
Proposed

Total Maximum Daily Loads

for the

Hillsboro Canal

WBID 3248A

Fecal Coliform

August 2011



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LIST OF ABBREVIATIONS

BMAP	Basin Management Action Plan
BMP	Best Management Practices
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FLUCCS	Florida Land Use Classification Code System
FS	Florida Statutes
HUC	Hydrologic Unit Code
IWR	Impaired Waters Rule
LA	Load Allocation
MGD	Million Gallons Per Day
ML/L	Milliliters Per Liter
MLRA	Major Land Resource Area
MOS	Margin of Safety
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer Systems
N/A	Not Applicable
NASS	National Agriculture Statistics Service
NPDES	National Pollutant Discharge Elimination System
OSTD	Onsite Sewer Treatment and Disposal Systems
SEC/DAY	Seconds Per Day
SJRWMD	St. Johns River Water Management District
STORET	STORage RETrieval database
SQ MI	Square Miles
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WBID	Water Body Identification
WLA	Waste Load Allocation
WMD	Water Management District
WQS	Water Quality Standard
WWTP	Wastewater Treatment Plant

SUMMARY SHEET

Total Maximum Daily Load (TMDL)

1. 303(d) Listed Segment:

WBID	Segment Name	Class and Waterbody Type	Major River Basin	HUC	County	State
3248A	Hillsboro Canal	Class III Freshwater	Everglades	03090202	Palm Beach	Florida

2. TMDL Endpoints/Targets: Fecal Coliform

3. TMDL Technical Approach: Statistical approach using available water quality data.

4. TMDL Waste Load and Load Allocation:

Constituent	TMDL Condition	
	WLA Reduction	LA % Reduction
Fecal Coliform	66%	66%

5. Endangered Species Present: No

6. USEPA Lead TMDL or Other: USEPA

7. TMDL Considers Point Sources/Non Point Sources: Point/MS4 and Non Point Source

8. There are no NPDES Discharges to surface waters.

1. Introduction

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not meeting water quality standards (WQS). The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Florida Department of Environmental Protection (FDEP) developed a statewide, watershed-based approach to water resource management. Under the watershed management approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political boundaries. The watershed management approach is the framework FDEP uses for implementing TMDLs. The state's 52 basins are divided into five groups. Water quality is assessed in each group on a rotating five-year cycle. The Everglades watershed is a Group 5 basin; it was designated for TMDL development by a consent decree. FDEP established five water management districts (WMD) responsible for managing ground and surface water supplies in the counties encompassing the districts. Hillsboro Canal 3248A resides in the South Florida Water Management District (SFWMD).

For the purpose of planning and management, the WMDs divided the district into planning units defined as either an individual primary tributary basin or a group of adjacent primary tributary basins with similar characteristics. These planning units contain smaller, hydrological based units called drainage basins, which are further divided by FDEP into "water segments". A water segment usually contains only one unique waterbody type (stream, lake, canal, etc.) and is about 5 square miles. Unique numbers or waterbody identification (WBIDs) numbers are assigned to each water segment.

2. Problem Definition

To determine the status of surface water quality in the state, three categories of data – chemistry data, biological data, and fish consumption advisories – were evaluated to determine potential impairments. The level of impairment is defined in the Identification of Impaired Surface Waters Rule (IWR), Section 62-303 of the Florida Administrative Code (F.A.C.). The IWR is FDEP's methodology for determining whether waters should be included on the state's planning list and verified list. Potential impairments are determined by assessing whether a waterbody meets the criteria for inclusion on the planning list. Once a waterbody is on the planning list, additional data and information will be collected and examined to determine if the water should be included on the verified list.

The TMDL addressed in this document is being established pursuant to commitments made by the United States Environmental Protection Agency (EPA) in the 1998 Consent Decree in the Florida TMDL lawsuit (Florida Wildlife Federation, et al. v. Carol Browner, et al., Civil Action No. 4: 98CV356-WS, 1998). That Consent Decree established a schedule for TMDL development for waters listed on Florida's EPA approved 1998 section 303(d) list. The 1998 section 303(d) list identified numerous Water Body Identifications (WBIDs) in the Everglades watershed as not supporting WQS. After assessing all readily available water quality data, EPA is responsible for developing a TMDL in WBID 3248A Hillsboro Canal (Figure 1). The parameter addressed in this TMDL is fecal coliform.

