

Plan of Study: Level II Water Quality Based Effluent Limitations for Gainesville Regional Utilities' Main Street Water Reclamation Facility

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EXECUTIVE SUMMARY

The purpose of this Plan of Study (POS), which follows the requirements of Chapter 62-650, Florida Administrative Code (F. A.C.), is to provide the Gainesville Regional Utilities (GRU) with the scientific basis needed to establish Level II Water Quality Based Effluent Limitations (WQBEL) for nutrients (total phosphorus and total nitrogen) for its Main Street Water Reclamation Facility (MSWRF). This WQBEL will determine the levels of nutrients in the point source discharge (*i.e.*, effluent nutrient limits) that attain the narrative nutrient criteria in paragraph 62-302.530(47)(b), F.A.C., and is a site-specific interpretation of the Numeric Nutrient Criteria (NNC).

Wasteload allocations (WLAs), derived from a TMDL to protect Alachua sink, are applicable to the GRU Main Street (FL0027251) facility (40,380 lbs yr⁻¹ of TN) and to the John R. Kelly Generating Station (FL0026646) (623 lbs yr⁻¹ of TN) (Gao *et al.* 2006). Both facilities discharge to Sweetwater Branch, Alachua County, Florida, which has several sampling stations for biology and water quality (**Figure 1 and 2, Table 1**).

As allowed under 62-302.531(2)(d.), F.A.C., this WQBEL POS must provide reasonable assurance that the direct receiving waters (Sweetwater Branch), as well as downstream receiving waters (Paynes Prairie), will comply with water quality standards, in this case, focusing on nutrients. The Plan of Study collates and summarizes previous data collection efforts in the area and outlines additional data collection and data analyses/modeling activities needed to satisfy the requirements of Chapter 62-302, F.A.C., for a Level II WQBEL to serve as a site-specific interpretation of the narrative nutrient criterion. The proposed WQBEL Study for MSWRF will support establishing an interpretation for Sweetwater Branch from the MSWRF discharge to Paynes Prairie.

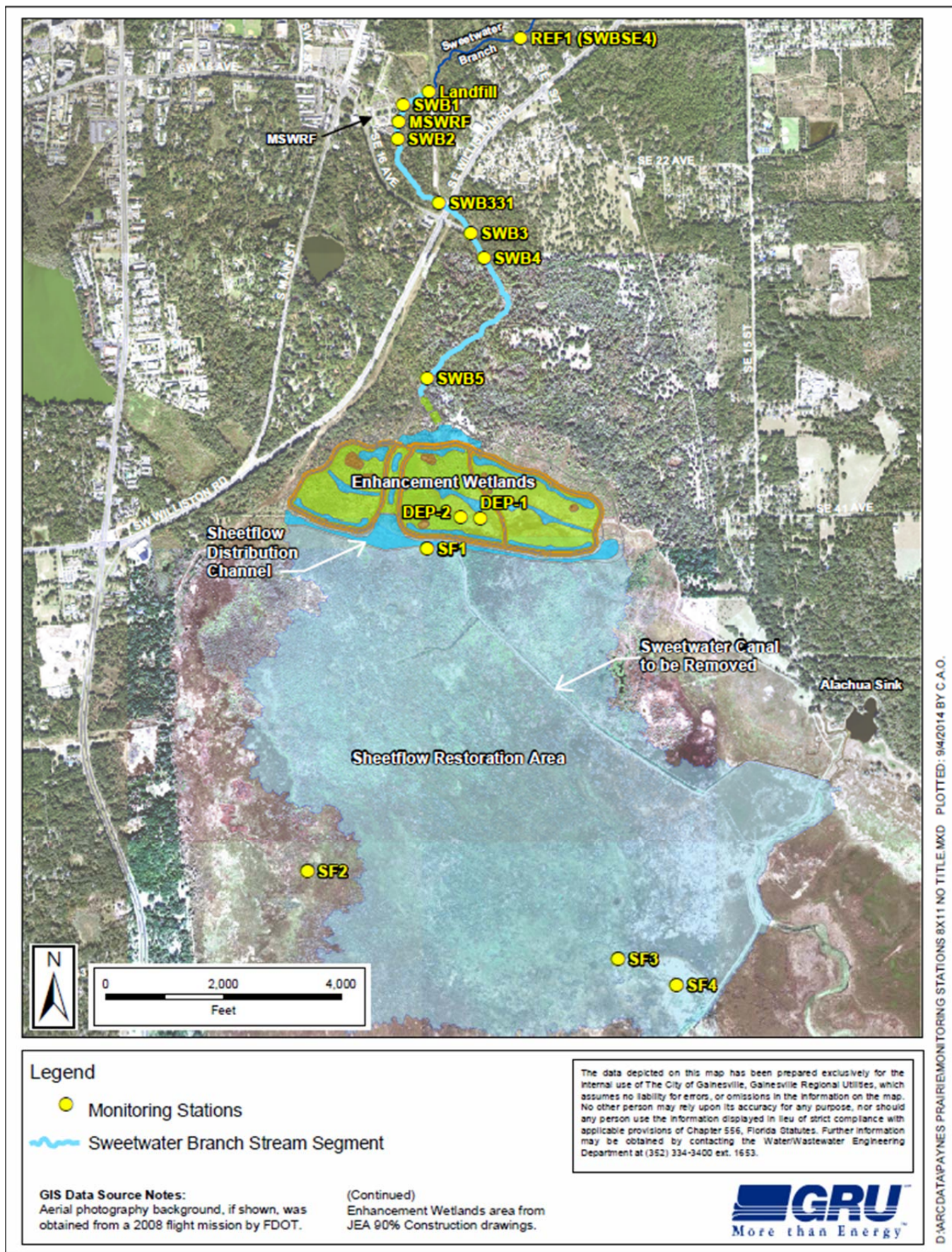


Figure 1. Overview map of Sweetwater Branch, Enhancement Wetlands, and Paynes Prairie.

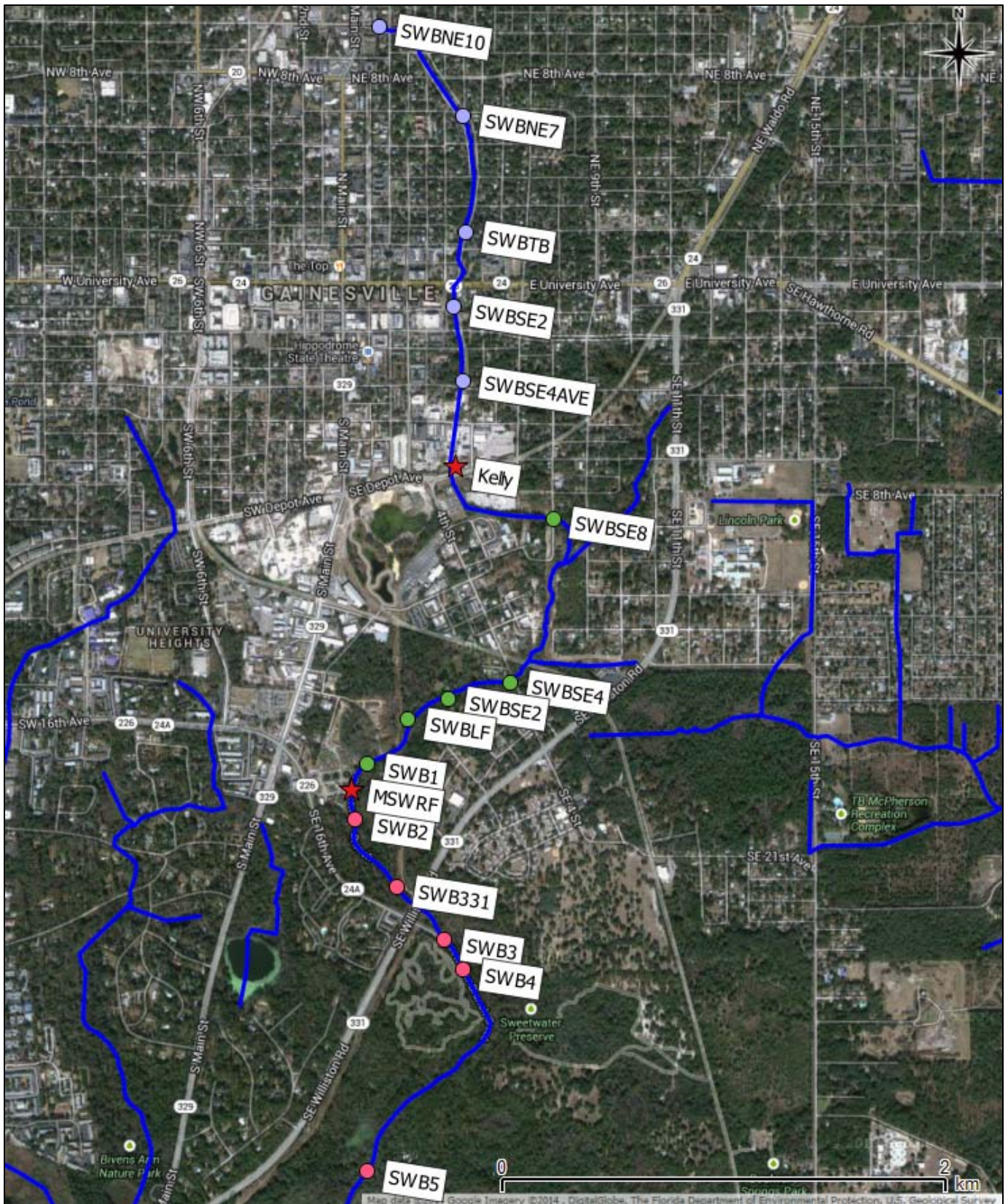


Figure 2. Map showing closer view of GRU Main Street Water Reclamation Facility (MSWRF) discharge and sampling stations in Sweetwater Branch. Blue dots include stations above the Kelly power plant, green dots include stations between JR Kelly and MSWRF, and pink dots include stations downstream of MSWRF. Facilities are indicated by a red star.

Table 1. Specific stations spatially grouped for analyses. Note different agencies use different names for the same sites.

Biological data				
Location	Site	Latitude	Longitude	Agency
Upstream of kelly	SWBNE10	29.66101	-82.32352	-
	SWBNE7	29.657859	-82.320106	Alachua County
	SWBTB	29.653792	-82.320018	-
	SWBSE2/SWBSE1	29.651158	-82.320501	Alachua County, FDEP, Frydenborg Eco.
	SWBSE4AVE	29.648554	-82.320133	-
Between facilities	SWBSE8	29.64371	-82.316459	-
	REF/REF1/SWBSE4	29.63795	-82.31822	Alachua County, FDEP, Frydenborg Eco., W&A
	SWBSE2	29.63737	-82.32074	-
	SWBLF	29.63666	-82.32234	Alachua County
	SWB1/SWU-1/Main Street Up	29.63507	-82.32402	FDEP
Downstream of MSWRF	SWB2/SWD-1/Main street Down	29.63312	-82.32448	FDEP, W&A
	SWB3	29.628903	-82.320869	FDEP, W&A
	SWB4	29.62785	-82.32011	FDEP
	SWB5	29.62075	-82.32402	Alachua Co., FDEP, Frydenborg Eco., W&A
	SWB331	29.63073	-82.32281	Alachua County
Dischargers	Kelly	29.6455	-82.32041	-
	MSWRF	29.63413	-82.32466	-

WQ data				
Location	Site	Latitude	Longitude	Agency
Upstream of kelly	SWBNE10	29.66101	-82.32352	Alachua County
	SWBNE7	29.657859	-82.320106	Alachua County
	SWBTB	29.653792	-82.320018	Alachua County
	SWBSE2/SWBSE1	29.651158	-82.320501	Alachua County, FDEP
	SWBSE4AVE	29.648554	-82.320133	Alachua County
Between facilities	SWBSE8	29.64371	-82.316459	Alachua County
	REF/REF1/SWBSE4	29.63795	-82.31822	GRU, Alachua County, FDEP
	SWBSE2	29.63737	-82.32074	Alachua County
	SWBLF	29.63666	-82.32234	Alachua County
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1 BACKGROUND

1.1 PURPOSE

The purpose of this Plan of Study (POS), which follows the requirements of Chapter 62-650, F. A.C., is to provide the Gainesville Regional Utilities (GRU) with the scientific basis needed to establish Level II Water Quality-Based Effluent Limitations (WQBEL) for nutrients (total phosphorus and total nitrogen) for its Main Street Water Reclamation Facility (MSWRF). This WQBEL will determine the levels of nutrients in the point source discharge (*i.e.*, effluent nutrient limits) that attain the narrative nutrient criteria in paragraph 62-302.530(47)(b), F.A.C., and is a site-specific interpretation of the Numeric Nutrient Criteria (NNC).

1.2 NUMERIC NUTRIENT CRITERIA REQUIREMENTS

The narrative nutrient criteria in paragraph 62-302.530(47)(b), F.A.C., states that “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.” The method for numerically interpreting this criteria, on a site-specific basis, is provided in Rule 62-302.531, F.A.C., using a hierarchical process. This hierarchical scheme specifies a prioritization for determining the numeric nutrient criteria that apply to a given waterbody.

The rule’s hierarchical approach gives preference to site-specific analyses that result in a numeric interpretation of the NNC. Site-specific interpretations are superior to more broadly applicable interpretations of the NNC because of the many natural factors affecting the expression of nutrient loadings on a given waterbody.

1.3 WATER QUALITY BASED EFFLUENT LIMITATIONS

The Water Quality Based Effluent Limitation (WQBEL) process, pursuant to Chapter 62-650, F.A.C., is the mechanism for determining the levels of nutrients in a point source discharge (*i.e.*, effluent nutrient limits) that will comply with the narrative criterion in paragraph 62-302.530(47)(b), F.A.C. The derivation of a Level II nutrient WQBEL is a site-specific interpretation of the NNC and is based on the highest permitted flows and the associated nutrient loads from a discharge. To serve as the interpretation of the narrative nutrient criteria, the WQBEL must provide nutrient limits for the discharge and from all other sources to the waterbody. Further, if downstream waters are anticipated to be potentially affected by the discharge of nutrients from an upstream facility, the potential impact must also be assessed, regardless of distance.

Revisions to a WQBEL for existing discharges are implemented through the permit renewal process and compliance schedules may be used to give permittees time to come into compliance with any new requirements pursuant to the provisions of subsection 403.088(2)(e) and (f), F.S., and subsections 62-620.610(12) and 62-620.620(6), F.A.C. New or expanded discharges are subject to an antidegradation review, and if the discharge contains nutrients that have the reasonable potential to cause or contribute to exceedances of the nutrient standard, it will need to have a WQBEL established and provide reasonable assurance at the time the permit is issued that the WQBEL will be met. It is anticipated that the process for renewing the GRU Main Street facility’s permit will be begin in September, 2014.

A WQBEL is recognized as the applicable interpretation of the narrative nutrient criteria if:

- a) The documentation for the WQBEL includes a site-specific numeric interpretation of the narrative criterion at paragraph 62-302.530(47)(b), F.A.C., for the waterbody;

- b) The WQBEL is established pursuant to the Level II Process contained at Rule 62-650.500, F.A.C.; and
- c) The public notice for the WQBEL specifically states that the Level II WQBEL includes a site-specific interpretation of the narrative for the receiving waterbody.

A WQBEL may be used to establish protective levels of nutrients in a discharge if the receiving water flora are healthy but the fauna are affected by other, non-nutrient stressors. Rule 62-302.531(2)(a)1.d., F.A.C., states, "Other site specific interpretations for one or more nutrients or nutrient response variables that are formally established by rule or final order by the Department, such as a Reasonable Assurance Demonstration pursuant to Rule 62-303.600, F.A.C., or Level II Water Quality Based Effluent Limitations (WQBEL) established pursuant to Rule 62-650.500, F.A.C. To be recognized as the applicable site specific numeric interpretation of the narrative nutrient criterion, the interpretation must establish the total allowable load or ambient concentration for at least one nutrient that results in attainment of the applicable nutrient response variable that represents achievement of the narrative nutrient criterion for the waterbody. A site specific interpretation is also allowable where there are documented adverse biological effects using one or more Biological Health Assessments, if information on chlorophyll *a* levels, algal mats or blooms, nuisance macrophyte growth, and changes in algal species composition indicate there are no imbalances in flora and a stressor identification study demonstrates that the adverse biological effects are not due to nutrients".

1.4 NUTRIENT ALLOCATIONS FROM THE FDEP TOTAL MAXIMUM DAILY LOAD (TMDL)

In the case of GRU Main Street facility and John R. Kelly Generating Station, wasteload allocations (WLAs), derived from a TMDL to protect Alachua sink, are applicable. The WLAs for NPDES wastewater discharges are 40,380 lbs yr⁻¹ of TN for the MSWRF (FL0027251) and 623 lbs yr⁻¹ of TN for the John R. Kelly Generating Station (FL0026646) (Gao *et al.* 2006). The WLA was based on the water quality data measured from 2000 through 2004. Both a critical dry and a critical wet condition were simulated by Gao *et al.* (2006) to assess the impacts associated with point and nonpoint source discharges to Alachua Sink. In both cases, a 54.5 % reduction of the point source loading from current conditions was needed to achieve the corresponding nutrient and chlorophyll targets in Alachua Sink.

In the 2006 TMDL report, the MSWRF contributed 88,748 lbs of TN, which is about 23% of the dry-year total TN load of 382,062 lbs discharged into Alachua Sink. The total allowable critical period TN loading to Alachua Sink is 204,870 lbs yr⁻¹ of TN (Gao *et al.* 2006)

The load from stormwater discharges permitted under the NPDES Stormwater Program (loads from MS4s) is also placed in the WLA. Based on the 2000 census, the Alachua Sink watershed includes areas that are covered by the MS4 Program, and the WLA for stormwater discharges is a 45% reduction in current loading from the MS4 (Gao *et al.* 2006). This percent reduction is the same percent reduction required under the load allocation (LA) for nonpoint sources.

1.5 PAYNES PRAIRIE SHEETFLOW RESTORATION PROJECT

To address the TMDL and other issues affecting Paynes Prairie, the City of Gainesville has implemented a comprehensive water quality enhancement and restoration project that will provide the following benefits (after Jones Edmunds and Wetland Solutions 2010):

- Produce high-quality water that flows into Paynes Prairie and then to Alachua Sink and the Floridan aquifer;
- Restore the hydroperiod of over 1,300 acres of wetlands through environmental reuse of wastewater effluent and treated stormwater;
- Remove trash and debris from water discharging to Paynes Prairie (after the Sedimentation Basin and prior to entering the Enhancement Wetland);

- Reduce sediment load from Sweetwater Branch (via a Sedimentation Basin);
- Restore part of the overall water balance to Paynes Prairie;
- Create approximately 125 acres of high-quality wetland wildlife habitat;
- Create a public access area for passive recreation and research within the Sweetwater Branch Wetland Park;
- Naturally assimilate nutrients, sediments, and other pollutants to protect Paynes Prairie and the Floridan aquifer; and
- Attain the City's and FDOT's Alachua Sink TMDL reduction requirements for nitrogen in a cost-effective way.

To obtain these benefits, specific performance criteria were established for different elements of the Project (Jones Edmunds and Wetland Solutions 2010). First, the discharge from the MSWRF would consist of a long-term average Total Nitrogen (TN) of less than 8.0 milligrams per liter (mg L^{-1}), with the annual average TN not to exceed 10.0 milligrams per liter (mg L^{-1}) and an average Total Phosphorus (TP) of 0.3 mg L^{-1} at a permitted average annual daily flow of 7.5 million gallons per day (MGD).

Next, a 125-acre Enhancement Wetland would be designed to treat the water from Sweetwater Branch, discharging an average TN of 3.0 mg L^{-1} , an average TP of 0.3 mg L^{-1} , with removal of suspended solids, floating trash, and debris to the maximum extent practicable before being discharged onto Paynes Prairie. Additional nutrients would be naturally assimilated (via uptake and incorporation into plant tissue) in Paynes Prairie to achieve the background concentrations of 1.4 mg L^{-1} TN and 0.1 mg L^{-1} TP.

Based on modeling (see below for more details) by Jones Edmunds and Wetland Solutions (2010), the enhanced wetlands and sheet flow restoration project will reduce the TN delivered to Paynes Prairie to a level that would meet the TMDL target. The treatment system was designed to satisfy the requirement for downstream protection of designated use.

1.5.1 Assessment of Enhanced Wetland Performance in Meeting the TMDL Target

As part of the Enhancement Wetland design process, Jones Edmunds and Wetland Solutions (2010) conducted modeling to determine the effectiveness of various sized wetlands for removing and assimilating nutrients. They ultimately used an improved version of the P-k-C* model of Kadlec and Wallace (2009), which is a variation of the previously-published tanks-in-series (TIS) formulation of the first-order k-C* model of Kadlec and Knight (1996). The P-k-C* model is based on long-term average conditions, it is widely accepted for use, has been extensively peer reviewed, has been calibrated with data from hundreds of wetlands, and is the preferred tool for sizing constructed wetlands and determining removal rate parameters from operational data (Jones Edmunds and Wetland Solutions 2010). The model incorporates the following key principles (after Jones Edmunds and Wetland Solutions 2010):

- Wetland removal processes are area-based and follow first-order kinetics;
- For some parameters, internal cycling results in non-zero background concentrations (C*);
- Physical factors that influence the hydraulic efficiency of wetlands, including topography, wetland geometry, vegetation density and spatial distribution, and wind fetch lead to non-plug-flow conditions and are included in calculations; and
- Factors that describe pollutant mixtures or contaminant "weathering" are also included in the model.

Following the procedure of Kadlec and Wallace (2009), Jones Edmunds and Wetland Solutions (2010) accounted for stochastic variability by reviewing applicable wetland operational data and evaluating the distribution of measured outflow concentrations around the model-estimated long-term average concentration. This allowed for the calculation of factors that relate the average value (model estimate) to various confidence levels that can then determine if outflow concentrations will be in compliance with permit limits. Jones Edmunds and Wetland Solutions (2010) used the following factors as multipliers on estimated long-term average wetland outflow concentrations:

- TN – 80th Percentile = 1.31
- TN – 90th Percentile = 1.53
- TP – 80th Percentile = 1.65
- TP – 90th Percentile = 2.29

Jones Edmunds and Wetland Solutions (2010) modeled wetland performance by estimating the nutrient inputs from the MSWRF, upstream base flows, and stormwater flows. Previous detailed performance estimates have also been conducted using measured water quality data from Sweetwater Branch at SR 331, which combines the upstream and MSWRF inputs (WSI 2006; WSI 2007).

For estimating inflow water quality to the proposed Enhancement Wetland, Jones Edmunds and Wetland Solutions (2010) assessed a range of “alternative” effluent water qualities representing several possible scenarios for the MSWRF discharge. Final nitrate concentrations and flow rates were the critical differences between the alternatives, while all options assumed chemical addition to reduce effluent TP concentrations to 0.3 mg/L. Some of the alternatives evaluated are summarized below (after Jones Edmunds and Wetland Solutions (2010):

- **Current**—The current annual average daily flow (AADF) is about 5.5 million gallons per day (MGD) or 8.5 cfs. Current effluent TN averages about 5.5 mg/L, with 4.5 mg/L as NO₃-N+NO₂-N.
- **Buildout (Alt. 1)**—The existing plant has a maximum permitted AADF of 7.5 MGD (11.6 cfs). As influent flows reach the permitted capacity, effluent TN is expected to increase to about 8.0 mg/L, with 7.2 mg/L as NO₃-N+NO₂-N.
- **Buildout with Contingency (Alt. 2)**—Allows for the maximum permitted AADF of 7.5 MGD, with an effluent TN of about 10 mg/L, with 9.0 mg/L as NO₃-N+NO₂-N.

As an example (after Jones Edmunds and Wetland Solutions (2010), **Figures 3 and 4** show estimated annual average performance for TN and TP as a function of wetted treatment area for buildout with contingency conditions (Alternative 2). For a 120-acre wetland, the annual average wetland effluent TN concentration was estimated to be about 2.6 mg/L, with 80% of monthly averages less than 3.4 mg/L and 90% of monthly averages less than 4.0 mg/L. The annual average wetland effluent TP concentration was estimated to be about 0.20 mg/L, with 80% of monthly averages less than 0.33 mg/L and 90% of monthly averages less than 0.461 mg/L (Jones Edmunds and Wetland Solutions 2010).

