Final

Total Maximum Daily Load

for

Fecal Coliform

in

Perdido River

WBID 462B

May 2012

Region4 serving the southeast

In compliance with the provisions of the Federal Clean Water Act, 33 U.S.C §1251 et. seq., as amended by the Water Quality Act of 1987, P.L. 400-4, the U.S. Environmental Protection Agency is hereby establishing the Total Maximum Daily Load (TMDL) for fecal coliform bacteria in Perdido River in Perdido River and Bay Basin (WBID 462B). Subsequent actions must be consistent with this TMDL.

/s/ 5/30/2012

James D. Giattina, Director Date

Water Protection Division

Table of Contents

Table of Figures

Table of Tables

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
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
NWFWMD	Northwest Florida Water Management District
OSTD	Onsite Sewer Treatment and Disposal Systems
SEC/DAY	Seconds Per Day
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
462B	Perdido River	Class III Freshwater	Perdido River and Bay	03140106	Escambia	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:

Waterbody	WBID	WLA[1]		LA	TMDL
		Facility (MPN/day)	Stormwater/MS4 (% Reduction)[2]	(% Reduction)[2]	(% Reduction)[2]
Perdido River	462B	N/A	N/A	75%	75%

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.

5. Endangered Species (yes or blank):

6. USEPA Lead TMDL or Other: USEPA

7. TMDL Considers Point Sources/Non Point Sources: Non Point Sources

8. NPDES Discharge to surface water addressed in TMDL: No

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 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. FDEP also established five water management districts (WMD) responsible for managing ground and surface water supplies in the counties encompassing the districts. Located in the Perdido River and Bay Basin, Perdido River is a Group 5 waterbody managed by the Northwest Florida Water Management District (NWFWMD).

For the purpose of planning and management, the WMDs divided the districts into planning units defined as either an individual primary tributary basin or a group of adjacent primary tributary basins with similar characteristics. Perdido River is located within the Perdido River Planning Unit. 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. This TMDL report addresses WBID 462B, a segment of Perdido River.

2. Problem Definition

To determine the status of surface water quality in Florida, 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 (FAC). Potential impairments are identified by FDEP using IWR methodology to assess 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 of impaired waters.

The TMDL addressed in this document is being established pursuant to commitments made by the United States Environmental Protection Agency (USEPA) 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 USEPA approved 1998 303(d) list. The 1998 303(d) list identified numerous WBIDs in the Perdido River and Bay Basin as not meeting WQS. After assessing all readily available water quality data, the USEPA is responsible for developing a TMDL for WBID 462B, Perdido River. The geographic location of this WBID is shown in Figure 1. The parameter addressed in this TMDL is fecal coliform bacteria.

