FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

CENTRAL DISTRICT • MIDDLE ST JOHNS BASIN

Final TMDL Report

Fecal Coliform TMDL for Little Econlockhatchee River (WBID 3001)

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STORET Program

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Basin Status Report for the Middle St. Johns Basin

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

Water Quality Assessment Report for the Middle St. Johns Basin

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U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida

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

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform bacteria for the Little Econlockhatchee River in the Middle St. Johns Basin. The river was verified as impaired for fecal coliform and therefore was included on the Verified List of impaired waters for the Middle St. Johns Basin that was adopted by Secretarial Order on May 19, 2009. The TMDL establishes the allowable fecal coliform loadings to Little Econlockhatchee River that would restore the waterbody so that it meets its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

The Little Econlockhatchee River is located in the north-central part of Orange County and in southern Seminole County (**Figure 1.1**). A major tributary of the Econlockhatchee River, the Little Econlockhatchee River originates in the relatively high lands of central Orange County, on the eastern edge of the Orlando metropolitan area. It flows primarily north in Orange County and northeast in Seminole County into the Econlockhatchee River. The Little Econlockhatchee is approximately 14.8 miles long, with a drainage area of 45,420 acres. Unlike the largely unaltered Econlockhatchee River proper, the Little Econlockhatchee River is extensively altered hydrologically, with substantial portions of the river channel canalized and interrupted by control structures. A number of canals draining various parts of the Orlando area flow into the Little Econlockhatchee River. The watershed of the Little Econlockhatchee is highly urbanized by residential land use.

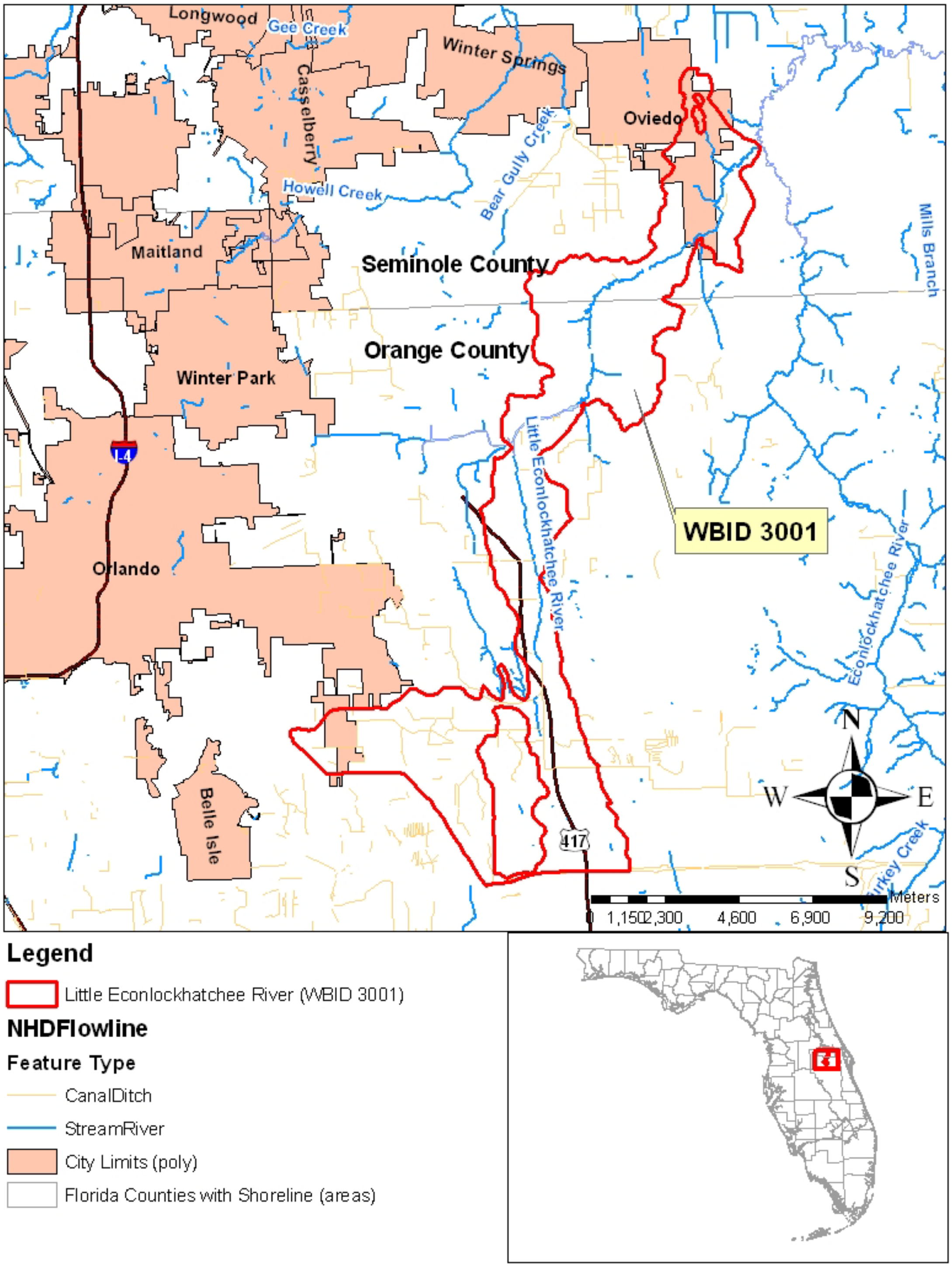
For assessment purposes, the Florida Department of Environmental Protection (Department) has divided the Middle St. Johns Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. This TMDL addresses WBID 3001, the Little Econlockhatchee River, for fecal coliform.

