

4.1 Introduction

The Sweetwater Branch Watershed encompasses 3.3 square miles of central Gainesville (Figure 4.1). The watershed boundaries include the area south of NW 23rd Avenue and west of Main Street and extend east to Waldo Road and south to the Paynes Prairie State Preserve. It has a mean land surface elevation of 180 feet National Geodetic Vertical Datum of 1929 (NGVD) in the upper basin at NE 10th Avenue and decreases to 59 feet NGVD at Paynes Prairie.

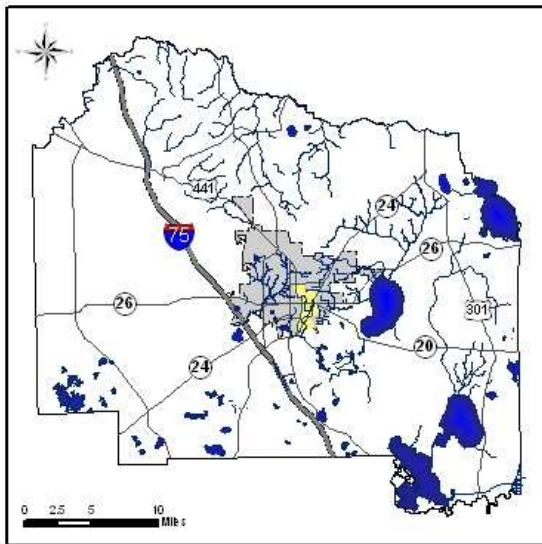


Figure 4.1 Location of the Sweetwater Branch Watershed in Alachua County

The upper reaches of the Sweetwater Branch Watershed are located in the Northern Highlands physiographic province (White 1970). As land surface elevations decrease toward Paynes Prairie, Sweetwater Branch crosses the Cody Scarp into the Alachua Lake Cross Valley in the Central Highlands physiographic province (White 1970). Sediments of the Hawthorn Group formations are exposed

along the stream banks in the lower reaches of the watershed where more recent Plio-Pleistocene terrace deposits of sands, silts, and clays have been eroded (Thomas et al 1985).

Soils in the Sweetwater Branch Watershed range from moderately well-drained in the upper portion of the watershed to poorly drained in the lower reaches. Soils are generally sandy at depths ranging from 20 to 40 inches below land surface and become loamy at depths below 20-40 inches (Thomas et al. 1985). The major soil type in the upper portion of the watershed is the well drained Millhopper-Urban land complex (Thomas et al 1985). Along the creek and in the floodplain, dominant soils types include the Kanapaha, Blichton, and Pomona sands. All are poorly drained soils, with sandy clay loam in the lower soils or subsoils (Thomas et al 1985). The Blichton sands contain ironstone and phosphatic limestone, the later indicative of the soil's origin from phosphatic materials of the Hawthorn Group formations. As the creek flows onto Paynes Prairie, Sparr fine sand and Wauberg sand are found along the north rim. Ledwith muck and Shenks muck, both very poorly drained fresh water marsh or wet prairie soils, cover the central area of the prairie (Thomas et al 1985).

Sweetwater Branch flows through the Duck Pond area, the heart of downtown Gainesville, and through the Depot Avenue residential/industrial district, where it is joined by Rosewood Branch (Figure 4.2). Rosewood Branch is a tributary that begins west of Waldo Road and in the vicinity of NE 11th Street and joins Sweetwater Branch near SE 10th Avenue. Sweetwater Branch continues southeast

through residential and natural areas before reaching an old landfill site. Further downstream, reclaimed water is discharged from the GRU Main Street Water Reclamation Facility (WRF). The creek continues south of Williston Road (SR 331) and flows into Paynes Prairie State Preserve, where it ultimately discharges to the Floridan aquifer via Alachua Sink.

Based on similar land uses in comparable basins, it is estimated that 60% of the watershed is impervious. The upper third of the basin is highly developed and consists mostly of residential and commercial land uses. This portion of the basin includes the Duck Pond neighborhood and the areas surrounding the Rosewood Branch tributary. The housing is a mixture of single-family homes and high-density apartments and condominiums. The lower two-thirds of the watershed contains some residential development but is used largely for com-

mercial, industrial, and institutional purposes. Notable industrial users include the GRU J.R. Kelly Electrical Power Generating Station (GRU Kelly Plant) and the GRU Main Street WRF. Only a small portion of the watershed, the area south of the GRU Main Street WRF and the portion of the creek that flows through Paynes Prairie, remains undeveloped.

4.2 Watershed Description

4.2.1 Headwaters

The headwaters of Sweetwater Branch begin below ground near NW 23rd Avenue and NW 6th Street and extend east to Waldo Road. Many of the natural springs and seeps from the surficial aquifer in the upper portion of the watershed have been channelized and exist as baseflow in the underground concrete culverts of the municipal stormwater system. The creek remains underground until it reaches NW 16th Avenue just west of Main Street. In

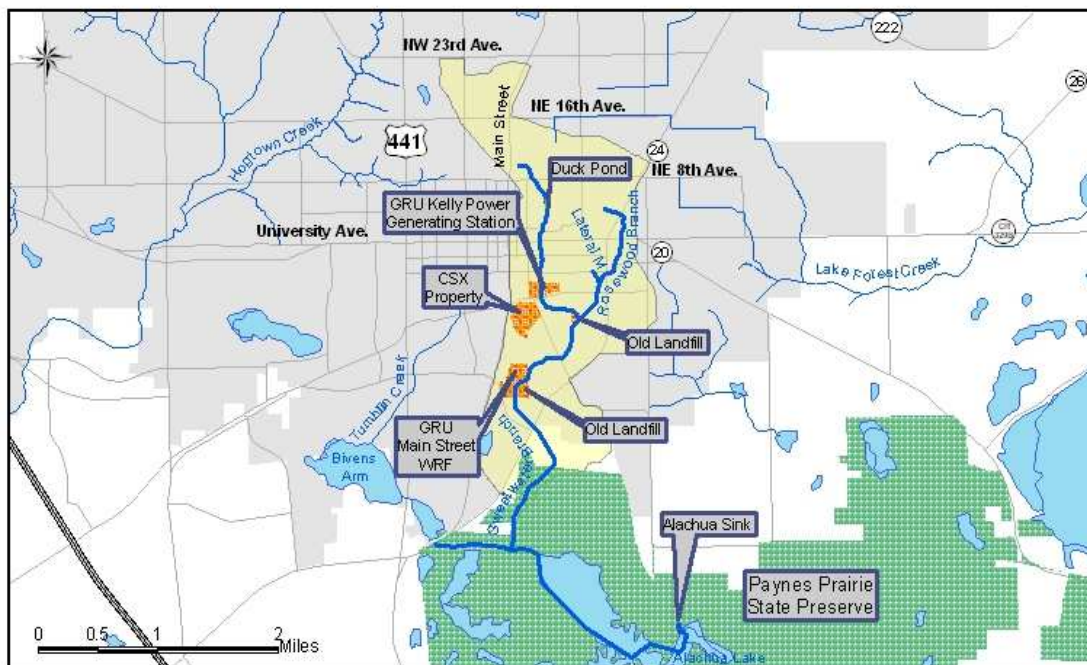


Figure 4.2 Notable features in the Sweetwater Branch Watershed

2001, ACEPD personnel performed 10 stream surveys of Sweetwater Branch, which are described below.

