FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

SOUTHWEST DISTRICT • TAMPA BAY BASIN

Final TMDL Report

Fecal Coliform TMDL for Bishop Creek Marine (WBID 1569) and Bishop Creek Freshwater (WBID 1569A)

Rhonda Peets

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Acknowledgments

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TMDL Program

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http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf

Florida 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: Tampa Bay

http://tlhdwf2.dep.state.fl.us/basin411/tampa/status/TAMPA_BAY.pdf

Water Quality Assessment Report: Tampa Bay

http://tlhdwf2.dep.state.fl.us/basin411/tampa/assessment/Tampa-Bay-WEBX.pdf

U.S. Environmental Protection Agency

Region 4: TMDLs in Florida

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National STORET Program

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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 the marine and freshwater portions of Bishop Creek, within the Tampa Bay Basin. During the first five-year basin rotation cycle, the creek was assessed as one waterbody and was verified as impaired for fecal coliform. It was therefore included on the Cycle 1 Verified List of impaired waters for the Tampa Bay Basin that was adopted by Secretarial Order on August 22, 2002. However, a more recent assessment supported the listing of two separate subdivisions (marine and fresh water) for the creek. These TMDLs establish the allowable loadings to Bishop Creek that would restore both portions of the creek so that they meet their applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

Bishop Creek is an urban stream located in the northwestern part of the Tampa Bay Basin (**Figure 1.1**), in the city of Safety Harbor, with the City of Oldsmar to the north and the city of Clearwater to the south. The watershed comprises two polygons representing the marine and freshwater portions of the creek. The marine portion is a natural tributary to Tampa Bay. The stream forks as it enters the freshwater area of the watershed, creating north and south branches. The southern branch continues inland for approximately 2 miles, and the northern branch extends approximately 1.5 miles inland. The marine portion of the Bishop Creek watershed is approximately 60 acres in size, and the freshwater portion encompasses 866 acres. Additional information about the creek's hydrology and geology are available in the Basin Status Report for Tampa Bay (Florida Department of Environmental Protection [Department], 2001).

For assessment purposes, the Department has divided the Tampa Bay Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. Bishop Creek Marine is WBID 1569, and Bishop Creek Freshwater is WBID 1569A. **Figure 1.2** shows the location of both WBIDs in Pinellas 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.

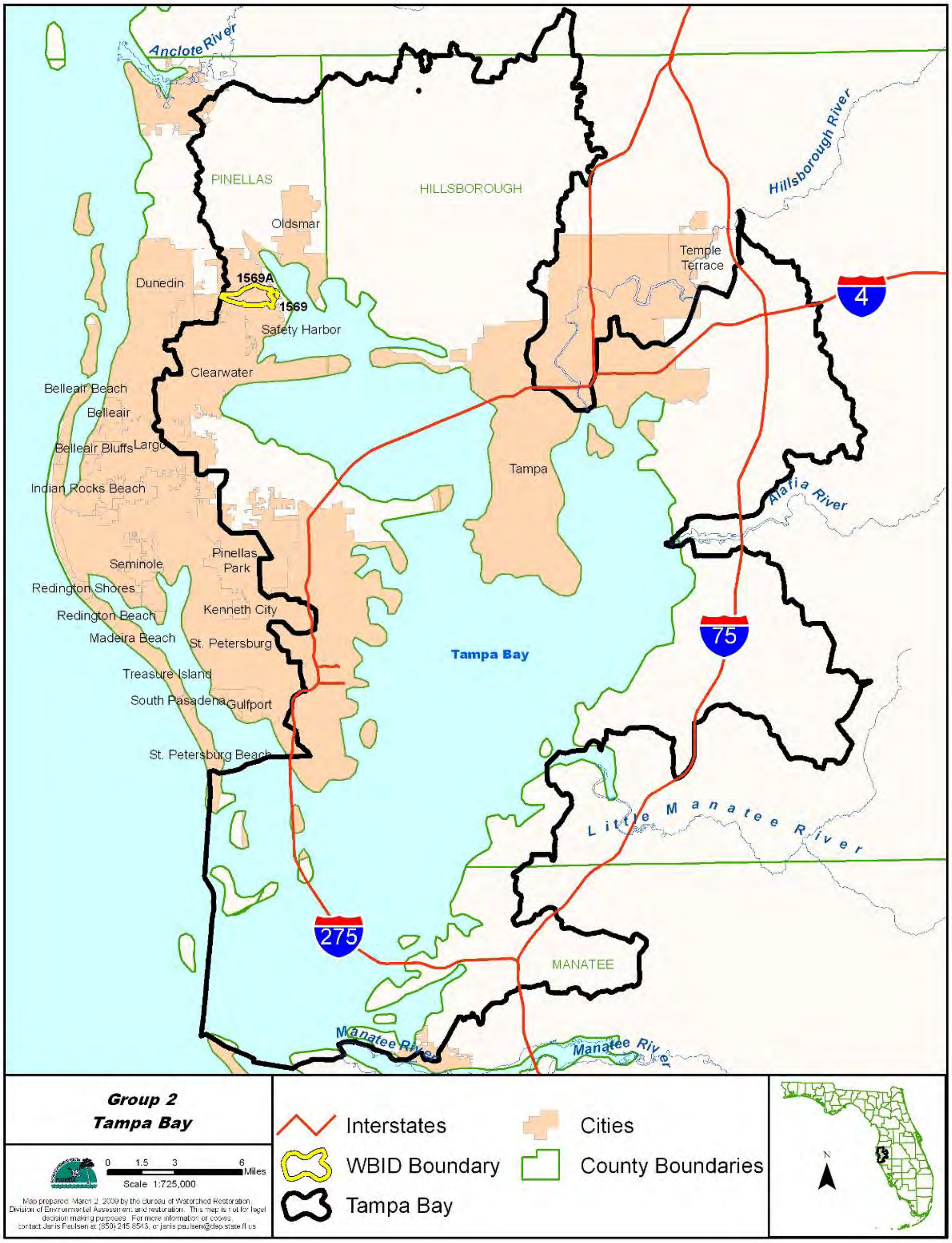

Figure 1.1. Location of the Bishop Creek Watershed (WBIDs 1569 and 1569A) in the Tampa Bay Basin and Major Hydrologic and Geopolitical Features in the Area

