FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Management

NORTHEAST DISTRICT • LOWER ST. JOHNS BASIN

Final TMDL Report

Fecal Coliform TMDL for Big Fishweir Creek, WBID 2280

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Contents

List of Tables

List of Figures

Websites

Florida Department of Environmental Protection, Bureau of Watershed Management

Total Maximum Daily Load (TMDL) Program
http://www.dep.state.fl.us/water/tmdl/index.htm
Identification of Impaired Surface Waters Rule
http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf
STORET Program
http://www.dep.state.fl.us/water/storet/index.htm
2008 305(b) Report
http://www.dep.state.fl.us/water/docs/2008_Integrated_Report.pdf
Criteria for Surface Water Quality Classifications
http://www.dep.state.fl.us/water/wqssp/classes.htm
Basin Status Report for the Lower St. Johns Basin
http://www.dep.state.fl.us/water/tmdl/stat_rep.htm
Water Quality Assessment Report for the Lower St. Johns Basin
http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida
http://www.epa.gov/region4/water/tmdl/florida/
National STORET Program
http://www.epa.gov/storet/

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform for Big Fishweir Creek, located in the Julington Creek Planning Unit of the Lower St. Johns Basin. The creek has been verified as impaired for fecal coliform, and was included on the Verified List of impaired waters for the Lower St. Johns Basin that was adopted by Secretarial Order in May 2004. This TMDL establishes the allowable loadings to Big Fishweir Creek that would restore the waterbody so that it meets its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

Big Fishweir Creek, located in Duval County in northeast Florida, has a drainage area of approximately 3.66 square miles (mi^2). The creek flows into the Ortega River, near its confluence to the St. Johns River (**Figures 1.1** and **1.2**). Big Fishweir Creek is about 2.25 miles long, is a second-order stream, and is tidally influenced. Little Fishweir Creek is a large tributary to Big Fishweir Creek and has its confluence near the mouth of Big Fishweir Creek.

The Big Fishweir Creek watershed is located in the central part of Duval County, on the north side of the Ortega River and on the west side of the St. Johns River. Additional information about the creek's hydrology and geology are available in the Basin Status Report for the Lower St. Johns Basin (Florida Department of Environmental Protection [Department], 2004).

For assessment purposes, the Department has divided the Lower St. Johns Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. Big Fishweir Creek consists of one segment, WBID 2280 (**Figure 1.2**), which this TMDL addresses.

Big Fishweir Creek is part of the Ortega River Planning Unit. Planning units are groups of smaller watersheds (WBIDs) that are part of a larger basin unit, in this case the Lower St. Johns Basin. The Ortega River Planning Unit consists of 30 WBIDs. **Figure 1.3** shows Big Fishweir Creek's location in the planning unit and the boundaries of the other WBIDs in the planning unit.

Figure 1.1. Location of Big Fishweir Creek, WBID 2280, and Major Geopolitical Features in the Lower St. Johns Basin

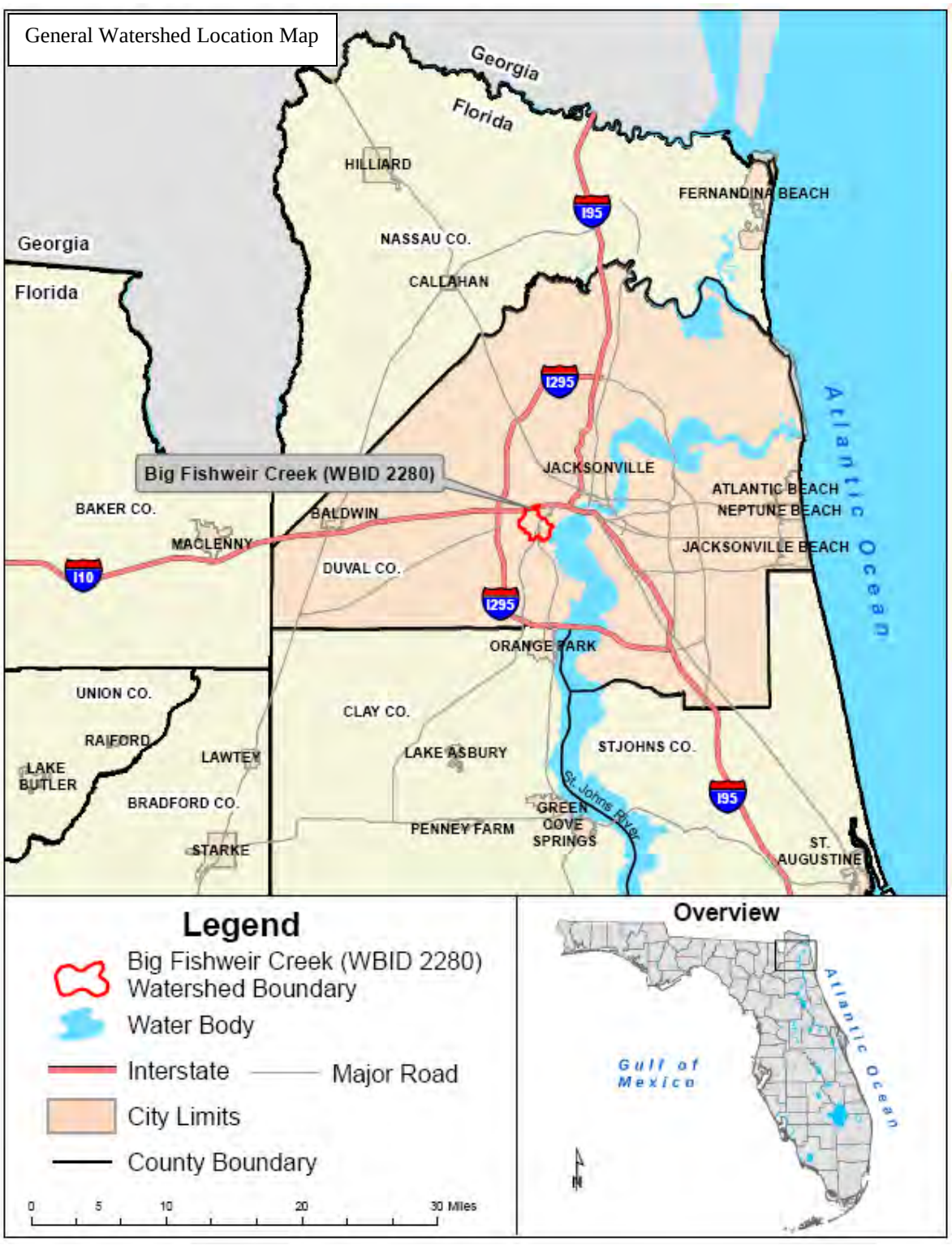


Figure 1.2. Overview of the Big Fishweir Creek Watershed, WBID 2280

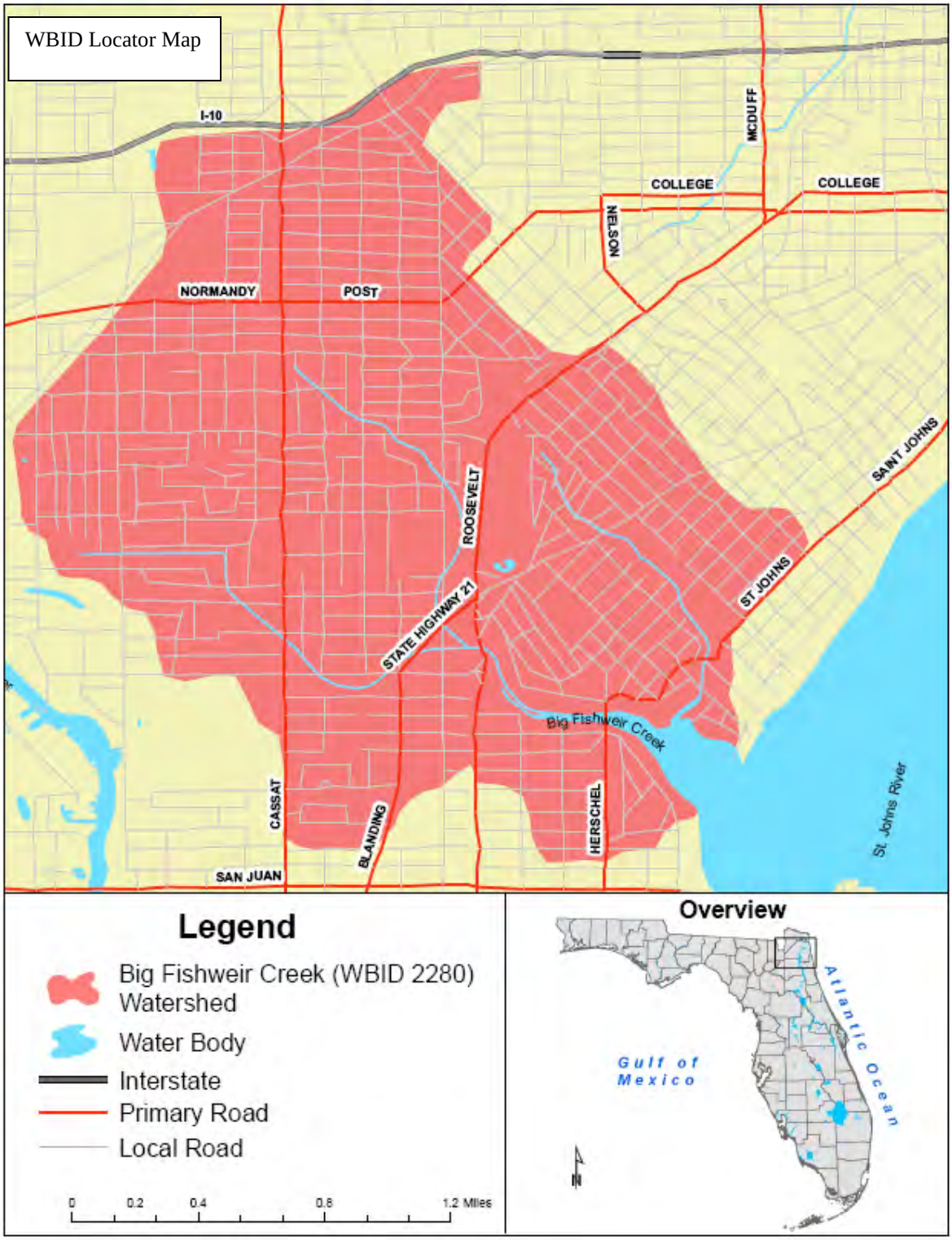
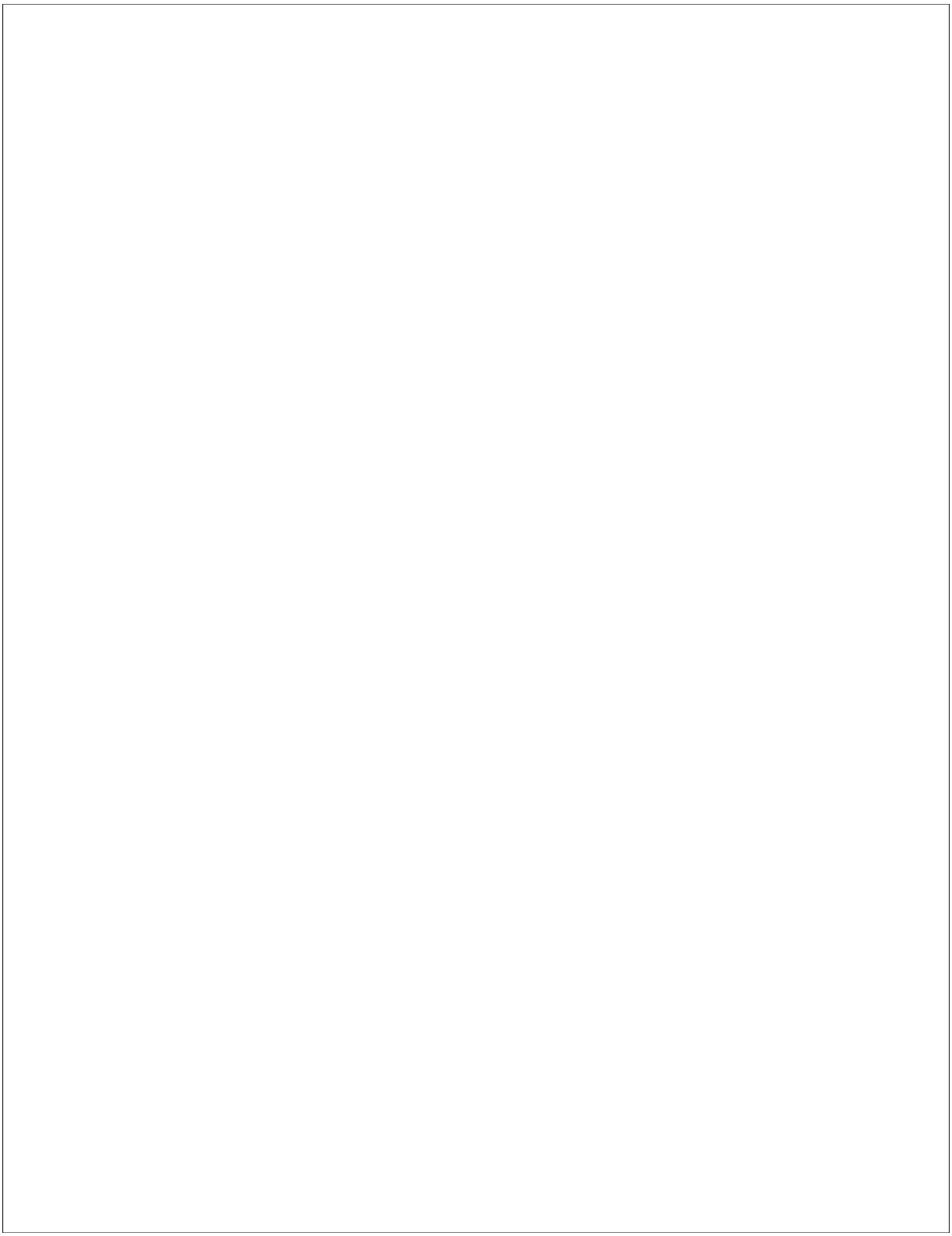


Figure 1.3. WBIDs in the Ortega River Planning Unit



1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. They provide important water quality restoration goals that will guide restoration activities.

This TMDL Report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of fecal coliform that caused the verified impairment of Big Fishweir Creek. These activities will depend heavily on the active participation of the St. Johns River Water Management District (SJRWMD), city of Jacksonville, Jacksonville Electric Authority (JEA), local businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing impairment of these waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]), and the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 55 waterbodies and 277 parameters in the Lower St. Johns Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rule-making process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was amended in 2006 and again in 2007.

2.1.1 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in Big Fishweir Creek and has verified that the creek is impaired for fecal coliform based on data in the Department's IWR database. **Tables 2.1** through **2.3** provide summary results for fecal coliform data for the verification period (which for Group 2 waters was January 1, 1996, to June 30, 2003), by month, season, and year, respectively. There are 22 observations collected after June 30, 2003 that are not reflected below.

There is an 83.7 percent overall exceedance rate for fecal coliform in Big Fishweir Creek and an 82.8 percent exceedance rate for the verified period. Exceedances occur in all 10 months for which data exist; there are no data from June or November (**Table 2.1**). There are 4 months with a 100 percent exceedance rate. Seasonally, exceedances occur in all seasons; exceedance rates are highest in the summer and fall (92.86 percent each), with the lowest exceedance rate occurring in the spring (56.25 percent) (**Table 2.2**). A total of 64 samples were collected within the verified period, ranging from 10 counts per 100 milliliters (counts/100mL) to 160,000 counts/100mL; 53 of the 64 observations exceed the state criterion of 400 counts/100mL.

Within the verified period in the Big Fishweir Creek watershed, data were collected between October 1996 and May 2003. When considering the data by year, all years have at least a 62 percent exceedance rate.

