FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

SOUTHWEST DISTRICT • SPRINGS COAST BASIN -
ANCLOTE RIVER/COASTAL PINELLAS COUNTY PLANNING UNIT

FINAL TMDL Report

Fecal Coliform TMDLs for McKay Creek Tidal (WBID 1633) and McKay Creek (WBID 1633B)

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Acknowledgments

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TMDL Program

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Florida STORET Program

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

2012 Integrated Report

http://www.dep.state.fl.us/water/docs/2012_integrated_report.pdf

Criteria for Surface Water Quality Classifications

http://www.dep.state.fl.us/water/wqssp/classes.htm

Water Quality Status Report: Springs Coast

http://waterwebprod.dep.state.fl.us/basin411/springscoast/status/SpringCst.pdf

Water Quality Assessment Report: Springs Coast

http://waterwebprod.dep.state.fl.us/basin411/springscoast/assessment/G5AS-Springs_Coast-LORES_Merged.pdf

U.S. Environmental Protection Agency

Region 4: TMDLs in Florida

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

National STORET Program

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Loads (TMDLs) for fecal coliform bacteria for the tidal and freshwaters segments of McKay Creek, located in the Springs Coast Basin. These systems were verified as impaired for fecal coliform by the Florida Department of Environmental Protection (Department) based on the Cycle 1 assessment period data (January 1, 1999 through June 30, 2006), and therefore were included on the Verified List of impaired waters for the Springs Coast Basin that was adopted by Secretarial Order on December 12, 2007 (amended on May 19, 2009). During the Cycle 2 verified period assessment, fecal coliform was not impaired for WBID 1633 based on the number of exceedances for the sample size. However, data available during the Cycle 2 assessment did not meet the exceedance ratio required by the IWR (Table 4) for delisting the waterbody; therefore, the parameter remains on the 303(d) list. The fecal coliform impairment in WBID1633B was confirmed by the Department during the Cycle 2 assessment period (January 1, 2004 through June 30, 2011).

These TMDLs establish the allowable fecal coliform loading to the McKay Creek tidal and freshwater segments that would restore these waterbodies so that they meet their applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

For assessment purposes, the Florida Department of Environmental Protection (Department) has divided the Springs Coast Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. McKay Creek Tidal has been identified as WBID 1633, and the freshwater portion of McKay Creek as WBID 1633B.

The McKay Creek Tidal and McKay Creek are two of 93 waterbody segments in the Springs Coast Basin, Anclote River / Coastal Pinellas County Unit. WBID 1633 is one of 22 waterbody segments in the Springs Coast Basin included on the initial 1998 303(d) list submitted by the Department to the United States Environmental Protection Agency (EPA). The 1998 303(d) list was incorporated into a 1999 Consent Decree between EPA and Earth Justice.

The initial list used data from stations listed in the Department's 1996 305(b) report. The report used best available information at the time to generally characterize the quality of Florida's waters. Some of the delineations of waterbody areas and locations of sampling stations for the 1998 303(d) list were inaccurate due to technical limitations at that time. With the primary goal of providing more accurate assessments, the Department has revised the delineations over time. EPA has labeled the redrawing of WBID boundaries "resegmentation," as the original stations corresponded to specific WBID areas or segments. Resegmented WBIDs are those WBIDs that have been altered from the initial 1998 303(d) Consent Decree or previous cycle boundaries. As a result of the resegmentation process for the Group 5 Basins, there are currently 40 Consent Decree waterbody segments in the Springs Coast Basin, including WBID 1633B. This number is based on Impaired Waters Rule (IWR, 62-303, F.A.C) Run 44x.

The McKay Creek watershed is located in the west central area of Pinellas County and includes part of the cities of Largo and Seminole and the Town of Belleair Bluffs (**Figure 1.1**). McKay Creek (WBID 1633B) drains to McKay Creek Tidal (WBID 1633). In addition to the main channel, McKay Creek has one tributary which discharges into Clearwater Harbor (**Figure**

1.2), and total approximately 6.2 miles in length. There are two lakes (with unique WBID numbers) located within WBID 1633B, Taylor Lake and the Walsingham Reservoir. Both are located along the main channel of the creek. Additional information about the hydrology of this area is available in the *General Hydrology of the Middle Gulf Area, Florida (Report of Investigation No. 56)*, by the US Geological Survey (Cherry et al., 1970).

The areas within the McKay Creek Tidal (WBID 1633) and McKay Creek (WBID 1633B) WBID boundaries are approximately 0.57 square miles (mi^2) (366 acres) and 6.5 mi^2 (4,177 acres), respectively. These areas are almost completely developed. Major land use types include low-, medium- and high- density residential, institutional, and commercial lands, with a portion of recreational/open space (undeveloped and developed parkland) located in WBID 1663B.

WBIDs 1633 and 1633B are located in the west-central coastal region of peninsular Florida, in the area identified as the Gulf Coastal Lowlands physiographic region, where soils are poorly drained and the water table is near land surface. Soils in this region are variable, they range from excessively drained sands to moderate or poorly drained soils with a sandy subsoil (USDA, 2006). As a result of extensive changes of the land surface for development, large portions of this area have soils types characterized as Urban Land (SWFWMD, 2002).

Two main aquifers are found in Pinellas County, the surficial aquifer and the Floridan aquifer. The surficial aquifer system consists of undifferentiated sands, shell material, silts and clayey sands of varying thickness (Causseaux, 1985). The principal uses for the surficial aquifer in Pinellas County are irrigation, limited domestic use, and dewatering projects for mining and infrastructure installation (SWFWMD, 2006). The Floridan aquifer system consists primarily of highly permeably carbonate rocks and is separated into two principal zones consisting of the fresh potable water of the Upper Floridan aquifer and the highly mineralized water of the Lower Floridan aquifer (Causseaux, 1985). In Pinellas County, the Upper Floridan aquifer is the principal source of water and is used for industrial, mining, public supply, domestic use, and irrigation purposes, as well as brackish water desalination in coastal communities (SWFWMD, 2006).

An important feature of the area is karst topography. Watersheds located in karst regions are extremely vulnerable to contamination. Many of these karst features infiltrate the water table forming a direct connection between land surface and the underlying aquifer systems, allowing interaction between surface and ground waters (SWFWMD, 2002) increasing the threat of ground water contamination from surface water pollutants (Trommer, 1987). Potential sources of contamination include saltwater encroachment and infiltration of contaminants carried in surface water, direct infiltration of contaminants (chemicals or pesticides applied to or spilled on the land, fertilizer carried in surface runoff), landfills, septic tanks, sewage-plant treatment ponds, and wells used to dispose of stormwater runoff or industrial waste (Miller, 1990).

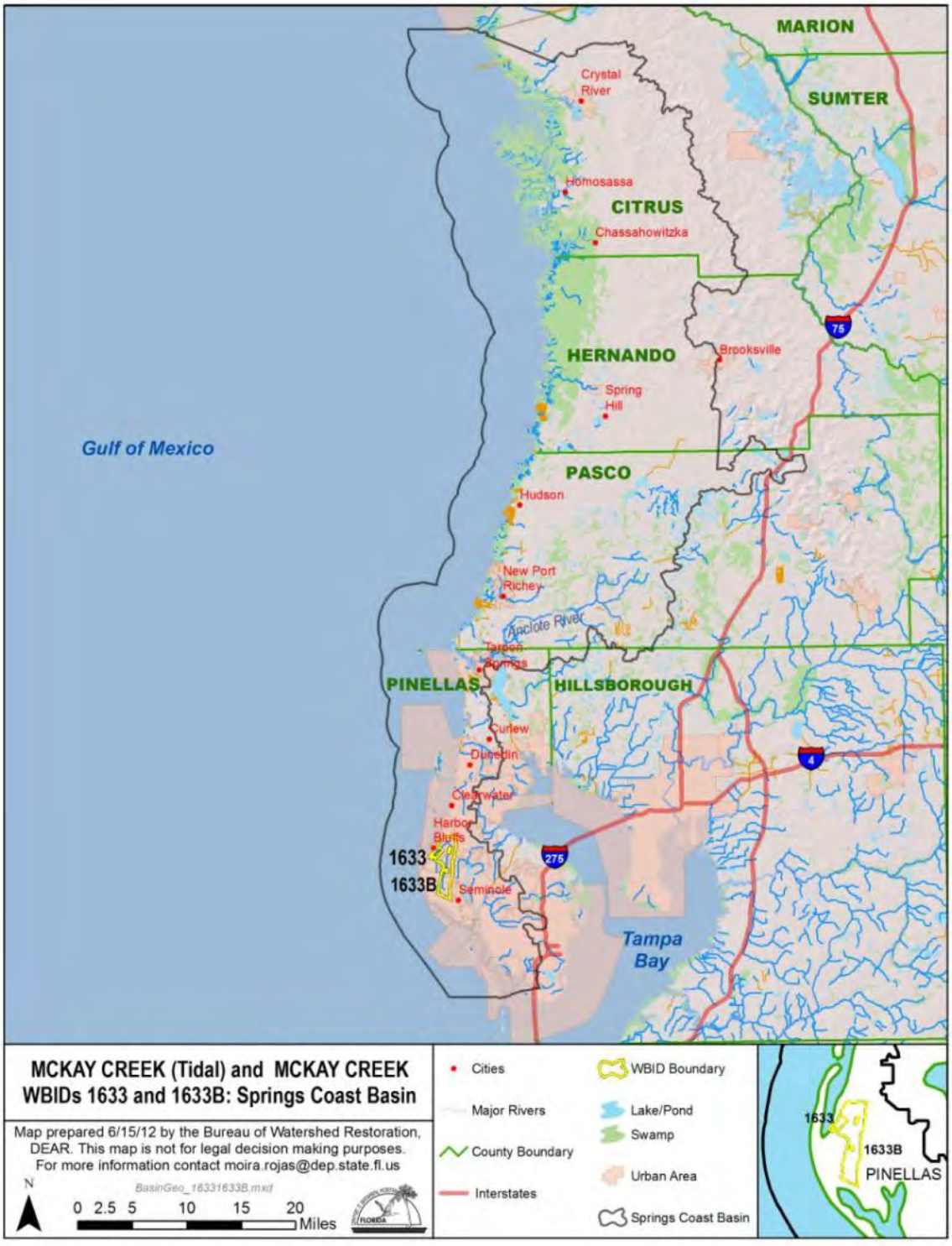

Figure 1.1. Location of the McKay Creek Tidal (WBID 1633) and the McKay Creek (WBID 1633B) WBIDs in the Springs Coast Basin and Major Hydrologic and Geopolitical Features in the Area

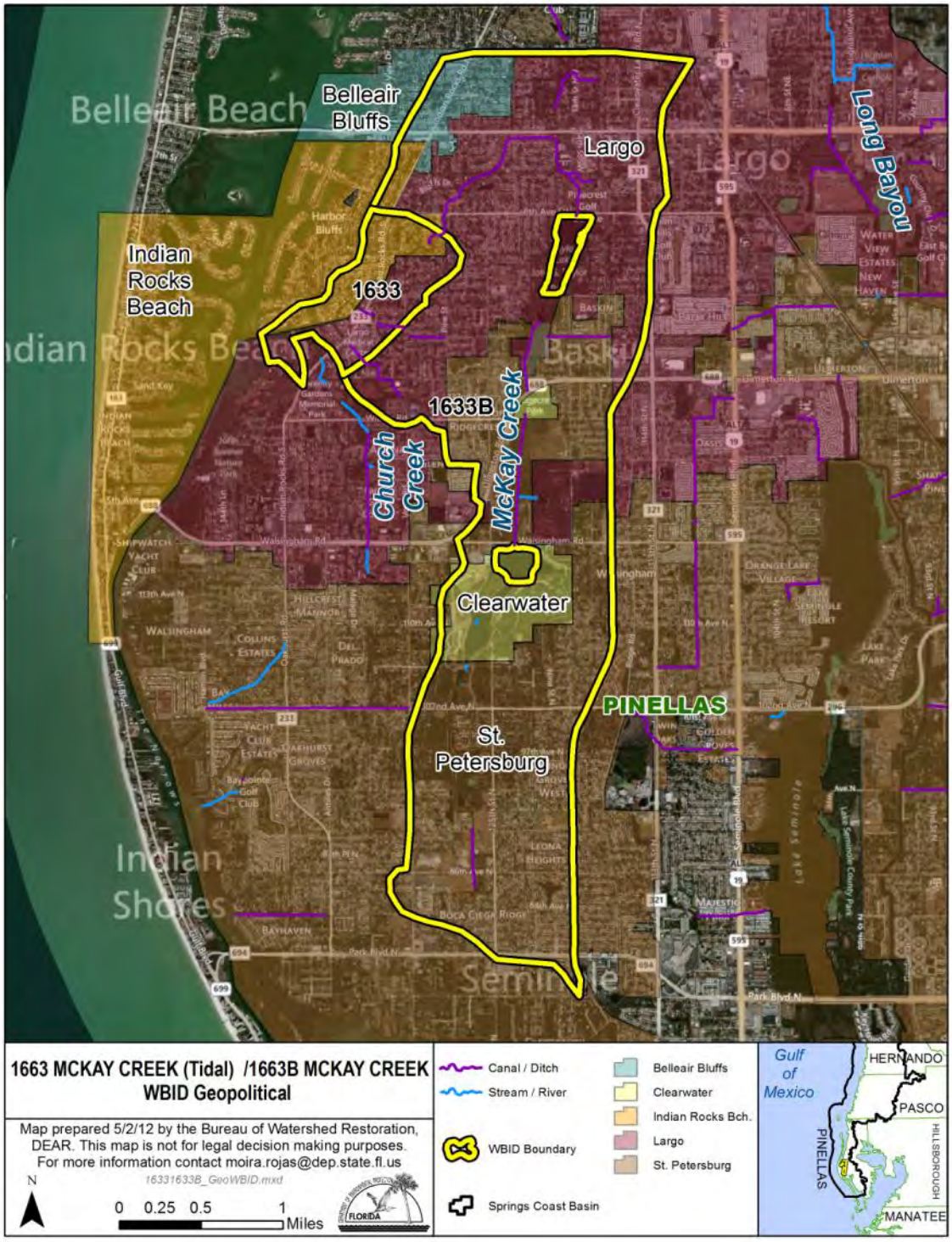

Figure 1.2. Location of the McKay Creek Tidal (WBID 1633) and the McKay Creek (WBID 1633B) WBIDs in Pinellas County

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, Section 403.067, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. They provide important water quality restoration goals that will guide restoration activities.

This TMDL report will be followed by the development and implementation of a restoration plan designed to reduce the amount of fecal coliform that caused the verified impairment of McKay Creek Tidal and McKay Creek basins. These activities will depend heavily on the active participation of the Southwest Florida Water Management District (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 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 identified 22 impaired waterbodies in the Springs Coast Basin on its initial 1998 303(d) list. As a result of the resegmentation process for the Group 5 Basins, there are currently 40 Consent Decree waterbody segments in the Springs Coast Basin (see **Section 1.2**). However, the FWRA (Section 403.067, F.S.) stated that all Florida 303(d) lists created before the adoption of the FWRA 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 WBIDs 1633 and 1633B, and has verified that these waterbody segments are impaired for fecal coliform bacteria. Verified impairment was based on the observation that, with a 90 percent confidence level based on binomial distribution, more than 10 percent of values exceeded the assessment threshold of 400 counts per 100 milliliters (counts/100mL) (see **Section 3.2** for details) in these WBIDs.

WBID 1633 was verified as impaired during the Cycle 1 assessment. In order to have sufficient data to assess this WBID, the assessment for Cycle 1 was based on planning period and verified period data (January 1, 1994 through June 30, 2006). During the Cycle 2 verified period assessment (January 1, 2004, through June 30, 2011), fecal coliform was not impaired for this waterbody based on the number of exceedances for the sample size (2/18). However, data available during the Cycle 2 assessment did not meet the exceedance ratio required by the IWR (Table 4) for delisting the waterbody; therefore, the parameter remains on the 303(d) list.

WBID 1633B was verified as impaired during the Cycle 1 verified period (January 1, 1999 through June 30, 2006) assessment. This impairment was confirmed in the Cycle 2 assessment (January 1, 2004, through June 30, 2011).

Table 2.1 summarizes fecal coliform monitoring results used for verified impairment for the Cycle 1 verified period for WBIDs 1633 and 1633B, and **Table 2.2** summarizes fecal coliform results used for verified impairment for the Cycle 2 assessment (based on IWR Run44x data) for WBIDs 1633 and 1633B. As they better represent the current conditions, results from

Run44x for the Cycle 2 verified period were used in the TMDL development process for these WBIDs.

Table 2.1. Summary of Fecal Coliform Monitoring Data for McKay Creek Tidal (WBID 1633) and McKay Creek (WBID 1633B) during the Cycle 1 Verified Period (January 1, 1999, through June 30, 2006)

This is a three-column table. Column 1 lists the parameter, and Columns 2-3 list the WBID number and Cycle 1 results.

**Cycle 1 Planning Period and Verified Period data (January 1, 1994 through June 30, 2006)*

Parameter	WBID	
	1633*	1633B
Total number of samples	46	52
IWR-required number of exceedances for the Verified List	8	9
Number of observed exceedances	35	13
Number of observed nonexceedances	11	39
Number of seasons during which samples were collected	4	4

Table 2.2. Summary of Fecal Coliform Monitoring Data for McKay Creek Tidal (WBID 1633) and McKay Creek (WBID 1633B) during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

This is a three-column table. Column 1 lists the parameter, Column 2-3 list the WBID number and corresponding Cycle 2 results.

Parameter	WBID	
	1633	1633B
Total number of samples	18	100
IWR-required number of exceedances for the Verified List	5	15
Number of observed exceedances	2	49
Number of observed non-exceedances	16	51
Number of seasons during which samples were collected	4	4
Highest observation (counts/100mL)	5,400	13,000
Lowest observation (counts/100mL)	10	1
Median observation (counts/100mL)	82	395
Mean observation (counts/100mL)	497	1,308

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criterion 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)**

Both WBIDs addressed in this report are Class III waterbodies, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. WBID 1633 is a Class III marine waterbody and WBID 1633B is a Class III freshwater waterbody. The criterion applicable to these TMDLs is the Class III (freshwater and marine) 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 (freshwater and marine) waters, as established by Rule 62-302, F.A.C., states the following:

> ***Fecal Coliform Bacteria:***
>
> *The most probable number (MPN) or membrane filter (MF) counts per 100 mL of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.*

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. There were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for this TMDL was not to exceed 400 counts/100mL for fecal coliform.

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 within the McKay Creek Tidal and McKay Creek WBID Boundaries

4.2.1 Point Sources

Wastewater Point Sources

There are no NPDES-permitted wastewater facilities in either the McKay Creek Tidal or the McKay Creek watersheds.

Municipal Separate Storm Sewer System Permittees

One NPDES municipal separate storm sewer systems (MS4) permit covers WBID 1633 (permit FLS000005), and one MS4 permit cover WBID 1633B (permits FLS000005). **Table 4.1** lists the NPDES MS4 permits, the permit holder and co-permittees for each WBID.

Table 4.1. Municipal Separate Storm Sewer System Permits Covering WBIDs 1633 and 1633B

This is a four-column table. Column 1 lists the WBID number, Column 2 lists the permit number, Column 3 lists the permit holder, and Column 4 lists the co-permitees.

WBID	Permit ID	Permit Holder	Co-Permittees
1663	FLS000005	Pinellas County	City of Largo
			Pinellas County
			FDOT District 7
1663B	FLS000005	Pinellas County	City of Largo
			City of Seminole
			Pinellas County
			City of Belleair Bluffs
			FDOT District 7

4.2.2 Land Uses and Nonpoint Sources

Accurately quantifying the fecal coliform loadings from nonpoint sources requires identifying nonpoint source categories, locating the sources, determining the intensity and frequency at which these sources create high fecal coliform loadings, and specifying the relative contributions from these sources. Depending on the land use distribution in a given watershed, frequently cited nonpoint sources in urban areas include failed septic tanks, leaking sewer lines, and pet feces.

In addition to the sources associated with anthropogenic activities, birds and other wildlife can also act as fecal coliform contributors to receiving waters. While detailed source information is not always available for accurately quantifying the fecal coliform loadings from different sources, land use information can provide some hints on the potential sources of observed fecal coliform impairment.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SWFWMD's 2009 land use coverage contained in the Department's geographic information system (GIS) library. Land use categories within the McKay Creek Tidal and McKay Creek WBID boundaries were aggregated using the Florida Land Use Code and Classification System (FLUCCS) expanded Level 1 codes (including low, medium, and high density residential) and tabulated in **Table 4.2**. **Table 4.2** also shows the total area within each WBID. The spatial distribution of the principal land uses within the WBID boundaries is shown in **Figure 4.1.**

Within both WBID boundaries, the dominant land use categories are urban land uses, including residential (low- medium- and high-density), urban built-up and transportation, which account for approximately 90% and 93% of the total acreage for WBID 1633 and 1633B, respectively. In WBIDs 1633 and 1633B, low impact land use areas, including upland forests, wetlands and water, make up approximately 10% and 6% of the total areas, respectively.

