Springs Run	167,917	146,727	38.7	0.082	0.127	3,331	8,271	--	--	11,602	1.27	4,540	0.497	7,062	0.774	60.9
	Juniper Creek	224,813	318,443	38.7	0.025	0.024	1,347	3,927	--	--	5,274	0.977	1,886	0.349	3,388	0.627	64.2
	Alexander Springs Creek	283,343	381,234	38.7	0.047	0.059	3,272	1,581	--	--	4,852	0.335	5,502	0.380	-649	-0.045	-13.4
Total Nitrogen	Wekiva River	167,444	783,020	38.7	1.44	1.08	58,602	77,711	40,948	10,836	188,097	10.2	206,172	11.2	-18,075	-0.979	-9.61
	Rock Springs Run	167,917	146,727	38.7	1.46	1.14	59,525	61,444	--	--	120,969	13.3	40,948	4.49	80,021	8.77	66.1
	Juniper Creek	224,813	318,443	38.7	0.304	0.274	16,608	42,047	--	--	58,654	10.9	21,300	3.94	37,355	6.92	63.7
	Alexander Springs Creek	283,343	381,234	38.7	0.228	0.615	15,703	15,063	--	--	30,766	2.12	57,341	3.96	-26,575	-1.83	-86.4
Total Kjeldahl Nitrogen	Wekiva River	167,444	783,020	38.7	0.183	0.815	7,489	48,882	33,515	6,296	96,183	5.21	155,312	8.41	-59,130	-3.20	-61.5
	Rock Springs Run	167,917	146,727	38.7	0.144	0.936	5,877	40,091	--	--	45,968	5.04	33,515	3.67	12,453	1.36	27.1
	Juniper Creek	224,813	318,443	38.7	0.225	0.253	12,248	29,399	--	--	41,647	7.71	19,658	3.64	21,989	4.07	52.8
	Alexander Springs Creek	283,343	381,234	38.7	0.191	0.604	13,180	9,956	--	--	23,136	1.60	56,233	3.88	-33,097	-2.28	-143
Nitrate+Nitrite Nitrogen	Wekiva River	167,444	783,020	38.7	1.30	0.267	53,031	18,877	7,390	4,540	83,838	4.54	50,700	2.75	33,139	1.79	39.5
	Rock Springs Run	167,917	146,727	38.7	1.50	0.208	61,220	14,602	--	--	75,822	8.31	7,390	0.809	68,432	7.50	90.3
	Juniper Creek	224,813	318,443	38.7	0.085	0.022	4,633	9,891	--	--	14,524	2.69	1,696	0.314	12,828	2.38	88.3
	Alexander Springs Creek	283,343	381,234	38.7	0.033	0.012	2,306	3,547	--	--	5,852	0.404	1,091	0.075	4,761	0.329	81.4

Stream Reach Area	
Wekiva River	75.98 ha
Rock Springs Run	37.57 ha
Juniper Creek	22.22 ha
Alexander Springs Creek	59.64 ha

Estimated total phosphorus loading rates varied from 0.34 kg/ha/d in Alexander Springs Creek to 1.27 kg/ha/d in Rocks Springs Run. Estimated total phosphorus assimilation rates varied from -0.28 kg/ha/d in the Wekiva River to 0.77 kg/ha/d in Rock Springs Run. Both the Wekiva River and Alexander Springs Creek had negative phosphorus assimilation rates while the other two streams had positive removal rates. Estimated total nitrogen loading rates varied from 2.12 kg/ha/d in Alexander Springs Creek to 13.3 kg/ha/d in Rock Springs Run. Estimated total nitrogen assimilation rates varied from -1.83 kg/ha/d in Alexander Springs Creek to 8.77 kg/ha/d in Rock Springs Run. Estimated total kjeldahl nitrogen loading rates varied from 1.60 kg/ha/d in Alexander Springs Creek to 5.21 kg/ha/d in the Wekiva River. Estimated total kjeldahl nitrogen assimilation rates varied from -3.20 kg/ha/d in the Wekiva River to 4.07 kg/ha/d in Juniper Creek. Estimated nitrate+nitrite nitrogen mass loading rates varied from 0.40 kg/ha/d in Alexander Springs Creek to 8.31 kg/ha/d in Rock Springs Run. Estimated nitrate+nitrite nitrogen assimilation rates were positive in all four streams and ranged from 0.33 kg/ha/d in Alexander Springs Creek to 7.50 kg/ha/d in Rock Springs Run.

3.6.1.1 Wekiva River

Estimated monthly mass balances for the Wekiva River stream reach are summarized in **Table 3-9**. Estimated assimilation rates for total phosphorus, total nitrogen, and kjeldahl nitrogen were consistently negative in this stream. Estimated assimilation rates for nitrate+nitrite nitrogen were consistently positive.

3.6.1.2 Rock Springs Run

Estimated monthly mass balances for the Rock Springs Run stream reach are summarized in **Table 3-10**. Estimated assimilation rates for total phosphorus, total nitrogen, kjeldahl nitrogen, and nitrate+nitrite nitrogen were generally positive.

3.6.1.3 Juniper Creek

Estimated monthly mass balances for the Juniper Creek stream reach are summarized in **Table 3-11**. With only a few exceptions, estimated monthly assimilation rates for all of the nutrient forms examined were consistently positive in this stream.

3.6.1.4 Alexander Springs Creek

Estimated monthly mass balances for the Alexander Springs Creek stream reach are summarized in **Table 3-12**. Estimated monthly assimilation rates for total phosphorus, total nitrogen, and kjeldahl nitrogen were generally negative in this stream. Estimated assimilation rates for nitrate+nitrite nitrogen were consistently positive.

3.6.2 Stream Segment Mass Balances

Stream segment mass balances for nitrogen and phosphorus forms are summarized in **Table 3-13**. Estimated total phosphorus mass removals were negative or low in all segments (-0.95 to 0.48 kg/ha/d) except in RSR-SEG-2 (1.02 kg/ha/d). Estimated mass reductions for ortho-phosphorus were negative or low (-1.20 to 0.34 kg/ha/d) in all segmens. Estimated total nitrogen mass load reductions were negative in the upper Rock Springs Run segment (-10.8 kg/ha/d) and were generally positive at the rest of the stations except for Alexander Springs Creek (-0.07 kg/ha/d). The highest organic

TABLE 3-9
SUMMARY OF ESTIMATED NUTRIENT LOAD REDUCTION RATES IN THE WEKIVA RIVER - JANUARY-AUGUST 2005

TP

	Inflow	Outflow		Inflow	Outflow	Inflow						Outflow		Removal		
	WR-MB1	WR-MB2	Rainfall	WR-MB1	WR-MB2	WR-MB1	Runoff	RSR	LWR	Total		WR-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	158,049	753,545	2.04	*0.102*	*0.127*	500	523	353	231	1,606	0.68	2,967	1.26	-1,360	-0.58	-84.7
February-05	152,348	631,070	1.56	0.102	*0.127*	435	400	242	123	1,199	0.56	2,244	1.05	-1,045	-0.49	-87.1
March-05	208,962	797,706	4.16	*0.112*	*0.127*	726	1,066	416	462	2,669	1.13	3,141	1.33	-472	-0.20	-17.7
April-05	153,841	591,240	1.21	*0.112*	*0.127*	517	310	358	203	1,388	0.61	2,253	0.99	-865	-0.38	-62.3
May-05	137,351	544,437	5.27	0.122	0.127	518	1,350	407	187	2,463	1.05	2,143	0.91	319	0.14	13.0
June-05	194,111	1,370,450	11.70	0.126	0.144	734	2,997	875	229	4,835	2.12	5,920	2.60	-1,085	-0.48	-22.4
July-05	*167,444*	*783,020*	9.47	0.129	0.169	670	2,426	1,086	220	4,401	1.87	4,102	1.74	299	0.13	6.8
August-05	*167,444*	792,691	3.33	0.127	0.142	659	853	803	293	2,609	1.11	3,489	1.48	-881	-0.37	-33.8
POR	167,444	783,020	38.74	0.117	0.138	4,758	9,924	4,540	1,949	21,171	1.15	26,259	1.42	-5,089	-0.28	-24.0

TKN

	Inflow	Outflow		Inflow	Outflow	Inflow						Outflow		Removal		
	WR-MB1	WR-MB2	Rainfall	WR-MB1	WR-MB2	WR-MB1	Runoff	RSR	LWR	Total		WR-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	158,049	753,545	2.04	0.16	0.50	784	2,574	3,253	625	7,236	3.07	11,680	5.0	-4,444	-1.89	-61.4
February-05	152,348	631,070	1.56	*0.15*	*0.65*	640	1,968	2,496	246	5,351	2.52	11,485	5.4	-6,135	-2.88	-114.7
March-05	208,962	797,706	4.16	*0.15*	0.80	972	5,249	3,471	1,589	11,281	4.79	19,783	8.4	-8,502	-3.61	-75.4
April-05	153,841	591,240	1.21	*0.15*	*0.78*	692	1,527	3,128	289	5,635	2.47	13,835	6.1	-8,200	-3.60	-145.5
May-05	137,351	544,437	5.27	0.14	0.75	596	6,650	2,444	269	9,959	4.23	12,658	5.4	-2,699	-1.15	-27.1
June-05	194,111	1,370,450	11.70	0.19	0.96	1,106	14,763	4,898	1,124	21,892	9.60	39,469	17.3	-17,577	-7.71	-80.3
July-05	*167,444*	*783,020*	9.47	0.12	0.96	623	11,949	8,364	923	21,858	9.28	23,303	9.9	-1,444	-0.61	-6.6
August-05	*167,444*	792,691	3.33	0.40	0.94	2,076	4,202	5,461	1,232	12,971	5.51	23,099	9.8	-10,128	-4.30	-78.1
POR	167,444	783,020	38.74	0.18	0.82	7,489	48,882	33,515	6,296	96,183	5.21	155,312	8.4	-59,130	-3.20	-61.5

NO2/NO3

	Inflow	Outflow		Inflow	Outflow	Inflow						Outflow		Removal		
	WR-MB1	WR-MB2	Rainfall	WR-MB1	WR-MB2	WR-MB1	Runoff	RSR	LWR	Total		WR-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	158,049	753,545	2.04	1.31	0.40	6,418	994	1,604	651	9,668	4.10	9,344	4.0	324	0.14	3.3
February-05	152,348	631,070	1.56	1.44	*0.35*	6,143	760	1,308	383	8,594	4.04	6,184	2.9	2,409	1.13	28.0
March-05	208,962	797,706	4.16	*1.31*	0.30	8,486	2,027	1,096	665	12,274	5.21	7,419	3.1	4,855	2.06	39.6
April-05	153,841	591,240	1.21	*1.31*	*0.32*	6,046	590	617	576	7,829	3.43	5,676	2.5	2,153	0.94	27.5
May-05	137,351	544,437	5.27	1.17	0.33	4,968	2,568	1,507	599	9,642	4.09	5,519	2.3	4,123	1.75	42.8
June-05	194,111	1,370,450	11.70	1.23	0.16	7,163	5,701	523	474	13,861	6.08	6,619	2.9	7,242	3.18	52.2
July-05	*167,444*	*783,020*	9.47	1.31	0.127	6,800	4,615	76	512	12,003	5.10	3,083	1.3	8,921	3.79	74.3
August-05	*167,444*	792,691	3.33	1.35	0.28	7,008	1,623	659	680	9,969	4.23	6,856	2.9	3,113	1.32	31.2
POR	167,444	783,020	38.74	1.30	0.27	53,031	18,877	7,390	4,540	83,838	4.54	50,700	2.7	33,139	1.79	39.5

TN

	Inflow	Outflow		Inflow	Outflow	Inflow						Outflow		Removal		
	WR-MB1	WR-MB2	Rainfall	WR-MB1	WR-MB2	WR-MB1	Runoff	RSR	LWR	Total		WR-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	158,049	753,545	2.04	1.47	0.90	7,202	3,886	4,857	1,276	17,222	7.3	21,024	8.9	-3,802	-1.61	-22.1
February-05	152,348	631,070	1.56	*1.38*	*1.01*	5,887	2,972	3,804	629	13,292	6.2	17,847	8.4	-4,555	-2.14	-34.3
March-05	208,962	797,706	4.16	*1.38*	1.11	8,939	7,925	4,567	2,254	23,685	10.1	27,449	11.7	-3,764	-1.60	-15.9
April-05	153,841	591,240	1.21	*1.38*	*1.09*	6,369	7,120	3,745	864	18,098	7.9	19,334	8.5	-1,235	-0.54	-6.8
May-05	137,351	544,437	5.27	1.28	1.07	5,429	10,040	3,951	868	20,289	8.6	18,059	7.7	2,230	0.95	11.0
June-05	194,111	1,370,450	11.70	1.42	1.12	8,269	22,290	5,421	1,601	37,582	16.5	46,047	20.2	-8,466	-3.71	-22.5
July-05	*167,444*	*783,020*	9.47	1.43	1.09	7,423	18,042	8,466	1,432	35,362	15.0	26,458	11.2	8,904	3.78	25.2
August-05	*167,444*	792,691	3.33	1.75	1.22	9,084	5,435	6,138	1,911	22,569	9.6	29,955	12.7	-7,386	-3.14	-32.7
POR	167,444	783,020	38.74	1.44	1.08	58,602	77,711	40,948	10,836	188,097	10.2	206,172	11.2	-18,075	-0.98	-9.6

Area 75.98 ha

TABLE 3-10
SUMMARY OF ESTIMATED NUTRIENT LOAD REDUCTION RATES IN ROCK SPRINGS RUN - JANUARY-AUGUST 2005

TP

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow				
	RSR-MB1	RSR-MB2	Rainfall	RSR-MB1	RSR-MB2	RSR-MB1	Runoff	Total		RSR-MB2		Removal		
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	171,089	147,798	2.04	*0.079*	0.077	419	436	855	0.73	353	0.30	502	0.43	58.7
February-05	171,089	141,510	1.56	0.079	0.061	378	333	711	0.68	242	0.23	469	0.45	66.0
March-05	172,802	147,308	4.16	*0.078*	0.091	418	888	1,306	1.12	416	0.36	890	0.76	68.2
April-05	169,058	137,180	1.21	*0.078*	0.087	396	258	654	0.58	358	0.32	296	0.26	45.2
May-05	162,673	131,406	5.27	0.076	0.100	383	1,125	1,508	1.30	407	0.35	1,101	0.95	73.0
June-05	160,789	158,514	11.70	0.084	0.184	405	2,498	2,903	2.58	875	0.78	2,028	1.80	69.9
July-05	*167,917*	164,508	9.47	0.093	0.213	484	2,022	2,506	2.15	1,086	0.93	1,420	1.22	56.7
August-05	*167,917*	145,596	3.33	0.086	0.178	448	711	1,159	0.99	803	0.69	355	0.31	30.7
POR	167,917	146,727	38.74	0.082	0.127	3,331	8,271	11,602	1.27	4,540	0.50	7,062	0.77	60.9

TKN

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow				
	RSR-MB1	RSR-MB2	Rainfall	RSR-MB1	RSR-MB2	RSR-MB1	Runoff	Total		RSR-MB2		Removal		
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	171,089	147,798	2.04	*0.13*	0.71	689	2,111	2,801	2.40	3,253	2.79	-452	-0.39	-16.2
February-05	171,089	141,510	1.56	*0.13*	0.63	623	1,614	2,237	2.13	2,496	2.37	-259	-0.25	-11.6
March-05	172,802	147,308	4.16	*0.13*	0.76	696	4,305	5,001	4.29	3,471	2.98	1,531	1.31	30.6
April-05	169,058	137,180	1.21	*0.13*	0.76	659	1,252	1,912	1.70	3,128	2.77	-1,216	-1.08	-63.6
May-05	162,673	131,406	5.27	*0.13*	0.60	656	5,454	6,109	5.25	2,444	2.10	3,665	3.15	60.0
June-05	160,789	158,514	11.70	0.13	1.03	627	12,108	12,735	11.3	4,898	4.35	7,837	6.95	61.5
July-05	*167,917*	164,508	9.47	0.11	1.64	573	9,800	10,373	8.91	8,364	7.18	2,009	1.73	19.4
August-05	*167,917*	145,596	3.33	0.26	1.21	1,353	3,446	4,800	4.12	5,461	4.69	-662	-0.57	-13.8
POR	167,917	146,727	38.74	0.14	0.94	5,877	40,091	45,968	5.04	33,515	3.67	12,453	1.36	27.1

NO2/NO3

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow				
	RSR-MB1	RSR-MB2	Rainfall	RSR-MB1	RSR-MB2	RSR-MB1	Runoff	Total		RSR-MB2		Removal		
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	171,089	147,798	2.04	*1.57*	0.35	8,327	769	9,096	7.81	1,604	1.38	7,492	6.43	82.4
February-05	171,089	141,510	1.56	1.57	0.33	7,521	588	8,109	7.71	1,308	1.24	6,802	6.47	83.9
March-05	172,802	147,308	4.16	*1.63*	0.24	8,732	1,568	10,300	8.84	1,096	0.94	9,204	7.90	89.4
April-05	169,058	137,180	1.21	*1.63*	0.15	8,267	456	8,723	7.74	617	0.55	8,106	7.19	92.9
May-05	162,673	131,406	5.27	1.68	0.37	8,472	1,986	10,458	8.98	1,507	1.29	8,951	7.69	85.6
June-05	160,789	158,514	11.70	1.32	0.11	6,367	4,410	10,777	9.56	523	0.46	10,254	9.10	95.1
July-05	*167,917*	164,508	9.47	1.27	0.015	6,611	3,570	10,180	8.74	76	0.07	10,104	8.68	99.2
August-05	*167,917*	145,596	3.33	1.33	0.146	6,923	1,255	8,178	7.02	659	0.57	7,519	6.46	91.9
POR	167,917	146,727	38.74	1.50	0.21	61,220	14,602	75,822	8.31	7,390	0.81	68,432	7.50	90.3

TN

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow				
	RSR-MB1	RSR-MB2	Rainfall	RSR-MB1	RSR-MB2	RSR-MB1	Runoff	Total		RSR-MB2		Removal		
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	171,089	147,798	2.04	*1.45*	1.06	7,690	3,081	10,771	9.25	4,857	4.17	5,915	5.08	54.9
February-05	171,089	141,510	1.56	*1.45*	0.96	6,946	2,356	9,302	8.84	3,804	3.62	5,498	5.23	59.1
March-05	172,802	147,308	4.16	*1.45*	1.00	7,767	6,283	14,050	12.1	4,567	3.92	9,483	8.14	67.5
April-05	169,058	137,180	1.21	*1.45*	0.91	7,354	5,570	12,924	11.5	3,745	3.32	9,179	8.14	71.0
May-05	162,673	131,406	5.27	*1.45*	0.97	7,312	7,959	15,271	13.1	3,951	3.39	11,320	9.72	74.1
June-05	160,789	158,514	11.70	1.45	1.14	6,994	17,670	24,664	21.9	5,421	4.81	19,243	17.1	78.0
July-05	*167,917*	164,508	9.47	1.38	1.66	7,183	14,302	21,485	18.4	8,466	7.27	13,020	11.2	60.6
August-05	*167,917*	145,596	3.33	1.59	1.36	8,277	4,224	12,501	10.73	6,138	5.27	6,363	5.46	50.9
POR	167,917	146,727	38.74	1.46	1.14	59,525	61,444	120,969	13.3	40,948	4.49	80,021	8.77	66.1

Area 37.57 ha

TABLE 3-11
SUMMARY OF ESTIMATED NUTRIENT LOAD REDUCTION RATES IN JUNIPER CREEK - JANUARY-AUGUST 2005

TP

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	JC-MB1	JC-MB2	Rainfall	JC-MB1	JC-MB2	JC-MB1	Runoff	Total		JC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	238,786	248,646	2.04	*0.017*	0.023	126	207	333	0.48	177	0.26	155	0.23	46.7
February-05	223,544	289,014	1.56	0.017	0.013	106	158	265	0.43	105	0.17	159	0.26	60.2
March-05	221,880	325,884	4.16	*0.017*	0.034	117	422	539	0.78	343	0.50	195	0.28	36.2
April-05	220,975	326,080	1.21	*0.017*	*0.028*	113	123	235	0.35	274	0.41	-39	-0.06	-16.4
May-05	219,751	333,003	5.27	0.017	0.022	116	534	650	0.94	227	0.33	423	0.61	65.1
June-05	220,828	335,230	11.70	0.030	0.017	199	1,186	1,385	2.08	171	0.26	1,214	1.82	87.7
July-05	221,195	342,570	9.47	0.034	0.026	233	960	1,193	1.73	276	0.40	917	1.33	76.9
August-05	231,544	347,120	3.33	0.047	0.029	337	338	675	0.98	312	0.45	363	0.53	53.8
POR	224,813	318,443	38.74	0.025	0.024	1,347	3,927	5,274	0.98	1,886	0.35	3,388	0.63	64.2

TKN

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	JC-MB1	JC-MB2	Rainfall	JC-MB1	JC-MB2	JC-MB1	Runoff	Total		JC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	238,786	248,646	2.04	*0.30*	0.12	2,221	1,548	3,769	5.47	925	1.34	2,844	4.13	75.5
February-05	223,544	289,014	1.56	*0.30*	0.14	1,878	1,184	3,062	4.92	1,133	1.82	1,929	3.10	63.0
March-05	221,880	325,884	4.16	0.30	0.39	2,063	3,157	5,220	7.58	3,889	5.65	1,331	1.93	25.5
April-05	220,975	326,080	1.21	*0.21*	*0.26*	1,392	918	2,310	3.47	2,543	3.82	-233	-0.35	-10.1
May-05	219,751	333,003	5.27	*0.21*	0.13	1,431	3,999	5,430	7.88	1,342	1.95	4,088	5.93	75.3
June-05	220,828	335,230	11.70	0.12	0.36	795	8,879	9,674	14.5	3,620	5.43	6,053	9.08	62.6
July-05	221,195	342,570	9.47	0.03	0.26	171	7,187	7,358	10.7	2,761	4.01	4,597	6.67	62.5
August-05	231,544	347,120	3.33	0.32	0.32	2,297	2,527	4,824	7.00	3,443	5.00	1,381	2.00	28.6
POR	224,813	318,443	38.74	0.22	0.25	12,248	29,399	41,647	7.71	19,658	3.64	21,989	4.07	52.8

NO2/NO3

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	JC-MB1	JC-MB2	Rainfall	JC-MB1	JC-MB2	JC-MB1	Runoff	Total		JC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	238,786	248,646	2.04	*0.10*	0.02	740	521	1,261	1.83	185	0.27	1,076	1.56	85.3
February-05	223,544	289,014	1.56	0.10	0.02	626	398	1,024	1.65	146	0.23	879	1.41	85.8
March-05	221,880	325,884	4.16	0.08	0.03	564	1,062	1,626	2.36	313	0.45	1,313	1.91	80.7
April-05	220,975	326,080	1.21	*0.08*	*0.02*	530	309	839	1.26	196	0.29	644	0.97	76.7
May-05	219,751	333,003	5.27	0.08	0.01	545	1,345	1,890	2.74	72	0.10	1,818	2.64	96.2
June-05	220,828	335,230	11.70	0.07	0.01	484	2,987	3,471	5.21	121	0.18	3,350	5.03	96.5
July-05	221,195	342,570	9.47	0.08	0.03	562	2,418	2,980	4.33	276	0.40	2,704	3.93	90.7
August-05	231,544	347,120	3.33	0.08	0.04	581	850	1,432	2.08	387	0.56	1,044	1.52	72.9
POR	224,813	318,443	38.74	0.08	0.02	4,633	9,891	14,524	2.69	1,696	0.31	12,828	2.38	88.3

TN

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	JC-MB1	JC-MB2	Rainfall	JC-MB1	JC-MB2	JC-MB1	Runoff	Total		JC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	238,786	248,646	2.04	*0.38*	0.14	2,813	2,141	4,954	7.19	1,110	1.61	3,844	5.58	77.6
February-05	223,544	289,014	1.56	*0.38*	0.16	2,379	1,637	4,016	6.45	1,279	2.06	2,737	4.40	68.2
March-05	221,880	325,884	4.16	0.38	0.42	2,628	4,365	6,993	10.2	4,203	6.10	2,790	4.05	39.9
April-05	220,975	326,080	1.21	*0.29*	*0.28*	1,922	3,566	5,489	8.23	2,739	4.11	2,750	4.12	50.1
May-05	219,751	333,003	5.27	*0.29*	0.14	1,976	5,530	7,506	10.9	1,414	2.05	6,091	8.84	81.2
June-05	220,828	335,230	11.70	0.19	0.37	1,279	12,278	13,556	20.3	3,741	5.61	9,815	14.7	72.4
July-05	221,195	342,570	9.47	0.11	0.29	734	9,938	10,671	15.5	3,037	4.41	7,634	11.1	71.5
August-05	231,544	347,120	3.33	0.40	0.35	2,878	2,592	5,471	7.94	3,777	5.48	1,694	2.46	31.0
POR	224,813	318,443	38.74	0.30	0.27	16,608	42,047	58,654	10.9	21,300	3.94	37,355	6.92	63.7

Area 22.22 ha

TABLE 3-12
SUMMARY OF ESTIMATED NUTRIENT LOAD REDUCTION RATES IN ALEXANDER SPRINGS CREEK - JANUARY-AUGUST 2005

TP

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	ASC-MB1	ASC-MB2	Rainfall	ASC-MB1	ASC-MB2	ASC-MB1	Runoff	Total		ASC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	286,249	390,865	2.04	*0.040*	0.046	355	83	438	0.237	557	0.30	-119	-0.064	-27.2
February-05	281,356	333,958	1.56	0.040	0.047	315	64	379	0.227	439	0.26	-61	-0.036	-16.0
March-05	298,482	430,695	4.16	*0.047*	0.057	435	170	605	0.327	761	0.41	-156	-0.085	-25.9
April-05	303,375	345,530	1.21	*0.047*	0.046	428	49	477	0.267	477	0.27	0	0.000	0.1
May-05	298,482	329,162	5.27	0.053	0.059	490	215	705	0.382	602	0.33	103	0.056	14.7
June-05	273,405	457,192	11.70	0.051	0.053	418	477	896	0.501	727	0.41	169	0.094	18.8
July-05	259,655	*381,234*	9.47	0.052	0.095	419	386	805	0.435	1,123	0.61	-318	-0.172	-39.5
August-05	265,735	*381,234*	3.33	0.050	0.069	412	136	548	0.296	815	0.44	-268	-0.145	-48.9
POR	283,343	381,234	38.74	0.047	0.059	3,272	1,581	4,852	0.335	5,502	0.38	-649	-0.045	-13.4

DP

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	ASC-MB1	ASC-MB2	Rainfall	ASC-MB1	ASC-MB2	ASC-MB1	Runoff	Total		ASC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	286,249	390,865	2.04	*0.048*	0.052	426	39	465	0.252	630	0.34	-165	-0.089	-35.5
February-05	281,356	333,958	1.56	*0.048*	0.049	378	30	408	0.244	458	0.27	-50	-0.030	-12.3
March-05	298,482	430,695	4.16	*0.048*	0.052	444	80	524	0.283	694	0.38	-170	-0.092	-32.5
April-05	303,375	345,530	1.21	*0.048*	0.054	437	23	460	0.257	560	0.31	-100	-0.056	-21.7
May-05	298,482	329,162	5.27	*0.048*	0.064	444	101	545	0.295	653	0.35	-108	-0.058	-19.8
June-05	273,405	457,192	11.70	0.048	0.043	394	224	618	0.345	590	0.33	28	0.016	4.5
July-05	259,655	*381,234*	9.47	0.049	0.072	394	181	576	0.311	851	0.46	-275	-0.149	-47.8
August-05	265,735	*381,234*	3.33	0.044	0.057	362	64	426	0.231	674	0.36	-247	-0.134	-58.0
POR	283,343	381,234	38.74	0.048	0.055	3,280	742	4,022	0.278	5,110	0.35	-1,088	-0.075	-27.0

TKN

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	ASC-MB1	ASC-MB2	Rainfall	ASC-MB1	ASC-MB2	ASC-MB1	Runoff	Total		ASC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	286,249	390,865	2.04	*0.19*	0.34	1,686	524	2,210	1.20	4,120	2.23	-1,909	-1.03	-86.4
February-05	281,356	333,958	1.56	*0.19*	0.27	1,497	401	1,898	1.14	2,525	1.51	-627	-0.375	-33.0
March-05	298,482	430,695	4.16	*0.19*	0.43	1,758	1,069	2,827	1.53	5,674	3.07	-2,847	-1.54	-100.7
April-05	303,375	345,530	1.21	*0.19*	0.24	1,729	311	2,040	1.14	2,488	1.39	-448	-0.250	-21.9
May-05	298,482	329,162	5.27	*0.19*	0.56	1,758	1,354	3,112	1.68	5,714	3.09	-2,602	-1.41	-83.6
June-05	273,405	457,192	11.70	0.19	1.07	1,558	3,007	4,565	2.55	14,676	8.20	-10,111	-5.65	-221.5
July-05	259,655	*381,234*	9.47	0.10	0.62	805	2,434	3,239	1.75	7,327	3.96	-4,089	-2.21	-126.2
August-05	265,735	*381,234*	3.33	0.29	1.16	2,389	856	3,245	1.755	13,709	7.42	-10,464	-5.66	-322.5
POR	283,343	381,234	38.74	0.19	0.60	13,180	9,956	23,136	1.60	56,233	3.88	-33,097	-2.28	-143.1

NO2/NO3

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	ASC-MB1	ASC-MB2	Rainfall	ASC-MB1	ASC-MB2	ASC-MB1	Runoff	Total		ASC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	286,249	390,865	2.04	*0.02*	0.01	177	187	364	0.197	73	0.039	292	0.158	80.0
February-05	281,356	333,958	1.56	0.02	0.00	158	143	300	0.180	37	0.022	263	0.157	87.5
March-05	298,482	430,695	4.16	*0.03*	0.01	278	381	658	0.356	134	0.072	525	0.284	79.7
April-05	303,375	345,530	1.21	*0.03*	0.01	273	111	384	0.215	62	0.035	322	0.180	83.8
May-05	298,482	329,162	5.27	0.03	0.02	278	482	760	0.411	235	0.127	525	0.284	69.1
June-05	273,405	457,192	11.70	0.04	0.01	353	1,071	1,424	0.796	137	0.077	1,287	0.719	90.4
July-05	259,655	*381,234*	9.47	0.05	0.017	394	867	1,261	0.682	201	0.109	1,060	0.574	84.1
August-05	265,735	*381,234*	3.33	0.05	0.018	395	305	700	0.379	213	0.115	488	0.264	69.6
POR	283,343	381,234	38.74	0.03	0.01	2,306	3,547	5,852	0.404	1,091	0.075	4,761	0.329	81.4

TN

	Inflow	Outflow		Inflow	Outflow	Inflow				Outflow		Removal		
	ASC-MB1	ASC-MB2	Rainfall	ASC-MB1	ASC-MB2	ASC-MB1	Runoff	Total		ASC-MB2				
Month	(m^3/d)	(m^3/d)	(in)	mg/L	mg/L	kg	kg	kg	kg/ha/d	kg	kg/ha/d	kg	kg/ha/d	%
January-05	286,249	390,865	2.04	*0.23*	0.35	2,041	754	2,795	1.51	4,192	2.27	-1,397	-0.756	-50.0
February-05	281,356	333,958	1.56	*0.23*	0.27	1,812	577	2,389	1.43	2,543	1.52	-155	-0.093	-6.5
March-05	298,482	430,695	4.16	*0.23*	0.44	2,128	1,538	3,666	1.98	5,808	3.14	-2,142	-1.16	-58.4
April-05	303,375	345,530	1.21	*0.23*	0.25	2,093	1,375	3,468	1.94	2,550	1.43	918	0.513	26.5
May-05	298,482	329,162	5.27	*0.23*	0.58	2,128	1,948	4,076	2.20	5,949	3.22	-1,873	-1.01	-45.9
June-05	273,405	457,192	11.70	0.23	1.08	1,911	4,325	6,236	3.49	14,813	8.28	-8,577	-4.79	-137.5
July-05	259,655	*381,234*	9.47	0.10	0.64	805	3,500	4,305	2.33	7,564	4.09	-3,258	-1.76	-75.7
August-05	265,735	*381,234*	3.33	0.34	1.18	2,784	1,047	3,831	2.07	13,922	7.53	-10,091	-5.46	-263.4
POR	283,343	381,234	38.74	0.23	0.62	15,703	15,063	30,766	2.12	57,341	3.96	-26,575	-1.83	-86.4

Area 59.64 ha

TABLE 3-13
SUMMARY OF ESTIMATED SEGMENT MASS REMOVALS FOR THE WEKIVA RIVER SYSTEM AND REFERENCE SITES

		Inflow												Outflow				Removal				
		Segment - Up				Other Inputs				Total				Segment - Down				Conc		Mass		
Parameter	Stream Segment	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)	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)	(%)
Total Phosphorus	Wekiva River Segment 1	0.122	164,520	20.0	5.94	--	--	--	--	0.122	164,520	20.0	5.94	0.124	162,772	20.1	5.98	-0.002	-1.87	-0.16	-0.05	-0.8
	Wekiva River Segment 2	0.129	710,077	91.3	9.26	--	--	--	--	0.129	710,077	91.3	9.26	0.135	710,077	95.9	9.73	-0.007	-5.08	-4.63	-0.47	-5.1
	Rock Springs Run Segment 1	0.093	149,346	13.9	5.46	--	--	--	--	0.093	149,346	13.9	5.46	0.095	170,718	16.3	6.41	-0.002	-2.69	-2.41	-0.95	-17.4
	Rock Springs Run Segment 2	0.146	166,472	24.2	5.05	--	--	--	--	0.146	166,472	24.2	5.05	0.138	139,693	19.3	4.03	0.007	4.94	4.90	1.02	20.2
	Juniper Creek Segment 1	0.025	282,151	7.11	8.20	0.025	35,414	0.89	1.02	0.025	317,565	8.00	9.23	0.024	321,263	7.58	8.75	0.002	6.29	0.42	0.48	5.2
	Alexander Springs Creek Segment 1	0.049	303,842	14.9	3.61	--	--	--	--	0.049	303,842	14.9	3.61	0.052	306,162	15.8	3.83	-0.003	-5.36	-0.92	-0.22	-6.2
Ortho Phosphorus	Wekiva River Segment 1	0.126	168,981	21.3	6.32	--	--	--	--	0.127	164,520	20.8	6.19	0.124	162,772	20.1	5.98	0.003	2.23	0.68	0.20	3.3
	Wekiva River Segment 2	0.116	710,077	82.6	8.38	--	--	--	--	0.116	710,077	82.6	8.38	0.116	710,077	82.1	8.34	0.001	0.53	0.44	0.04	0.5
	Rock Springs Run Segment 1	0.082	149,346	12.3	4.83	--	--	--	--	0.082	149,346	12.3	4.83	0.083	170,718	14.1	5.57	-0.001	-0.84	-1.87	-0.74	-15.3
	Rock Springs Run Segment 2	0.117	166,472	19.5	4.07	--	--	--	--	0.117	166,472	19.5	4.07	0.128	139,693	17.9	3.73	-0.011	-9.17	1.64	0.34	8.4
	Juniper Creek Segment 1	0.018	282,151	5.21	6.01	0.018	35,414	0.65	0.75	0.018	317,565	5.86	6.76	0.021	321,263	6.90	7.97	-0.003	-16.42	-1.04	-1.20	-17.8
	Alexander Springs Creek Segment 1	0.045	303,842	13.7	3.32	--	--	--	--	0.045	303,842	13.7	3.32	0.047	306,162	14.4	3.48	-0.002	-3.89	-0.64	-0.16	-4.7
Total Nitrogen	Wekiva River Segment 1	1.43	164,520	235	69.80	--	--	--	--	1.43	164,520	235	69.80	1.37	162,772	222	66.03	0.063	4.39	12.70	3.77	5.4
	Wekiva River Segment 2	0.79	585,822	464	47.09	--	--	--	--	1.12	710,077	793	80.49	1.01	710,077	719	72.95	0.105	9.37	74.30	7.54	9.4
	Rock Springs Run Segment 1	1.36	149,346	204	80.28	--	--	--	--	1.36	149,346	204	80.28	1.35	170,718	231	91.07	0.010	0.76	-27.38	-10.79	-13.4
	Rock Springs Run Segment 2	1.25	166,472	209	43.45	--	--	--	--	1.25	166,472	209	43.45	1.26	139,693	176	36.56	-0.003	-0.27	33.10	6.89	15.9
	Juniper Creek Segment 1	0.21	282,151	58.0	66.95	0.21	35,414	7.36	8.49	0.21	317,565	65.4	75.44	0.19	321,263	60.8	70.20	0.016	8.01	4.54	5.24	6.9
	Alexander Springs Creek Segment 1	0.33	303,842	99.7	24.14	--	--	--	--	0.33	303,842	99.7	24.14	0.33	306,162	100.0	24.21	0.002	0.48	-0.28	-0.07	-0.3
Total Organic Nitrogen	Wekiva River Segment 1	0.62	164,520	102.6	30.46	--	--	--	--	0.62	164,520	102.6	30.46	0.62	162,772	100.6	29.90	0.005	0.80	1.90	0.57	1.9
	Wekiva River Segment 2	0.77	710,077	546	55.46	--	--	--	--	0.77	710,077	546	55.46	0.68	710,077	486	49.30	0.085	11.10	60.67	6.16	11.1
	Rock Springs Run Segment 1	0.21	149,346	31.9	12.55	--	--	--	--	0.21	149,346	31.9	12.55	0.29	170,718	50.1	19.74	-0.080	-37.53	-18.23	-7.18	-57.2
	Rock Springs Run Segment 2	1.05	166,472	174	36.27	--	--	--	--	1.05	166,472	174	36.27	1.06	139,693	148	30.72	-0.010	-0.95	26.63	5.55	15.3
	Juniper Creek Segment 1	0.18	282,151	51.9	59.92	0.19	35,414	6.60	7.62	0.18	317,565	58.5	67.54	0.15	321,263	49.3	56.88	0.031	16.75	9.24	10.66	15.8
	Alexander Springs Creek Segment 1	0.31	303,842	93.5	22.66	--	--	--	--	0.31	303,842	93.5	22.66	0.31	306,162	94.7	22.94	-0.001	-0.46	-1.15	-0.28	-1.2
Total Inorganic Nitrogen	Wekiva River Segment 1	0.80	164,520	132	39.28	--	--	--	--	0.80	164,520	132	39.28	0.75	162,772	121.6	36.13	0.057	7.03	10.60	3.15	8.0
	Wekiva River Segment 2	0.35	710,077	247	25.03	--	--	--	--	0.35	710,077	247	25.03	0.33	710,077	233	23.65	0.019	5.53	13.63	1.38	5.5
	Rock Springs Run Segment 1	1.14	149,346	170	66.98	--	--	--	--	1.14	149,346	170	66.98	1.06	170,718	181	71.33	0.078	6.84	-11.04	-4.35	-6.5
	Rock Springs Run Segment 2	0.21	166,472	34.5	7.19	--	--	--	--	0.21	166,472	34.5	7.19	0.20	139,693	28.1	5.84	0.007	3.15	6.47	1.35	18.7
	Juniper Creek Segment 1	0.02	282,151	6.09	7.02	0.02	35,414	0.75	0.87	0.02	317,565	6.84	7.89	0.03	321,263	8.62	9.95	-0.005	-24.63	-1.78	-2.06	-26.1
	Alexander Springs Creek Segment 1	0.02	303,842	6.14	1.49	--	--	--	--	0.02	303,842	6.14	1.49	0.02	306,162	5.41	1.31	0.003	12.54	0.73	0.18	11.9

Wekiva River Segment 1	3.37	ha
Wekiva River Segment 2	9.85	ha
Rock Springs Run Segment 1	2.54	ha
Rock Springs Run Segment 2	4.80	ha
Juniper Creek Segment 1	0.87	ha
Alexander Springs Creek Segment 1	4.13	ha

nitrogen mass removal rate was estimated for the Juniper Creek segment (10.7 kg/ha/d) with lower rates at WR-SEG-2 (6.2 kg/ha/d), RSR-SEG-2 (5.55 kg/ha/d), WR-SEG-1 (0.57 kg/ha/d), ASC-SEG-1 (-0.28 kg/ha/d), and RSR-SEG-1 (-5.75 kg/ha/d). Estimated total inorganic nitrogen (primarily nitrate+nitrite nitrogen) mass removals were highest in the two Wekiva River segments (3.15 and 1.38 kg/ha/d), lower in RSR-SEG-2 (1.35 kg/ha/d) and ASC-SEG-1 (0.18 kg/ha/d), and negative at the other two segments.

3.6.2.1 Wekiva River Segments

Estimated nutrient mass balances for the Wekiva River segments are summarized in **Table 3-14**.

Estimated removals for total nitrogen in WR-SEG-1 were positive during the spring segment study (3.24 kg/ha/d) and the summer study (4.72 kg/ha/d). Total organic nitrogen estimated mass removals were negative during both sampling periods (-1.50 kg/ha/d in the spring and -8.10 kg/ha/d in the summer). Estimated mass removals for total inorganic nitrogen were consistently positive with a value of 1.18 kg/ha/d during the spring and 12.8 kg/ha/d during the summer. The estimated mass removal for total phosphorus was positive during the spring (0.27 kg/ha/d) and negative during the summer (-0.34 kg/ha/d). The estimated mass removal for ortho-phosphorus was positive during both seasons (spring: 0.33 kg/ha/d and summer: 0.06 kg/ha/d).

Estimated removals for total nitrogen in WR-SEG-2 were negative during the spring segment study (-7.59 kg/ha/d) and positive during the summer study (20.4 kg/ha/d). Total organic nitrogen estimated mass removals followed the same pattern (-10.3 kg/ha/d in the spring and 20.4 kg/ha/d in the summer). Estimated mass removals for total inorganic nitrogen were consistently positive with a value of 2.67 kg/ha/d during the spring and 0.09 kg/ha/d during the summer. The estimated mass removal for total phosphorus was negative during the spring (-0.28 kg/ha/d) and during the summer (-0.66 kg/ha/d). The estimated mass removal for ortho-phosphorus was close to zero during both seasons (spring: 0.00 kg/ha/d and summer: 0.04 kg/ha/d).

3.6.2.2 Rock Springs Run Segments

Estimated nutrient mass balances for the Rock Springs Run segments are summarized in **Table 3-15**.

Estimated removals for total nitrogen in RSR-SEG-1 were positive during the spring segment study (0.67 kg/ha/d) and negative during the summer study (-22.3 kg/ha/d). Total organic nitrogen estimated mass removals were negative during both sampling periods (-4.51 kg/ha/d in the spring and -9.89 kg/ha/d in the summer). Estimated mass removals for total inorganic nitrogen were positive during the spring sampling period (3.67 kg/ha/d) and negative during the summer (-12.4 kg/ha/d). The estimated mass removal for total phosphorus was positive during the spring (0.03 kg/ha/d) and negative during the summer (-1.93 kg/ha/d). The estimated mass removal for ortho-phosphorus was positive during the spring (0.13 kg/ha/d) and negative during the summer (-1.61 kg/ha/d).

TABLE 3-14

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN THE WEKIVA RIVER SEGMENTS

				Inflow				Outflow				Removal				
				Segment - Up				Segment - Down								
				Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	Date	Parameter	Units	(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)	(%)
WR-Seg1	Spring	TN	mg/L	1.28	150,046	191.3	56.8	1.21	148,797	180.4	53.6	0.063	4.9	10.9	3.24	5.7
		TON	mg/L	0.14	150,046	20.3	6.0	0.17	148,797	25.3	7.5	-0.035	-25.9	-5.0	-1.50	-24.9
		TIN	mg/L	1.11	150,046	165.8	49.3	1.09	148,797	161.8	48.1	0.018	1.6	4.0	1.18	2.4
		OP	mg/L	0.127	150,046	19.1	5.7	0.121	148,797	17.9	5.3	0.007	5.1	1.1	0.33	5.9
		TP	mg/L	0.128	150,046	19.1	5.7	0.123	148,797	18.2	5.4	0.005	3.9	0.9	0.27	4.7
	Summer	TN	mg/L	1.57	178,994	281.0	83.5	1.50	176,746	265.1	78.8	0.070	4.5	15.9	4.72	5.7
		TON	mg/L	0.21	178,994	37.2	11.1	0.37	176,746	64.5	19.2	-0.157	-75.5	-27.3	-8.10	-73.3
		TIN	mg/L	1.36	178,994	243.8	72.4	1.14	176,746	200.6	59.6	0.227	16.7	43.2	12.83	17.7
		OP	mg/L	0.127	178,994	22.6	6.7	0.127	176,746	22.4	6.7	-0.001	-0.4	0.2	0.06	0.9
		TP	mg/L	0.117	178,994	20.9	6.2	0.125	176,746	22.1	6.6	-0.008	-6.8	-1.2	-0.34	-5.5
	POR	TN	mg/L	1.43	164,520	235.0	69.8	1.37	162,772	222.3	66.0	0.063	4.4	12.7	3.77	5.4
		TON	mg/L	0.17	164,520	27.9	8.3	0.27	162,772	44.6	13.3	-0.105	-61.9	-16.8	-4.98	-60.2
		TIN	mg/L	1.25	164,520	204.8	60.8	1.11	162,772	180.6	53.6	0.135	10.9	24.2	7.20	11.8
		OP	mg/L	0.127	164,520	20.8	6.2	0.124	162,772	20.1	6.0	0.003	2.2	0.7	0.20	3.3
		TP	mg/L	0.122	164,520	20.0	5.9	0.124	162,772	20.1	6.0	-0.002	-1.9	-0.2	-0.05	-0.8
WR-Seg2	Spring	TN	mg/L	0.78	547,949	429.6	43.6	0.92	547,949	504.4	51.2	-0.137	-17.4	-74.8	-7.59	-17.4
		TON	mg/L	0.45	547,949	248.8	25.2	0.64	547,949	349.9	35.5	-0.185	-40.6	-101.1	-10.26	-40.6
		TIN	mg/L	0.33	547,949	180.8	18.4	0.28	547,949	154.5	15.7	0.048	14.5	26.3	2.67	14.5
		OP	mg/L	0.099	547,949	54.2	5.5	0.098	547,949	53.4	5.4	0.002	1.5	0.8	0.08	1.5
		TP	mg/L	0.115	547,949	63.0	6.4	0.120	547,949	65.8	6.7	-0.005	-4.3	-2.7	-0.28	-4.3
	Summer	TN	mg/L	1.29	872,204	1125.6	114.2	1.06	872,204	924.1	93.8	0.231	17.9	201.5	20.45	17.9
		TON	mg/L	0.92	872,204	802.4	81.4	0.69	872,204	601.8	61.1	0.230	25.0	200.6	20.36	25.0
		TIN	mg/L	0.37	872,204	323.2	32.8	0.37	872,204	322.3	32.7	0.001	0.3	0.9	0.09	0.3
		OP	mg/L	0.126	872,204	109.9	11.2	0.126	872,204	109.9	11.2	0.000	0.0	0.0	0.00	0.0
		TP	mg/L	0.138	872,204	119.9	12.2	0.145	872,204	126.5	12.8	-0.007	-5.5	-6.5	-0.66	-5.5
	POR	TN	mg/L	1.12	710,077	793.0	80.5	1.01	710,077	718.7	72.9	0.105	9.4	74.3	7.54	9.4
		TON	mg/L	0.77	710,077	546.4	55.5	0.68	710,077	485.7	49.3	0.085	11.1	60.7	6.16	11.1
		TIN	mg/L	0.35	710,077	246.6	25.0	0.33	710,077	233.0	23.6	0.019	5.5	13.6	1.38	5.5
		OP	mg/L	0.116	710,077	82.6	8.4	0.116	710,077	82.1	8.3	0.001	0.5	0.4	0.04	0.5
		TP	mg/L	0.129	710,077	91.3	9.3	0.135	710,077	95.9	9.7	-0.007	-5.1	-4.6	-0.47	-5.1

Segment Areas:	WR SEG 1	3.37	ha
	WR SEG 2	9.85	ha

TABLE 3-15

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN THE ROCK SPRINGS RUN SEGMENTS

				Inflow				Outflow				Removal				
				Segment - Up				Segment - Down								
				Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	Date	Parameter	Units	(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)	(%)
RSR-Seg1	Spring	TN	mg/L	1.42	169,572	240.8	94.87	1.41	169,572	239.1	94.20	0.010	0.7	1.7	0.67	0.7
		TON	mg/L	0.21	169,572	36.0	14.20	0.28	169,572	47.5	18.71	-0.068	-31.8	-11.4	-4.51	-31.8
		TIN	mg/L	1.19	169,572	200.9	79.17	1.13	169,572	191.6	75.50	0.055	4.6	9.3	3.67	4.6
		OP	mg/L	0.081	169,572	13.7	5.41	0.079	169,572	13.4	5.28	0.002	2.5	0.3	0.13	2.5
		TP	mg/L	0.092	169,572	15.5	6.11	0.091	169,572	15.4	6.08	0.001	0.5	0.1	0.03	0.5
	Summer	TN	mg/L	1.29	129,120	166.6	65.63	1.30	171,864	223.1	87.89	-0.008	-0.6	-56.5	-22.27	-33.9
		TON	mg/L	0.21	129,120	27.4	10.81	0.31	171,864	52.5	20.70	-0.093	-43.9	-25.1	-9.89	-91.5
		TIN	mg/L	1.08	129,120	139.1	54.82	0.99	171,864	170.5	67.19	0.085	7.9	-31.4	-12.37	-22.6
		OP	mg/L	0.084	129,120	10.8	4.25	0.087	171,864	14.9	5.86	-0.003	-3.6	-4.1	-1.61	-37.9
		TP	mg/L	0.095	129,120	12.2	4.81	0.100	171,864	17.1	6.74	-0.005	-5.3	-4.9	-1.93	-40.1
	POR	TN	mg/L	1.36	149,346	203.8	80.28	1.35	170,718	231.1	91.07	0.010	0.8	-27.4	-10.79	-13.4
		TON	mg/L	0.21	149,346	31.9	12.55	0.29	170,718	50.1	19.74	-0.080	-37.5	-18.2	-7.18	-57.2
		TIN	mg/L	1.14	149,346	170.0	66.98	1.06	170,718	181.0	71.33	0.078	6.8	-11.0	-4.35	-6.5
		OP	mg/L	0.082	149,346	12.3	4.83	0.083	170,718	14.1	5.57	-0.001	-0.8	-1.9	-0.74	-15.3
		TP	mg/L	0.093	149,346	13.9	5.46	0.095	170,718	16.3	6.41	-0.002	-2.7	-2.4	-0.95	-17.4
RSR-Seg2	Spring	TN	mg/L	0.92	141,234	130.4	27.15	1.04	141,234	146.3	30.47	-0.113	-12.2	-16.0	-3.32	-12.2
		TON	mg/L	0.62	141,234	87.6	18.24	0.77	141,234	108.7	22.65	-0.150	-24.2	-21.2	-4.41	-24.2
		TIN	mg/L	0.30	141,234	42.8	8.91	0.27	141,234	37.6	7.82	0.037	12.2	5.2	1.09	12.2
		OP	mg/L	0.082	141,234	11.6	2.41	0.104	141,234	14.6	3.04	-0.022	-26.2	-3.0	-0.63	-26.2
		TP	mg/L	0.098	141,234	13.8	2.87	0.094	141,234	13.2	2.75	0.004	4.1	0.6	0.12	4.1
	Summer	TN	mg/L	1.48	191,711	284.0	59.15	1.44	138,153	199.3	41.50	0.039	2.6	84.7	17.65	29.8
		TON	mg/L	1.32	191,711	252.7	52.62	1.29	138,153	177.7	37.01	0.032	2.4	74.9	15.61	29.7
		TIN	mg/L	0.16	191,711	31.3	6.53	0.16	138,153	21.6	4.49	0.008	4.6	9.8	2.04	31.2
		OP	mg/L	0.149	191,711	28.6	5.95	0.155	138,153	21.3	4.45	-0.006	-3.7	7.2	1.50	25.3
		TP	mg/L	0.179	191,711	34.3	7.15	0.181	138,153	24.9	5.19	-0.002	-0.8	9.4	1.95	27.3
	POR	TN	mg/L	1.25	166,472	208.7	43.45	1.26	139,693	175.6	36.56	-0.003	-0.3	33.1	6.89	15.9
		TON	mg/L	1.05	166,472	174.1	36.27	1.06	139,693	147.5	30.72	-0.010	-0.9	26.6	5.55	15.3
		TIN	mg/L	0.21	166,472	34.5	7.19	0.20	139,693	28.1	5.84	0.007	3.2	6.5	1.35	18.7
		OP	mg/L	0.117	166,472	19.5	4.07	0.128	139,693	17.9	3.73	-0.011	-9.2	1.6	0.34	8.4
		TP	mg/L	0.146	166,472	24.2	5.05	0.138	139,693	19.3	4.03	0.007	4.9	4.9	1.02	20.2

Segment Areas:	RSR SEG 1	2.54	ha
	RSR SEG 2	4.80	ha

Estimated removals for total nitrogen in RSR-SEG-2 were negative during the spring segment study (-3.32 kg/ha/d) and positive during the summer study (17.6 kg/ha/d). Total organic nitrogen estimated mass removals was negative during the spring (-4.41 kg/ha/d) and positive in the summer (15.6 kg/ha/d). Estimated mass removals for total inorganic nitrogen were positive during both sampling periods (1.09 kg/ha/d in the spring and 2.04 kg/ha/d in the summer). The estimated mass removal for total phosphorus was positive during both sampling periods (spring: 0.12 kg/ha/d and summer: 1.95 kg/ha/d). The estimated mass removal for ortho-phosphorus was negative during the spring (-0.63 kg/ha/d) and positive during the summer (1.50 kg/ha/d).

3.6.2.3 Juniper Creek Segment

Estimated nutrient mass balances for the Juniper Creek segment are summarized in **Table 3-16**. Estimated mass removals for total and organic nitrogen were consistently positive and higher during the spring sampling than during the summer. Total inorganic nitrogen mass removal estimates were negative in the spring and positive in the summer. Estimated phosphorus removal rates were also higher in the summer than in the spring at Juniper Creek.

3.6.2.4 Alexander Springs Creek Segment

Estimated nutrient mass balances for the Alexander Springs Creek segments are summarized in **Table 3-17**. Estimated mass removal rates for all nitrogen forms and for ortho-phosphorus were positive during the spring sampling event. There was no measurable net removal for total phosphorus during that period. Estimated segment mass removal rates for nitrogen and phosphorus forms were all negative during the summer sampling period.

3.7 Upstream/Downstream Ecosystem Metabolism

3.7.1 Atmospheric Oxygen Diffusion Estimates

Figure 3-8 summarizes diffusion estimates from this project as well as from previous work at Silver Springs, Florida using the same method. Detailed diffusion dome worksheets are included in **Appendix F**. Several of the diffusion estimates obtained during the Wekiva River System study appear to be unrealistic based on the preponderance of other data. All of these diffusion estimates were made under conditions of very low water oxygen tension (near spring boils). These conditions increase error in the method due to the very small resulting diffusion gradient between the water and the nitrogen-filled floating dome. Following flagging of those data points, the remaining points were used to develop the regression shown in **Figure 3-8** and used for subsequent diffusion correction estimates in the stream segment ecosystem metabolism studies.

3.7.2 Estimates of Oxygen Accrual from Side Inflows

The oxygen rate-of-change method uses estimates of upstream and downstream oxygen masses to estimate the net increase or decrease in dissolved oxygen due to community metabolism. Uncounted masses of dissolved oxygen arising from unquantified surface or groundwater inputs can contribute a significant mass of additional oxygen and

TABLE 3-16

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN THE JUNIPER CREEK SEGMENT

				Inflow												Outflow				Removal				
				Segment - Up				Other Inputs				Total				Segment - Down								
				Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	Date	Parameter	Units	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(mg/L)	(m^3/d)	(kg/d)	(kg/ha/d)	(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)	(%)
JC-Seg1	Spring	TN	mg/L	0.23	269,204	62.3	71.92	*0.23*	35,353	8.2	9.45	0.23	304,557	70.5	81.37	0.20	323,804	64.0	73.80	0.034	14.7	6.6	7.56	9.3
		TON	mg/L	0.22	269,204	58.1	67.11	*0.22*	35,353	7.6	8.81	0.22	304,557	65.8	75.92	0.15	323,804	48.8	56.33	0.065	30.2	17.0	19.59	25.8
		TIN	mg/L	0.02	269,204	4.2	4.82	*0.02*	35,353	0.5	0.63	0.02	304,557	4.7	5.45	0.03	323,804	8.7	10.00	-0.011	-72.6	-3.9	-4.55	-83.5
		OP	mg/L	0.017	269,204	4.6	5.28	*0.017*	35,353	0.6	0.69	0.017	304,557	5.2	5.98	0.017	323,804	5.5	6.35	0.000	0.0	-0.3	-0.38	-6.3
		TP	mg/L	0.024	269,204	6.3	7.30	*0.024*	35,353	0.8	0.96	0.024	304,557	7.2	8.26	0.025	323,804	7.9	9.16	-0.001	-4.3	-0.8	-0.90	-10.8
	Summer	TN	mg/L	0.18	295,099	53.7	61.98	*0.18*	35,475	6.5	7.45	0.18	330,574	60.2	69.43	0.18	318,723	56.9	65.66	0.004	1.9	3.3	3.78	5.4
		TON	mg/L	0.16	295,099	45.7	52.79	*0.16*	35,475	5.5	6.35	0.16	330,574	51.2	59.13	0.15	318,723	48.6	56.09	0.003	1.6	2.6	3.04	5.1
		TIN	mg/L	0.03	295,099	8.0	9.20	*0.03*	35,475	1.0	1.11	0.03	330,574	8.9	10.30	0.03	318,723	8.3	9.56	0.001	3.7	0.6	0.74	7.2
		OP	mg/L	0.020	295,099	5.8	6.64	*0.020*	35,475	0.7	0.80	0.020	330,574	6.4	7.44	0.025	318,723	7.8	9.01	-0.005	-25.6	-1.4	-1.57	-21.1
		TP	mg/L	0.027	295,099	7.8	9.02	*0.027*	35,475	0.9	1.08	0.027	330,574	8.8	10.11	0.023	318,723	7.2	8.28	0.004	15.1	1.6	1.83	18.1
	POR	TN	mg/L	0.21	282,151	58.0	66.95	0.21	35,426	7.4	8.49	0.21	317,578	65.4	75.44	0.19	321,263	60.8	70.20	0.016	8.0	4.5	5.24	6.9
		TON	mg/L	0.18	282,151	51.9	59.92	0.19	35,426	6.6	7.62	0.18	317,578	58.5	67.55	0.15	321,263	49.3	56.88	0.031	16.8	9.2	10.66	15.8
		TIN	mg/L	0.02	282,151	6.1	7.02	0.02	35,426	0.8	0.87	0.02	317,578	6.8	7.89	0.03	321,263	8.6	9.95	-0.005	-24.6	-1.8	-2.06	-26.1
		OP	mg/L	0.018	282,151	5.2	6.01	0.018	35,426	0.6	0.75	0.018	317,578	5.9	6.76	0.021	321,263	6.9	7.97	-0.003	-16.4	-1.0	-1.20	-17.8
		TP	mg/L	0.025	282,151	7.1	8.20	0.025	35,426	0.9	1.03	0.025	317,578	8.0	9.23	0.024	321,263	7.6	8.75	0.002	6.3	0.4	0.48	5.2

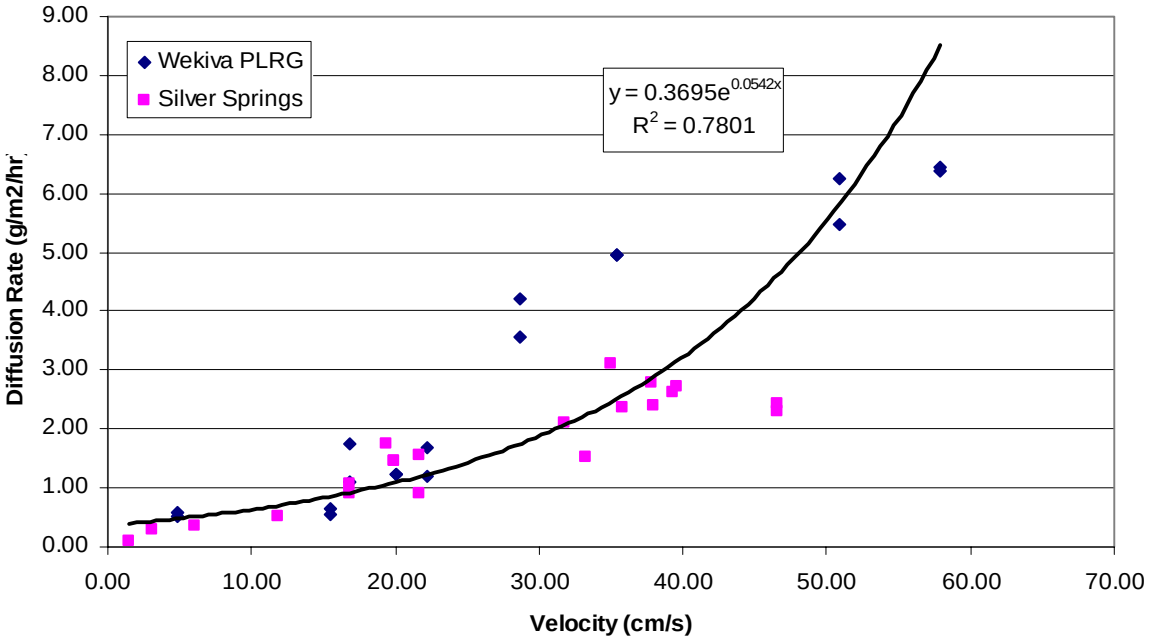
Segment Areas: JC SEG 1 0.87 ha

TABLE 3-17

SUMMARY OF ESTIMATED NUTRIENT MASS REMOVALS IN THE ALEXANDER SPRINGS CREEK SEGMENT

				Inflow				Outflow								
				Segment - Up				Segment - Down				Removal				
				Conc	Flow	Mass	Mass	Conc	Flow	Mass	Mass	Conc		Mass		
Site	Date	Parameter	Units	(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)	(%)
ASC-Seg1	Spring	TN	mg/L	0.21	273,099	58.6	14.19	0.16	273,099	44.5	10.78	0.052	24.0	14.1	3.41	24.0
		TON	mg/L	0.20	273,099	53.3	12.90	0.16	273,099	42.3	10.25	0.040	20.5	10.9	2.65	20.5
		TIN	mg/L	0.02	273,099	5.3	1.29	0.01	273,099	2.5	0.60	0.011	53.8	2.9	0.69	53.8
		OP	mg/L	0.041	273,099	11.2	2.71	0.038	273,099	10.2	2.48	0.003	8.5	1.0	0.23	8.5
		TP	mg/L	0.045	273,099	12.2	2.94	0.045	273,099	12.3	2.98	-0.001	-1.1	-0.1	-0.03	-1.1
	Summer	TN	mg/L	0.44	334,584	147.7	35.78	0.47	339,225	159.4	38.62	-0.029	-6.5	-11.7	-2.84	-7.9
		TON	mg/L	0.42	334,584	140.5	34.04	0.45	339,225	151.0	36.56	-0.025	-6.0	-10.4	-2.53	-7.4
		TIN	mg/L	0.02	334,584	7.2	1.74	0.03	339,225	8.5	2.05	-0.004	-16.3	-1.3	-0.31	-17.9
		OP	mg/L	0.049	334,584	16.2	3.93	0.054	339,225	18.3	4.44	-0.006	-11.3	-2.1	-0.51	-12.9
		TP	mg/L	0.053	334,584	17.6	4.25	0.058	339,225	19.5	4.72	-0.005	-9.5	-1.9	-0.47	-11.0
	POR	TN	mg/L	0.33	303,842	99.7	24.14	0.33	306,162	100.0	24.21	0.002	0.5	-0.3	-0.07	-0.3
		TON	mg/L	0.31	303,842	93.5	22.66	0.31	306,162	94.7	22.94	-0.001	-0.5	-1.2	-0.28	-1.2
		TIN	mg/L	0.02	303,842	6.1	1.49	0.02	306,162	5.4	1.31	0.003	12.5	0.7	0.18	11.9
		OP	mg/L	0.045	303,842	13.7	3.32	0.047	306,162	14.4	3.48	-0.002	-3.9	-0.6	-0.16	-4.7
		TP	mg/L	0.049	303,842	14.9	3.61	0.052	306,162	15.8	3.83	-0.003	-5.4	-0.9	-0.22	-6.2

Segment Areas: ASC SEG 1 4.13 ha



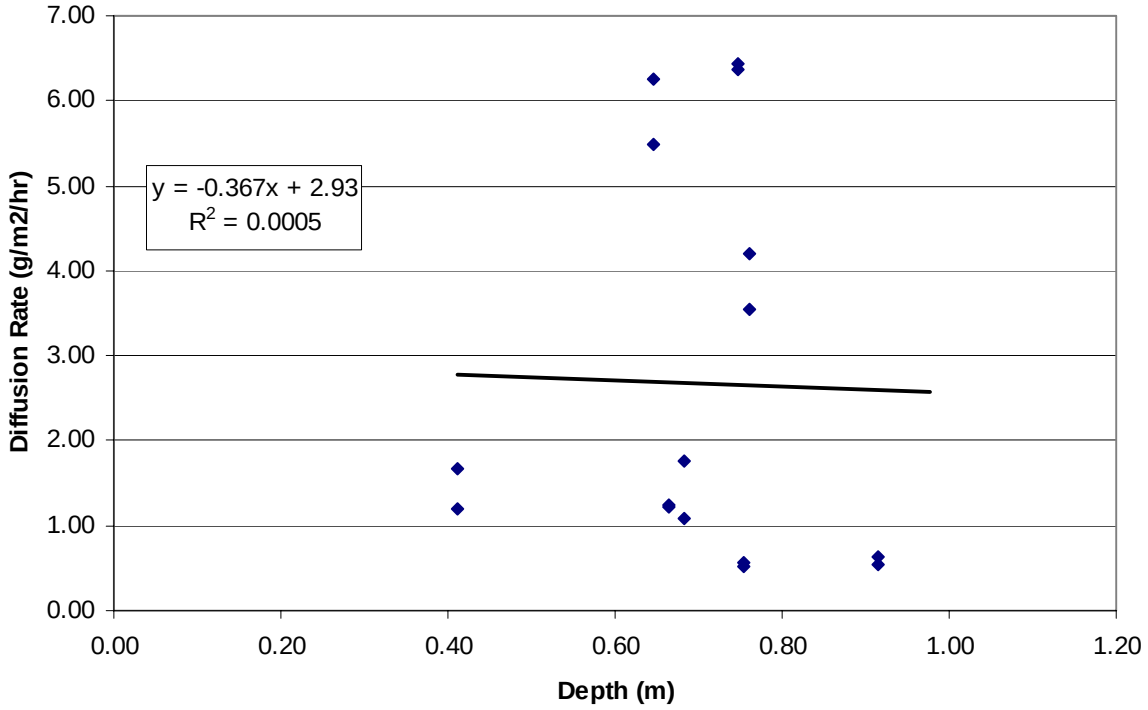


FIGURE 3-8

OBSERVED RELATIONSHIP BETWEEN MEASURED OXYGEN DIFFUSION RATE CONSTANT AND CURRENT VELOCITY AND WATER DEPTH IN THE WEKIVA RIVER SYSTEM, REFERENCE SITES, AND THE SILVER RIVER, FLORIDA.

produce errors in metabolism estimates. Upstream-downstream flows were examined for the existing segment datasets to determine whether an oxygen accrual correction was justified. The decision to apply this correction was made based on an examination of upstream and downstream flow data, the known occurrence of unaccounted inflows such as Sweetwater Spring in the Juniper Creek stream segment, and indications in the nighttime dissolved oxygen response at the downstream station that showed clear trends that were not accounted for by upstream dissolved oxygen patterns. In each case where this correction was made an average midnight oxygen rate-of-change was estimated based on typical daily values in the dataset and from estimated inflows. Oxygen accrual was then adjusted for all midnight values that differed substantially from this typical value and then intermediate hourly accrual values were interpolated between these daily estimates.

The oxygen accrual correction was applied to a greater or lesser extent for all stream segments with the exception of RSR-SEG-2 and ASC-SEG-1. The highest percentage accrual correction was applied to WR-SEG-2 during the spring sampling period (26%) where there was considerable variation in inflow water masses derived from Wekiva Falls and multiple, braided channels. During the summer sampling the accrual correction was only 4% in this segment. An 18% accrual correction was applied to RSR-SEG-1 during the relatively rainy spring event but no accrual correction was required in this segment during the summer event. Both positive (12%) and negative (-12%) were applied to the JC-SEG-1 during the summer and spring events. When accrual corrections are applied to an oxygen-rate-of-change dataset it means that CR and NPP24 results for these water bodies are estimates based on the assumed accrual rates. Estimates of GPP are not affected by these accrual assumptions.

3.7.3 Estimates of Depth and Color Effects on PAR Attenuation

Light attenuation is affected by water column depth to the growing plant layer as well as dissolved color in the water column. Plant depth in each stream segment was documented during the transect studies and used to estimate the depth of water that light had to travel through to reach the active photosynthesizing plant community. Estimated plant depths by segment were:

- WR-SEG-1 1.50 m (4.9 ft)
- WR-SEG-2 0.10 m (0.33 ft)
- RSR-SEG-1 0.50 m (1.6 ft)
- RSR-SEG-2 0.25 m (0.82 ft)
- JC-SEG-1 0.50 m (1.6 ft)
- ASC-SEG-1 0.10 m (0.33 ft)

Light attenuation was measured at the beginning and end of each stream segment ecological study period at the same time that water quality samples were collected. The detailed light attenuation data are provided in **Appendix F**. Color was observed to vary widely in all of the streams in response to rainfall/runoff events. These changes in color could easily affect estimates of the useful PAR reaching the plant community and the

resulting estimated ecological efficiency. PAR corrections were applied to daily data using observed relationships between the light attenuation coefficient, color, and specific conductance. Specific conductance was used as a surrogate for color since it was monitored continuously by the Troll 9000 multi-parameter data sonde. Correlations were made between specific conductance and color for each water body (**Figure 3-9**). These regressions were fairly useful with R^2 values between 0.30 and 1.0. Color is higher at lower specific conductance values due to the increasing fraction of rainwater and runoff in the streams under rainy conditions. This relationship is different in each stream due to the differing nature of the groundwater influence in each spring system.

Color was found to be highly correlated with the diffuse attenuation coefficient (k) for PAR (**Figure 3-10**). This observed effect is largely independent of stream water chemistry so data pairs for color and k were combined from all four stream reaches for this analysis.

Using the two relationships illustrated in **Figures 3-9** and **3-10**, k values were estimated for each day during the period of each stream segment ecosystem metabolism study. This process allowed refinement of the estimates of PAR actually reaching the plant levels in each stream segment.

3.7.4 Summary of Stream Segment Metabolism Estimates

Table 3-18 provides a summary of the Wekiva River System and reference site stream segment ecosystem metabolism estimates by season. Detailed spreadsheets used to calculate these metabolism estimates are provided in **Appendix G**.

Estimated average gross primary productivity (GPP) ranged from a low of 0.51 g $O_2/m^2/d$ in Rock Springs Run during the late spring sampling to a high of 7.67 g $O_2/m^2/d$ in Alexander Springs Creek during the same period. Community respiration (CR) estimates ranged from a low value of 4.35 g $O_2/m^2/d$ at Alexander Springs Creek Segment 1 to a high value of 15.6 g $O_2/m^2/d$ in WR-SEG-2. The resulting estimated 24-hour net primary productivity (NPP24) was positive in only one segment study with 0.77 g $O_2/m^2/d$ in ASC-SEG-1 during the late summer study. All other estimates of NPP24 were negative with a low value of -14.4 g $O_2/m^2/d$ in RSR-SEG-2 in late summer.

The community coefficient (P/R ratio) was greater than 1.0 for only one case (ASC-SEG-1 late summer) and was as low as 0.04 in RSR-SEG-2 in late summer. PAR ecological efficiency was estimated to range from a low of about 0.05 to 0.08 gO2/mol (0.4 to 0.6%) in both segments of Rock Springs Run, to a high of about 0.22 to 0.47 gO2/mol (1.8 to 3.8%) in the lower reaches of the Wekiva River, Juniper Creek, and Alexander Springs Creek during both sampling events.

Detailed ecosystem metabolism results are presented below for each stream segment.

3.7.5 Wekiva River Segment 1

Exhibits in **Appendix G** provide a visual and tabular summary of the detailed behavior of WR-SEG-1 during the late spring sampling period. **Figure 3-11** provides a summary of the daily community metabolism estimates for the period from April 29 through May 27, 2005. A strong diurnal curve was observed for oxygen, temperature, and pH at both the upstream (head spring pool outflow) and at the downstream segment stations. The

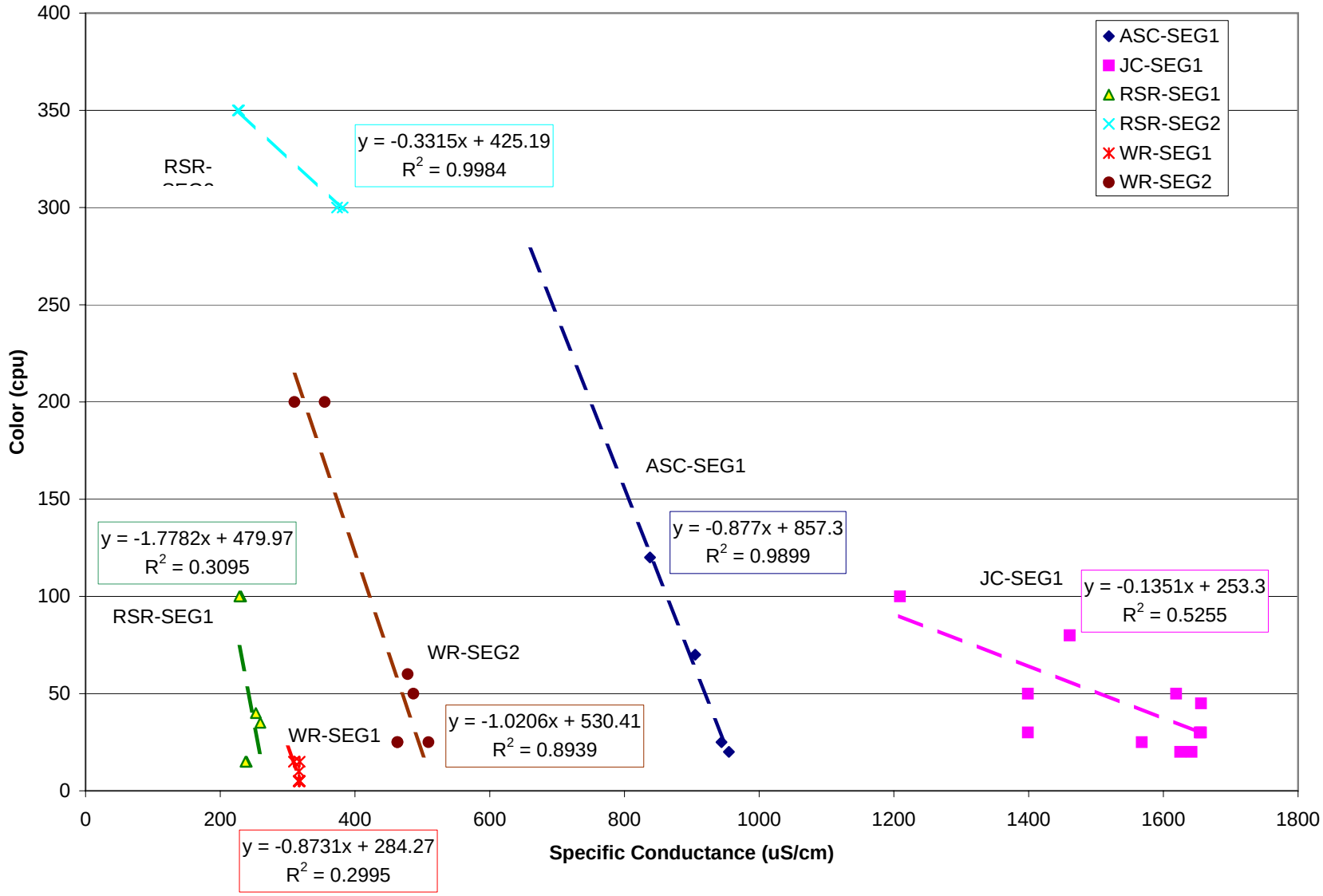


FIGURE 3-9
WEKIVA PLRG SEGMENTS - RELATIONSHIP BETWEEN SPECIFIC CONDUCTANCE AND COLOR

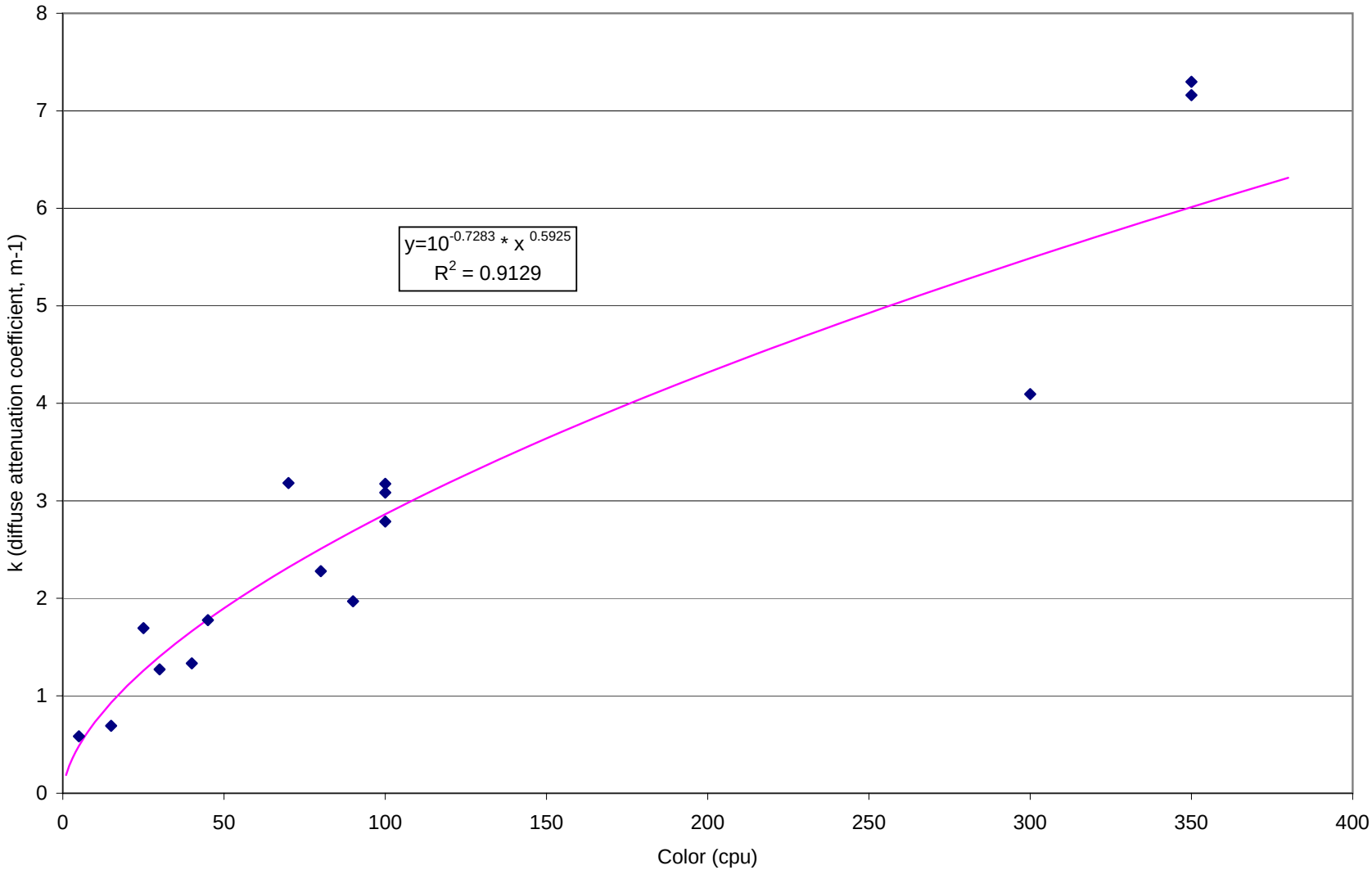
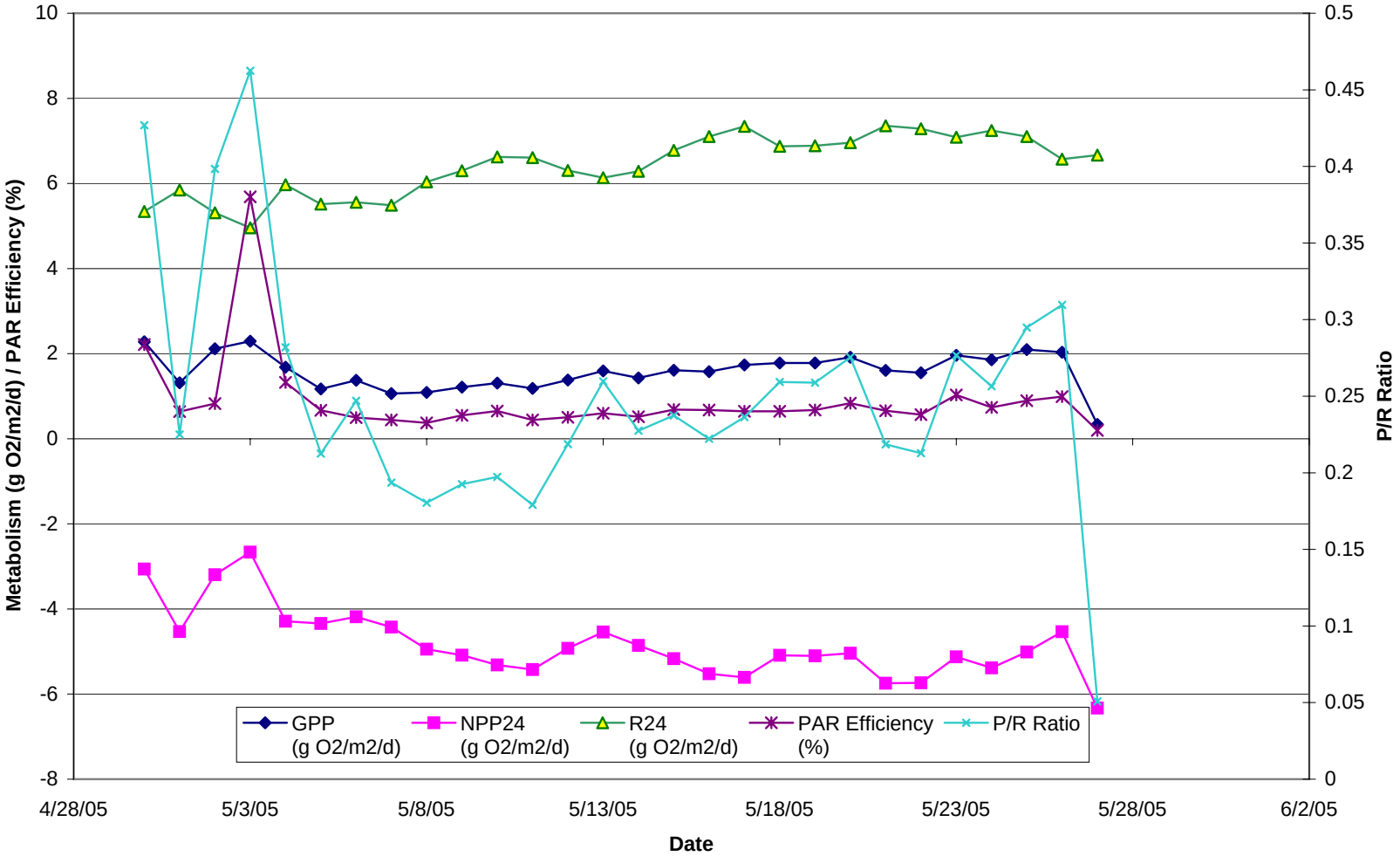


FIGURE 3-10
WEKIVA PLRG LIGHT ATTENUATION RELATIONSHIP WITH COLOR

TABLE 3-18
WEKIVA PLRG - METABOLISM SUMMARY

Segment	GPP	NPP24	R24	Avg. P/R ratio	Plant Depth (m)	PAR corr. ($mol/m^2/d$)	PAR Eff. ($g\ O_2/mol$)	PAR Eff. (%)	Velocity (cm/s)	HRT (hrs)	Color (cpu)	NOx (mg/L)	TP (mg/L)	Period-of-Record	
	($g\ O_2/m^2/d$)														
MARCH - MAY 2005															
WR SEG 1	1.58	-4.83	6.41	0.25	1.50	18.17	0.11	0.90	3.08	9.07	8.75	1.09	0.125	4/29/2005	5/27/2005
WR SEG 2	5.38	-10.27	15.64	0.35	0.10	28.75	0.22	1.79	11.25	1.88	40.0	0.300	0.118	4/28/2005	5/26/2005
RSR SEG 1	1.86	-9.42	11.28	0.17	0.50	23.72	0.08	0.67	7.51	3.05	26.3	1.15	0.091	4/1/2005	4/20/2005
RSR SEG 2	0.51	-6.91	7.42	0.07	0.25	10.22	0.05	0.42	12.60	2.82	193	0.270	0.096	4/1/2005	4/21/2005
ASC SEG 1	7.67	-2.62	10.28	0.75	0.10	27.30	0.36	2.94	7.73	2.54	58.8	0.009	0.045	4/29/2005	5/24/2005
JC SEG 1	6.67	-2.42	9.09	0.85	0.50	15.87	0.47	3.75	41.90	0.57	38.8	0.015	0.024	3/31/2005	4/18/2005
JULY - SEPTEMBER 2005															
WR SEG 1	1.67	-5.40	7.07	0.24	1.50	15.81	0.11	0.90	3.11	8.94	21.9	1.24	0.158	8/10/2005	8/31/2005
WR SEG 2	3.60	-2.96	6.56	0.56	0.10	26.50	0.14	1.16	11.11	1.90	96.3	0.365	0.141	8/9/2005	9/1/2005
RSR SEG 1	0.60	-6.98	7.57	0.07	0.50	14.58	0.05	0.38	7.52	3.04	77.5	1.03	0.097	7/12/2005	8/3/2005
RSR SEG 2	0.59	-14.40	14.99	0.04	0.25	8.49	0.07	0.56	14.76	2.48	350	0.045	0.180	7/12/2005	8/4/2005
ASC SEG 1	5.12	0.77	4.35	1.23	0.10	23.87	0.23	1.82	8.07	2.43	150	0.018	0.055	8/9/2005	8/29/2005
JC SEG 1	4.02	-3.94	7.97	0.52	0.50	16.63	0.26	2.08	25.93	0.92	65.0	0.023	0.025	7/11/2005	8/1/2005



Stats	GPP	NPP24	R24	P/R	PAR Eff.	
	($g\ O_2/m^2/d$)			ratio	(%)	($g\ O_2/mol$)
Avg	1.58	-4.83	6.41	0.25	0.90	0.11
Max	2.29	-2.66	7.35	0.46	5.69	0.70
Min	0.34	-6.33	4.96	0.05	0.20	0.02

FIGURE 3-11
WEKIVA RIVER - SEGMENT 1 METABOLISM ESTIMATES (4/29/05 - 5/27/05)

curves for specific conductance and for PAR illustrate the influence of a rain (and cloud) event on May 4, 2005 that resulted in increased flow and lowered downstream water temperature and pH. Daily dissolved oxygen rhythm was not greatly affected by this event and GPP was only slightly reduced. GPP ranged from 0.34 to 2.29 g $O_2/m^2/d$ with an average value of 1.58 g $O_2/m^2/d$. Respiration varied from 4.96 to 7.35 g $O_2/m^2/d$ with an average value of 6.41 g $O_2/m^2/d$. NPP was consistently negative at this station varying from -6.33 to -2.66 g $O_2/m^2/d$ with an average value of -4.83 g $O_2/m^2/d$. The resulting average P/R ratio was 0.25 and the estimated PAR efficiency averaged 0.11 gO_2/mol (0.90%).

Figure 3-12 provides a summary of the daily community metabolism estimates for the late summer period from August 10 through 31, 2005. A strong diurnal curve was observed for oxygen, temperature, and pH at both the upstream (head spring pool outflow) and at the downstream segment stations. GPP ranged from 0.99 to 2.09 g $O_2/m^2/d$ with an average value of 1.67 g $O_2/m^2/d$. Respiration varied from 6.57 to 7.54 g $O_2/m^2/d$ with an average value of 7.07 g $O_2/m^2/d$. NPP was consistently negative at this station varying from -6.55 to -4.91 g $O_2/m^2/d$ with an average value of -5.40 g $O_2/m^2/d$. The resulting average P/R ratio was 0.24 and the estimated PAR efficiency averaged 0.11 gO_2/mol (0.90%).

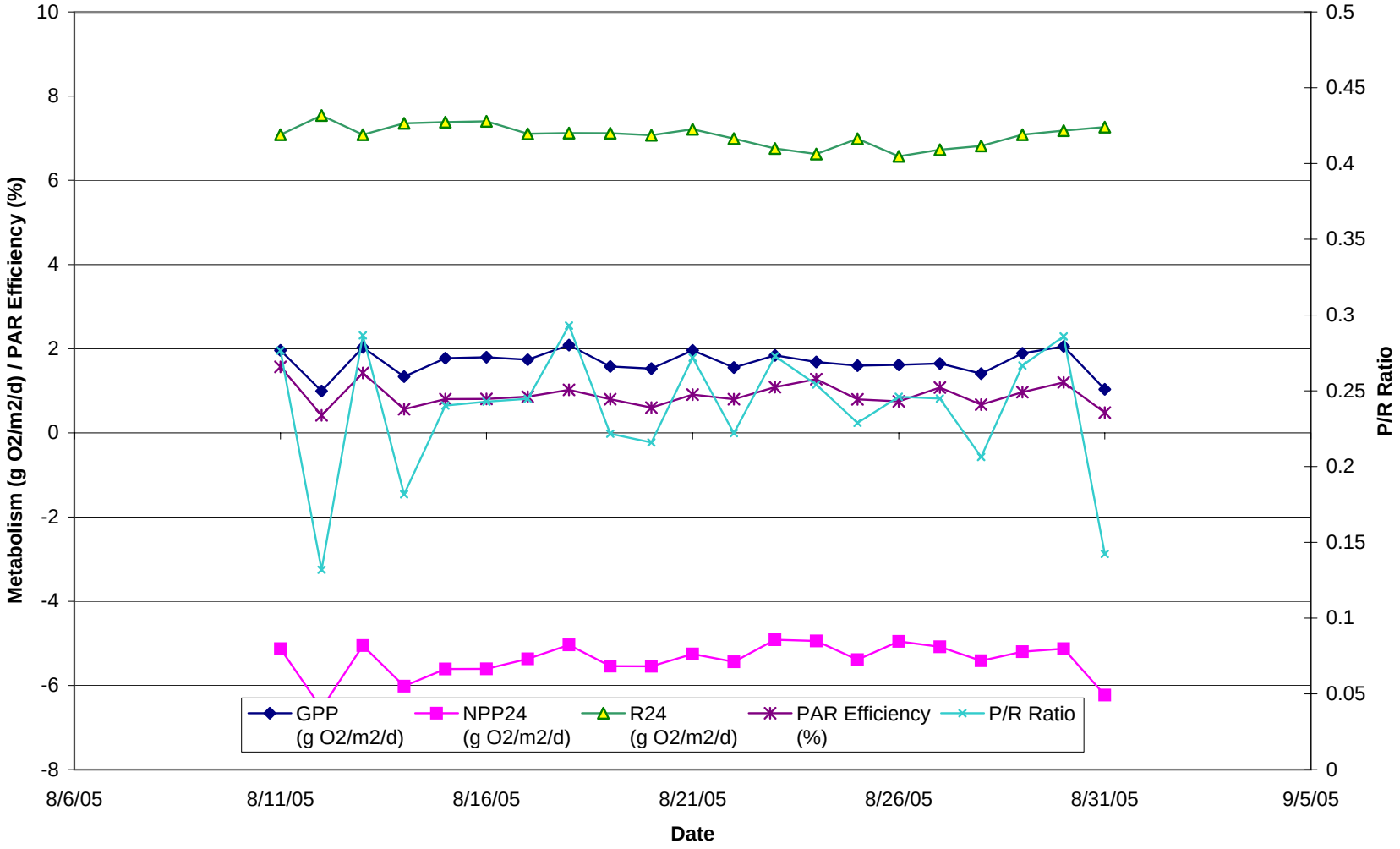
3.7.6 Wekiva River Segment 2

Exhibits in **Appendix G** provide a visual and tabular summary of the detailed behavior of WR-SEG-2 during the late spring sampling period. **Figure 3-13** provides a summary of the daily community metabolism estimates for the period from April 29 through May 27, 2005. A strong diurnal curve was observed for oxygen, temperature, and pH at both the upstream and downstream segment stations. The curves for specific conductance and for PAR illustrate the influence of a rain (and cloud) event on May 4, 2005 that resulted in increased flow and lowered downstream water temperature and pH. Daily dissolved oxygen rhythm was not greatly affected by this event and GPP was only slightly reduced. GPP ranged from 0.59 to 8.60 g $O_2/m^2/d$ with an average value of 5.38 g $O_2/m^2/d$. Respiration varied from 14.6 to 17.0 g $O_2/m^2/d$ with an average value of 15.6 g $O_2/m^2/d$. NPP was consistently negative at this station varying from -15.1 to -6.49 g $O_2/m^2/d$ with an average value of -10.3 g $O_2/m^2/d$. The resulting average P/R ratio was 0.35 and the estimated PAR efficiency averaged 0.22 gO_2/mol (1.79%).

Figure 3-14 provides a summary of the daily community metabolism estimates for the late summer period from August 9 through September 1, 2005. A strong diurnal curve was observed for oxygen, temperature, and pH at both the upstream and downstream segment stations. GPP ranged from -0.04 to 6.16 g $O_2/m^2/d$ with an average value of 3.60 g $O_2/m^2/d$. Respiration varied from 5.19 to 7.75 g $O_2/m^2/d$ with an average value of 6.56 g $O_2/m^2/d$. NPP was typically negative at this station varying from -6.19 to 0.65 g $O_2/m^2/d$ with an average value of -2.96 g $O_2/m^2/d$. The resulting average P/R ratio was 0.56 and the estimated PAR efficiency averaged 0.14 gO_2/mol (1.16%).

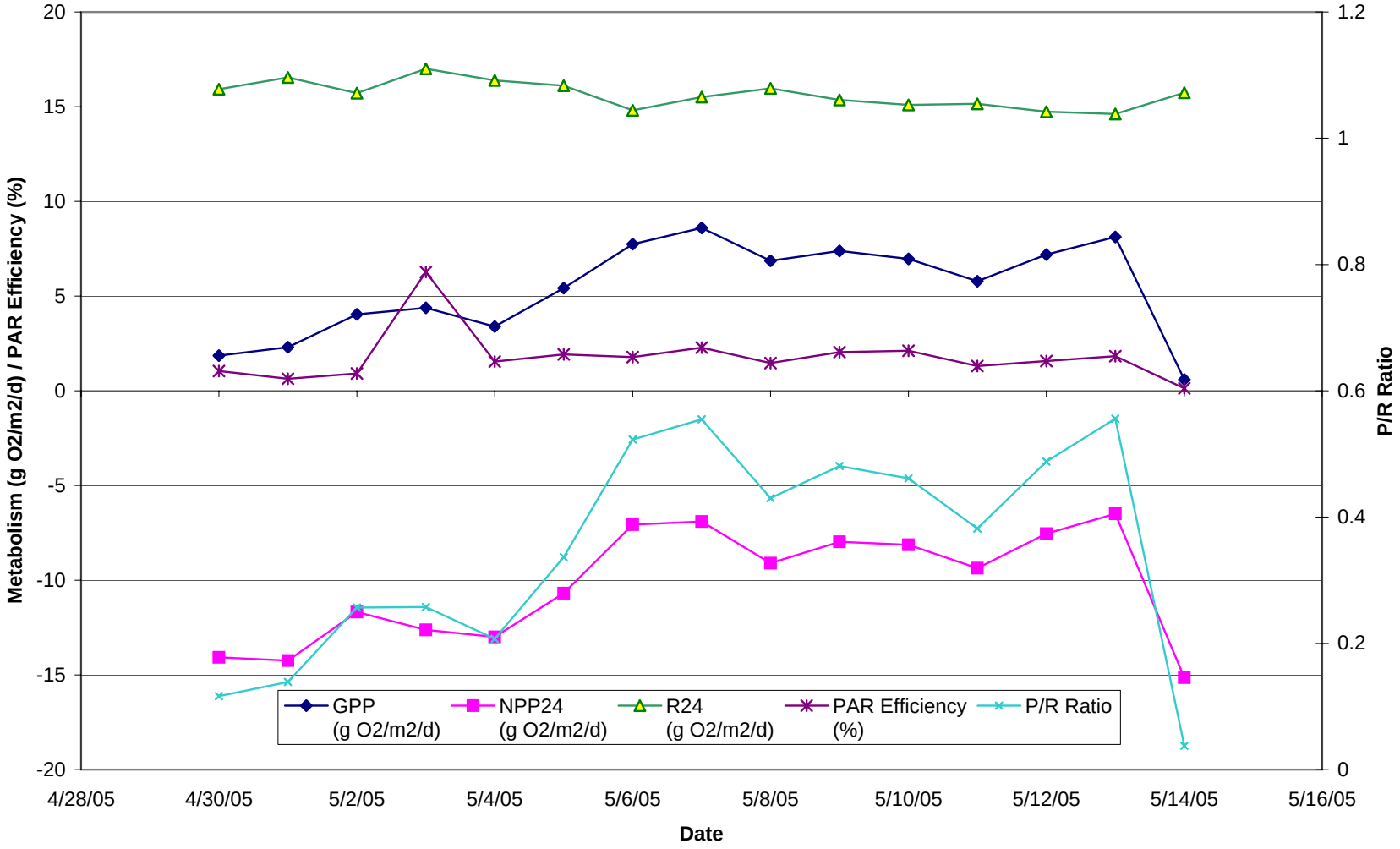
3.7.7 Rock Springs Run Segment 1

Exhibits in **Appendix G** provide a visual and tabular summary of the detailed behavior of RSR-SEG-1 during the spring sampling period. **Figure 3-15** provides a summary of the daily community metabolism estimates for the period from April 1 through April 20,



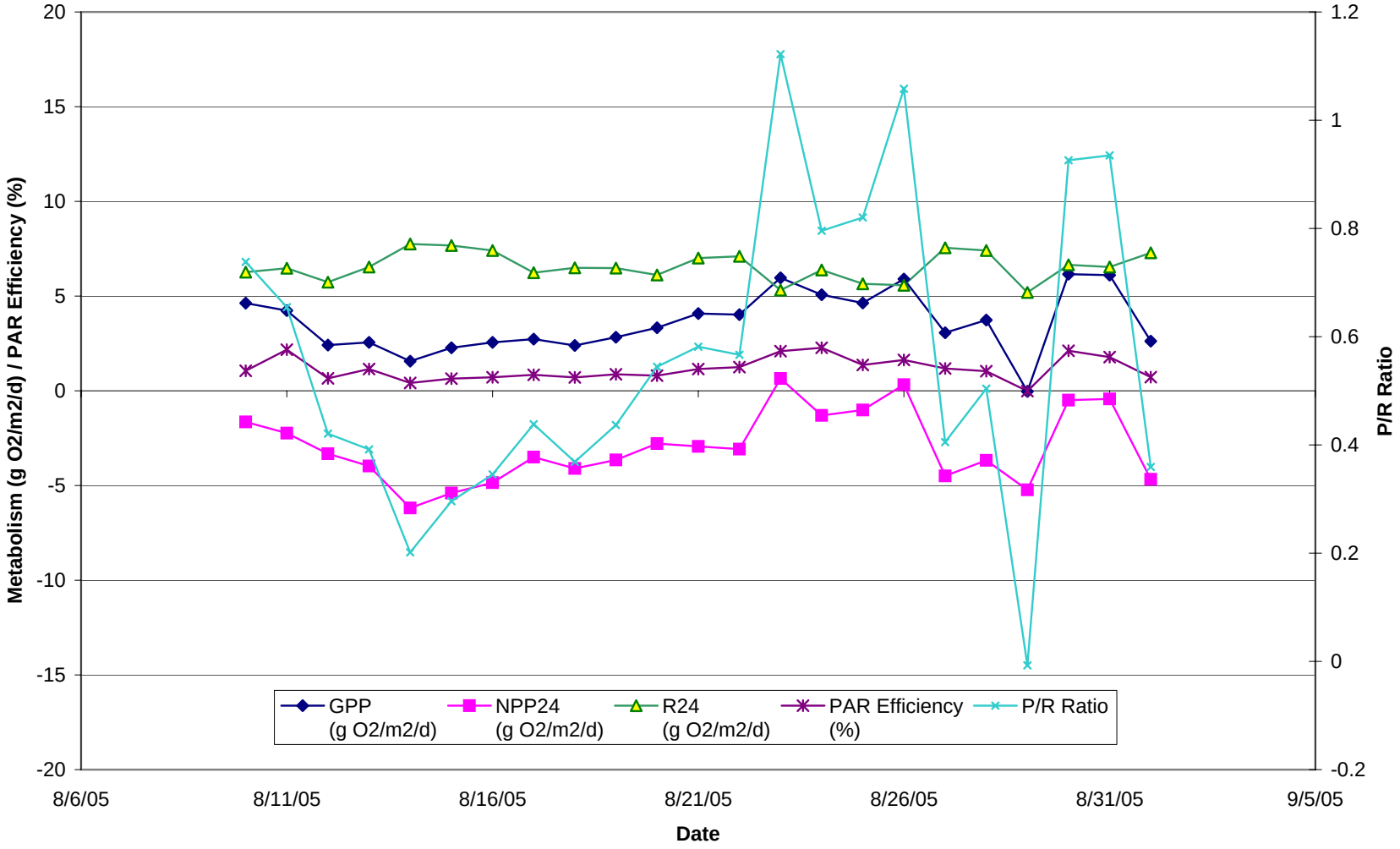
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	1.67	-5.40	7.07	0.24	0.90	0.11
Max	2.09	-4.91	7.54	0.29	1.57	0.19
Min	0.99	-6.55	6.57	0.13	0.42	0.05

FIGURE 3-12
WEKIVA RIVER - SEGMENT 1 METABOLISM ESTIMATES (8/10/05 - 8/31/05)



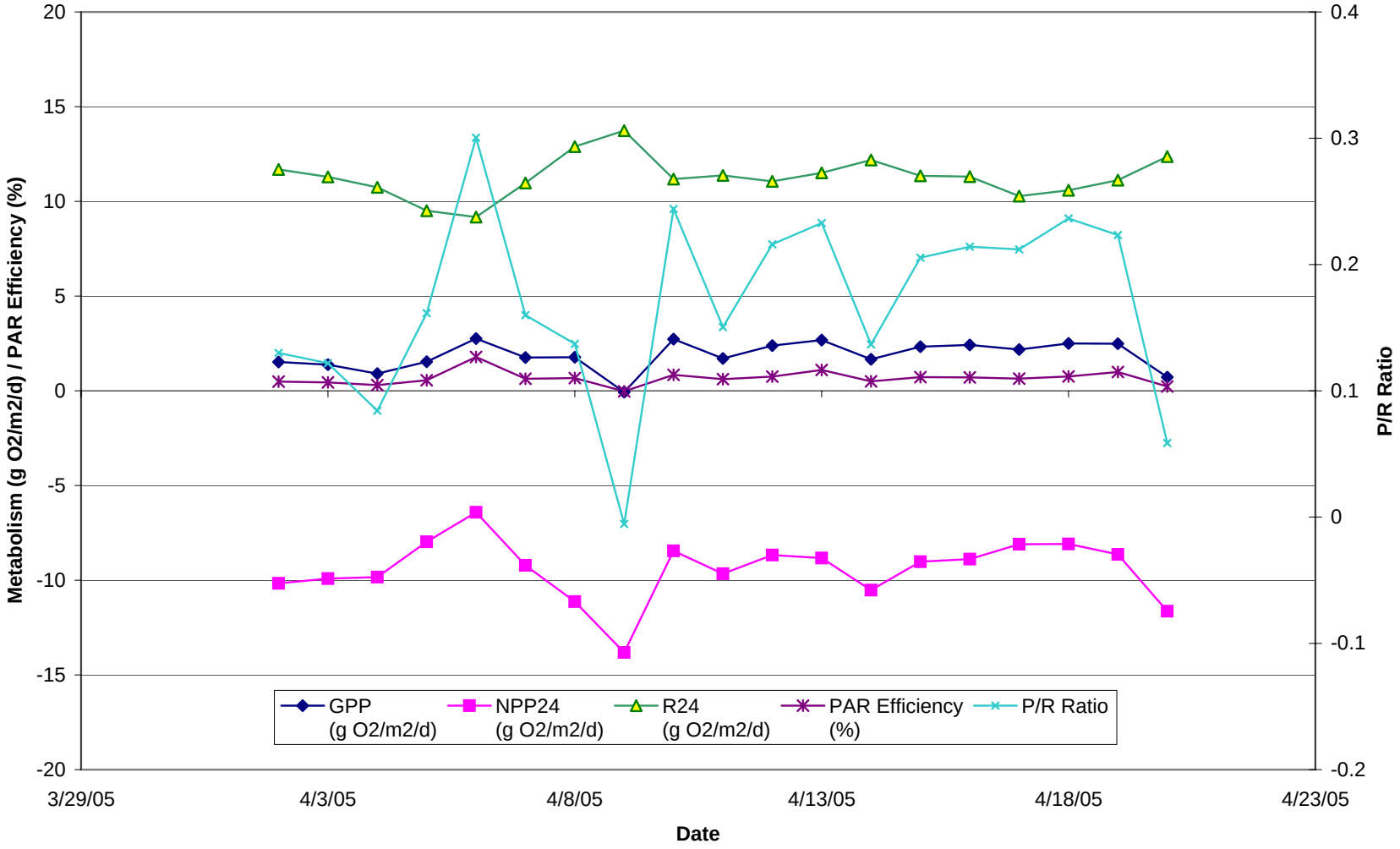
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff.	
	($g\ O_2/m^2/d$)				(%)	($g\ O_2/mol$)
Avg	5.38	-10.27	15.64	0.35	1.79	0.22
Max	8.60	-6.49	17.00	0.56	6.27	0.78
Min	0.59	-15.14	14.61	0.04	0.13	0.02

FIGURE 3-13
WEKIVA RIVER - SEGMENT 2 METABOLISM ESTIMATES (4/29/05 - 5/15/05)



Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$/mol)
	($g\ O_2/m^2/d$)					
Avg	3.60	-2.96	6.56	0.56	1.16	0.14
Max	6.16	0.65	7.75	1.12	2.27	0.28
Min	-0.04	-6.19	5.19	-0.01	-0.01	0.00

FIGURE 3-14
WEKIVA RIVER - SEGMENT 2 METABOLISM ESTIMATES (8/9/05 - 9/1/05)



Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	1.86	-9.42	11.28	0.17	0.67	0.08
Max	2.75	-6.41	13.74	0.30	1.78	0.22
Min	-0.07	-13.81	9.17	-0.01	-0.03	0.00

FIGURE 3-15
ROCK SPRING RUN - SEGMENT 1 METABOLISM ESTIMATES (4/1/05 - 4/20/05)

2005. A strong diurnal curve was observed for oxygen, temperature, and pH at both the upstream and downstream segment stations. GPP ranged from -0.07 to 2.75 g $O_2/m^2/d$ with an average value of 1.86 g $O_2/m^2/d$. Respiration varied from 9.17 to 13.7 g $O_2/m^2/d$ with an average value of 11.3 g $O_2/m^2/d$. NPP was consistently negative at this station varying from -13.8 to -6.41 g $O_2/m^2/d$ with an average value of -9.42 g $O_2/m^2/d$. The resulting average P/R ratio was 0.17 and the estimated PAR efficiency averaged 0.08 gO_2/mol (0.67%).

Figure 3-16 provides a summary of the daily community metabolism estimates for the summer period from July 12 through August 3, 2005. A weak diurnal curve was observed for oxygen and pH at both the upstream (head spring pool outflow and at the downstream segment stations. Evidence of several rainfall events is visible in the specific conductance data. GPP ranged from -0.65 to 1.47 g $O_2/m^2/d$ with an average value of 0.60 g $O_2/m^2/d$. Respiration varied from 4.57 to 8.81 g $O_2/m^2/d$ with an average value of 7.57 g $O_2/m^2/d$. NPP was typically negative at this station varying from -8.51 to -5.21 g $O_2/m^2/d$ with an average value of -6.98 g $O_2/m^2/d$. The resulting average P/R ratio was 0.07 and the estimated PAR efficiency averaged 0.05 gO_2/mol (0.38%).

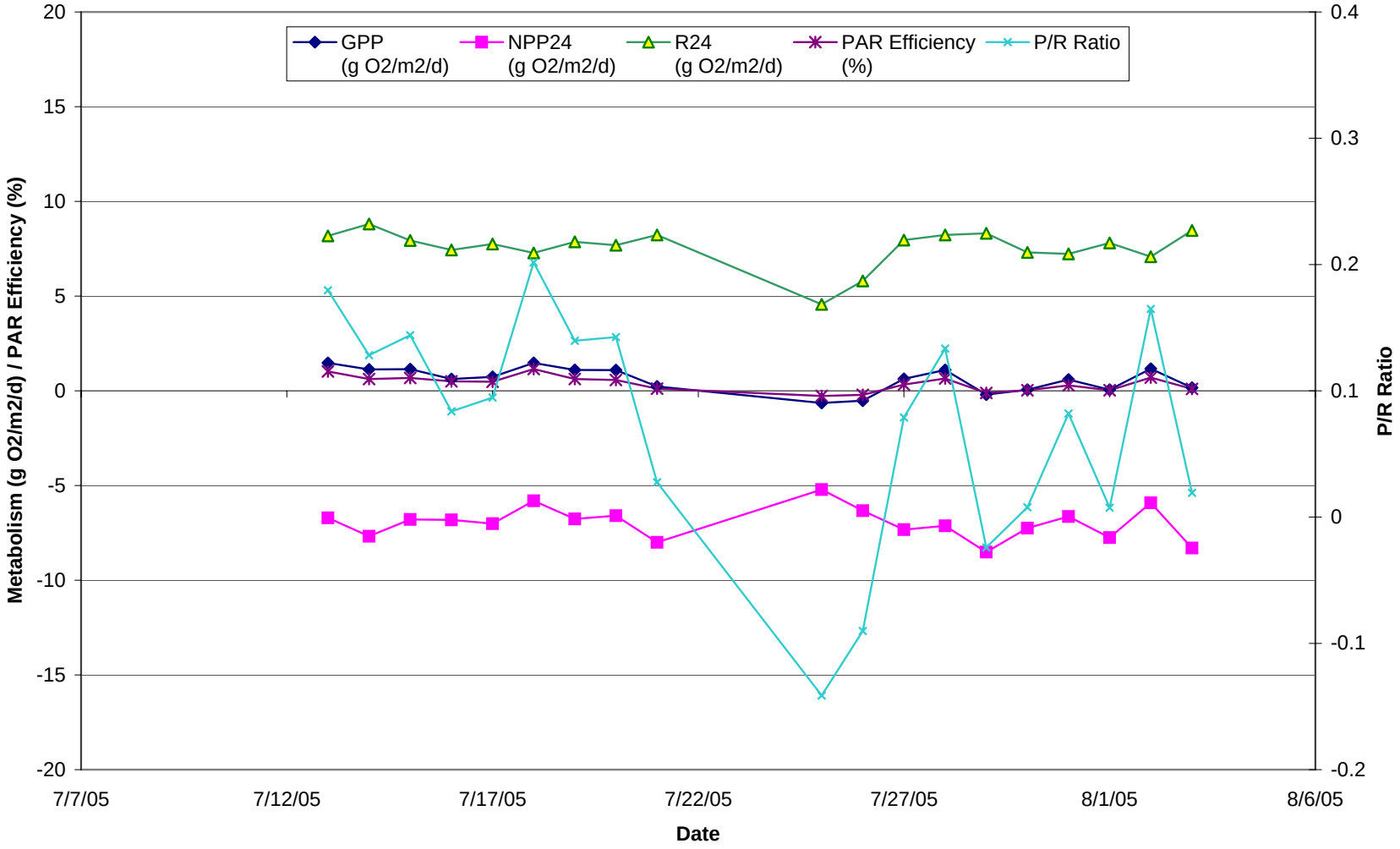
3.7.8 Rock Springs Run Segment 2

Exhibits in **Appendix G** provide a visual and tabular summary of the detailed behavior of RSR-SEG-2 during the spring sampling period. **Figure 3-17** provides a summary of the daily community metabolism estimates for the period from April 1 through April 21, 2005. A relatively weak diurnal curve was observed for oxygen and pH at both the upstream and downstream segment stations. GPP ranged from 0.03 to 0.77 g $O_2/m^2/d$ with an average value of 0.51 g $O_2/m^2/d$. Respiration varied from 6.70 to 8.43 g $O_2/m^2/d$ with an average value of 7.42 g $O_2/m^2/d$. NPP was consistently negative at this station varying from -8.40 to -6.08 g $O_2/m^2/d$ with an average value of -6.91 g $O_2/m^2/d$. The resulting average P/R ratio was 0.07 and the estimated PAR efficiency averaged 0.05 gO_2/mol (0.42%).

Figure 3-18 provides a summary of the daily community metabolism estimates for the summer period from July 12 through 29, 2005. A weak diurnal curve was observed for oxygen and pH at both the upstream and downstream segment stations. Evidence of several rainfall events is visible in the specific conductance data. GPP ranged from 0.31 to 1.58 g $O_2/m^2/d$ with an average value of 0.59 g $O_2/m^2/d$. Respiration varied from 11.3 to 18.9 g $O_2/m^2/d$ with an average value of 15.0 g $O_2/m^2/d$. NPP was typically negative at this station varying from -18.6 to -10.1 g $O_2/m^2/d$ with an average value of -14.4 g $O_2/m^2/d$. The resulting average P/R ratio was 0.04 and the estimated PAR efficiency averaged 0.07 gO_2/mol (0.56%).

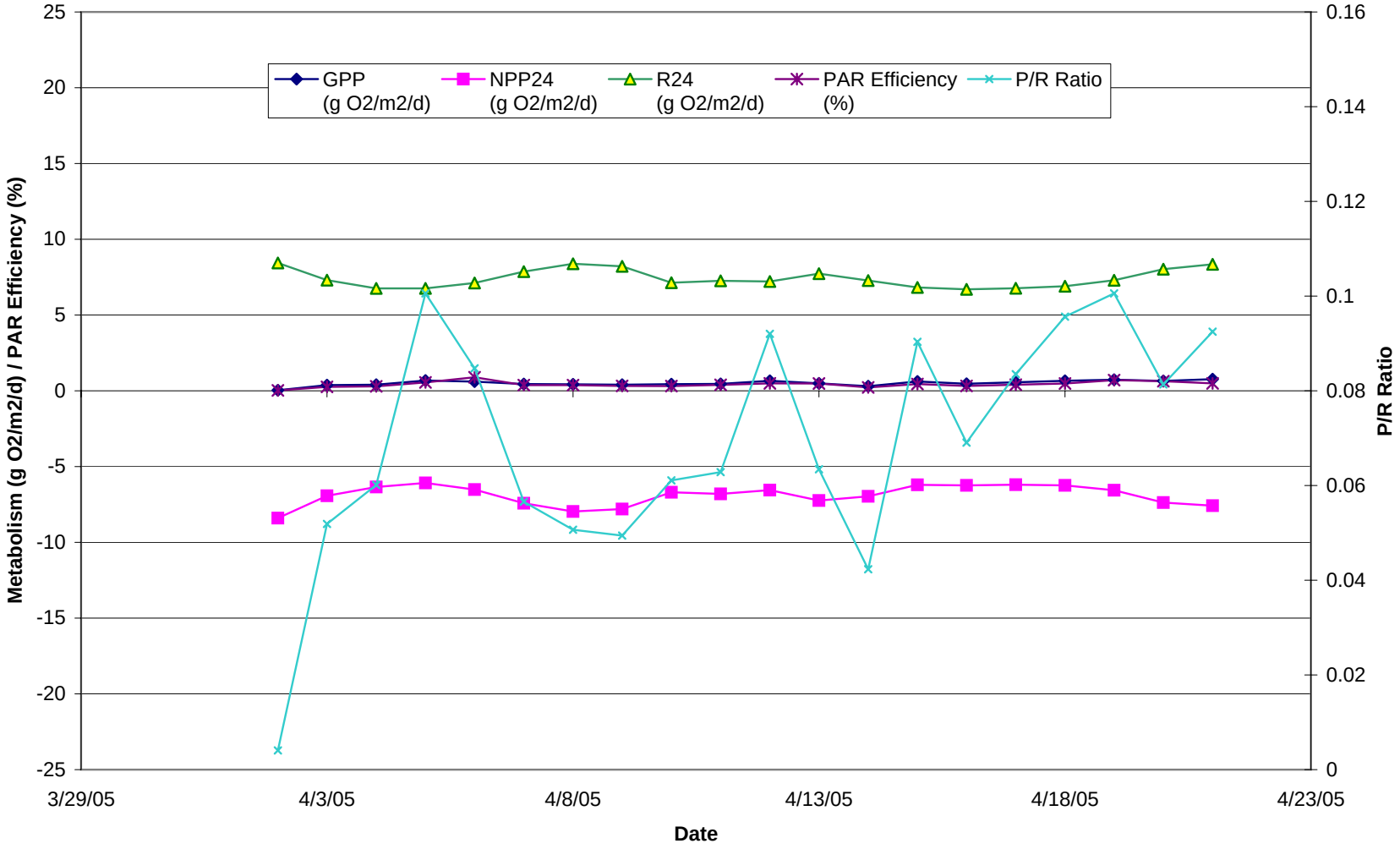
3.7.9 Juniper Creek Segment 1

Exhibits in **Appendix G** provide a visual and tabular summary of the detailed behavior of JC-SEG-1 during the spring sampling period. **Figure 3-19** provides a summary of the daily community metabolism estimates for the period from March 31 through April 18, 2005. Relatively strong diurnal curves were observed for oxygen, pH, and temperature at both the upstream and downstream segment stations. GPP ranged from 1.54 to 11.0 g $O_2/m^2/d$ with an average value of 6.67 g $O_2/m^2/d$. Respiration varied from 4.86 to 15.4 g $O_2/m^2/d$ with an average value of 9.09 g $O_2/m^2/d$. NPP was both negative and



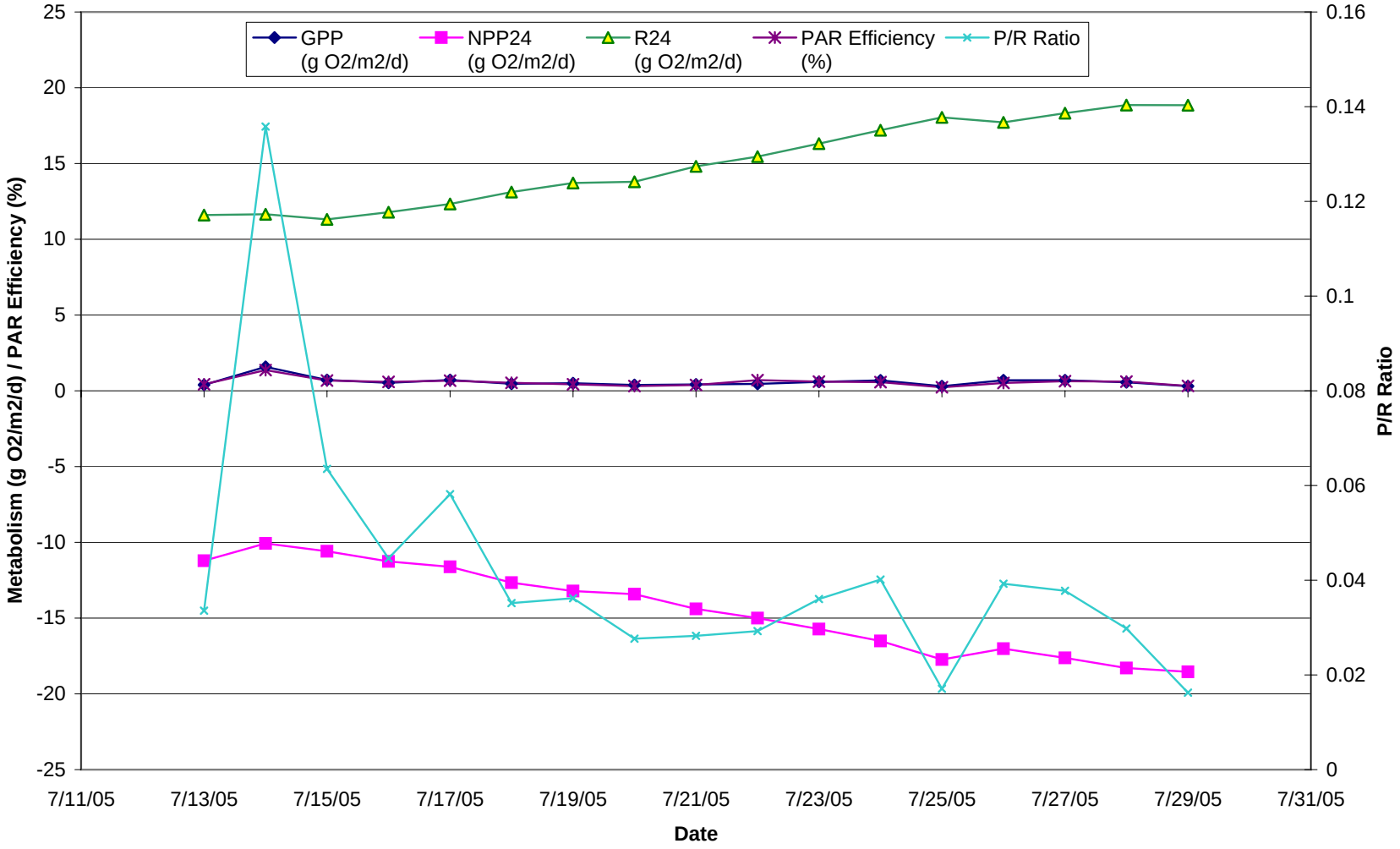
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	0.60	-6.98	7.57	0.07	0.38	0.05
Max	1.47	-5.21	8.81	0.20	1.15	0.14
Min	-0.65	-8.51	4.57	-0.14	-0.27	-0.03

FIGURE 3-16
ROCK SPRING RUN - SEGMENT 1 METABOLISM ESTIMATES (7/12/05 - 8/3/05)



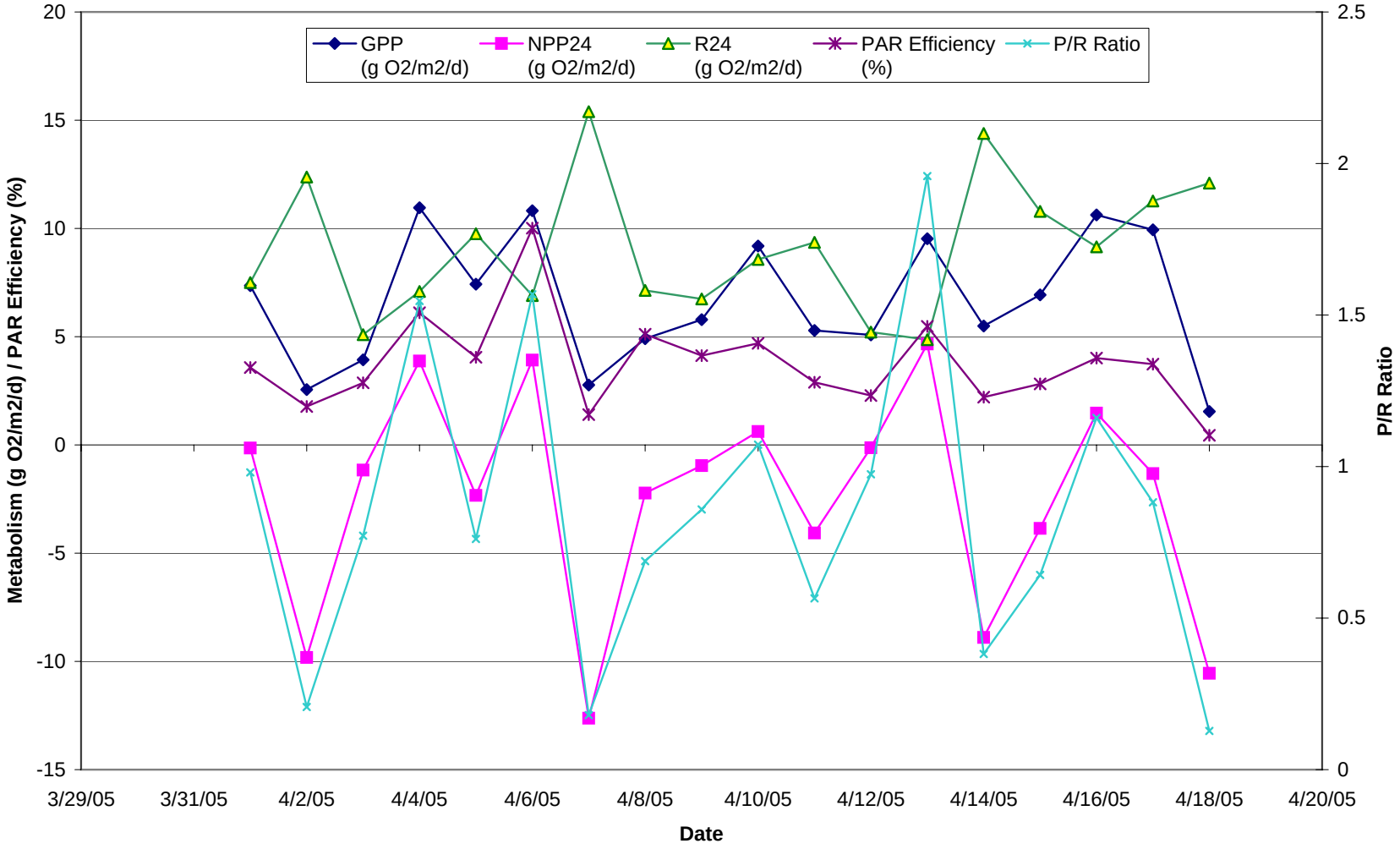
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2/mol$)
	($g\ O_2/m^2/d$)					
Avg	0.51	-6.91	7.42	0.07	0.42	0.05
Max	0.77	-6.08	8.43	0.10	0.89	0.11
Min	0.03	-8.40	6.70	0.00	0.02	0.00

FIGURE 3-17
ROCK SPRING RUN - SEGMENT 2 METABOLISM ESTIMATES (4/1/05 - 4/21/05)



Stats	GPP	NPP24	R24	P/R	PAR Eff.	
	($g\ O_2/m^2/d$)			ratio	(%)	($g\ O_2/mol$)
Avg	0.59	-14.40	14.99	0.04	0.56	0.07
Max	1.58	-10.07	18.86	0.14	1.36	0.17
Min	0.31	-18.55	11.31	0.02	0.23	0.03

FIGURE 3-18
ROCK SPRING RUN - SEGMENT 2 METABOLISM ESTIMATES (7/12/05 - 7/29/05)



Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2/mol$)
	($g\ O_2/m^2/d$)					
Avg	6.67	-2.42	9.09	0.85	3.75	0.47
Max	10.96	4.66	15.39	1.96	10.02	1.24
Min	1.54	-12.63	4.86	0.13	0.45	0.06

FIGURE 3-19
JUNIPER CREEK - SEGMENT 1 METABOLISM ESTIMATES (3/31/05 - 4/18/05)

positive at this station varying from -12.6 to 4.66 g $O_2/m^2/d$ with an average value of -2.42 g $O_2/m^2/d$. The resulting average P/R ratio was 0.85 and the estimated PAR efficiency averaged 0.47 gO_2/mol (3.75%).

Figure 3-20 provides a summary of the daily community metabolism estimates for the summer period from July 11 through August 1, 2005. A relatively strong diurnal curve was observed for oxygen, pH, and temperature at both the upstream and downstream segment stations. Evidence of a rainfall event on about July 29 was visible in the specific conductance data. GPP ranged from 1.19 to 7.56 g $O_2/m^2/d$ with an average value of 4.02 g $O_2/m^2/d$. Respiration varied from 6.04 to 10.4 g $O_2/m^2/d$ with an average value of 7.97 g $O_2/m^2/d$. NPP was both negative and positive at this station varying from -9.16 to 0.18 g $O_2/m^2/d$ with an average value of -3.94 g $O_2/m^2/d$. The resulting average P/R ratio was 0.52 and the estimated PAR efficiency averaged 0.26 gO_2/mol (2.08%).

3.7.10 Alexander Springs Creek Segment 1

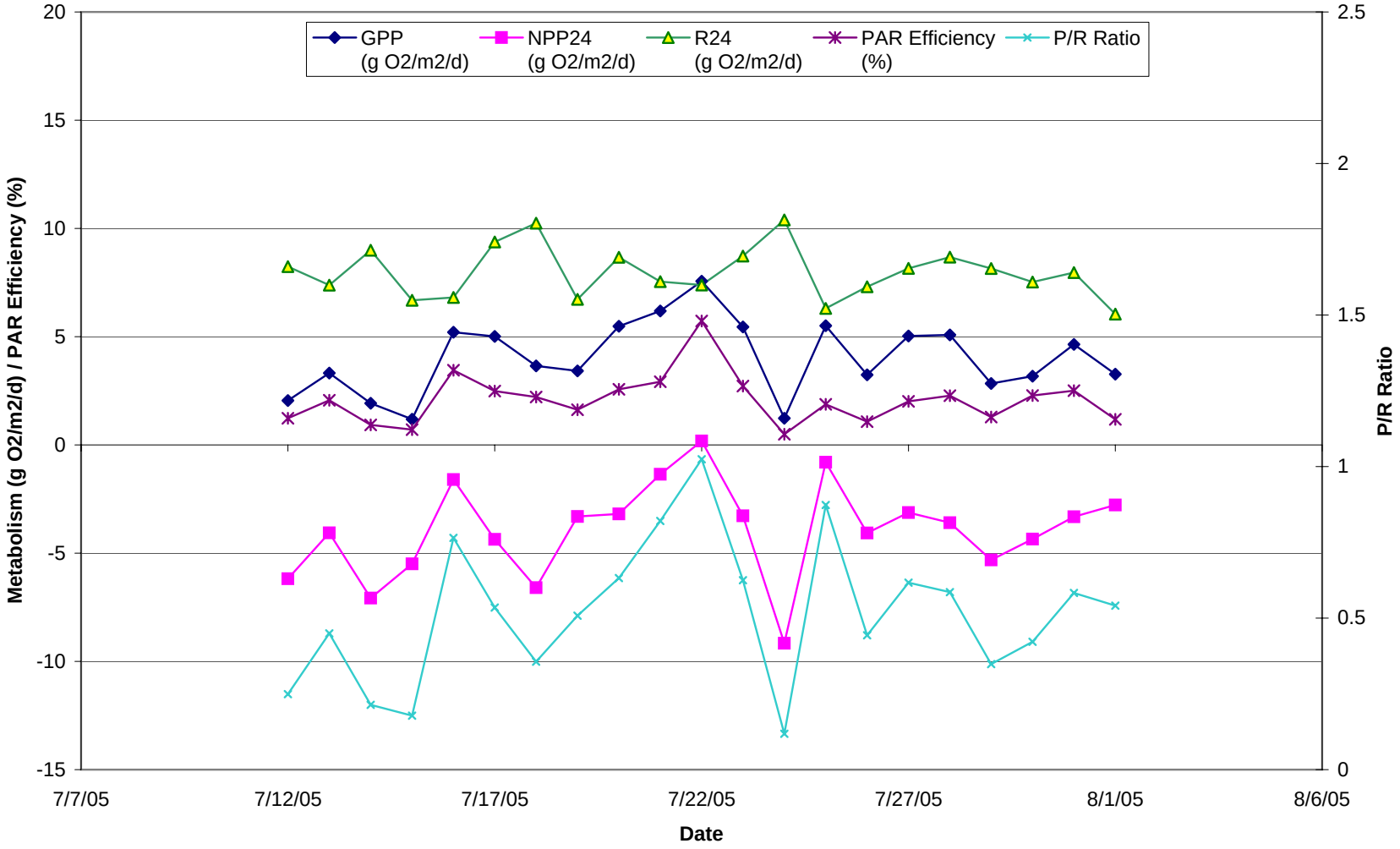
Exhibits in **Appendix G** provide a visual and tabular summary of the detailed behavior of ASC-SEG-1 during the late spring sampling period. **Figure 3-21** provides a summary of the daily community metabolism estimates for the period from April 29 through May 24, 2005. Pronounced diurnal curves were evident for oxygen, pH, and temperature at both the upstream and downstream segment stations. A significant rainy period around May 4 resulted in several days of diminished dissolved oxygen concentrations and pH values, as well as lower water temperatures. GPP ranged from 3.32 to 12.2 g $O_2/m^2/d$ with an average value of 7.67 g $O_2/m^2/d$. Respiration varied from 7.65 to 11.5 g $O_2/m^2/d$ with an average value of 10.3 g $O_2/m^2/d$. NPP was both negative and positive at this station varying from -8.02 to 1.66 g $O_2/m^2/d$ with an average value of -2.62 g $O_2/m^2/d$. The resulting average P/R ratio was 0.75 and the estimated PAR efficiency averaged 0.36 gO_2/mol (2.94%).

Figure 3-22 provides a summary of the daily community metabolism estimates for the late summer period from August 9 through 29, 2005. A strong diurnal curve was observed for oxygen, pH, and temperature at both the upstream and downstream segment stations. Evidence of a rainfall event on about August 18 was visible in the specific conductance, pH, dissolved oxygen, and water temperature data. GPP ranged from 2.38 to 6.37 g $O_2/m^2/d$ with an average value of 5.12 g $O_2/m^2/d$. Respiration varied from 2.60 to 5.57 g $O_2/m^2/d$ with an average value of 4.35 g $O_2/m^2/d$. NPP was both negative and positive at this station varying from -2.49 to 3.20 g $O_2/m^2/d$ with an average value of 0.77 g $O_2/m^2/d$. The resulting average P/R ratio was 1.23 and the estimated PAR efficiency averaged 0.23 gO_2/mol (1.82%).

3.8 Mesocosm Plant Metabolism

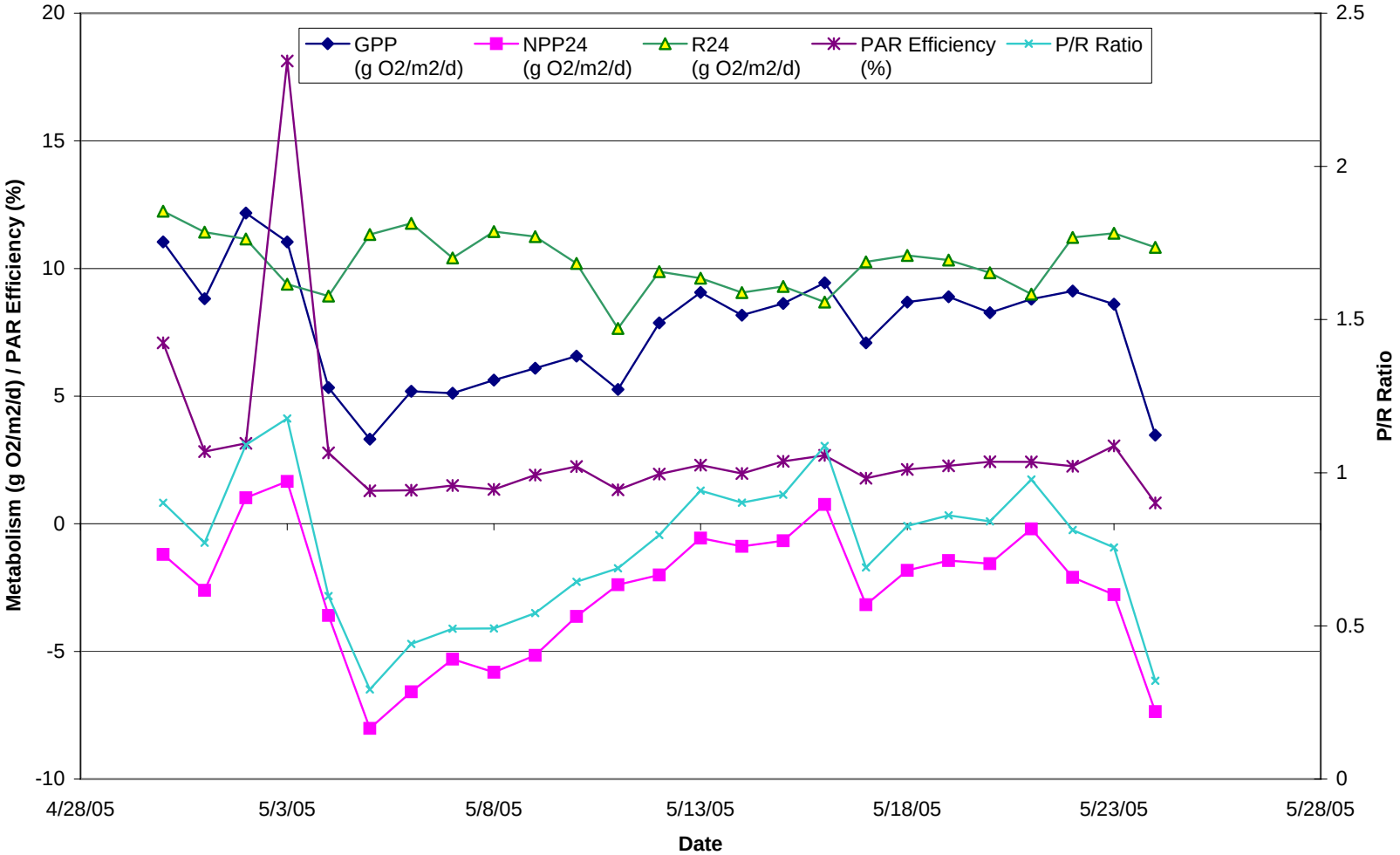
Tables 3-19 and **3-20** provide summaries of the mesocosm plant metabolism results. Detailed data summaries are provided in **Appendix H**.

Table 3-19 summarizes all of the mesocosm metabolism and experimental conditions by river and segment by reporting the average values for all plant species combined. The estimated GPP reported as $gO_2/m^2/d$ was higher in the Wekiva River mesocosms (average of both segments was 15.3 $gO_2/m^2/d$) compared to the Rock Springs Run



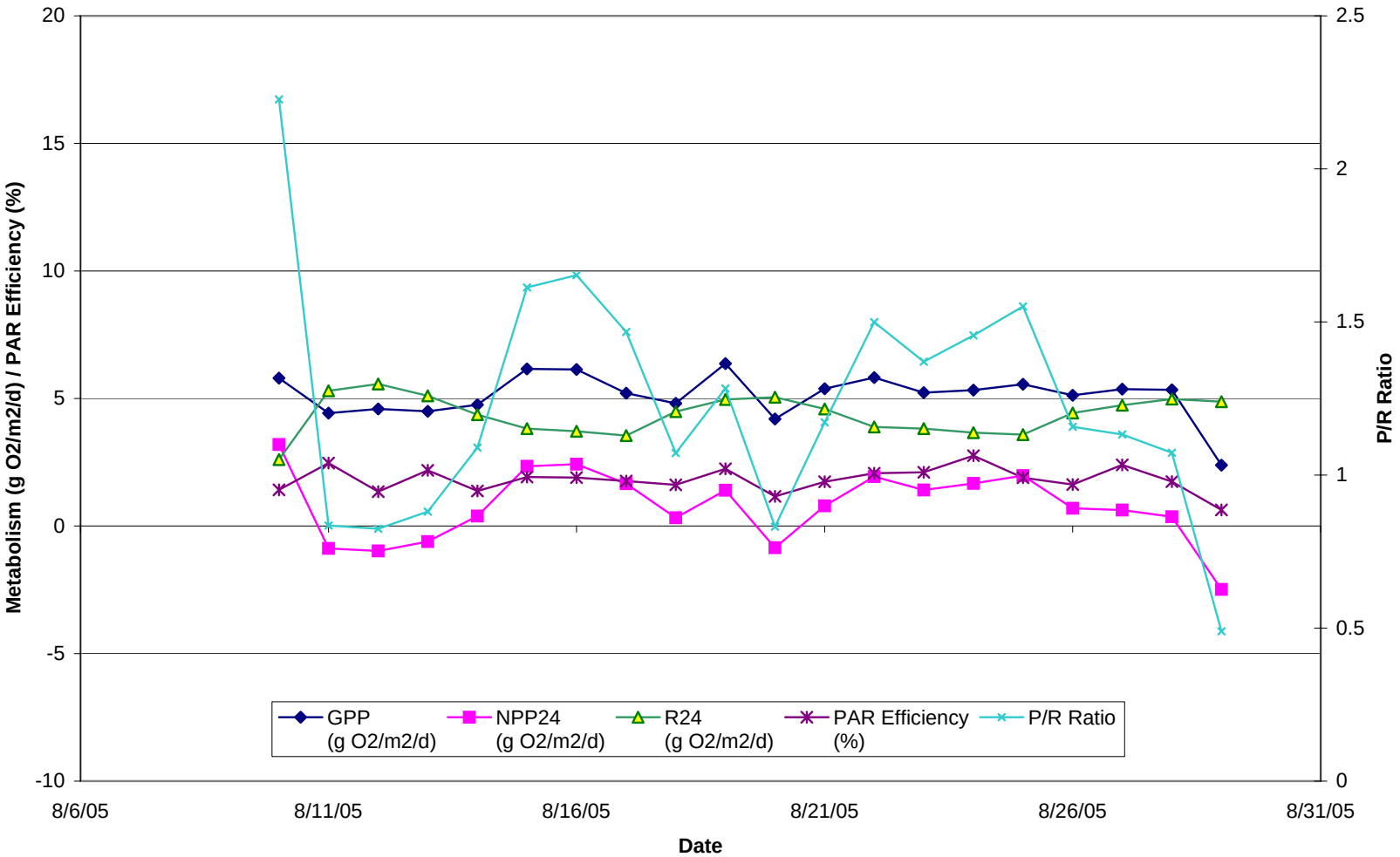
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	4.02	-3.94	7.97	0.52	2.08	0.26
Max	7.56	0.18	10.39	1.02	5.73	0.71
Min	1.19	-9.16	6.04	0.12	0.49	0.06

FIGURE 3-20
JUNIPER CREEK - SEGMENT 1 METABOLISM ESTIMATES (7/11/05 - 8/1/05)



Stats	GPP	NPP24	R24	P/R	PAR Eff.	
	($g\ O_2/m^2/d$)			ratio	(%)	($g\ O_2/mol$)
Avg	7.67	-2.62	10.28	0.75	2.94	0.36
Max	12.17	1.66	12.24	1.18	18.13	2.25
Min	3.32	-8.02	7.65	0.29	0.82	0.10

FIGURE 3-21
ALEXANDER SPRING CREEK - SEGMENT 1 METABOLISM ESTIMATES (4/29/05 - 5/24/05)



Stats	GPP	NPP24	R24	P/R	PAR Eff.	
	($g\ O_2/m^2/d$)			ratio	(%)	($g\ O_2/mol$)
Avg	5.12	0.77	4.35	1.23	1.82	0.23
Max	6.37	3.20	5.57	2.23	2.76	0.34
Min	2.38	-2.49	2.60	0.49	0.63	0.08

FIGURE 3-22

ALEXANDER SPRING CREEK - SEGMENT 1 METABOLISM ESTIMATES (8/9/05 - 8/29/05)

TABLE 3-19

WEKIVA PLRG - MESOCOSM STUDY SUMMARY FOR ALL PLANT SPECIES COMBINED

		WR			RSR			ASC	JC
PARAMETER	UNITS	SEG 1	SEG 2	Average	SEG 1	SEG 2	Average	SEG 1	SEG 1
UPSTREAM DO	mg/L	0.52	6.97	3.75	5.24	4.24	4.72	5.64	7.29
DOWNSTREAM DO		0.71	7.01	3.86	5.34	4.36	4.83	5.65	7.35
CHANGE DO		0.19	0.04	0.12	0.10	0.12	0.11	0.01	0.06
TRAVEL TIME	minutes	0.90	2.81	1.85	3.25	1.72	2.45	3.82	0.32
VELOCITY	m/hr	132	79	106	48.3	76.2	62.8	39.2	391
GPP	g $O_2/m^2/d$	19.5	11.1	15.3	7.64	12.4	10.1	5.17	10.60
NPP		17.0	3.80	10.41	2.51	5.50	4.06	-0.201	5.78
R		2.50	7.29	4.90	5.13	6.89	6.04	5.37	4.82
Vegetation	kg DW/m^2	0.594	1.282	0.938	0.579	0.797	0.692	0.637	1.080
GPP	g O_2/kg DW/d	35.3	37.2	36.2	19.0	9.14	13.9	9.67	22.50
NPP		31.0	16.4	23.7	6.18	16.5	11.5	-0.610	8.23
R24		4.30	20.8	12.6	12.8	7.22	9.90	10.3	14.27
PAR	mol/hr	0.253	0.113	0.183	0.243	0.243	0.243	0.228	0.38
	$mol/m^2/d$	26.9	24.6	25.7	34.2	10.3	21.8	23.2	39.8
GPP	g O_2/mol	0.751	0.442	0.597	0.232	0.450	0.345	0.225	0.378
NPP		0.646	0.127	0.386	0.073	0.123	0.090	-0.004	0.137
GPP	g O_2/kg DW/mol	1.31	1.15	1.23	0.594	0.910	0.700	0.401	0.802
NPP		1.13	0.471	0.80	0.188	0.219	0.198	-0.018	0.214

TABLE 3-20

WEKIVA PLRG MESOCOSM STUDY - AVERAGE GPP / NPP RESULTS FOR MESOCOSM VEGETATION TYPES

SEGMENT	Date	VALLISNERIA	FILAMENTOUS ALGAE	NITELLA	NAJAS & HYDRILLA	CERATO-PHYLLUM	UTRICULARIA	POTAMOGETON
GPP (g O2/kg DW/mol)								
WR SEG 1	5/27/2005	1.055	---	---	1.613	---	---	---
	8/31/2005	0.635	---	---	1.747 b	---	---	---
	Average	0.845	---	---	1.680	---	---	---
WR SEG 2	5/26/2005	0.588	---	3.523	---	---	---	---
	9/1/2005	0.451	0.081	---	---	---	---	---
	Average	0.519	0.081	3.523	---	---	---	---
RSR SEG 1	4/20/2005	0.347	0.088	---	---	---	---	---
	8/3/2005	0.303	---	---	---	---	1.071	---
	Average	0.325	0.088	---	---	---	1.071	---
RSR SEG 2	4/21/2005	0.932	0.098	0.760	---	---	---	---
	8/4/2005	0.441	---	---	1.058 a	---	---	---
	Average	0.686	0.098	0.760	1.058	---	---	---
ASC SEG 1	5/24/2005	0.272	---	---	---	0.189	---	---
	8/29/2005	0.410	---	---	---	0.735	---	---
	Average	0.341	---	---	---	0.462	---	---
JC SEG 1	4/18/2005	0.240	0.018	---	---	---	---	0.265
	8/1/2005	0.996	---	---	---	---	---	1.092
	Average	0.618	0.018	---	---	---	---	0.679
NPP (g O2/kg DW/mol)								
WR SEG 1	5/27/2005	0.844	---	---	1.289	---	---	---
	8/31/2005	0.612	---	---	1.483 b	---	---	---
	Average	0.728	---	---	1.386	---	---	---
WR SEG 2	5/26/2005	0.202	---	1.896	---	---	---	---
	9/1/2005	-0.029	0.023	---	---	---	---	---
	Average	0.087	0.023	1.896	---	---	---	---
RSR SEG 1	4/20/2005	0.046	0.012	---	---	---	---	---
	8/3/2005	0.131	---	---	---	---	0.259	---
	Average	0.089	0.012	---	---	---	0.259	---
RSR SEG 2	4/21/2005	0.622	0.017	0.403	---	---	---	---
	8/4/2005	0.168	---	---	0.175 a	---	---	---
	Average	0.395	0.017	0.403	0.175	---	---	---
ASC SEG 1	5/24/2005	0.017	---	---	---	0.008	---	---
	8/29/2005	0.175				0.047		
	Average	0.096	---	---	---	0.027	---	---
JC SEG 1	4/18/2005	-0.264	0.013	---	---	---	---	-0.546
	8/1/2005	0.265	---	---	---	---	---	-0.435
	Average	0.001	0.013	---	---	---	---	-0.491

[a] only included *Najas*

[a] included Najas & Filamentous Algae

mesocosms (average of both segments was 10.1 $gO_2/m^2/d$) and Juniper Creek (10.6 $gO_2/m^2/d$), and considerably lower in the Alexander Springs Creek mesocosms (5.17 $gO_2/m^2/d$). Wekiva River Segment 1 had the highest measured GPP at 19.5 $gO_2/m^2/d$. NPP followed the same pattern except that only Alexander Creek had a negative NPP.

Community respiration was similar in all four streams with averages between 4.82 and 6.04 $gO_2/m^2/d$. The highest CR was measured in Wekiva River Segment 2 with 7.29 $gO_2/m^2/d$. When normalized by the dry weight of vegetation in the mesocosms the CR was still not very different between treatment and reference sites (with averages between 9.90 and 14.3 gO_2/kg DW/d); however, the Wekiva River Segment 2 had the highest normalized CR with an average during the two seasons of 20.8 gO_2/kg DW/d.

Ecological efficiency reported as gO_2/mol was also highest in the Wekiva River mesocosms (0.597 gO_2/mol) compared to the average from the other three sites (0.225 to 0.378 gO_2/mol). The overall normalized results in gO_2/kg DW/mol were also similar with the highest in the two Wekiva River segments (average 1.23 gO_2/kg DW/mol) and the other three systems being similar (0.401 to 0.802 gO_2/kg DW/mol).

Table 3-20 reports these normalized GPP and NPP rates by plant species. *Vallisneria americana* was run during all of the mesocosm experiments across all of the water bodies and upstream and downstream segments. The estimated normalized GPP for tape grass was higher in the upper Wekiva River segment (0.845 gO_2/kg DW/mol) than at any other location (range from 0.325 to 0.618 gO_2/kg DW/mol). Uncorrected GPP and NPP for *Vallisneria* were higher in the Wekiva River (10.6 $gO_2/m^2/d$) and Rock Springs Run (8.49 $gO_2/m^2/d$) mesocosm studies than in the reference site studies (4.72 to 7.52 $gO_2/m^2/d$). This apparent difference between the affected and reference streams was not as apparent in the corrected mesocosm metabolism results.

The highest measured normalized GPP and NPP were found for *Nitella* sp. (3.52 and 1.90 gO_2/kg DW/mol, respectively) growing in the lower Wekiva River segment. The next highest recorded normalized GPP was for a combination of naiad and hydrilla tested in the upper segment of the Wekiva River (1.68 gO_2/kg DW/mol). Filamentous algae consistently had the lowest measured normalized GPP of any plant species with average values ranging from 0.018 gO_2/kg DW/mol in Juniper Creek to 0.088 gO_2/kg DW/mol in Rock Springs Run Segment 1. The observed order of tested plant species from highest to lowest corrected community metabolism estimates was: nitella> naiad> bladderwort> pond weed> tapegrass> coontail> filamentous algae.

3.8.1 Wekiva River Segment 1

Table 3-21 provides a summary of the plant mesocosm metabolism data for Wekiva River Segment 1 by date and plant species. During both spring and summer mesocosm events the naiad–dominated plant mixture mesocosm treatment had higher uncorrected and corrected GPP, NPP, and CR than the tape grass mesocosms. Measured ecological efficiency was also higher for the naiad than for the tape grass mesocosm treatments.

3.8.2 Wekiva River Segment 2

Table 3-22 provides a summary of the plant mesocosm metabolism data for Wekiva River Segment 2 by date and plant species. Nitella was available during the spring

TABLE 3-21
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1

		5/27/2005		8/31/2005	
PARAMETER	UNITS	NAJAS & HYDRILLA	VALLISNERIA	NAJAS & FILAMENTOUS ALGAE	VALLISNERIA
UPSTREAM DO	mg/L	0.48	0.48	0.57	0.56
DOWNSTREAM DO		0.70	0.59	0.85	0.70
CHANGE DO		0.22	0.11	0.28	0.13
TRAVEL TIME	minutes	0.95	0.77	0.91	0.96
VELOCITY	m/hr	115	143	121	115
GPP	g $O_2/m^2/d$	20.99	9.69	34.17	13.24
NPP		16.77	7.75	29.02	12.76
R		4.22	1.94	5.16	0.48
Vegetation	kg DW/m^2	0.709	0.546	0.509	0.613
GPP	g O_2/kg DW/d	29.60	17.75	67.20	21.60
NPP		23.65	14.20	57.06	20.82
R24		5.95	3.55	10.14	0.78
PAR	mol/hr	0.12	0.11	0.41	0.40
	$mol/m^2/d$	18.4	16.8	38.5	34.0
GPP	g O_2/mol	1.14	0.576	0.89	0.389
NPP		0.914	0.461	0.754	0.375
GPP	g O_2/kg DW/mol	1.61	1.06	1.75	0.63
NPP		1.29	0.844	1.48	0.612

TABLE 3-22
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2

		5/26/2005		9/1/2005	
PARAMETER	UNITS	VALLISNERIA	NITELLA	VALLISNERIA	FILAMENTOUS ALGAE
UPSTREAM DO	mg/L	7.06	7.14	6.84	6.88
DOWNSTREAM DO		7.12	7.25	6.80	6.91
CHANGE DO		0.07	0.12	-0.04	0.03
TRAVEL TIME	minutes	0.90	0.82	3.96	5.57
VELOCITY	m/hr	122	134	28	20
GPP	g $O_2/m^2/d$	14.59	20.04	4.71	3.84
NPP		5.02	10.79	-0.30	1.07
R		9.57	9.26	5.02	2.77
Vegetation	kg DW/m^2	0.728	0.160	0.678	3.560
GPP	g O_2/kg DW/d	20.05	125.11	6.95	1.08
NPP		6.90	67.33	-0.45	0.30
R24		13.15	57.78	7.40	0.78
PAR	mol/hr	0.12	0.11	0.12	0.11
	$mol/m^2/d$	34.1	35.5	15.4	13.3
GPP	g O_2/mol	0.43	0.564	0.31	0.288
NPP		0.147	0.304	-0.020	0.080
GPP	g O_2/kg DW/mol	0.59	3.52	0.45	0.08
NPP		0.20	1.896	-0.03	0.023

sampling but not observed during the summer sampling. Filamentous algae were abundant in the late summer and were used as the second plant treatment for that study. During the late spring sampling event, all indices of community metabolism were higher for the nitella mesocosm treatment than for the tape grass treatments. Corrected NPP was over 800% higher in spite of much higher CR. During the late summer sampling event, the corrected GPP and CR measurements were higher for tape grass than for the filamentous algae, but NPP was lower for the tape grass. Measured ecological efficiency was similar between the two treatments.

3.8.3 Rock Springs Run Segment 1

Table 3-23 provides a summary of the plant mesocosm metabolism data for Rock Springs Run Segment 1 by date and plant species. Corrected GPP was similar during the spring and summer sampling events for tape grass mesocosms but corrected CR was higher during the spring and therefore the corrected NPP was lower. Corrected GPP, NPP, CR, and ecological efficiency were all higher in the tape grass treatments during the spring event than in the filamentous algae treatment. During the summer sampling event, the *Utricularia* sp. (bladderwort) treatment had higher community metabolism indices than the tape grass treatment.

3.8.4 Rock Springs Run Segment 2

Table 3-24 provides a summary of the plant mesocosm metabolism data for Rock Springs Run Segment 2 by date and plant species. Three plant species were tested in mesocosms each during the spring event. Based on corrected community metabolism indices, tape grass had a slightly higher GPP and NPP than nitella, CR was slightly higher for nitella than for tape grass, ecological efficiency was highest for nitella, and the filamentous algae treatment was considerably lower for all indices. Tape grass and naiad were tested during the summer event. Corrected GPP and CR estimates were higher for the naiad than for the tape grass but NPP was similar for both and ecological efficiency was higher for tape grass than for the naiad.

3.8.5 Juniper Creek Segment 1

Table 3-25 provides a summary of the plant mesocosm metabolism data for Juniper Creek Segment 1 by date and plant species. Filamentous algae and tape grass were tested in the mesocosms during the spring sampling event. All community metabolism indices were higher for tape grass than for the filamentous algae. During the summer sampling event pondweed and tape grass metabolism was compared. Corrected GPP was similar for the two species but corrected CR was higher for the pondweed and the resulting corrected NPP was consequently lower.

3.8.6 Alexander Springs Creek Segment 1

Table 3-26 provides a summary of the plant mesocosm metabolism data for Alexander Springs Creek Segment 1 by date and plant species. Tape grass and coontail were used in both the spring and summer mesocosm studies. Corrected GPP, NPP, and CR indices were higher for both species during the summer sampling event compared to the spring event, yet ecological efficiency estimates were more similar between the two events.

TABLE 3-23
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1

		4/20/2005		8/3/2005	
PARAMETER	UNITS	VALLISNERIA	FILAMENTOUS ALGAE	VALLISNERIA	UTRICULARIA
UPSTREAM DO	mg/L	6.22	6.23	4.27	4.25
DOWNSTREAM DO		6.33	6.32	4.33	4.37
CHANGE DO		0.10	0.08	0.07	0.12
TRAVEL TIME	minutes	2.60	4.97	1.83	3.59
VELOCITY	m/hr	42	22	60	31
GPP	g $O_2/m^2/d$	7.59	3.22	5.27	7.48
NPP		1.02	0.43	2.28	1.81
R		6.57	2.79	2.99	5.68
Vegetation	kg DW/m^2	0.622	0.816	0.638	0.241
GPP	g O_2/kg DW/d	12.21	3.95	8.26	31.11
NPP		1.64	0.53	3.57	7.51
R24		10.57	3.42	4.69	23.60
PAR	mol/hr	0.264	0.335	0.189	0.199
	$mol/m^2/d$	35.2	44.7	27.2	29.1
GPP	g O_2/mol	0.215	0.072	0.194	0.258
NPP		0.029	0.010	0.084	0.062
GPP	g O_2/kg DW/mol	0.347	0.088	0.303	1.07
NPP		0.046	0.012	0.131	0.259

TABLE 3-24
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2

		4/21/2005			8/4/2005	
PARAMETER	UNITS	NITELLA	FILAMENTOUS ALGAE	VALLISNERIA	VALLISNERIA	NAJAS
UPSTREAM DO	mg/L	6.08	6.11	6.11	2.08	2.08
DOWNSTREAM DO		6.30	6.13	6.27	2.16	2.16
CHANGE DO		0.23	0.02	0.16	0.08	0.08
TRAVEL TIME	minutes	1.46	3.16	1.40	1.58	1.38
VELOCITY	m/hr	75	35	78	70	80
GPP	g $O_2/m^2/d$	20.94	3.31	14.26	6.82	12.37
NPP		11.11	0.56	9.51	2.60	2.05
R		9.83	2.75	4.75	4.22	10.33
Vegetation	kg DW/m^2	1.09	1.15	0.556	0.722	0.510
GPP	g O_2/kg DW/d	19.2	2.89	25.7	9.44	24.3
NPP		10.2	0.488	17.1	3.60	4.01
R24		9.03	2.40	8.54	5.84	20.2
PAR	mol/hr	0.209	0.203	0.196	0.166	0.174
	$mol/m^2/d$	25.3	29.4	27.5	21.4	22.9
GPP	g O_2/mol	0.827	0.113	0.518	0.318	0.540
NPP		0.439	0.019	0.346	0.121	0.089
GPP	g O_2/kg DW/mol	0.760	0.098	0.932	0.441	1.06
NPP		0.403	0.017	0.622	0.168	0.175

TABLE 3-25
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1

		4/18/2005			8/1/2005	
PARAMETER	UNITS	FILAMENTOUS ALGAE	POTAMOGETON	VALLISNERIA	POTAMOGETON	VALLISNERIA
UPSTREAM DO	mg/L	7.85	8.04	7.97	6.46	6.48
DOWNSTREAM DO		7.89	8.04	7.99	6.46	6.52
CHANGE DO		0.04	0.00	0.02	0.00	0.03
TRAVEL TIME	minutes	0.31	0.23	0.26	0.32	0.45
VELOCITY	m/hr	354	472	425	348	243
GPP	g $O_2/m^2/d$	3.28	5.05	4.02	12.16	11.03
NPP		2.29	-10.40	-4.40	-4.85	2.93
R		0.99	15.44	8.42	17.01	8.10
Vegetation	kg DW/m^2	3.295	0.367	0.316	0.398	0.531
GPP	g O_2/kg DW/d	0.99	13.75	12.71	30.52	20.77
NPP		0.70	-28.33	-13.93	-12.16	5.52
R24		0.30	42.07	26.64	42.69	15.25
PAR	mol/hr	0.52	0.46	0.50	0.27	0.22
	$mol/m^2/d$	54.0	51.8	52.9	28.0	20.9
GPP	g O_2/mol	0.06	0.097	0.076	0.44	0.529
NPP		0.042	-0.201	-0.083	-0.173	0.141
GPP	g O_2/kg DW/mol	0.02	0.27	0.24	1.09	1.00
NPP		0.01	-0.546	-0.264	-0.44	0.265

TABLE 3-26
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1

		5/24/2005		8/29/2005	
PARAMETER	UNITS	VALLISNERIA	CERATOPHYLLUM	VALLISNERIA	CERATOPHYLLUM
UPSTREAM DO	mg/L	6.20	6.16	5.10	5.00
DOWNSTREAM DO		6.22	6.22	5.08	5.00
CHANGE DO		0.02	0.06	-0.02	0.00
TRAVEL TIME	minutes	2.82	6.38	1.71	4.36
VELOCITY	m/hr	39	17	64	25
GPP	g $O_2/m^2/d$	3.76	3.50	5.68	8.29
NPP		0.24	0.14	2.43	0.53
R		3.52	3.36	3.25	7.77
Vegetation	kg DW/m^2	0.802	0.831	0.485	0.429
GPP	g O_2/kg DW/d	4.69	4.21	11.72	19.32
NPP		0.30	0.17	5.01	1.22
R24		4.39	4.04	6.71	18.09
PAR	mol/hr	0.14	0.20	0.30	0.29
	$mol/m^2/d$	17.3	22.3	28.6	26.3
GPP	g O_2/mol	0.22	0.157	0.20	0.315
NPP		0.014	0.006	0.085	0.020
GPP	g O_2/kg DW/mol	0.27	0.19	0.41	0.74
NPP		0.02	0.008	0.18	0.047

During the spring event, all corrected community metabolism estimates were similar between the two species; however, during the summer event the coontail had higher values for all community metabolism indices.

3.9 Community Export

3.9.1 Macrophyte Export

Table 3-27 summarizes the macrophyte export data for the Wekiva River System and Reference Site stream segment export trap studies. Data are reported as dry weight per upstream area per time (gDW/m^2/d). The measured net plant export at Wekiva River Segment 1 was highest with an average estimated value of about 1.67 gDW/m^2/d. Downstream in the Wekiva River the plant export was estimated as about 0.033 gDW/m^2/d. Estimated export rates in Rock Springs Run Segment 1 was 0.0064 gDW/m^2/d and 0.0027 gDW/m^2/d in Segment 2. Juniper Creek Segment 1 had an average export rate of about 0.018 gDW/m^2/d while the estimated export rate at Alexander Springs Creek Segment 1 was 0.373 gDW/m^2/d.

3.9.2 Particulate Export

Particulate export data for the study are summarized in **Table 3-28**. Detailed data for the plankton net particulate export measurements are provided in **Appendix I**. The highest average particulate export was measured at Wekiva River Segment 1 at 3.87 gDW/m^2/d. Particulate export measured downstream in the Wekiva River averaged 0.031 gDW/m^2/d. Particulate export in Rock Springs run was estimated as 0.092 gDW/m^2/d in Segment 1 and 0.123 gDW/m^2/d in Segment 2. Particulate export at the reference sites was 0.292 gDW/m^2/d in Juniper Creek and 0.192 gDW/m^2/d in Alexander Springs Creek.

TABLE 3-27

WEKIVA PLRG - EXPORT TRAP DETAILED DATA

Segment	Date	Start Time	End Time	Days	Wet Wt (g)	Dry Wt (g)	% Solids	Export (gDW/m/d)	Stream Width (m)	Export (g/d)	Area (m^2)	Export ($g/m^2/d$)
WR-SEG1	5/27/2005	7:47	11:31	0.16	45.0	9.68	21.5	62.2	7.60	473	1,587	0.298
	8/31/2008	9:30	15:00	0.23	612	145	23.7	634	7.60	4,817	1,587	3.04
WR-SEG2	5/26/2005	10:12	15:46	0.23	1,316	124	9.42	535	81	43,531	719,033	0.061
	9/1/2005	9:00	13:00	0.17	160	12.2	7.61	73.3	57.0	4,176	759,800	0.005
RSR-SEG1	4/20/2005	10:05	16:30	0.27	157	9.26	5.91	34.6	14.5	0,502	88,145	0.006
	8/3/2005	8:57	14:42	0.24	67.4	4.95	7.34	20.7	23.3	481	68,753	0.007
RSR-SEG2	4/21/2005	10:07	15:48	0.24	230	17.3	7.53	73.2	7.1	0,520	412,114	0.001
	8/4/2005	9:50	15:00	0.22	233	51.7	22.2	240	7.1	1,703	412,114	0.004
ASC-SEG1	5/24/2005	10:19	17:17	0.29	4,796	395	8.24	1,361	62.5	85,041	124,960	0.681
	8/29/2005	9:01	15:40	0.28	439	36.5	8.31	132	62.5	8,229	124,960	0.066
JC-SEG1	4/18/2005	10:08	18:10	0.33	1,215	181	14.9	541	10.9	5,884	222,200	0.026
	8/1/2005	9:19	14:44	0.23	652	46.8	7.18	207	10.9	2,257	222,200	0.010

TABLE 3-28
WEKIVA PLRG - AVERAGE PARTICULATE EXPORT

Station	Dry Matter (g/d)	Organic Matter (g/d)	Dry Matter ($g/m^2/d$)	Organic Matter ($g/m^2/d$)
WR-SEG1	6,147	1,712	3.87	1.08
WR-SEG2	22,909	11,561	0.031	0.016
RSR-SEG1	6,589	4,702	0.092	0.065
RSR-SEG2	50,832	35,180	0.123	0.085
ASC-SEG1	23,965	13,433	0.192	0.108
JC-SEG1	64,789	40,021	0.292	0.180

4.0 Identification of Impairment

4.1 Comparison to Florida Class III Water Quality Criteria and Reference Sites

The water quality in the Wekiva River System and in the reference streams is generally similar and meets Class III water quality criteria with a few exceptions. Key parameters that do not always meet standards include dissolved oxygen, pH, and nutrients.

4.1.1 Dissolved Oxygen

Dissolved oxygen concentration is extremely low in some spring boils. This was particularly noticeable in Wekiwa Springs, Rock Springs, and Alexander Springs. Juniper Springs has a high dissolved oxygen concentration. The causes of these low dissolved oxygen conditions in some springs are not fully understood. However, historic data from periods before extensive development indicate that most of these low oxygen tensions in springs are due to natural causes occurring in Florida's artesian groundwaters. Monitoring during this study and from previous data analyses (WSI 2004) indicate that dissolved oxygen concentrations in the Wekiva River remain well below saturation and below the Class III criterion of 5 mg/L (Chapter 62-302.530.31 Florida Administrative Code [F.A.C.]) for at least 1,300 m downstream of the main spring. Rock Springs Run has a similar condition and average dissolved oxygen levels in Alexander Springs Creek are still below 5 mg/L about 2,000 below the main spring. As noted earlier, dissolved oxygen concentrations in Juniper Springs appear to be much higher than in the other springs.

Based on the occurrence of similar or even worse dissolved oxygen conditions in at least one of the reference sites it can concluded that the fact that dissolved oxygen concentrations in the Wekiva River System do not meet water quality standards is a natural, non-abatable condition resulting from low dissolved oxygen tensions typical of many artesian groundwater fed springs. It is well known that there is an adapted aquatic fauna that regularly occurs in spring run environments with these naturally low dissolved oxygen conditions (Sloan 1956; Nordlie 1990; McKinsey and Chapman 1998; Walsh 2001).

4.1.2 Hydrogen Ion

Hydrogen ion (as measured by pH) is also covered by a Class III criterion in Florida inland fresh waters (Chapter 62-302.530.52 F.A.C.). The upper criterion for pH in Florida fresh waters is 8.0 s.u. A maximum value of 8.47 s.u. was documented in the lower segment of the Wekiva River during this project, clearly in response to high levels of primary production due to the dense beds of *Vallisneria americana*. Even higher pH levels were recorded in both Alexander Springs Creek (8.95 s.u.) and in Juniper Creek (8.63 s.u.) for similar reasons. Based on these observations it is concluded that diurnally high pH concentrations that occur in these fairly clear, spring-fed streams occur due to natural, non-abatable conditions (high plant productivity in clear water environments).

Plant and animal communities that naturally occur in these environments can be assumed to be adapted to these widely fluctuating hydrogen ion concentrations.

4.1.3 Nutrients

4.1.3.1 Florida Nutrient Criteria

Nutrients are covered under Florida's Class III fresh water criteria by a narrative standard (Chapter 62-302.530.48 a and b, F.A.C.):

> ***(48) (a) The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter. Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Sections 62-302.300, 62-302.700, and 62-4.242, F.A.C.***
>
> ***(48) (b) In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora and fauna.***

Ambient nutrient concentrations are also regulated in OFWs by Chapter 62-302.700, F.A.C., which does not allow degradation compared to 1979 baseline conditions. Previous work has demonstrated that nitrate nitrogen levels in the Wekiva River and Rock Springs Run have increased during the 1999-2003 period compared to the 1980-1985 period, resulting in degradation as defined in Florida's water quality standards (SJRWMD 2004 unpublished).

4.1.3.2 Comparison to Reference Streams

In this study Juniper Creek and Alexander Springs Creek were selected as the most scientifically-defensible reference sites for the two streams in the Wekiva River System. This defensibility is based on the detailed data comparisons made previously (WSI 2004) and on the data collected during the nine month study period described earlier in this report. These data indicate that the Wekiva River and Rock Springs Run are primarily dependent upon artesian spring flows for their hydrology and ecology during most seasonal and annual periods. During rainy periods, additional runoff is contributed by surrounding wetlands and uplands. The same hydrological conditions are evident in both Juniper Creek and Alexander Springs Creek. This comparison is especially obvious during dry years when all four streams have continuous clear, spring-dominated water. This comparison was also found to be valid during the nine-month study period when higher than average rainfall resulted in moderately blackwater (tannic colored) conditions in all four streams with short, intermittent clearing periods with declining color concentrations (and typically higher specific conductance) between rainfall events.

The primary differences between the Wekiva River System streams and the reference sites was found to be the mix of surrounding land use and the higher density of developed areas in the Wekiva River System watershed and springshed. These data were summarized in the previous report (WSI 2004) and found that 61% of the watershed in the Wekiva River Basin was uplands and 39% wetlands and water. These proportions were about 71% and 29% for the Rock Springs Run Basin. The two reference watersheds had about 88% uplands/12% wetlands in Juniper Creek Basin and 70% uplands/30% wetlands for the Alexander Springs Creek Basin.

In the 2000 land use estimates the Wekiva River Basin had about 52% of its uplands (32% of the entire watershed) in urban and agricultural land uses. The Rock Springs Run Basin had about 46% of its uplands and 33% of its entire watershed area in urban and agricultural land uses. By contrast the Juniper Creek Basin had an estimated 0.3% of its uplands and entire watershed in urban and agricultural land uses while the Alexander Creek Basin had about 2% of its uplands and entire basin in urban and agricultural land uses.

A comparison of nutrient concentrations between the Wekiva River System streams (Wekiva River upstream of SR 46 and all of Rock Springs Run) and the two reference sites located in the Ocala National Forest indicates that nutrients are measurably and consistently elevated in the Wekiva River System. **Table 3-2** presented above with data collected during the December 2004 through August 2005 study period noted markedly higher average total nitrogen concentrations in the Wekiva River (1.14 mg/L) and Rock Springs Run (1.23 mg/L) than in the two reference sites (Juniper Creek TN = 0.253 mg/L and Alexander Springs Creek TN = 0.383 mg/L). A similar observation was made for total phosphorus with an average concentration of 0.124 mg/L in the Wekiva River, 0.109 mg/L in Rock Springs Run, 0.023 mg/L in Juniper Creek, and 0.052 mg/L in Alexander Springs Creek. The differences for average nitrate+nitrite nitrogen (NO_x-N) concentrations is even greater between the Wekiva River System streams and the two reference streams (Wekiva River NO_x-N = 0.761 mg/L, Rock Springs Run NO_x-N = 0.626 mg/L, Juniper Creek NO_x-N = 0.038 mg/L, and Alexander Springs Creek NO_x-N = 0.024 mg/L). Based on these data comparisons and on the assumption that the reference sites represent spring-fed streams that are similar to the Wekiva River System streams but without the influence of urban and agricultural development, it is concluded that the Wekiva River System has "man-induced nutrient enrichment" as defined above and that this nutrient enrichment is "degradation" as also defined in Chapter 62-302.530.48 (a) and 62-302.700, F.A.C..

4.2 Is There an Imbalance in Natural Populations of Flora and Fauna?

4.2.1 Previous Studies

Previous studies of algal growth potential, aquatic macrophytes, macroinvertebrates, and fish in the Wekiva River System streams were reviewed in WSI (2004) and were somewhat inconclusive concerning nutrient-related impairment.

FDEP (2000) measured algal growth potential in the Wekiva River System in 1999 and found that all upstream sampling locations exceeded the 5 mg/l dry weight/L "problem threshold". Canfield and Hoyer (1988) concluded that aquatic macrophyte abundance in the Little Wekiva River was highly correlated with shading by streambank vegetation and by erosion upstream caused by human activities and resulting in the smothering of plant beds by moving sand.

Warren *et al.* (2000) studied populations of aquatic macroinvertebrates in the Wekiva River System and concluded that although the system is moderately eutrophied by nutrient additions, the aquatic habitat is healthy. FDEP (2000) conducted an ecological

assessment of the Wekiva River in 1999 based primarily on aquatic macroinvertebrate diversity and densities, and concluded that habitat quality was high at all stations and that Stream Condition Index scores were in the "Excellent" range. The FDEP study noted that nitrate nitrogen enrichment was prevalent throughout the study area and exceeded 95% of other Florida stream levels. Total phosphorus was noted as slightly elevated in the Little Wekiva River but ammonia and total kjeldahl nitrogen concentrations were below more than 50% of Florida streams. The largest potential habitat problem identified by FDEP was smothering from sand and silt.

Canfield and Hoyer (1988) also concluded that fish populations in the Little Wekiva River were stimulated by nutrient enrichment. VanGenechten (1999) studied fish populations in the Wekiva River System and found relatively high fish populations and species diversity but made no conclusions about the health or possible impairment of the system.

4.2.2 Ecological Studies

A variety of ecological indices were examined in this study to attempt to detect any measurable "imbalance" in the Wekiva River System streams compared to the control streams. These ecological indices provide quantitative measures of how multiple components of the aquatic ecosystem are reacting in concert to environmental forcing functions. Data collected during the nine month study described earlier in this report are presented in a comparative fashion to attempt to detect differences between the Wekiva River System streams and the reference sites and upstream to downstream within the Wekiva River system stream segments.

Table 4-1 provides an overall summary of the data collected for this study comparing the Wekiva River System streams to the reference sites. Although many indices of ecosystem response are reported, few clear trends emerge from these data.

Sediments in the upstream portions of the Wekiva River appear to be highly enriched in nutrients compared to all other stream segments. This apparent nutrient enrichment was being confirmed by additional sampling. These high sediment nutrient levels appear to indicate that past activities in this area of the river (probably plant management by repeated herbicide application) have saturated this stream segment with nutrients. Rock Springs Run showed no similar upstream-downstream sediment nutrient enrichment.

Water quality data for dissolved oxygen indicate that the reference sites have higher average concentrations than the Wekiva River and Rock Springs segments. However this parameter is highly sensitive to factors other than just plant productivity (temperature, current velocity, water depth, etc.) and the range of dissolved oxygen concentration variability masks any true difference that might be considered impairment. The average pH values for the reference sites are slightly higher than in the Wekiva River System sites, possibly indicating a difference in plant productivity effects. Specific conductance data indicate that the reference stream segments are measurably higher than the Wekiva River System segments in terms of dissolved salt content.

TABLE 4-1

SUMMARY COMPARISON OF ECOLOGICAL INDICES BETWEEN THE WEKIVA RIVER SYSTEM STREAMS AND THE REFERENCE STREAMS

PARAMETER GROUP	PARAMETER	UNITS	WR			RSR			Reference Stream Segments		
			SEG 1	SEG 2	Average	SEG 1	SEG 2	Average	ASC	JC	Average
SEDIMENTS	Carbon	percent	2.30	1.14	1.72	1.38	0.93	1.15	0.98	0.03	0.50
	Nitrogen	percent	0.70	0.11	0.40	0.13	0.06	0.10	0.11	0.03	0.07
	Phosphorus	mg/kg DW	21,739	361	11,050	540	136	338	838	107	473
WATER QUALITY	Dissolved Oxygen	mg/L	1.28	6.58	3.93	5.23	3.36	4.30	5.61	7.29	6.45
	pH	s.u	7.38	7.67	7.53	7.68	7.04	7.36	7.99	7.78	7.89
	Specific Conductance	µS/cm	314	433	374	240	272	256	830	1,443	1,137
	Total Nitrogen	mg/L	1.39	1.04	1.22	1.35	1.22	1.29	0.32	0.23	0.28
	Nitrate+Nitrite N	mg/L	1.17	0.318	0.745	1.09	0.157	0.624	0.014	0.021	0.017
	Total Phosphorus	mg/L	0.138	0.130	0.134	0.094	0.138	0.116	0.050	0.024	0.037
MASS LOADS	TN Loading Rate	kg/ha/d	69.8	80.5	75.1	80.3	43.5	61.9	24.1	75.4	49.8
	TIN Loading Rate	kg/ha/d	39.3	25.0	32.2	67.0	7.19	37.1	1.49	7.89	4.69
	TP Loading Rate	kg/ha/d	5.94	9.26	7.60	5.46	5.05	5.25	3.61	9.23	6.42
	TN Assimilation Rate	kg/ha/d	3.77	7.54	5.66	-10.8	6.89	-1.95	-0.07	5.24	2.59
	TIN Assimilation Rate	kg/ha/d	3.15	1.38	2.27	-4.35	1.35	-1.50	0.18	-2.06	-0.94
	TP Assimilation Rate	kg/ha/d	-0.05	-0.47	-0.26	-0.95	1.02	0.04	-0.22	0.48	0.13
PLANT COMMUNITY	Algae	percent cover	37.7	7.3	22.5	20.2	0.0	10.1	1.8	1.8	1.8
	Submerged Vegetation	percent cover	1.4	27.9	14.7	4.5	0.0	2.2	48.6	4.2	26.4
	Floating Plants	percent cover	4.8	8.1	6.4	10.7	26.7	18.7	8.5	1.6	5.0
	Emergents	percent cover	5.0	9.1	7.1	10.0	37.1	23.6	19.2	1.2	10.2
EXPORT	Macrophyte	$gDW/m^2/d$	1.67	0.033	0.85	0.006	0.003	0.005	0.373	0.018	0.196
	Fine Particulate	$gDW/m^2/d$	3.87	0.031	1.95	0.092	0.123	0.107	0.192	0.292	0.242
METABOLISM	Community GPP	$g\ O_2/m^2/d$	1.63	4.49	3.06	1.23	0.55	0.89	6.40	5.35	5.87
	Community NPP	$g\ O_2/m^2/d$	-5.11	-6.61	-5.86	-8.20	-10.66	-9.43	-0.92	-3.18	-2.05
	Community R	$g\ O_2/m^2/d$	6.74	11.10	8.92	9.43	11.20	10.32	7.32	8.53	7.92
	Community Ecol. Eff.	$g\ O_2/mol$	0.11	0.18	0.15	0.07	0.06	0.06	0.29	0.36	0.33
		percent	0.90	1.47	1.19	0.53	0.49	0.51	2.38	2.92	2.65
	Mesocosm GPP	g O2/kg DW/mol	1.31	1.15	1.23	0.59	0.91	0.75	0.40	0.80	0.60
	Mesocosm NPP	g O2/kg DW/mol	1.13	0.47	0.80	0.19	0.22	0.20	-0.02	0.21	0.10
	Mesocosm R	g O2/kg DW/d	4.30	20.85	12.57	12.81	7.22	10.02	10.28	14.27	12.27
	Mesocosm Ecol. Eff.	$g\ O_2/mol$	0.75	0.44	0.60	0.23	0.45	0.34	0.23	0.38	0.30
		percent	6.06	3.57	4.82	1.87	3.63	2.75	1.82	3.05	2.44
	Vallisneria GPP	g O2/kg DW/mol	0.85	0.52	0.68	0.32	0.69	0.51	0.34	0.62	0.48

Estimated average total nitrogen and total phosphorus mass loading rates to the Wekiva River System stream segments and to the reference stream segments were similar; however, the estimated mass loading rates for total inorganic nitrogen (TIN) were higher in the upstream Wekiva River System segments. This is one of the most obvious consistent differences observed between the two sets of streams. Average total nitrogen assimilation rates were variable in both the reference stream segments and in the Wekiva River System segments. Estimated total phosphorus assimilation rates were also not consistent between the Wekiva River System and reference sites.

Semi-quantitative plant cover estimates found higher benthic and floating algae populations in the Wekiva River System segments than in the reference sites. Percent cover estimates for submerged aquatic vegetation were more variable with greatest similarity between the Wekiva River downstream segment and the Alexander Springs segment and between Rock Springs Run segments and Juniper Creek. The higher submerged aquatic plant cover in Alexander Springs Creek than in the Wekiva River appears to be evidence of the effects of erosion impacts and resulting sediment smothering in that river.

Estimated segment GPP and NPP was consistently higher in the reference streams than in the Wekiva River System streams. There was no consistent difference for community respiration between the two sets of streams. In concert with the GPP data, estimated ecological efficiency was consistently higher in the reference streams than in the Wekiva River and in Rock Springs Run. Mesocosm plant metabolism data were generally similar between the Wekiva River System and reference stream segments, indicating that the differences observed for the community metabolism data were a system-level response and not just higher productivity of individual plant species.

Community metabolism results from the Wekiva River PLRG study can be compared to results published from other spring ecosystems in Florida (Odum 1957a and b; Knight 1980; Duarte and Canfield 1990) and other streams nationwide (Mulholland *et al.* 2001). At Silver Springs Odum (1957b) reported an annual average GPP of 15.5 $gO_2/m^2/d$, a CR of 14.6 $gO_2/m^2/d$, and by difference a NPP of about 0.9 $gO_2/m^2/d$. The ambient nitrate nitrogen concentration during Odum's Silver Springs study was about 0.46 mg/L. Knight (1980) restudied Silver Springs about 25 years later and reported average system metabolism estimates of GPP – 20.8 $gO_2/m^2/d$, CR – 10.7 $gO_2/m^2/d$, and NPP – 10.1 $gO_2/m^2/d$ when the ambient nitrate nitrogen concentration had risen to about 0.6 mg/L. A 50-year retrospective study is currently in progress at Silver Springs (WSI 2005). Nitrate nitrogen concentrations currently average about 1.1 mg/L in Silver Springs. The most recent study estimated an annual average GPP of 11.3 $gO_2/m^2/d$, a CR of 11.0 $gO_2/m^2/d$, and a NPP of 0.35 $gO_2/m^2/d$. PAR efficiency averaged 0.94 gO_2/mol.

Odum (1957a) also reported community metabolism data for eleven other Florida springs. He reported summer (July and August) values of GPP ranging from a low of 0.68 to a high of 34.0 $gO_2/m^2/d$. No CR, NPP, or nitrate concentrations were reported for these Florida springs.

The previous measurements of community metabolism reported by Odum, Knight, and WSI bracket the values measured in the Wekiva PLRG Study. Annual average GPP and

PAR efficiencies were much higher in the Silver River than in any of the Wekiva River System and reference streams during this shorter study. A preliminary examination of these data indicates that the Silver River aquatic ecosystem may either be highly variable from year-to-year in terms of community metabolism, or that it may be experiencing some impairment as a result of rising nitrate nitrogen concentrations.

Duarte and Canfield (1990) made rough estimates of peak GPP rates in 31 springs and spring runs in Florida and compared those numbers to the standing crop of submerged aquatic vegetation. They estimated peak GPP rates between -0.46 and 13.4 $gO_2/m^2/hr$. These estimates bracket our actual measured maximum hourly GPP rates during the spring and summer sampling events for Juniper Creek (0.95 and 2.69 $gO_2/m^2/hr$) and Alexander Springs Creek (0.77 and 1.44 $gO_2/m^2/hr$) and are generally higher than the values we measured in the Wekiva River Segment 1 (0.27 and 0.27 $gO_2/m^2/hr$) and Segment 2 (0.85 and 0.98 $gO_2/m^2/hr$) and in Rock Springs Run Segment 1 (0.23 and 0.41 $gO_2/m^2/hr$) and Segment 2 (0.14 and 0.49 $gO_2/m^2/hr$). Duarte and Canfield (1990) concluded that standing crops of submerged aquatic macrophytes were not influenced by water concentrations of either total nitrogen or total phosphorus in these springs and spring runs. They also reported that peak hourly GPP estimates were not correlated with either total nitrogen or total phosphorus concentrations in these springs, but were highly correlated with the standing crop of submerged aquatic vegetation.

Mulholland *et al.* (2001) reported stream metabolism results from a variety of autotrophic and heterotrophic streams. GPP estimates ranged from <0.1 to 15 $gO_2/m^2/d$. CR estimates ranged from about 2.0 to 11.1 $gO_2/m^2/d$. PAR efficiencies ranged from 0.042 to 0.45 gO_2/mol. GPP and NPP were not found to be correlated with either dissolved inorganic nitrogen or soluble reactive phosphorus concentrations but were significantly correlated with PAR. CR was correlated with soluble reactive phosphorus concentrations.

The Wekiva PLRG data summarized in **Table 4-1** and specifically the data for community metabolism indicate that an apparent impact or "imbalance" is measurable for the natural populations of flora and fauna in the Wekiva River System. Additional study under a range of seasonal and climatic conditions will need to be made to confirm these apparent ecosystem impacts.

5.0 Description of Other Pollutants/Stressors of Concern

5.1 Introduction

Nutrient conditions were the focus of the nine-month study described in this report. As concluded in Section 4.0, nutrient concentrations are elevated in the Wekiva River System compared to relatively unimpacted reference streams. However, estimated mass loading rates for total nitrogen and total phosphorus are not very different between the Wekiva River system streams and the reference streams. Estimated mass loading rates for total inorganic nitrogen and especially nitrate+nitrite nitrogen are clearly elevated in the Wekiva River System.

The observed ecosystem responses documented in this nine-month study are the result of all of the environmental forcing functions acting on the Wekiva River System stream segments. These forcing functions include many other variables in addition to nutrient concentrations and loads. A list of some of the most obvious factors that contribute to the ecological functioning of these spring-fed river systems includes:

- Groundwater inflows
- Groundwater quality
- Atmospheric inputs of water and chemical constituents
- Non-point source flow and chemical inputs from the watershed
- Sunlight
- Infrequent/unpredictable natural events (*e.g.*, hurricanes)
- Human perturbations (e.g., aquatic weed management and recreational use)

The groundwater effects caused by nutrient addition have been described previously (WSI 2004), as have atmospheric and watershed inputs of nutrients and water. Sunlight is a variable only in relation to streambank vegetation clearing and management of floating and emergent weeds. Several major hurricanes affected the Wekiva River System and reference site streams just prior to the beginning of this study (Charley - August 14, 2004; Frances - September 5, 2004; and Jeanne – September 26, 2004), and although not well documented by before and after studies, appeared to alter the occurrence of submerged aquatic plant communities in the four study streams. Plant community impacts in the Wekiva River appeared to be greater than in Alexander Springs Creek, possibly due to the much higher mobile sediment load in the Wekiva River (an apparently human-induced condition resulting from high development-related erosion in the urban watershed). Of particular concern as far as possible contributing stressors to the ecosystem-level differences observed between the Wekiva

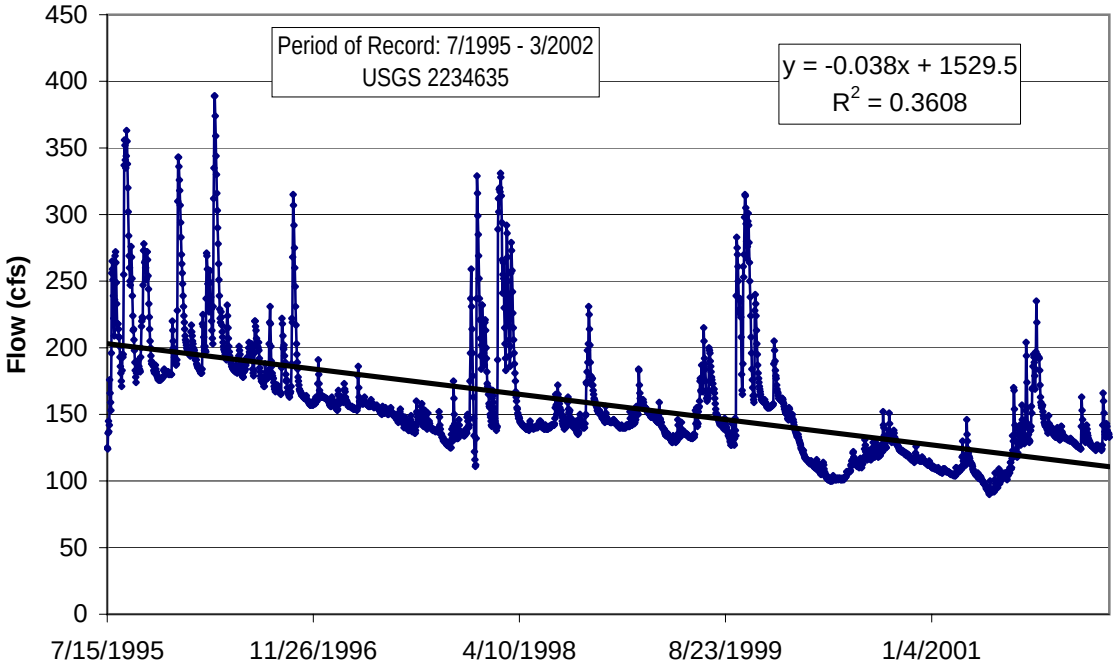
River System and Reference Site streams are the possible human perturbations related to: reduced groundwater inflow due to increasing withdrawals from the Florida aquifer, aquatic weed management activities, and recreational uses. Each of these possible stressors is briefly discussed below.

5.2 Human-Induced Reductions in Spring Flow

WSI (2004) summarized rainfall and spring discharge data for the project area for the period-of-record. The rainfall analysis showed no trend in rainfall amounts over the period from 1931 through 2001. Flow data for the thirteen named springs contributing to the Wekiva River and Rock Springs Run are insufficient to detect any long-term changes in spring discharge. Discharge records for the Wekiva River from 1995 through 2002 (**Figure 5-1**) appear to show a declining trend in flows measured just upstream of the Wekiva Marina (USGS 2234635 located downstream of Wekiwa Springs and Rock Springs Run but upstream of the confluence with the Little Wekiva River), and downstream in the Wekiva River at the old railroad crossing (USGS 022349993). The longer flow record for the SR 46 gage on the Wekiva River (USGS 02235000) does not appear to show a long-term declining discharge rate for the stream although the most recent 10-year period does have a slight downward trend that ended with rising flows since the end of 2002 (**Figure 5-2**). These data at least indicate that there may be a human-caused (non-climatic) reduction in spring discharges into the Wekiva River and Rock Springs Run, at least during the most recent decade. Also, Rao and Clapp (1996) demonstrated through modeling that based on current rates of increasing groundwater use, Wekiwa, Rock, and Miami Springs are expected to violate there minimum flow requirements by 2010. Additional analyses need to be rigorously conducted to determine whether flow reductions in these rivers are man-induced and whether they may be contributing to the observed ecological impairment documented by the current study.

5.3 Aquatic Plant Management Activities

The FDEP's Bureau of Invasive Plant Management and the US Army Corps of Engineers (USACE) conduct extensive aquatic weed management activities in the Wekiva River and Rock Springs Run (Nathalie Visscher, FDEP and Chance DuBose , USACE personal communications to Troy Keller, SJRWMD). Data for these activities were not fully available or analyzed for this study. However, some raw data on herbicide usage in the Wekiva River were provided by the USACE. For the nine-year period from August 1993 through December 2001 the USACE treated about 393 ha (972 ac) of mixed aquatic weed beds with 443 L (117 gal) of Rodeo, 784 L (207 gal) of Reward, 2,120 L (560 gal) of 2,4-D, 558 L (148 gal) of Aquathol, and 875 kg (1,970 lbs) granular Aquathal. Plants killed by these activities remain in the system and result in accumulations of organic sediments, patches of un-vegetated bottom areas formerly covered by floating plants, and un-quantified damage to non-target organisms. All historical data concerning aquatic plant management within the Wekiva River System should be compiled and analyzed to document the potential magnitude of these activities on ecosystem structure and function.



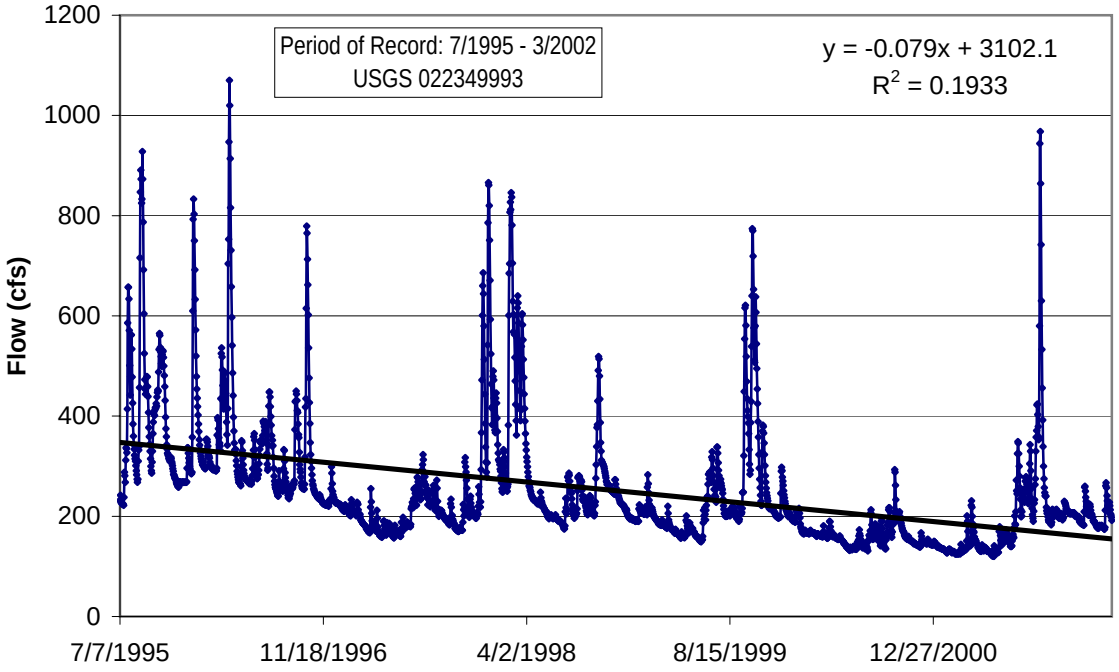
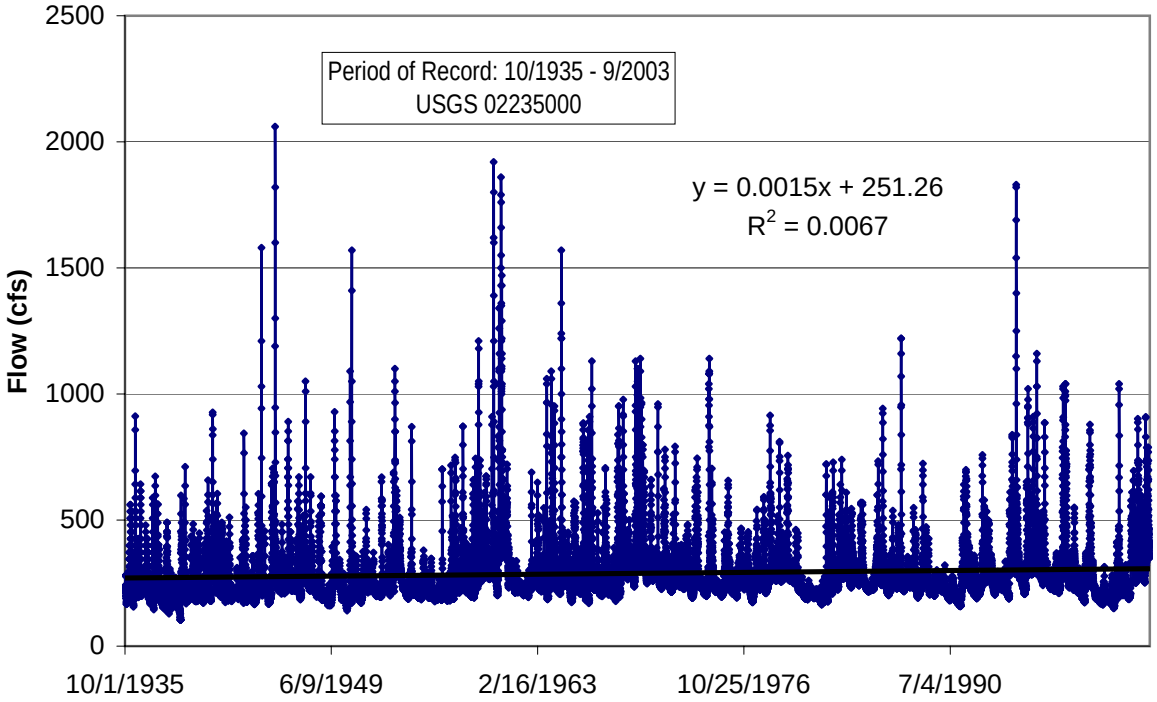


FIGURE 5-1
PERIOD-OF-RECORD DISCHARGE DATA FOR THE WEKIVA RIVER AT THE MARINA AND OLD RR CROSSING



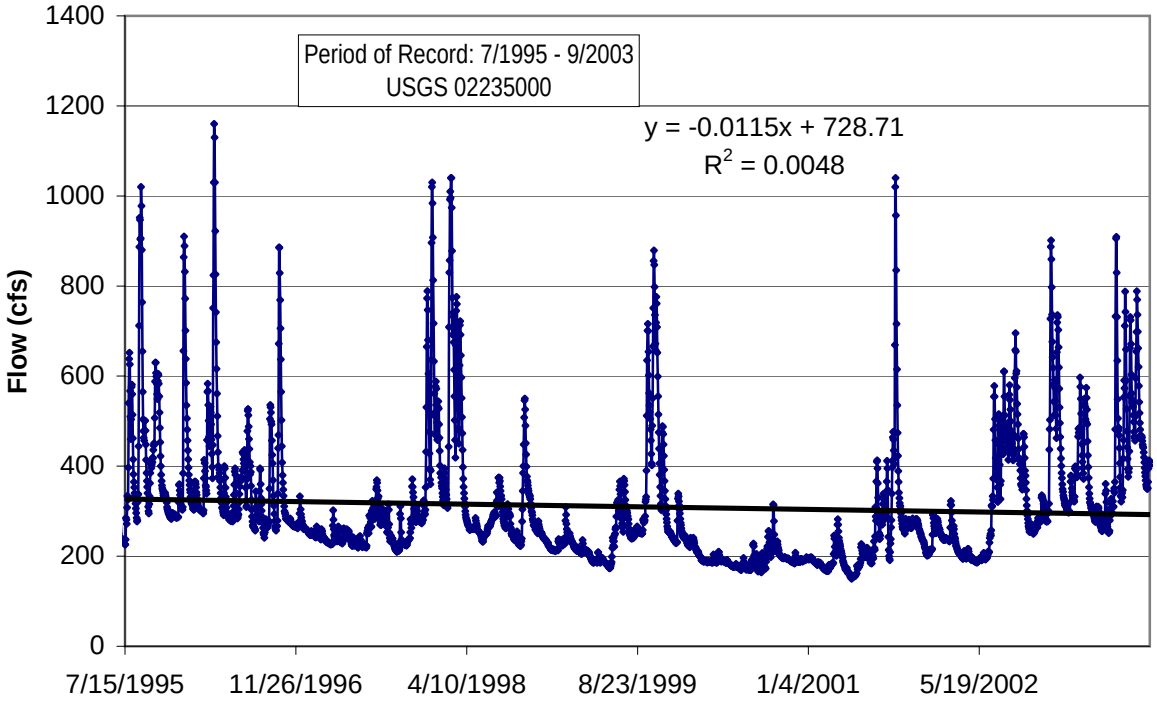


FIGURE 5-2
DISCHARGE SUMMARY FOR WEKIVA RIVER AT SR 46

5.4 Recreational Uses

The Wekiva River System streams and the Reference Site streams are used for recreational activities. Predominant activities observed during this study period were canoeing and kayaking. Some fishing was also observed and motor boats are occasionally seen on the lower portion of the Wekiva River. Recreational activities in these rivers were impacted by the hurricanes of fall 2004 due to tree falls and the difficulty of clearing and providing safe and convenient access. The level of recreational use observed during this nine-month study (approximately 50 to 20 boats per day in the Wekiwa Springs State Park, typically less than 5 boats per day down Rock Springs Run, Juniper Creek, and Alexander Springs Creek) was partially influenced by timing (field work was conducted on week days and recreational use is generally highest on weekends). However, other than at the head spring areas (Wekiwa Springs, Rock Springs, Juniper Springs, and Alexander Springs), and in Juniper Creek below US 19 where wading is very intensive, none of the stream reaches appeared to be excessively influenced by erosion or plant removal due to recreational human activities during this study period.

Previous research at Silver Glen Springs (Pandion 2003) and at the Ichetucknee River (Kurtz *et al.* 2003) have documented significant changes to submerged plant communities resulting from human recreational activities such as wading, sediment erosion, and smothering of plant communities by suspended sediments. As with the other two potential stressors discussed above, additional effort needs to be put into the analysis of potential impacts of human recreation on the natural flora and fauna of springs and spring runs in Florida.

6.0 Estimation of Acceptable Pollutant Concentration Targets

6.1 Introduction

Based on data collected for this study it appears that nutrient concentrations are elevated in the Wekiva River System compared to the reference sites. A review of water quality conditions in springs and spring runs over a larger geographical area in Florida provides one perspective for identifying acceptable nutrient targets. This section provides this comparison for nitrate-nitrite nitrogen and for total phosphorus.

A number of other avenues are also being pursued in parallel with this analysis to help identify levels of nutrients in the Wekiva River System that might result in impairment as defined by Florida water quality standards. These efforts include:

- Studies of nutrient effects on *Lyngbya* biomass in southwest Florida springs (Cowell and Dawes 2004)
- Studies of biological conditions in springs in the Suwannee River Water Management District (Hornsby *et al.* 1999)
- Comparisons of algae growth and diversity in springs throughout Florida (Stevenson 2005)
- A review of nitrate toxicity (Mattson 2005)
- And the draft Total Maximum Daily Load Report for Wekiva River and Rock Springs run (USEPA 2005)

Results from those studies will eventually be available for comparison to the proposed nutrient concentration targets suggested below.

6.2 Nitrate+Nitrite Nitrogen

6.2.1 Reference Spring Approach

Figure 6-1 provides a visual summary of the average nitrate+nitrite nitrogen concentrations for the studied springs in the St. Johns River Water Management District (SJRWMD 2002) and elsewhere in Florida (Laura Morse 2005, FDEP unpublished data). This data review indicates that over half of the studied springs in Florida (springs that are generally in undeveloped or less-developed areas) have average nitrate-nitrite nitrogen concentrations less than 0.5 mg/L and that 50% of the studied springs in the SJRWMD have an average nitrate+nitrite nitrogen concentration less than about 0.20 mg/L. Based on this comparison to reference springs in Florida, the range from 0.2 to 0.5 mg/L might be a target for full restoration of ecological functioning in the Wekiva River system streams.

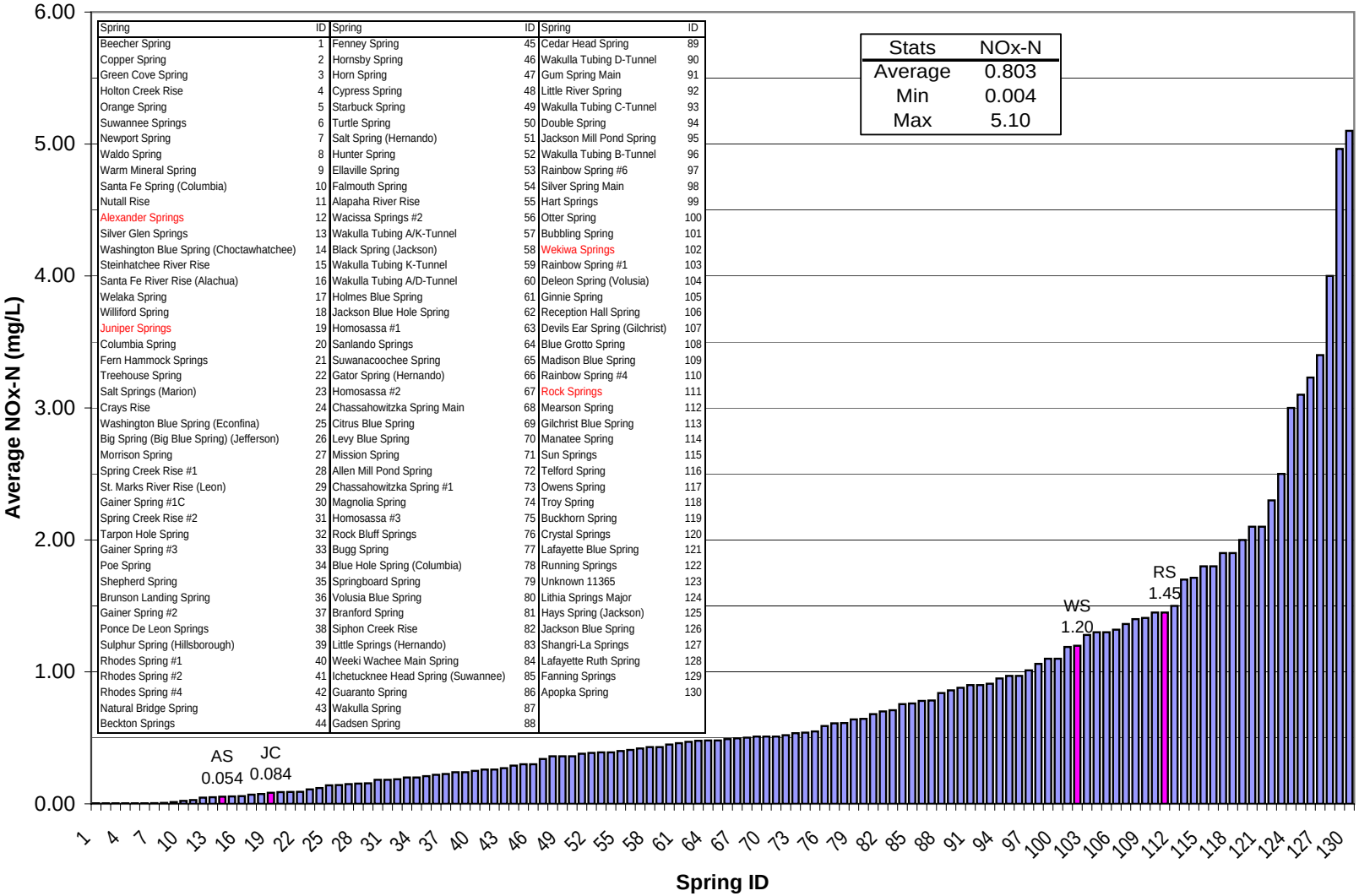


FIGURE 6-1

AVERAGE NOX-N CONCENTRATIONS FOR FLORIDA SPRINGS

6.2.2 Ecosystem Metabolism Approach

The ecosystem data collected for this study indicate that gross primary productivity (a measure of the total carbon fixation rate by the aquatic plant community) and ecological efficiency (a measure of how efficient an entire aquatic ecosystem is for converting solar energy inputs to fixed plant carbon) were measurably reduced in the Wekiva River System streams compared to the Reference Site streams (**Figure 6-2**). **Figure 6-3** illustrates that respiration rates for *Vallisneria* in *in situ* mesocosms in the Wekiva River System streams were also measurably reduced compared to the reference streams.

Based on a target ecological efficiency value equal to the average from the two Reference Site streams (3.25%), the Wekiva River was not fully recovered even at the downstream Wekiva River segment where the ecological efficiency was estimated as 1.71% and the average nitrate+nitrite nitrogen concentration was about 0.32 mg/L. In Rock Springs Run the ecological efficiency was even lower downstream (0.40%) at a nitrate+nitrite nitrogen concentration of 0.19 mg/L. Based on community metabolism data a suggested nitrate+nitrite nitrogen target concentration limit to avoid degradation of aquatic ecological structure and function is between 0.1 and 0.2 mg/L. Necessary pollutant load reductions will be estimated using the lower end of this range of target concentrations (0.1 mg/L), providing a conservative margin of safety towards restoration of aquatic ecological structure and function in the Wekiva River System.

6.3 Total Phosphorus

6.3.1 Reference Spring Approach

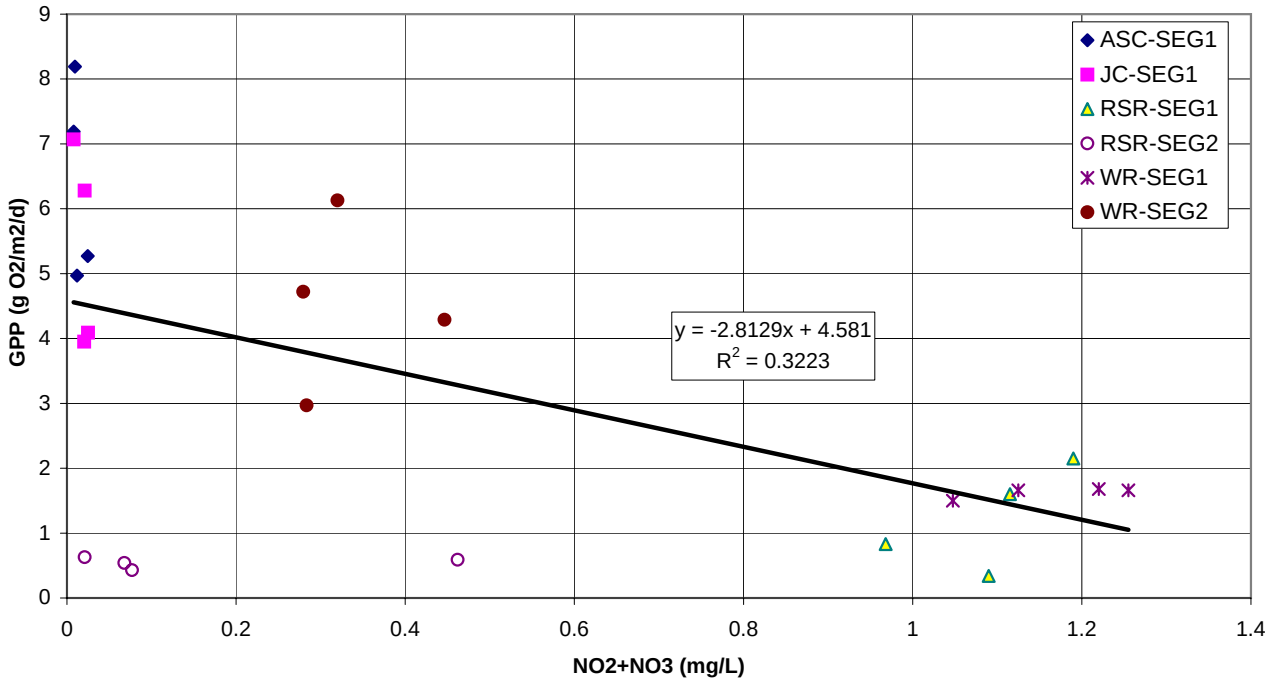
Figure 6-4 provides a visual summary of the average total phosphorus concentrations for the studied springs in the St. Johns River Water Management District (SJRWMD 2002) and elsewhere in Florida (Laura Morse 2005, FDEP unpublished data). This data review indicates that over half of the springs in the SJRWMD and in Florida have average total phosphorus concentrations less than about 0.05 mg/L. Based on comparison to reference springs in Florida, 0.05 mg/L total phosphorus might be a target for full restoration of ecological functioning in the Wekiva River System streams.

6.3.2 Ecosystem Metabolism Approach

The ecosystem data collected for this study indicate that at higher total phosphorus water concentrations, gross primary productivity and ecological efficiency were measurably reduced in the Wekiva River System streams compared to the Reference Site streams (**Figure 6-5**). **Figure 6-6** illustrates that respiration rates for *Vallisneria* in *in situ* mesocosms in the Wekiva River System streams were also measurably reduced at stations with higher total phosphorus concentrations.

Total phosphorus concentrations in the Wekiva River System streams were generally over 0.08 mg/L. These systems demonstrated impairment in terms of community metabolism indices. Based on community metabolism data, it is concluded that a target total phosphorus concentration to avoid impairment of ecological function is between 0.05 and 0.08 mg/L. Necessary pollutant load reductions will be estimated using the lower end of this range of target concentrations (0.05 mg/L), providing a conservative

margin of safety towards restoration of aquatic ecological structure and function in the Wekiva River System.



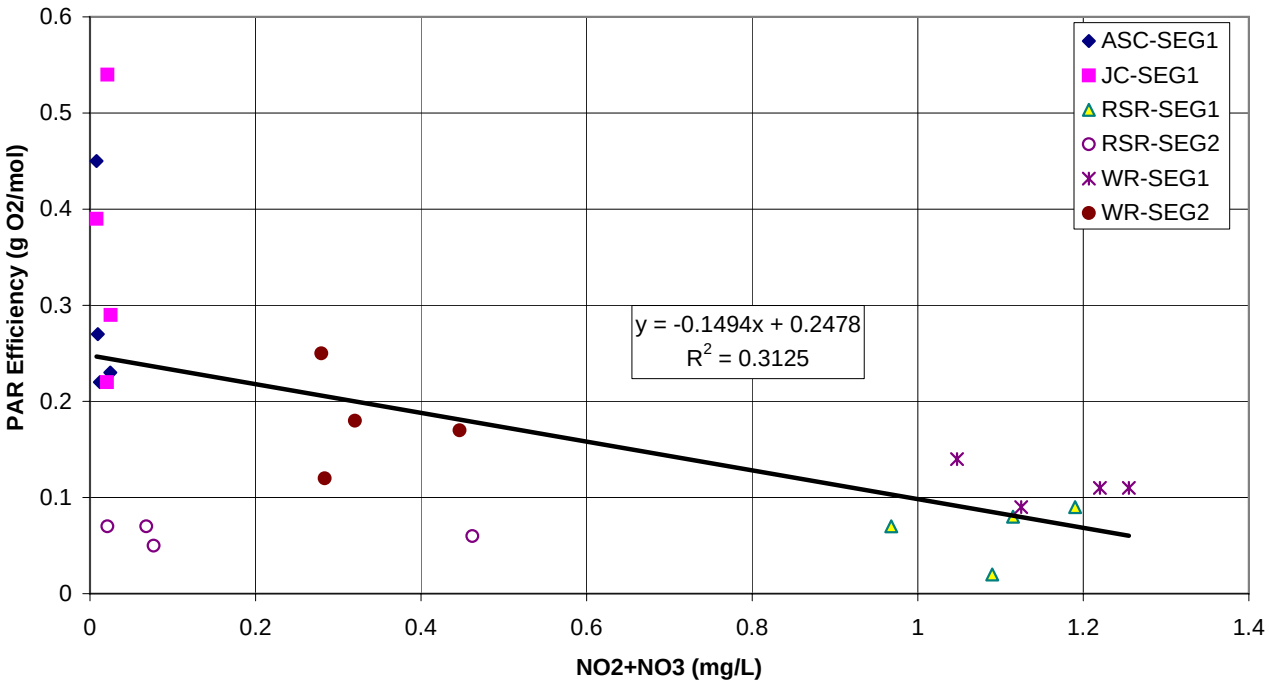
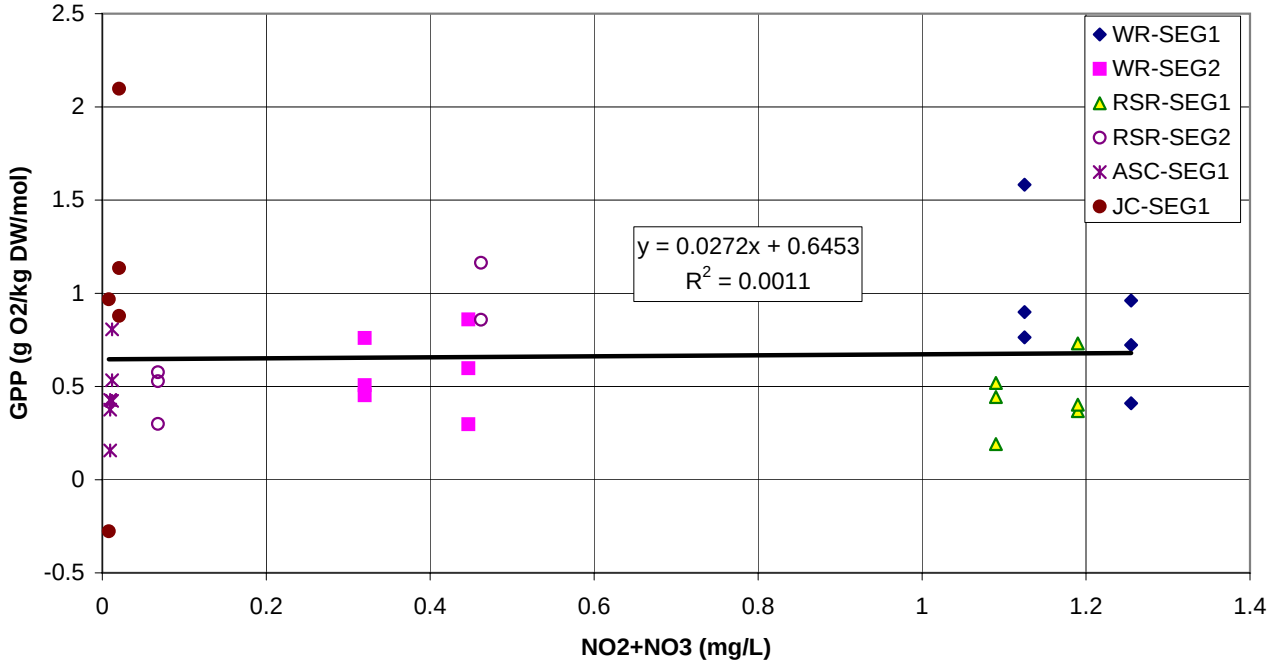


FIGURE 6-2

WEKIVA PLRG STUDY - OBSERVED RELATIONSHIP BETWEEN NITRATE-NITRITE NITROGEN CONCENTRATIONS AND STREAM SEGMENT GROSS PRIMARY PRODUCTIVITY AND ECOLOGICAL EFFICIENCY



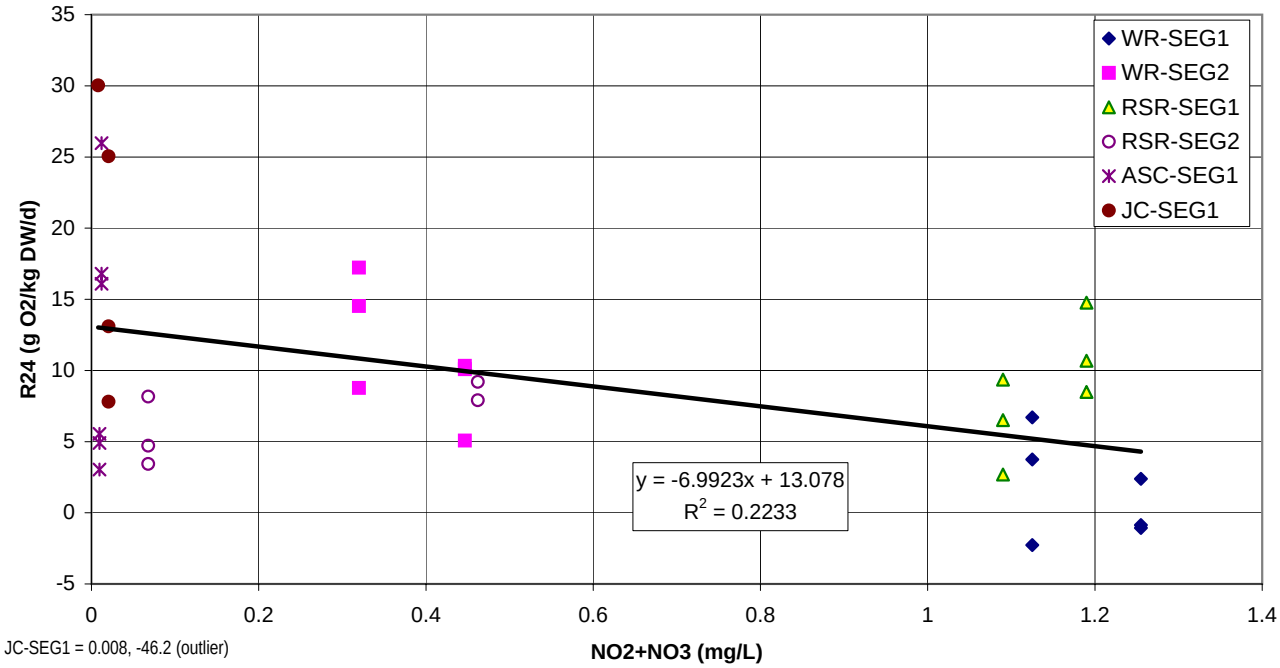
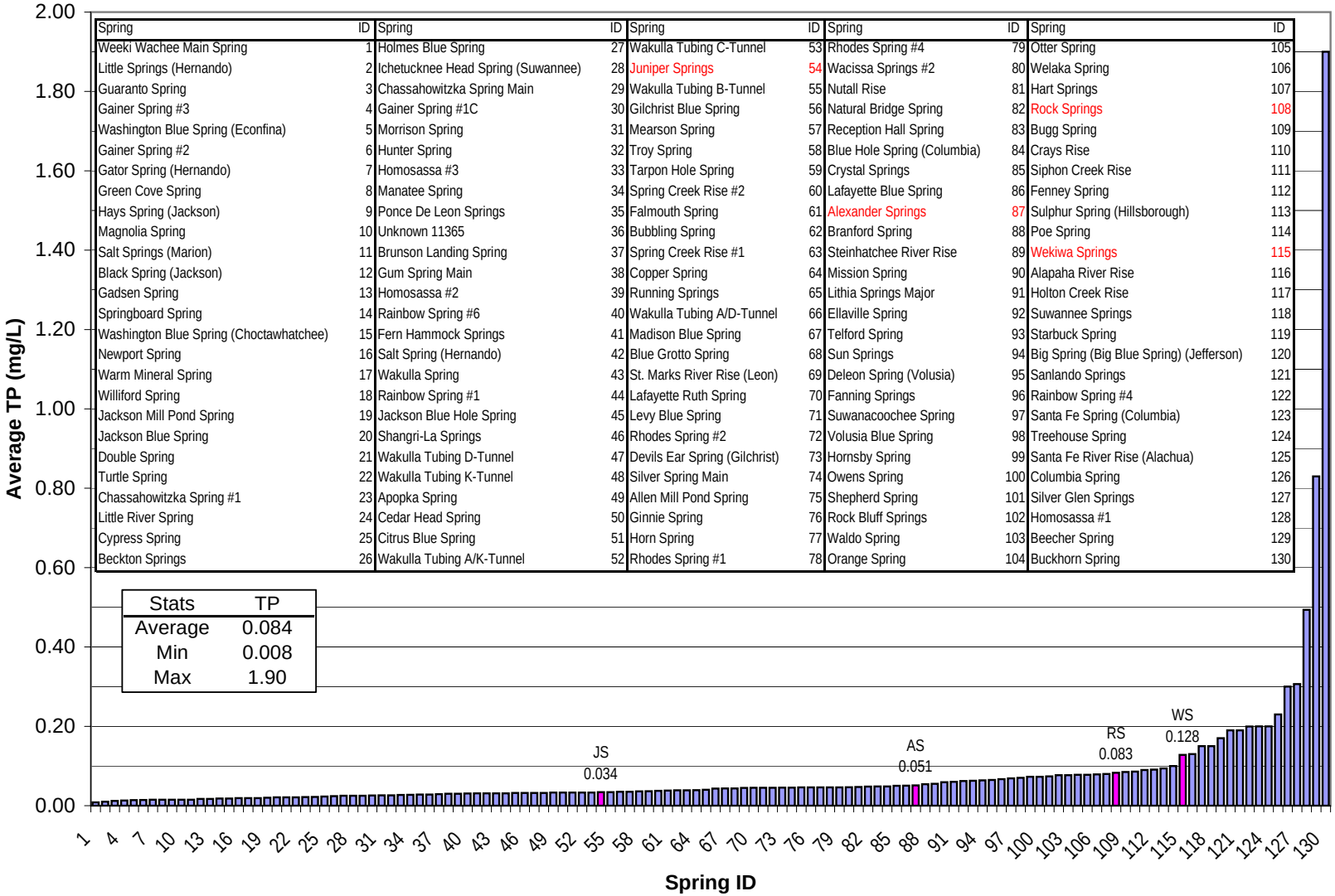


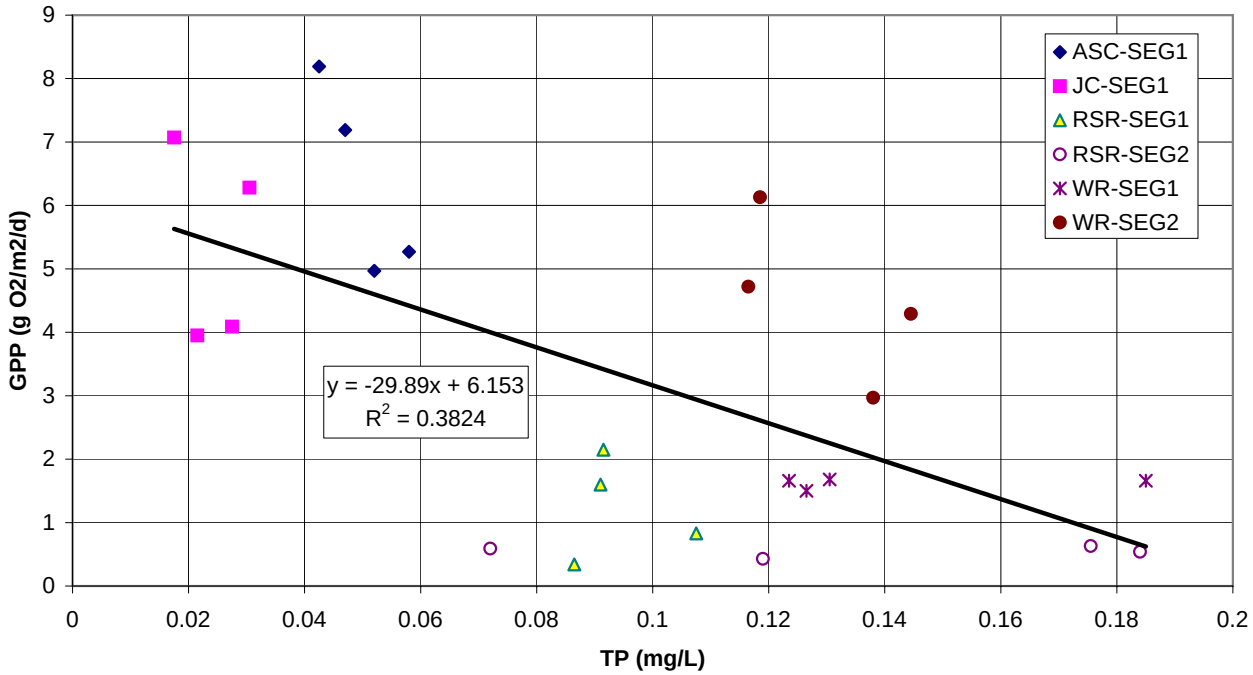
FIGURE 6-3

WEKIVA PLRG STUDY - OBSERVED RELATIONSHIP BETWEEN NITRATE-NITRITE NITROGEN CONCENTRATIONS AND *VALLISNERIA* MESOCOSM NORMALIZED GROSS PRIMARY PRODUCTIVITY AND COMMUNITY RESPIRATION



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 6-4
AVERAGE TP CONCENTRATIONS FOR FLORIDA SPRINGS



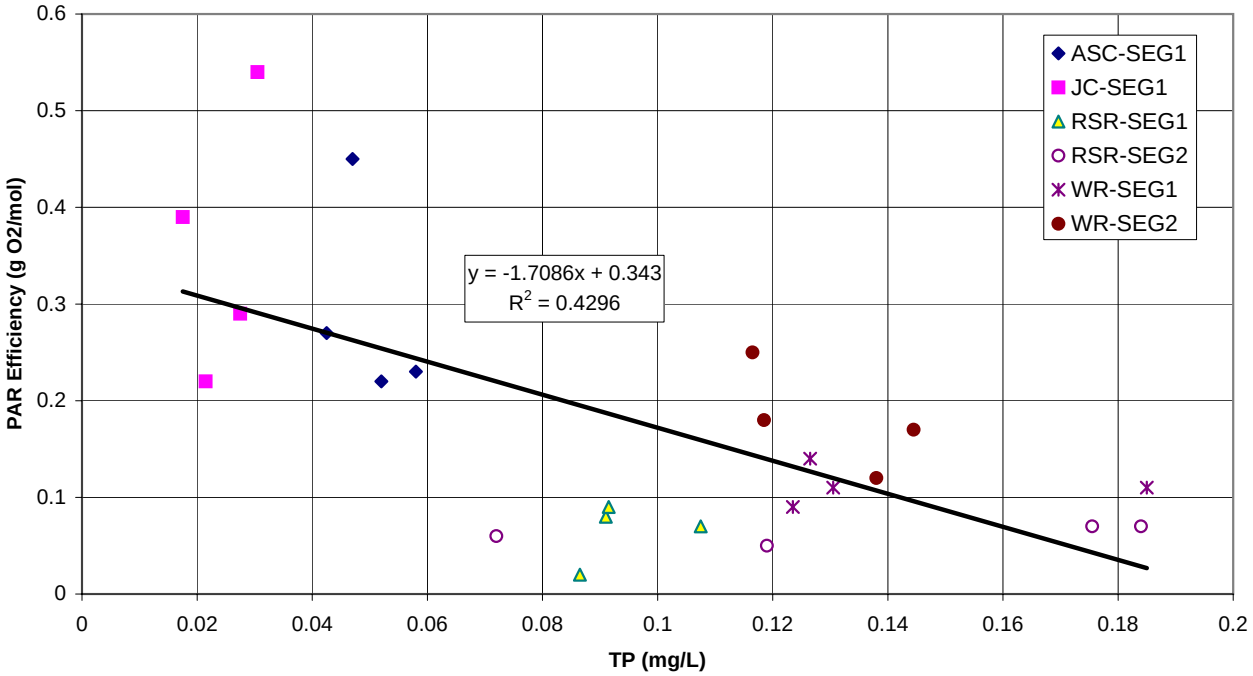
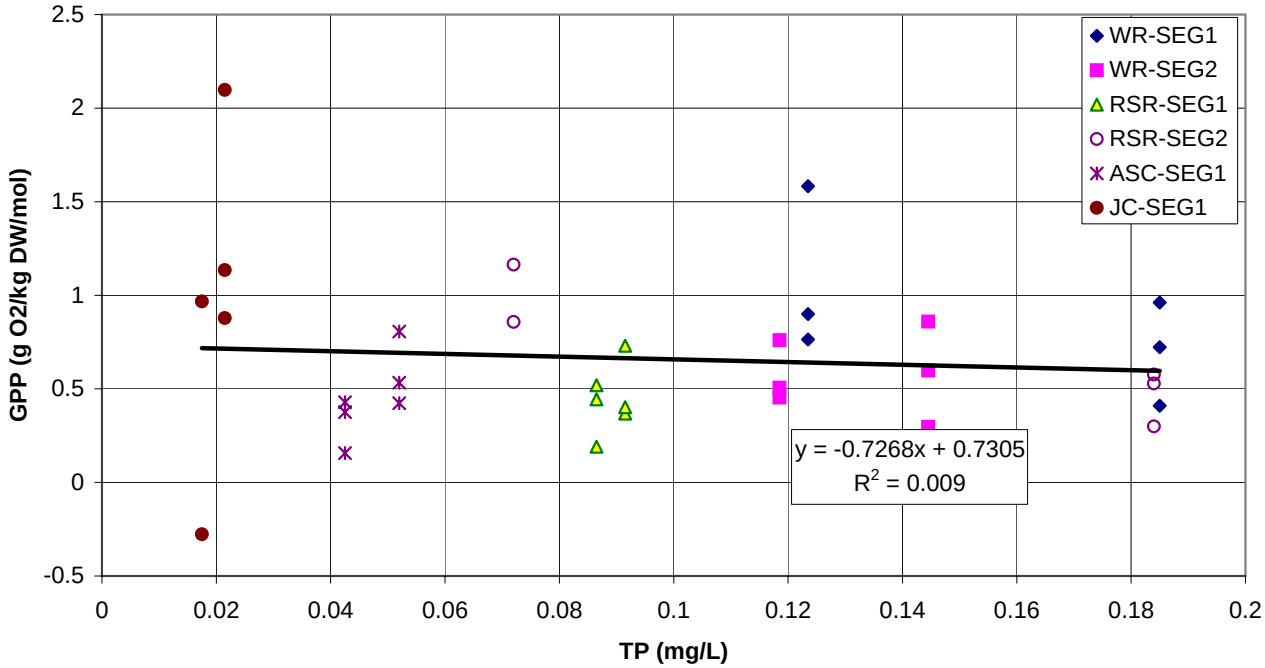


FIGURE 6-5

WEKIVA PLRG STUDY - OBSERVED RELATIONSHIP BETWEEN TOTAL PHOSPHORUS CONCENTRATIONS AND STREAM SEGMENT GROSS PRIMARY PRODUCTIVITY AND ECOLOGICAL EFFICIENCY



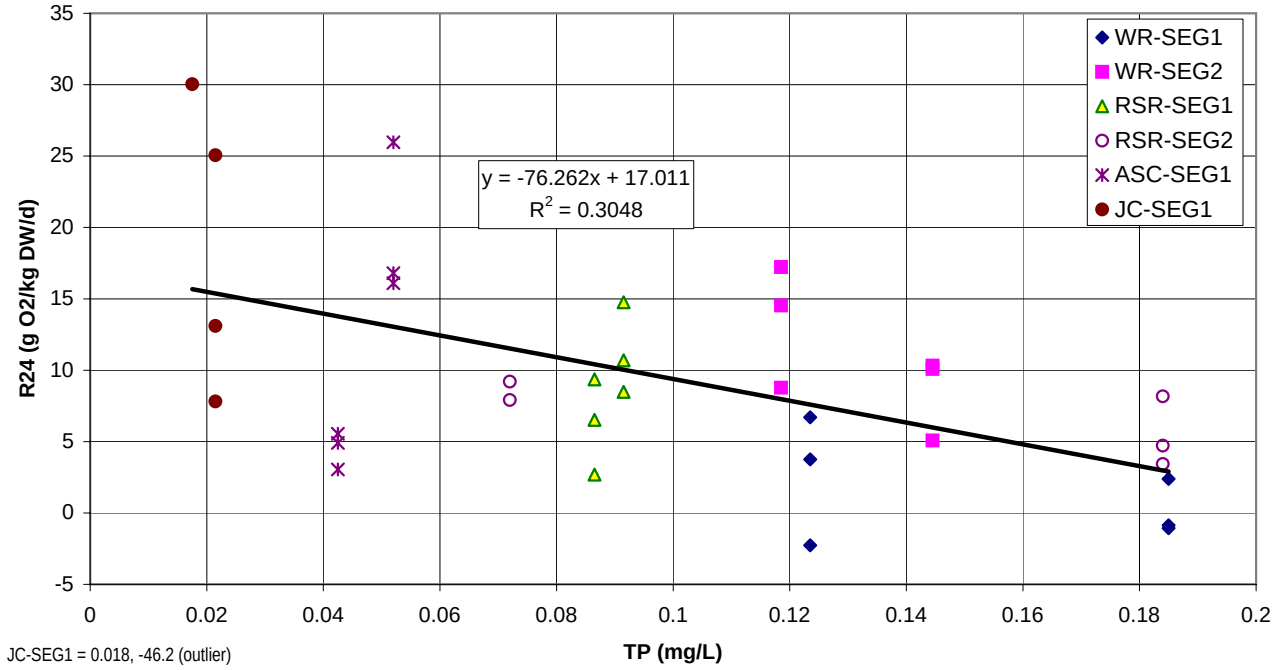


FIGURE 6-6

WEKIVA PLRG STUDY - OBSERVED RELATIONSHIP BETWEEN TOTAL PHOSPHORUS CONCENTRATIONS AND *VALLISNERIA* MESOCOSM NORMALIZED GROSS PRIMARY PRODUCTIVITY AND COMMUNITY RESPIRATION

7.0 Relationship between Pollutant Loading Rates and In-Stream Concentrations and Estimation of Necessary Pollutant Load Reduction

7.1 Nitrate-Nitrite Nitrogen

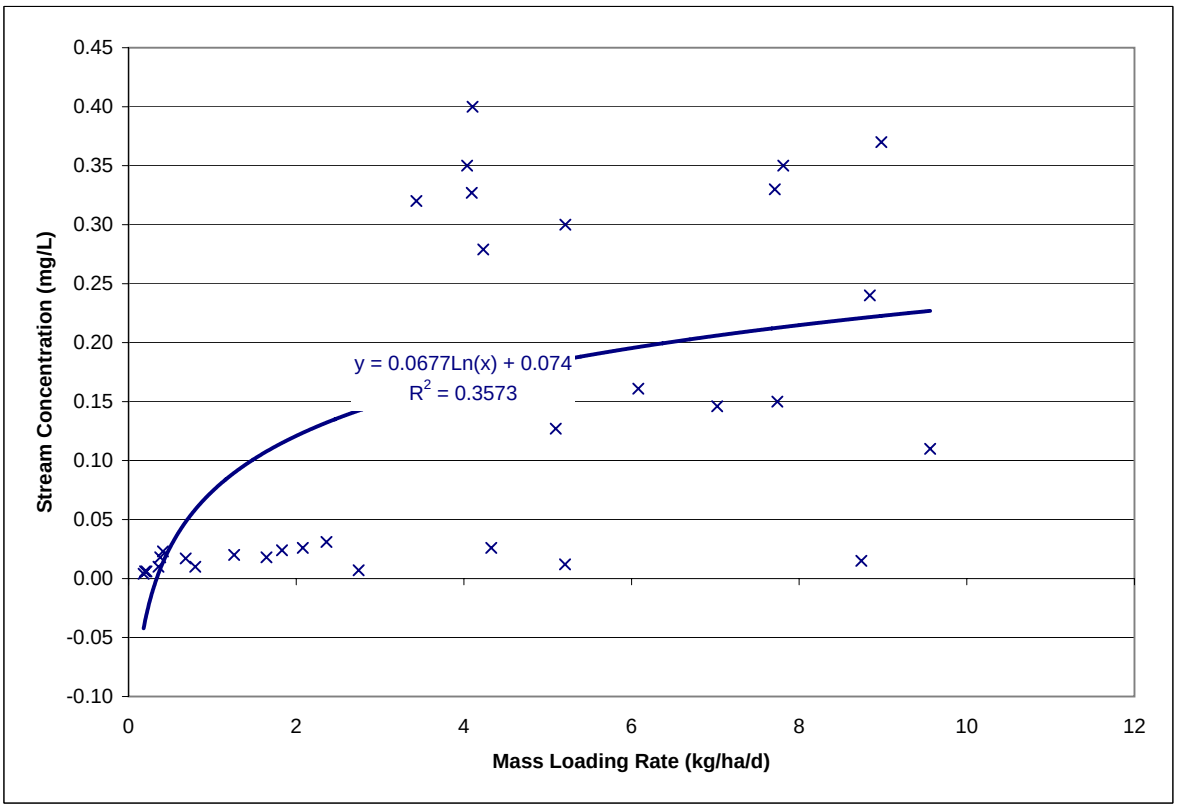
Figure 7-1 illustrates the observed relationship between loading and downstream concentration for nitrate+nitrite nitrogen. The observed relationship is somewhat weak (R^2 = 0.36) and will need to be improved through additional data collection and analysis prior to setting final load reduction goals. Based on the proposed nitrate+nitrite nitrogen in-stream concentration target of 0.1 to 0.2 mg/L at the downstream point in each river segment, this regression indicates that the acceptable nitrate+nitrite nitrogen mass loading rate must remain below 1.5 to 6.4 kg/ha/d. To set a target concentration at the upstream station, assimilation should be subtracted from the upstream concentration goal and the regression solved for the resulting lower downstream concentration.

Based on the estimated period-of-record nitrate+nitrite nitrogen load for the Wekiva River presented above in Section 3 (345 kg/d) and the regression shown in **Figure 7-1**, the load reduction goal would need to be about 231 kg/d (67%) to achieve the 0.1 mg/L target downstream. To meet that target upstream would require an even greater load reduction.

7.2 Total Phosphorus

Figure 7-2 illustrates the observed relationship between loading and downstream concentration for total phosphorus. The observed relationship is somewhat better (R^2 = 0.71) and could be improved through additional data collection and analysis prior to setting final load reduction goals. Based on a total phosphorus target concentration goal of 0.05 to 0.08 mg/L the total phosphorus mass loading rate goal should be between 0.27 and 0.45 kg/ha/d. Since there was no significant total phosphorus assimilation noted in the study reaches there is no need to include the upstream-downstream assimilation analysis suggested above for nitrate+nitrite nitrogen.

Based on the estimated period-of-record total phosphorus load for the Wekiva River presented above in Section 3 (87 kg/d) and the regression shown in **Figure 7-2**, the load reduction goal would need to be about 66 kg/d (76%) to achieve the 0.05 mg/L target downstream.