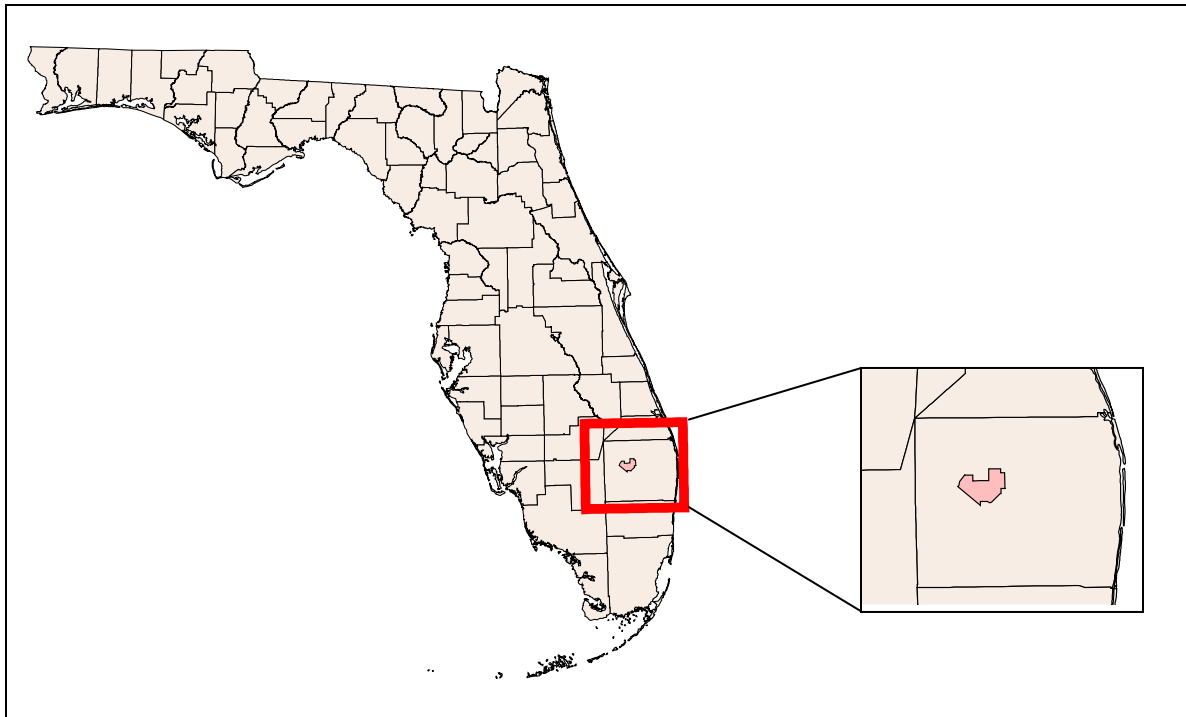


Figure 1 Location of WBID 3248A, Hillsboro Canal

3. Watershed Description

The Everglades watershed begins south of Lake Okeechobee and includes Everglades National Park, down through Florida Bay. Also known as the Everglades Protection Area, there are three Water Conservation Areas (WCAs) situated within the watershed which provide benefits such as flood protection and water supply storage. Everglades Agricultural Areas (EAAs) are also located in the watershed and contain sugarcane farms, crops and cattle ranches. The ecosystem of the Everglades watershed varies between sawgrass marshland and sloughs, with small islands of tropical hardwood hammocks interspersed. Hillsboro Canal, and forms the border between Broward and Palm Beach counties at its eastern end, flowing through WBID 3248A, an EAA, before reaching the Intracoastal Waterway between the cities of Boca Raton and Deerfield Beach. Additionally located within the WBID is the Sugarcane growers COOP.

Table 1 provides the landuse distribution for Hillsboro Canal, WBID: 3248A. The latest landuse coverages were obtained from the South Florida Water Management District’s GIS Data Distribution website. The landuses are described using the Florida Landuse Classification Code (FLUCC) Level 1. The predominant landuses draining directly to Hillsboro Canal is Row Crop at nearly 88%. Figure 2 illustrates the landuses in the Hillsboro Canal WBID.

Table 1 Landuse Distribution in WBID 3248A: Hillsboro Canal

WBID	Description	Area (ac)	Portion of Watershed (%)
3248A	Open Water	501.96	1.23%
3248A	Developed, Open Space	42.10	0.10%
3248A	Developed, Low intensity	204.67	0.50%
3248A	Developed, Medium intensity	1041.23	2.56%
3248A	Developed, High intensity	1810.49	4.45%
3248A	Clear cut/Sparse	391.15	0.96%
3248A	Quarries/Strip mines	84.92	0.21%
3248A	Deciduous Forest	9.64	0.02%
3248A	Golf courses	105.30	0.26%
3248A	Pasture	875.39	2.15%
3248A	Row Crop	35648.32	87.55%
3248A	Non-Forested Wetland (Freshwater)	4.68	0.01%
3248A	Totals	40719.85	100%