Table 4.2. Classification of Land Use Categories within the McKay Creek Tidal (WBID 1633) and McKay Creek (WBID 1633B) Boundaries in 2009

This is a six-column table. Column 1 lists the Level 1 land use code, Column 2 lists the land use description, Columns 3-6 list the acreage and the percent acreage land use in each WBID.

Level 1 Code	Land Use	WBID 1633		WBID 1633B	
		Acreage	% Acreage	Acreage	% Acreage
1000	Urban and built-up	27	7.4%	1129	27.0%
-	Low-density residential	0	0%	89	2.1%
-	Medium-density residential	0	0%	90	2.2%
-	High-density residential	302	82.5%	2,499	59.8%
2000	Agriculture	0	0%	27	0.6%
3000	Rangeland	0	0%	0	0%
4000	Upland forest	0	0%	31	0.7%
5000	Water	37	10.1%	131	3.1%
6000	Wetland	0	0%	90	2.2%
7000	Barren land	0	0%	0	0%
8000	Transportation, communication, and utilities	0	0%	91	2.2%
-	**TOTAL**	**366**	**100%**	**4,177**	**100%**

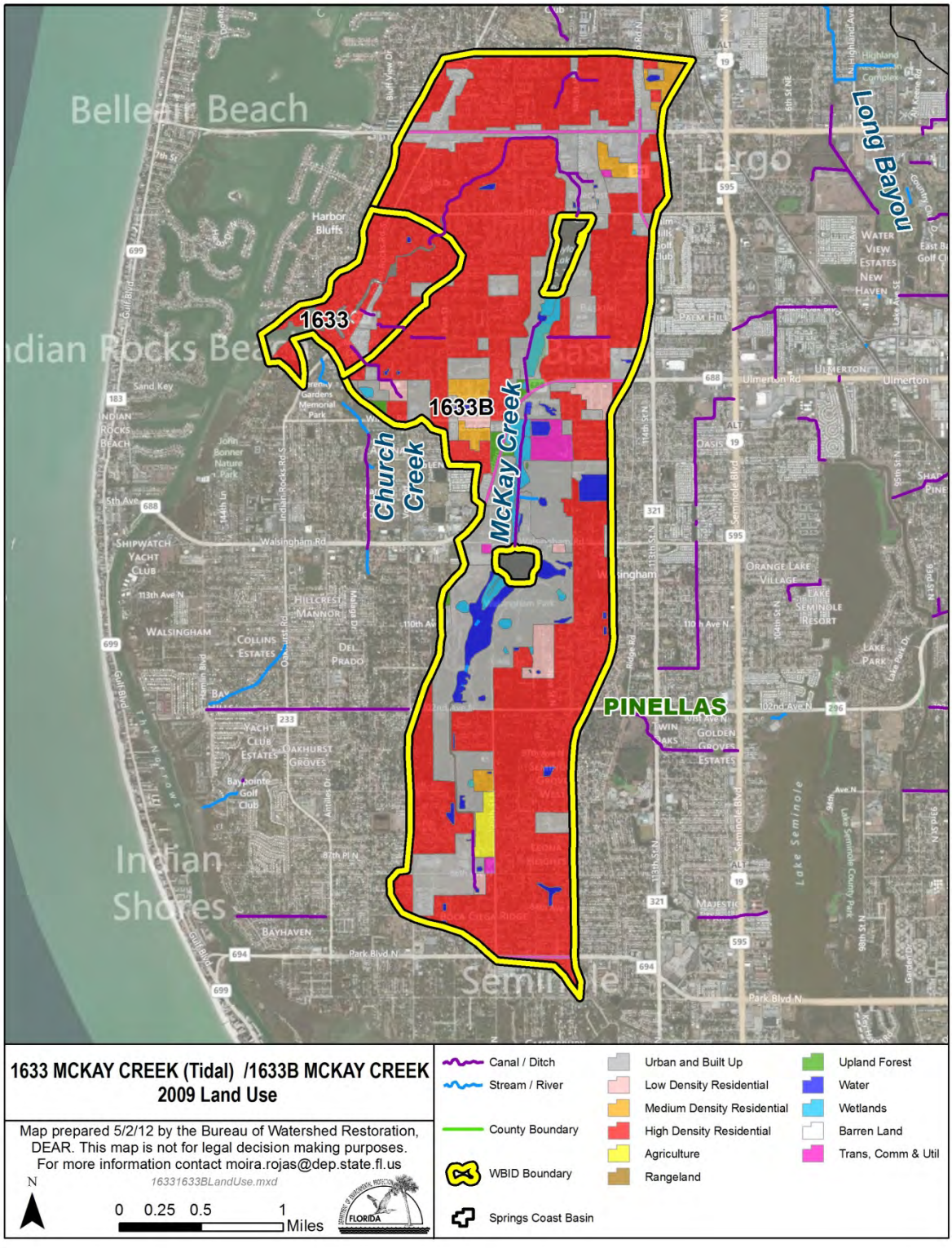

Figure 4.1. Principal Land Uses within the McKay Creek Tidal (WBID 1633) and McKay Creek (WBID 1633B) Boundaries in 2009

Urban Development

Because the dominant land use categories contributing to nonpoint source pollution are urban land areas – urban and built-up (commercial and services); medium- and high-density residential – possible sources for fecal coliform loadings can include failed septic tanks, sewer line leakages, and pet feces disposed of inappropriately. A preliminary quantification of the fecal coliform loadings from these sources was conducted to demonstrate the relative contributions. **Appendix B** provides detailed load estimates and describes the methods used for the quantification. It should be noted that the information included in **Appendix B** was only used to demonstrate the possible relative contributions from different sources.

Wildlife and Sediments

Wildlife and sediments could also contribute to fecal coliform exceedances in the watershed. Wildlife such as birds and raccoons have direct access to the waterbody and can deposit their feces directly into the water. Wildlife also deposit coliform bacteria with their feces onto land surfaces, where they can be transported during storm events to nearby streams. Studies have shown that fecal coliform bacteria can survive and reproduce in streambed sediments and can be re-suspended in surface water when conditions are right (Jamieson et al., 2005; Desmarais et al., 2002).

Current source identification methodologies cannot quantify the exact amount of fecal coliform loading from wildlife and/or sediment sources.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The fecal coliform TMDLs for the McKay Creek Tidal and McKay Creek WBIDs were developed using the "percent reduction" approach. Using this method, the percent reduction needed to meet the applicable criterion is calculated based on the 90th percentile of all measured concentrations collected during the Cycle 2 verified period (January 1, 2004, through June 30, 2011).

Because bacteriological counts in water are not normally distributed, a nonparametric method is more appropriate for the analysis of fecal coliform data (Hunter, 2002). The Hazen method, which uses a nonparametric formula, was used to determine the 90th percentile. The percent reduction of fecal coliform needed to meet the applicable criterion was calculated as described in **Section 5.1.3**.

5.1.1 Data Used in the Determination of the TMDL

Data used to develop these TMDLs were primarily provided by the Department, the Department's Southwest District, and Pinellas County Department of Environment and Infrastructure (DEMI). All data used in the development of these TMDLs and corresponding analyses were collected during the Cycle 2 verified period (January 1, 2004, through June, 30, 2011).

As a result of a TMDL Performance and Project Audit conducted in 2007 in the Southwest District laboratory and field operations, it was determined that due to discrepancies in data reported by the laboratory and the data in Florida STORET, certain data collected by the Department's Southwest District in WBID 1633 were unusable for verified list purposes. However, these data are usable for the development of the WBID 1633 TMDL, as well as for the temporal, spatial and critical condition analyses for the WBID.

Table 5.1 lists the stations where fecal coliform data were collected during this time period. **Figure 5.1 shows** the locations of these water quality stations in the McKay Creek Tidal and McKay Creek WBIDs.

Table 5.2 summarizes the descriptive statistics for WBIDs 1633 and 1633B for the Cycle 2 verified period fecal coliform results based on IWR Run44x.

Table 5.1. Stations Where Water Quality Samples Were Collected for Fecal Coliform Data during the Cycle 2 Verified Period (January 1, 2004, through June 30, 2011)

This is a three-column table. Column 1 lists the WBID number, Column 2 lists the station ID and Column 3 lists the agency collecting the data

WBID	Station ID	Agency
1633	21FLTPA 275356708249530	FDEP Southwest District
	21FLTPA 27541328249207	FDEP Southwest District
	21FLTPA 27542338248020	FDEP Southwest District
1633B	21FLGW 35437	FDEP
	21FLPDEM27-03	Pinellas County DEMI
	21FLPDEM27-09	Pinellas County DEMI
	21FLPDEM27-10	Pinellas County DEMI

Table 5.2. Descriptive Statistics of Fecal Coliform Data for WBIDs 1633 and 1633B for Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

This is a nine-column table. Column 1 lists the WBID number, and Columns 2-9 list the descriptive statistic and corresponding result.

[1]Coliform counts are #/100mL

WBID	Mean observation[1]	Standard deviation[1]	Median observation[1]	Highest observation[1]	Lowest observation[1]	25% quartile[1]	75% quartile[1]	# of samples
1633	307	897	97	5,400	10	44	148	40
1633B	1,308	2,191	395	13,000	1	29.5	1,200	100

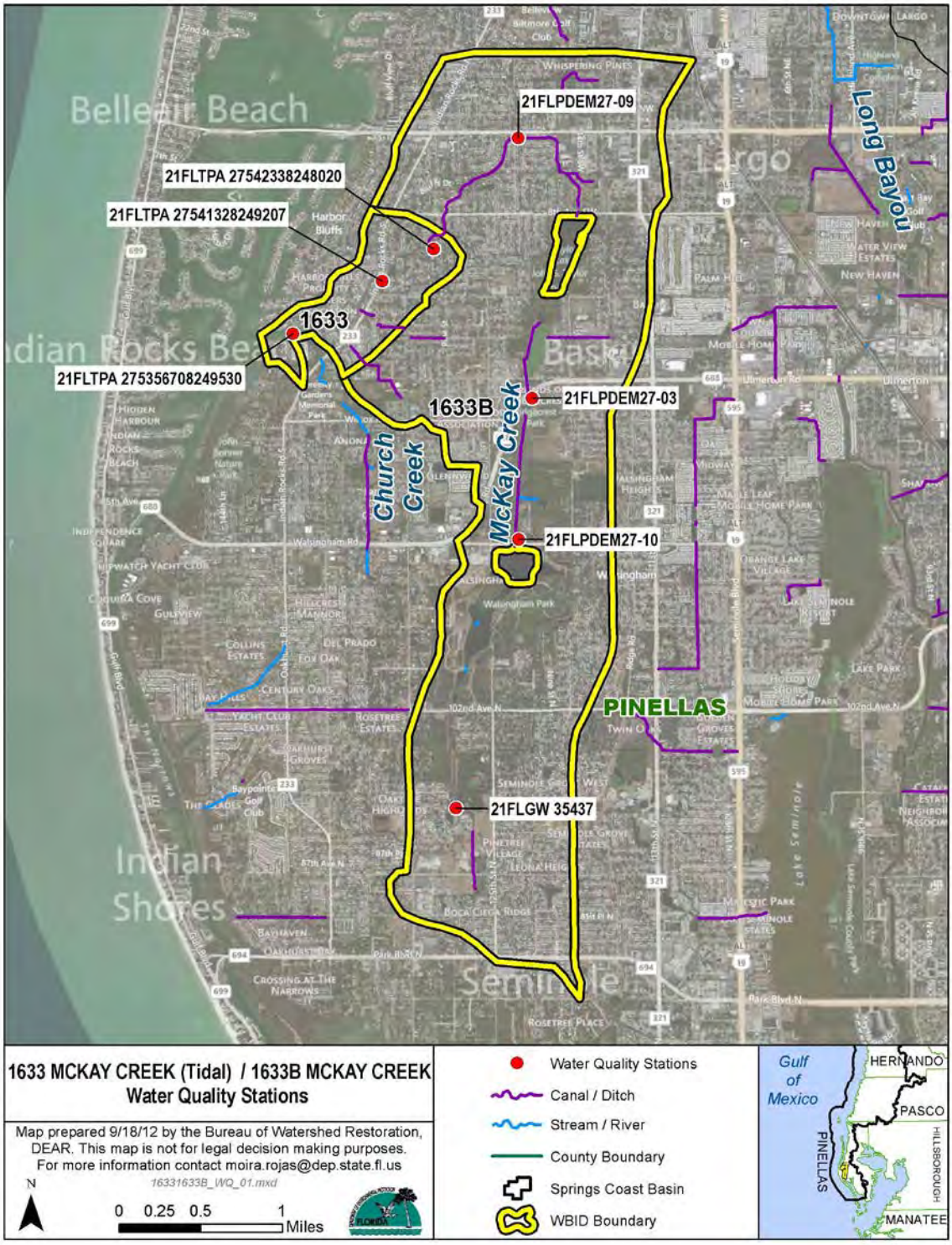

Figure 5.1. Location of IWR Water Quality Stations with Fecal Coliform Data in McKay Creek Tidal (WBID 1633) and McKay Creek (WBID 1633B)

Plots of fecal coliform data against time determined there were no significant increasing or decreasing trends (Prob>0.05) during the period of observation (January 1, 2004 through June 30, 2011) in either WBID 1633 or WBID 1633B. **Figures 5.2a** and **5.2b** show the fecal coliform concentration trends observed in McKay Creek Tidal and McKay Creek during the Cycle 2 verified period.

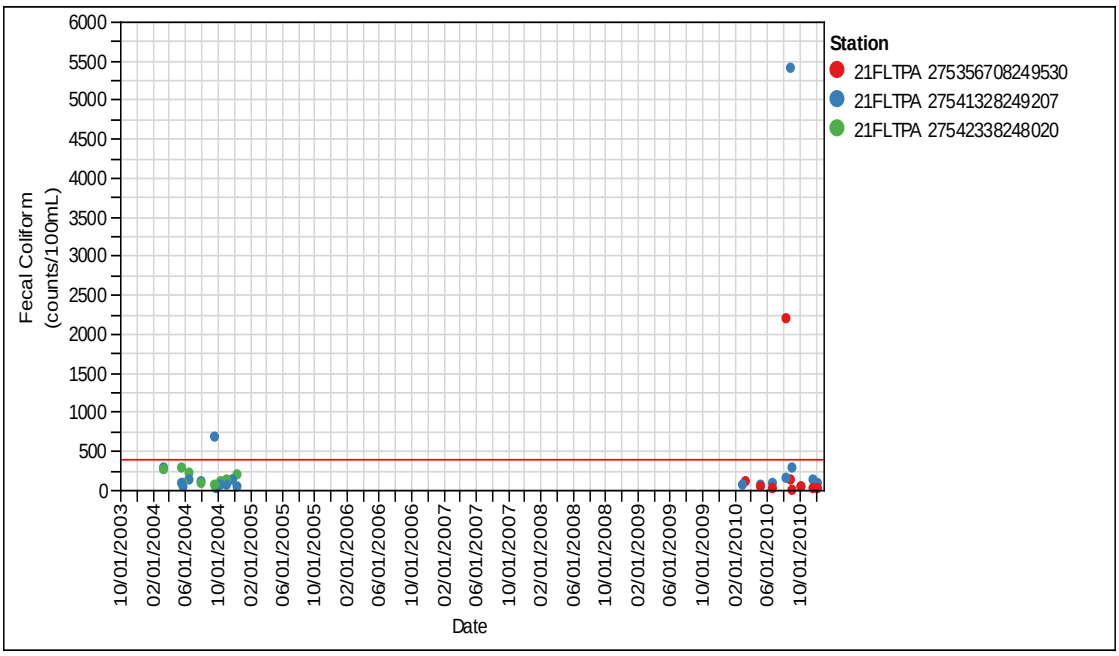

Figure 5.2a. Fecal Coliform Concentration Trends in McKay Creek Tidal (WBID 1633) for the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

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

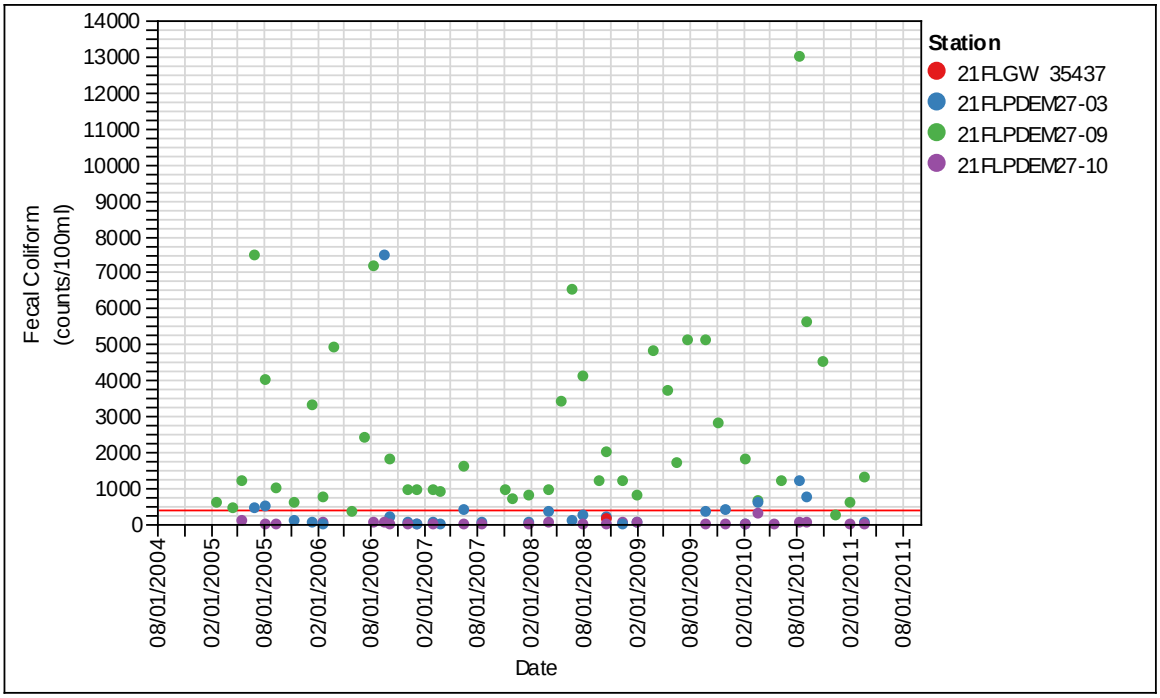

Figure 5.2b. Fecal Coliform Concentration Trends in McKay Creek (WBID 1633B) for the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

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

Temporal Patterns

MONTHLY AND SEASONAL TRENDS

Seasonally, in an impaired water influenced mainly by nonpoint sources, a peak in fecal coliform concentrations and exceedance rates is expected during the third quarter (summer, July–September), when conditions are rainy and warm, and lower concentrations and exceedance rates in the first and fourth quarters (winter, January–March; and fall, October–December), when conditions are drier and colder.

The WBIDs addressed in this report are located in an environment of humid southern temperate to subtropical climatic zones, with frosts/freezing temperatures occurring at least once a year. The average mean daily temperature is 70^{o}F, with mean summer temperatures in the low 80s and mean winter temperatures in the upper 50s. Average annual rainfall is approximately 53 inches, with two-thirds of rainfall occurring between June and September. Rainfall variability, both seasonally and from year to year, is high. The Gulf of Mexico is the prevailing factor affecting climate in this area; Gulf waters influence winter cold fronts and high summer temperatures (SWFWMD, 2002).

McKay Creek Tidal (WBID 1633)

Exceedances were only observed during the third quarter (25%). Fecal coliform exceedances were observed in two months in which measured fecal coliform concentrations were available (August and September); with the highest monthly average fecal coliform concentration and exceedance rate being observed in August (1,351 counts/100mL and 33%, respectively). The highest quarterly average fecal coliform concentration was also observed during this quarter-the rainy and warmer season (768 counts/100mL). **Tables 5.3a** and **5.3b** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3a. Summary Statistics of Fecal Coliform Data for All Stations in McKay Creek Tidal (WBID 1633) by Month during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	0	-	-	-	-	-	-
March	4	68	285	183	180	0	0
April	0	-	-	-	-	-	-
May	6	39	280	85	105	0	0
June	4	25	220	115	119	0	0
July	0	-	-	-	-	-	-
August	6	95	5,400	145	1,351	2	33
September	6	10	680	50	184	1	17
October	4	36	105	54	62	0	0
November	6	16	140	133	104	0	0
December	4	20	205	69	91	0	0

Table 5.3b. Summary Statistics of Fecal Coliform Data for All Stations in McKay Creek Tidal (WBID 1633) by Season during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	4	68	285	183	180	0	0
Quarter 2	10	25	280	93	110	0	0
Quarter 3	12	10	5,400	130	768	3	25
Quarter 4	14	16	205	82	88	0	0

McKay Creek (WBID 1633B)

Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2004-2011). Fecal coliform exceedances were observed in the McKay Creek basin in all months, with the highest monthly average fecal coliform concentration observed in August (2,604 counts/100mL) and the highest exceedance rate observed in November (80%). Elevated fecal coliform concentrations and exceedance rates greater than 40% were observed during all quarters. The highest quarterly exceedance rate was observed during the second quarter (59%) and highest quarterly average fecal coliform concentration was observed during the third quarter (2,287 counts/100mL), both quarters are the rainy and warmer seasons. **Tables 5.3c** and **5.3d** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3c. Summary Statistics of Fecal Coliform Data for All Stations in McKay Creek (WBID 1633B) by Month during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

This is an eight-column table. Column 1 lists the month, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100mL.
- = No data

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	8	7	3300	57	654	3	38
February	12	1	1,800	53.5	393	5	42
March	12	3	4,900	450	809	6	50
April	5	31	4,800	460	1,324	3	60
May	6	5	3,700	770	1,458	3	50
June	9	7	7,500	1200	2,164	6	67
July	5	2	5,100	2400	2,370	3	60
August	10	11	13,000	268.5	2,604	5	50
September	11	13	7,500	760	1,962	6	55
October	7	1	2,000	200	622	2	29
November	5	100	4,500	930	1,786	4	80
December	10	9	1,200	141	357	3	30

Table 5.3d. Summary Statistics of Fecal Coliform Data for All Stations in McKay Creek (WBID 1633B) by Season during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

This is an eight-column table. Column 1 lists the season, Column 2 lists the number of samples, Column 3 lists the minimum coliform count/100mL, Column 4 lists the maximum count, Column 5 lists the median count, Column 6 lists the mean count, Column 7 lists the number of exceedances, and Column 8 lists the percent exceedances.