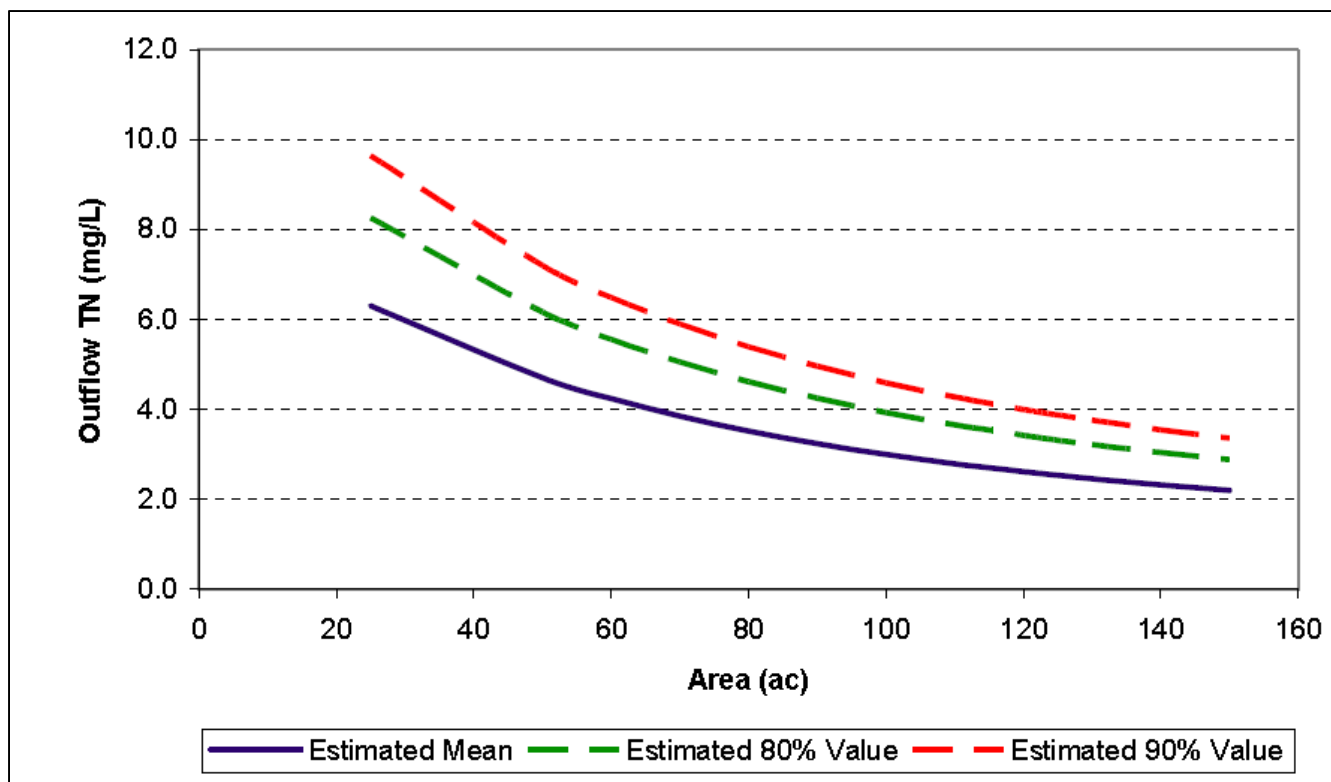


Figure 3. Estimated outflow Total Nitrogen as a function of wetland area – Buildout with contingency (Alt. 2) (after Jones Edmunds and Wetland Solutions (2010).

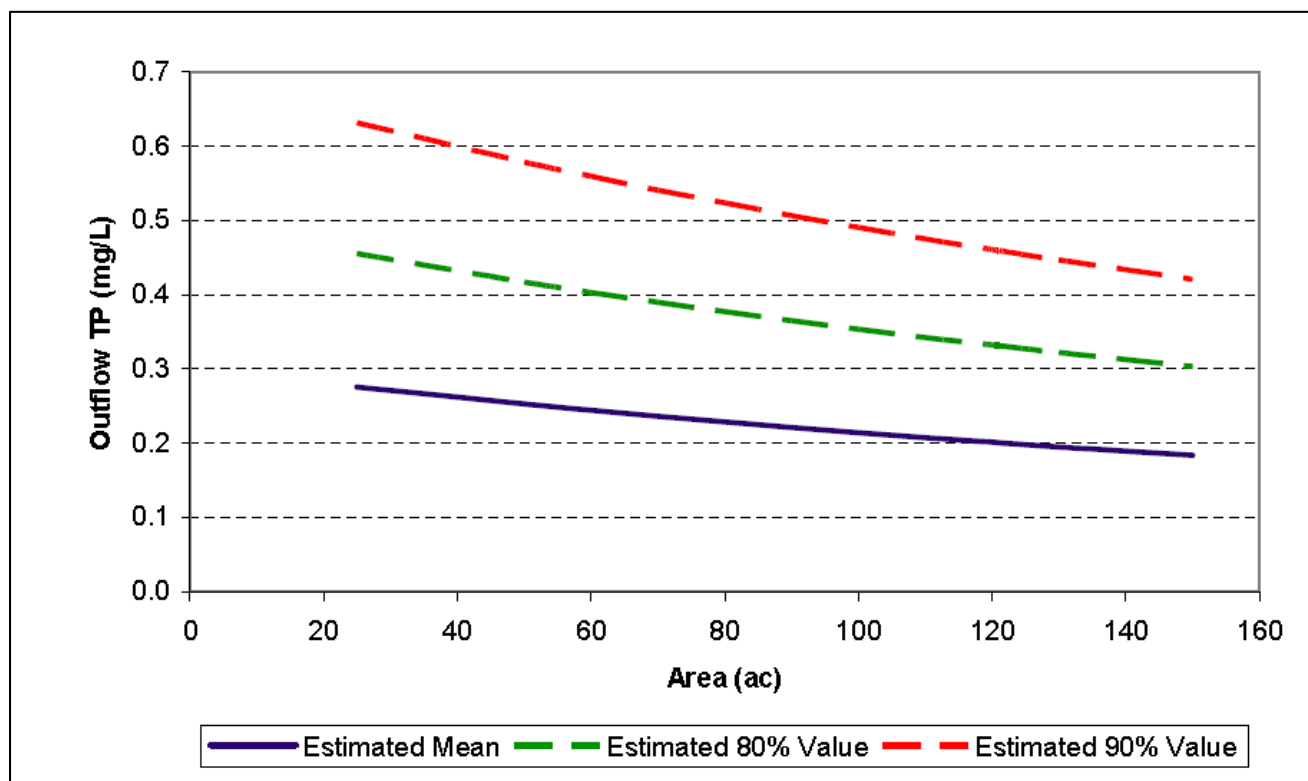


Figure 4. Estimated outflow Total Phosphorus as a function of wetland area – Buildout with contingency (Alt. 2) (after Jones Edmunds and Wetland Solutions (2010).

Based on modeling by WSI (2006), the outflow from the 125 acre enhancement treatment wetland system, under Alternative 2 (Buildout with contingency), would reduce TN load by 25,545 lbs/yr and TP load by 568 lbs/yr.

Jones Edmunds and Wetland Solutions (2010) drew the following conclusions from their analyses:

- Consistent with prior modeling efforts, a wetland area of approximately 125 acres is estimated to reduce current incoming TN loads to acceptable levels for discharge to Paynes Prairie State Park (PPSP) and partially achieves the requirements of the TMDL for Alachua Sink. Prior work (WSI 2006) showed that additional assimilation would occur within the hydrologically-restored section of PPSP and that the full requirements of the TMDL would be met by the time water reaches Alachua Sink (achieving natural background concentrations of 1.4 mg L^{-1} TN and 0.1 mg L^{-1} TP before entering the sink);
- A 125-acre wetland also provides additional TP load reduction that should be beneficial in restoring desirable plant communities within PPSP;
- A 125-acre wetland provides sufficient capacity to assimilate increased nutrient loads associated with buildout and possible future expansions of the MSWRF; and
- Limiting the peak inflow rate to 25 cfs results in minimal bypasses of untreated water to PPSP (about 3% of the annual TN load) without creating an excessive average or maximum hydraulic loading rate to the wetland Jones Edmunds and Wetland Solutions (2010).

1.6 SWEETWATER BRANCH

Previous modeling (see above) has demonstrated that the additional nutrient treatment proposed to be implemented at the MSWRF (*e.g.*, alum treatment to reduce TP to 0.3 mg L^{-1}), coupled with the significant TN reduction provided by the Enhancement Wetlands, would fully satisfy the TMDL and protect downstream waters (Jones Edmunds and Wetland Solutions 2010). However, it must be demonstrated that the nutrients in Sweetwater Branch (the 1.3 mile section that is located between the MSWRF discharge and the Enhanced Wetlands) would allow for protection of Class III designated uses (*i.e.*, a healthy, well balanced aquatic community). Because Sweetwater Branch is a highly physically altered water conveyance system (completely channelized by 1956), characterized by extreme hydrologic modifications and habitat limitations, there have been past failures of the Stream Condition Index (SCI). Therefore, included in this report will be a Stressor Identification evaluation to determine the causes of the faunal biological health issues in Sweetwater Branch.

2 PHYSICAL, BIOLOGICAL, AND CHEMICAL CHARACTERIZATION OF SWEETWATER BRANCH

2.1 PHYSICAL DATA

2.1.1 Physical Setting/System Description/Historical Perspective

Sweetwater Branch is located in Alachua County, Florida, originating within in the urban center of the City of Gainesville (**Figure 2**). This channelized, physically altered system flows to the south, through areas of residential and industrial land uses, past the Gainesville Regional Utilities (GRU) Main Street Water Reclamation Facility (MSWRF), which provides approximately 5.5 (MGD) of treated reclaimed water to Sweetwater Branch (FDEP 2014). During 2012, MSWRF contributed, on average, approximately 80% of total discharge of the system (FDEP 2014). Beyond the MSWRF, Sweetwater Branch continues to flow south for approximately 1.3 miles, until it reaches Paynes Prairie.

Prior to the development of the City of Gainesville, Sweetwater Branch was a small, intermittent stream, which received seepage and overland flow from the area's mixed pine and hardwood forests (FDEP 2002). Prior to the 1920s, approximately one MGD, on average, of water from Sweetwater Branch entered Paynes Prairie (west of its current location), where it would sheetflow to a wetland area known as Alachua Lake (Jones Edmunds and Wetland Solutions 2010). From the 1920s to the 1970s, Sweetwater Branch was subjected to a series of hydrologic modifications to reduce flooding in Gainesville and to allow cattle grazing on Paynes Prairie (Jones Edmunds and Wetland Solutions 2010). Among the most influential of the alterations was the complete channelization of Sweetwater Branch and the construction of the Sweetwater Canal through Paynes Prairie, which was completed by 1956 (Jones Edmunds and Wetland Solutions 2010). After 1956, Sweetwater Branch no longer discharged via sheetflow onto the Prairie, but instead, the flow was captured by the Sweetwater Canal, which conveyed the water directly to Alachua Sink and into the Floridan Aquifer (Jones Edmunds and Wetland Solutions 2010).

Because the majority of Gainesville was urbanized prior to the implementation of modern stormwater management practices, the prevalence of impervious surfaces in the drainage basin has highly altered the timing and volume of the stormwater that enters Sweetwater Branch (FDEP 2002). Additionally, nutrients were identified as causing excess chlorophyll *a* production in Alachua Sink, and in 2006, a Total Maximum Daily Load (TMDL) was developed identifying needed reductions in nutrients going to the sink. To comply with the TMDL and to reestablish sheetflow to Paynes Prairie, the City of Gainesville is implementing a comprehensive restoration project. As described above, the restoration project consists of filling in the canal connecting Sweetwater Branch to Alachua Sink and utilizing 125 acres of enhanced wetlands to effectively treat the majority of water flowing through Sweetwater Branch. Ultimately, this restoration project will provide for water with nutrient loads that will support a healthy, well balanced aquatic community in Sweetwater Branch, as well as provide for a significantly improved hydrologic regime for Paynes Prairie.

2.1.2 Land Use, Impervious Surfaces, and the Landscape Development Intensity Index

A land use characterization of the Sweetwater Branch watershed (WBID 2711) is provided in **Table 2** (Directly Connected Impervious Area was calculated based on values in **Table 3** below). The dominant land use is medium density residential (2-5 dwelling units/acre), making up about 36% of the total. Other adverse human land uses (in the absence of Best Management Practices) include commercial services (17%), institutional (6%), high density residential (5%), roads and highways (3%), and other light industrial uses (3%). Given these human land uses, approximately 70% of the basin is characterized by human activities that would be expected to result in a high degree of directly connected impervious areas (DCIA) (see below).

Table 2. Land use characterization of the Sweetwater Branch watershed (WBID 2711) (Source: FDEP 2014, including additional analysis of Directly Connected Impervious Area).

Land use	Number of acres	Percentage of land use in watershed	Directly Connected Impervious Area (DICA) score (%)	Acres w/ DCIA
Residential, medium density - 2-5 dwelling units/acre	757.51	35.7	64.2	486.32
Commercial and services	358.73	16.9	79.5	285.19
Upland mixed coniferous/hardwood	198.08	9.3	0.5	0.99
Mixed wetland hardwoods	146.46	6.9	30	10.11
Institutional	136.9	6.4	79.5	8.84
Residential, high density - 6 or more dwelling units/acre	108.18	5.1	79.5	5.52
Roads and highways (divided 4-lanes with medians)	69.93	3.3	36.2	2.31
Cemeteries	57.1	2.7	15.4	1.54
Other light industrial	54.19	2.6	79.5	1.38
Residential, low density - less than 2 dwelling units/acre	44.95	2.1	27.9	0.95
Community recreational facilities	30.85	1.4	79.5	0.45
Electrical power transmission lines	23.17	1.1	36.2	0.25
Sewage treatment	22.21	1.0	30	0.23
Electrical power facilities	22.02	1.0	79.5	0.23
Herbaceous upland nonforested	13.54	0.6	0.5	0.09
Military	12.33	0.6	79.5	0.07
Woodland pastures	11.65	0.5	0.5	0.06
Reservoirs - pits, retention ponds, dams	11	0.5	30	0.06
Freshwater marshes	10.49	0.5	30	0.05
Lakes	10.38	0.5	30	0.05
Water supply plants	8.57	0.4	79.5	0.03
Pine flatwoods	5.25	0.2	0.5	0.01
Parks and zoos	3	0.1	27.5	0.00
Wet prairies	2.86	0.1	30	0.00

Land use	Number of acres	Percentage of land use in watershed	Directly Connected Impervious Area (DCIA) score (%)	Acres w/ DCIA
Mixed scrub-shrub wetland	1.8	0.1	30	0.00
Grand Total	2121.17	100	NA	804.75

Gao *et al.* (2006) discussed the importance of calculating the percent impervious area of each land use category when estimating surface runoff using the Watershed Management Model (WMM) for the Alachua Sink TMDL. Studies throughout the United States over the past 15 years have shown that annual “per acre” discharge volumes are positively related to the amount of imperviousness in a land use (WMM 1998). During the process of calibrating the WMM for the Alachua Sink TMDL, Gao *et al.* (2006) adjusted the impervious and pervious runoff coefficients to fit model estimates to measured data and presented a table with the directly connected impervious area (DCIA) percentages for land use categories in the Sweetwater Branch watershed (**Table 3**).

Table 3. Percent directly connected impervious area (DCIA) for different land use categories (see Gao *et al.* 2006).

Land Use Categories	DCIA	Reference
Forest/rural open	0.5%	User’s Manual: WMM, 1998
Urban open	15.4%	User’s Manual: WMM, 1998
Agriculture	3.7%	Brown, 1995
Low-density residential	27.9%	User’s Manual: WMM, 1998
Medium-density residential	64.2%	User’s Manual: WMM, 1998
High-density residential	79.5%	User’s Manual: WMM, 1998
Communication/transportation	36.2%	Brown, 1995
Rangeland	3.7%	CDM
Water/wetland	30.0%	Harper and Livingston, 1999

Based on the land use categories and their respective percent directly connected impervious areas, **37.94 %** of the Sweetwater Branch watershed is calculated to be impervious.

Brown and Vivas (2005) developed a Landscape Development Intensity Index (LDI) to estimate the intensity of human land use based on nonrenewable energy flow. The LDI is calculated as the percentage area within the catchment of particular types of land use multiplied by the coefficient of energy use associated with that land use, summed over all land use types in the catchment:

$$LDI = \sum (LDI_i * \%LU_i)$$

Where:

LDI_i = the nonrenewable energy for a specific land use, and

$\%LU_i$ = the percentage of land area in the catchment with the specific land use.

The LDI coefficients are provided in **Table 4**.

Table 4. Landscape Development Intensity Index Coefficients

Category	Coefficient
Natural System	1
Pine Plantation	1.6
Pasture	3.4
Row Crops	4.5
Residential (low)	6.8
Residential (high)	7.6
Commercial	8.0
Industrial	8.3
Commercial (high)	9.2
Business District	10.0

The LDI for the Sweetwater Branch watershed is **6.4** (FDEP 2014). LDI values of 2 and below are considered to represent minimally disturbed conditions. During the development of the Human Disturbance Gradient for SCI metric selection, LDI values above 3.5 were used to represent significant human influences in the watershed (Fore *et al.* 2007). Therefore, an LDI of 6.4 for the Sweetwater Branch basin represents remarkable adverse human effects. FDEP has had a long history of using the LDI as a tool to estimate potential adverse human effects from various land uses on adjacent waterbodies, such as streams, lakes, and wetlands.

2.1.3 Hydrologic Information

It has been established that significant alterations in a system's hydrologic regime have adverse effects on aquatic life, especially benthic macroinvertebrates and fish (EPA 2014). Several studies have determined that 10-20 % of impervious surfaces in a watershed will generally lead to failing scores on various biological indices, although implementation of stormwater Best Management Practices (*e.g.*, providing a 30 m riparian buffer of native forest, along with other structural BMPs) can help mitigate these adverse effects to some degree (Horner *et al.* 2004, for a review, see EPA 2014). Note that because Gainesville was largely developed prior to modern stormwater rules, BMPs have not been widely implemented in the Sweetwater Branch watershed, meaning that adverse hydrologic effects associated with the 38% impervious surface area are largely unmitigated.

The Florida Department of Environmental Protection (FDEP) has developed a hydrologic modification scoring method for streams to rate the degree of hydrologic changes caused by human activities. Adverse activities evaluated by the method include the presence of dredging, ditching, consumptive use of ground water, and prevalence of impervious surfaces on the landscape. This hydrologic scoring method was one component of FDEP's human disturbance gradient (HDG), which was used to select effective biological metrics for the SCI and Biorecognition (BioRecon) (Fore *et al.* 2007). The hydrologic modification scores range from a natural hydrologic regime of 1 to an extremely altered regime of 10 (**Table 5**). After assessing the relevant factors in **Table 5**, FDEP calculated a hydrologic score of **9** for Sweetwater Branch, indicating that the flow regime is human controlled, in this case predominantly due to the amount of impervious surfaces in the watershed and the high degree of artificial channelization of Sweetwater Branch. These conditions can create water level and flow extremes that cause severe abrasion to benthic organisms, which result in "catastrophic drift," defined as extreme adverse changes in the community due to the flow regime (Paul and Meyer 2001). Gibbons *et al.* (2007) identified the main hydraulic factors that influence catastrophic drift in the aquatic community, which are hydraulic stress due to rapidly changing stream velocity, bed load transport and reduction of substrate stability due to increasing shear stress, and to "sandblast-effects" due to inorganic suspended particles (*e.g.*, sand).

Table 5. Hydrological Modification Scores and Descriptions.

<i>Best</i> 1-2 point	Flow regime as naturally occurs (slow and fairly continual release of water after rains), few impervious surfaces in watershed; high connectivity with ground water and surface features delivering water (e.g., sandhills, wetlands; no ditches, berms)
<i>Slight disturbance</i> 3-4 points	Flow regime minimally changed; some water withdrawals; some wetland drainage, some impervious surfaces in watershed, some ditching
<i>Moderately altered</i> 5-6 points	Flow regime moderately altered; hydrograph moderately flashy (scouring after rain events with subsequent reductions in flow), groundwater pumping evident; much wetland drainage, topographic alterations reduce natural water input; more impervious surfaces throughout watershed, dams/control structures change normal water delivery schedule
<i>Poor</i> 7-8 points	Flow regime highly altered; hydrograph very flashy (scouring after rain events with subsequent reductions in flow, leading to stagnant or dry conditions, related to large amounts of impervious surfaces and/or ditching throughout watershed); water withdrawals & impoundments/control structures severely alter flows, large amounts of impervious surfaces
<i>Very poor</i> 9-10 points	Flow regime entirely human controlled; hydrograph very flashy (scouring after rain events with subsequent reductions in flow, leading to stagnant or dry conditions, related to impervious surfaces and ditching throughout watershed); water withdrawals & impoundments fundamentally alter the nature of the ecosystem

Because of the above hydrologic modifications, including the high amount of impervious surfaces, the hydrograph for Sweetwater Branch is characterized by a series of extreme flow events (**Figure 5**).

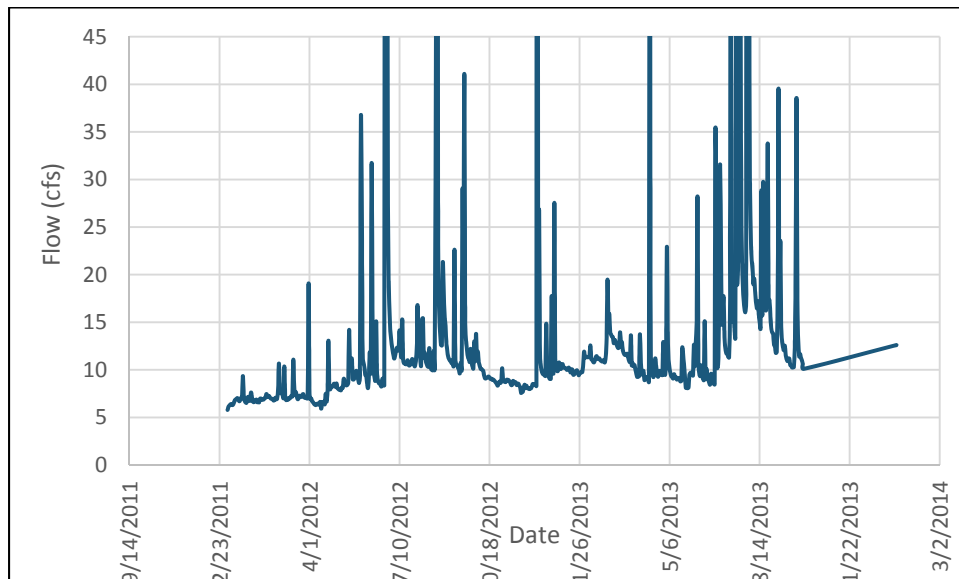


Figure 5. Hydrograph for Sweetwater Branch (measured at Williston Rd.) for 2012-2014 with scale truncated at 45 cfs to enable visualization of extreme discharge events (data from St. Johns River Water Management District).

2.1.4 Hydrologic Modification and Sediment Movement in Sweetwater Branch

The sediment movement in Sweetwater Branch that is associated with storm events was studied by Jones Edmunds (2010). They found that storm events, coupled with hydrologic modifications in the watershed, resulted in significant sediment movement (mostly sand) in Sweetwater Branch. For example, rainfall leading to a 20.3 cfs flow in Sweetwater Branch resulted in 540,437 ft³ of sediment transfer downstream, while a 43 cfs flow resulted in 1,401,601 ft³ of sediment movement and subsequent deposition (Jones Edmunds 2010). Since 2012, there have been in excess of 20 flow events that were greater than 20.3 cfs in Sweetwater Branch, indicating that extreme sediment movement is a significant issue.

2.1.5 Stream Habitat Information

The FDEP Stream Habitat Assessment consists of scoring eight parameters based of field measurements and observations, including substrate diversity, substrate availability, water velocity, habitat smothering, bank stability, degree of artificial channelization, riparian zone buffer width and riparian zone vegetation quality. Mean habitat scores in Sweetwater Branch are 90 points (suboptimal) upstream of the MSWRF discharge and 92 (suboptimal) downstream of the discharge (see **Table 6**).

As mentioned above, Sweetwater Branch has been entirely artificially channelized. Except for a small section near the Hawthorne Bike Trail (sometimes used as a reference site), artificial channelization scores routinely fall in the poor category, generally 3 points or less (see **Table 6**). This poor channelization score is often associated with low substrate availability, habitat smothering, and scouring during rain events (**Figure 6**).



Figure 6. Photo of Sweetwater Branch (1-24-14) taken south of Williston Road, showing the high degree of artificial channelization (note lack of sinuosity).

2.2 BIOLOGICAL DATA

A summary of biological data (including Rapid Periphyton Survey, Linear Vegetation Survey, Stream Condition Index, BioRecon, and Habitat Assessment) collected by various entities is found in **Table 7**.

Table 6. Habitat assessment information for site locations upstream of Kelly, between Kelly and MSWRF, and downstream of MSWRF.

