FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

NORTHWEST DISTRICT • PENSACOLA BAY BASIN

FINAL TMDL Report

Fecal Coliform TMDL for Escambia River (WBID 10F), Texar Bayou (WBID 738), and Carpenter Creek (WBID 676)

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Acknowledgments

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Websites

Florida Department of Environmental Protection, Bureau of Watershed Restoration

TMDL Program

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

Identification of Impaired Surface Waters Rule

http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf

Florida STORET Program

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

2012 Integrated Report

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

Criteria for Surface Water Quality Classifications

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

Basin Status Report : Pensacola Bay

http://www.dep.state.fl.us/water/basin411/pensacola/status.htm

Water Quality Assessment Report: Pensacola Bay

http://www.dep.state.fl.us/water/basin411/pensacola/assessment.htm

U.S. Environmental Protection Agency

Region 4: TMDLs in Florida

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

National STORET Program

http://www.epa.gov/storet/

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Loads (TMDLs) for fecal coliform bacteria for the Escambia River, Texar Bayou, and Carpenter Creek, located in the Pensacola Bay Basin. These waterbodies were verified as impaired for fecal coliform, and therefore were included on the Verified List of impaired waters for the Pensacola Bay Basin that was adopted by Secretarial Order in May 2006. The TMDLs establish the allowable fecal coliform loading to these water segments that would restore the waterbodies so that they meet their applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

For assessment purposes, the Florida Department of Environmental Protection (Department) has divided the Pensacola Bay Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. **Table 1.1** lists the WBID numbers for the waterbodies addressed in this report.

Table 1.1. WBID Number for Waterbodies Included in This TMDL Report

This is a two-column table. Column 1 lists the WBID number, and Column 2 lists the name of the waterbody segment.

WBID Number	Waterbody Segment
10F	Escambia River
738	Texar Bayou
676	Carpenter Creek

These waterbodies are located in the southeastern part of Escambia County, in northwest Florida, within or near the Pensacola city limits (**Figures 1.1** and **1.2**). The Conecuh River and Escambia River constitute a single 258-mile-long (415 kilometers [km]) river in Alabama and Florida. The river's name changes from the Conecuh to the Escambia near the Florida–Alabama line. After this point, the Escambia River flows 60 miles south to Escambia Bay, an arm of Pensacola Bay. The Escambia River segment (WBID 10F) includes the area approximately 4 miles upstream from the mouth of the river. Two counties lie on either side of the river: the northern portion is in Santa Rosa County and the southern portion in Escambia County. Land use adjoining the waterbody is urbanized on the Escambia County side and undeveloped on the Santa Rosa County side.

Carpenter Creek (WBID 676) is located in the western portion of the city of Pensacola. The creek flows south for 4.7 miles and drains into the northwestern boundary of Texar Bayou. Interstate Highways 10 and 110 pass through the Carpenter Creek watershed. Texar Bayou (WBID 738) flows 3.8 miles in a north-south direction and is 1,400 feet wide in the middle. The bayou receives fresh water from Carpenter Creek and overland flow along the banks of the bayou via stormwater outfalls, surface flow, and ground water discharge. Saline waters enter the bayou from Pensacola Bay in the south. The drainage area within the Carpenter Creek–Texar Bayou watershed is approximately 14 square miles (mi^2) and is highly urbanized.

Additional information about the hydrology and geology of these areas is available in the Water Quality Status Report for the Pensacola Bay Basin (Department 2004).

1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Laws of Florida).

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

A TMDL report is followed by the development and implementation of a restoration plan designed to reduce the amount of fecal coliform that caused the verified impairment of a waterbody. These activities depend heavily on the active participation of local governments, businesses, citizens, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions of fecal coliform and achieve the established TMDLs for impaired waterbodies.

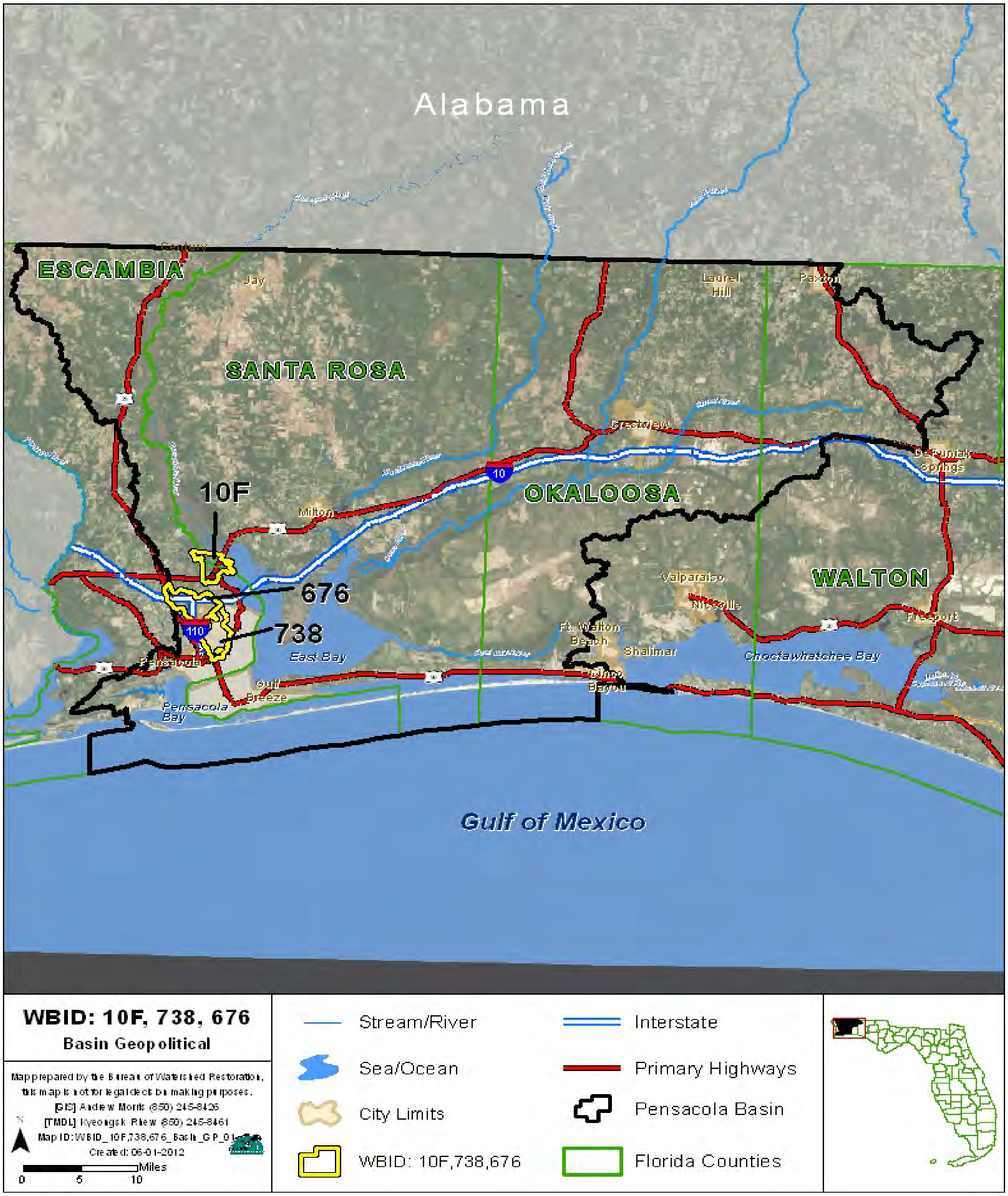


Figure 1.1. Location of the Escambia River (WBID 10F), Texar Bayou (WBID 736), and Carpenter Creek (WBID 676) Watersheds in the Pensacola Bay Basin and Major Geopolitical and Hydrologic Features in the Area

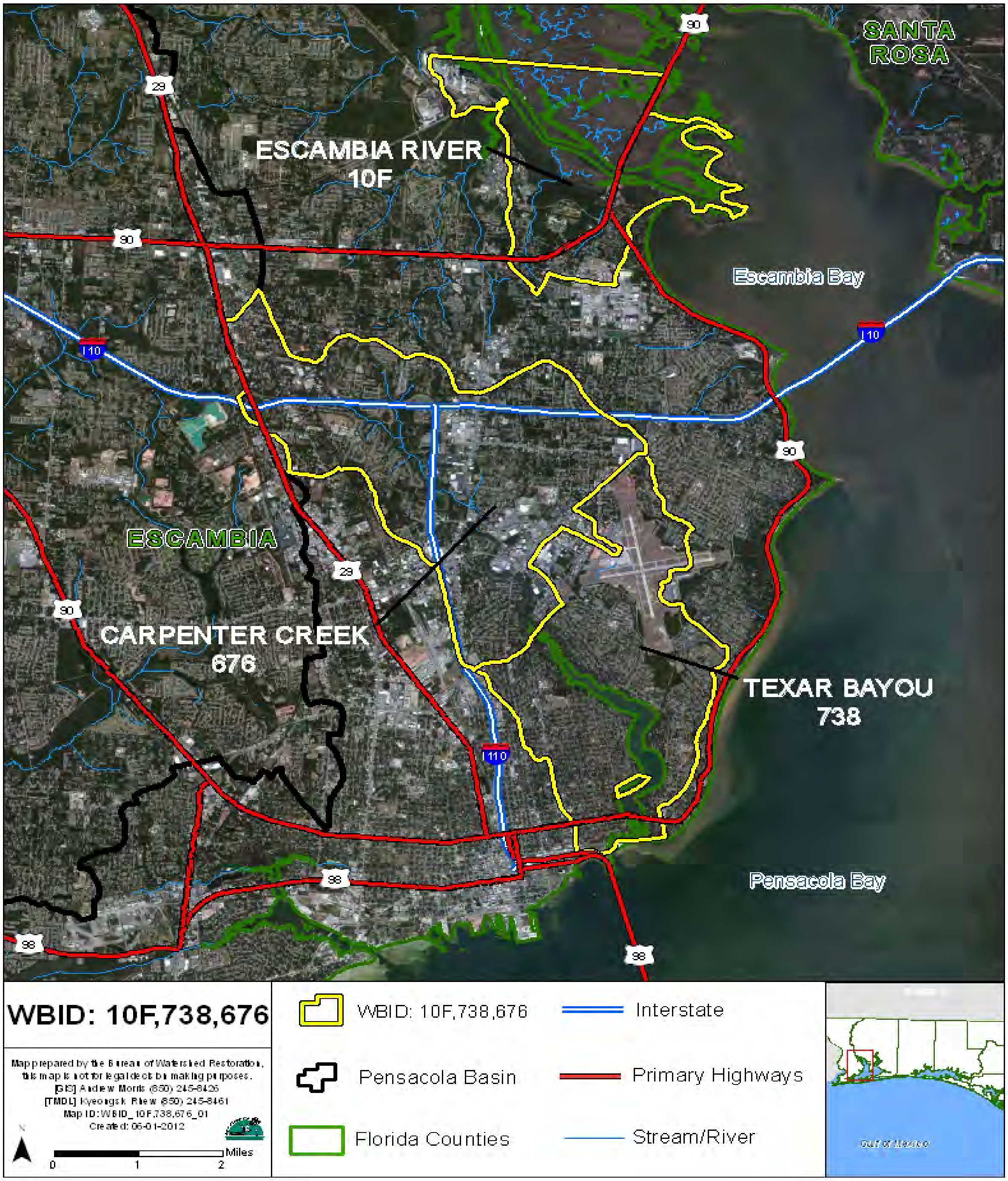


Figure 1.2. Detailed View of the Escambia River (WBID 10F), Texar Bayou (WBID 736), and Carpenter Creek (WBID 676) Watersheds and Major Geopolitical and Hydrologic Features in the Area

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]); the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 43 waterbodies in the Pensacola Bay Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was modified in 2006 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Escambia River, Texar Bayou, and Carpenter Creek, and and verified that these waterbody segments were impaired for fecal coliform bacteria in the Department's Cycle 1 assessment (January 1, 1998, through June 30, 2005). Verified impairment was based on the observation that, with a 90% confidence limit based on binomial distribution, more than 10% of the values exceeded the assessment threshold of 400 counts per 100 milliliters (counts/100mL) (see **Section 3.2** for details) in these WBIDs.

For the Escambia River, the Cycle 2 assessment results showed no impairment for fecal coliform bacteria. However, the Department could not delist this waterbody from the Verified List because the delisting requirement was not satisfied. Therefore, the Department has developed a fecal coliform bacteria TMDL for the Escambia River. For Texar Bayou, the impairment was confirmed based on the result of the Cycle 2 assessment (January 1, 2003, through June 30, 2010). For Carpenter Creek, 67 samples collected by the Bream Fishermen Association (BFA) were removed from the IWR database, leaving only 4 samples available during the Cycle 2 verified period, due to the result of the performance audit carried out in June 2011 by the Department. The deficiency findings of the audit were sampling, labeling, and preservation issues. As a result, the status for the Cycle 2 assessment was insufficient data. Therefore, the Department collected additional samples in March 2012 and developed a TMDL based on those available data.

Tables 2.1 and **2.2** summarize the fecal coliform monitoring results for the Cycle 1 and Cycle 2 verified periods for the Escambia River, Texar Bayou, and Carpenter Creek. As they better represent the current conditions, the results for the Cycle 2 verified period and more recent years were used in the TMDL development process.

Table 2.1. Summary of Fecal Coliform Monitoring Data for the Escambia River, Texar Bayou, and Carpenter Creek During the Cycle 1 Verified Period (January 1, 1998–June 30, 2005)

This is a four-column table. Column 1 lists the parameter, and Columns 2 through 4 list the WBID name and number and the corresponding Cycle 1 results.

Parameter	Escambia River (WBID 10F)	Texar Bayou (WBID 738)	Carpenter Creek (WBID 676)
Total number of samples	381	437	76
IWR-required number of exceedances for the Verified List	47	53	12
Number of observed exceedances	47	68	22
Number of observed nonexceedances	334	369	54
Number of seasons during which samples were collected	4	4	4

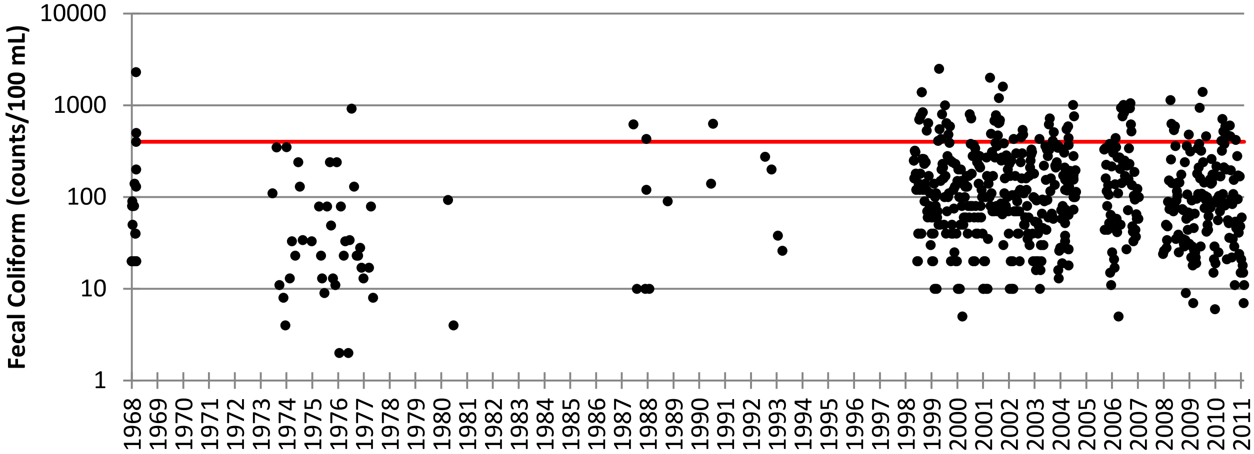
Table 2.2. Summary of Fecal Coliform Monitoring Data for the Escambia River, Texar Bayou, and Carpenter Creek During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

This is a four-column table. Column 1 lists the parameter, and Columns 2 through 4 list the WBID name and number and the corresponding Cycle 2 results.

Parameter	Escambia River (WBID 10F)	Texar Bayou (WBID 738)	Carpenter Creek (WBID 676)
Total number of samples	277	449	4
IWR-required number of exceedances for the Verified List	35	54	5
Number of observed exceedances	27	77	0
Number of observed nonexceedances	250	372	4
Number of seasons during which samples were collected	4	4	1
Highest observation (counts/100mL)	1,400	5,700	340
Lowest observation (counts/100mL)	5	1	23
Median observation (counts/100mL)	98	39	169
Mean observation (counts/100mL)	177	233	175
Assessment	Not impaired	Impaired	Insufficient Data

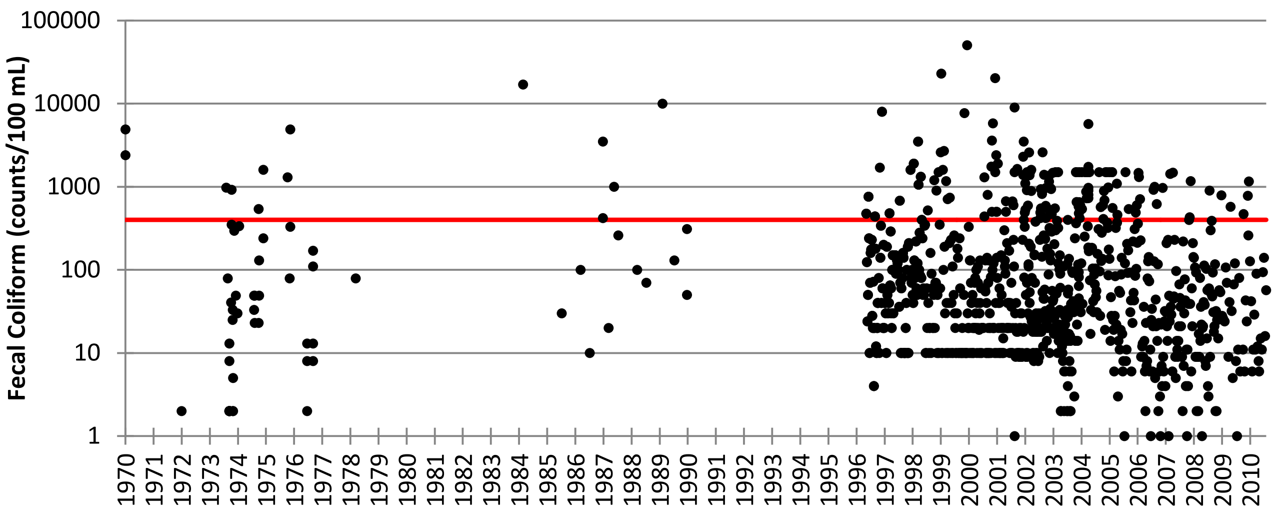
2.3 Period of Record Trend

Historical fecal coliform data collection started in 1968 and continued until 2011 in the Escambia River, from 1970 to 2011 in Texar Bayou, and from 1970 to 2012 in Carpenter Creek. Fecal coliform concentrations ranged from 2 to 2,500 counts/100mL, from 1 to 50,500 counts/100mL, and from 8 to 92,000 counts/100 mL, and averaged 187, 396, and 2,330 counts/100mL in Escambia River, Texar Bayou, and Carpenter Creek, respectively. Plotting the entire period of record (historical) fecal coliform data over time for the Escambia River (Prob> F = 0.1806), Texar Bayou (Prob> F = 0.055), and Carpenter Creek (Prob> F = 0.1396) revealed no significant increasing or decreasing trends (**Figures 2.1a**, **2.1b**, and **2.1c**).



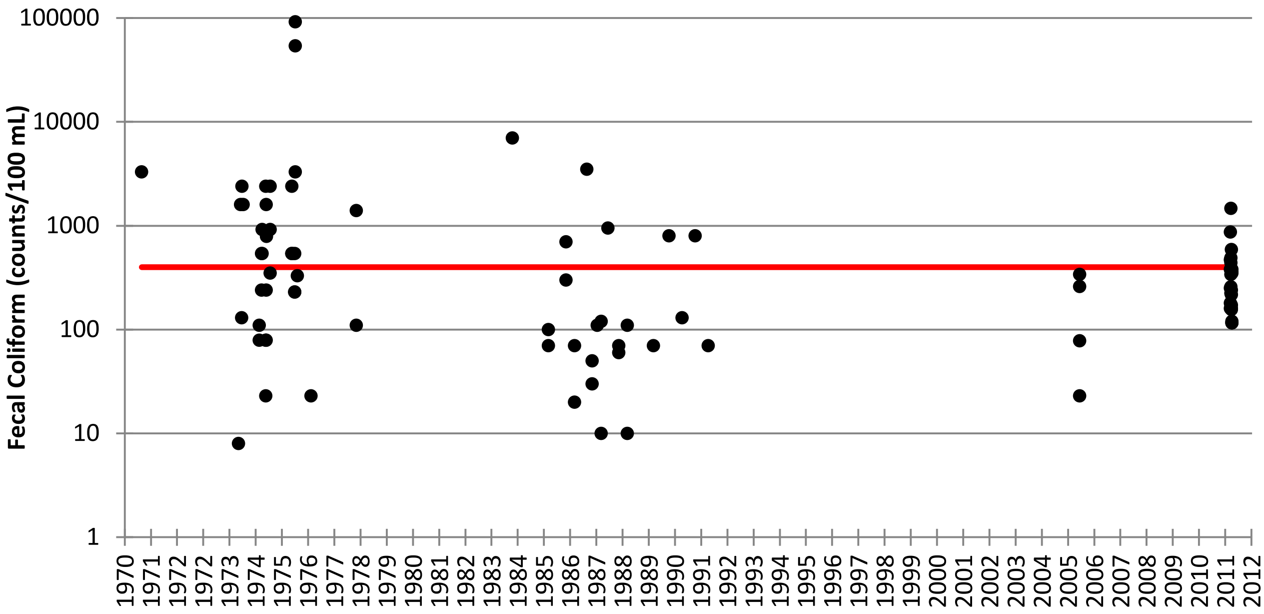
Note: The red line indicates the target concentration (400 counts/100mL).