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	32	1	4,900	60.5	614	14	43
Quarter 2	20	5	7,500	710	1,742	12	59
Quarter 3	26	2	13,000	620	2,287	14	55
Quarter 4	22	1	4,500	215	766	9	46

Using rainfall data collected at the SWFWMD rainfall gauge station (ID 22897) available on the Water Management Information System data warehouse (available: http://www18.swfwmd.state.fl.us/ResData/Search/ExtDefault.aspx), it was possible to compare monthly rainfall with monthly fecal coliform exceedance rates, as well as average quarterly rainfall with average quarterly fecal coliform exceedance rates at all stations (**Figures 5.3a** to **5.3d**). To calculate the monthly average rainfall for WBIDs 1633 and 1633B over the Cycle 2 verified period years, rainfall totals for each month were calculated by summing daily values, and then averaged over the period of observation years (2004 - 2011).

The impact of rainfall on monthly and quarterly exceedances in WBID 1633 is distinct. During the Cycle 2 verified period, monthly exceedance rates followed the monthly rainfall pattern very closely (**Figure 5.3a**). A similar exceedance rate and rainfall relationship was also observed for quarterly data (**Figure 5.3b**). The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 1663 high rainfall serves to negatively impact water quality in the basin.

In comparison, the impact of rainfall on monthly and quarterly exceedances in WBID 1633B is inconclusive. During the Cycle 2 verified period, monthly exceedance rates occurred independently of rainfall, and exceedances were recorded during lower and higher rainfall periods (**Figure 5.3a** and **Figure 5.3b**).

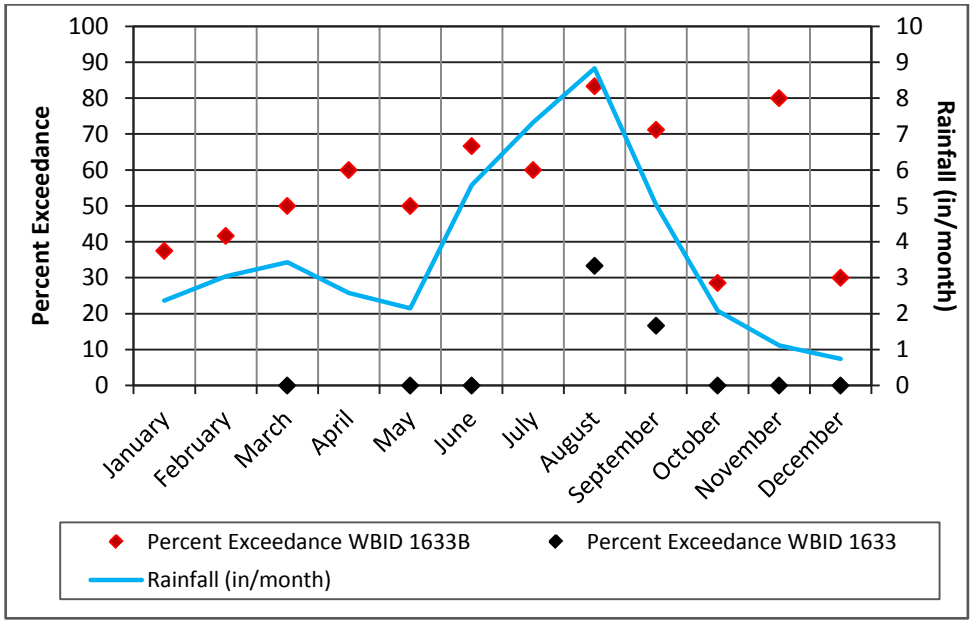

Figure 5.3a. Fecal Coliform Exceedances and Rainfall at All Stations in WBIDs 1633 and 1633B by Month during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

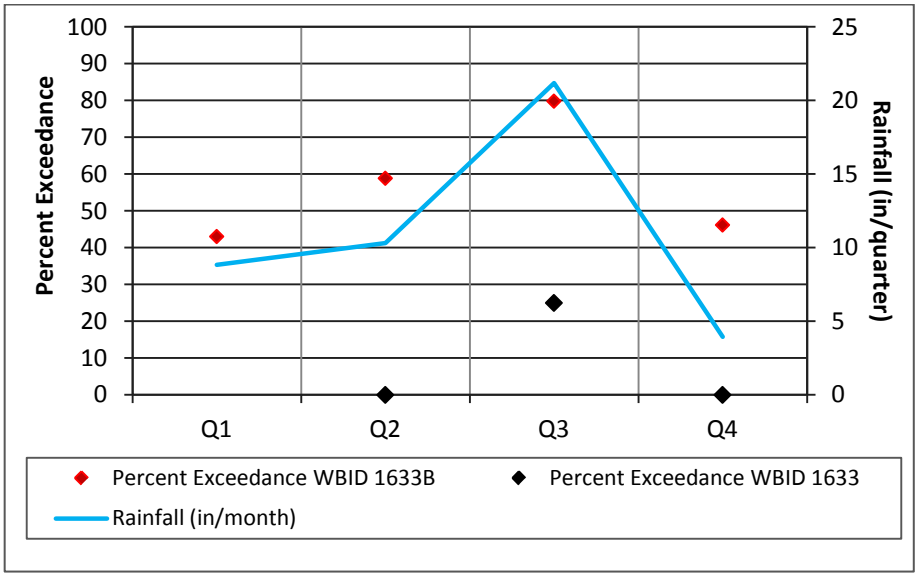

Figure 5.3b. Fecal Coliform Exceedances and Rainfall at All Stations in WBIDs 1633 and 1633B by Season during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

PERIOD OF RECORD TREND

A plot of historical fecal coliform data against time revealed a significant (Prob > 0.05) decreasing trend for the entire period of record (1991-2010) in McKay Creek Tidal (WBID 1633) (**Figure 5.4a**), and a significant (Prob > 0.05) increasing trend for the entire period of record in McKay Creek (WBID 1633B) (1991-2011) (**Figure 5.4b**). The significant decreasing trend observed in WBID 1633 does not eliminate the need for implementing steps to further reduce fecal coliform levels in the McKay Creek watershed.

The SWFWMD has been working with Pinellas County and the City of Largo on watershed management and stormwater improvement projects aimed at water quality and flood control in the McKay Creek watershed. These projects, located within WBIDs 1633 and 1633B, should improve the water quality of runoff and potentially reduce fecal coliform concentrations in McKay Creek. However, fecal coliform concentrations that exceed the state criteria are frequently recorded in WBID 1633B. Many of these samples are collected during periods of small or no rainfall, indicating that exceeding concentrations may not be a consequence of stormwater discharges, but due to other local sources (**Table 5.6b** and **Figure 5.7**).

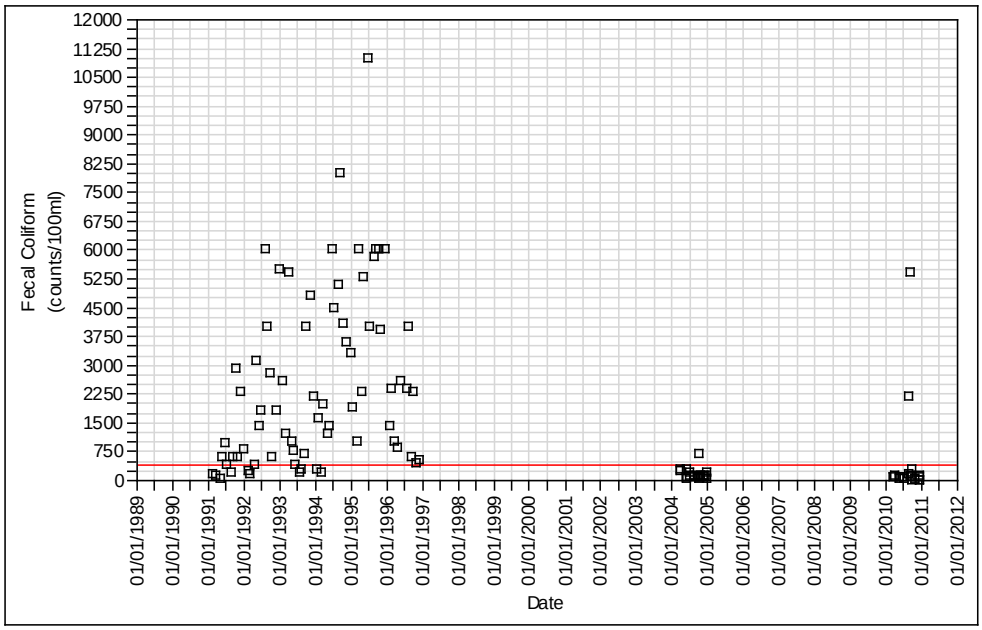

Figure 5.4a. Fecal Coliform Concentration Trends at McKay Creek Tidal (WBID 1633) for the Entire Period of Record (1991-2010)

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

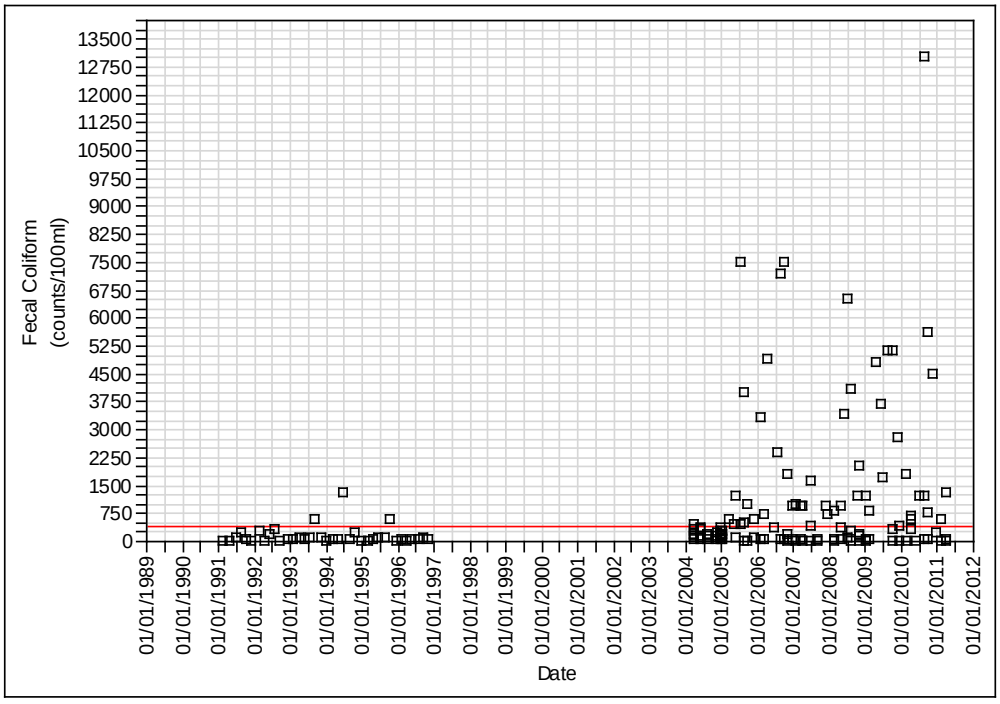

Figure 5.4b. Fecal Coliform Concentration Trends at McKay Creek (WBID 1633B) for the Entire Period of Record (1991-2011)

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

Spatial Patterns

Fecal coliform data from the Cycle 2 verified period (January 1, 2004–June 30, 2011) were analyzed to detect spatial trends (**Figures 5.5a** to **5.5b**). Stations are displayed from upstream to downstream (left to right). **Figure 5.6** shows the spatial distribution of the principal land uses and the locations of the water quality stations within each WBID.

McKay Creek Tidal (WBID 1633)

Fecal coliform concentrations that exceeded the State criteria where observed in two of the three sampling stations within the WBID (**Figure 5.5a**). The highest exceedance rate was recorded at Station 21FLTPA 275356708249530 (11%). Station 21FLTPA 27541328249207, which had the highest number of samples (n=20), had an exceedance rate of 10% and the highest fecal coliform concentration recorded in the WBID (5,400 counts/100mL). Samples at two of the three stations exceeded the single sample maximum criterion of 800 counts/100mL (**Table 5.4a**).

All sampling stations are located on the main channel of McKay Creek. Land use surrounding all stations in the WBID is predominantly classified as high density residential.

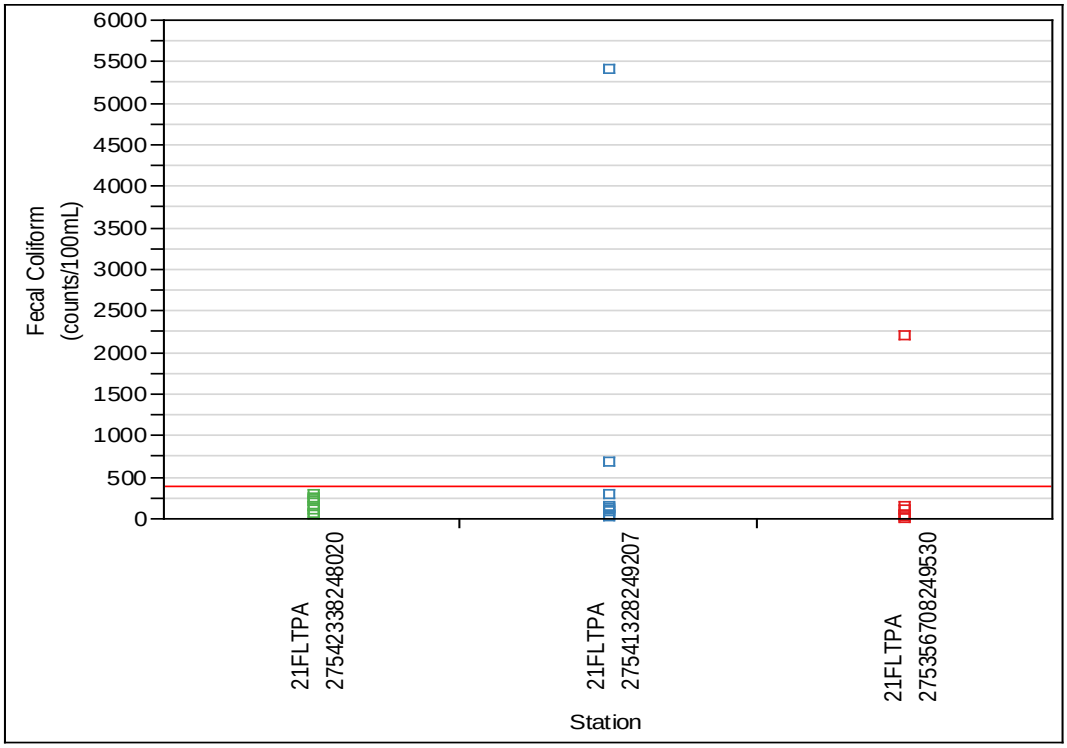

Figure 5.5a. Spatial Fecal Coliform Concentration Trends in McKay Creek Tidal (WBID 1633) by Station during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

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

Table 5.4a. Station Summary Statistics of Fecal Coliform Data for McKay Creek Tidal (WBID 1633) during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

This is an nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count/100mL, Column 5 liststhe maximum, Column 6 lists the median count, Column 7mean count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLTPA 275356708249530	2010	9	10	2,200	36	288	1	11
21FLTPA 27541328249207	2004 and 2010	20	25	5,400	96.5	402	2	10
21FLTPA 27542338248020	2004	11	35	280	135	148	0	0

McKay Creek (WBID 1633B)

Fecal coliform concentrations that exceeded the State criteria where observed in two of the four sampling stations within the WBID (**Figure 5.5b**). The highest exceedance rate and the highest fecal coliform concentration in the WBID were recorded at Station 21FLPDEM27-09 (96% and 13,000 counts/100mL, respectively). Samples at two of the four stations exceeded the single sample maximum criterion of 800 counts/100mL (**Table 5.4b**).

Residential areas are located within the proximity of all sampling stations in the WBID, with Station 21FLPDEM27-09 predominantly surrounded by land classified as high-density residential. All other stations in the WBID are surrounded by natural, undeveloped land.

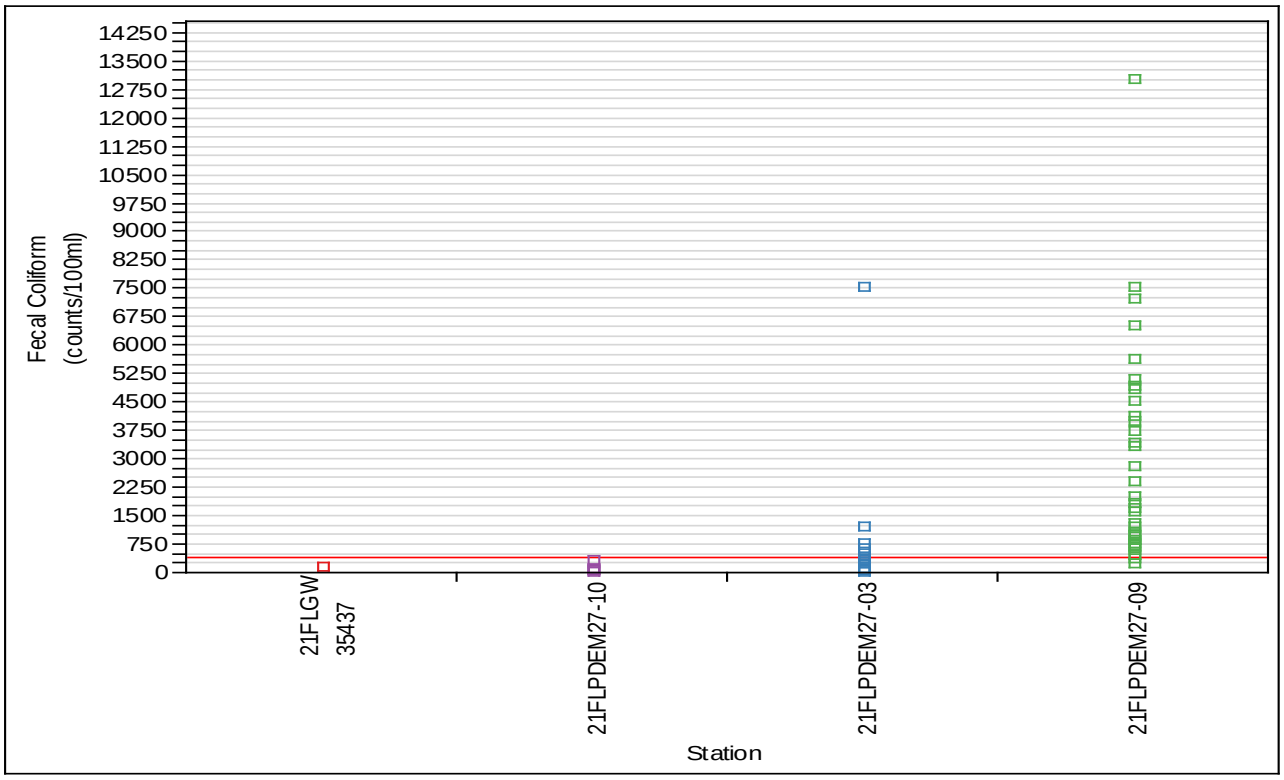

Figure 5.5b. Spatial Fecal Coliform Concentration Trends in McKay Creek (WBID 1633B) by Station during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

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

Table 5.4b. Station Summary Statistics of Fecal Coliform Data for McKay Creek (WBID 1633B) during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011)

This is an nine-column table. Column 1 lists the station, Column 2 lists the period of observation, Column 3 lists the number of samples, Column 4 lists the minimum count, Column 5 lists the maximum count/100mL, Column 6 lists the median count, Column 7 lists the mean count, Column 8 lists the number of exceedances, and Column 9 lists the percent exceedances.

