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 Cross Canal–North (WBID 1625)

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February 2010

Acknowledgments

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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

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U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida

http://www.epa.gov/region4/water/tmdl/florida/

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform for Cross Canal–North, located in the Coastal Old Tampa Bay Planning Unit within the Tampa Bay Basin (**Figure 1.1**). This estuarine stream (canal) was verified impaired for fecal coliform, and was included on the Verified List of impaired waters for the Tampa Bay Basin that was adopted by Secretarial Order on June 3, 2008. The TMDL establishes the allowable loadings to Cross Canal–North that would restore the waterbody so that it meets its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

To provide a more detailed geographic basis for assessing, reporting, and documenting water quality improvement projects, the Florida Department of Environmental Protection (Department) divides basin groups into smaller areas called planning units. Planning units help organize information and management strategies around prominent sub-basin characteristics and drainage features. To the extent possible, planning units were chosen to reflect sub-basins that had previously been defined by the Southwest Florida Water Management District (SWFWMD). Cross Canal–North is located in the Coastal Old Tampa Bay Tributary Planning Unit (**Figure 1.1**). For assessment purposes, the Department has divided the planning unit into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed. Cross Canal–North is WBID 1625 (**Figure 1.2**).

1.2.1 Cross Canal–North

The Cross Canal–North watershed encompasses 4,197 acres in Pinellas County (**Figure 1.2**). The predominant land use is approximately 3,203 acres of urban and built-up. Major population centers in the watershed include the cities of Pinellas Park and Highpoint.

The climate in Pinellas County, specifically areas surrounding the Cross Canal–North watershed, is subtropical, with annual rainfall averaging approximately 51.75 inches, although rainfall amounts can vary greatly from year to year (Climate Information for Management and Operational Decisions [CLIMOD], 2008). Based on data from a 30-year period (1971–2000), the average summer temperature is 89.2^{o}F, and the average winter temperature is 71.9^{o}F (CLIMOD, 2008).

The topography of the Cross Canal–North watershed reflects its location in the Southwestern Florida Flatwoods or Southwestern Coastal Plains ecoregion. Elevations range in the watershed from around 0 to 20 feet above sea level (Department, 2008). The predominant soil type is shelly sand and clay (Department, 2008).

Figure 1.1. Location of the Cross Canal–North Watershed (WBID 1625) in the Tampa Bay Basin with Major Hydrologic and Geopolitical Features in the Area