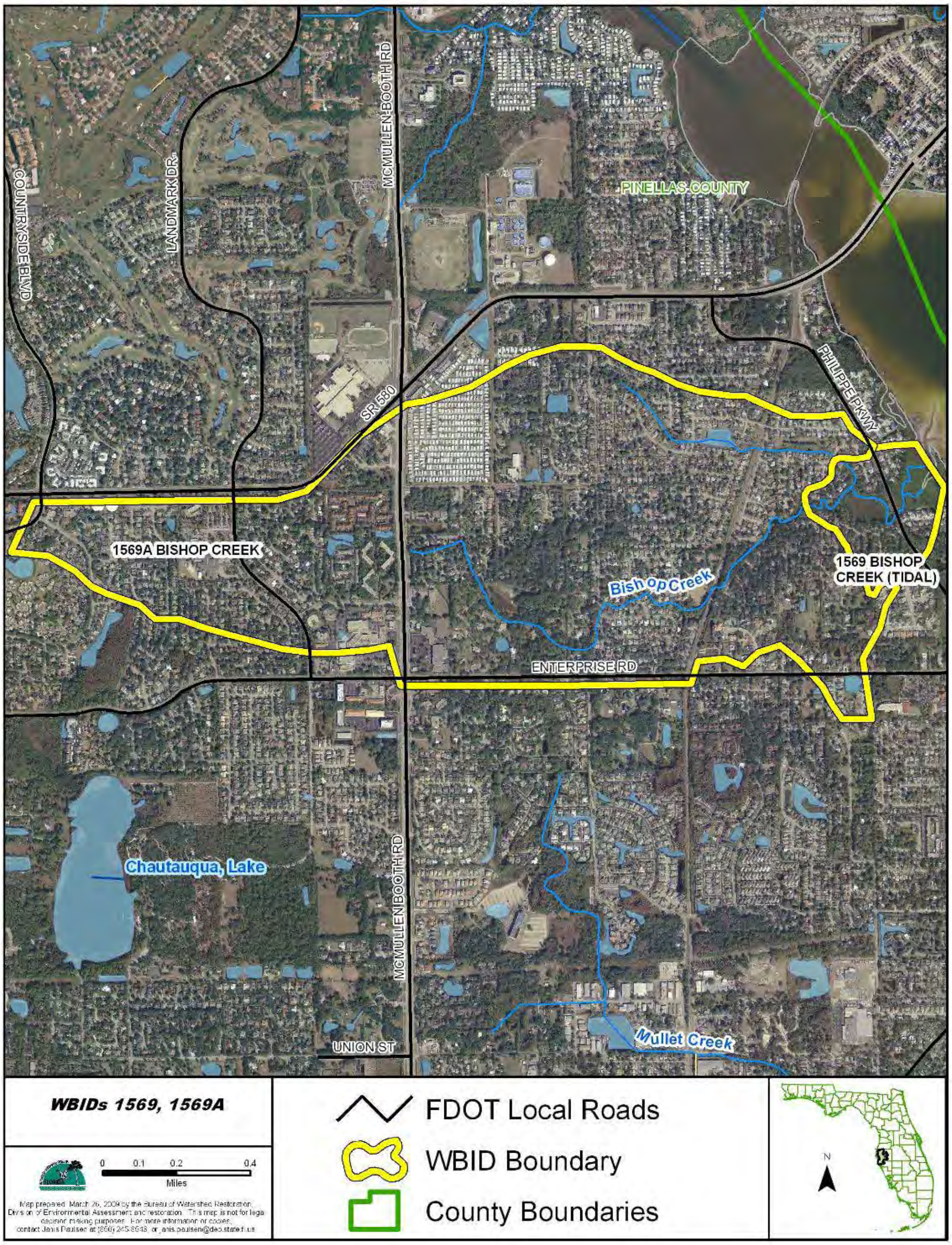

Figure 1.2. Location of the Bishop Creek Watershed (WBIDs 1569 and 1569A) in Pinellas County and Major Hydrologic and Geopolitical Features in the Area

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 Bishop Creek. These activities will depend heavily on the active participation of the Southwest Florida Water Management District (SWFWMD), Pinellas County's Department of Environmental Management (PDEM), 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 47 waterbodies in the Tampa Bay 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

In the Department's IWR database, Bishop Creek currently comprises two WBIDs: marine (WBID 1569) and freshwater (WBID 1569A). However, during the first basin rotation cycle assessment conducted by the Department from 2002 to 2003, both segments of the creek were treated as a single WBID (WBID 1569). The entire WBID was verified impaired for fecal coliform during the Cycle 1 assessment, based on the observation that 21 out of 25 samples exceeded the assessment threshold of 400 counts per 100 milliliters (counts/100mL). The waterbody was divided into two WBIDs during the Cycle 2 assessment conducted in 2008, and the 2008 data indicated that both the marine and freshwater WBIDs were still impaired for fecal coliform. Therefore, fecal coliform TMDLs are needed for both segments. **Table 2.1** lists the verified impairments for Bishop Creek.

Table 2.2 summarizes the fecal coliform data collected during the Cycle 1 and 2 assessments. The projected year for the fecal coliform bacteria TMDLs for Bishop Creek was 2008, but the Settlement Agreement between EPA and Earthjustice, which drives the TMDL development schedule for waters on the 1998 303(d) list, allows an additional nine months to complete the TMDLs. As such, these TMDLs must be adopted and submitted to the EPA by September 30, 2009.

The verified impairments for Bishop Creek were based on data collected by Pinellas County and the Department's Southwest District. **Figure 1.2** shows the location of the Bishop Creek watershed in Pinellas County. **Figures 2.1a** and **2.1b** display, respectively, the fecal coliform data collected from January 1, 2000, through June 30, 2008, by month for WBID 1569A; and from November to December 2008 for WBID 1569.

Table 2.1. Verified Impairments for Bishop Creek (WBIDs 1569 and 1569A)

This is a six-column table. Column 1 lists the WBID number, Column 2 lists the waterbody segment, Column 3 lists the waterbody type, Column 4 lists the waterbody class, Column 5 lists the 1998 303(d) parameters of concern, and Column 6 lists the parameter causing impairment

[1] M = Marine; F = Freshwater
[2] WBID 1569 (Bishop Creek) was included on the 1998 303(d) list for fecal coliform and dissolved oxygen, with a TMDL due date of 2008.
[3] N/A = Not applicable

WBID	Waterbody Segment	Waterbody Type	Waterbody Class[1]	1998 303(d) Parameters of Concern	Parameter Causing Impairment
1569	Bishop Creek	Estuary	IIIM	Coliform[2]	Fecal Coliform
1569A	Bishop Creek	Stream	IIIF	N/A[3]	Fecal Coliform

Table 2.2. Summary of Fecal Coliform Data for Bishop Creek (WBIDs 1569 and 1569A) During the Cycle 1 and 2 Assessments

This is a 10-column table. Column 1 lists the WBID number, Column 2 lists the total number of samples, Column 3 lists the IWR-required number of exceedances for the Verified List, Column 4 lists the number of observed exceedances, Column 5 lists the number of observed nonexceedances, Column 6 lists the number of seasons data were collected, Column 7 lists the mean value for fecal coliform (#/100mL), Column 8 lists the median value, Column 9 lists the minimum value, and Column 10 lists the maximum value.

*These data are for Cycle 1; WBID 1569 was split into WBIDs 1569 and 1569A in Cycle 2.

WBID	Total Number of Samples	IWR-required Number of Exceedances for the Verified List	Number of Observed Exceedances	Number of Observed Non-exceedances	Number of Seasons Data Were Collected	Mean (#/100mL)	Median (#/100mL)	Minimum (#/100mL)	Maximum (#/100mL)
1569*	25	5	21	4	4	1,718	1,100	75	8,600
1569	5	0	4	1	1	664	580	250	1,100
1569A	40	7	29	11	4	1,864	900	20	27,000

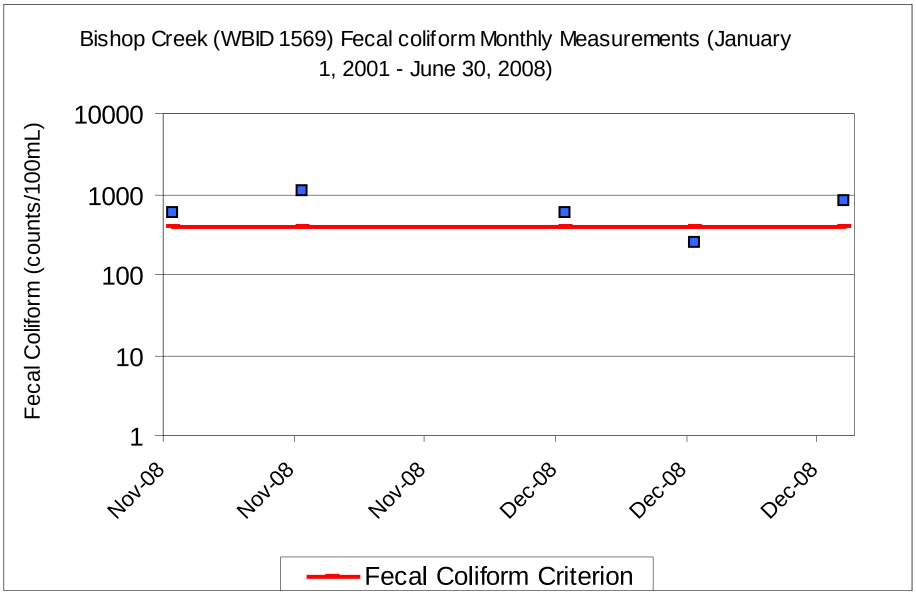

Figure 2.1a. Fecal Coliform Measurements for Bishop Creek Marine (WBID 1569), by Month (November–December 2008)