Table 2.1. Summary of Fecal Coliform Data by Month for the Verified Period (January 1, 1996–June 30, 2003), WBID 2280

Month	N	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Mean Precipitation
January	4	300	5,000	1,750	2,200	3	75.00	3.26
February	10	420	4,000	1,565	1,781	10	100.00	3.52
March	6	264	17,200	496	3,878	5	83.33	3.90
April	7	10	5,000	700	1,137	4	57.14	2.89
May	9	40	5,000	480	1,668	5	55.56	3.41
June	-	-	-	-	-	-	-	6.31
July	3	1,700	90,000	5,000	32,233	3	100.00	6.50
August	4	3,000	160,000	5,000	43,250	4	100.00	7.05
September	7	210	10,000	6,400	4,915	6	85.71	7.52
October	6	330	50,000	2,050	10,788	5	83.33	3.82
November	-	-	-	-	-	-	-	2.04
December	8	1,790	160,000	7,750	26,448	8	100.00	2.61

Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Mean precipitation is for Jacksonville International Airport (JIA) in inches. Means are monthly means based on data from 1955 to 2008.
- = No data available for month shown.

Table 2.2. Summary of Fecal Coliform Data by Season for the Verified Period (January 1, 1996–June 30, 2003), WBID 2280

Season	N	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Mean Total Precipitation
Winter	20	264	17,200	1,700	2,493	18	90.00	10.68
Spring	16	10	5,000	2,500	1,436	9	56.25	12.61
Summer	14	210	160,000	486	21,722	13	92.86	21.52
Fall	14	330	160,000	5,000	19,737	13	92.86	8.47

Winter is January–March; spring is April–June; summer is July–September; fall is October–December.
Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Mean precipitation is for JIA in inches. Means are based on the three months which constitute each season from 1955 – 2008.

Table 2.3. Summary of Fecal Coliform Data by Year for the Verified Period (January 1, 1996–June 30, 2003), WBID 2280

Year	N	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Total Precipitation
1996	2	1,300	2,400	1,850	1,850	2	100.00	57.27
1998	6	40	90,000	5,350	25,173	4	66.67	56.72
1999	8	330	5,000	3,000	3,041	7	87.50	42.44
2000	8	140	160,000	500	22,293	5	62.50	39.77
2001	12	10	160,000	2,500	16,450	10	83.33	49.14
2002	22	264	17,200	927	3,607	19	86.36	54.72
2003[1]	6	700	5,000	3,000	3,183	6	100.00	44.47

Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Precipitation is for JIA in inches, and represents the total precipitation for the year shown.
[1] 2003 only includes data through June 30, which is the end of the verified period.

Chapter 3: DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

Big Fishweir Creek is a Class III fresh waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criterion applicable to the impairment addressed by this TMDL is for fecal coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

3.2.1 Fecal Coliform Criterion

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentrations. The water quality criteria for protection of Class III waters, as established by Chapter 62-302, F.A.C., states the following:

> ***Fecal Coliform Bacteria****:*
> *The most probable number (MPN) or membrane filter (MF) counts/100mL of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.*

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. However, there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDL was not to exceed 400 counts/mL.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants 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 source" 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 System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, such as those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

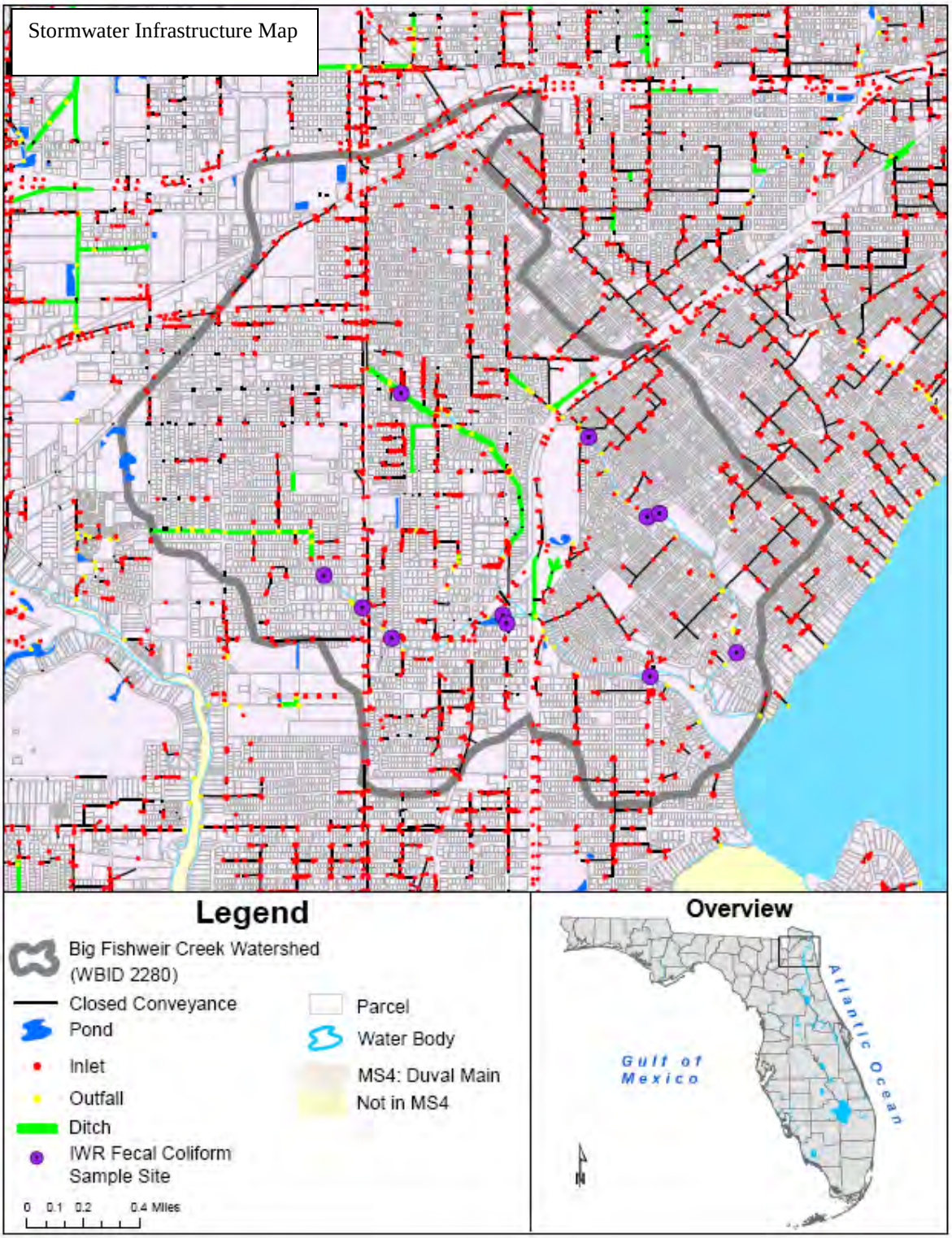
To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **AND** stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). 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.

4.2 Potential Sources of Coliform in the Big Fishweir Creek Watershed

4.2.1 Point Sources

There are no permitted wastewater facilities located in the watershed; therefore, impacts from wastewater facilities should be of minimal concern. **Figure 4.1** shows the stormwater infrastructure of the watershed. Outfalls represent points where a conveyance of stormwater discharges into a separate stormwater system through a channelized or natural waterway. Inlets are a component of the stormwater system located along the curbed edge of paved surfaces or the low point of an area to provide for the collection of stormwater runoff, access for inspection and maintenance, pipe junctions, sediment traps, or conflicts with other utilities (K. Grable, personal communication, October 16, 2008). In the Big Fishweir Creek watershed, there are 50 outfalls and 419 inlets.

Figure 4.1. Stormwater Infrastructure in the Big Fishweir Creek Watershed, WBID 2280



Municipal Separate Storm Sewer System Permittees

The city of Jacksonville and the Florida Department of Transportation (FDOT) District 2 are copermittees for a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000012) that includes the Big Fishweir Creek watershed.

4.2.2 Land Uses and Nonpoint Sources

Additional coliform loadings to Big Fishweir Creek are generated from nonpoint sources in the watershed. Potential nonpoint sources of coliform include loadings from surface runoff, wildlife, pets, leaking or overflowing sewer lines, and leaking septic tanks.

Land Uses

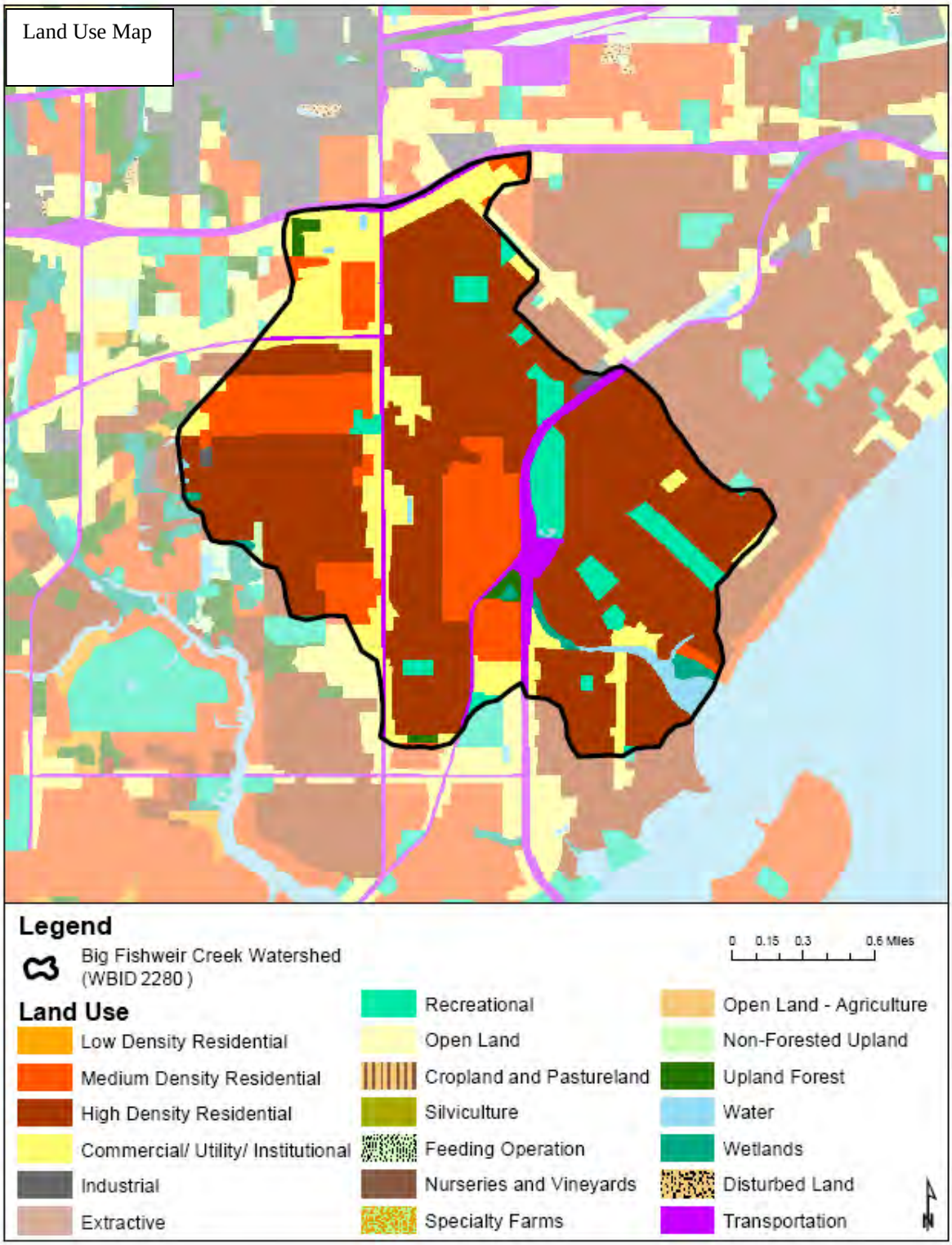
The spatial distribution and acreage of different land use categories were identified using the 2004 land use coverage contained in the Department's Geographic Information System (GIS) library, initially provided by the SJRWMD. Land use categories and acreages in the watershed were aggregated using the Level 2 codes tabulated in **Table 4.1. Figure 4.2** shows the principal Level 2 land uses in the watershed.

Being located near downtown Jacksonville, the Big Fishweir Creek watershed is highly urbanized. As **Table 4.1** shows, the majority of the land is high-density residential (58.7 percent), medium-density residential (15.1 percent), and commercial and services (13.1 percent). Natural areas occupy a very meager 3.1 percent (73.2 acres) of the watershed, attesting to how developed this watershed is.

Table 4.1. Level 2 Land Use Categories in the Big Fishweir Creek Watershed, WBID 2280

WBID	2004 Land Use	Acres	% of Total
2280	High-Density Residential	1,376.8	58.7
2280	Medium-Density Residential	353.0	15.1
2280	Commercial/Utility/Institutional	307.2	13.1
2280	Recreational	129.4	5.5
2280	Transportation	97.8	4.2
2280	Water	33.0	1.4
2280	Wetlands	20.1	0.9
2280	Upland Forest	15.7	0.7
2280	Industrial	6.1	0.3
2280	Nonforested Upland	4.4	0.2
TOTAL:		**2,343.5**	**100**

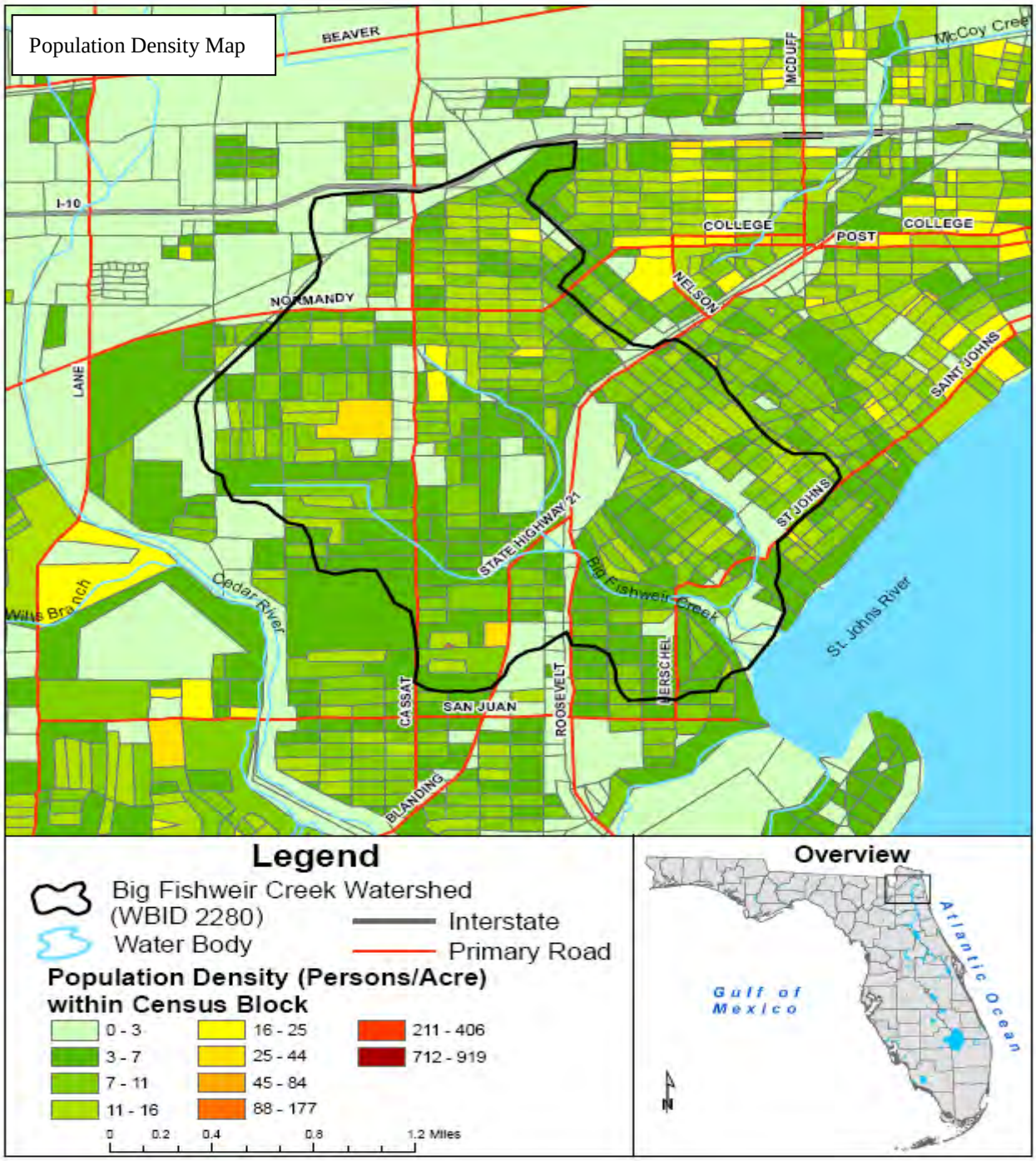
Figure 4.2. Principal Level 2 Land Uses in the Big Fishweir Creek Watershed, WBID 2280, in 2004



Population

According to the U.S Census Bureau, census block population densities in the Big Fishweir Creek watershed in the year 2000 ranged from 0 to 50,273 people/mi², with an average of 3,840 people/mi² (**Figure 4.3**). The estimated population in the watershed is 15,202 people. The Census Bureau reports that, for all of Duval County, the total population for 2000 was approximately 780,000, with 329,778 housing units and an average occupancy rate of 92.1 percent (303,747 units); additionally, the Bureau reported a housing density of 426 houses per square mile. This places Duval County seventh in housing densities and population in Florida (U.S. Census Bureau Website, 2005). The estimated average housing density in the Big Fishweir Creek watershed is 1,846 houses per square mile (based on population), which is considerably higher than the county average.