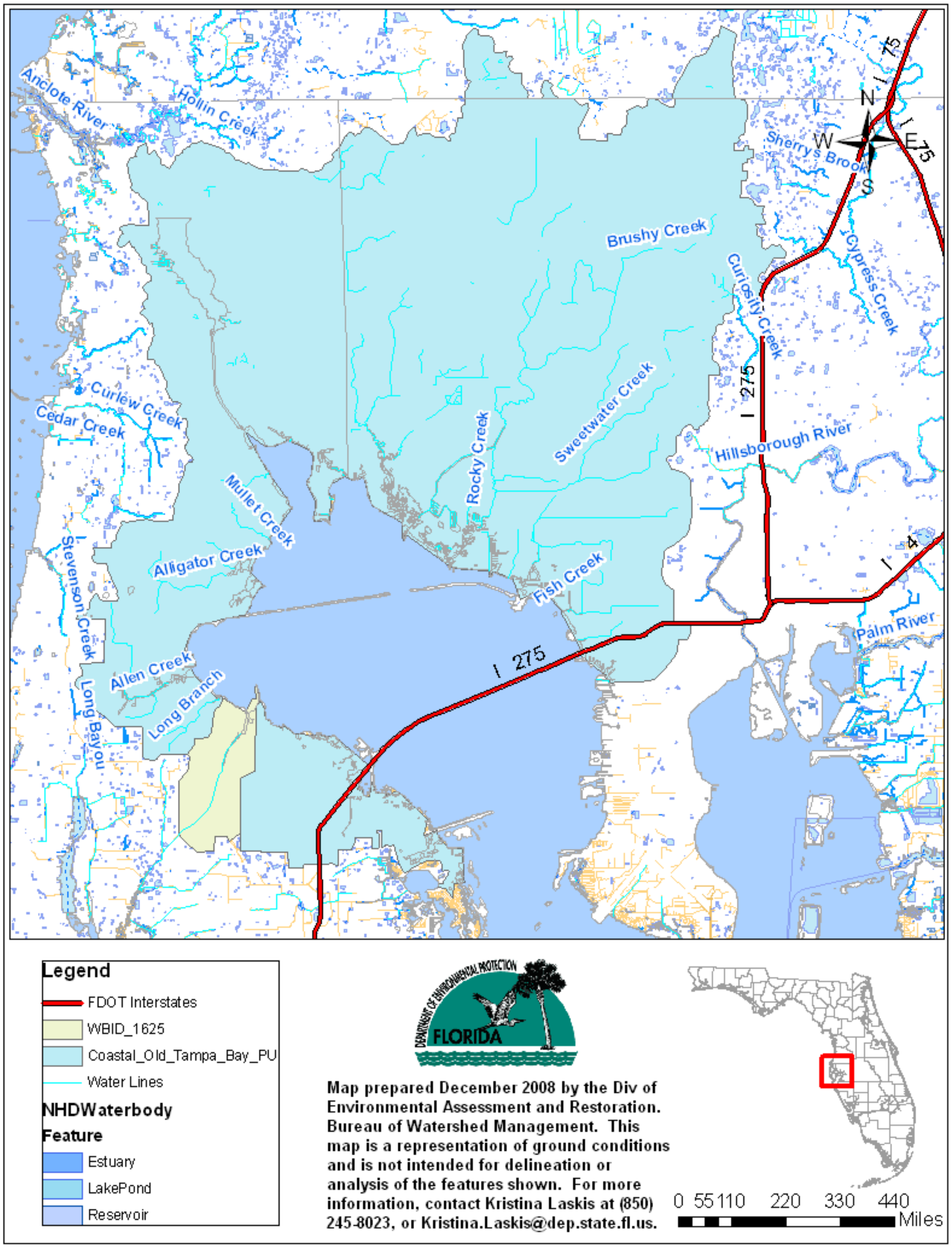
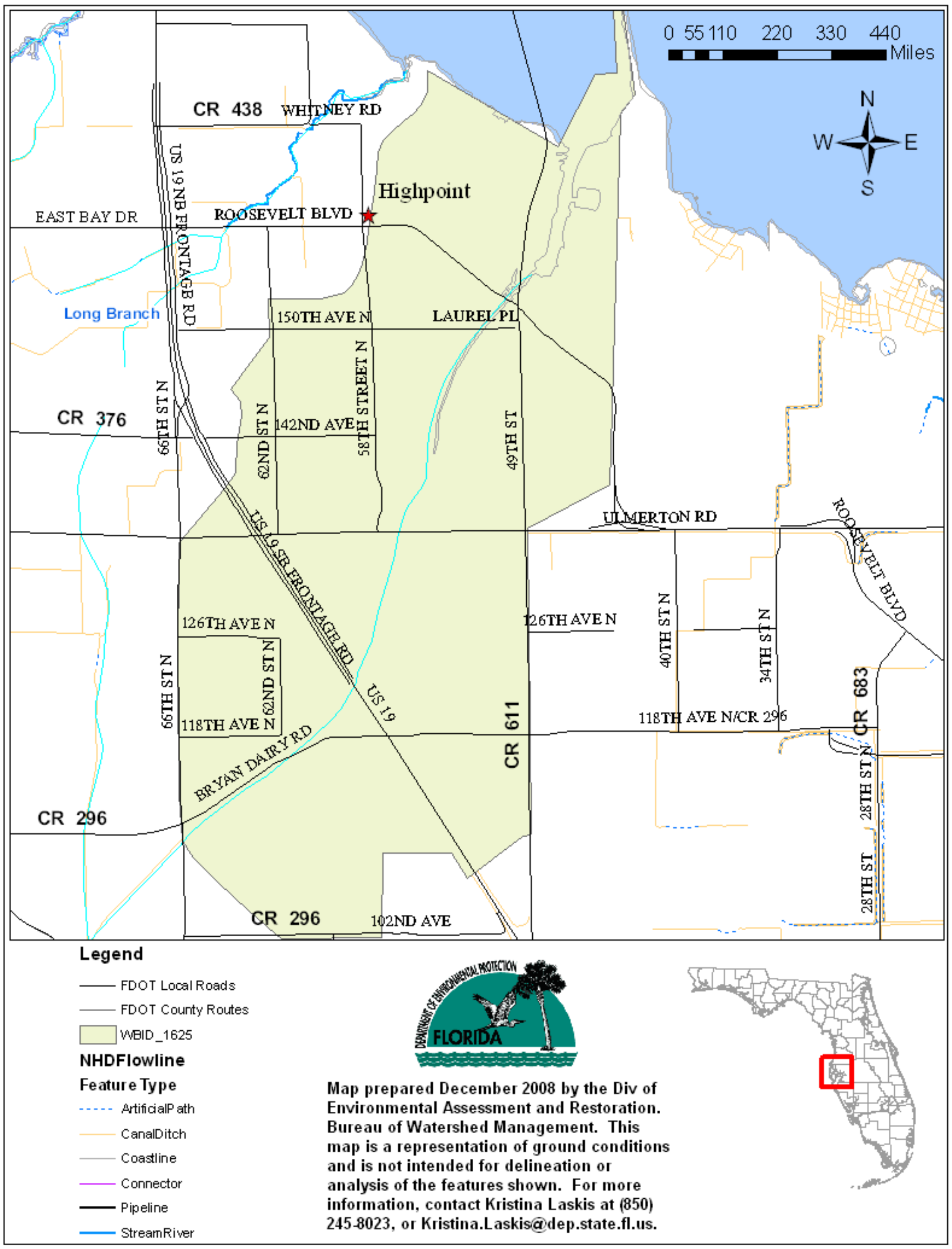


Figure 1.2. Location of the Cross Canal–North Watershed (WBID 1625) in Pinellas County with Major Hydrologic and Geopolitical Features in the Area



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 may be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of fecal coliform that caused the verified impairment of Cross Canal–North. These activities will depend heavily on the active participation of the SWFWMD, 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 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 contained several waterbodies in the Tampa Bay Basin, including Cross Canal–North. 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 the Cross Canal–North watershed and verified the impairments for fecal coliform (**Table 2.1**). **Table 2.2** summarizes the data collected during the verified period (January 1, 2000–June 30, 2007). As shown in **Table 2.1**, the projected year for the fecal coliform bacteria TMDLs 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.

This waterbody was verified as impaired based on fecal coliform because, using the IWR methodology, more than 10 percent of the values exceeded the Class III waterbody criterion of 400 counts per 100 milliliters (counts/100mL) for fecal coliform. Cross Canal–North had 22 exceedances out of 84 samples in the verified period.