Figure 2.1a. Fecal Coliform Concentration Trends in the Escambia River for the Entire Period of Record (1968–2011)



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

Figure 2.1b. Fecal Coliform Concentration Trends in Texar Bayou for the Entire Period of Record (1970–2011)



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

Figure 2.1c. Fecal Coliform Concentration Trends in Carpenter Creek for the Entire Period of Record (1970–2012)

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criterion Applicable to the TMDL

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

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

The Escambia River, Texar Bayou, and Carpenter Creek are Class III waterbodies, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The criterion applicable to these TMDLs is the Class III criterion for fecal coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentration. The water quality criterion for the protection of Class III waters, as established by Rule 62-302, F.A.C., states the following:

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

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. There were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDL was not to exceed 400 counts/100mL in any sampling event for fecal coliform. The 10% exceedance allowed by the water quality criterion for fecal coliform bacteria was not used directly in estimating the target load, but was included in the TMDL margin of safety (as described in subsequent chapters).

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants in the impaired waterbody and the amount of pollutant loadings contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term "point sources" has meant discharges to surface waters that typically have a continuous flow via a discernible, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

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

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

4.2 Potential Sources of Fecal Coliform within the Escambia River, Texar Bayou, and Carpenter Creek WBID Boundaries

4.2.1 Point Sources

Wastewater Point Sources

There is one NPDES-permitted facility (the Gulf Power Company-Crist Power Plant, Permit FL0002275) located within the Escambia River WBID boundary. One NPDES-permitted wastewater facility (Cemex-Pensacola Plant, Permit FLG110354) was identified within the Carpenter Creek WBID boundary. These facilities do not contribute fecal coliform bacteria to surface water. There are no NPDES-permitted facilities in the Texar Bayou watershed.

Municipal Separate Storm Sewer System Permittees

One Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000019) covers the Escambia River, Texar Bayou, and Carpenter Creek watersheds. The city of Pensacola, Escambia County, and Florida Department of Transportation (FDOT) District 3 are co-permittees. One Phase II MS4 permit (FLR04E057), held by the University of West Florida, also covers the Escambia River watershed.

4.2.2 Land Uses and Nonpoint Sources

Accurately quantifying the fecal coliform loadings from nonpoint sources requires identifying nonpoint source categories, locating the sources, determining the intensity and frequency at which these sources create high fecal coliform loadings, and specifying the relative contributions from these sources. Depending on the land use distribution in a given watershed, frequently cited nonpoint sources in urban areas include failed septic tanks, leaking sewer lines, and pet feces. For a watershed dominated by agricultural land uses, fecal coliform loadings can come from the runoff from areas with animal feeding operations or direct animal access to receiving waters.

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

Land Uses

The spatial distribution and acreage of different land use categories were identified using the Northwest Florida Water Management District's (NWFWMD) 2009–10 land use coverage contained in the Department's geographic information system (GIS) library. Land use categories within the Escambia River, Texar Bayou, and Carpenter Creek WBID boundaries were aggregated using the Florida Land Use Code and Classification System (FLUCCS) expanded Level 1 codes (including low-, medium-, and high-density residential) and tabulated in **Table 4.1**. **Figure 4.1** shows the spatial distribution of the principal land uses within each WBID boundary.

As shown in **Table 4.1**, the total area within the Escambia River WBID boundary is about 3,754 acres. The dominant land use category is wetland, which accounts for about 49% of the total WBID area. Urban lands, including urban and built-up; low-, medium-, and high-density residential; and transportation, communication, and utilities make up about 30% of the total WBID area. There is no agricultural land use within the Escambia River WBID boundary.

The total area within the Texar Bayou WBID boundary is about 5,266 acres. The dominant land use category is urban land (urban and built-up; low-, medium-, and high-density residential; and transportation, communication, and utilities), which accounts for about 87% of the total WBID area. Low-impact land use areas, including rangeland, water, wetlands, upland forest, and barren land, make up about 13% of the total WBID area. There is no agricultural land use within the Texar Bayou WBID boundary.

The total area within the Carpenter Creek WBID boundary is about 6,760 acres. The dominant land use category is urban land (urban and built-up; low-, medium-, and high-density residential; and transportation, communication, and utilities), which accounts for about 87% of the total WBID area. Low-impact land use areas, including rangeland, water, wetlands, upland forest, and barren land, make up about 13% of the total WBID area.

Urban Development

Given that the important land use categories contributing to nonpoint source pollution are urban land areas—urban and built-up (commercial and services), and medium- and high-density residential—possible sources for fecal coliform loadings can include failed septic tanks, sewer line leakage, and pet feces. A preliminary quantification of the fecal coliform loadings from these sources was conducted to demonstrate the relative contributions. **Appendix B** provides detailed load estimates and describes the methods used for the quantification. It should be noted that the information included in **Appendix B** was only used to demonstrate the possible relative contributions from different sources. These loading estimates were not used in establishing the final TMDLs.

Wildlife and Sediments

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

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

Table 4.1. Classification of Land Use Categories within the Escambia River, Texar Bayou, and Carpenter Creek WBID Boundaries

This is an eight-column table. Column 1 lists the Level 1 land use code, Column 2 lists the land use description, and Columns 3 through 8 list the acreage and percent acreage land use in each WBID.

- = Empty cell/no data

Level 1 Code	Land Use	Escambia River (WBID 10F) Acreage	Escambia River (WBID 10F) % Acreage	Texar Bayou (WBID 738) Acreage	Texar Bayou (WBID 738) % Acreage	Carpenter Creek (WBID 676) Acreage	Carpenter Creek (WBID 676) % Acreage
1000	Urban and built-up	349	9.3%	742	14.1%	1,927	28.5%
-	Low-density residential	49	1.3%	124	2.4%	173	2.6%
-	Medium-density residential	302	8.0%	2,475	47.0%	2,563	37.9%
-	High-density residential	104	2.8%	395	7.5%	646	9.6%
2000	Agriculture	-	0.0%	-	0.0%	2	0.0%
3000	Rangeland	28	0.7%	8	0.2%	50	0.7%
4000	Upland forest	308	8.2%	320	6.1%	624	9.2%
5000	Water	468	12.5%	362	6.9%	18	0.3%
6000	Wetland	1,826	48.6%	13	0.2%	217	3.2%
7000	Barren land	8	0.2%	1	0.0%	-	0.0%
8000	Transportation, communication, and utilities	312	8.3%	826	15.7%	540	8.0%
-	**TOTAL**	**3,754**	**100.0%**	**5,266**	**100.0%**	**6,760**	**100.0%**

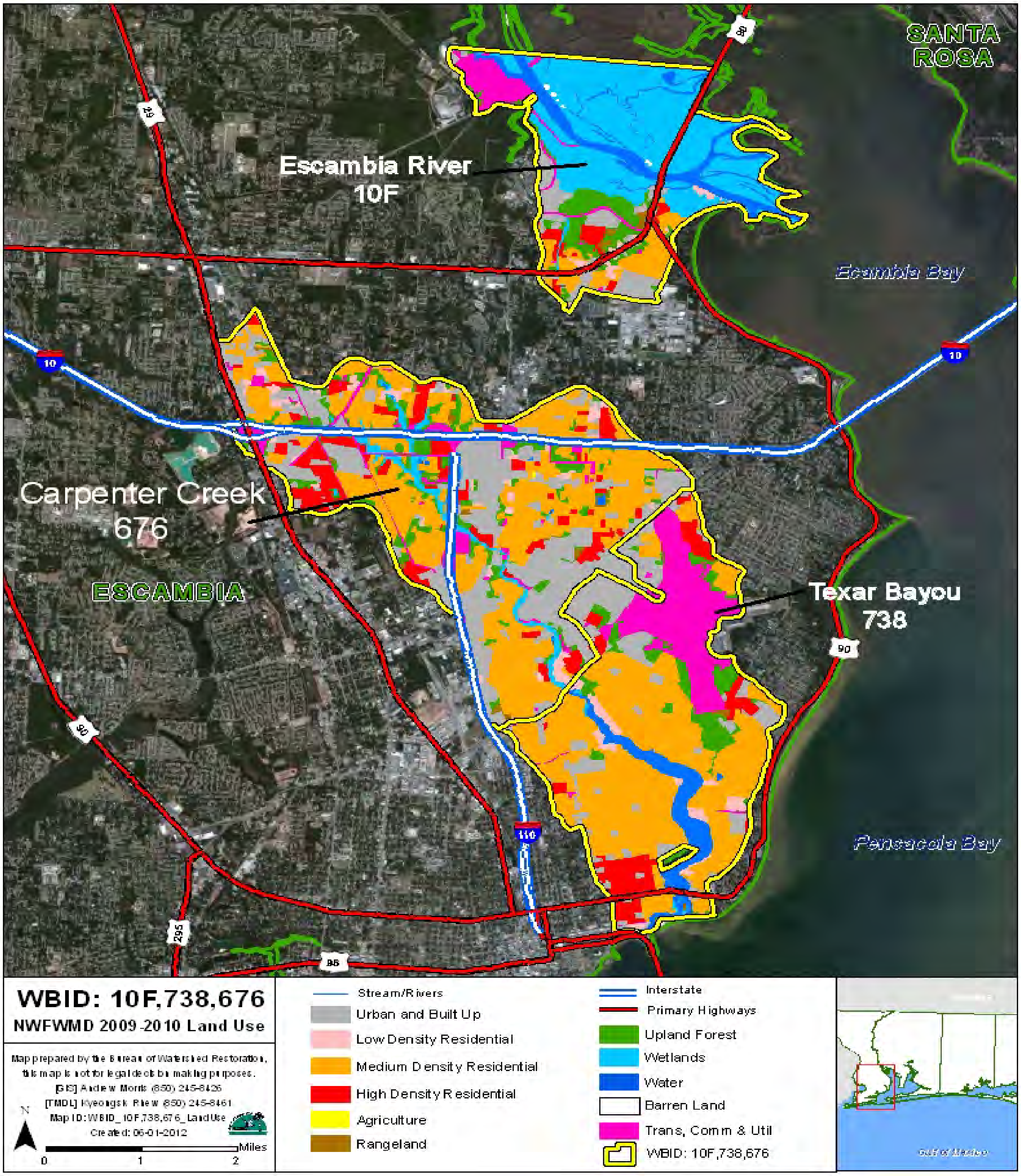


Figure 4.1. Principal Land Uses within the Escambia River, Texar Bayou, and Carpenter Creek WBID Boundaries in 2009–10

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The fecal coliform TMDL was developed using the Hazen method, which is a percent reduction approach. Using this method, the percent reduction needed to meet the applicable criterion is calculated based on the 90th percentile of all measured concentrations collected during the Cycle 2 verified period (January 1, 2003, through June 30, 2010) and a more recent year. Because bacteriological counts in water are not normally distributed, a nonparametric method is more appropriate for the analysis of fecal coliform data (Hunter 2002). The Hazen method, which uses a nonparametric formula, was used to determine the 90th percentile value. The percent reduction of fecal coliform needed to meet the applicable criterion was calculated as described in **Section 5.1.3**.

5.1.1 Data Used in the Determination of the TMDL

All data used for this TMDL report were provided by the Department's Northwest District office and the Florida Department of Health (FDOH). The data were included in Run_44 of the Department's IWR database. **Figure 5.1** shows the locations of the water quality sites where fecal coliform data were collected. These analyses used fecal coliform data collected during the Cycle 2 verified period and added a more recent year (January 1, 2003, through June 30, 2011) for the Escambia River and Texar Bayou to represent better the current conditions. For Carpenter Creek, data collected in 2006 and 2012 were used because of the data audit problem. During these periods, a total of 324 fecal coliform samples were collected from 5 water quality stations in the Escambia River, 469 samples from 8 water quality stations in Texar Bayou, and 28 samples from 9 water quality stations in Carpenter Creek.

Figure 5.2a shows the fecal coliform concentrations observed in the Escambia River. These ranged from 5 to 1,400 counts/100mL and averaged 175 counts/100mL during the period of observation. Plotting fecal coliform data by time for the Escambia River during the period of observation revealed no significant increasing or decreasing trend (Prob> F = 0.6143). In Texar Bayou, fecal coliform concentrations ranged from 1 to 5,700 counts/100mL and averaged 229 counts/100mL during the period of observation. Plotting fecal coliform data by time for Texar Bayou during the period of observation revealed a significant decreasing trend (Prob> F = 0.0014) (**Figure 5.2b**). In Carpenter Creek, fecal coliform concentrations ranged from 23 to 1,470 counts/100mL and averaged 333 counts/100mL during the period of observation (**Figure 5.2c**). Plotting fecal coliform data by time for Carpenter Creek during the period of observation revealed no significant increasing or decreasing trend (Prob> F = 0.2408).

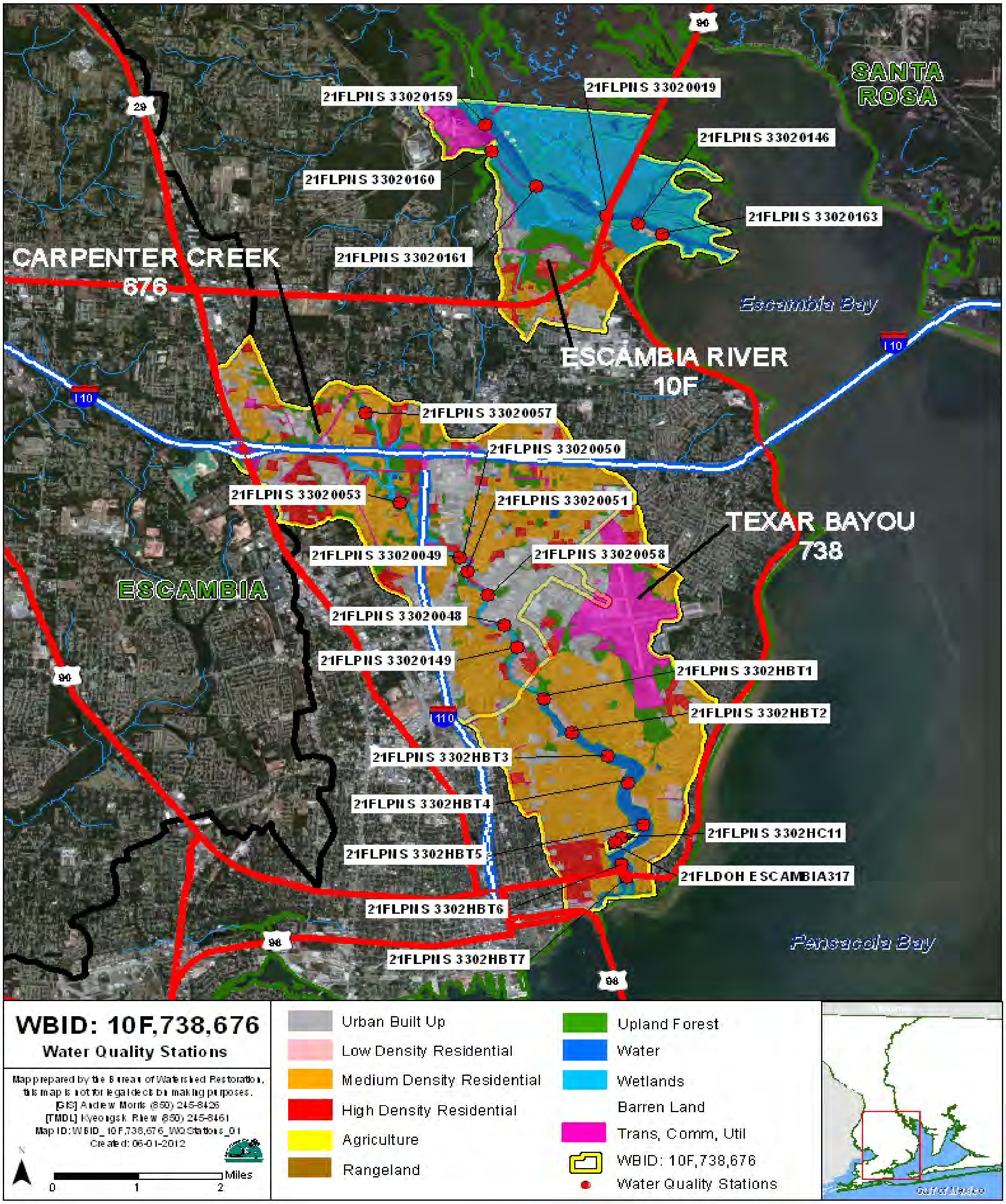
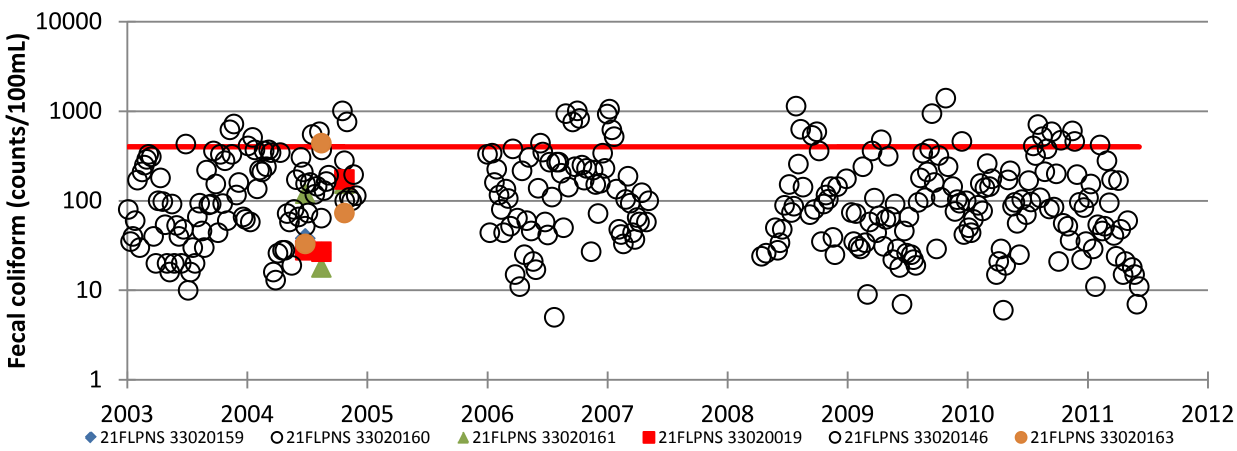
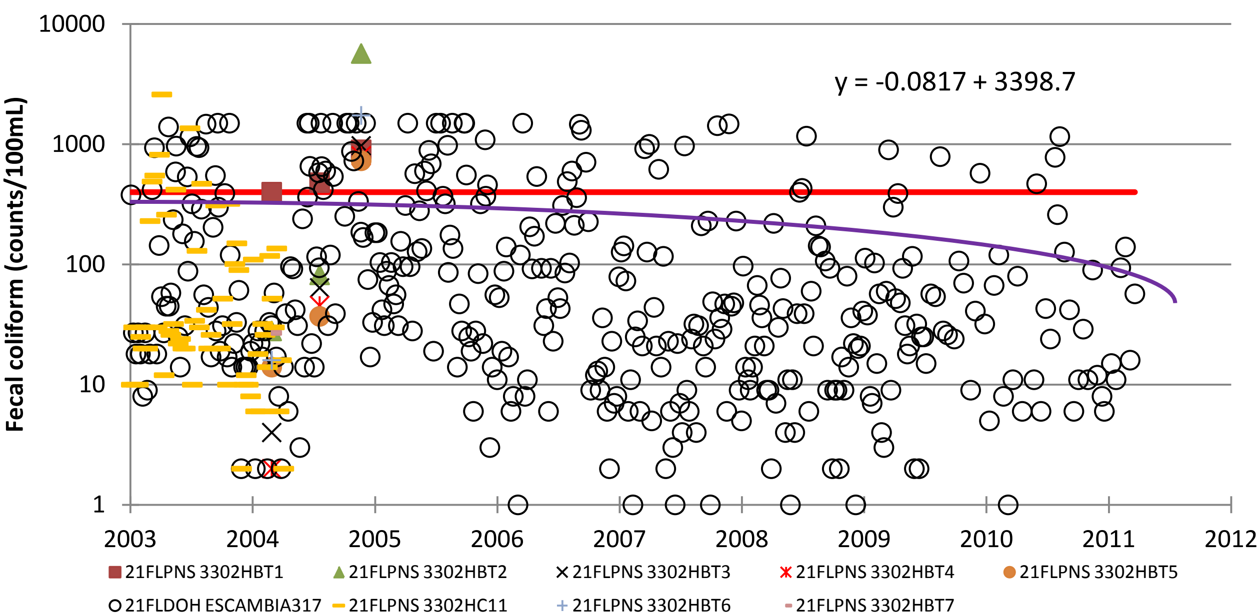


Figure 5.1. Location of Water Quality Stations in the Escambia River, Texar Bayou, and Carpenter Creek



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

Figure 5.2a. Trends in Fecal Coliform Concentrations in the Escambia River During the Period of Observation (January 1, 2003–June 30, 2011)



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

Figure 5.2b. Trends in Fecal Coliform Concentrations in Texar Bayou During the Period of Observation (January 1, 2003–June 30, 2011)

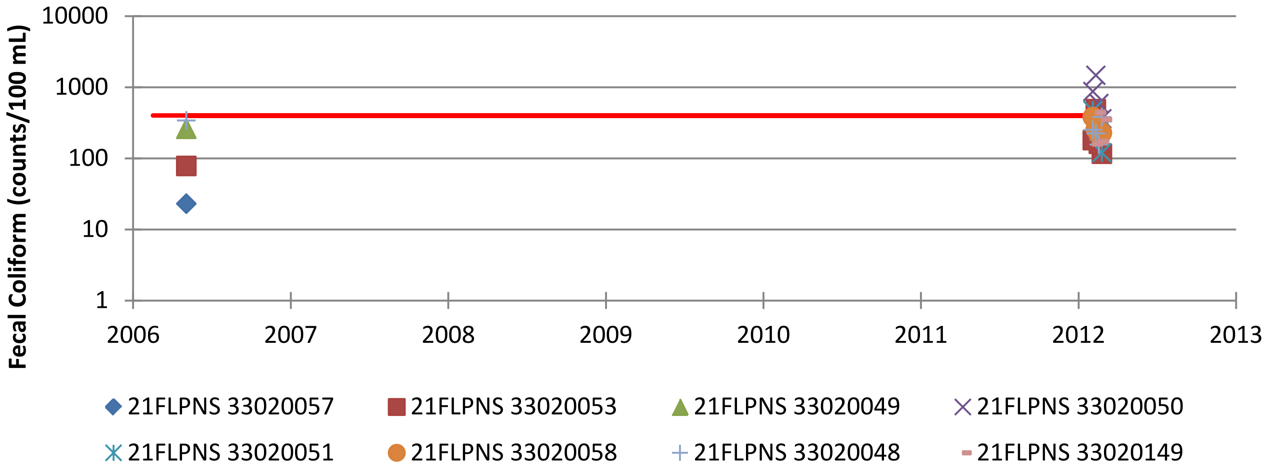


Figure 5.2c. Trends in Fecal Coliform Concentrations in Carpenter Creek During the Period of Observation (January 1, 2006–March 31, 2012)

Temporal Patterns

Monthly and Seasonal Trends

Seasonally, a peak in fecal coliform concentrations and exceedance rates is commonly observed during the third quarter (summer, July–September), when conditions are rainy and warm, and lower concentrations and exceedance rates are observed in the first quarter (winter, January–March), when conditions are drier and colder. In general, such a relationship was found in the Escambia River and Texar Bayou, although in the former, mean fecal coliform concentrations were slightly lower in the second quarter than in the first, and the third and fourth quarter results were very similar (**Tables 5.1a** and **5.1b**).

