Total Maximum Daily Load (TMDL)
For

Ochlockonee and St. Marks River Basins, Florida
(WBIDs 459, 746, 820, 857, 865, 916)

Nutrients, Fecal and Total Coliforms

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In compliance with the provisions of the Federal Clean Water Act, 33 U.S.C §1251 et. seq., as amended by the Water Quality Act of 1987, P.L. 400-4, the U.S Environmental Protection Agency is hereby establishing the Total Maximum Daily Load (TMDL) for nutrients, fecal and total coliforms in the Ochlockonee and St. Marks River Basins, Florida (WBIDs 459, 746, 820, 857, 865 and 916). Subsequent actions must be consistent with this TMDL.

Gail Mitchell for

James D. Giattina, Director
Water Management Division

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SUMMARY SHEET
Total Maximum Daily Load (TMDL) for
Ochlockonee and St. Marks River Basins

General Information for Listed Waterbodies

State	Florida
Impaired Waterbody (WBID)	Ward Creek (459); Harbinwood Estates Drain (746); Godby (820); Central Drainage Ditch (857), St. Augustine Branch (865), East Drainage Ditch (916)
County	Jefferson and Leon Counties
Major River Basin (s)	Ochlockonee and St. Marks Rivers
Watershed	03120001, 03120003
Constituent(s) Causing Impairments	Nutrient; Coliform
Designated Uses	Class III

The data used in the analysis were primarily from the Florida Impaired Water Rule (IWR) Run 11. An effort was made to acquire additional data from other agencies including municipalities. The coliform TMDL for Ward Creek was developed using the load duration curve approach. This approach is used when sufficient coliform and flow data are available to develop the load duration curve. For WBIDs with limited water quality coliform data (Central Drainage Ditch, St. Augustine Branch, and East Drainage Ditch), a percent reduction needed to achieve water quality standards was computed by comparing the median values of available data for each WBID to the water quality criteria. The target value for fecal coliform consisted of the State of Florida numeric criterion of 400 cfu/100mL of water. The one day maximum concentration of 2400 counts/100mL was used as the target for total coliform.

To develop a translation from the narrative nutrient criterion, a reference stream approach was used based on reference stream data previously collected from seven water quality stations in Florida. Using USEPA protocol for developing nutrient targets in rivers and streams, TN and TP targets were computed as the 75th percentile of the reference data for these parameters. Medians of data from water quality stations located in each WBID were computed and compared to these targets to derive needed percent reductions in nutrient loads. The TMDL summary tables for all the WBIDs follow.

Ward Creek (459) TMDL Load Allocation Summary

Parameter	Existing Load	TMDL Target	LA Reduction	Total Reduction
Fecal Coliform (#/day)	1.56E+10	4.79E+09	69%	69%

Harbinwood Estates (746) TMDL Load Allocation Summary[1]

Parameter	Existing Load	TMDL Target	WLA (MS4) Reduction	LA Reduction	Total Reduction
TP (mg/L)	0.23	0.15	35%	35%	35%

[1]Nutrient data collected as part of the "Septic Systems Survey" (Thorpe and Krottje, 2000) were included in the analysis.

Godby Ditch (820) TMDL Load Allocation Summary

Parameter	Existing Load	TMDL Target	WLA (MS4) Reduction	LA Reduction	Total Reduction
TP (mg/L)	0.16	0.15	6%	6%	6%

Central Drainage Ditch (857) TMDL Load Allocation Summary

Parameter	Existing Concentration	TMDL Target	WLA (MS4) Reduction	LA Reduction	Reduction
TN (mg/L)	0.73	0.72	1%	1%	1%
Fecal Coliform (#/100mL)	900	400	56%	56%	56%
Total Coliform (#/100mL)	33,500	2400	93%	93%	93%

St. Augustine Branch (865) Load Allocation Summary

Parameter	Existing Concentration	TMDL Target	WLA (MS4) Reduction	LA Reduction	Reduction
TN (mg/L)	1.03	0.72	30%	30%	30%
Fecal Coliform (#/100mL)	1,601	400	75%	75%	75%
Total Coliform (#/100mL)	12,250	2400	80%	80%	80%

East Drainage Ditch (916) Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (MS4) Reduction	LA Reduction	Reduction
Fecal Coliform (#/100mL)	2,350	400	83%	83%	83%
Total Coliform (#/100mL)	4,050	2,400	41%	41%	41%

1. INTRODUCTION

The Clean Water Act (CWA) [40 CFR Part 130] requires each State to identify waters within its boundaries not meeting water quality standards applicable to the water's designated uses. This list of identified waters (referred to as the 303(d) list) must be submitted to the U.S. Environmental Protection Agency (EPA) for review and approval. The "listed" waters identified by the State are prioritized for Total Maximum Daily Loads (TMDL) development based on factors described in CWA regulations, such as the use of the water and the severity of pollution. A separate TMDL is established for each pollutant at a level necessary to attain the applicable water quality standards taking into account seasonal variations and a margin of safety. The TMDL establishes allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. With this information, states can establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Florida Department of Environmental Protection (FDEP) developed a statewide, watershed-based approach to water resource management. Under the watershed management approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political boundaries. The watershed management approach is the framework DEP uses for implementing TMDLs. The state's 52 basins are divided into 5 groups. Water quality is assessed in each group on a rotating five-year cycle. Waterbodies addressed in this report are in the Ochlockonee and St. Marks River Basins and within the boundaries of the Northwest Florida Water Management District (NWFWMD).

2. WATERSHED DESCRIPTION AND PROBLEM DEFINITION

Five waterbodies in the St. Marks River Basin and one in the Lower Ochlockonee River Basin were identified on the Florida Department of Environmental Protection (FDEP) 1998 303(d) list as impaired for various parameters. Table 1 lists the impaired waters and cause of impairment. These waterbodies were scheduled for TMDL development by September 30, 2003. This schedule was mandated by a 1999 Consent Decree (Florida Wildlife Federation et. al. v. Carol Browner et. al., Case No. 98-356-CIV-Stafford). The pollutants for which TMDLs will be established are nutrients and coliform (Table 1). EPA is establishing the TMDLs in order to meet the requirements of the 1999 Consent Decree.

The impaired waterbodies in the St. Marks River Basin addressed in this document are Godby Ditch, Harbinwood Estates Drain, Central Drainage Ditch, St. Augustine Branch, East Drainage Ditch, and Ward Creek. These waterbodies are primarily within an urban setting consisting of the City of Tallahassee and suburban subdivisions except Ward Creek. Ward Creek consists of wetland areas west of the City of Monticello. Harbinwood Estates Drain, the only waterbody in the Lower Ochlockonee River Basin addressed in this document, is outside the limits of Tallahassee MS4 and in Leon County MS4. Figure 1 shows the location of the impaired waterbodies. Location maps of individual WBIDs are presented in Appendix A.

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Table 1. Impaired WBIDs Within Ochlockonee and St Marks River Basins[1]

Waterbody Name	Basin	HUC	WBID	Parameters
Ward Creek	St. Marks River	03120001	459	Coliform
Harbinwood Estates Drain	Ochlockonee River	03120003	746	Nutrient
Godby Ditch	St. Marks River	03120001	820	Nutrient
Central Drainage Ditch	St. Marks River	03120001	857	Nutrient, Coliform
St. Augustine Branch	St. Marks River	03120001	865	Nutrient, Coliform
East Drainage Ditch	St. Marks River	03120001	916	Coliform

[1]Northeast Drainage Ditch (WBID 756) located in the St Mark River Basin was also impaired by coliform but is addressed in a separate document.

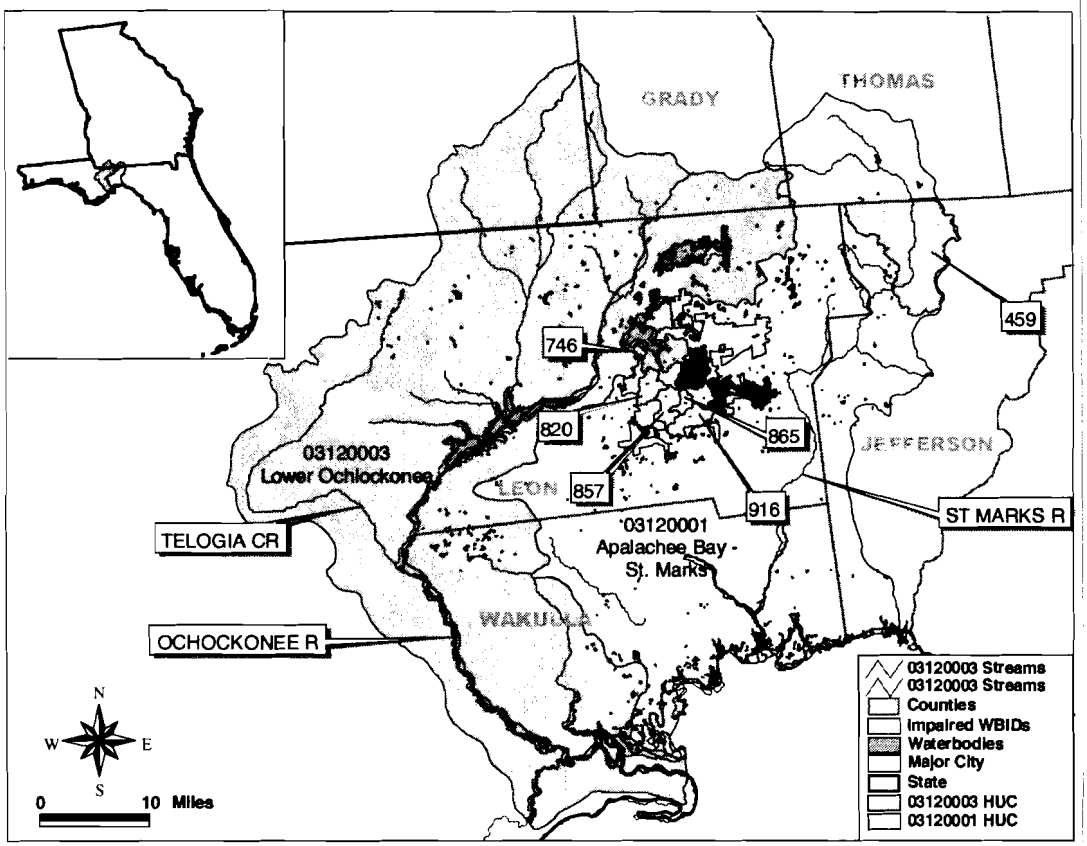


Figure 1. Impaired WBIDs within the Ochlockonee and St. Marks River Basins

3. WATER QUALITY STANDARDS AND TARGET IDENTIFICATION

The WBIDs discussed in this TMDL document are Class III Freshwater with designated use of Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife (FAC 62-302.400 (1)). The water quality standards in violation that led to the listing are as follows:

3.1. Nutrients

Florida's nutrient criterion is narrative only and states that nutrient concentrations of a body of water shall not be altered so as to cause an imbalance in natural populations of aquatic flora or fauna (FAC 62.302.530 (48)(b)). Accordingly, a nutrient-related target was needed to represent levels at which an imbalance in flora or fauna is expected to occur.

