FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration,

Bureau of Watershed Restoration

NORTHWEST DISTRICT • CHIPOLA RIVER BASIN

Final TMDL Report

Fecal Coliform TMDL for Otter Creek (WBID 819)

Rhonda Peets
Ben Ralys
Erin Wilcox

September, 2009

Acknowledgments

This TMDL analysis could not have been accomplished without significant contributions from staff in the Florida Department of Environmental Protection's Northwest District, Calhoun County, and Watershed Evaluation and TMDL Section.

Editorial assistance provided by Jan Mandrup-Poulsen, and Linda Lord.

For additional information on the watershed management approach and impaired waters in the Apalachicola/Chipola Basin, contact:

Bonita Gorham
Florida Department of Environmental Protection
Bureau of Watershed Restoration
Watershed Evaluation and TMDL Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
Email: bonita.gorham@dep.state.fl.us
Phone: (850) 245–8513
Fax: (850) 245–8434

Access to all data used in the development of this report can be obtained by contacting:

Rhonda Peets
Florida Department of Environmental Protection
Bureau of Watershed Restoration
Watershed Evaluation and TMDL Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
Email: Rhonda.peets@dep.state.fl.us
Phone: (850) 245–8438
Fax: (850) 245–8444

Dr. Xueqing Gao
Florida Department of Environmental Protection
Bureau of Watershed Restoration
Watershed Planning and Coordination Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
Email: xueqing.gao@dep.state.fl.us
Phone: (850) 245–8464
Fax: (850) 245–8444

Contents

List of Tables

List of Figures

Web sites

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/water/tmdl/docs/AmendedIWR.pdf

STORET Program

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

2006 Integrated Report

http://www.dep.state.fl.us/water/tmdl/docs/2006_Integrated_Report.pdf

2008 Integrated Report

http://www.dep.state.fl.us/water/docs/2008_Integrated_Report.pdf

Criteria for Surface Water Quality Classifications

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

Basin Status Report for the Apalachicola/Chipola Basin

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

Water Quality Assessment Report for the Apalachicola/Chipola Basin

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

Water Quality Assessment Reports

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

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads 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 Load (TMDL) for fecal coliform for Otter Creek in the Apalachicola/Chipola River Basin **(Figure 1.1)**. Otter Creek was verified as impaired for fecal coliform, and was included on the Verified List of impaired waters for the Apalachicola/Chipola River Basin that was adopted by Secretarial Order in January 1, 2001. This TMDL establishes the allowable loadings to Otter Creek that would restore the waterbody so that it meets its applicable water quality criteria for fecal coliform.

1.2 Identification of Waterbody

Otter Creek is located in the northern portion of Calhoun County, bordered by Clarksville highway on the east, county road 287 (Cr-287) on the west and state road 20 (SR-20) to the south. County road 287A (Cr-287A) crosses the creek midway, forming a connection from state road 287 in the west to Clarksville highway in the east**.** Otter Creek is approximately 3 miles long with a drainage area of approximately 3.3 square mile. Otter Creek is a surface drainage tributary flowing in a south easterly direction into Fourmile creek that outfall into the Chipola River. There are no major cities within the Otter Creek watershed. The closest cities are Altha, north of Otter Creek and Blountstown to the East **(Figure 1.1)**. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Apalachicola – Chipola River (Florida Department of Environmental Protection [Department], 2006.

For assessment purposes, the Department has divided the Apalachicola – Chipola River Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. Otter Creek is WBID 819 (**Figure 5.1**).

1.3 Background

This report was developed as part of the Florida Department of Environmental Protection's (Department) 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 fifty-two river basins over a five-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).