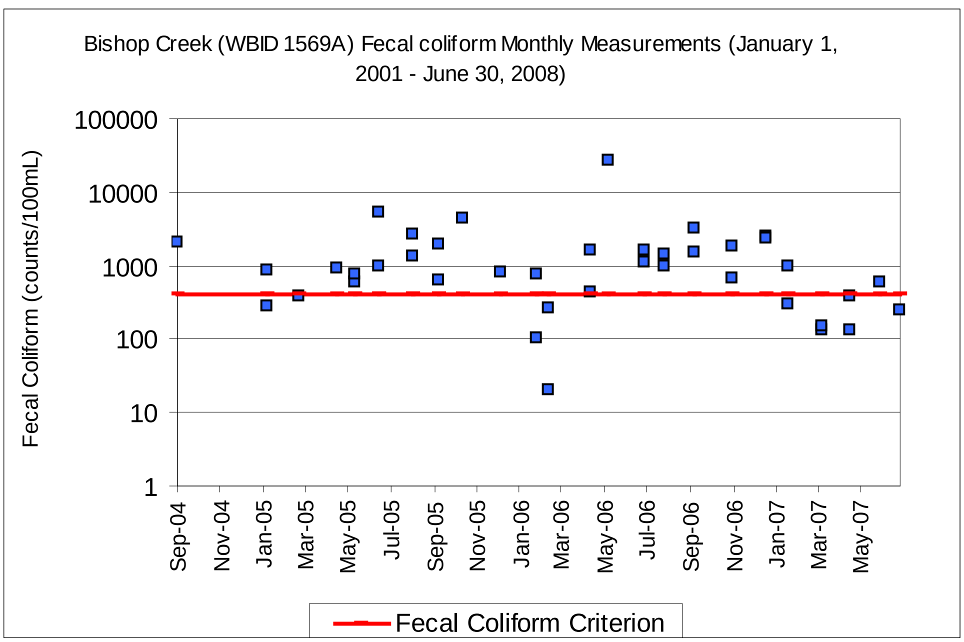

Figure 2.1b. Fecal Coliform Measurements for Bishop Creek Freshwater (WBID 1569A), by Month (January 1, 2001–June 30, 2008)

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)**

Bishop Creek is a Class III waterbody, 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. During the development of the TMDL (as described in subsequent chapters), 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.

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 Bishop Creek Watershed

4.2.1 Point Sources

There are no NPDES-permitted facilities discharging directly or indirectly into Bishop Creek.

Municipal Separate Storm Sewer System Permittees

The stormwater collection systems owned and operated by Pinellas County and co-permittees (Florida Department of Transportation [FDOT] District 7 and city of Clearwater) are covered by a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000005). There are no Phase II MS4 permits identified in the Bishop Creek watershed.

4.2.2 Land Uses and Nonpoint Sources

Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. Nonpoint pollution is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water (EPA, 1994). Potential nonpoint sources of coliform include loadings from surface runoff, wildlife, livestock, pets, leaking sewer lines, and leaking septic tanks.

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.

Agricultural Animals

Agricultural animals are the source of several types of coliform loading to streams. Agricultural activities, including runoff from pastureland and cattle in streams, can affect water quality. However, agriculture occupies less than 0.2 percent of the total land area of the Bishop Creek watershed.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SWFWMD's 2004 land use coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library. Land use categories in the 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 segment of the watershed.

As shown in **Tables 4.1a** and **4.1b,** the entire Bishop Creek watershed drains approximately 926 acres of land. The dominant land use category for the marine portion of the creek (WBID 1569) is medium-density residential (63 percent). However, a combination of low-, medium-, and high-density residential in the freshwater portion (WBID 1569A) accounts for 76.9 percent of the watershed, with the highest percentage being medium density, at 44.8 percent. The open-water, marine portion of the watershed, consisting of a curved channel opening to the bay, accounts for 35 percent of land use. The freshwater portion is only about 1 percent water; the urban and built-up category is approximately 12.2 percent; and transportation, communications, and utilities are a little less than 7 percent combined.

Table 4.1a. Classification of Land Use Categories for the Bishop Creek Watershed (WBID 1569)

This is a four-column table. Column 1 lists the Level 1 land use code, Column 2 lists the land use, Column 3 lists the acres, and Column 4 lists the percent acreage.

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Level 1 Code	Land Use	Acres	% Acreage
1000	Urban and Built-up	1	1.7%
1100	Low-Density Residential	0	0%
1200	Medium-Density Residential	38	63.3%
1300	High-Density Residential	0	0%
2000	Agriculture	0	0%
3000	Barren Land	0	0%
4000	Forest/Rural Open	0	0%
5000	Water	21	35%
6000	Wetlands	0	0%
8000	Transportation, Communication, and Utilities	0	0%
-	**Total:**	**60**	**100.00%**

Table 4.1b. Classification of Land Use Categories for the Bishop Creek Watershed (WBID 1569A)

This is a four-column table. Column 1 lists the Level 1 land use code, Column 2 lists the land use, Column 3 lists the acres, and Column 4 lists the percent acreage.

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Level 1 Code	Land Use	Acres	% Acreage
1000	Urban and Built-up	106	12.2%
1100	Low-Density Residential	102	11.9%
1200	Medium-Density Residential	388	44.8%
1300	High-Density Residential	175	20.2%
2000	Agriculture	2	0.2%
3000	Barren Land	0	0.0%
4000	Forest/Rural Open	18	2.1%
5000	Water	9	1.0%
6000	Wetlands	9	1.0%
8000	Transportation, Communication, and Utilities	57	6.6%
-	**Total:**	**866**	**100.00%**

