Draft

Fecal Indicator Bacteria TMDLs for the Everglades West Coast Basin

Water Quality Evaluation and TMDL Program
Division of Environmental Assessment and Restoration
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Executive Summary

This report documents fecal indicator bacteria (FIB) total maximum daily loads (TMDLs) for surface waterbodies in the Everglades West Coast Basin in southwest Florida that do not meet bacteriological quality criteria designed to protect human health and recreational uses, as defined in State of Florida's Surface Water Quality Standards (Chapter 62-302, F.A.C.).

The TMDLs presented in this report are for individual waterbody segments that are impaired for not meeting the applicable water quality criteria for *Escherichia coli* (*E. coli*), enterococci, or fecal coliform bacteria. The TMDLs are set at the FIB criteria in Chapter 62-302, F.A.C., applicable to the impaired waters. The TMDLs are expressed as concentration-based restoration targets (**Table EX-1**) consistent with the expression of the bacteriological criteria used to perform the surface water assessment resulting in the impairment listing. The target used for a given waterbody was set based on the component of the FIB criteria [i.e., 10 percent threshold value (TPTV) or median] that was listed as verified impaired. Additionally, reductions (percent reductions) in bacteria counts that are necessary to meet the applicable TMDL target are identified for individual impaired waterbodies. Reductions are specified for the waste load allocation (WLA) for National Pollutant Discharge Elimination System (NPDES) Stormwater and load allocation (LA). The Florida Department of Environmental Protection (DEP or department) confirmed that the percent reductions were fully protective of all components of the FIB criteria.

The report also provides general information on common bacteria sources and provides a web page to a Bacteria TMDL StoryMap showing the locations of waterbodies addressed by the FIB TMDLs and provides geographic information about potential sources of bacteria contributions to surface waters. This information serves as an aid for developing TMDL implementation strategies to control pollution.

Table EX-1. TMDL components for FIB impairments in the Everglades West Coast Basin

[1] F = Fresh; M = Marine

[2]The concentration-based fecal indicator bacteria TMDLs can be converted into a daily load expression by multiplying the applicable water quality criterion by the daily average volumetric flow representative of the water segment and the appropriate conversion factor. In this equation, flows may be determined from direct measurements or derived from calculation methods following generally accepted scientific procedures.

WBID	Waterbody Segment Name	Water-body Class[1]	Parameter	TMDL (TPTV of MPN or MF counts/ 100mL)[2]	WLA for Waste-water (counts/100mL)	WLA for NPDES Storm-water (Percent Reduction)	LA (Percent Reduction)
3278D	Cocohatchee (Inland Segment)	III-F	*E. coli*	410	Must meet permit limits	33	33
3259A	Cocohatchee River	II	Enterococci	130	Must meet permit limits	29	29

WBID	Waterbody Segment Name	Water-body Class[1]	Parameter	TMDL (TPTV of MPN or MF counts/ 100mL)[2]	WLA for Waste-water (counts/100mL)	WLA for NPDES Storm-water (Percent Reduction)	LA (Percent Reduction)
3278E	Cow Slough	III-F	*E. coli*	410	Must meet permit limits	72	72
3258D1	Estero River (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	89	89
3278R5	Gordon River (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	57	57
3278K	Gordon River Extension	III-F	*E. coli*	410	Must meet permit limits	45	45
3278R1	Haldeman Creek (Lower)	III-M	Enterococci	130	Must meet permit limits	81	81
3278R2	Haldeman Creek (Upper)	III-F	*E. coli*	410	Must meet permit limits	60	60
3258B2	Hendry Creek	III-M	Enterococci	130	Must meet permit limits	94	94
3258EB	Imperial River (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	94	94
3258ED	Leitner Creek	III-F	*E. coli*	410	Must meet permit limits	83	83
3258C2	Mullock Creek	III-F	*E. coli*	410	Must meet permit limits	59	59
3258C4	Mullock Creek (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	68	68
3278R4	Naples Bay (Coastal Segment)	II	Enterococci	130	Must meet permit limits	31	31
3278R4	Naples Bay (Coastal Segment)	II	Fecal Coliform	43 MPN	Must meet permit limits	76	76
3258F	Oak Creek	III-F	E. coli	410	Must meet permit limits	77	77
3278R3	Rock Creek	III-M	Enterococci	130	Must meet permit limits	89	89
3258H3	Spring Creek	III-F	*E. coli*	410	Must meet permit limits	35	35
3258H2	Spring Creek (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	92	92

Acknowledgments

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List of Abbreviations and Acronyms

µmhos/cm	Micromhos Per Centimeter
BPCP	Bacteria Pollution Control Plan
BMAP	Basin Management Action Plan
BMP	Best Management Practice
CAFO	Concentrated Animal Feeding Operation
CFR	Code of Federal Regulations
Counts/100mL	Counts Per 100 Milliliters
CWA	Clean Water Act
DEP	Florida Department of Environmental Protection
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FIB	Fecal Indicator Bacteria
F.S.	Florida Statutes
FWRA	Florida Watershed Restoration Act
GIS	Geographic Information System
HUC	Hydrologic Unit Code
IWR	Impaired Surface Waters Rule
LA	Load Allocation
LDI	Landscape Development Intensity
MF	Membrane Filter
mg/L	Milligrams Per Liter
MPN	Most Probable Number
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OSTDS	Onsite Sewage Treatment and Disposal System
PLRG	Pollutant Load Reduction Goal
PRP	Pollutant Reduction Plan
SSAC	Site Specific Alternative Criteria
SSO	Sanitary Sewer Overflow
SWIM	Surface Water Improvement and Management (Program)
TPTV	Ten Percent Threshold Value
TMDL	Total Maximum Daily Load
USGS	U.S. Geological Survey
WBID	Waterbody Identification (Number)
WLA	Wasteload Allocation

WWTF	Wastewater Treatment Facility

Chapter 1: Introduction

1.1 Purpose of Report

This report presents the total maximum daily loads (TMDLs) for individual waterbody segments, identified by waterbody identification numbers (WBIDs) that are impaired for fecal indicator bacteria (FIB). These WBIDs do not meet the applicable water quality criteria for *Escherichia coli* (*E. coli*), enterococci, or fecal coliform bacteria. The state uses *E. coli* bacteria in fresh waters, enterococci bacteria in estuarine or marine waters, and fecal coliform bacteria in marine waters designated for shellfishing (Class II) waters as indicator organisms for the presence of potentially harmful pathogens.

Each FIB TMDL analysis provides an overall percent reduction in bacteria counts for the impaired WBID needed to achieve the applicable criteria (the TMDL restoration target), found in the state's Surface Water Quality Standards (paragraphs 62-302.530(11)(a)–(d), Florida Administrative Code [F.A.C]). These concentration (count) based TMDLs are established for waterbodies verified impaired for *E. coli*, enterococci, or fecal coliform bacteria where sufficient data are available to calculate the percent reductions necessary to meet the criteria. The needed percent reduction to achieve the target concentration is calculated for each impaired waterbody to show the difference between the existing FIB concentrations and the applicable target concentrations for verified impaired waters. This report includes information to help identify potential sources contributing to the impairments.

Appendix A contains specific information on the FIB-impaired WBIDs that are the subject of this report. The appendix identifies the basis for the listing of each FIB-impaired WBID, summarizes existing data for the impaired segments, and lists the needed percent reduction to achieve the TMDL targets.

1.2 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act (CWA) requires states to submit to the U.S. Environmental Protection Agency (EPA) lists of surface waters that do not meet applicable water quality standards (impaired or threatened waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. DEP has developed such lists, commonly referred to as the 303(d) list, since 1992.

The Florida Watershed Restoration Act (FWRA) (Section 403.067, Florida Statutes [F.S.]) directed DEP to develop, and adopt by rule, a science-based methodology to identify impaired waters. The Environmental Regulation Commission adopted the methodology as Chapter 62-303, F.A.C. (the Impaired Surface Waters Rule [IWR]), in 2001. The rule was last amended in

2016. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (subsection 403.067(4), F.S.). The state's 303(d) list is amended biennially to include updates from the basin Verified Lists.

For assessment purposes, DEP has divided the state into major hydrologic basins that generally conform to the U.S. Geological Survey's 8-digit hydrologic unit codes (HUC). Within each 8-digit HUC basin, the surface waters are divided into assessment polygons with a unique WBID number for each waterbody segment. The surface water quality data in each WBID are evaluated following the IWR assessment methodology to identify waters that do not meet applicable water quality standards and are designated as impaired. The bacteria impaired waters, which are the subject of this report, are in the Everglades West Coast Basin (HUC 8 – 03090204).

Chapter 2: Description of Applicable Water Quality Standards

2.1 Classification of the Waterbodies and Criteria Applicable to the TMDL

Florida's surface waters are protected for seven designated use classifications, as follows:

Class	Designated Use
Class I	Potable Water Supplies
Class I-Treated	Treated Potable Water Supplies
Class II	Shellfish Propagation or Harvesting
Class III	Fish Consumption; Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Class III-Limited	Fish Consumption; Recreation or Limited Recreation; and/or Propagation and Maintenance of a Limited Population of Fish and Wildlife
Class IV	Agricultural Water Supplies
Class V	Navigation, Utility, and Industrial Use

Water quality classifications are arranged in order of the degree of protection required, with Class I waters having generally the most stringent water quality criteria and Class V the least. Class I, I-Treated, II, and III surface waters share water quality criteria established to protect fish consumption, recreation, and the propagation and maintenance of a healthy, well-balanced population of fish and wildlife (i.e., aquatic life use). Class III-Limited waterbodies may share full recreational or aquatic life uses on a site-specific basis. Site-specific alternative criteria (SSAC) may be developed for any or all of the following parameters: nutrients (including nutrient response variables), bacteria, dissolved oxygen, alkalinity, specific conductance, transparency, turbidity, biological integrity, or pH. However, there are currently no waters in Florida with a SSAC for FIB.

Class III and III-Limited waters may be additionally classified as either marine or freshwater based on the waterbody's chloride concentration or specific conductance. "Predominately marine waters" are defined in Subsection 62-302.200(30), F.A.C., as surface waters in which the chloride concentration is greater than or equal to 1,500 milligrams per liter (mg/L), or specific conductance is greater than or equal to 4,580 micromhos per centimeter (µmhos/cm). "Predominately fresh waters" are waters with chloride or specific conductance less than 1,500 mg/L or 4,580 µmhos/cm, respectively.

2.2 Applicable Water Quality Standards

Florida has adopted numeric bacteriological criteria to protect recreational (swimming) uses in Class I, I-Treated, II, III, and III-Limited waters. These criteria are based on the use of two bacterial indicators of fecal contamination, *E. coli* and enterococci. The criteria are designed to protect primary contact recreation, including swimming, bathing, surfing, water skiing, tubing, water play by children, and similar water contact activities where a high degree of bodily contact with the water and immersion and ingestion are likely. The FIB used depends on whether the waterbody is predominately marine (i.e., Class II or Class III Marine) or predominately fresh (i.e., Class I or Class III-Fresh). *E. coli* bacteriological criteria are applicable to fresh waters and enterococci criteria are applicable to marine waters.

In addition to enterococci criteria to protect recreational uses, Class II waters also have a criterion for fecal coliform bacteria to protect shellfishing uses, consistent with the indicator used by the Florida Department of Agriculture and Consumer Services (FDACS) to open and close designated shellfish harvesting areas.

Subsection 62-302.530(6), F.A.C., provides the bacteriological criteria applicable to Florida waters, and **Table 2.1** lists these criteria by surface water classification.

Table 2.1. Summary of FIB criteria applicable to Florida waters by surface water classification and associated sampling requirements

Bacteriological Parameter	Surface Water Classification	Criterion	Sample Requirements
Enterococci	Class II and Class III Marine	Most probable number (MPN) or membrane filter (MF) counts (number/100 milliliters [ml]) shall not exceed a monthly geometric mean of 35 nor exceed the Ten Percent Threshold Value (TPTV) of 130 in 10% or more of the samples during any 30-day period.	Monthly geometric means shall be based on a minimum of 10 samples taken on 10 different days over a 30-day period. If there are fewer than 10 samples in a month for a given location, the TPTV is assessed as a single-sample maximum.
E. coli	Class III Fresh	MPN or MF counts (number/100 ml) shall not exceed a monthly geometric mean of 126 nor exceed the TPTV of 410 in 10% or more of the samples during any 30-day period.	Monthly geometric means shall be based on a minimum of 10 samples taken on 10 different days over a 30-day period. If there are fewer than 10 samples in a month for a given location, the TPTV is assessed as a single-sample maximum.
E. coli	Class I	MPN or MF counts (number/100 ml) shall not exceed a monthly geometric mean of 126 nor exceed the TPTV of 410 in 10% or more of the samples during any 30-day period.	Monthly geometric means shall be based on a minimum of 5 samples taken on 5 different days over a 30-day period. If there are fewer than 5 samples in a month for a given location, the TPTV is assessed as a single-sample maximum.