4.2.2 NW 16th Avenue and Main Street to Duck Pond Weir

Visible surface flow of Sweetwater Branch begins as a ditch, west of the businesses bordering Main Street at NW 16th Avenue. At NW 14th Avenue, the stream flows beneath the Gainesville Shopping Center through a series of underground culverts and emerges from a 28-inch reinforced concrete pipe (RCP) culvert into a concrete-lined channel east of Main Street in the median of NE 10th Avenue.

The concrete channel conveys the creek through the historic Duck Pond residential district through a median constructed along the boulevard between NE 9th Avenue and NE 5th Avenue. Sweetwater Branch then flows through a six feet deep collection pond. The purpose of this con-

crete channel and pond was to convey storm water directly to the creek in order to reduce flooding potential. The pond was stocked at the time with exotic Muscovy ducks (*Cairina moschata*) and later became commonly known as the Duck Pond. The duck population has since reached an excess of 40 birds. The ducks were relocated in 2002 for construction activities associated with restoration. There are plans to bring in a population of native ducks when restoration efforts are complete. Water exits the south end of the pond via a weir at SE 5th Avenue.

4.2.3 Duck Pond to GRU Kelly Plant

From the Duck Pond, Sweetwater Branch flows south via a narrow concrete channel that is buckling in several places on the west side. At NE 1st Avenue, Sweetwater Branch flows through box culverts and emerges on the south side of University Avenue (SR 26). The creek then flows through Sweetwater Branch Park, located directly east of the county public library and federal building. Through funding from the St. Johns River Water Management District (SJRWMD), a baffle box was installed there in 1997 to capture trash and sediment from stormwater runoff prior to its discharge into the creek. The baffle box treats stormwater from a small area of the watershed in the vicinity of the Alachua County Administration Building and the public library. It is maintained by the City of Gainesville Public Works Department. At SE 4th Avenue, the creek flows through culverts beneath the GRU Kelly Plant.

4.2.4 GRU Kelly Plant to SE 4th Street

Sweetwater Branch flows through the center of the GRU Kelly Plant where it re-



Muscovy ducks on Sweetwater Branch at the Duck Pond weir at SE 5th Avenue (before recent restoration)

ceives a non-contact cooling water discharge. The stream exits GRU property and flows south through the Depot Avenue industrial district and the former CSX Transportation property, continuing through a primarily residential area of southeast Gainesville. Exposed sandy clay along the streambed and banks indicates the severity of streambed erosion occurring during high flow conditions. The Rosewood Branch tributary joins Sweetwater Branch in this section.

4.2.5 Rosewood Branch at NE 11th Street to SE 2nd Avenue

Rosewood Branch begins as a disjointed series of rivulets, running through neighborhoods on NE 11th Street just west of Waldo Road. The upper reaches of the creek are intermittently dry. The creek runs east beneath Waldo Road through a concrete spillway and a triple box culvert. In some places a bluish sheen on the water indicates the possibility of petroleum contamination. From Waldo Road to the cul-



Rosewood Branch running through a residential area along NE 11th Street

vert at NE 3rd Avenue, banks are moderately unstable due to erosion, and the streambed is covered with sand.

Just north of East University Avenue, a discharge with a strong bleach odor was observed flowing from an 18-inch metal corrugated drain pipe. After further investigation, it was determined that the discharge originated from a nearby used-appliance retailer. ACEPD staff required the business to cease the discharge and divert it to the sanitary sewer system.

The creek then passes under East University Avenue where the streambed is smothered with approximately three feet of sand. Rosewood Branch continues its intermittent nature as it travels through a concrete double-box culvert at SE 2nd Avenue.

4.2.6 Rosewood Branch at SE 2nd Avenue to Lateral M Tributary

Downstream of SE 2nd Avenue the banks of Rosewood Branch are less eroded due to the presence of heavy vegetative cover. The streambed is covered with sand and is littered with broken glass and debris. The creek flows southwest, passing under SE 4th Avenue and under Williston Road via a concrete-lined channel. West of Williston Road at SE 5th Ave, Rosewood Branch is joined by the Lateral M tributary which originates south of SE 2nd Street. This reach is typified by heavy sand deposition and areas of severe bank erosion.

4.2.7 Rosewood Branch at Lateral M to Confluence with Sweetwater Branch

This segment of stream is characterized by severe bank failure in places and a streambed littered with debris from an old

landfill site located in the vicinity of SE 9th Street and SE 9th Avenue. Trenches and pits along the riparian zone indicate bottle looter activity. At several places along this segment, a natural vegetative buffer is absent. Rosewood Branch joins Sweetwater Branch in this area.



Former landfill site at the confluence of Rosewood Branch and Sweetwater Branch

4.2.8 CSX Tributary

A channelized tributary to Sweetwater Branch extends south from the former CSX property (Figure 4.2), passing under Veitch Street and paralleling a power line easement to its confluence with Sweetwater Branch. Residual coal tar materials from a coal gasification plant, operated in the early 1900's, are present along the streambed. Coal tar materials that can be visually observed will be removed from the ditch as part of site remedial activities (ECT 2001). Ground water in the area of the former CSX site has been found to be contaminated with volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). Presently, these

contaminants do not appear to impact surface waters. The CSX tributary meets Sweetwater Branch upstream of the GRU Main Street WRF.

4.2.9 SE 4th Street to Williston Road

After joining Rosewood Branch, Sweetwater Branch continues to flow south through residential and natural areas prior to reaching an old city landfill site upstream of the GRU Main Street WRF. The WRF is located east of Main Street on the north side of SE 16th Avenue. The WRF discharges an average of 6.0 million gallons per day (MGD) of reclaimed water into Sweetwater Branch. The stream channel is significantly altered immediately downstream of the discharge point, visible by the lack of channel sinuosity. In several places, the channel is deeply incised, exposing the clayey sands and sandy clays of the Hawthorn Group formations. The natural sand streambed has been eroded due to the increased volume and velocity of streamflow. As the relief decreases further downstream, the channel is characterized by intensive sand smothering and clayey sand and sandy clay outcrops along the banks. The creek then passes under Williston Road through a 130 foot-long double-box culvert.

4.2.10 Williston Road to Alachua Sink

After crossing under Williston Road, Sweetwater Branch continues southeast through an undeveloped wooded area before reaching Paynes Prairie State Preserve. Scouring and sand deposition are evident in the creek's steep, eroded banks and severely sand smothered streambed. Once inside Paynes Prairie, the creek is artificially channelized and is referred to as the Sweetwater Branch Canal. The canal

was dredged in the 1930's by the Camp family, owners of Paynes Prairie at the time, in order to contain the flow of Sweetwater Branch and drain the area for agriculture (Weimer 2002). Sweetwater Branch Canal empties into Alachua Lake where it discharges to the Floridan aquifer via Alachua Sink.