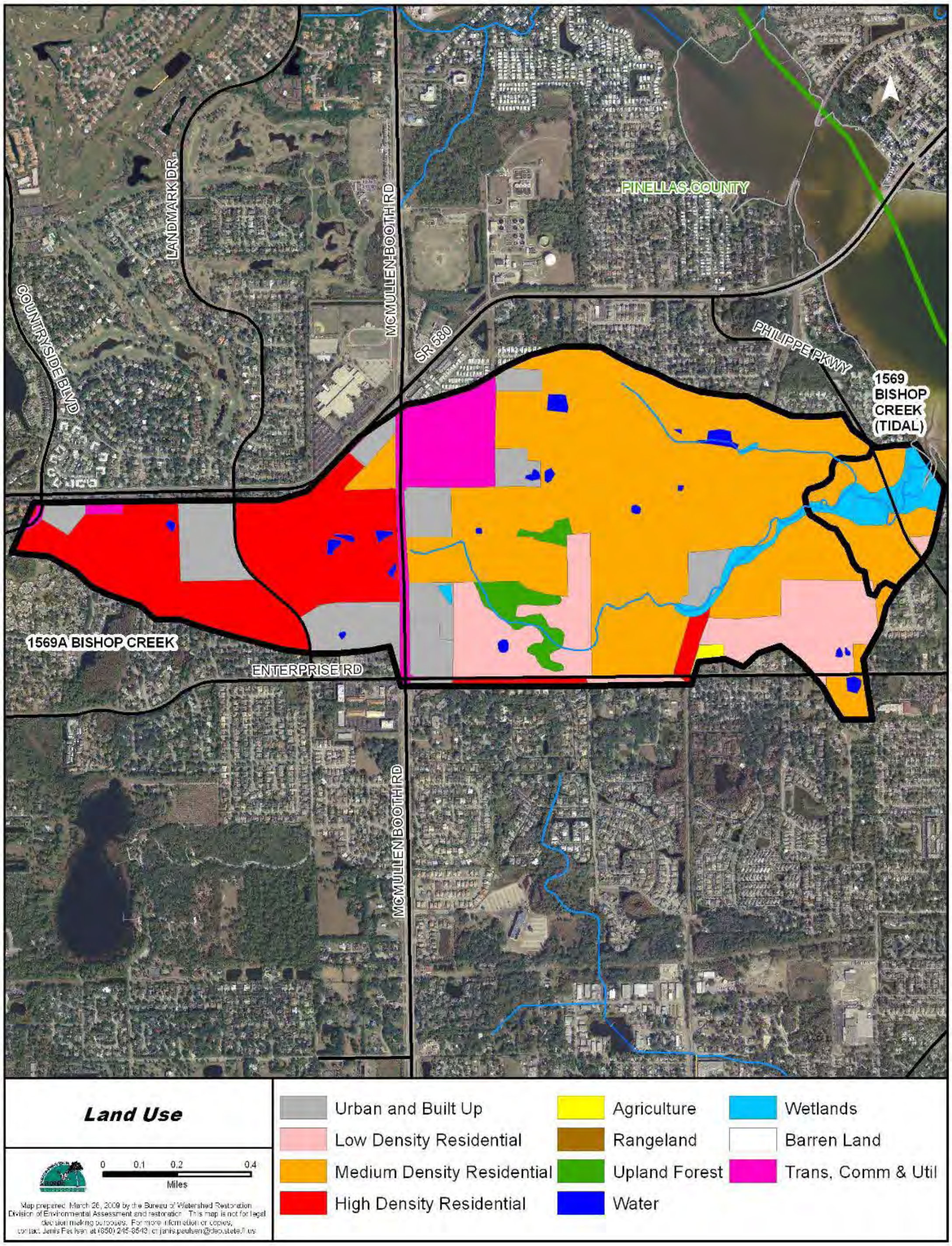

Figure 4.1. Principal Land Uses in the Bishop Creek Watershed (WBIDs 1569 and 1569A) in 2006

Urban Development

Pets (especially dogs) could be a significant source of coliform pollution through surface runoff in the Bishop Creek watershed. In addition to pets, other animal fecal coliform contributors commonly seen in urban areas include rats, pigeons, and sometimes raccoons.

Studies report that up to 95 percent of the fecal coliform found in urban stormwater can come from 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 streptococcus 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, Watson (2002) found that the amount of fecal coliform bacteria contributed by dogs in Stevenson Creek in Clearwater, Florida, was as important as that from septic tanks.

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 surface runoff measured in two urban areas (Bannerman et al., 1993; Steuer et al., 1997). While bacteria levels were widely different in the two studies, both indicated that residential lawns, driveways, and streets were the major source areas for bacteria.

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

This is a three-column table. Column 1 lists the geographic location, Column 2 lists the fecal coliform concentration in Marquette, Michigan, and Column 2 lists the fecal coliform concentration in Madison, Wisconsin.

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

The number of dogs in the Bishop Creek watershed is not known. Therefore, this analysis used the statistics produced by APPMA to estimate the possible fecal coliform loads contributed by dogs. The human population in WBIDs 1569 and 1569A calculated from the census track using Tiger Track 2000 data (the Department's GIS library) was approximately 231 and 3,878, respectively. According to the U.S. Census Bureau (2005–2007: 3-year estimates), there were 2.19 persons per household in Pinellas County. This adds up to about 105 and 1,753 households in WBIDs 1569 and 1569A, respectively. Assuming that 40 percent of the households in this area have 1 dog, the total number of dogs in WBIDs 1569 and 1569A is about 42 and 708, respectively.

According to the waste production rate for dogs and the fecal coliform counts per gram of dog wastes listed in **Table 4.3**, and 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 of residential areas is 577,080 grams/day. The total fecal coliform produced by dogs in WBIDs 1569 and 1569A is 1.66×10^{10} and 2.80×10^{11} counts/day, respectively.

It should be noted that this load only represents the fecal coliform load created in the 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

* Number from APPMA
Source: Weiskel et al., 1996

Type	Population Density (animal/household)	Wasteload (g/animal-day)	Fecal Coliform Density (fecal coliform/g)
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 drainage field can be flooded during the rainy season, and coliform bacteria can pollute the surface water through storm 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 go into 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 segment of the Bishop Creek 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 watershed (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 2007 Florida Department of Health (FDOH) onsite sewage GIS coverage (http://www.doh.state.fl.us/environment/programs/EhGis/EhGisDownload.htm), there are no houses on septic in the marine portion of the Bishop Creek watershed, and 17 housing units (*N*) are identified as being on septic tank in the freshwater portion of the watershed (**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 U.S. Census Bureau, the average household size for Pinellas County is about 2.19 people/household. The same population density was assumed for the Bishop Creek watershed. 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 $1x10^6$ counts/100mL for fecal coliform (EPA, 2001).

No measured septic tank failure rate data were available for the watershed when this TMDL analysis was conducted. Therefore the failure rate was derived from the number of septic tank and septic tank repair permits for the county published by FDOH (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 (**Table 4.4**).

Based on this information, a discovery rate of failed septic tanks for each year between 2002 and 2007 was calculated and listed in **Table 4.4**. Using the table, the average annual septic tank failure discovery rate for Pinellas County is about 0.69 percent. 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, or 3.5 percent. Based on **Equation 4.1**, the estimated fecal coliform loading from failed septic tanks in the freshwater portion of the Bishop Creek watershed (WBID 1569A) is approximately 3.45×10^{09} counts/day; there are no houses on septic in the marine portion (WBID 1569).

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

This is an eight-column table. Column 1 lists the type of septic tank data, Columns 2 through 7 list the numbers for 2002 through 2007, respectively, and Column 8 lists the average.

[1] The failure rate is 5 times the failure discovery rate.

Septic Tank Data	2002	2003	2004	2005	2006	2007	Average
New installations (septic tanks)	54	47	43	43	36	34	43
Accumulated installations (septic tanks)	23,578	23,632	23,679	23,722	23,765	23,801	23,696
Repair permits (septic tanks)	141	193	168	180	149	150	164
Failure discovery rate (%)	0.60%	0.82%	0.71%	0.76%	0.63%	0.63%	0.69%
Failure rate (%)[1]	3.0%	4.1%	3.5%	3.8%	3.1%	3.2%	3.5%