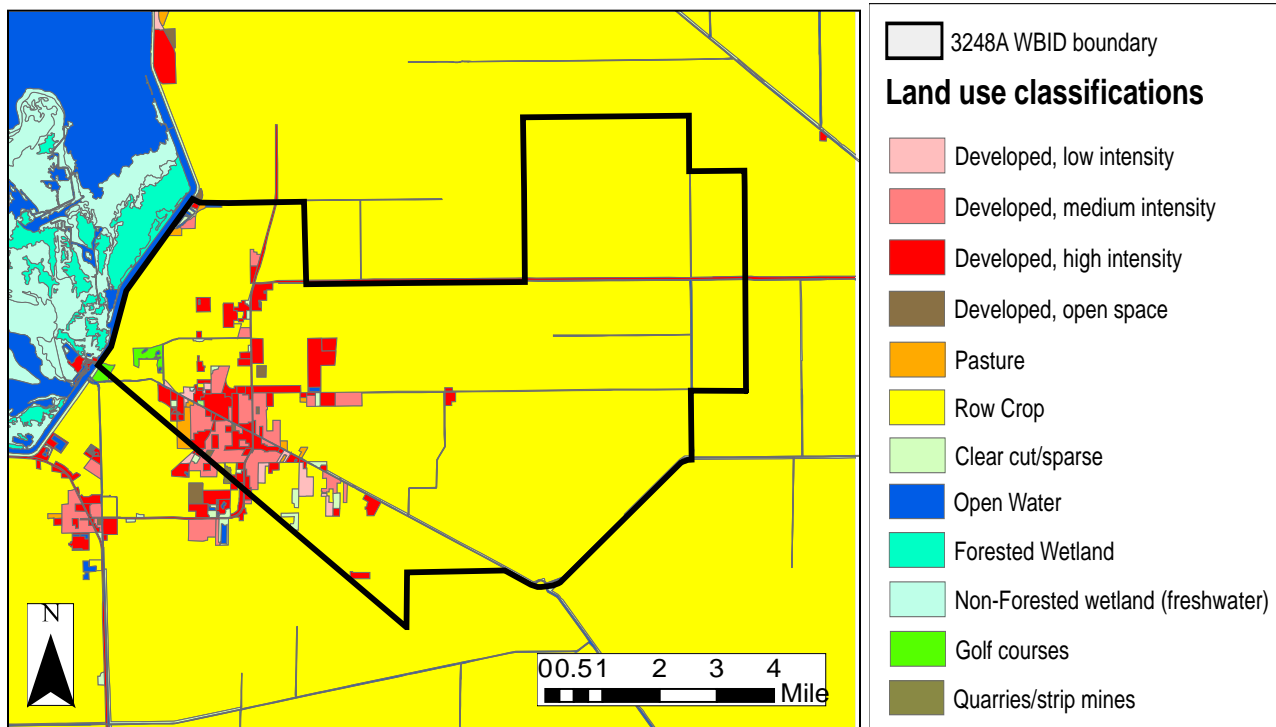


Figure 2 Hillsboro Canal Landuse Distribution

4. Water Quality Standards/TMDL Targets

The waterbodies in the Hillsboro Canal WBID are Class III Freshwater with a designated use of Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. Designated use classifications are described in the Florida Administrative Code (F.A.C.), Section 62-302.400(1), and water quality criteria for protection of all classes of waters are established in F.A.C. 62-302.530. Individual criteria should be considered in conjunction with other provisions in water quality standards, including Section 62-302.500 F.A.C. [Surface Waters: Minimum Criteria, General Criteria] that apply to all waters unless alternative criteria are specified in F.A.C. Section 62-302.530.

4.1. Fecal Coliform Bacteria (Class III Waters)

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. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

The geometric mean criteria reflect chronic or long-term water quality conditions, whereas the 400 and 800 values reflect acute or short-term conditions. To determine the impairment status of Hillsboro Canal, the available data were assessed against both components of the acute criteria. It was not possible to assess against the geometric mean criteria due to insufficient fecal coliform data. The 400 MPN/100ml criterion was selected as the TMDL endpoint, since this resulted in a more stringent reduction.

5. Water Quality Assessment

WBID 3248A Hillsboro Canal was listed as not attaining its designated uses on Florida's 1998 303(d) list for fecal coliform. To determine impairment an assessment of available data was conducted. The source for current ambient monitoring data for WBID 3248A Hillsboro Canal was the Impaired Waters Rule (IWR) data Run 43. The IWR database contains data from various sources within the state of Florida, including the WMDs and counties.

5.1. Water Quality Data

The tables and figures below present the station locations and time series data for fecal coliform for Hillsboro Canal.

Table 2 provides a list of the water quality monitoring stations in the Hillsboro Canal WBID, including the data range of the observations and the number of observations. Figure 3 illustrates where the IWR stations are located within the WBID.

Table 2 Water Quality Monitoring Stations for WBID 3248A: Hillsboro Canal

Station	Station Name	First Date	Last Date	No. Obs.
21FLGW 35027	SF5-LR-2028 L-14	7/22/2008 12:52	7/22/2008 12:52	1
21FLGW 35030	SF5-LR-2031 L-14	7/22/2008 12:28	7/22/2008 12:28	1
21FLGW 35320	SF5-SS-2010 UNNAMED SMALL STREAM	8/6/2008 14:26	8/6/2008 14:26	1
21FLGW 35327	SF5-SS-2041 UNNAMED SMALL STREAM	8/6/2008 13:41	8/6/2008 13:41	1
21FLGW 35329	SF5-SS-2047 UNNAMED SMALL STREAM	8/12/2008 10:13	8/12/2008 10:13	1
21FLGW 35331	SF5-SS-2052 UNNAMED SMALL STREAM	9/2/2008 10:57	9/2/2008 10:57	1
21FLGW 35332	SF5-SS-2059 UNNAMED SMALL STREAM	9/9/2008 10:33	9/9/2008 10:33	1
21FLGW 35339	SF5-SS-2077 UNNAMED SMALL STREAM	9/25/2008 13:19	9/25/2008 13:19	1
21FLGW 35346	SF5-SS-2090 UNNAMED SMALL STREAM	9/30/2008 11:03	9/30/2008 11:03	1
21FLWPB 28010753	Hillsboro Canal @ NW 5th St	1/19/2010 10:00	10/4/2010 10:10	6
21FLWPB 28010754	Hillsboro Canal @ SR-715	3/23/2010 9:45	10/4/2010 10:00	5
21FLWPB 52010003	Hillscan @ NW 2nd St	1/19/2010 10:10	10/4/2010 10:15	6
21FLWPB 52010004	Hillscan @ SR717 & Ave E	3/23/2010 10:15	10/4/2010 10:25	6