Figure 4.3. Population Density in the Big Fishweir Creek Watershed, WBID 2280, in 2000



Septic Tanks

Approximately 78 percent of Duval County residences are connected to a wastewater treatment plant, while the rest use septic tanks (JEA Water and Sewer Expansion Authority [WSEA] septic files) (PBS&J, 2007; and Florida Department of Health [FDOH] Website, 2006b). FDOH reports that as of fiscal year 2003–04, there were 88,834 permitted septic tanks in Duval County and for fiscal years 1993 to 2004, 5,479 permits for repairs were issued, or an average of approximately 457 repairs annually countywide.

As noted previously, there are about 3,840 people/mi^2, or 15,202 people, in the Big Fishweir Creek watershed. The average household has 2.25 people (see **Table 4.2**). The Department obtained septic tank repair permit data from JEA for its service area, which includes the Big Fishweir Creek watershed. The data include septic tank repair permit records issued from 1990 to 2006, areas serviced by a WWTF, and areas where large numbers of failing septic tanks are present. This information is presented in **Figure 4.4** in map form. The data show that 392 permits for repairs were issued during this time in the watershed. This equates to an average of 24.5 permits issued per year, which can be rounded up to 25 (to allow for those septic tanks where failures may not be known or have not been repaired). With 25 septic tank failures, 2.25 people per household, and using an estimate of 70 gallons/day/person (EPA, 2001), a potential loading of 5.7 x 10^9 fecal colonies/day is derived. **Table 4.3** shows this estimation.

Table 4.2. Estimated Average Household Size in the Big Fishweir Creek Watershed, WBID 2280

Household Size	Number of Households	% of Total	Number of People
1-person household	2,270	33.59%	2,270
2-person household	2,319	34.31%	4,638
3-person household	1,058	15.66%	3,174
4-person household	664	9.83%	2,656
5-person household	273	4.04%	1,365
6-person household	119	1.76%	714
7-or-more-person household	55	0.81%	385
TOTAL:	**6,758**	**100.00%**	**15,202**
		AVERAGE HOUSEHOLD SIZE:	**2.25**

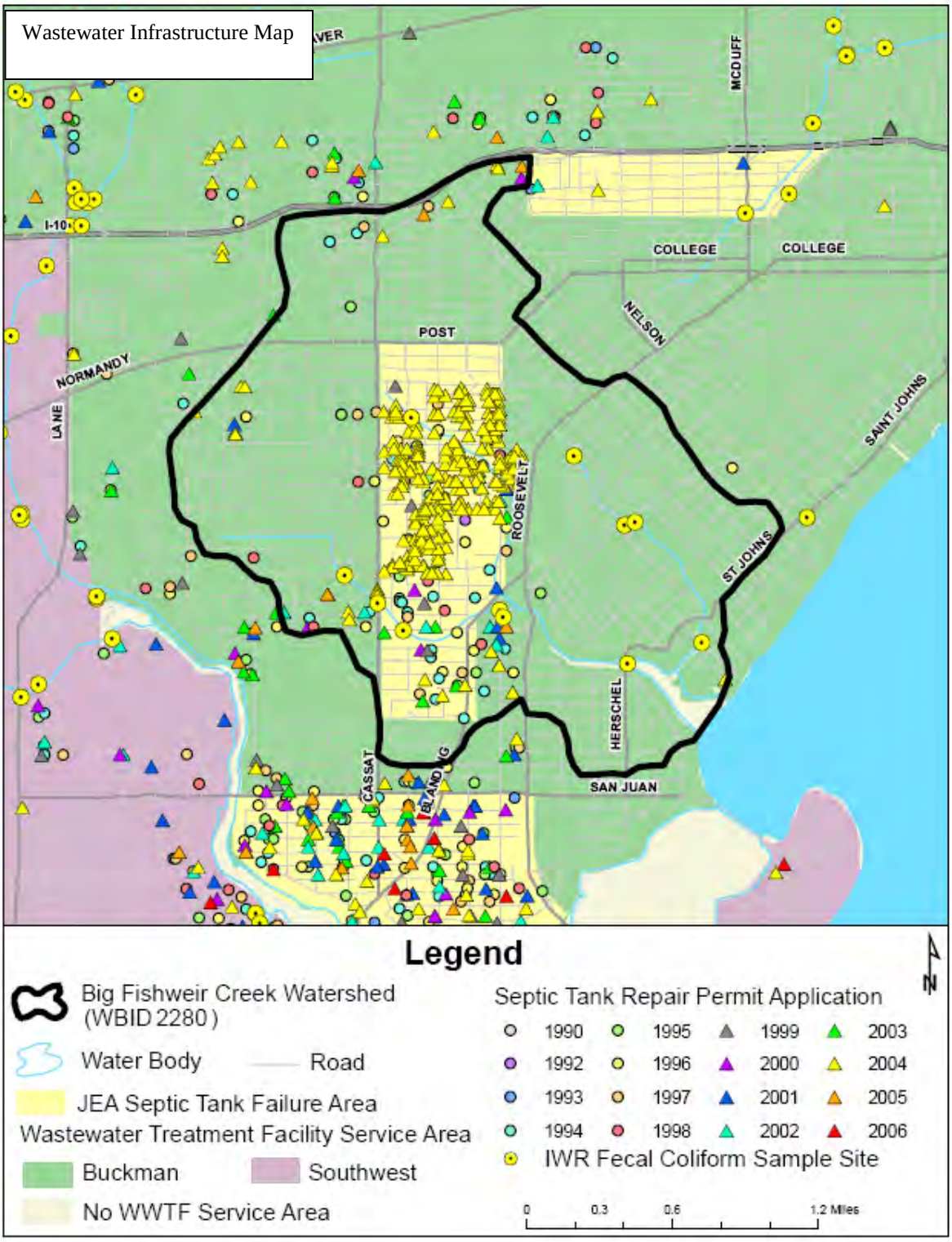
Data from U.S. Census Bureau Website, 2006, based on the Duval County blocks present in the Big Fishweir Creek watershed.

Table 4.3. Estimated Annual Fecal Coliform Loading from Failed Septic Tanks in the Big Fishweir Creek Watershed, WBID 2280

Estimated Number of Tank Failures[1]	Estimated Number People per Household[2]	Gallons/ Person/ Day[3]	Estimated Load from Failed Tanks[3]	Estimated Daily Load (counts/day)	Estimated Annual Load (counts/year)
25	2.25	70	1.00 x 10^4/mL	1.49 x 10^{11}	5.44 x 10^{13}

[1] Based on septic tank repair permits issued in the watershed from March 1990 to April 2004 (FDOH and JEA information); see text.
[2] From U.S Census Bureau; see **Table 4.2** for more information on this estimate.
[3] EPA, 2001.

Figure 4.4. Septic Tank Overflows in the Big Fishweir Creek Watershed, WBID 2280, 1990–2006



4.2.3 Other Potential Sources

Pets

It is possible that pets, especially dogs, have an impact on the waterbody. The Department has been unable to obtain data on the number of dogs in the area; however, estimates can be made using literature-based values of dog ownership rates (**Table 4.4**). For example, using household-to-dog ratio estimates from the American Veterinary Medical Association (AVMA), the approximate loading is 1.22×10^{12} organisms/day.

Table 4.4. Estimated Loading from Dogs in the Big Fishweir Creek Watershed, WBID 2280

Estimated Number of Households in 2280	Estimated Household:Dog Ratio[1]	Estimated Dog Population in Watershed	Estimated Number of Dogs with Impact to Creek	Estimated Counts/ Dog/Day[2]	Estimated Daily Load (counts/day)	Estimated Annual Load (counts/year)
6,758	0.361	2,440	244	5×10^{9}	1.22×10^{12}	4.45×10^{14}

[1] From the AVMA Website, which states the original source to be the *U.S Pet Ownership and Demographics Sourcebook*, 2002.
[2] EPA, 2001.

Leaking or Overflowing Wastewater Collection Systems

As noted previously, about 78 percent of households in Duval County are connected to a wastewater facility. Assuming 6,758 homes in the watershed, with 2.25 people per home, and a 70-gallon-per-person-per-day discharge, and also assuming that the countywide average of 78 percent are connected to a WWTF applies in Big Fishweir Creek, a daily flow of approximately 3.14×10^{6} liters (L) is transported through the collection system. The EPA (Davis, 2002) suggests that a 5 percent leakage rate from collection systems is a realistic estimate. Based on this rate and EPA values for fecal coliform in raw sewage, the potential loadings of fecal coliform from leaking sewer lines is 7.86×10^{12} counts/day (**Table 4.5**).

Table 4.5. Estimated Loading from Wastewater Collection Systems in the Big Fishweir Creek Watershed, WBID 2280

Estimated Homes on Central Sewer	Estimated Daily Flow (L)	Daily Leakage (L)	Raw Sewage (counts/100mL)	Estimated Daily Load (counts/day)	Estimated Annual Load (counts/year)
5,271	3.14×10^{6}	1.57×10^{5}	5×10^{6}	7.86×10^{12}	2.87×10^{15}

4.3 Source Summary

Table 4.6 summarizes the estimates from various sources. It is important to note that this is not a complete list (wildlife, for example, is missing) and represents estimates of potential loadings. Proximity to the waterbody, rainfall frequency and magnitude, soil types, drainage patterns, and temperature are just a few of the factors that could influence and determine the actual loadings from these sources that reach Big FishweirCreek.

Table 4.6. Summary of Estimated Potential Coliform Loading from Various Sources in the Big Fishweir Creek Watershed, WBID 2280

Source	Fecal Coliform	
	Estimated Daily Load (counts/day)	Estimated Annual Load (counts/year)
Permitted Facilities	N/A*	N/A*
Septic Tanks	1.49×10^{11}	5.44×10^{13}
Pets	1.22×10^{12}	4.45×10^{14}
Collection Systems	7.86×10^{12}	2.87×10^{15}

N/A = Not applicable

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The methodology used for this TMDL was the "percent reduction" methodology. The Department generally prefers to use the load duration curve or "Kansas method" for coliform TMDLs, but this method could not be used because there are no stream gauging stations on Big Fishweir Creek. To determine the TMDL, the percent reduction that would be required for each of the exceedances to meet the applicable criterion was determined, and the median value of all of these reductions for fecal coliform determined the overall required reduction, and is therefore the TMDL.

5.1.1 Data Used in the Determination of the TMDL

In addition to data in the Department's IWR database, the city of Jacksonville and U.S. Geological Survey (USGS) submitted additional data collected after the verified period. These data are included below and all were considered in TMDL development.

There are 13 sampling stations on Big Fishweir Creek that have fecal coliform observations (**Figure 5.1**). **Table 5.1** shows data collection information for each of the stations; **Figure 5.1** shows the location of the sample sites. **Table 5.2** shows observed historical data analysis, and **Appendix B** contains the fecal coliform observations for the entire period of record from the sites for the planning and verified periods for the Lower St. Johns Basin. **Figure 5.2** shows the historical observations visually over time.

Table 5.1. Sampling Station Summary for Big Fishweir Creek, WBID 2280

Station	Station Owner	Year											
		1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
112WRD 02246465	USGS				11	12	9					1	
112WRD 02246467	USGS				11	12	8						
21FLA 20030775	Department										1		
21FLA 20030776	Department										2	4	
21FLA 20030777	Department										5	11	1
21FLA 20030778	Department										3	6	
21FLA 20030797	Department										4	6	1
21FLA 20030798	Department										4	5	1
21FLA 20030799	Department										4	6	1
21FLA 20030801	Department										2	12	1
21FLJXWQCR139	City of Jacksonville	2	6	8	8	6	4	5	4	4	4	4	
21FLJXWQCR5	City of Jacksonville	2	6	8	8	7	15	10	10	9	4	4	
21FLJXWQCR6	City of Jacksonville					7	4	4	4	4	4	4	
N		**4**	**12**	**16**	**38**	**44**	**40**	**19**	**18**	**17**	**37**	**63**	**5**
											TOTAL:	**313**	

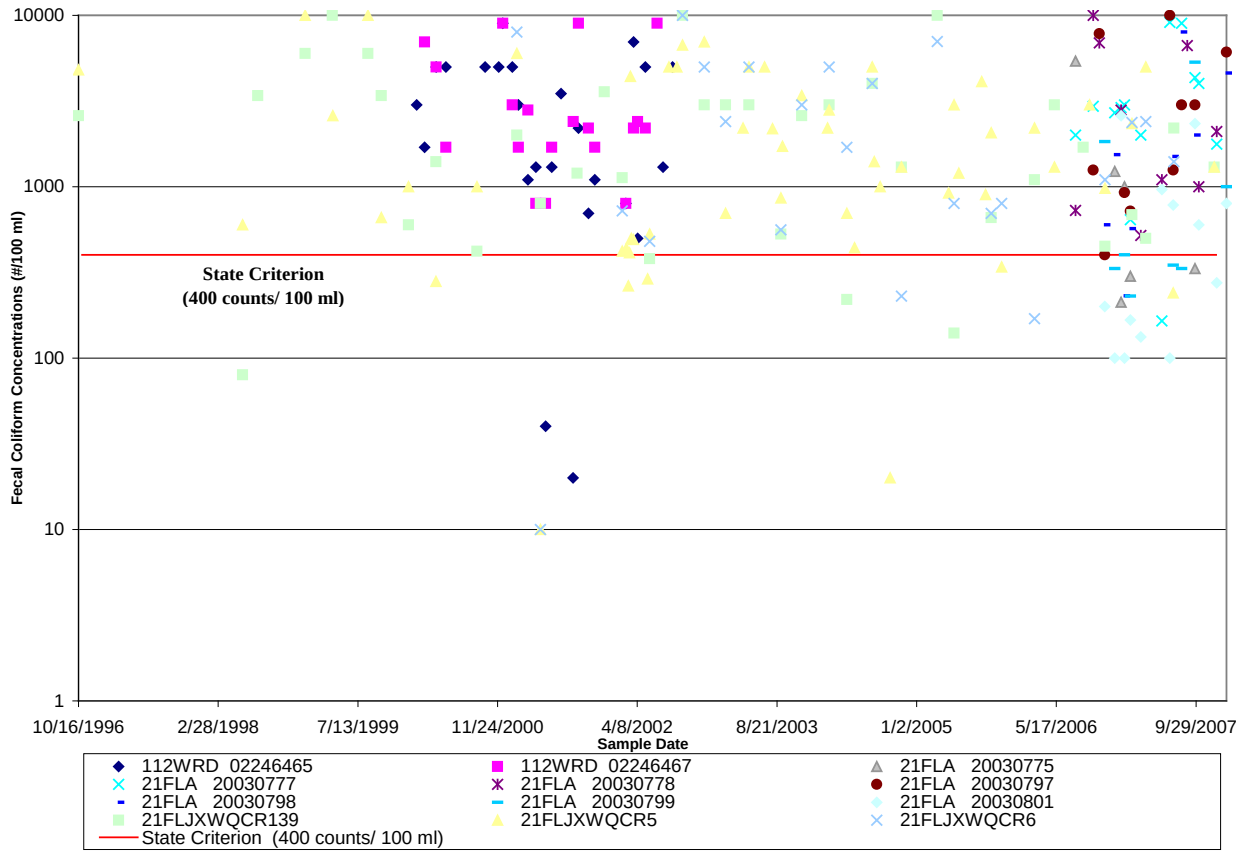
Table 5.2. Statistical Summary of Historical Data for Big Fishweir Creek, WBID 2280

Station	N	Max	Min	Median	Number of Exceedances	% Exceedances
112WRD 02246465	33	160,000	20	5,000	31	93.9%
112WRD 02246467	31	160,000	800	7,000	31	100.0%
21FLA 20030775	1	2,900	2,900	2,900	1	100.0%
21FLA 20030776	6	5,400	212	667	3	50.0%
21FLA 20030777	17	260,000	165	3,000	16	94.1%
21FLA 20030778	9	10,000	520	2,100	9	100.0%
21FLA 20030797	11	38,333	400	3,000	11	100.0%
21FLA 20030798	10	33,667	231	1,769	9	90.0%
21FLA 20030799	11	49,333	230	1,000	7	63.6%
21FLA 20030801	15	19,000	100	600	8	53.3%
21FLJXWQCR139	55	50,000	40	1,700	46	83.6%
21FLJXWQCR5	83	160,000	10	1,700	68	81.9%
21FLJXWQCR6	31	30,000	10	3,000	28	90.3%

Coliform concentrations are counts/100mL.