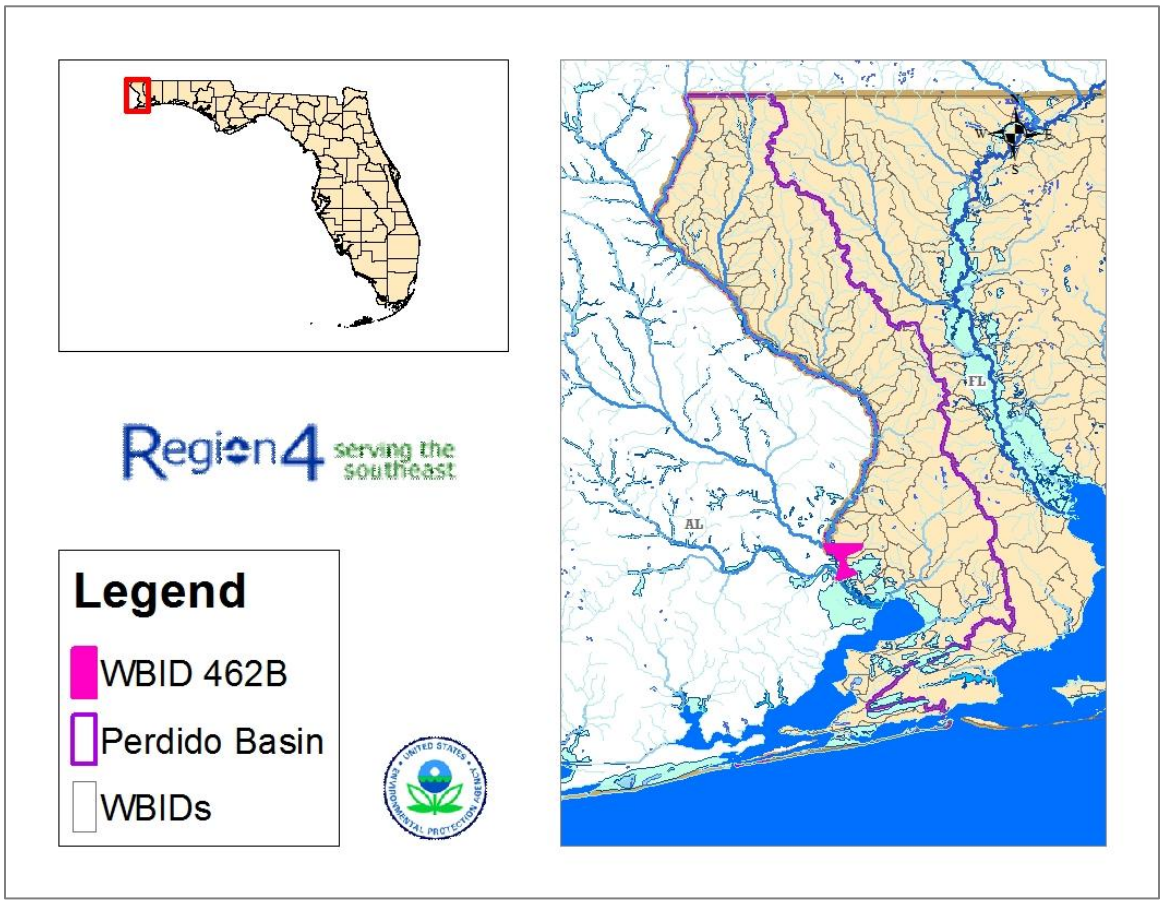

Figure 1. Location of WBID 462B – Perdido River

3. Watershed Description

Perdido River, specifically WBID 462B, is located within the Florida panhandle abutting the Florida and Alabama state line. WBID 462B is situated just north of the Perdido Bay which drains to the Gulf of Mexico. The Perdido, Styx, and Blackwater Rivers all drain into WBID 462B. WBID 462B, which is only a small portion of the Perdido River, encompasses approximately 1.7 mi^2 and consists almost completely of forests and wetlands (Figure 2). A breakdown of land use by acreage and percentage for WBID

462B is provided below in Table 1. The landuse coverages were obtained from the FDEP FTP site. The data is based on 2004 land cover features and is classified using Level 1 Florida Landuse Classification Codes (FLUCCs).