The verified impairments were based on data collected by the Department's Southwest District Office and Pinellas County DEM. **Figure 5.1** shows the WBID location and STORET stations. **Figure 2.1** displays the fecal coliform data collected during the verified period (January 1, 2000–June 30, 2007) for Cross Canal–North. The actual data collection period of record is January 2005 to June 2007.

Table 2.1. Verified Impairments for Cross Canal–North (WBID 1625)

[1] The projected year for the fecal coliform bacteria TMDLs 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.

WBID	Waterbody Segment	Parameters Included on the 1998 303(d) List	Parameter Causing Impairment	Projected Year for TMDL Development1
1625	Cross Canal–North	Fecal Coliform	Fecal Coliform	2008

Table 2.2. Summary of Fecal Coliform Data Collected During the Verified Period (January 1, 2000–June 30, 2007) for Cross Canal–North (WBID 1625)

Waterbody Segment	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 (counts/ 100mL)	Median (counts/ 100mL)	Minimum (counts/ 100mL)	Maximum (counts/ 100mL)
Cross Canal–North	84	13	22	62	4	435	220	5	3,300

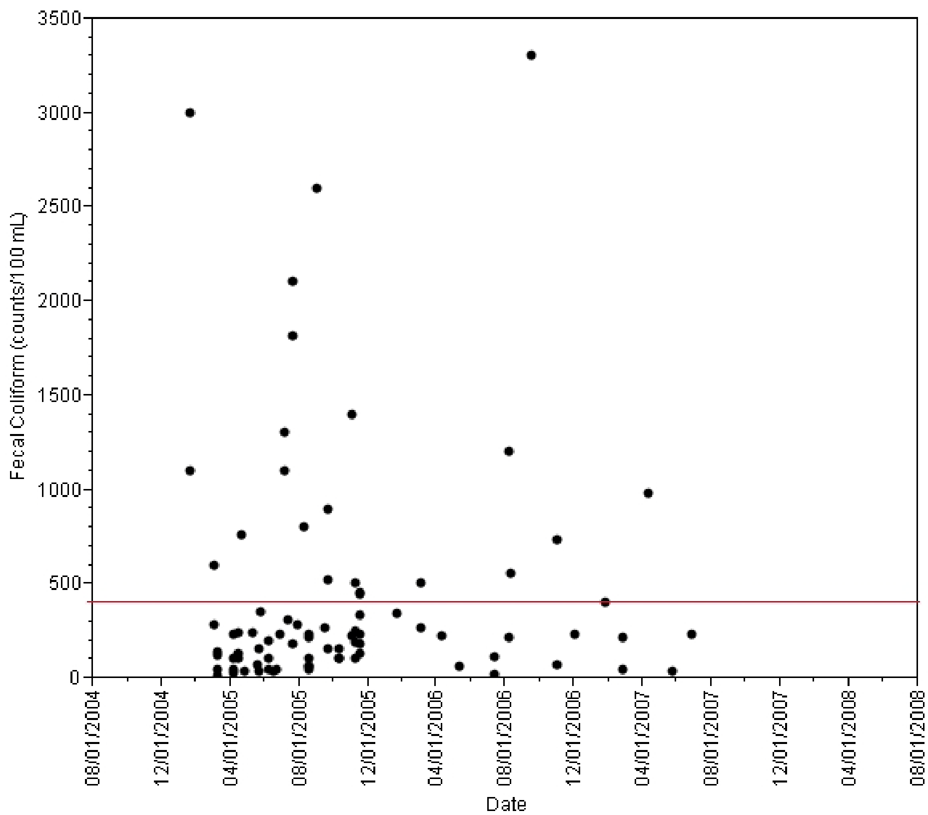


Figure 2.1. Fecal Coliform Measurements for Cross Canal–North (Verified Period: January 1, 2000–June 30, 2007)

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)**

Cross Canal–North 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 Class III water quality criterion applicable to the impairment addressed by this TMDL is for fecal coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentrations. The water quality criteria 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 this TMDL, there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDL was not to exceed 400 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 TMDL's 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 fecal coliform in the Cross Canal–North watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term “point sources” has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

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

To be consistent with Clean Water Act definitions, the term “point source” will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **and** stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of Fecal Coliform in the Cross Canal–North Watershed

4.2.1 Point Sources

NPDES Wastewater Facilities

There is one NPDES-permitted wastewater facility discharging to surface waters in the Cross Canal–North watershed: the City of Largo–Advanced Wastewater Treatment Facility (AWWTF) (FL0026603). However, the facility does not directly or indirectly discharge to the canal.

Municipal Separate Storm Sewer System Permittees

Municipal separate storm sewer systems (MS4s) may discharge nutrients to waterbodies in response to storm events. To address stormwater discharges, the EPA developed the NPDES stormwater permitting program. The stormwater collection systems in the Cross Canal–North watershed are maintained by Pinellas County (#FLS 000005) and the city of Pinellas Park

(Pinellas County co-permittee: #FLS 000005), city of Largo, (Pinellas County co-permittee: #FLS 000005), and Florida Department of Transportation (FDOT).

4.2.2 Land Uses and Nonpoint Sources

Additional fecal coliform loadings to Cross Canal–North are generated from nonpoint sources in the watershed. Potential nonpoint sources of coliform include loadings from surface runoff, wildlife, livestock, pets, leaking sewer lines, and leaking septic tanks.

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).