Using rainfall data collected at Pensacola Regional Airport (Climate Information for Management and Operational Decisions [CLIMOD] website 2008), it was possible to compare average quarterly total rainfall with long-term (2003 through 2011) with average monthly and quarterly fecal coliform exceedance rates at all stations (**Figures 5.3a** through **5.3f**). Rainfall differences among months were relatively small, but June to August was wetter than the other months. Seasonal differences in rainfall were also small, and the third quarter was wettest.

Escambia River

The highest quarterly exceedance rate was observed in the third quarter (19%), and the highest quarterly average fecal coliform concentration was observed during the fourth quarter (236 counts/100mL). The lowest exceedance rate was observed during the second quarter (2%). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–11). Except for March and May, fecal coliform exceedances were observed in the Escambia River in all other months. The highest monthly average fecal coliform concentration was observed in October (314 counts/100mL). **Tables 5.1a** and **5.1b** summarize the monthly and seasonal fecal coliform average and percent exceedances, respectively, during the period of observation for this WBID.

The influence of rainfall on monthly and quarterly exceedances in the watershed is inconclusive, as during the period of observation, monthly exceedance rates do not appear to be correlated with monthly rainfall. However, higher monthly exceedance rates occurred during months of higher rainfall, although in January the exceedance rate was high when average rainfall was low (**Figure 5.3a**). Quarterly high exceedance rates were recorded mostly during quarters of high rainfall (**Figure 5.3b**). The occurrence of higher exceedance rates during the wet season is an indication that high rainfall negatively impacts water quality in the WBID.

Texar Bayou

The highest quarterly exceedance rate and average fecal coliform concentration were observed in the third quarter (29% and 359 counts/100mL). The lowest exceedance rate was observed during the first quarter (5%). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–11). With the exception of January and February, fecal coliform exceedances were observed in Texar Bayou in all other months. The highest monthly average fecal coliform concentration was observed in November (441 counts/100mL). **Tables 5.1c** and **5.1d** summarize the monthly and seasonal fecal coliform average and percent exceedances, respectively, for data collected for the Cycle 2 verified period and more recent data for this WBID.

Monthly exceedance rates in WBID 738 show a general positive correlation with monthly rainfall (**Figure 5.3c**). A similar trend was also observed between quarterly rainfall and quarterly exceedance rates (**Figure 5.3d**). The occurrence of higher exceedance rates during wet season is an indication that high rainfall negatively impacts water quality in the WBID.

Carpenter Creek

For Carpenter Creek, temporal patterns of fecal coliform and relationship with rainfall are inconclusive because the samples were collected in only March and June (**Tables 5.1e** and **5.1f**, and **Figures 5.3e** and **5.3f**).

Table 5.1a. Summary Statistics of Fecal Coliform Data for All Stations in the Escambia River by Month During the Period of Observation (January 1, 2003–June 30, 2011)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	28	11	1,055	94	234	6	21%
February	28	29	420	96	127	1	4%
March	31	9	380	106	150	0	0%
April	30	6	480	40	82	1	3%
May	28	7	314	59	79	0	0%
June	32	7	440	50	91	1	3%
July	25	5	1,140	87	177	4	16%
August	31	18	940	164	246	6	19%
September	22	29	940	197	282	5	23%
October	26	21	1,400	172	314	5	19%
November	24	25	760	144	230	5	21%
December	19	22	460	100	135	1	5%

Table 5.1b. Summary Statistics of Fecal Coliform Data for All Stations in the Escambia River by Season During the Period of Observation (January 1, 2003–June 30, 2011)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	87	9	1,055	104	170	7	8%
Quarter 2	90	6	480	53	84	2	2%
Quarter 3	78	5	1,140	149	234	15	19%
Quarter 4	69	21	1,400	144	236	11	16%

Table 5.1c. Summary Statistics of Fecal Coliform Data for All Stations in Texar Bayou by Month During the Period of Observation (January 1, 2003–June 30, 2011)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	44	2	380	25	55	0	0%
February	39	1	140	25	39	0	0%
March	52	1	1,500	29	157	7	13%
April	38	2	2,600	53	278	6	16%
May	35	1	967	42	154	6	17%
June	39	1	1,500	25	222	8	21%
July	43	4	1,500	94	388	15	35%
August	36	4	1,500	142	349	10	28%
September	33	2	1,500	42	331	8	24%
October	34	1	1,500	30	272	6	18%
November	41	6	5,700	80	441	10	24%
December	35	1	1,500	14	96	3	9%

Table 5.1d. Summary Statistics of Fecal Coliform Data for All Stations in Texar Bayou by Season During the Period of Observation (January 1, 2003–June 30, 2011)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	135	1	1,500	27	90	7	5%
Quarter 2	112	1	2,600	43	219	20	18%
Quarter 3	112	2	1,500	112	359	33	29%
Quarter 4	110	1	5,700	32	279	19	17%

Table 5.1e. Summary Statistics of Fecal Coliform Data for All Stations in Carpenter Creek by Month During the Period of Observation (June 2006 and March 2012)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	-	-	-	-	-	-	-
February	-	-	-	-	-	-	-
March	24	116	1,470	255	359	6	25%
April	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-
June	4	23	340	169	175	0	0%
July	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-

Table 5.1f. Summary Statistics of Fecal Coliform Data for All Stations in Carpenter Creek by Season During the Period of Observation (June 2006 and March 2012)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	24	23	1,470	255	359	6	25%
Quarter 2	4	23	340	169	175	0	0%
Quarter 3	-	-	-	-	-	-	-
Quarter 4	-	-	-	-	-	-	-

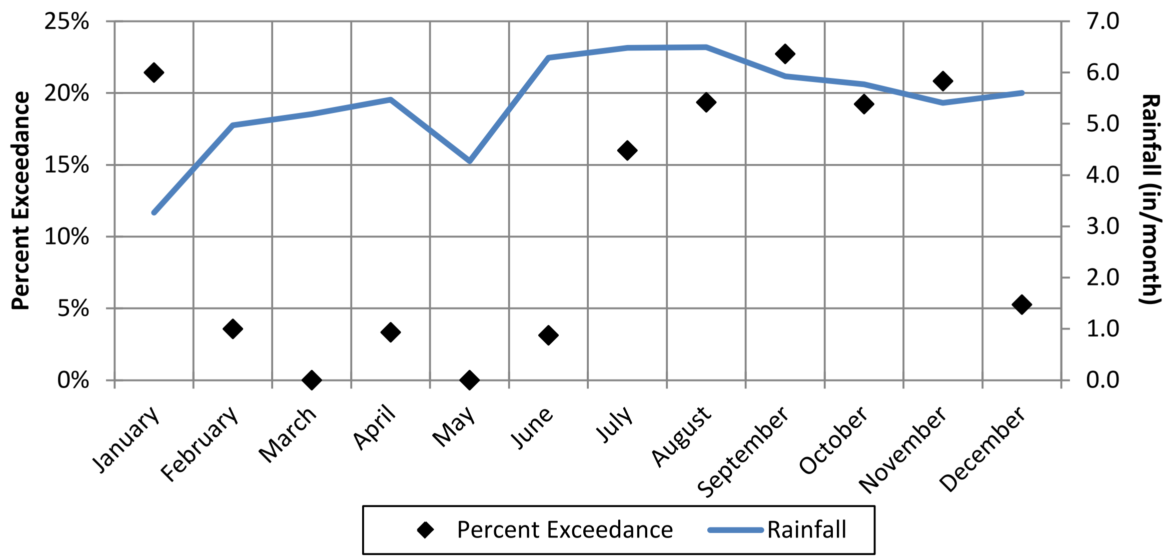


Figure 5.3a. Fecal Coliform Exceedances and Rainfall at All Stations in the Escambia River by Month During the Period of Observation (January 1, 2003–June 30, 2011)

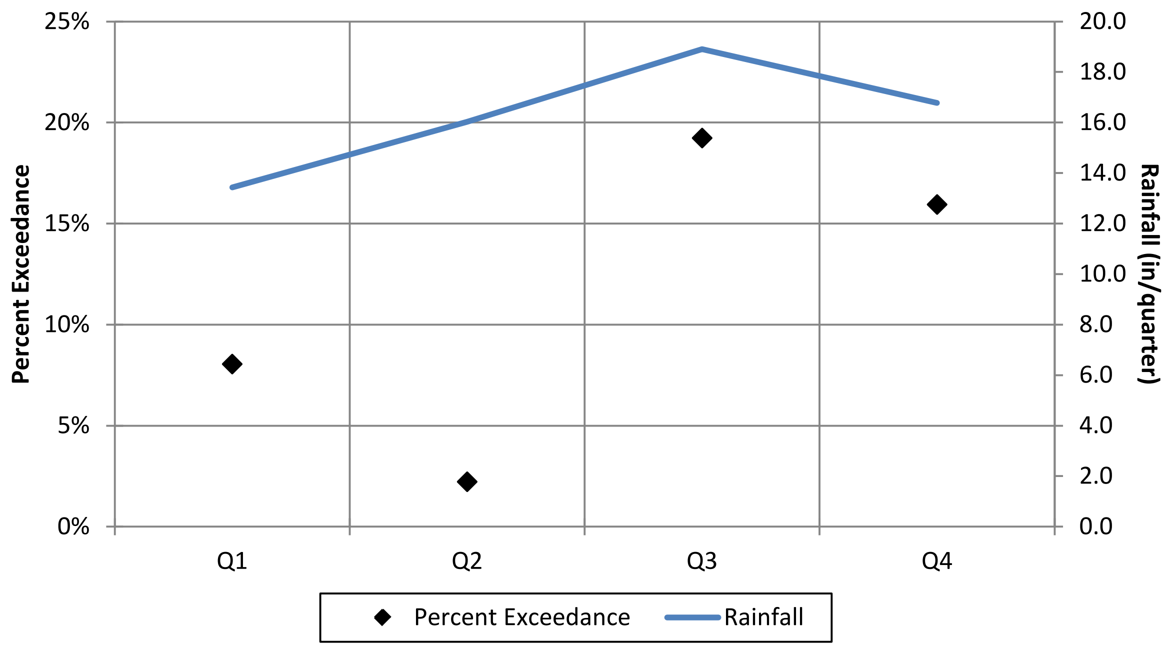


Figure 5.3b. Fecal Coliform Exceedances and Rainfall at All Stations in the Escambia River by Season During the Period of Observation (January 1, 2003–June 30, 2011)

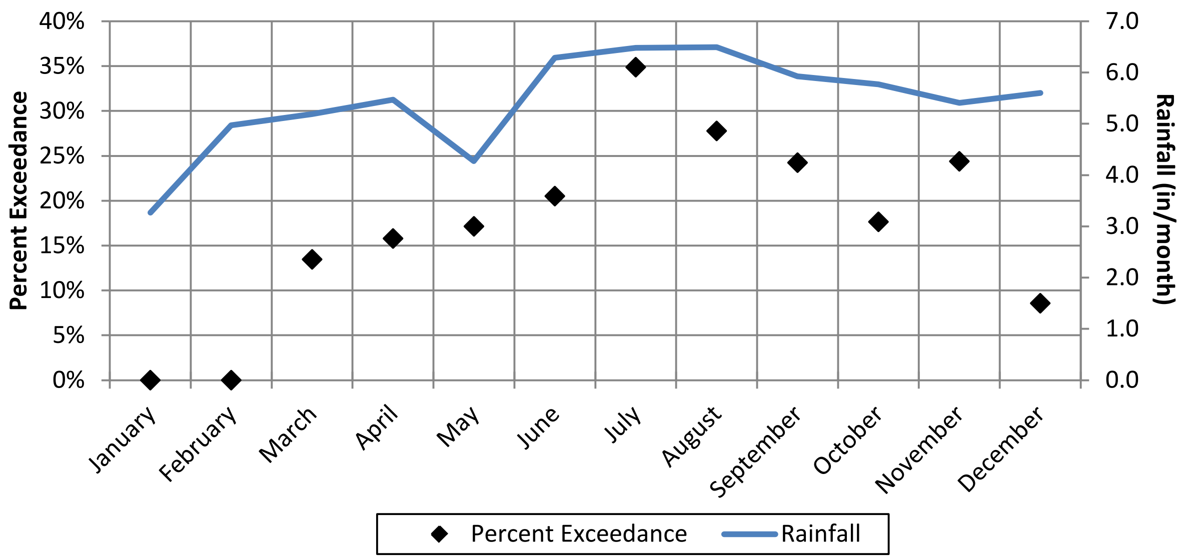


Figure 5.3c. Fecal Coliform Exceedances and Rainfall at All Stations in Texar Bayou by Month During the Period of Observation (January 1, 2003–June 30, 2011)

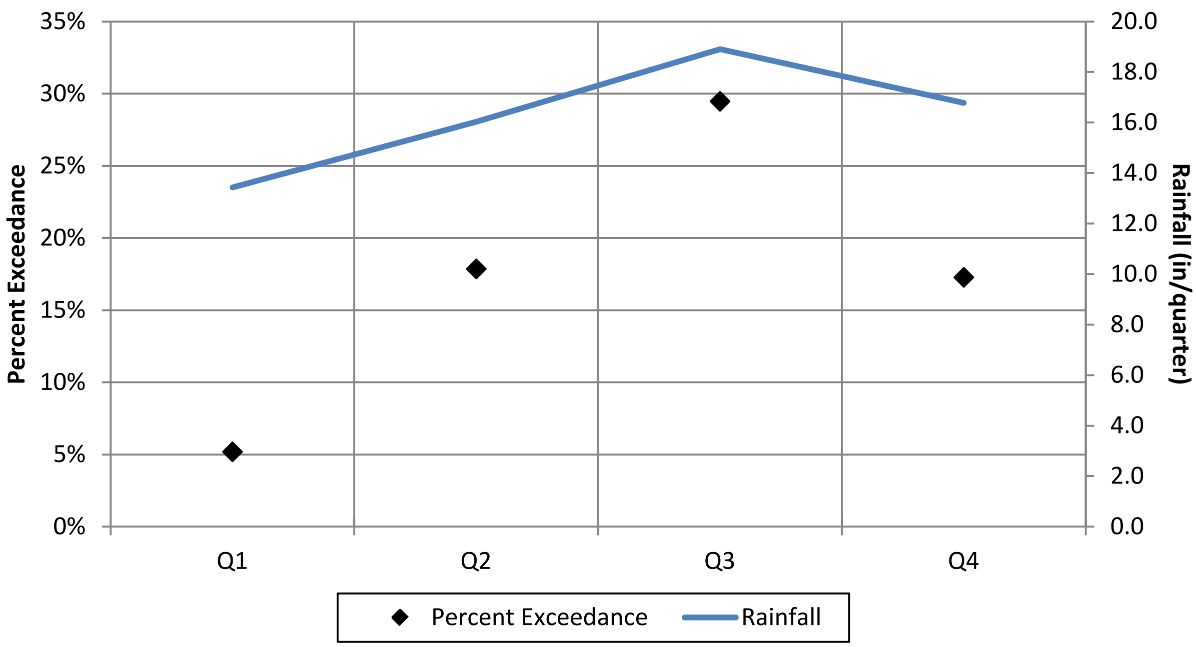


Figure 5.3d. Fecal Coliform Exceedances and Rainfall at All Stations in Texar Bayou by Season During the Period of Observation (January 1, 2003–June 30, 2011)

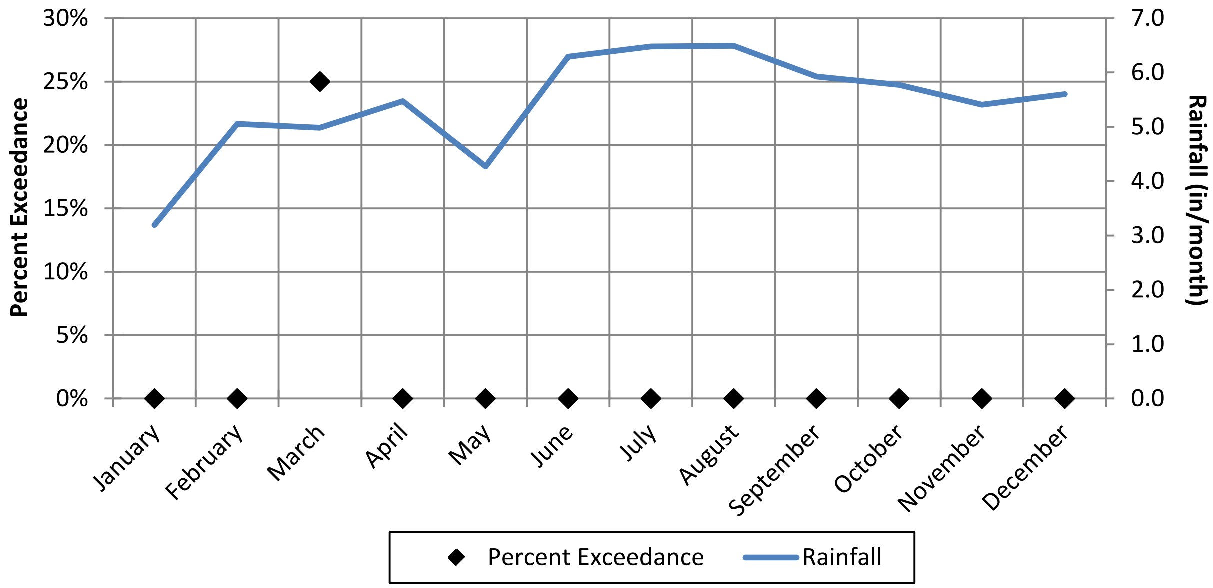


Figure 5.3e. Fecal Coliform Exceedances and Rainfall at All Stations in Carpenter Creek by Month During the Period of Observation (June 2006 and March 2012)

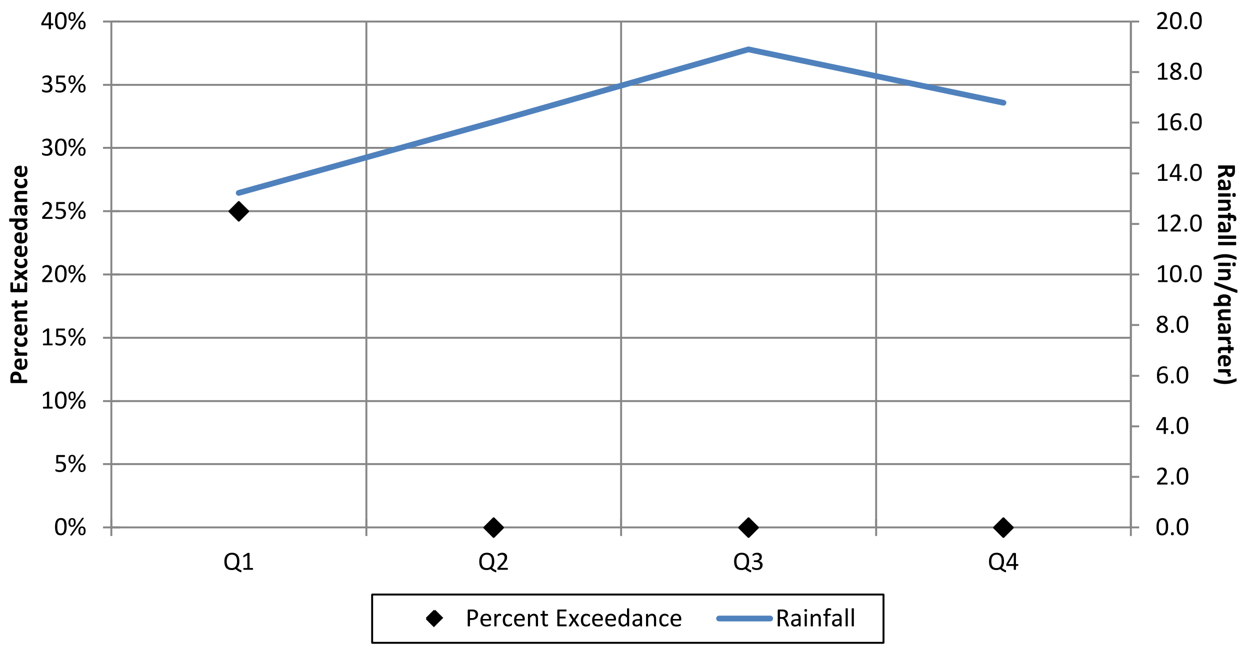


Figure 5.3f. Fecal Coliform Exceedances and Rainfall at All Stations in Carpenter Creek by Season During the Period of Observation (June 2006 and March 2012)

Spatial Patterns

Fecal coliform data from the period of observation (January 1, 2003, through June 30, 2011) for the Escambia River and Texar Bayou, and June 2006 and from March 2012 for Carpenter Creek, were analyzed to detect spatial trends in the data (**Figures 5.4a**, **5.4b**, and **5.4c**). The figures display stations from upstream to downstream (from left to right).

