FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

NORTHEAST DISTRICT • LOWER ST. JOHNS BASIN

Final TMDL Report

Fecal Coliform TMDL for Block House Creek, WBID 2207

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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
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U.S. Environmental Protection Agency, National STORET Program

Region 4: Total Maximum Daily Loads in Florida
http://www.epa.gov/region4/water/tmdl/florida/
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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform for Block House Creek in the Trout River 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 Block House Creek that would restore the waterbody so that it meets its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

Block House Creek, located in Duval County in northeast Florida, has a drainage area of approximately 2.52 square miles (mi^2). The creek flows into the Trout River, a direct tributary of the St. Johns River (**Figures 1.1** and **1.2**). Block House Creek is approximately 3.85 miles long and is a second-order stream.

The Block House Creek watershed is located in northern Duval County, on the north side of the St. Johns River just southwest of where Interstate 295 (I-295) crosses Cedar Creek. I-295 skirts the northern edge of the watershed, which encompasses a fairly rural part of Duval County. Additional information about the creek's hydrology and geology are available in the Basin Assessment 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. Block House Creek consists of one segment, WBID 2207 (**Figure 1.2**), which this TMDL addresses.

Block House Creek is part of the Trout 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 Trout River Planning Unit consists of 18 WBIDs. **Figure 1.3** shows the location of these WBIDs, Block House Creek's location in the planning unit, and a list of the other WBIDs in the planning unit.

Figure 1.1. Location of Block House Creek, WBID 2207, and Major Geopolitical Features in the Lower St. Johns Basin

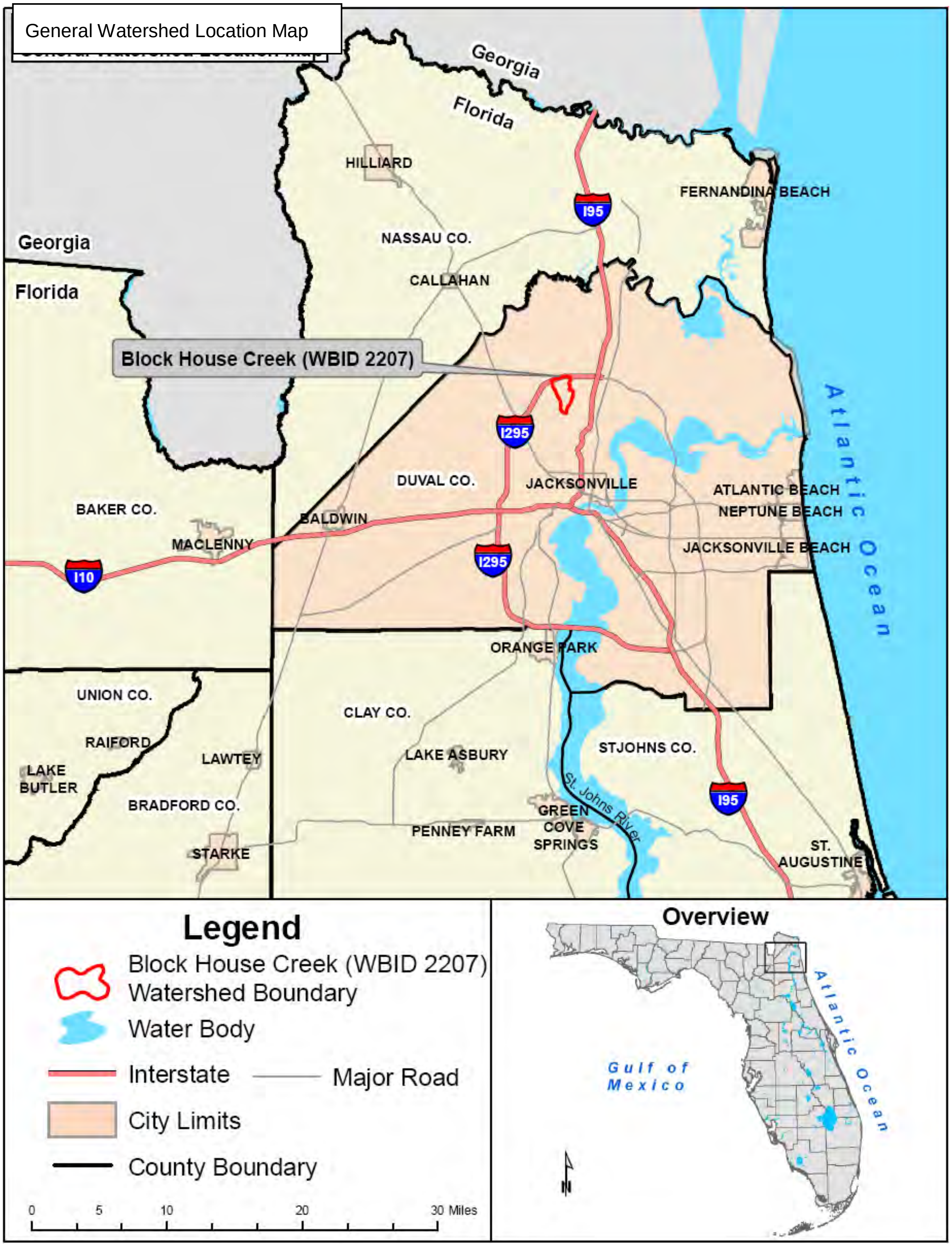


Figure 1.2. Overview of Block House Creek, WBID 2207

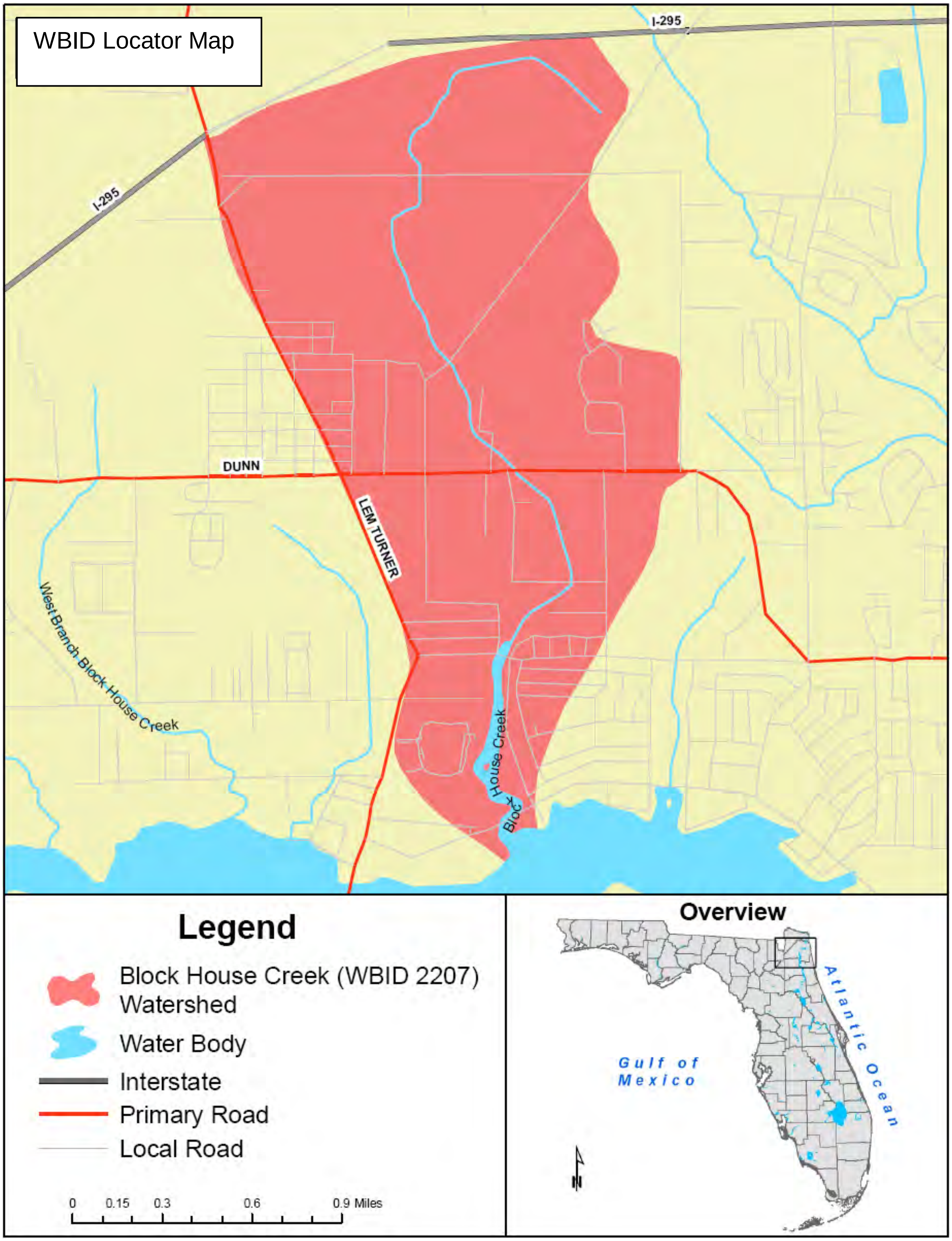
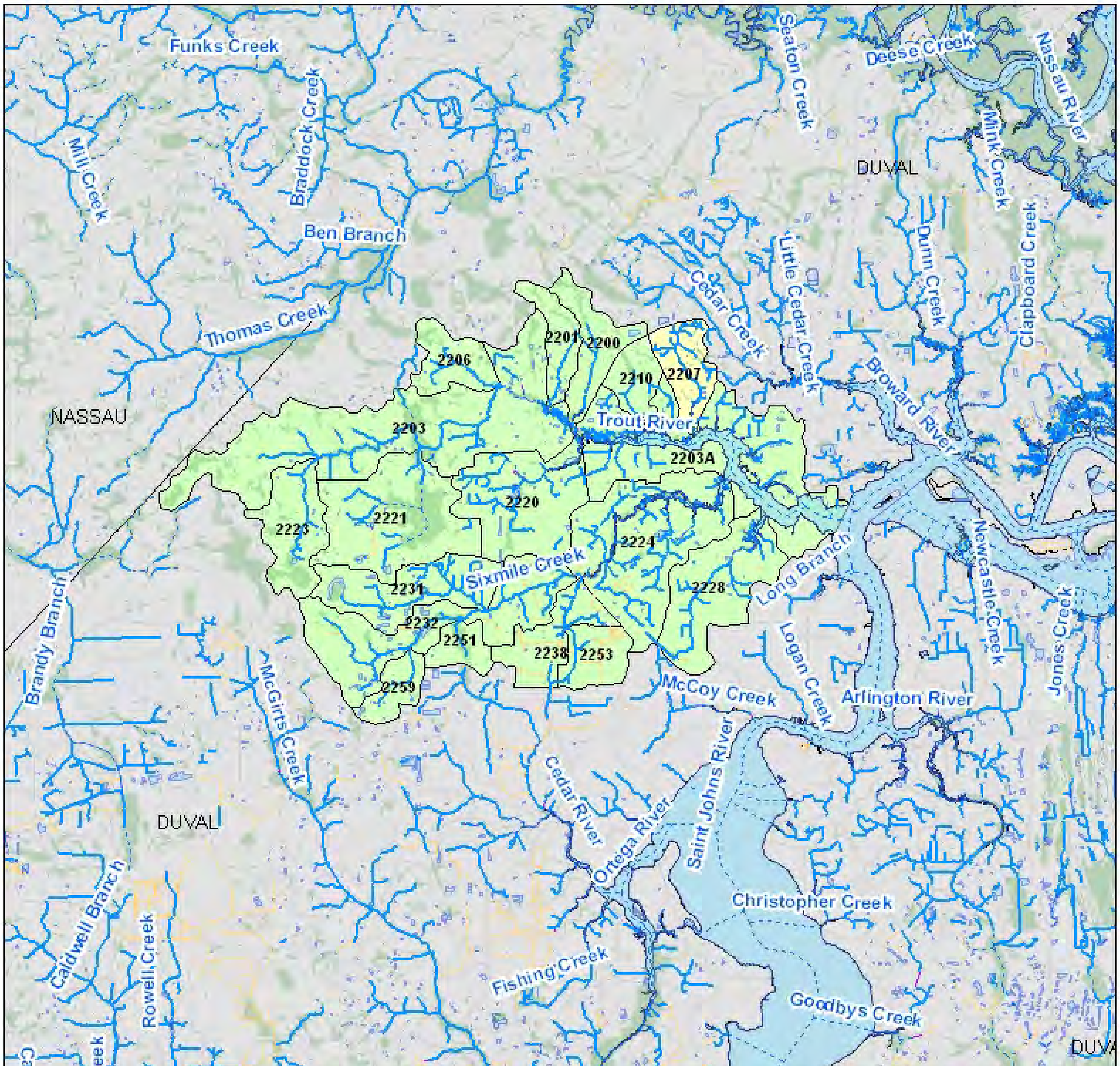
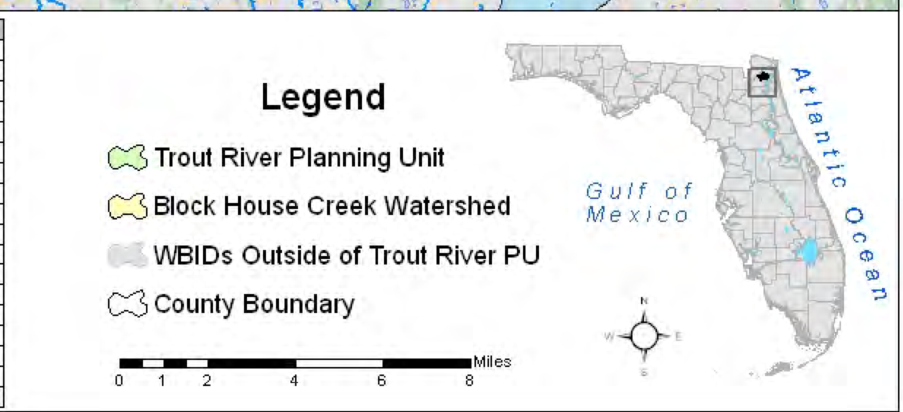