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLGW 35437	2008	1	150	150	150	150	0	0
21FLPDEM27-03	2005-2011	27	3	7,500	110	508	6	22
21FLPDEM27-09	2005-2011	45	230	13,000	1,300	2,580	43	96
21FLPDEM27-10	2005-2011	27	1	300	13	31	0	0

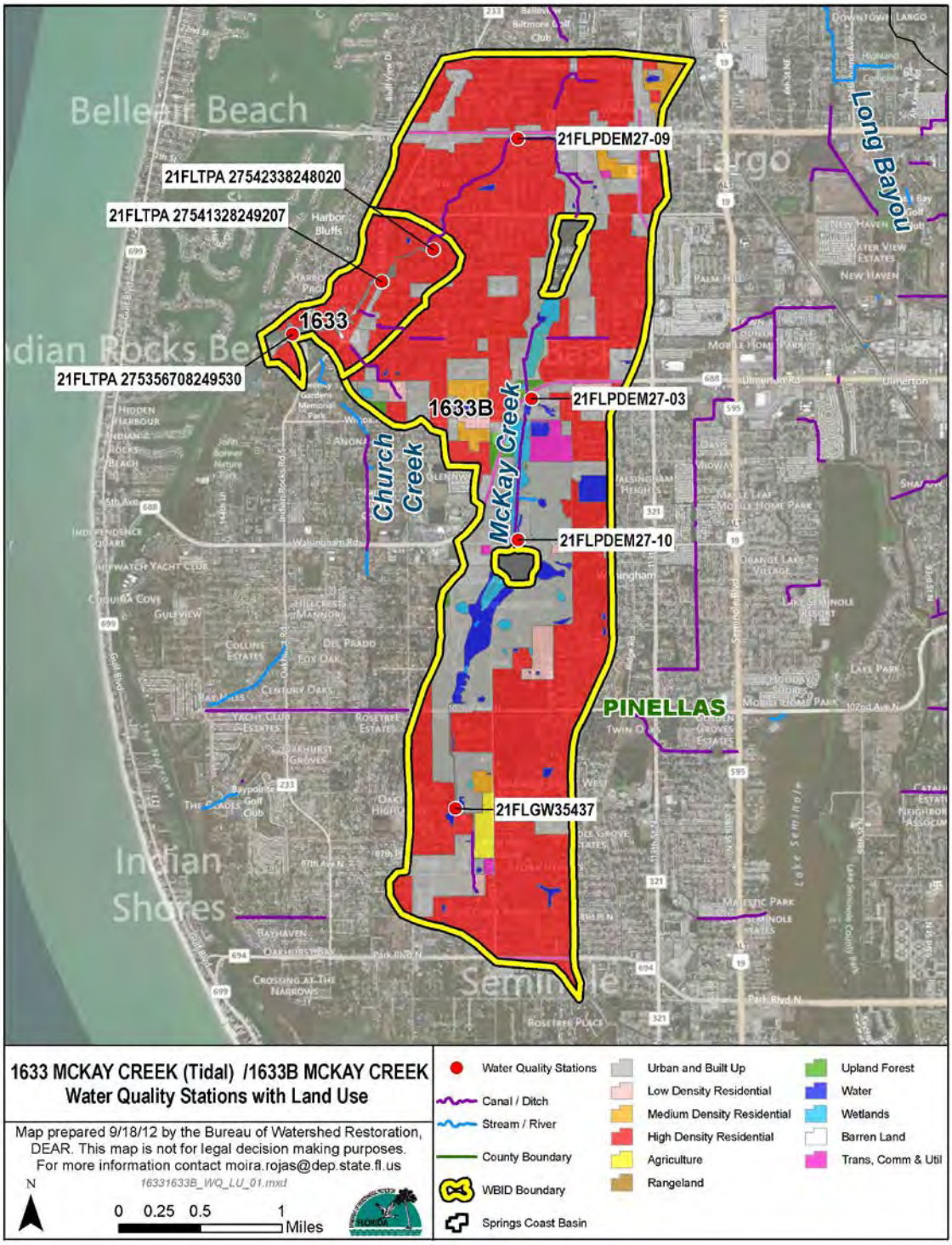

Figure 5.6. Principal Land Uses and Location of IWR Water Quality Stations with Fecal Coliform Data in WBIDs 1633 and 1633B

5.1.2 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, the fecal coliform contribution of wildlife with direct access to the receiving water can be more noticeable by contributing to exceedances during dry weather. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

Hydrologic conditions were analyzed using rainfall. A flow duration curve–type chart that would normally be applied to flow events was created using precipitation data from the SWFWMD rainfall gauge station (ID 22897). The chart was divided in the same manner as if flow were being analyzed, where extreme precipitation events represent the upper percentiles (0–5th percentile), followed by large precipitation events (5th–10th percentile), medium precipitation events (10th–40th percentile), small precipitation events (40th–60th percentile), and no recordable precipitation events (60th–100th percentile). Event precipitation ranges for both WBIDs were derived based on these percentile ranges and are presented in **Table 5.5**. Three-day (the day of and 2 days prior to sampling) precipitation accumulations were used in the analysis (**Tables 5.6a** and **5.6b** and **Figure 5.7a**).

Table 5.5. Precipitation Event Ranges for Rainfall Data for WBIDs 1633 and 1633B

This is a seven-column table. Column 1 lists WBID, Column 2 lists rainfall periods of records, Columns 3- 6 list the event range (in in/3-Day).

WBID	Rainfall Period of Record	Precipitation Event				
		Extreme	Large	Medium	Small	None/Not Measurable
1633	1977-2012	>1.87"	1.18" - 1.87"	0.05" - 1.18"	0.01" - 0.05"	<0.01"
1633B	1977-2012	>1.87"	1.18" - 1.87"	0.05" - 1.18"	0.01" - 0.05"	<0.01"

Mckay Creek Tidal (WBID 1633)

Historical data show that fecal coliform exceedances occurred only during medium precipitation events. The percentage of exceedances after periods of medium precipitation was 18%. **Table 5.6a** and **Figure 5.7** show fecal coliform data by hydrologic condition.

Table 5.6a. Summary of Fecal Coliform Data for Cycle 2 Verified Period (January 1, 2004 through June 30, 2011) by Hydrologic Condition for McKay Creek Tidal (WBID 1633)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Colum 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>1.87"	4	0	0%	4	100%
Large	1.18" - 1.87"	2	0	0%	2	100%
Medium	0.05" - 1.18"	17	3	18%	14	82%
Small	0.01" - 0.05"	4	0	0%	4	100%
None/ Not Measurable	<0.01"	13	0	0%	13	100%

McKay Creek (WBID 1633B)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions during which samples were collected (no samples were collected during large precipitation events). The highest percentage of exceedances occurred after periods of extreme precipitation (55%) and the lowest percentage of exceedances occurred after periods of small precipitation (40%). A relatively high percentage of exceedances occurred after periods of "none" or "not-measurable" precipitation (47.6%).

Given that exceedance rates and exceeding concentrations followed all of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels fecal coliform bacteria within the McKay Creek WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. Exceedance rates of 40% and greater occurred after all sampled precipitation events indicating nonpoint sources (that are rainfall dependent) and local sources (that are rainfall independent) are major contributing factors to elevated fecal coliform concentrations. **Table 5.6b** and **Figure 5.7** show fecal coliform data by hydrologic condition.

As fecal coliform exceedances occurred in all the of the sampled precipitation intervals, the target fecal coliform reduction calculated in the following section and shown in **Table 5.7b** is applicable under all rainfall conditions in the McKay Creek watershed.

Table 5.6b. Summary of Fecal Coliform Data for Cycle 2 Verified Period (January 1, 2004 through June 30, 2011) by Hydrologic Condition for McKay Creek (WBID 1633B)

This is a seven-column table. Column 1 lists the type of precipitation event, Column 2 lists the event range (in inches), Colum 3 lists the total number of samples, Column 4 lists the number of exceedances, Column 5 lists the percent exceedances, Column 6 lists the number of nonexceedances, and Column 7 lists the percent nonexceedances.

Precipitation Event	Event Range (in/3-Day)	Total Samples	Number of Exceedances	% Exceedances	Number of Non-exceedances	% Non-exceedances
Extreme	>1.87"	11	6	55%	5	46%
Large	1.18" - 1.87"	0	0	0	0	0
Medium	0.05" - 1.18"	37	19	51%	18	49%
Small	0.01" - 0.05"	10	4	40%	6	60%
None/ Not Measurable	<0.01"	42	20	48%	22	52%

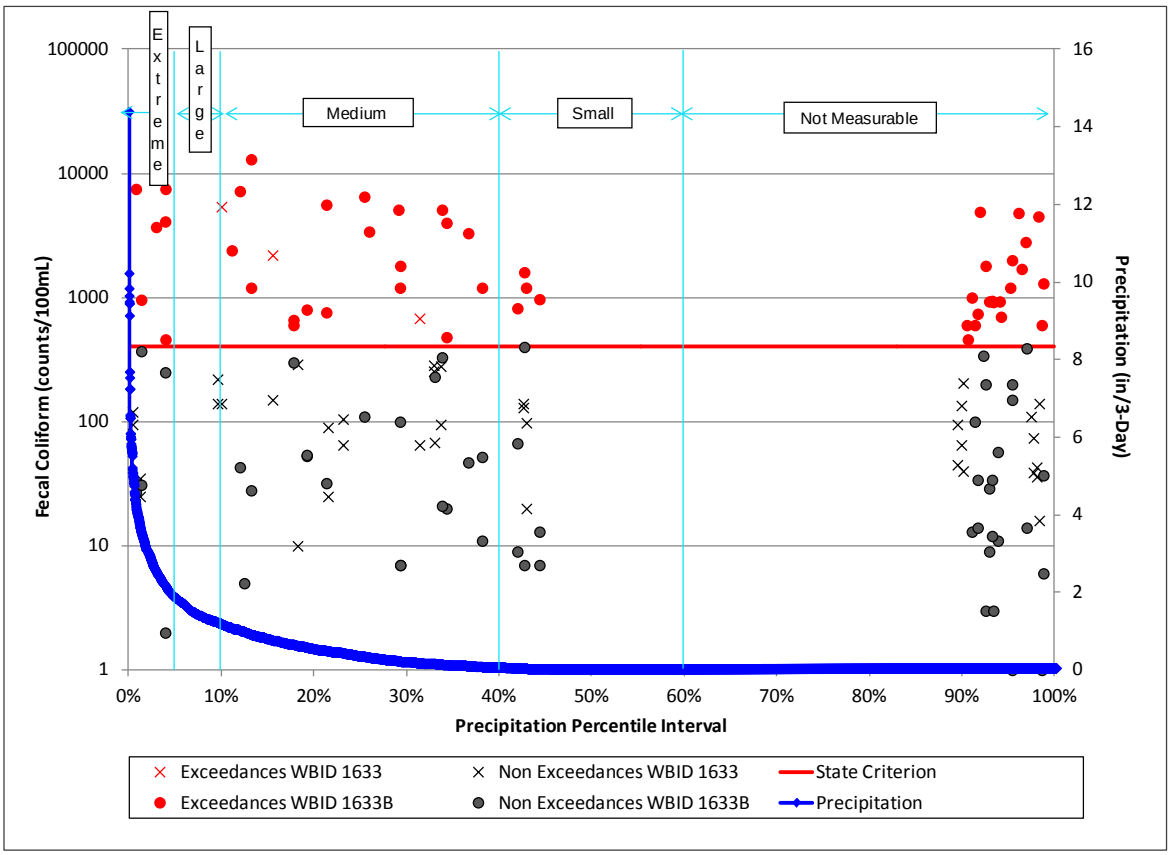

Figure 5.7. Fecal Coliform Data for Cycle 2 Verified Period (January 1, 2004 through June 30, 2011) by Hydrologic Condition for McKay Creek Tidal (WBID 1633) and McKay Creek (WBID 1633B)

5.1.3 TMDL Development Process

A simple reduction calculation was performed to determine the reduction in fecal coliform concentration necessary to achieve the concentration target (400 counts/100mL). The percent reduction needed to reduce the pollutant load was calculated by comparing the existing concentrations and target concentration using **Formula 1**:

$$\text{Needed \% Reduction} = \frac{\text{Existing } 90^{th} \text{ Percentile Concentration} - \text{Allowable Concentration}}{\text{Existing } 90^{th} \text{ Percentile Concentration}} \times 100 \quad \textbf{Formula 1}$$

Using the Hazen method for estimating percentiles, as described in Hunter (2002), the existing condition concentration was defined as the 90th percentile of all the fecal coliform data collected during the Cycle 2 verified period (January 1, 2004, to June 30, 2011). The 90th percentile is also called the 10 percent exceedance event. This will result in a target condition that is consistent with the state bacteriological water quality assessment threshold for Class III waters.

In applying this method, all of the available data are ranked (ordered) from the lowest to the highest (**Tables 5.7a** and **5.7b**), and **Formula 2** is used to determine the percentile value of each data point.

$$\text{Percentile} = \frac{\text{Rank} - 0.5}{\text{Total Number of Samples Collected}} \quad \textbf{Formula 2}$$

If none of the ranked values is shown to be the 90th percentile value, then the 90th percentile number (used to represent the existing condition concentration) is calculated by interpolating between the two data points adjacent (above and below) to the desired 90th percentile rank using **Formula 3,** as described below.

$$90^{\text{th}} \text{ Percentile Concentration} = C_{\text{lower}} + (P_{90\text{th}} * R) \quad \textbf{Formula 3}$$

Where:

- *C_{lower} is the fecal coliform concentration corresponding to the percentile lower than the 90th percentile*
- *P_{90th} is the percentile difference between the 90th percentile and the percentile number immediately lower than the 90th percentile*
- *R is a ratio defined as R = (fecal coliform concentration $_{upper}$ – fecal coliform concentration $_{lower)}$ / (percentile $_{upper}$ – percentile $_{lower}$).*

To calculate *R*, the percentile values below and above the 90th percentile are identified. Next, the fecal coliform concentrations corresponding to the lower and upper percentile values are identified. The fecal coliform concentration difference between the lower and higher percentiles is then calculated and divided by the unit percentile. The unit percentile difference is the

difference between the lower and upper percentiles. R is then calculated as R = (fecal coliform concentration $_{upper}$ – fecal coliform concentration $_{lower)}$ / (percentile $_{upper}$ – percentile $_{lower}$).

The C_{lower}, P_{90th}, and R, were substituted into **Formula 3** to calculate the 90th percentile fecal coliform concentration.

Tables 5.7a and **5.7b** show the individual fecal coliform data, the ranks, the percentiles for each individual data, the existing 90th percentile concentration, the allowable concentration (400 counts/100mL), and the percent reduction needed to meet the applicable water quality criterion for fecal coliform.

Based on the available Cycle 2 data for the McKay Creek Tidal (WBID 1633), using **Formula 1**, the 90th percentile concentration (288 counts/100mL) was determined to be below the 400 counts/100mL target concentration (**Table 5.7a**); as a result, no reduction is required for this WBID. It is anticipated that if the percent reduction for the freshwater segment of the system (WBID 1633B) is met, the entire McKay Creek system should be restored to meet its applicable water quality criterion for fecal coliform.

Using **Formula 1**, the percent reduction for the period of observation (January 1, 2004, to June 30, 2011) was calculated as 91 percent for McKay Creek (WBID 1633B) (i.e., % reduction needed = [(4,500 – 400) / 4,500]*100 = 91%) (**Table 5.7b**).

Table 5.7a. Calculation of Fecal Coliform Reductions for McKay Creek Tidal (WBID 1633) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the station, Column 2 lists the sampling date, Column 3 lists the fecal coliform concentration (counts/100mL), Column 4 lists the rank of fecal coliform concentration, and Column 5 lists the percentile of the fecal concentration distribution.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLTPA 275356708249530	9/7/2010	10	1	1%
21FLTPA 275356708249530	11/22/2010	16	2	4%
21FLTPA 275356708249530	12/7/2010	20	3	6%
21FLTPA 27541328249207	9/28/2004	25	4	9%
21FLTPA 275356708249530	6/21/2010	25	4	9%
21FLTPA 27542338248020	9/28/2004	35	6	14%
21FLTPA 275356708249530	10/11/2010	36	7	16%
21FLTPA 275356708249530	5/10/2010	39	8	19%
21FLTPA 27541328249207	12/14/2004	40	9	21%
21FLTPA 27541328249207	10/11/2010	43	10	24%
21FLTPA 27541328249207	5/25/2004	45	11	26%
21FLTPA 27541328249207	10/12/2004	65	12	29%
21FLTPA 27541328249207	11/3/2004	65	12	29%
21FLTPA 27542338248020	9/21/2004	65	12	29%
21FLTPA 27541328249207	3/1/2010	68	15	36%
21FLTPA 27541328249207	5/10/2010	74	16	39%
21FLTPA 27541328249207	6/21/2010	90	17	41%
21FLTPA 27541328249207	5/18/2004	95	18	44%
21FLTPA 27542338248020	5/25/2004	95	18	44%
21FLTPA 27542338248020	8/3/2004	95	18	44%
21FLTPA 27541328249207	12/7/2010	98	21	51%
21FLTPA 27542338248020	10/12/2004	105	22	54%
21FLTPA 275356708249530	3/16/2010	110	23	56%
21FLTPA 27541328249207	8/3/2004	120	24	59%
21FLTPA 27541328249207	11/30/2004	130	25	61%
21FLTPA 27542338248020	11/3/2004	135	26	64%
21FLTPA 27541328249207	6/15/2004	140	27	66%
21FLTPA 27542338248020	11/30/2004	140	27	66%
21FLTPA 27541328249207	11/22/2010	140	27	66%
21FLTPA 275356708249530	8/30/2010	140	27	66%
21FLTPA 27541328249207	8/10/2010	150	31	76%
21FLTPA 27542338248020	12/14/2004	205	32	79%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLTPA 27542338248020	6/15/2004	220	33	81%
21FLTPA 27542338248020	3/15/2004	255	34	84%
21FLTPA 27542338248020	5/18/2004	280	35	86%
21FLTPA 27541328249207	**3/15/2004**	**285**	**36**	**89%**
21FLTPA 27541328249207	**9/7/2010**	**290**	**37**	**91%**
21FLTPA 27541328249207	9/21/2004	680	38	94%
21FLTPA 275356708249530	8/10/2010	2200	39	96%
21FLTPA 27541328249207	8/30/2010	5400	40	99%
-	-	-	Existing condition concentration–90th percentile (counts/100mL)	288
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	No reduction required

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.7b. Calculation of Fecal Coliform Reductions for McKay Creek (WBID 1633B) TMDL Based on the Hazen Method

This is a five-column table. Column 1 lists the station, Column 2 lists the sampling date, Column 3 lists the fecal coliform concentration (counts/100mL), Column 4 lists the rank of fecal coliform concentration, and Column 5 lists the percentile of fecal concentration distribution.