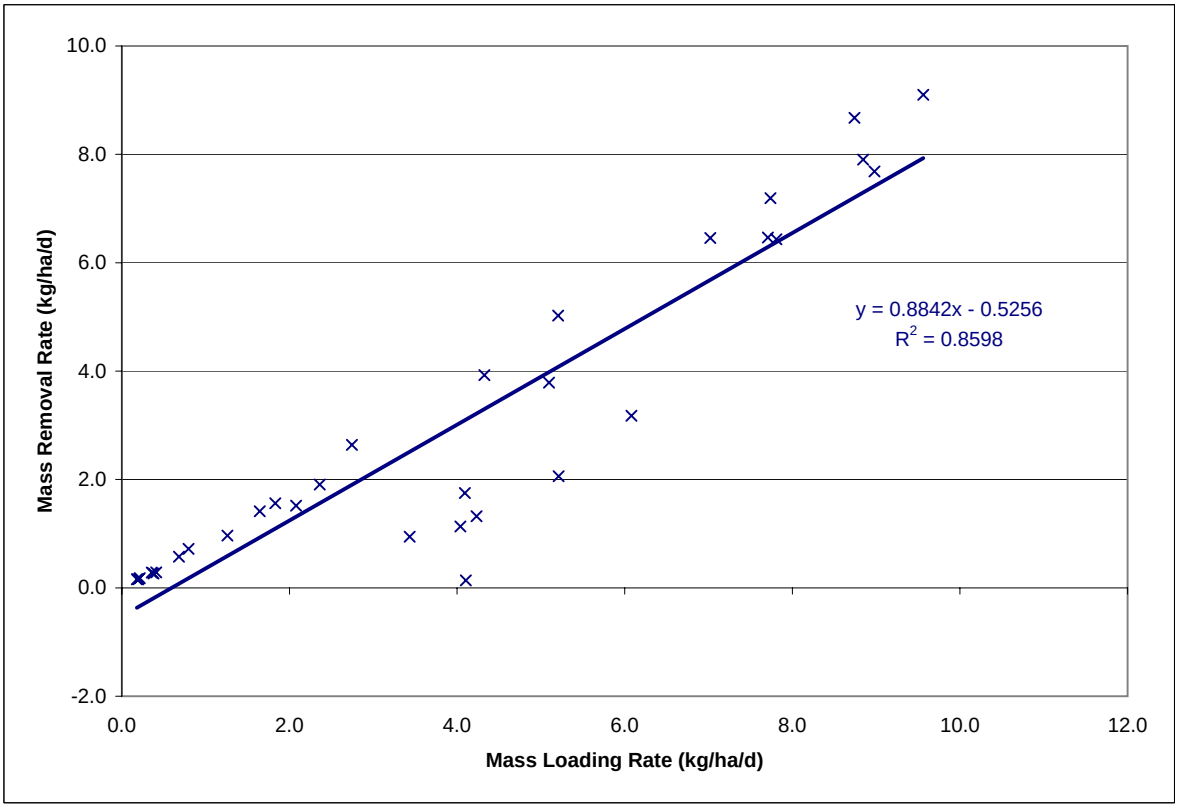
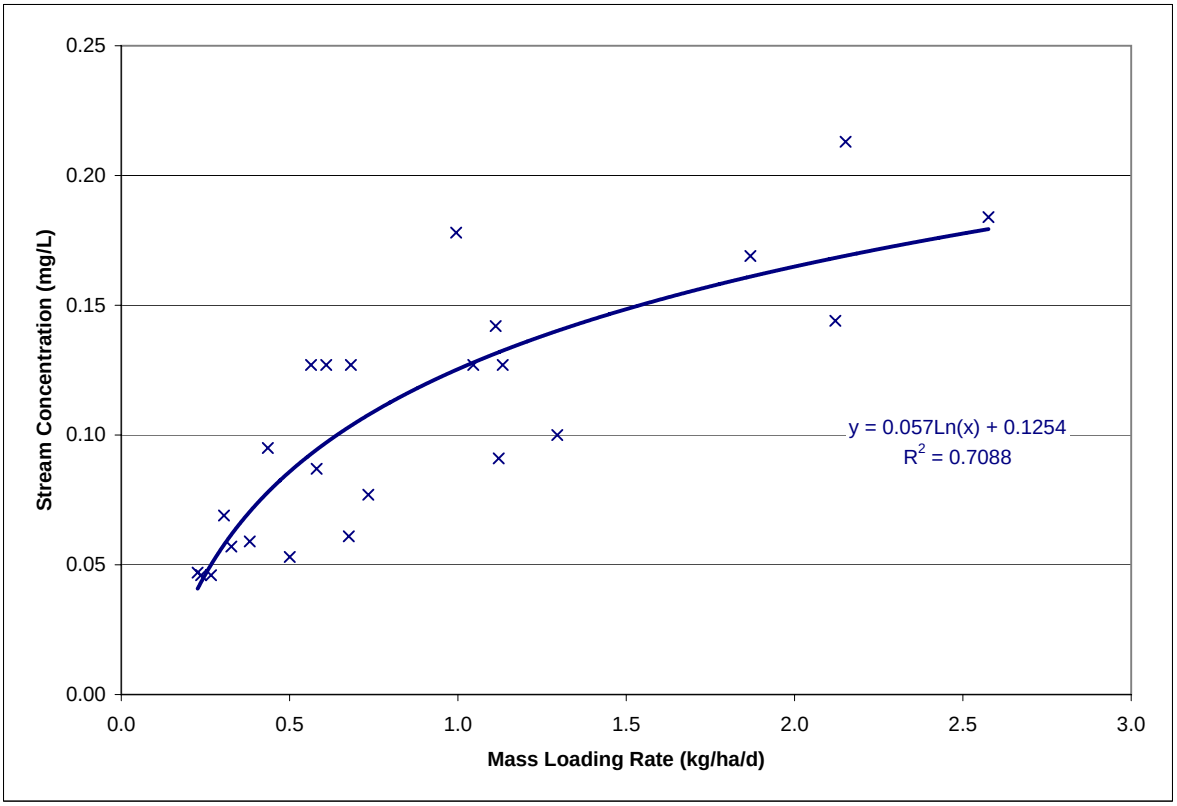


FIGURE 7-1
RELATIONSHIP BETWEEN MASS LOADING RATE, STREAM CONCENTRATION, AND MASS REMOVAL RATE FOR NITRATE+NITRITE-NITROGEN
WEKIVA RIVER, ROCK SPRINGS RUN, JUNIPER CREEK, AND ALEXANDER SPRINGS CREEK



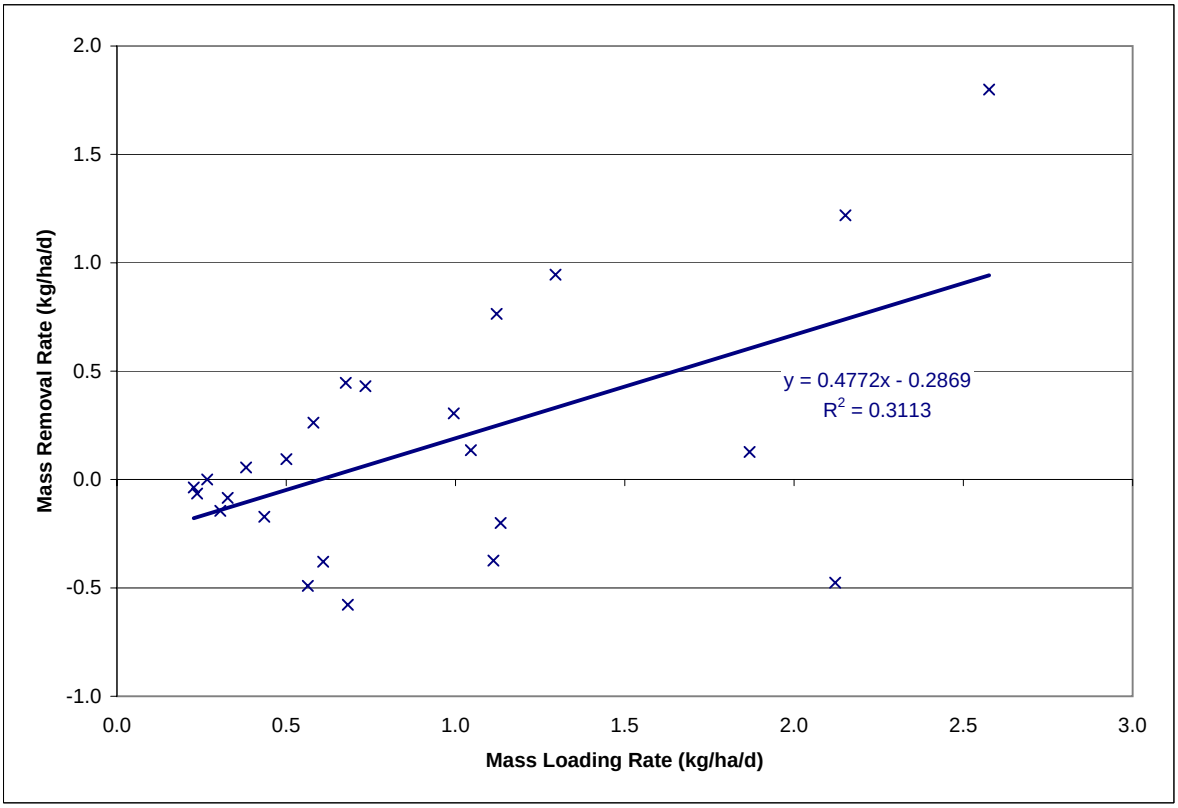


FIGURE 7-2
RELATIONSHIP BETWEEN MASS LOADING RATE, STREAM CONCENTRATION, AND MASS REMOVAL RATE FOR TOTAL PHOSPHORUS
WEKIVA RIVER, ROCK SPRINGS RUN, AND ALEXANDER SPRINGS CREEK (JUNIPER CREEK NOT INCLUDED)

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Appendix A

Wekiva River System and Reference Site Reach Reconnaissance Detailed Data

Appendix A-1

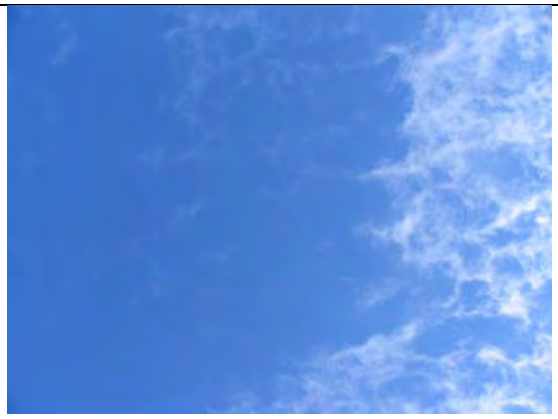
Wekiva River System Reach Reconnaissance Detailed Data

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-0.0
Latitude	28.71257
Longitude	81.46002
Depth (ft)	2.20
Width (m)	20
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.73
Light Attenuation	-0.069

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	---	---	7.5	3.0

Field Parameters

DO (mg/L)	0.45
DO (%)	5.9
Temp (C)	23.8
pH (SU)	7.42
Conductivity (uS/cm)	306.4
Sp. Cond.(uS/cm)	314.1

Dominant Species

NULU
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-0.0 km Stn (1/26/05 08:36)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-0.5
Latitude	28.71435
Longitude	81.45506
Depth (ft)	4.25
Width (m)	24
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.75
Light Attenuation	1.334

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	---	62.5	7.5

Field Parameters

DO (mg/L)	2.07
DO (%)	24.0
Temp (C)	22.8
pH (SU)	7.46
Conductivity (uS/cm)	294.9
Sp. Cond.(uS/cm)	308.7

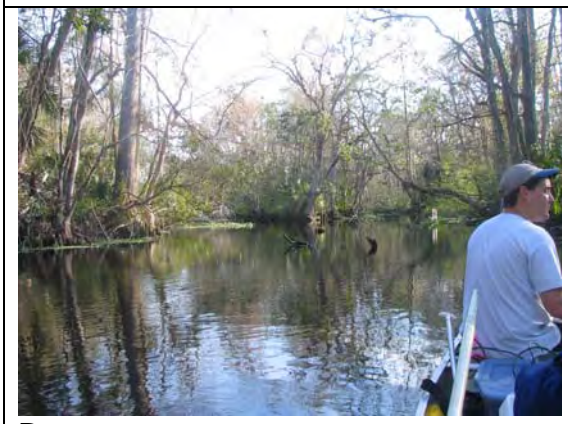
Dominant Species

PIST
HYUM, HYRA
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-0.5 km Stn (1/26/05 09:19)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-1.0
Latitude	28.71452
Longitude	81.45030
Depth (ft)	2.40
Width (m)	23
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.75
Light Attenuation	1.070

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	1.0	---	82.5	1.0

Field Parameters

DO (mg/L)	2.73
DO (%)	31.4
Temp (C)	22.1
pH (SU)	7.46
Conductivity (uS/cm)	288.3
Sp. Cond.(uS/cm)	305.9

Dominant Species

NULU
PIST
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-1.0 km StN (1/26/05 09:38)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-1.5
Latitude	28.71389
Longitude	81.44654
Depth (ft)	4.65
Width (m)	32
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.61
Light Attenuation	2.972

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	---	1.0	1.0

Field Parameters

DO (mg/L)	5.00
DO (%)	55.0
Temp (C)	18.1
pH (SU)	7.40
Conductivity (uS/cm)	257.4
Sp. Cond.(uS/cm)	294.3

Dominant Species

NULU
HYUM, HYRA

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-1.5 km Station (1/26/05 10:03)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-2.0
Latitude	28.71470
Longitude	81.44244
Depth (ft)	6.15
Width (m)	25
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.46
Light Attenuation	2.085

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	?	1.0

Field Parameters

DO (mg/L)	5.28
DO (%)	56.0
Temp (C)	17.3
pH (SU)	7.40
Conductivity (uS/cm)	243.1
Sp. Cond.(uS/cm)	285.0

Dominant Species

NULU
HYUM, HYRA

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-2.0 km Stn (1/26/05 10:18)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-2.5
Latitude	28.71729
Longitude	81.43855
Depth (ft)	6.50
Width (m)	29
Secchi Depth (ft)	5.67
Velocity (ft/s)	0.50
Light Attenuation	2.016

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	---	?	1.0

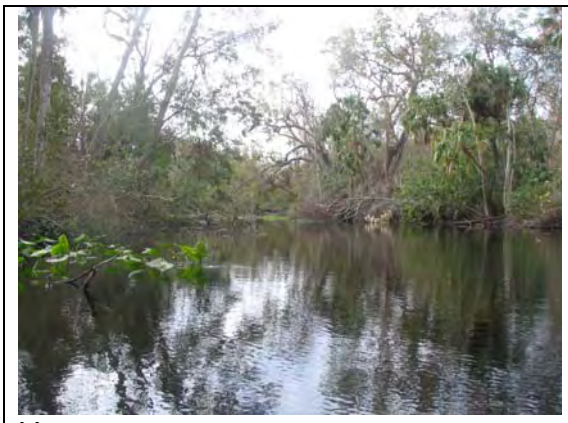
Field Parameters

DO (mg/L)	5.41
DO (%)	56.6
Temp (C)	17.2
pH (SU)	7.40
Conductivity (uS/cm)	242.6
Sp. Cond.(uS/cm)	285.7

Dominant Species

HYRA

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-2.5 km Stn (1/26/05 10:38)



Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-3.0
Latitude	28.72142
Longitude	81.43644
Depth (ft)	2.85
Width (m)	32
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.91
Light Attenuation	2.737

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	---	---	37.5	7.5

Field Parameters

DO (mg/L)	5.56
DO (%)	58.2
Temp (C)	17.2
pH (SU)	7.41
Conductivity (uS/cm)	244.2
Sp. Cond.(uS/cm)	287.9

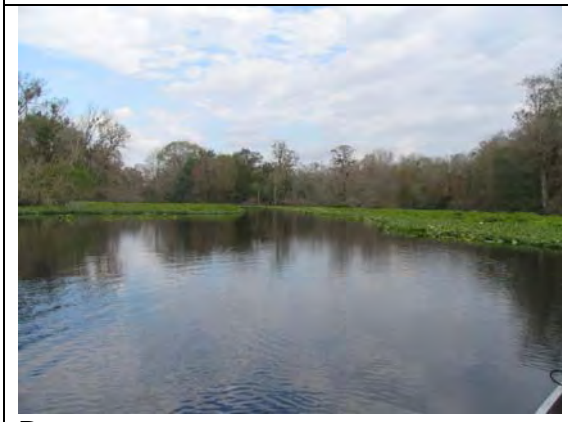
Dominant Species

NULU
HYRA
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-3.0 km Stn (1/26/05 10:56)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-3.5
Latitude	28.72445
Longitude	81.43275
Depth (ft)	3.05
Width (m)	59
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.86
Light Attenuation	2.786

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
62.5	---	7.5	7.5	1.0

Field Parameters

DO (mg/L)	5.81
DO (%)	60.4
Temp (C)	17.2
pH (SU)	7.44
Conductivity (uS/cm)	244.6
Sp. Cond.(uS/cm)	288.2

Dominant Species

NULU
TYLA
CIME
HYUM

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-3.5 km StN (1/26/05 11:10)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-4.0
Latitude	28.72819
Longitude	81.43018
Depth (ft)	2.89
Width (m)	35
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.08
Light Attenuation	3.578

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	37.5	7.5

Field Parameters

DO (mg/L)	6.28
DO (%)	65.3
Temp (C)	17.4
pH (SU)	7.46
Conductivity (uS/cm)	246.2
Sp. Cond.(uS/cm)	288.7

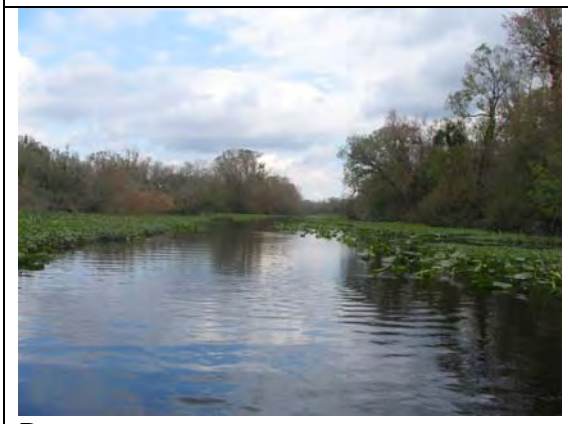
Dominant Species

HYUM
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-4.0 km Stn (1/26/05 11:46)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-4.5
Latitude	28.73190
Longitude	81.42735
Depth (ft)	2.82
Width (m)	38
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.70
Light Attenuation	2.733

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
62.5	---	---	17.5	7.5

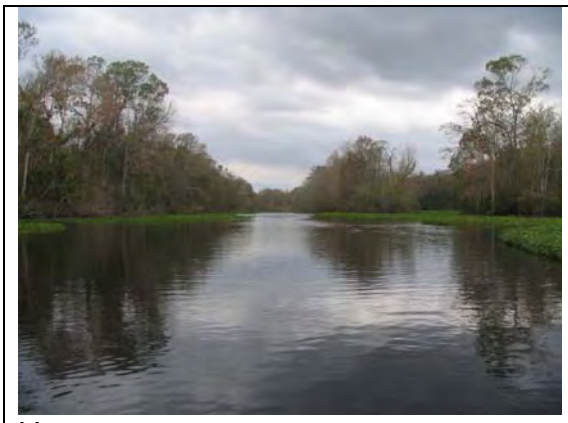
Field Parameters

DO (mg/L)	6.43
DO (%)	66.9
Temp (C)	17.2
pH (SU)	7.43
Conductivity (uS/cm)	246.6
Sp. Cond.(uS/cm)	290.6

Dominant Species

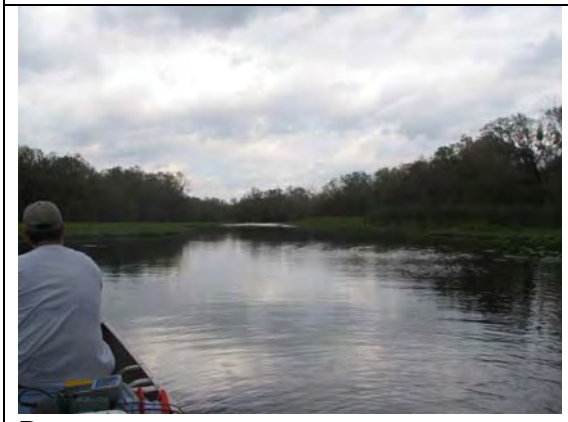
NULU
CIME
HYUM
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-4.5 km Stn (1/26/05 12:00)



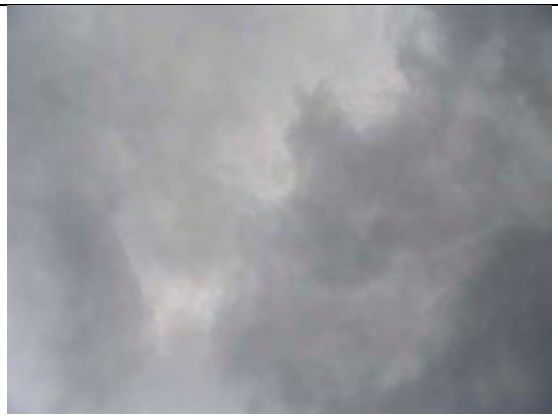
Upstream

Left Bank



Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-5.0
Latitude	28.73530
Longitude	81.42390
Depth (ft)	2.98
Width (m)	95
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.74
Light Attenuation	2.833

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
37.5	---	3.0	17.5	1.0

Field Parameters

DO (mg/L)	6.58
DO (%)	68.0
Temp (C)	17.1
pH (SU)	7.47
Conductivity (uS/cm)	246.5
Sp. Cond.(uS/cm)	291.0

Dominant Species

TYLA
POCO
CIME
HYUM

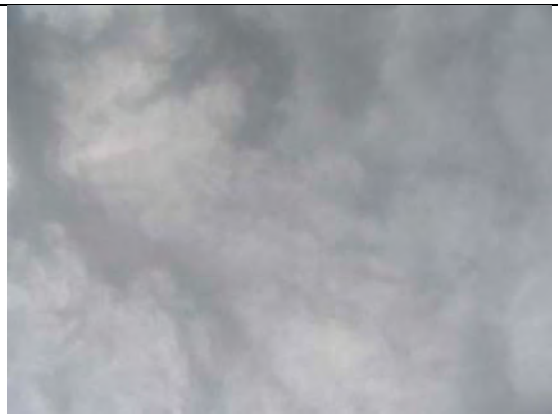
APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-5.0 km Stn (1/26/05 12:13)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-5.5
Latitude	28.73941
Longitude	81.42207
Depth (ft)	3.24
Width (m)	33
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.61
Light Attenuation	2.618

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	17.5	7.5

Field Parameters

DO (mg/L)	6.47
DO (%)	67.0
Temp (C)	16.9
pH (SU)	7.45
Conductivity (uS/cm)	247.9
Sp. Cond.(uS/cm)	293.9

Dominant Species

NULU
HYUM

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-5.5 km Stn (1/26/05 12:26)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-6.0
Latitude	28.74345
Longitude	81.41998
Depth (ft)	3.15
Width (m)	62
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.69
Light Attenuation	2.335

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	---	---	17.5	1.0

Field Parameters

DO (mg/L)	6.29
DO (%)	65.3
Temp (C)	16.8
pH (SU)	7.44
Conductivity (uS/cm)	248.6
Sp. Cond.(uS/cm)	296.6

Dominant Species

NULU
CIME
HYUM
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-6.0 km Stn (1/26/05 12:38)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-6.5
Latitude	28.74739
Longitude	81.41930
Depth (ft)	3.65
Width (m)	41
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.63
Light Attenuation	3.381

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	3.0	1.0

Field Parameters

DO (mg/L)	6.43
DO (%)	65.9
Temp (C)	16.7
pH (SU)	7.43
Conductivity (uS/cm)	250.2
Sp. Cond.(uS/cm)	298.3

Dominant Species

NULU
CIME
HYUM

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-6.5 km Stn (1/26/05 12:52)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-7.0
Latitude	28.75164
Longitude	81.41802
Depth (ft)	5.87
Width (m)	27
Secchi Depth (ft)	5.58
Velocity (ft/s)	0.74
Light Attenuation	2.341

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	---	7.5	7.5

Field Parameters

DO (mg/L)	6.43
DO (%)	66.2
Temp (C)	16.5
pH (SU)	7.44
Conductivity (uS/cm)	263.0
Sp. Cond.(uS/cm)	313.6

Dominant Species

HYUM

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-7.0 km Stn (1/26/05 13:07)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-7.5
Latitude	28.75517
Longitude	81.41662
Depth (ft)	3.89
Width (m)	30
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.52
Light Attenuation	2.637

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	---	3.0	7.5

Field Parameters

DO (mg/L)	6.53
DO (%)	66.8
Temp (C)	16.5
pH (SU)	7.44
Conductivity (uS/cm)	266.6
Sp. Cond.(uS/cm)	319.0

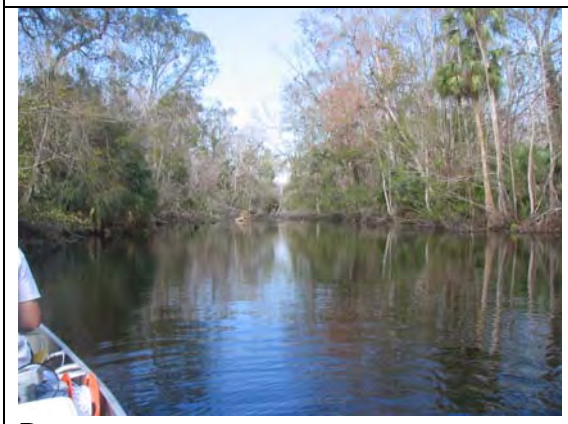
Dominant Species

PIST
HYUM
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-7.5 km Stn (1/26/05 13:26)

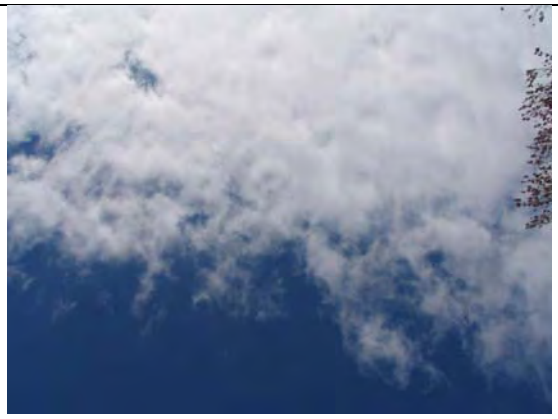
Upstream

Left Bank



Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-8.0
Latitude	28.75979
Longitude	81.41573
Depth (ft)	3.76
Width (m)	32
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.84
Light Attenuation	1.416

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	---	2.0	7.5

Field Parameters

DO (mg/L)	6.74
DO (%)	68.7
Temp (C)	16.4
pH (SU)	7.47
Conductivity (uS/cm)	263.9
Sp. Cond.(uS/cm)	317.9

Dominant Species

NULU
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-8.0 km Stn (1/26/05 13:58)

No Picture

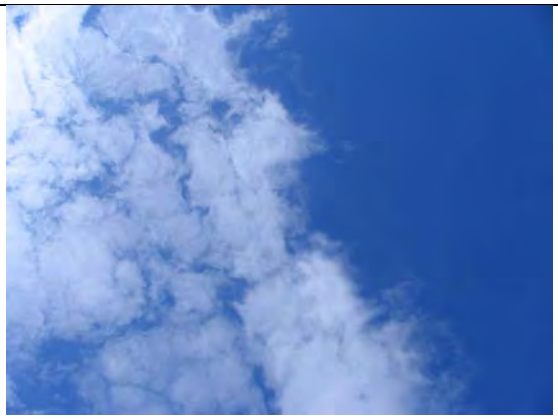
Upstream

Left Bank

Downstream

No Picture

Right Bank



Canopy

Physical Parameters

Station	WR-8.5
Latitude	28.76437
Longitude	81.41567
Depth (ft)	2.84
Width (m)	45
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.27
Light Attenuation	2.306

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	7.5	1.0

Field Parameters

DO (mg/L)	6.90
DO (%)	69.8
Temp (C)	16.0
pH (SU)	7.46
Conductivity (uS/cm)	262.9
Sp. Cond.(uS/cm)	318.3

Dominant Species

COES
NULU
HYUM
BEAL

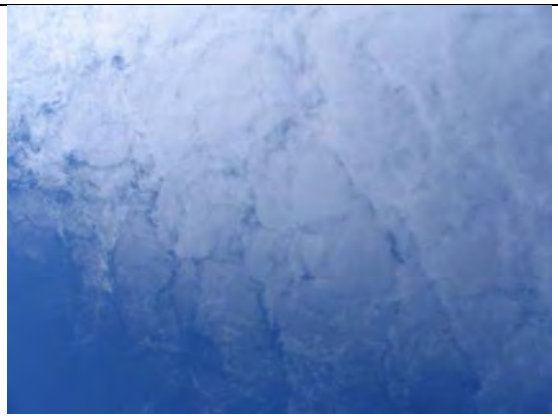
APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-8.5 km Stn (1/26/05 14:11)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-9.0
Latitude	28.76860
Longitude	81.41619
Depth (ft)	4.00
Width (m)	45
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.03
Light Attenuation	2.313

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	7.5	1.0

Field Parameters

DO (mg/L)	6.89
DO (%)	69.8
Temp (C)	16.0
pH (SU)	7.48
Conductivity (uS/cm)	264.5
Sp. Cond.(uS/cm)	319.5

Dominant Species

COES
NULU
CIME
HYUM
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-9.0 km Stn (1/26/05 14:23)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-9.5
Latitude	28.77276
Longitude	81.41572
Depth (ft)	2.40
Width (m)	38
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.81
Light Attenuation	2.297

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	---	---	62.5	1.0

Field Parameters

DO (mg/L)	7.25
DO (%)	73.2
Temp (C)	15.9
pH (SU)	7.48
Conductivity (uS/cm)	263.7
Sp. Cond.(uS/cm)	319.4

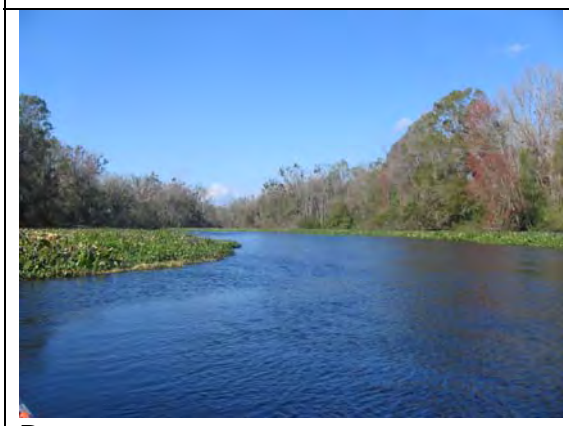
Dominant Species

NULU
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-9.5 km Stn (1/26/05 14:36)

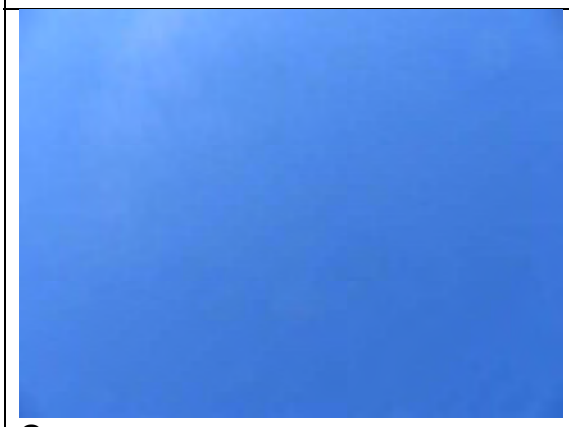
Upstream

Left Bank



Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-10.0
Latitude	28.77691
Longitude	81.41476
Depth (ft)	2.70
Width (m)	90
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.94
Light Attenuation	2.692

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
37.5	---	---	17.5	1.0

Field Parameters

DO (mg/L)	7.43
DO (%)	75.3
Temp (C)	16.0
pH (SU)	7.51
Conductivity (uS/cm)	264.9
Sp. Cond.(uS/cm)	320.7

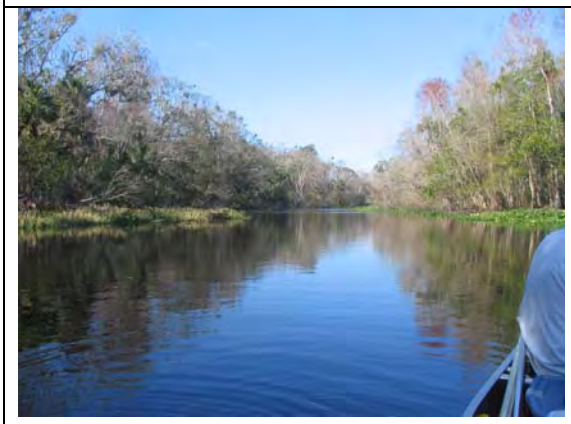
Dominant Species

COES
NULU
CIME
HYUM
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-10.0 km Stn (1/26/05 14:49)

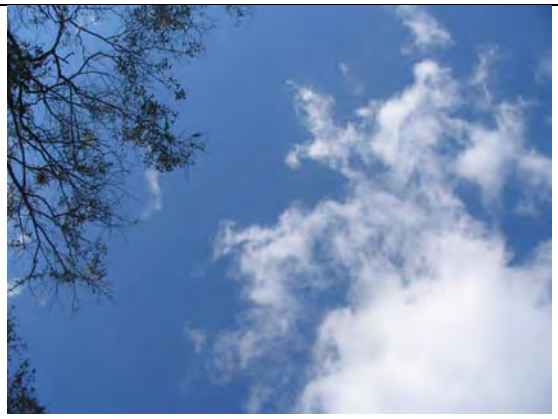
Upstream

Left Bank



Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-10.5
Latitude	28.78124
Longitude	81.41555
Depth (ft)	3.44
Width (m)	37
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.88
Light Attenuation	2.594

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	17.5	7.5

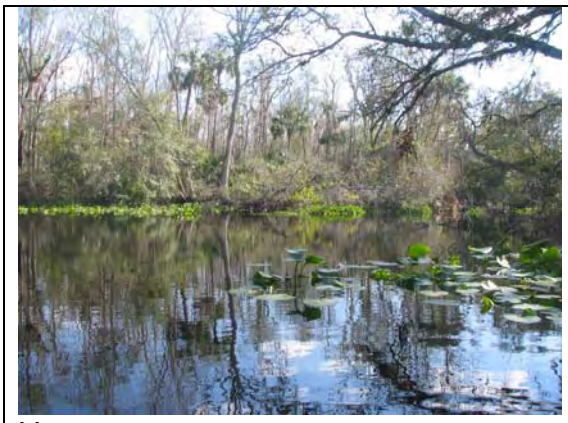
Field Parameters

DO (mg/L)	7.54
DO (%)	76.3
Temp (C)	16.0
pH (SU)	7.52
Conductivity (uS/cm)	265.1
Sp. Cond.(uS/cm)	320.9

Dominant Species

COES
NULU
HYUM
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-10.5 km Stn (1/26/05 15:03)



Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-11.0
Latitude	28.78515
Longitude	81.41515
Depth (ft)	4.25
Width (m)	33
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.21
Light Attenuation	2.412

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	?	1.0

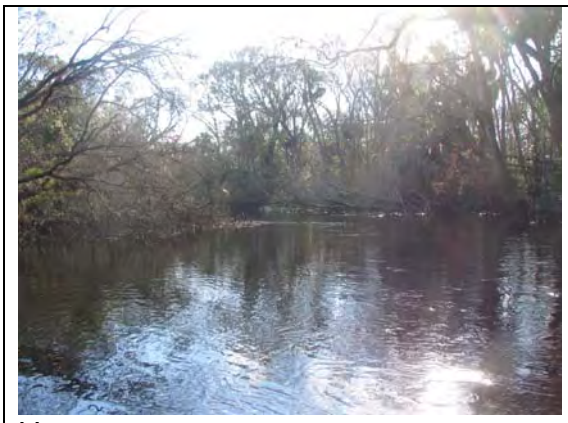
Field Parameters

DO (mg/L)	7.42
DO (%)	75.0
Temp (C)	16.0
pH (SU)	7.52
Conductivity (uS/cm)	266.7
Sp. Cond.(uS/cm)	322.8

Dominant Species

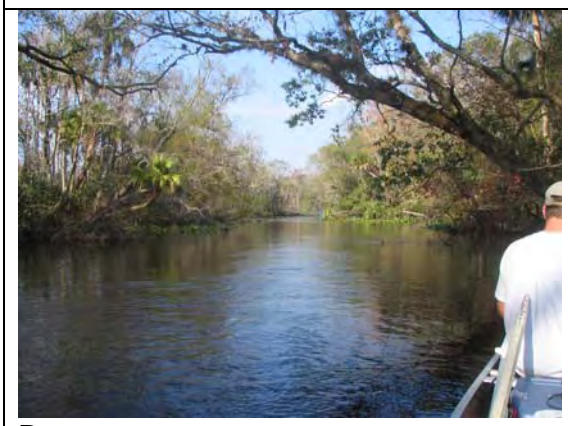
COES
NULU
HYUM

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-11.0 km Stn (1/26/05 15:14)



Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-11.5
Latitude	28.78941
Longitude	81.41426
Depth (ft)	3.95
Width (m)	23
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.28
Light Attenuation	0.482

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	---	17.5	17.5

Field Parameters

DO (mg/L)	7.74
DO (%)	78.5
Temp (C)	16.0
pH (SU)	7.54
Conductivity (uS/cm)	266.1
Sp. Cond.(uS/cm)	321.9

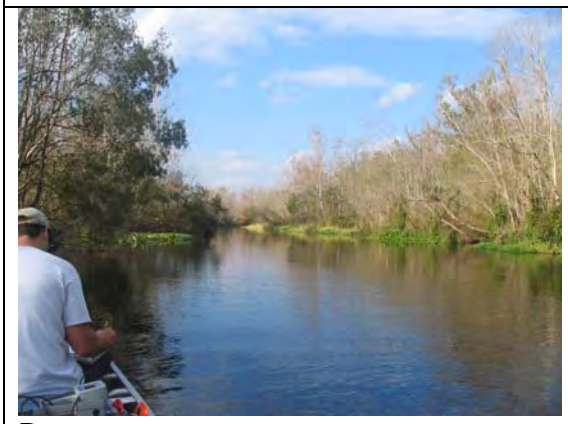
Dominant Species

COES
BEAL

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-11.5 km Stn (1/26/05 15:32)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-12.0
Latitude	28.79358
Longitude	81.41348
Depth (ft)	6.90
Width (m)	20
Secchi Depth (ft)	6.25
Velocity (ft/s)	0.73
Light Attenuation	2.123

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	---	?	3.0

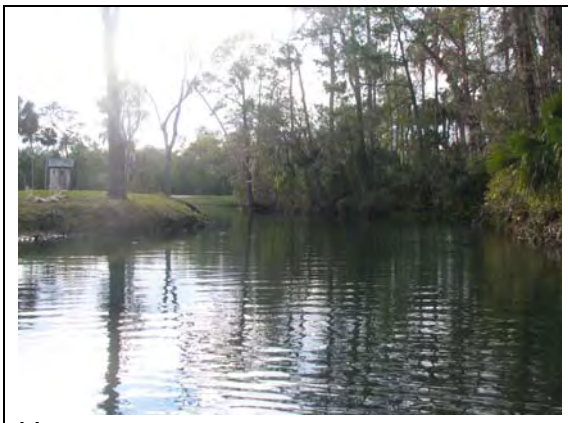
Field Parameters

DO (mg/L)	8.00
DO (%)	80.7
Temp (C)	16.1
pH (SU)	7.57
Conductivity (uS/cm)	266.8
Sp. Cond.(uS/cm)	322.1

Dominant Species

COES
NULU
POCO
HYUM
UNGR

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-12.0 km Stn (1/26/05 15:46)

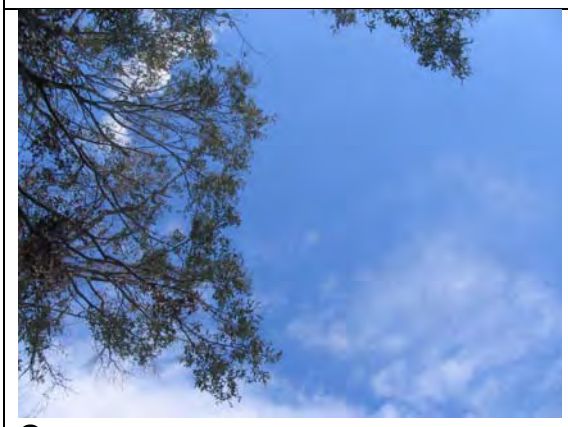


Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	Wekiva Falls
Latitude	28.79442
Longitude	81.41460
Depth (ft)	4.04
Width (m)	13
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.32
Light Attenuation	0.392

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
not estimated				

Dominant Species

Field Parameters

DO (mg/L)	2.57
DO (%)	30.5
Temp (C)	24.1
pH (SU)	7.82
Conductivity (uS/cm)	1,869
Sp. Cond.(uS/cm)	1,908

APPENDIX A-1. Wekiva River Reach Reconnaissance – Wekiva Falls (1/26/05 16:05)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-12.5
Latitude	28.79733
Longitude	81.41495
Depth (ft)	5.10
Width (m)	118
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.52
Light Attenuation	2.729

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	62.5	?	1.0

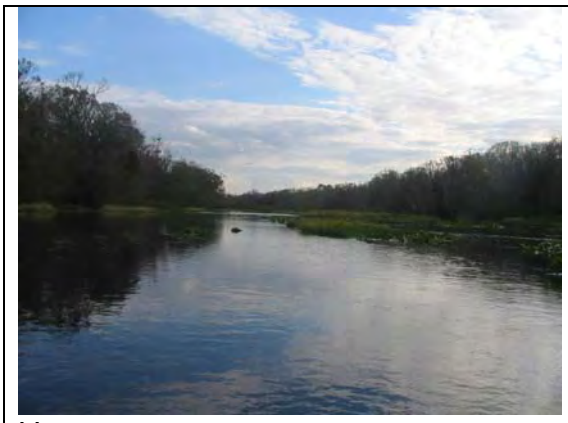
Field Parameters

DO (mg/L)	7.99
DO (%)	81.3
Temp (C)	16.2
pH (SU)	7.58
Conductivity (uS/cm)	269.6
Sp. Cond.(uS/cm)	324.8

Dominant Species

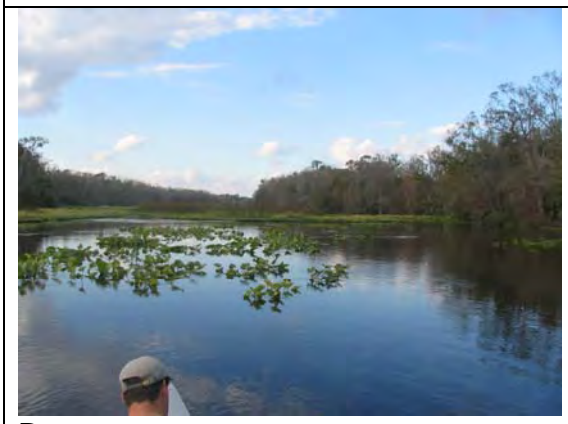
COES
TYLA
LISP
HYUM

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-12.5 km Stn (1/26/05 16:18)



Upstream

Left Bank



Downstream

Right Bank

NO PICTURE

Canopy

Physical Parameters

Station	WR-13.0
Latitude	28.80160
Longitude	81.41480
Depth (ft)	2.09
Width (m)	124
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.62
Light Attenuation	1.917

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	17.5	17.5	62.5	1.0

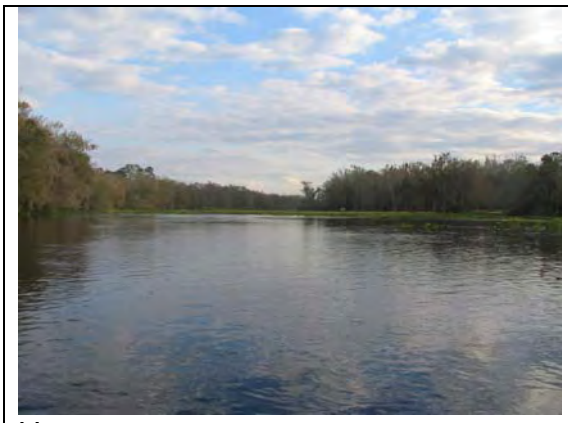
Field Parameters

DO (mg/L)	8.33
DO (%)	85.7
Temp (C)	16.5
pH (SU)	7.64
Conductivity (uS/cm)	310.6
Sp. Cond.(uS/cm)	369.0

Dominant Species

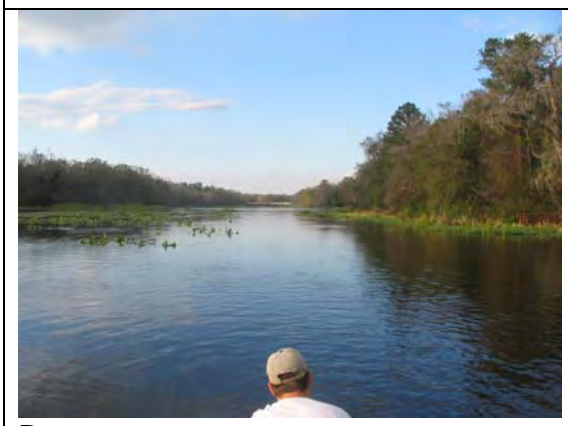
NULU, LISP
VAAM, CIME
MYUM
BEAL, UNGR

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-13.0 km Stn (1/26/05 16:36)



Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	WR-13.5
Latitude	28.80571
Longitude	81.41673
Depth (ft)	1.50
Width (m)	134
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.58
Light Attenuation	2.327

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	17.5	3.0	62.5	1.0

Field Parameters

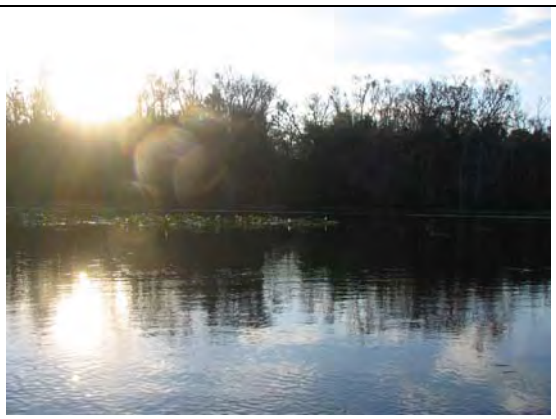
DO (mg/L)	9.11
DO (%)	93.5
Temp (C)	16.5
pH (SU)	7.74
Conductivity (uS/cm)	309.1
Sp. Cond.(uS/cm)	369.2

Dominant Species

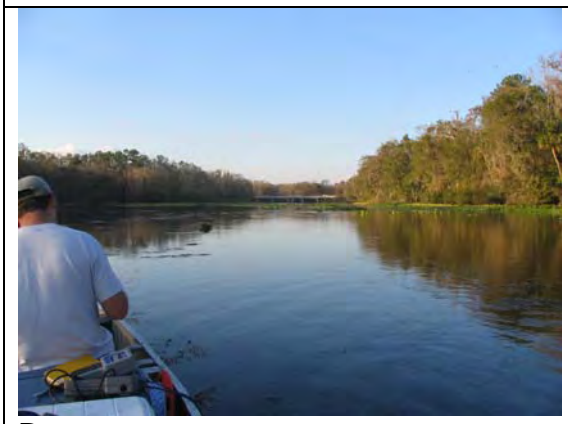
NULU, TYLA, LUSP
POCO, VAAM, CIME
NIFL, LESP, HYUM
BEAL, UNGR

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-13.5 km Stn (1/26/05 16:49)

Upstream

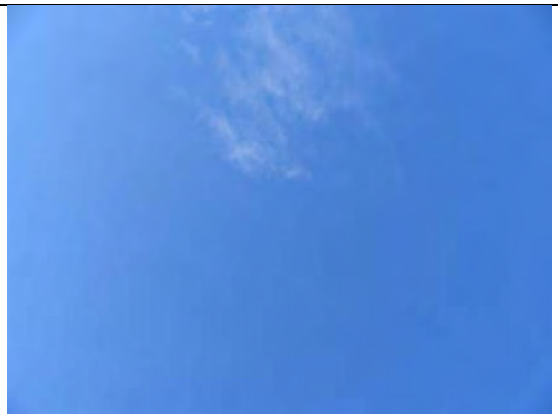


Left Bank



Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-14.0
Latitude	28.80991
Longitude	81.41781
Depth (ft)	1.25
Width (m)	130
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.48
Light Attenuation	3.676

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	17.5	---	37.5	1.0

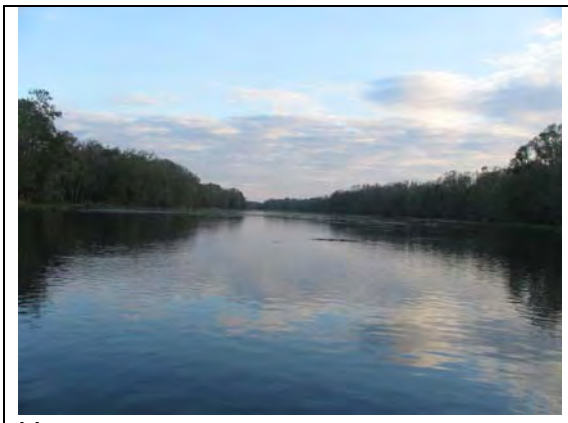
Field Parameters

DO (mg/L)	10.11
DO (%)	104.0
Temp (C)	16.8
pH (SU)	7.92
Conductivity (uS/cm)	320.0
Sp. Cond.(uS/cm)	381.6

Dominant Species

NULU
VAAM
NIFL
HYUM
BEAL, UNGR

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-14.0 km Stn (1/26/05 17:03)

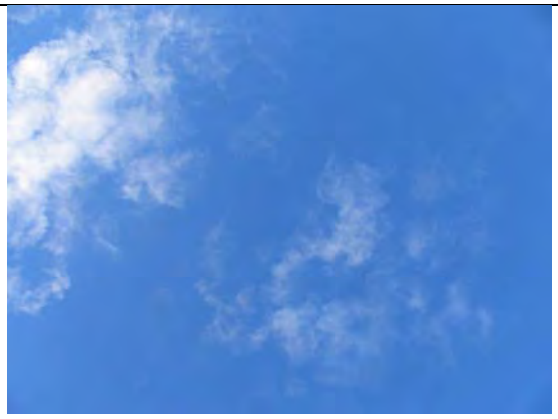


Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	WR-14.5
Latitude	28.81419
Longitude	81.41917
Depth (ft)	1.95
Width (m)	98
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.44
Light Attenuation	2.620

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	3.0	---	100	1.0

Field Parameters

DO (mg/L)	9.97
DO (%)	104.0
Temp (C)	17.1
pH (SU)	7.97
Conductivity (uS/cm)	404.5
Sp. Cond.(uS/cm)	476.7

Dominant Species

NULU, VAAM
NIFL, HYUM
TYLA
BEAL, UNGR

APPENDIX A-1. Wekiva River Reach Reconnaissance - WR-14.5 km Stn (1/26/05 17:16)

WEKIVA RIVER STREAM REACH RECONNAISSANCE - 1/26/2005

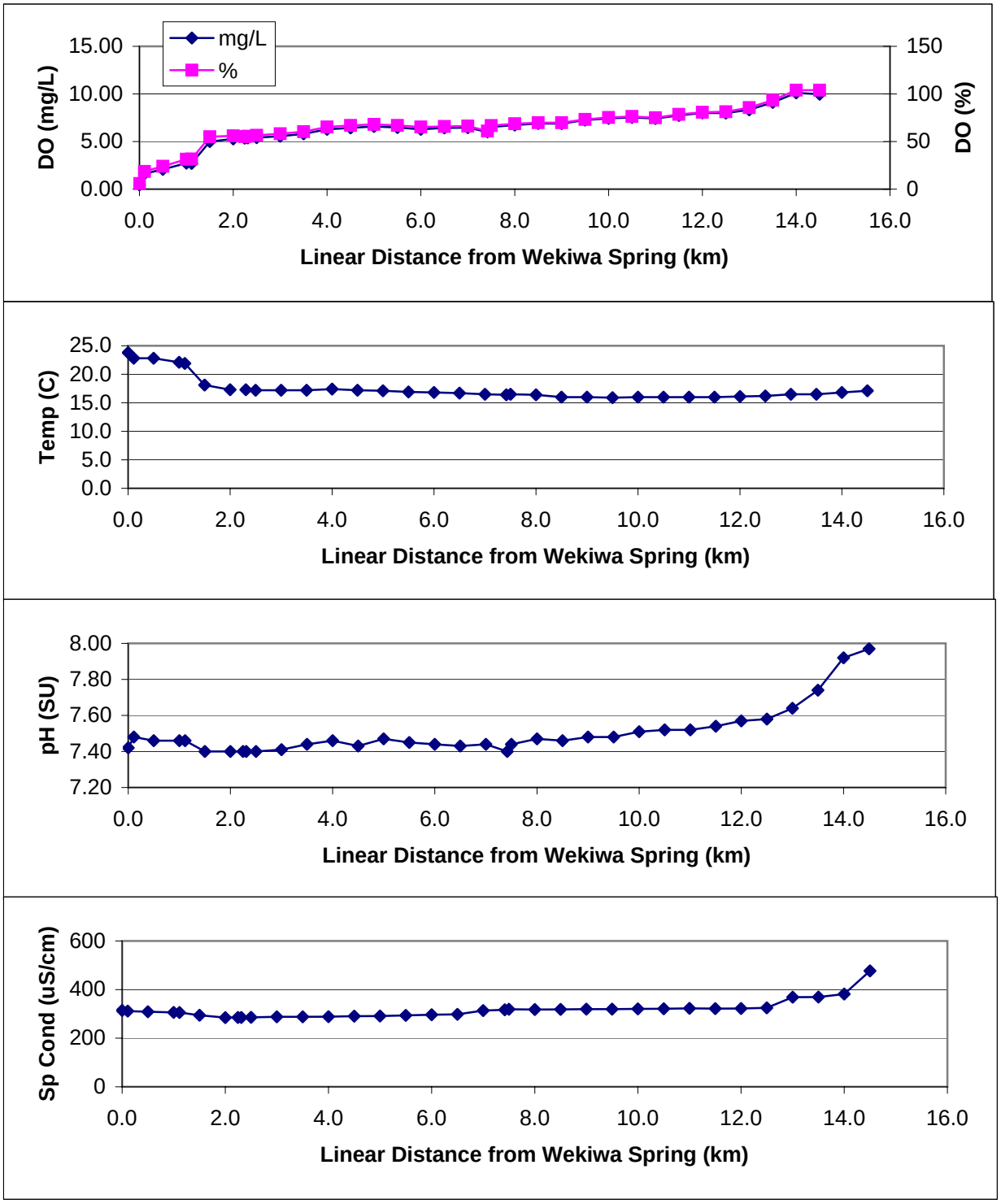
	Location						Water Quality Field Parameters							
Time	Station	Linear Distance (km)	Latitude	Longitude	Depth (ft)	Width (m)	DO (mg/L)	DO (%)	Temp (C)	pH (SU)	Cond (uS/cm)	SpCond (uS/cm)	Secchi Depth (ft)	Velocity (ft/s)
8:36	WR-0.0	0.0	28.71257	81.46002	2.20	20	0.45	5.9	23.8	7.42	306.4	314.1	bottom	0.73
9:07		0.1	28.71321	81.45920	8.92		1.62	18.6	22.8	7.48	297.0	311.5	bottom	
9:19	WR-0.5	0.5	28.71435	81.45506	4.25	24	2.07	24.0	22.8	7.46	294.9	308.7	bottom	0.75
9:38	WR-1.0	1.0	28.71452	81.45030	2.40	23	2.73	31.4	22.1	7.46	288.3	305.9	bottom	0.74
9:50		1.1	28.71507	81.44933			2.70	31.7	21.9	7.46	287.2	305.8		
10:03	WR-1.5	1.5	28.71389	81.44654	4.65	32	5.00	55.0	18.1	7.40	257.4	294.3	bottom	0.61
10:18	WR-2.0	2.0	28.71470	81.44244	6.15	25	5.28	56.0	17.3	7.40	243.1	285.0	bottom	0.46
10:31		2.2	28.71600	81.44054			5.36	55.2		7.40	242.6	285.1		
10:33		2.3	28.71642	81.44005			5.38	55.6	17.3	7.40	242.7	285.5		
10:38	WR-2.5	2.5	28.71729	81.43855	6.50	29	5.41	56.6	17.2	7.40	242.6	285.7	5.67	0.50
10:56	WR-3.0	3.0	28.72142	81.43644	2.85	32	5.56	58.2	17.2	7.41	244.2	287.9	bottom	0.91
11:10	WR-3.5	3.5	28.72445	81.43275	3.05	59	5.81	60.4	17.2	7.44	244.6	288.2	bottom	0.86
11:46	WR-4.0	4.0	28.72819	81.43018	2.89	35	6.28	65.3	17.4	7.46	246.2	288.7	bottom	1.08
12:00	WR-4.5	4.5	28.73190	81.42735	2.82	38	6.43	66.9	17.2	7.43	246.6	290.6	bottom	0.70
12:13	WR-5.0	5.0	28.73530	81.42390	2.98	95	6.58	68.0	17.1	7.47	246.5	291.0	bottom	0.74
12:26	WR-5.5	5.5	28.73941	81.42207	3.24	33	6.47	67.0	16.9	7.45	247.9	293.9	bottom	0.61
12:38	WR-6.0	6.0	28.74345	81.41998	3.15	62	6.29	65.3	16.8	7.44	248.6	296.6	bottom	0.69
12:52	WR-6.5	6.5	28.74739	81.41930	3.65	41	6.43	65.9	16.7	7.43	250.2	298.3	bottom	0.63
13:07	WR-7.0	7.0	28.75164	81.41802	5.87	27	6.46	66.2	16.5	7.44	263.0	313.6	5.58	0.74
13:20		7.4	28.75484	81.41738			6.01	61.1	16.4	7.40	263.5	316.7		
13:26	WR-7.5	7.5	28.75517	81.41662	3.89	30	6.53	66.8	16.5	7.44	266.6	319.0	bottom	0.52
13:58	WR-8.0	8.0	28.75979	81.41573	3.76	32	6.74	68.7	16.4	7.47	263.9	317.9	bottom	0.84
14:11	WR-8.5	8.5	28.76437	81.41567	2.84	45	6.90	69.8	16.0	7.46	262.9	318.3	bottom	1.27
14:23	WR-9.0	9.0	28.76860	81.41619	4.00	45	6.89	69.8	16.0	7.48	264.5	319.5	bottom	1.03
14:36	WR-9.5	9.5	28.77276	81.41572	2.40	38	7.25	73.2	15.9	7.48	263.7	319.4	bottom	1.81
14:49	WR-10.0	10.0	28.77691	81.41476	2.70	90	7.43	75.3	16.0	7.51	264.9	320.7	bottom	0.94
15:03	WR-10.5	10.5	28.78124	81.41555	3.44	37	7.54	76.3	16.0	7.52	265.1	320.9	bottom	0.88
15:14	WR-11.0	11.0	28.78515	81.41515	4.25	33	7.42	75.0	16.0	7.52	266.7	322.8	bottom	0.21
15:32	WR-11.5	11.5	28.78941	81.41426	3.95	23	7.74	78.5	16.0	7.54	266.1	321.9	bottom	1.28
15:46	WR-12.0	12.0	28.79358	81.41348	6.90	20	8.00	80.7	16.1	7.57	266.8	322.1	6.25	0.73
16:18	WR-12.5	12.5	28.79733	81.41495	5.10	118	7.99	81.3	16.2	7.58	269.6	324.8	bottom	1.52
16:36	WR-13.0	13.0	28.80160	81.41480	2.09	124	8.33	85.7	16.5	7.64	310.6	369.0	bottom	0.62
16:49	WR-13.5	13.5	28.80571	81.41673	1.50	134	9.11	93.5	16.5	7.74	309.1	369.2	bottom	0.58
17:03	WR-14.0	14.0	28.80991	81.41781	1.25	130	10.11	104.0	16.8	7.92	320.0	381.6	bottom	0.48
17:16	WR-14.5	14.5	28.81419	81.41917	1.95	98	9.97	104.0	17.1	7.97	404.5	476.7	bottom	0.44
9:52	RSR	1.1	28.71526	81.44947			7.60	71.2	12.4	7.28	200.1	264.7		
13:38	LWR	7.6	28.75563	81.41560	4.25		7.04	69.9	14.9	7.44	250.3	310.8		0.28
16:05	WFALLS	12.1	28.79442	81.41460	4.04	13	2.57	30.5	24.1	7.82	1869.0	1908.0		0.32

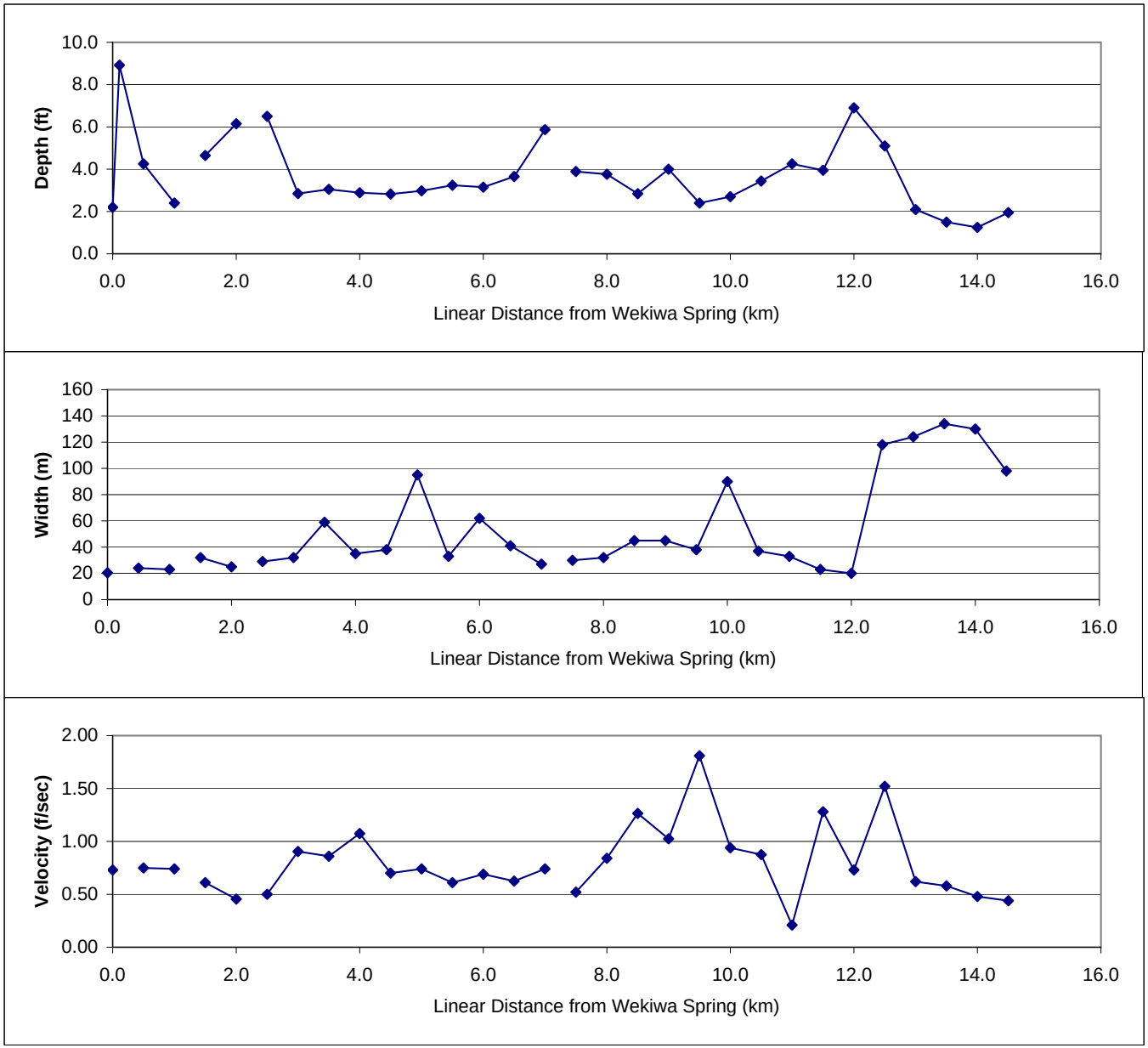
WEKIVA RIVER STREAM REACH RECONNAISSANCE - 1/26/2005

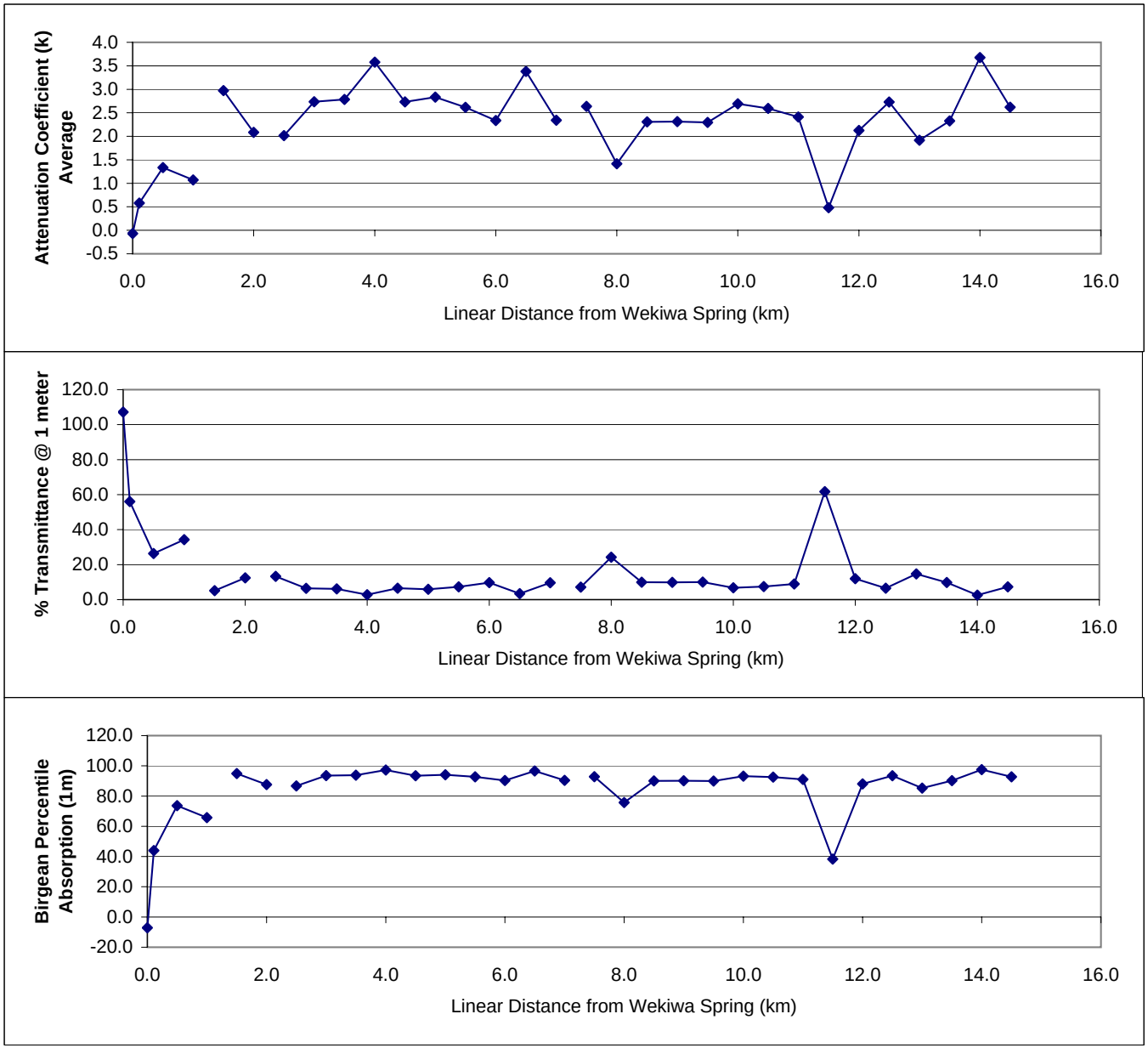
	Location				Percent Cover (%)					Dominant Spp.														
Time	Station	Linear Distance (km)	Latitude	Longitude	FAP	SAV	EMA	ALG (Benthic)	Canopy	Wild Taro (*Colocasia esculenta*)	Spatterdock (*Nuphar luteum*)	Water lettuce (*Pistia stratiotes*)	Cattail (*Typha latifolia*)	Pickerel Weed (*Pontederia cordata*)	Water primrose (*Ludwigia spp.*)	Tape grass (*Vallisneria americana*)	Water hemlock (*Cicuta mexicana*)	Stonewort (*Nitella flexilis*)	Duckweed (*Lemna spp.*)	Water pennyworts (*Hydrocotyle umbellata*)	Water pennyworts (*Hydrocotyle ranunculoides*)	Benthic Algae	Unknown Grass
8:36	WR-0.0	0.0	28.71257	81.46002	17.5			7.5	3.0		X											X	
9:07		0.1	28.71321	81.45920				100.0															
9:19	WR-0.5	0.5	28.71435	81.45506	3.0			62.5	7.5			X								X	X		
9:38	WR-1.0	1.0	28.71452	81.45030	3.0	1.0		82.5	1.0		X	X										X	
9:50		1.1	28.71507	81.44933																			
10:03	WR-1.5	1.5	28.71389	81.44654	3.0			1.0	1.0		X									X	X		
10:18	WR-2.0	2.0	28.71470	81.44244	7.5				1.0		X									X	X		
10:31		2.2	28.71600	81.44054																			
10:33		2.3	28.71642	81.44005																			
10:38	WR-2.5	2.5	28.71729	81.43855	1.0				1.0												X		
10:56	WR-3.0	3.0	28.72142	81.43644	17.5			37.5	7.5		X									X	X	X	
11:10	WR-3.5	3.5	28.72445	81.43275	62.5		7.5	7.5	1.0		X		X				X			X			
11:46	WR-4.0	4.0	28.72819	81.43018	7.5			37.5	7.5											X		X	
12:00	WR-4.5	4.5	28.73190	81.42735	62.5			17.5	7.5		X						X			X		X	
12:13	WR-5.0	5.0	28.73530	81.42390	37.5		3.0	17.5	1.0				X	X			X			X			
12:26	WR-5.5	5.5	28.73941	81.42207	7.5			17.5	7.5		X									X			
12:38	WR-6.0	6.0	28.74345	81.41998	17.5			17.5	1.0		X						X			X		X	
12:52	WR-6.5	6.5	28.74739	81.41930	7.5			3.0	1.0		X						X			X			
13:07	WR-7.0	7.0	28.75164	81.41802	1.0			7.5	7.5											X			
13:20		7.4	28.75484	81.41738																			
13:26	WR-7.5	7.5	28.75517	81.41662	3.0			3.0	7.5			X								X		X	
13:58	WR-8.0	8.0	28.75979	81.41573	3.0			2.0	7.5		X											X	
14:11	WR-8.5	8.5	28.76437	81.41567	7.5			7.5	1.0	X	X									X		X	
14:23	WR-9.0	9.0	28.76860	81.41619	7.5			7.5	1.0	X	X						X			X		X	
14:36	WR-9.5	9.5	28.77276	81.41572	17.5			62.5	1.0		X											X	
14:49	WR-10.0	10.0	28.77691	81.41476	37.5			17.5	1.0	X	X						X			X		X	
15:03	WR-10.5	10.5	28.78124	81.41555	7.5			17.5	7.5	X	X									X		X	
15:14	WR-11.0	11.0	28.78515	81.41515	7.5				1.0	X	X									X			
15:32	WR-11.5	11.5	28.78941	81.41426	1.0			17.5	17.5	X												X	
15:46	WR-12.0	12.0	28.79358	81.41348	3.0				3.0	X	X			X						X			X
16:18	WR-12.5	12.5	28.79733	81.41495	7.5		62.5		1.0	X			X		X					X			
16:36	WR-13.0	13.0	28.80160	81.41480	17.5	17.5	17.5	62.5	1.0		X				X	X	X			X		X	X
16:49	WR-13.5	13.5	28.80571	81.41673	7.5	17.5	3.0	62.5	1.0		X		X	X		X	X	X	X	X		X	X
17:03	WR-14.0	14.0	28.80991	81.41781	3.0	17.5		37.5	1.0		X					X		X		X		X	X
17:16	WR-14.5	14.5	28.81419	81.41917	7.5	3.0		100.0	1.0		X		X			X		X		X		X	X
9:52	RSR	1.1	28.71526	81.44947																			
13:38	LWR	7.6	28.75563	81.41560																			
16:05	WFALLS	12.1	28.79442	81.41460																			

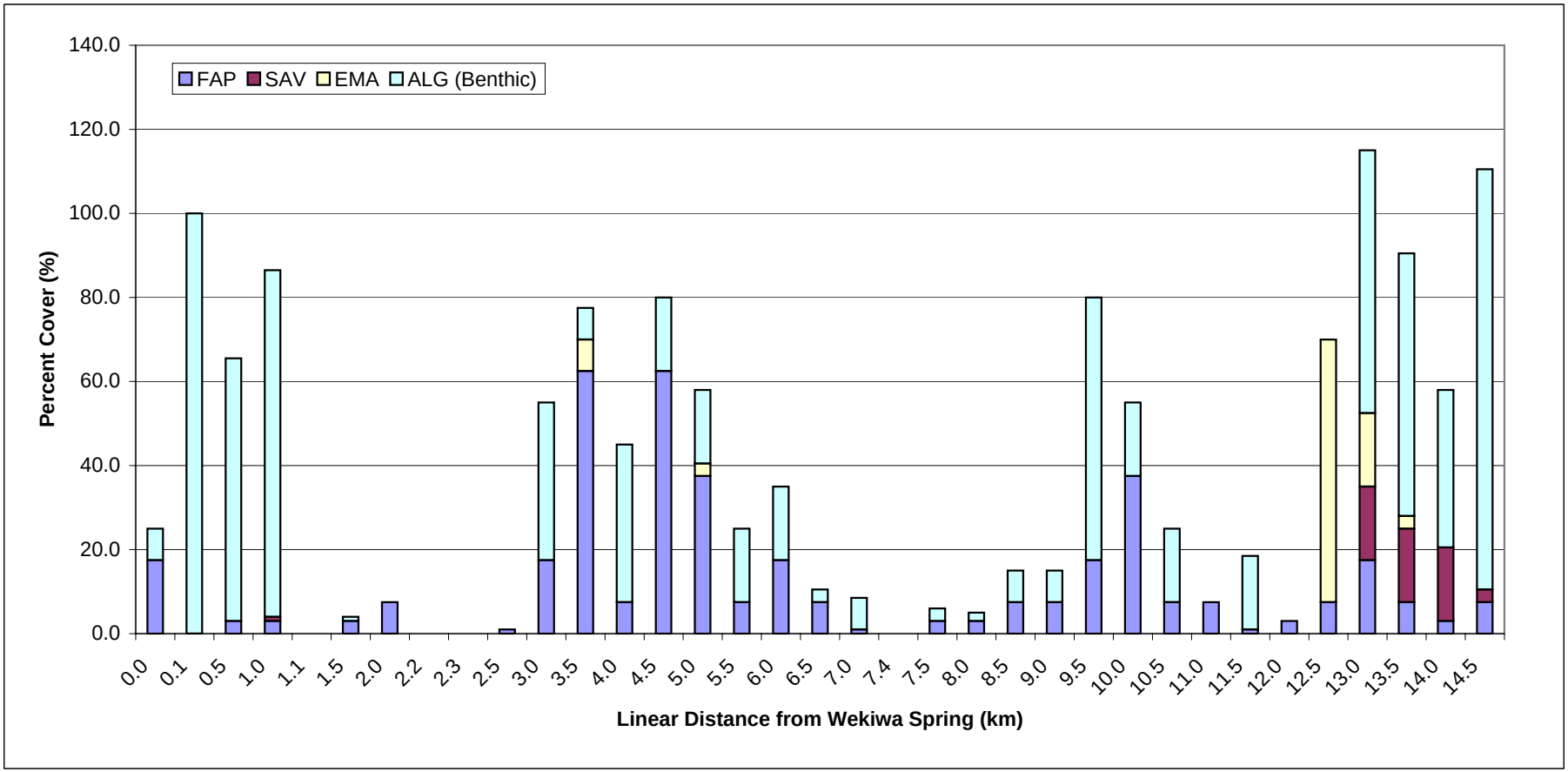
WEKIVA RIVER STREAM REACH RECONNAISSANCE - 1/26/2005

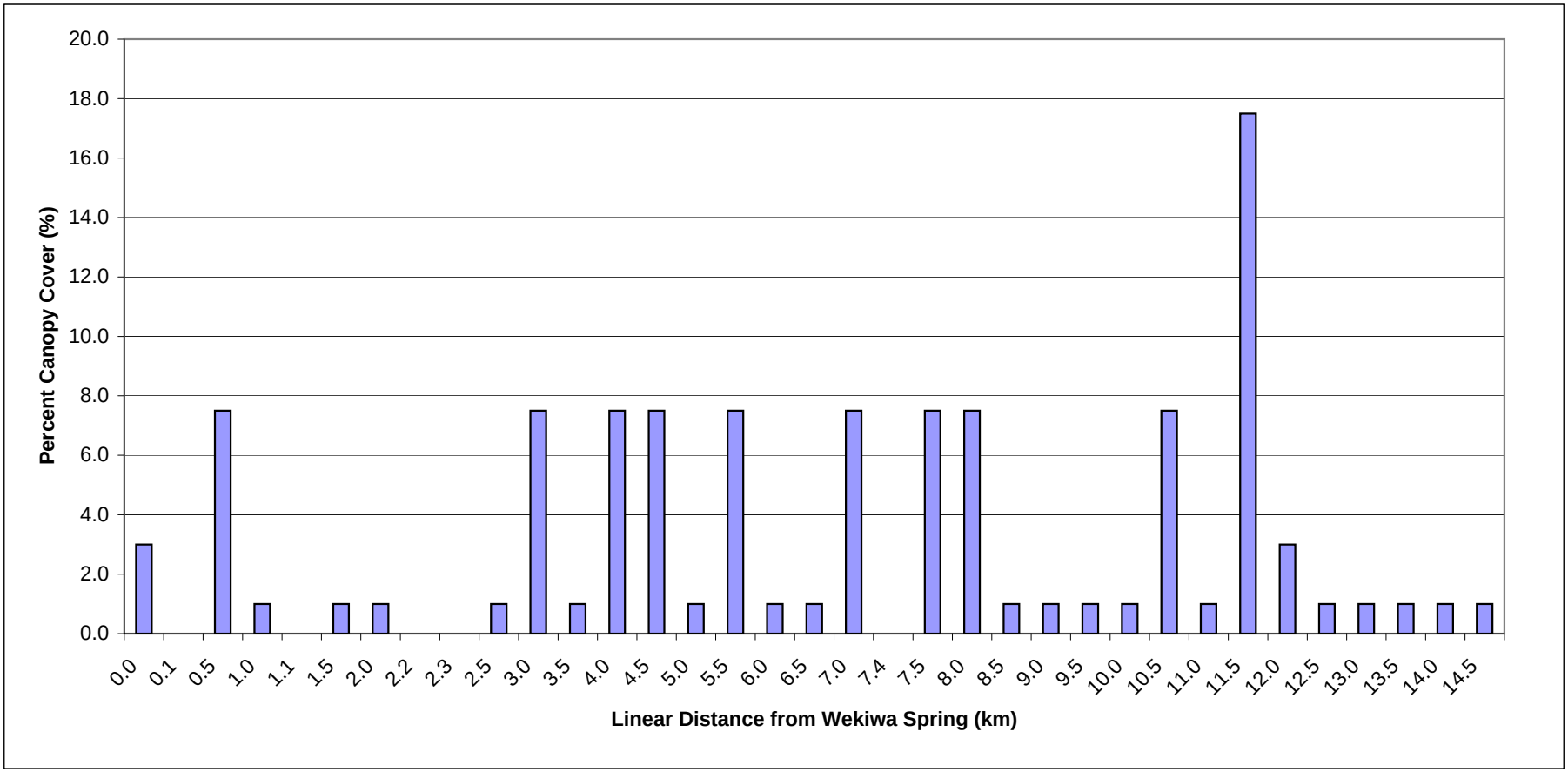
	Location				Light Transmission (umol/s/m2) / Depth (ft)								Light Attenuation Est.			
Time	Station	Linear Distance (km)	Latitude	Longitude	Air	Surface	1.0	2.0	3.0	4.0	5.0	6.0	k Average	Percent Transmittance @ 1 meter	Birgean Percentile Absorption (1m)	Notes
8:36	WR-0.0	0.0	28.71257	81.46002	69.6	61.0	62.3						-0.069	107.2	-7.2	Bottom light transmission at 1.5 ft
9:07		0.1	28.71321	81.45920	219.9	145.7			95.6			40.7	0.579	56.1	43.9	open lake nr main boil
9:19	WR-0.5	0.5	28.71435	81.45506	503.3	412.0			121.7				1.334	26.4	73.6	
9:38	WR-1.0	1.0	28.71452	81.45030	231.0	102.7		53.5					1.070	34.3	65.7	
9:50		1.1	28.71507	81.44933												upstream of RSR
10:03	WR-1.5	1.5	28.71389	81.44654	400.8	409.7	167.3	53.3	37.0				2.972	5.1	94.9	
10:18	WR-2.0	2.0	28.71470	81.44244	1016.9	971.8	584.9	228.1	123.7	80.4			2.085	12.4	87.6	Dark Wtr - can not quantify benthic cover
10:31		2.2	28.71600	81.44054												upstream of canal
10:33		2.3	28.71642	81.44005												downstream of canal
10:38	WR-2.5	2.5	28.71729	81.43855	339.6	290.8	140.6	81.4	50.8	29.4	18.3		2.016	13.3	86.7	Dark Wtr - can not quantify benthic cover
10:56	WR-3.0	3.0	28.72142	81.43644	713.3	347.3	147.2	68.8					2.737	6.5	93.5	Bottom light transmission at 1.83 ft
11:10	WR-3.5	3.5	28.72445	81.43275	719.0	503.1	196.0	111.0					2.786	6.2	93.8	Bottom light transmission at 1.92 ft
11:46	WR-4.0	4.0	28.72819	81.43018	1523.7	793.3	227.9	122.5					3.578	2.8	97.2	Bottom light transmission at 1.92 ft
12:00	WR-4.5	4.5	28.73190	81.42735	311.2	243.2	95.0	57.0					2.733	6.5	93.5	
12:13	WR-5.0	5.0	28.73530	81.42390	155.6	139.3	54.5	28.8					2.833	5.9	94.1	
12:26	WR-5.5	5.5	28.73941	81.42207	309.8	253.0	110.3	54.7					2.618	7.3	92.7	
12:38	WR-6.0	6.0	28.74345	81.41998	364.1	232.1	113.8	56.0					2.335	9.7	90.3	
12:52	WR-6.5	6.5	28.74739	81.41930	244.4	204.0	62.1	35.7					3.381	3.4	96.6	
13:07	WR-7.0	7.0	28.75164	81.41802	379.8	271.4	120.5	57.3	37.2	24.4			2.341	9.6	90.4	
13:20		7.4	28.75484	81.41738												upstream of LWR
13:26	WR-7.5	7.5	28.75517	81.41662	360.5	290.4	118.3	58.6	34.2				2.637	7.2	92.8	
13:58	WR-8.0	8.0	28.75979	81.41573	402.0	525.5	363.6	187.4	152.9				1.416	24.3	75.7	
14:11	WR-8.5	8.5	28.76437	81.41567	394.2	339.2	167.9						2.306	10.0	90.0	
14:23	WR-9.0	9.0	28.76860	81.41619	950.9	1147.3	608.8	245.8	136.0				2.313	9.9	90.1	
14:36	WR-9.5	9.5	28.77276	81.41572	420.3	673.6	334.5						2.297	10.1	89.9	
14:49	WR-10.0	10.0	28.77691	81.41476	975.0	1127.9	500.4	215.3					2.692	6.8	93.2	
15:03	WR-10.5	10.5	28.78124	81.41555	203.0	136.6	55.1	35.5					2.594	7.5	92.5	
15:14	WR-11.0	11.0	28.78515	81.41515	298.3	131.5	56.7	37.4					2.412	9.0	91.0	Dark Wtr - can not quantify benthic cover
15:32	WR-11.5	11.5	28.78941	81.41426	173.7	109.3	109.8	85.8	41.1				0.482	61.7	38.3	
15:46	WR-12.0	12.0	28.79358	81.41348	314.2	217.6	100.6	50.2	29.4	17.0	14.2	9.2	2.123	12.0	88.0	Dark Wtr - can not quantify benthic cover
16:18	WR-12.5	12.5	28.79733	81.41495	339.3	272.4	98.5	55.3	27.0	14.1			2.729	6.5	93.5	Dark Wtr - can not quantify benthic cover
16:36	WR-13.0	13.0	28.80160	81.41480	262.7	189.4	100.0	65.6					1.917	14.7	85.3	Bottom light transmission at 1.67 ft
16:49	WR-13.5	13.5	28.80571	81.41673	209.8	146.6	72.2						2.327	9.8	90.2	
17:03	WR-14.0	14.0	28.80991	81.41781	136.6	95.9	31.3						3.676	2.5	97.5	Bottom light transmission at 0.67 ft
17:16	WR-14.5	14.5	28.81419	81.41917	81.2	58.8	26.5						2.620	7.3	92.7	
9:52	RSR	1.1	28.71526	81.44947	411.5	527.0	175.1						3.615	2.7	97.3	Bottom light transmission at 1.25 ft
13:38	LWR	7.6	28.75563	81.41560	423.3	329.0	187.2	146.8	102.8				1.482	22.7	77.3	
16:05	WFALLS	12.1	28.79442	81.41460	239.5	191.8	191.4	114.1	143.6				0.392	67.5	32.5	

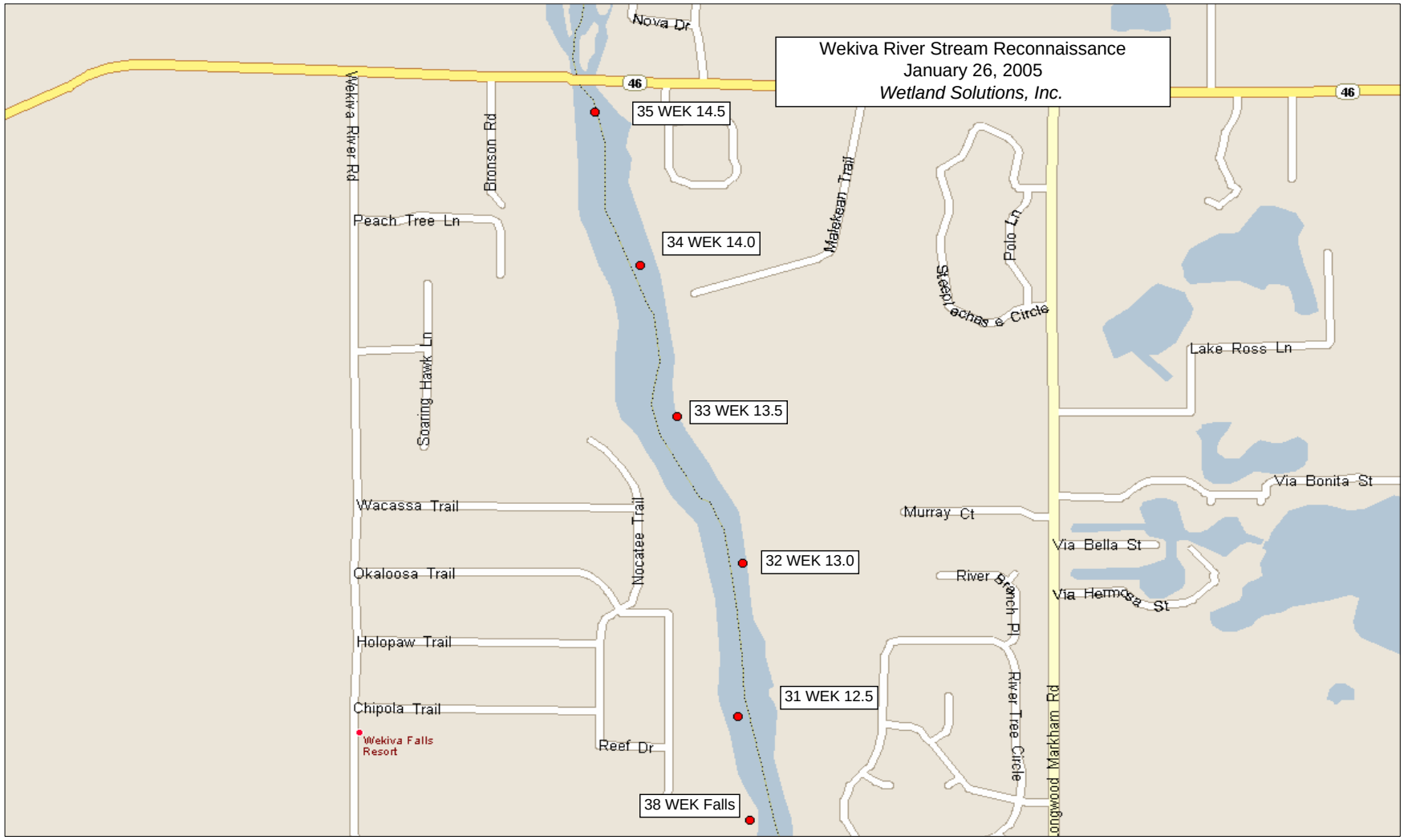

mg/L
%
DO (mg/L)
DO (%)
15.00
10.00
5.00
0.00
150
100
50
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Linear Distance from Wekiwa Spring (km)
Temp (C)
25.0
20.0
15.0
10.0
5.0
0.0
Linear Distance from Wekiwa Spring (km)
pH (SU)
8.00
7.80
7.60
7.40
7.20
Linear Distance from Wekiwa Spring (km)
Sp Cond (uS/cm)
600
400
200
0
Linear Distance from Wekiwa Spring (km)


Depth (ft)
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Linear Distance from Wekiwa Spring (km)
Width (m)
160
140
120
100
80
60
40
20
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Linear Distance from Wekiwa Spring (km)
Velocity (f/sec)
2.00
1.50
1.00
0.50
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Linear Distance from Wekiwa Spring (km)

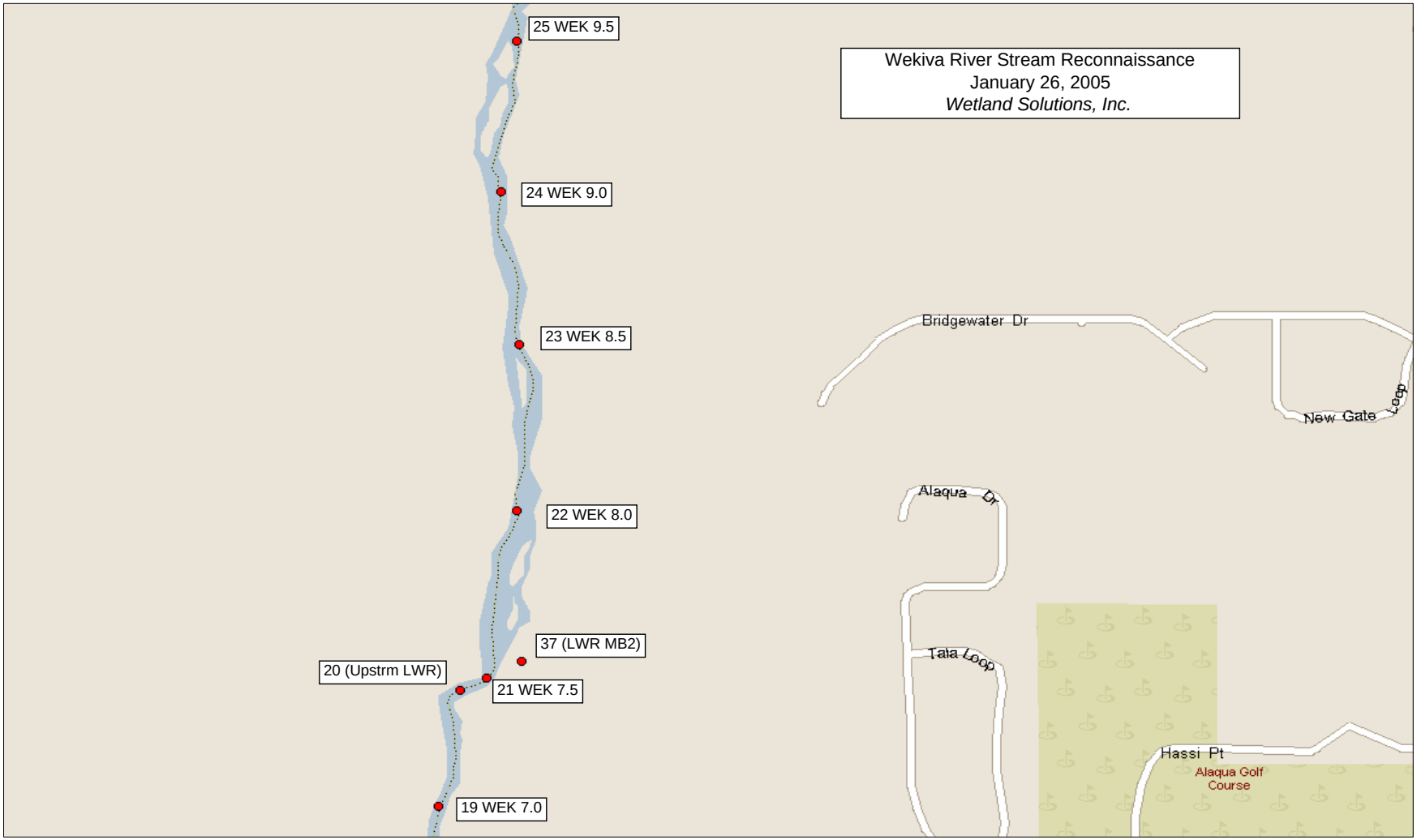

Attenuation Coefficient (k) Average
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Linear Distance from Wekiwa Spring (km)
% Transmittance @ 1 meter
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Linear Distance from Wekiwa Spring (km)
Birgean Percentile Absorption (1m)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Linear Distance from Wekiwa Spring (km)

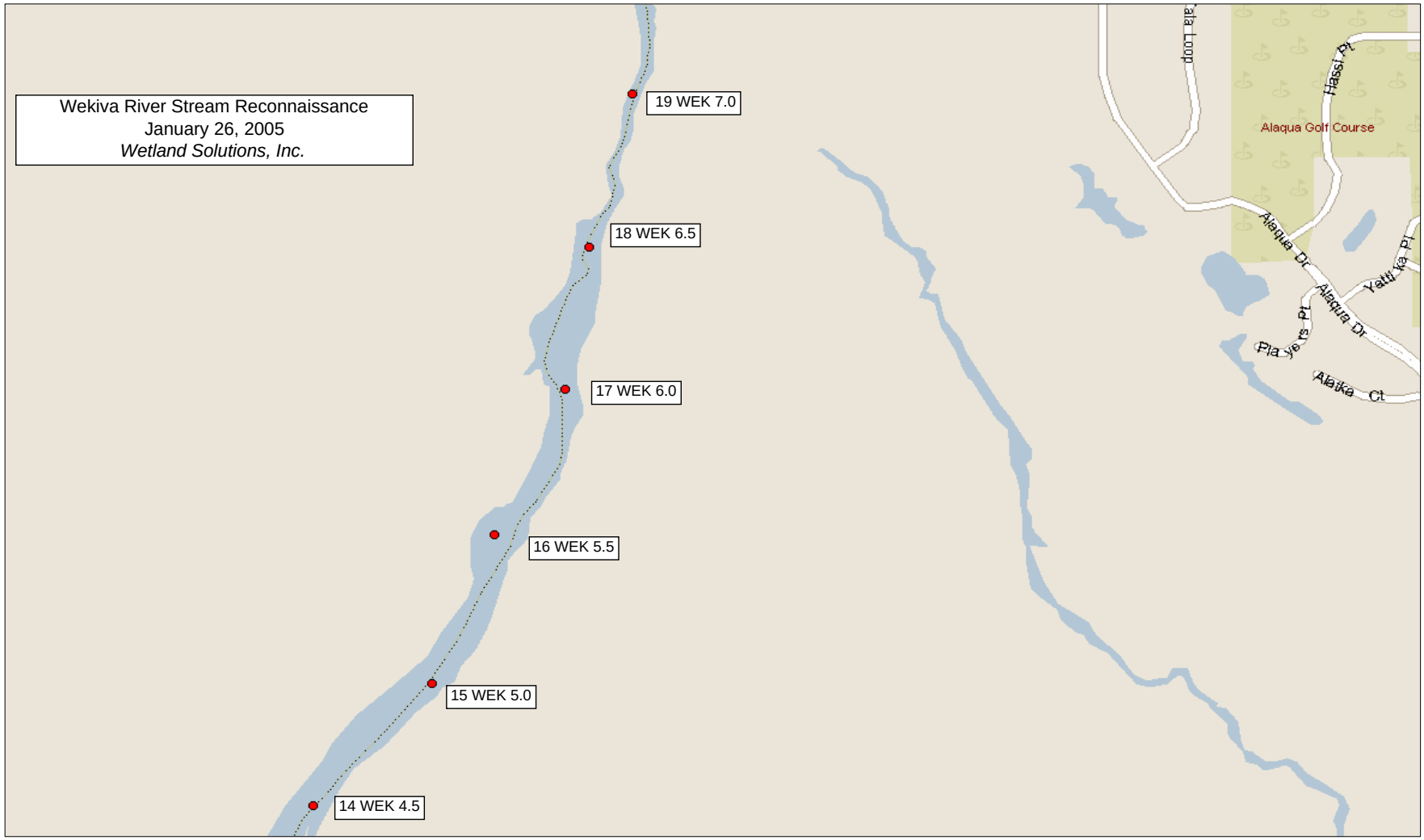

FAP
SAV
EMA
ALG (Benthic)
Percent Cover (%)
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
0.1
0.5
1.0
1.1
1.5
2.0
2.2
2.3
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.4
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
Linear Distance from Wekiwa Spring (km)

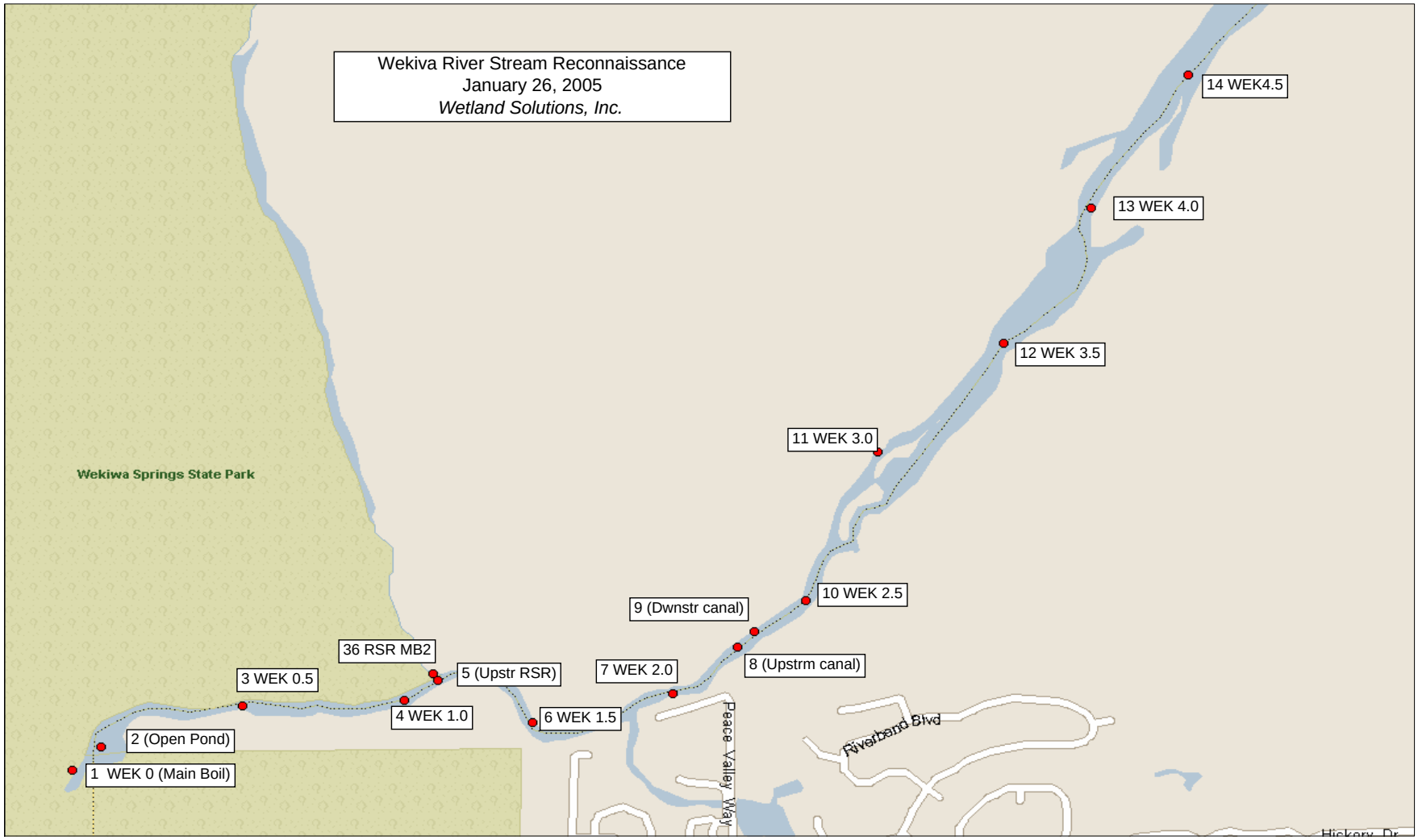

Percent Canopy Cover (%)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0 0.1 0.5 1.0 1.1 1.5 2.0 2.2 2.3 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.4 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5
Linear Distance from Wekiwa Spring (km)


Wekiva River Stream Reconnaissance
January 26, 2005
Wetland Solutions, Inc.
35 WEK 14.5
34 WEK 14.0
33 WEK 13.5
32 WEK 13.0
31 WEK 12.5
38 WEK Falls
Nova Dr
46
Wekiva River Rd
Bronson Rd
Peach Tree Ln
Soaring Hawk Ln
Wacassa Trail
Okaloosa Trail
Holopaw Trail
Chipola Trail
Wekiva Falls Resort
Reef Dr
Nocatee Trail
Malekean Trail
Steeplechase Circle
Polo Ln
Lake Ross Ln
Murray Ct
River Branch Pl
River Tree Circle
Via Bonita St
Via Bella St
Via Hermosa St
Longwood Markham Rd

38 WEK Falls
30 WEK 12.0
ver Tree Circle
Wekiva
Markham
Markham Rd
Wekiva River Stream Reconnaissance
January 26, 2005
Wetland Solutions, Inc.
29 WEK 11.5
28 WEK 11.0
27 WEK 10.5
26 WEK 10.0
25 WEK 9.5


Wekiva River Stream Reconnaissance
January 26, 2005
Wetland Solutions, Inc.
25 WEK 9.5
24 WEK 9.0
23 WEK 8.5
22 WEK 8.0
37 (LWR MB2)
20 (Upstrm LWR)
21 WEK 7.5
19 WEK 7.0
Bridgewater Dr
New Gate Loop
Alaqua Dr
Tala Loop
Hassi Pt
Alaqua Golf Course


Wekiva River Stream Reconnaissance
January 26, 2005
Wetland Solutions, Inc.
19 WEK 7.0
18 WEK 6.5
17 WEK 6.0
16 WEK 5.5
15 WEK 5.0
14 WEK 4.5
Alaqua Golf Course
Hassi Pt
Alaqua Dr
Alaqua Dr
Yatt'ka Pt
Pla ye rs Pt
Alaika Ct


Wekiva River Stream Reconnaissance
January 26, 2005
Wetland Solutions, Inc.
14 WEK4.5
13 WEK 4.0
12 WEK 3.5
11 WEK 3.0
10 WEK 2.5
9 (Dwnstr canal)
8 (Upstrm canal)
7 WEK 2.0
6 WEK 1.5
5 (Upstr RSR)
36 RSR MB2
4 WEK 1.0
3 WEK 0.5
2 (Open Pond)
1 WEK 0 (Main Boil)
Wekiwa Springs State Park
Peace Valley Way
Riverbend Blvd

CODE	SCIENTIFIC NAME	COMMON NAME
ACRU	*Acer rubrum*	Red Maple
AQMO		Aquatic mosses
BEAL		Benthic Algae
CAAQ	*Carya aquatica*	Water Hickory
CACA	*Carpinus caroliniana*	American Hornbeam
CAFL	*Canna flaccida*	Golden canna
CEDE	*Ceratophyllum demersum*	Coontail
CIME	*Cicuta mexicana*	Water hemlock
CLJA	*Cladium jamaicense*	Sawgrass
COES	*Colocasia esculenta*	Wild Taro
CRAM	*Crinum americanum*	Swamp lily
EICR	*Eichhornia crassipes*	Water hyacinth
EUBU	*Eugenia buxifolia*	Iron wood
FERN		Ferns
HYRA	*Hydrocotyle ranunculoides*	Water pennyworts
HYUM	*Hydrocotyle umbellata*	Water pennyworts
ILCA	Ilex cassine	Dahoon Holly
ISSP	*Iris sp.*	Iris
JUSP	*Juncus sp.*	Rushes
JUVI	Juniperus virginiana	Red Cedar
LESP	*Lemna sp.*	Duckweed
LIST	*Liquidambar styraciflua*	Sweetgum
LUSP	*Ludwigia sp.*	Water primrose
MAGR	*Magnolia grandiflora*	Southern Magnolia
MAVI	*Magnolia virginiana*	Sweet Bay
MISC	*Mikania scandens*	Climbing Hempweed
MYCE	*Myrica cerifera*	Wax Myrtle
NIFL	*Nitella flexilis*	Stonewort
NULU	*Nuphar luteum*	Spatterdock
PEBO	*Persea borbonia*	Red Bay
PEVI	*Peltandra virginica*	Arrow arum
PHAU	Phragmites australis	Common Reed
PIST	*Pistia stratiotes*	Water lettuce
PITA	*Pinus taeda*	Loblolly Pine
POCO	*Pontederia cordata*	Pickerel Weed
QUHE	*Quercus hemisphearica*	Laurel Oak
QUNI	*Quercus nigra*	Water Oak
QUPH	*Quercus phellos*	Willow Oak
QUVI	*Quercus virginiana*	Live Oak
SACE	*Saururus cernuus*	Lizard's tail
SALA	*Sagittaria lancifolia*	Arrowhead
SAPA	*Sabal palmetto*	Sabal Palm
SASP	*Sagittaria sp.*	Strap-leaf sagittaria
SASP	*Salix sp.*	Willow
SCSP	*Scripus sp.*	Bulrush
TADI	*Taxodium distichum*	Bald Cypress
TIAM	*Tilia americana*	Basswood
TYLA	*Typha latifolia*	Cattail
ULAM	*Ulmus americana*	Water elm
UNGR		Unknown Grass
UNSE		Unknown Sedge
VAAM	*Vallisneria americana*	Tape grass

Appendix A-2

Rock Spring Run Stream System Reach Reconnaissance Detailed Data

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-1st Brdg
Latitude	28.75616
Longitude	81.50164
Depth (ft)	3.40
Width (m)	40
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.12
Light Attenuation	0.361

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	---	7.5	37.5

Field Parameters

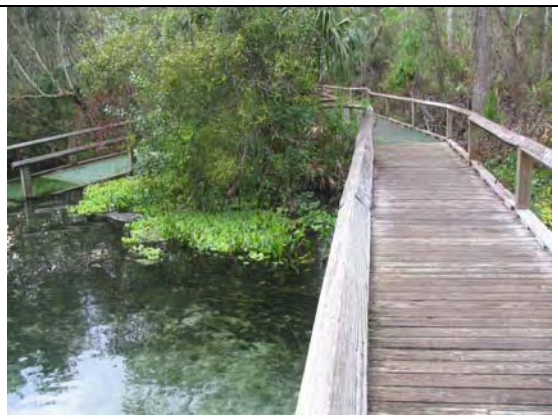
DO (mg/L)	0.83
DO (%)	9.80
Temp (C)	23.9
pH (SU)	7.8
Conductivity (uS/cm)	231.3
Sp. Cond.(uS/cm)	236.7

Dominant Species

QUVI
SAPA
MAGR
LIST

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance – RSR 1st Brdg Stn (2/23/05 17:15)

Upstream



Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR 2nd Landing
Latitude	28.75759
Longitude	81.49696
Depth (ft)	3.33
Width (m)	60
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.08
Light Attenuation	0.318

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	37.5	7.5	7.5	3.0

Field Parameters

DO (mg/L)	2.26
DO (%)	26.7
Temp (C)	23.9
pH (SU)	7.93
Conductivity (uS/cm)	231.4
Sp. Cond.(uS/cm)	236.8

Dominant Species

POCO
LESP, NULU, PIST, HYUM
VAAM
QUVI, ACRU, SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR 2nd Landing Stn (2/23/05 17:00)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-0.0
Latitude	28.76827
Longitude	81.50218
Depth (ft)	2.15
Width (m)	20
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.05
Light Attenuation	0.857

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
62.5	3.0	---	3.0	3.0

Field Parameters

DO (mg/L)	4.45
DO (%)	52.0
Temp (C)	23.2
pH (SU)	7.77
Conductivity (uS/cm)	228.1
Sp. Cond.(uS/cm)	237.2

Dominant Species

POCO
LESP, NULU, CIME, HYUM
SASP
PEBO, ACRU, SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-0.0 km Stn (2/23/05 08:35)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-0.5
Latitude	28.77215
Longitude	81.50282
Depth (ft)	2.60
Width (m)	23
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.65
Light Attenuation	1.920

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	92.5	3.0	---	3.0

Field Parameters

DO (mg/L)	4.78
DO (%)	55.6
Temp (C)	22.8
pH (SU)	7.72
Conductivity (uS/cm)	228.9
Sp. Cond.(uS/cm)	239.4

Dominant Species

POCO, CRAM
NULU, CIME, PIST, HYUM
VAAM
TADI, PEBO, ACRU

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-0.5 km Stn (2/23/05 08:47)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-1.0
Latitude	28.77565
Longitude	81.50032
Depth (ft)	2.90
Width (m)	44
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.38
Light Attenuation	0.999

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
62.5	---	---	3.0	3.0

Field Parameters

DO (mg/L)	4.55
DO (%)	52.2
Temp (C)	22.7
pH (SU)	7.69
Conductivity (uS/cm)	228.4
Sp. Cond.(uS/cm)	239.9

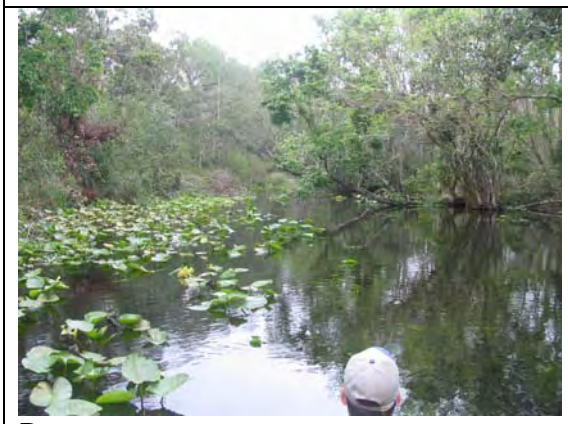
Dominant Species

NULU, CIME, PIST, HYUM
PEBO, ACRU, SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-1.0 km Stn (2/23/05 09:09)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-1.5
Latitude	28.77773
Longitude	81.49591
Depth (ft)	2.69
Width (m)	31
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.51
Light Attenuation	0.810

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	3.0	1.0	3.0	3.0

Field Parameters

DO (mg/L)	4.59
DO (%)	53.1
Temp (C)	22.5
pH (SU)	7.67
Conductivity (uS/cm)	227.8
Sp. Cond.(uS/cm)	239.7

Dominant Species

CIAM
NULU, CIME, PIAT, HYUM
VAAM
PEBO, ACRU, SAPA, CAAQ, MYCE

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-1.5 km Stn (2/23/05 09:23)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-2.0
Latitude	28.77750
Longitude	81.49265
Depth (ft)	2.34
Width (m)	28
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.79
Light Attenuation	0.440

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
37.5	---	2.0	62.5	17.5

Field Parameters

DO (mg/L)	4.97
DO (%)	57.3
Temp (C)	22.5
pH (SU)	7.67
Conductivity (uS/cm)	227.6
Sp. Cond.(uS/cm)	239.9

Dominant Species

TYLA, POCO, CIAM
LESP, NULU, CIME, PIST, HYUM / BEAL
PEBO, ACRU, SAPA, CAAQ, MYCE

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-2.0 km Stn (2/23/05 09:38)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-2.5
Latitude	28.77835
Longitude	81.48786
Depth (ft)	4.28
Width (m)	20
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.20
Light Attenuation	0.941

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	---	82.5	37.5

Field Parameters

DO (mg/L)	4.66
DO (%)	54.0
Temp (C)	22.4
pH (SU)	7.58
Conductivity (uS/cm)	227.2
Sp. Cond.(uS/cm)	240.1

Dominant Species

LESP, EICR
BEAL
QUHE, PEBO, ACRU, SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-2.5 km Stn (2/23/05 09:56)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-3.0
Latitude	28.77855
Longitude	81.48374
Depth (ft)	5.45
Width (m)	18
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.16
Light Attenuation	1.468

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	3.0	?	82.5

Field Parameters

DO (mg/L)	4.38
DO (%)	50.0
Temp (C)	22.1
pH (SU)	7.43
Conductivity (uS/cm)	233.9
Sp. Cond.(uS/cm)	248.2

Dominant Species

POCO
LESP, EICR
QUHE, PEBO, ACRU, SAPA
CAAQ

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-3.0 km Stn (2/23/05 10:17)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-3.5
Latitude	28.77508
Longitude	81.48164
Depth (ft)	6.15
Width (m)	22
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.33
Light Attenuation	1.691

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	1.0	?	62.5

Field Parameters

DO (mg/L)	3.77
DO (%)	43.2
Temp (C)	21.9
pH (SU)	7.33
Conductivity (uS/cm)	234.2
Sp. Cond.(uS/cm)	249.6

Dominant Species

PEVI, POCO
LESP, EICR
PEBO, ACRU, SAPA, CAAQ, QUPH

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-3.5 km Stn (2/23/05 10:33)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-4.0
Latitude	28.77092
Longitude	81.48152
Depth (ft)	5.35
Width (m)	21
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.32
Light Attenuation	1.400

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	1.0	?	17.5

Field Parameters

DO (mg/L)	3.53
DO (%)	39.9
Temp (C)	21.6
pH (SU)	7.23
Conductivity (uS/cm)	231.9
Sp. Cond.(uS/cm)	248.3

Dominant Species

PEVI
LESP, EICR
PEBO, ACRU, SAPA, CAAQ, MYCE

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-4.0 km Stn (2/23/05 10:51)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-4.5
Latitude	28.76782
Longitude	81.48238
Depth (ft)	2.80
Width (m)	16
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.42
Light Attenuation	1.576

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	---	?	17.5

Field Parameters

DO (mg/L)	3.37
DO (%)	38.1
Temp (C)	21.2
pH (SU)	7.16
Conductivity (uS/cm)	228.6
Sp. Cond.(uS/cm)	247.1

Dominant Species

LESP
ACRU, SAPA, CAAQ

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-4.5 km Stn (2/23/05 11:07)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-5.0
Latitude	28.76417
Longitude	81.48089
Depth (ft)	4.90
Width (m)	20
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.19
Light Attenuation	2.194

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	---	?	7.5

Field Parameters

DO (mg/L)	3.24
DO (%)	36.2
Temp (C)	20.9
pH (SU)	7.12
Conductivity (uS/cm)	225.3
Sp. Cond.(uS/cm)	244.9

Dominant Species

LESP, CIME
PEBO, ACRU, SAPA, CAAQ

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-5.0 km Stn (2/23/05 11:20)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-5.5
Latitude	28.76177
Longitude	81.47812
Depth (ft)	6.18
Width (m)	12
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.48
Light Attenuation	1.793

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	---	?	7.5

Field Parameters

DO (mg/L)	3.32
DO (%)	37.0
Temp (C)	20.8
pH (SU)	7.12
Conductivity (uS/cm)	225.4
Sp. Cond.(uS/cm)	245.6

Dominant Species

LESP
PEBO, ACRU, SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-5.5 km Stn (2/23/05 11:33)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-6.0
Latitude	28.75811
Longitude	81.47598
Depth (ft)	5.58
Width (m)	15
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.66
Light Attenuation	2.318

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	1.0	?	7.5

Field Parameters

DO (mg/L)	3.39
DO (%)	37.5
Temp (C)	20.6
pH (SU)	7.08
Conductivity (uS/cm)	223.4
Sp. Cond.(uS/cm)	244.9

Dominant Species

PEVI, POCO
LESP
PEBO, ACRU, SAPA, ULAM, QUNI

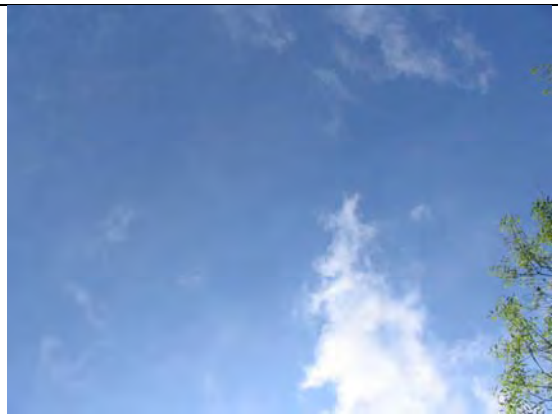
APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-6.0 km Stn (2/23/05 11:45)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	RSR-6.5
Latitude	28.75392
Longitude	81.47433
Depth (ft)	3.64
Width (m)	23
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.80
Light Attenuation	2.560

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	---	62.5	7.5

Field Parameters

DO (mg/L)	3.58
DO (%)	40.1
Temp (C)	20.5
pH (SU)	7.09
Conductivity (uS/cm)	223.9
Sp. Cond.(uS/cm)	245.5

Dominant Species

LESP, NULU
BEAL
QUHE, PEBO, ACRU, SAPA

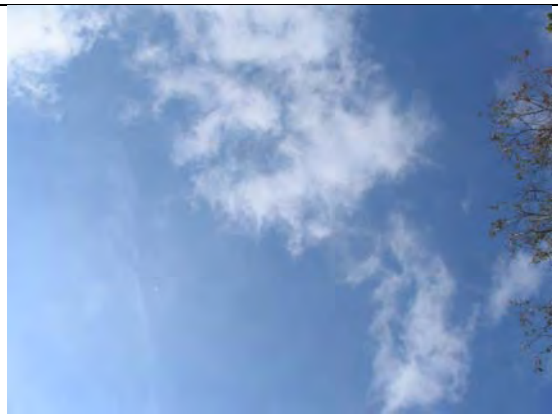
APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-6.5 km Stn (2/23/05 12:03)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	RSR-7.0
Latitude	28.75040
Longitude	81.47630
Depth (ft)	4.22
Width (m)	23
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.63
Light Attenuation	3.448

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	1.0	?	3.0

Field Parameters

DO (mg/L)	3.91
DO (%)	43.6
Temp (C)	20.5
pH (SU)	7.12
Conductivity (uS/cm)	224.7
Sp. Cond.(uS/cm)	246.3

Dominant Species

SALA
LESP, NULU, HYUM
QUVI, PEBO, ACRU, SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-7.0 km Stn (2/23/05 12:15)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-7.5
Latitude	28.74655
Longitude	81.47740
Depth (ft)	3.58
Width (m)	49
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.05
Light Attenuation	2.452

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
62.5	---	7.5	7.5	1.0

Field Parameters

DO (mg/L)	5.06
DO (%)	56.3
Temp (C)	20.7
pH (SU)	7.18
Conductivity (uS/cm)	225.8
Sp. Cond.(uS/cm)	246.5

Dominant Species

TYLA, POCO
LESP, NULU, EICR, HYUM
QUVI, PEBO, ACRU, SAPA

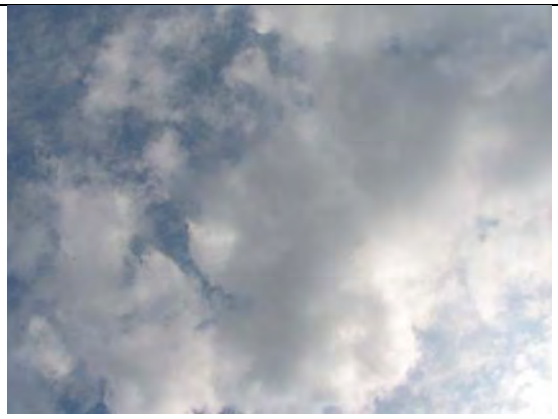
APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-7.5 km Stn (2/23/05 12:29)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	RSR-8.0
Latitude	28.74339
Longitude	81.47409
Depth (ft)	3.13
Width (m)	50
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.14
Light Attenuation	3.608

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
37.5	---	7.5	7.5	3.0

Field Parameters

DO (mg/L)	5.76
DO (%)	64.7
Temp (C)	20.9
pH (SU)	7.21
Conductivity (uS/cm)	226.7
Sp. Cond.(uS/cm)	246.6

Dominant Species

CLJA, UNSE, COES
LESP, NULU, CIME, HYUM
QUHE, QUVI, ACRU, SAPA
SASP

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-8.0 km Stn (2/23/05 12:42)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-8.5
Latitude	28.74185
Longitude	81.46995
Depth (ft)	4.70
Width (m)	30
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.22
Light Attenuation	3.167

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
82.5	3.0	7.5	3.0	3.0

Field Parameters

DO (mg/L)	5.85
DO (%)	65.7
Temp (C)	21.0
pH (SU)	7.23
Conductivity (uS/cm)	227.2
Sp. Cond.(uS/cm)	246.4

Dominant Species

SALA, TYLA, POCO, COES
LESP, NULU, EICR, HYUM
QUHE, QUVI, PITA, PEBO,
ACRU, SASP

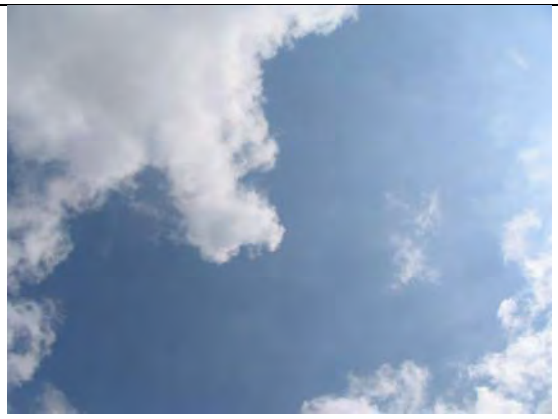
APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-8.5 km Stn (2/23/05 12:55)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	RSR-9.0
Latitude	28.73962
Longitude	81.46622
Depth (ft)	3.00
Width (m)	34
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.14
Light Attenuation	3.215

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
62.5	---	---	3.0	3.0

Field Parameters

DO (mg/L)	5.88
DO (%)	67.3
Temp (C)	21.1
pH (SU)	7.25
Conductivity (uS/cm)	227.3
Sp. Cond.(uS/cm)	246.1

Dominant Species

SALA, TYLA, COES
LESP, NULU, EICR, HYRA
QUHE, QUVI, PEBO, ACRU,
SASP

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-9.0 km Stn (2/23/05 13:09)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-9.5
Latitude	28.73794
Longitude	81.46198
Depth (ft)	3.75
Width (m)	18
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.03
Light Attenuation	2.139

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	---	7.5	62.5

Field Parameters

DO (mg/L)	6.35
DO (%)	71.2
Temp (C)	21.2
pH (SU)	7.28
Conductivity (uS/cm)	227
Sp. Cond.(uS/cm)	245.7

Dominant Species

CIME
TADI, PITA, ACRU, SAPA, QUNI

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-9.5 km Stn (2/23/05 13:35)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-10.0
Latitude	28.73721
Longitude	81.45854
Depth (ft)	3.79
Width (m)	21
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.69
Light Attenuation	2.859

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	1.0	7.5	82.5

Field Parameters

DO (mg/L)	6.39
DO (%)	72.1
Temp (C)	21.2
pH (SU)	7.31
Conductivity (uS/cm)	227.8
Sp. Cond.(uS/cm)	246.1

Dominant Species

POCO
EUBU, QUHE, ACRU, SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-10.0 km Stn (2/23/05 13:47)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-10.5
Latitude	28.73567
Longitude	81.45573
Depth (ft)	1.82
Width (m)	13
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.96
Light Attenuation	3.735

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	3.0	---	37.5

Field Parameters

DO (mg/L)	6.56
DO (%)	73.7
Temp (C)	21.1
pH (SU)	7.34
Conductivity (uS/cm)	227.6
Sp. Cond.(uS/cm)	246.5

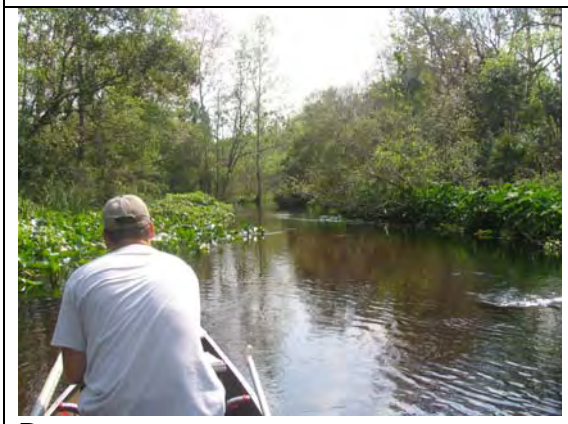
Dominant Species

SALA, UNSE, COES
EICR
QUHE, QUVI, PEBO, ACRU, MAVI

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-10.5 km Stn (2/23/05 14:02)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-11.0
Latitude	28.73200
Longitude	81.45514
Depth (ft)	2.93
Width (m)	38
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.35
Light Attenuation	2.758

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
37.5	---	37.5	7.5	3.0

Field Parameters

DO (mg/L)	6.48
DO (%)	73.6
Temp (C)	21.1
pH (SU)	7.36
Conductivity (uS/cm)	227.4
Sp. Cond.(uS/cm)	246.1

Dominant Species

CAFL, CLJA, COES, FERN
NULU, EICR
PEBO, ACRU, SAPA, LIST, MYCE

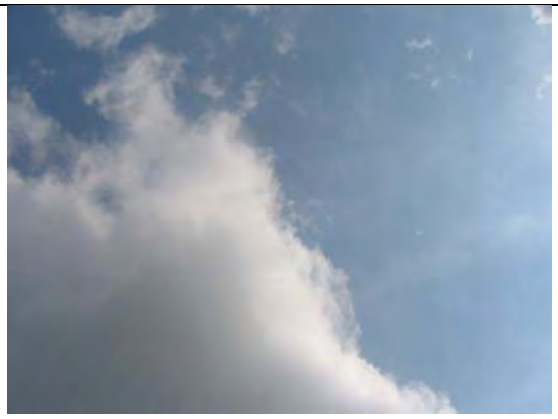
APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-11.0 km Stn (2/23/05 14:13)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	RSR-11.5
Latitude	28.72775
Longitude	81.45404
Depth (ft)	2.23
Width (m)	43
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.38
Light Attenuation	3.625

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
82.5	---	7.5	3.0	1.0

Field Parameters

DO (mg/L)	6.67
DO (%)	75.1
Temp (C)	21.2
pH (SU)	7.37
Conductivity (uS/cm)	227.6
Sp. Cond.(uS/cm)	246.5

Dominant Species

POCO, COES
NULU, CIME, EICR, HYRA, HYUM
QUHE, PEBO, ACRU

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-11.5 km Stn (2/23/05 14:28)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-12.0
Latitude	28.72419
Longitude	81.45256
Depth (ft)	2.48
Width (m)	37
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.93
Light Attenuation	3.107

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
62.5	---	7.5	3.0	3.0

Field Parameters

DO (mg/L)	6.69
DO (%)	75.3
Temp (C)	21.2
pH (SU)	7.4
Conductivity (uS/cm)	228.1
Sp. Cond.(uS/cm)	246.4

Dominant Species

SCSP, POCO, COES
NULU, CIME, EICR, HYUM
TIAM, QUHE, PEBO, ACRU,
SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-12.0 km Stn (2/23/05 14:42)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-12.5
Latitude	28.72009
Longitude	81.45143
Depth (ft)	1.57
Width (m)	18
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.02
Light Attenuation	3.430

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	1.0	1.0	3.0	82.5

Field Parameters

DO (mg/L)	6.70
DO (%)	75.8
Temp (C)	21.5
pH (SU)	7.44
Conductivity (uS/cm)	230
Sp. Cond.(uS/cm)	247

Dominant Species

CRAM, UNGR
CIME, EICR, HYUM
QUHE, PEBO, ACRU, SAPA

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-12.5 km Stn (2/23/05 14:55)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	RSR-13.0
Latitude	28.71619
Longitude	81.44991
Depth (ft)	2.55
Width (m)	52
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.00
Light Attenuation	2.767

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	---	3.0	37.5

Field Parameters

DO (mg/L)	7.12
DO (%)	80.1
Temp (C)	21.5
pH (SU)	7.49
Conductivity (uS/cm)	230.1
Sp. Cond.(uS/cm)	247.1

Dominant Species

CACA, PEBO, CAAQ

APPENDIX A-2. Rock Spring Run Stream Reach Reconnaissance - RSR-13.0 km Stn (2/23/05 15:08)

ROCK SPRING RUN STREAM REACH RECONNAISSANCE - 2/23//2005

	Location						Water Quality Field Parameters							
Time	Station	Linear Distance (km)	Latitude	Longitude	Depth (ft)	Width (m)	DO (mg/L)	DO (%)	Temp (C)	pH (SU)	Cond (uS/cm)	SpCond (uS/cm)	Secchi Depth (ft)	Velocity (ft/s)
17:15	RSR_1stBrdg	0.0	28.75616	81.50164	3.40	40	0.83	9.8	23.9	7.80	231.3	236.7	bottom	1.12
17:00	RSR_2ndLanding	0.6	28.75759	81.49696	3.33	60	2.26	26.7	23.9	7.93	231.4	236.8	bottom	1.08
8:35	RSR-0.0	2.3	28.76827	81.50218	2.15	20	4.45	52.0	23.2	7.77	228.1	237.2	bottom	1.05
8:47	RSR-0.5	2.8	28.77215	81.50282	2.60	23	4.78	55.6	22.8	7.72	228.9	239.4	bottom	0.65
9:09	RSR-1.0	3.3	28.77565	81.50032	2.90	44	4.55	52.2	22.7	7.69	228.4	239.9	bottom	0.38
9:23	RSR-1.5	3.8	28.77773	81.49591	2.69	31	4.59	53.1	22.5	7.67	227.8	239.7	bottom	0.51
9:38	RSR-2.0	4.3	28.77750	81.49265	2.34	28	4.97	57.3	22.5	7.67	227.6	239.9	bottom	0.79
9:56	RSR-2.5	4.8	28.77835	81.48786	4.28	20	4.66	54.0	22.4	7.58	227.2	240.1	bottom	0.20
10:17	RSR-3.0	5.3	28.77855	81.48374	5.45	18	4.38	50.0	22.1	7.43	233.9	248.2	bottom	0.16
10:33	RSR-3.5	5.8	28.77508	81.48164	6.15	22	3.77	43.2	21.9	7.33	234.2	249.6	bottom	0.33
10:51	RSR-4.0	6.3	28.77092	81.48152	5.35	21	3.53	39.9	21.6	7.23	231.9	248.3	bottom	0.32
11:07	RSR-4.5	6.8	28.76782	81.48238	2.80	16	3.37	38.1	21.2	7.16	228.6	247.1	bottom	0.42
11:20	RSR-5.0	7.3	28.76417	81.48089	4.90	20	3.24	36.2	20.9	7.12	225.3	244.9	bottom	0.19
11:33	RSR-5.5	7.8	28.76177	81.47812	6.18	12	3.32	37.0	20.8	7.12	225.4	245.6	bottom	0.48
11:45	RSR-6.0	8.3	28.75811	81.47598	5.58	15	3.39	37.5	20.6	7.08	223.4	244.9	bottom	0.66
12:03	RSR-6.5	8.8	28.75392	81.47433	3.64	23	3.58	40.1	20.5	7.09	223.9	245.5	bottom	0.80
12:15	RSR-7.0	9.3	28.75040	81.47630	4.22	23	3.91	43.6	20.5	7.12	224.7	246.3	bottom	0.63
12:29	RSR-7.5	9.8	28.74655	81.47740	3.58	49	5.06	56.3	20.7	7.18	225.8	246.5	bottom	1.05
12:42	RSR-8.0	10.3	28.74339	81.47409	3.13	50	5.76	64.7	20.9	7.21	226.7	246.6	bottom	1.14
12:55	RSR-8.5	10.8	28.74185	81.46995	4.70	30	5.85	65.7	21.0	7.23	227.2	246.4	bottom	1.22
13:09	RSR-9.0	11.3	28.73962	81.46622	3.00	34	5.88	67.3	21.1	7.25	227.3	246.1	bottom	1.14
13:35	RSR-9.5	11.8	28.73794	81.46198	3.75	18	6.35	71.2	21.2	7.28	227.0	245.7	bottom	1.03
13:47	RSR-10.0	12.3	28.73721	81.45854	3.79	21	6.39	72.1	21.2	7.31	227.8	246.1	bottom	0.69
14:02	RSR-10.5	12.8	28.73567	81.45573	1.82	13	6.56	73.7	21.1	7.34	227.6	246.5	bottom	0.96
14:13	RSR-11.0	13.3	28.73200	81.45514	2.93	38	6.48	73.6	21.1	7.36	227.4	246.1	bottom	1.35
14:28	RSR-11.5	13.8	28.72775	81.45404	2.23	43	6.67	75.1	21.2	7.37	227.6	246.5	bottom	1.38
14:42	RSR-12.0	14.3	28.72419	81.45256	2.48	37	6.69	75.3	21.2	7.40	228.1	246.4	bottom	0.93
14:55	RSR-12.5	14.8	28.72009	81.45143	1.57	18	6.70	75.8	21.5	7.44	230.0	247.0	bottom	1.02
15:08	RSR-13.0	15.3	28.71619	81.44991	2.55	52	7.12	80.1	21.5	7.49	230.1	247.1	bottom	1.00

ROCK SPRING RUN STREAM REACH RECONNAISSANCE - 2/23/2005

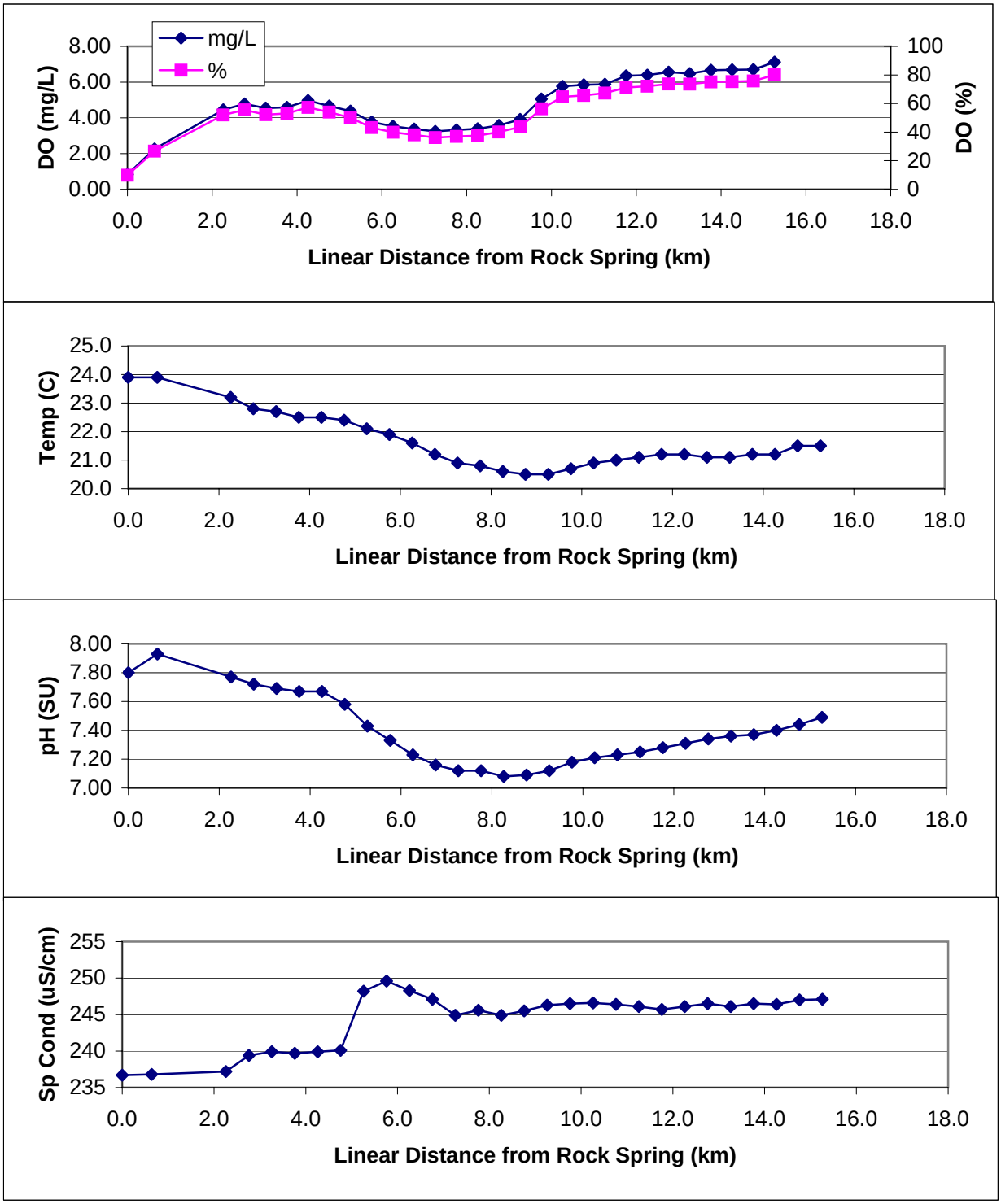
	Location				Percent Cover (%)					
Time	Station	Linear Distance (km)	Latitude	Longitude	FAP	SAV	EMA	ALG (Surface)	ALG (Benthic)	Canopy
17:15	RSR_1stBrdg	0.0	28.75616	81.50164					7.5	37.5
17:00	RSR_2ndLanding	0.6	28.75759	81.49696	7.5	37.5	7.5	3.0	7.5	3.0
8:35	RSR-0.0	2.3	28.76827	81.50218	62.5	3.0			3.0	3.0
8:47	RSR-0.5	2.8	28.77215	81.50282	3.0	92.5	3.0			3.0
9:09	RSR-1.0	3.3	28.77565	81.50032	62.5				3.0	3.0
9:23	RSR-1.5	3.8	28.77773	81.49591	17.5	3.0	1.0		3.0	3.0
9:38	RSR-2.0	4.3	28.77750	81.49265	37.5		2.0		62.5	17.5
9:56	RSR-2.5	4.8	28.77835	81.48786	7.5				82.5	37.5
10:17	RSR-3.0	5.3	28.77855	81.48374	3.0		3.0		?	82.5
10:33	RSR-3.5	5.8	28.77508	81.48164	3.0		1.0		?	62.5
10:51	RSR-4.0	6.3	28.77092	81.48152	3.0		1.0		?	17.5
11:07	RSR-4.5	6.8	28.76782	81.48238	3.0				?	17.5
11:20	RSR-5.0	7.3	28.76417	81.48089	3.0				?	7.5
11:33	RSR-5.5	7.8	28.76177	81.47812	1.0				?	7.5
11:45	RSR-6.0	8.3	28.75811	81.47598	3.0		1.0		?	7.5
12:03	RSR-6.5	8.8	28.75392	81.47433	3.0				62.5	7.5
12:15	RSR-7.0	9.3	28.75040	81.47630	3.0		1.0		?	3.0
12:29	RSR-7.5	9.8	28.74655	81.47740	62.5		7.5		7.5	1.0
12:42	RSR-8.0	10.3	28.74339	81.47409	37.5		7.5		7.5	3.0
12:55	RSR-8.5	10.8	28.74185	81.46995	82.5	3.0	7.5		3.0	3.0
13:09	RSR-9.0	11.3	28.73962	81.46622	62.5			1.0	3.0	3.0
13:35	RSR-9.5	11.8	28.73794	81.46198	1.0				7.5	62.5
13:47	RSR-10.0	12.3	28.73721	81.45854			1.0		7.5	82.5
14:02	RSR-10.5	12.8	28.73567	81.45573	1.0		3.0			37.5
14:13	RSR-11.0	13.3	28.73200	81.45514	37.5		37.5		7.5	3.0
14:28	RSR-11.5	13.8	28.72775	81.45404	82.5		7.5		3.0	1.0
14:42	RSR-12.0	14.3	28.72419	81.45256	62.5		7.5		3.0	3.0
14:55	RSR-12.5	14.8	28.72009	81.45143	7.5	1.0	1.0		3.0	82.5
15:08	RSR-13.0	15.3	28.71619	81.44991					3.0	37.5

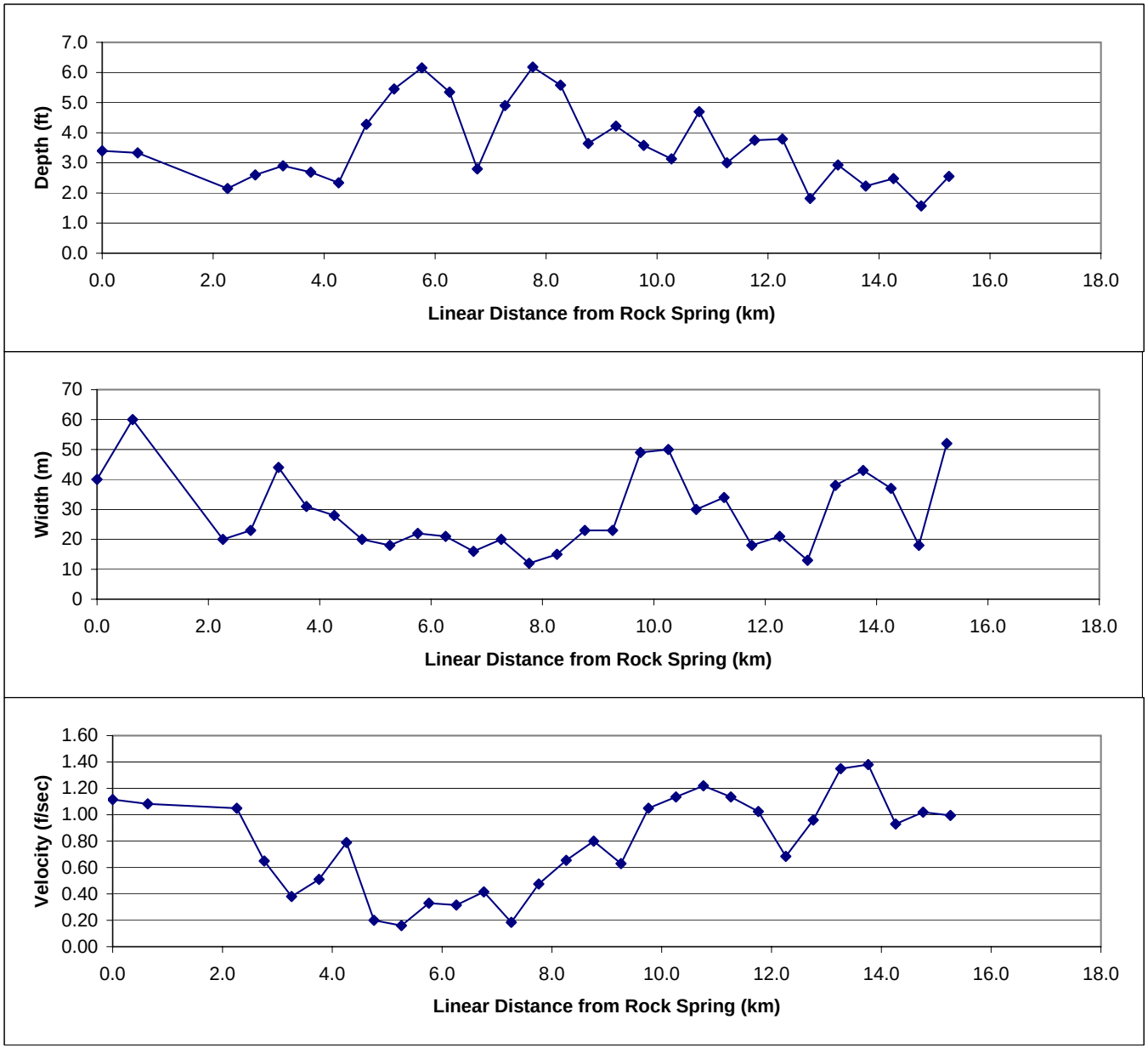
ROCK SPRING RUN STREAM REACH RECONNAISSANCE - 2/23/2005

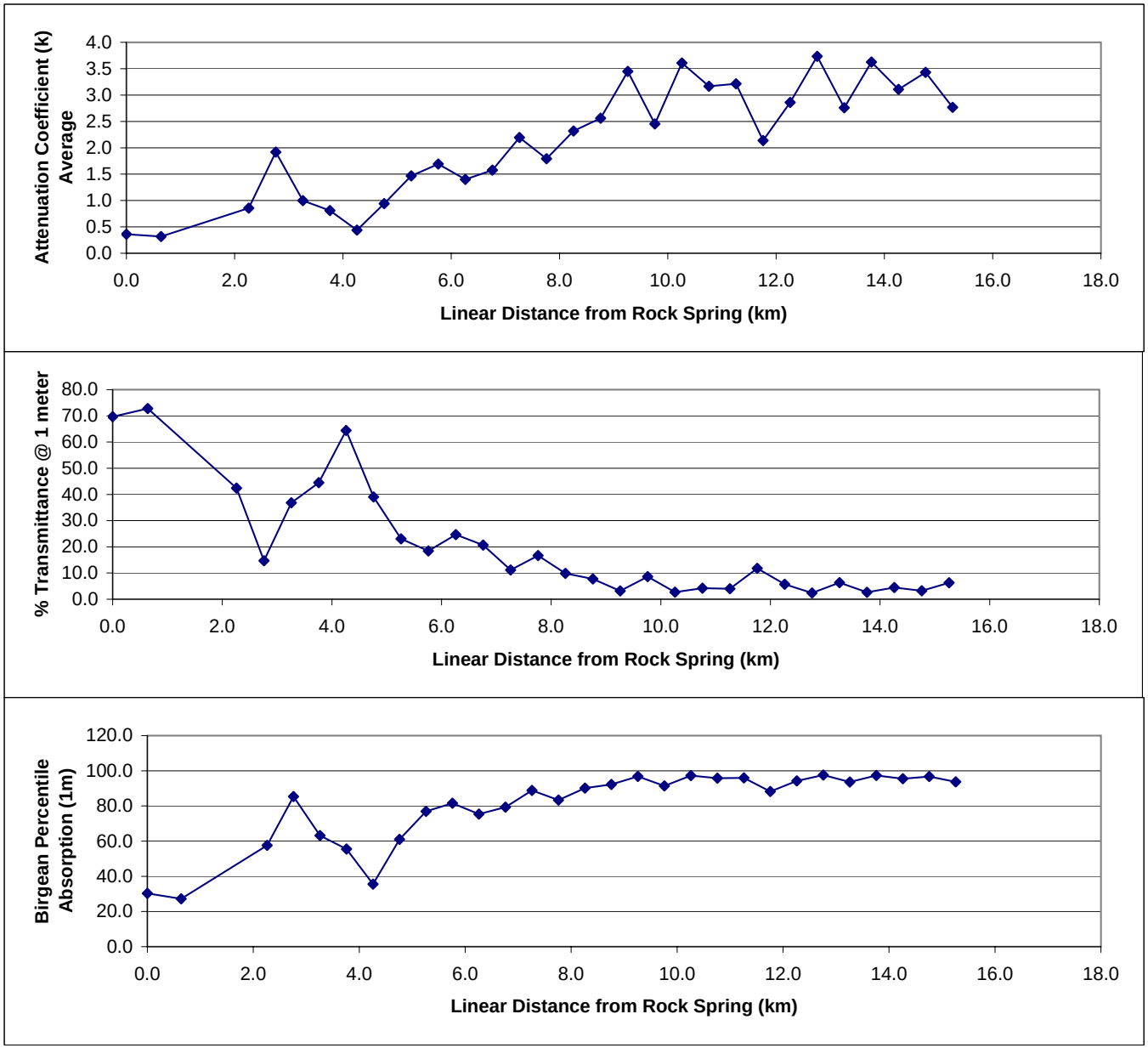
	Location				Dominant Spp.																																							
Time	Station	Linear Distance (km)	Latitude	Longitude	Arrow arum (*Peltandra virginica*)	Arrowhead (*Sagittaria lancifolia*)	Bulrush (*Scripus* sp.)	Cattail (*Typha latifolia*)	Ferns	Golden canna (*Canna flaccida*)	Pickerel Weed (*Pontederia cordata*)	Sawgrass (*Cladium jamaicense*)	Swamp lily (*Crinum americanum*)	Unknown Grass	Unknown Sedge	Wild Taro (*Colocasia esculenta*)	Duckweed (*Lemna spp.*)	Spatterdock (*Nuphar luteum*)	Water hemlock (*Cicuta mexicana*)	Water hyacinth (*Eichhornia crassipes*)	Water lettuce (*Pistia stratiotes*)	Water pennyworts (*Hydrocotyle ranunculoides*)	Water pennyworts (*Hydrocotyle umbellata*)	Strap-leaf sagittaria (*Sagittaria* spp.)	Tape grass (*Vallisneria americana*)	Benthic Algae	American Hornbeam (*Carpinus caroliniana*)	Bald Cypress (*Taxodium distichum*)	Basswood (*Tilia americana*)	Iron wood (*Eugenia buxifolia*)	Laurel Oak (*Quercus hemisphearica*)	Live Oak (*Quercus virginiana*)	Loblolly Pine (*Pinus taeda*)	Red Bay (*Persea borbonia*)	Red Maple (*Acer rubrum*)	Sabal Palm (*Sabal palmetto*)	Southern Magnolia (*Magnolia grandiflora*)	Sweet Bay (*Magnolia virginiana*)	Sweetgum (*Liquidambar styraciflua*)	Water elm (*Ulmus americana*)	Water Hickory (Carya aquatica)	Water Oak (*Quercus nigra*)	Wax Myrtle (*Myrica cerifera*)	Willow (*Salix* sp.)	Willow Oak (*Quercus phellos*)
17:15	RSR_1stBrdg	0.0	28.75616	81.50164																												X				X	X		X						
17:00	RSR_2ndLanding	0.6	28.75759	81.49696							X						X	X			X		X		X							X			X	X									
8:35	RSR-0.0	2.3	28.76827	81.50218							X						X	X	X		X		X	X										X	X	X									
8:47	RSR-0.5	2.8	28.77215	81.50282							X		X					X	X		X		X		X			X						X	X										
9:09	RSR-1.0	3.3	28.77565	81.50032														X	X		X		X											X	X	X									
9:23	RSR-1.5	3.8	28.77773	81.49591									X					X	X		X		X		X									X	X	X					X		X		
9:38	RSR-2.0	4.3	28.77750	81.49265				X			X		X				X	X	X		X		X			X								X	X	X					X		X		
9:56	RSR-2.5	4.8	28.77835	81.48786													X			X						X					X			X	X	X									
10:17	RSR-3.0	5.3	28.77855	81.48374							X						X			X											X			X	X	X					X				
10:33	RSR-3.5	5.8	28.77508	81.48164	X						X						X			X														X	X	X					X				X
10:51	RSR-4.0	6.3	28.77092	81.48152	X												X			X														X	X	X					X		X		
11:07	RSR-4.5	6.8	28.76782	81.48238													X																		X	X					X				
11:20	RSR-5.0	7.3	28.76417	81.48089													X		X															X	X	X					X				
11:33	RSR-5.5	7.8	28.76177	81.47812													X																	X	X	X									
11:45	RSR-6.0	8.3	28.75811	81.47598	X						X						X																	X	X	X				X		X			
12:03	RSR-6.5	8.8	28.75392	81.47433													X	X								X					X			X	X	X									
12:15	RSR-7.0	9.3	28.75040	81.47630		X											X	X					X									X		X	X	X									
12:29	RSR-7.5	9.8	28.74655	81.47740				X			X						X	X		X			X									X		X	X	X									
12:42	RSR-8.0	10.3	28.74339	81.47409								X			X	X	X	X	X				X								X	X			X	X								X	
12:55	RSR-8.5	10.8	28.74185	81.46995		X		X			X					X	X	X		X			X								X	X	X	X	X									X	
13:09	RSR-9.0	11.3	28.73962	81.46622		X		X								X	X	X		X		X									X	X		X	X									X	
13:35	RSR-9.5	11.8	28.73794	81.46198															X									X					X		X	X						X			
13:47	RSR-10.0	12.3	28.73721	81.45854							X																			X	X				X	X									
14:02	RSR-10.5	12.8	28.73567	81.45573		X									X	X				X											X	X		X	X			X							
14:13	RSR-11.0	13.3	28.73200	81.45514					X	X		X				X		X		X														X	X	X			X				X		
14:28	RSR-11.5	13.8	28.72775	81.45404							X					X		X	X	X		X	X								X			X	X										
14:42	RSR-12.0	14.3	28.72419	81.45256			X				X					X		X	X	X			X						X		X			X	X	X									
14:55	RSR-12.5	14.8	28.72009	81.45143									X	X					X	X			X								X			X	X	X									
15:08	RSR-13.0	15.3	28.71619	81.44991																							X							X							X				

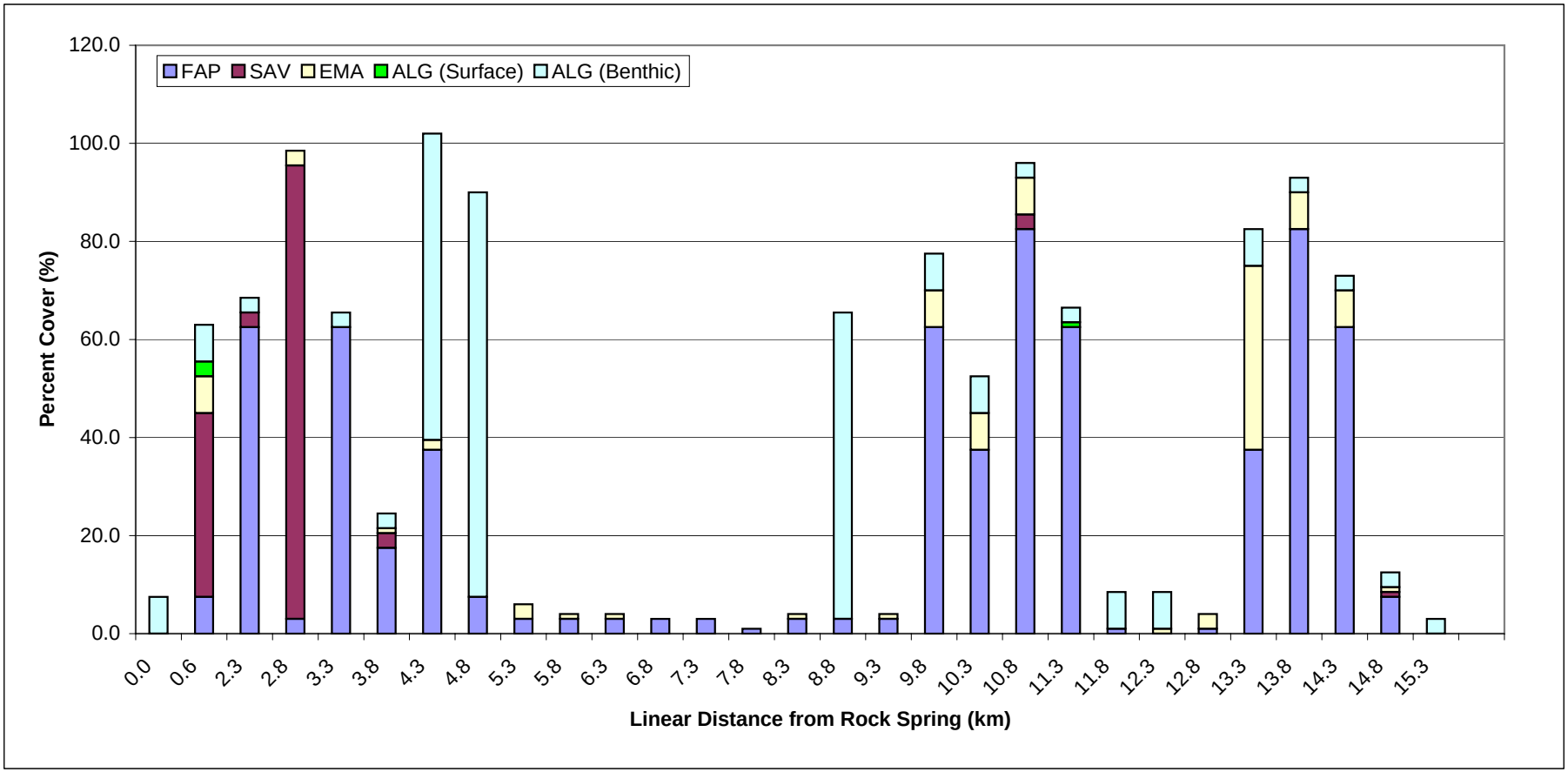
ROCK SPRING RUN STREAM REACH RECONNAISSANCE - 2/23/2005

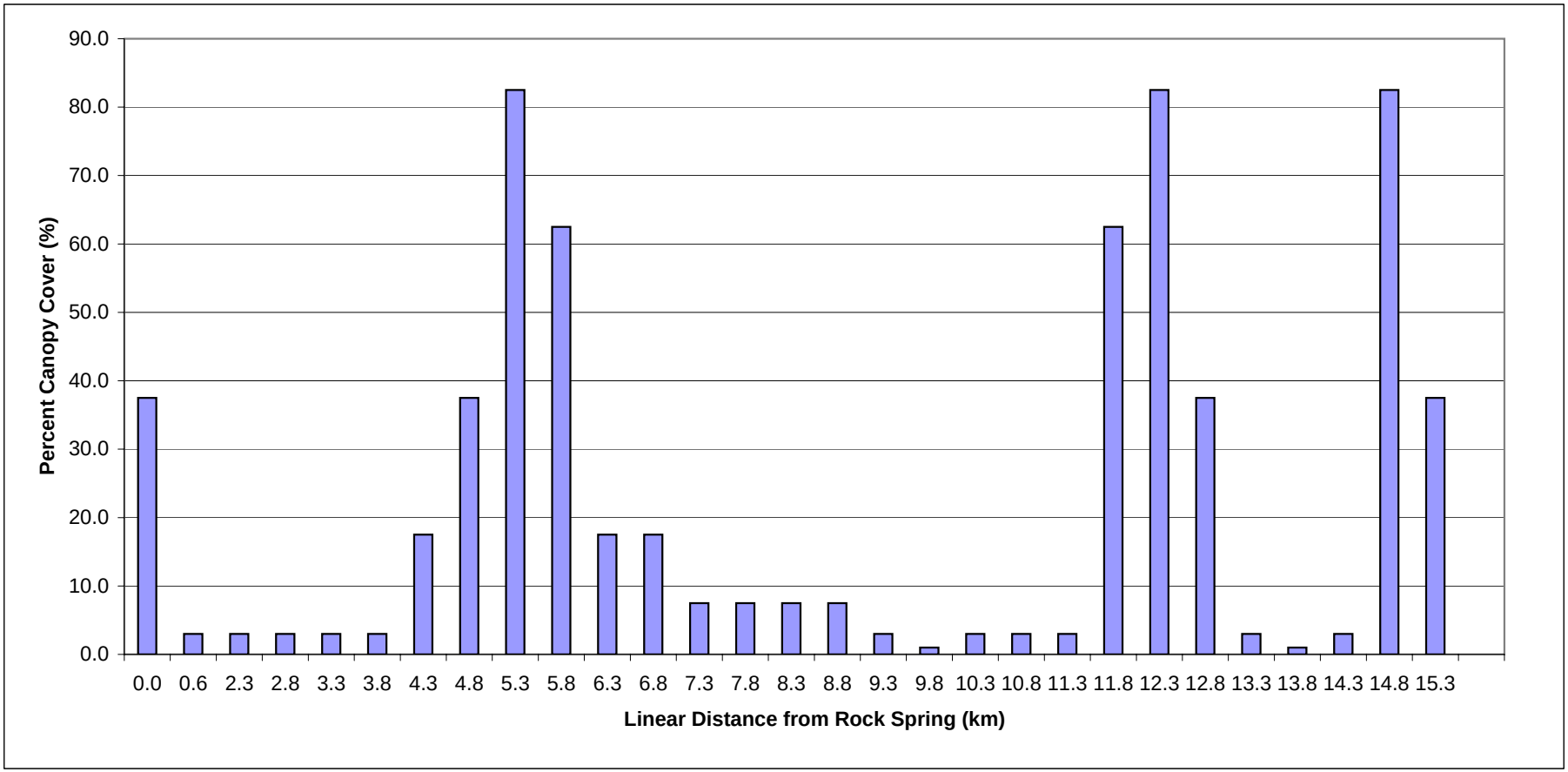
	Location				Light Transmission (umol/s/m2) / Depth (ft)								Light Attenuation Est.			
Time	Station	Linear Distance (km)	Latitude	Longitude	Air	Surface	1.0	2.0	3.0	4.0	5.0	6.0	k Average	Percent Transmittance @ 1 meter	Birgean Percentile Absorption (1m)	Notes
17:15	RSR_1stBrdg	0.0	28.75616	81.50164	61.8	59.1	53.1	46.5	43.5				0.361	69.7	30.3	
17:00	RSR_2ndLanding	0.6	28.75759	81.49696	49.4	41.0	38.1	32.2					0.318	72.8	27.2	
8:35	RSR-0.0	2.3	28.76827	81.50218	82.8	75.1	55.0	43.6	41.2				0.857	42.4	57.6	
8:47	RSR-0.5	2.8	28.77215	81.50282	124.0	100.2	55.8						1.920	14.7	85.3	tape grass 0.9 ft below water surface
9:09	RSR-1.0	3.3	28.77565	81.50032	139.9	125.0	92.1	68.1					0.999	36.8	63.2	
9:23	RSR-1.5	3.8	28.77773	81.49591	156.6	128.9	106.2	70.7					0.810	44.5	55.5	
9:38	RSR-2.0	4.3	28.77750	81.49265	126.5	102.2	90.7	75.8					0.440	64.4	35.6	bottom light reading at 1.5 ft
9:56	RSR-2.5	4.8	28.77835	81.48786	108.7	100.6	72.0	56.3	49.5				0.941	39.0	61.0	
10:17	RSR-3.0	5.3	28.77855	81.48374	87.1	74.9	42.3	30.7	22.7	16.6			1.468	23.0	77.0	unable to see bottom to estimate benthic algae
10:33	RSR-3.5	5.8	28.77508	81.48164	143.9	131.7	70.1	45.0	32.4	23.9			1.691	18.4	81.6	unable to see bottom to estimate benthic algae
10:51	RSR-4.0	6.3	28.77092	81.48152	280.3	261.2	161.4	113.2	78.9	50.9			1.400	24.6	75.4	unable to see bottom to estimate benthic algae
11:07	RSR-4.5	6.8	28.76782	81.48238	192.2	218.5	124.3	78.8	57.7	43.4			1.576	20.7	79.3	unable to see bottom to estimate benthic algae
11:20	RSR-5.0	7.3	28.76417	81.48089	360.1	352.1	161.3	99.0	59.8				2.194	11.1	88.9	unable to see bottom to estimate benthic algae
11:33	RSR-5.5	7.8	28.76177	81.47812	307.4	349.4	197.3	108.9	69.4	44.1	25.6		1.793	16.6	83.4	unable to see bottom to estimate benthic algae
11:45	RSR-6.0	8.3	28.75811	81.47598	996.3	1266.4	526.0	294.7	195.0	117.3			2.318	9.8	90.2	unable to see bottom to estimate benthic algae
12:03	RSR-6.5	8.8	28.75392	81.47433	1253.0	1226.5	508.8	314.3					2.560	7.7	92.3	
12:15	RSR-7.0	9.3	28.75040	81.47630	1220.3	1046.9	228.1	176.8	113.9				3.448	3.2	96.8	unable to see bottom to estimate benthic algae
12:29	RSR-7.5	9.8	28.74655	81.47740	1219.9	1071.9	508.3	239.8					2.452	8.6	91.4	
12:42	RSR-8.0	10.3	28.74339	81.47409	836.4	1199.0	304.2	228.9					3.608	2.7	97.3	at Big Buck Camp sign
12:55	RSR-8.5	10.8	28.74185	81.46995	630.5	475.6	165.1	69.3	34.5				3.167	4.2	95.8	
13:09	RSR-9.0	11.3	28.73962	81.46622	1520.7	1401.0	514.1	206.6					3.215	4.0	96.0	
13:35	RSR-9.5	11.8	28.73794	81.46198	719.7	510.7	274.0	159.6	53.6				2.139	11.8	88.2	
13:47	RSR-10.0	12.3	28.73721	81.45854	133.5	123.3	48.0	24.9					2.859	5.7	94.3	
14:02	RSR-10.5	12.8	28.73567	81.45573	577.4	706.2	226.2						3.735	2.4	97.6	
14:13	RSR-11.0	13.3	28.73200	81.45514	1367.1	1117.2	437.4	252.4					2.758	6.3	93.7	
14:28	RSR-11.5	13.8	28.72775	81.45404	882.7	439.4	145.5						3.625	2.7	97.3	
14:42	RSR-12.0	14.3	28.72419	81.45256	310.6	264.4	102.6						3.107	4.5	95.5	
14:55	RSR-12.5	14.8	28.72009	81.45143	189.9	141.8	49.9						3.430	3.2	96.8	
15:08	RSR-13.0	15.3	28.71619	81.44991	117.5	107.6	46.3						2.767	6.3	93.7	at RSR-MB2 station

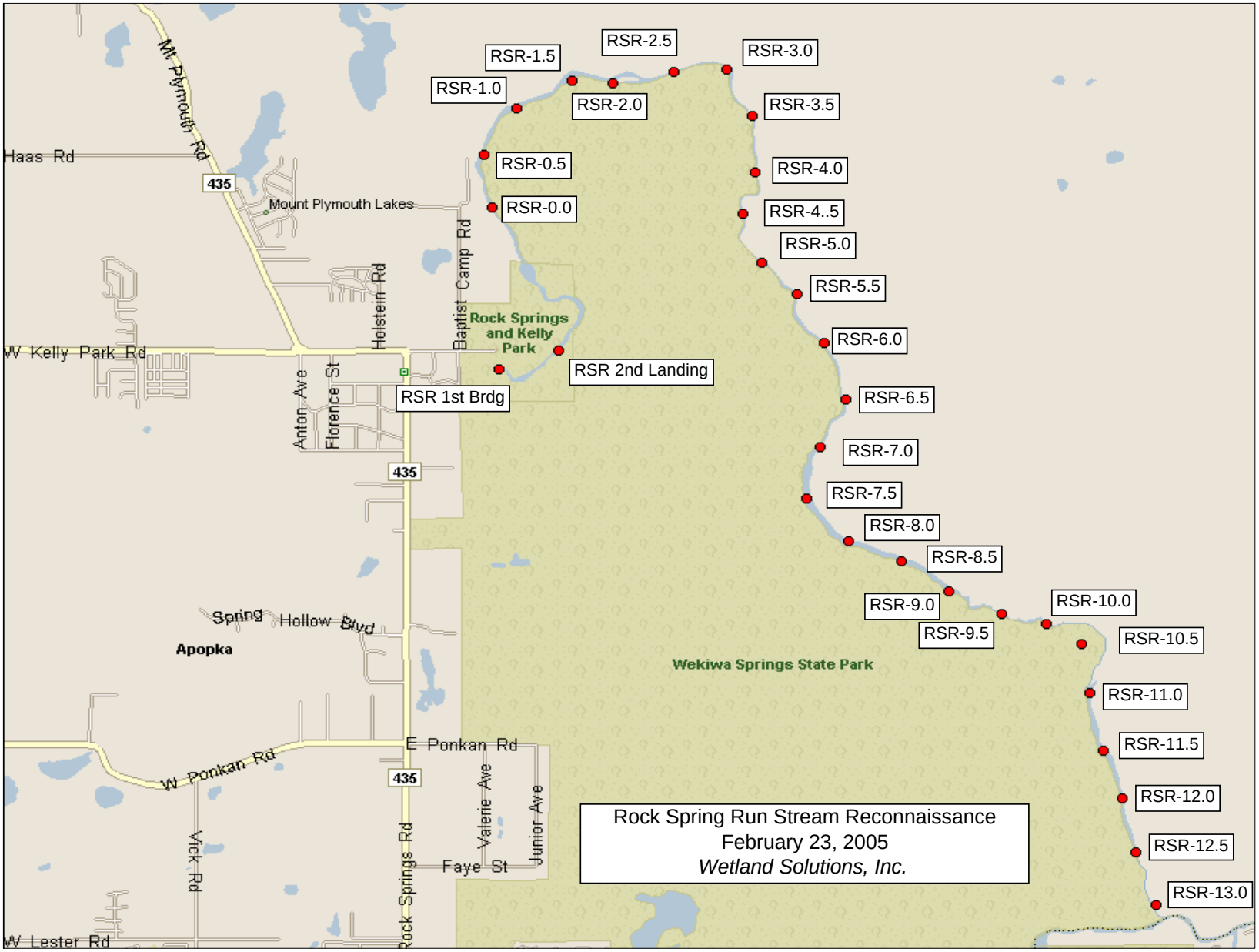

mg/L
%
DO (mg/L)
DO (%)
8.00
6.00
4.00
2.00
0.00
100
80
60
40
20
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Linear Distance from Rock Spring (km)
Temp (C)
25.0
24.0
23.0
22.0
21.0
20.0
Linear Distance from Rock Spring (km)
pH (SU)
8.00
7.80
7.60
7.40
7.20
7.00
Linear Distance from Rock Spring (km)
Sp Cond (uS/cm)
255
250
245
240
235
Linear Distance from Rock Spring (km)


Depth (ft)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Linear Distance from Rock Spring (km)
Width (m)
70
60
50
40
30
20
10
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Linear Distance from Rock Spring (km)
Velocity (f/sec)
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Linear Distance from Rock Spring (km)


Attenuation Coefficient (k) Average
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Linear Distance from Rock Spring (km)
% Transmittance @ 1 meter
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Linear Distance from Rock Spring (km)
Birgean Percentile Absorption (1m)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Linear Distance from Rock Spring (km)


FAP
SAV
EMA
ALG (Surface)
ALG (Benthic)
Percent Cover (%)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
0.6
2.3
2.8
3.3
3.8
4.3
4.8
5.3
5.8
6.3
6.8
7.3
7.8
8.3
8.8
9.3
9.8
10.3
10.8
11.3
11.8
12.3
12.8
13.3
13.8
14.3
14.8
15.3
Linear Distance from Rock Spring (km)


90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percent Canopy Cover (%)
0.0 0.6 2.3 2.8 3.3 3.8 4.3 4.8 5.3 5.8 6.3 6.8 7.3 7.8 8.3 8.8 9.3 9.8 10.3 10.8 11.3 11.8 12.3 12.8 13.3 13.8 14.3 14.8 15.3
Linear Distance from Rock Spring (km)


RSR-1.5
RSR-2.5
RSR-3.0
RSR-1.0
RSR-2.0
RSR-3.5
RSR-0.5
RSR-4.0
RSR-0.0
RSR-4..5
RSR-5.0
RSR-5.5
RSR-6.0
RSR 2nd Landing
RSR 1st Brdg
RSR-6.5
RSR-7.0
RSR-7.5
RSR-8.0
RSR-8.5
RSR-9.0
RSR-9.5
RSR-10.0
RSR-10.5
RSR-11.0
RSR-11.5
RSR-12.0
RSR-12.5
RSR-13.0
Rock Spring Run Stream Reconnaissance
February 23, 2005
Wetland Solutions, Inc.
Haas Rd
Mt Plymouth Rd
435
Mount Plymouth Lakes
Holstein Rd
Baptist Camp Rd
Rock Springs and Kelly Park
W Kelly Park Rd
Anton Ave
Florence St
Spring Hollow Blvd
Apopka
Wekiwa Springs State Park
E Ponkan Rd
W Ponkan Rd
Valerie Ave
Junior Ave
Faye St
Vick Rd
Rock Springs Rd
W Lester Rd

CODE	SCIENTIFIC NAME	COMMON NAME
ACRU	*Acer rubrum*	Red Maple
AQMO		Aquatic mosses
BEAL		Benthic Algae
CAAQ	*Carya aquatica*	Water Hickory
CACA	*Carpinus caroliniana*	American Hornbeam
CAFL	*Canna flaccida*	Golden canna
CEDE	*Ceratophyllum demersum*	Coontail
CIME	*Cicuta mexicana*	Water hemlock
CLJA	*Cladium jamaicense*	Sawgrass
COES	*Colocasia esculenta*	Wild Taro
CRAM	*Crinum americanum*	Swamp lily
EICR	*Eichhornia crassipes*	Water hyacinth
EUBU	*Eugenia buxifolia*	Iron wood
FERN		Ferns
HYRA	*Hydrocotyle ranunculoides*	Water pennyworts
HYUM	*Hydrocotyle umbellata*	Water pennyworts
ILCA	Ilex cassine	Dahoon Holly
ISSP	*Iris sp.*	Iris
JUSP	*Juncus sp.*	Rushes
JUVI	Juniperus virginiana	Red Cedar
LESP	*Lemna sp.*	Duckweed
LIST	*Liquidambar styraciflua*	Sweetgum
LUSP	*Ludwigia sp.*	Water primrose
MAGR	*Magnolia grandiflora*	Southern Magnolia
MAVI	*Magnolia virginiana*	Sweet Bay
MISC	*Mikania scandens*	Climbing Hempweed
MYCE	*Myrica cerifera*	Wax Myrtle
NIFL	*Nitella flexilis*	Stonewort
NULU	*Nuphar luteum*	Spatterdock
PEBO	*Persea borbonia*	Red Bay
PEVI	*Peltandra virginica*	Arrow arum
PHAU	Phragmites australis	Common Reed
PIST	*Pistia stratiotes*	Water lettuce
PITA	*Pinus taeda*	Loblolly Pine
POCO	*Pontederia cordata*	Pickerel Weed
QUHE	*Quercus hemisphearica*	Laurel Oak
QUNI	*Quercus nigra*	Water Oak
QUPH	*Quercus phellos*	Willow Oak
QUVI	*Quercus virginiana*	Live Oak
SACE	*Saururus cernuus*	Lizard's tail
SALA	*Sagittaria lancifolia*	Arrowhead
SAPA	*Sabal palmetto*	Sabal Palm
SASP	*Sagittaria sp.*	Strap-leaf sagittaria
SASP	*Salix sp.*	Willow
SCSP	*Scripus sp.*	Bulrush
TADI	*Taxodium distichum*	Bald Cypress
TIAM	*Tilia americana*	Basswood
TYLA	*Typha latifolia*	Cattail
ULAM	*Ulmus americana*	Water elm
UNGR		Unknown Grass
UNSE		Unknown Sedge
VAAM	*Vallisneria americana*	Tape grass

Appendix A-3

Juniper Creek Stream System Reach Reconnaissance Detailed Data

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-0.0
Latitude	29.18433
Longitude	81.71199
Depth (ft)	1.93
Width (m)	3.81
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.44
Light Attenuation	1.238

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	---	7.5	62.5

Field Parameters

DO (mg/L)	6.79
DO (%)	77.2
Temp (C)	21.8
pH (SU)	8.53
Conductivity (uS/cm)	99.3
Sp. Cond.(uS/cm)	105.7

Dominant Species

SAPA
QUHE
PEBO

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC-0.0 Stn (3/8/2005 10:05)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-0.5
Latitude	29.18513
Longitude	81.70819
Depth (ft)	2.24
Width (m)	4.572
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.96
Light Attenuation	5.646

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	---	3.0	82.5

Field Parameters

DO (mg/L)	6.76
DO (%)	76.0
Temp (C)	21.1
pH (SU)	7.52
Conductivity (uS/cm)	102.0
Sp. Cond.(uS/cm)	110.5

Dominant Species

ACRU
PEBO
SAPA

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 0.5 Stn (3/8/2005 10:38)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-1.0
Latitude	29.18452
Longitude	81.70401
Depth (ft)	2.05
Width (m)	18
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.91
Light Attenuation	4.963

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	62.5	3.0	---	62.5

Field Parameters

DO (mg/L)	6.46
DO (%)	72.6
Temp (C)	21.1
pH (SU)	7.62
Conductivity (uS/cm)	110.4
Sp. Cond.(uS/cm)	119.9

Dominant Species

CIME
SASP
PEBO
ACRU
SAPA

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 1.0 Stn (3/8/2005 11:13)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-1.5
Latitude	29.18361
Longitude	81.69958
Depth (ft)	5.79
Width (m)	23
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.65
Light Attenuation	2.335

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	17.5	3.0	17.5	37.5

Field Parameters

DO (mg/L)	6.59
DO (%)	73.4
Temp (C)	20.8
pH (SU)	7.37
Conductivity (uS/cm)	109.2
Sp. Cond.(uS/cm)	119.2

Dominant Species

MISC, POCO, CLJA
SASP, BEAL
QUVI, PEBO

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 1.5 Stn (3/8/2005 11:28)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-2.0
Latitude	29.18149
Longitude	81.69571
Depth (ft)	2.58
Width (m)	13
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.08
Light Attenuation	2.686

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	17.5	3.0	17.5	82.5

Field Parameters

DO (mg/L)	6.33
DO (%)	70.6
Temp (C)	20.6
pH (SU)	7.28
Conductivity (uS/cm)	117.8
Sp. Cond.(uS/cm)	129.1

Dominant Species

CLJA, CIME
VAAM, BEAL
TADI, QUVI, PEBO, ACRU, SAPA

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 2.0 Stn (3/8/2005 11:42)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-2.5
Latitude	29.18216
Longitude	81.69141
Depth (ft)	3.69
Width (m)	16
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.48
Light Attenuation	2.919

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	3.0	?	37.5

Field Parameters

DO (mg/L)	6.12
DO (%)	68.0
Temp (C)	20.6
pH (SU)	7.24
Conductivity (uS/cm)	126.5
Sp. Cond.(uS/cm)	138.7

Dominant Species

MISC, CRAM, UNSE
EICR
TADI, PEBO, JUVI, ACRU

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 2.5 Stn (3/8/2005 11:54)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-3.0
Latitude	29.18489
Longitude	81.68800
Depth (ft)	5.50
Width (m)	14
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.62
Light Attenuation	2.914

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	?	1.0	?	3.0

Field Parameters

DO (mg/L)	6.09
DO (%)	67.1
Temp (C)	20.5
pH (SU)	7.22
Conductivity (uS/cm)	125.1
Sp. Cond.(uS/cm)	137.4

Dominant Species

CIME
QUHE, PEBO, ACRU, SAPA

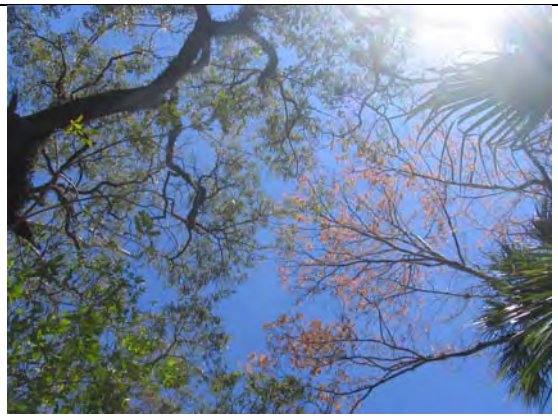
APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 3.0 Stn (3/8/2005 12:09)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	JC-3.5
Latitude	29.18839
Longitude	81.68493
Depth (ft)	2.62
Width (m)	9
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.79
Light Attenuation	4.158

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	3.0	?	82.5

Field Parameters

DO (mg/L)	5.94
DO (%)	66.0
Temp (C)	20.4
pH (SU)	7.19
Conductivity (uS/cm)	128.6
Sp. Cond.(uS/cm)	141.0

Dominant Species

CRAM, CIME
TADI, QUVI, PEBO, SAPA

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 3.5 Stn (3/8/2005 12:23)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-4.0
Latitude	29.19233
Longitude	81.68349
Depth (ft)	2.90
Width (m)	20
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.99
Light Attenuation	2.393

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	1.0	17.5	3.0

Field Parameters

DO (mg/L)	6.42
DO (%)	71.2
Temp (C)	20.5
pH (SU)	7.30
Conductivity (uS/cm)	128.7
Sp. Cond.(uS/cm)	141.4

Dominant Species

CLJA, UNSE, CIME, EICR
BEAL
TADI, QUHE, PEBO, ACRU, SAPA, MYCE

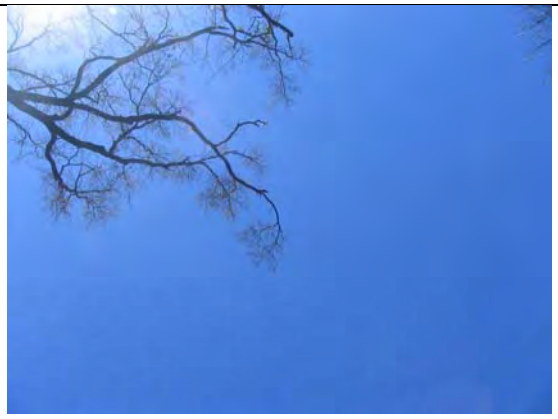
APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 4.0 Stn (3/8/2005 12:37)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	JC-4.5
Latitude	29.19526
Longitude	81.68130
Depth (ft)	4.96
Width (m)	12
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.58
Light Attenuation	3.083

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	1.0	?	7.5

Field Parameters

DO (mg/L)	6.71
DO (%)	74.6
Temp (C)	20.6
pH (SU)	7.27
Conductivity (uS/cm)	145.6
Sp. Cond.(uS/cm)	159.6

Dominant Species

CLJA

TADI, QUHE, ACRU, SAPA

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 4.5 Stn (3/8/2005 12:51)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-5.0
Latitude	29.19945
Longitude	81.68204
Depth (ft)	6.10
Width (m)	17
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.62
Light Attenuation	2.046

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	3.0	?	7.5

Field Parameters

DO (mg/L)	6.80
DO (%)	75.5
Temp (C)	20.5
pH (SU)	7.26
Conductivity (uS/cm)	150.4
Sp. Cond.(uS/cm)	165.3

Dominant Species

CIME

TADI, QUVI, PEBO, ACRU, SAPA, MYCE

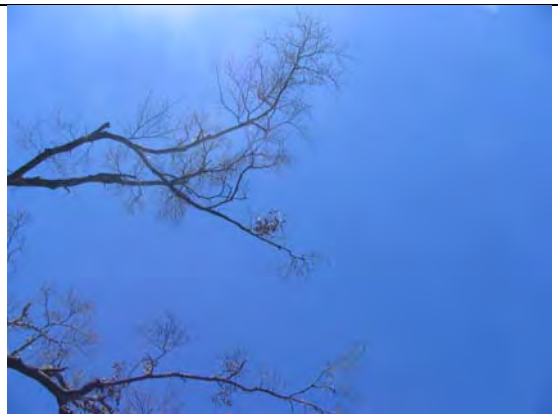
APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 5.0 Stn (3/8/2005 13:04)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	JC-5.5
Latitude	29.20312
Longitude	81.68464
Depth (ft)	4.23
Width (m)	18
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.82
Light Attenuation	2.074

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	3.0	---	7.5

Field Parameters

DO (mg/L)	6.86
DO (%)	76.3
Temp (C)	20.5
pH (SU)	7.34
Conductivity (uS/cm)	156.7
Sp. Cond.(uS/cm)	172.5

Dominant Species

CLJA, UNSE, CIME
EICR
TADI, QUVI, PEBO, SAPA, MAVI

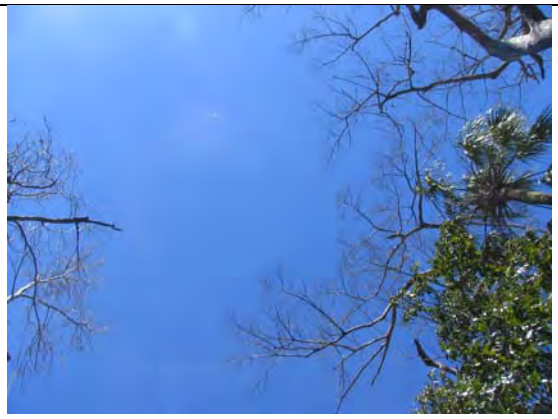
APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 5.5 Stn (3/8/2005 13:24)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	JC-6.0
Latitude	29.20707
Longitude	81.68455
Depth (ft)	4.08
Width (m)	9
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.29
Light Attenuation	1.904

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	3.0	1.0	37.5	17.5

Field Parameters

DO (mg/L)	6.91
DO (%)	76.6
Temp (C)	20.4
pH (SU)	7.28
Conductivity (uS/cm)	161.3
Sp. Cond.(uS/cm)	177.5

Dominant Species

CRAM, UNGR
AQMO, BEAL
TADI, PEBO, SAPA, MAVI

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 6.0 Stn (3/8/2005 13:36)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-6.5
Latitude	29.21040
Longitude	81.68311
Depth (ft)	3.25
Width (m)	11
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.35
Light Attenuation	2.863

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	---	---	---	62.5

Field Parameters

DO (mg/L)	6.94
DO (%)	77.0
Temp (C)	20.4
pH (SU)	7.27
Conductivity (uS/cm)	163.1
Sp. Cond.(uS/cm)	179.6

Dominant Species

TADI, QUHE, PEBO, ACRU

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 6.5 Stn (3/8/2005 13:51)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-7.0
Latitude	29.21331
Longitude	81.68108
Depth (ft)	4.68
Width (m)	11
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.33
Light Attenuation	3.765

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	---	---	62.5

Field Parameters

DO (mg/L)	6.97
DO (%)	77.6
Temp (C)	20.4
pH (SU)	7.30
Conductivity (uS/cm)	168.9
Sp. Cond.(uS/cm)	185.0

Dominant Species

EICR

TADI, PEBO, SAPA, MAVI, MYCE

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 7.0 Stn (3/8/2005 14:05)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-7.5
Latitude	29.21740
Longitude	81.67977
Depth (ft)	5.50
Width (m)	30
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.10
Light Attenuation	2.044

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
37.5	37.5	17.5	17.5	3.0

Field Parameters

DO (mg/L)	6.88
DO (%)	76.1
Temp (C)	20.5
pH (SU)	7.33
Conductivity (uS/cm)	252.1
Sp. Cond.(uS/cm)	284.9

Dominant Species

SCSP, TYLA, CLJA, UNSE
EICR, PIST, HYUM
VAAM, BEAL
TADI, QUVI, SAPA, MAVI, MYCE

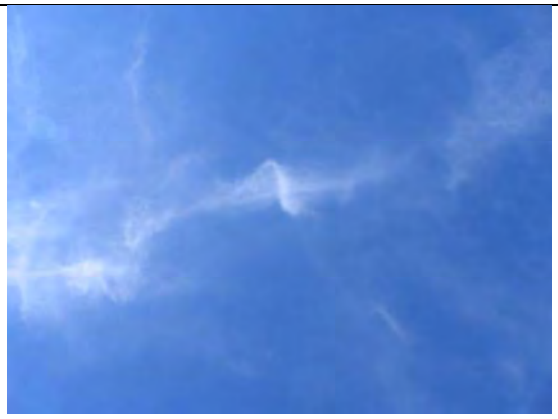
APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 7.5 Stn (3/8/2005 14:19)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	JC-8.0
Latitude	29.22146
Longitude	81.67954
Depth (ft)	1.95
Width (m)	52
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.67
Light Attenuation	2.205

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
37.5	62.5	17.5	37.5	3.0

Field Parameters

DO (mg/L)	7.16
DO (%)	80.0
Temp (C)	20.9
pH (SU)	7.45
Conductivity (uS/cm)	406.5
Sp. Cond.(uS/cm)	434.4

Dominant Species

CRAM, UNGR, CIME
EICR, PIST, HYUM
VAAM, BEAL
QUHE, PEBO, SAPA

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 8.0 Stn (3/8/2005 14:34)

Upstream

Left Bank

Downstream – NO PICTURE

Right Bank

Canopy

Physical Parameters

Station	JC-8.5
Latitude	29.22257
Longitude	81.67553
Depth (ft)	4.10
Width (m)	9
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.18
Light Attenuation	---

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
---	17.5	3.0	7.5	82.5

Field Parameters

DO (mg/L)	7.02
DO (%)	79.0
Temp (C)	21.1
pH (SU)	7.55
Conductivity (uS/cm)	579.0
Sp. Cond.(uS/cm)	628.0

Dominant Species

SUCE, CIME
VAAM
PEBO, SAPA, MAVI, MYCE

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 8.5 Stn (3/8/2005 14:46)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-9.0
Latitude	29.22192
Longitude	81.67071
Depth (ft)	4.20
Width (m)	41
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.60
Light Attenuation	2.042

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	82.5	17.5	---	1.0

Field Parameters

DO (mg/L)	7.12
DO (%)	83.1
Temp (C)	21.4
pH (SU)	7.61
Conductivity (uS/cm)	855.0
Sp. Cond.(uS/cm)	870.0

Dominant Species

SCSP, TYLA, CLJA, UNGR
EICR, NAGU, VAAM
QUHE, PEBO, SAPA

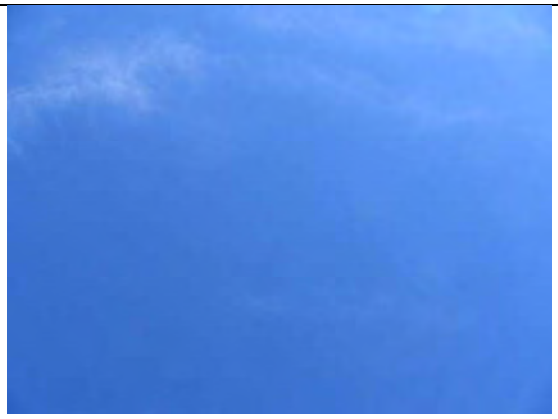
APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 9.0 Stn (3/8/2005 14:58)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	JC-9.5
Latitude	29.22246
Longitude	81.66588
Depth (ft)	3.25
Width (m)	40
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.04
Light Attenuation	2.223

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	37.5	62.5	7.5	1.0

Field Parameters

DO (mg/L)	7.58
DO (%)	85.9
Temp (C)	21.5
pH (SU)	7.72
Conductivity (uS/cm)	901.0
Sp. Cond.(uS/cm)	966.0

Dominant Species

SCSP, TYLA, UNGR, EICR
HYUM
QUHE, PEBO, SAPA, PICL, MYCE

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 9.5 Stn (3/8/2005 15:12)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	JC-10.0
Latitude	29.21987
Longitude	81.66272
Depth (ft)	4.45
Width (m)	12
Secchi Depth (ft)	Bottom
Velocity (ft/s)	2.15
Light Attenuation	7.874

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	62.5	17.5	17.5	62.5

Field Parameters

DO (mg/L)	7.72
DO (%)	87.7
Temp (C)	21.7
pH (SU)	7.73
Conductivity (uS/cm)	1054.0
Sp. Cond.(uS/cm)	1130.0

Dominant Species

CLJA, UNGR
EICR, BEAL
QUVI, SAPA, MAVI, MYCE

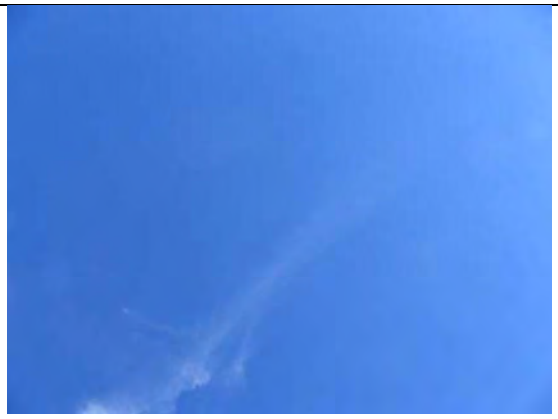
APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 10.0 Stn (3/8/2005 15:32)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	JC-10.5
Latitude	29.21768
Longitude	81.65858
Depth (ft)	2.20
Width (m)	41
Secchi Depth (ft)	Bottom
Velocity (ft/s)	0.97
Light Attenuation	3.476

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	3.0	37.5	1.0	1.0

Field Parameters

DO (mg/L)	7.22
DO (%)	82.5
Temp (C)	21.9
pH (SU)	7.77
Conductivity (uS/cm)	1298.0
Sp. Cond.(uS/cm)	1384.0

Dominant Species

TYLA, SLJA, UNGR
EICR
QUVI, SAPA, MYCE

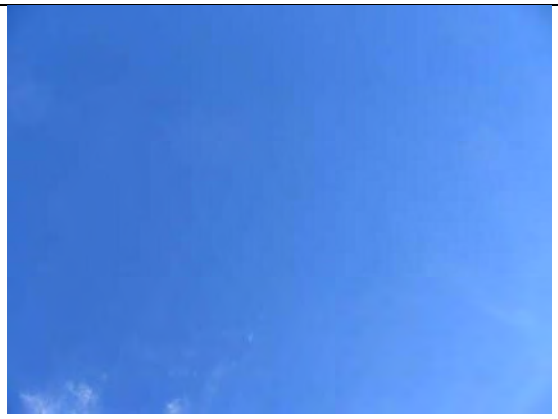
APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 10.5 Stn (3/8/2005 15:45)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	JC-11.0
Latitude	29.21456
Longitude	81.65546
Depth (ft)	2.55
Width (m)	40
Secchi Depth (ft)	Bottom
Velocity (ft/s)	1.48
Light Attenuation	3.068

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	---	62.5	3.0	1.0

Field Parameters

DO (mg/L)	7.37
DO (%)	84.0
Temp (C)	21.9
pH (SU)	7.79
Conductivity (uS/cm)	1314.0
Sp. Cond.(uS/cm)	1403.0

Dominant Species

CLJA, CRAM, UNGR
EICR, PIST, HYUM
MYCE

APPENDIX A-3. Juniper Creek Stream Reach Reconnaissance – JC 11.0 Stn (3/8/2005 15:55)

JUNIPER CREEK STREAM REACH RECONNAISSANCE - 3/8/2005

	Location						Water Quality Field Parameters							
Time	Station	Linear Distance (km)	Latitude	Longitude	Depth (ft)	Width (m)	DO (mg/L)	DO (%)	Temp (C)	pH (SU)	Cond (uS/cm)	SpCond (uS/cm)	Secchi Depth (ft)	Velocity (ft/s)
10:05	JC-0.0	0.0	29.18433	81.71199	1.93	4	6.79	77.2	21.8	8.53	99.3	105.7	bottom	0.44
10:38	JC-0.5	0.5	29.18513	81.70819	2.24	5	6.76	76.0	21.1	7.52	102.0	110.5	bottom	0.96
11:13	JC-1.0	1.0	29.18452	81.70401	2.05	18	6.46	72.6	21.1	7.62	110.4	119.9	bottom	0.91
11:28	JC-1.5	1.5	29.18361	81.69958	5.79	23	6.59	73.4	20.8	7.37	109.2	119.2	bottom	0.65
11:42	JC-2.0	2.0	29.18149	81.69571	2.58	13	6.33	70.6	20.6	7.28	117.8	129.1	bottom	1.08
11:54	JC-2.5	2.5	29.18216	81.69141	3.69	16	6.12	68.0	20.6	7.24	126.5	138.7	bottom	0.48
12:09	JC-3.0	3.0	29.18489	81.68800	5.50	14	6.09	67.1	20.5	7.22	125.1	137.4	bottom	0.62
12:23	JC-3.5	3.5	29.18839	81.68493	2.62	9	5.94	66.0	20.4	7.19	128.6	141.0	bottom	0.79
12:37	JC-4.0	4.0	29.19233	81.68349	2.90	20	6.42	71.2	20.5	7.30	128.7	141.4	bottom	0.99
12:51	JC-4.5	4.5	29.19526	81.68130	4.96	12	6.71	74.6	20.6	7.27	145.6	159.6	bottom	0.58
13:04	JC-5.0	5.0	29.19945	81.68204	6.10	17	6.80	75.5	20.5	7.26	150.4	165.3	bottom	0.62
13:24	JC-5.5	5.5	29.20312	81.68464	4.23	18	6.86	76.3	20.5	7.34	156.7	172.5	bottom	0.82
13:36	JC-6.0	6.0	29.20707	81.68455	4.08	9	6.91	76.6	20.4	7.28	161.3	177.5	bottom	1.29
13:51	JC-6.5	6.5	29.21040	81.68311	3.25	11	6.94	77.0	20.4	7.27	163.1	179.6	bottom	1.35
14:05	JC-7.0	7.0	29.21331	81.68108	4.68	11	6.97	77.6	20.4	7.30	168.9	185.0	bottom	1.33
14:19	JC-7.5	7.5	29.21740	81.67977	5.50	30	6.88	76.1	20.5	7.33	252.1	284.9	bottom	1.10
14:34	JC-8.0	8.0	29.22146	81.67954	1.95	52	7.16	80.0	20.9	7.45	406.5	434.4	bottom	1.67
14:46	JC-8.5	8.5	29.22257	81.67553	4.10	9	7.02	79.0	21.1	7.55	579.0	628.0	bottom	1.18
14:58	JC-9.0	9.0	29.22192	81.67071	4.20	41	7.12	83.1	21.4	7.61	855.0	870.0	bottom	1.60
15:12	JC-9.5	9.5	29.22246	81.66588	3.25	*40*	7.58	85.9	21.5	7.72	901.0	966.0	bottom	1.04
15:32	JC-10.0	10.0	29.21987	81.66272	4.45	*12*	7.72	87.7	21.7	7.73	1054.0	1130.0	bottom	2.15
15:45	JC-10.5	10.5	29.21768	81.65858	2.20	41	7.22	82.5	21.9	7.77	1298.0	1384.0	bottom	0.97
15:55	JC-11.0	11.0	29.21456	81.65546	2.55	40	7.37	84.0	21.9	7.79	1314.0	1403.0	bottom	1.48

JUNIPER CREEK STREAM REACH RECONNAISSANCE - 3/8/2005

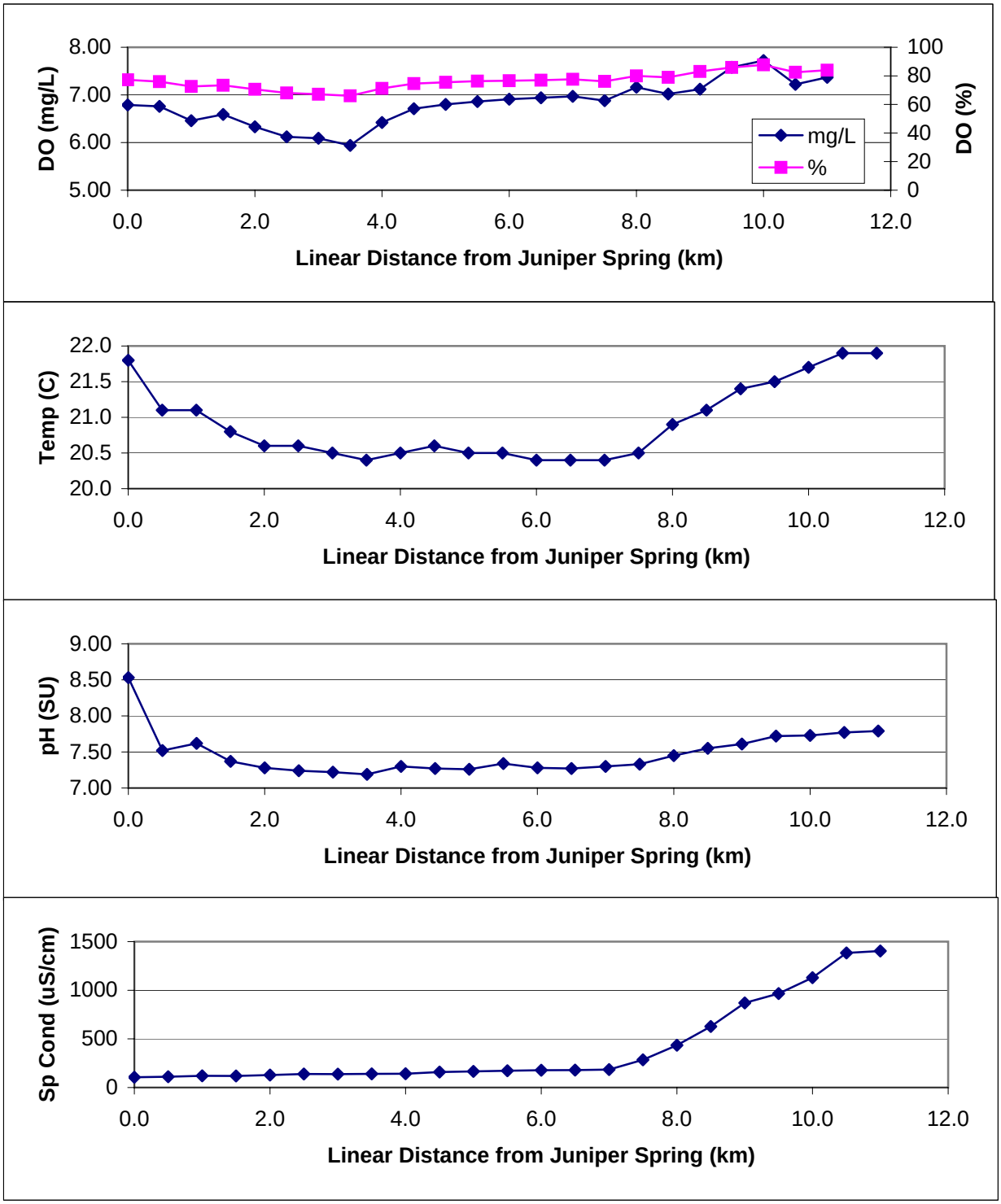
	Location				Percent Cover (%)					
Time	Station	Linear Distance (km)	Latitude	Longitude	FAP	SAV	EMA	ALG (Surface)	ALG (Benthic)	Canopy
10:05	JC-0.0	0.0	29.18433	81.71199					7.5	62.5
10:38	JC-0.5	0.5	29.18513	81.70819					3.0	82.5
11:13	JC-1.0	1.0	29.18452	81.70401		62.5	3.0			62.5
11:28	JC-1.5	1.5	29.18361	81.69958		17.5	3.0		17.5	37.5
11:42	JC-2.0	2.0	29.18149	81.69571		17.5	3.0		17.5	82.5
11:54	JC-2.5	2.5	29.18216	81.69141	1.0		3.0		?	37.5
12:09	JC-3.0	3.0	29.18489	81.68800		?	1.0		?	3.0
12:23	JC-3.5	3.5	29.18839	81.68493			3.0		?	82.5
12:37	JC-4.0	4.0	29.19233	81.68349	3.0		1.0		17.5	3.0
12:51	JC-4.5	4.5	29.19526	81.68130			1.0		?	7.5
13:04	JC-5.0	5.0	29.19945	81.68204			3.0		?	7.5
13:24	JC-5.5	5.5	29.20312	81.68464	1.0		3.0			7.5
13:36	JC-6.0	6.0	29.20707	81.68455		3.0	1.0		37.5	17.5
13:51	JC-6.5	6.5	29.21040	81.68311						62.5
14:05	JC-7.0	7.0	29.21331	81.68108	1.0					62.5
14:19	JC-7.5	7.5	29.21740	81.67977	37.5	37.5	17.5		17.5	3.0
14:34	JC-8.0	8.0	29.22146	81.67954	37.5	62.5	17.5		37.5	3.0
14:46	JC-8.5	8.5	29.22257	81.67553		17.5	3.0		7.5	82.5
14:58	JC-9.0	9.0	29.22192	81.67071	7.5	82.5	17.5			1.0
15:12	JC-9.5	9.5	29.22246	81.66588	17.5	37.5	62.5		7.5	1.0
15:32	JC-10.0	10.0	29.21987	81.66272	1.0	62.5	17.5		17.5	62.5
15:45	JC-10.5	10.5	29.21768	81.65858	7.5	3.0	37.5		1.0	1.0
15:55	JC-11.0	11.0	29.21456	81.65546	7.5		62.5		3.0	1.0

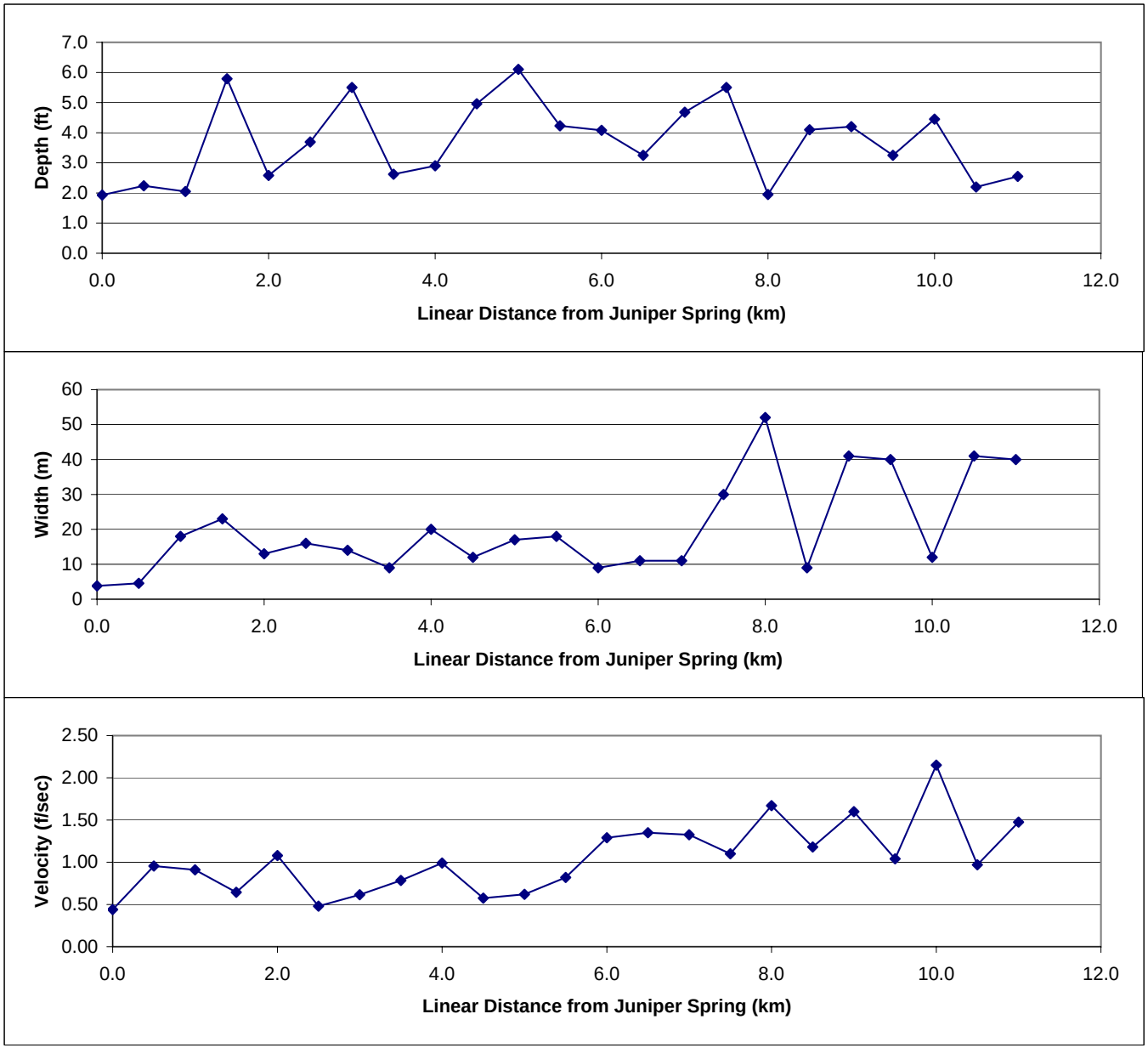
JUNIPER CREEK STREAM REACH RECONNAISSANCE - 3/8/2005

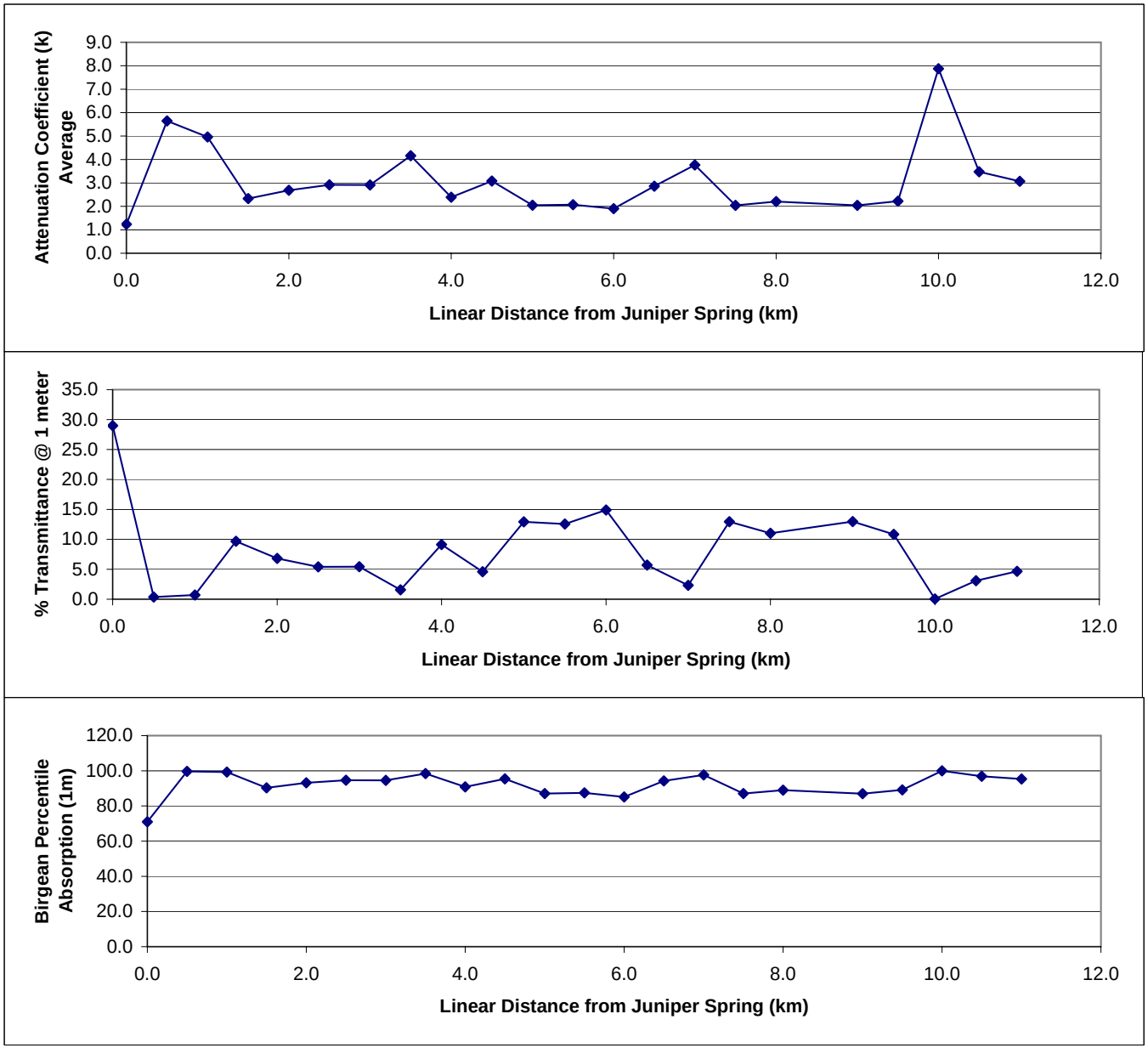
	Location																																
Time	Station	Linear Distance (km)	Latitude	Longitude	Bulrush (*Scripus* sp.)	Cattail (*Typha latifolia*)	Climbing Hempweed (*Mikania scandens*)	Lizard's tail (*Saururus cernuus*)	Pickerel Weed (*Pontederia cordata*)	Sawgrass (*Cladium jamaicense*)	Swamp lily (*Crinum americanum*)	Unknown Grass	Unknown Sedge	Water hemlock (*Cicuta mexicana*)	Aquatic Moss	Water hyacinth (*Eichhornia crassipes*)	Water lettuce (*Pistia stratiotes*)	Water pennyworts (*Hydrocotyle umbellata*)	Southern Naiad (*Najas guadalupensis*)	Strap-leaf sagittaria (*Sagittaria* spp.)	Tape grass (*Vallisneria americana*)	Benthic Algae	Bald Cypress (*Taxodium distichum*)	Laurel Oak (*Quercus hemisphearica*)	Live Oak (*Quercus virginiana*)	Red Bay (*Persea borbonia*)	Red Cedar (*Juniperus virginiana*)	Red Maple (*Acer rubrum*)	Sabal Palm (*Sabal palmetto*)	Sand Pine (*Pinus clausa*)	Sweet Bay (*Magnolia virginiana*)	Wax Myrtle (*Myrica cerifera*)
10:05	JC-0.0	0.0	29.18433	81.71199																				X		X			X				
10:38	JC-0.5	0.5	29.18513	81.70819																						X		X	X				
11:13	JC-1.0	1.0	29.18452	81.70401										X						X						X		X	X				
11:28	JC-1.5	1.5	29.18361	81.69958			X		X	X										X		X			X	X							
11:42	JC-2.0	2.0	29.18149	81.69571						X				X							X	X	X		X	X		X	X				X
11:54	JC-2.5	2.5	29.18216	81.69141			X				X		X			X							X			X	X	X					
12:09	JC-3.0	3.0	29.18489	81.68800										X										X		X		X	X				
12:23	JC-3.5	3.5	29.18839	81.68493							X			X									X		X	X			X				
12:37	JC-4.0	4.0	29.19233	81.68349						X			X	X		X						X	X	X		X		X	X				X
12:51	JC-4.5	4.5	29.19526	81.68130						X													X	X				X	X				
13:04	JC-5.0	5.0	29.19945	81.68204										X									X		X	X		X	X				X
13:24	JC-5.5	5.5	29.20312	81.68464						X			X	X		X							X		X	X			X			X	
13:36	JC-6.0	6.0	29.20707	81.68455							X	X			X							X	X			X			X			X	
13:51	JC-6.5	6.5	29.21040	81.68311																			X	X		X		X					
14:05	JC-7.0	7.0	29.21331	81.68108												X							X			X			X			X	X
14:19	JC-7.5	7.5	29.21740	81.67977	X	X				X			X			X	X	X			X	X	X		X				X			X	X
14:34	JC-8.0	8.0	29.22146	81.67954							X	X		X		X	X	X			X	X		X		X			X				
14:46	JC-8.5	8.5	29.22257	81.67553				X						X							X					X			X			X	X
14:58	JC-9.0	9.0	29.22192	81.67071	X	X				X		X				X			X		X			X		X			X				
15:12	JC-9.5	9.5	29.22246	81.66588	X	X						X				X		X						X		X			X	X			X
15:32	JC-10.0	10.0	29.21987	81.66272						X		X				X						X			X				X			X	X
15:45	JC-10.5	10.5	29.21768	81.65858		X				X		X				X									X				X				X
15:55	JC-11.0	11.0	29.21456	81.65546						X	X	X				X	X	X															X

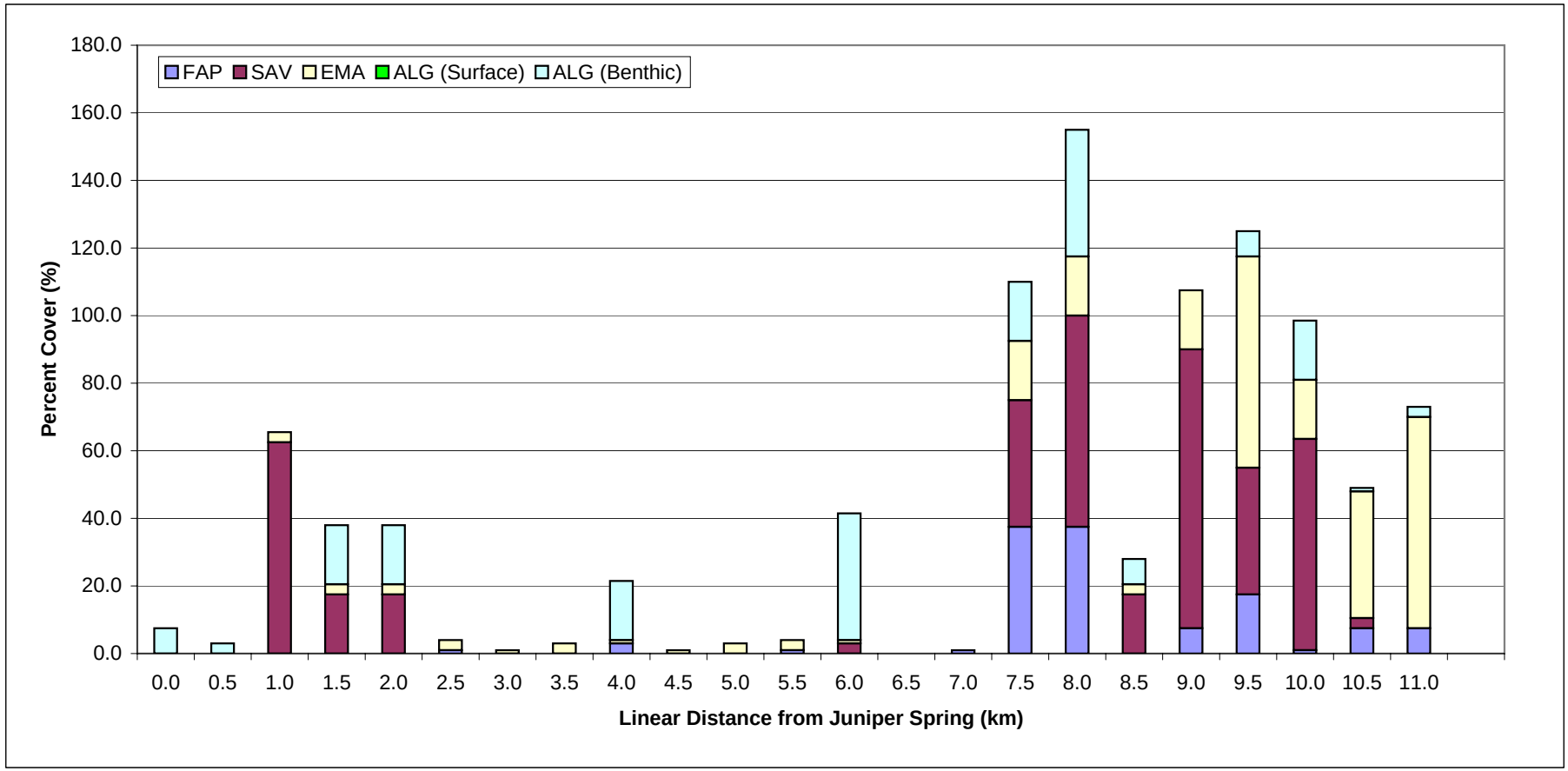
JUNIPER CREEK STREAM REACH RECONNAISSANCE - 3/8/2005

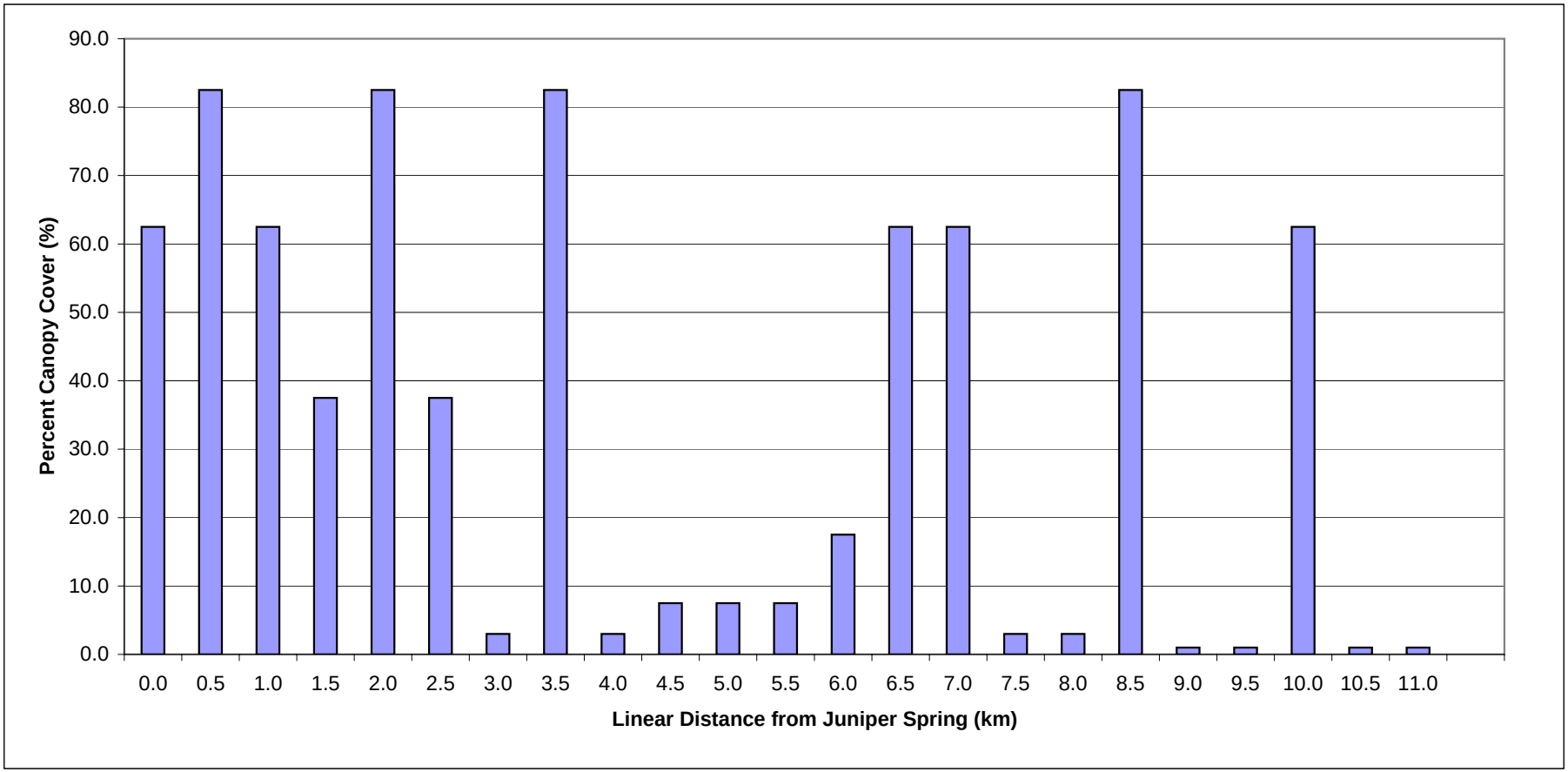
	Location				Light Transmission (umol/s/m2) / Depth (ft)								Light Attenuation Est.			
Time	Station	Linear Distance (km)	Latitude	Longitude	Air	Surface	1.0	2.0	3.0	4.0	5.0	6.0	k Average	Percent Transmittance @ 1 meter	Birgean Percentile Absorption (1m)	Notes
10:05	JC-0.0	0.0	29.18433	81.71199	365.8	383.9	263.2						1.238	29.0	71.0	
10:38	JC-0.5	0.5	29.18513	81.70819	529.2	692.3	123.8						5.646	0.4	99.6	
11:13	JC-1.0	1.0	29.18452	81.70401	1142.0	726.7	160.1						4.963	0.7	99.3	
11:28	JC-1.5	1.5	29.18361	81.69958	985.4	724.7	338.8	192.4					2.335	9.7	90.3	
11:42	JC-2.0	2.0	29.18149	81.69571	1600.1	744.6	328.4						2.686	6.8	93.2	
11:54	JC-2.5	2.5	29.18216	81.69141	1259.5	1178.1	504.4	183.0					2.919	5.4	94.6	can't see bottom to quanify benthic algae
12:09	JC-3.0	3.0	29.18489	81.68800	1649.4	1515.3	592.5	209.1	167.1				2.914	5.4	94.6	can't see bottom to quanify benthic algae/SAV
12:23	JC-3.5	3.5	29.18839	81.68493	1095.3	921.7	259.5						4.158	1.6	98.4	can't see bottom to quanify benthic algae
12:37	JC-4.0	4.0	29.19233	81.68349	1610.3	1482.8	723.7	336.4					2.393	9.1	90.9	
12:51	JC-4.5	4.5	29.19526	81.68130	817.5	1021.5	275.1	198.1	130.1				3.083	4.6	95.4	can't see bottom to quanify benthic algae
13:04	JC-5.0	5.0	29.19945	81.68204	1398.0	1250.9	642.4	322.3	210.4	135.4			2.046	12.9	87.1	can't see bottom to quanify benthic algae
13:24	JC-5.5	5.5	29.20312	81.68464	1723.2	1411.0	735.7	384.0	236.9				2.074	12.6	87.4	
13:36	JC-6.0	6.0	29.20707	81.68455	1571.9	1445.5	916.2	375.5	231.2				1.904	14.9	85.1	
13:51	JC-6.5	6.5	29.21040	81.68311	1367.1	1208.0	484.8	228.6					2.863	5.7	94.3	
14:05	JC-7.0	7.0	29.21331	81.68108	828.1	1212.0	266.6	120.1	119.4				3.765	2.3	97.7	
14:19	JC-7.5	7.5	29.21740	81.67977	1539.5	1369.6	672.8	384.1	233.9	147.7			2.044	12.9	87.1	
14:34	JC-8.0	8.0	29.22146	81.67954	1341.1	1232.5	629.4						2.205	11.0	89.0	
14:46	JC-8.5	8.5	29.22257	81.67553									#N/A	#N/A	#N/A	
14:58	JC-9.0	9.0	29.22192	81.67071	1436.0	1335.7	714.2	387.6					2.042	13.0	87.0	
15:12	JC-9.5	9.5	29.22246	81.66588	1218.8	1148.7	557.6	295.7	172.7				2.223	10.8	89.2	est. width
15:32	JC-10.0	10.0	29.21987	81.66272	831.9	752.1	59.3	8.2					7.874	0.0	100.0	est. width
15:45	JC-10.5	10.5	29.21768	81.65858	1246.7	940.7	326.1						3.476	3.1	96.9	
15:55	JC-11.0	11.0	29.21456	81.65546	999.3	1257.9	493.8						3.068	4.7	95.3	

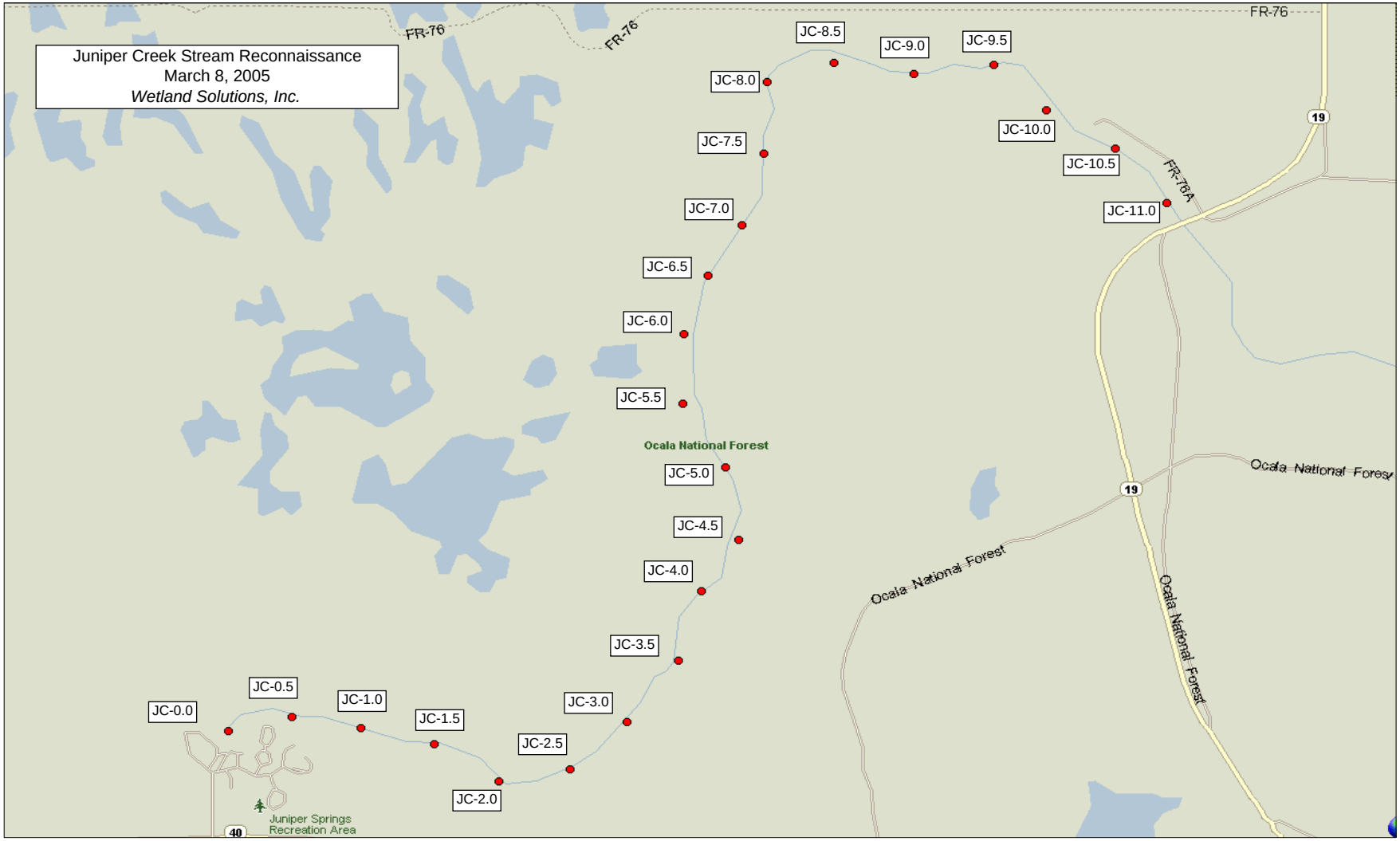

DO (mg/L)
8.00
7.00
6.00
5.00
DO (%)
100
80
60
40
20
0
mg/L
%
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Juniper Spring (km)
Temp (C)
22.0
21.5
21.0
20.5
20.0
Linear Distance from Juniper Spring (km)
pH (SU)
9.00
8.50
8.00
7.50
7.00
Linear Distance from Juniper Spring (km)
Sp Cond (uS/cm)
1500
1000
500
0
Linear Distance from Juniper Spring (km)


Depth (ft)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Juniper Spring (km)
Width (m)
60
50
40
30
20
10
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Juniper Spring (km)
Velocity (f/sec)
2.50
2.00
1.50
1.00
0.50
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Juniper Spring (km)


Attenuation Coefficient (k) Average
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Juniper Spring (km)
% Transmittance @ 1 meter
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Juniper Spring (km)
Birgean Percentile Absorption (1m)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Juniper Spring (km)


FAP
SAV
EMA
ALG (Surface)
ALG (Benthic)
Percent Cover (%)
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
Linear Distance from Juniper Spring (km)


90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percent Canopy Cover (%)
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0
Linear Distance from Juniper Spring (km)


Juniper Creek Stream Reconnaissance
March 8, 2005
Wetland Solutions, Inc.
FR-76
FR-76
FR-76
FR-76A
JC-0.0
JC-0.5
JC-1.0
JC-1.5
JC-2.0
JC-2.5
JC-3.0
JC-3.5
JC-4.0
JC-4.5
JC-5.0
JC-5.5
JC-6.0
JC-6.5
JC-7.0
JC-7.5
JC-8.0
JC-8.5
JC-9.0
JC-9.5
JC-10.0
JC-10.5
JC-11.0
Ocala National Forest
Ocala National Forest
Ocala National Forest
Ocala National Forest
19
19
40
Juniper Springs
Recreation Area

CODE	SCIENTIFIC NAME	COMMON NAME
ACRU	*Acer rubrum*	Red Maple
AQMO		Aquatic mosses
BEAL		Benthic Algae
CAAQ	*Carya aquatica*	Water Hickory
CACA	*Carpinus caroliniana*	American Hornbeam
CAFL	*Canna flaccida*	Golden canna
CEDE	*Ceratophyllum demersum*	Coontail
CIME	*Cicuta mexicana*	Water hemlock
CLJA	*Cladium jamaicense*	Sawgrass
COES	*Colocasia esculenta*	Wild Taro
CRAM	*Crinum americanum*	Swamp lily
EICR	*Eichhornia crassipes*	Water hyacinth
EUBU	*Eugenia buxifolia*	Iron wood
FERN		Ferns
HYRA	*Hydrocotyle ranunculoides*	Water pennyworts
HYUM	*Hydrocotyle umbellata*	Water pennyworts
ILCA	Ilex cassine	Dahoon Holly
ISSP	*Iris sp.*	Iris
JUSP	*Juncus sp.*	Rushes
JUVI	Juniperus virginiana	Red Cedar
LESP	*Lemna sp.*	Duckweed
LIST	*Liquidambar styraciflua*	Sweetgum
LUSP	*Ludwigia sp.*	Water primrose
MAGR	*Magnolia grandiflora*	Southern Magnolia
MAVI	*Magnolia virginiana*	Sweet Bay
MISC	*Mikania scandens*	Climbing Hempweed
MYCE	*Myrica cerifera*	Wax Myrtle
NIFL	*Nitella flexilis*	Stonewort
NULU	*Nuphar luteum*	Spatterdock
PEBO	*Persea borbonia*	Red Bay
PEVI	*Peltandra virginica*	Arrow arum
PHAU	Phragmites australis	Common Reed
PIST	*Pistia stratiotes*	Water lettuce
PITA	*Pinus taeda*	Loblolly Pine
POCO	*Pontederia cordata*	Pickerel Weed
QUHE	*Quercus hemisphearica*	Laurel Oak
QUNI	*Quercus nigra*	Water Oak
QUPH	*Quercus phellos*	Willow Oak
QUVI	*Quercus virginiana*	Live Oak
SACE	*Saururus cernuus*	Lizard's tail
SALA	*Sagittaria lancifolia*	Arrowhead
SAPA	*Sabal palmetto*	Sabal Palm
SASP	*Sagittaria sp.*	Strap-leaf sagittaria
SASP	*Salix sp.*	Willow
SCSP	*Scripus sp.*	Bulrush
TADI	*Taxodium distichum*	Bald Cypress
TIAM	*Tilia americana*	Basswood
TYLA	*Typha latifolia*	Cattail
ULAM	*Ulmus americana*	Water elm
UNGR		Unknown Grass
UNSE		Unknown Sedge
VAAM	*Vallisneria americana*	Tape grass

Appendix A-4

Alexander Spring Creek Stream System Reach Reconnaissance Detailed Data

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-0.0
Latitude	29.08192
Longitude	81.57672
Depth (ft)	3.15
Width (m)	62
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.34
Light Attenuation	0.504

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	17.5	1.0	98.0	1.0

Field Parameters

DO (mg/L)	1.57
DO (%)	18.4
Temp (C)	23.4
pH (SU)	8.05
Conductivity (uS/cm)	888
Sp. Cond.(uS/cm)	920

Dominant Species

TYLA, PHAU, POCO
NULU, EICR, HYUM, NAGU, BEAL
QUHE, JUVI, ACRU, SAPA, LIST
MYCE

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC-0.0 Stn (3/9/2005 10:26)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-0.5
Latitude	29.08534
Longitude	81.57742
Depth (ft)	6.60
Width (m)	62
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.43
Light Attenuation	0.672

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	3.0	3.0	8.5	3.0

Field Parameters

DO (mg/L)	3.17
DO (%)	36.7
Temp (C)	22.7
pH (SU)	8.07
Conductivity (uS/cm)	883
Sp. Cond.(uS/cm)	930

Dominant Species

SALA, POCO, CLJA
LESP, NULU, EICR, PIST, HYUM
CEDE, NAGU, VAAM
PEBO, ACRU

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 0.5 Stn (3/9/2005 10:46)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-1.0
Latitude	29.08564
Longitude	81.57269
Depth (ft)	2.63
Width (m)	31
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.59
Light Attenuation	1.256

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	100.0	3.0	---	3.0

Field Parameters

DO (mg/L)	3.05
DO (%)	34.6
Temp (C)	22.4
pH (SU)	7.94
Conductivity (uS/cm)	871
Sp. Cond.(uS/cm)	922

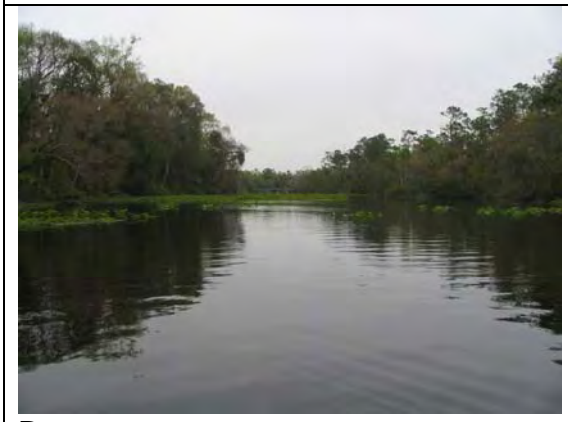
Dominant Species

POCO, CLJA, CIME
LESP, NULU, EICR, HYUM
VAAM
PEBO, ACRU, MYCE

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 1.0 Stn (3/9/2005 11:04)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-1.5
Latitude	29.08559
Longitude	81.56849
Depth (ft)	2.62
Width (m)	53
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.28
Light Attenuation	1.627

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	62.5	17.5	62.5	3.0

Field Parameters

DO (mg/L)	4.11
DO (%)	46.5
Temp (C)	21.6
pH (SU)	7.86
Conductivity (uS/cm)	809
Sp. Cond.(uS/cm)	868

Dominant Species

SALA, SCSP, CLJA, CIME
NULU, HYUM
VAAM, BEAL
QUHE, PEBO, ACRU, SAPA, LIST
MYCE

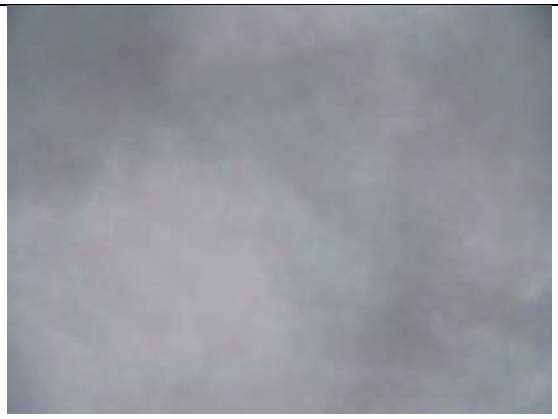
APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 1.5 Stn (3/9/2005 11:17)

Upstream

Left Bank

Downstream

Right Bank



Canopy

Physical Parameters

Station	ASC-2.0
Latitude	29.08163
Longitude	81.56636
Depth (ft)	1.97
Width (m)	69
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.16
Light Attenuation	2.189

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	82.5	3.0	35.0	1.0

Field Parameters

DO (mg/L)	5.59
DO (%)	63.0
Temp (C)	21.3
pH (SU)	7.97
Conductivity (uS/cm)	808
Sp. Cond.(uS/cm)	875

Dominant Species

SCSP, TYLA, UNGR, CIME
EICR, VAAM
TADI, QUVI, PITA, PEBO, ACRU

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 2.0 Stn (3/9/2005 11:30)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-2.5
Latitude	29.07704
Longitude	81.56677
Depth (ft)	2.22
Width (m)	76
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.11
Light Attenuation	

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	37.5	37.5	?	3.0

Field Parameters

DO (mg/L)	5.65
DO (%)	63.0
Temp (C)	20.9
pH (SU)	7.92
Conductivity (uS/cm)	804
Sp. Cond.(uS/cm)	876

Dominant Species

POCO, CRAM, UNGR, CIME
NULU, EICR, HYUM
VAAM
TADI, QUHE, JUVI, ACRU, SAPA
LIST, MYCE

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 2.5 Stn (3/9/2005 11:52)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-3.0
Latitude	29.07270
Longitude	81.56691
Depth (ft)	2.41
Width (m)	57
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.72
Light Attenuation	2.326

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	?	17.5	?	3.0

Field Parameters

DO (mg/L)	5.52
DO (%)	61.4
Temp (C)	20.5
pH (SU)	7.85
Conductivity (uS/cm)	784
Sp. Cond.(uS/cm)	860

Dominant Species

TYLA, CIME
NULU, HYUM
QUHE, PEBO, ACRU, SAPA

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 3.0 Stn (3/9/2005 12:06)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-3.5
Latitude	29.06870
Longitude	81.56592
Depth (ft)	3.12
Width (m)	59
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.34
Light Attenuation	2.101

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	?	1.0	?	1.0

Field Parameters

DO (mg/L)	5.43
DO (%)	59.4
Temp (C)	20.1
pH (SU)	7.75
Conductivity (uS/cm)	783
Sp. Cond.(uS/cm)	869

Dominant Species

TYLA, CLJA, CIME
NULU, HYUM
QUVI, PITA, PEBO, JUVI, ACRU

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 3.5 Stn (3/9/2005 12:19)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-4.0
Latitude	29.06711
Longitude	81.56194
Depth (ft)	2.82
Width (m)	70
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.41
Light Attenuation	2.118

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	17.5	17.5	37.5	3.0

Field Parameters

DO (mg/L)	5.39
DO (%)	59.0
Temp (C)	19.8
pH (SU)	7.72
Conductivity (uS/cm)	777
Sp. Cond.(uS/cm)	868

Dominant Species

TYLA, POCO, UNGR, CIME
NULU, EICR, HYUM
VAAM, BEAL
PEBO, JUVI, SAPA

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 4.0 Stn (3/9/2005 12:32)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-4.5
Latitude	29.06509
Longitude	81.55752
Depth (ft)	2.24
Width (m)	70
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.81
Light Attenuation	2.966

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	---	17.5	62.5	3.0

Field Parameters

DO (mg/L)	5.58
DO (%)	61.4
Temp (C)	19.6
pH (SU)	7.73
Conductivity (uS/cm)	774
Sp. Cond.(uS/cm)	869

Dominant Species

POCO, CLJA, CRAM, UNGR, CIME
NULU, EICR, PIST, HYUM
BEAL
TADI, QUVI, PEBO, ACRU, SAPA

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 4.5 Stn (3/9/2005 12:45)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-5.0
Latitude	29.06289
Longitude	81.55326
Depth (ft)	1.90
Width (m)	77
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.32
Light Attenuation	2.147

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	37.5	17.5	37.5	1.0

Field Parameters

DO (mg/L)	6.15
DO (%)	66.9
Temp (C)	19.3
pH (SU)	7.79
Conductivity (uS/cm)	770
Sp. Cond.(uS/cm)	868

Dominant Species

SCSP, CLJA, UNGR, CIME
NULU, EICR, HYUM
VAAM, BEAL
TADI, QUVI, ACRU, SAPA

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 5.0 Stn (3/9/2005 12:59)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-5.5
Latitude	29.06196
Longitude	81.54870
Depth (ft)	2.40
Width (m)	84
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.27
Light Attenuation	2.891

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	---	7.5	?	1.0

Field Parameters

DO (mg/L)	6.37
DO (%)	68.3
Temp (C)	19.1
pH (SU)	7.80
Conductivity (uS/cm)	762
Sp. Cond.(uS/cm)	866

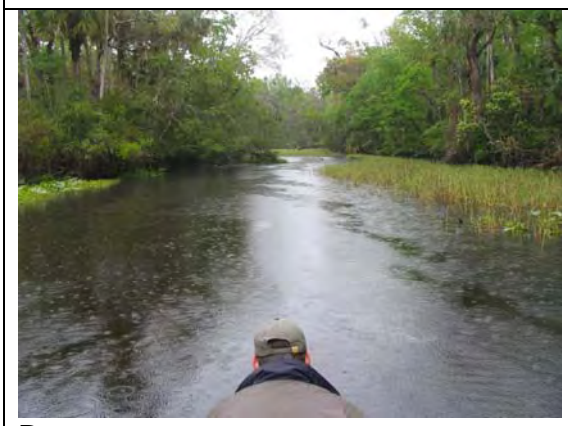
Dominant Species

SCSP, UNGR, CIME
NULU, EICR, PIST, HYUM
TADI, QUHE, ACRU, SAPA

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 5.5 Stn (3/9/2005 13:16)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-6.0
Latitude	29.06214
Longitude	81.54397
Depth (ft)	2.62
Width (m)	28
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.81
Light Attenuation	2.520

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	---	17.5	?	7.5

Field Parameters

DO (mg/L)	6.37
DO (%)	68.5
Temp (C)	18.8
pH (SU)	7.74
Conductivity (uS/cm)	758
Sp. Cond.(uS/cm)	863

Dominant Species

SALA, SCSP, UNGR, CIME
NULU, HYUM
TADI, PEBO, ACRU, SAPA, MYCE
SASP

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 6.0 Stn (3/9/2005 13:28)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-6.5
Latitude	29.06161
Longitude	81.53959
Depth (ft)	2.68
Width (m)	28
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.57
Light Attenuation	3.322

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	17.5	17.5	?	7.5

Field Parameters

DO (mg/L)	6.47
DO (%)	69.2
Temp (C)	18.6
pH (SU)	7.73
Conductivity (uS/cm)	727
Sp. Cond.(uS/cm)	833

Dominant Species

TYLA, UNGR, CIME
HYUM, VAAM
QUHE, ACRU, SAPA

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 6.5 Stn (3/9/2005 13:39)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-7.0
Latitude	29.06047
Longitude	81.53521
Depth (ft)	2.30
Width (m)	46
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.49
Light Attenuation	2.231

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
37.5	62.5	17.5	?	7.5

Field Parameters

DO (mg/L)	6.52
DO (%)	69.4
Temp (C)	18.5
pH (SU)	7.74
Conductivity (uS/cm)	757
Sp. Cond.(uS/cm)	871

Dominant Species

SCSP, POCO, CLJA, CRAM, UNSE
CIME, NULU, HYUM
VAAM
JUVI, ACRU, SAPA, LIST, MYCE

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 7.0 Stn (3/9/2005 13:50)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-7.5
Latitude	29.06008
Longitude	81.53101
Depth (ft)	4.44
Width (m)	26
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.53
Light Attenuation	2.357

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
3.0	7.5	3.0	3.0	7.5

Field Parameters

DO (mg/L)	6.51
DO (%)	69.2
Temp (C)	18.4
pH (SU)	7.72
Conductivity (uS/cm)	751
Sp. Cond.(uS/cm)	864

Dominant Species

IRSP, CRAM, CIME
NULU, VAAM
QUHE, SAPA, MYCE

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 7.5 Stn (3/9/2005 14:01)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-8.0
Latitude	29.05798
Longitude	81.52718
Depth (ft)	1.15
Width (m)	78
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.85
Light Attenuation	2.935

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	17.5	17.5	80.0	3.0

Field Parameters

DO (mg/L)	6.30
DO (%)	67.8
Temp (C)	18.2
pH (SU)	7.73
Conductivity (uS/cm)	752
Sp. Cond.(uS/cm)	867

Dominant Species

SALA, TYLA, POCO, CLJA, UNGR
CIME, NULU, HYUM
VAAM, BEAL
QUVI, PEBO, ACRU, SAPA

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 8.0 Stn (3/9/2005 14:15)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-8.5
Latitude	29.05616
Longitude	81.52311
Depth (ft)	2.62
Width (m)	18
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.90
Light Attenuation	2.495

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	---	7.5	37.5	17.5

Field Parameters

DO (mg/L)	6.71
DO (%)	70.3
Temp (C)	18.0
pH (SU)	7.71
Conductivity (uS/cm)	723
Sp. Cond.(uS/cm)	837

Dominant Species

CIME, HYUM, BEAL
TADI, QUHE, PEBO, SAPA, MYCE

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 8.5 Stn (3/9/2005 14:26)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-9.0
Latitude	29.05537
Longitude	81.51892
Depth (ft)	1.89
Width (m)	62
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.33
Light Attenuation	3.001

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	17.5	7.5	17.5	1.0

Field Parameters

DO (mg/L)	7.05
DO (%)	74.6
Temp (C)	17.9
pH (SU)	7.73
Conductivity (uS/cm)	720
Sp. Cond.(uS/cm)	836

Dominant Species

SCSP, TYLA, CIME
NULU, HYUM, VAAM
TADI, ACRU, SAPA, MYCE

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 9.0 Stn (3/9/2005 14:37)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-9.5
Latitude	29.05249
Longitude	81.51514
Depth (ft)	1.95
Width (m)	98
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.65
Light Attenuation	3.449

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
17.5	37.5	17.5	17.5	3.0

Field Parameters

DO (mg/L)	7.22
DO (%)	76.3
Temp (C)	18.0
pH (SU)	7.79
Conductivity (uS/cm)	732
Sp. Cond.(uS/cm)	848

Dominant Species

SALA, SCSP, POCO, UNGR, CIME
NULU, HYUM, NIFL, VAAM
TADI, PITA, ACRU, SAPA, MYCE
SASP

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 9.5 Stn (3/9/2005 14:49)

Upstream

Left Bank

Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-10.0
Latitude	29.04922
Longitude	81.51197
Depth (ft)	2.58
Width (m)	45
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.44
Light Attenuation	2.301

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
7.5	7.5	7.5	?	17.5

Field Parameters

DO (mg/L)	7.27
DO (%)	76.7
Temp (C)	18.0
pH (SU)	7.80
Conductivity (uS/cm)	729
Sp. Cond.(uS/cm)	845

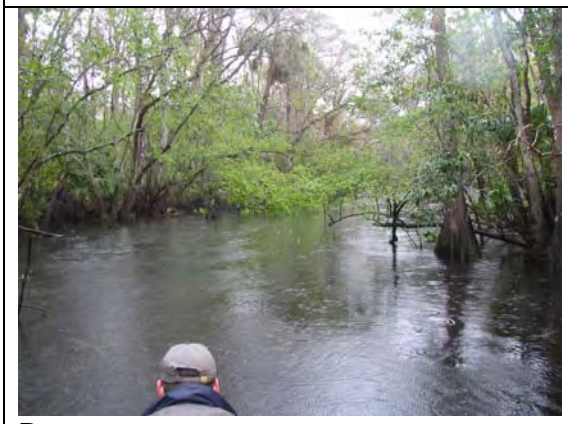
Dominant Species

SCSP, POCO, CIME
NULU, HYUM, NIFL
ILCA, ACRU, SAPA, MYCE, SASP

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 10.0 Stn (3/9/2005 15:00)

Upstream

Left Bank



Downstream

Right Bank

Canopy

Physical Parameters

Station	ASC-10.5
Latitude	29.04574
Longitude	81.50920
Depth (ft)	3.55
Width (m)	51
Secchi Depth (ft)	bottom
Velocity (ft/s)	0.68
Light Attenuation	2.899

Percent Cover (%)

FAP	SAV	EMA	ALG	Canopy
1.0	?	1.0	?	62.5

Field Parameters

DO (mg/L)	7.29
DO (%)	77.0
Temp (C)	18.0
pH (SU)	7.79
Conductivity (uS/cm)	728
Sp. Cond.(uS/cm)	845

Dominant Species

CRAM
EICR, HYUM
TADI, ILCA, ACRU, SAPA, MYCE

APPENDIX A-4. Alexander Spring Creek Stream Reach Reconnaissance – ASC 10.5 Stn (3/9/2005 15:11)

ALEXANDER SPRINGS CREEK STREAM REACH RECONNAISSANCE - 3/9/2005

	Location						Water Quality Field Parameters							
Time	Station	Linear Distance (km)	Latitude	Longitude	Depth (ft)	Width (m)	DO (mg/L)	DO (%)	Temp (C)	pH (SU)	Cond (uS/cm)	SpCond (uS/cm)	Secchi Depth (ft)	Velocity (ft/s)
10:26	ASC-0.0	0.0	29.08192	81.57672	3.15	62	1.57	18.4	23.4	8.05	888.0	920.0	bottom	0.34
10:46	ASC-0.5	0.5	29.08534	81.57742	6.60	*62*	3.17	36.7	22.7	8.07	883.0	930.0	bottom	0.43
11:04	ASC-1.0	1.0	29.08564	81.57269	2.63	31	3.05	34.6	22.4	7.94	871.0	922.0	bottom	0.59
11:17	ASC-1.5	1.5	29.08559	81.56849	2.62	53	4.11	46.5	21.6	7.86	809.0	868.0	bottom	0.28
11:30	ASC-2.0	2.0	29.08163	81.56636	1.97	69	5.59	63.0	21.3	7.97	808.0	875.0	bottom	0.16
11:52	ASC-2.5	2.5	29.07704	81.56677	2.22	76	5.65	63.0	20.9	7.92	804.0	876.0	bottom	0.11
12:06	ASC-3.0	3.0	29.07270	81.56691	2.41	57	5.52	61.4	20.5	7.85	784.0	860.0	bottom	0.72
12:19	ASC-3.5	3.5	29.06870	81.56592	3.12	59	5.43	59.4	20.1	7.75	783.0	869.0	bottom	0.34
12:32	ASC-4.0	4.0	29.06711	81.56194	2.82	70	5.39	59.0	19.8	7.72	777.0	868.0	bottom	0.41
12:45	ASC-4.5	4.5	29.06509	81.55752	2.24	70	5.58	61.4	19.6	7.73	774.0	869.0	bottom	0.81
12:59	ASC-5.0	5.0	29.06289	81.55326	1.90	77	6.15	66.9	19.3	7.79	770.0	868.0	bottom	0.32
13:16	ASC-5.5	5.5	29.06196	81.54870	2.40	84	6.37	68.3	19.1	7.80	762.0	866.0	bottom	0.27
13:28	ASC-6.0	6.0	29.06214	81.54397	2.62	28	6.37	68.5	18.8	7.74	758.0	863.0	bottom	0.81
13:39	ASC-6.5	6.5	29.06161	81.53959	2.68	28	6.47	69.2	18.6	7.73	727.0	833.0	bottom	0.57
13:50	ASC-7.0	7.0	29.06047	81.53521	2.30	46	6.52	69.4	18.5	7.74	757.0	871.0	bottom	0.49
14:01	ASC-7.5	7.5	29.06008	81.53101	4.44	26	6.51	69.2	18.4	7.72	751.0	864.0	bottom	0.53
14:15	ASC-8.0	8.0	29.05798	81.52718	1.15	78	6.30	67.8	18.2	7.73	752.0	867.0	bottom	0.85
14:26	ASC-8.5	8.5	29.05616	81.52311	2.62	18	6.71	70.3	18.0	7.71	723.0	837.0	bottom	0.90
14:37	ASC-9.0	9.0	29.05537	81.51892	1.89	62	7.05	74.6	17.9	7.73	720.0	836.0	bottom	0.33
14:49	ASC-9.5	9.5	29.05249	81.51514	1.95	98	7.22	76.3	18.0	7.79	732.0	848.0	bottom	0.65
15:00	ASC-10.0	10.0	29.04922	81.51197	2.58	45	7.27	76.7	18.0	7.80	729.0	845.0	bottom	0.44
15:11	ASC-10.5	10.5	29.04574	81.50920	3.55	51	7.29	77.0	18.0	7.79	728.0	845.0	bottom	0.68

ALEXANDER SPRINGS CREEK STREAM REACH RECONNAISSANCE - 3/9/2005

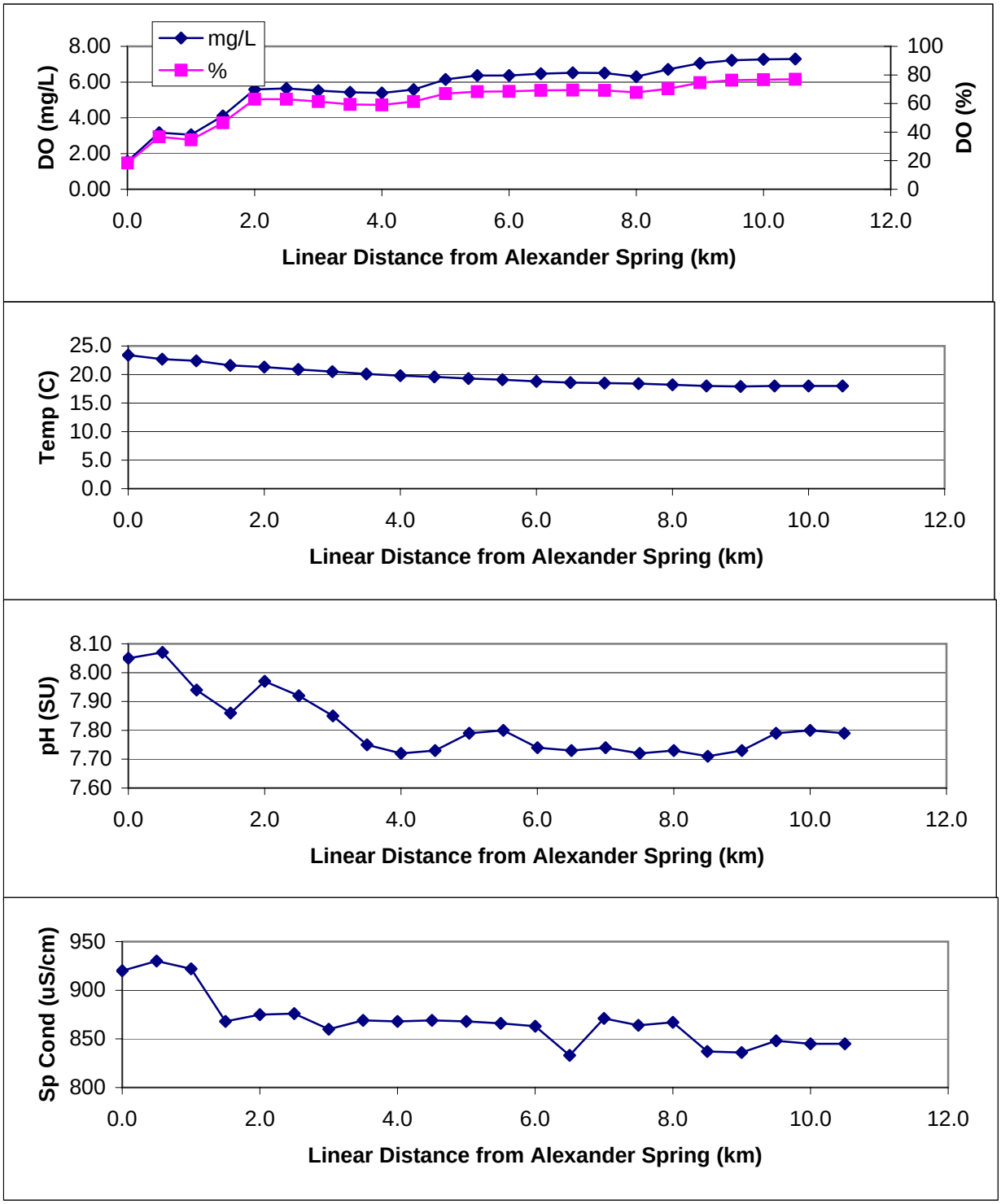
	Location				Percent Cover (%)					
Time	Station	Linear Distance (km)	Latitude	Longitude	FAP	SAV	EMA	ALG (Surface)	ALG (Benthic)	Canopy
10:26	ASC-0.0	0.0	29.08192	81.57672	1.0	17.5	1.0	1.0	97.0	1.0
10:46	ASC-0.5	0.5	29.08534	81.57742	7.5	3.0	3.0	1.0	7.5	3.0
11:04	ASC-1.0	1.0	29.08564	81.57269	3.0	100.0	3.0			3.0
11:17	ASC-1.5	1.5	29.08559	81.56849	17.5	62.5	17.5		62.5	3.0
11:30	ASC-2.0	2.0	29.08163	81.56636	1.0	82.5	3.0	17.5	17.5	1.0
11:52	ASC-2.5	2.5	29.07704	81.56677	17.5	37.5	37.5		?	3.0
12:06	ASC-3.0	3.0	29.07270	81.56691	17.5	?	17.5		?	3.0
12:19	ASC-3.5	3.5	29.06870	81.56592	1.0	?	1.0		?	1.0
12:32	ASC-4.0	4.0	29.06711	81.56194	17.5	17.5	17.5		37.5	3.0
12:45	ASC-4.5	4.5	29.06509	81.55752	17.5		17.5		62.5	3.0
12:59	ASC-5.0	5.0	29.06289	81.55326	17.5	37.5	17.5		37.5	1.0
13:16	ASC-5.5	5.5	29.06196	81.54870	17.5		7.5		?	1.0
13:28	ASC-6.0	6.0	29.06214	81.54397	3.0		17.5		?	7.5
13:39	ASC-6.5	6.5	29.06161	81.53959	7.5	17.5	17.5		?	7.5
13:50	ASC-7.0	7.0	29.06047	81.53521	37.5	62.5	17.5		?	7.5
14:01	ASC-7.5	7.5	29.06008	81.53101	3.0	7.5	3.0		3.0	7.5
14:15	ASC-8.0	8.0	29.05798	81.52718	7.5	17.5	17.5	17.5	62.5	3.0
14:26	ASC-8.5	8.5	29.05616	81.52311	1.0		7.5		37.5	17.5
14:37	ASC-9.0	9.0	29.05537	81.51892	17.5	17.5	7.5		17.5	1.0
14:49	ASC-9.5	9.5	29.05249	81.51514	17.5	37.5	17.5		17.5	3.0
15:00	ASC-10.0	10.0	29.04922	81.51197	7.5	7.5	7.5		?	17.5
15:11	ASC-10.5	10.5	29.04574	81.50920	1.0	?	1.0		?	62.5

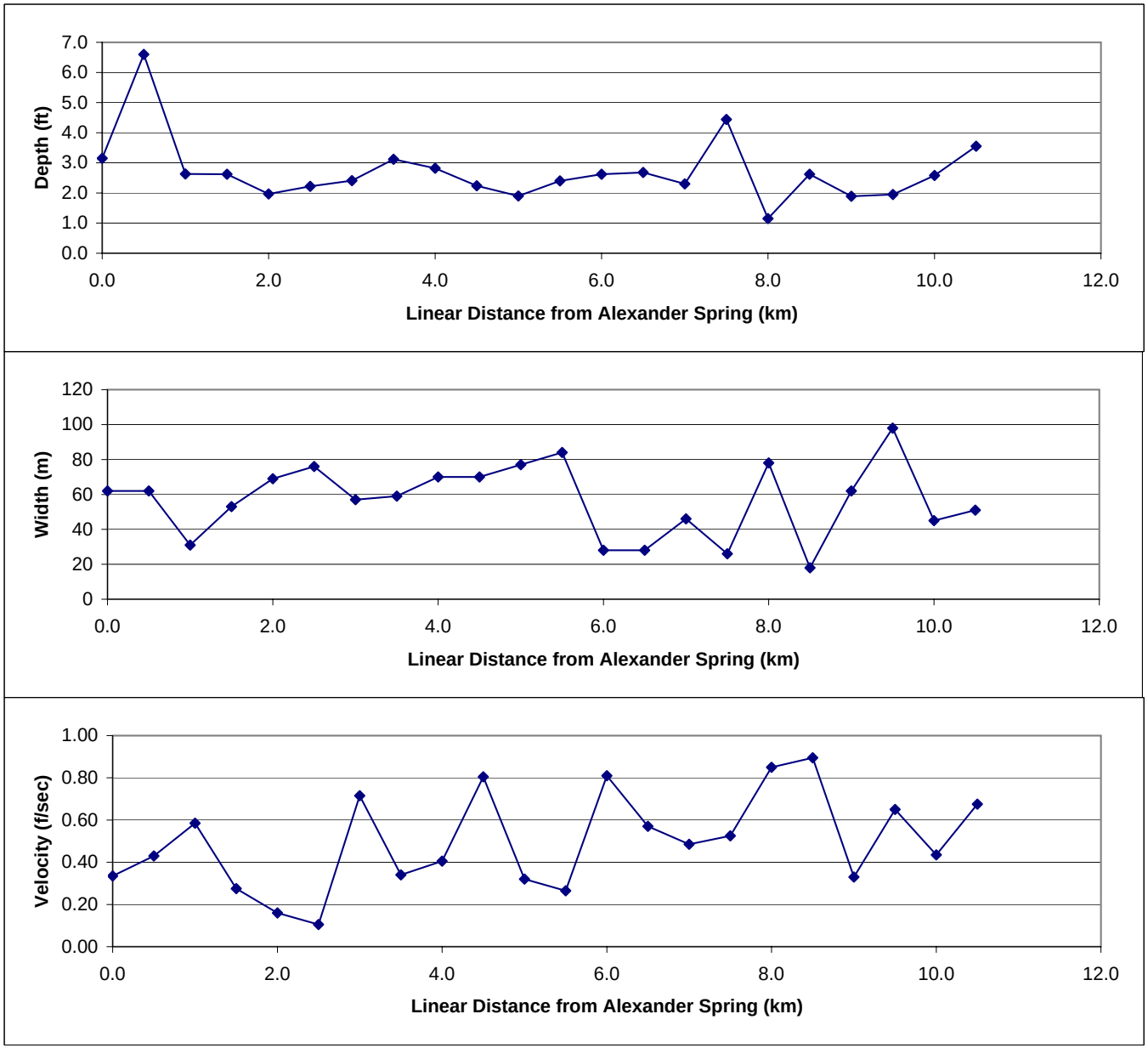
ALEXANDER SPRINGS CREEK STREAM REACH RECONNAISSANCE - 3/9/2005

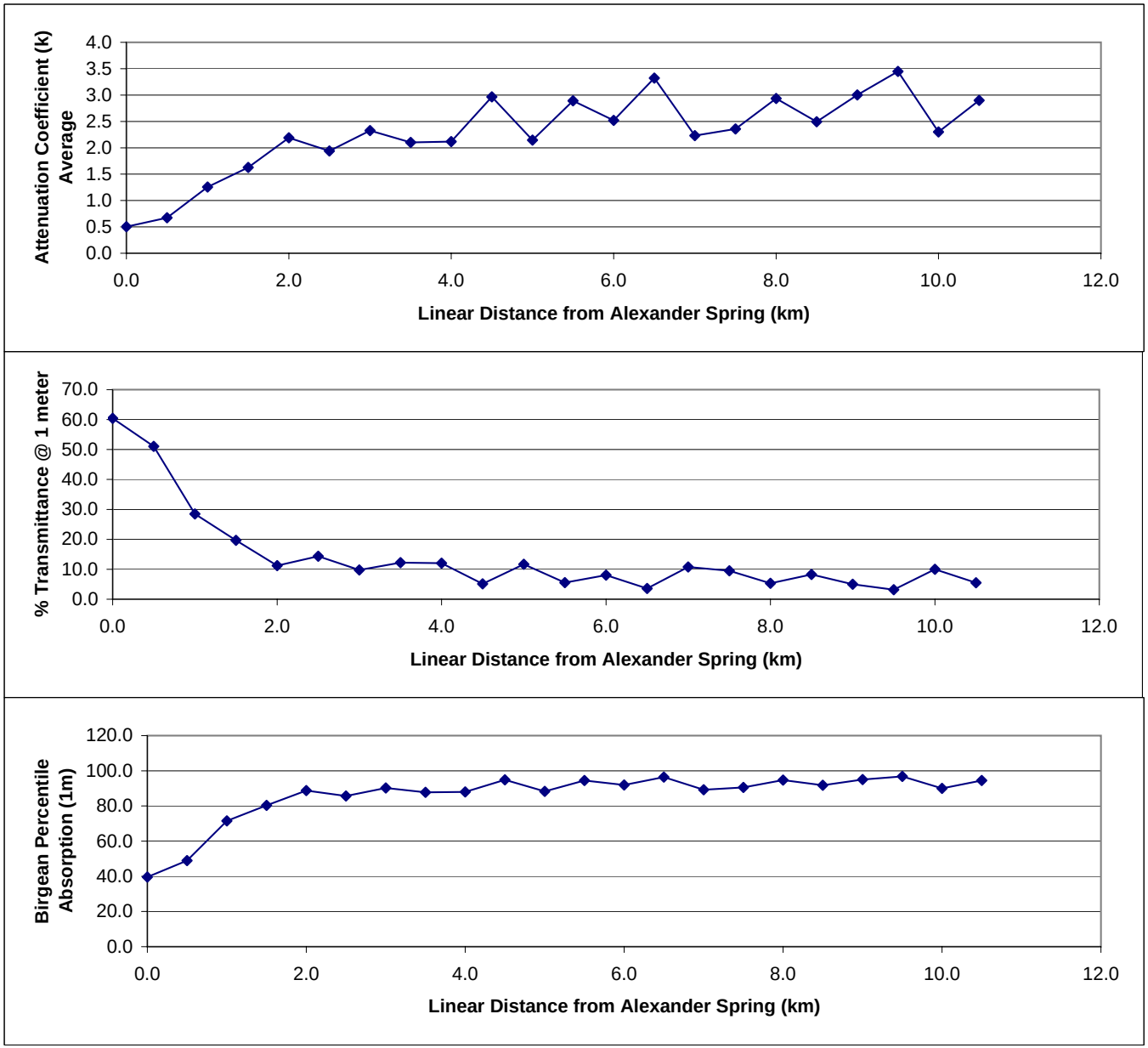
	Location				Dominant Spp.																																			
Time	Station	Linear Distance (km)	Latitude	Longitude	Arrowhead (*Sagittaria lancifolia*)	Bulrush (*Scripus* sp.)	Cattail (*Typha latifolia*)	Common Reed (*Phragmites australis*)	Iris (*Iris sp.*)	Pickerel Weed (*Pontederia cordata*)	Sawgrass (*Cladium jamaicense*)	Swamp lily (*Crinum americanum*)	Unknown Grass	Unknown Sedge	Water hemlock (*Cicuta mexicana*)	Duckweed (*Lemna spp.*)	Spatterdock (*Nuphar luteum*)	Water hyacinth (*Eichhornia crassipes*)	Water lettuce (*Pistia stratiotes*)	Water pennyworts (*Hydrocotyle umbellata*)	Coontail (*Ceratophyllum demersum*)	Southern Naiad (*Najas guadalupensis*)	Stonewort (*Nitella flexilis*)	Tape grass (*Vallisneria americana*)	Benthic Algae	Bald Cypress (*Taxodium distichum*)	Dahoon Holly (Ilex cassine)	Laurel Oak (*Quercus hemisphearica*)	Live Oak (*Quercus virginiana*)	Loblolly Pine (*Pinus taeda*)	Red Bay (*Persea borbonia*)	Red Cedar (*Juniperus virginiana*)	Red Maple (*Acer rubrum*)	Sabal Palm (*Sabal palmetto*)	Sweetgum (*Liquidambar styraciflua*)	Water elm (*Ulmus americana*)	Water Hickory (Carya aquatica)	Water Oak (*Quercus nigra*)	Wax Myrtle (*Myrica cerifera*)	Willow (*Salix* sp.)
10:26	ASC-0.0	0.0	29.08192	81.57672			X	X		X							X	X		X		X			X			X				X	X	X	X				X	
10:46	ASC-0.5	0.5	29.08534	81.57742	X					X	X					X	X	X	X	X	X	X		X							X		X						X	
11:04	ASC-1.0	1.0	29.08564	81.57269						X	X				X	X	X	X		X				X							X		X						X	
11:17	ASC-1.5	1.5	29.08559	81.56849	X	X					X				X		X			X				X	X			X			X		X	X	X				X	
11:30	ASC-2.0	2.0	29.08163	81.56636		X	X						X		X			X						X		X			X	X	X		X							
11:52	ASC-2.5	2.5	29.07704	81.56677						X		X	X		X		X	X		X				X		X		X				X	X	X	X				X	
12:06	ASC-3.0	3.0	29.07270	81.56691			X								X		X			X								X			X		X	X						
12:19	ASC-3.5	3.5	29.06870	81.56592			X				X				X		X			X									X	X	X	X	X							
12:32	ASC-4.0	4.0	29.06711	81.56194			X			X			X		X		X	X		X				X	X						X	X		X						
12:45	ASC-4.5	4.5	29.06509	81.55752						X	X	X	X		X		X	X	X	X					X	X			X		X		X	X						
12:59	ASC-5.0	5.0	29.06289	81.55326		X					X		X		X		X	X		X				X	X	X			X				X	X						
13:16	ASC-5.5	5.5	29.06196	81.54870		X							X		X		X	X	X	X						X		X					X	X						
13:28	ASC-6.0	6.0	29.06214	81.54397	X	X							X		X		X			X						X					X		X	X				X	X
13:39	ASC-6.5	6.5	29.06161	81.53959			X						X		X					X				X				X					X	X						
13:50	ASC-7.0	7.0	29.06047	81.53521		X				X	X	X		X	X		X			X				X								X	X	X	X				X	
14:01	ASC-7.5	7.5	29.06008	81.53101					X			X			X		X							X				X						X					X	
14:15	ASC-8.0	8.0	29.05798	81.52718	X		X			X	X		X		X		X			X				X	X				X		X		X	X						
14:26	ASC-8.5	8.5	29.05616	81.52311											X					X					X	X		X			X			X					X	
14:37	ASC-9.0	9.0	29.05537	81.51892		X	X								X		X			X				X		X							X	X					X	
14:49	ASC-9.5	9.5	29.05249	81.51514	X	X				X			X		X		X			X			X	X		X				X			X	X					X	X
15:00	ASC-10.0	10.0	29.04922	81.51197		X				X					X		X			X			X				X						X	X					X	X
15:11	ASC-10.5	10.5	29.04574	81.50920								X						X		X						X	X						X	X					X	

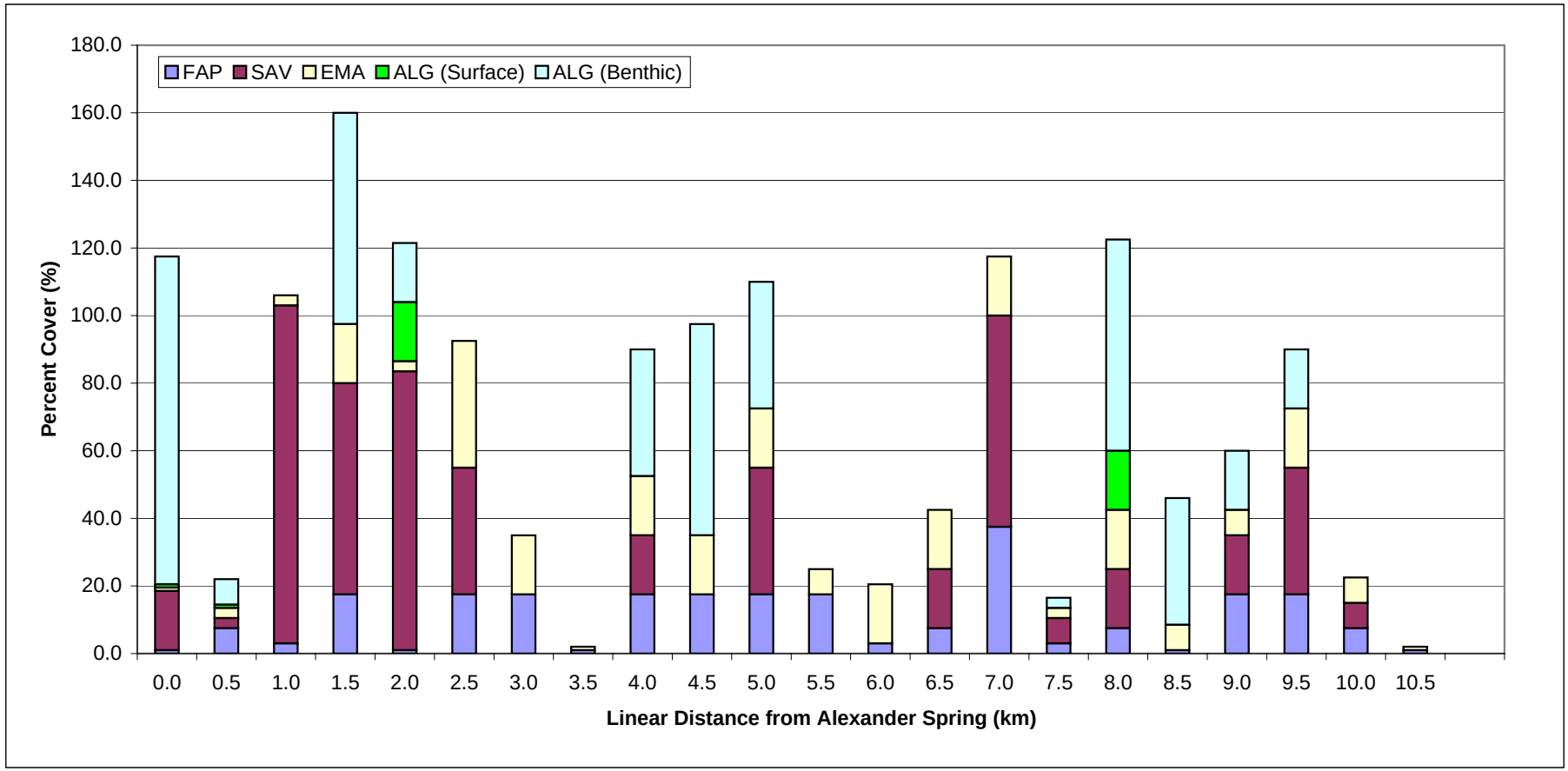
ALEXANDER SPRINGS CREEK STREAM REACH RECONNAISSANCE - 3/9/2005