Alachua Sink at Paynes Prairie during a period of low water

4.3 Physical Habitat and Biology

It is estimated, through stream surveys, that more than 80% of Sweetwater Branch lacks the in-stream habitat to support a healthy and diverse macroinvertebrate community. Sand smothering, lack of natural riparian buffer zones, bank instability, and increased water velocity all contribute to the impairment of habitats found in the creek.

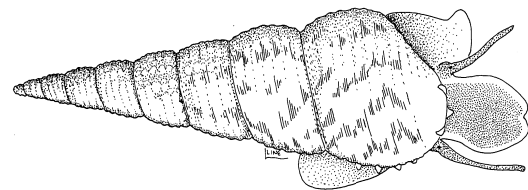
Data obtained in 2000 from Hester Dendy sampling of seven Alachua County creeks ranked Sweetwater Branch as the second most impaired (Evans 2000). Sweetwater Branch showed the second lowest total taxa count and number of organisms per square centimeter.

The ten stream surveys completed by ACEPD personnel found that the percentage of productive macroinvertebrate habitat (e.g. undercut banks, leaf packs, shell/rock rubble, root systems, and aquatic vegetation) was only 12% throughout Sweetwater Branch. The remainder of the potential habitat was sand smothered, with a sand depth ranging from 0.7 to three feet. Sweetwater Branch lacks quality habitat necessary to support a healthy macroinvertebrate population.

Habitat Assessments and BioRecons were completed in 1999 and 2001 on five segments of Sweetwater Branch by ACEPD personnel, with the assistance of Watershed Action Volunteers (WAV) and the FDEP (ACEPD 2001b, FDEP 1999). Figure 4.3 shows the Habitat Assessment scores for the following sites: south of SE 2nd Place (SWBSE2), SE 4th Street (SWBSE4), CSX Tributary at SE Veitch Street (SWBSE10), Williston Road (SWB331), and the north end of Paynes Prairie (SWBNPP). Table 4.1 shows the BioRecon scores for these five sites. Results for each site are discussed below.

4.3.1 Downstream of SE 2nd Place

This site (SWBSE2) scored 80 out of a possible 160 points on the Habitat Assessment, or 50%. It received low scores for riparian buffer width, water velocity,



Melanoides turricula, a common exotic macroinvertebrate found in Sweetwater Branch

Table 4.1 BioRecon scores for five sites on Sweetwater Branch

Metric	Target Value	SWB SE2	SWB SE4	SWB SE10	SWB 331	SWB NPP
Taxa Richness	≥ 18	12	13	8	10	14
EPT	≥ 4	0	1	0	1	1
FL Index	≥ 10	2	9	6	5	10
Metrics Passed		0	0	0	0	1
Biological Condition		Impaired	Impaired	Impaired	Impaired	Suspect

habitat smothering, and artificial channelization. Aquatic vegetation was the only favorable macroinvertebrate habitat present at this site. Additionally, it was estimated that nearly 80% of the streambed was sand smothered. The lack of quality habitat would explain the low BioRecon score and its corresponding impaired rating.

4.3.2 Sweetwater Branch at SE 4th St.

This site (SWBSE4) scored in the suboptimal range for six out of eight habitat parameters assessed; substrate availability, water velocity, habitat smothering, channelization, riparian buffer zone width, and riparian vegetation quality. Substrate diversity and bank stability scores were optimal and marginal, respectively. Despite high substrate diversity, the site received a low Habitat Assessment score of 101, or 63%, and was rated impaired by the BioRecon.

4.3.3 CSX Tributary at SE Veitch St.

This site (SWBSE10) received the highest Habitat Assessment score (114, or 71%)

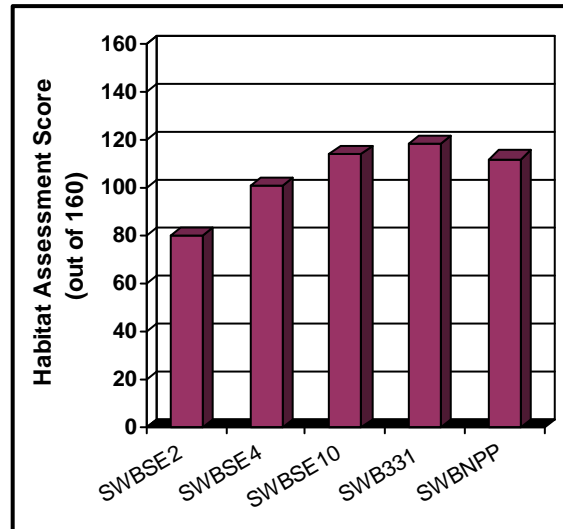


Figure 4.3 Habitat Assessment scores for five sites on Sweetwater Branch

of the five segments. However, the site failed all three BioRecon metrics. Habitat smothering and suboptimal substrate diversity are most likely the reason for its impaired status.

4.3.4 Sweetwater at Williston Road

This reach of Sweetwater Branch is severely impacted by erosion. The banks are steep, unstable, and heavily scoured in some places. This area is characterized by substantial sand smothering and a lack of substrate diversity and availability. The site (SWB331) failed all three BioRecon metrics, resulting in an impaired rating.

4.3.5 Sweetwater at North Paynes Prairie

Of the five stream segments assessed on Sweetwater Branch, this was the only segment (SWBNPP) to pass one metric of the BioRecon assessment. The segment passed the FL Index, however, it failed both the EPT and Taxa Richness metrics. The site received a Habitat Assessment score of 112, or 70%. Biologically, this

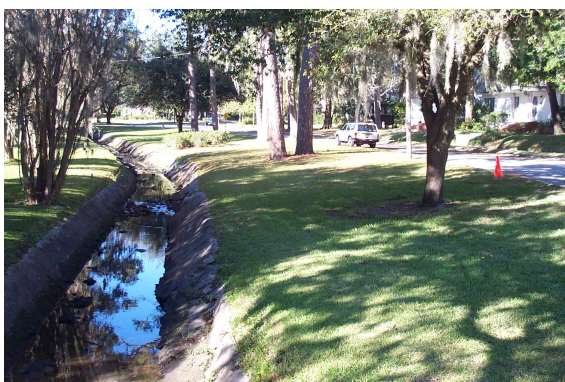
reach was rated as suspect, most likely due to severe habitat smothering, suboptimal riparian buffer zone width, and poor riparian vegetation quality.

4.4 Pollution Sources

Sweetwater Branch flows through highly impervious urban areas in downtown Gainesville, including numerous large parking lots which lack stormwater detention or retention systems. In addition, the stream bisects an industrial area of the city. Because of its urban and industrial location, a number of point and nonpoint pollution sources exist throughout the watershed.

4.4.1 Point sources

Although the Duck Pond is an asset to the neighborhood, the former presence of a large, year-round population of ducks and geese was the first visible point source of pollution in Sweetwater Branch. This concentration of ducks and geese produces animal waste that contributes bacteria and nutrients to downstream areas of the creek. At the Duck Pond weir, fecal coliform levels have been as high as 30,000 colony forming units (CFU)/100mL. Class III surface water quality standards allow for a one-time maximum of 800 CFU/100mL



Urban area north of the Duck Pond weir on Sweetwater Branch

(FDEP 1996a). These animal wastes also contain nitrates and ammonia. Elevated levels of these nutrients can cause algal blooms, which deplete the available oxygen in the water and adversely affect the health of aquatic ecosystems.