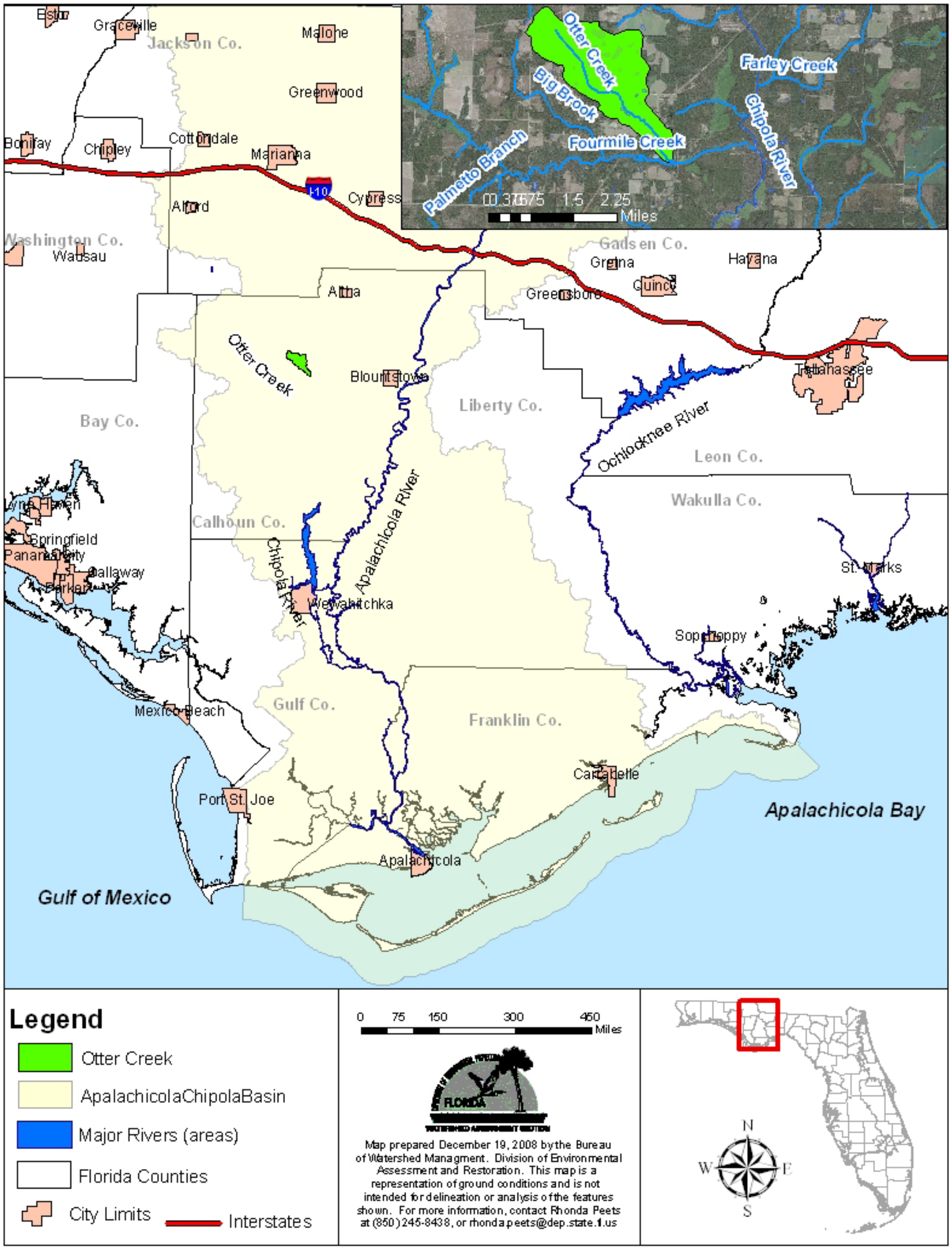

Figure 1.1. Location of Otter Creek and Major Geopolitical Features in the Apalachicola/Chipola Basin

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. TMDLs provide important water quality restoration goals that will guide restoration activities.

This TMDL Report will be followed by the development and implementation of a restoration plan, to reduce the amount of fecal coliform that caused the verified impairment of Otter Creek. These activities will depend heavily on the active participation of the Northwest Florida Water Management District, local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to 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 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 24 waterbodies in the Apalachicola/Chipola 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 2004 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in Otter Creek WBID 819 watersheds and verified the impairments for fecal coliform (**Table 2.1**). **Table 2.2** summarizes the data collected during the verification period January 1, 2001 – June 30, 2008. As shown in **Table 2.1**, the projected year for the fecal coliform bacteria TMDLs was 2008, but the Settlement Agreement between EPA and Earth Justice, which drives the TMDL development schedule for waters on the 1998 303(d) list, allows an additional nine months to complete the TMDLs. As such, these TMDLs must be adopted and submitted to EPA by September 30, 2009. These waterbodies were verified as impaired based on fecal coliform because, using the IWR methodology, more than 10 percent of the values exceeded the Class III freshwater criterion of 400 counts per 100 milliliters (counts/100mL) for fecal coliform: Otter Creek 6 Exceedances out of 22 samples in the verified period exceeded the criterion of 400 counts/100mL. The verified impairments were based on data collected by Department of Environmental Protection Northwest district and the Florida Biological Research Association. WBID location and STORET stations are shown in **Figure 5.1**. **Figures 2.1** displays the fecal coliform data collected from Data Period 2002-2007.

Table 2.1. Verified Impairments for Otter Creek (WBID 819)

Parameter Causing Impairment	Priority for TMDL Development	Projected Year for TMDL Development*	Verified Period
Fecal Coliform	Low	*2008	1/1/2001-6/30/2008

*The TMDLs were scheduled to be completed by December 31, 2008, based on a Consent Decree between the EPA and Earthjustice, but the Consent Decree allows a nine-month extension for completing the TMDL.

Table 2.2. Summary of Fecal Coliform Data for Otter Creek January 1, 2001-June 30, 2008

Waterbody	Total Number of Samples	IWR-required number of exceedances	Number of observed exceedances	Number of observed non exceedances	Number of seasons data was collected	Mean	Median	Min	Max
Otter Creek	22	5	6	16	4	295	160	22	1300

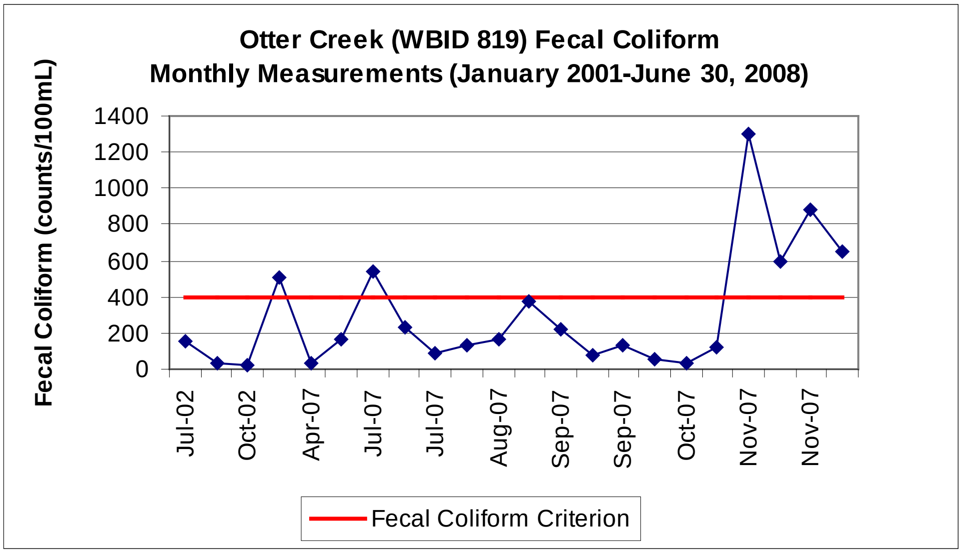

Figure 2.1. Fecal Coliform Measurements for Otter Creek, WBID 819 (January 2001-June 2008)

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria 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)**

Otter Creek is a Class III waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The criterion applicable to this TMDL 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 concentrations. The water quality criteria for protection of Class III waters, as established by Chapter 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. During the development of load duration curves for the impaired stream (as described in subsequent chapters), 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 TMDLs were not to exceed 400 MPN/100mL in any sampling event for fecal coliform. The 10 percent 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 TMDLs 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 Otter Creek watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination Program (NPDES). These nonpoint sources included certain urban stormwater discharges, including 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 in the Otter Creek Watershed

4.2.1 Point Sources

There are no NPDES permitted facilities in the Otter Creek watershed.

Municipal Separate Storm Sewer System Permittees

There are no phase I or phase II MS4 permits in Calhoun County.