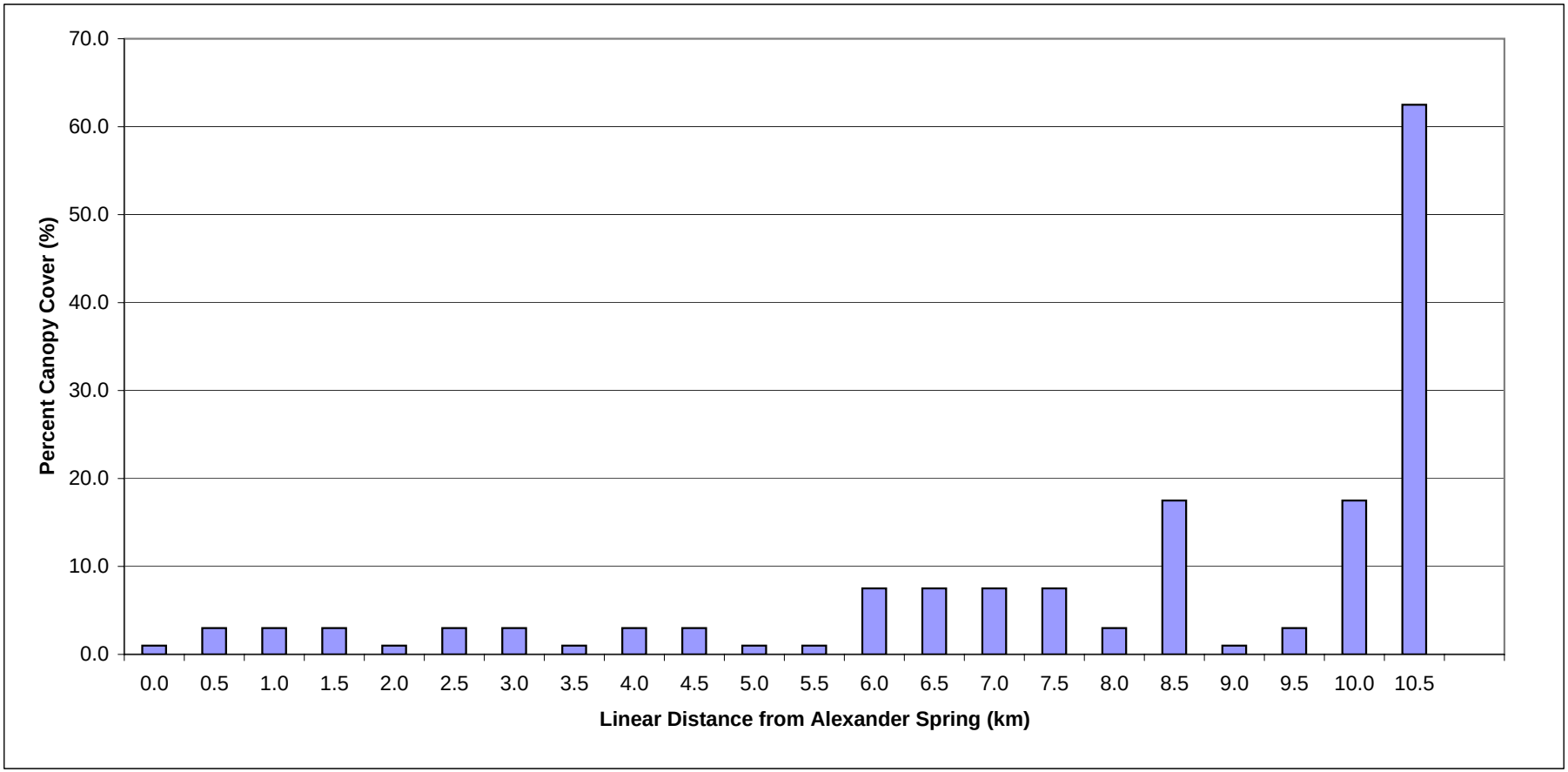
	Location				Light Transmission (umol/s/m2) / Depth (ft)								Light Attenuation Est.			
Time	Station	Linear Distance (km)	Latitude	Longitude	Air	Surface	1.0	2.0	3.0	4.0	5.0	6.0	k Average	Percent Transmittance @ 1 meter	Birgean Percentile Absorption (1m)	Notes
10:26	ASC-0.0	0.0	29.08192	81.57672	206.4	220.0	172.6	169.9	168.7				0.504	60.4	39.6	filamentous algae
10:46	ASC-0.5	0.5	29.08534	81.57742	389.8	357.4	294.0	241.2	206.2	136.3	126.4		0.672	51.1	48.9	est. width
11:04	ASC-1.0	1.0	29.08564	81.57269	120.3	98.1	66.9						1.256	28.5	71.5	
11:17	ASC-1.5	1.5	29.08559	81.56849	114.1	101.9	63.8	35.8					1.627	19.7	80.3	
11:30	ASC-2.0	2.0	29.08163	81.56636	135.8	100.1	51.3						2.189	11.2	88.8	filamentous algae on vegetation
11:52	ASC-2.5	2.5	29.07704	81.56677	116.8	110.2	61.0						1.940	14.4	85.6	rain starts - can't see to quantify benthic
12:06	ASC-3.0	3.0	29.07270	81.56691	147.4	129.5	63.7						2.326	9.8	90.2	not significant SAV
12:19	ASC-3.5	3.5	29.06870	81.56592	202.9	174.5	92.0						2.101	12.2	87.8	not significant SAV
12:32	ASC-4.0	4.0	29.06711	81.56194	338.3	324.3	164.1	95.9					2.118	12.0	88.0	
12:45	ASC-4.5	4.5	29.06509	81.55752	369.3	294.0	119.1						2.966	5.2	94.8	
12:59	ASC-5.0	5.0	29.06289	81.55326	254.8	215.4	112.0						2.147	11.7	88.3	
13:16	ASC-5.5	5.5	29.06196	81.54870	237.7	200.0	82.8						2.891	5.6	94.4	
13:28	ASC-6.0	6.0	29.06214	81.54397	137.1	116.4	54.0						2.520	8.0	92.0	
13:39	ASC-6.5	6.5	29.06161	81.53959	151.7	143.5	52.1						3.322	3.6	96.4	
13:50	ASC-7.0	7.0	29.06047	81.53521	156.6	152.5	77.3						2.231	10.7	89.3	
14:01	ASC-7.5	7.5	29.06008	81.53101	205.8	172.6	77.5	41.7	25.0				2.357	9.5	90.5	filamentous algae on vegetation
14:15	ASC-8.0	8.0	29.05798	81.52718	238.5	193.6	79.2						2.935	5.3	94.7	filamentous algae
14:26	ASC-8.5	8.5	29.05616	81.52311	76.1	66.3	31.0						2.495	8.3	91.7	
14:37	ASC-9.0	9.0	29.05537	81.51892	147.9	135.8	54.4						3.001	5.0	95.0	
14:49	ASC-9.5	9.5	29.05249	81.51514	186.8	158.6	55.4						3.449	3.2	96.8	
15:00	ASC-10.0	10.0	29.04922	81.51197	117.6	106.6	52.9						2.301	10.0	90.0	filamentous algae on vegetation
15:11	ASC-10.5	10.5	29.04574	81.50920	112.3	96.1	38.5	17.5					2.899	5.5	94.5	


mg/L
%
DO (mg/L)
DO (%)
8.00
6.00
4.00
2.00
0.00
100
80
60
40
20
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Alexander Spring (km)
Temp (C)
25.0
20.0
15.0
10.0
5.0
0.0
Linear Distance from Alexander Spring (km)
pH (SU)
8.10
8.00
7.90
7.80
7.70
7.60
Linear Distance from Alexander Spring (km)
Sp Cond (uS/cm)
950
900
850
800
Linear Distance from Alexander Spring (km)


Depth (ft)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Alexander Spring (km)
Width (m)
120
100
80
60
40
20
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Alexander Spring (km)
Velocity (f/sec)
1.00
0.80
0.60
0.40
0.20
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Alexander Spring (km)


Attenuation Coefficient (k) Average
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Alexander Spring (km)
% Transmittance @ 1 meter
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Alexander Spring (km)
Birgean Percentile Absorption (1m)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Linear Distance from Alexander Spring (km)


FAP
SAV
EMA
ALG (Surface)
ALG (Benthic)
Percent Cover (%)
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
Linear Distance from Alexander Spring (km)


70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percent Canopy Cover (%)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
Linear Distance from Alexander Spring (km)

Alexander Springs Creek Stream Reconnaissance
March 9, 2005
Wetland Solutions, Inc.
ASC-0.0
ASC-0.5
ASC-1.0
ASC-1.5
ASC-2.0
ASC-2.5
ASC-3.0
ASC-3.5
ASC-4.0
ASC-4.5
ASC-5.0
ASC-5.5
ASC-6.0
ASC-6.5
ASC-7.0
ASC-7.5
ASC-8.0
ASC-8.5
ASC-9.0
ASC-9.5
ASC-10.0
ASC-10.5
Alexander Springs
445
445
FR-544
FR-544
FR-552A
FR-552
St. Johns
Ocala National Forest
FR-38
FR-538A
FR-38
FR-38
Polar Bear Rd
Old Deer Rd
FR-539
FR-539
FR-540-2

CODE	SCIENTIFIC NAME	COMMON NAME
ACRU	*Acer rubrum*	Red Maple
AQMO		Aquatic mosses
BEAL		Benthic Algae
CAAQ	*Carya aquatica*	Water Hickory
CACA	*Carpinus caroliniana*	American Hornbeam
CAFL	*Canna flaccida*	Golden canna
CEDE	*Ceratophyllum demersum*	Coontail
CIME	*Cicuta mexicana*	Water hemlock
CLJA	*Cladium jamaicense*	Sawgrass
COES	*Colocasia esculenta*	Wild Taro
CRAM	*Crinum americanum*	Swamp lily
EICR	*Eichhornia crassipes*	Water hyacinth
EUBU	*Eugenia buxifolia*	Iron wood
FERN		Ferns
HYRA	*Hydrocotyle ranunculoides*	Water pennyworts
HYUM	*Hydrocotyle umbellata*	Water pennyworts
ILCA	Ilex cassine	Dahoon Holly
ISSP	*Iris sp.*	Iris
JUSP	*Juncus sp.*	Rushes
JUVI	Juniperus virginiana	Red Cedar
LESP	*Lemna sp.*	Duckweed
LIST	*Liquidambar styraciflua*	Sweetgum
LUSP	*Ludwigia sp.*	Water primrose
MAGR	*Magnolia grandiflora*	Southern Magnolia
MAVI	*Magnolia virginiana*	Sweet Bay
MISC	*Mikania scandens*	Climbing Hempweed
MYCE	*Myrica cerifera*	Wax Myrtle
NIFL	*Nitella flexilis*	Stonewort
NULU	*Nuphar luteum*	Spatterdock
PEBO	*Persea borbonia*	Red Bay
PEVI	*Peltandra virginica*	Arrow arum
PHAU	Phragmites australis	Common Reed
PIST	*Pistia stratiotes*	Water lettuce
PITA	*Pinus taeda*	Loblolly Pine
POCO	*Pontederia cordata*	Pickerel Weed
QUHE	*Quercus hemisphearica*	Laurel Oak
QUNI	*Quercus nigra*	Water Oak
QUPH	*Quercus phellos*	Willow Oak
QUVI	*Quercus virginiana*	Live Oak
SACE	*Saururus cernuus*	Lizard's tail
SALA	*Sagittaria lancifolia*	Arrowhead
SAPA	*Sabal palmetto*	Sabal Palm
SASP	*Sagittaria sp.*	Strap-leaf sagittaria
SASP	*Salix sp.*	Willow
SCSP	*Scripus sp.*	Bulrush
TADI	*Taxodium distichum*	Bald Cypress
TIAM	*Tilia americana*	Basswood
TYLA	*Typha latifolia*	Cattail
ULAM	*Ulmus americana*	Water elm
UNGR		Unknown Grass
UNSE		Unknown Sedge
VAAM	*Vallisneria americana*	Tape grass

Appendix B

Detailed Cross-Section Data for the Wekiva River System and Reference Site Stream Segments

APPENDIX B-1

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 1 - 05/09/05

	Transect			Interval			
Transect	**Channel Width (m)**	**Average Depth (m)**	**Cross-Sectional Area (m^2)**	**Distance Between Transects (m)**	**Est. Area (m^2)**	**Avg Cross-Sectional Area (m^2)**	**Est. Volume (m^3)**
1	20.4	0.512	11.1	---	---	---	---
2	120.6	2.139	320.8	148	10,415	165.9	24,506
3	19.1	0.99	20.3	105	7,304	170.5	17,838
4	27.2	0.759	17.5	110	2,532	18.9	2,069
5	20.1	0.807	17.7	99	2,335	17.6	1,737
6	20.5	0.985	21.5	111	2,254	19.6	2,172
7	22.8	0.966	23.6	99	2,135	22.6	2,222
8	19.1	1.054	21.9	120	2,513	22.8	2,735
9	20.3	0.887	19.3	106	2,085	20.6	2,185
10	19.1	0.846	17.6	106	2,092	18.4	1,961
Total	---	---	---	1,003	33,665	---	57,427
Average	30.9	0.994	49.1	111	3,741	53.0	6,381

Calculated Depth (m): 1.71

Staff (ft): 13.03

APPENDIX B-1
WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 1 - 05/9/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG1	1			0.0	1.0	0.00	0.00	119.02
				2.0	2.5	2.05	5.13	
				5.0	3.0	1.94	5.82	
				8.0	3.0	1.93	5.79	
				11.0	3.0	1.93	5.79	
				14.0	3.0	1.82	5.46	
				17.0	3.0	1.96	5.88	
				20.0	3.0	1.88	5.64	
				23.0	3.0	1.97	5.91	
				26.0	3.0	1.96	5.88	
				29.0	3.0	1.98	5.94	
				32.0	3.0	2.02	6.06	
				35.0	3.0	2.03	6.09	
				38.0	3.0	1.99	5.97	
				41.0	3.0	1.92	5.76	
				44.0	3.0	1.84	5.52	
				47.0	3.0	1.78	5.34	
				50.0	3.0	1.62	4.86	
				53.0	3.0	1.61	4.83	
				56.0	3.0	1.40	4.20	
				59.0	3.0	1.48	4.44	
				62.0	3.0	1.52	4.56	
				65.0	2.5	1.66	4.15	
				67.0	1.0	0.00	0.00	
WR-SEG1	2	28.71365	81.45929	0.0	0.5	0.00	0.00	3452.82
				1.0	34.9	0.70	24.46	
				69.9	45.9	7.80	358.27	
				92.9	21.3	10.00	213.25	
				112.5	23.0	8.50	195.21	
				138.8	34.4	9.80	337.60	
				181.4	47.6	11.20	532.81	
				233.9	50.9	11.00	559.38	
				283.2	44.3	10.80	478.35	
				322.5	39.4	9.90	389.76	
				361.9	36.1	8.80	317.58	
				394.7	16.9	2.73	46.15	
				395.7	0.5	0.00	0.00	

APPENDIX B-1
WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 1 - 05/9/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG1	3	28.71410	81.45835	0.0	1.0	0.00	0.00	218.46
				2.0	2.5	2.71	6.78	
				5.0	3.0	2.17	6.51	
				8.0	2.5	2.50	6.25	
				10.0	2.5	2.69	6.73	
				13.0	3.0	2.97	8.91	
				16.0	3.0	3.45	10.35	
				19.0	3.0	3.72	11.16	
				22.0	3.0	4.28	12.84	
				25.0	3.0	4.12	12.36	
				28.0	3.0	4.78	14.34	
				31.0	3.0	4.90	14.70	
				34.0	3.0	4.82	14.46	
				37.0	3.0	4.60	13.80	
				40.0	3.0	4.85	14.55	
				43.0	3.0	3.68	11.04	
				46.0	3.0	4.44	13.32	
				49.0	3.0	3.59	10.77	
				52.0	3.0	3.18	9.54	
				55.0	3.0	2.85	8.55	
				58.0	3.0	2.45	7.35	
				61.0	2.3	1.85	4.16	
				62.5	0.8	0.00	0.00	
WR-SEG1	4	28.71437	81.45736	0.0	0.5	0.00	0.00	188.23
				1.0	2.0	1.82	3.64	
				4.0	3.0	2.52	7.56	
				7.0	3.0	3.10	9.30	
				10.0	3.0	2.82	8.46	
				13.0	3.0	2.82	8.46	
				16.0	3.0	2.70	8.10	
				19.0	3.0	2.69	8.07	
				22.0	3.0	3.02	9.06	
				25.0	3.0	3.19	9.57	
				28.0	3.0	3.18	9.54	
				31.0	3.0	3.04	9.12	
				34.0	3.0	3.07	9.21	
				37.0	3.0	2.92	8.76	
				40.0	3.0	2.86	8.58	
				43.0	3.0	2.45	7.35	
				46.0	3.4	2.58	8.82	
				49.8	21.6	2.53	54.64	
				89.2	19.7	0.00	0.00	

APPENDIX B-1
WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 1 - 05/9/05

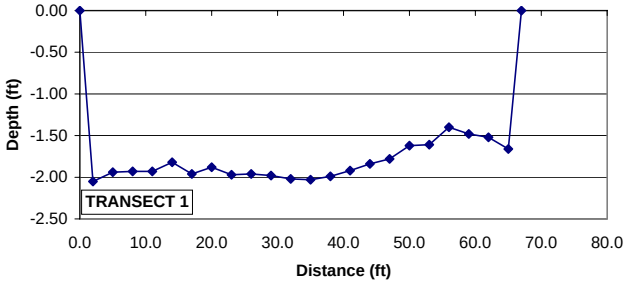
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG1	5	28.71433	81.45642	0.0	0.5	0.00	0.00	190.52
				1.0	2.0	0.64	1.28	
				4.0	3.0	1.27	3.81	
				7.0	3.0	1.55	4.65	
				10.0	3.0	2.04	6.12	
				13.0	3.0	3.13	9.39	
				16.0	3.0	3.43	10.29	
				19.0	3.0	4.00	12.00	
				22.0	3.0	4.14	12.42	
				25.0	3.0	4.05	12.15	
				28.0	3.0	4.32	12.96	
				31.0	3.0	4.60	13.80	
				34.0	3.0	4.72	14.16	
				37.0	3.0	4.72	14.16	
				40.0	3.0	4.57	13.71	
				43.0	3.0	4.17	12.51	
				46.0	3.0	3.68	11.04	
				49.0	3.0	2.65	7.95	
				52.0	3.0	1.90	5.70	
				55.0	3.0	1.35	4.05	
				58.0	3.0	1.29	3.87	
				61.0	3.7	1.01	3.75	
				65.4	2.5	0.30	0.75	
				66.0	0.3	0.00	0.00	
WR-SEG1	6	28.71448	81.45531	0.0	0.5	0.00	0.00	231.19
				1.0	2.0	1.51	3.02	
				4.0	3.0	1.76	5.28	
				7.0	3.0	2.77	8.31	
				10.0	3.0	3.98	11.94	
				13.0	3.0	4.22	12.66	
				16.0	3.0	4.23	12.69	
				19.0	3.0	4.42	13.26	
				22.0	3.5	4.30	15.05	
				26.0	3.0	4.26	12.78	
				28.0	2.5	4.36	10.90	
				31.0	3.0	4.12	12.36	
				34.0	3.0	5.00	15.00	
				37.0	3.0	5.22	15.66	
				40.0	3.0	5.28	15.84	
				43.0	3.0	4.96	14.88	
				46.0	3.0	4.40	13.20	
				49.0	3.0	3.60	10.80	
				52.0	3.0	3.86	11.58	
				55.0	3.0	1.94	5.82	
				58.0	3.0	1.38	4.14	
				61.0	3.0	1.15	3.45	
				64.0	3.2	0.80	2.57	
				67.4	1.7	0.00	0.00	

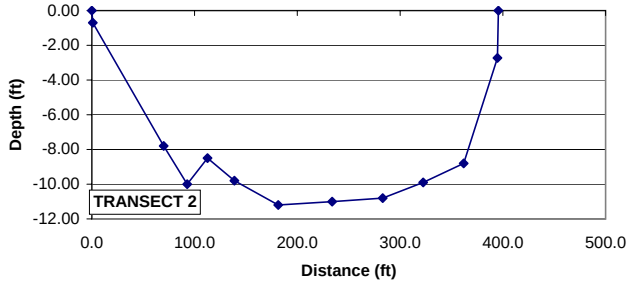
APPENDIX B-1
WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 1 - 05/9/05

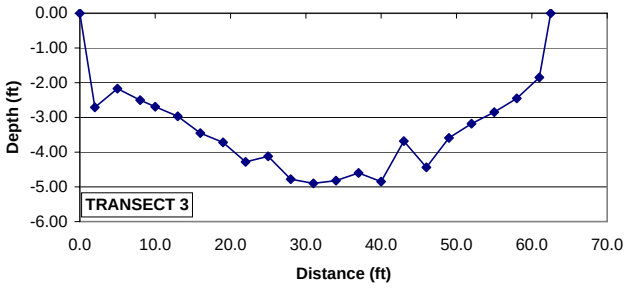
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG1	7	28.71444	81.45438	0.0	0.5	0.00	0.00	254.41
				1.0	2.0	0.55	1.10	
				4.0	3.0	0.90	2.70	
				7.0	3.0	1.23	3.69	
				10.0	3.0	1.86	5.58	
				13.0	3.0	2.34	7.02	
				16.0	3.0	2.94	8.82	
				19.0	3.0	3.33	9.99	
				22.0	3.0	3.51	10.53	
				25.0	3.0	4.04	12.12	
				28.0	3.0	3.92	11.76	
				31.0	3.0	4.15	12.45	
				34.0	3.0	4.00	12.00	
				37.0	3.0	4.50	13.50	
				40.0	3.0	4.22	12.66	
				43.0	3.0	4.43	13.29	
				46.0	3.0	4.00	12.00	
				49.0	3.0	4.54	13.62	
				52.0	3.0	4.53	13.59	
				55.0	3.0	4.50	13.50	
				58.0	3.0	4.60	13.80	
				61.0	3.0	3.78	11.34	
				64.0	3.0	3.82	11.46	
				67.0	3.0	3.62	10.86	
				70.0	3.0	3.34	10.02	
				73.0	2.4	2.95	7.01	
				74.8	0.9	0.00	0.00	
WR-SEG1	8	28.71444	81.45321	0.0	0.5	0.00	0.00	235.74
				1.0	2.0	1.71	3.42	
				4.0	3.0	3.04	9.12	
				7.0	3.0	3.02	9.06	
				10.0	3.0	3.56	10.68	
				13.0	3.0	3.73	11.19	
				16.0	4.5	4.05	18.23	
				22.0	3.0	4.19	12.57	
				22.0	1.5	4.16	6.24	
				25.0	3.0	4.46	13.38	
				28.0	3.0	4.92	14.76	
				31.0	3.0	4.98	14.94	
				34.0	3.0	4.54	13.62	
				37.0	3.0	4.42	13.26	
				40.0	3.0	4.63	13.89	
				43.0	3.0	4.28	12.84	
				46.0	3.0	4.20	12.60	
				49.0	3.0	4.10	12.30	
				52.0	3.0	3.70	11.10	
				55.0	3.0	4.02	12.06	
				58.0	3.0	2.52	7.56	
				61.0	2.3	1.30	2.93	
				62.5	0.8	0.00	0.00	

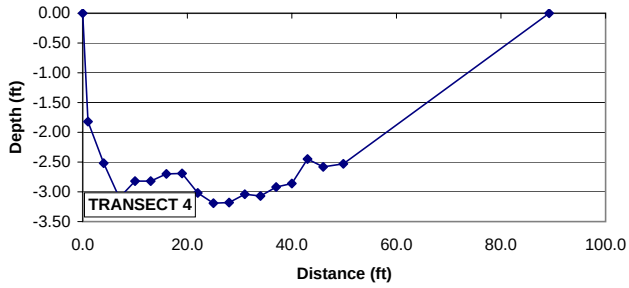
APPENDIX B-1
WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 1 - 05/9/05

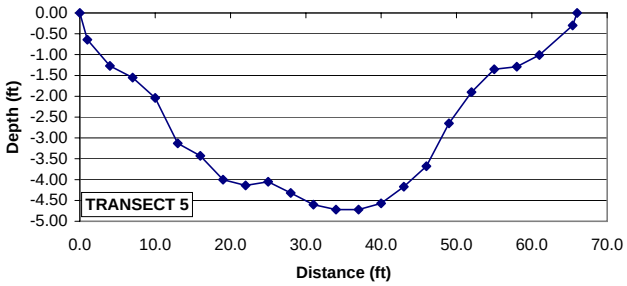
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG1	9	28.71447	81.45218	0.0	0.5	0.00	0.00	207.86
				1.0	2.0	1.13	2.26	
				4.0	3.0	1.62	4.86	
				7.0	3.0	1.12	3.36	
				10.0	3.0	2.65	7.95	
				13.0	3.0	3.26	9.78	
				16.0	3.0	3.65	10.95	
				19.0	3.0	3.85	11.55	
				22.0	3.0	3.47	10.41	
				25.0	3.0	3.86	11.58	
				28.0	3.0	3.46	10.38	
				31.0	3.0	4.13	12.39	
				34.0	3.0	4.43	13.29	
				37.0	3.0	4.22	12.66	
				40.0	3.0	4.28	12.84	
				43.0	3.0	3.78	11.34	
				46.0	3.0	3.49	10.47	
				49.0	3.0	3.37	10.11	
				52.0	3.0	3.22	9.66	
				55.0	3.0	2.76	8.28	
				58.0	3.0	3.90	11.70	
				61.0	3.0	2.18	6.54	
				64.0	2.8	2.00	5.50	
				66.5	1.3	0.00	0.00	
WR-SEG1	10	28.71447	81.45096	0.0	0.5	0.00	0.00	188.97
				1.0	2.0	1.75	3.50	
				4.0	3.0	2.75	8.25	
				7.0	3.0	2.60	7.80	
				10.0	3.0	3.05	9.15	
				13.0	3.0	3.36	10.08	
				16.0	3.0	2.76	8.28	
				19.0	3.0	3.40	10.20	
				22.0	3.0	3.50	10.50	
				25.0	3.0	3.35	10.05	
				28.0	3.0	3.65	10.95	
				31.0	3.0	3.43	10.29	
				34.0	3.0	3.60	10.80	
				37.0	3.0	3.51	10.53	
				40.0	3.0	3.67	11.01	
				43.0	3.0	3.68	11.04	
				46.0	3.0	3.40	10.20	
				49.0	3.0	3.34	10.02	
				52.0	3.0	3.20	9.60	
				55.0	3.0	2.80	8.40	
				58.0	3.0	1.88	5.64	
				61.0	2.3	1.19	2.68	
				62.5	0.8	0.00	0.00	

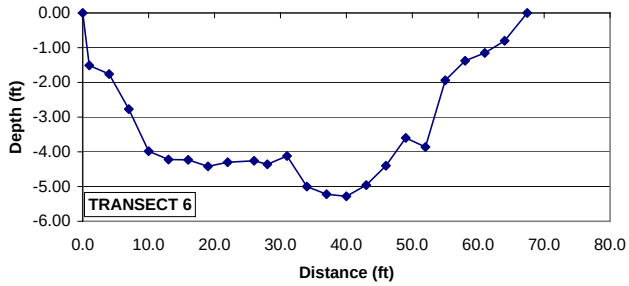


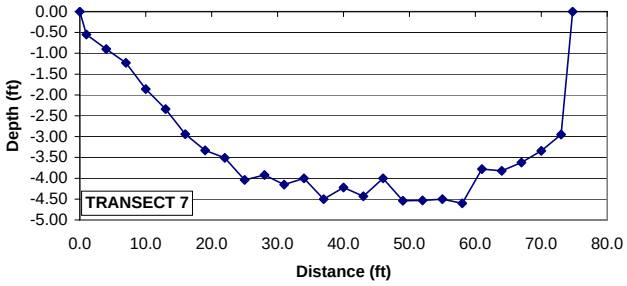


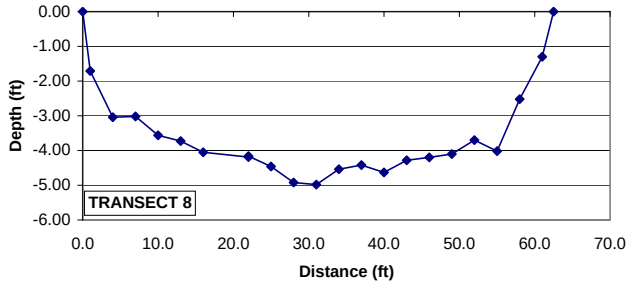


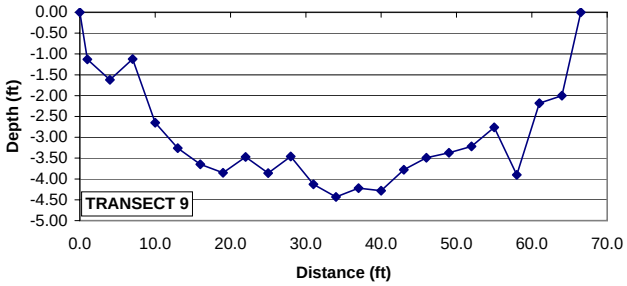


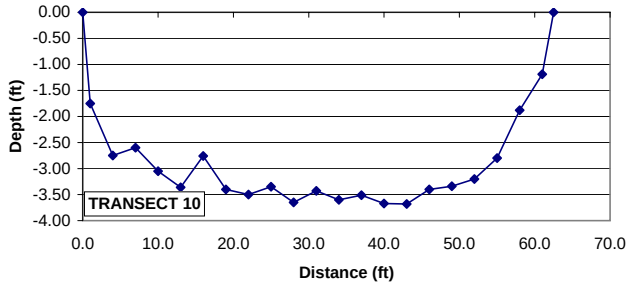












APPENDIX B-1

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 1 - 05/09/05

APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

	Transect			Interval			
Transect	**Channel Width (m)**	**Average Depth (m)**	**Cross-Sectional Area (m^2)**	**Distance Between Transects (m)**	**Est. Area (m^2)**	**Avg Cross-Sectional Area (m^2)**	**Est. Volume (m^3)**
1	121.9	0.462	93.3	---	---	---	---
2	151.5	0.438	62.0	90.8	12,408	77.7	7,050
3	135.2	0.44	62.9	75.9	10,872	62.4	4,737
4	139.3	0.410	55.0	80.0	10,976	58.9	4,714
5	145.5	0.383	57.4	104.3	14,846	56.2	5,861
6	132.1	0.321	43.6	84.0	11,667	50.5	4,246
7	119.8	0.217	28.2	79.9	10,065	35.9	2,872
8	128.1	0.383	36.6	87.0	10,789	32.4	2,823
9	105.5	0.584	57.1	64.6	7,542	46.8	3,024
10	62.9	1.047	71.8	111.2	9,364	64.4	7,165
Total	---	---	---	778	98,529	---	42,492
Average	124.2	0.469	56.8	86.4	10,948	53.9	4,721

Calculated Depth (m): 0.43
Staff (ft): 1.39

APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	1	28.80862	81.41693	0.0	4.0	0.00	0.00	1004.27
				8.0	9.0	1.20	10.80	
				18.0	10.0	1.15	11.50	
				28.0	10.0	1.10	11.00	
				38.0	10.0	1.11	11.10	
				48.0	10.0	1.32	13.20	
				58.0	10.0	1.27	12.70	
				68.0	10.0	1.20	12.00	
				78.0	10.0	1.25	12.50	
				88.0	10.0	1.20	12.00	
				98.0	10.0	1.40	14.00	
				108.0	10.0	1.44	14.40	
				118.0	10.0	1.55	15.50	
				128.0	10.0	1.70	17.00	
				138.0	10.0	1.60	16.00	
				148.0	10.0	1.72	17.20	
				158.0	10.0	1.59	15.90	
				168.0	10.0	1.72	17.20	
				178.0	10.0	1.65	16.50	
				188.0	10.0	2.02	20.20	
				198.0	10.0	2.22	22.20	
				208.0	10.0	1.95	19.50	
				218.0	10.0	1.86	18.60	
				228.0	10.0	1.23	12.30	
				238.0	10.0	0.98	9.80	
				248.0	10.0	0.90	9.00	
				258.0	10.0	0.82	8.20	
				268.0	10.0	0.70	7.00	
				278.0	105.3	4.00	421.00	
				278.5	5.0	4.15	20.75	
				288.0	9.8	3.35	32.66	
				298.0	10.0	2.05	20.50	
				308.0	10.0	1.23	12.30	
				318.0	10.0	1.00	10.00	
				328.0	10.0	0.93	9.30	
				338.0	10.0	1.13	11.30	
				348.0	10.0	1.75	17.50	
				358.0	10.0	1.54	15.40	
				368.0	10.0	1.55	15.50	
				378.0	10.0	1.62	16.20	
				388.0	10.0	1.52	15.20	
		28.80850	81.41819	398.0	6.0	1.56	9.36	
				400.0	1.0	0.00	0.00	

APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	2	28.80919	81.41845	0.0	24.6	0.00	0.00	667.65
				49.2	29.6	1.46	43.22	
				59.2	10.0	1.63	16.30	
				69.2	10.0	1.60	16.00	
				79.2	10.0	1.65	16.50	
				89.2	10.0	1.74	17.40	
				99.2	10.0	1.65	16.50	
				109.2	10.0	1.73	17.30	
				119.2	10.0	1.79	17.90	
				129.2	10.0	1.82	18.20	
				139.2	10.0	1.65	16.50	
				149.2	10.0	1.76	17.60	
				159.2	10.0	1.69	16.90	
				169.2	10.0	1.83	18.30	
				179.2	10.0	0.67	6.70	
				189.2	10.0	0.72	7.20	
				199.2	10.0	0.81	8.10	
				209.2	10.0	1.48	14.80	
				219.2	10.0	1.01	10.10	
				229.2	10.0	0.92	9.20	
				239.2	10.0	0.84	8.40	
				249.2	10.0	0.35	3.50	
				259.2	10.0	0.79	7.90	
				269.2	10.0	2.14	21.40	
				279.2	10.0	2.00	20.00	
				289.2	9.3	2.00	18.50	
				297.7	9.3	1.58	14.62	
				307.7	10.0	2.16	21.60	
				317.7	10.0	1.72	17.20	
				327.7	10.0	1.13	11.30	
				337.7	10.0	1.50	15.00	
				347.7	10.0	1.66	16.60	
				357.7	10.0	1.65	16.50	
				367.7	10.0	1.69	16.90	
				377.7	10.0	1.80	18.00	
				387.7	10.0	1.80	18.00	
				397.7	10.0	1.80	18.00	
				407.7	10.0	1.83	18.30	
				417.7	10.0	1.82	18.20	
				427.7	10.0	1.55	15.50	
				437.7	10.0	1.20	12.00	
				447.7	29.6	1.20	35.52	
				496.9	24.6	0.00	0.00	

APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	3	28.81009	81.41750	0.0	21.0	0.00	0.00	676.72
				2.0	11.0	0.82	9.02	
				12.0	11.0	1.05	11.55	
				22.0	15.0	1.30	19.50	
				32.0	10.0	1.05	10.50	
				42.0	10.0	1.30	13.00	
				52.0	10.0	1.24	12.40	
				62.0	10.0	1.49	14.90	
				72.0	10.0	1.35	13.50	
				82.0	10.0	1.36	13.60	
				92.0	10.0	1.41	14.10	
				102.0	10.0	1.37	13.70	
				112.0	10.0	1.33	13.30	
				122.0	10.0	1.41	14.10	
				132.0	10.0	1.45	14.50	
				142.0	10.0	1.62	16.20	
				152.0	10.0	1.83	18.30	
				162.0	10.0	1.72	17.20	
				172.0	10.0	1.50	15.00	
				182.0	10.0	1.67	16.70	
				192.0	10.0	1.59	15.90	
				202.0	10.0	1.65	16.50	
				212.0	10.0	1.60	16.00	
				222.0	10.0	1.53	15.30	
				232.0	10.0	1.60	16.00	
				242.0	10.0	1.70	17.00	
				252.0	10.0	1.91	19.10	
				262.0	10.0	1.82	18.20	
				272.0	10.0	1.86	18.60	
				282.0	10.0	1.83	18.30	
				292.0	10.0	1.78	17.80	
				302.0	10.0	1.72	17.20	
				312.0	10.0	1.69	16.90	
				322.0	10.0	1.54	15.40	
				332.0	10.0	1.62	16.20	
				342.0	10.0	1.53	15.30	
				352.0	10.0	1.65	16.50	
				362.0	10.0	1.65	16.50	
				372.0	10.0	1.63	16.30	
				382.0	10.0	1.33	13.30	
				392.0	10.0	1.32	13.20	
				402.0	10.0	1.42	14.20	
				412.0	10.0	1.48	14.80	
				422.0	10.0	1.88	18.80	
				432.0	10.7	1.15	12.35	
		28.77081	81.50311	443.5	5.7	0.00	0.00	

APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	4	28.81075	81.41795	0.0	32.8	0.00	0.00	592.14
				65.6	37.8	1.40	52.92	
				75.6	10.0	1.34	13.40	
				85.6	10.0	1.42	14.20	
				95.6	10.0	1.36	13.60	
				105.6	10.0	1.33	13.30	
				115.6	10.0	1.52	15.20	
				125.6	10.0	1.50	15.00	
				135.6	10.0	1.54	15.40	
				145.6	10.0	1.44	14.40	
				155.6	10.0	1.42	14.20	
				165.6	10.0	1.42	14.20	
				175.6	10.0	1.44	14.40	
				185.6	10.0	1.39	13.90	
				195.6	10.0	1.33	13.30	
				205.6	10.0	1.14	11.40	
				215.6	10.0	1.35	13.50	
				225.6	10.0	1.40	14.00	
				235.6	6.0	1.45	8.70	
				237.6	6.0	1.45	8.70	
				247.6	10.0	1.52	15.20	
				257.6	10.0	1.68	16.80	
				267.6	10.0	1.88	18.80	
				277.6	10.0	1.49	14.90	
				287.6	10.0	1.52	15.20	
				297.6	10.0	1.62	16.20	
				307.6	10.0	1.60	16.00	
				317.6	10.0	1.57	15.70	
				327.6	10.0	1.79	17.90	
				337.6	10.0	1.30	13.00	
				347.6	10.0	1.40	14.00	
				357.6	10.0	1.19	11.90	
				367.6	10.0	1.20	12.00	
				377.6	10.0	1.19	11.90	
				387.6	10.0	1.12	11.20	
				397.6	10.0	1.26	12.60	
				407.6	10.0	1.35	13.50	
				417.6	10.0	1.01	10.10	
				427.6	10.0	1.09	10.90	
				437.6	10.0	1.46	14.60	
		28.81034	81.41903	447.6	9.7	1.65	16.02	
				457.0	4.7	0.00	0.00	

APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	5	28.81162	81.41802	0.0	0.5	0.00	0.00	618.13
				1.0	5.5	0.36	1.98	
				11.0	10.0	0.85	8.50	
				21.0	10.0	1.17	11.70	
				31.0	10.0	1.35	13.50	
				41.0	10.0	1.49	14.90	
				51.0	10.0	1.50	15.00	
				61.0	10.0	1.44	14.40	
				71.0	10.0	1.39	13.90	
				81.0	10.0	1.52	15.20	
				91.0	10.0	1.50	15.00	
				101.0	10.0	1.30	13.00	
				111.0	10.0	1.26	12.60	
				121.0	10.0	1.22	12.20	
				131.0	10.0	1.33	13.30	
				141.0	10.0	1.05	10.50	
				151.0	10.0	1.40	14.00	
				161.0	10.0	1.23	12.30	
				171.0	10.0	1.25	12.50	
				181.0	10.0	1.25	12.50	
				191.0	10.0	1.11	11.10	
				201.0	10.0	1.16	11.60	
				211.0	10.0	1.35	13.50	
				221.0	10.0	1.32	13.20	
				231.0	10.0	1.26	12.60	
				241.0	10.0	1.30	13.00	
				251.0	10.0	1.24	12.40	
				261.0	10.0	1.75	17.50	
				271.0	10.0	1.72	17.20	
				281.0	10.0	1.51	15.10	
				291.0	10.0	1.47	14.70	
				301.0	10.0	1.34	13.40	
				311.0	10.0	1.30	13.00	
				321.0	10.0	1.49	14.90	
				331.0	10.0	1.29	12.90	
				341.0	10.0	1.60	16.00	
				351.0	10.0	1.33	13.30	
				361.0	10.0	1.51	15.10	
				371.0	10.0	1.29	12.90	
				381.0	10.0	1.38	13.80	
				391.0	10.0	1.36	13.60	
				401.0	10.0	1.47	14.70	
				411.0	10.0	1.30	13.00	
				421.0	10.0	1.25	12.50	
				431.0	10.0	1.00	10.00	
				441.0	10.0	1.12	11.20	
				451.0	10.0	1.02	10.20	
				461.0	13.2	1.42	18.75	
		28.81127	81.41933	477.4	8.2	0.00	0.00	

APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	6	28.81228	81.41827	0.0	3.4	0.00	0.00	469.60
				6.8	8.4	1.01	8.50	
				16.8	10.0	1.40	14.00	
				26.8	10.0	1.00	10.00	
				36.8	10.0	0.93	9.30	
				46.8	10.0	0.83	8.30	
				56.8	10.0	0.73	7.30	
				66.8	10.0	0.79	7.90	
				76.8	10.0	0.76	7.60	
				86.8	10.0	0.65	6.50	
				96.8	10.0	0.90	9.00	
				106.8	10.0	1.20	12.00	
				116.8	10.0	1.60	16.00	
				126.8	10.0	1.19	11.90	
				136.8	10.0	0.55	5.50	
				146.8	10.0	0.85	8.50	
				156.8	10.0	0.88	8.80	
				166.8	10.0	1.05	10.50	
				176.8	10.0	0.75	7.50	
				186.8	10.0	1.00	10.00	
				196.8	10.0	1.22	12.20	
				206.8	10.0	1.05	10.50	
				216.8	9.0	0.95	8.55	
				224.8	8.0	0.94	7.52	
				232.8	9.0	0.84	7.56	
				242.8	10.0	0.95	9.50	
				252.8	10.0	1.05	10.50	
				262.8	10.0	1.03	10.30	
				272.8	10.0	1.50	15.00	
				282.8	10.0	1.49	14.90	
				292.8	10.0	1.60	16.00	
				302.8	10.0	1.67	16.70	
				312.8	10.0	1.76	17.60	
				322.8	10.0	1.50	15.00	
				332.8	10.0	1.42	14.20	
				342.8	10.0	1.39	13.90	
				352.8	10.0	1.08	10.80	
				362.8	10.0	0.99	9.90	
				372.8	10.0	1.15	11.50	
				382.8	10.0	0.98	9.80	
				392.8	10.0	0.80	8.00	
				402.8	10.0	1.11	11.10	
				412.8	10.0	1.17	11.70	
				422.8	10.3	1.72	17.77	
		28.81209	81.41954	433.5	5.3	0.00	0.00	

APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	7	28.81302	81.41828	0.0	1.0	0.00	0.00	304.01
				2.0	6.0	1.76	10.56	
				12.0	7.5	2.04	15.30	
				17.0	7.5	1.40	10.50	
				27.0	10.0	0.45	4.50	
				37.0	10.0	0.00	0.00	
				47.0	10.0	0.01	0.10	
				57.0	10.0	0.35	3.50	
				67.0	10.0	0.15	1.50	
				77.0	10.0	0.00	0.00	
				87.0	10.0	0.45	4.50	
				97.0	10.0	0.75	7.50	
				107.0	10.0	1.32	13.20	
				117.0	10.0	0.98	9.80	
				127.0	10.0	0.90	9.00	
				137.0	10.0	0.90	9.00	
				147.0	10.0	0.92	9.20	
				157.0	10.0	0.97	9.70	
				167.0	10.0	0.68	6.80	
				177.0	10.0	1.00	10.00	
				187.0	10.0	1.15	11.50	
				197.0	10.0	1.09	10.90	
				207.0	10.0	1.02	10.20	
				217.0	10.0	1.06	10.60	
				227.0	10.0	1.25	12.50	
				237.0	10.0	0.97	9.70	
				247.0	10.0	0.96	9.60	
				257.0	10.0	1.57	15.70	
				267.0	10.0	1.02	10.20	
				277.0	10.0	0.95	9.50	
				287.0	10.0	0.80	8.00	
				297.0	10.0	0.87	8.70	
				307.0	10.0	0.65	6.50	
				317.0	10.0	0.43	4.30	
				327.0	10.0	0.39	3.90	
				337.0	10.0	0.62	6.20	
				347.0	10.0	1.32	13.20	
				357.0	10.0	0.13	1.30	
				367.0	7.5	0.36	2.70	
				372.0	5.0	0.40	2.00	
				377.0	4.0	0.00	0.00	
				380.0	2.5	0.20	0.50	
				382.0	3.5	0.00	0.00	
				387.0	4.0	0.00	0.00	
		28.81283	81.41942	390.0	3.0	0.55	1.65	
				393.0	1.5	0.00	0.00	

APPENDIX B-2

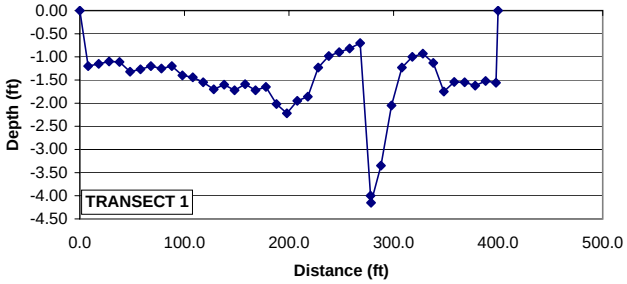
WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

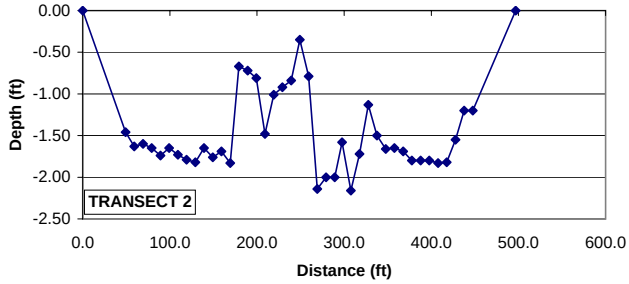
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	8	28.81371	81.41862	0.0	58.1	0.00	0.00	394.11
				116.3	63.1	0.55	34.73	
				126.3	10.0	0.95	9.50	
				136.3	10.0	1.43	14.30	
				146.3	10.0	1.27	12.70	
				156.3	10.0	1.32	13.20	
				166.3	10.0	1.20	12.00	
				176.3	10.0	1.40	14.00	
				186.3	10.0	1.15	11.50	
				196.3	10.0	1.13	11.30	
				206.3	10.0	1.26	12.60	
				216.3	10.0	1.35	13.50	
				226.3	10.0	1.39	13.90	
				236.3	10.0	1.52	15.20	
				246.3	6.0	1.46	8.76	
				248.3	6.0	1.60	9.60	
				258.3	10.0	1.89	18.90	
				268.3	10.0	1.90	19.00	
				278.3	10.0	1.59	15.90	
				288.3	10.0	1.52	15.20	
				298.3	10.0	1.33	13.30	
				308.3	10.0	1.27	12.70	
				318.3	10.0	1.29	12.90	
				328.3	10.0	1.50	15.00	
				338.3	46.0	1.40	64.41	
				420.3	41.0	0.00	0.00	
WR-SEG2	9	28.81428	81.41892	0.0	50.8	0.00	0.00	614.15
				101.7	55.8	2.20	122.85	
				111.7	10.0	2.12	21.20	
				121.7	10.0	2.23	22.30	
				131.7	10.0	3.00	30.00	
				141.7	10.0	3.45	34.50	
				151.7	10.0	2.65	26.50	
				161.7	10.0	1.16	11.60	
				171.7	10.0	1.21	12.10	
				181.7	10.0	1.89	18.90	
				191.7	10.0	1.76	17.60	
				201.7	10.0	1.65	16.50	
				211.7	10.0	1.49	14.90	
				221.7	10.0	1.62	16.20	
				231.7	10.0	1.75	17.50	
				241.7	10.0	2.04	20.40	
				251.7	10.0	2.32	23.20	
				261.7	10.0	2.77	27.70	
				271.7	10.0	2.66	26.60	
				281.7	10.0	2.51	25.10	
				291.7	10.0	1.86	18.60	
				301.7	10.0	2.96	29.60	
				311.7	10.0	1.16	11.60	
				321.7	10.0	1.79	17.90	
				331.7	10.0	1.92	19.20	
		28.81405	81.41971	341.7	7.3	1.60	11.60	
				346.2	2.3	0.00	0.00	

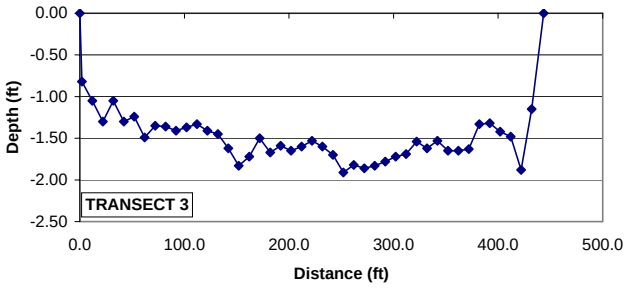
APPENDIX B-2

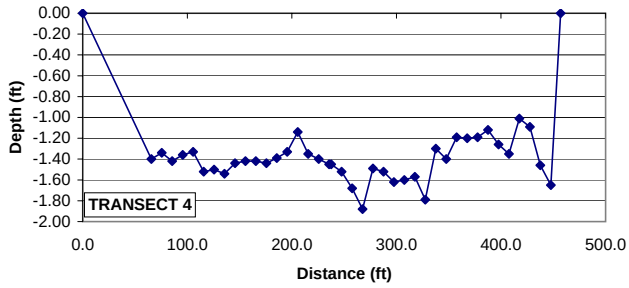
WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

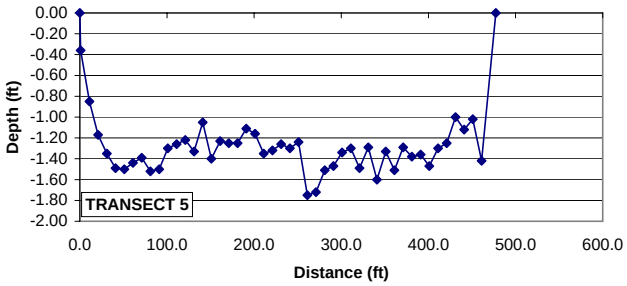
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
WR-SEG2	10	28.81532	81.41914	0.0	2.1	0.00	0.00	772.59
				4.3	7.1	2.82	20.09	
				14.3	10.0	5.23	52.30	
				24.3	10.0	5.30	53.00	
				34.3	10.0	4.10	41.00	
				44.3	10.0	3.16	31.60	
				54.3	10.0	2.40	24.00	
				64.3	10.0	2.31	23.10	
				74.3	10.0	2.86	28.60	
				84.3	10.0	2.71	27.10	
				94.3	10.0	2.72	27.20	
				104.3	10.0	3.39	33.90	
				114.3	10.0	4.83	48.30	
				124.3	10.0	5.60	56.00	
				134.3	10.0	4.92	49.20	
				144.3	10.0	4.80	48.00	
				154.3	10.0	4.20	42.00	
				164.3	10.0	4.14	41.40	
				174.3	10.0	4.10	41.00	
				184.3	10.0	4.17	41.70	
				194.3	10.0	2.90	29.00	
		28.77575	81.50046	204.3	6.0	2.35	14.10	
				206.3	1.0	0.00	0.00	

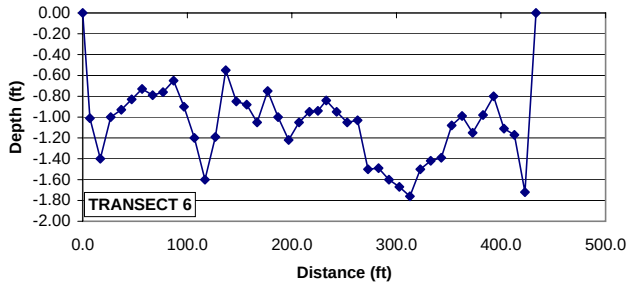


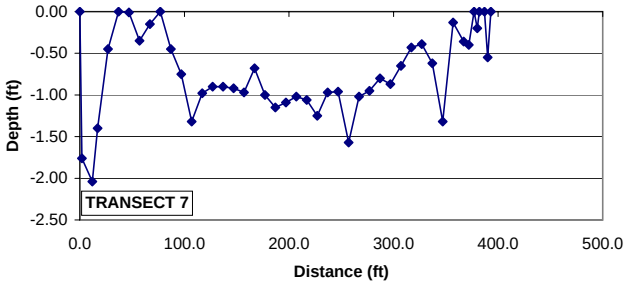


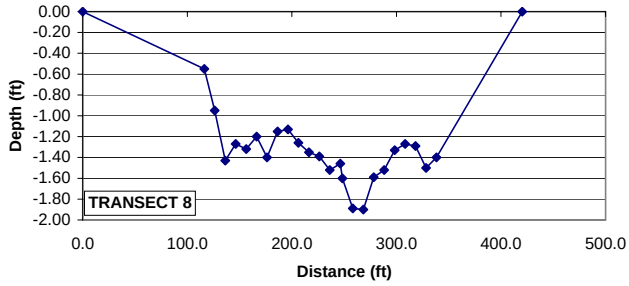


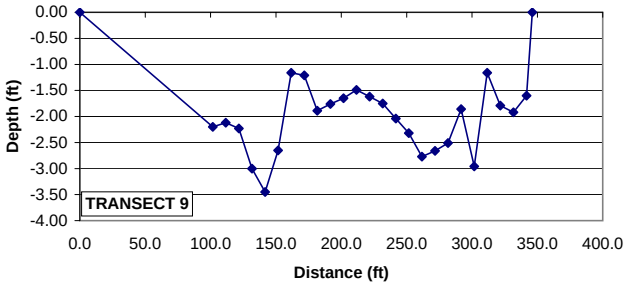


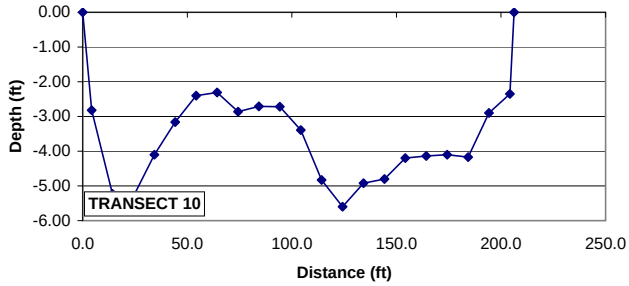












APPENDIX B-2

WEKIVA PLRG SEGMENT DEPTH PROFILES - WEKIVA RIVER SEGMENT 2 - 05/10/05

APPENDIX B-3

WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 1 - 05/11/05

	Transect			Interval			
Transect	**Channel Width (m)**	**Average Depth (m)**	**Cross-Sectional Area (m^2)**	**Distance Between Transects (m)**	**Est. Area (m^2)**	**Avg Cross-Sectional Area (m^2)**	**Est. Volume (m^3)**
1	31.9	0.426	11.9	---	---	---	---
2	32.2	0.948	33.1	91.0	2,914	22.5	2,045
3	24.4	1.14	29.1	100	2,827	31.1	3,108
4	33.1	0.955	33.4	93.0	2,672	31.2	2,903
5	27.5	0.712	14.1	87.0	2,635	23.7	2,063
6	35.4	0.717	28.0	92.0	2,892	21.0	1,933
7	26.1	0.667	17.0	100	3,071	22.5	2,247
8	28.0	0.673	22.2	80.0	2,164	19.6	1,568
9	35.6	0.839	30.2	95.0	3,022	26.2	2,491
10	38.5	0.629	21.4	86.0	3,184	25.8	2,218
Total	---	---	---	824	25,381	---	20,574
Average	31.3	0.770	24.0	91.6	2,820	24.8	2,286

Calculated Depth (m): 0.81

Staff (ft): 1.79

APPENDIX B-3
WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 1 - 05/11/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG1	1	28.76911	81.50278	0.0	31.2	0.00	0.00	127.67
				62.3	32.2	2.00	64.34	
				64.3	2.0	1.40	2.80	
				66.3	2.0	0.70	1.40	
				68.3	2.0	0.68	1.36	
				70.3	2.0	0.48	0.96	
				72.3	2.0	0.40	0.80	
				74.3	2.0	0.48	0.96	
				76.3	2.0	0.73	1.46	
				78.3	2.0	1.10	2.20	
				80.3	2.0	1.73	3.46	
				82.3	2.0	2.19	4.38	
				84.3	2.0	2.63	5.26	
				86.3	2.0	3.40	6.80	
				88.3	2.0	3.46	6.92	
				90.3	2.0	2.80	5.60	
				92.3	2.0	2.49	4.98	
				94.3	2.0	2.12	4.24	
				96.3	3.0	1.60	4.80	
				100.3	3.0	1.42	4.26	
				102.3	2.0	0.34	0.68	
				104.3	1.1	0.01	0.01	
				104.6	0.1	0.00	0.00	
RSR-SEG1	2	28.77000	81.50249	0.0	2.5	0.00	0.00	356.05
				5.0	5.0	1.12	5.60	
				10.0	5.0	1.93	9.65	
				15.0	5.0	2.25	11.25	
				20.0	5.0	2.60	13.00	
				25.0	5.0	2.99	14.95	
				30.0	5.0	3.93	19.65	
				35.0	5.0	5.13	25.65	
				40.0	5.0	6.05	30.25	
				45.0	5.0	7.10	35.50	
				50.0	5.0	6.29	31.45	
				55.0	5.0	6.34	31.70	
				60.0	5.0	4.94	24.70	
				65.0	5.0	4.92	24.60	
				70.0	5.0	3.90	19.50	
				75.0	5.0	3.25	16.25	
				80.0	5.0	2.80	14.00	
				85.0	5.0	1.77	8.85	
				90.0	5.0	1.25	6.25	
				95.0	5.0	1.16	5.80	
				100.0	5.0	1.05	5.25	
				105.0	2.8	0.80	2.20	
		28.76995	81.50288	105.5	0.3	0.00	0.00	

APPENDIX B-3
WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 1 - 05/11/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG1	3			0.0	1.5	0.00	0.00	312.95
				3.0	3.0	2.42	7.26	
				6.0	3.0	2.30	6.90	
				9.0	3.0	2.49	7.47	
				12.0	3.0	2.38	7.14	
				15.0	3.0	2.49	7.47	
				18.0	3.0	2.65	7.95	
				21.0	3.0	3.30	9.90	
				24.0	3.0	4.59	13.77	
				27.0	3.0	6.12	18.36	
				30.0	3.0	7.40	22.20	
				33.0	3.0	8.00	24.00	
				36.0	3.0	7.02	21.06	
				39.0	3.0	6.74	20.22	
				42.0	3.0	6.27	18.81	
				45.0	3.0	6.45	19.35	
				48.0	3.0	6.38	19.14	
				51.0	3.0	5.68	17.04	
				54.0	3.0	5.37	16.11	
				57.0	3.0	4.17	12.51	
				60.0	3.0	3.12	9.36	
				63.0	3.0	2.10	6.30	
				66.0	3.0	2.08	6.24	
				69.0	3.0	1.69	5.07	
				72.0	3.0	1.33	3.99	
				75.0	3.0	1.15	3.45	
				78.0	2.5	0.75	1.88	
		28.77081	81.50311	80.0	1.0	0.00	0.00	
RSR-SEG1	4	28.77165	81.50285	0.0	2.5	0.00	0.00	359.08
				5.0	5.0	1.09	5.45	
				10.0	5.0	1.55	7.75	
				15.0	5.0	1.89	9.45	
				20.0	5.0	2.13	10.65	
				25.0	5.0	2.08	10.40	
				30.0	5.0	2.35	11.75	
				35.0	5.0	2.29	11.45	
				40.0	5.0	2.16	10.80	
				45.0	5.0	1.96	9.80	
				50.0	5.0	1.61	8.05	
				55.0	5.0	2.02	10.10	
				60.0	5.0	2.38	11.90	
				65.0	5.0	2.93	14.65	
				70.0	5.0	4.50	22.50	
				75.0	5.0	6.82	34.10	
				80.0	5.0	8.55	42.75	
				85.0	5.0	8.28	41.40	
				90.0	5.0	6.78	33.90	
				95.0	5.0	5.53	27.65	
				100.0	5.0	3.30	16.50	
				105.0	4.3	1.90	8.08	
		28.77164	81.50323	108.5	1.8	0.00	0.00	

APPENDIX B-3
WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 1 - 05/11/05

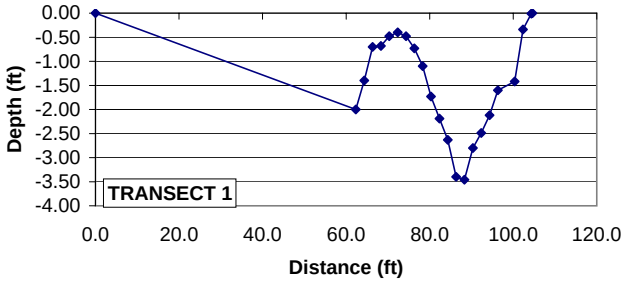
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG1	5	28.77234	81.50284	0.0	10.0	0.00	0.00	151.29
				20.0	11.0	2.09	22.99	
				22.0	2.0	2.25	4.50	
				24.0	2.0	2.50	5.00	
				26.0	2.0	2.64	5.28	
				28.0	2.0	2.83	5.66	
				30.0	2.0	2.90	5.80	
				32.0	2.0	2.92	5.84	
				34.0	2.0	2.90	5.80	
				36.0	2.0	3.00	6.00	
				38.0	2.0	2.99	5.98	
				40.0	2.0	3.00	6.00	
				42.0	2.0	2.95	5.90	
				44.0	2.0	2.85	5.70	
				46.0	2.0	2.80	5.60	
				48.0	2.0	2.76	5.52	
				50.0	2.0	2.73	5.46	
				52.0	2.0	2.70	5.40	
				54.0	2.0	2.56	5.12	
				56.0	2.0	2.75	5.50	
				58.0	2.0	1.82	3.64	
				60.0	2.0	1.52	3.04	
				62.0	2.0	1.60	3.20	
				64.0	14.1	1.30	18.36	
		28.77242	81.50285	90.2	13.1	0.00	0.00	
RSR-SEG1	6	28.77312	81.50234	0.0	1.0	0.00	0.00	300.94
				2.0	2.5	0.69	1.73	
				5.0	4.0	0.70	2.80	
				10.0	5.0	1.57	7.85	
				15.0	5.0	2.18	10.90	
				20.0	5.0	2.55	12.75	
				25.0	5.0	2.44	12.20	
				30.0	5.0	2.39	11.95	
				35.0	5.0	2.68	13.40	
				40.0	5.0	2.79	13.95	
				45.0	5.0	2.85	14.25	
				50.0	5.0	3.05	15.25	
				55.0	5.0	3.10	15.50	
				60.0	5.0	3.10	15.50	
				65.0	5.0	3.26	16.30	
				70.0	5.0	3.30	16.50	
				75.0	5.0	3.26	16.30	
				80.0	5.0	3.29	16.45	
				85.0	5.0	3.66	18.30	
				90.0	5.0	3.40	17.00	
				95.0	5.0	3.43	17.15	
				100.0	5.0	2.66	13.30	
				105.0	5.0	2.27	11.35	
				110.0	5.0	1.38	6.90	
				115.0	3.0	1.12	3.36	
		28.77320	81.50273	116.0	0.5	0.00	0.00	

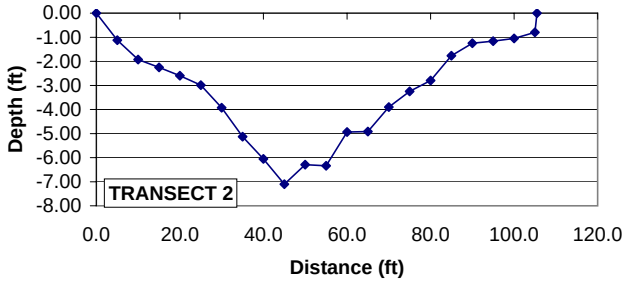
APPENDIX B-3
WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 1 - 05/11/05

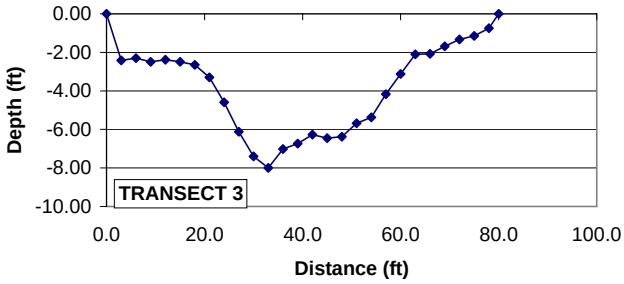
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG1	7	28.77396	81.50200	0.0	0.5	0.00	0.00	182.71
				1.0	2.0	0.15	0.30	
				4.0	3.0	0.64	1.92	
				7.0	3.0	1.10	3.30	
				10.0	3.0	1.25	3.75	
				13.0	3.0	1.52	4.56	
				16.0	3.0	1.89	5.67	
				19.0	3.0	2.12	6.36	
				22.0	3.0	2.58	7.74	
				25.0	3.0	2.62	7.86	
				28.0	3.0	2.93	8.79	
				31.0	3.0	3.10	9.30	
				34.0	3.0	3.15	9.45	
				37.0	3.0	3.23	9.69	
				40.0	3.0	3.31	9.93	
				43.0	3.0	3.30	9.90	
				46.0	3.0	3.30	9.90	
				49.0	3.0	3.31	9.93	
				52.0	3.5	3.30	11.55	
		28.77407	81.50220	56.0	16.8	3.15	52.81	
				85.5	14.8	0.00	0.00	
RSR-SEG1	8	28.77463	81.50164	0.0	0.5	0.00	0.00	239.13
				1.0	2.0	0.15	0.30	
				4.0	4.0	0.70	2.80	
				9.0	5.0	1.32	6.60	
				14.0	5.0	2.82	14.10	
				19.0	5.0	3.53	17.65	
				24.0	5.0	3.70	18.50	
				29.0	5.0	3.63	18.15	
				34.0	5.0	3.91	19.55	
				39.0	5.0	3.80	19.00	
				44.0	5.0	3.40	17.00	
				49.0	5.0	2.20	11.00	
				54.0	5.0	3.20	16.00	
				59.0	5.0	2.68	13.40	
				64.0	5.0	2.72	13.60	
				69.0	5.0	3.30	16.50	
				74.0	5.0	2.85	14.25	
				79.0	5.0	2.59	12.95	
				84.0	5.0	0.95	4.75	
				89.0	3.5	0.65	2.28	
				91.0	1.5	0.50	0.75	
		28.77464	81.50182	92.0	0.5	0.00	0.00	

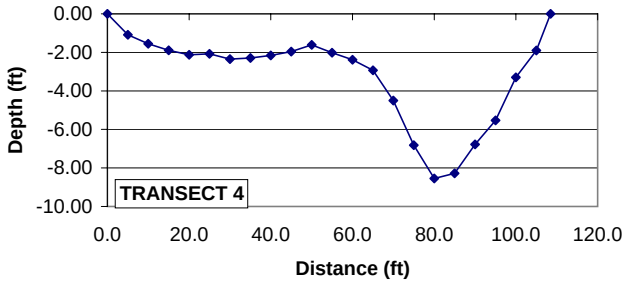
APPENDIX B-3
WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 1 - 05/11/05

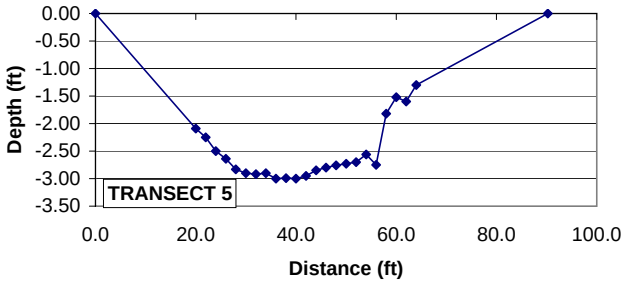
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG1	9	28.77527	81.50117	0.0	1.5	0.00	0.00	325.37
				3.0	4.0	1.74	6.96	
				8.0	5.0	1.81	9.05	
				13.0	5.0	2.25	11.25	
				18.0	5.0	2.30	11.50	
				23.0	5.0	2.47	12.35	
				28.0	5.0	2.70	13.50	
				33.0	5.0	2.85	14.25	
				38.0	5.0	3.06	15.30	
				43.0	5.0	3.19	15.95	
				48.0	5.0	3.20	16.00	
				53.0	5.0	3.30	16.50	
				58.0	5.0	3.24	16.20	
				63.0	5.0	3.40	17.00	
				68.0	5.0	3.45	17.25	
				73.0	5.0	3.49	17.45	
				78.0	5.0	3.55	17.75	
				83.0	5.0	3.58	17.90	
				88.0	5.0	3.49	17.45	
				93.0	5.0	3.65	18.25	
				98.0	3.7	3.18	11.66	
				100.3	9.4	3.40	31.85	
		28.77544	81.50120	116.7	8.2	0.00	0.00	
RSR-SEG1	10	28.77556	81.50025	0.0	0.5	0.00	0.00	229.88
				1.0	1.0	0.95	0.95	
				2.0	2.0	2.19	4.38	
				5.0	3.0	2.13	6.39	
				8.0	3.0	2.52	7.56	
				11.0	3.0	2.75	8.25	
				14.0	3.0	2.85	8.55	
				17.0	3.0	2.86	8.58	
				20.0	3.0	2.82	8.46	
				23.0	3.0	2.90	8.70	
				26.0	3.0	2.92	8.76	
				29.0	3.0	2.83	8.49	
				32.0	3.0	2.72	8.16	
				35.0	3.0	2.77	8.31	
				38.0	3.0	2.43	7.29	
				41.0	3.0	1.54	4.62	
				44.0	3.0	2.52	7.56	
				47.0	3.0	1.93	5.79	
				50.0	3.0	1.90	5.70	
				53.0	3.0	1.67	5.01	
				56.0	3.0	1.55	4.65	
				59.0	3.0	1.56	4.68	
				62.0	3.0	1.76	5.28	
				65.0	3.0	1.42	4.26	
				68.0	3.0	1.88	5.64	
				71.0	3.0	1.83	5.49	
				74.0	3.0	2.34	7.02	
		28.77575	81.50046	77.0	26.1	2.35	61.35	
				126.2	24.6	0.00	0.00	

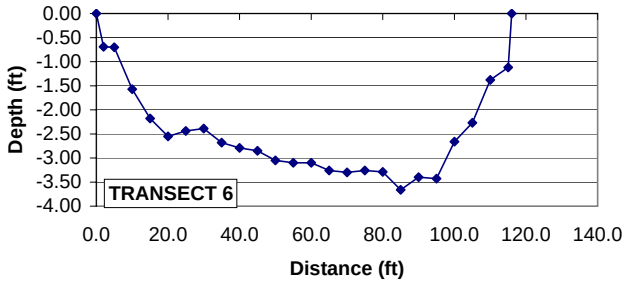


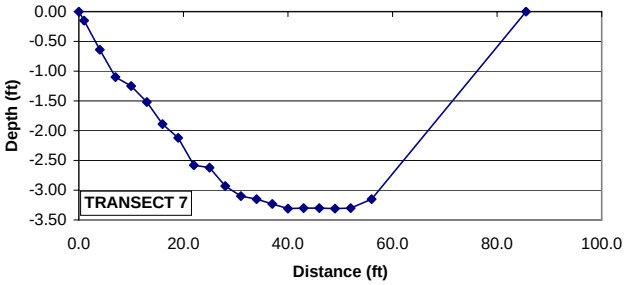


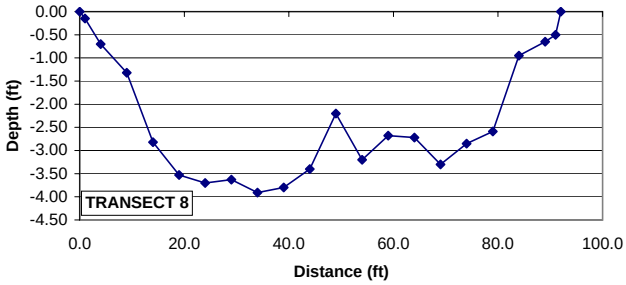


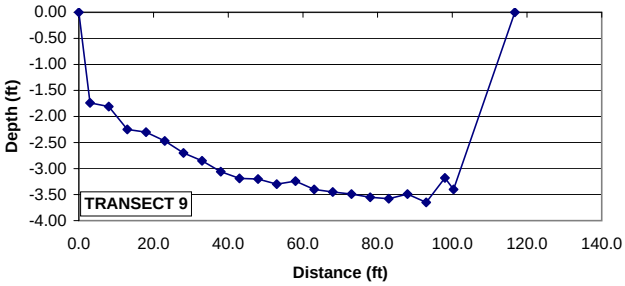


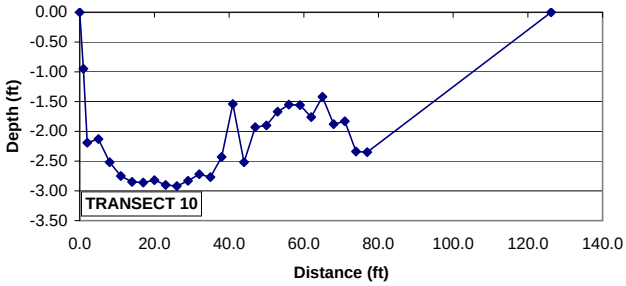












APPENDIX B-3
WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 1 - 05/11/05

APPENDIX B-4

WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 2. - 05/11/05

	Transect			Interval			
Transect	**Channel Width (m)**	**Average Depth (m)**	**Cross-Sectional Area (m^2)**	**Distance Between Transects (m)**	**Est. Area (m^2)**	**Avg Cross-Sectional Area (m^2)**	**Est. Volume (m^3)**
1	28.8	0.652	12.1	---	---	---	---
2	41.5	0.724	16.0	117	4,111	14.0	1,644
3	50.5	0.64	16.9	133	6,112	16.4	2,183
4	42.3	0.368	9.4	122	5,680	13.1	1,605
5	50.5	0.438	15.2	151	7,015	12.3	1,855
6	56.1	0.492	17.0	130	6,941	16.1	2,093
7	41.0	0.472	10.4	133	6,446	13.7	1,817
8	22.9	0.312	3.4	105	3,341	6.9	0,721
9	23.9	0.441	11.0	125	2,927	7.2	0,899
10	17.9	0.425	8.2	261	5,446	9.6	2,498
Total	---	---	---	1,277	48,018	---	15,316
Average	37.5	0.496	11.9	142	5,335	12.1	1,702

Calculated Depth (m): 0.32

Staff (ft): 1.40

APPENDIX B-4

WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 2 - 05/11/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG2	1	28.73111	81.45515	0.0	18.0	0.00	0.00	130.01
				36.1	19.0	2.82	53.71	
				38.1	2.0	1.95	3.90	
				40.1	2.0	1.45	2.90	
				42.1	2.0	1.32	2.64	
				44.1	2.0	1.90	3.80	
				46.1	2.0	2.69	5.38	
				48.1	2.0	3.43	6.86	
				50.1	2.0	3.29	6.58	
				52.1	2.0	3.16	6.32	
				54.1	2.0	2.72	5.44	
				56.1	2.0	2.65	5.30	
				58.1	2.0	3.04	6.08	
				60.1	2.0	2.80	5.60	
				62.1	2.0	2.85	5.70	
				64.1	2.0	2.60	5.20	
				66.1	2.0	1.95	3.90	
				68.1	14.1	0.05	0.71	
				94.3	13.1	0.00	0.00	
RSR-SEG2	2	28.73004	81.45493	0.0	32.8	0.00	0.00	172.42
				65.6	33.8	2.42	81.82	
				67.6	2.0	2.48	4.96	
				69.6	2.0	2.39	4.78	
				71.6	2.0	2.89	5.78	
				73.6	2.0	3.60	7.20	
				75.6	2.0	3.36	6.72	
				77.6	2.0	3.18	6.36	
				79.6	2.0	3.35	6.70	
				81.6	2.0	3.34	6.68	
				83.6	2.0	3.62	7.24	
				85.6	1.7	1.35	2.30	
				87.0	25.3	1.26	31.89	
				136.2	24.6	0.00	0.00	
RSR-SEG2	3	28.72890	81.45467	0.0	24.6	0.00	0.00	181.59
				49.2	25.6	3.02	77.33	
				51.2	2.0	3.30	6.60	
				53.2	2.0	3.25	6.50	
				55.2	2.0	3.15	6.30	
				57.2	2.0	3.12	6.24	
				59.2	2.0	3.30	6.60	
				61.2	2.0	3.12	6.24	
				63.2	2.0	2.63	5.26	
				65.2	2.0	2.29	4.58	
				67.2	2.0	2.17	4.34	
				69.2	2.0	1.32	2.64	
				71.2	2.0	1.15	2.30	
				73.2	2.0	1.95	3.90	
				75.2	2.0	1.00	2.00	
				77.2	45.3	0.90	40.76	
				165.8	44.3	0.00	0.00	

APPENDIX B-4

WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 2 - 05/11/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG2	4	28.72798	81.45427	0.0	19.7	0.00	0.00	100.85
				39.4	20.7	1.10	22.75	
				41.4	2.0	1.09	2.18	
				43.4	2.0	1.02	2.04	
				45.4	2.0	1.20	2.40	
				47.4	2.0	1.90	3.80	
				49.4	2.0	1.65	3.30	
				51.4	2.0	1.53	3.06	
				53.4	2.0	1.72	3.44	
				55.4	2.0	1.59	3.18	
				57.4	2.0	1.49	2.98	
				59.4	2.0	1.30	2.60	
				61.4	2.0	1.32	2.64	
				63.4	38.7	1.20	46.48	
				138.8	37.7	0.00	0.00	
RSR-SEG2	5	28.72703	81.45370	0.0	19.7	0.00	0.00	163.44
				39.4	20.7	1.49	30.82	
				41.4	2.0	1.53	3.06	
				43.4	2.0	1.54	3.08	
				45.4	2.0	2.02	4.04	
				47.4	2.0	1.92	3.84	
				49.4	2.0	1.83	3.66	
				51.4	2.0	1.86	3.72	
				53.4	2.0	1.73	3.46	
				55.4	2.0	1.73	3.46	
				57.4	2.0	1.32	2.64	
				59.4	2.0	1.38	2.76	
				61.4	2.0	1.32	2.64	
				63.4	2.0	1.62	3.24	
				65.4	2.0	1.32	2.64	
				67.4	50.2	1.80	90.38	
				165.8	49.2	0.00	0.00	
RSR-SEG2	6	28.72603	81.45302	0.0	57.4	0.00	0.00	182.77
				114.8	58.4	1.64	95.78	
				116.8	2.0	1.78	3.56	
				118.8	2.0	1.76	3.52	
				120.8	2.0	1.96	3.92	
				122.8	2.0	2.06	4.12	
				124.8	2.0	1.99	3.98	
				126.8	2.0	1.95	3.90	
				128.8	2.0	1.74	3.48	
				130.8	2.0	1.73	3.46	
				132.8	2.0	1.80	3.60	
				134.8	2.0	1.89	3.78	
				136.8	2.0	1.79	3.58	
				138.8	2.0	1.82	3.64	
				140.8	2.0	1.74	3.48	
				142.8	2.0	1.70	3.40	
				144.8	20.7	1.72	35.57	
				184.2	19.7	0.00	0.00	

APPENDIX B-4

WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 2 - 05/11/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG2	7	28.72494	81.42586	0.0	1.0	0.00	0.00	112.00
				2.0	2.0	0.84	1.68	
				4.0	2.0	1.30	2.60	
				6.0	2.0	1.30	2.60	
				8.0	2.0	2.09	4.18	
				10.0	2.0	2.60	5.20	
				12.0	2.0	2.80	5.60	
				14.0	2.0	2.62	5.24	
				16.0	2.0	2.37	4.74	
				18.0	2.0	1.69	3.38	
				20.0	2.0	1.40	2.80	
				22.0	2.0	1.22	2.44	
				24.0	2.0	1.10	2.20	
				26.0	2.0	1.22	2.44	
				28.0	2.0	2.10	4.20	
				30.0	2.0	2.42	4.84	
				32.0	2.0	2.58	5.16	
				34.0	2.0	2.14	4.28	
				36.0	2.0	1.76	3.52	
				38.0	2.0	1.10	2.20	
				40.0	2.0	1.05	2.10	
				42.0	2.0	1.33	2.66	
				44.0	2.0	0.86	1.72	
				46.0	45.3	0.80	36.22	
				134.6	44.3	0.00	0.00	
RSR-SEG2	8	28.72409	81.45251	0.0	24.6	0.00	0.00	36.46
				49.2	25.6	0.29	7.42	
				51.2	2.0	1.18	2.36	
				53.2	2.0	1.45	2.90	
				55.2	2.0	1.82	3.64	
				57.2	2.0	1.67	3.34	
				59.2	2.0	1.38	2.76	
				61.2	2.0	1.25	2.50	
				63.2	2.0	1.15	2.30	
				65.2	2.0	0.94	1.88	
				67.2	2.0	1.23	2.46	
				69.2	2.0	1.03	2.06	
				71.2	3.0	0.95	2.83	
				75.2	2.0	0.00	0.00	

APPENDIX B-4

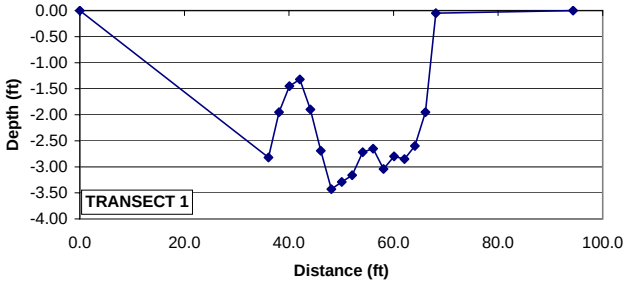
WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 2 - 05/11/05

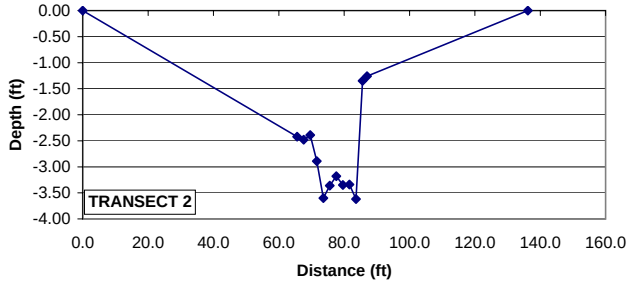
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG2	9	28.72306	81.45251	0.0	1.0	0.00	0.00	118.20
				2.0	2.0	1.30	2.60	
				4.0	2.0	1.40	2.80	
				6.0	2.0	1.30	2.60	
				8.0	2.0	1.59	3.18	
				10.0	2.0	1.46	2.92	
				12.0	2.0	1.45	2.90	
				14.0	2.0	1.43	2.86	
				16.0	2.0	1.39	2.78	
				18.0	2.0	1.49	2.98	
				20.0	2.0	1.53	3.06	
				22.0	2.0	1.22	2.44	
				24.0	2.0	0.96	1.92	
				26.0	2.0	0.92	1.84	
				28.0	2.0	0.93	1.86	
				30.0	2.0	1.06	2.12	
				32.0	2.0	1.42	2.84	
				34.0	2.0	1.57	3.14	
				36.0	2.0	1.84	3.68	
				38.0	2.0	1.42	2.84	
				40.0	2.0	2.26	4.52	
				42.0	2.0	2.00	4.00	
				44.0	2.0	1.59	3.18	
				46.0	2.0	1.76	3.52	
				48.0	2.0	1.96	3.92	
				50.0	2.0	2.22	4.44	
				52.0	2.0	2.26	4.52	
				54.0	2.0	2.13	4.26	
				56.0	2.0	2.13	4.26	
				58.0	2.0	1.88	3.76	
				60.0	2.0	2.00	4.00	
				62.0	2.0	2.00	4.00	
				64.0	2.0	1.82	3.64	
				66.0	2.0	1.72	3.44	
				68.0	2.0	1.32	2.64	
				70.0	2.0	1.45	2.90	
				72.0	2.0	1.35	2.70	
				74.0	2.0	0.85	1.70	
				76.0	1.6	0.75	1.22	
				77.3	1.1	0.20	0.23	
				78.3	0.5	0.00	0.00	

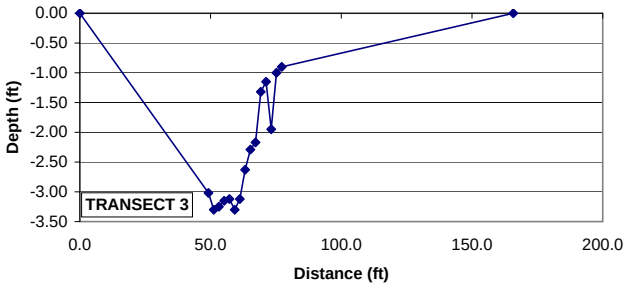
APPENDIX B-4

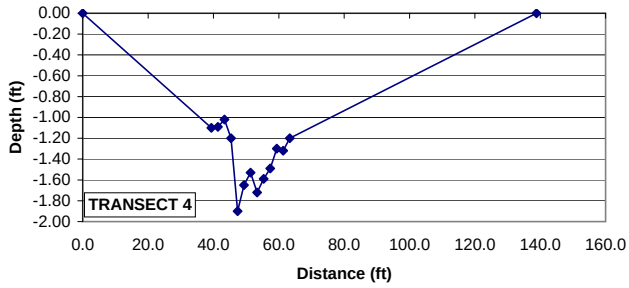
WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 2 - 05/11/05

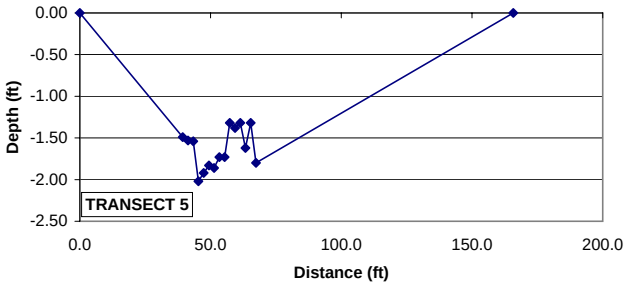
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
RSR-SEG2	10	28.72089	81.45170	0.0	0.5	0.00	0.00	87.84
				1.0	1.5	0.20	0.30	
				3.0	2.0	0.30	0.60	
				5.0	2.0	0.52	1.04	
				7.0	2.0	1.10	2.20	
				9.0	2.0	1.25	2.50	
				11.0	2.0	2.53	5.06	
				13.0	2.0	2.80	5.60	
				15.0	2.0	2.65	5.30	
				17.0	2.0	2.10	4.20	
				19.0	2.0	2.39	4.78	
				21.0	2.0	2.43	4.86	
				23.0	2.0	2.40	4.80	
				25.0	2.0	2.29	4.58	
				27.0	2.0	1.68	3.36	
				29.0	2.0	1.30	2.60	
				31.0	2.0	1.07	2.14	
				33.0	2.0	0.95	1.90	
				35.0	2.0	0.95	1.90	
				37.0	2.0	1.15	2.30	
				39.0	2.0	1.40	2.80	
				41.0	2.0	1.70	3.40	
				43.0	2.0	1.85	3.70	
				45.0	2.0	1.83	3.66	
				47.0	2.0	1.75	3.50	
				49.0	2.0	1.30	2.60	
				51.0	2.0	1.22	2.44	
				53.0	2.0	1.15	2.30	
				55.0	2.0	0.92	1.84	
				57.0	1.3	0.80	1.07	
				57.7	0.8	0.62	0.52	
				58.7	0.5	0.00	0.00	

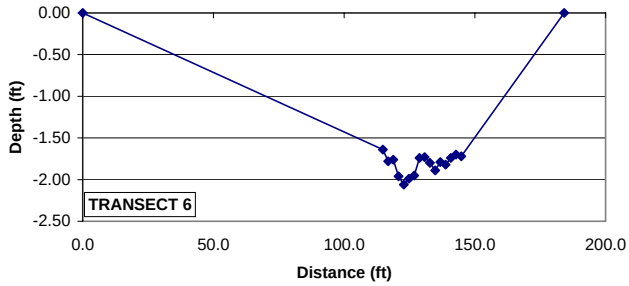


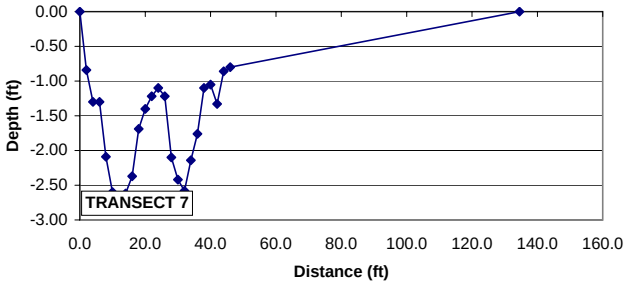


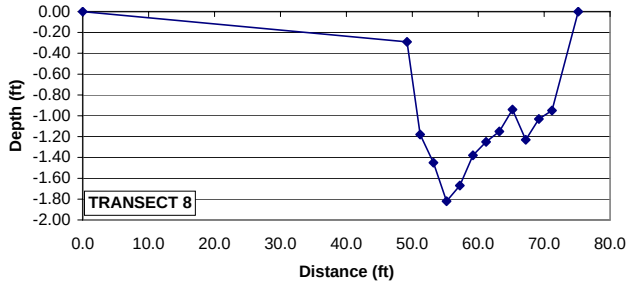


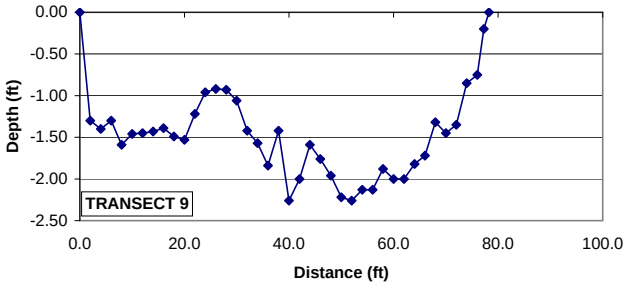


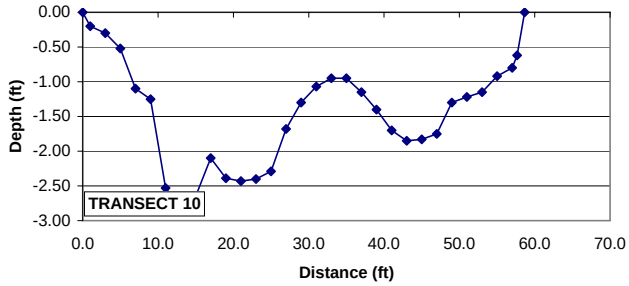












APPENDIX B-4

WEKIVA PLRG SEGMENT DEPTH PROFILES - ROCK SPRING RUN SEGMENT 2 - 05/11/05

APPENDIX B-5

WEKIVA PLRG SEGMENT DEPTH PROFILES - JUNIPER CREEK 05/05/05

	Transect			Interval			
Transect	**Channel Width (m)**	**Average Depth (m)**	**Cross-Sectional Area (m^2)**	**Distance Between Transects (m)**	**Est. Area (m^2)**	**Avg Cross-Sectional Area (m^2)**	**Est. Volume (m^3)**
1	9.9	0.77	8.33	---	---	---	---
2	8.7	0.70	6.84	105	975	7.58	796
3	9.8	0.60	6.42	85	785	6.63	563
4	11.2	0.71	8.65	82	862	7.53	618
5	11.0	0.85	10.34	94	1,044	9.49	892
6	10.8	0.78	8.56	102	1,110	9.45	964
7	12.0	0.83	8.53	87	992	8.55	744
8	7.3	1.10	9.42	105	1,018	8.97	942
9	10.0	0.86	9.27	97	843	9.34	906
10	10.9	0.74	8.52	99	1,035	8.89	880
Total	---	---	---	856	8,665	---	7,306
Average	10.2	0.79	8.49	95.1	963	8.49	812

Calculated Depth (m): 0.84

APPENDIX B-5

WEKIVA PLRG SEGMENT DEPTH PROFILES - JUNIPER CREEK 05/05/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
JC-SEG1	1	29.21904	81.66180	0.0	1.0	0.00	0.00	89.69
				2.0	2.0	0.71	1.42	
				4.0	2.0	1.50	3.00	
				6.0	2.0	1.93	3.86	
				8.0	2.0	1.82	3.64	
				10.0	2.0	2.49	4.98	
				12.0	2.0	2.85	5.70	
				14.0	2.0	3.15	6.30	
				16.0	2.0	3.72	7.44	
				18.0	2.0	4.31	8.62	
				20.0	2.0	4.27	8.54	
				22.0	2.0	4.15	8.30	
				24.0	2.0	3.93	7.86	
				26.0	2.0	3.80	7.60	
				28.0	2.0	3.45	6.90	
				30.0	2.0	2.21	4.42	
				32.0	1.3	0.89	1.11	
				32.5	0.3	0.00	0.00	
JC-SEG1	2	29.21867	81.66081	0.0	1.0	0.00	0.00	73.60
				2.0	2.0	3.35	6.70	
				4.0	2.0	3.65	7.30	
				6.0	2.0	3.85	7.70	
				8.0	2.0	3.71	7.42	
				10.0	2.0	3.65	7.30	
				12.0	2.0	3.55	7.10	
				14.0	2.0	3.52	7.04	
				16.0	2.0	3.21	6.42	
				18.0	2.0	3.08	6.16	
				20.0	2.0	2.34	4.68	
				22.0	2.0	1.40	2.80	
				24.0	2.0	0.92	1.84	
				26.0	2.0	0.49	0.98	
				28.0	1.2	0.13	0.16	
				28.4	0.2	0.00	0.00	
JC-SEG1	3	29.21831	81.66003	0.0	1.0	0.00	0.00	69.12
				2.0	2.0	0.42	0.84	
				4.0	2.0	0.91	1.82	
				6.0	2.0	1.14	2.28	
				8.0	2.0	1.66	3.32	
				10.0	2.0	1.55	3.10	
				12.0	2.0	1.29	2.58	
				14.0	2.0	1.20	2.40	
				16.0	2.0	1.45	2.90	
				18.0	2.0	2.19	4.38	
				20.0	2.0	2.80	5.60	
				22.0	2.0	3.46	6.92	
				24.0	2.0	4.63	9.26	
				26.0	2.0	4.40	8.80	
				28.0	2.0	3.65	7.30	
				30.0	2.0	2.93	5.86	
				32.0	1.1	1.60	1.76	
				32.2	0.1	0.00	0.00	

APPENDIX B-5

WEKIVA PLRG SEGMENT DEPTH PROFILES - JUNIPER CREEK 05/05/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
JC-SEG1	4	29.21802	81.65926	0.0	1.0	0.00	0.00	93.07
				2.0	2.0	1.39	2.78	
				4.0	2.0	1.62	3.24	
				6.0	2.0	1.83	3.66	
				8.0	2.0	2.48	4.96	
				10.0	2.0	2.59	5.18	
				12.0	2.0	3.38	6.76	
				14.0	2.0	3.54	7.08	
				16.0	2.0	3.12	6.24	
				18.0	2.0	3.32	6.64	
				20.0	2.0	3.32	6.64	
				22.0	2.0	3.35	6.70	
				24.0	2.0	3.32	6.64	
				26.0	2.0	3.26	6.52	
				28.0	2.0	2.94	5.88	
				30.0	2.0	2.20	4.40	
				32.0	2.0	2.09	4.18	
				34.0	2.0	2.19	4.38	
				36.0	1.4	0.85	1.19	
				36.8	0.4	0.00	0.00	
JC-SEG1	5	29.21751	81.65850	0.0	1.0	0.00	0.00	111.32
				2.0	2.0	1.73	3.46	
				4.0	2.0	2.12	4.24	
				6.0	2.0	2.02	4.04	
				8.0	2.0	2.80	5.60	
				10.0	2.0	3.55	7.10	
				12.0	2.0	3.79	7.58	
				14.0	2.0	4.17	8.34	
				16.0	2.0	4.25	8.50	
				18.0	2.0	4.01	8.02	
				20.0	2.0	3.60	7.20	
				22.0	2.0	3.84	7.68	
				24.0	2.0	3.46	6.92	
				26.0	2.0	3.92	7.84	
				28.0	2.0	3.95	7.90	
				30.0	2.0	3.32	6.64	
				32.0	2.0	3.40	6.80	
				34.0	2.0	1.71	3.42	
				36.0	1.1	0.04	0.04	
				36.1	0.1	0.00	0.00	

APPENDIX B-5

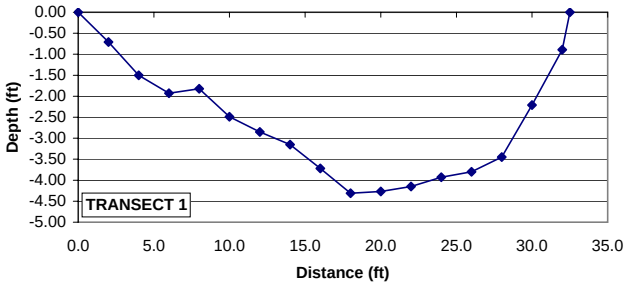
WEKIVA PLRG SEGMENT DEPTH PROFILES - JUNIPER CREEK 05/05/05

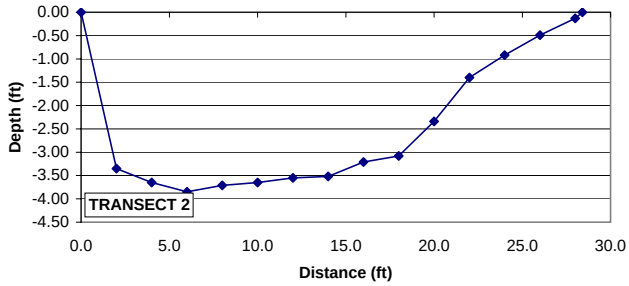
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
JC-SEG1	6	29.21676	81.65791	0.0	1.0	0.00	0.00	92.17
				2.0	2.0	3.51	7.02	
				4.0	2.0	3.50	7.00	
				6.0	2.0	3.82	7.64	
				8.0	2.0	3.68	7.36	
				10.0	2.0	3.64	7.28	
				12.0	2.0	3.61	7.22	
				14.0	2.0	3.54	7.08	
				16.0	2.0	3.46	6.92	
				18.0	2.0	3.22	6.44	
				20.0	2.0	2.99	5.98	
				22.0	2.0	2.98	5.96	
				24.0	2.0	3.00	6.00	
				26.0	2.0	2.62	5.24	
				28.0	2.0	1.80	3.60	
				30.0	2.0	0.53	1.06	
				32.0	2.7	0.14	0.37	
				35.3	1.7	0.00	0.00	
JC-SEG1	7	29.21653	81.65701	0.0	1.0	0.00	0.00	91.81
				2.0	2.0	2.59	5.18	
				4.0	2.0	3.12	6.24	
				6.0	2.0	2.65	5.30	
				8.0	2.0	4.83	9.66	
				10.0	2.0	4.33	8.66	
				12.0	2.0	4.06	8.12	
				14.0	2.0	3.62	7.24	
				16.0	2.0	3.34	6.68	
				18.0	2.0	3.03	6.06	
				20.0	2.0	2.89	5.78	
				22.0	2.0	2.84	5.68	
				24.0	2.0	2.76	5.52	
				26.0	2.0	2.40	4.80	
				28.0	6.8	1.02	6.89	
				39.5	5.8	0.00	0.00	
JC-SEG1	8	29.21581	81.65630	0.0	1.0	0.00	0.00	101.35
				2.0	2.0	3.65	7.30	
				4.0	2.0	6.32	12.64	
				6.0	2.0	6.94	13.88	
				8.0	2.0	6.89	13.78	
				10.0	2.0	6.11	12.22	
				12.0	2.0	5.21	10.42	
				14.0	2.0	4.40	8.80	
				16.0	2.0	3.44	6.88	
				18.0	2.0	2.83	5.66	
				20.0	2.0	2.42	4.84	
				22.0	2.0	2.39	4.78	
				24.0	1.1	0.14	0.15	
				24.1	0.1	0.00	0.00	

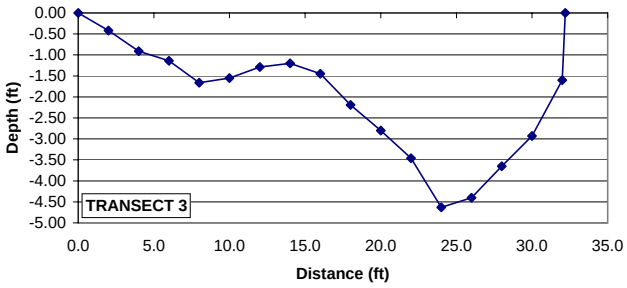
APPENDIX B-5

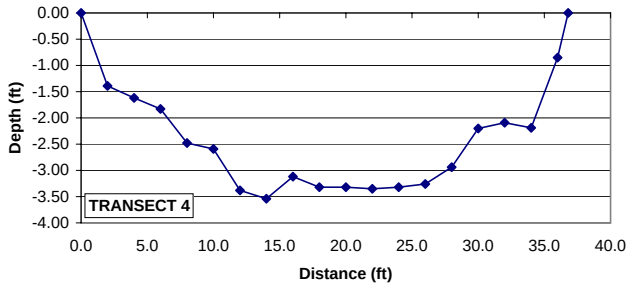
WEKIVA PLRG SEGMENT DEPTH PROFILES - JUNIPER CREEK 05/05/05

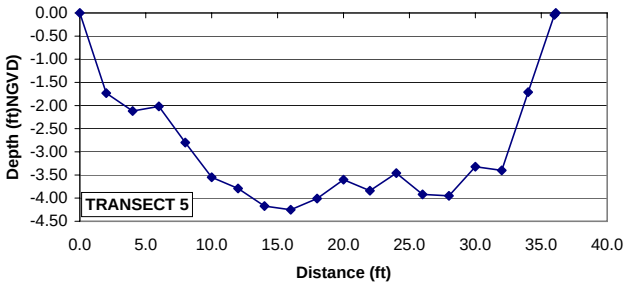
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
JC-SEG1	9	29.21503	81.65585	0.0	1.0	0.00	0.00	99.74
				2.0	2.0	0.91	1.82	
				4.0	2.0	0.30	0.60	
				6.0	2.0	1.73	3.46	
				8.0	2.0	2.44	4.88	
				10.0	2.0	2.92	5.84	
				12.0	2.0	3.42	6.84	
				14.0	2.0	3.79	7.58	
				16.0	2.0	3.66	7.32	
				18.0	2.0	3.88	7.76	
				20.0	2.0	4.02	8.04	
				22.0	2.0	4.17	8.34	
				24.0	2.0	4.02	8.04	
				26.0	2.0	4.05	8.10	
				28.0	2.0	4.16	8.32	
				30.0	2.0	3.95	7.90	
				32.0	1.5	3.36	4.90	
				32.9	0.5	0.00	0.00	
JC-SEG1	10	29.21420	81.65550	0.0	1.0	0.00	0.00	91.67
				2.0	2.0	3.55	7.10	
				4.0	2.0	3.82	7.64	
				6.0	2.0	3.65	7.30	
				8.0	2.0	3.40	6.80	
				10.0	2.0	2.99	5.98	
				12.0	2.0	2.63	5.26	
				14.0	2.0	2.55	5.10	
				16.0	2.0	2.62	5.24	
				18.0	2.0	2.60	5.20	
				20.0	2.0	2.59	5.18	
				22.0	2.0	2.36	4.72	
				24.0	2.0	2.44	4.88	
				26.0	2.0	2.29	4.58	
				28.0	2.0	2.27	4.54	
				30.0	2.0	2.40	4.80	
				32.0	2.0	2.16	4.32	
				34.0	1.9	1.64	3.03	
				35.7	0.9	0.00	0.00	

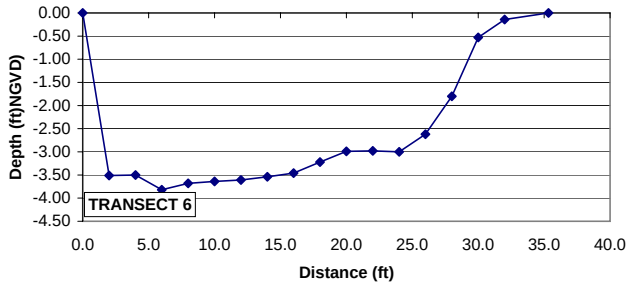


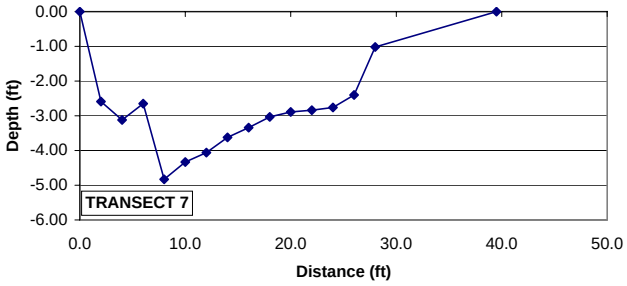


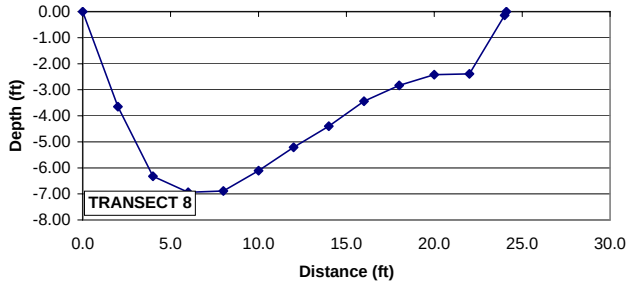


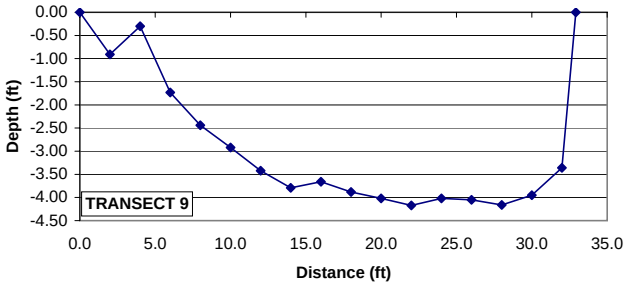


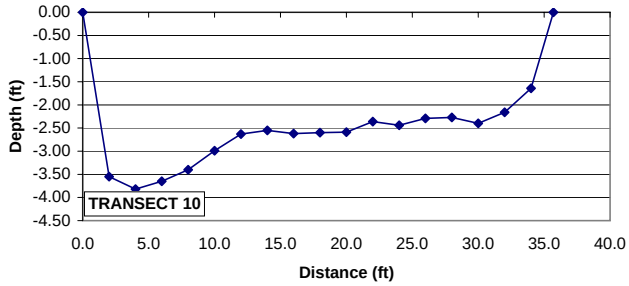












APPENDIX B-5
WEKIVA PLRG SEGMENT DEPTH PROFILES - JUNIPER CREEK 05/05/05

APPENDIX B-6

WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

	Transect			Interval			
Transect	**Channel Width (m)**	**Average Depth (m)**	**Cross-Sectional Area (m^2)**	**Distance Between Transects (m)**	**Est. Area (m^2)**	**Avg Cross-Sectional Area (m^2)**	**Est. Volume (m^3)**
1	61.3	0.58	39.49	---	---	---	---
2	64.8	0.61	43.58	51	3201	41.53	2109
3	61.0	0.63	41.66	96	6064	42.62	4111
4	46.1	0.68	31.91	74	3980	36.79	2736
5	45.9	0.60	28.31	84	3,855	30.11	2525
6	40.5	0.66	28.14	87	3,767	28.22	2463
7	72.6	0.52	39.52	89	5047	33.83	3021
8	73.5	0.52	41.63	62	4,516	40.58	2510
9	74.7	0.50	39.26	85	6267	40.44	3421
10	62.5	0.50	33.19	67	4,588	36.22	2423
Total	---	---	---	695	41,286	---	25,318
Average	60.3	0.58	36.67	77.3	4587	36.70	2813

Calculated Depth (m): 0.61

APPENDIX B-6

WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
ASC-SEG1	1			0.0	4.8	0.00	0.00	425.06
		29.08627	81.56971	9.6	9.8	3.69	36.11	
				19.6	10.0	3.10	31.00	
				29.6	10.0	2.24	22.40	
				39.6	10.0	2.85	28.50	
				49.6	10.0	3.35	33.50	
				59.6	10.0	2.15	21.50	
				69.6	10.0	1.98	19.80	
				79.6	10.0	2.25	22.50	
				89.6	10.0	2.92	29.20	
				99.6	15.0	2.89	43.35	
				119.6	15.0	2.38	35.70	
				129.6	10.0	2.23	22.30	
				139.6	10.0	1.83	18.30	
				149.6	10.0	1.52	15.20	
				159.6	10.0	1.42	14.20	
				169.6	10.0	1.27	12.70	
				179.6	10.0	1.10	11.00	
				189.6	10.0	0.63	6.30	
		29.08659	81.56931	199.6	5.8	0.26	1.50	
				201.1	0.8	0.00	0.00	
ASC-SEG1	2			0.0	0.5	0.00	0.00	469.05
		29.08596	81.56930	1.0	3.0	0.86	2.58	
				6.0	7.5	1.12	8.40	
				16.0	10.0	1.13	11.30	
				26.0	10.0	2.79	27.90	
				36.0	10.0	2.34	23.40	
				46.0	10.0	2.54	25.40	
				56.0	10.0	2.60	26.00	
				66.0	10.0	2.36	23.60	
				76.0	10.0	*2.50*	24.95	
				86.0	10.0	2.63	26.30	
				96.0	10.0	2.59	25.90	
				106.0	10.0	2.50	25.00	
				116.0	10.0	2.41	24.10	
				126.0	10.0	2.45	24.50	
				136.0	10.0	2.39	23.90	
				146.0	10.0	2.12	21.20	
				156.0	10.0	2.46	24.60	
				166.0	10.0	1.70	17.00	
				176.0	10.0	2.24	22.40	
				186.0	10.0	2.50	25.00	
				196.0	10.0	2.11	21.10	
		29.08639	81.56895	206.0	8.3	1.76	14.52	
				212.5	3.3	0.00	0.00	

APPENDIX B-6

WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
ASC-SEG1	3			0.0	2.5	0.00	0.00	448.48
		29.08538	81.56874	5.0	7.5	1.82	13.65	
				15.0	10.0	1.86	18.60	
				25.0	10.0	1.85	18.50	
				35.0	10.0	2.21	22.10	
				45.0	10.0	2.06	20.60	
				55.0	10.0	2.02	20.20	
				65.0	10.0	1.96	19.60	
				75.0	10.0	1.96	19.60	
				85.0	10.0	2.31	23.10	
				95.0	10.0	2.25	22.50	
				105.0	10.0	2.39	23.90	
				115.0	10.0	2.45	24.50	
				125.0	10.0	2.85	28.50	
				135.0	10.0	2.71	27.10	
				145.0	10.0	2.66	26.60	
				155.0	10.0	2.76	27.60	
				165.0	10.0	2.98	29.80	
				175.0	10.0	2.55	25.50	
				185.0	10.0	2.31	23.10	
		29.08564	81.56815	195.0	7.5	1.79	13.43	
				200.0	2.5	0.00	0.00	

APPENDIX B-6

WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
ASC-SEG1	4			0.0	3.0	0.00	0.00	343.45
		29.08475	81.56853	6.0	5.5	1.72	9.46	
				11.0	5.0	1.65	8.25	
				16.0	5.0	1.81	9.05	
				21.0	5.0	1.79	8.95	
				26.0	5.0	1.83	9.15	
				31.0	5.0	1.85	9.25	
				36.0	5.0	2.10	10.50	
				41.0	5.0	2.23	11.15	
				46.0	5.0	2.16	10.80	
				51.0	5.0	2.24	11.20	
				56.0	2.5	2.51	6.28	
				56.0	2.5	2.42	6.05	
				61.0	7.5	2.53	18.98	
				71.0	7.5	2.46	18.45	
				76.0	5.0	2.56	12.80	
				81.0	5.0	2.52	12.60	
				86.0	5.0	2.69	13.45	
				91.0	5.0	2.44	12.20	
				96.0	5.0	2.53	12.65	
				101.0	5.0	2.75	13.75	
				106.0	5.0	2.64	13.20	
				111.0	5.0	2.66	13.30	
				116.0	5.0	2.53	12.65	
				121.0	5.0	2.69	13.45	
				126.0	5.0	2.82	14.10	
				131.0	5.0	2.76	13.80	
				136.0	5.0	3.03	15.15	
				141.0	3.3	2.79	9.21	
		29.08501	81.56779	142.6	5.1	2.69	13.63	
				151.1	4.3	0.00	0.00	

APPENDIX B-6

WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
ASC-SEG1	5	29.08406	81.56812	0.0	2.5	0.00	0.00	304.68
				5.0	5.0	1.33	6.65	
				10.0	5.0	1.38	6.90	
				15.0	5.0	1.31	6.55	
				20.0	5.0	1.30	6.50	
				25.0	5.0	1.53	7.65	
				30.0	5.0	1.67	8.35	
				35.0	5.0	1.98	9.90	
				40.0	5.0	2.25	11.25	
				45.0	5.0	2.48	12.40	
				50.0	5.0	2.31	11.55	
				55.0	5.0	2.33	11.65	
				60.0	5.0	2.92	14.60	
				65.0	5.0	2.72	13.60	
				70.0	5.0	2.90	14.50	
				75.0	5.0	2.92	14.60	
				80.0	5.0	2.83	14.15	
				85.0	5.0	2.70	13.50	
				90.0	5.0	2.52	12.60	
				95.0	5.0	2.56	12.80	
				100.0	5.0	1.83	9.15	
				105.0	5.0	1.84	9.20	
				110.0	5.0	1.90	9.50	
				115.0	5.0	2.06	10.30	
				120.0	5.0	2.08	10.40	
				125.0	5.0	2.10	10.50	
				130.0	5.0	1.80	9.00	
				135.0	5.0	1.82	9.10	
				140.0	5.0	1.72	8.60	
		29.08427	81.56771	145.0	5.2	1.76	9.23	
				150.5	2.7	0.00	0.00	

APPENDIX B-6

WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
ASC-SEG1	6			0.0	0.5	0.00	0.00	302.94
		29.08336	81.56764	1.0	3.0	1.10	3.30	
				6.0	5.0	2.10	10.50	
				11.0	5.0	2.20	11.00	
				16.0	5.0	2.15	10.75	
				21.0	5.0	2.25	11.25	
				26.0	5.0	2.40	12.00	
				31.0	5.0	2.50	12.50	
				36.0	5.0	2.45	12.25	
				41.0	5.0	2.32	11.60	
				46.0	5.0	2.35	11.75	
				51.0	5.0	2.47	12.35	
				56.0	5.0	2.59	12.95	
				61.0	5.0	2.52	12.60	
				66.0	5.0	2.56	12.80	
				71.0	5.0	2.49	12.45	
				76.0	5.0	2.65	13.25	
				81.0	5.0	2.58	12.90	
				86.0	5.0	2.55	12.75	
				91.0	5.0	2.40	12.00	
				96.0	5.0	2.45	12.25	
				101.0	5.0	2.40	12.00	
				106.0	5.0	2.40	12.00	
				111.0	5.0	2.13	10.65	
				116.0	5.0	2.25	11.25	
				121.0	4.2	2.28	9.46	
		29.08361	81.56738	124.3	5.9	2.43	14.38	
				132.8	4.3	0.00	0.00	

APPENDIX B-6

WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
ASC-SEG1	7	29.08272	81.56731	0.0	2.5	0.00	0.00	425.37
				5.0	7.5	1.50	11.25	
				15.0	10.0	1.80	18.00	
				25.0	10.0	1.66	16.60	
				35.0	10.0	1.82	18.20	
				45.0	10.0	1.86	18.60	
				55.0	10.0	1.97	19.70	
				65.0	10.0	2.23	22.30	
				75.0	10.0	2.05	20.50	
				85.0	10.0	1.84	18.40	
				95.0	10.0	2.12	21.20	
				105.0	10.0	1.86	18.60	
				115.0	10.0	2.20	22.00	
				125.0	10.0	2.32	23.20	
				135.0	10.0	2.43	24.30	
				145.0	10.0	2.16	21.60	
				155.0	10.0	1.97	19.70	
				165.0	10.0	1.89	18.90	
				175.0	10.0	1.77	17.70	
				185.0	10.0	1.71	17.10	
				195.0	10.0	1.59	15.90	
				205.0	10.0	1.47	14.70	
				215.0	10.0	1.39	13.90	
		29.08295	81.56662	225.0	11.5	1.13	13.02	
				238.0	6.5	0.00	0.00	

APPENDIX B-6

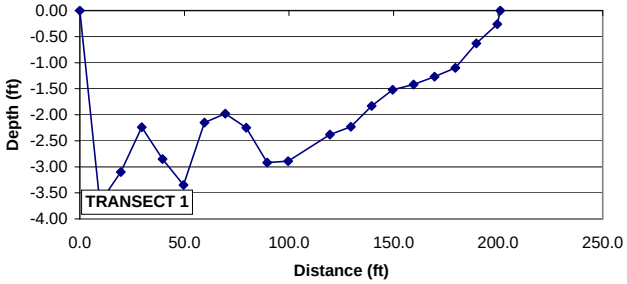
WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

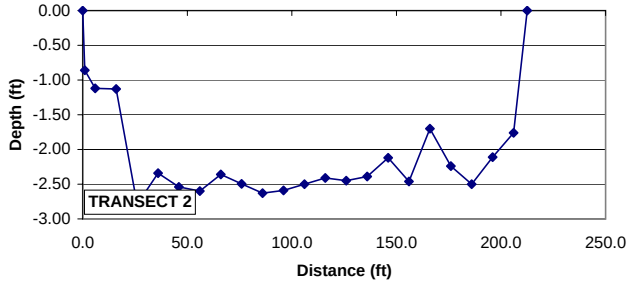
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
ASC-SEG1	8			0.0	0.5	0.00	0.00	448.14
		29.08216	81.56683	1.0	5.5	1.35	7.43	
				11.0	10.0	1.78	17.80	
				21.0	10.0	1.99	19.90	
				31.0	10.0	2.06	20.60	
				41.0	10.0	2.02	20.20	
				51.0	10.0	2.10	21.00	
				61.0	10.0	2.02	20.20	
				71.0	10.0	2.10	21.00	
				81.0	10.0	2.02	20.20	
				91.0	10.0	2.26	22.60	
				101.0	10.0	2.00	20.00	
				111.0	10.0	1.98	19.80	
				121.0	10.0	2.00	20.00	
				131.0	10.0	2.00	20.00	
				141.0	10.0	2.15	21.50	
				151.0	10.0	2.10	21.00	
				161.0	10.0	2.21	22.10	
				171.0	10.0	1.92	19.20	
				181.0	10.0	1.67	16.70	
				191.0	10.0	1.68	16.80	
				201.0	10.0	1.44	14.40	
				211.0	10.0	1.26	12.60	
				221.0	10.0	1.45	14.50	
				231.0	9.5	1.67	15.87	
		29.08255	81.56631	240.0	5.0	0.55	2.75	
				241.0	0.5	0.00	0.00	

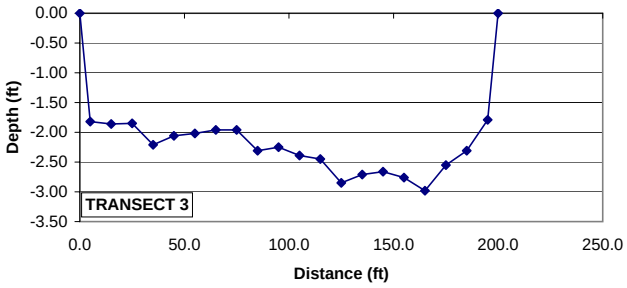
APPENDIX B-6

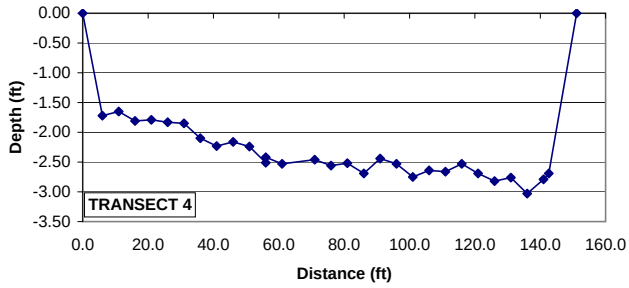
WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

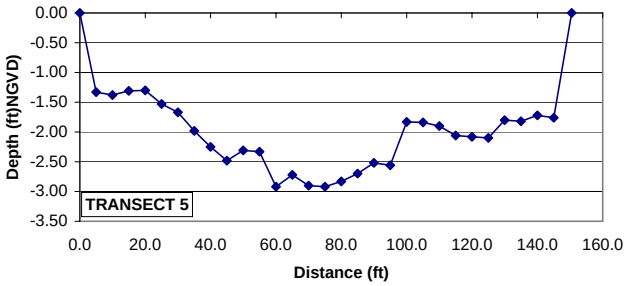
Location	Transect	Latitude	Longitude	Distance (ft)	Segment Width (ft)	Depth (ft)	Segment Area (ft^2)	Cross-Sectional Area (ft^2)
ASC-SEG1	9			0.0	2.5	0.00	0.00	422.54
		29.08167	81.56665	5.0	7.5	0.75	5.63	
				15.0	10.0	1.72	17.20	
				25.0	10.0	1.92	19.20	
				35.0	10.0	1.42	14.20	
				45.0	10.0	1.60	16.00	
				55.0	10.0	1.79	17.90	
				65.0	10.0	1.75	17.50	
				75.0	10.0	1.68	16.80	
				85.0	10.0	1.70	17.00	
				95.0	10.0	1.91	19.10	
				105.0	10.0	1.98	19.80	
				115.0	10.0	1.84	18.40	
				125.0	10.0	1.85	18.50	
				135.0	10.0	1.96	19.60	
				145.0	10.0	2.04	20.40	
				155.0	10.0	1.86	18.60	
				165.0	10.0	2.04	20.40	
				175.0	10.0	1.70	17.00	
				185.0	10.0	1.80	18.00	
				195.0	10.0	1.84	18.40	
				205.0	10.0	2.06	20.60	
				215.0	10.0	2.02	20.20	
				225.0	10.0	1.80	18.00	
		29.08171	81.56572	235.0	10.1	1.40	14.12	
				245.2	5.1	0.00	0.00	
ASC-SEG1	10			0.0	2.5	0.00	0.00	357.25
				5.0	7.5	0.82	6.15	
				15.0	10.0	1.80	18.00	
				25.0	10.0	1.90	19.00	
				35.0	10.0	1.81	18.10	
				45.0	10.0	1.75	17.50	
				55.0	10.0	2.09	20.90	
				65.0	10.0	1.85	18.50	
				75.0	10.0	1.80	18.00	
				85.0	10.0	1.80	18.00	
				95.0	10.0	1.70	17.00	
				105.0	10.0	1.76	17.60	
				115.0	10.0	1.82	18.20	
				125.0	10.0	1.94	19.40	
				135.0	10.0	2.00	20.00	
				145.0	10.0	2.05	20.50	
				155.0	10.0	2.05	20.50	
				165.0	10.0	2.00	20.00	
				175.0	10.0	1.84	18.40	
				185.0	10.0	1.66	16.60	
				195.0	10.0	1.49	14.90	
				205.0	5.0	0.00	0.00	

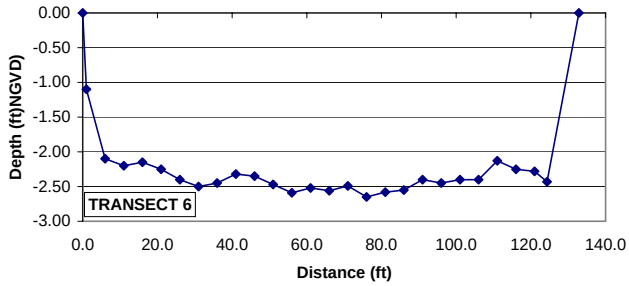


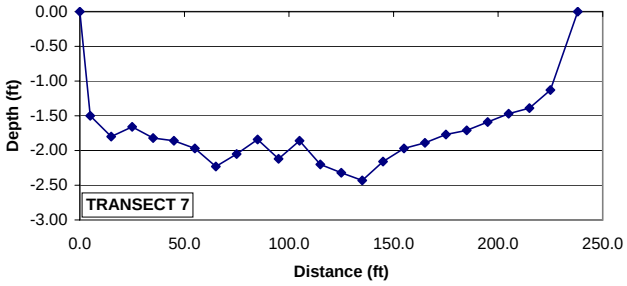


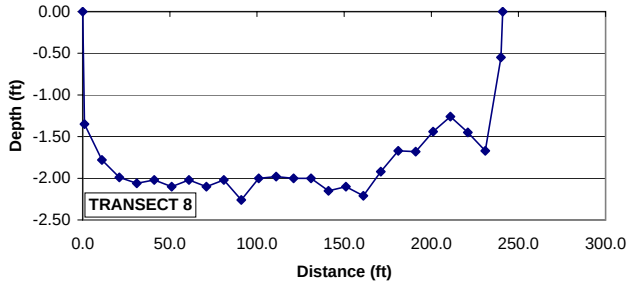


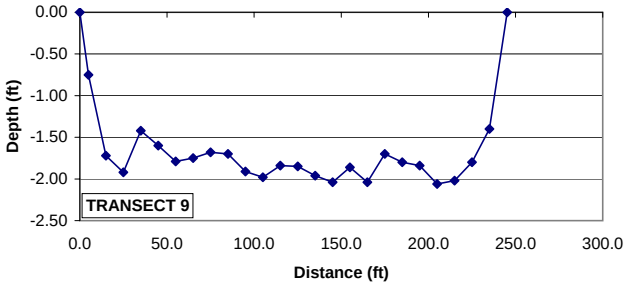


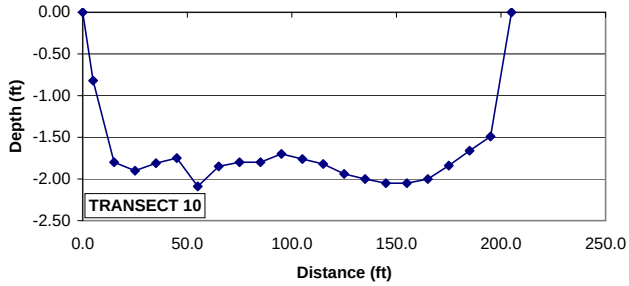










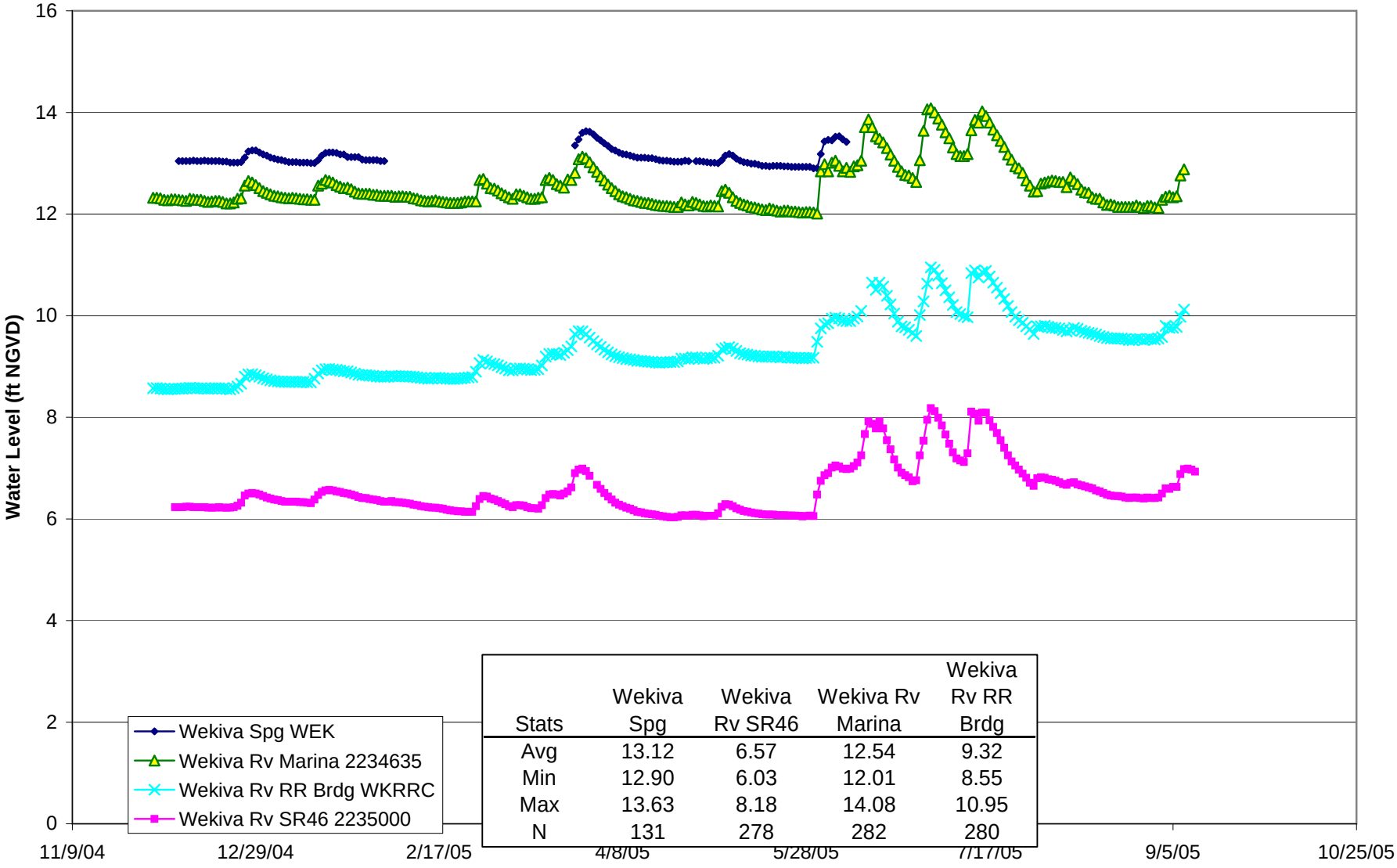


APPENDIX B-6

WEKIVA PLRG SEGMENT DEPTH PROFILES - ALEXANDER SPRING CREEK 05/03/05 & 5/24/05

Appendix C

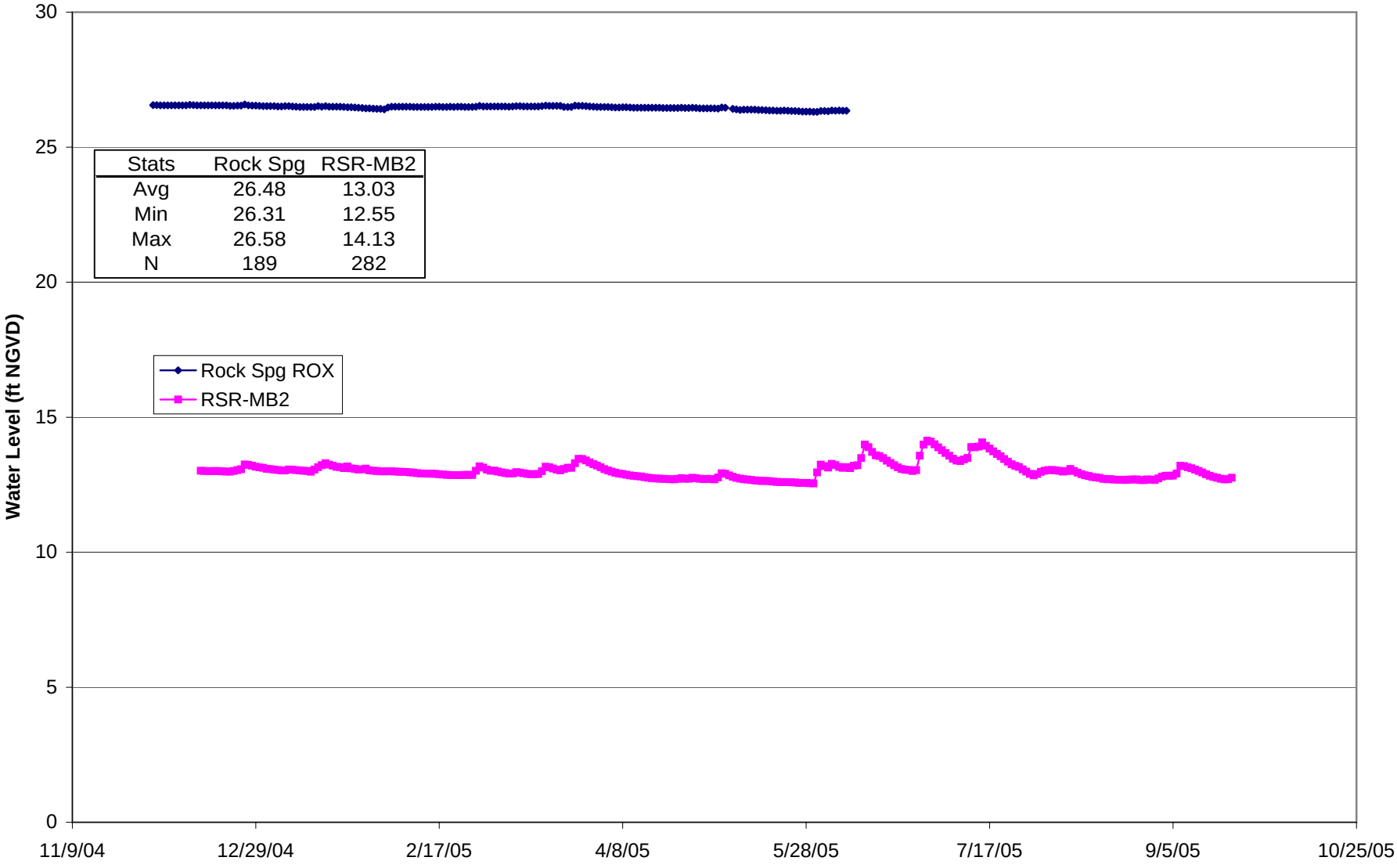
Detailed Stage and Discharge Data for the Wekiva River System and Reference Site Mass Balance Stations and Stream Segments



Stats	Wekiva Spg	Wekiva Rv SR46	Wekiva Rv Marina	Wekiva Rv RR Brdg
Avg	13.12	6.57	12.54	9.32
Min	12.90	6.03	12.01	8.55
Max	13.63	8.18	14.08	10.95
N	131	278	282	280

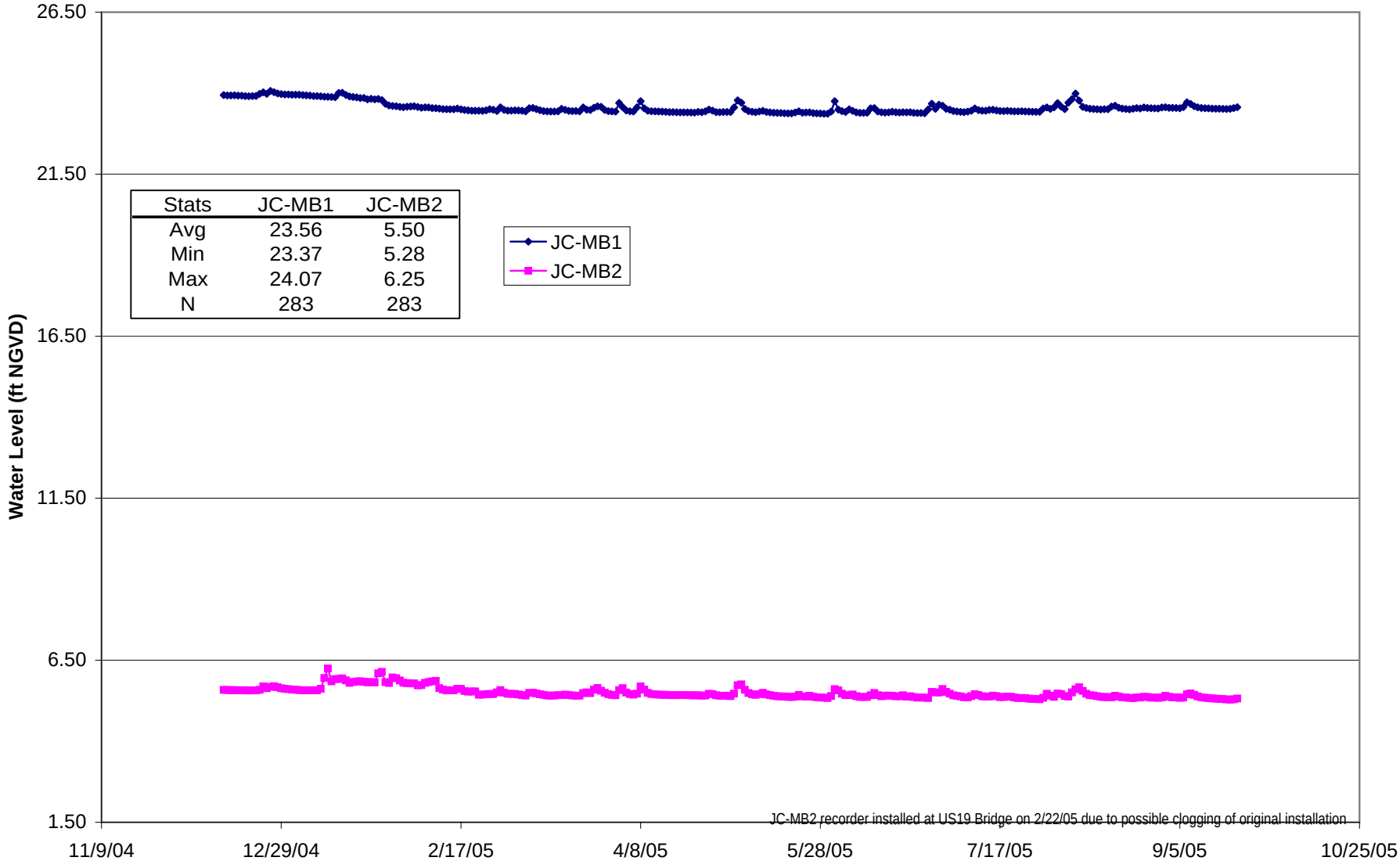
APPENDIX C-1

WEKIVA RIVER WATER LEVEL TIMESERIES - WEKIVA RIVER PLRG



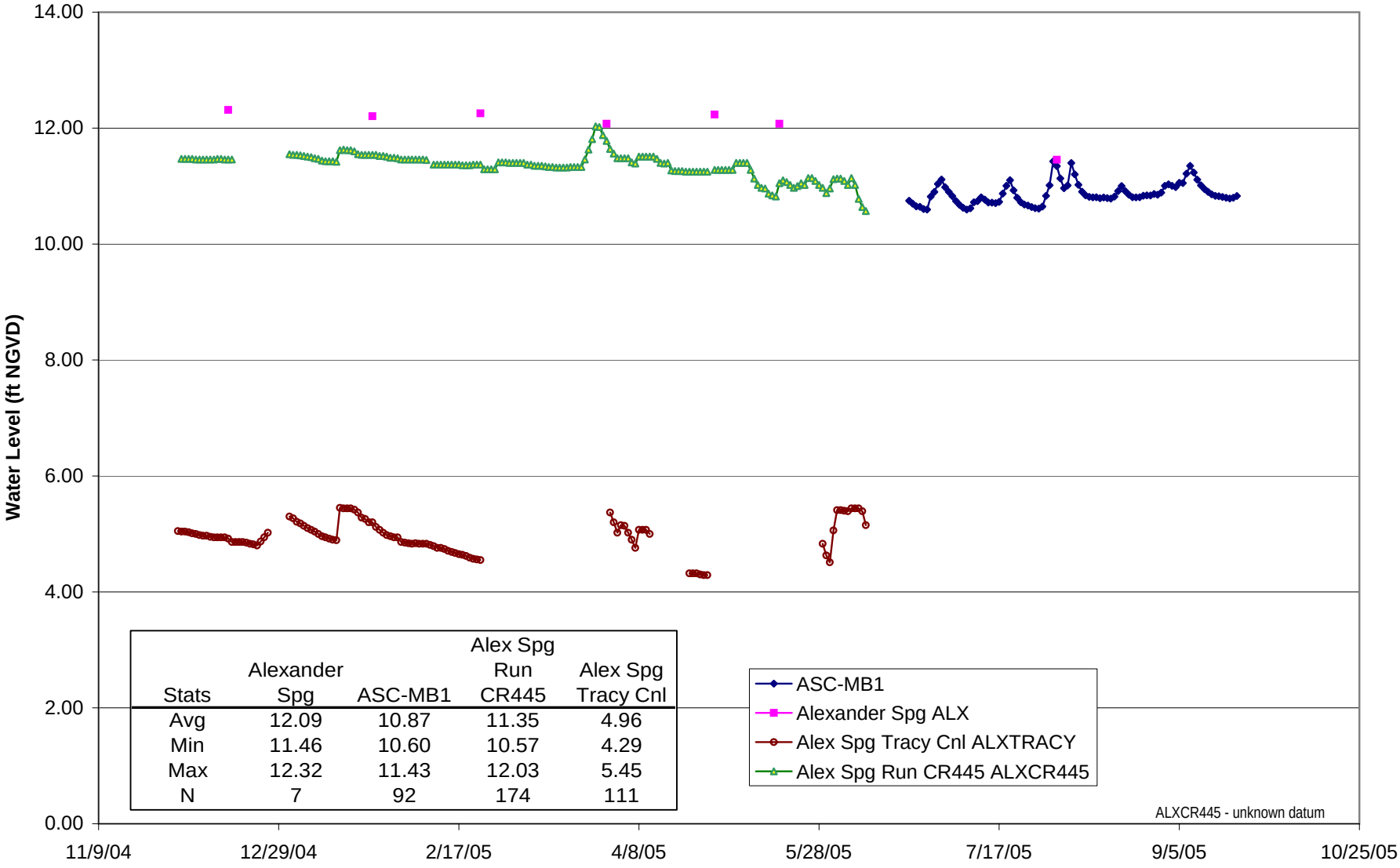
APPENDIX C-2

ROCK SPRING RUN WATER LEVEL TIMESERIES - WEKIVA RIVER PLRG



APPENDIX C-3

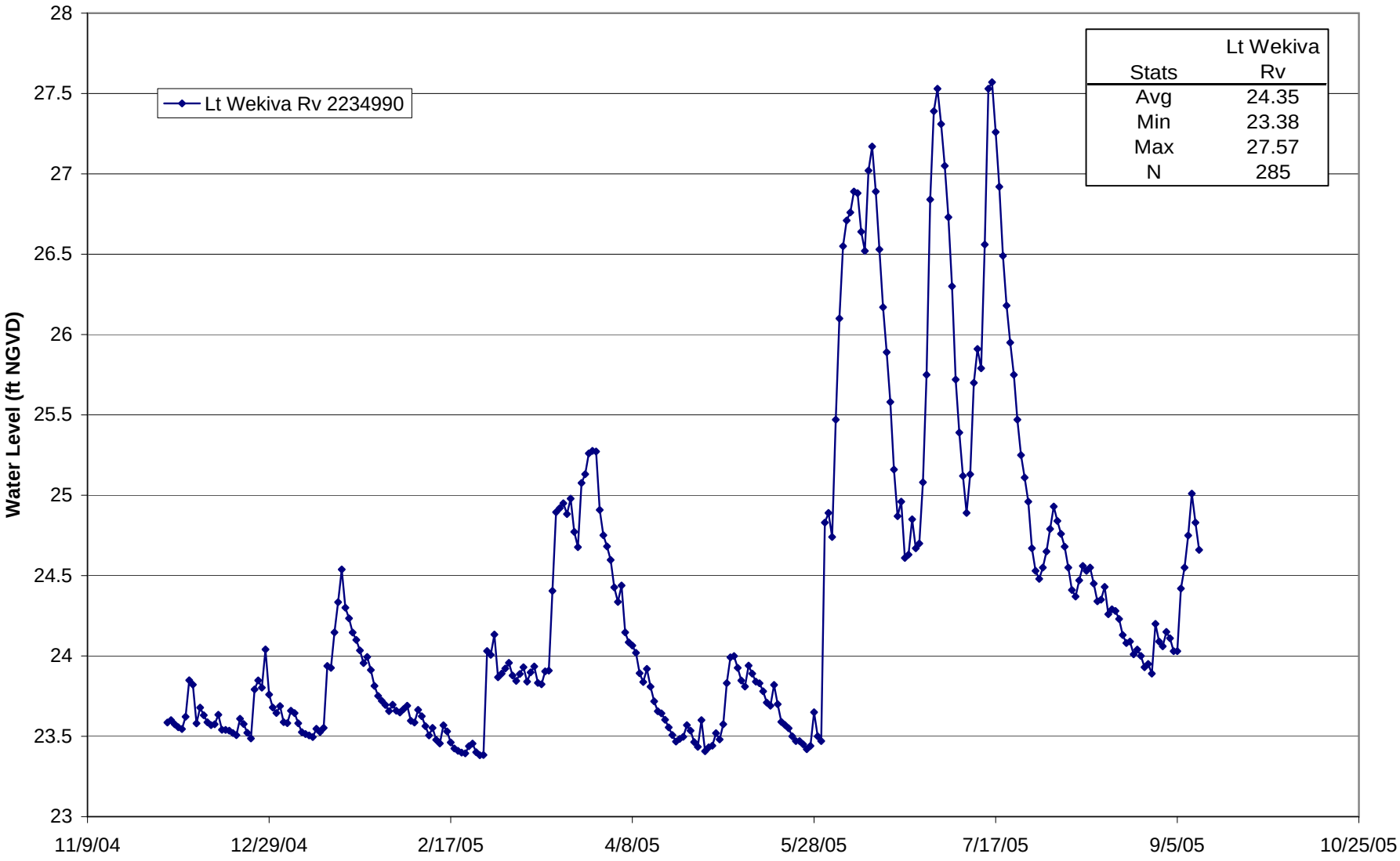
JUNIPER CREEK WATER LEVEL TIMESERIES - WEKIVA RIVER PLRG



Stats	Alexander Spg	ASC-MB1	Alex Spg Run CR445	Alex Spg Tracy Cnl
Avg	12.09	10.87	11.35	4.96
Min	11.46	10.60	10.57	4.29
Max	12.32	11.43	12.03	5.45
N	7	92	174	111

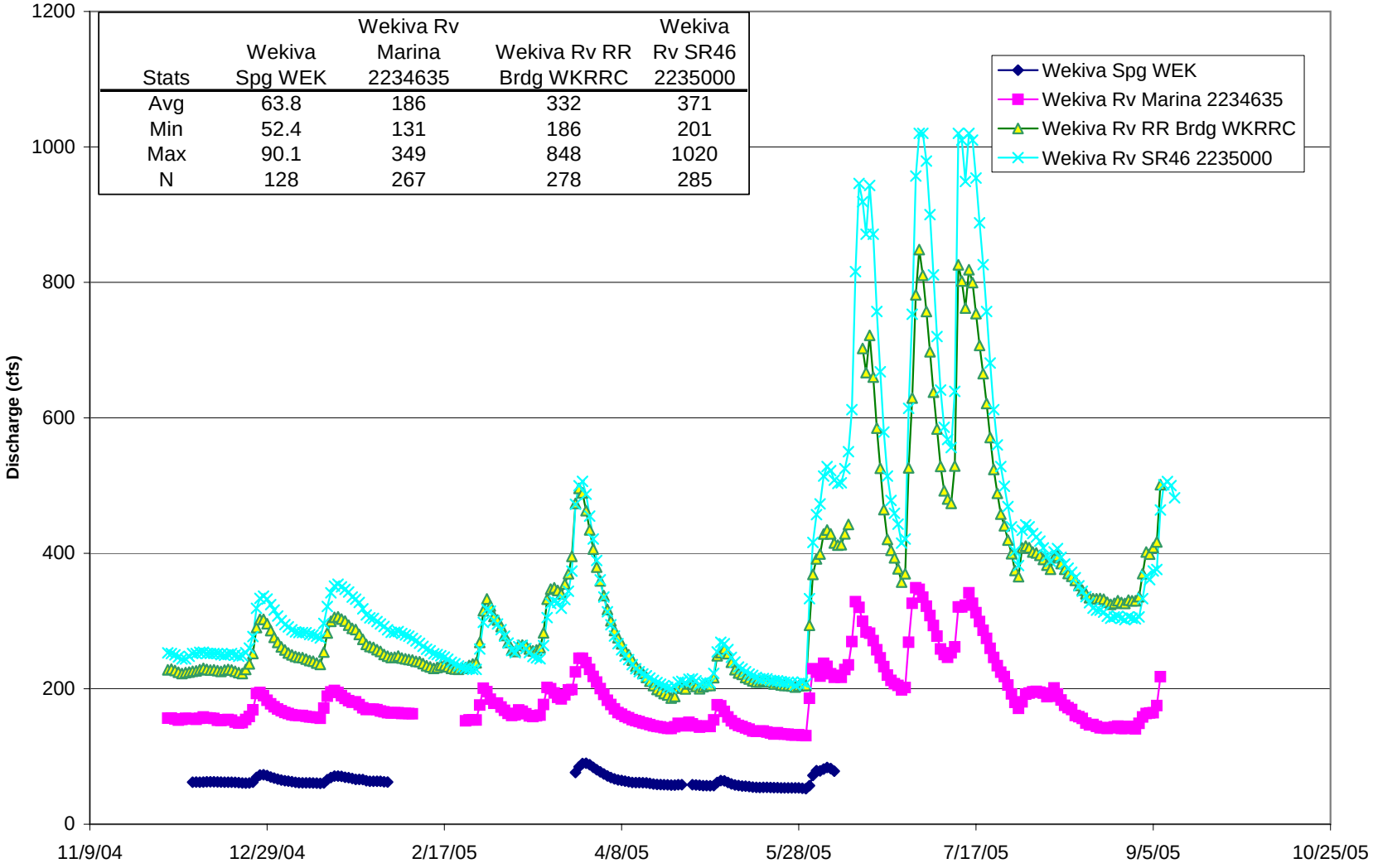
APPENDIX C-4

ALEXANDER SPRING CREEK WATER LEVEL TIMESERIES - WEKIVA RIVER PLRG



APPENDIX C-5

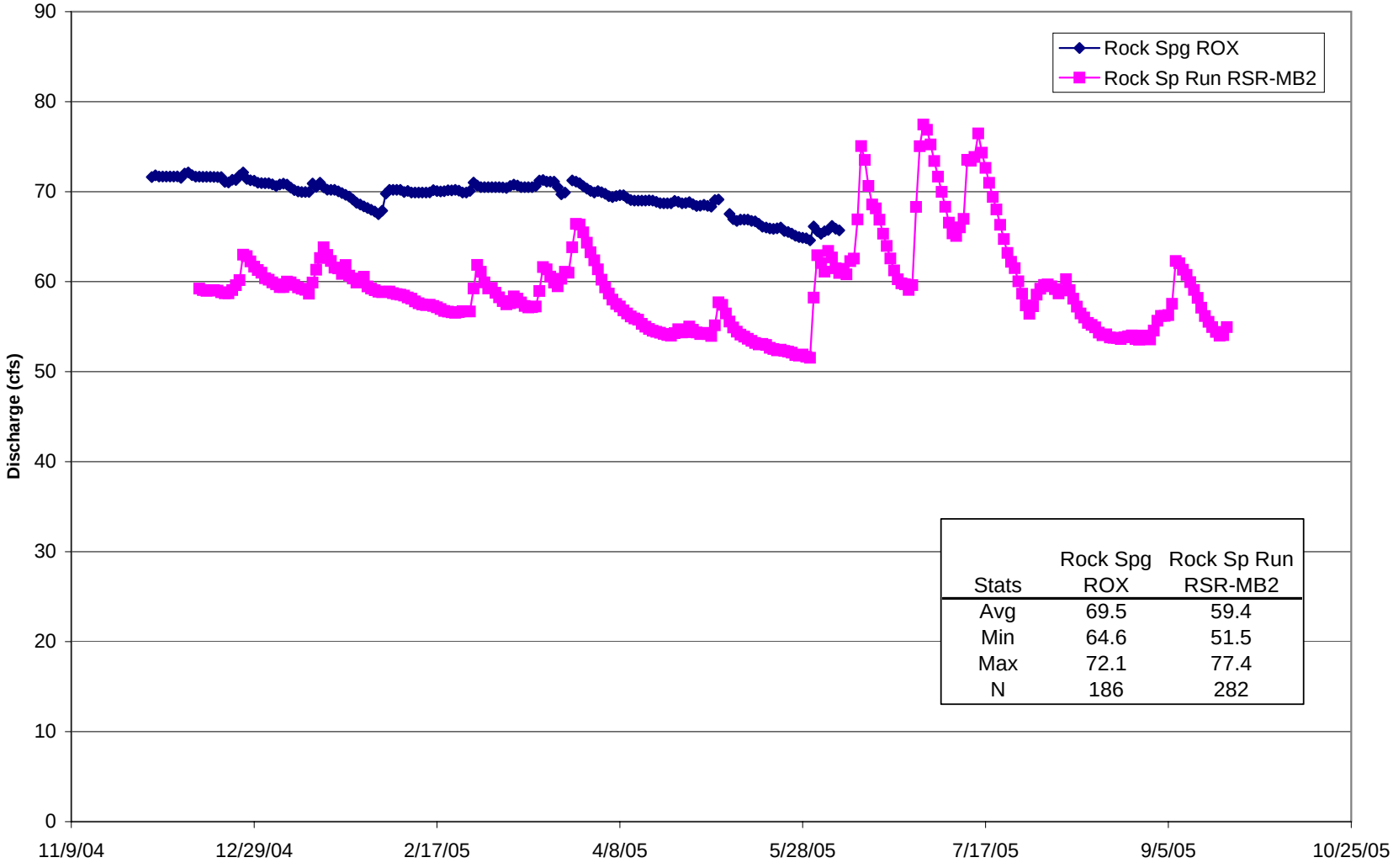
LITTLE WEKIVA RIVER WATER LEVEL TIMESERIES - WEKIVA RIVER PLRG



Stats	Wekiva Spg WEK	Wekiva Rv Marina 2234635	Wekiva Rv RR Brdg WKRRC	Wekiva Rv SR46 2235000
Avg	63.8	186	332	371
Min	52.4	131	186	201
Max	90.1	349	848	1020
N	128	267	278	285

APPENDIX C-6

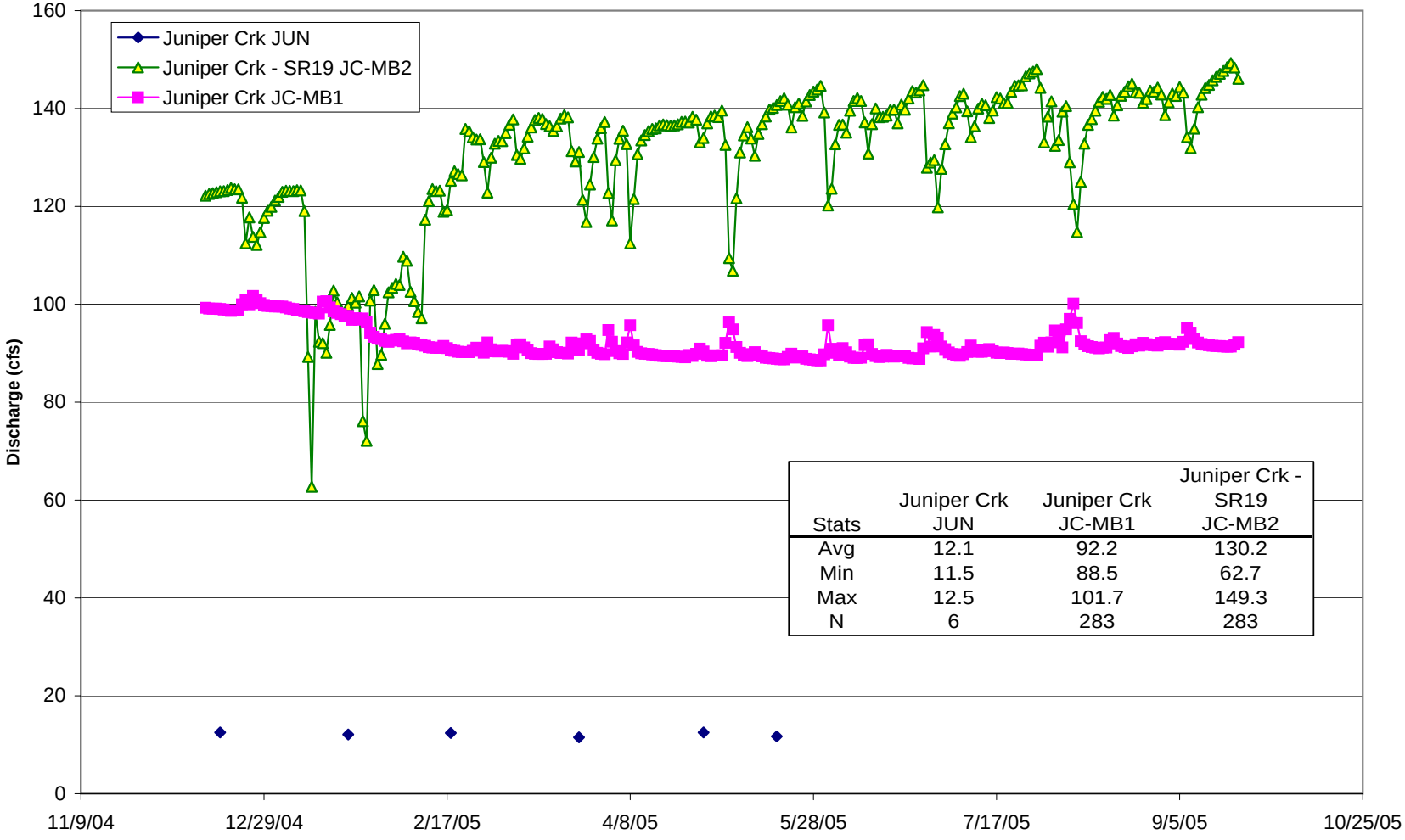
WEKIVA RIVER DISCHARAGE MEASUREMENTS - WEKIVA PLRG



Stats	Rock Spg ROX	Rock Sp Run RSR-MB2
Avg	69.5	59.4
Min	64.6	51.5
Max	72.1	77.4
N	186	282

APPENDIX C-7

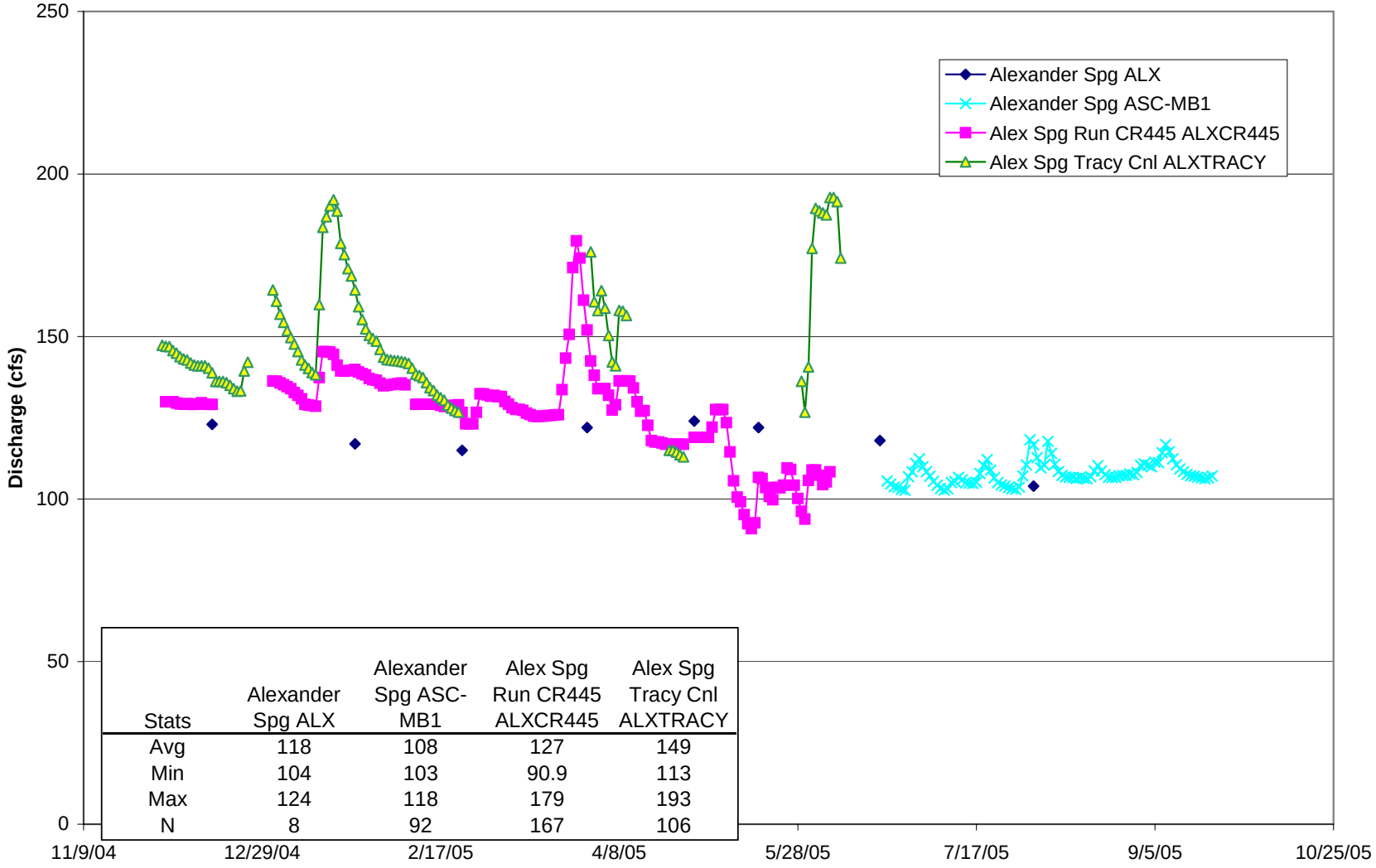
ROCK SPRING RUN DISCHARAGE MEASUREMENTS - WEKIVA PLRG



Stats	Juniper Crk JUN	Juniper Crk JC-MB1	Juniper Crk - SR19 JC-MB2
Avg	12.1	92.2	130.2
Min	11.5	88.5	62.7
Max	12.5	101.7	149.3
N	6	283	283

APPENDIX C-8

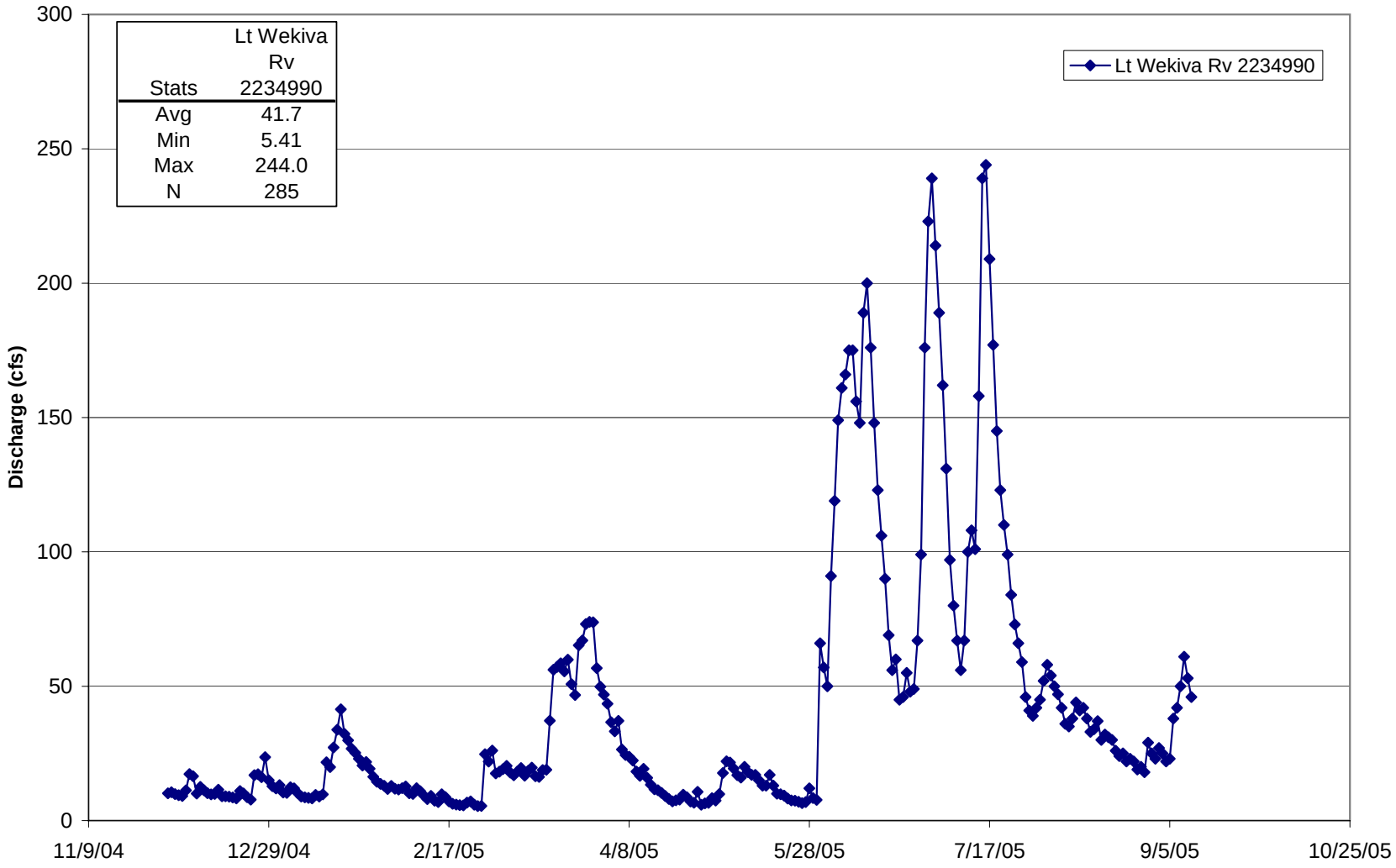
JUNIPER CREEK DISCHARAGE MEASUREMENTS - WEKIVA PLRG



Stats	Alexander Spg ALX	Alexander Spg ASC-MB1	Alex Spg Run CR445 ALXCR445	Alex Spg Tracy Cnl ALXTRACY
Avg	118	108	127	149
Min	104	103	90.9	113
Max	124	118	179	193
N	8	92	167	106

APPENDIX C-9

ALEXANDER SPRING CREEK DISCHARAGE MEASUREMENTS - WEKIVA PLRG



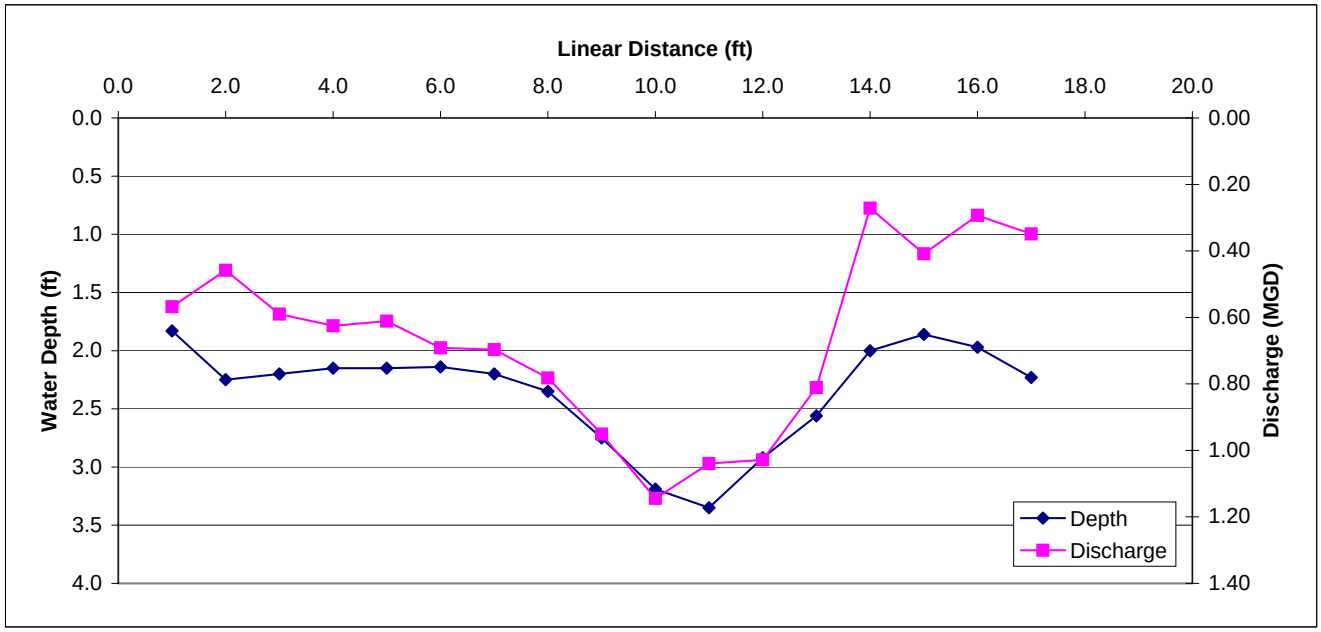
APPENDIX C-10

LITTLE WEKIVA RIVER DISCHARAGE MEASUREMENTS - WEKIVA PLRG

APPENDIX C-11

JCR-MB1 Marsh McBirney Cross Sectional Flow - 12/14/04

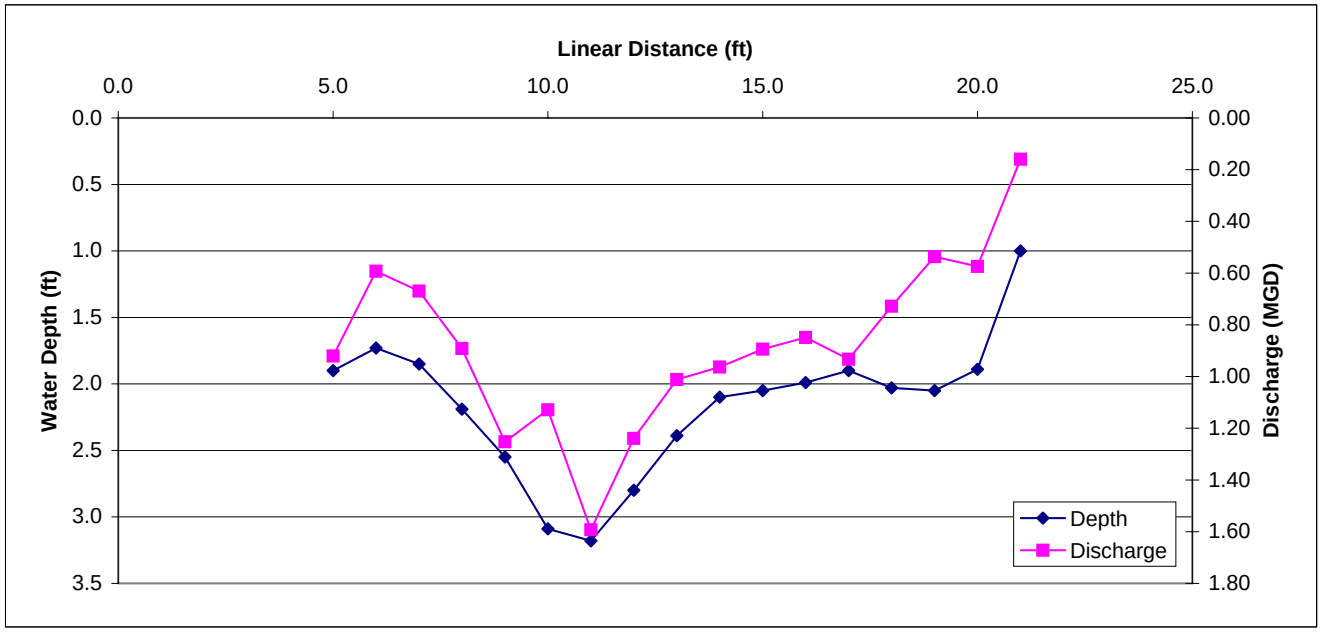
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	1.0	1.5	1.83		0.32		2.75	0.88	2149	0.57
	2.0	1.0	2.25	0.30		0.33	2.25	0.71	1734	0.46
	3.0	1.0	2.20	0.44		0.39	2.20	0.91	2234	0.59
	4.0	1.0	2.15	0.44		0.46	2.15	0.97	2367	0.63
	5.0	1.0	2.15	0.45		0.43	2.15	0.95	2314	0.61
	6.0	1.0	2.14	0.54		0.46	2.14	1.07	2618	0.69
	7.0	1.0	2.20	0.54		0.44	2.20	1.08	2637	0.70
	8.0	1.0	2.35	0.56		0.47	2.35	1.21	2961	0.78
	9.0	1.0	2.75	0.58		0.49	2.75	1.47	3600	0.95
	10.0	1.0	3.19	0.57		0.54	3.19	1.77	4332	1.14
	11.0	1.0	3.35	0.52		0.44	3.35	1.61	3934	1.04
	12.0	1.0	2.92	0.58		0.51	2.92	1.59	3893	1.03
	13.0	1.0	2.56	0.50		0.48	2.56	1.25	3069	0.81
	14.0	1.0	2.00		0.21		2.00	0.42	1028	0.27
	15.0	1.0	1.86		0.34		1.86	0.63	1547	0.41
	16.0	1.0	1.97		0.23		1.97	0.45	1109	0.29
	17.0	1.1	2.23	0.31		0.13	2.45	0.54	1320	0.35
End	17.6									
		17.6	2.4	0.49	0.28	0.43	41.24	17.51	42846	11.32



APPENDIX C-12

JCR-MB1 Marsh McBirney Cross Sectional Flow - 01/25/05

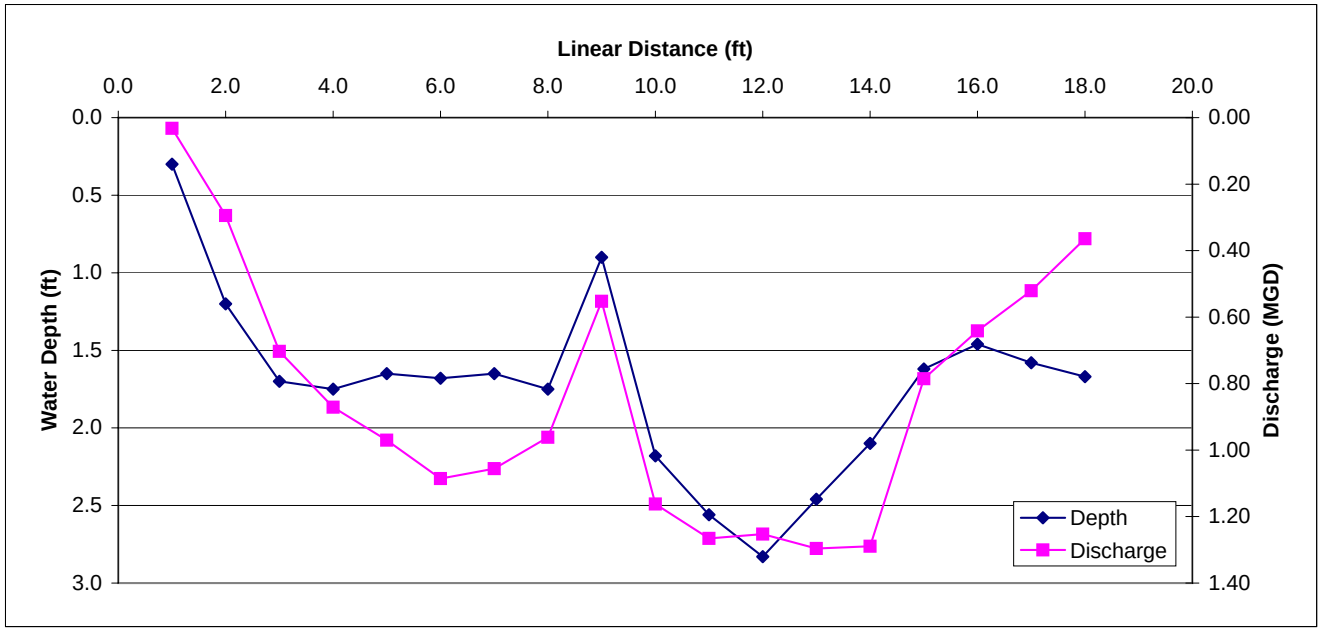
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	4.0									
	5.0	1.5	1.90		0.50		2.85	1.43	3486	0.92
	6.0	1.0	1.73		0.53		1.73	0.92	2243	0.59
	7.0	1.0	1.85		0.56		1.85	1.04	2535	0.67
	8.0	1.0	2.19	0.69		0.57	2.19	1.38	3376	0.89
	9.0	1.0	2.55	0.82		0.70	2.55	1.94	4741	1.25
	10.0	1.0	3.09	0.79		0.34	3.09	1.75	4271	1.13
	11.0	1.0	3.18	0.80		0.75	3.18	2.46	6030	1.59
	12.0	1.0	2.80	0.77		0.60	2.80	1.92	4693	1.24
	13.0	1.0	2.39	0.75		0.56	2.39	1.57	3830	1.01
	14.0	1.0	2.10	0.74		0.68	2.10	1.49	3648	0.96
	15.0	1.0	2.05	0.66		0.69	2.05	1.38	3385	0.89
	16.0	1.0	1.99		0.66		1.99	1.31	3213	0.85
	17.0	1.0	1.90		0.76		1.90	1.44	3533	0.93
	18.0	1.0	2.03	0.58		0.53	2.03	1.13	2756	0.73
	19.0	1.0	2.05	0.52		0.29	2.05	0.83	2031	0.54
	20.0	1.0	1.89		0.47		1.89	0.89	2173	0.57
	21.0	1.3	1.00		0.19		1.30	0.25	604	0.16
End	21.8									
		17.8	2.2	0.71	0.52	0.57	37.94	23.11	56550	14.94



APPENDIX C-13

JCR-MB1 Marsh McBirney Cross Sectional Flow - 02/22/05

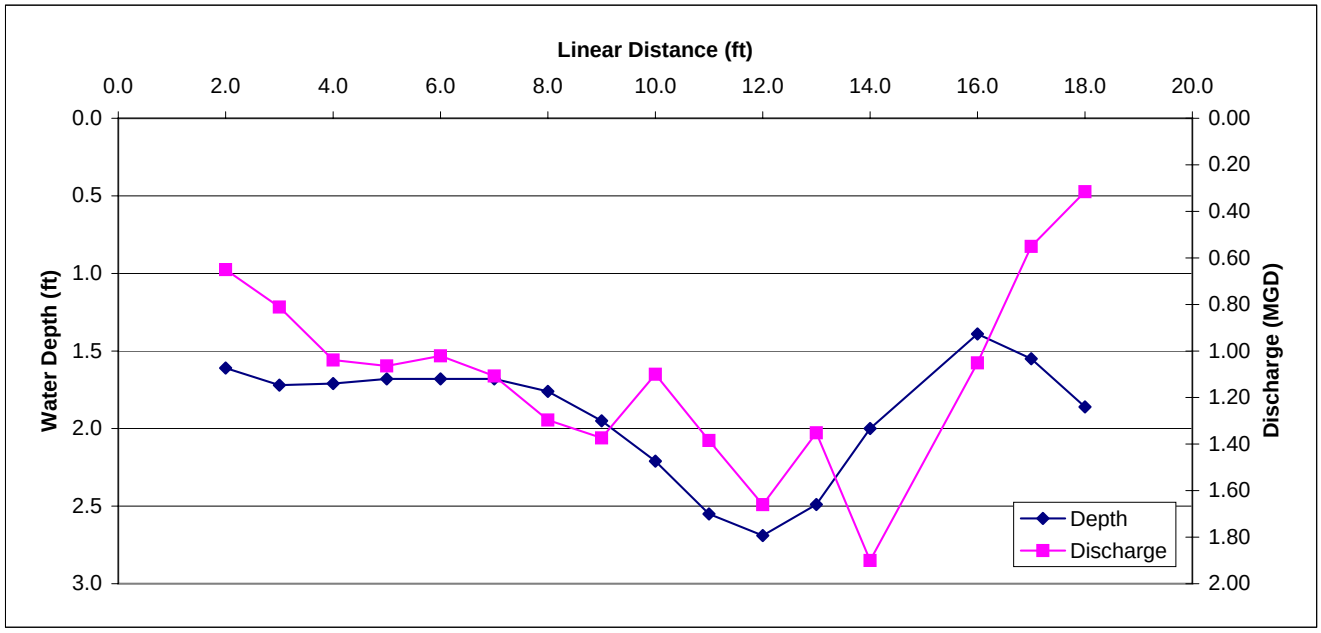
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.8									
	1.0	0.7	0.30		0.25		0.20	0.05	122	0.03
	2.0	1.0	1.20		0.38		1.20	0.46	1116	0.29
	3.0	1.0	1.70		0.64		1.70	1.09	2662	0.70
	4.0	1.0	1.75		0.77		1.75	1.35	3297	0.87
	5.0	1.0	1.65		0.91		1.65	1.50	3674	0.97
	6.0	1.0	1.68		1.00		1.68	1.68	4110	1.09
	7.0	1.0	1.65		0.99		1.65	1.63	3996	1.06
	8.0	1.0	1.75		0.85		1.75	1.49	3639	0.96
	9.0	1.0	0.90		0.95		0.90	0.86	2092	0.55
	10.0	1.0	2.18	0.95		0.70	2.18	1.80	4400	1.16
	11.0	1.0	2.56	0.86		0.67	2.56	1.96	4791	1.27
	12.0	1.0	2.83	0.81		0.56	2.83	1.94	4743	1.25
	13.0	1.0	2.46	0.89		0.74	2.46	2.00	4905	1.30
	14.0	1.0	2.10	1.00		0.90	2.10	2.00	4881	1.29
	15.0	1.0	1.62		0.75		1.62	1.22	2973	0.79
	16.0	1.0	1.46		0.68		1.46	0.99	2429	0.64
	17.0	1.0	1.58		0.51		1.58	0.81	1971	0.52
	18.0	1.3	1.67		0.27		2.09	0.56	1379	0.36
End	18.8									
		17.9	1.7	0.90	0.69	0.71	31.36	23.37	57180	15.11



APPENDIX C-14

JCR-MB1 Marsh McBirney Cross Sectional Flow - 03/31/05

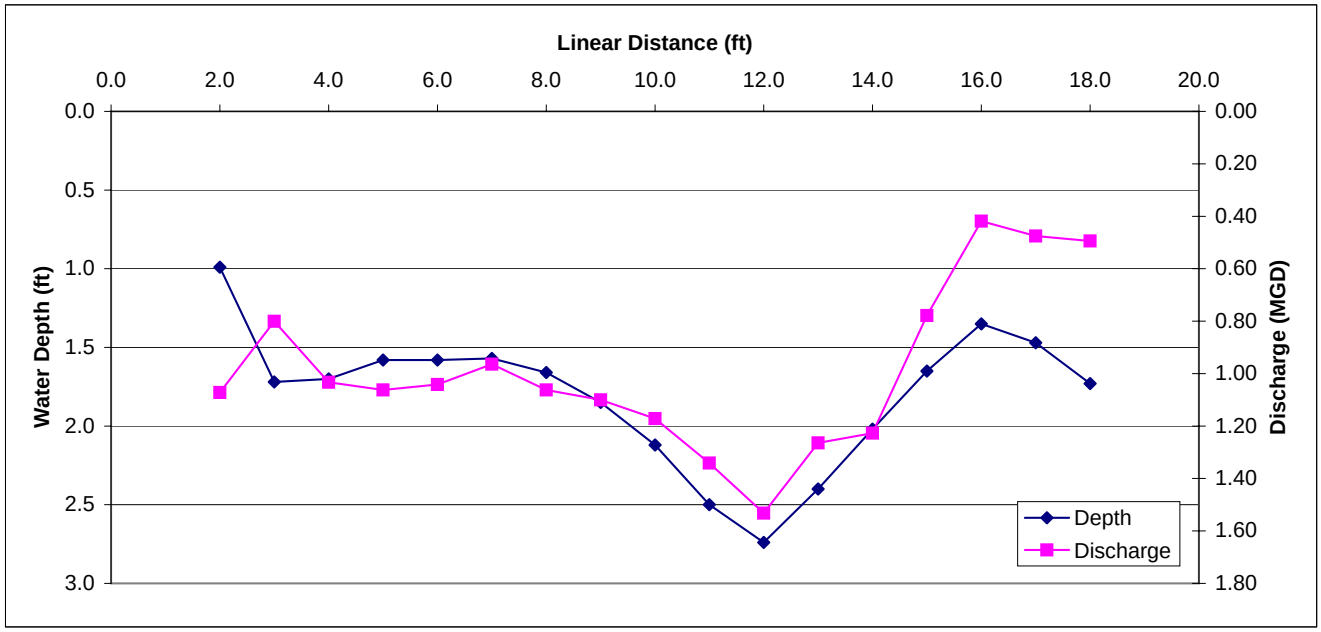
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	2.0	2.5	1.61		0.25		4.03	1.01	2462	0.65
	3.0	1.0	1.72		0.73		1.72	1.26	3072	0.81
	4.0	1.0	1.71		0.94		1.71	1.61	3933	1.04
	5.0	1.0	1.68		0.98		1.68	1.65	4028	1.06
	6.0	1.0	1.68		0.94		1.68	1.58	3864	1.02
	7.0	1.0	1.68		1.02		1.68	1.71	4192	1.11
	8.0	1.0	1.76		1.14		1.76	2.01	4909	1.30
	9.0	1.0	1.95		1.09		1.95	2.13	5200	1.37
	10.0	1.0	2.21	0.92		0.62	2.21	1.70	4163	1.10
	11.0	1.0	2.55	1.03		0.65	2.55	2.14	5241	1.38
	12.0	1.0	2.69	1.01		0.90	2.69	2.57	6285	1.66
	13.0	1.0	2.49	1.07		0.61	2.49	2.09	5117	1.35
	14.0	1.5	2.00		0.98		3.00	2.94	7193	1.90
	16.0	1.5	1.39		0.78		2.09	1.63	3979	1.05
	17.0	1.0	1.55		0.55		1.55	0.85	2086	0.55
	18.0	1.3	1.86		0.21		2.33	0.49	1195	0.32
End	18.8									
		18.8	1.9	1.01	0.80	0.70	35.11	27.35	66918	17.68



APPENDIX C-15

JCR-MB1 Marsh McBirney Cross Sectional Flow - 05/03/05

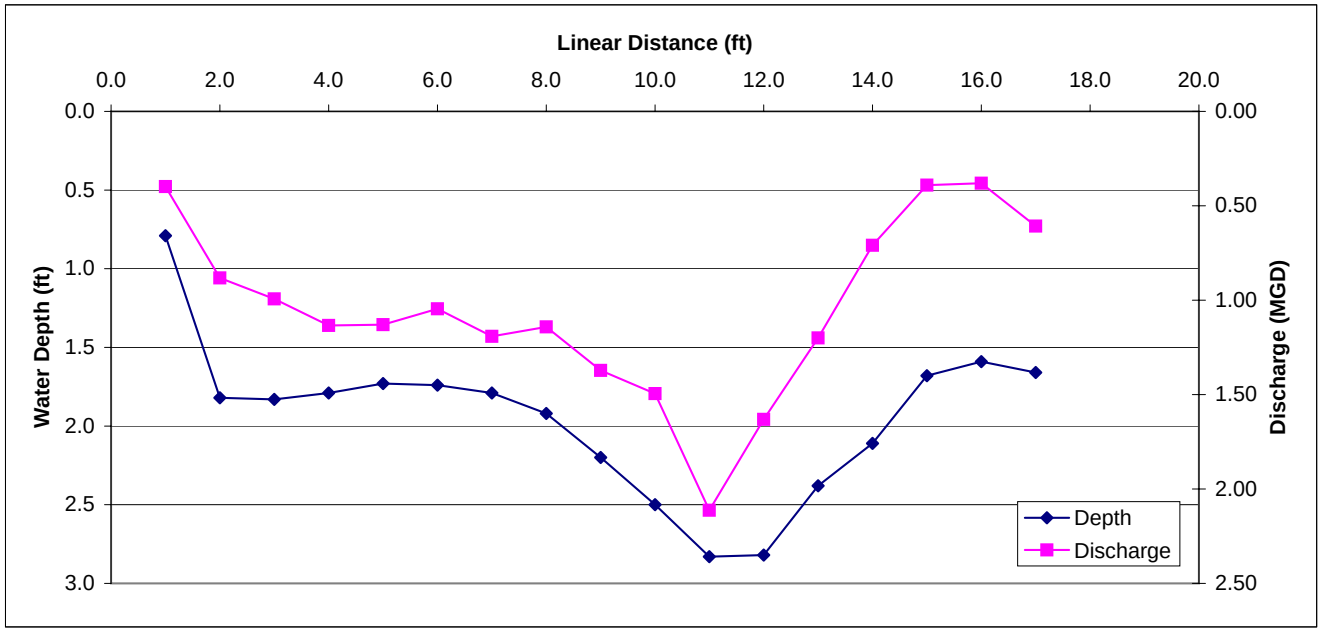
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	2.0	2.5	0.99		0.67		2.48	1.66	4057	1.07
	3.0	1.0	1.72		0.72		1.72	1.24	3030	0.80
	4.0	1.0	1.70		0.94		1.70	1.60	3910	1.03
	5.0	1.0	1.58		1.04		1.58	1.64	4020	1.06
	6.0	1.0	1.58		1.02		1.58	1.61	3943	1.04
	7.0	1.0	1.57		0.95		1.57	1.49	3649	0.96
	8.0	1.0	1.66		0.99		1.66	1.64	4021	1.06
	9.0	1.0	1.85		0.92		1.85	1.70	4164	1.10
	10.0	1.0	2.12	1.04		0.67	2.12	1.81	4435	1.17
	11.0	1.0	2.50	0.97		0.69	2.50	2.08	5077	1.34
	12.0	1.0	2.74	1.02		0.71	2.74	2.37	5799	1.53
	13.0	1.0	2.40	1.00		0.63	2.40	1.96	4786	1.26
	14.0	1.0	2.02		0.94		2.02	1.90	4646	1.23
	15.0	1.0	1.65		0.73		1.65	1.20	2947	0.78
	16.0	1.0	1.35		0.48		1.35	0.65	1585	0.42
	17.0	1.0	1.47		0.50		1.47	0.74	1798	0.48
	18.0	1.3	1.73		0.34		2.25	0.76	1871	0.49
End	18.8									
		18.8	1.8	1.01	0.79	0.68	32.63	26.05	63736	16.84



APPENDIX C-16

JCR-MB1 Marsh McBirney Cross Sectional Flow - 05/31/05

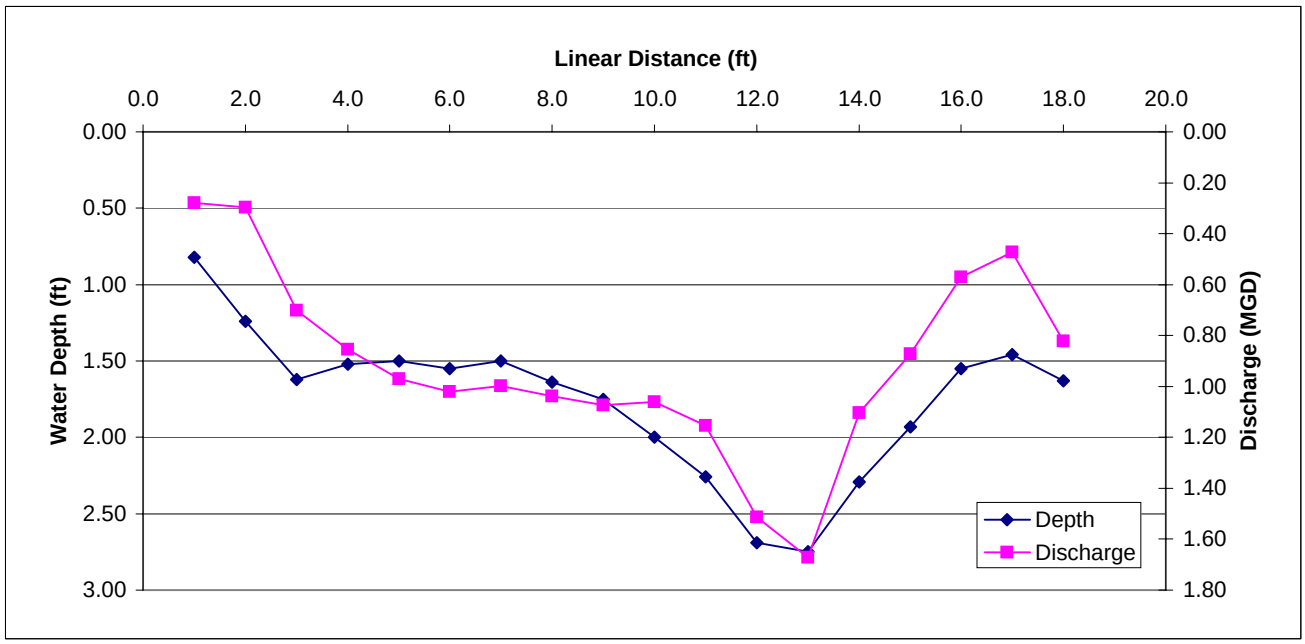
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	1.0	1.5	0.79		0.52		1.19	0.62	1508	0.40
	2.0	1.0	1.82		0.75		1.82	1.37	3340	0.88
	3.0	1.0	1.83		0.84		1.83	1.54	3761	0.99
	4.0	1.0	1.79		0.98		1.79	1.75	4292	1.13
	5.0	1.0	1.73		1.01		1.73	1.75	4275	1.13
	6.0	1.0	1.74		0.93		1.74	1.62	3959	1.05
	7.0	1.0	1.79		1.03		1.79	1.84	4511	1.19
	8.0	1.0	1.92		0.92		1.92	1.77	4322	1.14
	9.0	1.0	2.20	1.08		0.85	2.20	2.12	5194	1.37
	10.0	1.0	2.50	1.10		0.75	2.50	2.31	5658	1.49
	11.0	1.0	2.83	1.30		1.01	2.83	3.27	7997	2.11
	12.0	1.0	2.82	1.03		0.76	2.82	2.52	6175	1.63
	13.0	1.0	2.38	0.90		0.66	2.38	1.86	4542	1.20
	14.0	1.0	2.11	0.47		0.57	2.11	1.10	2684	0.71
	15.0	1.0	1.68		0.36		1.68	0.60	1480	0.39
	16.0	1.0	1.59		0.37		1.59	0.59	1439	0.38
	17.0	1.4	1.66		0.40		2.35	0.94	2301	0.61
End	17.9									
		17.9	2.0	0.98	0.74	0.77	34.27	27.56	67436	17.82



APPENDIX C-17

JC - MB 1 - Marsh McBirney Cross Sectional Flow - 06/22/2005

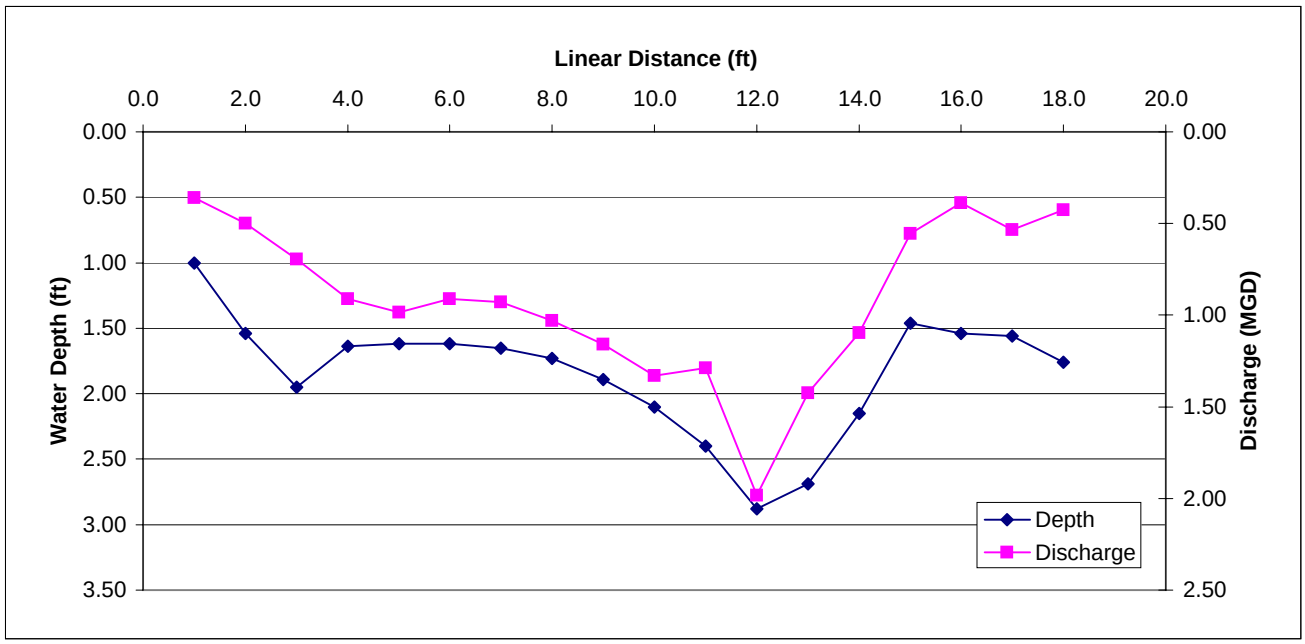
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.0									
	2.0	1.5	0.82		0.35		1.23	0.43	1053	0.28
	3.0	1.0	1.24		0.37		1.24	0.46	1122	0.30
	4.0	1.0	1.62		0.67		1.62	1.09	2656	0.70
	5.0	1.0	1.52		0.87		1.52	1.32	3235	0.85
	6.0	1.0	1.50		1.00		1.50	1.50	3670	0.97
	7.0	1.0	1.55		1.02		1.55	1.58	3868	1.02
	8.0	1.0	1.50		1.03		1.50	1.55	3780	1.00
	9.0	1.0	1.64		0.98		1.64	1.61	3932	1.04
	10.0	1.0	1.75		0.95		1.75	1.66	4067	1.07
	11.0	1.0	2.00		0.82		2.00	1.64	4012	1.06
	12.0	1.0	2.26	0.80		0.78	2.26	1.79	4368	1.15
	13.0	1.0	2.69	1.00		0.74	2.69	2.34	5726	1.51
	14.0	1.0	2.75	1.00		0.88	2.75	2.59	6324	1.67
	15.0	1.0	2.29	0.73		0.76	2.29	1.71	4174	1.10
	16.0	1.0	1.93		0.70		1.93	1.35	3305	0.87
	17.0	1.0	1.55		0.57		1.55	0.88	2162	0.57
	18.0	1.0	1.46		0.50		1.46	0.73	1786	0.47
	19.0	1.5	1.63		0.52		2.45	1.27	3111	0.82
End	20.0									
		19.0	1.76	0.88	0.74	0.79	32.93	25.49	62352	16.47



APPENDIX C-18

JC - MB 1 - Marsh McBirney Cross Sectional Flow - 07/11/2005

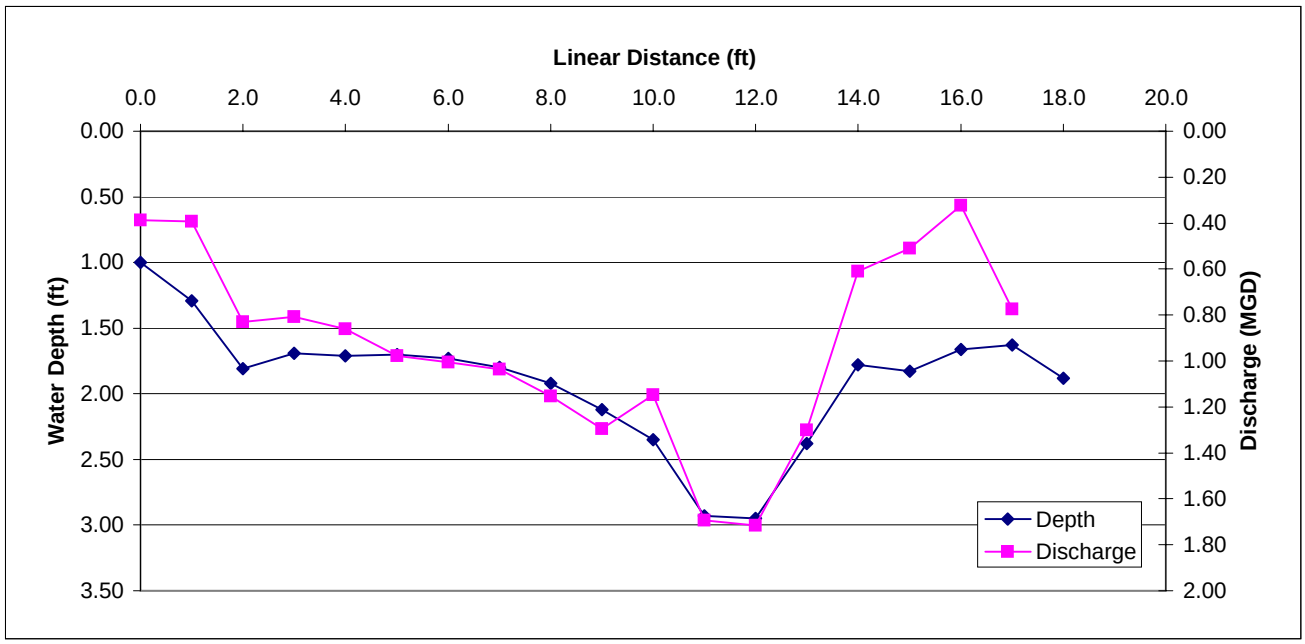
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.0									
	2.0	1.5	1.00		0.37		1.50	0.56	1358	0.36
	3.0	1.0	1.54		0.50		1.54	0.77	1884	0.50
	4.0	1.0	1.95		0.55		1.95	1.07	2624	0.69
	5.0	1.0	1.64		0.86		1.64	1.41	3451	0.91
	6.0	1.0	1.62		0.94		1.62	1.52	3726	0.98
	7.0	1.0	1.62		0.87		1.62	1.41	3448	0.91
	8.0	1.0	1.65		0.87		1.65	1.44	3512	0.93
	9.0	1.0	1.73		0.92		1.73	1.59	3894	1.03
	10.0	1.0	1.89		0.95		1.89	1.80	4393	1.16
	11.0	1.0	2.10	1.16		0.80	2.10	2.06	5035	1.33
	12.0	1.0	2.40	0.98		0.68	2.40	1.99	4874	1.29
	13.0	1.0	2.88	1.13		1.00	2.88	3.07	7504	1.98
	14.0	1.0	2.69	0.79		0.85	2.69	2.21	5397	1.43
	15.0	1.0	2.15	0.59		0.99	2.15	1.70	4156	1.10
	16.0	1.0	1.46		0.59		1.46	0.86	2107	0.56
	17.0	1.0	1.54		0.39		1.54	0.60	1469	0.39
	18.0	1.0	1.56		0.53		1.56	0.83	2023	0.53
	19.0	1.5	1.76		0.25		2.64	0.66	1615	0.43
End	20.0									
		19.0	1.84	0.93	0.66	0.86	34.56	25.53	62468	16.50



APPENDIX C-19

JC - MB 1 - Marsh McBirney Cross Sectional Flow - 08/09/2005

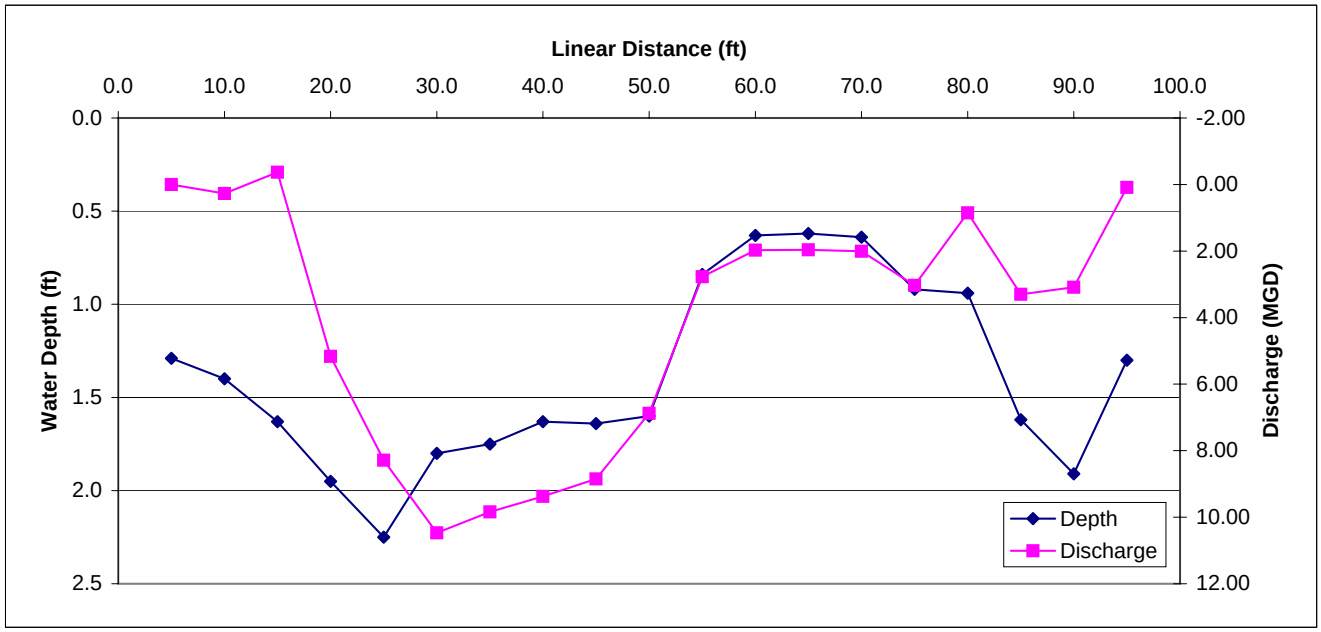
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	1.0	1.5	1.00		0.40		1.50	0.60	1468	0.39
	2.0	1.0	1.29		0.47		1.29	0.61	1483	0.39
	3.0	1.0	1.81		0.71		1.81	1.29	3144	0.83
	4.0	1.0	1.69		0.74		1.69	1.25	3060	0.81
	5.0	1.0	1.71		0.78		1.71	1.33	3263	0.86
	6.0	1.0	1.70		0.89		1.70	1.51	3702	0.98
	7.0	1.0	1.73		0.90		1.73	1.56	3809	1.01
	8.0	1.0	1.80		0.89		1.80	1.60	3919	1.04
	9.0	1.0	1.92		0.93		1.92	1.79	4369	1.15
	10.0	1.0	2.12	0.95		0.94	2.12	2.00	4901	1.29
	11.0	1.0	2.35	0.76		0.75	2.35	1.77	4341	1.15
	12.0	1.0	2.93	0.93		0.86	2.93	2.62	6416	1.69
	13.0	1.0	2.95	1.19		0.61	2.95	2.66	6496	1.72
	14.0	1.0	2.38	0.83		0.86	2.38	2.01	4920	1.30
	15.0	1.0	1.78		0.53		1.78	0.94	2308	0.61
	16.0	1.0	1.83		0.43		1.83	0.79	1925	0.51
	17.0	1.0	1.66		0.30		1.66	0.50	1218	0.32
	18.0	1.5	1.63		0.49		2.45	1.20	2931	0.77
End	19.0		1.88		0.32					
		19.0	1.90	0.93	0.63	0.80	35.60	26.03	63674	16.82



APPENDIX C-20

JCR-MB2 Marsh McBirney Cross Sectional Flow - 12/14/04

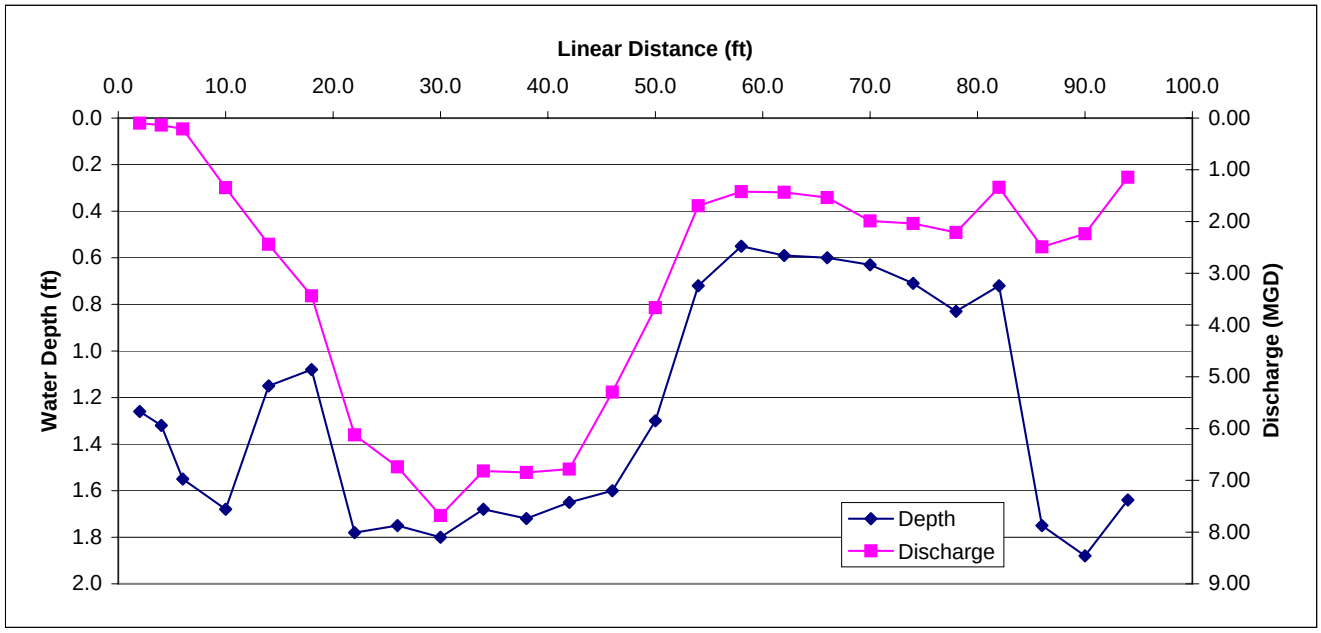
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	3.0									
	5.0	4.5	1.29		0.00		5.81	0.00	0	0.00
	10.0	5.0	1.40		0.06		7.00	0.42	1028	0.27
	15.0	5.0	1.63		-0.07		8.15	-0.57	-1396	-0.37
	20.0	5.0	1.95		0.82		9.75	8.00	19560	5.17
	25.0	5.0	2.25	1.27		1.01	11.25	12.83	31377	8.29
	30.0	5.0	1.80		1.80		9.00	16.20	39635	10.47
	35.0	5.0	1.75		1.74		8.75	15.23	37249	9.84
	40.0	5.0	1.63		1.78		8.15	14.51	35492	9.38
	45.0	5.0	1.64		1.67		8.20	13.69	33503	8.85
	50.0	5.0	1.60		1.33		8.00	10.64	26032	6.88
	55.0	5.0	0.84		1.02		4.20	4.28	10481	2.77
	60.0	5.0	0.63		0.97		3.15	3.06	7476	1.97
	65.0	5.0	0.62		0.98		3.10	3.04	7433	1.96
	70.0	5.0	0.64		0.97		3.20	3.10	7594	2.01
	75.0	5.0	0.92		1.02		4.60	4.69	11479	3.03
	80.0	5.0	0.94		0.28		4.70	1.32	3220	0.85
	85.0	5.0	1.62		0.63		8.10	5.10	12485	3.30
	90.0	5.0	1.91		0.50		9.55	4.78	11682	3.09
	95.0	3.5	1.30		0.03		4.55	0.14	334	0.09
End	96.0									
		93.0	1.4	1.27	0.86	1.01	129.21	120.44	294664	77.84



APPENDIX C-21

JCR-MB2 Marsh McBirney Cross Sectional Flow - 01/25/05

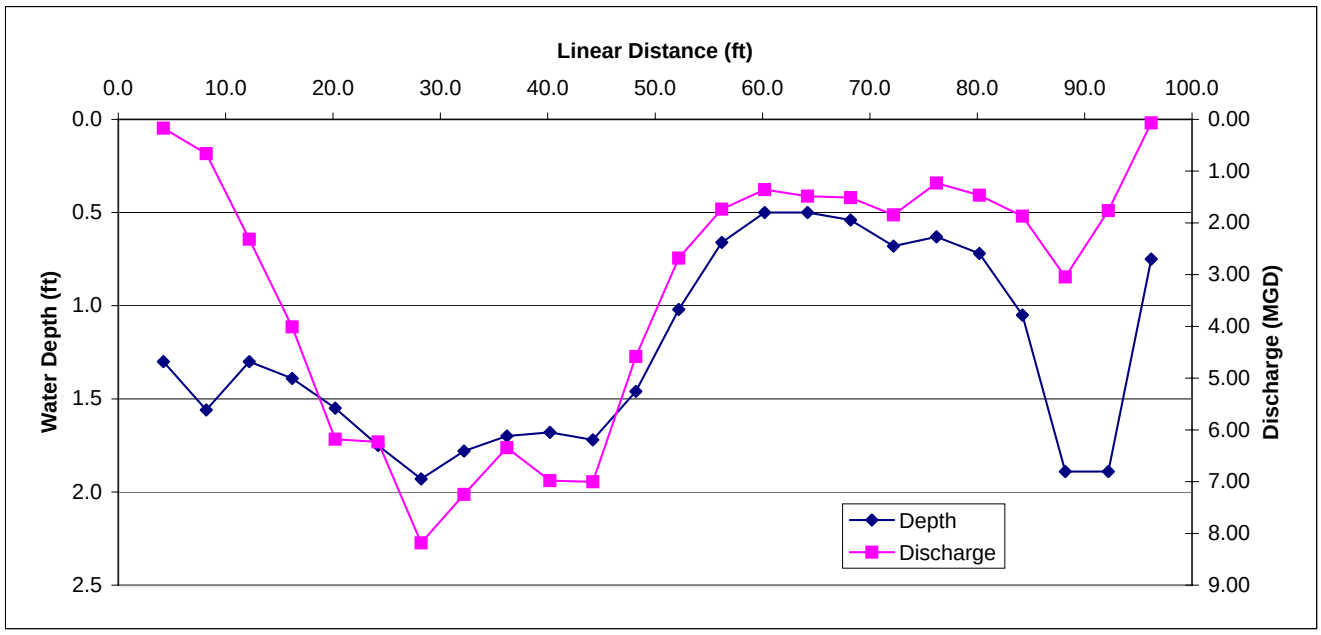
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	2.0	3.0	1.26		0.04		3.78	0.15	370	0.10
	4.0	2.0	1.32		0.08		2.64	0.21	517	0.14
	6.0	3.0	1.55		0.07		4.65	0.33	796	0.21
	10.0	4.0	1.68		0.31		6.72	2.08	5097	1.35
	14.0	4.0	1.15		0.82		4.60	3.77	9228	2.44
	18.0	4.0	1.08		1.23		4.32	5.31	13000	3.43
	22.0	4.0	1.78		1.33		7.12	9.47	23168	6.12
	26.0	4.0	1.75		1.49		7.00	10.43	25518	6.74
	30.0	4.0	1.80		1.65		7.20	11.88	29065	7.68
	34.0	4.0	1.68		1.57		6.72	10.55	25812	6.82
	38.0	4.0	1.72		1.54		6.88	10.60	25922	6.85
	42.0	4.0	1.65		1.59		6.60	10.49	25674	6.78
	46.0	4.0	1.60		1.28		6.40	8.19	20042	5.29
	50.0	4.0	1.30		1.09		5.20	5.67	13867	3.66
	54.0	4.0	0.72		0.91		2.88	2.62	6412	1.69
	58.0	4.0	0.55		1.00		2.20	2.20	5382	1.42
	62.0	4.0	0.59		0.94		2.36	2.22	5427	1.43
	66.0	4.0	0.60		0.99		2.40	2.38	5813	1.54
	70.0	4.0	0.63		1.22		2.52	3.07	7522	1.99
	74.0	4.0	0.71		1.11		2.84	3.15	7713	2.04
	78.0	4.0	0.83		1.03		3.32	3.42	8366	2.21
	82.0	4.0	0.72		0.72		2.88	2.07	5073	1.34
	86.0	4.0	1.75		0.55		7.00	3.85	9419	2.49
	90.0	4.0	1.88		0.46		7.52	3.46	8463	2.24
	94.0	4.5	1.64		0.24		7.38	1.77	4333	1.14
End	96.5									
		96.5	1.3		0.93		123.13	119.35	292003	77.14



APPENDIX C-22

JCR-MB2 Marsh McBirney Cross Sectional Flow - 02/24/05

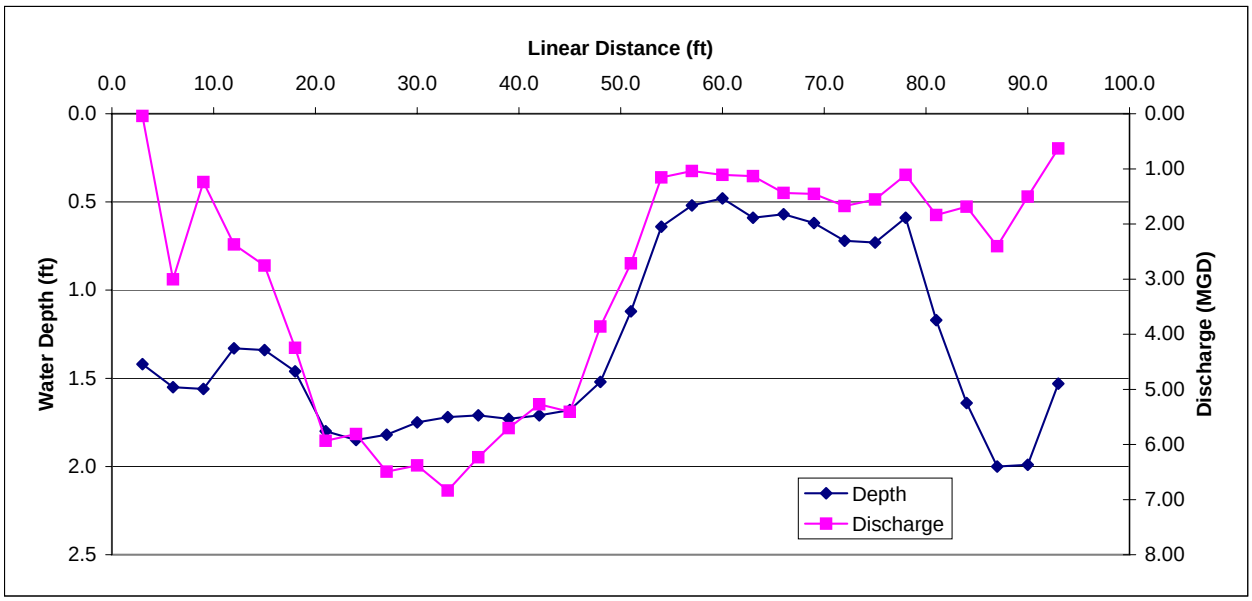
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	4.2	6.2	1.30		0.03		8.06	0.26	647	0.17
	8.2	4.0	1.56		0.16		6.24	1.02	2504	0.66
	12.2	4.0	1.30		0.69		5.20	3.58	8765	2.32
	16.2	4.0	1.39		1.12		5.56	6.20	15174	4.01
	20.2	4.0	1.55		1.54		6.20	9.56	23390	6.18
	24.2	4.0	1.75		1.38		7.00	9.65	23599	6.23
	28.2	4.0	1.93		1.64		7.72	12.66	30983	8.19
	32.2	4.0	1.78		1.57		7.12	11.21	27432	7.25
	36.2	4.0	1.70		1.44		6.80	9.82	24016	6.34
	40.2	4.0	1.68		1.61		6.72	10.80	26431	6.98
	44.2	4.0	1.72		1.57		6.88	10.83	26508	7.00
	48.2	4.0	1.46		1.21		5.84	7.09	17344	4.58
	52.2	4.0	1.02		1.02		4.08	4.15	10152	2.68
	56.2	4.0	0.66		1.02		2.64	2.69	6569	1.74
	60.2	4.0	0.50		1.05		2.00	2.10	5137	1.36
	64.2	4.0	0.50		1.15		2.00	2.30	5619	1.48
	68.2	4.0	0.54		1.08		2.16	2.34	5722	1.51
	72.2	4.0	0.68		1.05		2.72	2.86	6987	1.85
	76.2	4.0	0.63		0.75		2.52	1.90	4652	1.23
	80.2	4.0	0.72		0.79		2.88	2.27	5548	1.47
	84.2	4.0	1.05		0.69		4.20	2.89	7080	1.87
	88.2	4.0	1.89		0.62		7.56	4.71	11530	3.05
	92.2	4.0	1.89		0.36		7.56	2.73	6675	1.76
	96.2	2.2	0.75		0.07		1.63	0.11	261	0.07
End	96.4									
		96.4	1.2		0.98		121.29	123.73	302725	79.97



APPENDIX C-23

JCR-MB2 Marsh McBirney Cross Sectional Flow - 03/31/05

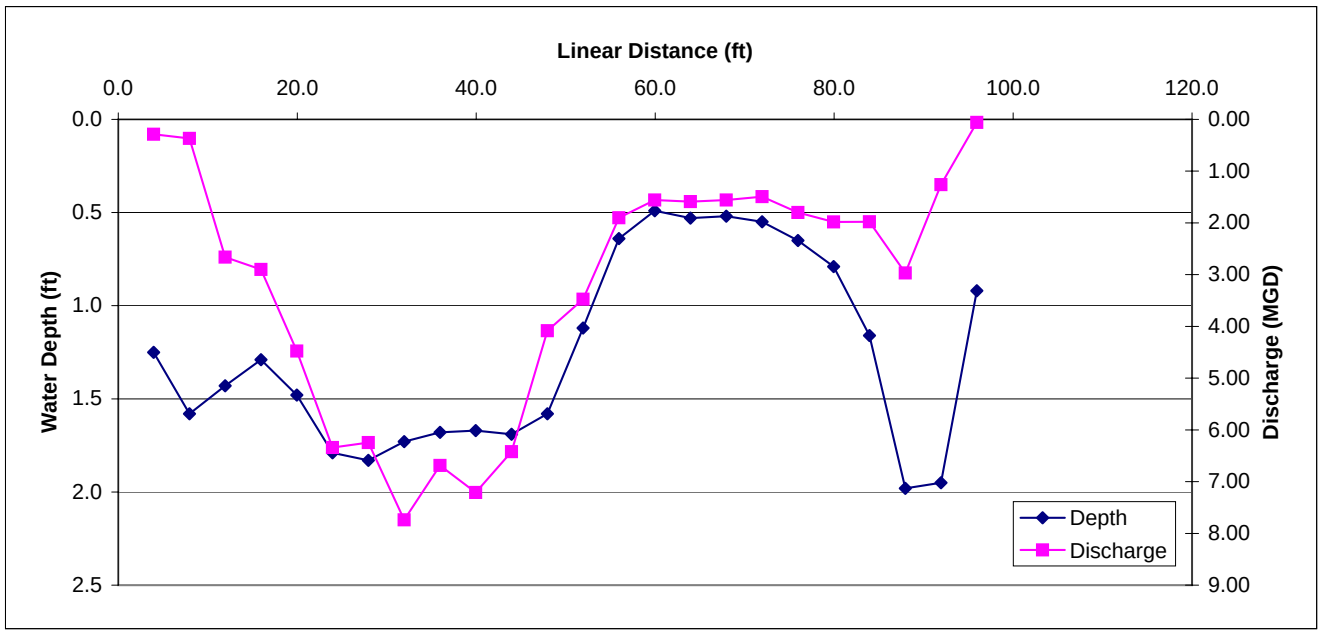
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	3.0	4.5	1.42		0.01		6.39	0.06	156	0.04
	6.0	3.0	1.55		1.00		4.65	4.65	11377	3.01
	9.0	3.0	1.56		0.41		4.68	1.92	4694	1.24
	12.0	3.0	1.33		0.92		3.99	3.67	8981	2.37
	15.0	3.0	1.34		1.06		4.02	4.26	10425	2.75
	18.0	3.0	1.46		1.50		4.38	6.57	16074	4.25
	21.0	3.0	1.80		1.70		5.40	9.18	22460	5.93
	24.0	3.0	1.85		1.62		5.55	8.99	21997	5.81
	27.0	3.0	1.82		1.84		5.46	10.05	24579	6.49
	30.0	3.0	1.75		1.88		5.25	9.87	24148	6.38
	33.0	3.0	1.72		2.05		5.16	10.58	25880	6.84
	36.0	3.0	1.71		1.88		5.13	9.64	23596	6.23
	39.0	3.0	1.73		1.70		5.19	8.82	21586	5.70
	42.0	3.0	1.71		1.59		5.13	8.16	19956	5.27
	45.0	3.0	1.68		1.66		5.04	8.37	20469	5.41
	48.0	3.0	1.52		1.31		4.56	5.97	14615	3.86
	51.0	3.0	1.12		1.25		3.36	4.20	10276	2.71
	54.0	3.0	0.64		0.93		1.92	1.79	4369	1.15
	57.0	3.0	0.52		1.03		1.56	1.61	3931	1.04
	60.0	3.0	0.48		1.19		1.44	1.71	4192	1.11
	63.0	3.0	0.59		0.99		1.77	1.75	4287	1.13
	66.0	3.0	0.57		1.30		1.71	2.22	5439	1.44
	69.0	3.0	0.62		1.21		1.86	2.25	5506	1.45
	72.0	3.0	0.72		1.20		2.16	2.59	6342	1.68
	75.0	3.0	0.73		1.10		2.19	2.41	5894	1.56
	78.0	3.0	0.59		0.97		1.77	1.72	4201	1.11
	81.0	3.0	1.17		0.81		3.51	2.84	6956	1.84
	84.0	3.0	1.64		0.53		4.92	2.61	6380	1.69
	87.0	3.0	2.00		0.62		6.00	3.72	9101	2.40
	90.0	3.0	1.99		0.39		5.97	2.33	5696	1.50
	93.0	3.8	1.53		0.17		5.74	0.98	2386	0.63
End	95.3									
		95.3	1.3		1.16		125.86	145.49	355948	94.03



APPENDIX C-24

JCR-MB2 Marsh McBirney Cross Sectional Flow - 4/18/05

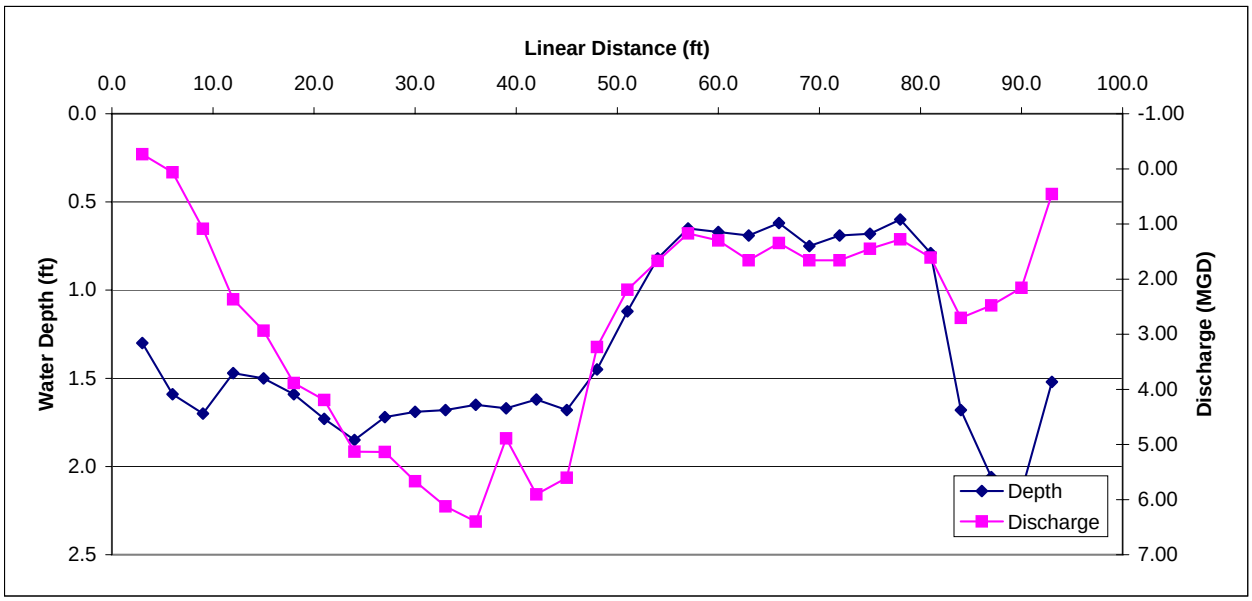
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	4.0	6.0	1.25		0.06		7.44	0.45	1092	0.29
	8.0	4.0	1.58		0.09		6.32	0.57	1392	0.37
	12.0	4.0	1.43		0.72		5.72	4.12	10076	2.66
	16.0	4.0	1.29		0.87		5.16	4.49	10983	2.90
	20.0	4.0	1.48		1.17		5.92	6.93	16946	4.48
	24.0	4.0	1.79		1.37		7.16	9.81	23999	6.34
	28.0	4.0	1.83		1.32		7.32	9.66	23640	6.25
	32.0	4.0	1.73		1.73		6.92	11.97	29289	7.74
	36.0	4.0	1.68		1.54		6.72	10.35	25319	6.69
	40.0	4.0	1.67		1.67		6.68	11.16	27293	7.21
	44.0	4.0	1.69		1.47		6.76	9.94	24312	6.42
	48.0	4.0	1.58		1.00		6.32	6.32	15462	4.08
	52.0	4.0	1.12		1.20		4.48	5.38	13153	3.47
	56.0	4.0	0.64		1.15		2.56	2.94	7203	1.90
	60.0	4.0	0.49		1.23		1.96	2.41	5898	1.56
	64.0	4.0	0.53		1.16		2.12	2.46	6017	1.59
	68.0	4.0	0.52		1.16		2.08	2.41	5903	1.56
	72.0	4.0	0.55		1.05		2.20	2.31	5652	1.49
	76.0	4.0	0.65		1.07		2.60	2.78	6806	1.80
	80.0	4.0	0.79		0.97		3.16	3.07	7499	1.98
	84.0	4.0	1.16		0.66		4.64	3.06	7492	1.98
	88.0	4.0	1.98		0.58		7.92	4.59	11239	2.97
	92.0	4.0	1.95		0.25		7.80	1.95	4771	1.26
	96.0	2.5	0.92		0.04		2.30	0.09	225	0.06
End	96.5									
		96.5	1.3		0.98		122.26	119.21	291661	77.05



APPENDIX C-25

JCR-MB2 Marsh McBirney Cross Sectional Flow - 05/31/05

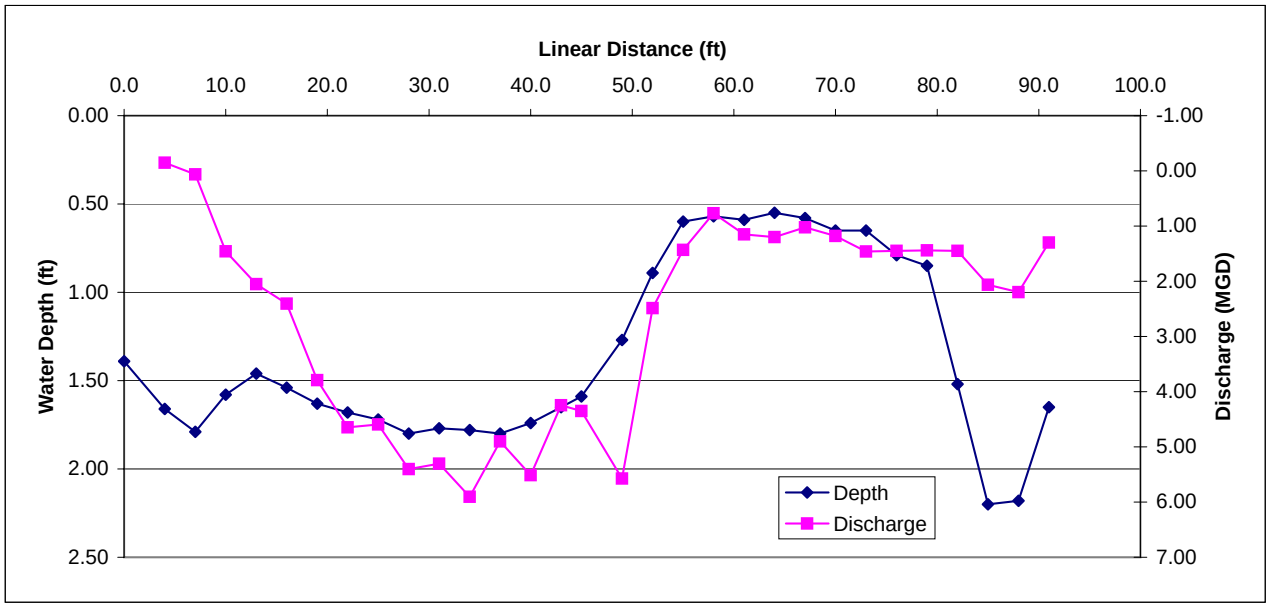
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	3.0	4.5	1.30		-0.07		5.85	-0.41	-1002	-0.26
	6.0	3.0	1.59		0.02		4.77	0.10	233	0.06
	9.0	3.0	1.70		0.33		5.10	1.68	4118	1.09
	12.0	3.0	1.47		0.83		4.41	3.66	8955	2.37
	15.0	3.0	1.50		1.01		4.50	4.55	11120	2.94
	18.0	3.0	1.59		1.26		4.77	6.01	14704	3.88
	21.0	3.0	1.73		1.25		5.19	6.49	15872	4.19
	24.0	3.0	1.85		1.43		5.55	7.94	19417	5.13
	27.0	3.0	1.72		1.54		5.16	7.95	19441	5.14
	30.0	3.0	1.69		1.73		5.07	8.77	21459	5.67
	33.0	3.0	1.68		1.88		5.04	9.48	23182	6.12
	36.0	3.0	1.65		2.00		4.95	9.90	24221	6.40
	39.0	3.0	1.67		1.51		5.01	7.57	18509	4.89
	42.0	3.0	1.62		1.88		4.86	9.14	22354	5.91
	45.0	3.0	1.68		1.72		5.04	8.67	21209	5.60
	48.0	3.0	1.45		1.15		4.35	5.00	12239	3.23
	51.0	3.0	1.12		1.01		3.36	3.39	8303	2.19
	54.0	3.0	0.82		1.05		2.46	2.58	6320	1.67
	57.0	3.0	0.65		0.93		1.95	1.81	4437	1.17
	60.0	3.0	0.67		1.00		2.01	2.01	4918	1.30
	63.0	3.0	0.69		1.24		2.07	2.57	6280	1.66
	66.0	3.0	0.62		1.12		1.86	2.08	5097	1.35
	69.0	3.0	0.75		1.14		2.25	2.57	6275	1.66
	72.0	3.0	0.69		1.24		2.07	2.57	6280	1.66
	75.0	3.0	0.68		1.10		2.04	2.24	5490	1.45
	78.0	3.0	0.60		1.10		1.80	1.98	4844	1.28
	81.0	3.0	0.79		1.05		2.37	2.49	6088	1.61
	84.0	3.0	1.68		0.83		5.04	4.18	10235	2.70
	87.0	3.0	2.06	0.73		0.51	6.18	3.83	9374	2.48
	90.0	3.0	2.14	0.57		0.47	6.42	3.34	8168	2.16
	93.0	3.3	1.52		0.14		5.07	0.71	1735	0.46
End	94.8									
		94.8	1.3	0.65	1.12	0.49	126.57	134.83	329875	87.15



APPENDIX C-26

JC - MB 2 - Marsh McBirney Cross Sectional Flow - 06/22/2005

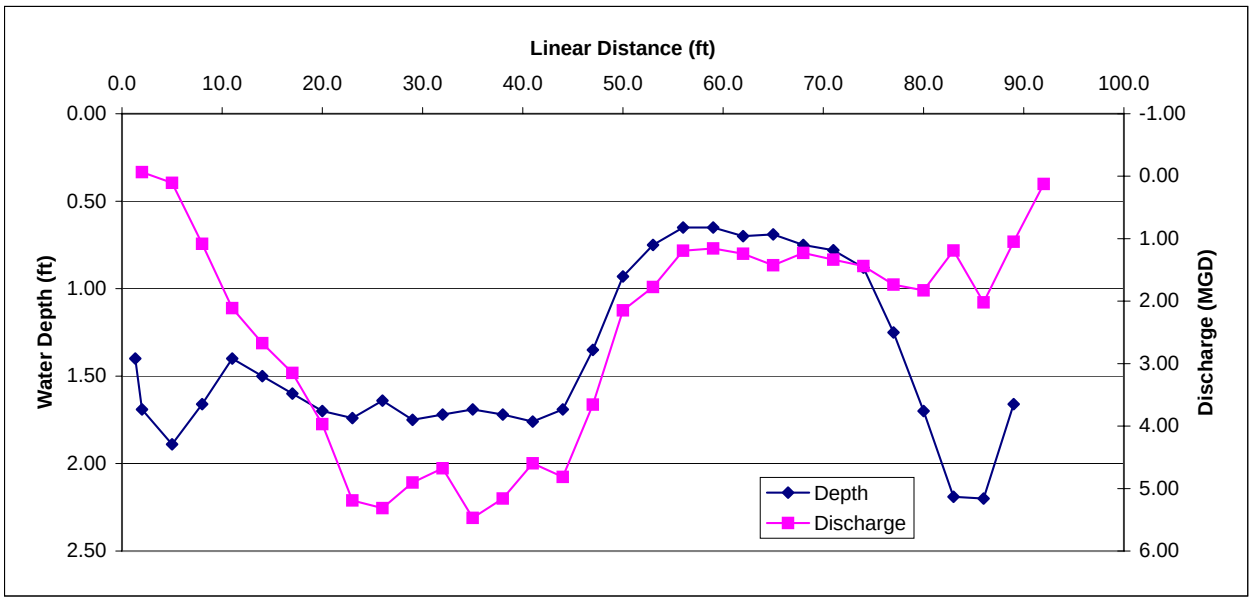
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	4.0	5.5	1.39		-0.03		7.65	-0.23	-561	-0.15
	7.0	3.0	1.66		0.02		4.98	0.10	244	0.06
	10.0	3.0	1.79		0.42		5.37	2.26	5518	1.46
	13.0	3.0	1.58		0.67		4.74	3.18	7770	2.05
	16.0	3.0	1.46		0.85		4.38	3.72	9109	2.41
	19.0	3.0	1.54		1.27		4.62	5.87	14355	3.79
	22.0	3.0	1.63		1.47		4.89	7.19	17587	4.65
	25.0	3.0	1.68		1.41		5.04	7.11	17386	4.59
	28.0	3.0	1.72		1.62		5.16	8.36	20451	5.40
	31.0	3.0	1.80		1.52		5.40	8.21	20081	5.31
	34.0	3.0	1.77		1.72		5.31	9.13	22345	5.90
	37.0	3.0	1.78		1.42		5.34	7.58	18552	4.90
	40.0	3.0	1.80		1.58		5.40	8.53	20874	5.51
	43.0	2.5	1.74		1.51		4.35	6.57	16070	4.25
	45.0	3.0	1.65		1.36		4.95	6.73	16470	4.35
	49.0	3.5	1.59		1.55		5.57	8.63	21104	5.58
	52.0	3.0	1.27		1.01		3.81	3.85	9415	2.49
	55.0	3.0	0.89		0.83		2.67	2.22	5422	1.43
	58.0	3.0	0.60		0.66		1.80	1.19	2907	0.77
	61.0	3.0	0.57		1.04		1.71	1.78	4351	1.15
	64.0	3.0	0.59		1.05		1.77	1.86	4547	1.20
	67.0	3.0	0.55		0.96		1.65	1.58	3875	1.02
	70.0	3.0	0.58		1.05		1.74	1.83	4470	1.18
	73.0	3.0	0.65		1.16		1.95	2.26	5534	1.46
	76.0	3.0	0.65		1.15		1.95	2.24	5486	1.45
	79.0	3.0	0.79		0.94		2.37	2.23	5450	1.44
	82.0	3.0	0.85		0.88		2.55	2.24	5490	1.45
	85.0	3.0	1.52		0.70		4.56	3.19	7809	2.06
	88.0	3.0	2.20	0.58		0.45	6.60	3.40	8316	2.20
	91.0	4.5	2.18	0.23		0.18	9.81	2.01	4920	1.30
End	94.0		1.65		0.10					
		94.0	1.36	0.41	1.03	0.32	128.08	124.81	305348	80.67



APPENDIX C-27

JC - MB 2 - Marsh McBirney Cross Sectional Flow - 07/11/2005

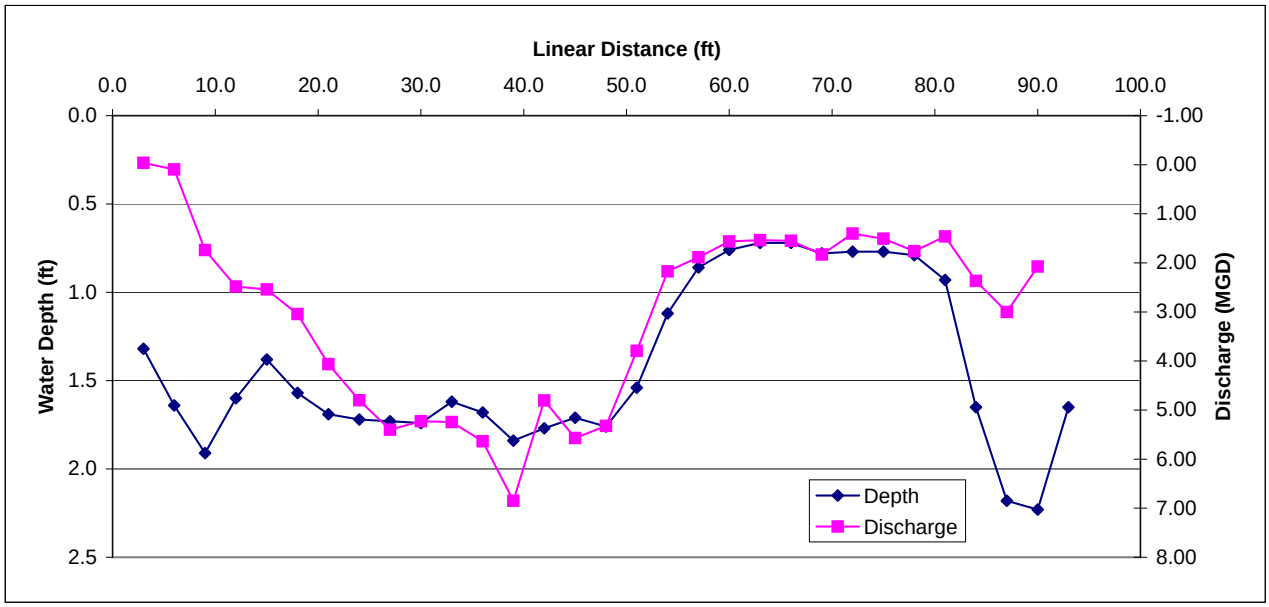
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.3									
	2.0	2.2	1.40		-0.03		3.04	-0.10	-244	-0.06
	5.0	3.0	1.69		0.03		5.07	0.17	407	0.11
	8.0	3.0	1.89		0.30		5.67	1.67	4096	1.08
	11.0	3.0	1.66		0.66		4.98	3.27	7995	2.11
	14.0	3.0	1.40		0.98		4.20	4.13	10114	2.67
	17.0	3.0	1.50		1.08		4.50	4.87	11920	3.15
	20.0	3.0	1.60		1.28		4.80	6.14	15026	3.97
	23.0	3.0	1.70		1.57		5.10	8.03	19650	5.19
	26.0	3.0	1.74		1.57		5.22	8.22	20112	5.31
	29.0	3.0	1.64		1.54		4.92	7.59	18561	4.90
	32.0	3.0	1.75		1.38		5.25	7.23	17699	4.68
	35.0	3.0	1.72		1.64		5.16	8.46	20709	5.47
	38.0	3.0	1.69		1.57		5.07	7.98	19534	5.16
	41.0	3.0	1.72		1.38		5.16	7.11	17396	4.60
	44.0	3.0	1.76		1.41		5.28	7.45	18224	4.81
	47.0	3.0	1.69		1.12		5.07	5.66	13837	3.66
	50.0	3.0	1.35		0.82		4.05	3.32	8127	2.15
	53.0	3.0	0.93		0.98		2.79	2.75	6718	1.77
	56.0	3.0	0.75		0.82		2.25	1.85	4515	1.19
	59.0	3.0	0.65		0.92		1.95	1.79	4383	1.16
	62.0	3.0	0.65		0.98		1.95	1.92	4696	1.24
	65.0	3.0	0.70		1.05		2.10	2.20	5394	1.42
	68.0	3.0	0.69		0.92		2.07	1.90	4652	1.23
	71.0	3.0	0.75		0.92		2.25	2.07	5057	1.34
	74.0	3.0	0.78		0.95		2.34	2.23	5447	1.44
	77.0	3.0	0.88		1.02		2.64	2.69	6569	1.74
	80.0	3.0	1.25		0.75		3.75	2.83	6923	1.83
	83.0	3.0	1.70		0.36		5.10	1.84	4503	1.19
	86.0	3.0	2.19	0.56		0.39	6.57	3.13	7647	2.02
	89.0	3.0	2.20	0.23		0.26	6.60	1.62	3973	1.05
	92.0	3.5	1.66		0.03		5.81	0.19	466	0.12
End	94.0									
		92.7	1.41	0.39	0.97	0.33	130.71	120.21	294106	77.70



APPENDIX C-28

JC - MB 2 - Marsh McBirney Cross Sectional Flow - 08/01/2005

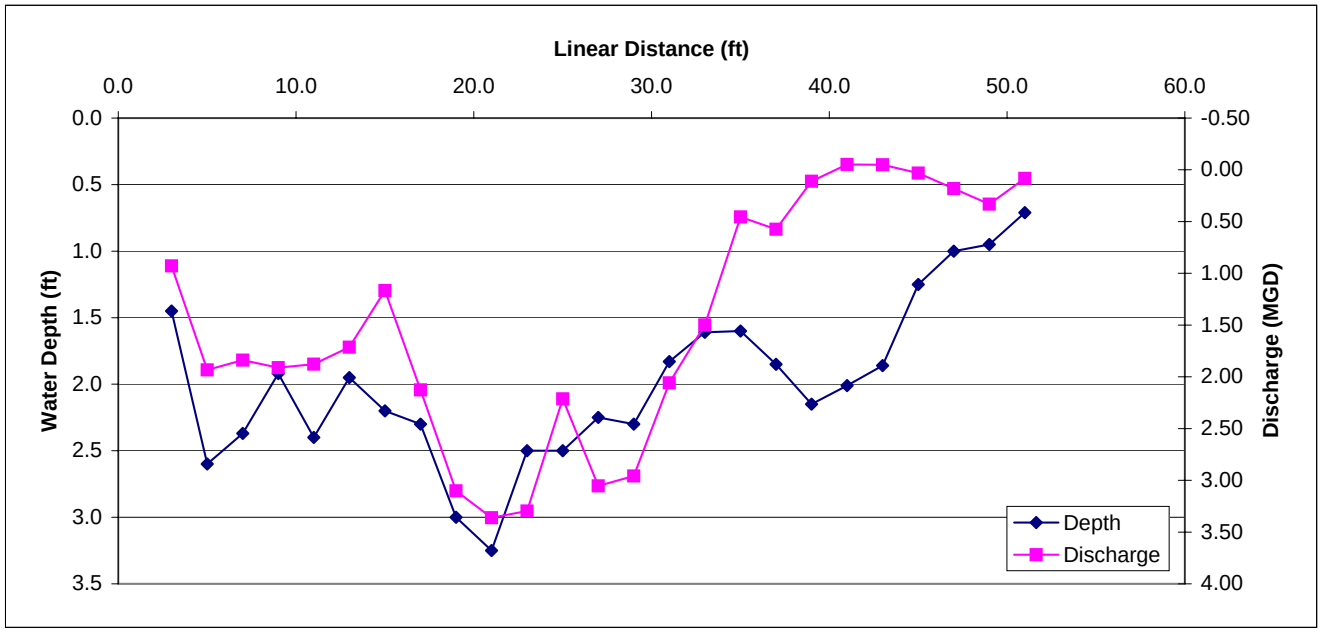
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	3.0	4.5	1.32		-0.01		5.94	-0.06	-145	-0.04
	6.0	3.0	1.64		0.03		4.92	0.15	361	0.10
	9.0	3.0	1.91		0.47		5.73	2.69	6589	1.74
	12.0	3.0	1.60		0.80		4.80	3.84	9395	2.48
	15.0	3.0	1.38		0.95		4.14	3.93	9622	2.54
	18.0	3.0	1.57		1.00		4.71	4.71	11523	3.04
	21.0	3.0	1.69		1.24		5.07	6.29	15381	4.06
	24.0	3.0	1.72		1.44		5.16	7.43	18179	4.80
	27.0	3.0	1.73		1.61		5.19	8.36	20443	5.40
	30.0	3.0	1.74		1.55		5.22	8.09	19795	5.23
	33.0	3.0	1.62		1.67		4.86	8.12	19857	5.25
	36.0	3.0	1.68		1.73		5.04	8.72	21332	5.64
	39.0	3.0	1.84		1.92		5.52	10.60	25930	6.85
	42.0	3.0	1.77		1.40		5.31	7.43	18188	4.80
	45.0	3.0	1.71		1.68		5.13	8.62	21086	5.57
	48.0	3.0	1.76		1.56		5.28	8.24	20152	5.32
	51.0	3.0	1.54		1.27		4.62	5.87	14355	3.79
	54.0	3.0	1.12		1.00		3.36	3.36	8220	2.17
	57.0	3.0	0.86		1.13		2.58	2.92	7133	1.88
	60.0	3.0	0.76		1.06		2.28	2.42	5913	1.56
	63.0	3.0	0.72		1.10		2.16	2.38	5813	1.54
	66.0	3.0	0.72		1.11		2.16	2.40	5866	1.55
	69.0	3.0	0.78		1.21		2.34	2.83	6927	1.83
	72.0	3.0	0.77		0.94		2.31	2.17	5312	1.40
	75.0	3.0	0.77		1.01		2.31	2.33	5708	1.51
	78.0	3.0	0.79		1.15		2.37	2.73	6668	1.76
	81.0	3.0	0.93		0.81		2.79	2.26	5529	1.46
	84.0	3.0	1.65		0.74		4.95	3.66	8962	2.37
	87.0	3.0	2.18	0.89		0.53	6.54	4.64	11360	3.00
	90.0	4.5	2.23	0.35		0.29	10.04	3.21	7856	2.08
End	93.0		1.65		0.19					
		93.0	1.42	0.62	1.10	0.41	132.83	140.32	343312	90.70



APPENDIX C-29

RSR-MB2 Marsh McBirney Cross Sectional Flow - 12/14/04

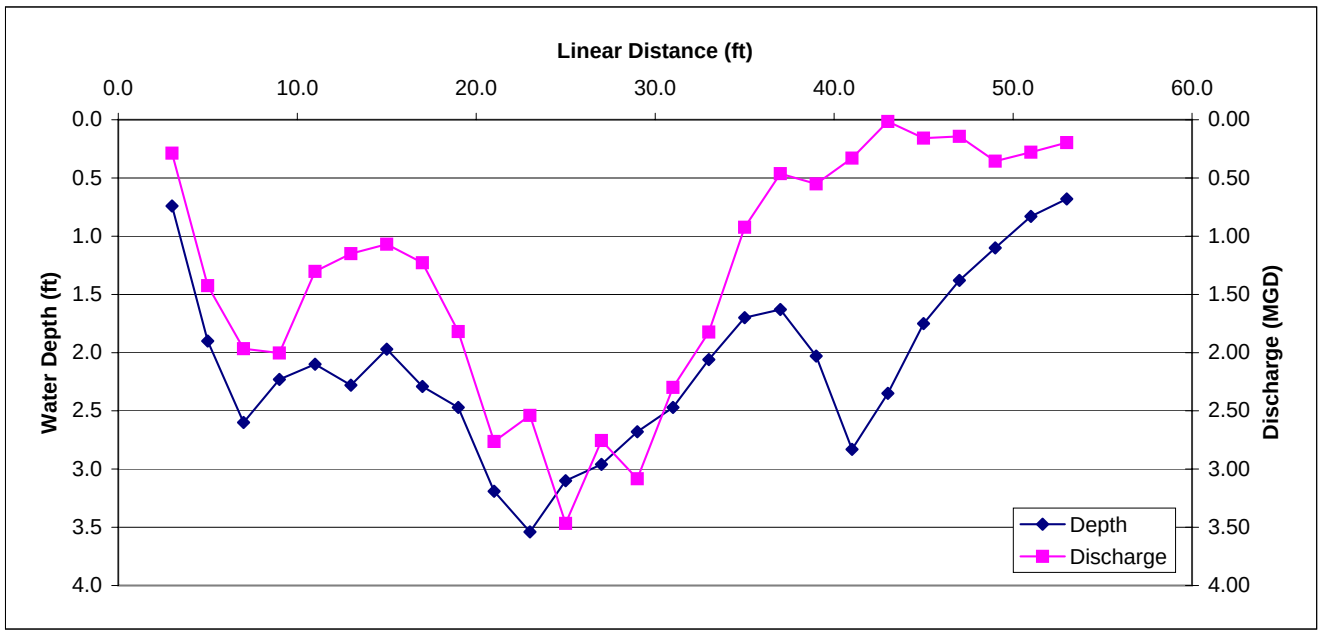
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.0									
	3.0	3.0	1.45		0.33		4.35	1.44	3512	0.93
	5.0	2.0	2.60	0.90		0.25	5.20	2.99	7315	1.93
	7.0	2.0	2.37	0.79		0.41	4.74	2.84	6958	1.84
	9.0	2.0	1.92		0.77		3.84	2.96	7234	1.91
	11.0	2.0	2.40	0.89		0.32	4.80	2.90	7105	1.88
	13.0	2.0	1.95		0.68		3.90	2.65	6488	1.71
	15.0	2.0	2.20	0.67		0.15	4.40	1.80	4414	1.17
	17.0	2.0	2.30	0.86		0.57	4.60	3.29	8047	2.13
	19.0	2.0	3.00	0.86		0.74	6.00	4.80	11744	3.10
	21.0	2.0	3.25	1.37		0.23	6.50	5.20	12722	3.36
	23.0	2.0	2.50	1.31		0.73	5.00	5.10	12478	3.30
	25.0	2.0	2.50	1.36		0.01	5.00	3.43	8380	2.21
	27.0	2.0	2.25	1.42		0.68	4.50	4.73	11560	3.05
	29.0	2.0	2.30	0.98		1.01	4.60	4.58	11198	2.96
	31.0	2.0	1.83		0.87		3.66	3.18	7790	2.06
	33.0	2.0	1.61		0.72		3.22	2.32	5672	1.50
	35.0	2.0	1.60		0.22		3.20	0.70	1722	0.46
	37.0	2.0	1.85		0.24		3.70	0.89	2173	0.57
	39.0	2.0	2.15	0.08		0.00	4.30	0.17	421	0.11
	41.0	2.0	2.01		-0.02		4.02	-0.08	-197	-0.05
	43.0	2.0	1.86		-0.02		3.72	-0.07	-182	-0.05
	45.0	2.0	1.25		0.02		2.50	0.05	122	0.03
	47.0	2.0	1.00		0.14		2.00	0.28	685	0.18
	49.0	2.0	0.95		0.27		1.90	0.51	1255	0.33
	51.0	3.0	0.71		0.06		2.13	0.13	313	0.08
End	53.0									
		52.0	2.0	0.96	0.33	0.43	101.78	56.78	138929	36.70



APPENDIX C-30

RSR-MB2 Marsh McBirney Cross Sectional Flow - 01/25/05

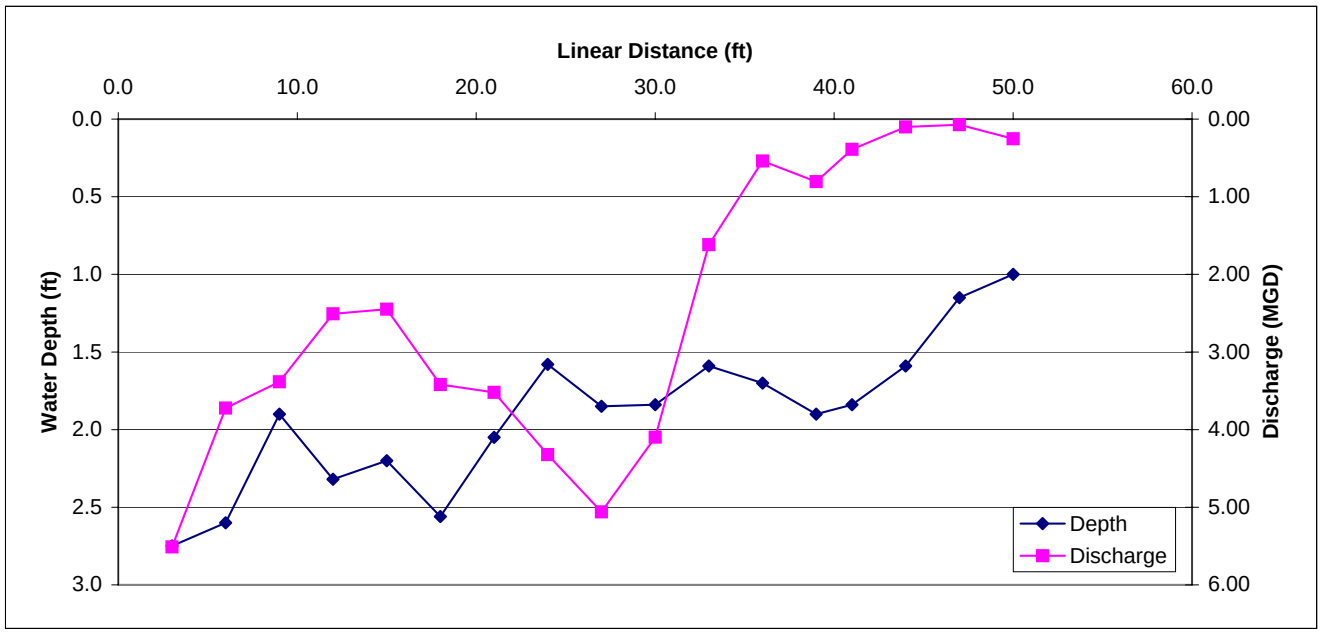
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.0									
	3.0	3.0	0.74		0.20		2.22	0.44	1086	0.29
	5.0	2.0	1.90		0.58		3.80	2.20	5392	1.42
	7.0	2.0	2.60	0.78		0.39	5.20	3.04	7442	1.97
	9.0	2.0	2.23	0.80		0.59	4.46	3.10	7584	2.00
	11.0	2.0	2.10	0.70		0.26	4.20	2.02	4932	1.30
	13.0	2.0	2.28	0.63		0.15	4.56	1.78	4351	1.15
	15.0	2.0	1.97		0.42		3.94	1.65	4049	1.07
	17.0	2.0	2.29	0.68		0.15	4.58	1.90	4650	1.23
	19.0	2.0	2.47	0.72		0.42	4.94	2.82	6889	1.82
	21.0	2.0	3.19	1.05		0.29	6.38	4.27	10458	2.76
	23.0	2.0	3.54	1.13		-0.02	7.08	3.93	9614	2.54
	25.0	2.0	3.10	1.39		0.34	6.20	5.36	13121	3.47
	27.0	2.0	2.96	1.35		0.09	5.92	4.26	10428	2.75
	29.0	2.0	2.68	1.31		0.47	5.36	4.77	11671	3.08
	31.0	2.0	2.47	0.81		0.63	4.94	3.56	8702	2.30
	33.0	2.0	2.06	0.84		0.53	4.12	2.82	6905	1.82
	35.0	2.0	1.70		0.42		3.40	1.43	3494	0.92
	37.0	2.0	1.63		0.22		3.26	0.72	1755	0.46
	39.0	2.0	2.03	0.27		0.15	4.06	0.85	2086	0.55
	41.0	2.0	2.83	0.16		0.02	5.66	0.51	1246	0.33
	43.0	2.0	2.35	0.00		0.01	4.70	0.02	57	0.02
	45.0	2.0	1.75		0.07		3.50	0.25	599	0.16
	47.0	2.0	1.38		0.08		2.76	0.22	540	0.14
	49.0	2.0	1.10		0.25		2.20	0.55	1346	0.36
	51.0	2.0	0.83		0.26		1.66	0.43	1056	0.28
	53.0	2.8	0.68		0.16		1.90	0.30	745	0.20
End	54.8									
		53.8	2.1	0.79	0.27	0.28	111.00	53.22	130199	34.40



APPENDIX C-31

RSR-MB2 Marsh McBirney Cross Sectional Flow - 02/23/05

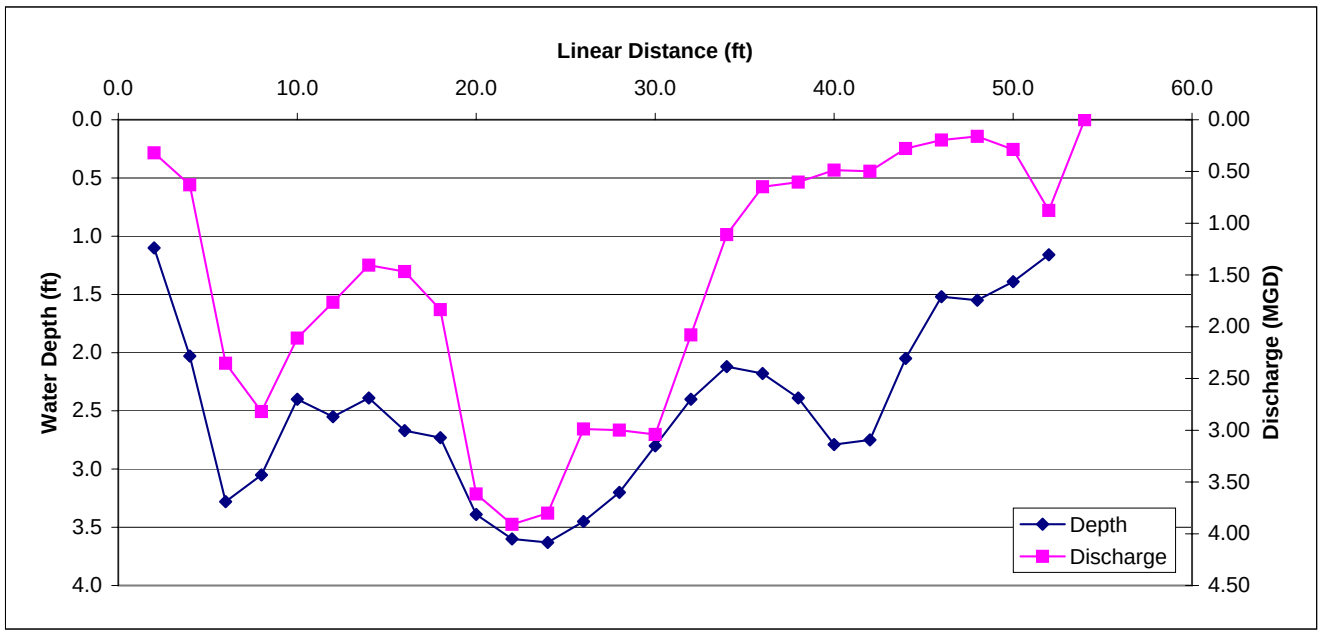
	Distance from Initial Point	Segment Width	Total Depth	Velocity (ft/s)			Segment Area	Discharge		
	(ft.)	(ft.)	(ft.)	0.2 x depth	0.6 x depth	0.8 x depth	(ft^2)	(ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	3.0	4.5	2.75	0.72		0.66	12.38	8.53	20860	5.51
	6.0	3.0	2.60	0.98		0.49	7.80	5.76	14087	3.72
	9.0	3.0	1.90		0.92		5.70	5.24	12811	3.38
	12.0	3.0	2.32	0.79		0.33	6.96	3.88	9497	2.51
	15.0	3.0	2.20	0.56		0.59	6.60	3.79	9271	2.45
	18.0	3.0	2.56	0.72		0.66	7.68	5.29	12946	3.42
	21.0	3.0	2.05	0.92		0.85	6.15	5.45	13329	3.52
	24.0	3.0	1.58		1.41		4.74	6.69	16360	4.32
	27.0	3.0	1.85		1.41		5.55	7.83	19156	5.06
	30.0	3.0	1.84		1.15		5.52	6.34	15508	4.10
	33.0	3.0	1.59		0.52		4.77	2.50	6126	1.62
	36.0	3.0	1.70		0.16		5.10	0.84	2047	0.54
	39.0	2.5	1.90		0.26		4.75	1.25	3050	0.81
	41.0	2.5	1.84		0.13		4.60	0.60	1477	0.39
	44.0	3.0	1.59		0.03		4.77	0.16	383	0.10
	47.0	3.0	1.15		0.03		3.45	0.11	277	0.07
	50.0	4.0	1.00		0.10		4.00	0.39	963	0.25
End	52.5									
		52.5	1.9	0.78	0.56	0.60	100.52	64.64	158147	41.78