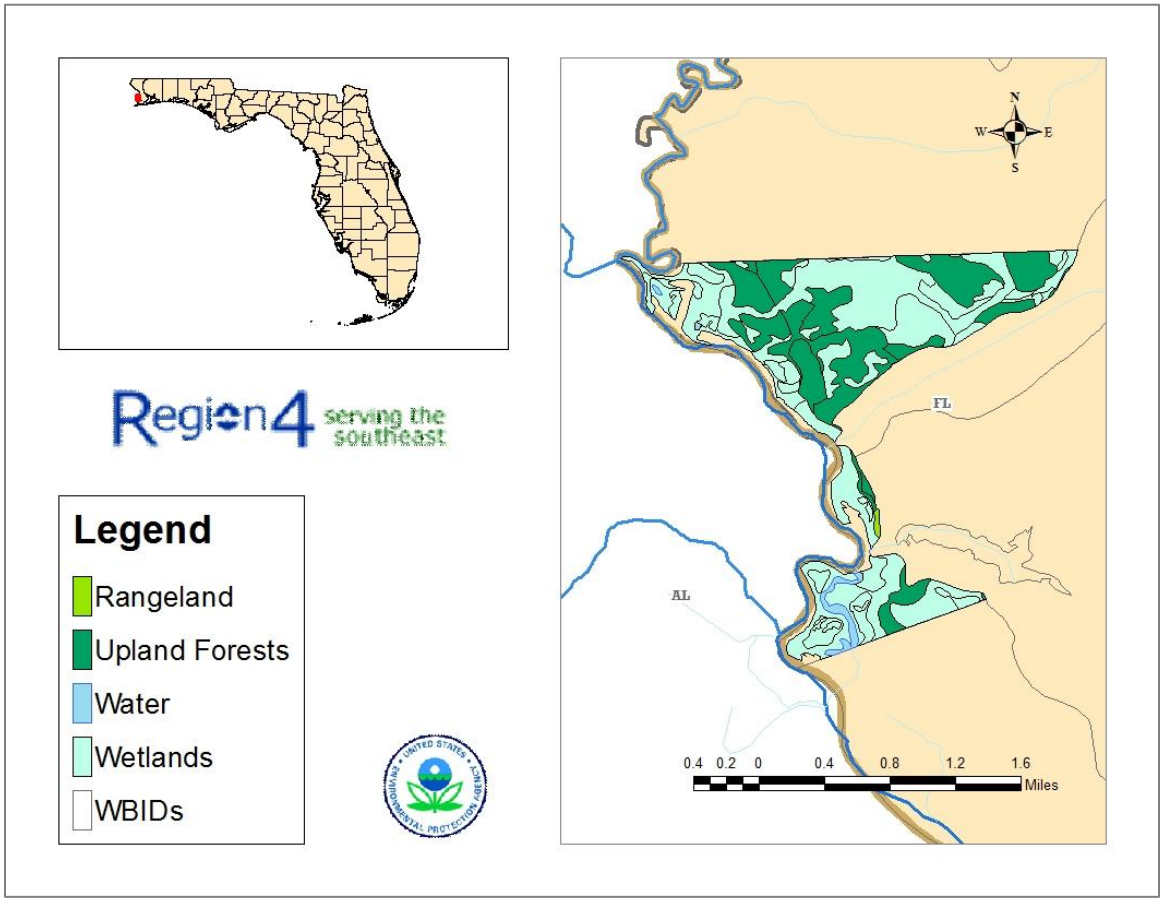

Figure 2. Perdido River – WBID 462B Landuse Distribution

Table 1. Landuse Distribution in WBID 462B: Perdido River

Impaired Waterbody	WBID(s)	Unit	Rangeland	Upland Forests	Water	Wetlands	Total
Perdido River	462B	Acres	3	378	19	667	1067
		percent	0.3	35.4	1.8	62.5	100%

Note: Areas in the table represent the watershed within WBID 462B.

WBID 462B is located on the Alabama and Florida state line; therefore, landuse in Alabama may also impact water quality within the WBID. Figure 3 depicts the landuse

area surrounding the WBID. The latest landuse coverages were obtained from the National Land Cover Database (NLCD) website and are based on 2007 land cover features. Pastures, crops and low intensity urban development are depicted to the west and northeast of WBID 462B.

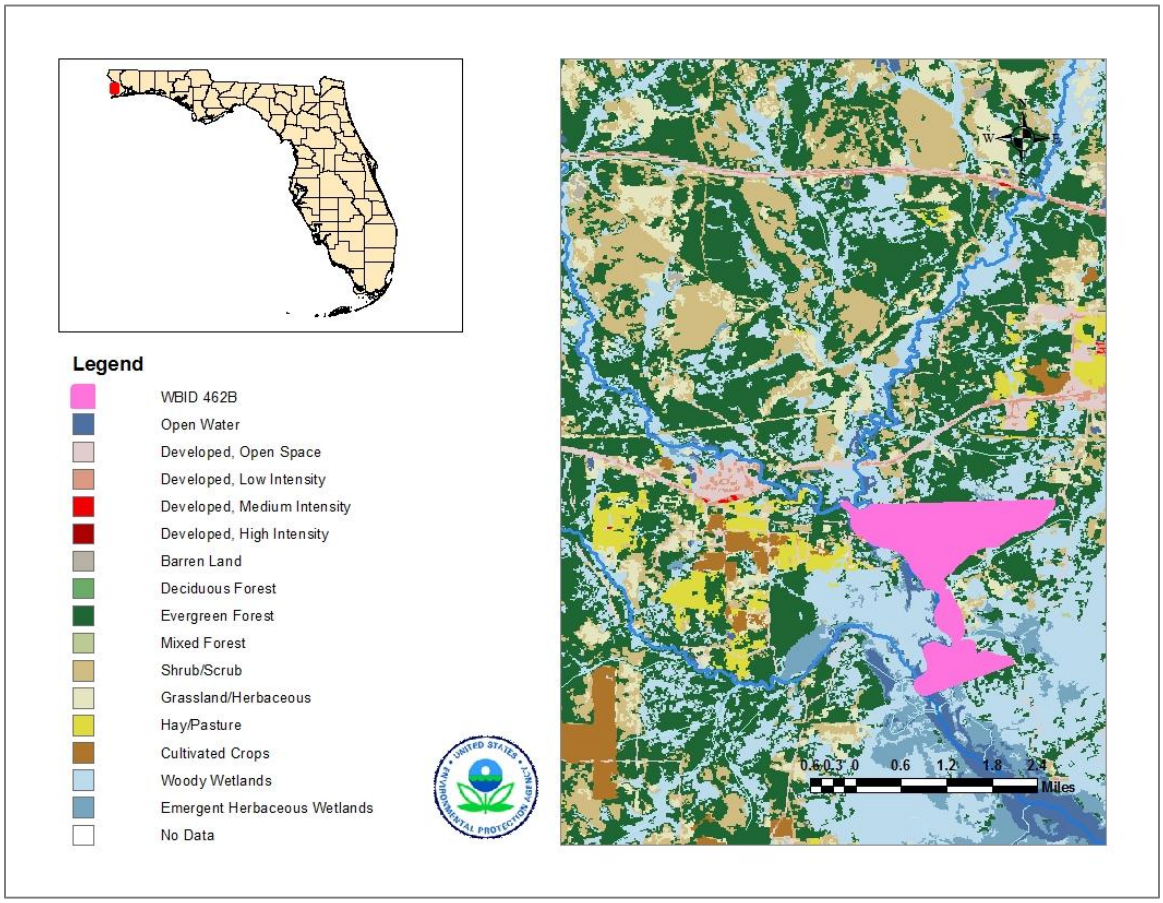

Figure 3. Land Use in the Area Surrounding WBID 462B, Perdido River.

