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 Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351)

Kyeongsik Rhew

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Acknowledgments

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2008 Integrated Report

http://www.dep.state.fl.us/water/docs/2008_Integrated_Report.pdf

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Region 4: Total Maximum Daily Loads in 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 bacteria for Pottsburg Creek and Julington Creek in the Lower St. Johns Basin. These waterbodies were verified as impaired for fecal coliform and therefore were included on the Verified List of impaired waters for the Lower St. Johns Basin that was adopted by Secretarial Order on May 27, 2004 for Pottsburg Creek and on May 19, 2009 for Julington Creek, respectively. The TMDLs establish the allowable fecal coliform loadings to Pottsburg Creek and Julington Creek that would restore these waterbodies so that they meet their applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

Pottsburg Creek and Julington Creek, located in Duval County in northeast Florida, drain areas of about 9.1 and 20.4 square miles (mi^2), respectively. Pottsburg Creek flows directly into the Arlington River, a tributary to the St. Johns River, and Julington Creek flows into Durbin Creek, also a tributary to the St. Johns (**Figures 1.1** and **1.2**). Pottsburg Creek and Julington Creek are approximately 8.2 and 9.1 miles long, respectively, and are second-order streams. The Pottsburg Creek and Julington Creek watersheds are located within the Jacksonville city limits, in the southeast portion of Duval County. Interstate 95 passes through these highly urbanized watersheds. Additional information about the creeks' hydrology and geology is available in the Basin Status Report for the Lower St. Johns (Florida Department of Environmental Protection [Department], 2002).

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. This TMDL addresses Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351) for fecal coliform.

Figure 1.1. Location of the Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351) Watersheds in the Lower St. Johns Basin, and Major Geopolitical Features in the Area

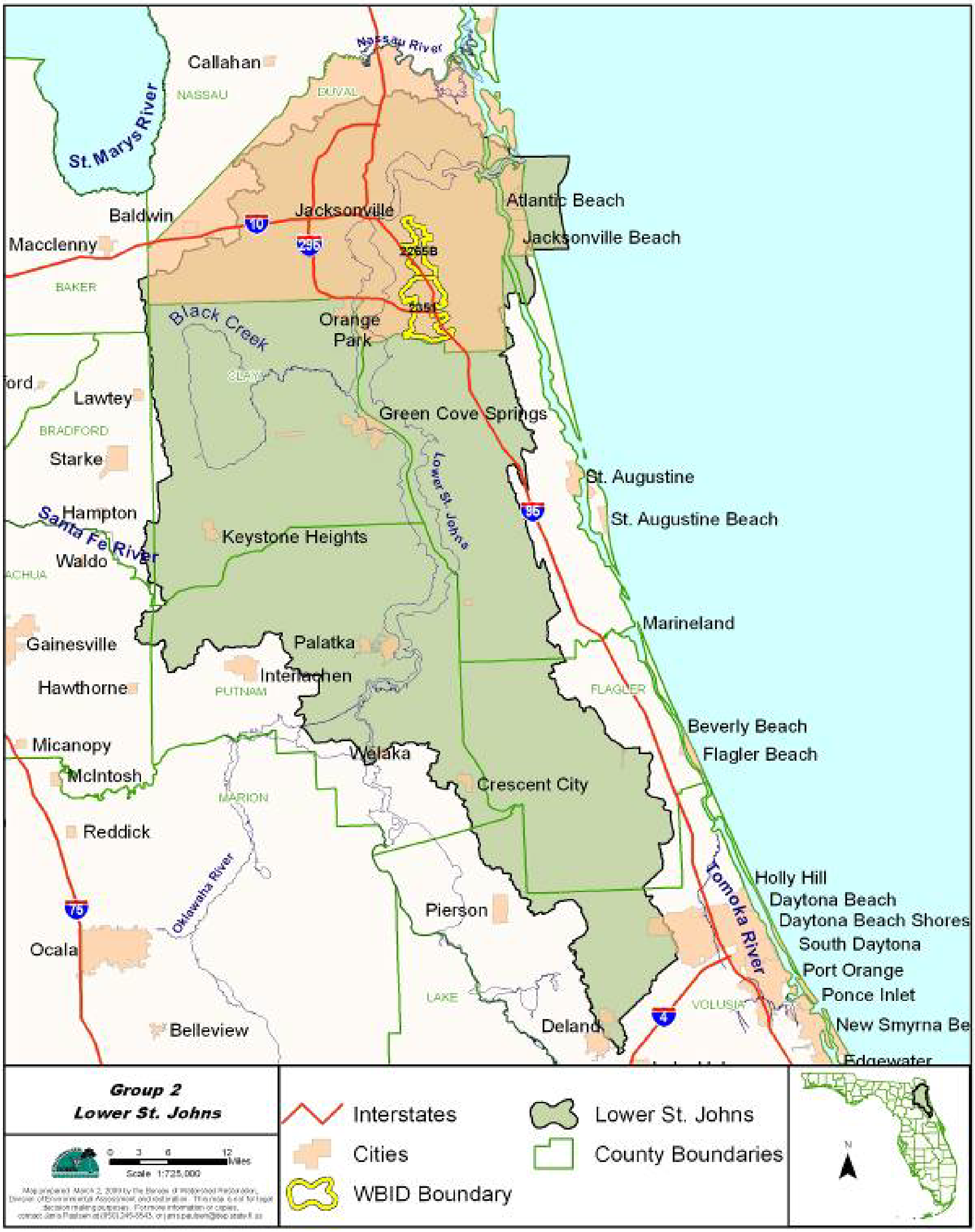
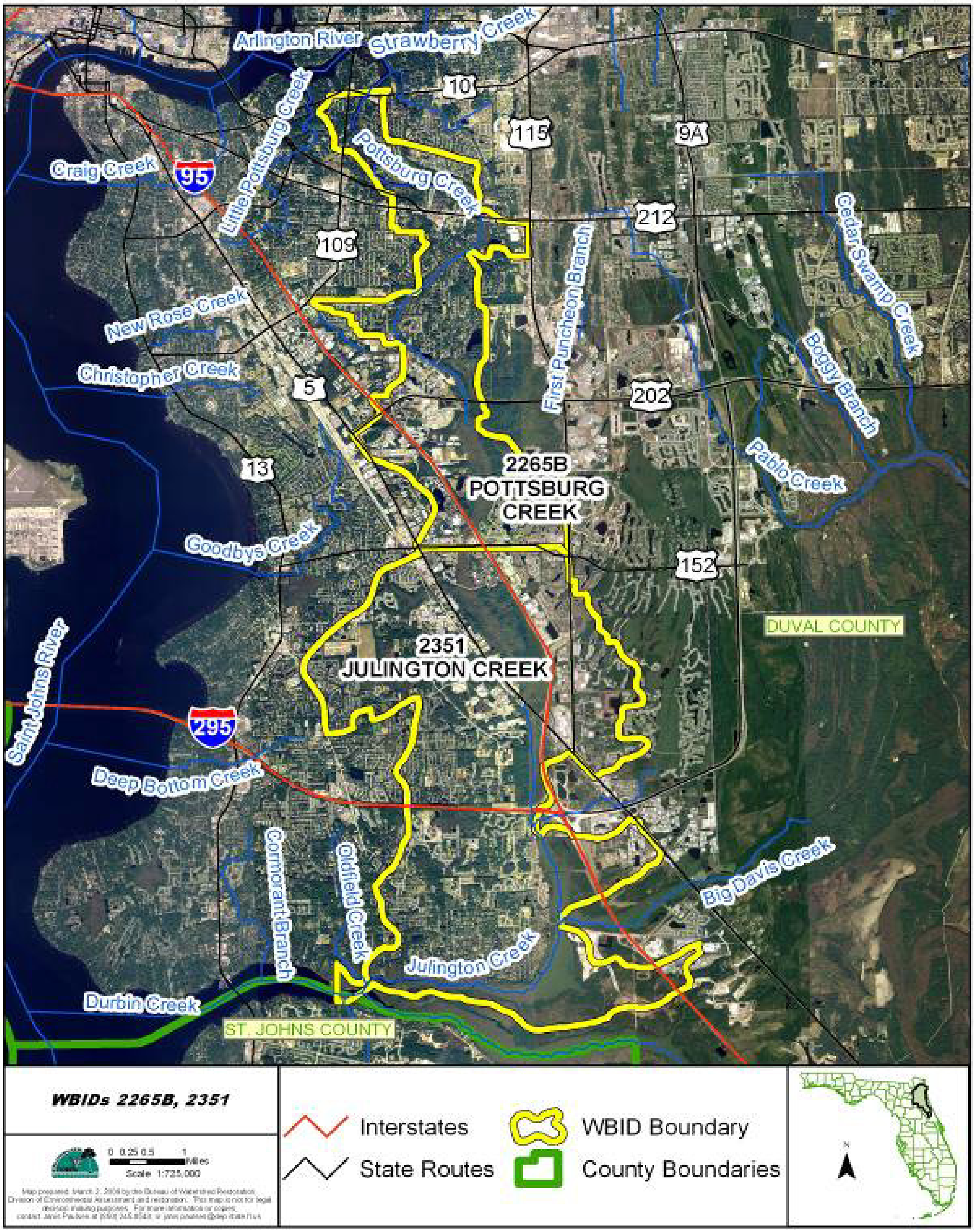


Figure 1.2. Location of the Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351) Watersheds in Duval County



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, designed to reduce the amount of fecal coliform that caused the verified impairment of Pottsburg Creek and Julington Creek. These activities will depend heavily on the active participation of the St. Johns River Water Management District (SJRWMD), local governments, 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) lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed 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.]); the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 55 waterbodies 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 rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was modified in 2006 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in Pottsburg Creek and Julington Creek and has verified that these waterbody segments are impaired for fecal coliform bacteria. The verifications of impairment were based on the observation that 27 out of 98 fecal coliform samples for Pottsburg Creek and 20 out of 83 samples for Julington Creek collected during the verified period (January 1, 2001, through June 30, 2008) exceeded the applicable fecal water quality criterion (Rule 62-302, F.A.C.).