4.2.2 Land Uses and Nonpoint Sources

Nonpoint source pollution can come from many different sources. Runoff loadings can deposit sources of coliform to a waterbody from wildlife, pets leaking septic tanks and sewer lines. Rainfall can present non point sources of pollution to lakes, rivers, wetlands streams and waterways as runoff. Nonpoint sources of pollutants can come from natural and anthropogenic sources. The Otter Creek area is approximately 28% agricultural, where surface runoff can present soil erosion, stream sedimentation and thermal pollution to the receiving waterbody (USDA). Wildlife such as birds, raccoons, bobcats, rabbits and occasionally deer could also contribute to fecal coliform exceedances in the watershed. These animals would have direct access to the stream especially since there is low urban and built up density and almost 50% upland forest. There were no point sources identified as discharging fecal coliform into Otter Creek.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the Florida Land Use, Cover, and Forms Classification System (FLUCCS) and the Northwest Florida Water Management District 1995 land use coverage contained in the Department's GIS library. Land use categories in the watershed were aggregated using the simplified Level 1 codes tabulated in **Table 4.1. Figure 4.1** shows the acreage of the principal land uses in the watershed. As shown in **Table 4.1,** the dominant land use is Upland Forest, approximately 48%. The Otter Creek watershed has a small area classified as low density residential, (Urban and Built – Up 5.25%). Agriculture is 27% of the area, with cows occupying a major area in the northern portion of the watershed.

Table 4.1. Classification of Land Use Categories in the Otter Creek Watershed

Level 1 Code	Land Use	Acreage	Square Miles	Percent of WBID
Otter Creek WBID 819				
1000	Urban and Built Up	95.35	0.15	5.25
2000	Agriculture	493.83	0.77	27.17
3000	Rangeland	182.25	0.28	10.03
4000	Upland Forests	865.56	1.35	47.62
5000	Water	6.90	0.01	0.38
6000	Wetlands	166.71	0.26	9.17
8000	Transportation, Communication and Utilities	7.13	0.01	0.39
Total		**1817.73**	**2.84**	**100.00**

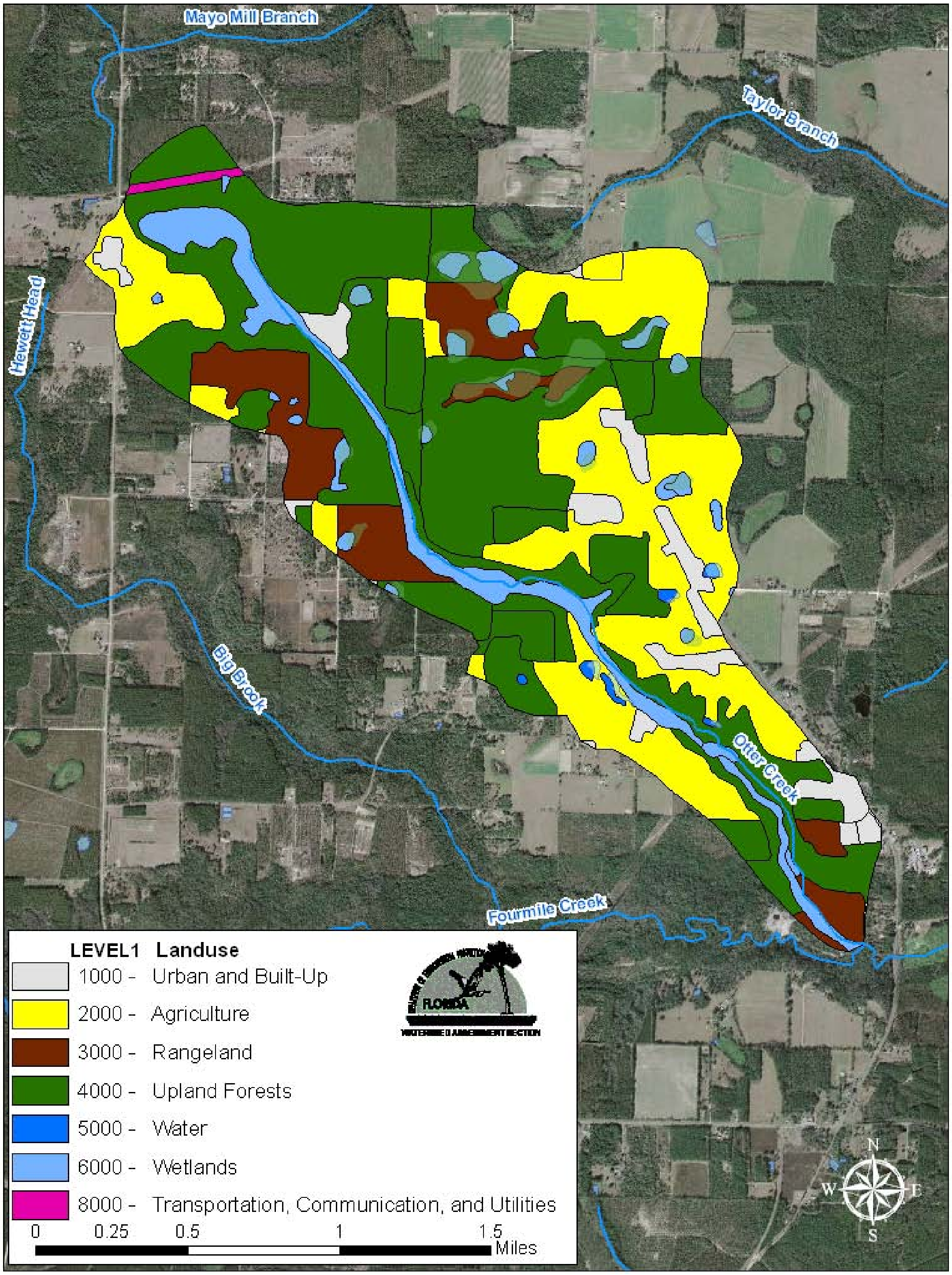

Figure 4.1. Principal Land Uses in the Otter Creek Watershed, 1995

Livestock

Another potential nonpoint source of coliforms includes livestock and other agricultural animals. **Table 4.2** summarizes cattle and hogs populations, and waste produced in tons per year, in (USDA, 1997 census) Calhoun County. Approximately 27 percent of the Otter Creek Watershed is specifically categorized as agriculture under the level 1 land use system. However, cow herding dominates the main upper Northwest portion of the Otter Creek watershed (**Figure 4.2**).

Table 4.2. Summary of Livestock waste in Calhoun County, 1997

Livestock	Year 1997 Inventory	Year 1997 Waste (Tons/yr)
Cattle	3711	29,000
Hogs	270	510

Source: US Dept. of Agricultural Statistics Service 1997

Picture: Erin Wilcox, FDEP

Figure 4.2. Cows in Otter Creek Watershed, Calhoun County, 2009

Urban Development

Fecal coliform contributors commonly seen in urban areas include rats, pigeons, and sometimes raccoons.