Bacteriological Parameter	Surface Water Classification	Criterion	Sample Requirements
Fecal Coliform	Class II	MPN or MF counts shall not exceed a median value of 14 with not more than 10% of the samples exceeding 43 (for MPN) or 31 (for MF).	To determine the percentage of samples exceeding the criteria when there are both MPN and MF samples for a waterbody, the percent shall be calculated as 100*(nmpn+nmf)/N, where nmpn is the number of MPN samples greater than 43, nmf is the number of MF samples greater than 31, and N is the total number of MPN and MF samples.

Chapter 3: Water Quality Assessment and Identification of Pollutants of Concern

3.1 Information on the Verified Impaired Waterbodies

DEP followed the methodology in the IWR (Chapter 62-303, F.A.C.) to assess water quality and verified a number of waterbody segments as impaired for fecal coliform, enterococci, or *E. coli* bacteria. Theseimpairments are based on the applicable designated uses and waterbody type. **Chapter 2** provides more details on the applicable water quality standards.

Waterbodies or waterbody segments (WBIDs) were placed on the Verified List because the data sufficiency and listing requirements were met as provided in subsection 62-303.460(3), F.A.C., for primary contact and recreation use support, subsection 62-303.470(3), F.A.C., for shellfish consumption use support, or subsection 62-303.480(3), F.A.C., for drinking water use support (see **Table 2.1** for additional details).

The department intends to develop FIB TMDLs for bacteria impaired waters on the Verified List, unless alternative restoration plans are approved by the department. For waterbodies not addressed by a previously adopted FIB TMDL, stakeholders have the opportunity to pursue an alternative restoration plan, such as a pollutant reduction plan (PRP). Stakeholders are expected to demonstrate that they have the technical, financial, and legal ability to implement restoration activities identified in the plan. It is the stakeholders' responsibility to demonstrate that the ongoing and/or planned projects will restore the impaired waterbody. Stakeholders interested in developing an alternative restoration plan can find additional information in the DEP's document entitled "Guidance on Developing Water Quality Restoration Plan as Alternatives to Total Maximum Daily Loads – Assessment Category 4b and 4e plans" (DEP 2021). Ideally, stakeholders should submit alternative restoration plan documentation during the biennial assessment so the waterbody and applicable parameter(s) can be placed in the appropriate assessment category prior to the initiation of TMDL development.

When a Class I, II, or III waterbody fails to meet its applicable water quality criteria for bacteriological quality, the waterbody is assessed as impaired under the IWR. Subject to data sufficiency and data quality requirements, exceedances of applicable criteria indicate that shellfish harvesting use support, primary contact and recreational use support is not attained. For bacteria assessments evaluated using the binomial distribution of discrete water quality samples, DEP applies the assessment process shown in **Figure 3.1**. This evaluation takes into consideration the minimum number of samples needed to perform an assessment, number of temporally independent exceedances and whether land use, chemical tracers, or molecular markers indicate potential anthropogenic sources of bacteria.

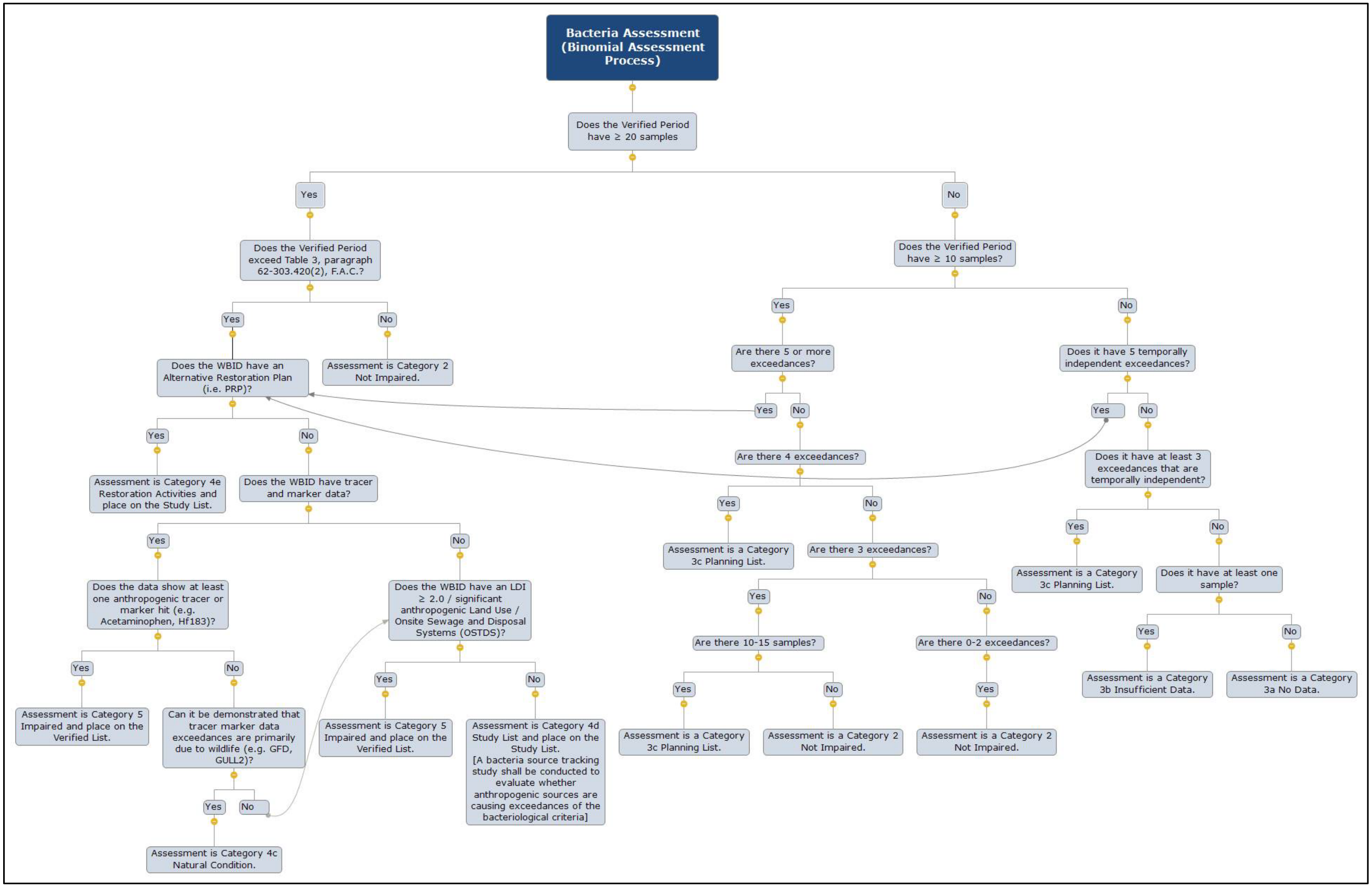

Figure 3.1. Bacteria assessments performed using the binomial distribution

DEP is proposing FIB TMDLs for the waterbody segments listed in **Table 3.1**. The locations of the impaired segments in the Everglades West Coast Basin are displayed in **Figure 3.2**. **Appendix G** provides detailed maps of the impaired waterbodies. These waterbodies have adequate bacteria results to represent existing conditions and calculate the percent reductions necessary to meet the applicable criteria, following the data sufficiency methodology described in **Subsection 5.2.1**. The sampling stations where bacteria results were used to derive the percent reductions are available to view in the Bacteria TMDL StoryMap. The WBID boundaries and sampling stations used for TMDL development are documented in the IWR Run 64 data layer coverages.

Within the Everglades West Coast Basin, the DEP is also updating one existing FIB TMDL for Hendry Creek (WBID 3258B2), a Class III Marine water. A fecal coliform bacteria TMDL for Hendry Creek was adopted by rule in 2008; however, DEP no longer assesses for fecal coliform bacteria as the applicable bacteriological parameter for the Class III designated use of recreation. As a result, an enterococci bacteria TMDL will replace the existing fecal coliform TMDL for Hendry Creek.

Table 3.1. Classification and applicable bacteriological quality criteria (fecal indicator bacteria) for waterbodies addressed in this TMDL development document. Table sorted by waterbody name.

[1] F = Fresh; M = Marine
[2] Verified impaired for exceeding the TPTV criterion and the Class II median count criterion

Waterbody Name	WBID	Classification[1]	Applicable Bacteriological Quality Criteria
Cocohatchee (Inland Segment)	3278D	III-F	*Escherichia coli*
Cocohatchee River	3259A	II	Enterococci
Cow Slough	3278E	III-F	*Escherichia coli*
Estero River (Marine Segment)	3258D1	III-M	Enterococci
Gordon River (Marine Segment)	3278R5	III-M	Enterococci
Gordon River Extension	3278K	III-F	*Escherichia coli*
Haldeman Creek (Lower)	3278R1	III-M	Enterococci
Haldeman Creek (Upper)	3278R2	III-F	*Escherichia coli*
Hendry Creek	3258B2	III-M	Enterococci
Imperial River (Marine Segment)	3258EB	III-M	Enterococci
Leitner Creek	3258ED	III-F	*Escherichia coli*
Mullock Creek	3258C2	III-F	*Escherichia coli*
Mullock Creek (Marine Segment)	3258C4	III-M	Enterococci
Naples Bay (Coastal Segment)	3278R4	II	Enterococci
Naples Bay (Coastal Segment)	3278R4	II	Fecal Coliform[2]
Oak Creek	3258F	III-F	*Escherichia coli*
Rock Creek	3278R3	III-M	Enterococci
Spring Creek	3258H3	III-F	*Escherichia coli*
Spring Creek (Marine Segment)	3258H2	III-M	Enterococci

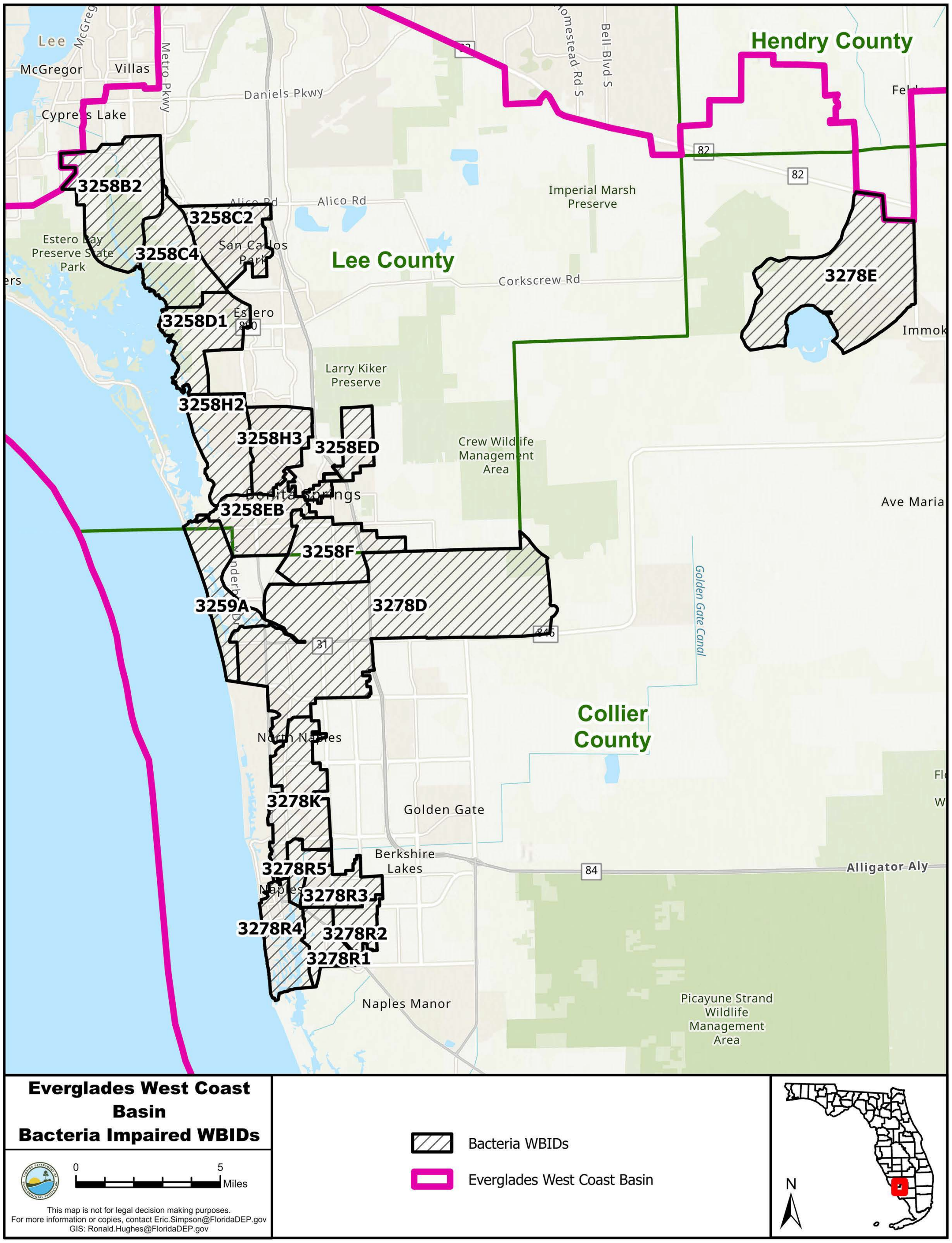

Figure 3.2. FIB Impaired Waterbodies in the Everglades West Coast Basin

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 are regulated through the NPDES program, which have a continuous flow via a discernable, confined and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) surface water outfalls are examples of traditional point sources. Point sources also include certain urban stormwater discharges, such as those from local government stormwater systems, construction sites, and a wide variety of industries. 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 septic systems; and atmospheric deposition.