Figure 1.3. WBIDs in the Trout River Planning Unit



WBID	NAME
2221	BAY DRAIN
2207	BLOCK HOUSE CREEK
2251	BULTS BAY
2259	CAMBON BRANCH
2201	GULLEY BRANCH
2200	HALF CREEK
2238	LITTLE SIXMILE CREEK
2206	LITTLE TROUT RIVER
2228	MONCRIEF CREEK
2220	NINEMILE CREEK
2224	RIBAULT RIVER
2232	SIXMILE CREEK REACH
2203	TROUT RIVER
2203	TROUT RIVER
2223	TROUT RIVER
2231	UNNAMED BRANCH
2253	UNNAMED DITCHES
2210	WEST BRANCH



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 Block House 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 52 waterbodies and 15 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 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in Block House 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 is a 76.19 percent overall exceedance rate for fecal coliform in Block House Creek during the verified period, with a total of 21 samples, ranging from 28 counts per 100 milliliters (counts/mL) to 17,000 counts/100 mL.

Exceedances occur in all months in which samples have been collected, with 100 percent exceedance rates occurring in January, March, April, May, July, September, and October (**Table 2.1**). All months have exceedance rates greater than or equal to 50 percent, except February (no samples), November (no samples), and December (a 0 percent exceedance rate). Sample size for each month is small, with all months having 3 or fewer samples, making interpretation difficult.

When aggregating data by season, the winter and spring seasons demonstrate the highest percentages of exceedances (100.00 and 83.33 percent, respectively). The winter season has the second lowest amount of rainfall, and the spring season has the second highest (**Table 2.2**). Due to small sample size, it is not clear whether the exceedances are directly associated with rainfall events, nonpoint sources, point sources, or seasonal variation.

After examining the yearly data, exceedance rates are very high in 1998, 1999, and 2003 (100.00 percent) (**Table 2.3**). Sample size is small, with only 3 samples in 1998, 4 in 1999, and 2 in 2003, making it difficult to verify potential trends.

There is one sampling site where historical data were collected during the verified period (January 1, 1996, to June 30, 2003), and all of the samples were taken by the city of Jacksonville. **Section 5.1** discusses sampling stations further.

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

Month	Number of Samples	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Mean Precipitation
January	2	2,400	17,000	9,700	9,700	2	100.00	2.55
February	0	-	-	-	-	-	-	2.82
March	3	440	11,000	580	4,007	3	100.00	4.26
April	2	1,700	5,000	3,350	3,350	2	100.00	2.79
May	1	520	520	520	520	1	100.00	1.61
June	3	330	1,400	430	720	2	66.67	6.18
July	1	17,000	17,000	17,000	17,000	1	100.00	6.36
August	2	28	9,000	4,514	4,514	1	50.00	6.97
September	2	3,500	4,000	3,750	3,750	2	100.00	10.01
October	2	2,200	2,400	2,300	2,300	2	100.00	3.74
November	0	-	-	-	-	-	-	1.81
December	3	170	298	184	217	0	0.00	3.46

- = Not applicable.
Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Mean precipitation is for Jacksonville International Airport (JIA) in inches

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

Season	Number of Samples	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Mean Precipitation
Winter	5	440	17,000	2,400	6,284	5	100.00	9.62
Spring	6	330	5,000	960	1,563	5	83.33	10.58
Summer	5	28	17,000	4,000	6,706	4	80.00	23.34
Fall	5	170	2,400	298	1,050	2	40.00	9.01

Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Mean precipitation is for JIA in inches.

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

Year	Number of Samples	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Mean Precipitation
1996	0	-	-	-	-	-	-	60.63
1997	0	-	-	-	-	-	-	57.27
1998	3	1,400	17,000	2,400	6,933	3	100.00	56.72
1999	4	2,200	9,000	3,700	4,650	4	100.00	42.44
2000	4	170	17,000	2,850	5,718	3	75.00	39.77
2001	4	184	11,000	1,915	3,754	2	50.00	49.14
2002	4	28	520	369	322	2	50.00	54.72
2003	2	430	580	505	505	2	100.00	27.36

- = Not applicable.
Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Total precipitation is for JIA in inches.

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)**

Block House 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 criterion 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 are 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 is that samples shall not exceed 400 counts/100mL.

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 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 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).

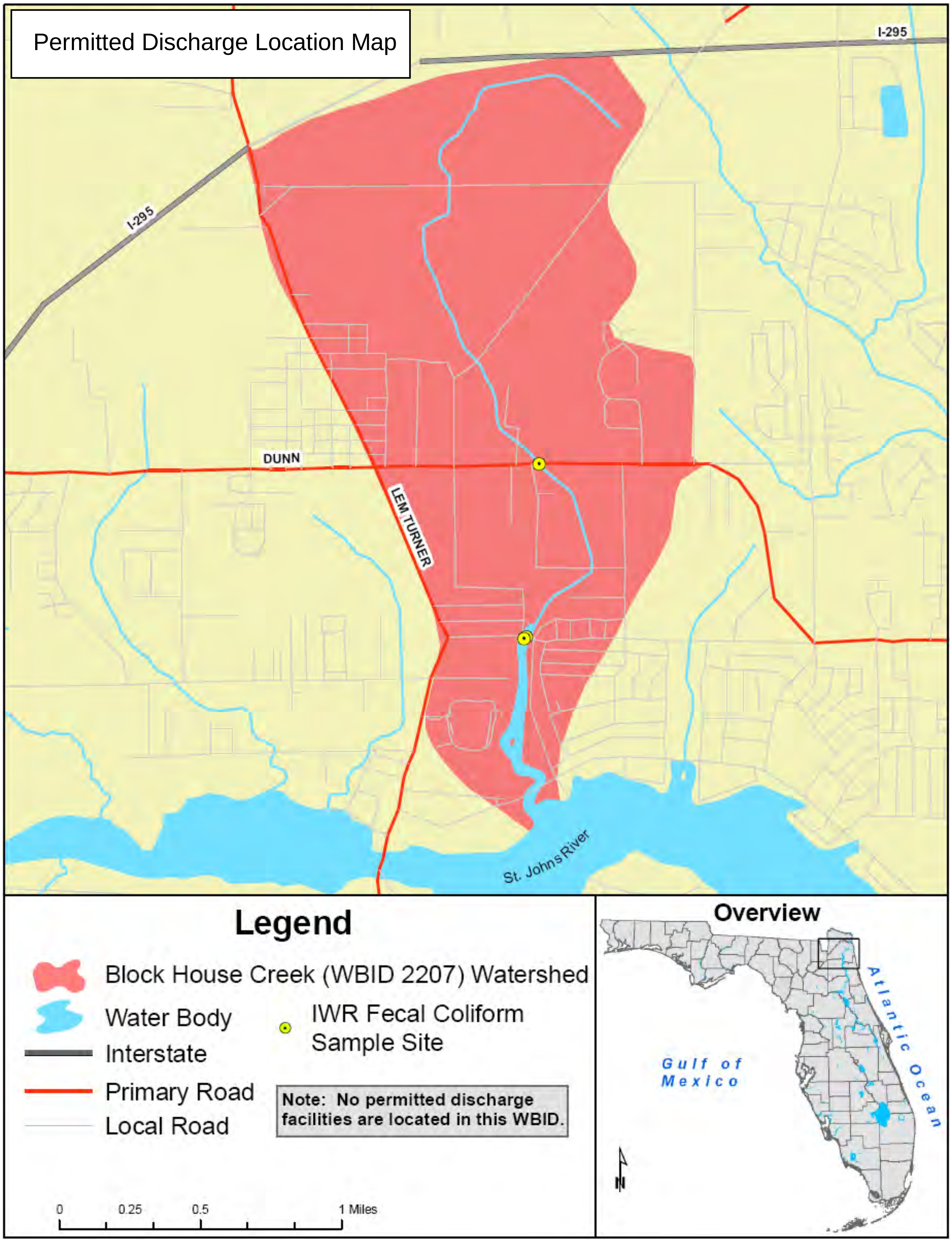
To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **AND** stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a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

4.2.1 Point Sources

There are currently no facilities with a permit to discharge wastewater in the Block House Creek watershed (**Figure 4.1**). This TMDL was calculated using data from one fecal coliform sampling site; the two additional sites shown in the figure are sites where data were collected following the calculation of the TMDL and initial drafting of this document.

Figure 4.1. Permitted Discharge Facilities in the Block House Creek Watershed, WBID 2207



Municipal Separate Storm Sewer System Permittees

The city of Jacksonville and Florida Department of Transportation (FDOT) District 2 are copermittees for a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000012) that covers the Block House Creek watershed. Responsibility for the permit is shared among FDOT and the cities of Jacksonville, Neptune Beach, and Atlantic Beach.

Figure 4.2 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 Block House Creek watershed, there are 68 outfalls and 331 inlets.

4.2.2 Land Uses and Nonpoint Sources

Additional coliform loadings to Block House Creek are generated from nonpoint sources in the watershed. Potential nonpoint sources of coliform include loadings from surface runoff, agriculture, 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 3 codes tabulated in **Table 4.1. Figure 4.3** shows the principal Level 3 land uses in the watershed.

The Block House Creek watershed is 2.52 square miles in size. As **Table 4.1** shows, much of the land in the watershed is natural (nearly 753 acres, or 47 percent), but a little more than half is covered by impacted areas (approximately 859 acres, or 53 percent) composed mostly of medium- and low-density residential (13.33 and 10.27 percent, respectively). The largest single land use is mixed forested wetland (15.16 percent), followed by pine flatwoods (13.98 percent) and medium-density residential (13.33 percent).

Population

According to the U.S. Census Bureau, census block population densities in the Block House Creek watershed in the year 2000 ranged from 0 to 10,243 people/mi^2 (0 to 16 people per acre), with an average of 1,089 people/mi^2 (1.70 people per acre) (**Figure 4.4**). Based on this average, the estimated population in the Block House Creek watershed is 2,744. The Census Bureau reports that, for all of Duval County, the total population for 2000 was 778,879, with 329,778 total housing units and an average occupancy rate of 92.1 percent (303,747 occupied housing units). For all of Duval County, the Bureau reported a housing density of approximately 426 housing units/mi^2 (which equates to just under 1 housing unit per acre [0.67]). 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 Block House Creek watershed is 395 housing units/mi^2 (which equates to just under 1 housing unit per acre [0.62]), based on population, which is slightly lower than that of Duval County.