	Upstream				Between									
Date	2/15/2001	12/15/2009	9/21/2010	4/18/2014	2/21/2001	2/10/2009	2/21/2012	9/11/2012	1/24/2014	10/29/2007	4/1/2002	4/17/2014		
Site	SWBSE2	SWBNE7	SWBLF	SWBSE2	SWBSE4	SWBSE4	REF1	REF1	REF1	SWB1	SWB1	SWB1		
Agency	Alachua Co.	Alachua Co.	Alachua Co.	Fry Eco	Alachua Co.	Alachua Co.	FDEP	FDEP	Fry Eco	FDEP	FDEP	FDEP		
Substrate diversity	-	-	-	11	-	-	11	8	12	11	14	8		
Substrate availability	-	-	-	7	-	-	6	8	8	6	6	5		
Water velocity	-	-	-	8	-	-	10	12	20	13	13	14		
Habitat smothering	-	-	-	13	-	-	13	14	17	11	11	10		
Primary score	-	-	-	39	-	-	40	42	57	41	44	37		
Artificial channelization	-	-	-	9	-	-	15	13	12	4	13	10		
Bank stability	-	-	-	9	-	-	10	10	10	6	10	14		
Riparian Buffer Zone Width	-	-	-	3	-	-	12	12	16	13	15	14		
Riparian Zone Vegetation Quality	-	-	-	8	-	-	13	13	16	20	16	14		
Secondary score	-	-	-	29	-	-	50	48	54	43	53	52		
Total score	80	93	90	68	101	91	90	90	111	84	97	89		
Downstream														
Date	5/2/2001	3/24/2009	9/21/2010	10/18/2011	10/18/2011	2/21/2012	2/21/2012	9/11/2012	1/24/2014	4/16/2014	10/29/2007	4/1/2002	4/17/2014	4/17/2014
Site	SWBPP	SWBPP	SWBSP	SWB3	SWB4	SWB3	SWB5	SWB5	SWB5	SWB5	SWB2	SWB2	SWB5	SWB2
Agency	Alachua Co.	Alachua Co.	Alachua Co.	FDEP	FDEP	FDEP	FDEP	FDEP	Fry Eco	Fry Eco	FDEP	FDEP	FDEP	FDEP
Substrate diversity	-	-	-	12	12	11	7	12	7	6	13	14	11	6
Substrate availability	-	-	-	12	8	10	5	6	4	4	9	8	6	13
Water velocity	-	-	-	18	17	20	12	13	20	20	19	16	18	20
Habitat smothering	-	-	-	8	6	6	11	11	3	3	12	11	11	4
Primary score	-	-	-	50	43	47	35	42	34	33	53	49	46	43
Artificial channelization	-	-	-	3	3	3	3	3	2	3	13	13	11	10
Bank stability	-	-	-	6	6	6	20	18	8	8	6	13	10	6
Riparian Buffer Zone Width	-	-	-	16	19	15	19	20	19	19	15	13	20	12
Riparian Zone Vegetation Quality	-	-	-	17	17	15	14	12	16	14	20	16	18	15
Secondary score	-	-	-	42	45	39	56	53	45	44	54	55	59	43
Total score	112	102	109	92	88	86	91	95	79	77	107	104	105	86

Table 7. Summary of biological data for Sweetwater Branch.

Upstream of Kelly								
Agency	Date	Site	HA	RPS (%4,5,6)	LVS		SCI	Biorecon
					mean C of C	%FLEPPC		
FDEP	9/23/1991	SWBSE2	marginal ^a	-	-	-	-	-
FDEP	8/5/1996	SWBSE2	suboptimal (87)	-	-	-	poor ^a	-
Alachua Co.	2/15/2001	SWBSE2	marginal (80)	-	-	-	-	impaired
Alachua Co.	12/15/2009	SWBNE7	suboptimal (93)	-	-	-	-	impaired
Fry Eco	4/16/2014	SWBSE2	marginal (68)	pass (3)	fail (1.4)	fail (63.2)	poor (23)	-
Overall			suboptimal	pass (3)	fail	fail	poor	Impaired
Between Kelly and MSWRF								
Agency	Date	Site	HA	RPS (%4,5,6)	LVS		SCI	Biorecon
					mean C of C	%FLEPPC		
FDEP	8/5/1996	SWBSE4	marginal (79)	-	-	-	poor ^a	-
Alachua Co.	2/21/2001	SWBSE4	suboptimal (101)	-	-	-	-	impaired
FDEP	4/1/2002	SWB1	suboptimal (98)	-	-	-	good ^a	-
FDEP	10/29/2007	SWB1	suboptimal (84)	-	-	-	poor (19)	-
Alachua Co.	2/10/2009	SWBSE4	suboptimal (91)	-	-	-	-	impaired
Alachua Co.	9/21/2010	SWBLF	suboptimal (91)	-	-	-	-	impaired
FDEP	2/1/2012	REF1	suboptimal (90)	-	-	-	healthy (44)	-
W&A	2/21/2012	REF1	-	fail (35)	pass ^b	pass ^b	-	-
W&A	5/1/2012	REF1	-	pass (0)	-	-	-	-
W&A	6/14/2012	REF1	-	pass (0)	pass ^b	pass ^b	-	-
W&A	7/16/2012	REF1	-	pass (0)	-	-	-	-
W&A	9/6/2012	REF1	-	pass (0)	-	-	-	-
FDEP	9/11/2012	REF1	suboptimal (90)	-	-	-	poor (24)	-
Fry Eco	1/24/2014	REF1	suboptimal (119)	pass (5)	pass ^b	pass ^b	-	-
FDEP	4/17/2014	SWB1	suboptimal (86)	pass (0)	pass ^b	pass ^b	healthy (45)	-
Overall			suboptimal	pass	pass	pass	poor	impaired

Table 7 (cont.). Summary of biological data for Sweetwater Branch continued.

Downstream of MSWRF								
Agency	Date	Site	HA	RPS (%4,5,6)	LVS		SCI	Biorecon
					mean C of C	%FLEPPC		
Alachua Co.	5/2/2001	SWB5	suboptimal (112)	-	-	-	-	suspect
FDEP	4/1/2002	SWB2	suboptimal (104)	-	-	-	poor ^a	-
FDEP	10/29/2007	SWB2	suboptimal (107)	-	-	-	poor (23)	-
Alachua Co.	3/24/2009	SWB5	suboptimal (102)	-	-	-	-	healthy
Alachua Co.	9/21/2010	SWB3	suboptimal (109)	-	-	-	-	impaired
FDEP	10/18/2011	SWB3	suboptimal (92)	-	pass ^b	pass ^b	poor (29)	-
FDEP	10/18/2011	SWB4	suboptimal (88)	-	pass ^b	pass ^b	poor (23)	-
FDEP	2/21/2012	SWB3	suboptimal (86)	fail (48)	pass (5.7)	pass (0.5)	poor (28)	-
FDEP	2/21/2012	SWB5	suboptimal (91)	fail (50)	fail (0.7)	pass (0.8)	poor (33)	-
W&A	2/22/2012	SWB2	-	pass (10)	pass ^b	pass ^b	-	-
W&A	5/1/2012	SWB2	-	pass (0)	-	-	-	-
W&A	5/1/2012	SWB3	-	pass (0)	-	-	-	-
W&A	5/1/2012	SWB5	-	pass (0)	-	-	-	-
W&A	6/14/2012	SWB2	-	pass (0)	pass ^b	pass ^b	-	-
W&A	6/14/2012	SWB3	-	pass (0)	pass ^b	pass ^b	-	-
W&A	6/14/2012	SWB5	-	pass (0)	fail (1.0)	pass (0.7)	-	-
W&A	7/16/2012	SWB2	-	pass (0)	-	-	-	-
W&A	7/16/2012	SWB3	-	pass (0)	-	-	-	-
W&A	7/16/2012	SWB5	-	pass (0)	-	-	-	-
W&A	9/6/2012	SWB2	-	pass (3)	-	-	-	-
W&A	9/6/2012	SWB5	-	pass (0)	-	-	-	-
FDEP	9/11/2012	SWB5	suboptimal (95)	-	-	-	poor (32)	-
Fry Eco	1/24/2014	SWB5	suboptimal (79)	pass (3)	pass ^b	pass ^b	-	-
Fry Eco	4/16/2014	SWB5	suboptimal (77)	pass (3)	pass ^b	pass ^b	-	-
FDEP	4/17/2014	SWB2	suboptimal (86)	pass (0)	pass ^b	pass ^b	poor (28)	-
FDEP	4/17/2014	SWB5	suboptimal (105)	pass (5)	pass ^b	pass ^b	healthy (39)	-
Average			suboptimal	pass	pass	pass	poor	impaired
a - qualitative score displayed only, as scoring metrics have been changed and are not directly comparable to current								
b - passed based on less than 2 square meters of macrophytes present								
LVS requires a mean C of C of 2.5 or more to pass, and a %FLEPPC under 24% to pass. The RPS requires the %4,5,6 to be less than 25%. A passing SCI score is 40 or more.								

2.2.1 Benthic Invertebrate Information

The BioRecon failed consistently (5 times in 5 samplings) in Sweetwater Branch upstream of the MSWRF. Downstream of the MSWRF, the BioRecon passed once, was “suspect” once, and failed once. Stream Condition Index scores averaged 33 (n=4) in Sweetwater Branch upstream of the MSWRF and 29 (n=8) downstream of the facility. These SCI scores do not achieve the minimum acceptable average score (40) for a healthy, well balanced stream. In a 2008 5th Year Inspection, with sampling concurrently conducted upstream and downstream from the MSWRF, FDEP concluded that “the macroinvertebrate community in this portion of Sweetwater Branch is already suppressed by other urban influences such that the effluent did not cause further degradation of the community”.

2.2.2 Linear Vegetation Survey

The LVS achieved the floral evidentiary threshold for macrophytes 5 times in 6 samplings (failing once) in Sweetwater Branch upstream of the MSWRF. Downstream of the MSWRF, the LVS passed 11 times (eleven date-station combinations), with the results often influenced by a lack of 2 m² of vascular plants in the water. The LVS failed on two separate occasions at SWB-5 (located just upstream from where Sweetwater Branch enters Paynes Prairie) prior to the ongoing restoration activities. Physical mitigation of this stream segment, along with continuing plant management activities, were responsible for restoring a healthy aquatic plant community at SWB-5, and subsequently, the past two temporally independent LVS samples achieved the NNC evidentiary thresholds.

Prior to the construction of the Paynes Prairie sedimentation basin, station SWB-5 represented an area with extreme physical disruption due to sedimentation, with sand and debris continually depositing in the area (**Figure 7**). This promoted deltaic, sand-smothered conditions where pioneer species (mainly exotic plants such as *Colocassia* and *Ruellia*) could outcompete other plants requiring more typical stream habitats (**Figure 8**). Construction of the sedimentation basin resulted in partial physical restoration of Sweetwater Branch at SWB-5, which is now characterized by an actual stream channel with banks, with optimal water velocity, and most recent LVS results that achieve the floristic evidentiary thresholds (**Figure 9**). Undesired aquatic vascular plants are now absent at SWB-5, and this is the direct result of the dramatically improved stream conditions associated with construction of the sedimentation basin (**Figure 10**), in conjunction with an exotic plant removal program conducted by the Paynes Prairie State Park staff (see below). Two temporally independent LVS samplings conducted at SWB-5 (on 1-24-14 and 4-16-14 by Frydenborg EcoLogic, and on 4-17-14 by FDEP) demonstrated that the LVS continues to achieve the evidentiary thresholds (no plants in water), confirming the success of the ongoing management activities.

The combination of physical restoration of lower Sweetwater Branch (SWB5) and active plant management provides reasonable assurance that the LVS endpoints will continue to be achieved. Paynes Prairie Preserve State Park conducts continuing management of non-native, invasive plant and animal species in accordance with the goals and priorities established in the Park’s 10 year management plan. The 2013-2023 plan identifies the goal of “Remove exotic and invasive plants and animals from the park and conduct needed maintenance control.” It also identifies the following specific objectives: annually treat 400 acres of exotic plant species in the park, and develop and implement measures to prevent the accidental introduction or further spread of invasive exotic plants in the park. Areas within the park are prioritized for treatment based on the threat posed by specific non-native species, and sensitivity, rarity, and relative importance of the natural community or site being threatened by invasion.

Treatment of the management zones within the preserve located adjacent to the Sweetwater Branch Sheetflow Restoration Project Enhancement Wetland will continue to be a priority due to the importance of the project in restoration of hydrology within the Paynes Prairie basin marsh. Initial treatments of the wild taro, Mexican petunia, Japanese climbing fern, air potato, Chinese tallow, glossy privet, camphor tree, coral ardisia, and Tradescantia were conducted in 2013 and 2014. Ongoing maintenance treatments of these species, and initial treatments of others detected adjacent to the project, are planned and will be conducted dependent upon funding and staffing levels within the park.



Figure 7. Pre-restoration photo of Sweetwater Branch at SWB-5, taken prior to construction of the sedimentation basin. Note deposition of sand and debris and deltaic-type conditions, promoting pioneer species such as *Colocassia* (photo by FDEP).



Figure 8. Pre-restoration photo at SWB-5 showing Sweetwater Branch flowing through deposition delta and *Colocassia* (photo by FDEP).



Figure 9. Post-restoration photo of Sweetwater Branch at SWB-5, in January, 2014, with the Sedimentation Basin in the distance. Note presence of a stream channel with banks and lack of exotic aquatic vegetation.



Figure 10. Post-restoration photo of Sweetwater Branch at SWB-5, January, 2014, emphasizing the recently developed stream banks.

2.2.3 Algae and Rapid Periphyton Survey

The RPS achieved the expected floral evidentiary threshold (< 25% coverage of rank 4-6) on 8 out of 9 station-date combinations (failing once) upstream of the MSWRF. Similarly, the RPS passed (< 25% coverage of rank 4-6) on 16 out of 18 station-date combinations (failing at two stations on the same day) downstream of the MSWRF. Since February, 2012, the RPS has passed downstream of the MSWRF on 16 station/date combinations, during four temporally independent samplings (conducted > 3 months apart).

2.2.3.1 Algal Community Response to Experimental Increased Nutrient Loading

A Before-After-Control-Impact Study was conducted during 2010 and 2011 to evaluate potential changes in algal species composition and abundance in response to an experimental increase in nutrient loading to Sweetwater Branch (WAR 2011). On four separate occasions, phytoplankton and periphyton were sampled and identified to species (and variety) level at three stations, one located upstream of the MSWRF and two located downstream of the outfall. Two of the samplings occurred prior to an experimental 2 MGD increase in the MSWRF discharge, which was conducted to partially simulate the nutrient loading that would be similar to a “full build-out” scenario. The experimental increase in the MSWRF discharge was accomplished by using GRU’s wastewater collection system to reroute raw wastewater flow from the Kanapaha Water Reclamation Facility to MSWRF. Two samplings occurred after the nutrient load increase to evaluate potential changes in the algal community associated with nutrient conditions that approached (but did not equal) those expected for a “full build-out” scenario. The period of increased nutrient loading began in January 2011 and continued until after the final (September 2011) algal sampling. Effluent flow and effluent nutrient concentrations that occurred during the study are found in **Table 8**.

Table 8. MSWRF discharge flow and effluent nutrient concentrations during the WAR periphyton study.

MSWRF effluent flow and nutrient concentration during WAR periphyton survey				
Sample Date	Flow (MGD)	Flow (CFS)	TP (mg/L)	TN (mg/L)
2/19/2010	6.84	10.58	-	3.92
9/21/2010	5.54	8.57	0.96	4.50
3/9/11 to 3/11/11	7.22	11.17	1.10	6.57
8/24/11 to 9/24/11	6.96	10.77	1.65	5.91

Although the Rapid Periphyton Survey was not conducted during the study, Mike Hein, the investigator that carried out the study at Water and Air Research, was contacted to provide some of his qualitative observations. During the sampling, filamentous periphyton was mainly associated with the rock filled wire mesh gabion baskets located upstream from the MSWRF, while filamentous periphyton tended to be rare in the shifting sand substrate located downstream of the discharge (Mike Hein, personal communication, 2014). However, Mr. Hein stated that if filamentous periphyton was present, it would have been collected as part of the natural substrate samples.

Diatoms (Bacillariophyceae) were consistently the dominant (generally >90%) group of algae collected, and no taxa potentially capable of producing toxins were observed, both pre- and post- the increased loading period (WAR 2011). Algal density (both phytoplankton and periphyton) was low, indicating a distinct lack of nuisance conditions (WAR 2011). For example, phytoplankton density ranged from 106 units/mL upstream of the MSWRF discharge to 1,705 units/mL downstream of the discharge during the study. These phytoplankton densities are associated with Annual Geometric Mean chlorophyll *a* values that complied with the reference site based expectation (<3.2 µg/L, see **Table 9**) (FDEP 2013). Algal densities from periphytometer samplers ranged from 3,399 units/cm² upstream of the discharge to 7,561 units/cm² and 1,252 units/cm² at sites located downstream of the discharge (WAR 2011). These densities are much lower than those associated with minimally disturbed, low nutrient reference site conditions in the Deerpoint Lake watershed, which ranged on average from 23,000 to 35,000 units/ cm² (FDEP 1992).

Based on non-metric multidimensional scaling analyses, there were no significant differences in community composition (*i.e.*, no adverse shifts or imbalances) observed when comparing the pre- with post- period of increased nutrient loading (WAR 2011). This is partial evidence that the nutrient loading (up to 7.2 MGD and 6.6 mg/L TN) that approximated conditions similar to a “full build-out” scenario of the MSWRF (7.5 MGD and 8 mg/L TN) would be protective of algal communities in Sweetwater Branch. This conclusion is similar to the results of a 2008 5th Year Bioassessment conducted by FDEP, which stated that “periphyton community composition did not differ between Control and Test Sites” (FDEP 2008). To definitively address the algal issue, comprehensive modeling will be conducted to evaluate the potential effects of the MSWRF discharge on phytoplankton and periphyton biomass at various nutrient loadings (see Chapter 4). The very fast travel time between the MSWRF discharge and the Enhancement Wetlands and the light-limited (shaded) conditions of Sweetwater Branch are factors that could mitigate the effects of nutrient loading in the waterbody.

FDEP requested that the flow from the Kelly Power Generating facility, located upstream of the MSWRF, be characterized in relation to the 2008 5th Year Assessment. The flow from the Kelly Plant averaged 0.193225 MGD for 2008, which is significantly lower than the 7.22 MGD from the MSWRF during portions of the post-loading period. The median annual flow from the Kelly Plant between 1998 and 2013 was 0.100258 MGD.

2.3 WATER QUALITY DATA

2.3.1 Nutrients and Chlorophyll

Total nitrogen (TN), total phosphorus (TP), and phaeophytin-corrected chlorophyll a (Chlorophyll) from all available sources (GRU, Alachua County, Impaired Waters Rule Database) were compiled for the period 2002-2013 (see stations in **Table 1**), and annual geometric means were calculated (consistent with the minimum data requirements in Chapter 62-302.531, F.A.C.) (**Table 9**). The data were segregated in a manner that allowed potential differences in nutrients (and the response variable) attributable to the MSWRF to be determined (**Figures 11-13**).

Table 9. Annual Geometric Means for TP, TN, and chlorophyll a (including the number of observations) in Sweetwater Branch, upstream of the Kelly facility, between Kelly and MSWRF, and downstream of MSWRF.

Year	Upstream of Kelly						Between Kelly and MSWRF						Downstream of MSWRF					
	TP (mg/L)		TN (mg/L)		Chlorophyll (ug/L)		TP (mg/L)		TN (mg/L)		Chlorophyll (ug/L)		TP (mg/L)		TN (mg/L)		Chlorophyll (ug/L)	
	AGM	n	AGM	n	AGM	n	AGM	n	AGM	n	AGM	n	AGM	n	AGM	n	AGM	n
2001	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0
2002	0.10	10	0.67	10	-	1	-	1	-	1	-	1	0.76	5	3.27	5	-	0
2003	0.08	16	0.77	18	-	0	-	1	-	1	-	1	0.84	9	3.38	10	-	1
2004	0.08	8	0.44	8	-	0	-	3	-	3	-	3	-	0	-	3	-	3
2005	0.15	10	0.64	7	0.97	7	0.18	10	0.60	9	0.56	9	0.49	4	3.08	7	0.63	6
2006	0.14	4	-	3	-	0	0.13	12	0.79	8	1.44	9	0.43	5	2.70	10	0.16	4
2007	-	3	-	3	-	0	0.25	12	0.63	8	0.20	8	0.67	4	3.53	8	0.60	4
2008	-	0	-	0	-	0	0.35	12	0.81	10	2.05	8	-	3	5.80	8	1.29	8
2009	-	0	-	0	-	0	0.30	12	0.80	8	0.21	8	0.44	4	4.10	8	0.41	7
2010	-	0	-	0	-	0	0.39	12	0.75	9	0.55	8	0.63	4	3.20	8	1.05	7
2011	0.28	7	0.35	7	-	0	0.31	13	0.47	9	1.76	9	0.98	8	4.02	8	1.69	8
2012	0.46	8	0.59	8	-	0	0.49	13	0.70	13	1.51	11	0.91	23	5.70	23	1.21	28
2013	0.41	4	0.59	4	-	0	0.49	6	0.72	6	1.82	4	0.84	6	4.43	6	1.06	6
Avg	0.21	5	0.58	5	0.97	1	0.32	8	0.70	7	1.12	6	0.70	6	3.93	8	0.90	6

Non detects, designated by U, were halved before averaging, as per standard protocol.

"-" indicates that data sufficiency requirements were not achieved

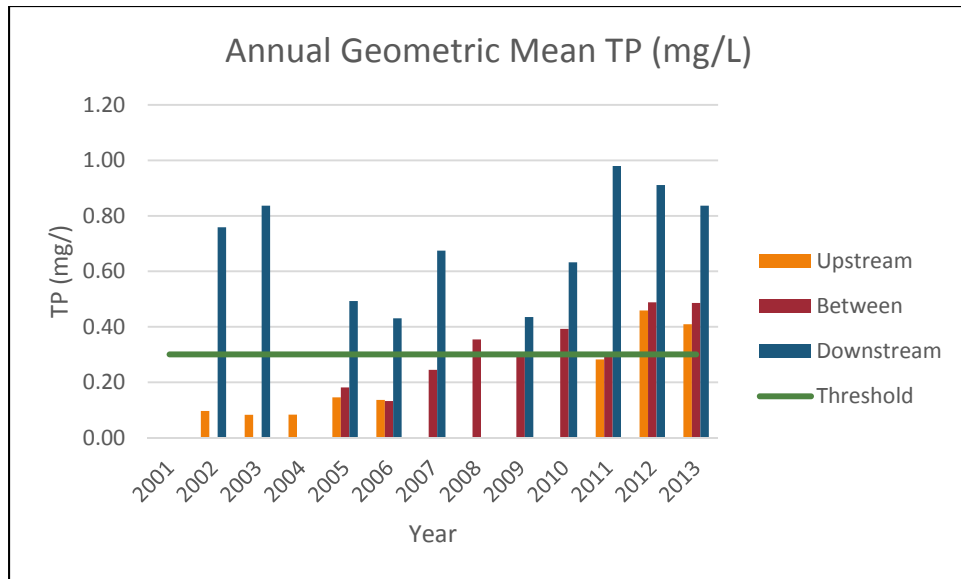


Figure 11. Total Phosphorus in Sweetwater Branch over time. “Upstream” includes stations above the Kelly power plant, “between” includes stations between Kelly and MSWRF, and “downstream” includes stations downstream of MSWRF.

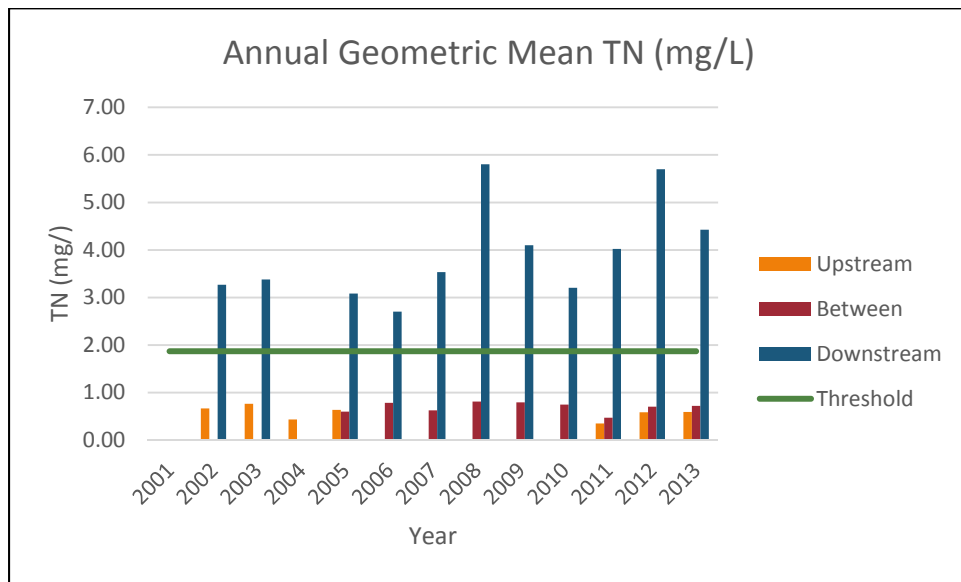


Figure 12. Total Nitrogen in Sweetwater Branch over time. “Upstream” includes stations above the Kelly power plant, “between” includes stations between Kelly and MSWRF, and “downstream” includes stations downstream of MSWRF.