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.

Figure 1.1. Location of the Little Econlockhatchee River in Orange County and Seminole County, and Major Hydrologic Features in the Area



This TMDL Report will be followed by the development and implementation of a restoration plan, designed to reduce the amount of fecal coliform that caused the verified impairment of the Little Econlockhatchee River. These activities will depend heavily on the active participation of the St. Johns River Water Management District (SJRWMD), 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 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 22 waterbodies in the Middle St. Johns 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 Little Econlockhatchee River and has verified that this waterbody segment is impaired for fecal coliform bacteria. The verification of impairment was based on the observation that 78 out of 268 fecal coliform samples collected during the verified period (January 1, 2001, through June 30, 2008) exceeded the applicable fecal coliform water quality criterion (Rule 62-302, F.A.C.).

Table 2.1 summarizes the fecal coliform monitoring results for the verified period for the Little Econlockhatchee River. **Appendix A** provides the fecal coliform observations during the verified period.

Table 2.1. Summary of Fecal Coliform Monitoring Data for the Little Econlockhatchee River (WBID 3001) During the Verified Period (January 1, 2001–June 30, 2008)

[1] Most probable number (MPN) per 100 milliliters
- = Empty cell

Waterbody (WBID)	Parameter	Fecal Coliform[1]
Little Econlockhatchee River (3001)	Total number of samples	268
Little Econlockhatchee River (3001)	IWR-required number of exceedances for the Verified List	34
Little Econlockhatchee River (3001)	Number of observed exceedances	78
Little Econlockhatchee River (3001)	Number of observed nonexceedances	190
Little Econlockhatchee River (3001)	Number of seasons during which samples were collected	4
Little Econlockhatchee River (3001)	Highest observation (MPN/100mL)[1]	5,900
Little Econlockhatchee River (3001)	Lowest observation (MPN/100mL)[1]	4
Little Econlockhatchee River (3001)	Median observation (MPN/100mL)[1]	215
Little Econlockhatchee River (3001)	Mean observation (MPN/100mL)[1]	509
-	**FINAL ASSESSMENT:**	**Impaired**

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 Little Econlockhatchee River is Class III fresh waterbody, with a designated use of recreation, propagation, and the 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 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. During the development of load duration curves for the impaired segment (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 TMDL was 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 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 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 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 B** 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 Little Econlockhatchee Watershed

4.2.1 Point Sources

Wastewater Point Sources

One NPDES-permitted wastewater facility was identified in the Little Econlockhatchee River watershed: the Iron Bridge Regional Water Reclamation Facility (FL 0037966), located in the southern part of Seminole County. The facility currently has a 28 million-gallon-per-day (mgd) annual average daily flow (AADF) permitted discharge to the Little Econlockhatchee River. The actual discharge from the facility to the Little Econlockhatchee River is significantly lower than the permitted 28 mgd. **Table 4.1** lists the AADF from the facility to the Little Econlockhatchee River, the annual average fecal coliform concentration of the discharge, and the annual average daily loadings from the facility to surface water.