Figure 4.2. Stormwater Infrastructure in the Block House Creek Watershed, WBID 2207

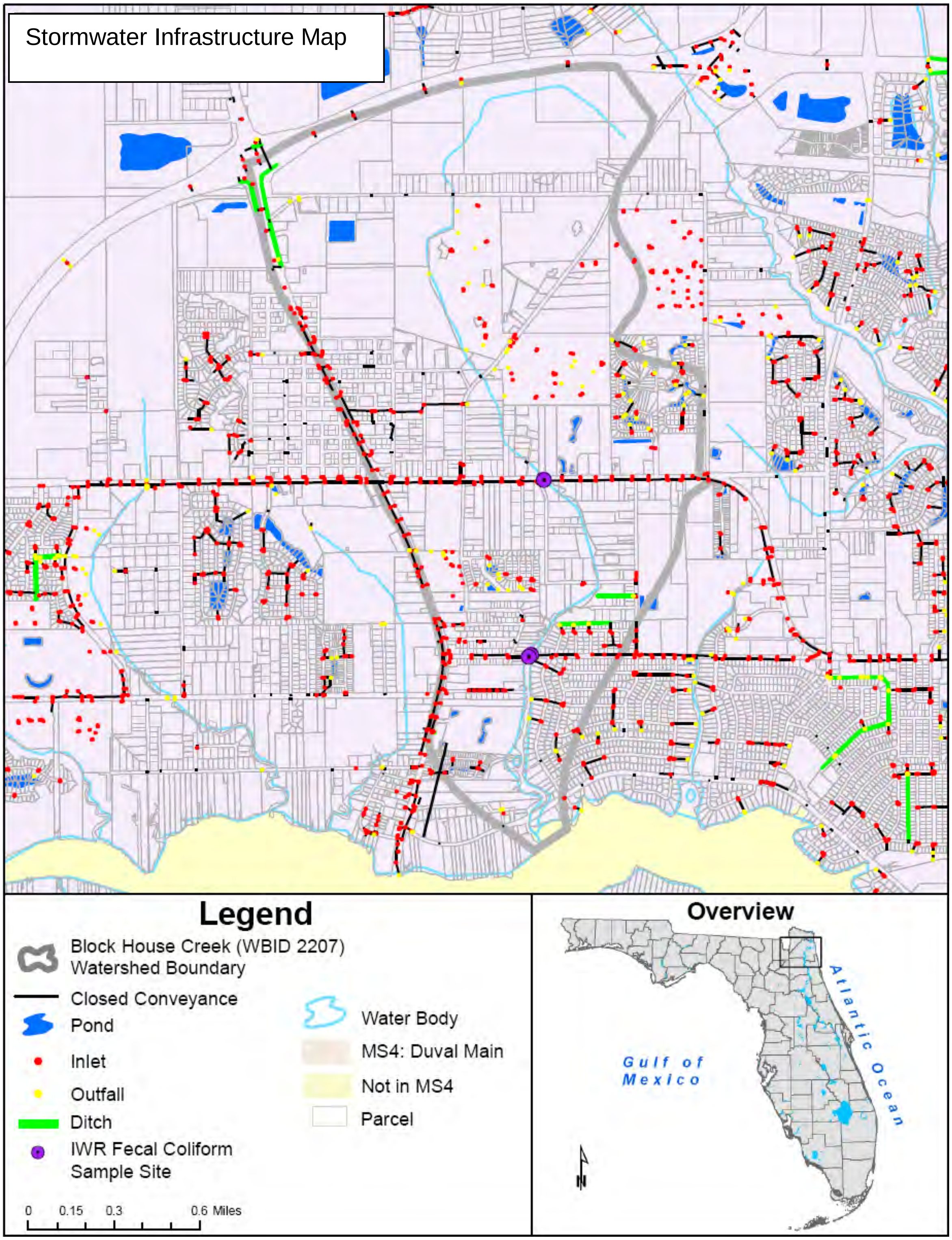


Table 4.1. Level 3 Land Use Categories in the Block House Creek Watershed, WBID 2207

Level 3 Land Use Code	Attribute	Area (acres)	% of Total Land Use
1100	Residential, low density–less than 2 dwelling units/acre	165.60	10.27
1200	Residential, medium density–2-5 dwelling units/acre	214.94	13.33
1300	Residential, high density–6 or more dwelling units/acre	137.51	8.53
1390	High density under construction	22.23	1.38
1400	Commercial and services	19.46	1.21
1700	Institutional	34.32	2.13
1860	Community recreational facilities	9.65	0.60
2110	Improved pastures (monoculture, planted forage crops)	50.08	3.11
2120	Unimproved pastures	84.61	5.25
2130	Woodland pastures	13.72	0.85
2140	Row crops	1.27	0.08
3100	Herbaceous upland nonforested	22.56	1.40
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub)	3.77	0.23
4110	Pine flatwoods	225.40	13.98
4340	Upland mixed coniferous/hardwood	182.16	11.30
5100	Streams and waterways	14.88	0.92
5300	Reservoirs–pits, retention ponds, dams	9.35	0.58
6170	Mixed wetland hardwoods	28.19	1.75
6210	Cypress	3.72	0.23
6300	Wetland forested mixed	244.32	15.16
6410	Freshwater marshes	1.01	0.06
6420	Saltwater marshes	21.29	1.32
6430	Wet prairies	5.64	0.35
8140	Roads and highways (divided 4-lanes with medians)	53.60	3.32
8310	Electrical power facilities	3.28	0.20
8320	Electrical power transmission lines	39.56	2.45
	TOTAL:	**1,612.12**	**100.00**

Figure 4.3. Principal Level 3 Land Uses in the Block House Creek Watershed, WBID 2207, in 2004

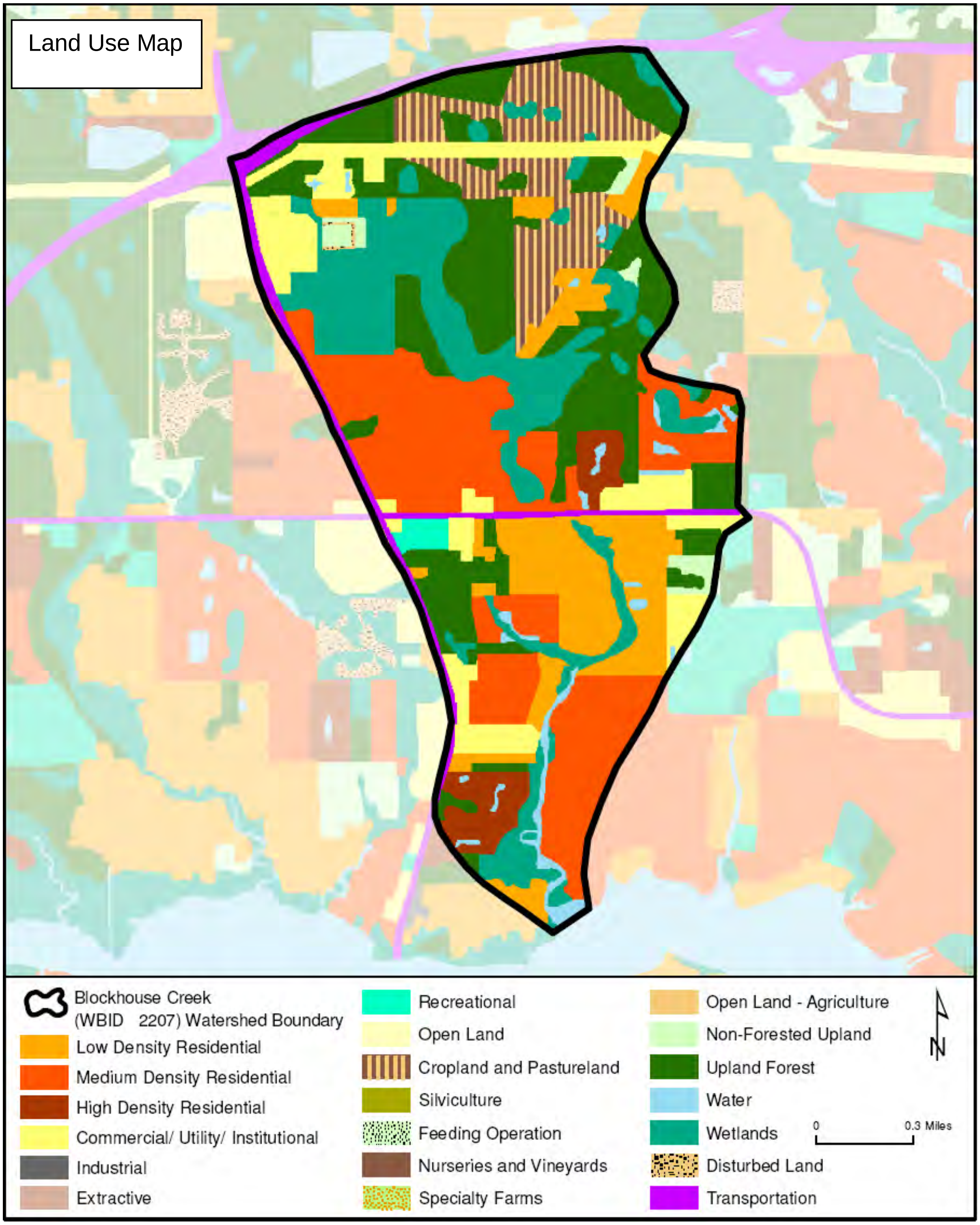
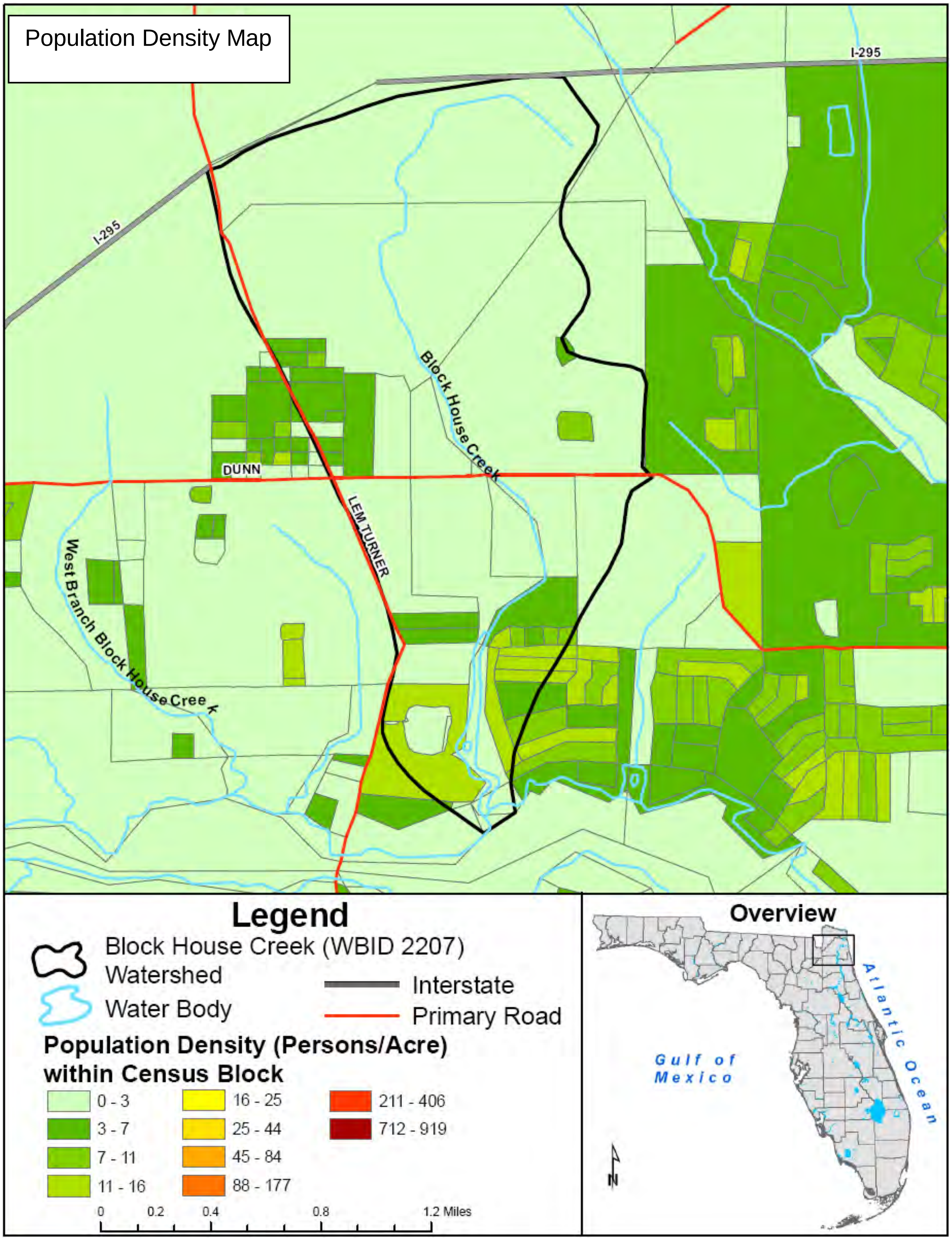


Figure 4.4. Population Density in the Block House Creek Watershed, WBID 2207, in 2000



Septic Tanks

Approximately 78 percent of Duval County residences are connected to a wastewater treatment plant, while the rest use septic tanks (Florida Department of Revenue cadastral data, 2003; and Florida Department of Health [FDOH] Website, 2006). FDOH reports that as of fiscal year 2006–07, there were 90,292 permitted septic tanks in Duval County, and for fiscal years 1991 to 2007 (missing 1992–93), 6,278 permits for repairs were issued, or an average of about 419 repairs annually countywide (FDOH Website, 2006).