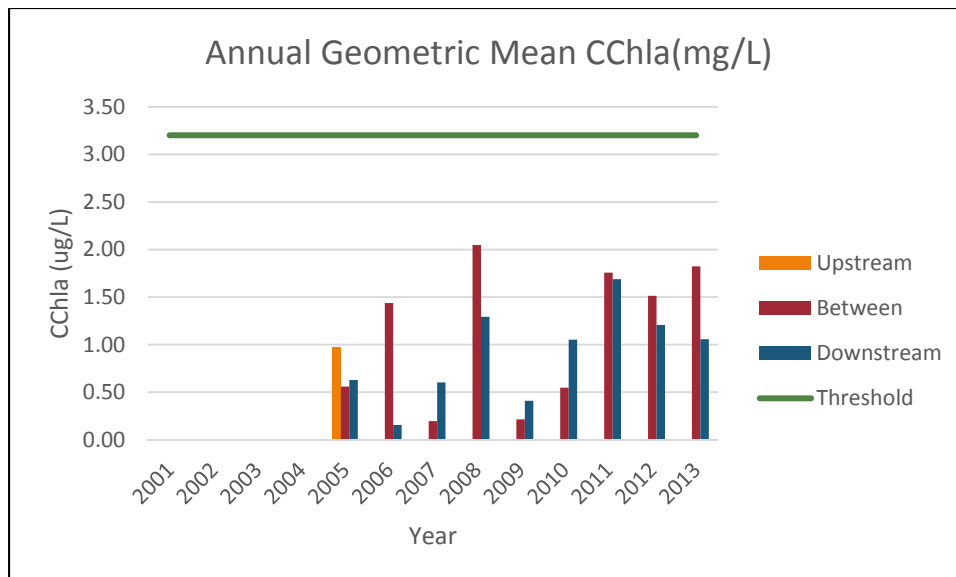


Figure 13. Chlorophyll a in Sweetwater Branch over time. “Upstream” includes stations above the Kelly power plant, “between” includes stations between Kelly and MSWRF, and “downstream” includes stations downstream of MSWRF.

While both TP and TN were increased as a result of the MSWRF discharge, an important biological response variable (chlorophyll a) was very low, both upstream and downstream from the facility, complying with the 3.2 µg/L evidentiary threshold in the Implementation Document (FDEP 2013).

2.3.2 Metered Parameters and Other Water Quality Data

Metered parameters and other selected water quality data collected from Sweetwater Branch over time, upstream and downstream of the MSWRF, are summarized in **Table 10**, for the time period 2002-2013. These data are provided in more detail in Section 8 of the Appendix. During the past five years, dissolved oxygen downstream of the MSWRF consistently achieved the former DO criterion of 5 mg/L, which was more stringent than the current criterion, meaning DO consistently complied with water quality standards. pH was circum-neutral throughout Sweetwater Branch. Although samples downstream of the MSWRF were moderately higher in specific conductance compared with the upstream measurements (due to the discharge), the water quality criterion of 1275 µmhos/cm was consistently achieved in all samples. Temperature tended to be higher downstream, but ammonia was low, both upstream and downstream from the MSWRF.

Table 10. Selected water quality parameters in Sweetwater Branch over time (with summary statistics), upstream of the Kelly discharge, between Kelly and MSWRF, and downstream of the MSWRF.

Year	Upstream of Kelly																								
	Dissolved oxygen (mg/L)					pH					Conductivity (umhos/cm)					Temperature (C°)					NH3 (mg/L)				
	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n
2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	3.86	10.01	5.73	6.01	7	6.39	7.59	7.33	7.18	7	285.00	345.00	331.00	326.57	7	16.55	24.47	20.43	20.85	7	0.01	0.33	0.05	0.13	7
2003	4.54	11.42	7.60	7.67	19	6.37	7.87	7.20	7.15	19	113.00	372.00	329.00	308.84	19	14.16	26.37	23.36	22.12	19	0.01	0.62	0.08	0.21	16
2004	1.40	10.22	7.70	6.67	16	6.84	7.54	7.27	7.22	16	153.00	361.00	268.00	263.75	16	16.22	31.26	21.50	22.43	16	ND	ND	ND	ND	ND
2005	0.22	7.79	4.18	4.72	9	6.41	7.35	6.94	6.95	9	96.00	351.00	244.00	248.56	9	18.74	29.64	22.16	23.44	9	0.02	1.00	0.23	0.33	5
2006	0.71	4.91	1.02	1.72	8	6.73	7.17	7.10	7.03	8	224.00	381.00	323.50	311.50	8	17.70	26.58	25.04	23.60	8	0.02	0.97	0.17	0.33	4
2007	1.27	2.02	1.61	1.63	3	6.87	7.08	7.05	7.00	3	174.00	384.00	334.00	297.33	3	18.98	30.26	24.95	24.73	3	0.16	0.52	0.23	0.31	3
2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2010	7.50	7.50	7.50	7.50	1	6.88	6.88	6.88	6.88	1	318.00	318.00	318.00	318.00	1	9.09	9.09	9.09	9.09	1	-	-	-	-	-
2011	1.29	6.06	2.91	3.83	9	6.76	7.52	7.37	7.28	9	169.00	383.00	296.00	279.33	9	18.32	28.02	19.97	22.55	9	0.01	0.06	0.02	0.03	4
2012	1.46	7.18	4.46	4.68	10	6.98	8.03	7.37	7.37	10	189.00	391.00	307.00	309.60	10	15.56	32.32	18.96	20.50	10	0.01	0.04	0.03	0.02	4
2013	5.43	9.09	7.79	7.44	3	7.48	7.58	7.49	7.52	3	292.00	351.00	301.20	314.73	3	15.44	27.90	21.31	21.55	3	0.04	0.08	0.06	0.06	2
Avg	2.77	7.62	5.05	5.19	8.5	6.77	7.46	7.20	7.16	8.5	201.30	363.70	305.17	297.82	8.5	16.08	26.59	20.68	21.09	8.5	0.04	0.45	0.11	0.18	5.63

Year	Between Kelly and MSWRF																								
	Dissolved oxygen (mg/L)					pH					Conductivity (umhos/cm)					Temperature (C°)					NH3 (mg/L)				
	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n
2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	7.70	7.70	7.70	7.70	1	7.30	7.30	7.30	7.30	1	914.00	914.00	914.00	914.00	1	22.20	22.20	22.20	22.20	1	0.06	0.06	0.06	0.06	1
2003	6.18	9.51	7.85	7.85	2	7.10	7.19	7.15	7.15	2	390.00	464.00	427.00	427.00	2	15.93	26.70	21.32	21.32	2	0.05	0.10	0.07	0.07	2
2004	6.83	8.69	7.30	7.61	3	7.50	8.00	7.60	7.70	3	315.00	500.00	490.00	435.00	3	15.70	27.00	25.80	22.83	3	0.10	0.30	0.10	0.17	3
2005	3.60	9.83	6.75	6.67	12	6.70	7.80	7.30	7.27	12	100.00	398.00	350.00	285.82	11	14.73	24.10	20.15	19.70	12	0.01	0.20	0.08	0.08	10
2006	5.50	10.07	5.80	6.69	11	6.30	7.90	6.78	7.07	11	150.00	550.00	409.00	398.60	10	14.31	25.31	21.20	20.87	11	0.01	0.11	0.07	0.06	11
2007	4.10	9.50	7.00	7.00	12	7.50	8.20	7.63	7.72	12	381.00	550.00	500.00	478.09	11	16.60	27.50	21.50	22.26	12	0.03	0.06	0.05	0.05	10
2008	7.80	10.65	9.60	9.43	8	7.60	8.10	8.00	7.70	8	200.00	450.00	350.00	316.25	8	18.80	23.90	19.80	20.58	8	0.02	0.10	0.04	0.05	12
2009	5.80	11.50	6.50	7.79	8	6.50	7.50	7.30	7.15	8	210.00	480.00	335.00	353.75	8	7.60	26.10	19.55	17.76	8	0.03	0.43	0.07	0.10	11
2010	6.24	10.99	8.40	8.30	13	6.58	7.76	7.10	7.21	13	186.00	450.00	392.00	380.78	13	6.20	26.36	16.87	17.16	13	0.02	0.25	0.04	0.08	12
2011	5.70	10.60	8.10	7.90	17	6.30	8.21	7.70	7.62	17	380.00	950.00	507.00	546.58	17	11.60	27.60	17.79	19.95	17	0.02	0.14	0.04	0.05	15
2012	6.54	9.60	7.72	7.72	19	7.08	8.44	7.70	7.76	19	400.00	975.00	702.00	701.94	18	13.75	28.61	20.65	20.90	19	0.03	0.15	0.06	0.06	17
2013	6.63	10.04	8.53	8.44	14	7.20	8.20	7.40	7.59	14	257.00	675.00	405.80	448.69	14	15.07	28.70	19.97	20.48	14	0.04	0.21	0.09	0.10	12
Avg	6.05	9.89	7.60	7.76	10	6.97	7.96	7.41	7.52	10	323.58	613.00	481.82	473.88	9.67	14.37	26.17	20.57	20.50	10	0.03	0.17	0.06	0.08	9.67

Table 10 (cont.). Selected water quality parameters in Sweetwater Branch over time (with summary statistics), upstream of the Kelly discharge, between Kelly and MSWRF, and downstream of the MSWRF.

Year	Downstream of MSWRF																								
	Dissolved oxygen (mg/L)					pH					Conductivity (umhos/cm)					Temperature (C°)					NH3 (mg/L)				
	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n	min	max	median	average	n
2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	8.00	10.15	8.61	9.07	5	7.20	7.72	7.50	7.49	5	559.00	1131.00	582.00	700.00	5	19.45	24.44	22.32	21.87	5	0.03	0.05	0.05	0.04	5
2003	6.88	11.33	8.24	8.55	13	7.12	7.70	7.43	7.45	13	409.00	953.00	727.00	693.15	13	16.72	27.21	25.49	23.46	13	0.01	0.10	0.05	0.04	10
2004	6.82	9.84	8.86	8.71	14	7.20	7.75	7.50	7.51	14	501.00	1165.00	809.50	811.00	14	17.02	28.60	25.25	23.12	14	0.10	0.40	0.10	0.20	3
2005	6.20	9.03	7.96	7.90	13	6.60	7.50	7.28	7.21	13	10.76	912.00	679.00	574.20	13	18.79	27.38	21.10	22.29	13	0.01	0.27	0.07	0.08	12
2006	7.10	8.72	7.85	7.85	15	6.70	7.90	7.38	7.30	15	240.00	1294.00	670.00	721.33	13	18.90	27.50	22.70	23.75	15	0.01	0.11	0.04	0.04	13
2007	7.10	8.60	8.00	7.95	12	7.20	7.80	7.46	7.45	12	410.00	1007.00	667.50	759.50	12	20.49	29.60	23.85	24.57	12	0.03	0.12	0.06	0.06	11
2008	8.40	9.80	9.20	9.15	7	7.30	7.80	7.70	7.63	8	500.00	750.00	510.00	565.00	8	21.00	26.10	22.55	22.93	8	0.02	0.30	0.07	0.09	12
2009	6.80	10.20	7.20	7.85	8	6.90	7.20	7.20	7.13	8	470.00	510.00	500.00	487.50	8	13.90	23.90	23.65	21.28	8	0.04	0.27	0.06	0.11	11
2010	7.04	9.64	7.70	8.06	12	7.10	7.70	7.25	7.41	12	400.00	1100.00	629.50	690.88	12	14.45	27.59	22.64	22.10	12	0.01	0.14	0.06	0.06	12
2011	6.71	10.30	8.10	8.08	12	6.95	7.75	7.48	7.47	12	650.00	1138.00	790.00	857.43	12	16.00	28.83	24.45	23.98	12	0.01	0.16	0.08	0.07	12
2012	7.28	9.50	8.52	8.45	23	6.85	8.25	7.60	7.68	23	580.00	1500.00	845.00	878.33	19	19.00	27.09	22.50	23.23	23	0.01	0.18	0.06	0.07	23
2013	7.03	9.63	8.23	8.04	7	7.00	7.60	7.20	7.32	7	432.70	950.00	680.00	719.24	7	16.85	27.40	21.24	22.07	7	0.04	0.15	0.09	0.09	6
Avg	7.11	9.73	8.21	8.30	11.8	7.01	7.72	7.42	7.42	11.8	430.21	1034.17	674.13	704.80	11.3	17.71	27.14	23.14	22.89	11.8	0.03	0.19	0.06	0.08	10.8

3 STRESSOR IDENTIFICATION ANALYSIS

Chapter 2, above, provided a Physical, Chemical, and Biological Characterization of Sweetwater Branch. Chapter 3 describes how this information will be synthesized to evaluate the most influential stressors causing faunal impairments. If it can be demonstrated that nutrient concentrations in Sweetwater Branch associated with the WQBEL are protective of designated uses, this will provide reasonable assurance for the permitting process.

EPA (2014) developed a Causal Analysis/Diagnosis Decision Information System (CADDIS), which recommends a five-step process for conducting a causal assessment at a particular site:

Step 1: Define the Case. Does biological health significantly differ when comparing data upstream and downstream from a discharge (e.g., in the case the MSWRF) containing nutrients, or are other physical factors influencing the system's biological response?

Step 2: List Candidate Causes. In Sweetwater Branch, targeted factors included water quality (especially nutrients and specific conductance), physical alteration (channelization and habitat), hydrologic modifications (impervious surfaces coupled with channelization), and landscape factors (LDI).

Step 3: Evaluate Data from the Case. These data are presented in Chapter 2, above.

Step 4: Evaluate Data from Elsewhere. Data from other systems will be evaluated below in conjunction with information from Sweetwater Branch.

Step 5: Identify Probable Causes. This is the conclusion that comes from the Stressor Identification analysis.

After sampling is complete, the information will be evaluated using the CADDIS approach as a framework, adapting the analysis to specific factors influencing Sweetwater Branch. Additionally, a Florida-specific Stressor Identification model developed by Dr. Curt Pollman (see below) shall also be evaluated.

3.1 FDEP'S CONCEPTUAL NUTRIENT ECOLOGICAL MODEL

FDEP (2013) recognized that adverse anthropogenic nutrient enrichment effects must follow a conceptual ecological model (**Figure 14**). If it can be demonstrated that there are no adverse floral effects associated with the nutrient regime by following the process established by Chapter 62-302, F.A.C. (FDEP 2013), one would conclude that the nutrient levels are protective of the Class III designated use. Because there were faunal impairments, evidence will be presented to appropriately identify the factors most influential in causing the faunal deficiencies.

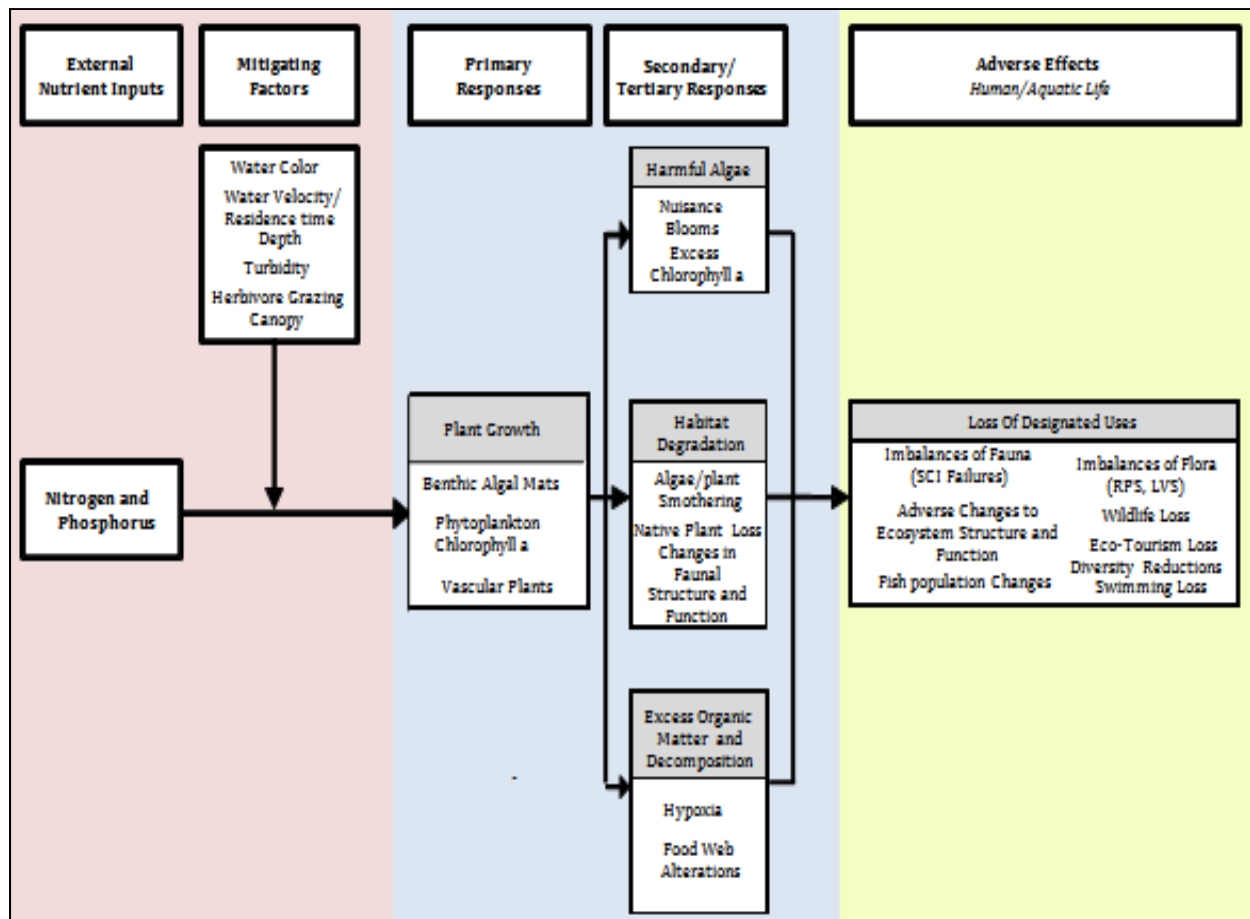


Figure 14. FDEP nutrient enrichment conceptual model used to assess potential adverse effects of nutrients on aquatic life and human uses in streams. Relationships between nutrients and biological responses are highly influenced by site-specific and mitigating factors.

3.2 HYDROLOGIC STRESS

EPA (2014a) documented case studies that conclusively link urbanization and increased watershed imperviousness to hydrologic impacts on streams. Existing reports and case studies provide strong evidence that urbanization negatively affects streams and results in problems such as loss of habitat, increased temperatures, sedimentation, and loss of fish populations (EPA 2014a, Moore and Palmer 2005) (**Figure 15**). Hydrologic stress will be evaluated as part of the stressor identification analysis.

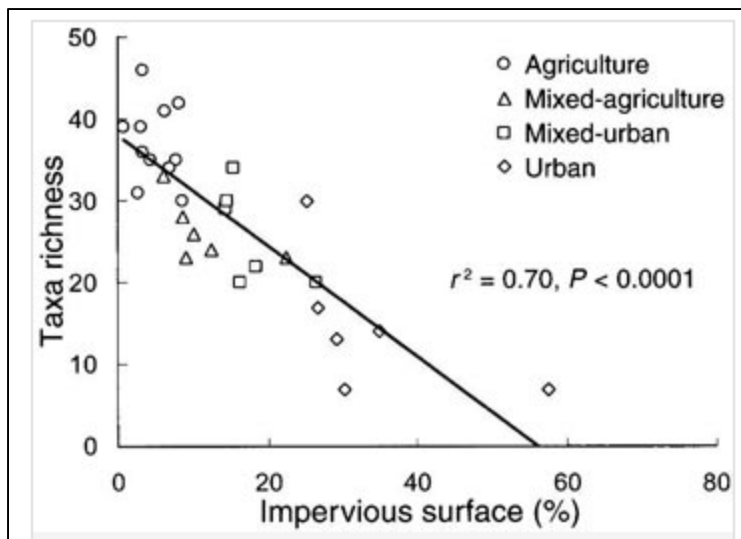


Figure 15. Relationship between total macroinvertebrate richness and % impervious surface cover in 29 headwater Maryland streams sampled in 2001. Taxa richness declined linearly with increasing impervious cover (from Moore and Palmer 2005).

3.3 LANDSCAPE USE INTENSITY STRESS

The LDI was one component of FDEP's human disturbance gradient (HDG), which was used to select effective biological metrics for the SCI and Bioreconnaissance (BioRecon) (Fore *et al* 2007), and the LDI will be evaluated as part of the stressor identification analysis.

3.4 HABITAT/ARTIFICIAL CHANNELIZATION STRESS

Particularly noteworthy in Sweetwater Branch is the low artificial channelization score (generally ≤ 3 in most of the system). Artificial channelization will be evaluated as part of the stressor identification analysis.

3.5 NUTRIENTS AND FAUNAL RESPONSE

For TN or TP to have an adverse effects on faunal health, responses must be consistent with FDEP's Nutrient Ecological Model (see Section 3.1 above). After the lower portion of Sweetwater Branch was restored (associated with construction of the sedimentation basin and exotic plant removal activities), both the January and April, 2014 samplings indicated that all floral evidentiary thresholds were met downstream of MSWRF, suggesting that fauna would not be adversely affected by the floral condition. The floral responses will be further analyzed as part of the study.

3.6 FLORAL HEALTH

The Rapid Periphyton Survey (RPS), Linear Vegetation Survey (LVS), and chlorophyll *a* data will be evaluated using the method in the NNC Implementation Document (FDEP 2013).

3.7 POLLMAN STRESSOR IDENTIFICATION MODEL

Dr. Curt Pollman developed a Stressor Identification Model specific for the SCI. The Pollman model evaluates the influence of water chemistry and habitat variables associated with the SCI collection (excess TKN, excess temperature, specific conductance, and dissolved oxygen, substrate diversity, water velocity, and artificial channelization), to predict an SCI score. Development of the model included the input variables in **Table 11**, and is especially useful when the list of

candidate stressors is limited to the factors in the table. The effect of moderate increases in conductivity on the SCI score may be estimated through this model.

Table 11. List of water quality variables and habitat scores used in development of the Pollman Stressor Identification Model (from Pollman 2012).

Water Quality	Habitat Scores
NH ₃	Artificial channelization
Color	Substrate availability
Specific conductance (field)	Substrate diversity
NO ₂ -NO ₃	Water velocity
pH	Habitat smothering
Temperature	Riparian vegetation quality
TKN	Riparian buffer width
TP	Bank stability
Turbidity	

Note that the model does not directly account for hydrologic modification, human landuse intensity stress, imperviousness of watershed surfaces, or sediment movement/scouring, which (as shown above) are significant stressors in the Sweetwater Branch watershed. Conversely, the calibration of the SCI metrics included hydrologic modification scores and the Landscape Development Intensity Index. It is important that hydrologic modification, human landuse intensity stress, imperviousness of watershed surfaces, and sediment movement/scouring also be evaluated in Sweetwater Branch, especially because they were not included in Dr. Pollman’s model. Failure to account for these factors would not accurately represent the conditions in Sweetwater Branch.

3.8 STRESSOR IDENTIFICATION SYNTHESIS

The various stressors will be evaluated using a weight of evidence approach, following the CADDIS method as a framework, while including information from the Pollman stressor identification model, but adapting the analysis to specific factors influencing Sweetwater Branch.

4 MODEL SELECTED AND SUBSEQUENT MODELING ANALYSES

4.1 MODEL SELECTED

Based on discussions with modeling staff at the Florida Department of Environmental Protection (DEP) and at Gainesville Regional Utilities (GRU), Dynamic Solutions, LLC (DS) will develop a one-dimensional water quality model (QUAL2K) for Sweetwater Branch to assess in-stream water quality and floral impacts resulting from permitted flows and nutrient loading from the GRU’s Main Street Water Reclamation Facility (MSWRF). The QUAL2K model was selected as being the most cost-effective and appropriate model for use in assessing alternative flows and concentrations coming from the GRU’s MSWRF and going to Sweetwater Branch. The WQBEL approach allows for setting effluent limitations that are

determined by the Department to be protective of the resource(s). By using the QUAL2K model to assess against a yet to be determined worst case condition, GRU will provide reasonable assurance that water quality standards will be met in Sweetwater Branch. As the QUAL2K model can provide model outputs for algal concentrations and periphyton under worst case conditions, the model was selected as being appropriate for establishing the WQBEL. All other point source and nonpoint source loads within the Sweetwater Branch watershed will also be assessed using the model. QUAL2K is a public domain, non-proprietary model. For a more complete description of the features of the QUAL2K model see: <http://www.epa.gov/athens/wwqtsc/html/qual2k.html>.