The term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring a NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). Stormwater systems, commonly referred to as municipal separate storm sewer systems (MS4s), may be required to have a NPDES permit depending on the population and discharge locations. 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. The responsibilities for bacteria source reductions in stormwater discharges within and outside of MS4 areas are determined in the TMDL implementation phase. MS4 permittees are responsible for source reductions in the areas serviced by stormwater infrastructure it owns or has responsible control over.

FIB impairments are commonly caused by fecal contamination originating from humans, livestock, pets and wildlife. The bacteria are found in the intestinal systems of warm-blooded animals. Human waste can enter surface waters from such activities as degraded sewer infrastructure, failing onsite sewage treatment and disposal systems (OSTDS) (septic tanks and drain fields), homeless camps, and direct illicit connections from homes or businesses. Contamination commonly ends up in local stormwater systems, where it is conveyed and discharged to surface waters. In agricultural areas, animal waste that is not managed properly can migrate into surface waters via runoff. Cattle manure and other livestock waste also contains pathogens harmful to humans (EPA 2010; 2012). Wastes from dogs and other domestic animals and livestock are not a natural part of the environment and waters contaminated by their feces can also pose health risks to humans. Waste from humans, agricultural animals, and domestic animals are considered anthropogenic sources of bacteria. Fecal wastes from wildlife that end up in stormwater systems or are deposited directly in surface waters are considered non-anthropogenic sources.

The following are general descriptions of potential point and nonpoint sources that can contribute to elevated levels of FIB in surface waters throughout the state. A Bacteria TMDL StoryMap that provides information to aid in identifying potential sources of bacteria contamination in surface waters is available at: Bacteria TMDL StoryMap. The potential sources of bacteria to individual waterbodies are thoroughly investigated when developing implementation plans to address bacteria impairments, as described in **Chapter 7**.

4.2 Potential Sources of FIB

4.2.1 Point Sources

PERMITTED WASTEWATER POINT SOURCES

Point sources include domestic and industrial WWTFs where effluent is discharged through outfall pipes to surface waters that are permitted under the NPDES program. Elevated bacteria counts at levels above permit limits may be found in discharges to surface waters because of malfunctioning or poorly maintained treatment systems. **Appendix B** lists the permitted wastewater facility surface water outfalls, by WBID, and the outfall locations are displayed in the Bacteria TMDL StoryMap.

In agricultural areas, point source discharges from concentrated animal feeding operations (CAFOs) can potentially contribute to elevated bacteria counts if animal wastes are not managed properly. CAFOs are generally defined as farms with 700 or more head of livestock confined for more than 45 days. These facilities generally congregate and feed animals, manage their manure, and operate on a small land area.

SANITARY SEWER OVERFLOWS (SSOS)

Discharge of untreated wastewater from SSOs are unpermitted discharges which can contribute to bacteria contamination of surface waters. SSOs result from failures in wastewater collection/transmission systems where raw sewage enters the environment. SSOs can occur for a number of reasons, including pipe obstructions, leaking sewer lines, pump station failures, and the infiltration of groundwater or inflow of stormwater into defective piping systems. Chapter 62-604, F.A.C., stipulates operation and maintenance regulations pertaining to collection/transmission systems and the reporting requirements of unauthorized releases or spills of wastewater from such systems.

MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4S)

An MS4 is a system of stormwater conveyances like roads, streets, catch basins, curbs, gutters, ditches, swales, channels, or storm drains that: is designed or used for collecting or conveying stormwater; discharges to surface waters of the state; and is publicly owned by governmental entities such as municipalities, counties, community development districts, universities, military bases and federal correctional facilities.

MS4s may be regulated by the department through NPDES permits. Regulated MS4 operators are required to develop and implement a Stormwater Management Program (SWMP) to reduce pollutant discharges to and from the MS4. The SWMP must include measures to educate the public on the impacts of illicit discharges to the MS4 and waterbodies, and control stormwater discharges through regulations, inspections and enforcement. Additionally, the MS4 permit requires operators that discharge to WBIDs with DEP-adopted and/or EPA established TMDLs to address wasteload allocations through participation in basin management action plans and/or development of TMDL implementation plans, including bacteria pollution control plans.

Stormwater is runoff generated from rain events that flow over land or impervious surfaces such as streets, parking lots, and rooftops. Contamination of stormwater by bacteria sources can occur as runoff picks up pollutants on the land surface which flows into local stormwater systems that ultimately discharge to surface waters. Stormwater contamination can occur due to illicit discharges, illicit connections, illegal dumping and improper garbage disposal, or contact with industrial materials and human or pet waste. Sanitary wastewater can also contaminate stormwater systems through infiltration of contaminated groundwater caused by damaged wastewater collection pipes, failing laterals and septic systems.

Entities with MS4 permits are displayed in the Bacteria TMDL StoryMap.

4.2.2 Land Uses and Nonpoint Sources

Obtaining an accurate accounting of bacteria contributions from nonpoint sources requires identifying nonpoint source categories, locating the sources, determining the intensity and frequency with which these sources create high bacteria loadings, and specifying the relative contributions from each source. Nonpoint sources include onsite sewage treatment and disposal systems (OSTDS) (septic tanks and drainfields), pets, livestock, the land application of sewage sludge and manure, solid waste, marina pumpout facilities, boat anchorages, waterbody sediments, and wildlife. These sources are associated with particular land use activities. While detailed source information is not always available for accurately quantifying the bacteria loadings from different sources, land use information can provide a useful starting point about potential sources of observed FIB impairments. Land uses associated with urban and agricultural activities typically include bacteria sources that can pose a greater human health risk compared to less developed areas.

LAND USES

The spatial distribution and acreage of different land use categories can be obtained from land use/land cover layers available in geographic information system (GIS) libraries. The spatial distribution of principal land uses in the areas of verified impaired WBIDs, obtained from data layers in the DEP's GIS library, is available to view in the Bacteria TMDL StoryMap. Data layers representing potential bacteria sources are also available on the StoryMap web page. The land use information and other data layers provided with this report are intended to serve as general information, which can be refined using other data obtained during the development of implementation plans, as discussed in **Chapter 7**.

NONPOINT SOURCES

The following are descriptions of common nonpoint sources that can contribute to bacteria contamination of surface waters.

> ***OSTDS*** – Properly functioning septic systems result in retention and die-off of most fecal and pathogenic bacteria (EPA 2002). Septic systems are expected to remove 99.999% of fecal coliform bacteria 24 inches below the bottom of drain fields (Chapter 62-6, F.A.C.). However, failing OSTDS can be a source of bacteria contamination in surface waters. Failing systems result in the discharge of untreated or partially treated wastewater onto the ground surface or into stormwater systems, surface water, or groundwater.
>
> The risk of contamination from failing systems is greater in areas with a relatively high groundwater table where the drain field can be flooded during the rainy season, resulting in ponding, and bacteria can pollute surface waters through stormwater runoff. Additionally, in these circumstances, a high water table can result in bacteria pollution reaching the receiving waters through baseflow, which

is the portion of flow derived from precipitation that infiltrates into the ground and is conveyed to surface waters through the shallow ground sub-surface.

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

Septic systems may also cause 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 system is built too close to the well (e.g., less than 75 feet), the septic system discharge will be situated within the cone of influence of the well. As a result, septic system effluent may enter the well, and once the polluted water is used for irrigation, fecal bacteria may reach the land surface and wash into surface waters through runoff.

Pet Waste – Pet (especially dog) waste can be a significant source of bacteria pollution through surface runoff to waterbodies. Studies report that up to 95% of the fecal coliform bacteria found in urban stormwater can have nonhuman origins (Alderiso et al. 1996; Trial et al. 1993).

The most important nonhuman contributors of fecal coliform bacteria are 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 bacteria in urban subwatersheds.

Solid Waste Storage and Disposal - Poorly managed dumpsters can contribute to pollutants in stormwater runoff. Improper garbage disposal, such as open, overflowing, or leaking dumpsters is an attractant to rodents, especially where food waste is stored. Open dumpster lids and missing drain plugs allow rain to wash over the trash inside the dumpster. Rainwater then flows from the dumpster, carrying bacteria and food sources to stormwater conveyance systems.

Stormwater systems associated with waste management facilities may be at risk for FIB contamination, including landfills, trash incinerators, and parking lots for recycling and garbage hauling trucks. The open land and food opportunities at landfills can attract nuisance wildlife, such as large flocks of seagulls, and refuse hauling facilities occasionally have issues with leaking storage (Michigan EGLE, 2019).

Agricultural Animals **-** Livestock and other agricultural animals are a potentially important source of bacteria in agricultural areas. Runoff from pastureland and rangeland along with agricultural animals having access to surface waters can affect water quality. Agricultural animal waste is associated with various pathogens in streams, including *E. coli, Salmonella, Giardia, Campylobacter, Shigella,* and *Cryptosporidium parvum* (Landry and Wolfe 1999). Research conducted by EPA indicates that fecal waste originating from cattle may pose human health risks comparable to the risks from human sources (EPA 2010; 2012).

Biosolids and Manure - Properly treated biosolids and manure are applied on land as a fertilizer supplement and a soil conditioner. Biosolids, also referred to as sewage sludge, is the solid byproduct generated when domestic wastewater is treated. The sludge, which is removed routinely from treatment plants, has a high organic content and contains moderate amounts of nutrients. Regulatory requirements are in place to protect public health and the environment, including treatment to destroy harmful microorganisms and management practices for land application sites. Biosolids may be applied in farming and ranching operations, to forest lands, and in public areas such as parks, or in land reclamation projects such as the restoration of mined properties. As with biosolids, animal manure can be a source of bacteria to surface waters if regulations are not followed. The likelihood of contamination is increased if manure or biosolids are applied to fields in excess of agronomic rates or under wet weather conditions (FDACS 2015).

Boats **-** Boats have the potential to discharge bacteria in sewage from installed toilets and graywater from sinks, baths, and showers. Waterbodies and marinas that are heavily used for recreational boating have been shown to have elevated levels of FIB (EPA 2001). Areas where discharges from boats can be a bacteria source are marinas and vessel anchorage locations.

Wildlife - In urban areas, wildlife can typically be found in city parks and corridors along waterways and thus can potentially be a source of bacteria. Pristine forested lands might appear to be unlikely candidates for pathogen sources; however, wildlife can contribute fecal bacteria in these areas. Many wildlife species are reservoirs of microorganisms that are potentially pathogenic to themselves, other wildlife, and humans (EPA 2001). Streams draining largely undeveloped watersheds with extensive riparian wetlands can be important natural sources of bacteria. Animal bacteria from saturated wetland surfaces is a known mechanism for bacterial transport to the streams draining them, as was observed in a wetland-dominated watershed free of bacteria sources related to development (Weiskel et al. 1996).

