FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

NORTHEAST DISTRICT • LOWER ST. JOHNS BASIN

TMDL Report

Fecal Coliform TMDL for Hogan Creek (WBID 2252)

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Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

http://www.dep.state.fl.us/water/tmdl/index.htm

Identification of Impaired Surface Waters Rule

http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf

STORET Program

http://www.dep.state.fl.us/water/storet/index.htm

2004 305(b) Report

http://www.dep.state.fl.us/water/docs/2004_Integrated_Report.pdf

Criteria for Surface Water Quality Classifications

http://www.dep.state.fl.us/legal/rules/shared/62-302.pdf

Basin Status Report for the Lower St. Johns River Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Water Quality Assessment Report for the Lower St. Johns River Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Allocation Technical Advisory Committee (ATAC) Report

http://www.dep.state.fl.us/water/tmdl/docs/Allocation.pdf

U.S. Environmental Protection Agency, 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 coliforms for the Hogan Creek watershed in the North Mainstem Planning Unit. The creek was verified as impaired for fecal coliforms, and was included on the Verified List of impaired waters for the Lower St. Johns River Basin that was adopted by Secretarial Order in May 2004. Hogan Creek is located in central Duval County, on the west side of the St. Johns River (**Figure 1.1**). This TMDL establishes the allowable loadings to Hogan Creek that would restore the waterbody so that it meets its applicable water quality criteria for fecal coliforms.

1.2 Identification of Waterbody

Hogan Creek is located in Duval County, in northeast Florida, and has an approximate 3.44 square-mile (mi^2) drainage area that flows directly into the St. Johns River (**Figure 1.2**). The creek is approximately 2.55 miles long and is a first order stream. The Hogan Creek watershed is located within the City of Jacksonville proper and, as a result, is highly urbanized. Additional information about the creek's hydrology and geology are available in the Basin Status Report for the Lower St. Johns River Basin (Florida Department of Environmental Protection [FDEP], 2004).

For assessment purposes, the Department has divided the St. Johns River Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. Hogan Creek lies within one WBID, 2252, as shown in **Figure 1.2**, which this TMDL addresses.

Hogan Creek is part of the North Mainstem Planning Unit (PU). Planning units are groups of smaller watersheds (WBIDs) which are part of a larger basin unit, in this case the Lower St. Johns Basin. The North Mainstem Planning Unit consists of 49 WBIDs. **Figure 1.3** shows the location of these WBIDs, Hogan Creek's proximity in the planning unit, as well as a list of other WBIDs in the PU.

Figure 1.1. Location of Hogan Creek and Major Geopolitical Features in the St. Johns River Basin

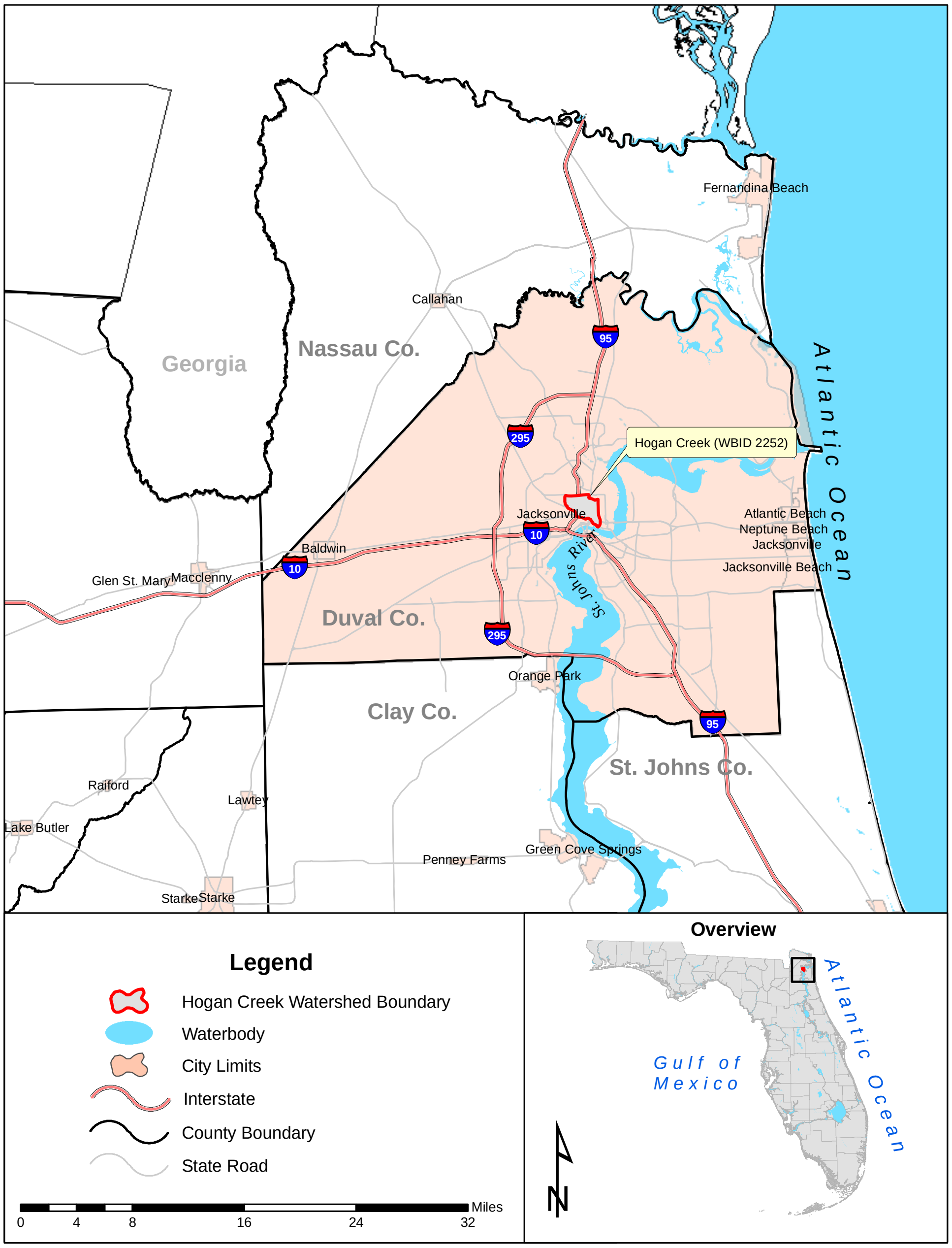


Figure 1.2. Overview of the Hogan Creek WBID

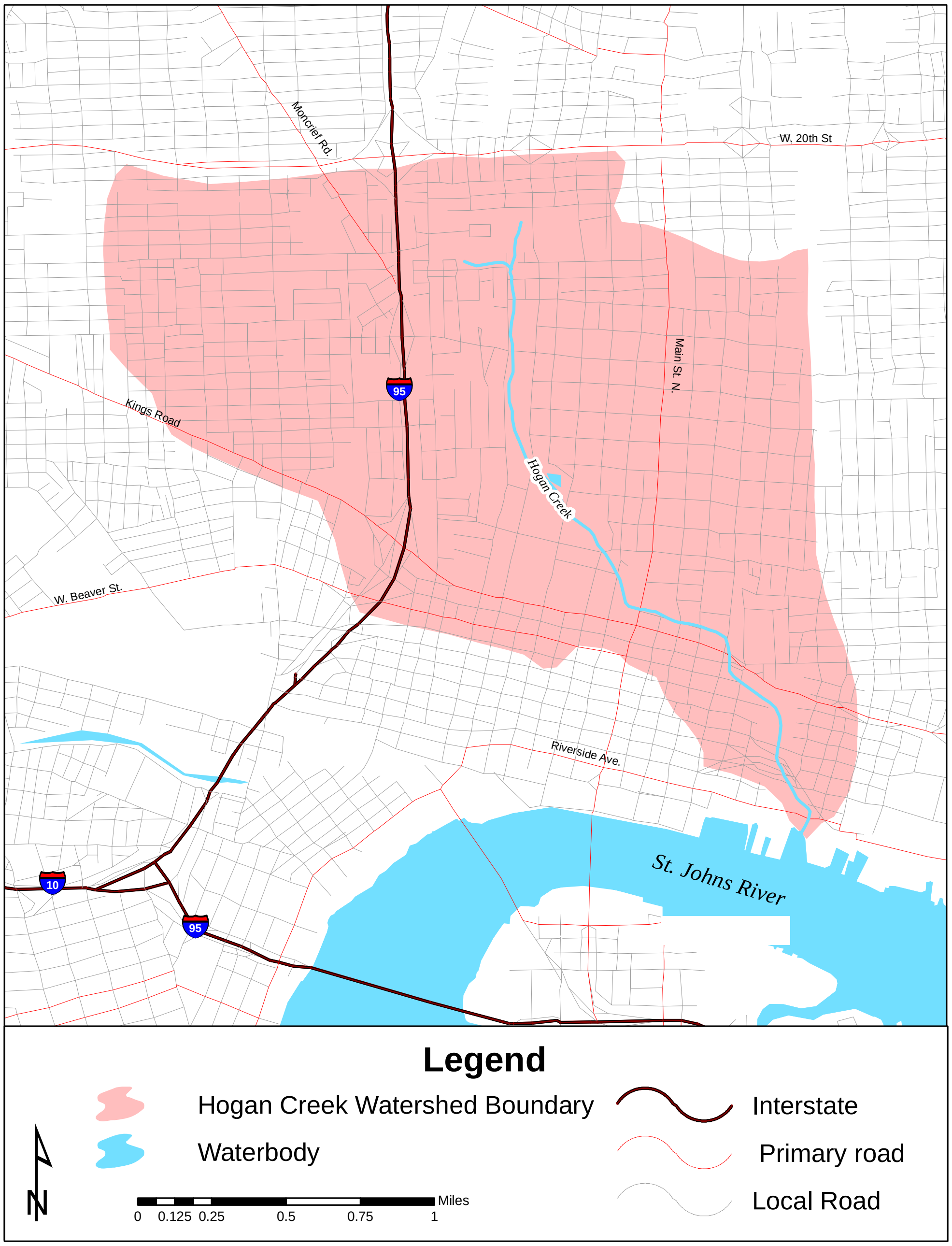
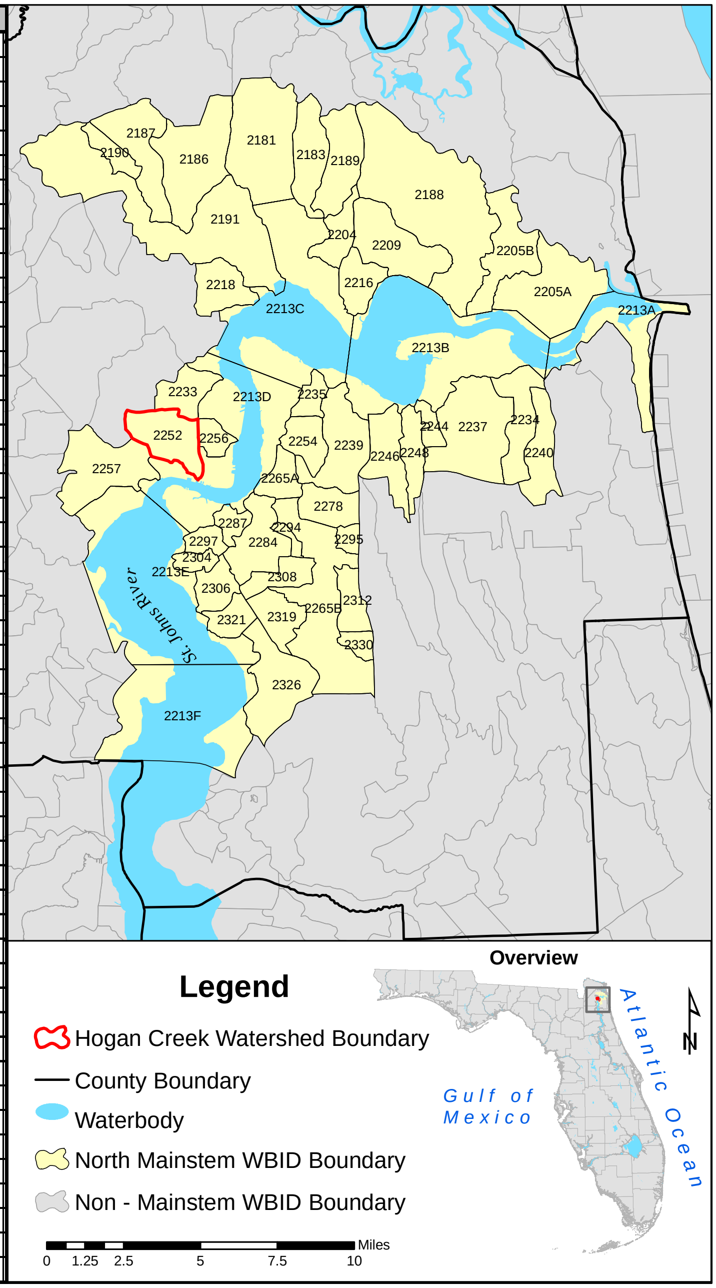