4.2 MODELING APPROACH

DS will set up the QUAL2K model using the observed flow, water quality data, and other information that are available for the period 1998 through 2013. In setting up the model, the following steps will be conducted:

- 1) A cumulative frequency (CF) distribution of all available flow data will be prepared using flows measured by the St. Johns River Water Management District's flow gauge located at SR 331 (Williston Road) for this period. This curve will be used to establish "bins" representing low, medium, and high flow conditions. The breakpoints between the bins will be selected once the available water quality data from stations located above the MSWRF have been assessed for any apparent break points or obvious partitions. Although the period of record ended in 2005, a CF distribution of the flow data gathered at a location above the MSWRF (at Depot Avenue) will be prepared to serve as a quality control check, as flow measured at this site, when combined with the flows discharged from the MSWRF, should be approximately equal to the flow values measured at the SR 331 gauge. The WQBEL report will identify any significant and protracted inconsistencies, and report on possible reasons, as well as how the discrepancies were resolved.
- 2) A weight of evidence approach will be employed to establish upstream boundary conditions for the period from 1998-2013. This will include using data collected at stations upstream of the MSWRF that are contained in the DEP's Impaired Waters Rule (IWR) database (Run #47), any other measured data collected at stations above the MSWRF plant not in the IWR database, values used in setting the 1987 WQBEL (which is still the basis for MSWRF's current permit limits), as well as data and information provided in the status report on baseflow and stormwater water quality in Gainesville Creeks (Alachua County, Environmental Protection Department, 2007), specifically including Sweetwater Branch. This list should not be considered as definitive, as other found and applicable data may be used. Once these analyses are completed, the dates the data were collected will be linked to the appropriate flow condition (as measured primarily at the SR 331 gage), and water quality data will be assigned to the low, medium, or high flow bin. DS staff will examine flows for the 3-day period prior to each data gathering date (to determine antecedent conditions) to assess whether the sample results are representative of flows consistent with those at the time of sample collection. While the median value in each flow bin will be the primary basis for setting the upstream boundary condition, consideration will be given to the values used in the 1987 WQBEL report, the adopted 2006 TMDL for Alachua Sink, the Alachua County 2007 Gainesville Streams report, or other applicable data sources. A final consideration will be to evaluate in-stream data gathered above the MSWRF during known protracted low flow (e.g., the Year 2000 drought) or high flow (e.g., the multiple hurricanes period of August and September 2004) conditions as a possible basis for setting the upstream low flow and high flow water quality conditions, respectively. Reported flows from the MSWRF will be assessed to determine whether a single set of flow and nutrient concentration values are adequate to represent the wastewater discharge over the range of flow conditions being modeled, *i.e.*, should the model employ different effluent inputs under low, medium, or high flow conditions in Sweetwater Branch).
- 3) The model domain will extend from a point beginning above the MSWRF point-of-discharge (but below the JR Kelly point-of-discharge) to the end of Sweetwater Branch, covering a distance of about 1.5 miles (see Figure 1). This end point may vary depending upon the flow condition being evaluated, as under extreme high flow conditions, some of the flow may by-pass the enhancement wetland system and travel in Sweetwater Branch

directly to Paynes Prairie. Based on the stream characteristics of Sweetwater Branch (Sweetwater Branch Stream Characterization Report by Jones Edmunds & Associates, Inc., 2010 for GRU), for better spatial representation, the modeled Sweetwater Branch segment will consist of five (5) reaches, with one reach that includes the MSWRF outfall and one reach for station SR 331, where continuous flows are available. Each reach will be further divided into a series of equally-spaced elements, such that length of any element is less than 100 meters.

- 4) Once set up, a confirmation process will be used to validate the model by using the inputs from the upstream boundary which will include the flow and load from the JR Kelly power plant, as applicable. Consideration will be made to ensure the JR Kelly power plant effluent is properly accounted for, as there are sampling stations from which data may be used, located both above and below that facility's point of discharge. The combined upstream flows and concentrations input to the model from upstream will be combined with applicable flows and concentrations from the MSWRF and then assessed against the measured data at the SR 331 gage and nearby water quality stations located downstream of the MSWRF. The QUAL2K model will be confirmed with the available observed water quality data using the three (low, medium, and high) quasi steady-state flow conditions. The quasi steady-state flow condition is assumed to be obtained if the flow at SR 331 was reasonably stable for a two or three day duration prior to each day that data were collected at the upstream locations. The water quality data collected during the quasi steady-state flow condition will be used to confirm the QUAL2K model performance. The confirmed QUAL2K model can then be used for various scenario analyses under different loading and flow conditions. The WQBEL report will contain the flows and water quality data used in confirmation of the QUAL2K model. For algal growth, the results produced by the model will be compared to the thresholds in the NNC Implementation document. Depending on the outcomes (*i.e.*, whether algal concentrations are above or below 3.2 ug/L), further documentation as to the health of the system may be needed. DS will set the initial periphyton at the 90th percentile of measured values collected using periphytometers placed at reference sites elsewhere in Florida, as well as based on applicable literature values. Among the data sets to be considered, GRU has obtained data (from the DEP's Biology Section) from a variety of studies (*e.g.*, Suwannee River, Kissimmee River, etc.) with results reported as ash-free dry weight. Unlike the confirmatory process that will be used to validate the model for water chemistry and algal growth, DS will use literature values for periphyton growth rates and compare changes that occur when adding higher flows or concentrations of nutrients from the MSWRF versus the existing and background conditions. The model outputs for periphyton (in units of biomass per unit area) for the existing unimpaired condition in Sweetwater Branch will be compared to results at the full permitted flows and concentrations coming from the GRU Main Street wastewater plant, thereby examining the relative change in periphyton that is expected to occur between the existing and potential future conditions. The predicted periphyton growth under each scenario will be provided in the WQBEL report, and the modeled biomass outcomes will be compared to measured values from Sweetwater Branch and to results reported from reference streams in the Peninsula bioregion. If a significant shift (*i.e.*, increase) in periphyton growth is predicted, a discussion of how that prediction may be mitigated by site-specific factors and conditions in Sweetwater Branch will be provided. (Note: for the purposes of establishing this WQBEL, the setting of "background conditions" will be based only on the removal of the MSWRF effluent.)

Using the model, the impacts of the two traditional point sources in the watershed will be examined using their current NPDES permit limits and other scenarios. Specifically, the MSWRF's effluent will be set using the facility's current permitted limits of 7.5 MGD (AADF) and 8 mg/L for Total Nitrogen (TN). Note that, while Total Phosphorus (TP) is expressed as "Report Only" in the MSWRF's current NPDES permit, GRU has spent considerable funds to enhance the removal of TP in the MSWRF's effluent. While the design expectation for the MSWRF is to be able to achieve 0.3 mg/L for TP, the WQBEL modeling will examine the expected impacts using TP concentrations higher than 0.3 mg/L, which, if shown to be protective, would allow flexibility in the operation of the wastewater facility and still maintain designated

uses in the downstream resources (*i.e.*, in SWB and Paynes Prairie) and its obligations under the Sweetwater Branch – Paynes Prairie Sheetflow Restoration Project permit (issued by the St Johns River Water Management District, Number 4-001-125967-1, June 2012). GRU may elect to examine other combinations of TN and TP concentrations in the process of preparing the WQBEL. For the GRU’s JR Kelly power plant, the flows will be set at 3.332 MGD (the combined Daily Maximum flows for three outfalls), but the current permit does not contain any numeric limits for TN or TP. DS anticipates that the TN and TP concentrations in the JR Kelly plant’s effluent will not be highly variable for any one year. Based on the information summarizing historic performance at the Kelly plant (contained in an internal DEP memo dated March 17, 2014, from Dr. Magley to Marc Harris of the Industrial Wastewater Program), for the period evaluated, the minimum and maximum annual average effluent concentrations for TN only ranged from 1.12 mg/L (in 1999) to 1.63 mg/L (in 2006). While the annual average values for TP in the effluent exhibited a greater range, from as low as 0.30 mg/L in 1999 to 1.02 mg/L in 2010 and 2011, TP was not included as a pollutant needing to be reduced in the 2006 TMDL adopted for Alachua Sink. However, as the real-world flows on the days of water quality data collection may be significantly different from the permitted flows (*e.g.*, due to shutdown periods at the power plant or due to decommissioned units coming off line), actual discharge data (both historic and more recently collected), when applicable, may be used in the model. The available effluent data from the JR Kelly plant will be assessed to determine appropriate concentrations of TN and TP to be used in each modeling scenario. The WQBEL report will provide the concentrations and loads used in each modeling scenario for each GRU facility.

4.3 SUBSEQUENT MODELING AND LOADING ANALYSES

The water quality model will allow for the determination of periphyton and algal growth predicted to occur in Sweetwater Branch under high, medium, and low flow conditions. In addition, DS will provide the predicted total annual loading of TN and TP at the outlet of Sweetwater Branch and the treatment wetland system under a full range of hydrological conditions, including a scenario using the maximum permitted effluent load from the MSWRF. As part of the WQBEL report, DS will also provide information on TN and TP concentrations going to and from the enhancement wetland, as well as those predicted concentrations going directly to Paynes Prairie when flows exceed the by-pass threshold condition.

This predicted annual load will be, in part, based on the assumed wetland treatment levels provided (Jones Edmunds and Wetland Solutions 2010) as a basis for calculating loads coming from the wetland under alternative flow and loading scenarios. Utilizing a methodology similar to that used by the DEP in its 2006 Final TMDL for Alachua Sink (see text associated with the production of Table 15 in the TMDL document), DS will provide the estimated annual load of TN due to the natural sources located in Lower Sweetwater Branch (*i.e.*, the TN load coming from that part of the watershed below the gauge at SR 331). Other sources of information, including studies (*e.g.*, those performed by Alachua County’s EPD), will be evaluated and used, as applicable. The resultant WQBEL report will allow the Department to make an evaluation of compliance with the established TMDL (2006) wasteload allocation for GRU’s Main Street Wastewater Reclamation Facility for Alachua Sink. All inputs and results from the modeling and other analyses will be provided in a draft WQBEL report for the Department to review.

5 ADDITIONAL DATA AND ANALYSIS NEEDS

Sweetwater Branch has been widely sampled to determine designated use attainment and the effect of nutrients and other physical stressors on biological health. **Table 12** summarizes the number of observations for biological and habitat measures.

Table 12. Biological and habitat measures in Sweetwater Branch at sites located upstream of the Kelly Plant, between the Kelly Plant and MSWRF, and downstream from the MSWRF.

Measure	Station-Dates Upstream of Kelly	Station-Dates Between	Station-Dates Downstream of MSWRF
RPS	1	7	18
LVS	1	4	12
BioRecon	2	3	3
SCI	2	6	9
HA	5	10	14

The available water chemistry data in Sweetwater Branch are sufficiently comprehensive to assess the influence of the MSWRF.

Based on a synthesis of the data and the supplementary biological sampling that was conducted in 2014, no additional sampling is recommended to finalize the biological information needs for the MSWRF WQBEL. The RPS has been conducted 8 times (date/station combinations) upstream of the MSWRF, and 18 times downstream (date/station combinations). LVS has been sampled 5 times upstream of the MSWRF, and 12 times downstream. SCI has been sampled 8 times upstream of the MSWRF, and 9 times downstream. HA has been sampled 15 times upstream of the MSWRF, and 14 times downstream of the MSWRF. Note that FDEP requires a minimum of two temporally independent biological collections to determine compliance with NNC, and the number of observations in Sweetwater Branch greatly exceeds the minimum requirement, and will be suitable for a stressor identification analysis.

5.1 PROPOSED WATER CHEMISTRY SAMPLING

No additional water chemistry data need to be collected in order to develop the proposed WQBEL. Future water quality sampling will comply with requirements established in DEP Permit Number FL0027251 and Administrative Order Number AO 136 NE for the MSWRF. Quarterly water quality sampling will be continued into the future, upstream and downstream from the MSWRF discharge in Sweetwater Branch. Once the Paynes Prairie Sheetflow project becomes fully operational, monthly water quality samples will be taken in the forebay and at the outfall of each wetland cell. The projected annual mass load of nitrogen from Sweetwater Branch going to Paynes Prairie will be calculated, using long-term monitoring data. When combined with the enhancement wetlands design performance expectations (cite Wetland Solutions document), these data will make possible an assessment of whether the proposed WQBEL is permissible, as well as provide reasonable assurance that the Alachua Sink TMDL's total nitrogen wasteload allocation for the MSWRF and the total allowable load under the TMDL will be achieved under the loading authorized in the site-specific interpretation of the narrative for Sweetwater Branch.

5.2 PROPOSED STATISTICAL ANALYSES TO SUPPORT BIOLOGICAL ASSESSMENTS

Although the floral and faunal evidentiary thresholds are essentially "pass vs. fail" information, a variety of relevant statistical methods will be used. These include the Welch two sample t-test to evaluate potential changes in various parameters associated with the discharge, linear regression or correlation analysis to determine the influence of one parameter on another, and a "weight of evidence" approach for the stressor identification analysis.

6 CONCLUSIONS

A substantial amount of biological and water chemistry data has already been collected in Sweetwater Branch and Paynes Prairie to support the evaluation of nutrients and other physical stressors on biological health. This Plan of Study

includes a comprehensive compilation of the existing data available in Sweetwater Branch and Paynes Prairie, and identifies additional modeling and statistical analyses of Sweetwater Branch that will be conducted to draw final conclusions regarding a protective WQBEL for nutrients. Once the modeling and data analyses have been completed, a protective WQBEL will be proposed.

7 REFERENCES

- Alachua County Environmental Protection Department, "A Status Report on Baseflow Water Quality, Stormwater and Ecological Health for the Orange Creek Basin 1998-2003," June 2007.
- Brown, M. T., and B. Vivas. 2005. Landscape development intensity index. *Environmental Monitoring and Assessment* 101: 289-309.
- EPA. 2014. Causal Analysis/Diagnosis Decision Information System (CADDIS) Website
<http://www.epa.gov/caddis/index.html>
- EPA. 2014a. Urbanization and Streams: Studies of Hydrologic Impacts
<http://www.epa.gov/owow/nps/urbanize/report.html>
- FDEP. 2002. Paynes Prairie Preserve State Park Unit Management Plan, Division of Recreation and Parks, February 7, 2002. Approved Plan.
- FDEP. 2008. Biological Assessment of GRU – Main Street WRF, Alachua County, NPDES #FL0027251, Sampled October 29, 2007. Biology Section. 73 pp.
- FDEP. 2012. [Sampling and Use of the Stream Condition Index \(SCI\) for Assessing Flowing Waters: A Primer](#). DEP-SAS-001/11. 46 pp.
- FDEP. 2014. Summary of Information Collected by DEP to Support a Possible Reclassification of Sweetwater Branch in Gainesville Florida to a Class III-Limited Waterbody (Draft). 18 pp.
- FDEP. 2013. Implementation of Florida's Numeric Nutrient Standards: Document Submitted to EPA in Support of the Department of Environmental Protection's Adopted Nutrient Standards for Streams, Spring Vents, Lakes, and Selected Estuaries. Florida Dept. Environmental Protection. 86 pp.
- FDEP. Memorandum from W. Magley to M. Harris, "Kelly Power Plant Request to Modify WLA/TMDL," March 17, 2014.
- FDEP. 1992. Biological water quality of the Deerpoint Lake Drainage Basin, Bay County, FL. Biology Section. 89 pp.
- Fore, L.S, R. Frydenborg, D. Miller, T. Frick, D. Whiting, J. Espy, and L. Wolfe. 2007. Development and testing of biomonitoring tools for macroinvertebrates in Florida streams (Stream Condition Index and BioRecon). Florida Dept. Environmental Protection. 110 pp.
- Gao, X, D. Gilbert, and W. Magley. 2006. Nutrient TMDL for Alachua Sink, WBID 2720A. Florida Dept. Environmental Protection. 104 pp.
- Gibbins, C., D. Vericat, and R.J Batalla. 2007. When is stream invertebrate drift catastrophic? The role of hydraulics and sediment transport in initiating drift during flood events. *Freshwater Biology*, 52, 2369–2384.
- Horner, R. R., C. W. May, and E.H. Livingston. 2004. Linkages between watershed and stream ecosystem conditions in three regions of the United States. Watershed Management Institute, Inc. EPA Cooperative Agreement CX824446. 156 pp.

- Jones Edmunds and Associates, Inc. and Wetland Solutions, Inc. 2010. *Sweetwater Branch/Paynes Prairie Sheetflow Restoration Preliminary Engineering Report*. Prepared for Gainesville Regional Utilities and City of Gainesville Public Works Department.
- Kadlec, R.H. and R.L. Knight. 1996. *Treatment Wetlands*. CRC Press/Lewis Publishers, Boca Raton, FL. 893 pp.
- Kadlec, R.H. and S.D. Wallace. 2009. *Treatment Wetlands Second Edition*. CRC Press/Lewis Publishers, Boca Raton, FL. 1,016 pp.
- Moore, A. A. and M.A. Palmer. 2005. Invertebrate biodiversity in agricultural and urban headwater streams: implications for conservation and management. *Ecological Applications* 15(4):1169-1177.
- Paul, M. J. and J. L. Meyer. 2001. Streams in the urban landscape. *Annual Review of Ecology and Systematics* 2: 333-365.
- Pollman, C. D. 2012. Contract WM943: Stream Stressor Identification Study Final Report. FDEP. 102 pp.
- St Johns River Water Management District. 2012. Permit Number 4-001-125967-1, Sweetwater Branch - Paynes Prairie Sheetflow Restoration Project (June 11, 2012)
- WAR. 2011. Sweetwater Branch Creek Algal Study, Gainesville, Florida. Water and Air Research, 73 pp.
- Wetland Solutions, Inc. (WSI). 2006. *Feasibility Analysis of Sweetwater Branch Sheetflow Restoration Project at Paynes Prairie Preserve State Park, Alachua County, Florida*. Report Prepared for the City of Gainesville and Florida Department of Environmental Protection, June 2006.
- Wetland Solutions, Inc. (WSI). 2007. *A Conceptual Plan for Sweetwater Branch/Paynes Prairie Sheetflow Restoration*. Prepared for the Gainesville City Commission. March 2007.
- WMM. 1998. User's Manual: Watershed management model, Version 4.1. Rouge River national wet weather demonstration project. Wayne County, Michigan. PRO-NPS-TM27.02.

8 APPENDIX

8.1 WQ DATA

Data were compiled from IWR, Alachua Co., GRU, and FDEP. Duplicates were removed and data were sorted by location and year prior to analysis.

station	date	location	Agency	DO (mg/ L)	DO %saturati on			pH (SU)				Con (umhos/c m)				Tem p (C°)				NH3 (mg/ L)
SWBNE10	10/17/2002	upstream of Kelly	Alachua county	4.36				7.36				331				24.46				0.244
SWBNE10	10/17/2002	upstream of Kelly	Alachua county	4.35				7.33				338				24.47				0.244
SWBSE1	10/17/2002	upstream of Kelly	Alachua county	5.93				7.56				344				20.43				0.046
SWBNE10	11/7/2002	upstream of Kelly	Alachua county	3.86				6.39				285				22.63				0.02
SWBSE1	11/7/2002	upstream of Kelly	Alachua county	5.73				7.32				345				18.52				0.018
SWBNE10	12/12/2002	upstream of Kelly	Alachua county	7.84				6.71				328				18.92				0.325
SWBSE1	12/12/2002	upstream of Kelly	Alachua county	10.01				7.59				315				16.55				0.014
SWBNE10	1/16/2003	upstream of Kelly	Alachua county	7.6				6.58				366				16.39				0.465
SWBSE1	1/16/2003	upstream of Kelly	Alachua county	11.42				7.09				340				14.16				0.068
SWBNE10	2/13/2003	upstream of Kelly	Alachua county	6.58				6.37				372				16.63				0.569
SWBSE1	2/13/2003	upstream of Kelly	Alachua county	9.89				6.9				339				17.59				0.067
SWBNE10	3/12/2003	upstream of Kelly	Alachua county	5.55				6.58				311				20.49				0.616
SWBSE1	3/12/2003	upstream of Kelly	Alachua county	9.13				7.34				346				21.81				0.081
SWBNE10	4/16/2003	upstream of Kelly	Alachua county	5.34				6.83				352				21.9				0.46
SWBSE1	4/16/2003	upstream of Kelly	Alachua county	9.13				7.57				330				23.3				0.024

SWBSE1	5/19/2004	upstream of Kelly	Alachua county	8.18				7.37				227				23.93				
SWBSE1	6/17/2004	upstream of Kelly	Alachua county	7.38				7.29				153				25.83				
SWBNE10	7/21/2004	upstream of Kelly	Alachua county	6.25				7.05				251				29.33				
SWBSE1	7/21/2004	upstream of Kelly	Alachua county	8.01				7.18				159				28.32				
SWBNE10	8/11/2004	upstream of Kelly	Alachua county	6.08				7.31				178				31.26				
SWBSE1	8/11/2004	upstream of Kelly	Alachua county	8.44				7.46				153				27.84				
SWBNE10	9/23/2004	upstream of Kelly	Alachua county	4.43				6.92				361				25.89				
SWBSE1	9/23/2004	upstream of Kelly	Alachua county	8.97				7.54				355				25.81				
SWBNE10	12/15/2004	upstream of Kelly	Alachua county	3.57				7.07				320				18.47				
SWBSE1	1/13/2005	upstream of Kelly	Alachua county																	
SWBNE10	3/23/2005	upstream of Kelly	Alachua county	3.68				6.94				96				19.65				
SWBSE1	3/23/2005	upstream of Kelly	Alachua county	7.4				7.11				188				19.91				
SWBNE10	5/12/2005	upstream of Kelly	Alachua county	4.18				6.41				243				22.07				
SWBSE1	5/12/2005	upstream of Kelly	Alachua county	7.79				7.18				212				22.16				
SWBNE10	6/22/2005	upstream of Kelly	Alachua county	0.22				6.84				350				26.12				1
SWBSE1	6/22/2005	upstream of Kelly	Alachua county	7.22				7.15				308				25.54				0.14
SWBNE10	8/11/2005	upstream of Kelly	Alachua county	3.85				6.74				244				29.64				0.234
SWBSE1	8/11/2005	upstream of Kelly	Alachua county	7.54				7.35				245				27.14				0.023
SWBNE10	9/12/200	upstream of	Alachua																	

	5	Kelly	county																	
SWBSE1	9/12/2005	upstream of Kelly	Alachua county																	
SWBNE10	12/14/2005	upstream of Kelly	Alachua county	0.63				6.87					351				18.74			0.276
SWBNE10	3/7/2006	upstream of Kelly	Alachua county	2.95				6.73					290				19.47			0.206
SWBNE10	4/25/2006	upstream of Kelly	Alachua county	0.91				6.92					315				24.82			
SWBNE10	5/2/2006	upstream of Kelly	Alachua county	0.77				7.11					364				22.49			
SWBNE10	5/9/2006	upstream of Kelly	Alachua county	1				7.15					224				26.58			
SWBNE10	6/22/2006	upstream of Kelly	Alachua county	1.43				6.95					332				26.07			0.135
SWBNE10	9/12/2006	upstream of Kelly	Alachua county	0.71				7.09					334				26.44			0.024
SWBSE1	9/12/2006	upstream of Kelly	Alachua county	4.91				7.17					252				25.26			
SWBNE10	11/14/2006	upstream of Kelly	Alachua county	1.04				7.11					381				17.7			0.971
SWBNE10	3/21/2007	upstream of Kelly	Alachua county	2.02				6.87					334				18.98			0.524
SWBSE1	4/25/2007	upstream of Kelly	Alachua county																	
SWBSE1	7/17/2007	upstream of Kelly	Alachua county																	
SWBSE1	7/24/2007	upstream of Kelly	Alachua county																	
SWBNE10	7/24/2007	upstream of Kelly	Alachua county																	
SWBSE1	7/25/2007	upstream of Kelly	Alachua county																	
SWBNE10	7/25/2007	upstream of Kelly	Alachua county																	
SWBSE1	7/26/2007	upstream of Kelly	Alachua county																	

SWBNE10	7/26/2007	upstream of Kelly	Alachua county																	
SWBNE10	8/27/2007	upstream of Kelly	Alachua county	1.61				7.08					174				30.26			0.164
SWBNE10	10/16/2007	upstream of Kelly	Alachua county	1.27				7.05					384				24.95			0.231
SWBNE10	2/1/2008	upstream of Kelly	Alachua county																	
SWBSE1	7/30/2008	upstream of Kelly	Alachua county																	
SWBNE10	7/30/2008	upstream of Kelly	Alachua county																	
SWBNE10	8/7/2008	upstream of Kelly	Alachua county																	
SWBSE1	9/3/2008	upstream of Kelly	Alachua county																	
SWBNE10	9/3/2008	upstream of Kelly	Alachua county																	
SWBNE10	11/24/2008	upstream of Kelly	Alachua county																	
SWBSE1	11/24/2008	upstream of Kelly	Alachua county																	
SWBNE10	2/10/2009	upstream of Kelly	Alachua county																	
SWBSE1	3/3/2009	upstream of Kelly	Alachua county																	
SWBNE10	3/3/2009	upstream of Kelly	Alachua county																	
SWBSE1	5/11/2009	upstream of Kelly	Alachua county																	
SWBNE10	5/11/2009	upstream of Kelly	Alachua county																	
SWBSE1	8/25/2009	upstream of Kelly	Alachua county																	
SWBNE10	8/25/2009	upstream of Kelly	Alachua county																	
SWBTB	12/9/200	upstream of	Alachua																	