The Department obtained septic tank repair permit data from JEA for its service area, which includes the Block House Creek watershed. These data are more watershed specific than the countywide FDOH data. Included are septic tank repair permit records issued from March 1990 to March 2004, areas serviced by a WWTF, and areas where large numbers of failing septic tanks are present. **Figure 4.5** presents this information in map form. There were 32 permits for repairs issued in the watershed during this time, or an average of 2.29 repairs per year. If this average is rounded up to 3 (to allow for those septic tanks where failures may not be known or have not been repaired), and using an estimate of 70 gallons/day/person (EPA, 2001), a loading of 2.18×10^{10} fecal coliform counts/day is derived.

The map shows that none of the Block House Creek watershed is in a septic tank phase-out area (an area with the highest priority to be sewered due to high septic tank failure rates). One of these areas is located just north of the watershed (depicted in orange). The District II WWTF services the Block House Creek watershed.

Table 4.2. Estimated Average Household Size in the Block House Creek Watershed, WBID 2207

Household Size	Number of Households	% of Total	Number of People
1-person household	188	18.90%	188
2-person household	325	32.61%	650
3-person household	212	21.25%	636
4-person household	153	15.35%	612
5-person household	74	7.47%	370
6-person household	31	3.15%	186
7-or-more-person household	13	1.27%	88
TOTAL:	**996**	**100.00%**	**2733**
	AVERAGE HOUSEHOLD SIZE:		**2.74**

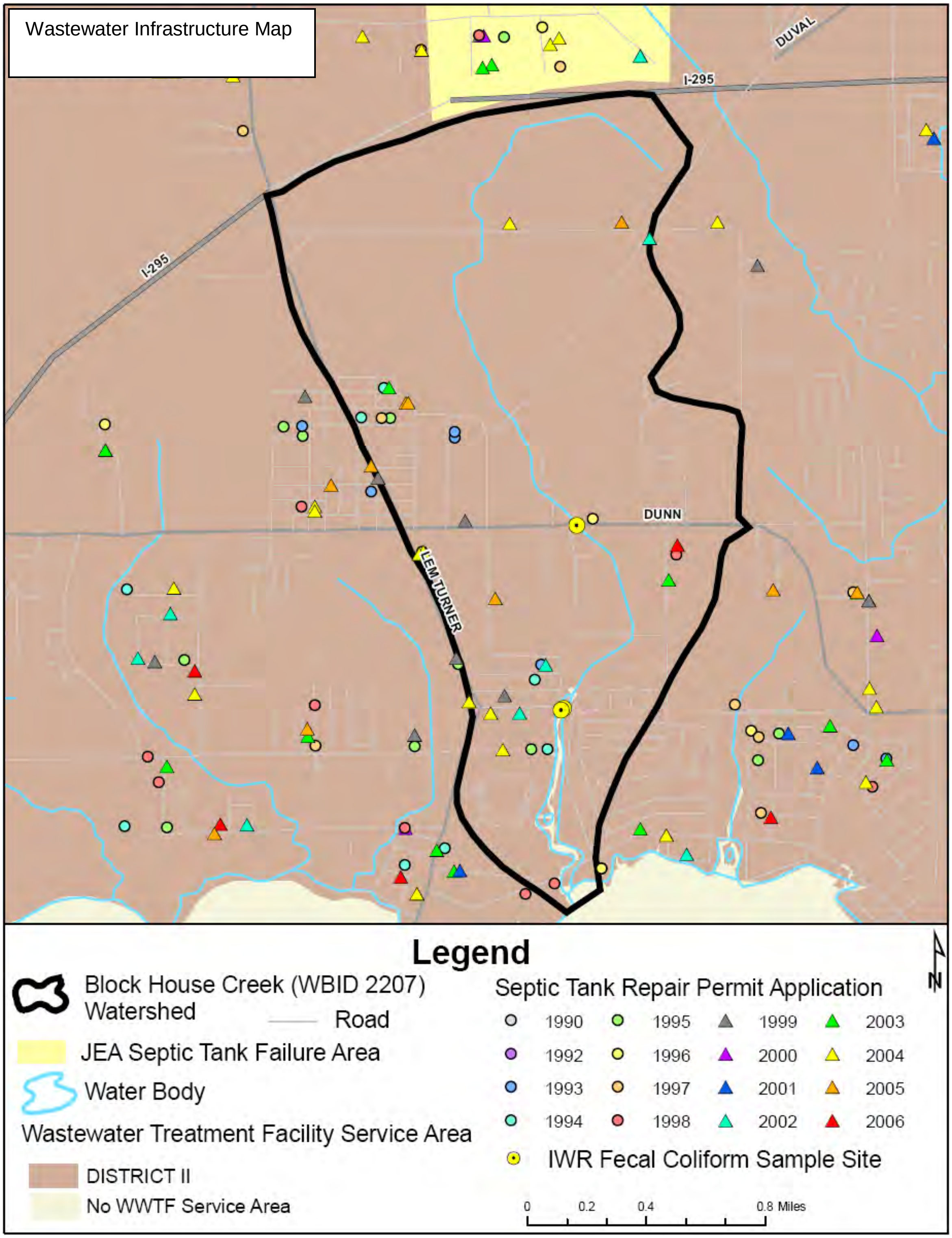
Data from U.S. Census Bureau Website, 2007, based on the Duval County blocks present in the Block House Creek watershed.

Table 4.3. Estimated Annual Fecal Coliform Loading from Failed Septic Tanks in the Block House Creek Watershed, WBID 2207

Estimated Population Density ($people/mi^2$)	WBID Area (mi^2)	Estimated Population in Watershed	Estimated Number of Tank Failures[1]	Estimated Load from Failed Tanks (counts/mL)[2]	Gallons/ Person/ Day[2]	Estimated Number of People per Household[3]	Estimated Daily Fecal Coliform Load from Failing Tanks (counts/day)	Estimated Yearly Fecal Coliform Load from Failing Tanks (counts/year)
1,085	2.52	2,733	3	1.00×10^4	70	2.74	2.18×10^{10}	7.95×10^{12}

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

Figure 4.5. Septic Tank Repair Permits Issued for the Block House Creek Watershed, WBID 2207, 1990–2004



4.3 Source Summary

4.3.1 Agriculture

According to Level 3 land use data, 4 different types of agricultural areas have been identified in the Block House Creek watershed. Unimproved pastures (84.62 acres) and improved pastures (50.08 acres) represent 5.25 and 3.11 percent, respectively, of the watershed. Woodland pastures (13.72 acres) and row crops (1.27 acres) represent 0.85 and 0.08 percent, respectively.

According to a 2006 Florida Department of Agriculture and Consumer Services' (FDACS) survey (FDACS, 2007), there are 8,000 cows in Duval County. Assuming that the improved pastures are primarily used to raise cattle, there are approximately 8,734 acres of land containing cows in Duval County, consisting of improved pastures (8,238 acres), cattle-feeding operations (337 acres), and dairies (159 acres). Using this information, there are about 0.92 cows per acre in Duval County and about 46 cows in the Block House Creek watershed, representing a potential fecal coliform loading of 4.60×10^{12} counts per day (**Table 4.4**).

Table 4.4. Estimated Loading from Cows in the Block House Creek Watershed, WBID 2207

Estimated Area of WBID 2207 Containing Cattle (acres)	Estimated Number of Cattle in WBID 2207[1]	Estimated Fecal Coliform (counts/cow/day[2])	Estimated Fecal Coliform (counts/day)	Estimated Fecal Coliform (counts/year)
50.08	46	1×10^{11}	4.60×10^{12}	1.68×10^{15}

[1] FDACS, 2007.

[2] EPA, 2001.

4.3.2 Pets

The Department has been unable to obtain data on the number of dogs in the Block House Creek watershed; however, estimates can be made based on dog ownership statistics from the American Veterinary Medical Association (AVMA). Based on U.S. Census Bureau data, there are an estimated 996 households in the watershed, and AVMA estimates that there are 0.58 dogs per household (AVMA Website, 2005). Using this information, there are approximately 578 dogs in the Block House Creek watershed, representing a potential fecal coliform loading of 2.89×10^{12} counts per day (**Table 4.5**).

Table 4.5. Estimated Loading from Dogs in the Block House Creek Watershed, WBID 2207

Estimated Number of Households in WBID 2207	Estimated Dog:Household Ratio[1]	Estimated Number of Dogs in WBID 2207	Estimated Fecal Coliform (counts/dog/day[2])	Estimated Fecal Coliform (counts/day)	Estimated Fecal Coliform (counts/year)
996	0.58	578	5×10^{9}	2.89×10^{12}	1.05×10^{15}

[1] From the AVMA Website, 2005, which states the original source to be the *U.S. Pet Ownership and Demographics Sourcebook*, 2002.

[2] EPA, 2001.

4.3.3 Leaking or Overflowing Wastewater Collection Systems

As noted previously, about 78 percent of the households in Duval County are connected to a wastewater facility. Assuming that this countywide average applies to the 996 households in the Block House Creek watershed, approximately 777 households in the watershed are connected to a wastewater facility. Given that there are 2.74 people per household in the Block House Creek watershed, each producing a 70-gallon-per-person-per-day discharge (EPA, 2001), a daily flow of approximately 4.12 x 10^5 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 (EPA, 2001), the potential loading of fecal coliform from leaking sewer lines is 1.41 x 10^{12} counts/day (**Table 4.6**).

Table 4.6. Estimated Loading from Wastewater Collection Systems in the Block House Creek Watershed, WBID 2207

Estimated Number of Homes on Central Sewer in WBID 2207	Estimated Daily Flow (L)	Daily Leakage (L)	Raw Sewage (counts/100mL)	Estimated Fecal Coliform (counts/day)	Estimated Fecal Coliform (counts/year)
777	5.64 x 10^5	2.82 x 10^4	5 x 10^6	1.41 x 10^{12}	5.15 x 10^{14}

Table 4.7 summarizes the various estimates from potential sources. It is important to note that this is not a complete list (for example, wildlife is missing), and that the potential loadings are estimates. Proximity to the waterbody, rainfall frequency and magnitude, soil types, drainage features, and temperature are just a few of the factors that could influence and determine the actual loadings from these sources that reach Block House Creek.

Table 4.7. Summary of Estimated Annual Potential Coliform Loading from Various Sources in the Block House Creek Watershed, WBID 2207

Source	Estimated Annual Load (counts/year)
Septic Tanks	7.95 x 10^{12}
Agriculture	1.68 x 10^{15}
Dogs	1.05 x 10^{15}
Collection Systems	5.15 x 10^{14}

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 Block House 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

One sampling station on Block House Creek has historical fecal coliform observations: Block House Creek at Leonid Road (STORET ID: 21FLJXWQTR37). **Figure 5.1** shows the location of this station, which was used to calculate the TMDL, as well as the location of two additional stations (21FLA 20030745 and 21FLA 20030027) where data were collected following the calculation of the TMDL and drafting of this document. The Block House Creek at Leonid Road station, which is monitored by the city of Jacksonville, is located approximately 0.3 miles east of the intersection of Leonid Road and Lem Turner Road. The city of Jacksonville maintained routine (mostly quarterly) sampling from 1991 to mid-1995 and from 1998 to 2006 at this station (21FLJXWQTR37).

Table 5.1 summarizes data collection information for this station, **Table 5.2** summarizes all historical data, and **Appendix B** contains all of the historical fecal coliform observations from the site for the planning and verified periods for the Lower St. Johns Basin. **Appendix B** also includes fecal coliform observations from stations 21FLA 20030745 and 21FLA 20030027 which became available after drafting of the document. **Figure 5.2** shows these observations over time. The station at Leonid Road exhibited an overall exceedance rate of more than 80 percent (**Table 5.2**).

Table 5.1. Sampling Station Summary for Block House Creek, WBID 2207

Station	STORET ID	Station Owner	Years with Data	Number of Samples
Block House Creek at Leonid Road	21FLJXWQTR37	City of Jacksonville	1991–95, 1998–2006	53

Table 5.2. Statistical Summary of All Historical Data for Block House Creek, WBID 2207

Station	STORET ID	Number of Samples	Minimum	Maximum	Median	Mean	Exceedances	% Exceedances
Block House Creek at Leonid	21FLJXWQTR37	53	28	17,000	1,400	2,555	44	83.02%

Station	STORET ID	Number of Samples	Minimum	Maximum	Median	Mean	Exceedances	% Exceedances
Road								

Coliform concentrations are counts/100mL.