Figure 1.3. WBIDs in the North Mainstem Planning Unit

WBID	Waterbody Name
2181	Dunn Creek
2191	Brow ard River
2203	Trout River
2204	Terrapin Creek
2207	Blockhouse Creek
2210	West Branch
2213P	Ortega River
2220	Nine Mile Creek
2224	Ribault River
2227	Sherman Creek
2228	Moncrief Creek
2232	Sixmile Reach
2233	Long Branch
2235	New Castle Creek
2238	Little Sixmile Creek
2239	Straw berry Creek
2240	Greenfield Creek
2244	Cow Head Creek
2246	Jones Creek
2248	Gin House Creek
2249A	Ortega River
2249B	McGirts Creek
2252	Hogan Creek
2254	Red Bay Branch
2256	Deer Creek
2257	McCoy Creek
2262	Cedar River
2265B	Potsburg Creek
2266	Hopkins Creek
2270	Hogpen Creek
2278	Silversmith Creek
2280	Big Fishw ier Creek
2282	Wills Branch
2284	Little Potsburg Creek
2287	Miller Creek
2297	Craig Creek
2299	Open Creek
2304	Miramar Creek
2306	New Rose Creek
2316	Williamson Creek
2321	Christopher Branch
2322	Butcher Pen Creek
2324	Fishing Creek
2326	Goodbys
2351	Julington Creek
2356	Big Davis Creek
2361	Deep Bottom Creek
2365	Durbin Creek
2370	Oldfield Creek
2381	Cormorant Branch
2385	Mandarin Drain



1.3 Background

This report was developed as part of the Florida Department of Environmental Protection's (Department) 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 fifty-two river basins over a five-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. TMDLs 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 coliforms that caused the verified impairment of Hogan Creek. These activities will depend heavily on the active participation of the St. Johns River Water Management District, the 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 EPA a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant source in each of these impaired 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.]). Florida's 1998 303(d) list included 55 waterbodies and 277 parameters in the Lower St. Johns River Basin, and the state's 303(d) list is amended annually to include basin updates.

However, the Florida Watershed Restoration Act (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.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in Hogan Creek and has verified the impairments listed in **Table 2.1**. **Tables 2.2** through **2.4** provide summary results for fecal coliform data for the verification period, which for Group 2 waters was January 1, 1996 – June 30, 2003, by month, season, and year, respectively.

Table 2.1. Hogan Creek Verified Impaired Parameters

WBID	Waterbody Segment	Parameters of Concern	Priority for TMDL Development	Projected Year for TMDL Development
2252	Hogan Creek	Fecal Coliforms	High	2004

There is an 86.8 percent overall exceedance rate for fecal coliforms in Hogan Creek. Exceedances occur in all months in which data exists except for except February. There is a 100 percent exceedance rate in July, August, September, and October; only February had no exceedances, but that is based on only one sample (**Table 2.2**). The sample size for each month is small, with all months having four or less samples. All seasons have at least a 66 percent exceedance rate, with summer having a 100 percent exceedance rate (**Table 2.3**). There are a total of 22 samples, ranging from 96 counts/100 mL to 24,000 counts/100 mL.

Data was collected between 1996 and 2002. There was a 100 percent exceedance rate for 1996, 1997, 1998, and 1999; there was a 75 percent exceedance rate in 2000 and 2002. The least percent exceedance occurred in 2001 (40 percent). All years have five or less observations.

There are two sites with historical fecal coliform data. One site only has 36 samples; the other has only two samples. Sampling stations are discussed further in **Section 5.1**.

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

Month	N	Minimum	Maximum	Median	Mean	No. of Exceedances	% Exceedance	Mean Precipitation
January	3	202	9,000	2,600	3,934	2	66.67%	2.39
February	1	170	170	170	170	0	0.00%	3.14
March	0	---	---	---	---	---	---	3.95
April	2	96	3,000	1,548	1,548	1	50.00%	2.8
May	4	100	2,600	550	950	3	75.00%	1.61
June	0	---	---	---	---	---	---	7.40
July	1	8,000	8,000	8,000	8,000	1	100.00%	6.72
August	1	17,000	17,000	17,000	17,000	1	100.00%	6.72
September	4	500	5,500	2,900	2,950	4	100.00%	9.94
October	3	1,300	14,000	11,000	8,767	3	100.00%	3.39
November	0	---	---	---	---	---	---	1.81
December	3	300	24,000	7,100	10,467	2	66.67%	3.12

Coliform counts are #/100 mL
Exceedances represent values above 400 counts/100 mL
Mean precipitation is from Jacksonville International Airport (JIA) in inches. Mean precipitation is the long term (1955 – 2004) mean for the stated month

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

Season	N	Minimum	Maximum	Median	Mean	No. of Exceedances	% Exceedance	Mean Precipitation
Winter	4	170	9,000	1,401	2,993	2	50.00%	10.72
Spring	6	96	3,000	550	1,149	4	66.67%	12.41
Summer	6	500	17,000	5,250	6,133	6	100.00%	21.15
Fall	6	300	24,000	9,050	9,617	5	83.33%	8.34

Coliform counts are #/100 mL
Winter = January – March; spring = April – June; summer = July – September; fall = October - December
Exceedances represent values above 400 counts/100 mL
Mean precipitation is from Jacksonville International Airport (JIA) in inches, and is the long term mean (1955 – 2004) for all three months of the season

Table 2.4. Summary of Fecal Coliform Data by Year for Verified Period (January 1, 1996 – June 30, 2003)

Year	N	Minimum	Maximum	Median	Mean	No. of Exceedances	% Exceedance	Total Precipitation
1996	1	1,300	1,300	1,300	1,300	1	100.00%	60.63
1997	1	800	800	800	800	1	100.00%	57.27
1998	3	2,600	11,000	8,000	7,200	3	100.00%	56.72
1999	4	2,600	17,000	8,500	9,150	4	100.00%	42.44
2000	4	300	9,000	530	2,590	3	75.00%	39.77
2001	5	100	7,100	202	2,514	2	40.00%	49.14
2002	4	96	24,000	3,020	7,534	3	75.00%	54.72

Coliform counts are #/100 mL
Exceedances represent values above 400 counts/100 mL
Precipitation is for Jacksonville International Airport (JIA) in inches, and represents the total precipitation for the year indicated

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)**

Hogan 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 criteria applicable to the impairment addressed by this TMDL are for fecal coliforms.

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 per 100 ml 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 criteria state that monthly averages shall be expressed as geometric means based on a minimum of ten samples taken over a thirty-day period. There were insufficient data (less 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 is not to exceed 400 in 10 percent of the samples.

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

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

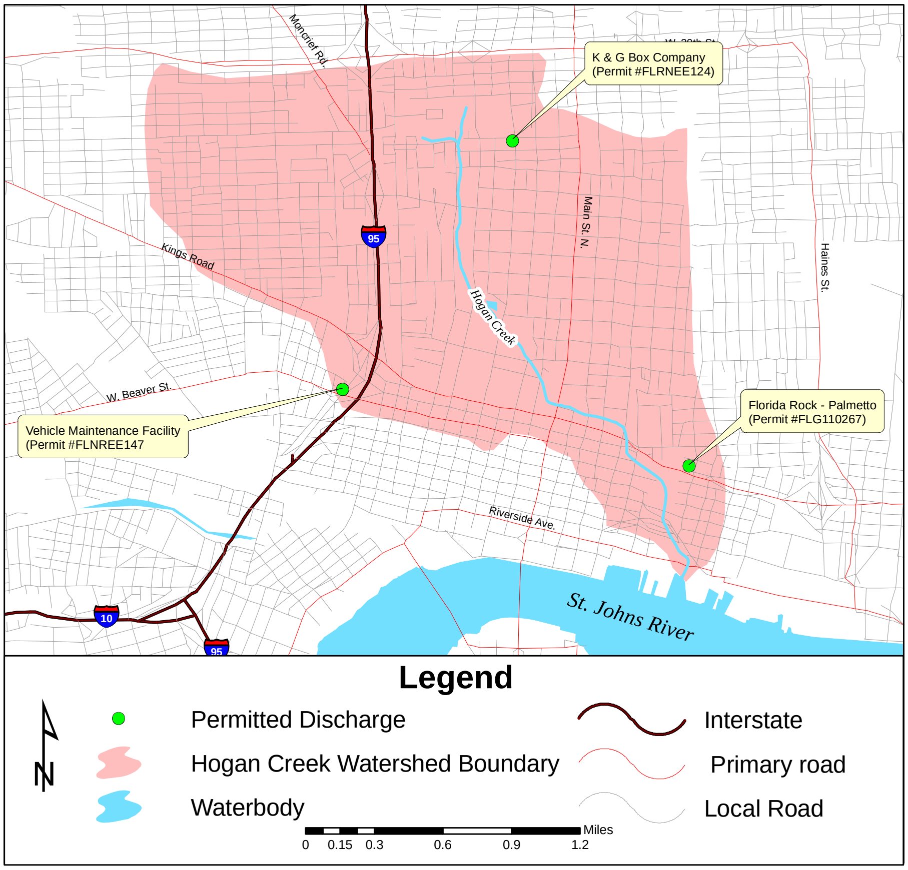
To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **AND** stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a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

4.2.1 Point Sources

There are three permitted facilities with permits in the Hogan Creek watershed. Florida Rock (permit #FLG110267) has been issued a general permit, which covers stormwater. Both of the other facilities, a United States Postal Service vehicle maintenance facility (permit #FLNREE147), and the K & G Box Company (permit #FLNREE124), have been issued general stormwater permits. Coliforms are not required to be monitored under general permits such as these. **Figure 4.1** shows the location of these facilities within the watershed.