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPDEM27-10	10/21/2008	1	1	1%
21FLPDEM27-10	2/2/2011	1	2	2%
21FLPDEM27-10	7/31/2008	2	3	3%
21FLPDEM27-03	3/28/2007	3	4	4%
21FLPDEM27-10	10/11/2006	3	5	5%
21FLPDEM27-10	5/17/2010	5	6	6%
21FLPDEM27-10	3/22/2011	6	7	7%
21FLPDEM27-03	1/11/2007	7	8	8%
21FLPDEM27-03	2/10/2010	7	9	9%
21FLPDEM27-10	6/19/2007	7	10	10%
21FLPDEM27-10	2/10/2010	7	11	11%
21FLPDEM27-10	12/11/2006	9	12	12%
21FLPDEM27-10	1/29/2008	9	13	13%
21FLPDEM27-03	12/16/2008	11	14	14%
21FLPDEM27-10	8/21/2007	11	15	15%
21FLPDEM27-10	3/7/2007	12	16	16%
21FLPDEM27-10	9/13/2005	13	17	17%
21FLPDEM27-10	1/11/2007	13	18	18%
21FLPDEM27-03	2/21/2006	14	19	19%
21FLPDEM27-10	12/3/2009	14	20	20%
21FLPDEM27-10	8/10/2005	20	21	21%
21FLPDEM27-10	9/23/2009	21	22	22%
21FLPDEM27-10	9/20/2006	27	23	23%
21FLPDEM27-10	8/11/2010	28	24	24%
21FLPDEM27-03	12/11/2006	29	25	25%
21FLPDEM27-10	4/7/2008	31	26	26%
21FLPDEM27-10	9/8/2010	32	27	27%
21FLPDEM27-03	3/7/2007	34	28	28%
21FLPDEM27-10	2/21/2006	34	29	29%
21FLPDEM27-03	3/22/2011	37	30	30%
21FLPDEM27-10	8/16/2006	43	31	31%
21FLPDEM27-03	1/18/2006	47	32	32%
21FLPDEM27-10	12/16/2008	52	33	33%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPDEM27-10	2/4/2009	53	34	34%
21FLPDEM27-03	2/4/2009	54	35	35%
21FLPDEM27-03	8/21/2007	57	36	36%
21FLPDEM27-03	1/29/2008	67	37	37%
21FLPDEM27-03	11/14/2005	100	38	38%
21FLPDEM27-10	5/16/2005	100	39	39%
21FLPDEM27-03	6/24/2008	110	40	40%
21FLGW 35437	10/21/2008	150	41	41%
21FLPDEM27-03	10/11/2006	200	42	42%
21FLPDEM27-03	10/21/2008	200	43	43%
21FLPDEM27-09	12/13/2010	230	44	44%
21FLPDEM27-03	7/31/2008	250	45	45%
21FLPDEM27-10	3/23/2010	300	46	46%
21FLPDEM27-03	9/23/2009	330	47	47%
21FLPDEM27-09	5/30/2006	340	48	48%
21FLPDEM27-03	4/7/2008	370	49	49%
21FLPDEM27-03	12/3/2009	390	50	50%
21FLPDEM27-03	6/19/2007	400	51	51%
21FLPDEM27-03	6/28/2005	460	52	52%
21FLPDEM27-09	4/19/2005	460	53	53%
21FLPDEM27-03	8/10/2005	480	54	54%
21FLPDEM27-03	3/23/2010	600	55	55%
21FLPDEM27-09	2/24/2005	600	56	56%
21FLPDEM27-09	11/14/2005	600	57	57%
21FLPDEM27-09	2/2/2011	600	58	58%
21FLPDEM27-09	3/23/2010	660	59	59%
21FLPDEM27-09	12/3/2007	700	60	60%
21FLPDEM27-09	2/21/2006	740	61	61%
21FLPDEM27-03	9/8/2010	760	62	62%
21FLPDEM27-09	2/4/2009	800	63	63%
21FLPDEM27-09	1/29/2008	820	64	64%
21FLPDEM27-09	3/28/2007	920	65	65%
21FLPDEM27-09	12/11/2006	930	66	66%
21FLPDEM27-09	11/6/2007	930	67	67%
21FLPDEM27-09	3/7/2007	940	68	68%
21FLPDEM27-09	4/7/2008	960	69	69%
21FLPDEM27-09	1/11/2007	970	70	70%
21FLPDEM27-09	9/13/2005	1000	71	71%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPDEM27-03	8/11/2010	1200	72	72%
21FLPDEM27-09	5/16/2005	1200	73	73%
21FLPDEM27-09	9/22/2008	1200	74	74%
21FLPDEM27-09	12/16/2008	1200	75	75%
21FLPDEM27-09	6/14/2010	1200	76	76%
21FLPDEM27-09	3/22/2011	1300	77	77%
21FLPDEM27-09	6/19/2007	1600	78	78%
21FLPDEM27-09	6/17/2009	1700	79	79%
21FLPDEM27-09	10/11/2006	1800	80	80%
21FLPDEM27-09	2/10/2010	1800	81	81%
21FLPDEM27-09	10/21/2008	2000	82	82%
21FLPDEM27-09	7/11/2006	2400	83	83%
21FLPDEM27-09	11/5/2009	2800	84	84%
21FLPDEM27-09	1/18/2006	3300	85	85%
21FLPDEM27-09	5/19/2008	3400	86	86%
21FLPDEM27-09	5/20/2009	3700	87	87%
21FLPDEM27-09	8/10/2005	4000	88	88%
21FLPDEM27-09	7/31/2008	4100	89	89%
21FLPDEM27-09	**11/3/2010**	**4500**	**90**	**90%**
21FLPDEM27-09	4/1/2009	4800	91	91%
21FLPDEM27-09	3/28/2006	4900	92	92%
21FLPDEM27-09	7/27/2009	5100	93	93%
21FLPDEM27-09	9/23/2009	5100	94	94%
21FLPDEM27-09	9/8/2010	5600	95	95%
21FLPDEM27-09	6/24/2008	6500	96	96%
21FLPDEM27-09	8/16/2006	7200	97	97%
21FLPDEM27-03	9/20/2006	7500	98	98%
21FLPDEM27-09	6/28/2005	7500	99	99%
21FLPDEM27-09	8/11/2010	13000	100	100%
-	-	-	Existing condition concentration–90th percentile (counts/100mL)	4,500
-	-	-	Allowable concentration (counts/100mL)	400
-	-	-	Final percent reduction	91

Note: Boldface type indicates concentration used in percent reduction calculations

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:

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

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

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

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

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

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure. The TMDLs for McKay Creek Tidal and McKay Creek are expressed as a percent reduction, and represent the maximum daily fecal coliform load the streams can assimilate without exceeding the fecal coliform criterion (**Table 6.1**).

Based on the available Cycle 2 data for the McKay Creek Tidal (WBID 1633), no reduction is required for this WBID. As a result, no additional regulation requirements will be set for land uses surrounding the marine portion of the McKay Creek system. It is anticipated that if the percent reduction for the freshwater segment of the system (WBID 1633B) is met, the entire McKay Creek system should be restored to meet its applicable water quality criterion for fecal coliform.

6.2 Load Allocation

Based on a percent reduction approach, the LA for percent reduction in fecal coliform from nonpoint sources for each WBID is presented in **Table 6.1**. 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

There are no NPDES-permitted wastewater facilities in either the McKay Creek Tidal or McKay Creek watersheds.

It should be noted that the state requires all NPDES-permitted wastewater 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 future point sources that may discharge in the WBID 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 percent reduction in current fecal coliform loading for each WBID is presented in **Table 6.1**.

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 not subtracting contributions from natural sources and sediments when the percent reduction was calculated. This makes the estimation of human contribution more stringent and therefore adds to the MOS.

Table 6.1. TMDL Components for Fecal Coliform in WBIDs 1633 and 1633B

This is an eight-column table. Column 1 lists WBID, Column 2 lists waterbody name, Column 3 lists the parameter, Column 4 lists the TMDL target (counts/100mL), Column 5 lists the WLA for wastewater (counts/100mL), Column 6 lists the WLA for NPDES stormwater (percent reduction), Column 7 lists the LA (percent reduction), and Column 8 lists the MOS.

[1] N/A = Not applicable

WBID	Waterbody Name	Parameter	TMDL (counts/100mL)	WLA for Wastewater (counts/100mL)	WLA for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
1633	McKay Creek (Tidal)	Fecal coliform	400	N/A[1]	No reduction required	No reduction required	No reduction required
1633B	McKay Creek	Fecal coliform	400	N/A[1]	91	91	Implicit

Chapter 7: TMDL IMPLEMENTATION

7.1 Basin Management Action Plan

Following the adoption of these TMDLs 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 these 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 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.

Many assessment tools are available to assist local governments and interested stakeholders in this detective work. The tools range from the simple (such as Walk the WBIDs and GIS mapping) to the complex (such as bacteria source tracking). Department staff will provide technical assistance, guidance, and oversight of local efforts to identify and minimize fecal coliform sources of pollution. Based on work in the Lower St Johns River Tributaries and Hillsborough Basins, the Department and local stakeholders have developed a logical process and tools to serve as a foundation for this detective work.

The Department has released a guidance document developed from the Department's experiences in collaborating with local stakeholders during BMAP efforts around the state (http://www.dep.state.fl.us/water/watersheds/docs/fcg_toolkit.pdf). The document provides local stakeholders useful information for identifying sources of fecal coliform bacteria in their watersheds and examples of management actions to address these sources. Tools such as the guidance document will 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 Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40, F.A.C., also requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, 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 Florida Department of Transportation throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES Stormwater Program in 2000.

An important difference between the federal NPDES and the state's stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focus on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 1,000 people. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Estimates of Fecal Coliform Loadings from Potential Sources

The Department provides these estimates for informational purposes only and did not use them to calculate the TMDL. These estimates are intended to give the public a general idea of the relative importance of each source in the waterbody. The estimates were based on the best information available to the Department when the calculation was made. The numbers provided do not represent the actual loadings from the sources.

Pets

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

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

According to the American Pet Products Manufacturers Association (APPMA), about 4 out of 10 U.S. households include at least 1 dog. A single gram of dog feces contains about 2.2 million fecal coliform bacteria (van der Wel, 1995). USA Today reports that studies have shown that about 40 percent of American dog owners do not pick up their dogs' feces (http://www.usatoday.com/news/science/2002-06-07-dog-usat.htm).

A rough estimate of fecal coliform loads from dogs within the WBID boundaries can be made using **Equation B.1**:

Load produced by dogs = # dogs in the WBID*450*0.4*2,200,000 **Equation B.1**

Where:

# of dogs is the estimated dog population within the WBID boundary;
450 is the waste production rate for a dog (grams/animal/day);
0.4 is the percent of dog owners that do not pick up their dog's waste; and
2,200,000 is the fecal coliform counts per gram of dog waste (counts/gram);

Given that the number of dogs within the McKay Creek Tidal and McKay Creek WBID boundaries is unknown, the statistics produced by APPMA were used in this analysis to estimate the possible fecal coliform loads contributed by dogs.

The number of households within the WBID boundaries was estimated in order to estimate the number of dogs within the WBID boundary. The number of households was estimated using information from the Florida Department of Revenue's (DOR) 2010 Cadastral tax parcel and ownership coverage contained in the Department's geographic information system (GIS) library. The final number of households within each WBID boundary was estimated by identifying

residential parcels using DOR's land use codes. The estimated number of households within each of the WBID boundaries is shown in **Table B.1**.

Based on literature (Weiskel et al., 1996), the waste production rate for a dog is 450 grams/animal/day, and the fecal coliform counts per gram of dog waste is 2,200,000 counts/gram (**Table B.1**). Therefore, assuming that 40 percent of dog owners do not pick up their dog's feces, the total waste produced by dogs and left on the land surface in residential areas is approximately 80,928 grams/day in WBID 1633 and 819,432 grams/day in WBID 1633B (**Table B.1**).

Based on **Equation B.1,** the estimated fecal coliform loading from dog waste within the WBID boundaries are presented in **Table B.1**.

It should be noted that these loads only represent the fecal coliform load created in the WBIDs and are not intended to be used to represent a part of the existing loads that reach the receiving waterbody. The fecal coliform loads that eventually reach the receiving waterbody could be significantly less than this value due to attenuation in overland transport.

Table B.1. Values used for the Estimation of Dog Waste Loading within the WBID Boundaries

This is an eight-column table. Column 1 lists the WBID number, Column 2 lists the estimated number of households in each WBID, Column 3 lists the estimated number of dogs in each WBID, Column 4 lists the percent of dog owners who do not pick up dog's waste, Column 5 lists per dog wasteload, Column 6 lists the fecal coliform density, Column 7 lists the waste produced by dogs left on land surface and Column 8 lists the estimated dog waste loading to each WBID.

WBID	Estimated # Households	Estimated # of Dogs	Percent of Dog Owners Who Do Not Pick Up Dog's Waste	Wasteload (grams/ animal-day)	Fecal Coliform Density (counts/gram)	Waste Produced Left on Land Surface (grams/day)	Loading (counts/day)
1633	1,124	450	0.4	450	2,200,000	80,928	1.78E+11
1633B	11,381	4,552	0.4	450	2,200,000	819,432	1.80E+12

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, the physical properties of an aquifer, such as thickness, sediment type (sand, silt, and clay), and location play a large part in determining whether contaminants from the land surface will reach the ground water (USGS, 2010). The risk of contamination is greater for unconfined (water-table) aquifers than for confined aquifers because they usually are nearer to land surface and lack an overlying confining layer to impede the movement of contaminants (USGS, 2010).

Sediment type (sand, silt, and clay) also determines the risk of contamination in a particular watershed. "Porosity, which is the proportion of a volume of rock or soil that consists of open spaces, tells us how much water rock or soil can retain. Permeability is a measure of how easily water can travel through porous soil or bedrock. Soil and loose sediments, such as sand and gravel, are porous and permeable. They can hold a lot of water, and it flows easily through

them. Although clay and shale are porous and can hold a lot of water, the pores in these fine-grained materials are so small that water flows very slowly through them. Clay has a low permeability (USGS, 2010)."

Also, the risk of contamination is increased for areas with a relatively high ground water table. The drain field can be flooded during the rainy season, resulting in ponding and coliform bacteria can pollute the surface water through stormwater runoff. Additionally, in these circumstances, a high water table can result in coliform bacteria pollution reaching the receiving waters through baseflow.

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

A rough estimate of fecal coliform loads from failed septic tanks within the WBID boundaries can be made using **Equation B.2**:

L = 37.85* N * Q * C * F **Equation B.2**

Where:

L is the fecal coliform daily load (counts/day);
N is the number of households using septic tanks in the WBID;
Q is the discharge rate for each septic tank (gallons/day);
C is the fecal coliform concentration for the septic tank discharge (counts/100mL);
F is the septic tank failure rate; and
37.85 is a conversion factor (100mL/gallon).

Based on the estimated total number of households within each WBID and Onsite Sewage Treatment Disposal Systems (OSTDS) data obtained from FDOH (available: http://www.doh.state.fl.us/environment/programs/ehgis/EhGisDownload.htm), the number of housing units *(N)* within each WBID boundary thought to be using septic tanks to treat their domestic wastewater is shown in (**Table B.2**). The location of these housing units is presented in **Figure B.1**.

The discharge rate from each septic tank (*Q*) was calculated by multiplying the average household size by the per capita wastewater production rate per day. Based on the information published by the Census Bureau, the average household size for Pinellas County is about 2.21 people/household. The same population densities were assumed within each WBID boundary. 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 WBID when these TMDLs were developed. Therefore, the failure rate was derived from the number of septic tanks in Pinellas County based on FDOH's septic tank inventory and the number of septic tank repair permits issued in both counties as published by FDOH (available http://www.myfloridaeh.com/ostds/statistics/ostdsstatistics.htm). The cumulative number of

septic tanks in Pinellas County on an annual basis was calculated by subtracting the number of issued septic tank installation permits for each year from the current number of septic tanks in the county based on FDOH's 2010-2011 inventory, assuming that none of the installed septic tanks will be removed after being installed (**Table B.3**). The reported number of septic tank repair permits was also obtained from the FDOH Website.

Based on this information, the annual discovery rates of failed septic tanks were calculated (**Table B.3**). The average annual septic tank failure discovery rate for Pinellas County is approximately 0.67 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 3.34 percent for Pinellas County. **Table B.2** shows the estimated fecal coliform loading from failed septic tanks within each WBID boundary based on **Equation B.2.** This estimated load refers to loading created within the watershed undergoing no attenuation, rather than the loadings eventually reaching the receiving water.

Table B.2. Estimated Number of Households Using Septic Tanks and Estimated Septic Tank Loading within each WBID Boundary

This is a three-column table. Column 1 lists the WBID number, Column 2 lists the number of households with a septic tank, and Column 3 lists the septic tank loading.

WBID	# Households Using Septic Tanks	Septic Tanks (counts/day)
1633	0	0.0E+00
1633B	13	2.5E+09

Table B.3. Estimated Number of Septic Tanks and Septic Tank Failure Rates for Pinellas County (1999–2010)

This is a six-column table. Column 1 lists the year, Columns 2 lists the number of newly installed septic tanks in each year, Column 3 lists the accumulated number of septic tanks, Column 4 lists the number of septic tank repair permits issued, Column 5 lists the failed septic tank discovery rate, and Column 6 lists the final failure rate.

Year	New installation	Accumulated installation	Repair permit	Failure discovery rate (%)	Failure rate (%)
1999	35	23,436	94	0.40	2.01
2000	50	23,471	190	0.81	4.05
2001	57	23,521	185	0.79	3.93
2002	54	23,578	141	0.60	2.99
2003	47	23,632	193	0.82	4.08
2004	43	23,679	168	0.71	3.55
2005	43	23,722	180	0.76	3.79
2006	36	23,765	149	0.63	3.13
2007	34	23,801	150	0.63	3.15
2008	28	23,835	153	0.64	3.21
2009	6	23,863	159	0.67	3.33
2010	9	23,869	137	0.57	2.87
Average	**36.83**	**23,681**	**158**	**0.67**	**3.34**

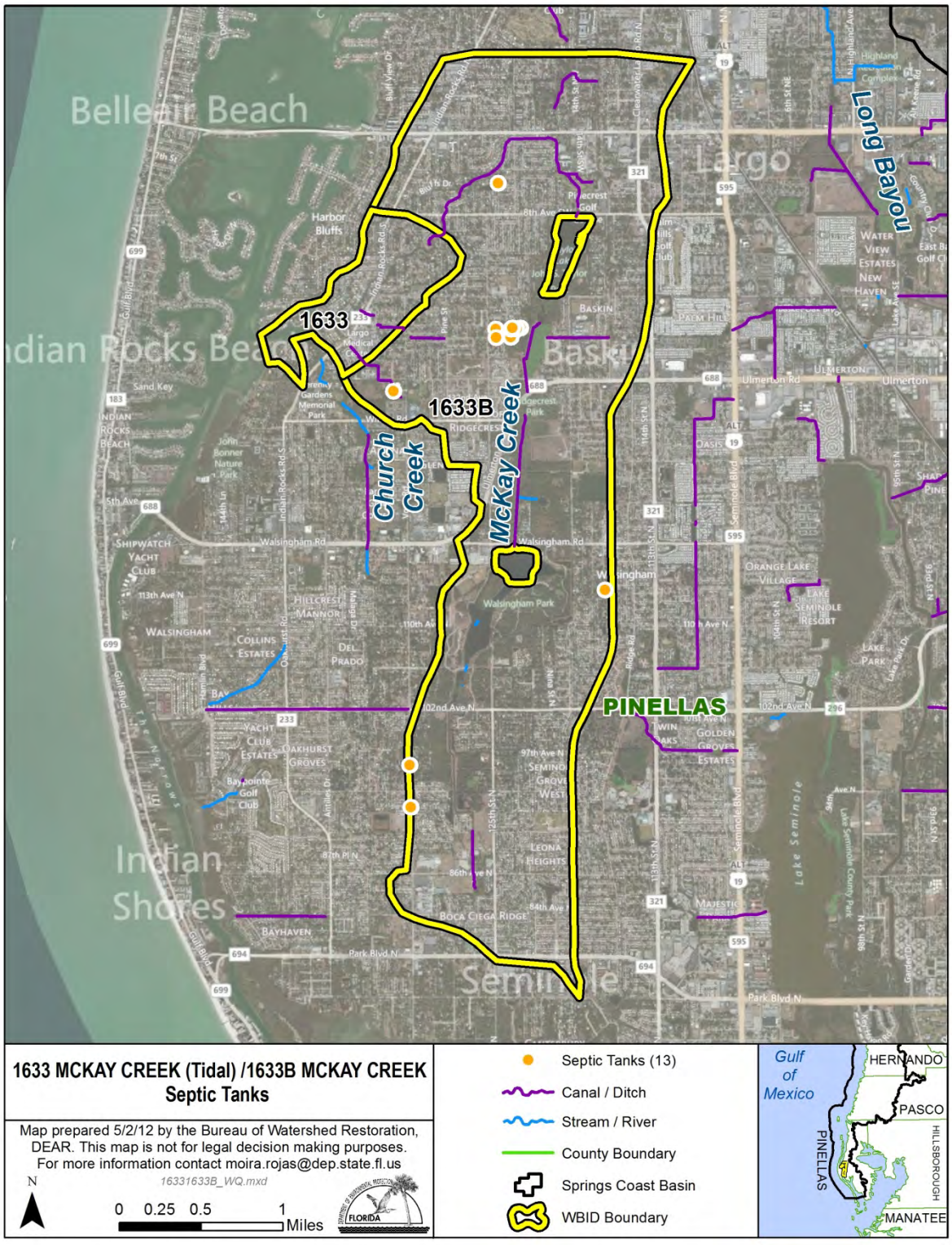

Figure B.1. Location of OSTDS Based on FDOH Data in the Residential Land Use Areas within the McKay Creek Tidal and McKay Creek WBID Boundaries

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. Therefore, in this report, the possible fecal coliform load contributed by sewer line leakage was estimated based on an empirical leakage rate of 0.5 percent of the total raw sewage (Culver et al., 2002) created within the WBIDs by the households connected to the sewer system.

The number of households *(N)* within the McKay Creek Tidal and McKay Creek WBID boundaries served by sewer systems is was estimated by subtracting the estimated number of households in the WBID (**Table B.**1) minus the estimated number of households using septic tanks (**Table B.2**). **Table B.4** shows the estimated number of households *(N)* within each WBID boundary estimated to be served by sewer systems.

Fecal coliform loading from sewer line leakage can be calculated based on the number of people in the watershed, typical per household generation rates, and typical fecal coliform concentrations in domestic sewage, assuming a leakage rate of 0.5 percent (Culver et al., 2002). Based on this assumption, a rough estimate of fecal coliform loads from leaks and SSOs within the WBID boundaries can be made using **Equation B.3.**

L = 37.85* N * Q * C * F **Equation B.3**

Where:

L is the fecal coliform daily load (counts/day);
N is the number of households using sanitary sewer in the WBID;
Q is the discharge rate for each household (gallons/day);
C is the fecal coliform concentration for domestic wastewater (counts/100mL);
F is the sewer line leakage rate; and
37.85 is a conversion factor (100mL/gallon).

The discharge rate through sewers from each household (*Q*) was calculated by multiplying the average household size for Pinellas County (2.21) (U.S. Census Bureau 2010) by the per capita wastewater production rate per day (70 gallons/day/person). The commonly cited concentration (*C*) for domestic wastewater is $1x10^6$ counts/100 mL for fecal coliform (EPA 2001). The contribution of fecal coliform through sewer line leakage was assumed to be 0.5 percent of the total sewage loading created from the population not on septic tanks (Culver *et al.* 2002). Based on **Equation B.3**, the approximate fecal coliform loading from sewer line leakage in each the WBID is summarized in **Table B.4.** This estimated load refers to loading created within the watershed undergoing no attenuation, rather than the loadings eventually reaching the receiving water.