Wildlife such as deer, bear, and feral hogs deposit their feces onto land surfaces, where the bacteria can be transported during storm events to nearby waterbodies. In addition, waterfowl such as geese, ducks, and herons can contaminate surface water with microbial pathogens by directly depositing feces into waterbodies (EPA 2001), especially in wetlands, lakes, ponds, and rivers.

Chapter 5: Determination of Assimilative Capacity

5.1 TMDL Development Approach

A TMDL is the amount of a pollutant that a receiving water can assimilate without exceeding water quality criteria or impairing the designated use. TMDLs represent the loading capacity of a waterbody including a margin of safety (MOS) to account for uncertainty in target-setting. The bacteria TMDLs for individual waterbody segments (WBIDs) are concentration-based using the applicable FIB criteria in Chapter 62-302, F.A.C. as restoration targets, that are expressed in terms of bacteria counts per 100 milliliters (counts/100 mL). The TMDLs are based on the assumption that the amount of bacteria expressed in concentration units is equal to the loading capacity.

The applicable FIB criteria in Chapter 62-302, F.A.C., and the methodology described in Chapter 62-303, F.A.C., were used to verify impairment in each waterbody segment. In the majority of cases, these segments have bacteria concentrations that exceed the TPTV criteria for *E. coli*, enterococci, or fecal coliform bacteria. In addition, Class II waters can be listed as verified impaired for having median concentration values exceeding the applicable fecal coliform bacteria criterion of 14 counts per 100 milliliters (counts/100 mL) of colony-forming units.

TMDL development includes the identification of percent reductions in existing conditions needed to meet TMDL targets. A percent reduction to achieve the target concentration is calculated for each impaired waterbody and is included in this TMDL analysis to show the difference between the existing FIB concentrations and the applicable target concentrations in verified impaired waters. The needed percent reductions only represent the relative difference between the existing and target bacteria concentrations. The percent reductions should not be interpreted as the needed reduction in bacteria loads entering the impaired waters. **Appendix A** lists the percent reductions needed to achieve the concentration-based TMDLs in each FIB-impaired WBID.

5.2 Determination of Percent Reductions

To show the difference between the existing *E. coli*, enterococci, and fecal coliform bacteria concentrations and the applicable target concentrations in verified impaired waters, a percent reduction to achieve the applicable target concentration was calculated for each impaired waterbody. As previously noted, the needed percent reduction only represents the relative difference between the existing and target bacteria concentrations.

5.2.1 Data Sufficiency Evaluation

Prior to calculating percent reductions, a data sufficiency evaluation was performed for each impaired WBID to determine if the available data were adequate for characterizing existing conditions, which are based on data collected in the last 10 years (2013 to 2022 period). Minimum data requirements for calculation of needed reductions were waterbodies with at least three years of data and 20 samples taken in the last 10 years, with at least five samples collected between June and September. Bacteria sample results reported with the following qualifier codes are excluded from analysis: ?, G, H, N, O, V, and Y. For stations with multiple results collected on the same day, the median value of the results is counted as one sample. The bacteria results used for this analysis are provided in **Appendix C**. The FIB impaired waters in the basin met the data sufficiency requirements, with all except four WBIDs (Cow Slough, Leitner Creek, Oak Creek and Spring Creek stream segments) having greater than 100 sample results in the last 10 years (**Appendix A)**.

In cases where verified impaired waters in the basin do not meet the data sufficiency requirements, DEP will collect additional data for the waterbodies to obtain a dataset representative of existing conditions, before TMDLs are adopted for those waterbody segments. In the future, TMDLs will be adopted for those waters where additional monitoring was performed and for waterbodies newly added to the verified impaired list with sufficient data to represent existing conditions.

5.2.2 Percent Reductions for Waters Exceeding the TPTV Criterion

To calculate the percent reduction needed to meet the TPTV criterion, the existing condition was represented by the 90th percentile value of the measured concentrations in the 2013-2022 period. The 90th percentile is also referred to as the 10 percent exceedance event because it will be exceeded with the probability of 0.10, which is consistent with the 10 percent threshold value expression of the criteria. 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.

Because bacteriological counts in water are not normally distributed, a nonparametric method is more appropriate for the analysis of fecal indicator bacteria data (Hunter 2002). Nonparametric methods account for skewed data distributions that are often observed in bacteria results. For waters verified impaired for exceeding the FIB TPTV, the Hazen method, which uses a nonparametric formula, was used to determine the 90th percentile. The percent reduction needed to reduce the existing bacteria concentration was calculated by comparing the existing concentrations and allowable target concentrations using **Formula 1**:

$$Needed\ \%\ Reduction = \frac{Existing\ 90th\ Percentile\ Concentration - Allowable\ Concentration}{Existing\ 90th\ Percentile\ Concentration} \quad (1)$$

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 data collected during the last 10 years, defined as the 2013-2022 period. The 90th percentile is also called the 10% exceedance event. This will result in a target condition that is consistent with the state bacteriological water quality criteria TPTV and assessment thresholds for verified impaired waters. Additionally, because microbiological results are log-normally distributed, the following calculations were done on the log-transformed concentration values.

The Hazen equation for determining the rank equivalent to the 90th percentile in a data set is shown in **Formula 2** as follows:

$$Hazen\ (r) = ½ + P*n/100 \qquad (2)$$

Where:

- *r is the rank of the relevant percentile*
- *n is the number of data points in the data set*
- *P is the percentile value (90th in this case)*

To determine the 90th percentile value in a data set, all of the available concentration results are ranked (ordered) from the lowest to the highest, and the result that equates to the Hazen rank identifies the 90th percentile.

If none of the results equate to the 90th percentile, the 90th percentile value is calculated by interpolation using the rank of results immediately below and above the 90th percentile rank using **Formula 3**:

$$90th\ Percentile\ Concentration = C_{lower} + \left(C_{higher} - C_{lower}\right) * (r - C_{lower}Rank) \qquad (3)$$

Where:

- C_{lower} is the concentration corresponding to the percentile lower than the 90th percentile.
- C_{higher} is the concentration corresponding to the percentile higher than the 90th percentile
- r is the Hazen rank of the 90th percentile
- C_{lower} Rank is the rank of the concentration immediately below the 90th percentile

As an example, **Appendix C** includes a spreadsheet of the calculations of summary statistics and the percent reduction necessary to attain the applicable criterion for Rock Creek (WBID 3278R3).

The *E. coli* and enterococci criteria consist of two components: 1) the TPTV criterion and 2) the monthly geometric mean criterion. All the water segments were listed as impaired for *E. coli* or enterococci bacteria using the applicable TPTV criterion to perform the assessment. None of the water segments had sufficient samples collected within a month, as defined in the criteria presented in **Chapter 2**, to calculate monthly geometric means.

In an effort to determine if the percent reductions, calculated using the 90th percentile values, are protective of potential exceedances of the monthly geometric mean criterion, a long-term (10-year) geometric mean value was used to calculate a percent reduction needed to meet that criterion magnitude. For each segment impaired for *E. coli* or enterococci bacteria, the geometric means of the results in the 2013-2022 period served as the substitute for monthly geometric means. The percent reductions in the 10-year period geometric means necessary to achieve the monthly geometric mean criterion were calculated for comparison to the reductions needed to meet the TPTV criterion. The percent reduction comparisons, **Appendix D**, show that with the exception of Leitner Creek, all of the bacteria reductions to meet the TPTV criterion are greater than the reductions to achieve the geometric mean criterion. In Leitner Creek, there is a minimal difference in percent reductions; the reduction to meet the TPTV criterion is 83% and the reduction to meet the monthly geometric mean criterion is 86%. As a result, the percent reductions calculated for the impairment listings are considered protective of both components of the *E. coli* and enterococci criteria.

5.2.3 Percent Reductions for Waters Exceeding the Class II Median Count Criterion

For Class II marine waters listed as verified impaired for median concentration values exceeding the applicable criterion of 14 counts/100 mL, the existing condition is expressed as the median value of the bacteria results collected in the last 10 years defined as the 2013-2022 period.

The percent reduction needed to reduce the existing median bacteria concentration was calculated by comparing the existing concentration and target concentration using **Formula 4**:

$$Needed\ \%\ Reduction = \frac{Existing\ Median\ Concentration - Allowable\ Median\ Concentration}{Existing\ Median\ Concentration} \quad (4)$$

If Class II marine waters are verified impaired for exceeding the applicable TPTV criterion and the median concentration value exceeds the applicable criterion of 14 counts/100 mL colony-forming units, the highest percent reduction will be assigned to the impaired segment.

5.3 Seasonal Variation

Florida bacteriological criteria are not seasonal. One set of numeric criteria apply equally throughout the calendar year. Organizations collecting surface water samples typically monitor conditions at regular intervals throughout the year to account for seasonal variability. The bacteria TMDL development data sufficiency requirements (described in **subsection 5.2.1.**) also take into account seasonal variability.

Chapter 6: Determination of Loading Allocations

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating loads to all 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 accounts for uncertainty in the relationship between effluent limitations and water quality:

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

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

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

The various components of the revised TMDL equation may not sum up to the value of the TMDL because (1) 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 (2) 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). Stormwater reductions are included in both the MS4 WLA and LA. However, in determining the overall stormwater reductions needed, DEP does not differentiate between the MS4 WLA and the LA, and instead applies the same overall reductions to both as if the two categories were a single category source, unless otherwise specified.

The approach used for setting FIB TMDLs is consistent with federal regulations, which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure—see 40 CFR § 130.2(i). The TMDLs for waters verified impaired for FIB are expressed as concentration-based restoration targets (**Table 6.1**) that are consistent with the expression and derivation of the bacteriological criteria used to perform the surface water assessment resulting in the impairment listing. **Appendix A** lists WBID-specific percent reductions in existing bacteria concentrations needed to achieve the FIB TMDL targets.

The loading capacity for FIB TMDLs can be expressed as a function of flow using the concentration based criteria applicable to the impaired water segment, to report daily loads as counts per day. The concentration-based TMDLs can be converted into a daily load expression by multiplying the applicable water quality criterion by the daily average volumetric flow representative of the water segment and the appropriate conversion factor. The method for converting the concentration-based TMDLs to loads is described in **Appendix E**.

Table 6.1. TMDL components for FIB impairments

[1] F = Fresh; M = Marine

[2]The concentration-based fecal indicator bacteria TMDLs can be converted into a daily load expression by multiplying the applicable water quality criterion by the daily average volumetric flow representative of the water segment and the appropriate conversion factor. In this equation, flows may be determined from direct measurements or derived from calculation methods following generally accepted scientific procedures.

WBID	Waterbody Segment Name	Water-body Class[1]	Parameter	TMDL (TPTV of MPN or MF counts/ 100mL)[2]	WLA for Waste-water (coun ts/100mL)	WLA for NPDES Storm-water (Percent Reduction)	LA (Percent Reduction)
3278D	Cocohatchee (Inland Segment)	III-F	*E. coli*	410	Must meet permit limits	33	33
3259A	Cocohatchee River	II	Enterococci	130	Must meet permit limits	29	29
3278E	Cow Slough	III-F	*E. coli*	410	Must meet permit limits	72	72
3258D1	Estero River (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	89	89
3278R5	Gordon River (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	57	57
3278K	Gordon River Extension	III-F	*E. coli*	410	Must meet permit limits	45	45
3278R1	Haldeman Creek (Lower)	III-M	Enterococci	130	Must meet permit limits	81	81
3278R2	Haldeman Creek (Upper)	III-F	*E. coli*	410	Must meet permit limits	60	60
3258B2	Hendry Creek	III-M	Enterococci	130	Must meet permit limits	94	94
3258EB	Imperial River (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	94	94
3258ED	Leitner Creek	III-F	*E. coli*	410	Must meet permit limits	83	83
3258C2	Mullock Creek	III-F	*E. coli*	410	Must meet permit limits	59	59
3258C4	Mullock Creek (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	68	68
3278R4	Naples Bay (Coastal Segment)	II	Enterococci	130	Must meet permit limits	31	31
3278R4	Naples Bay (Coastal Segment)	II	Fecal Coliform	43 MPN	Must meet permit limits	76	76
3258F	Oak Creek	III-F	E. coli	410	Must meet permit limits	77	77

WBID	Waterbody Segment Name	Water-body Class[1]	Parameter	TMDL (TPTV of MPN or MF counts/ 100mL)[2]	WLA for Waste-water (counts/100mL)	WLA for NPDES Storm-water (Percent Reduction)	LA (Percent Reduction)
3278R3	Rock Creek	III-M	Enterococci	130	Must meet permit limits	89	89
3258H3	Spring Creek	III-F	*E. coli*	410	Must meet permit limits	35	35
3258H2	Spring Creek (Marine Segment)	III-M	Enterococci	130	Must meet permit limits	92	92

6.2 Load Allocation

Table 6.1 identifies the FIB LAs for all nonpoint sources, including stormwater runoff and septic system contributions, using the concentration-based approach. The LA percent reduction necessary to meet the concentration-based target is calculated for the aggregation of all nonpoint sources of bacteria contributing to waterbody impairments. Implementation of TMDLs and their load allocations is conducted through various regulatory programs and the requirements of those programs.