Figure 4.1. Location of Permitted Discharges in Hogan Creek Watershed



Municipal Separate Storm Sewer System Permittees

Phase 1 or Phase 2 MS4s. The entire City of Jacksonville, including the Hogan Creek watershed, is covered by a Phase I NPDES municipal separate storm sewer system (MS4) permit (permit FLS000012) issued to the Florida Department of Transportation (FDOT) District 2. Responsibility for the permit is shared among FDOT, and the Cities of Jacksonville, Neptune Beach, and Atlantic Beach.

4.2.2 Land Uses and Nonpoint Sources

Additional coliform loadings to Hogan Creek are generated from nonpoint sources in the basin. Potential nonpoint sources of coliforms include loadings from surface runoff, wildlife, pets, leaking or overflowing sewage lines, and leaking septic tanks.

Land Uses

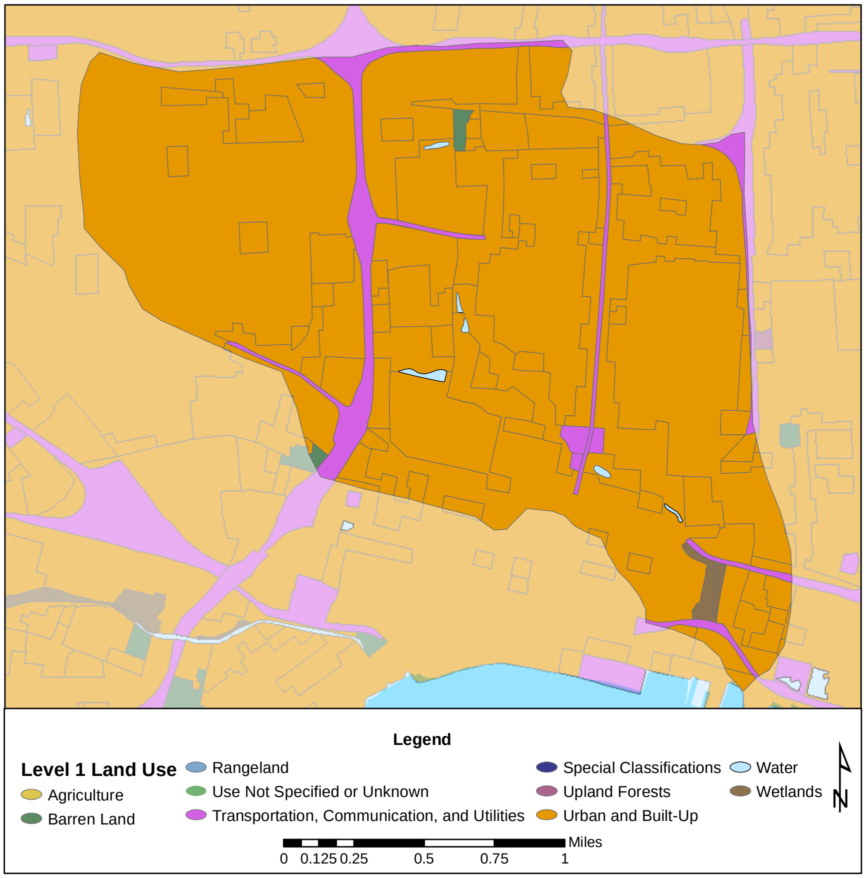
The spatial distribution and acreage of different land use categories were identified using the 2000 land use coverage contained in the Department's Geographic Information System (GIS) library, initially provided by the SJRWMD. Land use categories and acreages in the watershed were aggregated using the Level 3 codes tabulated in **Table 4.1. Figure 4.2** shows the principle land uses in the watershed.

Being within the City of Jacksonville proper, the Hogan Creek watershed is a highly urbanized and impacted area. As **Table 4.1** shows, the majority of the land is high density residential (49.32 percent), followed by commercial and services (19.95 percent) and institutional (12.41 percent). Natural land use types (open land, non-vegetated land, mixed scrub-shrub wetland, freshwaters marshes and streams and waterways) comprise a mere 34.41 acres or 1.56 percent of the land use in the watershed. Impacted areas comprise approximately 2,167.26 acres or 98.43 percent of the watershed.

Table 4.1. Level 3 Land Use Categories in the Hogan Creek Watershed

Level 3 Land Use Code	Attribute	Acres	Percent of Watershed
1200	Residential, high density - 6 or more dwelling units/acre	1,085.84	49.32%
1400	Commercial and services	439.23	19.95%
1700	Institutional	273.32	12.41%
1550	Other light industrial	109.92	4.99%
8140	Roads and highways (divided 4-lanes with medians)	94.46	4.29%
1860	Community recreational facilities	45.86	2.08%
1200	Residential, medium density - 2-5 dwelling units/acre	37.89	1.72%
1900	Open land	22.37	1.02%
1920	Inactive land with street pattern but no structures	13.25	0.60%
1480	Cemeteries	13.00	0.59%
8120	Railroads	10.55	0.48%
1800	Recreational	9.38	0.43%
8200	Communications	7.56	0.34%
1890	Other recreational (stables, go-carts, ...)	6.92	0.31%
7400	Disturbed land	6.34	0.29%
6500	Non-vegetated wetland	6.10	0.28%
5300	Reservoirs - pits, retention ponds, dams	5.41	0.25%
6460	Mixed scrub-shrub wetland	4.08	0.19%
1730	Military	3.40	0.15%
1561	Ship building & repair	2.64	0.12%
8330	Water supply plants	1.42	0.06%
6410	Freshwater marshes	1.26	0.06%
1870	Stadiums - facilities not associated with high schools, colleges, etc.	0.87	0.04%
5100	Streams and waterways	0.60	0.03%
	TOTAL:	**2,201.67**	**100.00%**

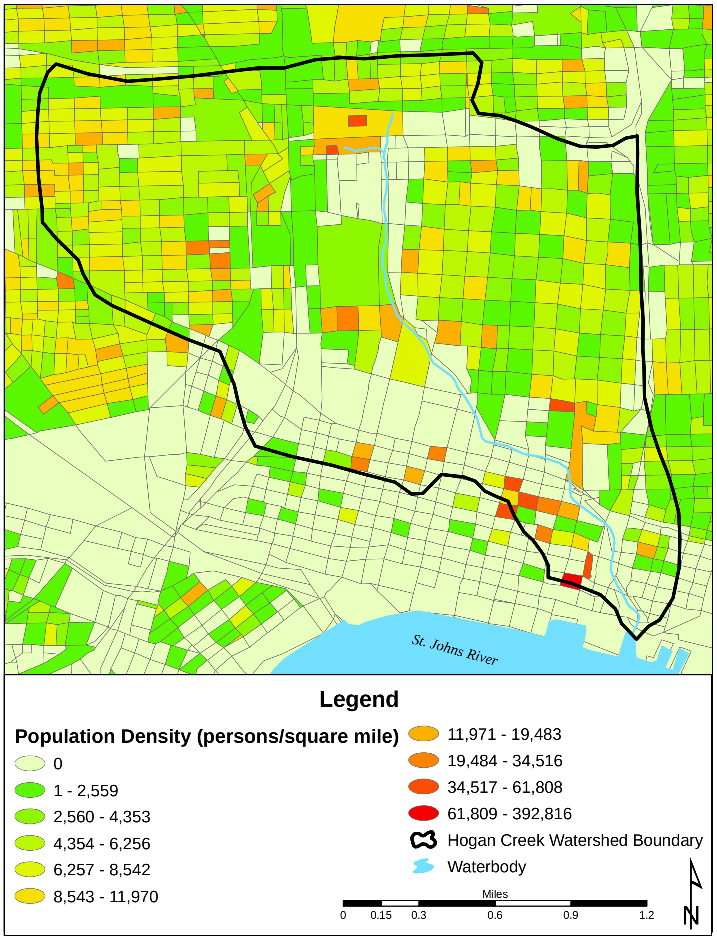
Figure 4.2. Principle Land Uses in the Hogan Creek Watershed



Population

According to the U.S Census Bureau, census block population densities in WBID 2252 in the year 2000 ranged from 0 – 392,816 persons per square mile, with an average 3,835 persons per square mile in the watershed **(Figure 4.3).** Based on this, the estimated population in the Hogan Creek watershed would be 13,191 persons. The 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). For all of Duval County, 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 Web site, 2005). In the Hogan Creek watershed, the estimated housing density is 1,739 units/mi^2. This is nearly four times that of the county average. This is not surprising, and much of Duval County is rural, and the Hogan Creek watershed is highly residential.

Figure 4.3. Population Density in the Hogan Creek Watershed



Septic Tanks

It is estimated that approximately 57 percent of residences within Duval County are connected to a wastewater treatment plant, with the rest utilizing septic tanks (Department of Revenue cadastral data, 2003, and Florida Department of Health Website, 2005a). The Florida Department of Health (DoH) reports that as of fiscal year 2003-2004, there were 88,834 permitted septic tanks in Duval County (Florida Department of Health Web site, 2005b). From fiscal years 1994–2004, 4,954 permits for repairs were issued, and 369 permits were issued for repair in fiscal year 2003-2004 (Florida Department of Health Web site, 2005c).

The Department obtained septic tank repair permit data from JEA and the Florida Department of Health for the JEA service area, which includes the Hogan Creek watershed. The data include septic tank repair permits issued from March 1990 – April 2004, areas serviced by a wastewater treatment facility (WWTF), and areas where high numbers of failing septic tanks are present. This information is presented in **Figure 4.4**. The data show there were 23 permits for repairs issued in the Hogan Creek watershed during this time, or an annual average of just under two (1.62) repairs. The entire watershed is serviced by the Buckman WWTF. None of the watershed area is considered to be a high septic tank failure area by JEA or areas where a historically high number of septic tanks have failed. These areas have the highest priority to be sewered and are known as septic tank phase-out areas.

Based on 2000 U.S. Census Bureau data, there is an estimated 3,835 persons/mi^2 in the WBID, or 13,191 persons in the watershed area. The average household in the Hogan Creek watershed has 2.20 persons (see **Table 4.2**). According to the DoH, there is an annual average of 450 repairs (fiscal years 1994 – 2004) in Duval County. Based on this, there is an average of approximately 2.0 failures in the Hogan Creek watershed annually. This estimate is similar to that based on data provided by JEA provided to the Department (1.62 repairs annually).