An exceedance under dry weather conditions could be considered as stemming primarily from baseflow, which carries the pollutant from the surficial aquifer. Baseflow pollution could result from many different sources, including failed septic tanks and sewer lines, which are covered in more detail later in this chapter. Livestock, pets, and wildlife (birds, alligators, raccoons, and etc.) could also contribute to the fecal coliform exceedances in the watershed because these animals have direct access to the stream, especially under low-flow conditions.

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) deposits 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.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the Florida Land Use, Cover, and Forms Classification System (FLUCCS) and the SWFWMD 2006 land use coverage contained in the Department's geographic information system (GIS) library. Land use categories in the Cross Canal–North watershed were aggregated using the simplified Level 1 codes tabulated in **Table 4.1**. The watershed encompasses 4,197 acres, and the predominant land use is approximately 3,203 acres of urban and built-up.

Table 4.1. Classification of Land Use Categories in the Cross Canal–North Watershed (WBID 1625)

- = Empty cell/no data

Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and Built-Up	2,173	51.78%
1100	Residential Low Density	65	1.55%
1200	Residential Medium Density	182	4.33%
1300	Residential High Density	783	18.65%
2000	Agriculture	11	0.26%
3000	Rangeland	4	0.09%
4000	Upland Forest/Rural Open	118	2.81%
5000	Water	247	5.89%
6000	Wetlands	195	4.66%
7000	Barren Land	13	0.31%
8000	Transportation, Communication, and Utilities	406	9.68%
-	**TOTAL:**	**4,197**	**100.00%**

Urban Development

Pets (especially dogs) could be a significant source of coliform pollution through surface runoff in the Cross Canal–North 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 1 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)

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 Cross Canal–North watershed is not known. Therefore, this analysis used the statistics produced by APPMA to estimate the possible fecal coliform loads contributed by dogs. Using county census (population density, housing units, etc.) and area (square miles) information, the census information was extrapolated for the Cross Canal–North watershed, which is located in Pinellas County. The estimated human population in Pinellas County (calculated from the U.S. Census Bureau in 2007) was approximately 917,437. The extrapolated human population in the Cross Canal–North watershed was approximately 23,354 (Pinellas County: 7,057 people, or 3,593 people per square mile).

According to the U.S. Census Bureau in 2007, there were 2.19 people per household in Pinellas County. The total number of households in the Cross Canal–North watershed is 10,762. Assuming that 40 percent of the households in this area have 1 dog, the total number of dogs in the Cross Canal–North watershed is approximately 4,304. According to Pinellas County Animal Services, 382 dogs are registered in the Cross Canal–North watershed. The Department is aware that there are nonregistered dogs in the watershed.

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 load produced by dogs for Cross Canal–North is 1.7×10^{12} counts/day of fecal coliform.

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 (grams/an-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 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 watershed can be made using **Equation 4.1**:

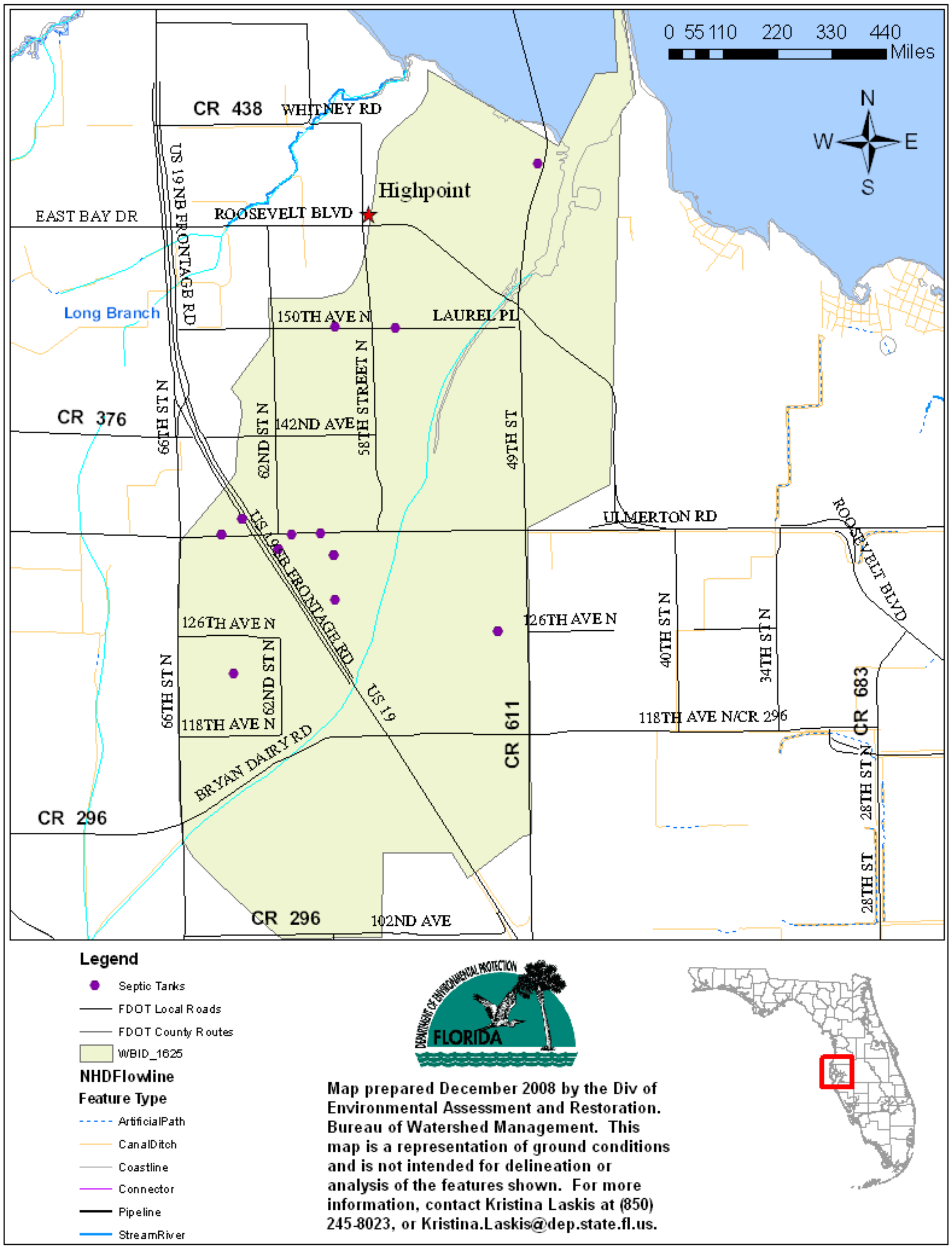
$$L = 37.85 * N * Q * C * F \qquad \text{(Equation 4.1)}$$