In determining the overall stormwater reductions in bacteria concentrations needed to achieve the applicable TMDL targets in **Table 6.1**, the TMDLs do not differentiate between the MS4 WLA and the LA, and instead apply the same overall percent reductions to both as if the two categories were a single category source. Aggregated allocations for a category of sources are not intended to be applied uniformly to individual sources in that category. The LA includes loading from stormwater discharges regulated by DEP and the water management districts that are not part of the NPDES stormwater program (see **Appendix F**). Although the TMDLs are based on the percent reductions from all sources to the waterbodies, it is not the department's intent to abate natural conditions. The needed reduction from anthropogenic inputs may be calculated based on more detailed source information conducted as part of a restoration plan (such as a BPCP).

Resources are available to facilitate achievement of the necessary reductions. DEP created an implementation guidance document with a focus on controlling urban sources of bacteria and the FDACS has prepared manuals with adopted BMPs that identify measures for reducing pollutants to surface waters from agricultural activities. These resources are described further in **Chapter 7.**

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

NPDES-permitted wastewater facility outfalls are available for viewing on the Bacteria TMDL StoryMap web page. **Appendix B** lists the wastewater facility outfalls associated with the impaired WBIDs. The state requires all NPDES-permitted wastewater point source dischargers to meet bacteria criteria contained in Subsection 62-302.530(6), F.A.C., and the disinfection requirements of Section 62-600.440, F.A.C. Permit effluent limitations for bacteria serve as the WLA for wastewater discharges. DEP does not allow mixing zones for bacteria.

6.3.2 NPDES Stormwater Discharges

MS4 permittees located in the vicinity of the impaired WBIDs are available to view at the Bacteria TMDL StoryMap web page. The MS4 permittee boundary areas are for informational purposes only. Otherwise, MS4 permittees are responsible for addressing the reductions necessary to meet the applicable bacteriological water quality criteria concentrations in the areas serviced by stormwater infrastructure it owns or operates.

In determining the overall stormwater reductions in bacteria concentrations needed to achieve the applicable TMDL targets (**Table 6.1**), the TMDLs do not differentiate between the MS4 WLA and the LA, and instead apply the same overall percent reductions to both as if the two categories were a single category source. Aggregated allocations for a category of sources are not intended to be applied uniformly to individual sources in that category. Pollutant reductions to attain a TMDL can come from many sources, and these percent reductions do not directly apply to any individual MS4 outfall.

6.4 Margin of Safety

The MOS is a required component of a TMDL and accounts for the uncertainty about the relationship between pollutant loads and the quality of the receiving waterbody. The MOS can either be implicitly accounted for by choosing conservative assumptions about loading or water quality response, or explicitly accounted for during the allocation of loadings. The explicit MOS usually takes the form of setting a TMDL target at a certain percentage below the protective target. An implicit MOS can be achieved by making conservative assumptions or using conservative approaches when developing a TMDL. For these TMDLs, an implicit MOS is applied, based on the following conservative assumptions:

(a) upstream and tributary bacterial concentrations are at the maximum allowable limit (i.e., criterion);

(b) although all sources are provided an allocation at the applicable water quality criterion, not all sources discharge at this maximum allocation at the same time;

(c) there is no bacteria die-off accounted for, when in reality bacteria concentrations diminish downstream from their source; and,

(d) all wastewater sources must meet both the applicable TPTV and geometric mean (as single sample maxima) at all times.

Chapter 7: Next Steps: Implementation Plan Development

7.1 Implementation Mechanisms

Following the adoption of a TMDL, implementation takes place through various measures. The implementation of TMDLs may occur through specific requirements in NPDES wastewater and stormwater permits, and, as appropriate, through local or regional water quality initiatives or basin management action plans (BMAPs).

Mechanisms to most efficiently address bacteria loading within impaired watersheds can be found in the department's document entitled "Restoring Bacteria-Impaired Waters A Toolkit to Help Local Stakeholders Identify and Eliminate Potential Pathogen Problems" (toolkit). Appropriate activities apply to a wide variety of stakeholders such as local governments, wastewater utilities, agriculture, the Florida Department of Health, the Florida Department of Transportation, and other federal, state and local governmental entities. The toolkit assists stakeholders by providing a range of potential activities, from the simple (such as Walk the WBIDs and GIS mapping) to the complex (such as bacteria source tracking). DEP may be available to provide technical assistance, guidance, and oversight of local efforts to identify and minimize bacteria sources of pollution.

Wastewater facilities must continue to meet applicable FIB criteria and effluent limitations in NPDES permits authorizing discharge to waters of the state that are issued under the provisions of Chapter 403, Florida Statutes (F.S.), and applicable rules in the F.A.C. Additionally, collection and transmission systems must be maintained and operated in accordance with Section 62-604.500, F.A.C., so that sanitary overflows or leaks do not cause or contribute to violations of the applicable FIB criteria.

7.2 Basin Management Action Plans

Information on the development and implementation of BMAPs is contained in Section 403.067, F.S. DEP may initiate and develop a BMAP that addresses some or all of the contributing areas to the TMDL waterbody. BMAPs are adopted by the DEP Secretary and are legally enforceable.

BMAPs describe the fair and equitable allocations of pollution reduction responsibilities to the sources in the watershed, as well as the management strategies that will be implemented to meet those responsibilities, funding strategies, mechanisms to track progress, and water quality monitoring. Local entities, such as wastewater facilities, industrial sources, agricultural producers, county and city stormwater systems, military bases, water control districts, state agencies, and individual property owners usually implement these strategies. BMAPs can also identify mechanisms to address potential pollutant loading from future growth and development.

7.3 Other Water Quality Initiatives

The Surface Water Improvement and Management (SWIM) Program is implemented by Florida's water management districts, by working cooperatively with DEP, other state and federal agencies, local governments, and private stakeholders. SWIM plans outline initiatives to accomplish watershed protection and restoration.

Additionally, FDACS develops and adopts BMP manuals specific to different agricultural commodities, such as row crops or cow-calf operations. Each manual is the result of research, field testing, and expert review, and each contains effective and practical means for improving water quality in agricultural and urban discharges. Many BMP manuals explicitly address techniques and practices for reducing sources of bacterial pollution, such as using buffers, setbacks, and swales to reduce or prevent the transport of pollutants from production areas to waterbodies.

7.4 Implementation Considerations

FIB impairments result from the cumulative effects of a multitude of potential sources, both natural and anthropogenic. Implementation of TMDLs and their allocations is conducted through various regulatory programs and the requirements of those programs. Reductions required of individual sources may be adjusted through these other programs as long as the reductions are consistent with achieving the overall allocations set forth in the TMDL. Aggregated allocations for a category of sources are not intended to be applied uniformly to individual sources in that category, unless otherwise specified.

Restoration of FIB impairments often relies on holistic approaches to address point and nonpoint sources. Plans need to include sufficient monitoring to identify the sources of the FIB impairment and appropriate remedial actions to address those sources. The combined active participation of state, county, and city authorities will be necessary to identify, reduce, eliminate, and prevent anthropogenic sources of FIB from reaching stormwater and receiving waterbodies.

Information on identifying urban and agricultural sources of bacteria—and best practices for involving stakeholders to address the sources is available at Restoring Bacteria Impaired Waters Toolkit.

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Appendices

Appendix A: Information on WBID-Specific Bacteria Data Summaries and Reductions. Table sorted by waterbody name.

Everglades West Coast Basin

Notes: The existing condition information provided in the table are for those water segments that meet the data sufficiency requirements described in subsection 5.2.1, based on bacteria results in the IWR Run 65 Database. Mullock Creek (WBID 3258C2), Mullock Creek - Marine (WBID 3258C4), Estero River – Marine (WBID 3258D1), Imperial River – Marine (WBID 3258EB), and Spring Creek – Marine (WBID 3258H2) were adopted as additions to the Verified List through a Secretarial Order signed on October 2, 2019. Cocohatchee (Inland Segment) (WBID 3278D) was adopted as an addition to the Verified List through a Secretarial Order signed on July 11, 2022.
HUC = Hydrologic unit code; F = Fresh; M = Marine

[1] Waterbody classifications are defined as follows:
I – Potable water supplies.
II – Shellfish propagation or harvesting.
III-F – Recreation; propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in fresh water.
III-M – Recreation; propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in marine water.
[2] The existing condition is represented by the data collected in the last 10 years, defined as the 2013-2022 period.
[3] The mean counts are provided for informational purposes only and are not used in any of the % reduction calculations.
[4] The long-term (2013 to 2022 period) median value is used to calculate the % reduction needed to meet the median count criterion (target).

WBID	Waterbody Segment Name	Water-body Type	Water-body Class[1]	FIB	Existing Condition: Number of Exceedances/ Number of Samples[2]	Existing Condition Bacteria Count Mean (counts/100ml)[2, 3]	Existing Condition Bacteria Count Median (counts/100ml)[2]	Existing Condition Bacteria Count 90th Percentile (counts/100ml)[2]	TMDL Target	% Reduction to Meet TMDL Target
3278D	Cocohatchee (Inland Segment)	Stream	III-F	*E. coli*	123/779	243	70	613	≤ 410 Counts / 100	33
3259A	Cocohatchee River	Estuary	II	Enterococci	146/1062	98	10	184	≤ 130 Counts / 100 mL	29
3278E	Cow Slough	Stream	III-F	*E. coli*	22/63	547	248	1473	≤ 410 Counts / 100 mL	72
3258D1	Estero River (Marine Segment)	Estuary	III-M	Enterococci	187/267	543	249	1202	≤ 130 Counts / 100 mL	89
3278R5	Gordon River (Marine Segment)	Estuary	III-M	Enterococci	56/194	169	74	303	≤ 130 Counts / 100 mL	57
3278K	Gordon River Extension	Stream	III-F	*E. coli*	28/163	365	123	757	≤ 410 Counts / 100 mL	45

WBID	Waterbody Segment Name	Water-body Type	Water-body Class[1]	FIB	Existing Condition: Number of Exceedances/ Number of Samples[2]	Existing Condition Bacteria Count Mean (counts/100ml)[2, 3]	Existing Condition Bacteria Count Median (counts/100ml)[2]	Existing Condition Bacteria Count 90th Percentile (counts/100ml)[2]	TMDL Target	% Reduction to Meet TMDL Target
3278R1	Haldeman Creek (Lower)	Estuary	III-M	Enterococci	81/196	247	88	711	≤ 130 Counts / 100 mL	81
3278R2	Haldeman Creek (Upper)	Stream	III-F	*E. coli*	45/153	427	166	1036	≤ 410 Counts / 100 mL	60
3258B2	Hendry Creek	Estuary	III-M	Enterococci	349/543	746	306	2420	≤ 130 Counts / 100 mL	94
3258EB	Imperial River (Marine Segment)	Estuary	III-M	Enterococci	175/296	588	209	2420	≤ 130 Counts / 100 mL	94
3258ED	Leitner Creek	Stream	III-F	*E. coli*	66/77	1132	921	2420	≤ 410 Counts / 100 mL	83
3258C2	Mullock Creek	Stream	III-F	*E. coli*	44/139	616	272	1019	≤ 410 Counts / 100 mL	59
3258C4	Mullock Creek (Marine Segment)	Estuary	III-M	Enterococci	31/159	212	42	412	≤ 130 Counts / 100 mL	68
3278R4	Naples Bay (Coastal Segment)	Estuary	II	Enterococci	68/512	80	10	190	≤ 130 Counts / 100 mL	31
3278R4	Naples Bay (Coastal Segment)	Estuary	II	Fecal Coliform	85/274	68	19	180	≤ 43 Counts / 100 mL	76
3278R4	Naples Bay (Coastal Segment)	Estuary	II	Fecal Coliform	NA	68	19 [4]	NA	≤ 14 MPN / 100 mL	24
3258F	Oak Creek	Stream	III-F	*E. coli*	19/31	771	579	1830	≤ 410 Counts / 100 mL	77
3278R3	Rock Creek	Estuary	III-M	Enterococci	97/192	504	134	1209	≤ 130 Counts / 100 mL	89
3258H3	Spring Creek	Stream	III-F	*E. coli*	12/76	356	172	638	≤ 410 Counts / 100 mL	35
3258H2	Spring Creek (Marine Segment)	Estuary	III-M	Enterococci	144/285	447	131	1733	≤ 130 Counts / 100 mL	92

Appendix B: Permitted Wastewater Facility Outfalls for Bacteria-Impaired WBIDs. Table sorted by waterbody name.