Figure 5.1. Historical Sample Sites in Block House Creek, WBID 2207

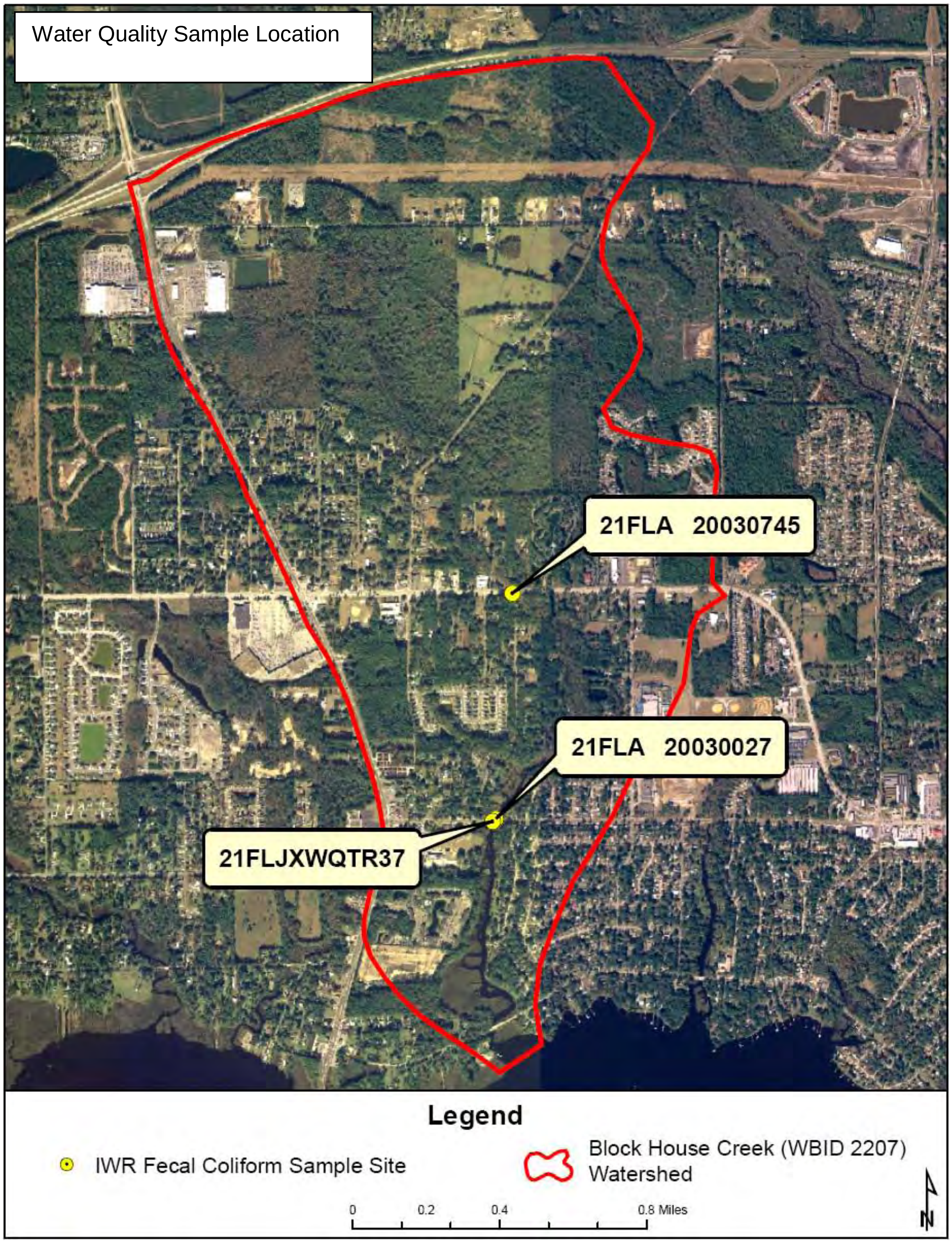
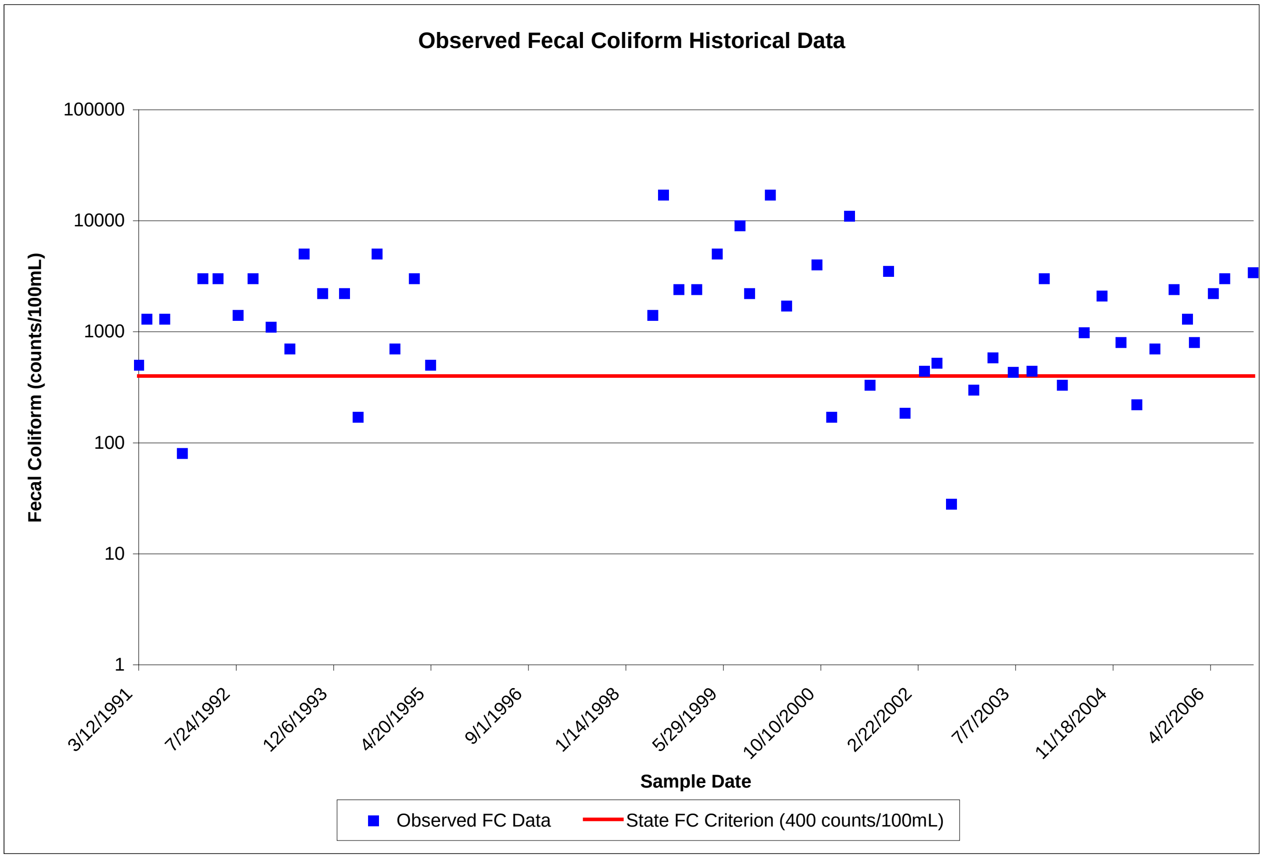


Figure 5.2. Historical Fecal Coliform Observations for Block House Creek, WBID 2207



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 82 percent. This means that in order to meet the state criterion of 400 counts/100mL, an 82 percent reduction in current loading is necessary, and this is therefore the TMDL for Block House Creek. **Table 5.3** shows the annual summaries of exceedances used to determine the TMDL by year, and **Table 5.4** shows the individual exceedances used in calculating the TMDL for Block House Creek.

Table 5.3. Annual Summary of Fecal Coliform Exceedances Used To Develop the TMDL for Block House Creek, WBID 2207

Year	Number of Samples	Minimum	Maximum	Median	Mean
1991	3	500	1,300	1,300	1,033
1992	4	1,400	3,000	3,000	2,600
1993	4	700	5,000	1,650	2,250
1994	3	700	5,000	2,200	2,633
1995	2	500	3,000	1,750	1,750
1998	3	1,400	17,000	2,400	6,933
1999	4	2,200	9,000	3,700	4,650
2000	3	1,700	17,000	4,000	7,567
2001	2	3,500	11,000	7,250	7,250
2002	2	440	520	480	480
2003	4	430	3,000	510	1,113
2004	3	800	2,100	980	1,293
2005	3	700	2,400	1,300	1,467
2006	4	800	3,400	2,600	2,350

Coliform counts are #/100mL and represent years for which exceedances exist.

Table 5.4. Calculation of Reductions for the Fecal Coliform TMDL for Block House Creek, WBID 2207

Sample Date	Location	Observed Value (Exceedance) (counts/100mL)	Required % Reduction
3/12/1991	Blockhouse Creek at Leonid Road	500	20.00%
4/23/1991	Blockhouse Creek at Leonid Road	1,300	69.23%
7/24/1991	Blockhouse Creek at Leonid Road	1,300	69.23%
2/5/1992	Blockhouse Creek at Leonid Road	3,000	86.67%
4/22/1992	Blockhouse Creek at Leonid Road	3,000	86.67%
8/3/1992	Blockhouse Creek at Leonid Road	1,400	71.43%
10/19/1992	Blockhouse Creek at Leonid Road	3,000	86.67%
1/20/1993	Blockhouse Creek at Leonid Road	1,100	63.64%
4/26/1993	Blockhouse Creek at Leonid Road	700	42.86%
7/8/1993	Blockhouse Creek at Leonid Road	5,000	92.00%
10/11/1993	Blockhouse Creek at Leonid Road	2,200	81.82%
1/31/1994	Blockhouse Creek at Leonid Road	2,200	81.82%
7/18/1994	Blockhouse Creek at Leonid Road	5,000	92.00%
10/17/1994	Blockhouse Creek at Leonid Road	700	42.86%
1/25/1995	Blockhouse Creek at Leonid Road	3,000	86.67%
4/18/1995	Blockhouse Creek at Leonid Road	500	20.00%
6/1/1998	Blockhouse Creek at Leonid Road	1,400	71.43%
7/27/1998	Blockhouse Creek at Leonid Road	17,000	97.65%
10/14/1998	Blockhouse Creek at Leonid Road	2,400	83.33%

Sample Date	Location	Observed Value (Exceedance) (counts/100mL)	Required % Reduction
1/13/1999	Blockhouse Creek at Leonid Road	2,400	83.33%
4/28/1999	Blockhouse Creek at Leonid Road	5,000	92.00%
8/23/1999	Blockhouse Creek at Leonid Road	9,000	95.56%
10/11/1999	Blockhouse Creek at Leonid Road	2,200	81.82%
1/26/2000	Blockhouse Creek at Leonid Road	17,000	97.65%
4/18/2000	Blockhouse Creek at Leonid Road	1,700	76.47%
9/21/2000	Blockhouse Creek at Leonid Road	4,000	90.00%
3/7/2001	Blockhouse Creek at Leonid Road	11,000	96.36%
9/24/2001	Blockhouse Creek at Leonid Road	3,500	88.57%
3/27/2002	Blockhouse Creek at Leonid Road	440	9.09%
5/30/2002	Blockhouse Creek at Leonid Road	520	23.08%
3/13/2003	Blockhouse Creek at Leonid Road	580	31.03%
6/25/2003	Blockhouse Creek at Leonid Road	430	6.98%
9/29/2003	Blockhouse Creek at Leonid Road	440	9.09%
12/2/2003	Blockhouse Creek at Leonid Road	3,000	86.67%
6/23/2004	Blockhouse Creek at Leonid Road	980	59.18%
9/23/2004	Blockhouse Creek at Leonid Road	2,100	80.95%
12/29/2004	Blockhouse Creek at Leonid Road	800	50.00%
6/21/2005	Blockhouse Creek at Leonid Road	700	42.86%
9/28/2005	Blockhouse Creek at Leonid Road	2,400	83.33%
12/5/2005	Blockhouse Creek at Leonid Road	1,300	69.23%
1/10/2006	Blockhouse Creek at Leonid Road	800	50.00%
6/14/2006	Blockhouse Creek at Leonid Road	3,000	86.67%
4/17/2006	Blockhouse Creek at Leonid Road	2,200	81.82%
11/8/2006	Blockhouse Creek at Leonid Road	3,400	88.24%
	MEDIAN:	**2,200**	**81.82%**

Observed values are #/100mL.

5.1.3 Critical Conditions/Seasonality

Exceedances in Block House Creek cannot be associated with flows, as no flow data are available in the watershed. Therefore, the effects of flow under various conditions cannot be determined or considered as a critical condition.

Appendix B provides historical fecal coliform observations in Block House 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 no such differences (**Appendices C** and **D**). It is very difficult to evaluate possible patterns among months due to the small sample sizes; the range in monthly observations for fecal coliform varied from 0 to 6 in a given month (**Table 2.1**). January, April, May, July, September, October, and November all had exceedance rates of 100 percent, while August and December had the lowest, at 50 percent. Grouping observations by season increased sample sizes for statistical comparison, as seen in **Table 2.2**, but sample size wass still relatively small (between 8 and 9 samples). Spring and summer demonstrated the greatest percentage of exceedances (88.89 percent) and fall exhibited the lowest (66.67 percent). **Appendix E** presents comparisons by station and season.