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 (available: http://www.doh.state.fl.us/environment/programs/EhGis/EhGisDownload.htm), about 17 housing units (*N*) were identified as being on septic tanks in the Cross Canal–North watershed (**Figure 4.1**). The Department is aware that the FDOH onsite sewage GIS coverage does not include all septic tanks and when an area converts to sewer line the septic tank information is not removed. 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 in 2007, the average household size for Pinellas County is 2.19 people/household. The same population density was assumed for the Cross Canal–North 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 1×10^6 counts/100mL for fecal coliform (EPA, 2001).

Figure 4.1. Distribution of Onsite Sewage Systems (Septic Tanks) in the Cross Canal–North Watershed (WBID 1625)



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 (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 (**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 6 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 3.45 percent, for Pinellas County. Based on **Equation 4.1**, the estimated fecal coliform loading from failed septic tanks in the Cross Canal–North watershed located in Pinellas County is approximately 7.81 x 10^9 counts/day.

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

\- = Empty cell/no data
[1] The failure rate is 5 times the failure discovery rate.

-	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]	2.99%	4.08%	3.55%	3.79%	3.13%	3.15%	3.45%

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 or malfunctioning 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 SSOs in the Cross Canal–North watershed can be made using **Equation 4.2**:

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

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.

There are 10,745 households (*N*) in the Cross Canal–North watershed that use sewer lines (total households minus septic tank households obtained from 2007 FDOH onsite sewage GIS coverage). The Department is aware that the FDOH onsite sewage GIS coverage does not include all septic tanks and when an area converts to sewer line the septic tank information is not removed. The discharge rate through the sewer line from each household (*Q*) was calculated by multiplying the average household size 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 the Cross Canal–North watershed is about 3.12×10^{11} counts/day.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

Typically, there are continuous flow measurements in a watershed that can be used to develop a fecal coliform TMDL. However, since Cross Canal–North is tidally influenced, this fecal coliform TMDL 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. Then a median percent reduction is calculated.

5.1.1 Data Used in the Determination of the TMDL

The data used to develop this TMDL were mainly provided by Department's Southwest District Office (21FLTPA) and Pinellas County DEM (21FLPDEM). **Figure 5.1** displays the locations of the water quality stations where fecal coliform data were collected for Cross Canal–North. **Appendix B** contains the fecal coliform data used in this analysis. **Figure 2.1** provides a graphical representation of the data.

5.1.2 TMDL Development Process

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

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

The fecal coliform TMDL was calculated as the median of the percent reductions needed over the data range where exceedances occurred (see **Appendix C** for the calculations). The median percent reduction for this data period (January 2000–June 2007) was 59 percent for Cross Canal–North.

Define the Critical Condition

The critical condition for coliform loadings in a given watershed depends 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, livestock and 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.