There is no known wastewater National Pollutant Discharge Elimination System (NPDES) permitted surface water discharge or Municipal Separate Storm Sewer System (MS4) permitted service area within the watershed.

4. Water Quality Standards/TMDL Targets

The Perdido River, WBID 462B, is a Class III Freshwater waterbody 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 FAC Section 62-302.400(1), and water quality criteria for protection of all classes of waters are established in FAC Section 62-302.530. Individual criteria should be considered in conjunction with other provisions in water quality standards, including Section 62-302.500 FAC. [Surface Waters: Minimum Criteria, General Criteria] that apply to all waters unless alternative criteria are specified in FAC 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. It was not possible to assess against the geometric mean criteria due to insufficient fecal coliform data. The 400 count/100 mL criterion was selected as the TMDL endpoint since this resulted in a more stringent reduction and satisfied both parts of the acute criteria. EPA believes implementation of the percent reduction required in this TMDL will achieve restoration of the waterbody. EPA assumes that the best management practices that will be used to achieve the prescribed reductions will ensure that all three parts of the standard will be met. Florida's continued monitoring and assessment of this waterbody will provide the data and information necessary to demonstrate whether the waterbody is fully restored.

5. Water Quality Assessment

WBID 462B was listed as not attaining its designated uses on Florida's 1998 303(d) list due to elevated fecal coliform bacteria. To confirm whether WBID 462B is impaired due to bacteria, an assessment of available data was conducted. The source for current ambient monitoring data for WBID 462B Perdido River was the IWR data Run 44. The IWR database contains data from various sources within the state of Florida, including the WMDs and counties.

5.1. Water Quality Data

The table and figures presented in this section provide the station locations and time series data for fecal coliform bacteria collected in Perdido River. Table 2 provides a list of the water quality monitoring stations in WBID 462B, including the date range and number of observations. Figure 4 illustrates where the IWR stations are located within the WBID.

Table 2. Water Quality Monitoring Stations for WBID 462B: Perdido River

Station	Station Name	First Date	Last Date	No. Obs
21FLPNS 3301462B1	Perdido River at Blackwater River (AL) Confluence	12/8/2005	1/4/2006	3
21FLPNS 3301462B2	Perdido River, 250 Meters above Blackwater (AL) Confluence	5/26/2005	1/4/2006	5
21FLPNS 3301462B3	Perdido River, Below Styx River near Brown's Landing	5/26/2005	1/4/2006	4