3.2. Fecal Coliform

"Most Probable Number or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of ten samples taken over a 30 day period." (FAC 62-302.530 (6)).

3.3. Total Coliform

The MPN per 100 ml of total coliform bacteria shall be less than or equal to 1,000 as a monthly average nor exceed 1,000 in more than 20 percent of the samples examined during any month, and less than or equal to 2,400 at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

4. LINKAGE OF WATER QUALITY STANDARDS TO THE CRITICAL RESOURCE

4.1. Nutrients

Excessive nutrients in a waterbody can have many unfavorable effects on the designated uses of that waterbody. They can affect the drinking water supply, recreational uses, aquatic life uses and fisheries use. Waterbodies are often listed as impaired for nutrients due to their role in accelerating eutrophication in a waterbody. An eutrophic system can easily succumb to excessive plant growth, particularly as phytoplankton, periphyton and macrophytes. The eutrophication process can adversely affect the waterbody by depleting oxygen in the system.

EPA's Ambient Water Quality Criteria Recommendations for rivers and streams suggest establishing nutrient targets based on the 75th percentile of reference stream conditions (USEPA, 2000a). To develop a translation from the narrative nutrient criterion, a reference stream approach was performed using reference stream data previously collected at seven water quality stations in the area (Table 2). The data collected at these stations is presented in Appendix B. Using EPA protocol for developing nutrient targets

in rivers and streams, the 75th percentiles of the reference nutrient data were computed and served as TMDL targets values (USEPA, 2000b). Results are shown in Table 3.

Table 2. Description of Water Quality Stations Located on Reference Streams

STORET_ID	STATION NICKNAME	STATION DESCRIPTION	WATERBODY NAME
22030061	LLOYDREF	Lloyd Creek S.R.158a Jefferson Co.	Lloyd Creek
31010140	NMOS REF	North Mosquito Ck	North Mosquito Creek
22020062	OKLREF	Oklawaha Ck	Oklawaha Creek
31010050	CRKREF	Crooked Creek @ HWY 270 Gadsden Co.	Crooked Creek
31010142	FLTREF	Flat Creek @ HWY 12 Gadsden Co.	Flat Creek
22020049	MULEREF	Mule Creek @ SR12 Liberty Co.	Mule Creek
31010051	SWTREF	Sweetwater Creek @ HWY 270 Liberty Co.	Sweetwater Creek

Table 3. Summary of Nutrient Targets

Parameter	Units	No of Stations	No of Data Points	75th Percentile of All Reference Data	TMDL Target
TN	mg/L	7	47	0.72	0.72
TP	mg/L	7	47	0.15	0.15

4.2. Fecal Coliform

Fecal coliform bacteria in the water column can induce gastrointestinal, respiratory, eye, ear, nose and throat illnesses and skin diseases in humans. In addition, fecal coliform are used as an indicator of the likely presence of pathogens that pose other potential health risks. To ensure that the fecal coliform TMDL is protective of both Florida one-day maximum criterion (800 counts/100ml) and the not to exceed criterion (400 counts/100ml in 10% of the samples), the latter was used as the TMDL target in computing percent reductions in fecal coliform loads.

4.3. Total Coliform

Total coliform bacteria generally indicate the presence of soil-associated bacteria and result from natural influences on a water body such as rainfall runoff as well as sewage inflows (i.e., acute conditions). By protecting the acute criteria (i.e., one-day maximum) bacteria concentrations in the stream should meet the chronic criteria. The target for the total coliform TMDL is the one-day maximum concentration of 2400 counts/100mL, as less than 10 samples were collected in a 30-day period to determine violations of the not-to exceed percentage criterion or the geometric mean.

5. WATER QUALITY ASSESSMENT

5.1. Water Quality Data

Most of the water quality data for the impaired segments within the Ochlockonee and St. Marks River Basins were obtained from the Florida Impaired Water Rule (IWR) Run 11.

An effort was made to solicit additional water quality data from other agencies and municipalities. Specific additional data sources included the "Septic System Survey" for Harbinwood Estates Drain (Thorpe and Krottje. 2000) and the "Cascade Trail Study" for Central Drainage Ditch and St. Augustine Branch (Environmental and Geotechnical Specialists, Inc., 2004).

6. SOURCE AND LOAD ASSESSMENT

6.1. Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of the pollutant of concern in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems; construction sites over five acres, and a wide variety of industries.

To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL. However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

6.2. Point Sources

Since 1984, all of the significant point sources have been removed from direct discharge to the drainage basin. Most of the treated effluent is land-applied. Municipal Separate Storm Sewer Systems (MS4s) are considered point sources regulated by the NPDES program. Discharge from storm water pipes and conveyances include urban runoff with some levels of bacteria and other pollutants. Another source of bacteria in residential communities is effluent from failing septic systems and sewer systems. In 1990, EPA developed rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) storm water program, designed to prevent harmful pollutants from being washed by storm water runoff into Municipal Separate Storm Sewer Systems

(MS4s) (or from being dumped directly into the MS4) and then discharged from the MS4 into local waterbodies.

Phase I of the NPDES program required operators of "medium" and "large" MS4s (those generally serving populations of 100,000 or greater) to implement a storm water management program as a means to control polluted discharges from MS4s. Approved storm water management programs for medium and large MS4s are required to address a variety of water quality related issues including roadway runoff management, municipal owned operations, hazardous waste treatment, etc. The City of Tallahassee and Leon County are covered under Phase I of the program and these MS4 impact all waters of impaired WBIDs except Ward Creek. For the purpose of these TMDLs, MS4 outfalls will have to meet the percent reductions allocated to point sources. Best management practices will need to be developed to achieve the reductions in bacteria, nutrients, and sediments as determined in TMDLs.

6.3. Nonpoint Sources

The primary loadings of coliform bacteria, nutrients, BOD, and TSS appear to be generated from the two permitted MS4 areas. Nonpoint sources, such as in Ward Creek, typically involve the accumulation of coliform bacteria on land surfaces that wash off as a result of storm events. Additional contributions of bacteria and nutrients may come from ground water, due to sources such as flooding, failed septic tanks, and the improper land application of domestic wastewater residuals. For coliform, an extended dry period followed by a storm event is usually the critical period when coliform levels in waterbodies exceed water quality criteria. Typical nonpoint sources include the following: wildlife; agricultural animals; pets in residential areas; onsite sewage treatment and disposal systems (septic tanks); land application of domestic wastewater residuals; and urban development (outside of MS4 discharges).

6.3.1. Wildlife

Wildlife deposit fecal coliform bacteria with their feces onto land surfaces where it can be transported during storm events to nearby streams. The bacteria load from wildlife is assumed to be part of background, as the contribution from this source is small relative to the load from urban areas. In addition, any strategy employed to control this source would probably have a negligible impact on obtaining water quality criteria.

6.3.2. Agricultural Animals

Agricultural animals (livestock) are the source of several types of fecal coliform loading to streams. Runoff from pastureland and cattle in streams can impact water quality. In Leon County, horses represent a significant portion of the livestock in the county.

6.3.3. Onsite Sewage Treatment and Disposal Systems (Septic Systems)

Onsite sewage treatment and disposal systems (OSTDs or septic tanks) are commonly used where providing central sewer is not cost effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTD is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning

properly, OSTDs can be a source of nutrients (nitrogen and phosphorus), pathogens, and other pollutants to both ground water and surface water.

6.3.4. Urban Development

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as outlined in Chapter 403 Florida Statutes (F.S.), was established as a technology-based program that relies upon the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, Florida Administrative Code (F.A.C.). The rule requires Water Management Districts (WMD) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL.

Florida's stormwater program is unique in having a performance standard for older stormwater systems that were built before the implementation of the Stormwater Rule in 1982. This rule states: "the pollutant loading from older stormwater management systems shall be reduced as needed to restore or maintain the beneficial uses of water" (Section 62-4-.432 (5)(c), F.A.C.).

Nonstructural and structural BMPs are an integral part of the State's stormwater programs. Nonstructural BMPs, often referred to as "source controls", are those that can be used to prevent the generation of NPS pollutants or to limit their transport off-site. Typical nonstructural BMPs include public education, land use management, preservation of wetlands and floodplains, and minimizing impervious surfaces. Technology-based structural BMPs are used to mitigate the increased stormwater peak discharge rate, volume, and pollutant loadings that accompany urbanization.

Land use categories aggregated using the simplified Level 1 and Level 2 codes found in the 1999 Florida Land Use and Cover Classification System (FLUCCS) coverage are presented in Table 4.

Table 4. Land Use Distributions for Impaired WBIDs

		Land Cover/Uses (%)								
WBID	**Total area (acres)**	**Residential**	**Com, Industrial, Public**	**Agriculture**	**Rangeland**	**Forest**	**Water**	**Wetlands**	**Transp and utilities**	**Barren& extractive**
459	16358	4.5	0.5	16.2	0.0	47.8	2.4	28.6	0.0	0.0
746	484	93.3	0.5	0.0	0.0	5.1	1.0	0.0	0.0	0.0
820	3430	62.8	13.1	0.4	0.0	19.7	0.8	0.7	2.6	0.0
857	3744	48.3	43.3	0.0	0.0	5.5	0.5	0.6	1.8	0.0
865	1555	45.2	52.4	0.0	0.0	0.0	0.2	0.1	2.2	0.0
916	4133	50.2	30.5	0.4	0.0	15.2	1.1	2.2	0.4	0.0

7. TECHNICAL APPROACH

7.1. Nutrients

Selection of the appropriate analytical tool is important to determine point and nonpoint source impacts on the water quality. However, a simple approach was used in the analysis due to limited water quality data for most WBIDs. Existing nutrient concentrations were determined by computing median values of available data for TN and TP for each impaired WBID. Then, percent reductions needed to achieve water quality criteria were determined by comparing these median values to TMDL nutrient targets presented in Table 3. Monitoring data for all WBIDs is presented in Appendix C.