Studies report that up to 95 percent of the fecal coliform found in urban stormwater can come from 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 for fecal coliform and fecal streptococcus bacteria. Trial et al. (1993) also reported that cats and dogs were the primary source of fecal coliform in urban watersheds. Using bacteria source tracking techniques, Watson (2002) found that the amount of fecal coliform bacteria contributed by dogs in Stevenson Creek in Clearwater, Florida, was as important as that from septic tanks.

According to the American Pet Products Manufacturers Association (APPMA), about 4 out of 10 U.S. households include at least one dog. A single gram of dog feces contains about 23 million fecal coliform bacteria (Van der Wel, 1995). Unfortunately, statistics show that about 40 percent of American dog owners do not pick up their dogs' feces.

Table 4.3 shows the fecal coliform concentrations of surface runoff measured in two urban areas (Bannerman et al., 1993; Steuer et al., 1997). While bacteria levels were widely different in the two studies, both indicated that residential lawns, driveways, and streets were the major source areas for bacteria.

Table 4.3. Concentrations (Geometric Mean Colonies per 100 mL) of Fecal Coliform from Urban Source Areas (Steuer et al., 1997; Bannerman et al., 1993)

Geographic Location	Marquette, MI	Madison, WI
Number of storms sampled	12	9
Commercial parking lot	4,200	1,758
High-traffic street	1,900	9,627
Medium-traffic street	2,400	56,554
Low-traffic street	280	92,061
Commercial rooftop	30	1,117
Residential rooftop	2,200	294
Residential driveway	1,900	34,294
Residential lawns	4,700	42,093
Basin outlet	10,200	175,106

The number of dogs in the Otter Creek watershed is not known. Therefore, this analysis used the statistics produced by APPMA to estimate the possible fecal coliform loads contributed by dogs. According to the U.S. Census Bureau, the estimated population of Calhoun County in 2006 was 13,410 persons. The human population in the Otter Creek watershed calculated from the census track using Tiger Track 2000 data (the Department's GIS library) was approximately

23; there were 2.53 persons per household in Calhoun County in 2000. This adds up to about 9 households in Otter Creek. Assuming that 40 percent of the households in this area have a dog, the total number of dogs in the Otter Creek watershed is about 4.

According to the waste production rate for dogs and the fecal coliform counts per gram of dog wastes listed in **Table 4.4**, and assuming that 40 percent of dog owners do not pick up dog feces, the total waste produced by dogs and left on the land surface of residential areas would be 720 grams/day. The total fecal coliform produced by dogs for Otter Creek would be 1.58 x 10^9 counts/day.

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

Table 4.4. Dog Population Density, Wasteload, and Fecal Coliform Density

Type	Population density (an/household)	Waste load (g/an-day)	Fecal coliform density (fecal coliform/g)
Dog	0.4*	450	2,200,000

* Number from APPMA.
Source: Weiskel et al., 1996.

Though pets and other indigenous wild life can be a significant source of coliform pollution in a watershed, the low residential density may not pose a threat to the creek.

Septic Tanks

Septic tanks (Onsite Sewage Treatment and Disposal Systems or OSTDS) can be another potential important source of coliform pollution in 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, in areas with a relatively high ground water table, the drainage field can be flooded during the rainy season, and coliform bacteria can pollute the surface water through storm runoff. 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 go into the well and once the polluted water is used to irrigate lawns, coliform bacteria may reach the land surface and wash into surface waters during the rainy season.

Data for septic tanks are based on 2007-2008 statistics results, with year-by-year additions based on new septic tank construction. The data do not reflect septic tanks that have been removed going back to 1970. For fiscal years 2007-2008, 17 permits for repairs were issued (Florida Department of Health Web site, 2008).

The Otter Creek Watershed comprises 2.84 square miles, or approximately 0.5 percent of the total land area of Calhoun County. According to the [U.S. Census Bureau] , the Calhoun County has a total area of 574 square miles (1,488 km^2), of which, 567 square miles (1,469 km^2) of it is land and 7 square miles (18 km^2) of it (1.22%) is water. A rough estimate of fecal coliform loads from failed septic tanks in each watershed can be made using **Equation 4.1**:

$$L = 37.85 * N * Q * C * F \qquad \textbf{Equation 4.1}$$

Where,

L is the fecal coliform daily load (counts/day);
N is the total number of septic tanks in the watershed (septic tanks);
Q is the discharge rate for each septic tank;
C is the fecal coliform concentration for the septic tank discharge, and
F is the septic tank failure rate.

Based on 2009 Florida Department of Health (FDOH) onsite sewage GIS coverage (http://www.doh.state.fl.us/environment/programs/EhGis/EhGisDownload.htm), about 7 housing units (*N*) were identified as being on septic tanks in the Otter Creek watershed (**Figure 4.3**). 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 U.S. Census Bureau (2000), the average household size for Calhoun County is about 2.53 people/household. The same population density was assumed for the Otter Creek watershed. A commonly cited value for per capita wastewater production rate is 70 gallons/day/person (EPA, 2001). The commonly cited concentration (*C*) for septic tank discharge is $1x10^6$ counts/100mL for fecal coliform (EPA, 2001).

No measured septic tank failure rate data were available for the watershed at the time this TMDL analysis was conducted. Therefore the failure rate was derived from the number of septic tank and septic tank repair permits for the county published by FDOH (http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm). The number of septic tanks in the county was calculated assuming that none of the installed septic tanks will be removed after being installed (**Table 4.5**). The reported number of septic tank repair permits was also obtained from the FDOH website (**Table 4.5**).

Based on this information, a discovery rate of failed septic tanks for each year between 2002 and 2007 was calculated and listed in **Table 4.5**. Using the table, the average annual septic tank failure discovery rate for Calhoun County is about 0.42 percent. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 2.1 percent. Based on **Equation 4.1**, the estimated fecal coliform loading from failed septic tanks in the Otter Creek watershed is approximately 7.04 x 10^8 counts/day.