[1] M = Marine; F = Fresh
[2] (Permit number: Outfall designation)

Waterbody Name	WBID	Classification[1]	FIB Impairment	NPDES Wastewater Facility Outfalls[2]
Cocohatchee River	3259A	II	Enterococci	
Cow Slough	3278E	III-F	*E. coli*	
Estero River (Marine Segment)	3258D1	III-M	Enterococci	
Gordon River (Marine Segment)	3278R5	III-M	Enterococci	City of Naples Water Reclamation Facility (FL0026271: D-002, D-003, D-005)
Gordon River Extension	3278K	III-F	*E. coli*	10th St N Area W Goodlette-Frank SS SW Improvements (FLG914741: D-001), City of Naples Water Reclamation Facility (FL0026271: D-004)
Haldeman Creek (Lower)	3278R1	III-M	Enterococci	
Haldeman Creek (Upper)	3278R2	III-F	*E. coli*	
Hendry Creek	3258B2	III-M	Enterococci	
Imperial River (Marine Segment)	3258EB	III-M	Enterococci	
Leitner Creek	3258ED	III-F	*E. coli*	
Mullock Creek	3258C2	III-F	*E. coli*	
Mullock Creek (Marine Segment)	3258C4	III-M	Enterococci	
Naples Bay (Coastal Segment)	3278R4	II	Enterococci, Fecal coliform	
Oak Creek	3258F	III-F	*E. coli*	
Rock Creek	3278R3	III-M	Enterococci	Collier County South County WRF (FL0141356: D-001, D-002)
Spring Creek	3258H3	III-F	*E. coli*	
Spring Creek (Marine Segment)	3258H2	III-M	Enterococci	

Appendix C: Supporting Information for TMDL Development

The appendix consists of two spreadsheets: 1) the bacteria results for all WBIDs that were used to characterize existing conditions, and 2) an example of the TMDL calculations for Rock Creek (WBID 3278R3).

https://publicfiles.dep.state.fl.us/DEAR/DEARweb/TMDL/Bacteria_TMDLs/AppendixC_EWCBasin_TMDLBacteriaResults_IWRRun65.xlsx

https://publicfiles.dep.state.fl.us/DEAR/DEARweb/TMDL/Bacteria_TMDLs/AppendixC_RockCreek_3278R3_Encoc_2013-2022.xlsx

Appendix D: Comparison of Percent Reductions to Meet the TMDL Targets and Geometric Mean Components of the Criteria

[1] Waterbody classifications are defined as follows:
I – Potable water supplies.
II – Shellfish propagation or harvesting.
III-F – Recreation; propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in fresh water.
III-M – Recreation; propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in marine water.
[2] The existing condition is represented by the data collected in the last 10 years, defined as the 2013-2022 period.

WBID	Water Segment Name	Water-body Type	Water-body Class[1]	Fecal Indicator Bacteria	Existing Condition Bacteria Count 90th Percentile (counts/100ml)[2]	TMDL Target (TPTV criterion)	% Reduction to Meet TMDL Target (TPTV criterion)	Existing Condition Bacteria Count Geometric Mean (counts/100ml)[2]	Monthly Geometric Mean Criterion	% Reduction to Meet Geometric Mean Criterion
3278D	Cocohatchee (Inland Segment)	Stream	III-F	*E. coli*	613	≤ 410 Counts / 100 mL	**33**	61	≤ 126 Counts / 100 mL	**0**
3259A	Cocohatchee River	Estuary	II	Enterococci	184	≤ 130 Counts / 100 mL	**29**	25	≤ 35 Counts / 100 mL	**0**
3278E	Cow Slough	Stream	III-F	*E. coli*	1473	≤ 410 Counts / 100 mL	**72**	254	≤ 126 Counts / 100 mL	**50**
3258D1	Estero River (Marine Segment)	Estuary	III-M	Enterococci	1202	≤ 130 Counts / 100 mL	**89**	229	≤ 35 Counts / 100 mL	**85**
3278R5	Gordon River (Marine Segment)	Estuary	III-M	Enterococci	303	≤ 130 Counts / 100 mL	**57**	69	≤ 35 Counts / 100 mL	**49**
3278K	Gordon River Extension	Stream	III-F	*E. coli*	757	≤ 410 Counts / 100 mL	**45**	138	≤ 126 Counts / 100 mL	**9**
3278R1	Haldeman Creek (Lower)	Estuary	III-M	Enterococci	711	≤ 130 Counts / 100 mL	**81**	85	≤ 35 Counts / 100 mL	**59**
3278R2	Haldeman Creek (Upper)	Stream	III-F	*E. coli*	1036	≤ 410 Counts / 100 mL	**60**	172	≤ 126 Counts / 100 mL	**27**
3258B2	Hendry Creek	Estuary	III-M	Enterococci	2420	≤ 130 Counts / 100 mL	**94**	222	≤ 35 Counts / 100 mL	**84**
3258EB	Imperial River (Marine Segment)	Estuary	III-M	Enterococci	2420	≤ 130 Counts / 100 mL	**94**	186	≤ 35 Counts / 100 mL	**81**
3258ED	Leitner Creek	Stream	III-F	*E. coli*	2420	≤ 410 Counts / 100 mL	**83**	880	≤ 126 Counts / 100 mL	**86**
3258C2	Mullock Creek	Stream	III-F	*E. coli*	1019	≤ 410 Counts / 100 mL	**59**	256	≤ 126 Counts / 100 mL	**51**
3258C4	Mullock Creek (Marine Segment)	Estuary	III-M	Enterococci	412	≤ 130 Counts / 100 mL	**68**	44	≤ 35 Counts / 100 mL	**21**
3278R4	Naples Bay (Coastal Segment)	Estuary	II	Enterococci	190	≤ 130 Counts / 100 mL	**31**	23	≤ 35 Counts / 100 mL	**0**

WBID	Water Segment Name	Water-body Type	Water-body Class[1]	Fecal Indicator Bacteria	Existing Condition Bacteria Count 90th Percentile (counts/100ml)[2]	TMDL Target (TPTV criterion)	% Reduction to Meet TMDL Target (TPTV criterion)	Existing Condition Bacteria Count Geometric Mean (counts/100ml)[2]	Monthly Geometric Mean Criterion	% Reduction to Meet Geometric Mean Criterion
3258F	Oak Creek	Stream	III-F	*E. coli*	1830	≤ 410 Counts / 100 mL	**77**	510	≤ 126 Counts / 100 mL	**75**
3278R3	Rock Creek	Estuary	III-M	Enterococci	1209	≤ 130 Counts / 100 mL	**89**	139	≤ 35 Counts / 100 mL	**75**
3258H3	Spring Creek	Stream	III-F	*E. coli*	638	≤ 410 Counts / 100 mL	**35**	183	≤ 126 Counts / 100 mL	**31**
3258H2	Spring Creek (Marine Segment)	Estuary	III-M	Enterococci	1733	≤ 130 Counts / 100 mL	**92**	119	≤ 35 Counts / 100 mL	**71**

Appendix E: Load Calculation Method

The loading capacity for FIB TMDLs can be expressed as a function of flow using the concentration based criteria applicable to the impaired water segment, to report daily loads (counts/day). The daily loads must be equal to the applicable water quality criterion multiplied by the average volumetric flow representative of the water segment and the appropriate conversion factor. The load can be calculated as:

$$\text{Daily Load (counts/day)} = \text{Criterion} \times \text{Volumetric Flow} \times \text{Conversion Factor}$$

Where:

Criterion: The applicable criterion in counts/100 mL.

Flow: The water segment flow in ft^3/s.

Conversion Factor: The value that converts the product of bacteria counts and flow to load and is equal to 24,465,758.4 seconds-mL/ft^3*-day.*

Stream flows, typically expressed as ft^3/s, from direct measurements or derived from calculation methods following generally accepted scientific procedures may be used to calculate loads. Accepted procedures include the drainage-area ratio method and regression equations for estimating streamflow at ungaged sites (Ries and Friesz, 2000).

Methods for determining flows or flushing rates (expressed as volume per unit time) in tidal portions of streams and rivers, tidal estuaries, and coastal systems are described in EPA 1985.

References:

Ries, K.G., III, and Friesz, P.J. 2000. Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water-Resources Investigations Report 00–4135.

USEPA. 1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants. Office of Research and Development. Athens, GA. EPA/600/6-85/002 b.

Appendix F: 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 designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C. In 1994, the DEP 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, as authorized under Part IV of Chapter 373, F.S.

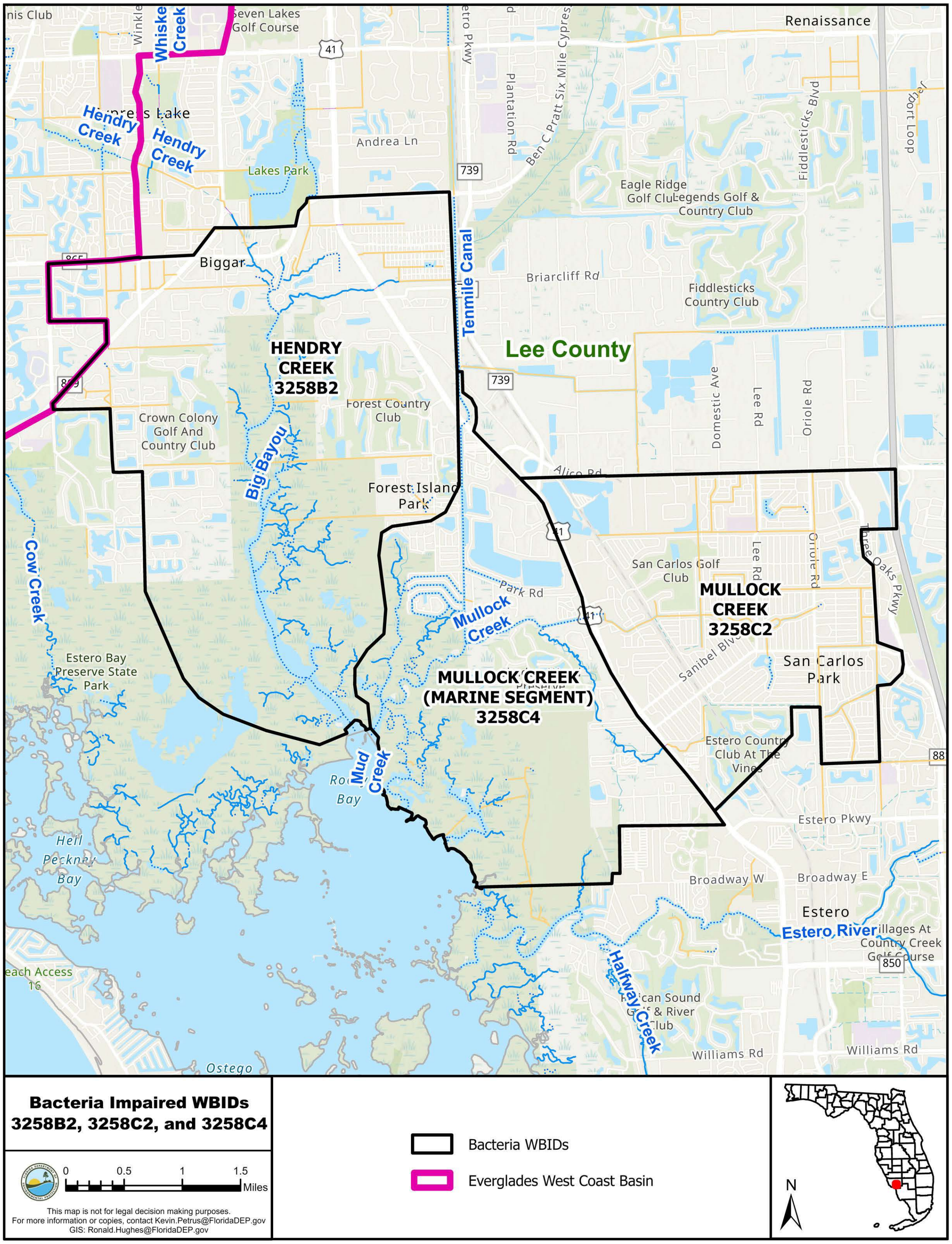
Chapter 62-40, F.A.C., also requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM Program plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. Waterbodies where PLRGs have been established include Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