Further downstream of the Duck Pond, Sweetwater Branch receives an FDEP permitted discharge from the GRU Kelly Electrical Generating Station. Since 1914, the GRU Kelly Plant has discharged cooling tower and boiler blowdown (water pumped up from the Floridan aquifer used to cool equipment that has been heated in the process of electricity generation) into Sweetwater Branch. A comprehensive assessment of the creek in the vicinity of the GRU Kelly Plant (FDEP 1996b) showed that no organic pollutants were detected in the discharge. A previous assessment (FDEP 1991) concluded that the receiving waters appeared more affected by stormwater than by the discharge from the GRU Kelly Plant.

Downstream from the GRU Kelly Plant are the former CSX Transportation property, a former city dump, and the GRU Main Street Water Reclamation Facility (WRF). The CSX site has been an industrial site since 1887 (W&AR 1989). From 1887 to 1913, the site belonged to the FC&P Railroad. Since that time, the site has been utilized by several different businesses including a coffin-manufacturing company, cotton and lumber mills, and an ice supplier.

The CSX property is contaminated with coal tar residuals from the former Manufactured Gas Plant (MGP) located north of the site. The site has been selected as an

EPA Regional Brownfields Pilot Project. Plans are currently underway to remediate the property and convert the area into a centralized stormwater treatment facility consisting of created wetlands and wet detention basins. This will be surrounded by a city park consisting of passive recreation facilities (ERM 1999).

The old city dump is a former landfill located adjacent to Sweetwater Branch, just upstream of the GRU Main Street WRF. The hazardous waste potential of this site was rated as minimal in a 1987 report by ACDES (now ACEPD; ACDES 1987). However, natural and accelerated erosional processes continue to expose the landfill material which now litters the streambed. The City of Gainesville Public Works Department is conducting assessment activities at the site under the direction of FDEP.

The GRU Main Street WRF discharges reclaimed water into Sweetwater Branch upstream of Williston Road. The plant opened in 1930 as a primary treatment facility with a treatment efficiency of about 30%. The plant has since undergone three upgrades, the most recent being in 1992 (Davis 2002). It is now an advanced treatment facility with an efficiency of 99% and an average throughput of approximately 6.0 MGD and a rated capacity of 7.5 MGD. Wastewater treatment includes preliminary treatment, three aeration basins, three secondary clarifiers, continuous backwash filters, pH control, chlorination, dechlorination, and post-aeration. Treatment residuals are stabilized and land applied at permitted sites.



Discharge from the GRU Main Street WRF into Sweetwater Branch

As a result of the increase in treatment efficiency over the years, many of the problems historically associated with the discharge of the reclaimed water have greatly diminished. However, the elevated concentrations of nutrients, primarily nitrogen and phosphorus, remain a concern. Additionally, the streamflows downstream of the WRF have caused serious erosional problems. The streambed is eroding vertically, the banks are steep and scoured, and heavy sand deposition smothers habitat. The increased nutrients in Sweetwater Branch enter Paynes Prairie further downstream, where they have the potential to alter the ecological characteristics of the wetland prairie. While some of the nutrients are sequestered in the wetland prairie system, the remaining nutrients enter the groundwater in the Floridan aquifer via Alachua Sink.

4.4.2 Nonpoint sources

In addition to stormwater nonpoint pollution in this highly urbanized watershed, several other nonpoint sources are evident along



Auto storage and repair shop adjacent to Sweetwater Branch

Sweetwater Branch. Machine and auto repair shops are common throughout the watershed and several are located adjacent to the stream channel. Many of these businesses repair and store machine parts on unsheltered, impervious areas that are stained with paint, oil, and grease. Without adequate riparian buffers in these areas, concerns arise with regard to potential leaks or spills of hazardous materials such as fuel, oil, and antifreeze that could enter the creek.

A constant concern for Sweetwater Branch is the presence of high levels of fecal coliform bacteria. The sources of these bacteria are currently being investigated. Similar to the Tumblin Creek Watershed, the sanitary sewer system commonly runs adjacent to Sweetwater Branch. Some of the collection system (sewer lines, manholes, private connections) is quite old and, should leaks occur, would contribute pollution to the creek. GRU has completed a wastewater system integrity program in both the Tumblin Creek and Sweetwater Branch Watersheds to locate and correct

leaks in the system. Human or animal waste and faulty septic systems could also contribute to elevated bacteria levels.

4.5 Baseflow Water Quality

ACEPD personnel have been conducting monthly baseflow water quality sampling at two sites, SWBSE4 (SE 4th Street) and SWB331(Williston Road), on Sweetwater Branch since February 1998. The SWBSE4 site is upstream of the GRU Main Street WRF, while the SWB331 site is downstream from the wastewater plant discharge. Beginning in March 2000, a third site, located along the channel joining Alachua Sink with the primary sink feature (ALACHCHAN) in Paynes Prairie, was added. Two additional sites on Sweetwater Branch were monitored toward the end of the study (7 to 9 months) at NE 10th Avenue (SWBNE10) and at SE 1st Avenue (SWBSE1).

4.5.1 Field Parameters

Field parameters monitored at these sites included water temperature, pH, specific conductance, dissolved oxygen (DO), and turbidity (Table 4.2). Median water tem-

Table 4.2 Comparison of field parameters among sites on Sweetwater Branch and at Alachua Channel

Parameter	SWB NE10	SWB SE1	SWB SE4	SWB 331	ALACH CHAN
Water Temp (°C)	20.5	20.4	20.8	23.2	22.6
pH (SU)	6.58	7.34	7.60	7.31	7.67
Sp. Cond. (uS/cm)	335	339	408	877	817
Turbidity (NTU)	2.6	0.9	1.4	0.9	5.9
DO (mg/L)	5.55	9.13	7.55	8.38	9.56

perature of Sweetwater Branch downstream of the GRU Main Street WRF (at SWB331) was 23.2°C (73.8°F). This value was similar to that in Tumblin Creek and at ALACHCHAN, but higher than other sites in this study, including the Sweetwater Branch sites upstream from the GRU Main Street WRF. Water temperatures at SWB331 were 2.4°C higher than those at SWBSE4. This increase in water temperature is most likely caused by the addition of reclaimed water discharged from the GRU Main Street WRF.

The median pH and dissolved oxygen (DO) for the five sites along Sweetwater Branch (Table 4.2) are consistent with other urban streams sampled in Gainesville. Median specific conductance for SWB331 and ALACHCHAN was more than double that at sites upstream from the GRU Main Street WRF (Figure 4.4). Specific conductance at these two sites was significantly higher than that of all other streams monitored in this study.