	9	Kelly	county																	
SWBNE10	12/9/2009	upstream of Kelly	Alachua county																	
SWBSE1	12/9/2009	upstream of Kelly	Alachua county																	
SWBSE1	3/30/2010	upstream of Kelly	Alachua county																	
SWBTB	3/30/2010	upstream of Kelly	Alachua county																	
SWBNE10	3/30/2010	upstream of Kelly	Alachua county																	
SWBSE1	6/22/2010	upstream of Kelly	Alachua county																	
SWBTB	6/22/2010	upstream of Kelly	Alachua county																	
SWBNE10	6/22/2010	upstream of Kelly	Alachua county																	
SWBSE1	9/2/2010	upstream of Kelly	Alachua county																	
SWBTB	9/2/2010	upstream of Kelly	Alachua county																	
SWBNE10	9/2/2010	upstream of Kelly	Alachua county																	
SWBSE1	11/8/2010	upstream of Kelly	Alachua county																	
SWBTB	11/8/2010	upstream of Kelly	Alachua county																	
SWBNE10	11/8/2010	upstream of Kelly	Alachua county																	
SWBSE4A VE	12/8/2010	upstream of Kelly	Alachua county	7.5	65.1			6.88				318				9.09				
SWBSE1	6/7/2011	upstream of Kelly	Alachua county	5.75	71.6			7.42				176				26.66				
SWBTB	6/7/2011	upstream of Kelly	Alachua county	2.49	30.6			7.15				169				26.13				
SWBNE10	6/7/2011	upstream of Kelly	Alachua county	1.29	16.5			7.52				257				28.02				

SWBSE1	6/16/2011	upstream of Kelly	Alachua county																
SWBTB	6/16/2011	upstream of Kelly	Alachua county																
SWBNE10	6/16/2011	upstream of Kelly	Alachua county																
SWBSE4AVE	6/20/2011	upstream of Kelly	Alachua county	2.27	27.6			7.36				335				26.14			0.011
SWBSE4AVE	8/8/2011	upstream of Kelly	Alachua county	6.06	64.5			7.37				308				18.32			0.03
SWBSE1	8/15/2011	upstream of Kelly	Alachua county																
SWBTB	8/15/2011	upstream of Kelly	Alachua county																
SWBNE10	8/15/2011	upstream of Kelly	Alachua county																
SWBSE4AVE	10/24/2011	upstream of Kelly	Alachua county	6.06	64.5			7.37				308				18.32			0.009
SWBNE10	11/7/2011	upstream of Kelly	Alachua county	2.26	24.8			7.43				383				19.97			
SWBTB	11/7/2011	upstream of Kelly	Alachua county	2.91	32			6.76				282				19.67			
SWBSE1	11/7/2011	upstream of Kelly	Alachua county	5.34	58.5			7.14				296				19.72			
SWBTB	11/8/2011	upstream of Kelly	Alachua county																
SWBTB	11/14/2011	upstream of Kelly	Alachua county																
SWBTB	11/22/2011	upstream of Kelly	Alachua county																
SWBTB	11/30/2011	upstream of Kelly	Alachua county																0.06
SWBSE4AVE	1/26/2012	upstream of Kelly	Alachua county	3.6	38.9			7.19				331				18.96			0.044
SWBSE1	2/9/2012	upstream of Kelly	Alachua county	5.29	53.1			7.39				307				15.56			
SWBTB	2/9/2012	upstream of	Alachua	2.46	24.6			7.1				300				16.0			

SWBSE4A VE	8/13/201 3	upstream of Kelly	Alachua county	5.43	69.4				7.48				301.2				27.9				
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station	date	year	location	Agency	DO (mg/ L)			DO %satur ation	pH (SU)				Con (umhos/ cm)				Te mp (C°)				NH3 (mg /L)
5th_yr_up	4/1/200 2	20 02	between Kelly and MSWRF	FDEP	7.70				7.30				914.00				22. 20				0.06
SWBSE4	2/13/20 03	20 03	between Kelly and MSWRF	Alachua county	9.51				7.19				464.00				15. 93				0.05
SWB1	12/1/20 03	20 03	between Kelly and MSWRF	GRU	6.18				7.10				390.00				26. 70				0.10
SWB1	3/1/200 4	20 04	between Kelly and MSWRF	GRU	8.69				7.60				315.00				15. 70				0.10
SWB1	6/1/200 4	20 04	between Kelly and MSWRF	GRU																	
SWB1	9/1/200 4	20 04	between Kelly and MSWRF	GRU	7.30				8.00				500.00				27. 00				0.10
SWB1	12/1/20 04	20 04	between Kelly and MSWRF	GRU	6.83				7.50				490.00				25. 80				0.30
Main St. upstream	1/3/200 5	20 05	between Kelly and MSWRF	GRU	9.20				7.80								15. 70				0.10
SWB1	3/1/200 5	20 05	between Kelly and MSWRF	GRU	9.20				7.80				385.00				15. 70				0.20
Main St. upstream	4/5/200 5	20 05	between Kelly and MSWRF	GRU	3.60				7.30				350.00				17. 40				0.08
SWBSE4	5/12/20 05	20 05	between Kelly and MSWRF	Alachua county	7.77				7.19				279.00				21. 15				
SWB1	6/1/200 5	20 05	between Kelly and MSWRF	GRU	3.60				7.30				350.00				17. 40				0.08
SWBSE4	6/23/20 05	20 05	between Kelly and MSWRF	Alachua county	6.70				7.52				381.00				24. 10				0.08
SWBSE4	6/23/20 05	20 05	between Kelly and MSWRF	Alachua county	6.70				7.52				381.00				24. 10				

Main St. upstream	7/27/20 05	20 05	between Kelly and MSWRF	GRU	6.80					6.80					100.00					22. 90					0.04
SWB1	9/1/200 5	20 05	between Kelly and MSWRF	GRU	6.79					6.80					100.00					22. 90					0.04
SWBSE4	9/12/20 05	20 05	between Kelly and MSWRF	Alachua county																					
SWB1	12/1/20 05	20 05	between Kelly and MSWRF	GRU	4.90					6.70					210.00					20. 15					0.09
Main St. upstream	12/13/2 005	20 05	between Kelly and MSWRF	GRU	4.90					6.70					210.00					20. 15					0.09
SWBSE4	12/14/2 005	20 05	between Kelly and MSWRF	Alachua county	9.83					7.77					398.00					14. 73					0.01
Main St. upstream	1/18/20 06	20 06	between Kelly and MSWRF	GRU	5.80					6.30										18. 10					
SWB1	3/1/200 6	20 06	between Kelly and MSWRF	GRU	5.80					6.30					150.00					18. 10					LE
SWBSE4	3/7/200 6	20 06	between Kelly and MSWRF	Alachua county	10.07					7.87					334.00					18. 55					0.01
Main St. upstream	4/6/200 6	20 06	between Kelly and MSWRF	GRU	5.70					6.60										21. 20					
Main St. upstream	5/24/20 06	20 06	between Kelly and MSWRF	GRU																				0.11	
SWB1	6/1/200 6	20 06	between Kelly and MSWRF	GRU	5.70					6.60					310.00					21. 20					0.11
SWBSE4	6/22/20 06	20 06	between Kelly and MSWRF	Alachua county	6.21					7.72					514.00					25. 31					0.04
Main St. upstream	6/28/20 06	20 06	between Kelly and MSWRF	GRU											310.00										
Main St. upstream	7/20/20 06	20 06	between Kelly and MSWRF	GRU	5.50					6.78					550.00					25. 30					0.07
SWB1	9/1/200 6	20 06	between Kelly and MSWRF	GRU	5.50					6.78					550.00					25. 30					0.07
SWBSE4	9/12/20 06	20 06	between Kelly and MSWRF	Alachua county	6.23					7.69					425.00					24. 71					0.04
Main St. upstream	10/30/2 006	20 06	between Kelly and MSWRF	GRU																				0.08	
SWBSE4	11/14/2	20	between Kelly and	Alachua	9.59					7.23					393.00					14.					0.04

	006	06	MSWRF	county														31						
SWB1	12/1/2006	2006	between Kelly and MSWRF	GRU	7.50					7.90					450.00				17.50					0.08
Main St. upstream	1/9/2007	2007	between Kelly and MSWRF	GRU	4.10					7.50					500.00				20.90					
SWB1	3/1/2007	2007	between Kelly and MSWRF	GRU	4.10					7.50					500.00				20.90					
SWBSE4	3/21/2007	2007	between Kelly and MSWRF	Alachua county	7.76					7.53					391.00				16.60					0.06
Main St. upstream	4/4/2007	2007	between Kelly and MSWRF	GRU	7.00					7.50					500.00				20.20					0.06
SWBSE8	4/25/2007	2007	between Kelly and MSWRF	Alachua county																				
SWB1	6/1/2007	2007	between Kelly and MSWRF	GRU	7.00					7.50					500.00				20.20					0.06
Main St. upstream	7/18/2007	2007	between Kelly and MSWRF	GRU	9.50					8.20									27.50					0.06
SWBSE4	7/24/2007	2007	between Kelly and MSWRF	Alachua county																				
SWBSE4	7/25/2007	2007	between Kelly and MSWRF	Alachua county																				
SWBSE4	7/26/2007	2007	between Kelly and MSWRF	Alachua county																				
SWBSE4	8/27/2007	2007	between Kelly and MSWRF	Alachua county	6.35					7.81					513.00				26.63					0.03
SWB1	9/1/2007	2007	between Kelly and MSWRF	GRU	9.50					8.20					550.00				27.50					0.06
SWBSE4	10/16/2007	2007	between Kelly and MSWRF	Alachua county	7.15					7.65					404.00				22.58					0.05
5th_yr_up	10/29/2007	2007	between Kelly and MSWRF	FDEP	9.30					7.60					381.00				19.90					0.03
Main St. upstream	11/20/2007	2007	between Kelly and MSWRF	GRU	6.10					7.80					510.00				22.10					0.04
SWB1	12/1/2007	2007	between Kelly and MSWRF	GRU	6.10					7.80					510.00				22.10					0.04
Main St. upstream	2/26/2008	2008	between Kelly and MSWRF	GRU	10.60					7.90					350.00				18.80					0.10

SWB1	3/1/2008	2008	between Kelly and MSWRF	GRU	10.65					7.90					350.00					18.80					n/a
SWBSE4	3/20/2008	2008	between Kelly and MSWRF	Alachua county																					0.07
Main St. upstream	5/14/2008	2008	between Kelly and MSWRF	GRU	9.60					8.10										19.80					0.04
SWB1	6/1/2008	2008	between Kelly and MSWRF	GRU	9.60					8.10					200.00					19.80					0.04
SWBSE4	6/17/2008	2008	between Kelly and MSWRF	Alachua county																					0.02
Main St. upstream	6/25/2008	2008	between Kelly and MSWRF	GRU											200.00										
Main St. upstream	7/9/2008	2008	between Kelly and MSWRF	GRU	9.80					81.00					450.00					19.80					0.08
SWBSE8	7/30/2008	2008	between Kelly and MSWRF	Alachua county																					
SWBSE4	8/7/2008	2008	between Kelly and MSWRF	Alachua county																					0.03
SWB1	9/1/2008	2008	between Kelly and MSWRF	GRU	9.60					8.10					200.00					19.80					0.04
SWBSE8	9/3/2008	2008	between Kelly and MSWRF	Alachua county																					
Main St. upstream	10/9/2008	2008	between Kelly and MSWRF	GRU	7.80					7.60					390.00					23.90					0.03
SWBSE4	10/20/2008	2008	between Kelly and MSWRF	Alachua county																					0.03
SWBSE8	11/24/2008	2008	between Kelly and MSWRF	Alachua county																					
SWBSE4	11/24/2008	2008	between Kelly and MSWRF	Alachua county																					
SWB1	12/1/2008	2008	between Kelly and MSWRF	GRU	7.80					7.60					390.00					23.90					0.03
Main St. upstream	1/21/2009	2009	between Kelly and MSWRF	GRU	11.50					7.50					350.00					7.60					
SWBSE4	2/10/2009	2009	between Kelly and MSWRF	Alachua county																					0.03
SWB1	3/1/2009	2009	between Kelly and MSWRF	GRU	11.50					7.50					350.00					7.6					

	9	09	MSWRF															0				n/a
SWBSE4	3/3/2009	2009	between Kelly and MSWRF	Alachua county																		
SWBSE8	3/3/2009	2009	between Kelly and MSWRF	Alachua county																		
SWBSE8	5/11/2009	2009	between Kelly and MSWRF	Alachua county																		
Main St. upstream	5/13/2009	2009	between Kelly and MSWRF	GRU	6.50				7.30				320.00				22.60				0.10	
SWB1	6/1/2009	2009	between Kelly and MSWRF	GRU	6.50				7.30				320.00				22.60				0.10	
SWBSE4	6/22/2009	2009	between Kelly and MSWRF	Alachua county																	0.07	
SWBSE4	8/25/2009	2009	between Kelly and MSWRF	Alachua county																		
SWBSE8	8/25/2009	2009	between Kelly and MSWRF	Alachua county																		
SWB1	9/1/2009	2009	between Kelly and MSWRF	GRU	6.50				7.30				320.00				22.60				0.10	
SWBSE4	9/3/2009	2009	between Kelly and MSWRF	Alachua county																	0.43	
Main St. upstream	9/14/2009	2009	between Kelly and MSWRF	GRU	8.20				7.30				210.00				26.10				0.03	
Main St. upstream	11/18/2009	2009	between Kelly and MSWRF	GRU	5.80				6.50				480.00				16.50				0.07	
SWB1	12/1/2009	2009	between Kelly and MSWRF	GRU	5.80				6.50				480.00				16.50				0.07	
SWBSE4	12/22/2009	2009	between Kelly and MSWRF	Alachua county																	0.04	
Main St. upstream	1/14/2010	2010	between Kelly and MSWRF	GRU	6.90				6.90				350.00				14.70				0.25	
SWBSE4	2/17/2010	2010	between Kelly and MSWRF	Alachua county	10.70			92.30	7.57				389.00				8.72				0.12	
SWB1	3/1/2010	2010	between Kelly and MSWRF	GRU	6.90				6.90				350.00				14.70				0.25	
Main St. upstream	5/26/2010	2010	between Kelly and MSWRF	GRU	8.40				7.10								22.40				0.04	

SWB1	6/1/2010	2010	between Kelly and MSWRF	GRU	8.40				7.10				390.00				22.40				0.04
Main St. upstream	6/24/2010	2010	between Kelly and MSWRF	GRU									390								
SWBSE4	6/30/2010	2010	between Kelly and MSWRF	Alachua county	6.51			79.20	7.57				186.00				25.42				0.08
SWBSE4	8/18/2010	2010	between Kelly and MSWRF	Alachua county	6.24			88.50	7.76				447.00				26.36				0.03
Main St. upstream	9/1/2010	2010	between Kelly and MSWRF	GRU	7.10				7.40				550.00				26.50				0.07
SWB1	9/1/2010	2010	between Kelly and MSWRF	GRU	8.40				7.10				390.00				22.40				0.04
SWB1	12/1/2010	2010	between Kelly and MSWRF	GRU	9.60				6.60				450.00				11.40				0.01 U
SWBSE4	12/1/2010	2010	between Kelly and MSWRF	Alachua county	6.94			71.60	7.69				394.00				16.87				0.02
Main St. upstream	12/6/2010	2010	between Kelly and MSWRF	GRU	9.60				6.60				450.00				11.40				0.01
SWBSE4	12/8/2010	2010	between Kelly and MSWRF	Alachua county	10.99			88.70	6.58				431.00				6.20				
Main St. upstream	2/9/2011	2011	between Kelly and MSWRF	GRU	10.60				6.30				380.00				11.60				0.14
SWB1	3/1/2011	2011	between Kelly and MSWRF	GRU	10.60				6.30				380.00				11.60				0.14
SWBSE4	3/8/2011	2011	between Kelly and MSWRF	Alachua county	9.09			91.50	7.73				385.00				15.68				0.03
Main St. upstream	5/12/2011	2011	between Kelly and MSWRF	GRU	6.20				7.70				950.00				24.00				0.05
SWB1	6/1/2011	2011	between Kelly and MSWRF	GRU	6.20				7.70				950.00				24.00				0.05
SWBSE4	6/7/2011	2011	between Kelly and MSWRF	Alachua county	6.50			79.10	7.64				457.00				25.20				
SWBSE4	6/16/2011	2011	between Kelly and MSWRF	Alachua county																	
SWBSE4	6/20/2011	2011	between Kelly and MSWRF	Alachua county	5.70			69.70	7.72				669.00				25.49				0.08
SWBSE8	6/20/20	20	between Kelly and	Alachua	7.60			96.50	8.21				648.00				27.				0.02

	11	11	MSWRF	county														60					
SWBSE4	8/8/2011	2011	between Kelly and MSWRF	Alachua county	8.15				82.20	7.45					523.00				15.75				0.04
SWBSE8	8/8/2011	2011	between Kelly and MSWRF	Alachua county	8.57				89.30	7.81					507.00				17.26				0.03
Main St. upstream	8/10/2011	2011	between Kelly and MSWRF	GRU	8.00					8.00					450.00				26.00				0.04
SWBSE4	8/15/2011	2011	between Kelly and MSWRF	Alachua county																			
SWBSE4	8/16/2011	2011	between Kelly and MSWRF	Alachua county																			
SWB1	9/1/2011	2011	between Kelly and MSWRF	GRU	8.00					8.00					450.00				26.00				0.04
SWBSE4	10/24/2011	2011	between Kelly and MSWRF	Alachua county	8.15				82.20	7.45					523.00				15.75				0.02
SWBSE8	10/24/2011	2011	between Kelly and MSWRF	Alachua county	8.57				89.30	7.81					507.00				17.26				0.05
SWBSE4	11/7/2011	2011	between Kelly and MSWRF	Alachua county	7.62				80.20	7.63					560.00				17.79				
Main St. upstream	11/21/2011	2011	between Kelly and MSWRF	GRU	8.10					7.60					650.00				18.50				0.11
Main St. upstream	12/13/2011	2011	between Kelly and MSWRF	GRU	8.50					7.50					400.00				15.60				0.01
upstream_MS WRF	1/12/2012	2012	between Kelly and MSWRF	GRU	9.60					7.50					800.00				14.50				0.06
SWBSE4	1/26/2012	2012	between Kelly and MSWRF	Alachua county	7.54				79.60	7.62					530.00				17.90				0.04
SWBSE8	1/26/2012	2012	between Kelly and MSWRF	Alachua county	7.45				80.00	7.70					537.00				18.77				0.04
SWBSE4	2/9/2012	2012	between Kelly and MSWRF	Alachua county	7.23				69.90	7.08					400.00				13.75				
REF1	2/29/2012	2012	between Kelly and MSWRF	GRU						7.60									21.20				0.03
REF1	3/27/2012	2012	between Kelly and MSWRF	GRU	7.00					7.25					790.00				18.40				0.06
SWBSE4	4/18/2012	2012	between Kelly and MSWRF	Alachua county	6.62				75.00	7.67					704.00				21.40				

SWBSE4	4/24/2012	2012	between Kelly and MSWRF	Alachua county	8.10			85.00	7.79			770.00			17.59			0.04
SWBSE8	4/24/2012	2012	between Kelly and MSWRF	Alachua county	7.95			88.70	8.23			962.00			20.65			0.06
REF1	4/26/2012	2012	between Kelly and MSWRF	GRU	8.30				8.44			975.00			20.40			0.08
REF1	5/15/2012	2012	between Kelly and MSWRF	GRU	7.40				8.26			840.00			23.80			0.06
upstream_M SWRF	5/30/2012	2012	between Kelly and MSWRF	GRU	8.80				7.25			700.00			24.80			0.02
REF1	6/13/2012	2012	between Kelly and MSWRF	GRU	7.37				8.24			700.00			25.70			0.03
SWBSE4	7/23/2012	2012	between Kelly and MSWRF	Alachua county	6.54			81.80	7.89			692.00			26.73			0.10
SWBSE8	7/23/2012	2012	between Kelly and MSWRF	Alachua county	6.63			85.70	8.04			715.00			28.61			0.05
upstream_M SWRF	9/5/2012	2012	between Kelly and MSWRF	GRU	8.20				7.40			550.00			25.00			0.04
upstream_M SWRF	10/15/2012	2012	between Kelly and MSWRF	GRU	8.00				7.60			550.00			23.50			0.06
SWBSE4	10/24/2012	2012	between Kelly and MSWRF	Alachua county														
SWBSE4	11/8/2012	2012	between Kelly and MSWRF	Alachua county	8.33			83.50	7.79			570.00			15.44			0.15
SWBSE8	11/8/2012	2012	between Kelly and MSWRF	Alachua county	7.89			85.10	8.04			850.00			19.01			0.10
upstream_M SWRF	1/25/2013	2013	between Kelly and MSWRF	GRU	9.13				7.20			600.00			15.80			0.10
upstream_M SWRF	1/25/2013	2013	between Kelly and MSWRF	GRU	9.13				7.20			600.00			15.80			0.10
SWBSE4	2/18/2013	2013	between Kelly and MSWRF	Alachua county	10.04			100.70	8.07			610.00			15.07			0.04
SWBSE8	2/18/2013	2013	between Kelly and MSWRF	Alachua county	8.77			92.50	8.20			675.00			17.86			0.05
SWBSE4	4/3/2013	2013	between Kelly and MSWRF	Alachua county														
upstream_M	4/8/2013	2013	between Kelly and MSWRF	GRU	8.65				7.20			370.00			17.			0.21

SWB331	1/16/2003	2003	downstream from MSWRF	Alachua county	11.33					7.12					773.00					16.72					0.05
SWB331	2/13/2003	2003	downstream from MSWRF	Alachua county	10.05					7.31					870.00					17.87					0.05
SWB331	3/12/2003	2003	downstream from MSWRF	Alachua county	8.79					7.30					580.00					21.33					0.05
SWB331	4/16/2003	2003	downstream from MSWRF	Alachua county	8.76					7.43					663.00					22.72					0.05
SWB331	5/7/2003	2003	downstream from MSWRF	Alachua county	8.24					7.38					727.00					26.02					0.05
SWB331	6/9/2003	2003	downstream from MSWRF	Alachua county	7.91					7.59					810.00					26.40					0.02
SWB331	7/9/2003	2003	downstream from MSWRF	Alachua county	8.02					7.60					953.00					27.21					0.03
SWB331	8/12/2003	2003	downstream from MSWRF	Alachua county	7.64					7.64					444.00					26.50					0.01
SWB331	9/9/2003	2003	downstream from MSWRF	Alachua county	8.17					7.62					624.00					26.02					0.03
SWB331	10/16/2003	2003	downstream from MSWRF	Alachua county	8.35					7.43					547.00					23.32					
SWB331	11/5/2003	2003	downstream from MSWRF	Alachua county	8.01					7.48					409.00					25.49					
SWD-1	12/1/2003	2003	downstream from MSWRF	GRU	6.88					7.70					750.00					25.80					0.10
SWB331	12/9/2003	2003	downstream from MSWRF	Alachua county	8.98					7.23					861.00					19.62					
SWB331	1/15/2004	2004	downstream from MSWRF	Alachua county	9.83					7.39					1165.00					18.51					
SWB331	2/11/2004	2004	downstream from MSWRF	Alachua county	9.22					7.48					911.00					18.70					
SWD-1	3/1/2004	2004	downstream from MSWRF	GRU	9.56					7.60					900.00					18.80					0.10
SWB331	3/10/2004	2004	downstream from MSWRF	Alachua county	9.81					7.60					810.00					18.24					
SWB331	4/14/2004	2004	downstream from MSWRF	Alachua county	9.22					7.75					745.00					19.53					
SWB331	5/19/2004	2004	downstream from MSWRF	Alachua county	8.32					7.75					1061.00					24.53					

	004	04	from MSWRF	county						65							73						
SWD-1	6/1/20 04	20 04	downstream from MSWRF	GRU																			
SWB331	6/17/2 004	20 04	downstream from MSWRF	Alachua county	7.82					7. 56				646.00				26. 81					
SWB331	7/21/2 004	20 04	downstream from MSWRF	Alachua county	8.49					7. 46				777.00				27. 85					
SWB331	8/11/2 004	20 04	downstream from MSWRF	Alachua county	9.84					7. 50				809.00				27. 18					
SWD-1	9/1/20 04	20 04	downstream from MSWRF	GRU	6.82					7. 50				1000.00				28. 60					0.10
SWB331	9/23/2 004	20 04	downstream from MSWRF	Alachua county	8.22					7. 46				566.00				25. 76					
SWB331	9/29/2 004	20 04	downstream from MSWRF	Alachua county	7.99					7. 26				501.00				25. 81					
SWD-1	12/1/2 004	20 04	downstream from MSWRF	GRU	7.23					7. 20				550.00				26. 20					0.40
SWB331	12/15/ 2004	20 04	downstream from MSWRF	Alachua county	9.63					7. 66				913.00				17. 02					
Main St. Downstream	1/3/20 05	20 05	downstream from MSWRF	GRU	9.03					7. 50				850.00				19. 80					0.10
SWD-1	3/1/20 05	20 05	downstream from MSWRF	GRU	9.03					7. 50				850.00				19. 80					0.10
SWB331	3/23/2 005	20 05	downstream from MSWRF	Alachua county	7.96					7. 37				679.00				21. 26					0.27
Main St. Downstream	4/5/20 05	20 05	downstream from MSWRF	GRU	8.80					6. 90				880.00				19. 60					0.06
SWB331	5/12/2 005	20 05	downstream from MSWRF	Alachua county	8.24					7. 47				912.00				23. 02					
SWD-1	6/1/20 05	20 05	downstream from MSWRF	GRU	8.80					6. 90				880.00				19. 60					0.06
SWB331	6/23/2 005	20 05	downstream from MSWRF	Alachua county	7.49					7. 43				847.00				25. 73					0.08
Main St. Downstream	7/27/2 005	20 05	downstream from MSWRF	GRU	7.10					6. 90				155.00				23. 90					0.06
SWB331	8/11/2 005	20 05	downstream from MSWRF	Alachua county	7.36					7. 45				504.00				27. 38					0.02