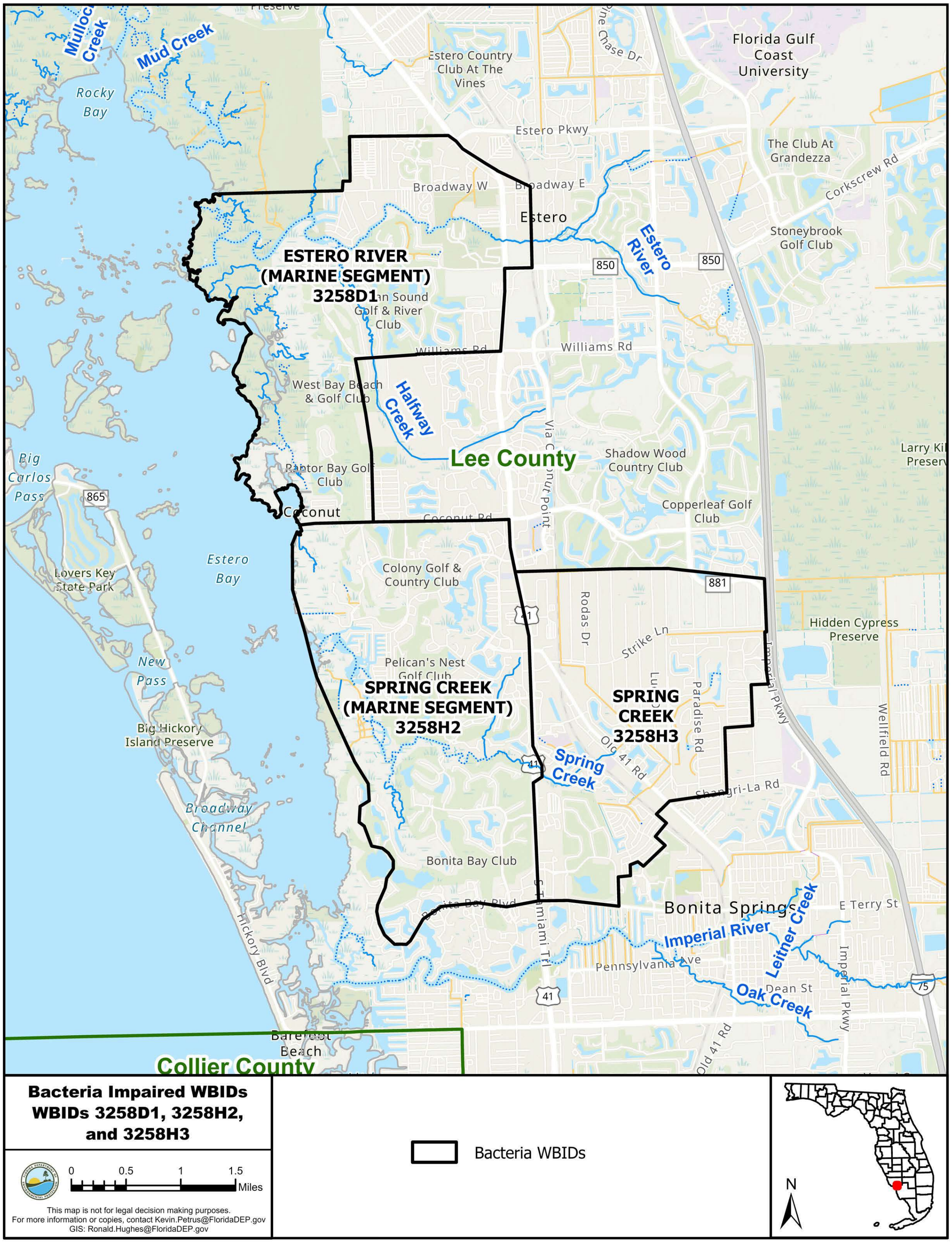
In 1987, the U.S. Congress established Section 402(p) as part of the federal CWA Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990 to address stormwater discharges associated with industrial activity, including 11 categories of industrial activity, construction activities disturbing five or more acres of land, and large and medium MS4s located in incorporated places and counties with populations of 100,000 or more.

However, because the master drainage systems of most local governments in Florida are physically interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 special districts; community development districts, water control districts, and Florida Department of Transportation throughout the 14 counties meeting the population criteria. DEP received authorization to implement the NPDES stormwater program in 2000. The authority to administer the program is set forth in Section 403.0885, F.S.

The Phase II NPDES stormwater program, promulgated in 1999, addresses additional sources, including small MS4s and small construction activities disturbing between one and five acres, and urbanized areas serving a minimum resident population of at least 1,000 individuals. While these urban stormwater discharges are 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. Phase I MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix G: Maps of FIB Impaired Water Segments




Mud Creek
Rocky Bay
Estero Country Club At The Vines
Florida Gulf Coast University
Estero Pkwy
The Club At Grandezza
Corkscrew Rd
Broadway W
Broadway E
Estero
Estero River
Stoneybrook Golf Club
850
ESTERO RIVER (MARINE SEGMENT) 3258D1
Williams Rd
West Bay Beach & Golf Club
Halfway Creek
Lee County
Shadow Wood Country Club
Larry Kiker Preserve
Big Carlos Pass
865
Raptor Bay Golf Club
Coconut
Copperleaf Golf Club
Estero Bay
Lovers Key State Park
Colony Golf & Country Club
881
Rodas Dr
Hidden Cypress Preserve
Strike Ln
New Pass
Pelican's Nest Golf Club
SPRING CREEK (MARINE SEGMENT) 3258H2
SPRING CREEK 3258H3
Paradise Rd
Imperial Pkwy
Wellfield Rd
Big Hickory Island Preserve
Old 41 Rd
Spring Creek
Broadway Channel
Bonita Bay Club
Bonita Springs
E Terry St
Leitner Creek
Imperial River
Hickory Blvd
S Tamiami Trl
Pennsylvania Ave
Dean St
Oak Creek
41
75
Barefoot Beach
Collier County
Bacteria Impaired WBIDs
WBIDs 3258D1, 3258H2, and 3258H3
0
0.5
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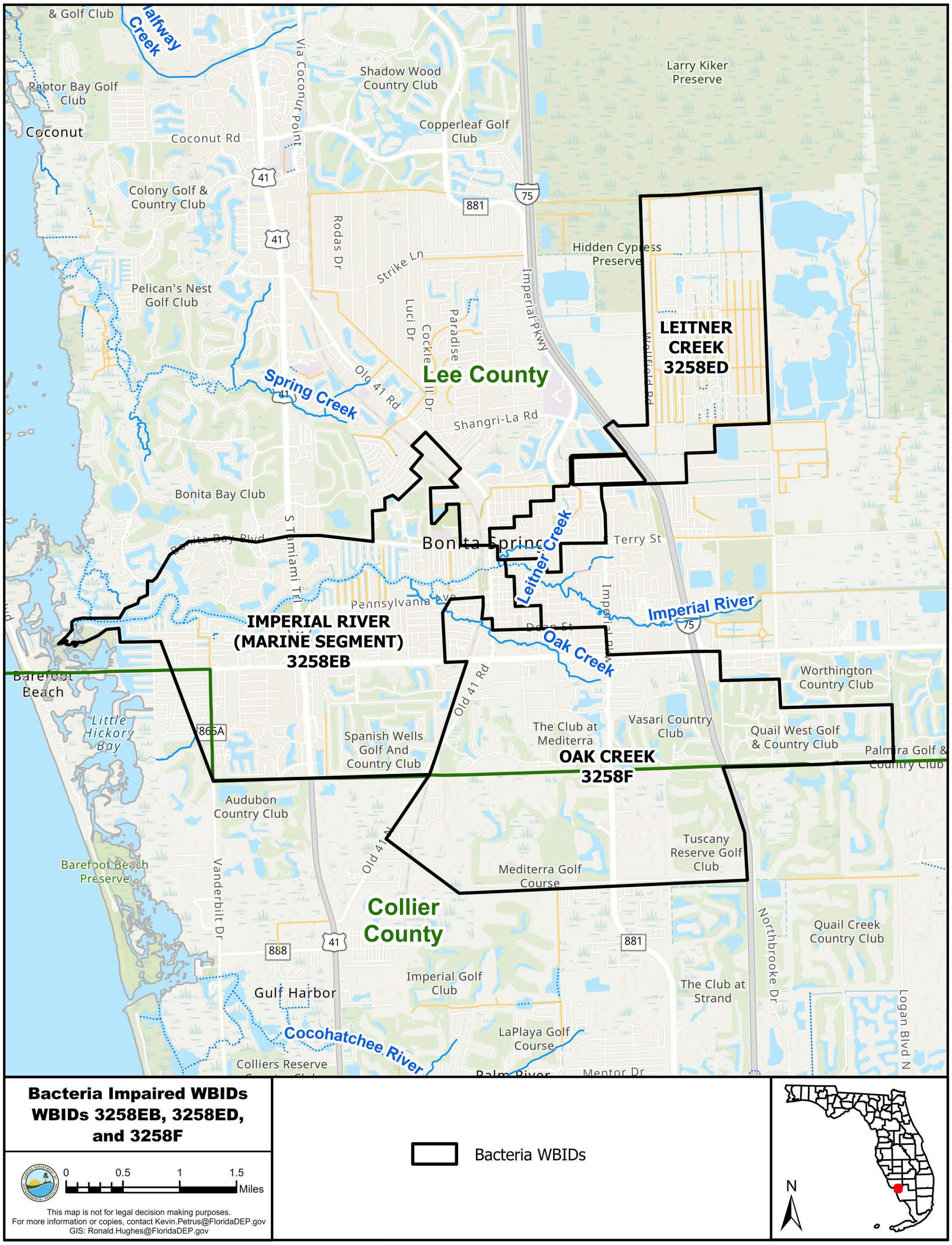
Miles
This map is not for legal decision making purposes.
For more information or copies, contact Kevin.Petrus@FloridaDEP.gov
GIS: Ronald.Hughes@FloridaDEP.gov
Bacteria WBIDs
N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WBIDs 3258EB, 3258ED, and 3258F
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IMPERIAL RIVER (MARINE SEGMENT) 3258EB
OAK CREEK 3258F
Lee County
Collier County
Bonita Springs
Spring Creek
Leitner Creek
Imperial River
Oak Creek
Cocohatchee River
Bacteria WBIDs
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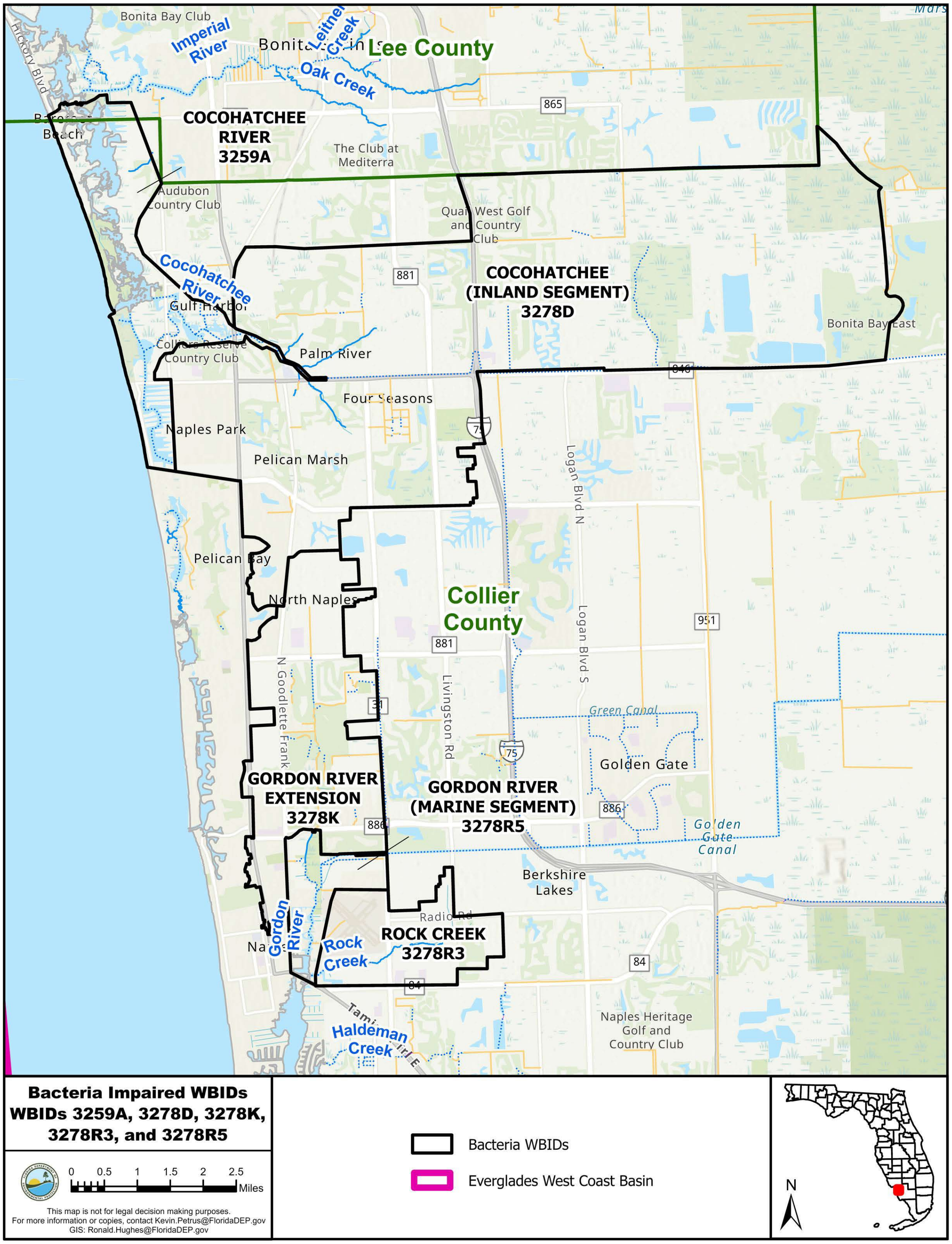
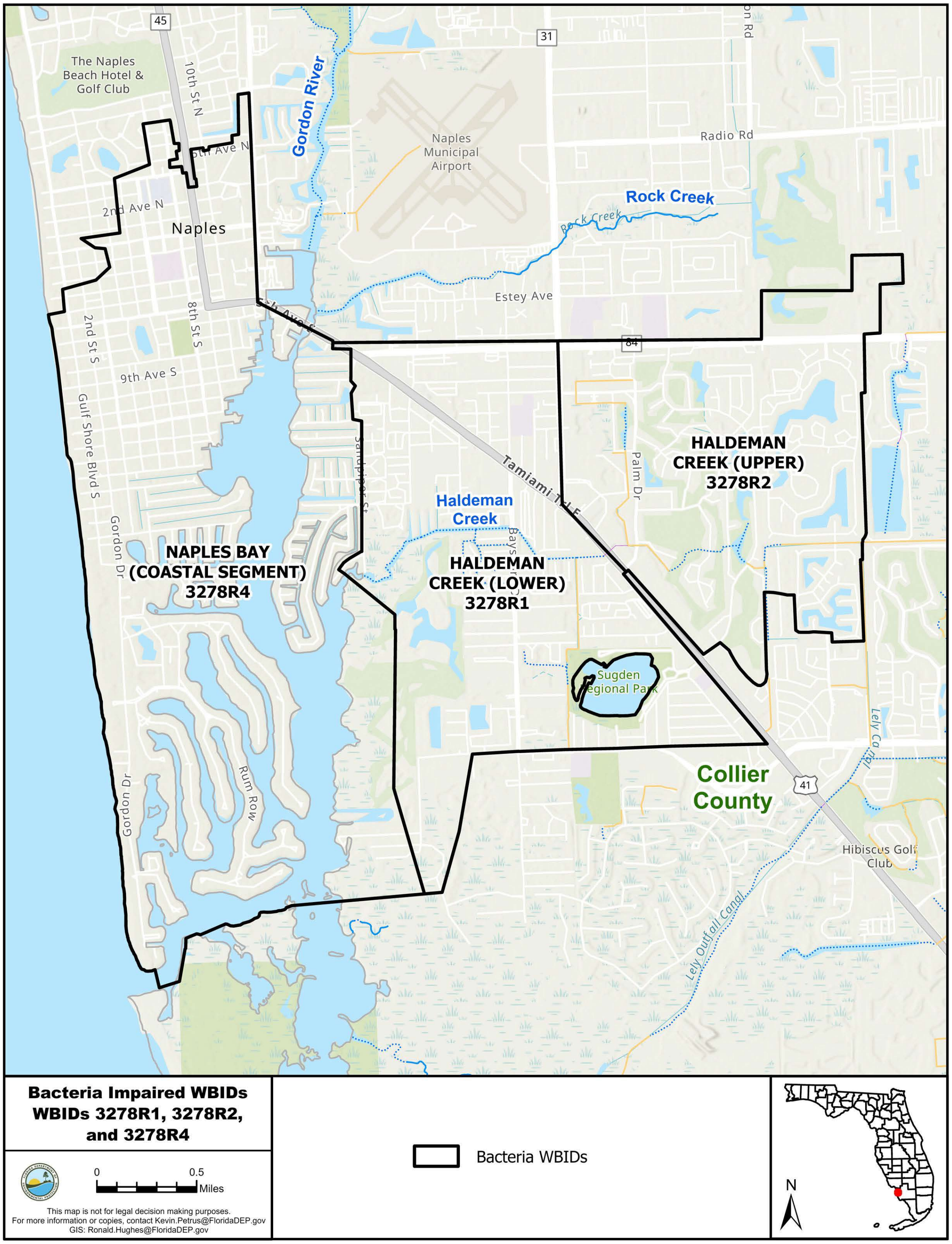
This map is not for legal decision making purposes.
For more information or copies, contact Kevin.Petrus@FloridaDEP.gov
GIS: Ronald.Hughes@FloridaDEP.gov