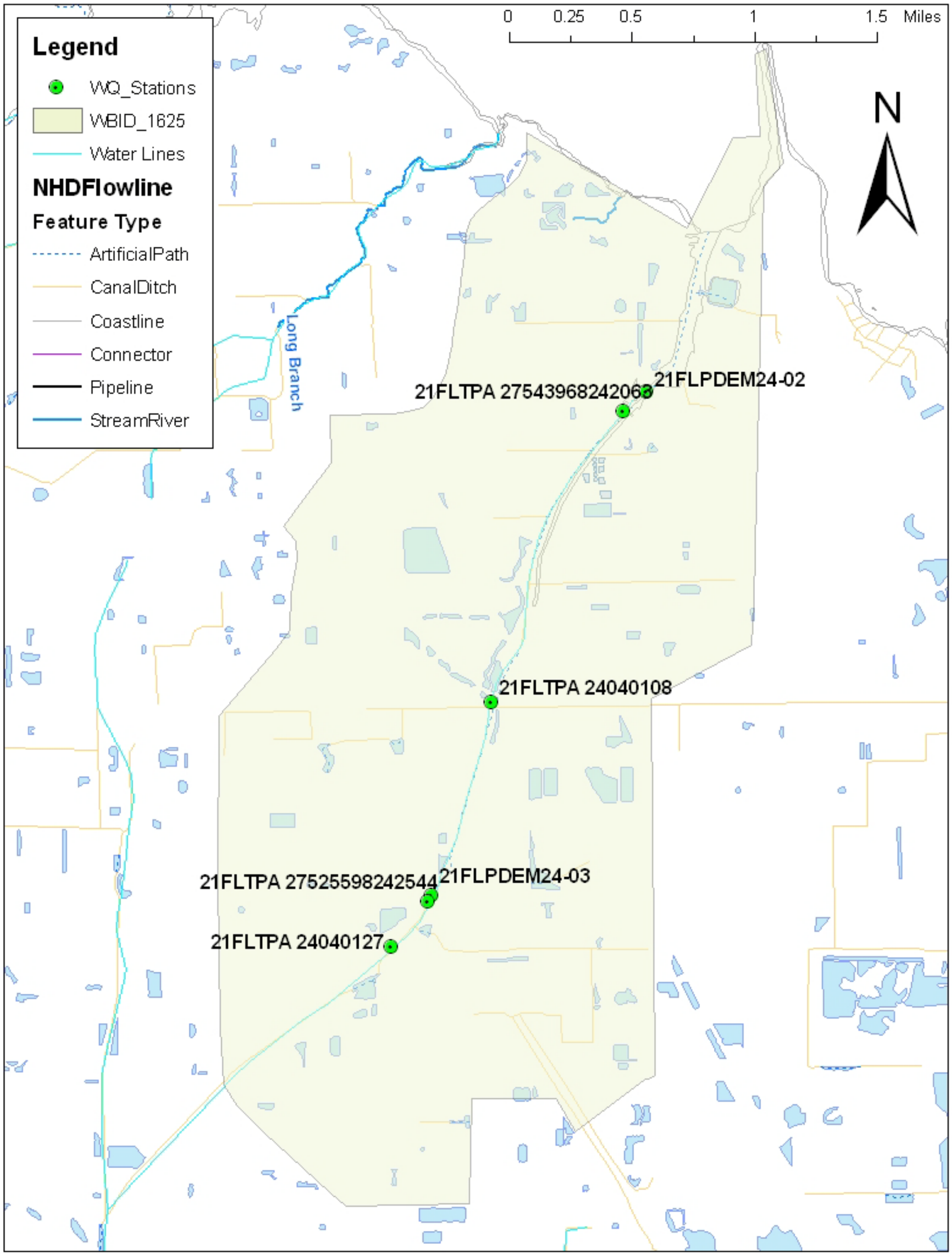


Figure 5.1. Water Quality Sampling Stations in Cross Canal–North (WBID 1625)

Based on the dominant land use in the watershed (urban and built-up), it is likely that many of the exceedances are from nonpoint sources and MS4s entering the waters through surface runoff. This could indicate that fecal coliform builds up on the land during dry periods and washes off into local waters during rain events.

5.1.3 Temporal Patterns

Measurements were sorted by month to determine whether there was a temporal pattern of exceedances. Monthly average rainfall data from St. Petersburg, Florida (087886) for the Cross Canal–North watershed were obtained and included in the analysis. Due to incomplete exceedance values for each month, a seasonal analysis could not be performed. **Table 5.1** presents summary statistics by month for fecal coliform and rainfall measurements. **Figure 5.2** displays this information graphically.

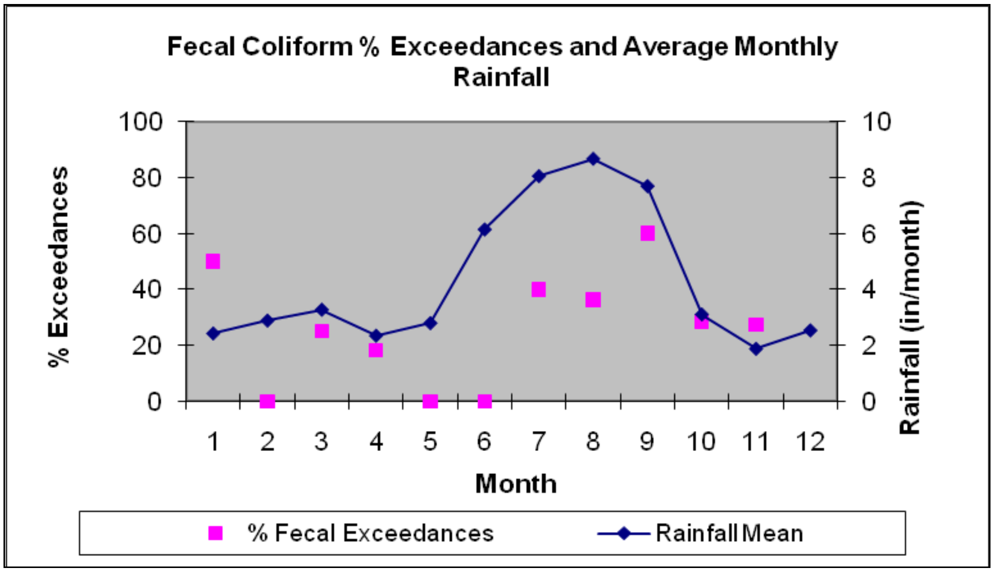
As shown in **Figure 5.2**, exceedances of the fecal coliform criterion in Cross Canal–North occur across the entire span of the average monthly rainfall record and throughout all seasons, implying potential fecal coliform bacteria sources during both baseflow (dry weather) and surface run-off (wet weather) events. The highest fecal coliform exceedance rates and concentrations were observed during the month of January and September.