7.2. Fecal Coliform

7.2.1. Ward Creek

The methodology used to estimate fecal coliform loads in Ward Creek is the "load duration curve". It is used only when there is a substantial amount of coliform data and is similar to the "Kansas Approach" developed by the State of Kansas (Stiles, 2001). This methodology has been well documented in the literature, with improved modifications used by EPA Region 4. Basically, the method relates the pollutant concentration to the flow of the stream to establish the existing loading capacity and the allowable pollutant load (TMDL) under a spectrum of flow conditions. TMDLs and required load reductions are determined by developing the flow and load duration curves (for allowable load and existing loading) and establishing the needed load reduction by comparing the existing loading to the allowable load under all flow or critical flow conditions.

Daily average flow data from 1998 to 2001 from the USGS gauge on Lost Creek at Arran, Florida (02327033) were used to generate a proportioned flow duration curve for Ward Creek (Figure 2). The drainage area for the Lost Creek gauge is 70.0 square miles and Ward Creek is approximately 62.1 square miles. The flow duration curve was then transformed into a load duration curve by multiplying flow values along the flow duration curve by the fecal coliform standard concentration and the appropriate flow conversion factor (Figure 3). This is a graph of allowable fecal coliform loads for Ward

Creek. Existing loads were computed by multiplying instream coliform concentrations measured during monitoring events by the estimated flow at the time of sampling and a flow conversion factor. Percent load reductions were computed for all exceedances of the standard using corresponding existing loads and allowable loads derived from the load duration curve. The TMDL and percent reductions in fecal coliform loads for Ward Creek are shown in Table 5.

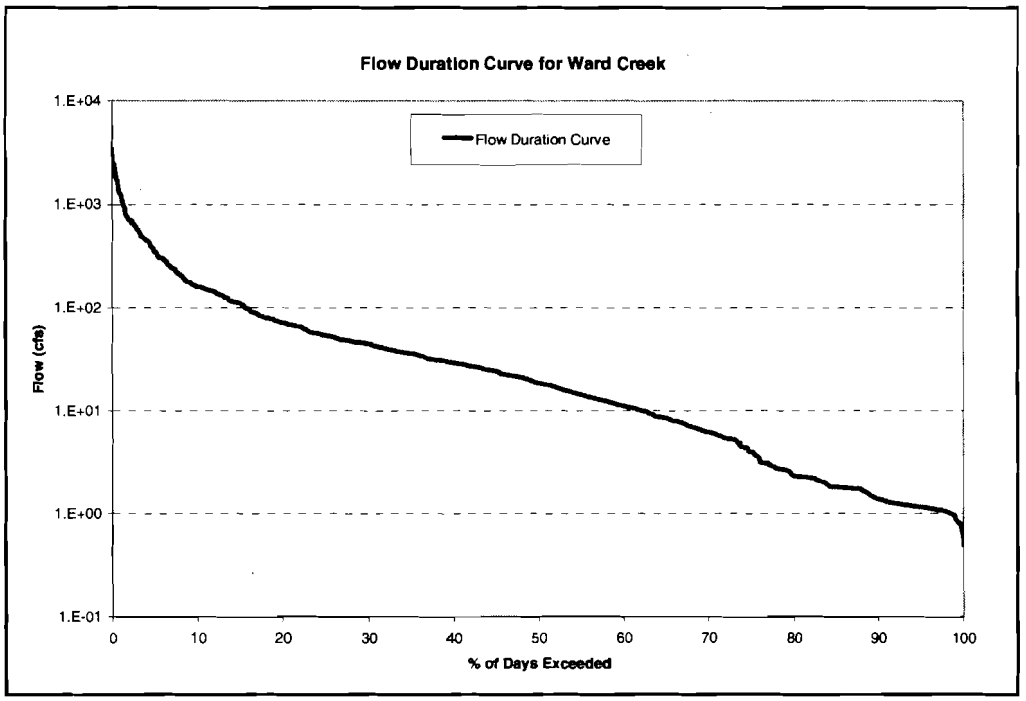


Figure 2. Flow Duration Curve for Ward Creek

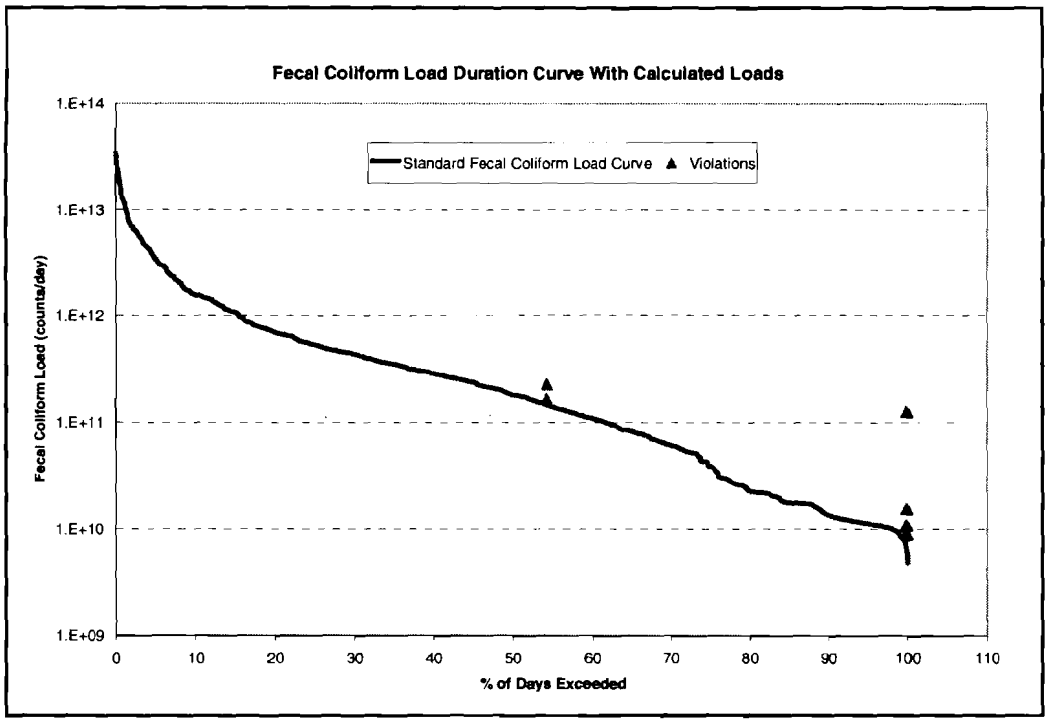


Figure 3. Load Duration Curve for Fecal Coliform in Ward Creek

Table 5. Fecal Coliform TMDL Load Calculation for Ward Creek

Date	Station	Station Description	Fecal Coliform (counts per 100 mL)	Flow (cfs)	Exceedance	Fecal Coliform Load (counts per day)	TMDL fecal Load (counts per day)	Reduction
11/5/2001	21FLDEP 304736908358575	Ward Crk At Magnolia Rd 1.9 Mi S Pine	700	0.64	100%	1.09E+10	4.79E+09	56%
11/5/2001	21FLDEP 304702008359058	Ward Crk At Magnolia Rd 1.9 Mi S Pine	1000	0.64	100%	1.56E+10	4.79E+09	69%
11/5/2001	21FLDEP 303730308352213	Trib To Ward Crk At Us 19 Abt 5.4 Mi N	8000	0.64	100%	1.25E+11	4.79E+09	96%
11/5/2001	21FLDEP 304816608359266	Trib To Ward Crk At Habersham Rd	570	0.64	100%	8.90E+09	4.79E+09	46%
11/5/2001	21FLDEP 303618108353357	Ward Crk At Sr 259 (Sr 142)	580	0.64	100%	9.06E+09	4.79E+09	47%
2/16/1999	21FLDEP 303730308352213	Trib To Ward Crk At Us 19 Abt 5.4 Mi N	620	14.90	54%	2.25E+11	1.45E+11	35%
2/16/1999	21FLDEP 304124808354140	Ward Crk At 12 Mile Post Rd	450	14.90	54%	1.64E+11	1.45E+11	11%
					Median	**1.56E+10**	**4.79E+09**	**69%**

7.2.2. Central Drainage Ditch, St Augustine Branch, East Drainage Ditch

Central Drainage Ditch, St Augustine Branch, and East Drainage Ditch did not have enough data to develop a load duration curve. In this case, the median of all violations of fecal coliform criteria was computed for each waterbody and compared to the water quality standard to derive the needed load reduction as follows:

$$\text{FC Percent Reduction} = \frac{100*(\text{Median of All Violations} - 400)}{\text{Median of All Violations}}$$

All monitoring data and computed medians of fecal coliform data are indicated in Appendix C.

7.3. Total Coliform

All waterbodies (Central Drainage Ditch, St Augustine Branch, East Drainage Ditch) impaired by coliform did not have substantial total coliform data to derive load duration curves. As in Section 7.2.2, the median of all violations of total coliform criteria was computed for each waterbody and compared to the water quality standard to derive the needed load reduction as follows:

$$\text{TC Percent Reduction} = \frac{100*(\text{Median of All Violations} - 2400)}{\text{Median of All Violations}}$$

8. TOTAL MAXIMUM DAILY LOAD (TMDL)

A total maximum daily load (TMDL) for a given pollutant and waterbody is comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is represented by the equation:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody while still achieving water quality standards. A portion of the TMDL allocated to each of the pollutant sources as WLA for point source and LA for non point source. The allocations for all pollutant sources are identified that cumulatively provide for the basis for the State to prescribe controls that will ultimately achieve water quality standards. TMDLs for the impaired waterbodies in Ochlockonee and St Marks Basins are presented in Tables 6 to 11. They are expressed in terms of counts/day and percent reduction for coliform, and concentrations and percent reductions for nutrient.