Table 2.1 summarizes the fecal coliform monitoring results for the cycle 1 verified period for Pottsburg Creek. **Tables 2.2** summarizes for the cycle 2 verified period for both Pottsburg Creek and Julington Creek, respectively. **Tables 2.3** through **2.5** also provide summary results for fecal coliform data for the verified period by month, season, and year in each waterbody, respectively.

Table 2.1. Summary of Fecal Coliform Monitoring Data for Pottsburg Creek (2265B) During the Cycle 1 Verified Period (January 1, 1996, through June 30, 2003)

\- = Empty cell
[1] Most probable number per 100 milliliters

Waterbody (WBID)	Parameter	Fecal Coliform
Pottsburg Creek (2265B)	Total number of samples	60
Pottsburg Creek (2265B)	IWR-required number of exceedances for the Verified List	10
Pottsburg Creek (2265B)	Number of observed exceedances	26
Pottsburg Creek (2265B)	Number of observed nonexceedances	34
Pottsburg Creek (2265B)	Number of seasons during which samples were collected	4
Pottsburg Creek (2265B)	Highest observation (MPN/100mL)[1]	16,000
Pottsburg Creek (2265B)	Lowest observation (MPN/100mL)[1]	60
Pottsburg Creek (2265B)	Median observation (MPN/100mL)[1]	340
Pottsburg Creek (2265B)	Mean observation (MPN/100mL)[1]	1,061
-	**FINAL ASSESSMENT:**	**Impaired**

Table 2.2. Summary of Fecal Coliform Monitoring Data for Pottsburg Creek (2265B) and Julington Creek (2351) During the Cycle 2 Verified Period (January 1, 2001, through June 30, 2008)

- = Empty cell
[1] Most probable number per 100 milliliters

Waterbody (WBID)	Parameter	Fecal Coliform
Pottsburg Creek (2265B)	Total number of samples	98
Pottsburg Creek (2265B)	IWR-required number of exceedances for the Verified List	15
Pottsburg Creek (2265B)	Number of observed exceedances	27
Pottsburg Creek (2265B)	Number of observed nonexceedances	71
Pottsburg Creek (2265B)	Number of seasons during which samples were collected	4
Pottsburg Creek (2265B)	Highest observation (MPN/100mL)[1]	40,000
Pottsburg Creek (2265B)	Lowest observation (MPN/100mL)[1]	18
Pottsburg Creek (2265B)	Median observation (MPN/100mL)[1]	240
Pottsburg Creek (2265B)	Mean observation (MPN/100mL)[1]	1,113
-	**FINAL ASSESSMENT:**	**Impaired**
Julington Creek (2351)	Total number of samples	83
Julington Creek (2351)	IWR-required number of exceedances for the Verified List	13
Julington Creek (2351)	Number of observed exceedances	20
Julington Creek (2351)	Number of observed nonexceedances	63
Julington Creek (2351)	Number of seasons during which samples were collected	4
Julington Creek (2351)	Highest observation (MPN/100mL)[1]	6,000
Julington Creek (2351)	Lowest observation (MPN/100mL)[1]	10
Julington Creek (2351)	Median observation (MPN/100mL)[1]	200
Julington Creek (2351)	Mean observation (MPN/100mL)[1]	470
-	**FINAL ASSESSMENT:**	**Impaired**

Table 2.3. Summary of Fecal Coliform Data by Month for Pottsburg Creek (WBID 2265B) from January 1, 1996 through June 30, 2008 and Julington Creek (WBID 2351) from January 1, 2001, through June 30, 2008

[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100mL.

WBID	Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
2265B	January	8	70	1,400	415	556	4	50
2265B	February	8	76	400	225	233	0	0
2265B	March	13	20	850	210	302	4	31
2265B	April	16	18	1,300	205	345	4	25
2265B	May	7	20	3,000	180	646	2	29
2265B	June	8	400	5,000	990	1,512	7	88
2265B	July	7	20	40,000	450	6,174	4	57
2265B	August	20	20	14,000	265	1,214	5	25
2265B	September	11	80	16,000	480	2,410	6	55
2265B	October	9	100	16,000	226	2,054	4	44
2265B	November	12	220	10,000	360	1,228	5	42
2265B	December	8	80	400	215	206	0	0
2351	January	4	20	390	146	176	0	0
2351	February	4	33	110	65	68	0	0
2351	March	8	20	580	150	206	1	13
2351	April	8	56	1,300	340	497	3	38
2351	May	9	10	1,700	260	714	4	44
2351	June	7	10	2,200	133	417	1	14
2351	July	9	54	760	170	255	1	11
2351	August	9	50	2,400	130	530	3	33
2351	September	7	60	6,000	400	1,431	3	43
2351	October	7	140	775	300	342	1	14
2351	November	8	12	800	280	403	3	38
2351	December	3	40	160	142	114	0	0

Table 2.4. Summary of Fecal Coliform Data by Season for Pottsburg Creek (WBID 2265B) from January 1, 1996 through June 30, 2008 and Julington Creek (WBID 2351) from January 1, 2001, through June 30, 2008

[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100mL.

WBID	Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
2265B	Winter	29	20	1,400	240	353	8	28
2265B	Spring	31	18	5,000	260	714	13	42
2265B	Summer	38	20	40,000	315	2,474	15	39
2265B	Fall	29	80	16,000	300	1,202	9	31
2351	Winter	16	20	580	101	164	1	6
2351	Spring	24	10	2,200	260	555	8	33
2351	Summer	25	50	6,000	200	683	7	28
2351	Fall	18	12	800	260	331	4	22

Table 2.5. Summary of Fecal Coliform Data by Year for Pottsburg Creek (WBID 2265B) from January 1, 1996 through June 30, 2008 and Julington Creek (WBID 2351) from January 1, 2001, through June 30, 2008

[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100mL.

WBID	Year	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
2265B	1996	1	800	800	800	800	1	100
2265B	1998	6	110	16000	1200	3973	4	67
2265B	1999	14	70	1700	315	576	6	43
2265B	2000	8	120	10000	950	2478	7	88
2265B	2001	6	80	1,000	230	348	1	17
2265B	2002	20	75	850	265	291	4	20
2265B	2003	12	90	2,100	465	540	7	58
2265B	2004	11	20	40,000	300	5314	4	36
2265B	2005	13	20	14,000	260	1,370	4	31
2265B	2006	8	20	3,000	230	616	2	25
2265B	2007	28	18	5,400	218	484	5	18
2351	2001	4	10	1,000	156	331	1	25
2351	2002	5	92	800	740	507	3	60
2351	2003	4	40	330	200	193	0	0
2351	2004	4	60	580	80	200	1	25
2351	2005	17	20	2,400	200	482	3	18
2351	2006	12	72	1,300	325	466	4	33
2351	2007	36	10	6,000	178	548	8	22
2351	2008	1	33	33	33	33	0	0

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criterion Applicable to the TMDLs

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)**

Pottsburg Creek and Julington Creek are Class III waterbodies, with a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The criterion applicable to these TMDLs is the Class III criterion for fecal coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentration. The water quality criterion for the protection of Class III waters, as established by Rule 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 criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. There were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDLs was not to exceed 400 MPN/100mL in any sampling event for fecal coliform. The 10 percent exceedance allowed by the water quality criterion for fecal coliform bacteria was not used directly in estimating the target load, but was included in the TMDLs' margin of safety (as described in subsequent chapters).

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 impaired waterbody and the amount of pollutant loadings 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 Fecal Coliform in the Pottsburg Creek and Julington Creek Watersheds

4.2.1 Point Sources

Wastewater Point Sources

There is one NPDES-pemitted wastewater facility (The Pantry # 6244, FLG912273) in the Pottsburg Creek watershed, and two NPDES-permitted wastewater facilities (Royal Lakes Water Reclamation Facility [WRF], FL0026751; and Cemex-Shad Road Concrete Batch Plant [CBP], FLG110367) in the Julington Creek watershed. FLG912273 and FLG110367 are a convenience store and a ready-mix concrete producing facility, respectively, and do not contribute fecal coliform bacteria to surface water. FL0026751 discharges its effluent not to Julington Creek but directly to the St. Johns River.

Municipal Separate Storm Sewer System Permittees

The city of Jacksonville and the Florida Department of Transportation (FDOT) District 2 are co-permittees for a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000012) that covers the Pottsburg Creek and Julington Creek watersheds. FDOT and the cities of Jacksonville, Neptune Beach, and Atlantic Beach share responsibility for the permit.

4.2.2 Land Uses and Nonpoint Sources

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SJRWMD's year 2004 land use coverage contained in the Department's geographic information system (GIS) library. Land use categories in each watershed were aggregated using the simplified Level 1 codes and tabulated in **Tables 4.1a** and **4.1b**. **Figure 4.1** shows the acreage of the principal land uses in each watershed.