SWD-1	9/1/2005	2005	downstream from MSWRF	GRU	7.10					6.90				155.00				23.90				0.06
SWD-1	12/1/2005	2005	downstream from MSWRF	GRU	6.20					6.60				330.00				21.10				0.07
Main St. Downstream	12/13/2005	2005	downstream from MSWRF	GRU	6.20					6.60				330.00				21.10				0.07
SWB331	12/14/2005	2005	downstream from MSWRF	Alachua county	8.88					7.28				10.76				18.79				0.01
SWD-1	3/1/2006	2006	downstream from MSWRF	GRU	7.10					6.70				300.00				18.90				LE
SWB331	3/7/2006	2006	downstream from MSWRF	Alachua county	8.72					7.40				985.00				20.23				0.01
Main St. Downstream	4/6/2006	2006	downstream from MSWRF	GRU	7.90					6.80								22.70				
SWB331	5/2/2006	2006	downstream from MSWRF	Alachua county	7.85					7.41				670.00				21.89				
SWB331	5/9/2006	2006	downstream from MSWRF	Alachua county	7.91					6.99				823.00				25.47				
Main St. Downstream	5/24/2006	2006	downstream from MSWRF	GRU	7.10					6.70								18.90				0.11
SWD-1	6/1/2006	2006	downstream from MSWRF	GRU	7.90					6.80				240.00				22.70				0.11
SWB331	6/6/2006	2006	downstream from MSWRF	Alachua county	7.91					7.25				1294.00				25.71				0.02
SWB331	6/22/2006	2006	downstream from MSWRF	Alachua county	7.59					7.38				842.00				27.33				0.01
Main St. Downstream	7/20/2006	2006	downstream from MSWRF	GRU	7.60					7.90				450.00				27.10				0.08
SWD-1	9/1/2006	2006	downstream from MSWRF	GRU	7.60					7.90				450.00				27.10				0.08
SWB331	9/5/2006	2006	downstream from MSWRF	Alachua county	7.68					7.49				769.00				27.50				0.01
SWB331	9/12/2006	2006	downstream from MSWRF	Alachua county	7.18					7.50				539.00				27.11				0.02
Main St. Downstream	10/30/2006	2006	downstream from MSWRF	GRU																		0.04
SWB331	11/14/	20	downstream	Alachua	8.38					7.				1144.00				19.				0.09

	2006	06	from MSWRF	county					30							51				
SWD-1	12/1/2006	2006	downstream from MSWRF	GRU	8.40				7.50				600.00			21.50				0.04
Main St. Downstream	1/9/2007	2007	downstream from MSWRF	GRU	7.10				7.20				550.00			24.10				
SWD-1	3/1/2007	2007	downstream from MSWRF	GRU	7.10				7.20				550.00			24.10				analysis not performed
SWB331	3/21/2007	2007	downstream from MSWRF	Alachua county	8.59				7.51				1007.00			20.49				0.05
Main St. Downstream	4/4/2007	2007	downstream from MSWRF	GRU	8.10				7.30				1000.00			22.40				0.06
SWB331	4/25/2007	2007	downstream from MSWRF	Alachua county																
SWD-1	6/1/2007	2007	downstream from MSWRF	GRU	8.10				7.30				1000.00			22.40				0.06
Main St. Downstream	7/18/2007	2007	downstream from MSWRF	GRU	8.10				7.80				410.00			29.60				0.07
SWB331	7/24/2007	2007	downstream from MSWRF	Alachua county																
SWB331	7/25/2007	2007	downstream from MSWRF	Alachua county																
SWB331	7/26/2007	2007	downstream from MSWRF	Alachua county																
SWB331	8/27/2007	2007	downstream from MSWRF	Alachua county	7.29				7.58				986.00			27.71				0.04
SWD-1	9/1/2007	2007	downstream from MSWRF	GRU	8.14				7.80				410.00			29.60				0.07
SWB331	10/16/2007	2007	downstream from MSWRF	Alachua county	7.86				7.42				785.00			25.28				0.05
5th_yr_dwn	10/29/2007	2007	downstream from MSWRF	FDEP	8.60				7.30				888.00			23.40				0.03
Main St. Downstream	11/20/2007	2007	downstream from MSWRF	GRU	7.90				7.50				450.00			23.60				0.12
SWD-1	12/1/2007	2007	downstream from MSWRF	GRU	7.90				7.50				450.00			23.60				0.12
Main St. Downstream	2/26/2008	2008	downstream from MSWRF	GRU	9.80				7.60				750.00			21.00				0.13

SWD-1	3/1/2008	2008	downstream from MSWRF	GRU	9.80					7.60					750.00					21.00					n/a
SWB331	3/20/2008	2008	downstream from MSWRF	Alachua county																					0.10
Main St. Downstream	5/14/2008	2008	downstream from MSWRF	GRU	9.20					7.80					500.00					22.80					0.07
SWD-1	6/1/2008	2008	downstream from MSWRF	GRU	9.20					7.80					500.00					22.30					0.07
SWB331	6/17/2008	2008	downstream from MSWRF	Alachua county																					0.02
Main St. Downstream	7/9/2008	2008	downstream from MSWRF	GRU	9.20					7.80					610.00					22.80					0.06
SWB331	8/7/2008	2008	downstream from MSWRF	Alachua county																					0.02
SWD-1	9/1/2008	2008	downstream from MSWRF	GRU	9.20					7.80					500.00					22.30					0.07
Main St. Downstream	10/9/2008	2008	downstream from MSWRF	GRU						7.30					510.00					26.10					0.03
SWB331	10/20/2008	2008	downstream from MSWRF	Alachua county																					0.06
SWD-1	12/1/2008	2008	downstream from MSWRF	GRU	8.40					7.30					510.00					26.10					0.30
Main St. Downstream	1/21/2009	2009	downstream from MSWRF	GRU	10.20					7.50					500.00					13.90					
SWB331	2/10/2009	2009	downstream from MSWRF	Alachua county																					0.04
SWD-1	3/1/2009	2009	downstream from MSWRF	GRU	10.20					7.20					500.00					13.90					n/a
Main St. Downstream	5/13/2009	2009	downstream from MSWRF	GRU	7.20					7.20					470.00					23.90					0.14
SWD-1	6/1/2009	2009	downstream from MSWRF	GRU	7.20					7.20					470.00					23.90					0.14
SWB331	6/22/2009	2009	downstream from MSWRF	Alachua county																					0.04
SWD-1	9/1/2009	2009	downstream from MSWRF	GRU	7.20					7.20					470.00					23.90					0.14
SWB331	9/3/20	20	downstream	Alachua																					0.27

	09	09	from MSWRF	county																				
Main St. Downstream	9/14/2009	2009	downstream from MSWRF	GRU	8.60					7.00					500.00					27.30				0.06
Main St. Downstream	11/18/2009	2009	downstream from MSWRF	GRU	6.80					6.90					510.00					23.40				0.06
SWD-1	12/1/2009	2009	downstream from MSWRF	GRU	6.80					6.90					510.00					23.40				0.06
SWB331	12/22/2009	2009	downstream from MSWRF	Alachua county																				0.06
Main St. Downstream	1/14/2010	2010	downstream from MSWRF	GRU	7.60					7.10					400.00					19.30				0.14
SWB331	2/17/2010	2010	downstream from MSWRF	Alachua county	9.64				94.70	7.58					575.00					14.45				0.01
SWD-1	3/1/2010	2010	downstream from MSWRF	GRU	7.60					7.10					400.00					19.30				0.14
Main St. Downstream	5/26/2010	2010	downstream from MSWRF	GRU	8.10					7.20					625.00					24.10				0.08
SWD-1	6/1/2010	2010	downstream from MSWRF	GRU	8.10					7.20					625.00					24.10				0.08
SWB331	6/30/2010	2010	downstream from MSWRF	Alachua county	7.25				90.60	7.62					644.00					26.59				0.06
SWB331	8/18/2010	2010	downstream from MSWRF	Alachua county	7.04				89.40	7.70					936.00					27.59				0.03
Main St. Downstream	9/1/2010	2010	downstream from MSWRF	GRU	7.70					7.30					1100.00					27.50				0.03
SWD-1	9/1/2010	2010	downstream from MSWRF	GRU	7.70					7.30					1100.00					27.50				0.07
SWD-1	12/1/2010	2010	downstream from MSWRF	GRU	9.60					7.10					634.00					16.10				0.01U
SWB331	12/1/2010	2010	downstream from MSWRF	Alachua county	7.57				85.40	7.64					613.00					21.17				0.04
Main St. Downstream	12/6/2010	2010	downstream from MSWRF	GRU	9.60					7.10					635.00					16.10				0.01
SWB331	2/1/2011	2011	downstream from MSWRF	Alachua county																				
Main St. Downstream	2/9/2011	2011	downstream from MSWRF	GRU	10.30					6.95					650.00					16.00				0.13

SWD-1	3/1/2011	2011	downstream from MSWRF	GRU	10.30					6.95				650.00				16.00				0.13
SWB331	3/8/2011	2011	downstream from MSWRF	Alachua county	9.19				100.40	7.56				1138.00				19.51				0.03
SWB331	3/9/2011	2011	downstream from MSWRF	Alachua county																		
Main St. Downstream	5/12/2011	2011	downstream from MSWRF	GRU	8.10					7.20				780.00				25.80				0.06
SWD-1	6/1/2011	2011	downstream from MSWRF	GRU	8.10					7.20				780.00				25.80				0.06
SWB331	6/20/2011	2011	downstream from MSWRF	Alachua county	6.71				84.70	7.58				682.00				27.06				0.01
SWB331	8/8/2011	2011	downstream from MSWRF	Alachua county	6.87				89.20	7.75				840.00				28.83				0.02
Main St. Downstream	8/10/2011	2011	downstream from MSWRF	GRU	7.70					7.60				900.00				28.00				0.16
SWD-1	9/1/2011	2011	downstream from MSWRF	GRU	7.70					7.60				900.00				28.00				0.16
SWB331	10/24/2011	2011	downstream from MSWRF	Alachua county	7.72				89.60	7.64				1012.00				22.65				0.06
Main St. Downstream	11/21/2011	2011	downstream from MSWRF	GRU	8.60					7.30				725.00				23.10				0.09
Main St. Downstream	12/13/2011	2011	downstream from MSWRF	GRU	8.90					7.40				800.00				19.30				0.14
MSWRF_downstream	1/12/2012	2012	downstream from MSWRF	GRU	9.20					7.20				850.00				19.00				0.18
SWB331	1/26/2012	2012	downstream from MSWRF	Alachua county	8.18				93.10	7.82				1039.00				21.61				0.07
SWB5	2/29/2012	2012	downstream from MSWRF	GRU	Scratched					7.50								22.00				0.07
SWB3	2/29/2012	2012	downstream from MSWRF	GRU	Scratched					7.60								22.50				0.05
SWB2	2/29/2012	2012	downstream from MSWRF	GRU	Scratched					7.60								22.50				0.05
SWB5	3/27/2012	2012	downstream from MSWRF	GRU	7.90					6.85				790.00				20.60				0.11
SWB3	3/27/2012	2012	downstream	GRU	8.70					7.				790.00				21.				0.05

	012	12	from MSWRF						10							60				
SWB2	3/27/2012	2012	downstream from MSWRF	GRU	8.80				7.15				790.00			21.00				0.05
SWB331	4/24/2012	2012	downstream from MSWRF	Alachua county	8.10			90.30	7.40				929.00			20.58				0.04
SWB5	4/26/2012	2012	downstream from MSWRF	GRU	8.60				8.10				1000.00			20.90				0.09
SWB3	4/26/2012	2012	downstream from MSWRF	GRU	9.30				8.10				950.00			21.90				0.08
SWB2	4/26/2012	2012	downstream from MSWRF	GRU	9.50				8.14				1000.00			21.00				0.08
SWB5	5/15/2012	2012	downstream from MSWRF	GRU	8.00				8.23				840.00			24.90				0.10
SWB3	5/15/2012	2012	downstream from MSWRF	GRU	8.70				8.15				850.00			25.30				0.06
SWB2	5/15/2012	2012	downstream from MSWRF	GRU	8.80				8.21				840.00			25.20				0.05
MSWRF_downstream	5/30/2012	2012	downstream from MSWRF	GRU	8.70				7.30				800.00			25.80				0.07
SWB5	6/13/2012	2012	downstream from MSWRF	GRU	7.61				7.99							26.10				0.04
SWB3	6/13/2012	2012	downstream from MSWRF	GRU	8.46				8.18							26.60				0.09
SWB2	6/13/2012	2012	downstream from MSWRF	GRU	8.58				8.25				1500.00			26.40				0.01
SWB331	7/23/2012	2012	downstream from MSWRF	Alachua county	7.28			91.80	7.71				912.00			27.09				0.04
MSWRF_downstream	9/5/2012	2012	downstream from MSWRF	GRU	8.30				7.20				600.00			26.50				0.04 I
MSWRF_downstream	10/15/2012	2012	downstream from MSWRF	GRU	8.10				7.40				580.00			25.30				0.04 I
SWB331	11/8/2012	2012	downstream from MSWRF	Alachua county	8.09			88.90	7.50				750.00			19.84				0.05
MSWRF_downstream	1/25/2013	2013	downstream from MSWRF	GRU	7.24				7.20				950.00			18.50				0.08
SWB331	2/18/2013	2013	downstream from MSWRF	Alachua county	9.63			99.50	7.60				672.00			16.85				0.04

MSWRF_dow nstream	4/8/20 13	20 13	downstream from MSWRF	GRU	8.47					7. 20					900.00					20. 70					0.15
SWB331	5/8/20 13	20 13	downstream from MSWRF	Alachua county	8.23				93.00	7. 46					680.00					21. 24					0.09
MSWRF_dow nstream	7/29/2 013	20 13	downstream from MSWRF	GRU	7.03					7. 00					550.00					26. 30					0.04 I
SWB331	8/13/2 013	20 13	downstream from MSWRF	Alachua county	7.03				88.80	7. 60					432.70					27. 40					
MSWRF_dow nstream	11/18/ 2013	20 13	downstream from MSWRF	GRU	8.66					7. 20					850.00					23. 50					0.11

8.2 NUTRIENT DATA

Data were compiled from IWR, Alachua Co., GRU, and FDEP reports, spreadsheets, and databases. Duplicates were removed and data were sorted by location and year prior to analysis. Chlorophyll data, when needed, were converted to ug/L from mg/L prior to analysis.

date	year	station	location	TP	-	TN	-	cchla
10/17/2002	2002	SWBNE10	upstream of kelly	0.13		1.14		
10/17/2002	2002	SWBNE10	upstream of kelly	0.11		1.08		
11/7/2002	2002	SWBNE10	upstream of kelly	0.14		0.73		
12/12/2002	2002	SWBNE10	upstream of kelly	0.06		1.01		
10/17/2002	2002	SWBNE10	upstream of kelly	0.12		1.50		
11/7/2002	2002	SWBSE1	upstream of kelly	0.14		0.46		
8/15/2002	2002	SWBSE1	upstream of kelly	0.077		0.353		
9/12/2002	2002	SWBSE1	upstream of kelly	0.079		0.412		
9/12/2002	2002	SWBSE1	upstream of kelly	0.084		0.467		
12/12/2002	2002	SWBSE1	upstream of kelly	0.07		0.41		
1/16/2003	2003	SWBNE10	upstream of kelly	0.06		1.13		
2/13/2003	2003	SWBNE10	upstream of kelly	0.05		1.22		
3/12/2003	2003	SWBNE10	upstream of kelly	0.10		1.53		
4/16/2003	2003	SWBNE10	upstream of kelly	0.06		1.30		
5/7/2003	2003	SWBNE10	upstream of kelly	0.11		1.31		
6/9/2003	2003	SWBNE10	upstream of kelly	0.11		1.10		
8/12/2003	2003	SWBNE10	upstream of kelly	0.17		0.62		
1/16/2003	2003	SWBSE1	upstream of kelly	0.04		0.96		
2/13/2003	2003	SWBSE1	upstream of kelly	0.06		0.89		
3/12/2003	2003	SWBSE1	upstream of kelly	0.09		1.09		
4/16/2003	2003	SWBSE1	upstream of kelly	0.07		0.50		
5/7/2003	2003	SWBSE1	upstream of kelly	0.07		0.33		
6/9/2003	2003	SWBSE1	upstream of kelly	0.11		0.65		
7/9/2003	2003	SWBSE1	upstream of kelly	0.09		0.43		
8/12/2003	2003	SWBSE1	upstream of kelly	0.17		0.76		
9/9/2003	2003	SWBSE1	upstream of kelly	0.08		0.59		
10/16/2003	2003	SWBSE1	upstream of kelly			0.51		

11/5/2003	2003	SWBSE1	upstream of kelly		0.34		
12/9/2003	2003	SWBSE1	upstream of kelly				
2/11/2004	2004	SWBNE10	upstream of kelly				
3/10/2004	2004	SWBNE10	upstream of kelly				
4/14/2004	2004	SWBNE10	upstream of kelly				
7/21/2004	2004	SWBNE10	upstream of kelly				
8/11/2004	2004	SWBNE10	upstream of kelly				
9/23/2004	2004	SWBNE10	upstream of kelly				
12/15/2004	2004	SWBNE10	upstream of kelly				
1/15/2004	2004	SWBSE1	upstream of kelly	0.05	0.13		
1/15/2004	2004	SWBSE1	upstream of kelly	1.50	2.80		
2/11/2004	2004	SWBSE1	upstream of kelly	0.05	0.61		
3/10/2004	2004	SWBSE1	upstream of kelly	0.05	0.40		
4/14/2004	2004	SWBSE1	upstream of kelly	0.05	0.13		
5/19/2004	2004	SWBSE1	upstream of kelly				
6/17/2004	2004	SWBSE1	upstream of kelly				
7/21/2004	2004	SWBSE1	upstream of kelly	0.10	0.54		
8/11/2004	2004	SWBSE1	upstream of kelly	0.05	0.37		
9/23/2004	2004	SWBSE1	upstream of kelly	0.05	0.63		
3/23/2005	2005	SWBNE10	upstream of kelly	0.10			
5/12/2005	2005	SWBNE10	upstream of kelly				
6/22/2005	2005	SWBNE10	upstream of kelly	0.44			3.10
8/11/2005	2005	SWBNE10	upstream of kelly	0.09	1.07		
9/12/2005	2005	SWBNE10	upstream of kelly				
12/14/2005	2005	SWBNE10	upstream of kelly	0.17	0.77		
1/13/2005	2005	SWBSE1	upstream of kelly				
3/23/2005	2005	SWBSE1	upstream of kelly				
5/12/2005	2005	SWBSE1	upstream of kelly				
6/22/2005	2005	SWBSE1	upstream of kelly	0.21			0.20
8/11/2005	2005	SWBSE1	upstream of kelly	0.11	1.01		1
9/12/2005	2005	SWBSE1	upstream of kelly				
3/15/2005	2005	SWBSE4AVE	upstream of kelly	0.09	0.49		1.1
6/7/2005	2005	SWBSE4AVE	upstream of kelly	0.12	0.41		1.1

8/29/2005	2005	SWBSE4AVE	upstream of kelly	0.08		0.26		1.1
11/14/2005	2005	SWBSE4AVE	upstream of kelly	0.32		0.98		1
3/7/2006	2006	SWBNE10	upstream of kelly	0.07		1.21		
4/25/2006	2006	SWBNE10	upstream of kelly					
5/2/2006	2006	SWBNE10	upstream of kelly					
5/9/2006	2006	SWBNE10	upstream of kelly					
6/22/2006	2006	SWBNE10	upstream of kelly	0.14		0.92		
9/12/2006	2006	SWBNE10	upstream of kelly	0.14				
11/14/2006	2006	SWBNE10	upstream of kelly	0.24		1.53		
9/12/2006	2006	SWBSE1	upstream of kelly					
3/21/2007	2007	SWBNE10	upstream of kelly	0.21		1.15		
7/24/2007	2007	SWBNE10	upstream of kelly					
7/25/2007	2007	SWBNE10	upstream of kelly					
7/26/2007	2007	SWBNE10	upstream of kelly					
8/27/2007	2007	SWBNE10	upstream of kelly	0.20		0.75		
10/16/2007	2007	SWBNE10	upstream of kelly	0.11		0.65		
4/25/2007	2007	SWBSE1	upstream of kelly					
7/17/2007	2007	SWBSE1	upstream of kelly					
7/24/2007	2007	SWBSE1	upstream of kelly					
7/25/2007	2007	SWBSE1	upstream of kelly					
7/26/2007	2007	SWBSE1	upstream of kelly					
4/25/2007	2007	SWBSE8	upstream of kelly					
2/1/2008	2008	SWBNE10	upstream of kelly					
7/30/2008	2008	SWBNE10	upstream of kelly					
8/7/2008	2008	SWBNE10	upstream of kelly					
9/3/2008	2008	SWBNE10	upstream of kelly					
11/24/2008	2008	SWBNE10	upstream of kelly					
7/30/2008	2008	SWBSE1	upstream of kelly					
9/3/2008	2008	SWBSE1	upstream of kelly					
11/24/2008	2008	SWBSE1	upstream of kelly					
7/30/2008	2008	SWBSE8	upstream of kelly					
9/3/2008	2008	SWBSE8	upstream of kelly					
11/24/2008	2008	SWBSE8	upstream of kelly					

2/10/2009	2009	SWBNE10	upstream of kelly					
3/3/2009	2009	SWBNE10	upstream of kelly					
5/11/2009	2009	SWBNE10	upstream of kelly					
8/25/2009	2009	SWBNE10	upstream of kelly					
12/9/2009	2009	SWBNE10	upstream of kelly					
3/3/2009	2009	SWBSE1	upstream of kelly					
5/11/2009	2009	SWBSE1	upstream of kelly					
8/25/2009	2009	SWBSE1	upstream of kelly					
12/9/2009	2009	SWBSE1	upstream of kelly					
3/3/2009	2009	SWBSE8	upstream of kelly					
5/11/2009	2009	SWBSE8	upstream of kelly					
8/25/2009	2009	SWBSE8	upstream of kelly					
12/9/2009	2009	SWBTB	upstream of kelly					
3/30/2010	2010	SWBNE10	upstream of kelly					
6/22/2010	2010	SWBNE10	upstream of kelly					
9/2/2010	2010	SWBNE10	upstream of kelly					
11/8/2010	2010	SWBNE10	upstream of kelly					
3/30/2010	2010	SWBSE1	upstream of kelly					
6/22/2010	2010	SWBSE1	upstream of kelly					
9/2/2010	2010	SWBSE1	upstream of kelly					
11/8/2010	2010	SWBSE1	upstream of kelly					
12/8/2010	2010	SWBSE4AVE	upstream of kelly					
3/30/2010	2010	SWBTB	upstream of kelly					
6/22/2010	2010	SWBTB	upstream of kelly					
9/2/2010	2010	SWBTB	upstream of kelly					
11/8/2010	2010	SWBTB	upstream of kelly					
6/7/2011	2011	SWBNE10	upstream of kelly					
6/16/2011	2011	SWBNE10	upstream of kelly					
8/15/2011	2011	SWBNE10	upstream of kelly					
11/7/2011	2011	SWBNE10	upstream of kelly					
6/7/2011	2011	SWBSE1	upstream of kelly					
6/16/2011	2011	SWBSE1	upstream of kelly					
8/15/2011	2011	SWBSE1	upstream of kelly					