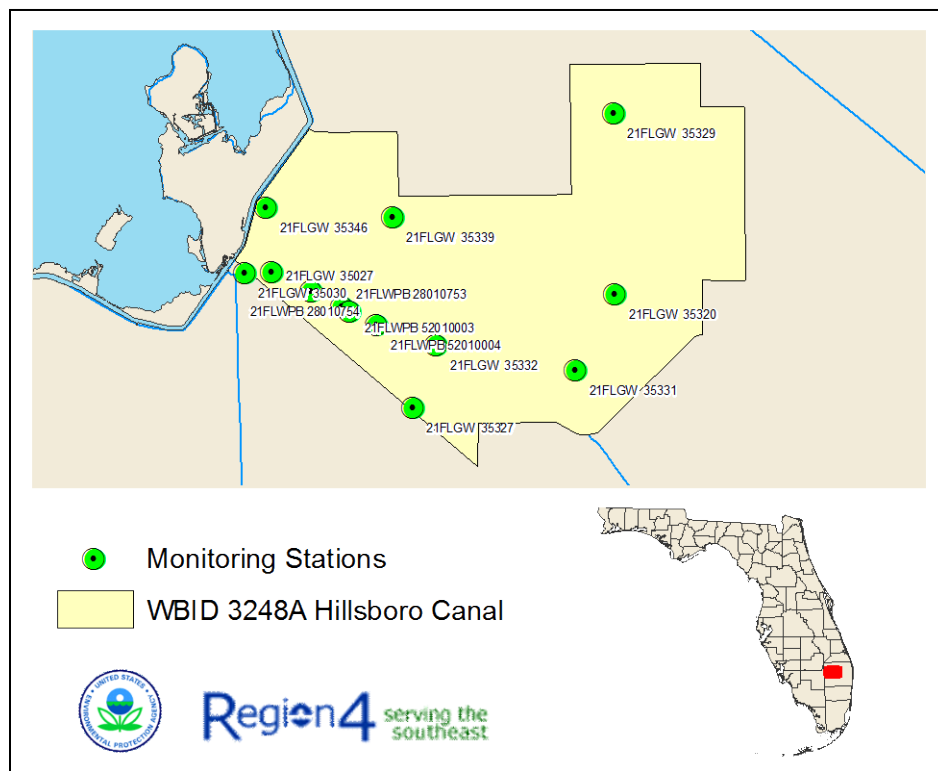


Figure 3 Station Location (with Fecal coliform data) for WBID 3248A: Hillsboro Canal

6.1.1. Wastewater/Industrial Permitted Facilities

A TMDL wasteload allocation (WLA) is given to wastewater and industrial NPDES permitted facilities discharging to surface waters within an impaired watershed. There are no wastewater NPDES permitted facilities in the Hillsboro Canal WBID, however there is a Land Application System (LAS) (Permit #FLA015040) for Sugar Growers COOP.

6.1.2. Stormwater Permitted Facilities/MS4s

The 1987 amendments to the Clean Water Act designated certain stormwater discharges as point sources requiring NPDES stormwater permits. The regulated activities involve MS4s, construction sites over one acre, and specific industrial operations. Although these types of stormwater discharges are now considered point sources with respect to permitting and TMDLs, they behave similarly to nonpoint sources in that they are driven by rainfall-runoff processes leading to the intermittent discharge of pollutants from land use activities in response to storms.

According to 40 CFR 122.26(b)(8), an MS4 is “a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

- (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law)...including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States.
- (ii) Designed or used for collecting or conveying storm water;
- (iii) Which is not a combined sewer; and
- (iv) Which is not part of a Publicly Owned Treatment Works.”

Municipal Separate Storm Sewer Systems (MS4s) may discharge nutrients and other pollutants to waterbodies in response to storm events. In 1990, USEPA developed rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) stormwater program, designed to prevent harmful pollutants from being washed by stormwater runoff into Municipal Separate Storm Sewer Systems (MS4s) (or from being dumped directly into the MS4) and then discharged from the MS4 into local waterbodies. Phase I of the program required operators of “medium” and “large” MS4s (those generally serving populations of 100,000 or greater) to implement a stormwater management program as a means to control polluted discharges from MS4s. Approved stormwater management programs for medium and large MS4s are required to address a variety of water quality related issues including roadway runoff management, municipal owned operations, hazardous waste treatment, etc.

Phase II of the rule extends coverage of the NPDES stormwater program to certain “small” MS4s. Small MS4s are defined as any MS4 that is not a medium or large MS4 covered by Phase I of the NPDES stormwater program. Only a select subset of small MS4s, referred to as “regulated small MS4s”, requires an NPDES stormwater permit. Regulated small MS4s are defined as all small MS4s located in “urbanized areas” as defined by the Bureau of the Census, and those small MS4s located outside of “urbanized areas” that are designated by NPDES permitting authorities.