As shown in **Tables 4.1a** and **4.1b**, the total areas of Pottsburg Creek and Julington Creek are about 5,819 and 13,037 acres, respectively. For both watersheds, the dominant land use is urban (urban and built-up; low-, medium-, and high-density residential; and transportation, communication, and utilities), which accounts for about 67.1 and 54.4 percent of the total Pottsburg Creek and Julington Creek watershed areas, respectively.

Because no conventional point sources were identified in the two watersheds, the primary loadings of fecal coliform into the creeks are generated by nonpoint sources or MS4-permitted areas in the watersheds. Nonpoint sources of coliform bacteria generally, but not always, come from the coliform bacteria that accumulate on land surfaces and wash off as a result of storm events, the contribution from ground water from sources such as failed septic tanks, and/or sewer line leakage. In addition, feces from pets in residential areas can be another important source of fecal coliform through the surface runoff.

Table 4.1a. Classification of Land Use Categories in the Pottsburg Creek Watershed (WBID 22654B) in 2004

- = Empty cell

Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and built-up	1,400	24.1%
-	Low-density residential	585	10.1%
-	Medium-density residential	1,022	17.6%
-	High-density residential	669	11.5%
2000	Agriculture	13	0.2%
3000	Rangeland	262	4.5%
4000	Upland forest	376	6.5%
5000	Water	318	5.5%
6000	Wetland	936	16.1%
7000	Barren land	11	0.2%
8000	Transportation, communication, and utilities	227	3.9%
-	**TOTAL:**	**5,819**	**100.0%**

Table 4.1b. Classification of Land Use Categories in the Julington Creek Watershed (WBID 2351) in 2004

- = Empty cell

Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and built-up	1,831	14.0%
-	Low-density residential	884	6.8%
-	Medium-density residential	3,177	24.4%
-	High-density residential	536	4.1%
2000	Agriculture	82	0.6%
3000	Rangeland	238	1.8%
4000	Upland forest	1,698	13.0%
5000	Water	521	4.0%
6000	Wetland	3,289	25.2%
7000	Barren land	118	0.9%
8000	Transportation, communication, and utilities	663	5.1%
-	**TOTAL:**	**13,037**	**100.0%**

Pets

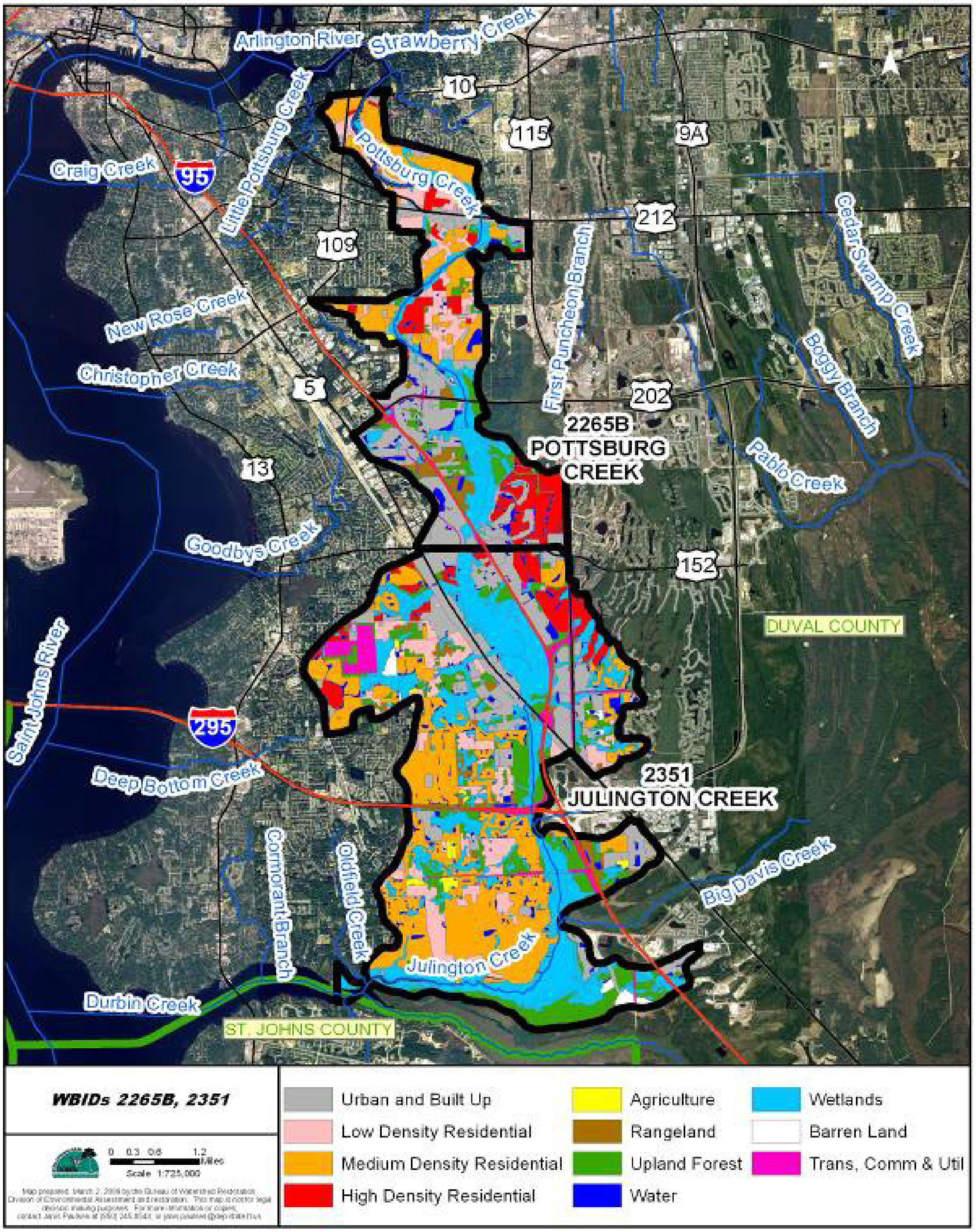
Pets (especially dogs) could be a significant source of coliform pollution through surface runoff in the Pottsburg Creek and Julington Creek watersheds. Studies report that up to 95 percent of the fecal coliform found in urban stormwater can have nonhuman origins (Alderiso et al., 1996; Trial et al., 1993).

The most important nonhuman fecal coliform contributors appear to be dogs and cats. In a highly urbanized Baltimore catchment, Lim and Olivieri (1982) found that dog feces were the single greatest source for fecal coliform and fecal strep bacteria. Trial et al. (1993) also reported that cats and dogs were the primary source of fecal coliform in urban watersheds. Using bacteria source tracking techniques, it was found in Stevenson Creek in Clearwater, Florida, that the amount of fecal coliform bacteria contributed by dogs was as important as those from septic tanks (Watson, 2002).

According to the American Pet Products Manufacturers Association (APPMA), about 4 out of 10 U.S. households include at least one dog. A single gram of dog feces contains about 23 million fecal coliform bacteria (van der Wel, 1995). Unfortunately, statistics show that about 40 percent of American dog owners do not pick up their dogs' feces. **Table 4.2** shows the fecal coliform concentrations of the surface runoff measured in two urban areas (Bannerman et al., 1993; Steuer et al., 1997). While bacteria levels differed widely in the two studies, both indicated that residential lawns, driveways, and streets were the major source areas for bacteria.

The number of dogs in the two watersheds is not known. Therefore, the statistics produced by APPMA were used in this analysis to estimate the possible fecal coliform loads contributed by dogs.

Figure 4.1. Principal Land Uses in the Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351) Watersheds in 2004



The human population in the Pottsburg Creek and Julington Creek watersheds calculated based on the Tiger Track 2000 data (Department's GIS library) was 17,930 and 28,233, respectively. According to the U.S. Census Bureau, there was an average of 2.51 people per household in Duval County in 2000. This gives about 7,143 households in the Pottsburg Creek watershed and 11,248 households in the Julington Creek watershed. Assuming that 40 percent of the households in this area have one dog, the total numbers of dogs in the watershed are about 2,857 and 4,499 in the Pottsburg Creek and Julington Creek watersheds, respectively.

Table 4.2. Concentrations (Geometric Mean Colonies/100mL) of Fecal Coliform from Urban Source Areas (Steuer et al., 1997; Bannerman et al., 1993)

Geographic Location	Marquette, Michigan	Madison, Wisconsin
Number of storms sampled	12	9
Commercial parking lot	4,200	1,758
High-traffic street	1,900	9,627
Medium-traffic street	2,400	56,554
Low-traffic street	280	92,061
Commercial rooftop	30	1,117
Residential rooftop	2,200	294
Residential driveway	1,900	34,294
Residential lawns	4,700	42,093
Basin outlet	10,200	175,106

Table 4.3 shows the waste production rate for a dog (450 grams/day) and the fecal coliform counts per gram of dog wastes (2,200,000 counts/gram). Assuming that 40 percent of dog owners do not pick up dog feces, the total waste produced by dogs and left on the land surface in residential areas is 514,327 and 809,871 grams/day in the Pottsburg Creek and Julington Creek watersheds, respectively. The total produced by dogs is 1.13×10^{12} and 1.78×10^{12} counts/day of fecal coliform in the Pottsburg Creek and Julington Creek watersheds, respectively. It should be noted that this load only represents the fecal coliform load created in each watershed and is not intended to be used to represent a part of the existing load that reaches the receiving waterbody. The fecal coliform load that eventually reaches the receiving waterbody could be significantly less than this value due to attenuation in overland transport.

Table 4.3. Dog Population Density, Wasteload, and Fecal Coliform Density (Weiskel et al., 1996)

* Number from APPMA.