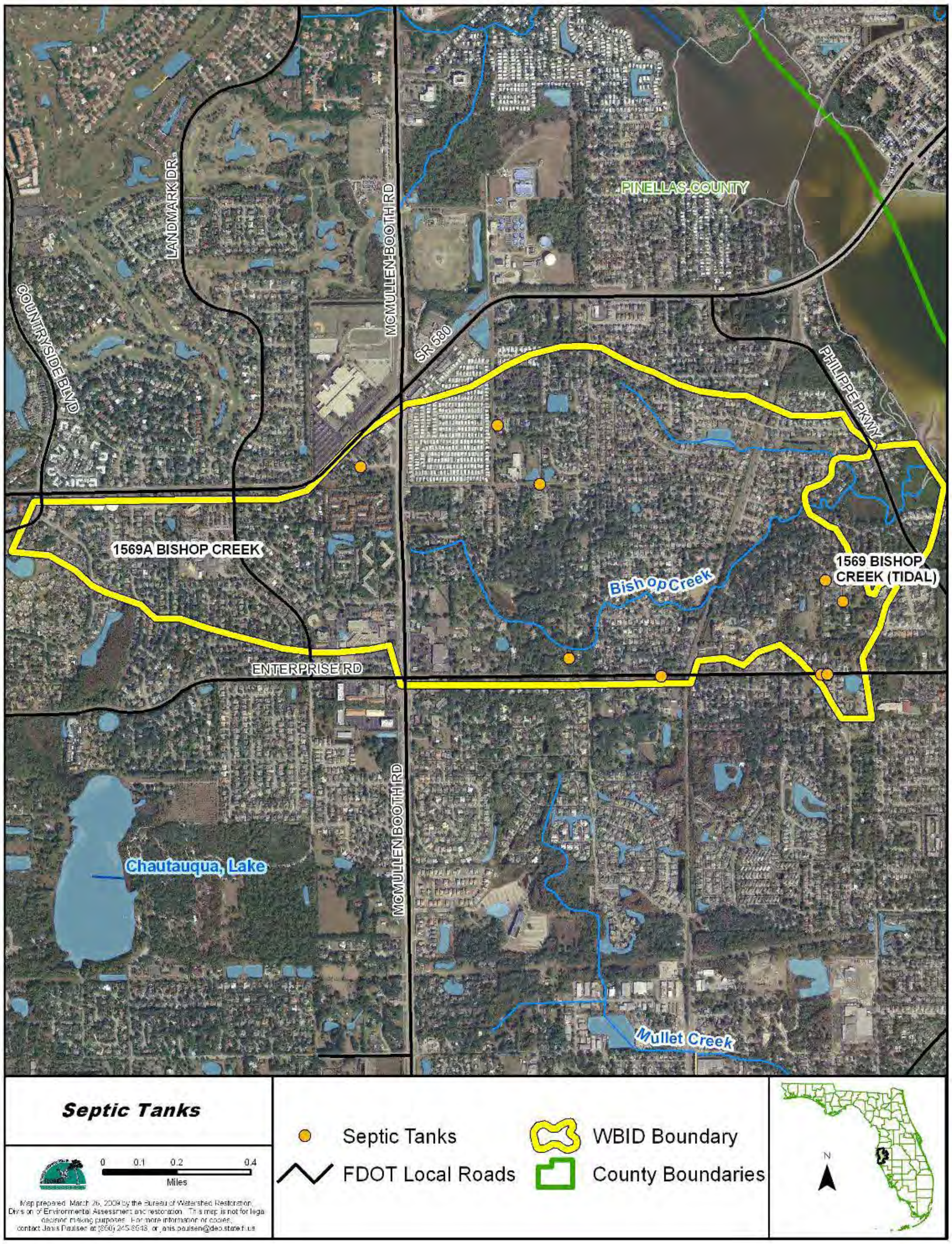

Figure 4.2. Distribution of Onsite Sewage Systems (Septic Tanks) in the Bishop Creek Watershed (WBIDs 1569 and 1569A)

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.

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 the typical fecal coliform concentration 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 overflows of sanitary sewer in the Bishop Creek watershed can be made using **Equation 4.2**:

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

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 the domestic wastewater discharge; and
- *F* is the sewer line leakage rate.

The number of households (*N*) in WBIDs 1569 and 1569A that use the sewer line is 105 and 1,753, respectively (total households minus septic tank households). The discharge rate through the sewer line from each household (*Q*) was calculated by multiplying the average household size (2.19 people) 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). Of the total number of households using the sewer line, 0.5 percent (*F*) was assumed as the sewer line leakage rate (Culver et al., 2002). Based on **Equation 4.2**, the estimated fecal coliform loading from sewer line leakage in WBIDs 1569 and WBID 1569A is about 3.1×10^{09} and 5.1×10^{10} counts/day, respectively.

Summary of Estimated Loadings from Dogs, Septic Tanks, and Sanitary Sewer Overflows

Table 4.5 summarizes the fecal coliform loadings from dogs, septic tanks, and SSOs for the marine and freshwater segments of the Bishop Creek watershed. These are for informational purposes only and are designed to give a rough estimate of the fecal coliform counts/day from each source.

Table 4.5. Estimated Fecal Coliform Loadings from Dogs, Septic Tanks, and SSOs in the Bishop Creek Watershed (WBIDs 1569 and 1569A)

This is a four-column table. Column 1 lists the waterbody (WBID number), Column 2 lists the fecal coliform loading from dogs (counts/day), Column 3 lists the loading from septic tanks (counts/day), and Column 4 lists the loading from SSOs (counts/day).

Waterbody (WBID)	Dogs (counts/day)	Septic Tanks (counts/day)	SSOs (counts/day)
Bishop Creek (WBID 1569)	1.66 x 1010	0	3.1 x 1009
Bishop Creek (WBID 1569A)	2.80 x 1011	3.45 x 1009	5.1 x 1010

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The fecal coliform TMDL calculation was developed using the "percent reduction" approach. For this method, the percent reduction needed to meet the applicable criterion is calculated for each value above the criterion, and then a median percent reduction is calculated.

5.1.1 Data Used in the Determination of the TMDL

The data used for this TMDL report were provided by the following:

- *Department's Southwest District—Station: 21FLTPA 2801568241139;*
- *Pinellas County—Stations: 21FLPDEM12-02; 21FLPDEM12-03, and 21FLPDEM12-04; and*
- *Department—Station: 21FLGW 22066.*

Figure 5.1 shows the locations of the sampling sites where fecal coliform data were collected. **Figures 2.1a** and **2.1b** display the fecal coliform data used in this analysis.

Previously collected data samples for the marine portion of Bishop Creek (WBID 1569) were audited and determined to be unusable, and thus were not available for the verified period assessment. The new data samples collected outside the verified period were collected in November and December 2008. Though the samples were below the required number, the IWR specifies that based on overwhelming evidence (4 out of 5 samples exceeded the fecal coliform criterion of 400 counts/100mL), this segment of the creek is currently impaired.

Also, since the freshwater portion of Bishop Creek (WBID 1569A) is hydrologically linked to the marine portion (WBID 1569), and the freshwater portion is currently impaired, this TMDL analysis includes both portions of the watershed.

5.1.2 TMDL Development Process for the Bishop Creek Watershed

As described in **Section 5.1**, the percent reduction needed to meet the fecal coliform criterion was determined for each individual exceedance using **Equation 5.1**:

$$\frac{[\text{measured exceedance} - \text{criterion}]*100}{\text{measured exceedance}} \qquad \textbf{(Equation 5.1)}$$

The fecal coliform TMDLs for Bishop Creek (WBIDs 1569 and 1569A) were calculated as the median of the percent reductions needed over the data range where exceedances occurred (see **Tables 5.1a** and **5.1b**). As noted in the next section, exceedances occurred throughout the data period for WBIDs 1569 and 1569A, and the median percent reduction for this period is 64 percent.

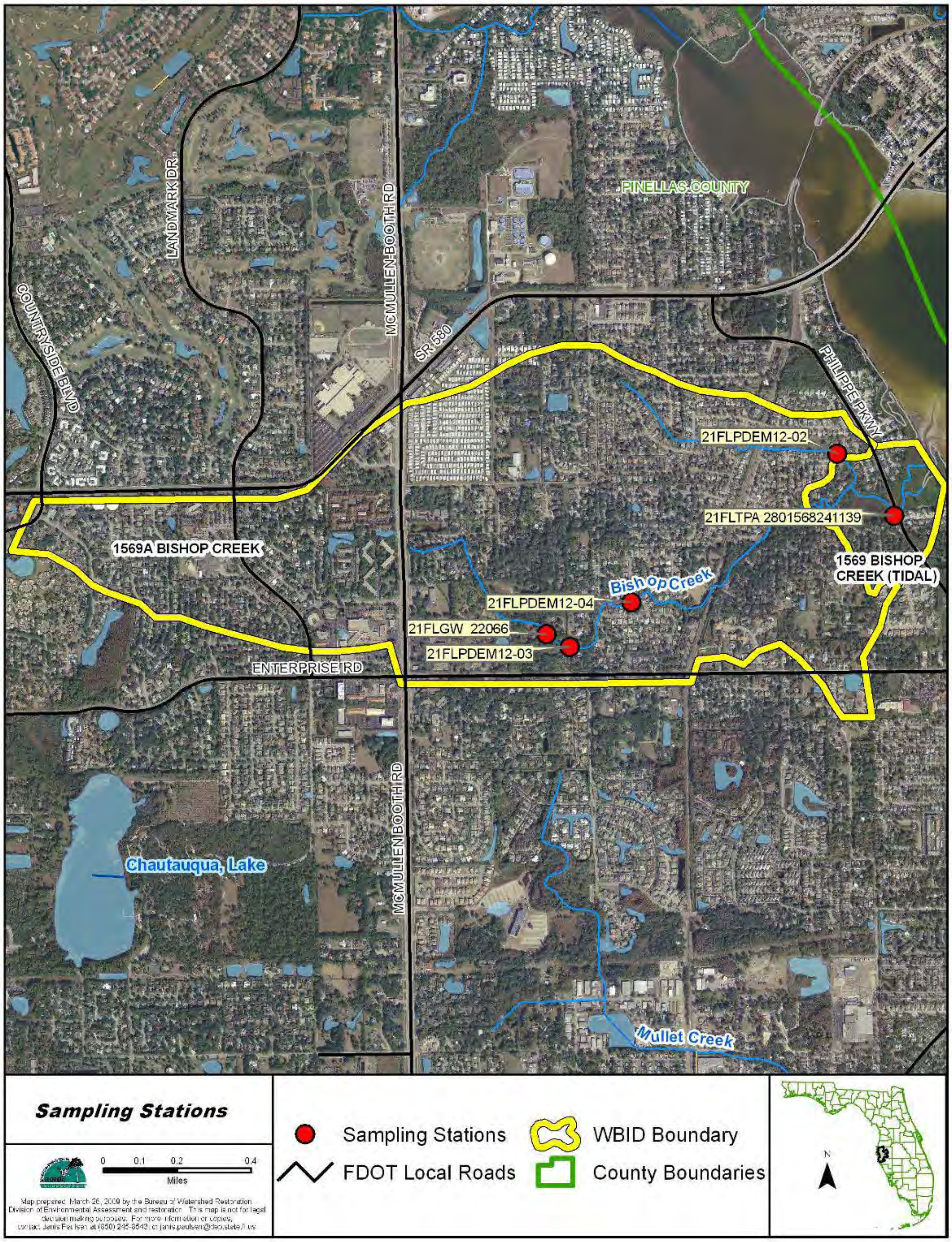

Figure 5.1. Locations of Water Quality Stations in the Bishop Creek Watershed (WBIDs 1569 and 1569A)