Figure 5.1. Historical Sample Sites in Big Fishweir Creek, WBID 2280

Figure 5.2. Historical Fecal Coliform Observations in Big Fishweir Creek, WBID 2280, 1996–2007



5.1.2 TMDL Development Process

Due to the lack of supporting flow information, a simple calculation was performed to determine the needed reduction. Exceedances of the state criterion were compared with the criterion of 400 counts/100mL. For each individual exceedance, an individual required reduction was calculated using the following:

$$\frac{[(\text{observed value}) - (\text{state criterion})] \times 100}{(\text{observed value})}$$

After the individual results were calculated, the median of the individual values was calculated, which is 86.7 percent. This means that in order to meet the state criterion of 400 counts/100mL in Big Fishweir Creek, an 86.7 percent reduction in current loading is necessary and is therefore the TMDL for Big Fishweir Creek. **Table 5.3** show the individual exceedances used in calculating the TMDL for Big Fishweir Creek.

Table 5.3. Calculations to Determine the Fecal Coliform TMDL for Big Fishweir Creek, WBID 2280

Sample Date	Location	Observed Exceedance*	Required % Reduction
10/16/1996	21FLJXWQCR139	2,600	84.6%
10/16/1996	21FLJXWQCR5	4,800	91.7%
10/16/1996	21FLJXWQCR5	600	33.3%
7/13/1998	21FLJXWQCR5	180,000	99.8%
7/20/1998	21FLJXWQCR139	3,400	88.2%
10/7/1998	21FLJXWQCR139	100,000	99.6%
10/7/1998	21FLJXWQCR5	18,000	97.8%
1/5/1999	21FLJXWQCR139	6,000	93.3%
1/5/1999	21FLJXWQCR5	10,000	96.0%
4/13/1999	21FLJXWQCR139	10,000	96.0%
4/14/1999	21FLJXWQCR5	2,600	84.6%
8/18/1999	21FLJXWQCR139	6,000	93.3%
8/18/1999	21FLJXWQCR5	10,000	96.0%
10/5/1999	21FLJXWQCR139	3,400	88.2%
10/5/1999	21FLJXWQCR5	660	39.4%
1/10/2000	21FLJXWQCR139	600	33.3%
1/10/2000	21FLJXWQCR5	1,000	60.0%
2/8/2000	112WRD 02246465	3,000	86.7%
2/8/2000	112WRD 02246467	17,000	97.6%
3/8/2000	112WRD 02246465	1,700	76.5%
3/8/2000	112WRD 02246467	7,000	94.3%
4/17/2000	21FLJXWQCR139	1,400	71.4%
4/18/2000	112WRD 02246465	5,000	92.0%
4/18/2000	112WRD 02246467	5,000	92.0%
5/23/2000	112WRD 02246465	5,000	92.0%
5/23/2000	112WRD 02246467	1,700	76.5%
6/12/2000	112WRD 02246465	160,000	99.8%
6/12/2000	112WRD 02246467	160,000	99.8%
7/11/2000	112WRD 02246465	11,000	96.4%
7/11/2000	112WRD 02246467	30,000	98.7%
8/8/2000	112WRD 02246465	11,000	96.4%
8/8/2000	112WRD 02246467	16,000	97.5%
9/6/2000	112WRD 02246465	50,000	99.2%
9/6/2000	112WRD 02246467	90,000	99.6%
9/11/2000	21FLJXWQCR139	420	4.8%
9/11/2000	21FLJXWQCR5	1,000	60.0%
10/10/2000	112WRD 02246465	5,000	92.0%
10/10/2000	112WRD 02246467	50,000	99.2%
11/28/2000	112WRD 02246465	5,000	92.0%
11/28/2000	112WRD 02246467	16,000	97.5%
12/13/2000	112WRD 02246465	9,000	95.6%
12/13/2000	112WRD 02246467	9,000	95.6%
12/18/2000	21FLJXWQCR139	32,000	98.8%
12/18/2000	21FLJXWQCR5	320,000	99.9%

Sample Date	Location	Observed Exceedance*	Required % Reduction
1/16/2001	112WRD 02246465	5,000	92.0%
1/16/2001	112WRD 02246467	3,000	86.7%
2/1/2001	21FLJXWQCR139	2,000	80.0%
2/1/2001	21FLJXWQCR5	6,000	93.3%
2/1/2001	21FLJXWQCR6	8,000	95.0%
2/7/2001	112WRD 02246465	3,000	86.7%
2/7/2001	112WRD 02246467	1,700	76.5%
3/13/2001	112WRD 02246465	1,100	63.6%
3/13/2001	112WRD 02246467	2,800	85.7%
4/10/2001	112WRD 02246465	1,300	69.2%
4/10/2001	112WRD 02246467	800	50.0%
4/26/2001	21FLJXWQCR139	800	50.0%
4/26/2001	112WRD 02246467	800	50.0%
6/6/2001	112WRD 02246465	1,300	69.2%
6/6/2001	112WRD 02246467	1,700	76.5%
7/9/2001	112WRD 02246465	3,500	88.6%
7/9/2001	112WRD 02246467	16,000	97.5%
8/22/2001	112WRD 02246467	2,400	83.3%
8/29/2001	21FLJXWQCR5	320,000	99.9%
9/5/2001	21FLJXWQCR139	1,200	66.7%
9/5/2001	21FLJXWQCR6	12,800	96.9%
9/10/2001	112WRD 02246465	2,200	81.8%
9/10/2001	112WRD 02246467	9,000	95.6%
10/15/2001	112WRD 02246465	700	42.9%
10/15/2001	112WRD 02246467	2,200	81.8%
11/7/2001	112WRD 02246465	1,100	63.6%
11/7/2001	112WRD 02246467	1,700	76.5%
12/10/2001	112WRD 02246465	30,000	98.7%
12/10/2001	112WRD 02246467	90,000	99.6%
12/11/2001	21FLJXWQCR139	3,580	88.8%
12/11/2001	21FLJXWQCR5	20,600	98.1%
12/11/2001	21FLJXWQCR6	17,000	97.6%
1/15/2002	112WRD 02246465	17,000	97.6%
1/15/2002	112WRD 02246467	22,000	98.2%
2/13/2002	21FLJXWQCR139	1,130	64.6%
2/13/2002	21FLJXWQCR5	420	4.8%
2/13/2002	21FLJXWQCR6	724	44.8%
2/26/2002	112WRD 02246465	800	50.0%
2/26/2002	112WRD 02246467	800	50.0%
2/28/2002	21FLJXWQCR5	436	8.3%
3/4/2002	21FLJXWQCR5	17,776	97.7%
3/11/2002	21FLJXWQCR5	412	2.9%
3/14/2002	21FLJXWQCR5	4,400	90.9%
3/18/2002	21FLJXWQCR5	500	20.0%
3/25/2002	21FLJXWQCR5	492	18.7%
3/26/2002	112WRD 02246465	7,000	94.3%
3/26/2002	112WRD 02246467	2,200	81.8%

Sample Date	Location	Observed Exceedance*	Required % Reduction
4/9/2002	112WRD 02246465	500	20.0%
4/9/2002	112WRD 02246467	2,400	83.3%
5/7/2002	112WRD 02246465	5,000	92.0%
5/7/2002	112WRD 02246467	2,200	81.8%
5/7/2002	21FLJXWQCR5	530	24.5%
5/7/2002	21FLJXWQCR6	480	16.7%
6/18/2002	112WRD 02246465	16,000	97.5%
6/18/2002	112WRD 02246467	9,000	95.6%
7/9/2002	112WRD 02246465	1,300	69.2%
7/9/2002	112WRD 02246467	160,000	99.8%
7/30/2002	21FLJXWQCR5	5,000	92.0%
8/12/2002	112WRD 02246465	5,000	92.0%
8/28/2002	21FLJXWQCR5	5,000	92.0%
9/17/2002	21FLJXWQCR139	10,000	96.0%
9/17/2002	21FLJXWQCR5	6,700	94.0%
9/17/2002	21FLJXWQCR6	10,000	96.0%
9/25/2002	112WRD 02246465	22,000	98.2%
9/25/2002	112WRD 02246467	50,000	99.2%
12/4/2002	21FLJXWQCR139	3,000	86.7%
12/4/2002	21FLJXWQCR5	7,000	94.3%
12/4/2002	21FLJXWQCR6	5,000	92.0%
2/18/2003	21FLJXWQCR139	3,000	86.7%
2/18/2003	21FLJXWQCR5	700	42.9%
2/18/2003	21FLJXWQCR6	2,400	83.3%
4/22/2003	21FLJXWQCR5	2,200	81.8%
5/13/2003	21FLJXWQCR139	3,000	86.7%
5/13/2003	21FLJXWQCR5	5,000	92.0%
5/13/2003	21FLJXWQCR6	5,000	92.0%
7/8/2003	21FLJXWQCR5	5,000	92.0%
8/5/2003	21FLJXWQCR5	2,180	81.7%
9/4/2003	21FLJXWQCR139	530	24.5%
9/4/2003	21FLJXWQCR5	860	53.5%
9/4/2003	21FLJXWQCR6	560	28.6%
9/10/2003	21FLJXWQCR5	1,720	76.7%
11/18/2003	21FLJXWQCR139	2,600	84.6%
11/18/2003	21FLJXWQCR5	3,400	88.2%
11/18/2003	21FLJXWQCR6	3,000	86.7%
2/18/2004	21FLJXWQCR5	2,200	81.8%
2/24/2004	21FLJXWQCR139	3,000	86.7%
2/24/2004	21FLJXWQCR5	2,800	85.7%
2/24/2004	21FLJXWQCR6	5,000	92.0%
2/24/2004	21FLJXWQCR5	700	42.9%
2/24/2004	21FLJXWQCR6	1,700	76.5%
5/25/2004	21FLJXWQCR5	440	9.1%
7/27/2004	21FLJXWQCR139	4,000	90.0%
7/27/2004	21FLJXWQCR5	5,000	92.0%
7/27/2004	21FLJXWQCR6	4,000	90.0%

Sample Date	Location	Observed Exceedance*	Required % Reduction
8/3/2004	21FLJXWQCR5	1,400	71.4%
8/24/2004	21FLJXWQCR5	1,000	60.0%
11/9/2004	21FLJXWQCR139	1,300	69.2%
11/9/2004	21FLJXWQCR5	1,300	69.2%
3/17/2005	21FLJXWQCR139	10,000	96.0%
3/17/2005	21FLJXWQCR5	10,950	96.3%
3/17/2005	21FLJXWQCR6	7,035	94.3%
4/26/2005	21FLJXWQCR5	920	56.5%
4/26/2005	21FLJXWQCR5	3,000	86.7%
4/26/2005	21FLJXWQCR6	800	50.0%
6/2/2005	21FLJXWQCR5	1,200	66.7%
7/12/2005	21FLJXWQCR5	11,435	96.5%
8/23/2005	21FLJXWQCR5	4,105	90.3%
9/6/2005	21FLJXWQCR5	900	55.6%
9/26/2005	21FLJXWQCR139	660	39.4%
9/26/2005	21FLJXWQCR5	2,060	80.6%
9/26/2005	21FLJXWQCR6	700	42.9%
9/26/2005	21FLJXWQCR6	800	50.0%
12/19/2005	21FLJXWQCR139	13,300	97.0%
2/28/2006	21FLJXWQCR139	1,100	63.6%
2/28/2006	21FLJXWQCR5	2,200	81.8%
5/10/2006	21FLJXWQCR139	3,000	86.7%
5/10/2006	21FLJXWQCR5	1,300	69.2%
5/10/2006	21FLJXWQCR6	30,000	98.7%
7/25/2006	21FLA 20030775	2,900	86.2%
7/25/2006	21FLA 20030776	5,400	92.6%
7/25/2006	21FLA 20030777	2,000	80.0%
7/25/2006	21FLA 20030778	727	45.0%
8/21/2006	21FLJXWQCR139	1,700	76.5%
9/13/2006	21FLJXWQCR5	3,000	86.7%
9/13/2006	21FLJXWQCR6	22,000	98.2%
9/26/2006	21FLA 20030777	2,950	86.4%
9/26/2006	21FLA 20030778	10,000	96.0%
9/26/2006	21FLA 20030797	1,250	68.0%
9/26/2006	21FLA 20030798	33,667	98.8%
9/26/2006	21FLA 20030799	49,333	99.2%
10/18/2006	21FLA 20030777	23,000	98.3%
10/18/2006	21FLA 20030778	6,909	94.2%
10/18/2006	21FLA 20030797	7,818	94.9%
10/18/2006	21FLA 20030798	21,000	98.1%
10/18/2006	21FLA 20030799	23,000	98.3%
11/6/2006	21FLA 20030777	11,400	96.5%
11/6/2006	21FLA 20030797	400	0.0%
11/6/2006	21FLA 20030798	600	33.3%
11/6/2006	21FLA 20030799	1,833	78.2%
11/7/2006	21FLJXWQCR139	450	11.1%
11/7/2006	21FLJXWQCR5	980	59.2%