Type	Population density (#/household)	Wasteload (grams/ day)	Fecal coliform density (fecal coliform/gram)
Dog	0.4*	450	2,200,000

Septic Tanks

Septic tanks are another potentially important source of coliform pollution in urban watersheds. When properly installed, most of the coliform from septic tanks should be removed within 50 meters of the drainage field (Minnesota Pollution Control Agency, 1999). However, in areas with a relatively high ground water table, the drain field can be flooded during the rainy season, and coliform bacteria can pollute the surface water through stormwater runoff.

Septic tanks may also cause coliform pollution when they are built too close to irrigation wells. Any well that is installed in the surficial aquifer system will cause a drawdown. If the septic tank system is built too close to the well (e.g., less than 75 feet), the septic tank discharge will be within the cone of influence of the well. As a result, septic tank effluent may enter the well, and once the polluted water is used to irrigate lawns, coliform bacteria may reach the land surface and wash into surface waters during the rainy season.

A rough estimate of fecal coliform loads from failed septic tanks in each watershed can be made using **Equation 4.1**:

$$L = 37.85 * N * Q * C * F \qquad \textbf{(Equation 4.1)}$$

Where:

- L is the fecal coliform daily load (counts/day);
- N is the total number of septic tanks in the area (septic tanks);
- Q is the discharge rate for each septic tank;
- C is the fecal coliform concentration for the septic tank discharge; and
- F is the septic tank failure rate.

Based on 2008 Florida Department of Health (FDOH) onsite sewage GIS coverage (available: http://www.doh.state.fl.us/environment/programs/EhGis/EhGisDownload.htm), about 859 and 984 housing units *(N)* were identified as being on septic tanks in the Pottsburg Creek and Julington Creek watersheds, respectively (**Figure 4.2**). The discharge rate from each septic tank (*Q*) was calculated by multiplying the average household size by the per capita wastewater production rate per day. Based on the information published by the Census Bureau, the average household size is about 2.51 people/household for Duval County. The same population densities were assumed for the Pottsburg Creek and Julington Creek watersheds. A commonly cited value for per capita wastewater production rate is 70 gallons/day/person (EPA, 2001). The commonly cited concentration (*C*) for septic tank discharge is 1×10^6 counts/100mL for fecal coliform (EPA, 2001).

No measured septic tank failure rate data were available for the watersheds when these TMDLs were developed. Therefore, the failure rate was derived from the number of septic tank and septic tank repair permits for Duval County published by FDOH (available: http://www.doh. state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm). The number of septic tanks in the county was calculated assuming that none of the installed septic tanks will be removed after being installed (**Table 4.4**). The reported number of septic tank repair permits was also obtained from the FDOH Website. Based on this information, discovery rates of failed septic tanks for each year between 2002 and 2007 were calculated and listed in **Table 4.4**.

Based on **Table 4.4**, the average annual septic tank failure discovery rate is about 0.34 percent for Duval County. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, which equals 1.7 percent. Based on **Equation 4.1**, the estimated fecal coliform loadings from failed septic tanks in the Pottsburg Creek and Julington Creek watersheds are about 9.71×10^{10} and 1.10×10^{11} counts/day, respectively.

Figure 4.2. Distribution of Onsite Sewage Disposal Systems (Septic Tanks) in the Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351) Watersheds

Table 4.4. Estimated Septic Tank Numbers and Septic Tank Failure Rates for Duval County, 2002–07

- = Empty cell
[1] Failure rate is 5 times the failure discovery rate.

-	2002	2003	2004	2005	2006	2007	Average
New installation (septic tanks)	359	459	373	487	598	576	475
Accumulated installation (septic tanks)	88,062	88,421	88,880	89,253	89,740	90,338	89,116
Repair permit (septic tanks)	369	369	324	226	249	269	301
Failure discovery rate (%)	0.42	0.42	0.36	0.25	0.28	0.30	0.34
Failure rate (%)[1]	2.1	2.1	1.8	1.3	1.4	1.5	1.7

Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) can also be a potential source of fecal bacteria pollution. Human sewage can be introduced into surface waters even when storm and sanitary sewers are separated. Leaks and overflows are common in many older sanitary sewers where capacity is exceeded, high rates of infiltration and inflow occur (i.e., outside water gets into pipes, reducing capacity), frequent blockages occur, or sewers are simply falling apart due to poor joints or pipe materials. Power failures at pumping stations are also a common cause of SSOs. The greatest risk of an SSO occurs during storm events; however, few comprehensive data are available to quantify SSO frequency and bacteria loads in most watersheds.

When this TMDL was developed, no information on sewer line coverage was available to the Department, and so it was difficult to determine with certainty whether the entire area was sewered. Typically, the high- and medium-density residential areas are sewered to avoid too-high septic tank density. Fecal coliform loading from sewer line leakage can be calculated based on the number of people in the watershed, typical per household generation rates, and typical fecal coliform concentrations in domestic sewage, assuming a leakage rate of 0.5 percent (Culver et al., 2002). Based on this assumption, a rough estimate of fecal coliform loads from leaks and SSOs in the Pottsburg Creek and Julington Creek watersheds can be made using **Equation 4.2**.

$$L = 37.85 * N * Q * C * F \qquad \textbf{(Equation 4.2)}$$

Where:

L is the fecal coliform daily load (counts/day);
N is the number of households using sanitary sewer in the watershed;
Q is the discharge rate for each household;
C is the fecal coliform concentration for domestic wastewater discharge; and
F is the sewer line leakage rate.

The number of households (N) in the Pottsburg Creek and Julington Creek watersheds connected to the sewer lines is 6,294 and 10,264 (total households minus septic tank households), respectively. The discharge rate through sewers from each household (Q) was calculated by multiplying the average household size (2.51 for Duval County) by the per capita wastewater production rate per day (70 gallons). The commonly cited concentration (C) for domestic wastewater is 1×10^6 counts/100mL for fecal coliform (EPA, 2001). The contribution of fecal coliform through sewer line leakage was assumed to be 0.5 percent of the total sewage loading created from the population not on septic tanks (Culver et al., 2002). Based on **Equation 4.2**, the estimated fecal coliform loadings from sewer line leakage in the Pottsburg Creek and Julington Creek watersheds are about 2.09 x 10^{11} and 3.41 x 10^{11} counts/day, respectively.

Wildlife

Wildlife deposit coliform bacteria with their feces onto land surfaces, where they can be transported during storm events to nearby streams. Some wildlife (such as otters, beavers, raccoons, and birds) deposit their feces directly into the water. The bacterial load from naturally occurring wildlife is assumed to be background. In addition, any strategy employed to control this source would probably have a negligible impact on attaining water quality standards.

Table 4.5 provides estimated fecal coliform loadings from dogs, septic tanks, and SSOs for the Pottsburg Creek and Julington Creek watersheds.

Table 4.5. Estimated Fecal Coliform Loadings from Dogs, Septic Tanks, and SSOs in the Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351) Watersheds

Waterbody	Dogs (counts/day)	Septic Tanks (counts/day)	SSOs (counts/day)
Pottsburg Creek	1.13 x 10^{12}	9.71 x 10^{10}	2.09 x 10^{11}
Julington Creek	1.78 x 10^{12}	1.10 x 10^{11}	3.41 x 10^{11}

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

No long-term stream flow information was available on Pottsburg Creek and Julington Creek; therefore, the load duration curve method could not be applied in this circumstance. To determine the required reduction for these TMDLs, 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 fecal coliform standard of 400 counts/100mL was determined. The median value of all of these reductions determined the overall required reduction, and therefore the TMDLs.

5.1.1 Data Used in the Determination of the TMDL

All data used for this TMDL report were provided by the Department's Northeast District office and the city of Jacksonville. **Figure 5.1** shows the locations of the water quality sites where fecal coliform data were collected. These analyses used fecal coliform data collected from 2001 to 2007 in Pottsburg Creek and from 2001 to 2008 in Julington Creek. During the sampling period, a total of 98 fecal coliform samples was collected from 7 sampling stations in Pottsburg Creek, and a total of 83 fecal coliform samples from 6 sampling stations in Julington Creek. **Figures 5.2a** and **5.2b** show the fecal coliform concentrations observed in the waterbodies.

In Pottsburg Creek, the concentration of fecal coliform ranged from 18 to 40,000 counts/100mL (**Figure 5.2a**) and averaged 1,113 counts/100mL during the verified period from 2001 to 2008. Seasonally, the highest fecal coliform concentration and exceedance rate were observed during the third quarter (July, August, and September) (**Figure 5.3a**). The lowest fecal coliform concentration was observed during the second quarter (April, May, and June), and the lowest exceedance rate was 14 percent during the fourth quarter (October, November, and December). Spatially, the fecal coliform concentrations and exceedance rates were high at the upstream stations (21FLJXQBP64 and 21FLJXQBP67) and decreased at the downstream stations (**Figure 5.4a**). Station 21FLA 20030064 was combined with 21FLJXWQBP64 in the graph because those stations are at the same location. Station 21FLA 20030815 was also combined with 21FLJXWQBP452 in the graph for the same reason. On each of the spatial distribution graphs, the X-axis is arranged from upstream (left) toward downstream (right) (**Figures 5.4a** and **5.4b**).