Table 6. Ward Creek (459) TMDL Load Allocation Summary

Parameter	Existing Load	TMDL Target	LA Reduction	Total Reduction
Fecal Coliform (#/day)	1.56E+10	4.79E+09	69%	69%

Table 7. Harbinwood Estates (746) TMDL Load Allocation Summary[1]

Parameter	Existing Load	TMDL Target	WLA (MS4) Reduction	LA Reduction	Total Reduction
TP (mg/L)	0.23	0.15	35%	35%	35%

[1]Nutrient data collected as part of the "Septic Systems Survey" (Thorpe and Krottje, 2000) were included in the analysis.

Table 8. Godby Ditch (820) TMDL Load Allocation Summary

Parameter	Existing Load	TMDL Target	WLA (MS4) Reduction	LA Reduction	Total Reduction
TP (mg/L)	0.16	0.15	6%	6%	6%

Table 9. Central Drainage Ditch (857) TMDL Load Allocation Summary

Parameter	Existing concentration	TMDL Target	WLA (MS4) Reduction	LA Reduction	Reduction
TN (mg/L)	0.73	0.72	1%	1%	1%
Fecal Coliform (#/100mL)	900	400	56%	56%	56%
Total Coliform (#/100mL)	33,500	2400	93%	93%	93%

Table 10. St. Augustine Branch (865) Load Allocation Summary

Parameter	Existing Concentration	TMDL Target	WLA (MS4) Reduction	LA Reduction	Reduction
TN (mg/L)	1.03	0.72	30%	30%	30%
Fecal Coliform (#/100mL)	1,601	400	75%	75%	75%
Total Coliform (#/100mL)	12,250	2400	80%	80%	80%

Table 11. East Drainage Ditch (916) Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (MS4) Reduction	LA Reduction	Reduction
Fecal Coliform (#/100mL)	2,350	400	83%	83%	83%
Total Coliform (#/100mL)	4,050	2,400	41%	41%	41%

8.1. Load Allocation

The TMDLs and their components (WLA, LA, and MOS) were derived based on an interpretation of analysis results and water quality standards or estimated parameter targets. Since the impaired WBIDs are covered by MS4 areas (except Ward Creek), the LA allocation is equivalent to WLA. It should be noted that any MS4 permittee will only

be responsible for reducing the loads associated with stormwater outfalls that it owns or otherwise has responsible control over.

8.2. Wasteload Allocation

WLA fraction attributable to continuous discharges is zero since there are no continuous point sources in any of the WBIDs. WLAs for stormwater discharges are typically expressed as "percent reduction" because it is very difficult to quantify loads from MS4s (given the "numerous discharge points") and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the "maximum extent practical" through the implementation of best management practices (BMPs). This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure.

8.3. Margin of Safety

There are two methods for incorporating a margin of safety (MOS) in the Ochlockonee and St Marks River Basin TMDL analysis: (1) by implicitly incorporating the MOS using conservative model assumptions to develop allocations, or (2) by explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations. An implicit MOS is included in these TMDLs for coliform by not allowing any exceedances of state criteria. However, intermittent natural exceedances of the criteria would be expected and therefore should be taken into account when determining impairment. An implicit MOS is also included in TMDLs for nutrients to take into account uncertainty associated with instream processes, limited data, and the use of median values.

8.4. Critical Conditions/Seasonality

The critical conditions for nonpoint source loadings are typically an extended dry period followed by a rainfall runoff event. During the dry weather period, pollutants build up on the land surface, and are then washed off by rainfall. The critical condition for point source loading occurs during periods of low stream flow when dilution is minimized. Water quality data have been collected during all time periods.

The TMDLs expressed in this report represent a combination of wet and dry weather loadings. The loading curve is a good example of examining the data under a series of flow conditions. The coliform TMDL expresses coliform counts as an average count per day. The average allowable count considers a range of flow conditions. Seasonal variation in coliform was incorporated in the loading curves by using the entire period of record of flow recorded at a nearby gauge. Seasonality was also addressed by using all water quality data associated with the impaired waters, which was collected during multiple seasons.

Seasonality is incorporated in nutrient TMDLs through the use of median concentrations of available data. This approach includes both the influences of wet and dry weather conditions on loadings to the waterbody. Furthermore, the use of multi-year analysis in the determination of median concentrations incorporates a range of wet and dry years.

9. Conclusion and Recommendations

TMDLs for most of the impaired WBIDs were based on limited monitoring data and simple calculations to compute needed load reductions. These TMDLs may be revised in the future as more water quality and flow data become available. The City of Tallahassee (COT) has embarked on an aggressive ambient water quality monitoring of these waterbodies. Its Lake Munson Basin Urban Ditch Monitoring Program, once implemented and completed, will provide water quality data for a period of six months in Godby Ditch, Central Drainage Ditch, St Augustine Branch, and East Drainage Ditch. While EPA recognizes that these data will result in a better understanding of the water quality status in these waterbodies, a long-term monitoring campaign (longer than six months) would be more useful for TMDL development or update purposes because it would provide substantial multi-year water quality data. The monitoring program would also target all the impairments identified in the 1998 303(d) list and not only parameters addressed in this TMDL document. It is also recommended that flow data be recorded at the time of sampling for water quality to allow parameter load computations and reductions needed to achieve water quality targets.

Structural management strategies outlined in the COT/Leon County's Stormwater Management Plan (NWFWMD, 1993) and COT Stormwater Pollution Reduction Program (SPRP) are currently being implemented and have resulted in water quality improvements of the impaired waterbodies. These improvements should be considered during the implementation phase of the TMDLs presented in this document. Some of these structural pollution reduction projects are the City of Tallahassee/Florida State University Stormwater Management in Central Drainage Ditch and St Augustine Branch drainage areas, the Central Ditch Stormwater Improvements, and the Tartary Drive Flood Relief.

References

Environmental and Geotechnical Specialists, Inc. 2004. Water Quality Testing Prepared for the Genesis Group. St Augustine Branch and Central Ditch Locations. Proposed Cascade Trail Blueprint 2000 and Beyond. Tallahassee and Leon County. Genesis Group Inc. Tallahassee. FL.

Stiles, T. C. 2001. A Simple Method to Define Bacteria TMDLs in Kansas. ASIWPCA/ACWF/WEF TMDL Science Issues Conference: On-site Program. St. Louis, MO. Pp. 375-378.

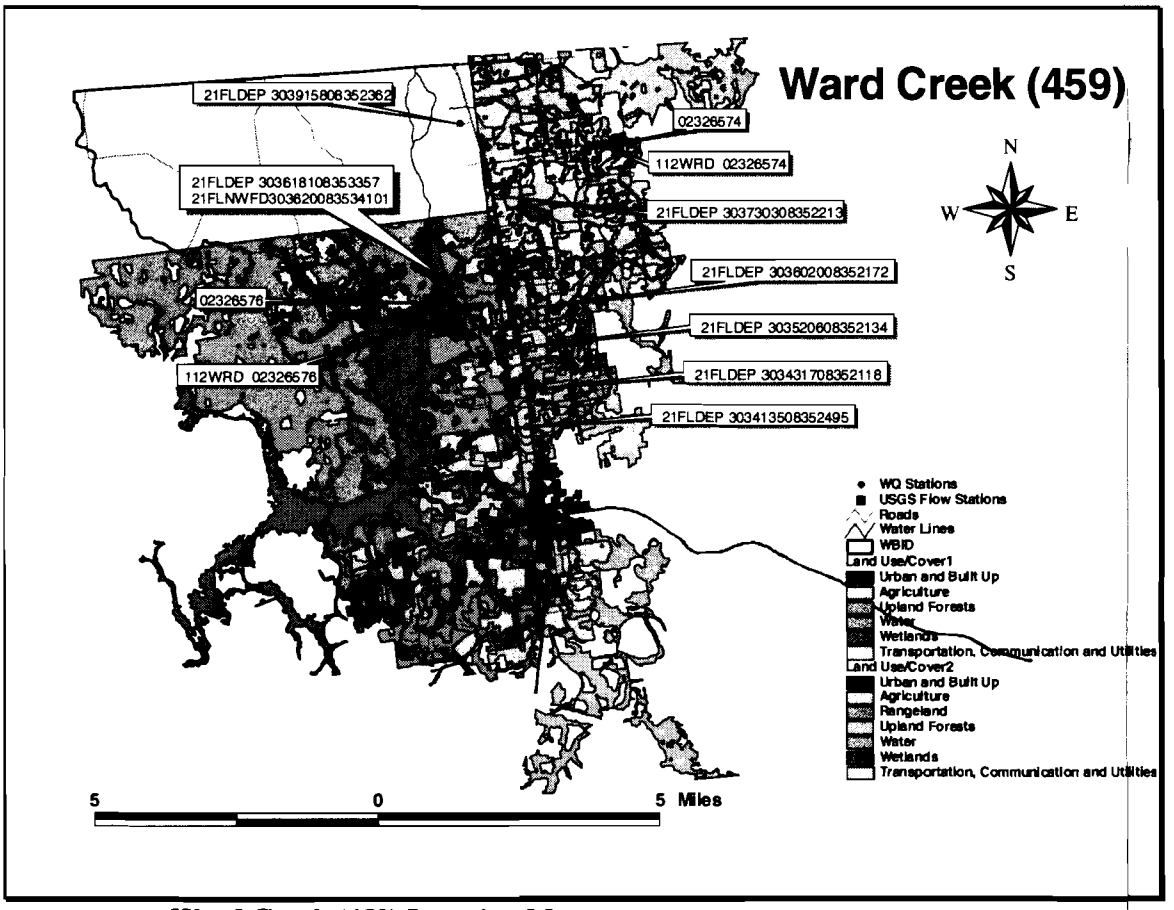
Thorpe and Krottje. 2000. Effects of Systems in the Lake Jackson Watershed. Lake Jackson SWIM Project Q-9: Evaluation of Septic Tank and Sewer Issues. NWFWMD Water Res. Spec. Rep. 002. Nov. 2000.

USEPA, 1991. Guidance for Water Quality –based Decisions: The TMDL Process. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA-440/4-91-001, April 1991.