Sample Date	Location	Observed Exceedance*	Required % Reduction
11/7/2006	21FLJXWQCR6	1,100	63.6%
12/12/2006	21FLA 20030776	1,230	67.5%
12/12/2006	21FLA 20030777	2,700	85.2%
12/12/2006	21FLA 20030797	38,333	99.0%
12/12/2006	21FLA 20030798	1,538	74.0%
12/12/2006	21FLA 20030777	2,900	86.2%
12/12/2006	21FLA 20030778	2,800	85.7%
12/12/2006	21FLA 20030801	2,600	84.6%
1/16/2007	21FLA 20030776	1,000	60.0%
1/16/2007	21FLA 20030777	3,000	86.7%
1/16/2007	21FLA 20030797	923	56.7%
1/16/2007	21FLA 20030799	400	0.0%
1/16/2007	21FLA 20030777	642	37.7%
1/16/2007	21FLA 20030797	720	44.4%
1/16/2007	21FLA 20030798	570	29.8%
2/12/2007	21FLJXWQCR139	687	41.8%
2/12/2007	21FLJXWQCR5	2,333	82.9%
2/12/2007	21FLJXWQCR6	2,373	83.1%
3/15/2007	21FLA 20030777	2,000	80.0%
3/15/2007	21FLA 20030778	520	23.1%
4/2/2007	21FLJXWQCR139	500	20.0%
4/2/2007	21FLJXWQCR5	5,000	92.0%
4/2/2007	21FLJXWQCR6	2,400	83.3%
4/2/2007	21FLA 20030778	1,100	63.6%
4/2/2007	21FLA 20030801	965	58.5%
6/27/2007	21FLA 20030777	9,100	95.6%
6/27/2007	21FLA 20030797	10,000	96.0%
6/27/2007	21FLA 20030799	23,400	98.3%
7/9/2007	21FLA 20030797	1,250	68.0%
7/9/2007	21FLA 20030798	1,500	73.3%
7/9/2007	21FLA 20030801	783	48.9%
7/11/2007	112WRD 02246465	13,000	96.9%
7/12/2007	21FLA 20030777	260,000	99.8%
7/12/2007	21FLJXWQCR139	2,200	81.8%
7/12/2007	21FLJXWQCR6	1,400	71.4%
8/8/2007	21FLA 20030777	9,000	95.6%
8/8/2007	21FLA 20030797	3,000	86.7%
8/8/2007	21FLA 20030798	8,000	95.0%
8/8/2007	21FLA 20030801	10,333	96.1%
8/29/2007	21FLA 20030778	6,667	94.0%
8/29/2007	21FLA 20030801	19,000	97.9%
8/29/2007	21FLA 20030777	4,333	90.8%
8/29/2007	21FLA 20030797	3,000	86.7%
8/29/2007	21FLA 20030798	2,000	80.0%
8/29/2007	21FLA 20030799	5,333	92.5%
8/29/2007	21FLA 20030801	2,333	82.9%
10/9/2007	21FLA 20030777	4,000	90.0%

Sample Date	Location	Observed Exceedance*	Required % Reduction
10/9/2007	21FLA 20030778	1,000	60.0%
10/9/2007	21FLA 20030801	600	33.3%
12/3/2007	21FLJXWQCR139	1,300	69.2%
12/3/2007	21FLJXWQCR5	1,300	69.2%
12/3/2007	21FLJXWQCR6	16,000	97.5%
12/12/2007	21FLA 20030777	1,775	77.5%
12/12/2007	21FLA 20030778	2,100	81.0%
1/16/2008	21FLA 20030777	10,600	96.2%
1/16/2008	21FLA 20030797	6,100	93.4%
1/16/2008	21FLA 20030798	4,600	91.3%
1/16/2008	21FLA 20030799	1,000	60.0%
1/16/2008	21FLA 20030801	800	50.0%
	MEDIAN:	**3,000**	**86.7%**

* Observed values are #/100mL.

5.1.3 Critical Conditions/Seasonality

Appendix B provides historical fecal coliform observations collected in Big Fishweir Creek. Coliform data are presented by month, season, and year to determine whether certain patterns are evident in the dataset.

A nonparametric test (Kruskal-Wallis) was applied to the fecal coliform dataset to determine whether there were significant differences among months or seasons. At an alpha (α) level of 0.05, there were significant differences among seasons and months (**Appendix C**). Grouping observations by season increased sample sizes for statistical comparison, as seen in **Table 2.2**. The greatest percentage of exceedances occurred in the fall (October to December) and summer (June to August). **Appendix D** presents comparisons of stations and seasons.

Rainfall records for JIA (**Appendix E** illustrates rainfall from 1990 to 2008) were used to determine rainfall amounts associated with individual sampling dates. Rainfall recorded on the day of sampling (1D), the cumulative total for the day of and the previous 2 days (3D), the cumulative total for the day of and the previous 6 days (7D), and the cumulative total for the day of and the previous 29 days (30D) were all paired with the respective coliform observation. A Spearman correlation matrix was generated that summarized the simple correlation coefficients between the rainfall and coliform values (**Appendix F**). The simple correlations (r values in the Spearman correlation table) between both fecal coliform and the various rainfall totals were positive, suggesting that as rainfall (and possible runoff) increased, so did the number of coliform.

Simple linear regressions were performed between coliform observations and rainfall totals to determine whether any of the relationships were significant at an α level of 0.05. The r^2 values between fecal coliform and precipitation regimes showed no significance (**Appendix G**). A table of historical monthly average rainfall (**Appendix H**) indicates that monthly rainfall totals increase in June, peak in September, and by October return to the levels observed in February and March. The highest percentage of exceedances occurred in the fall (October to December; see **Table 2.2**). **Appendix I** includes a table of annual rainfall from 1955 to 2008; the long-term average was 52.47 inches over this period. There does not appear to be an obvious correlation between total annual precipitation and percent exceedance of fecal coliform.

Assessment of Hydrologic Conditions

As no flow data were available, hydrologic conditions were analyzed using rainfall. A loading curve–type chart that would normally be applied to flow events was created using precipitation data from JIA from 1990 to 2004. The chart was divided as if flow were being analyzed, where extreme precipitation events represent the upper percentiles (0 to 5th percentile), followed by large precipitation events (5th to 10th percentile), medium precipitation events (10th to 40th percentile), small precipitation events (40th to 60th percentile), and no recordable precipitation events (60th to 100th percentile). The analysis used 3-day (the day of and 2 days prior to sampling) precipitation accumulations.

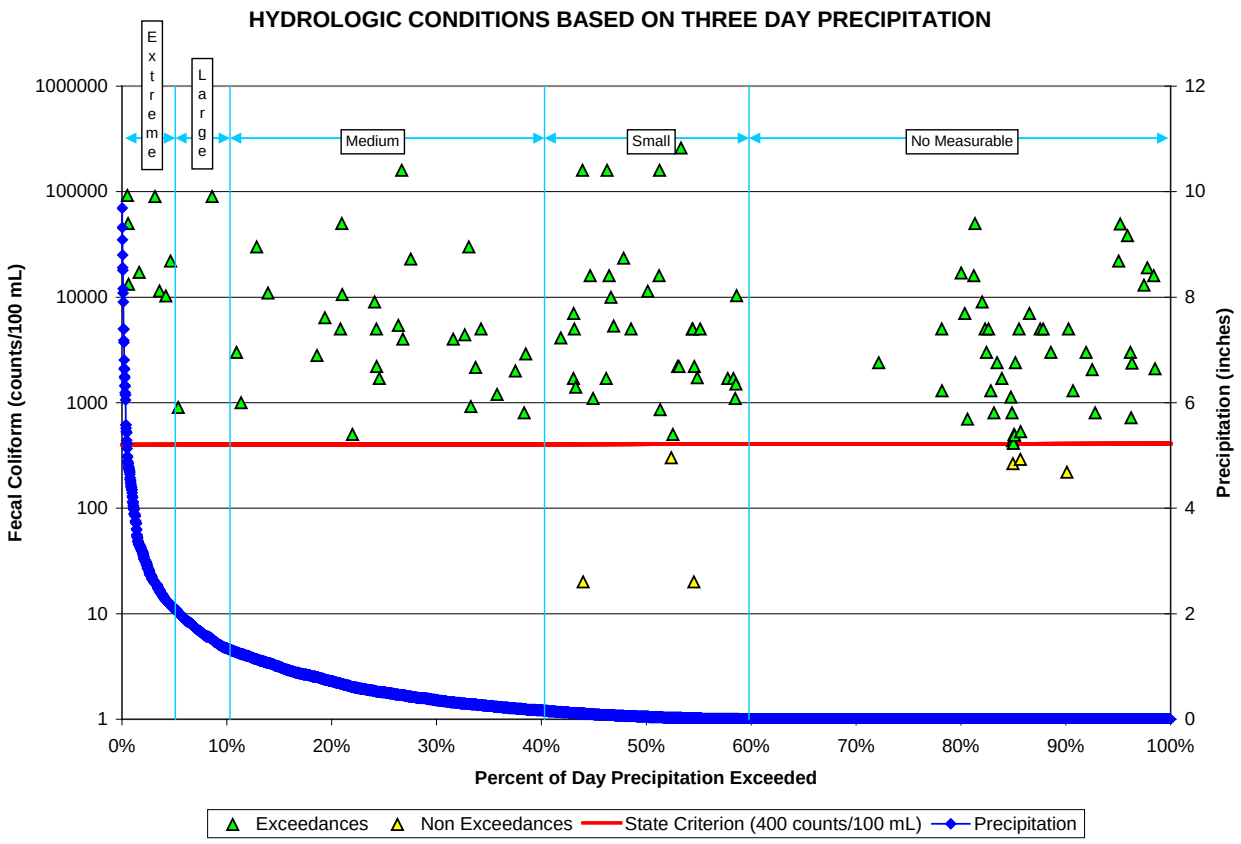
Data show that fecal coliform exceedances occurred over all hydrologic conditions for which data exist, and all have at least a 50 percent exceedance rate. However, the lowest percentage of exceedances (50 percent) occurred after medium precipitation events (0.18" to 1.33"). There were no data collected within 3 days of an extreme precipitation event. The highest percentage of exceedances (100 percent) occurred after large precipitation events.

If a large percentage of exceedances occur during no measurable precipitation days, it is suspected that point sources are contributing. Likewise, if a large percentage of exceedances occur after large and extreme precipitation events, this may indicate that the exceedances are nonpoint source driven; perhaps from stormwater conveyance systems or various land uses. It is difficult to draw conclusions without data from extreme event ranges; however, with exceedances spread throughout the ranges in which data exist, it is most likely that the exceedances stem from a variety of both point and nonpoint sources. **Table 5.4** summarizes data and hydrologic conditions. **Figure 5.3** shows the same data visually.

Table 5.4. Summary of Fecal Coliform Data by Hydrologic Condition for Big Fishweir Creek, WBID 2280

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.1"	8	8	100.00%	0	0.00%
Large	1.33" - 2.1"	2	2	100.00%	0	0.00%
Medium	0.18" - 1.33"	28	28	100.00%	0	0.00%
Small	0.01" - 0.18"	31	28	90.32%	3	9.68%
None/ Not Measurable	<0.01"	52	49	94.23%	3	5.77%

Figure 5.3. Fecal Coliform by Hydrologic Flow Condition for Big Fishweir Creek, WBID 2280



Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (wasteload allocations, or WLAs), nonpoint source loads (load allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

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

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\text{TMDL} \quad \sum \text{WLAs}_{\text{wastewater}} + \sum \text{WLAs}_{\text{NPDES Stormwater}} + \sum \text{LAs} + \text{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the 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**. The TMDL for Big Fishweir Creek is expressed in terms of both counts/100mL and percent reduction, and represents the maximum daily fecal coliform load the creek can assimilate and maintain the fecal coliform criterion (**Table 6.1).** Since the TMDL is a percent reduction, the reduction can be applied on a daily basis.

Table 6.1. TMDL Components for Big Fishweir Creek, WBID 2280

WBID	Parameter	TMDL (counts/ 100mL)	WLA		LA (% reduction)	MOS
			Wastewater (counts/day)	NPDES Stormwater		
2280	Fecal Coliform	400	N/A	87%	87	Implicit

6.2 Load Allocation

A fecal coliform reduction of 87 percent is required in Big Fishweir Creek from nonpoint sources. It should be noted that the load allocation includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

While there are currently no NPDES-permitted facilities in the Big Fishweir Creek watershed that require fecal coliform monitoring, any facilities seeking an NPDES permit to discharge to Big Fishweir Creek in the future will be required to meet the limits set forth in their perspective permit. For fecal coliform, discharge concentrations will not exceed 200 counts/100mL as a monthly average, 400 counts/100mL in more than 10 percent of the samples, or 800 counts/100mL at any given time. Permitted limits will meet TMDL requirements and will therefore protect water quality.

6.3.2 NPDES Stormwater Discharges

The WLA for the city of Jacksonville and FDOT's MS4 permit is an 87 percent reduction in Big Fishweir Creek in current anthropogenic fecal coliform loading. It should be noted that any MS4 permittee is only responsible for reducing the loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

While the LA and WLA for fecal coliform are expressed as the percent reductions needed to attain the applicable Class III criterion, it is the combined reductions from both anthropogenic point and nonpoint sources that will result in the required reduction of instream fecal and total coliform concentrations. However, it is not the intent of this TMDL to abate natural background conditions.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was assumed in the development of this TMDL by not allowing any exceedances of the state criterion, even though the actual criterion allows for 10 percent exceedances over the fecal coliform criterion, of 400 counts/100mL.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan, or BMAP, for the TMDL. The first BMAP for the tributaries to the Lower St. Johns River will address the 10 worst-case impairments in the 55 tributaries impaired for fecal coliform. Any future BMAPs will address additional subsets of the tributaries listed for fecal coliform.

In addition to addressing failing septic tanks, the BMAP may include some sort of public education program about pet waste cleanup. As **Table 4.4** shows, potential impacts from dogs in the watershed could be significant. If pet owners are educated on the potential impacts their pets are having on Big Fishweir Creek, and they are inclined to take action, this could potentially decrease a source load. When considering the significance of seven-day rainfall, this could be a potentially significant load to the stream.

Through the implementation of projects, activities, and additional source assessments in the BMAP, stakeholders expect the following outcomes:

Improved water quality trends in the tributaries of the Lower St. Johns River, which will also help improve water quality in the main stem of the river;

Decreased loading of the target pollutant (fecal coliform);

Enhanced public awareness of pollutant sources, pollutant impacts on water quality, and corresponding corrective actions;

Enhanced understanding of basin hydrology, water quality, and pollutant sources; and

The ability to evaluate management actions, estimate their benefits, and identify additional pollutant sources.

7.1.1 Determination of Worst-Case WBIDs

The initial determination of the worst-case WBIDs uses a ranking method that establishes the severity of bacterial contamination based on the number of exceedances of fecal coliform colony counts—i.e., the number of total fecal coliform samples in a waterbody during the period of record to indicate how many samples are over 800, 5,000, and 10,000 colony counts. A combined rank is then created based on the number of exceedances in each category. The WBIDs are sorted from worst to best to provide a guideline for assessment priorities, with the worst-case waterbody ranked first. Future BMAPs will continue to address the worst-case waters first, using the ranking method.

7.1.2 Identification of Probable Sources

Tributary Pollutant Assessment Project

Initial sampling for the study on the six initial WBIDs of highest concern began July 26, 2005, and was completed on February 1, 2006. The final deliverable (the *Tributary Pollutant Assessment Project Manual*) was submitted to JEA on June 1, 2006, and became available for public review and comment on June 16, 2006. Four types of fecal indicators (fecal coliform, *E. coli*., *Enterococci*, and coliphages) were studied. *Enterococcus faecalis* was also studied in an attempt to further identify potential sources of sewage, and samples were checked for human/ruminant primers.

The executive summary submitted to the Department by JEA and PBS&J is attached as **Appendix K**. The results of the study will be used to help guide the identification of restoration projects during BMAP development.

Technical Reports

In an effort to address the known impairments in the Lower St. Johns tributaries, the Department contracted with Post, Buckley, Schuh & Jernigan (PBS&J) to develop technical reports that describe and interpret the water quality, spatial, and geographic data from the Department, Duval County Health Department, city of Jacksonville, and JEA. The reports analyze the available data to identify the most probable sources of fecal coliform, which fall into five main categories, as follows: (1) stormwater, (2) onsite sewage treatment and disposal systems (OSTDS), (3) sewer infrastructure, (4) nonpoint sources such as pet waste, and (5) natural background such as wildlife. These reports were peer reviewed by technical stakeholders in the basin, who also provided additional input based on their knowledge of the tributaries.