Based on data provided by JEA, between March 1990 and April 2004 an average of 1.62 permits was issued in the watershed for septic tank repairs. If this estimate is rounded up to two (to allow for those septic tanks where failures may not be known or have not been repaired), and using 70 gallons/day/person (U.S. Environmental Protection Agency [USEPA], 2001), a loading of 1.17 x 10^{10} counts/day is derived or 4.26 x 10^{12} counts/year. This estimation is shown in **Table 4.3.**

Table 4.2. Estimation of Average Household Size in the Hogan Creek Watershed Area

Household Size	No. of Households	Percentage of Total	Number of People
1-person household	2,702	20.48%	2,702
2-person household	1,387	21.02%	2,774
3-person household	801	18.21%	2,403
4-person household	529	16.05%	2,116
5-person household	314	11.90%	1,570
6-person household	132	6.02%	792
7-or-more-person household	119	6.31%	833
TOTAL:	**5,984**	**100.00%**	**13,190**
		AVERAGE HOUSEHOLD SIZE:	**2.20**

Data from U.S. Census Bureau web site, 2005, based on Duval County tracts which are present in the Hogan Creek watershed

Table 4.3. Estimation of Annual Fecal Coliform Loading from Failed Septic Tanks in the Hogan Creek Watershed

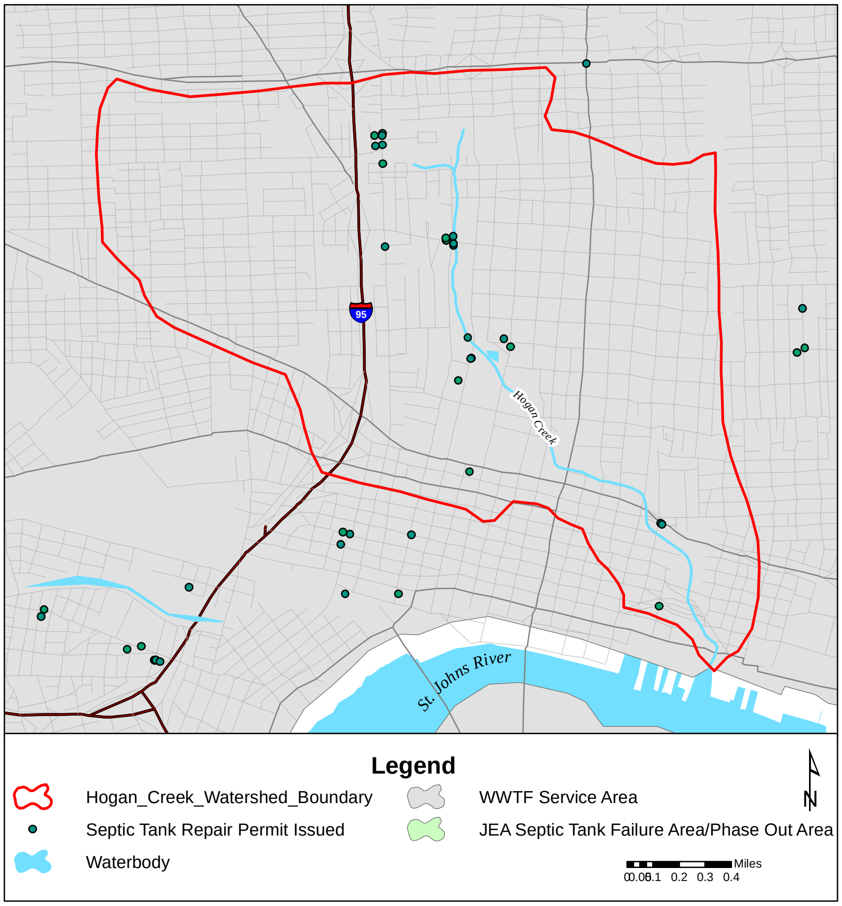
Estimated Population Density	WBID Area (mi^2)	Estimated Population in Watershed	Estimated Number of Tank Failures[1]	Daily Estimated Load From Failed Tank[2]	Gallons/ Person/ Day[2]	Estimated Number Persons Per Household[3]	Estimated Daily Load From Failing Tanks	Estimated Annual Load From Failing Tanks
3,835persons/mi^2	3.44	13,191	2	1.00 x 10^4/mL	70	2.20	1.17 x 10^{10}	4.26 x 10^{12}

[1] Based on septic tank repair permits issued in the watershed from March 1990 – November 2004 (FL. DoH and JEA information) – see text

[2] From EPA document "Protocol for Developing Pathogen TMDLs."

[3] From U.S Census Bureau, see Table 4.2 for more information on this estimate.

Figure 4.4. Septic Tank Repair Permits Issued March 1990 – April 2004 for Hogan Creek Area



4.3 Source Summary

4.3.1 Summary of Fecal Coliform Loadings to Hogan Creek from Various Sources

Table 4.4 summarizes the annual average fecal coliform counts (from 1991 through 2002) from runoff, and septic tank leakage, and other sources in the Hogan Creek watershed. As discussed in **Section 4.2.1**, there are three permitted discharges in the watershed, Florida Rock, U.S. Postal Service vehicle maintenance facility, and K & G Box Company. Discharges from these facilities are included in **Table**

4.4; however, based on the type of facility and type of discharge, the effects of the discharges with respect to coliforms on the creek is expected to be negligible.

Table 4.4. Average Annual Fecal Coliforms Counts in Hogan Creek

Year	Average Annual Count (#/100 mL)	N
1991	13,250	4
1992	14,825	4
1993	65,000	4
1994	1,450	2
1995	1,050	2
1996	1,300	1
1997	800	1
1998	7,200	3
1999	9,150	4
2000	2,590	4
2001	2,514	5
2002	7,534	4

According to Level 3 land use there are no agricultural areas in the Hogan Creek watershed. As noted in **Section 4.2.2** the majority of the land use (98.43 percent) consists of residential, commercial and services and other types impacted by humans. While it is doubtful that agriculture has any influence on the basin at all, as the area is highly urbanized with a large number of people per square mile, it is very possible that pets, especially dogs, are having an impact on the waterbody. The Department has been unable to obtain specific numbers of dogs in the area; however, estimates can be made, as in **Table 4.5**. For example, using household-to-dog ratio estimates from the American Veterinary Medical Association (AVMA), and assuming that 10 percent of coliforms reach the waterbody and are viable upon reaching it, the approximate loading would be 1.08×10^{12} counts/day. This is an estimate, as the actual loading from dogs is not known, however being a mostly downtown area, it is possible that this is still a high estimate.

Table 4.5. Estimated Loading from Dogs in the Hogan Creek Watershed

Estimated No. of Households in 2381	Estimated Household:Pet Ratio[1]	Estimated Total Dog Population in Watershed	Estimated Loading of Total	Estimated No. of Pets with Impact to Creek	Estimated Counts/ Pet/ Day[2]	Estimated Daily Load Counts/Day	Estimated Annual Load Counts/Year
5,984	0.361	2,160	10%	216	5×10^{9}	1.08×10^{12}	3.94×10^{14}

[1] From the American Veterinary Medical Association website, which states the original source to be the "U.S Pet Ownership and Demographics Sourcebook," 2002.
[2] From EPA document, "Protocol for Developing Pathogen TMDLs," 2001.

Due to the lack of flow data, no correlation between exceedances and flow can be made. However, there is an 86.84 percent overall exceedance rate, which occurs across all seasons and months for which data exists (**Tables 2.2** and **2.3**). Based on the exceedances rate, it is assumed that if a loading curve could be created, exceedances would be distributed across all flow regimes. It is possible that the chronic exceedances are a combination of factors. For example, it may be that failing septic tanks (**Figure 4.4)** contribute during low flow conditions. During higher flows, influenced by rain events, run-off containing feces from pets and other wildlife may be contributing to exceedances.

Leaking or Overflowing Wastewater Collection Systems

As noted previously, it has been estimated that 57 percent of households in Duval County are connected to wastewater facilities. Assuming 5,984 homes in the watershed, with 2.20 people per home, and a 70 gallon per person per day discharge, and also assuming that the countywide average of 57 percent are connected to a WWTF applies in the Hogan Creek watershed, a daily flow of approximately 921,536 gallons per day are transported through the collection system. The EPA Protocol for Developing Pathogen TMDLs (EPA, 2001) suggests that a 5% leakage rate from collection systems is realistic. Based on this and EPA values for fecal and total coliforms in raw sewage, the potential loadings of fecal and total coliforms from leaking sewer lines are 4.97 x 10^{12} counts/day or 1.81 x 10^{15} counts/year (**Table 4.6**).

Table 4.6. Estimated Loading from the Wastewater Collection Systems

Coliforms	Estimated Homes on Central Sewer	Estimated Daily Flow (L)	Daily Leakage (L)	Raw Sewage Counts/100mL	Estimated Counts/Day	Estimated Counts/Year
Fecal	3,411	1.98 x 10^5	9.94 x 10^3	5 x 10^6	4.97X 10^{12}	1.81 x 10^{15}

4.3 Source Summary

Table 4.7 summarizes the various 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, and temperature are just a few of the factors that could influence and determine the actual loadings from these sources that reach Hogan Creek.

Table 4.7. Summary of Estimated Potential Coliform Loading From Various Sources in the Hogan Creek Watershed

Source	Estimated Daily Load (counts/day	Estimated Annual Load (counts/year)
Permitted Discharges	N/A*	N/A*
Septic Tanks	1.17 x 10^{10}	4.26 x 10^{12}
Dogs	1.08 x 10^{12}	3.94 X 10^{14}
Collection Systems	4.97X 10^{12}	1.81 x 10^{15}

* There are currently no permitted facilities required to monitor for coliforms

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

There are no USGS stream gaging stations on Hogan Creek, therefore the load duration curve method could not be applied in this circumstance. To determine the required reduction for this TMDL, the required percent reduction that would be required for each of the exceedances was determined using all available data, and the percent reduction required to meet the state standard of 400 counts/100 mL was determined. The median value of all of these reductions determined the overall required reduction, and therefore the TMDL.

5.1.1 Data Used in the Determination of the TMDL

There are two sampling stations in WBID 2252 that have historical observations **(Figure 5.1).** One of the stations, Hogan Creek at Broad Street (STORET ID: 20030729) has been visited twice, both times by the Department. The primary collector of historical data is the City of Jacksonville, which maintained a routine sampling site at First Street (STORET ID: HC3). The creek was sampled quarterly for the most part from 1991 – 2002 by the City of Jacksonville. There have been 36 samples collected at this site during this time, with an 88.89 overall exceedance rate. **Table 5.1** shows data collection information for each of the stations. **Figure 5.1** shows the location of the sample sites. **Figure 5.2** is a chart showing the observed historical data analysis summary, and **Appendix B** contains the historical fecal coliform observations from both sites. All of the fecal coliform data in the IWR were used to develop the TMDL for Hogan Creek.