In October 2000, USEPA authorized FDEP to implement the NPDES stormwater program in all areas of Florida except Indian tribal lands. FDEP’s authority to administer the NPDES program is set forth in Section 403.0885, Florida Statutes (FS). The three major components of NPDES stormwater regulations are:

- MS4 permits that are issued to entities that own and operate master stormwater systems, primarily local governments. Permittees are required to implement comprehensive stormwater management programs designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable.
- Stormwater associated with industrial activities, which is regulated primarily by a multisector general permit that covers various types of industrial facilities. Regulated industrial facilities must obtain NPDES stormwater permit coverage and implement appropriate pollution prevention techniques to reduce contamination of stormwater.
- Construction activity general permits for projects that ultimately disturb one or more acres of land and which require the implementation of stormwater pollution prevention plans to provide for erosion and sediment control during construction.

There are two MS4s in the Hillsboro Canal WBID, one for the City of Belle Glade and another for Palm Beach County (turnpike district), permit number FLS000018.

6.2. *Non Point Sources*

Nonpoint sources of coliform are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of bacteria on land surfaces and wash off as a result of storm events. Typical nonpoint sources of coliform bacteria include:

- Wildlife
- Agricultural animals
- Onsite Sewer Treatment and Disposal Systems (septic tanks)
- Urban development (outside of Phase I or II MS4 permitted areas)

6.2.1. Wildlife

Wildlife contribute coliform bacteria by depositing feces onto land surfaces where it can be transported to nearby streams during storm events and by direct deposition to the waterbody by birds and other warm blooded animals. Bacteria originating from local wildlife are generally considered to represent natural background concentrations. In most impaired watersheds, the contribution from wildlife is small relative to the load from urban and agricultural areas. A very small percent of land use within WBID 3248A is forested, less than 0.02% is classified as forested areas.

6.2.2. Agriculture

Agriculture is a potential source of coliform delivery to streams, including runoff of manure from pastureland and cropland, and direct animal access to streams. Nearly 90 percent of the area within WBID 3248A is classified as agriculture, with about 2.2% percent used for pastureland and 87.6% percent used for cropland. With agriculture representing the largest small portion of the land use within the WBID, it is likely a source of pathogen loading to Hillsboro Canal.

6.2.3. Onsite Sewerage Treatment and Disposal Systems (Septic Tanks)

Onsite sewage treatment and disposal systems (OSTDs), including septic tanks, are commonly used where providing sewer systems access is not cost effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTD is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDs can be a source of nutrients, pathogens, and other pollutants to both ground water and surface water.

The state of Florida Department of Health publishes data on new septic tank installations and the number of septic tank repair permits issued for each county in Florida. Table 3 summarizes the cumulative number of septic systems installed since the 1970 census and the total number of repair permits issued for years between 1991-92 and 2009-10. The data do not reflect septic tanks removed from service. Because these data are summarized at the county level and only a small portion of the WBID is developed, the extent to which these values pertain to the impaired watershed is not known.

Table 3 County Estimates of Septic Tanks and Repair Permits.

County	Number Septic Tanks (1970- 2010)	Number of Repair Permits Issued (1991 – 2010)
Palm Beach	80,319	12,345

Note: Source: <http://www.doh.state.fl.us/environment/ostds/statistics/ostdsstatistics.htm>

6.2.4. Urban Areas/Pervious

Urban areas include land uses such as residential, industrial, utility swaths, extractive and commercial. For low intensity, it includes residential areas with less than 2 dwelling units (low density), while medium intensity includes residential areas with between 2 and 5 dwelling units (medium density). High intensity developed includes high density residential, commercial services, industrial, institutional, transportation, communication and utilities. Land uses in this category typically have somewhat high total nitrogen event mean concentrations and average total phosphorus event mean concentrations. Nutrient loading from MS4 and non-MS4 urban areas is attributable to multiple sources including stormwater runoff, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals.

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 outlined in Chapter 403 Florida Statutes (F.S.), was established as a technology-based program that relies upon the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C.

Florida's stormwater program is unique in having a performance standard for older stormwater systems that were built before the implementation of the Stormwater Rule in 1982. This rule states: "the pollutant loading from older stormwater management systems shall be reduced as needed to restore or maintain the beneficial uses of water" (Section 62-4-.432 (5)(c), F.A.C.).

Nonstructural and structural BMPs are an integral part of the State's stormwater programs. Nonstructural BMPs, often referred to as "source controls", are those that can be used to prevent the generation of nonpoint source pollutants or to limit their transport off-site. Typical nonstructural BMPs include public education, land use management, preservation of wetlands and floodplains, and minimization of impervious surfaces. Technology-based structural BMPs are used to mitigate the increased stormwater peak discharge rate, volume, and pollutant loadings that accompany urbanization.

7. Analytical Approach

The approach for calculating fecal coliform TMDLs depends on the number of water quality samples and the availability of flow data. When long-term records of water quality and flow data are not available, the TMDL is expressed as a percent reduction. Load duration curves are used to develop TMDLs when significant data are available to develop a relationship between flow and concentration. Flow measurements were not available for WBID 3248A, nor were sufficient information available to estimate flow; therefore, this TMDL is expressed as a percent reduction.