APPENDIX C-32

RSR-MB2 Marsh McBirney Cross Sectional Flow - 03/28/05

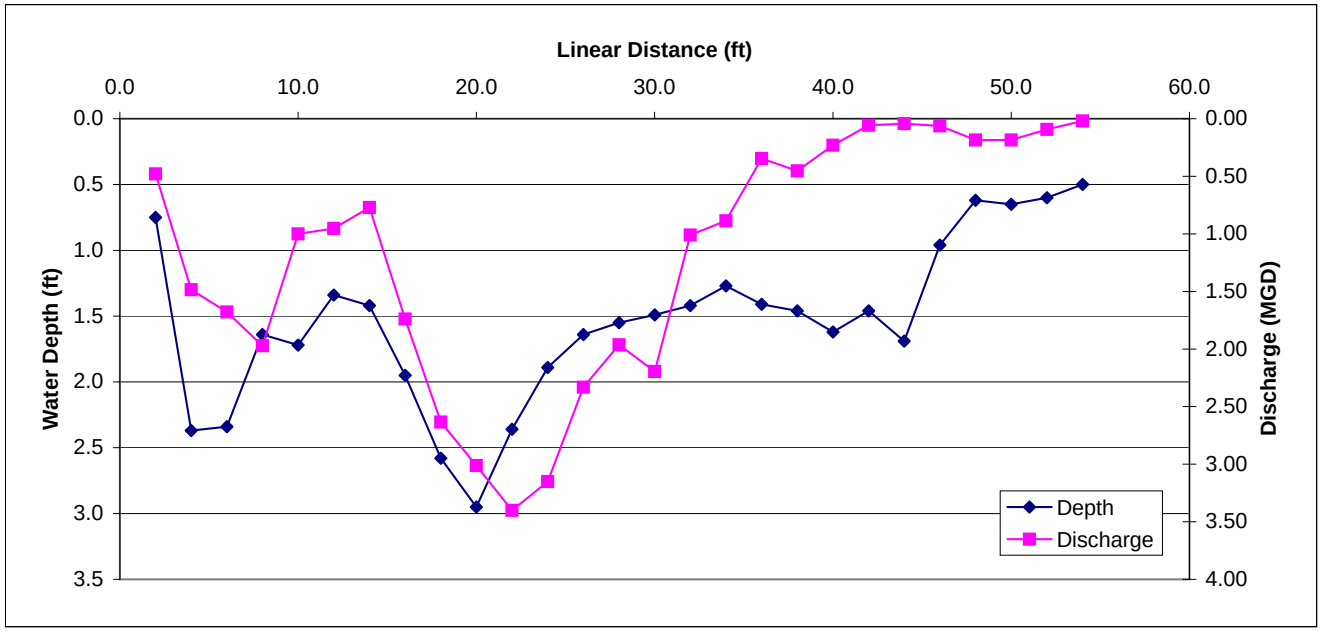
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	2.0	3.0	1.10		0.15		3.30	0.50	1211	0.32
	4.0	2.0	2.03	0.31		0.17	4.06	0.97	2384	0.63
	6.0	2.0	3.28	0.92		0.19	6.56	3.64	8907	2.35
	8.0	2.0	3.05	0.88		0.55	6.10	4.36	10671	2.82
	10.0	2.0	2.40	0.82		0.54	4.80	3.26	7986	2.11
	12.0	2.0	2.55	0.71		0.36	5.10	2.73	6675	1.76
	14.0	2.0	2.39	0.65		0.26	4.78	2.17	5321	1.41
	16.0	2.0	2.67	0.57		0.28	5.34	2.27	5553	1.47
	18.0	2.0	2.73	0.55		0.49	5.46	2.84	6946	1.84
	20.0	2.0	3.39	1.10		0.55	6.78	5.59	13685	3.62
	22.0	2.0	3.60	1.20		0.48	7.20	6.05	14797	3.91
	24.0	2.0	3.63	1.03		0.59	7.26	5.88	14387	3.80
	26.0	2.0	3.45	1.24		0.10	6.90	4.62	11311	2.99
	28.0	2.0	3.20	1.09		0.36	6.40	4.64	11352	3.00
	30.0	2.0	2.80	0.84		0.84	5.60	4.70	11509	3.04
	32.0	2.0	2.40	0.71		0.63	4.80	3.22	7868	2.08
	34.0	2.0	2.12	0.40		0.41	4.24	1.72	4201	1.11
	36.0	2.0	2.18	0.22		0.24	4.36	1.00	2453	0.65
	38.0	2.0	2.39	0.24		0.15	4.78	0.93	2280	0.60
	40.0	2.0	2.79	0.23		0.04	5.58	0.75	1843	0.49
	42.0	2.0	2.75	0.26		0.02	5.50	0.77	1884	0.50
	44.0	2.0	2.05	0.17		0.04	4.10	0.43	1053	0.28
	46.0	2.0	1.52		0.10		3.04	0.30	744	0.20
	48.0	2.0	1.55		0.08		3.10	0.25	607	0.16
	50.0	2.0	1.39		0.16		2.78	0.44	1088	0.29
	52.0	3.0	1.16		0.39		3.48	1.36	3320	0.88
End	54.0						0.00	0.00	0	0.00
		54.0	2.5	0.67	0.18	0.35	131.40	65.41	160037	42.28



APPENDIX C-33

RSR-MB2 Marsh McBirney Cross Sectional Flow - 4/21/05

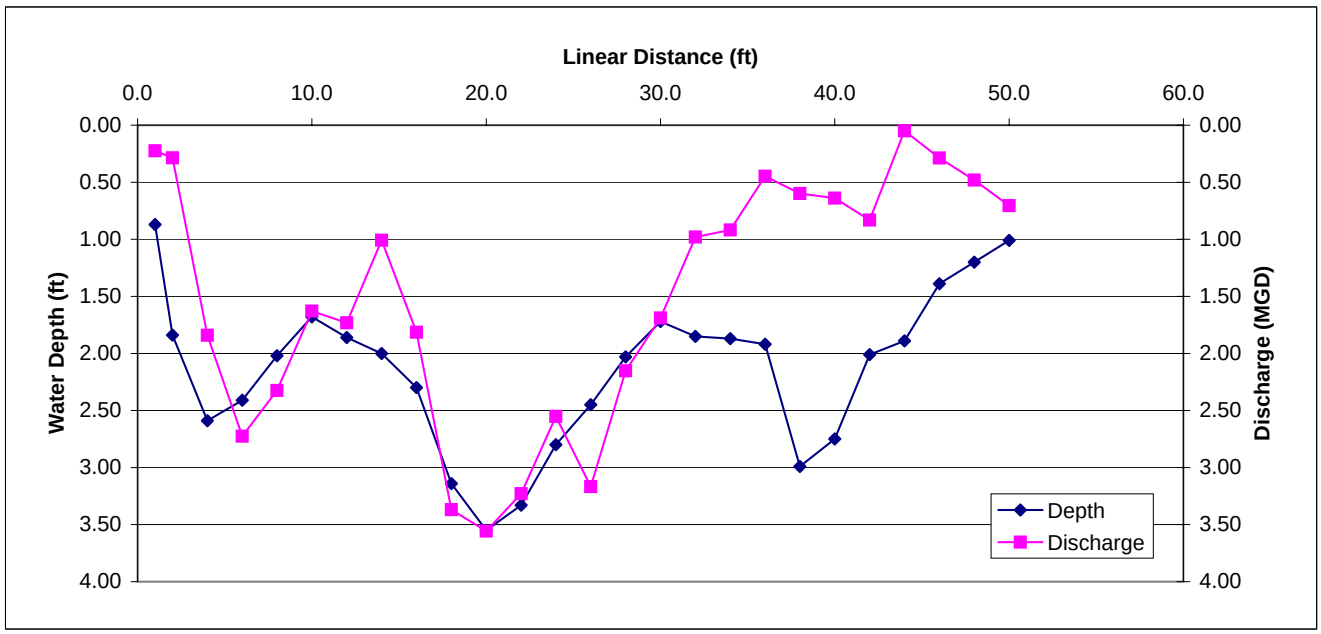
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	2.0	3.0	0.75		0.33		2.25	0.74	1817	0.48
	4.0	2.0	2.37	0.46		0.51	4.74	2.30	5624	1.49
	6.0	2.0	2.34	0.63		0.48	4.68	2.60	6355	1.68
	8.0	2.0	1.64		0.93		3.28	3.05	7463	1.97
	10.0	2.0	1.72		0.45		3.44	1.55	3787	1.00
	12.0	2.0	1.34		0.55		2.68	1.47	3606	0.95
	14.0	2.0	1.42		0.42		2.84	1.19	2918	0.77
	16.0	2.0	1.95		0.69		3.90	2.69	6584	1.74
	18.0	2.0	2.58	0.93		0.65	5.16	4.08	9973	2.63
	20.0	2.0	2.95	1.09		0.49	5.90	4.66	11403	3.01
	22.0	2.0	2.36	1.23		1.00	4.72	5.26	12876	3.40
	24.0	2.0	1.89		1.29		3.78	4.88	11930	3.15
	26.0	2.0	1.64		1.10		3.28	3.61	8827	2.33
	28.0	2.0	1.55		0.98		3.10	3.04	7433	1.96
	30.0	2.0	1.49		1.14		2.98	3.40	8312	2.20
	32.0	2.0	1.42		0.55		2.84	1.56	3822	1.01
	34.0	2.0	1.27		0.54		2.54	1.37	3356	0.89
	36.0	2.0	1.41		0.19		2.82	0.54	1311	0.35
	38.0	2.0	1.46		0.24		2.92	0.70	1715	0.45
	40.0	2.0	1.62		0.11		3.24	0.36	872	0.23
	42.0	2.0	1.46		0.03		2.92	0.09	214	0.06
	44.0	2.0	1.69		0.02		3.38	0.07	165	0.04
	46.0	2.0	0.96		0.05		1.92	0.10	235	0.06
	48.0	2.0	0.62		0.23		1.24	0.29	698	0.18
	50.0	2.0	0.65		0.22		1.30	0.29	700	0.18
	52.0	2.0	0.60		0.12		1.20	0.14	352	0.09
	54.0	1.5	0.50		0.04		0.75	0.03	73	0.02
End	54.5									
		54.5	1.5	0.87	0.46	0.63	83.80	50.04	122421	32.34



APPENDIX C-34

RSR - MB2 - Marsh McBirney Cross Sectional Flow - 06/22/2005

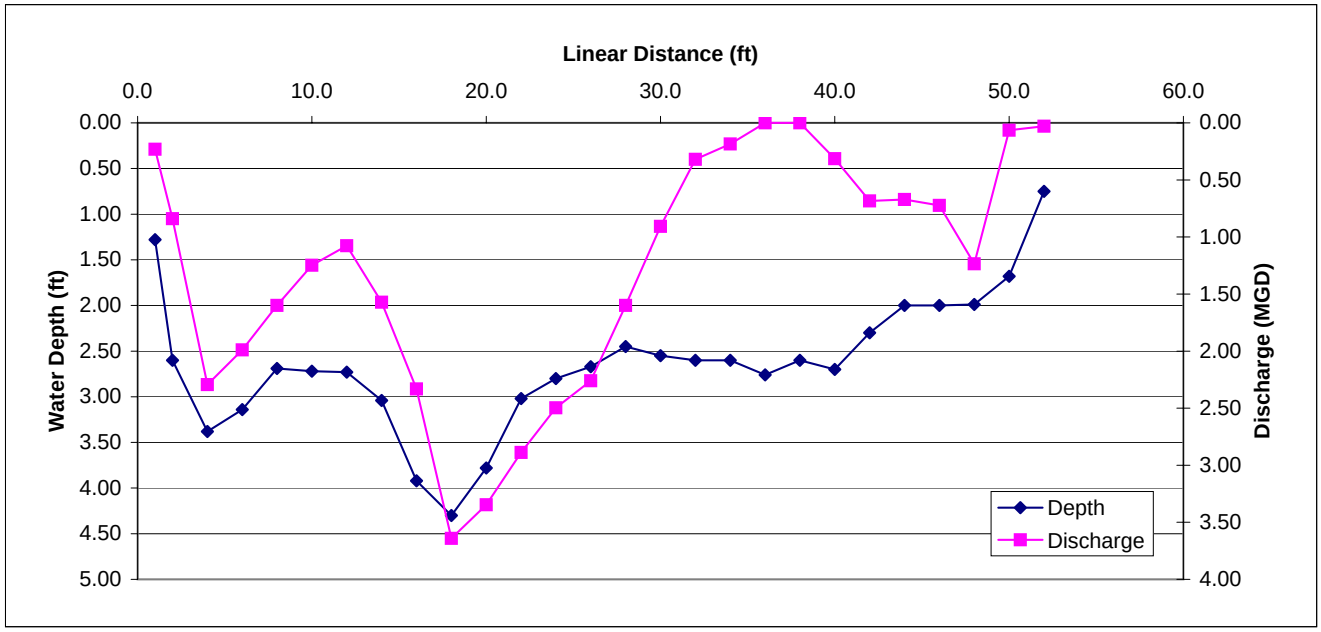
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.0									
	2.0	2.0	0.87		0.20		1.74	0.35	851	0.22
	4.0	2.0	1.84		0.12		3.68	0.44	1080	0.29
	6.0	2.0	2.59	0.70		0.40	5.18	2.85	6970	1.84
	8.0	2.0	2.41	1.03		0.72	4.82	4.22	10318	2.73
	10.0	2.0	2.02	0.94		0.84	4.04	3.60	8797	2.32
	12.0	2.0	1.68		0.75		3.36	2.52	6165	1.63
	14.0	2.0	1.86		0.72		3.72	2.68	6553	1.73
	16.0	2.0	2.00		0.39		4.00	1.56	3817	1.01
	18.0	2.0	2.30	0.60		0.62	4.60	2.81	6865	1.81
	20.0	2.0	3.14	0.86		0.80	6.28	5.21	12753	3.37
	22.0	2.0	3.55	1.02		0.53	7.10	5.50	13462	3.56
	24.0	2.0	3.33	1.22		0.28	6.66	5.00	12221	3.23
	26.0	2.0	2.80	1.24		0.17	5.60	3.95	9659	2.55
	28.0	2.0	2.45	1.08		0.92	4.90	4.90	11988	3.17
	30.0	2.0	2.03	0.85		0.79	4.06	3.33	8145	2.15
	32.0	2.0	1.72		0.76		3.44	2.61	6396	1.69
	34.0	2.0	1.85		0.41		3.70	1.52	3711	0.98
	36.0	2.0	1.87		0.38		3.74	1.42	3477	0.92
	38.0	2.0	1.92		0.18		3.84	0.69	1691	0.45
	40.0	2.0	2.99	0.31		0.00	5.98	0.93	2268	0.60
	42.0	2.0	2.75	0.35		0.01	5.50	0.99	2422	0.64
	44.0	2.0	2.01		0.32		4.02	1.29	3147	0.83
	46.0	2.0	1.89		0.02		3.78	0.08	185	0.05
	48.0	2.0	1.39		0.16		2.78	0.44	1088	0.29
	50.0	2.0	1.20		0.31		2.40	0.74	1820	0.48
	52.0	3.0	1.01		0.36		3.03	1.09	2669	0.71
End	54.0									
		53.0	2.13	0.85	0.36	0.51	111.95	60.71	148521	39.24



APPENDIX C-35

RSR - MB2 - Marsh McBirney Cross Sectional Flow - 07/12/2005

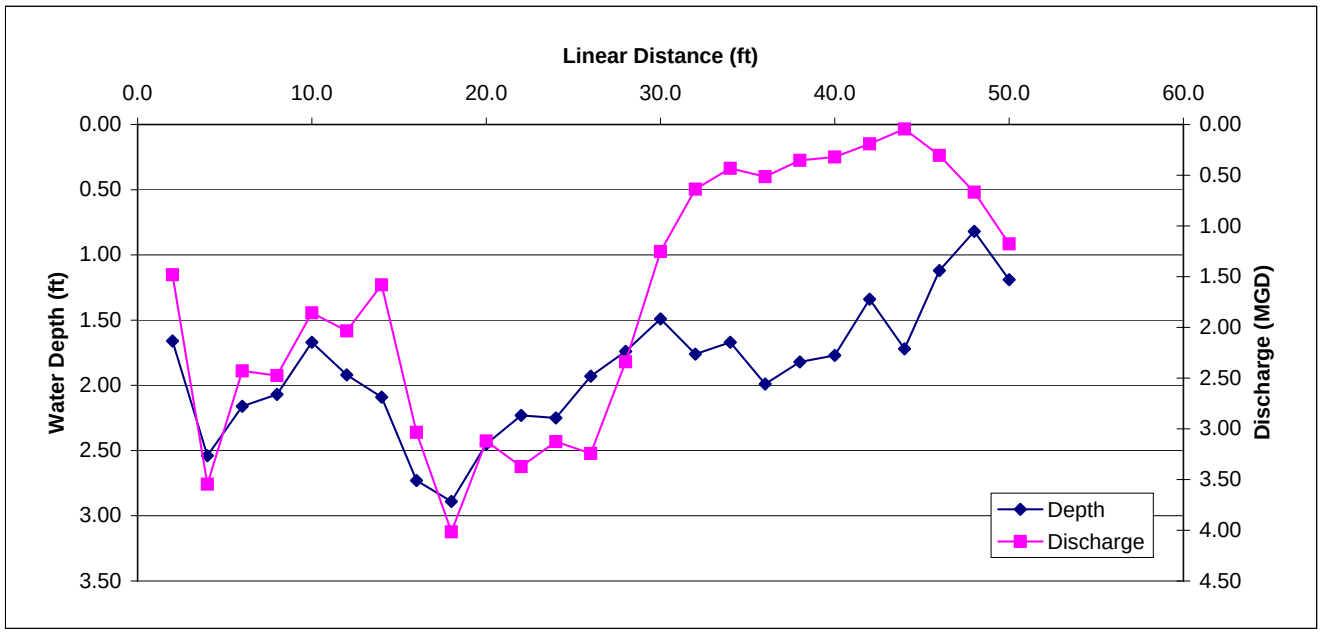
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.0									
	2.0	2.0	1.28		0.14		2.56	0.36	877	0.23
	4.0	2.0	2.60	0.29		0.21	5.20	1.30	3181	0.84
	6.0	2.0	3.38	0.57		0.48	6.76	3.55	8683	2.29
	8.0	2.0	3.14	0.56		0.42	6.28	3.08	7529	1.99
	10.0	2.0	2.69	0.55		0.37	5.38	2.47	6055	1.60
	12.0	2.0	2.72	0.39		0.32	5.44	1.93	4725	1.25
	14.0	2.0	2.73	0.40		0.21	5.46	1.67	4074	1.08
	16.0	2.0	3.04	0.42		0.38	6.08	2.43	5950	1.57
	18.0	2.0	3.92	0.52		0.40	7.84	3.61	8823	2.33
	20.0	2.0	4.30	0.72		0.59	8.60	5.63	13782	3.64
	22.0	2.0	3.78	0.76		0.61	7.56	5.18	12670	3.35
	24.0	2.0	3.02	0.70		0.78	6.04	4.47	10935	2.89
	26.0	2.0	2.80	0.67		0.71	5.60	3.86	9454	2.50
	28.0	2.0	2.67	0.65		0.66	5.34	3.50	8557	2.26
	30.0	2.0	2.45	0.44		0.57	4.90	2.47	6054	1.60
	32.0	2.0	2.55	0.21		0.34	5.10	1.40	3431	0.91
	34.0	2.0	2.60	0.07		0.12	5.20	0.49	1209	0.32
	36.0	2.0	2.60	0.03		0.08	5.20	0.29	700	0.18
	38.0	2.0	2.76	-0.01		0.01	5.52	0.00	0	0.00
	40.0	2.0	2.60	0.00		0.00	5.20	0.00	0	0.00
	42.0	2.0	2.70	0.18		0.00	5.40	0.49	1189	0.31
	44.0	2.0	2.30	0.26		0.20	4.60	1.06	2588	0.68
	46.0	2.0	2.00		0.26		4.00	1.04	2544	0.67
	48.0	2.0	2.00		0.28		4.00	1.12	2740	0.72
	50.0	2.0	1.99		0.48		3.98	1.91	4674	1.23
	52.0	2.0	1.68		0.03		3.36	0.10	247	0.07
	54.0	3.0	0.75		0.02		2.25	0.05	110	0.03
End	56.0									
		55.0	2.63	0.40	0.20	0.36	142.85	53.45	130780	34.55



APPENDIX C-36

RSR - MB2 - Marsh McBirney Cross Sectional Flow - 08/04/2005

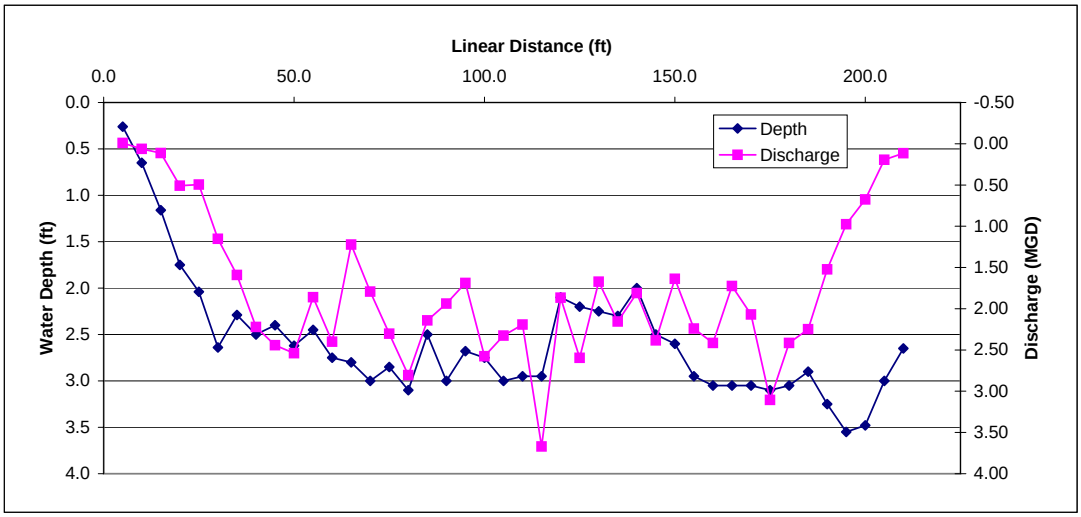
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	2.0									
	4.0	3.0	1.66		0.46		4.98	2.29	5605	1.48
	6.0	2.0	2.54	1.45		0.71	5.08	5.49	13423	3.55
	8.0	2.0	2.16	1.00		0.74	4.32	3.76	9195	2.43
	10.0	2.0	2.07	0.95		0.90	4.14	3.83	9369	2.48
	12.0	2.0	1.67		0.86		3.34	2.87	7028	1.86
	14.0	2.0	1.92		0.82		3.84	3.15	7704	2.04
	16.0	2.0	2.09	0.72		0.45	4.18	2.45	5983	1.58
	18.0	2.0	2.73	1.01		0.71	5.46	4.70	11488	3.03
	20.0	2.0	2.89	1.20		0.95	5.78	6.21	15202	4.02
	22.0	2.0	2.45	1.10		0.87	4.90	4.83	11808	3.12
	24.0	2.0	2.23	1.42		0.92	4.46	5.22	12767	3.37
	26.0	2.0	2.25	1.40		0.75	4.50	4.84	11835	3.13
	28.0	2.0	1.93		1.30		3.86	5.02	12277	3.24
	30.0	2.0	1.74		1.04		3.48	3.62	8855	2.34
	32.0	2.0	1.49		0.65		2.98	1.94	4739	1.25
	34.0	2.0	1.76		0.28		3.52	0.99	2411	0.64
	36.0	2.0	1.67		0.20		3.34	0.67	1634	0.43
	38.0	2.0	1.99		0.20		3.98	0.80	1947	0.51
	40.0	2.0	1.82		0.15		3.64	0.55	1336	0.35
	42.0	2.0	1.77		0.14		3.54	0.50	1213	0.32
	44.0	2.0	1.34		0.11		2.68	0.29	721	0.19
	46.0	2.0	1.72		0.02		3.44	0.07	168	0.04
	48.0	2.0	1.12		0.21		2.24	0.47	1151	0.30
	50.0	2.0	0.82		0.63		1.64	1.03	2528	0.67
	52.0	3.0	1.19		0.51		3.57	1.82	4454	1.18
End	54.0									
		52.0	1.88	1.14	0.47	0.78	96.89	67.38	164841	43.55



APPENDIX C-37

ASC - MB 1 - Marsh McBirney Cross Sectional Flow - 06/22/2005

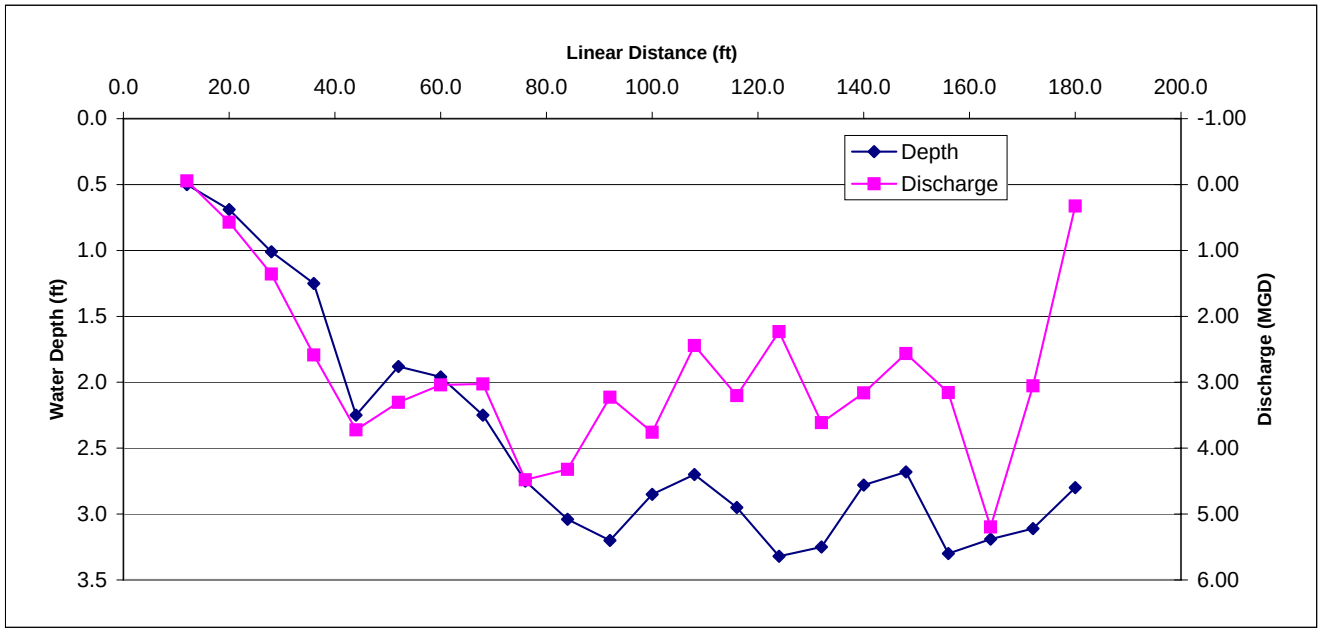
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	2.0									
	5.0	5.5	0.26		-0.01		1.43	-0.01	-35	-0.01
	10.0	5.0	0.65		0.03		3.25	0.10	239	0.06
	15.0	5.0	1.16		0.03		5.80	0.17	426	0.11
	20.0	5.0	1.75		0.09		8.75	0.79	1927	0.51
	25.0	5.0	2.04	0.04		0.11	10.20	0.77	1872	0.49
	30.0	5.0	2.64	0.13		0.14	13.20	1.78	4360	1.15
	35.0	5.0	2.29	0.14		0.29	11.45	2.46	6023	1.59
	40.0	5.0	2.50	0.28		0.27	12.50	3.44	8410	2.22
	45.0	5.0	2.40	0.31		0.32	12.00	3.78	9248	2.44
	50.0	5.0	2.62	0.23		0.37	13.10	3.93	9615	2.54
	55.0	5.0	2.45	0.19		0.28	12.25	2.88	7043	1.86
	60.0	5.0	2.75	0.22		0.32	13.75	3.71	9083	2.40
	65.0	5.0	2.80	0.10		0.17	14.00	1.89	4624	1.22
	70.0	5.0	3.00	0.28		0.09	15.00	2.78	6789	1.79
	75.0	5.0	2.85	0.34		0.16	14.25	3.56	8716	2.30
	80.0	5.0	3.10	0.36		0.20	15.50	4.34	10618	2.81
	85.0	5.0	2.50	0.37		0.16	12.50	3.31	8104	2.14
	90.0	5.0	3.00	0.27		0.13	15.00	3.00	7340	1.94
	95.0	5.0	2.68	0.26		0.13	13.40	2.61	6393	1.69
	100.0	5.0	2.75	0.33		0.25	13.75	3.99	9756	2.58
	105.0	5.0	3.00	0.37		0.11	15.00	3.60	8808	2.33
	110.0	5.0	2.95	0.36		0.10	14.75	3.39	8300	2.19
	115.0	5.0	2.95	0.40		0.37	14.75	5.68	13893	3.67
	120.0	5.0	2.10	0.32		0.23	10.50	2.89	7064	1.87
	125.0	5.0	2.20	0.40		0.33	11.00	4.02	9823	2.60
	130.0	5.0	2.25	0.26		0.20	11.25	2.59	6331	1.67
	135.0	5.0	2.30	0.32		0.26	11.50	3.34	8159	2.16
	140.0	5.0	2.00		0.28		10.00	2.80	6850	1.81
	145.0	5.0	2.50	0.38		0.21	12.50	3.69	9022	2.38
	150.0	5.0	2.60	0.25		0.14	13.00	2.54	6202	1.64
	155.0	5.0	2.95	0.29		0.18	14.75	3.47	8480	2.24
	160.0	5.0	3.05	0.31		0.18	15.25	3.74	9141	2.41
	165.0	5.0	3.05	0.26		0.09	15.25	2.67	6529	1.72
	170.0	5.0	3.05	0.26		0.16	15.25	3.20	7835	2.07
	175.0	5.0	3.10	0.38		0.24	15.50	4.81	11756	3.11
	180.0	5.0	3.05	0.25		0.24	15.25	3.74	9141	2.41
	185.0	5.0	2.90	0.23		0.25	14.50	3.48	8514	2.25
	190.0	5.0	3.25	0.21		0.08	16.25	2.36	5765	1.52
	195.0	5.0	3.55	0.07		0.10	17.75	1.51	3691	0.98
	200.0	5.0	3.48	0.11		0.01	17.40	1.04	2554	0.67
	205.0	5.0	3.00	0.00		0.04	15.00	0.30	734	0.19
	210.0	4.5	2.65	0.01		0.02	11.93	0.18	438	0.12
End	212.0									
		210.0	2.57	0.25	0.08	0.19	539.41	114.27	279581	73.86



APPENDIX C-38

ASC - MB 1 - Marsh McBirney Cross Sectional Flow - 07/11/2005

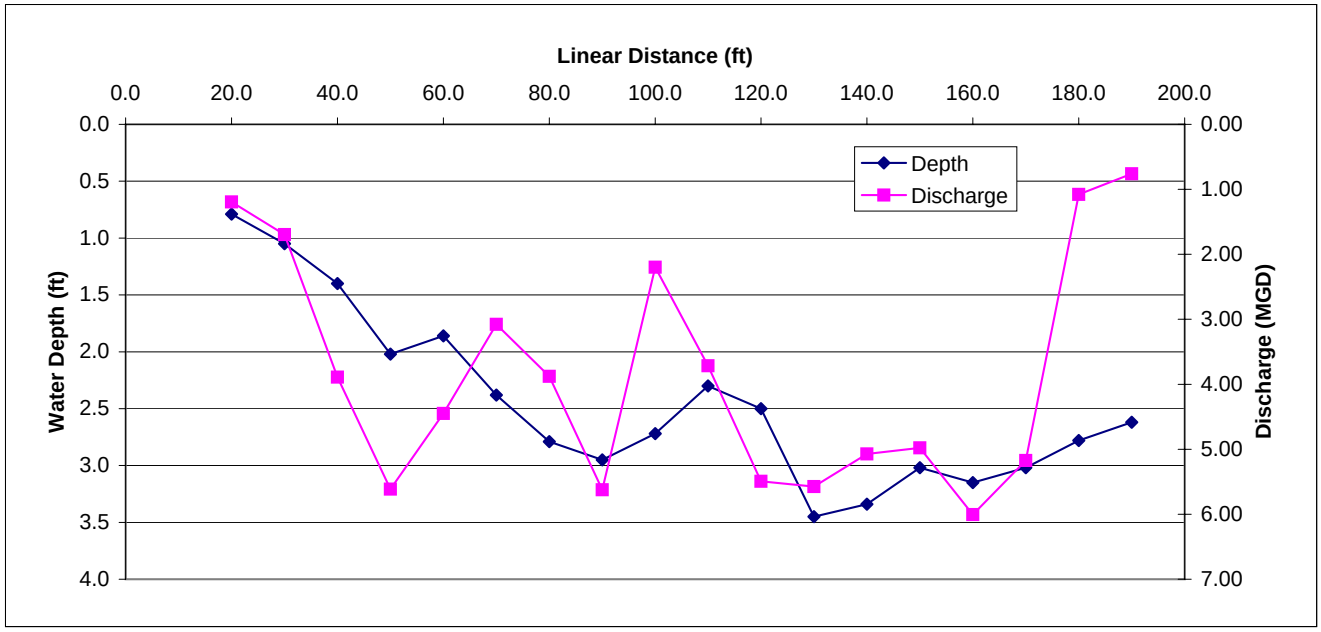
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	7.5									
	12.0	8.5	0.50		-0.02		4.25	-0.09	-208	-0.05
	20.0	8.0	0.69		0.16		5.52	0.88	2161	0.57
	28.0	8.0	1.01		0.26		8.08	2.10	5140	1.36
	36.0	8.0	1.25		0.40		10.00	4.00	9786	2.59
	44.0	8.0	2.25	0.35		0.29	18.00	5.76	14092	3.72
	52.0	8.0	1.88		0.34		15.04	5.11	12511	3.31
	60.0	8.0	1.96		0.30		15.68	4.70	11509	3.04
	68.0	8.0	2.25	0.34		0.18	18.00	4.68	11450	3.02
	76.0	8.0	2.75	0.44		0.19	22.00	6.93	16955	4.48
	84.0	8.0	3.04	0.42		0.13	24.32	6.69	16363	4.32
	92.0	8.0	3.20	0.33		0.06	25.60	4.99	12213	3.23
	100.0	8.0	2.85	0.46		0.05	22.80	5.81	14224	3.76
	108.0	8.0	2.70	0.39		-0.04	21.60	3.78	9248	2.44
	116.0	8.0	2.95	0.39		0.03	23.60	4.96	12125	3.20
	124.0	8.0	3.32	0.28		-0.02	26.56	3.45	8448	2.23
	132.0	8.0	3.25	0.21		0.22	26.00	5.59	13676	3.61
	140.0	8.0	2.78	0.32		0.12	22.24	4.89	11971	3.16
	148.0	8.0	2.68	0.23		0.14	21.44	3.97	9704	2.56
	156.0	8.0	3.30	0.25		0.12	26.40	4.88	11949	3.16
	164.0	8.0	3.19	0.30		0.33	25.52	8.04	19668	5.20
	172.0	8.0	3.11	0.26		0.12	24.88	4.73	11565	3.06
	180.0	12.0	2.80	0.02		0.01	33.60	0.50	1233	0.33
End	188.0									
		180.5	2.44	0.31	0.24	0.12	441.13	96.37	235783	62.29



APPENDIX C-39

ASC - MB 1 - Marsh McBirney Cross Sectional Flow - 08/09/2005

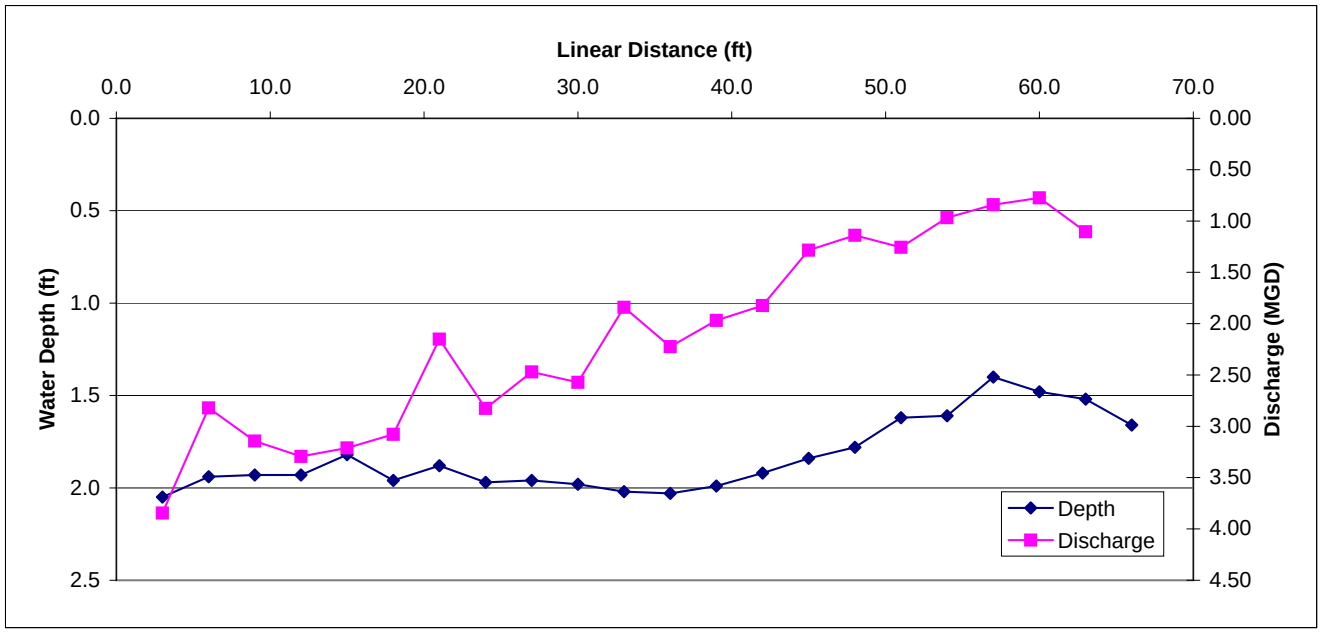
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	12.0									
	20.0	13.0	0.79		0.18		10.27	1.85	4523	1.19
	30.0	10.0	1.05		0.25		10.50	2.63	6422	1.70
	40.0	10.0	1.40		0.43		14.00	6.02	14728	3.89
	50.0	10.0	2.02		0.43		20.20	8.69	21251	5.61
	60.0	10.0	1.86		0.37		18.60	6.88	16837	4.45
	70.0	10.0	2.38	0.32		0.08	23.80	4.76	11646	3.08
	80.0	10.0	2.79	0.37		0.06	27.90	6.00	14676	3.88
	90.0	10.0	2.95	0.36		0.23	29.50	8.70	21291	5.62
	100.0	10.0	2.72	0.18		0.07	27.20	3.40	8318	2.20
	110.0	10.0	2.30	0.29		0.21	23.00	5.75	14068	3.72
	120.0	10.0	2.50	0.38		0.30	25.00	8.50	20796	5.49
	130.0	10.0	3.45	0.34		0.16	34.50	8.63	21102	5.57
	140.0	10.0	3.34	0.25		0.22	33.40	7.85	19203	5.07
	150.0	10.0	3.02	0.31		0.20	30.20	7.70	18841	4.98
	160.0	10.0	3.15	0.38		0.21	31.50	9.29	22735	6.01
	170.0	10.0	3.02	0.26		0.27	30.20	8.00	19580	5.17
	180.0	10.0	2.78	0.09		0.03	27.80	1.67	4081	1.08
	190.0	15.0	2.62	0.02		0.04	39.30	1.18	2885	0.76
End	200.0									
		188.0	2.45	0.27	0.33	0.16	456.87	107.49	262983	69.47



APPENDIX C-40

WR-SEG1-UP Marsh McBirney Cross Sectional Flow - 05/09/05

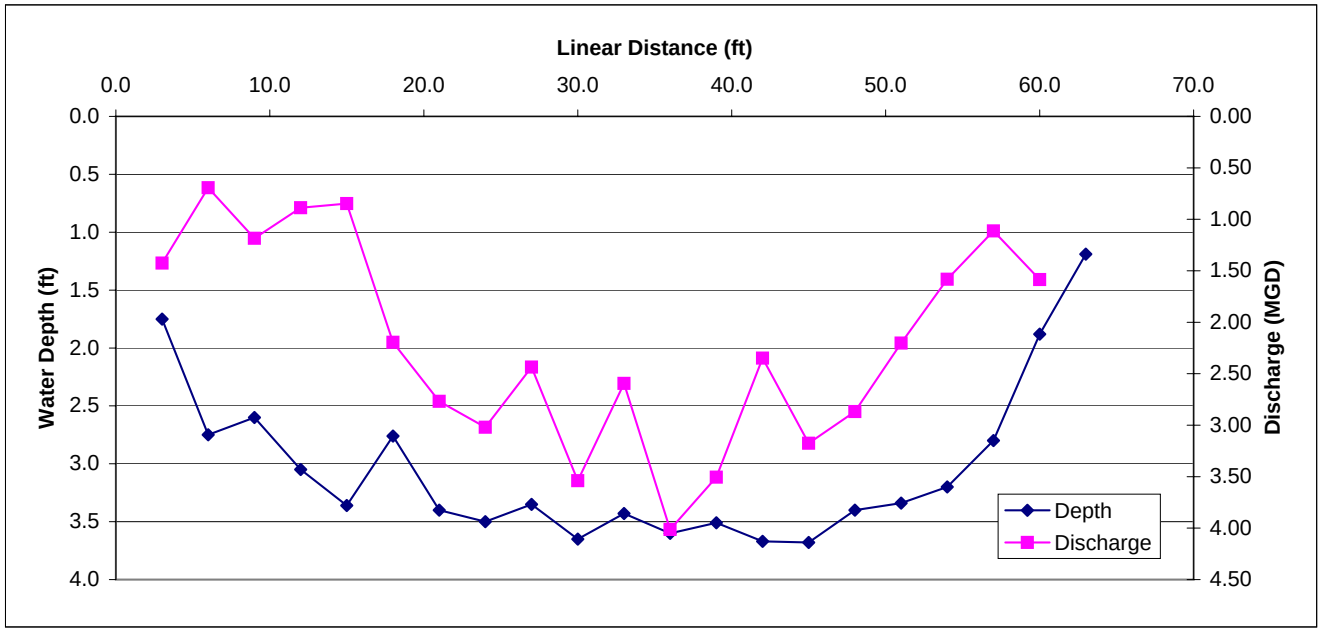
	Distance from Initial Point (ft)	Segment Width (ft)	Total Depth (ft)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	3.0	4.5	2.05	0.73		0.56	9.23	5.95	14557	3.85
	6.0	3.0	1.94		0.75		5.82	4.37	10679	2.82
	9.0	3.0	1.93		0.84		5.79	4.86	11899	3.14
	12.0	3.0	1.93		0.88		5.79	5.10	12466	3.29
	15.0	3.0	1.82		0.91		5.46	4.97	12156	3.21
	18.0	3.0	1.96		0.81		5.88	4.76	11653	3.08
	21.0	3.0	1.88		0.59		5.64	3.33	8141	2.15
	24.0	3.0	1.97		0.74		5.91	4.37	10700	2.83
	27.0	3.0	1.96		0.65		5.88	3.82	9351	2.47
	30.0	3.0	1.98		0.67		5.94	3.98	9737	2.57
	33.0	3.0	2.02		0.47		6.06	2.85	6968	1.84
	36.0	3.0	2.03	0.58		0.55	6.09	3.44	8418	2.22
	39.0	3.0	1.99		0.51		5.97	3.04	7449	1.97
	42.0	3.0	1.92		0.49		5.76	2.82	6905	1.82
	45.0	3.0	1.84		0.36		5.52	1.99	4862	1.28
	48.0	3.0	1.78		0.33		5.34	1.76	4311	1.14
	51.0	3.0	1.62		0.40		4.86	1.94	4756	1.26
	54.0	3.0	1.61		0.31		4.83	1.50	3663	0.97
	57.0	3.0	1.40		0.31		4.20	1.30	3185	0.84
	60.0	3.0	1.48		0.27		4.44	1.20	2933	0.77
	63.0	4.5	1.52		0.25		6.84	1.71	4184	1.11
End	66.0		1.66		0.16					
		66.0	1.83	0.66	0.54	0.56	121.25	69.07	168975	44.64



APPENDIX C-41

WR-SEG1-DOWN Marsh McBirney Cross Sectional Flow - 05/09/05

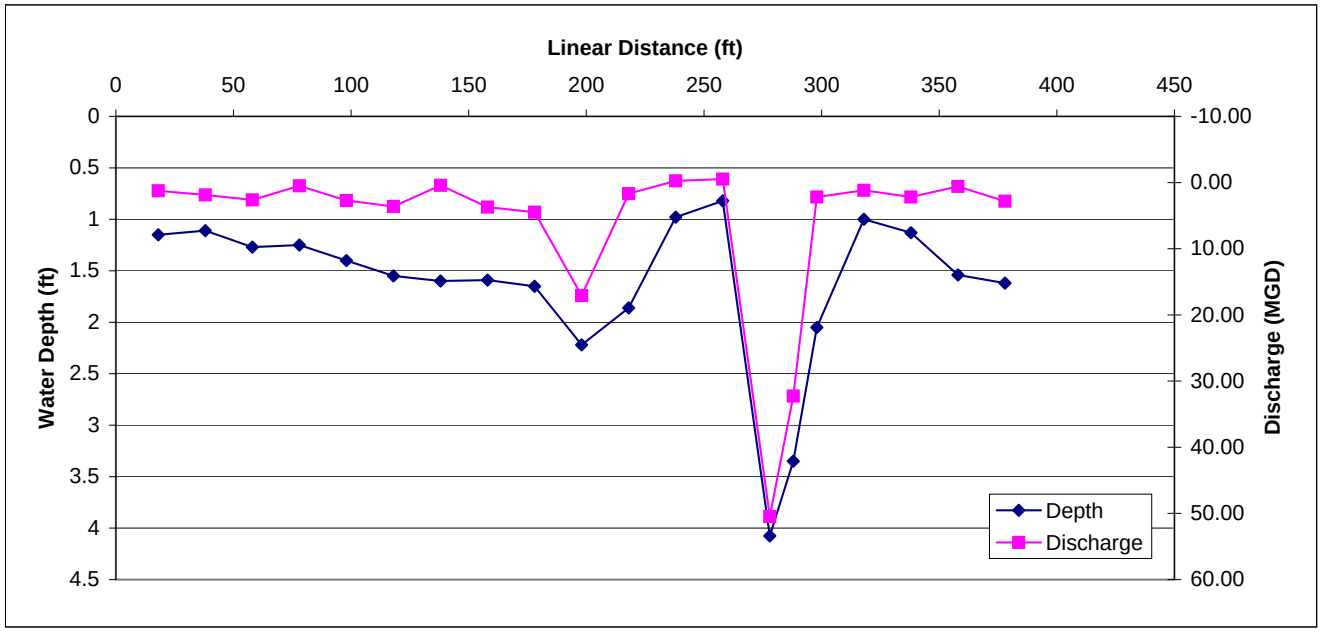
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	3.0	4.5	1.75		0.28		7.88	2.21	5395	1.43
	6.0	3.0	2.75	0.24		0.02	8.25	1.07	2624	0.69
	9.0	3.0	2.60	0.22		0.25	7.80	1.83	4485	1.18
	12.0	3.0	3.05	0.19		0.11	9.15	1.37	3358	0.89
	15.0	3.0	3.36	0.12		0.14	10.08	1.31	3206	0.85
	18.0	3.0	2.76	0.63		0.19	8.28	3.39	8306	2.19
	21.0	3.0	3.40	0.63		0.21	10.20	4.28	10481	2.77
	24.0	3.0	3.50	0.55		0.34	10.50	4.67	11432	3.02
	27.0	3.0	3.35	0.59		0.16	10.05	3.77	9221	2.44
	30.0	3.0	3.65	0.64		0.36	10.95	5.48	13395	3.54
	33.0	3.0	3.43	0.62		0.16	10.29	4.01	9818	2.59
	36.0	3.0	3.60	0.71		0.44	10.80	6.21	15193	4.01
	39.0	3.0	3.51	0.71		0.32	10.53	5.42	13268	3.51
	42.0	3.0	3.67	0.50		0.16	11.01	3.63	8889	2.35
	45.0	3.0	3.68	0.52		0.37	11.04	4.91	12020	3.18
	48.0	3.0	3.40	0.59		0.28	10.20	4.44	10855	2.87
	51.0	3.0	3.34	0.36		0.32	10.02	3.41	8335	2.20
	54.0	3.0	3.20	0.15		0.36	9.60	2.45	5989	1.58
	57.0	3.0	2.80	0.40		0.01	8.40	1.72	4213	1.11
	60.0	4.5	1.88		0.29		8.46	2.45	6002	1.59
End	63.0		1.19		0.30					
		63.0	3.04	0.47	0.29	0.23	193.49	68.05	166484	43.98



APPENDIX C-42

WR-SEG2-UP Marsh McBirney Cross Sectional Flow - 05/10/05

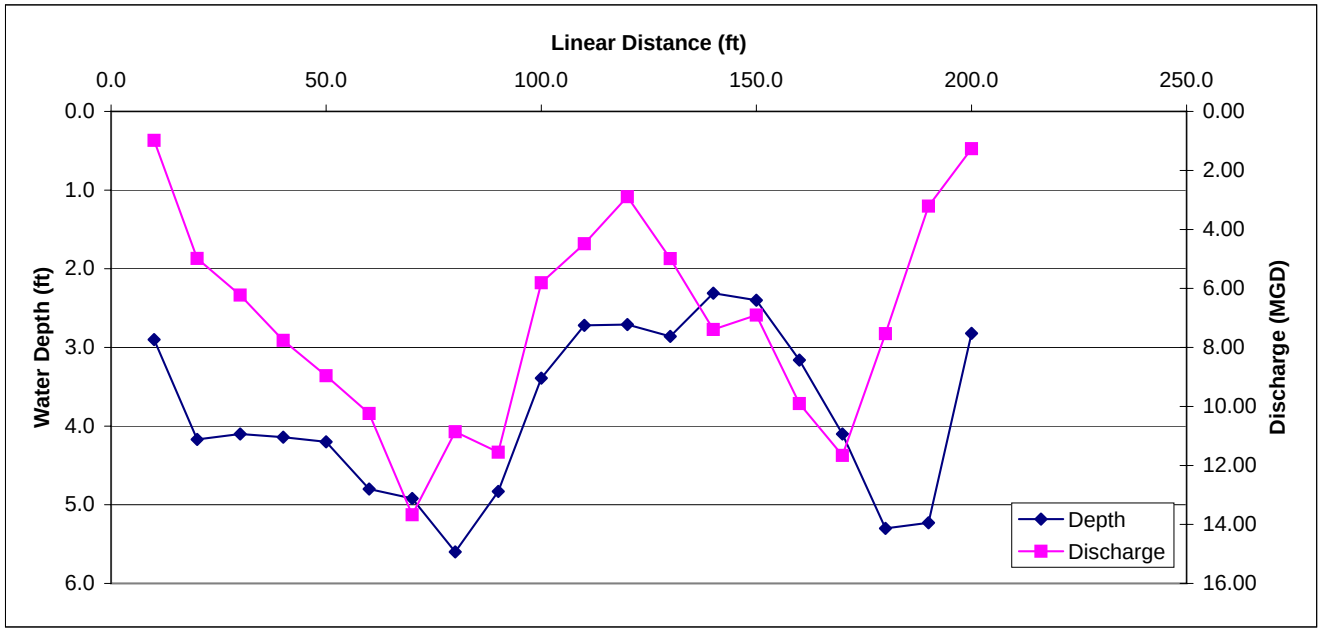
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0									
	18	28.0	1.15		0.06		32.20	1.93	4727	1.25
	38	20.0	1.11		0.13		22.20	2.89	7061	1.87
	58	20.0	1.27		0.16		25.40	4.06	9943	2.63
	78	20.0	1.25		0.03		25.00	0.75	1835	0.48
	98	20.0	1.40		0.15		28.00	4.20	10276	2.71
	118	20.0	1.55		0.18		31.00	5.58	13652	3.61
	138	20.0	1.60		0.02		32.00	0.64	1566	0.41
	158	20.0	1.59		0.18		31.80	5.72	14004	3.70
	178	20.0	1.65		0.21		33.00	6.93	16955	4.48
	198	20.0	2.22	0.66		0.53	44.40	26.42	64634	17.07
	218	20.0	1.86		0.07		37.20	2.60	6371	1.68
	238	20.0	0.98		-0.02		19.60	-0.39	-959	-0.25
	258	20.0	0.82		-0.05		16.40	-0.82	-2006	-0.53
	278	15.0	4.08	1.33		1.23	61.13	78.09	191046	50.47
	288	10.0	3.35	1.57		1.41	33.50	49.92	122121	32.26
	298	15.0	2.05	0.10		0.12	30.75	3.38	8276	2.19
	318	20.0	1.00		0.09		20.00	1.80	4404	1.16
	338	20.0	1.13		0.15		22.60	3.39	8294	2.19
	358	20.0	1.54		0.03		30.80	0.92	2261	0.60
	378	30.0	1.62		0.09		48.60	4.37	10701	2.83
End	398									
		398.0	1.66	0.91	0.09	0.82	625.6	202.4	495159	130.8



APPENDIX C-43

WR SEG2-DOWN Marsh McBirney Cross Sectional Flow - 05/10/05

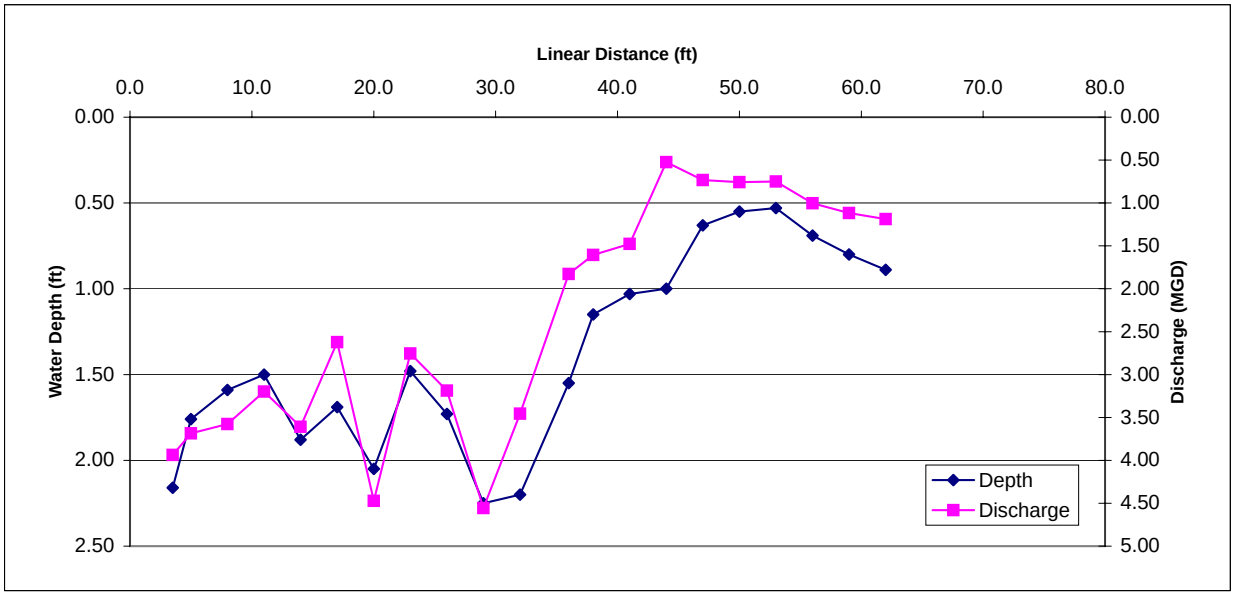
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	10.0	15.0	2.90	0.05		0.02	43.50	1.52	3725	0.98
	20.0	10.0	4.17	0.16		0.21	41.70	7.71	18874	4.99
	30.0	10.0	4.10	0.24		0.23	41.00	9.64	23573	6.23
	40.0	10.0	4.14	0.31		0.27	41.40	12.01	29374	7.76
	50.0	10.0	4.20	0.36		0.30	42.00	13.86	33910	8.96
	60.0	10.0	4.80	0.39		0.27	48.00	15.84	38754	10.24
	70.0	10.0	4.92	0.45		0.41	49.20	21.16	51760	13.67
	80.0	10.0	5.60	0.32		0.28	56.00	16.80	41102	10.86
	90.0	10.0	4.83	0.38		0.36	48.30	17.87	43723	11.55
	100.0	10.0	3.39	0.31		0.22	33.90	8.98	21979	5.81
	110.0	10.0	2.72	0.29		0.22	27.20	6.94	16969	4.48
	120.0	10.0	2.71	0.29		0.04	27.10	4.47	10940	2.89
	130.0	10.0	2.86	0.46		0.08	28.60	7.72	18892	4.99
	140.0	10.0	2.31	0.51		0.48	23.10	11.43	27975	7.39
	150.0	10.0	2.40	0.45		0.44	24.00	10.68	26129	6.90
	160.0	10.0	3.16	0.52		0.45	31.60	15.33	37496	9.91
	170.0	10.0	4.10	0.51		0.37	41.00	18.04	44136	11.66
	180.0	10.0	5.30	0.30		0.14	53.00	11.66	28527	7.54
	190.0	10.0	5.23	0.19		0.00	52.30	4.97	12156	3.21
	200.0	9.3	2.82	0.07		0.08	26.09	1.96	4786	1.26
End	204.3									
		204.3	3.8	0.33		0.24	779.0	218.6	534781	141.3



APPENDIX C-44

WR-SEG1-UP Marsh McBirney Cross Sectional Flow - 08/31/2005

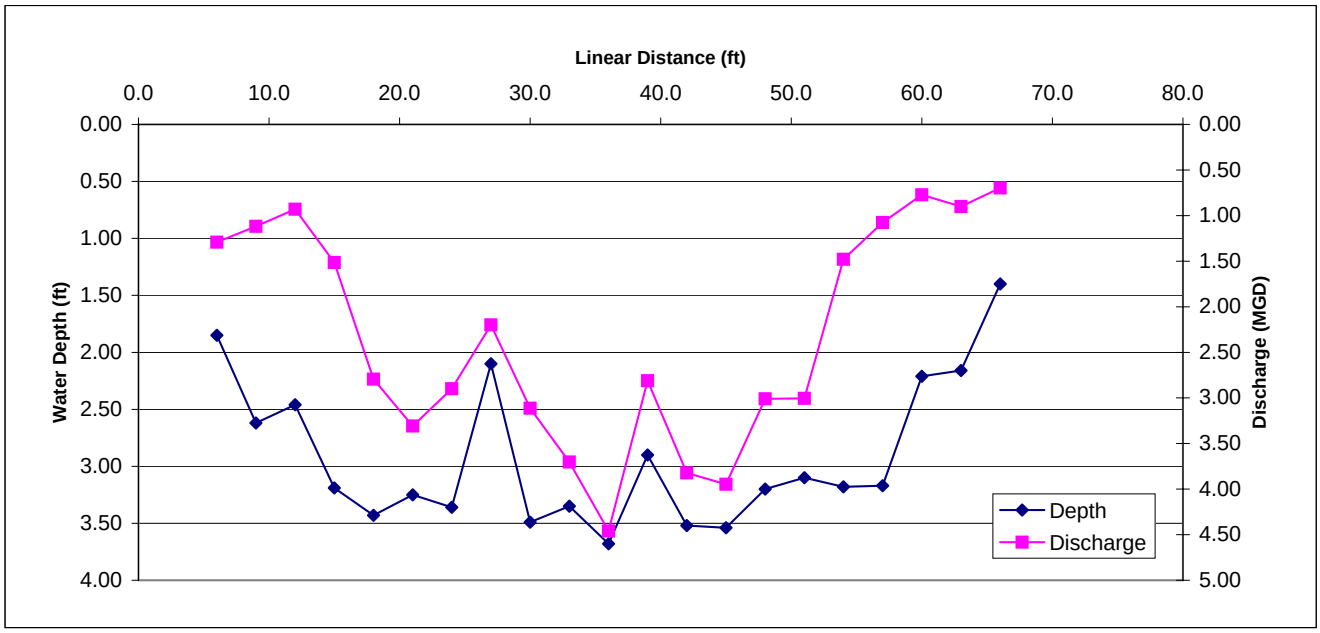
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	3.5									
	5.0	3.0	2.16	0.98		0.90	6.48	6.09	14903	3.94
	8.0	3.0	1.76		1.08		5.28	5.70	13951	3.69
	11.0	3.0	1.59		1.16		4.77	5.53	13537	3.58
	14.0	3.0	1.50		1.10		4.50	4.95	12111	3.20
	17.0	3.0	1.88		0.99		5.64	5.58	13661	3.61
	20.0	3.0	1.69		0.80		5.07	4.06	9923	2.62
	23.0	3.0	2.05	1.31		0.94	6.15	6.92	16927	4.47
	26.0	3.0	1.48		0.96		4.44	4.26	10428	2.75
	29.0	3.0	1.73		0.95		5.19	4.93	12063	3.19
	32.0	3.5	2.25	0.88		0.91	7.88	7.05	17244	4.56
	36.0	3.0	2.20	0.87		0.75	6.60	5.35	13079	3.46
	38.0	2.5	1.55		0.73		3.88	2.83	6921	1.83
	41.0	3.0	1.15		0.72		3.45	2.48	6077	1.61
	44.0	3.0	1.03		0.74		3.09	2.29	5594	1.48
	47.0	3.0	1.00		0.27		3.00	0.81	1982	0.52
	50.0	3.0	0.63		0.60		1.89	1.13	2774	0.73
	53.0	3.0	0.55		0.71		1.65	1.17	2866	0.76
	56.0	3.0	0.53		0.73		1.59	1.16	2840	0.75
	59.0	3.0	0.69		0.75		2.07	1.55	3798	1.00
	62.0	3.0	0.80		0.72		2.40	1.73	4228	1.12
	65.0	3.5	0.89		0.59		3.12	1.84	4496	1.19
End	67.0									
		63.5	1.39	1.01	0.80	0.88	88.13	77.42	189404	50.04



APPENDIX C-45

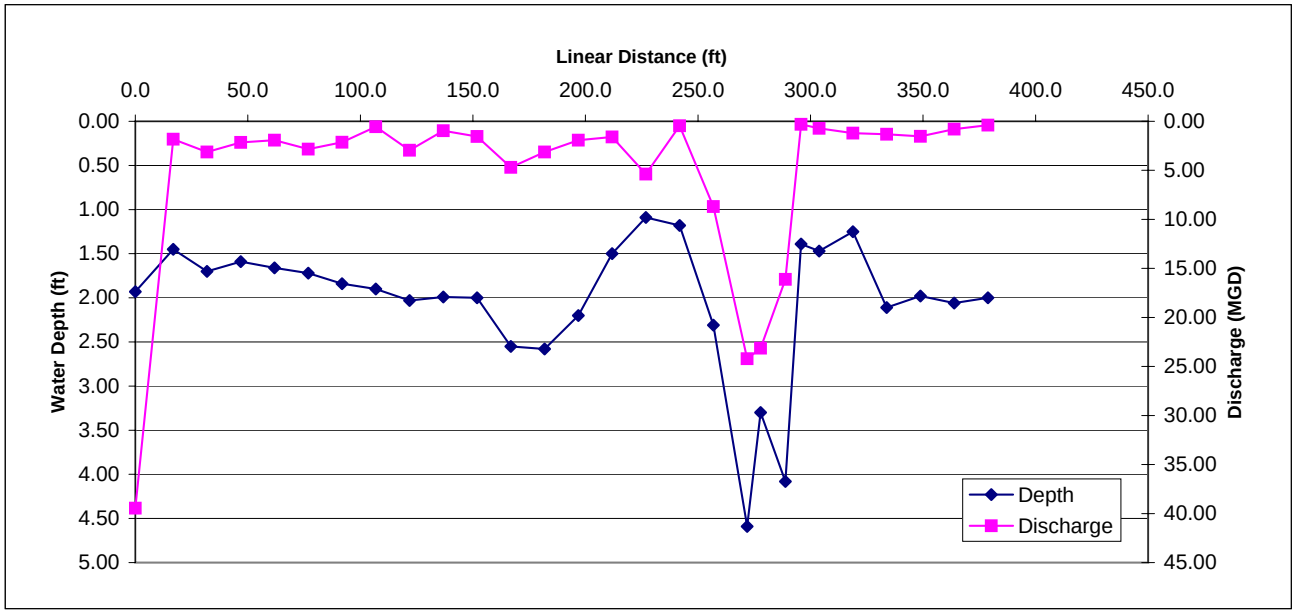
WR-SEG1-DOWN Marsh McBirney Cross Sectional Flow - 08/31/2005

	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)
Start	6.0									
	9.0	4.5	1.85		0.24		8.33	2.00	4888	1.29
	12.0	3.0	2.62	0.36		0.08	7.86	1.73	4231	1.12
	15.0	3.0	2.46	0.23		0.16	7.38	1.44	3521	0.93
	18.0	3.0	3.19	0.20		0.29	9.57	2.34	5736	1.52
	21.0	3.0	3.43	0.46		0.38	10.29	4.32	10574	2.79
	24.0	3.0	3.25	0.52		0.53	9.75	5.12	12523	3.31
	27.0	3.0	3.36	0.62		0.27	10.08	4.49	10974	2.90
	30.0	3.0	2.10	0.70		0.38	6.30	3.40	8323	2.20
	33.0	3.0	3.49	0.67		0.25	10.47	4.82	11783	3.11
	36.0	3.0	3.35	0.79		0.35	10.05	5.73	14015	3.70
	39.0	3.0	3.68	0.73		0.52	11.04	6.90	16881	4.46
	42.0	3.0	2.90	0.78		0.22	8.70	4.35	10643	2.81
	45.0	3.0	3.52	0.59		0.53	10.56	5.91	14468	3.82
	48.0	3.0	3.54	0.70		0.45	10.62	6.11	14940	3.95
	51.0	3.0	3.20	0.55		0.42	9.60	4.66	11391	3.01
	54.0	3.0	3.10	0.67		0.33	9.30	4.65	11377	3.01
	57.0	3.0	3.18	0.32		0.16	9.54	2.29	5602	1.48
	60.0	3.0	3.17	0.29		0.06	9.51	1.66	4072	1.08
	63.0	3.0	2.21	0.21		0.15	6.63	1.19	2920	0.77
	66.0	3.0	2.16	0.28		0.15	6.48	1.39	3409	0.90
	69.0	3.5	1.40		0.22		4.90	1.08	2637	0.70
End	71.0									
		65.0	2.91	0.51	0.23	0.30	186.96	75.58	184908	48.85



WR-SEG2-UP Marsh McBirney Cross Sectional Flow - 09/01/2005

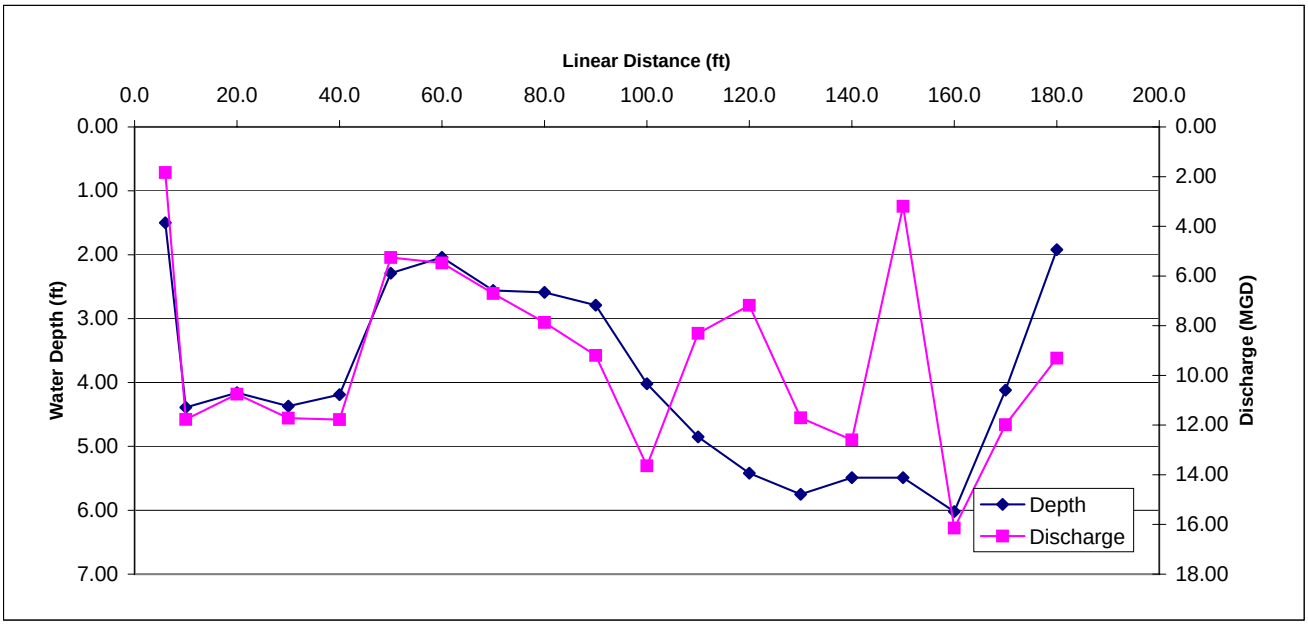
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	16.8	24.3	1.93		1.30		46.96	61.05	149369	39.46
	31.8	15.0	1.45		0.13		21.75	2.83	6918	1.83
	46.8	15.0	1.70		0.19		25.50	4.85	11854	3.13
	61.8	15.0	1.59		0.14		23.85	3.34	8169	2.16
	76.8	15.0	1.66		0.12		24.90	2.99	7310	1.93
	91.8	15.0	1.72		0.17		25.80	4.39	10731	2.83
	106.8	15.0	1.84		0.12		27.60	3.31	8103	2.14
	121.8	15.0	1.90		0.03		28.50	0.86	2092	0.55
	136.8	15.0	2.03	0.14		0.16	30.45	4.57	11175	2.95
	151.8	15.0	1.99		0.05		29.85	1.49	3652	0.96
	166.8	15.0	2.00		0.08		30.00	2.40	5872	1.55
	181.8	15.0	2.55	0.22		0.16	38.25	7.27	17780	4.70
	196.8	15.0	2.58	0.19		0.06	38.70	4.84	11835	3.13
	211.8	15.0	2.20	0.07		0.11	33.00	2.97	7266	1.92
	226.8	15.0	1.50		0.11		22.50	2.48	6055	1.60
	241.8	15.0	1.09		0.51		16.35	8.34	20401	5.39
	256.8	15.0	1.18		0.04		17.70	0.71	1732	0.46
	271.8	10.5	2.31	0.43		0.68	24.26	13.46	32935	8.70
	277.8	8.5	4.59	0.81		1.11	39.02	37.45	91635	24.21
	288.8	9.0	3.30	1.14		1.27	29.70	35.79	87559	23.13
	295.8	7.5	4.08	0.77		0.86	30.60	24.94	61015	16.12
	303.8	11.5	1.39		0.03		15.99	0.48	1173	0.31
	318.8	15.0	1.47		0.05		22.05	1.10	2697	0.71
	333.8	15.0	1.25		0.10		18.75	1.88	4587	1.21
	348.8	15.0	2.11	0.08		0.05	31.65	2.06	5033	1.33
	363.8	15.0	1.98		0.08		29.70	2.38	5813	1.54
	378.8	15.0	2.06	0.02		0.06	30.90	1.24	3024	0.80
End	393.8	7.5	2.00		0.04		15.00	0.60	1468	0.39
		393.8	2.05	0.39	0.18	0.45	769.27	240.03	587254	155.14



APPENDIX C-47

WR-SEG2-DOWN Marsh McBirney Cross Sectional Flow - 09/01/2005

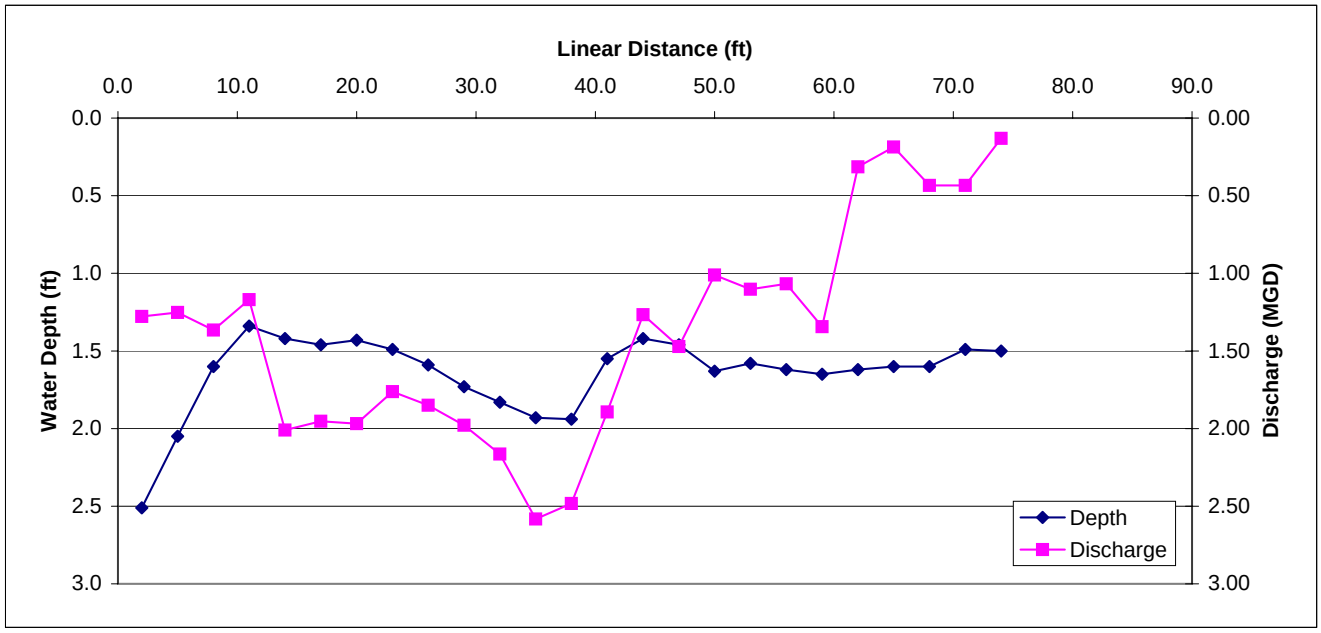
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	6.0									
	10.0	9.0	1.50		0.21		13.50	2.84	6936	1.83
	20.0	10.0	4.39	0.30		0.53	43.90	18.22	44573	11.78
	30.0	10.0	4.16	0.24		0.56	41.60	16.64	40711	10.75
	40.0	10.0	4.37	0.35		0.48	43.70	18.14	44370	11.72
	50.0	10.0	4.19	0.52		0.35	41.90	18.23	44593	11.78
	60.0	10.0	2.29	0.34		0.37	22.90	8.13	19889	5.25
	70.0	10.0	2.04	0.43		0.40	20.40	8.47	20713	5.47
	80.0	10.0	2.56	0.47		0.34	25.60	10.37	25366	6.70
	90.0	10.0	2.59	0.56		0.38	25.90	12.17	29782	7.87
	100.0	10.0	2.79	0.51		0.51	27.90	14.23	34812	9.20
	110.0	10.0	4.02	0.56		0.49	40.20	21.11	51635	13.64
	120.0	10.0	4.85	0.31		0.22	48.50	12.85	31445	8.31
	130.0	10.0	5.42	0.17		0.24	54.20	11.11	27184	7.18
	140.0	10.0	5.75	0.37		0.26	57.50	18.11	44314	11.71
	150.0	10.0	5.49	0.47		0.24	54.90	19.49	47683	12.60
	160.0	10.0	5.49	0.02		0.16	54.90	4.94	12089	3.19
	170.0	10.0	6.02	0.44		0.39	60.20	24.98	61123	16.15
	180.0	10.0	4.12	0.46		0.44	41.20	18.54	45360	11.98
	190.0	15.0	1.92		0.50		28.80	14.40	35231	9.31
End	200.0									
		194.0	3.89	0.38	0.36	0.37	747.70	272.96	667806	176.42



APPENDIX C-48

RSR-SEG1-UP Marsh McBirney Cross Sectional Flow - 4/20/05

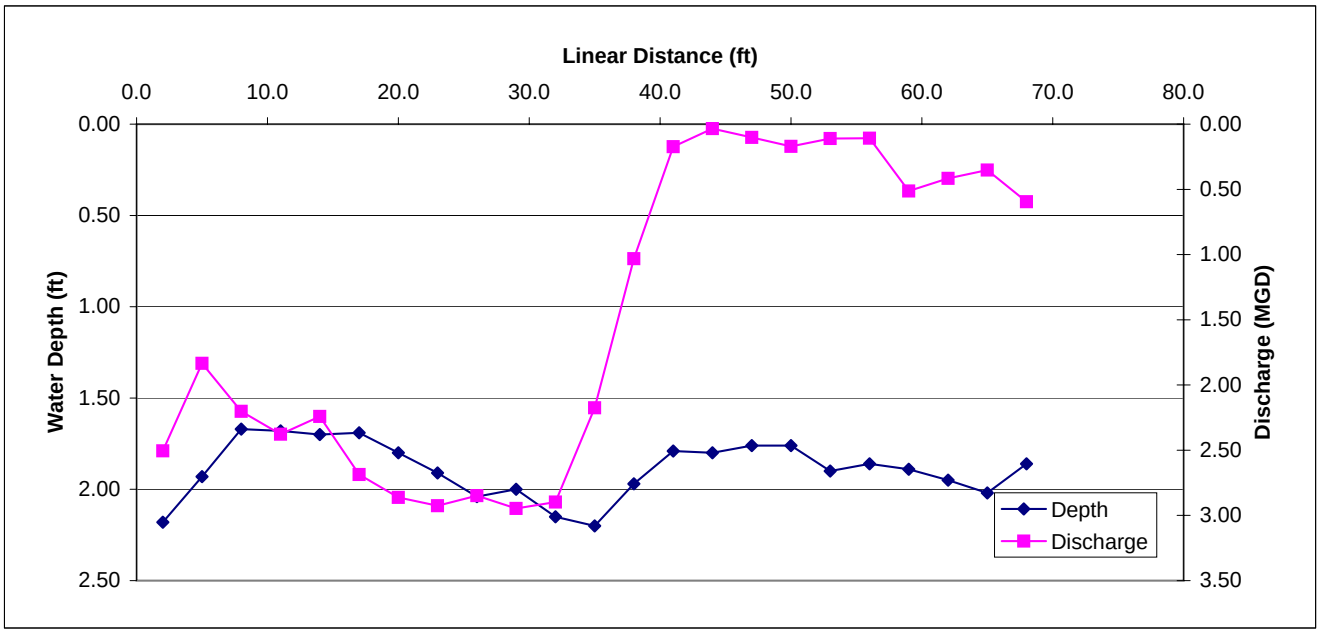
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	2.0	3.5	2.51	0.26		0.19	8.79	1.98	4836	1.28
	5.0	3.0	2.05	0.42		0.21	6.15	1.94	4740	1.25
	8.0	3.0	1.60		0.44		4.80	2.11	5167	1.37
	11.0	3.0	1.34		0.45		4.02	1.81	4426	1.17
	14.0	3.0	1.42		0.73		4.26	3.11	7608	2.01
	17.0	3.0	1.46		0.69		4.38	3.02	7394	1.95
	20.0	3.0	1.43		0.71		4.29	3.05	7452	1.97
	23.0	3.0	1.49		0.61		4.47	2.73	6671	1.76
	26.0	3.0	1.59		0.60		4.77	2.86	7002	1.85
	29.0	3.0	1.73		0.59		5.19	3.06	7492	1.98
	32.0	3.0	1.83		0.61		5.49	3.35	8193	2.16
	35.0	3.0	1.93		0.69		5.79	4.00	9774	2.58
	38.0	3.0	1.94		0.66		5.82	3.84	9398	2.48
	41.0	3.0	1.55		0.63		4.65	2.93	7167	1.89
	44.0	3.0	1.42		0.46		4.26	1.96	4794	1.27
	47.0	3.0	1.46		0.52		4.38	2.28	5572	1.47
	50.0	3.0	1.63		0.32		4.89	1.56	3828	1.01
	53.0	3.0	1.58		0.36		4.74	1.71	4175	1.10
	56.0	3.0	1.62		0.34		4.86	1.65	4043	1.07
	59.0	3.0	1.65		0.42		4.95	2.08	5086	1.34
	62.0	3.0	1.62		0.10		4.86	0.49	1189	0.31
	65.0	3.0	1.60		0.06		4.80	0.29	705	0.19
	68.0	3.0	1.60		0.14		4.80	0.67	1644	0.43
	71.0	3.0	1.49		0.15		4.47	0.67	1640	0.43
	74.0	4.5	1.50		0.03		6.75	0.20	495	0.13
End	77.0									
		77.0	1.6	0.34	0.45	0.20	126.63	53.34	130493	34.47



APPENDIX C-49

RSR-SEG1-UP Marsh McBirney Cross Sectional Flow - 07/12/2005

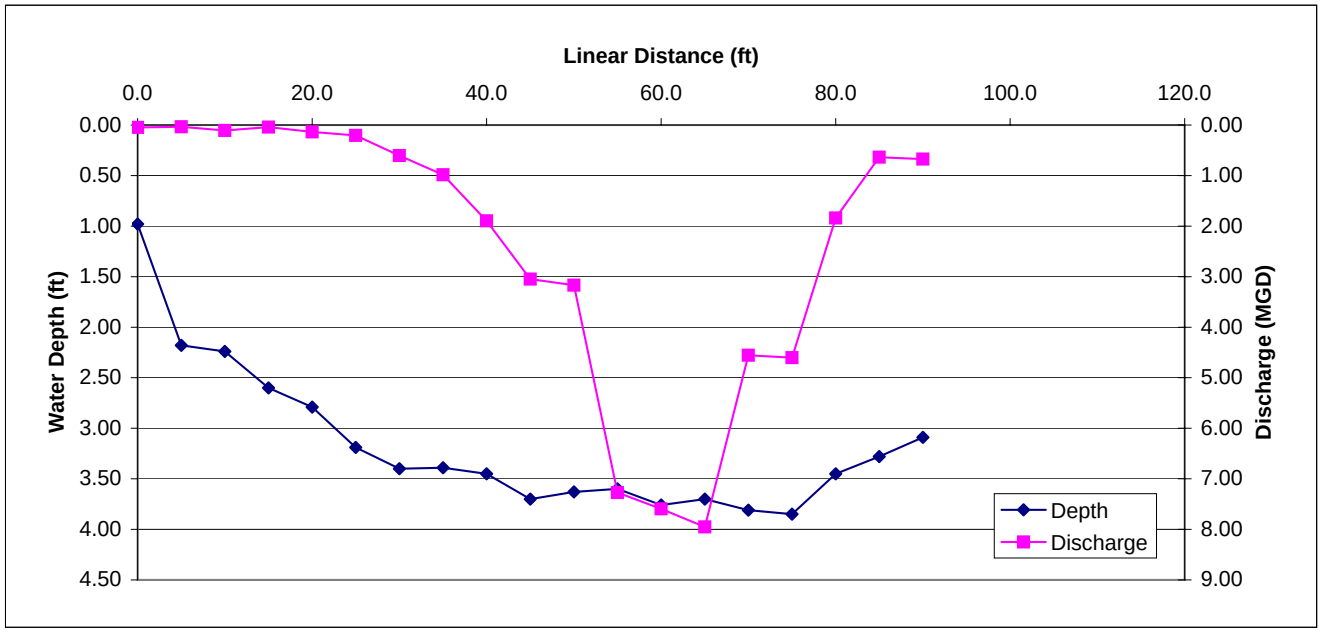
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	2.0									
	5.0	4.5	2.18	0.40		0.39	9.81	3.87	9480	2.50
	8.0	3.0	1.93		0.49		5.79	2.84	6941	1.83
	11.0	3.0	1.67		0.68		5.01	3.41	8335	2.20
	14.0	3.0	1.68		0.73		5.04	3.68	9001	2.38
	17.0	3.0	1.70		0.68		5.10	3.47	8485	2.24
	20.0	3.0	1.69		0.82		5.07	4.16	10171	2.69
	23.0	3.0	1.80		0.82		5.40	4.43	10833	2.86
	26.0	3.0	1.91		0.79		5.73	4.53	11075	2.93
	29.0	3.0	2.04	0.68		0.76	6.12	4.41	10781	2.85
	32.0	3.0	2.00		0.76		6.00	4.56	11156	2.95
	35.0	3.0	2.15	0.66		0.73	6.45	4.48	10967	2.90
	38.0	3.0	2.20	0.55		0.47	6.60	3.37	8235	2.18
	41.0	3.0	1.97		0.27		5.91	1.60	3904	1.03
	44.0	3.0	1.79		0.05		5.37	0.27	657	0.17
	47.0	3.0	1.80		0.01		5.40	0.05	132	0.03
	50.0	3.0	1.76		0.03		5.28	0.16	388	0.10
	53.0	3.0	1.76		0.05		5.28	0.26	646	0.17
	56.0	3.0	1.90		0.03		5.70	0.17	418	0.11
	59.0	3.0	1.86		0.03		5.58	0.17	410	0.11
	62.0	3.0	1.89		0.14		5.67	0.79	1942	0.51
	65.0	3.0	1.95		0.11		5.85	0.64	1574	0.42
	68.0	3.0	2.02		0.09		6.06	0.55	1334	0.35
	71.0	4.5	1.86		0.11		8.37	0.92	2253	0.60
End	74.0									
		72.0	1.89	0.57	0.35	0.59	136.59	52.78	129120	34.11



APPENDIX C-50

RSR-SEG1-DOWN Marsh McBirney Cross Sectional Flow - 07/12/2005

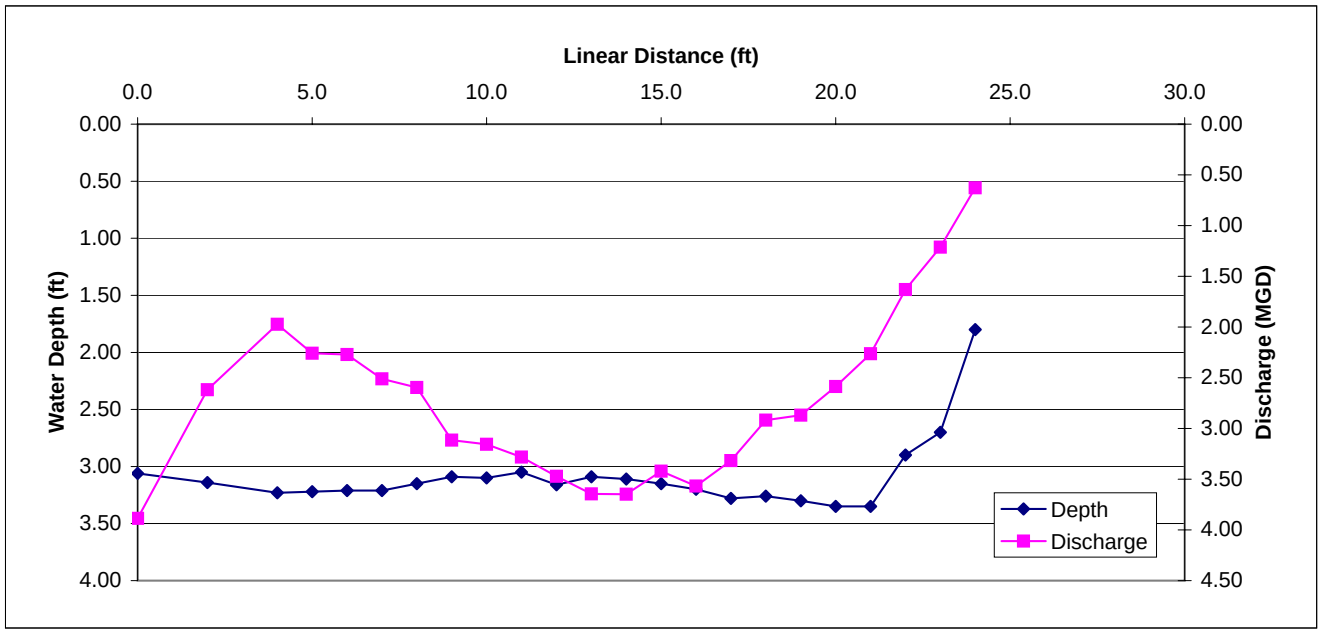
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	5.0	7.5	0.98		0.01		7.35	0.07	180	0.05
	10.0	5.0	2.18	0.00		0.01	10.90	0.05	133	0.04
	15.0	5.0	2.24	0.01		0.02	11.20	0.17	411	0.11
	20.0	5.0	2.60	0.00		0.01	13.00	0.07	159	0.04
	25.0	5.0	2.79	0.00		0.03	13.95	0.21	512	0.14
	30.0	5.0	3.19	0.02		0.02	15.95	0.32	780	0.21
	35.0	5.0	3.40	0.04		0.07	17.00	0.94	2288	0.60
	40.0	5.0	3.39	0.16		0.02	16.95	1.53	3732	0.99
	45.0	5.0	3.45	0.19		0.15	17.25	2.93	7175	1.90
	50.0	5.0	3.70	0.29		0.22	18.50	4.72	11542	3.05
	55.0	5.0	3.63	0.32		0.22	18.15	4.90	11989	3.17
	60.0	5.0	3.60	0.60		0.65	18.00	11.25	27524	7.27
	65.0	5.0	3.76	0.62		0.63	18.80	11.75	28747	7.59
	70.0	5.0	3.70	0.64		0.69	18.50	12.30	30099	7.95
	75.0	5.0	3.81	0.23		0.51	19.05	7.05	17245	4.56
	80.0	5.0	3.85	0.32		0.42	19.25	7.12	17426	4.60
	85.0	5.0	3.45	0.18		0.15	17.25	2.85	6964	1.84
	90.0	5.0	3.28	0.08		0.04	16.40	0.98	2407	0.64
	95.0	7.5	3.09	0.02		0.07	23.18	1.04	2551	0.67
End	100.0									
		100.0	3.16	0.21	0.01	0.22	310.63	70.25	171864	45.40



APPENDIX C-51

RSR-SEG2-UP Marsh McBirney Cross Sectional Flow - 07/12/2005

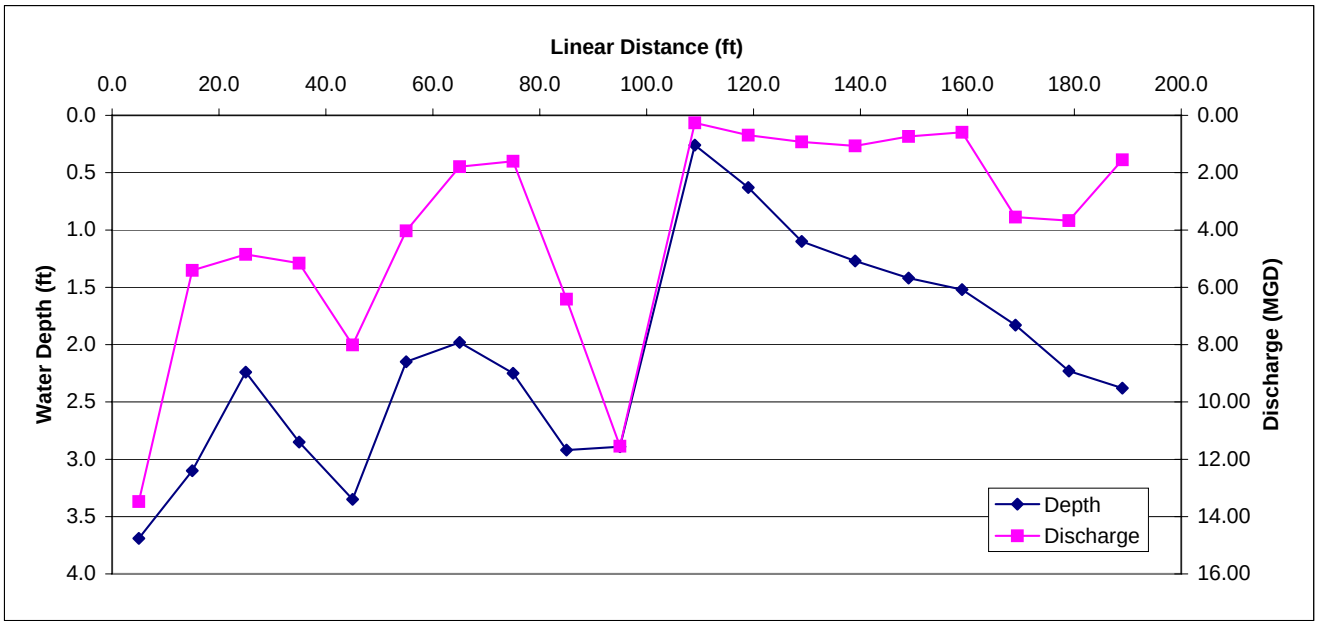
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	2.0	3.0	3.06	0.53		0.78	9.18	6.01	14711	3.89
	4.0	1.5	3.14	0.72		1.00	4.71	4.05	9910	2.62
	5.0	1.0	3.23	0.94		0.95	3.23	3.05	7468	1.97
	6.0	1.0	3.22	1.05		1.12	3.22	3.49	8548	2.26
	7.0	1.0	3.21	1.07		1.12	3.21	3.51	8600	2.27
	8.0	1.0	3.21	1.13		1.29	3.21	3.88	9503	2.51
	9.0	1.0	3.15	1.29		1.26	3.15	4.02	9826	2.60
	10.0	1.0	3.09	1.56		1.56	3.09	4.82	11793	3.12
	11.0	1.0	3.10	1.58		1.57	3.10	4.88	11945	3.16
	12.0	1.0	3.05	1.76		1.57	3.05	5.08	12424	3.28
	13.0	1.0	3.16	1.73		1.67	3.16	5.37	13143	3.47
	14.0	1.0	3.09	1.67		1.98	3.09	5.64	13797	3.64
	15.0	1.0	3.11	1.85		1.78	3.11	5.64	13810	3.65
	16.0	1.0	3.15	1.84		1.52	3.15	5.29	12947	3.42
	17.0	1.0	3.20	1.86		1.59	3.20	5.52	13505	3.57
	18.0	1.0	3.28	1.75		1.38	3.28	5.13	12559	3.32
	19.0	1.0	3.26	1.67		1.10	3.26	4.52	11047	2.92
	20.0	1.0	3.30	1.46		1.23	3.30	4.44	10859	2.87
	21.0	1.0	3.35	1.22		1.17	3.35	4.00	9794	2.59
	22.0	1.0	3.35	1.11		0.98	3.35	3.50	8565	2.26
	23.0	1.0	2.90	0.80		0.94	2.90	2.52	6173	1.63
	24.0	1.0	2.70	0.66		0.73	2.70	1.88	4591	1.21
	25.0	1.5	1.80		0.36		2.70	0.97	2378	0.63
End	26.0									
		26.0	3.09	1.33	0.36	1.29	79.70	97.24	237896	62.85



APPENDIX C-52

ASC-SEG1-UP Marsh McBirney Cross Sectional Flow - 05/03/05

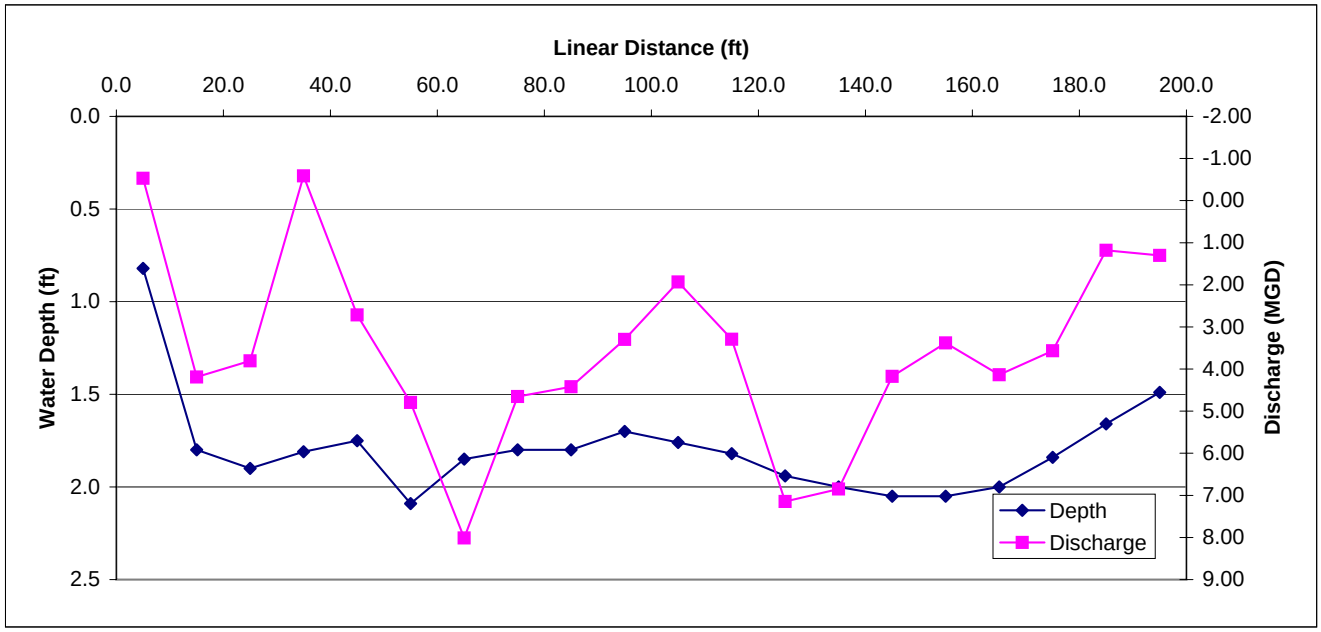
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	5.0	10.0	3.69	0.34		0.79	36.90	20.85	51007	13.48
	15.0	10.0	3.10	0.48		0.06	31.00	8.37	20478	5.41
	25.0	10.0	2.24	0.67		0.00	22.40	7.50	18359	4.85
	35.0	10.0	2.85	0.53		0.03	28.50	7.98	19524	5.16
	45.0	10.0	3.35	0.71		0.03	33.50	12.40	30325	8.01
	55.0	10.0	2.15	0.50		0.08	21.50	6.24	15254	4.03
	65.0	10.0	1.98		0.14		19.80	2.77	6782	1.79
	75.0	10.0	2.25	0.19		0.03	22.50	2.48	6055	1.60
	85.0	10.0	2.92	0.66		0.02	29.20	9.93	24290	6.42
	95.0	12.0	2.89	0.74		0.29	34.68	17.86	43696	11.54
	109.0	12.0	0.26		0.13		3.12	0.41	992	0.26
	119.0	10.0	0.63		0.17		6.30	1.07	2620	0.69
	129.0	10.0	1.10		0.13		11.00	1.43	3499	0.92
	139.0	10.0	1.27		0.13		12.70	1.65	4039	1.07
	149.0	10.0	1.42		0.08		14.20	1.14	2779	0.73
	159.0	10.0	1.52		0.06		15.20	0.91	2231	0.59
	169.0	10.0	1.83		0.30		18.30	5.49	13432	3.55
	179.0	10.0	2.23	0.48		0.03	22.30	5.69	13912	3.68
	189.0	6.5	2.38	0.29		0.02	15.47	2.40	5867	1.55
End	190.5									
		190.5	2.11	0.51	0.14	0.13	398.6	116.5	285143	75.33



APPENDIX C-53

ASC-SEG1-DOWN Marsh McBirney Cross Sectional Flow - 05/03/05

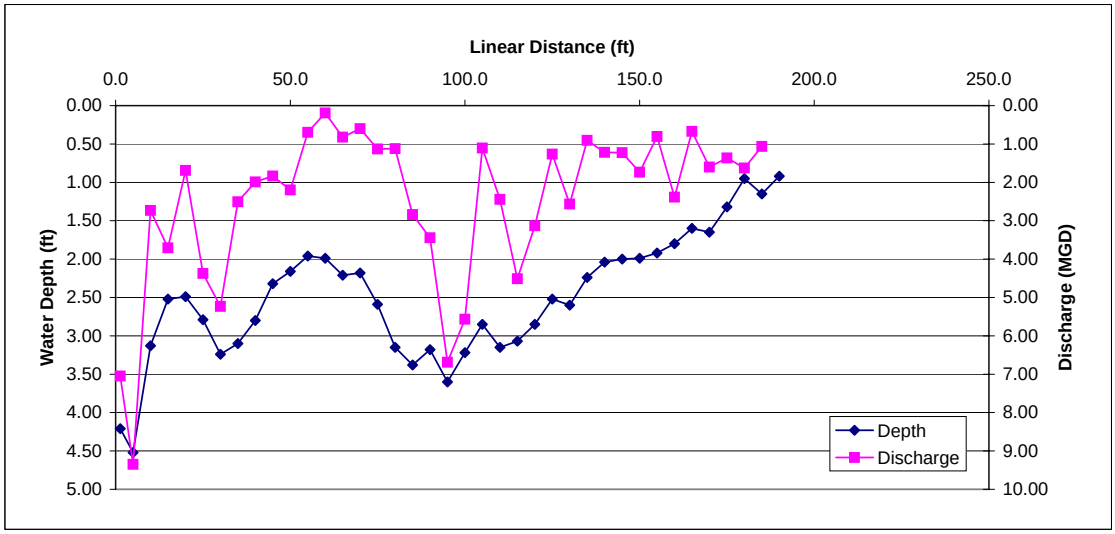
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	5.0	10.0	0.82		-0.10		8.20	-0.82	-2006	-0.53
	15.0	10.0	1.80		0.36		18.00	6.48	15854	4.19
	25.0	10.0	1.90		0.31		19.00	5.89	14410	3.81
	35.0	10.0	1.81		-0.05		18.10	-0.91	-2214	-0.58
	45.0	10.0	1.75		0.24		17.50	4.20	10276	2.71
	55.0	10.0	2.09	0.32		0.39	20.90	7.42	18152	4.80
	65.0	10.0	1.85		0.67		18.50	12.40	30325	8.01
	75.0	10.0	1.80		0.40		18.00	7.20	17615	4.65
	85.0	10.0	1.80		0.38		18.00	6.84	16735	4.42
	95.0	10.0	1.70		0.30		17.00	5.10	12478	3.30
	105.0	10.0	1.76		0.17		17.60	2.99	7320	1.93
	115.0	10.0	1.82		0.28		18.20	5.10	12468	3.29
	125.0	10.0	1.94		0.57		19.40	11.06	27054	7.15
	135.0	10.0	2.00		0.53		20.00	10.60	25934	6.85
	145.0	10.0	2.05	0.33		0.30	20.50	6.46	15799	4.17
	155.0	10.0	2.05	0.29		0.22	20.50	5.23	12789	3.38
	165.0	10.0	2.00		0.32		20.00	6.40	15658	4.14
	175.0	10.0	1.84		0.30		18.40	5.52	13505	3.57
	185.0	10.0	1.66		0.11		16.60	1.83	4467	1.18
	195.0	15.0	1.49		0.09		22.35	2.01	4921	1.30
End	205.0									
		205.0	1.80	0.31	0.29	0.30	366.75	110.99	271541	71.73



APPENDIX C-54

ASC-SEG1-UP Marsh McBirney Cross Sectional Flow - 08/29/2005

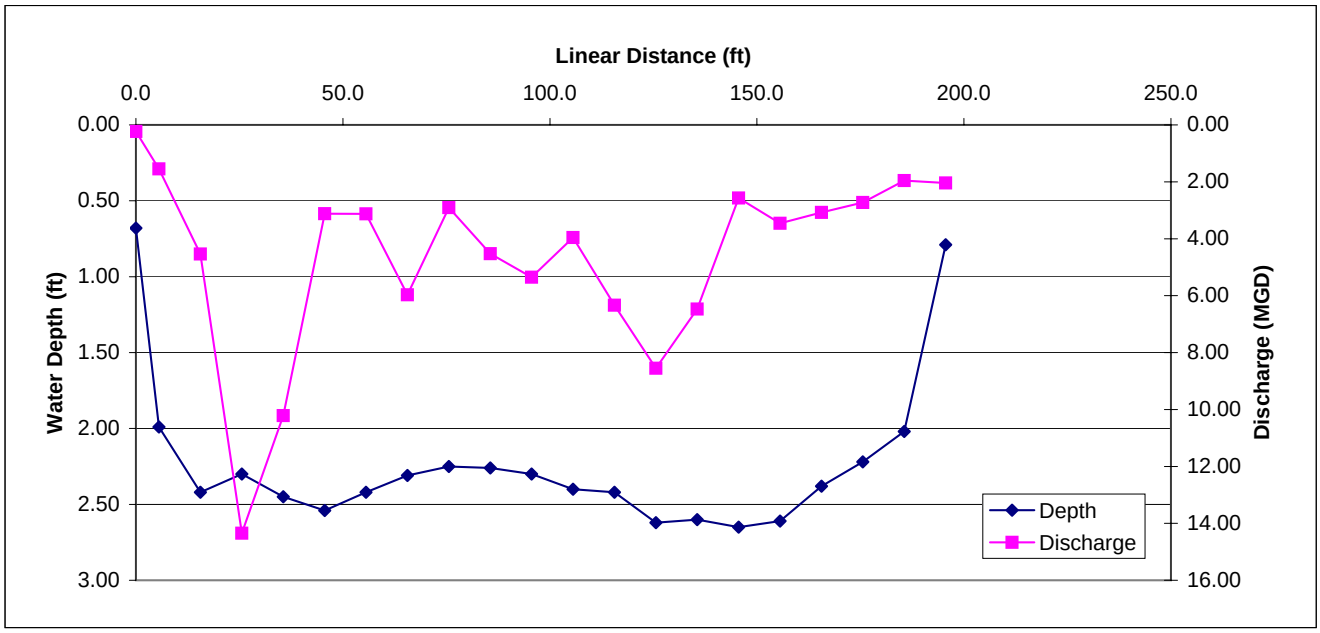
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.3		2.24	0.04		0.02				
	5.0	6.2	4.21	0.18		0.66	25.96	10.90	26677	7.05
	10.0	5.0	4.52	0.97		0.31	22.60	14.46	35387	9.35
	15.0	5.0	3.13	0.45		0.09	15.65	4.23	10338	2.73
	20.0	5.0	2.52	0.85		0.06	12.60	5.73	14026	3.71
	25.0	5.0	2.49	0.37		0.05	12.45	2.61	6397	1.69
	30.0	5.0	2.79	0.88		0.09	13.95	6.77	16553	4.37
	35.0	5.0	3.24	0.70		0.30	16.20	8.10	19817	5.24
	40.0	5.0	3.10	0.43		0.07	15.50	3.88	9480	2.50
	45.0	5.0	2.80	0.34		0.10	14.00	3.08	7535	1.99
	50.0	5.0	2.32	0.39		0.10	11.60	2.84	6953	1.84
	55.0	5.0	2.16	0.44		0.19	10.80	3.40	8323	2.20
	60.0	5.0	1.96		0.11		9.80	1.08	2637	0.70
	65.0	5.0	1.99		0.03		9.95	0.30	730	0.19
	70.0	5.0	2.21	0.21		0.02	11.05	1.27	3109	0.82
	75.0	5.0	2.18	0.14		0.03	10.90	0.93	2267	0.60
	80.0	5.0	2.59	0.24		0.03	12.95	1.75	4277	1.13
	85.0	5.0	3.15	0.17		0.05	15.75	1.73	4239	1.12
	90.0	5.0	3.38	0.41		0.11	16.90	4.39	10750	2.84
	95.0	5.0	3.18	0.64		0.03	15.90	5.33	13032	3.44
	100.0	5.0	3.60	0.72		0.43	18.00	10.35	25322	6.69
	105.0	5.0	3.22	0.67		0.40	16.10	8.61	21074	5.57
	110.0	5.0	2.85	0.18		0.06	14.25	1.71	4184	1.11
	115.0	5.0	3.15	0.39		0.09	15.75	3.78	9248	2.44
	120.0	5.0	3.07	0.74		0.17	15.35	6.98	17087	4.51
	125.0	5.0	2.85	0.51		0.17	14.25	4.85	11854	3.13
	130.0	5.0	2.52	0.15		0.16	12.60	1.95	4778	1.26
	135.0	5.0	2.60	0.50		0.11	13.00	3.97	9701	2.56
	140.0	5.0	2.24	0.18		0.07	11.20	1.40	3425	0.90
	145.0	5.0	2.04	0.28		0.09	10.20	1.89	4617	1.22
	150.0	5.0	2.00		0.19		10.00	1.90	4648	1.23
	155.0	5.0	1.99		0.27		9.95	2.69	6573	1.74
	160.0	5.0	1.92		0.13		9.60	1.25	3053	0.81
	165.0	5.0	1.80		0.41		9.00	3.69	9028	2.38
	170.0	5.0	1.60		0.13		8.00	1.04	2544	0.67
	175.0	5.0	1.65		0.30		8.25	2.48	6055	1.60
	180.0	5.0	1.32		0.32		6.60	2.11	5167	1.37
	185.0	5.0	0.95		0.53		4.75	2.52	6159	1.63
	190.0	6.5	1.15		0.22		7.48	1.64	4023	1.06
End	194.0		0.92		0.16					
		192.7	2.49	0.43	0.23	0.15	488.84	147.58	361070	95.39



APPENDIX C-55

ASC-SEG1-DOWN Marsh McBirney Cross Sectional Flow - 08/29/2005

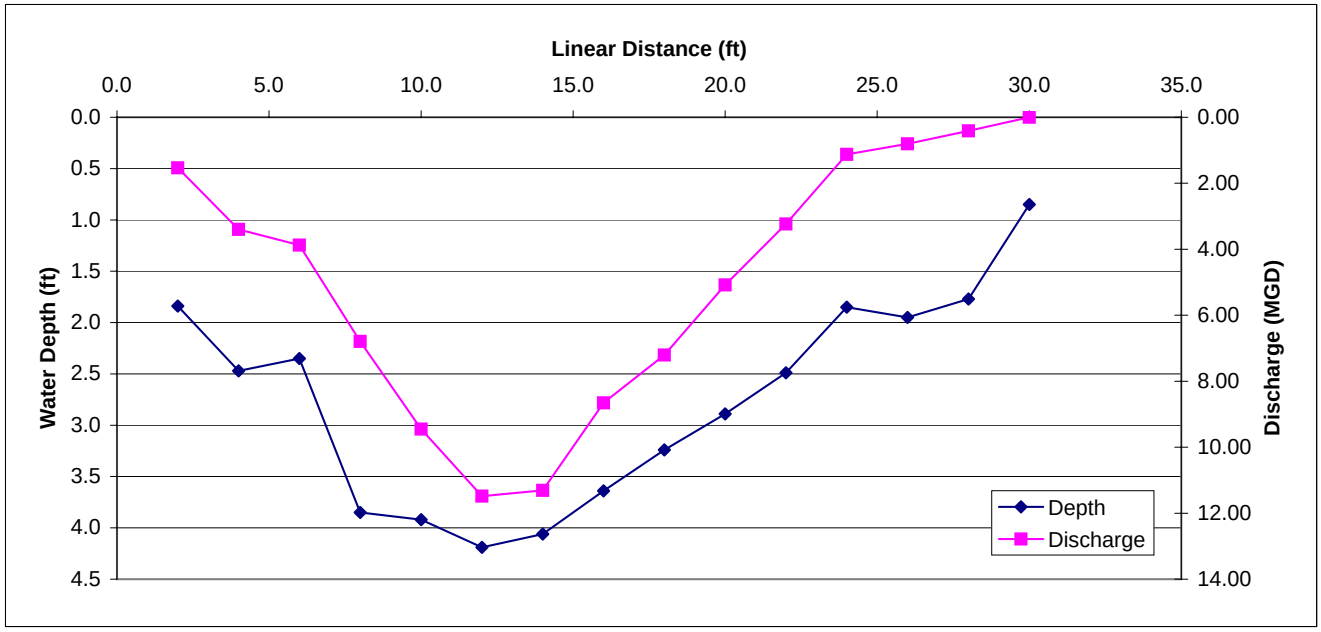
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	5.6	10.6	0.68		0.05		7.20	0.36	880	0.23
	15.6	10.0	1.99		0.12		19.90	2.39	5842	1.54
	25.6	10.0	2.42	0.22		0.36	24.20	7.02	17170	4.54
	35.6	10.0	2.30	1.02		0.91	23.00	22.20	54302	14.35
	45.6	10.0	2.45	0.64		0.65	24.50	15.80	38662	10.21
	55.6	10.0	2.54	0.15		0.23	25.40	4.83	11807	3.12
	65.6	10.0	2.42	0.22		0.18	24.20	4.84	11841	3.13
	75.6	10.0	2.31	0.37		0.43	23.10	9.24	22606	5.97
	85.6	10.0	2.25	0.18		0.22	22.50	4.50	11010	2.91
	95.6	10.0	2.26	0.30		0.32	22.60	7.01	17141	4.53
	105.6	10.0	2.30	0.42		0.30	23.00	8.28	20258	5.35
	115.6	10.0	2.40	0.24		0.27	24.00	6.12	14973	3.96
	125.6	10.0	2.42	0.38		0.43	24.20	9.80	23979	6.33
	135.6	10.0	2.62	0.51		0.50	26.20	13.23	32371	8.55
	145.6	10.0	2.60	0.38		0.39	26.00	10.01	24490	6.47
	155.6	10.0	2.65	0.19		0.11	26.50	3.98	9725	2.57
	165.6	10.0	2.61	0.28		0.13	26.10	5.35	13090	3.46
	175.6	10.0	2.38	0.19		0.21	23.80	4.76	11646	3.08
	185.6	10.0	2.22	0.19		0.19	22.20	4.22	10320	2.73
	195.6	10.0	2.02		0.15		20.20	3.03	7413	1.96
	205.6	12.5	0.79		0.32		9.88	3.16	7731	2.04
End	213.1									
		213.1	2.22	0.35	0.16	0.34	468.67	150.11	367258	97.02



APPENDIX C-56

JC-SEG1-UP Marsh McBirney Cross Sectional Flow - 03/31/05

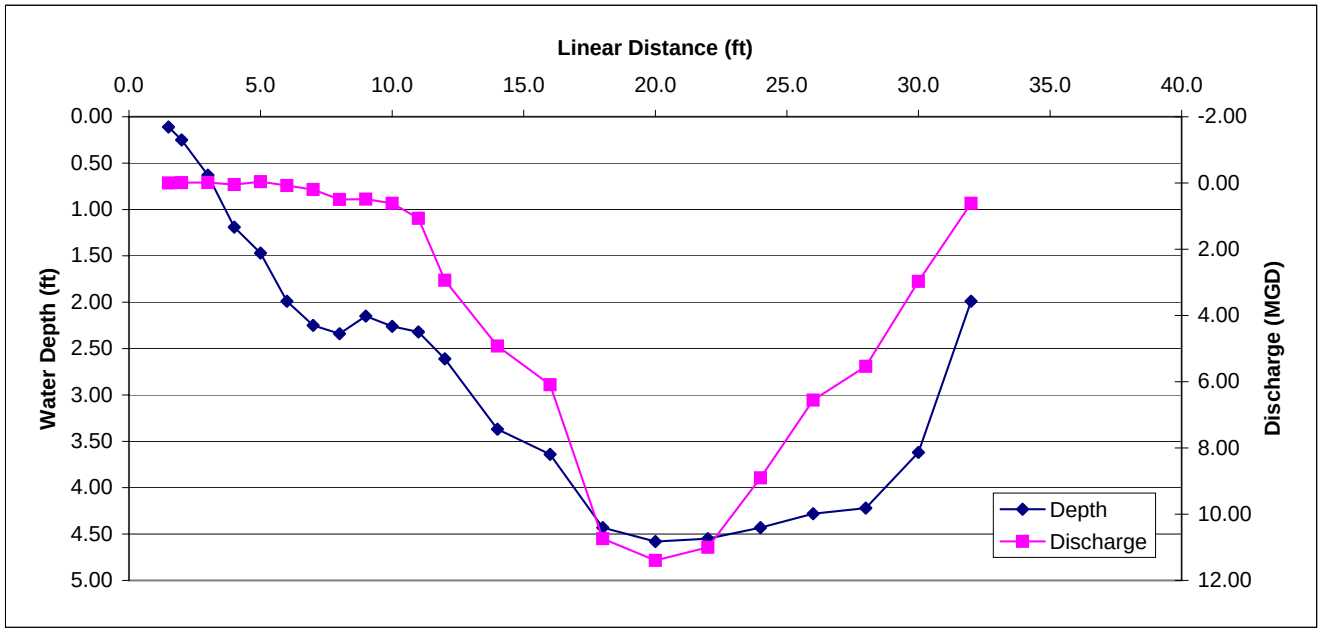
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	0.0									
	2.0	3.0	1.84		0.43		5.52	2.37	5807	1.53
	4.0	2.0	2.47	1.17		0.96	4.94	5.26	12872	3.40
	6.0	2.0	2.35	1.20		1.35	4.70	5.99	14661	3.87
	8.0	2.0	3.85	1.53		1.20	7.70	10.51	25715	6.79
	10.0	2.0	3.92	1.90		1.83	7.84	14.62	35773	9.45
	12.0	2.0	4.19	2.07		2.17	8.38	17.77	43465	11.48
	14.0	2.0	4.06	2.16		2.15	8.12	17.50	42812	11.31
	16.0	2.0	3.64	2.15		1.53	7.28	13.40	32772	8.66
	18.0	2.0	3.24	2.03		1.41	6.48	11.15	27269	7.20
	20.0	2.0	2.89	1.73		0.99	5.78	7.86	19232	5.08
	22.0	2.0	2.49	1.28		0.73	4.98	5.00	12245	3.23
	24.0	2.0	1.85		0.47		3.70	1.74	4255	1.12
	26.0	2.0	1.95		0.32		3.90	1.25	3053	0.81
	28.0	2.0	1.77		0.18		3.54	0.64	1559	0.41
	30.0	2.5	0.85		0.00		2.13	0.00	0	0.00
End	31.5									
		31.5	2.76	1.72	0.28	1.43	84.99	115.05	281489	74.36



APPENDIX C-57

JC-SEG1-UP Marsh McBirney Cross Sectional Flow - 07/11/2005

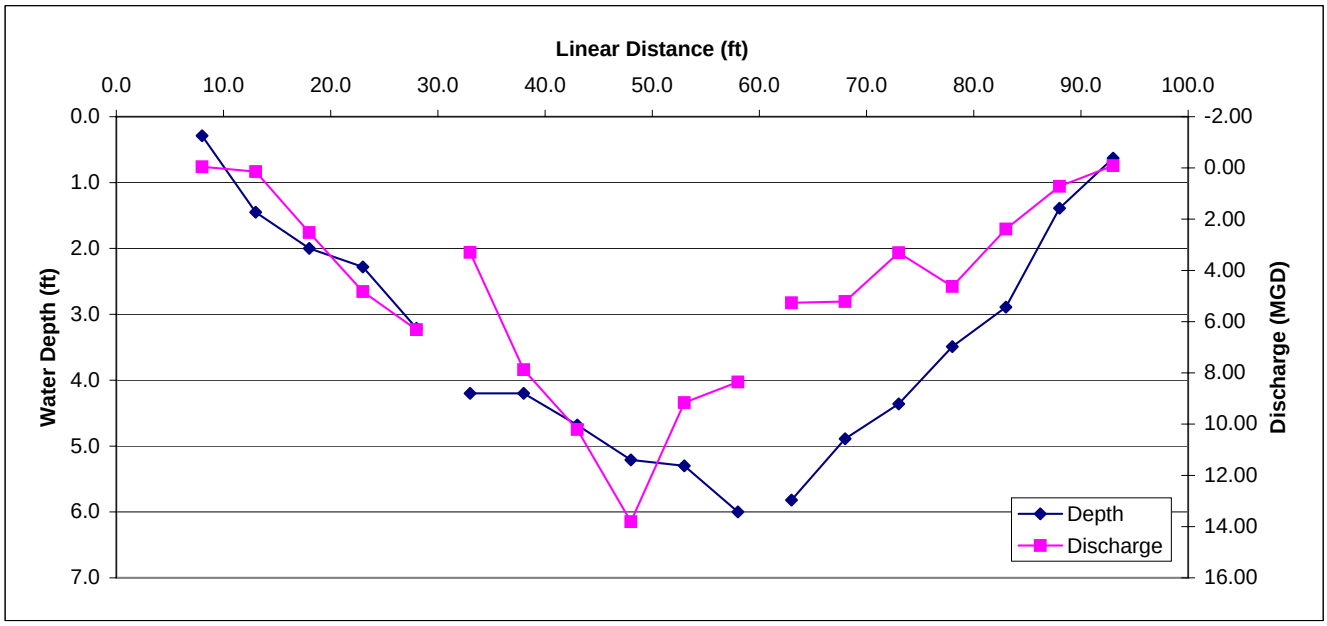
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	1.5									
	2.0	1.0	0.11		0.02		0.11	0.00	5	0.00
	3.0	1.0	0.25		-0.06		0.25	-0.02	-37	-0.01
	4.0	1.0	0.63		-0.03		0.63	-0.02	-46	-0.01
	5.0	1.0	1.19		0.06		1.19	0.07	175	0.05
	6.0	1.0	1.47		-0.04		1.47	-0.06	-144	-0.04
	7.0	1.0	1.99		0.06		1.99	0.12	292	0.08
	8.0	1.0	2.25	0.23		0.04	2.25	0.30	743	0.20
	9.0	1.0	2.34	0.46		0.20	2.34	0.77	1889	0.50
	10.0	1.0	2.15	0.45		0.25	2.15	0.75	1841	0.49
	11.0	1.0	2.26	0.48		0.36	2.26	0.95	2322	0.61
	12.0	1.5	2.32	0.44		0.51	3.48	1.65	4044	1.07
	14.0	2.0	2.61	1.00		0.74	5.22	4.54	11111	2.94
	16.0	2.0	3.37	1.31		0.95	6.74	7.62	18634	4.92
	18.0	2.0	3.64	1.29		1.23	7.28	9.43	23065	6.09
	20.0	2.0	4.43	1.66		1.30	8.86	16.61	40644	10.74
	22.0	2.0	4.58	2.01		2.09	9.16	17.63	43140	11.40
	24.0	2.0	4.55	2.25		1.84	9.10	17.02	41633	11.00
	26.0	2.0	4.43	1.98		1.49	8.86	13.78	33707	8.90
	28.0	2.0	4.28	1.41		1.13	8.56	10.14	24817	6.56
	30.0	2.0	4.22	1.20		0.96	8.44	8.57	20959	5.54
	32.0	2.0	3.62	1.27		0.83	7.24	4.60	11248	2.97
	34.0	2.8	1.99		0.17		5.57	0.95	2317	0.61
End	35.8									
		34.3	2.67	1.16	0.03	0.93	103.15	115.41	282361	74.59



APPENDIX C-58

WEKIVA RIVER NR MIAMI SPR BRIDGE Marsh McBirney Cross Sectional Flow - 01/25/05

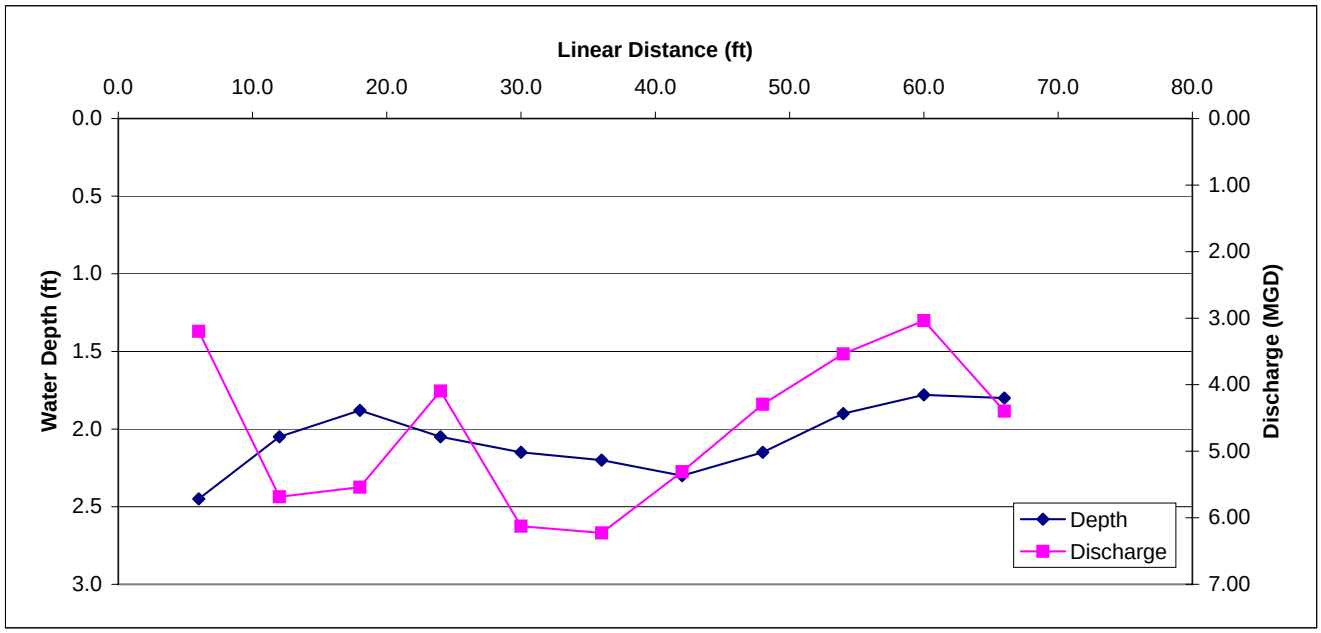
	Distance from Initial Point (ft.)	Segment Width (ft.)	Total Depth (ft.)	Velocity (ft/s) 0.2 x depth	0.6 x depth	0.8 x depth	Segment Area (ft^2)	Discharge (ft^3/s)	(m^3/d)	(MGD)
Start	3.0									
	8.0	7.5	0.29		-0.03		2.18	-0.07	-160	-0.04
	13.0	5.0	1.45		0.03		7.25	0.22	532	0.14
	18.0	5.0	2.00		0.39		10.00	3.90	9542	2.52
	23.0	5.0	2.28	0.67		0.64	11.40	7.47	18269	4.83
	28.0	4.1	3.21	0.77		0.72	13.11	9.77	23891	6.31
Piling Start	29.6									
Piling End	30.8									
	33.0	4.7	4.20	0.25		0.27	19.60	5.10	12468	3.29
	38.0	5.0	4.20	0.59		0.57	21.00	12.18	29799	7.87
	43.0	5.0	4.68	0.57		0.78	23.40	15.80	38644	10.21
	48.0	5.0	5.21	0.84		0.80	26.05	21.36	52261	13.81
	53.0	5.0	5.30	0.53		0.54	26.50	14.18	34686	9.16
	58.0	3.9	6.00	0.55		0.55	23.50	12.93	31622	8.35
Piling Start	59.4									
Piling End	60.5									
	63.0	5.0	5.82	0.34		0.22	29.10	8.15	19935	5.27
	68.0	5.0	4.89	0.20		0.46	24.45	8.07	19740	5.21
	73.0	5.0	4.36	0.29		0.18	21.80	5.12	12534	3.31
	78.0	5.0	3.49	0.43		0.39	17.45	7.15	17504	4.62
	83.0	5.0	2.89	0.22		0.29	14.45	3.68	9015	2.38
	88.0	5.0	1.39		0.16		6.95	1.11	2721	0.72
	93.0	7.5	0.63		-0.03		4.73	-0.14	-347	-0.09
End	98.0									
		92.7	3.5	0.48	0.10	0.49	302.91	135.97	332656	87.88



APPENDIX C-59

Wekiwa Springs Marsh McBirney Cross Sectional Flow - 01/25/05

	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)
Start	5.0									
	6.0	4.0	2.45	0.59		0.42	9.80	4.95	12108	3.20
	12.0	6.0	2.05	0.72		0.71	12.30	8.79	21516	5.68
	18.0	6.0	1.88		0.76		11.28	8.57	20974	5.54
	24.0	6.0	2.05	0.45		0.58	12.30	6.33	15498	4.09
	30.0	6.0	2.15	0.73		0.74	12.90	9.48	23197	6.13
	36.0	6.0	2.20	0.73		0.73	13.20	9.64	23575	6.23
	42.0	6.0	2.30	0.62		0.57	13.80	8.21	20089	5.31
	48.0	6.0	2.15	0.52		0.51	12.90	6.64	16254	4.29
	54.0	6.0	1.90		0.48		11.40	5.47	13388	3.54
	60.0	6.0	1.78		0.44		10.68	4.70	11497	3.04
	66.0	9.0	1.80		0.42		16.20	6.80	16647	4.40
End	72.0									
		67.0	2.1	0.62	0.53	0.61	136.76	79.60	194743	51.45



Appendix D

Detailed Water Quality Data for the Wekiva River System and Reference Sites

APPENDIX D-1

ALEXANDER SPRING CREEK MASS BALANCE STATIONS - WEKIVA PLRG

			12/14/2004	1/27/2005	2/24/2005	3/8/2005	3/28/2005	4/21/2005	5/24/2005	6/23/2005		7/11/2005		8/9/2005	
Parameter Group	Parameter	Units	ASC-MB2	ASC-MB2	ASC-MB2	ASC-MB2	ASC-MB2	ASC-MB2	ASC-MB2	ASC-MB1	ASC-MB2	ASC-MB1	ASC-MB2	ASC-MB1	ASC-MB2
Temperature	Temp	C	18.2	18.7	23.4	---	23.0	24.4	24.9	24.1	25.1	23.9	27.1	23.8	27.5
Dissolved Oxygen	DO	%	79.5	82.3	80.5	---	53.1	85.3	66.0	27.2	29.4	18.4	42.1	19.2	38.1
		mg/L	7.47	7.70	6.88	---	4.58	7.25	5.46	2.25	2.48	1.55	5.31	1.61	3.03
Physical	pH	SU	7.37	7.43	7.70	---	6.97	7.70	7.33	7.97	6.74	7.99	7.26	8.02	6.90
	Cond	uS/cm	677	669	838	---	527	920	669	1,022	553	951	656	925	505
	Sp Cond	uS/cm	782	761	872	---	554	928	674	1,042	551	966	640	947	491
	Color	cpu	80.0	80.0	35.0	---	1,280	45.0	180	15 I	400	5 I	300	0 I	400
	TURB	ntu	1.00	0.850	3.40	---	2.50	4.00	6.20	0.1 T	2.10	0.10 U	2.80	0.05 I	1.20
Oxygen Demand	BOD	mg/L	1.8 T	0.4 T	0.4 I	---	4.4 I	1.2 I	1.1 I	0.6 T	1.5 T	0.4 T	1.1 T	0.3 T	1.4 T
Solid	TSS	mg/L	4 I	0 T	5 I	---	0 T	4 I	1 I	0 T	1 T	1 I	1 I	1 I	4 I
	TDS	mg/L	393	432	539	---	339	529	424	606	381	566	416	576	384
	VSS	mg/L	4 T	3 T	5 T	---	5 I	5 I	8 I	2 T	1 T	2 I	3 I	3 I	4 I
General Inorganic	ALK	mg/L	68.8	63.6	72.2	---	46.9	78.2	53.3	78.0	42.0	77.9	51.9	78.5	42.0
	Cl -	mg/L	196	191	208	200	134	214	170	242	133	265	172	222	116
	SILICA	mg/L	9.40	7.10	6.50	---	15.0	7.10	10.2	9.60	16.1	9.60	14.9	8.42	14.4
	SO4	mg/L	51.8	45.3	59.1	---	36.4	59.4	46.2	66.4	32.7	62.2	43.2	66.7	37.2
	TC	mg/L	22.1	23.3	25.2	---	35.0	23.4	31.2	20.5	44.8	19.9	39.5	20.8	42.0
General Organic	DOC	mg/L	7.66	8.26	5.04	---	24.9	7.60	17.8	0.99 I	35.1	0.00 I	24.2	0.56 I	32.1
Nitrogen	NH3	mg/L	-0.004 T	-0.008 T	-0.007 T	---	0.018 I	-0.018 T	0.012 I	-0.018 T	0.018 T	-0.013 T	-0.003 T	-0.025 T	0.002 I
	NO2 + NO3	mg/L	0.142	0.006 I	0.004 U	0.004 I	0.016 I	0.006 I	0.023 I	0.043	0.01 I	0.049	0.017	0.048	0.018
	TKN	mg/L	0.480	0.34 I	0.27 I	0.30 I	0.550	0.24 I	0.56 I	0.19 I	1.07	0.1 U	0.62	0.29 I	1.16
	TN	mg/L	0.622	0.346	0.272	0.304	0.566	0.246	0.583	0.233	1.08	0.10	0.64	0.338	1.18
Phosphorus	SRP	mg/L	0.046	0.034	0.040	---	0.034	0.056	0.035	0.050	0.034	0.053	0.052	0.049	0.054
	TP/D/SPEC	mg/L	---	0.052	0.049	---	0.052	0.054	0.064	0.048	0.043	0.049	0.072	0.044	0.057
	TP/T/SPEC	mg/L	0.053	0.046	0.047	---	0.057	0.046	0.059	0.051	0.053	0.052	0.095	0.050	0.069
Metal	CA/T/ICP	mg/L	36.5	36.5	43.3	---	28.5	47.6	29.6	49.1	24.9	44.2	30.6	40.6	23.5
	FE/T/ICP	ug/L	59.8	62.7	47.2	---	187	68.1	155	5.6 I	426	2.2 I	233	5.7 I	430
	MG/T/ICP	mg/L	15.6	15.5	19.3	---	11.6	19.5	13.4	21.3	10.1	18.3	12.0	19.2	10.5
	NA/T/ICP	mg/L	96.4	97.7	130	---	77.7	123	90.2	133	67.7	134	89.7	124	68.5

Notes:

T, U = Result below detection limit

I = Result between detection limit and practical quantitation limit

APPENDIX D-2

JUNIPER CREEK MASS BALANCE STATIONS - WEKIVA PLRG

			12/14/2004	1/27/2005	2/24/2005	3/8/2005		3/28/2005	5/24/2005	6/23/2005		7/11/2005		8/1/2005	8/9/2005	
Parameter Group	Parameter	Units	JC-MB2	JC-MB2	JC-MB2	JC-MB1	JC-MB2	JC-MB2	JC-MB2	JC-MB1	JC-MB2	JC-MB1	JC-MB2	JC-MB2	JC-MB1	JC-MB2
Temperature	Temp	C	19.2	21.0	22.1	---	---	21.7	24.0	22.8	24.7	22.3	25.0	25.1	22.3	23.8
Dissolved Oxygen	DO	%	72.2	88.2	81.2	---	---	72.9	75.3	80.1	84.9	78.8	80.9	84.4	77.8	62.0
		mg/L	6.63	7.88	7.07	---	---	6.40	6.36	6.90	7.03	6.86	6.72	6.95	6.80	5.23
Physical	pH	SU	7.72	7.73	7.82	---	---	7.42	7.76	8.63	7.90	8.32	7.65	7.74	8.29	7.00
	Cond	uS/cm	1,474	1,498	1,548	---	---	1,277	1,620	113	1,606	106	1,454	1,585	110	1,206
	Sp Cond	uS/cm	1,654	1,625	1,642	---	---	1,357	1,568	118	1,619	114	1,461	1,588	116	1,238
	Color	cpu	30.0	20 I	20 I	---	---	280	25.0	15 I	50.0	0 I	80.0	35.0	0 I	200
	TURB	ntu	0.450	0.550	0.640	---	---	1.40	0.650	0.450	0.700	0.30 I	0.70	0.600	0.55	1.30
Oxygen Demand	BOD	mg/L	0.7 T	0.2 T	0.2 I	---	---	2.6 I	0.6 I	1.2 T	0.8 T	0.6 T	1.6 T	4.3 I	0.4 T	0.8 T
Solid	TSS	mg/L	1 T	1 T	0 T	---	---	2 I	0 I	1 T	2 I	0 I	3 I	3 I	2 I	3 I
	TDS	mg/L	869	954	969	---	---	777	947	68.0	948	77.0	865	967	86	746
	VSS	mg/L	4 T	2 T	3 T	---	---	6 I	1 I	1 T	4 T	2 I	2 I	3 I	3 I	4 I
General Inorganic	ALK	mg/L	54.4	55.4	56.7	---	---	54.4	56.0	44.8	52.6	44.2	50.9	55.9	44.3	45.1
	Cl -	mg/L	438	425	425	3.50	361	277	445	4.30	410	4.30	408	411	4.23	266
	SILICA	mg/L	8.90	8.70	7.60	---	---	11.9	9.10	9.60	9.60	9.60	10.6	9.00	8.77	10.8
	SO4	mg/L	140	95.6	125	---	---	111	126	11.2	122	10.9	115	116	14.0	105
	TC	mg/L	15.0	15.8	17.7	---	---	22.4	17.0	11.6	17.9	10.1	19.3	20.1	11.3	28.6
General Organic	DOC	mg/L	3.32 T	3.23 I	1.98 I	---	---	9.16	2.8 I	0.62 I	3.96 I	0.00 I	5.57	4.24	0.41 I	17.1
Nitrogen	NH3	mg/L	-0.004 T	-0.003 T	-0.002 T	---	---	-0.008 T	-0.22 I	-0.018 T	-0.018 T	-0.013 T	0.000 T	-0.023 I	-0.025 T	-0.012 T
	NO2 + NO3	mg/L	0.050	0.024	0.018	0.082	0.033	0.029	0.007 I	0.073	0.012 I	0.082	0.026	0.021	0.081	0.051
	TKN	mg/L	0.2 I	0.12 I	0.14 I	0.3 I	0.38 I	0.390	0.13 I	0.12 I	0.36 I	0.05 T	0.26 IQ	0.05 I	0.32 I	0.58
	TN	mg/L	0.250	0.144	0.158	0.382	0.413	0.419	0.137	0.193	0.372	0.107	0.286	0.071	0.40	0.63
Phosphorus	SRP	mg/L	0.016 T	0.011 I	0.017	---	---	0.021	0.01 I	0.022	0.017	0.023	0.015 I	0.014 I	0.023	0.014 I
	TP/D/SPEC	mg/L	---	0.014 I	0.024	---	---	0.029	0.019	0.020	0.01 I	0.026	0.024	0.034	0.023	0.017
	TP/T/SPEC	mg/L	0.016 T	0.023	0.013 I	---	---	0.034	0.022	0.030	0.017	0.034	0.026	0.019	0.047	0.038
Metal	CA/T/ICP	mg/L	54.0	56.4	58.2	---	---	50.4	53.6	13.5	50.6	14.0	52.20	50.0	13.4	40.4
	FE/T/ICP	ug/L	42.6	36.1	25.4	---	---	70.2	26.8	17.9	37.0	13.8	63.7	40.3	24.6	82.9
	MG/T/ICP	mg/L	30.1	30.8	33.4	---	---	26.6	31.2	4.99	29.1	4.93	27.2	29.2	5.03	22.8
	NA/T/ICP	mg/L	246	236	278	---	---	202	250	2.70	236	2.66	229.00	229	2.56	170

Notes:

T, U = Result below detection limit

I = Result between detection limit and practical quantitation limit

Q = Result analyzed out of holding time

APPENDIX D-3

LITTLE WEKIVA RIVER MASS BALANCE STATIONS - WEKIVA PLRG

			12/14/2004	1/27/2005	2/24/2005	3/28/2005	4/21/2005	5/26/2005	6/23/2005	7/11/2005	8/9/2005
Parameter Group	Parameter	Units	LWR-MB1	LWR-MB1	LWR-MB1	LWR-MB1	LWR-MB1	LWR-MB1	LWR-MB1	LWR-MB1	LWR-MB1
Temperature	Temp	C	22.3	21.3	23.5	24.1	24.7	25.0	25.8	28.1	28.2
Dissolved Oxygen	DO	%	59.1	57.6	48.1	64.7	58.4	57.6	47.2	65.0	55.9
		mg/L	5.11	5.10	4.08	5.46	4.86	4.75	3.85	5.08	4.36
Physical	pH	SU	7.54	7.36	7.38	7.16	7.47	7.65	7.41	7.47	7.50
	Cond	uS/cm	311	284	321	246	326	326	274	245	312
	Sp Cond	uS/cm	327	307	332	250	329	327	272	231	298
	Color	cpu	15 T	15 I	10 I	50.0	15 I	20 I	50.0	50.0	30.0
	TURB	ntu	0.600	1.50	1.00	2.40	0.700	0.4 I	2.20	3.10	1.80
Oxygen Demand	BOD	mg/L	0.9 T	1.2 T	0.7 I	5.6 I	1.2 I	2.1 I	2 I	2.1 I	1.4 U
Solid	TSS	mg/L	1 T	0 T	3 T	5 I	0 T	2 I	2 I	3 I	4 I
	TDS	mg/L	98.0	188	132	146	186	199	166	153	202
	VSS	mg/L	3 T	4 T	18 I	10 I	4 T	2 T	1 T	1 I	8 I
General Inorganic	ALK	mg/L	119	114	121	93.2	114	121	94.0	78.5	92.6
	Cl -	mg/L	23.5	22.5	20.9	21.8	22.8	23.1	21.5	21.6	27.2
	SILICA	mg/L	8.90	7.70	7.90	6.68	8.60	8.60	7.30	5.80	7.59
	SO4	mg/L	21.1	19.9	20.9	16.7	22.4	20.7	16.7	13.7	22.5
	TC	mg/L	30.6	32.8	38.1	31.2	30.9	39.7	29.0	29.8	30.4
General Organic	DOC	mg/L	3.76 T	6.08	3.42 I	10.8	9.90	5.95	8.99	7.74	7.25
Nitrogen	NH3	mg/L	0.016 I	0.038 I	0.022 I	0.042	-0.005 T	-0.013 T	0.051	0.020 I	0.021 I
	NO2 + NO3	mg/L	0.648	0.490	0.576	0.230	0.459	0.512	0.308	0.322	1.31
	TKN	mg/L	0.25 I	0.47 I	0.37 I	0.550	0.23 I	0.23 I	0.730	0.580	--- [a]
	TN	mg/L	0.898	0.960	0.946	0.780	0.689	0.742	1.04	0.902	---
Phosphorus	SRP	mg/L	0.164	0.160	0.166	0.092	0.158	0.153	0.111	0.063	0.216
	TP/D/SPEC	mg/L		0.166	0.182	0.148	0.162	0.142	0.115	0.085	0.213
	TP/T/SPEC	mg/L	0.180	0.174	0.185	0.160	0.162	0.160	0.149	0.138	0.234
Metal	CA/T/ICP	mg/L	39.0	39.4	44.1	33.6	42.9	41.5	31.1	28.3	34.3
	FE/T/ICP	ug/L	77.1	56.5	35.4	120	43.4	28.0	155	133	89.1
	MG/T/ICP	mg/L	10.5	9.55	12.2	6.93	11.1	11.3	7.20	5.45	8.24
	NA/T/ICP	mg/L	12.9	11.5	14.2	12.1	12.5	12.4	12.4	11.7	17.4

Notes:

T, U = Result below detection limit

I = Result between detection limit and practical quantitation limit

Q = Result analyzed out of holding time

[a] Not analyzed fro TKN. "Container was empty prior to analysis."

APPENDIX D-4

ROCK SPRING RUN MASS BALANCE STATIONS - WEKIVA PLRG

			6/23/2005	7/12/2005	8/10/2005
Parameter Group	Parameter	Units	RSR-MB1	RSR-MB1	RSR-MB1
Temperature	Temp	C	23.9	24.1	24.1
Dissolved Oxygen	DO	%	15.4	19.4	19.9
		mg/L	1.30	1.62	1.66
Physical	pH	SU	7.74	7.83	7.86
	Cond	uS/cm	235	238	235
	Sp Cond	uS/cm	241	243	239
	Color	cpu	15 I	5 I	5 I
	TURB	ntu	0.1 T	0.05 T	0.05 I
Oxygen Demand	BOD	mg/L	1.6 T	0.54 T	0.9 T
Solid	TSS	mg/L	0 T	0 T	3 I
	TDS	mg/L	153	160	125
	VSS	mg/L	2 T	0 T	5 I
General Inorganic	ALK	mg/L	91.2	93.3	92.5
	Cl -	mg/L	8.40	9.90	8.50
	SILICA	mg/L	11.1	10.7	10.3
	SO4	mg/L	19.3	19.6	18.8
	TC	mg/L	20.7	24.2	24.5
General Organic	DOC	mg/L	1.01 I	0.00 T	0.51 I
Nitrogen	NH3	mg/L	-0.018 T	-0.013 T	-0.025 T
	NO2 + NO3	mg/L	1.32	1.27	1.33
	TKN	mg/L	0.13 I	0.11 I	0.26 I
	TN	mg/L	1.45	1.38	1.59
Phosphorus	SRP	mg/L	0.086	0.079	0.087
	TP/D/SPEC	mg/L	0.079	0.091	0.084
	TP/T/SPEC	mg/L	0.084	0.093	0.086
Metal	CA/T/ICP	mg/L	28.7	31.0	29.0
	FE/T/ICP	ug/L	4.4 I	7.2 I	5.5 I
	MG/T/ICP	mg/L	9.12	9.06	9.16
	NA/T/ICP	mg/L	5.22	5.05	5.24

Notes:

T, U = Result below detection limit

I = Result between detection limit and practical quantitation limit

Q = Result analyzed out of holding time

APPENDIX D-5

WEKIVA RIVER MASS BALANCE STATIONS - WEKIVA PLRG

			1/26/2005	5/9/2005	5/27/2005	5/26/2005	6/23/2005		7/12/2005	7/11/2005	8/10/2005	8/9/2005
Parameter Group	Parameter	Units	WR-MB1	WR-MB1	WR-MB1	WR-MB2	WR-MB1	WR-MB2	WR-MB1	WR-MB2	WR-MB1	WR-MB2
Temperature	Temp	C	23.8	23.9	23.9	27.5	24.0	25.4	24.0	29.5	23.9	29.0
Dissolved Oxygen	DO	%	5.90	5.30	5.50	144	5.80	41.6	4.80	63.0	5.00	81.2
		mg/L	0.45	0.46	0.47	11.30	0.46	3.41	0.36	4.81	0.42	6.25
Physical	pH	SU	7.42	7.34	7.32	8.47	7.43	7.30	7.32	7.33	7.24	7.62
	Cond	uS/cm	306	310	311	480	311	356	311	337	311	360
	Sp Cond	uS/cm	314	316	318	463	318	355	318	310	318	333
	Color	cpu	---	5 I	5 I	25.0	15 I	200	5 I	200	5 I	150
	TURB	ntu	---	0.1 U	0 T	3.10	0.800	4.10	-0.10 T	4.70	0.05 I	1.90
Oxygen Demand	BOD	mg/L	---	0.1 T	1.3 T	2.4 I	1.5 T	1.8 T	0.40 T	1.4 T	0.1 T	1.1 T
Solid	TSS	mg/L	---	1 I	2 I	2 I	1 T	11.0	1 T	6 I	2 I	7 I
	TDS	mg/L	---	179	181	280	181	226	192	224	206	252
	VSS	mg/L	---	4 I	3 T	4 T	1 T	9 I	1 T	5 I	4 I	8 I
General Inorganic	ALK	mg/L	---	117	121	111	120	95.0	121	89.9	119	100
	Cl -	mg/L	13.4	16.1	16.2	56.3	16.4	41.0	19.0	38.3	16.2	38.5
	SILICA	mg/L	---	10.2	10.8	10.0	10.8	14.1	10.6	14.4	9.90	11.8
	SO4	mg/L	---	22.1	21.8	41.1	21.4	34.0	21.6	2.2	21.8	26.2
	TC	mg/L	---	30.4	39.7	39.6	27.4	47.4	32.2	48.3	31.7	42.7
General Organic	DOC	mg/L	---	1.9 I	5.38	6.67	1.72	21.1	0.00 T	22.3	0.46 I	19.4
Nitrogen	NH3	mg/L	---	-0.016 T	-0.022 T	-0.008 T	-0.018 T	0.004 T	-0.003 T	-0.013 T	-0.025 T	-0.018 T
	NO2 + NO3	mg/L	1.31	1.10	1.17	0.284	1.23	0.161	1.31	0.127	1.35	0.279
	TKN	mg/L	0.16 I	0.15 I	0.13 I	0.920	0.19 I	0.960	0.12 I	0.960	0.40 I	0.940
	TN	mg/L	1.47	1.25	1.30	1.20	1.42	1.12	1.43	1.09	1.75	1.22
Phosphorus	SRP	mg/L	---	0.126	0.128	0.099	0.161	0.117	0.119	0.132	0.134	0.124
	TP/D/SPEC	mg/L	---	0.135	0.120	0.100	0.120	0.118	0.127	0.151	0.129	0.134
	TP/T/SPEC	mg/L	---	0.128	0.127	0.122	0.126	0.144	0.129	0.169	0.127	0.142
Metal	CA/T/ICP	mg/L	---	38.3	38.0	44.6	39.0	38.0	42.2	36.3	38.2	35.4
	FE/T/ICP	ug/L	---	4 U	3.8 I	54.5	4.5 I	295	4.4 I	338	7.7 I	160
	MG/T/ICP	mg/L	---	11.0	11.6	13.3	11.2	9.79	11.6	8.60	11.3	9.90
	NA/T/ICP	mg/L	---	8.73	9.40	29.0	9.63	21.7	9.69	19.8	9.69	19.4

Notes:

T, U = Result below detection limit

I = Result between detection limit and practical quantitation limit

Q = Result analyzed out of holding time

APPENDIX D-6

ALEXANDER SPRING CREEK SEGMENT STATIONS - WEKIVA PLRG

			5/3/2005		5/24/2005		8/9/2005		8/29/2005	
Parameter Group	Parameter	Units	ASC-SEG1-UP	ASC-SEG1-DOWN	ASC-SEG1-UP	ASC-SEG1-DOWN	ASC-SEG1-UP	ASC-SEG1-DOWN	ASC-SEG1-UP	ASC-SEG1-DOWN
Temperature	Temp	C	25.4	26.2	25.1	26.1	25.6	25.8	25.6	26.3
Dissolved Oxygen	DO	%	85.3	118	59.2	81.9	39.1	51.7	49.3	68.4
		mg/L	6.99	9.49	4.88	6.67	3.13	4.20	4.02	5.51
Physical	pH	SU	8.68	8.95	7.83	8.30	7.30	7.47	7.65	7.75
	Cond	uS/cm	948	974	841	909	668	732	796	846
	Sp Cond	uS/cm	944	955	838	905	660	722	790	827
	Color	cpu	25.0	20 I	120	70.0	125	225	125	125
	TURB	ntu	0.15 I	0.450	0.500	0.700	0.500	0.800	0.460	1.27
Oxygen Demand	BOD	mg/L	0.4 I	0.4 I	0.3 I	0.7 I	0.5 T	0.6 T	0.2 I	0.5 I
Solid	TSS	mg/L	-1 I	4 I	0 I	2 I	2 I	4 I	0 I	0 I
	TDS	mg/L	569	556	505	526	442	475	559	567
	VSS	mg/L	6 I	3 I	3 I	4 I	5 I	7 I	0.0 I	0.4 I
General Inorganic	ALK	mg/L	76.0	77.3	67.2	71.6	53.9	60.0	66.4	63.3
	Cl -	mg/L	221	220	207	220	156	173	196	189
	SILICA	mg/L	8.60	7.30	9.90	9.00	11.6	11.0	11.1	11.6
	SO4	mg/L	68.0	69.6	55.6	57.4	46.5	52.3	53.7	50.9
	TC	mg/L	21.3	21.5	26.1	25.0	32.7	30.1	24.8	26.7
General Organic	DOC	mg/L	2.4 I	2.6 I	8.90	6.30	20.2	17.2	8.43	10.1
Nitrogen	NH3	mg/L	-0.007 T	-0.014 T	-0.015 T	-0.022 T	-0.011 T	-0.009 T	-0.012 T	-0.012 T
	NO2 + NO3	mg/L	0.014 I	0.004 U	0.015 I	0.004 I	0.025	0.024	0.008 I	0.016 I
	TKN	mg/L	0.1 I	0.13 I	0.3 I	0.19 I	0.610	0.570	0.24 I	0.33 I
	TN	mg/L	0.114	0.132	0.315	0.194	0.635	0.594	0.248	0.346
Phosphorus	SRP	mg/L	0.036	0.035	0.046	0.040	0.047	0.047	0.053	0.006 T
	TP/D/SPEC	mg/L	0.048	0.051	0.051	0.046	0.044	0.046	0.053	0.062
	TP/T/SPEC	mg/L	0.048	0.046	0.041	0.044	0.052	0.064	0.053	0.051
Metal	CA/T/ICP	mg/L	42.0	40.1	38.8	39.2	29.3	31.1	36.6	35.1
	FE/T/ICP	ug/L	16.9	12.1	54.1	25.1	160	114	78.9	111
	MG/T/ICP	mg/L	18.8	18.6	17.0	17.9	13.2	14.1	16.7	16.1
	NA/T/ICP	mg/L	124	124	112	122	87.0	93.4	110	104

Notes:

T, U = Result below detection limit

I = Result between detection limit and practical quantitation limit

Q = Result analyzed out of holding time

APPENDIX D-7

JUNIPER CREEK SEGMENT STATIONS - WEKIVA PLRG

			3/31/2005		4/18/2005		7/11/2005		8/1/2005	
Parameter Group	Parameter	Units	JC-SEG1-UP	JC-SEG1-DOWN	JC-SEG1-UP	JC-SEG1-DOWN	JC-SEG1-UP	JC-SEG1-DOWN	JC-SEG1-UP	JC-SEG1-DOWN
Temperature	Temp	C	22.4	22.5	22.4	22.5	24.7	25.0	25.0	25.1
Dissolved Oxygen	DO	%	97.8	86.1	97.8	86.1	82.8	80.9	86.1	84.4
		mg/L	8.50	7.47	8.50	7.47	6.88	6.72	7.11	6.95
Physical	pH	SU	8.04	8.03	8.04	8.03	7.58	7.65	7.78	7.74
	Cond	uS/cm	1,311	1,563	1,311	1,563	1,198	1,454	1,342	1,585
	Sp Cond	uS/cm	1,399	1,656	1,399	1,656	1,209	1,461	1,352	1,588
	Color	cpu	50.0	45.0	30.0	30.0	100	80.0	45.0	35.0
	TURB	ntu	0.35 I	0.25 I	0.550	0.35 I	0.75	0.70	0.650	0.600
Oxygen Demand	BOD	mg/L	0.5 T	0.4 T	3.4 I	0.7 I	1.2 T	1.6 T	3.69 I	4.3 I
Solid	TSS	mg/L	1 T	0 T	3.00	1 T	4 I	3 I	3 I	3 I
	TDS	mg/L	744	885	798	956	711	865	801	967
	VSS	mg/L	4 I	5 I	6 I	2 T	1 I	2 I	3 I	3 I
General Inorganic	ALK	mg/L	49.0	58.6	51.8	58.3	49.9	50.9	52.4	55.9
	Cl -	mg/L	267	309	346	409	332	408	336	411
	SILICA	mg/L	10.4	10.3	8.40	8.60	10.6	10.6	9.40	9.00
	SO4	mg/L	92.8	108	127	151	101	115	106	116
	TC	mg/L	17.6	17.2	17.8	18.7	20.0	19.3	21.2	20.1
General Organic	DOC	mg/L	5.25	4.58	2.68 I	3.77 I	6.66	5.57	5.10	4.24
Nitrogen	NH3	mg/L	0.006 T	0.011 I	-0.011 T	0.015 T	-0.013 T	0.000 T	-0.025 I	-0.023 I
	NO2 + NO3	mg/L	0.017	0.025	0.006 I	0.01 I	0.024	0.026	0.020	0.021
	TKN	mg/L	0.33 I	0.28 I	0.11 I	0.08 T	0.27 IQ	0.26 IQ	0.05 I	0.05 I
	TN	mg/L	0.347	0.305	0.116	0.090	0.294	0.286	0.070	0.071
Phosphorus	SRP	mg/L	0.025	0.025	0.009 I	0.009 I	0.020	0.015 I	0.015 I	0.014 I
	TP/D/SPEC	mg/L	0.032	0.024	0.017	0.019	0.016 I	0.024	0.019	0.034
	TP/T/SPEC	mg/L	0.032	0.029	0.015 I	0.020	0.029	0.026	0.024	0.019
Metal	CA/T/ICP	mg/L	51.1	58.8	52.3	58.4	45.30	52.20	45.1	50.0
	FE/T/ICP	ug/L	59.3	47.9	29.5	27.6	72.6	63.7	45.1	40.3
	MG/T/ICP	mg/L	26.6	31.2	28.5	30.5	22.7	27.2	26.1	29.2
	NA/T/ICP	mg/L	197	245	214	238	178.00	229.00	194	229

Notes:

T, U = Result below detection limit

I = Result between detection limit and practical quantitation limit

Q = Result analyzed out of holding time

APPENDIX D-8
ROCK SPRING RUN SEGMENT STATIONS - WEKIVA PLRG

			SEGMENT 1								SEGMENT 2							
			4/1/2005		4/20/2005		7/12/2005		8/3/2005		4/1/2005		4/21/2005		7/12/2005		8/4/2005	
Parameter Group	Parameter	Units	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN
Temperature	Temp	C	24.2	23.0	25.4	24.5	24.6	24.5	25.8	25.3	23.0	23.0	21.9	22.2	25.3	25.9	27.5	28.6
Dissolved Oxygen	DO	%	93.0	50.7	75.9	78.4	51.4	47.6	52.4	53.4	41.5	47.2	72.6	70.3	13.8	19.2	22.3	30.5
		mg/L	7.79	4.35	6.23	6.55	4.28	3.97	4.30	4.40	3.56	4.04	6.36	6.11	1.12	1.55	1.76	2.37
Physical	pH	SU	7.75	7.77	8.03	7.86	7.52	7.44	7.51	7.57	6.71	6.93	7.29	7.37	6.91	6.96	6.99	7.18
	Cond	uS/cm	255	243	235	234	226	228	232	237	359	367	236	236	231	229	245	247
	Sp Cond	uS/cm	259	253	238	239	228	231	232	236	373	382	252	252	228	226	233	234
	Color	cpu	35 Q	40 Q	15 I	15 I	100	100	50.0	60.0	300 Q	300 Q	80.0	90.0	350	350	300	400
	TURB	ntu	0.95 Q	0.2 IQ	0.25 I	0.35 I	0.65	0.80	0.500	0.450	0.6 Q	0.5 Q	0.25 I	0.800	1.70	2.20	2.40	3.70
Oxygen Demand	BOD	mg/L	1.5 TQ	0.6 TQ	1.2 I	0.9 I	0.42 T	1.3 T	0.4 T	1.2 T	1 TQ	1 TQ	1 I	1.5 I	1.3 T	1.5 T	1.3 T	1.5 T
Solid	TSS	mg/L	1 T	0 T	0 T	0 T	1 T	2 I	1 I	1 I	2 I	1 T	1 T	2 I	1 T	3 I	3 I	4 I
	TDS	mg/L	137	148	142	139	148	162	146	146	268	283	166	163	203	207	192	196
	VSS	mg/L	5 I	4 T	3 T	2 T	2 T	1 T	1 I	1 I	1 T	2 T	1 T	3 T	3 T	3 T	3 I	4 I
General Inorganic	ALK	mg/L	88.7	95.7	102	96.0	85.9	87.3	87.4	89.3	80.5	89.0	102	101	81.0	80.4	94.7	93.8
	Cl -	mg/L	10.7	10.2	9.00	8.30	10.0	10.5	8.40	8.50	19.0	19.2	9.80	9.90	17.9	18.6	12.3	12.0
	SILICA	mg/L	12.3	12.3	10.5	10.4	12.2	12.8	10.6	11.0	17.5	17.5	11.7	11.4	19.8	19.3	17.1	16.9
	SO4	mg/L	17.2	18.5	19.7	20.6	19.9	21.8	19.1	20.2	73.8	74.0	24.8	25.2	16.9	13.7	0.2 I	0.5 I
	TC	mg/L	26.8	27.7	27.1	27.7	29.8	32.4	31.0	29.3	53.3	53.7	32.1	31.3	59.3	58.5	61.0	58.5
General Organic	DOC	mg/L	6.08	4.96	0 I	0 I	6.92	8.79	5.40	6.82	32.0	31.5	12.1	13.4	37.5	36.6	35.5	35.9
Nitrogen	NH3	mg/L	-0.002 T	-0.001 T	-0.011 T	-0.011 T	-0.010 T	0.001 T	0.010 I	0.008 I	0.035 I	0.015 I	-0.008 T	-0.018 T	0.124	0.080	0.150	0.107
	NO2 + NO3	mg/L	1.14	1.09	1.22	1.16	1.01	0.926	1.13	1.05	0.079	0.075	0.487	0.437	0.006 I	0.036	0.047	0.089
	TKN	mg/L	0.39 I	0.39 I	0.09 T	0.18 I	0.36 I	0.39 I	0.08 I	0.23 I	0.940	1.24	0.34 I	0.32 I	1.50	1.37	1.41	1.39
	TN	mg/L	1.53	1.48	1.31	1.34	1.37	1.32	1.21	1.28	1.02	1.32	0.827	0.757	1.51	1.41	1.46	1.48
Phosphorus	SRP	mg/L	0.085 Q	0.083 Q	0.077	0.075	0.078	0.089	0.107	0.092	0.091 Q	0.086 Q	0.073	0.121	0.122	0.133	0.171	0.161
	TP/D/SPEC	mg/L	0.090	0.085	0.085	0.088	0.088	0.088	0.089	0.084	0.120	0.115	0.075	0.085	0.156	0.151	0.176	0.176
	TP/T/SPEC	mg/L	0.090	0.092	0.093	0.090	0.100	0.115	0.089	0.084	0.120	0.118	0.075	0.069	0.178	0.173	0.180	0.188
Metal	CA/T/ICP	mg/L	32.6	33.7	31.6	34.4	26.7	29.5	28.5	30.0	49.7	53.5	35.6	34.7	31.9	30.1	32.1	31.8
	FE/T/ICP	ug/L	32.9	38.1	11.7	18.6	75.7	98.1	44.7	57.0	393	384	97.4	91.1	492	471	268	298
	MG/T/ICP	mg/L	9.58	9.89	9.45	9.78	8.00	8.92	9.10	9.48	12.7	13.3	10.0	9.97	7.82	7.51	8.96	8.94
	NA/T/ICP	mg/L	5.34	5.50	5.03	5.08	4.90	5.26	5.15	5.24	9.15	9.57	5.58	5.58	7.41	7.35	6.40	6.35

Notes:
T, U = Result below detection limit
I = Result between detection limit and practical quantitation limit
Q = Result analyzed out of holding time

APPENDIX D-9
WEKIVA RIVER SEGMENT STATIONS - WEKIVA PLRG

			SEGMENT 1								SEGMENT 2							
			5/9/2005		5/27/2005		8/10/2005		8/31/2005		5/10/2005		5/26/2005		8/9/2005		9/1/2005	
Parameter Group	Parameter	Units	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN
Temperature	Temp	C	23.9	25.3	23.9	23.9	23.9	24.1	24.0	26.1	22.9	22.8	26.4	27.5	28.3	29	27.5	27.8
Dissolved Oxygen	DO	%	5.3	33.9	5.5	25.1	5.0	15.1	6.4	28.5	63.5	67.4	108.7	143.6	64.7	81.2	69.7	85.9
		mg/L	0.46	2.76	0.47	2.11	0.42	1.26	0.53	2.32	5.49	5.8	8.79	11.3	5.05	6.25	5.47	6.74
Physical	pH	SU	7.34	7.46	7.32	7.43	7.24	7.33	7.37	7.52	7.46	7.45	8.08	8.47	7.44	7.62	7.71	7.53
	Cond	uS/cm	309.7	309.1	311.2	309.5	310.9	294	311.1	304.8	456.4	464.9	520	480.2	426.5	359.8	485.9	495
	Sp Cond	uS/cm	316.3	309.4	317.9	316.7	317.6	300	317.8	303.8	478.1	486.7	509	463	404.6	332.6	466.4	471.8
	Color	cpu	5 I	15 I	5 I	10 I	5 I	60	5 U	20 I	60	50	25	25	150	150	45	40
	TURB	ntu	0.1 U	0.45	0 T	0.1 T	0.05 I	0.30 I	0.25 I	0.45	1.5	2.2	3.5	3.1	2.70	1.90	1.0	1.1
Oxygen Demand	BOD	mg/L	0.1 T	0.5 I	1.3 T	0.8 T	0.1 T	0.5 T	0.8 I	1.2 I	1 I	1 I	2.2 I	2.4 I	1.1 T	1.1 T	0.5 I	0.8 I
Solid	TSS	mg/L	1 I	5 I	2 I	-1 T	2 I	4 I	-1 I	0 I	0 I	3 I	5 I	2 I	7 I	7 I	1 I	1 I
	TDS	mg/L	179	181	181	196	206	202	207	205	301	290	310	280	295	252	307	302
	VSS	mg/L	4 I	4 I	3 T	0 T	4 I	6 I	-4 I	-3 I	3 I	8 I	6 I	4 T	6 I	8 I	-2 I	-1 I
General Inorganic	ALK	mg/L	117	118	121	120	119	115	120	120	108	107	114	111	98.5	100	105	105
	Cl -	mg/L	16.1	15.6	16.2	16	16.2	15.6	16.3	16.1	60.5	57.9	69.4	56.3	53.8	38.5	63.4	62.7
	SILICA	mg/L	10.2	9.1	10.8	10.4	9.9	11.1	10.3	10.8	10.1	9.7	10.3	10	11.8	11.8	11.1	11.3
	SO4	mg/L	22.1	21.5	21.8	22.5	21.8	20.0	20.8	21.1	47.9	47.5	49.7	41.1	33.4	26.2	43.8	42.5
	TC	mg/L	30.4	37.7	39.7	39.7	31.7	36.8	33.9	36.7	29	29.2	39.4	39.6	44.7	42.7	35.5	36.0
General Organic	DOC	mg/L	1.9 I	3.6 I	5.38	6.41	0.46 I	7.91	1.15 I	3.56 I	7.6	8.1	6.24	6.67	18.3	19.4	6.18	7.38
Nitrogen	NH3	mg/L	-0.016 T	-0.009 T	-0.022 T	-0.022 T	-0.025 T	-0.012 T	0.029 I	-0.012 T	0.007 I	0.008 I	-0.018 T	-0.008 T	-0.008 T	-0.018 T	-0.012 T	-0.012 T
	NO2 + NO3	mg/L	1.10	0.995	1.17	1.08	1.35	1.09	1.34	1.17	0.292	0.267	0.356	0.284	0.288	0.279	0.443	0.450
	TKN	mg/L	0.15 I	0.21 I	0.13 I	0.14 I	0.40 I	0.51	-0.06 T	0.23 I	0.5 I	0.37 I	0.42	0.92	1.25	0.940	0.600	0.450
	TN	mg/L	1.25	1.21	1.30	1.22	1.75	1.60	1.365	1.4	0.792	0.637	0.776	1.204	1.54	1.22	1.04	0.900
Phosphorus	SRP	mg/L	0.126	0.119	0.128	0.122	0.134	0.138	0.124	0.120	0.099	0.096	0.099	0.099	0.124	0.124	0.122	0.120
	TP/D/SPEC	mg/L	0.135	0.143	0.12	0.11	0.129	0.134	0.107	0.116	0.143	0.122	0.097	0.1	0.134	0.134	0.118	0.118
	TP/T/SPEC	mg/L	0.128	0.125	0.127	0.12	0.127	0.134	0.150	0.220	0.115	0.118	0.115	0.122	0.134	0.142	0.141	0.148
Metal	CA/T/ICP	mg/L	38.3	39.8	38	38	38.2	36.7	39.7	38.7	43.8	44.5	45.5	44.6	37.0	35.4	43.3	43.1
	FE/T/ICP	ug/L	4 U	19.6	3.8 I	11.1	7.7 I	67.5	7.2 I	36.7	93	76.6	41.8	54.5	156	160	40.2	59.9
	MG/T/ICP	mg/L	11	11.4	11.6	11.4	11.3	10.7	11.8	11.5	12.7	12.5	14	13.3	10.6	9.90	13.2	13.1
	NA/T/ICP	mg/L	8.73	9.2	9.4	9.25	9.69	9.26	9.90	9.59	32.4	29.7	34.9	29	26.1	19.4	34.7	34.0

Notes:
T, U = Result below detection limit
I = Result between detection limit and practical quantitation limit
Q = Result analyzed out of holding time

APPENDIX D-10

SJRWMD STATIONS - WEKIVA PLRG (DECEMBER 2004 - AUGUST 2005)

			Wekiva River					Rock Spring Run											Juniper Creek		Alexander	
			WR-MB1		WR-MB2			RSR-MB1		RSR-MB2									JC-MB1		ASC-MB1	
			Wekiwa Springs		02235000			ROX		RSR-WR									JUN		ALX	
Parameter Group	Parameter	Units	2/16/05	5/18/05	1/11/05	3/1/05	5/4/05	2/16/05	5/18/05	12/7/04	1/4/05	2/1/05	3/1/05	4/5/05	5/9/05	6/8/05	7/6/05	8/3/05	2/18/05	5/20/05	2/18/05	5/20/05
Temperature	Temp	C	23.6	24.0	20.5	18.8	22.0	24.0	24.1	18.9	17.3	14.8	17.3	18.4	21.1	26.1	26.7	26.1	21.2	22.5	22.4	24.9
Dissolved Oxygen	DO	mg/L	---	---	8.27	6.73	5.73	---	---	5.79	6.04	7.28	5.97	5.49	5.72	3.67	1.87	2.97	---	---	---	---
Physical	pH	SU	7.17	7.43	7.74	7.21	7.70	7.43	7.71	6.81	6.82	7.01	6.82	6.67	7.09	6.93	7.04	6.40	8.18	8.47	8.01	8.32
	Sp Cond	uS/cm	343	336	369	418	423	259	254	226	230	245	242	301	244	265	233	211	118	116	1,020	1,093
	Color	cpu	---	---	70.0	80.0	50.0	---	---	160	140	140	120	200 IQ	120 I	250 I	600 IY	250 I	---	---	---	---
	TURB	ntu	---	---	1.1 I	2.10	1.83	---	---	1 I	0.25 T	0.74 I	1.2 I	1.5 I	1.9 I	4.10	1.8 IY	2.40	---	---	---	---
Solid	TSS	mg/L	---	---	2 T	3.5 T	4.5 T	---	---	2 T	0 T	-1 T	1 T	2 T	0 T	5 I	3 TY	4 T	---	---	---	---
	TDS	mg/L	194	190	219	256	248	140	144	173	185	171	187	251	177	206	247 Y	195	62.7	65.3	585	596
General Inorganic	ALK	mg/L	121	120	108	95.6	104	89.1	94.0	96.5	83.0	87.3	89.3	88.7	93.1	89.1	82.9 Y	93.2	44.4	44.0	89.7	82.0
	Cl -	mg/L	15.6	14.5	28.1	40.6	40.8	8.56	9.27	11.6	11.5	12.4	11.8	14.9	10.6	14.8	19.5	11.3	4.87	3.89	215	232
	SILICA	mg/L	---	---	---	---	---	---	---	12.7	10.9	10.7	10.0	16.6	2.62 I	2.51 I	10.8 Y	5.80	---	---	---	---
	SO4	mg/L	22.4	19.6	28.4	39.7	31.4	19.2	17.6	25.6	31.2	37.1	33.2	47.5	25.3	41.1	24.8 Y	11.3 I	6.13	3.85	63.6	---
	TC	mg/L	---	---	8.34	12.6	6.51	---	---	17.2	13.4	14.8	18.3	25.4	14.4	28.0	48.1 Y	30.2	---	---	---	---
General Organic	DOC	mg/L	---	---	---	---	---	---	---	17.2	13.5	13.0	15.9	22.7	11.4	26.0	45 Y	26.4	---	---	---	---
Nitrogen	NH3	mg/L	---	---	0.009 T	0.021 I	0.059	---	---	-0.012 T	-0.013 T	0.006 T	-0.006 T	0.004 T	-0.018 T	0.023 I	0.112 Y	0.034 I	---	---	---	---
	NO2 + NO3	mg/L	1.44	1.23	0.40	0.30	0.37	1.57	1.68	0.44	0.35	0.33	0.24	0.15	0.37	0.11	0.015 IY	0.146	0.10	0.08	0.02	0.03
	TKN	mg/L	---	---	0.50	0.80	0.58	---	---	0.83	0.71	0.63	0.76	0.76	0.60	1.03	1.64 Y	1.21	---	---	---	---
	TN	mg/L	---	---	0.90	1.11	0.94	---	---	1.27	1.06	0.96	1.00	0.91	0.97	1.14	1.66	1.36	---	---	---	---
Phosphorus	TP/T	mg/L	0.102	0.110	0.118	0.107	0.132	0.079	0.076	0.099	0.077	0.061	0.091	0.087	0.100	0.184	0.213 Y	0.178	0.017	0.017	0.040	0.053
Metal	CA/T	mg/L	38.6	41.0	40.8	41.7	---	30.8	30.9	35.7	35.3	34.9	35.4	44.6	35.6	37.5	36.9	31.3	12.3	12.6	42.8	45.0
	FE/T	ug/L	---	---	86.3 I	118.6 I	---	---	---	167	156	133	195	263	126 I	314	624	271	---	---	---	---
	MG/T	mg/L	10.8	11.4	11.1	11.3	---	9.18	9.10	10.0	10.1	9.98	10.0	11.8	10.2	10.1	8.52	9.00	4.22	4.33	18.9	20.0
	NA/T	mg/L	9.12	9.79	16.4	23.7	---	5.14	5.17	---	---	---	---	---	---	---	---	---	2.38	2.51	123	134

Notes:

T, U = Result below detection limit

I = Result between detection limit and practical quantitation limit

Q = Result analyzed out of holding time

Y = The laboratory analysis was from an unpreserved or improperly preserved sample

Appendix E

Detailed Plant Community Data from the Wekiva River System and Reference Site Stream Segments

APPENDIX E

SUMMARY OF WEKIVA RIVER SYSTEM AND REFERENCE STREAM SEGMENT AQUATIC PLANT COMMUNITIES

		Segment								
Species	Group	WR 1	WR 2	Average	RSR 1	RSR 2	Average	ASC	JC	Average
Benthic Algae	ALG	35.41		17.70	19.91		9.95	0.57	0.04	0.30
Filamentous Algae	ALG	1.58		0.79	0.29		0.15	1.20		0.60
Floating Algae	ALG	0.74		0.37	0.01		0.01			
Green Fil. Algae - Benthic	ALG								0.63	0.32
Nitella sp.	ALG		7.32	3.66						
Periphyton	ALG								1.15	0.58
Alternanthera philoxeroides	EMA	0.07	4.85	2.46		1.10	0.55			
Bacopa sp.	EMA								0.01	0.01
Cicuta mexicana	EMA	2.90	0.90	1.90	8.71	14.64	11.67	15.77		7.89
Cladium jamaicense	EMA					0.25	0.13	0.10	0.38	0.24
Colocasia esculenta	EMA					10.73	5.36			
Emergent Grass - unidentified	EMA	0.18	0.01	0.09		0.80	0.40	0.03		0.02
Eupatorium capillifolium	EMA		0.01	0.00						
Ferns	EMA	0.50		0.25		0.09	0.05		0.10	0.05
Hibiscus sp.	EMA							0.25		0.13
Juncus sp.	EMA								0.01	0.01
Ludwigia peruviana	EMA		0.24	0.12	0.46		0.23	0.25		0.13
Mikania scandens	EMA	0.72	0.28	0.50	0.01	0.10	0.05	0.51	0.37	0.44
Peltandra virginica	EMA					0.10	0.05			
Pontederia cordata	EMA		0.57	0.28	0.73	5.63	3.18	0.53		0.26
Rumex vertigillatus	EMA					0.85	0.42			
Sagittaria latifolia	EMA					1.19	0.59	0.45		0.22
Saururus cernuus	EMA					0.59	0.30		0.00	0.00
Scirpus sp.	EMA				0.01	0.13	0.07	0.33	0.02	0.17
Sedge	EMA		0.00	0.00	0.05	0.50	0.27	0.25	0.03	0.14
Typha latifolia	EMA		2.28	1.14		0.25	0.12	0.70	0.29	0.49
Urtica dioica	EMA	0.66		0.33	0.04	0.08	0.06			
Zizania sp.	EMA					0.11	0.05			
Azolla caroliniana	FAP		0.27	0.14						
Eichhornia crassipes	FAP	0.54	2.89	1.72		19.55	9.78	2.50	1.32	1.91
Hydrocotyle ranunculoides	FAP	0.54	1.30	0.92		0.25	0.13			
Hydrocotyle umbellata	FAP	1.08	1.76	1.42	5.01	3.20	4.10	4.23	0.14	2.18
Lemna sp.	FAP	0.81	0.63	0.72	1.32	0.25	0.78			
Nuphar lutea	FAP	0.89	1.07	0.98	2.89	3.39	3.14	1.52		0.76
Pistia stratiotes	FAP	0.90	0.18	0.54	1.52		0.76	0.24	0.05	0.15
Salvinia molesta	FAP								0.05	0.03
Ceratophyllum demersum	SAV							0.07		0.03
Najas guadalupensis	SAV	1.45	1.64	1.54					0.04	0.02
Potamogeton sp.	SAV								4.16	2.08
Unknown SAV	SAV		0.04	0.02	0.74		0.37			
Vallisneria americana	SAV		26.19	13.10	3.76		1.88	48.51		24.25
Cephalanthus occidentalis	SHR		0.02	0.01		0.14	0.07			
Itea virginica	SHR				0.00		0.00			
Myrica cerifera	SHR	1.09	0.05	0.57		0.79	0.40	0.08	1.13	0.60
Sambucus canadensis	SHR					0.29	0.15			
Toxicodendron radicans	VINE		0.22	0.11						
Vitus sp.	VINE				0.08		0.04	0.02		0.01
ALG		37.73	7.32	22.52	20.21	0.00	10.11	1.77	1.82	1.80
EMA		5.03	9.13	7.08	10.00	37.11	23.55	19.16	1.22	10.19
FAP		4.77	8.11	6.44	10.73	26.65	18.69	8.50	1.56	5.03
SAV		1.45	27.87	14.66	4.49	0.00	2.25	48.58	4.21	26.39
SHR		1.09	0.07	0.58	0.00	1.22	0.61	0.08	1.13	0.60
VINE		0.00	0.22	0.11	0.08	0.00	0.04	0.02	0.00	0.01
TOTAL		50.07	52.72	51.39	45.52	64.99	55.25	78.10	9.94	44.02

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER

JC- SEG1 TRANSECTS 1 - 10

	Linear Distance (m)										Total					
	Transect										Linear	Cover		Frequency		Importance
Species	1	2	3	4	5	6	7	8	9	10	Distance (m)	Percent	Relative	Absolute	Relative	Value
Bacopa sp.							0.01				0.01	0.01	0.12	0.01	1.85	0.98
Benthic Algae				0.04							0.04	0.04	0.39	0.01	1.85	1.12
Cladium jamaicense	0.10					0.01		0.19	0.06	0.01	0.37	0.38	3.80	0.09	12.96	8.38
Eichhornia crassipes				0.22			0.03		0.93	0.13	1.31	1.32	13.31	0.06	9.26	11.28
Ferns									0.10		0.10	0.10	1.03	0.01	1.85	1.44
Green Fil. Algae - Benthic			0.62								0.62	0.63	6.35	0.04	5.56	5.95
Hydrocotyle umbellata				0.01	0.02		0.01	0.10			0.13	0.14	1.37	0.05	7.41	4.39
Juncus sp.									0.01		0.01	0.01	0.13	0.01	1.85	0.99
Mikania scandens				0.37							0.37	0.37	3.74	0.01	1.85	2.80
Myrica cerifera										1.12	1.12	1.13	11.35	0.01	1.85	6.60
Najas guadalupensis										0.04	0.04	0.04	0.45	0.03	3.70	2.08
Periphyton				0.38		0.25		0.15		0.36	1.14	1.15	11.61	0.05	7.41	9.51
Pistia stratiotes									0.05		0.05	0.05	0.52	0.01	1.85	1.18
Potamogeton sp.		0.51	0.57	2.06	0.91			0.07			4.12	4.16	41.89	0.03	3.70	22.80
Salvinia molesta									0.05		0.05	0.05	0.52	0.01	1.85	1.18
Saururus cernuus		0.00									0.00	0.00	0.03	0.19	27.78	13.90
Scirpus sp.			0.02								0.02	0.02	0.20	0.01	1.85	1.03
Sedge				0.03							0.03	0.03	0.31	0.01	1.85	1.08
Typha latifolia				0.27			0.01				0.28	0.29	2.89	0.03	3.70	3.30
Total	0.10	0.51	1.22	3.39	0.93	0.27	0.06	0.51	1.21	1.65	9.84	9.94	100.00	0.68	100.00	100.00
canopy	2.96	2.60				6.46				0.02	12.05	12.16		0.31		
organic sediment	0.77	1.05	0.78	0.05	1.37	0.47	0.55	1.42	0.41	0.15	7.03	7.09		0.39		
sand	8.74	8.14	2.35	11.64	10.39	12.00	6.24	5.92	8.00	10.72	84.14	84.91		0.95		
wood debris	0.37	0.09					0.69				1.14	1.15		0.09		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 9.9-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 1 (5/3/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cladium jamaicense								0.10	0.10	1.03	100.00	0.13	100.00	100.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	1.03	100.00	0.13	100.00	100.00
canopy	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	2.96	30.00		1.00		
organic sediment	0.29	0.36	0.04					0.08	0.77	7.76		0.50		
sand	0.95	0.87	1.07	1.05	1.18	1.24	1.24	1.15	8.74	88.50		1.00		
wood debris			0.13	0.19	0.06				0.37	3.74		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 8.7-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 2

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Potamogeton sp.	0.51								0.51	5.87	99.40	0.13	50.00	74.70
Saururus cernuus	0.003								0.00	0.04	0.60	0.13	50.00	25.30
Total	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	5.90	100.00	0.25	100.00	100.00
canopy	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	2.60	30.00		1.00		
organic sediment	0.54	0.23				0.07	0.11	0.11	1.05	12.14		0.63		
sand	0.54	0.86	1.08	1.08	1.08	1.55	0.97	0.97	8.14	94.02		1.00		
wood debris						0.08	0.01		0.09	1.00		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 9.8-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 3

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Green Fil. Algae - Benthic	0.19	0.30	0.14						0.62	6.36	51.28	0.38	37.50	44.39
Potamogeton sp.			0.05	0.38	0.14	0.003			0.57	5.84	47.08	0.50	50.00	48.54
Scirpus sp.	0.02								0.02	0.20	1.64	0.13	12.50	7.07
Total	0.21	0.30	0.19	0.38	0.14	0.00	0.00	0.00	1.22	12.40	100.00	1.00	100.00	100.00
organic sediment	0.08					0.28	0.42	0.01	0.78	7.98		0.50		
sand	0.69	0.01				0.65	0.98	0.02	2.35	23.90		0.63		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 11.2-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 4

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic Algae						0.04			0.04	0.34	1.12	0.13	8.33	4.73
Eichhornia crassipes								0.22	0.22	2.00	6.60	0.13	8.33	7.47
Hydrocotyle umbellata	0.01								0.01	0.07	0.22	0.13	8.33	4.28
Mikania scandens								0.37	0.37	3.29	10.87	0.13	8.33	9.60
Periphyton	0.38								0.38	3.40	11.25	0.13	8.33	9.79
Potamogeton sp.	0.22	0.98	0.45	0.40				0.01	2.06	18.43	60.94	0.63	41.67	51.30
Sedge	0.03								0.03	0.27	0.90	0.13	8.33	4.62
Typha latifolia								0.27	0.27	2.45	8.10	0.13	8.33	8.22
Total	0.63	0.98	0.45	0.40	0.00	0.04	0.00	0.88	3.39	30.25	100.00	1.50	100.00	100.00

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 11.0-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 5

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Hydrocotyle umbellata	0.02								0.02	0.14	1.64	0.13	16.67	9.16
Potamogeton sp.	0.11	0.47	0.23		0.02			0.09	0.91	8.29	98.36	0.63	83.33	90.84
Total	0.13	0.47	0.23	0.00	0.02	0.00	0.00	0.09	0.93	8.43	100.00	0.75	100.00	100.00
organic sediment	0.03		0.18	0.69			0.32	0.17	1.37	12.49		0.63		
sand	1.63	1.37	1.20	0.69	1.37	1.37	1.37	1.37	10.39	94.43		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 10.8-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 6

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cladium jamaicense	0.01								0.01	0.12	4.73	0.13	50.00	27.36
Periphyton	0.25								0.25	2.36	95.27	0.13	50.00	72.64
Total	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	2.48	100.00	0.25	100.00	100.00
canopy	0.808	0.808	0.808	0.808	0.808	0.808	0.808	0.808	6.46	60.00		1.00		
organic sediment						0.01	0.03	0.44	0.47	4.41		0.38		
sand	1.00	1.25	1.25	1.25	1.25	1.61	2.48	1.91	12.00	111.39		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 9.0-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 7

Species	Segment								Total Linear	Cover		Frequency		Importance
	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Bacopa sp.								0.01	0.01	0.13	18.61	0.13	25.00	21.80
Eichhornia crassipes								0.03	0.03	0.33	48.84	0.13	25.00	36.92
Hydrocotyle umbellata								0.01	0.01	0.11	16.28	0.13	25.00	20.64
Typha latifolia								0.01	0.01	0.11	16.28	0.13	25.00	20.64
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.68	100.00	0.50	100.00	100.00
organic sediment	0.06	0.00					0.00	0.49	0.55	6.12		0.50		
sand	1.07	0.02	1.12	1.12	1.12	1.12	0.04	0.63	6.24	69.41		1.00		
wood debris		0.66	0.02						0.69	7.63		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 7.3-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 8

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cladium jamaicense	0.15							0.04	0.19	2.61	37.47	0.25	40.00	38.74
Hydrocotyle umbellata								0.10	0.10	1.38	19.85	0.13	20.00	19.92
Periphyton								0.15	0.15	2.08	29.77	0.13	20.00	24.89
Potamogeton sp.	0.07								0.07	0.90	12.90	0.13	20.00	16.45
Total	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.51	6.97	100.00	0.63	100.00	100.00
organic sediment	0.83	0.59							1.42	19.31		0.25		
sand	0.09	0.33	0.92	0.92	0.92	0.92	0.92	0.92	5.92	80.69		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 10.5-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 9

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cladium jamaicense	0.05							0.01	0.06	0.58	5.06	0.25	25.00	15.03
Eichhornia crassipes	0.79	0.14							0.93	8.82	77.04	0.25	25.00	51.02
Ferns								0.10	0.10	0.96	8.42	0.13	12.50	10.46
Juncus sp.		0.01							0.01	0.12	1.06	0.13	12.50	6.78
Pistia stratiotes		0.05							0.05	0.48	4.21	0.13	12.50	8.36
Salvinia molesta		0.05							0.05	0.48	4.21	0.13	12.50	8.36
Total	0.84	0.25	0.00	0.00	0.00	0.00	0.00	0.11	1.21	11.45	100.00	1.00	100.00	100.00
organic sediment		0.15						0.25	0.41	3.86		0.25		
sand		1.09	1.32	1.32	1.32	1.32	1.32	0.33	8.00	75.90		0.88		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 10.9-m LINE INTERCEPT TRANSECT

JC- SEG1 - TRANSECT 10

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cladium jamaicense								0.01	0.01	0.07	0.46	0.13	16.67	8.56
Eichhornia crassipes	0.13								0.13	1.17	7.69	0.13	16.67	12.18
Myrica cerifera	1.12								1.12	10.28	67.64	0.13	16.67	42.15
Najas guadalupensis							0.02	0.02	0.04	0.41	2.69	0.25	33.33	18.01
Periphyton								0.36	0.36	3.27	21.52	0.13	16.67	19.09
Total	1.24	0.00	0.00	0.00	0.00	0.00	0.02	0.39	1.65	15.20	100.00	0.75	100.00	100.00
canopy	0.02								0.02	0.21		0.13		
organic sediment	0.15								0.15	1.40		0.13		
sand	1.20	1.36	1.36	1.36	1.36	1.36	1.36	1.36	10.72	98.58		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER

ASC- SEG1 TRANSECTS 1 - 9 (5/3/05 & 5/24/05)

	Linear Distance (m)									Total					
	Transect									Linear	Cover		Frequency		Importance
Species	1	2	3	4	5	6	7	8	9	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic algae	3.73									3.73	0.57	0.73	0.04	1.64	1.18
Ceratophyllum demersum		0.18	0.25		0.01					0.44	0.07	0.09	0.04	1.64	0.86
Cicuta mexicana		4.78	3.05	68.53	3.60	10.97	3.34	9.28		103.55	15.77	20.19	0.31	12.02	16.11
Cladium jamaicense		0.64								0.64	0.10	0.12	0.03	1.09	0.61
Eichhornia crassipes		0.09	0.76	5.60	3.90	5.60		0.47		16.43	2.50	3.20	0.19	7.65	5.43
Emergent Grass							0.08	0.14		0.22	0.03	0.04	0.04	1.64	0.84
Filamentous Algae					7.90					7.90	1.20	1.54	0.06	2.19	1.86
Hibiscus sp.	1.65									1.65	0.25	0.32	0.03	1.09	0.71
Hydrocotyle umbellata	1.68	6.26	0.08	8.40	3.61	2.80	4.73	0.24		27.80	4.23	5.42	0.40	15.85	10.63
Ludwigia peruviana	1.65									1.65	0.25	0.32	0.03	1.09	0.71
Mikania scandens							3.33			3.33	0.51	0.65	0.01	0.55	0.60
Myrica cerifera		0.50								0.50	0.08	0.10	0.03	1.09	0.60
Nuphar lutea		0.25	0.86	5.60		3.28				9.99	1.52	1.95	0.18	7.10	4.53
Pistia stratiotes		1.05	0.15			0.38				1.59	0.24	0.31	0.07	2.73	1.52
Pontederia cordata	1.65	1.48							0.34	3.47	0.53	0.68	0.07	2.73	1.70
Sagittaria latifolia	1.65	1.28								2.93	0.45	0.57	0.06	2.19	1.38
Scirpus sp.	1.65	0.10						0.40		2.15	0.33	0.42	0.08	3.28	1.85
Sedge	1.65									1.65	0.25	0.32	0.03	1.09	0.71
Typha latifolia		0.26			4.31					4.57	0.70	0.89	0.08	3.28	2.08
Vallisneria americana	46.96	36.71	33.38	32.55	32.44	19.27	37.51	42.67	37.00	318.49	48.51	62.11	0.74	28.96	45.54
Vitus sp.		0.10								0.10	0.02	0.02	0.03	1.09	0.56
Total	62.27	53.67	38.54	120.69	55.77	42.30	48.99	53.19	37.34	512.76	78.10	100.00	2.54	100.00	100.00
canopy	3.30	10.04	1.22	9.77	3.60	2.80		4.01	5.00	39.73	6.05		0.29		
organic sediment	2.49		16.91	40.97	3.34		32.29	2.04	37.92	135.97	20.71		0.44		
sand	5.08		4.73	0.64	2.50		7.59	2.04	5.69	28.27	4.31		0.32		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 73.1-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 1 (5/3/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic algae		0.91	1.45	1.37					3.73	5.11	6.00	0.38	12.00	9.00
Hibiscus sp.	1.00	0.65							1.65	2.26	2.65	0.25	8.00	5.32
Hydrocotyle umbellata	1.00	0.65						0.03	1.68	2.30	2.70	0.38	12.00	7.35
Ludwigia peruviana	1.00	0.65							1.65	2.26	2.65	0.25	8.00	5.32
Pontederia cordata	1.00	0.65							1.65	2.26	2.65	0.25	8.00	5.32
Sagittaria latifolia	1.00	0.65							1.65	2.26	2.65	0.25	8.00	5.32
Scirpus sp.	1.00	0.65							1.65	2.26	2.65	0.25	8.00	5.32
Sedge	1.00	0.65							1.65	2.26	2.65	0.25	8.00	5.32
Vallisneria americana		0.01	7.60	7.76	6.76	9.12	9.13	6.58	46.96	64.27	75.41	0.88	28.00	51.70
Total	7.03	5.44	9.05	9.13	6.76	9.12	9.13	6.61	62.27	85.23	100.00	3.13	100.00	100.00
canopy	2.01	1.29							3.30	4.52		0.25		
organic sediment		0.12	0.00		0.38			2.00	2.49	3.41		0.50		
sand		2.23	0.08		1.99	0.02		0.75	5.08	6.95		0.63		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 79.7-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 2 (5/24/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Ceratophyllum demersum				0.18					0.18	0.22	0.33	0.13	2.70	1.52
Cicuta mexicana	1.99	0.71					0.10	1.97	4.78	6.00	8.90	0.50	10.81	9.86
Cladium jamaicense	0.50	0.14							0.64	0.80	1.19	0.25	5.41	3.30
Eichhornia crassipes							0.09		0.09	0.11	0.17	0.13	2.70	1.44
Hydrocotyle umbellata	0.50	0.38	0.50	0.60	0.50	0.50	0.78	2.51	6.26	7.85	11.66	1.00	21.62	16.64
Myrica cerifera							0.00	0.50	0.50	0.63	0.94	0.25	5.41	3.17
Nuphar lutea				0.25					0.25	0.31	0.46	0.13	2.70	1.58
Pistia stratiotes		0.74	0.05					0.26	1.05	1.32	1.95	0.38	8.11	5.03
Pontederia cordata	1.00	0.48							1.48	1.86	2.76	0.25	5.41	4.08
Sagittaria latifolia	1.00	0.28							1.28	1.61	2.39	0.25	5.41	3.90
Scirpus sp.		0.09	0.00						0.10	0.12	0.18	0.25	5.41	2.79
Typha latifolia	0.20	0.06							0.26	0.32	0.48	0.25	5.41	2.94
Vallisneria americana			7.60	6.59	8.96	8.96	4.60		36.71	46.08	68.40	0.63	13.51	40.96
Vitus sp.							0.00	0.10	0.10	0.13	0.19	0.25	5.41	2.80
Total	5.18	2.89	8.15	7.61	9.46	9.46	5.58	5.34	53.67	67.36	100.00	4.63	100.00	100.00
canopy	\	1.99					0.08	7.97	10.04	12.60		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 61.0-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 3 (5/3/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Ceratophyllum demersum						0.25			0.25	0.42	0.66	0.13	7.69	4.18
Cicuta mexicana								3.05	3.05	5.00	7.91	0.13	7.69	7.80
Eichhornia crassipes								0.76	0.76	1.25	1.98	0.13	7.69	4.83
Hydrocotyle umbellata						0.02		0.06	0.08	0.13	0.21	0.25	15.38	7.80
Nuphar lutea						0.86			0.86	1.42	2.24	0.13	7.69	4.97
Pistia stratiotes								0.15	0.15	0.25	0.40	0.13	7.69	4.04
Vallisneria americana	2.59	7.62	7.62	7.62	7.62	0.30			33.38	54.75	86.61	0.75	46.15	66.38
Total	2.59	7.62	7.62	7.62	7.62	1.44	0.00	4.02	38.54	63.21	100.00	1.63	100.00	100.00
canopy	1.22								1.22	2.00		0.13		
organic sediment	3.28					5.85	6.10	1.68	16.91	27.74		0.50		
sand	1.74					1.46	1.52		4.73	7.76		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 69.6-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 4 (5/24/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana	1.33				16.80	16.80	16.80	16.80	68.53	98.46	56.79	0.63	23.81	40.30
Eichhornia crassipes					1.40	1.40	1.40	1.40	5.60	8.05	4.64	0.50	19.05	11.84
Hydrocotyle umbellata					0.57	2.61	2.61	2.61	8.40	12.07	6.96	0.50	19.05	13.00
Nuphar lutea					1.40	1.40	1.40	1.40	5.60	8.05	4.64	0.50	19.05	11.84
Vallisneria americana	7.38	11.31	9.65	4.21					32.55	46.77	26.97	0.50	19.05	23.01
Total	8.71	11.31	9.65	4.21	20.17	22.21	22.21	22.21	120.69	173.39	100.00	2.63	100.00	100.00
canopy	2.61	2.61	1.55					3.00	9.77	14.03		0.50		
organic sediment	8.06	8.70	8.70	8.70	6.80				40.97	58.85		0.63		
sand	0.64								0.64	0.92		0.13		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 64.5-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 5 (5/3/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Ceratophyllum demersum					0.01				0.01	0.01	0.01	0.13	4.00	2.01
Cicuta mexicana						0.38	1.61	1.61	3.60	5.58	6.45	0.38	12.00	9.23
Eichhornia crassipes						0.68	1.61	1.61	3.90	6.06	7.00	0.38	12.00	9.50
Filamentous Algae	0.66	0.71			5.50	1.02			7.90	12.25	14.16	0.50	16.00	15.08
Hydrocotyle umbellata					0.01	0.38	1.61	1.61	3.61	5.60	6.48	0.50	16.00	11.24
Typha latifolia					0.65	0.44	1.61	1.61	4.31	6.69	7.73	0.50	16.00	11.87
Vallisneria americana	5.29	7.35	8.06	5.49	2.56	3.68			32.44	50.30	58.16	0.75	24.00	41.08
Total	5.95	8.06	8.06	5.49	8.73	6.58	6.45	6.45	55.77	86.49	100.00	3.13	100.00	100.00
canopy						0.38	1.61	1.61	3.60	5.58	6.45	0.38	12.00	9.23
organic sediment	2.11			0.88		0.35			3.34	5.18		0.38		
sand				1.68		0.82			2.50	3.88		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 71.6-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 6 (5/24/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana	5.37				0.23	1.79	1.79	1.79	10.97	15.33	25.94	0.63	20.83	23.39
Eichhornia crassipes					0.23	1.79	1.79	1.79	5.60	7.82	13.24	0.50	16.67	14.95
Hydrocotyle umbellata					0.12	0.89	0.89	0.89	2.80	3.91	6.62	0.50	16.67	11.64
Nuphar lutea	0.23	0.96	0.34		0.41	0.45	0.45	0.45	3.28	4.58	7.74	0.88	29.17	18.46
Pistia stratiotes	0.38								0.38	0.54	0.91	0.13	4.17	2.54
Vallisneria americana			4.21	8.05	7.00				19.27	26.93	45.55	0.38	12.50	29.03
Total	5.99	0.96	4.55	8.05	8.00	4.92	4.92	4.92	42.30	59.11	100.00	3.00	100.00	100.00
canopy					0.12	0.89	0.89	0.89	2.80	3.91		0.50		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 81.6-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 7 (5/3/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana	0.01							3.33	3.34	4.09	6.82	0.25	14.29	10.55
Emergent Grass	0.08								0.08	0.10	0.17	0.13	7.14	3.65
Hydrocotyle umbellata	0.76						0.64	3.33	4.73	5.79	9.66	0.38	21.43	15.54
Mikania scandens								3.33	3.33	4.08	6.80	0.13	7.14	6.97
Vallisneria americana	3.28	10.20	10.20	4.10	3.36	5.87	0.49		37.51	45.95	76.56	0.88	50.00	63.28
Total	4.13	10.20	10.20	4.10	3.36	5.87	1.13	10.00	48.99	60.02	100.00	1.75	100.00	100.00
organic sediment	8.03			7.01	3.64	5.06	8.34	0.20	32.29	39.56		0.75		
sand	0.86			0.53	4.18	0.56	1.45		7.59	9.30		0.63		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 80.8-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 8 (5/24/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana	8.64							0.64	9.28	11.47	17.44	0.25	13.33	15.39
Eichhornia crassipes								0.47	0.47	0.58	0.88	0.13	6.67	3.77
Emergent Grass							0.08	0.06	0.14	0.17	0.25	0.25	13.33	6.79
Hydrocotyle umbellata								0.24	0.24	0.29	0.44	0.13	6.67	3.56
Scirpus sp.	0.40	0.00							0.40	0.50	0.75	0.25	13.33	7.04
Vallisneria americana		7.31	9.10	9.10	6.71	5.05	4.31	1.09	42.67	52.78	80.23	0.88	46.67	63.45
Total	9.04	7.31	9.10	9.10	6.71	5.05	4.39	2.49	53.19	65.79	100.00	1.88	100.00	100.00
canopy	2.00							2.01	4.01	4.96		0.25		
organic sediment	1.05	0.99							2.04	2.53		0.25		
sand	1.05	0.99							2.04	2.53		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 74.7-m LINE INTERCEPT TRANSECT

ASC- SEG1 - TRANSECT 9 (5/3/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Pontederia cordata	0.34								0.34	0.45	0.90	0.13	11.11	6.01
Vallisneria americana	2.36	9.18	5.94	4.20	3.64	9.03	2.34	0.32	37.00	49.51	99.10	1.00	88.89	93.99
Total	2.69	9.18	5.94	4.20	3.64	9.03	2.34	0.32	37.34	49.96	100.00	1.13	100.00	100.00
canopy	2.50							2.50	5.00	6.69		0.25		
organic sediment	5.88	0.32	4.24	4.60	5.58	0.42	9.34	7.56	37.92	50.75		1.00		
sand	0.80		0.78	0.84	1.49			1.79	5.69	7.61		0.63		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER

WR- SEG1 TRANSECTS 1 - 10 (5/9/05)

	Linear Distance (m)										Total					
	Transect										Linear	Cover		Frequency		Importance
Species	1	2	3	4	5	6	7	8	9	10	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides			0.23								0.23	0.07	0.14	0.01	0.90	0.52
Benthic Algae		117.3									117.27	35.41	70.72	0.11	7.21	38.96
Cicuta mexicana				9.60							9.60	2.90	5.79	0.06	3.60	4.70
Eichhornia crassipes				1.80							1.80	0.54	1.09	0.06	3.60	2.34
Emergent Grass - unidentified				0.60							0.60	0.18	0.36	0.06	3.60	1.98
Ferns			1.67								1.67	0.50	1.01	0.04	2.70	1.85
Filamentous Algae	4.38	0.85									5.23	1.58	3.16	0.13	8.11	5.63
Floating Algae		2.46									2.46	0.74	1.48	0.11	7.21	4.35
Hydrocotyle ranunculoides						0.27			1.35	0.18	1.80	0.54	1.09	0.07	4.50	2.80
Hydrocotyle umbellata		0.27	2.65	0.60	0.07		0.00				3.59	1.08	2.16	0.17	10.81	6.49
Lemna sp.		0.30	2.18		0.20		0.00				2.68	0.81	1.61	0.10	6.31	3.96
Mikania scandens			1.67	0.60				0.11			2.38	0.72	1.44	0.11	7.21	4.32
Myrica cerifera		1.52	1.68	0.40							3.60	1.09	2.17	0.08	5.41	3.79
Najas guadalupensis		4.80									4.80	1.45	2.89	0.03	1.80	2.35
Nuphar lutea	0.48	1.23	0.11	0.09	0.75		0.28				2.94	0.89	1.77	0.21	13.51	7.64
Pistia stratiotes		1.00	0.11			0.27	0.30	0.23	1.02	0.06	3.00	0.90	1.81	0.15	9.91	5.86
Urtica dioica			1.68		0.51						2.19	0.66	1.32	0.06	3.60	2.46
Total	4.86	129.70	11.97	13.69	1.53	0.55	0.58	0.34	2.37	0.24	165.83	50.07	100.00	1.54	100.00	100.00
canopy					5.49	7.01	4.83	9.39	14.63	8.94	50.28	15.18		0.25		
subcanopy			0.47	0.40	0.26	0.04	0.00		0.23		1.39	0.42		0.10		
organic sediment			19.66	9.43	20.73	19.61	23.39	19.66	19.87	19.66	152.01	45.89		0.69		
floating organic mat										0.36	0.36	0.11		0.00		
sand	16.35			6.11		1.55			1.01		25.02	7.55		0.24		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 20.7-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 1 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Filamentous Algae	0.03	0.03	0.03	0.64	0.78	0.78	0.81	1.30	4.38	21.13	90.08	1.00	88.89	89.48
Nuphar lutea								0.48	0.48	2.33	9.92	0.13	11.11	10.52
Total	0.03	0.03	0.03	0.64	0.78	0.78	0.81	1.78	4.86	23.46	100.00	1.13	100.00	100.00
sand	2.56	2.56	2.56	1.95	1.81	1.81	1.78	1.30	16.35	78.87		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 123.0-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 2 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic Algae	9.65	15.38	15.38	15.38	15.38	15.38	15.38	15.38	117.27	95.34	90.42	1.00	24.24	57.33
Filamentous Algae	0.85								0.85	0.69	0.66	0.13	3.03	1.84
Hydrocotyle umbellata	0.02							0.25	0.27	0.22	0.20	0.25	6.06	3.13
Lemna sp.	0.20							0.10	0.30	0.24	0.23	0.25	6.06	3.14
Myrica cerifera	1.52								1.52	1.24	1.18	0.13	3.03	2.10
Najas guadalupensis	1.80							3.00	4.80	3.90	3.70	0.25	6.06	4.88
Nuphar lutea	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	1.23	1.00	0.95	1.00	24.24	12.60
Floating Algae	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	2.46	2.00	1.90	1.00	24.24	13.07
Pistia stratiotes								1.00	1.00	0.81	0.77	0.13	3.03	1.90
Total	14.50	15.84	15.84	15.84	15.84	15.84	15.84	20.19	129.70	105.45	100.00	4.13	100.00	100.00

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 29.7-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 3 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	0.23								0.23	0.77	1.91	0.13	4.17	3.04
Ferns						0.43	0.62	0.62	1.67	5.62	13.92	0.38	12.50	13.21
Hydrocotyle umbellata	0.02					1.39	0.62	0.62	2.65	8.93	22.13	0.50	16.67	19.40
Lemna sp.	0.46					0.48	0.62	0.62	2.18	7.34	18.19	0.50	16.67	17.43
Mikania scandens						0.43	0.62	0.62	1.67	5.62	13.92	0.38	12.50	13.21
Nuphar lutea			0.01		0.10				0.11	0.37	0.92	0.25	8.33	4.62
Urtica dioica						0.44	0.62	0.62	1.68	5.66	14.03	0.38	12.50	13.26
Pistia stratiotes	0.11								0.11	0.39	0.95	0.13	4.17	2.56
Myrica cerifera						0.44	0.62	0.62	1.68	5.66	14.03	0.38	12.50	13.26
Total	0.82	0.00	0.01	0.00	0.10	3.62	3.71	3.71	11.97	40.36	100.00	3.00	100.00	100.00
subcanopy	0.47								0.47	1.58		0.13		
organic sediment	3.71	3.71	3.71	3.71	3.71	1.12			19.66	66.28		0.75		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 27.8-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 4 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Hydrocotyle umbellata					0.08	0.17	0.17	0.17	0.60	2.16	4.38	0.50	17.39	10.89
Mikania scandens					0.08	0.17	0.17	0.17	0.60	2.16	4.38	0.50	17.39	10.89
Nuphar lutea				0.09					0.09	0.32	0.65	0.13	4.35	2.50
Emergent Grass - unidentified					0.08	0.17	0.17	0.17	0.60	2.16	4.38	0.50	17.39	10.89
Cicuta mexicana					1.26	2.78	2.78	2.78	9.60	34.53	70.15	0.50	17.39	43.77
Eichhornia crassipes					0.24	0.52	0.52	0.52	1.80	6.48	13.15	0.50	17.39	15.27
Myrica cerifera	0.35	0.05							0.40	1.43	2.90	0.25	8.70	5.80
Total	0.35	0.05	0.00	0.09	1.73	3.82	3.82	3.82	13.69	49.23	100.00	2.88	100.00	100.00
subcanopy	0.35	0.05							0.40	1.43		0.25		
organic sediment	3.47	3.23	1.74	0.83	0.16				9.43	33.94		0.63		
sand		0.25	1.74	2.64	1.48				6.11	21.98		0.50		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 20.7-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 5 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Lemna sp.		0.20							0.20	0.98	13.25	0.13	16.67	14.96
Hydrocotyle umbellata							0.02	0.05	0.07	0.35	4.75	0.25	33.33	19.04
Nuphar lutea		0.11	0.64						0.75	3.62	48.87	0.25	33.33	41.10
Urtica dioica	0.51								0.51	2.45	33.13	0.13	16.67	24.90
Total	0.51	0.32	0.64	0.00	0.00	0.00	0.02	0.05	1.53	7.40	100.00	0.75	100.00	100.00
canopy						0.30	2.59	2.59	5.49	26.47		0.38		
subcanopy	0.26								0.26	1.25		0.13		
organic sediment	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	20.73	100.00		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 21.2-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 6 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Hydrocotyle ranunculoides							0.04	0.23	0.27	1.29	50.00	0.25	50.00	50.00
Pistia stratiotes							0.04	0.23	0.27	1.29	50.00	0.25	50.00	50.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.46	0.55	2.58	100.00	0.50	100.00	100.00
canopy						1.72	2.64	2.64	7.01	33.13		0.38		
subcanopy	0.04								0.04	0.20		0.13		
organic sediment	2.64	2.64	2.02	1.72	2.64	2.64	2.64	2.64	19.61	92.68		1.00		
sand			0.63	0.92					1.55	7.32		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 23.4-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 7 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Lemna sp.						0.11	0.58	0.58	1.28	5.47	20.41	0.38	30.00	25.21
Hydrocotyle umbellata						0.32	2.05	2.05	4.41	18.85	70.31	0.38	30.00	50.16
Nuphar lutea			0.28						0.28	1.19	4.46	0.13	10.00	7.23
Pistia stratiotes						0.01	0.15	0.15	0.30	1.29	4.82	0.38	30.00	17.41
Total	0.00	0.00	0.28	0.00	0.00	0.44	2.78	2.78	6.27	26.81	100.00	1.25	100.00	100.00
canopy	2.92	1.90							4.83	20.63		0.25		
subcanopy	0.18	0.03							0.21	0.88	3.28	0.25	20.00	11.64
organic sediment	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	23.39	100.00		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 19.7-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 8 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Mikania scandens	0.11								0.11	0.58	33.33	0.13	50.00	41.67
Pistia stratiotes	0.23								0.23	1.16	66.67	0.13	50.00	58.33
Total	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	1.74	100.00	0.25	100.00	100.00
canopy				1.52	1.97	1.97	1.97	1.97	9.39	47.75		0.63		
organic sediment	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	19.66	100.00		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 25.5-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 9 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Hydrocotyle ranunculoides						0.07	0.64	0.64	1.35	5.29	56.84	0.38	50.00	53.42
Pistia stratiotes						0.02	0.37	0.64	1.02	4.02	43.16	0.38	50.00	46.58
Total	0.00	0.00	0.00	0.00	0.00	0.09	1.00	1.27	2.37	9.31	100.00	0.75	100.00	100.00
canopy	3.18	3.18	3.18	3.18	1.91				14.63	57.49		0.63		
subcanopy							0.07	0.16	0.23	0.90		0.25		
organic sediment	3.18	3.18	2.81	2.55	3.18	3.18	1.79		19.87	78.06		0.88		
sand			0.37	0.64	0.01				1.01	3.97		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 19.7-m LINE INTERCEPT TRANSECT

WR- SEG1 - TRANSECT 10 (5/9/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Hydrocotyle ranunculoides		0.06					0.05	0.07	0.18	0.93	76.60	0.38	75.00	75.80
Pistia stratiotes		0.06							0.06	0.28	23.40	0.13	25.00	24.20
Total	0.00	0.11	0.00	0.00	0.00	0.00	0.05	0.07	0.24	1.21	100.00	0.50	100.00	100.00
canopy	1.72	1.72	0.29			0.29	2.46	2.46	8.94	45.48		0.75		
floating organic mat							0.36		0.36	1.81		0.13		
organic sediment	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	19.66	100.00		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER

WR- SEG2 TRANSECTS 1 - 10 (5/10/05 & 5/26/05)

	Linear Distance (m)										Total					
	Transect										Linear	Cover		Frequency		Importance
Species	1	2	3	4	5	6	7	8	9	10	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	15.98	0.05	5.89	20.23	0.83	0.75	0.35	15.00	2.24		61.32	4.85	9.19	0.36	10.57	9.88
Azolla caroliniana		1.5							1.96		3.46	0.27	0.52	0.03	0.81	0.67
Cephalanthus occidentalis					0.25						0.25	0.02	0.04	0.01	0.41	0.22
Cicuta mexicana	2.80	4.68			3.50	0.30			0.13		11.41	0.90	1.71	0.07	2.03	1.87
Eichhornia crassipes	2.11	9.74	0.32	8.19	10.68	1.25	2.63	1.70			36.62	2.89	5.49	0.36	10.57	8.03
Emergent Grass - unidentified		0.05					0.03				0.08	0.01	0.01	0.03	0.81	0.41
Eupatorium capillifolium							0.09				0.09	0.01	0.01	0.01	0.41	0.21
Hydrocotyle ranunculoides		1.27		0.37		1.16	6.50		7.16		16.45	1.30	2.47	0.18	5.28	3.87
Hydrocotyle umbellata	3.66		3.24	0.12	1.28	1.45		6.26	6.20	0.03	22.22	1.76	3.33	0.22	6.50	4.92
Lemna sp.	1.39	3.22	0.28	0.70	0.15	0.34	0.55	0.01	1.34		7.97	0.63	1.19	0.32	9.35	5.27
Ludwigia peruviana									3.10		3.10	0.24	0.46	0.04	1.22	0.84
Mikania scandens						3.51					3.51	0.28	0.53	0.04	1.22	0.87
Myrica cerifera					0.25					0.43	0.68	0.05	0.10	0.01	0.41	0.25
Najas guadalupensis		1.60		17.47		1.68					20.74	1.64	3.11	0.11	3.25	3.18
Nitella sp.	22.93	13.51	4.31	21.13	17.62	2.06	4.70	6.38		0.01	92.64	7.32	13.89	0.42	12.20	13.04
Nuphar lutea	0.59	0.09	0.66	3.94	1.51				6.79		13.58	1.07	2.04	0.25	7.32	4.68
Pistia stratiotes		0.75				1.44		0.06	0.07		2.32	0.18	0.35	0.06	1.63	0.99
Pontederia cordata		5.25	1.52	0.08			0.30				7.15	0.57	1.07	0.08	2.44	1.76
Sedge							0.05				0.05	0.00	0.01	0.01	0.41	0.21
Toxicodendron radicans			2.80								2.80	0.22	0.42	0.01	0.41	0.41
Typha latifolia		0.03						28.80			28.83	2.28	4.32	0.08	2.44	3.38
Unknown SAV						0.50					0.50	0.04	0.07	0.01	0.41	0.24
Vallisneria americana	53.63	57.85	93.68	0.70	48.48	53.02	24.08	0.02			331.46	26.19	49.68	0.68	19.92	34.80
Total	103.09	99.59	112.70	72.92	84.55	67.43	39.27	58.22	28.97	0.46	667.21	52.72	100.00	3.42	100.00	100.00
canopy		9.00	13.25	1.94	43.95	12.83	0.64		0.41		82.03	6.48		0.22		
organic sediment	71.78	95.44	54.43	53.52	64.78	22.82	44.36	18.03	38.37	42.18	505.70	39.96		0.89		
sand	49.78	21.66	85.78	48.97	0.00	68.79	75.51	24.80	36.46	20.07	431.83	34.12		0.83		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 135.6-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 1 (5/10/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	3.38							12.60	15.98	11.78	15.50	0.25	6.45	10.98
Hydrocotyle umbellata	3.38							0.28	3.66	2.70	3.55	0.25	6.45	5.00
Lemna sp.	0.11	0.33	0.21			0.23	0.40	0.12	1.39	1.03	1.35	0.75	19.35	10.35
Nitella sp.	0.31	4.46	4.88	5.27	7.78	0.23			22.93	16.91	22.24	0.75	19.35	20.80
Nuphar lutea					0.59				0.59	0.44	0.58	0.13	3.23	1.90
Vallisneria americana	8.16	5.20	6.82	4.45	5.04	9.84	11.46	2.66	53.63	39.54	52.02	1.00	25.81	38.91
Cicuta mexicana								2.80	2.80	2.06	2.72	0.13	3.23	2.97
Eichhornia crassipes	0.14	0.23			0.20	0.74	0.80		2.11	1.55	2.04	0.63	16.13	9.09
Total	15.47	10.22	11.91	9.72	13.61	11.04	12.66	18.45	103.09	76.01	100.00	3.88	100.00	100.00
organic sediment	8.80	3.39	11.23	6.74	10.35	12.43	15.90	2.95	71.78	52.93		1.00		
sand	8.16	13.56	5.73	10.21	6.61	4.47	1.05		49.78	36.71		0.88		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 152.2-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 2 (5/26/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides					0.04		0.01		0.05	0.03	0.05	0.25	7.14	3.60
Azolla caroliniana	1.50								1.50	0.99	1.51	0.13	3.57	2.54
Hydrocotyle ranunculoides	1.25		0.01						1.27	0.83	1.27	0.25	7.14	4.21
Lemna sp.	3.04		0.18						3.22	2.11	3.23	0.25	7.14	5.19
Najas guadalupensis			1.60						1.60	1.05	1.60	0.13	3.57	2.59
Nitella sp.		1.58	1.91	3.41	6.61				13.51	8.88	13.57	0.50	14.29	13.93
Nuphar lutea			0.01	0.08					0.09	0.06	0.09	0.25	7.14	3.61
Pontederia cordata	0.75							4.50	5.25	3.45	5.27	0.25	7.14	6.21
Typha latifolia				0.03					0.03	0.02	0.03	0.13	3.57	1.80
Emergent Grass - unidentified				0.05					0.05	0.04	0.05	0.13	3.57	1.81
Vallisneria americana	0.43	11.99	10.24		3.15	14.37	17.68		57.85	38.00	58.09	0.75	21.43	39.76
Cicuta mexicana	4.68								4.68	3.08	4.70	0.13	3.57	4.14
Eichhornia crassipes				9.17	0.57				9.74	6.40	9.78	0.25	7.14	8.46
Pistia stratiotes	0.75								0.75	0.49	0.75	0.13	3.57	2.16
Total	12.40	13.57	13.95	12.74	10.37	14.37	17.69	4.50	99.59	65.42	100.00	3.50	100.00	100.00
Canopy	4.50							7.50	9.00	5.91		0.25		
organic sediment	4.03	19.03	12.66	10.97	13.93	15.49	17.96	1.38	95.44	62.70	95.83	1.00	28.57	62.20
sand			6.37	3.19	4.84	3.54	1.07	2.65	21.66	14.23	21.75	0.75	21.43	21.59

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 143.7-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 3 (5/10/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	5.26				0.32			0.30	5.89	4.10	5.23	0.38	11.54	8.38
Hydrocotyle umbellata	0.66				2.58				3.24	2.25	2.87	0.25	7.69	5.28
Lemna sp.				0.07			0.21		0.28	0.20	0.25	0.25	7.69	3.97
Nitella sp.		0.71	0.13	2.24	0.76	0.47			4.31	3.00	3.82	0.63	19.23	11.53
Nuphar lutea	0.66								0.66	0.46	0.58	0.13	3.85	2.21
Pontederia cordata	0.60	0.92							1.52	1.06	1.35	0.25	7.69	4.52
Toxicodendron radicans								2.80	2.80	1.95	2.48	0.13	3.85	3.17
Vallisneria americana	2.10	11.48	12.78	11.23	9.56	22.53	16.17	7.82	93.68	65.19	83.13	1.00	30.77	56.95
Eichhornia crassipes				0.25			0.06		0.32	0.22	0.28	0.25	7.69	3.99
Total	9.28	13.12	12.91	13.80	13.23	23.00	16.44	10.93	112.70	78.42	100.00	3.25	100.00	100.00
canopy	4.04	1.29						7.92	13.25	9.22		0.38		
subcanopy	2.18	1.48							3.66	2.55		0.25		
organic sediment	3.59	3.59	7.87	8.98	9.92	7.14	8.98	4.35	54.43	37.87		1.00		
sand	14.37	14.37	10.09	8.98	8.05	10.83	8.98	10.11	85.78	59.69		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 139.3-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 4 (5/26/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	16.54	2.62				1.05	0.01		20.23	14.52	27.74	0.50	13.33	20.54
Hydrocotyle ranunculoides			0.31					0.05	0.37	0.26	0.50	0.25	6.67	3.58
Hydrocotyle umbellata		0.12							0.12	0.08	0.16	0.13	3.33	1.75
Lemna sp.			0.02			0.68			0.70	0.50	0.96	0.25	6.67	3.81
Najas guadalupensis			1.13	8.33	6.17	1.05	0.79		17.47	12.54	23.95	0.63	16.67	20.31
Nitella sp.		6.08	14.59				0.47		21.13	15.17	28.98	0.38	10.00	19.49
Nuphar lutea		1.13	1.99				0.48	0.35	3.94	2.83	5.41	0.50	13.33	9.37
Pontederia cordata								0.08	0.08	0.05	0.10	0.13	3.33	1.72
Vallisneria americana				0.02		0.27	0.41	0.01	0.70	0.50	0.96	0.50	13.33	7.15
Eichhornia crassipes		1.05	0.04			6.66		0.44	8.19	5.88	11.24	0.50	13.33	12.28
Total	16.54	11.00	18.07	8.34	6.17	9.71	2.16	0.92	72.92	52.35	100.00	3.75	100.00	100.00
canopy	0.87	0.13						0.94	1.94	1.39		0.38		
organic sediment		2.32	1.41	9.61	5.28	10.14	11.35	13.40	53.52	38.42		0.88		
sand		11.60	1.41	7.80	12.13	7.28	6.06	2.69	48.97	35.16		0.88		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 145.5-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 5 (5/10/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	0.49	0.16	0.14	0.05					0.83	0.57	0.98	0.50	12.90	6.94
Cephalanthus occidentalis								0.25	0.25	0.17	0.30	0.13	3.23	1.76
Hydrocotyle umbellata		1.28							1.28	0.88	1.51	0.13	3.23	2.37
Lemna sp.		0.10	0.06						0.15	0.10	0.18	0.25	6.45	3.32
Nitella sp.	3.77	3.63	1.12	8.09	1.01				17.62	12.11	20.84	0.63	16.13	18.48
Nuphar lutea			0.66	0.08	0.22	0.01		0.54	1.51	1.04	1.79	0.63	16.13	8.96
Vallisneria americana	10.79	4.05	5.28		4.28	6.40	15.55	2.13	48.48	33.32	57.33	0.88	22.58	39.96
Cicuta mexicana								3.50	3.50	2.41	4.14	0.13	3.23	3.68
Eichhornia crassipes	0.24	0.47	4.39	5.58					10.68	7.34	12.63	0.50	12.90	12.77
Myrica cerifera								0.25	0.25	0.17	0.30	0.13	3.23	1.76
Total	15.29	9.69	11.64	13.79	5.51	6.41	15.55	6.68	84.55	58.11	100.00	3.88	100.00	100.00
canopy	9.53	12.73	12.73	8.96					43.95	30.21		0.50		
subcanopy	3.05	3.64	3.64	2.56					12.89	8.86		0.50		
organic sediment	14.30	4.75	9.27	5.75	5.56	4.72	14.55	5.86	64.78	44.52		1.00		
sand	3.89	13.44	8.92	12.44	12.62	13.47	3.64	7.32		0.00		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 132.1-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 6 (5/10/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	0.01	0.73	0.01						0.75	0.57	1.12	0.38	9.68	5.40
Hydrocotyle ranunculoides			1.16						1.16	0.87	1.71	0.13	3.23	2.47
Hydrocotyle umbellata		1.14						0.30	1.45	1.09	2.14	0.25	6.45	4.30
Lemna sp.		0.02					0.25	0.07	0.34	0.25	0.50	0.38	9.68	5.09
Mikania scandens	0.97	1.52	1.02						3.51	2.65	5.20	0.38	9.68	7.44
Nitella sp.		0.91	0.63	0.51					2.06	1.56	3.05	0.38	9.68	6.36
Najas guadalupensis				0.56	1.12				1.68	1.27	2.49	0.25	6.45	4.47
Unknown SAV				0.50					0.50	0.38	0.74	0.13	3.23	1.98
Vallisneria americana	8.51	0.93	8.42	5.26	8.60	11.93	7.53	1.84	53.02	40.13	78.63	1.00	25.81	52.22
Cicuta mexicana			0.30						0.30	0.22	0.44	0.13	3.23	1.83
Eichhornia crassipes		0.13	0.01					1.11	1.25	0.94	1.85	0.38	9.68	5.76
Pistia stratiotes								1.44	1.44	1.09	2.14	0.13	3.23	2.68
Total	9.48	5.38	11.55	6.83	9.72	11.93	7.78	4.77	67.43	51.04	100.00	3.88	100.00	100.00
canopy	3.78							9.04	12.83	9.71		0.25		
organic sediment	2.89	3.30	3.30	3.30	0.49		3.89	5.64	22.82	17.27		0.88		
sand	11.55	13.21	13.21	13.21	1.97		9.08	6.56	68.79	52.06		0.88		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 119.8-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 7 (5/10/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	0.18	0.17							0.35	0.29	0.89	0.25	9.09	4.99
Eupatorium capillifolium								0.09	0.09	0.08	0.23	0.13	4.55	2.39
Hydrocotyle ranunculoides	2.33	3.89						0.28	6.50	5.43	16.55	0.38	13.64	15.09
Lemna sp.	0.55								0.55	0.46	1.40	0.13	4.55	2.97
Nitella sp.	1.89	2.80							4.70	3.92	11.97	0.25	9.09	10.53
Pontederia cordata								0.30	0.30	0.25	0.78	0.13	4.55	2.66
Sedge								0.05	0.05	0.04	0.12	0.13	4.55	2.33
Emergent Grass - unidentified								0.03	0.03	0.02	0.06	0.13	4.55	2.31
Vallisneria americana	0.38		1.96	3.38	5.33	3.76	8.91	0.36	24.08	20.10	61.31	0.88	31.82	46.56
Eichhornia crassipes	0.23	1.16					1.23		2.63	2.20	6.70	0.38	13.64	10.17
Total	5.57	8.02	1.96	3.38	5.33	3.76	10.15	1.10	39.27	32.78	100.00	2.75	100.00	100.00
canopy	0.64								0.64	0.53		0.13		
'island'	3.68	2.74							6.43	5.36		0.25		
organic sediment	7.84	9.00	1.50	3.77	2.99	5.09	9.69	4.49	44.36	37.03		1.00		
sand	7.14	5.98	13.48	11.21	11.98	9.88	5.29	10.56	75.51	63.03		1.00		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 129.5-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 8 (5/10/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides							5.29	9.71	15.00	11.58	25.76	0.25	10.00	17.88
Typha latifolia	11.33	11.33	1.14				1.76	3.24	28.80	22.24	49.46	0.63	25.00	37.23
Hydrocotyle umbellata	1.62	1.62	0.16				1.24	1.62	6.26	4.83	10.74	0.63	25.00	17.87
Lemna sp.			0.01						0.01	0.01	0.02	0.13	5.00	2.51
Nitella sp.			6.26	0.11					6.38	4.92	10.95	0.25	10.00	10.47
Vallisneria americana				0.02					0.02	0.01	0.03	0.13	5.00	2.52
Eichhornia crassipes	0.81	0.81	0.08						1.70	1.31	2.92	0.38	15.00	8.96
Pistia stratiotes			0.06						0.06	0.05	0.11	0.13	5.00	2.55
Total	13.76	13.76	7.72	0.13	0.00	0.00	8.29	14.57	58.22	44.96	100.00	2.50	100.00	100.00
organic sediment			12.46	4.42	1.06		0.09		18.03	13.92		0.50		
sand			3.20	11.77	9.56		0.27		24.80	19.15		0.50		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 105.5-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 9 (5/10/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	0.66	0.66	0.23				0.69		2.24	2.12	7.73	0.50	14.81	11.27
Azolla caroliniana								1.96	1.96	1.85	6.75	0.13	3.70	5.23
Hydrocotyle ranunculoides	0.66	0.66	0.23				2.21	3.40	7.16	6.78	24.71	0.63	18.52	21.61
Hydrocotyle umbellata	2.64	2.64	0.92						6.20	5.88	21.40	0.38	11.11	16.26
Lemna sp.	0.40	0.40	0.14					0.41	1.34	1.27	4.61	0.50	14.81	9.71
Ludwigia peruviana	1.32	1.32	0.46						3.10	2.94	10.70	0.38	11.11	10.91
Nuphar lutea	1.98	1.98	0.69				0.88	1.25	6.79	6.43	23.42	0.63	18.52	20.97
Cicuta mexicana								0.13	0.13	0.12	0.45	0.13	3.70	2.08
Pistia stratiotes								0.07	0.07	0.06	0.23	0.13	3.70	1.96
Total	7.65	7.65	2.68	0.00	0.00	0.00	3.78	7.21	28.97	27.46	100.00	3.38	100.00	100.00
canopy								0.41	0.41	0.39		0.13		
organic sediment			5.37	2.64	2.64	3.36	11.16	13.19	38.37	36.36		0.75		
sand			3.20	10.55	10.55	9.83	2.33		36.46	34.55		0.63		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 62.3-m LINE INTERCEPT TRANSECT

WR- SEG2 - TRANSECT 10 (5/10/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Hydrocotyle umbellata								0.03	0.03	0.04	5.52	0.13	33.33	19.43
Myrica cerifera								0.43	0.43	0.69	92.74	0.13	33.33	63.04
Nitella sp.								0.01	0.01	0.01	1.74	0.13	33.33	17.54
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.46	0.74	100.00	0.38	100.00	100.00
organic sediment	6.23	6.23	6.23	6.23	3.53	2.33	5.19	6.23	42.18	67.76	9168.11	1.00	266.67	4717.39
sand	1.56	1.56	1.56	1.56	4.25	5.45	2.59	1.56	20.07	32.24	4362.14	1.00	266.67	2314.40

Note: *Nitella sp.* present in last segment, however can not see bottom to quantify

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER

RSR- SEG1 TRANSECTS 1 - 10 (5/11/05)

	Linear Distance (m)										Total					
	Transect										Linear	Cover		Frequency		Importance
Species	1	2	3	4	5	6	7	8	9	10	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic Algae		30.04	0.01			11.58		14.10	6.89		62.63	19.91	43.74	0.28	11.46	27.60
Cicuta mexicana	17.10	0.21			0.34		3.09	1.81	0.16	4.68	27.40	8.71	19.14	0.26	10.94	15.04
Filamentous Algae				0.91							0.91	0.29	0.64	0.01	0.52	0.58
Floating Algae		0.04									0.04	0.01	0.03	0.01	0.52	0.27
Hydrocotyle umbellata	2.33		0.41	0.34		0.19	6.82		0.52	5.13	15.75	5.01	11.00	0.26	10.94	10.97
Itea virginica		0.01									0.01	0.00	0.01	0.01	0.52	0.26
Lemna sp.		0.11	2.07	0.18		0.07		0.94	0.45	0.32	4.14	1.32	2.89	0.25	10.42	6.65
Ludwigia peruviana		1.45									1.45	0.46	1.01	0.03	1.04	1.03
Mikania scandens								0.02			0.02	0.01	0.01	0.01	0.52	0.27
Nuphar lutea	0.95	1.85	0.15	1.25		0.23	1.04	0.25	1.15	2.23	9.10	2.89	6.35	0.49	20.31	13.33
Pistia stratiotes		0.05	0.40	0.14	1.38	1.53	0.13	0.40	0.52	0.25	4.79	1.52	3.34	0.31	13.02	8.18
Pontederia cordata						0.43		0.33	1.38	0.15	2.29	0.73	1.60	0.09	3.65	2.62
Scirpus sp.								0.02			0.02	0.01	0.02	0.03	1.04	0.53
Sedge				0.01			0.06	0.09			0.15	0.05	0.11	0.04	1.56	0.83
Unknown SAV						0.82			1.49		2.32	0.74	1.62	0.04	1.56	1.59
Urtica dioica									0.10	0.02	0.12	0.04	0.08	0.04	1.56	0.82
Vallisneria americana	0.12			6.82	4.32	0.17	0.21	0.17			11.81	3.76	8.25	0.23	9.38	8.81
Vitus sp.				0.25							0.25	0.08	0.17	0.03	1.04	0.61
Total	20.50	33.76	3.04	9.90	6.05	15.02	11.35	18.13	12.66	12.78	143.19	45.52	100.00	2.40	100.00	100.00
canopy	8.84	8.32	4.15	2.93	10.36	7.96	6.31	7.35	4.39	2.28	62.88	19.99		0.36		
subcanopy		0.39	0.46	4.75	6.58		0.04				12.21	3.88		0.03		
organic sediment	4.97		6.56	11.72	10.69	19.87	15.67	11.51	30.15	22.19	133.33	42.39		0.58		
sand	8.52		1.64	0.32	2.67	3.29	1.40		0.43	0.98	19.24	6.12		0.29		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 31.9-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 1 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana	3.59	3.59	3.59	3.59	2.75				17.10	53.64	83.41	0.63	38.46	60.94
Hydrocotyle umbellata					0.55	1.78			2.33	7.31	11.37	0.25	15.38	13.38
Nuphar lutea	0.20	0.20	0.20	0.20	0.15				0.95	2.98	4.63	0.63	38.46	21.55
Vallisneria americana								0.12	0.12	0.37	0.58	0.13	7.69	4.14
Total	3.79	3.79	3.79	3.79	3.46	1.78	0.00	0.12	20.50	64.31	100.00	1.63	100.00	100.00
canopy						2.46	3.19	3.19	8.84	27.73		0.38		
organic sediment					0.65	2.12	0.47	1.73	4.97	15.60		0.50		
sand					0.28	1.86	4.13	2.25	8.52	26.71		0.50		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 33.2-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 2 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic Algae	3.74	3.74	3.74	3.74	3.74	3.74	3.35	4.27	30.04	90.42	88.99	1.00	40.00	64.50
Cicuta mexicana								0.21	0.21	0.64	0.63	0.13	5.00	2.82
Floating Algae								0.04	0.04	0.12	0.12	0.13	5.00	2.56
Itea virginica	0.01								0.01	0.04	0.04	0.13	5.00	2.52
Lemna sp.								0.11	0.11	0.32	0.32	0.13	5.00	2.66
Ludwigia peruviana		0.17						1.28	1.45	4.36	4.29	0.25	10.00	7.14
Nuphar lutea				0.18	0.20	0.48		0.99	1.85	5.57	5.48	0.50	20.00	12.74
Pistia stratiotes	0.03							0.02	0.05	0.14	0.14	0.25	10.00	5.07
Total	3.78	3.91	3.74	3.92	3.94	4.22	3.35	6.91	33.76	101.61	100.00	2.50	100.00	100.00
canopy	2.91	2.91	2.51						8.32	25.05		0.38		
subcanopy	0.39								0.39	1.16		0.13		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 23.5-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 3 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic Algae						0.01			0.01	0.06	0.38	0.13	5.88	3.13
Hydrocotyle umbellata						0.12	0.15	0.15	0.41	1.75	11.74	0.38	17.65	14.69
Lemna sp.	0.15	0.15	0.13			0.47	0.59	0.59	2.07	8.81	59.17	0.75	35.29	47.23
Nuphar lutea	0.08	0.07							0.15	0.62	4.18	0.25	11.76	7.97
Pistia stratiotes	0.08					0.12	0.15	0.06	0.40	1.70	11.45	0.50	23.53	17.49
Sabal palmetto	0.46								0.46	1.95	13.08	0.13	5.88	9.48
Total	0.76	0.21	0.13	0.00	0.00	0.71	0.88	0.79	3.49	14.89	100.00	2.13	100.00	100.00
canopy	1.17	1.17	1.17	0.62					4.15	17.66		0.50		
organic sediment						1.87	2.35	2.35	6.56	27.97		0.38		
sand						0.47	0.59	0.59	1.64	6.99		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 36.6-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 4 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Filamentous Algae				0.91					0.91	2.50	9.24	0.13	5.56	7.40
Hydrocotyle umbellata	0.01						0.10	0.23	0.34	0.92	3.39	0.38	16.67	10.03
Lemna sp.	0.01						0.17		0.18	0.49	1.80	0.25	11.11	6.46
Nuphar lutea	0.34	0.75	0.08	0.09					1.25	3.43	12.68	0.50	22.22	17.45
Pistia stratiotes							0.14		0.14	0.38	1.39	0.13	5.56	3.47
Sedge	0.01								0.01	0.01	0.05	0.13	5.56	2.80
Vallisneria americana				0.24	1.31	1.87	3.40		6.82	18.67	68.93	0.50	22.22	45.58
Vitus sp.							0.02	0.23	0.25	0.68	2.53	0.25	11.11	6.82
Total	0.36	0.75	0.08	1.24	1.31	1.87	3.83	0.46	9.90	27.08	100.00	2.25	100.00	100.00
canopy	2.93								2.93	8.01		0.13		
subcanopy							0.41	4.34	4.75	13.00		0.25		
organic sediment				0.60	4.40	2.59	4.13		11.72	32.06		0.50		
sand					0.17	0.15			0.32	0.88		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 27.5-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 5 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana		0.23				0.11			0.34	1.25	5.67	0.25	20.00	12.84
Pistia stratiotes					0.32	0.92	0.07	0.07	1.38	5.02	22.81	0.50	40.00	31.41
Vallisneria americana		0.16	1.88	2.13	0.16				4.32	15.75	71.51	0.50	40.00	55.76
Total	0.00	0.38	1.88	2.13	0.48	1.04	0.07	0.07	6.05	22.02	100.00	1.25	100.00	100.00
canopy	5.83	4.53							10.36	37.74		0.25		
subcanopy	1.03	0.80				0.17	0.51	0.51	3.03	11.03		0.63		
organic sediment		0.61	2.75	2.75	2.75	1.84			10.69	38.93		0.63		
sand		0.15	0.69	0.69	0.69	0.46			2.67	9.73		0.63		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 34.7-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 6 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic Algae				3.66	4.34	3.58			11.58	33.33	77.12	0.38	17.65	47.38
Hydrocotyle umbellata	0.11	0.08							0.19	0.56	1.29	0.25	11.76	6.53
Lemna sp.	0.05	0.02							0.07	0.20	0.46	0.25	11.76	6.11
Nuphar lutea		0.19	0.00		0.04				0.23	0.65	1.51	0.38	17.65	9.58
Pistia stratiotes	0.11	1.34	0.08						1.53	4.39	10.16	0.38	17.65	13.91
Pontederia cordata	0.43								0.43	1.23	2.84	0.13	5.88	4.36
Unknown SAV	0.82								0.82	2.37	5.48	0.13	5.88	5.68
Vallisneria americana	0.02	0.15							0.17	0.49	1.14	0.25	11.76	6.45
Total	1.54	1.78	0.08	3.66	4.38	3.58	0.00	0.00	15.02	43.22	100.00	2.13	100.00	100.00
canopy						0.14	3.91	3.91	7.96	22.89		0.38		
organic sediment	4.34	4.07	1.74	0.27		0.76	4.34	4.34	19.87	57.19		0.88		
sand		0.27	2.61	0.41					3.29	9.47		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 26.1-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 7 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana					1.57	0.87	0.33	0.33	3.09	11.87	27.26	0.50	21.05	24.16
Hydrocotyle umbellata					1.42	1.49	1.96	1.96	6.82	26.18	60.12	0.50	21.05	40.59
Nuphar lutea	0.05	0.33	0.21			0.12	0.16	0.16	1.04	3.99	9.15	0.75	31.58	20.37
Pistia stratiotes					0.13				0.13	0.51	1.16	0.13	5.26	3.21
Sedge	0.06								0.06	0.21	0.49	0.13	5.26	2.88
Vallisneria americana			0.04	0.16	0.00				0.21	0.79	1.81	0.38	15.79	8.80
Total	0.11	0.33	0.25	0.16	3.13	2.48	2.44	2.44	11.35	43.55	100.00	2.38	100.00	100.00
canopy	2.93	2.93	0.44						6.31	24.20		0.38		
subcanopy		0.04							0.04	0.14		0.13		
organic sediment	3.26	3.26	2.64	2.61	3.12	0.78			15.67	60.10		0.75		
sand			0.61	0.65	0.14				1.40	5.38		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 27.4-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 8 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic Algae		3.28	3.43	3.43	3.43	0.53			14.10	51.39	77.76	0.63	19.23	48.49
Cicuta mexicana						0.43	1.37	0.01	1.81	6.59	9.98	0.38	11.54	10.76
Lemna sp.						0.05	0.21	0.69	0.94	3.44	5.21	0.38	11.54	8.38
Mikania scandens	0.02								0.02	0.06	0.10	0.13	3.85	1.97
Nuphar lutea				0.04	0.14	0.07			0.25	0.91	1.38	0.38	11.54	6.46
Pistia stratiotes						0.05	0.17	0.17	0.40	1.44	2.19	0.38	11.54	6.86
Pontederia cordata	0.33								0.33	1.20	1.82	0.13	3.85	2.83
Scirpus sp.	0.02	0.00							0.02	0.08	0.13	0.25	7.69	3.91
Sedge	0.09								0.09	0.33	0.50	0.13	3.85	2.18
Vallisneria americana		0.02	0.05	0.06	0.05				0.17	0.62	0.94	0.50	15.38	8.16
Total	0.46	3.29	3.47	3.53	3.62	1.14	1.75	0.87	18.13	66.09	100.00	3.25	100.00	100.00
canopy					0.46	2.30	2.30	2.30	7.35	26.80		0.50		
organic sediment	3.43	0.15				1.07	3.43	3.43	11.51	41.94		0.63		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 35.6-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 9 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Benthic Algae	0.84	2.22	2.22	1.49	0.12				6.89	19.37	54.41	0.63	22.73	38.57
Cicuta mexicana	0.11						0.05		0.16	0.45	1.26	0.25	9.09	5.18
Hydrocotyle umbellata							0.52		0.52	1.46	4.09	0.13	4.55	4.32
Lemna sp.	0.01						0.36	0.09	0.45	1.27	3.57	0.38	13.64	8.60
Nuphar lutea	0.16	0.21	0.14		0.21	0.43			1.15	3.23	9.07	0.63	22.73	15.90
Pistia stratiotes							0.52		0.52	1.46	4.09	0.13	4.55	4.32
Pontederia cordata	1.38								1.38	3.89	10.93	0.13	4.55	7.74
Unknown SAV	1.30	0.20							1.49	4.20	11.79	0.25	9.09	10.44
Urtica dioica							0.01	0.09	0.10	0.28	0.79	0.25	9.09	4.94
Total	3.80	2.63	2.37	1.49	0.33	0.43	1.45	0.18	12.66	35.59	100.00	2.75	100.00	100.00
canopy	1.19						0.53	2.67	4.39	12.33		0.38		
organic sediment	4.45	4.45	4.45	4.45	4.02	4.45	3.90		30.15	84.75		0.88		
sand					0.43				0.43	1.20		0.13		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 38.2-m LINE INTERCEPT TRANSECT

RSR- SEG1 - TRANSECT 10 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana					0.39	1.43	1.43	1.43	4.68	12.27	36.63	0.50	12.90	24.77
Hydrocotyle umbellata			0.36	0.95	0.95	0.95	0.95	0.95	5.13	13.45	40.16	0.75	19.35	29.76
Lemna sp.			0.05	0.14	0.12				0.32	0.84	2.50	0.38	9.68	6.09
Nuphar lutea		0.12	0.48	0.48	0.44	0.24	0.24	0.24	2.23	5.85	17.45	0.88	22.58	20.02
Pistia stratiotes			0.01	0.05	0.05	0.05	0.05	0.05	0.25	0.66	1.96	0.75	19.35	10.66
Pontederia cordata					0.01	0.05	0.05	0.05	0.15	0.39	1.17	0.50	12.90	7.04
Urtica dioica	0.02								0.02	0.04	0.12	0.13	3.23	1.67
Total	0.02	0.12	0.91	1.62	1.96	2.72	2.72	2.72	12.78	33.49	100.00	3.88	100.00	100.00
canopy	1.05	1.05	0.18						2.28	5.97		0.38		
organic sediment	4.43	4.14	4.77	4.77	4.08				22.19	58.14		0.63		
sand	0.34	0.63							0.98	2.56		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER

RSR- SEG2 TRANSECTS 1 - 10 (5/11/05)

	Linear Distance (m)										Total					
	Transect										Linear	Cover		Frequency		Importance
Species	1	2	3	4	5	6	7	8	9	10	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides		4.00				0.35					4.35	1.10	1.69	0.11	2.68	2.18
Cephalanthus occidentalis			0.54								0.54	0.14	0.21	0.06	1.49	0.85
Cicuta mexicana			12.44	12.53	13.05	4.36	2.70	10.80	2.13		58.01	14.64	22.52	0.46	11.01	16.77
Cladium jamaicense			0.54	0.46							1.00	0.25	0.39	0.13	2.98	1.68
Colocasia esculenta		7.16	13.50				10.80	3.53	7.17	0.35	42.51	10.73	16.51	0.38	8.93	12.72
Eichhornia crassipes		3.43		13.89	11.91	32.82	14.70	0.75			77.50	19.55	30.09	0.45	10.71	20.40
Emergent Grass - unidentified	3.16										3.16	0.80	1.22	0.05	1.19	1.21
Ferns	0.16	0.20									0.36	0.09	0.14	0.09	2.08	1.11
Hydrocotyle ranunculoides						0.63		0.04	0.34		1.01	0.25	0.39	0.05	1.19	0.79
Hydrocotyle umbellata	5.42	3.83	2.89	0.06				0.26		0.22	12.67	3.20	4.92	0.19	4.46	4.69
Lemna sp.		1.00									1.00	0.25	0.39	0.05	1.19	0.79
Mikania scandens			0.15			0.24					0.39	0.10	0.15	0.06	1.49	0.82
Myrica cerifera	0.80	1.00	1.35								3.15	0.79	1.22	0.15	3.57	2.40
Nuphar lutea		1.00		4.23	2.95	2.50	1.68	1.09			13.45	3.39	5.22	0.50	11.90	8.56
Peltandra virginica	0.40										0.40	0.10	0.16	0.04	0.89	0.52
Pontederia cordata	2.90	2.10		3.68	2.78	5.25	0.78	4.69	0.13		22.31	5.63	8.66	0.55	13.10	10.88
Rumex vertigillatus						0.35			3.00		3.35	0.85	1.30	0.10	2.38	1.84
Sagittaria latifolia		1.00	1.35				1.35		1.00		4.70	1.19	1.82	0.23	5.36	3.59
Sambucus canadensis				1.15							1.15	0.29	0.45	0.06	1.49	0.97
Saururus cernuus	1.60	0.75									2.35	0.59	0.91	0.08	1.79	1.35
Scirpus sp.		0.50									0.50	0.13	0.19	0.09	2.08	1.14
Sedge	0.40	1.50								0.06	1.96	0.50	0.76	0.09	2.08	1.42
Typha latifolia			0.99								0.99	0.25	0.38	0.10	2.38	1.38
Urtica dioica		0.20							0.10		0.30	0.08	0.12	0.09	2.08	1.10
Zizania sp.					0.44						0.44	0.11	0.17	0.06	1.49	0.83
Total	14.84	27.67	33.75	36.00	31.11	46.51	32.02	21.16	13.86	0.63	257.56	64.99	100.00	4.20	100.00	100.00
canopy	0.55		0.15	6.95	0.36	1.55	4.17	9.00	9.91	10.36	43.00	10.85		0.64		
subcanopy	0.96	0.00	0.00	0.00	1.04	0.00	0.00	0.00	0.00	0.00	2.00	0.50		0.00		
organic sediment	3.96	4.06	5.22	1.33	4.45	2.44	7.91	3.01	13.21	13.28	58.88	14.86		0.43		
sand	5.79	2.44	3.31	6.13	4.27	3.66	4.48	3.97	15.80	3.99	53.86	13.59		0.35		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 28.8-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 1 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Ferns						0.02	0.07	0.07	0.16	0.56	1.07	0.38	10.00	5.53
Hydrocotyle umbellata	0.54	0.54	0.93	3.41					5.42	18.86	36.15	0.50	13.33	24.74
Liquidambar styraciflua						0.02	0.07	0.07	0.16	0.56	1.07	0.38	10.00	5.53
Myrica cerifera						0.08	0.36	0.36	0.80	2.78	5.33	0.38	10.00	7.67
Peltandra virginica						0.04	0.18	0.18	0.40	1.39	2.67	0.38	10.00	6.33
Pontederia cordata	0.90	0.90	0.90	0.21					2.90	10.09	19.35	0.50	13.33	16.34
Saururus cernuus						0.16	0.72	0.72	1.60	5.56	10.67	0.38	10.00	10.33
Sedge						0.04	0.18	0.18	0.40	1.39	2.67	0.38	10.00	6.33
Unknown Grass	0.72	0.72	0.72	1.00					3.16	10.97	21.03	0.50	13.33	17.18
Total	2.16	2.16	2.55	4.62	0.00	0.36	1.58	1.58	15.00	52.17	100.00	3.75	100.00	100.00
canopy	0.18	0.18	0.18	0.01					0.55	1.91		0.50		
subcanopy						0.08	0.36	0.36	0.80	2.78		0.38		
organic sediment				2.83	0.99	0.14			3.96	13.78		0.38		
sand				0.55	2.60	2.64			5.79	20.14		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 41.5-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 2 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	1.04	1.04	1.04	0.89					4.00	9.64	14.45	0.50	6.06	10.26
Colocasia esculenta	0.10	0.10	0.10	0.09	0.20	2.41	2.08	2.08	7.16	17.26	25.88	1.00	12.12	19.00
Eichhornia crassipes	0.52	0.52	0.52	0.89	0.98				3.43	8.27	12.40	0.63	7.58	9.99
Ferns	0.05	0.05	0.05	0.04					0.20	0.48	0.72	0.50	6.06	3.39
Hydrocotyle umbellata	0.52	0.52	0.52	1.04	1.23				3.83	9.23	13.84	0.63	7.58	10.71
Lemna sp.	0.26	0.26	0.26	0.22					1.00	2.41	3.61	0.50	6.06	4.84
Myrica cerifera	0.26	0.26	0.26	0.22					1.00	2.41	3.61	0.50	6.06	4.84
Nuphar lutea	0.26	0.26	0.26	0.22					1.00	2.41	3.61	0.50	6.06	4.84
Pontederia cordata	0.16	0.16	0.16	0.13		0.46	0.52	0.52	2.10	5.06	7.59	0.88	10.61	9.10
Sagittaria latifolia	0.26	0.26	0.26	0.22					1.00	2.41	3.61	0.50	6.06	4.84
Saururus cernuus						0.23	0.26	0.26	0.75	1.81	2.71	0.38	4.55	3.63
Scirpus sp.	0.05	0.05	0.05	0.04		0.09	0.10	0.10	0.50	1.20	1.81	0.88	10.61	6.21
Sedge						0.46	0.52	0.52	1.50	3.61	5.42	0.38	4.55	4.98
Urtica dioica	0.05	0.05	0.05	0.04					0.20	0.48	0.72	0.50	6.06	3.39
Total	3.53	3.53	3.53	4.07	2.41	3.66	3.48	3.48	27.67	66.68	100.00	8.25	100.00	100.00
organic sediment				0.75	2.75	0.56			4.06	9.79		0.38		
sand					2.44				2.44	5.88		0.13		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 50.5-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 3 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cephalanthus occidentalis				0.03	0.13	0.13	0.13	0.13	0.54	1.07	1.60	0.63	12.50	7.05
Cicuta mexicana	4.74	4.74	2.97						12.44	24.62	36.87	0.38	7.50	22.19
Cladium jamaicense				0.03	0.13	0.13	0.13	0.13	0.54	1.07	1.60	0.63	12.50	7.05
Colocasia esculenta				0.87	3.16	3.16	3.16	3.16	13.50	26.71	40.00	0.63	12.50	26.25
Hydrocotyle umbellata				2.89					2.89	5.71	8.55	0.13	2.50	5.52
Mikania scandens	0.06	0.06	0.02						0.15	0.30	0.44	0.38	7.50	3.97
Myrica cerifera				0.09	0.32	0.32	0.32	0.32	1.35	2.67	4.00	0.63	12.50	8.25
Sagittaria latifolia				0.09	0.32	0.32	0.32	0.32	1.35	2.67	4.00	0.63	12.50	8.25
Typha latifolia	0.19	0.19	0.07	0.03	0.13	0.13	0.13	0.13	0.99	1.96	2.93	1.00	20.00	11.47
Total	4.99	4.99	3.06	4.03	4.17	4.17	4.17	4.17	33.75	66.78	100.00	5.00	100.00	100.00
canopy	0.06	0.06	0.02						0.15	0.30		0.38		
organic sediment			1.47	3.75					5.22	10.33		0.25		
sand			2.48	0.83					3.31	6.56		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 42.5-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 4 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana	5.31	5.31	1.92						12.53	29.51	34.81	0.38	9.68	22.25
Cladium jamaicense				0.04	0.11	0.11	0.11	0.11	0.46	1.08	1.28	0.63	16.13	8.70
Eichhornia crassipes			0.09	1.06	3.19	3.19	3.19	3.19	13.89	32.70	38.57	0.75	19.35	28.96
Hydrocotyle umbellata			0.06						0.06	0.14	0.16	0.13	3.23	1.69
Nuphar lutea			0.23	0.81	0.80	0.80	0.80	0.80	4.23	9.95	11.74	0.75	19.35	15.55
Pontederia cordata				0.50	0.80	0.80	0.80	0.80	3.68	8.68	10.24	0.63	16.13	13.18
Sambucus canadensis				0.09	0.27	0.27	0.27	0.27	1.15	2.71	3.19	0.63	16.13	9.66
Total	5.31	5.31	2.29	2.50	5.15	5.15	5.15	5.15	36.00	84.77	100.00	3.88	100.00	100.00
canopy	0.53	0.53	0.14	0.44	1.33	1.33	1.33	1.33	6.95	16.37		1.00		
organic sediment			1.16	0.18					1.33	3.14		0.25		
sand			2.77	3.37					6.13	14.44		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 50.7-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 5 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana	4.25	4.25	1.29	0.08	0.80	0.80	0.80	0.80	13.05	25.73	41.93	1.00	23.53	32.73
Eichhornia crassipes				1.29	2.65	2.65	2.65	2.65	11.91	23.48	38.27	0.63	14.71	26.49
Nuphar lutea	0.11	0.11	0.31	0.31	0.53	0.53	0.53	0.53	2.95	5.82	9.48	1.00	23.53	16.50
Pontederia cordata	0.27	0.27	0.07	0.05	0.53	0.53	0.53	0.53	2.78	5.47	8.92	1.00	23.53	16.23
Zizania sp.				0.01	0.11	0.11	0.11	0.11	0.44	0.86	1.40	0.63	14.71	8.05
Total	4.62	4.62	1.67	1.74	4.62	4.62	4.62	4.62	31.11	61.35	100.00	4.25	100.00	100.00
canopy	0.16	0.16	0.04						0.36	0.71		0.38		
subcanopy	0.27	0.27	0.07	0.01	0.11	0.11	0.11	0.11	1.04	2.04		1.00		
organic sediment			2.70	1.74					4.45	8.77		0.25		
sand			1.22	3.04					4.27	8.41		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 56.1-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 6 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Alternanthera philoxeroides	0.07	0.07	0.07	0.07	0.07				0.35	0.62	0.75	0.63	11.63	6.19
Rumex vertigillatus	0.07	0.07	0.07	0.07	0.07				0.35	0.62	0.75	0.63	11.63	6.19
Cicuta mexicana	0.14	0.14	0.14	0.14	0.14	0.06	1.49	2.11	4.36	7.77	9.38	1.00	18.60	13.99
Eichhornia crassipes	4.91	4.91	4.91	4.91	4.89	0.77	3.29	4.21	32.82	58.46	70.57	1.00	18.60	44.59
Hydrocotyle ranunculoides							0.28	0.35	0.63	1.12	1.36	0.25	4.65	3.00
Mikania scandens							0.10	0.14	0.24	0.43	0.52	0.25	4.65	2.58
Nuphar lutea	0.21	0.21	0.21	0.21	0.21	0.25	0.50	0.70	2.50	4.46	5.38	1.00	18.60	11.99
Pontederia cordata	1.05	1.05	1.05	1.05	1.04				5.25	9.35	11.29	0.63	11.63	11.46
Total	6.46	6.46	6.46	6.46	6.42	1.09	5.67	7.51	46.51	82.84	100.00	5.38	100.00	100.00
canopy	0.07	0.07	0.07	0.07	0.07		0.50	0.70	1.55	2.76		0.88		
organic sediment						1.83	0.61		2.44	4.35		0.25		
sand						2.24	1.43		3.66	6.52		0.25		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 40.4-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 7 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana			0.17	0.51	0.51	0.51	0.51	0.51	2.70	6.68	8.43	0.75	15.79	12.11
Colocasia esculenta			0.70	2.02	2.02	2.02	2.02	2.02	10.80	26.73	33.73	0.75	15.79	24.76
Eichhornia crassipes	1.80	1.58	1.22	2.02	2.02	2.02	2.02	2.02	14.70	36.39	45.93	1.00	21.05	33.49
Nuphar lutea			0.42	0.25	0.25	0.25	0.25	0.25	1.68	4.16	5.25	0.75	15.79	10.52
Pontederia cordata			0.28	0.10	0.10	0.10	0.10	0.10	0.78	1.93	2.44	0.75	15.79	9.11
Sagittaria latifolia			0.09	0.25	0.25	0.25	0.25	0.25	1.35	3.34	4.22	0.75	15.79	10.00
Total	1.80	1.58	2.87	5.15	5.15	5.15	5.15	5.15	32.02	79.22	100.00	4.75	100.00	100.00
canopy	3.63		0.03	0.10	0.10	0.10	0.10	0.10	4.17	10.31		0.88		
organic sediment	4.04	2.55	1.32						7.91	19.58		0.38		
sand	0.25	2.24	1.98						4.48	11.08		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 35.0-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 8 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Cicuta mexicana	0.87	0.87	0.87	0.38		2.55	2.62	2.62	10.80	30.87	51.03	0.88	18.42	34.73
Colocasia esculenta	0.22	0.22	0.22	0.28		0.85	0.87	0.87	3.53	10.10	16.69	0.88	18.42	17.56
Eichhornia crassipes	0.22	0.22	0.22	0.09					0.75	2.14	3.54	0.50	10.53	7.04
Hydrocotyle ranunculoides					0.04				0.04	0.10	0.17	0.13	2.63	1.40
Hydrocotyle umbellata						0.09	0.09	0.09	0.26	0.74	1.23	0.38	7.89	4.56
Nuphar lutea	0.09	0.09	0.09	0.14	0.43	0.09	0.09	0.09	1.09	3.13	5.17	1.00	21.05	13.11
Pontederia cordata	0.87	0.87	0.87	0.67	0.04	0.49	0.44	0.44	4.69	13.41	22.17	1.00	21.05	21.61
Total	2.27	2.27	2.27	1.55	0.51	4.06	4.11	4.11	21.16	60.49	100.00	4.75	100.00	100.00
canopy	2.62	2.62	2.62	1.13					9.00	25.73		0.50		
organic sediment				0.67	2.24	0.10			3.01	8.61		0.38		
sand				1.82	2.13	0.02			3.97	11.36		0.38		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 33.5-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 9 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Rumex vertigillatus	1.26	1.26	0.48						3.00	8.94	21.64	0.38	18.75	20.19
Cicuta mexicana							1.17	0.96	2.13	6.34	15.33	0.25	12.50	13.92
Colocasia esculenta	2.52	2.52	2.14						7.17	21.37	51.70	0.38	18.75	35.23
Hydrocotyle ranunculoides						0.34			0.34	1.02	2.47	0.13	6.25	4.36
Pontederia cordata								0.13	0.13	0.38	0.92	0.13	6.25	3.58
Sagittaria latifolia	0.42	0.42	0.16						1.00	2.98	7.21	0.38	18.75	12.98
Urtica dioica	0.04	0.04	0.02						0.10	0.30	0.72	0.38	18.75	9.74
Total	4.24	4.24	2.80	0.00	0.00	0.34	1.17	1.08	13.86	41.33	100.00	2.00	100.00	100.00
canopy	0.84	0.84	0.32		0.36	2.52	2.52	2.52	9.91	29.54		0.88		
organic sediment			1.23	0.72	1.50	3.05	3.35	3.35	13.21	39.39		0.75		
sand			1.35	3.47	2.69	1.58	3.35	3.35	15.80	47.11		0.75		