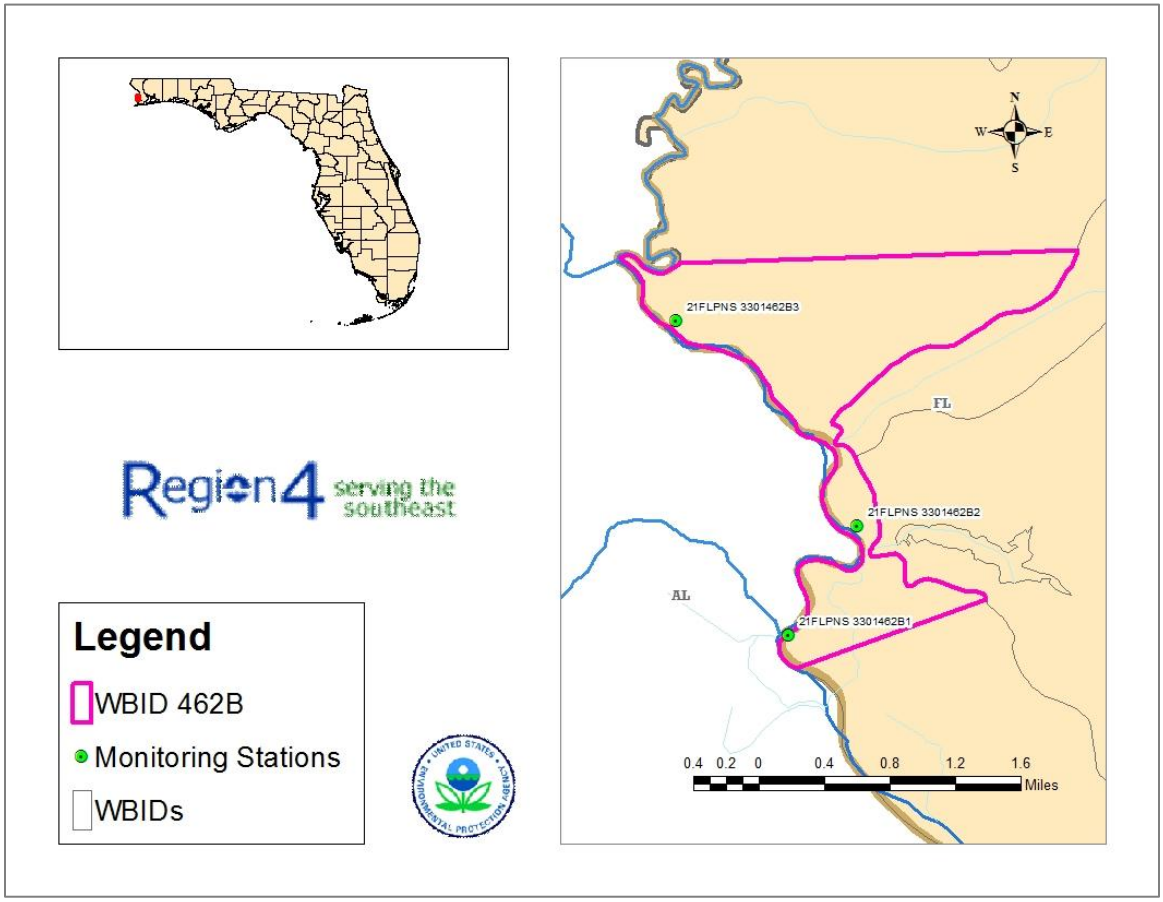

Figure 4. Station Locations for WBID 462B: Perdido River

Fecal Coliform

Figure 5 provides a time series plot of fecal coliform data in Perdido River (WBID 462B). There were 3 monitoring stations used in the assessment that included a total of 12 observations of which 4 (33 percent) are above the water quality standard of 400 counts/100 mL fecal coliform. Only a limited amount of fecal coliform data is available for WBID 426B. Note 3 of the 4 exceedances were detected on the same day, January 4, 2006.

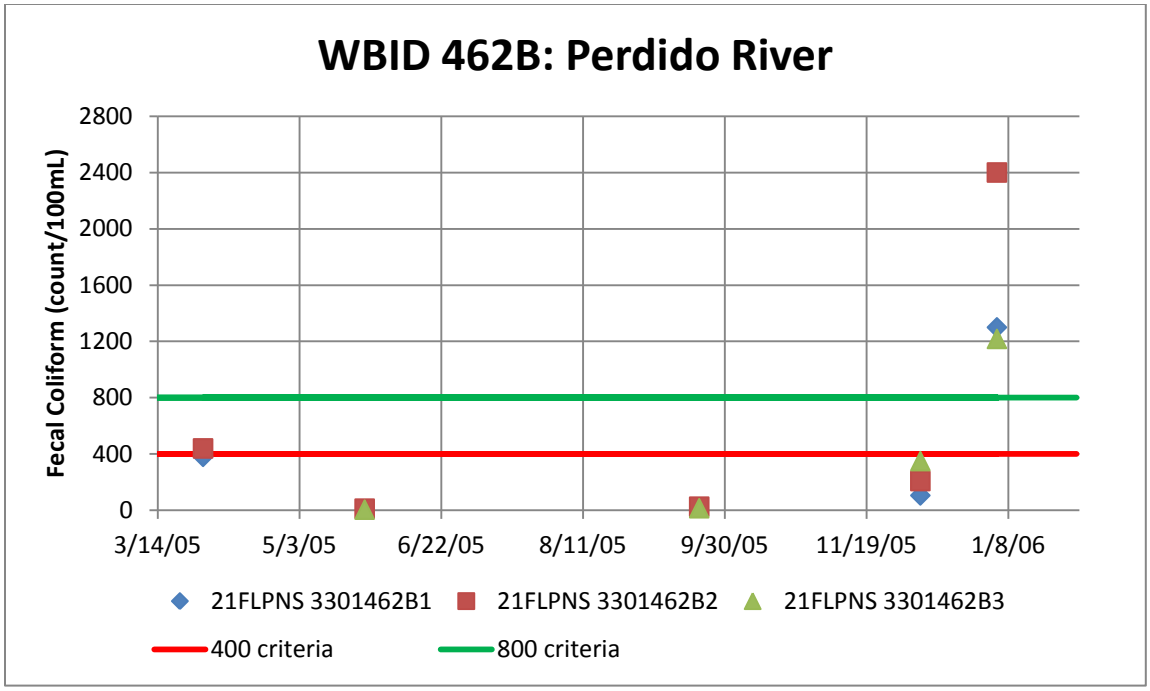

Figure 5. WBID 462B: Perdido River Measured Fecal Coliform

Several samples were flagged with laboratory remark codes. The complete list of data used in this TMDL analysis is provided in Section 8.2 (Existing Conditions), along with any associated laboratory remark codes. Summary statistics for the fecal coliform data are provided in Table 3.