7.1. Percent Reduction Approach for TMDL Development

Under this “percent reduction” method, the percent reduction needed to meet the applicable criterion is calculated based on a percentile of all measured concentrations. The (p X 100) percentile is the value with the cumulative probability of p. For example, the 90th percentile has a cumulative probability of 0.90. The 90th percentile is also called the 10 percent exceedance event because it will be exceeded with the probability of 0.10. Therefore, considering a set of water quality data, 90 percent of the measured values are lower than the 90th percentile concentration and 10 percent are higher. Since the water quality standard states the fecal coliform concentration shall not exceed 400 counts per 100 ml in 10 percent of the samples, 400 should be targeted with a percentile slightly larger than 90 to ensure less than 10 percent of the values exceed 400. There are many formulas for determining the percentile and these can be found in many text books on statistics. In these TMDLs the Hazen formula was used since it is recommended in Hunter’s Applied Microbiology (2002) article concerning bacteria in water. Application of the Hazen formula to data collected in WBID 3248A is provided in Appendix A and summarized below.

The percent reduction was also calculated using the maximum concentration measured in the WBID and the 800 criterion. The larger of the two percent reduction values was selected as the TMDL. The TMDL percent reduction required to meet the coliform criteria is based on the following equation:

Percent Reduction = (existing 90th percentile concentration – criteria) / existing 90th percentile concentration × 100

8. TMDL Determination

A total maximum daily load (TMDL) for a given pollutant and waterbody is comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is represented by the equation:

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

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody and still achieve water quality standards and the waterbody’s designated use. In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be set and thereby provide the basis to establish water quality-based controls.

The TMDL was determined the percent reduction in loadings using the measured data, not to exceed the 400 MPN/100 ml more than 10% of the time. The calculated TMDL reduction for Hillsboro canal (WBID 3248A) is summarized in Table 4.

Table 4 TMDL Load Allocations for Hillsboro Canal (3248A)

Waterbody	WBID	WLA ¹		LA (% Reduction) ²	TMDL (% Reduction) ²
		Facility (MPN/day)	MS4 (% Reduction) ²		
Hillsboro Canal	3248A	N/A	N/A	66%	66%

Notes:

1. The WLA is typically separated into the components originating from continuous wastewater NPDES facilities (e.g. WWTPs) and from stormwater NPDES permitted facilities/public bodies (e.g. MS4s).
2. Overall percent reduction required to achieve the 400 counts/100ml fecal coliform criterion. The MOS is implicit and does not take away from the TMDL value.

The TMDL is expressed as a daily load by multiplying the water quality target by an estimate of flow in the WBID. Hillsboro Canal is gaged (location just upstream of the WBID; USGS station 02280500), however because it is a canal, the flow direction changes dependant on which pump is activated. Therefore it is not possible to estimate flow associated with the available data, as it does not account for changes in flow direction. However, it is recommended that flow be measured at the time of sampling to ensure compliance with the TMDL. The maximum one day load the stream can transport in any 30-day period and maintain water quality standards is calculated by multiplying 400 MPN/100 ml times the flow (in cubic feet per second), along with a conversion factor to obtain units of fecal coliform counts/day.

8.1. Critical Conditions and Seasonal Variation

The critical conditions can be defined as the environmental conditions requiring the largest reduction to meet standards. By achieving the reduction for critical conditions, water quality standards should be achieved during all other times. Seasonal variation must also be considered in TMDL development to ensure that water quality standards will be met during all seasons of the year.

The critical condition for nonpoint source coliform loading is typically an extended dry period followed by a rainfall-runoff event. During dry weather periods, coliforms build up on the land surface, and are washed off by subsequent rainfall. The critical condition for point source loading usually occurs during periods of low streamflow when dilution is minimized. A comparison of the fecal coliform concentrations against area precipitation data suggests that the excursion could have occurred in response to rainfall received the day or two prior to sampling. Critical conditions and seasonal variation are accounted for in the TMDL analysis for Hillsboro Canal by selecting the largest percent reduction from the entire period of measured water quality data, and using it to represent the pollutant reduction required year-round, for the entire watershed.

8.2. Existing Conditions

Existing conditions represent the current water quality conditions of a waterbody. Existing conditions are being represented using the 90th percentile of measured concentrations. Fecal coliform samples collected in WBID 3248A, as well as the 90th percentile and percent reduction required to meet the TMDL target, are shown in Table 5.

Table 5. Fecal Coliform Measurements in Hillsboro Canal (WBID 3248A).

Date	Time	Station	Fecal Coliform (counts/100 ml)	Remark Code
7/22/2008	1252	21FLGW 35027	720	B
7/22/2008	1228	21FLGW 35030	1100	B
8/6/2008	1426	21FLGW 35320	5800	Q
8/6/2008	1341	21FLGW 35327	4700	Q
8/12/2008	1013	21FLGW 35329	1300	B
9/2/2008	1057	21FLGW 35331	200	Q
9/9/2008	1033	21FLGW 35332	120	B
9/25/2008	1319	21FLGW 35339	94	Q
9/30/2008	1103	21FLGW 35346	230	Q
1/19/2010	1000	21FLWPB 28010753	7	B
3/23/2010	0955	21FLWPB 28010753	70	
5/11/2010	1000	21FLWPB 28010753	76	
6/7/2010	1000	21FLWPB 28010753	180	B
7/28/2010	0935	21FLWPB 28010753	18	B
10/4/2010	1010	21FLWPB 28010753	28	B
3/23/2010	0945	21FLWPB 28010754	33	B
5/11/2010	0935	21FLWPB 28010754	44	
6/7/2010	0945	21FLWPB 28010754	195	B
7/28/2010	0925	21FLWPB 28010754	3	B
10/4/2010	1000	21FLWPB 28010754	10	B
1/19/2010	1010	21FLWPB 52010003	7	B
3/23/2010	1005	21FLWPB 52010003	64	
5/11/2010	1010	21FLWPB 52010003	18	B
6/7/2010	1005	21FLWPB 52010003	134	B
7/28/2010	0945	21FLWPB 52010003	44	
10/4/2010	1015	21FLWPB 52010003	50	
1/19/2010	1020	21FLWPB 52010004	8	B
3/23/2010	1015	21FLWPB 52010004	80	
5/11/2010	1020	21FLWPB 52010004	46	
6/7/2010	1015	21FLWPB 52010004	70	
7/28/2010	0955	21FLWPB 52010004	62	
10/4/2010	1025	21FLWPB 52010004	28	B
90th Percentile Fecal Coliform Concentration			1160	
Percent Reduction to meet TMDL Target			66 percent	