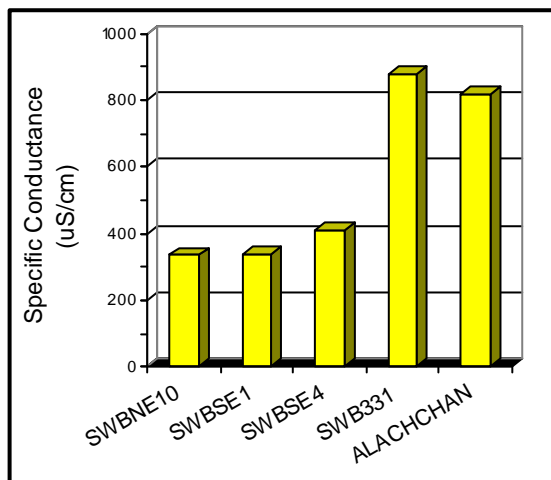


Figure 4.4 Comparison of median specific conductance for sites along Sweetwater Branch and at Alachua Channel

This doubling of conductance concentrations in Sweetwater Branch is a result of the addition of reclaimed water from the GRU Main Street WRF. Reclaimed water is inherently high in conductance due to the presence of chlorides and sulfates which are found in numerous everyday products, including table salt and cleaning agents.

4.5.2 Nutrients

Total ammonia (NH₄-T) was quite high at SWBNE10, with a median concentration of 0.460 mg/L (Figure 4.5). Median values at the three downstream sites on Sweetwater Branch were at least 10 times less. The total ammonia (NH₄-T) concentrations at these downstream sites were similar to those for the other streams monitored in this study. The source of the ammonia is not known, but it is oxidized in the Duck Pond, resulting in lower ammonia concentrations downstream.

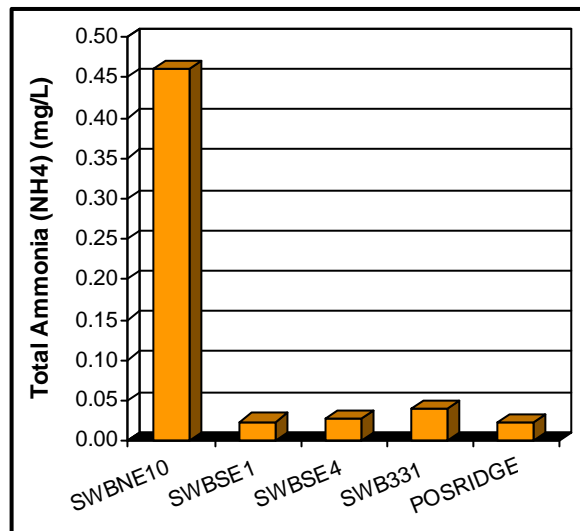


Figure 4.5. Comparison of median total ammonia (NH₄-T) at four sites on Sweetwater Branch and at Possum Creek

Total nitrate plus nitrite ($\text{NO}_x\text{-T}$) concentrations at the three sites on Sweetwater Branch upstream from the GRU Main Street WRF are similar to those in Tumble Creek and some sites in Hogtown Creek, but are lower than those in Possum Creek (Figure 4.6). $\text{NO}_x\text{-T}$ concentrations below the GRU Main Street WRF, however, are over ten times higher (2.863 mg/L) than they are just upstream from the WRF (0.23 mg/L). $\text{NO}_x\text{-T}$ concentrations in the Alachua Channel on Paynes Prairie are also very high (median concentration of 1.936 mg/L), reflecting the input of nitrates and nitrites from the WRF further upstream.

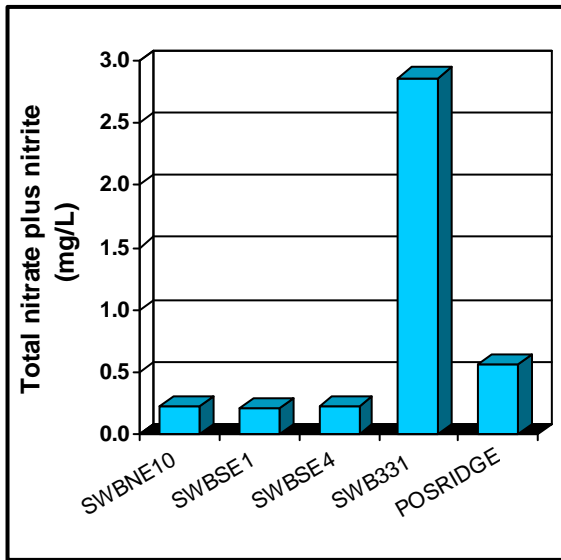


Figure 4.6. Comparison of median total nitrate plus nitrite ($\text{NO}_x\text{-T}$) at four sites on Sweetwater Branch and at Possum Creek

Total phosphorus (TP-T) concentrations at sites upstream from the GRU Main Street WRF were similar to those in other streams in this study, with the exception of Hogtown Creek and Possum Creek which had median concentrations over three times higher (Figure 4.7). Total phospho-

rus concentrations on Sweetwater Branch below the GRU Main Street WRF (SWB331) were similar to those in Possum Creek, and slightly higher than those in Hogtown Creek. While the high total phosphorus concentrations in Hogtown Creek and Possum Creek are most likely caused by the stream cutting through the phosphatic units in Hawthorn Group formations, that is not the probable cause for the high total phosphorus concentrations at SWB331. While total phosphorus concentrations are uniformly high at all sampling sites throughout Hogtown Creek and Possum Creek, they are only high in Sweetwater Branch just below the GRU Main Street WRF. Given the short distance between the SE 4th Street sampling site on Sweetwater Branch (median concentration of 0.19 mg/L) and the sampling site at SWB331 just below the GRU Main Street WRF (median concentration of 0.84 mg/L), it is likely that this increase in total phosphorus is due to the reclaimed water discharge.

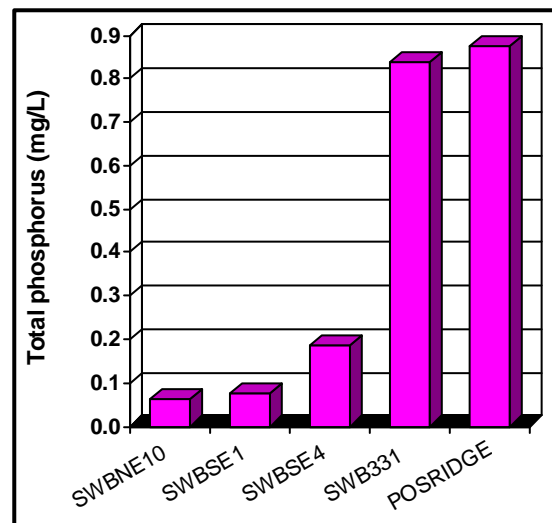


Figure 4.7. Comparison of median total phosphorus (TP-T) at four sites on Sweetwater Branch and at Possum Creek

4.5.3 General Chemical Constituents

Chlorides and sulfates were both highest in Sweetwater Branch. The four highest median sulfate concentrations for all the streams in this study all occurred on Sweetwater Branch sites. Sulfates were higher at the SE 1st Avenue (SWBSE1) site (37.46 mg/L) than on all other streams in the study, and continued to increase further downstream in Sweetwater Branch. Sulfate concentrations at SWBSE1 are slightly higher than those on Tumblin Creek at SW 5th Avenue (35.65 mg/L); causes for the elevated sulfates at these two sites are not known. Sulfates increased by about 63% in Sweetwater Branch after receiving cooling water discharge from the GRU Kelly Generating Station. This water is extracted from the lower portion of the upper Floridan aquifer, and contains higher concentrations of sulfate due to the presence of gypsum (CaSO₄). Sulfates increase further by approximately 54% after receiving reclaimed water from the GRU Main Street WRF.