Table 5.1a. Calculation of Percent Reduction in Fecal Coliform Necessary To Meet the Water Quality Standard of 400 Colonies/100mL in Bishop Creek (WBID 1569)

This is a six-column table. Column 1 lists the WBID number, Column 2 lists the station number, Column 3 lists the date, Column 4 lists the fecal coliform exceedances (#/100mL), Column 5 lists the fecal coliform target (#/100mL), and Column 6 lists the percent reduction needed to meet the target.

- = Empty cell/no data

WBID	Station	Sampling Date	Fecal Coliform Exceedances (#/100mL)	Fecal Coliform Target (#/100mL)	% Reduction
1569	21FLTPA 2801568241139	11/12/2008	570	400	30%
1569	21FLTPA 2801568241139	11/19/2008	1,100	400	64%
1569	21FLTPA 2801568241139	12/3/2008	580	400	31%
1569	21FLTPA 2801568241139	12/18/2008	820	400	51%
-	-	-	-	**MEDIAN:**	**41%**

Table 5.1b. Calculation of Percent Reduction in Fecal Coliform Necessary To Meet the Water Quality Standard of 400 Colonies/100mL in Bishop Creek (WBID 1569A)

This is a six-column table. Column 1 lists the WBID number, Column 2 lists the station number, Column 3 lists the date, Column 4 lists the fecal coliform exceedances (#/100mL), Column 5 lists the fecal coliform target (#/100mL), and Column 6 lists the percent reduction needed to meet the target.

- = Empty cell/no data

WBID	Station	Sampling Date	Fecal Coliform Exceedances (#/100mL)	Fecal Coliform Target (#/100mL)	% Reduction
1569A	21FLGW 22066	9/2/2004	2,100	400	81%
1569A	21FLPDEM12-02	5/12/2005	600	400	33%
1569A	21FLPDEM12-02	6/16/2005	5,400	400	93%
1569A	21FLPDEM12-02	8/4/2005	2,700	400	85%
1569A	21FLPDEM12-02	9/8/2005	640	400	38%
1569A	21FLPDEM12-02	4/13/2006	430	400	7%
1569A	21FLPDEM12-02	6/28/2006	1,100	400	64%
1569A	21FLPDEM12-02	7/27/2006	1,400	400	71%
1569A	21FLPDEM12-02	9/6/2006	3,200	400	88%
1569A	21FLPDEM12-02	11/1/2006	1,800	400	78%
1569A	21FLPDEM12-02	12/18/2006	2,500	400	84%
1569A	21FLPDEM12-02	1/18/2007	1,000	400	60%
1569A	21FLPDEM12-03	1/6/2005	880	400	55%
1569A	21FLPDEM12-03	4/18/2005	920	400	57%
1569A	21FLPDEM12-03	5/12/2005	740	400	46%
1569A	21FLPDEM12-03	6/16/2005	1,000	400	60%

WBID	Station	Sampling Date	Fecal Coliform Exceedances (#/100mL)	Fecal Coliform Target (#/100mL)	% Reduction
1569A	21FLPDEM12-03	8/4/2005	1,300	400	69%
1569A	21FLPDEM12-03	9/8/2005	2,000	400	80%
1569A	21FLPDEM12-03	10/13/2005	4,500	400	91%
1569A	21FLPDEM12-03	12/5/2005	830	400	52%
1569A	21FLPDEM12-03	1/25/2006	770	400	48%
1569A	21FLPDEM12-03	4/13/2006	1,600	400	75%
1569A	21FLPDEM12-03	5/8/2006	27,000	400	99%
1569A	21FLPDEM12-03	6/28/2006	1,600	400	75%
1569A	21FLPDEM12-03	7/27/2006	1,000	400	60%
1569A	21FLPDEM12-03	9/6/2006	1,500	400	73%
1569A	21FLPDEM12-03	11/1/2006	670	400	40%
1569A	21FLPDEM12-03	12/18/2006	2,400	400	83%
1569A	21FLPDEM12-04	5/29/2007	580	400	31%
-	**-**	**-**	**-**	**MEDIAN:**	**64%**

5.1.3 Critical Conditions/Seasonality

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

Data collected for Cycle 1 were analyzed for critical seasonal condition (**Table 5.2a** and **Figure 5.2a**); no seasonal pattern was observed. There were exceedances throughout the data period (1995–96). The data collected for the marine portion of Bishop Creek (WBID 1569) were audited and failed, and thus were not used in the TMDL analysis. For Cycle 2, seasonal conditions in the marine portion of the creek could not be determined due to limited data. The data were collected over a period of two months (**Table 5.2b** and **Figure 5.2b**).

There was no comparison of rainfall data. However, in the freshwater portion of the Bishop Creek watershed (WBID 1569A), rainfall data were compared with the measured fecal coliform data. Measurements were sorted by month and season (the calendar year was divided into quarters) to determine whether there was a temporal pattern of exceedances. Monthly rainfall data from St. Petersburg International Airport (KPIE) were also obtained and included in the analysis.

Table 5.2c and **Figure 5.2c**, and **Table 5.2d** and **Figure 6.2d**, summarize fecal coliform statistics for WBID 1569A by month and season (quarter), respectively (Winter: January–March; Spring: April–June; Summer: July–September; Fall: November–December). There were no data for October. The data for WBID 1569A reflected a temporal pattern of seasonal increase. During the summer months (or the third quarter), June to September, exceedances were observed with increasing mean rainfall. Also, using a seasonal approach, there was a direct correlation with rainfall and the percent exceedances, indicating that surface runoff or increased fecal coliform levels in the freshwater portion of Bishop Creek (WBID 1569A) may be having significant effects. The Bishop Creek watershed is a highly urbanized area, with a septic tank failure rate for Pinellas County averaging 3.5 percent.

Table 5.2a. Cycle 1 Summary Statistics of Fecal Coliform Data for Bishop Creek (WBID 1569), by Season (1995–96)

This is a nine-column table. Column 1 lists the season (quarter), Column 2 lists the number of cases, Column 3 lists the minimum fecal coliform concentration (#/100mL), Column 4 lists the maximum concentration, Column 5 lists the median concentration, Column 6 lists the mean concentration, Column 7 lists the number of exceedances, Column 8 lists the percent exceedances of cases, and Column 9 lists the rainfall mean (inches).