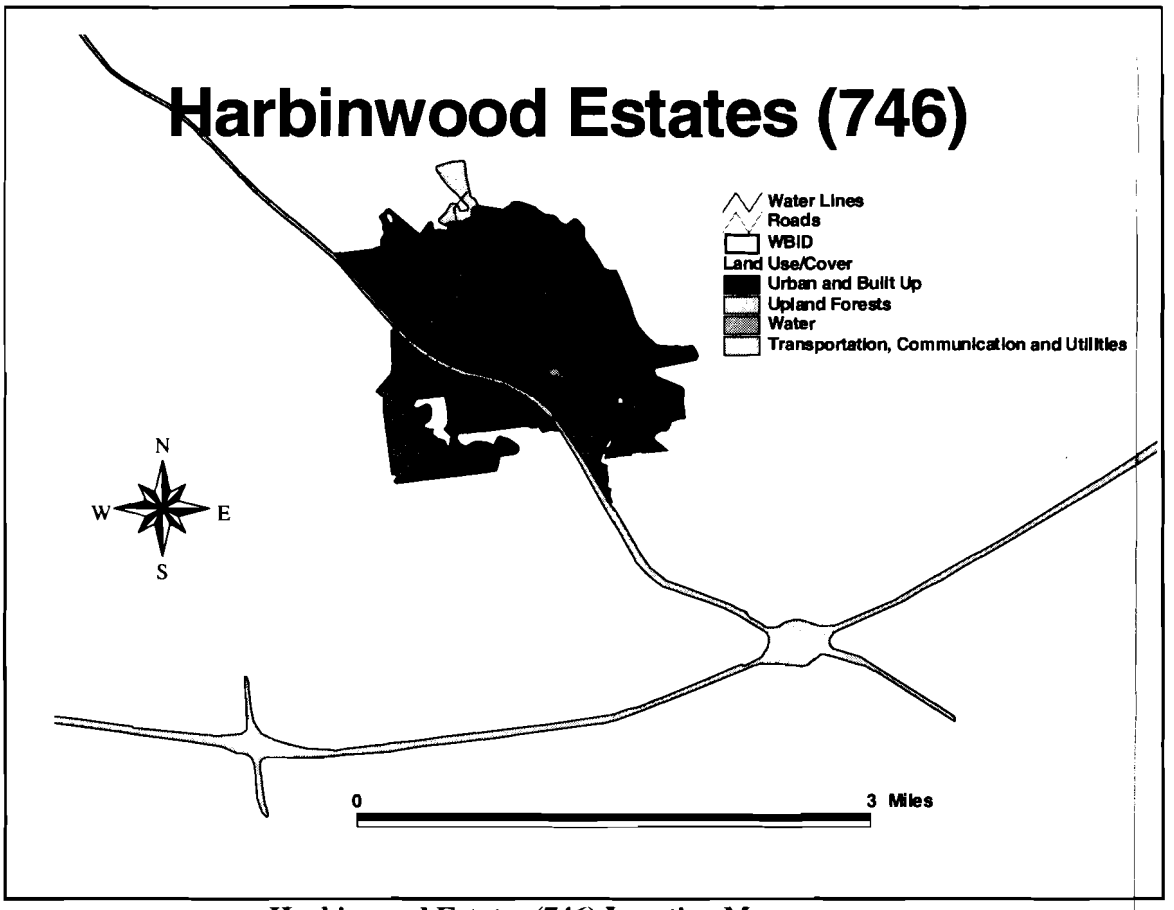
USEPA, 2000a. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria. Rivers and Streams in Ecoregion XII. United States Environmental Protection Agency, Office of Water. EPA 822-B-00-020. Dec. 2000.

USEPA, 2000b. Nutrient Criteria Technical Guidance Manual: River and Streams. United States Environmental Protection Agency, Office of Water. EPA 822-B-00-002.

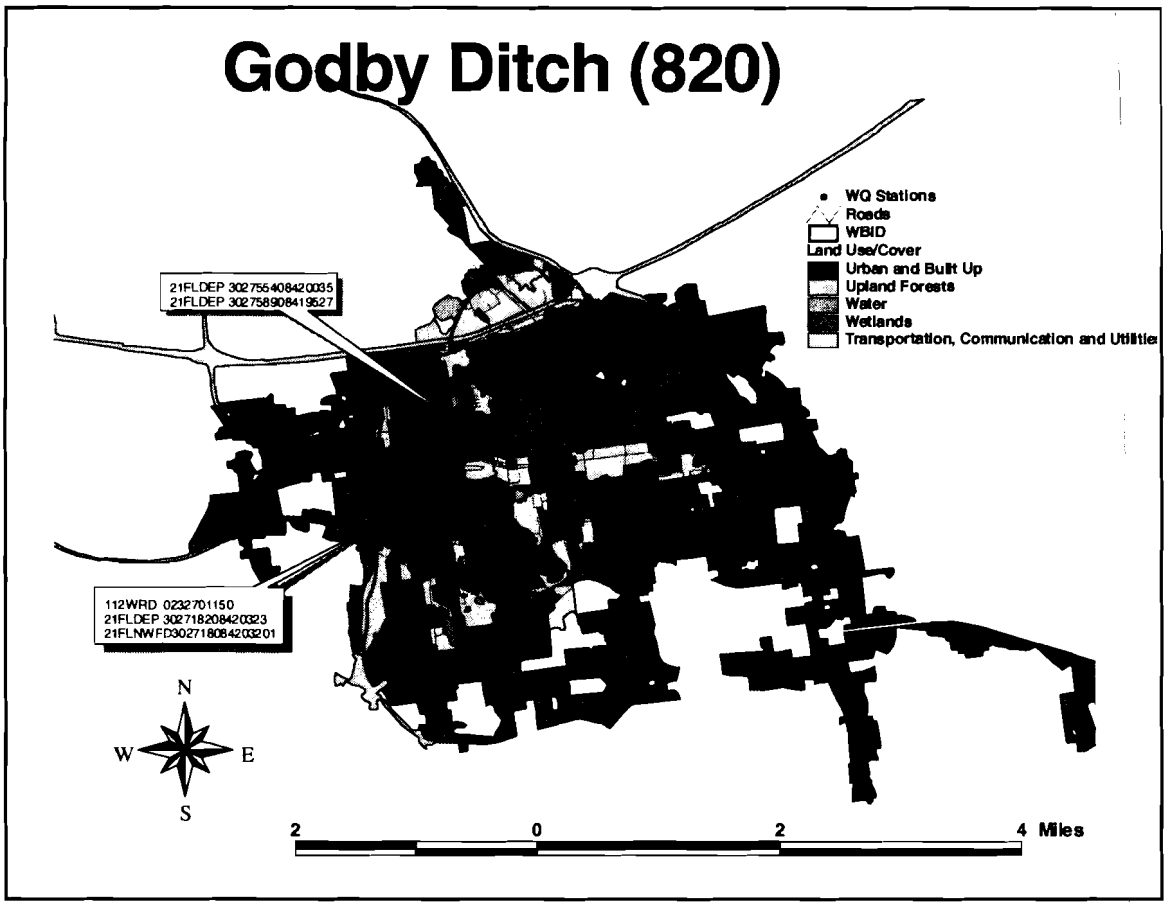
Appendix A – Figures of the Impaired WBIDs