Table 4.5. Estimated Septic Numbers and Septic Failure Rates for Calhoun County, 2002–07

Septic Tanks	2002	2003	2004	2005	2006	2007	Average
New Installation	74	99	35	79	88	94	78
Accumulated installation	4709	4783	4882	4917	4996	5084	4895
Repair Permit	27	30	5	19	26	17	21
Failure discovery rate (%)	0.57	0.63	0.10	0.39	0.52	0.33	0.42
Failure rate (%)*	2.9	3.1	0.5	1.9	2.6	1.7	2.1

* The failure rate is 5 times the failure discovery rate.

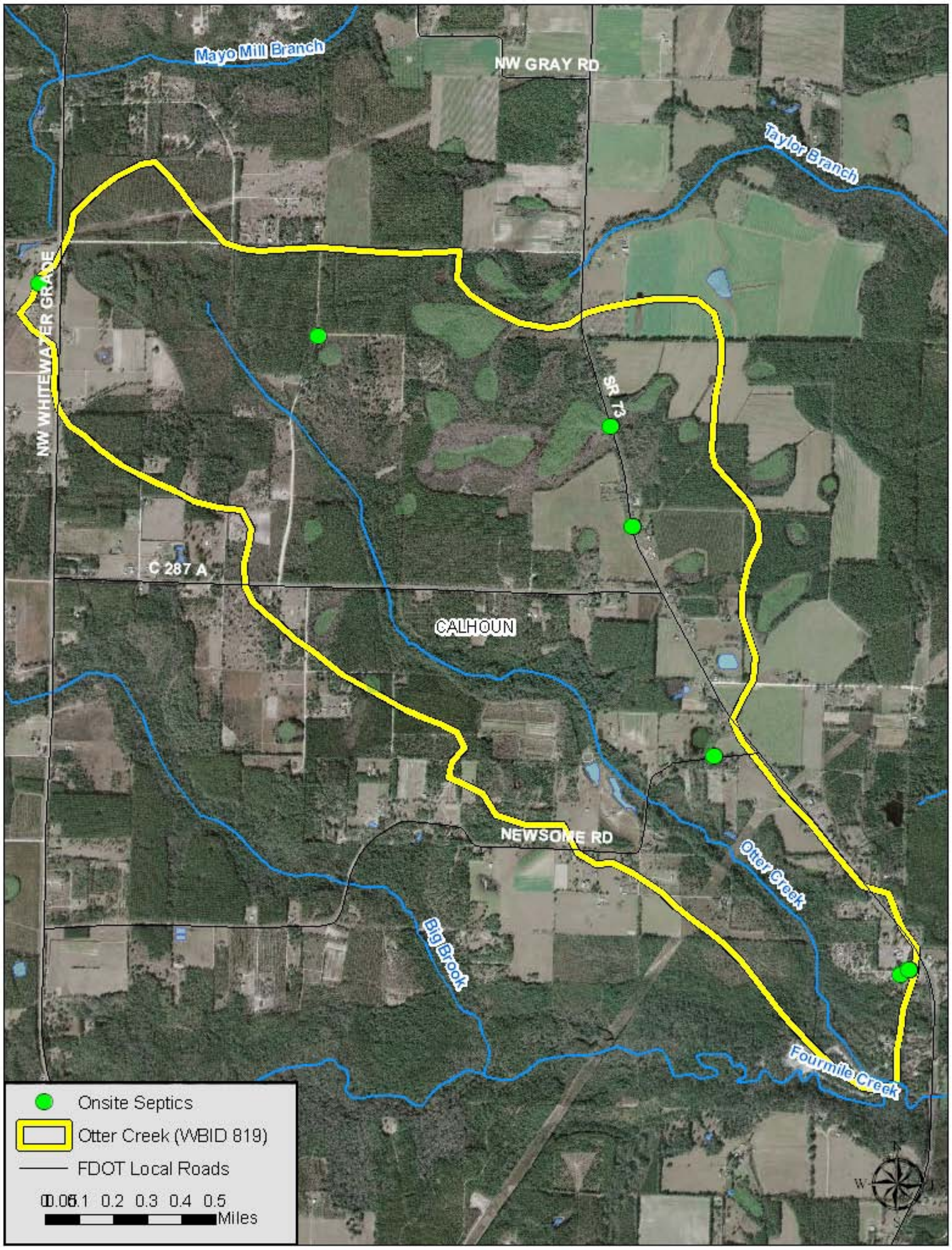

Figure 4.3. Distribution of Onsite Sewage Systems in the Otter Creek Watershed

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

Typically, there are continuous flow measurements in a watershed that can be used to develop bacteria TMDL. However, there are no flow gauges in the Otter Creek stream, therefore the fecal coliform TMDL calculations was developed using the “percent reduction” approach. For this method, the percent reduction need to meet the applicable criterion, and then a median percent reduction calculated.

5.1.1 Data Used in the Determination of the TMDL

The data used to develop this TMDL were provided from the Florida Department of Environmental Protection (FDEP) stations: 21FLWQA 302726008511491, 21 FLWQA 302758408512395; the (FDEP) Northwest District stations: 21FLPNS 302726008511491, 21FLPNS 302758408512395 and the Biological Research Association Stations: 21FLBRA 819-A; 21FLBRA 819-B. **Figure 5.1** shows the locations of the water quality sites from which fecal coliform data were collected. **Figure 2.1** displays the fecal coliform data used in this analysis. The samples were extracted from Florida STORET and used in this analysis for the verified period January 1, 2001 to June 30, 2008.