In Julington Creek, the concentration of fecal coliform ranged from 10 to 6,000 counts/100mL (**Figure 5.2b**) and averaged 470 counts/100mL during the verified period. Seasonally, higher fecal coliform concentrations and exceedance rates were observed during the second and third quarters than during the first and fourth quarters (**Figure 5.3b**). Spatially, the fecal coliform concentration was highest at the upstream station, but the exceedance rate was highest at the downstream station. Stations 21FLA 20030517, 21FLA 20030598, and 21FLA 20030597 were combined with 21FLJXWQJC440, 21FLJXWQJC3, and 21FLJXWQJC339, respectively, in the graph because those stations are at the same locations (**Figure 5.4b**).

Figure 5.1. Locations of Water Quality Stations in Pottsburg Creek (WBID 2256B) and Julington Creek (WBID 2351)

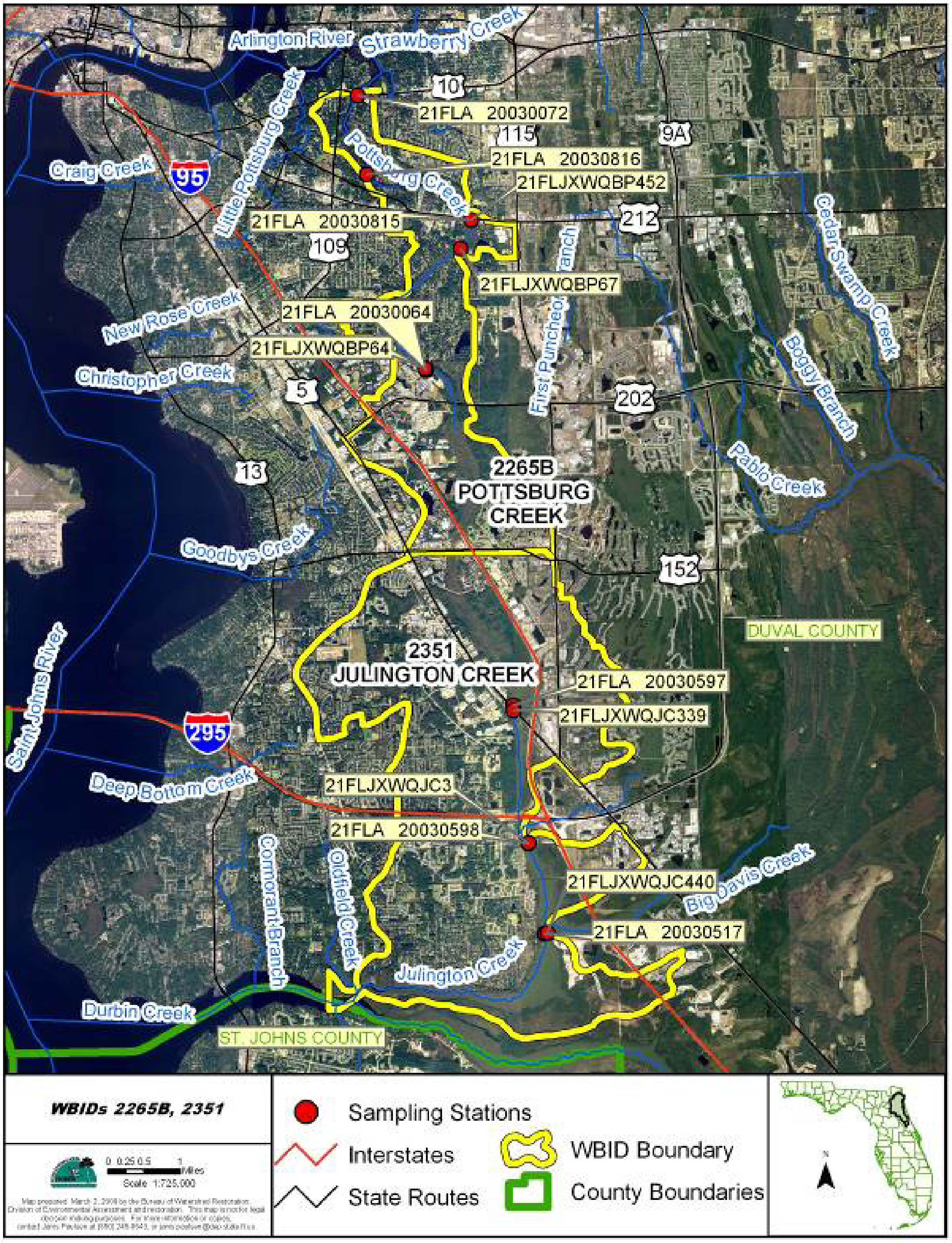


Figure 5.2a. Trend of Fecal Coliform Concentrations in Pottsburg Creek (WBID 2265B) During the Cycle 2 Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

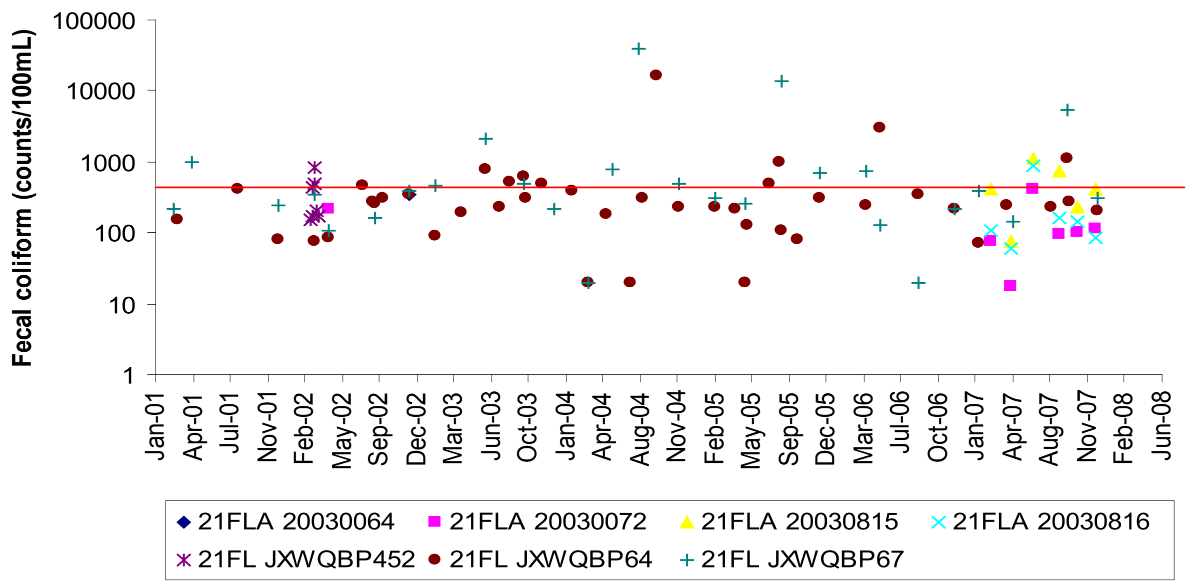


Figure 5.2b. Trend of Fecal Coliform Concentrations in Julington Creek (WBID 2351) During the Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

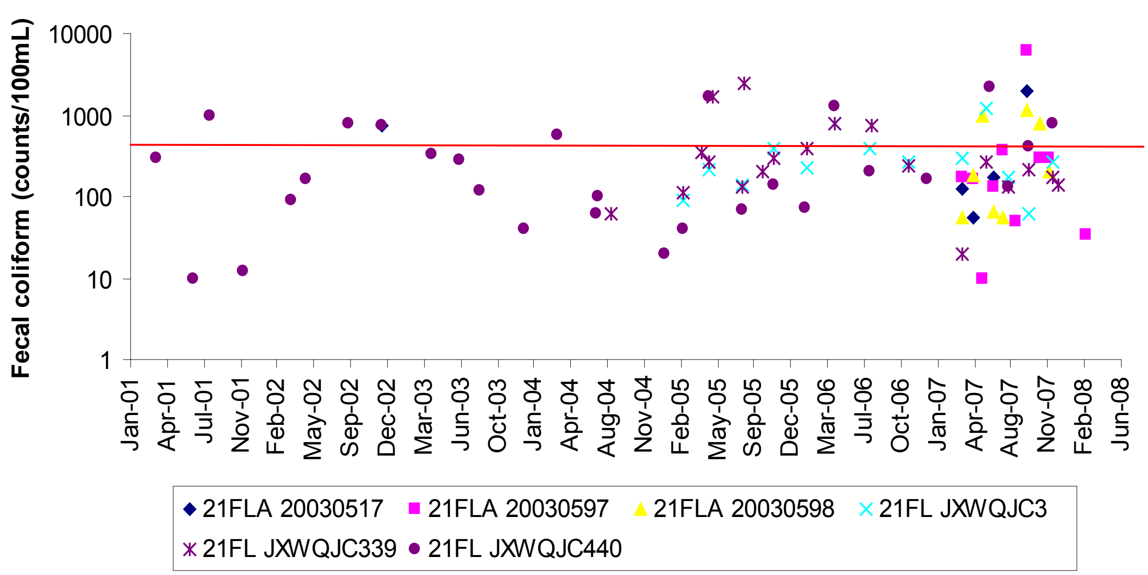


Figure 5.3a. Seasonal Trend of Fecal Coliform Concentration and Exceedance Rate in Pottsburg Creek (WBID 2265B) During the Cycle 2 Verified Period