Table 5.1. Summary Statistics of Fecal Coliform and Rainfall Data for Cross Canal–North (WBID 1625) by Month

Month	Number of Cases	Minimum	Maximum	Median	Mean	Number of Exceedances	% Fecal Exceedances	Rainfall Mean
1	4	340	3000	750	1210	2	50	2.42
2	2	43	210	127	127	0	0	2.88
3	8	5	600	200	243	2	25	3.27
4	11	25	980	125	260	2	18	2.34
5	7	30	350	65	132	0	0	2.79
6	7	35	230	100	126	0	0	6.14
7	10	20	2100	295	738	4	40	8.05
8	11	40	2600	210	551	4	36	8.67
9	5	150	3300	520	1024	3	60	7.69
10	7	67	1400	150	396	2	29	3.1
11	11	100	500	230	275	3	27	1.87
12								2.53

Empty cell = No Data

Figure 5.2. Fecal Coliform Exceedances and Rainfall for Cross Canal–North (WBID 1625) by Month



5.1.4 Spatial Patterns

Fecal coliform data from water quality sampling stations for the 2005 - 2007 data period were analyzed to detect spatial trends in the data (**Table 5.2**). The period of observation for the Pinellas DEM stations (21FLPDEM) were 2005 – 2007. The period of observation for the Southwest District Office stations (21FLTPA) was 2005. Stations 21FLPDEM24-02 and 21FLTPA27543968242063 had the highest fecal coliform exceedance rate at 38% and 33%, respectively. The landuse surrounding these stations are primarily urban**.**

Table 5.2. Station Summary Statistics of the Fecal Coliform Data for Cross Canal - North (WBID 1625)

Station	Period of Obs	# of Samples	Min	Max	Mean	Median	# of Exceed	% Exceed
21FLPDEM24-02	2005-2007	24	20	3300	602	230	9	38
21FLPDEM24-03	2005-2007	14	43	1400	439	235	4	29
21FLTPA 24040108	2005	8	25	2100	381	73	2	25
21FLTPA 24040127	2005	23	5	2600	340	150	4	17
21FLTPA 27525598242544	2005	8	105	450	194	183	1	13
21FLTPA 27543968242063	2005	6	60	1810	512	280	2	33

Coliform counts are #/100 mL.
Exceedances represent values above 400 counts/100 mL.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

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

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

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

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

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

WLAs for stormwater discharges are typically expressed as "percent reduction" because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the "maximum extent practical" through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL for Cross Canal–North is expressed in terms of MPN/day and percent reduction, and represents the maximum daily fecal coliform loads the canal can assimilate and maintain the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for Fecal Coliform in Cross Canal–North (WBID 1625)

WBID	Parameter	TMDL (counts/day)	WLA for Wastewater (counts/day)	WLA for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
1625	Fecal Coliform	400/100mL	N/A	59%	59%	Implicit

N/A – Not applicable

6.2 Load Allocation

A fecal coliform reduction of 59 percent for Cross Canal–North (WBID 1625) is needed from nonpoint sources. 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

A fecal coliform reduction of 59 percent for Cross Canal–North is needed from point sources. There is one NPDES wastewater facility permitted to discharge to surface waters in the Cross Canal–North 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

A fecal coliform reduction of 59 percent is needed for Cross Canal–North. There are several NPDES MS4 permits in the watershed. The stormwater collection systems in the watershed are owned and operated by Pinellas County (#FLS 000005) and the city of Pinellas Park (Pinellas County co-permittee: #FLS 000005), city of Largo (Pinellas County co-permittee: #FLS 000005), and FDOT. It should be noted that any future 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 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 this TMDL by rule, the Department will determine the best course of action regarding its 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 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 the following:

- *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 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.

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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 Rule 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.

The rule 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 stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 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 has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the FDOT throughout the 15 counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES Program will expand the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 10,000 people. The revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

Appendix B: Fecal Coliform Data for Cross Canal–North (WBID 1625) during the Verified Period (January 2000–June 2007)

Station	Date	Result
21FLPDEM24-03	1/19/2005	1100
21FLPDEM24-02	1/19/2005	3000
21FLPDEM24-03	3/3/2005	280
21FLPDEM24-02	3/3/2005	600
21FLTPA 24040127	3/7/2005	5
21FLTPA 24040108	3/7/2005	45
21FLTPA 27525598242544	3/7/2005	115
21FLTPA 27543968242063	3/7/2005	140
21FLTPA 24040108	4/4/2005	25
21FLTPA 24040127	4/4/2005	40
21FLTPA 27525598242544	4/4/2005	105
21FLTPA 27543968242063	4/4/2005	230
21FLTPA 24040127	4/12/2005	125
21FLPDEM24-02	4/14/2005	100
21FLPDEM24-03	4/14/2005	240
21FLTPA 24040127	4/19/2005	760
21FLTPA 24040127	4/26/2005	35
21FLTPA 24040127	5/10/2005	235
21FLTPA 24040127	5/17/2005	65
21FLPDEM24-02	5/19/2005	30
21FLPDEM24-03	5/19/2005	150
21FLTPA 24040127	5/24/2005	350
21FLTPA 24040108	6/7/2005	45
21FLTPA 24040127	6/7/2005	100
21FLTPA 27525598242544	6/7/2005	200
21FLTPA 24040127	6/14/2005	35
21FLTPA 24040127	6/21/2005	45
21FLTPA 24040127	6/27/2005	230
21FLPDEM24-02	7/5/2005	1100
21FLPDEM24-03	7/5/2005	1300
21FLTPA 24040127	7/11/2005	310
21FLTPA 24040127	7/18/2005	175
21FLTPA 27525598242544	7/18/2005	175
21FLTPA 27543968242063	7/18/2005	1810
21FLTPA 24040108	7/18/2005	2100
21FLTPA 24040127	7/26/2005	280
21FLTPA 24040127	8/8/2005	800