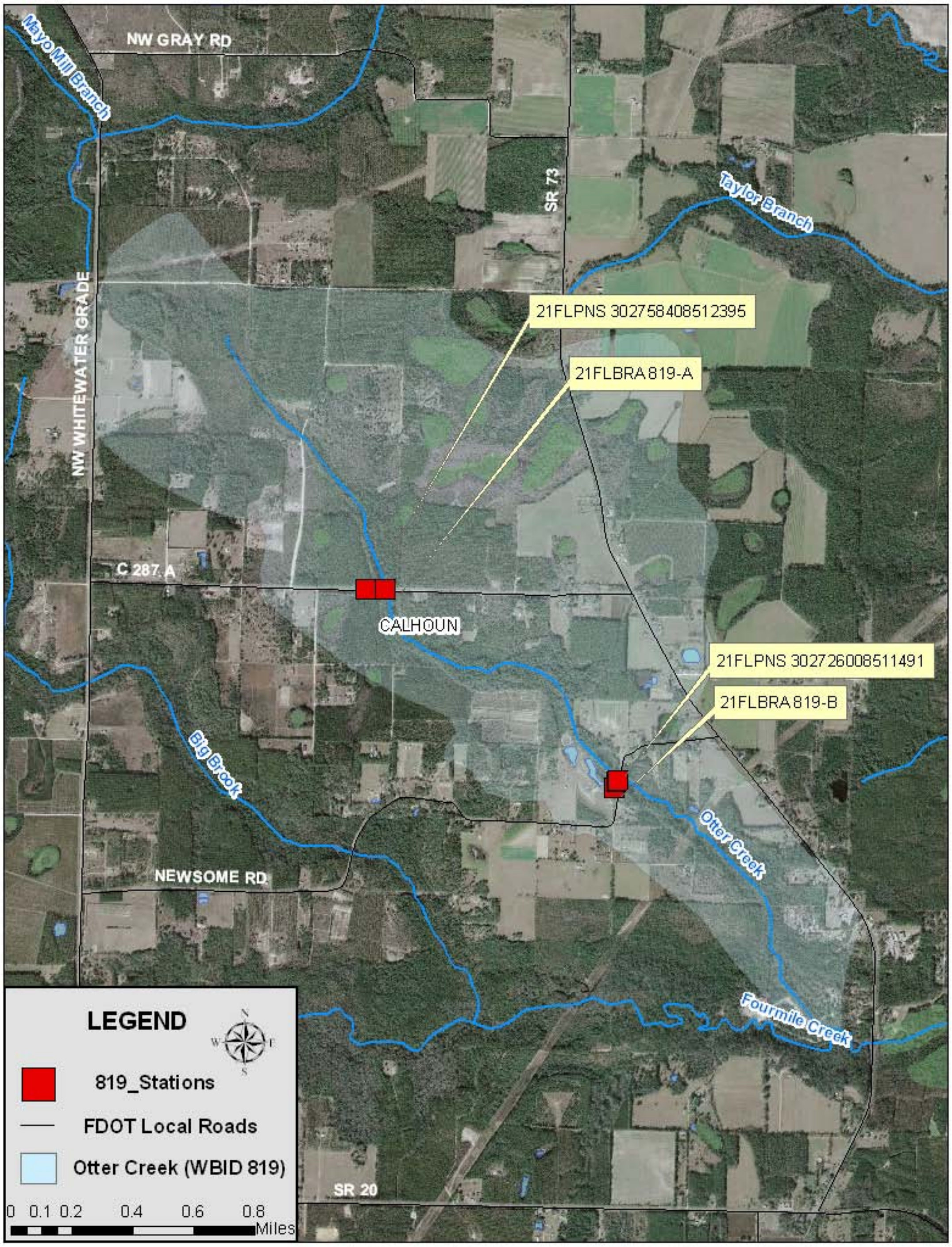

Figure 5.1. Monitoring Sites in Otter Creek, WBID 819

5.1.2 TMDL Development Process for Otter Creek

As described in **Section 5.1**, the percent reduction needed to meet the fecal coliform criterion was determined for each individual exceedance using the following equation:

$$\textbf{(2)}\ \frac{[\text{measured exceedance} - \text{criterion}]*100}{\text{measured exceedance}}$$

The fecal coliform TMDL was calculated as the median of the percent reductions needed over the data range where exceedances occurred (see **Table 5.1** for data). The median percent reduction for this period was 35 percent.

Table 5.1. Calculation of Percent Reduction in Fecal Coliform Necessary To Meet the Water Quality Standard of 400 Colonies/100mL in Otter Creek, WBID 819

Date	Station	Fecal Coliform Exceedances	Fecal Coliform Target	% Reduction
11/8/2007	21FLPNS 302758408512395	1300	400	69
11/29/2007	21FLPNS 302758408512395	880	400	55
12/11/2007	21FLPNS 302726008511491	650	400	38
11/29/2007	21FLPNS 302726008511491	590	400	32
7/11/2007	21FLBRA 819-A	540	400	26
4/24/2007	21FLPNS 302726008511491	510	400	22
			MEDIAN	**35**

5.1.3 Critical Conditions/Seasonality

The critical conditions for coliform loadings in a given watershed depend on the existence of point sources and land use patterns in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period, followed by a rainfall runoff event. During wet weather periods, coliform bacteria that have built up on the land surface under dry weather conditions are washed off by rainfall, resulting in wet weather exceedances. However, significant nonpoint source contributions could also occur under dry weather conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer, and coliform bacteria are brought into the receiving waters through baseflow. Livestock with direct access to the receiving water could also contribute to the exceedances during dry weather conditions. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

Spatial and Temporal Patterns

There was no spatial pattern to the fecal coliform data for the Otter Creek watershed. The fecal coliform data was limited to 2007 (no samples collected during the first quarter), and two samples collected in 2002.

Measurements were sorted by month and season (the calendar year was divided into quarters) to determine whether there was a temporal pattern of exceedances. Monthly rainfall data from Clarksville 2N (081601) located within the Otter Creek WBID, were also obtained and included in the analysis. **Table 5.2** presents summary statistics by month and season, respectively, for fecal coliform measurements (winter: January–March; spring: April–June; summer: July–September; fall: October–December). The highest exceedance frequency is observed during the fall, which could relate to base flow contribution of fecal coliform. **Figure 5.2** shows this information graphically.

Table 5.2. Summary Statistics of Fecal Coliform Data for Otter Creek, WBID 819, by Month and Season

Month	Number of Cases	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances of Cases	Rainfall Mean
1								3.68
2								5.41
3								6.21
4	2	29	510	270	270	1	50	2.95
5								3.95
6	1	170	170	170	170	0	0	6.95
7	5	36	540	150	210	1	20	8.19
8	3	130	370	170	223	0	0	6.49
9	3	78	220	130	143	0	0	5.26
10	3	22	50	33	35	0	0	3.78
11	4	120	1300	735	723	3	75	4.28
12	1	650	650	650	650	1	100	3.13
Season	**Number of Cases**	**Minimum**	**Maximum**	**Median**	**Mean**	**Number of Exceedances**	**% Exceedances of Cases**	**Rainfall Mean**
Winter								
Spring	3	199	680	440	440	1	33	4.62
Summer	11	244	1130	450	576	1	9	6.65
Fall	8	792	2000	1418	1408	4	50	3.73