Table 3. Water Quality Statistics for Fecal Coliform

Monitoring Station	Minimum Concentration (#/100ml)	Maximum Concentration (#/100ml)	Mean Concentration (#/100ml)	Standard Deviation (#/100ml)	# Samples >400 (#/100ml)	# Samples >800 (#/100ml)
21FLPNS 3301462B1	106	1300	595	625	1	1
21FLPNS 3301462B2	12	2400	617	1012	2	1
21FLPNS 3301462B3	5	1218	397	570	1	1

Stream flow is an important factor affecting water quality, especially insofar as it can be used to correlate flow rate with observed exceedances and determine the available loading capacity for pollutants. However, flow data was not available for Perdido River, specifically WBID 462B. Daily precipitation data collected at Pensacola Regional Airport (COOP ID 86997) was compared with the fecal coliform results to identify the hydrologic conditions under which excursions above the criteria occurred (see Figure 6).

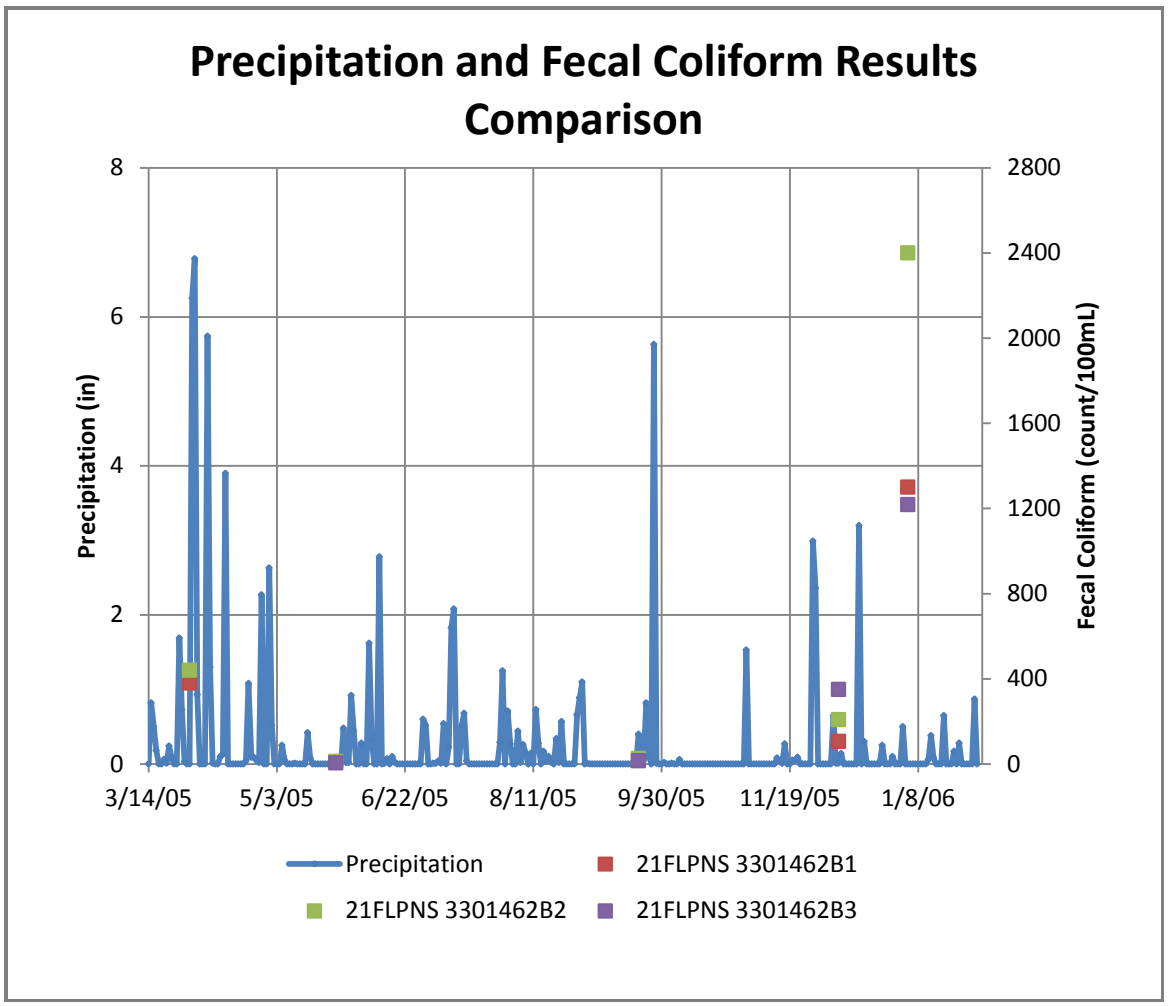

Figure 6. Comparison of Fecal Coliform Concentrations in WBID 462B and Rainfall at Pensacola Regional Airport (COOP ID 86997)

Based on the comparison, all of the fecal coliform data was collected during conditions of less than 0.5 inches of rainfall. Without any additional data, fecal coliform concentrations during wet conditions cannot be evaluated. Depending on the source of the contamination, exceedances of the fecal coliform criteria can occur in response to rainfall events. Conservatively, implementation of this TMDL should address controlling nonpoint sources during both wet and dry weather conditions.