Table 5.1. Sampling Station Summary for the Hogan Creek Watershed

Station	STORET ID	Station Owner	Years With Data	N
HOGAN CREEK AT FIRST STREET	21FLJXWQHC3	City of Jacksonville	1991-2002	36
HOGANS CREEK AT BROAD STREET	21FLA 20030729	FL. Dept. of Env. Protection	2000-2001	2

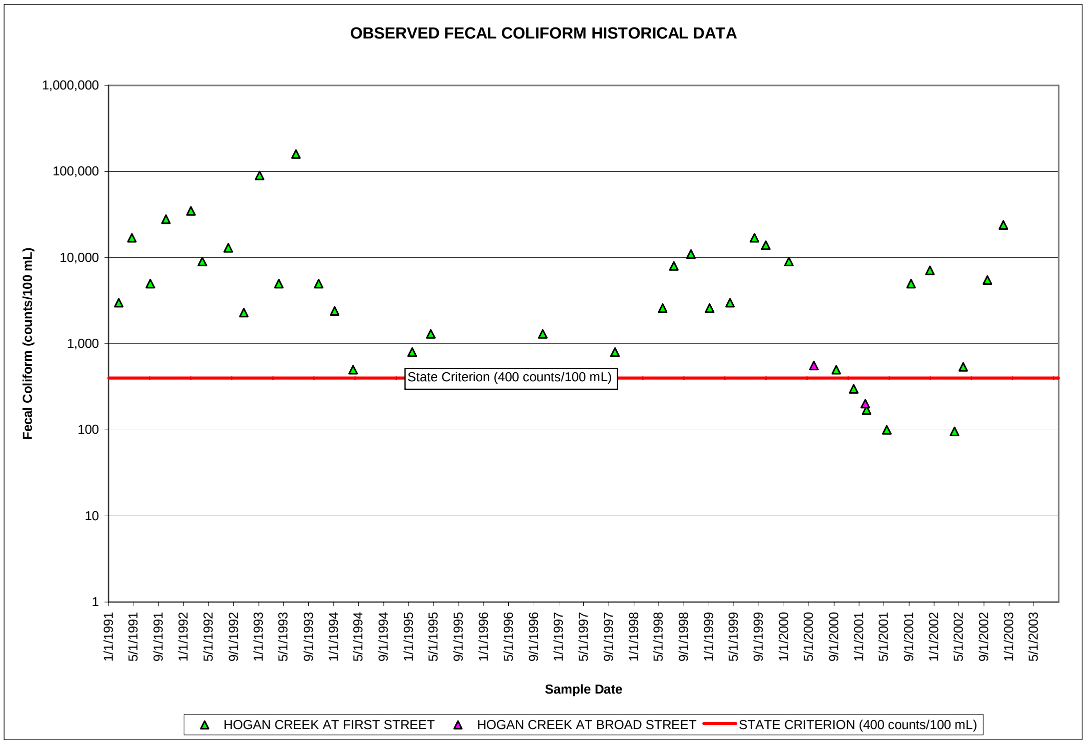
Table 5.2. Statistical Table of Observed Historical Data for Hogan Creek

Station	N	Minimum	Maximum	Median	Mean	Exceedances	% Exceedances
HOGAN CREEK AT FIRST STREET	36	96	160,000	5,000	13,609	32	88.89%
HOGANS CREEK AT BROAD STREET	2	202	560	381	381	1	50.00%

Coliform concentrations are counts/100 mL

Figure 5.1. Historical Sample Sites in Hogan Creek Watershed

Figure 5.2. Historical Observations for Hogan Creek



5.1.2 TMDL Development Process

Due to the lack of supporting information, mainly flow data, a simple straight forward calculation was performed to determine the needed reduction. Exceedances of the state criterion were compared to 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 92.00 percent. This means that in order to meet the state criterion of 400 counts/100mL, a 92 percent reduction in current loading is necessary, and is therefore the TMDL for Hogan Creek. **Table 5.3** shows annual summaries of data used in the calculation of the TMDL and **Table 5.4** shows the individual reduction calculations for Hogan Creek, which includes all exceedances.

Table 5.3. Annual Summary of Data Used to Develop the TMDL for Hogan Creek

Year	N	Minimum	Maximum	Median	Mean
1991	4	3,000	28,000	11,000	13,250
1992	4	2,300	35,000	11,000	14,825
1993	4	5,000	160,000	47,500	65,000
1994	2	500	2,400	1,450	1,450
1995	2	800	1,300	1,050	1,050
1996	1	1,300	1,300	1,300	1,300
1997	1	800	800	800	800
1998	3	2,600	11,000	8,000	7,200
1999	4	2,600	17,000	8,500	9,150
2000	3	500	9,000	560	3,353
2001	2	5,000	7,100	6,050	6,050
2002	3	540	24,000	5,500	10,013

Coliform counts are #/100 mL

Table 5.4. Calculation of Reductions for the Fecal Coliform TMDL for Hogan Creek

Sample Date	Location	Exceedance	Required Reduction
2/19/1991	HOGAN CREEK AT FIRST STREET	3,000	86.67%
4/24/1991	HOGAN CREEK AT FIRST STREET	17,000	97.65%
7/23/1991	HOGAN CREEK AT FIRST STREET	5,000	92.00%
10/7/1991	HOGAN CREEK AT FIRST STREET	28,000	98.57%
2/5/1992	HOGAN CREEK AT FIRST STREET	35,000	98.86%
4/1/1992	HOGAN CREEK AT FIRST STREET	9,000	95.56%
8/5/1992	HOGAN CREEK AT FIRST STREET	13,000	96.92%
10/20/1992	HOGAN CREEK AT FIRST STREET	2,300	82.61%
1/5/1993	HOGAN CREEK AT FIRST STREET	90,000	99.56%
4/8/1993	HOGAN CREEK AT FIRST STREET	5,000	92.00%
7/1/1993	HOGAN CREEK AT FIRST STREET	160,000	99.75%
10/19/1993	HOGAN CREEK AT FIRST STREET	5,000	92.00%
1/5/1994	HOGAN CREEK AT FIRST STREET	2,400	83.33%
4/5/1994	HOGAN CREEK AT FIRST STREET	500	20.00%
1/17/1995	HOGAN CREEK AT FIRST STREET	800	50.00%
4/18/1995	HOGAN CREEK AT FIRST STREET	1,300	69.23%
10/14/1996	HOGAN CREEK AT FIRST STREET	1,300	69.23%
9/30/1997	HOGAN CREEK AT FIRST STREET	800	50.00%
5/20/1998	HOGAN CREEK AT FIRST STREET	2,600	84.62%
7/14/1998	HOGAN CREEK AT FIRST STREET	8,000	95.00%
10/5/1998	HOGAN CREEK AT FIRST STREET	11,000	96.36%
1/4/1999	HOGAN CREEK AT FIRST STREET	2,600	84.62%
4/13/1999	HOGAN CREEK AT FIRST STREET	3,000	86.67%
8/10/1999	HOGAN CREEK AT FIRST STREET	17,000	97.65%
10/4/1999	HOGAN CREEK AT FIRST STREET	14,000	97.14%
1/25/2000	HOGAN CREEK AT FIRST STREET	9,000	95.56%
5/25/2000	HOGAN CREEK AT BROAD STREET	560	28.57%
9/11/2000	HOGAN CREEK AT FIRST STREET	500	20.00%
9/10/2001	HOGAN CREEK AT FIRST STREET	5,000	92.00%
12/11/2001	HOGAN CREEK AT FIRST STREET	7,100	94.37%
5/22/2002	HOGAN CREEK AT FIRST STREET	540	25.93%
9/17/2002	HOGAN CREEK AT FIRST STREET	5,500	92.73%
12/4/2002	HOGAN CREEK AT FIRST STREET	24,000	98.33%
	MEDIAN:	**5,000**	**92.00%**

5.1.3 Critical Conditions/Seasonality

Exceedances in Hogan Creek can't be associated with flows, as no flow data within the basin have been reported. Therefore, the effects of flow under various conditions can't be determined or be considered as a critical condition.

Kruskall – Wallis tests were used to analyze significance between fecal coliforms and month and season. Fecal coliforms showed some significance to season and month. With exception of February, exceedances occurred in all months in which data exists, and across all seasons. Results of the analysis are included as **Appendices C** and **D**. All analyses are significant at the 0.05 alpha (α) level.

Kruskall – Wallis tests were also used to analyze fecal coliform data and several rainfall regimes, which included sampling day (1 day), sampling day and two days prior (3 day) and sampling day and six days prior (7 day). There was significance to one day precipitation, but analysis of three and seven days showed none. This may not be surprising, considering this is essentially a downtown area. The drainage system is designed to collect rainwater quickly and keep flooding to a minimum, thereby allowing stormwater to reach the creek faster than it might under more rural conditions. The results of these analyses are included as **Appendix E**. Rainfall at Jacksonville International Airport (JIA) for years 1990 – 2004 is presented in **Appendix F**. Again, all analyses are significant at the 0.05 α level.

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 – 2004 instead. The chart was divided in the same manner as if flow was being analyzed, where extreme precipitation events represent the upper percentiles (0-5th percentile), followed by large precipitation events (5th – 10th percentile), medium precipitation events (10th – 40th percentile), small precipitation events (40th – 60th percentile), and no recordable precipitation (60th – 100th percentile). Three day (day of and two days prior to sampling) precipitation accumulations were used in the analysis.

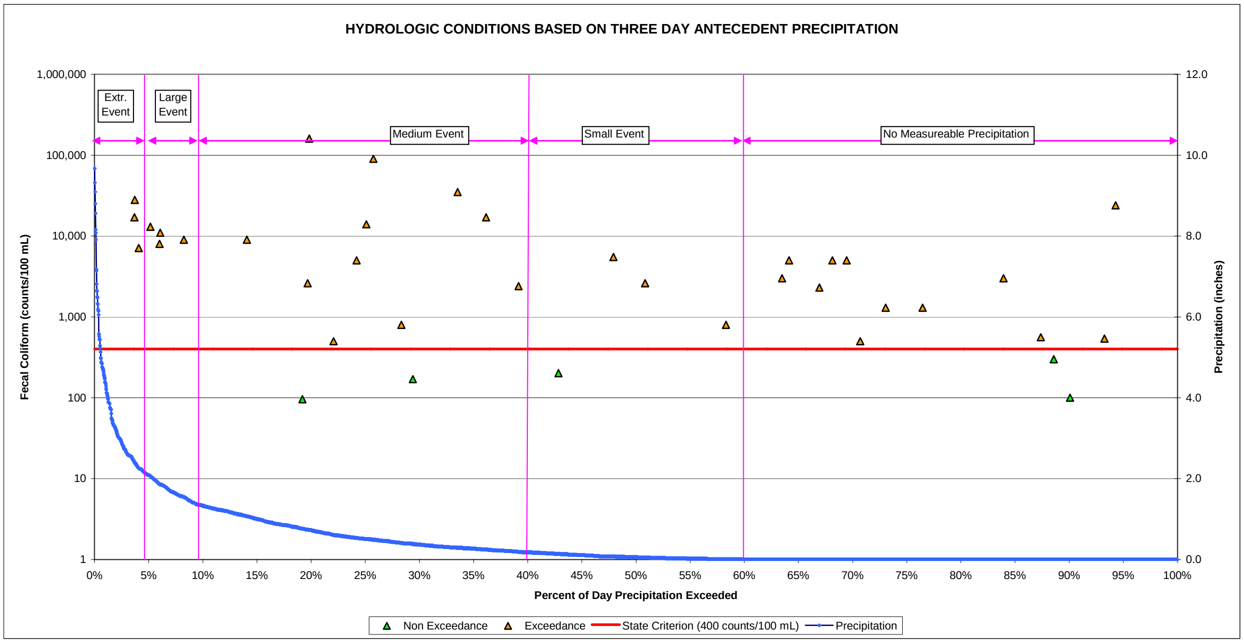
Data show that exceedances occurred over all hydrologic conditions; however, the lowest percentage of exceedances (75 percent) occurred after what would be considered small precipitation events. There were 100 percent exceedances after both large and extreme events. The greatest number of samples (14) was collected after periods of no measurable precipitation. If a large percentage of exceedances occur during no measurable precipitation event range, it is suspected that point sources are contributing. Likewise, if a large percentage of exceedances are found to be occurring after large and extreme precipitation events, this may indicate that exceedances tend to be nonpoint source driven; perhaps from stormwater conveyance systems or various land uses. This seems to indicate that nonpoint sources are contributing to exceedances in Hogan Creek. **Table 5.5** is a summary of data and hydrologic conditions. **Figure 5.3** shows the same data visually.