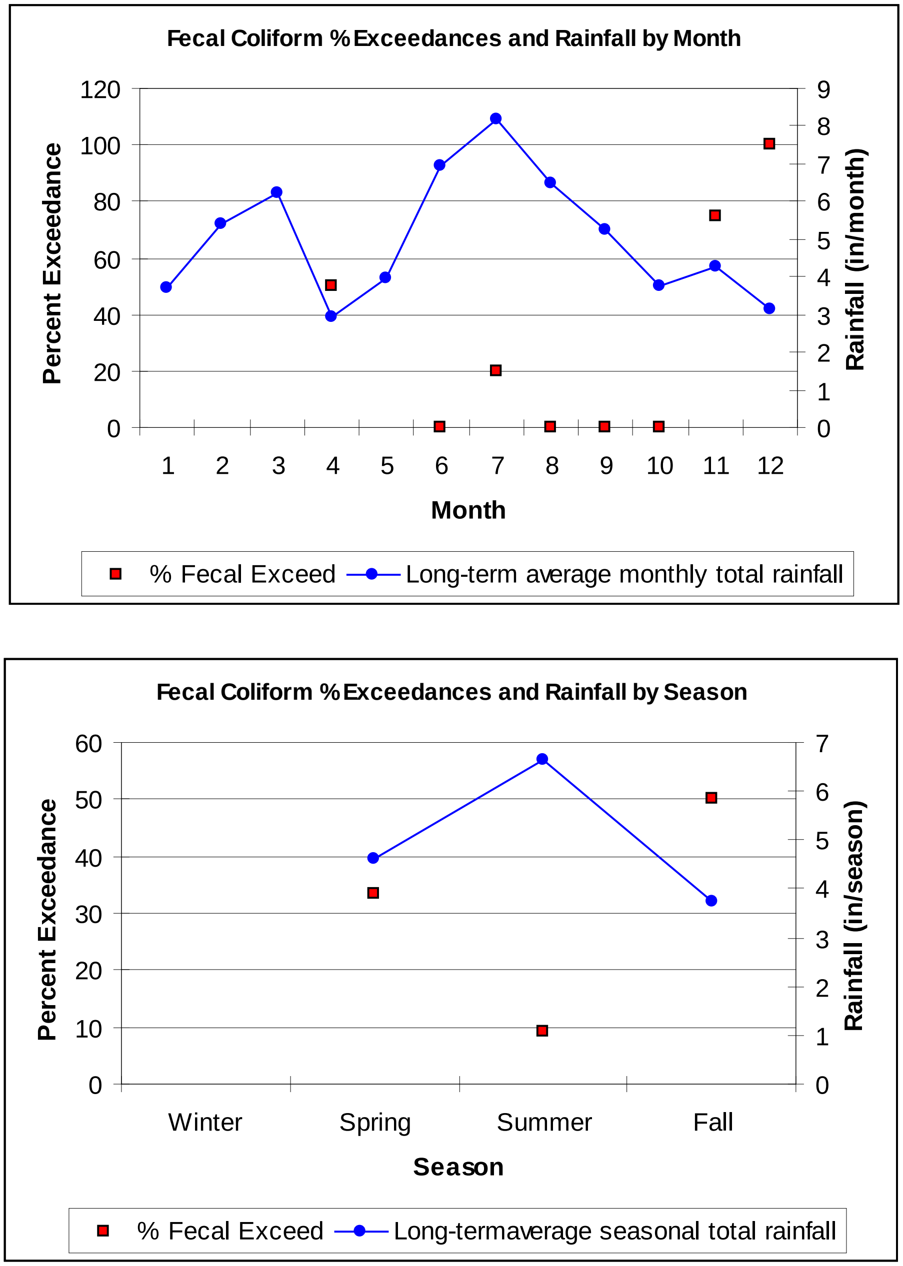

Figure 5.2. Fecal Coliform Exceedances and Rainfall for Otter Creek, WBID 819, by Month and Season, 2000-2007

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 (Waste Load Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

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

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

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

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

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of 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 TMDL for the Otter Creek are expressed in terms of MPN/day and percent reduction, and represent the maximum daily fecal coliform loads the stream can assimilate and maintain the fecal coliform criterion **(Table 6.1).**

Table 6.1. TMDL Components for Fecal Coliform in Otter Creek (WBID 819)

WBID	Parameter	TMDL (counts/day)	WLA		LA (% reduction)	MOS
			Wastewater (counts/day)	NPDES Stormwater (% reduction)		
819	Fecal Coliform	400 #/100mL	N/A	N/A	35	Implicit

N/A – Not applicable.

6.2 Load Allocation

A fecal coliform reduction of 35 percent for Otter Creek is needed from nonpoint sources. 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

No NPDES-permitted wastewater facilities with fecal coliform limits were identified in Otter Creek. 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. These requirements will also be applied to any possible future point sources that may discharge in the watershed to meet end-of-pipe standards for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

There are no stormwater discharges with an MS4 permit within the Otter Creek watershed. 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, February 2001), an implicit MOS was used in the development of this TMDL. A Margin of Safety was included in the TMDL by meeting the water quality criterion of 400 colonies/100mL, while the actual criterion allows for a 10 percent exceedance over that level.

Chapter 7: TMDL IMPLEMENTATION

TMDL Implementation

Following the adoption of this TMDL by rule, the Department will determine the best course of action regarding its implementation. Depending upon 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. Basin Management Action Plans 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 a BMAP is needed to support the implementation of this TMDL, 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:

- 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 obligations of wastewater point source, MS4 and non-MS4 stakeholders in TMDL implementation, enhanced transparency in DEP decision-making, and built strong relationships between DEP and local stakeholders that have benefited other program areas.

However, in some basins, and for some parameters, particularly those with fecal coliform impairments, the development of a BMAP using the process described above will not be the most efficient way to restore a waterbody, such that it meets its' designated uses. Why? 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. There are a multitude of assessment tools that are available to assist local governments and interested stakeholders in this detective work. The tools range from the simple – such as Walk the WBIDs and GIS mapping - to the complex such as Bacteria Source Tracking. Department staff will provide technical assistance, guidance, and oversight of local efforts to identify and minimize fecal coliform sources of pollution. Based on work in the Lower St Johns River tributaries and the Hillsborough River 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 roadmap for restoration activities, while still meeting the requirements of Chapter 403.067(7), F.S.

References

Alderiso, K., D. Wait, and M. Sobsey. 1996. Detection and characterization of make-specific RNA coliphages in a New York City Reservoir to distinguish between human and nonhuman sources of contamination. In*: Proceedings of a Symposium on New York City Water Supply Studies*, J.J. McDonnell et al. (eds.). TPS-96-2. Herndon, Virginia: American Water Resources Association.