6. Source and Load Assessment

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources of pollutants in the watershed and the amount of loading contributed by each of these sources. Sources are broadly classified as either point or nonpoint sources. Coliform bacteria can enter surface waters from both point and nonpoint sources.

6.1. Point Sources

A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits. NPDES permitted discharges include continuous discharges such as wastewater treatment facilities as well as some stormwater driven sources such as municipal separate storm sewer systems (MS4s), certain industrial facilities, and construction sites over one acre.

6.1.1. Wastewater/Industrial Permitted Facilities

There are no wastewater or industrial NPDES permitted facilities that discharge to or upstream of Perdido River, specifically WBID 462B.

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."

MS4s may discharge coliform bacteria and other pollutants to waterbodies in response to storm events. In 1990, USEPA developed rules establishing Phase I of the NPDES stormwater program, designed to prevent harmful pollutants from being washed by stormwater runoff into 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 no MS4 stormwater permitted facilities that discharge to or upstream of Perdido River, specifically WBID 462B.

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. Approximately 36 percent of the land area within WBID 462B is designated as forested or rangeland and approximately 64 percent of the land area is designated as water or wetlands. Therefore, natural landuse is the sole landuse designated in WBID 462B. As such, wildlife could be relevant sources of bacteria to Perdido River, WBID 462B. However, the percentages provided above only pertain to the landuse within WBID 462B. Both urban development and agriculture landuses are located to the west and northeast of WBID 462B and are also potential sources of bacteria contamination. Additionally, Perdido River is located on the state line between Alabama and Florida. A portion of the developed land within this watershed is located within the state of Alabama.

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. Agriculture is not a landuse designated within WBID 462B; however, agriculture is present within the watershed to the west and northeast of WBID 462B and could be a potential source of pathogen loadings to Perdido River. A portion of the agriculture lands within this watershed are located within the state of Alabama.

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. Although no OSTDs are located within WBID 462B, urban development is located within the watershed to the west and northeast of WBID 462B. Therefore, OSTDs could be a potential source of pathogen loadings to Perdido River. A portion of the urban developed lands within this watershed are located within the state of Alabama.

6.2.4. Urban Areas/Pervious

Urban areas include landuses such as residential, industrial, utility swaths, extractive and commercial. Fecal coliform loading from urban areas (whether within an MS4 jurisdiction or not) is attributable to multiple sources including storm water 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 FS, 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, FAC.

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), FAC).

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.

The area within the Perdido River watershed, specifically WBID 462B, is composed of natural undeveloped landuses. However, a portion of the watershed, located to the west and northeast of WBID 462B, does have some urban development. Consequently, urban landuse could be a potential source of pathogen loadings to Perdido River. A portion of the urban developed lands within this watershed are located within the state of Alabama.

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 is available to develop a relationship between flow and concentration. Flow measurements were not available for WBID 462B; therefore, this TMDL is expressed as a percent reduction.

7.1. Percent Reduction Approach for TMDL Development

Under this 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. There are many formulas for determining the percentile and these can be found in many text books on statistics. The Hazen formula was used in this TMDL 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 462B is provided in Appendix A.

The TMDL percent reduction required to meet the coliform criteria is based on the following equation:

$$\%\text{Reduction} = \left(\frac{[existing] - [criterion]}{[existing]} \right) \times 100$$

Where:
% Reduction = percent reduction
[*existing*] = existing concentration
[*criterion*] = criterion concentration (i.e., target)

8. TMDL Determination

A TMDL for a given pollutant and waterbody is comprised of the sum of individual waste load 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:

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

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 percent reduction that meets the acute criteria for Class III waters was calculated by comparing the 90th percentile value with the 400 counts/100 mL criterion. The calculated TMDL reduction for WBID 462B, Perdido River is summarized in Table 4.

Table 4. Summary of TMDL Components.

Waterbody	WBID	WLA[1]		LA	TMDL
		Facility (MPN/day)	Stormwater/MS4 (% Reduction)[2]	(% Reduction)[2]	(% Reduction)[2]
Perdido River	462B	N/A	N/A	75%	75%

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/100 mL 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. Flow data is not available for Perdido River, and it is not possible to estimate flow associated with the available data. However, it is recommended that flow be measured at the time of sampling to ensure compliance with the TMDL. The maximum load the stream can transport on any one day and maintain water quality standards is calculated by multiplying 800 counts/100 mL by the flow (in cubic feet per second), along with a conversion factor to obtain units of fecal coliform counts per 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.