7.1.3 Issues To Be Addressed in Future Watershed Management Cycles

The BMAP process identified the following items that should be addressed in future watershed management cycles to ensure that future BMAPs use the most accurate information:

1. ***Source Identification***—*Sources of fecal coliform impairment are particularly difficult to trace. For this reason, the BMAP includes source identification studies as management actions.*

2. ***Septic Tanks***—*The Department is implementing a study, Evaluation of Septic Tank Influences on Nutrient Loading to the Lower St. Johns River Basin and Its Tributaries, to better understand the nutrient and bacteria loading from septic tanks via ground water by monitoring conditions at representative sites. The study seeks to answer questions on potential OSTDS impacts and the attenuation of nitrogen, phosphorus, and bacteria (fecal coliform) by soil, under the range of conditions that represent typical OSTDS sites near impaired surface waters. It will also document the nutrients and bacteria in the receiving Lower St. Johns tributaries at each site. The results will provide information about the relative contribution of fecal coliform from septic tanks located near the impaired tributaries.*

3. ***GIS Information***—*During the BMAP process, the available GIS data, which provide a basis for some of the source analyses, have improved. As more information becomes available, the updated GIS database for the tributaries*

will be utilized to aid in source identification. This information will include determining the spatial locations for private wastewater systems and infrastructure, collecting jurisdictional or systemwide programs and activities on a WBID scale for future reporting and assessment, and systematically updating all GIS information databases used to compile the BMAP.

7.1.4 BMAP Implementation

The BMAP requires that all stakeholders implement their projects to achieve reductions as soon as practicable. However, the full implementation of the BMAP will be a long-term process. While some of the projects and activities in the BMAP are recently completed or currently ongoing, several projects will require more time to design, secure funding, and construct. Although funding the projects could be an issue, funding limitations do not affect the requirement that every entity must implement the activities listed in the BMAP.

Since BMAP implementation is a long-term process, the TMDL targets established for the Lower St. Johns Basin will not be achieved in the next five years. It may take even longer for the tributaries to respond to reduced loadings and fully meet applicable water quality standards. Regular follow-up and continued coordination and communication among the stakeholders will be essential to ensure the implementation of management strategies and the assessment of their incremental effects. Any additional management actions required to achieve TMDLs, if necessary, will be developed as part of BMAP follow-up.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

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 authorized in Chapter 403, F.S., was established as a technology-based program that relies on 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, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the state's water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations

Chapter 62-40, F.A.C., also requires the water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the FDOT throughout the 15 counties meeting the population criteria. EPA authorized the Department to implement the NPDES stormwater program (except for tribal lands) in October 2000.

An important difference between the federal and the state's stormwater/environmental resource permitting programs is that the NPDES program covers both new and existing discharges, while the state's program focuses on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 10,000 people. These revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution, such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Historical Fecal Coliform Observations in Big Fishweir Creek, WBID 2280

Sample Date	Station	Location	Value (#/100mL)	Remark Code
10/16/1996	21FLJXWQCR5	Little Fishweir Creek at Park St	2,400	
10/16/1996	21FLJXWQCR5	Little Fishweir Creek at Park St	2,400	
10/16/1996	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,300	
10/16/1996	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,300	
7/13/1998	21FLJXWQCR5	Little Fishweir Creek at Park St	90,000	
7/13/1998	21FLJXWQCR5	Little Fishweir Creek at Park St	90,000	
10/7/1998	21FLJXWQCR139	Big Fishweir Creek at Hershel St	50,000	
10/7/1998	21FLJXWQCR139	Big Fishweir Creek at Hershel St	50,000	
10/7/1998	21FLJXWQCR5	Little Fishweir Creek at Park St	9,000	
10/7/1998	21FLJXWQCR5	Little Fishweir Creek at Park St	9,000	
7/20/1998	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,700	
7/20/1998	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,700	
5/26/1998	21FLJXWQCR5	Little Fishweir Creek at Park St	300	
5/26/1998	21FLJXWQCR5	Little Fishweir Creek at Park St	300	
5/26/1998	21FLJXWQCR139	Big Fishweir Creek at Hershel St	40	
5/26/1998	21FLJXWQCR139	Big Fishweir Creek at Hershel St	40	
4/13/1999	21FLJXWQCR139	Big Fishweir Creek at Hershel St	5,000	
4/13/1999	21FLJXWQCR139	Big Fishweir Creek at Hershel St	5,000	
1/5/1999	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
1/5/1999	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
8/18/1999	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
8/18/1999	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
1/5/1999	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
1/5/1999	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
8/18/1999	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
8/18/1999	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
10/5/1999	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,700	
10/5/1999	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,700	
4/14/1999	21FLJXWQCR5	Little Fishweir Creek at Park St	1,300	
4/14/1999	21FLJXWQCR5	Little Fishweir Creek at Park St	1,300	
10/5/1999	21FLJXWQCR5	Little Fishweir Creek at Park St	330	
10/5/1999	21FLJXWQCR5	Little Fishweir Creek at Park St	330	
6/12/2000	112WRD 02246465		160,000	
6/12/2000	112WRD 02246467		160,000	
12/18/2000	21FLJXWQCR5	Little Fishweir Creek at Park St	160,000	L
12/18/2000	21FLJXWQCR5	Little Fishweir Creek at Park St	160,000	L
9/6/2000	112WRD 02246467		90,000	
9/6/2000	112WRD 02246465		50,000	
10/10/2000	112WRD 02246467		50,000	
7/11/2000	112WRD 02246467		30,000	
2/8/2000	112WRD 02246467		17,000	
8/8/2000	112WRD 02246467		16,000	
11/28/2000	112WRD 02246467		16,000	>
12/18/2000	21FLJXWQCR139	Big Fishweir Creek at Hershel St	16,000	
12/18/2000	21FLJXWQCR139	Big Fishweir Creek at Hershel St	16,000	
7/11/2000	112WRD 02246465		11,000	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
8/8/2000	112WRD 02246465		11,000	
12/13/2000	112WRD 02246465		9,000	
12/13/2000	112WRD 02246467		9,000	
3/8/2000	112WRD 02246467		7,000	
4/18/2000	112WRD 02246465		5,000	
5/23/2000	112WRD 02246465		5,000	
10/10/2000	112WRD 02246465		5,000	
11/28/2000	112WRD 02246465		5,000	
4/18/2000	112WRD 02246467		5,000	
2/8/2000	112WRD 02246465		3,000	
3/8/2000	112WRD 02246465		1,700	
5/23/2000	112WRD 02246467		1,700	
4/17/2000	21FLJXWQCR139	Big Fishweir Creek at Hershel St	700	
4/17/2000	21FLJXWQCR139	Big Fishweir Creek at Hershel St	700	
1/10/2000	21FLJXWQCR5	Little Fishweir Creek at Park St	500	
1/10/2000	21FLJXWQCR5	Little Fishweir Creek at Park St	500	
9/11/2000	21FLJXWQCR5	Little Fishweir Creek at Park St	500	
9/11/2000	21FLJXWQCR5	Little Fishweir Creek at Park St	500	
1/10/2000	21FLJXWQCR139	Big Fishweir Creek at Hershel St	300	
1/10/2000	21FLJXWQCR139	Big Fishweir Creek at Hershel St	300	
9/11/2000	21FLJXWQCR139	Big Fishweir Creek at Hershel St	210	
9/11/2000	21FLJXWQCR139	Big Fishweir Creek at Hershel St	210	
4/17/2000	21FLJXWQCR5	Little Fishweir Creek at Park St	140	
4/17/2000	21FLJXWQCR5	Little Fishweir Creek at Park St	140	
8/29/2001	21FLJXWQCR5	Little Fishweir Creek at Park St	160,000	
8/29/2001	21FLJXWQCR5	Little Fishweir Creek at Park St	160,000	
12/10/2001	112WRD 02246467		90,000	
12/10/2001	112WRD 02246465		30,000	
7/9/2001	112WRD 02246467		16,000	>
12/11/2001	21FLJXWQCR5	Little Fishweir Creek at Park St	10,300	
12/11/2001	21FLJXWQCR5	Little Fishweir Creek at Park St	10,300	
9/10/2001	112WRD 02246467		9,000	
12/11/2001	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	8,500	
12/11/2001	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	8,500	
9/5/2001	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	6,400	
9/5/2001	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	6,400	
1/16/2001	112WRD 02246465		5,000	
2/1/2001	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	4,000	
2/1/2001	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	4,000	
7/9/2001	112WRD 02246465		3,500	
2/7/2001	112WRD 02246465		3,000	
1/16/2001	112WRD 02246467		3,000	
2/1/2001	21FLJXWQCR5	Little Fishweir Creek at Park St	3,000	
2/1/2001	21FLJXWQCR5	Little Fishweir Creek at Park St	3,000	
3/13/2001	112WRD 02246467		2,800	
8/22/2001	112WRD 02246467		2,400	
9/10/2001	112WRD 02246465		2,200	
10/15/2001	112WRD 02246467		2,200	
2/1/2001	21FLJXWQCR139	Big Fishweir Creek at Hershel St	2,000	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
12/11/2001	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,790	
12/11/2001	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,790	
2/7/2001	112WRD 02246467		1,700	
6/6/2001	112WRD 02246467		1,700	
11/7/2001	112WRD 02246467		1,700	
4/10/2001	112WRD 02246465		1,300	
6/6/2001	112WRD 02246465		1,300	
3/13/2001	112WRD 02246465		1,100	
11/7/2001	112WRD 02246465		1,100	
4/10/2001	112WRD 02246467		800	
5/15/2001	112WRD 02246467		800	
4/26/2001	21FLJXWQCR139	Big Fishweir Creek at Hershel St	800	
10/15/2001	112WRD 02246465		700	
9/5/2001	21FLJXWQCR139	Big Fishweir Creek at Hershel St	600	
9/5/2001	21FLJXWQCR139	Big Fishweir Creek at Hershel St	600	
5/15/2001	112WRD 02246465		40	
8/21/2001	112WRD 02246465		20	<
4/26/2001	21FLJXWQCR5	Little Fishweir Creek at Park St	10	
4/26/2001	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	10	
7/9/2002	112WRD 02246467		160,000	>
9/25/2002	112WRD 02246467		50,000	
9/25/2002	112WRD 02246465		22,000	
1/15/2002	112WRD 02246467		22,000	
3/4/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	17,200	
1/15/2002	112WRD 02246465		17,000	
6/18/2002	112WRD 02246465		16,000	
9/17/2002	21FLJXWQCR139	Big Fishweir Creek at Hershel St	10,000	
9/17/2002	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	10,000	
6/18/2002	112WRD 02246467		9,000	
3/26/2002	112WRD 02246465		7,000	
12/4/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	7,000	
9/17/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	6,700	
5/7/2002	112WRD 02246465		5,000	
8/12/2002	112WRD 02246465		5,000	
7/30/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
8/28/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
12/4/2002	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	5,000	
3/14/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	4,400	
12/4/2002	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
4/9/2002	112WRD 02246467		2,400	
3/26/2002	112WRD 02246467		2,200	
5/7/2002	112WRD 02246467		2,200	
7/9/2002	112WRD 02246465		1,300	
2/13/2002	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,130	
2/26/2002	112WRD 02246465		800	
2/26/2002	112WRD 02246467		800	
2/13/2002	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	724	
3/4/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	576	
5/22/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	530	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
4/9/2002	112WRD 02246465		500	
3/18/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	500	
3/25/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	492	
5/22/2002	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	480	
2/28/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	436	
2/13/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	420	
3/11/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	412	
5/22/2002	21FLJXWQCR139	Big Fishweir Creek at Hershel St	380	
5/15/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	290	
3/7/2002	21FLJXWQCR5	Little Fishweir Creek at Park St	264	
5/13/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
7/8/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
5/13/2003	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	5,000	
2/18/2003	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
5/13/2003	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
11/18/2003	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	3,000	
2/18/2003	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	2,400	
4/22/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	2,200	
8/5/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	2,160	
9/10/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	1,720	
11/18/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	1,700	
11/18/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	1,700	
11/18/2003	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,300	
11/18/2003	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,300	
9/4/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	860	
2/18/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	700	
9/4/2003	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	560	
9/4/2003	21FLJXWQCR139	Big Fishweir Creek at Hershel St	530	
8/5/2003	21FLJXWQCR5	Little Fishweir Creek at Park St	20	
7/27/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
2/24/2004	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	5,000	
7/27/2004	21FLJXWQCR139	Big Fishweir Creek at Hershel St	4,000	
7/27/2004	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	4,000	
2/24/2004	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
2/24/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	2,800	
2/18/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	2,200	
4/27/2004	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	1,700	
8/3/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	1,400	
11/9/2004	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,300	
11/9/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	1,300	
8/24/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	1,000	
4/27/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	700	
11/9/2004	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	230	
4/27/2004	21FLJXWQCR139	Big Fishweir Creek at Hershel St	220	
5/25/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	220	
5/25/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	220	Q
9/29/2004	21FLJXWQCR5	Little Fishweir Creek at Park St	20	I
12/19/2005	21FLJXWQCR139	Big Fishweir Creek at Hershel St	13,300	
7/12/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	11,435	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
3/17/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	10,950	
3/17/2005	21FLJXWQCR139	Big Fishweir Creek at Hershel St	10,000	
3/17/2005	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	7,035	
8/23/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	4,105	
5/16/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	3,000	
9/26/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	2,060	
6/2/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	1,200	
4/26/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	920	
9/6/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	900	
5/16/2005	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	800	
11/2/2005	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	800	
9/26/2005	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	700	
9/26/2005	21FLJXWQCR139	Big Fishweir Creek at Hershel St	660	
11/2/2005	21FLJXWQCR5	Little Fishweir Creek at Park St	340	
5/16/2005	21FLJXWQCR139	Big Fishweir Creek at Hershel St	140	
9/26/2006	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	49,333	B
12/12/2006	21FLA 20030797	Little Fishweir @ Macarthur	38,333	B
9/26/2006	21FLA 20030798	Little Fishweir @ Park St	33,667	B
5/10/2006	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	30,000	
10/18/2006	21FLA 20030777	Big Fishweir Cr Sf @ Park St	23,000	
10/18/2006	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	23,000	
9/13/2006	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	22,000	
10/18/2006	21FLA 20030798	Little Fishweir @ Park St	21,000	
11/6/2006	21FLA 20030777	Big Fishweir Cr Sf @ Park St	11,400	
9/26/2006	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	10,000	
10/18/2006	21FLA 20030797	Little Fishweir @ Macarthur	7,818	A
10/18/2006	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	6,909	A
7/25/2006	21FLA 20030776	Big Fishweir Cr Sf @ Clarendon St	5,400	
5/10/2006	21FLJXWQCR139	Big Fishweir Creek at Hershel St	3,000	
9/13/2006	21FLJXWQCR5	Little Fishweir Creek at Park St	3,000	
9/26/2006	21FLA 20030777	Big Fishweir Cr Sf @ Park St	2,950	
7/25/2006	21FLA 20030775	Big Fishweir Cr Sf @ Cassat Ave	2,900	
12/12/2006	21FLA 20030777	Big Fishweir Cr Sf @ Park St	2,700	
2/28/2006	21FLJXWQCR5	Little Fishweir Creek at Park St	2,200	
7/25/2006	21FLA 20030777	Big Fishweir Cr Sf @ Park St	2,000	A
11/6/2006	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	1,833	
8/21/2006	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,700	
12/12/2006	21FLA 20030798	Little Fishweir @ Park St	1,538	A
5/10/2006	21FLJXWQCR5	Little Fishweir Creek at Park St	1,300	
9/26/2006	21FLA 20030797	Little Fishweir @ Macarthur	1,250	
12/12/2006	21FLA 20030776	Big Fishweir Cr Sf @ Clarendon St	1,230	A
2/28/2006	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,100	
11/7/2006	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	1,100	
11/7/2006	21FLJXWQCR5	Little Fishweir Creek at Park St	980	
7/25/2006	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	727	A
11/6/2006	21FLA 20030798	Little Fishweir @ Park St	600	B
11/7/2006	21FLJXWQCR139	Big Fishweir Creek at Hershel St	450	
11/6/2006	21FLA 20030797	Little Fishweir @ Macarthur	400	B
12/12/2006	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	333	B