SUMMARY OF SHRUB / HERBACEOUS GROUND COVER ON ONE 17.3-m LINE INTERCEPT TRANSECT

RSR- SEG2 - TRANSECT 10 (5/11/05)

	Segment								Total Linear	Cover		Frequency		Importance
Species	A	B	C	D	E	F	G	H	Distance (m)	Percent	Relative	Absolute	Relative	Value
Colocasia esculenta	0.35								0.35	2.03	55.53	0.13	33.33	44.43
Hydrocotyle umbellata					0.22				0.22	1.26	34.41	0.13	33.33	33.87
Sedge	0.06								0.06	0.37	10.06	0.13	33.33	21.70
Total	0.41	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.63	3.65	100.00	0.38	100.00	100.00
canopy	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	10.36	60.00		1.00		
organic sediment	0.65	1.48	1.08	1.44	2.16	2.16	2.16	2.16	13.28	76.88		1.00		
sand	1.51	0.68	1.08	0.72					3.99	23.12		0.50		

Appendix F

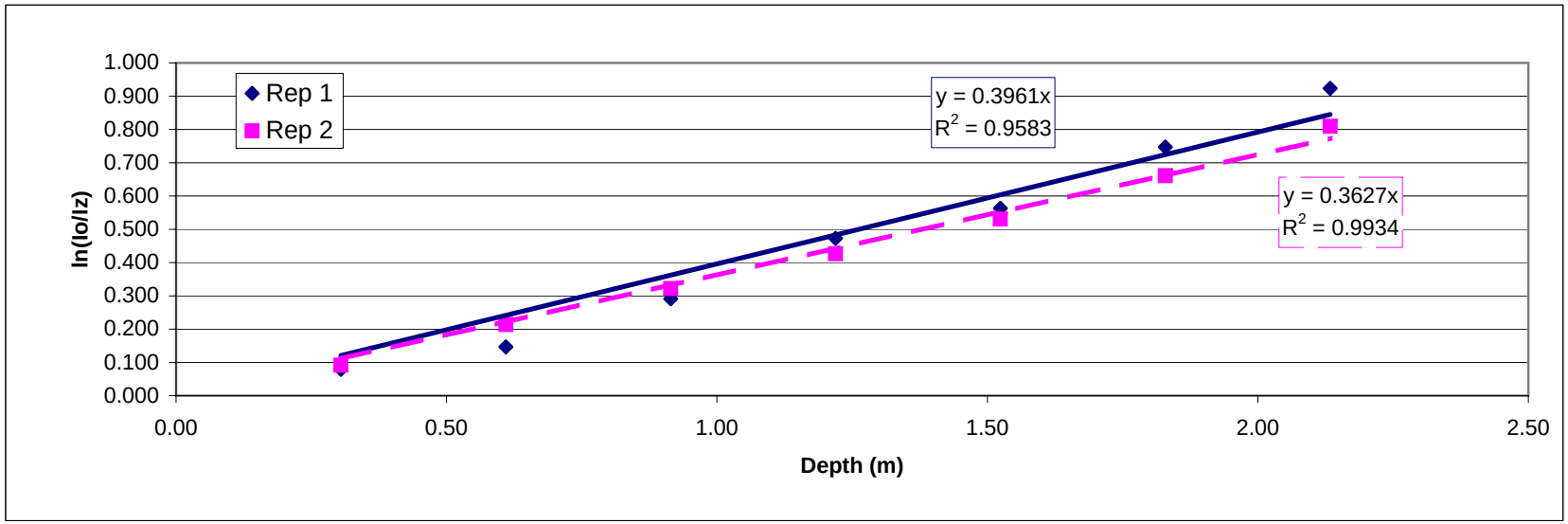
Detailed Light Attenuation Data for Wekiva River System and Reference Site Stream Segment Metabolism Studies

APPENDIX F-1

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 1 (UPSTREAM LAGOON) - 04/29/05

Depth (m)	Rep 1				Depth (m)	Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1791.95	7.49			air	1758.6	7.47		
surface	1650.9	7.41			surface	1563.7	7.35		
0.30	1524.8	7.33	0.079	0.261	0.30	1426.6	7.26	0.092	0.301
0.61	1425.6	7.26	0.147	0.241	0.61	1262.6	7.14	0.214	0.351
0.91	1234.2	7.12	0.291	0.318	0.91	1133	7.03	0.322	0.352
1.22	1028.8	6.94	0.473	0.388	1.22	1020.9	6.93	0.426	0.350
1.52	940.1	6.85	0.563	0.369	1.52	919.7	6.82	0.531	0.348
1.83	782.1	6.66	0.747	0.409	1.83	807.5	6.69	0.661	0.361
2.13	655.5	6.49	0.924	0.433	2.13	695.8	6.55	0.810	0.380

k (diffuse attenuation coefficient = slope, m-1)	0.396	k (diffuse attenuation coefficient = slope, m-1)	0.363
k average	0.345	k average	0.349
percent transmittance @ 1.0 meter	67.30	percent transmittance @ 1.0 meter	69.58
Birgean Percentile Absorption (1m)	32.70	Birgean Percentile Absorption (1m)	30.42

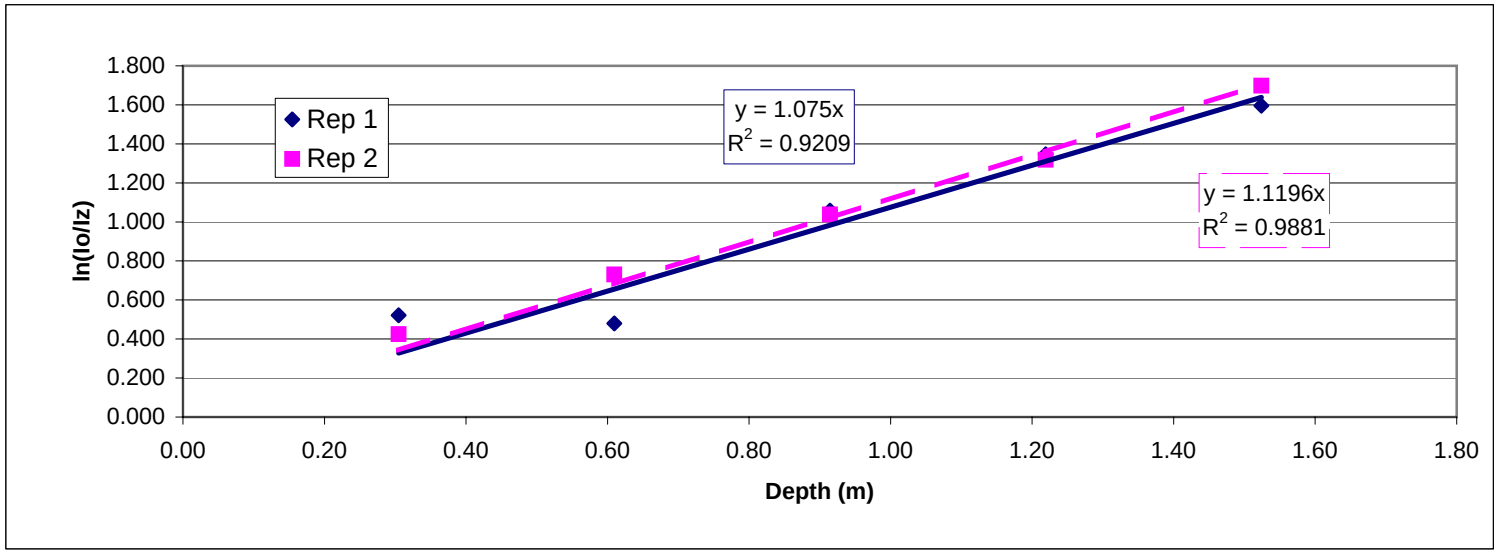


APPENDIX F-1

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 1 (UPSTREAM) - 08/10/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	634.4	6.45			642.3	6.47		
surface	577.7	6.36			577.4	6.36		
0.30	342.80	5.84	0.522	1.712	377.50	5.93	0.425	1.394
0.61	357.60	5.88	0.480	0.787	278.00	5.63	0.731	1.199
0.91	200.50	5.30	1.058	1.157	204.50	5.32	1.038	1.135
1.22	150.33	5.01	1.346	1.104	154.47	5.04	1.319	1.081
1.52	117.10	4.76	1.596	1.047	105.62	4.66	1.699	1.115

k (diffuse attenuation coefficient = slope, m-1)	1.075	1.120
k average	1.162	1.185
percent transmittance @ 1.0 meter	34.13	32.64
Birgean Percentile Absorption (1m)	65.87	67.36

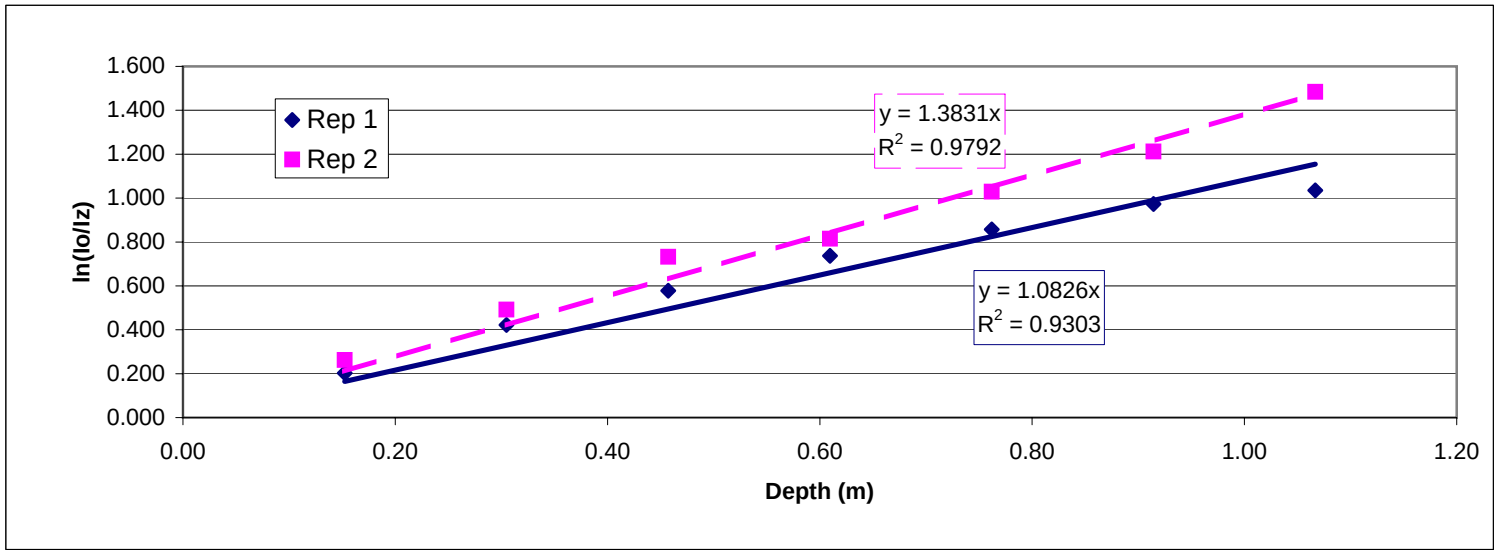


APPENDIX F-1

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 1 (DOWNSTREAM) - 08/10/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	214.2	5.37			426.1	6.05		
surface	233.9	5.45			380.7	5.94		
0.15	190.94	5.25	0.203	1.332	292.90	5.68	0.262	1.720
0.30	153.42	5.03	0.422	1.384	232.70	5.45	0.492	1.615
0.46	131.17	4.88	0.578	1.265	183.01	5.21	0.732	1.602
0.61	111.96	4.72	0.737	1.209	168.49	5.13	0.815	1.337
0.76	99.24	4.60	0.857	1.125	136.06	4.91	1.029	1.350
0.91	88.41	4.48	0.973	1.064	113.31	4.73	1.212	1.325
1.07	83.07	4.42	1.035	0.970	86.31	4.46	1.484	1.391

k (diffuse attenuation coefficient = slope, m-1)	1.083	1.383
k average	1.193	1.477
percent transmittance @ 1.0 meter	33.87	25.08
Birgean Percentile Absorption (1m)	66.13	74.92

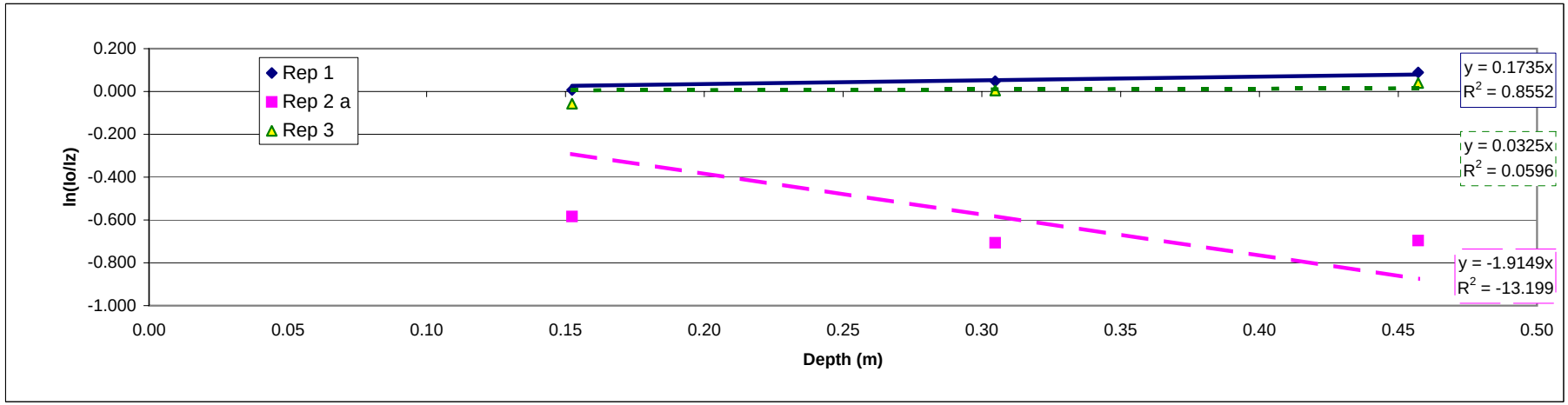


APPENDIX F-1

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 1 (UPSTREAM) - 8/31/05

Depth (m)	Rep 1				Rep 2 [a]				Rep 3			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1284	7.16			695	6.54			499.4	6.21		
surface	1575.2	7.36			703.3	6.56			446.2	6.10		
0.15	1563.7	7.35	0.007	0.048	1260.6	7.14	-0.584	-3.829	472.4	6.16	-0.057	-0.374
0.30	1501.4	7.31	0.048	0.157	1425.6	7.26	-0.707	-2.318	444.3	6.10	0.004	0.014
0.46	1441.1	7.27	0.089	0.195	1411.1	7.25	-0.696	-1.523	429	6.06	0.039	0.086

k (diffuse attenuation coefficient = slope, m-1)	0.174	-1.915	0.033
k average	0.133	-2.557	-0.091
percent transmittance @ 1.0 meter	84.07	678.65	96.80
Birgean Percentile Absorption (1m)	15.93	-578.65	3.20



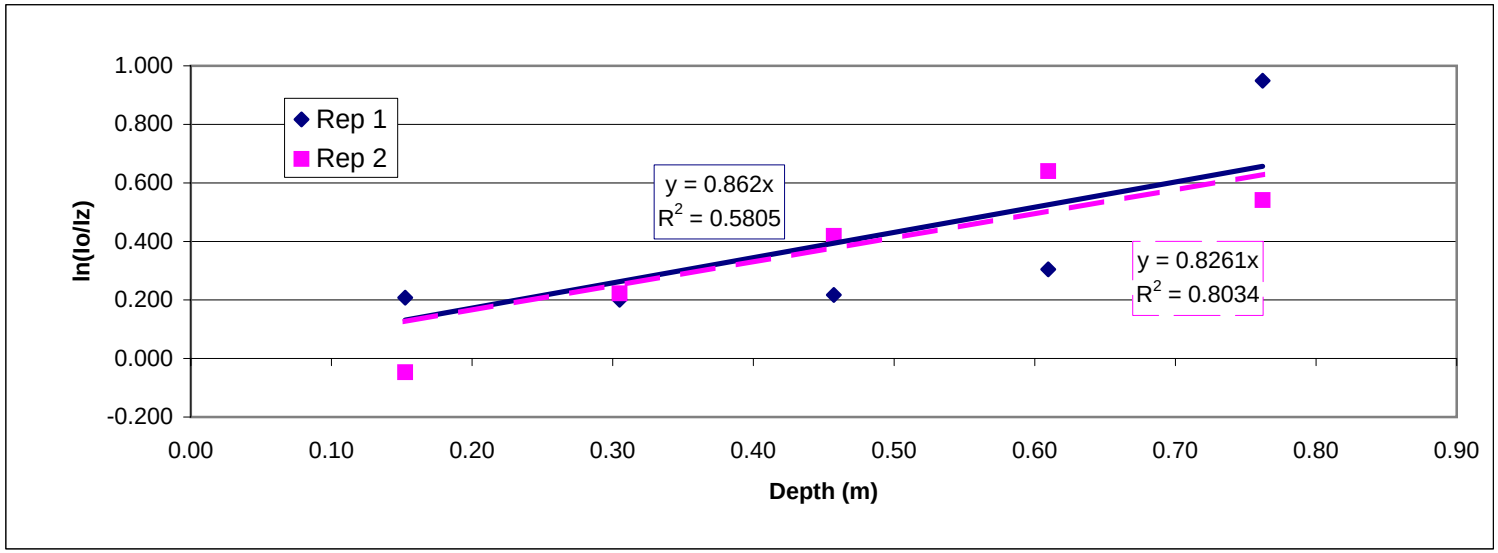
[a] clouds cleared when collecting measurements @ 0.15 m

APPENDIX F-1

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 1 (DOWNSTREAM) - 08/31/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	105.7	4.66			100.4	4.61		
surface	96.8	4.57			82.8	4.42		
0.15	78.61	4.36	0.208	1.362	86.78	4.46	-0.047	-0.309
0.30	79.16	4.37	0.201	0.658	66.26	4.19	0.223	0.731
0.46	77.88	4.36	0.217	0.475	54.46	4.00	0.419	0.916
0.61	71.35	4.27	0.305	0.500	43.64	3.78	0.640	1.050
0.76	37.44	3.62	0.949	1.246	48.17	3.87	0.542	0.711

k (diffuse attenuation coefficient = slope, m-1)	0.862	0.826
k average	0.848	0.620
percent transmittance @ 1.0 meter	42.23	43.78
Birgean Percentile Absorption (1m)	57.77	56.22

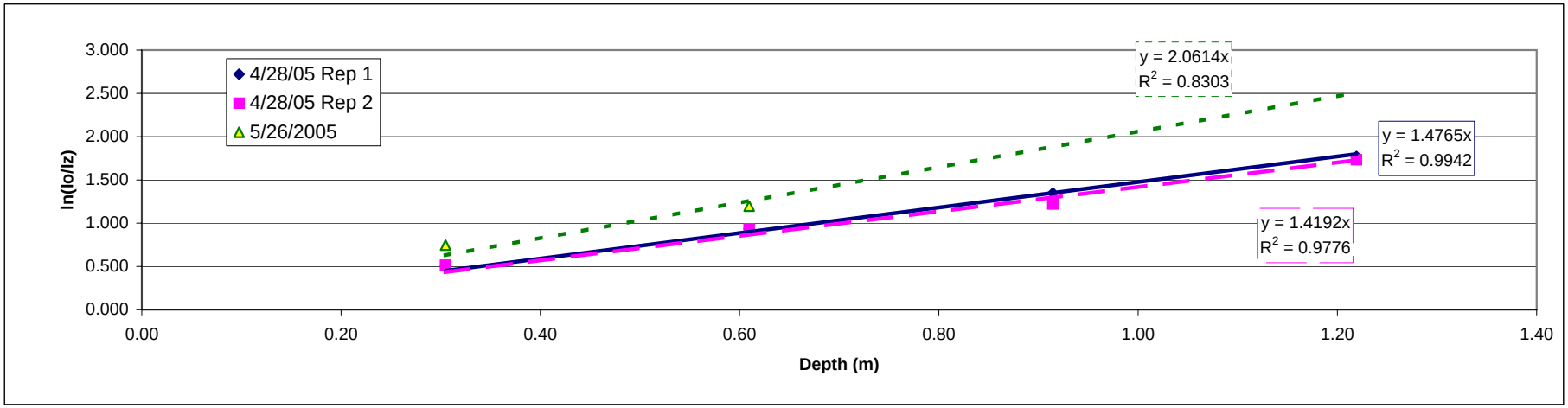


APPENDIX F-2

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 2 (UPSTREAM)

Depth (m)	4/28/05 Rep 1				Depth (m)	4/28/05 Rep 2				Depth (m)	5/26/2005			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1628.7	7.40			air	1581.9	7.37			air	369.5	5.91		
surface	1515.4	7.32			surface	1446.6	7.28			surface	473.6	6.16		
0.30	915.7	6.82	0.504	1.653	0.30	864.8	6.76	0.514	1.688	0.55	224.6	5.41	0.746	1.360
0.61	593.7	6.39	0.937	1.537	0.61	567.7	6.34	0.935	1.534	0.61	142.96	4.96	1.198	1.965
0.91	394.2	5.98	1.347	1.473	0.91	426.8	6.06	1.221	1.335					
1.22	257.9	5.55	1.771	1.452	1.22	255.8	5.54	1.733	1.421					

k (diffuse attenuation coefficient = slope, m-1)	1.476	1.419	1.694
k average	1.529	1.495	1.662
percent transmittance @ 1.0 meter	22.84	24.19	18.38
Birgean Percentile Absorption (1m)	77.16	75.81	81.62

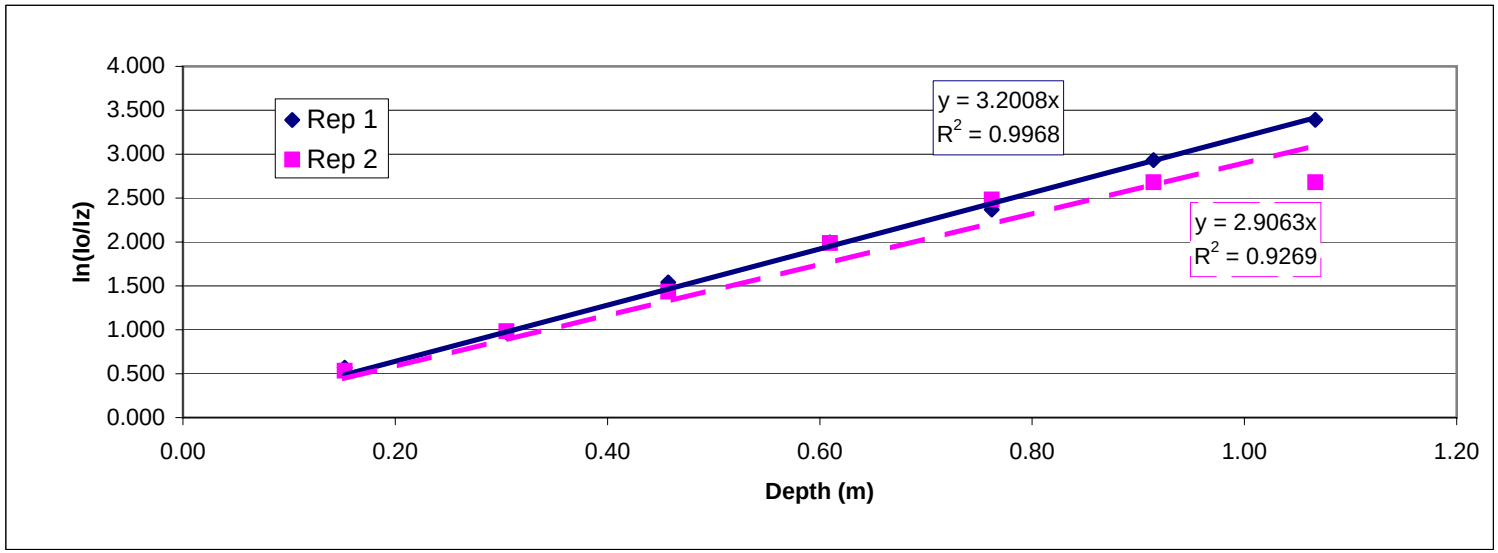


APPENDIX F-2

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 2 (UPSTREAM) - 08/09/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1421.0	7.26			1316.4	7.18		
surface	1188.6	7.08			978.6	6.89		
0.15	672.80	6.51	0.569	3.734	573.60	6.35	0.534	3.505
0.30	449.90	6.11	0.972	3.187	365.70	5.90	0.984	3.229
0.46	254.80	5.54	1.540	3.368	233.40	5.45	1.433	3.135
0.61	161.55	5.08	1.996	3.274	134.07	4.90	1.988	3.261
0.76	111.28	4.71	2.368	3.108	81.70	4.40	2.483	3.259
0.91	63.34	4.15	2.932	3.206	67.10	4.21	2.680	2.931
1.07	39.99	3.69	3.392	3.180	67.10	4.21	2.680	2.512

k (diffuse attenuation coefficient = slope, m-1)	3.201	2.906
k average	3.294	3.119
percent transmittance @ 1.0 meter	4.07	5.47
Birgean Percentile Absorption (1m)	95.93	94.53

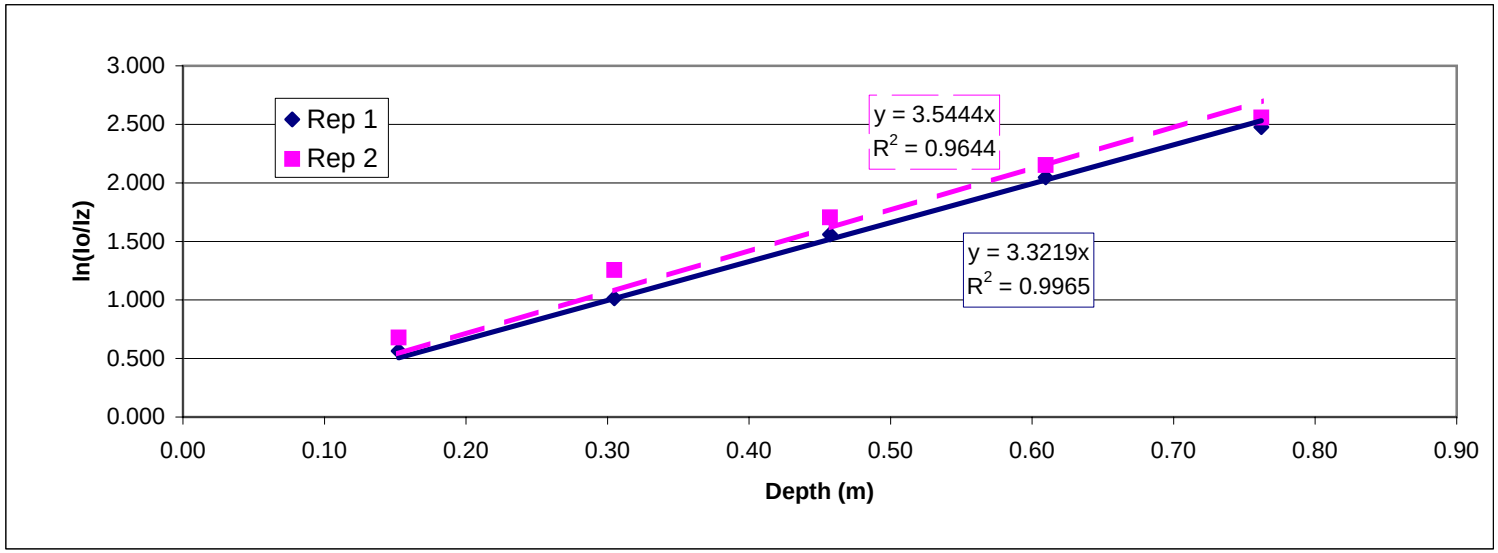


APPENDIX F-2

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 2 (DOWNSTREAM) - 08/09/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1084.9	6.99			1027.5	6.93		
surface	828.9	6.72			884.3	6.78		
0.15	471.50	6.16	0.564	3.702	448.40	6.11	0.679	4.456
0.30	300.70	5.71	1.014	3.327	251.90	5.53	1.256	4.120
0.46	174.37	5.16	1.559	3.410	160.66	5.08	1.706	3.730
0.61	106.99	4.67	2.047	3.359	102.80	4.63	2.152	3.530
0.76	69.61	4.24	2.477	3.251	68.44	4.23	2.559	3.358

k (diffuse attenuation coefficient = slope, m-1)	3.322	3.544
k average	3.410	3.839
percent transmittance @ 1.0 meter	3.61	2.89
Birgean Percentile Absorption (1m)	96.39	97.11

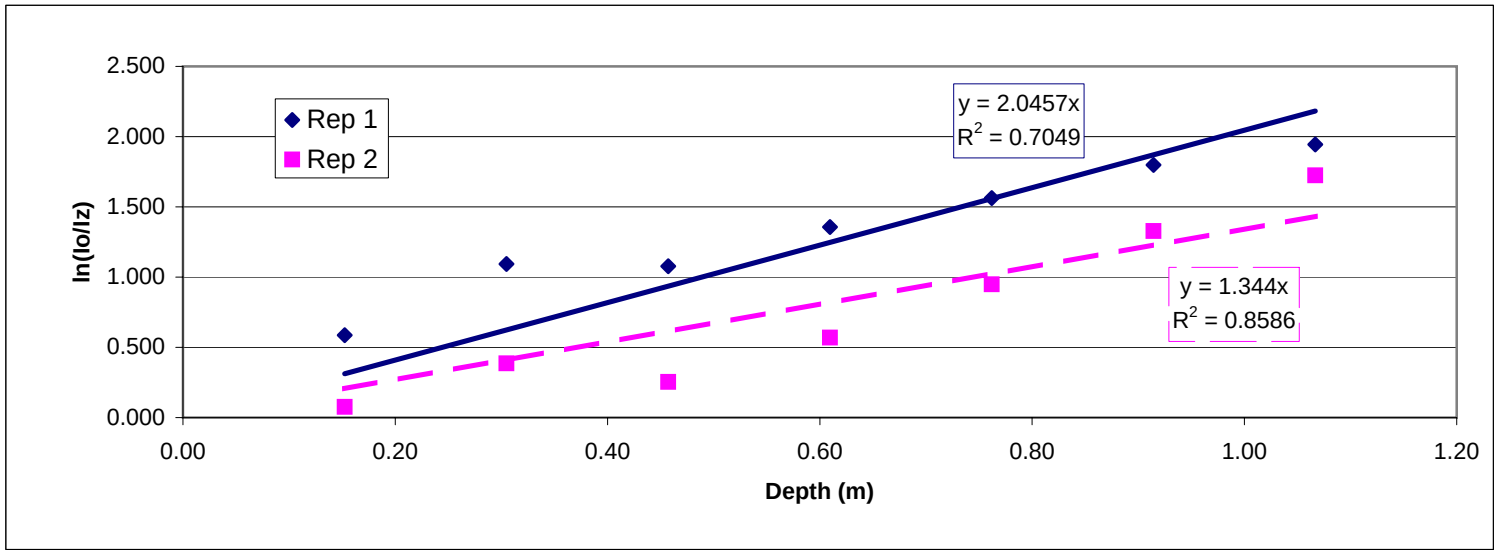


APPENDIX F-2

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 2 (UPSTREAM) - 09/01/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	766.6	6.64			941.8	6.85		
surface	697.6	6.55			634.3	6.45		
0.15	388.0	5.96	0.587	3.849	587.6	6.38	0.076	0.502
0.30	233.8	5.45	1.093	3.587	431.0	6.07	0.386	1.268
0.46	237.5	5.47	1.077	2.357	492.1	6.20	0.254	0.555
0.61	179.6	5.19	1.357	2.226	358.7	5.88	0.570	0.935
0.76	146.2	4.98	1.563	2.051	245.7	5.50	0.948	1.245
0.91	115.6	4.75	1.798	1.966	168.0	5.12	1.328	1.453
1.07	99.8	4.60	1.945	1.823	113.1	4.73	1.725	1.617

k (diffuse attenuation coefficient = slope, m-1)	2.046	1.344
k average	2.551	1.082
percent transmittance @ 1.0 meter	12.93	26.08
Birgean Percentile Absorption (1m)	87.07	73.92

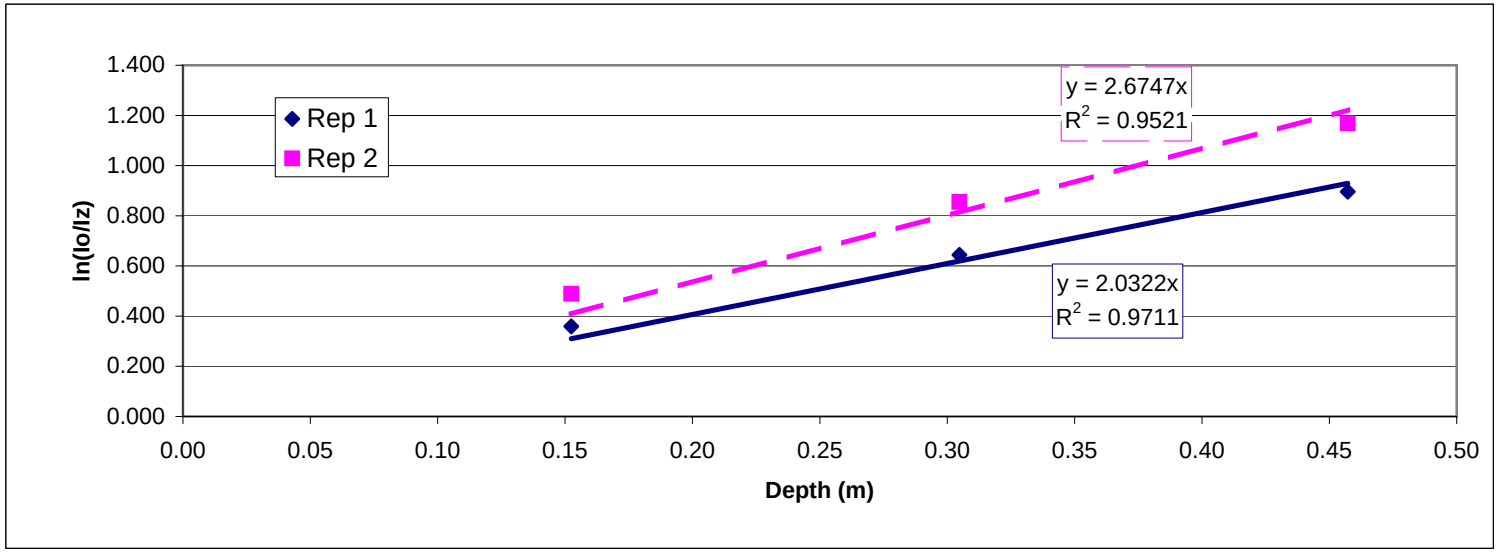


APPENDIX F-2

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - WEKIVA RIVER SEGMENT 2 (DOWNSTREAM) - 09/01/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	363.4	5.90			454.3	6.12		
surface	368.7	5.91			483.8	6.18		
0.15	257.40	5.55	0.359	2.358	296.70	5.69	0.489	3.208
0.30	193.61	5.27	0.644	2.113	205.70	5.33	0.855	2.806
0.46	150.49	5.01	0.896	1.960	150.29	5.01	1.169	2.557

k (diffuse attenuation coefficient = slope, m-1)	2.032	2.675
k average	2.144	2.857
percent transmittance @ 1.0 meter	13.10	6.89
Birgean Percentile Absorption (1m)	86.90	93.11

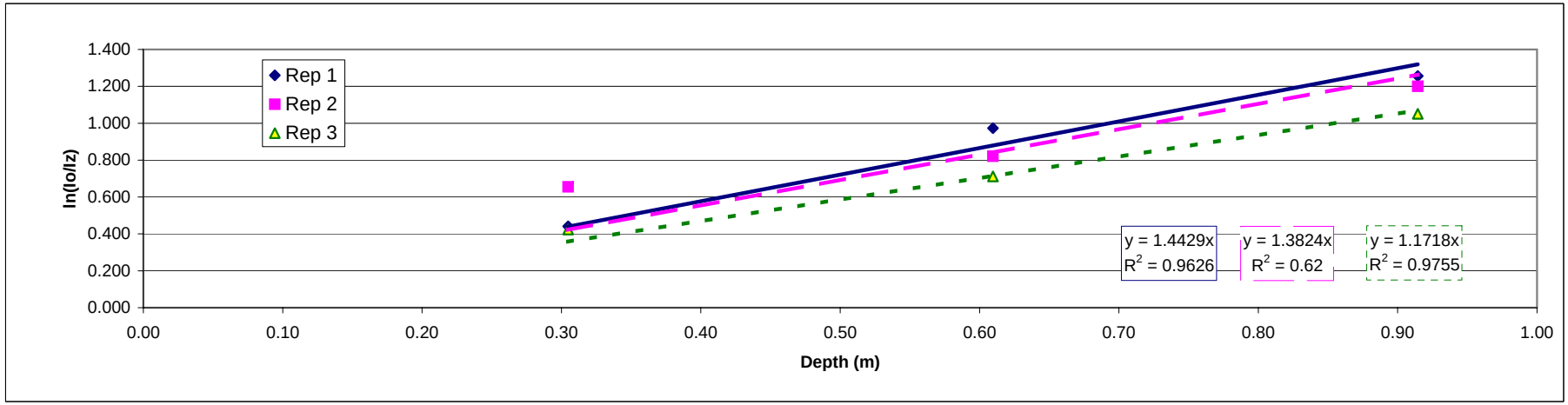


APPENDIX F-3

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 1 (DOWNSTREAM) - 04/01/05

Depth (m)	Rep 1				Rep 2				Rep 3			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1441.7	7.27			1269.7	7.15			1333.2	7.20		
surface	1487.8	7.31			1495.8	7.31			1450.5	7.28		
0.30	957.1	6.86	0.441	1.447	776.6	6.65	0.655	2.151	949.7	6.86	0.424	1.389
0.61	562	6.33	0.974	1.597	658.2	6.49	0.821	1.347	711.7	6.57	0.712	1.168
0.91	423.6	6.05	1.256	1.374	450.3	6.11	1.201	1.313	507.1	6.23	1.051	1.149

k (diffuse attenuation coefficient = slope, m-1)	1.443	1.382	1.172
k average	1.473	1.603	1.236
percent transmittance @ 1.0 meter	23.62	25.10	30.98
Birgean Percentile Absorption (1m)	76.38	74.90	69.02

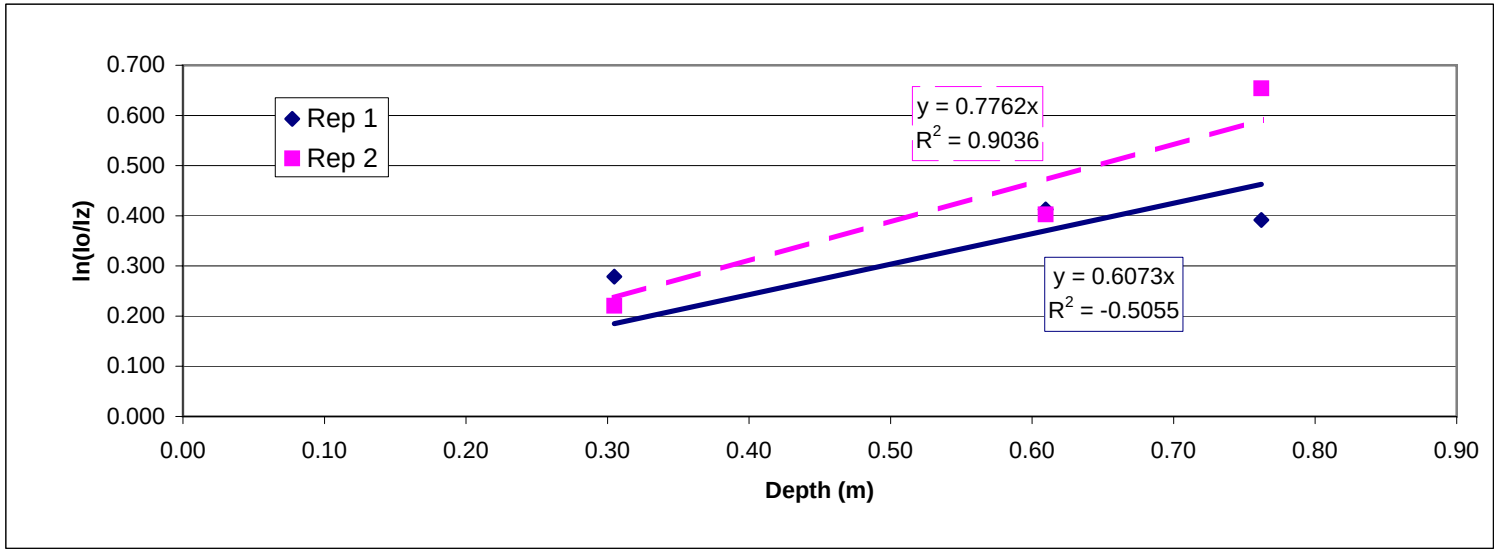


APPENDIX F-3

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 1 (DOWNSTREAM) - 04/20/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	389.6	5.97			1867.4	7.53		
surface	370.1	5.91			1969.5	7.59		
0.30	280.1	5.64	0.279	0.914	1579.6	7.36	0.221	0.724
0.61	245	5.50	0.413	0.677	1316.5	7.18	0.403	0.661
0.76	250.2	5.52	0.392	0.514	1023.9	6.93	0.654	0.858

k (diffuse attenuation coefficient = slope, m-1)	0.607	0.776
k average	0.702	0.748
percent transmittance @ 1.0 meter	54.48	46.01
Birgean Percentile Absorption (1m)	45.52	53.99

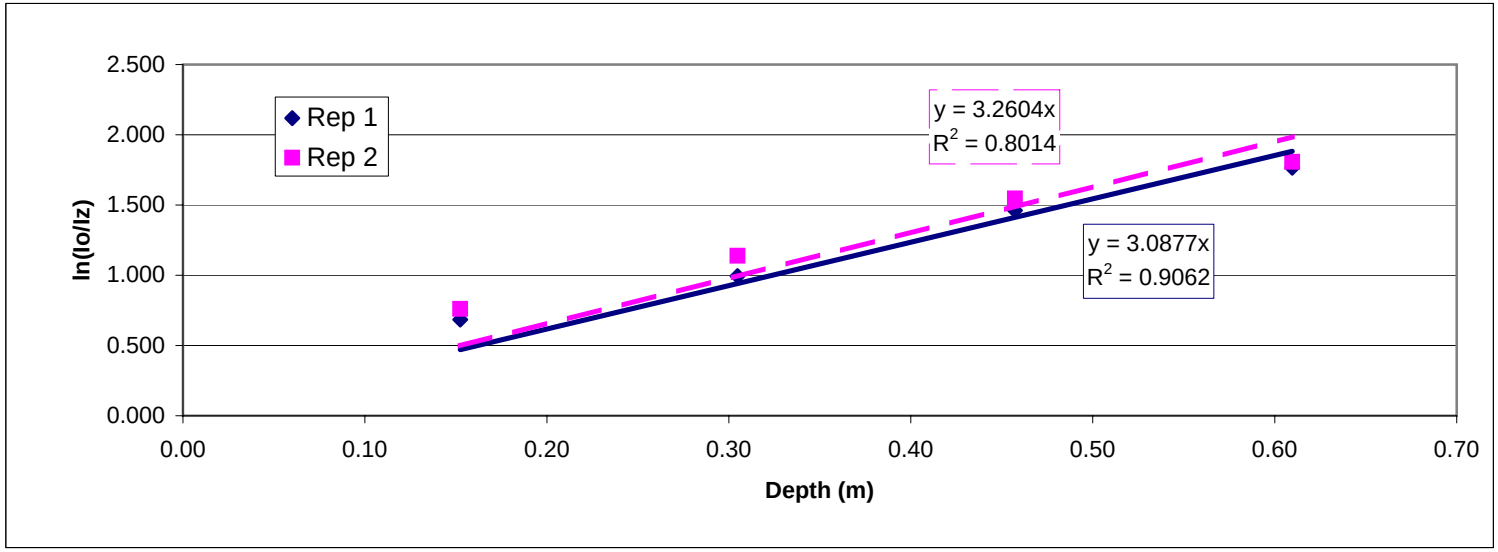


APPENDIX F-3

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 1 (DOWNSTREAM) - 07/12/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	122.77	4.81			122.24	4.81		
surface	123.27	4.81			127.86	4.85		
0.15	62.15	4.13	0.685	4.494	59.78	4.09	0.760	4.989
0.30	45.60	3.82	0.994	3.263	40.93	3.71	1.139	3.737
0.46	28.60	3.35	1.461	3.195	27.24	3.30	1.546	3.382
0.61	21.10	3.05	1.765	2.896	20.98	3.04	1.807	2.965

k (diffuse attenuation coefficient = slope, m-1)	3.088	3.260
k average	3.462	3.768
percent transmittance @ 1.0 meter	4.56	3.84
Birgean Percentile Absorption (1m)	95.44	96.16

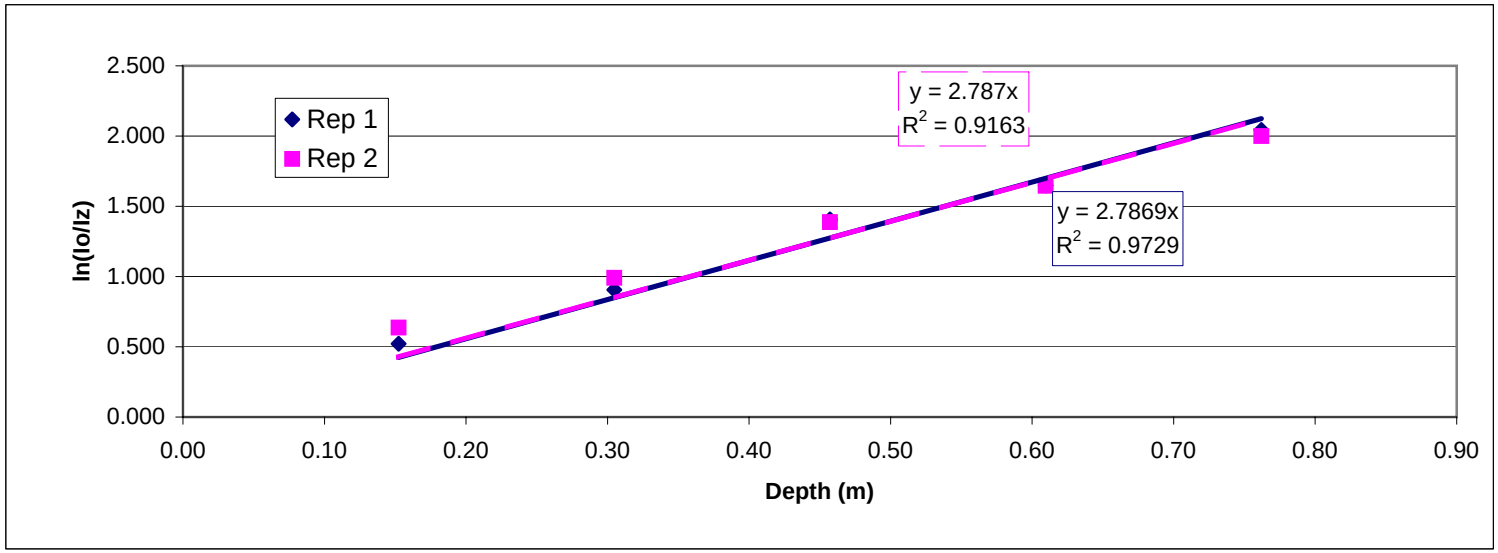


APPENDIX F-3

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 1 (UPSTREAM) - 07/12/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	299.20	5.70			323.40	5.78		
surface	283.30	5.65			294.90	5.69		
0.15	168.18	5.13	0.521	3.422	155.97	5.05	0.637	4.180
0.30	114.59	4.74	0.905	2.970	109.51	4.70	0.991	3.250
0.46	69.38	4.24	1.407	3.077	73.65	4.30	1.387	3.034
0.61	54.52	4.00	1.648	2.703	56.89	4.04	1.646	2.699
0.76	36.72	3.60	2.043	2.681	39.92	3.69	2.000	2.624

k (diffuse attenuation coefficient = slope, m-1)	2.787	2.787
k average	2.971	3.158
percent transmittance @ 1.0 meter	6.16	6.16
Birgean Percentile Absorption (1m)	93.84	93.84

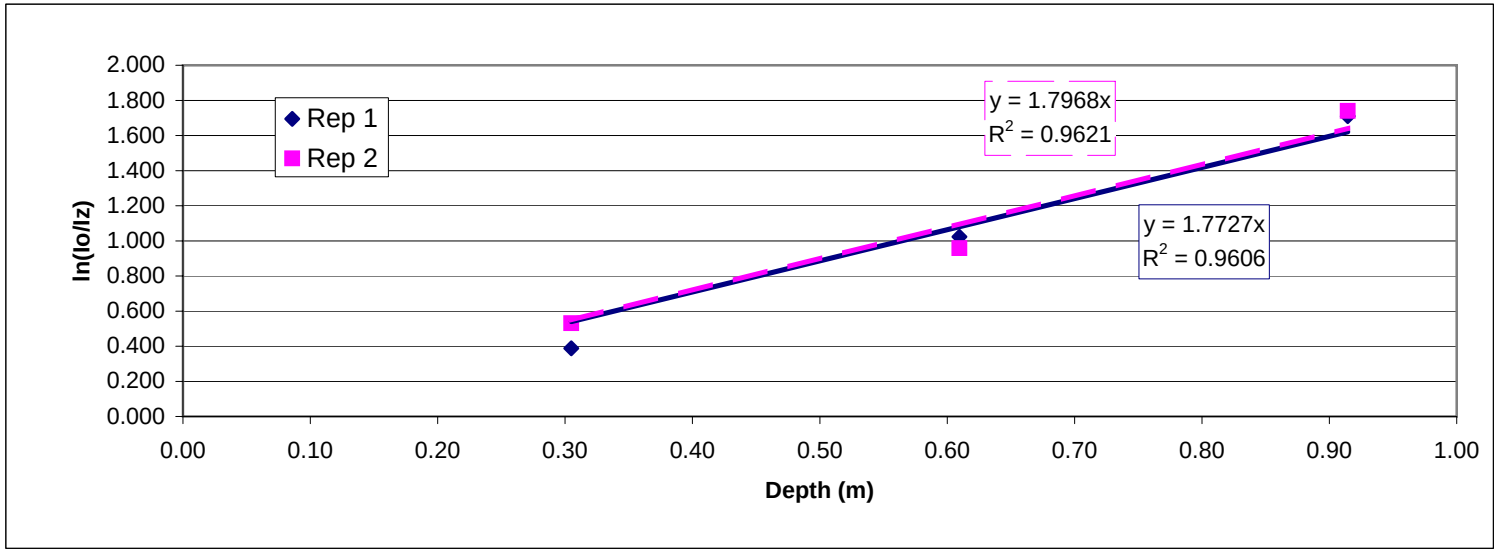


APPENDIX F-3

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 1 (UPSTREAM) - 08/03/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	368.30	5.91			342.90	5.84		
surface	267.20	5.59			390.20	5.97		
0.30	181.29	5.20	0.388	1.273	229.40	5.44	0.531	1.743
0.61	96.05	4.56	1.023	1.678	149.69	5.01	0.958	1.572
0.91	48.32	3.88	1.710	1.870	68.49	4.23	1.740	1.903

k (diffuse attenuation coefficient = slope, m-1)	1.773	1.797
k average	1.607	1.739
percent transmittance @ 1.0 meter	16.99	16.58
Birgean Percentile Absorption (1m)	83.01	83.42

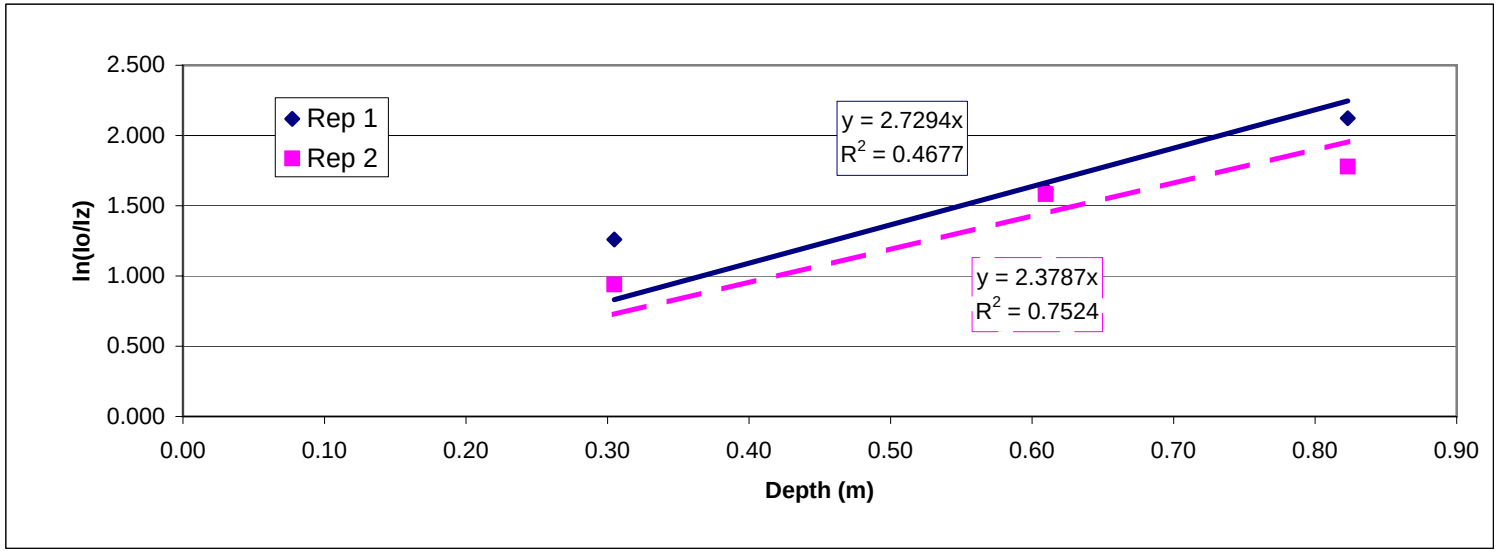


APPENDIX F-3

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 1 (DOWNSTREAM) - 08/03/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	807.40	6.69			884.00	6.78		
surface	1029.30	6.94			805.50	6.69		
0.30	292.00	5.68	1.260	4.133	314.80	5.75	0.940	3.082
0.61	204.60	5.32	1.616	2.650	165.34	5.11	1.583	2.598
0.82	123.12	4.81	2.123	2.580	135.93	4.91	1.779	2.162

k (diffuse attenuation coefficient = slope, m-1)	2.729	2.379
k average	3.121	2.614
percent transmittance @ 1.0 meter	6.53	9.27
Birgean Percentile Absorption (1m)	93.47	90.73

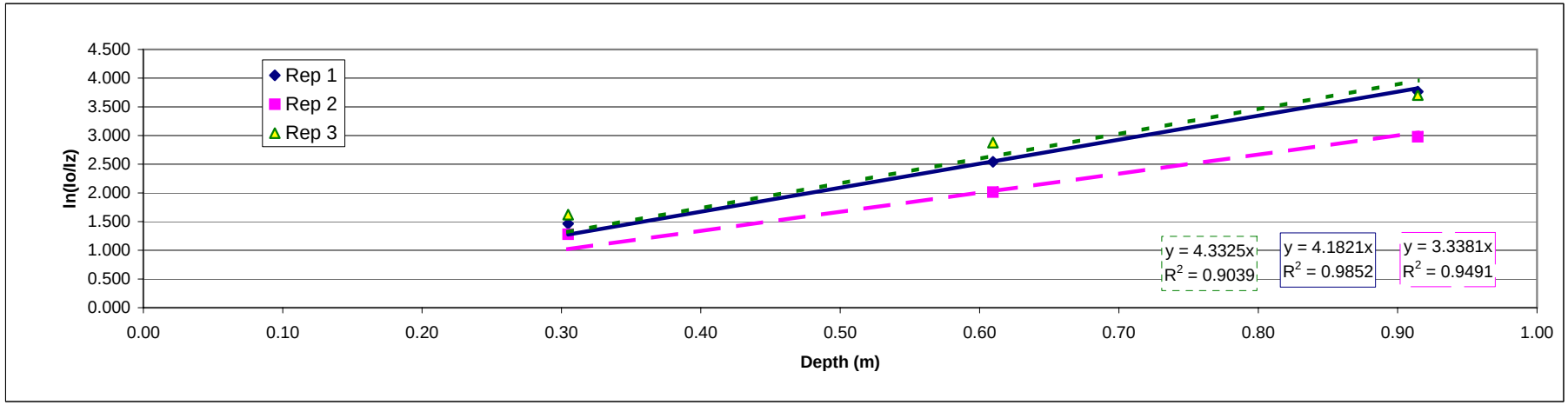


APPENDIX F-4

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 2 (DOWNSTREAM) - 04/01/05

Depth (m)	Rep 1				Rep 2				Rep 3			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	407.1	6.01			243.6	5.50			184.67	5.22		
surface	492.9	6.20			202.8	5.31			205.6	5.33		
0.30	114.02	4.74	1.464	4.803	56.46	4.03	1.279	4.195	40.66	3.71	1.621	5.317
0.61	38.84	3.66	2.541	4.168	27.06	3.30	2.014	3.304	11.58	2.45	2.877	4.719
0.91	11.4	2.43	3.767	4.119	10.31	2.33	2.979	3.258	5.06	1.62	3.705	4.051

k (diffuse attenuation coefficient = slope, m-1)	4.182	3.338	4.333
k average	4.363	3.586	4.696
percent transmittance @ 1.0 meter	1.53	3.55	1.31
Birgean Percentile Absorption (1m)	98.47	96.45	98.69

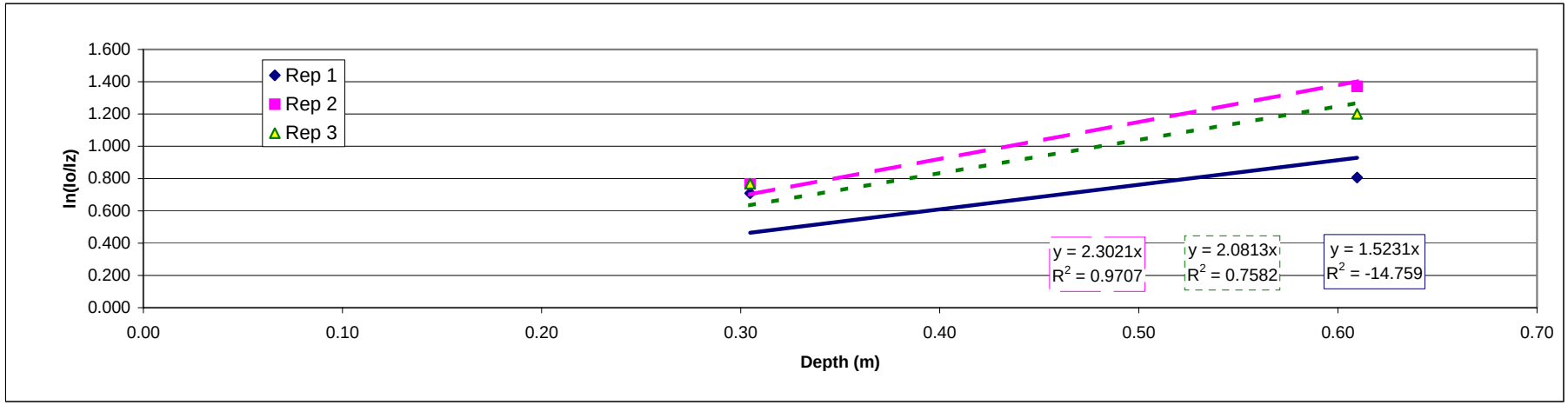


APPENDIX F-4

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 2 (DOWNSTREAM) - 04/21/05

Depth (m)	Rep 1				Rep 2				Rep 3			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	435.8	6.08			1412.3	7.25			1330.8	7.19		
surface	319.8	5.77			1603.6	7.38			1653.9	7.41		
0.30	157.42	5.06	0.709	2.325	744.7	6.61	0.767	2.516	766.6	6.64	0.769	2.523
0.61	142.81	4.96	0.806	1.322	407.2	6.01	1.371	2.249	497.4	6.21	1.201	1.971

k (diffuse attenuation coefficient = slope, m-1)	1.523	2.302	2.081
k average	1.824	2.383	2.247
percent transmittance @ 1.0 meter	21.80	10.00	12.48
Birgean Percentile Absorption (1m)	78.20	90.00	87.52

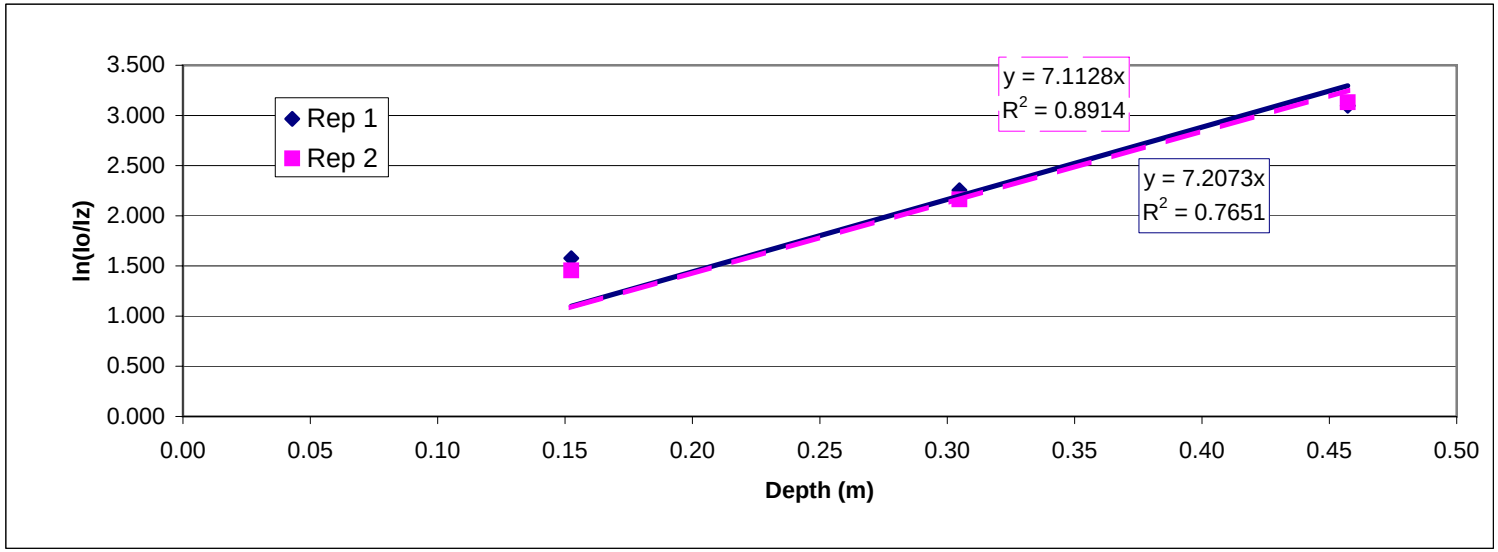


APPENDIX F-4

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 2 (DOWNSTREAM) - 07/12/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	41.95	3.74			44.39	3.79		
surface	34.97	3.55			34.80	3.55		
0.15	7.22	1.98	1.578	10.352	8.11	2.09	1.457	9.557
0.30	3.67	1.30	2.254	7.396	4.00	1.39	2.163	7.098
0.46	1.58	0.46	3.097	6.774	1.52	0.42	3.131	6.848

k (diffuse attenuation coefficient = slope, m-1)	7.207	7.113
k average	8.174	7.834
percent transmittance @ 1.0 meter	0.07	0.08
Birgean Percentile Absorption (1m)	99.93	99.92

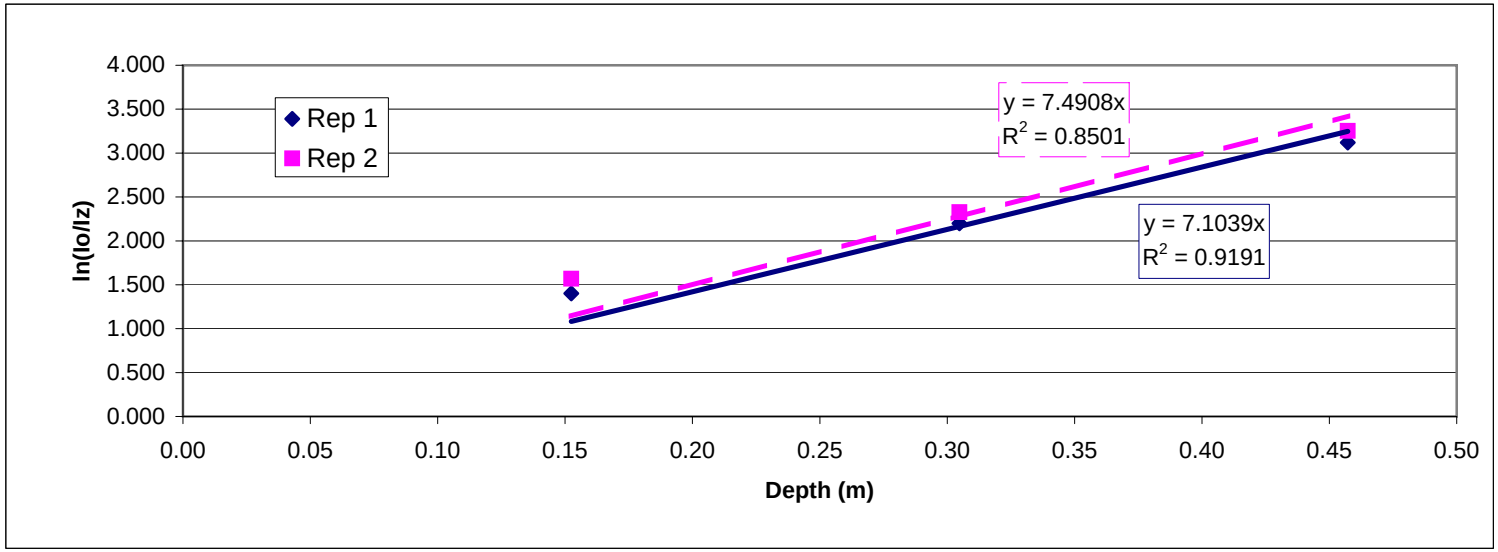


APPENDIX F-4

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 2 (UPSTREAM) - 07/12/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	176.88	5.18			176.77	5.17		
surface	135.28	4.91			151.33	5.02		
0.15	33.31	3.51	1.401	9.196	31.54	3.45	1.568	10.290
0.30	15.00	2.71	2.199	7.216	14.76	2.69	2.328	7.636
0.46	5.98	1.79	3.119	6.822	5.85	1.77	3.253	7.115

k (diffuse attenuation coefficient = slope, m-1)	7.104	7.491
k average	7.744	8.347
percent transmittance @ 1.0 meter	0.08	0.06
Birgean Percentile Absorption (1m)	99.92	99.94

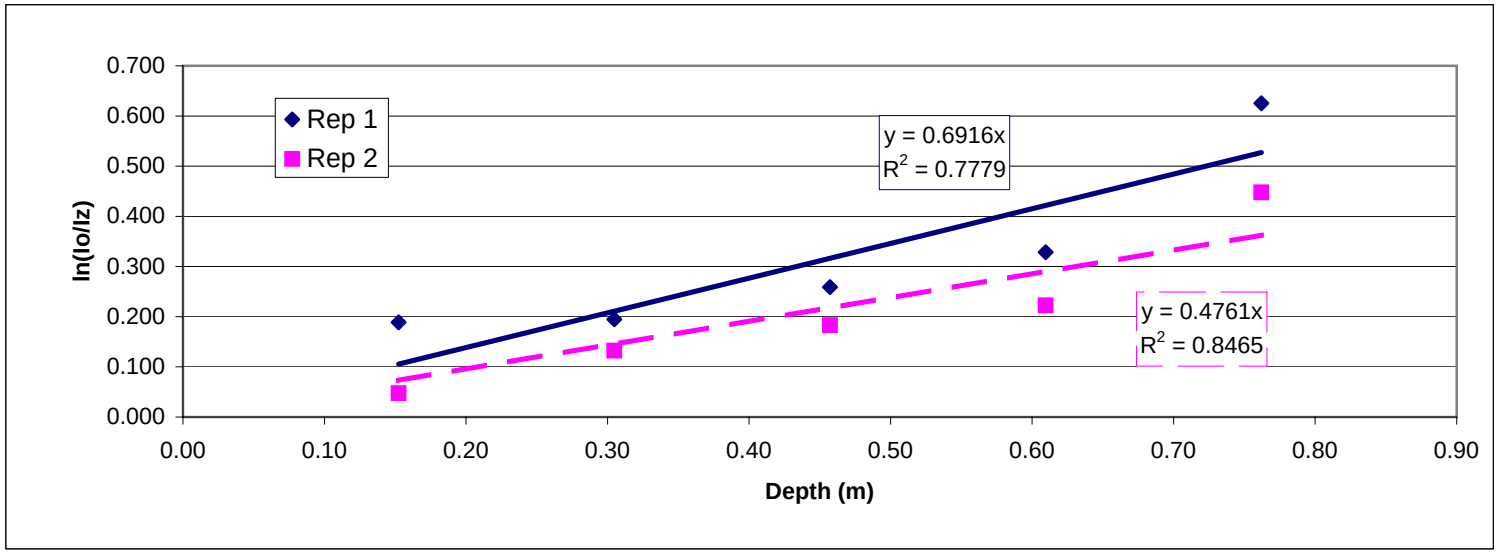


APPENDIX F-4

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN MB1 (@ BRIDGE) - 07/12/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	448.1	6.11			527.6	6.27		
surface	417.2	6.03			372.4	5.92		
0.15	345.4	5.84	0.189	1.239	355.1	5.87	0.048	0.312
0.30	343.3	5.84	0.195	0.640	326.2	5.79	0.132	0.435
0.46	322.0	5.77	0.259	0.567	310.1	5.74	0.183	0.400
0.61	300.4	5.71	0.328	0.539	298.1	5.70	0.223	0.365
0.76	223.2	5.41	0.625	0.821	238.0	5.47	0.448	0.588

k (diffuse attenuation coefficient = slope, m-1)	0.692	0.476
k average	0.761	0.420
percent transmittance @ 1.0 meter	50.08	62.12
Birgean Percentile Absorption (1m)	49.92	37.88

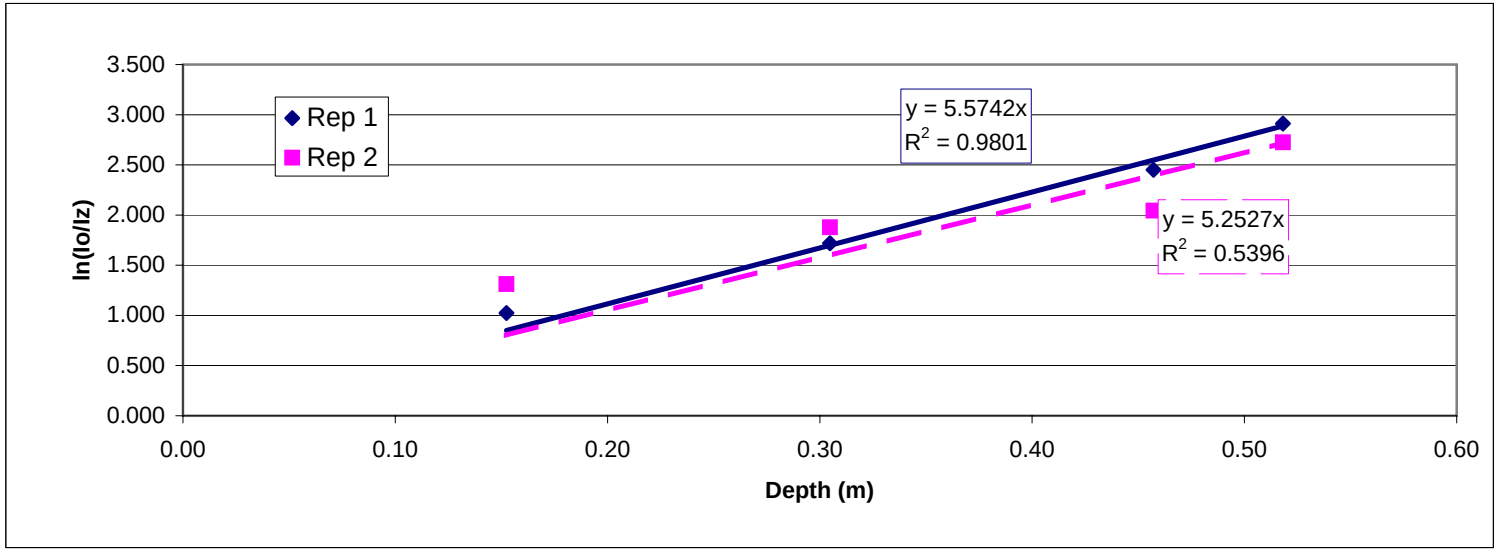


APPENDIX F-4

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 2 (DOWNSTREAM) - 08/04/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	276.3	5.62			281.0	5.64		
surface	225.4	5.42			208.9	5.34		
0.15	80.95	4.39	1.024	6.719	56.23	4.03	1.312	8.612
0.30	40.39	3.70	1.719	5.641	31.95	3.46	1.878	6.160
0.46	19.44	2.97	2.451	5.360	27.07	3.30	2.043	4.469
0.52	12.26	2.51	2.912	5.619	13.70	2.62	2.724	5.258

k (diffuse attenuation coefficient = slope, m-1)	5.574	5.253
k average	5.835	6.125
percent transmittance @ 1.0 meter	0.38	0.52
Birgean Percentile Absorption (1m)	99.62	99.48

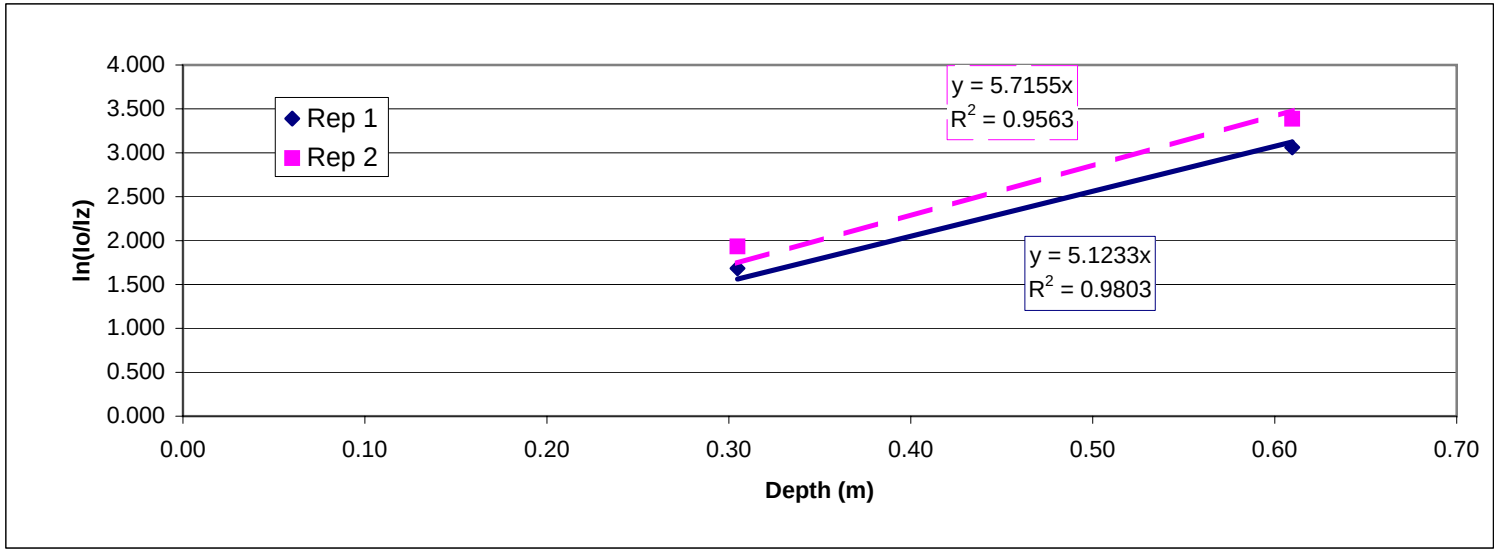


APPENDIX F-4

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ROCK SPRING RUN SEGMENT 2 (UPSTREAM) - 08/04/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	268.80	5.59			659.30	6.49		
surface	212.20	5.36			295.50	5.69		
0.30	39.39	3.67	1.684	5.525	42.71	3.75	1.934	6.346
0.61	9.93	2.30	3.062	5.023	9.98	2.30	3.388	5.558

k (diffuse attenuation coefficient = slope, m-1)	5.123	5.715
k average	5.274	5.952
percent transmittance @ 1.0 meter	0.60	0.33
Birgean Percentile Absorption (1m)	99.40	99.67

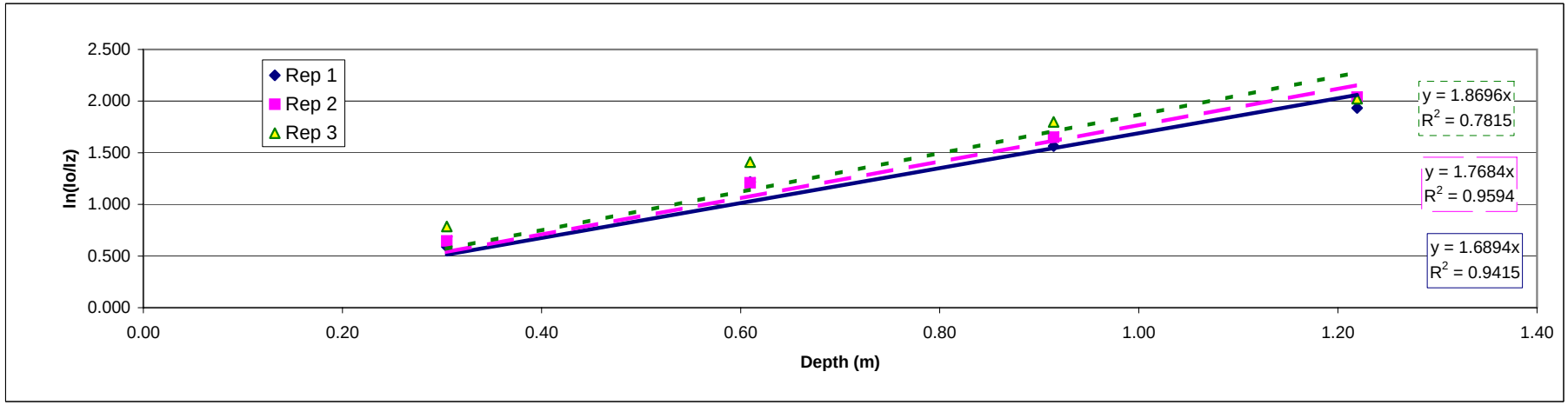


APPENDIX F-5

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - JUNIPER CREEK SEGMENT 1 (DOWNSTREAM) - 03/31/05

Depth (m)	Rep 1				Rep 2				Rep 3			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	163.12	5.09			134.13	4.90			145.18	4.98		
surface	134.37	4.90			132.92	4.89			130.93	4.87		
0.30	74.51	4.31	0.590	1.935	69.68	4.24	0.646	2.119	59.65	4.09	0.786	2.579
0.61	39.77	3.68	1.217	1.997	39.66	3.68	1.209	1.984	31.99	3.47	1.409	2.312
0.91	28.12	3.34	1.564	1.711	25.51	3.24	1.651	1.805	21.68	3.08	1.798	1.967
1.22	19.45	2.97	1.933	1.585	17.31	2.85	2.038	1.672	17.3	2.85	2.024	1.660

k (diffuse attenuation coefficient = slope, m-1)	1.689	1.768	1.870
k average	1.807	1.895	2.129
percent transmittance @ 1.0 meter	18.46	17.06	15.42
Birgean Percentile Absorption (1m)	81.54	82.94	84.58

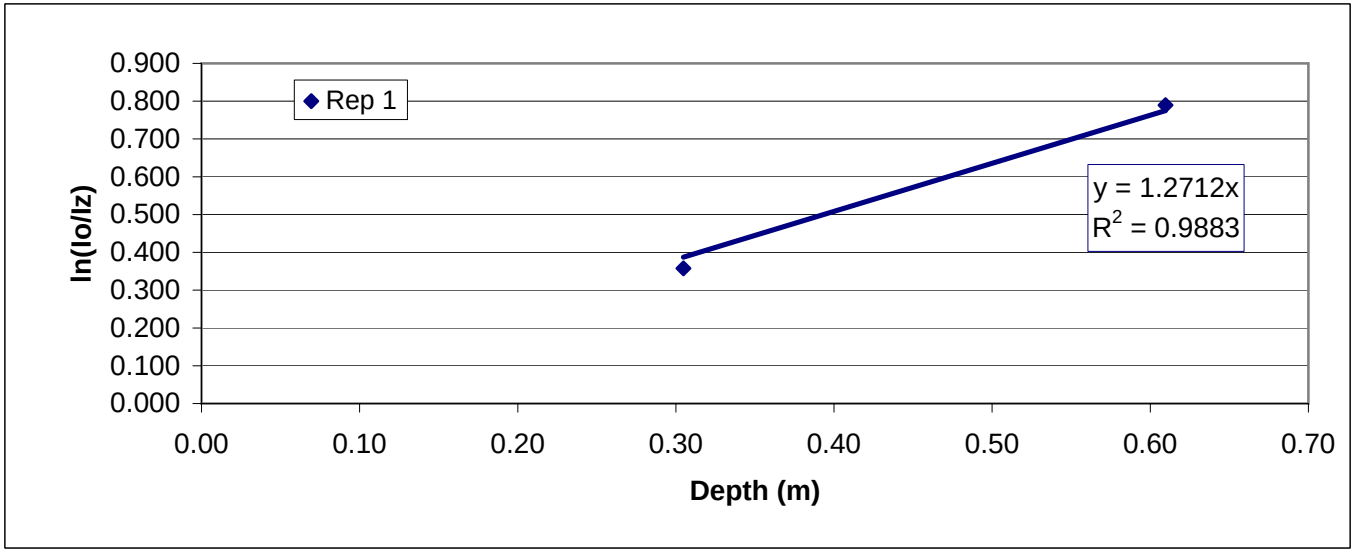


APPENDIX F-5

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - JUNIPER CREEK SEGMENT 1 (DOWNSTREAM) - 04/15/05

Depth (m)	Rep 1			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	880.2	6.78		
surface	743.2	6.61		
0.30	519.6	6.25	0.358	1.174
0.61	337.4	5.82	0.790	1.295

k (diffuse attenuation coefficient = slope, m-1)		1.271
k average		1.235
percent transmittance @	1.0 meter	28.05
Birgean Percentile Absorption (1m)		71.95

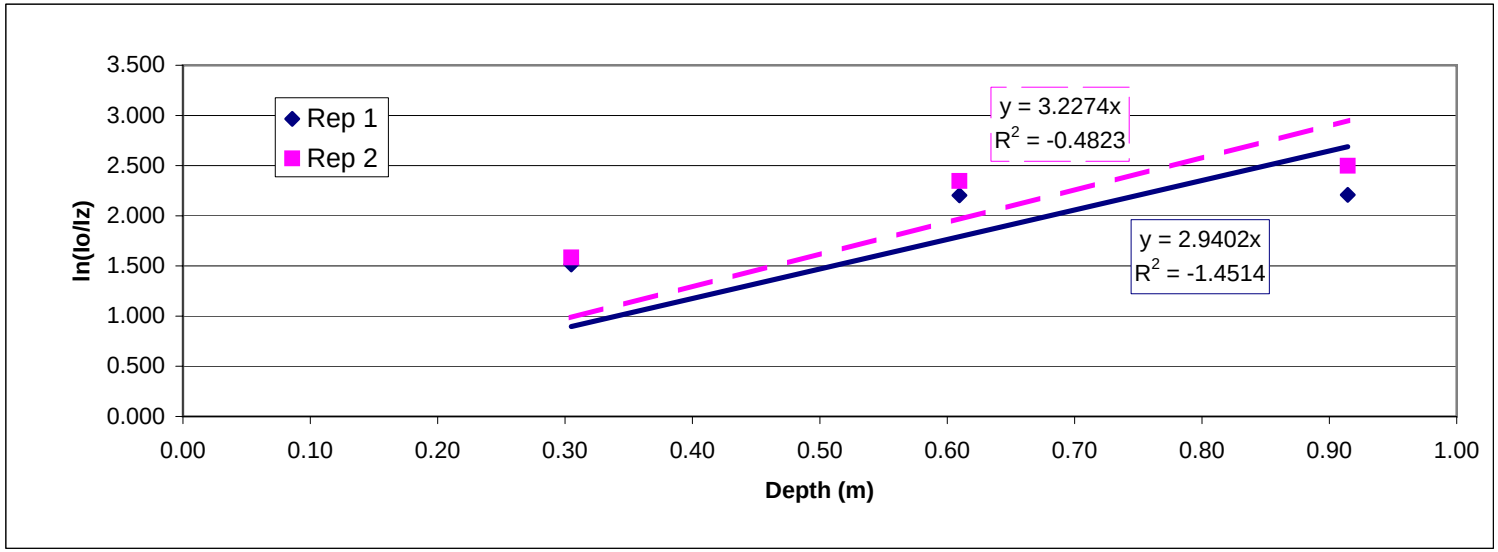


APPENDIX F-5

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - JUNIPER CREEK SEGMENT 1 (UPSTREAM) - 07/11/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	874.2	6.77			874.2	6.77		
surface	1109.1	7.01			1334.9	7.20		
0.30	244	5.50	1.514	4.968	273.7	5.61	1.585	5.199
0.61	122.37	4.81	2.204	3.616	127.71	4.85	2.347	3.850
0.91	121.92	4.80	2.208	2.415	109.81	4.70	2.498	2.732

k (diffuse attenuation coefficient = slope, m-1)	2.940	3.227
k average	3.666	3.927
percent transmittance @ 1.0 meter	5.29	3.97
Birgean Percentile Absorption (1m)	94.71	96.03

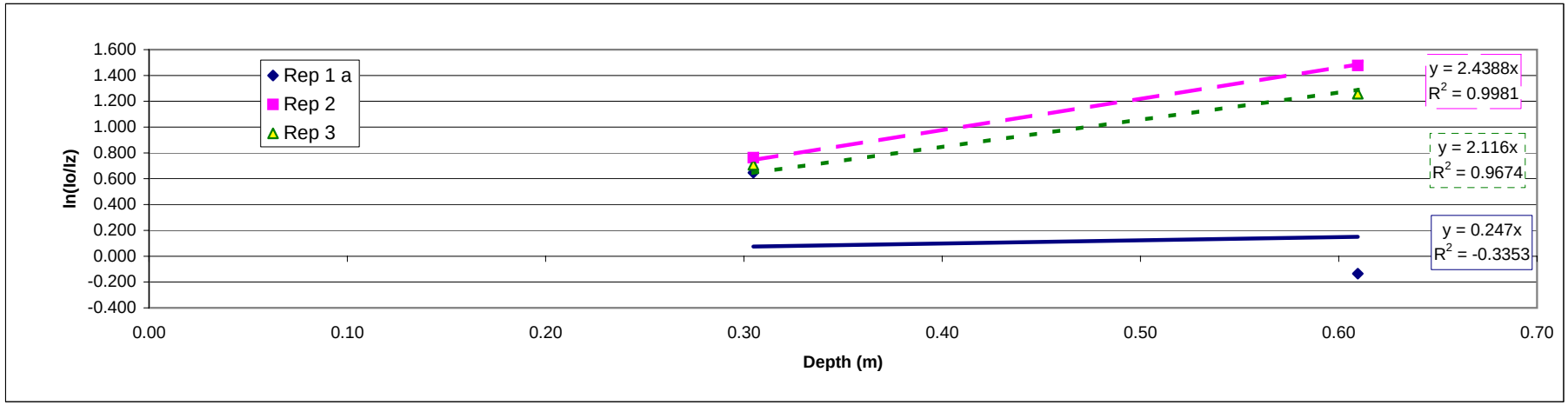


APPENDIX F-5

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - JUNIPER CREEK SEGMENT 1 (DOWNSTREAM) - 7/11/05

Depth (m)	Rep 1 [a]				Rep 2				Rep 3			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	468.5	6.15			1374.2	7.23			921.35	6.83		
surface	390	5.97			1616.1	7.39			1536.8	7.34		
0.30	204.2	5.32	0.647	2.123	753.7	6.62	0.763	2.503	757.2	6.63	0.708	2.322
0.61	446.5	6.10	-0.135	-0.222	369	5.91	1.477	2.423	436.6	6.08	1.258	2.064

k (diffuse attenuation coefficient = slope, m-1)	0.247	2.439	2.116
k average	0.950	2.463	2.193
percent transmittance @ 1.0 meter	78.11	8.73	12.05
Birgean Percentile Absorption (1m)	21.89	91.27	87.95



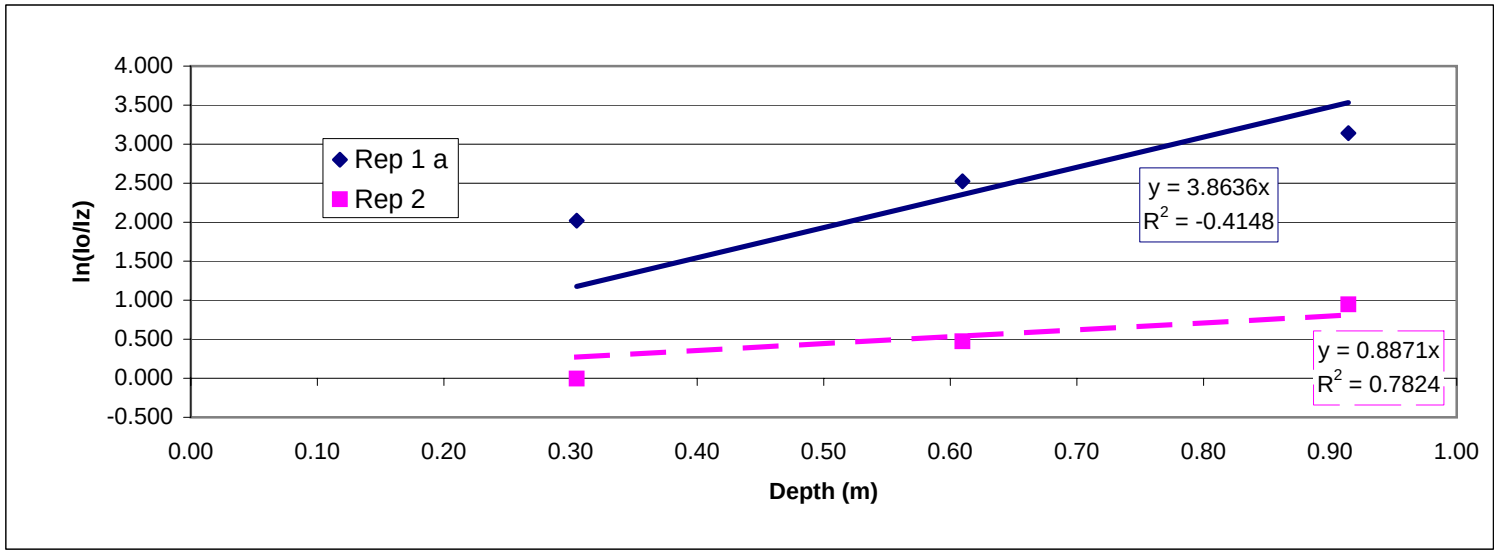
[a] clouds cleared when collecting measurements @ 0.61 m

APPENDIX F-5

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - JUNIPER CREEK SEGMENT 1 (DOWNSTREAM) - 08/01/05

Depth (m)	Rep 1 [a]				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1685	7.43			263.2	5.57		
surface	1069.7	6.98			118.03	4.77		
0.30	141.96	4.96	2.020	6.626	118.59	4.78	-0.005	-0.016
0.61	85.78	4.45	2.523	4.139	73.44	4.30	0.474	0.778
0.91	46.29	3.83	3.140	3.434	45.78	3.82	0.947	1.036

k (diffuse attenuation coefficient = slope, m-1)	3.864	0.887
k average	4.733	0.600
percent transmittance @ 1.0 meter	2.10	41.18
Birgean Percentile Absorption (1m)	97.90	58.82



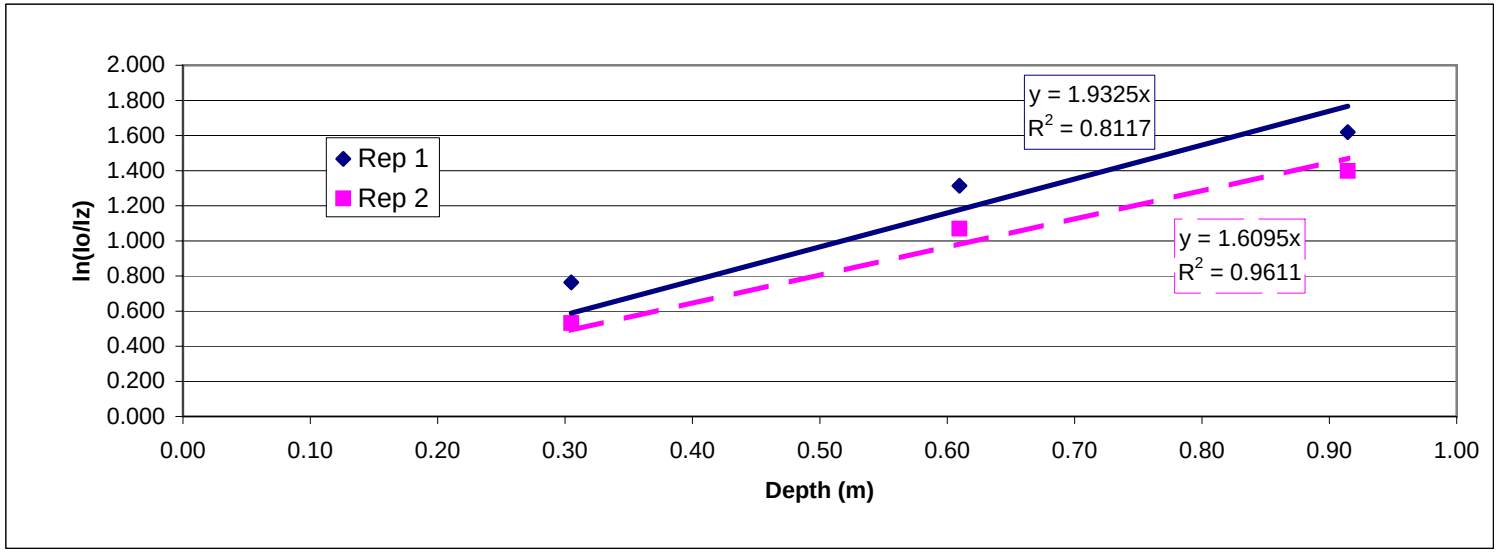
[a] cloud cover when collecting measurements @ 0.30 m

APPENDIX F-5

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - JUNIPER CREEK SEGMENT 1 (UPSTREAM) - 08/01/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	276.40	5.62			359.40	5.88		
surface	271.30	5.60			288.20	5.66		
0.30	126.46	4.84	0.763	2.504	169.23	5.13	0.532	1.747
0.61	72.94	4.29	1.314	2.155	98.90	4.59	1.070	1.755
0.91	53.76	3.98	1.619	1.770	71.15	4.26	1.399	1.530

k (diffuse attenuation coefficient = slope, m-1)	1.933	1.610
k average	2.143	1.677
percent transmittance @ 1.0 meter	14.48	20.00
Birgean Percentile Absorption (1m)	85.52	80.00

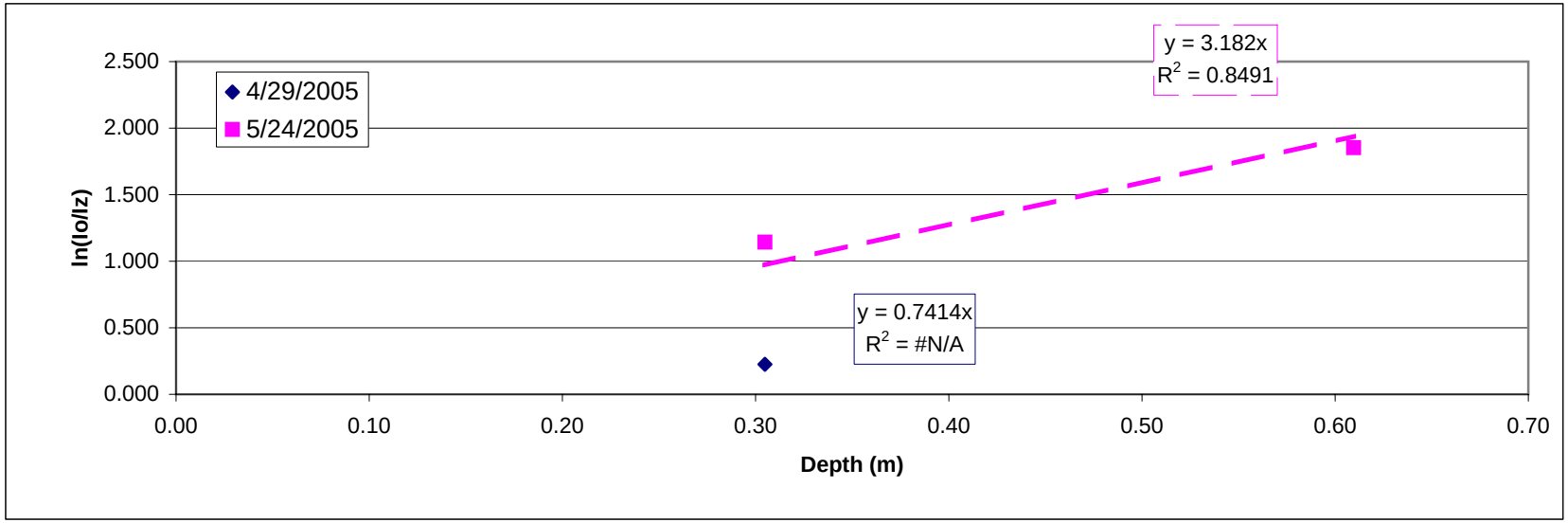


APPENDIX F-6

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ALEXANDER SPRING CREEK SEGMENT 1 (DOWNSTREAM)

Depth (m)	4/29/2005				Depth (m)	5/24/2005			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	91.01	4.51			air	362.3	5.89		
surface	62.00	4.13			surface	300.3	5.70		
0.30	49.46	3.90	0.226	0.741	0.30	95.66	4.56	1.144	3.753
					0.61	47.09	3.85	1.853	3.039

k (diffuse attenuation coefficient = slope, m-1)	---	k (diffuse attenuation coefficient = slope, m-1)	3.182
k average	0.741	k average	3.396
percent transmittance @ 1.0 meter	---	percent transmittance @ 1.0 meter	4.15
Birgean Percentile Absorption (1m)	---	Birgean Percentile Absorption (1m)	95.85

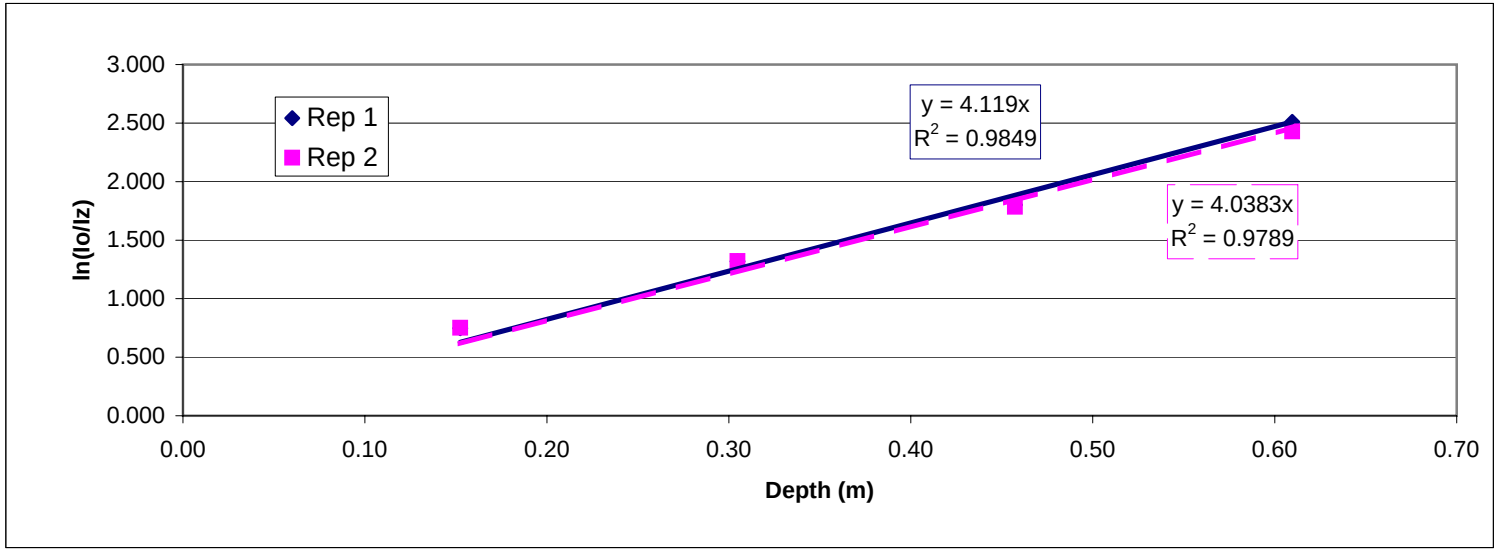


APPENDIX F-6

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ALEXANDER SPRING CREEK SEGMENT 1 (DOWNSTREAM) - 08/09/05

Depth (m)	Rep 1				Rep 2			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1680.8	7.43			1689.1	7.43		
surface	1401.0	7.24			1292.8	7.16		
0.15	663.10	6.50	0.748	4.908	609.40	6.41	0.752	4.935
0.30	374.50	5.93	1.319	4.329	344.60	5.84	1.322	4.338
0.46	231.40	5.44	1.801	3.939	217.00	5.38	1.785	3.903
0.61	113.77	4.73	2.511	4.119	114.02	4.74	2.428	3.983

k (diffuse attenuation coefficient = slope, m-1)	4.119	4.038
k average	4.324	4.290
percent transmittance @ 1.0 meter	1.63	1.76
Birgean Percentile Absorption (1m)	98.37	98.24

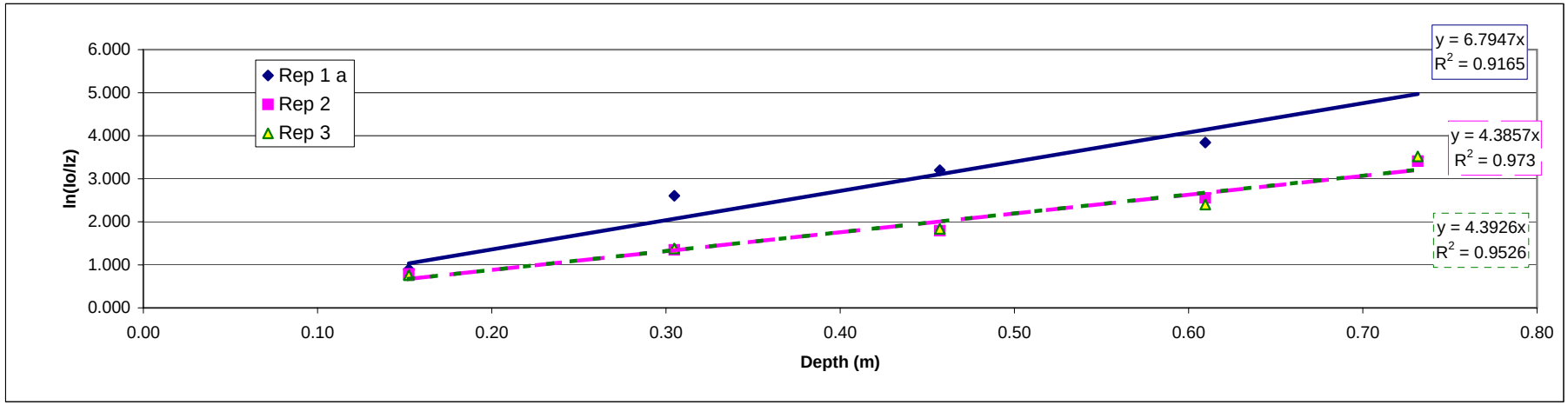


APPENDIX F-6

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ALEXANDER SPRING CREEK SEGMENT 1 (UPSTREAM) - 08/09/05

Depth (m)	Rep 1 [a]				Rep 2				Rep 3			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1720.5	7.45			1827.8	7.51			1821.3	7.51		
surface	1425	7.26			1461.5	7.29			1450.5	7.28		
0.15	582	6.37	0.895	5.876	663.4	6.50	0.790	5.183	678.8	6.52	0.759	4.983
0.30	105.54	4.66	2.603	8.539	379.4	5.94	1.349	4.425	365.5	5.90	1.378	4.522
0.46	58.15	4.06	3.199	6.997	243	5.49	1.794	3.924	231.3	5.44	1.836	4.016
0.61	30.57	3.42	3.842	6.302	113.62	4.73	2.554	4.190	131.63	4.88	2.400	3.936
0.73					48.33	3.88	3.409	4.660	43.04	3.76	3.518	4.809

k (diffuse attenuation coefficient = slope, m-1)	6.795	4.386	4.393
k average	6.929	4.476	4.453
percent transmittance @ 1.0 meter	0.11	1.25	1.24
Birgean Percentile Absorption (1m)	99.89	98.75	98.76



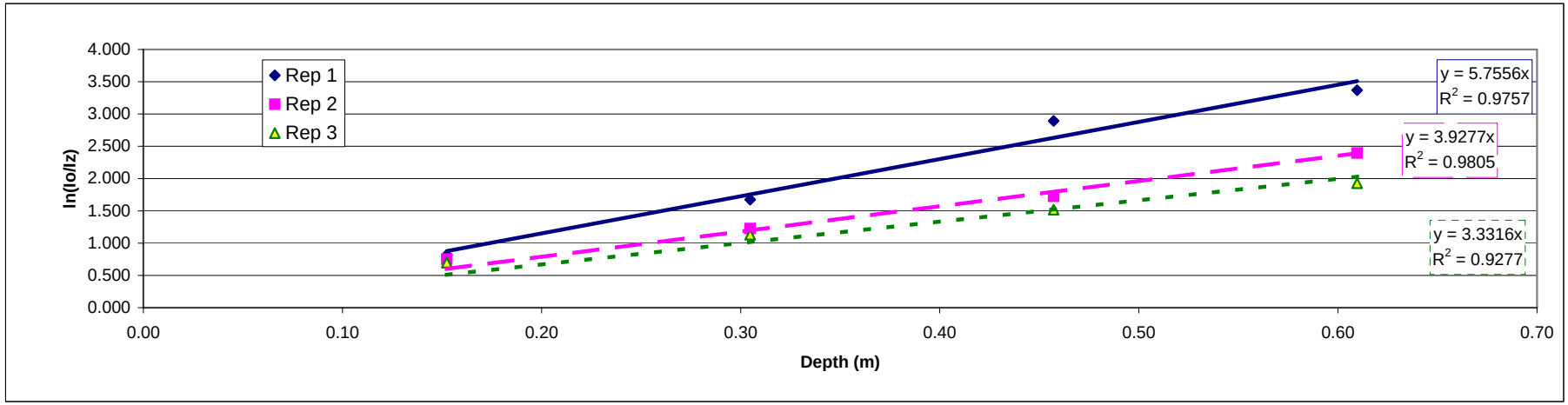
[a] partly cloudy

APPENDIX F-6

WEKIVA PLRG LIGHT ATTENUATION ESTIMATES - ALEXANDER SPRING CREEK SEGMENT 1 (DOWNSTREAM) - 8/29/05

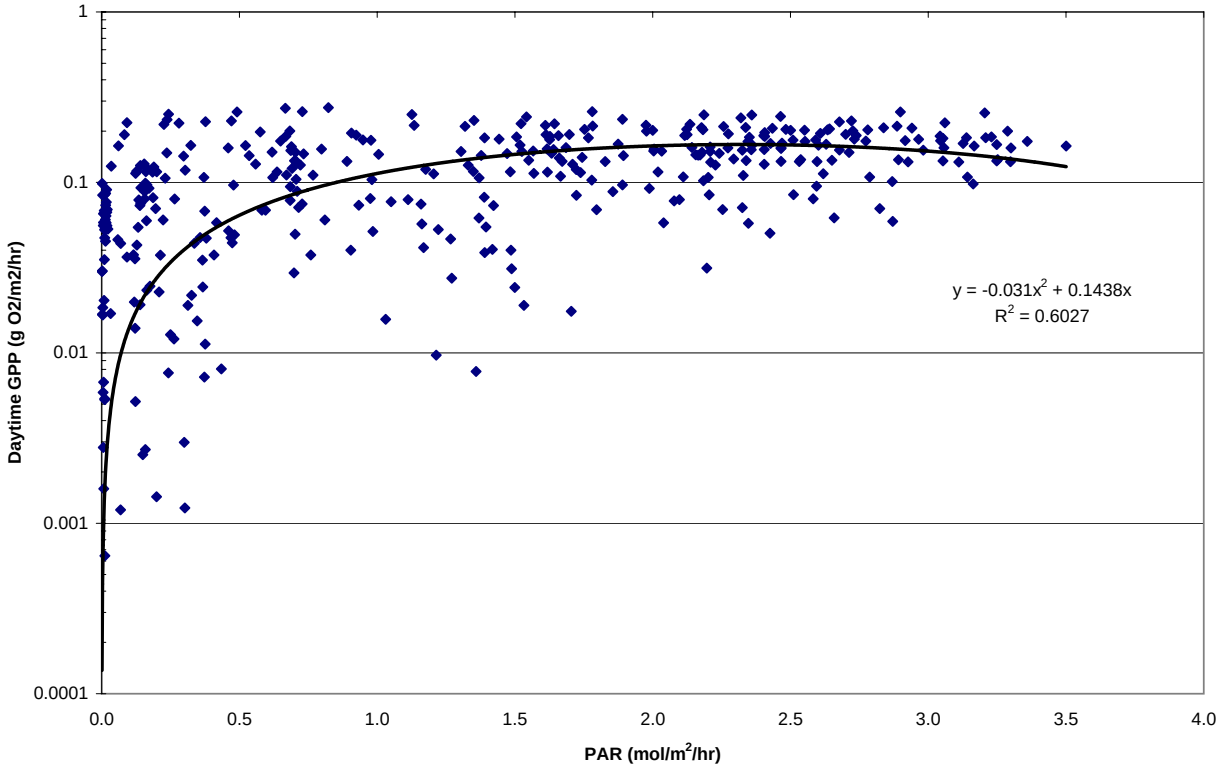
Depth (m)	Rep 1				Rep 2				Rep 3			
z	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)	Iz	ln(Iz)	ln(Io/Iz)	k (m-1)
air	1100	7.00			913.5	6.82			902.9	6.81		
surface	938.1	6.84			1131	7.03			1082.2	6.99		
0.15	415	6.03	0.816	5.352	533.7	6.28	0.751	4.928	538.5	6.29	0.698	4.580
0.30	175.91	5.17	1.674	5.492	332.3	5.81	1.225	4.018	349.1	5.86	1.131	3.712
0.46	51.99	3.95	2.893	6.327	201.5	5.31	1.725	3.773	236.9	5.47	1.519	3.323
0.61	32.32	3.48	3.368	5.525	103.08	4.64	2.395	3.929	157.32	5.06	1.928	3.163

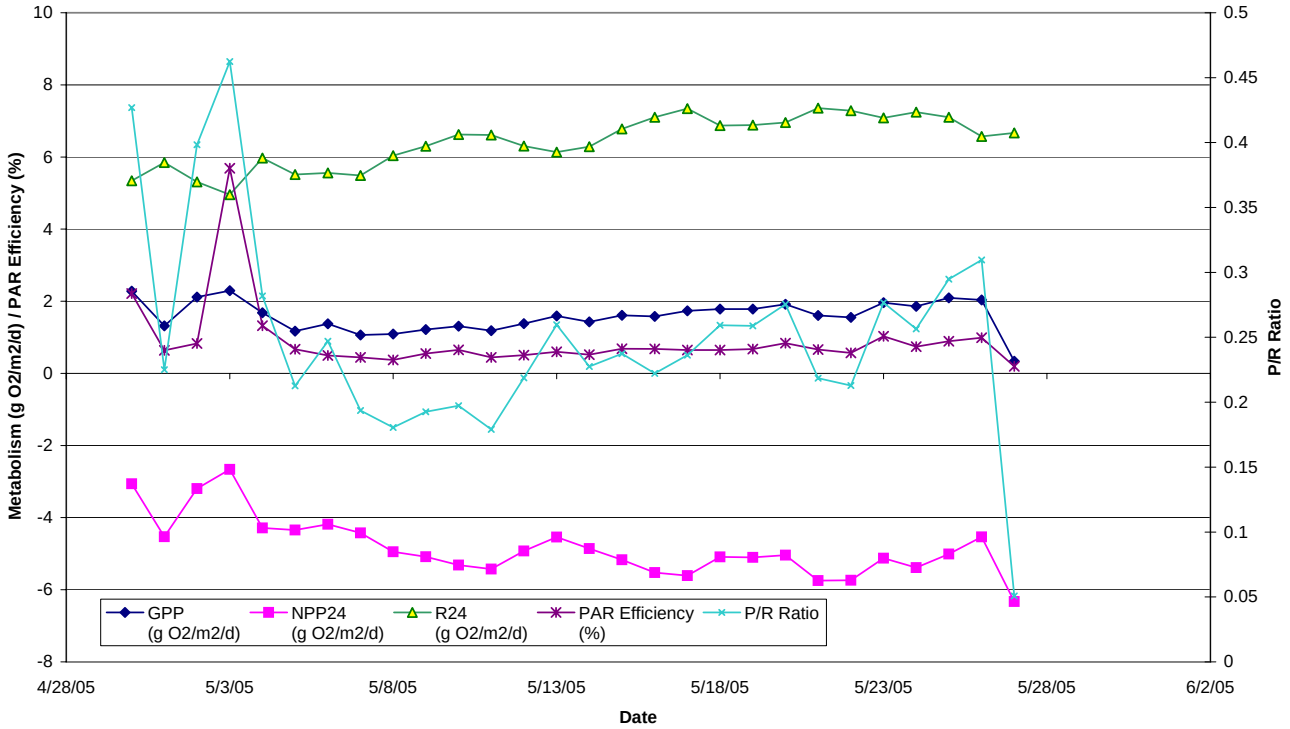
k (diffuse attenuation coefficient = slope, m-1)	5.756	3.928	3.332
k average	5.674	4.162	3.694
percent transmittance @ 1.0 meter	0.32	1.97	3.57
Birgean Percentile Absorption (1m)	99.68	98.03	96.43



Appendix G

Detailed Estimates of Stream Segment Ecosystem Metabolism in the Wekiva River System and Reference Streams



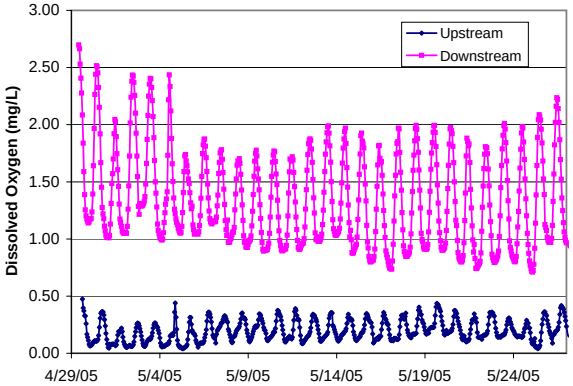


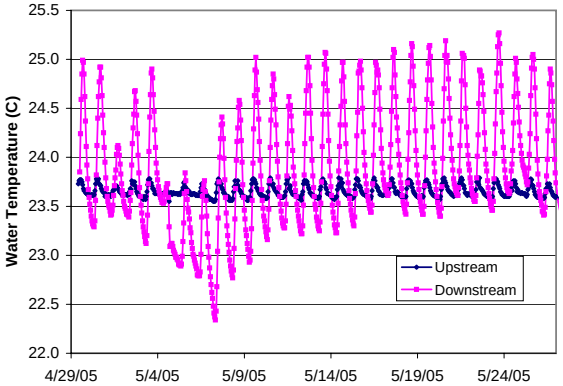
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	1.58	-4.83	6.41	0.25	0.90	0.11
Max	2.29	-2.66	7.35	0.46	5.69	0.70
Min	0.34	-6.33	4.96	0.05	0.20	0.02

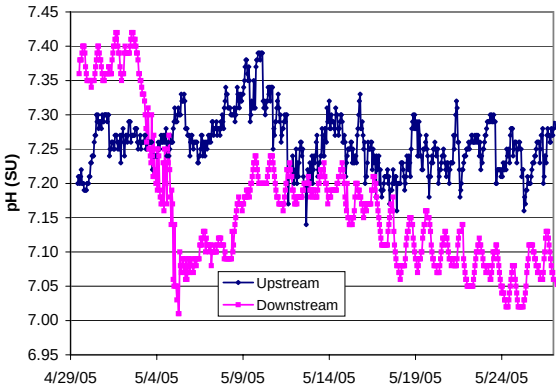
APPENDIX G-1
WEKIVA RIVER - SEGMENT 1 METABOLISM ESTIMATES (4/29/05 - 5/27/05)

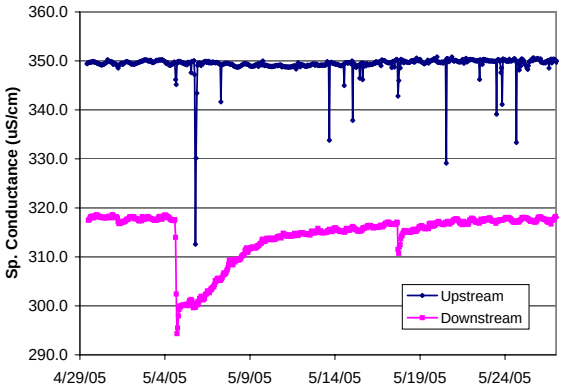
APPENDIX G-1

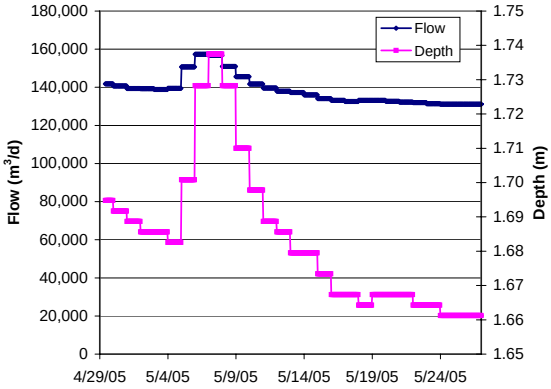
WEKIVA RIVER - SEGMENT 1 METABOLISM SUMMARY - (4/29/05 - 5/27/05)

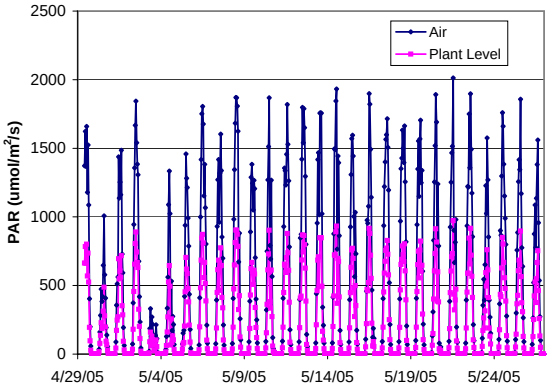


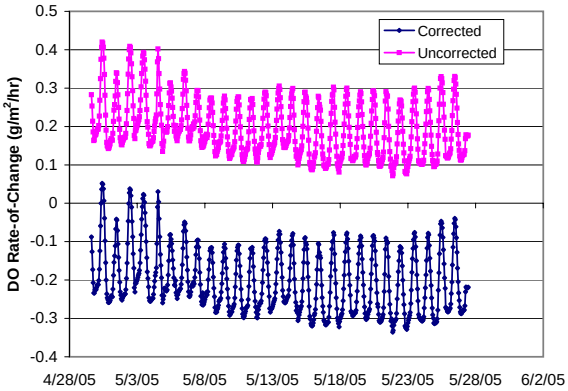




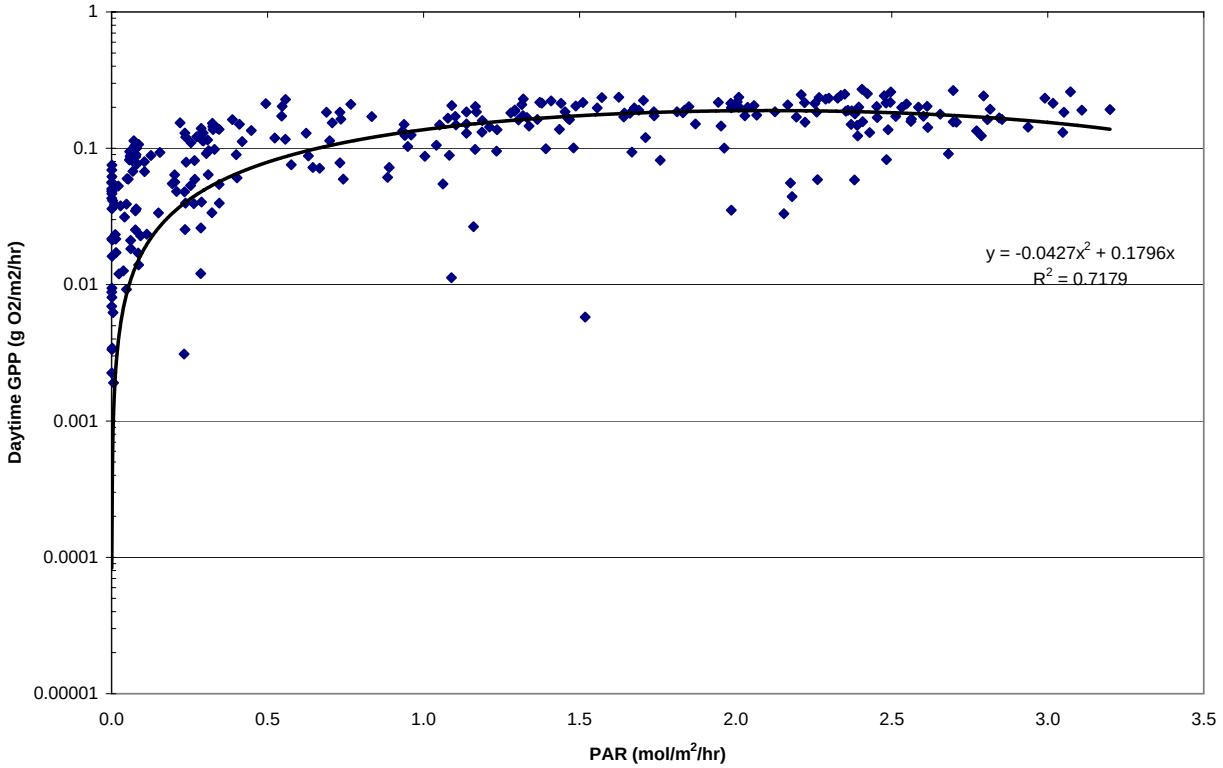


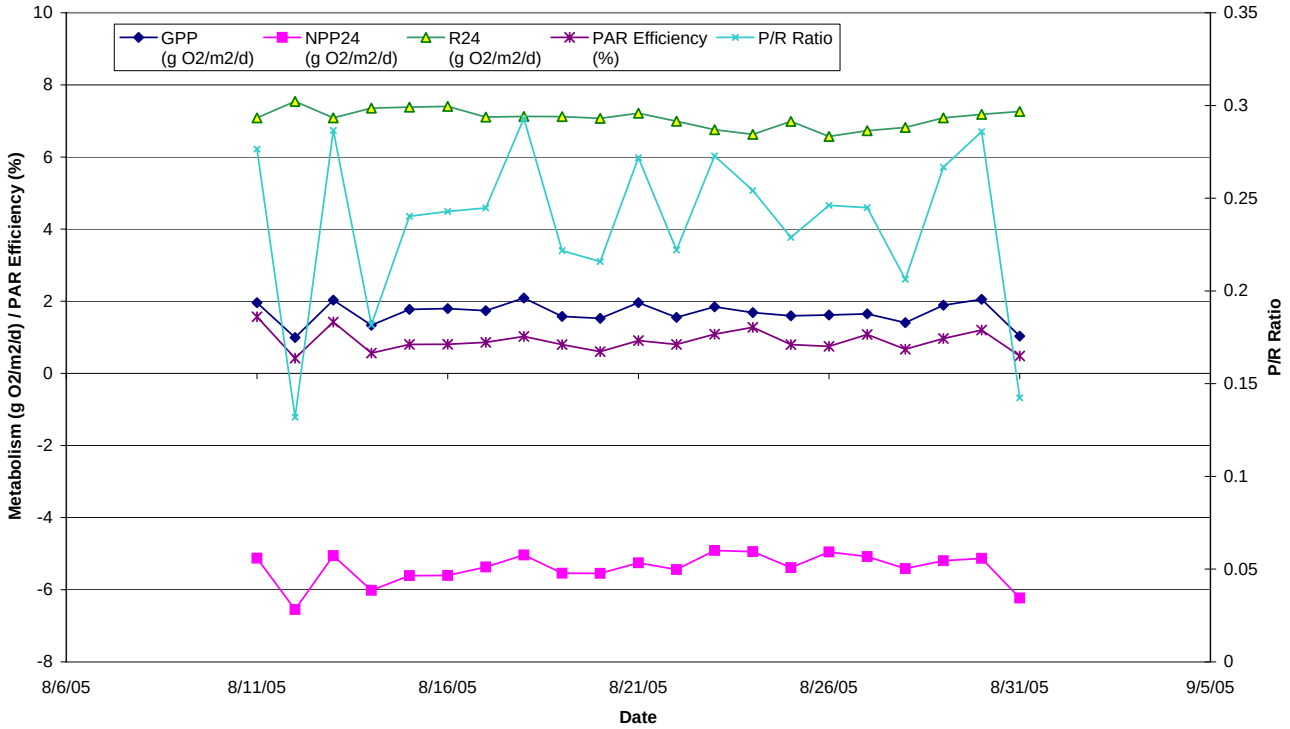






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	0.198	0.040	0.590	674
down		1.35	0.710	2.76	671
Wtr Temp - up	C	23.7	23.6	23.8	674
down		23.9	22.3	25.3	671
pH - up	SU	7.26	7.14	7.39	674
down		7.17	7.01	7.42	671
SpCond - up	uS/cm	349	313	351	674
down		315	294	319	671
Flow - up	m^3/d	138,346	131,112	157,364	29
Depth	m	1.68	1.66	1.74	29
PAR - air	$umol/m^2/s$	444	0.0	2,013	674
plant		214	0.0	0,972	674
DO rate chng	$g/m^2/hr$				
corr		-0.200	-0.336	0.052	669
uncorr		0.196	0.071	0.420	669



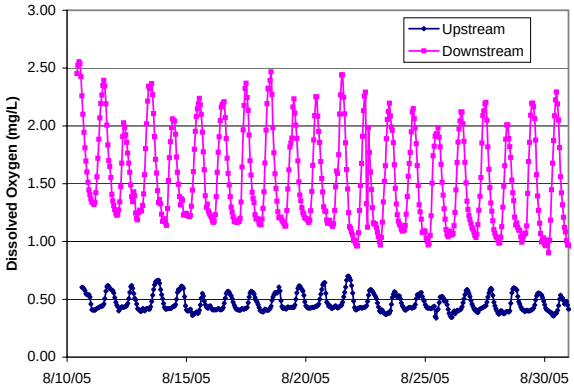


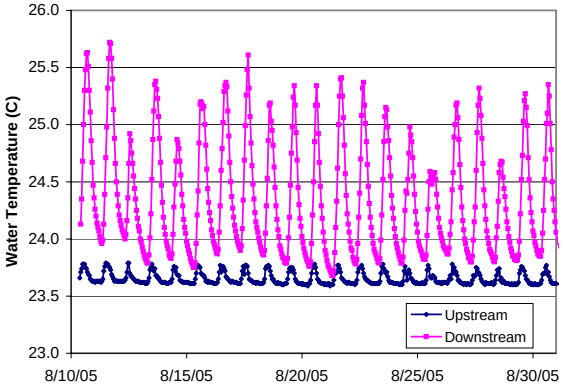
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	1.67	-5.40	7.07	0.24	0.90	0.11
Max	2.09	-4.91	7.54	0.29	1.57	0.19
Min	0.99	-6.55	6.57	0.13	0.42	0.05

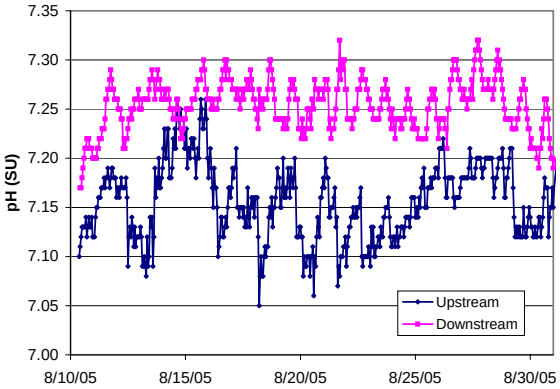
APPENDIX G-1
WEKIVA RIVER - SEGMENT 1 METABOLISM ESTIMATES (8/10/05 - 8/31/05)

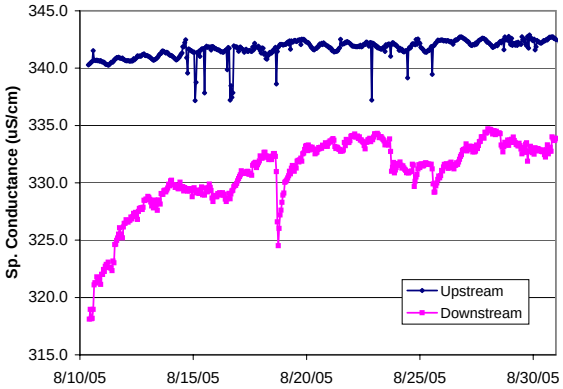
APPENDIX G-1

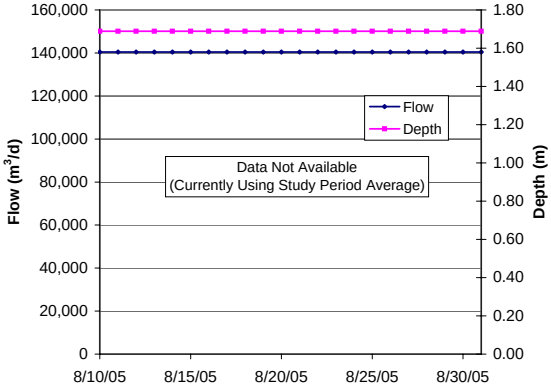
WEKIVA RIVER - SEGMENT 1 METABOLISM SUMMARY - (8/10/05 - 8/31/05)

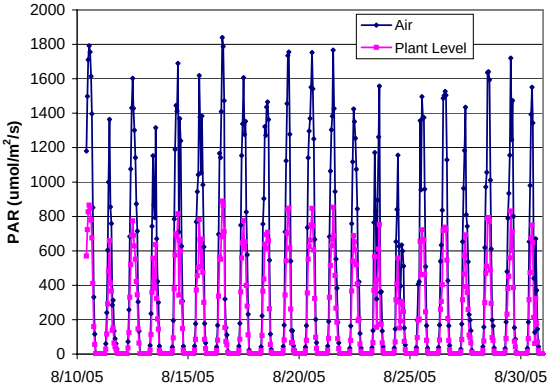


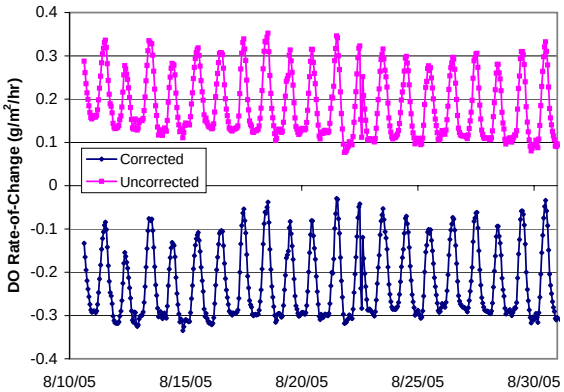




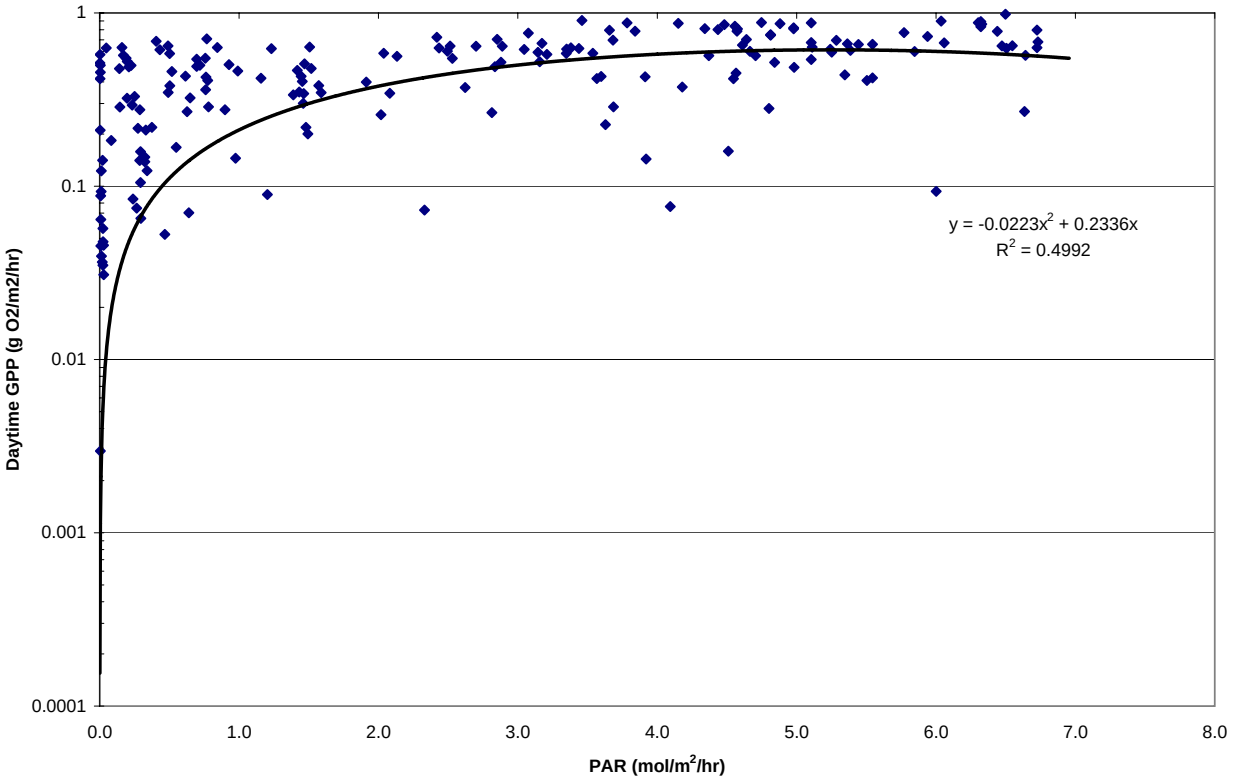


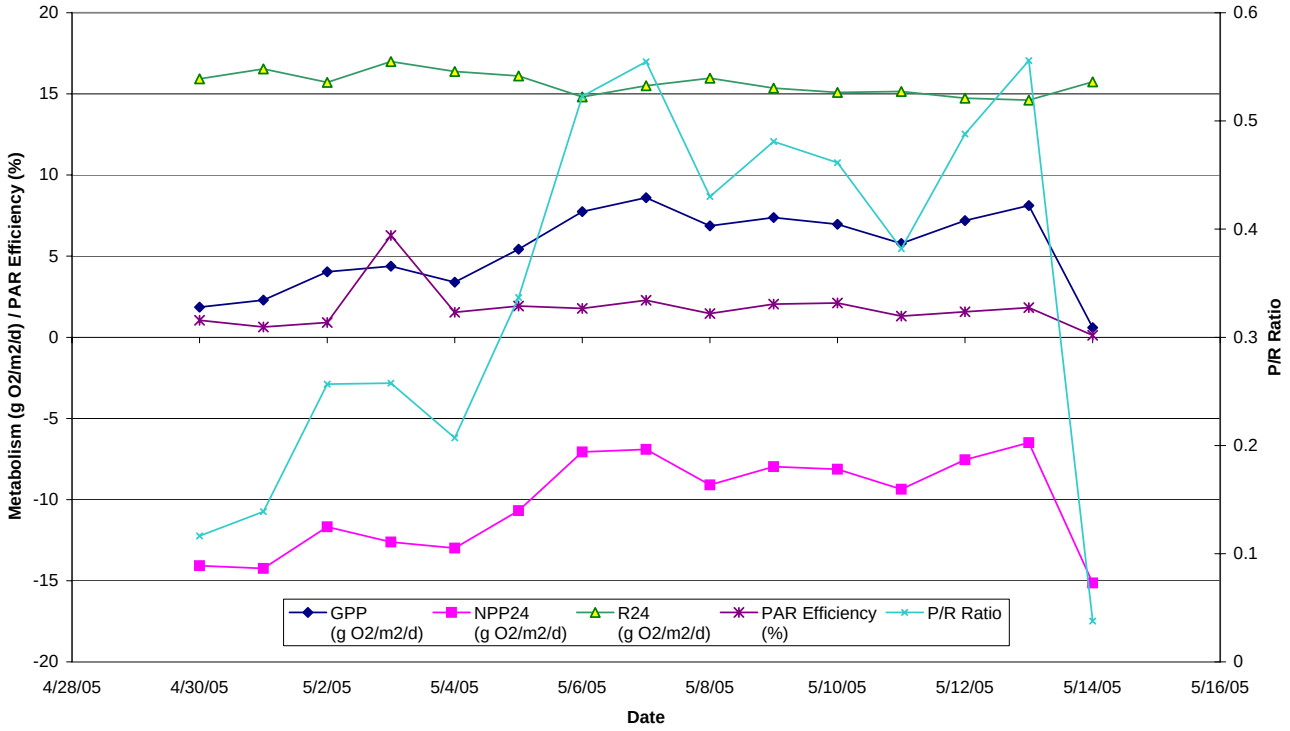






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	0.469	0.270	0.710	510
down		1.54	0.260	2.59	508
Wtr Temp - up	C	23.7	23.6	23.8	510
down		24.4	23.7	25.7	508
pH - up	SU	7.15	7.05	7.26	510
down		7.25	7.17	7.32	508
SpCond - up	uS/cm	342	337	343	510
down		331	318	335	508
Flow - up	m^3/d	140,433	140,433	140,433	22
Depth	m	1.69	1.69	1.69	22
PAR - air	$umol/m^2/s$	392	-0.1	1,840	508
plant		189	0.0	889	508
DO rate chng	$g/m^2/hr$				
corr		-0.223	-0.336	0.052	669
uncorr		0.184	0.077	0.352	503



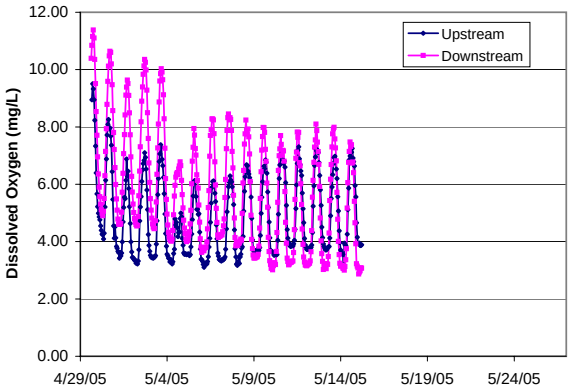


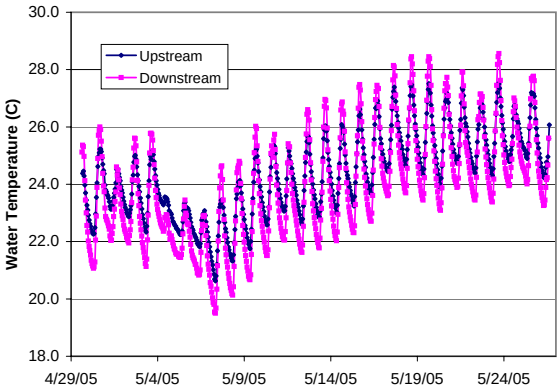
Stats	GPP	NPP24	R24	P/R	PAR Eff.	
	($g\ O_2/m^2/d$)			ratio	(%)	($g\ O_2/mol$)
Avg	5.38	-10.27	15.64	0.35	1.79	0.22
Max	8.60	-6.49	17.00	0.56	6.27	0.78
Min	0.59	-15.14	14.61	0.04	0.13	0.02

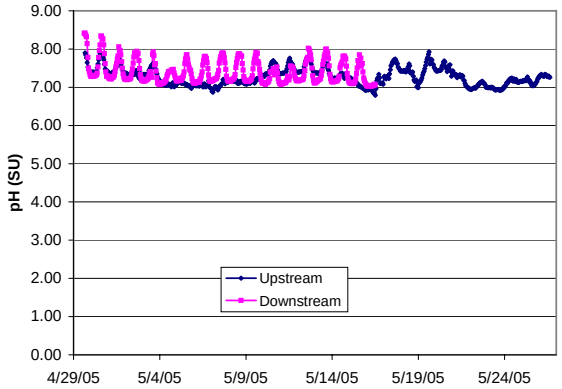
APPENDIX G-2
WEKIVA RIVER - SEGMENT 2 METABOLISM ESTIMATES (4/29/05 - 5/15/05)

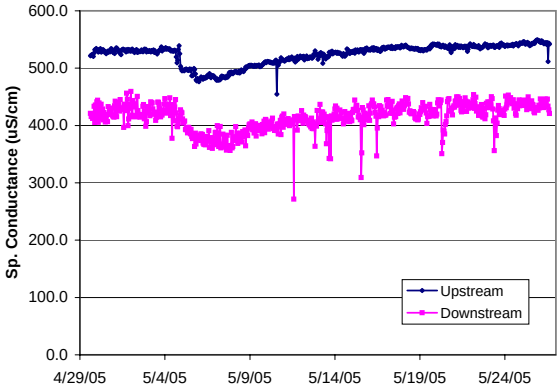
APPENDIX G-2

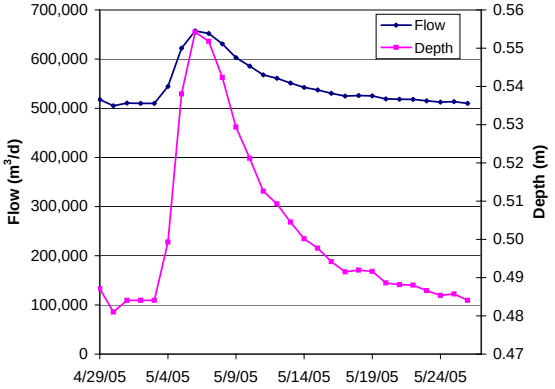
WEKIVA RIVER - SEGMENT 2 METABOLISM SUMMARY - (4/29/05 - 5/27/05)

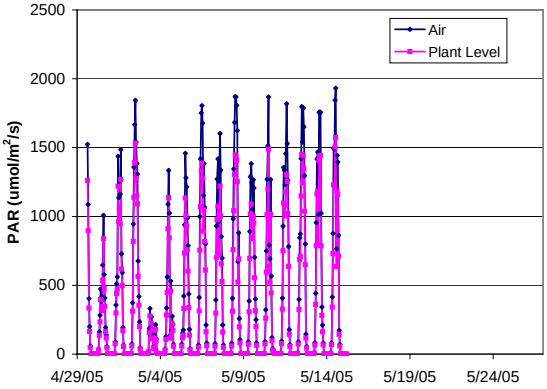


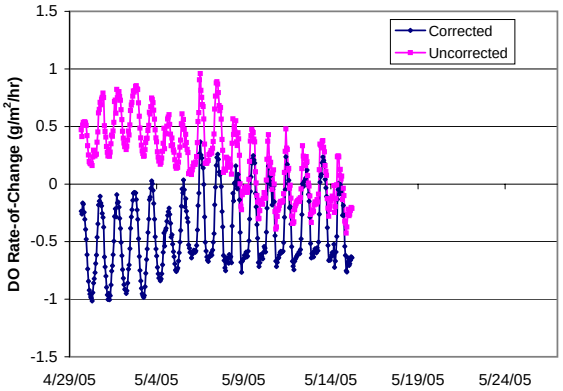




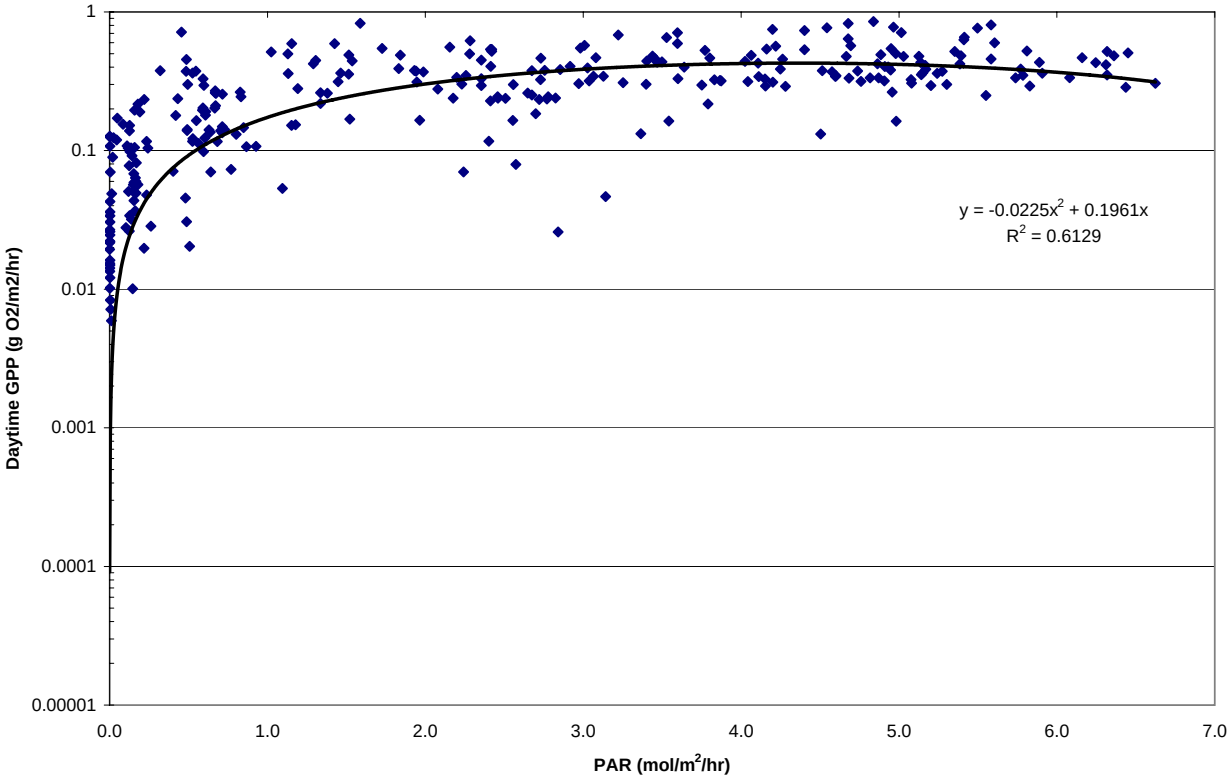


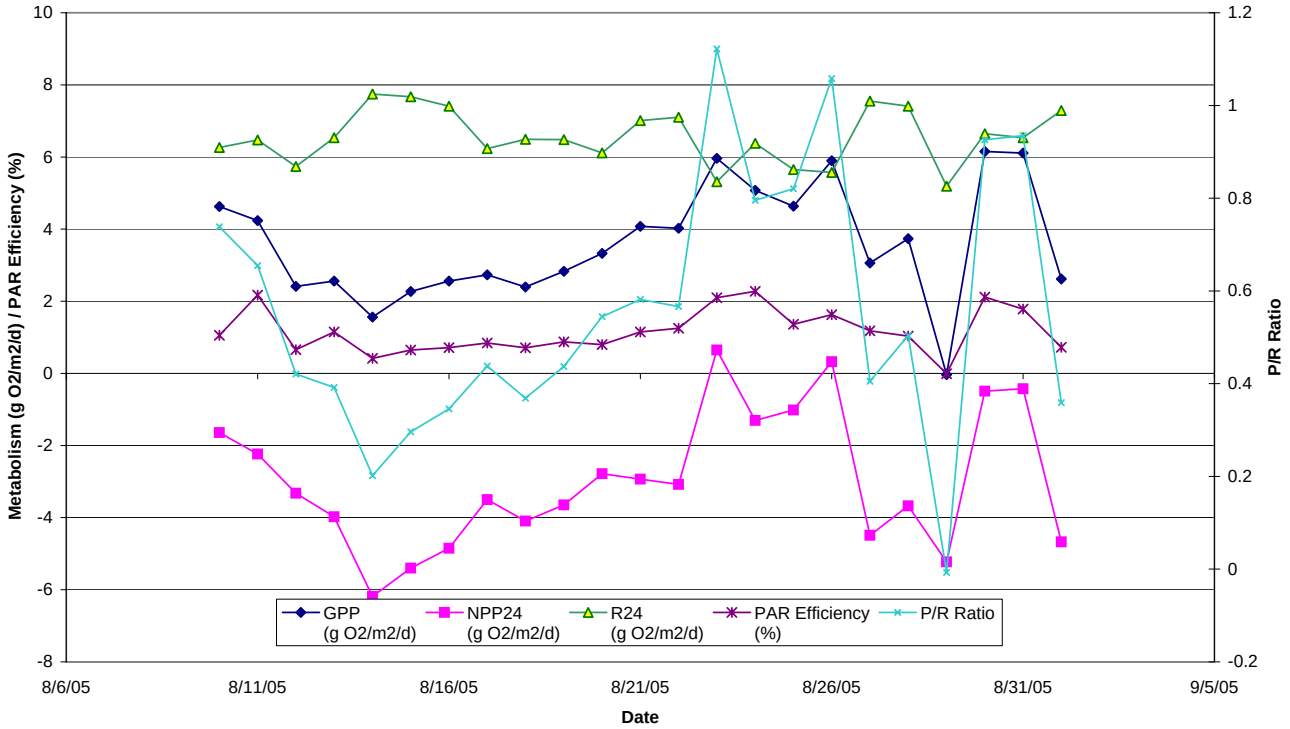






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	4.89	3.10	9.51	374
down		5.81	2.87	11.4	375
Wtr Temp - up	C	24.4	20.6	27.5	648
down		23.9	19.5	28.6	648
pH - up	SU	7.28	6.79	7.93	648
down		7.40	7.02	8.42	406
SpCond - up	uS/cm	524	454	550	649
down		415	272	459	649
Flow - down	m^3/d	547,258	505,051	657,489	28
Depth	m	0.502	0.481	0.554	28
PAR - air	$umol/m^2/s$	408	0.0	1,932	375
plant		327	0.0	1,574	375
DO rate chng	$g/m^2/hr$				
corr		-0.414	-1.015	0.366	374
uncorr		0.241	-0.426	0.96	374



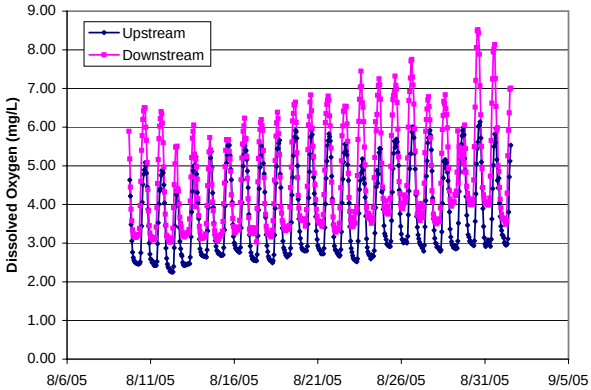


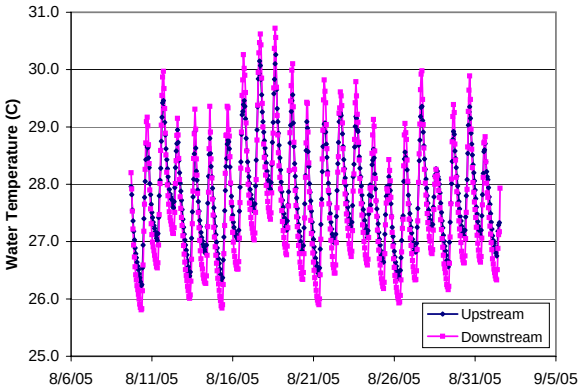
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	3.60	-2.96	6.56	0.56	1.16	0.14
Max	6.16	0.65	7.75	1.12	2.27	0.28
Min	-0.04	-6.19	5.19	-0.01	-0.01	0.00

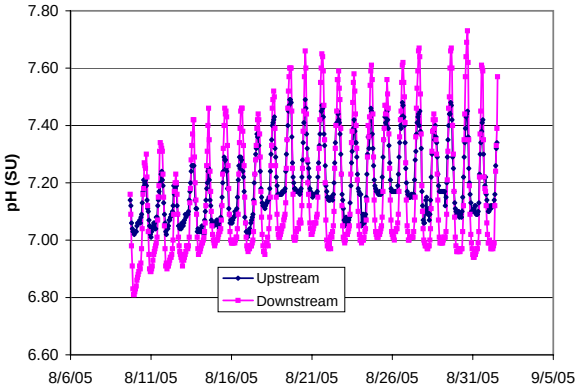
APPENDIX G-2
WEKIVA RIVER - SEGMENT 2 METABOLISM ESTIMATES (8/9/05 - 9/1/05)

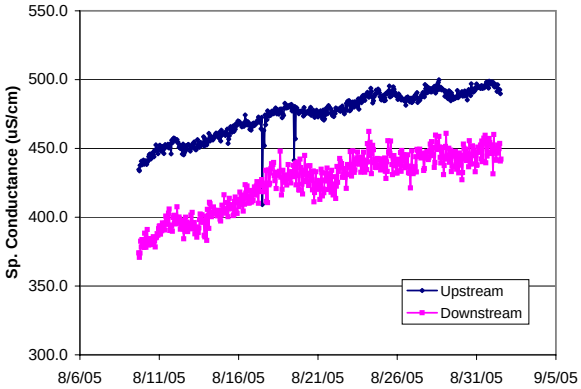
APPENDIX G-2

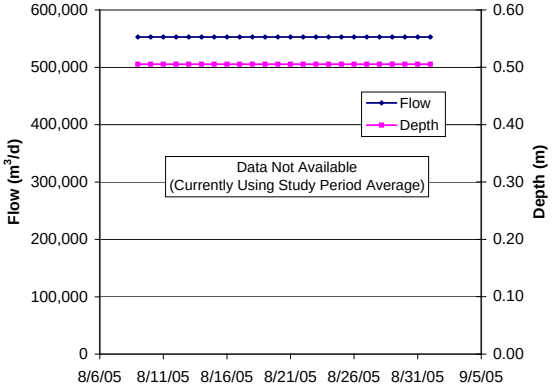
WEKIVA RIVER - SEGMENT 2 METABOLISM SUMMARY - (8/09/05 - 9/01/05)

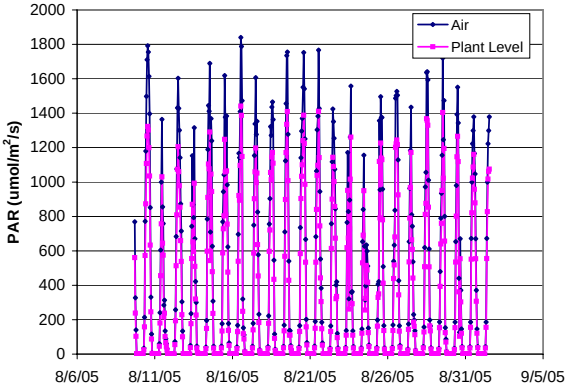


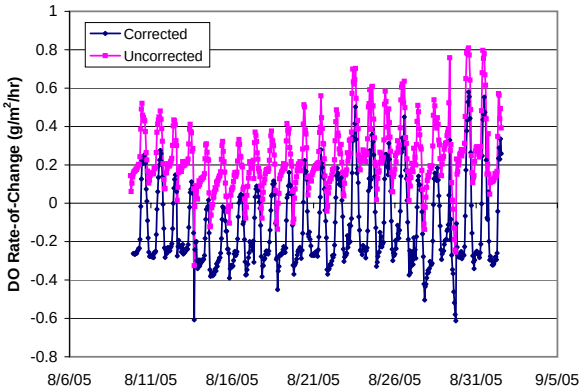




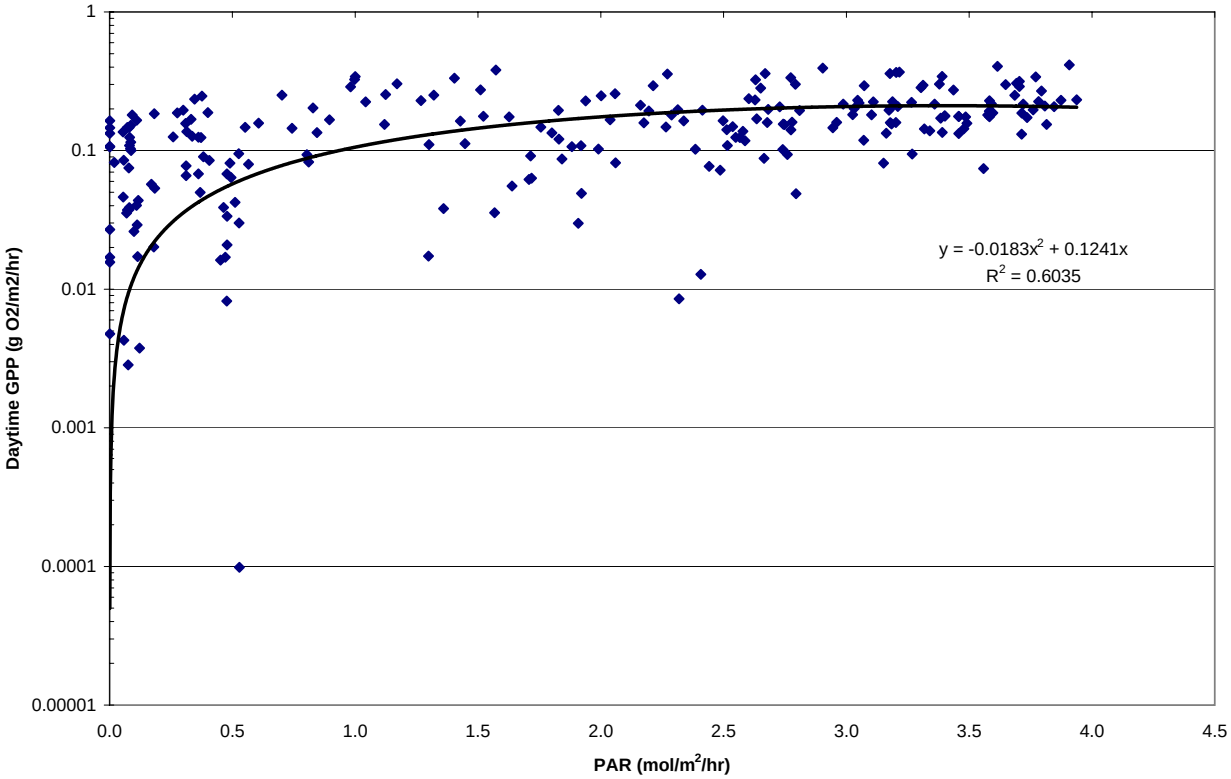


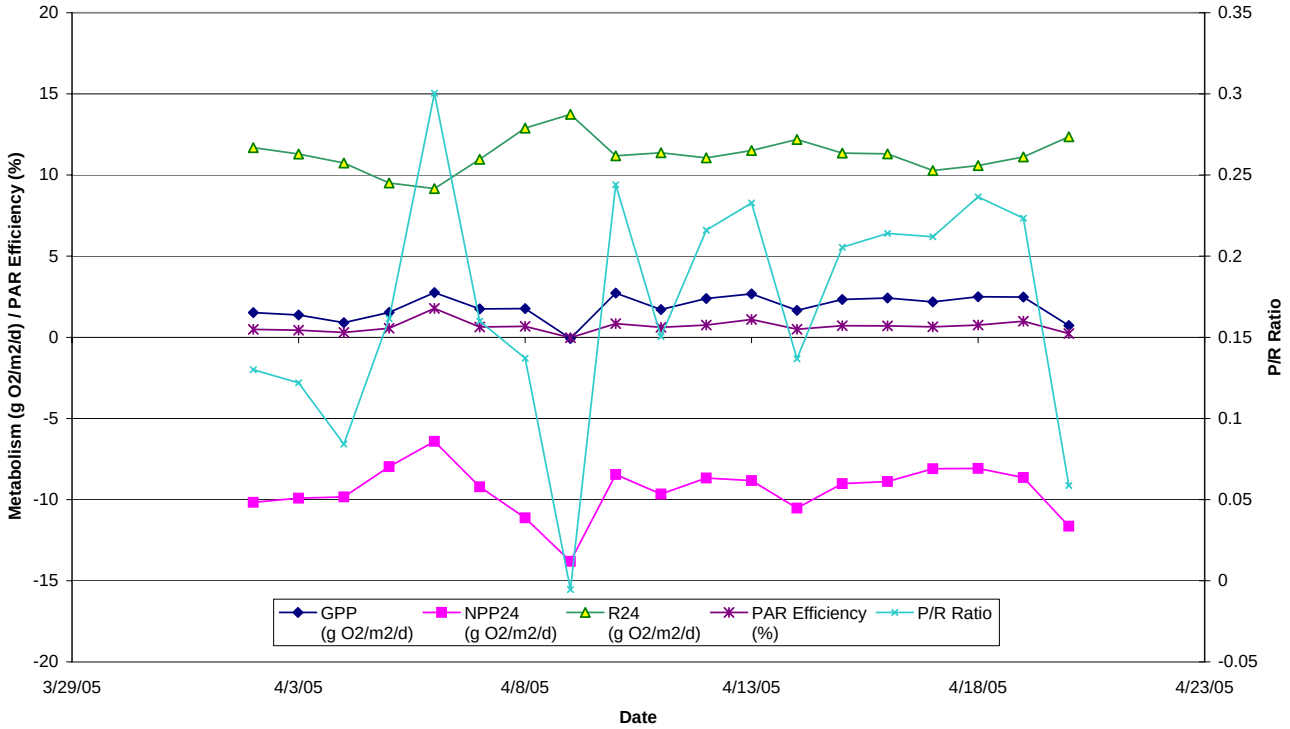






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.75	2.25	6.14	548
down		4.64	3.02	8.52	549
Wtr Temp - up	C	27.8	26.2	30.3	548
down		27.6	25.8	30.7	549
pH - up	SU	7.19	7.01	7.49	548
down		7.16	6.81	7.73	549
SpCond - up	uS/cm	475	409	500	548
down		425	371	462	549
Flow - down	m^3/d	552,926	552,926	552,926	24
Depth	m	0.505	0.505	0.505	24
PAR - air	$umol/m^2/s$	384	-0.1	1,840	549
plant		304	-0.1	1,442	549
DO rate chng	$g/m^2/hr$				
corr		-0.121	-0.612	0.580	548
uncorr		0.238	-0.325	0.809	548



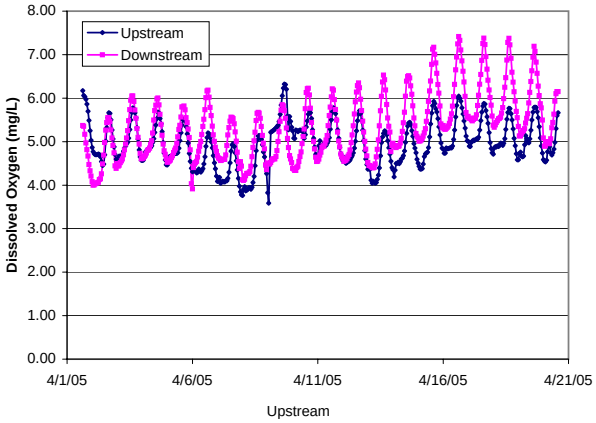


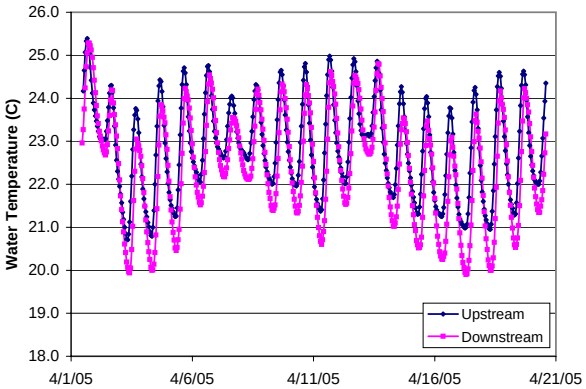
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2/mol$)
	($g\ O_2/m^2/d$)					
Avg	1.86	-9.42	11.28	0.17	0.67	0.08
Max	2.75	-6.41	13.74	0.30	1.78	0.22
Min	-0.07	-13.81	9.17	-0.01	-0.03	0.00

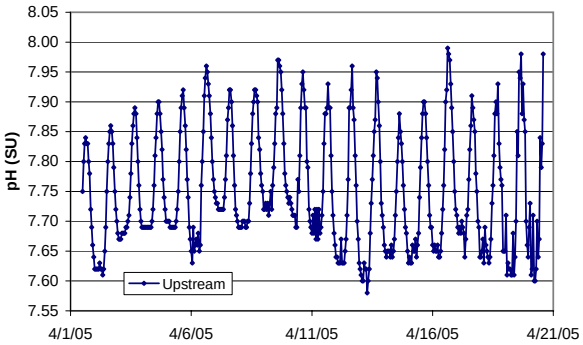
APPENDIX G-3
ROCK SPRING RUN - SEGMENT 1 METABOLISM ESTIMATES (4/1/05 - 4/20/05)

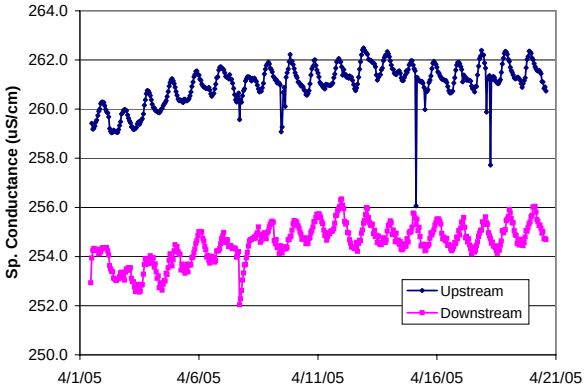
APPENDIX G-3

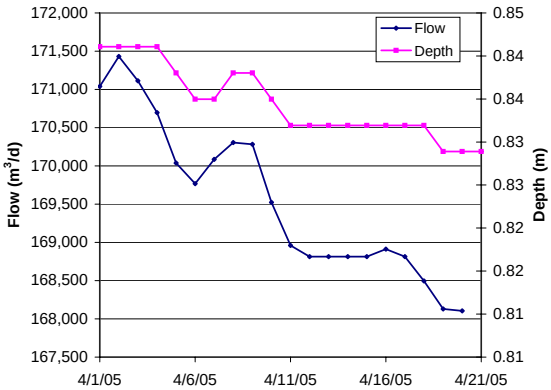
ROCK SPRING RUN - SEGMENT 1 METABOLISM SUMMARY - (4/01/05 - 4/20/05)

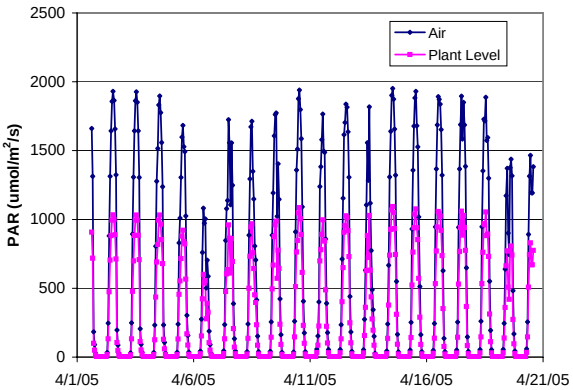


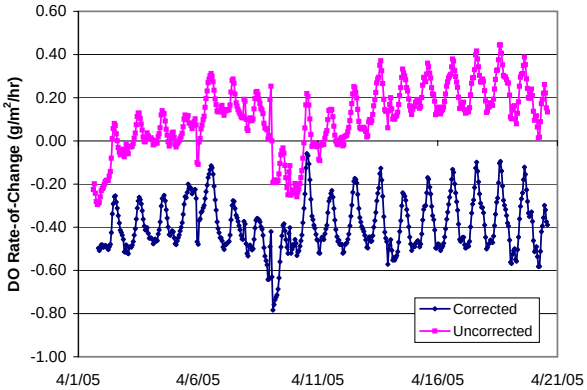




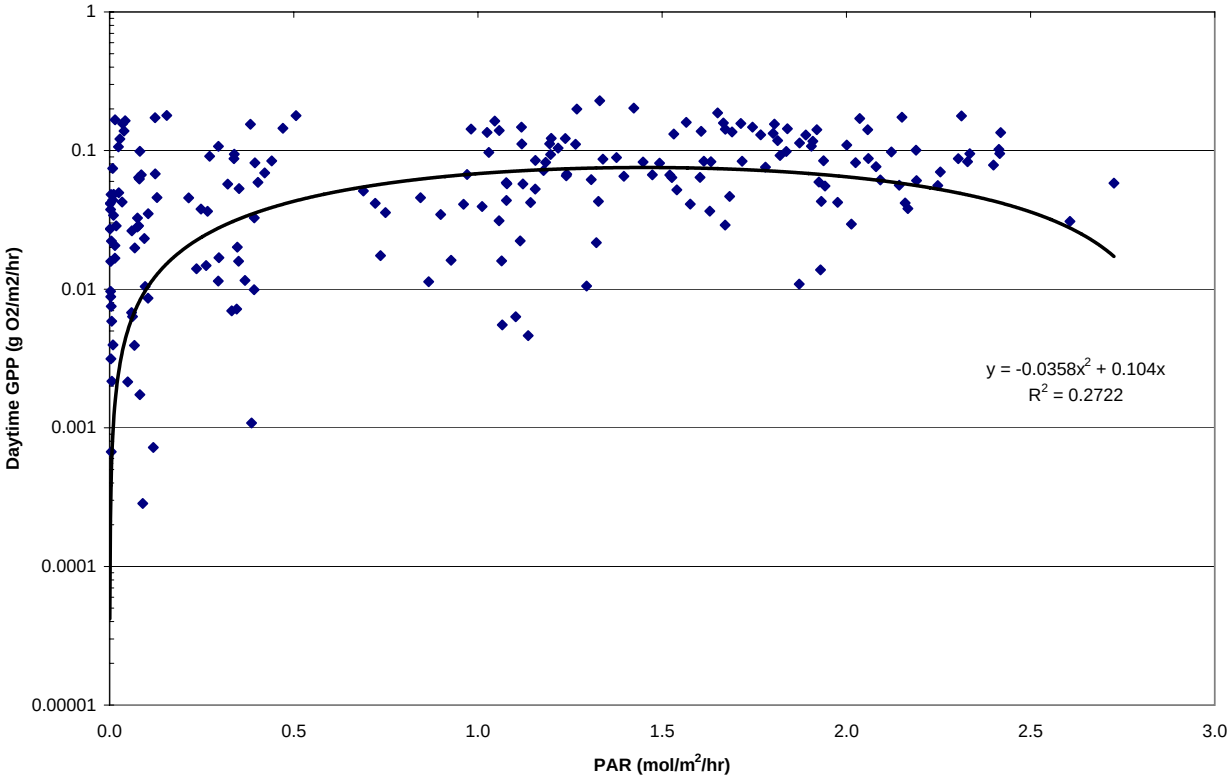


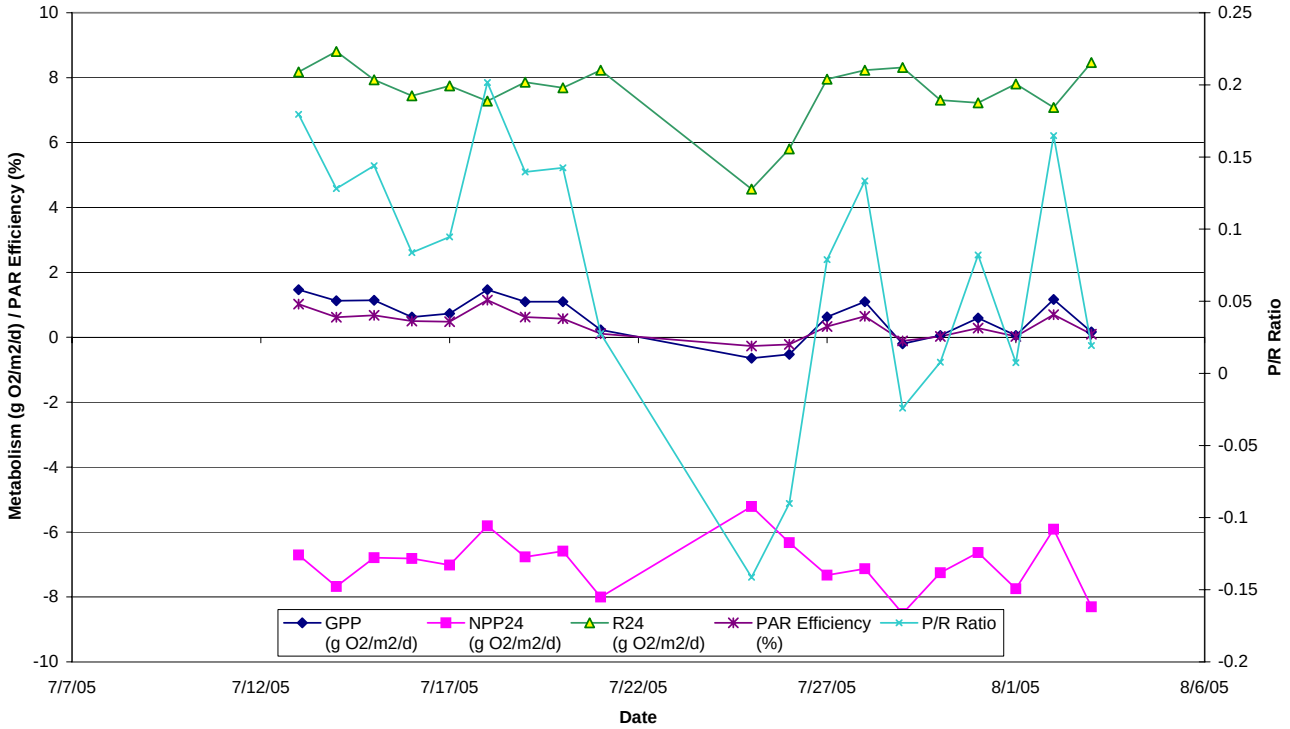






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	4.95	3.59	6.32	456
down		5.33	3.92	7.42	456
Wtr Temp - up	C	22.9	20.7	25.4	459
down		22.4	19.9	25.3	460
pH - up	SU	7.75	7.58	7.99	459
down		---	---	---	---
SpCond - up	uS/cm	261	256	262	459
down		255	252	256	460
Flow - up	m^3/d	169,548	168,104	171,432	20
Depth	m	0.835	0.829	0.841	21
PAR - air	$umol/m^2/s$	490	0.0	1,951	456
plant		273	0.0	1,094	456
DO rate chng	$g/m^2/hr$				
corr		-0.391	-0.784	-0.059	456
uncorr		0.103	-0.295	0.445	456



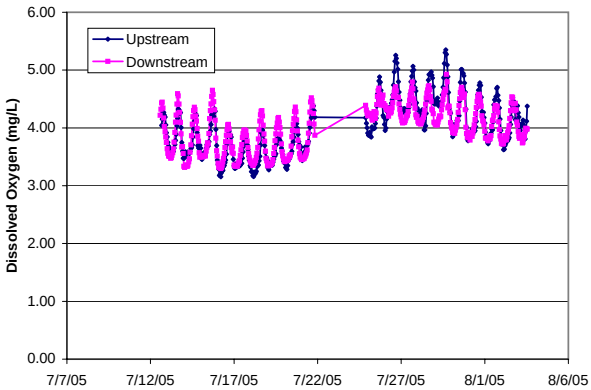


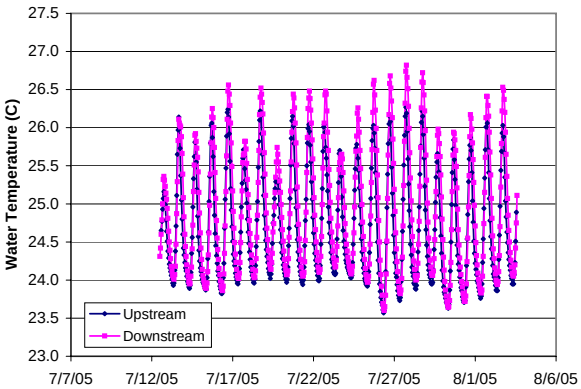
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	0.60	-6.98	7.57	0.07	0.38	0.05
Max	1.47	-5.21	8.81	0.20	1.15	0.14
Min	-0.65	-8.51	4.57	-0.14	-0.27	-0.03

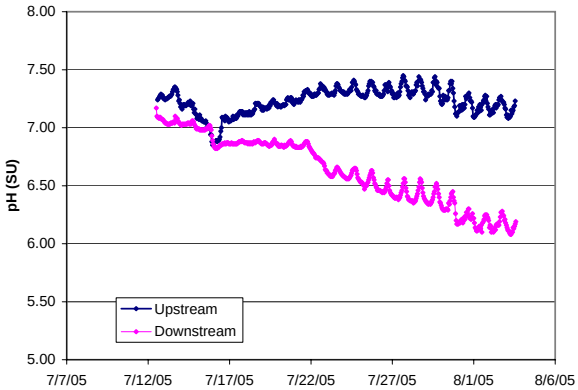
APPENDIX G-3
ROCK SPRING RUN - SEGMENT 1 METABOLISM ESTIMATES (7/12/05 - 8/3/05)

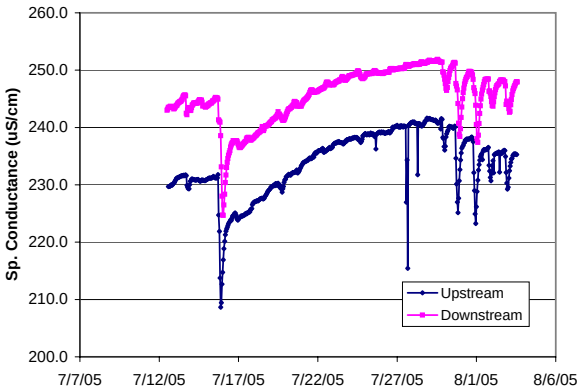
APPENDIX G-3

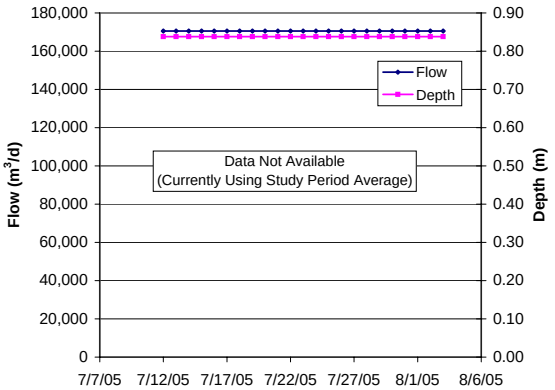
ROCK SPRING RUN - SEGMENT 1 METABOLISM SUMMARY - (7/12/05 - 8/03/05)

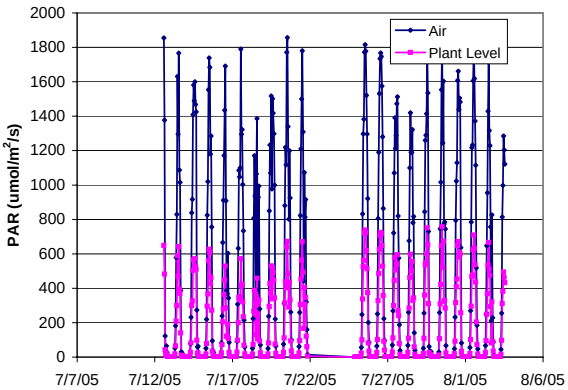


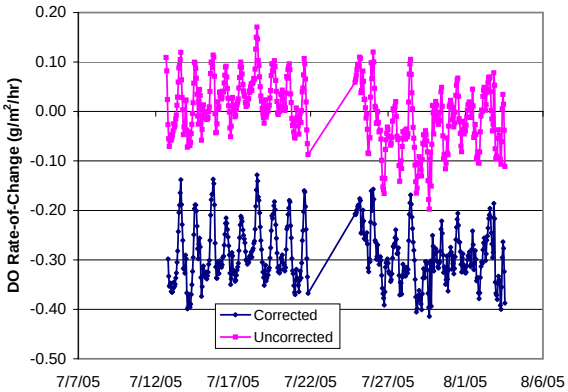




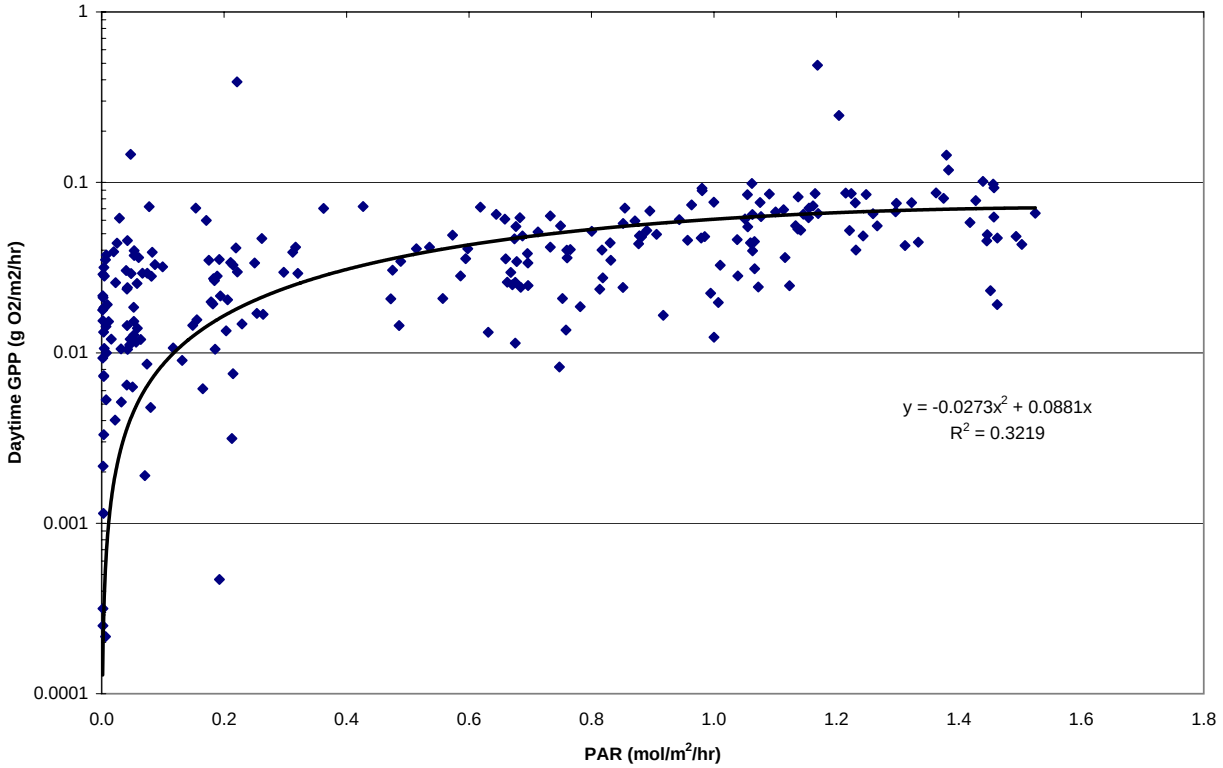


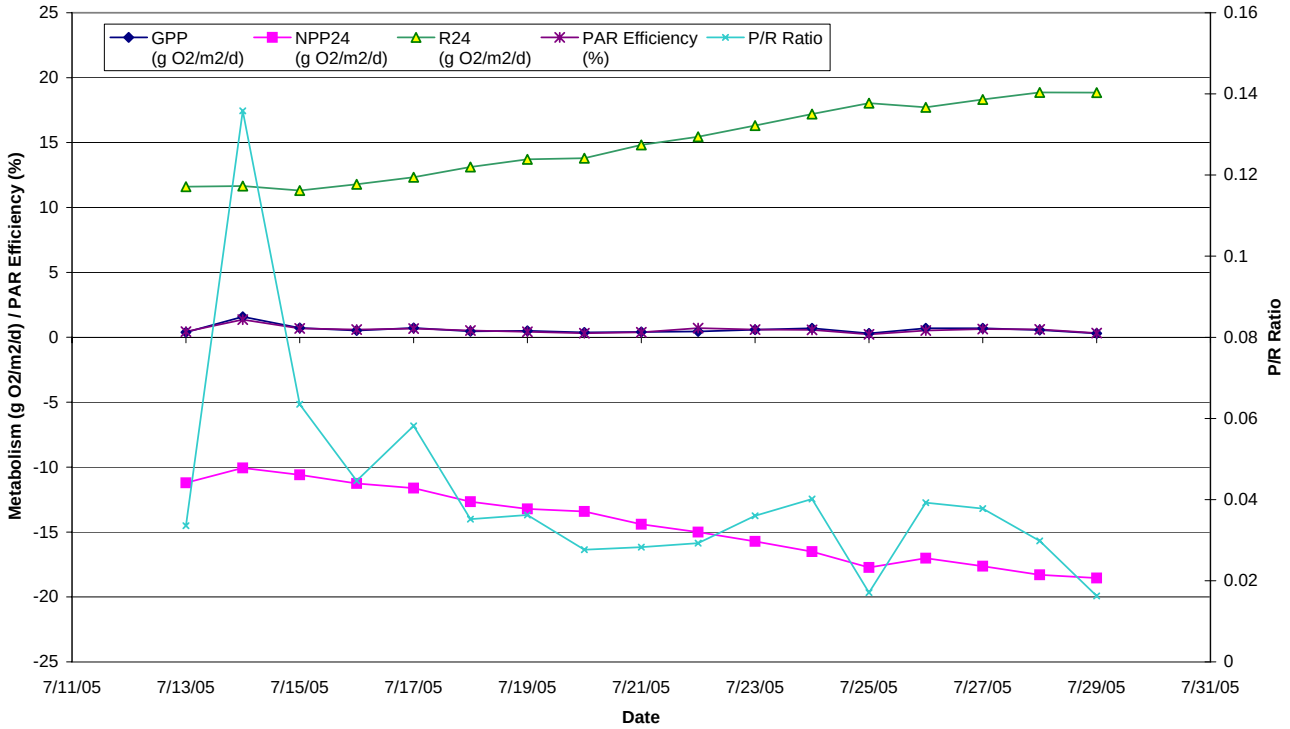






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	4.00	3.15	5.35	454
down		4.00	3.29	4.93	456
Wtr Temp - up	C	24.7	23.6	26.3	528
down		24.9	23.6	26.8	531
pH - up	SU	7.23	6.85	7.45	528
down		6.63	6.08	7.17	531
SpCond - up	uS/cm	234	209	242	528
down		246	225	252	531
Flow - up	m^3/d	170,526	170,526	170,526	23
Depth	m	0.84	0.84	0.84	23
PAR - air	$umol/m^2/s$	442	0.0	1,857	456
plant		167	0.0	0,757	456
DO rate chng	$g/m^2/hr$				
corr		-0.290	-0.414	-0.128	454
uncorr		-0.002	-0.198	0.171	454



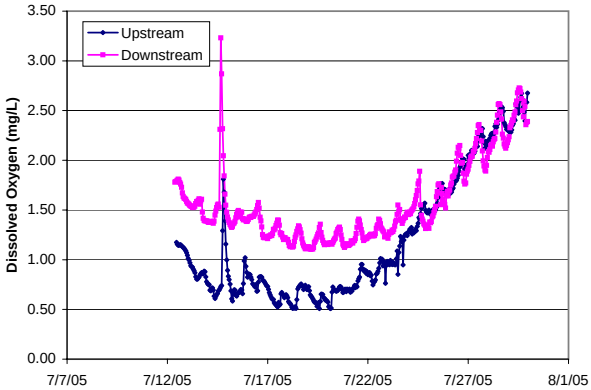


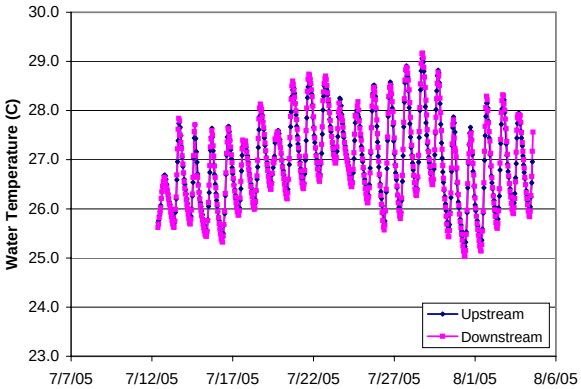
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff.	
	($g\ O_2/m^2/d$)				(%)	($g\ O_2/mol$)
Avg	0.59	-14.40	14.99	0.04	0.56	0.07
Max	1.58	-10.07	18.86	0.14	1.36	0.17
Min	0.31	-18.55	11.31	0.02	0.23	0.03

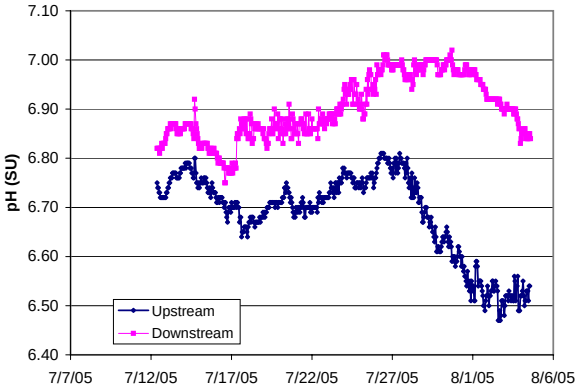
APPENDIX G-4
ROCK SPRING RUN - SEGMENT 2 METABOLISM ESTIMATES (7/12/05 - 7/29/05)

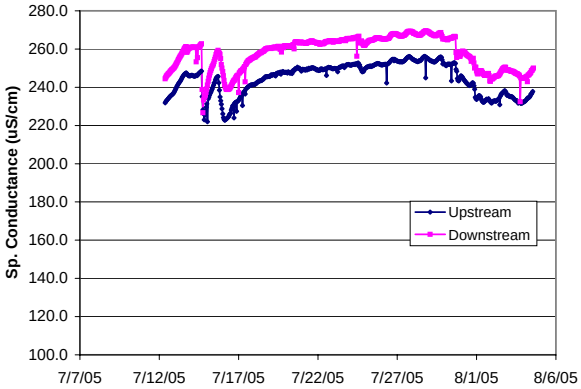
APPENDIX G-4

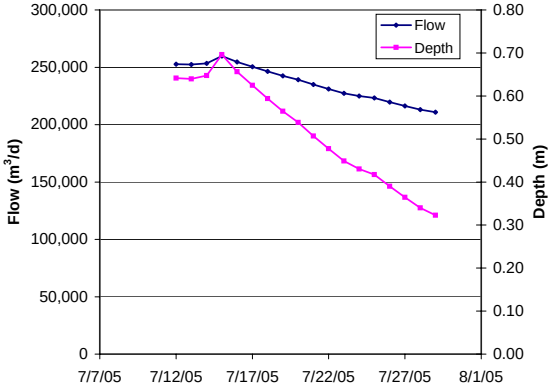
ROCK SPRING RUN - SEGMENT 2 METABOLISM SUMMARY - (7/12/05 - 7/29/05)

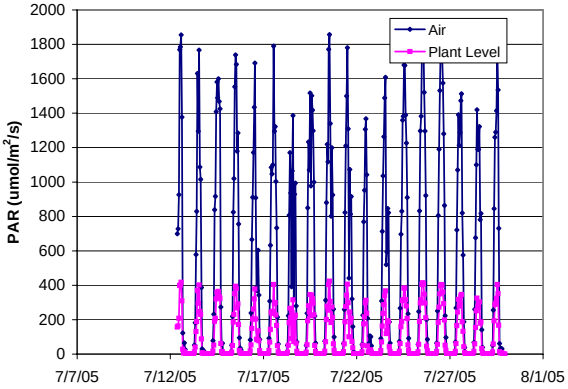


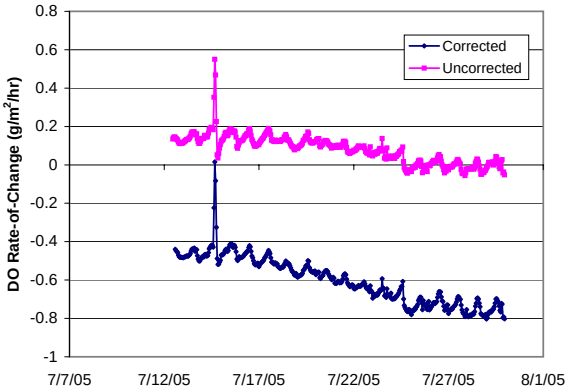




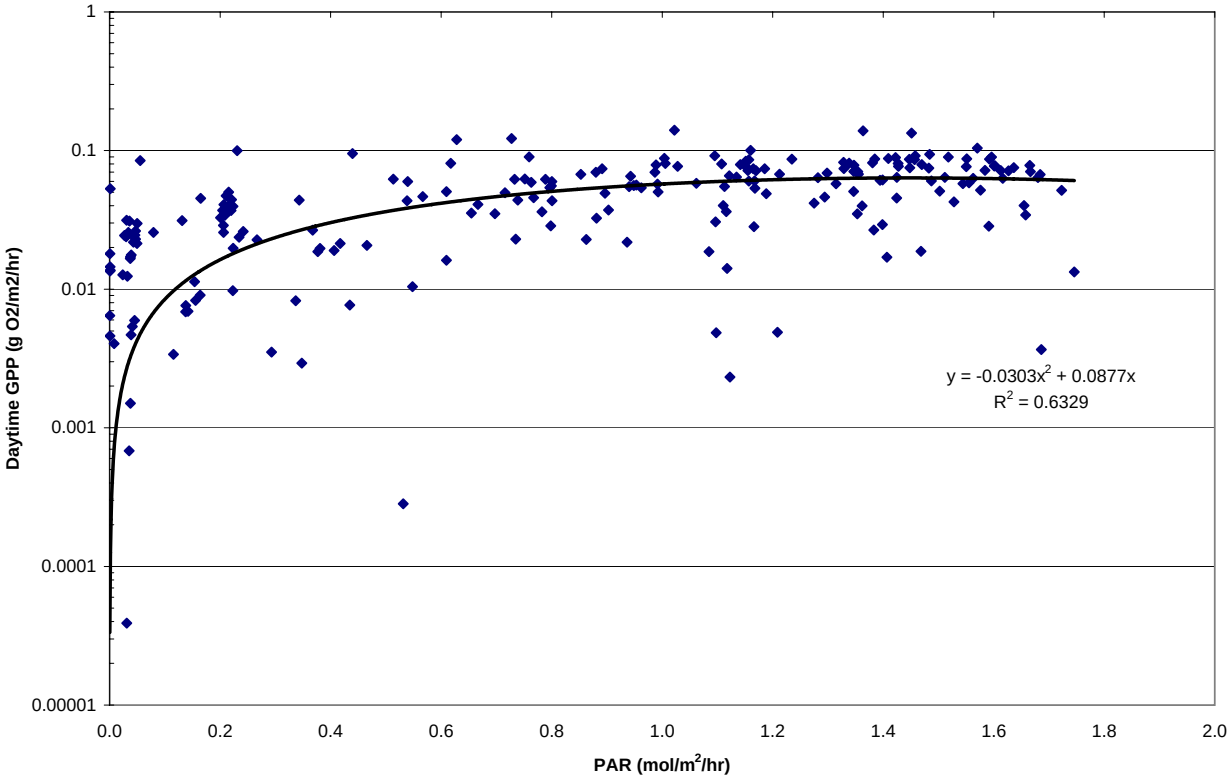


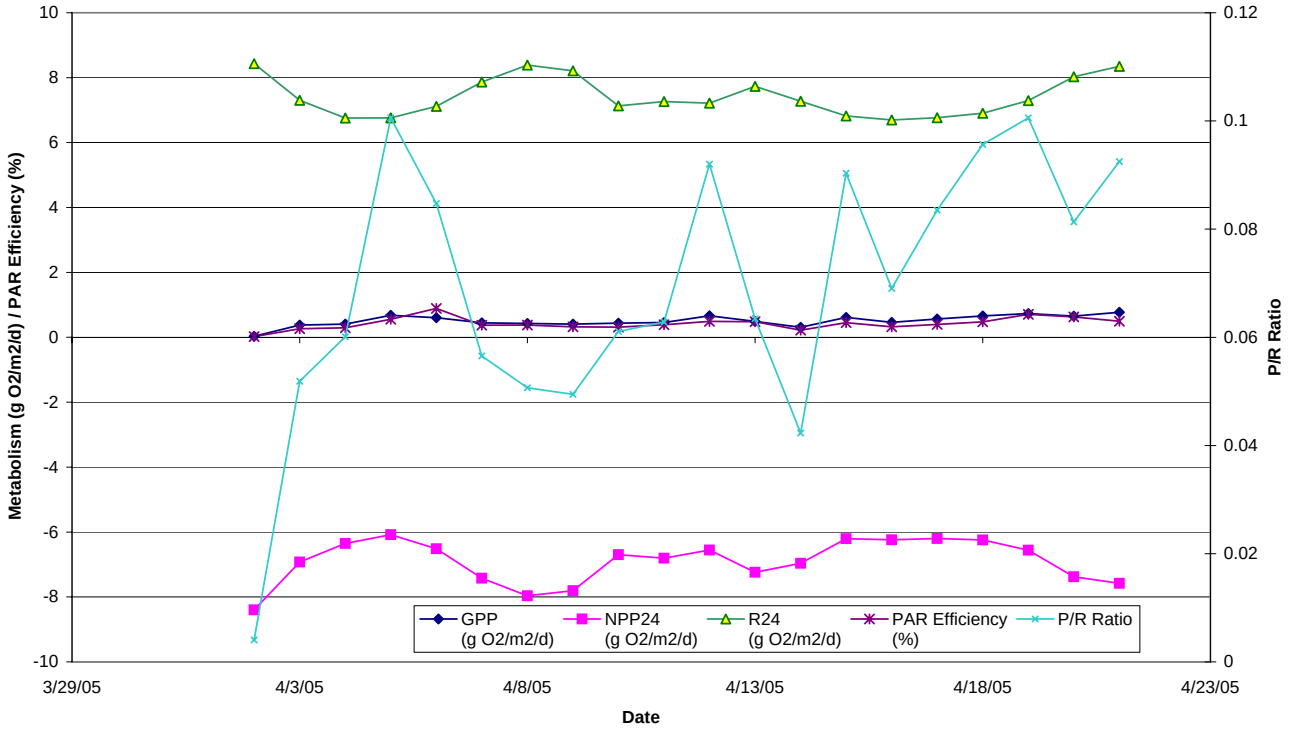






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	1.20	0.51	2.68	421
down		1.57	1.10	3.23	423
Wtr Temp - up	C	27.0	25.2	29.1	460
down		27.0	25.0	29.2	460
pH - up	SU	6.72	6.56	6.81	460
down		6.90	6.75	7.02	460
SpCond - up	uS/cm	246	222	256	460
down		260	227	270	460
Flow - up	m^3/d	236,301	210,829	259,861	18
Depth	m	0.517	0.323	0.696	18
PAR - air	$umol/m^2/s$	438	0.0	1,857	423
plant		100	0.0	0,424	423
DO rate chng	$g/m^2/hr$				
corr		-0.601	-0.804	0.015	421
uncorr		0.080	-0.056	0.550	421



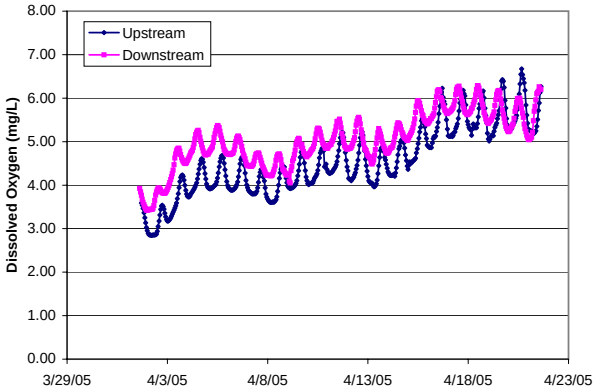


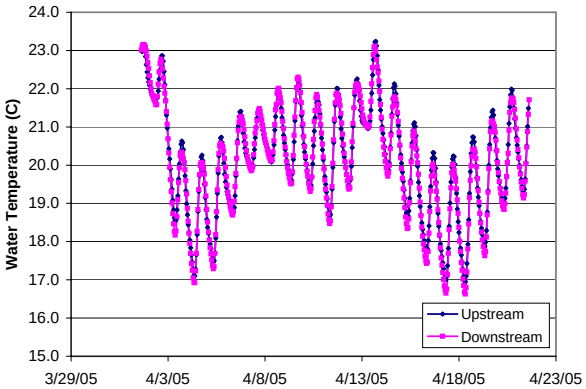
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2/mol$)
	($g\ O_2/m^2/d$)					
Avg	0.51	-6.91	7.42	0.07	0.42	0.05
Max	0.77	-6.08	8.43	0.10	0.89	0.11
Min	0.03	-8.40	6.70	0.00	0.02	0.00

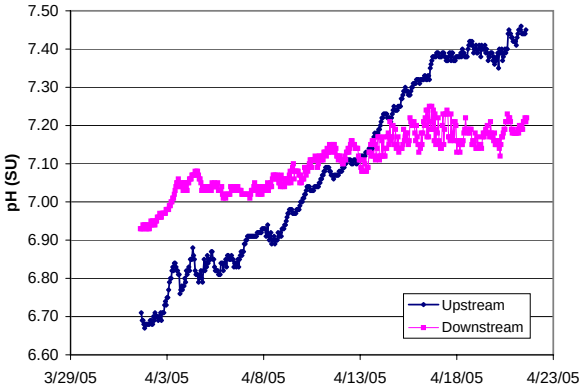
APPENDIX G-4
ROCK SPRING RUN - SEGMENT 2 METABOLISM ESTIMATES (4/1/05 - 4/21/05)

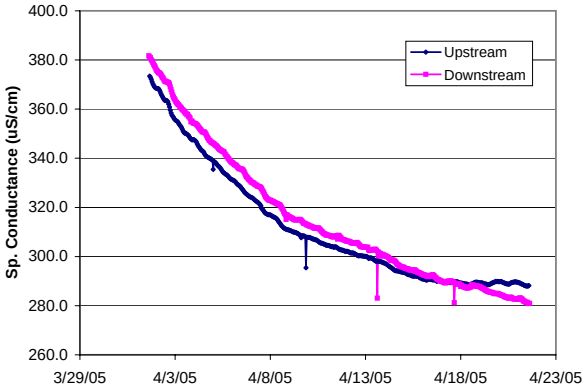
APPENDIX G-4

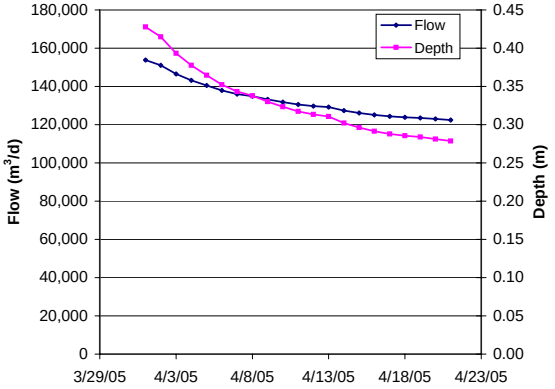
ROCK SPRING RUN - SEGMENT 2 METABOLISM SUMMARY - (4/01/05 - 4/21/05)

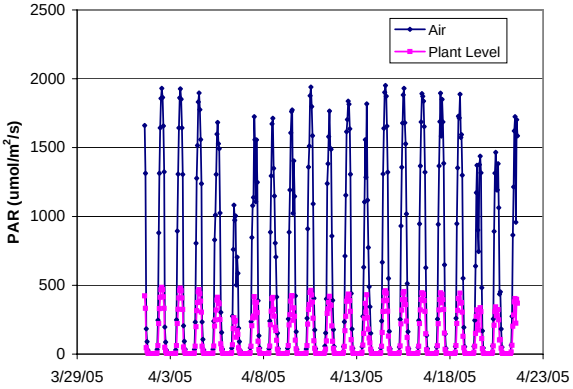


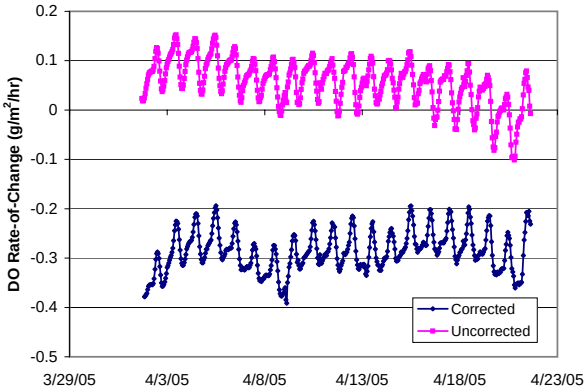




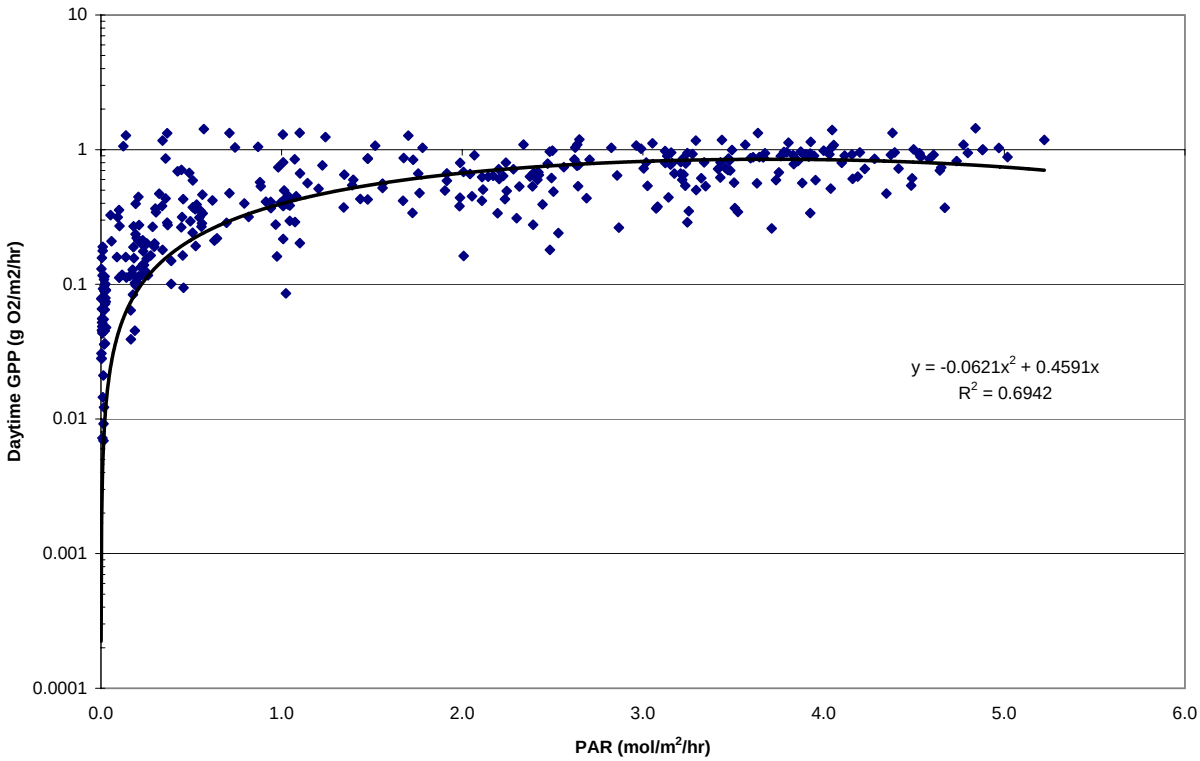


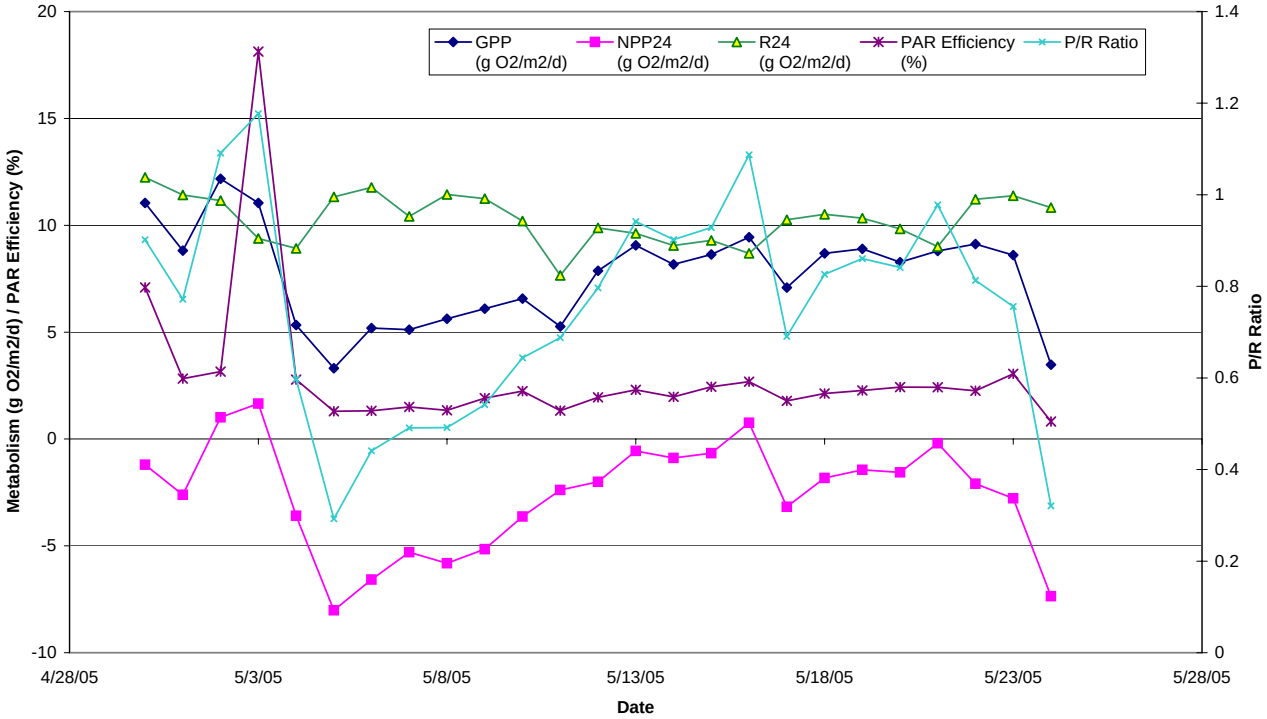






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	4.51	2.84	6.43	454
down		5.01	3.42	6.29	456
Wtr Temp - up	C	20.1	17.0	23.2	459
down		20.1	16.6	23.2	460
pH - up	SU	7.07	6.67	7.45	459
down		7.10	6.93	7.25	460
SpCond - up	uS/cm	312	288	373	459
down		316	281	382	460
Flow - up	m^3/d	133,056	122,422	153,769	21
Depth	m	0.329	0.279	0.428	21
PAR - air	$umol/m^2/s$	490	0.0	1,951	456
plant		118	0.0	0,485	456
DO rate chng	$g/m^2/hr$				
corr		-0.287	-0.391	-0.194	454
uncorr		0.060	-0.082	0.152	454



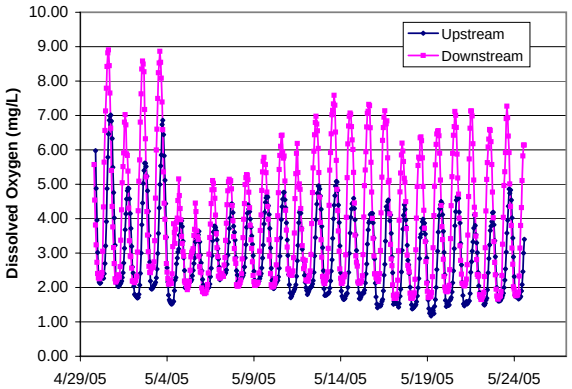


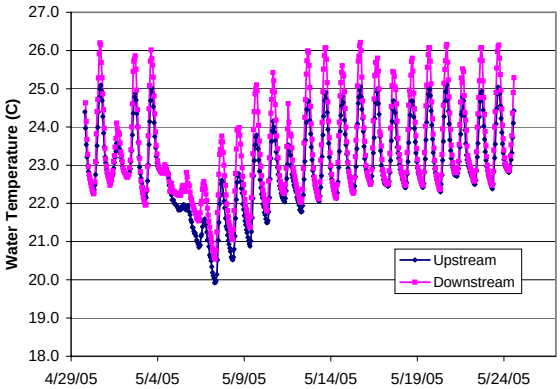
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2/mol$)
	($g\ O_2/m^2/d$)					
Avg	7.67	-2.62	10.28	0.75	2.94	0.36
Max	12.17	1.66	12.24	1.18	18.13	2.25
Min	3.32	-8.02	7.65	0.29	0.82	0.10

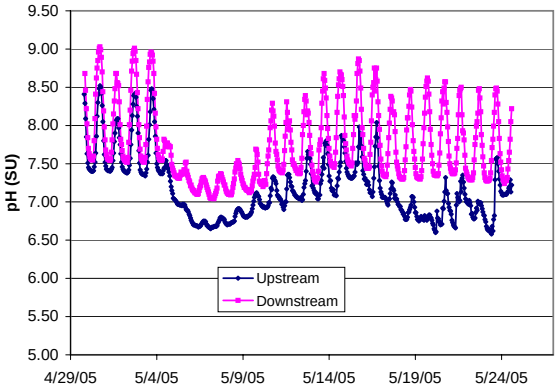
APPENDIX G-5
ALEXANDER SPRING CREEK - SEGMENT 1 METABOLISM ESTIMATES (4/29/05 - 5/24/05)

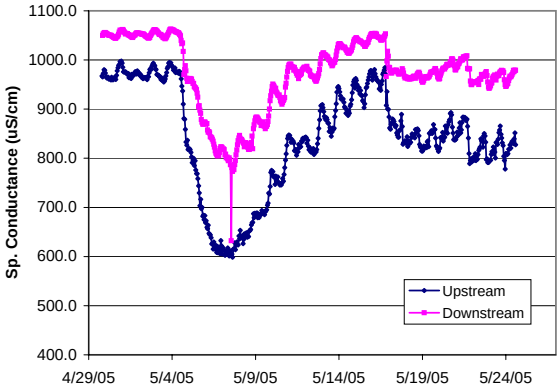
APPENDIX G-5

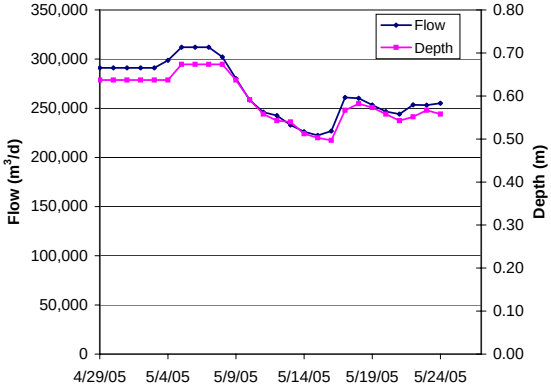
ALEXANDER SPRING CREEK - SEGMENT 1 METABOLISM SUMMARY - (4/29/05 - 5/24/05)

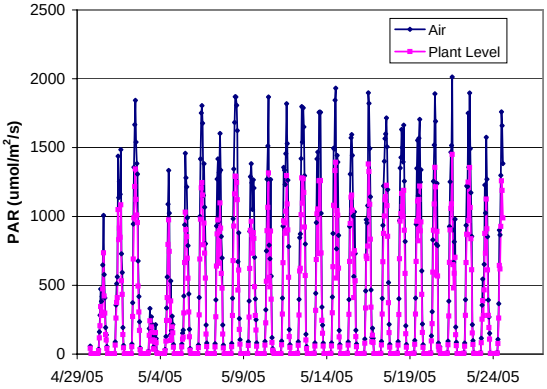


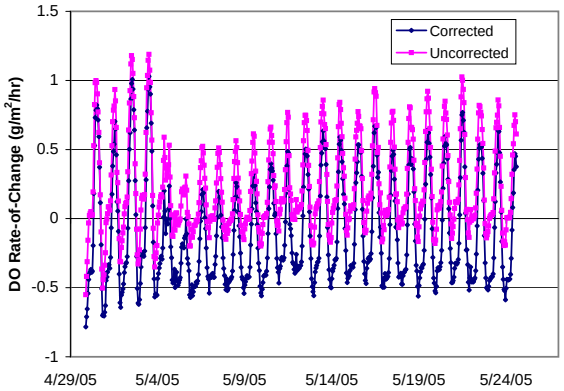




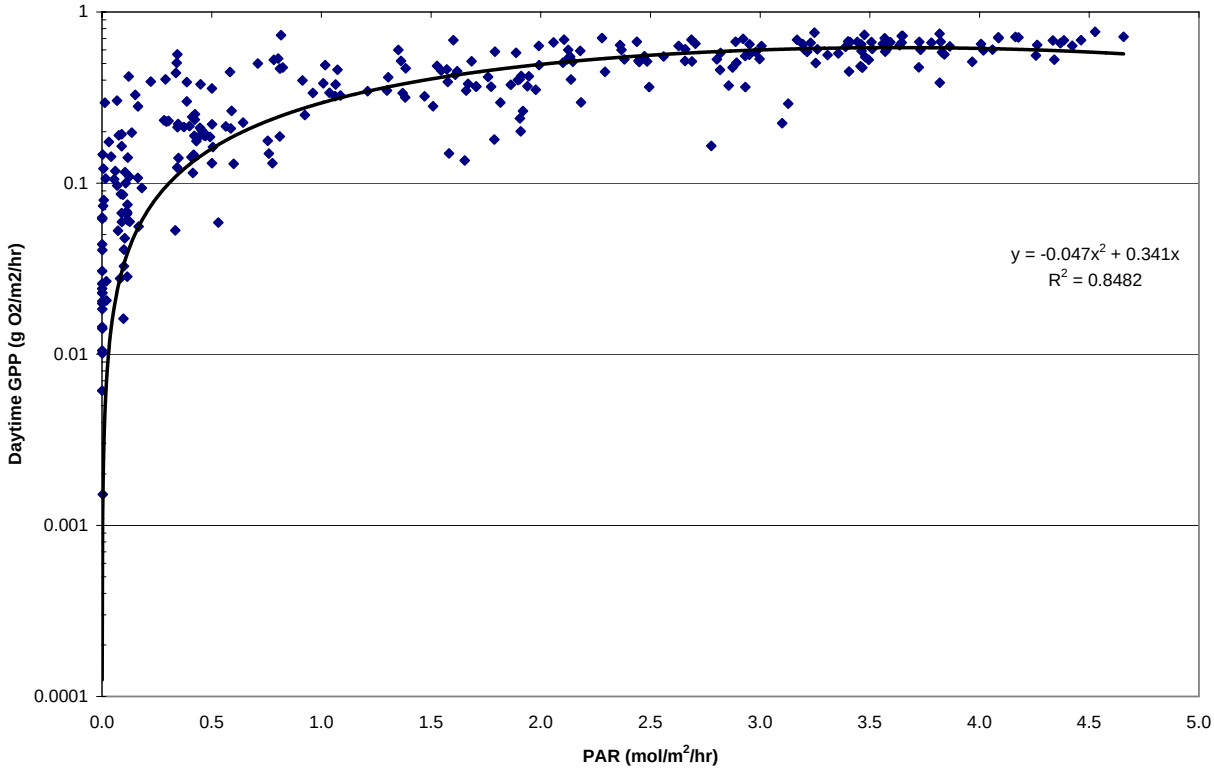


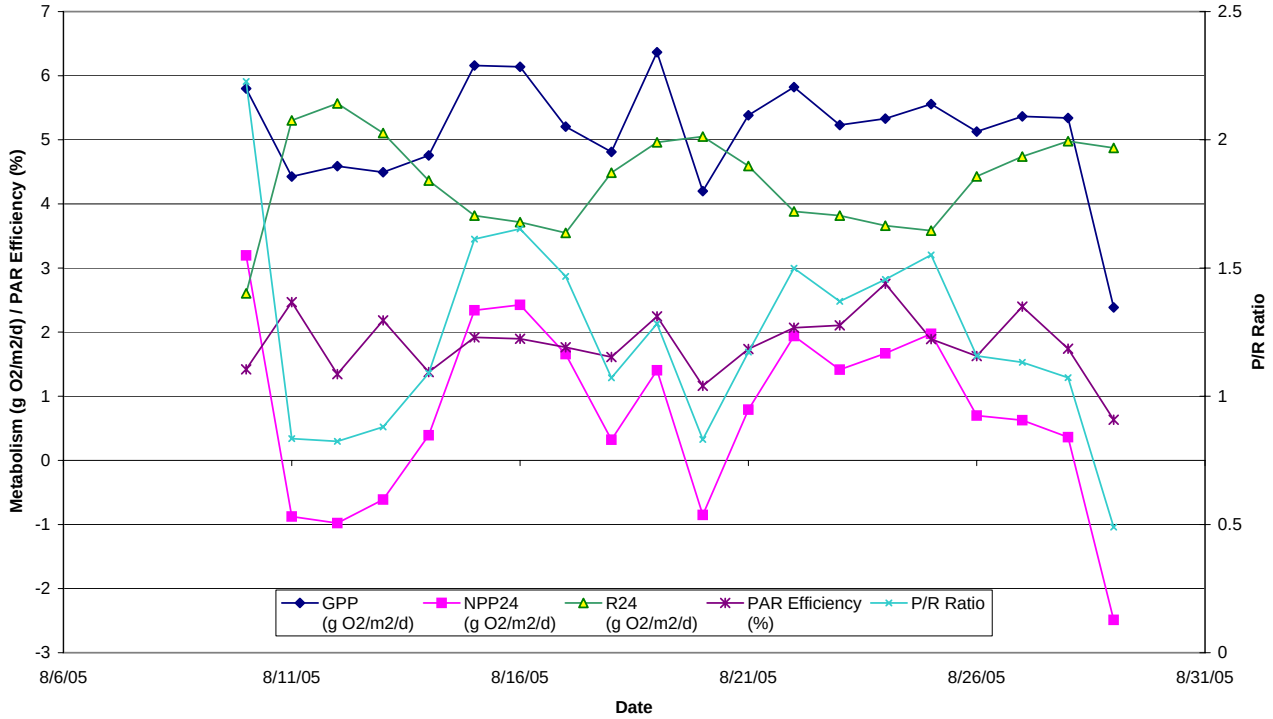






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	3.03	1.41	7.01	401
down		3.96	1.82	8.9	402
Wtr Temp - up	C	22.9	19.9	25.1	596
down		23.4	20.5	26.2	595
pH - up	SU	7.17	6.58	8.52	596
down		7.74	7.04	9.03	595
SpCond - up	uS/cm	842	598	998	596
down		972	632	1063	595
Flow - down	m^3/d	267,511	222,394	312,085	26
Depth	m	0.592	0.497	0.674	26
PAR - air	$umol/m^2/s$	417	0.0	1,932	403
plant		297	0.0	1,394	403
DO rate chng	$g/m^2/hr$				
corr		-0.116	-0.784	1.029	400
uncorr		0.213	-0.551	1.19	400



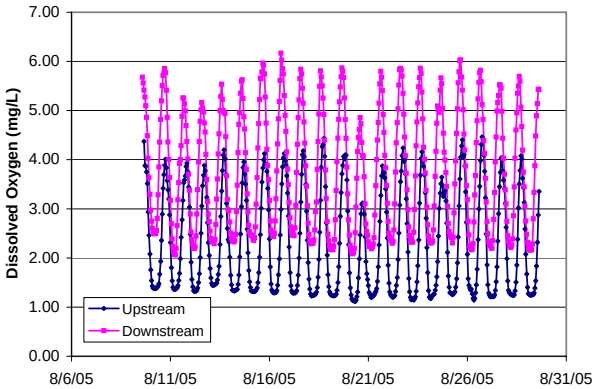


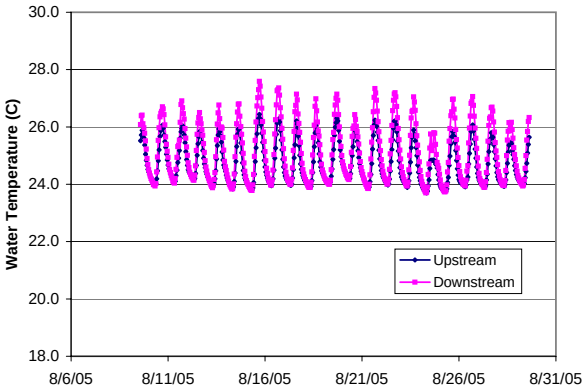
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2/mol$)
	($g\ O_2/m^2/d$)					
Avg	5.12	0.77	4.35	1.23	1.82	0.23
Max	6.37	3.20	5.57	2.23	2.76	0.34
Min	2.38	-2.49	2.60	0.49	0.63	0.08

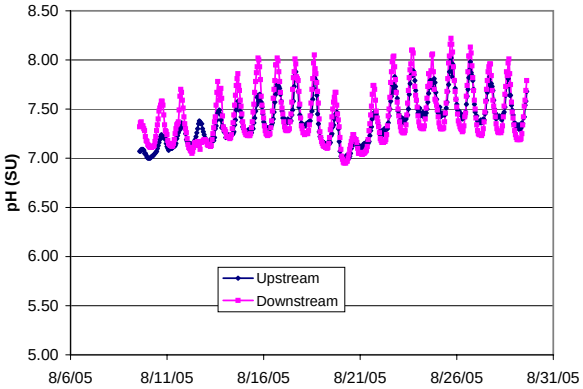
APPENDIX G-5
ALEXANDER SPRING CREEK - SEGMENT 1 METABOLISM ESTIMATES (8/9/05 - 8/29/05)

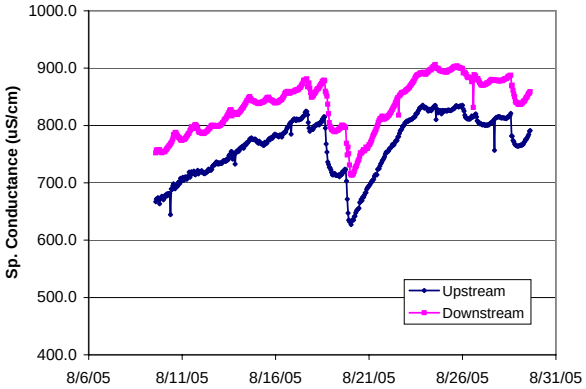
APPENDIX G-5

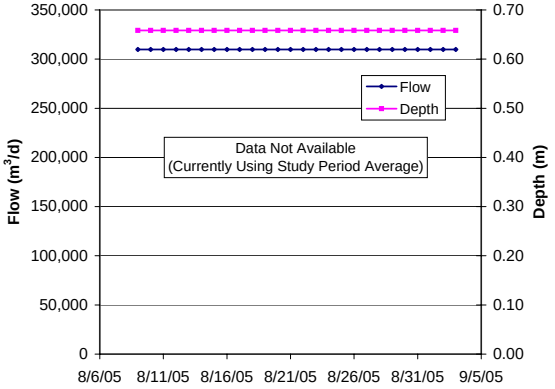
ALEXANDER SPRING CREEK - SEGMENT 1 METABOLISM SUMMARY - (8/09/05 - 8/29/05)

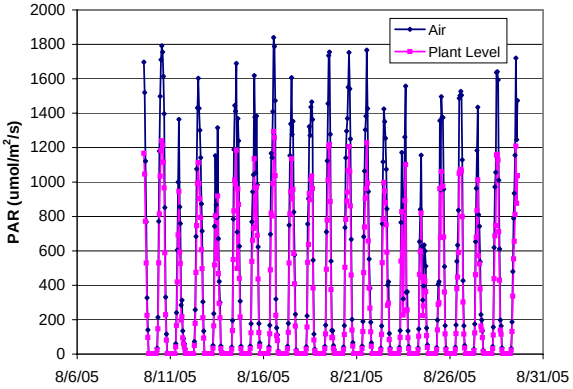


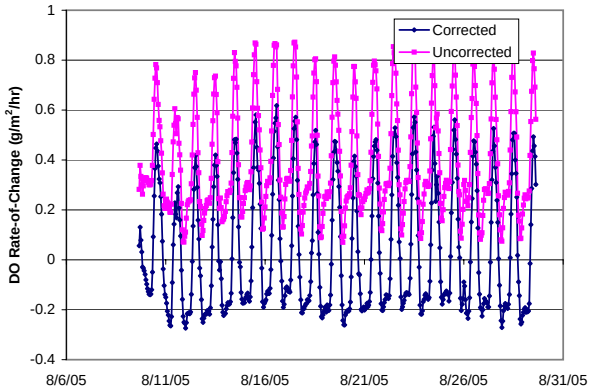




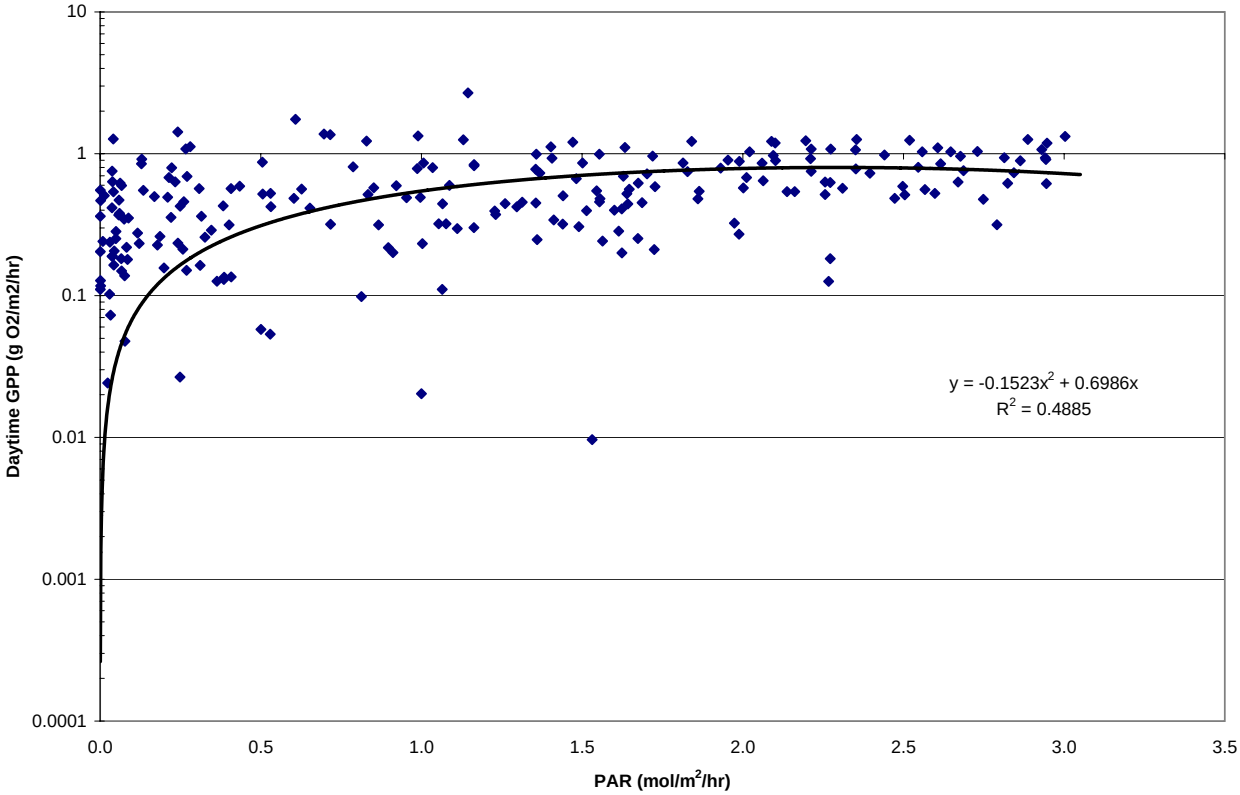


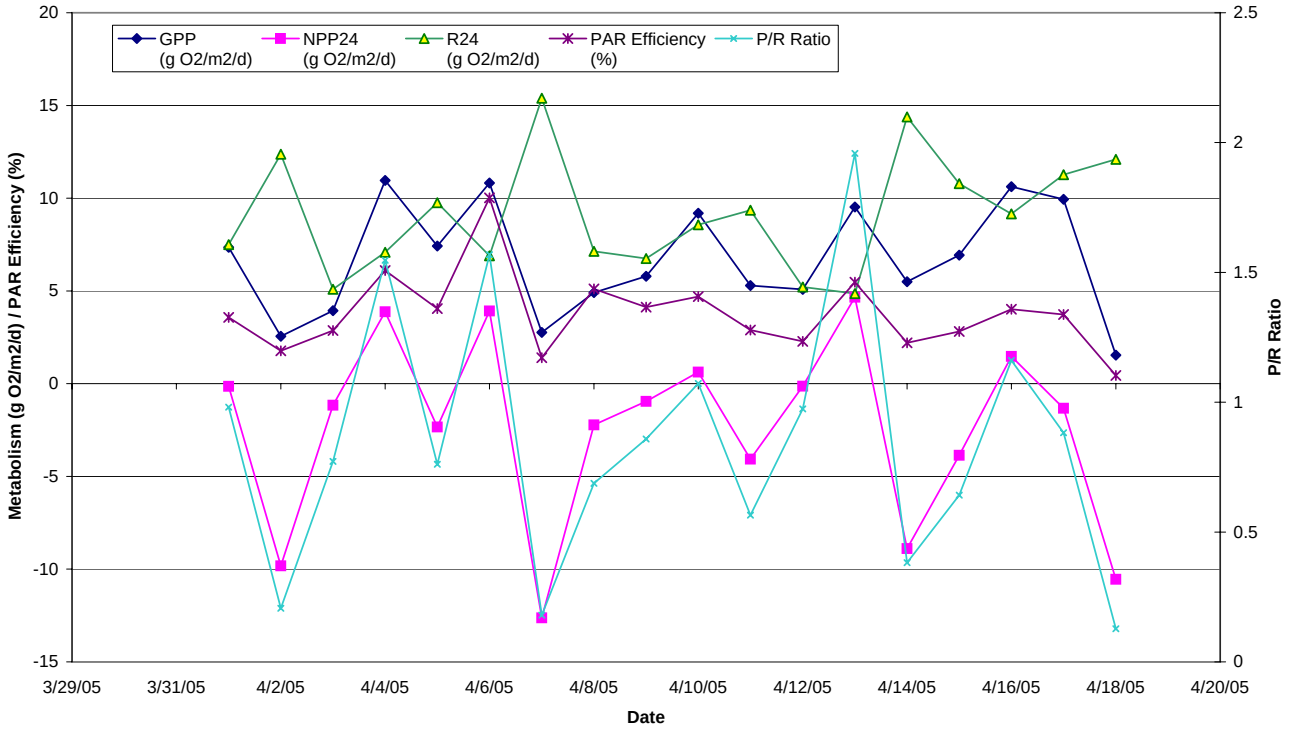






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	2.31	1.11	4.43	401
down		3.78	2.06	6.2	402
Wtr Temp - up	C	24.7	23.7	26.4	482
down		25.1	23.7	27.6	482
pH - up	SU	7.39	6.99	8.02	482
down		7.43	6.95	8.22	482
SpCond - up	uS/cm	764	627	835	482
down		835	714	906	482
Flow - down	m^3/d	309,848	309,848	309,848	26
Depth	m	0.658	0.658	0.658	26
PAR - air	$umol/m^2/s$	396	-0.1	1,840	482
plant		277	-0.1	1,293	482
DO rate chng	$g/m^2/hr$				
corr		0.038	-0.274	0.618	480
uncorr		0.397	0.070	0.90	480



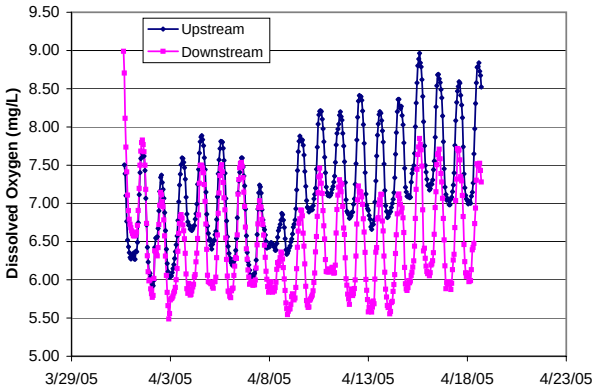


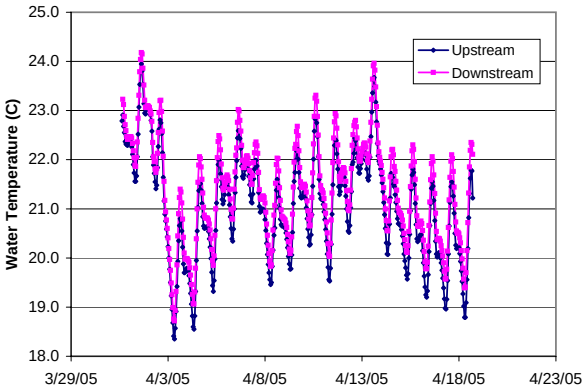
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff. (%)	PAR Eff. ($g\ O_2$)
	($g\ O_2/m^2/d$)					
Avg	6.67	-2.42	9.09	0.85	3.75	0.47
Max	10.96	4.66	15.39	1.96	10.02	1.24
Min	1.54	-12.63	4.86	0.13	0.45	0.06

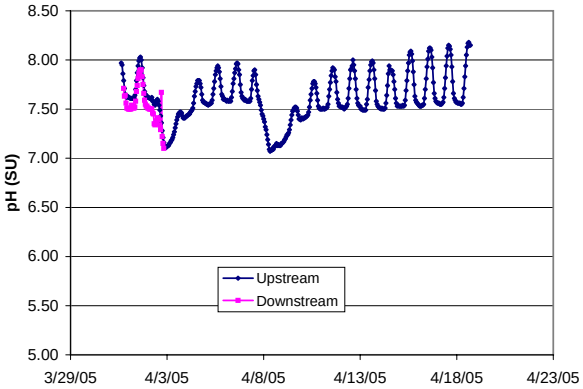
APPENDIX G-6
JUNIPER CREEK - SEGMENT 1 METABOLISM ESTIMATES (3/31/05 - 4/18/05)

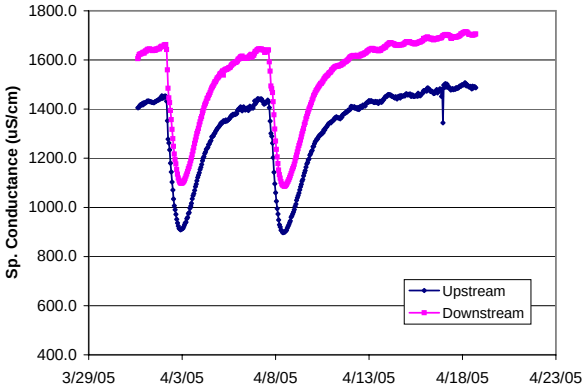
APPENDIX G-6

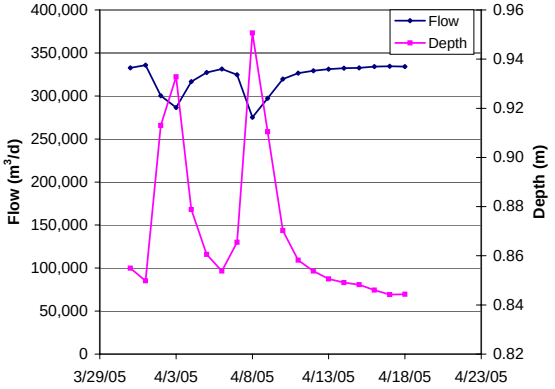
JUNIPER CREEK - SEGMENT 1 METABOLISM SUMMARY - (3/31/05 - 4/18/05)

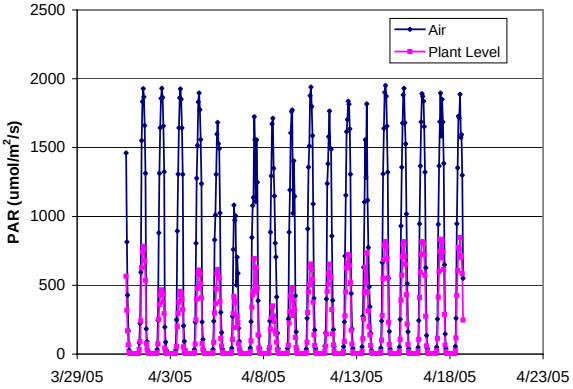


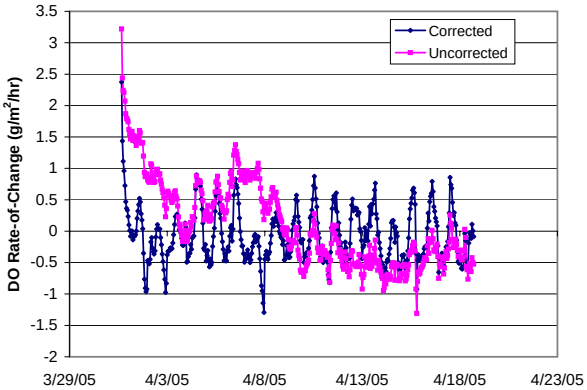




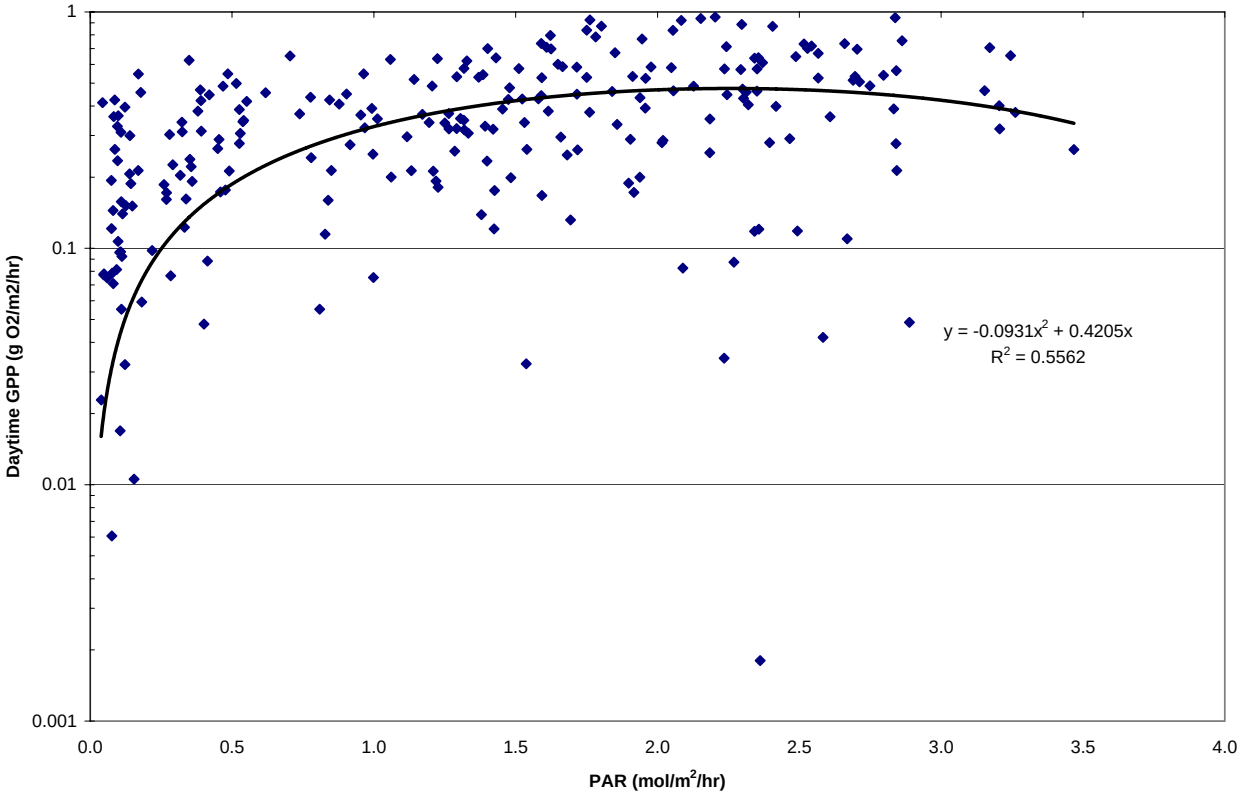


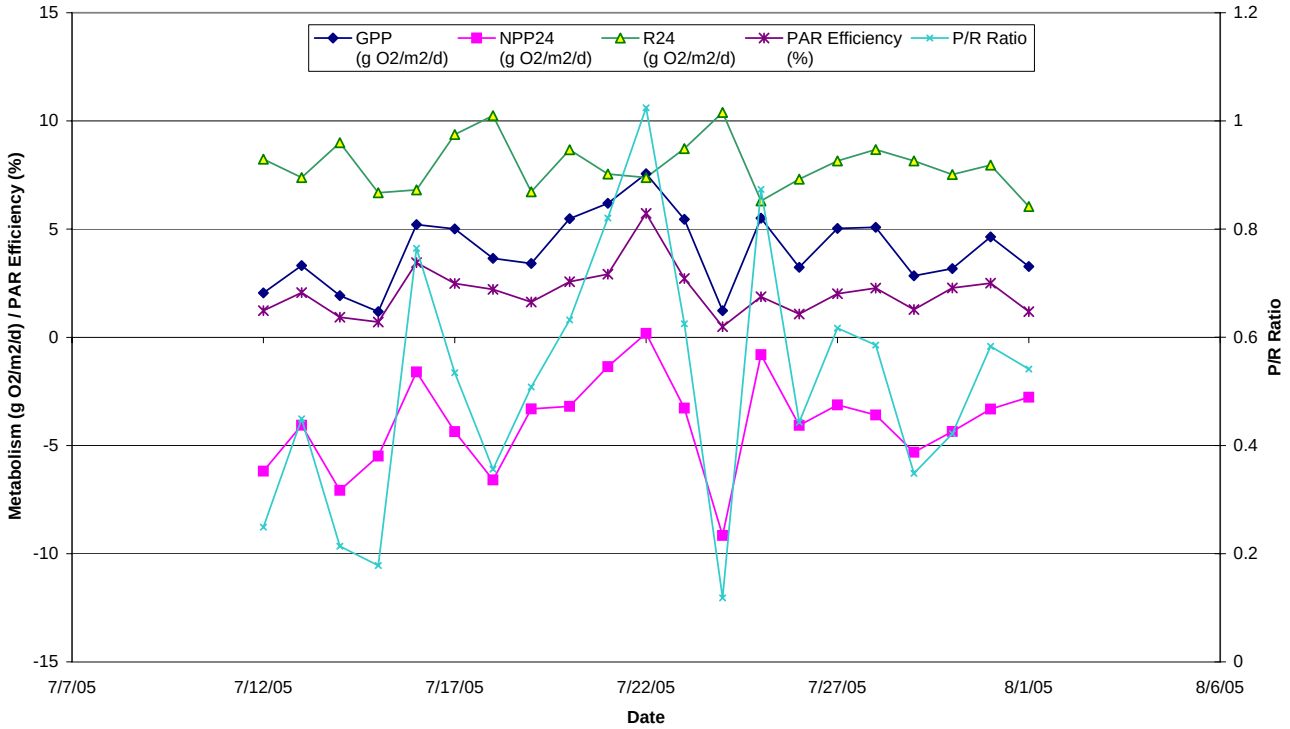






Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	7.20	5.92	8.96	433
down		6.47	5.49	9.0	435
Wtr Temp - up	C	21.1	18.4	24.0	435
down		21.4	18.7	24.2	434
pH - up	SU	7.61	7.07	8.18	435
down		7.54	7.10	7.90	51
SpCond - up	uS/cm	1329	897	1507	435
down		1535	1086	1714	435
Flow - down	m^3/d	321,197	275,152	335,800	19
Depth	m	0.870	0.844	0.951	19
PAR - air	$umol/m^2/s$	475	0.0	1,951	403
plant		167	0.0	0,818	403
DO rate chng	$g/m^2/hr$				
corr		-0.079	-1.293	1.436	433
uncorr		0.104	-1.309	2.44	433



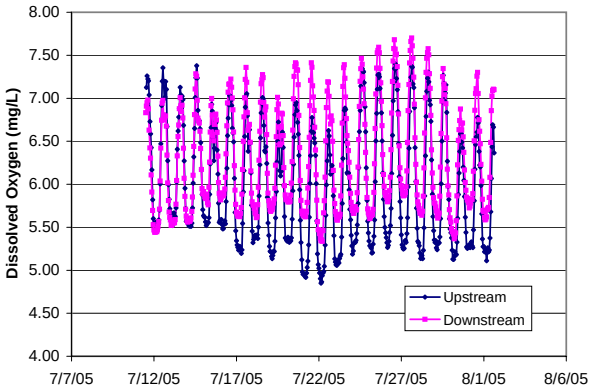


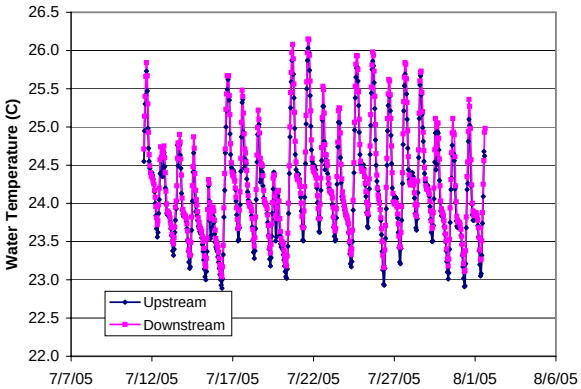
Stats	GPP	NPP24	R24	P/R ratio	PAR Eff.	
	($g\ O_2/m^2/d$)				(%)	($g\ O_2/mol$)
Avg	4.02	-3.94	7.97	0.52	2.08	0.26
Max	7.56	0.18	10.39	1.02	5.73	0.71
Min	1.19	-9.16	6.04	0.12	0.49	0.06

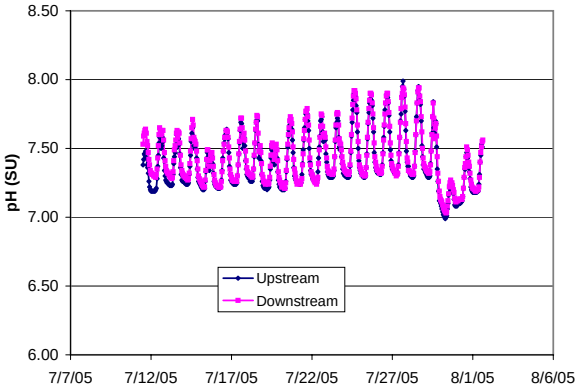
APPENDIX G-6
JUNIPER CREEK - SEGMENT 1 METABOLISM ESTIMATES (7/11/05 - 8/1/05)

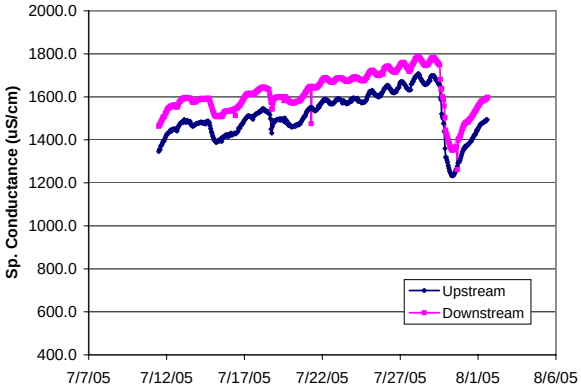
APPENDIX G-6

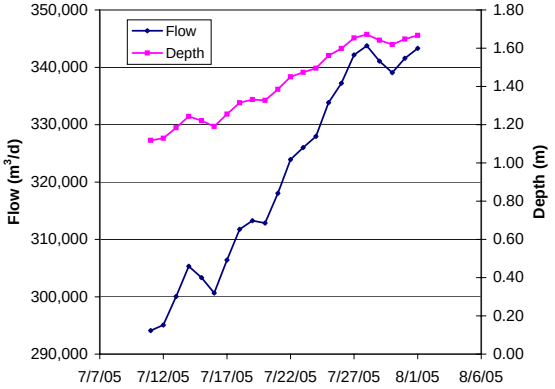
JUNIPER CREEK - SEGMENT 1 METABOLISM SUMMARY - (7/11/05 - 8/01/05)

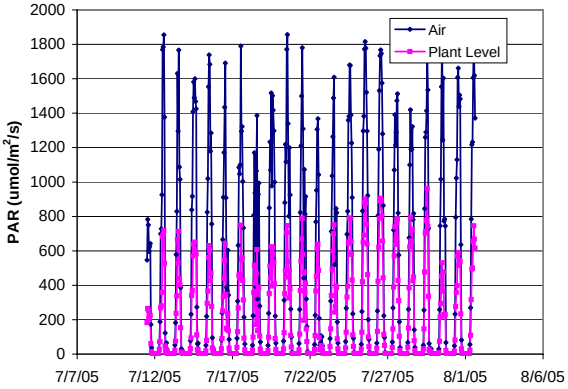


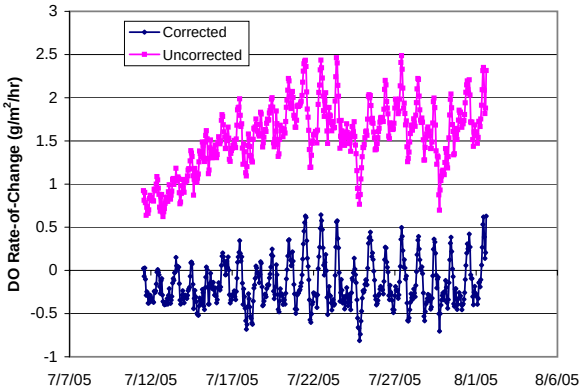












Parameter	Units	Avg	Min	Max	N
DO - up	mg/L	5.98	4.85	7.40	506
down		6.31	5.34	7.7	508
Wtr Temp - up	C	24.1	22.9	26.0	507
down		24.3	23.0	26.2	508
pH - up	SU	7.40	6.99	7.99	507
down		7.43	7.03	7.94	508
SpCond - up	uS/cm	1514	1233	1709	507
down		1616	1262	1788	508
Flow - down	m^3/d	320,946	294,112	343,754	22
Depth	m	1.417	1.118	1.672	22
PAR - air	$umol/m^2/s$	437	0.0	1,857	508
plant		190	0.0	0,963	508
DO rate chng	$g/m^2/hr$				
corr		-0.159	-0.813	0.644	506
uncorr		1.542	0.622	2.49	506

Appendix H

Detailed Estimates of Mesocosm Plant Metabolism in the Wekiva River System and Reference Streams

APPENDIX H-1

MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1

		5/27/2005		8/31/2005	
PARAMETER	UNITS	NAJAS & HYDRILLA	VALLISNERIA	NAJAS & FILAMENTOUS ALGAE	VALLISNERIA
UPSTREAM DO	mg/L	0.48	0.48	0.57	0.56
DOWNSTREAM DO		0.70	0.59	0.85	0.70
CHANGE DO		0.22	0.11	0.28	0.13
TRAVEL TIME	minutes	0.95	0.77	0.91	0.96
VELOCITY	m/hr	115	143	121	115
GPP	g $O_2/m^2/d$	20.99	9.69	34.17	13.24
NPP		16.77	7.75	29.02	12.76
R		4.22	1.94	5.16	0.48
Vegetation	kg DW/m^2	0.709	0.546	0.509	0.613
GPP	g O_2/kg DW/d	29.60	17.75	67.20	21.60
NPP		23.65	14.20	57.06	20.82
R24		5.95	3.55	10.14	0.78
PAR	mol/hr	0.12	0.11	0.41	0.40
	$mol/m^2/d$	18.4	16.8	38.5	34.0
GPP	g O_2/mol	1.14	0.576	0.89	0.389
NPP		0.914	0.461	0.754	0.375
GPP	g O_2/kg DW/mol	1.61	1.06	1.75	0.63
NPP		1.29	0.844	1.48	0.612