21FLPDEM24-02	8/15/2005	60
21FLPDEM24-03	8/15/2005	230
21FLTPA 24040108	8/16/2005	40
21FLTPA 27543968242063	8/16/2005	60
21FLTPA 24040127	8/16/2005	105
21FLTPA 27525598242544	8/16/2005	210
21FLTPA 24040127	8/30/2005	2600
21FLTPA 24040127	9/13/2005	260
21FLPDEM24-02	9/19/2005	150
21FLPDEM24-03	9/19/2005	520
21FLTPA 24040127	9/20/2005	890
21FLTPA 24040108	10/10/2005	100
21FLTPA 27525598242544	10/10/2005	105
21FLTPA 24040127	10/10/2005	150
21FLPDEM24-02	10/31/2005	220
21FLPDEM24-03	10/31/2005	1400
21FLTPA 24040127	11/7/2005	100
21FLTPA 27525598242544	11/7/2005	190
21FLTPA 24040108	11/7/2005	250
21FLTPA 27543968242063	11/7/2005	500
21FLTPA 24040127	11/14/2005	125
21FLTPA 27543968242063	11/14/2005	330
21FLTPA 24040108	11/14/2005	440
21FLTPA 27525598242544	11/14/2005	450
21FLPDEM24-02	11/16/2005	180
21FLPDEM24-03	11/16/2005	230
21FLPDEM24-02	1/19/2006	340
21FLPDEM24-03	3/2/2006	260
21FLPDEM24-02	3/2/2006	500
21FLPDEM24-02	4/10/2006	220
21FLPDEM24-02	5/10/2006	60
21FLPDEM24-02	7/10/2006	20
21FLPDEM24-03	7/10/2006	110
21FLPDEM24-03	8/7/2006	210
21FLPDEM24-02	8/7/2006	1200
21FLPDEM24-02	8/10/2006	550
21FLPDEM24-02	9/14/2006	3300
21FLPDEM24-03	10/31/2006	67
21FLPDEM24-02	10/31/2006	730
21FLPDEM24-02	11/29/2006	230
21FLPDEM24-02	1/23/2007	400

21FLPDEM24-03	2/22/2007	43
21FLPDEM24-02	2/22/2007	210
21FLPDEM24-02	4/10/2007	980
21FLPDEM24-02	5/23/2007	33
21FLPDEM24-02	6/25/2007	230
21FLPDEM24-02	9/13/2007	180
21FLPDEM24-02	10/10/2007	210
21FLPDEM24-03	10/10/2007	2400
21FLPDEM24-02	12/4/2007	390
21FLPDEM24-02	2/4/2008	730
21FLPDEM24-03	3/20/2008	500
21FLPDEM24-02	3/20/2008	800
21FLPDEM24-02	5/1/2008	210
21FLPDEM24-02	7/1/2008	14
21FLPDEM24-03	8/7/2008	170
21FLPDEM24-02	8/7/2008	750
21FLPDEM24-02	9/9/2008	28
21FLPDEM24-03	9/9/2008	40
21FLPDEM24-02	10/22/2008	30
21FLPDEM24-03	10/22/2008	74
21FLPDEM24-02	12/18/2008	590
21FLPDEM24-02	1/27/2009	55
21FLPDEM24-02	4/8/2009	390
21FLPDEM24-02	5/19/2009	640
21FLPDEM24-02	6/18/2009	87
21FLPDEM24-03	11/9/2009	210
21FLPDEM24-02	11/9/2009	1300
21FLPDEM24-02	12/8/2009	420

Appendix C: Fecal Coliform Percent Reduction for Cross CanalNorth (WBID 1625) during the Verified Period (January 2000–June 2007)

Station	Date	Result	Class III Criterion	Percent Reduction
21FLTPA 24040108	11/14/2005	440	400	9
21FLTPA 27525598242544	11/14/2005	450	400	11
21FLTPA 27543968242063	11/7/2005	500	400	20
21FLPDEM24-02	3/2/2006	500	400	20
21FLPDEM24-03	9/19/2005	520	400	23
21FLPDEM24-02	8/10/2006	550	400	27
21FLPDEM24-02	3/3/2005	600	400	33
21FLPDEM24-02	10/31/2006	730	400	45
21FLTPA 24040127	4/19/2005	760	400	47
21FLTPA 24040127	8/8/2005	800	400	50
21FLTPA 24040127	9/20/2005	890	400	55
21FLPDEM24-02	4/10/2007	980	400	59
21FLPDEM24-03	1/19/2005	1100	400	64
21FLPDEM24-02	7/5/2005	1100	400	64
21FLPDEM24-02	8/7/2006	1200	400	67
21FLPDEM24-03	7/5/2005	1300	400	69
21FLPDEM24-03	10/31/2005	1400	400	71
21FLTPA 27543968242063	7/18/2005	1810	400	78
21FLTPA 24040108	7/18/2005	2100	400	81
21FLPDEM24-03	10/10/2007	2400	400	83
21FLTPA 24040127	8/30/2005	2600	400	85
21FLPDEM24-02	1/19/2005	3000	400	87
21FLPDEM24-02	9/14/2006	3300	400	88
			Median	59

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