Chloride concentrations in Sweetwater Branch downstream from the GRU Main Street WRF were higher than at all other sites monitored on the streams in this study. These high chlorides and sulfates are caused by the addition of reclaimed water. Chlorides and sulfates are common in everyday household products. The use of sulfur dioxide (SO₂) to dechlorinate the reclaimed water may increase sulfate concentrations. Chloride concentrations in Sweetwater Branch upstream from the WRF are similar to those in other streams in this study.

4.5.4 Coliform Bacteria

From a human health standpoint, the consistently high levels of fecal coliform bacteria found in Sweetwater Branch are a concern. Figure 4.8 shows fecal coliform levels from samples taken on August 16, 2000. The elevated levels could have originated from several sources including animal waste (pet and/or wild), malfunctioning septic tanks, leaky sanitary sewer lines, and failing connections to municipal sewer lines. As with Tumblin Creek, the ACEPD contracted with the University of South Florida to conduct bacterial source tracking (BST) using antibiotic resistance analyses (ARA) techniques and with BCS

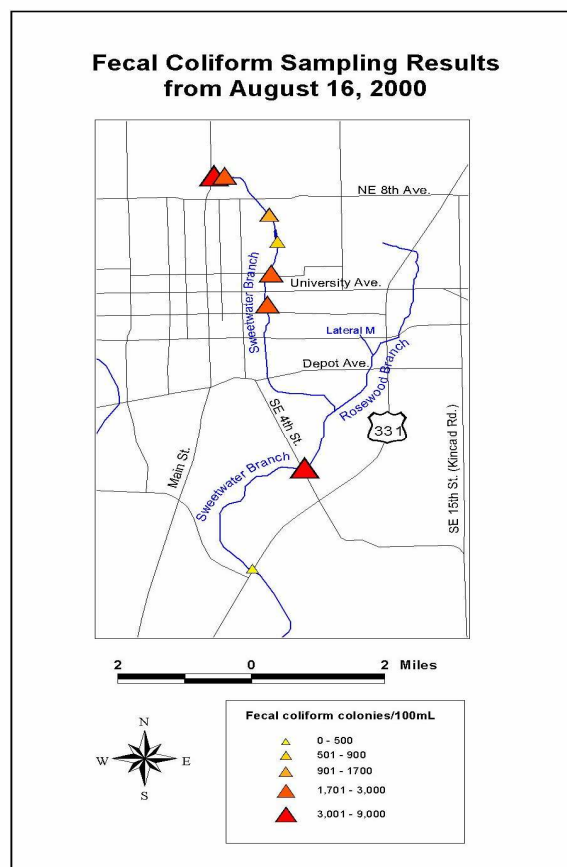


Figure 4.8 Fecal coliform bacteria sampling results in the Sweetwater Branch Watershed from August 16, 2000

of North Florida, Inc. to perform ribotyping testing techniques, in an attempt to determine the sources of the elevated fecal coliform bacteria concentrations. Results indicate lower concentrations of fecal coliform bacteria overall in 2002, and less contamination from human sources in 2002 than samples from 2000 and 2001 (Harwood, 2003b).

4.6 Stormwater

Stormflow data were collected on Sweetwater Branch by ACEPD personnel from April 2000 to February 2002. Data was collected at five sites along Sweetwater Branch, although accompanying baseflow data was collected at only three sites. Those three sites included SE 1st Avenue (SWBSE1), SE 4th Street (SWBSE4), and the northern part of Paynes Prairie (SWBNPP). SWBNPP stormflow data is compared to baseflow measurements at nearby SWB331.

Turbidity and total suspended solids both increased during stormflow periods at all three Sweetwater Branch sites. Turbidity at

both SWBSE4 and SWBNPP, increased by over 1,800%, from a median turbidity values of 1.4 and 0.9 NTU during baseflow to 28.2 and 17.5 NTU during stormflow, respectively. Significant increases in turbidity during stormflow were observed at nearly all the streams in this study. Turbidity increases on Sweetwater Branch were similar to those on Possum Creek during stormflow periods.

Increases in total ammonia (NH_x-T), Total Kjeldahl Nitrogen (TKN-T), and total organic carbon (TOC) were also observed during stormflow periods on Sweetwater Branch. Similar increases in these parameters were also observed on other streams in this study.

Figure 4.9 shows a comparison of median NO_x-T concentrations during baseflow and stormflow conditions. Changes in NO_x-T during stormflow were relatively small in Sweetwater Branch, compared to the other streams in this study. While NO_x-T increased by about 30% in the



Sweetwater Branch upstream of SE 4th Street

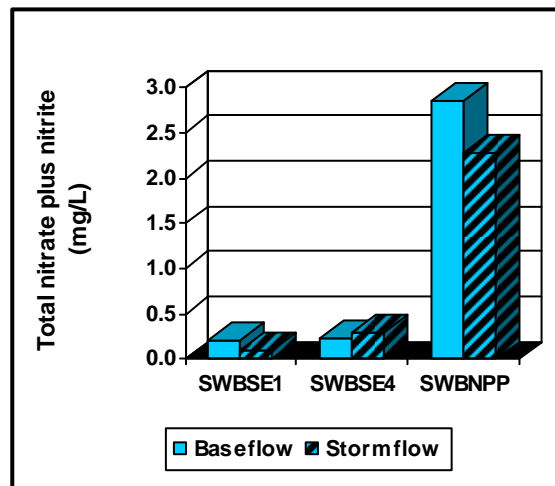


Figure 4.9 Comparison of median total nitrate plus nitrite (NO_x-T) concentrations for three sites on Sweetwater Branch under baseflow and stormflow conditions

middle of the watershed (at SWBSE4) during stormflow, it decreased at both the upper and lower sites (Figure 4.9). Even with the decrease during stormflow, $\text{NO}_x\text{-T}$ concentrations were still about six to ten times higher in Sweetwater Branch downstream from the GRU Main Street WRF than anywhere else monitored in this study.

Total orthophosphate ($\text{PO}_4\text{-T}$) concentrations more than doubled during stormflow at SWBSE1 (from a baseflow value of 0.046 to 0.096 mg/L), while a more modest 31% increase was observed at SWBSE4 (from a baseflow value of 0.142 to 0.186 mg/L; Figure 4.10). Total orthophosphate concentrations at these two sites, even during stormflow, were relatively low compared to the other streams in this study. Total orthophosphate concentrations remained unchanged in Sweetwater Branch below the GRU Main Street WRF at SWBNPP. The total orthophosphate concentrations at SWBNPP were similar to those observed in both Hogtown Creek and Possum Creek.