Sample Date	Station	Location	Value (#/100mL)	Remark Code
11/6/2006	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	200	U
2/28/2006	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	170	
12/12/2006	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	100	B
7/12/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	260,000	
6/27/2007	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	23,400	B
8/29/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	19,000	
12/3/2007	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	16,000	Q
7/11/2007	112WRD 02246465		13,000	>
8/8/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	10,333	
6/27/2007	21FLA 20030797	Little Fishweir @ Macarthur	10,000	B
6/27/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	9,100	B
8/8/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	9,000	B
8/8/2007	21FLA 20030798	Little Fishweir @ Park St	8,000	
8/29/2007	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	6,667	
9/25/2007	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	5,333	B
4/2/2007	21FLJXWQCR5	Little Fishweir Creek at Park St	5,000	
9/25/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	4,333	B
10/9/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	4,000	B
1/16/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	3,000	
8/8/2007	21FLA 20030797	Little Fishweir @ Macarthur	3,000	B
9/25/2007	21FLA 20030797	Little Fishweir @ Macarthur	3,000	B
1/4/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	2,900	
1/4/2007	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	2,800	
1/4/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	2,600	
4/2/2007	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	2,400	
2/12/2007	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	2,373	
9/25/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	2,333	B
2/12/2007	21FLJXWQCR5	Little Fishweir Creek at Park St	2,333	
7/12/2007	21FLJXWQCR139	Big Fishweir Creek at Hershel St	2,200	
12/12/2007	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	2,100	
3/15/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	2,000	
9/25/2007	21FLA 20030798	Little Fishweir @ Park St	2,000	B
12/12/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	1,775	A
7/9/2007	21FLA 20030798	Little Fishweir @ Park St	1,500	
7/12/2007	21FLJXWQCR6	Little Fishweir Creek at Greenwood Ave.	1,400	Q
12/3/2007	21FLJXWQCR139	Big Fishweir Creek at Hershel St	1,300	Q
12/3/2007	21FLJXWQCR5	Little Fishweir Creek at Park St	1,300	Q
7/9/2007	21FLA 20030797	Little Fishweir @ Macarthur	1,250	
5/30/2007	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	1,100	B
1/16/2007	21FLA 20030776	Big Fishweir Cr Sf @ Clarendon St	1,000	
10/9/2007	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	1,000	
5/30/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	965	A
1/16/2007	21FLA 20030797	Little Fishweir @ Macarthur	923	A
7/9/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	783	A
2/6/2007	21FLA 20030797	Little Fishweir @ Macarthur	720	
2/12/2007	21FLJXWQCR139	Big Fishweir Creek at Hershel St	687	
2/6/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	642	A
10/9/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	600	
2/6/2007	21FLA 20030798	Little Fishweir @ Park St	570	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
3/15/2007	21FLA 20030778	Big Fishweir Cr Nf @ Hamilton St	520	
4/2/2007	21FLJXWQCR139	Big Fishweir Creek at Hershel St	500	
1/16/2007	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	400	B
7/9/2007	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	348	A
9/25/2007	21FLA 20030776	Big Fishweir Cr Sf @ Clarendon St	333	U
8/8/2007	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	333	B
2/6/2007	21FLA 20030776	Big Fishweir Cr Sf @ Clarendon St	300	
12/12/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	275	A
7/9/2007	21FLJXWQCR5	Little Fishweir Creek at Park St	240	
1/16/2007	21FLA 20030798	Little Fishweir @ Park St	231	A
2/6/2007	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	230	
1/4/2007	21FLA 20030776	Big Fishweir Cr Sf @ Clarendon St	212	A
2/6/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	167	A
5/30/2007	21FLA 20030777	Big Fishweir Cr Sf @ Park St	165	A
3/15/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	133	A
1/16/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	100	B
6/27/2007	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	100	U
1/16/2008	21FLA 20030777	Big Fishweir Cr Sf @ Park St	10,600	B
1/16/2008	21FLA 20030797	Little Fishweir @ Macarthur	6,100	B
1/16/2008	21FLA 20030798	Little Fishweir @ Park St	4,600	
1/16/2008	21FLA 20030799	Nf Big Fishweir Cr @ Woodruff Ave	1,000	B
1/16/2008	21FLA 20030801	Big Fishweir Cr Sf @ Hamilton St	800	B

Shaded cells represent values that exceed 400 counts/100mL.

Remark Code:

A Value reported is the mean of two or more determinations.

B Results based on colony counts outside the acceptable range.

K Off-scale low. Actual value not known, but known to be less than value shown.

L Off-scale high. Actual value not known, but known to be greater than value shown.

P Too numerous to count.

Q Sample held beyond normal holding time.

U Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use. In the case of species, undetermined sex.

Appendix C: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Season and Month, Big Fishweir Creek, WBID 2280

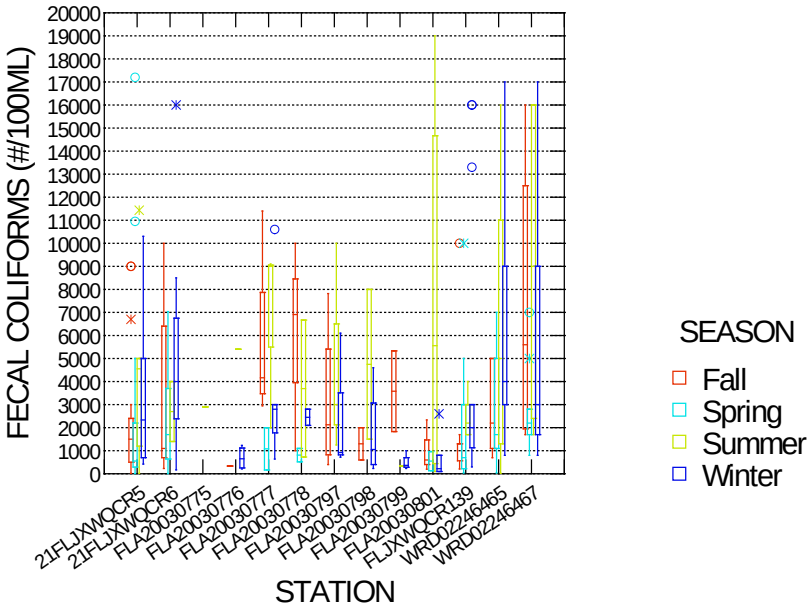
Group	Count	Rank Sum
Fall	85	13605
Spring	72	8445.5
Summer	65	12747.5
Winter	91	14343

Kruskal-Wallis Test Statistic = 26.125
Probability is 0.000 assuming Chi-square distribution with 3 df

Group	Count	Rank Sum
January	27	3893
February	34	4347
March	19	2793
April	25	2759.5
May	28	2893
June	11	2323.5
July	29	5587.5
August	25	4836.5
September	39	6476.5
October	24	4497
November	22	2631.5
December	30	6103

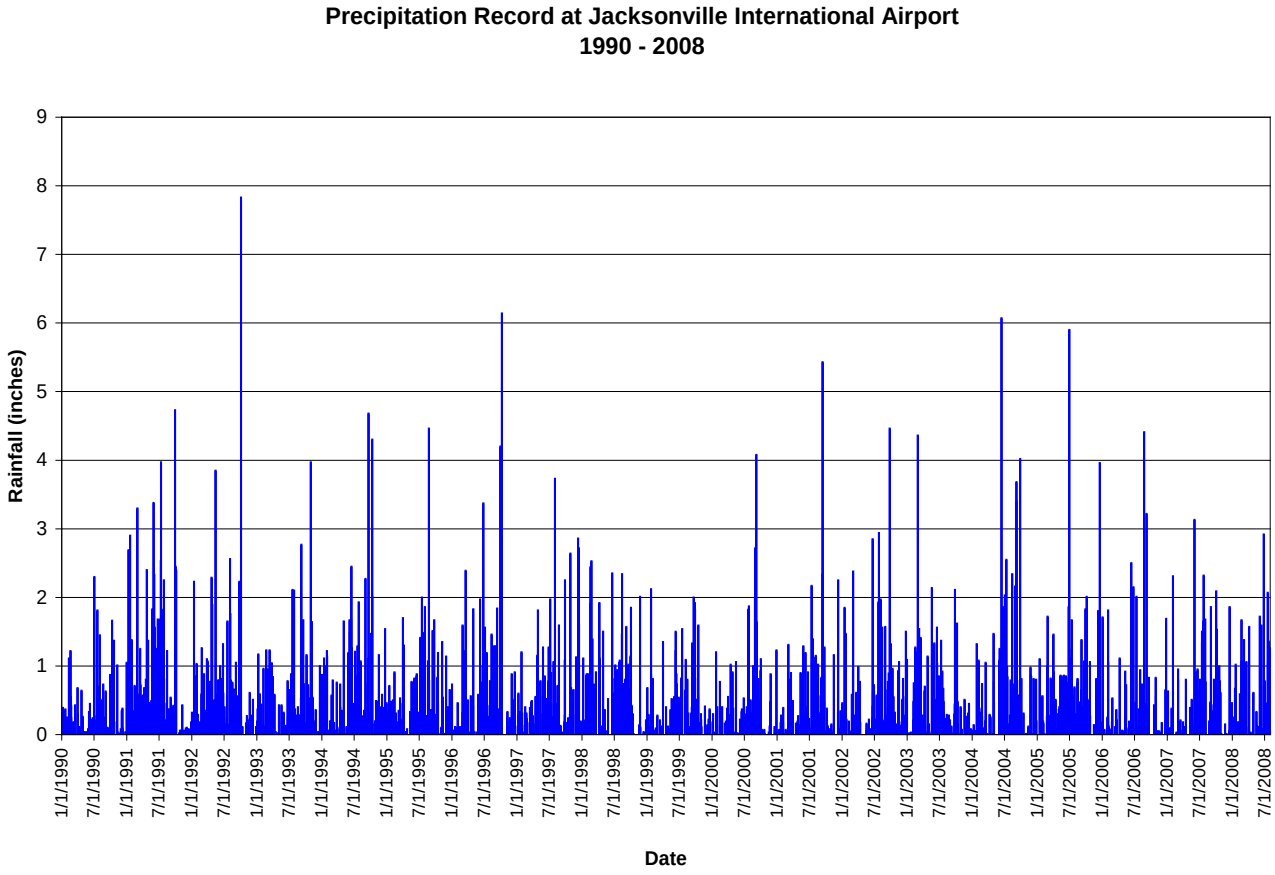
Kruskal-Wallis Test Statistic = 48.090
Probability is 0.000 assuming Chi-square distribution with 11 df

Appendix D: Chart of Fecal Coliform Observations by Season and Station in Big Fishweir Creek, WBID 2280



STORET ID	Station
21FLJXWQCR5	Little Fishweir Creek at Park St
21FLJXWQCR6	Little Fishweir Creek t Greenwood Ave.
FLA20030775	Big Fishweir Cr Sf @ Cassat Ave
FLA20030776	Big Fishweir Cr Sf @ Clarendon St
FLA20030777	Big Fishweir Cr Sf @ Park St
FLA20030778	Big Fishweir Cr Nf @ Hamilton St
FLA20030797	Little Fishweir @ Macarthur
FLA20030798	Little Fishweir @ Park St
FLA20030799	Nf Big Fishweir Cr @ Woodruff Ave
FLA20030801	Big Fishweir Cr Sf @ Hamilton St
FLJXWQCR139	Big Fishweir Creek at Hershel St
WRD02246465	
WRD02246467	

Appendix E: Chart of Rainfall for JIA, 1990–2008



Appendix F: Spearman Correlation Matrix Analysis for Precipitation and Fecal Coliform in Big Fishweir Creek, WBID 2280

	YEAR	MONTH	FECALS	V1DAYPRECIP	V3DAYPRECIP	V7DAYPRECIP	CUMULATIVET
YEAR	1						
MONTH	0.991	1					
FECALS	-0.142	-0.112	1				
V1DAYPRECIP	0.007	0.003	0.206	1			
V3DAYPRECIP	-0.087	-0.077	0.261	0.641	1		
V7DAYPRECIP	-0.063	-0.056	0.089	0.298	0.607	1	
CUMULATIVET	0.014	0.046	0.212	0.156	0.318	0.435	1

Appendix G: Analysis of Fecal Coliform Observations and Precipitation in Big Fishweir Creek, WBID 2280

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING PRECIPITATION

Multiple R: 0.211 Squared multiple R: 0.045

Adjusted squared multiple R: 0.042 Standard error of estimate: 29101.256

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	8859.48	1703.44	0	.	5.201	0.000
V1DAYPRECIP	15114.4	3962.8	0.211	1	3.814	0.000

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.23E+10	1	1.23E+10	14.547	0.000
Residual	2.63E+11	311	8.47E+08		

Durbin-Watson D Statistic 1.354
First Order Autocorrelation 0.322

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND 2 DAYS PRIOR PRECIPITATION

Multiple R: 0.166 Squared multiple R: 0.028

Adjusted squared multiple R: 0.024 Standard error of estimate: 29360.396

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	8376.352	1813.43	0	.	4.619	0.000
V3DAYPRECIP	6134.543	2064.92	0.166	1	2.971	0.003

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	7.61E+09	1	7.61E+09	8.826	0.003
Residual	2.68E+11	311	8.62E+08		

Durbin-Watson D Statistic 1.348
First Order Autocorrelation 0.326

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND 6 DAYS PRIOR PRECIPITATION

Multiple R: 0.079 Squared multiple R: 0.006

Adjusted squared multiple R: 0.000 Standard error of estimate: 29733.719

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	9539.029	2007.36	0	.	4.752	0
V7DAYPRECIP	1102.485	1199.26	0.052	1	0.919	0.359

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	7.47E+08	1	7.47E+08	0.845	0.359
Residual	2.75E+11	311	8.84E+08		

Durbin-Watson D Statistic 1.347
First Order Autocorrelation 0.326

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND 29 DAYS PRIOR PRECIPITATION

Multiple R: 0.071 Squared multiple R: 0.005

Adjusted squared multiple R: 0.002 Standard error of estimate: 29698.094

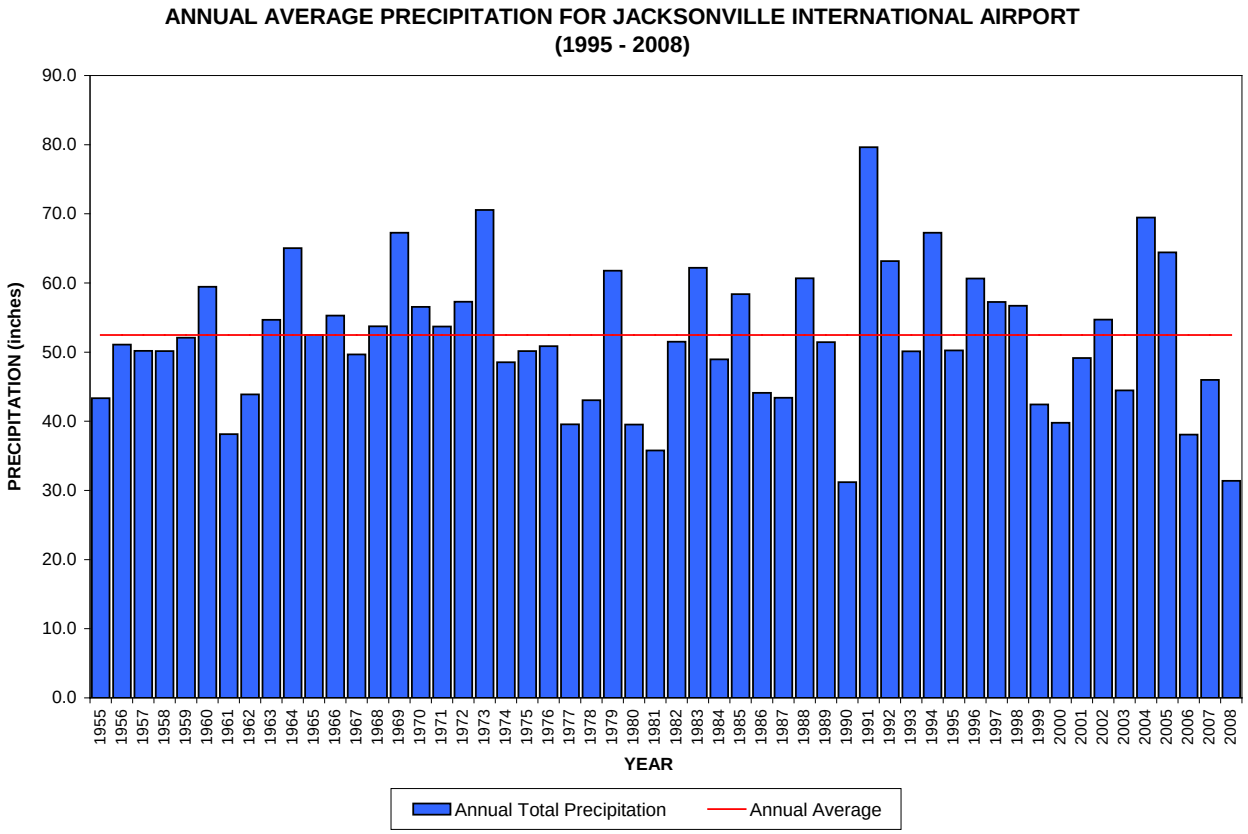
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	7983.983	2635.01	0	.	3.03	0.003
CUMULATIVET	625.974	495.847	0.071	1	1.262	0.208