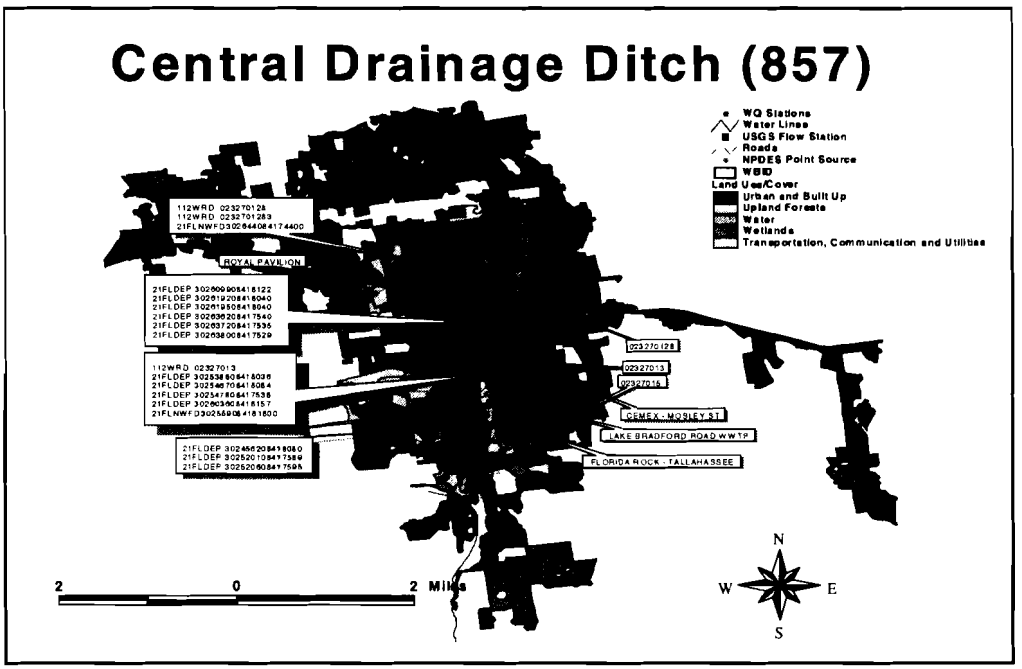
Ward Creek (459) Location Map



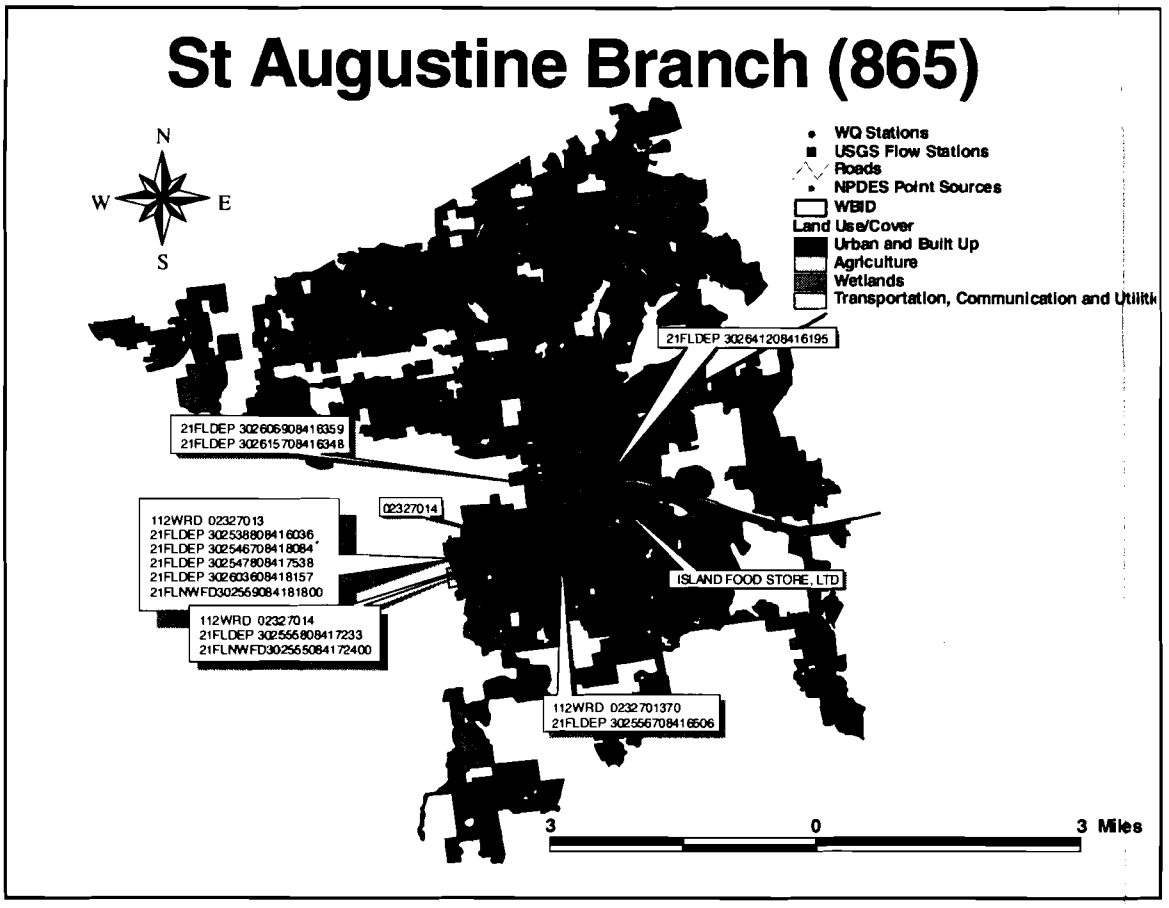
Harbinwood Estates (746) Location Map



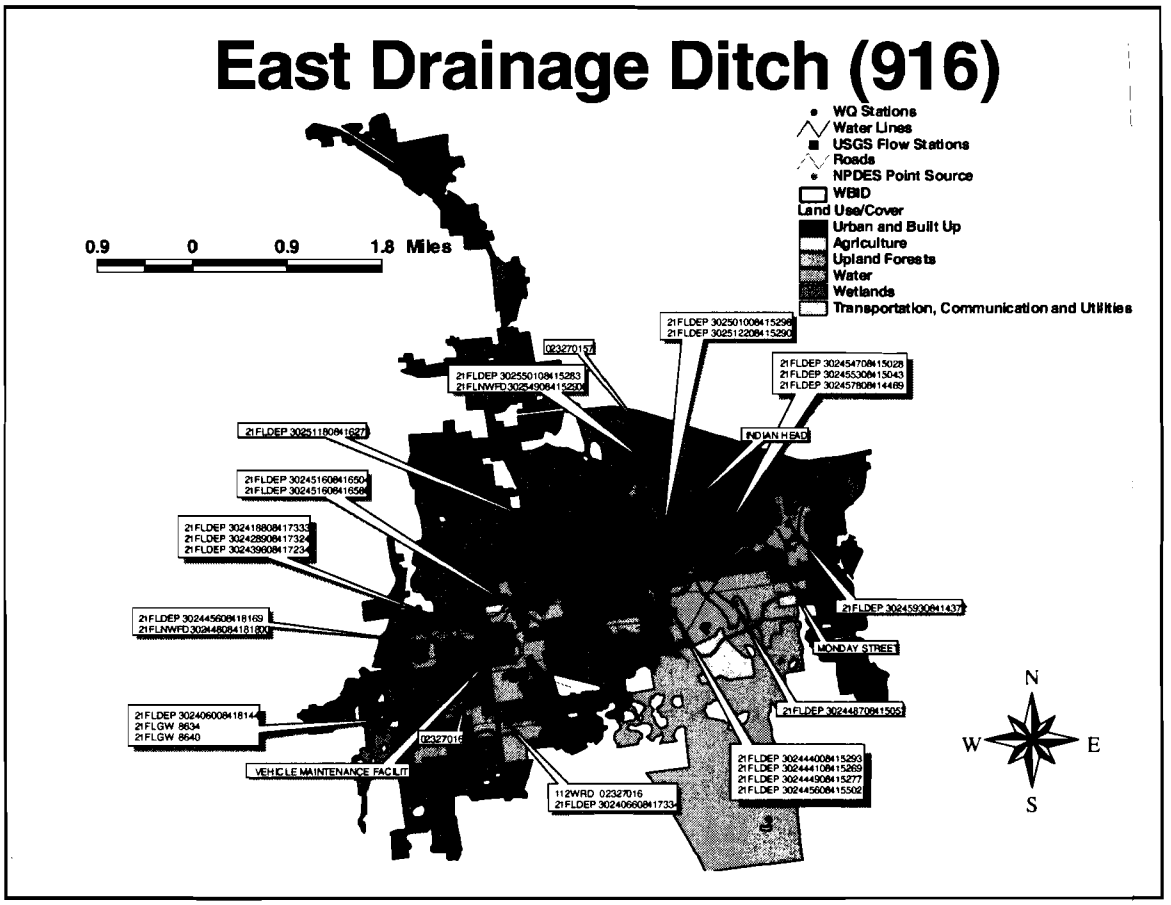
Godby Ditch (820) Location Map



Central Drainage Ditch (857) Location Map



St. Augustine Branch (865) Location Map



East Drainage Ditch (916) Location Map

Appendix B – Reference Stream Data

TN Reference Data Summary

Station_ID	Date and Time	PCode	TN (mg/L)	Medians
21FLA 22020049	07/08/1992 21:30	TN	0.327	
21FLA 22020049	03/25/1993 10:30	TN	0.32	
21FLA 22020049	03/25/1993 11:11	TN	0.32	
21FLA 22020049	07/20/1993 08:00	TN	0.329	
21FLA 22020049	03/21/1994 19:10	TN	0.312	
21FLA 22020049	08/01/1994 11:45	TN	0.623	
21FLA 22020049	02/13/1995 10:15	TN	0.847	
21FLA 22020049	02/13/1995 11:11	TN	0.85	
21FLA 22020049	07/09/1996 11:00	TN	0.394	
21FLA 22020049	07/09/1996 11:00	TN	0.394	0.3615
21FLA 22020062	08/01/1994 10:30	TN	0.493	
21FLA 22020062	02/13/1995 11:30	TN	0.744	
21FLA 22020062	07/19/1995 11:00	TN	0.328	
21FLA 22020062	02/13/1996 12:00	TN	0.245	
21FLA 22020062	08/12/1997 14:15	TN	0.664	0.493
21FLA 22030061	03/30/1993 10:00	TN	0.65	
21FLA 22030061	07/22/1993 11:30	TN	0.67	
21FLA 22030061	03/22/1994 11:00	TN	0.62	
21FLA 22030061	02/15/1995 11:11	TN	0.86	
21FLA 22030061	02/15/1995 14:15	TN	0.86	0.67
21FLA 31010050	07/08/1992 22:42	TN	0.392	
21FLA 31010050	03/25/1993 12:00	TN	0.37	
21FLA 31010050	07/20/1993 11:00	TN	0.38	
21FLA 31010050	03/21/1994 11:30	TN	0.339	
21FLA 31010050	08/01/1994 12:30	TN	0.334	
21FLA 31010050	02/13/1995 13:00	TN	0.398	
21FLA 31010050	07/09/1996 11:00	TN	0.426	
21FLA 31010050	07/09/1996 11:00	TN	0.426	0.426
21FLA 31010051	03/25/1993 11:11	TN	0.28	
21FLA 31010051	03/25/1993 19:15	TN	0.28	
21FLA 31010051	07/20/1993 21:30	TN	0.252	
21FLA 31010051	03/21/1994 10:40	TN	0.237	
21FLA 31010051	08/01/1994 13:30	TN	0.264	
21FLA 31010051	02/13/1995 18:00	TN	0.63	
21FLA 31010051	07/19/1995 22:45	TN	0.232	
21FLA 31010051	02/13/1996 08:00	TN	0.29	0.272
21FLA 31010140	08/01/1994 21:30	TN	0.96	
21FLA 31010140	02/13/1995 10:00	TN	2.21	
21FLA 31010140	07/10/1996 21:30	TN	1.27	
21FLA 31010140	07/10/1996 21:30	TN	1.27	1.27
21FLA 31010142	03/25/1993 14:00	TN	0.68	
21FLA 31010142	07/20/1993 12:30	TN	0.68	
21FLA 31010142	03/21/1994 12:30	TN	0.69	
21FLA 31010142	08/01/1994 10:15	TN	0.54	
21FLA 31010142	02/13/1995 11:30	TN	2.7	
21FLA 31010142	07/09/1996 11:00	TN	0.78	

21FLA 31010142	07/09/1996 11:00	TN	0.78	0.69
		75th =	0.717	0.68
			all	medians
		count =	47	7