Escambia River

Fecal coliform concentrations that exceeded the state criterion were observed in 2 of the 6 sampling stations within the Escambia River (**Table 5.2a** and **Figure 5.4a**). Station 21FLPNS 33020146, located in the downstream portion of the waterbody, had 95% of total samples collected in the WBID from 2003 to 2011 and 97% of total exceedances. Only 15 samples out of 324 were collected from the 5 other stations, and these samples were collected only in 2004. Out of these 15 samples, only 1 sample from Station 21FLPNS 33020163 exceeded the criterion.

Texar Bayou

Fecal coliform concentrations that exceeded the state criterion were observed in 8 of the 9 sampling stations within Texar Bayou (**Table 5.2b** and **Figure 5.4b**). Station 21FLDOH, located in Bayview Park (city of Pensacola), had 83% of total samples collected in the WBID from 2003 to 2011 and 82% of total exceedances. Station 21FLPNS3302HC11, also located in Bayview Park, showed 7 exceedances. Station 21FLPNS 33020159, located upstream of the waterbody, showed the highest percent of exceedances (67%; 2 of 3 samples).

Carpenter Creek

Fecal coliform concentrations that exceeded the state criterion were observed in 4 of the 8 sampling stations within Carpenter Creek (**Table 5.2c** and **Figure 5.4c**). Station 21FLPNS 33020050, located in the middle of the creek, showed the highest exceedance rate (75%; 3 of 4 samples) and average concentration (823 counts/100mL). It appears that Interstate 110 runoff contributes to the high counts. There is a large stormwater pond just to the northwest of Station 21FLPNS 33020050 that captures stormwater runoff from the road and eventually discharges into the creek.

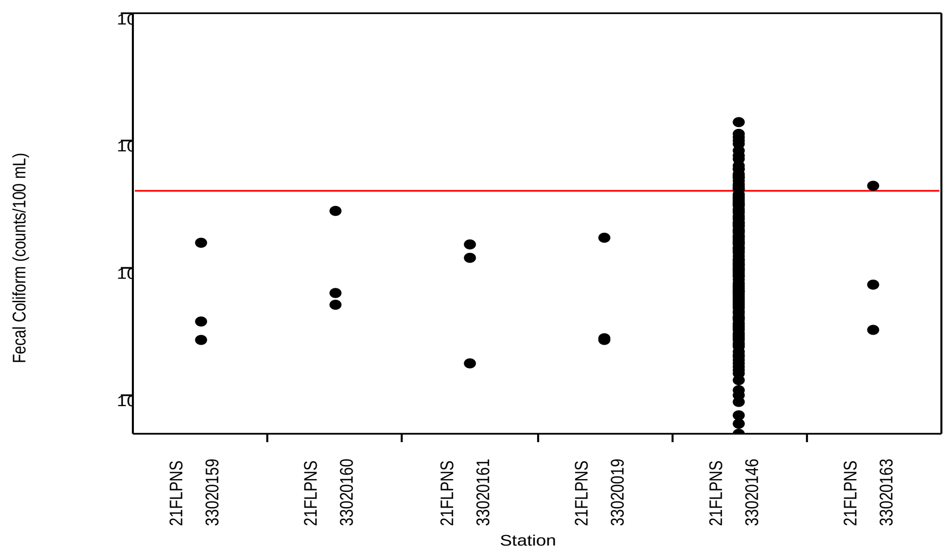


Figure 5.4a. Spatial Fecal Coliform Concentration Trends in the Escambia River by Station During the Period of Observation (January 1, 2003–June 30, 2011)

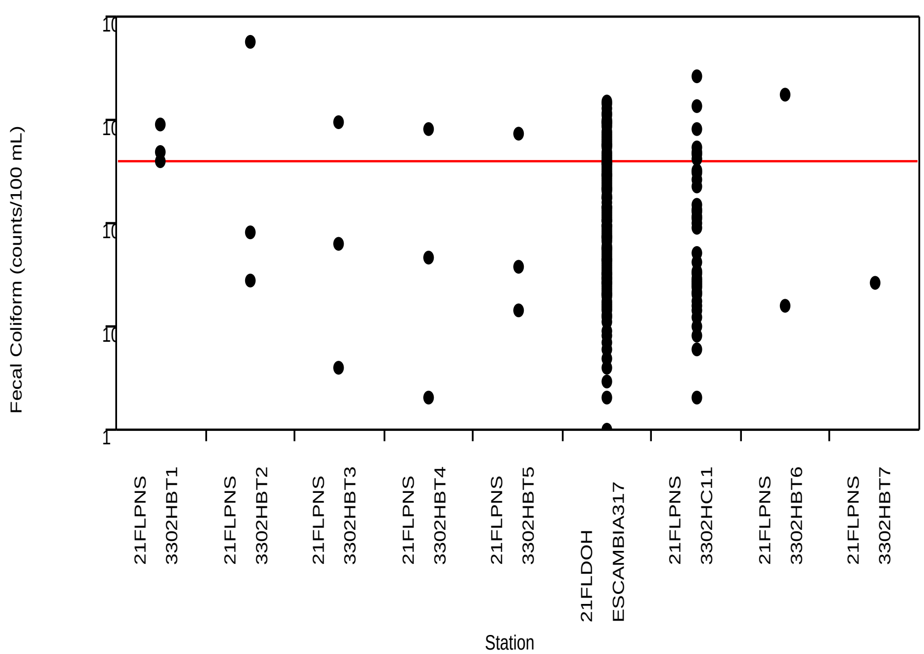


Figure 5.4b. Spatial Fecal Coliform Concentration Trends in Texar Bayou by Station During the Period of Observation (January 1, 2003–June 30, 2011)

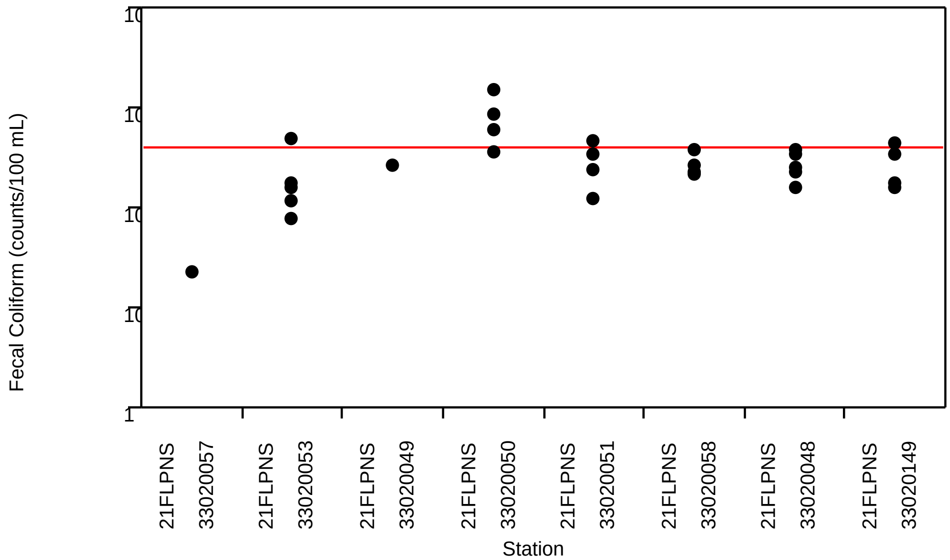


Figure 5.4c. Spatial Fecal Coliform Concentration Trends in Carpenter Creek by Station During the Period of Observation (June 2006–March 2012)

Table 5.2a. Station Summary Statistics of Fecal Coliform Data for the Escambia River During the Period of Observation (January 1, 2003–June 30, 2011)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLPNS 33020159	2004	3	27	159	38	75	0	0%
21FLPNS 33020160	2004	3	52	280	64	132	0	0%
21FLPNS 33020161	2004	3	18	155	120	98	0	0%
21FLPNS 33020019	2004	3	27	173	28	76	0	0%
21FLPNS 33020146	2003–11	309	5	1,400	96	178	34	11%
21FLPNS 33020163	2004	3	33	440	73	182	1	33%

Table 5.2b. Station Summary Statistics of Fecal Coliform Data for Texar Bayou During the Period of Observation (January 1, 2003–June 30, 2011)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLPNS 3302HBT1	2004	3	400	901	480	594	2	67%
21FLPNS 3302HBT2	2004	3	28	5,700	82	1,937	1	33%
21FLPNS 3302HBT3	2004	3	4	973	64	347	1	33%
21FLPNS 3302HBT4	2004	3	2	802	46	283	1	33%
21FLPNS 3302HBT5	2004	3	14	37	730	260	1	33%
21FLDOH ESCAMBIA317	2003–11	389	1	1,500	42	221	65	17%
21FLPNS 3302HC11	2003–04	62	2	2,600	27	155	7	11%
21FLPNS 3302HBT6	2004	2	16	1,740	878	878	1	50%
21FLPNS 3302HBT7	2004	1	27	27	27	27	0	0%

Table 5.2c. Station Summary Statistics of Fecal Coliform Data for Carpenter Creek During the Period of Observation (June 2006 and March 2012)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLPNS 33020057	2006	1	23	23	23	23	0	0.0%
21FLPNS 33020053	2006, 2012	5	78	490	160	205	1	20.0%
21FLPNS 33020049	2006	1	260	260	260	260	0	0.0%
21FLPNS 33020050	2012	4	360	1470	730	823	3	75.0%
21FLPNS 33020051	2012	4	120	470	290	293	1	25.0%
21FLPNS 33020058	2012	4	217	380	243	271	0	0.0%
21FLPNS 33020048	2006, 2012	5	156	380	251	270	0	0.0%
21FLPNS 33020149	2012	4	160	440	261	281	1	25.0%

5.1.2 Critical Condition

The critical condition for coliform loadings in a given watershed depends on many factors, including the presence of point sources and the land use pattern in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period followed by a rainfall runoff event. During the wet weather period, rainfall washes off coliform bacteria that have built up on the land surface under dry conditions, resulting in the wet weather exceedances. However, significant nonpoint source contributions can also appear under dry conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer, and fecal coliform bacteria are brought into the receiving waters through baseflow. In addition, the fecal coliform contribution of wildlife with direct access to the receiving water can be more noticeable during dry weather, by contributing to exceedances. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

Hydrologic conditions were analyzed using rainfall in the Escambia River, Texar Bayou, and Carpenter Creek watersheds. A loading curve–type chart that would normally be applied to flow events was created using precipitation data from the Pensacola Regional Airport. The chart was divided in the same manner as if flow were being analyzed, where extreme precipitation events represent the upper percentiles (0–5th percentile), followed by large precipitation events (5th–10th percentile), medium precipitation events (10th–40th percentile), small precipitation events (40th–60th percentile), and no recordable precipitation events (60th–100th percentile). Three-day (the day of and 2 days prior to sampling) precipitation accumulations were used in the analysis (**Tables 5.3a, 5.3b,** and **5.3c,** and **Figures 5.5a, 5.5b,** and **5.5c**).

Escambia River

Data show that fecal coliform exceedances occurred over all hydrologic conditions. The highest percentage of exceedances (36%) occurred after extreme precipitation events. The lowest percentage occurred during the period of no measurable precipitation events (6.8%). Exceedance rates increased from conditions when rainfall was not measurable to extreme precipitation conditions, indicating that nonpoint sources are probably a major contributing factor. The exceedance rate for a no measurable precipitation event is not insignificant, reaching 6.8%. These exceedances at baseflow can be attributed to ground water contributions from failed septic tanks and/or leaking collection systems. **Table 5.3a** and **Figure 5.5a** show fecal coliform data by hydrologic condition.

Texar Bayou

Data show that fecal coliform exceedances occurred over all hydrologic conditions. The highest percentage of exceedances (73%) occurred after extreme precipitation events. The lowest percentage occurred during the period of no measurable precipitation events (4.9%). Exceedance rates increased from conditions when rainfall was not measurable to extreme precipitation conditions, indicating that nonpoint sources are probably a major contributing factor. While the lowest percentage of exceedances occurred after periods of no or little rainfall, the exceedance rate should not be considered insignificant, as this might indicate that local sources are contributing to elevated fecal coliform concentration. **Table 5.3b** and **Figure 5.5b** show fecal coliform data by hydrologic condition.

Carpenter Creek

Due to seasonally limited sampling activities, fecal coliform exceedance rates do not reflect rainfall events well. However, exceedance rates appear high after medium precipitation events (41.7%), indicating that nonpoint sources are probably a major contributing factor. The exceedance rate for a no measurable precipitation event is not insignificant, reaching 6.3%. The exceedance at baseflow can be attributed to ground water contributions from failed septic tanks and/or leaking collection systems. **Table 5.3c** and **Figure 5.5c** show fecal coliform data by hydrologic condition.

Table 5.3a. Summary of Fecal Coliform Data for the Escambia River by Hydrologic Condition During the Period of Observation (January 1, 2003–June 30, 2011)

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

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.47"	14	5	36%	9	64%
Large	1.66" - 2.47"	16	5	31%	11	69%
Medium	0.19" - 1.66"	111	12	10.8%	99	89%
Small	0.01" - 0.19"	51	4	7.8%	47	92%
None/ Not Measurable	<0.01"	132	9	6.8%	123	93.2%

Table 5.3b. Summary of Fecal Coliform Data for Texar Bayou by Hydrologic Condition During the Period of Observation (January 1, 2003–June 30, 2011)

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

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.47"	22	16	73%	6	27%
Large	1.66" - 2.47"	22	10	45%	12	55%
Medium	0.19" - 1.66"	150	34	22.7%	116	77%
Small	0.01" - 0.19"	72	9	12.5%	63	88%
None/ Not Measurable	<0.01"	203	10	4.9%	193	95.1%

Table 5.3c. Summary of Fecal Coliform Data for Carpenter Creek by Hydrologic Condition During the Period of Observation (January 1, 2003–March 31, 2012)

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

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Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.46"	-	-	-	-	-
Large	1.65" - 2.46"	-	-	-	-	-
Medium	0.19" - 1.65"	12	5	41.7%	7	58.3%
Small	0.01" - 0.19"	-	-	-	-	-
None/ Not Measurable	<0.01"	16	1	6.3%	15	93.8%

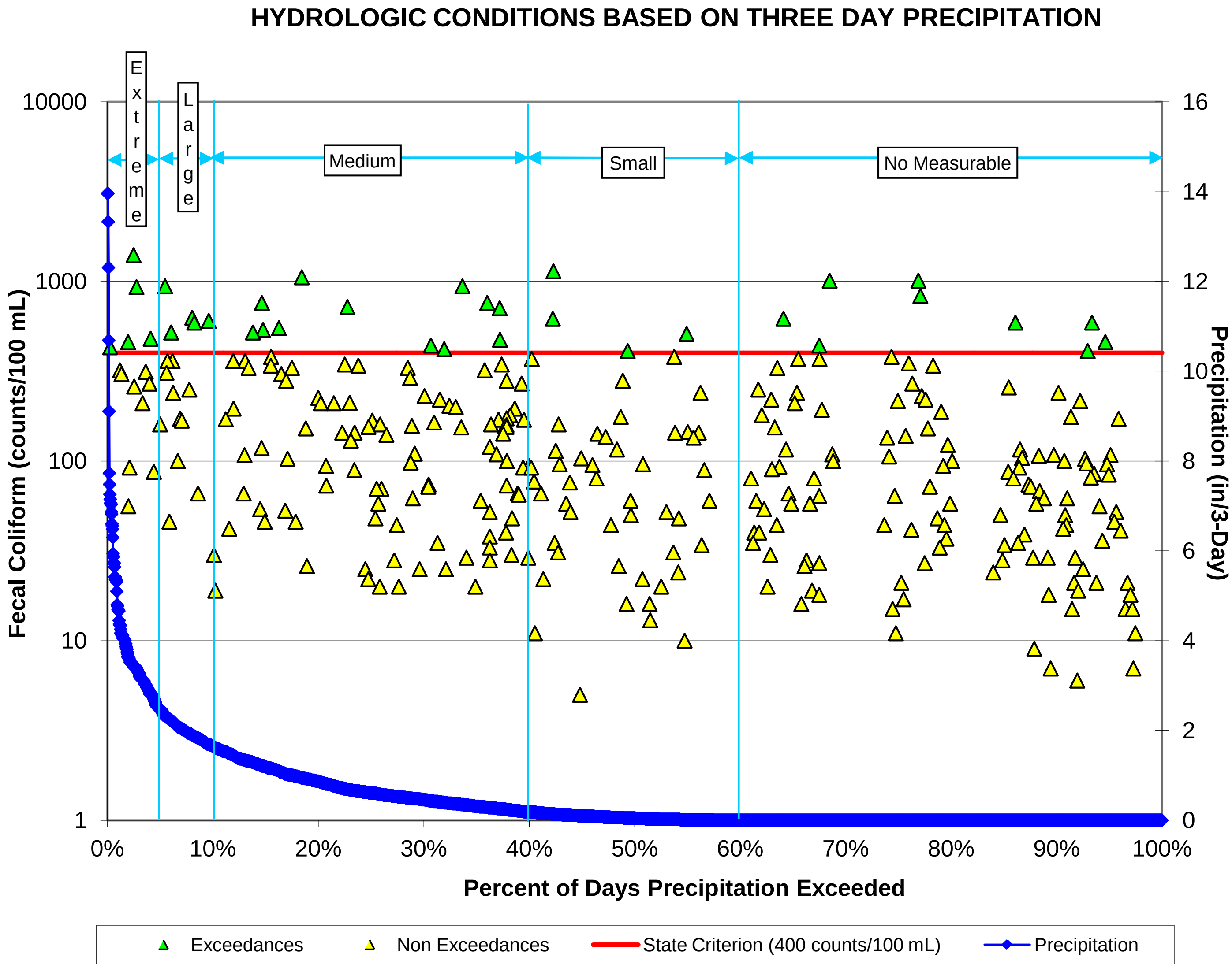

Figure 5.5a. Fecal Coliform Data for the Escambia River by Hydrologic Condition During the Period of Observation (January 1, 2003–June 30, 2011)