Daily precipitation data collected at Pensacola Regional Airport (COOP ID 86997) was compared with the fecal coliform results to identify the hydrologic conditions under which excursions above the criteria occurred. However, all of the fecal coliform data available for WBID 462B was collected during dry weather conditions. Without any additional data, fecal coliform concentrations during wet conditions cannot be evaluated. Conservatively, critical conditions and seasonal variation are accounted for in the TMDL analysis for WBID 462B 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 for WBID 462B are being represented using the 90th percentile of measured concentrations. The 90th percentile and percent reduction required to meet the TMDL target are shown below in Table 5.

Table 5. Fecal Coliform Measurements in WBID 462B, Perdido River

Date	Time	Station	Fecal Coliform (count/100ml)	Remark Code
3/30/2005	1235	21FLPNS 3301462B1	380	
12/8/2005	1340	21FLPNS 3301462B1	106	
1/4/2006	954	21FLPNS 3301462B1	1300	B
3/30/2005	1220	21FLPNS 3301462B2	440	A
5/26/2005	1205	21FLPNS 3301462B2	12	B
9/21/2005	1130	21FLPNS 3301462B2	26	B
12/8/2005	1240	21FLPNS 3301462B2	208	B
1/4/2006	1004	21FLPNS 3301462B2	2400	
5/26/2005	1135	21FLPNS 3301462B3	5	B
9/21/2005	1115	21FLPNS 3301462B3	15	B
12/8/2005	1256	21FLPNS 3301462B3	350	
1/4/2006	1020	21FLPNS 3301462B3	1218	B
90th Percentile Fecal Coliform Concentration			**1575**	
Percent Reduction to meet TMDL Target			**75 percent**	

Several samples were flagged with laboratory remark codes. The following laboratory remark codes were associated with at least one of the samples reviewed for inclusion in this TMDL analysis:

Remark Code A – The laboratory remark code A indicates that the result value reported is the mean of two or more samples. However, the values were considered to be accurate and are acceptable for use in the TMDL analysis.

Remark Code B –The laboratory remark code B indicates that the sample result was based upon colony counts outside of the acceptable range. However, the colony counts were considered to be an accurate count and are acceptable for use in the TMDL analysis.

8.3. Margin of Safety

There are two methods for incorporating an 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 that discharge to Perdido River, WBID 462B.

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 stormwater permitted facilities and/or 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 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 assumes, 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, this TMDL 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.

There are no MS4s or stormwater permitted facilities that discharge to or upstream of Perdido River, specifically WBID 462B.

8.5. Load Allocations

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

9. Recommendations

This TMDL analysis was based on limited data. It is recommended that additional fecal coliform 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 the 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.

USEPA, 1991. *Guidance for Water Quality –based Decisions: The TMDL Process.* U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA-440/4-91-001, April 1991.

Appendix A

Fecal Coliform Data and Percentiles for WBID 462B

Date	Station	Result (counts/100mL)	Rank	Percentile by Hazen Method
5/26/2005	21FLPNS 3301462B3	5	1	4%
5/26/2005	21FLPNS 3301462B2	12	2	13%
9/21/2005	21FLPNS 3301462B3	15	3	21%
9/21/2005	21FLPNS 3301462B2	26	4	29%
12/8/2005	21FLPNS 3301462B1	106	5	38%
12/8/2005	21FLPNS 3301462B2	208	6	46%
12/8/2005	21FLPNS 3301462B3	350	7	54%
3/30/2005	21FLPNS 3301462B1	380	8	63%
3/30/2005	21FLPNS 3301462B2	440	9	71%
1/4/2006	21FLPNS 3301462B3	1218	10	79%
1/4/2006	21FLPNS 3301462B1	1300	11	88%
1/4/2006	21FLPNS 3301462B2	2400	12	96%

In this TMDL the Hazen formula was used to calculate percentiles since it is recommended in Hunter's Applied Microbiology (2002) article concerning bacteria in water. To calculate the percentile associated with the sample concentrations, the data is first sorted by concentration, lowest to highest. A ranking is assigned to each sample, with the lowest concentration having a rank of 1 and the highest concentration having a rank equivalent to the total number of samples collected. The percentile is calculated as follows:

Percentile = (Rank – 0.5)/ (total number of samples collected)

For example, for WBID 462B on September 21, 2005, a fecal coliform concentration of 15 counts/100 mL was measured at station 21FLPNS 3301462B3. This concentration ranks number 3 out of 12 samples collected in WBID 462B. The associated percentile is calculated as:

Percentile = (3-0.5)/12 = 0.21 = 21%

This implies that 21 percent of the time, the instream concentration is less than 15 counts/100 mL.