Season (quarter)	Number of Cases	Minimum (#/100mL)	Maximum (#/100mL)	Median (#/100mL)	Mean (#/100mL)	Number of Exceedances	% Exceedances of Cases	Rainfall Mean (inches)
1	6	640	8,600	820	1,207	6	100%	7.9
2	6	75	3,900	695	1,231	5	83%	13.91
3	7	200	2,100	1,000	974	7	100%	25.82
4	6	160	5,600	1,600	1,985	5	83%	6.67

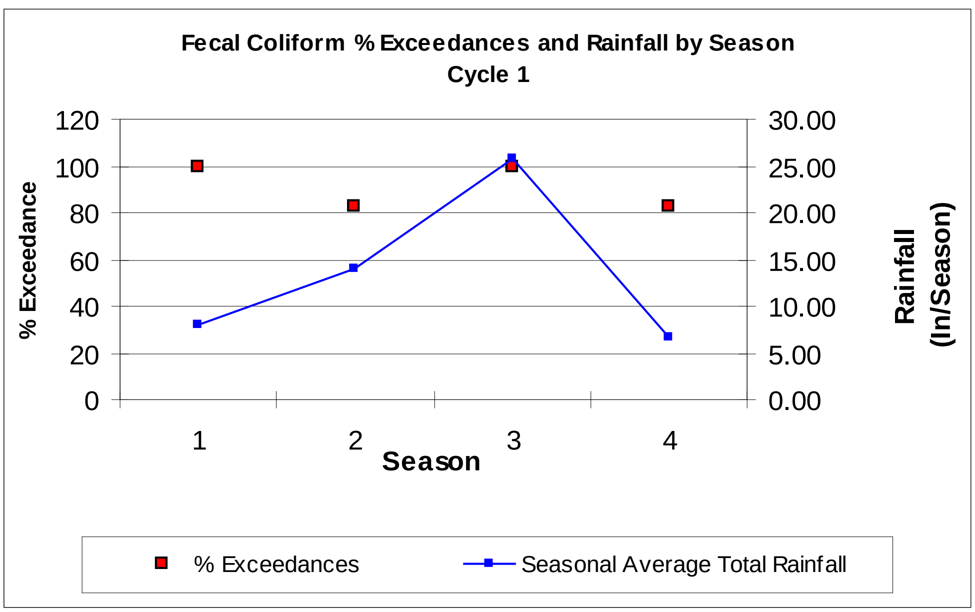

Figure 5.2a. Cycle 1 Fecal Coliform Exceedances and Rainfall for Bishop Creek (WBID 1569), by Season (1995–96)

Table 5.2b. Cycle 2 Summary Statistics of Fecal Coliform Data for Bishop Creek (WBID 1569), by Month (November–December 2008)

This is an eight-column table. Column 1 lists the month (year), Column 2 lists the number of cases, Column 3 lists the minimum fecal coliform concentration (#/100mL), Column 4 lists the maximum concentration, Column 5 lists the median concentration, Column 6 lists the mean concentration, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances of cases.

Month (year)	Number of Cases	Minimum (#/100mL)	Maximum (#/100mL)	Median (#/100mL)	Mean (#/100mL)	Number of Exceedances	% Exceedances of Cases
November (2008)	2	570	1,100	835	835	2	100%
December (2008)	3	250	820	250	825	2	67%

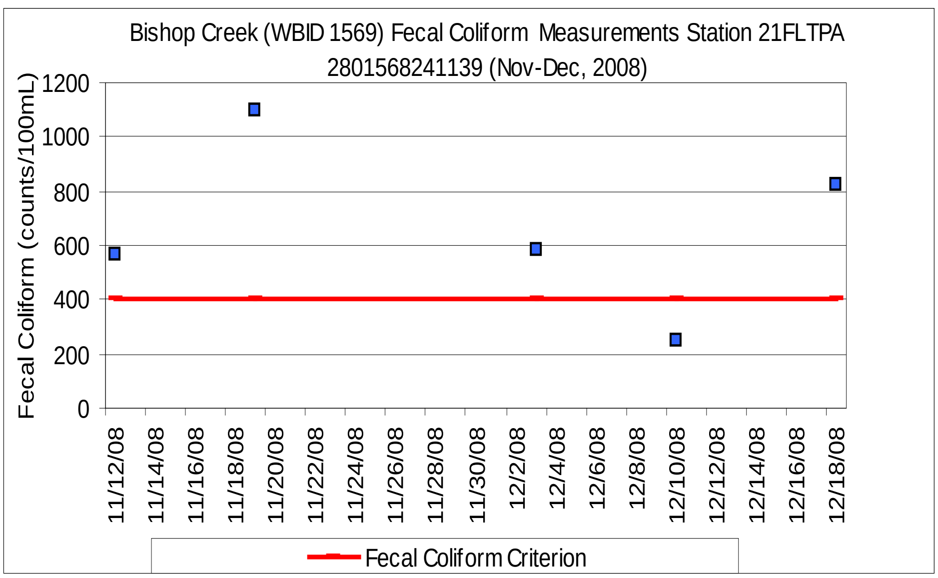

Figure 5.2b. Cycle 2 Fecal Coliform Exceedances for Bishop Creek (WBID 1569) (November–December 2008)

Table 5.2c. Summary Statistics of Fecal Coliform Data for Bishop Creek (WBID 1569A), by Month (2000–07)

This is a nine-column table. Column 1 lists the month, Column 2 lists the number of cases, Column 3 lists the minimum fecal coliform concentration (#/100mL), Column 4 lists the maximum concentration, Column 5 lists the median concentration, Column 6 lists the mean concentration, Column 7 lists the number of exceedances, Column 8 lists the percent exceedances of cases, and Column 9 lists the rainfall mean (inches).

* ND = No data

Month	Number of Cases	Minimum (#/100mL)	Maximum (#/100mL)	Median (#/100mL)	Mean (#/100mL)	Number of Exceedances	% Exceedances of Cases	Rainfall Mean (inches)
1	6	100	1,000	535	555	3	50%	1.83
2	3	20	380	270	223	0	0%	3.68
3	2	130	150	140	140	0	0%	2.39
4	5	130	1,600	430	694	3	60%	2.25
5	4	580	27,000	670	7,230	4	100%	1.89
6	5	240	5,400	1,100	1,868	4	80%	9.77
7	2	1,000	1,400	1,200	1,200	2	100%	9.73
8	2	1,300	2,700	2,000	2,000	2	100%	8.87
9	5	640	3,200	2,000	1,888	5	100%	7.22
10	ND	ND	ND	ND	ND	ND	ND	2.01
11	2	670	1,800	1,235	1,235	2	100%	1.22
12	3	830	2,500	1,665	1,665	2	100%	3.44

Table 5.2d. Summary Statistics of Fecal Coliform Data for Bishop Creek (WBID 1569A), by Season (2000–07)

This is a nine-column table. Column 1 lists the season (quarter), Column 2 lists the number of cases, Column 3 lists the minimum fecal coliform concentration (#/100mL), Column 4 lists the maximum concentration, Column 5 lists the median concentration, Column 6 lists the mean concentration, Column 7 lists the number of exceedances, Column 8 lists the percent exceedances of cases, and Column 9 lists the rainfall mean (inches).

Season (quarter)	Number of Cases	Minimum (#/100mL)	Maximum (#/100mL)	Median (#/100mL)	Mean (#/100mL)	Number of Exceedances	% Exceedances of Cases	Rainfall Mean (inches)
1	11	20	1,000	270	306	3	27%	7.9
2	14	130	27,000	670	3,264	11	79%	13.91
3	9	640	3,200	2,000	1,696	9	100%	25.82
4	5	670	2,500	1,450	1,450	4	80%	6.67

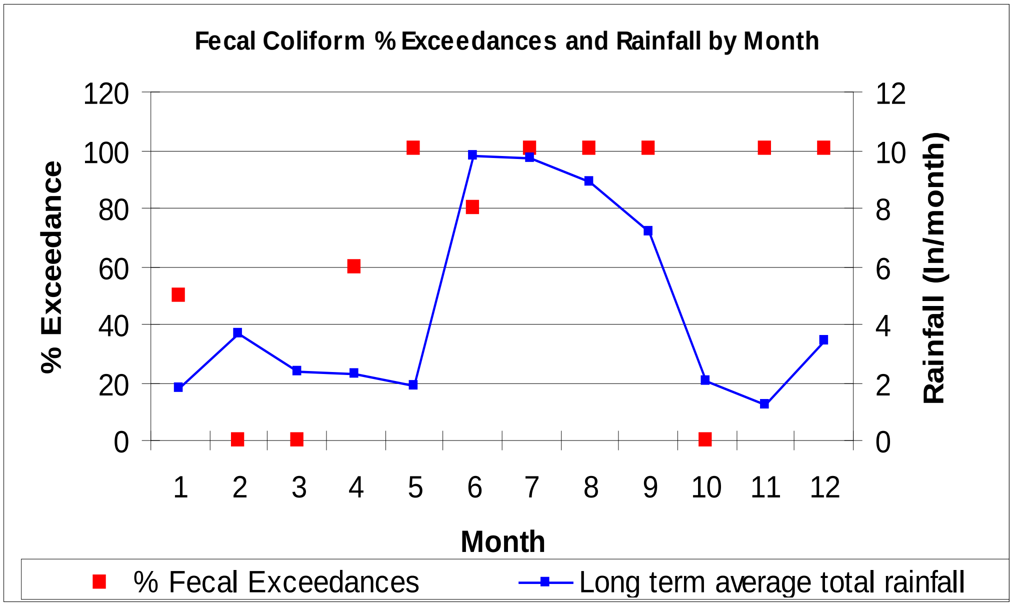

Figure 5.2c. Fecal Coliform Exceedances and Rainfall for Bishop Creek (WBID 1569A), by Month (2000–07)