APPENDIX H-1

MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05

		NAJAS & HYDRILLA				VALLISNERIA				CONTROL			
PARAMETER	UNITS	1	4	9	Average [a]	2	6	7	Average [a]	3	5	8	Average
UPSTREAM DO	mg/L	0.47	0.48	0.49	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
DOWNSTREAM DO		0.83	0.59	0.69	0.70	0.59	0.61	0.57	0.59	0.49	0.48	0.49	0.49
CHANGE DO		0.36	0.11	0.20	0.22	0.12	0.13	0.09	0.11	0.01	0.00	0.00	0.01
TRAVEL TIME	minutes	1.49	0.52	0.84	0.95	0.72	0.98	0.61	0.77	0.14	0.13	0.14	0.14
VELOCITY	m/hr	73.4	210	130	115	153	112	181	143	781	821	797	799
GPP	g $O_2/m^2/d$	20.99	20.19	20.87	20.99	7.13	8.77	13.35	9.69	---	---	---	---
NPP		16.54	14.75	19.16	16.77	8.36	6.52	10.03	7.75	---	---	---	---
R		4.45	5.44	1.71	4.22	-1.23	2.25	3.32	1.94	---	---	---	---
Vegetation	kg DW/m^2	0.828	0.636	0.664	0.709	0.542	0.600	0.496	0.546	---	---	---	---
GPP	g O_2/kg DW/d	25.35	31.75	31.43	29.60	13.14	14.61	26.94	17.75	---	---	---	---
NPP		19.98	23.19	28.85	23.65	15.41	10.86	20.24	14.20	---	---	---	---
R24		5.37	8.56	2.57	5.95	-2.27	3.75	6.70	3.55	---	---	---	---
PAR	mol/hr	0.13	0.11	0.12	0.12	0.11	0.10	0.11	0.11	---	---	---	---
	$mol/m^2/d$	20.0	17.1	17.9	18.4	17.2	16.2	17.0	16.8	---	---	---	---
GPP	g O_2/mol	1.05	1.18	1.17	1.14	0.414	0.540	0.784	0.576	---	---	---	---
NPP		0.827	0.860	1.07	0.914	0.486	0.401	0.589	0.461	---	---	---	---
GPP	g O_2/kg DW/mol	1.27	1.85	1.75	1.61	0.763	0.899	1.58	1.06	---	---	---	---
NPP		0.999	1.35	1.61	1.29	0.895	0.669	1.19	0.844	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
NAJAS & HYDRILLA	1	7:58	0.35	0.40	0.05	---	*0.05*	0.02	---	0.00	0.000	1.49	73.4	20.99	16.54	4.45	0.828	25.35	19.98	5.37	20.01	1.05	0.83	1.27	1.00
		8:24	0.37	0.30	-0.07	---	-0.07	-0.02	---	0.00	0.000														
		8:52	0.42	0.33	-0.09	---	-0.09	-0.03	---	0.00	0.000														
		9:16	0.43	0.36	-0.07	---	-0.07	-0.02	---	0.00	0.000														
		9:36	0.44	0.79	0.35	---	0.35	0.12	1.15	204.10	0.102														
		9:56	0.48	0.86	0.38	---	0.38	0.13	0.99	255.90	0.128														
		10:17	0.46	1.00	0.54	---	0.54	0.18	1.07	336.50	0.169														
		10:41	0.56	1.46	0.90	---	0.90	0.30	1.25	482.00	0.242														
		11:03	0.63	1.71	1.08	---	1.08	0.36	0.83	861.80	0.432														
		11:22	0.58	1.08	0.51	---	0.51	0.17	0.79	424.60	0.213														
	4	8:06	0.35	0.34	-0.01	---	*-0.01*	-0.01	---	0.00	0.000	0.52	209.7	20.19	14.75	5.44	0.636	31.75	23.19	8.56	17.14	1.18	0.86	1.85	1.35
		8:34	0.39	0.36	-0.03	---	-0.03	-0.03	---	0.00	0.000														
		9:00	0.43	0.40	-0.03	---	-0.03	-0.03	---	0.00	0.000														
		9:24	0.45	0.42	-0.03	---	-0.03	-0.03	---	0.00	0.000														
		9:42	0.47	0.59	0.12	---	0.12	0.12	0.72	327.10	0.164														
		10:04	0.47	0.59	0.12	---	0.12	0.11	0.85	270.50	0.136														
		10:24	0.51	0.66	0.15	---	0.15	0.15	0.95	305.80	0.153														
		10:49	0.55	0.76	0.21	---	0.21	0.20	0.81	492.60	0.247														
		11:10	0.60	0.94	0.35	---	0.35	0.33	1.53	429.10	0.215														
		11:28	0.57	0.81	0.24	---	0.24	0.23	1.22	372.50	0.187														
	9	8:22	0.37	0.33	-0.04	---	*-0.04*	-0.02	---	0.00	0.000	0.84	130.5	20.87	19.16	1.71	0.664	31.43	28.85	2.57	17.91	1.17	1.07	1.75	1.61
		8:48	0.41	0.36	-0.05	---	-0.05	-0.03	---	0.00	0.000														
		9:15	0.43	0.45	0.02	---	0.02	0.01	---	0.00	0.000														
		9:33	0.44	0.42	-0.02	---	-0.02	-0.01	---	0.00	0.000														
		9:54	0.47	0.68	0.21	---	0.21	0.12	0.90	272.50	0.137														
		10:13	0.45	0.66	0.21	---	0.21	0.12	0.93	268.00	0.134														
		10:40	0.54	0.98	0.44	---	0.44	0.26	1.11	464.60	0.233														
		10:59	0.62	1.12	0.50	---	0.50	0.30	1.38	429.40	0.215														
		11:20	0.57	1.08	0.52	---	0.52	0.31	1.34	454.30	0.228														
		11:35	0.56	0.82	0.26	---	0.26	0.15	0.75	407.70	0.205														
	Average	8:08	0.36	0.36	0.00	0.02	*-0.02*	-0.01	---	0.00	0.000	0.95	115.2	20.99	16.77	4.22	0.709	29.60	23.65	5.95	18.35	1.14	0.91	1.61	1.29
		8:35	0.39	0.34	-0.05	0.00	-0.05	-0.03	---	0.00	0.000														
		9:02	0.43	0.39	-0.04	0.00	-0.04	-0.02	---	0.00	0.000														
		9:24	0.44	0.40	-0.04	0.01	-0.05	-0.03	---	0.00	0.000														
		9:44	0.46	0.69	0.23	0.01	0.22	0.12	0.87	267.90	0.134														
		10:04	0.47	0.70	0.24	0.01	0.23	0.12	0.91	264.80	0.133														
		10:27	0.50	0.88	0.38	0.01	0.37	0.19	1.04	368.97	0.185														
		10:49	0.58	1.11	0.54	-0.01	0.55	0.29	1.23	468.00	0.235														
		11:11	0.60	1.24	0.65	0.02	0.63	0.33	1.13	581.73	0.292														
		11:28	0.57	0.90	0.33	0.00	0.34	0.18	0.88	401.60	0.201														

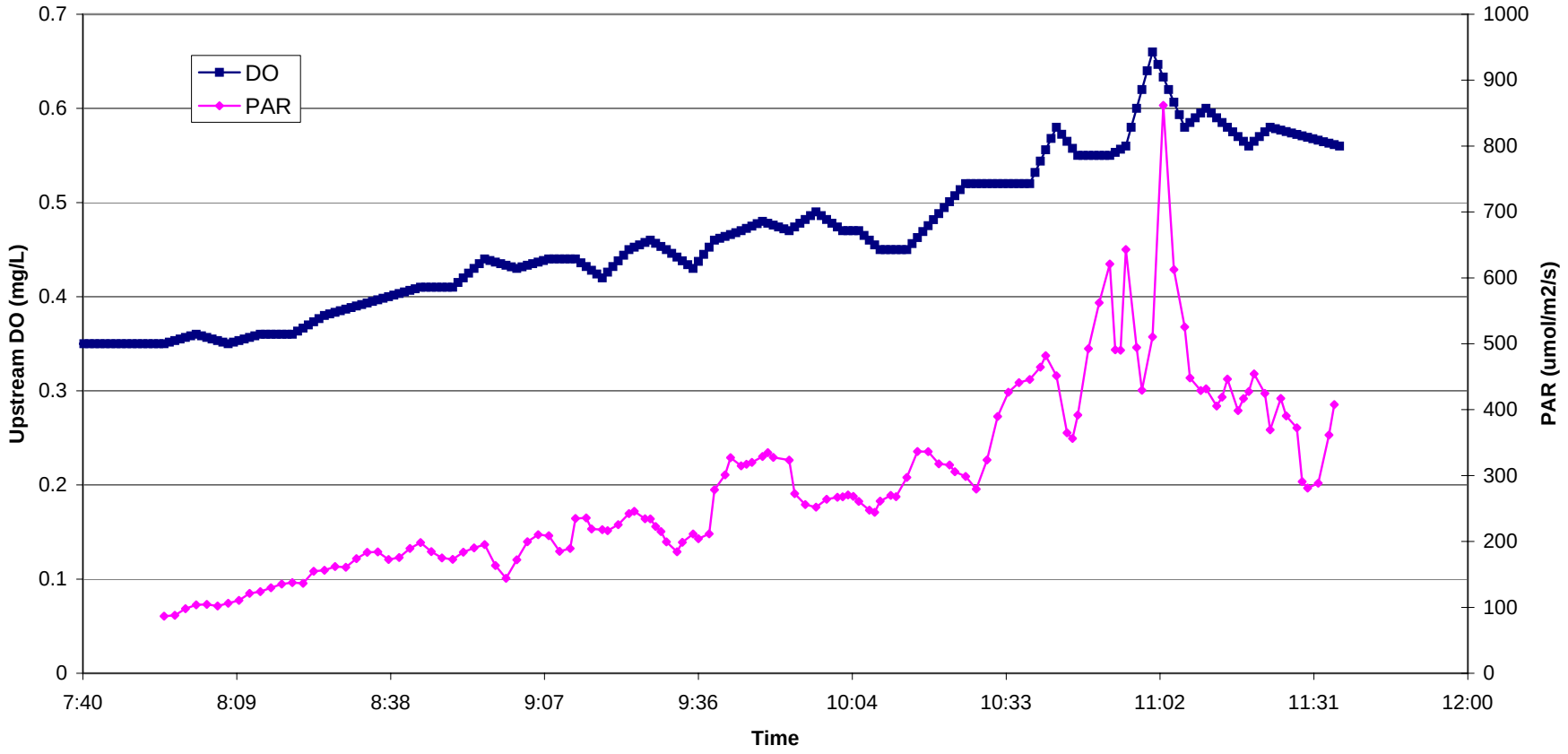
APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
VALLISNERIA	2	8:00	0.36	0.53	0.17	---	*0.17*	0.12	---	0.00	0.000	0.72	153.3	7.13	8.36	-1.23	0.542	13.14	15.41	-2.27	17.21	0.41	0.49	0.76	0.90
		8:28	0.38	0.41	0.03	---	0.03	0.02	---	0.00	0.000														
		8:54	0.43	0.43	0.00	---	0.00	0.00	---	0.00	0.000														
		9:19	0.43	0.43	0.00	---	0.00	0.00	---	0.00	0.000														
		9:38	0.45	0.56	0.11	---	0.11	0.08	0.71	211.60	0.106														
		10:00	0.48	0.57	0.09	---	0.09	0.06	0.46	264.10	0.132														
		10:19	0.48	0.65	0.17	---	0.17	0.12	0.72	336.30	0.169														
		10:45	0.57	0.75	0.19	---	0.19	0.13	0.71	364.80	0.183														
		11:05	0.61	0.85	0.24	---	0.24	0.17	0.55	612.60	0.307														
		11:25	0.58	0.74	0.16	---	0.16	0.11	0.54	417.10	0.209														
	6	8:12	0.36	0.51	0.15	---	*0.15*	0.08	---	0.00	0.000	0.98	112.2	8.77	6.52	2.25	0.600	14.61	10.86	3.75	16.24	0.54	0.40	0.90	0.67
		8:40	0.40	0.38	-0.02	---	-0.02	-0.01	---	0.00	0.000														
		9:06	0.44	0.41	-0.03	---	-0.03	-0.01	---	0.00	0.000														
		9:28	0.46	0.43	-0.03	---	-0.03	-0.01	---	0.00	0.000														
		9:46	0.48	0.57	0.10	---	0.10	0.05	0.30	319.90	0.160														
		10:08	0.46	0.58	0.12	---	0.12	0.06	0.49	247.50	0.124														
		10:30	0.52	0.69	0.17	---	0.17	0.09	0.54	323.60	0.162														
		10:54	0.55	0.86	0.31	---	0.31	0.16	0.64	490.90	0.246														
		11:14	0.59	0.87	0.29	---	0.29	0.15	0.69	419.10	0.210														
		11:30	0.57	0.81	0.24	---	0.24	0.12	0.87	281.00	0.141														
	7	8:16	0.36	0.38	0.02	---	*0.02*	0.02	---	0.00	0.000	0.61	181.2	13.35	10.03	3.32	0.496	26.94	20.24	6.70	17.02	0.78	0.59	1.58	1.19
		8:42	0.41	0.38	-0.03	---	-0.03	-0.02	---	0.00	0.000														
		9:10	0.44	0.42	-0.02	---	-0.02	-0.02	---	0.00	0.000														
		9:29	0.45	0.43	-0.02	---	-0.02	-0.02	---	0.00	0.000														
		9:49	0.48	0.55	0.07	---	0.07	0.06	0.35	334.70	0.168														
		10:09	0.46	0.56	0.11	---	0.11	0.09	0.71	244.20	0.123														
		10:34	0.52	0.64	0.12	---	0.12	0.10	0.46	426.40	0.214														
		10:55	0.56	0.79	0.23	---	0.23	0.19	0.78	490.10	0.246														
		11:17	0.57	0.81	0.24	---	0.24	0.20	0.99	398.60	0.200														
		11:32	0.57	0.76	0.19	---	0.19	0.16	1.11	288.40	0.145														
	Average	8:09	0.36	0.47	0.12	0.02	*0.10*	0.06	---	0.00	0.000	0.77	143.2	9.69	7.75	1.94	0.546	17.75	14.20	3.55	16.82	0.58	0.46	1.06	0.84
		8:36	0.40	0.39	-0.01	0.00	-0.01	0.00	---	0.00	0.000														
		9:03	0.44	0.42	-0.02	0.00	-0.02	-0.01	---	0.00	0.000														
		9:25	0.45	0.43	-0.02	0.01	-0.03	-0.02	---	0.00	0.000														
		9:44	0.47	0.56	0.09	0.01	0.09	0.06	0.39	288.73	0.145														
		10:05	0.47	0.57	0.10	0.01	0.10	0.06	0.51	251.93	0.126														
		10:27	0.51	0.66	0.15	0.01	0.15	0.09	0.52	362.10	0.182														
		10:51	0.56	0.80	0.24	-0.01	0.25	0.17	0.74	448.60	0.225														
		11:12	0.59	0.84	0.26	0.02	0.24	0.16	0.65	476.77	0.239														
		11:29	0.57	0.77	0.20	0.00	0.20	0.13	0.80	328.83	0.165														

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
CONTROL	3	8:04	0.36	0.37	0.01	---	*0.01*	0.05	---	0.00	0.000	0.14	781.4	---	---	---	---	---	---	---	---	---	---	---	---
		8:30	0.39	0.40	0.01	---	0.01	0.05	---	0.00	0.000														
		8:58	0.44	0.44	0.00	---	0.00	0.01	---	0.00	0.000														
		9:21	0.44	0.46	0.02	---	0.02	0.08	---	0.00	0.000														
		9:41	0.46	0.47	0.01	---	0.01	0.02	0.14	301.00	0.151														
		10:02	0.47	0.49	0.02	---	0.02	0.06	0.43	267.10	0.134														
		10:23	0.50	0.51	0.01	---	0.01	0.03	0.20	316.00	0.159														
		10:46	0.56	0.56	0.00	---	0.00	0.01	0.05	356.30	0.179														
		11:08	0.59	0.59	0.01	---	0.01	0.02	0.08	448.10	0.225														
		11:26	0.58	0.57	-0.01	---	-0.01	-0.02	-0.10	390.50	0.196														
	5	8:10	0.35	0.37	0.02	---	*0.02*	0.06	---	0.00	0.000	0.13	821.4	---	---	---	---	---	---	---	---	---	---	---	---
		8:36	0.40	0.39	-0.01	---	-0.01	-0.02	---	0.00	0.000														
		9:04	0.43	0.44	0.01	---	0.01	0.02	---	0.00	0.000														
		9:26	0.46	0.45	-0.01	---	-0.01	-0.03	---	0.00	0.000														
		9:45	0.47	0.47	0.00	---	0.00	-0.01	-0.06	317.10	0.159														
		10:05	0.47	0.47	0.00	---	0.00	0.00	0.00	268.50	0.135														
		10:28	0.52	0.52	0.00	---	0.00	0.00	0.00	279.40	0.140														
		10:51	0.55	0.54	-0.01	---	-0.01	-0.04	-0.13	562.20	0.282														
		11:13	0.59	0.62	0.03	---	0.03	0.11	0.55	405.50	0.203														
		11:29	0.57	0.57	0.00	---	0.00	0.00	-0.02	290.90	0.146														
	8	8:18	0.36	0.38	0.02	---	*0.02*	0.07	---	0.00	0.000	0.14	796.6	---	---	---	---	---	---	---	---	---	---	---	---
		8:46	0.41	0.40	-0.01	---	-0.01	-0.04	---	0.00	0.000														
		9:12	0.44	0.44	0.00	---	0.00	0.00	---	0.00	0.000														
		9:32	0.44	0.46	0.02	---	0.02	0.07	---	0.00	0.000														
		9:50	0.48	0.49	0.01	---	0.01	0.05	0.31	327.50	0.164														
		10:12	0.45	0.45	0.00	---	0.00	0.00	0.00	269.90	0.135														
		10:36	0.52	0.54	0.02	---	0.02	0.07	0.33	441.10	0.221														
		10:58	0.60	0.57	-0.03	---	-0.03	-0.11	-0.44	494.30	0.248														
		11:18	0.57	0.58	0.02	---	0.02	0.05	0.26	416.80	0.209														
		11:34	0.56	0.56	0.00	---	0.00	-0.01	-0.06	361.50	0.181														
	Average	8:10	0.36	0.37	0.02	---	*0.02*	0.06	---	0.00	0.000	0.14	799.5	---	---	---	---	---	---	---	---	---	---	---	---
		8:37	0.40	0.40	0.00	---	0.00	0.00	---	0.00	0.000														
		9:04	0.44	0.44	0.00	---	0.00	0.01	---	0.00	0.000														
		9:26	0.45	0.46	0.01	---	0.01	0.04	---	0.00	0.000														
		9:45	0.47	0.48	0.01	---	0.01	0.02	0.13	315.20	0.158														
		10:06	0.46	0.47	0.01	---	0.01	0.02	0.14	268.50	0.135														
		10:29	0.51	0.52	0.01	---	0.01	0.04	0.20	345.50	0.173														
		10:51	0.57	0.56	-0.01	---	-0.01	-0.05	-0.19	470.93	0.236														
		11:13	0.58	0.60	0.02	---	0.02	0.06	0.29	423.47	0.212														
		11:29	0.57	0.57	0.00	---	0.00	-0.01	-0.06	347.63	0.174														

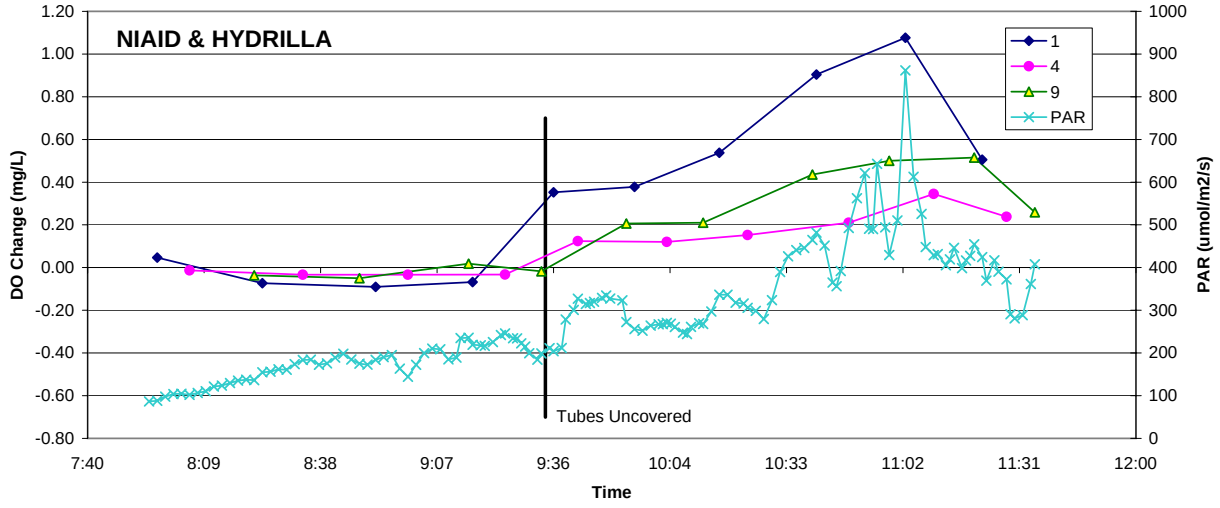
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13
Note: First reading in each mesocosm not used in analyses due to startup

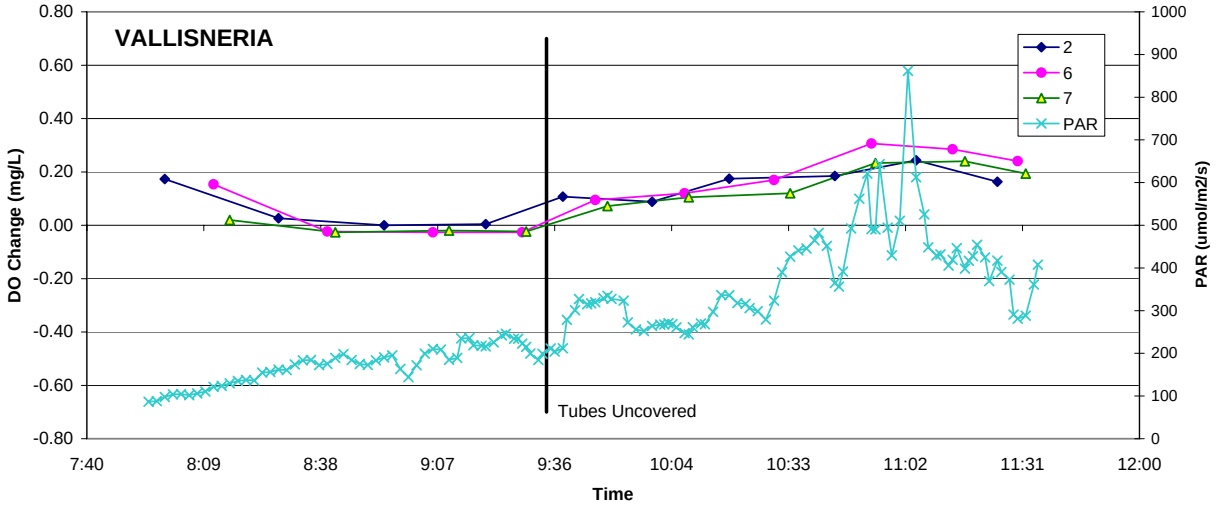


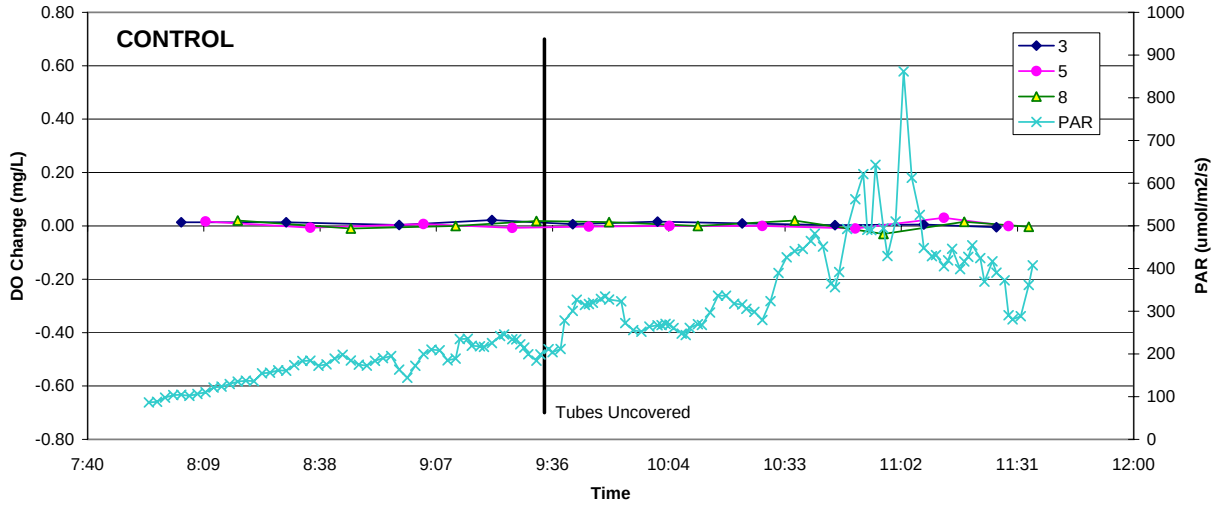
APPENDIX H-1

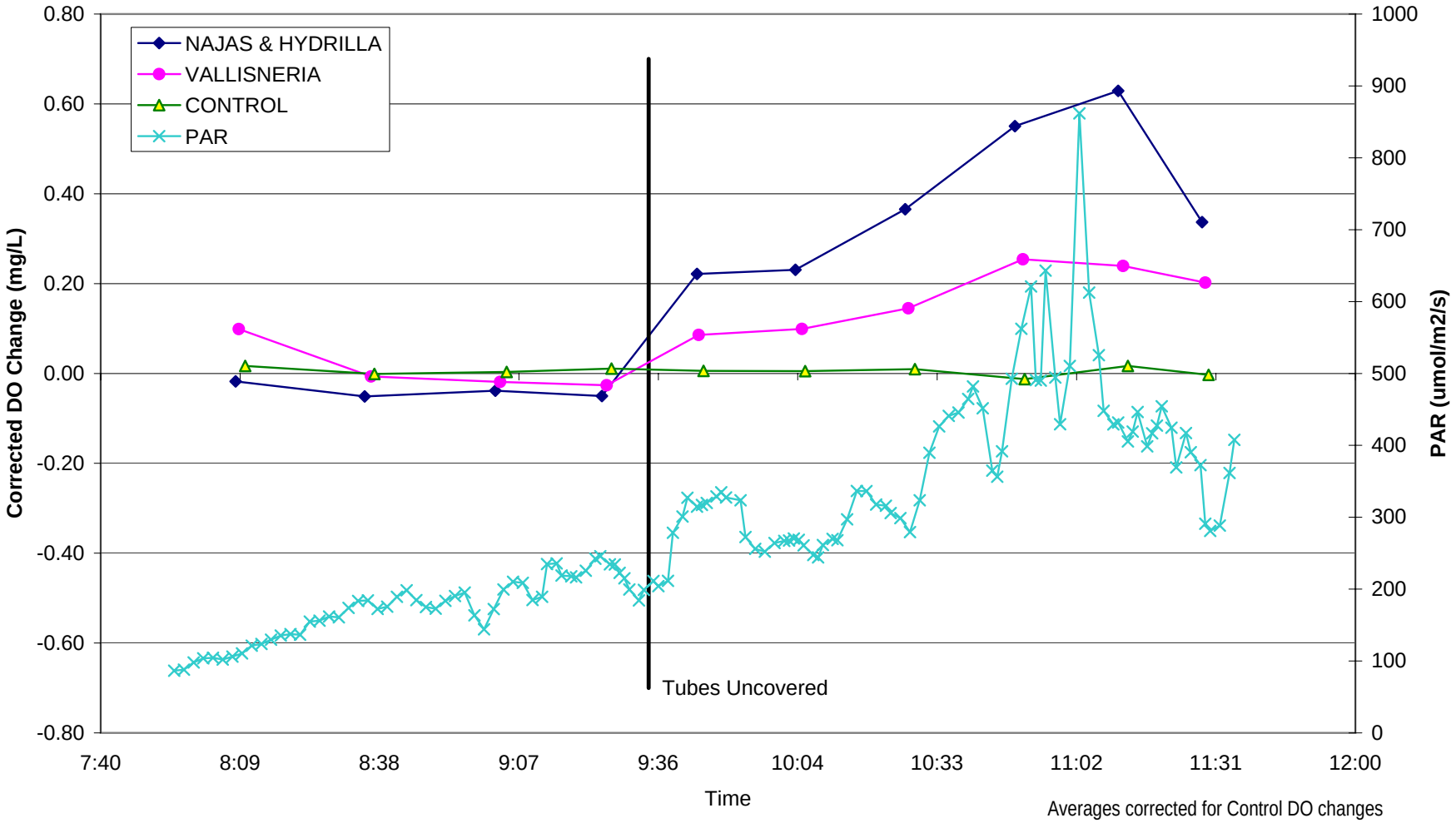
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05



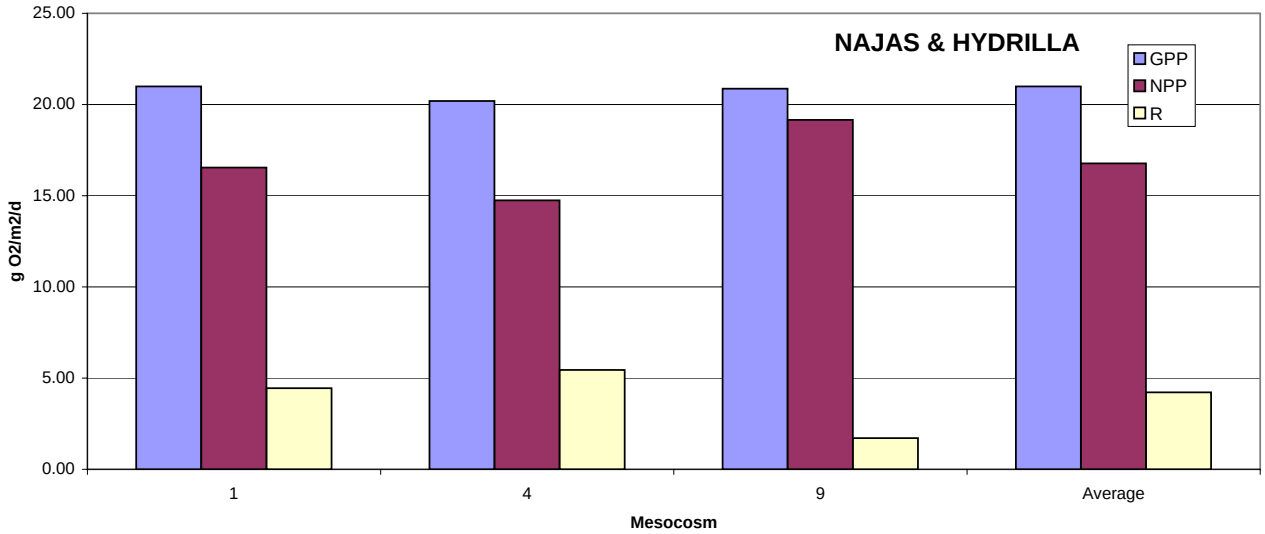


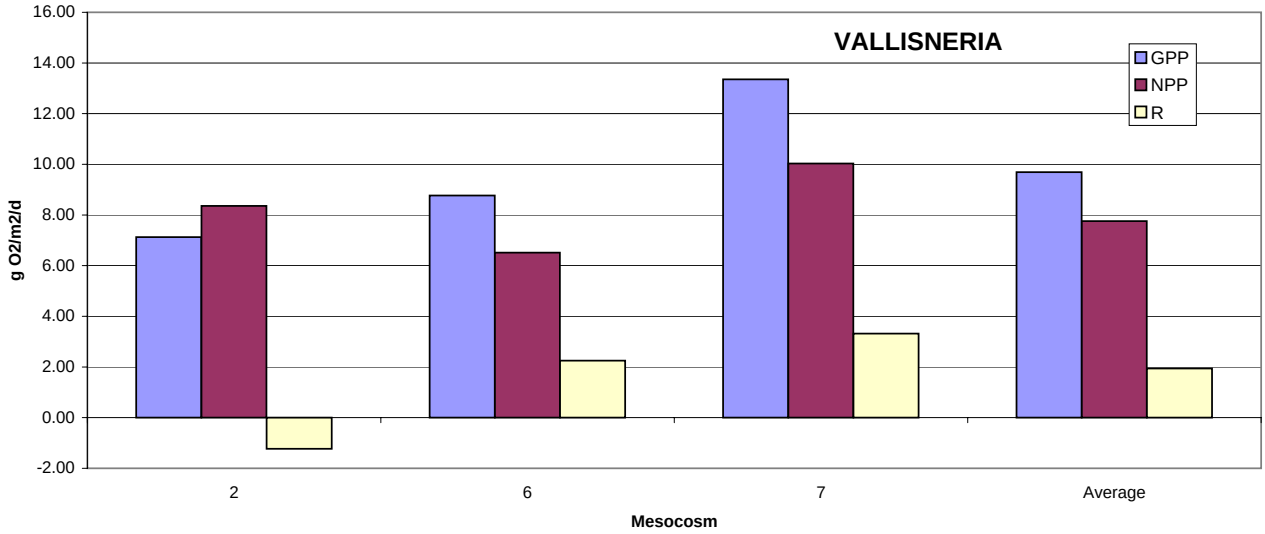




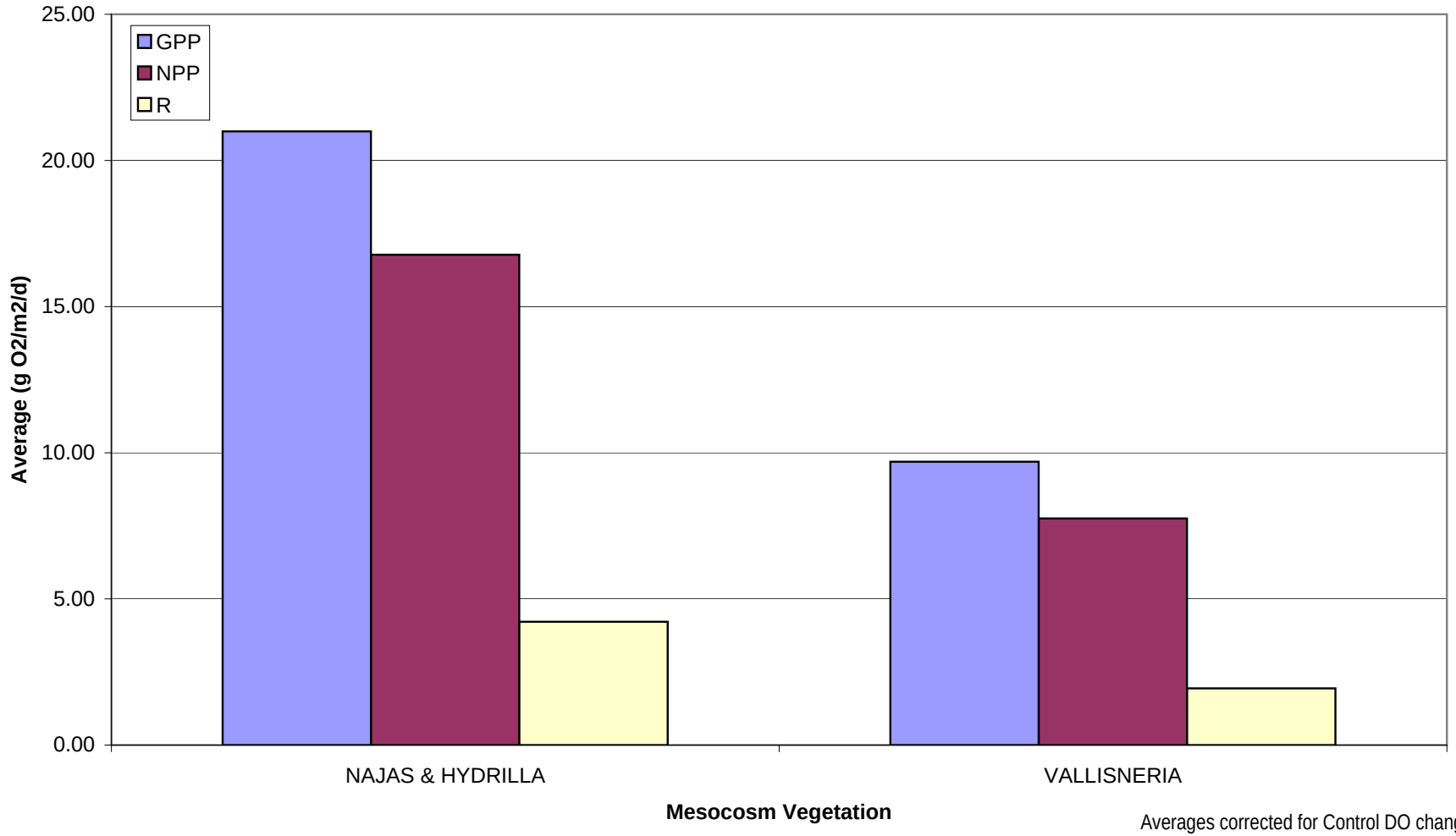
APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05





Averages corrected for Control DO changes



Averages corrected for Control DO changes

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 5/27/05

APPENDIX H-1

MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05

		NAJAS & FILAMENTOUS ALGAE				VALLISNERIA				CONTROL			
PARAMETER	UNITS	1	4	9	Average [a]	3	6	7	Average [a]	2	5	8	Average
UPSTREAM DO	mg/L	0.57	0.56	0.57	0.57	0.57	0.56	0.56	0.56	0.57	0.56	0.56	0.56
DOWNSTREAM DO		0.91	0.76	0.88	0.85	0.68	0.67	0.73	0.70	0.56	0.55	0.60	0.57
CHANGE DO		0.34	0.20	0.31	0.28	0.12	0.11	0.17	0.13	-0.02	0.00	0.03	0.00
TRAVEL TIME	minutes	1.09	0.82	0.81	0.91	1.18	0.77	0.92	0.96	0.12	0.15	0.14	0.14
VELOCITY	m/hr	100.5	133	136	121	93	143	119	115	895	735	812	809
GPP	g $O_2/m^2/d$	39.24	27.17	35.44	34.17	11.11	13.31	16.77	13.24	---	---	---	---
NPP		29.77	22.91	35.63	29.02	9.46	13.85	17.32	12.76	---	---	---	---
R		9.47	4.26	-0.19	5.16	1.65	-0.54	-0.56	0.48	---	---	---	---
Vegetation	kg DW/m^2	0.469	0.635	0.422	0.509	0.692	0.625	0.522	0.613	---	---	---	---
GPP	g O_2/kg DW/d	83.65	42.80	84.02	67.20	16.05	21.28	32.13	21.60	---	---	---	---
NPP		63.47	36.10	84.47	57.06	13.67	22.15	33.20	20.82	---	---	---	---
R24		20.18	6.71	-0.45	10.14	2.38	-0.87	-1.07	0.78	---	---	---	---
PAR	mol/hr	0.414	0.387	0.433	0.409	0.451	0.316	0.358	0.401	---	---	---	---
	$mol/m^2/d$	37.3	37.8	40.4	38.5	39.1	29.5	33.4	34.0	---	---	---	---
GPP	g O_2/mol	1.052	0.72	0.88	0.888	0.284	0.452	0.502	0.389	---	---	---	---
NPP		0.798	0.607	0.88	0.754	0.242	0.470	0.518	0.375	---	---	---	---
GPP	g O_2/kg DW/mol	2.243	1.13	2.08	1.75	0.410	0.722	0.96	0.635	---	---	---	---
NPP		1.702	0.96	2.09	1.483	0.349	0.752	0.99	0.612	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05

	MESOCOSM		UPSTREAM	DOWNSTREAM	DO CHANGE					PAR		TRAVEL	VELOCITY	GPP	NPP	R	Vegetation	GPP	NPP	R	PAR	GPP	NPP	GPP	NPP
PLANT	NUMBER	TIME	DO (mg/L)	DO (mg/L)	(mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	(umol/m^2/s)	(mol/hr)	TIME (min)	(m/hr)	(g O$_2$/m^2/d)			(kg DW/m^2)	(g O$_2$/kgDW/d)			(mol/m^2/d)	(g O$_2$/mol)		(g O$_2$/kgDW/mol)	
NAJAS &	1	10:03	0.52	0.74	0.22	---	0.22	0.10	1.04	195.20	0.098	1.09	100.5	39.24	29.77	9.47	0.469	83.65	63.47	20.18	37.30	1.05	0.80	2.24	1.70
FILAMENTOUS ALGAE		10:24	0.52	0.73	0.21	---	0.21	0.10	0.98	196.60	0.099														
		10:44	0.51	0.87	0.36	---	0.36	0.16	1.20	272.60	0.137														
		11:03	0.51	1.27	0.76	---	0.76	0.35	2.81	245.30	0.123														
		11:32	0.55	1.61	1.06	---	1.06	0.49	0.77	1255.60	0.630														
		11:53	0.61	1.80	1.20	---	1.20	0.55	0.87	1255.10	0.630														
		12:18	0.64	1.70	1.06	---	1.06	0.49	0.73	1337.40	0.671														
		12:36	0.66	1.68	1.02	---	1.02	0.47	0.69	1340.40	0.672														
		12:56	0.63	1.92	1.30	---	1.30	0.59	1.10	1074.20	0.539														
		13:09	0.63	0.62	-0.01	---	-0.01	0.00	-0.01	1076.70	0.540														
		13:24	0.62	0.51	-0.11	---	-0.11	-0.05	---	---	---														
		13:38	0.61	0.49	-0.12	---	-0.12	-0.06	---	---	---														
		13:53	0.62	0.47	-0.15	---	-0.15	-0.07	---	---	---														
		14:07	0.59	0.46	-0.13	---	-0.13	-0.06	---	---	---														
		14:21	0.57	0.42	-0.15	---	-0.15	-0.07	---	---	---														
		14:34	0.54	0.39	-0.15	---	-0.15	-0.07	---	---	---														
		14:48	0.51	0.37	-0.14	---	-0.14	-0.06	---	---	---														
		15:02	0.47	0.35	-0.12	---	-0.12	-0.06	---	---	---														
	4	10:11	0.52	0.65	0.13	---	0.13	0.08	0.96	165.39	0.083	0.82	133.0	27.17	22.91	4.26	0.635	42.80	36.10	6.71	37.75	0.72	0.61	1.13	0.96
		10:31	0.52	0.59	0.08	---	0.08	0.05	0.58	156.62	0.079														
		10:50	0.52	0.76	0.24	---	0.24	0.15	1.10	266.00	0.133														
		11:14	0.53	1.06	0.53	---	0.53	0.32	1.66	385.20	0.193														
		11:38	0.56	1.11	0.56	---	0.56	0.34	0.56	1198.80	0.601														
		12:02	0.59	1.03	0.44	---	0.44	0.27	0.41	1278.60	0.641														
		12:24	0.62	1.12	0.51	---	0.51	0.31	0.47	1308.00	0.656														
		12:44	0.61	1.38	0.77	---	0.77	0.47	0.83	1125.50	0.565														
		13:00	0.63	1.34	0.71	---	0.71	0.43	0.62	1375.80	0.690														
		13:14	0.62	0.63	0.01	---	0.01	0.00	0.02	448.50	0.225														
		13:28	0.60	0.55	-0.05	---	-0.05	-0.03	---	---	---														
		13:43	0.60	0.55	-0.05	---	-0.05	-0.03	---	---	---														
		13:57	0.60	0.55	-0.05	---	-0.05	-0.03	---	---	---														
		14:12	0.58	0.53	-0.05	---	-0.05	-0.03	---	---	---														
		14:25	0.55	0.51	-0.04	---	-0.04	-0.02	---	---	---														
		14:39	0.51	0.46	-0.05	---	-0.05	-0.03	---	---	---														
		14:52	0.50	0.44	-0.06	---	-0.06	-0.03	---	---	---														
		15:07	0.44	0.40	-0.04	---	-0.04	-0.02	---	---	---														
	9	10:23	0.52	0.70	0.19	---	0.19	0.11	1.28	178.01	0.089	0.81	135.9	35.44	35.63	-0.19	0.422	84.02	84.47	-0.45	40.35	0.88	0.88	2.08	2.09
		10:41	0.52	0.76	0.24	---	0.24	0.15	1.47	203.40	0.102														
		11:01	0.51	0.92	0.41	---	0.41	0.25	1.94	260.50	0.131														
		11:27	0.55	1.24	0.69	---	0.69	0.43	1.38	616.10	0.309														
		11:52	0.59	1.38	0.79	---	0.79	0.49	0.80	1221.70	0.613														
		12:14	0.62	1.41	0.79	---	0.79	0.49	0.75	1300.50	0.652														
		12:35	0.63	1.26	0.63	---	0.63	0.39	0.56	1378.80	0.692														
		12:53	0.63	1.49	0.87	---	0.87	0.54	0.85	1250.10	0.627														
		13:08	0.62	1.56	0.94	---	0.94	0.58	0.86	1351.30	0.678														
		13:21	0.64	0.74	0.10	---	0.10	0.06	---	---	---														
		13:37	0.62	0.62	0.01	---	0.01	0.00	---	---	---														
		13:51	0.63	0.61	-0.02	---	-0.02	-0.01	---	---	---														
		14:06	0.60	0.58	-0.02	---	-0.02	-0.01	---	---	---														
		14:19	0.56	0.57	0.01	---	0.01	0.01	---	---	---														
		14:33	0.55	0.55	0.00	---	0.00	0.00	---	---	---														
		14:46	0.51	0.48	-0.03	---	-0.03	-0.02	---	---	---														
		15:00	0.50	0.48	-0.02	---	-0.02	-0.01	---	---	---														
		15:15	0.43	0.41	-0.02	---	-0.02	-0.01	---	---	---														
	Average	10:12	0.52	0.70	0.18	-0.01	*0.19*	0.10	1.16	179.53	0.090	0.91	120.9	34.17	29.02	5.16	0.509	67.20	57.06	10.14	38.47	0.89	0.75	1.75	1.48
		10:32	0.52	0.69	0.18	0.01	0.17	0.09	0.98	185.54	0.093														
		10:51	0.51	0.85	0.34	0.01	0.33	0.18	1.35	266.37	0.134														
		11:14	0.53	1.19	0.66	0.00	0.65	0.36	1.73	415.53	0.208														
		11:40	0.56	1.37	0.80	0.02	0.79	0.43	0.70	1225.37	0.615														
		12:03	0.60	1.41	0.81	0.00	0.81	0.45	0.70	1278.07	0.641														
		12:25	0.63	1.36	0.73	0.01	0.72	0.40	0.59	1341.40	0.673														
		12:44	0.63	1.52	0.88	0.00	0.88	0.49	0.78	1238.67	0.621														
		13:01	0.63	1.61	0.98	0.02	0.96	0.53	0.83	1267.10	0.636														
		13:14	0.63	0.66	0.03	0.00	0.04	0.02	0.06	762.60	0.383														
		13:29	0.61	0.56	-0.05	0.01	-0.06	-0.04	---	---	---														
		13:44	0.61	0.55	-0.06	-0.01	-0.05	-0.03	---	---	---														
		13:58	0.61	0.53	-0.07	0.00	-0.07	-0.04	---	---	---														
		14:12	0.57	0.52	-0.05	0.02	-0.07	-0.04	---	---	---														
		14:26	0.56	0.49	-0.06	0.00	-0.07	-0.04	---	---	---														
		14:39	0.52	0.44	-0.08	0.00	-0.07	-0.04	---	---	---														
		14:53	0.50	0.43	-0.07	0.01	-0.08	-0.04	---	---	---														
		15:08	0.45	0.39	-0.06	0.00	-0.06	-0.03	---	---	---														

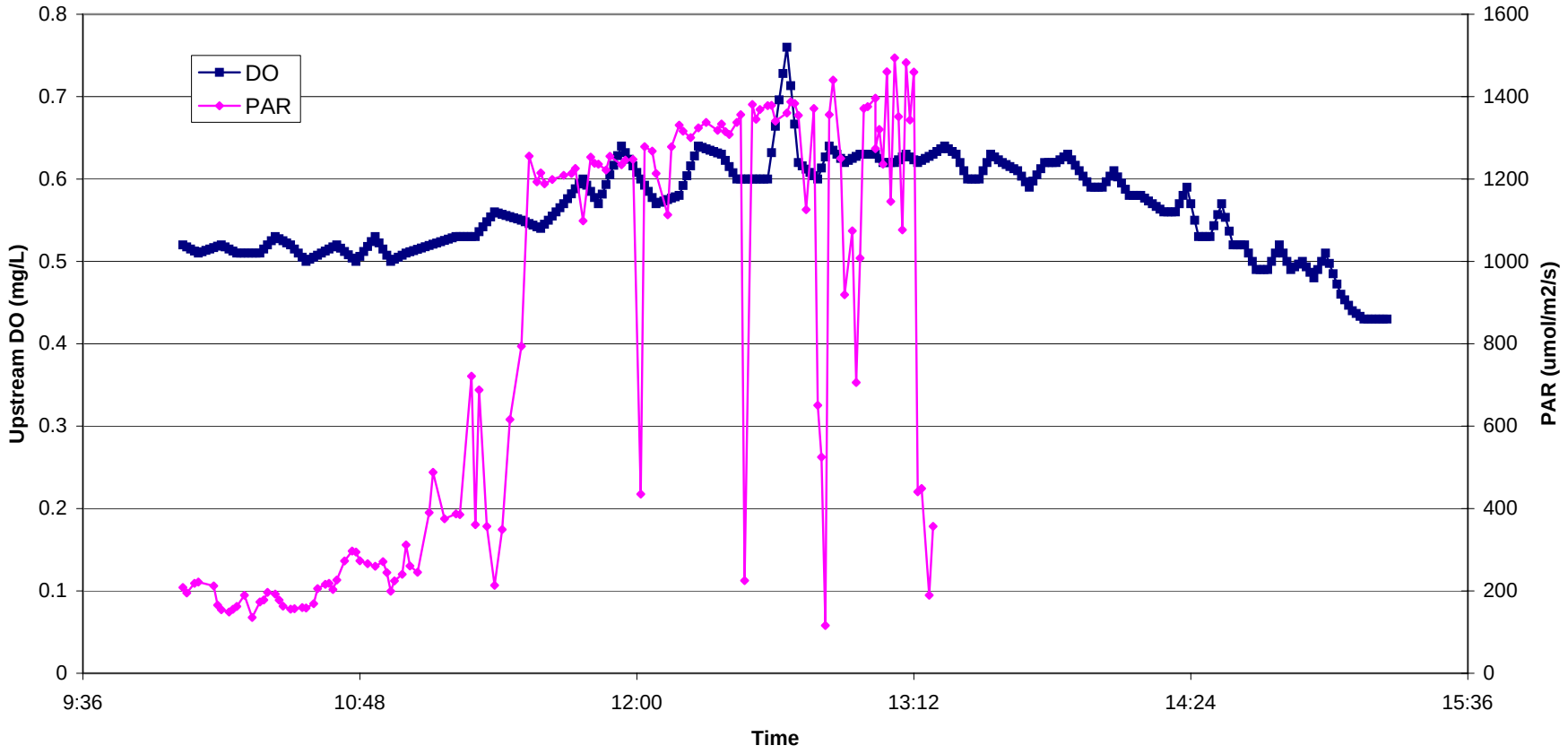
APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
VALLISNERIA	3	10:10	0.52	0.96	0.44	---	0.44	0.19	1.76	212.20	0.106	1.18	92.9	11.11	9.46	1.65	0.692	16.05	13.67	2.38	39.15	0.28	0.24	0.41	0.35
		10:28	0.53	0.69	0.17	---	0.17	0.07	0.86	162.90	0.082														
		10:48	0.51	0.70	0.19	---	0.19	0.08	0.60	272.90	0.137														
		11:10	0.53	0.73	0.20	---	0.20	0.09	0.46	375.00	0.188														
		11:36	0.55	0.82	0.28	---	0.28	0.12	0.20	1188.40	0.596														
		11:59	0.62	0.87	0.25	---	0.25	0.11	0.17	1247.70	0.626														
		12:23	0.62	0.84	0.22	---	0.22	0.09	0.14	1315.00	0.660														
		12:41	0.67	0.94	0.27	---	0.27	0.12	0.17	1383.20	0.694														
		12:59	0.63	0.93	0.30	---	0.30	0.13	0.18	1371.30	0.688														
		13:12	0.62	0.68	0.06	---	0.06	0.02	0.03	1459.50	0.732														
		13:27	0.60	0.62	0.02	---	0.02	0.01	---	---	---														
		13:41	0.60	0.57	-0.03	---	-0.03	-0.01	---	---	---														
		13:56	0.60	0.56	-0.04	---	-0.04	-0.02	---	---	---														
		14:10	0.58	0.54	-0.04	---	-0.04	-0.02	---	---	---														
		14:24	0.57	0.53	-0.04	---	-0.04	-0.02	---	---	---														
		14:37	0.52	0.48	-0.04	---	-0.04	-0.02	---	---	---														
		14:51	0.49	0.44	-0.05	---	-0.05	-0.02	---	---	---														
		15:05	0.45	0.41	-0.04	---	-0.04	-0.02	---	---	---														
	6	10:15	0.51	0.81	0.30	---	0.30	0.19	2.49	155.37	0.078	0.77	143.3	13.31	13.85	-0.54	0.625	21.28	22.15	-0.87	29.46	0.45	0.47	0.72	0.75
		10:36	0.51	0.68	0.18	---	0.18	0.11	1.35	168.78	0.085														
		10:55	0.51	0.66	0.15	---	0.15	0.10	0.81	244.60	0.123														
		11:19	0.54	0.75	0.21	---	0.21	0.14	0.41	687.90	0.345														
		11:44	0.59	0.81	0.22	---	0.22	0.15	0.24	1225.70	0.615														
		12:08	0.58	0.83	0.26	---	0.26	0.17	0.30	1113.10	0.558														
		12:28	0.60	0.75	0.15	---	0.15	0.10	0.87	224.90	0.113														
		12:48	0.61	0.87	0.26	---	0.26	0.17	0.64	524.90	0.263														
		13:03	0.63	0.91	0.29	---	0.29	0.19	0.28	1320.40	0.662														
		13:18	0.63	0.73	0.10	---	0.10	0.06	---	---	---														
		13:31	0.62	0.64	0.02	---	0.02	0.01	---	---	---														
		13:47	0.62	0.63	0.01	---	0.01	0.01	---	---	---														
		14:00	0.59	0.59	0.00	---	0.00	0.00	---	---	---														
		14:15	0.57	0.55	-0.02	---	-0.02	-0.01	---	---	---														
		14:28	0.53	0.51	-0.02	---	-0.02	-0.01	---	---	---														
		14:42	0.49	0.47	-0.02	---	-0.02	-0.01	---	---	---														
		14:55	0.49	0.47	-0.02	---	-0.02	-0.01	---	---	---														
		15:10	0.43	0.42	-0.01	---	-0.01	-0.01	---	---	---														
	7	10:18	0.51	1.01	0.50	---	0.50	0.27	2.87	189.37	0.095	0.92	119.4	16.77	17.32	-0.56	0.522	32.13	33.20	-1.07	33.43	0.50	0.52	0.96	0.99
		10:37	0.51	0.76	0.25	---	0.25	0.14	1.33	205.60	0.103														
		10:57	0.50	0.71	0.21	---	0.21	0.11	1.00	224.20	0.112														
		11:21	0.55	0.87	0.32	---	0.32	0.18	0.98	356.60	0.179														
		11:48	0.59	0.93	0.35	---	0.35	0.19	0.30	1253.10	0.629														
		12:09	0.58	0.91	0.33	---	0.33	0.18	0.28	1278.10	0.641														
		12:31	0.60	0.91	0.31	---	0.31	0.17	0.25	1344.90	0.675														
		12:49	0.63	0.97	0.34	---	0.34	0.19	3.21	116.10	0.058														
		13:05	0.62	1.03	0.41	---	0.41	0.22	0.30	1460.50	0.733														
		13:19	0.64	0.79	0.15	---	0.15	0.08	---	---	---														
		13:33	0.63	0.66	0.03	---	0.03	0.02	---	---	---														
		13:48	0.62	0.64	0.02	---	0.02	0.01	---	---	---														
		14:02	0.60	0.59	-0.01	---	-0.01	0.00	---	---	---														
		14:16	0.56	0.54	-0.02	---	-0.02	-0.01	---	---	---														
		14:30	0.54	0.50	-0.04	---	-0.04	-0.02	---	---	---														
		14:43	0.49	0.47	-0.02	---	-0.02	-0.01	---	---	---														
		14:57	0.49	0.46	-0.03	---	-0.03	-0.02	---	---	---														
		15:11	0.43	0.40	-0.03	---	-0.03	-0.02	---	---	---														
	Average	10:14	0.51	0.93	0.41	-0.01	0.42	0.22	2.38	185.65	0.093	0.96	114.9	13.24	12.76	0.48	0.613	21.60	20.82	0.78	34.01	0.39	0.38	0.63	0.61
		10:33	0.51	0.71	0.20	0.01	0.19	0.10	1.09	179.09	0.090														
		10:53	0.51	0.69	0.18	0.01	0.18	0.09	0.75	247.23	0.124														
		11:16	0.54	0.78	0.25	0.00	0.24	0.13	0.54	473.17	0.237														
		11:42	0.57	0.85	0.28	0.02	0.26	0.14	0.23	1222.40	0.613														
		12:05	0.59	0.87	0.28	0.00	0.28	0.15	0.24	1212.97	0.609														
		12:27	0.61	0.83	0.23	0.01	0.21	0.11	0.23	961.60	0.482														
		12:46	0.64	0.93	0.29	0.00	0.29	0.15	0.45	674.73	0.338														
		13:02	0.63	0.96	0.33	0.02	0.31	0.16	0.23	1384.07	0.694														
		13:16	0.63	0.73	0.10	0.00	0.11	0.06	0.08	1459.50	0.732														
		13:30	0.62	0.64	0.02	0.01	0.01	0.01	---	---	---														
		13:45	0.61	0.61	0.00	-0.01	0.01	0.01	---	---	---														
		13:59	0.60	0.58	-0.02	0.00	-0.01	-0.01	---	---	---														
		14:13	0.57	0.54	-0.03	0.02	-0.04	-0.02	---	---	---														
		14:27	0.55	0.51	-0.03	0.00	-0.04	-0.02	---	---	---														
		14:40	0.50	0.47	-0.03	0.00	-0.02	-0.01	---	---	---														
		14:54	0.49	0.46	-0.03	0.01	-0.04	-0.02	---	---	---														
		15:08	0.44	0.41	-0.03	0.00	-0.03	-0.01	---	---	---														

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05

	MESOCOSM		UPSTREAM	DOWNSTREAM	DO CHANGE					PAR		TRAVEL	VELOCITY	GPP	NPP	R	Vegetation	GPP	NPP	R	PAR	GPP	NPP	GPP	NPP
PLANT	NUMBER	TIME	DO (mg/L)	DO (mg/L)	(mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	(umol/m^2/s)	(mol/hr)	TIME (min)	(m/hr)	(g O_2/m^2/d)			(kg DW/m^2)	(g O_2/kgDW/d)			(mol/m^2/d)	(g O_2/mol)		(g O_2/kgDW/mol)	
CONTROL	2	10:05	0.51	0.50	-0.01	---	-0.01	-0.05	-0.47	218.50	0.110	0.12	895.3	---	---	---	---	---	---	---	---	---	---	---	---
		10:27	0.53	0.51	-0.02	---	-0.02	-0.07	-0.80	177.51	0.089														
		10:46	0.50	0.51	0.01	---	0.01	0.02	0.16	296.60	0.149														
		11:07	0.52	0.51	-0.01	---	-0.01	-0.04	-0.18	488.10	0.245														
		11:34	0.54	0.55	0.01	---	0.01	0.03	0.05	1193.30	0.599														
		11:57	0.63	0.58	-0.05	---	-0.05	-0.21	-0.34	1245.70	0.625														
		12:21	0.63	0.64	0.01	---	0.01	0.03	0.05	1318.40	0.661														
		12:40	0.71	0.70	-0.01	---	-0.01	-0.05	-0.08	1387.70	0.696														
		12:57	0.63	0.63	0.00	---	0.00	0.01	0.03	705.80	0.354														
		13:11	0.63	0.58	-0.05	---	-0.05	-0.19	-0.28	1343.40	0.674														
		13:25	0.61	0.63	0.02	---	0.02	0.08	---	---	---														
		13:40	0.60	0.56	-0.04	---	-0.04	-0.18	---	---	---														
		13:54	0.62	0.56	-0.06	---	-0.06	-0.23	---	---	---														
		14:09	0.58	0.57	-0.01	---	-0.01	-0.04	---	---	---														
		14:22	0.58	0.55	-0.03	---	-0.03	-0.12	---	---	---														
		14:36	0.52	0.51	-0.01	---	-0.01	-0.04	---	---	---														
		14:49	0.50	0.50	0.00	---	0.00	0.00	---	---	---														
		15:04	0.45	0.44	-0.01	---	-0.01	-0.05	---	---	---														
	5	10:14	0.52	0.48	-0.04	---	-0.04	-0.12	-1.57	148.59	0.075	0.15	734.8	---	---	---	---	---	---	---	---	---	---	---	---
		10:33	0.51	0.51	0.01	---	0.01	0.02	0.21	159.51	0.080														
		10:54	0.52	0.51	-0.01	---	-0.01	-0.02	-0.12	270.90	0.136														
		11:17	0.53	0.53	0.00	---	0.00	0.00	0.00	721.30	0.362														
		11:43	0.58	0.58	0.00	---	0.00	-0.01	-0.01	1213.30	0.609														
		12:04	0.58	0.61	0.03	---	0.03	0.11	0.17	1267.60	0.636														
		12:27	0.60	0.57	-0.03	---	-0.03	-0.10	-0.15	1356.30	0.680														
		12:46	0.60	0.60	0.00	---	0.00	-0.01	-0.02	1371.30	0.688														
		13:02	0.63	0.60	-0.03	---	-0.03	-0.10	-0.14	1396.20	0.700														
		13:16	0.63	0.64	0.01	---	0.01	0.04	0.44	189.52	0.095														
		13:30	0.61	0.60	-0.01	---	-0.01	-0.03	---	---	---														
		13:45	0.61	0.59	-0.02	---	-0.02	-0.08	---	---	---														
		13:59	0.59	0.61	0.02	---	0.02	0.07	---	---	---														
		14:13	0.57	0.58	0.01	---	0.01	0.02	---	---	---														
		14:27	0.53	0.53	0.00	---	0.00	0.00	---	---	---														
		14:40	0.50	0.49	-0.01	---	-0.01	-0.03	---	---	---														
		14:54	0.49	0.49	0.00	---	0.00	-0.01	---	---	---														
		15:08	0.43	0.43	0.00	---	0.00	-0.01	---	---	---														
	8	10:20	0.51	0.53	0.02	---	0.02	0.07	1.09	135.53	0.068	0.14	812.5	---	---	---	---	---	---	---	---	---	---	---	---
		10:40	0.52	0.56	0.05	---	0.05	0.17	1.52	218.20	0.109														
		10:59	0.51	0.53	0.02	---	0.02	0.08	0.69	240.30	0.121														
		11:25	0.56	0.58	0.02	---	0.02	0.08	0.48	349.00	0.175														
		11:49	0.58	0.62	0.04	---	0.04	0.16	0.25	1238.20	0.621														
		12:12	0.59	0.61	0.02	---	0.02	0.07	0.10	1316.00	0.660														
		12:32	0.60	0.66	0.06	---	0.06	0.22	0.32	1368.80	0.687														
		12:51	0.64	0.65	0.02	---	0.02	0.06	0.08	1440.10	0.722														
		13:06	0.62	0.71	0.09	---	0.09	0.33	0.58	1145.60	0.575														
		13:21	0.64	0.66	0.02	---	0.02	0.09	---	---	---														
		13:34	0.62	0.65	0.03	---	0.03	0.10	---	---	---														
		13:50	0.62	0.65	0.03	---	0.03	0.10	---	---	---														
		14:03	0.60	0.63	0.03	---	0.03	0.10	---	---	---														
		14:18	0.56	0.61	0.05	---	0.05	0.19	---	---	---														
		14:31	0.56	0.59	0.03	---	0.03	0.12	---	---	---														
		14:45	0.50	0.51	0.01	---	0.01	0.04	---	---	---														
		14:58	0.50	0.52	0.02	---	0.02	0.07	---	---	---														
		15:14	0.43	0.45	0.02	---	0.02	0.07	---	---	---														
	Average	10:13	0.51	0.50	-0.01	---	*-0.01*	-0.03	-0.40	167.54	0.084	0.14	808.9	---	---	---	---	---	---	---	---	---	---	---	---
		10:33	0.52	0.53	0.01	---	*0.01*	0.04	0.43	185.07	0.093														
		10:53	0.51	0.52	0.01	---	*0.01*	0.03	0.21	269.27	0.135														
		11:16	0.54	0.54	0.00	---	*0.00*	0.01	0.06	519.47	0.261														
		11:42	0.57	0.58	0.02	---	*0.02*	0.06	0.10	1214.93	0.610														
		12:04	0.60	0.60	0.00	---	*0.00*	0.00	0.00	1276.43	0.640														
		12:26	0.61	0.62	0.01	---	*0.01*	0.05	0.07	1347.83	0.676														
		12:45	0.65	0.65	0.00	---	*0.00*	0.00	0.00	1399.70	0.702														
		13:01	0.63	0.65	0.02	---	*0.02*	0.08	0.14	1082.53	0.543														
		13:16	0.63	0.63	0.00	---	*0.00*	-0.01	-0.03	766.46	0.385														
		13:29	0.61	0.63	0.01	---	*0.01*	0.05	---	---	---														
		13:45	0.61	0.60	-0.01	---	*-0.01*	-0.05	---	---	---														
		13:58	0.60	0.60	0.00	---	*0.00*	-0.01	---	---	---														
		14:13	0.57	0.59	0.02	---	*0.02*	0.06	---	---	---														
		14:26	0.56	0.56	0.00	---	*0.00*	0.00	---	---	---														
		14:40	0.51	0.50	0.00	---	*0.00*	-0.01	---	---	---														
		14:53	0.50	0.50	0.01	---	*0.01*	0.02	---	---	---														
		15:08	0.44	0.44	0.00	---	*0.00*	0.00	---	---	---														

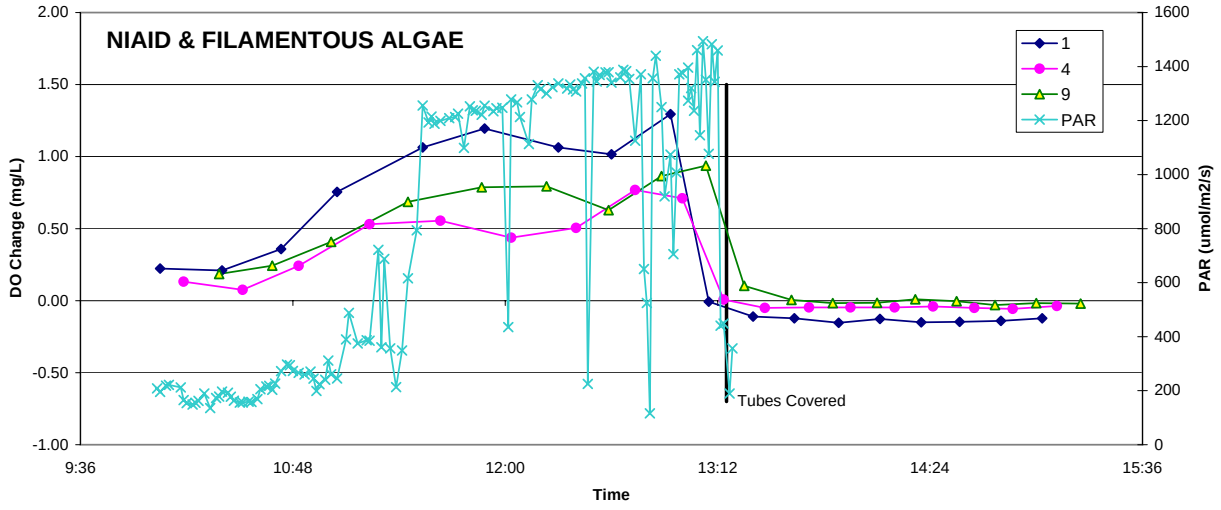
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

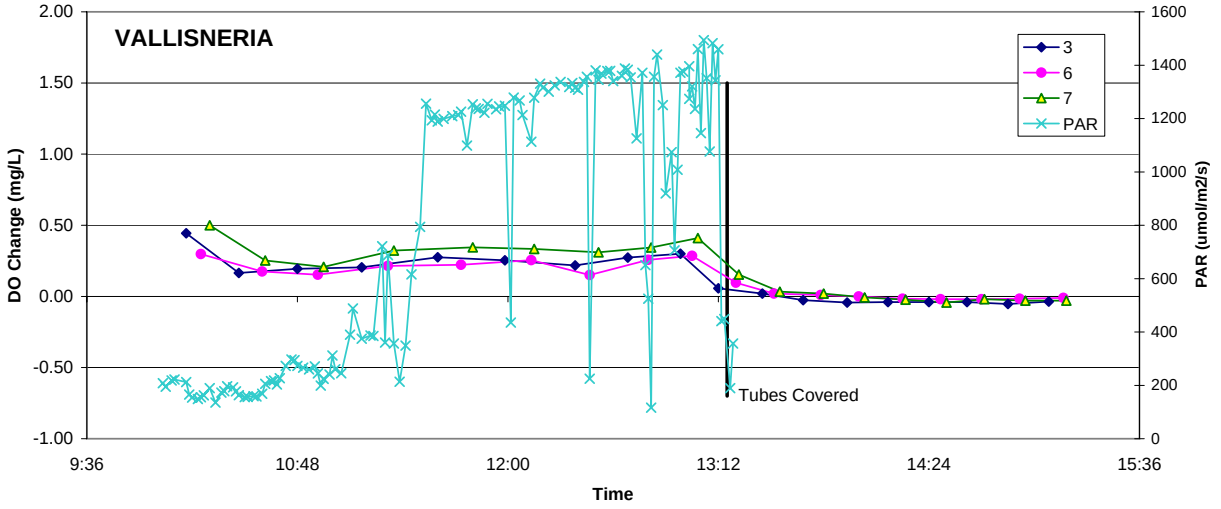


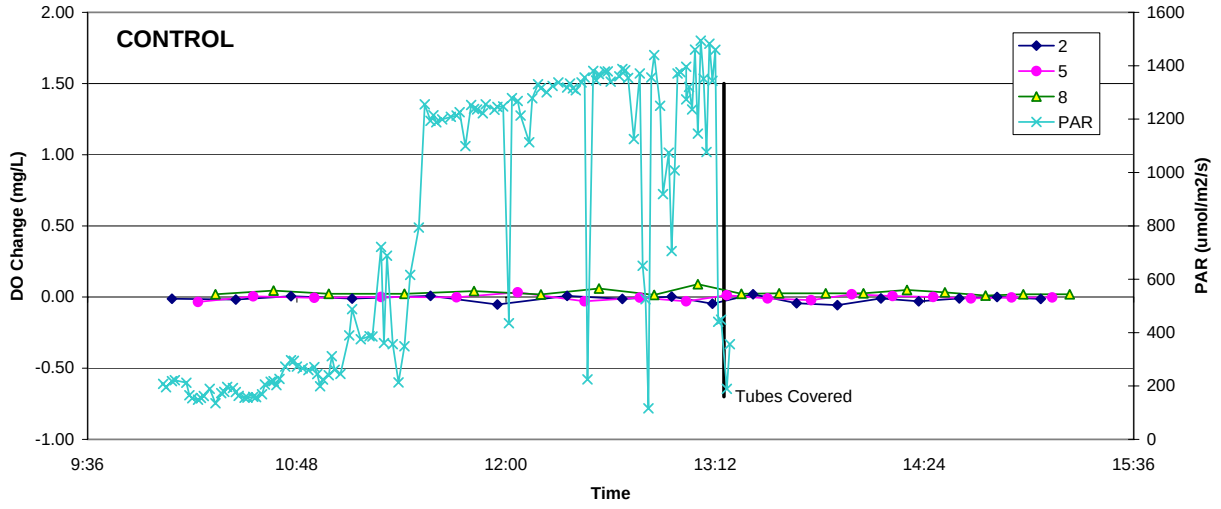
APPENDIX H-1

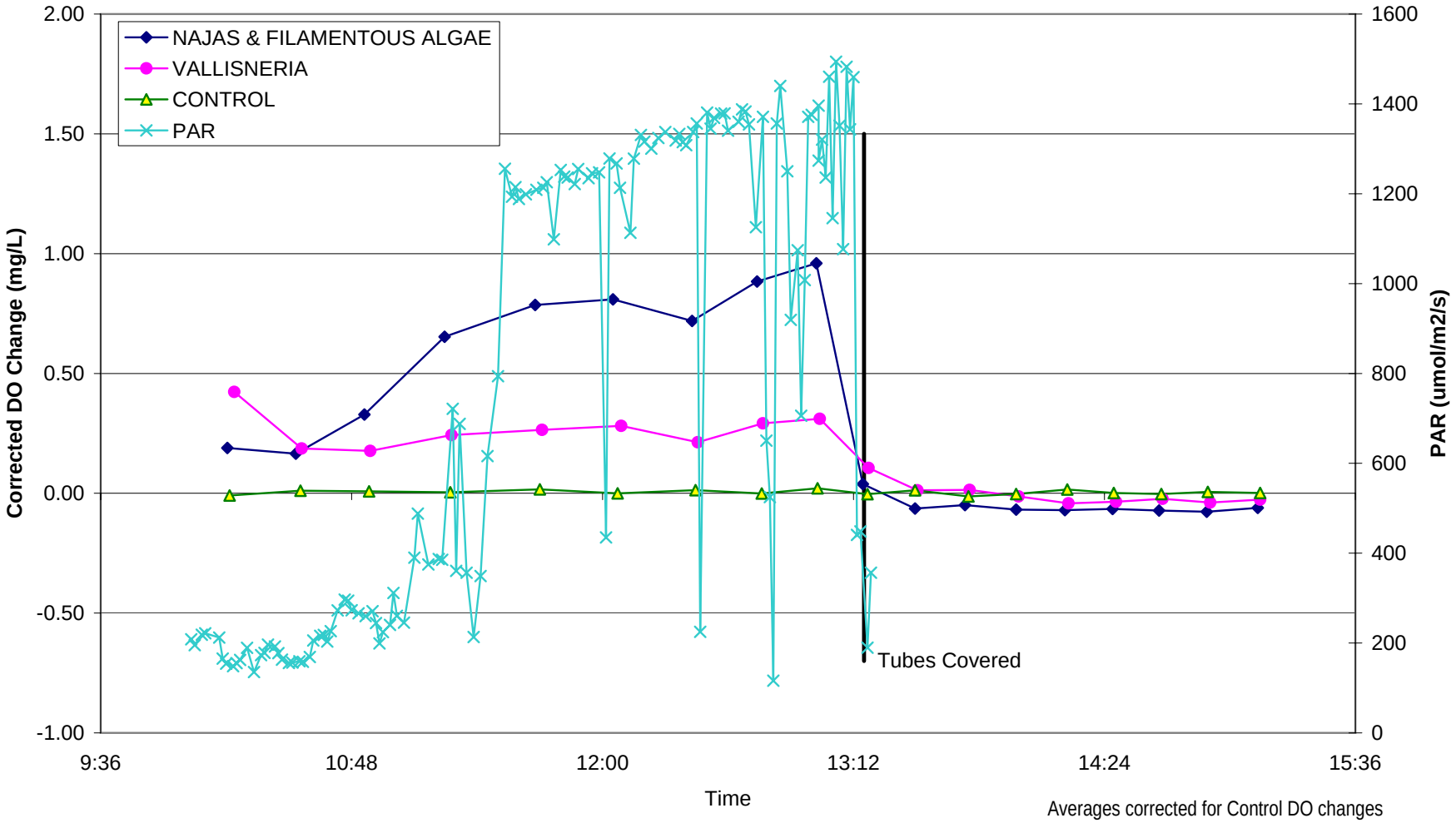
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05



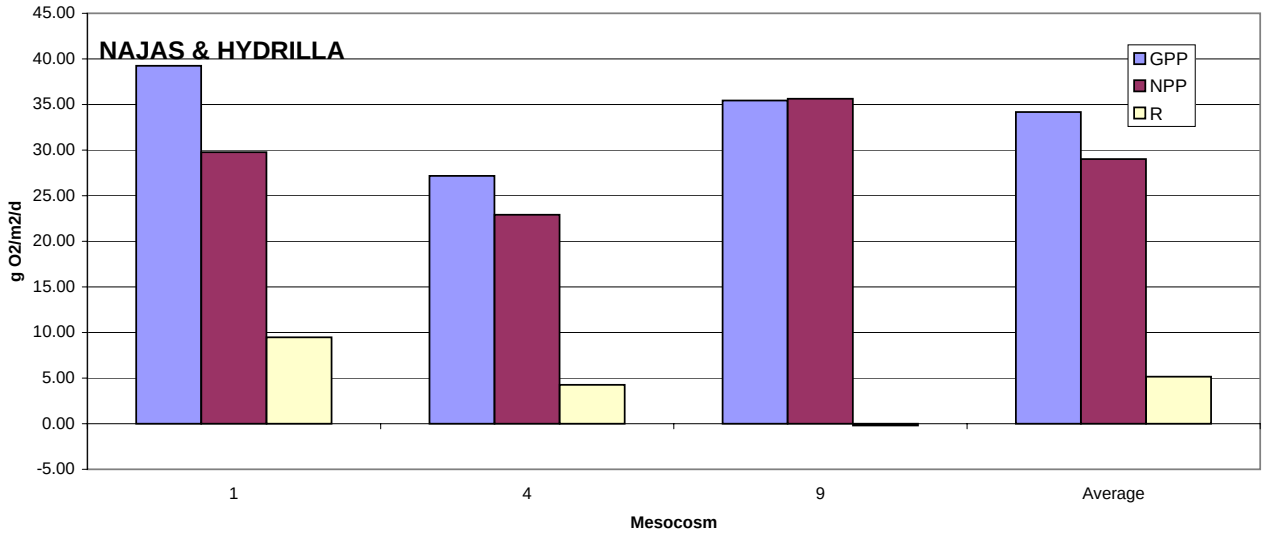


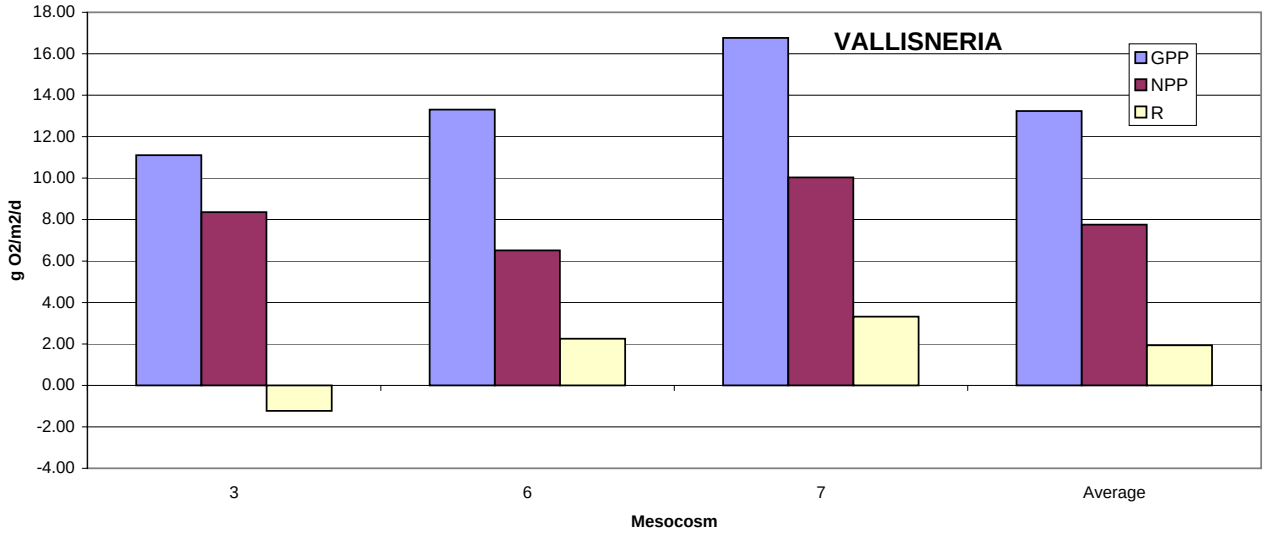




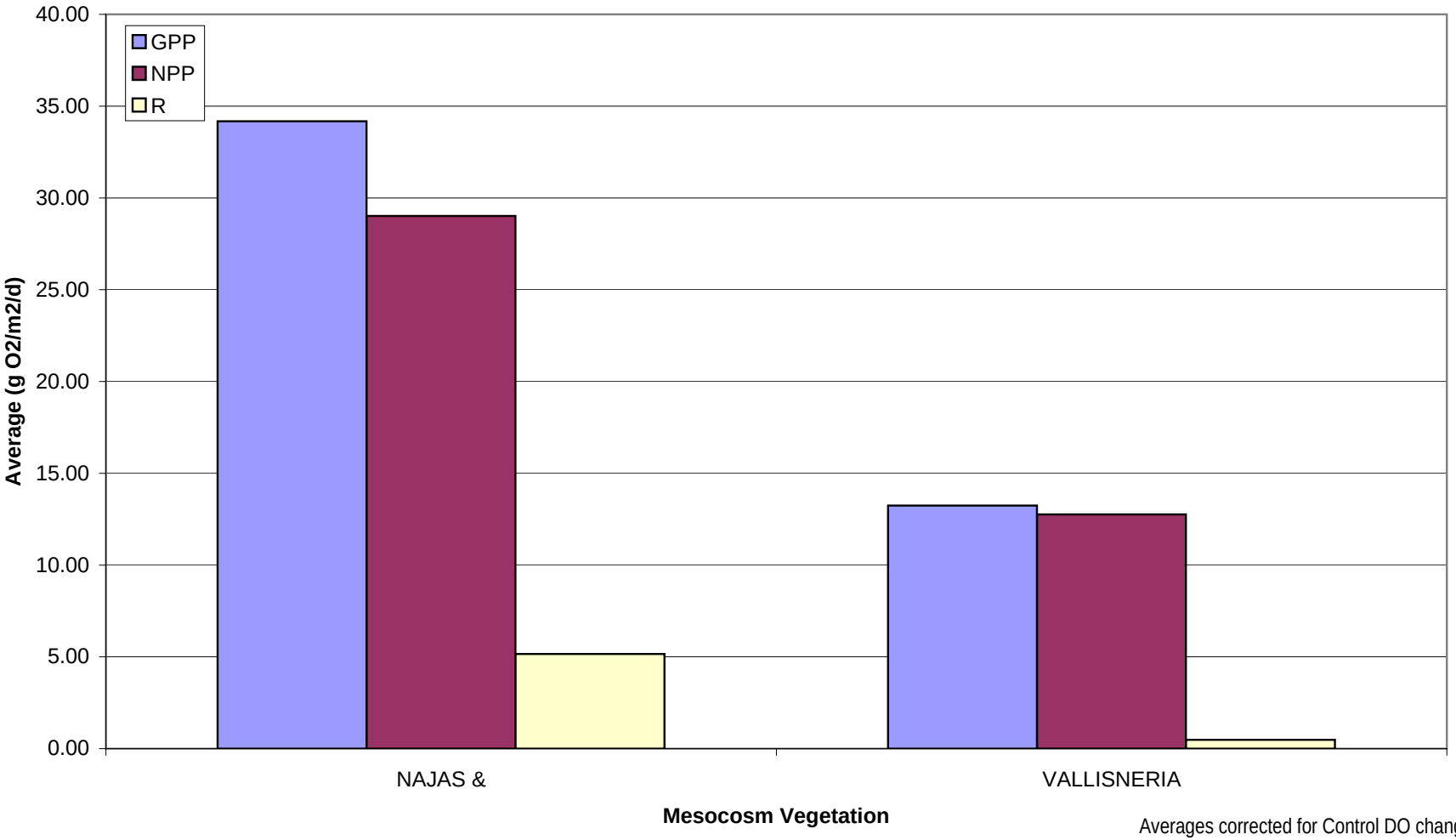
APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05





Averages corrected for Control DO changes



Averages corrected for Control DO changes

APPENDIX H-1
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 1 - 8/31/05

APPENDIX H-2

MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2

		5/26/2005		9/1/2005	
PARAMETER	UNITS	VALLISNERIA	NITELLA	VALLISNERIA	FILAMENTOUS ALGAE
UPSTREAM DO	mg/L	7.06	7.14	6.84	6.88
DOWNSTREAM DO		7.12	7.25	6.80	6.91
CHANGE DO		0.07	0.12	-0.04	0.03
TRAVEL TIME	minutes	0.90	0.82	3.96	5.57
VELOCITY	m/hr	122	134	28	20
GPP	g $O_2/m^2/d$	14.59	20.04	4.71	3.84
NPP		5.02	10.79	-0.30	1.07
R		9.57	9.26	5.02	2.77
Vegetation	kg DW/m^2	0.728	0.160	0.678	3.560
GPP	g O_2/kg DW/d	20.05	125.11	6.95	1.08
NPP		6.90	67.33	-0.45	0.30
R24		13.15	57.78	7.40	0.78
PAR	mol/hr	0.12	0.11	0.12	0.11
	$mol/m^2/d$	34.1	35.5	15.4	13.3
GPP	g O_2/mol	0.43	0.564	0.31	0.288
NPP		0.147	0.304	-0.020	0.080
GPP	g O_2/kg DW/mol	0.59	3.52	0.45	0.08
NPP		0.20	1.896	-0.03	0.023

APPENDIX H-2

MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05

		VALLISNERIA				NITELLA				CONTROL			
PARAMETER	UNITS	1	3	7	Average [a]	4	8	9	Average [a]	2	5	6	Average
UPSTREAM DO	mg/L	7.00	7.04	7.14	7.06	7.06	7.16	7.19	7.14	7.02	7.08	7.10	7.07
DOWNSTREAM DO		7.07	7.06	7.22	7.12	7.13	7.26	7.35	7.25	6.99	7.07	7.10	7.06
CHANGE DO		0.07	0.03	0.08	0.07	0.08	0.10	0.16	0.12	-0.03	-0.01	0.00	-0.01
TRAVEL TIME	minutes	0.87	0.93	0.91	0.90	0.71	0.79	0.96	0.82	0.17	0.19	0.17	0.18
VELOCITY	m/hr	126.5	119	120	122	154	138	114	134	648	582	629	618
GPP	g $O_2/m^2/d$	17.09	11.88	12.90	14.59	15.11	20.49	21.38	20.04	---	---	---	---
NPP24		4.63	1.10	6.60	5.02	7.68	8.72	12.16	10.79	---	---	---	---
R24		12.46	10.79	6.29	9.57	7.42	11.76	9.22	9.26	---	---	---	---
Vegetation	kg DW/m^2	0.723	0.742	0.717	0.728	0.145	0.144	0.192	0.160	---	---	---	---
GPP	g O_2/kg DW/d	23.63	16.01	17.98	20.05	104.3	142.2	111.5	125.1	---	---	---	---
NPP24		6.40	1.48	9.21	6.90	53.0	60.6	63.4	67.3	---	---	---	---
R24		17.22	14.53	8.77	13.15	51.23	81.67	48.08	57.78	---	---	---	---
PAR	mol/hr	0.129	0.110	0.115	0.118	0.111	0.104	0.109	0.108	---	---	---	---
	$mol/m^2/d$	31.1	31.6	39.7	34.1	34.5	38.3	33.8	35.5	---	---	---	---
GPP	g O_2/mol	0.550	0.376	0.325	0.428	0.438	0.535	0.633	0.564	---	---	---	---
NPP		0.149	0.035	0.166	0.147	0.223	0.228	0.360	0.304	---	---	---	---
GPP	g O_2/kg DW/mol	0.760	0.506	0.453	0.588	3.02	3.72	3.30	3.52	---	---	---	---
NPP		0.206	0.047	0.232	0.202	1.54	1.58	1.88	1.90	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g $O_2/m^2/d$)	NPP	R	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
VALLISNERIA	1	11:20	5.90	6.00	0.10	---	0.10	0.06	0.43	260.0	0.13	0.87	126.5	17.09	4.63	12.46	0.723	23.63	6.40	17.22	31.08	0.55	0.15	0.76	0.21
		11:46	5.96	6.24	0.28	---	0.28	0.16	0.92	348.8	0.17														
		12:14	6.29	6.47	0.18	---	0.18	0.10	0.38	545.2	0.27														
		12:40	6.62	6.82	0.20	---	0.20	0.12	0.47	502.0	0.25														
		13:08	6.91	7.06	0.15	---	0.15	0.09	0.21	845.9	0.42														
		13:34	7.28	7.52	0.24	---	0.24	0.14	0.18	1483.0	0.74														
		14:02	7.58	7.39	-0.19	---	-0.19	-0.11	---	0.00	0.00														
		14:28	7.74	7.61	-0.13	---	-0.13	-0.07	---	0.00	0.00														
		14:56	7.71	7.65	-0.06	---	-0.06	-0.03	---	0.00	0.00														
		15:22	8.02	7.89	-0.13	---	-0.13	-0.07	---	0.00	0.00														
	3	11:26	5.91	6.01	0.10	---	0.10	0.06	0.37	303.7	0.15	0.93	118.6	11.88	1.10	10.79	0.742	16.01	1.48	14.53	31.60	0.38	0.03	0.51	0.05
		11:52	5.98	6.09	0.11	---	0.11	0.06	0.32	385.1	0.19														
		12:20	6.35	6.47	0.12	---	0.12	0.06	0.20	632.6	0.32														
		12:46	6.71	6.83	0.12	---	0.12	0.06	0.29	439.6	0.22														
		13:14	6.95	7.09	0.14	---	0.14	0.08	0.18	860.3	0.43														
		13:40	7.38	7.50	0.12	---	0.12	0.07	0.09	1430.6	0.72														
		14:08	7.57	7.46	-0.11	---	-0.11	-0.06	---	0.00	0.00														
		14:34	7.75	7.63	-0.12	---	-0.12	-0.06	---	0.00	0.00														
		15:02	7.83	7.69	-0.14	---	-0.14	-0.08	---	0.00	0.00														
		15:28	7.97	7.87	-0.10	---	-0.10	-0.05	---	0.00	0.00														
	7	11:38	5.93	6.08	0.15	---	0.15	0.08	0.68	236.6	0.12	0.91	120.2	12.90	6.60	6.29	0.717	17.98	9.21	8.77	39.68	0.33	0.17	0.45	0.23
		12:04	6.14	6.28	0.14	---	0.14	0.08	0.31	498.0	0.25														
		12:32	6.50	6.63	0.13	---	0.13	0.07	0.28	515.4	0.26														
		12:58	6.79	6.97	0.18	---	0.18	0.10	0.28	701.8	0.35														
		13:26	7.09	7.33	0.24	---	0.24	0.13	0.16	1627.5	0.82														
		13:52	7.39	7.67	0.28	---	0.28	0.15	0.20	1507.4	0.76														
		14:20	7.71	7.63	-0.08	---	-0.08	-0.04	---	0.00	0.00														
		14:46	7.84	7.83	0.00	---	0.00	0.00	---	0.00	0.00														
		15:14	8.00	7.87	-0.13	---	-0.13	-0.07	---	0.00	0.00														
		15:40	7.97	7.91	-0.06	---	-0.06	-0.03	---	0.00	0.00														
	Average	11:28	5.91	6.03	0.12	-0.01	0.13	0.07	0.54	266.8	0.13	0.90	121.6	14.59	5.02	9.57	0.728	20.05	6.90	13.15	34.12	0.43	0.15	0.59	0.20
		11:54	6.03	6.20	0.18	-0.01	0.19	0.10	0.51	410.6	0.21														
		12:22	6.38	6.52	0.14	0.01	0.13	0.07	0.26	564.4	0.28														
		12:48	6.71	6.87	0.17	-0.03	0.20	0.11	0.39	547.8	0.27														
		13:16	6.98	7.16	0.18	-0.03	0.20	0.11	0.20	1111.2	0.56														
		13:42	7.35	7.56	0.21	-0.03	0.24	0.13	0.18	1473.7	0.74														
		14:10	7.62	7.49	-0.12	-0.01	-0.12	-0.07	---	0.00	0.00														
		14:36	7.77	7.69	-0.08	0.00	-0.09	-0.05	---	0.00	0.00														
		15:04	7.85	7.74	-0.11	0.00	-0.11	-0.06	---	0.00	0.00														
		15:30	7.98	7.89	-0.09	0.00	-0.09	-0.05	---	0.00	0.00														

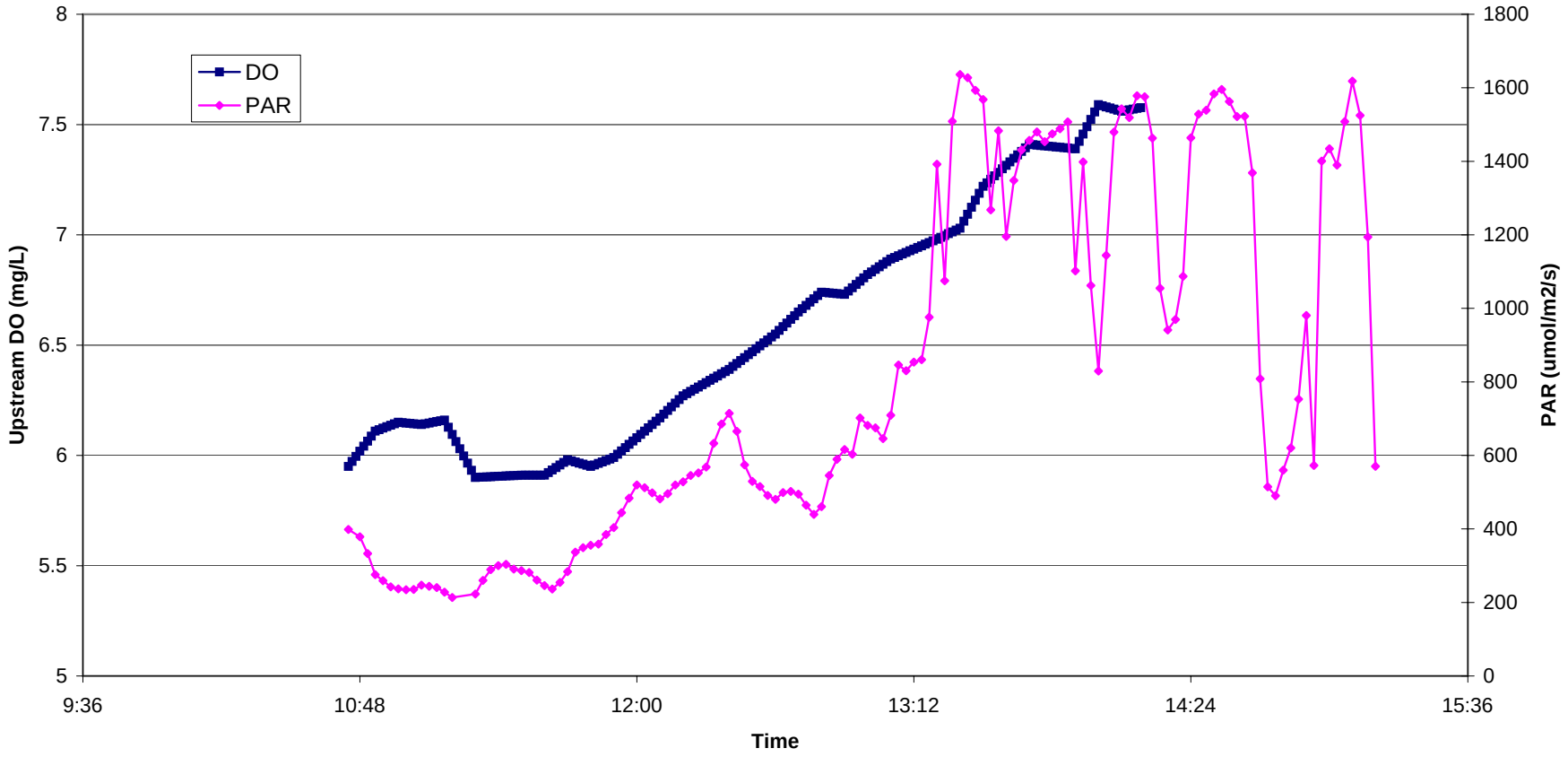
APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g $O_2/m^2/d$)	NPP	R	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
NITELLA	4	11:28	5.91	6.01	0.10	---	0.10	0.07	0.49	291.0	0.15	0.71	154.3	15.11	7.68	7.42	0.145	104.27	53.04	51.23	34.49	0.44	0.22	3.02	1.54
		11:56	6.02	6.16	0.14	---	0.14	0.10	0.44	444.1	0.22														
		12:22	6.37	6.63	0.26	---	0.26	0.18	0.53	685.4	0.34														
		12:50	6.74	6.90	0.16	---	0.16	0.11	0.42	545.2	0.27														
		13:16	6.97	7.18	0.22	---	0.22	0.15	0.31	976.0	0.49														
		13:44	7.41	7.54	0.13	---	0.13	0.09	0.13	1480.0	0.74														
		14:10	7.57	7.51	-0.06	---	-0.06	-0.04	---	0.00	0.00														
		14:38	7.78	7.72	-0.06	---	-0.06	-0.04	---	0.00	0.00														
		15:04	7.85	7.76	-0.09	---	-0.09	-0.06	---	0.00	0.00														
		15:32	7.95	7.91	-0.04	---	-0.04	-0.03	---	0.00	0.00														
	8	11:40	5.96	6.08	0.12	---	0.12	0.08	0.61	254.7	0.13	0.79	138.2	20.49	8.72	11.76	0.144	142.24	60.57	81.67	38.28	0.54	0.23	3.72	1.58
		12:08	6.20	6.42	0.22	---	0.22	0.14	0.55	495.8	0.25														
		12:34	6.52	6.76	0.24	---	0.24	0.15	0.61	491.0	0.25														
		13:02	6.84	7.03	0.19	---	0.19	0.12	0.35	674.9	0.34														
		13:28	7.16	7.46	0.30	---	0.30	0.19	0.24	1593.1	0.80														
		13:56	7.46	7.83	0.37	---	0.37	0.24	0.34	1398.2	0.70														
		14:22	7.74	7.71	-0.03	---	-0.03	-0.02	---	0.00	0.00														
		14:50	7.78	7.65	-0.13	---	-0.13	-0.08	---	0.00	0.00														
		15:16	8.00	7.89	-0.11	---	-0.11	-0.07	---	0.00	0.00														
		15:44	7.97	7.81	-0.16	---	-0.16	-0.10	---	0.00	0.00														
	9	11:44	5.97	6.26	0.29	---	0.29	0.15	0.90	336.9	0.17	0.96	114.5	21.38	12.16	9.22	0.192	111.52	63.44	48.08	33.78	0.63	0.36	3.30	1.88
		12:10	6.24	6.58	0.34	---	0.34	0.18	0.69	519.5	0.26														
		12:38	6.58	6.93	0.35	---	0.35	0.18	0.72	498.9	0.25														
		13:04	6.87	7.25	0.38	---	0.38	0.20	0.62	645.7	0.32														
		13:32	7.25	7.54	0.29	---	0.29	0.15	0.24	1268.1	0.64														
		13:58	7.52	7.89	0.37	---	0.37	0.19	0.36	1062.2	0.53														
		14:26	7.76	7.68	-0.08	---	-0.08	-0.04	---	0.00	0.00														
		14:52	7.72	7.60	-0.12	---	-0.12	-0.06	---	0.00	0.00														
		15:20	8.01	7.93	-0.08	---	-0.08	-0.04	---	0.00	0.00														
		15:46	7.96	7.83	-0.13	---	-0.13	-0.07	---	0.00	0.00														
	Average	11:37	5.95	6.12	0.17	-0.01	0.19	0.11	0.77	294.2	0.15	0.82	133.6	20.04	10.79	9.26	0.160	125.11	67.33	57.78	35.52	0.56	0.30	3.52	1.90
		12:04	6.15	6.39	0.23	-0.01	0.24	0.15	0.61	486.5	0.24														
		12:31	6.49	6.77	0.28	0.01	0.27	0.17	0.59	558.4	0.28														
		12:58	6.82	7.06	0.24	-0.03	0.27	0.17	0.53	621.9	0.31														
		13:25	7.12	7.39	0.27	-0.03	0.30	0.18	0.28	1279.1	0.64														
		13:52	7.46	7.75	0.29	-0.03	0.32	0.19	0.29	1313.5	0.66														
		14:19	7.69	7.63	-0.06	-0.01	-0.05	-0.03	---	0.00	0.00														
		14:46	7.76	7.66	-0.10	0.00	-0.10	-0.06	---	0.00	0.00														
		15:13	7.95	7.86	-0.09	0.00	-0.09	-0.06	---	0.00	0.00														
		15:40	7.96	7.85	-0.11	0.00	-0.11	-0.06	---	0.00	0.00														

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
CONTROL	2	11:22	5.90	5.86	-0.04	---	-0.04	-0.13	-0.88	289.3	0.15	0.17	648.0	---	---	---	---	---	---	---	---	---	---	---	---
		11:50	5.96	5.89	-0.07	---	-0.07	-0.22	-1.20	358.7	0.18														
		12:16	6.31	6.33	0.02	---	0.02	0.06	0.21	552.5	0.28														
		12:44	6.68	6.65	-0.03	---	-0.03	-0.09	-0.38	464.4	0.23														
		13:10	6.92	6.86	-0.06	---	-0.06	-0.18	-0.43	830.4	0.42														
		13:38	7.35	7.27	-0.08	---	-0.08	-0.23	-0.34	1347.9	0.68														
		14:04	7.57	7.55	-0.02	---	-0.02	-0.06	---	0.00	0.00														
		14:32	7.73	7.71	-0.02	---	-0.02	-0.07	---	0.00	0.00														
		14:58	7.76	7.80	0.04	---	0.04	0.11	---	0.00	0.00														
		15:26	7.99	7.99	0.00	---	0.00	-0.01	---	0.00	0.00														
	5	11:32	5.91	5.90	-0.01	---	-0.01	-0.03	-0.19	281.4	0.14	0.19	581.9	---	---	---	---	---	---	---	---	---	---	---	---
		11:58	6.05	6.09	0.04	---	0.04	0.11	0.44	483.6	0.24														
		12:26	6.42	6.39	-0.03	---	-0.03	-0.07	-0.21	665.5	0.33														
		12:52	6.73	6.72	-0.01	---	-0.01	-0.04	-0.12	589.3	0.30														
		13:20	7.00	6.99	-0.01	---	-0.01	-0.02	-0.03	1075.2	0.54														
		13:46	7.40	7.37	-0.03	---	-0.03	-0.09	-0.12	1453.5	0.73														
		14:14	7.61	7.59	-0.02	---	-0.02	-0.05	---	0.00	0.00														
		14:40	7.79	7.79	0.00	---	0.00	0.00	---	0.00	0.00														
		15:08	7.90	7.92	0.02	---	0.02	0.04	---	0.00	0.00														
		15:34	7.96	7.95	-0.01	---	-0.01	-0.03	---	0.00	0.00														
	6	11:34	5.91	5.92	0.01	---	0.01	0.03	0.22	260.6	0.13	0.17	629.4	---	---	---	---	---	---	---	---	---	---	---	---
		12:02	6.11	6.11	0.00	---	0.00	0.00	0.00	512.3	0.26														
		12:28	6.44	6.48	0.04	---	0.04	0.11	0.37	574.4	0.29														
		12:56	6.76	6.72	-0.04	---	-0.04	-0.11	-0.38	603.2	0.30														
		13:22	7.01	7.00	-0.01	---	-0.01	-0.04	-0.05	1508.9	0.76														
		13:50	7.40	7.43	0.03	---	0.03	0.10	0.13	1488.5	0.75														
		14:16	7.64	7.66	0.02	---	0.02	0.06	---	0.00	0.00														
		14:44	7.82	7.85	0.03	---	0.03	0.09	---	0.00	0.00														
		15:10	7.95	7.89	-0.06	---	-0.06	-0.16	---	0.00	0.00														
		15:38	7.97	7.97	0.00	---	0.00	0.00	---	0.00	0.00														
	Average	11:29	5.91	5.89	-0.01	---	-0.01	-0.04	-0.29	277.1	0.14	0.18	618.5	---	---	---	---	---	---	---	---	---	---	---	---
		11:56	6.04	6.03	-0.01	---	-0.01	-0.03	-0.14	451.5	0.23														
		12:23	6.39	6.40	0.01	---	0.01	0.03	0.09	597.5	0.30														
		12:50	6.72	6.70	-0.03	---	-0.03	-0.08	-0.28	552.3	0.28														
		13:17	6.98	6.95	-0.03	---	-0.03	-0.08	-0.13	1138.2	0.57														
		13:44	7.38	7.36	-0.03	---	-0.03	-0.07	-0.10	1430.0	0.72														
		14:11	7.61	7.60	-0.01	---	-0.01	-0.02	---	0.00	0.00														
		14:38	7.78	7.78	0.00	---	0.00	0.01	---	0.00	0.00														
		15:05	7.87	7.87	0.00	---	0.00	0.00	---	0.00	0.00														
		15:32	7.97	7.97	0.00	---	0.00	-0.01	---	0.00	0.00														

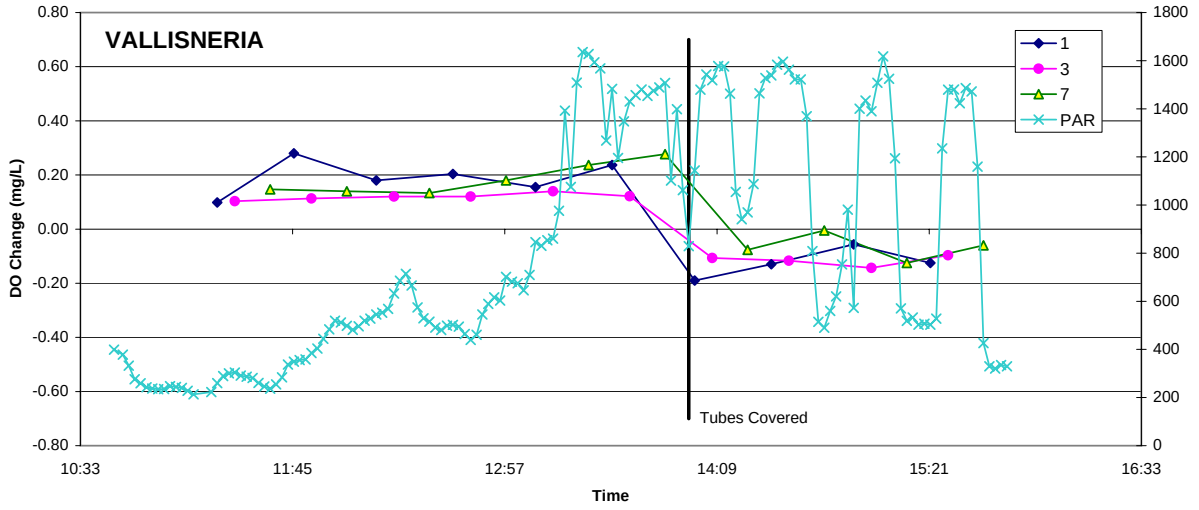
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

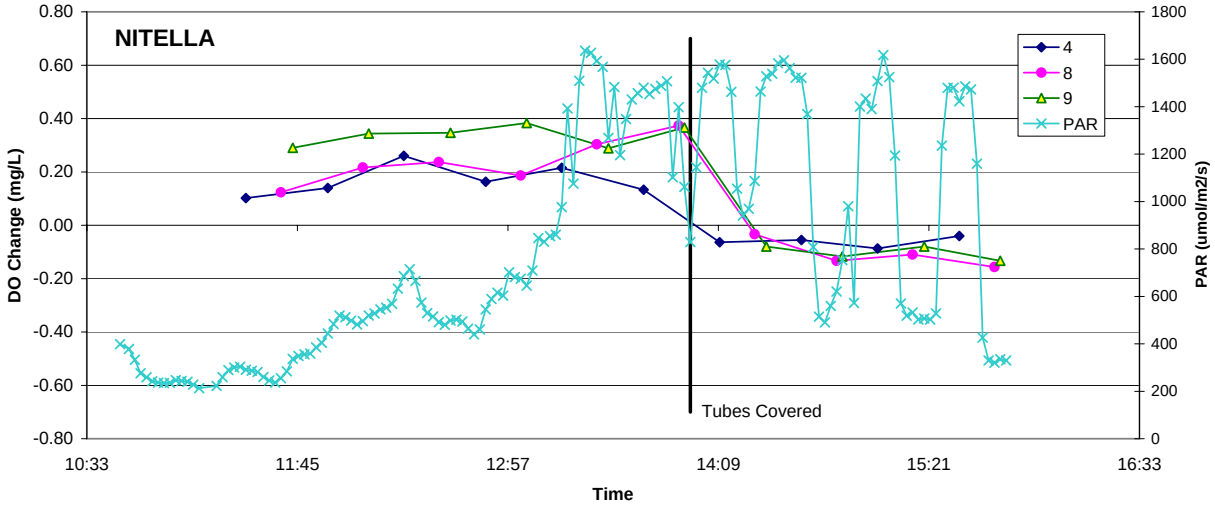


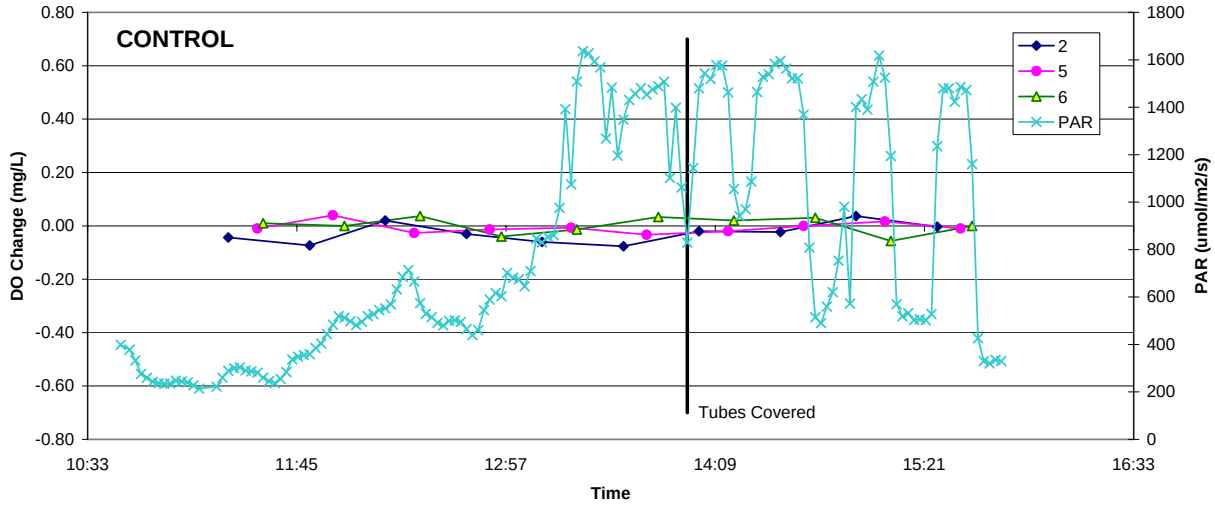
APPENDIX H-2

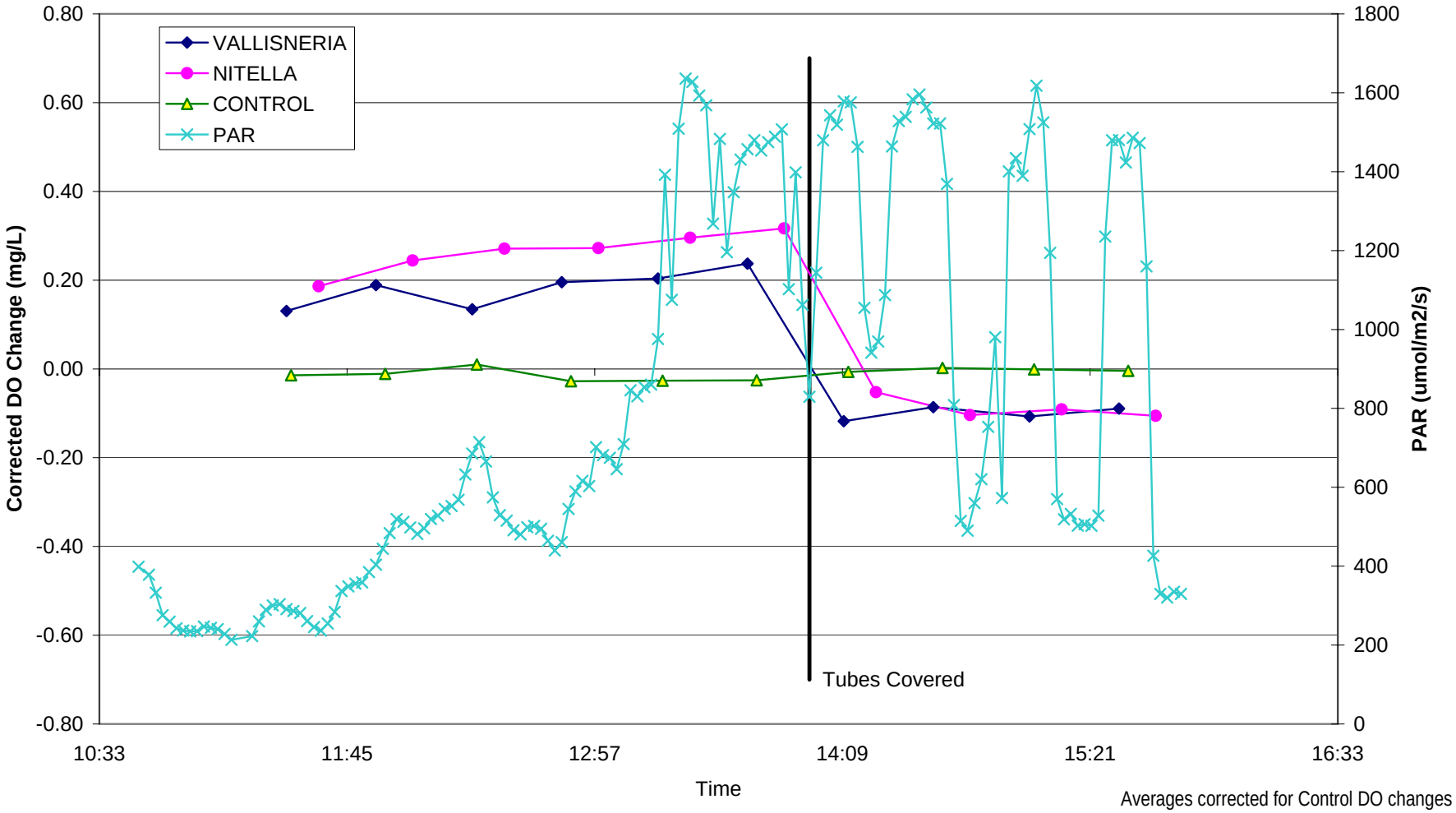
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05





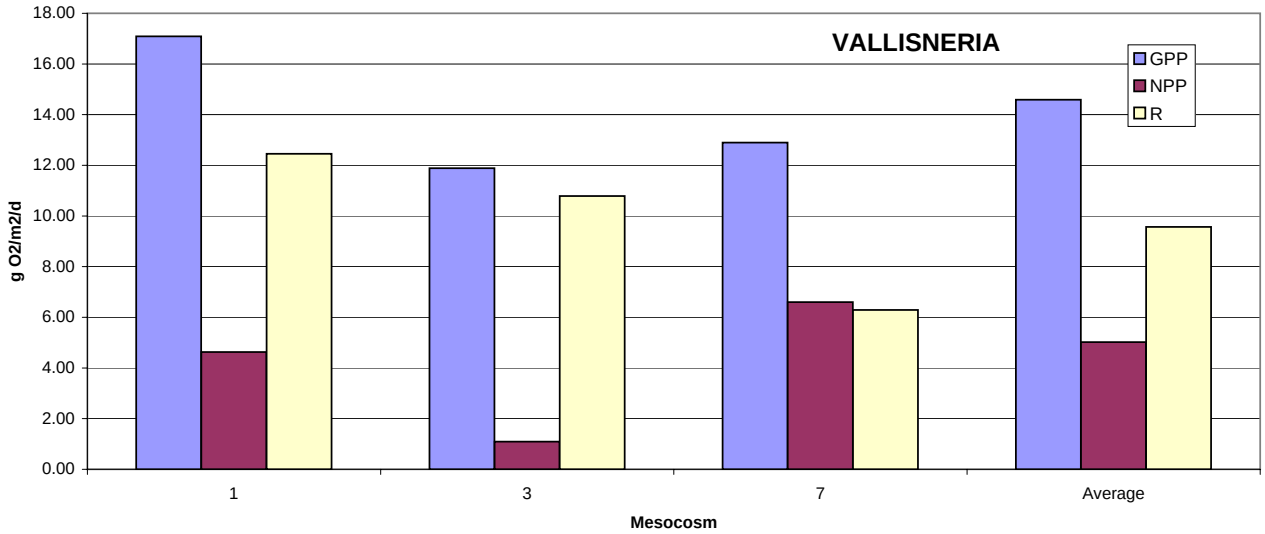


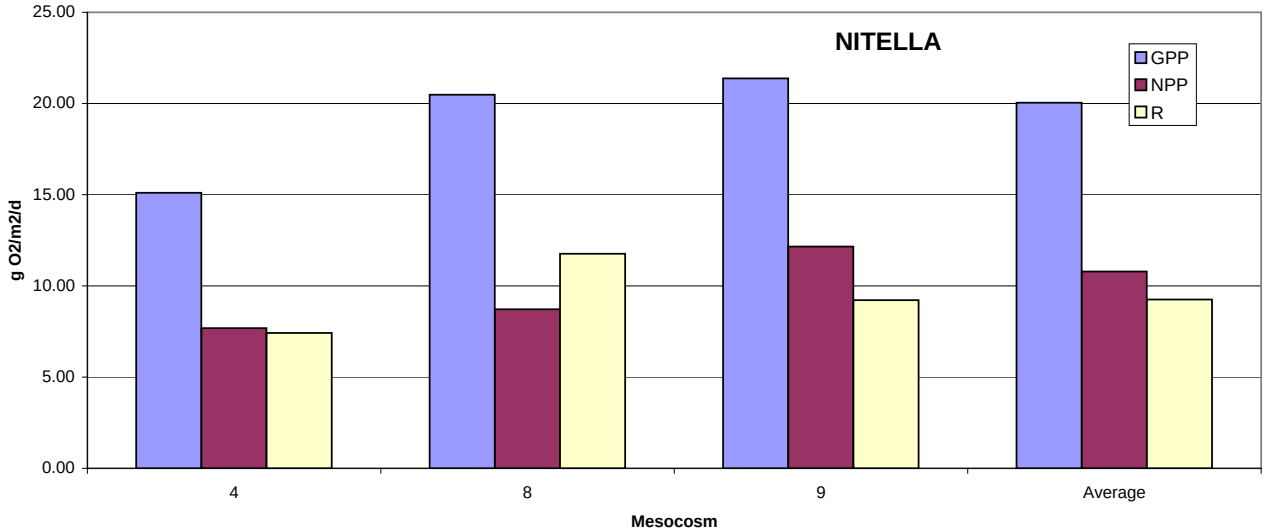


Averages corrected for Control DO changes

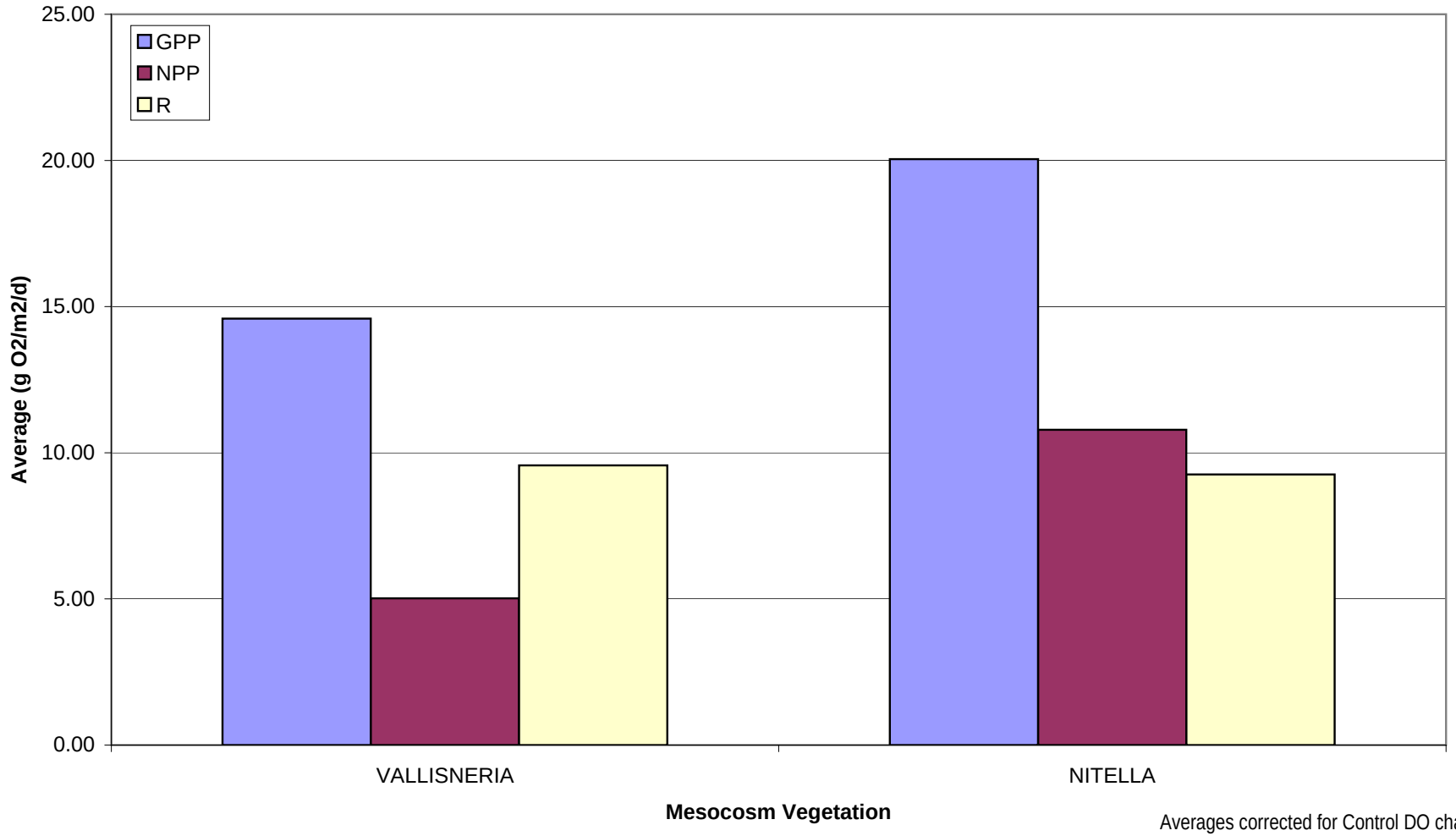
APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05





Averages corrected for Control DO changes



Averages corrected for Control DO changes

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 5/26/05

APPENDIX H-2

MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05

		VALLISNERIA				FILAMENTOUS ALGAE				CONTROL			
PARAMETER	UNITS	1	4	7	Average [a]	3	6	9	Average [a]	2	5	8	Average
UPSTREAM DO	mg/L	6.78	6.84	6.80	6.84	6.82	6.88	6.94	6.88	6.80	6.86	6.91	6.86
DOWNSTREAM DO		6.73	6.84	6.77	6.80	6.88	6.89	6.95	6.91	6.80	6.86	6.92	6.86
CHANGE DO		-0.05	0.00	-0.04	-0.04	0.06	0.01	0.01	0.03	0.00	0.00	0.00	0.00
TRAVEL TIME	minutes	5.35	2.98	3.54	3.96	10.10	4.72	1.89	5.57	0.64	0.53	0.49	0.55
VELOCITY	m/hr	20.5	37	31	28	11	23	58	20	171	208	224	198
GPP	g $O_2/m^2/d$	3.31	7.72	6.67	4.71	2.40	4.50	9.62	3.84	---	---	---	---
NPP24		-0.30	1.28	-0.38	-0.30	0.93	0.95	2.22	1.07	---	---	---	---
R24		3.61	6.44	7.05	5.02	1.47	3.54	7.40	2.77	---	---	---	---
Vegetation	kg DW/m^2	0.712	0.624	0.699	0.678	2.512	3.367	4.802	3.560	---	---	---	---
GPP	g O_2/kg DW/d	4.65	12.37	9.54	6.95	1.0	1.3	2.0	1.1	---	---	---	---
NPP24		-0.42	2.05	-0.55	-0.45	0.4	0.3	0.5	0.3	---	---	---	---
R24		5.07	10.32	10.09	7.40	0.58	1.05	1.54	0.78	---	---	---	---
PAR	mol/hr	0.129	0.110	0.115	0.118	0.111	0.104	0.109	0.108	---	---	---	---
	$mol/m^2/d$	15.7	14.4	15.9	15.4	13.6	14.2	12.2	13.3	---	---	---	---
GPP	g O_2/mol	0.212	0.536	0.418	0.306	0.176	0.316	0.788	0.288	---	---	---	---
NPP		-0.019	0.089	-0.024	-0.020	0.068	0.067	0.182	0.080	---	---	---	---
GPP	g O_2/kg DW/mol	0.297	0.859	0.598	0.451	0.070	0.094	0.164	0.081	---	---	---	---
NPP		-0.027	0.142	-0.034	-0.029	0.027	0.020	0.038	0.023	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g $O_2/m^2/d$)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
VALLISNERIA	1	9:53	5.88	5.99	0.11	---	0.11	0.01	0.04	496.6	0.25	5.35	20.5	3.31	-0.30	3.61	0.712	4.65	-0.42	5.07	15.67	0.21	-0.02	0.30	-0.03
		10:13	6.16	6.32	0.16	---	0.16	0.01	0.09	321.9	0.16														
		10:31	6.44	6.63	0.19	---	0.19	0.02	0.12	292.0	0.15														
		10:48	6.63	6.82	0.19	---	0.19	0.02	0.10	340.3	0.17														
		11:07	6.82	6.95	0.13	---	0.13	0.01	0.11	223.1	0.11														
		11:19	6.75	6.73	-0.02	---	-0.02	0.00	-0.03	162.2	0.08														
		11:31	6.79	6.57	-0.22	---	-0.22	-0.02	---	---	---														
		11:48	6.91	6.70	-0.21	---	-0.21	-0.02	---	---	---														
		12:05	7.18	6.93	-0.25	---	-0.25	-0.02	---	---	---														
		12:21	7.39	7.10	-0.29	---	-0.29	-0.03	---	---	---														
		12:38	7.62	7.26	-0.36	---	-0.36	-0.03	---	---	---														
	4	10:03	6.02	6.31	0.29	---	0.29	0.05	0.19	503.2	0.25	2.98	36.8	7.72	1.28	6.44	0.624	12.37	2.05	10.32	14.40	0.54	0.09	0.86	0.14
		10:18	6.21	6.44	0.23	---	0.23	0.04	0.27	287.2	0.14														
		10:38	6.53	6.79	0.27	---	0.27	0.04	0.31	285.8	0.14														
		10:54	6.71	6.97	0.26	---	0.26	0.04	0.31	279.2	0.14														
		11:12	6.79	7.09	0.31	---	0.31	0.05	0.56	183.2	0.09														
		11:23	6.78	6.75	-0.03	---	-0.03	0.00	---	---	---														
		11:37	6.76	6.54	-0.22	---	-0.22	-0.04	---	---	---														
		11:53	6.98	6.72	-0.26	---	-0.26	-0.04	---	---	---														
		12:11	7.25	6.99	-0.26	---	-0.26	-0.04	---	---	---														
		12:26	7.43	7.11	-0.32	---	-0.32	-0.05	---	---	---														
		12:46	7.78	7.53	-0.25	---	-0.25	-0.04	---	---	---														
	7	9:47	5.78	5.94	0.16	---	0.16	0.02	0.14	319.2	0.16	3.54	31.0	6.67	-0.38	7.05	0.699	9.54	-0.55	10.09	15.95	0.42	-0.02	0.60	-0.03
		10:07	6.10	6.33	0.24	---	0.24	0.03	0.22	303.2	0.15														
		10:25	6.33	6.48	0.15	---	0.15	0.02	0.06	717.8	0.36														
		10:43	6.58	6.88	0.30	---	0.30	0.04	0.31	271.5	0.14														
		11:02	6.73	6.90	0.17	---	0.17	0.02	0.19	253.8	0.13														
		11:15	6.79	7.06	0.27	---	0.27	0.04	0.43	178.9	0.09														
		11:27	6.81	6.67	-0.14	---	-0.14	-0.02	---	---	---														
		11:42	6.80	6.53	-0.27	---	-0.27	-0.04	---	---	---														
		12:00	7.11	6.83	-0.28	---	-0.28	-0.04	---	---	---														
		12:16	7.32	7.02	-0.30	---	-0.30	-0.04	---	---	---														
		12:33	7.49	7.15	-0.34	---	-0.34	-0.05	---	---	---														
		12:50	7.82	7.40	-0.42	---	-0.42	-0.06	---	---	---														
	Average	10:01	6.00	6.21	0.21	0.01	0.20	0.03	0.12	434.33	0.22	3.96	27.7	4.71	-0.30	5.02	0.678	6.95	-0.45	7.40	15.41	0.31	-0.02	0.45	-0.03
		10:18	6.23	6.41	0.18	0.00	0.19	0.02	0.11	442.30	0.22														
		10:37	6.52	6.77	0.25	0.01	0.25	0.03	0.22	283.10	0.14														
		10:54	6.69	6.90	0.21	0.00	0.20	0.03	0.18	291.10	0.15														
		11:11	6.80	7.03	0.24	-0.02	0.26	0.03	0.33	195.07	0.10														
		11:23	6.78	6.72	-0.06	0.02	-0.08	-0.01	-0.12	162.20	0.08														
		11:36	6.79	6.55	-0.24	-0.01	-0.23	-0.03	---	---	---														
		11:53	7.00	6.75	-0.25	0.00	-0.25	-0.03	---	---	---														
		12:10	7.25	6.98	-0.27	0.01	-0.27	-0.03	---	---	---														
		12:26	7.43	7.12	-0.31	0.01	-0.33	-0.04	---	---	---														
		12:44	7.74	7.40	-0.34	-0.01	-0.34	-0.04	---	---	---														

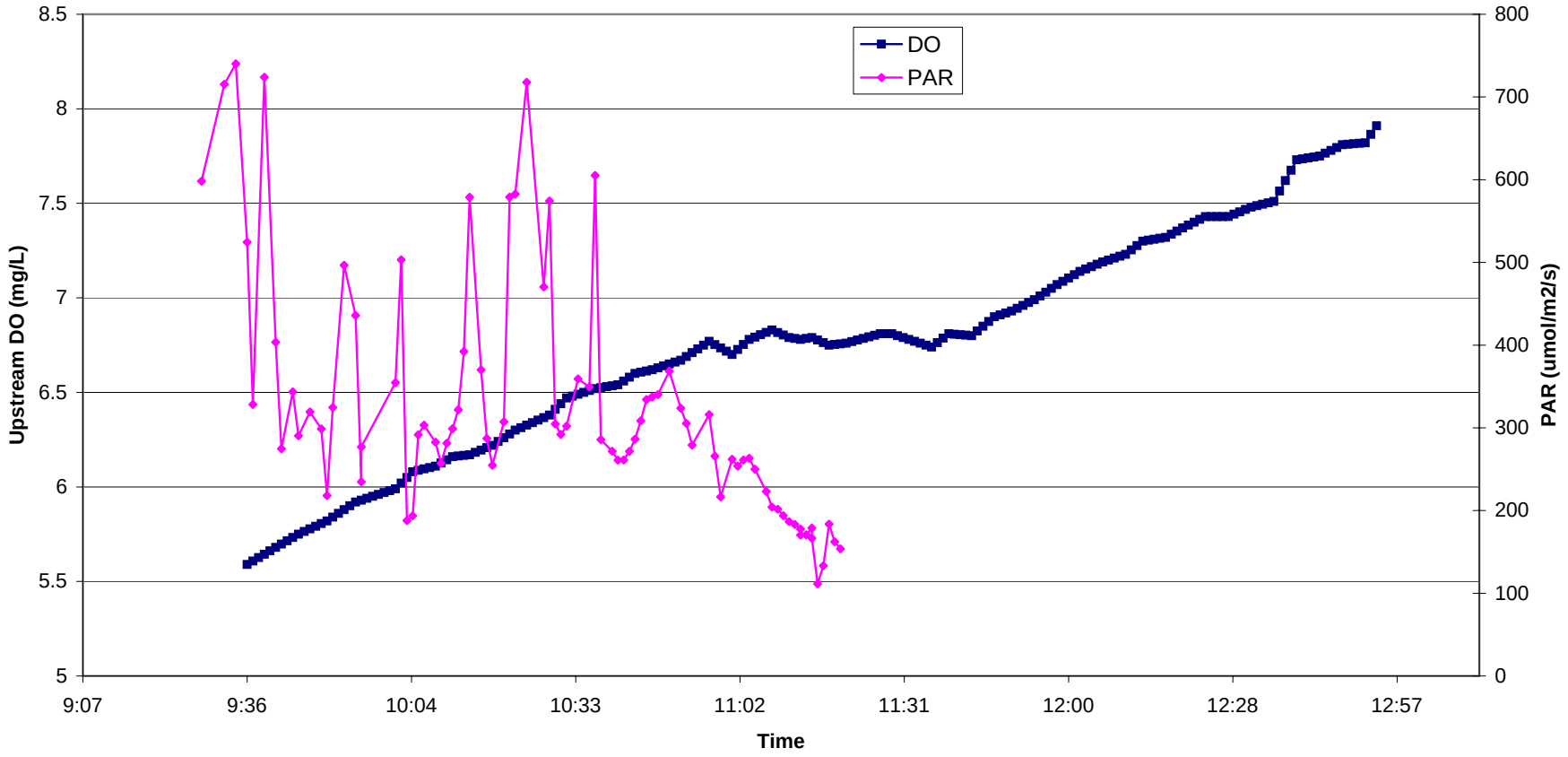
APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
FILAMENTOUS ALGAE	3	9:56	5.93	6.00	0.07	---	0.07	0.00	0.03	234.7	0.12	10.10	10.9	2.40	0.93	1.47	2.512	0.95	0.37	0.58	13.60	0.18	0.07	0.07	0.03
		10:17	6.20	6.52	0.32	---	0.32	0.02	0.09	370.1	0.19														
		10:36	6.51	6.76	0.25	---	0.25	0.01	0.07	349.4	0.18														
		10:53	6.69	7.16	0.47	---	0.47	0.02	0.15	305.3	0.15														
		11:10	6.80	7.42	0.62	---	0.62	0.03	0.31	193.8	0.10														
		11:22	6.77	6.67	-0.10	---	-0.10	0.00	---	---	---														
		11:34	6.76	6.59	-0.17	---	-0.17	-0.01	---	---	---														
		11:52	6.96	6.82	-0.14	---	-0.14	-0.01	---	---	---														
		12:08	7.21	7.09	-0.12	---	-0.12	-0.01	---	---	---														
		12:25	7.43	7.18	-0.25	---	-0.25	-0.01	---	---	---														
		12:43	7.75	7.49	-0.26	---	-0.26	-0.01	---	---	---														
	6	10:06	6.09	6.23	0.14	---	0.14	0.02	0.10	291.7	0.15	4.72	23.3	4.50	0.95	3.54	3.367	1.34	0.28	1.05	14.22	0.32	0.07	0.09	0.02
		10:22	6.28	6.50	0.22	---	0.22	0.02	0.08	579.0	0.29														
		10:42	6.56	6.80	0.24	---	0.24	0.03	0.19	261.2	0.13														
		10:59	6.74	7.08	0.35	---	0.35	0.04	0.34	216.6	0.11														
		11:14	6.79	7.14	0.36	---	0.36	0.04	0.44	170.8	0.09														
		11:25	6.79	6.62	-0.17	---	-0.17	-0.02	---	---	---														
		11:41	6.81	6.59	-0.22	---	-0.22	-0.02	---	---	---														
		11:57	7.05	6.89	-0.16	---	-0.16	-0.02	---	---	---														
		12:14	7.31	7.18	-0.13	---	-0.13	-0.01	---	---	---														
		12:31	7.47	7.22	-0.25	---	-0.25	-0.03	---	---	---														
		12:49	7.81	7.57	-0.24	---	-0.24	-0.03	---	---	---														
	9	10:11	6.14	6.38	0.24	---	0.24	0.06	0.44	281.4	0.14	1.89	57.9	9.62	2.22	7.40	4.802	2.00	0.46	1.54	12.20	0.79	0.18	0.16	0.04
		10:30	6.41	6.70	0.29	---	0.29	0.08	0.50	304.7	0.15														
		10:46	6.61	6.86	0.25	---	0.25	0.07	0.39	334.2	0.17														
		11:05	6.79	7.04	0.25	---	0.25	0.07	0.52	250.0	0.13														
		11:17	6.76	6.88	0.12	---	0.12	0.03	0.46	133.3	0.07														
		11:30	6.80	6.59	-0.21	---	-0.21	-0.06	---	---	---														
		11:45	6.85	6.65	-0.20	---	-0.20	-0.05	---	---	---														
		12:03	7.15	7.00	-0.15	---	-0.15	-0.04	---	---	---														
		12:19	7.35	7.23	-0.12	---	-0.12	-0.03	---	---	---														
		12:37	7.57	7.39	-0.18	---	-0.18	-0.05	---	---	---														
		12:53	7.87	7.75	-0.12	---	-0.12	-0.03	---	---	---														
	Average	10:04	6.05	6.20	0.15	0.01	0.14	0.01	0.09	269.27	0.14	5.57	19.7	3.84	1.07	2.77	3.560	1.08	0.30	0.78	13.34	0.29	0.08	0.08	0.02
		10:23	6.30	6.57	0.28	0.00	0.28	0.03	0.12	417.93	0.21														
		10:41	6.56	6.81	0.25	0.01	0.24	0.02	0.14	314.93	0.16														
		10:59	6.74	7.09	0.35	0.00	0.35	0.03	0.24	257.30	0.13														
		11:13	6.78	7.15	0.36	-0.02	0.38	0.03	0.41	165.97	0.08														
		11:25	6.79	6.63	-0.16	0.02	-0.18	-0.02	---	---	---														
		11:40	6.81	6.61	-0.20	-0.01	-0.18	-0.02	---	---	---														
		11:57	7.05	6.90	-0.15	0.00	-0.15	-0.01	---	---	---														
		12:13	7.29	7.17	-0.12	0.01	-0.13	-0.01	---	---	---														
		12:31	7.49	7.26	-0.22	0.01	-0.24	-0.02	---	---	---														
		12:48	7.81	7.60	-0.20	-0.01	-0.20	-0.02	---	---	---														

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O₂/m²/d)	NPP	R	Vegetation (kg DW/m²)	GPP (g O₂/kgDW/d)	NPP	R	PAR (mol/m²/d)	GPP (g O₂/mol)	NPP	GPP (g O₂/kgDW/mol)	NPP
CONTROL	2	9:56	5.93	5.95	0.02	---	0.02	0.02	0.13	234.7	0.12	0.64	171.1	---	---	---	---	---	---	---	---	---	---	---	---
		10:14	6.17	6.18	0.01	---	0.01	0.01	0.05	392.2	0.20														
		10:34	6.49	6.52	0.03	---	0.03	0.02	0.13	359.2	0.18														
		10:50	6.65	6.64	-0.01	---	-0.01	-0.01	-0.04	368.5	0.18														
		11:09	6.82	6.78	-0.04	---	-0.04	-0.03	-0.28	201.6	0.10														
		11:20	6.76	6.78	0.02	---	0.02	0.02	0.24	153.8	0.08														
		11:33	6.77	6.75	-0.02	---	-0.02	-0.02	---	---	---														
		11:49	6.92	6.90	-0.02	---	-0.02	-0.02	---	---	---														
		12:07	7.20	7.22	0.02	---	0.02	0.02	---	---	---														
		12:23	7.42	7.41	0.00	---	0.00	0.00	---	---	---														
		12:41	7.74	7.70	-0.04	---	-0.04	-0.03	---	---	---														
	5	10:04	6.05	6.05	0.00	---	0.00	0.00	0.00	188.0	0.09	0.53	208.0	---	---	---	---	---	---	---	---	---	---	---	---
		10:21	6.26	6.25	-0.01	---	-0.01	-0.01	-0.06	307.3	0.15														
		10:40	6.54	6.52	-0.02	---	-0.02	-0.01	-0.10	271.7	0.14														
		10:58	6.75	6.76	0.01	---	0.01	0.01	0.05	265.8	0.13														
		11:13	6.78	6.78	0.00	---	0.00	0.00	0.00	177.6	0.09														
		11:24	6.79	6.82	0.04	---	0.04	0.03	---	---	---														
		11:38	6.79	6.77	-0.02	---	-0.02	-0.02	---	---	---														
		11:56	7.03	7.05	0.02	---	0.02	0.02	---	---	---														
		12:12	7.28	7.24	-0.04	---	-0.04	-0.03	---	---	---														
		12:29	7.44	7.49	0.05	---	0.05	0.05	---	---	---														
		12:47	7.80	7.78	-0.01	---	-0.01	-0.01	---	---	---														
	8	10:10	6.13	6.13	0.00	---	0.00	0.00	0.03	257.2	0.13	0.49	223.6	---	---	---	---	---	---	---	---	---	---	---	---
		10:28	6.37	6.35	-0.02	---	-0.02	-0.02	-0.07	470.4	0.24														
		10:45	6.61	6.61	0.00	---	0.00	0.00	0.02	308.4	0.15														
		11:03	6.75	6.77	0.02	---	0.02	0.02	0.13	261.2	0.13														
		11:16	6.78	6.75	-0.03	---	-0.03	-0.03	-0.49	111.4	0.06														
		11:28	6.81	6.80	-0.01	---	-0.01	-0.01	---	---	---														
		11:44	6.83	6.83	0.00	---	0.00	0.01	---	---	---														
		12:01	7.12	7.12	0.00	---	0.00	0.00	---	---	---														
		12:18	7.34	7.37	0.03	---	0.03	0.03	---	---	---														
		12:35	7.50	7.50	0.00	---	0.00	0.00	---	---	---														
		12:52	7.82	7.85	0.03	---	0.03	0.03	---	---	---														
	Average	10:03	6.04	6.04	0.01	---	0.01	0.01	0.06	226.6	0.11	0.55	198.4	---	---	---	---	---	---	---	---	---	---	---	---
		10:21	6.26	6.26	0.00	---	0.00	0.00	-0.02	390.0	0.20														
		10:39	6.54	6.55	0.01	---	0.01	0.01	0.04	313.1	0.16														
		10:57	6.72	6.72	0.00	---	0.00	0.00	0.03	298.5	0.15														
		11:12	6.79	6.77	-0.02	---	-0.02	-0.02	-0.23	163.5	0.08														
		11:24	6.78	6.80	0.02	---	0.02	0.01	0.19	153.8	0.08														
		11:38	6.79	6.78	-0.01	---	-0.01	-0.01	---	---	---														
		11:55	7.02	7.02	0.00	---	0.00	0.00	---	---	---														
		12:12	7.27	7.28	0.01	---	0.01	0.01	---	---	---														
		12:29	7.45	7.47	0.01	---	0.01	0.01	---	---	---														
		12:46	7.78	7.78	-0.01	---	-0.01	-0.01	---	---	---														

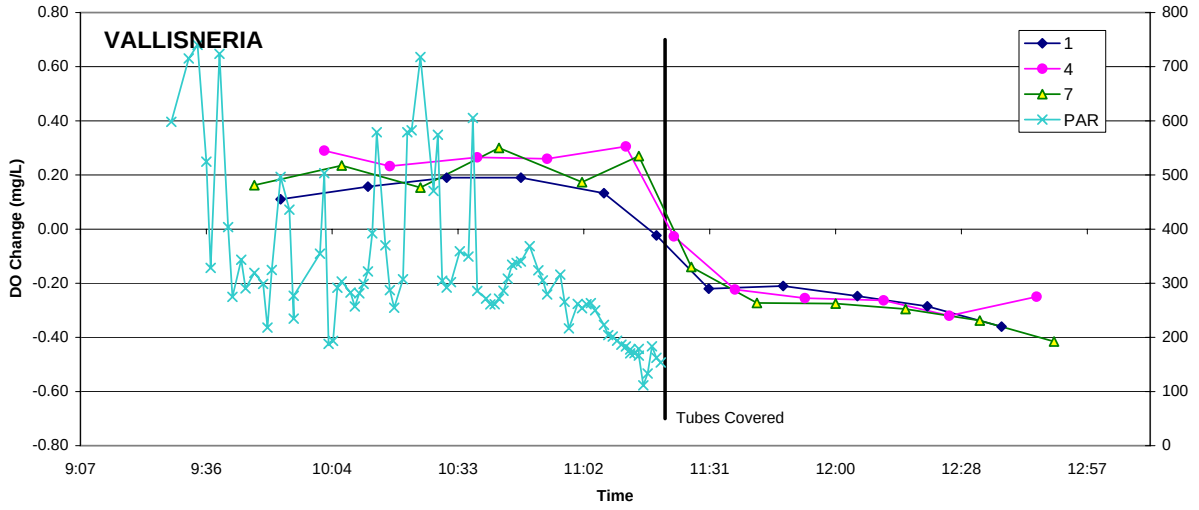
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

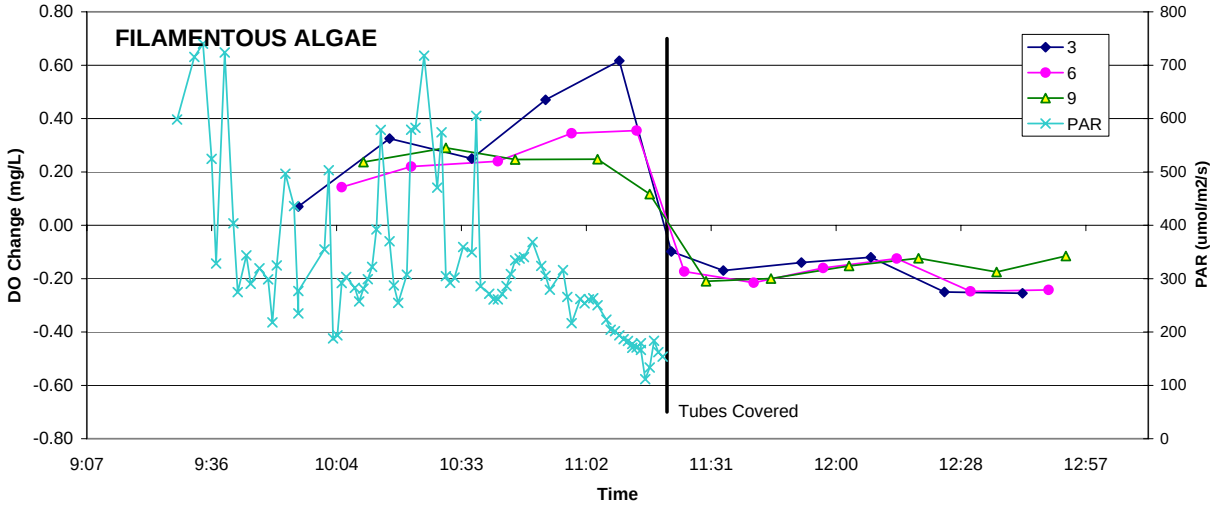


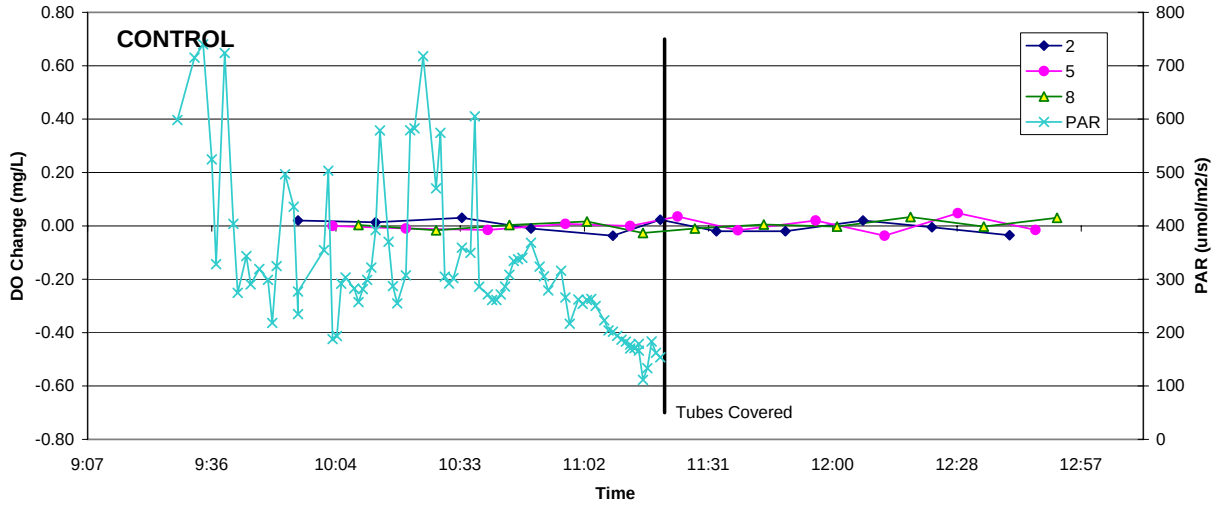
APPENDIX H-2

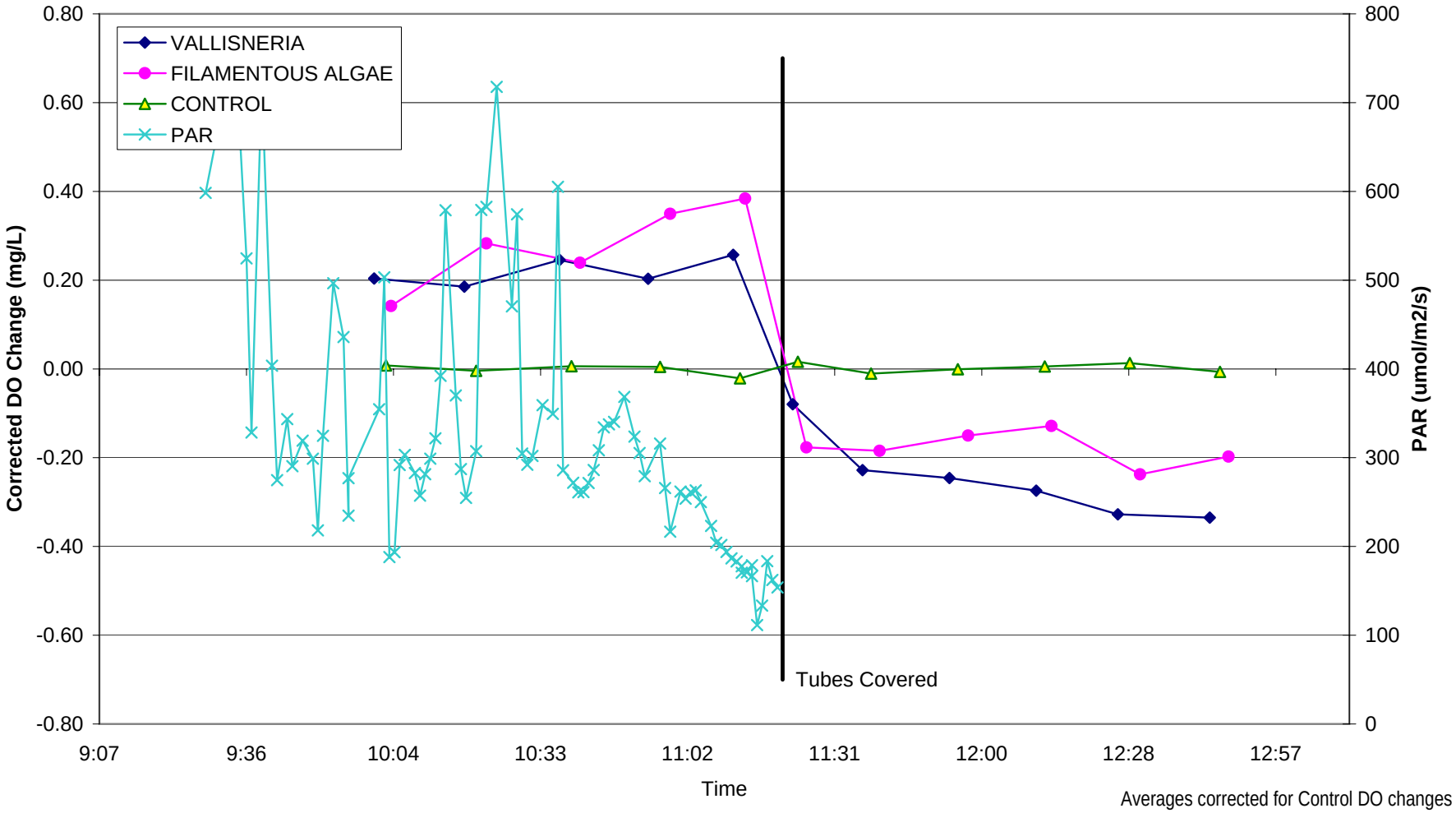
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05



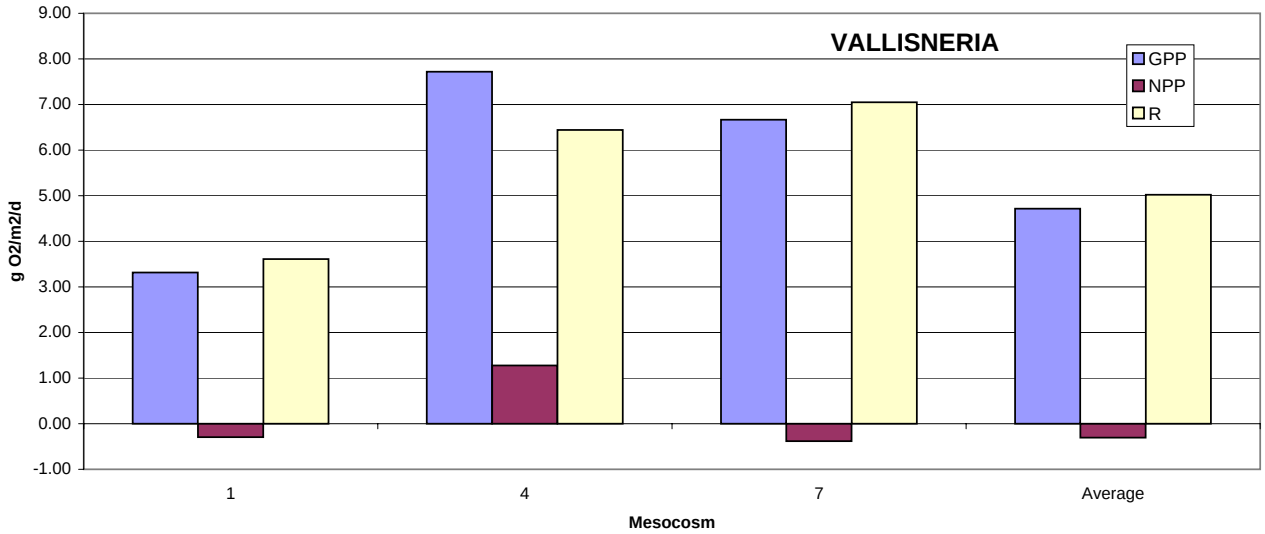


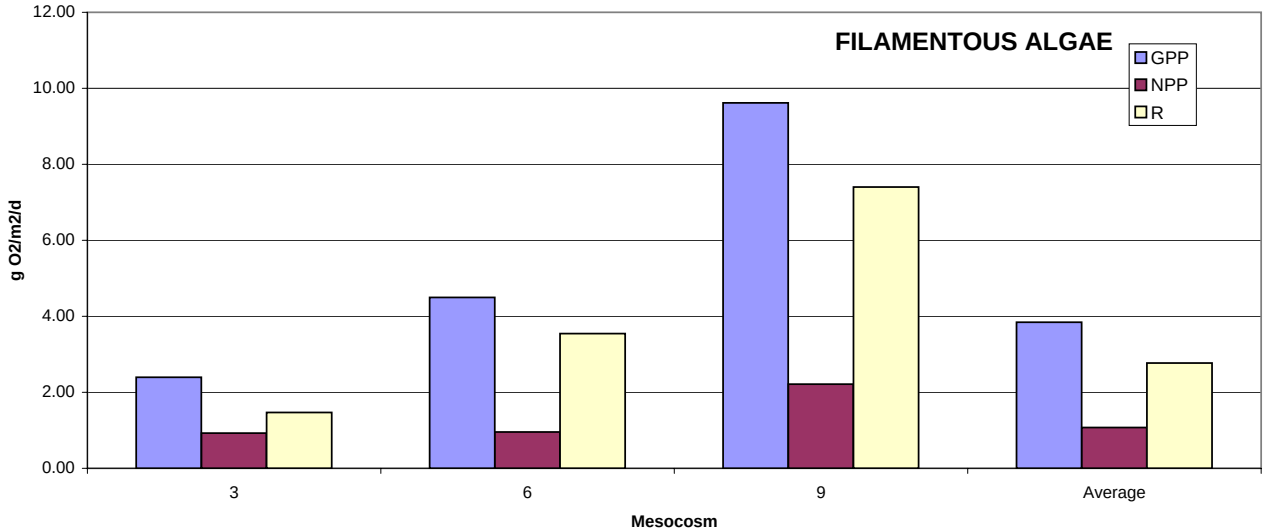




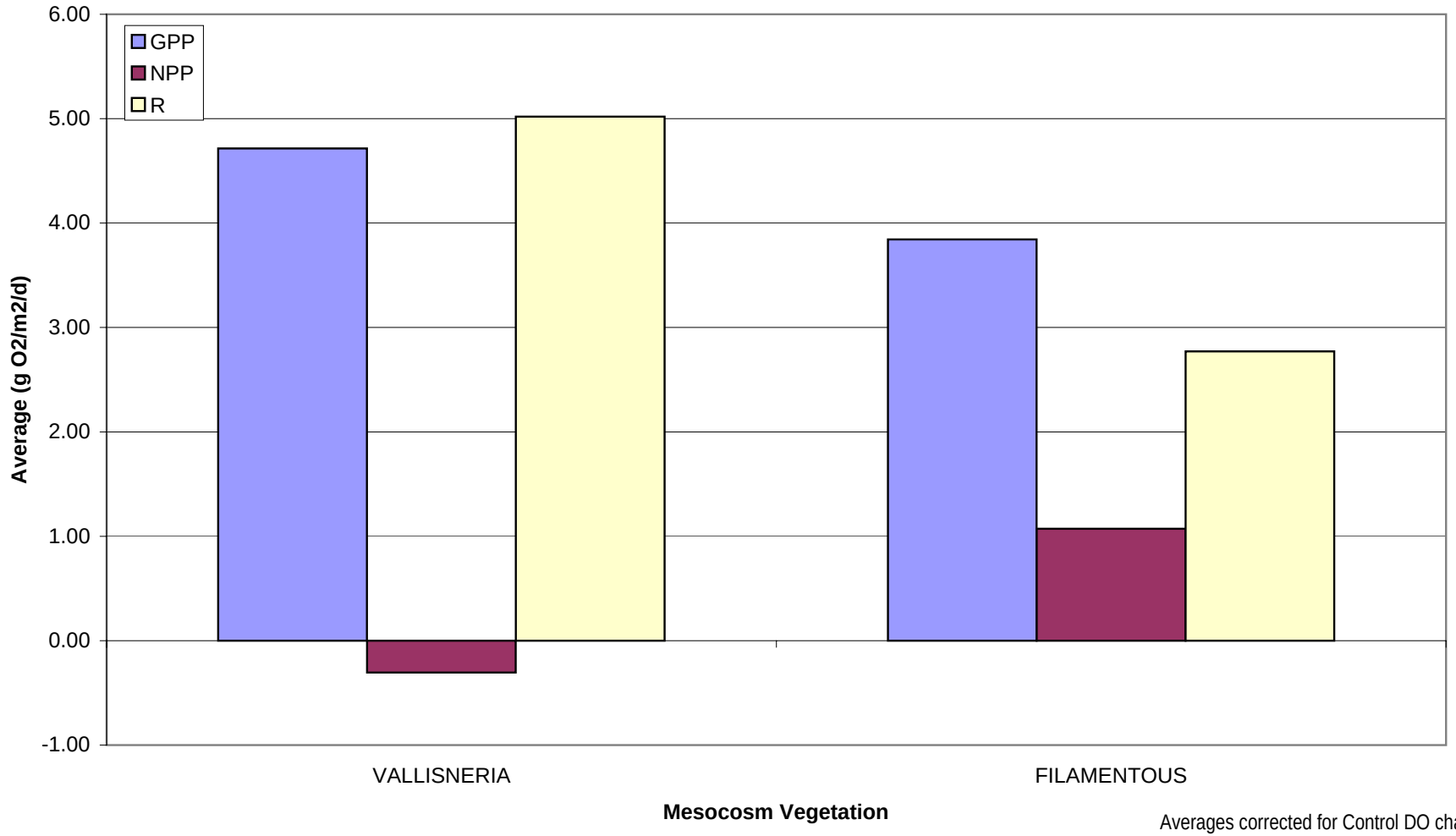
APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05





Averages corrected for Control DO changes



Averages corrected for Control DO changes

APPENDIX H-2
MESOCOSM STUDY AT WEKIVA RIVER SEGMENT 2 - 9/01/05

APPENDIX H-3

MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1

		4/20/2005		8/3/2005	
PARAMETER	UNITS	VALLISNERIA	FILAMENTOUS ALGAE	VALLISNERIA	UTRICULARIA
UPSTREAM DO	mg/L	6.22	6.23	4.27	4.25
DOWNSTREAM DO		6.33	6.32	4.33	4.37
CHANGE DO		0.10	0.08	0.07	0.12
TRAVEL TIME	minutes	2.60	4.97	1.83	3.59
VELOCITY	m/hr	42	22	60	31
GPP	g $O_2/m^2/d$	7.59	3.22	5.27	7.48
NPP		1.02	0.43	2.28	1.81
R		6.57	2.79	2.99	5.68
Vegetation	kg DW/m^2	0.622	0.816	0.638	0.241
GPP	g O_2/kg DW/d	12.21	3.95	8.26	31.11
NPP		1.64	0.53	3.57	7.51
R24		10.57	3.42	4.69	23.60
PAR	mol/hr	0.264	0.335	0.189	0.199
	$mol/m^2/d$	35.2	44.7	27.2	29.1
GPP	g O_2/mol	0.215	0.072	0.194	0.258
NPP		0.029	0.010	0.084	0.062
GPP	g O_2/kg DW/mol	0.347	0.088	0.303	1.07
NPP		0.046	0.012	0.131	0.259

APPENDIX H-3

MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05

		VALLISNERIA				FILAMENTOUS ALGAE				CONTROL			
PARAMETER	UNITS	1	2	3	Average [a]	4	5	6	Average [a]	7	8	9	Average
UPSTREAM DO	mg/L	6.21	6.23	6.24	6.22	6.23	6.23	6.23	6.23	6.23	6.24	6.27	6.25
DOWNSTREAM DO		6.33	6.36	6.31	6.33	6.42	6.35	6.20	6.32	6.24	6.26	6.29	6.26
CHANGE DO		0.12	0.14	0.08	0.10	0.18	0.12	-0.03	0.08	0.01	0.01	0.02	0.01
TRAVEL TIME	minutes	3.58	2.90	1.32	2.60	9.37	2.60	2.95	4.97	0.31	0.30	0.26	0.29
VELOCITY	m/hr	30.6	37.8	83.3	42.2	11.7	42.2	37.2	22.1	351	364	425	377
GPP	g $O_2/m^2/d$	6.29	8.70	19.33	7.59	2.78	6.21	2.77	3.22	---	---	---	---
NPP24		1.04	1.56	10.78	1.02	0.87	2.23	-1.59	0.43	---	---	---	---
R24		5.25	7.13	8.55	6.57	1.91	3.97	4.36	2.79	---	---	---	---
Vegetation	kg DW/m^2	0.619	0.667	0.579	0.622	1.336	0.615	0.496	0.816	---	---	---	---
GPP	g O_2/kg DW/d	10.17	13.03	33.37	12.21	2.08	10.09	5.59	3.95	---	---	---	---
NPP24		1.68	2.34	18.61	1.64	0.65	3.63	-3.21	0.53	---	---	---	---
R24		8.49	10.69	14.76	10.57	1.43	6.46	8.80	3.42	---	---	---	---
PAR	mol/hr	0.208	0.243	0.343	0.264	0.330	0.368	0.308	0.335	---	---	---	---
	$mol/m^2/d$	27.7	32.4	45.7	35.2	44.0	49.0	41.0	44.7	---	---	---	---
GPP	g O_2/mol	0.227	0.268	0.423	0.215	0.063	0.127	0.068	0.072	---	---	---	---
NPP		0.038	0.048	0.236	0.029	0.020	0.046	-0.039	0.010	---	---	---	---
GPP	g O_2/kg DW/mol	0.368	0.402	0.731	0.347	0.047	0.206	0.136	0.088	---	---	---	---
NPP		0.061	0.072	0.407	0.046	0.015	0.074	-0.078	0.012	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m²/d)	NPP (g O_2/m²/d)	R (g O_2/m²/d)	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
VALLISNERIA	1	11:01	5.60	5.97	0.37	---	0.37	0.05	0.17	601.6	0.30	3.58	30.6	6.29	1.04	5.25	0.619	10.17	1.68	8.49	27.66	0.23	0.04	0.37	0.06
		11:34	5.77	6.03	0.26	---	0.26	0.04	0.17	428.60	0.22														
		11:57	5.83	6.08	0.25	---	0.25	0.04	0.14	498.20	0.25														
		12:26	5.97	6.32	0.35	---	0.35	0.05	0.15	662.50	0.33														
		12:52	6.10	6.37	0.27	---	0.27	0.04	0.22	349.90	0.18														
		13:20	6.28	6.56	0.28	---	0.28	0.04	0.06	1343.40	0.67														
		13:48	6.44	6.51	0.07	---	0.07	0.01	0.07	252.70	0.13														
		14:20	6.58	6.41	-0.17	---	-0.17	-0.02	---	0.00	0.00														
		14:52	6.72	6.50	-0.22	---	-0.22	-0.03	---	0.00	0.00														
		15:19	6.78	6.51	-0.27	---	-0.27	-0.04	---	0.00	0.00														
	2	11:03	5.63	6.18	0.55	---	0.55	0.09	0.40	476.6	0.24	2.90	37.8	8.70	1.56	7.13	0.667	13.03	2.34	10.69	32.39	0.27	0.05	0.40	0.07
		11:36	5.76	6.11	0.35	---	0.35	0.06	0.38	317.10	0.16														
		12:01	5.87	6.11	0.24	---	0.24	0.04	0.10	798.00	0.40														
		12:28	6.01	6.33	0.32	---	0.32	0.05	0.16	666.30	0.33														
		12:56	6.13	6.35	0.22	---	0.22	0.04	0.08	980.50	0.49														
		13:22	6.30	6.62	0.32	---	0.32	0.06	0.08	1360.80	0.68														
		13:50	6.48	6.58	0.10	---	0.10	0.02	0.14	245.30	0.12														
		14:22	6.56	6.39	-0.17	---	-0.17	-0.03	---	0.00	0.00														
		14:54	6.74	6.47	-0.27	---	-0.27	-0.05	---	0.00	0.00														
		15:23	6.78	6.50	-0.28	---	-0.28	-0.05	---	0.00	0.00														
	3	11:07	5.63	5.87	0.24	---	0.24	0.09	0.16	1129.0	0.57	1.32	83.3	19.33	10.78	8.55	0.579	33.37	18.61	14.76	45.67	0.42	0.24	0.73	0.41
		11:40	5.75	5.88	0.13	---	0.13	0.05	0.40	248.60	0.12														
		12:03	5.91	6.07	0.16	---	0.16	0.06	0.09	1454.00	0.73														
		12:32	6.09	6.19	0.10	---	0.10	0.04	0.15	492.30	0.25														
		12:58	6.13	6.30	0.17	---	0.17	0.06	0.12	1060.20	0.53														
		13:26	6.30	6.50	0.20	---	0.20	0.07	0.09	1611.50	0.81														
		13:55	6.46	6.62	0.16	---	0.16	0.06	0.15	835.40	0.42														
		14:28	6.55	6.49	-0.06	---	-0.06	-0.02	---	0.00	0.00														
		14:58	6.76	6.59	-0.17	---	-0.17	-0.06	---	0.00	0.00														
		15:25	6.79	6.62	-0.17	---	-0.17	-0.06	---	0.00	0.00														
	Average	11:03	5.62	6.01	0.39	0.06	0.32	0.06	0.17	735.7	0.37	2.60	42.2	7.59	1.02	6.57	0.622	12.21	1.64	10.57	35.24	0.22	0.03	0.35	0.05
		11:36	5.76	6.01	0.25	0.01	0.24	0.05	0.28	331.43	0.17														
		12:00	5.87	6.09	0.22	0.02	0.20	0.04	0.08	916.73	0.46														
		12:28	6.02	6.28	0.26	0.02	0.24	0.05	0.15	607.03	0.30														
		12:55	6.12	6.34	0.22	0.02	0.20	0.04	0.10	796.87	0.40														
		13:22	6.29	6.56	0.27	0.02	0.24	0.05	0.07	1438.57	0.72														
		13:51	6.46	6.57	0.11	-0.02	0.13	0.02	0.11	444.47	0.22														
		14:23	6.56	6.43	-0.13	0.00	-0.14	-0.03	---	0.00	0.00														
		14:54	6.74	6.52	-0.22	0.02	-0.24	-0.05	---	0.00	0.00														
		15:22	6.78	6.54	-0.24	-0.02	-0.22	-0.04	---	0.00	0.00														

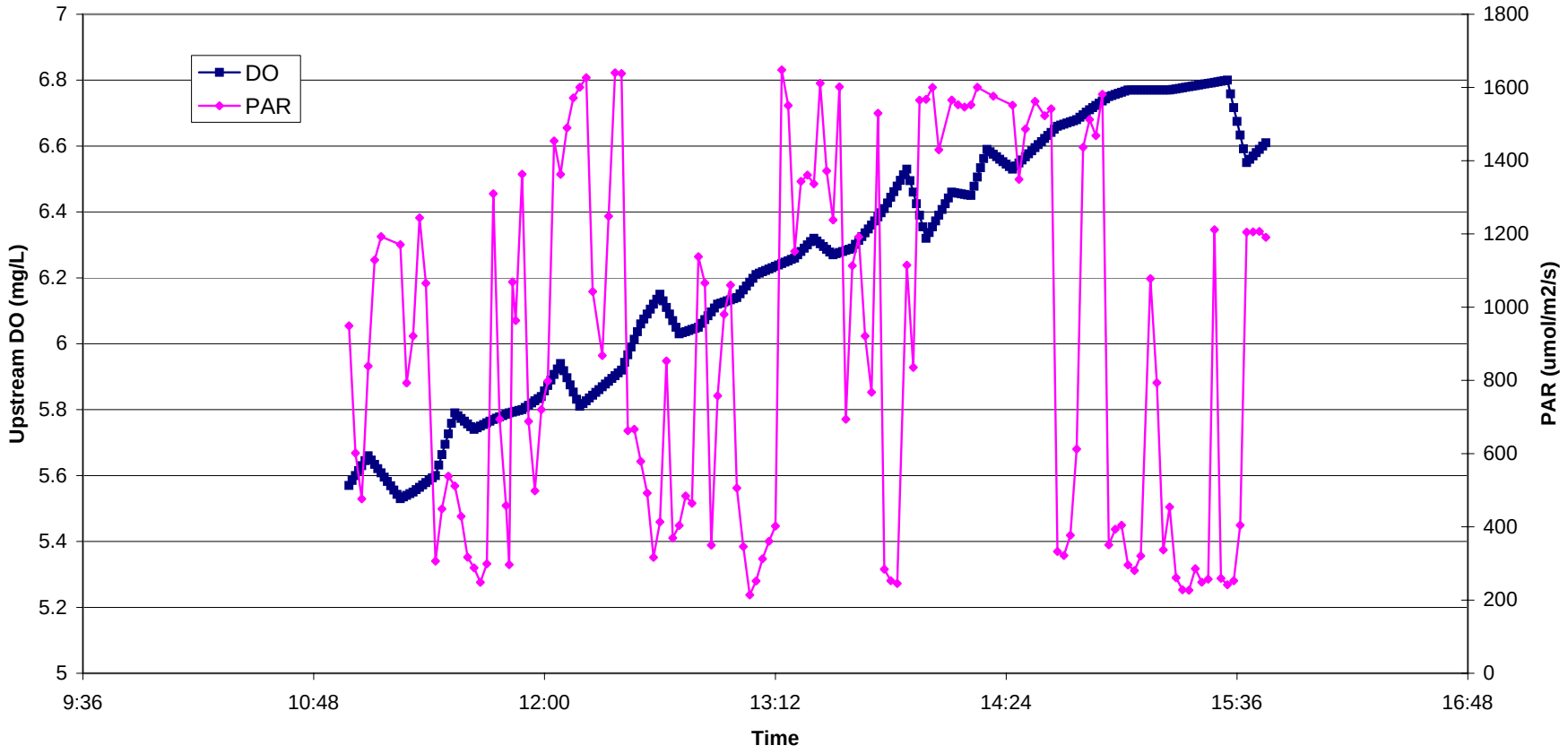
APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP	NPP	R	Vegetation (kg DW/m²)	GPP	NPP	R	PAR (mol/m²/d)	GPP	NPP	GPP	NPP
														(g O_2/m²/d)				(g O_2/kgDW/d)				(g O_2/mol)		(g O_2/kgDW/mol)	
FILAMENTOUS ALGAE	4	11:09	5.61	6.19	0.58	---	0.58	0.03	0.05	1192.8	0.60	9.37	11.7	2.78	0.87	1.91	1.336	2.08	0.65	1.43	44.00	0.06	0.02	0.05	0.01
		11:42	5.76	5.88	0.12	---	0.12	0.01	0.04	299.00	0.15														
		12:07	5.90	6.08	0.18	---	0.18	0.01	0.01	1489.50	0.75														
		12:34	6.12	6.50	0.38	---	0.38	0.02	0.13	316.50	0.16														
		13:02	6.16	6.57	0.41	---	0.41	0.02	0.13	346.00	0.17														
		13:28	6.29	6.71	0.42	---	0.42	0.02	0.03	1372.30	0.69														
		13:57	6.39	6.75	0.36	---	0.36	0.02	0.02	1565.20	0.79														
		14:30	6.57	6.44	-0.13	---	-0.13	-0.01	---	0.00	0.00														
		15:00	6.76	6.52	-0.24	---	-0.24	-0.01	---	0.00	0.00														
		15:29	6.79	6.54	-0.25	---	-0.25	-0.01	---	0.00	0.00														
	5	11:17	5.54	6.23	0.69	---	0.69	0.13	0.33	793.0	0.40	2.60	42.2	6.21	2.23	3.97	0.615	10.09	3.63	6.46	48.99	0.13	0.05	0.21	0.07
		11:46	5.78	5.88	0.10	---	0.10	0.02	0.06	693.80	0.35														
		12:09	5.85	6.09	0.24	---	0.24	0.05	0.06	1571.70	0.79														
		12:38	6.11	6.21	0.10	---	0.10	0.02	0.04	852.90	0.43														
		13:04	6.19	6.35	0.16	---	0.16	0.03	0.29	214.00	0.11														
		13:32	6.28	6.67	0.39	---	0.39	0.08	0.09	1601.60	0.80														
		14:01	6.36	6.25	-0.11	---	-0.11	-0.02	-0.03	1600.10	0.80														
		14:36	6.62	6.50	-0.12	---	-0.12	-0.02	---	0.00	0.00														
		15:04	6.77	6.64	-0.13	---	-0.13	-0.03	---	0.00	0.00														
		15:31	6.80	6.69	-0.11	---	-0.11	-0.02	---	0.00	0.00														
	6	11:21	5.56	5.30	-0.26	---	-0.26	-0.04	-0.07	1244.2	0.62	2.95	37.2	2.77	-1.59	4.36	0.496	5.59	-3.21	8.80	41.02	0.07	-0.04	0.14	-0.08
		11:48	5.79	5.81	0.02	---	0.02	0.00	0.02	458.00	0.23														
		12:13	5.83	5.96	0.13	---	0.13	0.02	0.03	1627.00	0.82														
		12:40	6.07	6.20	0.13	---	0.13	0.02	0.12	369.60	0.19														
		13:08	6.22	6.25	0.03	---	0.03	0.01	0.03	312.60	0.16														
		13:34	6.28	6.54	0.26	---	0.26	0.04	0.13	693.80	0.35														
		14:03	6.39	6.26	-0.13	---	-0.13	-0.02	-0.03	1429.60	0.72														
		14:38	6.64	6.54	-0.10	---	-0.10	-0.02	---	0.00	0.00														
		15:06	6.77	6.66	-0.11	---	-0.11	-0.02	---	0.00	0.00														
		15:35	6.72	6.48	-0.24	---	-0.24	-0.04	---	0.00	0.00														
	Average	11:15	5.57	5.91	0.34	0.06	0.28	0.03	0.05	1076.7	0.54	4.97	22.1	3.22	0.43	2.79	0.816	3.95	0.53	3.42	44.67	0.07	0.01	0.09	0.01
		11:45	5.77	5.86	0.08	0.01	0.08	0.01	0.03	483.60	0.24														
		12:09	5.86	6.04	0.18	0.02	0.16	0.02	0.02	1562.73	0.78														
		12:37	6.10	6.30	0.20	0.02	0.18	0.02	0.07	513.00	0.26														
		13:04	6.19	6.39	0.20	0.02	0.18	0.02	0.12	290.87	0.15														
		13:31	6.28	6.64	0.36	0.02	0.34	0.03	0.06	1222.57	0.61														
		14:00	6.38	6.42	0.04	-0.02	0.06	0.01	0.01	1531.63	0.77														
		14:34	6.61	6.49	-0.12	0.00	-0.12	-0.01	---	0.00	0.00														
		15:03	6.77	6.61	-0.16	0.02	-0.18	-0.02	---	0.00	0.00														
		15:31	6.77	6.57	-0.20	-0.02	-0.18	-0.02	---	0.00	0.00														

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m²/d)	NPP (g O_2/m²/d)	R (g O_2/m²/d)	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
CONTROL	7	11:23	5.58	5.70	0.12	---	0.12	0.19	0.36	1065.2	0.53	0.31	350.6	---	---	---	---	---	---	---	---	---	---	---	---
		11:50	5.79	5.79	0.00	---	0.00	0.00	-0.01	1068.70	0.54														
		12:15	5.84	5.90	0.06	---	0.06	0.09	0.17	1042.80	0.52														
		12:44	6.04	6.04	0.00	---	0.00	0.01	0.02	484.10	0.24														
		13:10	6.23	6.25	0.02	---	0.02	0.04	0.21	360.60	0.18														
		13:38	6.31	6.35	0.04	---	0.04	0.06	0.10	1191.80	0.60														
		14:09	6.46	6.40	-0.06	---	-0.06	-0.09	-0.12	1552.70	0.78														
		14:42	6.67	6.69	0.02	---	0.02	0.04	---	0.00	0.00														
		15:11	6.77	6.77	0.00	---	0.00	0.00	---	0.00	0.00														
		15:37	6.63	6.53	-0.10	---	-0.10	-0.17	---	0.00	0.00														
	8	11:28	5.66	5.63	-0.03	---	-0.03	-0.06	-0.25	449.1	0.23	0.30	364.3	---	---	---	---	---	---	---	---	---	---	---	---
		11:51	5.80	5.80	0.00	---	0.00	0.01	0.02	963.50	0.48														
		12:20	5.89	5.90	0.01	---	0.01	0.02	0.04	1248.20	0.63														
		12:46	6.04	6.08	0.04	---	0.04	0.06	0.26	464.40	0.23														
		13:14	6.24	6.26	0.02	---	0.02	0.03	0.03	1648.00	0.83														
		13:40	6.34	6.37	0.03	---	0.03	0.06	0.12	921.20	0.46														
		14:11	6.45	6.44	-0.01	---	-0.01	-0.02	-0.03	1546.30	0.78														
		14:44	6.67	6.67	0.00	---	0.00	-0.01	---	0.00	0.00														
		15:13	6.77	6.81	0.04	---	0.04	0.07	---	0.00	0.00														
		15:41	6.57	6.59	0.02	---	0.02	0.03	---	0.00	0.00														
	9	11:30	5.73	5.82	0.09	---	0.09	0.18	0.67	538.4	0.27	0.26	424.8	---	---	---	---	---	---	---	---	---	---	---	---
		11:55	5.81	5.83	0.02	---	0.02	0.03	0.09	687.90	0.35														
		12:22	5.90	5.90	0.00	---	0.00	-0.01	-0.01	1640.00	0.82														
		12:50	6.07	6.09	0.02	---	0.02	0.03	0.06	1066.20	0.53														
		13:16	6.25	6.27	0.02	---	0.02	0.04	0.05	1550.70	0.78														
		13:44	6.39	6.38	0.00	---	0.00	-0.01	-0.01	1529.80	0.77														
		14:15	6.51	6.52	0.01	---	0.01	0.03	0.03	1600.60	0.80														
		14:48	6.70	6.69	0.00	---	0.00	-0.01	---	0.00	0.00														
		15:17	6.77	6.80	0.03	---	0.03	0.05	---	0.00	0.00														
		15:43	6.59	6.61	0.02	---	0.02	0.04	---	0.00	0.00														
	Average	11:27	5.66	5.72	0.06	---	0.06	0.10	0.30	684.2	0.34	0.29	377.3	---	---	---	---	---	---	---	---	---	---	---	---
		11:52	5.80	5.81	0.01	---	0.01	0.01	0.02	906.70	0.45														
		12:19	5.88	5.90	0.02	---	0.02	0.04	0.06	1310.33	0.66														
		12:46	6.05	6.07	0.02	---	0.02	0.03	0.10	671.57	0.34														
		13:13	6.24	6.26	0.02	---	0.02	0.03	0.06	1186.43	0.60														
		13:40	6.35	6.37	0.02	---	0.02	0.04	0.06	1214.27	0.61														
		14:11	6.47	6.45	-0.02	---	-0.02	-0.03	-0.04	1566.53	0.79														
		14:44	6.68	6.68	0.00	---	0.00	0.01	---	0.00	0.00														
		15:13	6.77	6.79	0.02	---	0.02	0.04	---	0.00	0.00														
		15:40	6.60	6.58	-0.02	---	-0.02	-0.04	---	0.00	0.00														

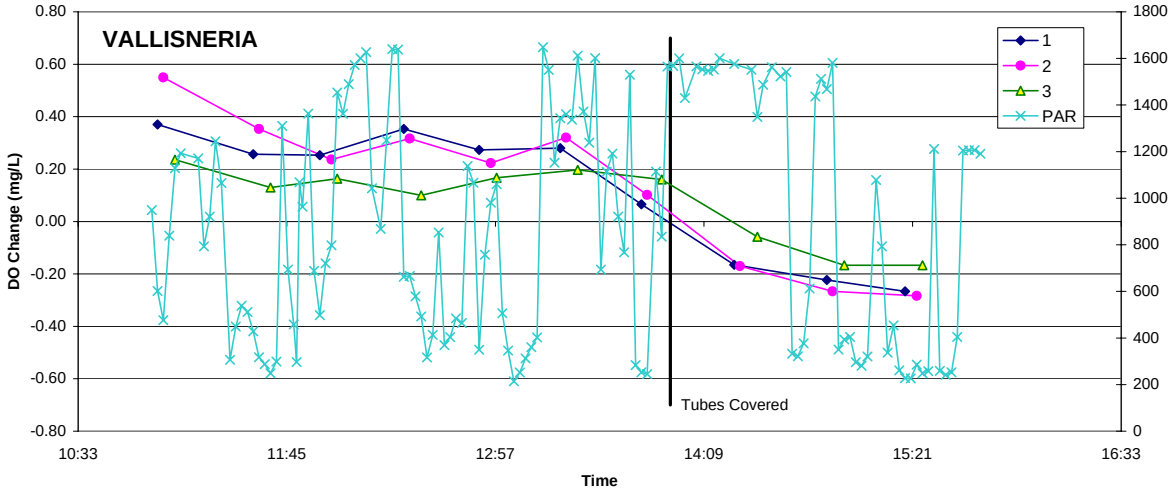
Mesocosm Area (m²): 0.1394
Mesocosm Volume (m³): 0.00834
Daylight (hrs/d): 13

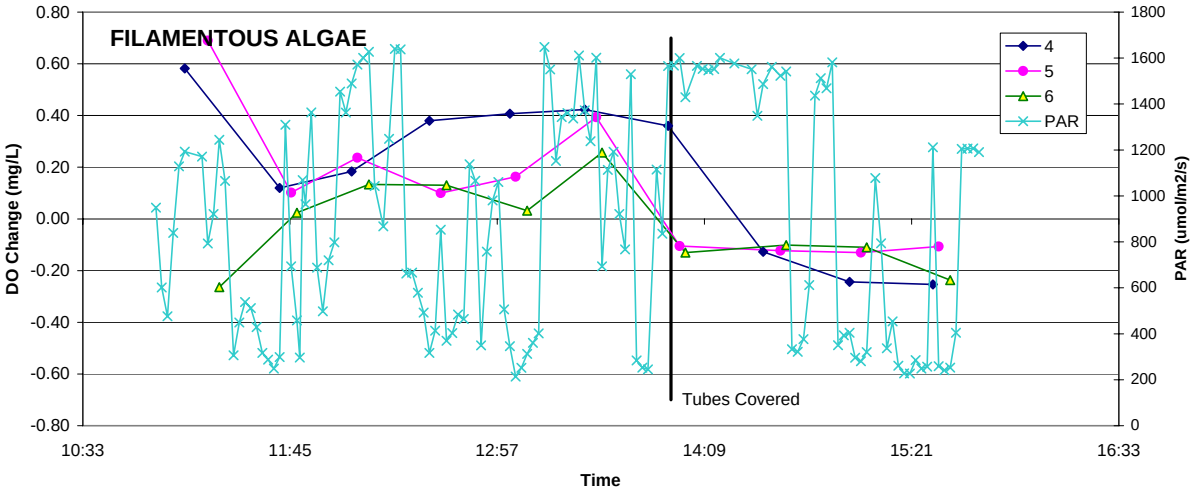


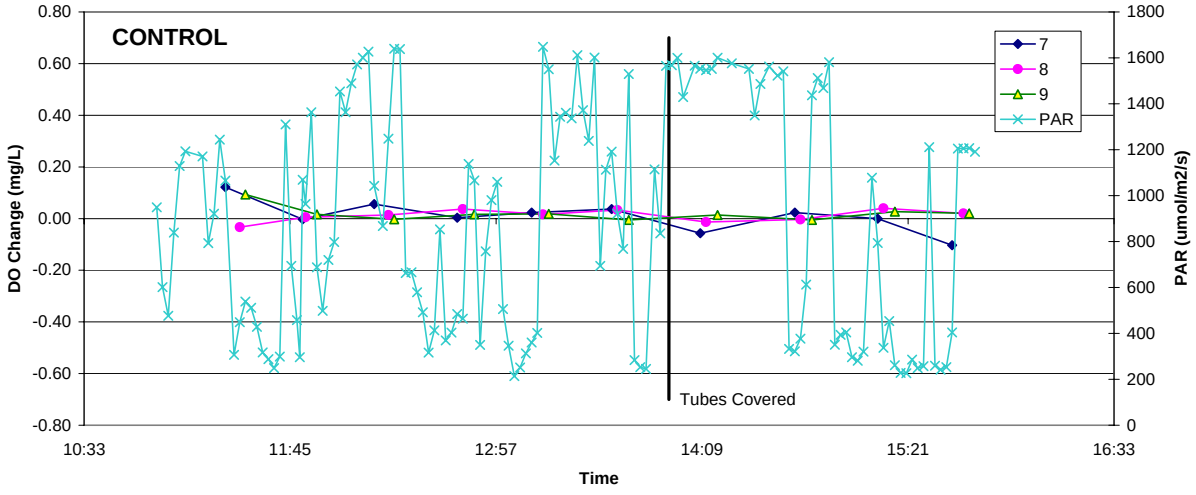
APPENDIX H-3

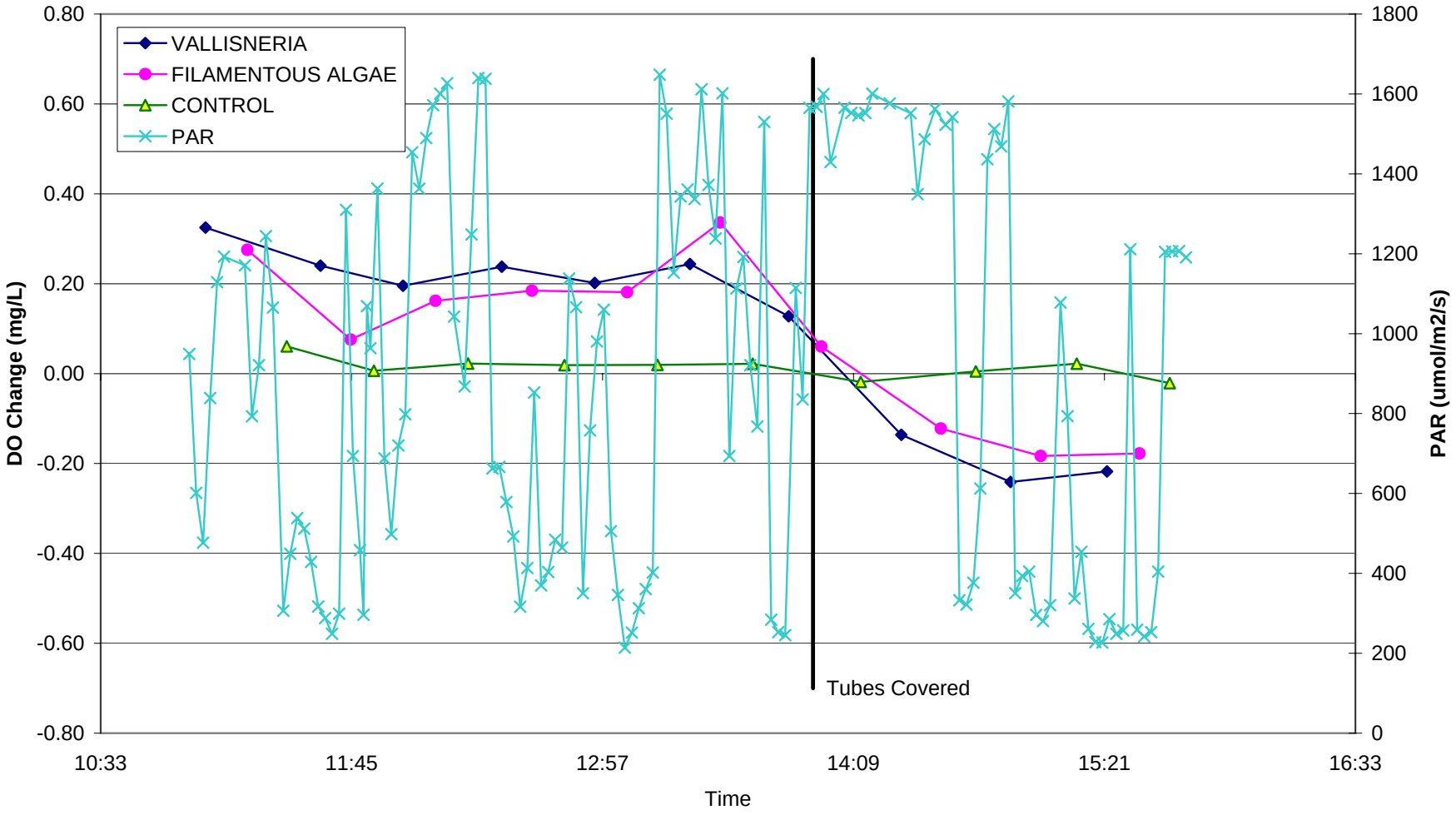
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05



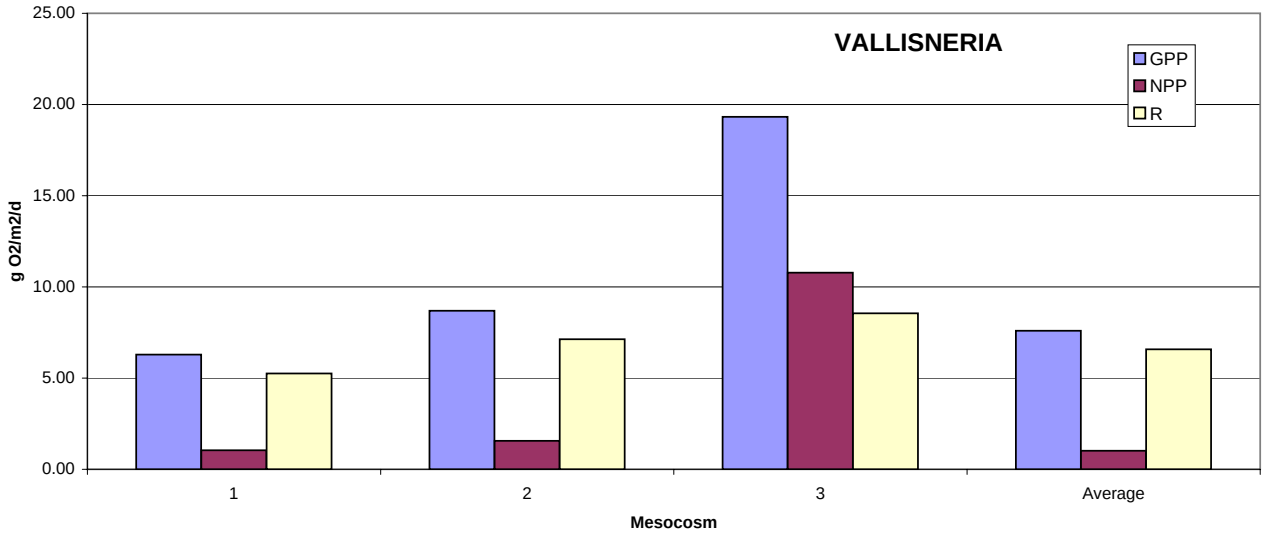


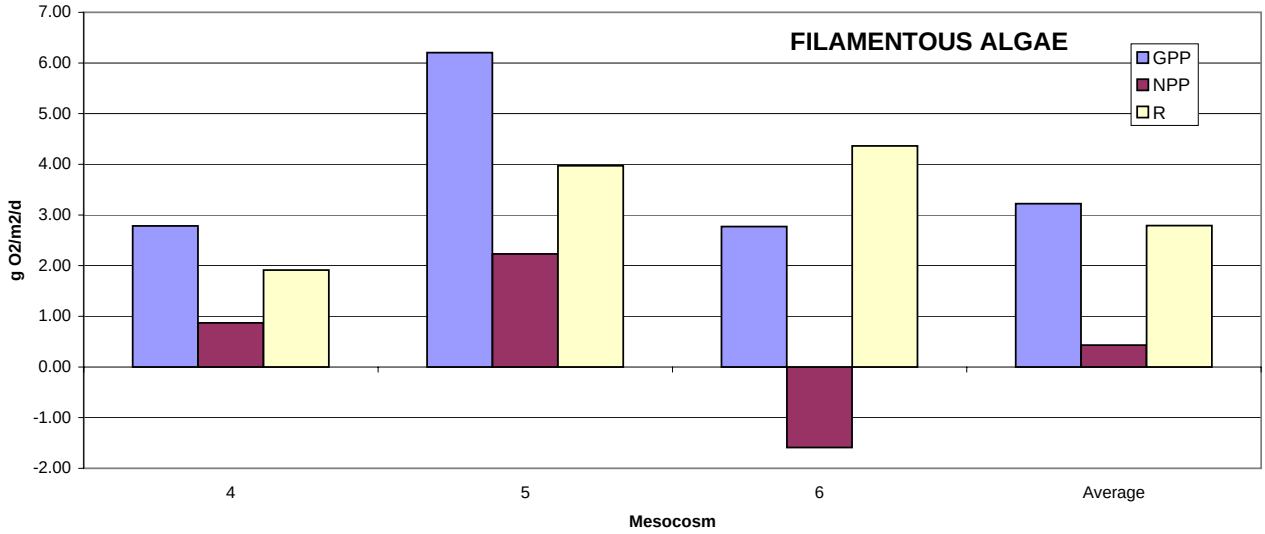




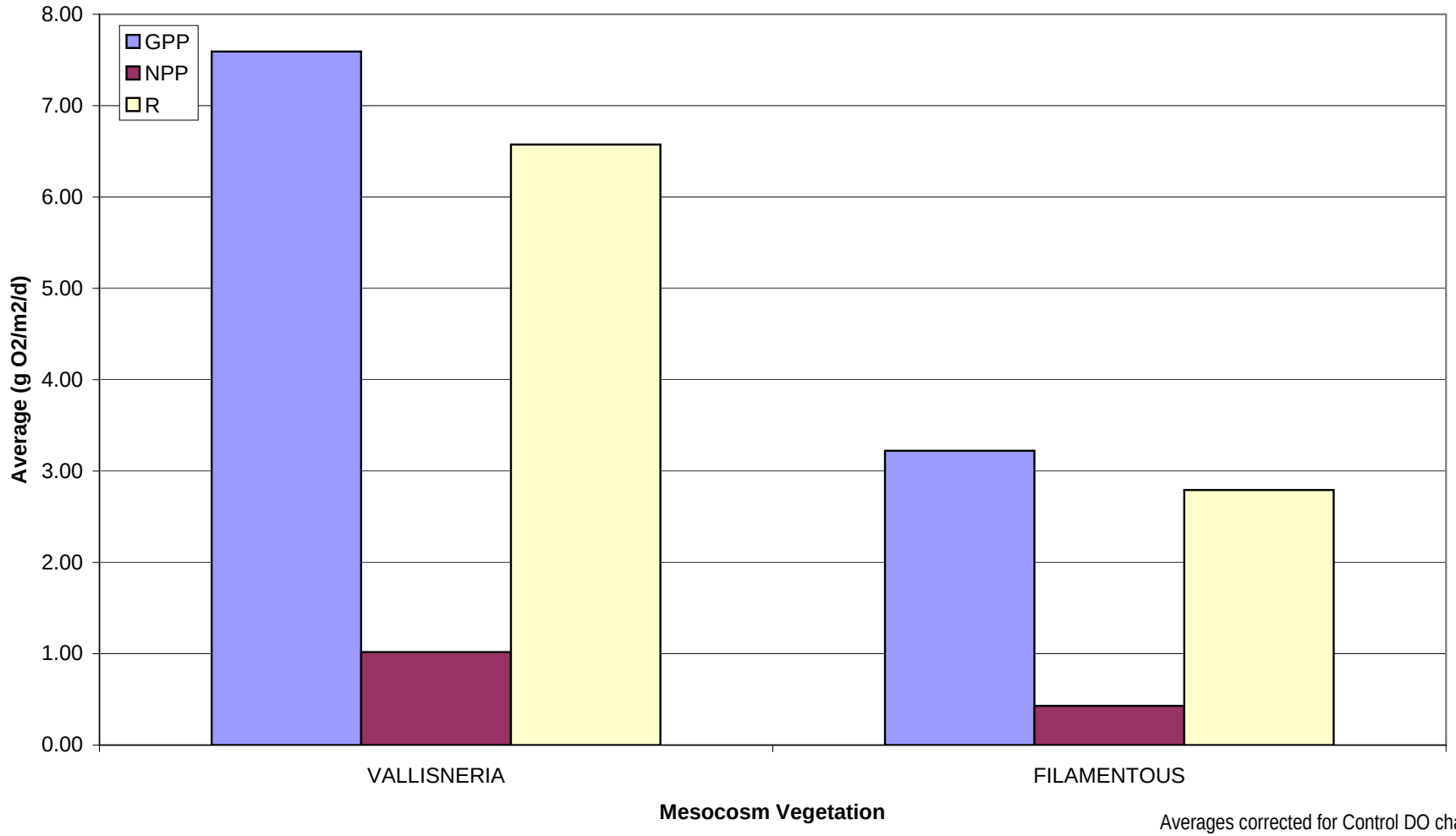
APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05





Averages corrected for Control DO changes



Averages corrected for Control DO changes

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 4/20/05

APPENDIX H-3

MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05

		VALLISNERIA				UTRICULARIA				CONTROL			
PARAMETER	UNITS	1	3	6	Average [a]	4	7	9	Average [a]	2	5	8	Average
UPSTREAM DO	mg/L	4.24	4.28	4.25	4.27	4.25	4.25	4.26	4.25	4.23	4.25	4.25	4.24
DOWNSTREAM DO		4.29	4.35	4.33	4.33	4.38	4.34	4.40	4.37	4.23	4.24	4.28	4.25
CHANGE DO		0.05	0.07	0.08	0.07	0.13	0.08	0.15	0.12	0.00	-0.01	0.03	0.01
TRAVEL TIME	minutes	0.96	1.53	3.00	1.83	4.30	4.79	1.68	3.59	0.21	0.20	0.23	0.21
VELOCITY	m/hr	114.2	71.8	36.5	59.9	25.5	22.9	65.2	30.6	523	538	477	511
GPP	g $O_2/m^2/d$	7.54	8.27	3.70	5.27	6.08	5.98	14.03	7.48	---	---	---	---
NPP24		3.37	2.38	1.96	2.28	1.10	0.75	5.64	1.81	---	---	---	---
R24		4.17	5.89	1.74	2.99	4.98	5.22	8.39	5.68	---	---	---	---
Vegetation	kg DW/m^2	0.639	0.630	0.646	0.638	0.245	0.297	0.180	0.241	---	---	---	---
GPP	g O_2/kg DW/d	11.79	13.14	5.73	8.26	24.82	20.15	77.82	31.11	---	---	---	---
NPP24		5.27	3.78	3.04	3.57	4.48	2.54	31.29	7.51	---	---	---	---
R24		6.52	9.36	2.69	4.69	20.34	17.62	46.54	23.60	---	---	---	---
PAR	mol/hr	0.183	0.175	0.187	0.189	0.170	0.195	0.203	0.199	---	---	---	---
	$mol/m^2/d$	26.6	25.3	30.0	27.2	26.0	31.2	31.3	29.1	---	---	---	---
GPP	g O_2/mol	0.284	0.327	0.123	0.194	0.234	0.191	0.448	0.258	---	---	---	---
NPP		0.127	0.094	0.065	0.084	0.042	0.024	0.180	0.062	---	---	---	---
GPP	g O_2/kg DW/mol	0.444	0.519	0.191	0.303	0.956	0.645	2.48	1.07	---	---	---	---
NPP		0.198	0.149	0.101	0.131	0.173	0.081	0.999	0.259	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m²/d)	NPP (g O_2/m²/d)	R (g O_2/m²/d)	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
VALLISNERIA	1	9:58	3.71	3.84	0.13	---	0.13	0.07	1.96	67.9	0.03	0.96	114.2	7.54	3.37	4.17	0.639	11.79	5.27	6.52	26.56	0.28	0.13	0.44	0.20
		10:18	3.90	3.81	-0.09	---	-0.09	-0.04	-0.68	130.60	0.07														
		10:46	3.97	3.91	-0.05	---	-0.05	-0.03	-0.64	88.98	0.04														
		11:00	3.90	3.78	-0.12	---	-0.12	-0.06	-0.85	151.23	0.08														
		11:16	4.16	4.10	-0.06	---	-0.06	-0.03	-0.38	164.00	0.08														
		11:29	4.10	4.02	-0.08	---	-0.08	-0.04	-0.49	174.76	0.09														
		11:49	3.91	3.80	-0.11	---	-0.11	-0.05	-0.83	130.75	0.07														
		12:04	3.99	4.00	0.02	---	0.02	0.01	0.06	248.80	0.12														
		12:21	4.23	4.31	0.08	---	0.08	0.04	0.37	216.30	0.11														
		12:38	4.35	4.50	0.15	---	0.15	0.08	0.15	1002.90	0.50														
		12:55	4.19	4.27	0.08	---	0.08	0.04	0.09	970.00	0.49														
		13:11	4.55	4.79	0.24	---	0.24	0.13	0.34	743.70	0.37														
		13:33	4.52	4.58	0.06	---	0.06	0.03	---	---	---														
		13:50	4.56	4.85	0.29	---	0.29	0.15	---	---	---														
		14:09	4.58	4.66	0.08	---	0.08	0.04	---	---	---														
		14:23	4.72	4.85	0.13	---	0.13	0.07	---	---	---														
		14:38	4.73	4.90	0.17	---	0.17	0.09	0.27	660.90	0.33														
	3	10:03	3.90	3.78	-0.12	---	-0.12	-0.04	-1.06	71.3	0.04	1.53	71.8	8.27	2.38	5.89	0.630	13.14	3.78	9.36	25.31	0.33	0.09	0.52	0.15
		10:24	4.02	3.88	-0.14	---	-0.14	-0.04	-0.90	99.00	0.05														
		10:49	3.98	3.86	-0.12	---	-0.12	-0.04	-0.90	83.34	0.04														
		11:03	3.97	3.87	-0.10	---	-0.10	-0.03	-0.37	168.68	0.08														
		11:19	4.16	4.09	-0.07	---	-0.07	-0.02	-0.36	133.89	0.07														
		11:32	4.14	4.05	-0.09	---	-0.09	-0.03	-0.31	190.32	0.10														
		11:53	3.86	3.96	0.10	---	0.10	0.03	0.42	160.01	0.08														
		12:08	4.05	4.11	0.06	---	0.06	0.02	0.17	231.70	0.12														
		12:24	4.31	4.41	0.10	---	0.10	0.03	0.12	544.20	0.27														
		12:41	4.34	4.50	0.16	---	0.16	0.05	0.16	685.90	0.34														
		12:58	4.20	4.32	0.12	---	0.12	0.04	0.08	1009.40	0.51														
		13:14	4.57	4.75	0.18	---	0.18	0.06	0.23	508.20	0.25														
		13:38	4.63	4.76	0.13	---	0.13	0.04	---	---	---														
		13:54	4.52	4.86	0.35	---	0.35	0.11	---	---	---														
		14:12	4.63	4.77	0.14	---	0.14	0.05	---	---	---														
		14:26	4.72	4.94	0.22	---	0.22	0.07	---	---	---														
		14:41	4.72	5.00	0.28	---	0.28	0.09	0.28	646.80	0.32														
	6	9:49	3.73	3.89	0.16	---	0.16	0.03	0.79	68.7	0.03	3.00	36.5	3.70	1.96	1.74	0.646	5.73	3.04	2.69	29.97	0.12	0.07	0.19	0.10
		10:10	3.76	3.77	0.01	---	0.01	0.00	0.01	152.73	0.08														
		10:35	3.88	3.79	-0.09	---	-0.09	-0.02	-0.17	178.45	0.09														
		10:54	3.89	3.79	-0.10	---	-0.10	-0.02	-0.35	91.82	0.05														
		11:08	3.99	3.87	-0.12	---	-0.12	-0.02	-0.16	251.10	0.13														
		11:23	4.10	3.96	-0.14	---	-0.14	-0.02	-0.41	112.00	0.06														
		11:37	4.12	3.98	-0.14	---	-0.14	-0.02	-0.30	159.41	0.08														
		11:57	3.87	3.83	-0.04	---	-0.04	-0.01	-0.03	490.40	0.25														
		12:14	4.19	4.26	0.07	---	0.07	0.01	0.02	924.70	0.46														
		12:29	4.32	4.36	0.04	---	0.04	0.01	0.03	502.90	0.25														
		12:48	4.34	4.52	0.18	---	0.18	0.03	0.34	174.32	0.09														
		13:03	4.45	4.52	0.07	---	0.07	0.01	0.02	987.00	0.50														
		13:19	4.57	4.82	0.25	---	0.25	0.04	---	---	---														
		13:43	4.65	4.88	0.23	---	0.23	0.04	---	---	---														
		14:00	4.54	4.88	0.34	---	0.34	0.06	---	---	---														
		14:16	4.64	4.84	0.20	---	0.20	0.03	---	---	---														
		14:32	4.73	5.04	0.31	---	0.31	0.05	---	---	---														
		14:47	4.72	5.01	0.29	---	0.29	0.05	0.13	762.60	0.38														

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m²/d)	NPP	R	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
	Average	10:03	3.79	3.80	0.01	-0.03	0.03	0.01	0.18	97.3	0.05	1.83	59.9	5.27	2.28	2.99	0.638	8.26	3.57	4.69	27.25	0.19	0.08	0.30	0.13
		10:25	3.93	3.83	-0.10	-0.12	0.01	0.00	0.05	136.02	0.07														
		10:49	3.94	3.85	-0.09	0.01	-0.10	-0.03	-0.61	88.05	0.04														
		11:03	3.95	3.84	-0.11	0.03	-0.15	-0.04	-0.42	190.34	0.10														
		11:19	4.14	4.05	-0.09	-0.03	-0.06	-0.02	-0.25	136.63	0.07														
		11:32	4.12	4.02	-0.11	0.01	-0.12	-0.03	-0.36	174.83	0.09														
		11:53	3.88	3.86	-0.01	-0.01	0.00	0.00	-0.01	260.39	0.13														
		12:08	4.08	4.12	0.05	0.00	0.05	0.01	0.05	468.40	0.23														
		12:24	4.29	4.36	0.07	0.01	0.06	0.02	0.08	421.13	0.21														
		12:42	4.34	4.51	0.16	0.01	0.15	0.04	0.14	621.04	0.31														
		12:58	4.28	4.37	0.09	-0.05	0.14	0.04	0.07	988.80	0.50														
		13:14	4.56	4.79	0.22	0.07	0.15	0.04	0.13	625.95	0.31														
		13:38	4.60	4.74	0.14	0.05	0.09	0.02	---	---	---														
		13:54	4.54	4.86	0.33	0.02	0.31	0.08	---	---	---														
		14:12	4.61	4.76	0.14	0.01	0.14	0.04	---	---	---														
		14:27	4.72	4.94	0.22	-0.03	0.25	0.07	---	---	---														
		14:42	4.72	4.97	0.25	0.01	0.24	0.06	0.19	690.10	0.35														
UTRICULARIA	4	9:43	3.74	3.81	0.07	---	0.07	0.01	0.18	94.0	0.05	4.30	25.5	6.08	1.10	4.98	0.245	24.82	4.48	20.34	25.95	0.23	0.04	0.96	0.17
		10:05	3.85	3.58	-0.27	---	-0.27	-0.03	-0.81	77.08	0.04														
		10:26	3.99	3.54	-0.45	---	-0.45	-0.05	-1.10	94.16	0.05														
		10:51	3.93	3.68	-0.25	---	-0.25	-0.03	-0.67	84.49	0.04														
		11:05	3.99	3.73	-0.26	---	-0.26	-0.03	-0.32	186.63	0.09														
		11:20	4.13	3.83	-0.30	---	-0.30	-0.03	-0.54	126.46	0.06														
		11:34	4.16	3.86	-0.30	---	-0.30	-0.03	-0.33	205.60	0.10														
		11:54	3.85	3.94	0.09	---	0.09	0.01	0.13	150.34	0.08														
		12:11	4.13	4.31	0.18	---	0.18	0.02	0.06	706.80	0.35														
		12:25	4.33	4.57	0.24	---	0.24	0.03	0.08	681.90	0.34														
		12:44	4.33	4.76	0.44	---	0.44	0.05	0.47	214.70	0.11														
		13:00	4.29	4.71	0.42	---	0.42	0.05	0.10	1005.40	0.50														
		13:16	4.58	5.01	0.43	---	0.43	0.05	0.23	444.10	0.22														
		13:39	4.61	5.17	0.56	---	0.56	0.07	---	---	---														
		13:57	4.52	4.83	0.31	---	0.31	0.04	---	---	---														
		14:13	4.65	5.01	0.36	---	0.36	0.04	---	---	---														
		14:28	4.71	5.28	0.57	---	0.57	0.07	---	---	---														
		14:42	4.72	5.24	0.52	---	0.52	0.06	0.18	678.60	0.34														
	7	9:51	3.72	3.72	0.00	---	0.00	0.00	-0.01	75.6	0.04	4.79	22.9	5.98	0.75	5.22	0.297	20.15	2.54	17.62	31.23	0.19	0.02	0.65	0.08
		10:13	3.76	3.47	-0.29	---	-0.29	-0.03	-0.36	169.63	0.09														
		10:37	3.89	3.66	-0.23	---	-0.23	-0.02	-0.30	160.31	0.08														
		10:56	3.88	3.56	-0.32	---	-0.32	-0.03	-0.61	108.81	0.05														
		11:09	4.00	3.60	-0.40	---	-0.40	-0.04	-0.32	256.40	0.13														
		11:25	4.10	3.71	-0.39	---	-0.39	-0.04	-0.61	133.59	0.07														
		11:38	4.10	3.70	-0.40	---	-0.40	-0.04	-0.53	155.97	0.08														
		11:59	3.90	3.88	-0.02	---	-0.02	0.00	-0.01	592.70	0.30														
		12:15	4.20	4.23	0.03	---	0.03	0.00	0.01	910.70	0.46														
		12:31	4.31	4.43	0.13	---	0.13	0.01	0.07	353.00	0.18														
		12:49	4.35	4.82	0.48	---	0.48	0.05	0.31	324.20	0.16														
		13:05	4.51	5.01	0.50	---	0.50	0.05	0.10	1035.80	0.52														
		13:20	4.57	4.84	0.27	---	0.27	0.03	---	---	---														
		13:45	4.65	5.10	0.45	---	0.45	0.05	---	---	---														
		14:02	4.55	4.78	0.23	---	0.23	0.02	---	---	---														
		14:18	4.62	5.20	0.58	---	0.58	0.06	---	---	---														
		14:33	4.74	5.10	0.36	---	0.36	0.04	---	---	---														
		14:49	4.72	5.26	0.54	---	0.54	0.06	0.14	787.70	0.40														

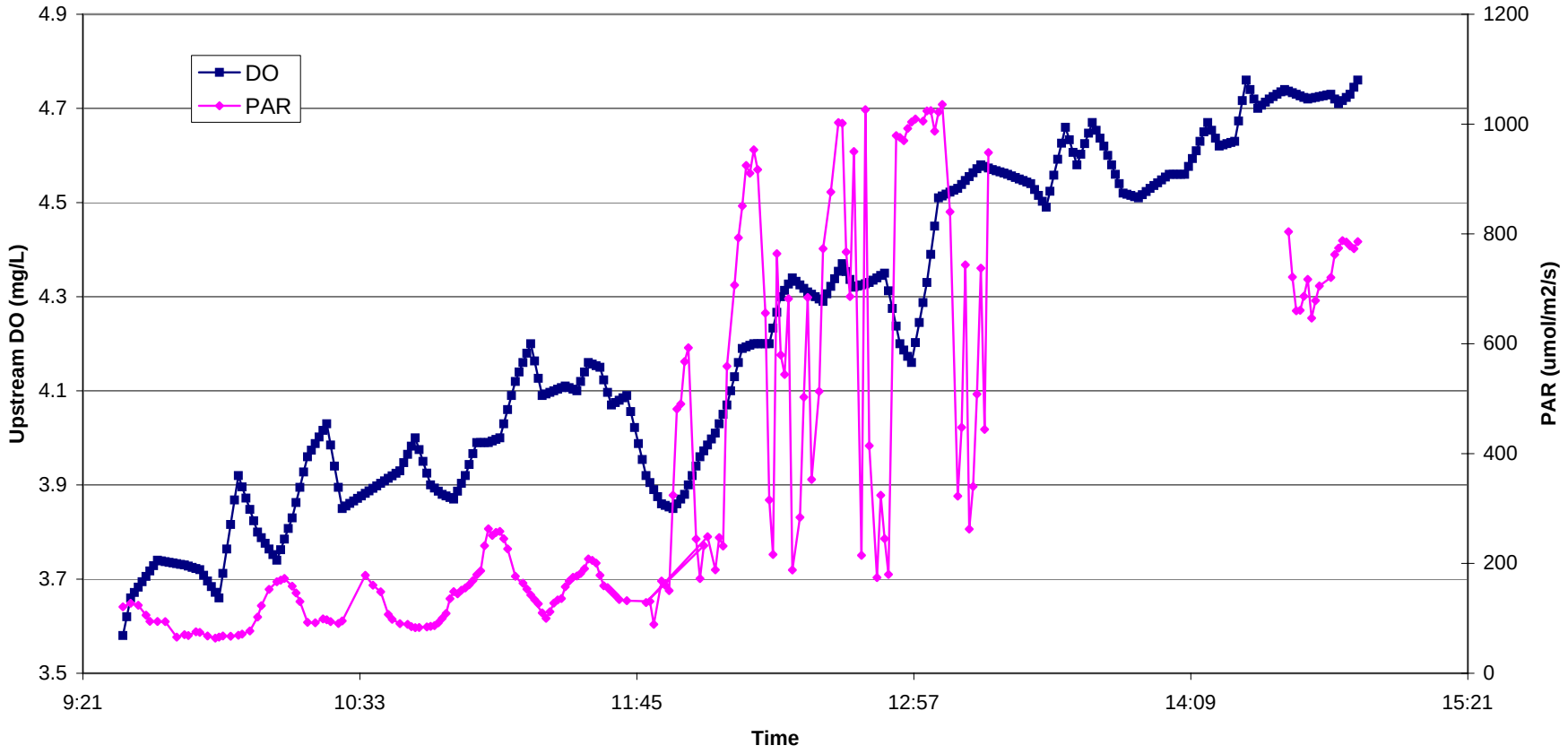
APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m²/d)	NPP (g O_2/m²/d)	R (g O_2/m²/d)	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
	9	9:56	3.67	3.56	-0.11	---	-0.11	-0.03	-1.04	63.9	0.03	1.68	65.2	14.03	5.64	8.39	0.180	77.82	31.29	46.54	31.33	0.45	0.18	2.48	1.00
		10:17	3.86	3.61	-0.25	---	-0.25	-0.08	-1.02	146.25	0.07														
		10:42	3.92	3.77	-0.15	---	-0.15	-0.04	-0.90	98.15	0.05														
		10:59	3.89	3.74	-0.15	---	-0.15	-0.04	-0.60	144.76	0.07														
		11:12	4.06	3.88	-0.18	---	-0.18	-0.05	-0.47	226.40	0.11														
		11:28	4.11	3.91	-0.20	---	-0.20	-0.06	-0.69	168.08	0.08														
		11:41	4.08	3.97	-0.11	---	-0.11	-0.03	-0.48	134.39	0.07														
		12:03	3.97	4.04	0.07	---	0.07	0.02	0.17	232.40	0.12														
		12:19	4.20	4.47	0.27	---	0.27	0.08	0.24	656.00	0.33														
		12:36	4.32	4.52	0.20	---	0.20	0.06	0.13	876.30	0.44														
		12:53	4.24	4.44	0.20	---	0.20	0.06	0.12	979.00	0.49														
		13:10	4.54	5.07	0.53	---	0.53	0.16	0.70	447.70	0.22														
		13:30	4.52	4.91	0.40	---	0.40	0.12	---	---	---														
		13:49	4.58	4.92	0.34	---	0.34	0.10	---	---	---														
		14:07	4.56	4.80	0.24	---	0.24	0.07	---	---	---														
		14:22	4.67	5.19	0.52	---	0.52	0.15	---	---	---														
		14:36	4.73	5.25	0.52	---	0.52	0.15	0.42	721.50	0.36														
		14:52	4.75	5.23	0.49	---	0.49	0.14	0.37	773.10	0.39														
	Average	9:50	3.71	3.70	-0.01	0.13	-0.15	-0.02	-0.52	77.8	0.04	3.59	30.6	7.48	1.81	5.68	0.241	31.11	7.51	23.60	29.06	0.26	0.06	1.07	0.26
		10:11	3.82	3.55	-0.27	-0.03	-0.24	-0.03	-0.52	130.99	0.07														
		10:35	3.93	3.66	-0.28	-0.12	-0.16	-0.02	-0.38	117.54	0.06														
		10:55	3.90	3.66	-0.24	0.01	-0.25	-0.03	-0.61	112.69	0.06														
		11:08	4.02	3.74	-0.28	0.03	-0.31	-0.04	-0.39	223.14	0.11														
		11:24	4.11	3.82	-0.30	-0.03	-0.27	-0.04	-0.52	142.71	0.07														
		11:37	4.11	3.84	-0.27	0.01	-0.28	-0.04	-0.47	165.32	0.08														
		11:58	3.91	3.95	0.04	-0.01	0.05	0.01	0.05	325.15	0.16														
		12:15	4.18	4.34	0.16	0.00	0.16	0.02	0.06	757.83	0.38														
		12:30	4.32	4.51	0.19	0.01	0.18	0.03	0.08	637.07	0.32														
		12:48	4.30	4.67	0.37	0.01	0.36	0.05	0.20	505.97	0.25														
		13:05	4.45	4.93	0.48	-0.05	0.53	0.07	0.18	829.63	0.42														
		13:22	4.55	4.92	0.37	0.07	0.30	0.04	0.19	444.10	0.22														
		13:44	4.61	5.06	0.45	0.05	0.40	0.06	---	---	---														
		14:02	4.54	4.80	0.26	0.02	0.24	0.03	---	---	---														
		14:17	4.65	5.13	0.48	0.01	0.48	0.07	---	---	---														
		14:32	4.73	5.21	0.48	-0.03	0.52	0.07	0.20	721.50	0.36														
		14:47	4.73	5.24	0.51	0.01	0.51	0.07	0.19	746.47	0.37														
CONTROL	2	9:38	3.71	3.72	0.01	---	0.01	0.03	0.64	105.8	0.05	0.21	523.1	---	---	---	---	---	---	---	---	---	---	---	---
		10:00	3.82	3.83	0.01	---	0.01	0.03	0.99	67.47	0.03														
		10:22	3.99	3.84	-0.15	---	-0.15	-0.35	-7.65	91.97	0.05														
		10:47	3.98	4.02	0.04	---	0.04	0.09	2.10	84.84	0.04														
		11:02	3.94	4.03	0.09	---	0.09	0.21	2.56	161.06	0.08														
		11:17	4.18	4.18	0.00	---	0.00	0.00	0.00	153.23	0.08														
		11:31	4.12	4.15	0.03	---	0.03	0.07	0.78	181.89	0.09														
		11:50	3.89	3.84	-0.05	---	-0.05	-0.12	-2.67	89.12	0.04														
		12:07	4.03	4.00	-0.03	---	-0.03	-0.07	-0.58	247.00	0.12														
		12:22	4.27	4.29	0.02	---	0.02	0.06	0.15	764.10	0.38														
		12:40	4.35	4.35	0.00	---	0.00	-0.01	-0.02	767.10	0.38														
		12:56	4.17	4.15	-0.02	---	-0.02	-0.06	-0.11	992.00	0.50														
		13:13	4.56	4.59	0.03	---	0.03	0.06	0.37	340.20	0.17														
		13:35	4.59	4.61	0.02	---	0.02	0.04	---	---	---														
		13:53	4.52	4.52	0.00	---	0.00	0.01	---	---	---														
		14:10	4.59	4.62	0.03	---	0.03	0.06	---	---	---														
		14:25	4.74	4.64	-0.10	---	-0.10	-0.24	---	---	---														
		14:39	4.72	4.73	0.01	---	0.01	0.02	0.05	686.40	0.34														

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m²/d)	NPP (g O_2/m²/d)	R (g O_2/m²/d)	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
	5	9:46	3.73	3.81	0.08	---	0.08	0.19	5.73	65.9	0.03	0.20	538.0	---	---	---	---	---	---	---	---	---	---	---	---
		10:08	3.79	3.83	0.04	---	0.04	0.10	1.67	123.02	0.06														
		10:28	3.90	3.70	-0.20	---	-0.20	-0.48	-10.53	90.57	0.05														
		10:53	3.89	3.93	0.04	---	0.04	0.09	2.07	86.63	0.04														
		11:06	3.99	3.95	-0.04	---	-0.04	-0.10	-0.84	232.30	0.12														
		11:22	4.09	4.09	0.00	---	0.00	-0.01	-0.16	99.99	0.05														
		11:35	4.15	4.08	-0.07	---	-0.07	-0.18	-1.79	200.50	0.10														
		11:56	3.86	3.87	0.01	---	0.01	0.02	0.10	481.10	0.24														
		12:12	4.16	4.19	0.03	---	0.03	0.07	0.19	793.00	0.40														
		12:28	4.33	4.31	-0.02	---	-0.02	-0.04	-0.26	283.90	0.14														
		12:45	4.33	4.39	0.06	---	0.06	0.15	0.30	1026.30	0.51														
		13:02	4.39	4.21	-0.18	---	-0.18	-0.44	-0.86	1024.40	0.51														
		13:17	4.57	4.62	0.05	---	0.05	0.11	0.24	948.10	0.48														
		13:42	4.63	4.70	0.08	---	0.08	0.18	---	---	---														
		13:58	4.52	4.58	0.06	---	0.06	0.14	---	---	---														
		14:15	4.65	4.55	-0.10	---	-0.10	-0.25	---	---	---														
		14:29	4.71	4.75	0.04	---	0.04	0.09	---	---	---														
		14:43	4.73	4.75	0.03	---	0.03	0.06	0.17	705.30	0.35														
	8	9:54	3.70	4.00	0.30	---	0.30	0.66	19.41	67.8	0.03	0.23	476.5	---	---	---	---	---	---	---	---	---	---	---	---
		10:14	3.79	3.65	-0.14	---	-0.14	-0.29	-3.39	172.67	0.09														
		10:41	3.91	3.91	0.00	---	0.00	-0.01	-0.16	107.17	0.05														
		10:57	3.87	3.83	-0.04	---	-0.04	-0.09	-1.38	135.78	0.07														
		11:11	4.03	4.08	0.05	---	0.05	0.11	0.88	245.10	0.12														
		11:26	4.11	4.03	-0.08	---	-0.08	-0.17	-2.44	136.18	0.07														
		11:40	4.08	4.15	0.08	---	0.08	0.16	2.29	141.81	0.07														
		12:01	3.94	3.95	0.01	---	0.01	0.02	0.18	244.50	0.12														
		12:17	4.20	4.20	0.00	---	0.00	0.00	0.00	917.20	0.46														
		12:33	4.30	4.31	0.01	---	0.01	0.03	0.13	513.40	0.26														
		12:51	4.31	4.28	-0.03	---	-0.03	-0.07	-0.78	179.95	0.09														
		13:07	4.52	4.59	0.07	---	0.07	0.15	0.35	840.40	0.42														
		13:29	4.53	4.67	0.14	---	0.14	0.31	---	---	---														
		13:46	4.64	4.69	0.05	---	0.05	0.12	---	---	---														
		14:05	4.56	4.56	0.00	---	0.00	0.00	---	---	---														
		14:20	4.63	4.72	0.09	---	0.09	0.20	---	---	---														
		14:35	4.74	4.70	-0.04	---	-0.04	-0.08	-0.20	804.00	0.40														
		14:50	4.72	4.72	0.00	---	0.00	-0.01	-0.02	785.10	0.39														
	Average	9:46	3.71	3.84	0.13	---	0.13	0.31	7.67	79.8	0.04	0.21	511.2	---	---	---	---	---	---	---	---	---	---	---	---
		10:07	3.80	3.77	-0.03	---	-0.03	-0.06	-1.01	121.05	0.06														
		10:30	3.93	3.82	-0.12	---	-0.12	-0.27	-5.57	96.57	0.05														
		10:52	3.92	3.93	0.01	---	0.01	0.02	0.47	102.42	0.05														
		11:06	3.99	4.02	0.03	---	0.03	0.08	0.70	212.82	0.11														
		11:21	4.13	4.10	-0.03	---	-0.03	-0.06	-0.95	129.80	0.07														
		11:35	4.12	4.13	0.01	---	0.01	0.02	0.28	174.73	0.09														
		11:55	3.90	3.89	-0.01	---	-0.01	-0.02	-0.17	271.57	0.14														
		12:12	4.13	4.13	0.00	---	0.00	0.00	0.00	652.40	0.33														
		12:27	4.30	4.30	0.01	---	0.01	0.02	0.07	520.47	0.26														
		12:45	4.33	4.34	0.01	---	0.01	0.02	0.06	657.78	0.33														
		13:01	4.36	4.32	-0.05	---	-0.05	-0.11	-0.22	952.27	0.48														
		13:19	4.55	4.63	0.07	---	0.07	0.17	0.52	644.15	0.32														
		13:41	4.62	4.67	0.05	---	0.05	0.11	---	---	---														
		13:58	4.53	4.55	0.02	---	0.02	0.05	---	---	---														
		14:15	4.62	4.63	0.01	---	0.01	0.01	---	---	---														
		14:29	4.73	4.70	-0.03	---	-0.03	-0.08	-0.19	804.00	0.40														
		14:44	4.72	4.73	0.01	---	0.01	0.02	0.06	725.60	0.36														

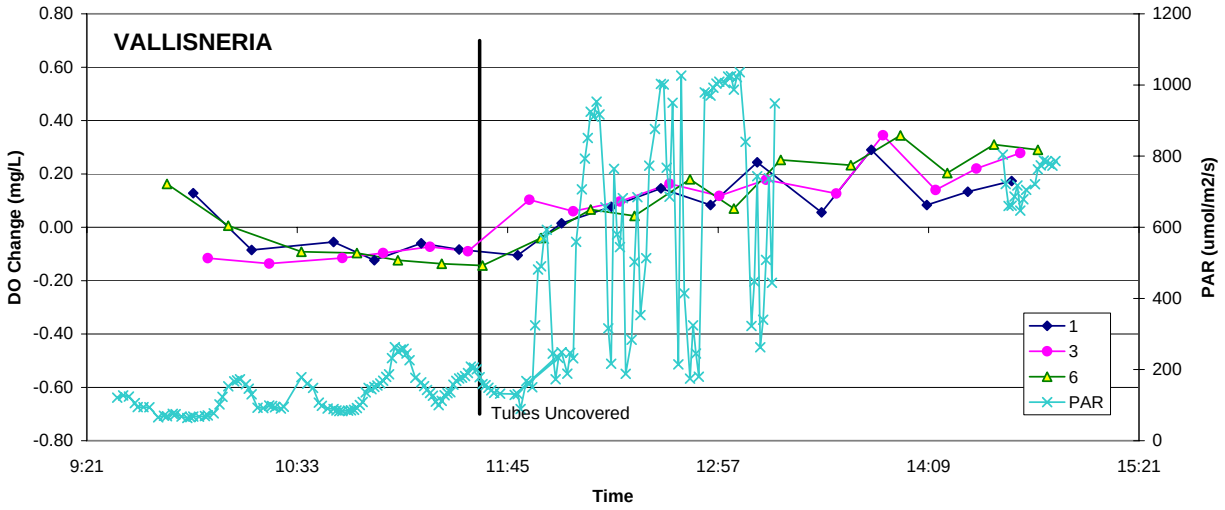
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

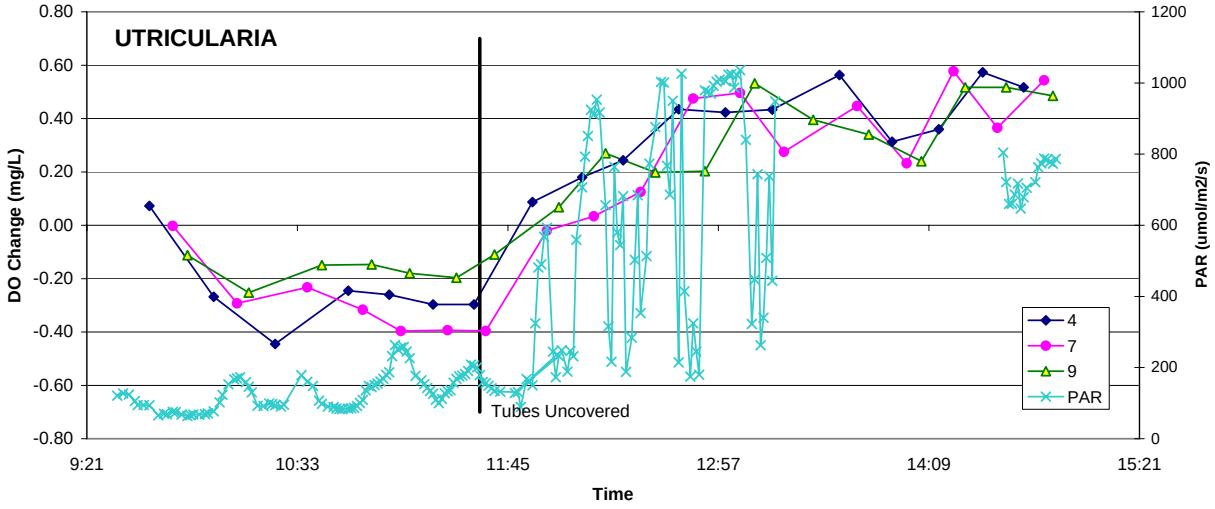


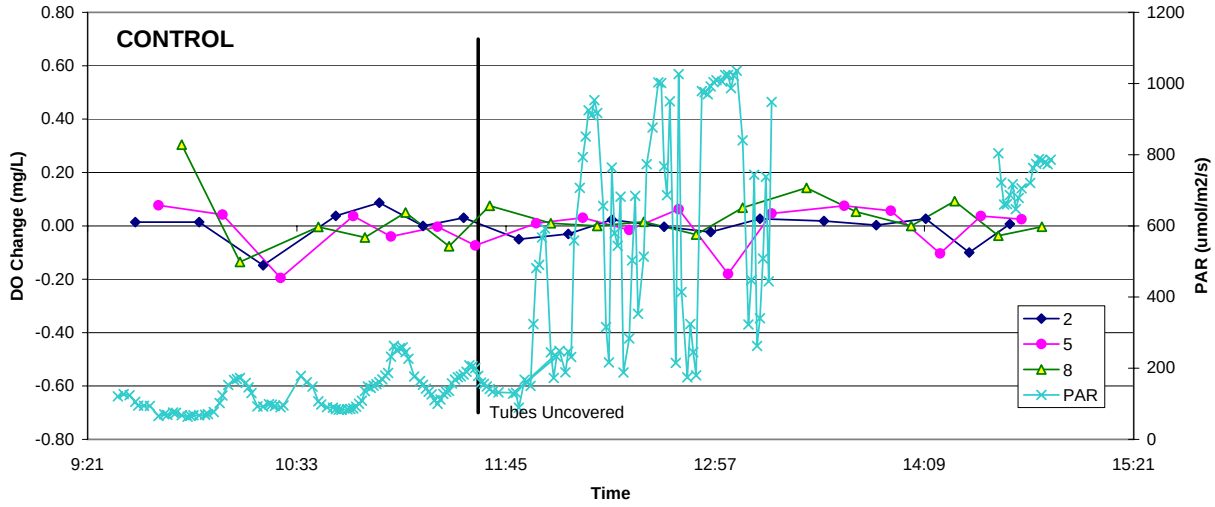
APPENDIX H-3

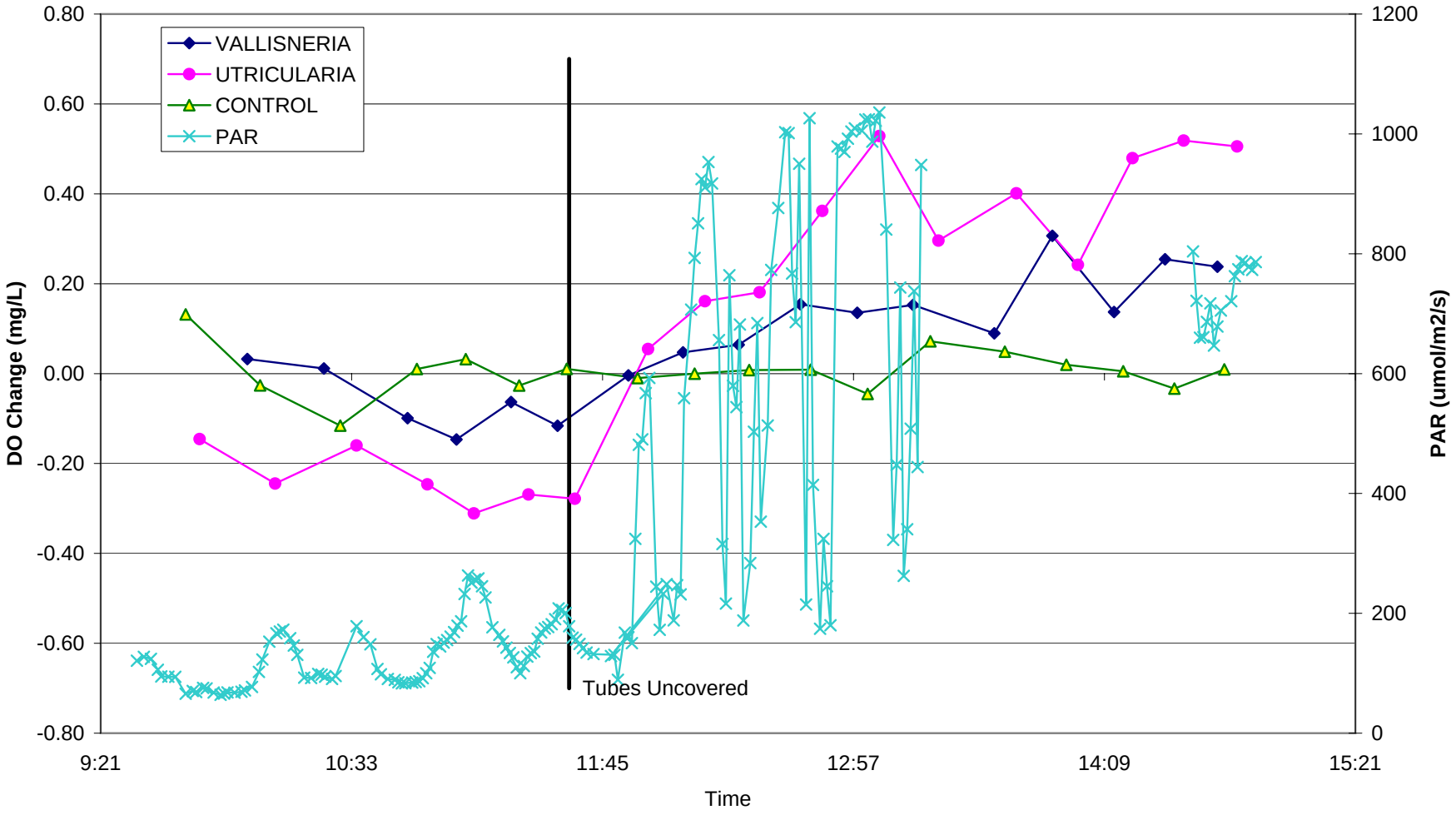
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05



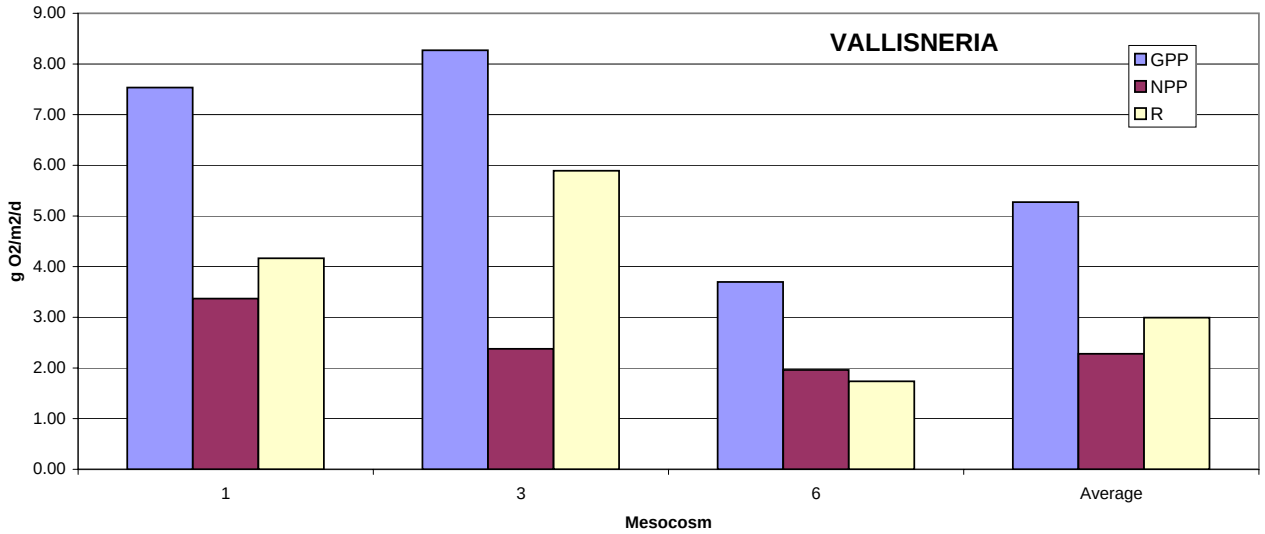


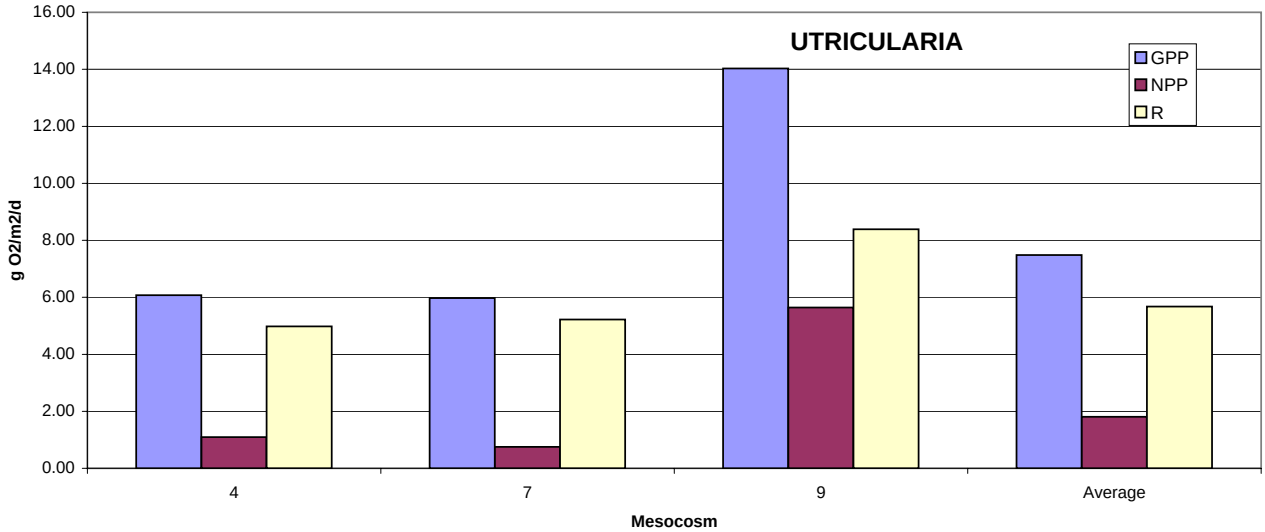




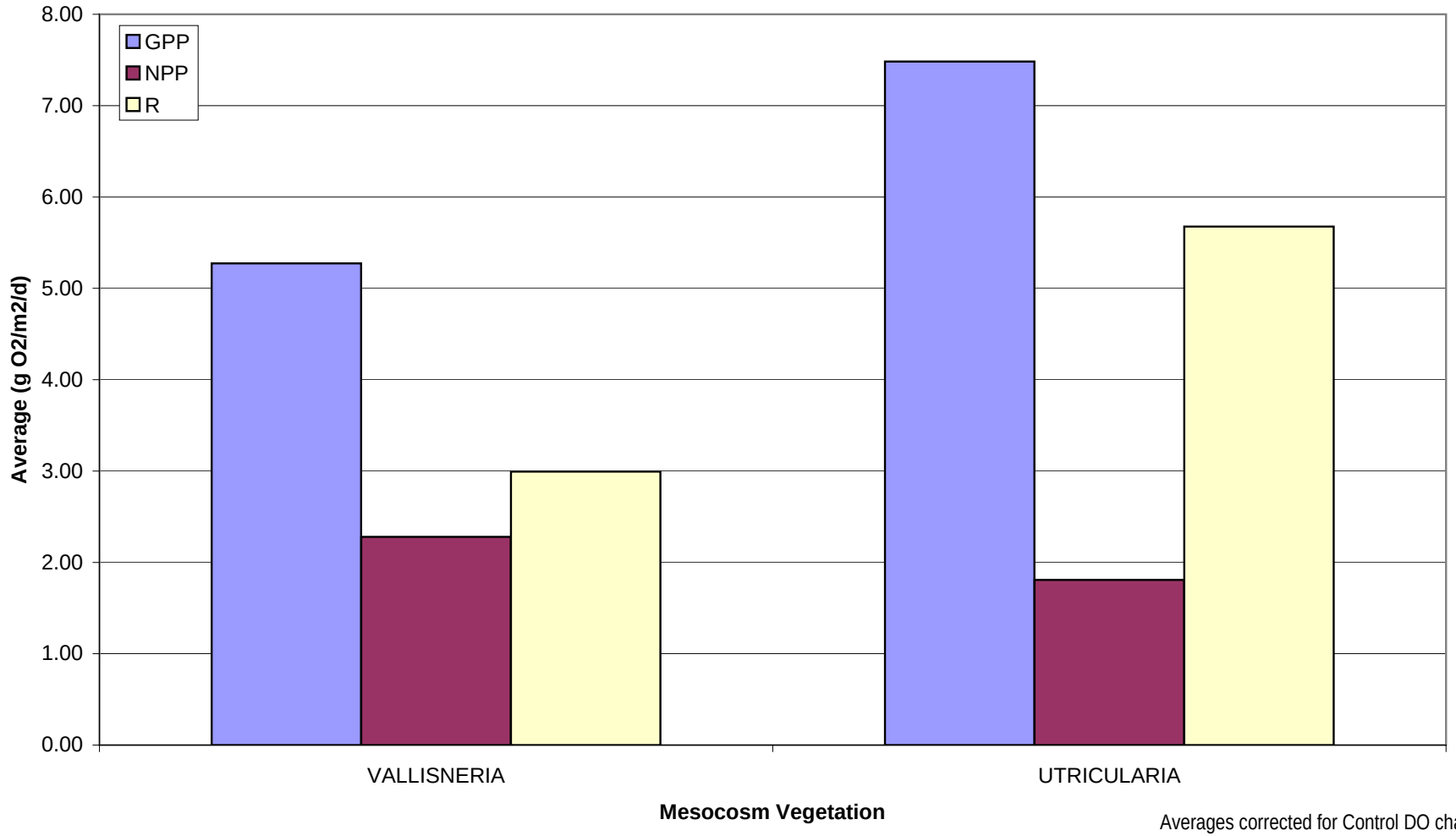
APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05





Averages corrected for Control DO changes



Averages corrected for Control DO changes

APPENDIX H-3
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 1 - 8/3/05

APPENDIX H-4

MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2

		4/21/2005			8/4/2005	
PARAMETER	UNITS	NITELLA	FILAMENTOUS ALGAE	VALLISNERIA	VALLISNERIA	NAJAS
UPSTREAM DO	mg/L	6.08	6.11	6.11	2.08	2.08
DOWNSTREAM DO		6.30	6.13	6.27	2.16	2.16
CHANGE DO		0.23	0.02	0.16	0.08	0.08
TRAVEL TIME	minutes	1.46	3.16	1.40	1.58	1.38
VELOCITY	m/hr	75	35	78	70	80
GPP	g $O_2/m^2/d$	20.94	3.31	14.26	6.82	12.37
NPP		11.11	0.56	9.51	2.60	2.05
R		9.83	2.75	4.75	4.22	10.33
Vegetation	kg DW/m^2	1.09	1.15	0.556	0.722	0.510
GPP	g O_2/kg DW/d	19.2	2.89	25.7	9.44	24.3
NPP		10.2	0.488	17.1	3.60	4.01
R24		9.03	2.40	8.54	5.84	20.2
PAR	mol/hr	0.209	0.203	0.196	0.166	0.174
	$mol/m^2/d$	25.3	29.4	27.5	21.4	22.9
GPP	g O_2/mol	0.827	0.113	0.518	0.318	0.540
NPP		0.439	0.019	0.346	0.121	0.089
GPP	g O_2/kg DW/mol	0.760	0.098	0.932	0.441	1.06
NPP		0.403	0.017	0.622	0.168	0.175

APPENDIX H-4

MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05

		NITELLA				FILAMENTOUS ALGAE			VALLISNERIA			CONTROL		
PARAMETER	UNITS	4	5	6	Average [a]	1	9	Average [a]	7	8	Average [a]	2	3	Average
UPSTREAM DO	mg/L	6.08	6.08	6.08	6.08	6.11	6.11	6.11	6.12	6.11	6.11	6.08	6.07	6.08
DOWNSTREAM DO		6.37	6.29	6.26	6.30	6.11	6.16	6.13	6.26	6.26	6.27	6.07	6.07	6.08
CHANGE DO		0.29	0.21	0.19	0.23	0.00	0.05	0.02	0.14	0.15	0.16	0.00	0.00	0.00
TRAVEL TIME	minutes	1.58	1.42	1.39	1.46	5.33	0.99	3.16	1.41	1.39	1.40	0.33	0.27	0.30
VELOCITY	m/hr	69.3	77.5	78.8	75.0	20.6	110.3	34.7	77.9	78.8	78.4	335	413	370
GPP	g $O_2/m^2/d$	18.38	20.85	22.41	20.94	2.15	7.66	3.31	14.29	14.18	14.26	---	---	---
NPP24		13.71	10.31	9.15	11.11	-0.03	3.83	0.56	9.81	9.18	9.51	---	---	---
R24		4.67	10.54	13.26	9.83	2.17	3.83	2.75	4.49	5.01	4.75	---	---	---
Vegetation	kg DW/m^2	0.593	0.921	1.751	1.089	1.181	1.109	1.145	0.567	0.544	0.556	---	---	---
GPP	g O_2/kg DW/d	31.0	22.6	12.8	19.2	1.82	6.91	2.89	25.2	26.1	25.7	---	---	---
NPP		23.1	11.2	5.22	10.2	-0.021	3.45	0.488	17.3	16.9	17.1	---	---	---
R24		7.87	11.4	7.57	9.03	1.84	3.45	2.40	7.91	9.20	8.54	---	---	---
PAR	mol/hr	0.211	0.225	0.189	0.209	0.176	0.231	0.203	0.153	0.212	0.196	---	---	---
	$mol/m^2/d$	24.4	27.1	24.4	25.3	24.9	33.8	29.4	21.6	30.4	27.5	---	---	---
GPP	g O_2/mol	0.753	0.769	0.917	0.827	0.086	0.226	0.113	0.660	0.467	0.518	---	---	---
NPP		0.561	0.380	0.374	0.439	-0.001	0.113	0.019	0.453	0.302	0.346	---	---	---
GPP	g O_2/kg DW/mol	1.27	0.835	0.524	0.760	0.073	0.204	0.098	1.16	0.858	0.932	---	---	---
NPP		0.946	0.413	0.214	0.403	-0.0009	0.102	0.017	0.798	0.555	0.622	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
NITELLA	4	11:20	5.95	6.44	0.49	---	0.49	0.15	0.44	694.8	0.35	1.58	69.3	18.38	13.71	4.67	0.593	30.97	23.10	7.87	24.41	0.75	0.56	1.27	0.95
		11:46	5.98	6.31	0.33	---	0.33	0.10	1.04	199.80	0.10														
		12:14	6.05	6.75	0.70	---	0.70	0.22	0.52	858.80	0.43														
		12:40	6.11	6.91	0.80	---	0.80	0.25	1.30	387.40	0.19														
		13:08	6.07	6.84	0.77	---	0.77	0.24	0.54	900.20	0.45														
		13:48	5.96	6.09	0.13	---	0.13	0.04	0.92	89.12	0.04														
		14:18	6.05	6.00	-0.05	---	-0.05	-0.01	-0.04	669.90	0.34														
		14:46	6.20	6.10	-0.10	---	-0.10	-0.03	-0.41	149.84	0.08														
		15:12	6.20	6.10	-0.10	---	-0.10	-0.03	-0.47	134.14	0.07														
		15:40	6.21	6.11	-0.10	---	-0.10	-0.03	-0.48	131.64	0.07														
	5	11:22	5.92	6.41	0.49	---	0.49	0.17	0.48	717.80	0.36	1.42	77.5	20.85	10.31	10.54	0.921	22.63	11.19	11.44	27.12	0.77	0.38	0.83	0.41
		11:50	6.01	6.60	0.59	---	0.59	0.21	0.53	791.10	0.40														
		12:16	6.05	6.75	0.70	---	0.70	0.25	0.57	860.80	0.43														
		12:44	6.10	6.23	0.13	---	0.13	0.04	0.76	117.60	0.06														
		13:10	6.07	6.80	0.73	---	0.73	0.26	0.58	889.20	0.45														
		13:52	5.95	6.07	0.12	---	0.12	0.04	0.84	100.24	0.05														
		14:22	6.07	5.86	-0.21	---	-0.21	-0.07	-0.25	600.10	0.30														
		14:48	6.20	6.05	-0.15	---	-0.15	-0.05	-0.72	150.39	0.08														
		15:16	6.20	6.07	-0.13	---	-0.13	-0.05	-0.69	132.64	0.07														
		15:42	6.21	6.01	-0.20	---	-0.20	-0.07	-1.14	123.37	0.06														
	6	11:26	5.86	6.60	0.74	---	0.74	0.27	0.76	701.80	0.35	1.39	78.8	22.41	9.15	13.26	1.751	12.80	5.22	7.57	24.43	0.92	0.37	0.52	0.21
		11:52	5.99	6.66	0.67	---	0.67	0.24	0.62	766.10	0.38														
		12:20	6.07	6.28	0.21	---	0.21	0.08	0.20	783.60	0.39														
		12:46	6.10	6.16	0.06	---	0.06	0.02	0.43	105.67	0.05														
		13:14	6.08	6.97	0.89	---	0.89	0.32	0.95	673.90	0.34														
		13:54	5.95	6.10	0.15	---	0.15	0.05	1.07	100.66	0.05														
		14:24	6.10	5.84	-0.26	---	-0.26	-0.09	-0.72	257.80	0.13														
		14:52	6.21	6.00	-0.21	---	-0.21	-0.08	-1.10	139.57	0.07														
		15:18	6.20	5.98	-0.22	---	-0.22	-0.08	-1.33	118.78	0.06														
		15:46	6.20	6.04	-0.16	---	-0.16	-0.06	-0.91	128.20	0.06														
	Average	11:22	5.91	6.48	0.57	-0.04	0.61	0.21	0.59	704.80	0.35	1.46	75.0	20.94	11.11	9.83	1.089	19.24	10.21	9.03	25.32	0.83	0.44	0.76	0.40
		11:49	5.99	6.52	0.53	0.01	0.52	0.18	0.60	585.67	0.29														
		12:16	6.06	6.59	0.54	0.00	0.54	0.19	0.44	834.40	0.42														
		12:43	6.10	6.43	0.33	-0.01	0.34	0.12	1.13	203.56	0.10														
		13:10	6.07	6.87	0.80	0.00	0.80	0.27	0.67	821.10	0.41														
		13:51	5.95	6.09	0.13	0.00	0.13	0.04	0.90	96.67	0.05														
		14:21	6.07	5.90	-0.17	0.02	-0.19	-0.07	-0.25	509.27	0.26														
		14:48	6.20	6.05	-0.15	0.03	-0.18	-0.06	-0.86	146.60	0.07														
		15:15	6.20	6.05	-0.15	-0.01	-0.14	-0.05	-0.76	128.52	0.06														
		15:42	6.21	6.05	-0.15	0.00	-0.15	-0.05	-0.80	127.74	0.06														

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
FILAMENTOUS ALGAE	1	12:04	6.03	6.15	0.12	---	0.12	0.01	0.03	828.90	0.42	5.33	20.6	2.15	-0.03	2.17	1.181	1.82	-0.02	1.84	24.86	0.09	0.00	0.07	0.00
		12:32	6.10	6.36	0.26	---	0.26	0.02	0.06	875.30	0.44														
		12:58	6.06	6.07	0.01	---	0.01	0.00	0.01	92.57	0.05														
		13:40	5.96	6.13	0.17	---	0.17	0.02	0.26	124.77	0.06														
		14:10	6.04	6.04	0.00	---	0.00	0.00	0.00	734.70	0.37														
		14:36	6.12	6.11	-0.01	---	-0.01	0.00	-0.01	156.22	0.08														
		15:04	6.23	6.07	-0.16	---	-0.16	-0.01	-0.23	128.11	0.06														
		15:30	6.21	6.02	-0.19	---	-0.19	-0.02	-0.28	129.10	0.06														
		15:58	6.21	6.03	-0.18	---	-0.18	-0.02	-0.41	81.62	0.04														
	9	12:02	6.03	6.13	0.10	---	0.10	0.05	0.13	819.00	0.41	0.99	110.3	7.66	3.83	3.83	1.109	6.91	3.45	3.45	33.85	0.23	0.11	0.20	0.10
		12:28	6.09	6.27	0.18	---	0.18	0.09	0.21	867.80	0.44														
		12:56	6.07	6.10	0.03	---	0.03	0.02	0.36	92.41	0.05														
		13:22	6.09	6.30	0.21	---	0.21	0.11	0.22	948.60	0.48														
		14:04	6.01	6.07	0.07	---	0.07	0.03	0.07	888.20	0.45														
		14:34	6.08	6.03	-0.05	---	-0.05	-0.03	-0.30	176.01	0.09														
		15:00	6.23	6.18	-0.05	---	-0.05	-0.03	-0.46	116.74	0.06														
		15:28	6.22	6.15	-0.07	---	-0.07	-0.03	-0.47	141.71	0.07														
		15:54	6.20	6.20	0.00	---	0.00	0.00	-0.04	87.88	0.04														
	Average	12:03	6.03	6.14	0.11	-0.04	0.15	0.02	0.06	823.95	0.41	3.16	34.7	3.31	0.56	2.75	1.145	2.89	0.49	2.40	29.35	0.11	0.02	0.10	0.02
		12:30	6.09	6.32	0.22	0.01	0.21	0.03	0.08	871.55	0.44														
		12:57	6.07	6.09	0.02	0.00	0.03	0.00	0.09	92.49	0.05														
		13:31	6.03	6.22	0.19	-0.01	0.20	0.03	0.12	536.69	0.27														
		14:07	6.02	6.06	0.03	0.00	0.04	0.01	0.01	811.45	0.41														
		14:35	6.10	6.07	-0.03	0.00	-0.03	-0.01	-0.07	166.12	0.08														
		15:02	6.23	6.13	-0.11	0.02	-0.12	-0.02	-0.32	122.43	0.06														
		15:29	6.22	6.09	-0.13	0.03	-0.16	-0.03	-0.37	135.41	0.07														
		15:56	6.21	6.12	-0.09	-0.01	-0.09	-0.01	-0.32	84.75	0.04														

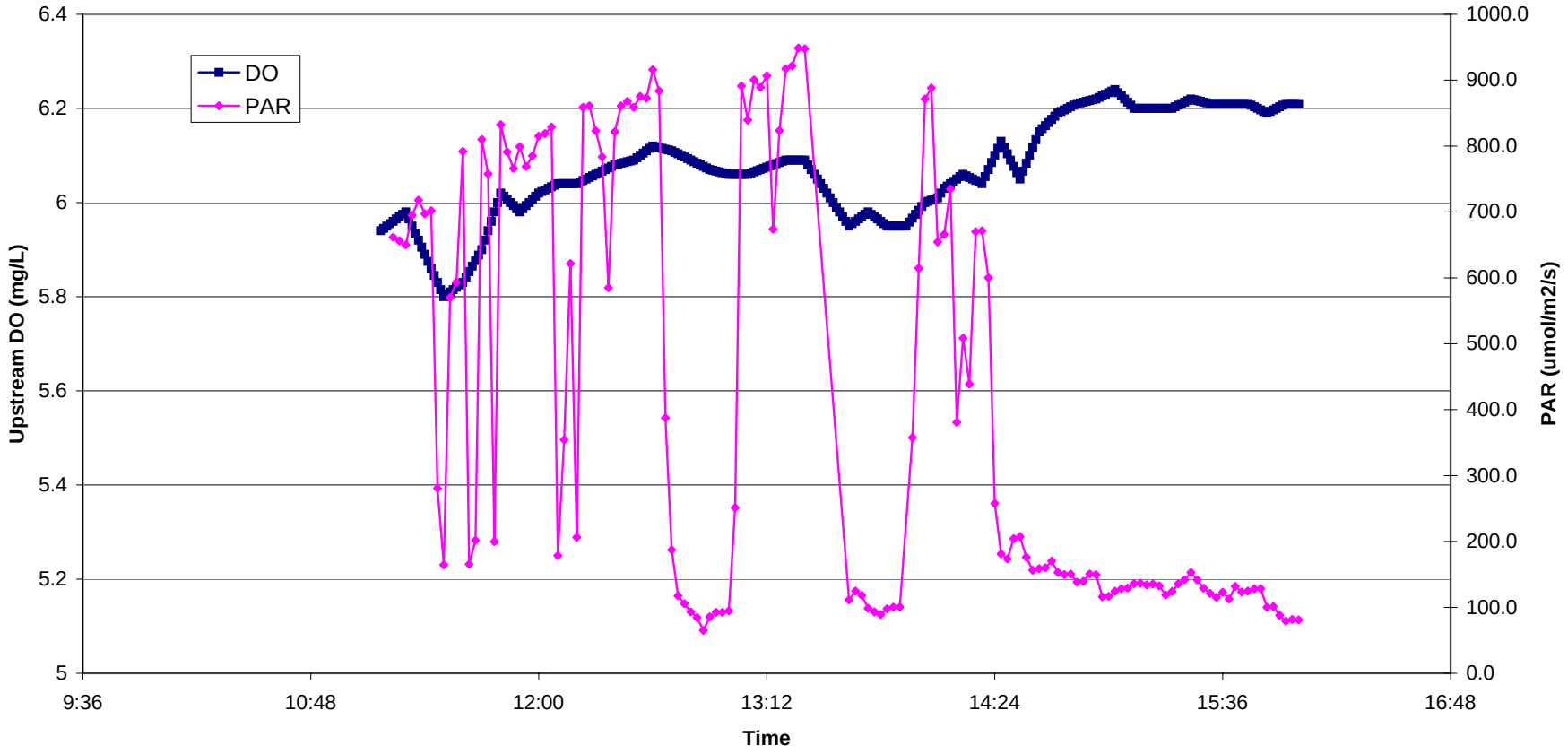
APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
VALLISNERIA	7	12:22	6.07	6.37	0.30	---	0.30	0.11	0.36	584.80	0.29	1.41	77.9	14.29	9.81	4.49	0.567	25.20	17.29	7.91	21.65	0.66	0.45	1.16	0.80
		12:50	6.08	6.60	0.52	---	0.52	0.18	4.33	84.49	0.04														
		13:16	6.09	6.51	0.43	---	0.43	0.15	0.37	823.50	0.41														
		13:58	5.97	6.16	0.19	---	0.19	0.07	0.38	357.54	0.18														
		14:28	6.10	6.09	-0.01	---	-0.01	0.00	-0.05	173.52	0.09														
		14:54	6.22	6.16	-0.06	---	-0.06	-0.02	-0.27	150.64	0.08														
		15:22	6.21	6.11	-0.10	---	-0.10	-0.03	-0.50	135.78	0.07														
		15:48	6.20	6.07	-0.13	---	-0.13	-0.05	-0.70	128.50	0.06														
	8	11:58	6.01	6.37	0.36	---	0.36	0.13	0.33	785.10	0.39	1.39	78.8	14.18	9.18	5.01	0.544	26.08	16.87	9.20	30.39	0.47	0.30	0.86	0.56
		12:26	6.08	6.55	0.47	---	0.47	0.17	0.39	860.80	0.43														
		12:52	6.08	6.32	0.24	---	0.24	0.09	2.68	65.15	0.03														
		13:20	6.09	6.53	0.44	---	0.44	0.16	0.34	921.70	0.46														
		14:00	5.98	6.18	0.20	---	0.20	0.07	0.23	614.42	0.31														
		14:30	6.08	6.07	-0.01	---	-0.01	0.00	-0.02	204.10	0.10														
		14:58	6.23	6.15	-0.08	---	-0.08	-0.03	-0.47	116.09	0.06														
		15:24	6.21	6.07	-0.14	---	-0.14	-0.05	-0.72	142.01	0.07														
		15:52	6.20	6.10	-0.10	---	-0.10	-0.03	-0.68	101.24	0.05														
	Average	11:58	6.01	6.37	0.36	---	0.36	0.13	0.33	785.10	0.39	1.40	78.4	14.26	9.51	4.75	0.556	25.66	17.12	8.54	27.53	0.52	0.35	0.93	0.62
		12:24	6.08	6.46	0.38	---	0.38	0.14	0.38	722.80	0.36														
		12:51	6.08	6.46	0.38	---	0.38	0.14	3.62	74.82	0.04														
		13:18	6.09	6.52	0.43	---	0.43	0.15	0.35	872.60	0.44														
		13:59	5.98	6.17	0.20	---	0.20	0.07	0.29	485.98	0.24														
		14:29	6.09	6.08	-0.01	---	-0.01	0.00	-0.04	188.81	0.09														
		14:56	6.22	6.16	-0.07	---	-0.07	-0.02	-0.36	133.37	0.07														
		15:23	6.21	6.09	-0.12	---	-0.12	-0.04	-0.62	138.90	0.07														
		15:50	6.20	6.09	-0.11	---	-0.11	-0.04	-0.69	114.87	0.06														