TP Reference Data Summary

Station_ID	Date and Time	PCode	Depth_M	RCode	Result	Medians
21FLA 22020049	07/08/1992 21:30	TP	0.98	T	0.025	
21FLA 22020049	03/25/1993 10:30	TP	0.5		0.024	
21FLA 22020049	03/25/1993 11:11	TP	0.5		0.024	
21FLA 22020049	07/20/1993 08:00	TP	0.5	T	0.014	
21FLA 22020049	03/21/1994 19:10	TP	1		0.027	
21FLA 22020049	08/01/1994 11:45	TP	0.5		0.036	
21FLA 22020049	02/13/1995 10:15	TP	0.5		0.049	
21FLA 22020049	02/13/1995 11:11	TP	0.5		0.049	
21FLA 22020049	07/09/1996 11:00	TP	1		0.037	
21FLA 22020049	07/09/1996 11:00	TP	0.5		0.037	0.0315
21FLA 22020062	08/01/1994 10:30	TP	0.5		0.013	
21FLA 22020062	02/13/1995 11:30	TP	0.5		0.041	
21FLA 22020062	07/19/1995 11:00	TP	0.5		0.012	
21FLA 22020062	02/13/1996 12:00	TP	1	U	0.004	
21FLA 22020062	08/12/1997 14:15	TP	0.3	I	0.018	0.013
21FLA 22030061	03/30/1993 10:00	TP	0.5		0.15	
21FLA 22030061	07/22/1993 11:30	TP	0.5		0.13	
21FLA 22030061	03/22/1994 11:00	TP	1		0.11	
21FLA 22030061	02/15/1995 11:11	TP	0.5		0.14	
21FLA 22030061	02/15/1995 14:15	TP	0.5		0.14	0.14
21FLA 31010050	07/08/1992 22:42	TP	0.66		0.2	
21FLA 31010050	03/25/1993 12:00	TP	0.5		0.16	
21FLA 31010050	07/20/1993 11:00	TP	0.5		0.18	
21FLA 31010050	03/21/1994 11:30	TP	1		0.13	
21FLA 31010050	08/01/1994 12:30	TP	0.98		0.15	
21FLA 31010050	02/13/1995 13:00	TP	0.5		0.16	
21FLA 31010050	07/09/1996 11:00	TP	0.5	A	0.21	
21FLA 31010050	07/09/1996 11:00	TP	1	A	0.21	0.17
21FLA 31010051	03/25/1993 11:11	TP	0.5		0.031	
21FLA 31010051	03/25/1993 19:15	TP	0.5		0.031	
21FLA 31010051	07/20/1993 21:30	TP	0.5	T	0.013	
21FLA 31010051	03/21/1994 10:40	TP	1		0.028	
21FLA 31010051	08/01/1994 13:30	TP	0.5		0.027	
21FLA 31010051	02/13/1995 18:00	TP	0.5		0.026	
21FLA 31010051	07/19/1995 22:45	TP	0.5		0.04	
21FLA 31010051	02/13/1996 08:00	TP	1		0.017	0.0275
21FLA 31010140	08/01/1994 21:30	TP	3.6		0.077	

21FLA 31010140	02/13/1995 10:00	TP	0.5		0.2	
21FLA 31010140	07/10/1996 21:30	TP	0.5		0.12	
21FLA 31010140	07/10/1996 21:30	TP	1		0.12	0.12
21FLA 31010142	03/25/1993 14:00	TP	0.5		0.13	
21FLA 31010142	07/20/1993 12:30	TP	0.5		0.17	
21FLA 31010142	03/21/1994 12:30	TP	1		0.15	
21FLA 31010142	08/01/1994 10:15	TP	1.64		0.13	
21FLA 31010142	02/13/1995 11:30	TP	0.5		0.87	
21FLA 31010142	07/09/1996 11:00	TP	0.5		0.22	
21FLA 31010142	07/09/1996 11:00	TP	1		0.22	0.17
				75th =	0.15	0.15
					all	medians
				count =	47	7

Appendix C – Monitoring Data

Data for Ward Creek (WBID #459)

Fecal Coliform

Month	Day	Year	Station	Location	Counts/100 mL
2	12	1998	21FLNWFDS265	Ward Creek	350
2	12	1998	21FLNWFD303620083534101	Ward Cr. Ab Lk. Miccosukee	350
5	11	1998	21FLNWFD303620083534101	Ward Cr. Ab Lk. Miccosukee	40
8	11	1998	21FLNWFD303620083534101	Ward Cr. Ab Lk. Miccosukee	42
2	16	1999	21FLDEP 303602008352172	Trib To Ward Crk At Us 19 Abt 3.8	310
2	16	1999	21FLDEP 303730308352213	Trib To Ward Crk At Us 19 Abt 5.4	620
2	16	1999	21FLDEP 303618108353357	Ward Crk At Sr 259 (Sr 142)	28
2	16	1999	21FLDEP 304308308355525	Ward Crk At New Hope Rd	1
2	16	1999	21FLDEP 304124808354140	Ward Crk At 12 Mile Post Rd	450
2	16	1999	21FLDEP 304308308355525	Ward Crk At New Hope Rd	1
8	3	1999	21FLDEP 304308308355525	Ward Crk At New Hope Rd	64
8	3	1999	21FLDEP 303618108353357	Ward Crk At Sr 259 (Sr 142)	40
2	28	2000	21FLDEP 303618108353357	Ward Crk At Sr 259 (Sr 142)	50
11	5	2001	21FLDEP 304736908358575	Ward Crk At Magnolia Rd 1.9 Mi S	700
11	5	2001	21FLDEP 304124808354140	Ward Crk At 12 Mile Post Rd	16
11	5	2001	21FLDEP 303413508352495	Trib To Ward Crk At Us 19 Abt 3.4	180
11	5	2001	21FLDEP 304308308355525	Ward Crk At New Hope Rd	40
11	5	2001	21FLDEP 304800408359273	Trib To Ward Crk At Hampton Ct	260
11	5	2001	21FLDEP 304702008359058	Ward Crk At Magnolia Rd 1.9 Mi S	1000
11	5	2001	21FLDEP 303730308352213	Trib To Ward Crk At Us 19 Abt 5.4	8000
11	5	2001	21FLDEP 304816608359266	Trib To Ward Crk At Habersham	570
11	5	2001	21FLDEP 303602008352172	Trib To Ward Crk At Us 19 Abt 3.8	42
11	5	2001	21FLDEP 303618108353357	Ward Crk At Sr 259 (Sr 142)	580
11	5	2001	21FLDEP 304511808357587	Ward Crk At Millpond Rd 3.2 Mi N	400

Total Coliform

Month	Day	Year	Station	Location	Counts/100
2	12	1998	21FLNWFD303620083534101	Ward Cr. Ab Lk. Miccosukee	800
2	12	1998	21FLNWFDS265	Ward Creek	800
2	16	1999	21FLDEP 304308308355525	Ward Crk At New Hope Rd	60

2	16	1999	21FLDEP 304308308355525	Ward Crk At New Hope Rd	40
2	16	1999	21FLDEP 303618108353357	Ward Crk At Sr 259 (Sr 142)	100
2	16	1999	21FLDEP 303730308352213	Trib To Ward Crk At Us 19 Abt 5.4	2400
2	16	1999	21FLDEP 303602008352172	Trib To Ward Crk At Us 19 Abt 3.8	2000
2	16	1999	21FLDEP 304124808354140	Ward Crk At 12 Mile Post Rd	450
8	3	1999	21FLDEP 303618108353357	Ward Crk At Sr 259 (Sr 142)	2500
8	3	1999	21FLDEP 304308308355525	Ward Crk At New Hope Rd	850
2	28	2000	21FLDEP 303618108353357	Ward Crk At Sr 259 (Sr 142)	240
				Median (violations only)	**2500**

Data for Harbinwood Estates Drain (WBID #746)

Total Nitrogen

Month	Day	Year	Station	Location	mg/L
8	21	2001	21FLDEP 303101108419582	Jackson Heights Crk At Faulk Dr	0.540
8	21	2001	21FLDEP 303053008419571	Jackson Heights Crk At Harriet Dr	0.480
8	21	2001	21FLDEP 303121008420136	Jackson Heights Crk At Jackson	0.370
4	19	1995	2-S488*		0.500
4	24	1995	3-S488*		0.565
1	2	1996	5-S488*		0.740
2	22	1996	6-S488*		1.400
3	20	1996	7-S488*		0.420
3	29	1995	1-S489*		0.660
4	19	1995	2-S489*		0.385
4	24	1995	3-S489*		0.500
1	2	1996	5-S489*		0.520
2	22	1996	6-S489*		0.660
3	20	1996	7-S489*		0.620
				Median	**0.530**

Total Phosphorus

Month	Day	Year	Station	Location	mg/L
8	21	2001	21FLDEP 303121008420136	Jackson Heights Crk Jackson View	0.190
8	21	2001	21FLDEP 303053008419571	Jackson Heights Crk At Harriet Dr	0.220
8	21	2001	21FLDEP 303101108419582	Jackson Heights Crk At Faulk Dr	0.230

3	29	1995	1-S488*		0.138
3	29	1995	1-S489*		0.09
4	19	1995	2-S488*		0.15
4	19	1995	2-S489*		0.10
4	24	1995	3-S488*		0.53
4	24	1995	3-S489*		0.14
1	2	1996	5-S488*		0.21
1	2	1996	5-S489*		0.23
2	22	1996	6-S488*		0.14
2	22	1996	6-S489*		0.39
3	20	1996	7-S488*		0.17
3	20	1996	7-S489*		0.48
				Median	**0.19**

* Data from these stations is part of the "Septic Systems Survey" (Thorpe and Krottje, 2000).