Appendix G contains charts showing comparisons between each station and season. The charts show that most of the exceedances occur at the First Road site, which should be expected considering this is where the vast majority of the samples have been collected. It also indicates that summer and fall have the most exceedances.

Table 5.5. Summary of Fecal Coliform Data by Hydrologic Condition

Hydrologic Condition	Precipitation Range	Total Values	No. of Exceedances	Percent Exceedance	Number of Non-Excedances	Percent Non-Exceedance
Extreme	>2.1"	3	3	100.00%	0	0.00%
Large	1.33" - 2.1"	5	5	100.00%	0	0.00%
Medium	0.18" - 1.33"	12	10	83.33%	2	16.67%
Small	0.01" - 0.18"	4	3	75.00%	1	25.00%
None/Not Measurable	<0.01"	14	12	85.71%	2	14.29%

Figure 5.3. Fecal Coliform Data by Hydrological Condition Based on Antecedent Rainfall



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 (Waste Load 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:

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

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

$$\textbf{TMDL} \cong \sum \textbf{WLAs}_{\textbf{wastewater}} + \sum \textbf{WLAs}_{\textbf{NPDES Stormwater}} + \sum \textbf{LAs} + \textbf{MOS}$$

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 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**. TMDLs for Hogan Creek are expressed in terms of counts per 100 mL, and represent the maximum daily fecal coliform load the creek can assimilate and maintain the fecal coliform criterion **(Table 6.1).**

Table 6.1. TMDL Components for Hogan Creek

WBID	Parameter	TMDL (counts/100 mL)	WLA		LA (Percent Reduction)	MOS
			Wastewater (counts/day)	NPDES Stormwater		
2252	Fecal Coliform	400	N/A	92.00%	92.00%	Implicit

6.2 Load Allocation (LA)

A fecal coliform reduction of 92percent is required 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 (WLA)

As mentioned previously, there are three permitted facilities with discharge permits in the Hogan Creek watershed. They are all general or stormwater permits, and as such monitoring for coliforms is not required; however, based on activities associated with these facilities, it is doubtful that these they are impacting fecal coliform concentrations in Hogan Creek.

6.3.1 NPDES Wastewater Discharges

There are currently no permitted NPDES wastewater discharges in this basin. However, as part of this TMDL, any future wastewater discharge permits issued within the Hogan Creek watershed will be required to meet state Class III criteria for fecal coliforms as well as the TMDL value, and therefore will not be allowed to exceed fecal coliform levels of 200 counts/100 mL as a monthly average or 400 counts/100 mL more than 10% of the time.

Deleted: basin

6.3.2 NPDES Stormwater Discharges

The City of Jacksonville, including the Hogan Creek drainage basin, is covered by a Phase I MS4 permit (permit FL000012), which includes the City of Jacksonville, City of Atlantic Beach, and the City of Neptune Beach. Permit responsibility is shared among the City of Jacksonville, City of Atlantic Beach, the City of Neptune Beach, and the Florida Department of Transportation (FDOT) District 2. In addition, Florida Rock, the U.S. Postal Service, and K & G Box Company have been issued general stormwater discharge permits.

The WLA for stormwater discharges with a Municipal Separate Storm Sewer System (MS4) permit is a 92 percent reduction in current fecal coliform loading from the MS4. It should be noted that any MS4 permittee will only be responsible for reducing the loads associated with stormwater outfalls for which it owns or otherwise has responsible control, and is not responsible for reducing other nonpoint source loads within its jurisdiction.

6.4 Margin of Safety (MOS)

Consistent with the recommendations of the Allocation Technical Advisory Committee (FDEP, February 2001), an implicit margin of safety (MOS) was assumed in the development of this TMDL. A MOS was included in the TMDL by not allowing any exceedances of the state criterion, even though intermittent natural exceedances of the criterion would be expected and would be taken into account when determining impairment. Additionally, the TMDL calculated for fecal coliforms was based on meeting the water quality criterion of 400 counts/100 mL without any exceedances, while the actual criterion allows for 10 percent exceedances over the criterion.

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 for the TMDL, which will be a component of the Basin Management Action Plan (BMAP) for Hogan Creek. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

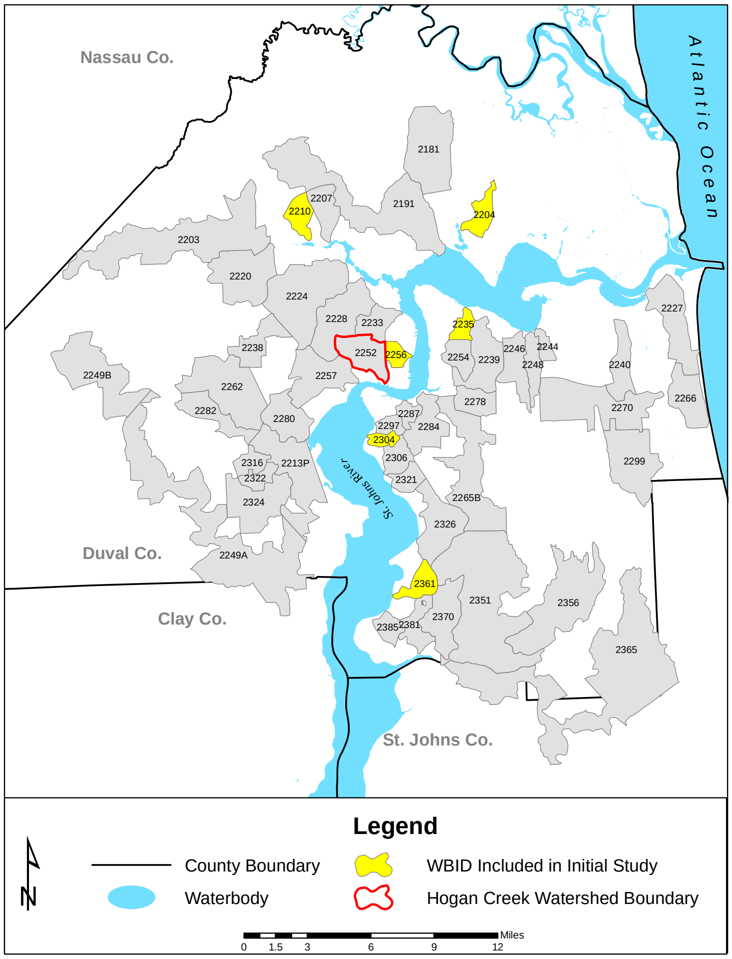
- Appropriate allocations among the affected parties,
- A description of the load reduction activities to be undertaken,
- Timetables for project implementation and completion,
- Funding mechanisms that may be utilized,
- Any applicable signed agreement,
- Local ordinances defining actions to be taken or prohibited,
- Local water quality standards, permits, or load limitation agreements, and
- Monitoring and follow-up measures.

The BMAP for Hogan Creek will include the results of a project funded by JEA. The project will consider 51 drainage basins in the general area of the City of Jacksonville, which includes Hogan Creek. The goal of the project is known as the Tributary Pollution Assessment Project (TPAP). A Tributary Assessment Team (TAT) consisting of representatives from JEA, the Department, City of Jacksonville, Duval County Health Department, Water and Sewer Expansion Authority, U.S. Army Corps of Engineers, St. Johns River Keepers, and PBS & J, who is the primary contractor for the project.

The goal of the TPAP is to devise a standard manual that can be used for tributary sanitary surveys in the Duval County area. The manual will be developed by studying six of the 51 watersheds deemed to be of the highest priority by JEA and the contractors, along with a control watershed. After the manual has been developed, it will be applied to the remaining 45 watersheds, and may then be expanded to other watersheds in the Duval County area. The manual will be used to help better determine the health of these watersheds and to determine potential sources of contamination, especially with respect to fecal coliforms. This will help JEA, who is the sewer utility provider in the area, concentrate repair efforts and to identify those areas where failing septic tanks may be playing a role in contamination. A map of the drainage basins included in this initial study is shown in **Figure 7.1**, and include:

- Big Davis Creek (2356)
- Big Fishwier Creek (2280)
- Blockhouse Creek (2207)
- Broward River (2191)
- Butcher Pen Creek (2322)
- Cedar River (2262)
- Christopher Branch (2321)
- Cormorant Branch (2381)
- Cow Head Creek (2244)
- Craig Creek (2297)
- Deep Bottom Creek (2361)
- Deer Creek (2256)
- Dunn Creek (2181)
- Durbin Creek (2365)
- Fishing Creek (2324)
- Gin House Creek (2248)
- Goodbys Creek (2236)
- Greenfield Creek (2240)
- Hogan Creek (2252)
- Hogpen Creek (2270)
- Hopkins Creek (2266)
- Jones Creek (2246)
- Julington Creek (2351)
- Little Potsburg Creek (2284)
- Little Sixmile Creek (2238)
- Long Branch (2233)
- Mandarin Drain (2385)
- McCoy Creek (2257)
- McGirts Creek (2249B)
- Miller Creek (2287)
- Miramar Creek (2304)
- Moncrief Creek (2228)
- New Castle Creek (2235)
- New Rose Creek (2306)
- Nine Mile Creek (2220)
- Oldfield Creek (2370)
- Open Creek (2299)
- Ortega River (2213P)
- Ortega River (2249A)
- Potsburg Creek (2265B)
- Red Bay Branch (2254)
- Ribault River (2224)
- Sherman Creek (2227)
- Silversmith Creek (2278)
- Sixmile Reach (2232)
- Strawberry Creek (2239)
- Terrapin Creek (2204)
- Trout River (2203)
- West Branch (2210)
- Williamson Creek (2316)
- Wills Branch (2282)

Figure 7.1. Map of WBIDs included in the TPAP study



The WBIDs included in this study have been categorized, based on the primary land use (SJRWMD 2000 data) in the WBID – urban, suburban, or rural. Further efforts were made to identify potential sources of fecal coliform contamination based on land uses, JEA information, and survey data. The WBIDs were then prioritized based on this, as well as existing data. Six WBIDs of highest concern were selected for the initial study (3 urban, 2 suburban, and 1 rural). At the time this document was compiled, a control waterbody had yet to be selected.

Initial sampling for the study is set to begin on the six initial WBIDs on July 26, 2005 and end on February 1, 2006. The final deliverable (manual) will be submitted to JEA on June 1, 2006, and will be available for public review and comment on June 16, 2006. Four types of fecal indicators (fecal coliforms, *E. coli*., *Enterococci*, and coliphages) will be studied. *Enterococcus faecalis* will be studied in an attempt to further identify potential sources of sewage, and samples will be checked for human/ruminant primers. In addition, optical brighteners (using fluorometric techniques) will be included to bolster potential sewage sources input identification.