The pattern of rainfall could be a factor contributing to these monthly or seasonal differences. Rainfall records for JIA (**Appendix F** 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 sampling and 29 days prior (30D) were all paired with the respective coliform observation based on date. A Spearman correlation matrix was generated that summarized the simple correlation coefficients between the various rainfall and coliform values (**Appendix G**). The simple correlations (r values in the Spearman correlation table) between both fecal coliform and the various rainfall totals were all positive, suggesting that as rainfall (and possible runoff) increased, the number of coliform increased.

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. None of the r^2 values between fecal coliform and the various precipitation intervals was significant (see **Appendix H**). A table of historical monthly average rainfall (**Appendix I**) indicates that monthly rainfall totals increase in June, peak in September, and by October return to the levels observed in February and March. **Appendix J** contains a graph of annual rainfall at JIA from 1955 to 2008 versus the long-term average (52.56 inches) over this period. From 1996 to 1998, rainfall was above average, while 1999 to 2001 were below average, and 2002 was again above average. Below-average rainfall occurred again during 2003, with rainfall returning to above average in 2004 and 2005. From 2006 to 2008, rainfall was below average. Exceedances occur almost all of the time, making it difficult to correlate them to rainfall patterns.

Table 2.3 indicates that exceedances do not appear to follow the same pattern as rainfall. The highest percentage of exceedances was seen in 1998 (100 percent; 3 samples), 1999 (100 percent; 4 samples), and 2003 (100 percent; 2 samples). In 1998, there was above-average rainfall, while 1999 and 2003 had below-average rainfall. The lowest percentage of exceedances was observed in 2001 (50 percent; 4 samples) and 2002 (50 percent; 4 samples). In 2001, rainfall was below average, and 2002 was an above-average rainfall year. A trend cannot really be established, and again this is probably attributable to small sample size, between 3 and 4 samples per year.

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 2008. The chart was divided in the same manner 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 (**Figure 5.3**).

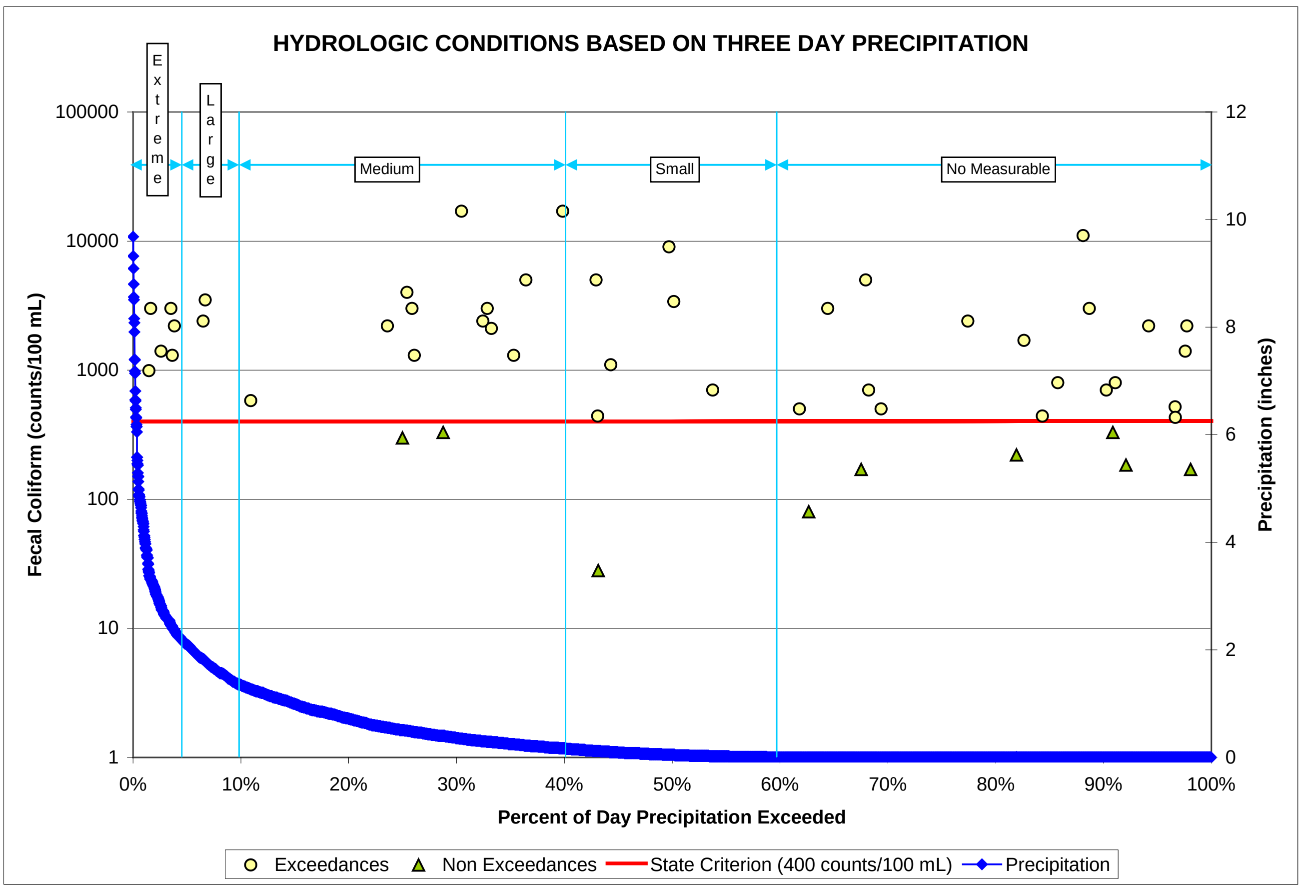
Fecal coliform exceedances occurred over all hydrologic conditions for which data exist. The lowest percentage of exceedances occurred during periods of small precipitation events (77.78

percent). The greatest percentage of exceedances (100.00 percent) occurred during large and extreme precipitation events. Exceedances decrease as precipitation amounts decrease, indicating that nonpoint sources are probably a major contributing factor. There are still large numbers of exceedances occurring with little or no precipitation, indicating that ground water contributions with elevated coliform levels could be affecting the creek as well. A pattern could become clearer if more samples were collected, especially following extreme and large rainfall events. **Table 5.5** summarizes data and hydrologic conditions; **Figure 5.3** shows the same data visually.

Table 5.5. Summary of Fecal Coliform Data by Hydrologic Condition for Block House Creek, WBID 2207

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances	% Exceedance	Number of Nonexceedances	% Nonexceedances
Extreme	>2.1"	6	6	100.00%	0	0.00%
Large	1.33" - 2.1"	2	2	100.00%	0	0.00%
Medium	0.18" - 1.33"	13	11	84.62%	2	15.38%
Small	0.01" - 0.18"	8	7	87.50%	1	12.50%
None/ No Measurable	<0.01"	24	18	75.00%	6	25.00%

Figure 5.3. Fecal Coliform Data by Hydrologic Condition Based on Rainfall for Block House Creek, WBID 2207



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:

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

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 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 Block House 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**).

Table 6.1. TMDL Components for Block House Creek, WBID 2207

WBID	Parameter	TMDL (counts/100mL)	WLA Wastewater (colonies/day)	WLA NPDES Stormwater	LA (% reduction)	MOS
2207	Fecal Coliform	400	N/A	82%	82%	Implicit

N/A = Not applicable

6.2 Load Allocation

A fecal coliform reduction of 82 percent 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

6.3.1 NPDES Wastewater Discharges

As mentioned previously, there are no permitted wastewater facilities with a discharge permit in the Block House Creek watershed. Any new potential discharger is expected to comply with the Class III criterion for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

The Block House Creek watershed falls under Phase I MS4 Permit FLS000012, with the city of Jacksonville and FDOT District 2 as copermittees. The wasteload allocation for this permit is an 82 percent reduction in current anthropogenic fecal coliform loading from the MS4. 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.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an MOS was used 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 Block House 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.*

7.2 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.

7.3 Identification of Probable Sources

7.3.1 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.

7.3.2 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.

7.4 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.*

7.5 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. The EPA authorized the Department to implement the NPDES Stormwater Program (except for tribal lands) in October 2000.

An important difference between the federal and state 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. The 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 Block House Creek, WBID 2207

Sample Date	Station	Location	Value (counts/100mL)
3/12/1991	21FLJXWQTR37	Blockhouse Creek at Leonid Road	500
4/23/1991	21FLJXWQTR37	Blockhouse Creek at Leonid Road	1,300
7/24/1991	21FLJXWQTR37	Blockhouse Creek at Leonid Road	1,300
10/22/1991	21FLJXWQTR37	Blockhouse Creek at Leonid Road	80
2/5/1992	21FLJXWQTR37	Blockhouse Creek at Leonid Road	3,000
4/22/1992	21FLJXWQTR37	Blockhouse Creek at Leonid Road	3,000
8/3/1992	21FLJXWQTR37	Blockhouse Creek at Leonid Road	1,400
10/19/1992	21FLJXWQTR37	Blockhouse Creek at Leonid Road	3,000
1/20/1993	21FLJXWQTR37	Blockhouse Creek at Leonid Road	1,100
4/26/1993	21FLJXWQTR37	Blockhouse Creek at Leonid Road	700
7/8/1993	21FLJXWQTR37	Blockhouse Creek at Leonid Road	5,000
10/11/1993	21FLJXWQTR37	Blockhouse Creek at Leonid Road	2,200
1/31/1994	21FLJXWQTR37	Blockhouse Creek at Leonid Road	2,200
4/11/1994	21FLJXWQTR37	Blockhouse Creek at Leonid Road	170
7/18/1994	21FLJXWQTR37	Blockhouse Creek at Leonid Road	5,000
10/17/1994	21FLJXWQTR37	Blockhouse Creek at Leonid Road	700
1/25/1995	21FLJXWQTR37	Blockhouse Creek at Leonid Road	3,000
4/18/1995	21FLJXWQTR37	Blockhouse Creek at Leonid Road	500
6/1/1998	21FLJXWQTR37	Blockhouse Creek at Leonid Road	1,400
7/27/1998	21FLJXWQTR37	Blockhouse Creek at Leonid Road	17,000
10/14/1998	21FLJXWQTR37	Blockhouse Creek at Leonid Road	2,400
1/13/1999	21FLJXWQTR37	Blockhouse Creek at Leonid Road	2,400
4/28/1999	21FLJXWQTR37	Blockhouse Creek at Leonid Road	5,000
8/23/1999	21FLJXWQTR37	Blockhouse Creek at Leonid Road	9,000
10/11/1999	21FLJXWQTR37	Blockhouse Creek at Leonid Road	2,200
1/26/2000	21FLJXWQTR37	Blockhouse Creek at Leonid Road	17,000
4/18/2000	21FLJXWQTR37	Blockhouse Creek at Leonid Road	1,700
9/21/2000	21FLJXWQTR37	Blockhouse Creek at Leonid Road	4,000
12/6/2000	21FLJXWQTR37	Blockhouse Creek at Leonid Road	170
3/7/2001	21FLJXWQTR37	Blockhouse Creek at Leonid Road	11,000
6/20/2001	21FLJXWQTR37	Blockhouse Creek at Leonid Road	330
9/24/2001	21FLJXWQTR37	Blockhouse Creek at Leonid Road	3,500
12/17/2001	21FLJXWQTR37	Blockhouse Creek at Leonid Road	184
3/27/2002	21FLJXWQTR37	Blockhouse Creek at Leonid Road	440
5/30/2002	21FLJXWQTR37	Blockhouse Creek at Leonid Road	520
8/12/2002	21FLJXWQTR37	Blockhouse Creek at Leonid Road	28
12/5/2002	21FLJXWQTR37	Blockhouse Creek at Leonid Road	298
3/13/2003	21FLJXWQTR37	Blockhouse Creek at Leonid Road	580
6/25/2003	21FLJXWQTR37	Blockhouse Creek at Leonid Road	430

Sample Date	Station	Location	Value (counts/100mL)
9/29/2003	21FLJXWQTR37	Blockhouse Creek at Leonid Road	440
12/2/2003	21FLJXWQTR37	Blockhouse Creek at Leonid Road	3,000
3/3/2004	21FLJXWQTR37	Blockhouse Creek at Leonid Road	330
6/23/2004	21FLJXWQTR37	Blockhouse Creek at Leonid Road	980
9/23/2004	21FLJXWQTR37	Blockhouse Creek at Leonid Road	2,100
12/29/2004	21FLJXWQTR37	Blockhouse Creek at Leonid Road	800
3/21/2005	21FLJXWQTR37	Blockhouse Creek at Leonid Road	220
6/21/2005	21FLJXWQTR37	Blockhouse Creek at Leonid Road	700
9/28/2005	21FLJXWQTR37	Blockhouse Creek at Leonid Road	2,400
12/5/2005	21FLJXWQTR37	Blockhouse Creek at Leonid Road	1,300
1/10/2006	21FLJXWQTR37	Blockhouse Creek at Leonid Road	800
6/14/2006	21FLJXWQTR37	Blockhouse Creek at Leonid Road	3,000
4/17/2006	21FLJXWQTR37	Blockhouse Creek at Leonid Road	2,200
11/8/2006	21FLJXWQTR37	Blockhouse Creek at Leonid Road	3,400

NOTE: Some samples are represented in the table as an average of duplicates (i.e., same date and location), per the IWR, for TMDL determination.