11/7/2011	2011	SWBSE1	upstream of kelly					
6/20/2011	2011	SWBSE4AVE	upstream of kelly	0.185		0.326		
8/8/2011	2011	SWBSE4AVE	upstream of kelly	0.191		0.125		
10/24/2011	2011	SWBSE4AVE	upstream of kelly	0.184		0.444		
6/20/2011	2011	SWBSE8	upstream of kelly	0.53		0.54		
8/8/2011	2011	SWBSE8	upstream of kelly	0.36		0.26		
10/24/2011	2011	SWBSE8	upstream of kelly	0.66		0.80		
6/7/2011	2011	SWBTB	upstream of kelly					
6/16/2011	2011	SWBTB	upstream of kelly					
8/15/2011	2011	SWBTB	upstream of kelly					
11/7/2011	2011	SWBTB	upstream of kelly					
11/8/2011	2011	SWBTB	upstream of kelly					
11/14/2011	2011	SWBTB	upstream of kelly					
11/22/2011	2011	SWBTB	upstream of kelly					
11/30/2011	2011	SWBTB	upstream of kelly	0.18		0.35		
2/9/2012	2012	SWBNE10	upstream of kelly					
4/18/2012	2012	SWBNE10	upstream of kelly					
10/24/2012	2012	SWBNE10	upstream of kelly					
2/9/2012	2012	SWBSE1	upstream of kelly					
4/18/2012	2012	SWBSE1	upstream of kelly					
10/24/2012	2012	SWBSE1	upstream of kelly					
1/26/2012	2012	SWBSE4AVE	upstream of kelly	0.253		0.279		
4/24/2012	2012	SWBSE4AVE	upstream of kelly	0.21		0.17		
7/23/2012	2012	SWBSE4AVE	upstream of kelly	0.1		0.52		
11/8/2012	2012	SWBSE4AVE	upstream of kelly	1.61		0.29		
1/26/2012	2012	SWBSE8	upstream of kelly	0.47		1.09		
4/24/2012	2012	SWBSE8	upstream of kelly	0.70		1.10		
7/23/2012	2012	SWBSE8	upstream of kelly	0.70		1.30		
11/8/2012	2012	SWBSE8	upstream of kelly	1.00		1.30		
2/9/2012	2012	SWBTB	upstream of kelly					
4/18/2012	2012	SWBTB	upstream of kelly					
10/24/2012	2012	SWBTB	upstream of kelly					
4/3/2013	2013	SWBNE10	upstream of kelly					

5/13/2013	2013	SWBNE10	upstream of kelly					
4/3/2013	2013	SWBSE1	upstream of kelly					
5/13/2013	2013	SWBSE1	upstream of kelly					
2/18/2013	2013	SWBSE4AVE	upstream of kelly	0.636	1			
5/8/2013	2013	SWBSE4AVE	upstream of kelly	0.124	0.24			
8/13/2013	2013	SWBSE4AVE	upstream of kelly					
2/18/2013	2013	SWBSE8	upstream of kelly	1.68	1.40			
5/8/2013	2013	SWBSE8	upstream of kelly	0.21	0.37			
8/13/2013	2013	SWBSE8	upstream of kelly					
4/3/2013	2013	SWBTB	upstream of kelly					
5/13/2013	2013	SWBTB	upstream of kelly					

date	year	station	location	TP	-	TN	-	cchla
4/1/2002	2002	dep 5th year	between kelly and MSWRF	0.31		0.73		
12/1/2003	2003	SWB-1	between kelly and MSWRF	0.40		0.60		0.50000
2/13/2003	2003	SWBSE4	between kelly and MSWRF	0.12		0.76		
3/1/2004	2004	SWB-1	between kelly and MSWRF	0.20		0.40		0.50000
6/1/2004	2004	SWB-1	between kelly and MSWRF					
9/1/2004	2004	SWB-1	between kelly and MSWRF	0.40		0.70		0.20000
12/1/2004	2004	SWB-1	between kelly and MSWRF	1.00		0.60		1.00000
3/1/2005	2005	SWB-1	between kelly and MSWRF	0.20		0.40		1.10000
6/1/2005	2005	SWB-1	between kelly and MSWRF	0.16		0.55		0.50000
9/1/2005	2005	SWB-1	between kelly and MSWRF	0.21		0.82		2.10000
12/1/2005	2005	SWB-1	between kelly and MSWRF	0.15		0.54		0.10000
5/12/2005	2005	SWBSE4	between kelly and MSWRF					
6/23/2005	2005	SWBSE4	between kelly and MSWRF	0.23		0.89		0.20000
6/23/2005	2005	SWBSE4	between kelly and MSWRF					
9/12/2005	2005	SWBSE4	between kelly and MSWRF					
12/14/2005	2005	SWBSE4	between kelly and MSWRF	0.17		0.61		
1/3/2005	2005	SWB-1	between kelly and MSWRF	0.20		0.40		1.10000
4/5/2005	2005	SWB-1	between kelly and MSWRF	0.16		0.60		1.00000
7/27/2005	2005	SWB-1	between kelly and MSWRF	0.21		0.80		2.10000

11/16/2005	2005	SWB-1	between kelly and MSWRF	0.15			0.10000
3/1/2006	2006	SWB-1	between kelly and MSWRF	0.07		0.68	1.61000
6/1/2006	2006	SWB-1	between kelly and MSWRF	0.04		0.49	0.50000
9/1/2006	2006	SWB-1	between kelly and MSWRF	0.21		0.73	2.10000
12/1/2006	2006	SWB-1	between kelly and MSWRF	0.26		0.72	4.30000
3/7/2006	2006	SWBSE4	between kelly and MSWRF	0.11		1.14	
6/22/2006	2006	SWBSE4	between kelly and MSWRF	0.23		0.80	
9/12/2006	2006	SWBSE4	between kelly and MSWRF	0.29		2.40	
11/14/2006	2006	SWBSE4	between kelly and MSWRF	0.17		0.38	
1/18/2006	2006	SWB-1	between kelly and MSWRF	0.07			1.60000
4/6/2006	2006	SWB-1	between kelly and MSWRF	0.04			0.50000
6/28/2006	2006	SWB-1	between kelly and MSWRF				0.50000
7/20/2006	2006	SWB-1	between kelly and MSWRF	0.21			2.10000
10/30/2006	2006	SWB-1	between kelly and MSWRF	0.26			4.30000
3/1/2007	2007	SWB-1	between kelly and MSWRF	0.16		0.58	0.01100
6/1/2007	2007	SWB-1	between kelly and MSWRF	0.43		1.10	0.01100
9/1/2007	2007	SWB-1	between kelly and MSWRF	0.36		0.97	0.01100
10/29/2007	2007	dep 5th year SWB-1	between kelly and MSWRF	0.26		0.57	
12/1/2007	2007	SWB-1	between kelly and MSWRF	0.17		0.30	1.10000
3/21/2007	2007	SWBSE4	between kelly and MSWRF	0.17		0.46	
7/24/2007	2007	SWBSE4	between kelly and MSWRF				
7/25/2007	2007	SWBSE4	between kelly and MSWRF				
7/26/2007	2007	SWBSE4	between kelly and MSWRF				
8/27/2007	2007	SWBSE4	between kelly and MSWRF	0.36		0.82	
10/16/2007	2007	SWBSE4	between kelly and MSWRF	0.17		0.59	
1/9/2007	2007	SWB-1	between kelly and MSWRF	0.16			1.10000
4/4/2007	2007	SWB-1	between kelly and MSWRF	0.43			1.10000
7/18/2007	2007	SWB-1	between kelly and MSWRF	0.36			1.11000
12/3/2007	2007	SWB-1	between kelly and MSWRF	0.17			1.10000
3/1/2008	2008	SWB-1	between kelly and MSWRF	0.20		0.93	1.10000
6/1/2008	2008	SWB-1	between kelly and MSWRF	2.07		0.48	2.10000
9/1/2008	2008	SWB-1	between kelly and MSWRF	2.07		0.48	2.10000

12/1/2008	2008	SWB-1	between kelly and MSWRF	0.15		0.73		3.21000
3/20/2008	2008	SWBSE4	between kelly and MSWRF	0.28		1.09		
6/17/2008	2008	SWBSE4	between kelly and MSWRF	0.21		1.09		
8/7/2008	2008	SWBSE4	between kelly and MSWRF	0.21		1.16		
10/20/2008	2008	SWBSE4	between kelly and MSWRF	0.23		1.15		
11/24/2008	2008	SWBSE4	between kelly and MSWRF					
2/26/2008	2008	SWB-1	between kelly and MSWRF	0.20		0.90		1.10000
5/14/2008	2008	SWB-1	between kelly and MSWRF	2.07				2.10000
7/9/2008	2008	SWB-1	between kelly and MSWRF	0.18		0.56		2.70000
11/20/2008	2008	SWB-1	between kelly and MSWRF	0.15				3.20000
3/1/2009	2009	SWB-1	between kelly and MSWRF	0.10		0.39		0.11000
6/1/2009	2009	SWB-1	between kelly and MSWRF	0.62		0.81		0.11000
9/1/2009	2009	SWB-1	between kelly and MSWRF	0.62		0.81		0.11000
12/1/2009	2009	SWB-1	between kelly and MSWRF	0.66		1.12		1.61000
2/10/2009	2009	SWBSE4	between kelly and MSWRF	0.12		0.63		
3/3/2009	2009	SWBSE4	between kelly and MSWRF					
6/22/2009	2009	SWBSE4	between kelly and MSWRF	0.47		1.18		
8/25/2009	2009	SWBSE4	between kelly and MSWRF					
9/3/2009	2009	SWBSE4	between kelly and MSWRF	0.21		0.98		
12/22/2009	2009	SWBSE4	between kelly and MSWRF	0.22		0.78		
1/21/2009	2009	SWB-1	between kelly and MSWRF	0.10				0.11000
5/13/2009	2009	SWB-1	between kelly and MSWRF	0.62				0.11000
9/14/2009	2009	SWB-1	between kelly and MSWRF	0.19				0.11000
11/18/2009	2009	SWB-1	between kelly and MSWRF	0.66				1.60000
3/1/2010	2010	SWB-1	between kelly and MSWRF	0.37		0.64		0.11000
6/1/2010	2010	SWB-1	between kelly and MSWRF	0.84		0.90		0.11000
9/1/2010	2010	SWB-1	between kelly and MSWRF	0.84		0.90		0.11000
12/1/2010	2010	SWB-1	between kelly and MSWRF	0.26		0.51		2.10000
2/17/2010	2010	SWBSE4	between kelly and MSWRF	0.17		0.85		
6/30/2010	2010	SWBSE4	between kelly and MSWRF	0.22		0.75		
8/18/2010	2010	SWBSE4	between kelly and MSWRF	0.37		0.73		
12/1/2010	2010	SWBSE4	between kelly and MSWRF	0.35		0.66		
12/8/2010	2010	SWBSE4	between kelly and MSWRF					

1/14/2010	2010	SWB-1	between kelly and MSWRF	0.37			0.60000
5/26/2010	2010	SWB-1	between kelly and MSWRF	0.84		0.90	1.10000
9/1/2010	2010	SWB-1	between kelly and MSWRF	0.51			2.10000
12/6/2010	2010	SWB-1	between kelly and MSWRF	0.26			2.10000
3/1/2011	2011	SWB-1	between kelly and MSWRF	0.18		0.53	1.10000
6/1/2011	2011	SWB-1	between kelly and MSWRF	0.61		0.52	7.50000
9/1/2011	2011	SWB-1	between kelly and MSWRF	0.20		0.51	1.10000
11/21/2011	2011	Upstream_MS	between kelly and MSWRF	0.48		0.71	1.10000
3/8/2011	2011	SWBSE4	between kelly and MSWRF	0.18		0.36	
6/7/2011	2011	SWBSE4	between kelly and MSWRF				
6/16/2011	2011	SWBSE4	between kelly and MSWRF				
6/20/2011	2011	SWBSE4	between kelly and MSWRF	0.46		0.85	
8/8/2011	2011	SWBSE4	between kelly and MSWRF	0.27		0.20	
8/15/2011	2011	SWBSE4	between kelly and MSWRF				
8/16/2011	2011	SWBSE4	between kelly and MSWRF				
10/24/2011	2011	SWBSE4	between kelly and MSWRF	0.32		0.61	
11/7/2011	2011	SWBSE4	between kelly and MSWRF				
2/9/2011	2011	SWB-1	between kelly and MSWRF	0.18			1.10000
5/12/2011	2011	SWB-1	between kelly and MSWRF	0.61			7.50000
8/10/2011	2011	SWB-1	between kelly and MSWRF	0.20			1.10000
11/21/2011	2011	SWB-1	between kelly and MSWRF	0.48			1.10000
12/13/2011	2011	SWB-1	between kelly and MSWRF	0.28		0.33	1.60000
1/12/2012	2012	SWB-1	between kelly and MSWRF	0.45		0.94	1.10000
2/29/2012	2012	REF1	between kelly and MSWRF	0.25		0.35	2.70000
3/27/2012	2012	REF1	between kelly and MSWRF	0.61		0.72	2.10000
4/26/2012	2012	REF1	between kelly and MSWRF	0.66		0.95	2.10000
5/15/2012	2012	REF1	between kelly and MSWRF	0.96		0.96	1.00000
5/30/2012	2012	SWB-1	between kelly and MSWRF	0.14		0.09	1.60000
6/13/2012	2012	REF1	between kelly and MSWRF	0.42		0.56	1.10000
7/16/2012	2012	REF1	between kelly and MSWRF				1.10000
8/21/2012	2012	REF1	between kelly and MSWRF				3.10000
9/5/2012	2012	SWB-1	between kelly and MSWRF	0.43		0.81	1.10000
10/15/2012	2012	SWB-1	between kelly and MSWRF	0.68		1.38	1.10000

1/26/2012	2012	SWBSE4	between kelly and MSWRF	0.40		0.79		
2/9/2012	2012	SWBSE4	between kelly and MSWRF					
4/18/2012	2012	SWBSE4	between kelly and MSWRF					
4/24/2012	2012	SWBSE4	between kelly and MSWRF	0.54		0.77		
7/23/2012	2012	SWBSE4	between kelly and MSWRF	0.57		1.10		
10/24/2012	2012	SWBSE4	between kelly and MSWRF					
11/8/2012	2012	SWBSE4	between kelly and MSWRF	0.96		1.30		
1/25/2013	2013	SWB-1	between kelly and MSWRF	0.86		0.88		6.90000
4/8/2013	2013	SWB-1	between kelly and MSWRF	0.37		0.57		3.20000
7/29/2013	2013	SWB-1	between kelly and MSWRF	0.34		0.99		0.50000
11/18/2013	2013	SWB-1	between kelly and MSWRF	0.63		0.87		1.00000
2/18/2013	2013	SWBSE4	between kelly and MSWRF	1.44		1.00		
4/3/2013	2013	SWBSE4	between kelly and MSWRF					
5/8/2013	2013	SWBSE4	between kelly and MSWRF	0.13		0.33		
5/13/2013	2013	SWBSE4	between kelly and MSWRF					
8/13/2013	2013	SWBSE4	between kelly and MSWRF					

date	year	station	location	TP	-	TN	-	cchla
4/1/2002	2002	dep 5th year	downstream from MSWRF	0.52		2.2		
10/17/2002	2002	SWB331	downstream from MSWRF	0.764		3.145		
11/7/2002	2002	SWB331	downstream from MSWRF	1.207		3.289		
12/12/2002	2002	SWB331	downstream from MSWRF	0.726		3.765		
12/12/2002	2002	SWB331	downstream from MSWRF	0.724		4.354		
1/16/2003	2003	SWB331	downstream from MSWRF	1.566		6.474		
2/13/2003	2003	SWB331	downstream from MSWRF	1.13		5.203		
3/12/2003	2003	SWB331	downstream from MSWRF	0.376		4.353		
4/16/2003	2003	SWB331	downstream from MSWRF	0.61		3.245		
5/7/2003	2003	SWB331	downstream from MSWRF	2.42		4.665		
6/9/2003	2003	SWB331	downstream from MSWRF	0.319		2.055		
7/9/2003	2003	SWB331	downstream from MSWRF	1.942		4.913		
8/12/2003	2003	SWB331	downstream from MSWRF	0.51		1.395		

9/9/2003	2003	SWB331	downstream from MSWRF	0.646		2.314		
10/16/2003	2003	SWB331	downstream from MSWRF					
11/5/2003	2003	SWB331	downstream from MSWRF					
12/1/2003	2003	SWD-1	downstream from MSWRF			2.7		2.41
12/9/2003	2003	SWB331	downstream from MSWRF					
1/15/2004	2004	SWB331	downstream from MSWRF					
2/11/2004	2004	SWB331	downstream from MSWRF					
3/1/2004	2004	SWD-1	downstream from MSWRF			3		0.5
3/10/2004	2004	SWB331	downstream from MSWRF					
4/14/2004	2004	SWB331	downstream from MSWRF					
5/19/2004	2004	SWB331	downstream from MSWRF					
6/1/2004	2004	SWD-1	downstream from MSWRF					
6/17/2004	2004	SWB331	downstream from MSWRF					
7/21/2004	2004	SWB331	downstream from MSWRF					
8/11/2004	2004	SWB331	downstream from MSWRF					
9/1/2004	2004	SWD-1	downstream from MSWRF			1.6		1
9/23/2004	2004	SWB331	downstream from MSWRF					
9/29/2004	2004	SWB331	downstream from MSWRF					
12/1/2004	2004	SWD-1	downstream from MSWRF			3.1		1
12/15/2004	2004	SWB331	downstream from MSWRF					
3/1/2005	2005	SWD-1	downstream from MSWRF			2.2		1.1
3/23/2005	2005	SWB331	downstream from MSWRF	0.1				
5/12/2005	2005	SWB331	downstream from MSWRF					
6/1/2005	2005	SWD-1	downstream from MSWRF			2.31		0.5
6/23/2005	2005	SWB331	downstream from MSWRF	0.46		2.17		0.2
8/11/2005	2005	SWB331	downstream from MSWRF	0.95		2.57		
9/1/2005	2005	SWD-1	downstream from MSWRF			2.97		1.1
12/1/2005	2005	SWD-1	downstream from MSWRF			6.67		0.51
12/14/2005	2005	SWB331	downstream from MSWRF	1.35		4.73		1
3/1/2006	2006	SWD-1	downstream from MSWRF			4.38		0.51
3/7/2006	2006	SWB331	downstream from MSWRF	0.365		4.03		
5/2/2006	2006	SWB331	downstream from MSWRF					
5/9/2006	2006	SWB331	downstream from MSWRF					

6/1/2006	2006	SWD-1	downstream from MSWRF		2.17	0.5
6/6/2006	2006	SWB331	downstream from MSWRF	0.659	3.3	
6/22/2006	2006	SWB331	downstream from MSWRF	1.04	2.41	
9/1/2006	2006	SWD-1	downstream from MSWRF		3.18	1.1
9/5/2006	2006	SWB331	downstream from MSWRF	0.761	3.07	
9/12/2006	2006	SWB331	downstream from MSWRF	0.078	0.644	
11/14/2006	2006	SWB331	downstream from MSWRF		3.35	
12/1/2006	2006	SWD-1	downstream from MSWRF		3.25	0.0021
3/1/2007	2007	SWD-1	downstream from MSWRF		4.23	0.1
3/21/2007	2007	SWB331	downstream from MSWRF	0.411	5.43	
4/25/2007	2007	SWB331	downstream from MSWRF			
6/1/2007	2007	SWD-1	downstream from MSWRF		5.77	1.1
7/24/2007	2007	SWB331	downstream from MSWRF			
7/25/2007	2007	SWB331	downstream from MSWRF			
7/26/2007	2007	SWB331	downstream from MSWRF			
8/27/2007	2007	SWB331	downstream from MSWRF	0.711	3.51	
9/1/2007	2007	SWD-1	downstream from MSWRF		3.62	1.1
10/16/2007	2007	SWB331	downstream from MSWRF	1.39	3.89	
10/29/2007	2007	dep 5th year	downstream from MSWRF	0.51	6.2	
12/1/2007	2007	SWD-1	downstream from MSWRF		0.6	1.1
3/1/2008	2008	SWD-1	downstream from MSWRF		3.87	1.1
3/20/2008	2008	SWB331	downstream from MSWRF		4.54	2.1
6/1/2008	2008	SWD-1	downstream from MSWRF		7.85	1.1
6/17/2008	2008	SWB331	downstream from MSWRF	1.84	6.74	1.1
8/7/2008	2008	SWB331	downstream from MSWRF	4.66	6.11	1.1
9/1/2008	2008	SWD-1	downstream from MSWRF		7.85	1.1
10/20/2008	2008	SWB331	downstream from MSWRF	0.803	5.37	1.1
12/1/2008	2008	SWD-1	downstream from MSWRF		5.36	2.1
2/10/2009	2009	SWB331	downstream from MSWRF	0.147	4.73	1.1
3/1/2009	2009	SWD-1	downstream from MSWRF		6.93	0.11
6/1/2009	2009	SWD-1	downstream from MSWRF		3.79	0.11
6/22/2009	2009	SWB331	downstream from MSWRF	0.827	2.71	1.1

9/1/2009	2009	SWD-1	downstream from MSWRF		3.79	0.11
9/3/2009	2009	SWB331	downstream from MSWRF	0.308	3.38	
12/1/2009	2009	SWD-1	downstream from MSWRF		5.28	1.1
12/22/2009	2009	SWB331	downstream from MSWRF	0.958	3.51	1.1
2/17/2010	2010	SWB331	downstream from MSWRF	0.169	4.64	2.1
3/1/2010	2010	SWD-1	downstream from MSWRF		7.01	0.6
6/1/2010	2010	SWD-1	downstream from MSWRF		3.86	0.11
6/30/2010	2010	SWB331	downstream from MSWRF	0.442	2.85	1.1
8/18/2010	2010	SWB331	downstream from MSWRF	1.01	2.61	2.1
9/1/2010	2010	SWD-1	downstream from MSWRF		0.68	2.11
12/1/2010	2010	SWD-1	downstream from MSWRF		5.12	2.11
12/1/2010	2010	SWB331	downstream from MSWRF	2.12	3.42	
2/1/2011	2011	SWB331	downstream from MSWRF			1.1
3/1/2011	2011	SWD-1	downstream from MSWRF	0.15	7.09	1.1
3/8/2011	2011	SWB331	downstream from MSWRF	1.82	4.43	
3/9/2011	2011	SWB331	downstream from MSWRF			3.2
6/1/2011	2011	SWD-1	downstream from MSWRF	1.31	4.51	3.2
6/20/2011	2011	SWB331	downstream from MSWRF	0.797	2.47	1.1
8/8/2011	2011	SWB331	downstream from MSWRF	1.29	2.99	
9/1/2011	2011	SWD-1	downstream from MSWRF	1.19	4.84	2.1
10/24/2011	2011	SWB331	downstream from MSWRF	1.44	2.93	2.1
11/21/2011	2011	SWB2	downstream from MSWRF	1.35	4.62	1.1
1/12/2012	2012	SWB2	downstream from MSWRF	4.52	9.1	1.1
1/26/2012	2012	SWB331	downstream from MSWRF	0.931	3.99	1.1
2/29/2012	2012	SWB2	downstream from MSWRF	0.52	4.53	1.1
2/29/2012	2012	SWB3	downstream from MSWRF	0.52	4.53	1.1
2/29/2012	2012	SWB5	downstream from MSWRF	0.61	4.93	1.1
3/27/2012	2012	SWB2	downstream from MSWRF	1.58	6.45	1.1
3/27/2012	2012	SWB3	downstream from MSWRF	1.89	5.82	2.1
3/27/2012	2012	SWB5	downstream from MSWRF	1.57	6.12	2.1
4/24/2012	2012	SWB331	downstream from MSWRF	0.5	6.3	1.1
4/26/2012	2012	SWB2	downstream from MSWRF	0.47	7.89	1
4/26/2012	2012	SWB3	downstream from MSWRF	0.56	7.19	1.1

4/26/2012	2012	SWB5	downstream from MSWRF	0.48		7.79		1
5/15/2012	2012	SWB2	downstream from MSWRF	1.8		6.86		2.1
5/15/2012	2012	SWB3	downstream from MSWRF	1.8		6.86		1.1
5/15/2012	2012	SWB5	downstream from MSWRF	1.7		7.16		1.1
5/30/2012	2012	SWB2	downstream from MSWRF	0.32		3.36		1.1
6/13/2012	2012	SWB2	downstream from MSWRF	0.64		6.37		1
6/13/2012	2012	SWB3	downstream from MSWRF	0.73		6.39		1.1
6/13/2012	2012	SWB5	downstream from MSWRF	0.59		6.13		1.1
7/16/2012	2012	SWB2	downstream from MSWRF					1
7/16/2012	2012	SWB3	downstream from MSWRF					1
7/16/2012	2012	SWB5	downstream from MSWRF					1.1
7/23/2012	2012	SWB331	downstream from MSWRF	0.45		4.3		2.1
8/21/2012	2012	SWB2	downstream from MSWRF					1.1
8/21/2012	2012	SWB3	downstream from MSWRF					2.1
9/5/2012	2012	SWB2	downstream from MSWRF	1.67		4.01		1.1
10/15/2012	2012	SWB2	downstream from MSWRF	0.50		3.53		0.5
11/8/2012	2012	SWB331	downstream from MSWRF	3.14		6		2.1
1/25/2013	2013	SWB2	downstream from MSWRF	2.22		5.3		1.1
2/18/2013	2013	SWB331	downstream from MSWRF	2.76		5.7		1.1
4/8/2013	2013	SWB2	downstream from MSWRF	0.38		5.56		2.1
5/8/2013	2013	SWB331	downstream from MSWRF	0.362		3.7		1.1
7/29/2013	2013	SWB2	downstream from MSWRF	0.59		2.71		0.5
8/13/2013	2013	SWB331	downstream from MSWRF					
11/18/2013	2013	SWB2	downstream from MSWRF	0.69		4.48		1