Table B.4. Estimated Number of Households Served by Sanitary Sewers and Estimated Fecal Coliform Loading from Sewer Line Leakage within each WBID Boundary

This is a three-column table. Column 1 lists the WBID number, Column 2 lists the number of households served by sanitary sewers, Column 3 lists the sanitary sewer loading

WBID	# of Households Served by Sanitary Sewers	Sanitary Sewer (counts/day)
1633	1,124	3.3E+10
1633B	11,368	3.3E+11

Wildlife

Wildlife (deer, birds, raccoons) is another possible source of fecal coliform bacteria within the McKay Creek Tidal and McKay Creek WBID boundaries. However, as these represent natural inputs, no reductions are assigned to these sources by this TMDL.

Appendix C: TMDL Public Comments for Fecal Coliform TMDLs

September 27, 2012

Kelli Hammer Levy, Director
Watershed Management Division
Pinellas County Department of Environment and Infrastructure
300 South Garden Avenue
Clearwater, Florida 33756

Re: Comments on the Draft TMDLs for:

- Curlew Creek Freshwater Segment (1538A) – Fecal Coliform
- Pinellas Park Ditch No.1 (Tidal Segment) (1662) – Fecal Coliform
- McKay Creek Tidal (1633) and McKay Creek (1633B) – Fecal Coliform

Dear Ms. Hammer Levy:

Thank you for your comments regarding our recently proposed Total Maximum Daily Load (TMDL) reports for fecal coliform in the Springs Coast basin. The Department appreciates the time and effort you put into reviewing these draft TMDLs. This letter is in response to your comment letter dated July 26, 2012. Below are the comments from Pinellas County and our responses to these comments:

Curlew Creek Freshwater Segment (1538A) Fecal Coliform

1. 1.2 Identification of Waterbody (pg 1): Curlew Creek discharges to Clearwater Harbor.

FDEP Response:

Revisions to the TMDL report have been made.

2. 1.2 Identification of Waterbody (pg 1, paragraph 4): A better description of the waterbody should be included, For example, differentiate between the freshwater and tidal segments. Describe the three tributaries. In Figure 1.2, it appears that two tributaries are included in WBID 1538A and the third is a major named tributary with its own WBID, which should be noted. Verify that the main channel is 13 miles in length, which does not appear to be accurate according to Figure 1.2.

FDEP Response:

Revisions to *Figure 1.2* and the language in *1.2 Identification of Waterbody (pg 1, paragraph 4 and pg 2, paragraph 1)* the TMDL report have been made:

The watershed of Curlew Creek Freshwater Segment is located in the northeast region of Pinellas County and includes parts of the cities of Clearwater and Dunedin (Figure 1.1). The headwaters are located in the southern part of the basin in the cities of Clearwater and Safety Harbor. The main channel of Curlew Creek originates near the intersection of Enterprise Road and Countryside Blvd. and flows in a northwest direction for where it enters into St. Joseph Sound south of Causeway Blvd. There are three tributaries to the major outfall, with the outlet of the creek flowing west into St. Joseph Sound (Figure 1.2). A major tributary to Curlew Creek is Jerry Branch, which receives drainage from Spring Lake and Jerry Lake.

The total length of the main channel (including both the freshwater and marine portions of the channel) is approximately 6 miles. The length of the freshwater portion, within WBID 1538A, is

approximately 3.5 miles. Additional information about the hydrology of this area is available in the *General Hydrology of the Middle Gulf Area, Florida (Report of Investigation No. 56)*, by the US Geological Survey (Cherry et al., 1970).

3. Table 2.1 (pg 7) Include minimum, maximum median, and mean for Cycle 1

FDEP Response:

The requested information has been added to *Table 2.1* in the TMDL report.

*4. Table 2.1 (pg 7): The IWR Run44x database available at http./Ipublicfiles.dep.state.fl. us/dear/IWR/ contains 89 fecal coliform results for WBID1538A, but data for **only** 60 samples are listed. Please explain the discrepancy.*

FDEP Response:

The County is correct, IWR Run 44x does include 89 fecal coliform samples for the Cycle 2 planning (January 1, 1999 through June 30, 2006) and verified periods (January 1, 2004 through June 30, 2011). However, as a result of a TMDL Performance and Project Audit conducted in 2007 in the Southwest District laboratory and field operations, it was determined that data generated prior to September 2007 by the Department's Southwest District in WBID 1538A were unusable for verified list purposes; in the case of this WBID 29, samples did not meet the Department's QA/QC requirements for data usable for verified list purposes. The number listed in Table 2.1 (n=60) corresponds to samples collected after September 2007, which were determined usable for the Cycle 2 assessment of the WBID for verified list purposes.

The numbers presented in Table 2.1 summarize the number of samples, exceedances and non-exceedances observed in WBID 1538A for the Cycle 1 and Cycle 2 verified periods used by the Department's Watershed Assessment Section to assess water quality in the WBID for verified list purposes.

5. Table 4.1 (pg 10): Remove the City of Safety Harbor and add the City of Clearwater to the list of co-permitees in this WBID.

FDEP Response:

Revisions to the TMDL report have been made.

6. 4.2.1 Wastewater Point Sources (pg 9): Include a map showing the location of the Mid- County WWTP discharge to Curlew Creek.

FDEP Response:

Figure 4.1. Location of Mid-County WWTF Discharge and Surface Water Sampling Stations has been added to the TMDL report.

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7. 5.1 Determination of Loading Capacity (pg 14): The final sentence incorrectly references Section 5.1.2. The percent reduction was calculated in section 5.1.3

FDEP Response:

Revisions to the TMDL report have been made.

8. 5.1.1 Data Used in the Determination of the TMDL: The City of Dunedin and Mid-County WWTF data are not available through STORET. Please provide information on the Department's quality assessment for this data. Provide information on field and laboratory methods, qualifiers, and other information so that stakeholders are ensured data are of sufficient quality for use in TMDL determination.

FDEP Response:

Data collected for the City of Dunedin's Surface Water Quality Monitoring Program to assist in compliance with the City's MS4 permit are collected by Applied Sciences Consulting, Inc. Appropriate FDEP Standard Operating Procedures (SOPs) are strictly adhered to during sample collection. Samples are submitted to Advanced Environmental Laboratories, Inc. (AEL), a National Environmental Laboratory Accreditation Conference (NELAC) certified laboratory (DOH #E84589) for analysis. In February 2012, the Department conducted an audit of this facility to verify compliance to the quality control requirements in Chapter 5 of the NELAC Standards, Standard Methods 20th edition, section 9020 (SM9020), Chapter 62-160, Florida Administrative Code (F.A.C.) and continued accreditation with the Florida Department of Health under the National Environmental Laboratory Accreditation Program (NELAP) for fecal coliforms. No major deficiencies were noted during the audit.

Mid-County WWTF data are collected pursuant to requirements of the facility's NPDES permit. Samples collected by the WWTF during the Cycle 2 verified period were also submitted to AEL for analyses.

9. 5.1.1 Data Used in the Determination of the TMDL (pg 14, paragraph 3): There is a typo in the final sentence; change "fin" to "in".

FDEP Response:

Revisions to the TMDL report have been made.

10. 5.1.1 Data Used in the Determination of the TMDL: There are two stations with fecal coliform data in the IWR Run44x database located in WB1D1538A that were not used in calculating the TMDL. These are stations 2IFLTPA 28024988245339 and 21 FLTPA 28024988240542. Please provide an explanation for their exclusion or recalculate TMDL if appropriate.

FDEP Response:

Data from these stations were not included in the original percent reduction calculation due to being excluded from the dataset used during the Verified Period listing assessment as a result of issues associated with data auditing (see response to Comment 4). Including these data into the

percent reduction calculation changes the final percent reduction only from 90% to 87%, which does not represent a significant change. Regardless of whether the percent reduction is 90% or 87%, the general approach to address the fecal impairment will be the same (e.g. local entities will need to walk the WBIDs, identify the sources, etc.). The focus on restoration and implementation of the TMDL should be on meeting the state criterion of 400 counts/100mL to ensure that the receiving water fecal coliform concentrations meet the state water quality criteria.

11. Figure 5.1 (pg 16): Include City of Dunedin and Mid-County WWTF sites in the map. During the Springs Coast TMDL Public Workshop held 7/1 3/2012, the Department indicated that no lat/long information was available for these sites and some sites were assumed to be "co-located". This should be explained in detail in the TMDL document. Also, provide an explanation why exact locations could not be obtained from the data providers. The lack of available key information such as location causes concern that other important information potentially affecting data quality and usability are also unknown.

FDEP Response:

At the time of TMDL development the Department had not yet received lat/long information from the City of Dunedin and therefore, determined the sampling site location using the best information available. Following the public workshop, the Department re-issued a request for this information and received it on 7/26/2012. Lat/Long information for WWTF upstream and downstream sites were provided by the Department's Southwest District on 8/6/2012.

An updated map (*Figure 5.1. Location of Water Quality Stations with Fecal Coliform Data in Curlew Creek Freshwater Segment (WBID 1538A)*) with all sampling stations has been included in the TMDL report.

12. Table 5.2 (pg 17): The table lists the total number of samples for the Cycle 2 Verified Period from the IWR Run44x, City of Dunedin, and Mid-County WWTF as 126. However, there are 85 samples for the sites listed in the IWR database and according to section 5.1.1, 36 samples from the City of Dunedin and 30 samples from Mid-County for a total of 155 samples. Please explain the discrepancy.

FDEP Response:

The number of samples listed in Table 5.2 corresponds to the samples used in the TMDL development process (n=126) (see responses to Comments 4 and 8).

13. Monthly and Seasonal Trends (pg 20): The Tampa International Airport is located several miles away from Curlew Creek. There are two USGS stations with available daily rainfall data in the Curlew Creek WBID and therefore more appropriate for this analysis. These are station 02309425- Curlew Creek at County Road 1 Near Ozona and station 02309415 Curlew Creek at Evan Road Near Dunedin. Summer/wet season storms are typically small and isolated, which can create large rainfall differences over short distances. It is important to use the nearest available rainfall data to ensure the data reflect actual conditions in the WBID.

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FDEP Response:

Revisions to the TMDL report have been made based on rainfall data obtained from USGS station 02309425.

14. Monthly and Season Trends (pg 20): Caution should be used when using this type of analysis to make statements about rainfall and stormwater impacts to fecal coliform data. The data may not lend to these types of conclusions due to the large spatial and temporal scales resulting from the assessment of long term monthly rainfall averages, monthly percent exceedances, and combining station data within a WBID. For a better assessment, stations and sampling events should be analyzed individually using actual rainfall data at the time of sampling rather than monthly averages

FDEP Response:

The Department agrees with the County; stations and sampling events should be analyzed individually. However, the available long-term water quality dataset used for this analysis predominantly came from one station (21FLPDEM10-02) and data from the remaining stations only covered small portions of the period of record (see Figure 5.2). When data from these other stations was available, they appeared to share similar trends with the data collected at station 21FLPDEM10-02. Therefore, for this particular TMDL, aggregating all the data for monthly and seasonal trend analyses is appropriate.

15. Spatial Patterns (pg 22) and Figure 5.6: Where do the Mid-County stations fall in the upstream to downstream order and why are they not displayed in order?

FDEP Response:

Figure 5.6. Spatial Fecal Coliform Concentration Trends in Curlew Creek Freshwater Segment (WBID 1538A) by Station during the Cycle 2 Verified Period (January 1, 2004 through June 30, 2011) in the TMDL report has been revised.

16. Spatial Patterns (pg 22): The 42,000 count/100 ml result at station 7 needs to be verified. This result is 4 times higher than fecal coliform counts associated with raw sewage. It is unlikely the creek experienced fecal coliform counts at this extreme high, unless an active sanitary sewage overflow or other abnormal event was being sampled during special monitoring, which would not reflect ambient conditions in the creek, therefore should not be included in the TMDL determination. No station location information was provided and no quality assurance information for this data has been made available. This data should not be included in the TMDL determination. The presence of this data point in the dataset for TMDL determination lends to questioning the validity of other data obtained from the City of Dunedin and Mid-County facility and quality assurance measures taken in collecting and reporting the data. Assurance needs to be provided that a thorough TMDL usability analysis was made, data was collected and reported following Chapter 62-160 F.A.C., and that the monitoring objectives were appropriate for TMDL determination.

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FDEP Response:

Data were collected at Site 7 as part of the City of Dunedin's Surface Water Quality Monitoring Program to assist in compliance with the City's MS4 permit are collected by Applied Sciences

Consulting, Inc. appropriate FDEP Standard Operating Procedures (SOPs) are strictly adhered to during sample collection. Samples are submitted to Advanced Environmental Laboratories, Inc. (AEL), a National Environmental Laboratory Accreditation Conference (NELAC) certified laboratory (DOH #E84589) for analyses. See response to Comment 8 for more detailed information.

The sampling report provided by the City of Dunedin to the Department for the 2011-2012 Surface Water Quality Monitoring Program, did not include any data qualifier associated with the 42,000 counts/100mL collected on 6/23/2011 at Site 7. The only observation included in the report referred to low flow observed at the sampling site on the sampling date. The Department does not have any evidence that this particular data point is invalid. It would be appreciated if the County could provide the Department with any available information related to the sampling date (e.g. whether an active sanitary sewage overflow or other abnormal event was being sampled during special monitoring).

17. Spatial Patterns, Figure 5.7: Include City of Dunedin and Mid-County sites on the map.

FDEP Response:

Figure 5.7 Principal Land Uses and Location of the IWR Water Quality Stations with Fecal Coliform Data in WBID 1538A in the TMDL report has been revised.

18. 5.1.2. Critical Condition (pg 25): See previous comment about rainfall data station.

FDEP Response:

See response to Comment 13.

19. 5.1.2. Critical Condition (pg 25): Discharge data for Curlew Creek is available at USGS site 02309425 Curlew Creek at County Road 1 Near Ozona and station 02309415 Curlew Creek at Evan Road Near Dunedin. Discharge data is more appropriate than rainfall in analyzing hydrologic conditions.

FDEP Response:

Revisions to the TMDL report have been made. Hydrologic conditions for WBID 1538A were analyzed using discharge data. A flow duration curve–type chart applied to flow events was created using discharge data from the USGS station (02309425).

20. Table 5.6 (pg 29): The qualified data points in Table 3 should be removed and the TMDL recalculated due to insufficient data quality. The sample from 6/11/2007 failed quality control criteria. The 2,600 MPN/100mL sample from 9/22/2008 was analyzed 36 hours past the 6 hour holding time, the 5,500 MPN/100ml sample from 9/22/2008 was analyzed 47 hours past holding time, and the sample from

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10/16/2008 was analyzed 42 hours past holding time.

Table 3. Data used in the TMDL determination that failed quality control criteria.

Date	Fecal Coliform (MPN/100m1)	Result Qualifier	Qualifier Definition
6/11/2007	2400	J	Estimated value; value not accurate.
9/22/2008	2,600	Q	Sample held beyond the accepted holding time
9/22/2008	5,500	Q	Sample held beyond the accepted holding time
10/16/2008	3,100	Q	Sample held beyond the accepted holding time.

FDEP Response:

The Department appreciates the County's effort to ensure sufficient data quality. However, removal of these data points from the dataset results in a 1% change in the needed percent reduction (from 90% to 89%), which is an insignificant difference and will not influence the implementation of the TMDL. Removal of only the data point with the "J" qualifier does not result in any change in the needed percent reduction, it remains at 90%.

The Department closely examined the holding times for these samples. After discussing with STORET staff, we found that for the three samples with the "Q" qualifier collected on 9/22/2008, 9/22/2008 and 10/16/2008, the holding times ended at 26, 26, and 25 hours, when the lab began to incubate these samples. Based on studies conducted by the FDEP Laboratory, results observed between fecal coliform samples held between 6-24 hours did not vary significantly. As these samples were held only a couple of hours over the 24 hours, the Department does not expect that a dramatic change in results would be observed. Therefore, including these three data points in the dataset appears to be appropriate.

21. 6.3.2 NPDES Stormwater Discharges (pg 34): The WLA for stormwater discharges with an MS4 permit is a 90% reduction not a 92% reduction as stated.

FDEP Response:

Revisions to the TMDL report have been made.

22. 6.4 Margin of Safety (pg 34): Pinellas County disagrees with the margin of safety employed. The contributions from natural sources and sediments are unknown, as noted in the TMDL document section 4.2.2 and Appendix B. Including these sources as a margin of safety is not an appropriate means to address their contributions, If the actual contributions from these sources are large, the margin of safety will be unreasonably large and MS4 required reductions unobtainable. Efforts should be made to quantify these sources. Until a better understanding of these sources is developed, the WLA for stormwater is unsupported.

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FDEP Response:

The Department agrees with the County that contributions from the natural sources are unknown and can vary. At the time this TMDL was developed, the Department did not have sufficient information to quantify contributions from natural sources. However, if during the TMDL implementation process, the County can quantify contributions from natural sources, the needed percent reduction can be reduced accordingly. It is not Department's intention to reduce fecal coliform concentrations beyond the natural condition.

23. 7.2 Other TMDL Implementation Tools (pg 36, paragraph 3): Is the Department referring to the Implementation Guidance for the Fecal Coliform Total Maximum Daily Loads Adopted by the Florida Department of Environmental Protection which has been available since March 2011, or are additional guidance documents being developed? The availability of this guidance document should be noted in the section.

FDEP Response:

Yes, the tool referred to in Section 7.2 is the Implementation Guidance. Revisions to the TMDL report have been made to include a hyperlink to the document.

Appendix B: Estimate of Fecal Coliform Loadings from Potential Sources

24. Pets: Calculations and data sources for loading from dogs are unclear and the section could be better organized. For example, Table B1 only includes some of the values used in the load calculation. The source for the waste production rate is not provided in the text. The waste production number used in the calculations is provided after the calculation results, rather than before. The source for the statistic that 40% of owners do not pick up pet waste is not provided. Please clearly state each value used in the calculation along with its source and include the formula used to find the total load.

FDEP Response:

Revisions to the section have been made.

The source for waste production and fecal coliform counts per gram of dog waste which was provided in caption for Table B.1 [*Dog Population Density, Wasteload and Fecal Coliform Density Based on the Literature (Weiskel et al., 1996)*] has been added to the text and Table B.1 has been revised.

25. Pets (pg 40, paragraph 4): The statistic that 40% of households own at least one dog does not take into account owners with multiple dogs, which could result in an underestimation of number of dogs in the WBID.

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FDEP Response:

The Department agrees with the County's observation. However, without another statistic, and particularly without specific information about the local area, the one dog per household assumption is the best available information. Regardless, quantifying the fecal loading from dogs is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation.

26. Septic Tanks (pg 42, paragraph 2): The FDOH GIS data downloaded from http://www.doh.state.fl.us/environment/programs/EhGis/EhGisDownload.htm used to determine the number of septic tanks in WBID 1538A results in a gross underestimation of the actual number septic tanks. Selecting data from this shapefile for Pinellas County results in a total of 3,661 records for existing, new, or repaired septic tanks. From this data the Department found that 104 tanks were located in WBID 1538A. According to the statistics at http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm there were a total of 23,869 septic tanks in Pinellas County in 2010 based on data collected since 1970. This is 20,208 septic tanks more than the GIS data estimate for existing septic tanks for the county. There are several reasons for the difference in septic tanks numbers. First, the oldest record in the GIS data is from 1998, while the statistics are based 1970 census data plus the number of systems installed since 1970. Any septic that was installed prior to 1998 without a DOH repair permit is not reflected in the GIS data. The GIS data therefore is not appropriate for estimated septic tank numbers.

FDEP Response:

The information provided in the proposed TMDL regarding septic tank systems in Pinellas County was included to demonstrate that septic tank systems are a potential source of fecal coliform bacteria. Quantifying the fecal loading from septic tanks is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation.

It would be appreciated if the County could provide the Department with specific information on septic tanks within the WBID to update the septic tank load calculation. Again, re-calculation of septic tank loading will not influence the final TMDL.

27. Septic Tanks (p 42, paragraph 5): Replace "Miami-Dade County" with "Pinellas County".

FDEP Response:

Revisions to the TMDL report have been made.

28. Septic Tanks (pg 42, paragraph 5 and Table 8.2): It should be made clear that the loads given refer to loading to the land surface and that attenuation during transport to surface water could result in significant reductions in the counts/day actually reaching surface water.

FDEP Response:

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The statement "*This estimated load refers to loading created within the watershed undergoing no attenuation, rather than the loadings eventually reaching the receiving water" has been added* to the TMDL report.

29. Sanitary Sewer Overflows (pg 45): According to Culver, "the magnitude of human contributions from a sewer system is site-specific, dependent on the age, design, and condition of the sewer systems" (2002). The assumption of 0.5 percent leakage rate may not be appropriate for this area and its use should be well qualified.

FDEP Response:

Based on Culver et al., the 0.5% leakage rate assumes that there would be some load from the sanitary sewage system given that there is always the potential for leakage from both sanitary and stormwater sewer systems and episodic pipe failures.

Again, as with the quantification of the fecal loading from septic tanks and dog waste, the load quantification from sanitary sewer overflows is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation. The Department would appreciate it if the County could provide a percent leakage rate more specific to the area.

30. Sanitary Sewer Overflows (pg 45): There is no source provided for the per capital wastewater production rate of 70 gallons/day/person.

FDEP Response:

Revisions to the TMDL report have been made.