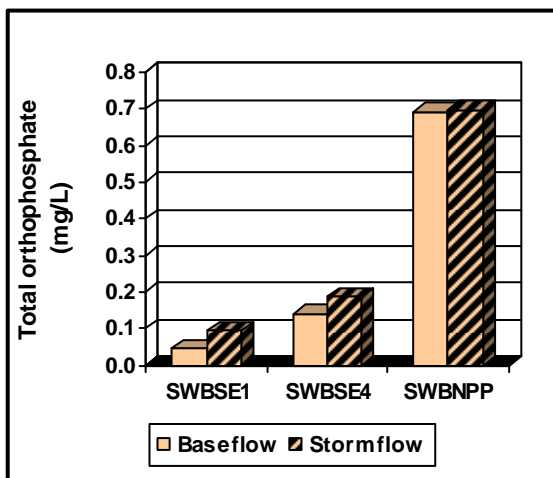


Figure 4.10 Comparison of median total orthophosphate ($\text{PO}_4\text{-T}$) concentrations for three sites on Sweetwater Branch under baseflow and stormflow conditions

During storm events, total phosphorus (TP-T) concentrations increased significantly in all urban streams in this study. Increases were dramatic in Sweetwater Branch as well (Figure 4.11), with median concentrations at SWBSE4 increasing 272% (from 0.187 mg/L at baseflow to 0.696 mg/L during stormflow). Total phosphorus concentrations nearly doubled at SWBSE1 (from a baseflow value of 0.077 mg/L to 0.145 mg/L), while they increased by 102% at SWBNPP, from 0.836 mg/L to 1.692 mg/L. Stormflow total phosphorus concentrations at SWBNPP were similar to those in Hogtown Creek and Possum Creek during stormflow periods.

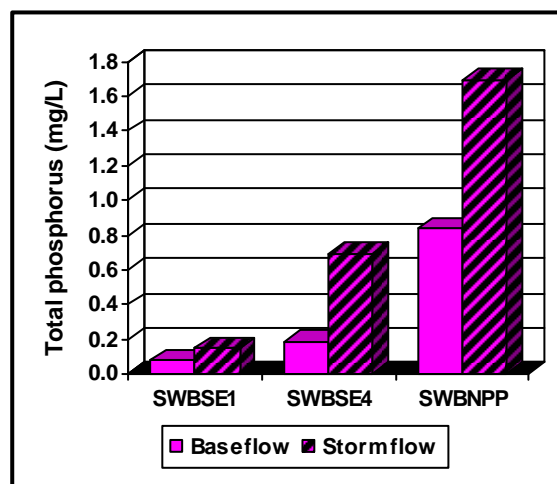


Figure 4.11 Comparison of median total phosphorus (TP-T) concentrations for three sites on Sweetwater Branch under baseflow and stormflow conditions

4.7 Ecosystem Health

Historically, Sweetwater Branch was a small spring-fed stream that meandered through a young Gainesville. As the city grew, so did the need to prevent flooding, hence many segments of the creek were channelized. Substantial increases in the impervious surface area throughout the watershed resulted in greater volumes and ve-

localities of storm runoff directed, without treatment, to Sweetwater Branch. Today, in addition to increased urban storm flow inputs, the creek receives millions of additional gallons of flow per day from the Main Street WRF (Davis, P. 2004).

These dramatic increases in flow patterns have altered the character of the creek. In addition, segments of the creek are littered with landfill debris, bacteria levels flourish in the upper reaches, and native vegetation has been replaced in many places by exotic and invasive species.

4.7.1 Biological Integrity

The natural riparian buffer zone along Sweetwater Branch ranged from zero to 20 feet throughout most of the watershed. Only a few segments had over 60 feet of natural riparian zone, which is the minimum considered optimal for a waterway. In the upper reaches, many creek segments lack a shaded canopy; however, the natural canopy is prevalent in the lower reaches of Sweetwater Branch prior to entering Paynes Prairie.

Overstory vegetation along Sweetwater Branch includes several native trees including box elder (*Acer negundo*), water oak (*Quercus nigra*), pignut hickory (*Carya glabra*), blue beech (*Carpinus caroliniana*), sugarberry (*Celtis laevigata*), and sweetgum (*Liquidambar styraciflua*).

Understory vegetation can be characterized as poor and is comprised of opportunistic species such as elderberry (*Sambucus canadensis*) and numerous invasive exotic species such as Mexican petunia (*Ruellia brittoniana*), wild taro (*Colocasia esculenta*), and air potato (*Dioscorea bulbifera*).



Mexican Petunia (*Ruellia brittoniana*). An exotic and highly invasive plant found along Sweetwater Branch

era). Drummond (2000) reported such deviations from natural plant communities can alter soil properties, affect wildlife populations, and change the overall ecology of an area.

Aquatic vegetation (both emergent and submergent) is uncommon in Sweetwater Branch due primarily to erosion and sedimentation. Both processes alter the natural streambed, resulting in unfavorable conditions for plant growth. The exception would be the upper channelized portions where the invasive, exotic hydrilla (*Hydrilla verticillata*) and native *sagittaria* spp. are present.

Although many of the biotic communities of the creek are severely impaired, Sweetwater Branch supports several forms of wildlife. Fish species, such as the mosquito fish, were abundant in most reaches of the creek. Common birdlife includes most of the native songbirds of the Gainesville area, woodpeckers, red-tailed hawks, osprey, and barred owls. Alligators, turkeys, and aquatic turtles are quite common as the stream approaches Paynes Prairie State Preserve.

4.7.2 Physical Integrity

Many reaches of Sweetwater Branch have been artificially channelized. The creek begins as a straightened ditch near Main Street and NW 16th Avenue and emerges from under the Gainesville Shopping Center in a straight, concrete-lined channel that continues through the Duck Pond neighborhood. The stream is channelized again as it flows south through downtown Gainesville and under the GRU Kelly Plant. Sweetwater Branch retains some of its sinuosity as it travels to the GRU Main Street WRF. After this point, however, it is channelized until it reaches Alachua Lake at Paynes Prairie.

Most of these channels were installed to direct flow toward the creek and away from development, in order to prevent flooding during storm events. A weir was installed south of the duck pond at NE 5th Avenue to concentrate flow to the center of the channel and minimize bank scouring. The artificial channels, along with the resulting increased velocity and flow during rain events, have had a detrimental effect on the stability and integrity of the creek ecosystem.

From the GRU Kelly plant to SE 4th Street, exposed clayey sand and sandy clay along the streambed and banks indicate the severity of streambed erosion that occurs during stormflow conditions. The stream channel is further eroded downstream of the confluence with GRU's Main Street WRF reclaimed water discharge. The banks in this area are very steep with exposed tree root systems, bare soil, and evidence of bank erosion.

The sediments eroded under baseflow and stormflow conditions eventually settle out when the velocity of the water decreases due to lessened relief. The majority of this sedimentation takes place on Paynes Prairie, where sand depths exceed three feet in the stream channel. This excess sediment smothers potential habitat for macroinvertebrates, prevents aquatic vegetation from establishing, and can deposit contaminants from upstream sites.

Historically, flow from Sweetwater Branch, entered Paynes Prairie as sheet flow. This changed, however, when the Camp family dredged a channel to promote drainage for livestock. This channel bypasses natural wetlands which once helped filter out nutrients and sediments before reaching the lake and discharging to the Floridan Aquifer via the primary sink feature at Alachua Sink.