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
CONTROL	2	11:14	5.96	5.95	-0.01	---	-0.01	-0.02	-0.05	661.50	0.33	0.33	335.0	---	---	---	---	---	---	---	---	---	---	---	---
		11:40	5.88	5.91	0.03	---	0.03	0.05	0.50	201.70	0.10														
		12:08	6.04	6.03	-0.01	---	-0.01	-0.02	-0.09	354.40	0.18														
		12:34	6.11	6.10	-0.01	---	-0.01	-0.02	-0.03	872.80	0.44														
		13:02	6.06	6.04	-0.02	---	-0.02	-0.03	-0.24	251.10	0.13														
		13:42	5.97	5.99	0.02	---	0.02	0.03	0.52	118.14	0.06														
		14:12	6.05	6.04	-0.01	---	-0.01	-0.02	-0.08	380.80	0.19														
		14:40	6.16	6.19	0.03	---	0.03	0.04	0.51	160.06	0.08														
		15:06	6.21	6.20	-0.01	---	-0.01	-0.02	-0.31	129.40	0.06														
		15:34	6.21	6.21	0.00	---	0.00	0.00	0.00	115.14	0.06														
		16:00	6.21	6.16	-0.05	---	-0.05	-0.08	-1.88	81.05	0.04														
	3	11:16	5.97	5.91	-0.06	---	-0.06	-0.11	-0.34	656.00	0.33	0.27	412.6	---	---	---	---	---	---	---	---	---	---	---	---
		11:44	5.94	5.93	-0.01	---	-0.01	-0.02	-0.05	757.70	0.38														
		12:10	6.04	6.04	0.00	---	0.00	0.00	0.00	621.60	0.31														
		12:38	6.12	6.11	-0.01	---	-0.01	-0.01	-0.03	883.70	0.44														
		13:04	6.06	6.07	0.01	---	0.01	0.02	0.04	891.20	0.45														
		13:46	5.97	5.96	-0.01	---	-0.01	-0.02	-0.40	93.21	0.05														
		14:16	6.05	6.10	0.05	---	0.05	0.09	0.40	438.90	0.22														
		14:42	6.18	6.21	0.03	---	0.03	0.06	0.73	170.23	0.09														
		15:10	6.20	6.20	0.00	---	0.00	0.00	0.00	136.73	0.07														
		15:36	6.21	6.20	-0.01	---	-0.01	-0.02	-0.31	122.92	0.06														
	Average	11:15	5.97	5.93	-0.04	---	-0.04	-0.06	-0.18	658.75	0.33	0.30	369.8	---	---	---	---	---	---	---	---	---	---	---	---
		11:42	5.91	5.92	0.01	---	0.01	0.02	0.08	479.70	0.24														
		12:09	6.04	6.04	0.00	---	0.00	-0.01	-0.03	488.00	0.24														
		12:36	6.11	6.11	-0.01	---	-0.01	-0.01	-0.03	878.25	0.44														
		13:03	6.06	6.06	0.00	---	0.00	-0.01	-0.03	571.15	0.29														
		13:44	5.97	5.98	0.00	---	0.00	0.01	0.16	105.68	0.05														
		14:14	6.05	6.07	0.02	---	0.02	0.03	0.15	409.85	0.21														
		14:41	6.17	6.20	0.03	---	0.03	0.05	0.61	165.15	0.08														
		15:08	6.21	6.20	-0.01	---	-0.01	-0.01	-0.17	133.07	0.07														
		15:35	6.21	6.21	0.00	---	0.00	-0.01	-0.14	119.03	0.06														
		16:00	6.21	6.16	-0.05	---	-0.05	-0.08	-2.07	81.05	0.04														

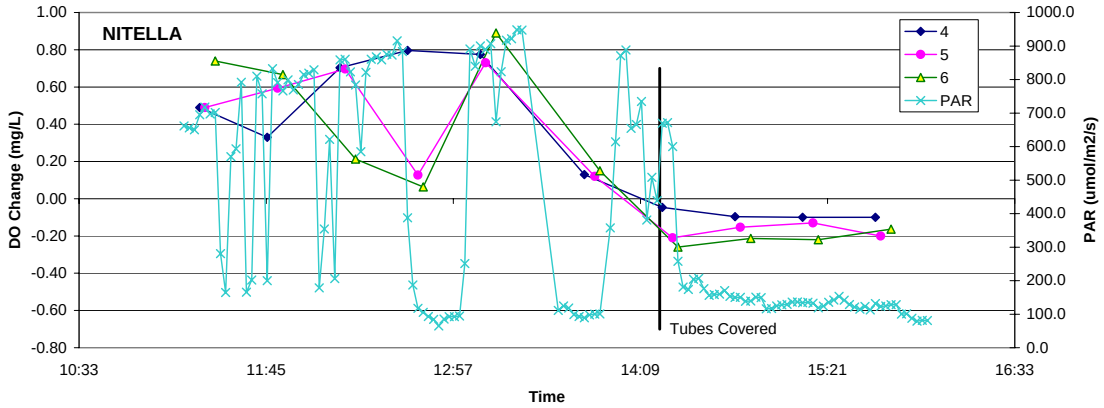
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

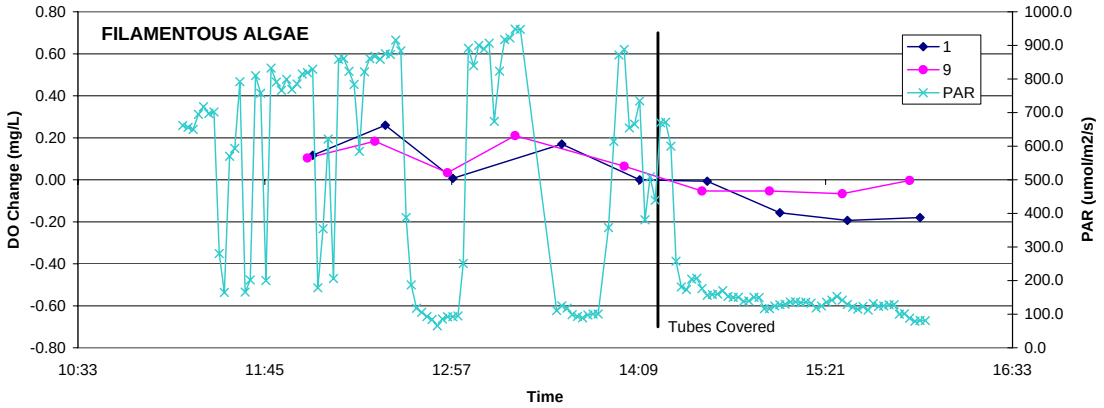


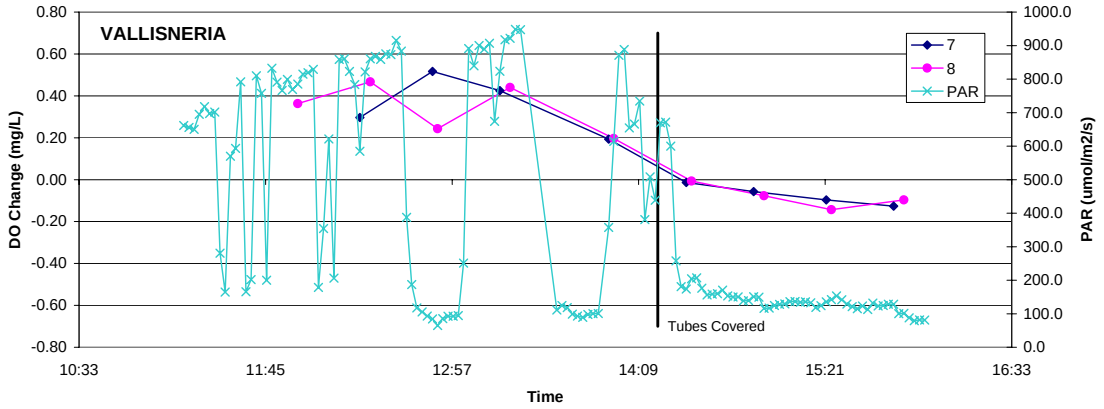
APPENDIX H-4

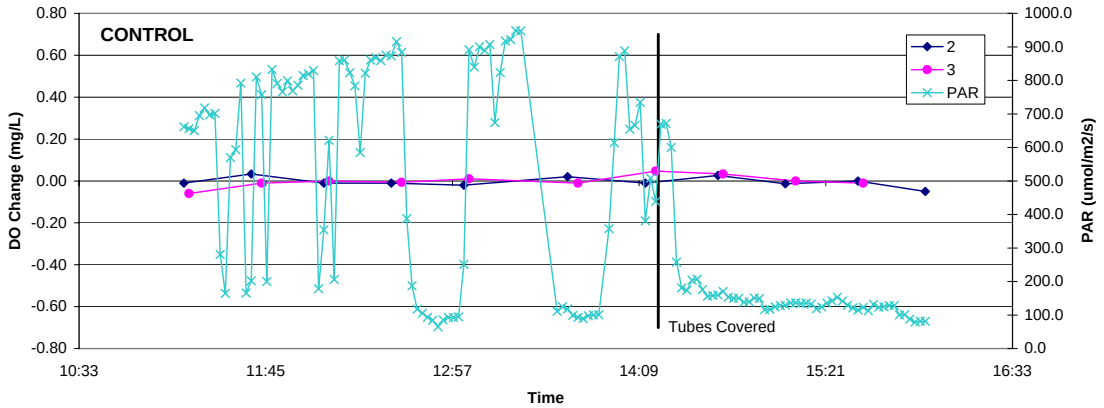
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05

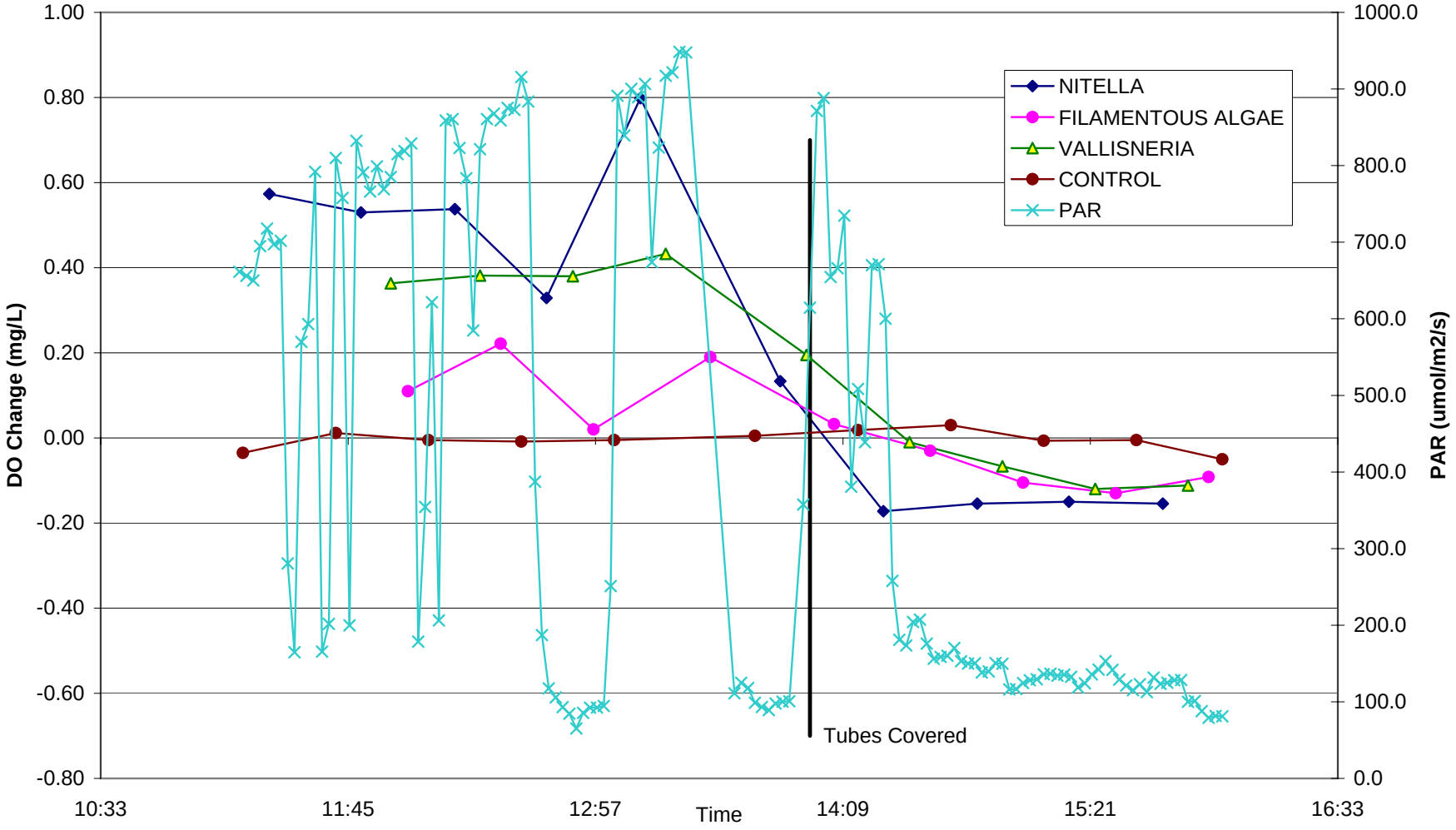
APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05





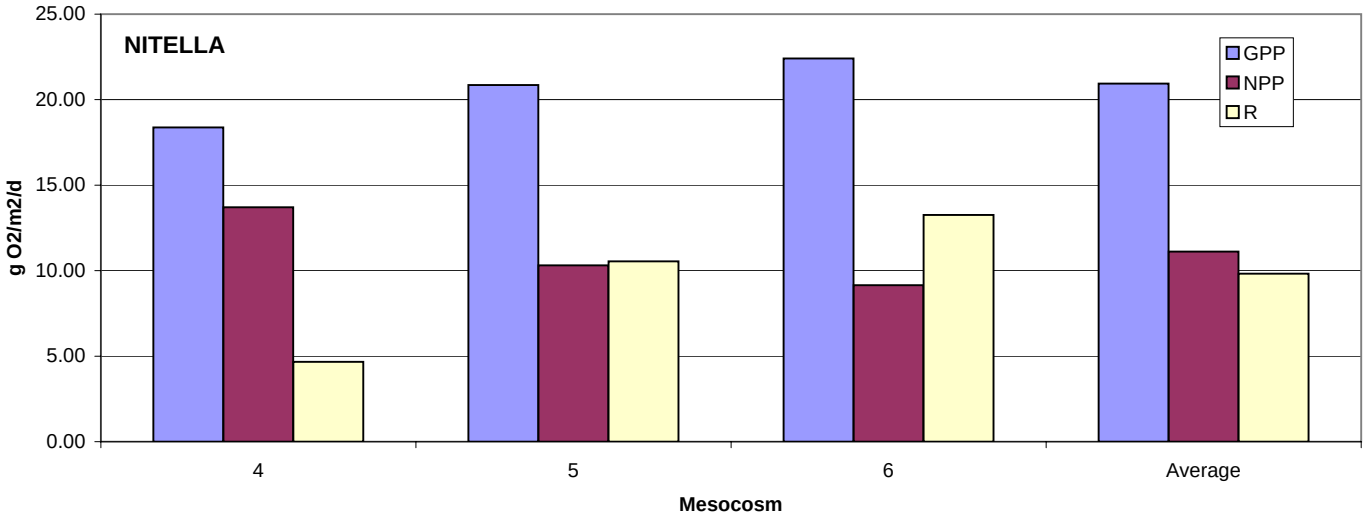


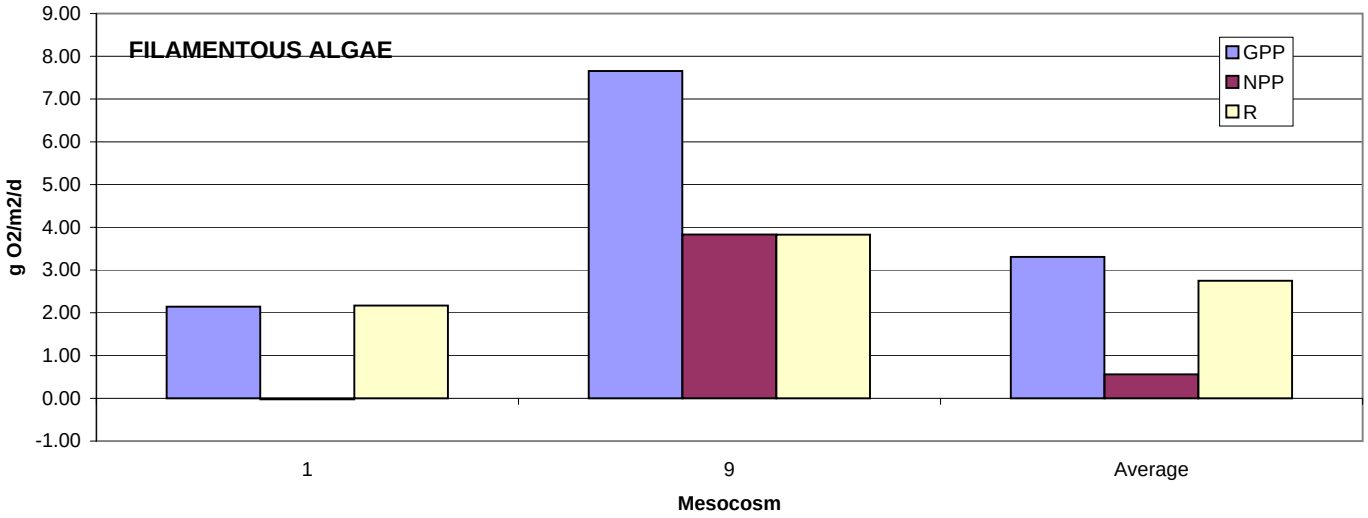


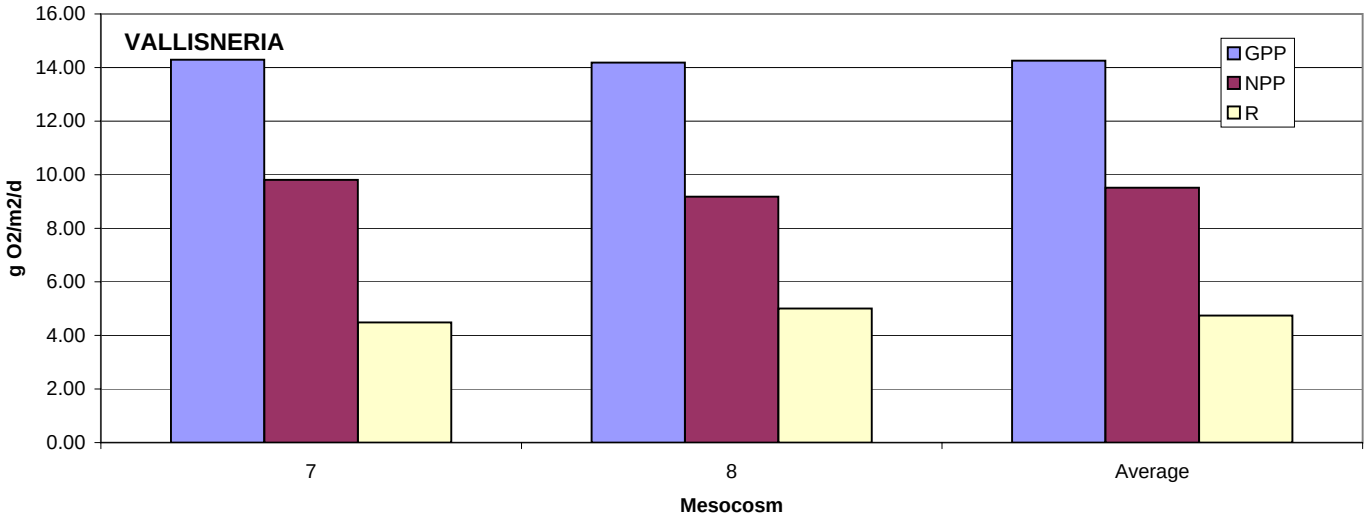


APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05

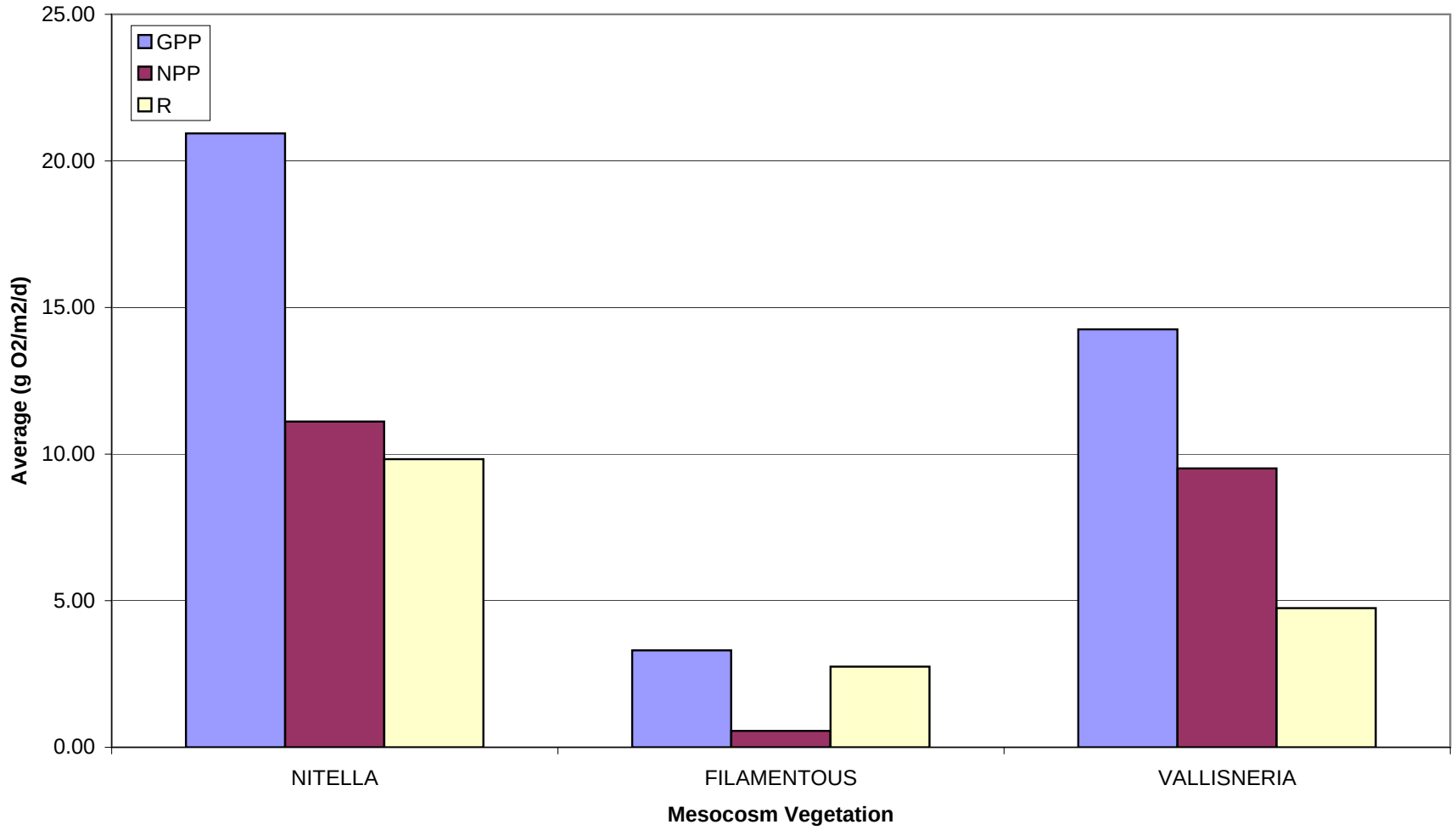
APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05







Averages corrected for Control DO changes



APPENDIX H-4

MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 4/21/05

Averages corrected for Control DO changes

APPENDIX H-4

MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

		VALLISNERIA				NAJAS				CONTROL			
PARAMETER	UNITS	1	4	7	Average [a]	3	6	9	Average [a]	2	5	8	Average
UPSTREAM DO	mg/L	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08
DOWNSTREAM DO		2.17	2.14	2.18	2.16	2.17	2.17	2.16	2.16	2.07	2.08	2.09	2.08
CHANGE DO		0.09	0.06	0.10	0.08	0.09	0.09	0.08	0.08	-0.01	0.00	0.01	0.00
TRAVEL TIME	minutes	1.89	1.22	1.63	1.58	1.98	1.16	0.98	1.38	0.22	0.17	0.17	0.19
VELOCITY	m/hr	58.2	89.9	67.5	69.6	55.4	94.4	111.5	79.7	499	658	639	589
GPP	g $O_2/m^2/d$	5.31	5.81	9.20	6.82	8.08	15.16	17.50	12.37	---	---	---	---
NPP24		2.64	2.88	2.94	2.60	2.01	2.62	2.42	2.05	---	---	---	---
R24		2.67	2.93	6.26	4.22	6.07	12.54	15.08	10.33	---	---	---	---
Vegetation	kg DW/m^2	0.778	0.622	0.767	0.722	0.573	0.317	0.640	0.510	---	---	---	---
GPP	g O_2/kg DW/d	6.83	9.34	12.00	9.44	14.11	47.82	27.34	24.26	---	---	---	---
NPP24		3.40	4.63	3.83	3.60	3.52	8.27	3.78	4.01	---	---	---	---
R24		3.43	4.71	8.17	5.84	10.60	39.55	23.56	20.25	---	---	---	---
PAR	mol/hr	0.171	0.134	0.170	0.166	0.171	0.156	0.175	0.174	---	---	---	---
	$mol/m^2/d$	22.8	16.2	22.7	21.4	22.5	21.0	23.6	22.9	---	---	---	---
GPP	g O_2/mol	0.233	0.359	0.405	0.318	0.359	0.720	0.742	0.540	---	---	---	---
NPP		0.116	0.178	0.129	0.121	0.089	0.125	0.103	0.089	---	---	---	---
GPP	g O_2/kg DW/mol	0.299	0.577	0.528	0.441	0.626	2.27	1.16	1.06	---	---	---	---
NPP		0.149	0.286	0.169	0.168	0.156	0.393	0.160	0.175	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
VALLISNERIA	1	9:26	2.10	2.50	0.40	---	0.40	0.11	4.10	51.6	0.03	1.89	58.2	5.31	2.64	2.67	0.778	6.83	3.40	3.43	22.82	0.23	0.12	0.30	0.15
		9:44	2.02	2.12	0.10	---	0.10	0.03	1.83	28.19	0.01														
		9:59	2.00	1.93	-0.07	---	-0.07	-0.02	-1.08	34.43	0.02														
		10:14	2.00	1.88	-0.12	---	-0.12	-0.03	-1.30	49.77	0.02														
		10:29	2.00	1.83	-0.17	---	-0.17	-0.05	-1.58	57.89	0.03														
		10:45	2.12	1.89	-0.23	---	-0.23	-0.06	-1.14	106.47	0.05														
		11:04	2.11	1.80	-0.31	---	-0.31	-0.08	-0.37	444.20	0.22														
		11:17	2.06	2.02	-0.04	---	-0.04	-0.01	-0.05	440.00	0.22														
		11:31	2.06	2.17	0.11	---	0.11	0.03	0.11	546.40	0.27														
		11:44	2.07	2.22	0.15	---	0.15	0.04	0.14	560.20	0.28														
		11:57	2.08	2.23	0.15	---	0.15	0.04	0.14	558.30	0.28														
		12:13	2.10	2.31	0.21	---	0.21	0.06	0.20	553.40	0.28														
		12:29	2.10	2.27	0.17	---	0.17	0.05	0.73	124.97	0.06														
		12:41	2.11	2.33	0.22	---	0.22	0.06	0.20	589.70	0.30														
		12:56	2.11	2.32	0.21	---	0.21	0.06	0.17	663.10	0.33														
		13:07	2.12	2.34	0.22	---	0.22	0.06	0.16	715.00	0.36														
		13:21	2.12	2.23	0.11	---	0.11	0.03	---	---	---														
		13:35	2.12	2.32	0.20	---	0.20	0.05	---	---	---														
		13:49	2.09	2.26	0.17	---	0.17	0.05	---	---	---														
		14:02	2.11	2.23	0.12	---	0.12	0.03	---	---	---														
		14:21	2.09	2.29	0.20	---	0.20	0.05	0.21	505.90	0.25														
		14:33	2.07	2.20	0.13	---	0.13	0.03	0.65	106.17	0.05														
	4	9:31	2.08	2.26	0.18	---	0.18	0.07	5.00	29.8	0.01	1.22	89.9	5.81	2.88	2.93	0.622	9.34	4.63	4.71	16.19	0.36	0.18	0.58	0.29
		9:50	2.03	2.04	0.01	---	0.01	0.01	0.23	47.24	0.02														
		10:03	1.98	1.94	-0.04	---	-0.04	-0.02	-0.82	43.32	0.02														
		10:20	1.99	1.90	-0.09	---	-0.09	-0.04	-1.85	41.27	0.02														
		10:33	2.02	1.94	-0.08	---	-0.08	-0.03	-1.37	47.56	0.02														
		10:54	2.14	2.01	-0.13	---	-0.13	-0.05	-0.27	396.30	0.20														
		11:08	2.07	1.93	-0.14	---	-0.14	-0.06	-0.23	491.50	0.25														
		11:22	2.08	2.12	0.04	---	0.04	0.02	0.07	467.80	0.23														
		11:35	2.07	2.15	0.08	---	0.08	0.03	0.32	211.70	0.11														
		11:49	2.09	2.21	0.12	---	0.12	0.05	0.30	331.50	0.17														
		12:01	2.09	2.23	0.15	---	0.15	0.06	0.21	573.10	0.29														
		12:20	2.10	2.24	0.14	---	0.14	0.06	0.19	603.00	0.30														
		12:33	2.10	2.21	0.11	---	0.11	0.05	0.41	223.60	0.11														
		12:46	2.11	2.25	0.14	---	0.14	0.06	0.18	664.20	0.33														
		12:59	2.11	2.24	0.13	---	0.13	0.05	0.52	204.10	0.10														
		13:12	2.11	2.29	0.18	---	0.18	0.07	---	---	---														
		13:27	2.11	2.23	0.12	---	0.12	0.05	---	---	---														
		13:40	2.11	2.16	0.05	---	0.05	0.02	---	---	---														
		13:53	2.09	2.22	0.13	---	0.13	0.05	---	---	---														
		14:08	2.11	2.25	0.14	---	0.14	0.06	---	---	---														
		14:25	2.10	2.15	0.05	---	0.05	0.02	0.53	82.34	0.04														
		14:38	2.03	2.10	0.07	---	0.07	0.03	0.55	99.00	0.05														

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
	7	9:38	2.05	2.46	0.41	---	0.41	0.13	8.86	28.4	0.01	1.63	67.5	9.20	2.94	6.26	0.767	12.00	3.83	8.17	22.72	0.40	0.13	0.53	0.17
		9:54	2.02	2.12	0.11	---	0.11	0.03	2.17	29.68	0.01														
		10:09	2.01	1.91	-0.10	---	-0.10	-0.03	-1.52	38.45	0.02														
		10:24	2.01	1.80	-0.21	---	-0.21	-0.07	-3.26	40.22	0.02														
		10:39	2.05	1.77	-0.28	---	-0.28	-0.08	-2.21	76.26	0.04														
		10:58	2.14	1.74	-0.40	---	-0.40	-0.12	-1.36	182.59	0.09														
		11:14	2.08	1.72	-0.36	---	-0.36	-0.11	-0.43	509.50	0.26														
		11:27	2.06	2.10	0.04	---	0.04	0.01	0.04	528.70	0.27														
		11:40	2.06	2.19	0.13	---	0.13	0.04	0.14	559.20	0.28														
		11:53	2.08	2.14	0.06	---	0.06	0.02	0.38	96.85	0.05														
		12:07	2.09	2.34	0.25	---	0.25	0.08	0.25	600.50	0.30														
		12:24	2.10	2.37	0.27	---	0.27	0.08	0.27	606.40	0.30														
		12:38	2.11	2.39	0.29	---	0.29	0.09	0.28	616.50	0.31														
		12:50	2.11	2.39	0.28	---	0.28	0.09	0.26	671.50	0.34														
		13:04	2.12	2.42	0.30	---	0.30	0.09	0.26	704.40	0.35														
		13:16	2.11	2.43	0.32	---	0.32	0.10	---	---	---														
		13:32	2.11	2.40	0.29	---	0.29	0.09	---	---	---														
		13:44	2.11	2.21	0.10	---	0.10	0.03	---	---	---														
		13:59	2.11	2.35	0.24	---	0.24	0.07	---	---	---														
		14:11	2.11	2.39	0.28	---	0.28	0.09	---	---	---														
		14:30	2.07	2.18	0.12	---	0.12	0.04	0.20	360.10	0.18														
		14:41	2.04	2.11	0.07	---	0.07	0.02	0.40	111.01	0.06														
	Average	9:31	2.08	2.41	0.33	-0.02	0.35	0.11	6.04	36.6	0.02	1.58	69.6	6.82	2.60	4.22	0.722	9.44	3.60	5.84	21.43	0.32	0.12	0.44	0.17
		9:49	2.02	2.09	0.07	0.01	0.06	0.02	1.10	35.0	0.02														
		10:03	2.00	1.93	-0.07	0.01	-0.08	-0.03	-1.37	38.7	0.02														
		10:19	2.00	1.86	-0.14	0.03	-0.17	-0.05	-2.47	43.8	0.02														
		10:33	2.02	1.85	-0.18	0.01	-0.19	-0.06	-1.95	60.6	0.03														
		10:52	2.13	1.88	-0.25	0.00	-0.26	-0.08	-0.71	228.5	0.11														
		11:08	2.09	1.82	-0.27	-0.02	-0.25	-0.08	-0.33	481.7	0.24														
		11:22	2.07	2.08	0.01	0.01	0.00	0.00	0.00	478.8	0.24														
		11:35	2.06	2.17	0.11	0.00	0.11	0.03	0.16	439.1	0.22														
		11:48	2.08	2.19	0.11	0.01	0.10	0.03	0.20	329.5	0.17														
		12:01	2.09	2.27	0.18	0.00	0.18	0.06	0.20	577.3	0.29														
		12:19	2.10	2.31	0.21	0.00	0.21	0.07	0.22	587.6	0.29														
		12:33	2.10	2.29	0.19	0.00	0.19	0.06	0.37	321.7	0.16														
		12:45	2.11	2.32	0.22	0.00	0.22	0.07	0.21	641.8	0.32														
		12:59	2.11	2.33	0.21	0.00	0.21	0.07	0.26	523.9	0.26														
		13:11	2.11	2.35	0.24	-0.01	0.25	0.08	0.22	715.0	0.36														
		13:26	2.11	2.29	0.17	0.01	0.17	0.05	---	---	---														
		13:39	2.11	2.23	0.12	0.00	0.12	0.04	---	---	---														
		13:53	2.10	2.28	0.18	0.00	0.18	0.06	---	---	---														
		14:07	2.11	2.29	0.18	0.00	0.18	0.06	---	---	---														
		14:25	2.08	2.21	0.12	0.01	0.12	0.04	0.23	316.1	0.16														
		14:37	2.05	2.14	0.09	0.02	0.07	0.02	0.41	105.4	0.05														

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
NAJAS	3	9:30	2.07	2.17	0.11	---	0.11	0.03	1.35	39.1	0.02	1.98	55.4	8.08	2.01	6.07	0.573	14.11	3.52	10.60	22.53	0.36	0.09	0.63	0.16
		9:48	2.02	1.81	-0.21	---	-0.21	-0.05	-3.24	32.65	0.02														
		10:02	1.98	1.80	-0.18	---	-0.18	-0.04	-2.70	32.93	0.02														
		10:18	1.99	1.85	-0.14	---	-0.14	-0.04	-1.66	43.24	0.02														
		10:32	2.02	1.86	-0.16	---	-0.16	-0.04	-1.48	52.84	0.03														
		10:51	2.13	1.95	-0.18	---	-0.18	-0.04	-0.46	194.71	0.10														
		11:07	2.08	1.86	-0.22	---	-0.22	-0.06	-0.26	432.10	0.22														
		11:20	2.07	2.16	0.09	---	0.09	0.02	0.11	407.90	0.20														
		11:34	2.06	2.30	0.24	---	0.24	0.06	0.53	226.40	0.11														
		11:47	2.08	2.25	0.17	---	0.17	0.04	0.14	589.70	0.30														
		12:00	2.08	2.33	0.25	---	0.25	0.06	0.22	565.60	0.28														
		12:18	2.10	2.37	0.27	---	0.27	0.07	0.24	566.60	0.28														
		12:32	2.09	2.30	0.21	---	0.21	0.05	0.17	598.80	0.30														
		12:44	2.11	2.35	0.24	---	0.24	0.06	0.18	658.00	0.33														
		12:58	2.11	2.37	0.26	---	0.26	0.07	0.18	718.20	0.36														
		13:10	2.11	2.38	0.27	---	0.27	0.07	0.20	664.20	0.33														
		13:26	2.11	2.18	0.07	---	0.07	0.02	---	---	---														
		13:38	2.11	2.19	0.08	---	0.08	0.02	---	---	---														
		13:52	2.09	2.35	0.26	---	0.26	0.07	---	---	---														
		14:06	2.11	2.37	0.26	---	0.26	0.07	---	---	---														
		14:24	2.09	2.35	0.26	---	0.26	0.06	0.65	199.14	0.10														
		14:36	2.04	2.19	0.15	---	0.15	0.04	0.74	100.19	0.05														
	6	9:35	2.07	2.02	-0.05	---	-0.05	-0.02	-1.51	28.4	0.01	1.16	94.4	15.16	2.62	12.54	0.317	47.82	8.27	39.55	21.05	0.72	0.12	2.27	0.39
		9:53	2.03	1.88	-0.15	---	-0.15	-0.06	-3.93	32.24	0.02														
		10:06	2.00	1.86	-0.14	---	-0.14	-0.06	-3.25	36.05	0.02														
		10:23	2.01	1.76	-0.25	---	-0.25	-0.11	-2.47	85.83	0.04														
		10:37	2.02	1.87	-0.15	---	-0.15	-0.07	-1.96	67.14	0.03														
		10:57	2.15	1.89	-0.26	---	-0.26	-0.11	-1.18	187.33	0.09														
		11:12	2.08	1.89	-0.19	---	-0.19	-0.08	-0.45	363.30	0.18														
		11:25	2.07	2.25	0.18	---	0.18	0.08	0.30	521.10	0.26														
		11:38	2.06	2.20	0.14	---	0.14	0.06	0.22	531.20	0.27														
		11:52	2.08	2.11	0.03	---	0.03	0.01	0.31	77.18	0.04														
		12:05	2.09	2.34	0.25	---	0.25	0.11	0.37	580.50	0.29														
		12:23	2.10	2.37	0.27	---	0.27	0.12	0.43	534.20	0.27														
		12:36	2.10	2.34	0.24	---	0.24	0.10	0.33	630.20	0.32														
		12:49	2.10	2.39	0.29	---	0.29	0.12	0.37	662.00	0.33														
		13:02	2.11	2.39	0.28	---	0.28	0.12	0.32	746.70	0.37														
		13:15	2.11	2.40	0.29	---	0.29	0.12	---	---	---														
		13:30	2.11	2.42	0.31	---	0.31	0.13	---	---	---														
		13:42	2.10	2.13	0.03	---	0.03	0.01	---	---	---														
		13:56	2.10	2.44	0.34	---	0.34	0.15	---	---	---														
		14:11	2.11	2.45	0.34	---	0.34	0.15	---	---	---														
		14:28	2.07	2.12	0.05	---	0.05	0.02	0.39	103.53	0.05														
		14:41	2.04	2.14	0.10	---	0.10	0.04	0.79	111.01	0.06														

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
	9	9:43	2.03	1.90	-0.13	---	-0.13	-0.06	-3.81	33.2	0.02	0.98	111.5	17.50	2.42	15.08	0.640	27.34	3.78	23.56	23.59	0.74	0.10	1.16	0.16
		9:58	2.00	1.88	-0.12	---	-0.12	-0.06	-3.52	33.58	0.02														
		10:12	2.01	1.83	-0.18	---	-0.18	-0.09	-3.81	47.22	0.02														
		10:27	2.01	1.84	-0.17	---	-0.17	-0.08	-1.34	125.61	0.06														
		10:44	2.12	1.86	-0.26	---	-0.26	-0.13	-2.91	90.47	0.05														
		11:01	2.13	1.93	-0.20	---	-0.20	-0.10	-1.72	117.79	0.06														
		11:16	2.06	1.90	-0.16	---	-0.16	-0.08	-0.36	449.50	0.23														
		11:29	2.06	2.17	0.11	---	0.11	0.06	0.22	513.40	0.26														
		11:43	2.07	2.22	0.15	---	0.15	0.08	0.31	491.60	0.25														
		11:55	2.08	2.20	0.12	---	0.12	0.06	0.21	588.60	0.30														
		12:12	2.10	2.36	0.26	---	0.26	0.13	0.50	529.60	0.27														
		12:27	2.10	2.32	0.22	---	0.22	0.11	0.37	609.20	0.31														
		12:40	2.11	2.35	0.24	---	0.24	0.12	0.38	645.80	0.32														
		12:53	2.11	2.37	0.26	---	0.26	0.13	0.38	699.10	0.35														
		13:06	2.12	2.41	0.29	---	0.29	0.15	0.41	711.80	0.36														
		13:19	2.12	2.38	0.26	---	0.26	0.13	---	---	---														
		13:34	2.11	2.39	0.28	---	0.28	0.14	---	---	---														
		13:47	2.10	2.40	0.30	---	0.30	0.15	---	---	---														
		14:01	2.11	2.22	0.11	---	0.11	0.06	---	---	---														
		14:14	2.10	2.32	0.22	---	0.22	0.11	---	---	---														
		14:32	2.07	2.15	0.08	---	0.08	0.04	0.63	129.65	0.07														
		14:44	2.03	2.08	0.05	---	0.05	0.02	0.40	121.38	0.06														
	Average	9:36	2.05	2.03	-0.02	-0.02	0.00	0.00	-0.10	33.6	0.02	1.38	79.7	12.37	2.05	10.33	0.510	24.26	4.01	20.25	22.92	0.54	0.09	1.06	0.18
		9:53	2.01	1.86	-0.16	0.01	-0.17	-0.06	-3.74	32.82	0.02														
		10:06	1.99	1.83	-0.16	0.01	-0.18	-0.06	-3.34	38.73	0.02														
		10:22	2.00	1.82	-0.19	0.03	-0.21	-0.08	-1.82	84.89	0.04														
		10:37	2.05	1.86	-0.19	0.01	-0.20	-0.07	-2.07	70.15	0.04														
		10:56	2.13	1.92	-0.21	0.00	-0.21	-0.08	-0.93	166.61	0.08														
		11:11	2.07	1.88	-0.19	-0.02	-0.18	-0.06	-0.31	414.97	0.21														
		11:24	2.07	2.19	0.13	0.01	0.12	0.04	0.18	480.80	0.24														
		11:38	2.07	2.24	0.17	0.00	0.18	0.06	0.31	416.40	0.21														
		11:51	2.08	2.19	0.10	0.01	0.10	0.04	0.17	418.49	0.21														
		12:05	2.09	2.34	0.25	0.00	0.25	0.09	0.33	558.57	0.28														
		12:22	2.10	2.35	0.25	0.00	0.25	0.09	0.32	570.00	0.29														
		12:36	2.10	2.33	0.23	0.00	0.23	0.08	0.26	624.93	0.31														
		12:48	2.11	2.37	0.26	0.00	0.26	0.10	0.28	673.03	0.34														
		13:02	2.11	2.39	0.28	0.00	0.28	0.10	0.28	725.57	0.36														
		13:14	2.11	2.39	0.27	-0.01	0.28	0.10	0.31	664.20	0.33														
		13:30	2.11	2.33	0.22	0.01	0.21	0.08	---	---	---														
		13:42	2.10	2.24	0.14	0.00	0.13	0.05	---	---	---														
		13:56	2.10	2.34	0.24	0.00	0.24	0.09	---	---	---														
		14:10	2.11	2.38	0.27	0.00	0.27	0.10	---	---	---														
		14:28	2.08	2.21	0.13	0.01	0.12	0.04	0.61	144.11	0.07														
		14:40	2.04	2.14	0.10	0.02	0.08	0.03	0.51	110.86	0.06														

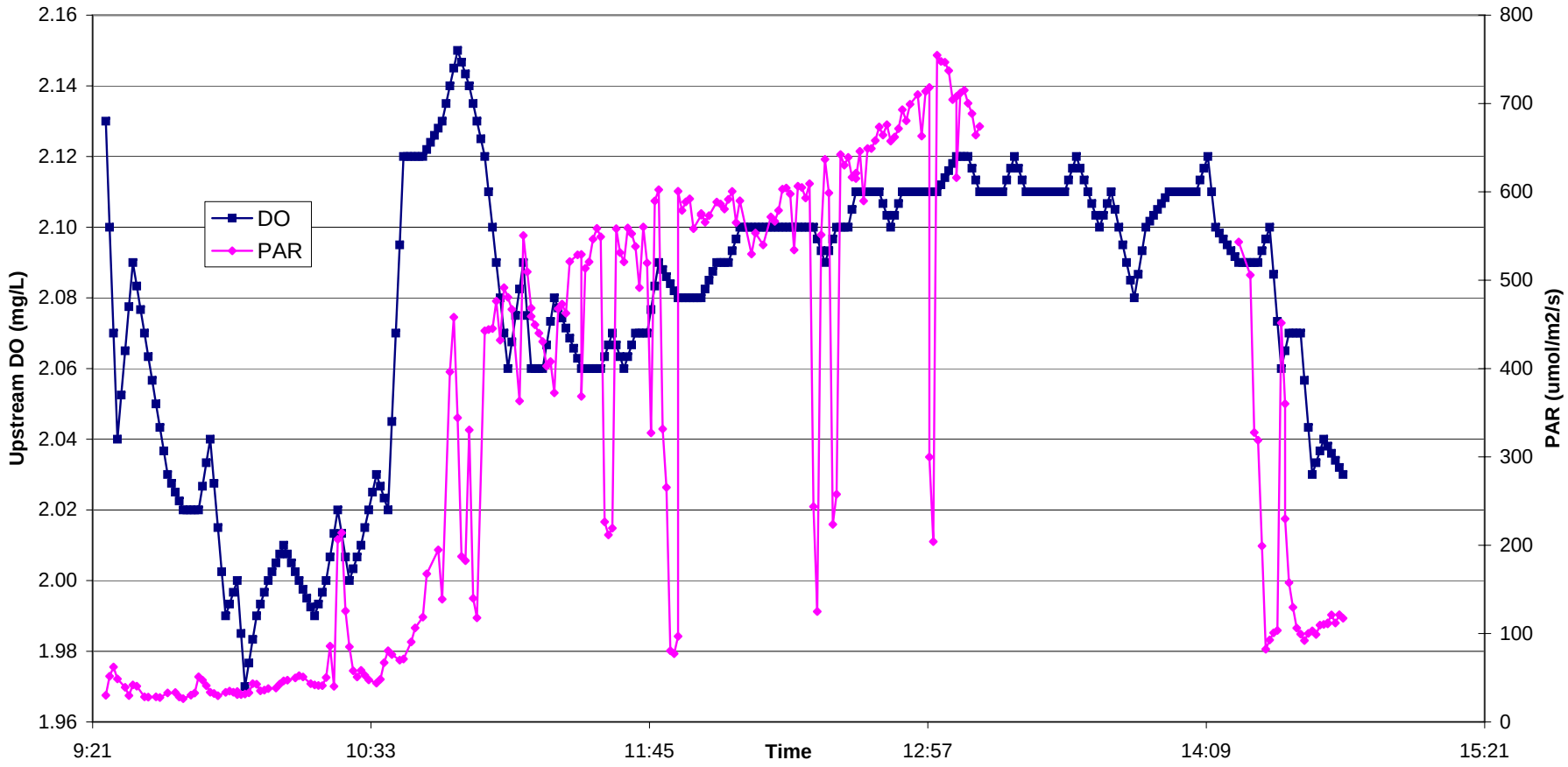
APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
CONTROL	2	9:27	2.07	2.02	-0.05	---	-0.05	-0.11	-3.64	62.2	0.03	0.22	498.9	---	---	---	---	---	---	---	---	---	---	---	---
		9:47	2.02	2.03	0.01	---	0.01	0.02	1.50	30.25	0.02														
		10:00	1.99	2.01	0.02	---	0.02	0.06	3.67	30.90	0.02														
		10:16	2.00	2.01	0.01	---	0.01	0.03	1.11	50.96	0.03														
		10:30	2.01	2.00	-0.01	---	-0.01	-0.02	-0.59	50.92	0.03														
		10:48	2.12	2.09	-0.03	---	-0.03	-0.07	-0.87	167.64	0.08														
		11:05	2.10	2.06	-0.04	---	-0.04	-0.09	-0.41	445.30	0.22														
		11:19	2.07	2.06	-0.01	---	-0.01	-0.02	-0.08	402.70	0.20														
		11:32	2.06	2.06	0.00	---	0.00	0.00	0.00	558.70	0.28														
		11:46	2.08	2.07	-0.01	---	-0.01	-0.02	-0.09	327.20	0.16														
		11:59	2.08	2.07	-0.01	---	-0.01	-0.02	-0.08	573.60	0.29														
		12:17	2.10	2.10	0.00	---	0.00	0.00	0.00	571.70	0.29														
		12:30	2.09	2.10	0.01	---	0.01	0.02	0.05	551.40	0.28														
		12:43	2.11	2.11	0.00	---	0.00	0.00	0.00	649.00	0.33														
		12:57	2.11	2.11	0.00	---	0.00	0.00	0.00	713.80	0.36														
		13:09	2.12	2.10	-0.02	---	-0.02	-0.04	-0.11	688.50	0.35														
		13:22	2.11	2.11	0.00	---	0.00	-0.01	---	---	---														
		13:37	2.12	2.12	0.00	---	0.00	0.01	---	---	---														
		13:50	2.09	2.08	0.00	---	0.00	-0.01	---	---	---														
		14:05	2.11	2.10	-0.01	---	-0.01	-0.02	---	---	---														
		14:22	2.09	2.08	-0.01	---	-0.01	-0.02	-0.14	327.60	0.16														
		14:35	2.06	2.08	0.02	---	0.02	0.05	1.15	92.21	0.05														
	5	9:33	2.08	2.05	-0.03	---	-0.03	-0.10	-4.93	40.4	0.02	0.17	657.7	---	---	---	---	---	---	---	---	---	---	---	---
		9:51	2.03	2.05	0.02	---	0.02	0.05	2.42	41.11	0.02														
		10:05	1.99	2.01	0.02	---	0.02	0.05	2.83	35.24	0.02														
		10:21	2.00	2.04	0.04	---	0.04	0.13	6.30	41.14	0.02														
		10:36	2.03	2.04	0.01	---	0.01	0.04	1.65	48.27	0.02														
		10:55	2.15	2.15	0.00	---	0.00	0.01	0.07	458.10	0.23														
		11:10	2.07	2.06	-0.01	---	-0.01	-0.02	-0.10	467.00	0.23														
		11:23	2.07	2.09	0.02	---	0.02	0.05	0.20	473.10	0.24														
		11:37	2.07	2.06	-0.01	---	-0.01	-0.02	-0.07	558.30	0.28														
		11:50	2.09	2.10	0.01	---	0.01	0.04	0.32	265.40	0.13														
		12:04	2.09	2.08	-0.01	---	-0.01	-0.03	-0.10	586.30	0.29														
		12:21	2.10	2.10	0.00	---	0.00	0.00	0.00	604.40	0.30														
		12:35	2.10	2.10	0.00	---	0.00	0.00	0.00	642.20	0.32														
		12:47	2.10	2.10	0.00	---	0.00	-0.01	-0.03	676.00	0.34														
		13:01	2.11	2.11	0.00	---	0.00	-0.01	-0.02	747.70	0.38														
		13:13	2.11	2.11	0.00	---	0.00	0.00	---	---	---														
		13:29	2.11	2.12	0.01	---	0.01	0.03	---	---	---														
		13:41	2.10	2.11	0.01	---	0.01	0.02	---	---	---														
		13:55	2.10	2.10	0.00	---	0.00	0.00	---	---	---														
		14:09	2.12	2.12	0.00	---	0.00	0.01	---	---	---														
		14:27	2.09	2.10	0.01	---	0.01	0.04	0.79	100.89	0.05														
		14:39	2.04	2.03	-0.01	---	-0.01	-0.02	-0.36	109.51	0.05														

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
	8	9:39	2.04	2.07	0.03	---	0.03	0.08	5.61	27.6	0.01	0.17	639.2	---	---	---	---	---	---	---	---	---	---	---	---
		9:57	1.99	2.00	0.01	---	0.01	0.02	1.11	34.89	0.02														
		10:10	2.01	2.01	0.00	---	0.00	0.01	0.34	42.79	0.02														
		10:26	2.01	2.04	0.03	---	0.03	0.08	0.72	214.10	0.11														
		10:41	2.10	2.12	0.02	---	0.02	0.07	2.08	69.95	0.04														
		11:00	2.14	2.17	0.04	---	0.04	0.10	1.45	139.82	0.07														
		11:15	2.06	2.06	0.00	---	0.00	0.00	0.00	468.50	0.24														
		11:28	2.06	2.08	0.02	---	0.02	0.06	0.22	529.10	0.27														
		11:41	2.07	2.07	0.00	---	0.00	0.01	0.04	552.60	0.28														
		11:54	2.08	2.09	0.01	---	0.01	0.03	0.10	578.90	0.29														
		12:08	2.10	2.12	0.02	---	0.02	0.07	0.24	565.10	0.28														
		12:26	2.10	2.10	0.00	---	0.00	0.00	0.00	593.00	0.30														
		12:39	2.11	2.11	0.00	---	0.00	0.00	0.00	621.20	0.31														
		12:52	2.11	2.11	0.00	---	0.00	0.00	0.00	680.50	0.34														
		13:05	2.12	2.12	0.00	---	0.00	0.00	0.00	707.90	0.36														
		13:18	2.11	2.11	0.00	---	0.00	-0.01	---	---	---														
		13:32	2.11	2.12	0.01	---	0.01	0.03	---	---	---														
		13:46	2.11	2.10	0.00	---	0.00	-0.01	---	---	---														
		14:00	2.11	2.12	0.01	---	0.01	0.03	---	---	---														
		14:13	2.10	2.11	0.01	---	0.01	0.03	---	---	---														
		14:30	2.07	2.08	0.02	---	0.02	0.04	0.24	360.10	0.18														
		14:43	2.03	2.08	0.05	---	0.05	0.13	2.39	111.94	0.06														
	Average	9:33	2.07	2.05	-0.02	---	-0.02	-0.05	-2.33	43.4	0.02	0.19	589.5	---	---	---	---	---	---	---	---	---	---	---	---
		9:51	2.02	2.03	0.01	---	0.01	0.03	1.68	35.42	0.02														
		10:05	2.00	2.01	0.01	---	0.01	0.04	2.17	36.31	0.02														
		10:21	2.00	2.03	0.03	---	0.03	0.07	1.44	102.07	0.05														
		10:35	2.04	2.05	0.01	---	0.01	0.03	1.00	56.38	0.03														
		10:54	2.13	2.14	0.00	---	0.00	0.01	0.06	255.19	0.13														
		11:10	2.08	2.06	-0.02	---	-0.02	-0.04	-0.18	460.27	0.23														
		11:23	2.07	2.08	0.01	---	0.01	0.03	0.11	468.30	0.23														
		11:36	2.06	2.06	0.00	---	0.00	0.00	-0.01	556.53	0.28														
		11:50	2.08	2.09	0.01	---	0.01	0.02	0.08	390.50	0.20														
		12:03	2.09	2.09	0.00	---	0.00	0.00	0.01	575.00	0.29														
		12:21	2.10	2.10	0.00	---	0.00	0.00	0.00	589.70	0.30														
		12:34	2.10	2.10	0.00	---	0.00	0.01	0.02	604.93	0.30														
		12:47	2.11	2.11	0.00	---	0.00	0.00	-0.01	668.50	0.34														
		13:01	2.11	2.11	0.00	---	0.00	0.00	0.00	723.13	0.36														
		13:13	2.11	2.11	-0.01	---	-0.01	-0.02	-0.05	688.50	0.35														
		13:27	2.11	2.12	0.01	---	0.01	0.01	---	---	---														
		13:41	2.11	2.11	0.00	---	0.00	0.00	---	---	---														
		13:55	2.10	2.10	0.00	---	0.00	0.00	---	---	---														
		14:09	2.11	2.11	0.00	---	0.00	0.00	---	---	---														
		14:26	2.08	2.09	0.01	---	0.01	0.02	0.12	262.86	0.13														
		14:39	2.04	2.06	0.02	---	0.02	0.06	1.07	104.55	0.05														

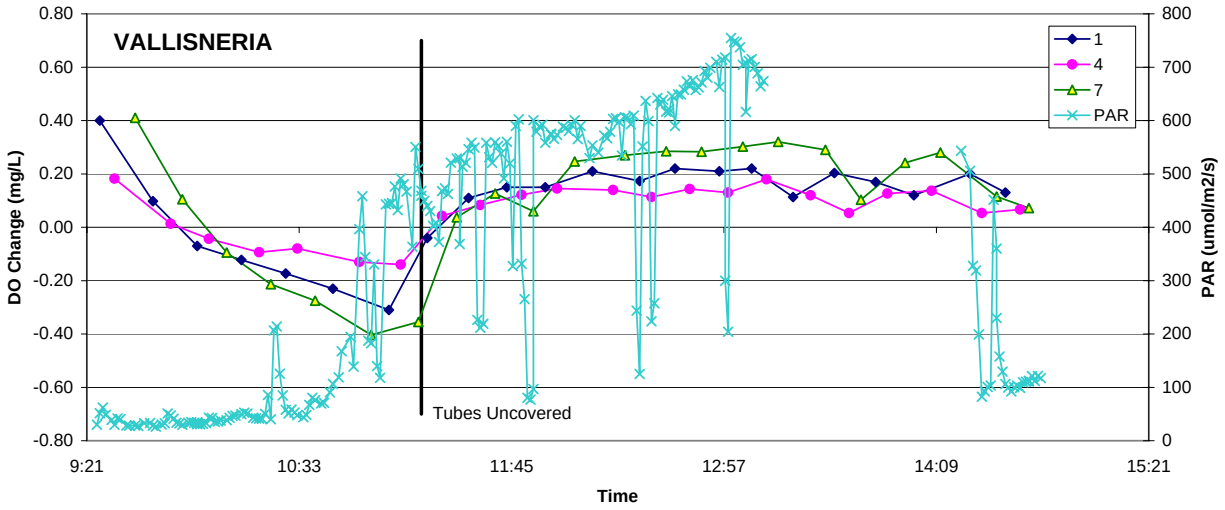
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

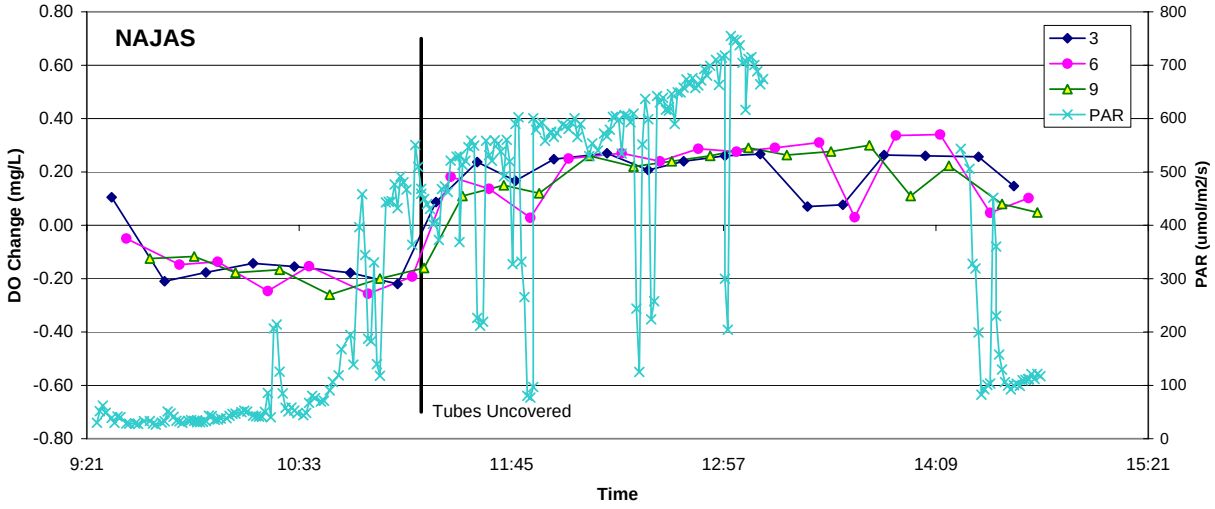


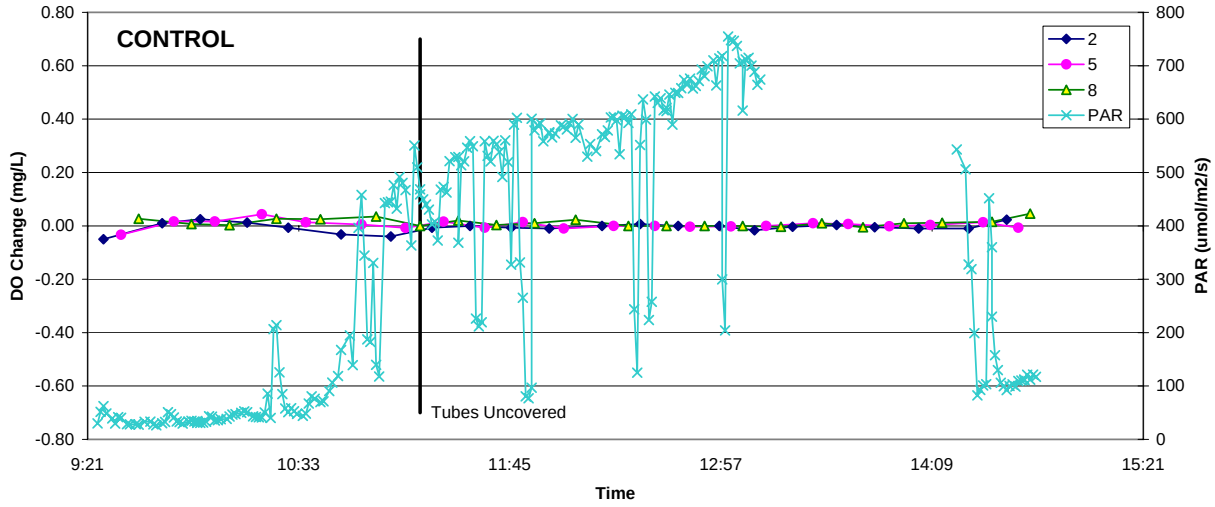
APPENDIX H-4

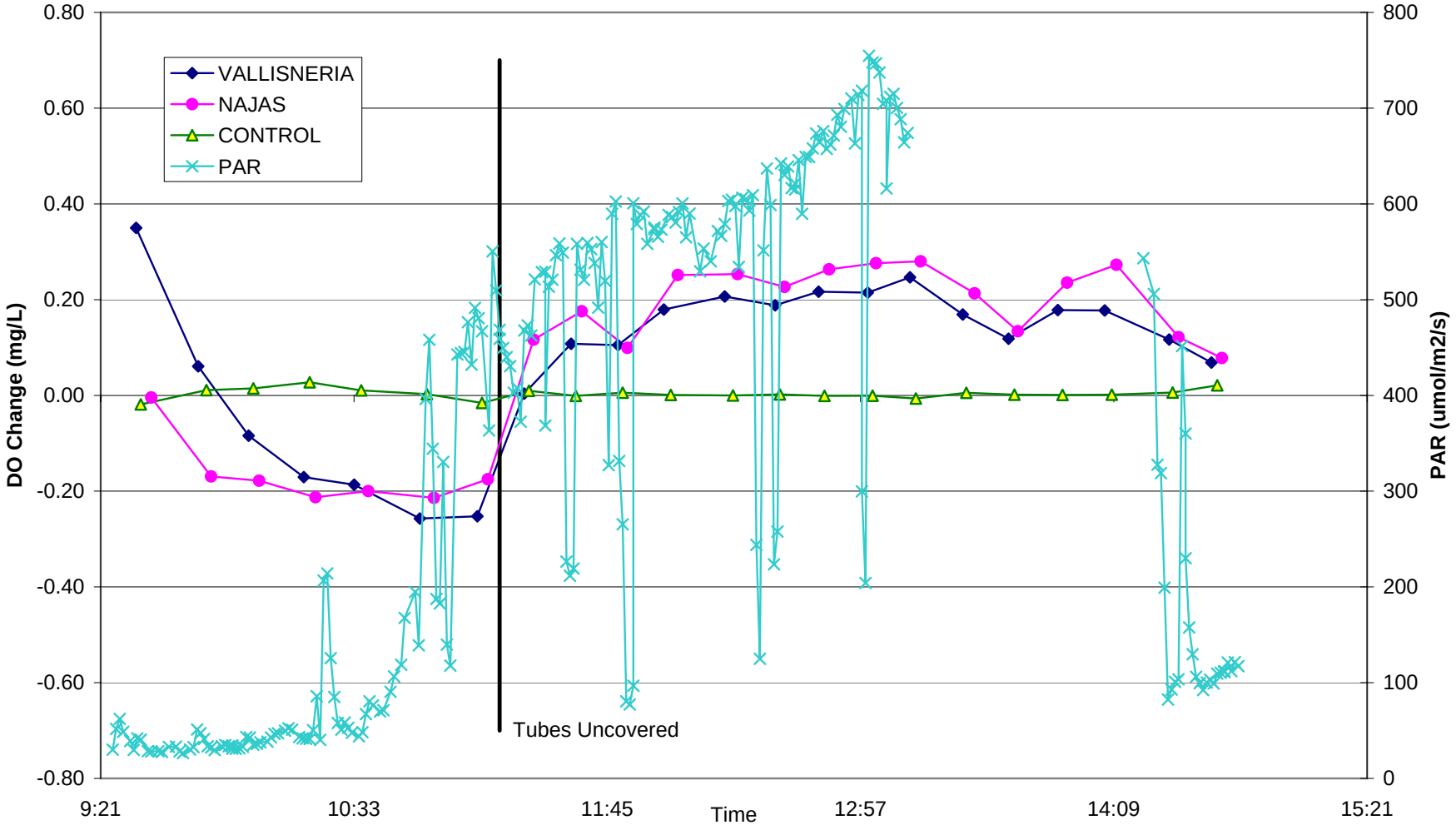
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05



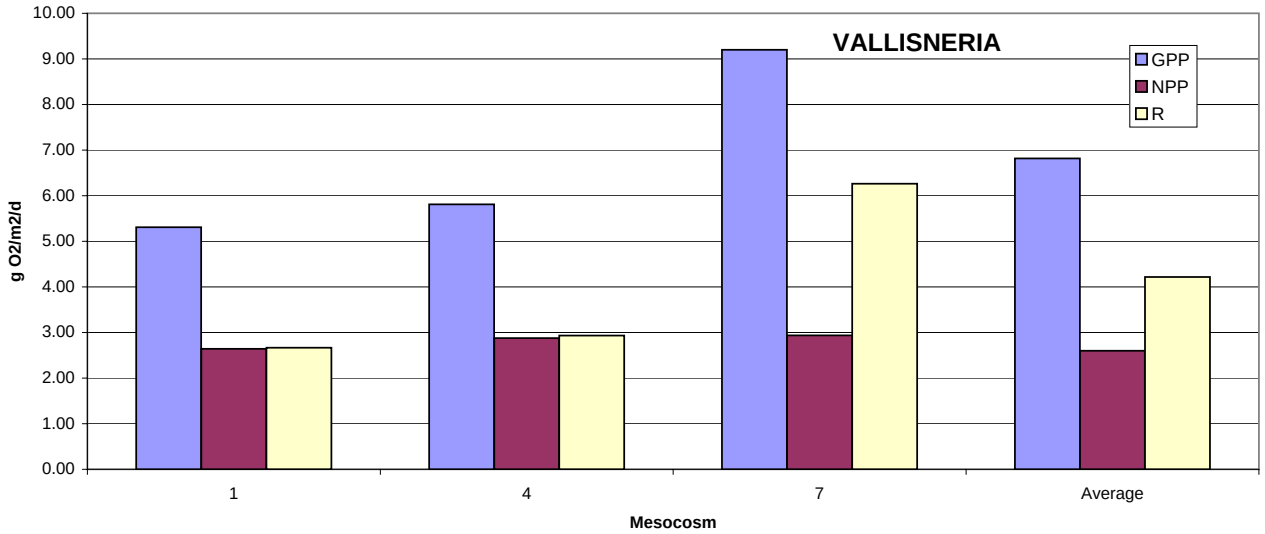


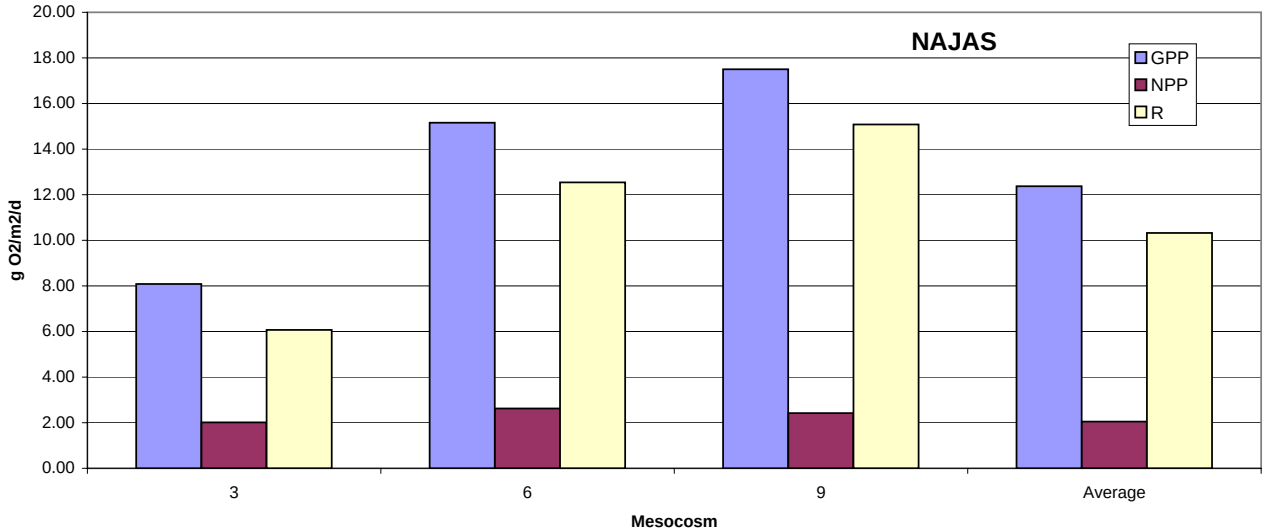




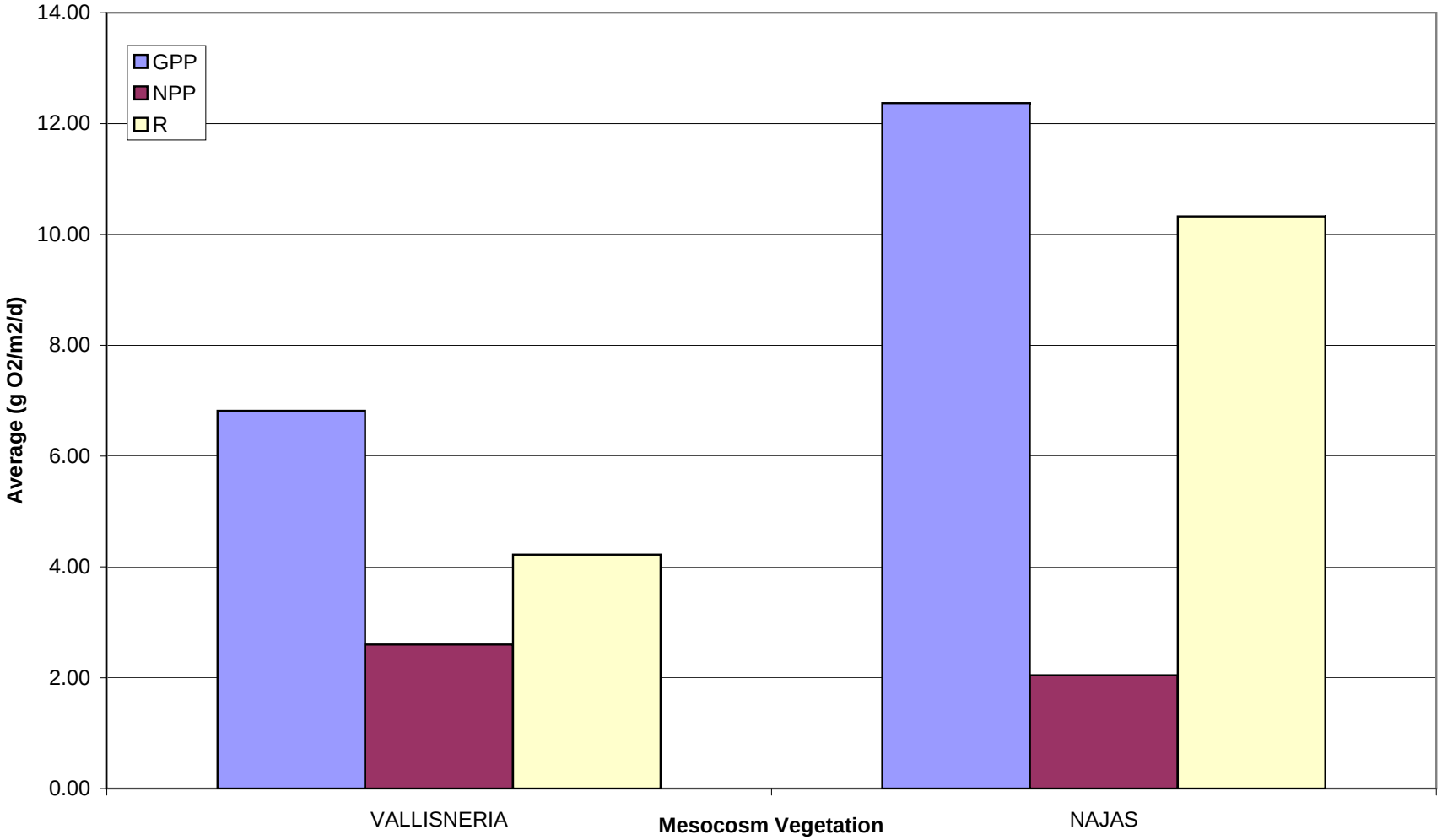
APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05





Averages corrected for Control DO changes



APPENDIX H-4
MESOCOSM STUDY AT ROCK SPRING RUN SEGMENT 2 - 8/4/05

APPENDIX H-5

MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1

		5/24/2005		8/29/2005	
PARAMETER	UNITS	VALLISNERIA	CERATOPHYLLUM	VALLISNERIA	CERATOPHYLLUM
UPSTREAM DO	mg/L	6.20	6.16	5.10	5.00
DOWNSTREAM DO		6.22	6.22	5.08	5.00
CHANGE DO		0.02	0.06	-0.02	0.00
TRAVEL TIME	minutes	2.82	6.38	1.71	4.36
VELOCITY	m/hr	39	17	64	25
GPP	g $O_2/m^2/d$	3.76	3.50	5.68	8.29
NPP		0.24	0.14	2.43	0.53
R		3.52	3.36	3.25	7.77
Vegetation	kg DW/m^2	0.802	0.831	0.485	0.429
GPP	g O_2/kg DW/d	4.69	4.21	11.72	19.32
NPP		0.30	0.17	5.01	1.22
R24		4.39	4.04	6.71	18.09
PAR	mol/hr	0.14	0.20	0.30	0.29
	$mol/m^2/d$	17.3	22.3	28.6	26.3
GPP	g O_2/mol	0.22	0.157	0.20	0.315
NPP		0.014	0.006	0.085	0.020
GPP	g O_2/kg DW/mol	0.27	0.19	0.41	0.74
NPP		0.02	0.008	0.18	0.047

APPENDIX H-5

MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05

		VALLISNERIA				CERATOPHYLLUM				CONTROL			
PARAMETER	UNITS	1	2	3	Average [a]	7	8	9	Average [a]	4	5	6	Average
UPSTREAM DO	mg/L	6.19	6.21	6.21	6.20	6.25	6.26	6.16	6.16	6.03	6.03	6.01	5.99
DOWNSTREAM DO		6.23	6.21	6.24	6.22	6.33	6.27	6.22	6.22	6.03	6.05	6.04	6.01
CHANGE DO		0.04	0.01	0.03	0.02	0.08	0.02	0.05	0.06	0.00	0.02	0.03	0.02
TRAVEL TIME	minutes	2.98	3.47	2.01	2.82	6.44	4.80	7.91	6.38	0.47	0.50	0.47	0.48
VELOCITY	m/hr	36.9	31.6	54.6	38.9	17.0	22.9	13.9	17.2	232	221	235	229
GPP	g $O_2/m^2/d$	4.54	2.75	5.00	3.76	3.50	4.93	2.76	3.50	---	---	---	---
NPP24		0.66	-0.13	1.28	0.24	0.94	0.15	0.27	0.14	---	---	---	---
R24		3.87	2.88	3.72	3.52	2.56	4.77	2.49	3.36	---	---	---	---
Vegetation	kg DW/m^2	0.789	0.947	0.671	0.802	1.170	0.731	0.593	0.831	---	---	---	---
GPP	g O_2/kg DW/d	5.75	2.90	7.44	4.69	2.99	6.74	4.65	4.21	---	---	---	---
NPP24		0.84	-0.14	1.90	0.30	0.80	0.21	0.46	0.17	---	---	---	---
R24		4.91	3.04	5.54	4.39	2.19	6.53	4.19	4.04	---	---	---	---
PAR	mol/hr	0.120	0.155	0.174	0.140	0.196	0.147	0.186	0.201	---	---	---	---
	$mol/m^2/d$	13.4	18.5	19.8	17.3	23.3	19.6	21.6	22.3	---	---	---	---
GPP	g O_2/mol	0.338	0.149	0.252	0.218	0.150	0.251	0.128	0.157	---	---	---	---
NPP		0.049	-0.007	0.064	0.014	0.040	0.008	0.013	0.006	---	---	---	---
GPP	g O_2/kg DW/mol	0.428	0.157	0.375	0.272	0.128	0.343	0.215	0.189	---	---	---	---
NPP		0.063	-0.007	0.096	0.017	0.034	0.011	0.021	0.008	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
VALLISNERIA	1	11:40	5.39	5.64	0.25	---	0.25	0.04	0.47	180.7	0.09	2.98	36.9	4.54	0.66	3.87	0.789	5.75	0.84	4.91	13.43	0.34	0.05	0.43	0.06
		12:06	5.84	5.99	0.15	---	0.15	0.03	0.10	492.3	0.25														
		12:34	6.24	6.40	0.16	---	0.16	0.03	0.43	124.1	0.06														
		13:00	6.52	6.72	0.20	---	0.20	0.03	0.18	367.5	0.18														
		13:28	6.91	7.05	0.14	---	0.14	0.02	0.20	238.3	0.12														
		13:54	6.54	6.57	0.03	---	0.03	0.01	0.03	319.5	0.16														
		14:22	6.68	6.58	-0.10	---	-0.10	-0.02	-0.31	109.6	0.05														
		14:48	6.60	6.47	-0.13	---	-0.13	-0.02	-0.54	78.3	0.04														
		15:42	5.82	5.65	-0.17	---	-0.17	-0.03	---	---	---														
		17:11	5.36	5.22	-0.14	---	-0.14	-0.02	---	---	---														
	2	11:42	5.43	5.52	0.09	---	0.09	0.01	0.10	255.50	0.13	3.47	31.6	2.75	-0.13	2.88	0.947	2.90	-0.14	3.04	18.50	0.15	-0.01	0.16	-0.01
		12:10	5.88	6.01	0.13	---	0.13	0.02	0.08	477.60	0.24														
		12:36	6.26	6.33	0.07	---	0.07	0.01	0.11	177.85	0.09														
		13:04	6.60	6.74	0.14	---	0.14	0.02	0.05	760.10	0.38														
		13:30	6.89	7.03	0.14	---	0.14	0.02	0.17	231.40	0.12														
		13:58	6.57	6.53	-0.04	---	-0.04	-0.01	-0.02	469.50	0.24														
		14:24	6.67	6.55	-0.12	---	-0.12	-0.02	-0.69	49.93	0.03														
		14:52	6.63	6.57	-0.06	---	-0.06	-0.01	-0.29	56.03	0.03														
		15:48	5.79	5.68	-0.11	---	-0.11	-0.02	---	---	---														
		17:12	5.34	5.16	-0.18	---	-0.18	-0.03	---	---	---														
	3	11:46	5.51	5.70	0.19	---	0.19	0.05	0.44	208.20	0.10	2.01	54.6	5.00	1.28	3.72	0.671	7.44	1.90	5.54	19.84	0.25	0.06	0.38	0.10
		12:12	5.89	6.06	0.17	---	0.17	0.04	0.17	502.20	0.25														
		12:40	6.28	6.42	0.14	---	0.14	0.03	0.09	729.80	0.37														
		13:06	6.64	6.81	0.17	---	0.17	0.04	0.12	694.80	0.35														
		13:34	6.87	6.98	0.11	---	0.11	0.03	0.46	119.28	0.06														
		14:00	6.59	6.59	0.00	---	0.00	0.00	0.00	289.20	0.15														
		14:28	6.62	6.55	-0.07	---	-0.07	-0.02	-0.07	529.90	0.27														
		14:54	6.61	6.56	-0.05	---	-0.05	-0.01	-0.56	47.13	0.02														
		15:22	6.21	6.16	-0.05	---	-0.05	-0.01	-3.36	7.40	0.00														
		15:50	5.78	5.66	-0.12	---	-0.12	-0.03	---	---	---														
		17:15	5.32	5.18	-0.14	---	-0.14	-0.03	---	---	---														
	Average	11:42	5.44	5.62	0.18	0.01	0.17	0.03	0.28	214.80	0.11	2.82	38.9	3.76	0.24	3.52	0.802	4.69	0.30	4.39	17.26	0.22	0.01	0.27	0.02
		12:09	5.87	6.02	0.15	0.03	0.12	0.02	0.09	490.70	0.25														
		12:36	6.26	6.38	0.12	0.02	0.10	0.02	0.11	343.92	0.17														
		13:03	6.59	6.76	0.17	0.00	0.17	0.03	0.10	607.47	0.30														
		13:30	6.89	7.02	0.13	0.00	0.13	0.02	0.23	196.33	0.10														
		13:57	6.57	6.56	0.00	0.02	-0.02	0.00	-0.02	359.40	0.18														
		14:24	6.66	6.56	-0.10	0.05	-0.15	-0.03	-0.23	229.80	0.12														
		14:51	6.61	6.53	-0.08	0.01	-0.09	-0.02	-0.53	60.47	0.03														
		15:22	6.21	6.16	-0.05	---	-0.05	-0.01	-2.39	7.40	0.00														
		15:46	5.80	5.66	-0.13	---	-0.13	-0.02	---	---	---														
		17:12	5.34	5.19	-0.15	0.00	-0.16	-0.03	---	---	---														

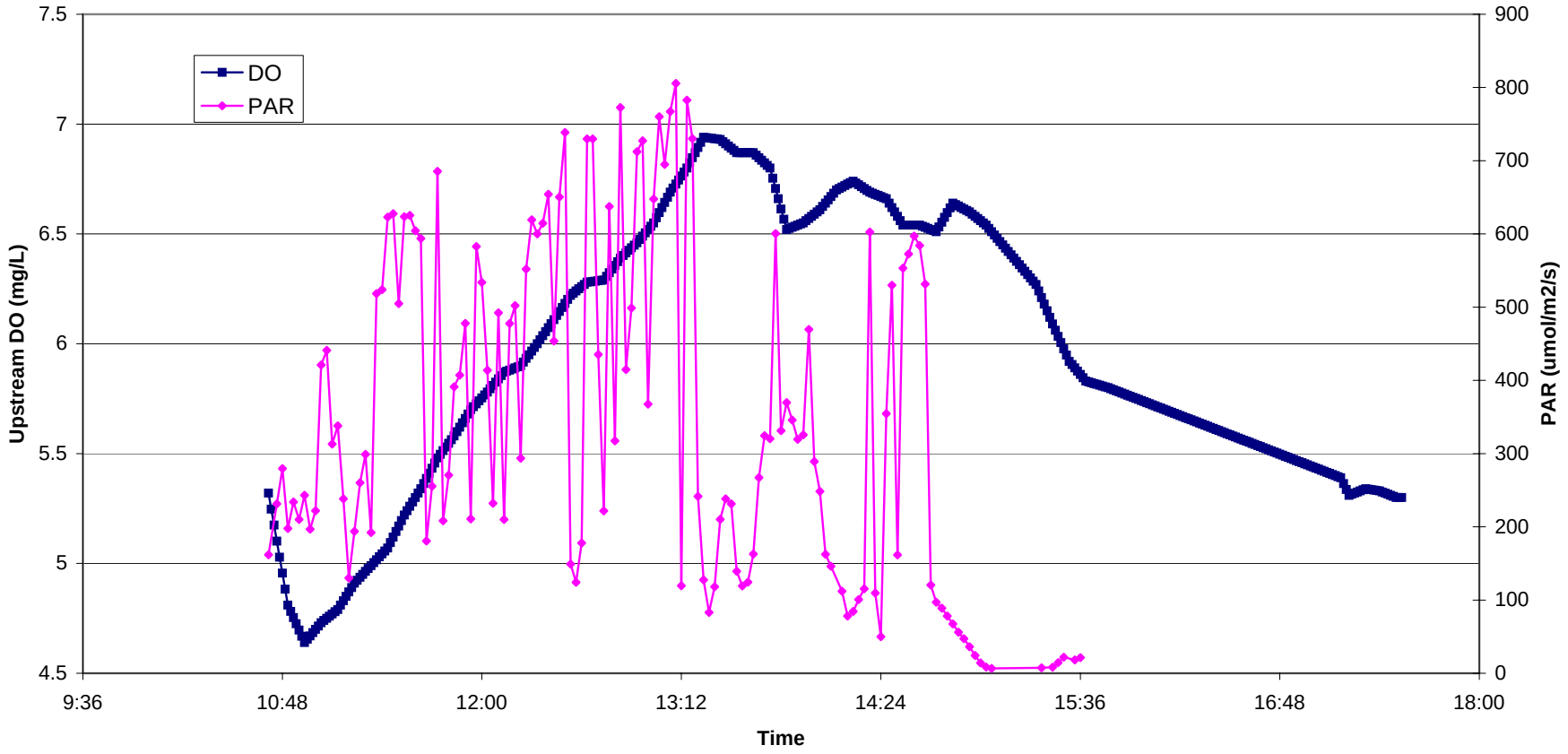
APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
CERATOPHYLLUM	7	11:58	5.73	6.04	0.31	---	0.31	0.02	0.08	582.90	0.29	6.44	17.0	3.50	0.94	2.56	1.170	2.99	0.80	2.19	23.34	0.15	0.04	0.13	0.03
		12:24	6.07	6.42	0.35	---	0.35	0.03	0.08	654.20	0.33														
		12:52	6.41	6.71	0.30	---	0.30	0.02	0.11	414.70	0.21														
		13:18	6.89	7.22	0.33	---	0.33	0.03	0.21	241.60	0.12														
		13:46	6.71	6.88	0.17	---	0.17	0.01	0.04	600.40	0.30														
		14:12	6.73	6.69	-0.04	---	-0.04	0.00	-0.07	78.11	0.04														
		14:40	6.53	6.32	-0.21	---	-0.21	-0.02	-0.06	531.50	0.27														
		15:34	5.89	5.63	-0.26	---	-0.26	-0.02	-2.21	18.22	0.01														
		17:26	5.32	5.06	-0.26	---	-0.26	-0.02	---	---	---														
	8	12:00	5.75	5.99	0.24	---	0.24	0.02	0.09	533.90	0.27	4.80	22.9	4.93	0.15	4.77	0.731	6.74	0.21	6.53	19.63	0.25	0.01	0.34	0.01
		12:28	6.15	6.39	0.24	---	0.24	0.03	0.08	650.40	0.33														
		12:54	6.44	6.73	0.29	---	0.29	0.03	0.12	498.80	0.25														
		13:22	6.94	7.10	0.16	---	0.16	0.02	0.41	82.99	0.04														
		13:48	6.61	6.88	0.27	---	0.27	0.03	0.17	331.30	0.17														
		14:16	6.72	6.59	-0.13	---	-0.13	-0.01	-0.28	100.74	0.05														
		14:42	6.52	6.26	-0.26	---	-0.26	-0.03	-0.45	120.58	0.06														
		15:36	5.86	5.56	-0.30	---	-0.30	-0.03	-2.93	21.32	0.01														
		17:28	5.31	4.94	-0.37	---	-0.37	-0.04	---	---	---														
	9	11:36	5.30	5.47	0.17	---	0.17	0.01	0.04	604.30	0.30	7.91	13.9	2.76	0.27	2.49	0.593	4.65	0.46	4.19	21.57	0.13	0.01	0.22	0.02
		12:04	5.81	6.06	0.25	---	0.25	0.02	0.14	232.10	0.12														
		12:30	6.18	6.47	0.29	---	0.29	0.02	0.05	738.50	0.37														
		12:58	6.49	6.77	0.28	---	0.28	0.02	0.05	727.20	0.36														
		13:24	6.93	7.08	0.15	---	0.15	0.01	0.16	118.14	0.06														
		13:52	6.53	6.83	0.30	---	0.30	0.02	0.11	345.70	0.17														
		14:18	6.71	6.60	-0.11	---	-0.11	-0.01	-0.12	115.30	0.06														
		14:46	6.55	6.33	-0.22	---	-0.22	-0.01	-0.32	88.92	0.04														
		15:40	5.82	5.54	-0.28	---	-0.28	-0.02	---	---	---														
		17:32	5.30	5.00	-0.30	---	-0.30	-0.02	---	---	---														
	Average	11:36	5.30	5.47	0.17	0.04	0.13	0.01	0.03	604.30	0.30	6.38	17.2	3.50	0.14	3.36	0.831	4.21	0.17	4.04	22.27	0.16	0.01	0.19	0.01
		12:00	5.76	6.03	0.27	0.01	0.26	0.02	0.09	449.63	0.23														
		12:27	6.13	6.43	0.29	0.03	0.26	0.02	0.06	681.03	0.34														
		12:54	6.45	6.74	0.29	0.02	0.27	0.02	0.08	546.90	0.27														
		13:21	6.92	7.13	0.21	0.00	0.21	0.02	0.22	147.58	0.07														
		13:48	6.62	6.86	0.25	0.00	0.24	0.02	0.09	425.80	0.21														
		14:15	6.72	6.63	-0.09	0.02	-0.11	-0.01	-0.17	98.05	0.05														
		14:42	6.53	6.30	-0.23	0.05	-0.28	-0.02	-0.18	247.00	0.12														
		15:36	5.86	5.58	-0.28	0.01	-0.29	-0.02	---	---	---														
		17:28	5.31	5.00	-0.31	0.00	-0.31	-0.02	---	---	---														

APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
CONTROL	4	10:54	4.70	4.68	-0.02	---	-0.02	-0.02	-0.17	210.10	0.11	0.47	232.2	---	---	---	---	---	---	---	---	---	---	---	---
		11:22	5.02	5.02	0.00	---	0.00	0.00	0.01	518.60	0.26														
		11:48	5.55	5.56	0.01	---	0.01	0.01	0.10	270.50	0.14														
		12:16	5.93	5.94	0.01	---	0.01	0.01	0.03	551.90	0.28														
		12:42	6.29	6.27	-0.02	---	-0.02	-0.02	-0.08	435.40	0.22														
		13:10	6.73	6.70	-0.03	---	-0.03	-0.03	-0.07	805.50	0.40														
		13:36	6.87	6.89	0.02	---	0.02	0.02	0.34	124.42	0.06														
		14:04	6.64	6.59	-0.05	---	-0.05	-0.05	-0.65	162.45	0.08														
		14:30	6.58	6.66	0.08	---	0.08	0.08	1.05	161.56	0.08														
		14:58	6.58	6.58	0.00	---	0.00	0.00	0.00	24.24	0.01														
		15:24	6.15	6.11	-0.04	---	-0.04	-0.04	---	---	---														
		17:17	5.33	5.34	0.01	---	0.01	0.01	---	---	---														
	5	10:58	4.67	4.79	0.12	---	0.12	0.12	1.23	196.65	0.10	0.50	221.4	---	---	---	---	---	---	---	---	---	---	---	---
		11:24	5.04	5.04	0.00	---	0.00	0.00	-0.01	523.80	0.26														
		11:52	5.62	5.65	0.03	---	0.03	0.03	0.15	407.10	0.20														
		12:18	5.97	5.99	0.02	---	0.02	0.02	0.08	619.30	0.31														
		12:46	6.32	6.33	0.01	---	0.01	0.01	0.02	637.50	0.32														
		13:12	6.76	6.78	0.02	---	0.02	0.02	0.28	119.53	0.06														
		13:40	6.85	6.86	0.01	---	0.01	0.01	0.10	267.20	0.13														
		14:06	6.67	6.68	0.01	---	0.01	0.01	0.14	146.15	0.07														
		14:34	6.54	6.57	0.03	---	0.03	0.03	0.11	572.70	0.29														
		15:00	6.56	6.58	0.02	---	0.02	0.02	2.85	14.14	0.01														
		15:28	6.03	6.01	-0.02	---	-0.02	-0.02	-3.25	14.43	0.01														
		17:21	5.34	5.33	-0.01	---	-0.01	-0.01	---	---	---														
	6	11:00	4.70	4.73	0.03	---	0.03	0.03	0.29	221.90	0.11	0.47	234.5	---	---	---	---	---	---	---	---	---	---	---	---
		11:28	5.12	5.14	0.02	---	0.02	0.02	0.07	627.60	0.31														
		11:54	5.66	5.70	0.04	---	0.04	0.04	0.18	477.90	0.24														
		12:22	6.04	6.06	0.02	---	0.02	0.02	0.08	614.60	0.31														
		12:48	6.36	6.40	0.04	---	0.04	0.05	0.29	317.30	0.16														
		13:16	6.85	6.86	0.01	---	0.01	0.01	0.04	730.20	0.37														
		13:42	6.82	6.80	-0.02	---	-0.02	-0.02	-0.15	324.40	0.16														
		14:10	6.71	6.80	0.09	---	0.09	0.09	1.65	112.13	0.06														
		14:36	6.54	6.58	0.04	---	0.04	0.04	0.14	597.10	0.30														
		15:30	5.98	5.99	0.01	---	0.01	0.01	1.29	21.96	0.01														
		17:23	5.33	5.34	0.01	---	0.01	0.01	---	---	---														
	Average	10:57	4.69	4.73	0.04	---	0.04	0.05	0.45	209.55	0.11	0.48	229.2	---	---	---	---	---	---	---	---	---	---	---	---
		11:24	5.06	5.07	0.01	---	0.01	0.01	0.02	556.67	0.28														
		11:51	5.61	5.64	0.03	---	0.03	0.03	0.14	385.17	0.19														
		12:18	5.98	6.00	0.02	---	0.02	0.02	0.06	595.27	0.30														
		13:12	6.78	6.78	0.00	---	0.00	0.00	0.08	551.74	0.28														
		13:39	6.85	6.85	0.00	---	0.00	0.00	0.10	238.67	0.12														
		14:06	6.67	6.69	0.02	---	0.02	0.02	0.38	140.24	0.07														
		14:33	6.55	6.60	0.05	---	0.05	0.05	0.43	443.79	0.22														
		15:09	6.37	6.38	0.01	---	0.01	0.01	1.38	20.11	0.01														
		17:20	5.33	5.34	0.00	---	0.00	0.00	---	---	---														

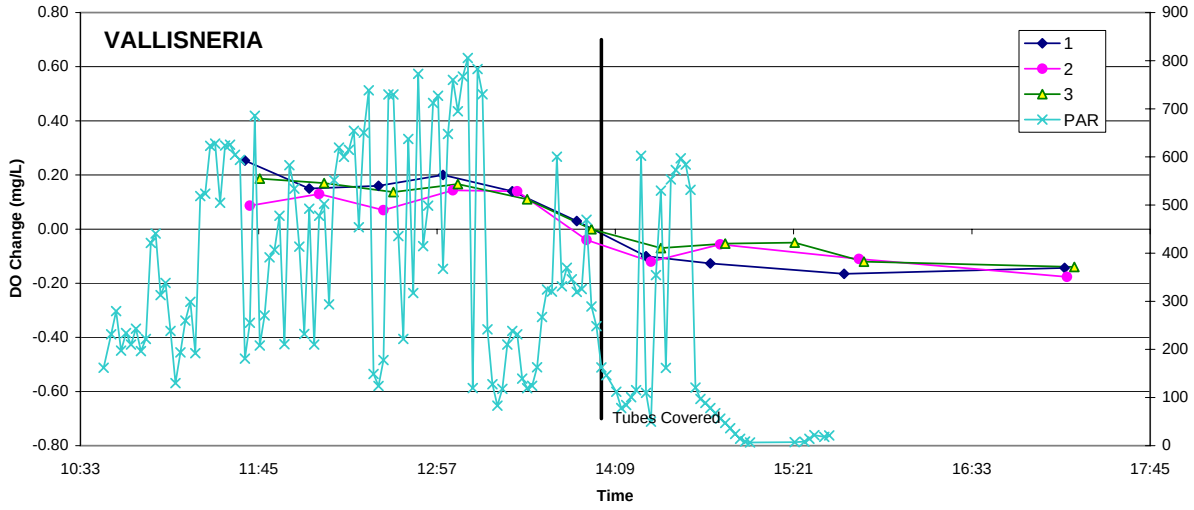
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

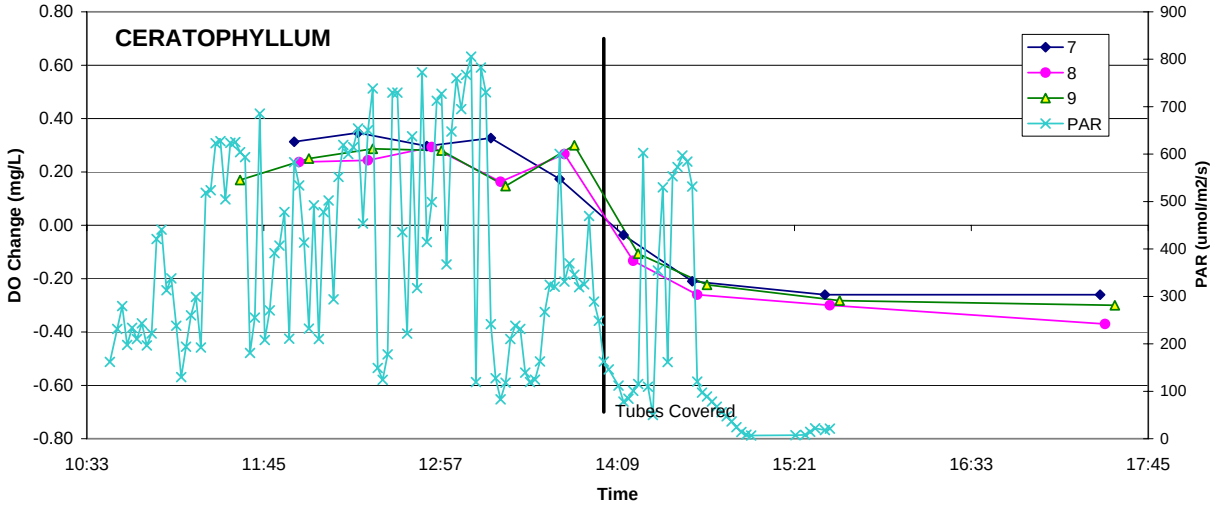


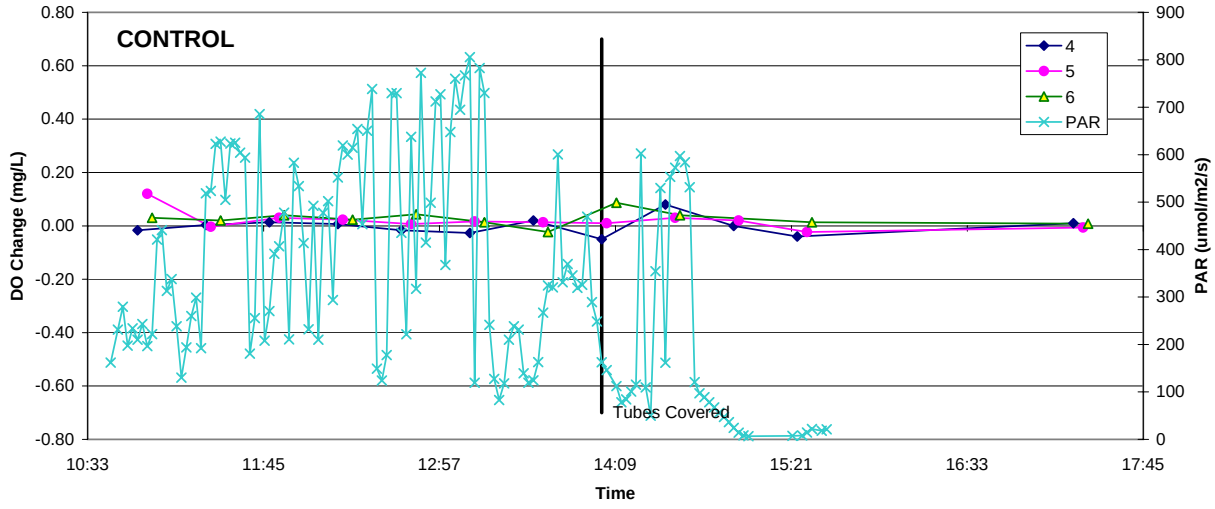
APPENDIX H-5

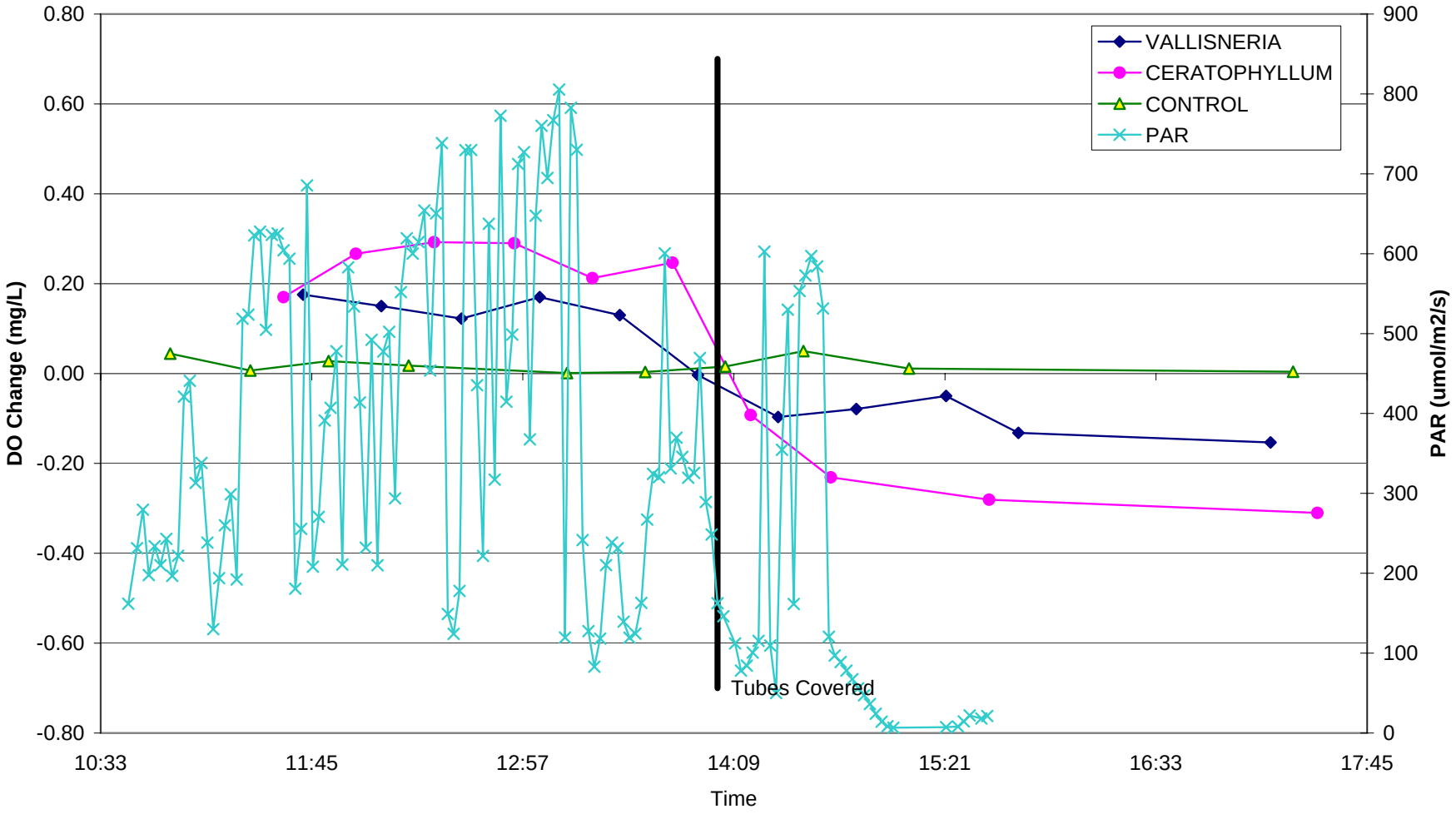
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05

APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05



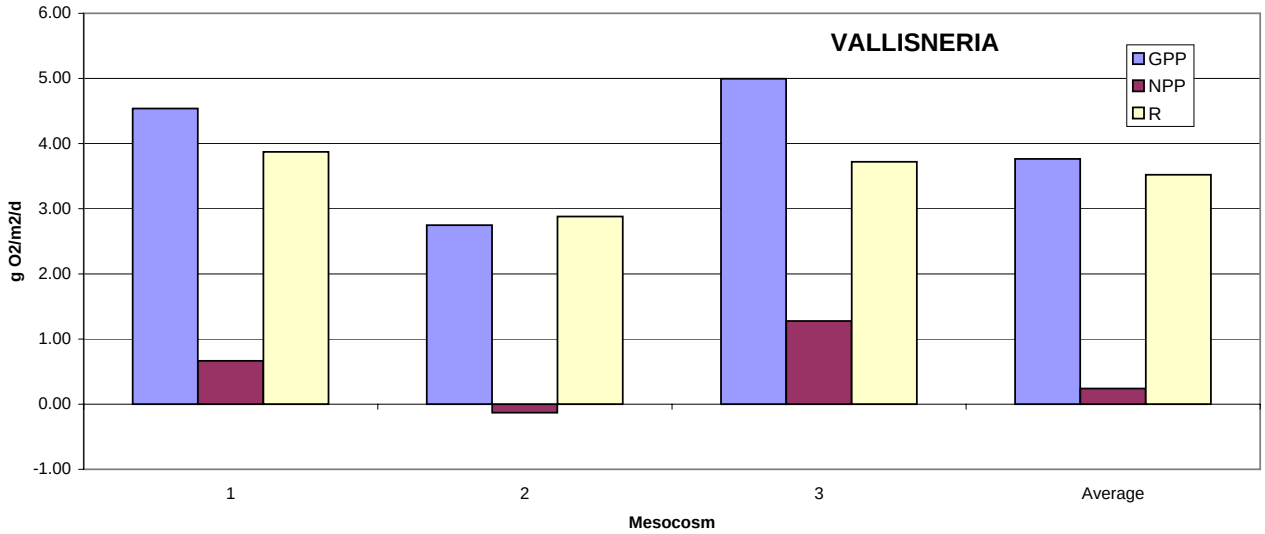


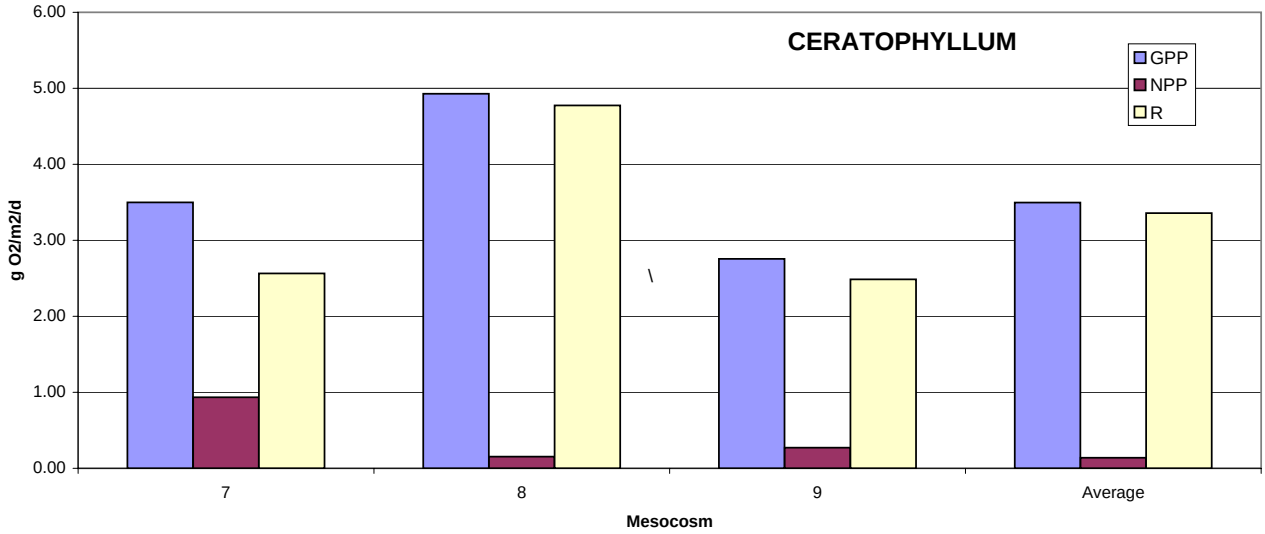




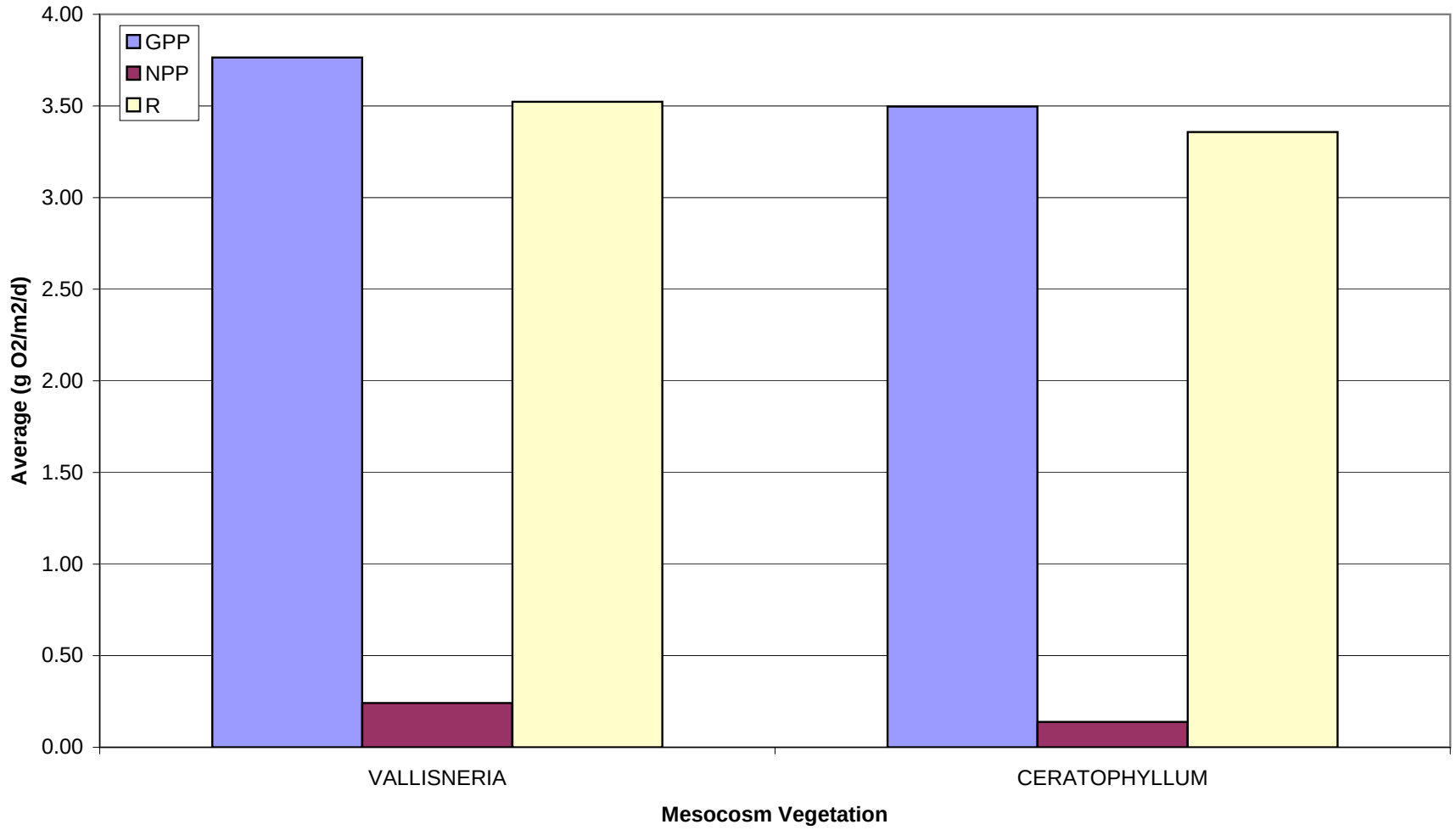
APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05

APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05





Averages corrected for Control DO changes



APPENDIX H-5

MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 5/24/05

Averages corrected for Control DO changes

APPENDIX H-5

MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05

		VALLISNERIA				CERATOPHYLLUM				CONTROL			
PARAMETER	UNITS	3	6	7	Average [a]	1	4	8	Average [a]	2	5	9	Average
UPSTREAM DO	mg/L	5.07	5.10	5.14	5.10	5.02	5.01	5.09	5.00	4.90	4.95	5.03	4.96
DOWNSTREAM DO		5.03	5.09	5.12	5.08	5.04	4.97	5.07	5.00	4.81	4.87	4.98	4.89
CHANGE DO		-0.04	-0.02	-0.02	-0.02	0.03	-0.04	-0.02	0.00	-0.09	-0.08	-0.05	-0.07
TRAVEL TIME	minutes	1.64	1.65	1.84	1.71	7.67	2.01	3.39	4.36	0.29	0.32	0.48	0.36
VELOCITY	m/hr	66.8	66.4	59.5	64.1	14.3	54.6	32.4	25.2	378	346	230	303
GPP	g $O_2/m^2/d$	8.27	5.74	9.40	5.68	5.92	4.39	4.88	8.29	---	---	---	---
NPP24		-2.34	-1.01	-1.10	2.43	0.21	-0.73	-0.60	0.53	---	---	---	---
R24		10.60	6.75	10.50	3.25	5.71	5.12	5.48	7.77	---	---	---	---
Vegetation	kg DW/m^2	0.631	0.419	0.404	0.485	0.413	0.439	0.436	0.429	---	---	---	---
GPP	g O_2/kg DW/d	13.10	13.68	23.24	11.72	14.32	10.00	11.20	19.32	---	---	---	---
NPP24		-3.70	-2.42	-2.73	5.01	0.51	-1.67	-1.39	1.22	---	---	---	---
R24		16.80	16.09	25.97	6.71	13.81	11.67	12.59	18.09	---	---	---	---
PAR	mol/hr	0.284	0.314	0.303	0.300	0.298	0.259	0.295	0.285	---	---	---	---
	$mol/m^2/d$	24.6	32.3	28.8	28.6	26.7	22.0	27.5	26.3	---	---	---	---
GPP	g O_2/mol	0.336	0.177	0.326	0.199	0.221	0.199	0.177	0.315	---	---	---	---
NPP		-0.095	-0.031	-0.038	0.085	0.008	-0.033	-0.022	0.020	---	---	---	---
GPP	g O_2/kg DW/mol	0.533	0.423	0.807	0.410	0.536	0.454	0.407	0.735	---	---	---	---
NPP		-0.151	-0.075	-0.095	0.175	0.019	-0.076	-0.050	0.047	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
VALLISNERIA	3	10:29	3.86	4.04	0.18	---	0.18	0.05	0.22	485.4	0.24	1.64	66.8	8.27	-2.34	10.60	0.631	13.10	-3.70	16.80	24.57	0.34	-0.10	0.53	-0.15
		10:48	4.05	4.09	0.04	---	0.04	0.01	0.07	369.8	0.19														
		11:06	4.13	4.32	0.19	---	0.19	0.06	0.16	699.8	0.35														
		11:28	4.47	4.60	0.14	---	0.14	0.04	0.10	796.5	0.40														
		11:46	4.65	4.73	0.08	---	0.08	0.02	0.05	904.7	0.45														
		12:05	4.77	4.78	0.01	---	0.01	0.00	0.02	319.3	0.16														
		12:23	4.85	5.00	0.15	---	0.15	0.05	0.43	212.6	0.11														
		12:41	4.93	5.01	0.09	---	0.09	0.03	0.09	558.3	0.28														
		12:58	5.10	5.14	0.04	---	0.04	0.01	0.10	252.6	0.13														
		13:12	5.33	5.31	-0.02	---	-0.02	-0.01	-0.02	650.0	0.33														
		13:33	5.24	5.16	-0.08	---	-0.08	-0.02	-0.05	946.6	0.47														
		13:50	5.76	5.13	-0.63	---	-0.63	-0.19	-0.37	1036.3	0.52														
		14:10	5.46	5.39	-0.07	---	-0.07	-0.02	-0.25	176.5	0.09														
		14:26	5.63	5.38	-0.25	---	-0.25	-0.08	-0.17	929.6	0.47														
		14:43	5.65	5.51	-0.14	---	-0.14	-0.04	-0.33	259.1	0.13														
		14:57	5.71	5.58	-0.13	---	-0.13	-0.04	-0.37	206.0	0.10														
		15:13	5.79	5.58	-0.21	---	-0.21	-0.07	-0.25	519.9	0.26														
		15:28	5.83	5.73	-0.10	---	-0.10	-0.03	-0.07	869.8	0.44														
	6	10:34	3.89	4.06	0.17	---	0.17	0.05	0.49	204.9	0.10	1.65	66.4	5.74	-1.01	6.75	0.419	13.68	-2.42	16.09	32.34	0.18	-0.03	0.42	-0.07
		10:55	4.06	4.17	0.11	---	0.11	0.03	0.10	717.8	0.36														
		11:12	4.22	4.30	0.08	---	0.08	0.02	0.06	730.7	0.37														
		11:34	4.51	4.65	0.14	---	0.14	0.04	0.10	831.4	0.42														
		11:52	4.70	4.73	0.03	---	0.03	0.01	0.02	887.2	0.45														
		12:12	4.75	4.86	0.11	---	0.11	0.03	0.27	250.5	0.13														
		12:29	4.97	4.97	0.00	---	0.00	0.00	0.00	877.3	0.44														
		12:48	4.98	5.08	0.10	---	0.10	0.03	0.05	1155.5	0.58														
		13:04	5.19	5.17	-0.02	---	-0.02	-0.01	-0.04	296.1	0.15														
		13:17	5.20	5.22	0.02	---	0.02	0.00	0.01	959.0	0.48														
		13:38	5.14	5.14	0.00	---	0.00	0.00	0.00	640.5	0.32														
		13:58	5.91	5.65	-0.26	---	-0.26	-0.08	-0.43	366.5	0.18														
		14:15	5.55	5.25	-0.30	---	-0.30	-0.09	-0.19	974.0	0.49														
		14:32	5.63	5.54	-0.09	---	-0.09	-0.03	-0.06	954.6	0.48														
		14:47	5.71	5.55	-0.16	---	-0.16	-0.05	-0.41	233.1	0.12														
		15:03	5.77	5.67	-0.10	---	-0.10	-0.03	-0.29	212.8	0.11														
		15:17	5.82	5.74	-0.08	---	-0.08	-0.02	-0.07	728.7	0.37														
		15:33	5.88	5.84	-0.04	---	-0.04	-0.01	-0.09	256.1	0.13														
	7	10:36	3.91	4.05	0.14	---	0.14	0.04	0.31	273.8	0.14	1.84	59.5	9.40	-1.10	10.50	0.404	23.24	-2.73	25.97	28.82	0.33	-0.04	0.81	-0.09
		10:56	4.08	4.19	0.11	---	0.11	0.03	0.09	736.2	0.37														
		11:15	4.25	4.51	0.26	---	0.26	0.08	0.20	770.6	0.39														
		11:35	4.56	4.69	0.13	---	0.13	0.04	0.09	921.2	0.46														
		11:55	4.71	4.81	0.10	---	0.10	0.03	0.14	420.2	0.21														
		12:13	4.77	4.79	0.02	---	0.02	0.01	0.04	240.9	0.12														
		12:31	4.97	4.94	-0.02	---	-0.02	-0.01	-0.02	947.6	0.48														
		12:50	4.98	5.13	0.15	---	0.15	0.05	0.23	395.8	0.20														
		13:06	5.29	5.25	-0.04	---	-0.04	-0.01	-0.03	983.0	0.49														
		13:18	5.28	5.75	0.47	---	0.47	0.14	0.61	468.4	0.23														
		13:41	5.24	5.28	0.04	---	0.04	0.01	0.10	237.7	0.12														
		13:59	5.82	5.23	-0.59	---	-0.59	-0.18	-1.00	359.8	0.18														
		14:18	5.70	5.32	-0.38	---	-0.38	-0.12	-1.09	212.0	0.11														
		14:33	5.66	5.35	-0.31	---	-0.31	-0.10	-0.19	991.9	0.50														
		14:49	5.75	5.62	-0.13	---	-0.13	-0.04	-0.08	910.2	0.46														
		15:04	5.77	5.69	-0.08	---	-0.08	-0.02	-0.05	912.2	0.46														
		15:20	5.82	5.74	-0.08	---	-0.08	-0.02	-0.06	866.3	0.43														
		15:34	5.89	5.82	-0.07	---	-0.07	-0.02	-0.19	222.6	0.11														
	Average	10:33	3.89	4.05	0.16	-0.06	0.22	0.06	0.40	321.37	0.16	1.71	64.1	5.68	2.43	3.25	0.485	11.72	5.01	6.71	28.57	0.20	0.08	0.41	0.18
		10:53	4.06	4.15	0.09	-0.05	0.14	0.04	0.13	607.93	0.30														
		11:11	4.20	4.38	0.17	-0.02	0.19	0.06	0.15	733.70	0.37														
		11:32	4.51	4.65	0.14	-0.04	0.18	0.05	0.12	849.70	0.43														
		11:51	4.69	4.76	0.07	0.00	0.07	0.02	0.05	737.37	0.37														
		12:10	4.76	4.81	0.05	-0.08	0.13	0.04	0.28	270.23	0.14														
		12:27	4.93	4.97	0.04	-0.16	0.20	0.06	0.17	679.17	0.34														
		12:46	4.96	5.07	0.11	0.00	0.11	0.03	0.09	703.20	0.35														
		13:02	5.19	5.19	-0.01	0.07	-0.07	-0.02	-0.08	510.57	0.26														
		13:15	5.27	5.43	0.16	-0.11	0.27	0.08	0.22	692.47	0.35														
		13:37	5.21	5.19	-0.01	-0.09	0.07	0.02	0.07	608.27	0.31														
		13:55	5.83	5.34	-0.49	-0.32	-0.17	-0.05	-0.17	587.53	0.29														
		14:14	5.57	5.32	-0.25	-0.21	-0.04	-0.01	-0.06	454.18	0.23														
		14:30	5.64	5.42	-0.22	-0.12	-0.10	-0.03	-0.06	958.70	0.48														
		14:46	5.70	5.56	-0.14	-0.10	-0.04	-0.01	-0.05	467.47	0.23														
		15:01	5.75	5.65	-0.10	-0.01	-0.09	-0.03	-0.12	443.67	0.22														
		15:16	5.81	5.69	-0.12	-0.01	-0.11	-0.03	-0.09	704.97	0.35														
		15:31	5.87	5.80	-0.07	-0.04	-0.03	-0.01	-0.04	449.50	0.23														

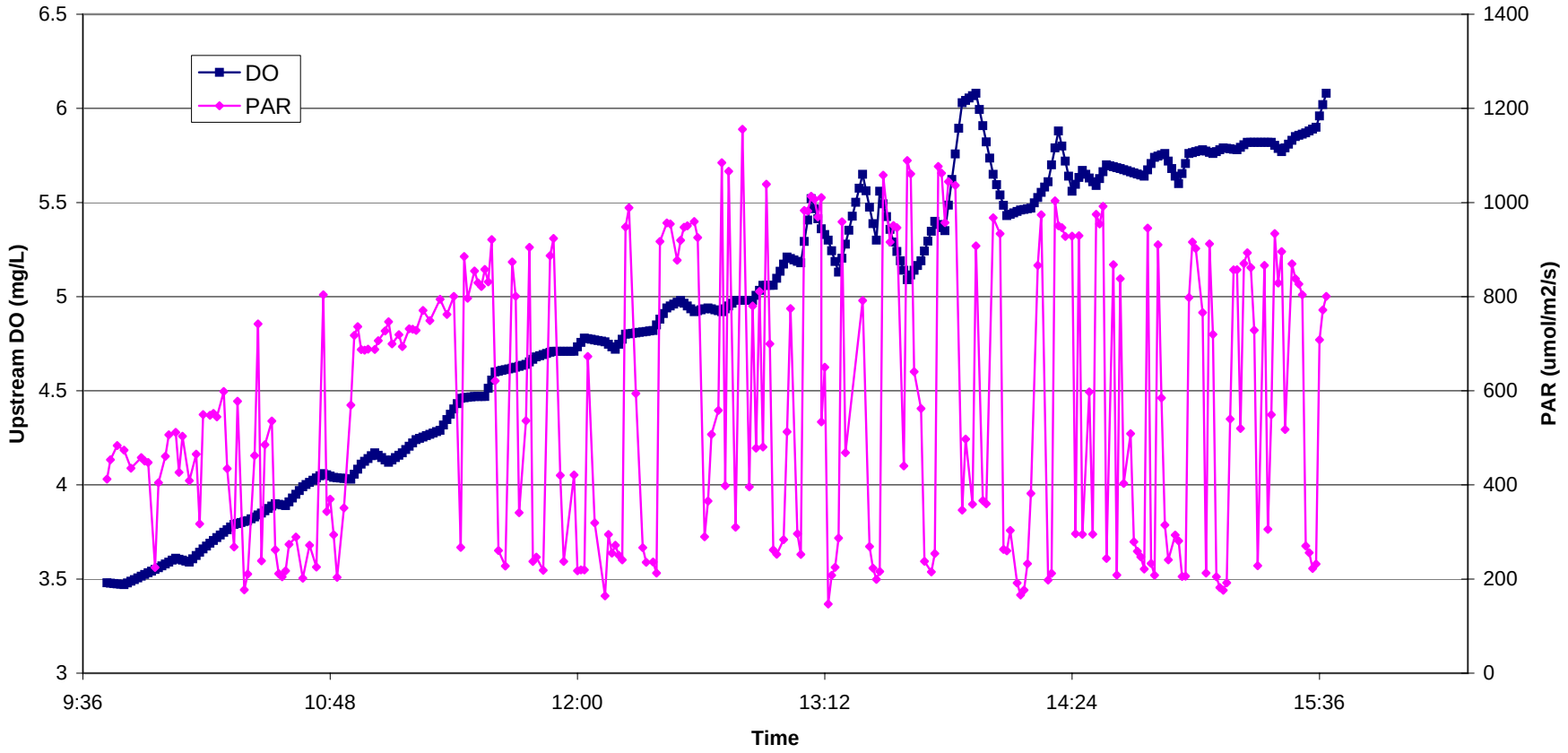
APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
CERATOPHYLLUM	1	10:05	3.60	4.00	0.40	---	0.40	0.03	0.10	503.50	0.25	7.67	14.3	5.92	0.21	5.71	0.413	14.32	0.51	13.81	26.73	0.22	0.01	0.54	0.02
		10:26	3.83	4.09	0.26	---	0.26	0.02	0.07	462.20	0.23														
		10:44	4.04	4.20	0.16	---	0.16	0.01	0.09	225.60	0.11														
		11:02	4.16	4.83	0.67	---	0.67	0.04	0.12	706.30	0.35														
		11:24	4.40	4.85	0.45	---	0.45	0.03	0.07	800.50	0.40														
		11:42	4.63	5.15	0.53	---	0.53	0.03	0.09	801.00	0.40														
		12:01	4.76	5.26	0.50	---	0.50	0.03	0.30	219.40	0.11														
		12:19	4.81	5.57	0.76	---	0.76	0.05	0.37	266.50	0.13														
		12:37	4.94	5.37	0.44	---	0.44	0.03	0.20	289.80	0.15														
		12:55	5.06	5.52	0.46	---	0.46	0.03	0.06	1038.80	0.52														
		13:10	5.41	5.90	0.49	---	0.49	0.03	0.07	969.50	0.49														
		13:29	5.49	5.49	0.00	---	0.00	0.00	0.00	1058.20	0.53														
		13:46	5.37	4.81	-0.56	---	-0.56	-0.04	-0.07	1062.20	0.53														
		14:06	5.44	4.98	-0.46	---	-0.46	-0.03	-0.20	303.20	0.15														
		14:22	5.72	5.14	-0.58	---	-0.58	-0.04	-0.08	928.10	0.47														
		14:39	5.67	5.06	-0.61	---	-0.61	-0.04	-0.20	403.20	0.20														
		14:54	5.64	5.24	-0.40	---	-0.40	-0.03	-0.18	293.40	0.15														
		15:09	5.79	4.89	-0.90	---	-0.90	-0.06	-0.61	191.91	0.10														
		15:10	5.79	5.37	-0.42	---	-0.42	-0.03	-0.10	540.00	0.27														
		15:24	5.79	5.14	-0.65	---	-0.65	-0.04	-0.10	828.90	0.42														
	4	10:13	3.69	4.06	0.37	---	0.37	0.02	0.09	547.90	0.27	2.01	54.6	4.39	-0.73	5.12	0.439	10.00	-1.67	11.67	22.02	0.20	-0.03	0.45	-0.08
		10:31	3.89	4.15	0.26	---	0.26	0.02	0.06	535.80	0.27														
		10:50	4.04	4.22	0.18	---	0.18	0.01	0.12	203.60	0.10														
		11:08	4.16	4.56	0.40	---	0.40	0.03	0.07	719.30	0.36														
		11:31	4.47	4.83	0.36	---	0.36	0.02	0.06	829.40	0.42														
		11:47	4.67	4.95	0.28	---	0.28	0.02	0.16	237.40	0.12														
		12:09	4.75	4.89	0.14	---	0.14	0.01	0.06	294.60	0.15														
		12:24	4.88	5.08	0.20	---	0.20	0.01	0.03	917.20	0.46														
		12:43	4.94	5.25	0.32	---	0.32	0.02	0.10	398.20	0.20														
		13:00	5.17	5.27	0.10	---	0.10	0.01	0.04	283.70	0.14														
		13:14	5.24	5.54	0.30	---	0.30	0.02	0.19	207.70	0.10														
		13:35	5.14	4.81	-0.33	---	-0.33	-0.02	-0.10	440.40	0.22														
		13:53	6.04	4.88	-1.16	---	-1.16	-0.08	-0.30	497.40	0.25														
		14:11	5.47	5.12	-0.35	---	-0.35	-0.02	-0.19	232.40	0.12														
		14:29	5.63	5.29	-0.34	---	-0.34	-0.02	-0.07	597.60	0.30														
		14:44	5.65	5.25	-0.40	---	-0.40	-0.03	-0.21	247.20	0.12														
		14:59	5.77	5.43	-0.34	---	-0.34	-0.02	-0.05	916.20	0.46														
		15:14	5.81	5.38	-0.43	---	-0.43	-0.03	-0.06	870.30	0.44														
		15:30	5.86	5.55	-0.31	---	-0.31	-0.02	-0.05	826.90	0.41														
	8	10:21	3.80	4.15	0.36	---	0.36	0.02	0.08	577.70	0.29	3.39	32.4	4.88	-0.60	5.48	0.436	11.20	-1.39	12.59	27.52	0.18	-0.02	0.41	-0.05
		10:38	3.95	4.10	0.15	---	0.15	0.01	0.07	289.10	0.15														
		10:58	4.13	4.40	0.28	---	0.28	0.02	0.05	686.40	0.34														
		11:17	4.27	4.61	0.34	---	0.34	0.02	0.06	749.20	0.38														
		11:37	4.60	5.20	0.60	---	0.60	0.04	0.30	260.60	0.13														
		11:56	4.71	5.19	0.48	---	0.48	0.03	0.26	237.50	0.12														
		12:15	4.80	5.03	0.23	---	0.23	0.01	0.03	989.00	0.50														
		12:32	4.95	5.21	0.26	---	0.26	0.02	0.04	950.60	0.48														
		12:52	5.01	5.54	0.53	---	0.53	0.03	0.15	478.10	0.24														
		13:07	5.41	5.67	0.26	---	0.26	0.02	0.03	982.00	0.49														
		13:25	5.48	5.44	-0.03	---	-0.03	0.00	-0.02	269.20	0.14														
		13:43	5.35	4.91	-0.44	---	-0.44	-0.03	-0.26	215.10	0.11														
		14:03	5.54	4.87	-0.67	---	-0.67	-0.04	-0.09	933.60	0.47														
		14:19	5.79	5.05	-0.74	---	-0.74	-0.05	-0.10	1003.40	0.50														
		14:36	5.69	5.22	-0.47	---	-0.47	-0.03	-0.07	867.80	0.44														
		14:50	5.75	5.35	-0.40	---	-0.40	-0.03	-0.09	584.70	0.29														
		15:06	5.77	5.37	-0.40	---	-0.40	-0.03	-0.25	204.90	0.10														
		15:21	5.82	5.46	-0.36	---	-0.36	-0.02	-0.15	305.60	0.15														
		15:36	5.96	5.54	-0.42	---	-0.42	-0.03	-0.09	606.60	0.30														
	Average	10:05	3.80	4.15	0.36	-0.01	0.37	0.04	0.15	577.70	0.29	4.36	25.2	8.29	0.53	7.77	0.429	19.32	1.22	18.09	26.28	0.32	0.02	0.74	0.05
		10:20	3.77	4.10	0.33	-0.05	0.38	0.04	0.16	529.27	0.27														
		10:37	3.96	4.15	0.19	-0.06	0.25	0.03	0.16	350.17	0.18														
		10:56	4.11	4.48	0.38	-0.05	0.43	0.05	0.18	532.10	0.27														
		11:16	4.28	4.67	0.40	-0.02	0.42	0.05	0.13	756.33	0.38														
		11:36	4.57	5.06	0.49	-0.04	0.54	0.06	0.20	630.33	0.32														
		11:54	4.71	5.13	0.42	0.00	0.42	0.05	0.42	231.43	0.12														
		12:14	4.79	5.16	0.38	-0.08	0.46	0.05	0.20	516.70	0.26														
		12:31	4.92	5.22	0.30	-0.16	0.46	0.05	0.15	719.20	0.36														
		12:50	5.00	5.44	0.44	0.00	0.44	0.05	0.16	638.37	0.32														
		13:05	5.33	5.61	0.28	0.07	0.22	0.02	0.07	745.07	0.37														
		13:22	5.40	5.49	0.09	-0.11	0.20	0.02	0.09	511.70	0.26														
		13:41	5.28	4.84	-0.44	-0.09	-0.35	-0.04	-0.14	572.57	0.29														
		14:00	5.67	4.91	-0.76	-0.32	-0.44	-0.05	-0.17	578.07	0.29														
		14:17	5.66	5.10	-0.56	-0.21	-0.35	-0.04	-0.11	721.30	0.36														
		14:34	5.66	5.19	-0.47	-0.12	-0.35	-0.04	-0.13	622.87	0.31														
		14:49	5.68	5.28	-0.40	-0.10	-0.30	-0.03	-0.18	375.10	0.19														
		15:04	5.77	5.23	-0.54	-0.01	-0.54	-0.06	-0.28	437.67	0.22														
		15:15	5.80	5.40	-0.40	-0.01	-0.39	-0.04	-0.16	571.97	0.29														
		15:30	5.87	5.41	-0.46	-0.04	-0.42	-0.05	-0.13	754.13	0.38														

APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
CONTROL	2	9:46	3.47	3.45	-0.02	---	-0.02	-0.04	-0.17	483.70	0.24	0.29	377.5	---	---	---	---	---	---	---	---	---	---	---	---
		10:09	3.63	3.54	-0.09	---	-0.09	-0.15	-0.63	465.30	0.23														
		10:27	3.84	3.80	-0.04	---	-0.04	-0.07	-0.18	742.20	0.37														
		10:47	4.05	4.01	-0.04	---	-0.04	-0.07	-0.43	343.40	0.17														
		11:04	4.13	4.20	0.07	---	0.07	0.12	0.32	727.20	0.36														
		11:27	4.46	4.42	-0.04	---	-0.04	-0.07	-0.16	885.20	0.44														
		11:43	4.63	4.59	-0.04	---	-0.04	-0.07	-0.40	340.90	0.17														
		12:03	4.78	4.70	-0.08	---	-0.08	-0.13	-0.39	672.90	0.34														
		12:20	4.82	4.61	-0.21	---	-0.21	-0.35	-2.99	235.60	0.12														
		12:39	4.94	4.83	-0.11	---	-0.11	-0.18	-0.71	507.40	0.25														
		12:56	5.06	5.13	0.07	---	0.07	0.12	0.34	699.80	0.35														
		13:11	5.36	5.24	-0.12	---	-0.12	-0.21	-0.41	1010.40	0.51														
		13:31	5.36	5.00	-0.36	---	-0.36	-0.62	-1.34	916.20	0.46														
		13:48	5.49	5.32	-0.17	---	-0.17	-0.29	-0.55	1044.30	0.52														
		14:08	5.45	5.30	-0.15	---	-0.15	-0.26	-2.73	191.57	0.10														
		14:25	5.60	5.45	-0.15	---	-0.15	-0.25	-1.70	296.20	0.15														
		14:41	5.66	5.42	-0.24	---	-0.24	-0.42	-1.64	509.00	0.26														
		14:56	5.65	5.66	0.01	---	0.01	0.01	0.11	205.50	0.10														
		15:11	5.78	5.69	-0.09	---	-0.09	-0.16	-0.37	856.90	0.43														
		15:26	5.79	5.81	0.02	---	0.02	0.03	0.13	517.90	0.26														
	5	9:55	3.53	3.53	0.00	---	0.00	0.00	-0.02	447.60	0.22	0.32	345.9	---	---	---	---	---	---	---	---	---	---	---	---
		10:14	3.71	3.66	-0.04	---	-0.04	-0.07	-0.26	551.80	0.28														
		10:33	3.90	3.89	-0.01	---	-0.01	-0.01	-0.10	211.40	0.11														
		10:52	4.03	3.98	-0.05	---	-0.05	-0.09	-0.48	351.00	0.18														
		11:11	4.21	4.09	-0.12	---	-0.12	-0.18	-0.49	731.70	0.37														
		11:32	4.47	4.41	-0.06	---	-0.06	-0.09	-0.23	821.50	0.41														
		11:50	4.69	4.69	0.00	---	0.00	0.00	-0.03	218.50	0.11														
		12:10	4.73	4.71	-0.02	---	-0.02	-0.04	-0.29	255.20	0.13														
		12:27	4.95	4.78	-0.17	---	-0.17	-0.27	-0.56	954.60	0.48														
		12:44	4.95	4.96	0.01	---	0.01	0.02	0.03	1066.20	0.53														
		13:02	5.20	5.20	0.00	---	0.00	0.00	-0.01	774.60	0.39														
		13:15	5.19	5.15	-0.04	---	-0.04	-0.06	-0.51	225.00	0.11														
		13:37	5.12	5.09	-0.03	---	-0.03	-0.04	-0.07	1060.70	0.53														
		13:55	6.07	5.24	-0.83	---	-0.83	-1.31	-7.25	359.10	0.18														
		14:14	5.53	5.31	-0.22	---	-0.22	-0.34	-0.78	866.30	0.43														
		14:30	5.61	5.59	-0.02	---	-0.02	-0.03	-0.21	295.30	0.15														
		14:46	5.67	5.72	0.05	---	0.05	0.07	0.16	945.60	0.47														
		15:00	5.77	5.73	-0.04	---	-0.04	-0.06	-0.14	902.20	0.45														
		15:16	5.82	5.82	0.00	---	0.00	0.00	0.00	861.80	0.43														
		15:31	5.86	5.90	0.04	---	0.04	0.06	---	---	---														
	9	10:04	3.61	3.59	-0.02	---	-0.02	-0.02	-0.07	426.50	0.21	0.48	230.0	---	---	---	---	---	---	---	---	---	---	---	---
		10:23	3.81	3.78	-0.03	---	-0.03	-0.03	-0.30	177.06	0.09														
		10:42	4.01	3.88	-0.13	---	-0.13	-0.14	-1.03	271.70	0.14														
		10:59	4.14	4.08	-0.06	---	-0.06	-0.06	-0.18	688.40	0.35														
		11:22	4.35	4.33	-0.02	---	-0.02	-0.02	-0.05	762.10	0.38														
		11:39	4.61	4.58	-0.03	---	-0.03	-0.03	-0.29	227.50	0.11														
		12:00	4.73	4.78	0.05	---	0.05	0.05	0.45	217.50	0.11														
		12:17	4.81	4.66	-0.15	---	-0.15	-0.15	-0.52	594.20	0.30														
		12:35	4.93	4.82	-0.11	---	-0.11	-0.11	-0.24	925.60	0.46														
		12:53	5.03	5.13	0.10	---	0.10	0.10	0.25	811.00	0.41														
		13:09	5.47	5.60	0.13	---	0.13	0.14	0.28	1006.90	0.51														
		13:26	5.39	5.21	-0.18	---	-0.18	-0.19	-1.66	223.00	0.11														
		13:45	5.38	5.50	0.12	---	0.12	0.12	0.23	1076.70	0.54														
		14:04	5.49	5.51	0.02	---	0.02	0.03	0.20	262.90	0.13														
		14:21	5.80	5.54	-0.26	---	-0.26	-0.27	-0.57	946.60	0.47														
		14:37	5.69	5.49	-0.19	---	-0.19	-0.20	-1.96	208.50	0.10														
		14:52	5.72	5.62	-0.10	---	-0.10	-0.10	-0.87	240.80	0.12														
		15:07	5.78	5.79	0.01	---	0.01	0.01	0.11	181.94	0.09														
		15:23	5.80	5.86	0.06	---	0.06	0.06	0.13	934.10	0.47														
		15:37	6.02	5.85	-0.17	---	-0.17	-0.18	---	---	---														
	Average	9:55	3.54	3.52	-0.01	---	-0.01	-0.02	-0.09	452.60	0.23	0.36	303.4	---	---	---	---	---	---	---	---	---	---	---	---
		10:15	3.71	3.66	-0.05	---	-0.05	-0.07	-0.39	398.05	0.20														
		10:34	3.92	3.86	-0.06	---	-0.06	-0.08	-0.44	408.43	0.20														
		10:52	4.08	4.02	-0.05	---	-0.05	-0.07	-0.37	460.93	0.23														
		11:12	4.23	4.21	-0.02	---	-0.02	-0.03	-0.07	740.33	0.37														
		11:32	4.51	4.47	-0.04	---	-0.04	-0.06	-0.23	644.73	0.32														
		11:51	4.69	4.69	0.00	---	0.00	0.00	0.01	258.97	0.13														
		12:10	4.77	4.69	-0.08	---	-0.08	-0.11	-0.40	507.43	0.25														
		12:27	4.90	4.74	-0.16	---	-0.16	-0.22	-1.26	705.27	0.35														
		12:45	4.97	4.97	0.00	---	0.00	0.00	-0.14	794.87	0.40														
		13:02	5.24	5.31	0.07	---	0.07	0.09	0.20	827.10	0.41														
		13:17	5.31	5.20	-0.11	---	-0.11	-0.15	-0.86	486.13	0.24														
		13:37	5.29	5.20	-0.09	---	-0.09	-0.12	-0.40	1017.87	0.51														
		13:55	5.68	5.36	-0.32	---	-0.32	-0.45	-2.53	555.43	0.28														
		14:14	5.59	5.38	-0.21	---	-0.21	-0.29	-1.36	668.16	0.34														
		14:30	5.63	5.51	-0.12	---	-0.12	-0.17	-1.29	266.67	0.13														
		14:46	5.69	5.59	-0.10	---	-0.10	-0.14	-0.78	565.13	0.28														
		15:01	5.73	5.73	-0.01	---	-0.01	-0.01	0.03	429.88	0.22														
		15:16	5.80	5.79	-0.01	---	-0.01	-0.02	-0.08	884.27	0.44														
		15:31	5.89	5.85	-0.04	---	-0.04	-0.05	0.13	517.90	0.26														

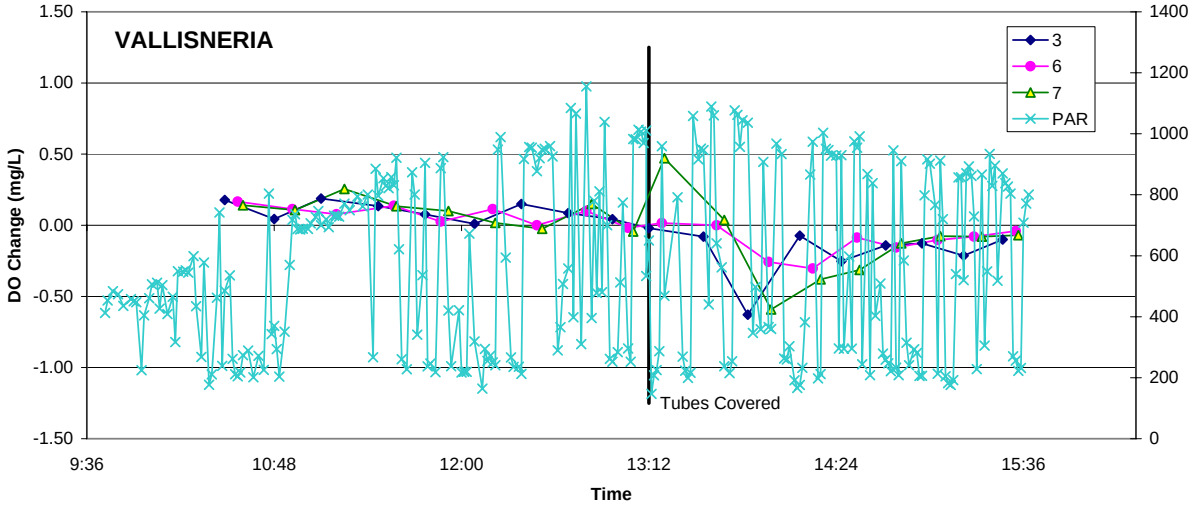
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

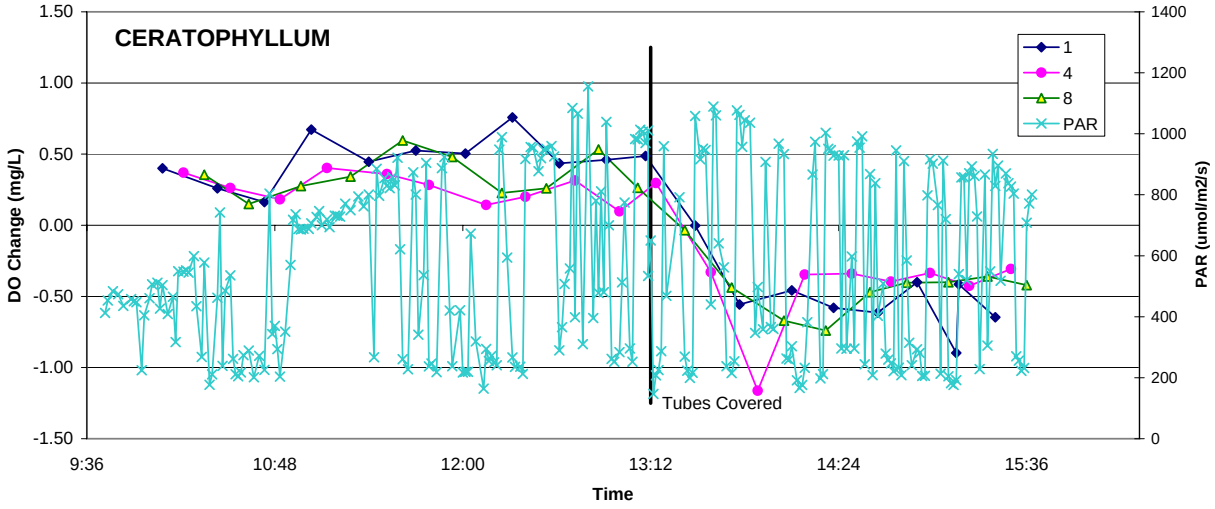


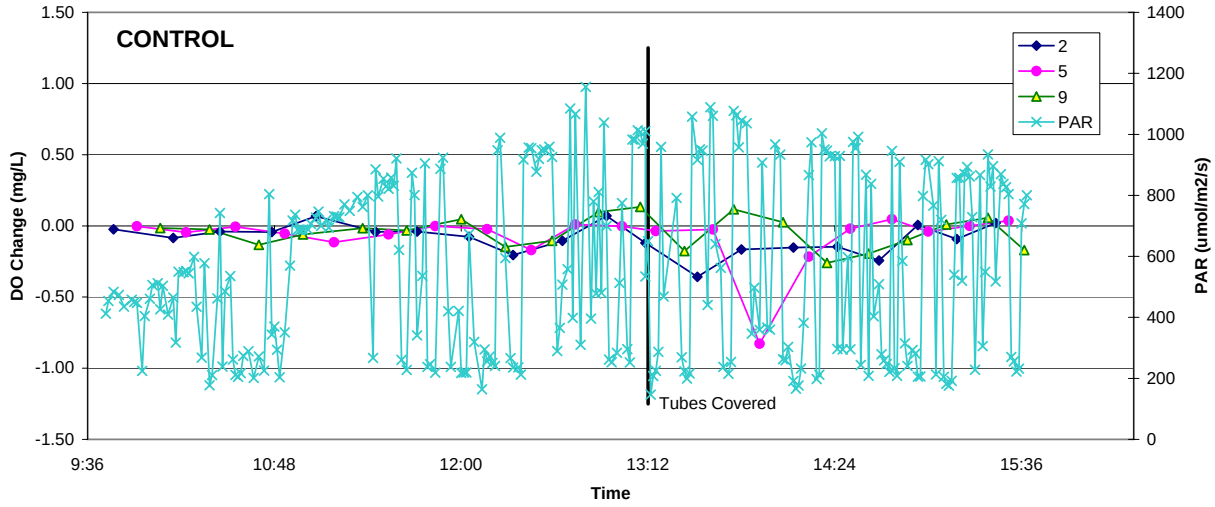
APPENDIX H-5

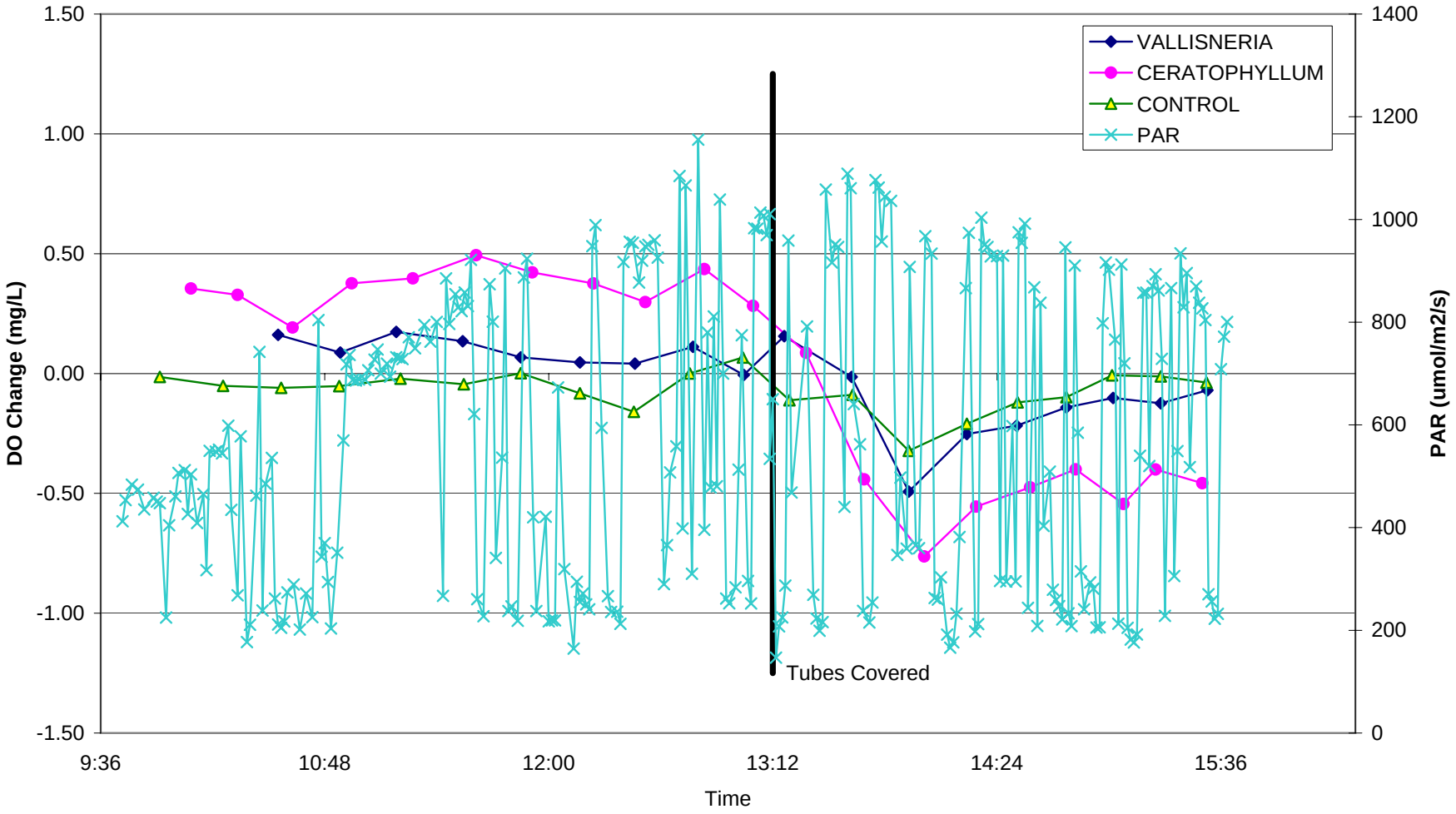
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05

APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05



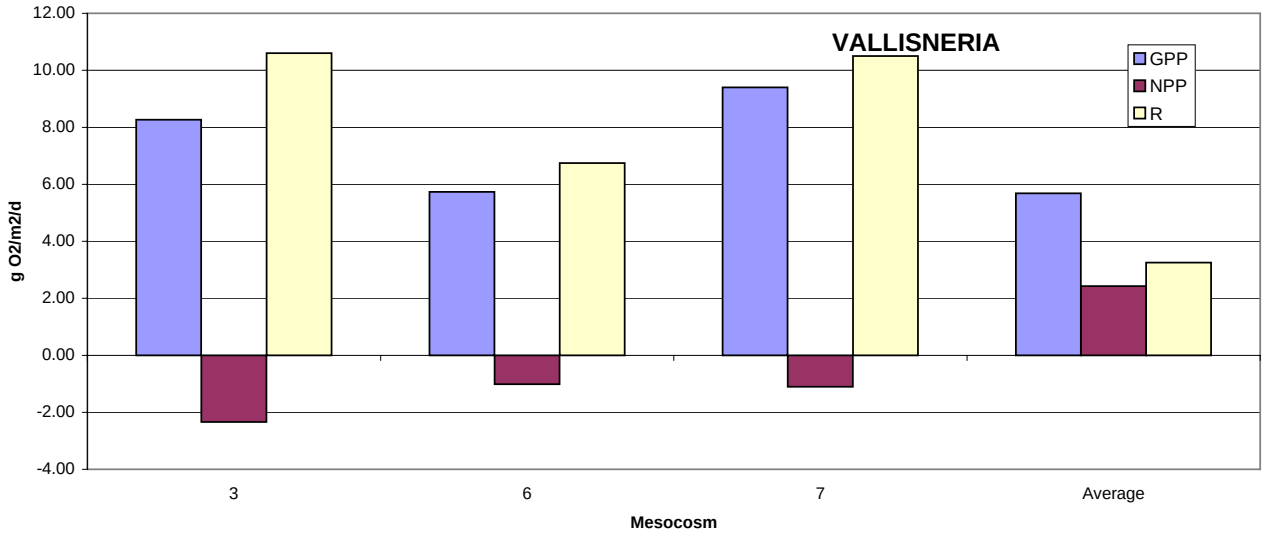


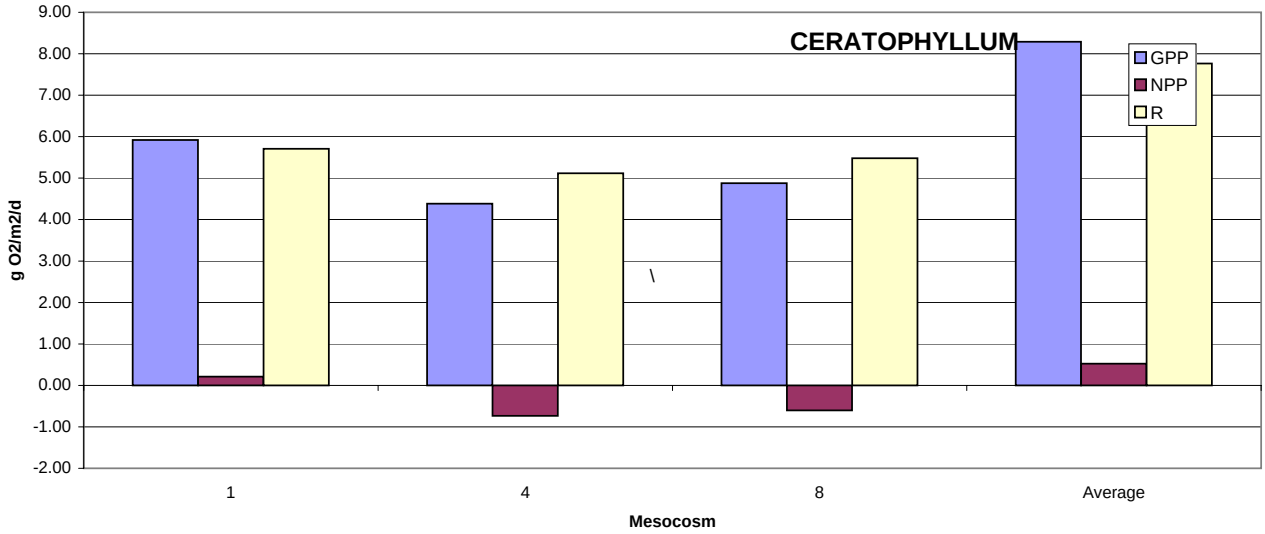




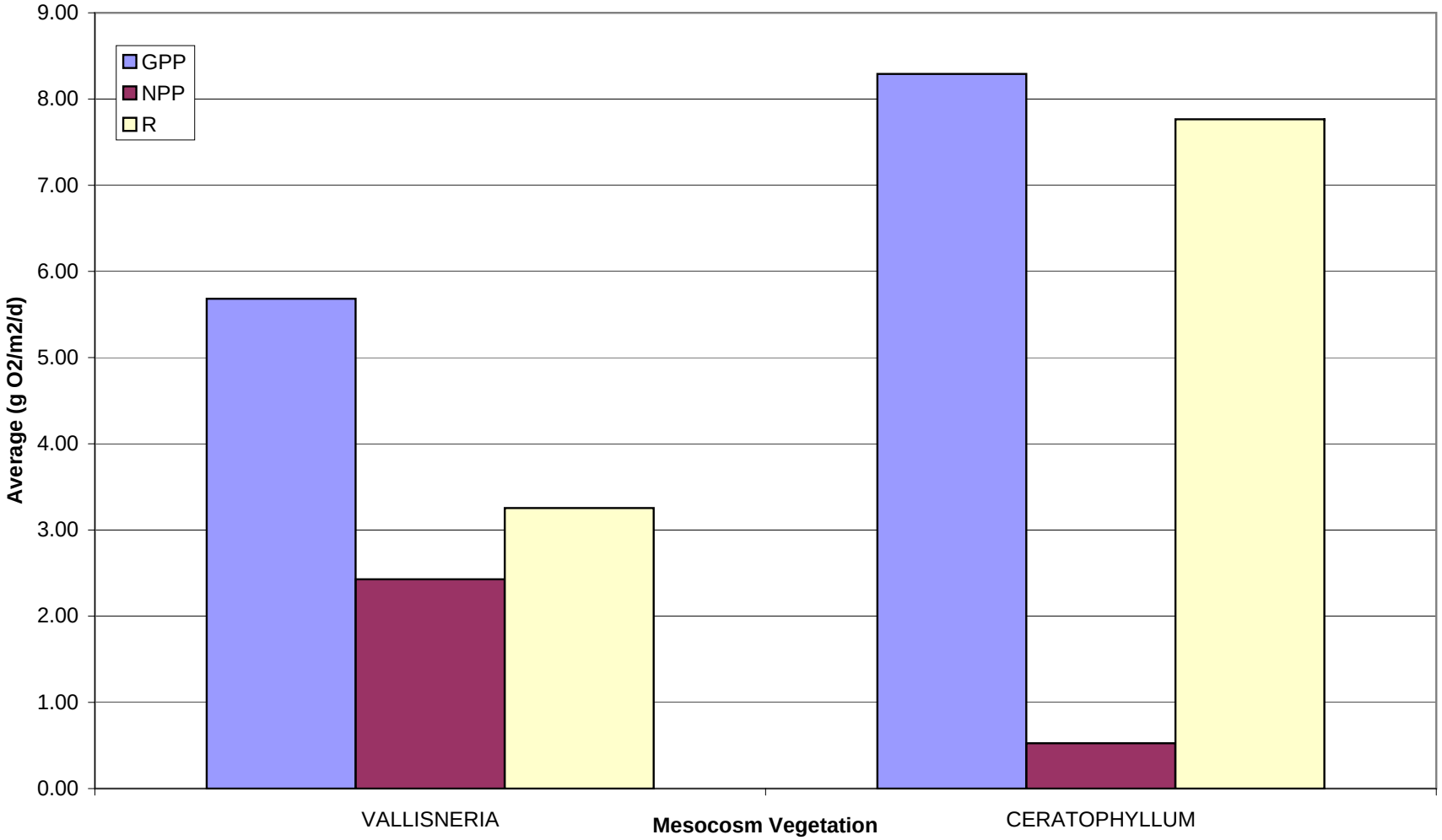
APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05

APPENDIX H-5
MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05





Averages corrected for Control DO changes



APPENDIX H-5

MESOCOSM STUDY AT ALEXANDER SPRING CREEK SEGMENT 1 - 8/29/05

Averages corrected for Control DO changes

APPENDIX H-6

MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1

		4/18/2005			8/1/2005	
PARAMETER	UNITS	FILAMENTOUS ALGAE	POTAMOGETON	VALLISNERIA	POTAMOGETON	VALLISNERIA
UPSTREAM DO	mg/L	7.85	8.04	7.97	6.46	6.48
DOWNSTREAM DO		7.89	8.04	7.99	6.46	6.52
CHANGE DO		0.04	0.00	0.02	0.00	0.03
TRAVEL TIME	minutes	0.31	0.23	0.26	0.32	0.45
VELOCITY	m/hr	354	472	425	348	243
GPP	g $O_2/m^2/d$	3.28	5.05	4.02	12.16	11.03
NPP		2.29	-10.40	-4.40	-4.85	2.93
R		0.99	15.44	8.42	17.01	8.10
Vegetation	kg DW/m^2	3.295	0.367	0.316	0.398	0.531
GPP	g O_2/kg DW/d	0.99	13.75	12.71	30.52	20.77
NPP		0.70	-28.33	-13.93	-12.16	5.52
R24		0.30	42.07	26.64	42.69	15.25
PAR	mol/hr	0.52	0.46	0.50	0.27	0.22
	$mol/m^2/d$	54.0	51.8	52.9	28.0	20.9
GPP	g O_2/mol	0.06	0.097	0.076	0.44	0.529
NPP		0.042	-0.201	-0.083	-0.173	0.141
GPP	g O_2/kg DW/mol	0.02	0.27	0.24	1.09	1.00
NPP		0.01	-0.546	-0.264	-0.44	0.265

APPENDIX H-6

MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05

		FILAMENTOUS ALGAE				VALLISNERIA			UNKNOWN GRASS			CONTROL		
PARAMETER	UNITS	1	2	3	Average [a]	4	5	Average [a]	6	7	Average [a]	8	9	Average
UPSTREAM DO	mg/L	7.98	7.94	7.95	7.85	8.01	8.00	7.97	8.01	8.01	8.04	7.87	7.87	7.86
DOWNSTREAM DO		7.99	7.99	8.02	7.89	8.09	8.09	7.99	8.19	8.25	8.04	7.87	7.79	7.88
CHANGE DO		0.02	0.05	0.07	0.04	0.07	0.10	0.02	0.18	0.23	0.00	0.00	-0.08	0.02
TRAVEL TIME	minutes	0.20	0.57	0.16	0.31	0.25	0.27	0.26	0.24	0.22	0.23	0.14	0.17	0.15
VELOCITY	m/hr	553	192	697	354	447	406	425	456	489	472	788	656	716
GPP	g $O_2/m^2/d$	15.27	-3.70	6.73	3.28	-4.67	16.01	4.02	12.87	5.51	5.05	---	---	---
NPP24		4.42	7.21	27.25	2.29	10.26	6.72	-4.40	3.61	-1.69	-10.40	---	---	---
R24		10.85	-10.91	-20.52	0.99	-14.93	9.29	8.42	9.26	7.19	15.44	---	---	---
Vegetation	kg DW/m^2	5.624	1.653	2.607	3.295	0.323	0.309	0.316	0.497	0.237	0.367	---	---	---
GPP	g O_2/kg DW/d	2.72	-2.24	2.58	0.99	-14.47	51.75	12.71	25.88	23.26	13.75	---	---	---
NPP24		0.79	4.36	10.45	0.70	31.76	21.72	-13.93	7.26	-7.13	-28.33	---	---	---
R24		1.93	-6.60	-7.87	0.30	-46.22	30.04	26.64	18.62	30.39	42.07	---	---	---
PAR	mol/hr	0.528	0.518	0.506	0.516	0.483	0.486	0.496	0.428	0.434	0.461	---	---	---
	$mol/m^2/d$	53.6	54.5	53.9	54.0	52.2	53.5	52.9	52.4	51.3	51.8	---	---	---
GPP	g O_2/mol	0.285	-0.068	0.125	0.061	-0.089	0.299	0.076	0.246	0.107	0.097	---	---	---
NPP		0.082	0.132	0.505	0.042	0.196	0.126	-0.083	0.069	-0.033	-0.201	---	---	---
GPP	g O_2/kg DW/mol	0.051	-0.041	0.048	0.018	-0.277	0.968	0.240	0.494	0.453	0.265	---	---	---
NPP		0.015	0.080	0.194	0.013	0.608	0.406	-0.264	0.139	-0.139	-0.546	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m²/d)	NPP (g O_2/m²/d)	R (g O_2/m²/d)	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)	NOTES
FILAMENTOUS ALGAE	1	11:28	7.25	7.35	0.10	---	0.10	0.25	0.41	1201.5	0.60	0.20	552.8	15.27	4.42	10.85	5.624	2.72	0.79	1.93	53.58	0.28	0.08	0.05	0.01	
		11:47	7.38	7.45	0.07	---	0.07	0.17	0.28	1219.00	0.61															
		12:20	7.65	7.68	0.03	---	0.03	0.08	0.12	1312.20	0.66															
		12:46	8.04	8.14	0.11	---	0.11	0.26	0.48	1093.30	0.55															
		13:13	8.16	8.16	0.00	---	0.00	-0.01	-0.02	1025.00	0.51															
		13:39	8.21	8.22	0.01	---	0.01	0.03	0.06	1107.30	0.56															
		14:15	8.20	8.20	0.00	---	0.00	0.00	0.00	1162.60	0.58															
		14:44	8.21	8.22	0.01	---	0.01	0.03	0.05	1038.90	0.52															
		15:10	8.20	8.20	0.00	---	0.00	0.00	0.00	1214.00	0.61															inflow plugged
		15:12	8.19	8.19	0.00	---	0.00	-0.01	-0.02	1085.30	0.54															
		15:14	8.19	8.15	-0.04	---	-0.04	-0.10	-0.17	1139.70	0.57															
		15:16	8.18	8.17	-0.01	---	-0.01	-0.03	-0.06	1040.40	0.52															
		15:18	8.18	8.19	0.01	---	0.01	0.03	0.07	1019.00	0.51															
		15:20	8.17	8.20	0.03	---	0.03	0.07	0.14	1080.30	0.54															
		15:22	8.16	8.21	0.05	---	0.05	0.11	0.22	1042.90	0.52															
		17:04	7.88	7.82	-0.06	---	-0.06	-0.15	-0.44	684.80	0.34															unplugged, covered
		17:32	7.34	7.35	0.01	---	0.01	0.03	0.12	415.90	0.21															
	2	11:30	7.29	7.34	0.05	---	0.05	0.05	0.08	1215.00	0.61	0.57	191.6	-3.70	7.21	-10.91	1.653	-2.24	4.36	-6.60	54.47	-0.07	0.13	-0.04	0.08	
		11:49	7.40	7.47	0.07	---	0.07	0.06	0.09	1239.00	0.62															
		12:22	7.70	7.67	-0.03	---	-0.03	-0.02	-0.04	1271.90	0.64															
		12:48	7.99	8.12	0.13	---	0.13	0.11	0.21	1041.90	0.52															
		13:15	8.21	8.21	0.00	---	0.00	0.00	0.00	1103.80	0.55															
		13:42	8.20	8.21	0.01	---	0.01	0.01	0.01	1142.70	0.57															
		14:17	8.20	8.18	-0.02	---	-0.02	-0.02	-0.03	1230.50	0.62															
		14:46	8.23	8.23	0.01	---	0.01	0.00	0.01	1066.40	0.53															
		15:24	8.16	8.24	0.08	---	0.08	0.07	0.13	1063.40	0.53															inflow plugged
		15:26	8.15	8.23	0.08	---	0.08	0.07	0.13	1063.90	0.53															
		15:28	8.15	8.21	0.06	---	0.06	0.06	0.11	963.60	0.48															
		15:30	8.14	8.21	0.07	---	0.07	0.06	0.11	1045.90	0.52															
		15:32	8.14	8.22	0.08	---	0.08	0.07	0.15	974.10	0.49															
		17:06	7.89	7.94	0.05	---	0.05	0.04	0.14	614.00	0.31															unplugged, covered
		17:36	7.34	7.43	0.09	---	0.09	0.08	0.37	449.80	0.23															
	3	11:32	7.32	7.39	0.07	---	0.07	0.23	0.40	1145.20	0.57	0.16	696.7	6.73	27.25	-20.52	2.607	2.58	10.45	-7.87	53.93	0.12	0.51	0.05	0.19	
		11:52	7.44	7.56	0.12	---	0.12	0.39	0.66	1181.10	0.59															
		12:25	7.77	7.89	0.12	---	0.12	0.39	0.60	1281.30	0.64															
		12:51	8.00	8.09	0.09	---	0.09	0.27	0.51	1074.40	0.54															
		13:19	8.25	8.27	0.02	---	0.02	0.06	0.11	1143.70	0.57															
		13:48	8.22	8.28	0.06	---	0.06	0.21	0.38	1072.90	0.54															
		14:21	8.20	8.18	-0.02	---	-0.02	-0.05	-0.09	1186.10	0.60															
		14:50	8.24	8.25	0.01	---	0.01	0.03	0.06	1134.70	0.57															
		15:35	8.13	8.21	0.08	---	0.08	0.27	0.51	1040.90	0.52															inflow plugged
		15:37	8.12	8.21	0.09	---	0.09	0.28	0.59	960.60	0.48															
		15:39	8.11	8.21	0.10	---	0.10	0.30	0.66	919.20	0.46															
		15:41	8.11	8.22	0.11	---	0.11	0.35	0.67	1050.90	0.53															
		15:43	8.10	8.23	0.13	---	0.13	0.40	0.85	950.20	0.48															
		17:10	7.93	7.99	0.06	---	0.06	0.19	0.70	540.70	0.27															unplugged, covered
		17:40	7.36	7.37	0.01	---	0.01	0.05	0.22	437.20	0.22															
	Average	11:30	7.29	7.36	0.07	0.04	0.04	0.06	0.11	1187.23	0.60	0.31	354.5	3.28	2.29	0.99	3.295	0.99	0.70	0.30	54.00	0.06	0.04	0.02	0.01	
		11:49	7.41	7.49	0.09	0.05	0.04	0.06	0.10	1213.03	0.61															
		12:22	7.70	7.75	0.04	-0.03	0.07	0.12	0.18	1288.47	0.65															
		12:48	8.01	8.12	0.11	0.06	0.04	0.07	0.13	1069.87	0.54															
		13:15	8.21	8.21	0.01	0.00	0.00	0.01	0.01	1090.83	0.55															
		13:43	8.21	8.24	0.03	0.00	0.03	0.04	0.08	1107.63	0.56															
		14:17	8.20	8.19	-0.01	-0.01	0.00	-0.01	-0.01	1193.07	0.60															
		14:46	8.23	8.23	0.01	0.08	-0.07	-0.12	-0.22	1080.00	0.54															
		17:06	7.90	7.92	0.02	0.01	0.00	0.01	0.02	613.17	0.31															covered
		17:36	7.34	7.38	0.04	0.05	-0.01	-0.02	-0.08	434.30	0.22															

APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m²/d)	NPP (g O_2/m²/d)	R (g O_2/m²/d)	Vegetation (kg DW/m²)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m²/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)	NOTES
VALLISNERIA	4	11:57	7.49	7.49	0.00	---	0.00	0.00	0.00	1245.50	0.62	0.25	447.3	-4.67	10.26	-14.93	0.323	-14.47	31.76	-46.22	52.23	-0.09	0.20	-0.28	0.61	
		12:30	7.91	7.88	-0.03	---	-0.03	-0.05	-0.11	1018.00	0.51															
		12:54	8.06	8.13	0.07	---	0.07	0.15	0.32	957.60	0.48															
		13:21	8.25	8.27	0.02	---	0.02	0.04	0.08	1002.50	0.50															
		13:51	8.23	8.27	0.04	---	0.04	0.08	0.13	1261.90	0.63															
		14:23	8.19	8.20	0.01	---	0.01	0.02	0.03	1213.50	0.61															
		14:52	8.24	8.25	0.01	---	0.01	0.02	0.04	1113.20	0.56															
		15:45	8.10	8.23	0.13	---	0.13	0.27	0.60	899.80	0.45															inflow plugged
		15:47	8.09	8.21	0.12	---	0.12	0.24	0.53	919.70	0.46															
		15:49	8.09	8.22	0.13	---	0.13	0.28	0.55	996.50	0.50															
		15:51	8.08	8.23	0.15	---	0.15	0.31	0.63	965.60	0.48															
		15:53	8.07	8.24	0.17	---	0.17	0.34	0.72	940.70	0.47															
		15:55	8.07	8.25	0.18	---	0.18	0.37	0.76	972.60	0.49															
		17:12	7.96	8.00	0.04	---	0.04	0.08	0.33	494.60	0.25															unplugged, covered
		17:44	7.37	7.41	0.04	---	0.04	0.09	0.42	438.20	0.22															
	5	12:00	7.52	7.54	0.02	---	0.02	0.04	0.06	1302.30	0.65	0.27	405.5	16.01	6.72	9.29	0.309	51.75	21.72	30.04	53.49	0.30	0.13	0.97	0.41	
		12:31	7.94	8.01	0.07	---	0.07	0.13	0.26	1007.50	0.51															
		12:57	8.08	8.13	0.05	---	0.05	0.09	0.16	1143.70	0.57															
		13:26	8.24	8.23	-0.01	---	-0.01	-0.02	-0.03	1092.80	0.55															
		13:56	8.24	8.24	0.00	---	0.00	0.00	0.00	1207.00	0.61															
		14:27	8.16	8.18	0.02	---	0.02	0.04	0.07	1206.00	0.61															
		14:56	8.24	8.23	-0.01	---	-0.01	-0.01	-0.02	1041.40	0.52															
		16:00	8.05	8.25	0.20	---	0.20	0.36	0.78	931.70	0.47															inflow plugged
		16:02	8.05	8.26	0.21	---	0.21	0.39	0.85	920.20	0.46															
		16:04	8.04	8.27	0.23	---	0.23	0.42	0.91	923.70	0.46															
		16:06	8.04	8.21	0.18	---	0.18	0.32	0.70	921.70	0.46															
		16:10	8.02	8.16	0.14	---	0.14	0.25	0.56	899.80	0.45															
		16:12	8.02	8.21	0.19	---	0.19	0.36	0.83	855.90	0.43															
		16:14	8.01	8.31	0.30	---	0.30	0.55	1.13	975.60	0.49															
		17:16	7.97	7.86	-0.11	---	-0.11	-0.21	-0.68	610.20	0.31															unplugged, covered
		17:48	7.37	7.42	0.05	---	0.05	0.10	0.44	457.00	0.23															
	Average	11:58	7.51	7.52	0.01	0.05	-0.04	-0.07	-0.12	1273.90	0.64	0.26	425.4	4.02	-4.40	8.42	0.316	12.71	-13.93	26.64	52.86	0.08	-0.08	0.24	-0.26	
		12:30	7.92	7.95	0.02	-0.03	0.05	0.10	0.20	1012.75	0.51															
		12:55	8.07	8.13	0.06	0.06	0.00	0.00	0.00	1050.65	0.53															
		13:23	8.25	8.25	0.00	0.00	0.00	0.01	0.01	1047.65	0.53															
		13:53	8.24	8.26	0.02	0.00	0.02	0.03	0.06	1234.45	0.62															
		14:25	8.17	8.19	0.02	-0.01	0.02	0.05	0.08	1209.75	0.61															
		14:54	8.24	8.24	0.00	0.08	-0.08	-0.15	-0.29	1077.30	0.54															
		17:14	7.97	7.93	-0.04	0.01	-0.05	-0.10	-0.34	552.40	0.28															covered
		17:46	7.37	7.42	0.05	0.05	0.00	0.00	-0.01	447.60	0.22															

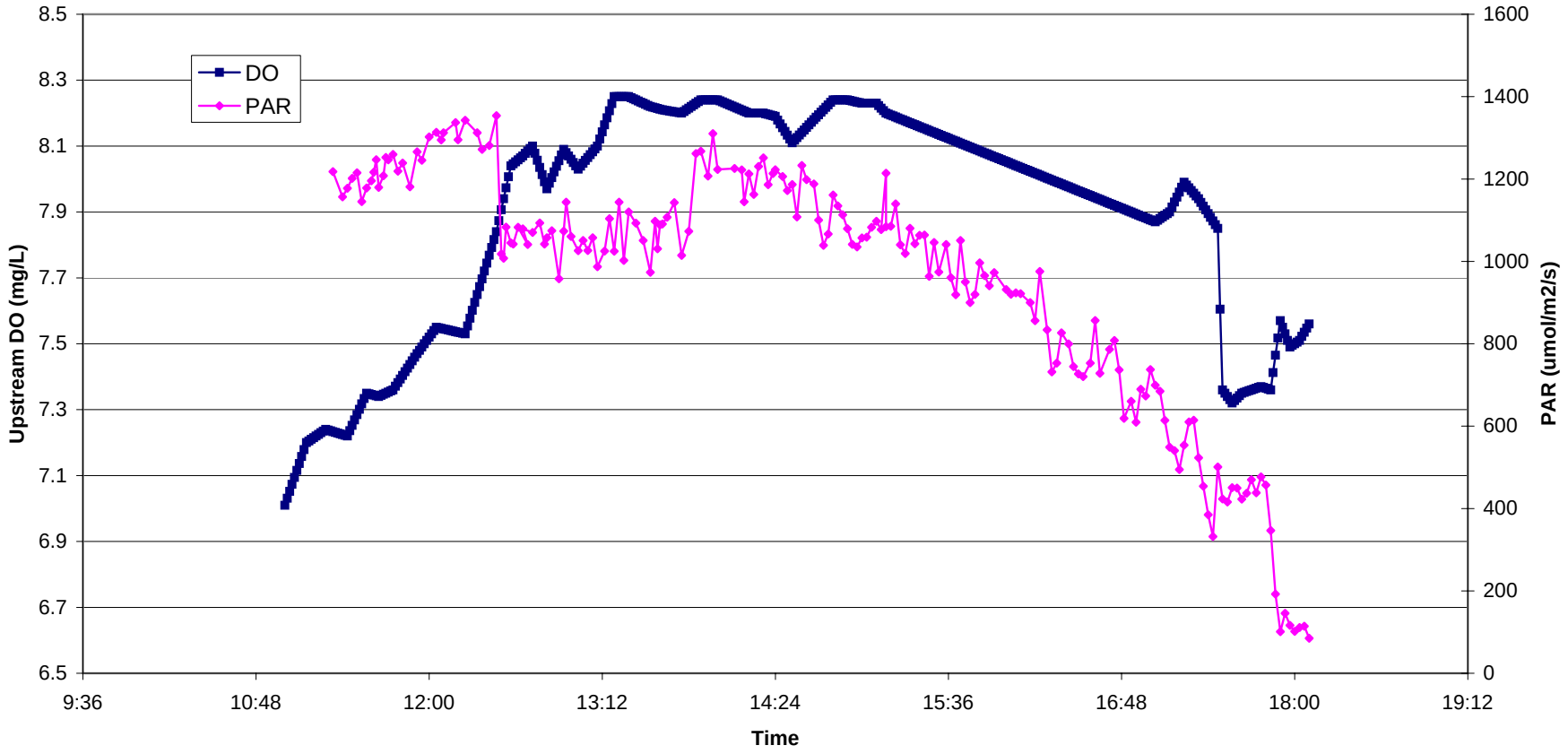
APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP	NPP	R	Vegetation (kg DW/m²)	GPP	NPP	R	PAR (mol/m²/d)	GPP	NPP	GPP	NPP	NOTES
														(g O_2/m²/d)				(g O_2/kgDW/d)				(g O_2/mol)		(g O_2/kgDW/mol)		
UNK. GRASS	6	12:32	7.97	8.03	0.06	---	0.06	0.12	0.22	1083.30	0.54	0.24	456.4	12.87	3.61	9.26	0.497	25.88	7.26	18.62	52.35	0.25	0.07	0.49	0.14	
		12:59	8.06	8.07	0.01	---	0.01	0.02	0.04	1060.40	0.53															
		13:29	8.23	8.24	0.01	---	0.01	0.02	0.04	1050.90	0.53															
		13:58	8.24	8.27	0.03	---	0.03	0.06	0.09	1310.30	0.66															
		14:29	8.13	8.09	-0.04	---	-0.04	-0.09	-0.15	1172.10	0.59															
		14:58	8.23	8.23	0.00	---	0.00	-0.01	-0.01	1035.00	0.52															
		16:17	8.00	8.06	0.06	---	0.06	0.12	0.29	833.90	0.42															inflow plugged
		16:19	8.00	8.52	0.52	---	0.52	1.09	2.97	731.70	0.37															
		16:21	7.99	8.69	0.70	---	0.70	1.46	3.85	753.10	0.38															
		16:23	7.98	8.50	0.52	---	0.52	1.07	2.59	826.50	0.41															
		16:26	7.98	8.54	0.56	---	0.56	1.17	2.93	799.50	0.40															
		16:28	7.97	8.72	0.75	---	0.75	1.56	4.18	744.60	0.37															
		16:30	7.96	7.82	-0.14	---	-0.14	-0.30	-0.82	726.70	0.36															unplugged
		16:32	7.96	7.94	-0.02	---	-0.02	-0.04	-0.11	720.20	0.36															
		17:18	7.96	7.89	-0.07	---	-0.07	-0.14	-0.45	614.50	0.31															covered
		17:52	7.47	7.48	0.02	---	0.02	0.03	0.32	192.28	0.10															
	7	12:35	8.05	8.09	0.04	---	0.04	0.10	0.19	1041.90	0.52	0.22	488.5	5.51	-1.69	7.19	0.237	23.26	-7.13	30.39	51.34	0.11	-0.03	0.45	-0.14	
		13:04	8.05	8.06	0.01	---	0.01	0.03	0.05	1050.90	0.53															
		13:34	8.22	8.22	0.00	---	0.00	0.01	0.02	1097.30	0.55															
		14:07	8.22	8.21	-0.01	---	-0.01	-0.02	-0.03	1225.50	0.61															
		14:33	8.13	8.11	-0.02	---	-0.02	-0.03	-0.06	1107.80	0.56															
		15:02	8.23	8.24	0.01	---	0.01	0.02	0.04	1058.90	0.53															
		16:35	7.95	8.80	0.85	---	0.85	1.89	5.01	753.10	0.38															inflow plugged
		16:37	7.94	8.81	0.87	---	0.87	1.93	4.49	856.40	0.43															
		16:39	7.94	8.78	0.84	---	0.84	1.88	5.14	728.20	0.37															
		17:22	7.92	7.91	-0.01	---	-0.01	-0.02	-0.07	454.00	0.23															unplugged, covered
		17:56	7.53	7.50	-0.03	---	-0.03	-0.07	-0.92	145.59	0.07															
	Average	12:33	8.01	8.06	0.05	0.06	-0.01	-0.03	-0.05	1062.60	0.53	0.23	471.9	5.05	-10.40	15.44	0.367	13.75	-28.33	42.07	51.85	0.10	-0.20	0.27	-0.55	
		13:01	8.05	8.07	0.01	0.00	0.01	0.02	0.04	1055.65	0.53															
		13:31	8.22	8.23	0.01	0.00	0.01	0.01	0.02	1074.10	0.54															
		14:02	8.23	8.24	0.01	-0.01	0.02	0.04	0.06	1267.90	0.64															
		14:31	8.13	8.10	-0.03	0.08	-0.11	-0.24	-0.42	1139.95	0.57															
		15:00	8.23	8.24	0.00	0.01	-0.01	-0.02	-0.04	1046.95	0.53															
		17:20	7.94	7.90	-0.04	0.05	-0.09	-0.19	-0.71	534.25	0.27															covered
		17:54	7.50	7.49	-0.01	-0.01	0.00	0.01	0.13	168.94	0.08															

APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m²/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP	NPP	R	Vegetation (kg DW/m²)	GPP	NPP	R	PAR (mol/m²/d)	GPP	NPP	GPP	NPP	NOTES
														(g O_2/m²/d)				(g O_2/kgDW/d)				(g O_2/mol)		(g O_2/kgDW/mol)		
CONTROL	8	11:20	7.23	7.33	0.10	---	0.10	0.35	0.57	1218.00	0.61	0.14	787.5	---	---	---	---	---	---	---	---	---	---	---	---	
		11:42	7.35	7.37	0.02	---	0.02	0.07	0.11	1252.40	0.63															
		12:11	7.54	7.50	-0.04	---	-0.04	-0.13	-0.20	1337.20	0.67															
		12:37	8.06	8.15	0.09	---	0.09	0.33	0.61	1082.80	0.54															
		13:06	8.07	8.06	0.00	---	0.00	-0.02	-0.03	1026.50	0.51															
		13:35	8.21	8.23	0.02	---	0.02	0.06	0.11	1030.50	0.52															
		14:10	8.21	8.20	-0.01	---	-0.01	-0.03	-0.05	1222.00	0.61															
		14:35	8.14	8.24	0.10	---	0.10	0.36	0.57	1233.00	0.62															
		15:04	8.23	8.25	0.02	---	0.02	0.07	0.13	1082.80	0.54															
		16:43	7.93	7.84	-0.09	---	-0.09	-0.31	-0.78	786.50	0.39															inflow plugged
		16:45	7.92	7.83	-0.09	---	-0.09	-0.32	-0.80	808.00	0.41															
		16:47	7.91	7.79	-0.12	---	-0.12	-0.45	-1.21	736.70	0.37															
		16:49	7.91	7.82	-0.09	---	-0.09	-0.32	-1.02	619.00	0.31															
		17:24	7.90	7.95	0.06	---	0.06	0.20	1.02	385.00	0.19															unplugged, covered
		18:00	7.50	7.50	0.00	---	0.00	0.00	0.00	101.85	0.05															
	9	11:24	7.22	7.20	-0.02	---	-0.02	-0.07	-0.13	1156.60	0.58	0.17	655.7	---	---	---	---	---	---	---	---	---	---	---	---	
		11:43	7.35	7.43	0.08	---	0.08	0.23	0.37	1246.50	0.63															
		12:12	7.54	7.51	-0.03	---	-0.03	-0.07	-0.12	1295.30	0.65															
		12:41	8.09	8.12	0.03	---	0.03	0.10	0.20	1040.90	0.52															
		13:08	8.08	8.09	0.01	---	0.01	0.02	0.04	1057.40	0.53															
		13:36	8.21	8.20	-0.01	---	-0.01	-0.04	-0.07	1088.80	0.55															
		14:11	8.21	8.20	-0.01	---	-0.01	-0.02	-0.03	1144.70	0.57															
		14:37	8.16	8.22	0.06	---	0.06	0.19	0.31	1198.50	0.60															
		15:08	8.22	8.22	0.01	---	0.01	0.01	0.03	1077.40	0.54															
		16:52	7.90	7.58	-0.32	---	-0.32	-0.96	-2.88	660.30	0.33															inflow plugged
		16:54	7.89	7.60	-0.29	---	-0.29	-0.88	-2.87	609.50	0.31															
		16:56	7.89	7.62	-0.27	---	-0.27	-0.80	-2.31	689.50	0.35															
		16:58	7.88	7.65	-0.23	---	-0.23	-0.69	-2.05	673.30	0.34															
		17:00	7.88	7.63	-0.25	---	-0.25	-0.74	-1.99	737.20	0.37															
		17:26	7.87	7.92	0.05	---	0.05	0.14	0.85	332.00	0.17															unplugged, covered
		18:04	7.54	7.51	-0.03	---	-0.03	-0.07	-1.31	114.12	0.06															
	Average	11:22	7.23	7.27	0.04	---	0.04	0.12	0.20	1187.30	0.60	0.15	715.6	---	---	---	---	---	---	---	---	---	---	---	---	
		11:42	7.35	7.40	0.05	---	0.05	0.16	0.25	1249.45	0.63															
		12:11	7.54	7.51	-0.03	---	-0.03	-0.10	-0.15	1316.25	0.66															
		12:39	8.07	8.14	0.06	---	0.06	0.21	0.39	1061.85	0.53															
		13:07	8.07	8.08	0.00	---	0.00	0.00	0.01	1041.95	0.52															
		13:35	8.21	8.22	0.00	---	0.00	0.01	0.01	1059.65	0.53															
		14:10	8.21	8.20	-0.01	---	-0.01	-0.03	-0.04	1183.35	0.59															
		14:36	8.15	8.23	0.08	---	0.08	0.26	0.43	1215.75	0.61															
		15:06	8.22	8.24	0.01	---	0.01	0.04	0.08	1080.10	0.54															
		17:25	7.88	7.94	0.05	---	0.05	0.17	0.93	358.50	0.18															covered
		18:02	7.52	7.51	-0.01	---	-0.01	-0.04	-0.75	107.99	0.05															

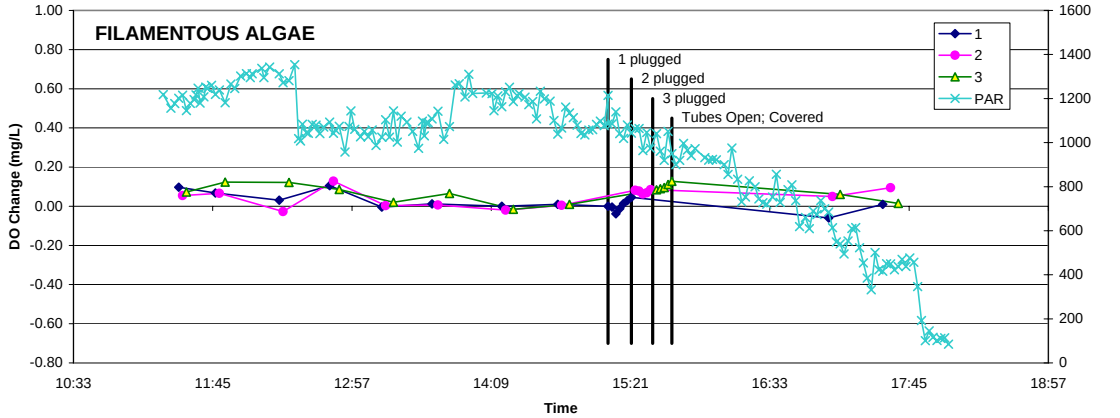
Mesocosm Area (m²): 0.1394
Mesocosm Volume (m³): 0.00834
Daylight (hrs/d): 13

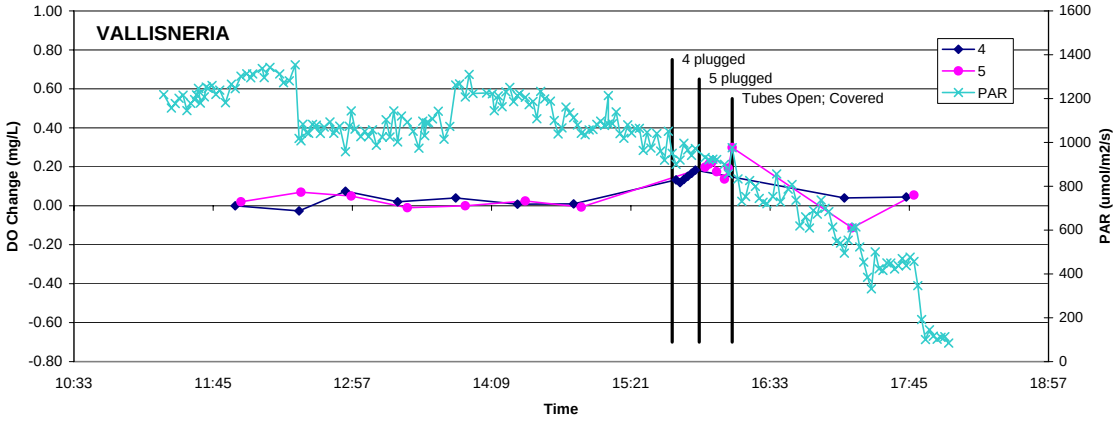


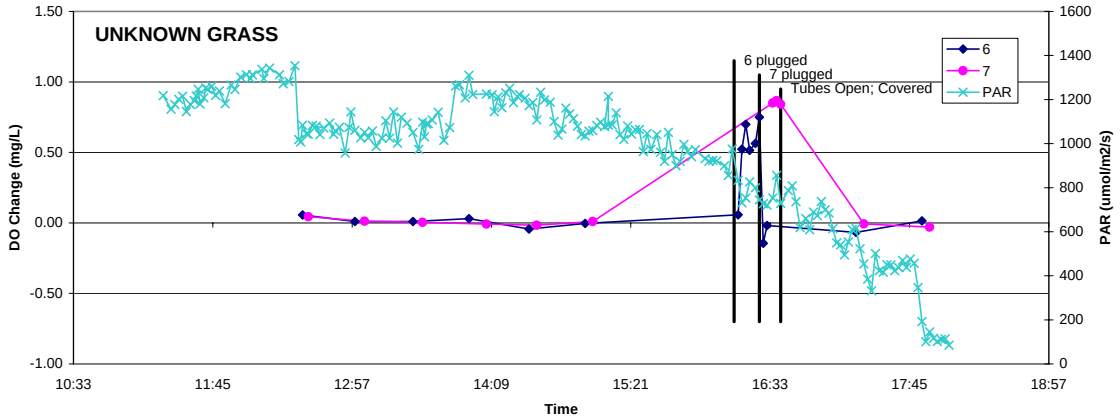
APPENDIX H-6

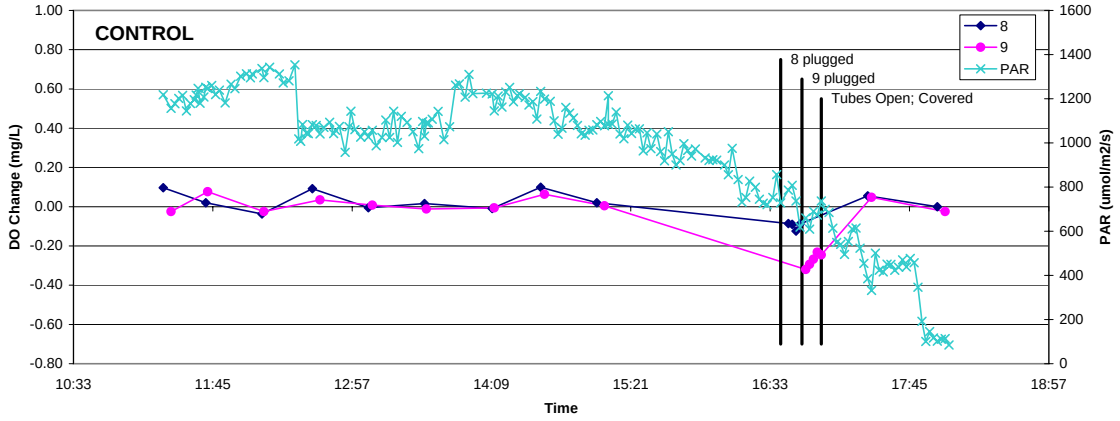
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05

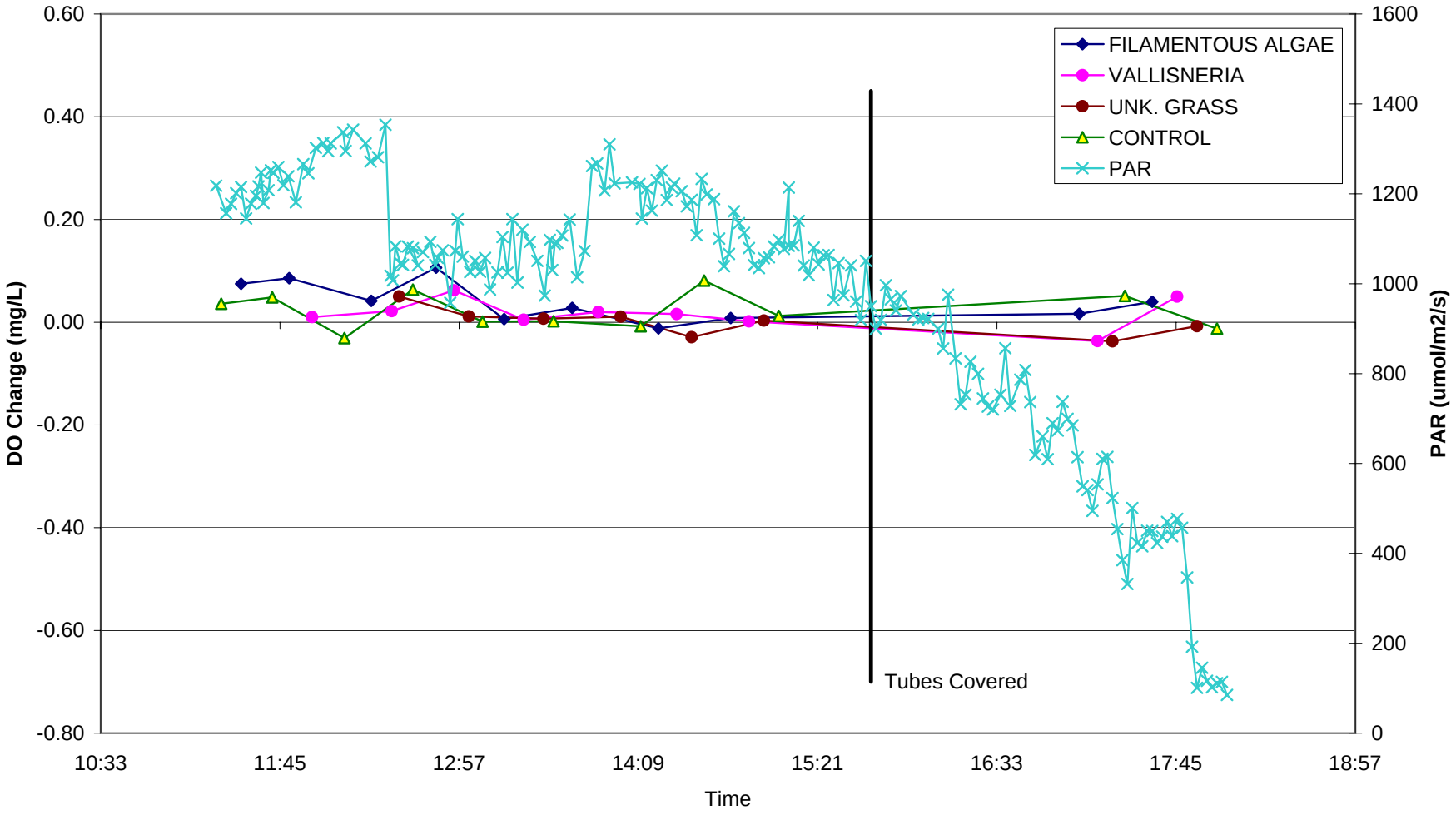
APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05





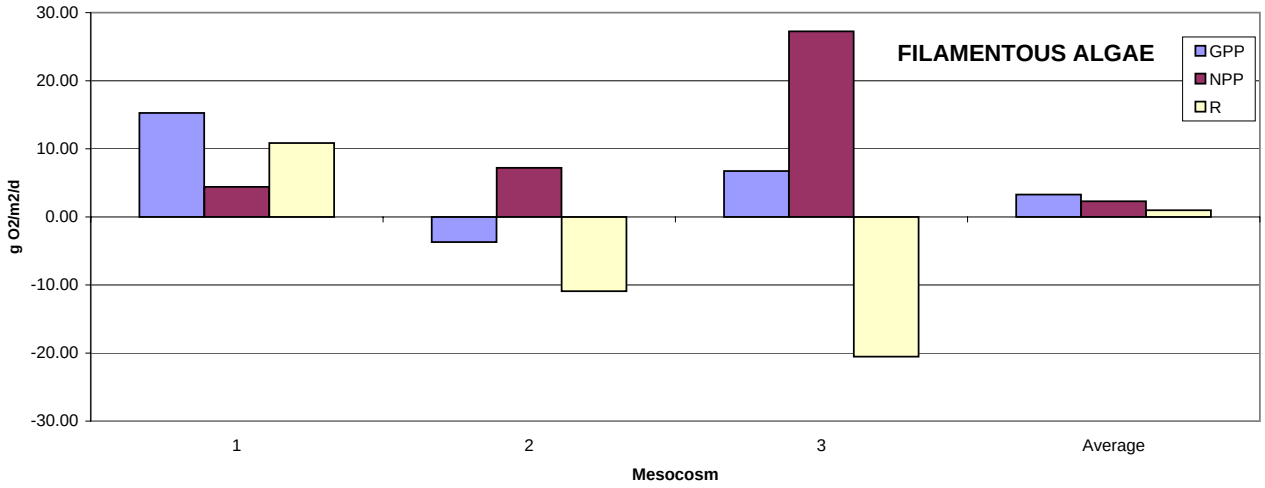


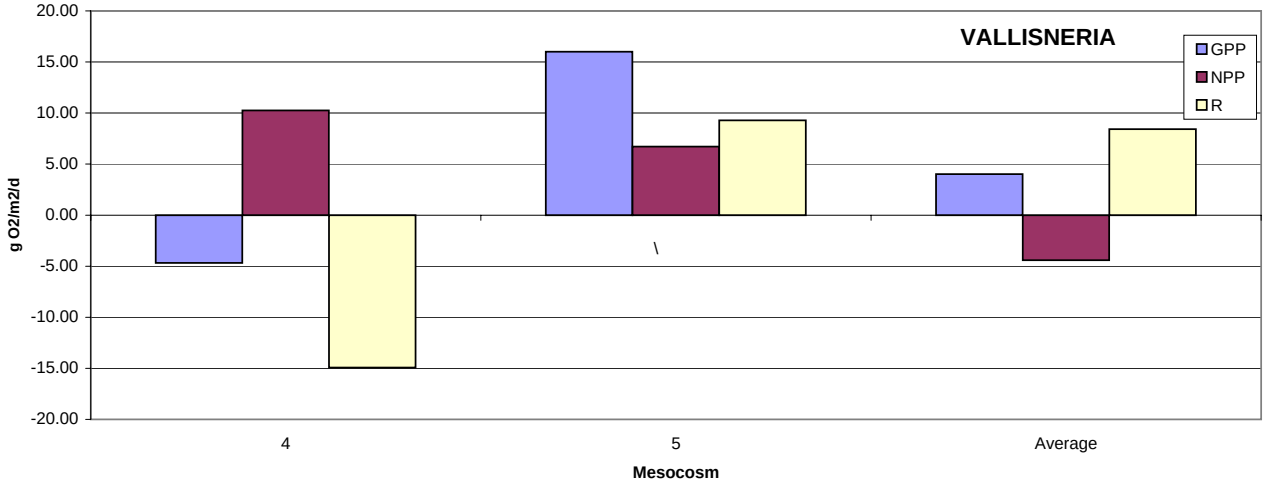


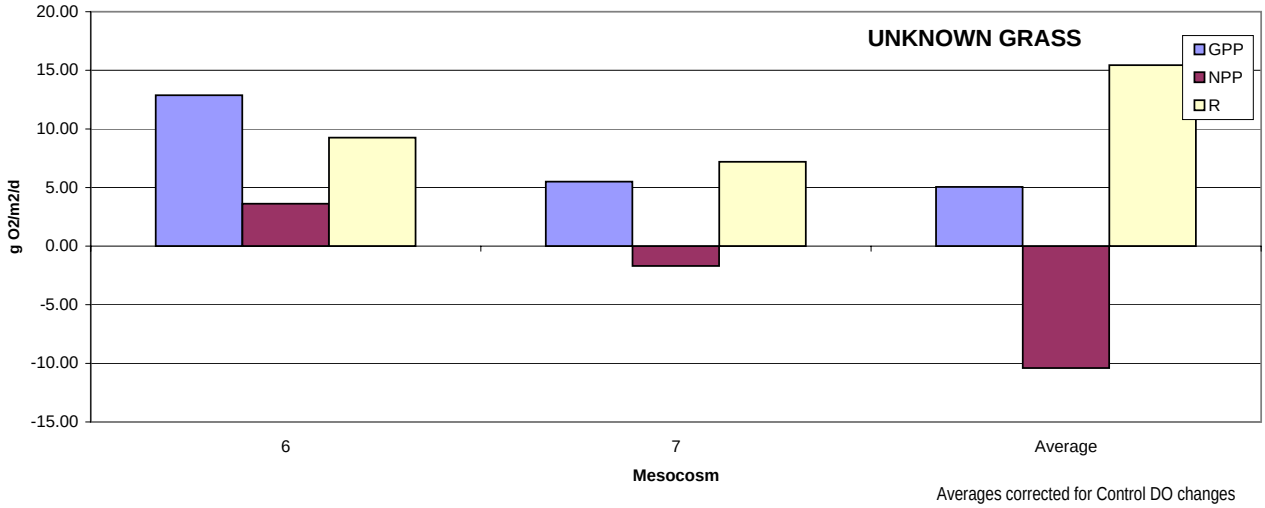


APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05

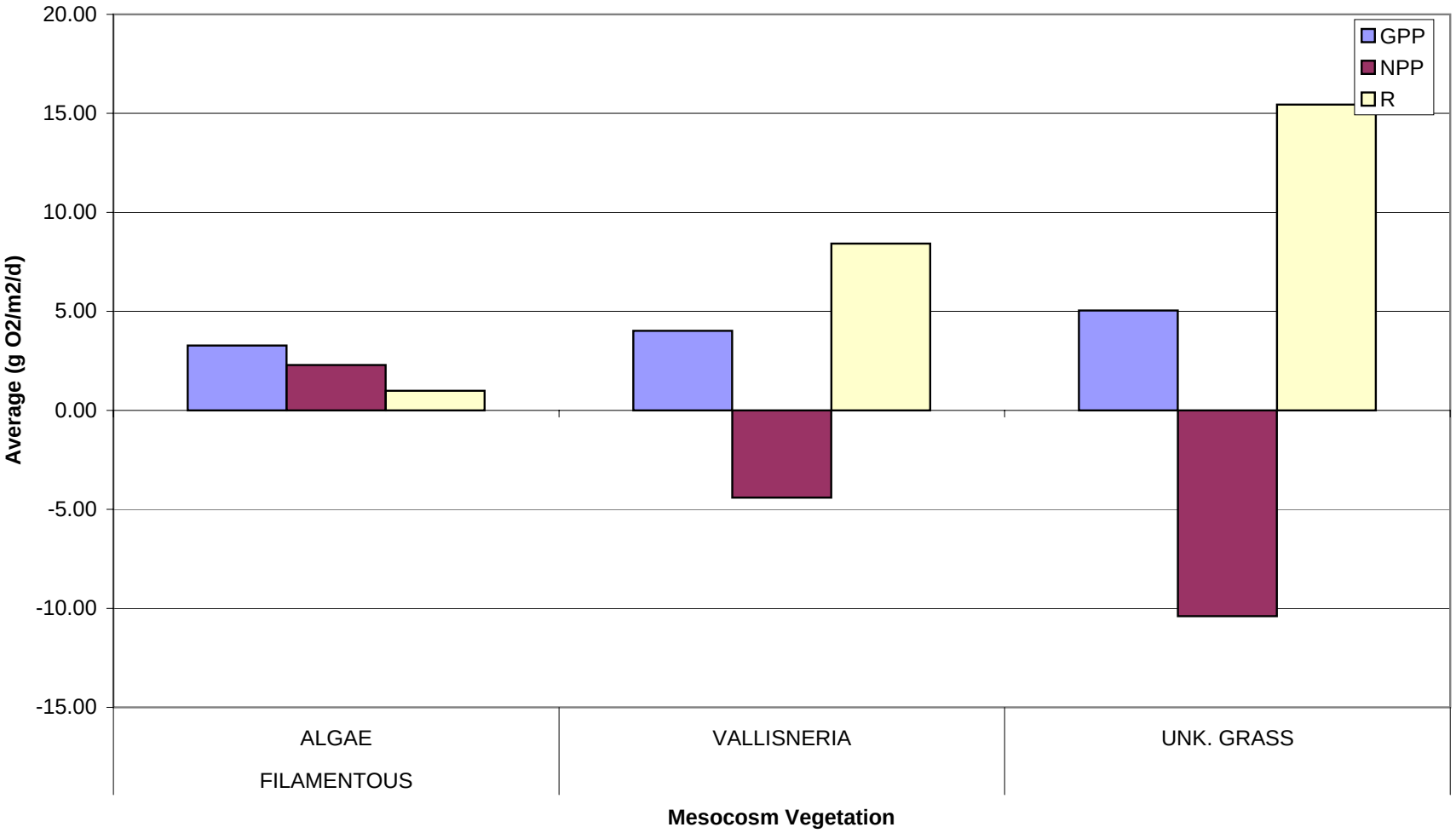
APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05







Averages corrected for Control DO changes



APPENDIX H-6

MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 4/18/05

Averages corrected for Control DO changes

APPENDIX H-6

MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05

		POTAMOGETON				VALLISNERIA				CONTROL			
PARAMETER	UNITS	2	3	8	Average [a]	6	7	9	Average [a]	1	4		Average
UPSTREAM DO	mg/L	6.43	6.44	6.49	6.46	6.47	6.49	6.49	6.48	6.44	6.45	6.46	6.45
DOWNSTREAM DO		6.45	6.45	6.47	6.46	6.49	6.51	6.55	6.52	6.46	6.46	6.48	6.47
CHANGE DO		0.01	0.00	-0.02	0.00	0.01	0.02	0.06	0.03	0.02	0.01	0.02	0.02
TRAVEL TIME	minutes	0.40	0.28	0.27	0.32	0.36	0.41	0.58	0.45	0.11	0.11	0.11	0.11
VELOCITY	m/hr	275	392	411	348	306	266	189	243	992	997	956	981
GPP	g $O_2/m^2/d$	13.98	15.59	17.74	12.16	11.93	17.71	12.83	11.03	---	---	---	---
NPP24		3.24	1.20	-5.63	-4.85	3.55	5.99	9.04	2.93	---	---	---	---
R24		10.74	14.40	23.36	17.01	8.38	11.72	3.79	8.10	---	---	---	---
Vegetation	kg DW/m^2	0.365	0.345	0.485	0.398	0.640	0.468	0.485	0.531	---	---	---	---
GPP	g O_2/kg DW/d	38.31	45.17	36.54	30.52	18.66	37.86	26.43	20.77	---	---	---	---
NPP24		8.89	3.47	-11.60	-12.16	5.56	12.81	18.62	5.52	---	---	---	---
R24		29.42	41.70	48.14	42.69	13.10	25.06	7.81	15.25	---	---	---	---
PAR	mol/hr	0.310	0.374	0.185	0.275	0.228	0.194	0.250	0.224	---	---	---	---
	$mol/m^2/d$	31.7	34.9	17.2	28.0	21.2	18.1	23.3	20.9	---	---	---	---
GPP	g O_2/mol	0.441	0.447	1.03	0.435	0.562	0.981	0.551	0.529	---	---	---	---
NPP		0.102	0.034	-0.326	-0.173	0.167	0.332	0.388	0.141	---	---	---	---
GPP	g O_2/kg DW/mol	1.21	1.29	2.12	1.09	0.879	2.10	1.13	0.996	---	---	---	---
NPP		0.280	0.099	-0.673	-0.435	0.262	0.709	0.800	0.265	---	---	---	---

[a] Averages corrected for Control DO changes

APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
POTAMOGETON	2	9:58	6.04	6.03	0.00	---	0.00	-0.01	-0.03	479.8	0.24	0.40	275.0	13.98	3.24	10.74	0.365	38.31	8.89	29.42	31.70	0.44	0.10	1.21	0.28
		10:22	6.34	6.45	0.11	---	0.11	0.13	0.53	506.20	0.25														
		10:50	6.43	6.48	0.05	---	0.05	0.07	0.20	682.40	0.34														
		11:20	6.26	6.37	0.11	---	0.11	0.13	0.30	885.70	0.44														
		11:48	6.29	6.38	0.09	---	0.09	0.11	0.24	890.70	0.45														
		12:14	6.52	6.58	0.06	---	0.06	0.08	0.44	339.10	0.17														
		12:42	6.54	6.62	0.08	---	0.08	0.10	0.21	957.10	0.48														
		13:10	6.63	6.54	-0.09	---	-0.09	-0.12	-1.18	198.46	0.10														
		13:38	6.62	6.60	-0.02	---	-0.02	-0.02	---	---	---														
		14:04	6.41	6.35	-0.06	---	-0.06	-0.08	---	---	---														
		14:27	6.51	6.49	-0.02	---	-0.02	-0.02	---	---	---														
		14:46	6.50	6.57	0.07	---	0.07	0.08	---	---	---														
		15:02	6.55	6.38	-0.17	---	-0.17	-0.22	---	---	---														
	3	10:00	6.05	6.19	0.14	---	0.14	0.25	1.10	446.70	0.22	0.28	391.7	15.59	1.20	14.40	0.345	45.17	3.47	41.70	34.92	0.45	0.03	1.29	0.10
		10:26	6.39	6.35	-0.04	---	-0.04	-0.07	-0.24	543.70	0.27														
		10:52	6.41	6.44	0.03	---	0.03	0.05	0.15	639.30	0.32														
		11:24	6.34	6.38	0.04	---	0.04	0.07	0.16	865.80	0.43														
		11:50	6.31	6.35	0.04	---	0.04	0.08	0.18	862.80	0.43														
		12:18	6.51	6.58	0.07	---	0.07	0.12	0.26	923.70	0.46														
		12:44	6.55	6.60	0.05	---	0.05	0.09	0.19	941.60	0.47														
		13:14	6.62	6.68	0.06	---	0.06	0.11	---	---	---														
		13:40	6.61	6.58	-0.03	---	-0.03	-0.06	---	---	---														
		14:08	6.39	6.41	0.02	---	0.02	0.04	---	---	---														
		14:28	6.48	6.40	-0.07	---	-0.07	-0.13	---	---	---														
		14:49	6.56	6.40	-0.16	---	-0.16	-0.29	---	---	---														
		15:03	6.53	6.43	-0.10	---	-0.10	-0.17	---	---	---														
	8	10:14	6.23	6.22	0.00	---	0.00	-0.01	-0.04	516.80	0.26	0.27	411.1	17.74	-5.63	23.36	0.485	36.54	-11.60	48.14	17.24	1.03	-0.33	2.12	-0.67
		10:40	6.38	6.41	0.03	---	0.03	0.06	0.20	618.00	0.31														
		11:10	6.40	6.50	0.11	---	0.11	0.20	0.52	761.10	0.38														
		11:38	6.41	6.38	-0.03	---	-0.03	-0.05	-0.65	152.78	0.08														
		12:06	6.48	6.56	0.08	---	0.08	0.15	1.26	236.90	0.12														
		12:32	6.54	6.56	0.02	---	0.02	0.03	0.37	168.03	0.08														
		13:00	6.63	6.63	0.00	---	0.00	0.00	0.00	125.41	0.06														
		13:28	6.67	6.59	-0.08	---	-0.08	-0.15	---	---	---														
		13:56	6.56	6.51	-0.05	---	-0.05	-0.09	---	---	---														
		14:21	6.52	6.44	-0.08	---	-0.08	-0.15	---	---	---														
		14:40	6.44	6.35	-0.09	---	-0.09	-0.16	---	---	---														
		14:57	6.59	6.53	-0.06	---	-0.06	-0.11	---	---	---														
		15:11	6.55	6.47	-0.08	---	-0.08	-0.15	---	---	---														
	Average	10:04	6.10	6.15	0.04	0.03	0.01	0.01	0.06	481.08	0.24	0.32	348.0	12.16	-4.85	17.01	0.398	30.52	-12.16	42.69	27.95	0.44	-0.17	1.09	-0.44
		10:29	6.37	6.40	0.03	0.04	-0.01	-0.01	-0.03	555.97	0.28														
		10:57	6.41	6.47	0.06	0.04	0.02	0.03	0.09	694.27	0.35														
		11:27	6.34	6.38	0.04	0.01	0.03	0.05	0.16	634.76	0.32														
		11:54	6.36	6.43	0.07	0.03	0.04	0.07	0.21	663.47	0.33														
		12:21	6.53	6.57	0.05	0.04	0.01	0.01	0.04	476.94	0.24														
		12:48	6.57	6.62	0.04	0.01	0.04	0.06	0.17	674.70	0.34														
		13:17	6.64	6.60	-0.04	0.01	-0.05	-0.08	-0.78	198.46	0.10														
		13:44	6.60	6.56	-0.03	0.01	-0.04	-0.07	---	---	---														
		14:11	6.44	6.40	-0.04	0.03	-0.07	-0.11	---	---	---														
		14:31	6.47	6.41	-0.06	0.01	-0.07	-0.11	---	---	---														
		14:50	6.55	6.50	-0.05	-0.01	-0.04	-0.07	---	---	---														
		15:05	6.54	6.43	-0.12	-0.01	-0.10	-0.16	---	---	---														

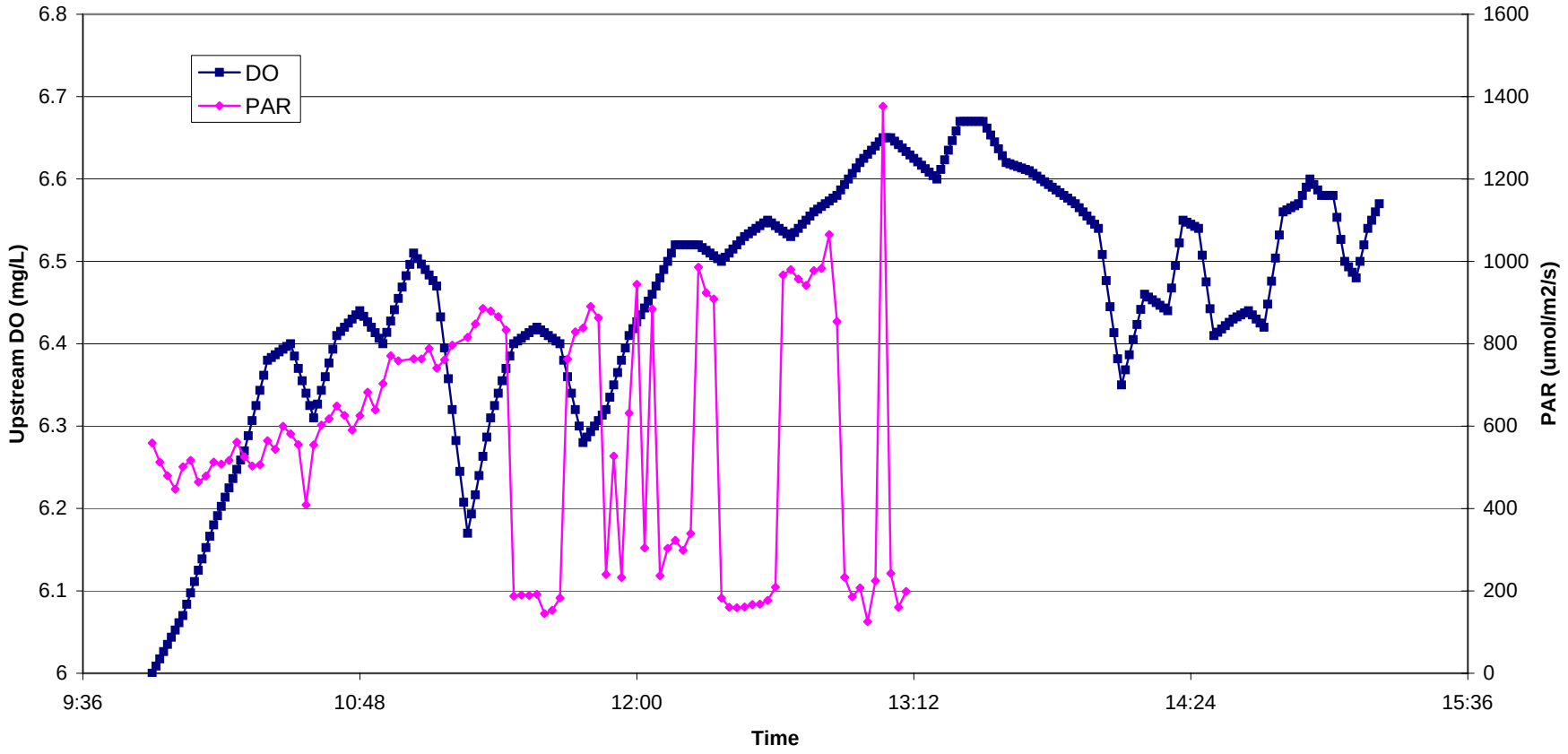
APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP	R	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP	R	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP	GPP (g O_2/kgDW/mol)	NPP
VALLISNERIA	6	10:08	6.15	6.23	0.08	---	0.08	0.11	0.45	479.00	0.24	0.36	306.1	11.93	3.55	8.38	0.640	18.66	5.56	13.10	21.24	0.56	0.17	0.88	0.26
		10:34	6.34	6.37	0.03	---	0.03	0.04	0.20	409.00	0.21														
		11:04	6.50	6.58	0.08	---	0.08	0.12	0.30	763.10	0.38														
		11:32	6.41	6.36	-0.05	---	-0.05	-0.07	-0.78	189.08	0.09														
		12:00	6.43	6.54	0.11	---	0.11	0.16	0.33	944.10	0.47														
		12:26	6.52	6.59	0.07	---	0.07	0.10	1.22	159.16	0.08														
		12:54	6.59	6.67	0.08	---	0.08	0.11	0.92	233.00	0.12														
		13:22	6.65	6.66	0.01	---	0.01	0.02	---	---	---														
		13:50	6.58	6.52	-0.06	---	-0.06	-0.09	---	---	---														
		14:16	6.45	6.42	-0.03	---	-0.03	-0.04	---	---	---														
		14:36	6.43	6.41	-0.02	---	-0.02	-0.03	---	---	---														
		14:54	6.59	6.56	-0.03	---	-0.03	-0.04	---	---	---														
		15:08	6.50	6.42	-0.08	---	-0.08	-0.11	---	---	---														
	7	10:12	6.20	6.35	0.15	---	0.15	0.21	0.81	507.90	0.25	0.41	266.2	17.71	5.99	11.72	0.468	37.86	12.81	25.06	18.06	0.98	0.33	2.10	0.71
		10:38	6.34	6.39	0.05	---	0.05	0.07	0.22	602.60	0.30														
		11:06	6.48	6.53	0.05	---	0.05	0.07	0.16	788.60	0.40														
		11:36	6.41	6.49	0.08	---	0.08	0.11	1.47	144.91	0.07														
		12:02	6.44	6.62	0.18	---	0.18	0.25	1.61	304.40	0.15														
		12:30	6.54	6.60	0.06	---	0.06	0.09	1.06	166.79	0.08														
		12:56	6.61	6.66	0.05	---	0.05	0.07	0.80	185.48	0.09														
		13:26	6.67	6.65	-0.02	---	-0.02	-0.03	---	---	---														
		13:52	6.58	6.55	-0.03	---	-0.03	-0.04	---	---	---														
		14:20	6.50	6.40	-0.09	---	-0.09	-0.13	---	---	---														
		14:38	6.44	6.42	-0.02	---	-0.02	-0.02	---	---	---														
		14:56	6.59	6.56	-0.03	---	-0.03	-0.05	---	---	---														
		15:09	6.52	6.42	-0.10	---	-0.10	-0.14	---	---	---														
	9	10:16	6.25	6.37	0.12	---	0.12	0.11	0.37	561.20	0.28	0.58	188.8	12.83	9.04	3.79	0.485	26.43	18.62	7.81	23.29	0.55	0.39	1.13	0.80
		10:44	6.42	6.57	0.15	---	0.15	0.13	0.41	625.70	0.31														
		11:12	6.32	6.66	0.34	---	0.34	0.29	0.73	796.50	0.40														
		11:42	6.36	6.51	0.15	---	0.15	0.13	0.34	762.60	0.38														
		12:08	6.50	6.61	0.11	---	0.11	0.09	0.62	303.50	0.15														
		12:36	6.54	6.58	0.04	---	0.04	0.03	0.30	209.00	0.10														
		13:02	6.64	6.67	0.03	---	0.03	0.03	0.23	224.40	0.11														
		13:32	6.65	6.63	-0.02	---	-0.02	-0.02	---	---	---														
		13:58	6.55	6.48	-0.07	---	-0.07	-0.06	---	---	---														
		14:24	6.55	6.51	-0.04	---	-0.04	-0.03	---	---	---														
		14:42	6.43	6.40	-0.02	---	-0.02	-0.02	---	---	---														
		14:59	6.58	6.53	-0.05	---	-0.05	-0.04	---	---	---														
		15:12	6.56	6.61	0.05	---	0.05	0.04	---	---	---														
	Average	10:12	6.20	6.32	0.12	0.03	0.08	0.09	0.35	516.03	0.26	0.45	243.5	11.03	2.93	8.10	0.531	20.77	5.52	15.25	20.86	0.53	0.14	1.00	0.26
		10:38	6.37	6.44	0.08	0.04	0.04	0.04	0.14	545.77	0.27														
		11:07	6.43	6.59	0.16	0.04	0.11	0.13	0.32	782.73	0.39														
		11:36	6.40	6.45	0.06	0.01	0.05	0.05	0.30	365.53	0.18														
		12:03	6.46	6.59	0.13	0.03	0.11	0.12	0.46	517.33	0.26														
		12:30	6.53	6.59	0.06	0.04	0.02	0.02	0.19	178.32	0.09														
		12:57	6.61	6.67	0.05	0.01	0.05	0.05	0.47	214.29	0.11														
		13:26	6.66	6.65	-0.01	0.01	-0.02	-0.02	---	---	---														
		13:53	6.57	6.52	-0.05	0.01	-0.06	-0.07	---	---	---														
		14:20	6.50	6.44	-0.05	0.03	-0.08	-0.09	---	---	---														
		14:38	6.43	6.41	-0.02	0.01	-0.03	-0.04	---	---	---														
		14:56	6.59	6.55	-0.04	-0.01	-0.03	-0.03	---	---	---														
		15:09	6.53	6.48	-0.04	-0.01	-0.03	-0.03	---	---	---														

APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05

PLANT	MESOCOSM NUMBER	TIME	UPSTREAM DO (mg/L)	DOWNSTREAM DO (mg/L)	DO CHANGE (mg/L)	CNTRL (mg/L)	CORR (mg/L)	(g/hr)	(g/mol)	PAR (umol/m^2/s)	(mol/hr)	TRAVEL TIME (min)	VELOCITY (m/hr)	GPP (g O_2/m^2/d)	NPP (g O_2/m^2/d)	R (g O_2/m^2/d)	Vegetation (kg DW/m^2)	GPP (g O_2/kgDW/d)	NPP (g O_2/kgDW/d)	R (g O_2/kgDW/d)	PAR (mol/m^2/d)	GPP (g O_2/mol)	NPP (g O_2/mol)	GPP (g O_2/kgDW/mol)	NPP (g O_2/kgDW/mol)
CONTROL	1	9:56	6.02	6.06	0.04	---	0.04	0.19	0.75	512.80	0.26	0.11	992.0	---	---	---	---	---	---	---	---	---	---	---	---
		10:20	6.31	6.45	0.14	---	0.14	0.65	2.57	503.30	0.25														
		10:46	6.43	6.40	-0.03	---	-0.03	-0.14	-0.46	590.20	0.30														
		11:18	6.22	6.25	0.03	---	0.03	0.15	0.35	847.90	0.43														
		11:44	6.32	6.43	0.11	---	0.11	0.50	1.20	828.90	0.42														
		12:12	6.52	6.55	0.03	---	0.03	0.14	0.91	298.40	0.15														
		12:38	6.54	6.56	0.02	---	0.02	0.11	0.22	967.00	0.49														
		13:08	6.64	6.56	-0.08	---	-0.08	-0.37	-4.60	160.16	0.08														
		13:34	6.64	6.63	-0.01	---	-0.01	-0.03	---	---	---														
		14:02	6.48	6.48	0.00	---	0.00	0.02	---	---	---														
		14:25	6.54	6.55	0.01	---	0.01	0.03	---	---	---														
		14:44	6.45	6.50	0.05	---	0.05	0.24	---	---	---														
		15:00	6.58	6.50	-0.08	---	-0.08	-0.36	---	---	---														
	4	10:04	6.10	6.17	0.07	---	0.07	0.33	1.27	517.00	0.26	0.11	997.0	---	---	---	---	---	---	---	---	---	---	---	---
		10:28	6.39	6.34	-0.05	---	-0.05	-0.24	-0.81	599.60	0.30														
		10:56	6.43	6.49	0.06	---	0.06	0.28	0.74	770.60	0.39														
		11:26	6.37	6.36	-0.01	---	-0.01	-0.05	-0.11	833.40	0.42														
		11:54	6.35	6.35	0.00	---	0.00	0.00	0.00	527.20	0.26														
		12:20	6.51	6.55	0.04	---	0.04	0.20	0.43	908.70	0.46														
		12:48	6.57	6.57	0.00	---	0.00	0.02	0.03	983.00	0.49														
		13:16	6.61	6.70	0.09	---	0.09	0.42	---	---	---														
		13:44	6.60	6.62	0.02	---	0.02	0.08	---	---	---														
		14:10	6.42	6.43	0.01	---	0.01	0.03	---	---	---														
		14:32	6.42	6.44	0.02	---	0.02	0.10	---	---	---														
		14:50	6.57	6.50	-0.07	---	-0.07	-0.30	---	---	---														
		15:05	6.49	6.47	-0.02	---	-0.02	-0.11	---	---	---														
	5	10:06	6.13	6.11	-0.01	---	-0.01	-0.07	-0.29	464.10	0.23	0.11	956.0	---	---	---	---	---	---	---	---	---	---	---	---
		10:32	6.37	6.40	0.03	---	0.03	0.14	0.49	555.30	0.28														
		10:58	6.46	6.55	0.09	---	0.09	0.43	1.13	758.60	0.38														
		11:30	6.41	6.41	0.00	---	0.00	0.02	0.16	189.97	0.10														
		11:56	6.38	6.35	-0.03	---	-0.03	-0.14	-1.17	232.80	0.12														
		12:24	6.51	6.56	0.05	---	0.05	0.23	2.83	160.08	0.08														
		12:50	6.57	6.57	0.00	---	0.00	-0.02	-0.03	1065.20	0.53														
		13:20	6.62	6.65	0.03	---	0.03	0.12	---	---	---														
		13:46	6.60	6.61	0.01	---	0.01	0.06	---	---	---														
		14:14	6.45	6.52	0.07	---	0.07	0.30	---	---	---														
		14:34	6.43	6.43	0.00	---	0.00	0.02	---	---	---														
		14:53	6.58	6.57	-0.01	---	-0.01	-0.05	---	---	---														
		15:06	6.49	6.55	0.06	---	0.06	0.29	---	---	---														
	Average	10:02	6.08	6.11	0.03	---	0.03	0.15	0.60	497.97	0.25	0.11	981.3	---	---	---	---	---	---	---	---	---	---	---	---
		10:26	6.36	6.40	0.04	---	0.04	0.18	0.65	552.73	0.28														
		10:53	6.44	6.48	0.04	---	0.04	0.19	0.54	706.47	0.35														
		11:24	6.33	6.34	0.01	---	0.01	0.04	0.13	623.76	0.31														
		11:51	6.35	6.38	0.03	---	0.03	0.12	0.45	529.63	0.27														
		12:18	6.51	6.55	0.04	---	0.04	0.18	0.80	455.73	0.23														
		12:45	6.56	6.57	0.01	---	0.01	0.03	0.07	1005.07	0.50														
		13:14	6.62	6.64	0.01	---	0.01	0.05	0.68	160.16	0.08														
		13:41	6.61	6.62	0.01	---	0.01	0.03	---	---	---														
		14:08	6.45	6.48	0.03	---	0.03	0.11	---	---	---														
		14:30	6.46	6.47	0.01	---	0.01	0.05	---	---	---														
		14:49	6.53	6.52	-0.01	---	-0.01	-0.03	---	---	---														
		15:03	6.52	6.51	-0.01	---	-0.01	-0.06	---	---	---														

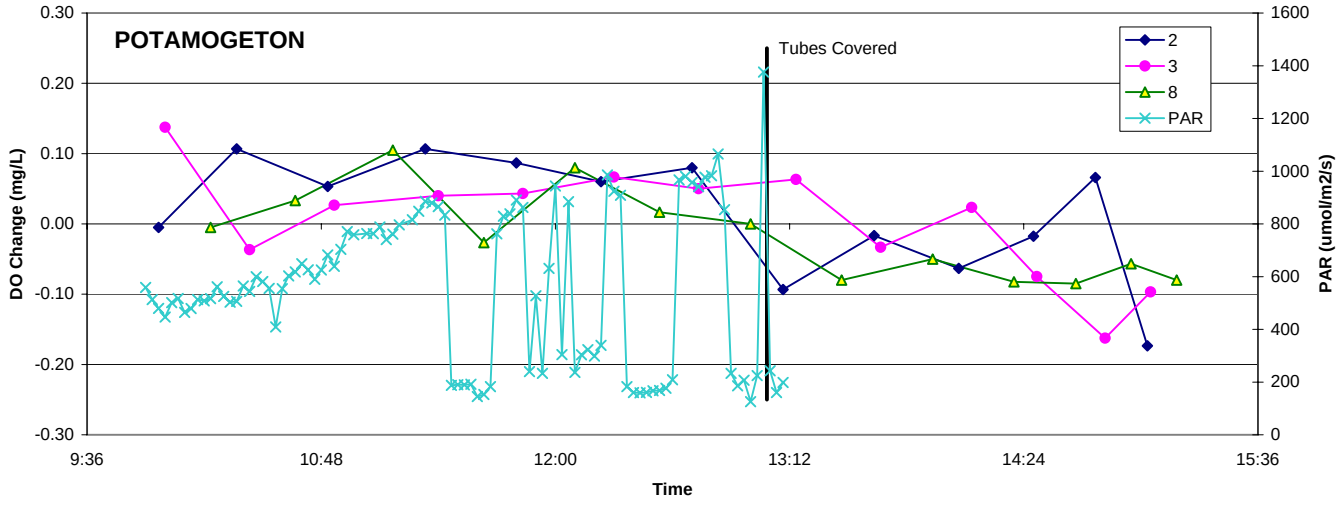
Mesocosm Area (m^2): 0.1394
Mesocosm Volume (m^3): 0.00834
Daylight (hrs/d): 13

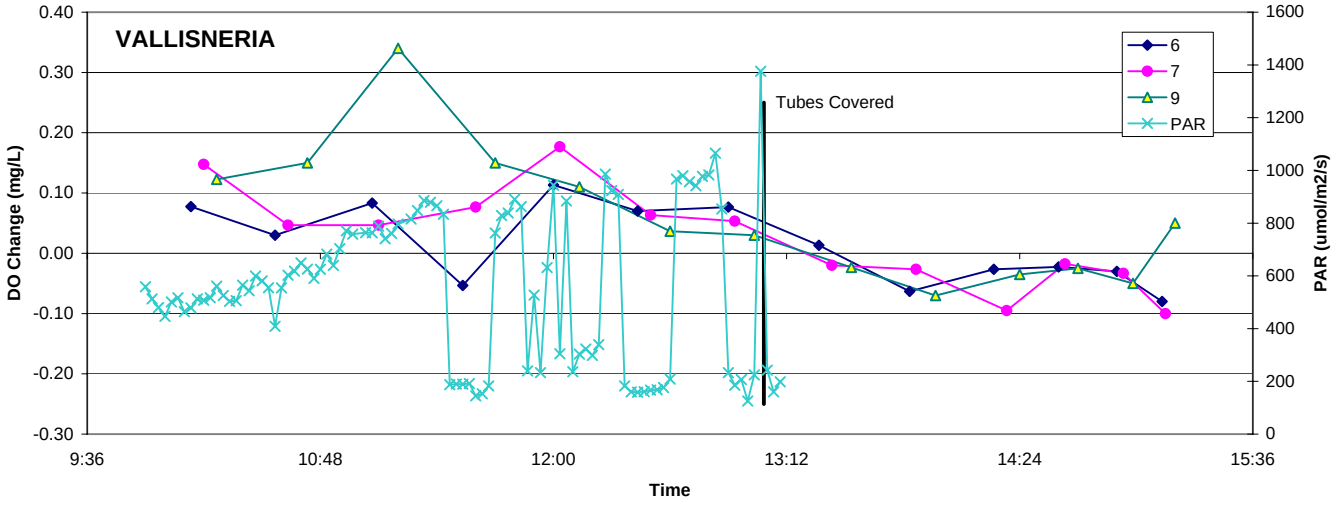


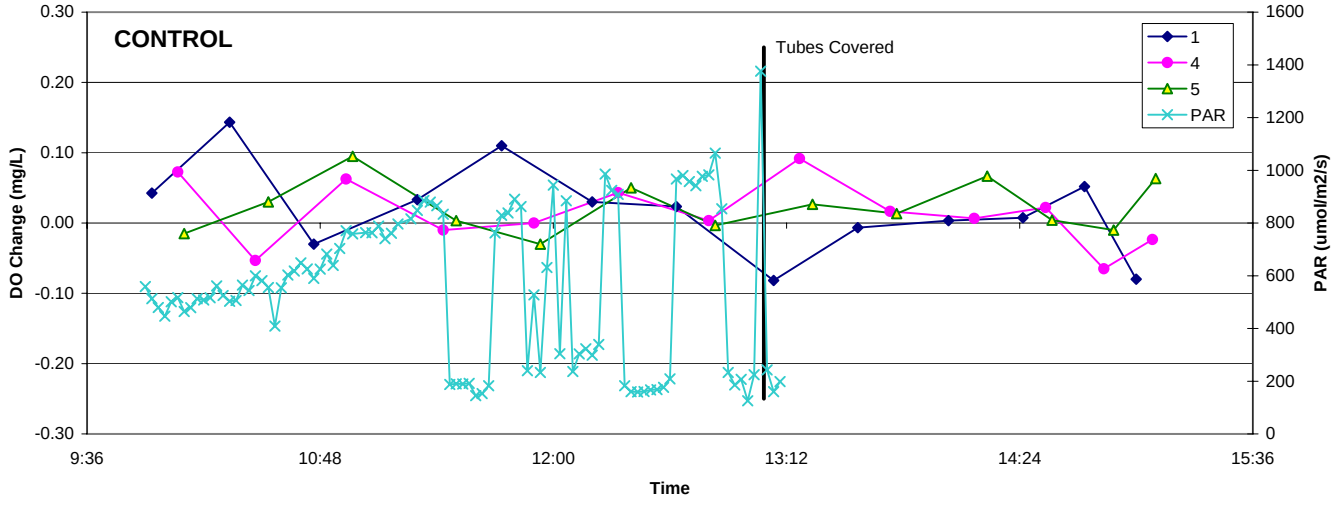
APPENDIX H-6

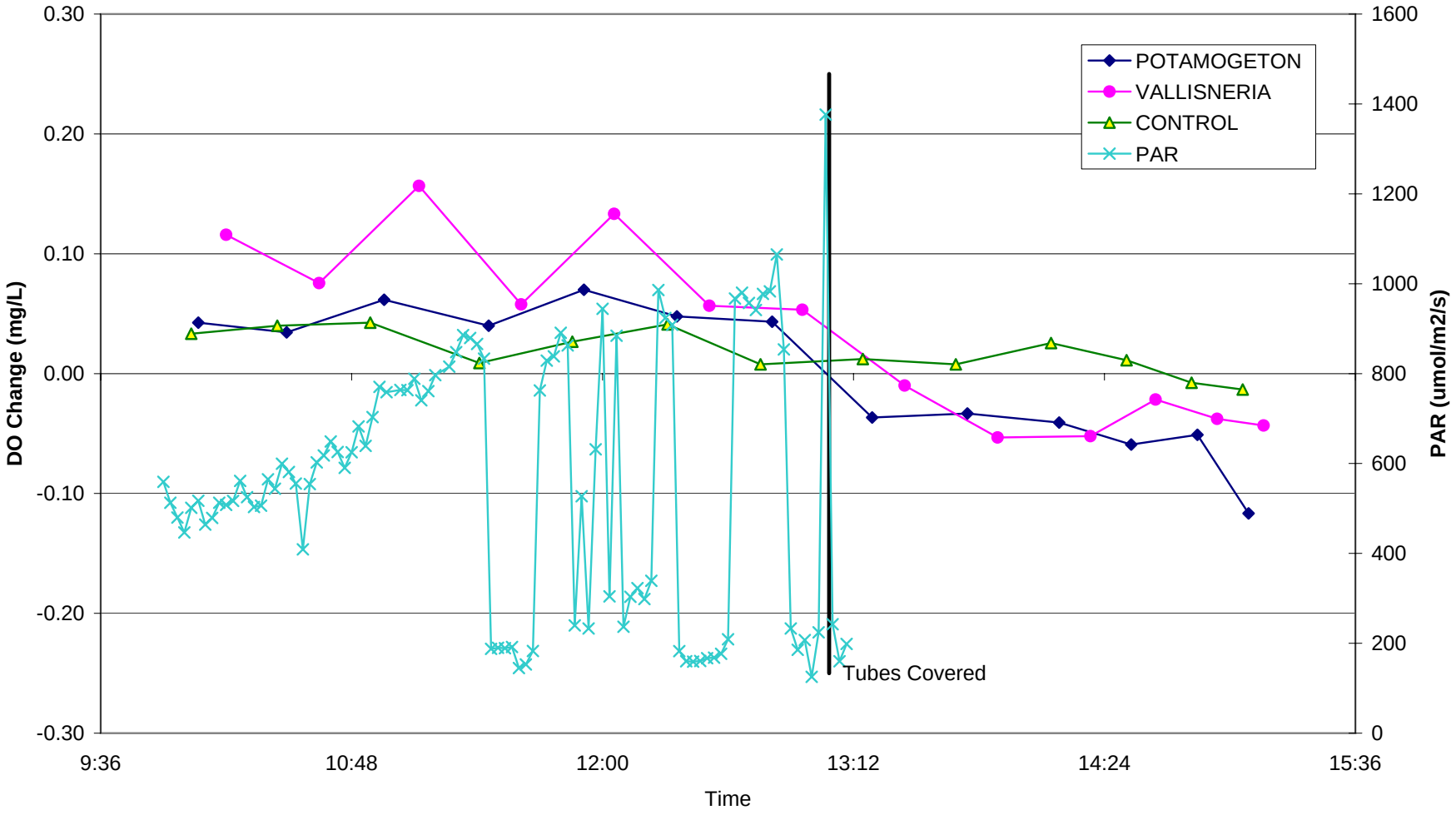
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05

APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05



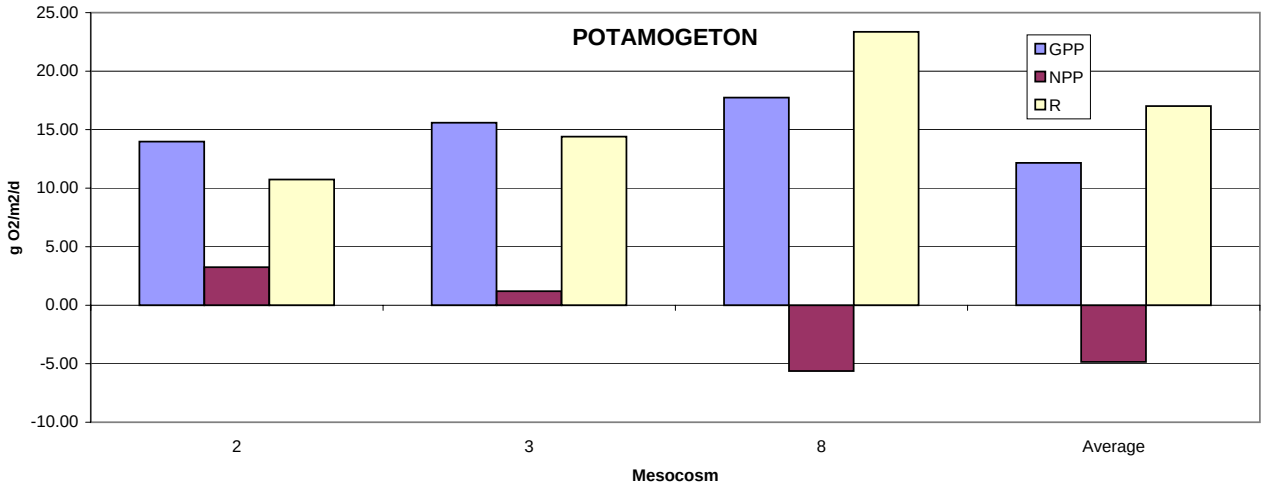


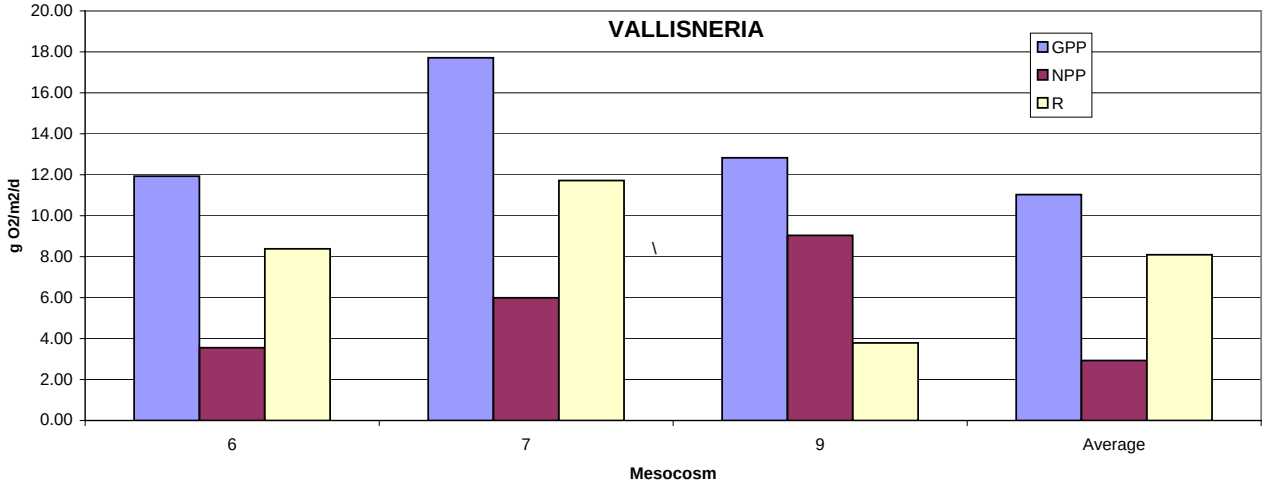




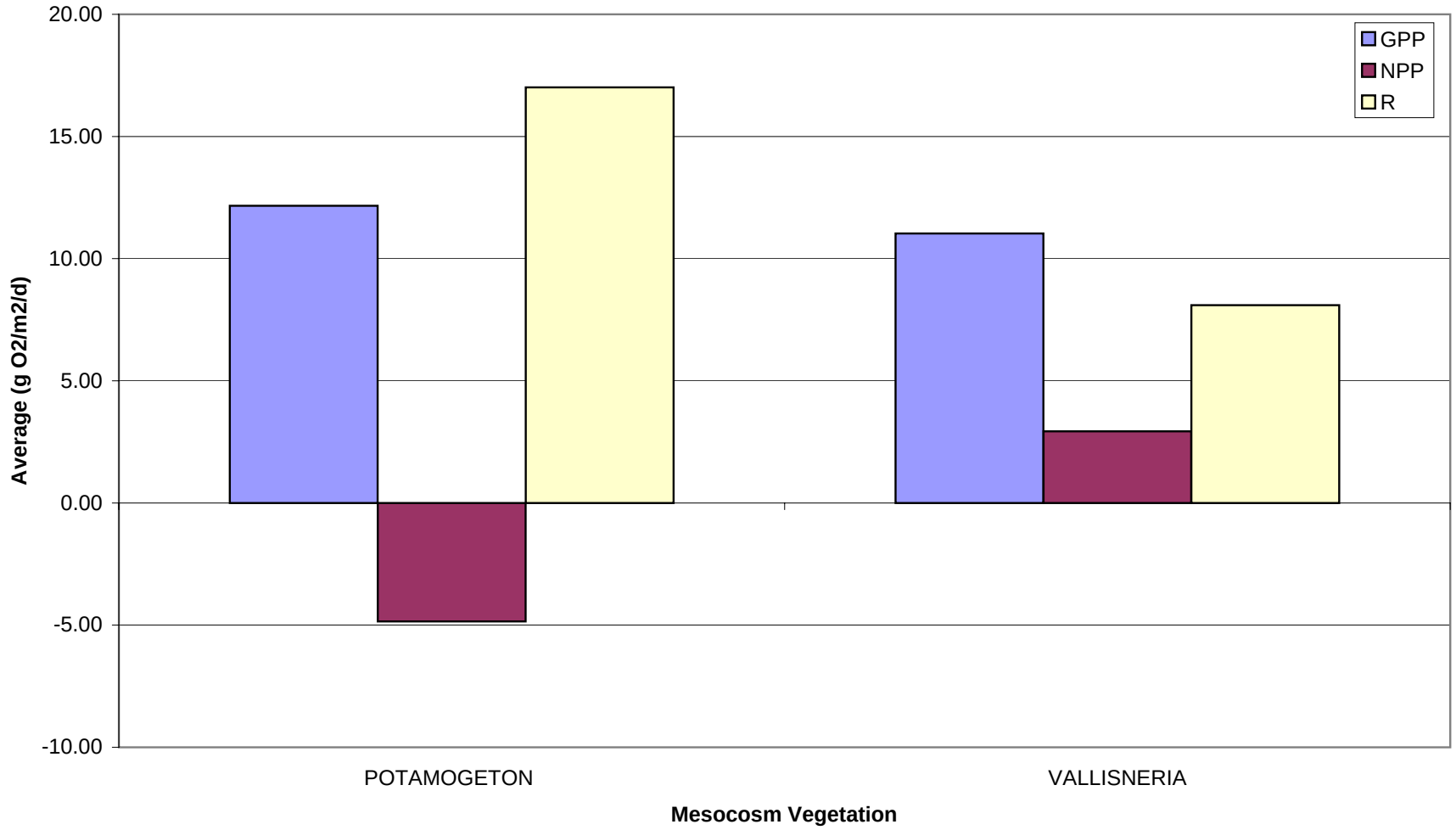
APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05

APPENDIX H-6
MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05





Averages corrected for Control DO changes



APPENDIX H-6

MESOCOSM STUDY AT JUNIPER CREEK SEGMENT 1 - 8/1/05

Averages corrected for Control DO changes

Appendix I

Plankton Tow Fine Particulate Export Data for the Wekiva River System Streams and Reference Streams

APPENDIX I
WEKIVA RIVER PLRG - PLANKTON TOW RESULTS

											Laboratory Analysis					Total Sample							
Segment	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)	Vol. Dried (mL)	Dry Wt. (g)	Ash Wt. (g)	% Ash	Ash-Free Dry Wt. (g)	Dry Wt. (g)	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 ($g/m^2/d$)
WR-SEG1	5/27/05	11:57	1	1,587	129	1.52	0.1886	0.320	7.77	257	63	0.10	0.06	60.00	0.0400	0.408	0.1632	0.05247	0.02099	6,880	2,752	4.336	1.735
		12:05	2	1,587	122	1.52	0.1886	0.320	7.35	269	64	0.13	0.10	76.92	0.0300	0.546	0.1261	0.07436	0.01716	9,750	2,250	6.145	1.418
		12:13	3	1,587	122	1.52	0.1886	0.320	7.36	242	70	0.24	0.18	75.00	0.0600	0.830	0.2074	0.11274	0.02819	14,782	3,696	9.317	2.329
WR-SEG1	8/31/05	10:21	1	1,587	356	2.19	0.1886	0.253	17.00	90	62	0.13	0.09	69.23	0.0400	0.189	0.0581	0.01110	0.00342	2,103	647	1.325	0.408
		10:33	2	1,587	506	2.19	0.1886	0.226	21.54	84	65	0.12	0.08	66.67	0.0400	0.155	0.0517	0.00720	0.00240	1,364	455	0.860	0.287
		10:46	3	1,587	524	2.19	0.1886	0.210	20.79	84	65	0.17	0.13	76.47	0.0400	0.220	0.0517	0.01056	0.00249	2,001	471	1.261	0.297
WR-SEG2	5/26/05	11:57	1	719,033	129	5.90	0.1886	1.050	25.50	257	63	0.31	0.15	48.39	0.1600	1.265	0.6527	0.04959	0.02560	25,298	13,057	0.035	0.018
		12:05	2	719,033	122	5.90	0.1886	1.050	24.10	269	64	0.23	0.10	43.48	0.1300	0.967	0.5464	0.04011	0.02267	20,460	11,564	0.028	0.016
		12:13	3	719,033	122	5.90	0.1886	1.050	24.14	242	70	0.41	0.18	43.90	0.2300	1.417	0.7951	0.05872	0.03294	29,953	16,803	0.042	0.023
WR-SEG2	9/1/05	9:57	1	759,800	482	7.73	0.1886	0.061	5.54	64	64	0.34	0.19	55.88	0.1500	0.340	0.1500	0.06132	0.02705	40,946	18,064	0.054	0.024
		10:10	2	759,800	484	7.73	0.1886	0.095	8.63	93	69	0.11	0.06	54.55	0.0500	0.148	0.0674	0.01717	0.00781	11,467	5,212	0.015	0.007
		10:23	3	759,800	486	7.73	0.1886	0.098	8.95	100	64	0.08	0.04	50.00	0.0400	0.125	0.0625	0.01397	0.00699	9,329	4,665	0.012	0.006
RSR-SEG1	4/20/05	12:18	1	88,145	429	1.51	0.1886	0.131	10.61	75	63	0.21	0.05	23.81	0.1600	0.250	0.1905	0.02357	0.01796	3,076	2,343	0.035	0.027
		12:37	2	88,145	597	1.51	0.1886	0.131	14.76	65	65	0.29	0.07	24.14	0.2200	0.290	0.2200	0.01965	0.01491	2,564	1,945	0.029	0.022
		12:55	3	88,145	598	1.51	0.1886	0.131	14.78	60	60	0.26	0.06	23.08	0.2000	0.260	0.2000	0.01759	0.01353	2,295	1,765	0.026	0.020
RSR-SEG1	8/3/05	10:05	1	68,753	293	*1.51*	0.1886	0.174	9.60	214	62	0.20	0.06	30.00	0.1400	0.690	0.4832	0.07190	0.05033	9,381	6,567	0.136	0.096
		10:21	2	68,753	503	*1.51*	0.1886	0.152	14.46	232	60	0.31	0.09	29.03	0.2200	1.199	0.8507	0.08290	0.05883	10,817	7,677	0.157	0.112
		10:39	3	68,753	512	*1.51*	0.1886	0.149	14.42	224	64	0.36	0.11	30.56	0.2500	1.260	0.8750	0.08737	0.06068	11,401	7,917	0.166	0.115
RSR-SEG2	4/21/05	12:17	1	412,114	299	1.42	0.1886	0.332	18.74	104	53	0.76	0.23	30.26	0.5300	1.491	1.0400	0.07959	0.05550	9,744	6,795	0.024	0.016
		12:31	2	412,114	297	1.42	0.1886	0.332	18.61	150	65	0.74	0.20	27.03	0.5400	1.708	1.2462	0.09175	0.06695	11,232	8,197	0.027	0.020
		12:45	3	412,114	311	1.42	0.1886	0.332	19.49	200	65	0.59	0.17	28.81	0.4200	1.815	1.2923	0.09315	0.06631	11,403	8,118	0.028	0.020
RSR-SEG2	8/4/05	9:58	1	412,114	275	1.91	0.1886	0.152	7.90	250	62	1.01	0.30	29.70	0.7100	4.073	2.8629	0.51559	0.36245	84,998	59,751	0.206	0.145
		10:11	2	412,114	235	1.91	0.1886	0.165	7.29	246	60	0.89	0.29	32.58	0.6000	3.649	2.4600	0.50050	0.33741	82,509	55,624	0.200	0.135
		10:26	3	412,114	232	1.91	0.1886	0.128	5.61	236	64	0.97	0.30	30.93	0.6700	3.577	2.4706	0.63756	0.44038	105,105	72,598	0.255	0.176
ASC-SEG1	5/24/05	12:20	1	124,960	303	2.95	0.1886	0.079	4.52	283	73	0.18	0.09	50.00	0.0900	0.698	0.3489	0.15424	0.07712	39,346	19,673	0.315	0.157
		12:30	2	124,960	298	2.95	0.1886	0.079	4.46	134	65	0.23	0.11	47.83	0.1200	0.474	0.2474	0.10634	0.05548	27,129	14,154	0.217	0.113
		12:42	3	124,960	299	2.95	0.1886	0.079	4.47	151	66	0.18	0.09	50.00	0.0900	0.412	0.2059	0.09218	0.04609	23,515	11,758	0.188	0.094
ASC-SEG1	8/29/05	10:42	1	124,960	295	4.25	0.1886	0.119	6.60	95	61	0.23	0.08	34.78	0.1500	0.358	0.2336	0.05423	0.03537	19,918	12,990	0.159	0.104
		10:52	2	124,960	303	4.25	0.1886	0.091	5.22	73	66	0.20	0.07	35.00	0.1300	0.221	0.1438	0.04239	0.02756	15,570	10,120	0.125	0.081
		11:04	3	124,960	313	4.25	0.1886	0.098	5.77	92	64	0.20	0.07	35.00	0.1300	0.288	0.1869	0.04987	0.03241	18,314	11,904	0.147	0.095
JC-SEG1	4/18/05	12:46	1	222,200	427	3.38	0.1886	0.549	44.17	450	63	0.62	0.22	35.48	0.4000	4.429	2.8571	0.10025	0.06468	29,240	18,864	0.132	0.085
		13:14	2	222,200	122	3.38	0.1886	0.433	9.96	486	70	0.34	0.13	38.24	0.2100	2.361	1.4580	0.23701	0.14639	69,127	42,696	0.311	0.192
		13:34	3	222,200	123	3.38	0.1886	0.448	10.40	500	75	0.59	0.27	45.76	0.3200	3.933	2.1333	0.37838	0.20522	110,361	59,857	0.497	0.269
JC-SEG1	8/1/05	10:06	1	222,200	211	3.97	0.1886	0.485	19.29	250	55	0.71	0.25	35.21	0.4600	3.227	2.0909	0.16732	0.10840	57,447	37,219	0.259	0.168
		10:16	2	222,200	222	3.97	0.1886	0.454	19.04	216	62	1.03	0.34	33.01	0.6900	3.588	2.4039	0.18843	0.12623	64,694	43,339	0.291	0.195
		10:30	3	222,200	230	3.97	0.1886	0.463	20.08	238	64	0.91	0.31	34.07	0.6000	3.384	2.2313	0.16853	0.11112	57,862	38,151	0.260	0.172

Note: italics are estimated values - data not available

APPENDIX D

Attached Algae Survey on the Wekiva River and Rock Springs Run

Final Report from GreenWater Labs (2005)

TASK 2 FINAL REPORT

Attached Algal Assessment
For The Wekiva River And Rock Springs Run

August 15, 2005

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Introduction/Background

The Wekiva Parkway and Protection Act of 2004 requires the St. Johns River Water Management District (SJRWMD) to develop Pollutant Load Reduction Goals (PLRGs) for the Wekiva Study Area by December 1, 2005. Attached algae are thought to be important indicators of nutrient pollutants. The SJRWMD therefore contracted for an assessment of the distribution, composition and biomass of attached algae and characterization of habitats where attached algae are located in the Wekiva River (WR) and Rock Springs Run (RSR).