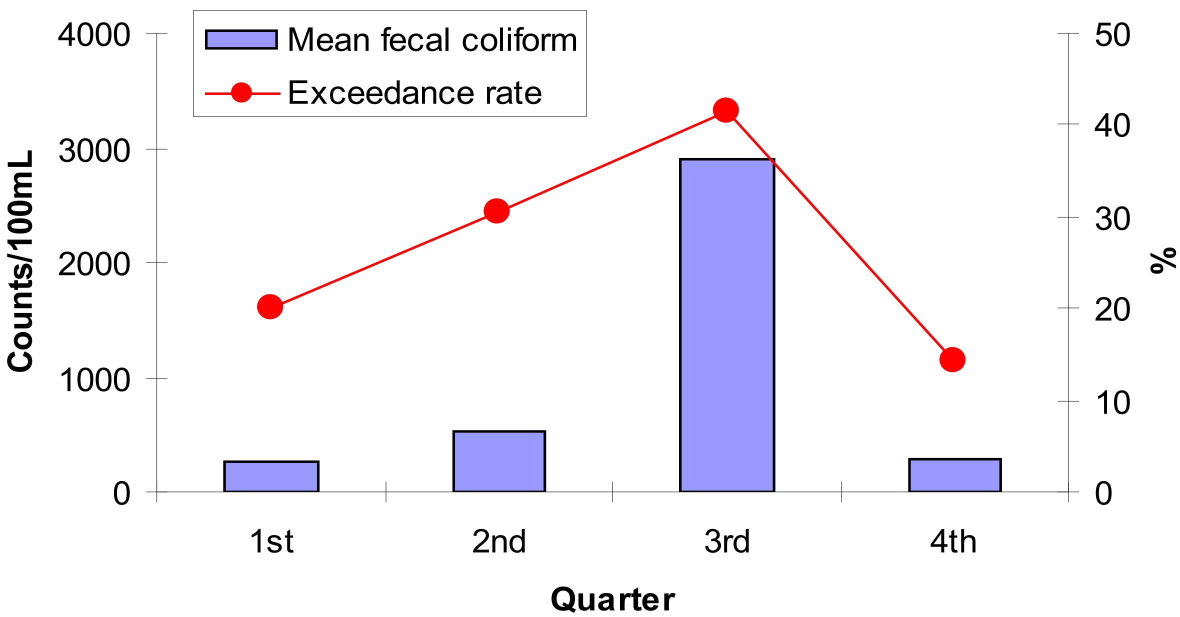


Figure 5.3b. Seasonal Trend of Fecal Coliform Concentration and Exceedance Rate in Julington Creek (WBID 2351) During the Verified Period

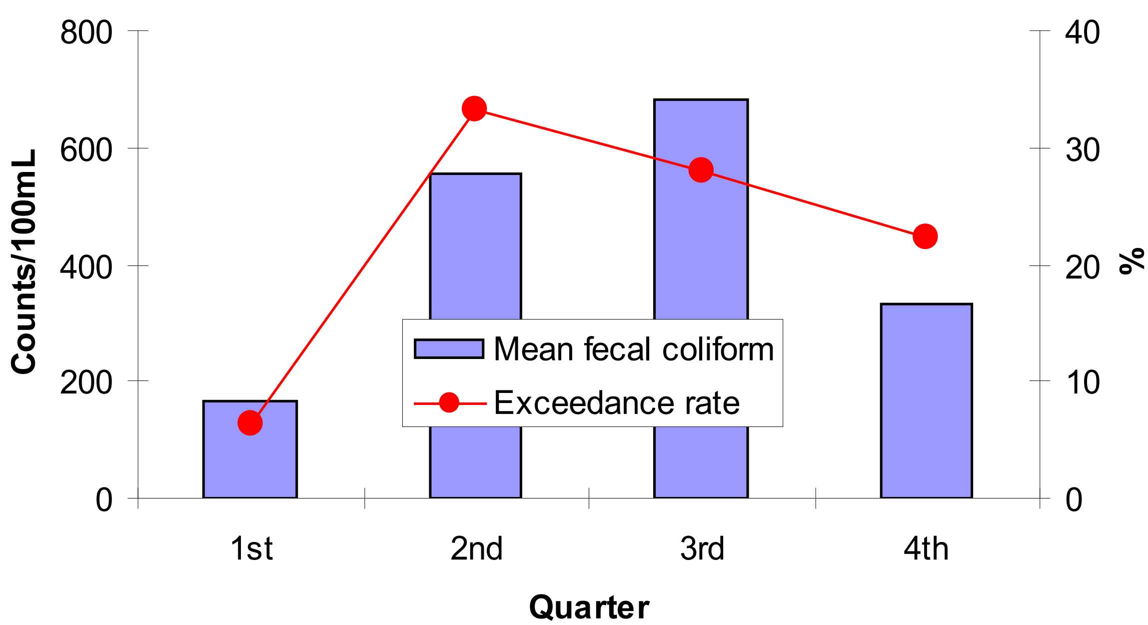


Figure 5.4a. Spatial Trend of Fecal Coliform Concentration and Exceedance Rate in Pottsburg Creek (WBID 2265B) During the Cycle 2 Verified Period

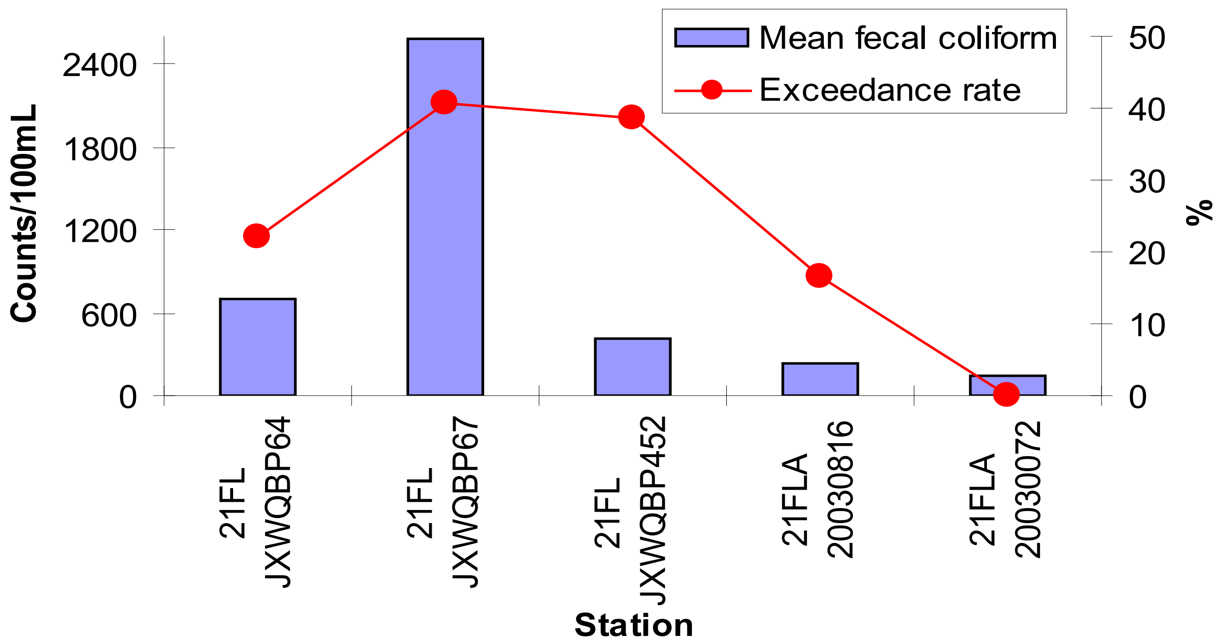
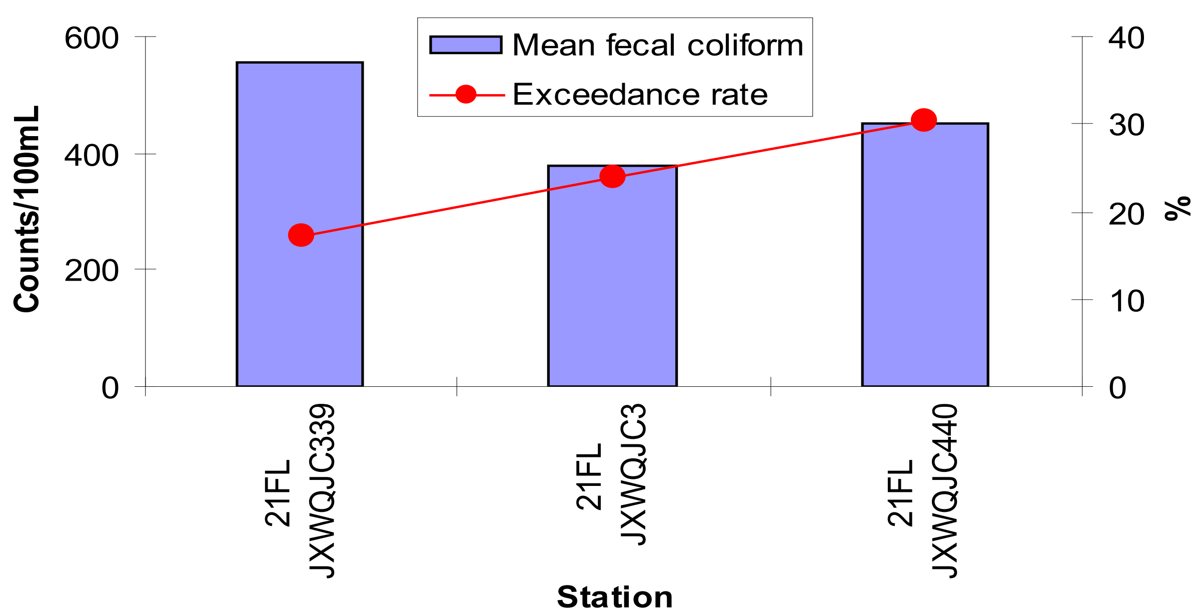


Figure 5.4b. Spatial Trend of Fecal Coliform Concentration and Exceedance Rate in Julington Creek (WBID 2351) During the Verified Period



5.1.2 TMDL Development Process

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

$$\textbf{Load reduction} = \frac{\textbf{Existing loading} - \textbf{Allowable loading}}{\textbf{Existing loading}} \times \textbf{100\%}$$

After the individual results were calculated, the median of the individual values was calculated. **Tables 5.1a** and **5.1b** show the individual reduction calculations for fecal coliform. The median reductions were 50.0 and 59.4 percent for Pottsburg Creek and Julington Creek, respectively.