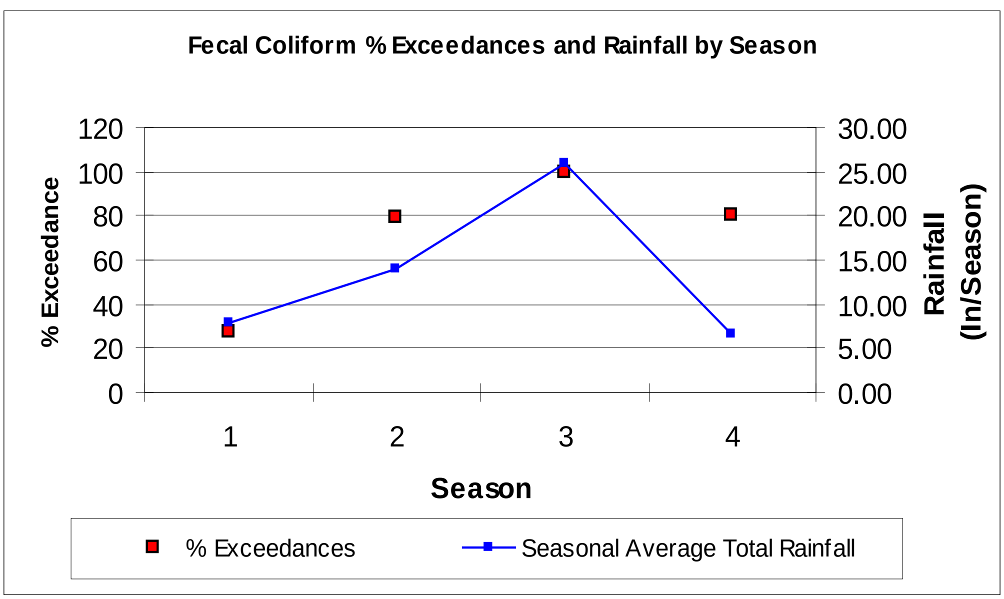

Figure 5.2d. Fecal Coliform Exceedances and Rainfall for Bishop Creek (WBID 1569A), by Season (2000–07)

5.1.4 Spatial Patterns

There was one water quality station with fecal coliform data for the marine portion of Bishop Creek (WBID 1569) (**Table 5.3a**) (Station: 21 FLTPA 2801568241139) and four water quality stations for the freshwater portion (Stations: 21FLPDEM12-02, 21FLPDEM12-03, 21FLPDEM12-04, and 21FLGW 220666). As mentioned earlier, the data for the marine portion of the creek are limited, and therefore no spatial pattern could be determined or compared.

In contrast, the freshwater portion of Bishop Creek (WBID 1569A) shows a pattern. Station 21FLPDEM12-02, which is upstream on the north fork of the stream, has 17 samples, of which 11 are impaired. By comparison, Station 21FLPDEM12-03, located upstream on the south fork, also has 17 samples, of which 16 were impaired. These 2 stations are located in medium-density residential communities. The data from Station 21FLPDEM12-03 were limited, as there were only 5 samples, and Station 21FLGW 220666 had only 1 sample (**Table 5.3b**).

Table 5.3a. Summary Statistics of Fecal Coliform Data for Bishop Creek (WBID 1569), by Station

This is a six-column table. Column 1 lists the station number, Column 2 lists the average fecal coliform concentration (#/100mL), Column 3 lists the number of samples, Column 4 lists the number of exceedances, Column 5 lists the minimum concentration (#/100mL), and Column 6 lists the maximum concentration (#/100mL).

Station	Average (#/100mL)	Number of Samples	Exceedances	Minimum (#/100mL)	Maximum (#/100mL)
21 FLTPA 2801568241139	664	5	4	250	1,100

Table 5.3b. Summary Statistics of Fecal Coliform Data for Bishop Creek (WBID 1569A), by Station

This is a six-column table. Column 1 lists the station number, Column 2 lists the average fecal coliform concentration (#/100mL), Column 3 lists the number of samples, Column 4 lists the number of exceedances, Column 5 lists the minimum concentration (#/100mL), and Column 6 lists the maximum concentration (#/100mL).

Station	Average (#/100mL)	Number of Samples	Exceedances	Minimum (#/100mL)	Maximum (#/100mL)
21FLPDEM12-02	1,399	17	11	20	5,400
21FLPDEM12-03	2,742	17	16	270	27,000
21FLPDEM12-04	280	5	1	130	2,400
21FLGW 7713	1	1	1	1	1

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 marine portion of the Bishop Creek watershed is hydrologically linked to the upstream fresh watershed; therefore, an across-the-board percent reduction of 64 for both watersheds appears reasonable, especially for the implementation of BMPs. The TMDLs for Bishop Creek (marine and freshwater) are expressed in terms of a percent reduction; these TMDLs also represent the maximum daily fecal coliform loads the creek can assimilate and meet the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for Fecal Coliform in Bishop Creek (WBIDs 1569 and 1569A)

This is a seven-column table. Column 1 lists the WBID number, Column 2 lists the parameter, Column 3 lists the TMDL target concentration (counts/day), Column 4 lists the WLA for wastewater (counts/day), Column 5 lists the WLA for NPDES stormwater (percent reduction), Column 6 lists the LA (percent reduction), and Column 7 lists the MOS.

N/A – Not applicable

WBID	Parameter	TMDL (counts/day)	WLA for Wastewater (counts/day)	WLA for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
1569	Fecal Coliform	400 #/100mL	N/A	64%	64%	Implicit
1569A	Fecal Coliform	400 #/100mL	N/A	64%	64%	Implicit

6.2 Load Allocation

Fecal coliform reductions of 64 percent are needed from nonpoint sources for Bishop Creek (WBIDs 1569 and 1569A). 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 Bishop Creek watershed. The state already requires all NPDES point source dischargers to meet bacteria criteria at the end of the pipe. It is the Department's current practice not to allow mixing zones for bacteria. Any point sources that may discharge in the watershed in the future will also be required to meet end-of-pipe standards for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 64 percent reduction in current fecal coliform levels for WBIDs 1569 and 1569A. 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 this TMDL by meeting the fecal coliform water quality criterion of 400 colonies/100mL, while the actual criterion allows for a 10 percent exceedance over that level.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of these TMDLs by rule, the Department will determine the best course of action regarding their implementation. Depending on 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. BMAPs 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 that a BMAP is needed to support the implementation of the TMDLs, 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 the following:

- *Water quality goals (based directly on the TMDLs);*
- *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 TMDLs;*
- *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 the obligations of wastewater point source, MS4, and non-MS4 stakeholders in TMDL implementation; enhanced transparency in the Department's decision making; and built strong relationships between the Department and local stakeholders that have benefited other program areas.

7.2 Other TMDL Implementation Tools

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. This is 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.

A multitude of assessment tools is 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 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 road map for restoration activities, while still meeting the requirements of Subsection 403.067(7), F.S.

References

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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 (ERP) regulations.

Rule 62-40 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, they 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 Permit Programs is that the NPDES Program covers both new and existing discharges, while the ERP 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 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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