The objectives of this study were to assess attached algal communities in the WR and RSR to determine their distribution patterns, habitat characteristics, species composition and biomass.

The study had two tasks. The first (Task 1) was a qualitative visual survey of attached algal communities along the Wekiva River from Wekiwa Springs to the confluence of Blackwater Creek and along Rock Springs Run from Rock Springs to the confluence of the Wekiva River. The final report for Task 1was submitted in November 2004 and is attached here as Appendix I. The second task (Task 2) was a quantitative analysis of attached algal species composition, density and biomass from 15 sites in the Wekiwa Springs/Wekiva River and 10 sites from Rock Springs/Rock Springs Run. This report summarizes the findings of Task 2.

Study Methods

Quantitative Analysis of Attached Algal Communities

A total of 15 sampling sites for Wekiwa Spring/Wekiva River (WR-01 through WR-15) and 10 sites for Rock Springs/Rock Springs Run (RSR-01 through RSR-10) were selected by the SJRWMD (Figures 1A & 1B). RSR-04 was inaccessible due to downed trees and was not sampled. Each site was sampled twice, once in winter and once in summer. Digital photos were taken of each site.

Winter sampling occurred in December 2004-January 2005 and summer sampling in June 2005. At each sampling location a GPS point was captured using a WAAS-enabled Magellan MAP 330 hand-held Global Positioning System. A calibrated YSI 6600 Sonde was used to measure water temperature, pH, dissolved oxygen, conductivity, salinity and water depth. Water velocity was measured using an electronic flow meter and canopy cover was determined with a hemispherical densiometer.

Water was collected by hand in field-rinsed bottles for analysis of color, TP-T, PO_4-D, NO_x-T, NH_3-T, TKN-T, Cl-T, Fe-T, Ca-T and Mg-T and immediately put on ice. A portable pump and filter tower were used to filter the samples to be analyzed for dissolved phosphorus. Samples were analyzed at PPB Laboratories, Inc. in Gainesville, Florida. Water quality data files are on the attached CD.

Using garden shears, 6-10 pieces of the dominant available substrate for attached algae were collected, placed in labeled bags and put on ice. Field notes taken included all available substrates for attached algal colonization, composition of aquatic vegetation at the site and a

qualitative visual assessment of the relative abundance of attached algae. Digital photographs were taken to document each site (submitted on attached CD).

In the lab, substrate samples were scraped by hand for analysis of algal species composition and enumeration, attached algal chl-*a* and periphyton biomass. Surface area of scraped surface (cm^2) was recorded. Samples for algae identification and enumeration were preserved with Lugol's solution.

Samples for algae identification and enumeration were analyzed using Utermöhl settling chambers and an inverted microscope. Enumeration was performed on a Nikon Eclipse TE200 inverted microscope equipped with phase contrast optics. Before beginning enumeration the slide was scanned at low power to ensure that distribution of cells was relatively uniform. Only intact, viable cells were counted. Counts were made as natural units (cells, filaments, colonies). The goal was to count a total of 400-600 natural units per sample. A minimum of 10 and a maximum of 50 fields were counted at both 400X and 200X. An additional scan of the entire slide was made at 100X to count large and/or rare taxa. A maximum of 100 fields combined at 400 and 200X plus the 100X scan was performed on any sample.

For colonial and filamentous forms number of cells per colony or filament were recorded (20-30 filaments or colonies for each species if possible) and the mean used to calculate cells/natural unit. Cell biovolumes were calculated by measuring 10-15 cells (if possible; more if necessary depending on variability of species) for length, width and depth and applying the volumetric formula for the best fitted geometric shape or shapes (Hillebrand et al., 1999. J. Phycology, 35: 403-424).

Samples for periphyton biomass were filtered on to pre-combusted, pre-weighed 47 mm GF/C filters. Filters were dried to a constant weight at 105^oC, weighed, placed in a muffle furnace at 500^oC for one hour and re-weighed to determine periphyton ash-free dry weight.

Although it was not specified in the contract, Greenwater Labs took the initiative to use non-parametric statistics (Mann-Whitney Test or Kruskal-Wallis Test) to analyze for significant differences in biomass indicators (natural units, cells, biovolume and AFDW) and field water quality parameters between systems (WR vs. RSR) and within systems by site, by season (Winter vs. Summer), by spring sites vs. river/run sites and by substrate type. StatView was the statistical software that was used for these analyses.

Data Report

Quantitative Analysis of Attached Algal Communities

Tables 2-A and 2-B show the date and time each site was sampled, the latitude and longitude of sample collection and the type of substrate collected for algal enumeration, periphyton biomass determination and chlorophyll-a analysis for both winter (Table 2-A) and summer sampling (Table 2-B). Three types of substrate were collected/scraped for WR (rock wall, vegetation and woody debris) and two types for RSR (vegetation and woody debris). Vegetation samples were primarily submerged stems of the emergent *Nuphar advena* but *Alternanthera philoxeroides*

(alligator-weed), *Eichhornia crassipes* (water hyacinth) and *Vallisneria americana* (tape-grass) were also collected. Woody debris consisted of submerged branches and twigs of fallen trees.

Site Descriptions (also see digital photos)

Wekiva River Sites:

WR-01: Site located in Wekiwa Springs. Available substrates for attached algae included the sandstone wall of swimming area and rocks on the streambed. No aquatic vegetation was present at this site. Benthic patches of filamentous algae were present as well as algae attached to swimming area wall. At times area was highly susceptible to disturbance from human activity.

WR-02: Site was located just downstream from swimming area of Wekiwa Springs. Available substrates for attached algae included emergent (*Nuphar advena*) and floating (*Hydrocotyle* sp., dollarweed) vegetation as well as submerged portions of a wooden footbridge and the sandstone wall along the bank. Visible clumps of filamentous algae were entangled with aquatic vegetation.

WR-03: Site located along the shoreline mid-way down the "lake-like" section of the Wekiva River that was immediately downstream of the spring. Available substrates for algal colonization included woody debris, floating vegetation and the sandy bottom. Aquatic vegetation included *Hydrocotyle* sp., *Pistia stratiotes* (water-lettuce) and *Lemna* sp. (duckweed). Clumps of algae were associated with floating vegetation and also submerged twigs. A thick benthic mat of filamentous algae was also present.

WR-04: Site located at the end of "lake-like" section of the Wekiva River. Available algal substrates included woody debris, floating vegetation and the sandy bottom. Aquatic vegetation included *Hydrocotyle* sp. *Pistia stratiotes*, *Nuphar advena* (leaves below the waterline), *Vallisneria americana* (in summer) and *Sagittaria* sp. (arrowhead). A thick benthic mat of filamentous algae was present as well as visible accumulations of algae on submerged twigs and entangled with *Hydrocotyle* sp.

WR-05: Site was in an area of moderate canopy cover. In winter site included woody debris and a patch of *Hydrocotyle* sp. In summer *Pistia stratiotes* and *Nuphar advena* were also present. Visible attached algae were present in both the winter and summer.

WR-06: Site was in an area of low canopy cover and in winter included *Nuphar advena* and *Alternanthera philoxeroides* as well as *Hydrocotyle* sp. and *Pistia stratiotes*. In summer *Cicuta mexicana* (water-hemlock) was also present. Light to heavy attached algae coverage was observed associated with some of the aquatic vegetation.

WR-07: Site was in an area of low canopy cover and included extensive growths of *Hydrocotyle* sp. with *Nuphar advena* growing on the outside edges. Some *Typha* sp. (cat-tail) and *Pistia stratiotes* were present, as well as *Cicuta mexicana* in the summer. Only light accumulations of attached algae were observed.

WR-08: Site was in an area of moderate canopy cover and included woody debris and *Nuphar advena* in the winter as well as *Hydrocotlye* sp. in the summer. There was no visible algae in the winter but moderate to heavy accumulations were noted in the summer.

WR-09: Site was in an area of low canopy cover and had an extensive stand of *Nuphar advena*. In the summer *Hydrocotyle* sp., *Cicuta mexicana* and *Colocasia esculenta* (Wild Taro) were also present. Light to moderate coverage of attached algae, including filamentous green algae, was seen on *Nuphar* stems.

WR-10: Site was in an area of moderate canopy cover and in winter had *Nuphar advena* and *Hydrocotyle* sp. present. In summer these species had been replaced mostly with *Alternanthera philoxeroides* with some *Colocasia esculenta*. In winter light to moderate coverage of algae, including filamentous red algae, was seen on *Nuphar* stems. In summer no visible accumulations of algae were noted.

WR-11: Site had no canopy cover and was in a wide, shallow stretch of the river. In winter *Nuphar advena* and *Hydrocotyle* sp. were present as well as patches of *Chara* sp. In summer *Vallisneria americana* was present as well. In winter sparse coverage of attached algae on *Nuphar* stems was seen while in summer no visible accumulations of algae were observed.

WR-12: Site was in an area of low canopy cover and in winter available substrates included floating vegetation (*Eichhornia crassipes*), woody debris and shells. In summer *Vallisneria americana* was present. Light to moderate attached algae coverage was noticed on the *Eichhornia* in the winter while no visible algae was observed on the *Vallisneria* in the summer.

WR-13: Site had fairly high shoreline canopy cover and in winter contained mainly floating aquatic vegetation including *Alternanthera philoxeroides*, *Hydrocotyle* sp. and *Eichhornia crassipes*. In summer this floating vegetation was absent and woody debris was the available substrate for algal colonization. No visible algae accumulations were noted in either winter of summer.

WR-14: Site was in an area of high canopy cover and had *Nuphar advena* and woody debris as available substrates. Sparse attached algal coverage was observed on the *Nuphar* stems in the winter but not in the summer.

WR-15: Site was in an area of moderate canopy cover and had *Nuphar advena* and woody debris as available substrates. Light to moderate attached algal coverage was observed on the *Nuphar* stems in the winter but not in the summer.

Rock Springs Run Sites:

RSR-01: Site was located in Rock Springs, by the boil. In winter the only available substrate for algal colonization was rock and some filamentous green algae was associated with this substrate. In the summer *Vallisneria americana* was present in addition to the rock surface as potential algal substrates. In summer filamentous green algae and cyanobacteria were attached/entangled with the *Vallisneria* and attached to the rock surface.

RSR-02: Site was located in Rock Springs. Available substrates for algal attachment included rock, emergent vegetation, floating vegetation and submerged vegetation. Emergent vegetation included *Sagittaria* sp. and *Typha* sp. Floating vegetation included *Hydrocotyle* sp., *Pistia stratiotes* and *Lemna* sp. Submerged aquatic species included *Vallisneria americana* and *Ceratophyllum demersum* (coon-tail). Filamentous green algae and cyanobacteria were attached/entangled with aquatic vegetation as well as forming benthic mats.

RSR-03: Site was located at the end of the swimming area in Kelly Park. Available substrates included the sandstone wall of swimming area, the sandy bottom, emergent vegetation (*Nuphar advena*), floating vegetation (*Hydrocotyle* sp.) and submerged vegetation (*Vallisneria americana*). Filamentous algae was observed attached to *Vallisneria* and other macrophytes as well as forming patches on the sandy bottom.

RSR-04: Site was located between Kelly Park and Kelly Landing but was not accessible due to fallen trees and was not sampled in winter or summer.

RSR-05: Site was in an area of moderate canopy cover and available substrates included woody debris, floating vegetation (*Hydrocotyle* sp), emergent vegetation (*Nuphar advena*) and in winter also some short *Vallisneria americana* plants. Light coverage of attached algae was noted on *Nuphar* stems in both seasons.

RSR-06: Site was in an area of heavy canopy cover. Potential substrates for algal colonization included woody debris in both winter and summer, *Hydrocotyle* sp. in winter and *Eichhorinia crassipes* in summer. Light accumulations of attached algae were seen on woody debris in both winter and summer. A large mass of *Lemna* sp. was present in the summer in this stretch of the run, occasionally filling up the run from side to side and becoming so thick as to make passage by canoe difficult.

RSR-07: Site was in an area of heavy canopy cover. Woody debris was the principal substrate available for algal attachment, although in winter there was a small stand of *Nuphar advena*. Some *Lemna* sp. was present in the summer. Light accumulations of attached algae were seen on woody debris in both winter and summer.

RSR-08: Site was in an area of moderate to heavy canopy cover and available substrates included *Nuphar advena*, *Hydrocotyle* sp., *Eichhornia crassipes* and woody debris. Other vegetation in the area included *Sagittaria* sp. *Colocasia esculenta* and *Cicuta mexicana* (in summer). Light coverage of attached algae was observed on *Nuphar* stems in both winter and summer.

RSR-09: Site was in an area of heavy canopy cover and with the exception of a small amount of *Eichhornia crassipes* present in the winter, the only available substrate for algal attachment was woody debris. Light accumulation of attached algae was observed on woody debris in winter but was not seen in summer.

RSR-10: Site was in an area of heavy canopy cover and with the exception of a small amount of *Eichhornia crassipes* and *Hydrocotyle* sp. present in the winter, the only available substrate for algal attachment was woody debris. Light to moderate accumulations of attached algae was observed on woody debris both winter and summer.

Wekiva River Biomass Indicators

In WR winter samples, highest observed algal natural units per scraped area (units/cm^2) occurred at WR-03, WR-04, WR-05 and WR-12 with densities exceeding 100,000 units/cm^2 (Figure 2). WR-04 had a unit density of over 1 million units/cm^2. Eight of the 15 sites sampled had densities less than 10,000 units/cm^2. In summer samples, densities of algal natural units were greater than 100,000 units/cm^2 at WR-01, WR-02, WR-3, WR-04 and WR-07 and only at WR-14 were numbers less than 10,000 units/cm^2.

In WR winter samples, highest observed algal cells per scraped area (cells/cm^2) occurred at WR-03, WR-04 and WR-12 with densities exceeding 1,000,000 cells/cm^2 (Figure 3). WR-04 had a cell density of over 14 million cells/cm^2. Three sites (WR-01, WR-02 and WR-05) had cell numbers between 100,000 and 1,000,000 cells/cm^2 and 6 sites had cell densities less than 10,000 cells/cm^2. In summer samples, densities of algal cells were greater than 1 million cells/cm^2 at 6 sites: WR-01, WR-02, WR-03, WR-04, WR-07 and WR-11. Unlike in the winter, no locations had cell densities below 10,000 cells/cm^2.

In WR winter samples, highest observed algal biovolume per scraped area (um3/cm^2) occurred at WR-04 and WR-05 with values exceeding $1.0x10^{10}$ um^3/cm^2 (Figure 4). Five other sites had biovolumes between $1.0x10^8$ um^3/cm^2 and $1.0x10^9$ um^3/cm^2 and 6 locations had biovolumes less than $1.0x10^7$ um^3/cm^2. In summer samples no sites had biovolumes greater than $1.0x10^{10}$ um^3/cm^2 but three sites (WR-01, WR-02 and WR-04) had biovolumes between $1.0x10^9$ um^3/cm^2 and $1.0x10^{10}$ um^3/cm^2. At only two sites (WR-12 and WR-14) were summer biovolumes less than $1.0x10^7$ um^3/cm^2.

Periphyton ash-free dry weights (AFDW) for WR winter samples were highest at WR-04 (1.2502 mg/cm^2), followed by WR-03 (0.3448 mg/cm^2) (Figure 5). Winter AFDW values at the remaining 13 WR sites were all less than 0.2000 mg/cm^2. AFDW for WR summer samples were also highest at WR-04 (0.5752 mg/cm^2), followed by WR-02 (0.4075 mg/cm^2) and WR-01 (0.3681 mg/cm^2). Summer AFDW values at the remaining 12 WR sites were all less than 0.2000 mg/cm^2.

In WR summer samples, highest attached algal chlorophyll-*a* corrected (chl-*a*) levels occurred at WR-01 and WR-02 with values exceeding 4,500 mg/m^3 (Figure 6). WR-04 and WR-05 had the next highest chl-*a* levels, with values between 2,000 and 2,500 mg/m^3. The lowest recorded chl-*a* levels were observed at WR-12, WR-13 and WR-14, with values less than 500 mg/m^3. Laboratory error resulted in no winter chl-*a* levels being obtained.

Rock Springs Run Biomass Indicators

In RSR winter samples, highest observed algal natural units per scraped area (units/cm^2) occurred at RSR-10 with a density exceeding 1,000,000 units/cm^2 (Figure 7). RSR-06 and RSR-07 had unit densities between 100,000 and 500,000 units/cm^2. Two of the 9 sites sampled (RSR-

01 and RSR-03) had densities less than 10,000 units/cm^2. In summer samples, a density of algal natural units greater than 100,000 units/cm^2 only occurred at RSR-02. Seven of the eight remaining sites had unit densities between 10,000 and 100,000 units/cm^2 and only one location (RSR-08) had a density of less than 10,000 units/cm^2.

In RSR winter samples, highest observed algal cells per scraped area (cells/cm^2) occurred at RSR-10 with a density exceeding 1,000,000 cells/cm^2 (Figure 8). Four sites (RSR-02, RSR-06, RSR-07 and RSR-09) had cell numbers between 100,000 and 1,000,000 cells/cm^2 and only one site (RSR-01) had a cell density less than 10,000 cells/cm^2. In summer samples, no sites had densities of algal cells greater than 1 million cells/cm^2, but 6 locations (RSR-01, RSR-02, RSR-03, RSR-06, RSR-09 and RSR-10) had cell numbers between 100,000 and 1,000,000 cells/cm^2. Only one location (RSR-08) had a density of less than 10,000 cells/cm^2.

In RSR winter samples, highest observed algal biovolume per scraped area (um3/cm^2) occurred at RSR-10 with a value exceeding $1.0x10^9$ um^3/cm^2 (Figure 9). Four other sites (RSR-06, RSR-07, RSR-08 and RSR-09) had biovolumes between $1.0x10^8$ um^3/cm^2 and $1.0x10^9$ um^3/cm^2 and the remaining four locations had biovolumes between $1.0x10^7$ um^3/cm^2 and $1.0x10^8$ um^3/cm^2. In summer samples two sites (RSR-01 and RSR-03) had biovolumes greater than $1.0x10^9$ um^3/cm^2 and two sites (RSR-02 and RSR-10) had biovolumes between $1.0x10^8$ um^3/cm^2 and $1.0x10^9$ um^3/cm^2. Lowest biovolumes (between $1.0x10^6$ um^3/cm^2 and $1.0x10^7$ um^3/cm^2) were observed at RSR-07 and RSR-08.

Periphyton ash-free dry weights (AFDW) for RSR winter samples were highest at RSR-02 (0.3536 mg/cm^2), followed by RSR-01 (0.1396 mg/cm^2) and RSR-10 (0.1321 mg/cm^2) (Figure 10). Two other sites (RSR-07 and RSR-09) had AFDW values between 0.0500 and 0.1000 mg/cm^2 and the remaining four RSR sites all had AFDW less than 0.0500 mg/cm^2. AFDW for RSR summer samples were highest at RSR-01 (0.1105 mg/cm^2). Four sites (RSR-02, RSR-03, RSR-09 and RSR-10) had AFDW values between 0.0500 and 0.1000 mg/cm^2. Summer AFDW values at the remaining four RSR sites were all less than 0.0500 mg/cm^2.

In RSR summer samples, highest attached algal chlorophyll-*a* (corrected) levels occurred at RSR-01 and RSR-02 with values exceeding 4,500 mg/m^3 (Figure 11). RSR-03 had the next highest chl-*a* level (3,368 mg/m^3). RSR-05 and RSR-10 had chl-*a* levels between 1,000 and 2,000 mg/m^3 and the remaining four sites had chl-*a* values less than 500 mg/m^3. Laboratory error resulted in no winter chl-*a* levels being obtained.

<u>Biomass Indicator Statistical Analysis</u>

Table 3 shows the results of the non-parametric statistical analyses of the biomass data. No significant differences were found in unit density, cell density, biovolume or AFDW between Wekiva River and Rock Springs Run (values were means for all sites and both seasons for the two systems).

For WR, AFDW was the only biomass indicator that varied significantly ($p=0.0494$) by sample site (Table 3), with mean AFDW for both seasons at WR-04 being significantly higher than at other locations. Only cell density was significantly different between sampling seasons in WR ($p=0.0191$) with higher mean values in the summer than in the winter. When sites were grouped

into “spring” sites (WR-01 through WR-04; those in the spring and prior to the narrowing of the river) and “river” sites (WR-5-WR-15) significant differences between groups existed for all four biomass indicators (p values all <0.001), with higher values occurring in the “spring” sites. Significant differences in all four biomass indicators occurred between substrate types as well (p values all <0.02), with values from vegetation being significantly lower than those scraped from rock walls in the spring or from woody debris.

For RSR there were no significant differences in any of the biomass indicators between sample sites, seasons or substrates (vegetation and woody debris) (Table 3). Only AFDW between “spring” sites (those in Kelly Park) and “run” sites (those downstream of the park) varied significantly (P=0.0114), with higher values occurring at the “spring” sites.

Wekiva River Attached Algal Communities

Winter:
In winter, diatoms (Bacillariophyta) were the algal group accounting for the highest percent of total algal biovolume in 11 of 15 WR sites (Table 4). Diatoms made up over 90% of total winter biovolume at three sites (WR-04, WR-05 and WR-13). Dominant diatom taxa included the large centric diatom *Terpsinoe americana*, the unicellular pennate diatom *Cocconeis* spp. and several large chain-forming pennate diatoms including pennate diatom sp. 13 and *Eunotia* spp. (Table 5).

In two winter samples, WR-02 and WR-12, chlorophytes accounted for the highest percentage of total biovolume (48.0% and 95.7% respectively). In these samples filamentous green algae such as *Spirogyra* sp. 1, *Cladophora glomerata*, *Stigeoclonium* sp. 1 and *Oedogonium* sp. 1 were abundant. Chlorophytes were second in percent of total biovolume in four samples (WR-01, WR-07, WR-11 and WR-13).

In the remaining two winter WR samples (WR-06 and WR-15) red algae (Rhodophyta) accounted for the highest percentage of total biovolume (56.0% and 52,5% respectively). The filamentous taxa *Batrachospermum* sp. 1 was the principal red alga species found. Red algae were second in percent of total biovolume in six samples (WR-02, WR-05, WR-08, WR-09, WR-10 and WR-14).

Cyanobacteria (Cyanobacteria, cyanophytes, blue-green algae) were never the dominant contributor to total biovolume in the winter. The maximum contribution to total algal biovolume in WR winter samples by cyanobacteria was 10.3% at WR-03. Cyanobacteria were second in percent of total biovolume in two samples (WR-03 and WR-04: 7.0%). The filamentous cyanobacteria *Lyngbya wollei* was the dominant cyanophyte observed.

Summer:
In summer, diatoms were the algal group accounting for the highest percent of total algal biovolume in 13 of 15 WR sites (Table 4). Diatoms made up over 90% of total summer biovolume at three sites (WR-04, WR-10 and WR-13). Dominant diatom taxa included the large centric diatoms *Terpsinoe americana*, *Pleurosira laevis* and *Melosira* spp. (incl. *M. varians* and *M. undulata*) as well as various chain-forming (pennate diatom sp. 13, *Eunotia* spp. and pennate

diatom sp. 22) and unicellular pennate diatoms (incl. *Cocconeis* spp, *Navicula* spp. and pennate diatom sp. 1) (Table 5).

Chlorophytes were never the dominant contributor to total biovolume in the summer, but made up the second highest percentage at two sites (WR-01: 33.8% and WR-10: 1.6%). Filamentous green algae including *Mougeotia* sp. 3, *Spirogyra* sp. 2, *Stigeoclonium* sp. 1 and *Oedogonium* sp. 1 were the most important species in the summer for this group.

Red algae were the biovolume dominants at one location (WR-09: 62.9%) in the summer and were second most abundant at five sites (WR-05, WR-06, WR-08, WR-14 and WR-15). As in the winter, *Batrachospermum* sp. 1 was the most important species of red algae.

Cyanobacteria were the dominant biovolume contributors at WR-12 in the summer, accounting for 70.6% of the total. This was due to an abundance of small filamentous (*Heteroleibleinia* sp. 1), unicellular and colonial (cf. *Cyanocystis* sp. 1) cyanophytes in this sample. Cyanophytes made up the second highest percentage of total biovolume at six sites (WR-02, WR-03, WR-04, WR-07, WR-11 and WR-13). In WR-02 through WR-04 the dominant cyanophytes were *Lyngbya wollei* and *Phormidium* sp. 1, while at sites further downstream *Heteroleibleinia* sp. 1 became more important in terms of biomass. *Heteroleibleinia* sp. 1 accounted for 82.4% of cells/cm^2 in WR-01 in the summer, but due to its small cell size compared to other taxa present it only accounted for 4.6% of total biovolume.

<u>Rock Springs Run Attached Algal Communities</u>
Winter:
In winter, diatoms (Bacillariophyta) were the algal group accounting for the highest percent of total algal biovolume in 7 of 9 RSR sites (Table 6). In five of these locations (RSR-06, RSR-07, RSR-08, RSR-09 and RSR-10) diatoms accounted for over 96% of total biovolume. Dominant diatom taxa in RSR winter samples included *Terpsinoe americana*, *Pleurosira laevis*, *Cocconeis* spp., pennate diatom sp. 13, *Eunotia* spp. and Navicula spp. (Table 7).

Chlorophytes were never the dominant contributor to total biovolume in the winter, but made up the second highest percentage at two sites (RSR-02: 34.5% and RSR-09: 0.8%). Green algae were not found at three sites (RSR-06, RSR-08, RSR-10). The dominant green algae found in the winter in RSR included *Stigeoclonium* sp. 1, *Cladophora glomerata* and *Oedogonium* sp. 1.

Red algae were only found at two sampling locations in RSR in the winter (RSR-03 and RSR-05) and were not the dominant contributor to total biovolume at either. However, red algae did make up the second highest percentage (29.1%) of total biovolume at RSR-05. *Batrachospermum* sp. 1 was the principal red alga taxa present.

Cyanobacteria were the greatest biovolume contributors at RSR-03, accounting for 48.1% of the total, due principally to the presence of *Lyngbya wollei*. Downstream of RSR-03, cyanobacteria contributed little to total biovolume (maximum of 0.9% at RSR-05).

The filamentous yellow-green alga (Xanthophyta) *Vaucheria* sp. 1 made up 51.7% of winter total biovolume at RSR-01. This was the only sample in which *Vaucheria* appeared in this study

although some benthic mats sampled in both RSR and WR were mostly composed of this species.

At two sites (RSR-07 and RSR-10), small, unknown unicells or unknown colonies of small cells were the second highest contributor to total biovolume. The percent of total biovolume for these unknowns was 2.8% at RSR-07 and 0.8% at RSR-10.

Summer:
In summer, diatoms were the algal group accounting for the highest percent of total algal biovolume in 8 of 9 RSR sites (Table 6). Diatoms made up over 90% of total summer biovolume at five sites (RSR-01, RSR-02, RSR-06, RSR-09 and RSR-10). Dominant diatom taxa included *Terpsinoe americana*, *Pleurosira laevis*, *Melosira* spp. (incl. *M. varians* and *M. undulata*), pennate diatom sp. 13, *Eunotia* spp., *Synedra* spp. and *Navicula* spp. (Table 7).

Chlorophytes (primarily chlorophyte unicell sp. 5 and chlorophyte colony sp. 4) were the dominant summer biovolume contributors at RSR-07, accounting for 50.0% of the total. At two other sites (RSR-05: 12.4% and RSR-10: 3.1%) green algae, mainly *Oedogonium* sp. 3, were the second highest contributor to total biovolume.

Red algae were found at four sampling locations in RSR in the summer (RSR-01, RSR-02, RSR-03 and RSR-05) and were not the dominant contributor to total biovolume at any. However, red algae did make up the second highest percentage of total biovolume at RSR-02 (4.4%) and RSR-03 (5.8%). *Batrachospermum* sp. 1 was the principal red alga taxa present.

Cyanobacteria were never the dominant contributor to total biovolume in RSR in summer, but made up the second highest percentage at three sites (RSR-01: 1.3%, RSR-06: 0.9% and RSR-09: 2.1%). *Lyngbya wollei* was the dominant cyanophyte at the spring sites.

At two sites (RSR-07 and RSR-8), small, unknown unicells or unknown colonies of small cells were the second highest contributor to total biovolume. The percent of total biovolume for these unknowns was 42.0% at RSR-07 and 11.6% at RSR-10.

<u>Wekiva River Field Water Quality</u>
Water temperatures in WR ranged from 14.18 ^{o}C at WR-14 to 23.69 ^{o}C at WR-02 in the winter and from 23.86 ^{o}C at WR-02 to 26.60 ^{o}C at WR-12 in summer (Table 8). Winter pH values varied from 7.25 at WR-08 to 7.91 at WR-12 and summer values from 7.07 at WR-10 to 7.51 at WR-04. Dissolved oxygen (D.O) levels in winter ranged from 0.79 mg/L at WR-01 to 9.29 mg/L at WR-12 and in summer from 1.33 mg/L at WR-02 to 4.91 at WR-12. Conductivity in winter and summer was lowest at WR-05 (0.306 mS/cm and 0.317 mS/cm respectively) and highest at WR-12 (1.139 mS/cm and 0.834 mS/cm respectively). Lowest water depth in winter was recorded at WR-11 (0.19 m) and highest at WR-04 (1.37 m). Lowest water depth in summer was also observed at WR-11 (0.56 m) and highest at WR-10 (1.75). Winter and summer flow was lowest at WR-03 (0.00 m/s and 0.01 m/s respectively) and highest at WR-10 (0.29 m/s and 0.45 m/ respectively).

Rock Springs Run Field Water Quality

Water temperatures in RSR ranged from 18.43 ^{o}C at RSR-07 to 23.79 ^{o}C at RSR-03 in the winter and from 23.71 ^{o}C at RSR-01 to 25.23 ^{o}C at RSR-10 in summer (Table 8-A). Winter pH values in RSR varied from 7.07 at RSR-08 to 7.87 at RSR-03 and summer values from 6.69 at RSR-08 to 7.88 at RSR-03. Dissolved oxygen levels in winter in RSR ranged from 1.94 mg/L at RSR-01 to 7.14 mg/L at RSR-10 and in summer from 0.58 mg/L at RSR-07 to 3.47 at RSR-05. Conductivity in RSR ranged from 0.257 mS/cm at RSR-01 and RSR-02 to 0.267 mS/cm at RSR-10 in the winter and from 0.219 mS/cm at RSR-09 to 0.283 mS/cm at RSR-06 in summer. Lowest water depth in winter (Table 8-B) was recorded at RSR-10 (0.30 m) and highest at RSR-01 (0.88 m). Lowest water depth in summer was also observed at RSR-10 (0.40 m) and highest at RSR-06 (1.40). Winter flow values in RSR varied from 0.06 m/s at RSR-03 to 0.38 m/s at RSR-10 and summer values from 0.07 at RSR-06 to 0.33 at RSR-09.

Field Water Quality Statistical Analysis

Table 9 shows the results of the non-parametric statistical analyses of the field water quality data. No significant differences were found in temperature, pH, dissolved oxygen concentration, site depth and water flow between WR and RSR (values were means for all sites and both seasons for the two systems). WR was found to have significantly higher mean conductivity ($p<0.0001$) and salinity ($p<0.0001$) than RSR. Sites in RSR had significantly higher ($p=0.0014$) mean canopy cover than did sites in WR.

In WR conductivity ($p=0.0150$), salinity (0.0200) and canopy cover ($p=0.0475$) varied significantly by sample site (Table 9). Conductivity and salinity were higher from sites WR-12 through WR-15. Temperature ($p<0.0001$), pH ($p<0.0001$) and D.O. (0.0066) significantly varied between winter and summer. Lower mean water temperature, higher mean pH and higher mean D.O occurred in the winter compared to the summer. When sites were grouped into “spring” sites (WR-01 through WR-04) and “River” sites (WR-5-WR-15) significant differences between groups existed for D.O ($p<0.0001$; lower in “spring” sites) and flow ($p=0.0329$; higher in “River” sites). Significant differences in mean D.O. ($p=0.0207$) and mean flow ($p=0.0074$) occurred at sites with different substrate types. The only rock sample was from WR-01 where oxygen levels were low. Vegetation was sampled at areas of higher flows compared to samples of rock wall and woody debris.

For RSR there were no significant differences in any of the water quality parameters between sites (Table 9). Temperature ($p=0.0009$), D.O. ($p=0.0054$) and salinity (0.0081) significantly varied between winter and summer. Lower mean temperature, higher mean D.O. and higher mean salinity occurred in the winter compared to the summer. Mean pH ($p=0.0007$) and mean canopy cover ($p=0.0218$) between “spring” sites (those in Kelly Park) and “Run” sites (those downstream of the park) varied significantly, with higher pH values at the “spring” sites and higher canopy cover at the “Run” sites. Significant differences in mean pH ($p=0.0164$) and canopy cover ($p=0.0029$) occurred at sites with different substrate types. Sites where vegetation samples were collected had higher mean pH values and locations where woody debris was sampled had higher mean canopy cover.

Conclusions

Highest biomass of attached algae was found at sites in and around the springs for both Wekiva River and Rock Springs Run. Diatoms were the dominant algal group both in terms of biomass and diversity at the majority of sites. Filamentous cyanobacteria (particularly *Lyngbya wollei* and *Phormidium*) were most abundant in terms of biomass at the spring sites although the thin cyanophyte filament *Heteroleibleinia* was important at some downstream sites.

Cyanobacteria overall comprised a greater percentage of total biovolume in summer compared to winter. Chlorophytes (particularly *Spirogyra*, *Mougeotia* and *Cladophora glomerata*) were most abundant in terms of biomass at the spring sites although accumulations of filamentous green algae (*Cladophora glomerata* and *Oedogonium*) were observed in the wide, shallow section of the Wekiva River upstream of the SR46 bridge. The filamentous red alga *Batrachospermum* was found in both the WR and RSR, but was more abundant and at a higher percentage of sites in the WR. The filamentous xanthophyte *Vaucheria* was more abundant in WR and RSR than indicated by this study. The sampling methodology excluded benthic mats, of which some extensive ones composed of *Vaucheria* were present at times in both systems.

AFDW was the best measure for assessing attached/entangled filamentous algal biomass (even though it includes non-algal organic matter) because clumps of filamentous algae were difficult to analyze using traditional counting techniques. The result is that microscopic examination did an excellent job assessing biovolume of attached diatoms, small filamentous algae and diatoms and other small algae associated with filamentous algae but underestimated the biovolume of larger accumulations of filamentous algae. Therefore the reported values in this study for units/cm^2, cells/cm^2 and um^3/cm^2 from spring samples are underestimates and the importance of diatoms at the spring sites may be overstated.

Blackwater Creek
WR-15
WR-14
WR-13
WR-12
46
WR-11
WR-10
WR-09
WR-08
WR-07
WR-06
WR-05
WR-04
WR-03
WR-02
WR-01
Wekiwa Springs
RSR-01 Rock Springs
RSR-02
RSR-03
RSR-04
RSR-05
RSR-06
RSR-07
RSR-08
RSR-09
RSR-10
Rock Springs Run
Wekiva River
Little Wekiva River
ROCK SPRINGS ROAD
WEKIWA SPRING ROAD
Figure 1A.
Algal Survey on Wekiva River
and Rock Springs Run
Green Water Labs, Inc.
N
W
E
S
0.5 0.25 0 0.5 Miles
1:56000
Legend
Springs
Marsh, Wetland, Swamp
Waterbodies
Sampling Stations for Task 2
Rock Springs Run
Wekiva River Run
The St. Johns River Water Management District prepares and uses this information for its own purposes and this information may not be suitable for other purposes. This information is provided as is. Further documentation of this data can be obtained by contacting: St. Johns River Water Management District, Geographic Information Systems, Program Management, P.O. Box 1429, 4049 Reid Street Palatka, Florida 32178-1429. Tel: (386) 329-4176.

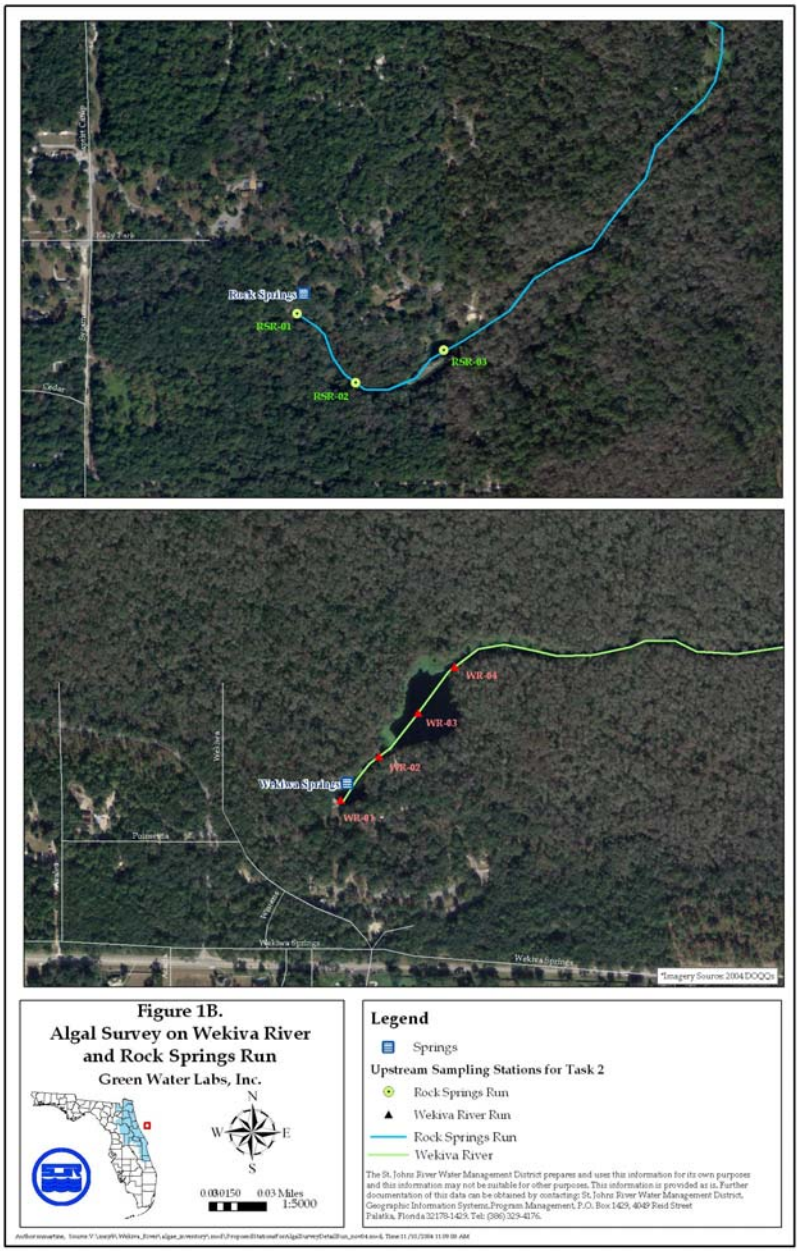

Figure 1B.
Algal Survey on Wekiva River and Rock Springs Run
Green Water Labs, Inc.

Figure 2: Wekiva River Total Natural Units/cm^2

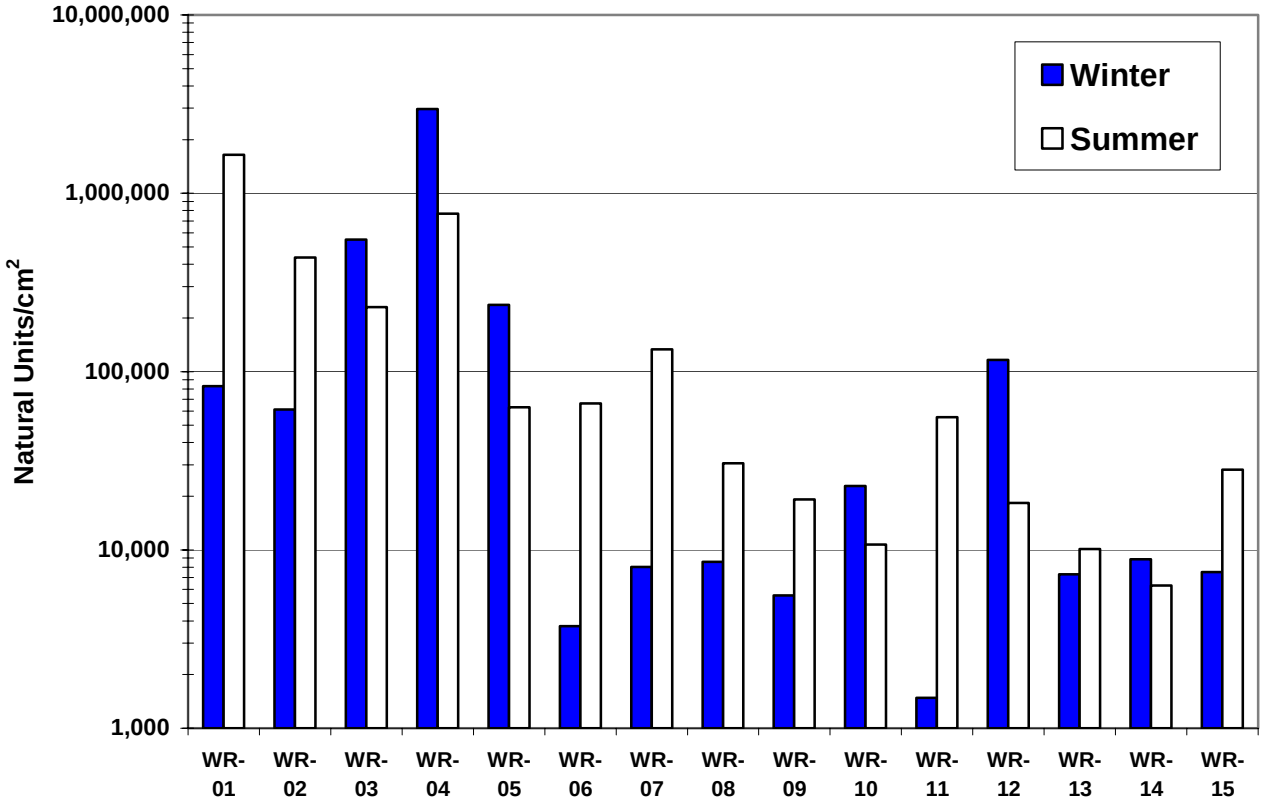

Figure 3: Wekiva River Total Cells/cm^2

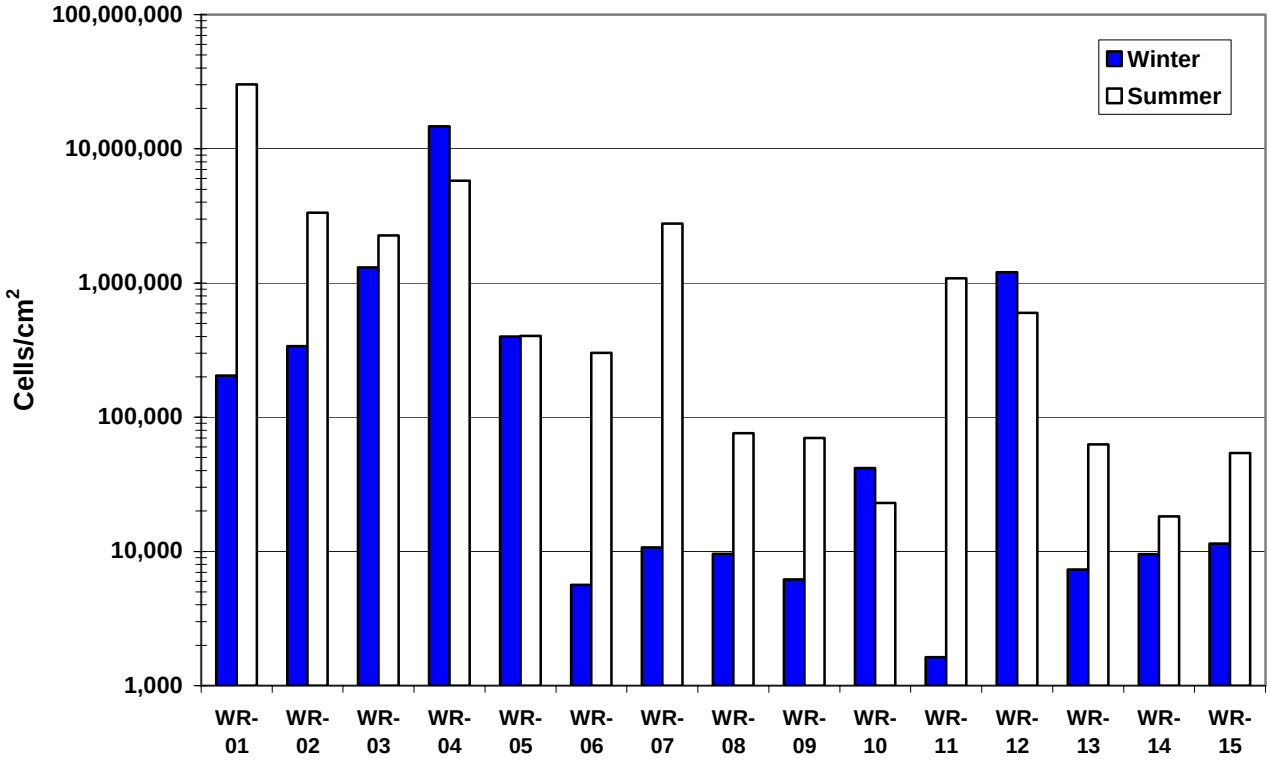

Figure 4: Wekiva River Total Biovolume (um^3/cm^2)

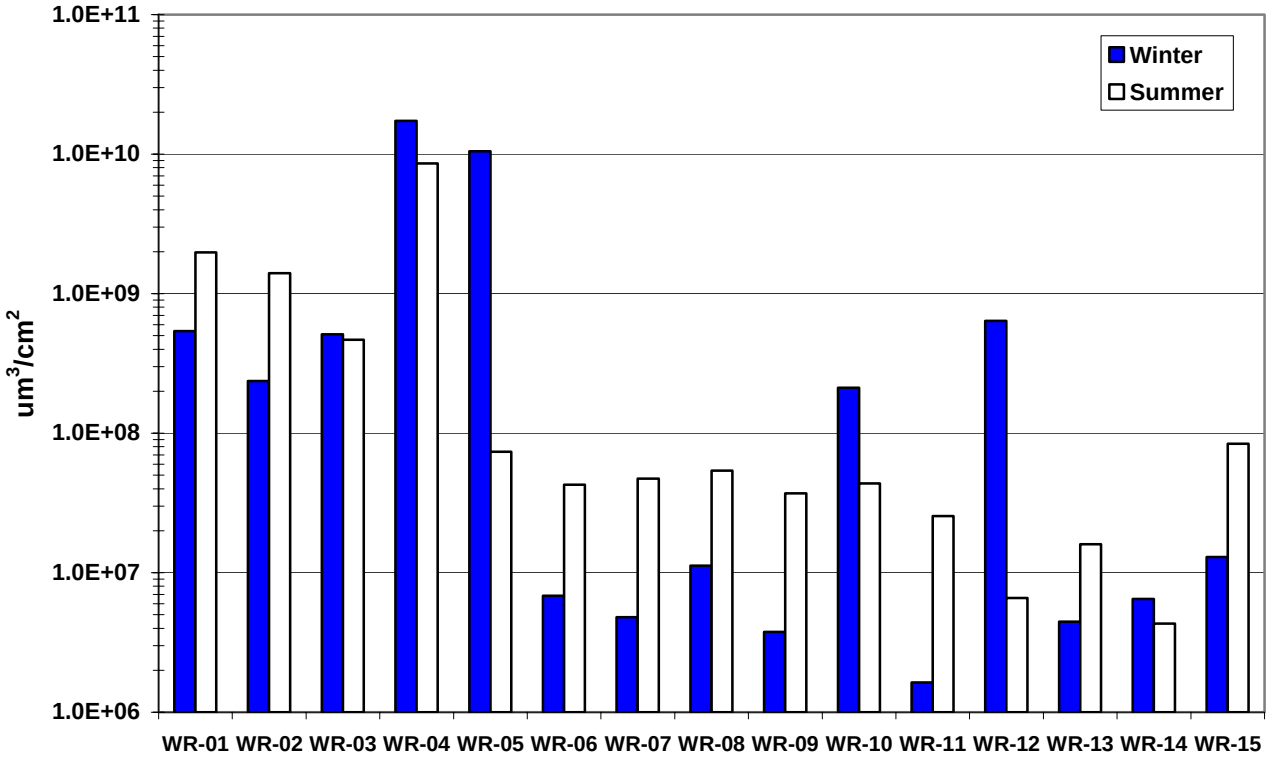

Figure 5: Wekiva River Ash-Free Dry Weight

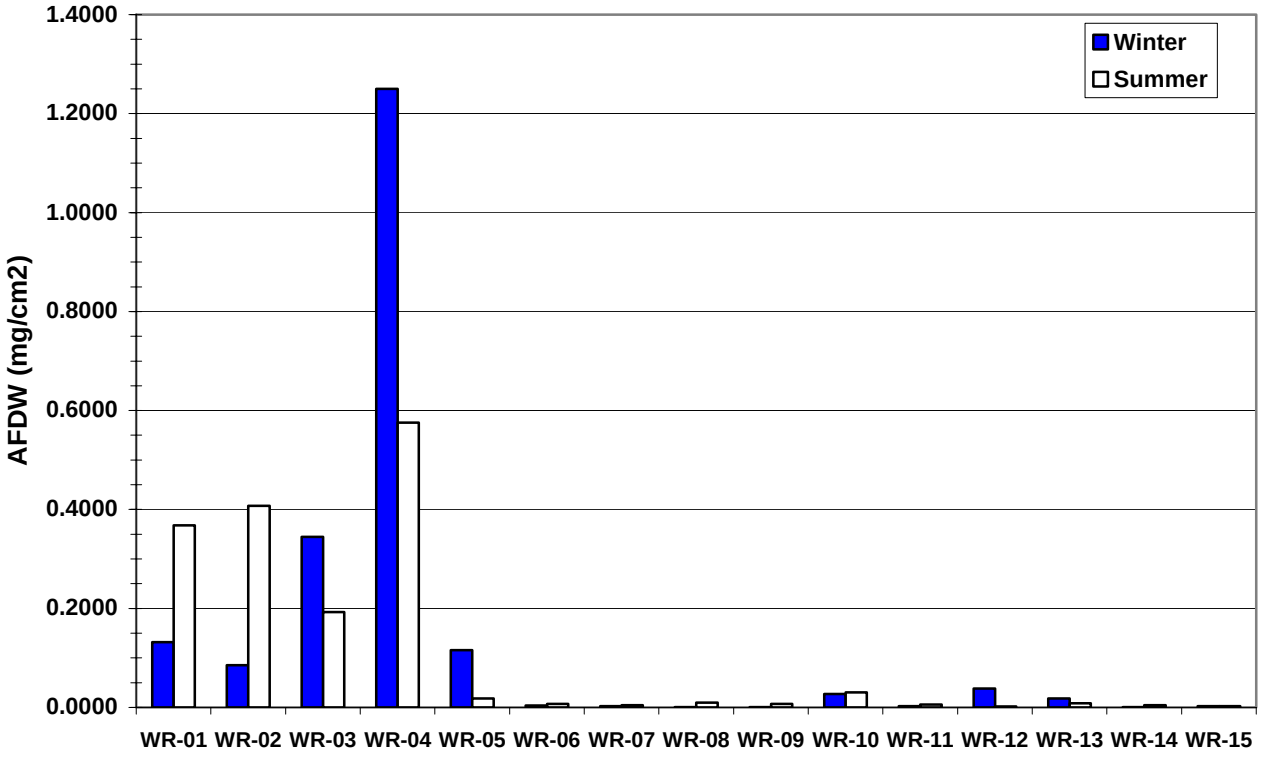

Figure 6: Wekiva River Summer 2005 Chl-a Corrected

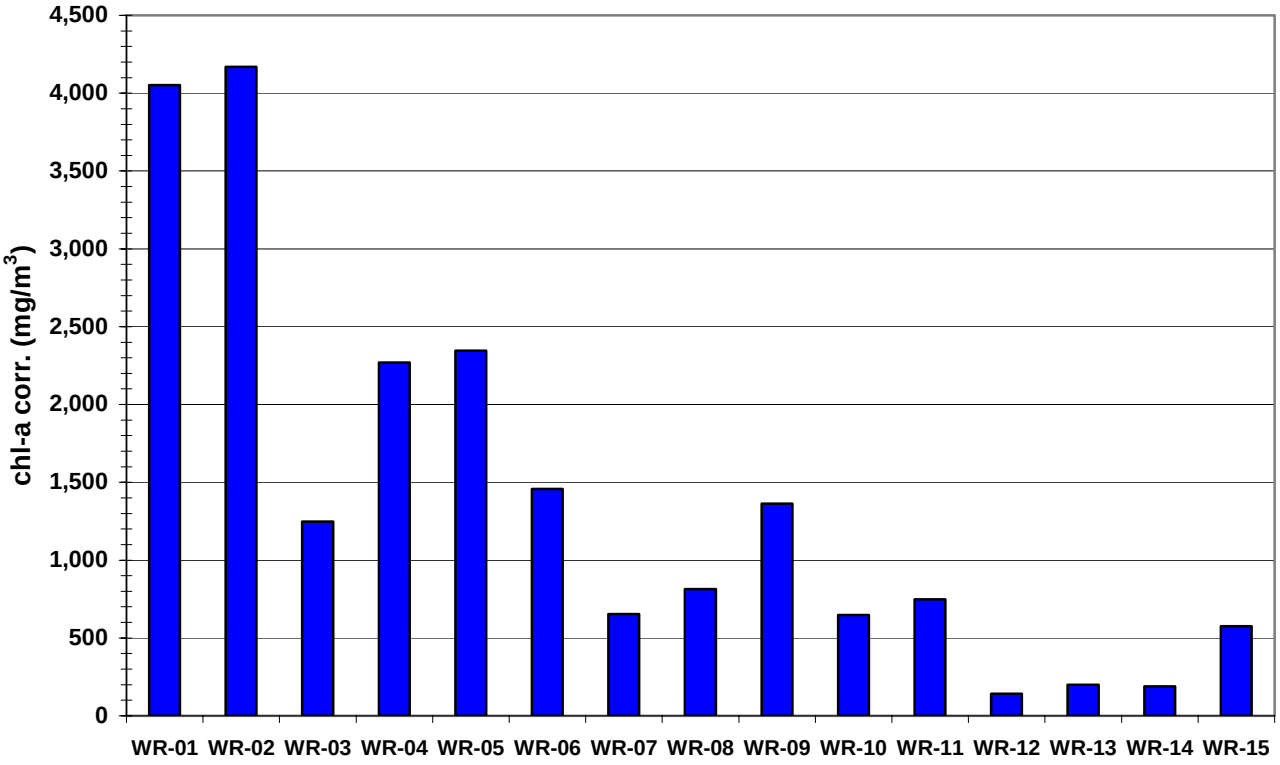

Figure 7: Rock Springs Run Total Natural Units/cm^2

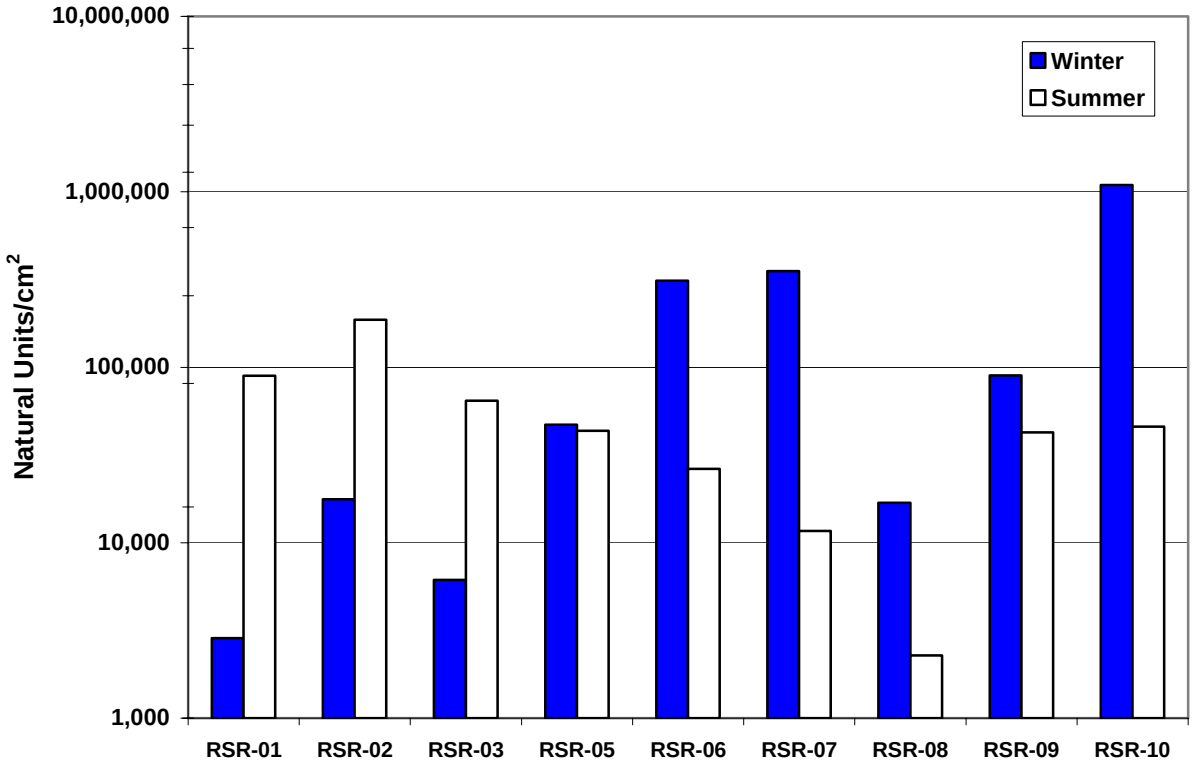

Figure 8: Rock Springs Run Total Cells/cm^2

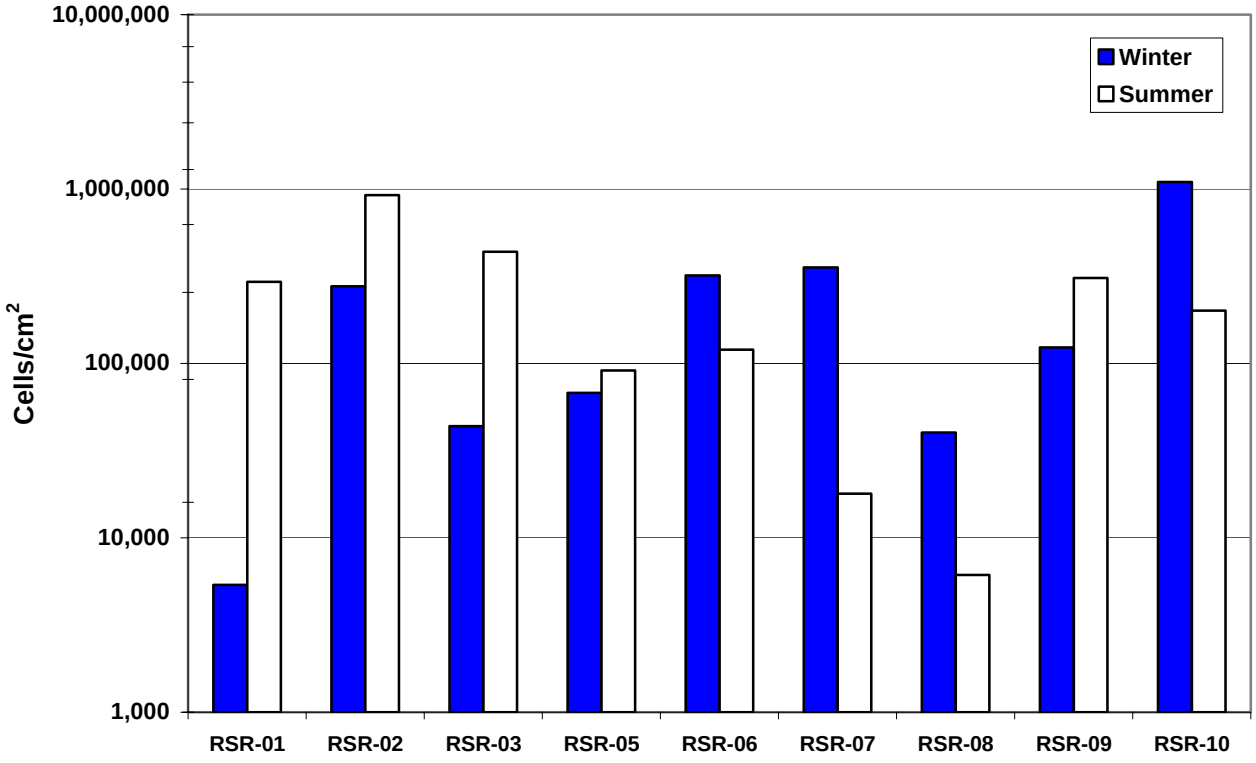

Figure 9: Rock Springs Run Total Biovolume (um^3/cm^2)

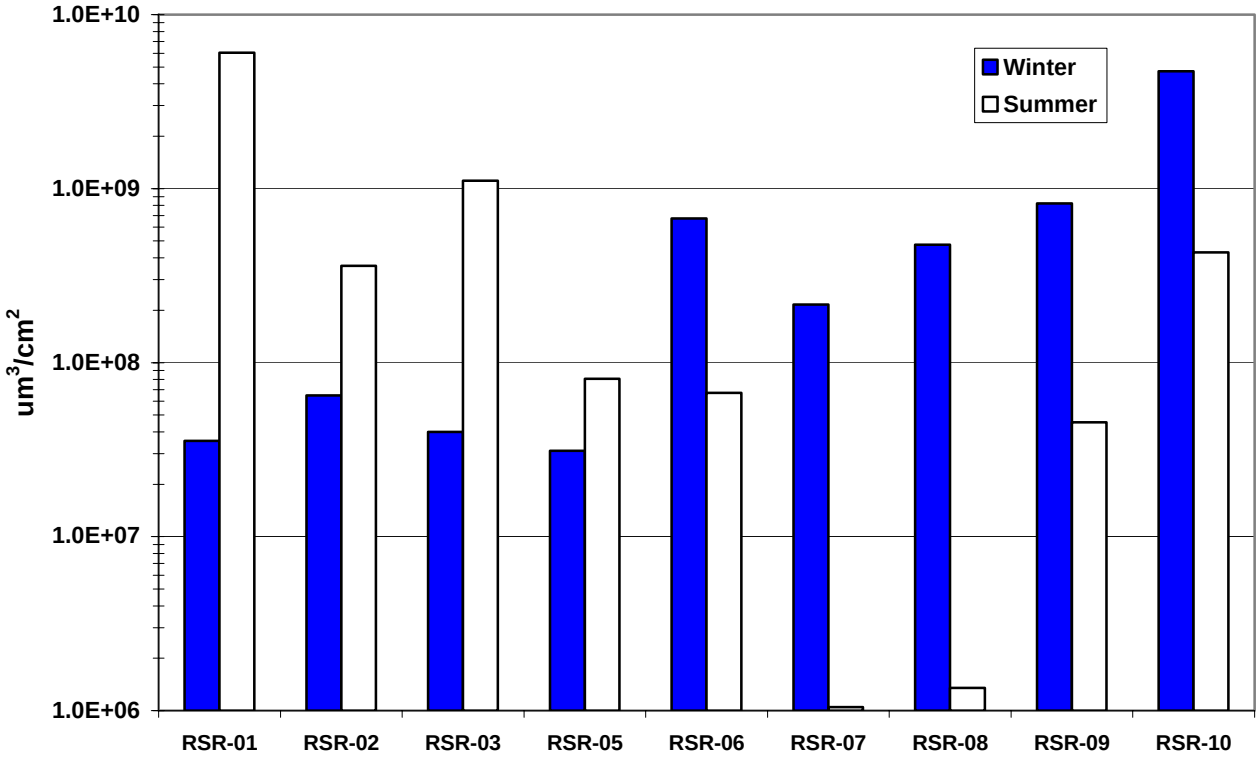

Figure 10: Rock Springs Run Ash-Free Dry Weight

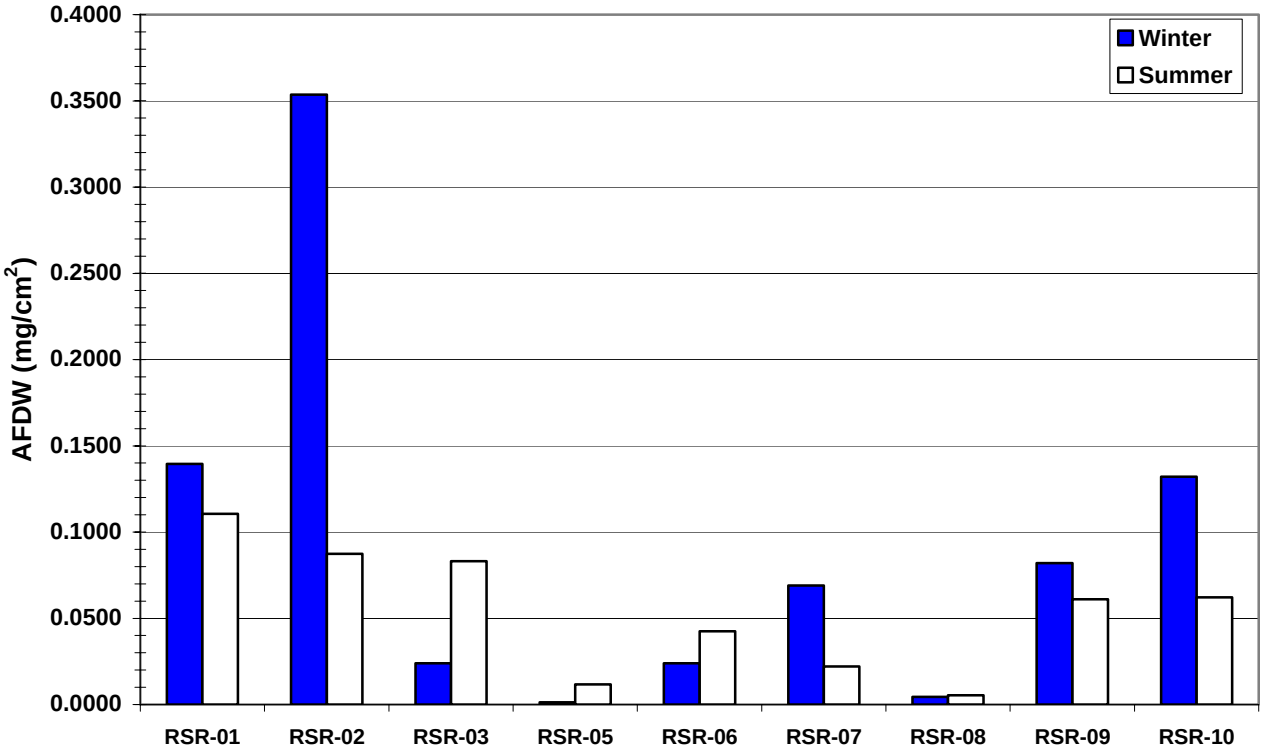

Figure 11: Rock Springs Run Summer 2005 Chl-a (Corrected)

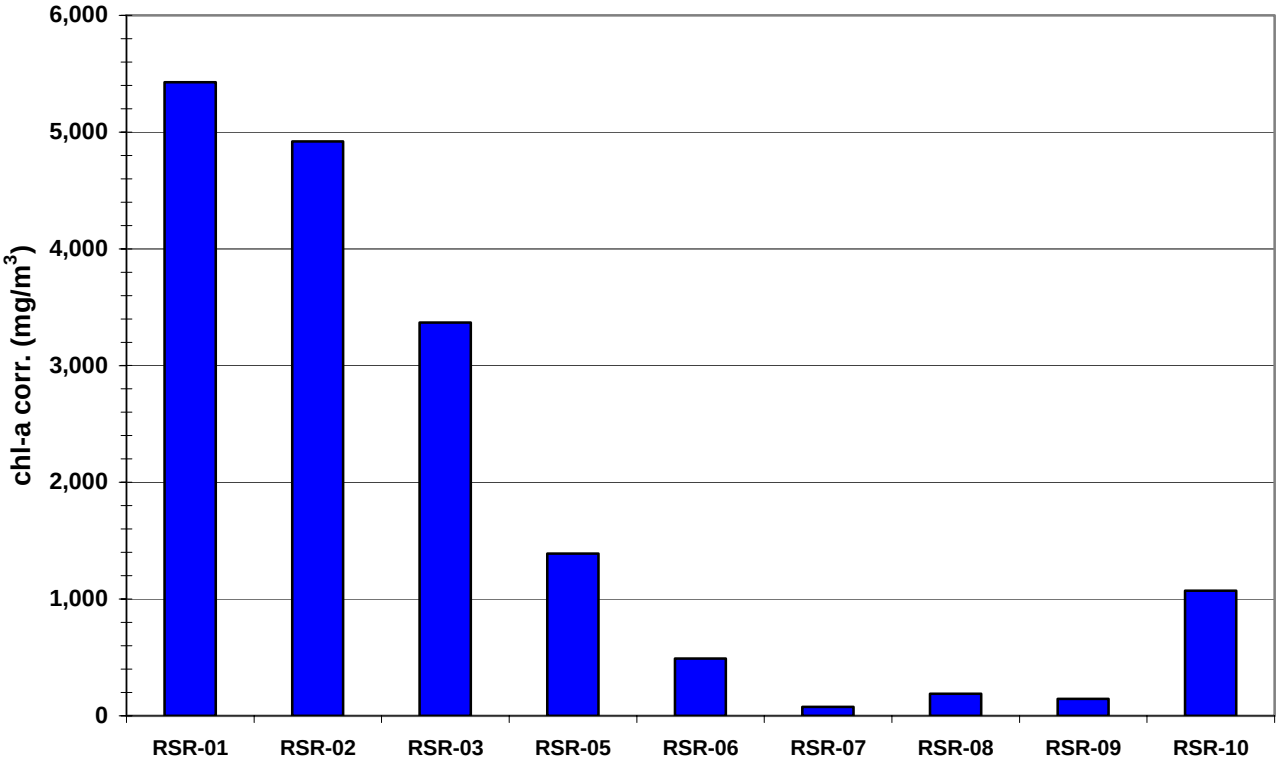

Table 2-A: Winter sampling dates and times, GPS coordinates and collected substrates

SITE	DATE	TIME	LAT.	LONG.	COLLECTED SUBSTRATE
WR-01	041229	1005	28°42.717	81°27.629	Rock wall scrapings
WR-02	041229	1048	28°42.756	81°27.588	*Nuphar*
WR-03	041214	1555	28°42.807	81°27.565	Woody debris
WR-04	041214	1515	28°42.841	81°27.519	Woody debris
WR-05	041214	1405	28°42.875	81°26.586	Woody debris
WR-06	041214	1230	28°43.648	81°25.820	*Nuphar*
WR-07	041214	1105	28°44.561	81°25.197	*Nuphar*
WR-08	041228	1200	28°45.543	81°24.956	*Nuphar*
WR-09	041228	1245	28°46.593	81°24.894	*Nuphar*
WR-10	041228	1340	28°47.572	81°24.814	*Nuphar*
WR-11	041228	1425	28°48.570	81°25.068	*Nuphar*
WR-12	041215	1525	28°49.578	81°24.910	*Eichhornia*
WR-13	041215	1400	28°50.245	81°24.150	*Alternanthera*
WR-14	041215	1220	28°50.884	81°23.460	*Nuphar*
WR-15	041215	1143	28°51.462	81°22.794	*Nuphar*
RSR-01	041229	1210	28°45.374	81°30.093	*Vallisneria*
RSR-02	041229	1244	28°45.318	81°29.999	*Vallisneria*
RSR-03	041229	1339	28°45.348	81°29.954	*Vallisneria*
RSR-05	050105	1000	28°46.657	81°29.785	*Nuphar*
RSR-06	050105	1100	28°46.208	81°28.863	Woody debris
RSR-07	050105	1150	28°45.348	81°28.491	Woody debris
RSR-08	050105	1245	28°44.533	81°28.210	*Nuphar*
RSR-09	050105	1340	28°44.157	81°27.400	Woody debris
RSR-10	050105	1435	28°43.137	81°27.057	Woody debris

Table 2-B: Summer sampling dates and times, GPS coordinates and collected substrates

SITE	DATE	TIME	LAT.	LONG.	COLLECTED SUBSTRATE
WR-01	050609	1206	28°42.716	81°27.628	Rock wall scrapings
WR-02	050609	1120	28°42.759	81°27.592	*Nuphar*
WR-03	050609	1030	28°42.809	81°27.563	Woody debris
WR-04	050609	1055	28°42.841	81°27.518	Woody debris
WR-05	050623	1140	28°42.880	81°26.595	*Nuphar*
WR-06	050623	1220	28°43.646	81°25.823	*Nuphar*
WR-07	050623	1250	28°44.565	81°25.200	*Nuphar*
WR-08	050623	1455	28°45.552	81°24.953	*Nuphar*
WR-09	050623	1530	28°46.596	81°24.897	*Nuphar*
WR-10	050621	1545	28°47.566	81°24.806	*Alternanthera*
WR-11	050621	1450	28°48.552	81°25.078	*Nuphar*
WR-12	050621	1406	28°49.600	81°24.912	*Vallisneria*
WR-13	050621	1300	28°50.247	81°24.152	Woody debris
WR-14	050621	1210	28°50.884	81°23.454	*Nuphar*
WR-15	050621	1110	28°51.463	81°22.793	*Nuphar*
RSR-01	050609	1322	28°45.376	81°30.090	*Vallisneria*
RSR-02	050609	1402	28°45.318	81°29.998	*Vallisneria*
RSR-03	050609	1435	28°45.347	81°29.952	*Vallisneria*
RSR-05	050628	1110	28°46.663	81°29.769	*Nuphar*
RSR-06	050628	1200	28°46.195	81°28.869	Woody debris
RSR-07	050628	1245	28°45.336	81°28.492	Woody debris
RSR-08	050628	1425	28°44.540	81°28.226	*Nuphar*
RSR-09	050628	1530	28°44.158	81°27.390	Woody debris
RSR-10	050628	1615	28°43.132	81°27.041	Woody debris

Table 3: Results (p-values) of statistical analysis relating biomass indicators between Wekiva River and Rock Springs Run and within each system by site, season, spring vs. river/run and substrate type. *=significantly different, p≤0.05

Wekiva River vs RSR	
Biomass Indicator	**By System**
	(Mann-Whitney)
Units/cm^2	0.8647
Cells/cm^2	0.7015
um^3/cm^2	0.3169
AFDW (mg/cm^2)	0.1599

Wekiva River				
Biomass Indicator	**By Site**	**By Season**	**By Spring vs. River**	**By Substrate**
	(Kruskal Wallis)	(Mann-Whitney)	(Mann-Whitney)	(Kruskal Wallis)
Units/cm^2	0.1342	0.1524	0.0002*	0.0045*
Cells/cm^2	0.1848	0.0191*	0.0006*	0.0191*
um^3/cm^2	0.0821	0.5203	0.0003*	0.0044*
AFDW (mg/cm^2)	0.0494*	0.5337	<0.0001*	0.0020*

Rock Springs Run				
Biomass Indicator	**By Site**	**By Season**	**By Spring vs. Run**	**By Substrate**
	(Kruskal Wallis)	(Mann-Whitney)	(Mann-Whitney)	(Mann-Whitney)
Units/cm^2	0.6982	0.5660	0.5741	0.1097
Cells/cm^2	0.4865	0.8253	0.6396	0.2135
um^3/cm^2	0.8103	0.8253	0.7079	0.5340
AFDW (mg/cm^2)	0.0731	0.6911	0.0114*	0.9292

Table 4: Wekiva River percent of total biovolume by major algal group.

Site	% Total BV By Group	% Total BV By Group	Site	% Total BV By Group	% Total BV By Group
	Winter	**Summer**		**Winter**	**Summer**
WR-01	BACIL 85.7 CHLOR 12.2 CYANO 1.9 RHODO 0.0	BACIL 38.4 CHLOR 33.8 CYANO 27.7 RHODO 0.0	WR-09	BACIL 73.0 RHODO 23.6 CYANO 0.2 CHLOR 0.02	RHODO 62.9 BACIL 33.5 CHLOR 2.0 CYANO 1.3
WR-02	CHLOR 48.0 RHODO 26.9 BACIL 13.6 CYANO 1.4	BACIL 46.4 CYANO 40.0 CHLOR 13.5 RHODO 0.0	WR-10	BACIL 62.7 RHODO 36.9 CHLOR 0.1 CYANO 0.01	BACIL 97.4 CHLOR 1.6 CYANO 0.3 RHODO 0.0
WR-03	BACIL 77.1 CYANO 10.3 RHODO 8.9 CHLOR 0.4	BACIL 64.3 CYANO 18.1 RHODO 11.0 CHLOR 6.3	WR-11	BACIL 61.8 CHLOR 35.6 CYANO 2.4 RHODO 0.0	BACIL 62.8 CYANO 31.5 CHLOR 4.6 RHODO 0.8
WR-04	BACIL 90.7 CYANO 7.0 RHODO 2.2 CHLOR 0.2	BACIL 92.9 CYANO 3.4 RHODO 1.9 CHLOR 6.3	WR-12	CHLOR 95.7 BACIL 2.4 CYANO 1.6 RHODO 0.0	CYANO 70.6 BACIL 25.9 CHLOR 1.9 RHODO 0.0
WR-05	BACIL 94.4 RHODO 5.3 CHLOR 0.2 CYANO 0.0	BACIL 44.9 RHODO 44.2 CHLOR 6.3 CYANO 4.5	WR-13	BACIL 93.1 CHLOR 4.6 CYANO 0.03 RHODO 0.0	BACIL 90.0 CYANO 9.4 CHLOR 0.4 RHODO 0.0
WR-06	RHODO 56.0 BACIL 35.8 CHLOR 5.7 CYANO 0.13	BACIL 79.3 RHODO 13.5 CYANO 4.2 CHLOR 2.9	WR-14	BACIL 82.8 RHODO 7.3 CHLOR 5.1 CYANO 0.0	BACIL 86.6 RHODO 7.2 CYANO 1.8 CHLOR 1.4
WR-07	BACIL 64.4 CHLOR 31.3 CYANO 0.0 RHODO 0.0	BACIL 43.7 CYANO 41.6 CHLOR 12.3 RHODO 2.2	WR-15	RHODO 52.5 BACIL 42.1 CHLOR 4.8 CYANO 0.18	BACIL 61.3 RHODO 37.0 CHLOR 1.3 RHODO 0.2
WR-08	BACIL 61.8 RHODO 35.5 CHLOR 0.0 CYANO 0.0	BACIL 79.0 RHODO 19.2 CHLOR 1.2 CYANO 0.5			

Table 5-A: Wekiva River dominant algal taxa (in terms of biovolume). B=Bacillariophyta, CH=Chlorophyta, CY=Cyanophyta, R=Rhodophyta, U=Unknown, X=Xanthophyta

	WINTER	SUMMER
WR-01	Terpsinoe americana (B) pennate diatom sp. 13 (B) Eunotia sp. 4 (B) Cladophora glomerata (CH) Mougeotia sp. (CH)	Mougeotia sp. 3 (CH) Lyngbya wollei (CY) pennate diatom sp. 38 (B) Heteroleibleinia sp. 1 (CY) Synedra sp. 3 (B)
WR-02	Spirogyra sp. 1 (CH) Batrchospermum sp. 1 (R) Lyngbya wollei (CY) pennate diatom sp. 13 (B) Closterium sp. 1 (CH)	Lyngbya wollei (CY) Terpsinoe americana (B) pennate diatom sp. 22 (B) Spirogyra sp. 2 (CH) Phormidium sp. 1 (CY)
WR-03	pennate diatom sp. 22 (B) Batrachospermum sp. 1 (R) Lyngbya wollei (CY) pennate diatom sp. 13 (B) diatom sp. 3 (B)	Terpsinoe americana (B) Phormidium sp. 1 (CY) Lyngbya wollei (CY) Oedogonium sp. 3 (CH) pennate diatom sp. 22 (B)
WR-04	pennate diatom sp. 12 (B) pennate diatom sp. 22 (B) Terpsinoe americana (B) Lyngbya wollei (CY) Pinnularia sp. 1 (B)	Terpsinoe americana (B) Melosira varians (B) pennate diatom sp. 22 (B) Melosira undulata (B) Spirogyra sp. 2 (CH)
WR-05	Terpsinoe americana (B) Batrachospermum sp. 1 (R) Eunotia sp. 4 (B) pennate diatom sp. 13 (B) pennate diatom sp. 9 (B)	Batrachospermum sp. 1 (R) Terpsinoe americana (B) pennate diatom sp. 13 (B) Stigeoclonium sp. 1 (CH) Eunotia sp. 3 (B)
WR-06	Batrachospermum sp. 1 (R) Cocconeis sp. 1 (B) Eunotia sp. 3 (B) Terpsinoe americana (B) Stigeoclonium sp. 1 (CH)	Gomphonema sp. 9 (B) Terpsinoe americana (B) Batrachospermum sp. 1 (R) pennate diatom sp. 1 (B) Eunotia sp. 3 (B)
WR-07	Stigeoclonium sp. 1 (CH) Cocconeis sp. 1 (B) pennate diatom sp. 11 (B) pennate diatom sp. 12 (B) pennate diatom sp. 3 (B)	Heteroleibleinia sp. 1 (CY) pennate diatom sp. 1 (B) Stigeoclonium sp. 1 (CH) Eunotia sp. 4 (B) pennate diatom sp. 3 (B)
WR-08	Batrachospermum sp. 1 (R) Cocconeis sp. 1 (B) Cocconeis sp. 2 (B) Terpsinoe americana (B) Eunotia sp. 3 (B)	Batrachospermum sp. 1 (R) centric diatom sp. 3 (B) Terpsinoe americana (B) centric diatom sp. 6 (B) Navicula sp. 1 (B)

Table 5-B: Wekiva River dominant algal taxa (in terms of biovolume).

	WINTER	SUMMER
WR-09	Cocconeis sp. 1 (B) Batrachospermum sp. 1 (R) pennate diatom sp. 13 (B) pennate diatom sp. 1 (B) centric diatom sp. 1 (B)	Batrachospermum sp. 1 (R) Navicula sp. 4 (B) centric diatom sp. 6 (B) Navicula sp. 2 (B) Gomphonema sp. 1 (B)
WR-10	Terpsinoe americana (B) Batrachospermum sp. 1 (R) Pleurosira laevis (B) Cocconeis sp. 1 (B) pennate diatom sp. 13 (B)	Terpsinoe americana (B) Pleurosira laevis (B) Eunotia sp. 4 (B) Navicula sp. 1 (B) centric diatom sp. 3 (B)
WR-11	Cocconeis sp. 1 (B) Cladophora glomerata (CH) Cocconeis sp. 2 (B) Eunotia sp. 3 (B) unicell, sphere 5-7.5 um (U)	Cocconeis sp. 1 (B) Heteroleibleinia sp. 1 (CY) pennate diatom sp. 3 (B) Stigeoclonium sp. 1 (CH) pennate diatom sp. 1 (B)
WR-12	Cladophora glomerata (CH) Stigeoclonium sp. 1 (CH) Oedogonium sp. 1 (CH) cf. Xenococcus sp. 1 (CY) Cocconeis sp. 1 (B)	Heteroleibleinia sp. 1 (CY) Cocconeis sp. 1 (B) cyanophyte unicell, oval 5-7.5um (CY) cf. Cyanocystis sp. (CY) pennate diatom sp. 1
WR-13	Cocconeis sp. 1 (B) Navicula sp. 5 (B) Cocconeis sp. 2 (B) pennate diatom sp. 3 (B) Navicula sp. 1 (B)	Terpsinoe americana (B) Pleurosira laevis (B) Oscillatoria/Phormidium sp. 3 (CY) Navicula sp. 1 (B) Cocconeis sp. 1 (B)
WR-14	Cocconeis sp. 1 (B) Cocconeis sp. 2 (B) Batrachospermum sp. 1 (R) Stigeoclonium sp. 1 (CH) Terpsinoe americana (B)	Navicula sp. 1 (B) Diatoma sp. 4 (B) Navicula sp. 4 (B) Cocconeis sp. 2 (B) Batrachospermum sp. 1 (R)
WR-15	Batrachospermum sp. 1 (R) Cocconeis sp. 1 (B) Terpsinoe americana (B) Stigeoclonium sp. 1 (CH) Cocconeis sp. 2 (B)	Terpsinoe americana (B) Batrachospermum sp. 1 (R) Navicula sp. 1 (B) Navicula sp. 2 (B) Cocconeis sp. 1 (B)

Table 6: Rock Springs Run percent of total biovolume by major algal group.

Site	% Total BV By Group	% Total BV By Group	Site	% Total BV By Group	% Total BV By Group
	Winter	**Summer**		**Winter**	**Summer**
RSR-01	XANTH 51.7 BACIL 42.9 CYANO 5.2 CHLOR 0.03 RHODO 0.0	BACIL 98.4 CYANO 1.3 CHLOR 0.1 RHODO 0.1	RSR-09	BACIL 99.2 CHLOR 0.8 CYANO 0.01 RHODO 0.0	BACIL 94.0 CYANO 2.1 CHLOR 1.4 RHODO 0.0
RSR-02	BACIL 56.0 CHLOR 34.5 CYANO 9.3 RHODO 0.0	BACIL 92.7 RHODO 4.4 CHLOR 1.6 RHODO 0.1	RSR-10	BACIL 99.2 UNK 0.8 CHLOR 0.0 CYANO 0.0 RHODO 0.0	BACIL 96.3 CHLOR 3.1 CYANO 0.3 RHODO 0.0
RSR-03	CYANO 48.1 BACIL 40.4 CHLOR 10.9 RHODO 0.4	BACIL 87.2 RHODO 5.8 CYANO 4.1 CHLOR 2.9			
RSR-05	BACIL 69.7 RHODO 29.1 CYANO 0.9 CHLOR 0.03	BACIL 86.8 CHLOR 12.3 CYANO 0.4 RHODO 0.2			
RSR-06	BACIL 99.1 CYANO 0.01 CHLOR 0.0 RHODO 0.0	BACIL 98.3 CYANO 0.9 CHLOR 0.3 RHODO 0.0			
RSR-07	BACIL 96.9 UNK 2.8 CHLOR 0.30 CYANO 0.001 RHODO 0.0	CHLOR 50.0 UNK 42.0 BACIL 7.0 CYANO 1.0 RHODO 0.0			
RSR-08	BACIL 99.9 CYANO 0.01 CHLOR 0.0 RHODO 0.0	BACIL 81.6 UNK 11.6 CHLOR 6.2 CYANO 0.6 RHODO 0.0			

Table 7-A: Rock Springs Run dominant algal taxa (in terms of biovolume). B=Bacillariophyta, CH=Chlorophyta, CY=Cyanophyta, R=Rhodophyta, U=Unknown, X=Xanthophyta

	WINTER	SUMMER
RSR-01	Vaucheria sp. (X) Pleurosira laevis (B) Terpsinoe americana (B) Lyngbya wollei (CY) Cocconeis sp. 1 (B)	Terpsinoe americana (B) Melosira undulata (B) Pleurosira laevis (B) Lyngbya wollei (CY) pennate diatom sp. 13
RSR-02	Terpsinoe americana (B) Stigeoclonium sp. 1 (CH) Cladophora glomerata (CH) Oedogonium sp. 1 (CH) cf. Xenococcus sp. 1 (CY)	pennate diatom sp. 13 (B) Terpsinoe americana (B) Synedra sp. 3 (B) Pleurosira laevis (B) pennate diatom sp. 22 (B)
RSR-03	Lyngbya wollei (CY) Terpsinoe americana (B) Cocconeis sp. 2 (B) Oedogonium sp. 1 (CH) Cocconeis sp. 1 (B)	Terpsinoe americana (B) Batrachospermum sp. (R) Lyngbya wollei (CY) pennate diatom sp. 13 (B) Oedogonium sp. 3 (CH)
RSR-05	Eunotia sp. 4 (B) Batrachospermum sp. 1 (R) Eunotia sp. 3 (B) Achnanthidium sp. 6 (B) pennate diatom sp. 13 (B)	Terpsinoe americana (B) Eunotia sp. 3 (B) Oedogonium sp. 3 (CH) Eunotia sp. 4 (B) Cocconeis sp. 1 (B)
RSR-06	Terpinoe americana (B) Eunotia sp. 3 (B) Eunotia sp. 4 (B) pennate diatom sp. 13 (B) pennate diatom sp. 1 (B)	Terpsinoe americana (B) Eunotia sp. 3 (B) Synedra sp. 4 (B) Pleurosira laevis (B) Navicula sp. 4 (B)

Table 7-B: Rock Springs Run dominant algal taxa (in terms of biovolume). B=Bacillariophyta, CH=Chlorophyta, CY=Cyanophyta, R=Rhodophyta, U=Unknown, X=Xanthophyta

	WINTER	SUMMER
RSR-07	Eunotia sp. 3 (B) Eunotia sp. 4 (B) Navicula sp. 7 (B) Terpsinoe americana (B) pennate diatom sp. 5 (B)	chlorophyte unicell sp. 5 (CH) unknown unicell sp. 5 (U) unicell, sphere 5-7.5um (U) chlorophyte colony sp. 4 (CH) unicell, oval 5-7.5um (U)
RSR-08	Eunotia sp. 4 (B) Eunotia sp. 3 (B) pennate diatom sp. 13 (B) pennate diatom sp. 32 (B) Navicula sp. 1 (B)	Eunotia sp. 4 (B) Eunotia sp. 3 (B) Navicula sp. 4 (B) unicell, oval 5-7.5um (U) Navicula sp. 1 (B)
RSR-09	Eunotia sp. 4 (B) Terpsinoe americana (B) Eunotia sp. 3 (B) pennate diatom sp. 13 (B) pennate diatom sp. 3 (B)	Terpsinoe americana (B) pennate diatom sp. 22 (B) Navicula sp. 4 (B) Synedra sp. 4 (B) Melosria varians (B)
RSR-10	Terpsinoe americana (B) Pleurosira laevis (B) pennate diatom sp. 13 (B) Eunotia sp. 4 (B) Nitzschia sp. 4 (B)	Terpsinoe americana (B) Pleurosira laevis (B) Oedogonium sp. 3 (CH) Eunotia sp. 4 (B) Navicula sp. 4

Table 8-A: Field water quality data. W=winter data collected Dec. 2004-Jan. 2005 S=summer data collected June 2005

SITE	TEMP.	TEMP.	pH	pH	D.O.	D.O.	COND.	COND.	SALIN.	SALIN.
	(oC)	(oC)			(mg/L)	(mg/L)	(mS/cm)	(mS/cm)	(ppt)	(ppt)
	W	S	W	S	W	S	W	S	W	S
WR-01	23.68	24.07	7.36	7.32	0.79	1.59	0.343	0.340	0.17	0.16
WR-02	23.69	23.86	7.36	7.29	1.57	1.33	0.342	0.340	0.16	0.16
WR-03	23.20	24.13	7.54	7.41	2.90	2.20	0.342	0.333	0.16	0.16
WR-04	23.38	24.23	7.51	7.51	2.67	2.05	0.342	0.338	0.16	0.16
WR-05	19.66	24.46	7.54	7.27	6.08	2.73	0.306	0.317	0.15	0.15
WR-06	18.93	24.94	7.53	7.24	6.45	3.76	0.307	0.320	0.15	0.15
WR-07	17.97	25.44	7.52	7.16	6.11	2.79	0.311	0.331	0.15	0.16
WR-08	14.36	25.62	7.25	7.23	6.25	2.55	0.349	0.355	0.17	0.17
WR-09	14.45	25.42	7.30	7.18	7.41	3.04	0.354	0.356	0.17	0.17
WR-10	14.57	26.14	7.35	7.07	7.89	3.87	0.356	0.356	0.17	0.17
WR-11	15.08	26.41	7.46	7.14	9.25	4.68	0.382	0.464	0.18	0.22
WR-12	16.89	26.60	7.91	7.25	9.29	4.91	1.139	0.834	0.57	0.41
WR-13	15.01	26.14	7.76	7.13	8.98	4.01	0.992	0.672	0.49	0.33
WR-14	14.18	25.69	7.66	7.15	7.81	4.14	1.002	0.673	0.50	0.33
WR-15	13.96	25.53	7.67	7.24	8.33	4.63	1.000	0.668	0.50	0.32
RSR-01	23.69	23.71	7.76	7.69	1.94	1.03	0.257	0.260	0.12	0.12
RSR-02	23.72	23.75	7.80	7.69	2.63	2.01	0.257	0.259	0.12	0.11
RSR-03	23.79	23.94	7.87	7.88	3.78	3.22	0.258	0.259	0.12	0.11
RSR-05	21.36	24.26	7.61	7.23	5.60	3.47	0.260	0.228	0.12	0.11
RSR-06	19.55	24.80	7.17	6.81	3.92	1.23	0.262	0.283	0.12	0.13
RSR-07	18.43	25.08	7.15	6.70	3.50	0.58	0.262	0.232	0.12	0.11
RSR-08	18.98	25.04	7.07	6.69	5.19	1.75	0.266	0.227	0.13	0.11
RSR-09	18.80	25.13	7.14	6.79	5.81	2.94	0.265	0.219	0.13	0.10
RSR-10	19.24	25.23	7.31	6.87	7.14	3.46	0.267	0.223	0.13	0.10

Table 8-B: Field water quality data. W = winter data collected Dec. 2004-Jan. 2005 S = summer data collected June 2005

SITE	DEPTH	DEPTH	FLOW	FLOW	COVER	COVER
	(m)	(m)	(m/s)	(m/s)	(n,e,s,w)	(n,e,s,w)
	W	S	W	S	W	S
WR-01	1.27	0.73	0.09	0.06	0,5,0,0	0,12,0,0
WR-02	0.74	0.81	0.26	0.11	14,12,2,8	6,21,8,19
WR-03	1.10	0.91	0.00	0.01	2,2,5,13	2,0,3,5
WR-04	1.37	1.22	0.07	0.07	5,7,2,0	4,8,13,10
WR-05	0.90	1.14	0.03	0.15	13,16,9,2	5,17,9,4
WR-06	0.65	0.84	0.09	0.21	0,0,0,0	0,1,2,0
WR-07	0.88	1.07	0.06	0.11	0,0,0,0	0,0,0,0
WR-08	0.54	1.24	0.20	0.15	13,2,8,19	12,3,15,7
WR-09	0.57	0.93	0.18	0.18	0,0,3,0	0,0,0,2
WR-10	0.73	1.75	0.29	0.45	0,3,4,0	3,17,19,18
WR-11	0.19	0.56	0.05	0.26	0,0,0,0	0,0,0,0
WR-12	0.33	0.69	0.06	0.19	0,0.5,1,0	0,2,2,0
WR-13	0.73	1.13	0.08	0.14	3,4,4,1	2,19,22,6
WR-14	1.25	1.68	0.12	0.12	5,6,11,10	24,14,16,24
WR-15	0.94	0.90	0.19	0.10	0,0.5,0,2	2,11,0,12
RSR-01	0.88	0.79	0.24	0.26	21,9,16,7	19,24,22,9
RSR-02	0.84	0.66	0.19	0.18	1.5,0,0,0	0,2,0,0
RSR-03	0.76	0.79	0.06	0.19	0,0,3,3	0,0,7,19
RSR-05	0.68	0.96	0.13	0.14	7,3,0,7	17,3,8,18
RSR-06	0.59	1.40	0.09	0.07	20,20,23,23	24,24,24,24
RSR-07	0.82	1.10	0.08	0.18	21,20,23,23	24,24,24,24
RSR-08	0.53	1.21	0.28	0.28	3,0,0,9	16,20,22,24
RSR-09	0.48	0.81	0.30	0.33	5,13,13,12	18,21,24,24
RSR-10	0.30	0.40	0.38	0.13	13,16,13,11	24,22,24,21

Table 9: Results (p-values) of statistical analysis relating field water quality parameters between Wekiva River and Rock Springs Run and within each system by site, season, spring vs. river/run and substrate type. *=significantly different, p≤0.05

Wekiva River vs RSR	
WQ Parameter	**By System**
	(Mann-Whitney)
Temp	0.9575
pH	0.3884
D.O.	0.0771
Conductivity	<0.0001*
Salinity	<0.0001*
Depth	0.1200
Flow	0.0686
Cover	0.0014*

Wekiva River				
WQ Parameter	**By Site**	**By Season**	**By Spring vs. River**	**By Substrate**
	(Kruskal Wallis)	(Mann-Whitney)	(Mann-Whitney)	(Kruskal Wallis)
Temp	>0.9999	<0.0001*	>0.9999	0.9259
pH	0.9393	<0.0001*	0.2139	0.5018
D.O.	0.1509	0.0066*	<0.0001*	0.0207*
Conductivity	0.0150*	0.7244	0.0607	0.2284
Salinity	0.0200*	0.7400	0.0575	0.3077
Depth	0.2432	0.1354	0.2410	0.1623
Flow	0.2447	0.1647	0.0329*	0.0074*
Cover	0.0475*	0.2058	0.2410	0.3093

Rock Springs Run				
WQ Parameter	**By Site**	**By Season**	**By Spring vs. Run**	**By Substrate**
	(Kruskal Wallis)	(Mann-Whitney)	(Mann-Whitney)	(Mann-Whitney)
Temp	0.9992	0.0009*	>0.9999	0.9292
pH	0.0737	0.1711	0.0007*	0.0164*
D.O.	0.5160	0.0054*	0.1601	0.5340
Conductivity	0.9117	0.0521	0.6065	0.4239
Salinity	0.9742	0.0081*	0.7787	0.7558
Depth	0.5095	0.1023	0.7787	0.4772
Flow	0.1576	0.9296	0.8883	0.8590
Cover	0.1048	0.0934	0.0218*	0.0029*

APPENDIX I

Attached Algal Assessment for the Wekiva River and Rock Springs Run

TASK 1 FINAL REPORT
Document the Distribution of Attached Algae
November 2004

Prepared For:
St. Johns River Water Management District
P.O. Box 1429
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Prepared By:
GreenWater Laboratories
205 Zeagler Dr., Suite 302
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I. Introduction

The St. Johns River Water Management District has been legislatively mandated to define pollutant load reduction goals for the Wekiva River and Rock Springs Run.
Extensive algal growth is often indicative of the presence of pollutants in a water body. Additionally, some types of algae can produce toxins that can be detrimental ecologically and adversely affect human health. This survey will determine the composition, distribution, biomass and habitat of periphyton and metaphyton, in the Wekiva River and Rock Springs Run.

The project will be carried out and authored by Andrew Chapman and Peter D'Aiuto, Green Water Laboratories, 205 Zeagler Drive, Suite 302, Palatka, FL 32177.

II. Survey Methods

Wekiwa Springs was surveyed by foot on the morning of November 4, 2004. A survey of Wekiva River from Wekiwa Springs to Katie's Landing was followed by kayak on that same day. Wekiva River from Wekiva Park downstream to the confluence of Blackwater Creek was surveyed by canoe on November 6, 2004. Kelly Park (Rock Springs) was surveyed by foot on November 7, 2004 and Rock Springs Run from King's Landing downstream to the Wekiva River was surveyed by canoe on November 8, 2004.

All areas were accessible by foot, kayak or canoe with the exception of the stretch downstream from the end of the swimming area at Kelly Park to King's Landing. The stretch was not passable with a canoe or kayak due to downed trees and extensive vegetation. However, we were able to view a small section of this stretch from the banks of "Camp Joy" (just down the road from Kelly Park), where coordinates and observations were recorded.

GPS points were captured using a WAAS-enabled Magellan MAP 330 hand-held Global Positioning System. Points were captured for locations with significant algal coverage (approx. $1m^2$ or greater), locations of potentially important substrates for periphytic algae colonization (i.e. *Vallisneria* beds or stands of emergent/floating vegetation) or to mark stretches with no visible attached/benthic algae. Digital photographs were taken to document areas with visible attached algae, substrates utilized by filamentous algae and diversity of algal taxa. See photos on attached CD.

Small samples of filamentous algae were collected from 12 locations and observed using a Nikon Eclipse TE 200 inverted microscope.

III. Survey Results

The most abundant and diverse algal assemblages were observed just downstream from the boils of both Rock Springs and Wekiva Springs. Generally, algal biomass diminished with distance from the boils. One exception was in the area north of HWY 46 on the Wekiva River. The river becomes shallow and supports beds of *Vallisneria* that serve as anchors for filamentous algae. The only toxin-producing alga observed was *Lyngbya wollei*, which was relatively abundant just downstream from the boils of both springs.

IV. Sampling Site Locations and Descriptions

WR			RSR		
Point #	**Latitude**	**Longitude**	**Point #**	**Latitude**	**Longitude**
1	28°42.753	81°27.589	1	28°45.384	81°30.102
2	28°42.761	81°27.601	2	28°45.382	81°30.099
3	28°42.759	81°27.594	3	28°45.380	81°30.077
4	28°42.764	81°27.579	4	28°45.326	81°29.993
5	28°42.772	81°27.575	5	28°45.333	81°29.984
6	28°42.780	81°27.553	6	28°45.341	81°29.964
7	28°42.803	81°27.532	7	28°45.347	81°29.975
8	28°42.837	81°27.522	8	28°45.452	81°29.821
9	28°42.844	81°27.512	9	28°45.434	81°29.860
10	28°42.845	81°27.507	10	28°46.041	81°30.113
11	28°42.856	81°27.366	11	GPS Error	GPS Error
12	28°43.363	81°26.062	12	28°46.304	81°30.182
13	28°43.828	81°25.695	13	28°46.680	81°29.718
14	28°44.818	81°25.153	14	28°46.671	81°29.650
15	28°45.376	81°24.989	15	28°46.667	81°29.012
16	28°46.574	81°24.901	16	28°45.379	81°28.490
17	28°47.169	81°24.879	17	GPS Error	GPS Error
18	28°47.983	81°24.914	18	28°42.235	81°26.660
19	28°48.276	81°25.020			
20	28°48.802	81°25.144			
21	28°49.690	81°24.656			
22	28°50.534	81°23.753			
23	28°50.918	81°23.405			
24	GPS Error	GPS Error			

GPS Point # Site Description

Wekiva River

1,2,3. Wekiwa Springs Park. Just downstream from spring head, near footbridge. Filamentous algal mat entangled with *Nuphar*. Some smaller benthic mats. (11/04/04)

4. Beginning of benthic algal mat after launch. (11/04/04)

5. Center of benthic algal mat after launch. (11/04/04)

6. End of benthic algal mat after launch. (11/04/04)

7. Small cove with benthic mat. (11/04/04)

8. Surface mat entangled with *Pistia* and *Hydrocotyle*. (11/04/04)

9. Surface mat entangled with *Pistia* and *Hydrocotyle*. (11/04/04)

10. Beginning of stretch of thick benthic algae cover. (11/04/04)

11. End of stretch of thick benthic algae cover. (11/04/04)

12. No benthic mats observed. Some attached algae and midge cases on woody debris and *Nuphar* stems. (11/04/04)

13. No submerged aquatic vegetation (SAV), no benthic algae but some attached algae on emergents and woody debris. (11/04/04)

14. No benthic algae. Decreased areas of *Nuphar* and *Hydrocotyle*. Some attached algae on emergents and woody debris. (11/04/04)

15. Confluence of Little Wekiva River. Lots of fallen trees upstream and in front of confluence. *Nupar*, *Hydrocotyle* and emergent grass with small amounts of associated filamentous algae. (11/04/04)

16. First *Vallisneria* since near Rock Springs Run, but distribution is patchy and overall health appears to be poor. (11/04/04)

17. Shallow sand bar with good *Vallisneria*. Moderate coverage of epiphytic algae on blades including colonies of the filamentous red alga *Batrachospermum*. (11/04/04)

18. Exposed *Vallisneria* on shallow sand bars; plants dead or dying. Some attached algae on nearby submerged *Vallisneria*. Beginning of larger beds of healthy *Vallisneria*. (11/04/04)

19. Thick *Vallisneria* beds. Some long filaments of attached filamentous green algae. Some accumulations of detached *Vallisneria* associated with *Nuphar*. (11/04/04)

20. Just upstream of HWY 46 bridge. Sparse *Vallisneria*. Much more extensive *Vallisneria* coverage prior to hurricanes. (11/04/04)

21. State canoe launch south of HWY 46. No visible algae. (11/06/04)

22. Private boat rental. No visible algae; water dark and turbid. (11/06/04)

23. Some dead *Vallisneria* along edges; no visible algae. (11/06/04)

24. Near confluence of Blackwater Creek. No visible algae; water dark and turbid. (11/06/04)

<u>Rock Springs Run</u>

1. Boil at Rock Springs. Benthic filamentous algae. (11/07/04)

2. Benthic filamentous algae. (11/07/04)

3. *Vallisneria* bed with associated filamentous algae. (11/07/04)

4. North side of island. Benthic filamentous algae. (11/07/04)

5. NE side of island. *Vallisneria* bed with periphyton. (11/07/04)

6. *Vallisneria* bed along stream edges; filamentous algal mats. (11/07/04)

7. Algae growing on sediment. (11/07/04)

8. End of swim area in park. *Vallisneria* with periphyton. (11/07/04)

9. Steps going into stream covered with attached algae. (11/07/04)

10. By Camp Joy. Filamentous algae along edges. (11/07/04)

11. Filamentous green algal mats entangled with woody debris and along shoreline and also forming benthic clumps. Patches of fine benthic accumulations of cyanobacteria. (11/08/04)

12. Extensive coverage of filamentous green algal mat. (11/08/04)

13. Extensive areas of *Vallisneria* and floating/emergent plants (*Nuphar*, *Pistia*, *Pontederia*) with little/no algae observed. (11/08/04)

14. Extensive *Vallisneria* with significant filamentous green algal clumps/mats. Also *Chara* with entangled filamentous green algae. (11/08/04)

15. Deeper, more turbid water. Run narrower, heavily canopied. No observed filamentous algae, SAV or emergent/floating vegetation. (11/08/04)

16. Run opens up, emergent/floating vegetation on both sides. Little to no filamentous algae observed. (11/08/04)

17. Run narrows and flow increases. Lots of woody debris, but no visible filamentous algae. (11/08/04)

18. Just downstream from confluence of Rock Springs Run and Wekiva River. No visible filamentous algae. (11/08/04)

V. Identification of Collected Filamentous Algae

GPS Point #	Algal Taxa
Wekiva River	
1	*Lyngbya wollei* (Cyanobacteria; dominant), *Rhizoclonium hieroglyphicum* (Chlorophyta), *Spirogyra* sp. (Chlorophyta)
10	*Vaucheria* sp. (Xanthophyta)
12	*Stigeoclonium* sp. (Chlorophyta)
17	*Batrachospermum* sp. (Rhodophyta)
19	*Cladophora glomerata* (Chlorophyta), *Oedogonium* sp. (Chlorophyta), *Spirogyra* sp. (Chlorophyta)
Rock Springs Run	
25	*Rhizoclonium hieroglyphicum*, *Spirogyra* sp., *Cladophora glomerata*, *Mougeotia* sp. (Chlorophyta)
27	*Lyngbya wollei*, *Spirogyra* sp.
28	*Cladophora glomerata*, *Rhizoclonium hieroglyphicum*
32	*Rhizoclonium hieroglyphicum*, *Spirogyra* sp.
33	*Spirogyra* sp., *Cladophora glomerata*, *Rhizoclonium hieroglyphicum*, *Phormidium* sp. (Cyanophyta), *Lyngbya wollei*
35	*Vaucheria* sp.
36	*Vaucheria* sp.

Table 1. Field notes.

Point #	Date	Photo Name	Sample	Algal Mat	Comment
Wekiva River					
1	11/4/2004	WR Point 1 Nov 04	x	x	Wekiwa Springs Park. Just downstream from spring head, near footbridge. Filamentous algal mat entangled with Nuphar. Some smaller benthic mats.
2	11/4/2004	WR Point 2 Nov 04		x	Wekiwa Spirngs Park. Just downstream from spring head, near footbridge. Filamentous algal mat entangled with Nuphar. Some smaller benthic mats.
3	11/4/2004			x	Wekiwa Spirngs Park. Just downstream from spring head, near footbridge. Filamentous algal mat entangled with Nuphar. Some smaller benthic mats.
4	11/4/2004			x	Beginning of benthic algal mat after launch.
5	11/4/2004			x	Center of benthic algal mat after launch.
6	11/4/2004			x	End of benthic algal mat after launch.
7	11/4/2004			x	Small cove with benthic mat.
8	11/4/2004			x	Surface mat entangled with Pistia and Hydrocotyle.
9	11/4/2004			x	Surface mat entangled with Pistia and Hydrocotyle.
10	11/4/2004	WR Point 10 Nov 04	x	x	Beginning of stretch of thick benthic algae cover.
11	11/4/2004				End of stretch of thick benthic algae cover.
12	11/4/2004	WR Point 12 Nov 04a and WR Point 12 Nov 04b	x		No benthic mats observed. Some attached algae and midge cases on woody debris and Nuphar stems.
13	11/4/2004	WR Point 13 Nov 04			No submerged aquatic vegetation (SAV), no benthic algae but some attached algae on emergents and woody debris.
14	11/4/2004				No benthic algae. Decreased areas of Nuphar and Hydrocotyle. Some attached algae on emergents and woody debris.
15	11/4/2004				Confluence of Little Wekiva River. Lots of fallen trees upstream and in front of confluence. Nupar, Hydrocotyle and emergent grass with small amounts of associated filamentous algae.
16	11/4/2004				First Vallisneria since near Rock Springs Run, but distribution is patchy and overall health appears to be poor.
17	11/4/2004		x		Shallow sand bar with good Vallisneria. Moderate coverage of epiphytic algae on blades including colonies of the filamentous red alga Audouinella.
18	11/4/2004				Exposed Vallisneria on shallow sand bars; plants dead or dying. Some attached algae on nearby submerged Valisneria. Beginning of larger beds of healthy Vallisneria.
19	11/4/2004		x		Thick Vallisneria beds. Some long filaments of attached filamentous green algae. Some accumulations of detached Vallisneria associated with Nuphar.
20	11/4/2004				Just upstream of HWY 46 bridge. Sparse Vallisneria. Much more extensive Vallisneria coverage prior to hurricanes.
21	11/6/2004				State canoe launch south of rt 46, no visible algae
22	11/6/2004				Private boat rental, no visible algae, water dark and turbid
23	11/6/2004				Some dead Vallisneria along edges, no algae
24	11/6/2004				Turn Around, no visible algae, water brown.
Rock Springs Run					
1	11/7/2004	RSR Point 1	x		Boil @ Rock Springs, visible dark green and gray periphyton

		Nov 04			
2	11/7/2004			x	Small collection of filamentous algae
3	11/7/2004	RSR Point 3 Nov 04	x	x	Gray and green filaments, Vallisneria bed
4	11/7/2004	RSR Point 4 Nov 04a and RSR Point 4 Nov 04b	x	x	North side of island; brown green and gray filamentous algae, algae growing on top of sediment also included in sample vial.
5	11/7/2004			x	NE side of island; Vallisneria bed with periphyton
6	11/7/2004			x	Gray matts, lots of Vallisneria Along stream edges.
7	11/7/2004	RSR Point 7 Nov 04		x	Algae growing on top of sediment
8	11/7/2004	RSR Point 8 Nov 04	x	x	End of "swim" area in park, Vallisneria with periphyton.
9	11/7/2004	RSR Point 9 Nov 04	x	x	Steps going into stream covered with "fuzzy"alage
10	11/7/2004				By "Camp Joy" Filamentous algae along edges, parked on dirt road
11	11/8/2004		x	x	Filamentous green algal mats entangled with woody debris and along shoreline and also forming benthic clumps. Patches of fine benthic accumulations of cyanobacteria.
12	11/8/2004		x	x	Extensive coverage of filamentous green algal mat.
13	11/8/2004				Extensive areas of Vallisneria and floating/emergent plants (Nuphar, Pistia, Pontederia) with little/no algae observed
14	11/8/2004			x	Extensive Vallisneria with significant filamentous green algal clumps/mats. Also Chara with entangled filamentous green algae.
15	11/8/2004				Deeper, more turbid water. Run narrower, heavily canopied. No observed filamentous algae, SAV or emergent/floating vegetation.
16	11/8/2004				Run opens up, emergent/floating vegetation on both sides. Little to no filamentous algae observed.
17	11/8/2004				Run narrows and flow increases. Lots of woody debris but no visible filamentous algae.
18	11/8/2004				Just downstream from confluence of Rock Springs Run and Wekiva River. No visible filamentous algae.

Attachment: CD of digital photos and water quality data for PPB Labs for Tasks 1 & 2

APPENDIX E

Potential Nitrate Toxicity to Aquatic Animals in the Wekiva River and Rock Springs Run

Potential Nitrate Toxicity to Aquatic Animals in the Wekiva River and Rock Springs Run and Associated Nitrate Concentration Targets[1]

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Carol L. Lippincott Ph.D.

St. Johns River Water Management District
Palatka, Florida
January 23, 2006

Introduction

The St. Johns River Water Management District (SJRWMD) is required by the Wekiva Parkway and Protection Act of 2004 to develop Pollution Load Reduction Goals (PLRGs) for water bodies in the Wekiva River basin. The Act emphasized investigation into effects of elevated nitrogen in these water bodies.

Increasing levels of anthropogenically derived nitrate in Florida springs have become an important water quality management issue (Florida Springs Task Force, 2000). Studies have shown that nitrogen loading from agricultural, urban, and recreational land uses introduces nitrate into groundwater, which then emerges in springs fed by that groundwater (Katz et al., 1999; Jones et al., 1996). Much of the concern with nitrate in springs has focused on its ecological effects (i.e., eutrophication, increased algal production, and water quality and habitat changes associated with algal growth). Nitrate is also known to have physiologically toxic effects on humans and animals as a result of being exposed to water with excessively high nitrate levels.

The purpose of this overview is to summarize evidence from the literature of toxic effects of nitrate for aquatic animals and potential threshold concentrations to consider in developing PLRGs for the Wekiva River and its largest upstream tributary, Rock Springs Run. Both of these groundwater-fed streams contain nitrate at elevated concentrations relative to less impacted spring-run streams in Florida (WSI, 2004; FDEP, 2000).

Background

In natural waters, nitrate (NO_3^-) coexists with nitrite (NO_2^-). Nitrite is produced from various forms of organic nitrogen and ammonia, mediated by nitrifying bacteria as part of the nitrogen cycle in aquatic environments (Lewis and Morris, 1986; Wetzel, 1983). In aerobic conditions, most nitrite is converted to the more stable nitrate, and nitrite is typically present at very low concentrations (Guillette and Edwards, 2005). Current analytical methods used to measure levels of nitrate in surface and ground waters

[1] T. Edwards (University of Florida) provided a helpful review of this paper.

actually measure both NO_3^- and NO_2^-, and levels are expressed as "nitrate/nitrite-nitrogen" (NO_3/NO_2-N or "NOx") (Edwards et al., 2004).

Specific mechanisms of nitrate toxicity vary depending upon a number of factors, both *in situ* and *in vivo*. Nitrate and/or nitrite enter an animal either through permeable membranes, such as the gills of fish or tadpoles or the skin of adult amphibians, or via ingestion (mammals and birds). It appears that nitrite is actively taken up by the chloride transport mechanism across gill membranes (Jensen, 1996; Lewis and Morris, 1986). Within body fluids, nitrate can be converted to nitrite, or nitrate can accumulate due to hepatic detoxification of nitrite (Edwards et al., 2004).

In a review of toxic effects of nitrate, Edwards et al. (2004) noted that nitrate or nitrite can interfere with steroid hormone synthesis, can affect sperm motility and viability, can affect fecundity, or can be toxic to embryos. Nitrate interferes with hemoglobin in the bloodstream, reducing its ability to carry oxygen and causing tissue hypoxia and cyanosis. In vertebrate animals, nitrate toxicity is manifested as methemoglobinemia (Lewis and Morris, 1986; Marco and Blaustein, 1999), a disorder that involves oxidation of the iron on the hemoglobin molecule by nitrate. This disrupts the ability of hemoglobin to bind oxygen reversibly, reducing its oxygen-carrying capacity. An emerging body of data also indicates that nitrate may act as an endocrine disruptor in fishes and reptiles (Guillette and Edwards, 2005; Edwards, 2005), affecting various metabolic processes through disruption of hormone synthesis.

Invertebrate Studies

Scott and Crunkilton (2000) examined toxicity of nitrate to two planktonic crustaceans, the cladocerans *Ceriodaphnia dubia* and *Daphnia magna*. Acute toxicity was evaluated in test concentrations of 150 to 2,500 mg/L NO_3-N. Median LC_{50} values for *C dubia* were 374 mg/L NO_3-N and 323-611 mg/L NO_3-N for *D. magna*. Chronic toxicity was evaluated by measuring neonate production in these two cladocerans. The "No Observed Effect Concentration" (NOEC) ranged from 7.1-56.5 mg/L NO_3-N for *C dubia* and 358 mg/L for *D. magna*. The "Lowest Observed Effect Concentration" (LOEC) ranged from 14.1-113 mg/l for *C. dubia* and was 717 mg/L for *D. magna*.

Camargo and Ward (1995) studied the effects of nitrate on larvae of the caddisflies *Cheumatopsyche pettiti* and *Hydropsyche occidentalis*. They conducted short-term toxicity tests using NO_3-N concentrations of 18.3-251 mg/L. They then used a multifactor probit analysis of these results to evaluate long-term effects of nitrate (over the course of a year) to estimate "Safe Concentrations" (SC's). They noted that SC is similar to the "No Observed Effect Concentration" (NOEC) of traditional toxicity tests. Early instar larvae were more sensitive to nitrate than last instar stages, in that they exhibited higher mortality in response to nitrate. Mean SC's (expressed as 8760-hour $LC_{0.01}$) were 2.4 mg/L for early instar *C. pettiti* and 1.4 mg/L for *H. occidentalis*. Mean SC's for last instar larvae of these two insects were 3.5 and 2.2 mg/L NO_3-N. From their analysis, they concluded that benthic invertebrates may be more sensitive to nitrate toxicity than many fish.

Jensen (1996) found that the crayfish *Astacus astacus* actively accumulates nitrite, via the same mechanism used in chloride uptake. Nitrate, however passively, accumulates via simple diffusion across permeable membranes. Within the crayfish's blood nitrite is detoxified to nitrate. Jensen (1996) believed the main physiological effects of nitrate/nitrite on crayfish would be on osmoregulation and ionic balance. However, "methemoglobinemia-like" symptoms may also occur. Oxygen transport in crustacean blood is based on haemocyanin. Its oxygen affinity may decrease with nitrite exposure (Cheng and Chen, 1999), especially at low pH. The effect of nitrite on hemocyanin appears to be less than the effect on hemoglobin. The hemocyanin condition would not technically be called methemoglobinemia, but it is the haemocyanin equivalent, indicating that oxygen transport can be affected in animals with hemocyanin.

Fish Studies

Edwards, et al. (2004) reviewed literature on nitrate effects on fish. Several studies experimentally evaluated nitrate toxicity on various fishes, using values ranging from 50 mg/L up to over 1,000 mg/L NO_3-N. Lewis and Morris (1986) reviewed aspects of the toxicity of nitrite to fish. Under conditions of low DO and/or high pH, higher levels of nitrite may occur than found under normal, more aerobic conditions. Nitrate may also be converted to nitrite in the body of fish. A summary of 96-hour LC_{50} levels of nitrite for relevant fishes found in the Wekiva River (or taxa similar to those found in the river) is in Table 1. Channel catfish was regarded as a sensitive species, although black bullhead (another catfish) was not as sensitive to nitrite.

Table 1. Summary of 96-hour LC_{50} (concentration at which 50% of the test organisms die in 96 hours) for various warm water fish taxa found in the Wekiva River (- or similar to taxa found in the Wekiva). Source: Lewis and Morris, 1986.**

FISH TAXON	96 hour LC_{50} (mg/L NO_2-N)
Channel catfish (*Ictalurus punctatus*)	7.1-12.8
Black bullhead (other Ictaluridae)**	> 32
Fathead minnow (Cyprinidae)**	2.3-70
White sucker (Catastomidae) **	> 80
Largemouth bass (*Micropterus salmoides*)	140
Bluegill (*Lepomis macrochirus*)	2.4-144
Mosquitofish (*Gambusia holbrooki*)	1.5
Blue tilapia (*Oreochromis aureus*)	16

As can be seen from the data in Table 1, there is a wide range of tolerance to nitrite, both among and within species. Lewis and Morris (1986) considered centrarchids, such as Largemouth bass and Bluegill "insensitive taxa". The range of values for Bluegill, however, was reported to be as low as 2.4 mg/L nitrite-N. Tests with Fathead minnow

suggest low LC_{50} values (down to 2.3 mg/L nitrite-N), although Scott and Crunkilton (2000) found a median 96 hr LC_{50} of 1,341 mg/L NO_3-N for Fathead minnow.

Edwards, et al. (2004) and Edwards (2005) examined reproductive characteristics of male and female Mosquitofish (*Gambusia holbrooki*) collected from 8 north Florida springs with nitrate concentrations ranging from 0.23-4.52 mg/L NO_3-N. Reproductive characteristics examined were:

> Males: body size, gonadosomatic index (GSI), hepatosomatic index (HSI), tissue androgen levels, sperm counts and viability, gonopodium length, and testicular histology.
> Females: body size, GSI, HSI, tissue estradiol levels, fecundity (# embryos/female), mean embryo weight.

In springs with nitrate levels $\geq$ 4 mg/L NO_3-N, she found that adult male mosquitofish exhibited testicular hypertrophy, reduced levels of one androgen (11-ketotestosterone), and reduced total sperm counts per sperm packet. Similarly, among females, nitrate exposure (>4 mg/L NO_3-N) was related to low dry weight of developing *Gambusia* embryos and decreased rate of reproductive activity among mature females. This indicated what she termed "reproductive disturbance" among mosquitofish when nitrate levels exceed a 4 mg/L threshold.

Consideration needs to be given to potential nitrate impacts on more sensitive fish life stages such as eggs, embryos and fry. Edwards et al. (2004) noted that one study of salmonids found larval mortality at nitrate concentrations of 2.3-7.6 mg/L, and their studies of mosquitofish in Florida springs (noted above) found adverse effects on embryos within this range. Kincheloe et al. (1979) examined toxicity of nitrate to the eggs and fry of several taxa of salmonids. They used sodium nitrate concentrations of 0-20 mg/L, which equated to effective NO_3-N concentrations of 0-4.5 mg/L. Statistically significant increased egg mortality was seen at threshold NO_3-N concentrations of 1.1-4.5 mg/L, depending upon the species of fish. These studies were conducted in fairly "soft" waters of low alkalinity (unlike the hard, calcium-rich water of Florida's spring-run streams) and were conducted on coldwater fish taxa not found in Florida. However, these results do indicate that impacts on eggs, embryos, and/or fry is a valid concern.

Amphibian Studies

Amphibians are often promoted as excellent "sentinel" species to examine the ecological effects of toxicants (Murphy et al., 2000). Studies have been conducted on amphibians for two main reasons: the physiological importance of their skin in respiration and hydration and their complex life history, encompassing both aquatic and terrestrial habitats. Edwards et al. (2004) reviewed a number of studies reported in the literature. Negative effects included behavioral abnormalities (decreased activity, reduced feeding, disequilibrium), deformities, mortality, and altered timing of metamorphosis. Table 2 summarizes results of a literature review, selectively citing data from studies that examined nitrate levels relevant to those seen in Florida spring-

Table 2. Summary of nitrate toxicity effects on amphibians, from Edwards et al. (2004); Marco and Blaustein (1999); Marco et al. (1999); Hecnar (1995); Langan (2003).

TAXON	LIFE STAGE	NO_3-N TEST RANGE (mg/L)	NOTES
Bufo bufo	Tadpole	9-23	Reduced feeding; reduced growth rate; increased mortality
Bufo terrestris	Tadpole	5-30	Increased time to metamorphosis and lower thryroxine levels in tadpoles exposed to 30 mg/L.
Bufo terrestris	Tadpole	0-30 mg/L $NaNO_3$; this represented range of 0-4.94 NO_3-N	Decreased time to metamor-phosis at highest nitrate treatment
Pseudacris triseriata	Tadpole	2.5-10	Decreased survival over 100 days; behavioral and developmental abnormalities
Rana pipiens; Rana clamitans	Tadpole	2.5-10	Decreased survival over 100 days; behavioral and developmental abnormalities
Rana temporaria	Tadpole	0-5	Reduced growth rates and smaller metamorphic size
Rana pretiosa; Rana aurora; Bufo boreas; Hyla regilla; Ambystoma gracile	Tadpole (newly hatched)	0.78-25	*R. pretiosa* had higher mortality at 6.25 mg/L (not statistically significant) and significantly higher mortality at 12.5 mg/L
Rana pretiosa; Rana aurora; Bufo boreas; Hyla regilla; Ambystoma gracile	Tadpole (newly hatched)	0.22-7 mg/L nitrite (NO_2-N)	15 day LC_{50} ~ 2 mg/L; “significant mortality” at 1 mg/L nitrite
Rana cascadae	Tadpole	3.5 mg/L nitrite (NO_2-N)	Slowed development; increased time to complete metamorphosis

run streams. Edwards et al. concluded from their literature survey and their own work that nitrate must be considered a possible cause of amphibian deformities and has the potential to be an endocrine disrupter. Many field studies cite confounding factors such as habitat destruction and introduced species that complicate isolation of nitrate toxicity impacts to amphibian populations in the field. Nonetheless, nitrate toxicity is a factor that should be considered in amphibian conservation.

In addition to literature surveys, Edwards et al. (2004) conducted laboratory studies on effects of nitrate in filtered water and unfiltered spring water on development and metamorphosis of the Southern toad (*Bufo terrestris*). This toad is reported to occur in several habitats around the Wekiva River (National Park Service, 1999). Egg clutches were obtained and raised to metamorphosis (emergence of forelimbs). For the life history characteristics examined in this study, nitrate concentrations of 5 mg/L were not statistically different from controls (no nitrate added). In several cases nitrate levels of 15 mg/L were also not statistically different from controls. Tadpoles raised at nitrate levels of 30 mg/L took less time to reach metamorphosis. Tadpoles exposed to concentrations of nitrate that fluctuated between 0 and 30 mg/L NO_3-N had reduced levels of the hormone thyroxine, which governs the timing of metamorphosis. Two sets of this experiment were performed, one using filtered water and another unfiltered spring water. In filtered water with 30 mg/L NO_3-N, tadpoles metamorphosed up to 5days earlier than control animals. However, spring water tadpoles reared in 30 mg/L NO_3-N delayed metamorphosis by 6 days compared to animals reared in filtered water at the same nitrate concentration.

Langan (2003) also examined the effects of nitrate on growth and development of *B. terrestris* tadpoles. She used solutions of sodium nitrate from 5 to 30 mg/L, which equaled effective NO_3-N concentrations of 0.824 - 4.944 mg/L. She found no statistically significant effects on growth, but found that tadpoles raised at the highest nitrate level exhibited significantly shorter time to metamorphosis. She surmised that this might be due to stress effects at the higher nitrate concentration, with the tadpoles developing faster in order to escape from the nitrate-enriched water.

Hecnar (1995) examined the effects of nitrate at concentrations of 2.5 to 10 mg/L on growth and development of tadpoles of *Bufo americanus*, *Pseudacris triseriata*, *Rana pipiens* and *R. clamitans* from the Ontario region. Statistically significant effects on metamorphosis and survivorship were seen in the 5 mg/L and10 mg/L treatments (reduced survivorship and lower rate of metamorphosis). Behavioral differences (reduced swimming and feeding activity) were noted in all treatment concentrations down to 2.5 mg/L. Decreased swimming activity, paralysis and deformities (bent tails) were noted with increasing time of exposure.

<u>Reptile Studies</u>

Guillette and Edwards (2005) evaluated effects of nitrate levels in juvenile alligators from seven central Florida lakes. They found that plasma testosterone levels in both male and female juvenile alligators were negatively correlated with lake Total N and

nitrate-N levels. In female juveniles, a significant positive correlation was found between plasma E2 (estradiol) and lake nitrate concentrations between 0.01-0.04 mg/L NO_3-N. (Guillette and Edwards, 2005). These findings should be regarded as preliminary until more definitive cause/effect studies are done.

Bird and Mammalian Studies

Toxic effects of nitrate on birds and mammals result from ingestion of contaminated water. The human health standard for nitrate is 10 mg/L (http://www.dep.state.fl.us/water/drinkingwater). Cattle may be affected by toxic levels of nitrate in water contaminated by fertilizer or manure runoff. Nitrate levels reported harmful to cattle are:

0-44 mg/L	-	Not harmful
45-132	-	Slight possibility of harm
133-220	-	Risky over long period of time
221-660	-	Some losses (of cattle) expected
661-8880	-	Increased losses expected
> 880	-	Heavy losses

Source: http://www.vetmed.ucdavis.edu/vetext/INF-BE_cca/INF-BE_cca01/INF-BE_cca0111.html

Another source (http://www.uwex.edu/ces/forage/pubs/nitrate.htm) indicated drinking water levels of 10-20 mg/L NO_3-N are considered "safe for humans and livestock"; levels of 20-40 mg/L are considered "unsafe for humans" and "might cause problems for livestock"; levels of 40-100 mg/L are considered "unsafe for humans" and "risky for livestock".

Toxicity Thresholds Relative to Nitrate Concentrations in the Wekiva River and Rock Springs Run

Figures 1 & 2 show nitrate concentrations in the Wekiva River and Rock Springs Run over the past 21 years and the four lowest toxicity thresholds for aquatic animals cited in this review. Table 3 describes period-of-record nitrate data for each spring-run stream.

Table 3. Descriptive statistics for nitrate (mg/L NO_3/NO_2-N) in the Wekiva River and Rock Springs Run for the period-of-record (1984-2005).

	# of Samples	Range	Mean	Median	Standard Deviation
Wekiva River	167	<0.01-1.53	0.69	0.69	0.43
Rock Springs Run	136	0.02-1.84	1.12	1.27	0.49

Early instar larvae of two caddisfly genera found in the Wekiva River (*Hydropsyche* and C*heumatopsyche*) showed increased mortality over their larval lifetime at nitrate levels of 1.4 - 2.4 mg/L (Camargo and Ward, 1995). Two frog genera found in the Wekiva River (*Rana* sp. and *Pseudacris* sp.) showed adverse sublethal effects at nitrate levels

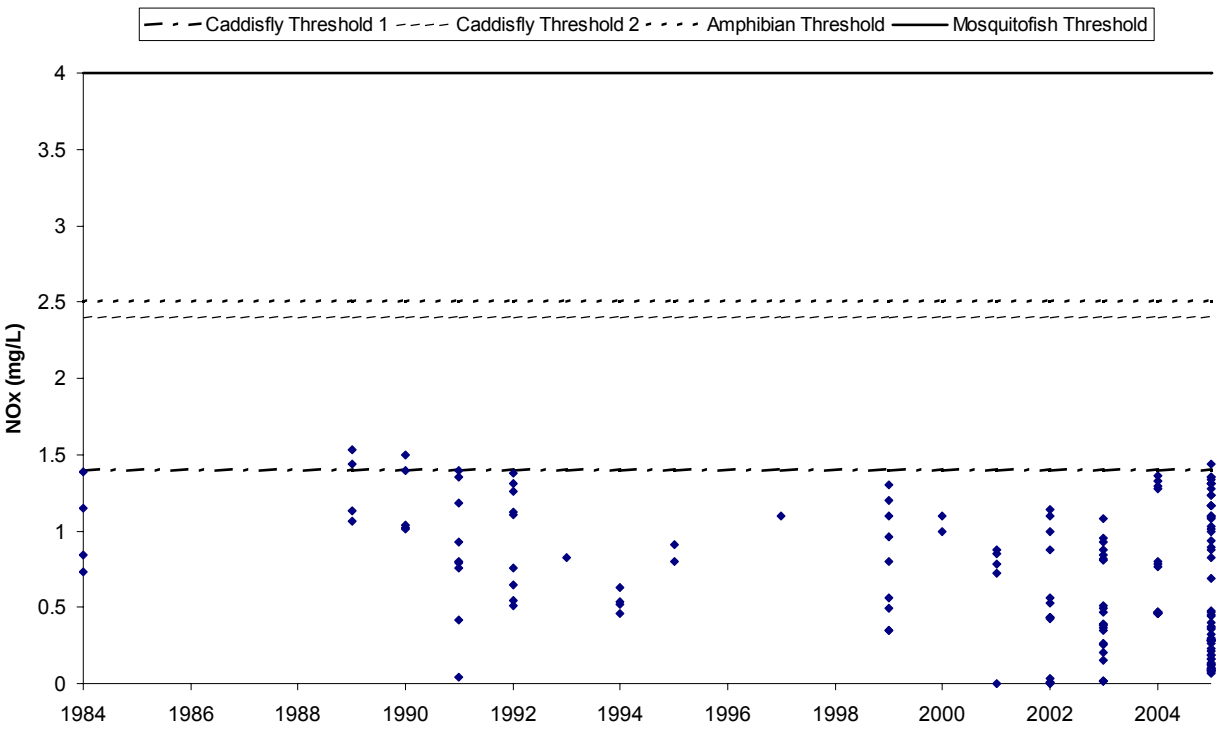

Figure 1. Period-of-record nitrate in the Wekiva River and nitrate toxicity thresholds for certain caddisflies, amphibians (frogs), and mosquitofish.

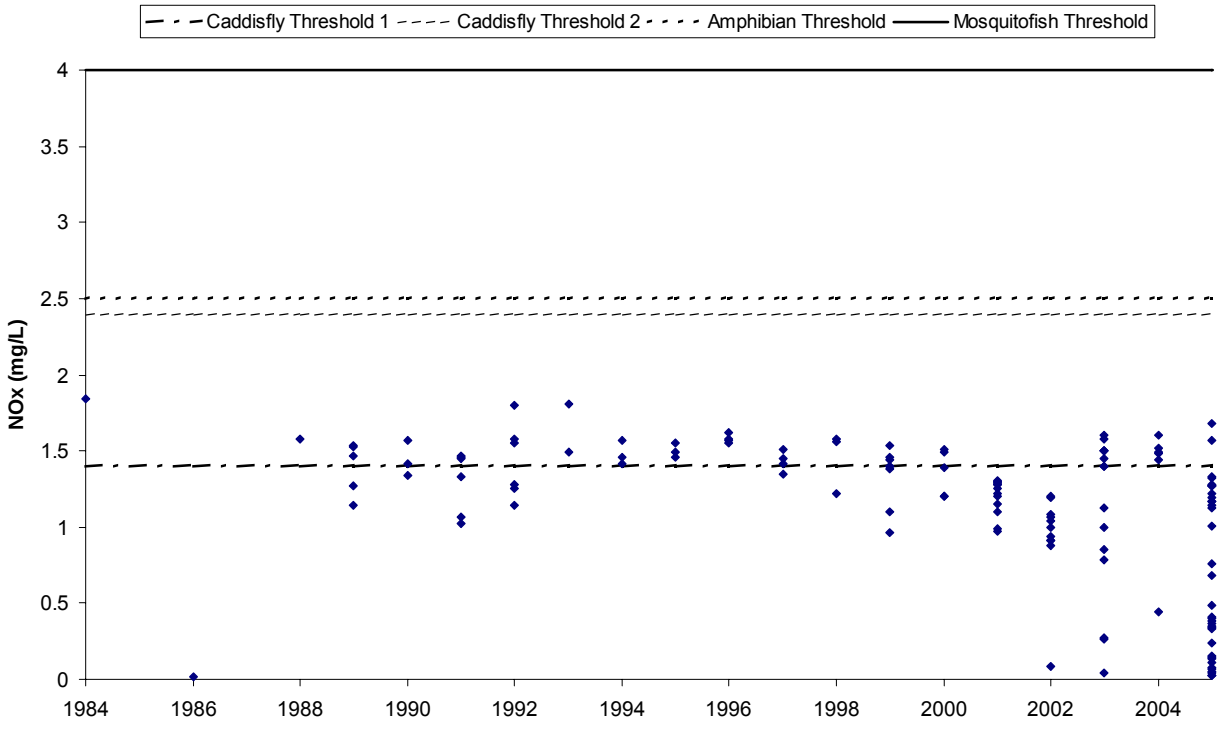

Figure 2. Period-of-record nitrate in Rock Springs Run and nitrate toxicity thresholds for certain caddisflies, amphibians (frogs), and mosquitofish.

of 2.5 mg/L (Hecnar, 1995). Mosquitofish, which are found in the Wekiva River (Walsh and Williams, 2003; Warren et al., 2000) exhibited adverse sublethal effects at nitrate levels above 4 mg/L.

Nitrate concentrations recorded through 2005 for the Wekiva River and Rock Springs Run exceeded the lower toxicity threshold for caddisflies (1.4 mg/L) for 3% of the Wekiva River samples and 38% of the Rock Springs Run samples. An increase in maximum nitrate of 1.00 mg/L (67%) for the Wekiva River and 0.70 mg/L (39%) in Rock Springs Run would meet or exceed toxicity thresholds for other caddisflies and for certain frogs.

The laboratory studies described in this summary were conducted over the larval lifetime of the animal (e.g., entire larval life of caddisflies; frogs from egg to adult). There was no indication of the frequency or duration of exposure required to cause the described effects in the field. Therefore, additional analyses were performed to account for this uncertainty in determining nitrate concentration targets for the Wekiva River and Rock Springs Run that would protect aquatic animals from nitrate toxicity effects.

Deriving Protective Nitrate Concentrations through Application of Uncertainty Factors

Derivation of a protective nitrate concentration requires consideration of the sources of uncertainty inherent in the limitations of the available data. The USEPA (1995a, 1995b), USFWS (2003), and USFWS, USEPA, and New Jersey Department of Environmental Protection (2001) have employed up to four uncertainty factors to set protective exposure limits for toxic contaminants:

1) an interspecies uncertainty factor (UF_A);
2) an exposure duration uncertainty factor (subchronic to chronic: UF_S);
3) an exposure endpoint uncertainty factor (UF_L) – equivalent to a concentration between the “Lowest Observed Effect Level” (LOEL) and the “No Observed Effect Level” (NOEL), and;
4) an intraspecific uncertainty factor (UF_I).

Determining UF_A

The interspecies uncertainty factor may range from 1 to 1000 and is applied to the NOEL to account for uncertainties associated with extrapolation from one species to another. These uncertainties are associated with differences in toxicokinetics; processes determining rates of uptake, internal distribution, detoxification and elimination; and toxicodynamics; processes that determine the effect of the toxin on the organism such as enzyme inhibition or facilitation and DNA binding. The size of the uncertainty factor can be derived from alometric scaling based on the relative sizes of the test organism and the target organism, the known degree of variation in acute and chronic sensitivity of the target taxa, and best professional judgment considering the physicochemistry, toxicokinetics, and toxicodynamics of the toxin and the amount and quality of data available.

Determining UF_S

This factor is used when the data available were derived from short-term studies and the desired threshold is one that would be protective during long-term exposure. The need for this adjustment stems from several considerations. First, a long-term exposure is required for some contaminants to reach equilibrium levels in the target organisms. Second, physiological mechanisms that compensate for exposure to the toxin may break down after long periods of exposure. Third, latent adverse effects that occur after exposure may be missed. Finally, sensitive life stages may not be represented in short-term studies. In birds, these factors ranged from 10-20 for short-term studies in birds and from 1-5 for moderate-term to long-term studies. Larger adjustments are needed when the data available were derived from studies of short duration compared to the life expectancy of the target organism. Larger adjustments are also needed if the data were derived from studies with durations shorter than the time needed to achieve equilibrium concentrations in the tissues of the target organism.

Determining UF_L

This uncertainty factor is derived from the ratios of LOEL to NOEL. Based on a review of 275 LOEL:NOEL ratios, more than half were less than or equal to 3 and 97% were less than or equal to 10 (USEPA, 1995b). A value greater than 1 is used whenever the dose-response threshold is unknown. Unbounded LOELs from steep dose-response curves would require smaller uncertainty factors than unbounded LOELs from curves with shallow slopes. The severity of the effects should also be considered, with a large factor being used for more severe effects.

Determining (UF_I)

This factor is designed to protect sensitive individuals within a population. USEPA (1995b) recommended an intraspecies uncertainty factor of 10 applied to the NOEL. This uncertainty factor is used to convert a NOEL for an *average* individual within a tested population, to a NOEL for the more sensitive individuals of the population. This protection is required for protection of endangered species (USEPA, 1995b).

<u>Application of Uncertainty Factors</u>

These uncertainty factors have been used for wildlife to derive safe doses and water quality criteria. They were applied to derive safe doses of methylmercury for endangered species in California as follows:

$$RfD = TD/(UF_A \times UF_S \times UF_L),$$

where Rf D is the reference (safe) dose in mg/kg/d and TD is the test dose (mg/kg/d) (USFWS, 2003).

The RfD can be used to derive a safe wildlife value (WV, safe concentration) as follows:

$$WV = RfD \times Wt/(W + \Sigma(F_i \times BAF_i)),$$

where Wt is the weight of the target organism (kg), W is the water consumption rate (L/d) , Fi is the amount of food from trophic level i consumed per day (kg/d), and BAFi is the bioaccumulation factor from water to food for trophic level i (L/kg)(USEPA, 1995b).

In the case of aquatic organisms directly exposed to the concentration of a contaminant in the water, either through gills or skin, the relevant tests use concentration rather than dose and the equation for safe concentration would simplify to

$$SC = TC/(UF_A \times UF_S \times UF_L),$$

Where SC is the safe concentration (ug/l) and TC is the test concentration (ug/l).

<u>Application of Uncertainty Factors to Nitrate Toxicity Thresholds</u>

Aquatic Insects

The SC derived by Camargo and Ward (1995) could be considered an estimate of the LOEL for caddisflies if sublethal effects are taken into account (see below). They considered it equivalent to an NOEL, but their endpoint was lethality. Through application of appropriate uncertainty factors an estimate of the protective concentration of nitrate for aquatic insects can be derived.

UF_I - None of the aquatic insects of the Wekiva River and Rock Springs Run have been designated as endangered so the intraspecific uncertainty factor (UF_I) is irrelevant.

UF_S - The probit analysis used by Camargo and Ward (1995) is a quantitative extrapolation from short-term to long-term effects. In this sense, it has accounted for the uncertainty normally associated with relating short-term and long-term exposure. Therefore, we assign a value of 1 for UF_S.

UF_L - The probit analysis was based on an experimental endpoint of lethality. To be sufficiently protective, however, the endpoint should be less severe than lethality, such as reproductive, developmental, or behavioral impairment. There is considerable uncertainty associated with extrapolation from an endpoint of lethality to an endpoint of sublethal impairment. If the SC developed by Camargo and Ward is taken as a LOEL (from consideration of sublethal effects), this uncertainty is comparable to that associated with extrapolation from LOEL to NOEL. EPA (1995) found that the LOEL:NOEL ratio is generally not greater than 10 and more than half of those examined were not more than 3. We recommend a value of 5 for this uncertainty factor.

UF_A - Finally, to account for the potential that other aquatic insects or invertebrates are more sensitive than these species of caddisfly, we would recommend a value of 2 for

UF_A. This is a small correction because studies of other species of aquatic invertebrates are not suggestive of sensitivities well below that of the caddisflies (see review above on p. 2). We conclude that it is unlikely that other species of aquatic insects are more than twice as sensitive to nitrate than caddisflies.

Using values of 1, 5, and 2 for UF_S, UF_L, and UF_A, respectively, we derive **a final protective concentration of 0.14 mg NO_3/L for aquatic insects.**

Amphibians

It is important to note that amphibian populations have declined globally and there is now believed to be the potential for extinction of hundreds of species within just a few decades (Stuart et al., 2004). Moreover, one of the identified threats to amphibians in North America is nitrate pollution (Rouse et al., 1999). Given this background, the achievement of protective levels of nitrate for all amphibian species in the Wekiva River and Rock Springs Run seems especially critical. The behavioral effects observed by Hecnar (1995) at 2.5 mg NO_3/L can be taken as an unbounded LOEL for the species tested and uncertainty factors can be applied to derive a protective concentration for amphibians.

UF_I - As with the caddisflies UF_I is not relevant.

UF_A - Because there are many more species of frogs potentially occurring in the Wekiva River and Rock Springs Run than those tested to date, and because there is little basis for concluding that the species tested by Hecnar (1995) are among the most sensitive species, an adjustment for interspecific uncertainty is warranted. To this end, we believe an uncertainty factor of 5 is reasonable for UF_A, for two reasons. First, a major basis for interspecific variation in sensitivity to toxins is variation in body mass (EPA, 1995) and there is considerable variation in average body mass of amphibians potentially associated with the Wekiva River and Rock Springs Run. The little grass frog (*Pseudacris grylio*) ranges from about 11 – 17 cm (Conant, 1975) while the pig frog (*Rana grylio*) ranges from 80-140 cm. Second, there can be considerable variation in sensitivity even among species of similar size. For example, in birds, similarly sized species can exhibit a 10-fold variation in sensitivity to toxins (EPA, 1995).

UF_L - Because the behavioral effects observed by Hecnar (1995) are a particularly sensitive endpoint, and because at the lowest concentration where behavioral effects were observed (2.5 mg NO_3-N/L) the number of metamorphs did not differ significantly from controls, we believe an uncertainty factor of 2 for UF_L is adequate. In other words, we believe that it is unlikely that behavioral effects would be observed in the tested species at a concentration of 1.25 mg NO_3-N/L.

UF_S - The Hecnar study did not span the entire life cycle of the species, however, and must be considered short-term. To account for potential life cycle effects not observed in the short term, we believe a factor of 2 is warranted for UF_S. A larger factor seems unnecessary since the Hecnar study did span the developmental period. Using values

of 5, 2, and 2, for UF_A, UF_L, and UF_S, respectively we derive **a final protective concentration for amphibians of 0.125 mg NO_3/L.**

Comparison to Other Work

The uncertainty factors we have employed are not extreme. In an examination of the protectiveness for listed wildlife in California of the human health criterion for methylmercury, the USFWS used uncertainty values of 1-3 (USFWS, 2003). Uncertainty factors of 10 are common (Newman and Unger, 2003).

Environment Canada developed guidelines for nitrate for the protection of aquatic organisms (Environment Canada, 2003). The recommended interim freshwater guideline was 13 mg/L NO_3. Converting this value to NO_3-N yields a guideline of 2.9 mg/L. This is well above the concentration we have recommended as protective. Hecnar (1995), however, observed deleterious behavioral effects in amphibians at concentrations as low as 2.5 mg/L NO_3-N. Thus, an amphibian NOEL must lie below 2.5 mg/L NO_3-N. Camargo and Ward (1995) extrapolated a safe concentration of 1.4 mg/L NO_3-N for a caddisfly species. If one accounts for the uncertainty associated with interspecific differences, a protective concentration for aquatic insects must lie below 1.4 mg/L NO_3-N.

Threshold Nitrate Concentrations Based on Uncertainty Factors

Application of uncertainty factors to reported toxicity thresholds for certain aquatic insects and amphibians indicated nitrate concentration thresholds of **0.125 mg/L for certain amphibians and 0.140 mg/ L for certain aquatic insects** to protect these aquatic animals in the Wekiva River and Rock Springs Run from nitrate toxicity effects.

Summary

- Nitrate toxicity is manifested in several ways: it can affect the reproductive system, can affect embryonic development and survival, decreases oxygen-carrying ability of the blood, or can act as an endocrine disruptor.
- Median chronic toxicity values for one species of cladoceran were 14.1 to 113 mg/L nitrate.
- Nitrate levels above 1.4 mg/L caused increased mortality to young larvae of one species of caddisfly (*Hydropsyche occidentalis*), while levels greater than 2.4 mg/L were chronically toxic (increased mortality) to young larvae of a second caddisfly species (*Cheumatopsyche pettiti*).
- Crayfish actively accumulate nitrite, which may interfere with osmoregulation or disrupt oxygen-carrying capacity of the blood.
- Fish toxicity to nitrate and nitrite varies widely. Nitrite levels as low as 1.5 to 2.4 mg/L NO_2-N can be toxic to fishes found in the Wekiva system. Nitrate levels of > 4 mg/L affected reproductive characteristics of Mosquitofish in Florida springs. Consideration should be given to potential impacts of nitrate on more sensitive fish life stages, such as eggs or fry.

- Nitrate levels as low as 2.5-5 mg/L had adverse effects (reduced growth rates, decreased survival, and behavioral and developmental abnormalities) on tadpoles of certain anuran taxa.
- Central Florida alligators from lakes showed potential endocrine disruption at nitrate levels between 0.01-0.04 mg/L, but no causal relationships were experimentally demonstrated.
- Nitrate in the Wekiva River and Rock Springs Run for over the past 21 years has exceeded and approached toxicity thresholds for certain caddisflies and frogs.
- Various uncertainty factors have been used in toxicology to account for sources of uncertainty inherent in the application of short-term laboratory toxicity test data to potential long-term exposure effects in natural ecosystems.
- Application of uncertainty factors indicated nitrate concentration thresholds of 0.125 to 0.140 mg/L to protect certain caddisflies and frogs in the Wekiva River and Rocks Spring Run from nitrate toxicity effects.

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APPENDIX F

Coliform Analysis
in the Wekiva River and Rock Springs Run

Verification of Impairment and Proposed Reductions for Coliform Bacteria In the Wekiva River and Rock Springs Run

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Introduction

Purpose

The St. Johns River Water Management District (SJRWMD) is required by the Wekiva Parkway and Protection Act of 2004 to develop Pollutant Load Reduction Goals (PLRGs) for the Wekiva basin by December 2005. The Act requires the Florida Department of Environmental Protection (FDEP) to then develop Total Maximum Daily Loads (TMDLs) based on the PLRGs within the next year.

This study was conducted to determine if the Wekiva River and Rock Springs Run are impaired for total and fecal coliform bacteria according to Florida's Impaired Waters Rule (IWR) as defined in Chapter 62-303 of the Florida Administrative Code (F.A.C.). If impairment is indicated, then necessary reductions in coliform bacteria to meet state water quality standards will be proposed.

Elevated levels of coliform bacteria in surface waters are a concern because they indicate the presence of pathogens. Sources for coliform bacteria include point sources, such as wastewater treatment plants, and non-point sources, such as wildlife, livestock, and failing septic systems. Storm events transport coliform bacteria from non-point sources to the receiving water bodies.

Currently FDEP does not list the Wekiva River or Rock Springs Run as impaired for fecal or total coliforms. EPA proposed TMDLs for fecal and total coliforms for Rock Springs Run in September 2005 (USEPA, 2005b).

Location

The Wekiva River and Rock Springs Run are located in Orange, Lake, and Seminole counties, Florida, north of the city of Orlando (Figure 1). The Wekiva River flows for 16 miles from Wekiwa Spring in Wekiva River State Park to the St. Johns River. Rock Springs Run flows for 9 miles from Rock Spring in Kelly Park to the Wekiva River. Both spring-fed streams flow almost entirely through public conservation lands.

Identification of Water Bodies

FDEP assigns water body identification numbers (WBID) to all water bodies or segments of water bodies in Florida for water quality assessment purposes. Rock Springs Run is designated as WBID 2967 (Figure 1). The Wekiva River is divided into two segments. WBID 2956 extends for 4.5 miles from Wekiwa Spring to the confluence with the Little Wekiva River. WBID 2956A covers an approximately 11-mile long segment of the Wekiva River from the confluence with the Little Wekiva River to just above the confluence with the St. Johns River (Figure 1). In this analysis, the segment of the Wekiva River that is located in WBID 2956 will be referred to, as "Upper Wekiva" and the segment in WBID 2956A will be called "Lower Wekiva".

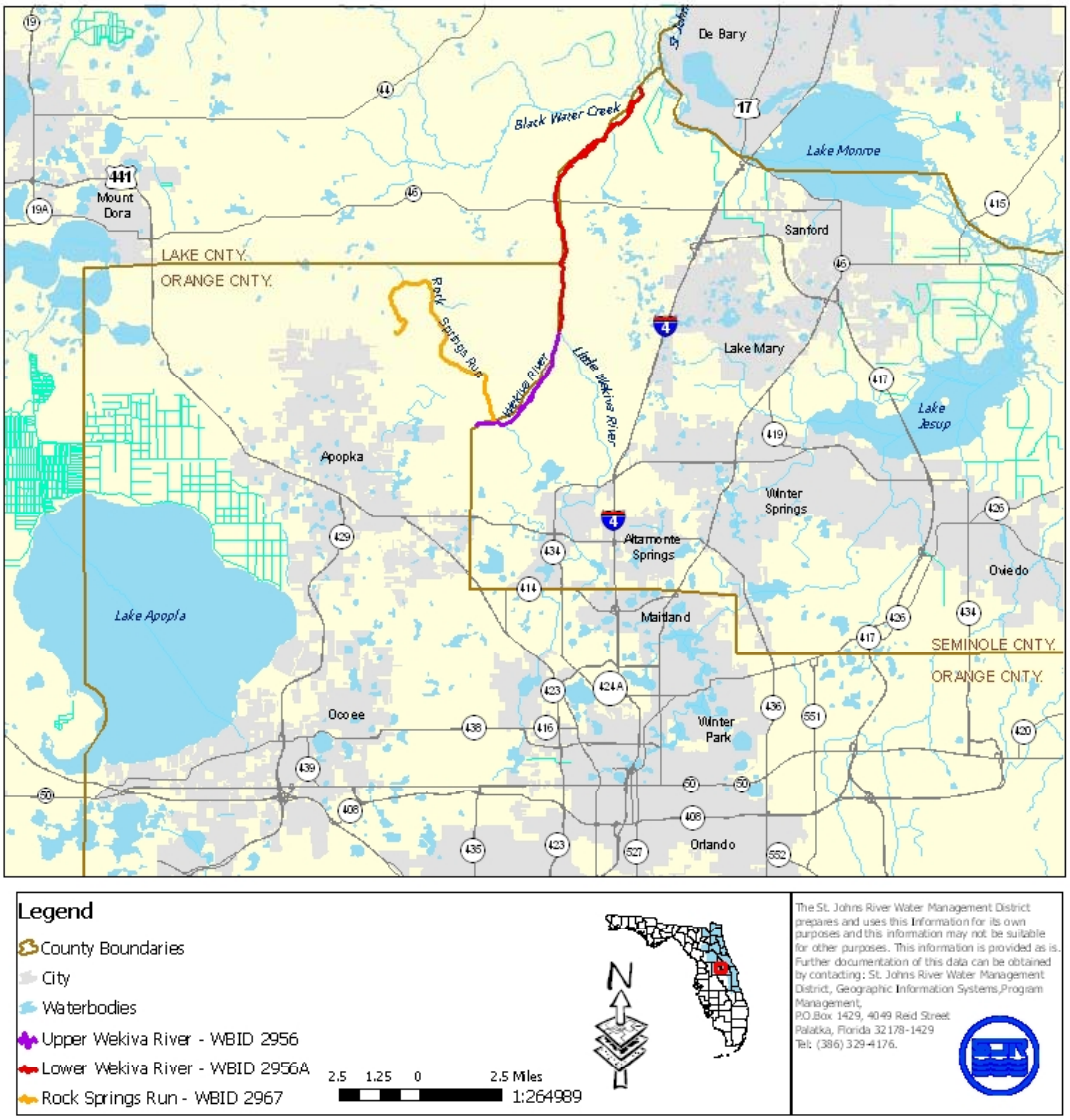

Figure 1: Location of the Wekiva River and Rocks Springs Run, and WBIDs assigned by FDEP.

Verification of Impairment

Water Quality Criteria for Coliforms

The Wekiva River and Rocks Springs Run are classified by the State of Florida as Class III water bodies which means their "designated use" is "recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife." Water quality criteria for the protection of Class III waters are established by the State of Florida in the Criteria for Surface Water Quality Classification (F.A.C. Section 62-302.530). The Impaired Waters Rule refers to these for criteria to determine impairment of water bodies or segments for which TMDLs will be developed. For this study the parameters examined

were Bacteriological Quality / Total Coliform Bacteria and Bacteriological Quality / Fecal Coliform Bacteria.

Numeric criteria for bacterial quality are expressed in terms of fecal coliform and total coliform bacteria counts, or number of colonies, per 100 ml. The Criteria for Surface Water Quality Classification specify the following criteria for the Bacteriological Quality (Coliform Bacteria) for predominantly fresh water Class III Waters:

Total Coliforms

≤ 1,000 as a monthly average; nor exceed 1,000 in more than 20% of the samples examined during any month; ≤ 2,400 at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period, using either MPN (Most Probable Number) or MF (Membrane Filter) counts.

Fecal Coliforms

MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples over a 30-day period.

In this analysis the 'at any one time' criteria of 2,400 and 800 counts/ 100ml were used for total and fecal coliforms, respectively. Monthly geometric means could not be calculated for either fecal or total coliforms because the necessary 10 samples per month were not available.

In order to verify impairment according to the IWR, the measured exceedances must indicate with at least 90% confidence that the actual exceedance rate is greater or equal to ten percent.

Data Evaluated

In accordance with the IWR, data used to verify impairment must have been collected within the past 7.5 years. Total and fecal coliform data used by SJRWMD for this analysis were provided by Orange County and were collected from August 1997 to April 2005 at monitoring stations located as shown in Figure 2 and described in Table 1.

Table 1: Summary of data used in this analysis

Sampling Location	Stream Reach	WBID	Station Name(s)	# of samples
Wekiva River @ Wekiva Marina	Upper Wekiva	2956	BWB	25
Wekiva River @ SR 46	Lower Wekiva	2956A	BWC	20
Rock Springs Run @ Camp Joy Baptist Church	Rock Springs Run	2967	BWA, BWAA	27

Using data that met IWR requirements, the number of samples that exceeded the applicable water quality standards for fecal and total coliforms was determined. Values were averaged when two samples were taken within a seven-day period. If the average exceeded the water quality criterion, the two samples were counted as one exceedance.

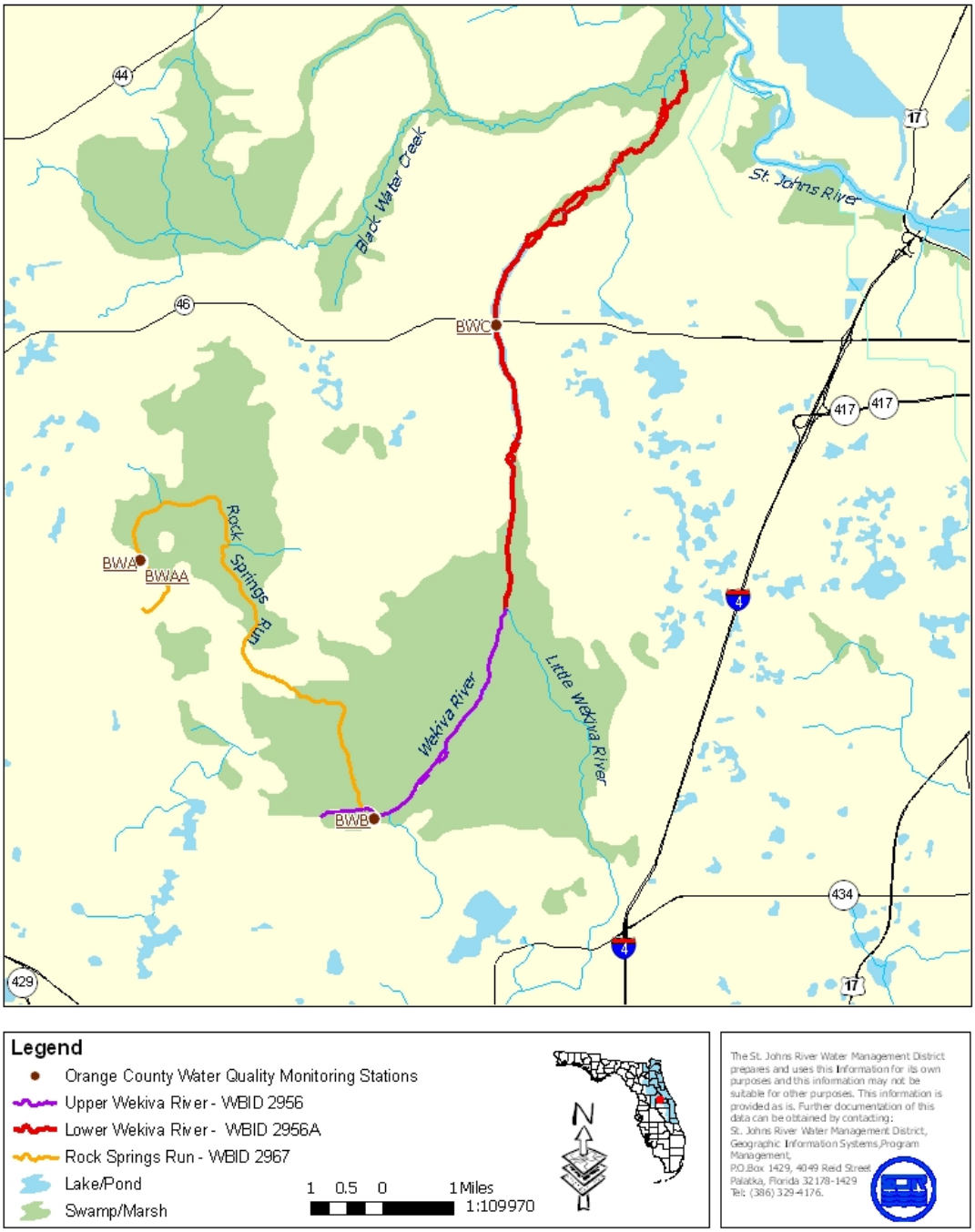

Figure 2: Orange County water quality monitoring stations used in this analysis.

Results of Impairment Analysis

Total Coliforms

Based on IWR criteria, the Wekiva River and Rock Springs Run are impaired for total coliforms. Table 2 summarizes the results of data analysis. Appendix A contains total coliform data used in this analysis.

Table 2: Summary of total coliform impairment analysis for the Wekiva River and Rock Springs Run.

River Segment	WBID	Station(s)	# of Samples	# of Exceedances	# Required to Verify Impairment	Impaired
Upper Wekiva	2956	BWB	25	10 (40%)	5	Yes
Lower Wekiva	2956A	BWC	20	9 (45%)	5	Yes
Rock Springs Run	2967	BWA, BWAA	28	12 (43%)	6	Yes

Fecal Coliforms

Based on IWR criteria, the Wekiva River and Rock Springs Run are not impaired for fecal coliforms. Table 3 summarized the results of data analysis. Appendix B contains the fecal coliform data used in this analysis.

Table 3: Summary of fecal coliform impairment analysis for the Wekiva River and Rock Springs Run.

River Segment	WBID	Station(s)	# of Samples	# of Exceedances	# Required to Verify Impairment	Impaired
Upper Wekiva	2956	BWB	26	0	5	No
Lower Wekiva	2956A	BWC	20	0	5	No
Rock Springs	2967	BWA, BWAA	28	1	6	No

Calculation of Necessary Reductions

Methods

With total coliform impairment verified for the Wekiva River and Rock Springs Run, SJRWMD calculated necessary reductions to meet state water quality standards. These calculations were based on methods used by the United States Environmental Protection Agency (EPA) and FDEP to develop TMDLs for coliforms. Reductions proposed by SJRWMD will guide FDEP in their development of TMDLs.

Coliform TMDLs have been based on flow-duration and load-duration curves (FDEP, 2004; USEPA, 2003). This approach requires flow data for stations at which coliform data was collected for all sampling dates. Flow data were not available for all water monitoring stations used in this impairment analysis, so this approach was not used.

Another approach to coliform TMDLs, the percent-reduction method (USEPA, 2005a), calculates the percentage by which the measured exceedance value has to be decreased in order to meet the water quality standard. This value is calculated based on the following equation:

Percent Reduction = [(existing concentration-criterion)/existing concentration] * 100

Using the water quality criterion of 2,400 counts /100ml for total coliforms, the necessary reduction percentage is calculated for each exceedance value. The median of all percentages is the necessary reduction for coliforms. Because only those values that constitute exceedances of the applicable water quality standard are used in the calculation, a margin of safety is implied with this methodology (implicit margin of safety).

SJRWMD chose the percent-reduction approach for this analysis because it provides a straightforward way of estimating necessary reductions with relatively small data sets. The percent-reduction method provides a concentration reduction, not a load reduction. Total coliform load reductions cannot be calculated for the Wekiva River and Rock Springs Run at this time because there is not sufficient flow data to estimate coliform loads.

Proposed Reductions in Total Coliforms

Tables 4 through 6 show the results of the percent-reduction method to calculate necessary concentration reductions of total coliforms for Wekiva River and Rock Springs Run. Table 7 summarizes these proposed reductions.

Table 4: Calculation of total coliform reduction for Upper Wekiva River (WBID 2956). All data is from station BWB.

Date	Measured Exceedance Value (CFU/100ml)	% Reduction to Meet Criterion
3/23/98	4100	41.46
11/16/99	2400	0.00
8/15/01	4700	48.94
12/12/01	2500	4.00
4/9/02	5400	55.56
7/18/02	5100	52.94
10/24/02	8600	72.09
1/13/03	4600	47.83
4/7/03	6100	60.66
10/13/03	4000	40.00
	Median:	**48.38**

Table 5: Calculation of total coliform reduction for Lower Wekiva River (WBID 2956A). All data is from station BWC.

Date	Measured Exceedance Value (CFU/100ml)	% Reduction to Meet Criterion
10/28/97	4300	44.19
3/23/98	2800	14.29
11/16/99	3100	22.58
6/13/01	3400	29.41
8/15/01	8200	70.73
12/12/01	16700	85.63
1/14/02	3900	38.46
4/9/02	3000	20.00
7/18/02	3400	29.41
	Median:	**29.41**

Table 6: Calculation of total coliform reduction for Rock Springs Run (WBID 2967).

Date	Station	Measured Exceedance Value (CFU/100ml)	% Reduction to Meet Criterion
10/28/97	BWA	5750	58.26
7/26/99	BWA	3800	36.84
3/2/00	BWA	2900	17.24
6/13/01	BWA	5000	52.00
8/15/01	BWA	16700	85.63
12/12/01	BWA	13000	81.54
4/7/03	BWA	3700	35.14
8/15/01	BWAA	3500	31.43
1/14/02	BWAA	4600	47.83
4/10/02	BWAA	2800	14.29
7/18/02	BWAA	8000	70.00
10/24/02	BWAA	8700	72.41
		Median Value:	**49.91**

Table 7: Proposed total coliform reductions for Upper Wekiva River, Lower Wekiva River, and Rock Springs Run

River Segment	WBID	Proposed Total Coliform Reduction
Upper Wekiva	2956	49%
Lower Wekiva	2956A	30%
Rock Springs	2967	50%

Summary and Conclusions

The Wekiva River and Rock Springs Run are verified as impaired for total coliform bacteria based on analysis of the most recent coliform data collected by Orange County according to criteria in Florida's Impaired Waters Rule (Florida Administrative Code Section 62-302.530). Since 1997, the upstream segment of the Wekiva River has exceeded the 2,400 counts / 100 ml criterion 40% of the time, the downstream segment exceeded 45% of the time, and Rocks Springs Run exceeded 43% of the time. Additionally, the swim area in Kelly Park at the headwaters of Rock Springs Run was closed five times between 2000 and 2005 by the Orange County Department of Health because of exceedance of coliform standards (Michael Kempton - Site Supervisor, personal communication).

Concentration reductions for total coliform bacteria were calculated using the percent-reduction method used by EPA (USEPA 2005a, and USEPA 2005b). Based on this, the proposed concentration reduction for total coliforms is 49% for the Upper Wekiva River, 30% for the Lower Wekiva River, and 50% for Rock Springs Run.

Based on the data used in this analysis Wekiva River and Rock Springs Run are not impaired for fecal coliform bacteria.

References

FDEP. 2004. TMDL Report: Fecal and Total Coliform TMDL for Blackwater Creek, WBID 1482. Florida Dept. of Environmental Protection Technical Report, City, State. v, 27 pp.

USEPA . 2005a. Total Maximum Daily Load (TMDL) for Fecal Coliform in Brooker Creek and Total Coliform in Roosevelt Basin: Channel 2. Technical Report. U.S. Environmental Protection Agency, Region 4, Atlanta, GA. vi, 21 pp, A-4.

USEPA . 2005b. Total Maximum Daily Load (TMDL) for Fecal and Total Coliform in Upper and Lower St. Johns River Basin (WBIDs 2630A, 2326, 2322, 2252, 2224, 2567B and 2967). U.S. Environmental Protection Agency, Region 4, Atlanta, GA. vi, 25 pp, B-4.

USEPA. 2003. Proposed Total Maximum Daily Load Development for the Ochlocknee and St. Marks River Basins, Florida – Nutrients, DO, BOD, Fecal Coliform, Total Coliform, Turbidity, and TS. Technical Report. U.S. Environmental Protection Agency, Region 4, Atlanta, GA. vii, 54 pp.

Appendix A - Total Coliform Data Used in This Analysis

Total Coliform data for stations BWA/BWAA, Rock Springs Run at Camp Joy Baptist Church

Date	Station	Total Coliforms (CFU/ 100 ml)	Exceedance*	Source
8/21/97	BWA	B10150	Excl	Orange County
10/28/97	BWA	5750	Yes	Orange County
3/23/98	BWA	2200	No	Orange County
6/22/98	BWA	B1400	Excl	Orange County
9/28/98	BWA	7400J	Excl	Orange County
2/17/99	BWA	690	Avg	Orange County
2/17/99	BWA	690	No	Orange County
4/26/99	BWA	B1630	Excl	Orange County
4/26/99	BWA	1630	No	Orange County
7/26/99	BWA	3,800	Avg	Orange County
7/26/99	BWA	3800	Yes	Orange County
11/16/99	BWA	B1900	Excl	Orange County
11/16/99	BWA	1900	No	Orange County
3/2/00	BWA	2900	Yes	Orange County
6/22/00	BWA	2200	No	Orange County
11/28/00	BWA	2100	No	Orange County
2/12/01	BWA	2300	No	Orange County
6/13/01	BWA	5000	Yes	Orange County
8/15/01	BWA	16700	Yes	Orange County
12/12/01	BWA	13000	Yes	Orange County
4/7/03	BWA	3700	Yes	Orange County
6/13/01	BWAA	2000	No	Orange County
8/15/01	BWAA	3500	Yes	Orange County
1/14/02	BWAA	4600	Yes	Orange County
4/10/02	BWAA	2800	Yes	Orange County
7/18/02	BWAA	8000	Yes	Orange County
10/24/02	BWAA	8700	Yes	Orange County
1/13/03	BWAA	330	No	Orange County
7/29/03	BWAA	210	No	Orange County
10/13/03	BWAA	250	No	Orange County
1/12/04	BWAA	160	No	Orange County
4/21/04	BWAA	7900J3	Excl	Orange County
7/12/04	BWAA	240	No	Orange County
10/11/04	BWAA	680	No	Orange County
1/6/05	BWAA	230	No	Orange County
4/7/05	BWAA	110	No	Orange County

Total Coliform data for station BWB, Wekiva River at Wekiva Marina

Date	Total Coliforms (CFU/ 100 ml)	Exceedance *	Source
8/21/97	B1800	Excl	Orange County
8/21/97	B22	Excl	Orange County
10/28/97	108	No	Orange County
10/28/97	202	Avg	Orange County
3/23/98	4100	Yes	Orange County
3/23/98	B20	Excl	Orange County
6/22/98	69	No	Orange County
6/23/98	B32	Excl	Orange County
6/24/98	3900	Avg	Orange County
9/28/98	L800J	Excl	Orange County
9/28/98	46J	Excl	Orange County
2/17/99	400	Avg	Orange County
2/17/99	B30	Excl	Orange County
2/17/99	400	No	Orange County
4/26/99	74	Avg	Orange County
4/26/99	B14	Excl	Orange County
4/27/99	74	No	Orange County
7/26/99	1,040	Avg	Orange County
7/26/99	1040	No	Orange County
7/27/99	B18	Excl	Orange County
8/23/99	300	No	Orange County
11/16/99	2400	Yes	Orange County
11/16/99	B6	Excl	Orange County
11/16/99	2400	Avg	Orange County
3/2/00	300	No	Orange County
6/22/00	470	No	Orange County
11/28/00	2000	No	Orange County
2/12/01	340	No	Orange County
6/13/01	1100	No	Orange County
8/15/01	4700	Yes	Orange County
12/12/01	2500	Yes	Orange County
4/9/02	5400	Yes	Orange County
7/18/02	5100	Yes	Orange County
10/24/02	8600	Yes	Orange County
1/13/03	4600	Yes	Orange County
4/7/03	6100	Yes	Orange County
7/29/03	42	No	Orange County
10/13/03	4000	Yes	Orange County
1/12/04	660	No	Orange County
4/21/04	1180	No	Orange County
7/12/04	810	No	Orange County
1/6/05	8600J3	Excl	Orange County
4/7/05	11400J3	Excl	Orange County

Total Coliform data for station BWC, Wekiva River at SR 46

Date	Total Coliforms (CFU/ 100 ml)	Exceedance *	Source
8/21/97	B1400	No	Orange County
10/28/97	4300	Yes	Orange County
3/23/98	2800	YES	Orange County
6/22/98	B30	Avg	Orange County
6/23/98	B30	No	Orange County
9/28/98	L800J	No	Orange County
2/17/99	B180	Avg	Orange County
2/17/99	180	No	Orange County
4/26/99	B830	Avg	Orange County
4/26/99	830	No	Orange County
7/26/99	B244	Avg	Orange County
7/26/99	244	No	Orange County
8/23/99	20	No	Orange County
11/16/99	3100	Avg	Orange County
11/16/99	3100	Yes	Orange County
3/2/00	2200	No	Orange County
6/22/00	500	No	Orange County
11/28/00	1500	No	Orange County
2/12/01	280	No	Orange County
6/13/01	3400	Yes	Orange County
8/15/01	8200	Yes	Orange County
12/12/01	16700	Yes	Orange County
1/14/02	3900	Yes	Orange County
4/9/02	3000	Yes	Orange County
7/18/02	3400	Yes	Orange County
1/6/05	9800J3	Excl	Orange County
4/7/05	10100J3	Excl	Orange County

* Data marked 'Avg' were taken within 7 days of another sample. In this case the values were averaged and if the averaged values exceeded the standard, one of the data points was counted as an exceedance. Data marked 'Excl' were excluded from the analysis because the qualifier next to the data value indicated that this data was not reliable.

Appendix B – Fecal Coliform Data Used in This Analysis

Fecal Coliform data for stations BWA/BWAA, Rock Springs Run at Camp Joy Baptist Church

Date	Station	Fecal Coliforms (CFU/ 100 ml)	Exceedance *	Source
8/21/97	BWA	L600	Excl	Orange County
10/28/97	BWA	B630	Excl	Orange County
3/23/98	BWA	B190	Excl	Orange County
6/22/98	BWA	74	No	Orange County
9/28/98	BWA	360	No	Orange County
2/17/99	BWA	80	Avg	Orange County
2/17/99	BWA	80	No	Orange County
4/26/99	BWA	B240	Excl	Orange County
4/26/99	BWA	240	No	Orange County
7/26/99	BWA	B730	Excl	Orange County
7/26/99	BWA	730	No	Orange County
11/16/99	BWA	220	Avg	Orange County
11/16/99	BWA	220	No	Orange County
3/2/00	BWA	100	No	Orange County
6/22/00	BWA	282	No	Orange County
11/28/00	BWA	440	No	Orange County
2/12/01	BWA	272	No	Orange County
6/13/01	BWA	360	No	Orange County
8/15/01	BWA	910	Yes	Orange County
12/12/01	BWA	340	No	Orange County
4/7/03	BWA	116	No	Orange County
6/13/01	BWAA	172	No	Orange County
8/15/01	BWAA	210	No	Orange County
1/14/02	BWAA	60	No	Orange County
4/10/02	BWAA	60	No	Orange County
7/18/02	BWAA	100	No	Orange County
10/24/02	BWAA	126	No	Orange County
1/13/03	BWAA	30	No	Orange County
7/29/03	BWAA	52	No	Orange County
10/13/03	BWAA	40	No	Orange County
1/12/04	BWAA	24	No	Orange County
4/21/04	BWAA	104J3	Excl	Orange County
7/12/04	BWAA	50	No	Orange County
10/11/04	BWAA	110	No	Orange County
1/6/05	BWAA	50	No	Orange County
4/7/05	BWAA	10	No	Orange County

Fecal Coliform data for station BWC, Wekiva River at SR 46

Date	Fecal Coliforms (CFU/ 100 ml)	Exceedance *	Source
8/21/97	B190	Excl	Orange County
8/21/97	K2	Excl	Orange County
10/28/97	78	No	Orange County
10/28/97	K2	Excl	Orange County
3/23/98	B80	Excl	Orange County
3/23/98	K2	Excl	Orange County
6/22/98	B27	Excl	Orange County
6/23/98	B2	Excl	Orange County
6/24/98	64	Avg	Orange County
9/28/98	220	No	Orange County
9/28/98	K2	Excl	Orange County
2/17/99	113	Avg	Orange County
2/17/99	K2	Excl	Orange County
2/17/99	113	No	Orange County
4/26/99	B24	Avg	Orange County
4/26/99	K2	Excl	Orange County
4/27/99	24	No	Orange County
7/26/99	B122	Avg	Orange County
7/26/99	122	No	Orange County
7/27/99	B4	Excl	Orange County
8/23/99	120	No	Orange County
11/16/99	44	No	Orange County
11/16/99	K2	Excl	Orange County
11/16/99	44	Avg	Orange County
3/2/00	54	No	Orange County
6/22/00	88	No	Orange County
11/28/00	120	No	Orange County
2/12/01	170	No	Orange County
6/13/01	54	No	Orange County
8/15/01	92	No	Orange County
12/12/01	106	No	Orange County
4/9/02	10	No	Orange County
7/18/02	40	No	Orange County
10/24/02	2	No	Orange County
1/13/03	150	No	Orange County
4/7/03	12	No	Orange County
7/29/03	24	No	Orange County
10/13/03	190	No	Orange County
1/12/04	70	No	Orange County
4/21/04	2	No	Orange County
7/12/04	20	No	Orange County
1/6/05	60	No	Orange County
4/7/05	42	No	Orange County

Fecal Coliform data for station BWC, Wekiva River at SR 46

Date	Fecal Coliforms (CFU/100 ml)	Exceedance *	Source
8/21/97	B120	Excl	Orange County
10/28/97	200	No	Orange County
3/23/98	B40	Excl	Orange County
6/22/98	B22	Excl	Orange County
6/23/98	B22	Excl	Orange County
9/28/98	B50	Excl	Orange County
2/17/99	52	Avg	Orange County
2/17/99	52	No	Orange County
4/26/99	84	Avg	Orange County
4/26/99	84	No	Orange County
7/26/99	B296	Excl	Orange County
7/26/99	296	No	Orange County
8/23/99	28	No	Orange County
11/16/99	B164	Excl	Orange County
11/16/99	164	No	Orange County
3/2/00	10	No	Orange County
6/22/00	28	No	Orange County
11/28/00	30	No	Orange County
2/12/01	46	No	Orange County
6/13/01	102	No	Orange County
8/15/01	180	No	Orange County
12/12/01	74	No	Orange County
1/14/02	136	No	Orange County
4/9/02	8	No	Orange County
7/18/02	66	No	Orange County
1/6/05	60	No	Orange County
4/7/05	26	No	Orange County

* Data marked 'Avg' were taken within 7 days of another sample. In this case the values were averaged and if the averaged values exceeded the standard, one of the data points was counted as an exceedance. Data marked 'Excl' were excluded from the analysis because the qualifier next to the data value indicated that this data was not reliable.

APPENDIX G

Total Phosphorus Thresholds and Concentration Targets for Growth of Cyanobacteria and Chlorophyta in the Attached Algal Community

Additional Analysis of Greenwater Labs Data

Effects of Total Phosphorus on Attached Algal Community Composition in the Wekiva River System and Application to PLRG Development

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January, 2006

INTRODUCTION

The St. Johns River Water Management District (SJRWMD) is developing Pollution Load Reduction Goals (PLRGs) for the Wekiva River and its largest upstream tributary, Rock Springs Run, to fulfill the requirements of the Wekiva Parkway and Protection Act of 2004. The Act specified that the focus should be on nitrogen, due to the identified nitrate enrichment in Wekiwa and Rock Springs (Osburn et al., 2002; FDEP, 2000). However it is well-known that phosphorus is a major limiting nutrient in freshwater ecosystems. Recent analyses indicated that phosphorus was the key growth-limiting nutrient for algae at 15 out of 27 (56%) spring systems in Florida (Stevenson et al. 2004). Therefore, SJRWMD is examining the role of phosphorus as a pollutant in the Wekiva River and Rock Springs Run.

Of the many taxa of algae found in Florida spring and spring-run ecosystems, the Cyanobacteria (blue-green algae) and Chlorophyta (green algae) are of greatest concern, because it has been well-established that under conditions of increased nutrient loading, these plants can form large blooms and mats which cause a variety of ecological problems (Lembi, 2003; Keenan et al., 2003). These include reductions in the nutritional quality of the algal community for herbivores, depressed dissolved oxygen levels, and production of toxins. It has likewise been well established that phosphorus appears to be a key limiting nutrient for cyanobacterial production (Brönmark and Hansson, 1998). Based on this, the best available existing data were used to examine phosphorus and biovolume of attached algal in the Wekiva River and Rock Springs Run. This analysis will be used to help develop a phosphorus target concentration as part of the PLRG development process.

METHODS

GreenWater Labs (2005) collected attached algae from selected substrata (aquatic plants, wood, rock) at 15 stations in the Wekiva River and 9 stations in Rock Springs Run (Appendix C). Concurrent water chemistry data were collected with these algae samples. Sampling was conducted in December 2004/January 2005 (“winter”) and

June 2005 ("summer"). Measurements of the algal community included chlorophyll a, cell density, biovolume, and ash-free dry weight (AFDW) biomass.

Proportion of various major algal groups (Division or Class) was determined by GreenWater Labs from biovolume measurements. Correlation between percent Cyanobacteria and Chlorophyta biovolume and total phosphorus (TP) concentration were examined using Pearson's Product-Moment coefficient. Examination of graphical data indicated one apparent outlier value (Figure 1) that was excluded from the statistical analysis.

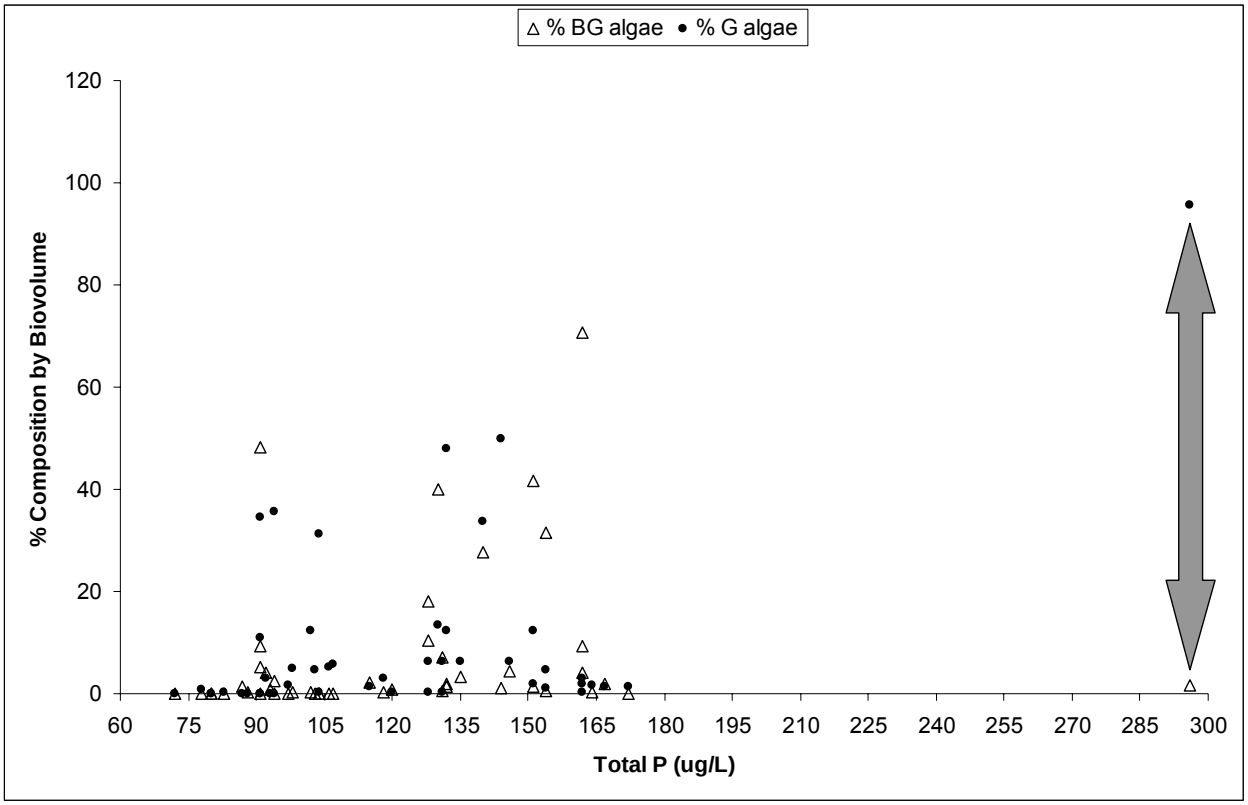

Figure 1. Percent Cyanobacteria (="%BG algae") and Chlorophyta (="%G algae") biovolume in the attached algal communities in the Wekiva River and Rock Springs Run vs. total phosphorus concentration. The outlier data points indicated with the arrow were excluded from statistical analyses.

There was a statistically significant positive correlation between TP concentration and the % biovolume of Cyanobacteria in the attached algal community (Pearson correlation coefficient=0.303; p=0.038), but no significant correlation with % biovolume Chlorophyta. Figure 2 shows the relationships for both algal groups.

Substantial increases in the proportion of Cyanobacteria and Chlorophyta in the attached algal community appear to occur above a threshold TP concentration of about

90 µg/L (0.09 mg/L; Figure 2). This is similar to that observed for the Upper St. Johns River Basin (USJRB) based on increases in the proportion of Cyanobacteria (Keenan et al. 2003). That analysis used phytoplankton data from the USJRB lakes, but it appears this threshold may also apply to periphyton as well. Low proportions of cyanobacteria and chlorophyta in the attached algal community are also associated with higher TP values, but the high proportion values only occur above 90 µg/L, as was observed in the USJRB.

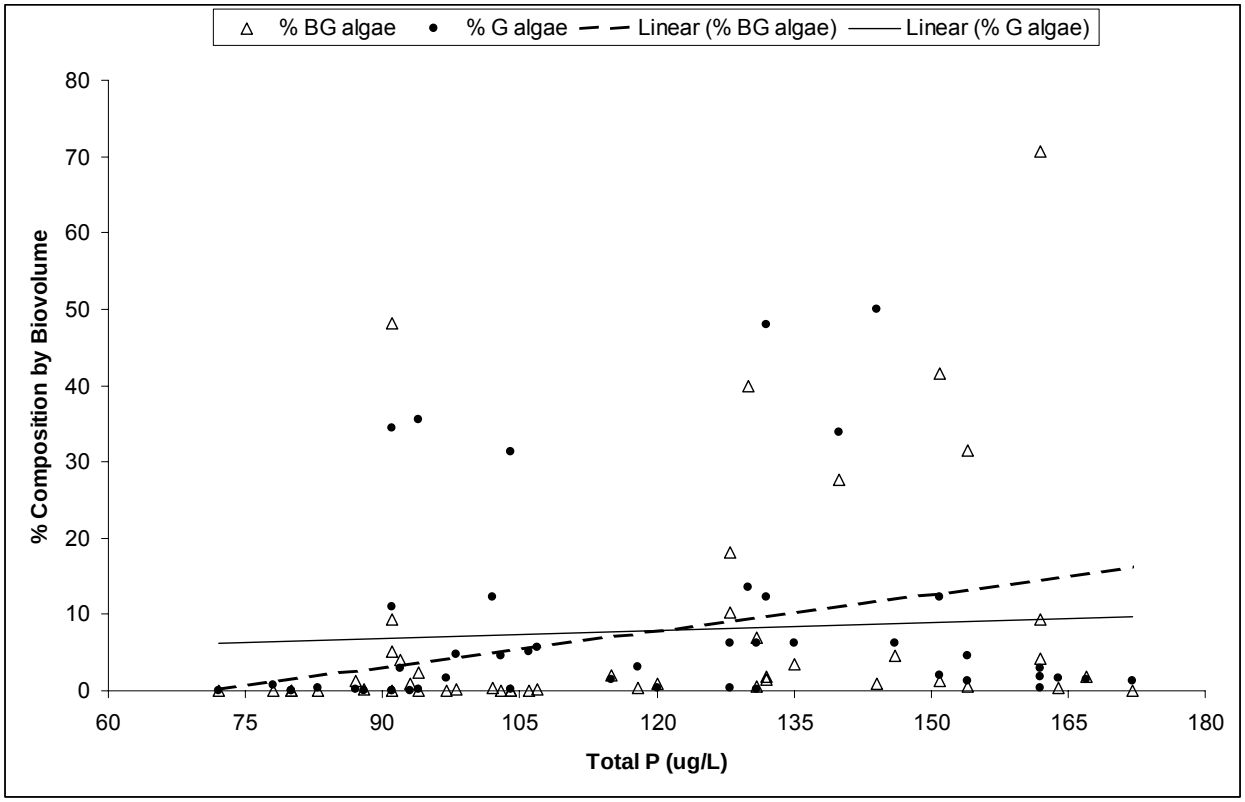

Figure 2. Percent Cyanobacteria (”%BG algae”) and Chlorophyta (”%G algae”) biovolume in the attached algal community in the Wekiva River and Rock Springs Run versus total phosphorus concentration.

DEVELOPMENT OF PHOSPHORUS CONCENTRATION TARGET

TP data for the Wekiva River and Rock Springs Run approximate a normal distribution, so a statistical procedure was used to calculate a new population mean concentration for TP in the Wekiva River and Rock Springs Run that would have a small probability of exceeding this 90 µg/l threshold (based on the existing variability in the data) for growth of Cyanobacteria and Chlorophyta in the attached algal community.

Because TP in both of these spring-run streams were shown to have a statistically significant decreasing temporal trend, a “current condition” dataset was used for this

analysis that consisted of the largest and most recent data that showed no significantly significant temporal trend. For both the Wekiva River and Rock Springs Run, the current condition data began in 1985 and was normally distributed.

From an ecologically conservative standpoint, TP concentrations in the Wekiva River and Rock Spring Run should remain at or below 90 µg/L 90% of the time in order to prevent excessive growth of cyanobacteria and chlorophyta in the attached algal community. Using this as a starting point, a mean TP concentration can be calculated based on a probability of 90% that a randomly collected water sample will have a TP concentration at or less than the 90 µg/L threshold. To determine this new mean TP concentration, the equation developed is:

$$M + 1.29*S = 90\ \mu g/l \qquad \text{eq. (1)}$$

M is the new (= target) mean TP concentration and S is the standard deviation of the new TP data population. 1.29 is the "Z score" (normal deviate for a one-tailed proportion of the normal curve), obtained from standard tables found in most statistical texts. This equation satisfies the criteria that 90% of the samples in the new population will have TP concentrations at or less than 90 µg/l. By solving this equation a new mean (target) TP concentration (M) can be calculated. Since S is also unknown, S is substituted with CV*M in the equation:

$$M + (1.29)(CV*M) = 90\ \mu g/l \qquad \text{eq. (2)}$$

CV is the Coefficient of Variation of the existing data set (the data set we are using). It is assumed the CV value is equivalent for both the existing and new population of data.

<u>Wekiva River</u>. CV = 0.40 from the existing data set. For a normally distributed population, the probability of getting a value between (Mean – 1.29*S) and (Mean + 1.29*S) is 80%. However, the probability of getting a value that is at or less than (Mean + 1.29*S) is 90%. By substituting CV = 0.40 to eq. (2) and solving for M, the new target mean TP concentration for the Wekiva River is:

$$M + (1.29)(0.40*M) = 90\ \mu g/l$$
$$M = 59\ \mu g/l$$

<u>Rock Springs Run</u>. The new mean TP concentration is determined in the same way:

$$M + (1.29)(CV*M) = 90\ \mu g/l \qquad \text{eq. (3)}$$
$$M + (1.29)(0.37*M) = 90$$
$$\text{Mean} = 61\ \mu g/l$$

Where:

Mean is the new population mean
CV is the Coefficient of Variation (= 0.37)
1.29 is the Z value from the Normal distribution table (one-tailed).

CONCLUSION

Based on this statistical analysis, the mean target concentrations that should result in TP remaining at or below the observed algal-growth threshold of 90 µg/l 90% of the time are:

Wekiva River	59 µg/L
Rock Springs Run	61 µg/L

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APPENDIX H

Analysis of Periphyton and Nitrate Levels in the Suwannee River

Excerpted from:

Hornsby, D., R. A. Mattson, and T. Mirti. 2000. Surfacewater Quality and Biological Monitoring. Annual Report. 1999. Suwannee River Water Management District Technical Report WR-00-04. iv, 148 pp pp. (.pdf file)

Surfacewater Quality and Biological Monitoring Annual Report 1999

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WR-00-04

Surfacewater Quality and Biological
Annual Report
1999

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Introduction

An ambient surfacewater quality monitoring network was established in 1989 to determine the water quality status of the Surface Water Improvement and Management (SWIM) priority water bodies within Suwannee River Water Management District (SRWMD). It also serves as an early warning system to identify changing conditions in water quality.

The network provides water quality analysis based on water chemistry and aquatic biological samples. The information collected is used to identify seasonal variations and long-term trends in water quality and to help determine if land use practices affect water quality and aquatic communities.

The network includes a total of 81 stations for baseline water chemistry sampling (Figure 1). The network is sampled in the following manner: 81 stations for water chemistry, 21 stations for aquatic biology, and 25 stations for bacteria (Table 3). Table 4 shows the parameter list for the network.

Report Format

This report contains a graphical presentation of six water chemistry and four biological parameters, offering a brief, yet useful, indication of river, stream, and lake conditions. Data collected for water years 1998 and 1999 are presented. A water year is from October through September (i.e., water year 1999 is from October 1998 through September 1999). The period of record used for the determination of the percentiles are water years 1989 to 1994 (see Statistical Summary of Surfacewater Quality for Water Years 1989 to 1994 [WR-95-03]).

Section one of this report is divided into five basins: Aucilla River, Coastal Rivers, Santa Fe River, Suwannee River, and Waccasassa River, and presents data for rivers and streams. Section two presents data of springs which were sampled during water year 1999.

Water quality conditions for each water body are qualitatively summarized with a rating of good, fair, and poor based on water chemistry conditions. While the rating system provides a quick way of determining the general status of a water body, a more complete understanding of actual conditions is available by examining the data presented in the report.

Each water body is given an SRWMD water quality rating and DEP 305(b) water quality rating of Good, Fair, or Poor. Both water quality ratings are presented as an aid in evaluating the condition of each water body. When there is a difference between the SRWMD water quality rating and the DEP 305(b) rating, an explanation is given under the comment section of the individual water body information sheet. A poor or fair rating does not mean the water is unfit for human contact (swimming).

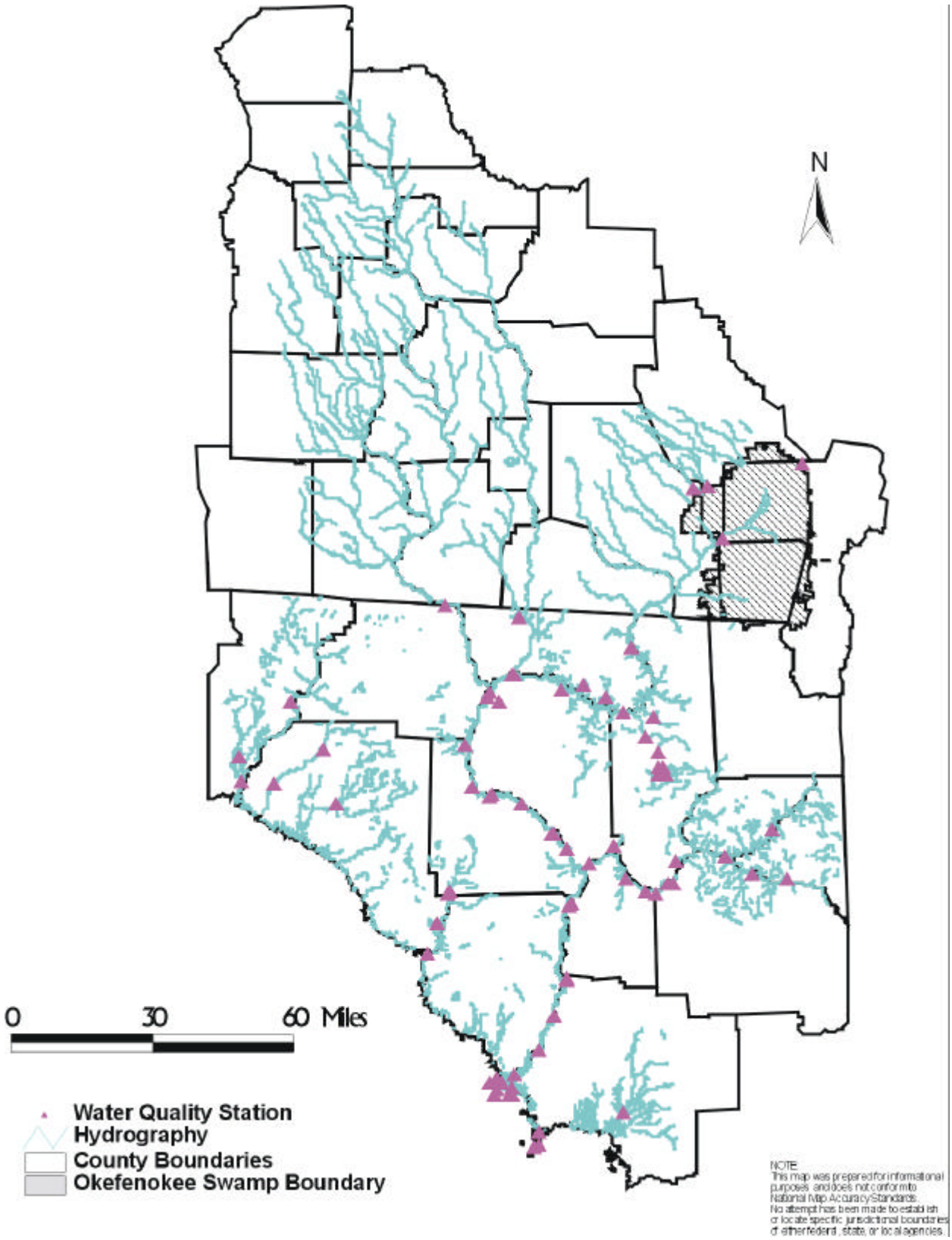


Figure 1. SRWMD surfacewater quality monitoring network.

The report uses percentiles, rather than averages, to more accurately account for changes in water quality due to variations in rainfall, the change of seasons, and the influences of land uses in and around cities, farms, industries, and homes.

The dotted line represents the 25 th percentile for the period of record. The broken line represents the 75 th percentile for the period of record. Thus, 50% of the data for the period of record falls between the 25 th and 75 th percentiles.

The 75 th percentile represents the highest limit of what we "normally" would expect to observe. The 25 th percentile represents the lowest limit of the "normal" range. When parameters fall outside these limits, explanations are given under the comments section.

The data in this report is displayed graphically. ***Line graphs*** are used to display water chemistry data that was collected monthly. ***Point graphs*** are used to display water chemistry data that was collected bimonthly (or six times). ***Bar graphs*** are used to display new water chemistry station(s) and biological data which is collected quarterly.

Surfacewater Quality Parameters

Chemistry

Specific Conductance (Conductivity)

Conductivity is a measure of water's ability to conduct electrical current. Conductivity is measured in units of micromhos cm^{-1} (µmhos cm^{-1}) and is related to the amount of dissolved salts (ions) in the water. The SRWMD's surface waters, with generally low concentrations of dissolved salts, have lower conductivity. Ground water from the Floridan aquifer system has relatively high concentrations of dissolved salts. As ground water enters the system via springs and seeps, the conductivity of surface water increases. It may also suggest the presence of point source discharges in surface water, due to the dissolved solids in the effluent.

pH

pH is a measure of the acidity or alkalinity of water. The pH scale is 0 to 6.99 acidic, 7 neutral, and 7.01 to 14 basic. Aquatic life is greatly affected when the pH is below 3 or above 11.

Surface waters are generally acidic (i.e., pH less than 7) due to rainfall and organic acids, which are by-products of organic decomposition. In a natural system, pH rarely goes below 3 or above 11.

Dissolved Oxygen (DO)

Dissolved oxygen is a measurement of the concentration of oxygen (O_2) contained in water. The unit used for DO measurement is mg L^{-1}.

The two sources of oxygen are the atmosphere and photosynthesis by aquatic plants. Most aquatic life requires DO in the water for survival, and most biological communities

need at least five milligrams per liter (5 mg L^{-1}) to support healthy communities. However, dissolved oxygen of less than 5 mg L^{-1} does occur naturally in the environment.

Swamp environments can have DO concentration less than 5 mg L^{-1}. Ground water also has a low concentration of DO due to the lack of interaction with the atmosphere. Therefore, when surface waters are fed by ground water from springs, the result may be localized areas where DO concentration is less than 5 mg L^{-1}.

Color

Color is a physical measurement of the lightness and darkness of the water. Color is measured in platinum-cobalt units (PCU). Natural color in water is a result of dissolved organic compounds such as humic and tannic acids. The color of the water affects how much sunlight (needed for aquatic plant photosynthesis) can penetrate into the water. The darker the water, the less light is able to penetrate.

Nitrate-Nitrogen (Nitrate plus Nitrite-Nitrogen [NO_3+NO_2-N])

Nitrate-nitrogen is a nutrient required by aquatic organisms for growth and reproduction. Concentration of nitrates is expressed as mg of nitrogen per liter of water (mg of N L^{-1}). High concentrations of nitrates may create an imbalance in a natural surfacewater system, causing algal blooms or other adverse effects. Nitrate-nitrogen concentrations that exceed the drinking water standard (10 mg of N L^{-1}) can result in methemoglobinemia or "blue baby" disease in infants.

Total Phosphorus (TP)

Phosphorus is a nutrient needed by aquatic organisms for growth and reproduction. As with nitrates, too much phosphorus in water can adversely impact the natural system. Total phosphorus is a measure of the concentration of all forms of phosphorus in water, and is expressed as mg phosphorus L^{-1} of water (mg of P L^{-1}).

Biology

An important part of the SRWMD's surfacewater monitoring program is sampling of different types of aquatic fauna and flora to evaluate the biological integrity or "health" of our lakes and rivers. Both nationally and at a state level, it is now recognized that an effective surfacewater quality monitoring program must consist of both water chemistry and biological sampling to get a true picture of "water quality."

In the SRWMD's monitoring program, two groups of aquatic organisms are sampled: benthic invertebrates and algae. Benthic invertebrates are generally small, invertebrate animals which live on or in the bottom environment of a river or lake. "Benthic" refers to "bottom-dwelling." Examples of these animals are snails, clams, crayfish, aquatic insects, and aquatic worms. The algae sampled in the SRWMD's monitoring program are microscopic plants found in all rivers and lakes. In rivers, the SRWMD samples periphytic algae; those living attached to hard surfaces. In lakes, we sample phytoplankton; algae which live suspended and floating freely in the water column.

These two groups of aquatic organisms have been used for many years to assess water quality. The methods used to sample them are well-established. It has been shown scientifically that populations and communities of these organisms exhibit characteristic responses to various kinds of pollution stress.

DEFINITIONS OF BIOLOGICAL METRICS

The data from the aquatic biological sampling are presented as various numeric scores or "metrics," which are quantitative measures of the biological communities. An analogy to how these values describe biological "health" in surface waters is the various indices (or "metrics") which define the condition or health of the nation's economy. The Dow Jones Industrial Average, the Unemployment Index, and the Consumer Price Index ("index of inflation") are all numeric measures by which people assess the condition of the national economy. In a similar way the biological metrics presented in this report describe the status or health of the biological communities in our surface waters.

The metrics presented in this report are:

Benthic Invertebrate Taxa Richness - the total number of taxa (different kinds or species) of benthic invertebrates present. Higher numbers mean more taxa present, which generally reflects a healthier benthic invertebrate community.

Benthic Invertebrate Diversity - an index which describes the composition of the benthic invertebrate community in terms of the number of taxa present and the extent to which the community is dominated by few or many taxa. Higher numbers mean higher diversity in the invertebrate community; meaning that the community is composed of an even mix of many different taxa. Lower diversity means that fewer taxa are present or that the community is dominated by only one or a few taxa. Lower diversity is generally indicative of some type of human disturbance.

Benthic Invertebrate EPT Score - the number of taxa of mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera) present. Notice that "EPT" is the first letter of each of the group scientific names. These three aquatic insect groups generally indicate "clean water" conditions. Many of the taxa in these three groups are intolerant of water pollution. A higher score means more "EPT" organisms are present, indicating cleaner, less polluted water.

Periphytic Algal Taxa Richness - the total number of taxa (particular kinds or species) of periphytic (attached to underwater objects) algae present. Higher numbers mean more taxa present, generally indicative of better water quality.

Results and Discussions

Graphs showing summaries of the biological metrics for each of the active river biological monitoring sites are shown along with the respective water chemistry summaries. Note that at some sites (those on the Suwannee and Santa Fe), both invertebrates and algae are monitored, while at other sites (those on other rivers) only invertebrates are

monitored. In general, the biological data support the conclusions derived from the water chemistry data. Sampling sites which have fair water quality also tend to have lower scores for one or more biological metrics.

Metric scores for the river sampling sites generally fell within the “expected” range (between the 25th and 75th percentiles), or were better than expected (exceeded the 75th percentile), during 1999. Reduced scores in winter (samples from March) are usually seen and appear to be an expected seasonal occurrence caused by low temperatures, flooding, lower food availability, etc. In smaller streams such as the New River, Steinhatchee River, and Falling Creek, lower than expected scores (below the 25th percentile) in the spring or summer are probably due to low streamflows and more stagnant water conditions, with fewer species of aquatic invertebrates able to tolerate these conditions. Metric scores for 1998 were similar to or lower than 1999 scores. Lower scores in the earlier part of 1998 were probably due to the high floods experienced that year. Overall, the rivers in the region continue to support diverse populations of benthic invertebrates and algae.

Alligator Lake benthic invertebrate data from two sampling sites are shown with the chemistry data for the lake. Sampling resumed on this lake in January 1997. Data from the 1998 and 1999 water years are shown. Benthic taxa richness and diversity were lower in the South Lake compared to the North Lake. The sampling site at the South Lake is unvegetated, while the North Lake has submerged vegetation cover in the form of the native plant coontail and the exotic plant hydrilla. This submerged vegetation provides additional habitat which may account for the higher invertebrate richness and diversity in the North Lake in 1998. No samples were collected in the entire lake in June 1999 and none in the North Lake in September 1999 due to the lake drying up via a sink hole (the South Lake had reflooded somewhat by September 1999, so that it could be sampled). Benthic invertebrate communities in Alligator Lake generally indicate fair water quality due the the lack of abundance of “clean-water” invertebrate taxa such as mayfly or caddisfly nymphs and the abundance of pollution tolerant taxa such as certain midges and oligochaete worms.

NITROGEN AND ALGAE IN THE SUWANNEE RIVER

Discussion in this and previous Annual Surfacewater reports have highlighted issues regarding increased loading of nitrogen as nitrate to the middle Suwannee River via groundwater inflow from springs. Work done by both the SRWMD and the U.S. Geological Survey (Ham and Hatzell, 1996) have indicated statistically significant increasing trends for nitrate-nitrogen concentrations in the middle Suwannee ("Reach 3"). Nitrate is a basic plant nutrient which can cause water quality problems by promoting the excessive or undesirable growth of algae in surface waters. In lakes, this is usually the growth of the microscopic floating algae (phytoplankton), leading to "green water." In rivers and springs, nitrate may promote excessive growth of larger, filamentous algae (Figure 2), which grow attached to rocks and other hard surfaces.

Analysis of the District's monitoring data indicate statistically significant relationships between nitrate-nitrogen and algal abundance. Figure 3 shows the correlation of mean nitrate-nitrogen concentrations versus mean periphyton biomass (a measure of standing crop or mass) using data from sampling sites in the Suwannee, Santa Fe, and Withlacoochee Rivers where these two variables have been measured concurrently. This graph and a correlation analyses indicate a statistically significant positive correlation between nitrate-nitrogen and periphyton biomass ($r = 0.84$; $P < 0.001$), indicating a strong association between nitrate-nitrogen levels and amounts of algal growth. There is also a significant positive correlation between mean algal density (# cells per square cm) and mean nitrate-nitrogen level at these same sampling sites (Figure 4: $r = 0.77$; $P < 0.01$), which supports the conclusion that nitrate-nitrogen is having an effect on algal growth in the Suwannee and other rivers.

There is very little historical data to compare with beyond 10 years ago, thus it is hard to make conclusions regarding trends in algal growth in the Suwannee over the past 20 years. Figure 5 shows periphyton biomass at two sites in the middle Suwannee: Suwannee River at Luraville and Suwannee River at Rock Bluff. Shown on these graphs is mean biomass from SRWMD monitoring (initiated in 1990) and similar data from a study conducted by the Florida Department of Environmental Protection in 1982-83 at these same locations. For the past five years, higher amounts of biomass are seen compared to earlier sampling intervals. The amount of variation in biomass also appears to have increased during this time; biomass fluctuates more, from high levels to very low levels. Increased variation in biological variables can be a sign of increasing pollution stress (National Research Council, 1986; Karr and Chu, 1997). Determining whether there is an increasing trend in periphyton biomass in the middle Suwannee will require continued monitoring.

These effects of the nitrate-nitrogen loading to the Suwannee River appear to be evident in the estuary of the river as well. Studies conducted for the SRWMD by the University of Florida (Phlips and Bledsoe 1999) have shown that nitrate-nitrogen is typically the nutrient which most limits algal growth in the estuary, and that there is a positive relationship between phytoplankton biomass (as indicated by the concentration of the

A. Branford Spring. Note algal growth on spring bed in background.

B. Algal mats on the Suwannee River near Fannin Springs.

Figure 2. Photographs of filamentous algae on the Suwannee River and in some of its springs this past year.

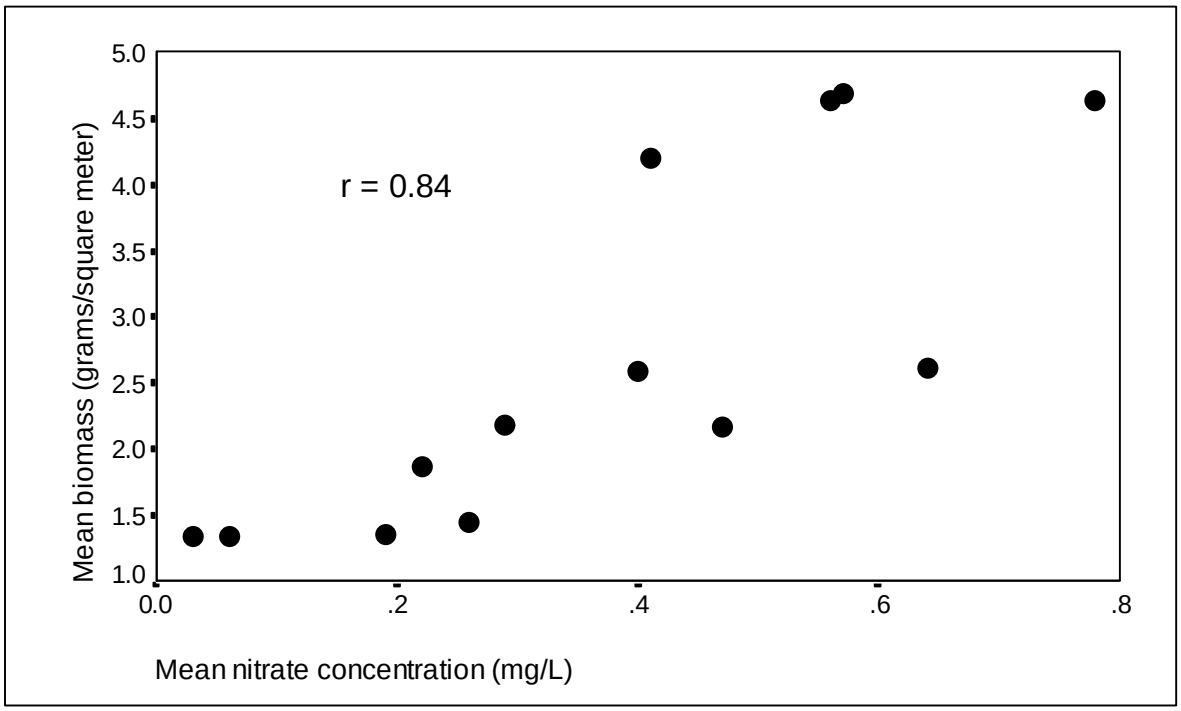


Figure 3. Graph showing relationship between mean nitrate-nitrogen concentration and mean periphyton biomass from sampling sites on the Suwannee, Santa Fe, and Withlacoochee Rivers.

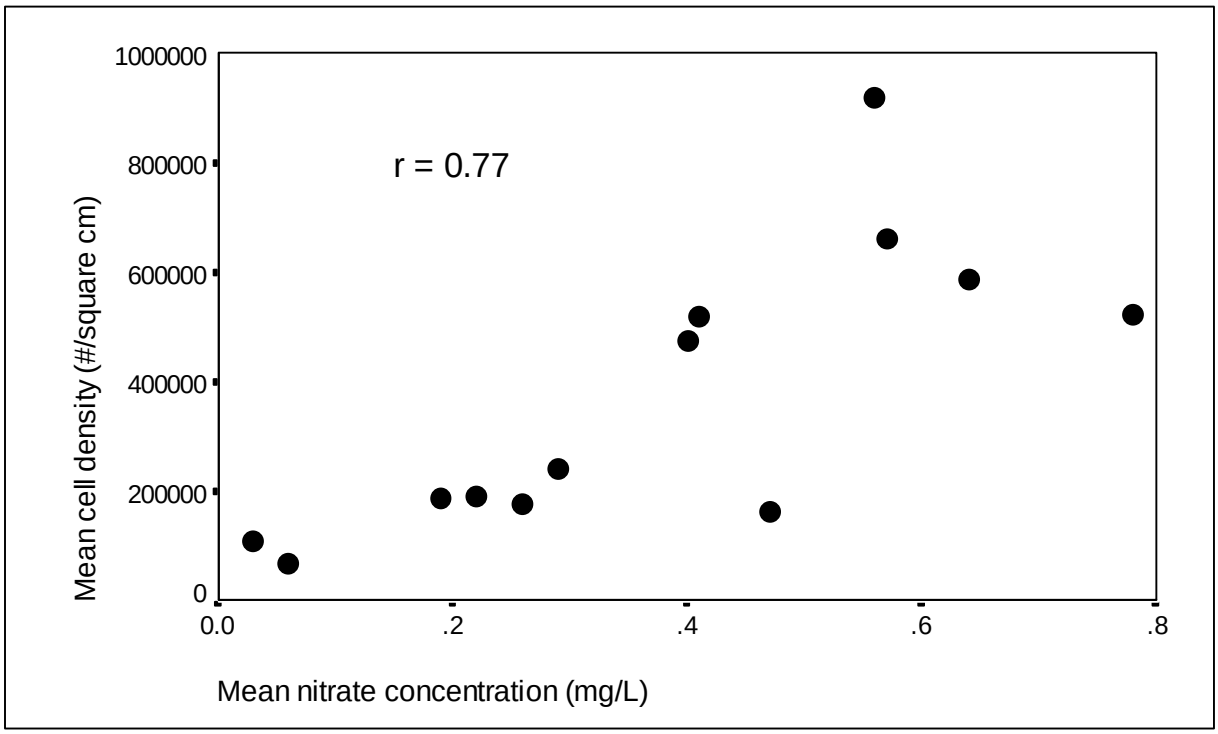
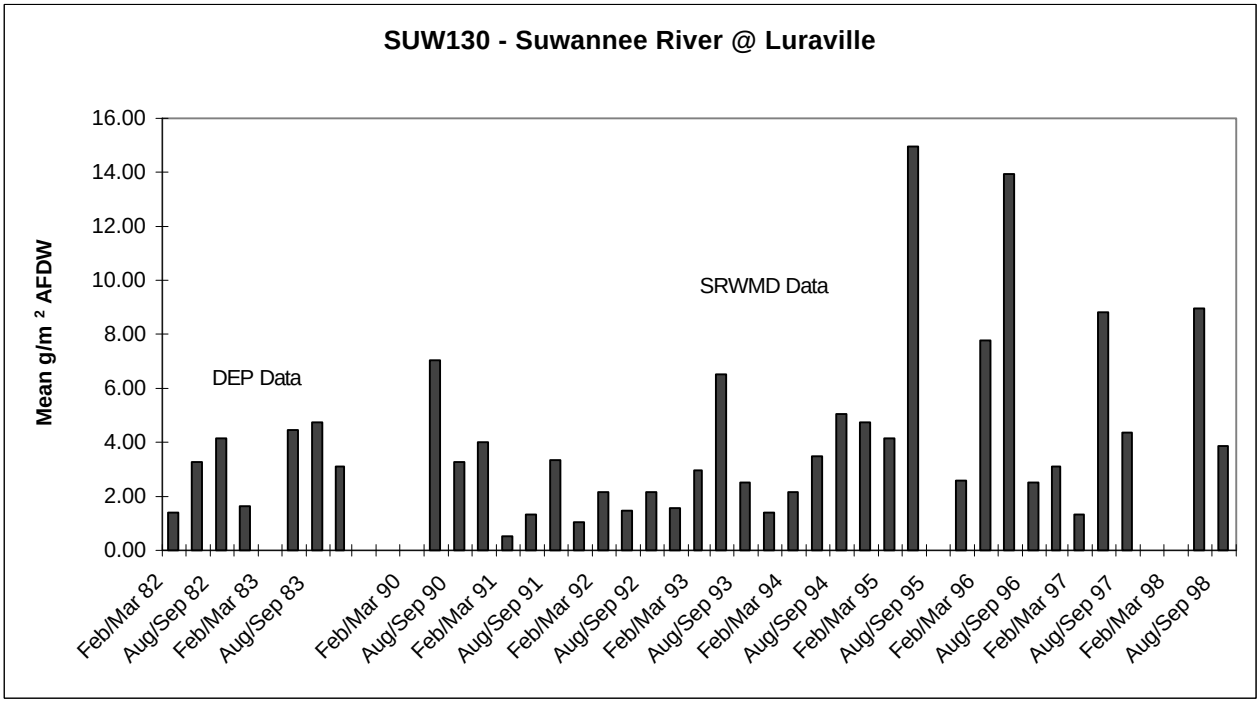


Figure 4. Graph showing relationship between mean nitrate-nitrogen concentration and mean periphyton algal cell density from sampling sites on the Suwannee, Santa Fe, and Withlacoochee Rivers.



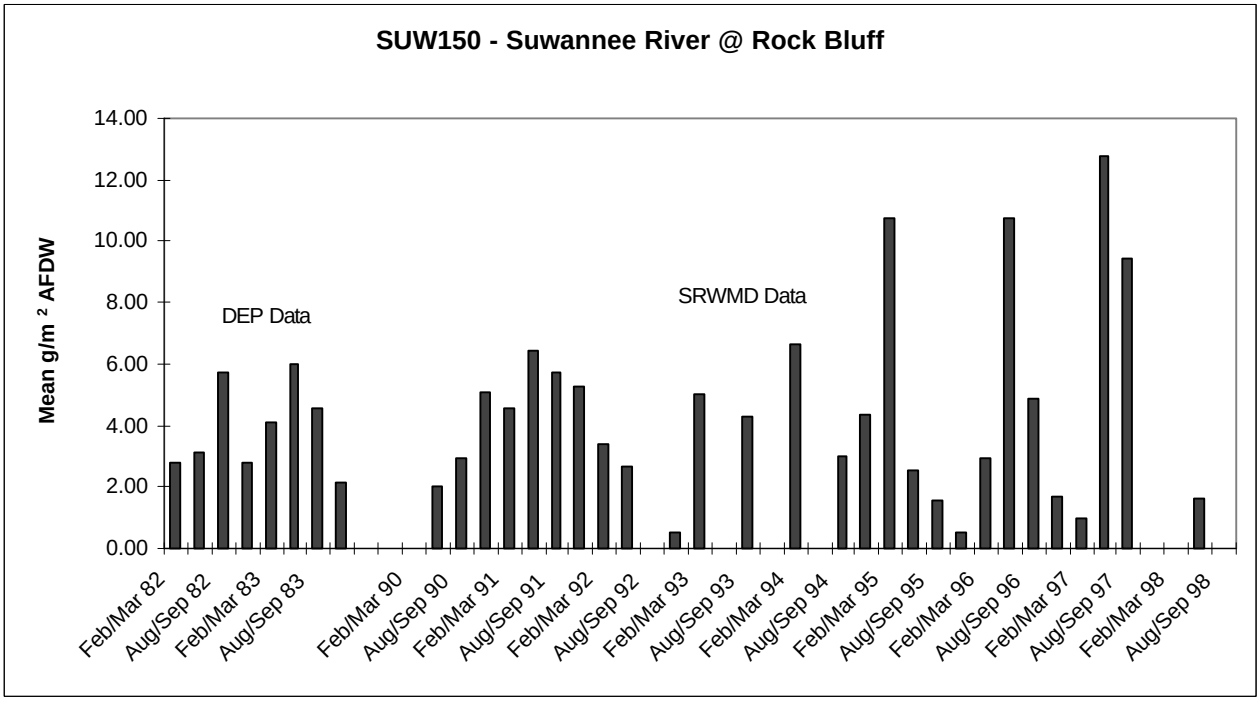


Figure 5. Plots of periphyton biomass over time at two sampling sites in the middle Suwannee River. Data from an earlier DEP study at these sites and more recent data from SRWMD monitoring are shown.

plant pigment “chlorophyll *a*”) and nitrate-nitrogen concentrations (see Figure 6: r = 0.85; P = 0.017).

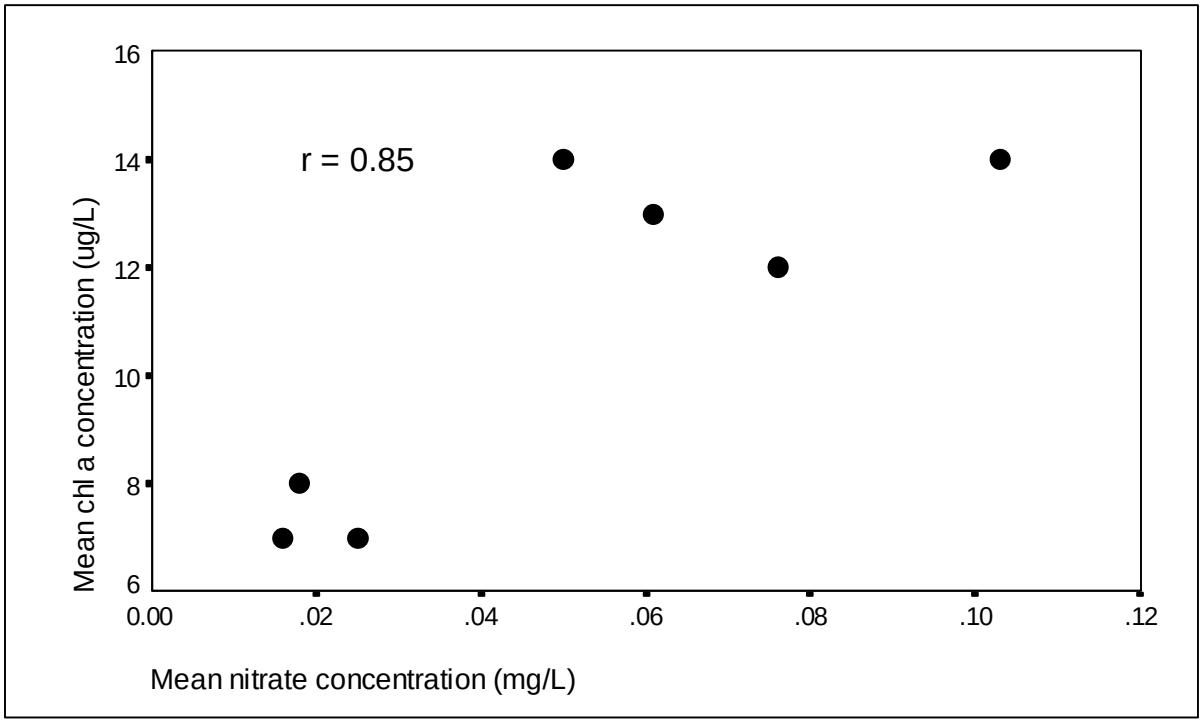


Figure 6. Graph showing relationship between mean nitrate-nitrogen concentration and mean phytoplankton biomass (estimated from concentration of chlorophyll *a*) from sampling sites in the Suwannee estuary. Source: Phlips and Bledsoe 1999.

At this time, the SRWMD’s monitoring data indicate that the nitrate-nitrogen in the river is having a biological effect. The lack of a water quality standard for nitrate-nitrogen makes it difficult to make the statement that the river is “degraded.”+ A narrative standard exists which states that “nutrient concentrations shall not be altered so as to cause an imbalance in natural populations of fauna and flora” (Chap. 62-302.530, Fla. Administrative Code). Studies in northern U.S. streams have defined “nuisance” levels of filamentous periphytic algae as > 100-150 mg chlorophyll *a* m^{-2} or about 20% cover of the stream bottom (Welch and others 1988). Chlorophyll levels in the periphyton have not been measured in the SRWMD’s monitoring program, but it will be considered in future monitoring efforts to see if this level is reached or exceeded in the Suwannee.

WATER QUALITY RATINGS

Based on the SRWMD water quality rating, nineteen water bodies and ten springs are rated Good (Table 1). Nine water bodies, eight springs, and one lake are rated Fair (Table 2). Ten springs are rated Poor (Table 3). There was no change in the water quality rating for streams and rivers from 1998 to 1999. One spring improved in water quality from 1998 to 1999. However, two springs declined in water quality from 1998 to 1999.

The data collected from the surfacewater quality monitoring network has identified the Reaches 3, 4, 5, and 6 of the Suwannee River as being impacted by increasing nutrients (i.e., nitrate-nitrogen). Also, Reach 2 of the Santa Fe River shows nutrient enrichment similar to the Suwannee River.

Table 1. SRWMD rated water bodies – Good.

Rivers and Streams	***Springs***	***Lakes***
Aucilla River*	ALA112971#	
Wacissa River*	Alapaha Rise*	
Econfina River*	Columbia#	
Steinhatchee River*	COL61981*	
Ichetucknee River*	Ellaville#	
Olustee Creek*	Hampton#	
Price Creek*	Poe+	
Santa Fe River Reach 1*	Suwannee*	
Sampson River*	Steinhatchee*	
Alapaha River*	Steinhatchee Rise#	
Falling Creek*		
Okefenokee Swamp*		
Robinson Branch*		
Rocky Creek*		
Suwannee River Reach 1*		
Suwannee River Reach 2*		
Withlacoochee River*		
Cedar Key*		
Waccasassa River*		

* - Rating same as 1998
+ - Rating improved from 1998
** - Rating declined from 1998
# - Not rated in 1998

Table 2. SRWMD rated water bodies – Fair.

Rivers and Streams	***Springs***	***Lakes***
New River*	Blue (Gilchrist Co.)*	Alligator*
Santa Fe River Reach 2*	Falmouth**	
Camp Branch*	Hart*	
Hunter Creek*	Hornsby*	
Suwannee River Reaches 3*	Little River*	
Suwannee River Reaches 4*	Manatee*	
Suwannee River Reaches 5*	Rock Bluff **	
Suwannee River Reaches 6*	Royal*	
Swift Creek*		

* - Rating same as 1998
+ - Rating improved from 1998
** - Rating declined from 1998
# - Not rated in 1998

Table 3. SRWMD rated water bodies – Poor.

Rivers and Streams	***Springs***	***Lakes***
	Charles**	
	Convict*	
	Fannin*	
	Lafayette Blue*	
	Ruth*	
	Suwannee Blue*	
	SUW718971*	
	SUW725971*	
	Telford*	
	Troy*	

* - Rating same as 1998
+ - Rating improved from 1998
** - Rating declined from 1998
# - Not rated in 1998

Hydrologic Conditions During Water Year 1999

Annual mean streamflow for the 1998 water year in the Suwannee River basin ranged from 150 to 200 percent of the long-term mean. The upper Suwannee and the Withlacoochee Rivers, with about 200 percent of normal, were the highest, while the Middle Suwannee Basin, with about 150 percent of normal, was the lowest. Above normal rainfall in the basin resulted in high flows from January to March, and roughly constituted a 10-year flood event. The flooding was directly followed by a period of rainfall deficit from mid-March through June, resulting in a precipitous decline in flows. The water year finished with high levels again as the basin was impacted by two hurricanes, Earl and Georges, in early and late September.

Annual mean streamflow for the 1999 water year in the Suwannee River Basin ranged from 24 to 67 percent of the long-term mean. The lower Santa Fe River, with about 65 percent of normal, was the highest, while the Upper Suwannee and Santa Fe Basins, with about 30 percent of normal, were the lowest. Highest flows occurred in early October as the runoff from Hurricane Georges passed through the basin. From that point on, flows diminished, with slight increases during February and again in July- August. The 1999 calendar year was the fourth driest on record since 1932. Minimum or near minimum mean monthly flows were recorded from May through September.

Mean monthly flow for the 1998 and 1999 water years at the Suwannee River near Wilcox, the most downstream station on the river, are shown on Figure 7 along with the long-term mean monthly flow.

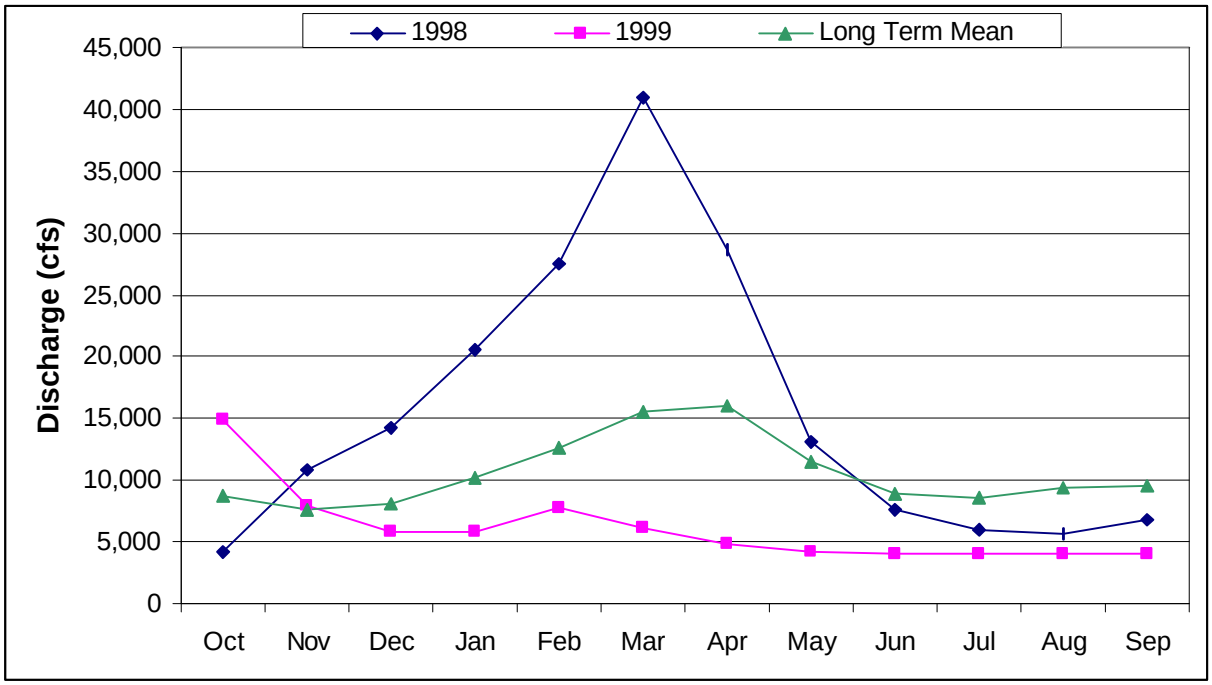


Figure 7. Monthly mean discharges for the Suwannee River to the Gulf of Mexico for water years 1998 and 1999.

Nutrient Loadings for Water Year 1999

In water year 1999, 4,745 tons of nitrate-nitrogen and 693 tons of total phosphorus were transported to the Suwannee River Estuary. Even though the Middle Suwannee River Basin (Reach 3) only covers 8.6 % of the total Suwannee River Basin, it accounted for 46.95 % of the annual nitrate-nitrogen load and 10.04 % of the total phosphorus load. The Santa Fe River Reach 2 only covers 5.7 % of the total Suwannee River Basin, it accounted for 20.72 % of the annual nitrate-nitrogen load and 10.93 % of the total phosphorus. Other basin area to loading relationships are presented in Table 4. Figure 8 provides a summary of relative nutrient loadings in the Suwannee River Basin.

Table 4. Nutrient loadings by basin/reach in the Suwannee River Basin.

		Annual Loads (tons/year)			
Contributing Basin	**Area (mi²)**	**Nitrate-N**	**% of Load**	**Total Phosphorus**	**% of Load**
Suwannee Reach 1	2430	83.55	1.76	229.55	33.12
Alapaha River	1801	194.65	4.10	69.51	10.03
Withlacoochee	2382	564.65	11.90	82.85	11.95
Suwannee Reach 2	443	425.56	8.97	71.43	10.31
Suwannee Reach 3	824	2228.02	46.95	69.58	10.04
Santa Fe Reach 1	820	21.38	0.45	33.43	4.82
Santa Fe Reach 2	564	983.02	20.72	75.77	10.93
Suwannee Reach 4,5, & 6	686	244.47	5.15	60.95	8.79
Total	9950	4745.32		693.05	

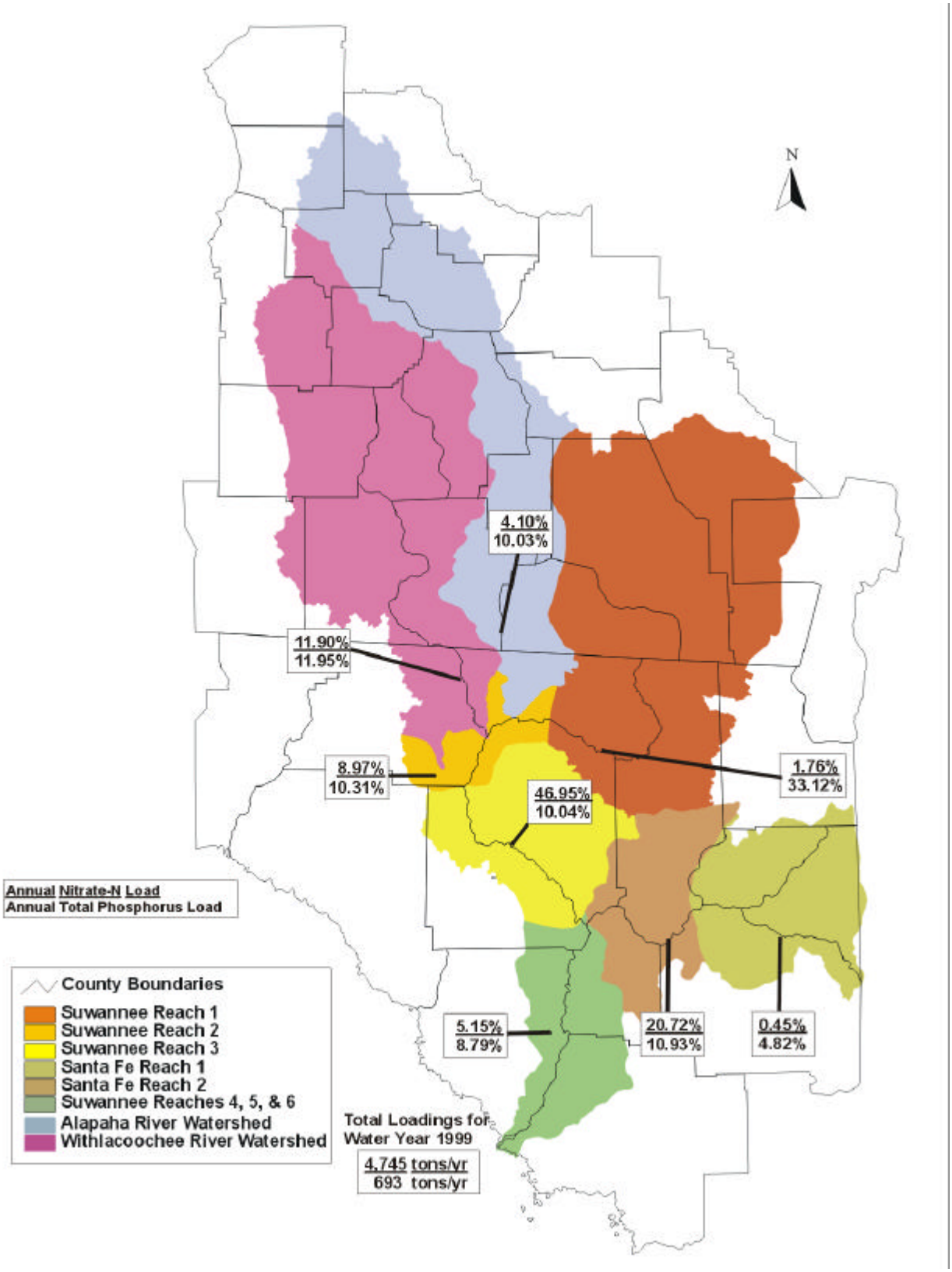


Figure 8. Nutrient loadings by basin/reach in the Suwannee River Basin.

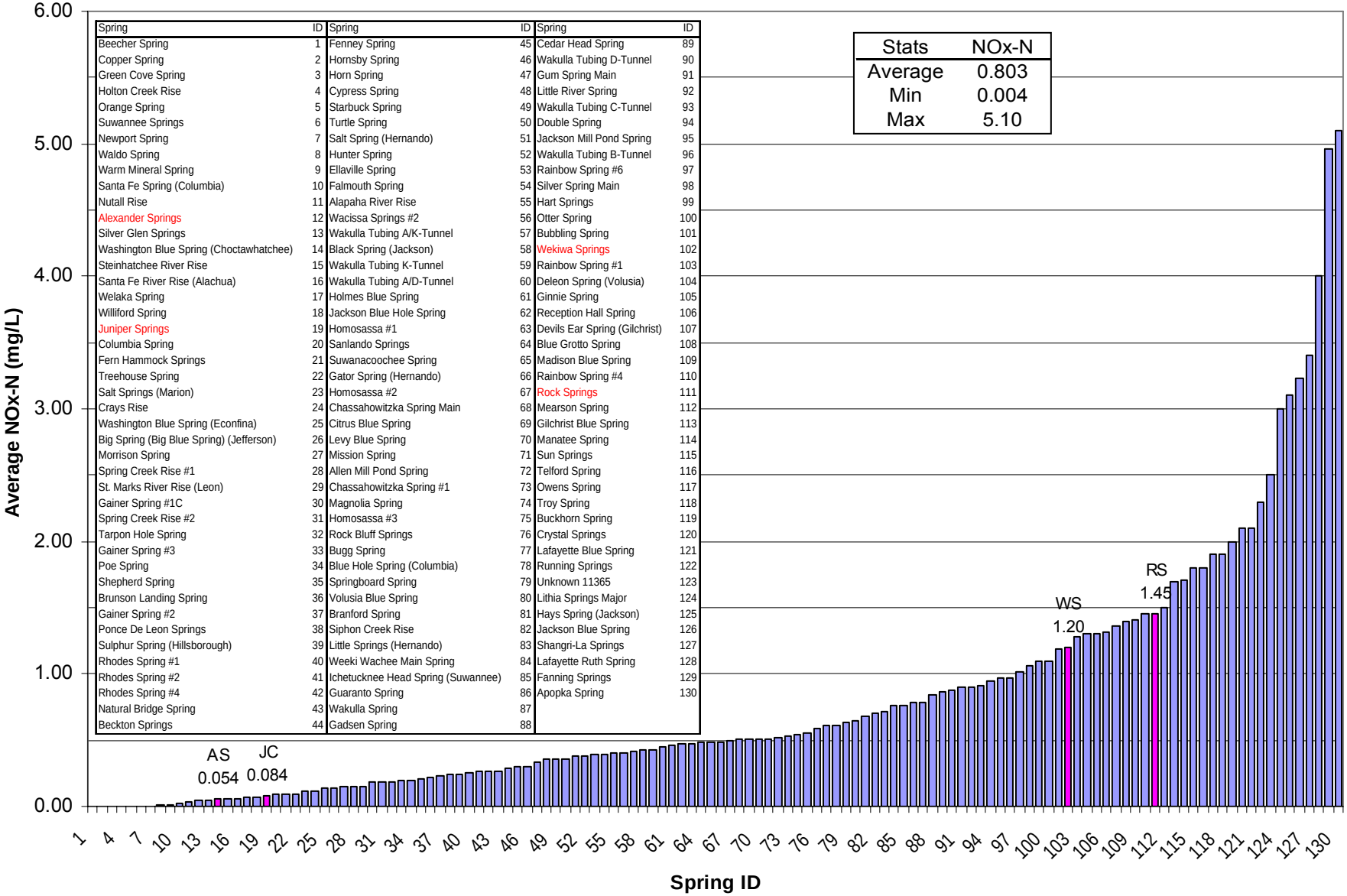
APPENDIX I

Nutrients in Less Impacted Spring-Run Streams
and in
130 Florida Springs

Table I-1. Nitrate-nitrite (NOx) and total phosphorus (TP) levels in selected spring-run streams in Florida (STORET). Periods of record and sample size vary. Shaded cells indicate streams considered less-impacted by nitrate enrichment.

	Non-exceedance percentile ("at or below")					
SPRING RUN	10	25	Average	Median	75	90
Juniper						
NOx (mg/L)	0.070	0.075	0.083	0.080	0.083	0.099
TP (mg/L)	0.017	0.023	0.026	0.023	0.029	0.033
Alexander						
NOx (mg/L)	0.030	0.036	0.047	0.047	0.055	0.065
TP (mg/L)	0.039	0.040	0.046	0.044	0.052	0.054
Wacissa						
NOx (mg/L)	0.020	0.040	0.068	0.060	0.095	0.124
TP (mg/L)	0.029	0.035	0.050	0.044	0.058	0.081
Wakulla						
NOx (mg/L)	0.248	0.350	0.394	0.390	0.420	0.556
TP (mg/L)	0.021	0.023	0.031	0.025	0.033	0.034
Ichetucknee						
NOx (mg/L)	0.368	0.420	0.499	0.480	0.570	0.670
TP (mg/L)	0.048	0.053	0.063	0.061	0.068	0.086
Silver						
NOx (mg/L)	0.540	0.650	0.830	0.895	0.993	1.000
TP (mg/L)	0.030	0.040	0.043	0.040	0.050	0.057

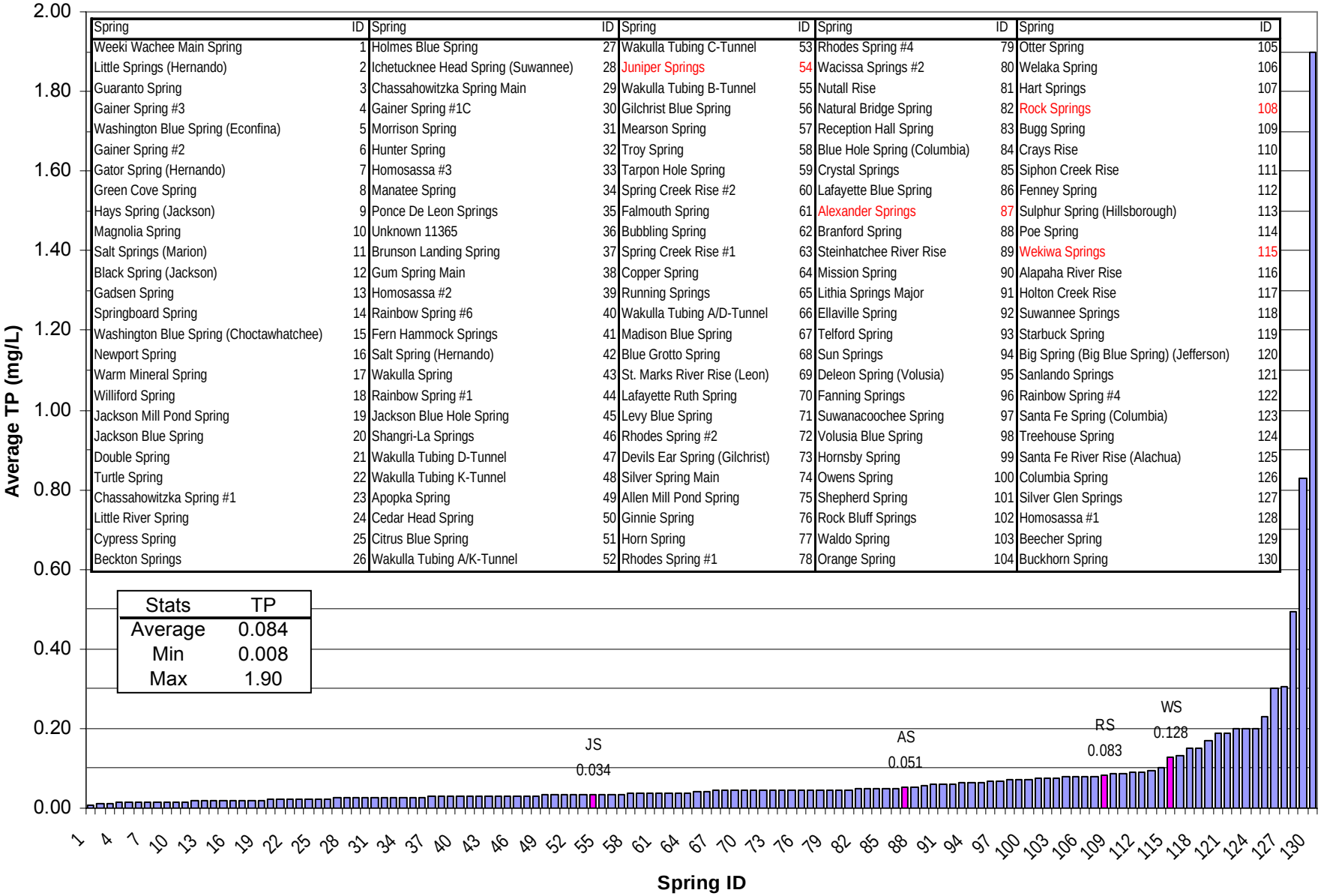
Figure I-1. Distribution of mean nitrate concentrations in 130 Florida springs (WSI, 2005).



Stats	NOx-N
Average	0.803
Min	0.004
Max	5.10

Spring	ID	Spring	ID	Spring	ID
Beecher Spring	1	Fenney Spring	45	Cedar Head Spring	89
Copper Spring	2	Hornsby Spring	46	Wakulla Tubing D-Tunnel	90
Green Cove Spring	3	Horn Spring	47	Gum Spring Main	91
Holton Creek Rise	4	Cypress Spring	48	Little River Spring	92
Orange Spring	5	Starbuck Spring	49	Wakulla Tubing C-Tunnel	93
Suwannee Springs	6	Turtle Spring	50	Double Spring	94
Newport Spring	7	Salt Spring (Hernando)	51	Jackson Mill Pond Spring	95
Waldo Spring	8	Hunter Spring	52	Wakulla Tubing B-Tunnel	96
Warm Mineral Spring	9	Ellaville Spring	53	Rainbow Spring #6	97
Santa Fe Spring (Columbia)	10	Falmouth Spring	54	Silver Spring Main	98
Nutall Rise	11	Alapaha River Rise	55	Hart Springs	99
Alexander Springs	12	Wacissa Springs #2	56	Otter Spring	100
Silver Glen Springs	13	Wakulla Tubing A/K-Tunnel	57	Bubbling Spring	101
Washington Blue Spring (Choctawhatchee)	14	Black Spring (Jackson)	58	Wekiwa Springs	102
Steinhatchee River Rise	15	Wakulla Tubing K-Tunnel	59	Rainbow Spring #1	103
Santa Fe River Rise (Alachua)	16	Wakulla Tubing A/D-Tunnel	60	Deleon Spring (Volusia)	104
Welaka Spring	17	Holmes Blue Spring	61	Ginnie Spring	105
Williford Spring	18	Jackson Blue Hole Spring	62	Reception Hall Spring	106
Juniper Springs	19	Homosassa #1	63	Devils Ear Spring (Gilchrist)	107
Columbia Spring	20	Sanlando Springs	64	Blue Grotto Spring	108
Fern Hammock Springs	21	Suwanacoochee Spring	65	Madison Blue Spring	109
Treehouse Spring	22	Gator Spring (Hernando)	66	Rainbow Spring #4	110
Salt Springs (Marion)	23	Homosassa #2	67	Rock Springs	111
Crays Rise	24	Chassahowitzka Spring Main	68	Mearson Spring	112
Washington Blue Spring (Econfina)	25	Citrus Blue Spring	69	Gilchrist Blue Spring	113
Big Spring (Big Blue Spring) (Jefferson)	26	Levy Blue Spring	70	Manatee Spring	114
Morrison Spring	27	Mission Spring	71	Sun Springs	115
Spring Creek Rise #1	28	Allen Mill Pond Spring	72	Telford Spring	116
St. Marks River Rise (Leon)	29	Chassahowitzka Spring #1	73	Owens Spring	117
Gainer Spring #1C	30	Magnolia Spring	74	Troy Spring	118
Spring Creek Rise #2	31	Homosassa #3	75	Buckhorn Spring	119
Tarpon Hole Spring	32	Rock Bluff Springs	76	Crystal Springs	120
Gainer Spring #3	33	Bugg Spring	77	Lafayette Blue Spring	121
Poe Spring	34	Blue Hole Spring (Columbia)	78	Running Springs	122
Shepherd Spring	35	Springboard Spring	79	Unknown 11365	123
Brunson Landing Spring	36	Volusia Blue Spring	80	Lithia Springs Major	124
Gainer Spring #2	37	Branford Spring	81	Hays Spring (Jackson)	125
Ponce De Leon Springs	38	Siphon Creek Rise	82	Jackson Blue Spring	126
Sulphur Spring (Hillsborough)	39	Little Springs (Hernando)	83	Shangri-La Springs	127
Rhodes Spring #1	40	Weeki Wachee Main Spring	84	Lafayette Ruth Spring	128
Rhodes Spring #2	41	Ichetucknee Head Spring (Suwannee)	85	Fanning Springs	129
Rhodes Spring #4	42	Guaranto Spring	86	Apopka Spring	130
Natural Bridge Spring	43	Wakulla Spring	87		
Beckton Springs	44	Gadsen Spring	88		

Figure I-2. Distribution of mean total phosphorus concentrations in 130 Florida springs (WSI, 2005).



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

APPENDIX J

Epiphytes on Submerged Aquatic Vegetation in Headsprings of the Ichetucknee River, Florida

Excerpted from:

PBS&J. 2004. Mapping and Monitoring Submerged Aquatic Vegetation in Ichetucknee Springs – 2004. Report submitted to the Suwannee River Water Management District, Live Oak, FL. Pp. variously numbered; 6 Appendices.

Mapping and Monitoring Submerged Aquatic Vegetation in Ichetucknee Springs - 2004

Final Report

June 30, 2004

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Executive Summary

In 2003, the SRWMD began collecting ecological data within the Ichetucknee Springs and River to provide baseline information regarding the current health of this aquatic ecosystem. This report describes the second year of data collection to further characterize the Ichetucknee River and includes the mapping and monitoring of submerged aquatic vegetation (SAV) and collection and analysis of water quality data.

The specific goals for this project were:

- To remap portions of the river which are exposed to intensive recreational use (e.g., docks used for entry and exit points by tubers, swimmers, and canoeists) and perform a change analysis of these areas to compare SAV map data between 2003 and 2004;

- To develop spatial data for river depth, flow, reach and tree canopy shade, and assess those data with respect to 2003 SAV mapping data; and

- To conduct sampling of SAV, periphyton, and water chemistry to continue to document existing condition and to provide a basis for defining the relationship between water flow and SAV abundance and biomass.

SAV coverage declined by approximately 454 m^2 or 0.1 acres between 2003 and 2004. This represents an approximate 2% loss within the remapped areas. The observed loss was a result of changes in SAV to either bare bottom or emergent vegetation coverage. The greatest losses of SAV occurred at the downstream take out area at US 27. A few small patches of *Sagittaria* and *Valisneria* converted to bare bottom (approximately 110 m^2), along with one patch of *Chara* (140 m^2). This loss in SAV appears to have been caused by disturbances resulting from reconstruction of the floating dock structures and also changes in flow velocities caused by the installation of a new floating barrier across the river at this location. Overall, changes in SAV coverage were minimal between the two mapping periods and the majority of loss can be explained by temporary impacts associated with the reconstruction of the take out area near US 27. Other losses were the result of conversion of former SAV polygons to emergent polygons, likely due to lower river water levels observed during the drier 2004 mapping period.

Based on the spatial mapping analyses for the river, the vast majority of the river is less than 2 m deep. Just over 50% of the river is less than 1 m deep (75,000 m^2), with a slightly smaller area (62,000 m^2) between 1 and 2 m deep. The 2 to 3 meter interval is small (5,000 m^2, less then 5%) and occurs in Reach 3 (Rice Marsh) and the lower reaches. In general, flow follows the same trends as the depth, with more rapid flow in areas with greater depth.

With respect to river reach, tree canopy shade decreases from reach 1 to 3, increases to reach 6, then decreases again, although more gradually, to reach 9. The decrease in shade around reach 3 is due to the greater width of the river in this area, and the presence of *Zizania* beds beyond the tree canopy. These two characteristics result in more open surface area away from the fringing tree canopy. The decrease in shade in reaches 8 and 9 appear to be due in part to the more east-west orientation of the river.

Executive Summary

Analyses between nutrients and SAV cover, SAV biomass and periphyton were made among samples collected from the main river. No significant relationships were observed ($p > 0.05$), between nutrients and these parameters, suggesting that nutrient concentrations are not limiting for SAV or periphyton in the main river. Specific analyses were also conducted to characterize relationships between SAV coverage and depth, flow and terrestrial canopy cover. SAV coverage and depth were positively correlated ($r^2 = 0.03$), suggesting that depth was not limiting SAV growth in this river. We did not observe a significant correlation between stream flow and SAV coverage. When comparing SAV coverage to terrestrial canopy cover (%), a weak negative correlation was observed ($r^2 = 0.02$), suggesting that terrestrial canopy, in some cases, may reduce potential SAV coverage.

As part of the 2004 sampling effort, six distinct springs (collectively referred to as "feeder springs") were individually investigated. Comparisons among feeder springs were also made for temperature, specific conductivity, dissolved oxygen, pH, color, total nitrogen, nitrate, ammonium, total phosphorus, soluble reactive phosphorus, and periphyton abundance. Discharge values ranged from 1.5 m^3/s for Singing Spring to 5.8 m^3/s for Blue Spring. Based on these discharge estimates these feeder springs were collectively discharging 18.3 m^3/s (646.3 cubic feet per second) of ground water. At the time of sampling, mean specific conductivity ranged from 291.0 µS/cm for Blue Spring to 352.0 µS/cm for Millpond Spring, with an average of 312.4 µS/cm for all six springs. Mean total nitrogen concentrations ranged from 333 µg/L for Millpond Spring to 1043 µg/L for Main Spring, with an average total nitrogen concentration of 663 µg/L for all six springs. Considerable variation in total nitrogen concentrations among the feeder springs was observed with higher values in the Main and Blue Springs.

Mean periphyton abundance ranged from 0.025 mg chl/g host plant wet wt for Main Spring to 1.025 mg chl/g host plant wet wt for Singing Spring, with an average periphyton abundance of 0.371 mg chl/g host plant wet wt for all six springs. Several of the springs were significantly different with respect to periphyton abundance on host macrophytes. Periphyton abundance in the feeder springs was not significantly correlated with nitrate concentrations nor with total nitrogen concentrations. However, there was a significant positive correlation between periphyton abundance and soluble reactive phosphorus concentrations, as well as total phosphorus. This relationship suggests that phosphorous may be the limiting nutrient for periphyton in these feeder springs.

Based on the results of this study, the following recommendations are suggested to further characterize and document SAV and water quality conditions within the river:

1. Although only a small change in SAV coverage was observed within the high use areas, remapping should be conducted annually to maintain a historical record of coverage and also to assess whether the losses which occurred at the US 27 take-out dock area has recovered. A complete remapping effort of the entire river should be performed at least once every five years.

2. Creation of a digital map from the 1979 Dutoit study should be performed to compare historical SAV and current trends in SAV coverage.

3. Water quality sampling should be continued to further assess the relationships between groundwater flows and surface water quality in the river and associated relationships with SAV coverage, biomass, and periphyton abundance.

Bivariate fit of periphyton abundance (mg chl/g host wet wt) by SRP (µg/L)

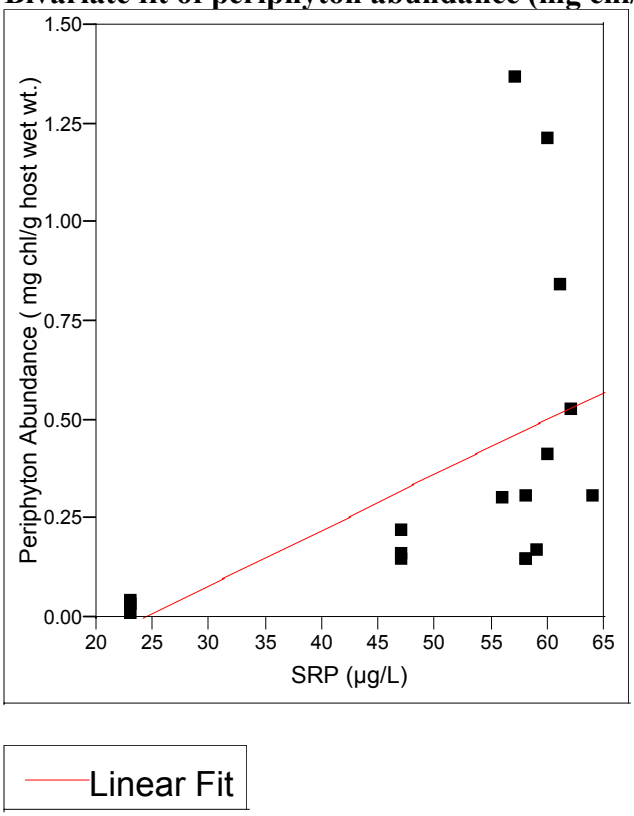

Figure F-57. Empirical relationship between soluble reactive phosphorus (SRP) concentrations and periphyton abundance (mg chl/g host plant wet wt) for the feeder springs of the Ichetucknee River.

Linear Fit

Periphyton Abundance (mg chl/g host wet wt) = -0.340803 + 0.0140228 SRP (µg/L)

Summary of Fit

R Square	0.25
R Square Adjusted	0.20
Root Mean Square Error	0.36
Mean of Response	0.37
Observations	17

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.6337767	0.633777	4.9094
Error	15	1.9364322	0.129095	Prob > F
C. Total	16	2.5702089		0.0426

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0.340803	0.332888	-1.02	0.3222
SRP (µg/L)	0.0140228	0.006329	2.22	0.0426