Lee County
Collier County
COCOHATCHEE RIVER 3259A
COCOHATCHEE (INLAND SEGMENT) 3278D
GORDON RIVER EXTENSION 3278K
GORDON RIVER (MARINE SEGMENT) 3278R5
ROCK CREEK 3278R3
Imperial River
Leitner Creek
Oak Creek
Cocohatchee River
Gordon River
Rock Creek
Haldeman Creek
Green Canal
Golden Gate Canal
Bonita Bay Club
The Club at Mediterra
Audubon Country Club
Quail West Golf and Country Club
Bonita Bay East
Palm River
Four Seasons
Naples Park
Pelican Marsh
Pelican Bay
North Naples
Golden Gate
Berkshire Lakes
Naples Heritage Golf and Country Club
Logan Blvd N
Logan Blvd S
Livingston Rd
N Goodlette Frank
Radio Rd
Hickory Blvd
Bacteria Impaired WBIDs
WBIDs 3259A, 3278D, 3278K, 3278R3, and 3278R5
0 0.5 1 1.5 2 2.5 Miles
This map is not for legal decision making purposes.
For more information or copies, contact Kevin.Petrus@FloridaDEP.gov
GIS: Ronald.Hughes@FloridaDEP.gov
Bacteria WBIDs
Everglades West Coast Basin
N


The Naples Beach Hotel & Golf Club
10th St N
Gordon River
Naples Municipal Airport
Radio Rd
Rock Creek
Rock Creek
2nd Ave N
5th Ave N
Naples
Estey Ave
8th St S
2nd St S
9th Ave S
Gulf Shore Blvd S
Tamiami Trl E
Palm Dr
HALDEMAN CREEK (UPPER) 3278R2
Haldeman Creek
HALDEMAN CREEK (LOWER) 3278R1
NAPLES BAY (COASTAL SEGMENT) 3278R4
Gordon Dr
Sugden Regional Park
Collier County
Rum Row
Gordon Dr
Hibiscus Golf Club
Lely Outfall Canal
Bacteria Impaired WBIDs
WBIDs 3278R1, 3278R2, and 3278R4
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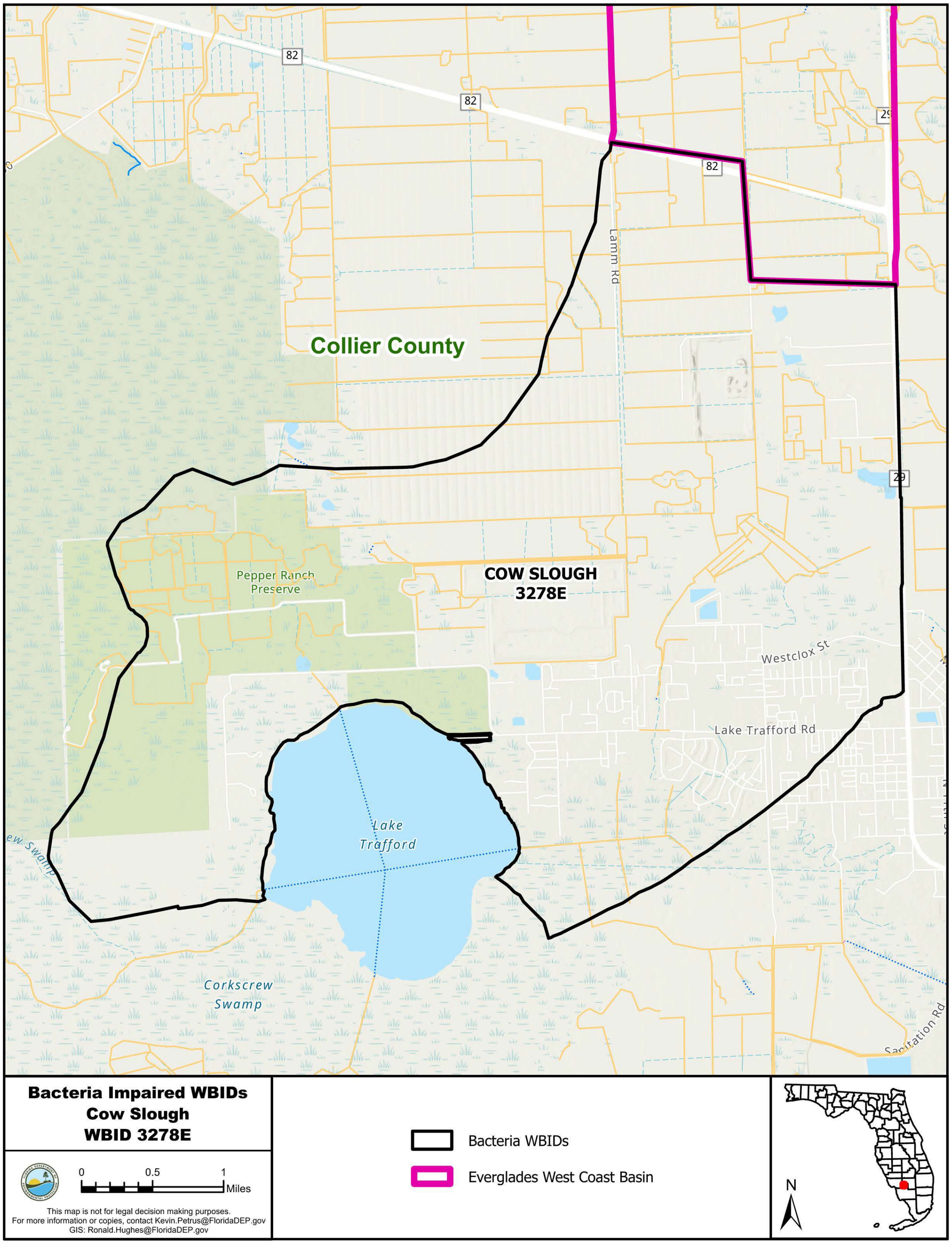
For more information or copies, contact Kevin.Petrus@FloridaDEP.gov
GIS: Ronald.Hughes@FloridaDEP.gov
Bacteria WBIDs
N


82
82
82
29
29
Lamm Rd
Collier County
Pepper Ranch
Preserve
COW SLOUGH
3278E
Westclox St
Lake Trafford Rd
Lake
Trafford
Corkscrew
Swamp
Sanitation Rd
Bacteria Impaired WBIDs
Cow Slough
WBID 3278E
0
0.5
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Miles
This map is not for legal decision making purposes.
For more information or copies, contact Kevin.Petrus@FloridaDEP.gov
GIS: Ronald.Hughes@FloridaDEP.gov
Bacteria WBIDs
Everglades West Coast Basin
N