Association of Metropolitan Sewerage Agencies. 1994. *Separate sanitary sewer overflows: What do we currently know?* Washington, D.C.

Bannerman, R., D. Owens, R. Dodds, and N. Hornewer. 1993. Sources of pollutants in Wisconsin stormwater. *Water Science and Technology 28(3-5): 241-259.*

Culver T.B. Y. Jia, R. Tikoo, J. Simsic, and R. Garwood. 2002. Development of the Total Maximum Daily Load (TMDL) for fecal coliform bacteria in Moore's Creek, Albemarle County, Virginia. Virginia Department of Environmental Quality.

Florida Administrative Code. *Rule 62-302, Surface water quality standards.*

Florida Administrative Code. *Rule 62-303, Identification of impaired surface waters.*

Florida Department of Environmental Protection. February 2001. *A report to the Governor and the Legislature on the allocation of Total Maximum Daily Loads in Florida.* Tallahassee, Florida: Bureau of Watershed Management.

———. 2005. *Basin Status Report: Apalachicola-Chipola.* Tallahassee, Florida: Bureau of Watershed Management.

Florida Department of Health Website. 2008. Available: http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm.

Florida Watershed Restoration Act. *Chapter 99-223, Laws of Florida.*

Hirsch, R.M. 1982. A comparison of four streamflow record extension techniques. *Water Resources Research, 18: 1081-1088.*

Lim, S., and V. Olivieri. 1982. *Sources of microorganisms in urban runoff.* Jones Falls Urban Runoff Project. Baltimore, Maryland: Johns Hopkins School of Public Health and Hygiene.

Minnesota Pollution Control Agency. 1999. *Effect of septic systems on ground water quality.* Ground Water and Assessment Program. Baxter, Minnesota.

Singhofen & Associates, Inc. 2001. *Little Econlockhatchee River Basin stormwater management master plan, final report.* Prepared for the Board of County Commissioners, Orange County, Florida.

Steuer, J., W. Selbig, N. Hornewer, and J. Prey. 1997. *Sources of contamination in an urban basin in Marquette, Michigan and an analysis of concentrations, loads, and data quality.* USGS Water Resources Investigation Report 97-4242. Middleton, Michigan.

Trial, W., et al. 1993. Bacterial source tracking: Studies in an urban Seattle watershed. *Puget Sound Notes. 30: 1-3.*

U.S. Environmental Protection Agency. January 2001. *Protocol for developing pathogen TMDLs.* 1st ed. Assessment and Watershed Protection Division. EPA 841-R-00-002.

———. 1994. *Nonpoint source pollution: The nation's largest water quality problem.* Pointer No. 1. EPA-841-F-94-005. Available: http://www.epa.gov/owow/nps/facts/point1.htm.

Van der Wel, B. 1995. Dog pollution. *The Magazine of the Hydrological Society of South Australia, 2(1) 1.*

Watson, T. June 6, 2002. Dog waste poses threat to water. *USA Today.*

Weiskel, P.K., B.L Howes, and G.R. Heufflder. 1996. Coliform contamination of a coastal embayment: Sources and transport pathway. *Environmental Science and Technology 1872-1881.*

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 Chapter 62-40, F.A.C.

The rule requires the state's water management districts (WMDs) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG has been developed for Newnans Lake at the time this study was conducted.

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 stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific Standard Industrial Classification (SIC) codes, construction sites disturbing five or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (MS4s). However, because the master drainage systems of most local governments in Florida are interconnected, the EPA has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the fifteen counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES Program will expand the need for these permits to construction sites between one and five acres, and to local governments with as few as 10,000 people. These revised rules require that these additional activities obtain permits by 2003. 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 similar to other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a re-opener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

Appendix B: Comments and responses

Comments and responses to Office of Agricultural Water Policy (OAWP) Florida Department of Agriculture (FDAC)

Comment: Page 9, Section 4.2.2 – The document states that agriculture is approximately 50% of the "Otter Creek area." Table 4.1 indicates that 37.2% of the "Otter Creek Watershed" is in agriculture, when combining agriculture and rangeland per the Level I FLUCCS code. We just note the discrepancy for your consideration. If the "area" is different than the "watershed," you may want to explain the difference.

Response: Page 9: The statement on agriculture was a typed error the agriculture is approximately 27%.

Comment: Page 11, Table 4.2 – Lists 3,700 cattle in Calhoun County for calendar year 1997. More recent data from the 2008 Florida Agriculture Statistical Directory lists beef cows in Calhoun County at around 2,000. This significant reduction in cattle in the county might be worth noting, along with the reduced figure for tons/yr of manure.

Response: Page 11: All the cows in Calhoun County was included in the 1997 report not only beef cows, the 2008 report reflect an increase to 4,000 in the County.

Comment: Page 14, Septic Tanks – The text refers to Table 4.4 in stating that there are 5 OSTDS in the watershed. It appears that the reference should be to Table 4.5 instead. However, even Table 4.5 does not provide that particular information. A later reference to Figure 4.3 to support that there are 5 septic tanks in the watershed leads to a map that displays 9 OSTDS, assuming that the map does not include territory outside the watershed. We don't mean to get mired in detail, especially on a non-ag issue, but this was confusing and thought it worth mentioning. Or maybe we just read it wrong.

Response: Page 14: A new DOH coverage shows 7 OSTDS in the watershed and should be seen in figure 4.3 and not Table 4.4.

Comment: Page 17, Section 5.1 – This is our main observation: The report does not explain the monitoring protocol. A description of how and under what conditions samples were taken would be really helpful. If you decide not to include it in the report, we'd be interested in getting a description via e-mail.

Response: Page 17: Monitoring protocol is done according to DEP Standard Operating Procedures (SOP)

Comment: Page 19 – On page 19 the report states "all of the exceedances occurred in the summer months." Tables 5.1 and 5.2 show that 4 of the 6 exceedances were in the Fall, one was in the Spring, and one was in the Summer.

Response: Page 19: Statement has been corrected and will be updated in the final document.

Florida Department of Environmental Protection
Division of Environmental Assessment and Restoration
Bureau of Watershed Restoration
2600 Blair Stone Road, Mail Station 3565
Tallahassee, Florida 32399-2400
(850) 245-8561
www2.dep.state.fl.us/water/