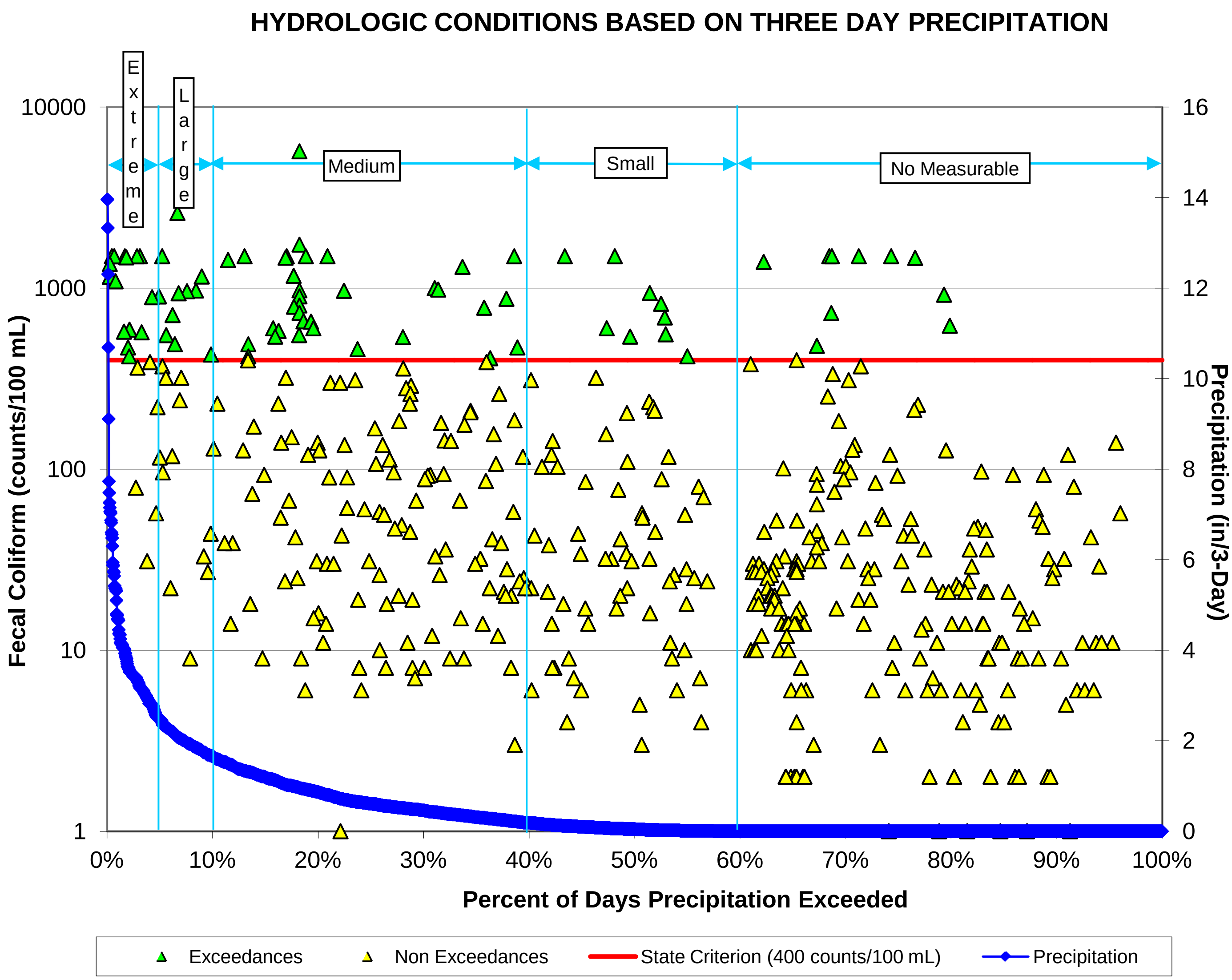

Figure 5.5b. Fecal Coliform Data for Texar Bayou by Hydrologic Condition During the Period of Observation (January 1, 2003–June 30, 2011)

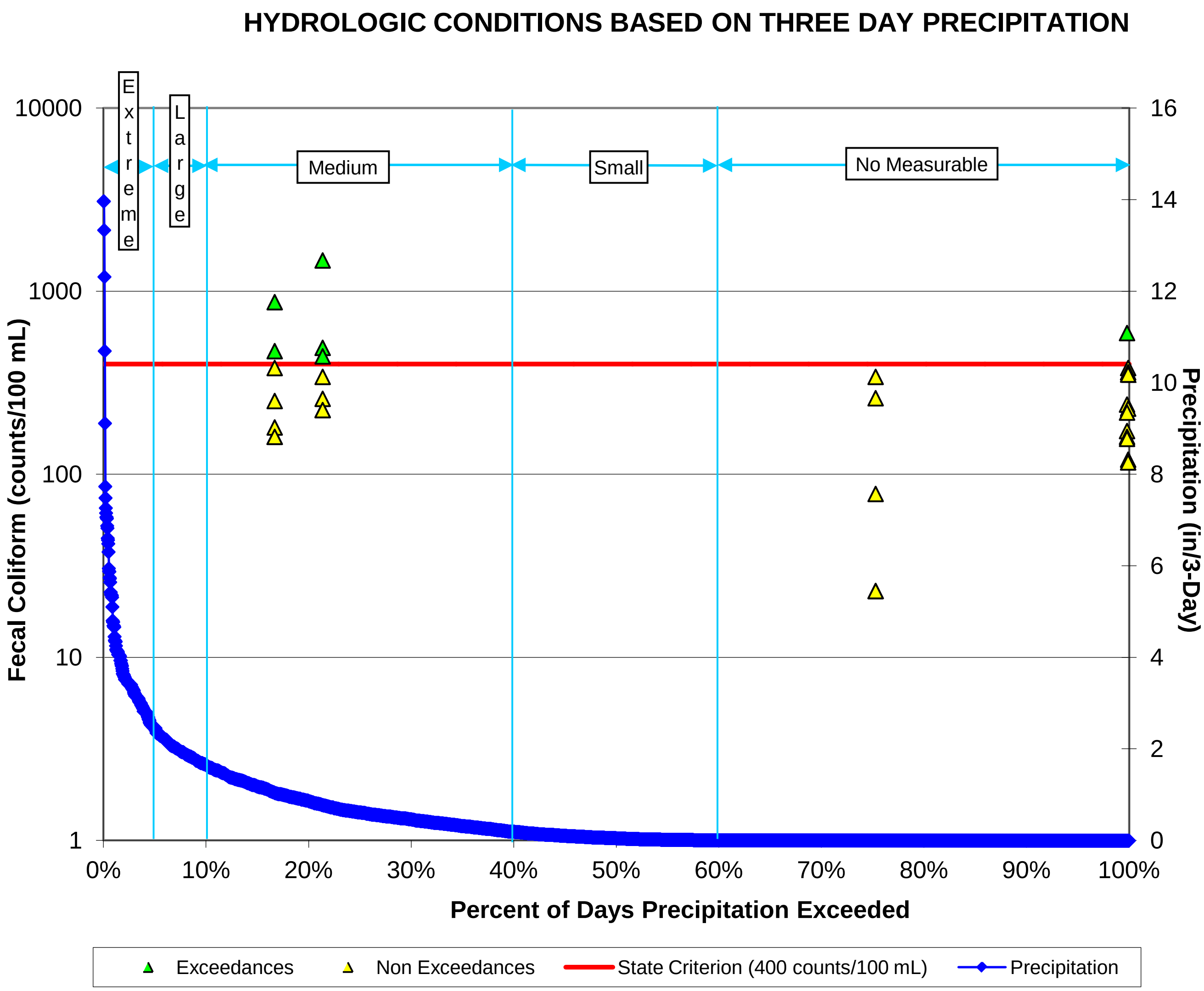

Figure 5.5c. Fecal Coliform Data for Carpenter Creek by Hydrologic Condition During the Period of Observation (January 1, 2003–March 31, 2012)

5.1.3 TMDL Development Process

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

$$\textbf{Needed \% reduction} = \frac{\textbf{Existing 90th percentile concentration} - \textbf{Allowable concentration}}{\textbf{Existing 90th percentile concentration}} \times \textbf{100\%} \qquad \textbf{Formula 1}$$

Using the Hazen method for estimating percentiles, as described in Hunter (2002), the existing condition concentration was defined as the 90th percentile of all the fecal coliform data collected during the Cycle 2 verified period (January 1, 2003, to June 30, 2010) and a more recent year (up to March 2012). This will result in a target condition that is consistent with the state bacteriological water quality assessment threshold for Class III waters.

In applying this method, all of the available data are ranked (ordered) from the lowest to the highest (**Tables C.1** through **C.3**), and **Formula 2** is used to determine the percentile value of each data point:

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

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

$$\textbf{90}^{th}\textbf{ Percentile Concentration} = C_{lower} + (P90^{th} * R) \qquad \textbf{Formula 3}$$

Where:

C_{lower} is the fecal coliform concentration corresponding to the percentile lower than the 90th percentile (e.g., in this case, 780 counts/100mL for Texar Bayou);

P_{90th} is the percentile difference between the 90th percentile and the percentile number immediately lower than the 90th percentile (in this case, 89.9%), or 90.0% – 89.9% = 0.1%; and

R is a ratio defined as R = (fecal coliform concentration $_{upper}$ – fecal coliform concentration $_{lower}$) / (percentile $_{upper}$ – percentile $_{lower}$).

To calculate *R*, the percentile values below and above the 90th percentile were identified, in this case, 89.9 and 90.1%, respectively (**Table C.2**). Next, the fecal coliform concentrations corresponding to the lower and upper percentile values were identified (780 and 790 counts/100mL, respectively) (**Table C.2**). The fecal coliform concentration difference between the lower and higher percentiles was then calculated and divided by the unit percentile. The unit percentile difference is the difference between the lower and upper percentiles (e.g., 90.1% – 89.9% = 0.2 percentile unit difference). R was then calculated as R = (790 – 780) / (90.1% – 89.9%) = 50. The C_{lower}, $P90^{th}$, and *R* were substituted into **Formula 3** to calculate the 90th percentile fecal coliform concentration (i.e., 90th percentile concentration = 780 + (0.1*50) = 785 counts/100mL). Using **Formula 1**, the percent reductions for the period of observation (January 1, 2003, through June 30, 2011) were calculated for the Escambia River, Texar Bayou, and Carpenter Creek, and are presented in **Tables C.1** through **C.3**, respectively (e.g., for Texar Bayou, % reduction needed = [(785 – 400) / 785]*100 = 49%).

Tables C.1 through **C.3** present the individual fecal coliform data, the ranks, the percentiles for each individual data, the existing 90th percentile concentration, the allowable concentration (400 counts/100mL), and the percent reduction needed to meet the applicable water quality criterion for fecal coliform for each WBID.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

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

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

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

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

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (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).

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

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure. The TMDLs for the Escambia River, Texar Bayou, and Carpenter Creek are expressed in terms of counts/100mL and percent reduction, and represent the maximum daily fecal coliform load these streams can assimilate without exceeding the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for Fecal Coliform in the Escambia River, Texar Bayou, and Carpenter Creek

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

N/A – Not applicable

WBID	Waterbody Name	Parameter	TMDL (counts/ 100mL)	WLA for Wastewater (counts/ 100mL)	WLA for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
10F	Escambia River	Fecal coliform	400	N/A	5%	5%	Implicit
738	Texar Bayou	Fecal coliform	400	N/A	49%	49%	Implicit
676	Carpenter Creek	Fecal coliform	400	N/A	28%	28%	Implicit

6.2 Load Allocation

A fecal coliform reduction of 5, 49, and 28% is needed from nonpoint sources in the Escambia River, Texar Bayou, and Carpenter Creek watersheds, respectively. It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix A**).

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

There is one NPDES-permitted facility (the Gulf Power Company-Crist Power Plant, FL0002275) located within the Escambia River WBID boundary. One NPDES-permitted wastewater facility (Cemex-Pensacola Plant, FLG110354) was identified within the Carpenter Creek WBID boundary. These facilities do not contribute fecal coliform bacteria to surface water. There are no NPDES-permitted facilities in the Texar Bayou watershed.

The state already requires all NPDES point source dischargers to meet bacteria criteria at the end of the pipe. It is the Department's current practice not to allow mixing zones for bacteria. Any point sources that may discharge in the WBID in the future will also be required to meet end-of-pipe standards for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 5, 49, and 28% reduction in current fecal coliform loadings for the Escambia River, Texar Bayou, and Carpenter Creek, respectively. It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department 2001), an implicit MOS was used in the development of these TMDLs by not subtracting contributions from natural sources and sediments when the percent reduction was calculated. This makes the estimation of human contribution more stringent and therefore adds to the MOS.

Chapter 7: TMDL IMPLEMENTATION

7.1 Basin Management Action Plan

Following the adoption of these TMDLs by rule, the Department will determine the best course of action regarding its implementation. Depending on the pollutant(s) causing the waterbody impairment and the significance of the waterbody, the Department will select the best course of action leading to the development of a plan to restore the waterbody. Often this will be accomplished cooperatively with stakeholders by creating a Basin Management Action Plan, referred to as the BMAP. BMAPs are the primary mechanism through which TMDLs are implemented in Florida (see Subsection 403.067[7], F.S.). A single BMAP may provide the conceptual plan for the restoration of one or many impaired waterbodies.

If the Department determines that a BMAP is needed to support the implementation of these TMDLs, a BMAP will be developed through a transparent, stakeholder-driven process intended to result in a plan that is cost-effective, technically feasible, and meets the restoration needs of the applicable waterbodies. Once adopted by order of the Department Secretary, BMAPs are enforceable through wastewater and municipal stormwater permits for point sources and through BMP implementation for nonpoint sources. Among other components, BMAPs typically include the following:

- *Water quality goals (based directly on the TMDL);*
- *Refined source identification;*
- *Load reduction requirements for stakeholders (quantitative detailed allocations, if technically feasible);*
- *A description of the load reduction activities to be undertaken, including structural projects, nonstructural BMPs, and public education and outreach;*
- *A description of further research, data collection, or source identification needed in order to achieve the TMDL;*
- *Timetables for implementation;*
- *Implementation funding mechanisms;*
- *An evaluation of future increases in pollutant loading due to population growth;*
- *Implementation milestones, project tracking, water quality monitoring, and adaptive management procedures; and*
- *Stakeholder statements of commitment (typically a local government resolution).*

BMAPs are updated through annual meetings and may be officially revised every five years. Completed BMAPs in the state have improved communication and cooperation among local stakeholders and state agencies; improved internal communication within local governments; applied high-quality science and local information in managing water resources; clarified the obligations of wastewater point source, MS4, and non-MS4 stakeholders in TMDL implementation; enhanced transparency in the Department's decision making; and built strong relationships between the Department and local stakeholders that have benefited other program areas.

7.2 Other TMDL Implementation Tools

However, in some basins, and for some parameters, particularly those with fecal coliform impairments, the development of a BMAP using the process described above will not be the most efficient way to restore a waterbody so that it meets its designated uses. This is because fecal coliform impairments result from the cumulative effects of a multitude of potential sources, both natural and anthropogenic. Addressing these problems requires good old-fashioned detective work that is best done by those in the area.

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

In the near future, the Department will be releasing these tools to assist local stakeholders with the development of local implementation plans to address fecal coliform impairments. In such cases, the Department will rely on these local initiatives as a more cost-effective and simplified approach to identify the actions needed to put in place a road map for restoration activities, while still meeting the requirements of Subsection 403.067(7), F.S.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit (ERP) regulations.

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

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES Stormwater Program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and the master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and FDOT throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES Stormwater Program in 2000.

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

Appendix B: Estimates of Fecal Coliform Loadings from Potential Sources

The Department has provided these estimations for informational purposes only and did not use them to calculate the TMDLs. They are intended to give the public a general idea of the relative importance of each source within each waterbody. The estimates were based on the best information available to the Department when the calculations were made. The numbers provided do not represent actual loadings from the sources.

Pets

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

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

According to the American Pet Products Manufacturers Association (APPMA), about 4 out of 10 U.S. households include at least 1 dog. A single gram of dog feces contains about 2.2 million fecal coliform bacteria (Weiskel *et al.* 1996). Unfortunately, statistics show that about 40% of American dog owners do not pick up their dogs' feces. The number of dogs within the Escambia River, Texar Bayou, and Carpenter Creek WBID boundaries is not known. Therefore, the statistics produced by APPMA were used in this analysis to estimate the possible fecal coliform loads contributed by dogs.

Using information from the Florida Department of Revenue's (DOR) 2009 Cadastral tax parcel and ownership coverage contained in the Department's GIS library, residential parcels were identified using DOR's residential land use codes. The final number of households within each WBID boundary was calculated by adding the number of residential units on the parcels for all improved residential land use codes. **Table B.1** shows the estimated number of households within each of the WBID boundaries. **Table B.2** shows the waste production rate for a dog (450 grams/animal/day) and the fecal coliform counts per gram of dog waste (2,200,000 counts/gram).

Table B.1 also shows the estimated number of dogs within each WBID boundary, assuming that 40% of the households in these areas have 1 dog; the total waste produced (grams/day) by dogs and left on the land surface in residential areas in the WBIDs, assuming that 40% of dog owners do not pick up their dogs' feces; and the total load of fecal coliform produced by dogs (counts/day) within each WBID boundary.

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

Table B.1. Estimated Number of Households and Dogs, Waste Produced (grams/day) by Dogs Left on the Land Surface, and Total Load of Fecal Coliform (counts/day) Produced by Dogs within Each WBID Boundary

This is a five-column table. Column 1 lists the waterbody name and WBID number, Column 2 lists the number of households, Column 3 lists the number of dogs, Column 4 lists the waste produced left on land, and Column 5 lists the fecal coliform loading.

Waterbody Name (WBID Number)	Number of Households	Number of Dogs	Waste Produced Left on Land Surface (grams/day)	Loading (counts/day)
Escambia River (WBID 10F)	1,185	474	85,320	1.88×10^{11}
Texar Bayou (WBID 738)	8,847	3,539	637,020	1.40×10^{12}
Carpenter Creek (WBID 676)	10,993	4,397	791,496	1.74×10^{12}

Table B.2. Dog Population Density, Wasteload, and Fecal Coliform Density (Weiskel *et al.* 1996)

This is a four-column table. Column 1 lists the animal type (dog), Column 2 lists the population density, Column 3 lists the wasteload, and Column 4 lists the fecal coliform density.

* Number from APPMA

Type	Population Density (animals/household)	Wasteload (grams/animal-day)	Fecal Coliform Density (counts/gram)
Dog	0.4*	450	2,200,000

Septic Tanks

Septic tanks are another potentially important source of coliform pollution in urban watersheds. When properly installed, most of the coliform from septic tanks should be removed within 50 meters of the drainage field (Minnesota Pollution Control Agency 1999). However, the physical properties of an aquifer, such as thickness, sediment type (sand, silt, and clay), and location play a large part in determining whether contaminants from the land surface will reach the ground water (U.S. Geological Survey [USGS] 2010). The risk of contamination is greater for unconfined (water table) aquifers than for confined aquifers because the former usually are nearer to the land surface and lack an overlying confining layer to impede the movement of contaminants (USGS 2010).

Sediment type (sand, silt, and clay) also determines the risk of contamination in a particular watershed. According to the USGS (2010), “Porosity, which is the proportion of a volume of rock or soil that consists of open spaces, tells us how much water rock or soil can retain. Permeability is a measure of how easily water can travel through porous soil or bedrock. Soil and loose sediments, such as sand and gravel, are porous and permeable. They can hold a lot of water, and it flows easily through them. Although clay and shale are porous and can hold a lot of water, the pores in these fine-grained materials are so small that water flows very slowly through them. Clay has a low permeability.”

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

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

A rough estimate of fecal coliform loads from failed septic tanks within the Escambia River, Texar Bayou, and Carpenter Creek WBID boundaries can be made using **Equation B.1**:

$$L = 37.85 * N * Q * C * F \qquad \textbf{Equation B.1}$$

Where:

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

Based on FDOH's 2012 onsite sewage GIS coverage contained in the Department's GIS library, the numbers of households were identified as being on active septic tanks in each of the WBID boundaries (**Figure B.1** and **Table B.3**). The discharge rate from each septic tank (*Q*) was calculated by multiplying the average household size by the per capita wastewater production rate per day. Based on the information published by the Census Bureau, the average household size for Escambia County is about 2.44 people/household. The same population densities were assumed within each WBID boundary. A commonly cited value for per capita wastewater production rate is 70 gallons/day/person (EPA 2001). The commonly cited concentration (*C*) for septic tank discharge is 1x106 counts/100mL for fecal coliform (EPA 2001).

No measured septic tank failure rate data were available for the WBIDs when these TMDLs were developed. Therefore, the failure rate was derived from the number of septic tanks in Escambia County based on FDOH's septic tank inventory and the number of septic tank repair permits issued in Escambia County, as published by FDOH (available: http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm). The cumulative number of septic tanks in Escambia County on an annual basis was calculated by subtracting the number of issued septic tank installation permits for each year from the current number of septic tanks in the county based on FDOH's 2009–10 inventory, assuming that none of the installed septic tanks will be removed after being installed (**Table B.4**). The reported number of septic tank repair permits was also obtained from the FDOH website. Based on **Table B.4**, the average annual septic tank failure discovery rate is about 0.72% for Escambia County. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 3.59%. Based on **Equation B.1**, the estimated fecal coliform loadings from failed septic tanks within the Escambia River, Texar

Bayou, and Carpenter Creek WBID boundaries are about 4.9 x 10^{10}, 3.9 x 10^{10}, and 4.5 x 10^{11} counts/day, respectively.