Additional data available after document drafted

Sample Date	Station	Location	Value (counts/100mL)
12/5/2002	21FLA 20030027	BLOCKHOUSE CR AT LEONID RD	298
11/14/2006	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	667
2/20/2007	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	5450
2/20/2007	21FLA 20030027	BLOCKHOUSE CR AT LEONID RD	1900
3/20/2007	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	1294
3/20/2007	21FLA 20030027	BLOCKHOUSE CR AT LEONID RD	88
4/17/2007	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	2500
4/17/2007	21FLA 20030027	BLOCKHOUSE CR AT LEONID RD	304
7/17/2007	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	344
7/18/2007	21FLA 20030027	BLOCKHOUSE CR AT LEONID RD	*Non-detect
8/21/2007	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	360
8/21/2007	21FLA 20030027	BLOCKHOUSE CR AT LEONID RD	1500
9/18/2007	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	14000
9/18/2007	21FLA 20030027	BLOCKHOUSE CR AT LEONID RD	109
11/6/2007	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	1082
11/6/2007	21FLA 20030027	BLOCKHOUSE CR AT LEONID RD	350
3/17/2008	21FLA 20030745	BLOCK HOUSE CR @ DUNN AVE	400

Appendix C: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Season in Block House Creek, WBID 2207

Categorical values encountered during processing are:
SEASON$ (4 levels)
FALL, SPRING, SUMMER, WINTER

Kruskal-Wallis One-Way Analysis of Variance for 53 cases
Dependent variable is FECAL
Grouping variable is SEASON$

Group	Count	Rank Sum
FALL	13	307.000
SPRING	14	319.000
SUMMER	13	453.000
WINTER	13	352.000

Kruskal-Wallis Test Statistic = 5.037
Probability is 0.169 assuming Chi-square distribution with 3 df

Appendix D: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Month in Block House Creek, WBID 2207

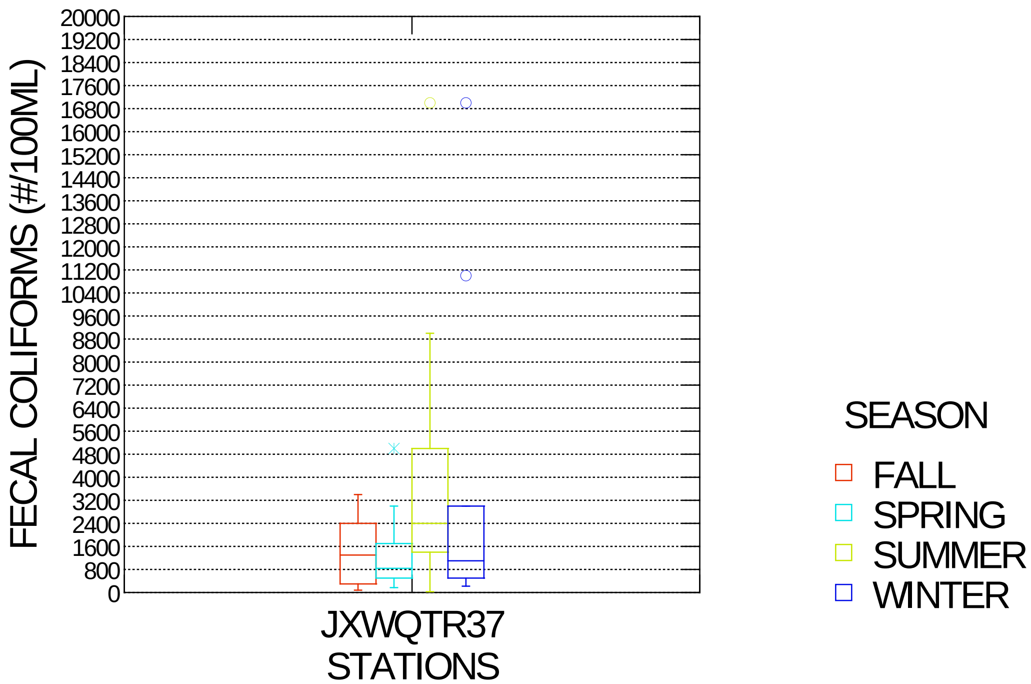
Categorical values encountered during processing are:
MONTH (11 levels)
1, 2, 3, 4, 5, 6, 7,
8, 9, 10, 11, 12

Kruskal-Wallis One-Way Analysis of Variance for 53 cases
Dependent variable is FECAL
Grouping variable is MONTH

Group	Count	Rank Sum
1	6	205.000
2	1	40.500
3	6	106.500
4	7	177.500
5	1	15.000
6	6	126.500
7	5	206.000
8	3	78.500
9	5	168.500
10	6	161.500
11	1	44.000
12	6	101.500

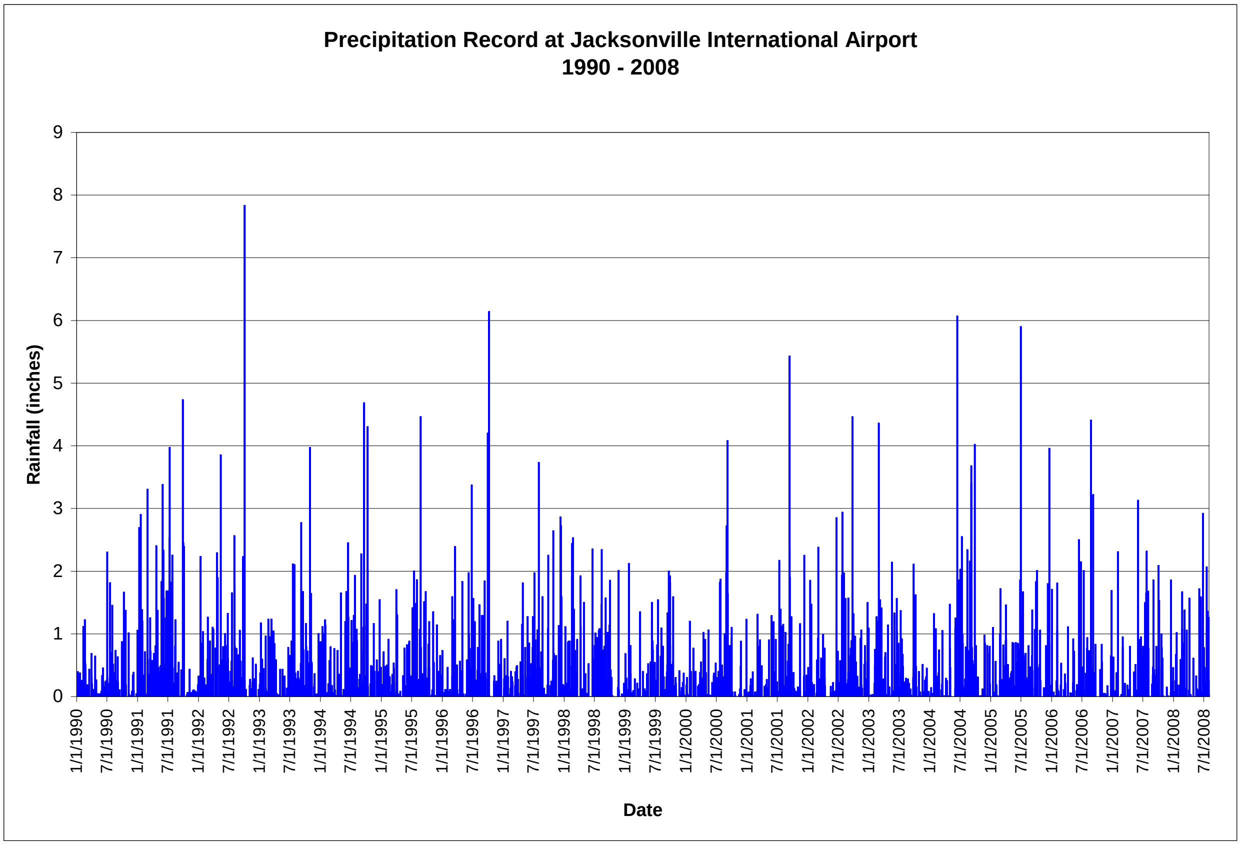
Kruskal-Wallis Test Statistic = 14.760
Probability is 0.194 assuming Chi-square distribution with 11 df

Appendix E: Chart of Fecal Coliform Observations by Season and Station in Block House Creek, WBID 2207



Station	STORET ID
Blockhouse Creek at Leonid Road	21FLJXWQTR37

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

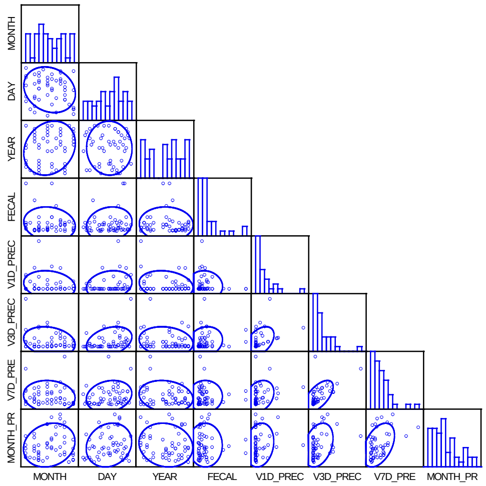


Appendix G: Spearman Correlation Matrix Analysis for Precipitation and Fecal Coliform in Block House Creek, WBID 2207

Spearman correlation matrix

	MONTH	DAY	YEAR	FECAL	V1D_PREC
MONTH	1.000				
DAY	-0.172	1.000			
YEAR	0.144	-0.009	1.000		
FECAL	-0.050	0.073	-0.127	1.000	
V1D_PREC	-0.168	0.179	0.075	0.026	1.000
V3D_PREC	-0.052	0.392	-0.038	0.297	0.592
V7D_PRE	-0.202	0.211	-0.037	0.166	0.347
MONTH_PR	0.132	0.130	-0.131	0.064	0.149

	V3D_PREC	V7D_PRE	MONTH_PR
V3D_PREC	1.000		
V7D_PRE	0.711	1.000	
MONTH_PR	0.387	0.445	1.000



Number of observations: 53

Appendix H: Analysis of Fecal Coliform Observations and Precipitation in Block House Creek, WBID 2207

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING PRECIPITATION

Dep Var: FECAL N: 53 Multiple R: 0.102 Squared multiple R: 0.010

Adjusted squared multiple R: 0.000 Standard error of estimate: 3586.531

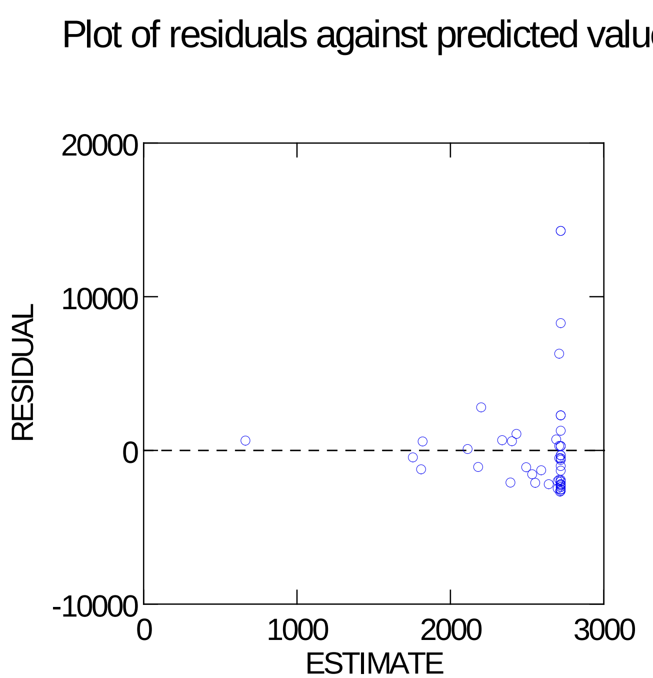
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2718.928	541.532	0.000	.	5.021	0.000
V1D_PREC	-978.437	1339.716	-0.102	1.000	-0.730	0.469