Table 5.1a. Calculation of Fecal Coliform Reductions for the TMDL for Pottsburg Creek (WBID 2265B)

- = Empty cell
[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100mL.

Date	Station	Fecal Coliform Exceedances[1, 2]	Fecal Coliform Target[1]	% Reduction
4/17/2001	21FLJXWQBP67	1,000	400	60.0%
3/4/2002	21FLJXWQBP452	440	400	9.1%
3/11/2002	21FLJXWQBP452	490	400	18.4%
3/14/2002	21FLJXWQBP452	850	400	52.9%
7/17/2002	21FLJXWQBP64	450	400	11.1%
1/29/2003	21FLJXWQBP67	450	400	11.1%
6/16/2003	21FLJXWQBP64	800	400	50.0%
6/16/2003	21FLJXWQBP67	2,100	400	81.0%
8/19/2003	21FLJXWQBP64	510	400	21.6%
9/22/2003	21FLJXWQBP67	480	400	16.7%
9/22/2003	21FLJXWQBP64	610	400	34.4%
11/12/2003	21FLJXWQBP64	500	400	20.0%
5/18/2004	21FLJXWQBP67	800	400	50.0%
7/28/2004	21FLJXWQBP67	40,000	400	99.0%
9/14/2004	21FLJXWQBP64	16,000	400	97.5%
11/15/2004	21FLJXWQBP67	500	400	20.0%
7/12/2005	21FLJXWQBP64	485	400	17.5%
8/9/2005	21FLJXWQBP64	980	400	59.2%
8/16/2005	21FLJXWQBP67	14,000	400	97.1%
11/28/2005	21FLJXWQBP67	700	400	42.9%
3/29/2006	21FLJXWQBP67	740	400	45.9%
5/8/2006	21FLJXWQBP64	3,000	400	86.7%
6/20/2007	21FLA 20030816	880	400	54.5%
6/21/2007	21FLA 20030815	1,114	400	64.1%
8/28/2007	21FLA 20030815	733	400	45.4%

Date	Station	Fecal Coliform Exceedances[1, 2]	Fecal Coliform Target[1]	% Reduction
9/20/2007	21FLJXWQBP64	1,100	400	63.6%
9/20/2007	21FLJXWQBP67	5,400	400	92.6%
-	-	-	**Median % Reduction**	**50.0%**

Table 5.1b. Calculation of Fecal Coliform Reductions for the TMDL for Julington Creek (WBID 2351)

- = Empty cell
[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100mL.

Date	Station	Fecal Coliform Exceedances[1, 2]	Fecal Coliform Target[1]	% Reduction
8/14/2001	21FLJXWQJC440	1,000	400	60.0%
8/26/2002	21FLJXWQJC440	800	400	50.0%
11/25/2002	21FLA 20030517	740	400	45.9%
11/25/2002	21FLJXWQJC440	740	400	45.9%
3/17/2004	21FLJXWQJC440	580	400	31.0%
5/4/2005	21FLJXWQJC440	1,700	400	76.5%
5/16/2005	21FLJXWQJC339	1,650	400	75.8%
8/9/2005	21FLJXWQJC339	2,400	400	83.3%
4/12/2006	21FLJXWQJC3	800	400	50.0%
4/12/2006	21FLJXWQJC339	800	400	50.0%
4/12/2006	21FLJXWQJC440	1,300	400	69.2%
7/24/2006	21FLJXWQJC339	760	400	47.4%
5/21/2007	21FLA 20030598	973	400	58.9%
5/31/2007	21FLJXWQJC3	1,200	400	66.7%
6/7/2007	21FLJXWQJC440	2,200	400	81.8%
9/17/2007	21FLA 20030598	1,150	400	65.2%
9/17/2007	21FLA 20030517	2,000	400	80.0%
9/17/2007	21FLA 20030597	6,000	400	93.3%
10/22/2007	21FLA 20030598	775	400	48.4%
11/26/2007	21FLJXWQJC440	800	400	50.0%
-	-	-	**Median % Reduction**	**59.4%**

5.1.3 Critical Conditions

The critical conditions for coliform loadings in a given watershed depend on many factors, including the presence of point sources and the land use pattern in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period followed by a rainfall runoff event. During the wet weather period, rainfall washes off coliform bacteria that have built up on the land surface under dry conditions, resulting in the wet weather exceedances. However, significant nonpoint source contributions can also appear under dry conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer, and fecal coliform bacteria are brought into the receiving waters through baseflow. In addition, wildlife with direct access to the receiving water can contribute to the exceedance during dry weather. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

As no current flow data were available for the two waterbodies, hydrologic conditions were analyzed using rainfall. A loading curve–type chart that would normally be applied to flow events was instead created using precipitation data from Jacksonville International Airport for the period 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 (0–5th 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 events (60th–100th percentile). Three-day (the day of and two days prior to sampling) precipitation accumulations were used in the analysis (**Tables 5. 2a** and **5.2b; Figures 5.5a** and **5.5b**).

Historical data show that there were significant fecal coliform exceedances in high precipitation events (extreme, large, and medium) in both waterbodies, indicating that nonpoint sources are probably a major contributing factor. The exceedance rates for little or no precipitation event, while generally low, are not insignificant. These exceedances at baseflow can be attributed to ground water contributions from failed septic tanks and/or leaking collection systems. Thus, the Department did not focus on a particular set of critical conditions for either waterbody. **Tables 5.2a** and **5.2b** and **Figures 5.5a** and **5.5b** show fecal coliform data by hydrologic condition for Pottsburg Creek and Julington Creek, respectively.

Table 5.2a. Summary of Fecal Coliform Data by Hydrologic Condition for Pottsburg Creek (WBID 2265B)

[1] Exceedances represent values above 400 counts/100mL.

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances[1]	% Exceedances	Number of Nonexceedances[1]	% Nonexceedances
Extreme	>2.1"	2	2	100.00%	0	0.00%
Large	1.33" - 2.1"	7	5	71.43%	2	28.57%
Medium	0.18" - 1.33"	40	13	32.50%	27	67.50%
Small	0.01" - 0.18"	21	8	38.10%	13	61.90%
None/Not Measurable	<0.01"	56	16	28.57%	40	71.43%

Table 5.2b. Summary of Fecal Coliform Data by Hydrologic Condition for Julington Creek (WBID 2351)

[1] Exceedances represent values above 400 counts/100mL.

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances[1]	% Exceedances	Number of Nonexceedances[1]	% Nonexceedances
Extreme	>2.1"	4	0	0.00%	4	100.00%
Large	1.33" - 2.1"	2	0	0.00%	2	100.00%
Medium	0.18" - 1.33"	31	11	35.48%	20	64.52%
Small	0.01" - 0.18"	21	3	14.29%	18	85.71%
None/Not Measurable	<0.01"	57	9	15.79%	48	84.21%

Figure 5.5a. Fecal Coliform Data by Hydrologic Condition Based on Rainfall for Pottsburg Creek (WBID 2265B)