Table B.3. Estimated Number of Households Using Septic Tanks and Estimated Septic Tank Loading within Each WBID Boundary

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

Waterbody Name (WBID Number)	Number of Households Using Septic Tanks	Septic Tanks (counts/day)
Escambia River (WBID 10F)	213	4.9 x 10^{10}
Texar Bayou (WBID 738)	174	3.9 x 10^{10}
Carpenter Creek (WBID 676)	1,934	4.5 x 10^{11}

Table B.4. Estimated Number of Septic Tanks and Septic Tank Failure Rates for Escambia County, 2003–10

This is a 10-column table. Column 1 lists the parameter, Columns 2 through 9 list the estimate for each year from 2003 to 2010, respectively, and Column 10 lists the average.

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

Year	2003	2004	2005	2006	2007	2008	2009	2010	Average
Number of new septic tank installations	365	272	390	436	314	238	161	146	290
Cumulative total number of septic tanks	67,489	67,761	68,151	68,587	68,901	69,139	69,300	69,446	68,597
Number of septic tank repair permits issued	733	612	507	533	413	408	477	252	492
Failure discovery rate (%)	1.09%	0.90%	0.74%	0.78%	0.60%	0.59%	0.69%	0.36%	0.72%
Failure rate (%)[1]	5.43%	4.52%	3.72%	3.89%	3.00%	2.95%	3.44%	1.81%	3.59%

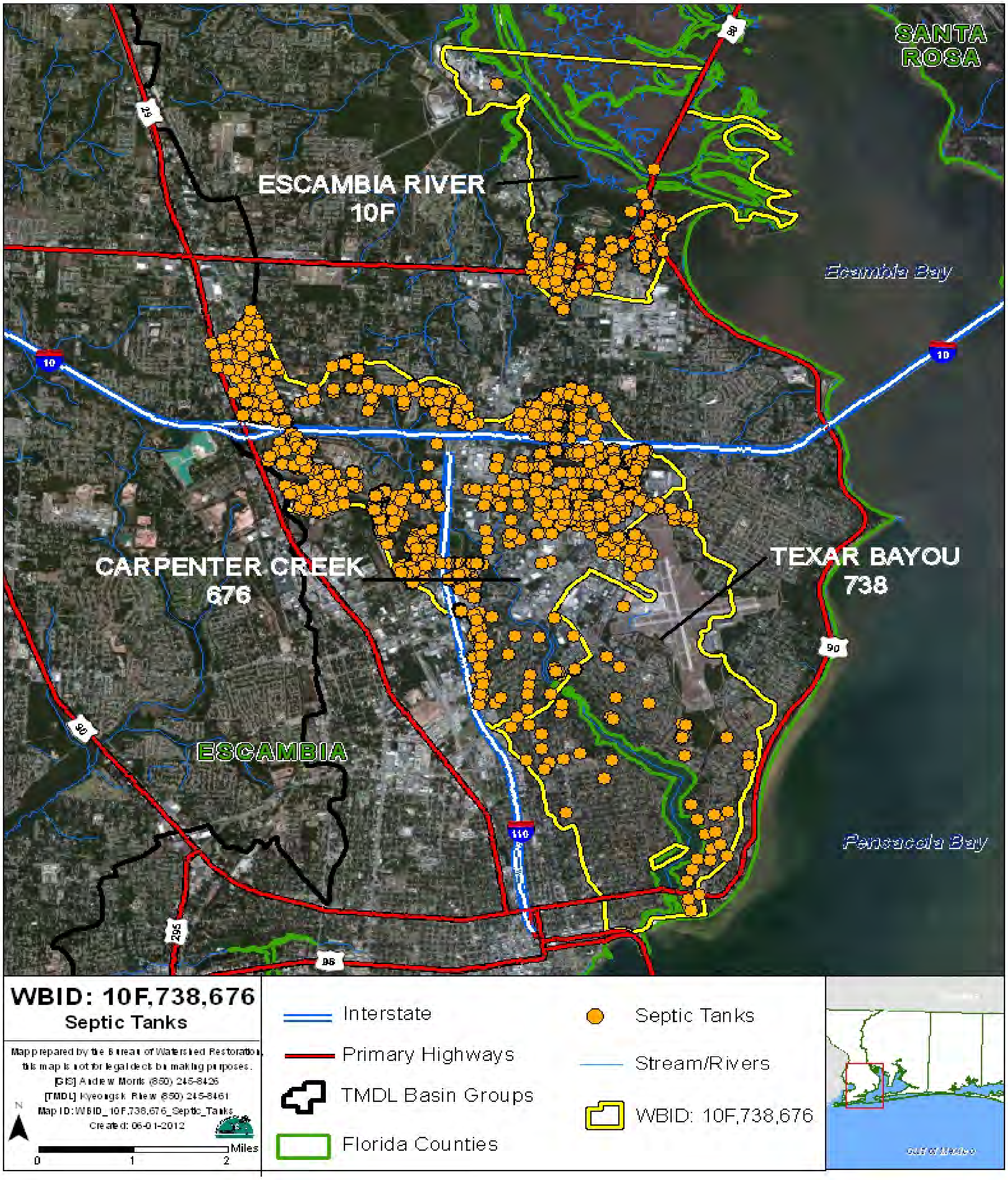

Figure B.1. Distribution of Onsite Sewage Disposal Systems (Septic Tanks) in the Residential Land Use Areas within the Escambia River, Texar Bayou, and Carpenter Creek WBID Boundaries

Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) can also be a potential source of fecal bacteria pollution. Human sewage can be introduced into surface waters even when storm and sanitary sewers are separated. Leaks and overflows are common in many older sanitary sewers where capacity is exceeded, high rates of infiltration and inflow occur (i.e., outside water gets into pipes, reducing capacity), frequent blockages occur, or sewers are simply falling apart due to poor joints or pipe materials. Power failures at pumping stations are also a common cause of SSOs. The greatest risk of an SSO occurs during storm events; however, few comprehensive data are available to quantify SSO frequency and bacteria loads in most watersheds. Therefore, in this report, the possible fecal coliform load contributed by sewer line leakage was estimated based on an empirical leakage rate of 0.5% of the total raw sewage (Culver *et al.* 2002) created within the WBIDs by the households connected to the sewer system.

Fecal coliform loading from sewer line leakage can be calculated based on the number of people in the watershed, typical per household generation rates, and typical fecal coliform concentrations in domestic sewage, assuming a leakage rate of 0.5% (Culver *et al.* 2002). Based on this assumption, a rough estimate of fecal coliform loads from leaks and SSOs within the Escambia River, Texar Bayou, and Carpenter Creek WBID boundaries can be made using **Equation B.2:**

$$L = 37.85 * N * Q * C * F \qquad \textbf{Equation B.2}$$

Where:

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

Table B.5 lists the numbers of households *(N)* tied to sewer lines (total households minus households using septic tanks) within each of the WBID boundaries. The discharge rate through sewers from each household (*Q*) was calculated by multiplying the average household size for Escambia County (2.44) (U.S. Census Bureau website 2006–10) by the per capita wastewater production rate per day (70 gallons/day/person). The commonly cited concentration (*C*) for domestic wastewater is $1x10^6$ counts/100mL for fecal coliform (EPA 2001). The contribution of fecal coliform through sewer line leakage was assumed to be 0.5% of the total sewage loading created from the population not on septic tanks (Culver *et al.* 2002). Based on **Equation B.2**, the estimated fecal coliform loadings from sewer line leakage within the Escambia River, Texar Bayou, and Carpenter Creek WBID boundaries are about 3.14×10^{10}, 2.81×10^{11}, and 2.93×10^{11} counts/day, respectively.

Table B.5. Estimated Number of Households Served by Sanitary Sewers and Estimated Fecal Coliform Loading from Sewer Line Leakage within each WBID Boundary

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

Waterbody Name (WBID Number)	Number of Households Served by Sanitary Sewers	Sanitary Sewer (counts/day)
Escambia River (WBID 10F)	972	3.14×10^{10}
Texar Bayou (WBID 738)	8,681	2.81×10^{11}
Carpenter Creek (WBID 676)	9,059	2.93×10^{11}

Wildlife

Wildlife is another possible source of fecal coliform bacteria within the Escambia River, Texar Bayou, and Carpenter Creek WBID boundaries. However, as these represent natural inputs, no reductions are assigned to these sources by these TMDLs.

Appendix C: Calculation of Fecal Coliform Reductions for the TMDLs

Table C.1. Calculation of Fecal Coliform Reductions for the Escambia River (WBID 10F) TMDL Based on the Hazen Method

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

Note: The row with boldface type and yellow highlighting indicates the 90th percentile.
- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	7/25/2006	5	1	0%
21FLPNS 33020146	4/20/2010	6	2	0%
21FLPNS 33020146	6/16/2009	7	3	1%
21FLPNS 33020146	5/31/2011	7	4	1%
21FLPNS 33020146	3/3/2009	9	5	1%
21FLPNS 33020146	7/8/2003	10	6	2%
21FLPNS 33020146	4/11/2006	11	7	2%
21FLPNS 33020146	1/25/2011	11	8	2%
21FLPNS 33020146	6/7/2011	11	9	3%
21FLPNS 33020146	3/30/2004	13	10	3%
21FLPNS 33020146	3/28/2006	15	11	3%
21FLPNS 33020146	3/30/2010	15	12	4%
21FLPNS 33020146	4/19/2011	15	13	4%
21FLPNS 33020146	5/24/2011	15	14	4%
21FLPNS 33020146	5/13/2003	16	15	4%
21FLPNS 33020146	7/15/2003	16	16	5%
21FLPNS 33020146	3/23/2004	16	17	5%
21FLPNS 33020146	5/30/2006	17	18	5%
21FLPNS 33020161	8/16/2004	18	19	6%
21FLPNS 33020146	6/9/2009	18	20	6%
21FLPNS 33020146	5/17/2011	18	21	6%
21FLPNS 33020146	5/18/2004	19	22	7%
21FLPNS 33020146	7/28/2009	19	23	7%
21FLPNS 33020146	4/27/2010	19	24	7%
21FLPNS 33020146	4/1/2003	20	25	8%
21FLPNS 33020146	5/5/2003	20	26	8%
21FLPNS 33020146	5/27/2003	20	27	8%
21FLPNS 33020146	6/17/2003	20	28	8%
21FLPNS 33020146	7/29/2003	20	29	9%
21FLPNS 33020146	5/22/2006	21	30	9%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	4/6/2010	21	31	9%
21FLPNS 33020146	10/5/2010	21	32	10%
21FLPNS 33020146	4/26/2011	21	33	10%
21FLPNS 33020146	5/19/2009	22	34	10%
21FLPNS 33020146	7/21/2009	22	35	11%
21FLPNS 33020146	12/14/2010	22	36	11%
21FLPNS 33020146	4/15/2008	24	37	11%
21FLPNS 33020146	3/29/2011	24	38	12%
21FLPNS 33020146	4/25/2006	25	39	12%
21FLPNS 33020146	11/24/2008	25	40	12%
21FLPNS 33020146	7/14/2009	25	41	13%
21FLPNS 33020146	6/8/2010	25	42	13%
21FLPNS 33020146	4/6/2004	26	43	13%
21FLPNS 33020146	4/29/2008	26	44	13%
21FLPNS 33020146	6/30/2009	26	45	14%
21FLPNS 33020019	8/16/2004	27	46	14%
21FLPNS 33020159	8/16/2004	27	47	14%
21FLPNS 33020146	11/14/2006	27	48	15%
21FLPNS 33020146	4/20/2004	28	49	15%
21FLPNS 33020146	4/27/2004	28	50	15%
21FLPNS 33020019	6/28/2004	28	51	16%
21FLPNS 33020146	6/3/2008	28	52	16%
21FLPNS 33020146	2/10/2009	29	53	16%
21FLPNS 33020146	6/2/2009	29	54	17%
21FLPNS 33020146	9/29/2009	29	55	17%
21FLPNS 33020146	4/13/2010	29	56	17%
21FLPNS 33020146	1/18/2011	29	57	17%
21FLPNS 33020146	2/11/2003	30	58	18%
21FLPNS 33020146	7/22/2003	30	59	18%
21FLPNS 33020146	8/26/2003	30	60	18%
21FLPNS 33020146	2/3/2009	31	61	19%
21FLPNS 33020146	4/21/2009	31	62	19%
21FLPNS 33020163	6/28/2004	33	63	19%
21FLPNS 33020146	2/20/2007	33	64	20%
21FLPNS 33020146	6/10/2008	34	65	20%
21FLPNS 33020146	2/24/2009	34	66	20%
21FLPNS 33020146	1/14/2003	35	67	21%
21FLPNS 33020146	10/14/2008	35	68	21%
21FLPNS 33020146	1/20/2009	35	69	21%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	12/27/2010	35	70	21%
21FLPNS 33020146	11/9/2010	36	71	22%
21FLPNS 33020146	3/27/2007	37	72	22%
21FLPNS 33020159	6/28/2004	38	73	22%
21FLPNS 33020146	11/18/2008	39	74	23%
21FLPNS 33020146	1/21/2003	40	75	23%
21FLPNS 33020146	3/25/2003	40	76	23%
21FLPNS 33020146	6/10/2003	40	77	24%
21FLPNS 33020146	3/22/2011	41	78	24%
21FLPNS 33020146	7/5/2006	42	79	24%
21FLPNS 33020146	2/13/2007	42	80	25%
21FLPNS 33020146	12/21/2009	42	81	25%
21FLPNS 33020146	10/7/2003	44	82	25%
21FLPNS 33020146	1/10/2006	44	83	25%
21FLPNS 33020146	2/21/2006	44	84	26%
21FLPNS 33020146	3/20/2007	44	85	26%
21FLPNS 33020146	3/31/2009	44	86	26%
21FLPNS 33020146	1/12/2010	44	87	27%
21FLPNS 33020146	8/19/2003	46	88	27%
21FLPNS 33020146	5/16/2006	46	89	27%
21FLPNS 33020146	6/23/2009	46	90	28%
21FLPNS 33020146	2/15/2011	46	91	28%
21FLPNS 33020146	6/24/2003	48	92	28%
21FLPNS 33020146	2/6/2007	48	93	29%
21FLPNS 33020146	6/17/2008	48	94	29%
21FLPNS 33020146	4/12/2011	48	95	29%
21FLPNS 33020146	8/22/2006	50	96	29%
21FLPNS 33020146	5/27/2008	50	97	30%
21FLPNS 33020146	1/5/2010	50	98	30%
21FLPNS 33020160	6/28/2004	52	99	30%
21FLPNS 33020146	3/14/2006	52	100	31%
21FLPNS 33020146	11/2/2010	52	101	31%
21FLPNS 33020146	2/22/2011	52	102	31%
21FLPNS 33020146	6/3/2003	53	103	32%
21FLPNS 33020146	4/29/2003	54	104	32%
21FLPNS 33020146	2/1/2011	54	105	32%
21FLPNS 33020146	6/1/2010	56	106	33%
21FLPNS 33020146	10/19/2010	56	107	33%
21FLPNS 33020146	1/13/2004	58	108	33%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	5/11/2004	58	109	33%
21FLPNS 33020146	6/27/2006	58	110	34%
21FLPNS 33020146	4/10/2007	58	111	34%
21FLPNS 33020146	5/1/2007	58	112	34%
21FLPNS 33020146	3/10/2009	58	113	35%
21FLPNS 33020146	1/28/2003	60	114	35%
21FLPNS 33020146	11/4/2003	60	115	35%
21FLPNS 33020146	5/2/2006	60	116	36%
21FLPNS 33020146	5/3/2011	60	117	36%
21FLPNS 33020146	12/29/2003	62	118	36%
21FLPNS 33020146	4/28/2009	62	119	37%
21FLPNS 33020146	1/19/2010	62	120	37%
21FLPNS 33020160	8/16/2004	64	121	37%
21FLPNS 33020146	4/4/2006	64	122	38%
21FLPNS 33020146	4/3/2007	65	123	38%
21FLPNS 33020146	8/5/2003	66	124	38%
21FLPNS 33020146	12/22/2003	66	125	38%
21FLPNS 33020146	6/8/2004	66	126	39%
21FLPNS 33020146	5/12/2009	66	127	39%
21FLPNS 33020146	7/7/2009	66	128	39%
21FLPNS 33020146	4/7/2009	68	129	40%
21FLPNS 33020146	9/9/2008	70	130	40%
21FLPNS 33020146	6/29/2010	70	131	40%
21FLPNS 33020146	5/4/2004	72	132	41%
21FLPNS 33020146	12/5/2006	72	133	41%
21FLPNS 33020146	1/27/2009	72	134	41%
21FLPNS 33020146	7/6/2004	73	135	42%
21FLPNS 33020163	10/25/2004	73	136	42%
21FLPNS 33020146	7/15/2008	74	137	42%
21FLPNS 33020146	1/13/2009	74	138	42%
21FLPNS 33020146	11/24/2009	76	139	43%
21FLPNS 33020146	2/16/2010	77	140	43%
21FLPNS 33020146	1/7/2003	80	141	43%
21FLPNS 33020146	5/25/2004	80	142	44%
21FLPNS 33020146	2/14/2006	80	143	44%
21FLPNS 33020146	9/23/2008	80	144	44%
21FLPNS 33020146	9/7/2010	81	145	45%
21FLPNS 33020146	12/21/2010	84	146	45%
21FLPNS 33020146	9/21/2010	85	147	45%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	7/22/2008	87	148	46%
21FLPNS 33020146	5/18/2010	87	149	46%
21FLPNS 33020146	6/24/2008	89	150	46%
21FLPNS 33020146	2/2/2010	89	151	46%
21FLPNS 33020146	9/9/2003	90	152	47%
21FLPNS 33020146	5/20/2003	92	153	47%
21FLPNS 33020146	9/16/2003	92	154	47%
21FLPNS 33020146	10/21/2008	92	155	48%
21FLPNS 33020146	5/26/2009	92	156	48%
21FLPNS 33020146	10/21/2003	93	157	48%
21FLPNS 33020146	8/12/2003	94	158	49%
21FLPNS 33020146	3/13/2007	94	159	49%
21FLPNS 33020146	12/8/2009	94	160	49%
21FLPNS 33020146	3/8/2011	95	161	50%
21FLPNS 33020146	8/4/2009	96	162	50%
21FLPNS 33020146	5/25/2010	96	163	50%
21FLPNS 33020146	12/7/2010	96	164	50%
21FLPNS 33020146	7/13/2010	97	165	51%
21FLPNS 33020146	4/22/2003	98	166	51%
21FLPNS 33020146	4/8/2003	100	167	51%
21FLPNS 33020146	10/26/2004	100	168	52%
21FLPNS 33020146	11/16/2004	100	169	52%
21FLPNS 33020146	5/8/2007	100	170	52%
21FLPNS 33020146	12/28/2009	100	171	53%
21FLPNS 33020146	12/1/2009	103	172	53%
21FLPNS 33020146	6/15/2010	103	173	53%
21FLPNS 33020146	2/27/2007	104	174	54%
21FLPNS 33020146	11/4/2008	104	175	54%
21FLPNS 33020146	3/7/2006	106	176	54%
21FLPNS 33020146	3/24/2009	107	177	54%
21FLPNS 33020146	8/25/2009	108	178	55%
21FLPNS 33020146	8/10/2010	108	179	55%
21FLPNS 33020146	1/4/2011	108	180	55%
21FLPNS 33020146	11/9/2004	109	181	56%
21FLPNS 33020146	10/13/2009	109	182	56%
21FLPNS 33020146	7/18/2006	110	183	56%
21FLPNS 33020146	11/30/2004	114	184	57%
21FLPNS 33020146	12/2/2003	116	185	57%
21FLPNS 33020146	2/7/2006	116	186	57%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	10/28/2008	116	187	58%
21FLPNS 33020146	7/27/2004	118	188	58%
21FLPNS 33020161	6/28/2004	120	189	58%
21FLPNS 33020146	4/17/2007	123	190	58%
21FLPNS 33020146	8/24/2004	130	191	59%
21FLPNS 33020146	2/28/2006	135	192	59%
21FLPNS 33020146	1/30/2007	135	193	59%
21FLPNS 33020146	2/3/2004	136	194	60%
21FLPNS 33020146	6/6/2006	138	195	60%
21FLPNS 33020146	2/23/2010	140	196	60%
21FLPNS 33020146	9/6/2006	142	197	61%
21FLPNS 33020146	8/19/2008	142	198	61%
21FLPNS 33020146	11/12/2008	144	199	61%
21FLPNS 33020146	12/2/2008	144	200	62%
21FLPNS 33020146	11/17/2009	144	201	62%
21FLPNS 33020146	3/9/2010	144	202	62%
21FLPNS 33020146	8/3/2004	145	203	63%
21FLPNS 33020146	11/28/2006	152	204	63%
21FLPNS 33020146	7/8/2008	152	205	63%
21FLPNS 33020146	9/30/2003	154	206	63%
21FLPNS 33020146	1/11/2011	154	207	64%
21FLPNS 33020146	6/29/2004	155	208	64%
21FLPNS 33020161	10/25/2004	155	209	64%
21FLPNS 33020146	2/9/2010	156	210	65%
21FLPNS 33020146	12/12/2006	157	211	65%
21FLPNS 33020159	10/25/2004	159	212	65%
21FLPNS 33020146	12/9/2003	160	213	66%
21FLPNS 33020146	7/13/2004	160	214	66%
21FLPNS 33020146	1/24/2006	160	215	66%
21FLPNS 33020146	9/22/2009	160	216	67%
21FLPNS 33020146	8/31/2004	164	217	67%
21FLPNS 33020146	7/6/2010	168	218	67%
21FLPNS 33020146	4/5/2011	168	219	67%
21FLPNS 33020146	2/4/2003	170	220	68%
21FLPNS 33020146	10/24/2006	170	221	68%
21FLPNS 33020146	5/4/2010	171	222	68%
21FLPNS 33020146	6/1/2004	172	223	69%
21FLPNS 33020146	3/15/2011	172	224	69%
21FLPNS 33020019	10/25/2004	173	225	69%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	12/29/2008	176	226	70%
21FLPNS 33020146	3/16/2010	176	227	70%
21FLPNS 33020146	4/15/2003	180	228	70%
21FLPNS 33020146	8/11/2009	180	229	71%
21FLPNS 33020146	3/6/2007	188	230	71%
21FLPNS 33020146	9/7/2004	193	231	71%
21FLPNS 33020146	11/22/2004	196	232	71%
21FLPNS 33020146	11/30/2010	196	233	72%
21FLPNS 33020146	9/28/2010	200	234	72%
21FLPNS 33020146	8/15/2006	203	235	72%
21FLPNS 33020146	2/18/2003	210	236	73%
21FLPNS 33020146	2/17/2004	210	237	73%
21FLPNS 33020146	6/22/2004	210	238	73%
21FLPNS 33020146	9/1/2009	210	239	74%
21FLPNS 33020146	8/24/2010	211	240	74%
21FLPNS 33020146	4/18/2006	216	241	74%
21FLPNS 33020146	5/11/2010	216	242	75%
21FLPNS 33020146	9/2/2003	220	243	75%
21FLPNS 33020146	2/10/2004	220	244	75%
21FLPNS 33020146	11/20/2006	220	245	75%
21FLPNS 33020146	1/31/2006	225	246	76%
21FLPNS 33020146	10/31/2006	230	247	76%
21FLPNS 33020146	12/26/2006	230	248	76%
21FLPNS 33020146	3/2/2004	240	249	77%
21FLPNS 33020146	9/26/2006	240	250	77%
21FLPNS 33020146	2/17/2009	240	251	77%
21FLPNS 33020146	11/3/2009	240	252	78%
21FLPNS 33020146	2/25/2003	250	253	78%
21FLPNS 33020146	10/17/2006	250	254	78%
21FLPNS 33020146	8/5/2008	257	255	79%
21FLPNS 33020146	3/2/2010	260	256	79%
21FLPNS 33020146	7/11/2006	270	257	79%
21FLPNS 33020146	8/1/2006	270	258	79%
21FLPNS 33020146	8/8/2006	270	259	80%
21FLPNS 33020146	10/28/2003	280	260	80%
21FLPNS 33020160	10/25/2004	280	261	80%
21FLPNS 33020146	3/1/2011	280	262	81%
21FLPNS 33020146	3/4/2003	290	263	81%
21FLPNS 33020146	6/15/2004	305	264	81%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	5/9/2006	305	265	82%
21FLPNS 33020146	3/18/2003	310	266	82%
21FLPNS 33020146	5/5/2009	314	267	82%
21FLPNS 33020146	10/6/2009	320	268	83%
21FLPNS 33020146	7/27/2010	320	269	83%
21FLPNS 33020146	3/10/2003	330	270	83%
21FLPNS 33020146	10/14/2003	330	271	83%
21FLPNS 33020146	11/18/2003	330	272	84%
21FLPNS 33020146	1/3/2006	330	273	84%
21FLPNS 33020146	1/17/2006	340	274	84%
21FLPNS 33020146	12/19/2006	340	275	85%
21FLPNS 33020146	8/18/2009	340	276	85%
21FLPNS 33020146	3/16/2004	345	277	85%
21FLPNS 33020146	4/13/2004	345	278	86%
21FLPNS 33020146	6/20/2006	350	279	86%
21FLPNS 33020146	9/23/2003	360	280	86%
21FLPNS 33020146	2/24/2004	360	281	87%
21FLPNS 33020146	10/7/2008	360	282	87%
21FLPNS 33020146	3/17/2009	360	283	87%
21FLPNS 33020146	1/27/2004	370	284	88%
21FLPNS 33020146	3/9/2004	370	285	88%
21FLPNS 33020146	8/17/2004	370	286	88%
21FLPNS 33020146	3/21/2006	380	287	88%
21FLPNS 33020146	9/8/2009	380	288	89%
21FLPNS 33020146	8/31/2010	380	289	89%
21FLPNS 33020146	1/6/2004	410	290	89%
21FLPNS 33020146	7/20/2010	410	291	89.7%
21FLPNS 33020146	**2/8/2011**	**420**	**292**	**90.0%**
21FLPNS 33020146	7/1/2003	430	293	90.3%
21FLPNS 33020163	8/16/2004	440	294	91%
21FLPNS 33020146	6/13/2006	440	295	91%
21FLPNS 33020146	12/15/2009	460	296	91%
21FLPNS 33020146	11/23/2010	460	297	92%
21FLPNS 33020146	10/12/2010	474	298	92%
21FLPNS 33020146	4/14/2009	480	299	92%
21FLPNS 33020146	1/20/2004	510	300	92%
21FLPNS 33020146	1/23/2007	520	301	93%
21FLPNS 33020146	8/17/2010	520	302	93%
21FLPNS 33020146	9/16/2008	537	303	93%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020146	7/19/2004	550	304	94%
21FLPNS 33020146	8/10/2004	590	305	94%
21FLPNS 33020146	9/30/2008	590	306	94%
21FLPNS 33020146	9/14/2010	590	307	95%
21FLPNS 33020146	11/16/2010	603	308	95%
21FLPNS 33020146	11/12/2003	620	309	95%
21FLPNS 33020146	1/16/2007	620	310	96%
21FLPNS 33020146	8/12/2008	629	311	96%
21FLPNS 33020146	8/3/2010	710	312	96%
21FLPNS 33020146	11/24/2003	720	313	96%
21FLPNS 33020146	9/19/2006	759	314	97%
21FLPNS 33020146	11/2/2004	760	315	97%
21FLPNS 33020146	10/10/2006	830	316	97%
21FLPNS 33020146	1/2/2007	930	317	98%
21FLPNS 33020146	8/29/2006	940	318	98%
21FLPNS 33020146	9/15/2009	940	319	98%
21FLPNS 33020146	10/19/2004	1,009	320	99%
21FLPNS 33020146	10/3/2006	1,010	321	99%
21FLPNS 33020146	1/9/2007	1,055	322	99%
21FLPNS 33020146	7/29/2008	1,140	323	100%
21FLPNS 33020146	10/27/2009	1,400	324	100%
-	**-**	**-**	**Existing condition concentration- 90th percentile (counts/100mL)**	**420**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**
-	**-**	**-**	**Final % reduction**	**5%**