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	6861031.940	1	6861031.940	0.533	0.469
Residual	6.56023E+08	51	1.28632E+07		

*** WARNING ***
Case 2 has large leverage (Leverage = 0.540)
Case 20 is an outlier (Studentized Residual = 4.830)
Case 26 is an outlier (Studentized Residual = 4.830)

Durbin-Watson D Statistic 2.153
First Order Autocorrelation -0.081



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

Dep Var: FECAL   N: 53   Multiple R: 0.130   Squared multiple R: 0.017

Adjusted squared multiple R: 0.000   Standard error of estimate: 3574.510

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2277.824	572.840	0.000	.	3.976	0.000
V3D_PREC	482.821	514.521	0.130	1.000	0.938	0.352

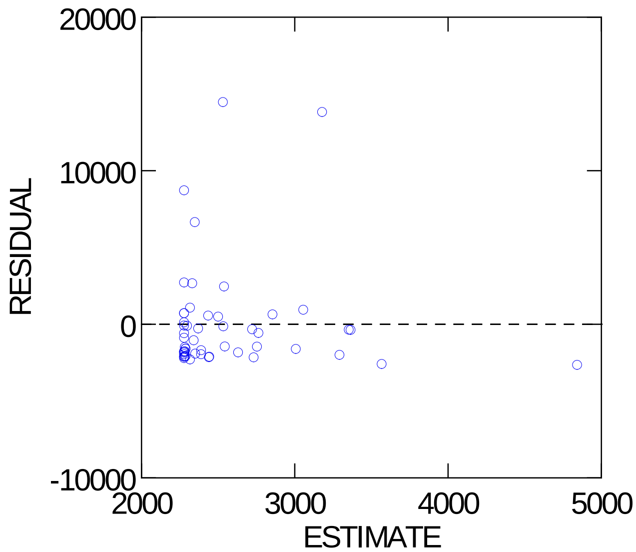
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.12512E+07	1	1.12512E+07	0.881	0.352
Residual	6.51633E+08	51	1.27771E+07		

*** WARNING ***
Case 13 has large leverage (Leverage = 0.484)
Case 20 is an outlier (Studentized Residual = 4.934)
Case 26 is an outlier (Studentized Residual = 4.736)

Durbin-Watson D Statistic 2.018
First Order Autocorrelation -0.012

Plot of residuals against predicted values



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

Dep Var: FECAL N: 53 Multiple R: 0.005 Squared multiple R: 0.000

Adjusted squared multiple R: 0.000 Standard error of estimate: 3605.199

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2568.856	657.331	0.000	.	3.908	0.000
V7D_PRE	-9.524	291.176	-0.005	1.000	-0.033	0.974

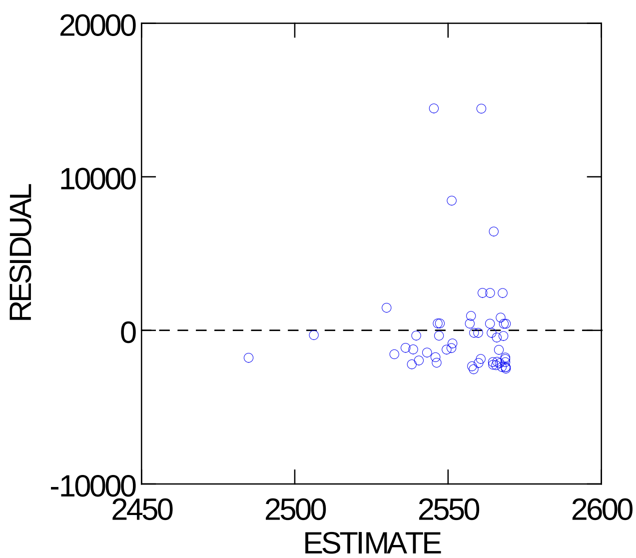
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	13905.621	1	13905.621	0.001	0.974
Residual	6.62871E+08	51	1.29975E+07		

*** WARNING ***
Case 16 has large leverage (Leverage = 0.369)
Case 20 is an outlier (Studentized Residual = 4.867)
Case 26 is an outlier (Studentized Residual = 4.888)

Durbin-Watson D Statistic 2.088
First Order Autocorrelation -0.048

Plot of residuals against predicted values



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

Dep Var: FECAL N: 53 Multiple R: 0.010 Squared multiple R: 0.000

Adjusted squared multiple R: 0.000 Standard error of estimate: 3605.055

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2607.468	885.536	0.000	.	2.945	0.005
MONTH_PR	-9.531	132.647	-0.010	1.000	-0.072	0.943

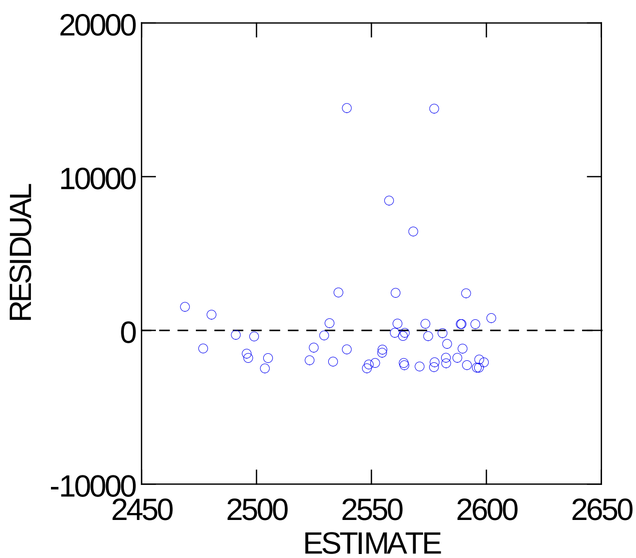
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	67101.141	1	67101.141	0.005	0.943
Residual	6.62817E+08	51	1.29964E+07		

*** WARNING ***
Case 20 is an outlier (Studentized Residual = 4.881)
Case 26 is an outlier (Studentized Residual = 4.877)

Durbin-Watson D Statistic 2.098
First Order Autocorrelation -0.053

Plot of residuals against predicted values



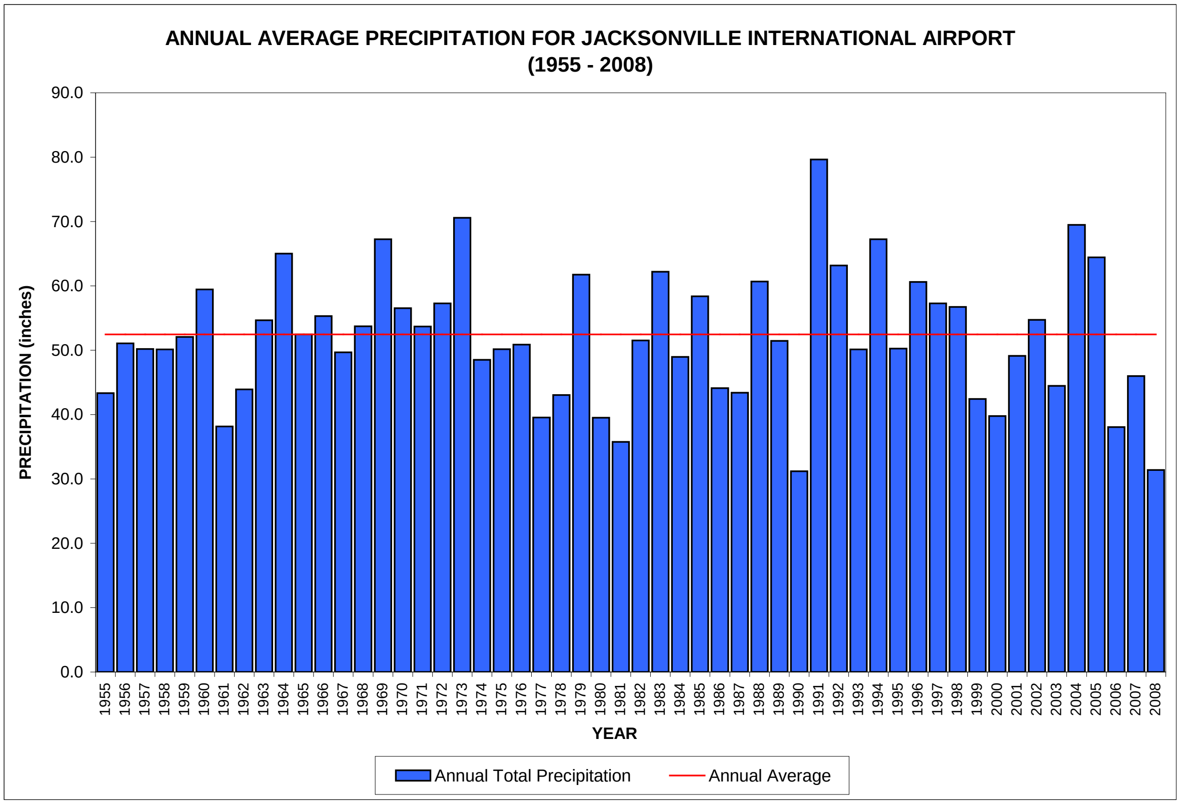
Appendix I: Monthly and Annual Precipitation from JIA, 1955–2008

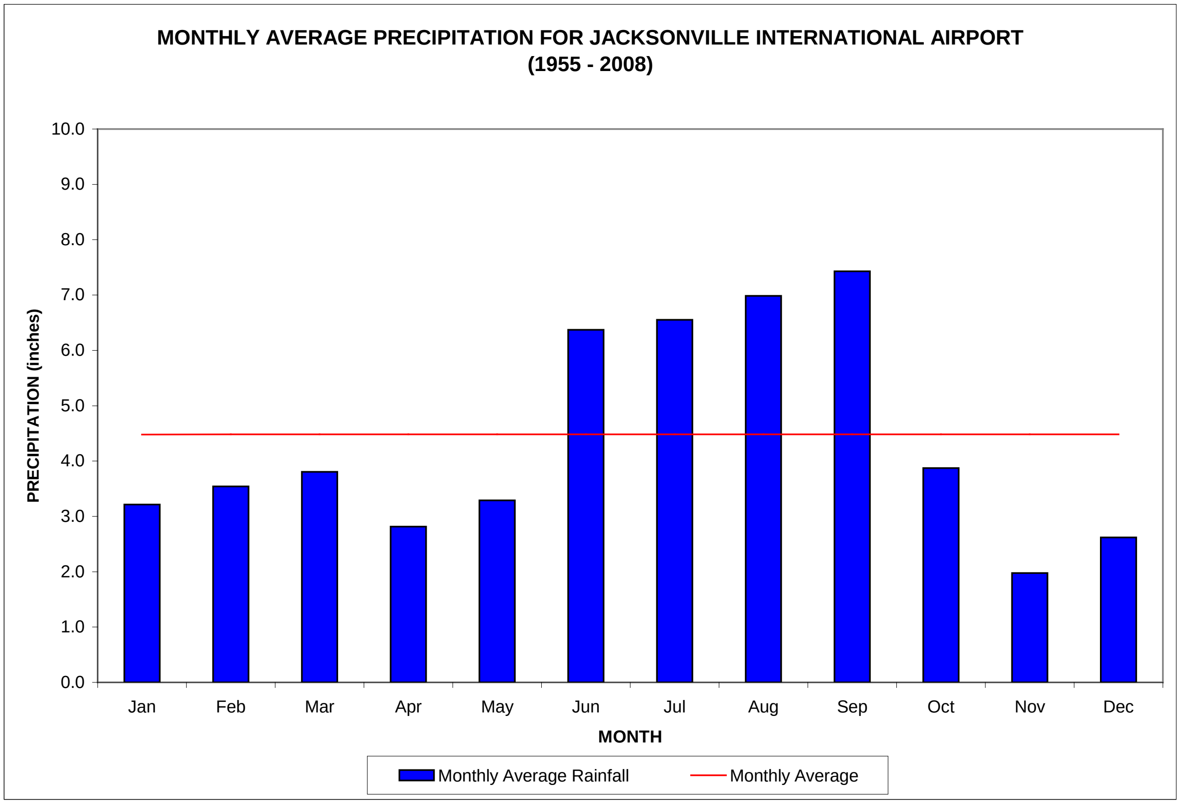
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1955	3.1	2.46	1.66	1.5	4.51	2.7	5.53	3.85	10.6	5.36	1.9	0.2	**43.33**
1956	2.9	2.94	0.81	2.33	3.98	7.87	8.25	5.24	2.89	13.4	0.4	0	**51.08**
1957	0.3	1.69	3.87	1.61	5.25	7.1	12.3	3.3	8.33	3.5	1.6	1.3	**50.18**
1958	3.4	3.74	3.38	8.24	3.79	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**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
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**
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: Annual and Monthly Average Precipitation at JIA





Appendix K: 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.

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

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