The executive summary submitted to the Department by JEA and PBS & J is attached as **Appendix H**. It is expected that the results of this study will be used as the basis for BMAP development.

In addition to addressing failing septic tanks, BMAP plans may include some sort of public education in picking up after dogs. As **Table 4.5** shows, potential impacts from dogs could be significant. If pet owners are educated on the potential impacts their pets are having on Hogan Creek, and they are inclined to take action, this could potentially decrease a source load.

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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.

The rule requires the state's water management districts (WMDs) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG has been developed for Newnans Lake at the time this study was conducted.

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. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific Standard Industrial Classification (SIC) codes, construction sites disturbing five or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (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 Florida Department of Transportation throughout the fifteen counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES Program will expand the need for these permits to construction sites between one and five 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 similar to other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a re-opener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

Appendix B: Historical Fecal Coliform Observations in Hogan Creek

WATERBODY	WBID	SAMPLE DATE	STATION	LOCATION	VALUE (#/100mL)	REMARK CODE
HOGAN CREEK	2252	2/19/1991	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	3,000	
HOGAN CREEK	2252	2/19/1991	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	3,000	
HOGAN CREEK	2252	4/24/1991	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	17,000	
HOGAN CREEK	2252	4/24/1991	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	17,000	
HOGAN CREEK	2252	7/23/1991	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,000	
HOGAN CREEK	2252	7/23/1991	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,000	
HOGAN CREEK	2252	10/7/1991	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	28,000	
HOGAN CREEK	2252	10/7/1991	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	28,000	
HOGAN CREEK	2252	2/5/1992	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	35,000	
HOGAN CREEK	2252	2/5/1992	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	35,000	
HOGAN CREEK	2252	4/1/1992	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	9,000	
HOGAN CREEK	2252	4/1/1992	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	9,000	
HOGAN CREEK	2252	8/5/1992	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	13,000	
HOGAN CREEK	2252	8/5/1992	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	13,000	
HOGAN CREEK	2252	10/20/1992	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	2,300	
HOGAN CREEK	2252	10/20/1992	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	2,300	
HOGAN CREEK	2252	1/5/1993	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	90,000	
HOGAN CREEK	2252	1/5/1993	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	90,000	
HOGAN CREEK	2252	4/8/1993	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,000	
HOGAN CREEK	2252	4/8/1993	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,000	
HOGAN CREEK	2252	7/1/1993	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	160,000	L
HOGAN CREEK	2252	7/1/1993	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	160,000	L
HOGAN CREEK	2252	10/19/1993	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,000	
HOGAN CREEK	2252	10/19/1993	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,000	
HOGAN CREEK	2252	1/5/1994	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	2,400	
HOGAN CREEK	2252	1/5/1994	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	2,400	
HOGAN CREEK	2252	4/5/1994	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	500	
HOGAN CREEK	2252	4/5/1994	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	500	
HOGAN CREEK	2252	1/17/1995	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	800	
HOGAN CREEK	2252	1/17/1995	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	800	
HOGAN CREEK	2252	4/18/1995	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	1,300	
HOGAN CREEK	2252	4/18/1995	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	1,300	
HOGAN CREEK	2252	10/14/1996	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	1,300	
HOGAN CREEK	2252	10/14/1996	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	1,300	
HOGAN CREEK	2252	9/30/1997	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	800	
HOGAN CREEK	2252	9/30/1997	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	800	
HOGAN CREEK	2252	5/20/1998	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	2,600	
HOGAN CREEK	2252	5/20/1998	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	2,600	
HOGAN CREEK	2252	7/14/1998	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	8,000	
HOGAN CREEK	2252	7/14/1998	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	8,000	
HOGAN CREEK	2252	10/5/1998	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	11,000	
HOGAN CREEK	2252	10/5/1998	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	11,000	
HOGAN CREEK	2252	1/4/1999	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	2,600	
HOGAN CREEK	2252	1/4/1999	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	2,600	
HOGAN CREEK	2252	4/13/1999	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	3,000	
HOGAN CREEK	2252	4/13/1999	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	3,000	

WATERBODY	WBID	SAMPLE DATE	STATION	LOCATION	VALUE (#/100mL)	REMARK CODE
HOGAN CREEK	2252	8/10/1999	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	17,000	
HOGAN CREEK	2252	8/10/1999	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	17,000	
HOGAN CREEK	2252	10/4/1999	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	14,000	
HOGAN CREEK	2252	10/4/1999	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	14,000	
HOGAN CREEK	2252	1/25/2000	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	9,000	
HOGAN CREEK	2252	1/25/2000	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	9,000	
HOGAN CREEK	2252	4/12/2000	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	500	
HOGAN CREEK	2252	4/12/2000	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	500	
HOGAN CREEK	2252	5/25/2000	21FLA 20030729	HOGANS CREEK AT BROAD STREET	560	
HOGAN CREEK	2252	9/11/2000	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	500	
HOGAN CREEK	2252	9/11/2000	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	500	
HOGAN CREEK	2252	9/12/2000	21FLA 20030729	HOGANS CREEK AT BROAD STREET	10,500	
HOGAN CREEK	2252	12/5/2000	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	300	
HOGAN CREEK	2252	12/5/2000	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	300	
HOGAN CREEK	2252	1/30/2001	21FLA 20030729	HOGANS CREEK AT BROAD STREET	202	
HOGAN CREEK	2252	2/6/2001	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	170	
HOGAN CREEK	2252	2/6/2001	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	170	
HOGAN CREEK	2252	5/15/2001	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	100	
HOGAN CREEK	2252	5/15/2001	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	100	
HOGAN CREEK	2252	9/10/2001	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,000	
HOGAN CREEK	2252	9/10/2001	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,000	
HOGAN CREEK	2252	12/11/2001	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	7,100	
HOGAN CREEK	2252	12/11/2001	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	7,100	
HOGAN CREEK	2252	4/10/2002	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	96	
HOGAN CREEK	2252	5/22/2002	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	540	
HOGAN CREEK	2252	9/17/2002	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	5,500	
HOGAN CREEK	2252	12/4/2002	21FLJXWQHC3	HOGAN CREEK AT FIRST STREET	24,000	

Shaded cells are values which exceed the state criterion of 400 counts/100 mL

Remark Codes: L – Off-scale high. Actual value not known, but known to be greater then value shown

NOTE: Some samples were seen as duplicates (i.e. same date and location) and were averaged, per the IWR, for TMDL determination. Appendix B includes all data contained in the IWR database. For this reason, some discrepancies may exist between Appendix B and tables contained in the text.

Appendix C: Kruskall – Wallis Analysis of Fecal Coliform Observations versus Month in Hogan Creek

The following results are for:
WBID = 2252

Categorical values encountered during processing are:
MONTH (9 levels)
1, 2, 4, 5, 7, 8, 9,
10, 12

Kruskal-Wallis One-Way Analysis of Variance for 73 cases
Dependent variable is VALUE
Grouping variable is MONTH

Group	Count	Rank Sum
1	11	403.000
2	6	215.000
4	15	470.000
5	6	97.000
7	6	323.000
8	4	240.000
9	8	240.000
10	12	540.000
12	5	173.000

Kruskal-Wallis Test Statistic = 18.048
Probability is 0.021 assuming Chi-square distribution with 8 df

Appendix D: Kruskall – Wallis Analysis of Fecal Coliform Observations versus Season in Hogan Creek

The following results are for:
WBID = 2252

Categorical values encountered during processing are:
SEASON2 (4 levels)
1, 2, 3, 4

Kruskal-Wallis One-Way Analysis of Variance for 73 cases
Dependent variable is VALUE
Grouping variable is SEASON2

Group	Count	Rank Sum
1	17	618.000
2	21	567.000
3	18	803.000
4	17	713.000

Kruskal-Wallis Test Statistic = 7.943
Probability is 0.047 assuming Chi-square distribution with 3 df

Appendix E: Analysis of Fecal Coliform Observations versus Precipitation in Hogan Creek

FECAL COLIFORM DATA VERSUS DAY (1 day) OF SAMPLING PRECIPITATION

WBID = 2252

Dep Var: VALUE N: 73 Multiple R: 0.489 Squared multiple R: 0.240

Adjusted squared multiple R: 0.229 Standard error of estimate: 25859.799

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	7322.731	3270.038	0.000	.	2.239	0.028
V1D_PREC	74069.082	15661.872	0.489	1.000	4.729	0.000

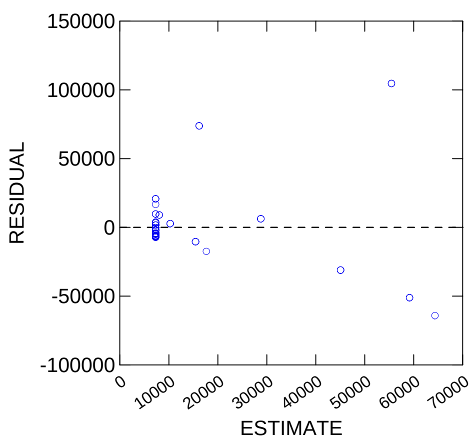
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.49567E+10	1	1.49567E+10	22.366	0.000
Residual	4.74798E+10	71	6.68729E+08		

*** WARNING ***
Case 258 has large leverage (Leverage = 0.189)
Case 264 is an outlier (Studentized Residual = 5.031)
Case 265 is an outlier (Studentized Residual = 5.031)

Durbin-Watson D Statistic 1.053
First Order Autocorrelation 0.469

Plot of residuals against predicted values



FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND TWO DAYS (3 day) PRIOR PRECIPITATION

The following results are for:
WBID = 2252

Dep Var: VALUE N: 73 Multiple R: 0.144 Squared multiple R: 0.021

Adjusted squared multiple R: 0.007 Standard error of estimate: 29347.296

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	10048.337	4283.774	0.000	.	2.346	0.022
V3D_PREC	5394.648	4413.452	0.144	1.000	1.222	0.226

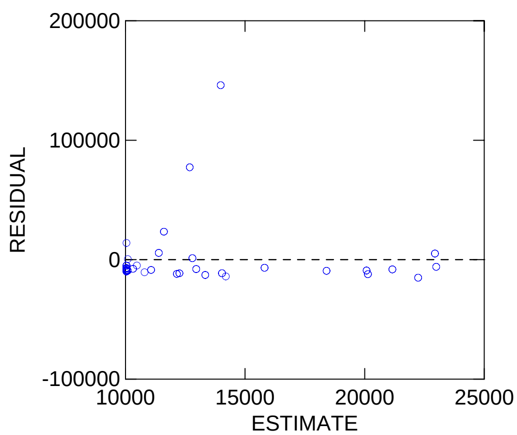
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.28678E+09	1	1.28678E+09	1.494	0.226
Residual	6.11497E+10	71	8.61264E+08		

*** WARNING ***
Case 264 is an outlier (Studentized Residual = 6.189)
Case 265 is an outlier (Studentized Residual = 6.189)

Durbin-Watson D Statistic 1.011
First Order Autocorrelation 0.493

Plot of residuals against predicted values



FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND SIX DAYS (7 day) PRIOR PRECIPITATION