31. Sanitary Sewer Overflows (pg 45 and Table 8.3): It should be made clear that the loads given refer to loading to the land surface and that attenuation during transport to surface water could result in significant reductions in the counts/day actually reaching surface water.

FDEP Response:

The statement "*This estimated load refers to loading created within the watershed undergoing no attenuation, rather than the loadings eventually reaching the receiving water"* has been added to the TMDL report.

32. Provide a summary table that includes total loads from pets, sanitary sewer overflows, septic tanks and relative percent contributions to the WBID.

FDEP Response:

A load summary describing the estimated contribution from each source is provided at the end of each section. These calculations are only meant to compare and illustrate potential contributions

from each of these sources. However, as the contributions from natural sources cannot be quantified at this point, the sum of contributions from quantified human sources may not represent the total loads contributed to the observed in-stream exceedance. Therefore, calculating a relative percent contribution to the WBID from quantified sources may cause confusion.

Pinellas Park Ditch No. 1 (Tidal Segment) (WBID 1662) — Fecal Coliform

1. Identification of Waterbody (pg 1, paragraph 5): The Cross Bayou Canal flows into Boca Ciega Bay.

FDEP Response:

Revisions to *1.2 Identification of Waterbody (pg 1, paragraph 5)* in the TMDL report have been made.

2. Information on Verified Impairment (pg 6): WBID 1662 was verified as impaired during the Cycle 1 assessment based on 12.5 years of data (January 1, 1994 through June 30, 2006). However, 62-303.400 (3) F.A.C. states that "unless information presented to the Department demonstrates otherwise, data more than 7.5 years old at the time the water segment is proposed for listing on the verified list are not representative of current conditions and shall not be used except to evaluate historical trend in chlorophyll or TSIs."

FDEP Response:

For the revised Cycle 1 Group 5 assessments, the USEPA requested that the Department's Watershed Assessment Section base impairments for this WBID on the Period of Record data. Group 5 lists were revised to make necessary changes in response to an EPA review. In addition, the Cycle 2 information supports the Cycle 1 assessment that the WBID meets the verified list impairment thresholds.

3. Table 2.1 (pg 7): Include minimum, maximum, median, and mean for Cycle 1.

FDEP Response:

The requested information has been added to *Table 2.1* in the TMDL report.

4. Municipal Separate Storm System Permittees (pg 9, paragraph 5) and Table 4.1 (pg 10): Only the Pinellas County MS4 permit (FLS000005) covers WBID 1662. References to the City of St. Petersburg permit (FLS000007) should be removed.

FDEP Response:

Revisions to the TMDL report have been made.

5. 5.1 Determination of Loading Capacity (pg 13): The final sentence incorrectly references Section 5.1.2. The percent reduction was calculated in section 5.1.3.

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FDEP Response:

Revisions to the TMDL report have been made.

6. 5.1.1 Data Used in the Determination of the TMDL (pgl3): Please expand on the data discrepancies identified in the 2007 audit for WBID1662. Why was it determined that data was not appropriate for IWR purposes, but usable for TMDL development? Include a list of specific results, so that we can fully understand how the use of questionable data may have affected the TMDL determination and whether it was appropriate use of the data.

FDEP Response:

As a result of a TMDL Performance and Project Audit conducted in 2007 in the Southwest District laboratory and field operations, it was determined that data generated before September 2007 could be used for planning list purposes, and data generated after September 2007 could be used for the verified and planning lists. The impaired water listing process addresses the water quality condition of hundreds, sometimes thousands of water segments in the state. In many cases, it is impossible to examine each individual data point used in the listing process. Therefore, the QA/QC requirement on the data being used for verified list purposes is high.

However, the TMDL process allows examining the used data in a much more detailed manner. If we find that a data audit call is not specifically targeting a parameter (in this case, fecal coliform concentration), and the audited data showed similar magnitude and trend with the high quality data, we would use these audited data based on best professional judgment. In addition, we have no direct evidence that the data determined to be usable for planning list purposes (used also for TMDL development) had quality control issues.

7. 5.1.1 Data Used in the Determination of the TMDL (pgl3): There is an insufficient amount of data for TMDL determination (n=19). Seventeen of the samples were taken during a 9 month period during 2006, leaving the majority of the 7.5 year period unrepresented. In fact, even the Department noted the limitations of the dataset concluding that "due to the limited dataset available for this WBID, no meaningful trend analysis could be conducted." This data is now over five years old and not representative of current conditions. This TMDL should be reassessed following additional data collection.

FDEP Response:

See response to Comment 8 for further information on revisions to the sample (n=19) number.

During the Cycle 2 verified period (January 1, 2004 through June 30, 2011) assessment, WBID 1662 was verified as impaired for fecal coliform based on the observation that 5/18 samples exceeded the state criteria for fecal coliform bacteria. The Impaired Waters Rule (IWR) (62-303.420(7)(a)) states that "*based on representative data collected and analyzed in accordance with Chapter 62-160, F.A.C.",* a waterbody with less than twenty samples will be place on the verified list if "*there are less than twenty samples, but there are five or more samples that do not meet an applicable water quality criterion based on data from at least five temporally independent sampling events*".

The IWR does not specify that data need to be collected uniformly throughout the verified period. The only specification is presented in 62-303.400 (3) F.A.C. "*data more than 7.5 years old at the time the water segment is proposed for listing on the verified list are not representative of current conditions*". In the case of WBID 1662, all samples used for verification purposes and TMDL development were collected during the Cycle 2 verified period years (January 1, 2004 through June 30, 2011), and are therefore, as per the IWR, representative of current conditions.

The conclusion that "*due to the limited dataset available for this WBID, no meaningful trend analysis could be conducted",* was intended to state that the Department is aware that due to the small dataset available, a statistically meaningful trend for the Cycle 2 verified period could not be determined. This, however, does not imply that these data are not appropriate for TMDL development purposes.

8. 5.1.1 Data Used in the Determination of the TMDL (pg13, paragraph 3): There are 19 total samples listed for TMDL determination, however, table 5.5 contains 23 samples. Provide an explanation for the discrepancy and recalculate the TMDL with the correct samples if needed.

FDEP Response:

The County is correct, the number of samples collected at Station 21FLTPA 27510058244141 should be 21. Revisions to the TMDL report have been made. The percent reduction does not need to be recalculated, as the dataset used in the calculation was the correct one.

9. 5.1.1 Data Used in the Determination of the TMDL (pgl3, paragraph 4): The average fecal coliform concentration is stated to be 929 counts/100mL which disagrees with 1,112 counts/100mL listed in Table 2.1.

FDEP Response:

The descriptive statistics provided in Section 5.1.1 correspond to data used in TMDL development (n=23) (see response to Comment 6). The summary of fecal coliform monitoring data provided in Table 2.1 corresponds to data used for Cycle 2 verified list purposes for WBID 1662 (n=18) (see response to Comment 6).

10. Monthly and Seasonal Trends (pg 18): The SWFWMD rainfall gauge 22897 is located over four miles away. There are three USGS stations with available daily rainfall data that are closer and therefore more appropriate for this analysis. The closest is station 02308870 which is less than 1.5 miles from WBID 1662. Summer/wet season storms are typically small and isolated, which can create large rainfall differences over short distances. It is important to use the nearest available rainfall data to ensure the data reflect actual conditions in the WBID.

FDEP Response:

Revisions to the TMDL report have been made based on rainfall data obtained from USGS station 02308870.

11. Monthly and Seasonal Trends (p 18); Pinellas County disagrees with the statement The occurrence of higher exceedance rates during wet seasons is an indication that in WBID 1662 high rainfall serves to negatively impact water quality in the basin. Figure 5.3 does not support this statement. Q4 had the least rainfall, but an exceedance rate only slightly less than Q3 which experienced the highest rainfall. Q1 had more rainfall than Q4, but no exceedances. According to Table 5,2b, dry season quarters 2 and 4 each had only one less exceedance than Quarter 3 and the highest mean occurred in Quarter 2. In addition, the monthly impact of rainfall was found to be inconclusive. There is also a contradictory statement on page 19: "Many of the samples are collected during periods of small or no rainfall, indicating that exceeding concentrations may not be a consequence of stormwater discharges, but rather other local sources."

FDEP Response:

Revisions have been made to the last sentence *pg 18, paragraph 2* in the TMDL report.

12. Monthly and Season Trends (pg 18): Caution should be used when using this type of analysis to make statements about rainfall and stormwater impacts to fecal coliform data. The data may not lend to these types of conclusions due to the large spatial and temporal scales resulting from the assessment of long term monthly rainfall averages, monthly percent exceedances, and combining station data within a WBID, For a better assessment, stations and sampling events should be analyzed individually using actual rainfall data at the time of sampling rather than monthly averages

FDEP Response:

The Department agrees with the County, stations and sampling events should be analyzed individually. However, the real long-term water quality dataset used for this analysis predominantly came from one station (21FLTPA 27510058244141). Only one sample was collected at each of the other two stations (21FLGW 35439 and 21FLTPA 27505328243417). Therefore, for this particular TMDL, aggregating all the data for monthly and season trend analyses is appropriate.

13. Period of Record Trend (pg 19): Rainfall for the period of record shown in Figure 5.4 should be provided to support the statement "Many of the samples are collected during periods of small or no rainfall, indicating that exceeding concentrations may not be a consequence of stormwater discharges, but rather other local sources."

FDEP Response:

Revisions to the TMDL report have been made. Quoted language has been moved to *pg 18, paragraph 5*, and a reference to Figure 5.6 Hydrologic Conditions graph has been added to that section.

14. Critical Condition (pg 22): See previous comment about use of rainfall data from the SWFWMD gauge 22897.

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FDEP Response:

Revisions to the TMDL report have been made based on rainfall data obtained from USGS station 02308870.

15. Table 5.5 (pg 27): The outlier 12,000 MPN/100ml was sampled 6/13/2006 following an extreme rain event. Available rain data from nearby USGS gages 02307834 and 02308870 recorded 3.78" and 3.35" of rain, respectively, on the day prior to sample collection (6/12/06). This data point needs to be removed as it is not indicative of ambient conditions and is likely showing fecal coliforms present in the sediments being re-suspended by the heavy flows.

FDEP Response:

The Department agrees with the County that extreme values should not be used to quantify the existing condition, which is the reason why we do not use the 100 percentile value to represent the existing condition in a WBID. Instead, we used 90th percentile value. Although the 12,000 counts/100mL is included in the dataset for statistical analysis, it was not used to represent the existing condition.

In addition, the Department does not have a sufficiently strong justification to exclude this data point the TMDL analyses. It would be appreciated if the County could provide the Department with evidence as to whether this sample was collected under a 25-year 24-hour rainfall condition or under any other uncharacteristic event that may have occurred at the time of sampling.

16. Table 5.5 (pg 27): The qualified data points in Table 2 should be removed and the TMDL recalculated due to insufficient data quality. Samples from 7/10/2006 and 7/25/2006 failed quality control criteria and the sample from 10/20/2008 was analyzed 45 hours past the 6 hour holding time.

Table 2. Data used in the TMDL determination that failed quality control criteria.

Date	***Fecal Coliform (MPN/100ml)***	***Result Qualifier***	***Qualifier Definition***
7/10/2006	*22*	*?*	*Data is rejected and should not be used. Some of all of the quality control data for the analyte were outside criteria, and the presence or absence of the analyte cannot be determined from the data.*
7/25/2006	*140*	*J*	*Estimated value; value not accurate.*
10/20/2008	*140*	*Q*	*Sample held beyond the accepted holding time.*

FDEP Response:

The Department appreciates the County's effort to ensure sufficient data quality. The revised TMDL calculation with the data points removed results in a percent reduction of 82% (with an

existing 90th percentile concentration of 2,256 counts/mL). Removing the three data points listed in Table 2. above does not result in a significant change in percent reduction from the original 77% (with a 1,770 counts/100mL 90th percentile concentration) calculated for this WBID and would not change the necessary steps for implementation. The primary focus should be to ensure that the in-stream concentration meets the state fecal coliform criteria rather than measuring the load reduction achieved with stormwater.

The Department appreciates the County's effort to ensure sufficient data quality. However, removal of these data points from the dataset results in a 5% change in the needed percent reduction (from 77% to 82%), which is an insignificant difference and will not influence the implementation of the TMDL. Removal of only the data points with the "J" and "?" qualifier results in the same percent reduction (82%) as when all three samples are removed.

The Department closely examined the holding times for this sample. After discussing with STORET staff, we found that for the "Q" qualifier collected on 10/20/2008, the holding times ended at 26 hours, when the lab began to incubate the sample. Based on studies conducted by the FDEP Laboratory, results observed between fecal coliform samples held between 6-24 hours did not vary significantly. As this sample was held only a couple of hours over the 24 hours, the Department does not expect that a dramatic change in results would be observed. Therefore, including this data point in the dataset appears to be appropriate.

17. Table 5.5 (pg 27): There is insufficient data to determine a TMDL for this waterbody. Only 23 data points were used to calculate the TMDL. Three of these should be excluded due to data quality concerns. One of these data points is the only sample taken after 2006. This will result in the TMDL being calculated from only 20 points, 19 of which were taken during one nine month period six years ago. All exceedances occurred during a six month period, which could reflect an atypical short term local water quality problem. This data does not reflect current conditions in the stream and due to the limited data, current and long term conditions and trends are unknown. The Hazen method used in this TMDL determination has been shown to perform poorly for bacteriological datasets with small sample sizes (Hunter, 2002).

FDEP Response:

As mentioned in a previous response, the IWR does not specify that data need to be collected uniformly throughout the verified period. The only specification is presented in 62-303.400 (3) F.A.C. "*data more than 7.5 years old at the time the water segment is proposed for listing on the verified list are not representative of current conditions*". In the case of WBID 1662, all samples used for verification purposes and TMDL development were collected during the Cycle 2 verified period years (January 1, 2004 through June 30, 2011), and are therefore, as per the IWR, representative of current conditions.

18. 6.4 Margin of Safety (pg 29): Pinellas County disagrees with the margin of safety employed. The contributions from natural sources and sediments are unknown, as noted in the TMDL document section 4.2.2 and Appendix B. Including these sources as a margin of safety is not an appropriate means to address their contributions. If the actual contributions from these sources are large, the margin of safety will be unreasonably large and MS4 required reductions unobtainable. Efforts should be made to quantify these sources. Until a better understanding of these sources is developed, the WLA for stormwater is unsupported.

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FDEP Response:

The Department agrees with the County that contributions from the natural sources are unknown and can vary. At the time this TMDL was developed, the Department did not have sufficient information to quantify contributions from natural sources. However, if during the TMDL implementation process, the County can quantify contributions from natural sources, the needed percent reduction can be reduced accordingly. It is not Department's intention to reduce fecal coliform concentrations beyond the natural condition.

Appendix B: Estimate of Fecal Coliform Loadings from Potential Sources

19. Pets: Calculations and data sources for loading from dogs are unclear and the section could be better organized. For example, Table B.1 only includes some of the values used in the load calculation. The source for the waste production rate is not provided in the text. The waste production number used in the calculations is provided after the calculation results, rather than before. The source for the statistic that 40% of owners do not pick up pet waste is not provided. Please clearly state each statistic used and its source and include the formula used to find the total load.

FDEP Response:

Revisions to the section have been made.

The source for waste production and fecal coliform counts per gram of dog waste which was provided in caption for Table B.1 [*Dog Population Density, Wasteload and Fecal Coliform Density Based on the Literature (Weiskel et al., 1996)*] has been added to the text and *Table B.1* has been revised.

20. Pets (pg 35, paragraph 4). The statistic that 40% of households own at least one dog does not take into account owners with multiple dogs, which could result in an underestimation of number of dogs in the WBID.

FDEP Response:

The Department agrees with the County's observation. However, without another statistic, and particularly without specific information about the local area, the one dog per household assumption is the best available information. Regardless, quantifying the fecal loading from dogs is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation.

21. Sanitary Sewer Overflows (pg 36): According to Culver, "the magnitude of human contributions from a sewer system is site-specific, dependent on the age, design, and condition of the sewer systems" (2002). The assumption of 0.5 percent leakage rate may not be appropriate for this area and its use should be well qualified.

FDEP Response:
Based on Culver et al., the 0.5% leakage rate assumes that there would be some load from the sanitary sewage system given that there is always the potential for leakage from both sanitary and stormwater sewer systems and episodic pipe failures.

Again, as with the quantification of the fecal loading from septic tanks and dog waste, the load quantification from sanitary sewer overflows is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation. The Department would appreciate it if the County could provide a percent leakage rate more specific to the area.

22. Sanitary Sewer Overflows (pg 36): There is no source provided for the per capital wastewater production rate of 70 gallons/day/person.

FDEP Response:

Revisions to the TMDL report have been made.

23. Sanitary Sewer Overflows, Table B.3: It should be made clear that the loads given refer to loading to the land surface and that attenuation during transport to surface water could result in significant reductions in the counts/day actually reaching surface water.

FDEP Response:

The statement "*This estimated load refers to loading created within the watershed undergoing no attenuation, rather than the loadings eventually reaching the receiving water"* has been added to the TMDL report.

24. Septic Tanks (pg 37): Since the number of septic tanks is used to determine the number of households served by sanitary sewers, this section should come before the Sanitary Sewer Overflow section.

FDEP Response:

Revisions to the TMDL report have been made.

25. Septic Tanks (pg 37): Include where FDOH data can be found.

FDEP Response:

Revisions to the TMDL report have been made.

26. Septic Tanks (pg 37): FDOH data likely underestimates the number of septic tanks within the WBID and is not suitable for this calculation.

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FDEP Response:

The information provided in the proposed TMDL regarding septic tank systems in Pinellas County was included to demonstrate that septic tank systems are a potential source of fecal coliform bacteria. Quantifying the fecal loading from septic tanks is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation.

It would be appreciated if the County could provide the Department with specific information on septic tanks within the WBID to update the septic tank load calculation. Again, re-calculation of septic tank loading will not influence the final TMDL.

27. Provide a summary table that includes total loads from pets, sanitary sewer overflows, septic tanks and relative percent contributions to the WBID.

FDEP Response:

A load summary describing the estimated contribution from each source is provided at the end of each section. These calculations are only meant to compare and illustrate potential contributions from each of these sources. However, as the contributions from natural sources cannot be quantified at this point, the sum of contributions from quantified human sources may not represent the total loads contributed to the observed in-stream exceedance. Therefore, calculating a relative percent contribution to the WBID from quantified sources may cause confusion.

McKay Creek Tidal (1633) and McKay Creek (1633B) Fecal Coliform

1. 2.2 Information of Verified Impairment (pg 6): WBID 1633 was verified as impaired during the Cycle 1 assessment based on 12.5 years of data (January 1, 1994 through June 30, 2006). However, 62-303.400 (3) F.A.C. states that "unless information presented to the Department demonstrates otherwise, data more than 7.5 years old at the time the water segment is proposed for listing on the verified list are not representative of current conditions and shall not be used except to evaluate historical trend in chlorophyll or TSIs." During the Cycle 2 verified period assessment (January 1, 2004, through June 30, 2011), WBID 1633 was found to be not impaired for fecal coliform based on the number of exceedances for the sample size. There were only two exceedances out of 18 samples, while five exceedances were required to verify impairment. The waterbody, however, remained on the verified list. Pinellas County believes this water was incorrectly placed on the verified list for both Cycle 1 and Cycle 2, therefore, does not require a TMDL at this time.

FDEP Response:

For the revised Cycle 1 Group 5 assessments, the US EPA requested that the Department's Watershed Assessment Section base impairments for WBID 1633 on the Period of Record data. Group 5 lists were revised to make necessary changes in response to an US EPA review. Therefore, the assessment for Cycle 1 for this WBID was based on planning period and verified period data (January 1, 1994 through June 30, 2006). As for the Cycle 2 verified period assessment, as stated in the TMDL report, *"during the Cycle 2 verified period assessment*

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(January 1, 2004, through June 30, 2011), fecal coliform was not impaired for this waterbody based on the number of exceedances for the sample size (2/18). However, data available during the Cycle 2 assessment did not meet the exceedance ratio required by the IWR (Table 4) for delisting the waterbody; therefore, the parameter remains on the 303(d) list".
In the TMDL report, the Department concluded that WBID 1633 did not require a TMDL (page 35 of the report dated June 2012, available on FDEP's website), "*based on the available Cycle 2 data for the McKay Creek Tidal (WBID 1633), the needed percent reduction calculated for the period of observation (January 1, 2004, to June 30, 2011) determined that a TMDL is not needed for this WBID (Table 5.7a). It is anticipated that if the coliform reductions for the freshwater segment of the McKay Creek system (WBID 1633B) are met, the entire McKay Creek system should be restored to meet its applicable water quality criterion for fecal coliform*".

This language has since been revised to read "*based on the available Cycle 2 data for the McKay Creek Tidal (WBID 1633), using Formula 1, the 90th percentile concentration (288 counts/100mL) was determined to be below the 400 counts/100mL target concentration (Table 5.7a); as a result, no reduction is required for this WBID. It is anticipated that if the percent reduction for the freshwater segment of the system (WBID 1633B) is met, the entire McKay Creek system should be restored to meet its applicable water quality criterion for fecal coliform".*

2. 4.2.1 Point Sources, Municipal Separate Storm Sewer System Permittees (pg 9-10):
Only the Pinellas County MS4 permit (FLS000005) covers WBID 1633B. References to the City of St. Petersburg permit (FLS000007) should be removed.