Table C.2. Calculation of Fecal Coliform Reductions for the Texar Bayou (WBID 738) TMDL Based on the Hazen Method

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

Note: The row with boldface type and yellow highlighting indicates the concentrations closest to the 90th percentile.
- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	3/6/2006	1	1	0%
21FLDOH ESCAMBIA317	2/12/2007	1	2	0%
21FLDOH ESCAMBIA317	6/18/2007	1	3	1%
21FLDOH ESCAMBIA317	10/1/2007	1	4	1%
21FLDOH ESCAMBIA317	5/27/2008	1	5	1%
21FLDOH ESCAMBIA317	12/8/2008	1	6	1%
21FLDOH ESCAMBIA317	3/8/2010	1	7	1%
21FLDOH ESCAMBIA317	12/1/2003	2	8	2%
21FLPNS 3302HC11	12/2/2003	2	9	2%
21FLDOH ESCAMBIA317	1/12/2004	2	10	2%
21FLDOH ESCAMBIA317	2/17/2004	2	11	2%
21FLPNS 3302HBT4	3/1/2004	2	12	2%
21FLDOH ESCAMBIA317	3/29/2004	2	13	3%
21FLPNS 3302HC11	4/6/2004	2	14	3%
21FLDOH ESCAMBIA317	12/4/2006	2	15	3%
21FLDOH ESCAMBIA317	5/21/2007	2	16	3%
21FLDOH ESCAMBIA317	3/31/2008	2	17	4%
21FLDOH ESCAMBIA317	9/29/2008	2	18	4%
21FLDOH ESCAMBIA317	10/20/2008	2	19	4%
21FLDOH ESCAMBIA317	6/1/2009	2	20	4%
21FLDOH ESCAMBIA317	6/15/2009	2	21	4%
21FLDOH ESCAMBIA317	5/24/2004	3	22	5%
21FLDOH ESCAMBIA317	12/12/2005	3	23	5%
21FLDOH ESCAMBIA317	6/11/2007	3	24	5%
21FLDOH ESCAMBIA317	3/2/2009	3	25	5%
21FLPNS 3302HBT3	3/1/2004	4	26	5%
21FLDOH ESCAMBIA317	7/9/2007	4	27	6%
21FLDOH ESCAMBIA317	8/20/2007	4	28	6%
21FLDOH ESCAMBIA317	5/12/2008	4	29	6%
21FLDOH ESCAMBIA317	6/9/2008	4	30	6%
21FLDOH ESCAMBIA317	2/23/2009	4	31	7%
21FLDOH ESCAMBIA317	4/9/2007	5	32	7%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	1/2/2008	5	33	7%
21FLDOH ESCAMBIA317	1/11/2010	5	34	7%
21FLPNS 3302HC11	1/13/2004	6	35	7%
21FLPNS 3302HC11	1/27/2004	6	36	8%
21FLPNS 3302HC11	3/23/2004	6	37	8%
21FLDOH ESCAMBIA317	4/19/2004	6	38	8%
21FLDOH ESCAMBIA317	10/24/2005	6	39	8%
21FLDOH ESCAMBIA317	2/13/2006	6	40	8%
21FLDOH ESCAMBIA317	6/5/2006	6	41	9%
21FLDOH ESCAMBIA317	11/27/2006	6	42	9%
21FLDOH ESCAMBIA317	1/29/2007	6	43	9%
21FLDOH ESCAMBIA317	3/5/2007	6	44	9%
21FLDOH ESCAMBIA317	6/4/2007	6	45	9%
21FLDOH ESCAMBIA317	7/30/2007	6	46	10%
21FLDOH ESCAMBIA317	11/19/2007	6	47	10%
21FLDOH ESCAMBIA317	7/21/2008	6	48	10%
21FLDOH ESCAMBIA317	4/19/2010	6	49	10%
21FLDOH ESCAMBIA317	6/14/2010	6	50	11%
21FLDOH ESCAMBIA317	9/20/2010	6	51	11%
21FLDOH ESCAMBIA317	12/20/2010	6	52	11%
21FLDOH ESCAMBIA317	12/18/2006	7	53	11%
21FLDOH ESCAMBIA317	7/2/2007	7	54	11%
21FLDOH ESCAMBIA317	4/14/2008	7	55	12%
21FLDOH ESCAMBIA317	1/26/2009	7	56	12%
21FLDOH ESCAMBIA317	2/10/2003	8	57	12%
21FLPNS 3302HC11	12/29/2003	8	58	12%
21FLDOH ESCAMBIA317	3/22/2004	8	59	12%
21FLDOH ESCAMBIA317	2/20/2006	8	60	13%
21FLDOH ESCAMBIA317	3/27/2006	8	61	13%
21FLDOH ESCAMBIA317	12/26/2006	8	62	13%
21FLDOH ESCAMBIA317	1/20/2009	8	63	13%
21FLDOH ESCAMBIA317	2/22/2010	8	64	14%
21FLDOH ESCAMBIA317	12/13/2010	8	65	14%
21FLDOH ESCAMBIA317	2/24/2003	9	66	14%
21FLDOH ESCAMBIA317	10/9/2006	9	67	14%
21FLDOH ESCAMBIA317	11/6/2006	9	68	14%
21FLDOH ESCAMBIA317	7/23/2007	9	69	15%
21FLDOH ESCAMBIA317	12/26/2007	9	70	15%
21FLDOH ESCAMBIA317	1/28/2008	9	71	15%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	3/17/2008	9	72	15%
21FLDOH ESCAMBIA317	3/24/2008	9	73	15%
21FLDOH ESCAMBIA317	9/15/2008	9	74	16%
21FLDOH ESCAMBIA317	10/6/2008	9	75	16%
21FLDOH ESCAMBIA317	10/13/2008	9	76	16%
21FLDOH ESCAMBIA317	11/3/2008	9	77	16%
21FLDOH ESCAMBIA317	3/23/2009	9	78	17%
21FLDOH ESCAMBIA317	11/16/2009	9	79	17%
21FLPNS 3302HC11	1/7/2003	10	80	17%
21FLPNS 3302HC11	1/21/2003	10	81	17%
21FLPNS 3302HC11	1/28/2003	10	82	17%
21FLPNS 3302HC11	7/8/2003	10	83	18%
21FLPNS 3302HC11	10/21/2003	10	84	18%
21FLPNS 3302HC11	12/9/2003	10	85	18%
21FLPNS 3302HC11	12/22/2003	10	86	18%
21FLDOH ESCAMBIA317	1/3/2006	11	87	18%
21FLDOH ESCAMBIA317	4/3/2006	11	88	19%
21FLDOH ESCAMBIA317	2/5/2007	11	89	19%
21FLDOH ESCAMBIA317	1/22/2008	11	90	19%
21FLDOH ESCAMBIA317	5/19/2008	11	91	19%
21FLDOH ESCAMBIA317	6/2/2008	11	92	20%
21FLDOH ESCAMBIA317	3/22/2010	11	93	20%
21FLDOH ESCAMBIA317	5/24/2010	11	94	20%
21FLDOH ESCAMBIA317	10/4/2010	11	95	20%
21FLDOH ESCAMBIA317	11/1/2010	11	96	20%
21FLDOH ESCAMBIA317	1/24/2011	11	97	21%
21FLPNS 3302HC11	4/15/2003	12	98	21%
21FLPNS 3302HC11	12/16/2003	12	99	21%
21FLDOH ESCAMBIA317	10/23/2006	12	100	21%
21FLDOH ESCAMBIA317	11/29/2010	12	101	21%
21FLDOH ESCAMBIA317	10/30/2006	13	102	22%
21FLDOH ESCAMBIA317	6/2/2003	14	103	22%
21FLDOH ESCAMBIA317	11/3/2003	14	104	22%
21FLDOH ESCAMBIA317	12/8/2003	14	105	22%
21FLDOH ESCAMBIA317	12/15/2003	14	106	22%
21FLDOH ESCAMBIA317	12/22/2003	14	107	23%
21FLPNS 3302HC11	2/17/2004	14	108	23%
21FLPNS 3302HBT5	3/1/2004	14	109	23%
21FLDOH ESCAMBIA317	4/5/2004	14	110	23%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	6/7/2004	14	111	24%
21FLDOH ESCAMBIA317	7/6/2004	14	112	24%
21FLDOH ESCAMBIA317	9/6/2005	14	113	24%
21FLDOH ESCAMBIA317	12/19/2005	14	114	24%
21FLDOH ESCAMBIA317	11/20/2006	14	115	24%
21FLDOH ESCAMBIA317	5/7/2007	14	116	25%
21FLDOH ESCAMBIA317	9/17/2007	14	117	25%
21FLDOH ESCAMBIA317	1/14/2008	14	118	25%
21FLDOH ESCAMBIA317	2/4/2008	14	119	25%
21FLDOH ESCAMBIA317	11/17/2008	14	120	25%
21FLDOH ESCAMBIA317	2/9/2009	15	121	26%
21FLDOH ESCAMBIA317	7/6/2009	15	122	26%
21FLDOH ESCAMBIA317	1/10/2011	15	123	26%
21FLPNS 3302HBT6	3/1/2004	16	124	26%
21FLPNS 3302HC11	3/30/2004	16	125	27%
21FLDOH ESCAMBIA317	3/7/2011	16	126	27%
21FLDOH ESCAMBIA317	9/2/2003	17	127	27%
21FLDOH ESCAMBIA317	10/20/2003	17	128	27%
21FLDOH ESCAMBIA317	2/2/2004	17	129	27%
21FLDOH ESCAMBIA317	3/15/2004	17	130	28%
21FLDOH ESCAMBIA317	12/20/2004	17	131	28%
21FLDOH ESCAMBIA317	2/6/2006	17	132	28%
21FLDOH ESCAMBIA317	10/27/2008	17	133	28%
21FLDOH ESCAMBIA317	1/21/2003	18	134	28%
21FLDOH ESCAMBIA317	2/3/2003	18	135	29%
21FLDOH ESCAMBIA317	3/3/2003	18	136	29%
21FLDOH ESCAMBIA317	3/24/2003	18	137	29%
21FLPNS 3302HC11	1/20/2004	18	138	29%
21FLDOH ESCAMBIA317	5/11/2009	18	139	30%
21FLDOH ESCAMBIA317	9/29/2003	19	140	30%
21FLDOH ESCAMBIA317	12/29/2003	19	141	30%
21FLDOH ESCAMBIA317	6/27/2005	19	142	30%
21FLDOH ESCAMBIA317	10/17/2005	19	143	30%
21FLDOH ESCAMBIA317	1/17/2006	19	144	31%
21FLPNS 3302HC11	2/11/2003	20	145	31%
21FLPNS 3302HC11	2/25/2003	20	146	31%
21FLPNS 3302HC11	6/10/2003	20	147	31%
21FLPNS 3302HC11	6/17/2003	20	148	31%
21FLPNS 3302HC11	8/26/2003	20	149	32%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 3302HC11	9/9/2003	20	150	32%
21FLPNS 3302HC11	9/30/2003	20	151	32%
21FLDOH ESCAMBIA317	12/15/2008	20	152	32%
21FLDOH ESCAMBIA317	3/12/2007	21	153	33%
21FLDOH ESCAMBIA317	4/23/2007	21	154	33%
21FLDOH ESCAMBIA317	9/10/2007	21	155	33%
21FLDOH ESCAMBIA317	2/11/2008	21	156	33%
21FLDOH ESCAMBIA317	3/10/2008	21	157	33%
21FLDOH ESCAMBIA317	8/4/2008	21	158	34%
21FLDOH ESCAMBIA317	12/22/2008	21	159	34%
21FLDOH ESCAMBIA317	5/18/2009	21	160	34%
21FLPNS 3302HC11	5/27/2003	22	161	34%
21FLDOH ESCAMBIA317	11/10/2003	22	162	34%
21FLDOH ESCAMBIA317	1/5/2004	22	163	35%
21FLDOH ESCAMBIA317	1/26/2004	22	164	35%
21FLDOH ESCAMBIA317	6/28/2004	22	165	35%
21FLDOH ESCAMBIA317	11/21/2005	22	166	35%
21FLDOH ESCAMBIA317	6/25/2007	22	167	36%
21FLDOH ESCAMBIA317	12/1/2008	22	168	36%
21FLDOH ESCAMBIA317	6/19/2006	23	169	36%
21FLDOH ESCAMBIA317	12/11/2006	23	170	36%
21FLDOH ESCAMBIA317	5/29/2007	23	171	36%
21FLPNS 3302HC11	6/3/2003	24	172	37%
21FLDOH ESCAMBIA317	8/6/2007	24	173	37%
21FLDOH ESCAMBIA317	10/15/2007	24	174	37%
21FLDOH ESCAMBIA317	9/28/2009	24	175	37%
21FLDOH ESCAMBIA317	7/12/2010	24	176	37%
21FLPNS 3302HC11	2/4/2003	25	177	38%
21FLDOH ESCAMBIA317	5/27/2003	25	178	38%
21FLDOH ESCAMBIA317	10/10/2005	25	179	38%
21FLDOH ESCAMBIA317	2/19/2007	25	180	38%
21FLDOH ESCAMBIA317	6/22/2009	25	181	38%
21FLDOH ESCAMBIA317	6/29/2009	25	182	39%
21FLPNS 3302HC11	5/5/2003	26	183	39%
21FLPNS 3302HC11	9/2/2003	26	184	39%
21FLPNS 3302HC11	2/10/2004	26	185	39%
21FLDOH ESCAMBIA317	9/8/2009	26	186	40%
21FLDOH ESCAMBIA317	1/13/2003	27	187	40%
21FLDOH ESCAMBIA317	1/27/2003	27	188	40%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	2/17/2003	27	189	40%
21FLDOH ESCAMBIA317	4/14/2003	27	190	40%
21FLPNS 3302HBT7	3/1/2004	27	191	41%
21FLPNS 3302HC11	4/29/2003	28	192	41%
21FLDOH ESCAMBIA317	9/17/2003	28	193	41%
21FLDOH ESCAMBIA317	1/20/2004	28	194	41%
21FLDOH ESCAMBIA317	2/9/2004	28	195	41%
21FLPNS 3302HBT2	3/1/2004	28	196	42%
21FLDOH ESCAMBIA317	4/25/2005	28	197	42%
21FLDOH ESCAMBIA317	9/19/2005	28	198	42%
21FLDOH ESCAMBIA317	10/31/2005	28	199	42%
21FLDOH ESCAMBIA317	8/26/2009	28	200	43%
21FLDOH ESCAMBIA317	11/5/2007	29	201	43%
21FLDOH ESCAMBIA317	10/18/2010	29	202	43%
21FLPNS 3302HC11	1/14/2003	30	203	43%
21FLPNS 3302HC11	2/18/2003	30	204	43%
21FLPNS 3302HC11	3/25/2003	30	205	44%
21FLPNS 3302HC11	7/29/2003	30	206	44%
21FLPNS 3302HC11	3/9/2004	30	207	44%
21FLDOH ESCAMBIA317	4/21/2008	30	208	44%
21FLDOH ESCAMBIA317	6/16/2003	31	209	44%
21FLDOH ESCAMBIA317	10/6/2003	31	210	45%
21FLDOH ESCAMBIA317	3/1/2004	31	211	45%
21FLDOH ESCAMBIA317	5/17/2004	31	212	45%
21FLDOH ESCAMBIA317	8/16/2004	31	213	45%
21FLDOH ESCAMBIA317	1/31/2005	31	214	46%
21FLDOH ESCAMBIA317	3/14/2005	31	215	46%
21FLDOH ESCAMBIA317	5/22/2006	31	216	46%
21FLDOH ESCAMBIA317	8/27/2007	31	217	46%
21FLDOH ESCAMBIA317	5/4/2009	31	218	46%
21FLPNS 3302HC11	5/13/2003	32	219	47%
21FLPNS 3302HC11	11/4/2003	32	220	47%
21FLPNS 3302HC11	2/3/2004	32	221	47%
21FLDOH ESCAMBIA317	8/13/2007	32	222	47%
21FLDOH ESCAMBIA317	6/8/2009	32	223	47%
21FLDOH ESCAMBIA317	12/28/2009	32	224	48%
21FLDOH ESCAMBIA317	11/17/2003	33	225	48%
21FLDOH ESCAMBIA317	2/23/2004	33	226	48%
21FLDOH ESCAMBIA317	12/27/2004	33	227	48%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 3302HC11	7/15/2003	34	228	49%
21FLDOH ESCAMBIA317	2/26/2007	34	229	49%
21FLDOH ESCAMBIA317	11/13/2006	36	230	49%
21FLDOH ESCAMBIA317	10/29/2007	36	231	49%
21FLDOH ESCAMBIA317	3/3/2008	36	232	49%
21FLDOH ESCAMBIA317	11/24/2008	36	233	50%
21FLPNS 3302HBT5	7/22/2004	37	234	50%
21FLDOH ESCAMBIA317	1/12/2009	38	235	50%
21FLDOH ESCAMBIA317	4/12/2004	39	236	50%
21FLDOH ESCAMBIA317	9/7/2004	39	237	50%
21FLDOH ESCAMBIA317	6/16/2008	39	238	51%
21FLDOH ESCAMBIA317	7/7/2008	39	239	51%
21FLDOH ESCAMBIA317	12/29/2008	41	240	51%
21FLDOH ESCAMBIA317	11/30/2009	41	241	51%
21FLPNS 3302HC11	8/19/2003	42	242	51%
21FLDOH ESCAMBIA317	5/10/2004	42	243	52%
21FLDOH ESCAMBIA317	1/24/2005	42	244	52%
21FLDOH ESCAMBIA317	9/7/2010	42	245	52%
21FLDOH ESCAMBIA317	5/30/2006	43	246	52%
21FLDOH ESCAMBIA317	7/10/2006	43	247	53%
21FLDOH ESCAMBIA317	5/5/2008	43	248	53%
21FLDOH ESCAMBIA317	6/28/2010	43	249	53%
21FLDOH ESCAMBIA317	8/25/2003	44	250	53%
21FLDOH ESCAMBIA317	4/16/2007	44	251	53%
21FLDOH ESCAMBIA317	4/21/2003	45	252	54%
21FLDOH ESCAMBIA317	4/30/2003	45	253	54%
21FLDOH ESCAMBIA317	12/3/2007	45	254	54%
21FLPNS 3302HBT4	7/22/2004	45.5	255	54%
21FLDOH ESCAMBIA317	2/25/2008	46	256	54%
21FLDOH ESCAMBIA317	2/28/2005	47	257	55%
21FLDOH ESCAMBIA317	9/12/2005	47	258	55%
21FLDOH ESCAMBIA317	11/13/2007	47	259	55%
21FLDOH ESCAMBIA317	12/10/2007	48	260	55%