4.8 Hydrology

Streamflow data were collected extensively on Sweetwater Branch at both the Depot Avenue (DEPOT) and SR 331 (SWB331) crossings (Table 4.3). The mean streamflow at DEPOT is 1.2 cubic feet per second (cfs). The mean discharge from the GRU Main Street WRF is 8.5 cfs. Downstream from the GRU Main Street WRF at SWB331, the mean streamflow is 12.7 cfs. The GRU Main Street WRF therefore provides about 67% of the baseflow to Sweetwater Branch as it enters Paynes Prairie, based on mean flows. If median flows are used, then the WRF contributes about 79% of the baseflow (Table 4.3). Using median values is the better approach for addressing baseflow

Table 4.3 Comparison of baseflow and stormflow hydrology, based on percent exceedance graphs

Data Collection Site	Baseflow - 50% Exceedance	Stormflow - 5% Exceedance
SWB at Depot Avenue	0.47	4.76
Tributaries and Discharges	1.76	9.86
GRU Main Street WRF	8.51	10.38
SWB at Williston Road	10.74	25.00

Stormflow is defined here as flows exceeded only 5% of the time. Flow for the tributaries and discharges segment, between DEPOT and WRF, was calculated by differences. WRF discharge was based on June 20, 2000 data, the date of maximum streamflows at DEPOT and SWB331 during the period of record.

contributions, since medians are less influenced by the high flows during storm events.

The maximum flow recorded at DEPOT over the 3 year period (September 1999 through September 2002) was 46.3 cfs, while the maximum flow at SWB331 was 155.6 cfs (Appendix F). Streamflow contributions from the segments of Sweetwater Branch during stormflow periods are shown in Table 4.3. While the contribution to flow from the GRU Main Street WRF increases by only an estimated 22% during stormflow events, stormflows are about 10 times higher at DEPOT and are estimated to be about 5.6 times higher for the tributaries and discharges entering Sweetwater Branch between DEPOT and the WRF. The impact of the impervious land surfaces in this watershed on stormflow increases is apparent.

4.9 Summary

Similar to the Tumblin Creek Watershed, the Sweetwater Branch basin is highly urbanized and is almost completely developed. Most of the natural stream channel has been artificially straightened and much of the baseflow, in the form of springs and seeps from the surficial aquifer system, enters the stream via the stormwater management system. When it rains, high volumes of water flow into the ditches and storm drains that lead directly to the creek.

Most of the urban development within the basin occurred prior to state and local requirements for stormwater management (retention/detention basins, etc.). The lack of stormwater management systems allows the direct discharge of non-treated stormwater to Sweetwater Branch. Rainfall no longer slowly infiltrates through the ground, gradually entering the creek through surficial aquifer springs and seeps, but instead flows rapidly into the creek as the rainfall event occurs, intensifying erosion and pollutant transport to



Sweetwater Branch at a culvert at SE 3rd



Sweetwater Branch at SE 4th Street.

the creek. In addition, the majority of the watershed lacks adequate riparian buffers which function to attenuate rate, volume, and quality of stormwater.

Increased stormflow, coupled with potential pollutant sources such as the GRU Kelly Generating Station, contaminants from the former coal gasification facility, bulk fuel storage, and petroleum contaminated groundwater, threaten the quality of Sweetwater Branch. Remediation activities and implementation of Alachua County hazardous materials code and other County and State regulations, help minimize these potential impacts.

The baseflow in Sweetwater Branch is augmented, on average, by 6.0 MGD of reclaimed water from the GRU Main Street WRF. Downstream of this discharge, nutrient concentrations increase dramatically, and sediments migrate downstream even under baseflow conditions. As Sweetwater Branch continues downstream, these nutrients and sediments flow into Paynes Prairie, ultimately reaching the Floridan aquifer. Groundwater nitrate concentrations are a growing

concern in many areas of Florida, including high levels of nitrates surfacing from the groundwater at nearby Silver Springs and in springs along the Santa Fe River.

The City of Gainesville Public Works Department is currently conducting two treatment and restoration projects. In the upper part of the watershed, a project titled “Redesign of the Duck Pond for Effective Water Management” is underway to improve water quality and assist with flood and erosion control. The project includes the creation of riparian wetlands, micro-detention ponds, littoral fringing wetlands, and use of baffle systems and biodegradable textiles (Crisman and Prenger 1999).

Projects in the lower part of the watershed include “Revitalizing the Sweetwater,” a stormwater retrofit project headed by the City of Gainesville in cooperation with the FDEP and SJRWMD. The project scope includes the purchase of properties for the construction of stormwater treatment parks, debris removal systems, and stream restoration efforts (Pearson 2001). The project also incorporates public education and outreach efforts and an illicit discharge detection program to identify the sources of the extremely high fecal coliform levels in the upper part of the watershed. The overall goal of both projects is to meet or exceed Class III water quality standards on Sweetwater Branch. Educating residents and owners and personnel employed in industrial and commercial activities in the watershed is an important step toward reducing nonpoint source pollution. Educational activities are underway through the SJRWMD WAV program and Adopt-A-River. Both

Chapter 4: Sweetwater Branch

June 2007

organizations have been undertaking public information activities in the watershed, including storm drain stenciling and creek cleanups.

The long-term goals of treatment and restoration activities in the Sweetwater Branch Watershed include providing increased stormwater treatment and increasing the native riparian buffer zone throughout the watershed. Increasing riparian buffer widths, planting native vegetation, and providing stormwater treatment are key restoration activities that will aid in improving in-stream biological habitat, decreasing bank and streambed erosion and sedimentation, and enhancing water quality.

The major treatment and restoration needs in the watershed are summarized below.

- Property acquisition and native plantings to increase natural riparian buffer widths and buffer effectiveness along the stream corridor
- Property acquisition to retain open space and existing forested lands in the watershed
- Stormwater management with retention basins or retrofitting of existing systems throughout the watershed, which will attenuate the volume and rate of stormflow, improve stormwater water quality, and reduce sediment erosion and transport in the stream
- Installation of a litter screen to capture trash in Sweetwater Branch at Williston Road, before it is washed onto Paynes Prairie

- Continuation of monitoring activities at the former industrial and petroleum contamination facilities in the watershed to assure that contaminants do not adversely impact the creek
- Evaluation of options to reduce the loading of nitrates and phosphates from reclaimed water that is discharged into Sweetwater Branch, and ultimately into Paynes Prairie and the Floridan aquifer
- Identification and control of the sources of fecal coliform bacteria in the upper part of the Sweetwater Branch Watershed
- Implementation of the “Redesign of the Duck Pond for Effective Water Management” project and
- Implementation of the “Revitalizing the Sweetwater” project



Restoration area on Sweetwater Branch upstream of the Duck Pond

It is critical to increase the size and quality of riparian buffers and provide more stormwater treatment throughout the entire watershed while retaining existing forested lands. Regional stormwater basins at the CSX site and downstream of the GRU Main Street WRF will improve

stormwater quality and decrease sediment erosion and transport in the creek. Public education programs are important and should be continued in the watershed. Continued local, state, and federal funding for projects such as “Revitalizing the Sweetwater” should also be encouraged.