FDEP Response:

Revisions to the TMDL report have been made.

3. Table 4.1 (pg 10): Co-Permittees associated with the WBIDs are incorrect. Pinellas County should be added to WBID 1663 and City of Indian Rock Beach should be removed. The City of Clearwater, City of Indian Rocks Beach, and City of St. Petersburg (FLS000007) should be removed from 1663B.

FDEP Response:

Revisions to the TMDL report have been made.

4. 5.1 Determination of Loading Capacity (pg 14): The final sentence incorrectly references Section 5.1.2. The percent reduction was calculated in section 5.1.3.

FDEP Response:

Revisions to the TMDL report have been made.

5. 5.1.1 Data Used in the Determination of the TMDL (pgl4): Please expand on the data discrepancies identified in the 2007 audit for WBID 1633. Why was it determined that data was not appropriate for IWR

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purposes, but usable for TMDL development? Include a list of specific results, so that we can fully understand how the use of questionable data may have affected the TMDL determination and whether it was appropriate use of the data.

FDEP Response:

As a result of a TMDL Performance and Project Audit conducted in 2007 in the Southwest District laboratory and field operations, it was determined that data generated before September 2007 could be used for planning list purposes, and data generated after September 2007 could be used for the verified and planning lists. The impaired water listing process addresses the water quality condition of hundreds, sometimes thousands of water segments in the state. In many cases, it is impossible to examine each individual data point used in the listing process. Therefore, the QA/QC requirement on the data being used for verified list purposes is high.

However, the TMDL process allows examining the used data in a much more detailed manner. If we find that a data audit call is not specifically targeting a parameter (in this case, fecal coliform concentration), and the audited data showed similar magnitude and trend with the high quality data, we would use these audited data based on best professional judgment. In addition, we have no direct evidence that the data determined to be usable for planning list purposes (used also for TMDL development) had quality control issues.

Regardless of the data used, and as stated in a previous response, the Department concluded that no reduction is required for WBID 1633.

Tables 1 and 2 below list data used for verification purposes and TMDL development, respectively.

Table 1. Data used for Cycle 2 verified period assessment. As per the audit, all data used were generated after September 2007.

WBID	Station	Date	Fecal Coliform (counts/100mL)
1633	21FLTPA 275356708249530	9/7/2010	10
1633	21FLTPA 275356708249530	11/22/2010	16
1633	21FLTPA 275356708249530	12/7/2010	20
1633	21FLTPA 275356708249530	6/21/2010	25
1633	21FLTPA 275356708249530	10/11/2010	36
1633	21FLTPA 275356708249530	5/10/2010	39
1633	21FLTPA 27541328249207	10/11/2010	43
1633	21FLTPA 27541328249207	3/1/2010	68
1633	21FLTPA 27541328249207	5/10/2010	74
1633	21FLTPA 27541328249207	6/21/2010	90
1633	21FLTPA 27541328249207	12/7/2010	98

WBID	Station	Date	Fecal Coliform (counts/100mL)
1633	21FLTPA 275356708249530	3/16/2010	110
1633	21FLTPA 275356708249530	8/30/2010	140
1633	21FLTPA 27541328249207	11/22/2010	140
1633	21FLTPA 27541328249207	8/10/2010	150
1633	21FLTPA 27541328249207	9/7/2010	290
1633	21FLTPA 275356708249530	8/10/2010	2200
1633	21FLTPA 27541328249207	8/30/2010	5400

Table 2. Data used for the development of the WBID 1633 TMDL; data are usable for the development of the WBID 1633 TMDL, as well as for the temporal, spatial and critical condition analyses for the WBID.

WBID	Station	Date	Fecal Coliform (counts/100mL)
1633	21FLTPA 275356708249530	9/7/2010	10
1633	21FLTPA 275356708249530	11/22/2010	16
1633	21FLTPA 275356708249530	12/7/2010	20
1633	21FLTPA 27541328249207	9/28/2004	25
1633	21FLTPA 275356708249530	6/21/2010	25
1633	21FLTPA 27542338248020	9/28/2004	35
1633	21FLTPA 275356708249530	10/11/2010	36
1633	21FLTPA 275356708249530	5/10/2010	39
1633	21FLTPA 27541328249207	12/14/2004	40
1633	21FLTPA 27541328249207	10/11/2010	43
1633	21FLTPA 27541328249207	5/25/2004	45
1633	21FLTPA 27542338248020	9/21/2004	65
1633	21FLTPA 27541328249207	10/12/2004	65
1633	21FLTPA 27541328249207	11/3/2004	65
1633	21FLTPA 27541328249207	3/1/2010	68
1633	21FLTPA 27541328249207	5/10/2010	74
1633	21FLTPA 27541328249207	6/21/2010	90
1633	21FLTPA 27541328249207	5/18/2004	95
1633	21FLTPA 27542338248020	5/25/2004	95
1633	21FLTPA 27542338248020	8/3/2004	95
1633	21FLTPA 27541328249207	12/7/2010	98
1633	21FLTPA 27542338248020	10/12/2004	105
1633	21FLTPA 275356708249530	3/16/2010	110
1633	21FLTPA 27541328249207	8/3/2004	120
1633	21FLTPA 27541328249207	11/30/2004	130

WBID	Station	Date	Fecal Coliform (counts/100mL)
1633	21FLTPA 27542338248020	11/3/2004	135
1633	21FLTPA 27541328249207	6/15/2004	140
1633	21FLTPA 27542338248020	11/30/2004	140
1633	21FLTPA 275356708249530	8/30/2010	140
1633	21FLTPA 27541328249207	11/22/2010	140
1633	21FLTPA 27541328249207	8/10/2010	150
1633	21FLTPA 27542338248020	12/14/2004	205
1633	21FLTPA 27542338248020	6/15/2004	220
1633	21FLTPA 27542338248020	3/15/2004	255
1633	21FLTPA 27542338248020	5/18/2004	280
1633	21FLTPA 27541328249207	3/15/2004	285
1633	21FLTPA 27541328249207	9/7/2010	290
1633	21FLTPA 27541328249207	9/21/2004	680
1633	21FLTPA 275356708249530	8/10/2010	2200
1633	21FLTPA 27541328249207	8/30/2010	5400

6. 5.1.1 Data used in the Determination of the TMDL, Table 5.1 (pg 15): Several IWR Run44x stations located in WBID 1633B were not used including 2IFLTPA 27525378248329, 21FLTPA 27543408248589, 2IFLTPA 27544608248480, 21FLTPA 27545608248150, and 2IFLTPA 27550008248318. Please explain why this data was not used. The TMDL should be recalculated using all available data.

FDEP Response:

As a result of a TMDL Performance and Project Audit conducted in 2007 in the Southwest District laboratory and field operations, it was determined that certain data collected by the Department's Southwest District in WBID 1633 were unusable for verified list purposes, including data collected at stations 2IFLTPA 27525378248329, 21FLTPA 27543408248589, 2IFLTPA 27544608248480, 21FLTPA 27545608248150, and 2IFLTPA 27550008248318 reason why the data were not included during the verified period assessment (see response to Comment 5).

A recalculation of the TMDL including these data results in an 89% reduction (with a 90th percentile of 3,700 counts/100mL). This does not represent a significant change in percent reduction from the original 91% (with a 90th percentile of 4,500 counts/100mL) calculated for this WBID and will not influence the implementation of the TMDL. The focus on restoration and implementation of the TMDL should be on meeting the state criterion of 400 counts/100mL, rather than the percent reduction.

7. Monthly and Seasonal Trends (pg 19-21): Table 5.3b should be presented before 5.3a and Table 5.3d should be presented before 5.3c to coincide with the order they are explained in the text.

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FDEP Response:

Revisions to the text order in the TMDL report have been made.

8. Monthly and Seasonal Trends, Figure 5.3a (pg 22): Explain how SWFWMD rainfall data was used to find monthly averages. Was data from the entire period of record used or only the Cycle 2 verified period?

FDEP Response:

Revisions to the TMDL report have been made; requested language has been added to *pg 22, paragraph 1.*

9. Monthly and Seasonal Trends (pg 22, paragraph 4): The statement "the occurrence of higher exceedance rates during wet seasons is an indication that in both WBID 1633 and 1633B high rainfall serves to negatively impact water quality in these basins" contradicts the previous paragraph that states "the impact of rainfall on monthly and quarterly exceedances in WBID 1633B is inconclusive" and that "monthly exceedance rates occurred independently of rainfall".

FDEP Response:

Revisions to *pg 22, paragraph 3* in the TMDL report have been made.

10. Monthly and Season Trends: Caution should be used when using this type of analysis to make statements about rainfall and stormwater impacts to fecal coliform data. The data may not lend to these types of conclusions due to the large spatial and temporal scales resulting from the assessment of long term monthly rainfall averages, monthly percent exceedances, and combining station data within a WBID. For a better assessment, stations and sampling events should be analyzed individually using actual rainfall data at the time of sampling rather than monthly averages.

FDEP Response:

The Department agrees with the County, stations and sampling events should be analyzed individually. However, for this particular TMDL, 46 of the 49 observed exceedances in the dataset were from Station 21FLPDEM27-09. The other three stations only had 6 exceedances combined. Therefore, aggregating all the data for monthly and season trends analyses for this TMDL may not significantly impact the exceedance trend.

11. Period of Record Trend (pg 23): Rainfall for the period of record shown in Figure 5.4 should be provided to support the statement "Many of the samples are collected during periods of small or no rainfall, indicating that exceeding concentrations may not be a consequence of stormwater discharges, but rather other local sources."

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FDEP Response:

Revisions to the TMDL report have been made; references to Table 5.6b and Figure 5.7 have been included on *pg 23, paragraph 2*.

12. Period of Record Trend (p23): The statement "many of these samples are collected during periods of small or no rainfall, indicating that exceeding concentration may not be a consequences of stormwater discharges, but due to other local sources" should only be applied to WBID 1633B, as the previous section noted a distinct relationship between rainfall and exceedances in VVBID 1633.

FDEP Response:

Revisions to the TMDL report have been made.

13. Spatial Patterns (pg 25 - 28): The majority of exceedances occurred at site 21 FLPDEM27-09 (43 of 49 exceedances). Pinellas County conducted targeted fecal coliform sampling on January 27th, 2012 in the vicinity of this station. Six sites were sampled for fecal coliform. Five locations upstream of 21 FLPDEM27-09 and one downstream were selected beginning at the Taylor Lake Outfall (upstream of site 21 FLTPA 27545608248150) and working downstream. Fecal Coliform results increased moving downstream as seen in Table 1. The locations of the sites and associated results are shown in Figure 1.

Table 1. Fecal coliform results for McKay Creek sampling on January 27, 2012.

Fecal Coliform (#/100mL)	***Distance from upstream site (m)***	***Site description***
240	*n/a*	*Taylor Lake outfall*
880	*200*	*Near 21FLTPA 27545608248150*
1160	*190*	*Largo Medical's groundwater discharge*
2200	*375*	*Near Veterinarian office*
2250	*220*	*21FLPDEM27-09*
2100	*90*	*Downstream from 27-09*

There appears to be a Fecal Coliform issue in this particular stretch of McKay Creeks which is solely located in the City of Largos jurisdiction. Lab results and maps of the targeted sampling conducted by Pinellas County were turned over to the City of Largo for further investigation These documents are available upon request. The City of Largo has since performed their own sampling and investigation in the area. Results should be obtained from the City of Largo.

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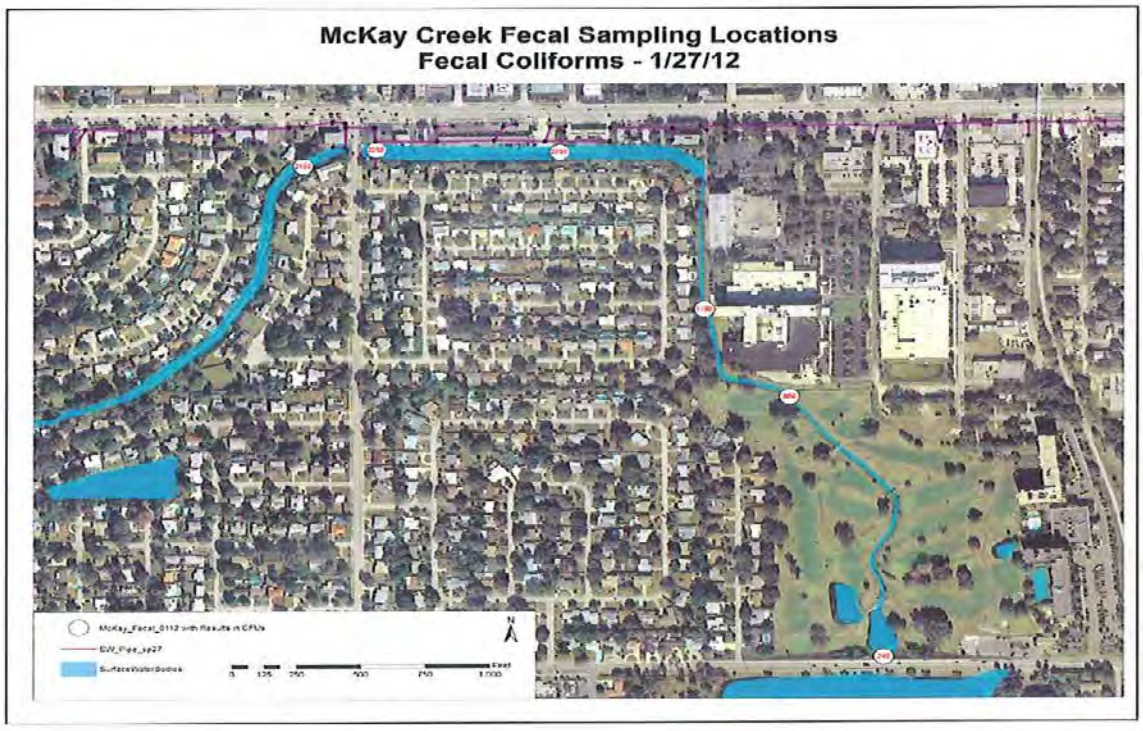
Figure 1 - McKay Creek Fecal Sampling Locations Fecal Coliforms -1/27/12



FDEP Response:

The Department recognizes and values the proactive approach that the County and City of Largo have taken to identify problems associated with bacteria pollution in WBID 1633B. Following the adoption of these TMDLs by rule, the next phase of the TMDL process will be the development of a TMDL implementation plan. These efforts will provide a good starting point for implementation of the TMDL. The Department looks forward to working with the County and City of Largo throughout the process of creating the TMDL implementation plan for potential source identification, to ensure that the appropriate source assessment tools are used, that management actions are sufficient to address the potential sources, and that the completed plan includes the necessary actions to achieve the TMDL.

14. Figure 5.6 (p29): The stations in WBID 1633B are missing.

FDEP Response:

Revisions to the TMDL report have been made.

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15. 6. 4 Margin of Safety: Pinellas County disagrees with the margin of safety employed. The contributions from natural sources and sediments are unknown, as noted in the TMDL document section 4.2.2 and Appendix B. Including these sources as a margin of safety is not an appropriate means to address their contributions. If the actual contributions from these sources are large, the margin of safety will be unreasonably large and MS4 required reductions unobtainable. Efforts should be made to quantify these sources. Until a better understanding of these sources is developed, the WLA for stormwater is unsupported.

FDEP Response:

The Department agrees with the County that contributions from the natural sources are unknown and can vary. At the time this TMDL was developed, the Department did not have sufficient information to quantify contributions from natural sources. However, if during the TMDL implementation process, the County can quantify contributions from natural sources, the needed percent reduction can be reduced accordingly. It is not Department's intention to reduce fecal coliform concentrations beyond the natural condition.

16. 5.1.3 TMDL Development Process: The Hazen method calculation used to determine load reduction is biased by elevated data from site 21 FLPDEM27-09. These are not representative conditions of the whole watershed; instead they represent a localized problem that is currently under investigation by the City of Largo. Based on the January 27, 2012 targeted study and additional investigations conducted by the City of Largo, it is estimated that only approximately 0.5 miles of the 6 miles of total creek length in WBID 16338 has elevated fecal coliform levels. Investigations have led to a hospital facility trash compactor that operates in a parking lot close the creek. Sediments may also be a source in this stretch of the creek. Corrective actions in this section of the creek should result in fecal coliform concentrations that meet water quality standards. The runoff from the private hospital facility and loading from sediments in the creek should not be included in the calculation for the reduction required by the MS4. The WLA for the MS4 should be recalculated excluding data from 21 FLPDEM27-09.

FDEP Response:

Thank you for your insights regarding the County's and City of Largo's willingness to reduce pollutants from their jurisdictional areas. The Department agrees with the County, the majority of exceedances in the WBID are observed at Station 21 FLPDEM27-09 and the influence on the final TMDL calculation by the data collected from this station. However, the intent of this TMDL is to define the needed pollutant load reduction so that the water quality in the receiving water can meet the state water quality criteria. It is beyond the scope of this TMDL to allocate detailed percent reduction to specific areas of the impaired watershed. Following the adoption of this TMDL by rule, the next phase of the TMDL process will be the development of an implementation plan. At that time, the County and City can work with the Department to allocate the needed reduction to a specific area of the watershed. The percent reduction specified in this TMDL does not have to be uniformly applied across the entire watershed of the impaired water segment, nor does it need to be applied uniformly across the entire impaired water segments. The County and City can work closely with the Department to identify pollutant sources and address them. The goal of restoring the waterbody is to meet fecal coliform bacteria water quality standards.

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Appendix B: Estimate of Fecal Coliform Loadings from Potential Sources

17. Pets: Calculations and data sources for loading from dogs are unclear and the section could be better organized. Please clearly state each statistic used and its source. Include the formula used to find the total load.

FDEP Response:

Revisions to the section have been made.

18. Pets (pg 48, paragraph 4). The statistic that 40% of households own at least one dog does not take into account owners with multiple dogs, which could result in an underestimation of number of dogs in the WBID.

FDEP Response:

The Department agrees with the County's observation. However, without another statistic, and particularly without specific information from the local area, the one dog per household assumption is the best available information. Regardless, quantifying the fecal loading from dogs is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation.

19. Sanitary Sewer Overflows (pg 49): According to Culver, "the magnitude of human contributions from a sewer system is site-specific, dependent on the age, design, and condition of the sewer systems" (2002). The assumption of 0.5 percent leakage rate may not be appropriate for this area and its use should be well qualified.

FDEP Response:

Based on Culver et al., the 0.5% leakage rate assumes that there would be some load from the sanitary sewage system given that there is always the potential for leakage from both sanitary and stormwater sewer systems and episodic pipe failures.

Again, as with the quantification of the fecal loading from septic tanks and dog waste, the load quantification from sanitary sewer overflows is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation. The Department would appreciate it if the County could provide a percent leakage rate more specific to the area.

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20. Sanitary Sewer Overflows (pg 49): Include where FDOH data can be found and explain how this data was used to estimate the number of properties connected to the sewer system.

FDEP Response:

Comment has been addressed, as shown in response to Comment 23 below.

21. Sanitary Sewer Overflows (top of pg 50): Purpose for reference to Figure B.1 is unclear.

FDEP Response:

Revisions to the TMDL report have been made.

22. Sanitary Sewer Overflows (top of pg 50 and Figure B.3): Clearly state that the number of households served by sanitary sewers was found by subtracting the number of septic tanks (found using the FDOH data) from the total number of households within each WBID.

FDEP Response:

Revisions to the TMDL report have been made.

23. Septic Tanks (pg 50): Since the number of septic tanks is used to determine the number of households served by sanitary sewers, this section should come before the Sanitary Sewer Overflow section.

FDEP Response:

Revisions to the TMDL report have been made.

24. Septic Tanks (pg 52) FDOH data likely underestimates the number of septic tanks in the WBID and is not suitable for this calculation.

FDEP Response:

The information provided in the proposed TMDL regarding septic tank systems in Pinellas County was included to demonstrate that septic tank systems are a potential source of fecal coliform bacteria. Quantifying the fecal loading from septic tanks is only meant to compare contributions from different sources. The final TMDL is not influenced by the calculation.

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It would be appreciated if the County could provide the Department with specific information on septic tanks within the WBID to update the septic tank load calculation. Again, re-calculation of septic tank loading will not influence the final TMDL.

25. Provide a summary table that includes total loads from pets, sanitary sewer overflows, septic tanks and relative percent contributions for each WBID.

FDEP Response:

A load summary describing the estimated contribution from each source is provided at the end of each section. These calculations are only meant to compare and illustrate potential contributions from each of these sources. However, since the contributions from natural sources cannot be quantified at this point, the sum of contributions from quantified human sources may not represent the total loads contributed to the observed in-stream exceedance. Therefore, calculating a relative percent contribution to the WBID from quantified sources may cause confusion.

Again, thank you very much for your time and effort in reviewing our TMDLs. We hope to continuously working with you to improve the quality of our TMDLs and restore Florida waters.
Please contact me at Jan.Mandrup-Poulsen@dep.state.fl.us if you have any further comments.

Sincerely,

Jan Mandrup-Poulsen, Administrator
Watershed Evaluation and TMDL Section
Florida Department of Environmental Protection

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