Notes:

1. Remark Code B means that the colony counts were made outside of the acceptable range.
2. Remark Code Q means sample held beyond normal holding time.

Several of the fecal coliform measurements in the Hillsboro Canal (WBID 3248A) have a remark code of B. Samples with laboratory remark codes B have colony counts that were made outside of the acceptable range. However, the colony counts are considered to be accurate counts and are acceptable for use in the TMDL analysis. Additionally, several samples collected were flagged with remark code Q. The laboratory remark code Q indicates that the samples were held beyond normal holding time. However, holding samples on ice slows the metabolism of the organisms resulting in no appreciable growth. Actual concentrations are expected to be at least as high as the values reported. Therefore, these samples were included in the TMDL analysis.

8.3. *Margin of Safety*

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: a) implicitly incorporate the MOS using conservative assumptions to develop TMDL allocations; or b) explicitly reserve a portion of the TMDL as the MOS and use the remainder for point and nonpoint source allocations. An implicit MOS was incorporated into the TMDL approach by including natural sources of fecal coliform bacteria in the calculation of existing conditions. This conservatively estimates the anthropogenic contributions and increases the required reduction for the TMDL.

8.4. *Waste Load Allocations*

Only MS4s and NPDES facilities discharging directly into water segments (or upstream tributaries of those segments) are assigned a WLA. The WLAs, if applicable, are expressed separately for continuous discharge facilities (e.g., WWTPs) and MS4 areas, as the former discharges during all weather conditions whereas the later discharges in response to storm events.

8.4.1. *Wastewater/Industrial Permitted Facilities*

There are no wastewater or industrial NPDES permitted facilities in the Hillsboro Canal, specifically WBID 3248A.

8.4.2. *Stormwater Permitted Facilities/MS4s*

The WLA for stormwater permitted facilities/MS4s are expressed in terms of percent reductions equivalent to the reductions required for nonpoint sources. Given the available data, it is not possible to estimate loadings coming exclusively from the MS4 areas. Although the aggregate wasteload allocations for stormwater discharges are expressed in numeric form, i.e. percent reduction, based on the information available today, it is infeasible to calculate numeric WLAs for individual stormwater outfalls because discharges from these sources can be highly intermittent, are usually characterized by very high flows occurring over relatively short time intervals, and carry a variety of pollutants whose nature and extent varies according to geography and local land use. For example, municipal sources such as those covered by these TMDLs often include numerous individual outfalls spread over large areas. Water quality impacts, in turn, also depend on a wide range of factors, including the magnitude and duration of rainfall events, the time period between events, soil conditions, fraction of land that is impervious to rainfall, other land use activities, and the ratio of stormwater discharge to receiving water flow.

This TMDL assume for the reasons stated above that it is infeasible to calculate numeric water quality-based effluent limitations for stormwater discharges. Therefore, in the absence of information presented to the permitting authority showing otherwise, these TMDLs assumes that water quality-based effluent limitations for stormwater sources of nutrients derived from this TMDL can be expressed in narrative form (e.g., as best management practices), provided that: (1) the permitting authority explains in the permit fact sheet the reasons it expects the chosen BMPs to achieve the aggregate wasteload allocation for these stormwater discharges; and (2) the state will perform ambient water quality monitoring for the purpose of determining whether the BMPs in fact are achieving such aggregate wasteload allocation.

The percent reduction calculated for nonpoint sources is assigned to the MS4 as loads from both sources typically occur in response to storm events. Permitted MS4s will be responsible for reducing only the loads associated with stormwater outfalls which it owns, manages, or otherwise has responsible control. MS4s are not responsible for reducing other nonpoint source loads within its jurisdiction. All future MS4s permitted in the area are automatically prescribed a WLA equivalent to the percent reduction assigned to the LA. Best management practices for the MS4 service should be developed to meet the percent reduction as prescribed in Table 4.

8.5. Load Allocations

The load allocation for nonpoint sources was assigned a percent reduction from the current loadings coming into Hillsboro Canal.

9. RECOMMENDATIONS

This TMDL is based on a limited amount of data. It is recommended that additional data be collected to ensure surface water conditions are accurately represented. Additionally, flow should be measured at the time of sampling so that loads can be calculated.