Analysis of Variance

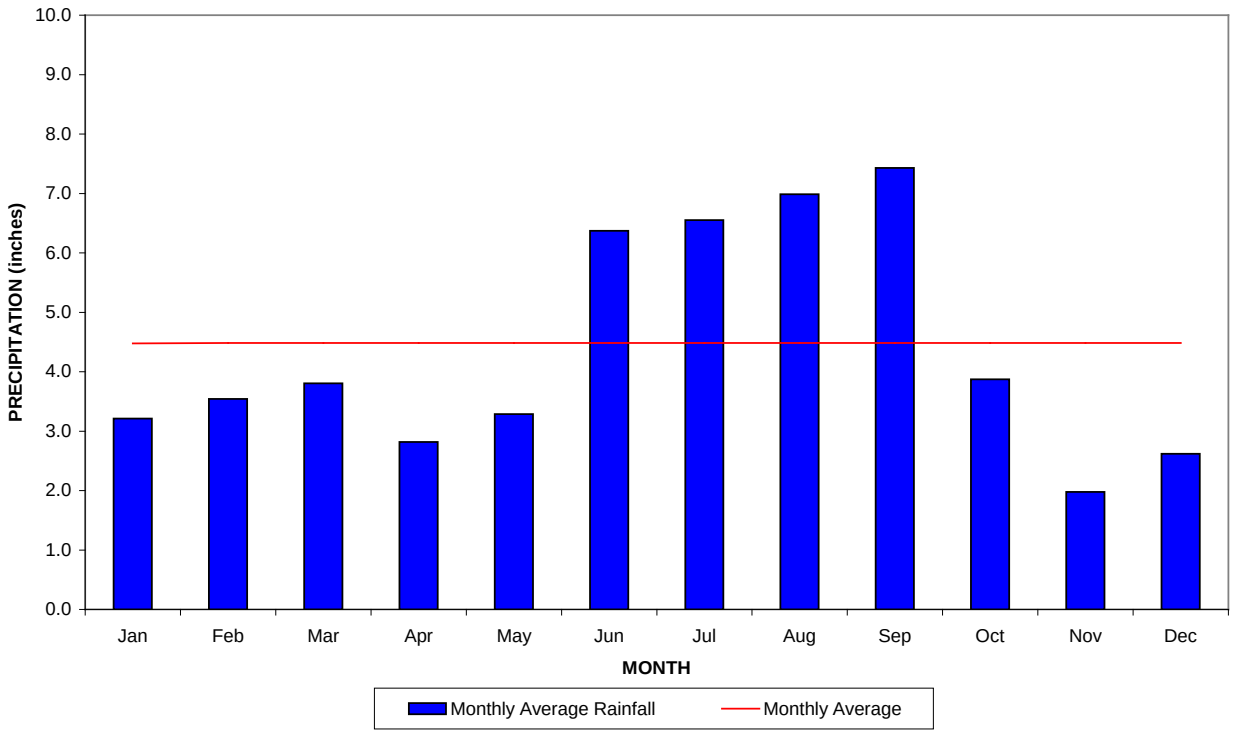
Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.41E+09	1	1.41E+09	1.594	0.208
Residual	2.74E+11	311	8.82E+08		

Durbin-Watson D Statistic 1.363
First Order Autocorrelation 0.318

Appendix H: Annual and Monthly Average Precipitation at JIA



MONTHLY AVERAGE PRECIPITATION FOR JACKSONVILLE INTERNATIONAL AIRPORT (1955 - 2008)



Appendix I: Monthly and Annual Precipitation at JIA, 1955–2008

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1955	3.1	2.46	1.66	1.5	4.51	2.7	5.53	3.85	10.6	5.36	1.9	0.2	**43.33**
1956	2.9	2.94	0.81	2.33	3.98	7.87	8.25	5.24	2.89	13.4	0.4	0	**51.08**
1957	0.3	1.69	3.87	1.61	5.25	7.1	12.3	3.3	8.33	3.5	1.6	1.3	**50.18**
1958	3.4	3.74	3.38	8.24	3.79	3.96	4.37	4.67	4.75	5.07	2	2.8	**50.14**
1959	3	5.22	9.75	2.65	9.2	2.94	4.51	2.86	5.67	3.12	2.2	1	**52.08**
1960	2.1	5.17	6.94	3.54	1.18	4.7	16.2	6.5	8.57	2.95	0.1	1.5	**59.45**
1961	2.9	4.85	1.17	4.16	3.06	5.27	3.48	10.6	1.02	0.27	0.9	0.5	**38.15**
1962	2.2	0.52	3.1	2.36	1.12	8.22	6.31	10.1	4.37	1.13	2.1	2.5	**43.9**
1963	5.4	6.93	2.23	1.75	1.74	12.5	6.47	4.95	4.88	1.53	2.7	3.6	**54.66**
1964	7.3	6.55	1.76	4.65	4.8	4.67	6.12	5.63	10.3	5.09	3.3	4.8	**65.03**
1965	0.7	5.5	3.91	0.95	0.94	9.79	2.71	9.58	11	1.75	1.9	3.8	**52.47**
1966	4.6	5.97	0.71	2.25	10.4	7.74	11.1	3.88	5.94	1.38	0.2	1.1	**55.3**
1967	3.1	4.35	0.81	2	1.18	12.9	5.22	12.3	1.8	1.13	0.2	4.7	**49.68**
1968	0.8	3.05	1.2	0.99	2.17	12.3	6.84	16.2	2.68	5.09	1.3	1.1	**53.72**
1969	0.8	3.39	4.23	0.34	3.78	5.12	5.89	15.1	10.3	9.81	4.6	3.9	**67.26**
1970	4.2	8.85	9.98	1.77	1.84	2.65	7.6	11	3.2	3.95	0	1.6	**56.55**
1971	2	2.55	2.41	4.07	1.9	5.52	5.07	12.8	4.17	6.46	0.8	5.9	**53.69**
1972	5.8	3.48	4.43	2.98	8.26	6.75	3.15	9.76	2.6	4.46	4.2	1.4	**57.29**
1973	4.6	5.07	10.2	11.6	5.33	4.1	5.45	7.49	7.86	4.08	0.4	4.3	**70.57**
1974	0.3	1.28	3.47	1.53	4.14	5.53	9.83	11.2	8.13	0.34	1	1.7	**48.52**
1975	3.5	2.58	2.46	5.78	7	5.21	6.36	6.23	5.24	3.63	0.4	1.8	**50.15**
1976	2.3	1.05	3.41	0.63	10	4.26	5.41	6.37	8.56	1.63	2.4	4.8	**50.87**
1977	3	3.24	1.03	1.76	3.07	2.65	1.97	7.26	7.45	1.68	3.1	3.4	**39.56**
1978	4.6	4.17	2.83	2.24	9.18	2.62	6.67	2.39	4.4	1.26	0.8	1.8	**43.04**
1979	6.3	3.75	1	4.18	7.54	5.91	4.67	4.78	17.8	0.25	3.6	2	**61.76**
1980	2.6	1.06	6.83	3.91	3.02	4.59	5.29	3.97	3.03	2.69	2.3	0.2	**39.53**
1981	0.9	4.53	5.41	0.32	1.48	3.31	2.46	6.47	1.22	1.35	4.9	3.4	**35.77**
1982	3	1.67	4.26	3.6	3.55	8.06	3.81	6.93	9.32	3.37	1.9	2	**51.52**
1983	7.2	4.27	8.46	4.65	1.38	6.86	6.11	4.63	4.61	4.29	3.3	6.4	**62.19**
1984	2.1	4.67	5.77	3.14	1.46	4.76	6.01	3.78	12.3	1.53	3.3	0.1	**48.96**
1985	1.1	1.45	1.26	2.76	2.08	3.71	6.33	8.93	16.8	8.34	2.1	3.6	**58.39**
1986	4.2	4.72	5.44	0.93	2.13	2.53	3.27	9.6	1.99	1.8	2.9	4.7	**44.1**
1987	4.1	6.47	6.27	0.14	0.75	4.18	4.4	4.48	7.13	0.3	5	0.2	**43.39**
1988	6.4	6.08	2.65	3.44	1.35	3.71	4.5	8.48	16.4	2.35	4.3	1.1	**60.68**
1989	1.7	1.77	2.14	2.79	1.55	3.66	8.98	9.16	14.4	1.39	0.5	3.4	**51.45**
1990	1.8	4.07	1.59	1.34	0.18	1.59	6.53	3.81	2.6	4.54	1.2	1.9	**31.2**
1991	10	1.52	7.33	6.31	9.35	11.7	15.9	3.48	6.2	6.36	0.7	0.6	**79.63**
1992	5.8	2.64	4.09	5.33	5.97	7.04	3.32	10.8	7.33	8.34	1.9	0.7	**63.18**
1993	3.9	2.89	5.98	0.85	1.6	2.52	7.54	2.96	7.6	8.84	3.6	1.9	**50.12**
1994	6.6	0.92	2.14	1.51	3.15	14	8.26	3.29	9.79	10.2	3.5	3.9	**67.26**
1995	1.9	2.07	3.67	1.77	1.77	5.35	9.45	9.93	5.41	3.53	3.2	2.2	**50.25**
1996	1.1	1.11	6.83	2.85	0.72	11.4	4.2	7.83	8.49	11.5	1.4	3.2	**60.63**
1997	2.9	1.28	1.84	4.56	3.43	6.33	7.69	8.24	3.97	4.84	2.4	9.8	**57.27**
1998	3.5	11.1	2.64	4.71	0.96	2.95	7.29	10.1	7.65	3.01	2.4	0.4	**56.72**
1999	4.6	1.7	0.4	1.92	1.02	7.75	3.56	3.51	13	3.24	0.8	0.9	**42.44**
2000	2.8	1.17	1.79	2.6	1.15	2.43	5.69	7.38	11.6	0.23	1.6	1.4	**39.77**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
2001	0.9	0.68	5.48	0.62	2.56	5.59	8.31	3.58	16	0.81	1.4	3.1	**49.14**
2002	4.5	0.82	4.38	2.41	0.47	6.24	7.8	8.14	9.31	2.58	2.7	5.4	**54.72**
2003	0.1	4.66	10.7	2.63	2.54	6.75	7.33	1.83	3.04	2.98	0.7	1.2	**44.47**
2004	1.6	4.47	1.36	2.02	1.24	17.2	8.6	9.85	16.3	1.32	2.9	2.7	**69.47**
2005	1.9	3.56	3.67	4.53	3.51	14.8	7.37	4.43	5.76	6.49	1.1	7.4	**64.44**
2006	2.30	3.91	0.68	1.22	2.01	7.25	3.97	7.08	4.55	1.81	0.39	2.90	**38.07**
2007	2.29	2.40	2.22	1.02	1.12	6.68	9.48	3.57	5.44	8.85	0.17	2.74	**45.98**
2008	2.63	5.22	3.50	2.34	0.66	8.21	8.83						**31.39**
AVG	**3.21**	**3.54**	**3.81**	**2.82**	**3.29**	**6.37**	**6.55**	**6.99**	**7.43**	**3.87**	**1.98**	**2.62**	**52.47**

Rainfall is in inches, and represents data from JIA.

Appendix J: Executive Summary of Tributary Pollution Assessment Project

Note: *This appendix contains the executive summary of the Tributary Pollution Assessment Project (TPAP) submitted to the Department by JEA and PBS&J. The six phases detailed in the methodology development and evaluation section have already been completed as of the date of this TMDL. In place of the public workshop mentioned in the section describing Phase 6, the* Tributary Pollution Assessment Manual *was presented to the Jacksonville Waterways Commission on February 1, 2007.*

The Tributary Pollution Assessment Project involves developing and evaluating a methodology for conducting tributary pollution assessments for listed water bodies in the Duval County area, as referenced in the Reasonable Assurance (RA) Plan. Duval County has approximately 100 tributary Water Body IDs (WBIDs), i.e. small to large tributaries of the St. Johns River, identified by the State. The RA Plan provides reasonable assurance that the fecal coliform levels of the 51 top-ranked WBIDs will be reduced sufficiently to restore them to their designated use for recreation. The 51 WBIDs are grouped into four priority groups in the RA Plan.
PBS&J was contracted by JEA to develop a methodology for conducting tributary pollution assessments for sources of fecal coliform contamination in the listed tributaries. This methodology will be field-verified by conducting sanitary surveys of selected tributary water body segments, and revised based on lessons learned from this process. The final product of this endeavor will be a *Tributary Pollution Assessment Manual* that can be used as a blueprint for conducting sanitary surveys.

The Tributary Pollution Assessment Project is a continuation of the effort started under the RA Plan. The RA Plan participants have been brought together to form the Tributary Assessment Team (TAT). The TAT will serve as an advisory committee to the PBS&J Project Team throughout the development of the *Tributary Pollution Assessment Manual*. The TAT is composed of representatives from:

JEA
City of Jacksonville Environmental Quality Division
City of Jacksonville Public Works Department
Duval County Health Department
Florida Department of Environmental Protection
St. Johns Riverkeeper
Water and Sewer Expansion Authority
US Army Corps of Engineers

Other representatives (from these and additional entities) may be included in the TAT activities in varying roles, as relevant.

Our approach for developing and evaluating a methodology for conducting tributary pollution assessments is divided into six major phases including:

1) Pre-planning;
2) Planning;
3) Development of Tributary Pollution Assessment Manual;
4) Evaluation of Methodology/Manual by Conducting Sanitary Surveys;
5) Summary Report; and

6) Public Workshop.
The Pre-Planning phase (Phase I) entailed four main goals:

1) to obtain and review all documents included in the RA Plan;
2) to develop categories for tributary classification and categorize the 51 priority WBIDs;
3) to overlay each WBID onto land use, infrastructure, and historical sampling maps to begin assessing probable sources and migration pathways; and
4) to develop the *Draft Work Plan*.

The Planning phase (Phase II) begins with the organization and initial meeting of the Tributary Assessment Team (TAT) with the ultimate goal of finalizing the *Work Plan*.

The Development of the *Tributary Pollution Assessment Manual* phase (Phase III) primarily involves the formulation of the assessment methodology for each tributary category described in the Pre-Planning phase, the use of a decision tree to determine which assessment methodology corresponds to each of the highest-ranked WBIDs, and the establishment of a model monitoring plan for each tributary category. This phase will be completed upon submitting the *Manual* to the TAT for review.

The next phase, Evaluation of Methodology/Manual by Conducting Sanitary Surveys (Phase IV), entails field-verification of the methodology described in the *Draft Tributary Pollution Assessment Manual* for the highest ranked water bodies for each category (or as determined to ensure adequate geographical representation of the study area) and applying the results to recommend generic corrective actions and revise the methodology, if necessary. The outcome of this phase would be the *Tributary Pollution Assessment Manual.*

The final two phases, Summary Report (Phase V) and Public Workshop (Phase VI), would entail providing a summary of the results of the tributary pollution assessments, including a discussion of lessons learned and site-specific corrective actions, to JEA and presenting the results from the *Tributary Pollution Assessment Manual* to the public. The final phase would also include a written summary of public input received at the workshop.

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