21FLDOH ESCAMBIA317	4/20/2009	48	261	56%
21FLDOH ESCAMBIA317	10/8/2007	49	262	56%
21FLPNS 3302HC11	10/7/2003	52	263	56%
21FLPNS 3302HC11	3/2/2004	52	264	56%
21FLDOH ESCAMBIA317	4/6/2009	52	265	56%
21FLDOH ESCAMBIA317	1/9/2006	53	266	57%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	7/3/2006	53	267	57%
21FLDOH ESCAMBIA317	4/7/2003	54	268	57%
21FLDOH ESCAMBIA317	8/3/2009	54	269	57%
21FLDOH ESCAMBIA317	8/11/2003	56	270	57%
21FLDOH ESCAMBIA317	3/7/2005	56	271	58%
21FLDOH ESCAMBIA317	12/27/2005	56	272	58%
21FLDOH ESCAMBIA317	2/16/2009	57	273	58%
21FLDOH ESCAMBIA317	7/20/2009	57	274	58%
21FLDOH ESCAMBIA317	3/21/2011	57	275	59%
21FLDOH ESCAMBIA317	5/5/2003	58	276	59%
21FLDOH ESCAMBIA317	3/8/2004	58	277	59%
21FLDOH ESCAMBIA317	7/28/2008	60	278	59%
21FLDOH ESCAMBIA317	3/9/2009	60	279	59%
21FLDOH ESCAMBIA317	11/24/2003	61	280	60%
21FLPNS 3302HBT3	7/22/2004	64	281	60%
21FLDOH ESCAMBIA317	2/14/2005	67	282	60%
21FLDOH ESCAMBIA317	2/18/2008	67	283	60%
21FLDOH ESCAMBIA317	1/25/2010	67	284	60%
21FLDOH ESCAMBIA317	10/26/2009	70	285	61%
21FLDOH ESCAMBIA317	1/22/2007	73	286	61%
21FLDOH ESCAMBIA317	12/13/2004	75	287	61%
21FLDOH ESCAMBIA317	4/28/2008	77	288	61%
21FLDOH ESCAMBIA317	1/1/2007	79	289	62%
21FLDOH ESCAMBIA317	11/12/2008	80	290	62%
21FLDOH ESCAMBIA317	4/5/2010	80	291	62%
21FLPNS 3302HBT2	7/22/2004	82	292	62%
21FLDOH ESCAMBIA317	11/7/2005	84	293	62%
21FLDOH ESCAMBIA317	7/24/2006	85	294	63%
21FLDOH ESCAMBIA317	8/10/2005	86	295	63%
21FLDOH ESCAMBIA317	6/25/2003	88	296	63%
21FLDOH ESCAMBIA317	2/7/2005	88	297	63%
21FLDOH ESCAMBIA317	1/23/2006	88	298	63%
21FLPNS 3302HC11	11/24/2003	90	299	64%
21FLDOH ESCAMBIA317	11/15/2010	90	300	64%
21FLDOH ESCAMBIA317	5/3/2004	92	301	64%
21FLDOH ESCAMBIA317	4/17/2006	92	302	64%
21FLDOH ESCAMBIA317	5/15/2006	93	303	64%
21FLDOH ESCAMBIA317	6/12/2006	93	304	65%
21FLDOH ESCAMBIA317	9/22/2008	93	305	65%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	4/27/2009	93	306	65%
21FLDOH ESCAMBIA317	7/21/2004	94	307	65%
21FLDOH ESCAMBIA317	2/7/2011	94	308	66%
21FLDOH ESCAMBIA317	4/26/2004	96	309	66%
21FLDOH ESCAMBIA317	3/28/2005	96	310	66%
21FLDOH ESCAMBIA317	4/18/2005	96	311	66%
21FLDOH ESCAMBIA317	1/7/2008	97	312	66%
21FLPNS 3302HC11	11/12/2003	101	313	67%
21FLDOH ESCAMBIA317	8/7/2006	103	314	67%
21FLDOH ESCAMBIA317	2/2/2009	103	315	67%
21FLDOH ESCAMBIA317	1/18/2005	104	316	67%
21FLDOH ESCAMBIA317	2/21/2005	104	317	67%
21FLDOH ESCAMBIA317	9/8/2008	107	318	68%
21FLDOH ESCAMBIA317	10/12/2009	107	319	68%
21FLPNS 3302HC11	1/6/2004	110	320	68%
21FLDOH ESCAMBIA317	1/5/2009	113	321	68%
21FLDOH ESCAMBIA317	7/13/2004	116	322	69%
21FLDOH ESCAMBIA317	5/14/2007	117	323	69%
21FLDOH ESCAMBIA317	5/26/2009	117	324	69%
21FLPNS 3302HC11	2/24/2004	118	325	69%
21FLDOH ESCAMBIA317	10/29/2003	120	326	69%
21FLDOH ESCAMBIA317	8/23/2004	120	327	70%
21FLDOH ESCAMBIA317	3/13/2006	120	328	70%
21FLDOH ESCAMBIA317	2/8/2010	120	329	70%
21FLDOH ESCAMBIA317	1/8/2007	127	330	70%
21FLDOH ESCAMBIA317	3/26/2007	127	331	70%
21FLDOH ESCAMBIA317	8/23/2010	127	332	71%
21FLDOH ESCAMBIA317	5/9/2005	128	333	71%
21FLPNS 3302HC11	7/22/2003	130	334	71%
21FLPNS 3302HC11	3/16/2004	136	335	71%
21FLDOH ESCAMBIA317	5/23/2005	136	336	72%
21FLDOH ESCAMBIA317	8/24/2005	136	337	72%
21FLDOH ESCAMBIA317	1/30/2006	140	338	72%
21FLDOH ESCAMBIA317	8/25/2008	140	339	72%
21FLDOH ESCAMBIA317	2/21/2011	140	340	72%
21FLDOH ESCAMBIA317	1/16/2007	143	341	73%
21FLDOH ESCAMBIA317	8/18/2008	143	342	73%
21FLDOH ESCAMBIA317	3/31/2003	144	343	73%
21FLPNS 3302HC11	11/18/2003	150	344	73%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	7/14/2003	156	345	73%
21FLDOH ESCAMBIA317	3/21/2005	156	346	74%
21FLDOH ESCAMBIA317	11/29/2004	168	347	74%
21FLDOH ESCAMBIA317	4/24/2006	172	348	74%
21FLDOH ESCAMBIA317	8/15/2005	176	349	74%
21FLDOH ESCAMBIA317	6/9/2003	180	350	75%
21FLDOH ESCAMBIA317	1/3/2005	184	351	75%
21FLDOH ESCAMBIA317	1/10/2005	184	352	75%
21FLDOH ESCAMBIA317	11/22/2004	186	353	75%
21FLDOH ESCAMBIA317	9/8/2003	204	354	75%
21FLDOH ESCAMBIA317	4/10/2006	206	355	76%
21FLDOH ESCAMBIA317	9/4/2007	210	356	76%
21FLDOH ESCAMBIA317	8/11/2008	210	357	76%
21FLDOH ESCAMBIA317	8/21/2006	212	358	76%
21FLDOH ESCAMBIA317	6/26/2006	220	359	76%
21FLDOH ESCAMBIA317	4/7/2008	220	360	77%
21FLDOH ESCAMBIA317	10/2/2006	227	361	77%
21FLPNS 3302HC11	3/4/2003	230	362	77%
21FLDOH ESCAMBIA317	9/24/2007	230	363	77%
21FLDOH ESCAMBIA317	12/17/2007	230	364	78%
21FLDOH ESCAMBIA317	5/12/2003	236	365	78%
21FLDOH ESCAMBIA317	6/1/2004	240	366	78%
21FLDOH ESCAMBIA317	10/5/2004	252	367	78%
21FLPNS 3302HC11	4/22/2003	260	368	78%
21FLDOH ESCAMBIA317	8/2/2010	260	369	79%
21FLDOH ESCAMBIA317	5/16/2005	280	370	79%
21FLDOH ESCAMBIA317	8/4/2003	289	371	79%
21FLDOH ESCAMBIA317	9/24/2003	300	372	79%
21FLDOH ESCAMBIA317	3/30/2009	300	373	79%
21FLPNS 3302HC11	9/16/2003	310	374	80%
21FLDOH ESCAMBIA317	4/4/2005	310	375	80%
21FLDOH ESCAMBIA317	7/17/2006	310	376	80%
21FLDOH ESCAMBIA317	7/7/2003	320	377	80%
21FLPNS 3302HC11	10/28/2003	320	378	80%
21FLDOH ESCAMBIA317	8/1/2005	320	379	81%
21FLDOH ESCAMBIA317	11/14/2005	320	380	81%
21FLDOH ESCAMBIA317	11/15/2004	335	381	81%
21FLDOH ESCAMBIA317	8/28/2006	360	382	81%
21FLDOH ESCAMBIA317	6/16/2004	364	383	82%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	7/25/2005	370	384	82%
21FLDOH ESCAMBIA317	11/30/2005	370	385	82%
21FLDOH ESCAMBIA317	1/6/2003	380	386	82%
21FLDOH ESCAMBIA317	10/13/2003	390	387	82%
21FLDOH ESCAMBIA317	4/13/2009	390	388	83%
21FLDOH ESCAMBIA317	6/23/2008	399	389	83%
21FLPNS 3302HBT1	3/1/2004	400	390	83%
21FLDOH ESCAMBIA317	6/6/2005	410	391	83%
21FLDOH ESCAMBIA317	3/10/2003	420	392	83%
21FLPNS 3302HC11	5/20/2003	420	393	84%
21FLDOH ESCAMBIA317	8/2/2004	420	394	84%
21FLDOH ESCAMBIA317	7/1/2008	430	395	84%
21FLDOH ESCAMBIA317	12/5/2005	460	396	84%
21FLPNS 3302HC11	8/5/2003	470	397	85%
21FLDOH ESCAMBIA317	6/1/2010	470	398	85%
21FLPNS 3302HBT1	7/22/2004	480	399	85%
21FLPNS 3302HC11	3/10/2003	490	400	85%
21FLDOH ESCAMBIA317	7/31/2006	490	401	85%
21FLDOH ESCAMBIA317	6/23/2003	536	402	86%
21FLDOH ESCAMBIA317	9/1/2004	540	403	86%
21FLDOH ESCAMBIA317	5/1/2006	540	404	86%
21FLPNS 3302HC11	3/18/2003	550	405	86%
21FLDOH ESCAMBIA317	9/15/2003	550	406	86%
21FLDOH ESCAMBIA317	10/3/2005	556	407	87%
21FLDOH ESCAMBIA317	5/2/2005	570	408	87%
21FLDOH ESCAMBIA317	12/14/2009	575	409	87%
21FLDOH ESCAMBIA317	7/19/2004	580	410	87%
21FLDOH ESCAMBIA317	5/19/2003	590	411	88%
21FLDOH ESCAMBIA317	8/9/2004	600	412	88%
21FLDOH ESCAMBIA317	5/31/2005	600	413	88%
21FLDOH ESCAMBIA317	8/14/2006	600	414	88%
21FLDOH ESCAMBIA317	4/30/2007	620	415	88%
21FLDOH ESCAMBIA317	7/28/2004	653	416	89%
21FLDOH ESCAMBIA317	6/23/2004	656	417	89%
21FLDOH ESCAMBIA317	6/20/2005	689	418	89%
21FLDOH ESCAMBIA317	9/25/2006	710	419	89%
21FLDOH ESCAMBIA317	11/1/2004	728	420	89%
21FLPNS 3302HBT5	11/23/2004	730	421	89.7%
21FLDOH ESCAMBIA317	**7/26/2010**	**780**	**422**	**89.9%**

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	**8/17/2009**	**790**	**423**	**90.1%**
21FLPNS 3302HBT4	11/23/2004	802	424	90.3%
21FLPNS 3302HC11	4/1/2003	820	425	91%
21FLDOH ESCAMBIA317	10/25/2004	873	426	91%
21FLDOH ESCAMBIA317	6/13/2005	891	427	91%
21FLDOH ESCAMBIA317	3/16/2009	900	428	91%
21FLPNS 3302HBT1	11/23/2004	901	429	91%
21FLDOH ESCAMBIA317	3/19/2007	920	430	92%
21FLDOH ESCAMBIA317	3/17/2003	937	431	92%
21FLDOH ESCAMBIA317	7/28/2003	939	432	92%
21FLDOH ESCAMBIA317	7/21/2003	961	433	92%
21FLDOH ESCAMBIA317	5/21/2003	967	434	92%
21FLDOH ESCAMBIA317	7/16/2007	970	435	93%
21FLPNS 3302HBT3	11/23/2004	973	436	93%
21FLDOH ESCAMBIA317	8/8/2005	982	437	93%
21FLDOH ESCAMBIA317	4/2/2007	1,000	438	93%
21FLDOH ESCAMBIA317	11/28/2005	1,091	439	93%
21FLDOH ESCAMBIA317	7/1/2003	1,155	440	94%
21FLDOH ESCAMBIA317	8/9/2010	1,160	441	94%
21FLDOH ESCAMBIA317	7/14/2008	1,170	442	94%
21FLDOH ESCAMBIA317	9/11/2006	1,310	443	94%
21FLPNS 3302HC11	7/1/2003	1,360	444	95%
21FLDOH ESCAMBIA317	4/28/2003	1,396	445	95%
21FLDOH ESCAMBIA317	10/22/2007	1,430	446	95%
21FLDOH ESCAMBIA317	9/5/2006	1,470	447	95%
21FLDOH ESCAMBIA317	8/18/2003	1,473	448	95%
21FLDOH ESCAMBIA317	11/26/2007	1,480	449	96%
21FLDOH ESCAMBIA317	9/22/2003	1,500	450	96%
21FLDOH ESCAMBIA317	10/27/2003	1,500	451	96%
21FLDOH ESCAMBIA317	6/14/2004	1,500	452	96%
21FLDOH ESCAMBIA317	6/21/2004	1,500	453	96%
21FLDOH ESCAMBIA317	7/26/2004	1,500	454	97%
21FLDOH ESCAMBIA317	8/30/2004	1,500	455	97%
21FLDOH ESCAMBIA317	10/11/2004	1,500	456	97%
21FLDOH ESCAMBIA317	10/18/2004	1,500	457	97%
21FLDOH ESCAMBIA317	11/8/2004	1,500	458	98%
21FLDOH ESCAMBIA317	12/6/2004	1,500	459	98%
21FLDOH ESCAMBIA317	4/11/2005	1,500	460	98%
21FLDOH ESCAMBIA317	7/5/2005	1,500	461	98%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH ESCAMBIA317	7/18/2005	1,500	462	98%
21FLDOH ESCAMBIA317	8/22/2005	1,500	463	99%
21FLDOH ESCAMBIA317	9/26/2005	1,500	464	99%
21FLDOH ESCAMBIA317	9/28/2005	1,500	465	99%
21FLDOH ESCAMBIA317	3/20/2006	1,500	466	99%
21FLPNS 3302HBT6	11/23/2004	1,740	467	99%
21FLPNS 3302HC11	4/8/2003	2,600	468	100%
21FLPNS 3302HBT2	11/23/2004	5,700	469	100%
-	**-**	**-**	**Existing condition concentration-90th percentile (counts/100mL)**	**785**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**
-	**-**	**-**	**Final % reduction**	**49%**

Table C.3. Calculation of Fecal Coliform Reductions for the Carpenter Creek (WBID 676) TMDL Based on the Hazen Method

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

Note: The row with boldface type and yellow highlighting indicates the concentrations closest to the 90th percentile.
\- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLPNS 33020057	6/5/2006	23	1	2%
21FLPNS 33020053	6/5/2006	78	2	5%
21FLPNS 33020053	3/26/2012	116	3	9%
21FLPNS 33020051	3/26/2012	120	4	13%
21FLPNS 33020048	3/19/2012	156	5	16%
21FLPNS 33020053	3/19/2012	160	6	20%
21FLPNS 33020149	3/5/2012	160	7	23%
21FLPNS 33020149	3/19/2012	172	8	27%
21FLPNS 33020053	3/5/2012	180	9	30%
21FLPNS 33020058	3/19/2012	217	10	34%
21FLPNS 33020048	3/12/2012	224	11	38%
21FLPNS 33020058	3/26/2012	228	12	41%
21FLPNS 33020051	3/19/2012	240	13	45%
21FLPNS 33020048	3/5/2012	251	14	48%
21FLPNS 33020058	3/12/2012	258	15	52%
21FLPNS 33020049	6/5/2006	260	16	55%
21FLPNS 33020051	3/12/2012	340	17	59%
21FLPNS 33020048	6/5/2006	340	18	63%
21FLPNS 33020149	3/26/2012	350	19	66%
21FLPNS 33020050	3/26/2012	360	20	70%
21FLPNS 33020058	3/5/2012	380	21	73%
21FLPNS 33020048	3/26/2012	380	22	77%
21FLPNS 33020149	3/12/2012	440	23	80%
21FLPNS 33020051	3/5/2012	470	24	84%
21FLPNS 33020053	**3/12/2012**	**490**	**25**	**88%**
21FLPNS 33020050	**3/19/2012**	**590**	**26**	**91%**
21FLPNS 33020050	3/5/2012	870	27	95%
21FLPNS 33020050	3/12/2012	1,470	28	98%
-	**-**	**-**	**Existing condition concentration-90th percentile (counts/100mL)**	**557**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
-	**-**	**-**	**Final % reduction**	**28%**

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