The initial step in implementing a pathogen TMDL is to more specifically locate source(s) of bacteria in the watershed. FDEP employs the Basin Management Action Plan (B-MAP) as the mechanism for developing strategies to accomplish the specified load reductions. Components of a B-MAP are:

- Allocations among stakeholders
- Listing of specific activities to achieve reductions
- Project initiation and completion timeliness
- Identification of funding opportunities
- Agreements
- Local ordinances
- Local water quality standards and permits
- Follow-up monitoring

10. References

Florida Administrative Code. Chapter 62-302, Surface Water Quality Standards.

Florida Administrative Code. Chapter 62-303, Identification of Impaired Surface Waters.

P.R. Hunter. 2002. The Society for Applied Microbiology, Letters in Applied Microbiology. 34. 283–286.

11. Appendix A

Station	Station Name	PCode	Date & Time	RCode	Value	Units	Depth
21FLGW 35027	SF5-LR-2028 L-14	FCOLI	7/22/2008 12:52	B	720	100mL	0.3
21FLGW 35030	SF5-LR-2031 L-14	FCOLI	7/22/2008 12:28	B	1,100	100mL	0.3
21FLGW 35320	SF5-SS-2010 UNNAMED SMALL STREAM	FCOLI	8/6/2008 14:26	Q	5,800	100mL	0.1
21FLGW 35327	SF5-SS-2041 UNNAMED SMALL STREAM	FCOLI	8/6/2008 13:41	Q	4,700	100mL	0.3
21FLGW 35329	SF5-SS-2047 UNNAMED SMALL STREAM	FCOLI	8/12/2008 10:13	B	1,300	100mL	0.2
21FLGW 35331	SF5-SS-2052 UNNAMED SMALL STREAM	FCOLI	9/2/2008 10:57	Q	200	100mL	0.3
21FLGW 35332	SF5-SS-2059 UNNAMED SMALL STREAM	FCOLI	9/9/2008 10:33	B	120	100mL	0.3
21FLGW 35339	SF5-SS-2077 UNNAMED SMALL STREAM	FCOLI	9/25/2008 13:19	Q	94	100mL	0.3
21FLGW 35346	SF5-SS-2090 UNNAMED SMALL STREAM	FCOLI	9/30/2008 11:03	Q	230	100mL	0.2
21FLWPB 28010753	Hillsboro Canal @ NW 5th St	FCOLI	1/19/2010 10:00	B	7	100mL	
21FLWPB 28010753	Hillsboro Canal @ NW 5th St	FCOLI	3/23/2010 9:55		70	100mL	0.3
21FLWPB 28010753	Hillsboro Canal @ NW 5th St	FCOLI	5/11/2010 10:00		76	100mL	0.3
21FLWPB 28010753	Hillsboro Canal @ NW 5th St	FCOLI	6/7/2010 10:00	B	180	100mL	0.3
21FLWPB 28010753	Hillsboro Canal @ NW 5th St	FCOLI	7/28/2010 9:35	B	18	100mL	0.3
21FLWPB 28010753	Hillsboro Canal @ NW 5th St	FCOLI	10/4/2010 10:10	B	28	100mL	0.3
21FLWPB 28010754	Hillsboro Canal @ SR-715	FCOLI	3/23/2010 9:45	B	33	100mL	0.3
21FLWPB 28010754	Hillsboro Canal @ SR-715	FCOLI	5/11/2010 9:35		44	100mL	0.3
21FLWPB 28010754	Hillsboro Canal @ SR-715	FCOLI	6/7/2010 9:45	B	195	100mL	0.3
21FLWPB 28010754	Hillsboro Canal @ SR-715	FCOLI	7/28/2010 9:25	B	3	100mL	0.3
21FLWPB 28010754	Hillsboro Canal @ SR-715	FCOLI	10/4/2010 10:00	B	10	100mL	0.3
21FLWPB 52010003	Hillscan @ NW 2nd St	FCOLI	1/19/2010 10:10	B	7	100mL	
21FLWPB 52010003	Hillscan @ NW 2nd St	FCOLI	3/23/2010 10:05		64	100mL	0.3
21FLWPB 52010003	Hillscan @ NW 2nd St	FCOLI	5/11/2010 10:10	B	18	100mL	0.3
21FLWPB 52010003	Hillscan @ NW 2nd St	FCOLI	6/7/2010 10:05	B	134	100mL	0.3
21FLWPB 52010003	Hillscan @ NW 2nd St	FCOLI	7/28/2010 9:45		44	100mL	0.3
21FLWPB 52010003	Hillscan @ NW 2nd St	FCOLI	10/4/2010 10:15		50	100mL	0.3

21FLWPB 52010004	Hillscan @ SR717 & Ave E	FCOLI	1/19/2010 10:20	B	8	100mL	
21FLWPB 52010004	Hillscan @ SR717 & Ave E	FCOLI	3/23/2010 10:15		80	100mL	0.3
21FLWPB 52010004	Hillscan @ SR717 & Ave E	FCOLI	5/11/2010 10:20		46	100mL	0.3
21FLWPB 52010004	Hillscan @ SR717 & Ave E	FCOLI	6/7/2010 10:15		70	100mL	0.3
21FLWPB 52010004	Hillscan @ SR717 & Ave E	FCOLI	7/28/2010 9:55		62	100mL	0.3
21FLWPB 52010004	Hillscan @ SR717 & Ave E	FCOLI	10/4/2010 10:25	B	28	100mL	0.3