Data for Godby Ditch (WBID #820)

Total Nitrogen

Month	Day	Year	Station	Location	mg/L
3	26	2002	21FLDEP 302718208420323	WDD AT US 90 (DS OLD TEAM	0.404
3	26	2002	21FLDEP 302718208420323	WDD AT US 90 (DS OLD TEAM	0.394
3	26	2002	21FLDEP 302755408420035	WDD AT THARPE ST	0.274
				median	**0.394**

Total Phosphorus

Month	Day	Year	Station	Location	mg/L
3	26	2002	21FLDEP 302718208420323	WDD AT US 90 (DS OLD TEAM	0.17
3	26	2002	21FLDEP 302755408420035	WDD AT THARPE ST	0.13
3	26	2002	21FLDEP 302718208420323	WDD AT US 90 (DS OLD TEAM	0.16
				Median	**0.16**

Dataset for Central Drainage Ditch (WBID #857)

Fecal Coliform

Month	Day	Year	Station*	Location	Counts/ ml
3	26	2002	21FLDEP	CDD AT ORANGE AVE	370
3	26	2002	21FLDEP	CDD AT STADIUM DR	730

3	26	2002	21FLDEP	CDD AT JACKSON BLUFF RD DS	300
2	20	2004	Station 6-Cascade Trail Study	Central Ditch Eppes Dr Between Jasckson Bluff and Airport Dr	220
2	20	2004	Station 7-Cascade Trail Study	Central Ditch at Lake Bradford East of Pepper	80
2	20	2004	Station 8-Cascade Trail Study	Central Ditch South of CSX Railroad on West of Gene and Gamble ST	50
2	20	2004	Station 9-Cascade Trail Study	Central Ditch at Kissimmee Street Just West of Mill	110
2	20	2004	Station 10-Cascade Trail Study	Central Ditch at West Orange Ave. West of Springhill	1601
5	7	2004	Station 6-Cascade Trail Study	Central Ditch Eppes Dr Between Jasckson Bluff and Airport Dr	300
5	7	2004	Station 7-Cascade Trail Study	Central Ditch at Lake Bradford East of Pepper	240
5	7	2004	Station 8-Cascade Trail Study	Central Ditch South of CSX Railroad on West of Gene and Gamble ST	500
5	7	2004	Station 9-Cascade Trail Study	Central Ditch at Kissimmee Street Just West of Mill	1601
5	7	2004	Station 10-Cascade Trail Study	Central Ditch at West Orange Ave. West of Springhill	900
				(Median of Violations only)	**900**

Total Coliform

Month	Day	Year	Station	Location	Counts/ ml
3	26	2002	21FLDEP 302445608418169	CDD AT ORANGE AVE	**19000**
3	26	2002	21FLDEP 302609908418122	CDD AT STADIUM DR	**48000**
3	26	2002	21FLDEP 302538808418036	CDD AT JACKSON BLUFF RD DS	1600
				Median (violations only)	**33,500**

Total Nitrogen

Month	Day	Year	Station	Location	mg/L
3	17	1999	21FLDEP 302445608418169	CDD AT ORANGE AVE	0.73
3	26	2002	21FLDEP 302538808418036	CDD AT JACKSON BLUFF RD DS	0.94
3	26	2002	21FLDEP 302609908418122	CDD AT STADIUM DR	0.75
3	26	2002	21FLDEP 302445608418169	CDD AT ORANGE AVE	0.37
2	20	2004	Station 6-Cascade Trail Study	Central Ditch Eppes Dr Between Jasckson Bluff and Airport Dr	0.96
2	20	2004	Station 7-Cascade Trail Study	Central Ditch at Lake Bradford East of	0.53

2	20	2004	Station 8-Cascade Trail Study	Central Ditch South of CSX Railroad on West of Gene and Gamble ST	0.64
2	20	2004	Station 9-Cascade Trail Study	Central Ditch at Kissimmee Street Just West of Mill	0.54
2	20	2004	Station 10-Cascade Trail Study	Central Ditch at West Orange Ave. West of Springhill	0.95
				Median	**0.726**

Total Phosphorus

Month	Day	Year	Station	Location	mg/L
3	8	1993	FLAMINREF		0.10
3	8	1993	FLAMINTEST		0.12
3	17	1999	21FLDEP 302445608418169	CDD AT ORANGE AVE	0.11
3	26	2002	21FLDEP 302609908418122	CDD AT STADIUM DR	0.18
3	26	2002	21FLDEP 302538808418036	CDD AT JACKSON BLUFF RD DS	0.092
3	26	2002	21FLDEP 302445608418169	CDD AT ORANGE AVE	0.11
2	20	2004	Station 6-Cascade Trail Study	Central Ditch Eppes Dr Between Jasckson Bluff and Airport Dr	0.13
2	20	2004	Station 7-Cascade Trail Study	Central Ditch at Lake Bradford East of Pepper	0.09
2	20	2004	Station 8-Cascade Trail Study	Central Ditch South of CSX Railroad on West of Gene and Gamble ST	0.14
2	20	2004	Station 9-Cascade Trail Study	Central Ditch at Kissimmee Street Just West of Mill	0.13
2	20	2004	Station 10-Cascade Trail Study	Central Ditch at West Orange Ave. West of Springhill	0.11
				Median	**0.11**

*The Cascade Trail study is reported in Environmental and Geotechnical Specialists, Inc (2004).

Data for St. Augustine Branch (WBID #865)

Fecal Coliform

Month	Day	Year	Station	Location	Counts/mL
3	17	1999	-	-	176
3	26	2002	21FLDEP 302606908416359	ST AUGUSTINE BR AT GAINES ST	**760**

3	26	2002	21FLDEP 302555808417233	ST AUGUSTIN BR AT WAHNISH WAY AND	270
2	20	2004	Station 1- Cascade Trail Study	St. Augustine Branch at Bloxham St. South of Gaines	50
2	20	2004	Station 2- Cascade Trail Study	St. Augustine Branch at South Monroe St. South of CSC Raiulroad	90
2	20	2004	Station 3- Cascade Trail Study	St. Augustine Branch at Railroad Ave. and FAMU Way	**1601**
2	20	2004	Station 4- Cascade Trail Study	St. Augustine Branch at Gamble St.	**500**
2	20	2004	Station 5- Cascade Trail Study	St. Augustine Branch at Franklin Blvd. South of Tennessee	**900**
5	7	2004	Station 1- Cascade Trail Study	St. Augustine Branch at Bloxham St. South of Gaines	1601
5	7	2004	Station 2- Cascade Trail Study	St. Augustine Branch at South Monroe St. South of CSC Raiulroad	500
5	7	2004	Station 3- Cascade Trail Study	St. Augustine Branch at Railroad Ave. and FAMU Way	**1601**
5	7	2004	Station 4- Cascade Trail Study	St. Augustine Branch at Gamble St.	**1601**
5	7	2004	Station 5- Cascade Trail Study	St. Augustine Branch at Franklin Blvd. South of Tennessee	**1601**
				Median (violations only)	**1601**

Total Coliform

Month	Day	Year	Station*	Location	Counts/mL
3	17	1999			475
3	26	2002	21FLDEP	ST AUGUSTINE BR AT GAINES	**16000**
3	26	2002	21FLDEP	ST AUGUSTINE BR AT	**8500**
				Median (violations only)	**12,250**

Total Nitrogen

Month	Day	Year	Station*	Location	mg/L
3	17	1999	21FLDEP	ST AUGUSTINE BR AT	0.51
3	26	2002	21FLDEP	ST AUGUSTINE BR AT	0.36
3	26	2002	21FLDEP	ST AUGUSTINE BR AT GAINES	0.66

2	20	2004	Station 1-Cascade Trail Study	St Augustine Branch at Franklin Blvd South of Tennessee St.	1.30
2	20	2004	Station 2-Cascade Trail Study	St Augustine Branch at Bloxham St. South of Gaines	0.95
2	20	2004	Station 3-Cascade Trail Study	St Augustine Branch at South Monroe south of CSX Railroad	2.00
2	20	2004	Station 4-Cascade Trail Study	St Augustine Branch at Railroad Ave. and FAMU Way	1.10
2	20	2004	Station 5-Cascade Trail Study	St Augustine Branch at Gable St. North of CSX Railroad	1.10
				Median	**1.03**
Total Phosphorus					
Month	**Day**	**Year**	**Station**	**Location**	**mg/L**
3	17	1999	21FLDEP	ST AUGUSTINE BR AT	0.05
3	26	2002	21FLDEP	ST AUGUSTINE BR AT	0.08
3	26	2002	21FLDEP	ST AUGUSTINE BR AT GAINES	0.20
2	20	2004	Station 1-Cascade Trail Study	St Augustine Branch at Franklin Blvd South of Tennessee St	0.09
2	20	2004	Station 2-Cascade Trail Study	St Augustine Branch at Bloxham St. South of Gaines	0.09
2	20	2004	Station 3-Cascade Trail Study	St Augustine Branch at South Monroe south of CSX Railroad	0.15
2	20	2004	Station 4-Cascade Trail Study	St Augustine Branch at Railroad Ave. and FAMU Way	0.09
2	20	2004	Station 5-Cascade Trail Study	St Augustine Branch at Gable St. North of CSX Railroad	0.09
				Median	**0.09**

*The Cascade Trail study is reported in Environmental and Geotechnical Specialists, Inc (2004)

East Drainage Ditch (WBID #916)

Fecal Coliform					
Month	**Day**	**Year**	**Station**	**Location**	**Counts/mL**
2	18	1997		ST MARK'S BASIN STUDY	168
3	23	1999		APAKINNENE	30

8	29	2000	21FLGW 8634	NWA-HS-1025	60
8	29	2000	21FLGW 8640	NWA-HS-1035	270
3	26	2002	21FLDEP 302459308414372	EAST DRAINAGE DITCH (EDD) AT PAUL	30
3	26	2002	21FLDEP 302439608417234	EDD AT WAHNISH WAY	270
3	26	2002	21FLDEP 302501008415298	INDIANHEAD CRK AT WEKAWA NENE	1300
3	26	2002	21FLDEP 302448708415057	EDD AT BLAIRSTONE RD	3400
3	26	2002	21FLDEP 302511808416273	COUNTRY CLUB CRK AT MAGNOLIA DR	230
3	26	2002	21FLDEP 302406008418144	EDD AT N RIDGE RD	76
3	26	2002	21FLDEP 302439608417234	EDD AT WAHNISH WAY	350
				Median (violations only)	**2,350**

Total Coliform

Month	Day	Year	Station	Location	Counts/mL
2	18	1997		ENGLISH BRANCH	640
3	23	1999		APAKINNENE	877
8	29	2000	21FLGW 8634	NWA-HS-1025	120
8	29	2000	21FLGW 8640	NWA-HS-1035	1200
3	26	2002	21FLDEP 302406008418144	EDD AT N RIDGE RD	2600
3	26	2002	21FLDEP 302459308414372	EAST DRAINAGE DITCH (EDD) AT PAUL	130
3	26	2002	21FLDEP 302501008415298	INDIANHEAD CRK AT WEKAWA NENE	5000
3	26	2002	21FLDEP 302439608417234	EDD AT WAHNISH WAY	2500
3	26	2002	21FLDEP 302439608417234	EDD AT WAHNISH WAY	4500
3	26	2002	21FLDEP 302511808416273	COUNTRY CLUB CRK AT MAGNOLIA DR	3600
3	26	2002	21FLDEP 302448708415057	EDD AT BLAIRSTONE RD	11000
				Median (violations only)	**4,050**