The following results are for:
WBID = 2252

Dep Var: VALUE N: 73 Multiple R: 0.071 Squared multiple R: 0.005

Adjusted squared multiple R: 0.000 Standard error of estimate: 29578.850

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	11367.980	4581.550	0.000	.	2.481	0.015
V7D_PRE	1128.657	1872.052	0.071	1.000	0.603	0.548

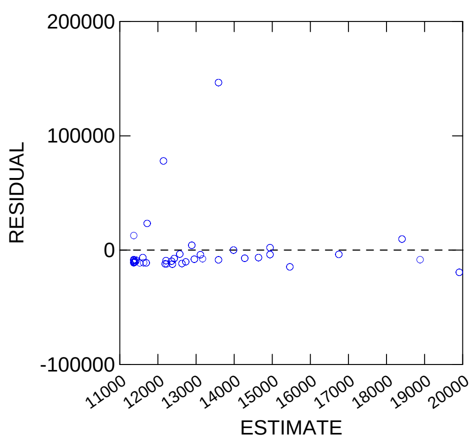
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	3.18017E+08	1	3.18017E+08	0.363	0.548
Residual	6.21185E+10	71	8.74908E+08		

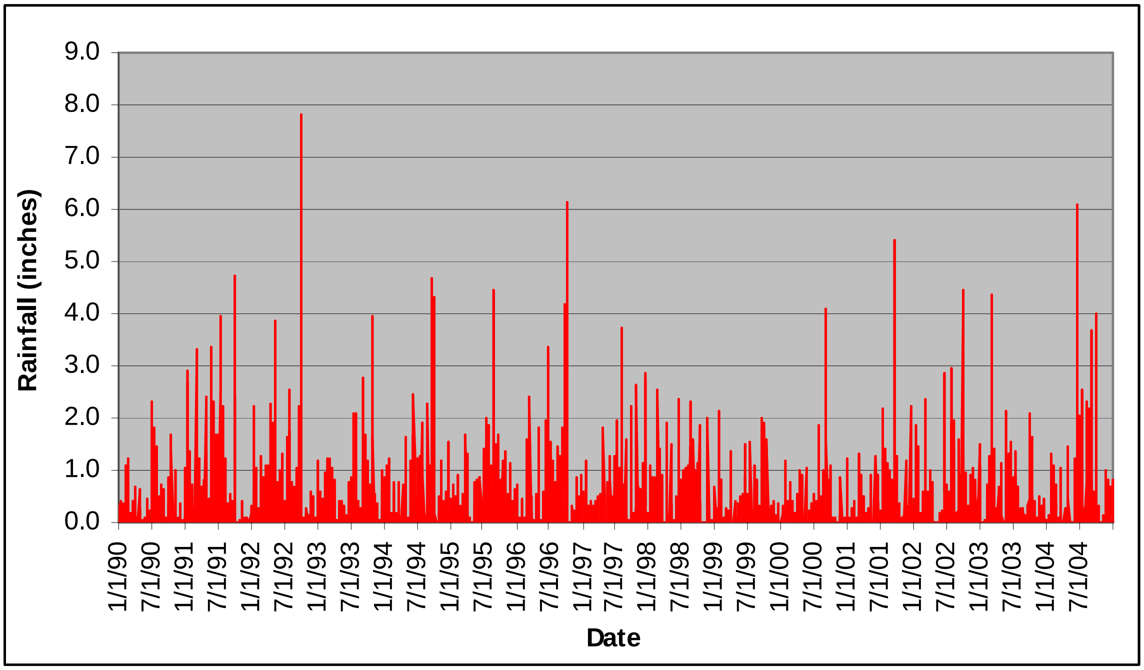
*** WARNING ***
Case 264 is an outlier (Studentized Residual = 6.140)
Case 265 is an outlier (Studentized Residual = 6.140)

Durbin-Watson D Statistic 1.005
First Order Autocorrelation 0.496

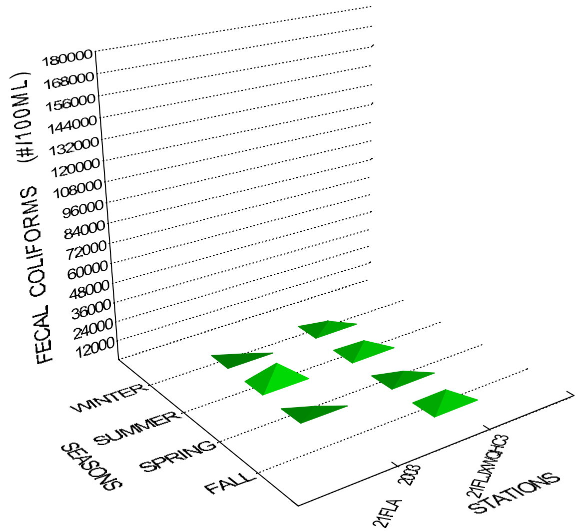
Plot of residuals against predicted values



Appendix F: Chart of Rainfall for Jacksonville International Airport (JIA) from 1990 – 2004

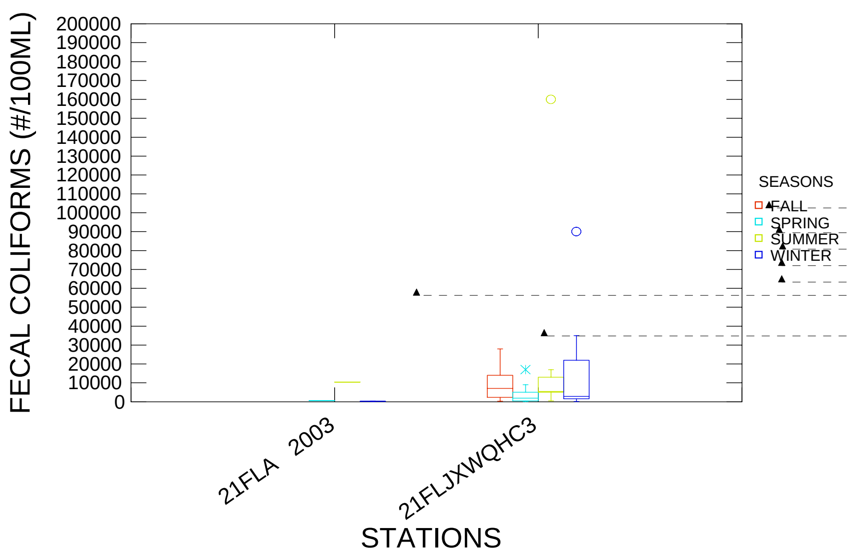


Appendix G: Fecal Coliform Observations versus Season and Station in Hogan Creek



STORET ID	Station
21FLJXWQHC3	HOGAN CREEK AT FIRST STREET
21FLA 20030729	HOGANS CREEK AT BROAD STREET

FECAL COLIFORMS BY SITE AND SEASON



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Appendix H: Executive Summary of Tributary Pollution Assessment Project (TPAP)

Tributary Pollution Assessment
Executive Summary

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.

For additional information, please contact: Don Deis, PBS&J Project Manager, at (904) 363-8442 or drdeis@pbsj.com.

Appendix I: Department Responses to Comments Received Regarding this TMDL for Hogan Creek

1. The watershed is located within the urban areas of the City of Jacksonville but leaking collection lines are not mentioned as a possible source of fecal coliform.

   RESPONSE: Document has been revised to include potential loading estimates from leaking collection systems.

2. The TMDL (expressed as percent reduction) appear to be based on the median value of the data violating the water quality criteria using all data collected in the WBID (i.e., includes data collected prior to January 1996 for Group 2 waters). The resulting load reduction is 92%. As a check, the percent reductions were calculated using the median value of the data violations measured during the listing cycle and a 92 percent reduction is needed. There is no difference in the reduction and modification of the TMDL is not necessary.

   RESPONSE: No response necessary by FDEP.

3. The percent reductions calculated in the TMDL were compared to the reduction calculated using the 90th percentile concentration (EPA's group 3 approach for estimating the TMDL when expressed as a percent reduction). The 90th percentile concentration for Fecal Coliform is 13,100 counts/100mL, requiring a reduction of 97% to achieve the water quality criteria of 400 counts/100mL. The reduction for fecal coliform using the 90th percentile concentration is not significantly higher than the reduction proposed by FDEP. Modification of the TMDL value is not necessary.

   RESPONSE: No response necessary by FDEP.

The following comments were general comments regarding coliform TMDLs developed in the Lower St. Johns River basin.

1. Specifying a load rather than a concentration for the TMDL WLA - The Department does not currently issue load limit permits for coliforms. The Department feels that concentration based permits for coliforms are more appropriate. Concentrations are flow independent, and therefore should meet state water quality criteria no matter what the discharge flow is. A load limit would be discharge flow dependent, and could allow higher concentrations of coliforms if the facility is not discharging at permitted flow. For example, a facility may be discharging at 50 percent of design flow. If a load based WLA was in effect, effluent coliform concentrations could be two-times the state criterion, and still be meeting the WLA. A concentration based WLA would not allow effluent coliform concentrations to exceed the state criteria, no matter what the discharge flow is. The Department feels that a concentration based WLA is more appropriate, and more protective of state water quality criteria.

2. The septic tank loading estimates are higher than those for leaking wastewater collection systems, or seem high in general - As discussed in the document, the estimates of loading from collection systems are based on general information which is available to the

Department. The document clearly states that these estimates are "potential" loads, and site specific information (such as soil types/characteristics, water level, proximity of drainfields to surface waters, etc.), which the Department does not have, would be required to calculate estimates closer to actual loading. The numbers used in the calculations are published numbers. The septic tank loading estimate is based on the number of failures, according to JEA data, which is much more site specific than that of collection systems.

As mentioned at the end of the document, the City of Jacksonville is currently developing a sanitary survey manual, which will be used to more accurately assess potential sources of coliforms in this and other basins. What the Department proposed are just estimates, and further analysis will be done as part of the BMAP phase as an attempt to better quantify individual source contributions.

3. It may be more appropriate to base leaking wastewater collection system estimates on the design flow of the WWTP adjusted for the percent that leaks out of the system and the percent of linear feet of collection lines within the WBID rather than population - The Department feels that the approach used to estimate potential loads from leaking wastewater systems is adequate. The Department does not have direct access to the linear feet of collection line in the basin, or for the service area. In addition, the wastewater facility services several industrial facilities, which if estimates were based on the method proposed above, would not fairly represent the true loads from the collection system. Even if the necessary data were available, the suggested approach would be very time intensive, but more importantly, would not be likely to produce better estimates.

   Furthermore, the design capacity of the Buckman WWTF, which services the majority of the coliform TMDL in the basin, is 52.5 MGD. From 2000 – 2004 the average monthly flow was 30.6 MGD – 58 percent of the design flow. By basing calculations on the design flow, in this case, could severely over estimate the loading from leaking collection pipes. Even if the average flow was used to calculate the loading, non-domestic discharges to the system would still be included in the estimate, and would still result in an overestimation.

   The estimate proposed in the document is just that, an estimate, that the Department feels has been fairly calculated based on the estimated number of households in the basin and the number of people per household. The numbers used in the estimates (coliform concentrations and gallons/person/day) were based on numbers published by EPA in *Protocol for Developing Pathogen TMDLs.*

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