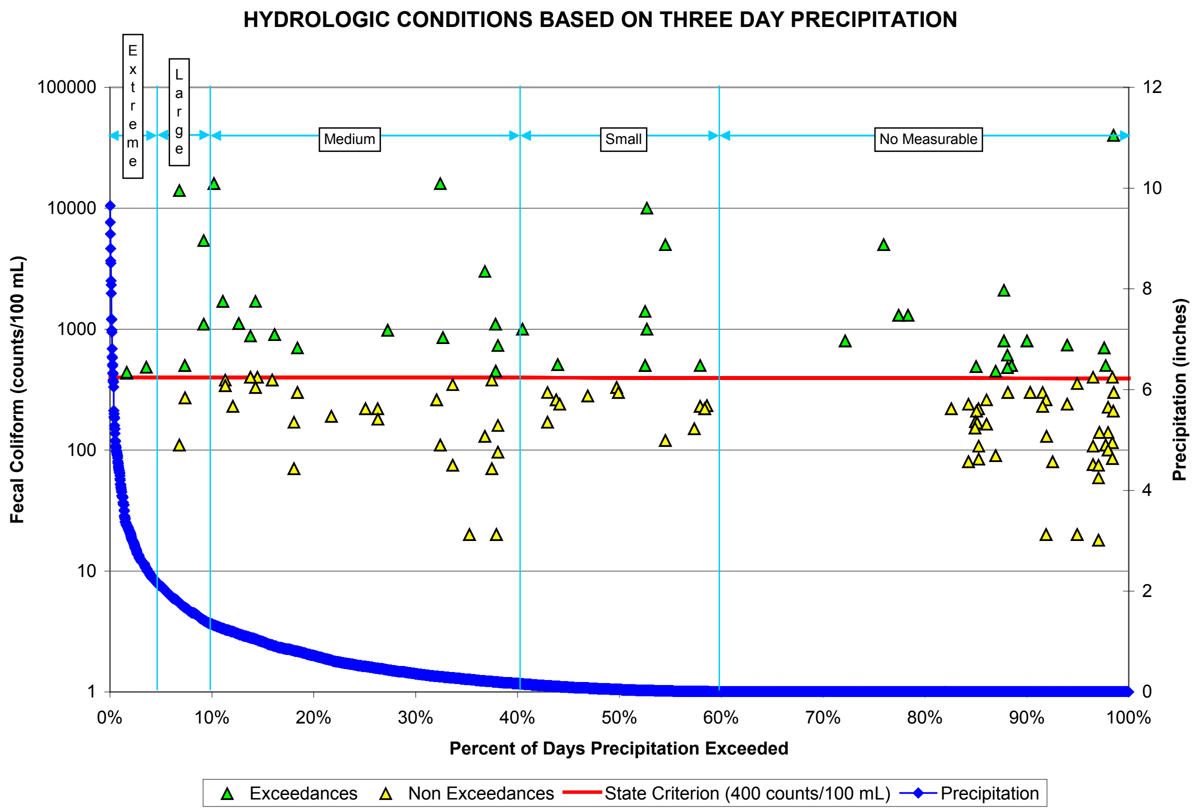
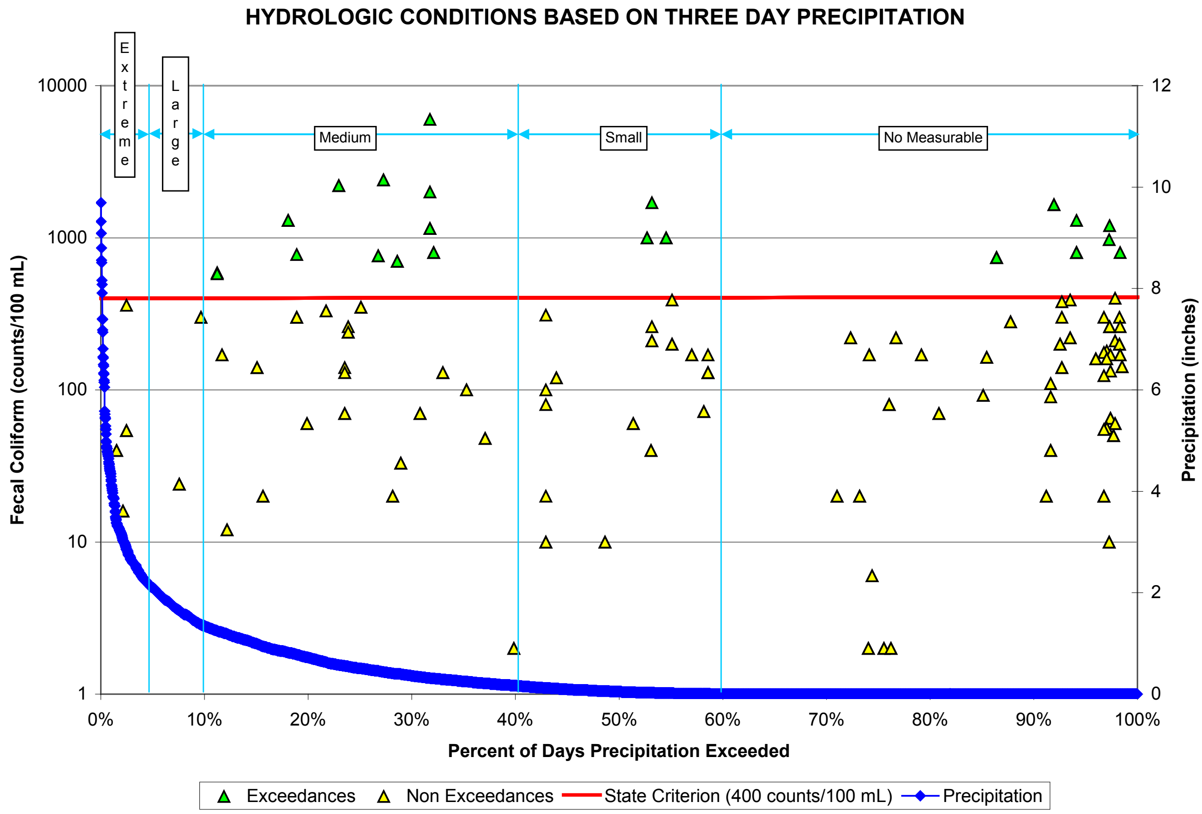


Figure 5.5b. Fecal Coliform Data by Hydrologic Condition Based on Rainfall for Julington Creek (WBID 2351)



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:

TMDL = $\sum$ WLAs + $\sum$ LAs + MOS

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

TMDL $\cong \sum$ $WLAs_{wastewater}$ + $\sum$ $WLAs_{NPDES\ Stormwater}$ + $\sum$ LAs + 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 TMDLs for Pottsburg Creek and Julington Creek are expressed in terms of MPN/day and percent reduction, and represent the maximum daily fecal coliform load each stream can assimilate without exceeding the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for Fecal Coliform in Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351)

NA = Not applicable

WBID	Parameter	TMDL (counts/100mL)	Wasteload Allocation for Wastewater (counts/100mL)	Wasteload Allocation for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
2265B	Fecal coliform	400	NA	50%	50 %	Implicit
2351	Fecal coliform	400	NA	59%	59 %	Implicit

6.2 Load Allocation

A fecal coliform reduction of 50 and 59 percent is needed from nonpoint sources in the Pottsburg Creek and Julington Creek watersheds, respectively. It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES stormwater program (see **Appendix A**).

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

No NPDES-permitted wastewater facilities with fecal coliform limits were identified in the Pottsburg Creek and Julington Creek watersheds.

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 50 and 59 percent reduction in current fecal coliform for Pottsburg Creek (WBID 2265B) and Julington Creek (WBID 2351), respectively. It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic 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 implicit MOS was used in the development of these 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 TMDLs calculated for fecal coliform were based on meeting the water quality criterion of 400 counts/100mL without any exceedances, while the actual criterion allows for 10 percent exceedances over the fecal coliform criterion.

Chapter 7: TMDL IMPLEMENTATION

TMDL Implementation

Following the adoption of this TMDL by rule, the Department will determine the best course of action regarding its implementation. Depending upon the pollutant(s) causing the waterbody impairment and the significance of the waterbody, the Department will select the best course of action leading to the development of a plan to restore the waterbody. Often this will be accomplished cooperatively with stakeholders by creating a Basin Management Action Plan, referred to as the BMAP. Basin Management Action Plans are the primary mechanism through which TMDLs are implemented in Florida [see Subsection 403.067(7) F.S.]. A single BMAP may provide the conceptual plan for the restoration of one or many impaired waterbodies.

If the Department determines a BMAP is needed to support the implementation of this TMDL, a BMAP will be developed through a transparent stakeholder-driven process intended to result in a plan that is cost-effective, technically feasible, and meets the restoration needs of the applicable waterbodies. Once adopted by order of the Department Secretary, BMAPs are enforceable through wastewater and municipal stormwater permits for point sources and through BMP implementation for nonpoint sources. Among other components, BMAPs typically include:

- Water quality goals (based directly on the TMDL);
- Refined source identification;
- Load reduction requirements for stakeholders (quantitative detailed allocations, if technically feasible);
- A description of the load reduction activities to be undertaken, including structural projects, nonstructural BMPs, and public education and outreach;
- A description of further research, data collection, or source identification needed in order to achieve the TMDL;
- Timetables for implementation;
- Implementation funding mechanisms;
- An evaluation of future increases in pollutant loading due to population growth;
- Implementation milestones, project tracking, water quality monitoring, and adaptive management procedures; and
- Stakeholder statements of commitment (typically a local government resolution).

BMAPs are updated through annual meetings and may be officially revised every five years. Completed BMAPs in the state have improved communication and cooperation among local stakeholders and state agencies, improved internal communication within local governments, applied high-quality science and local information in managing water resources, clarified obligations of wastewater point source, MS4 and non-MS4 stakeholders in TMDL implementation, enhanced transparency in DEP decision-making, and built strong relationships between DEP and local stakeholders that have benefited other program areas.

However, in some basins, and for some parameters, particularly those with fecal coliform impairments, the development of a BMAP using the process described above will not be the most efficient way to restore a waterbody, such that it meets its' designated uses. Why? Because fecal coliform impairments result from the cumulative effects of a multitude of potential sources, both natural and anthropogenic. Addressing these problems requires good old fashioned detective work that is best done by those in the area. There are a multitude of assessment tools that are available to assist local governments and interested stakeholders in this detective work. The tools range from the simple – such as Walk the WBIDs and GIS mapping - to the complex such as Bacteria Source Tracking. Department staff will provide technical assistance, guidance, and oversight of local efforts to identify and minimize fecal coliform sources of pollution. Based on work in the Lower St Johns River tributaries and the Hillsborough River basin, the Department and local stakeholders have developed a logical process and tools to serve as a foundation for this detective work. In the near future, the Department will be releasing these tools to assist local stakeholders with the development of local implementation plans to address fecal coliform impairments. In such cases, the Department will rely on these local initiatives as a more cost-effective and simplified approach to identify the actions needed to put in place a roadmap for restoration activities, while still meeting the requirements of Chapter 403.067(7), F.S.

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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 Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40, F.A.C., also requires the state's 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. 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.

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 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 the 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 implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the FDOT throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES Stormwater Program in 2000.

An important difference between the federal NPDES and the state's stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focus 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 1,000 people. 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.

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