Table 4.1. AADF, Annual Average Fecal Coliform Concentration, and Annual Average Daily Fecal Colifrom Load to the Little Econlockhatchee River from the Iron Bridge Regional Water Reclamation Facility

Year	AADF (mgd)	Annual average concentration (counts/100mL)	Annual average daily loads (counts/day)
2003	8.30	0.51	1.62E+08
2004	8.42	0.56	1.80E+08
2005	7.53	0.56	1.59E+08
2006	8.06	0.71	2.16E+08
2007	6.98	0.62	1.63E+08
Mean:	**7.86**	**0.59**	**1.76E+08**

Based on the state water quality criterion, the MPN or 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. During the five-year period from June 1, 2003, through December 31, 2007, the Iron Bridge Regional Water Reclamation Facility never exceeded the monthly average, 200 counts/100mL, and the 10 percent threshold, 400 counts/100mL. Therefore, this facility should be allowed to continue discharging at its current rate.

In addition, there is an existing 35.0 mgd, AADF permitted–capacity created treatment/reuse wetland system consisting of about 1,640 acres, including berms and buffer zones and 17 cells. Reclaimed water from the wetland system overflows via two reinforced concrete pipes to an unnamed ditch, and from there to the St. Johns River, or sheet flows across an adjacent natural wetlands (Seminole Ranch) of about 640 acres, and from there to the St. Johns River. There is also an existing 20.3 mgd, AADF permitted–capacity slow-rate public access land application system consisting of public access irrigation of residential lawns, golf courses, cemeteries, parks, landscape areas, highway medians, rights of way, and edible crops.

Starlight Ranch Mobile Home Community (MHC) WWTF (FLA010868) is a state-permitted domestic wastewater facility, but not an NPDES-permitted facility. Therefore, no surface discharge is allowed from the facility. According to the Department's Central District Office, an unauthorized discharge was observed from Percolation Pond #1 during a field inspection conducted on January 24, 2005. Effluent was being continuously discharged into an adjacent canal via the emergency overflow pipe. This canal appeared to flow to the Little Econlockhatchee River. The Central District Office sent the facility a warning letter (signed by the Central District Director on March 7, 2005). The Department does not have any evidence that the unauthorized discharge was responsible for the elevated fecal coliform concentration in the Little Econlockhatchee River (see **Appendix C** for details). The unauthorized discharge is not a TMDL issue but a compliance issue.

Municipal Separate Storm Sewer System Permittees

In the Little Econlockhatchee River watershed, Orange County has a Phase I municipal separate storm sewer system (MS4) permit (FLS000011). The Florida Department of Transportation (FDOT) District 5 is a copermittee. In addition, the city of Orlando holds a separate Phase I permit (FLS000014). Seminole County holds an MS4 Phase I permit (FLS000038), with FDOT District 5 and the city of Oviedo as copermittees. No Phase II permittees were identified in the watershed.

4.2.2 Land Uses and Nonpoint Sources

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SJRWMD's year 2004 land use coverage (scale 1:96,000) contained in the Department's geographic information system (GIS) library. Land use categories in the watershed were aggregated using the simplified Level 1 codes and tabulated in **Table 4.2**. **Figure 4.1** shows the acreage of the principal land uses in the watershed.

As shown in **Table 4.2**, the total area of the Little Econlockhatchee River watershed is about 19,032 acres. The dominant land use category is urban (urban and built-up; low-, medium-, and high-density residential; and transportation, communication, and utilities), which accounts for about 57.1 percent of the total watershed area. Of the 10,965 acres of urban lands, residential land use occupies about 8,083 acres, or about 42.5 percent of the total watershed area. Natural land uses, including water/wetlands, upland forest, and barren land, occupy about 5,782 acres, accounting for about 30.4 percent of the total watershed area.

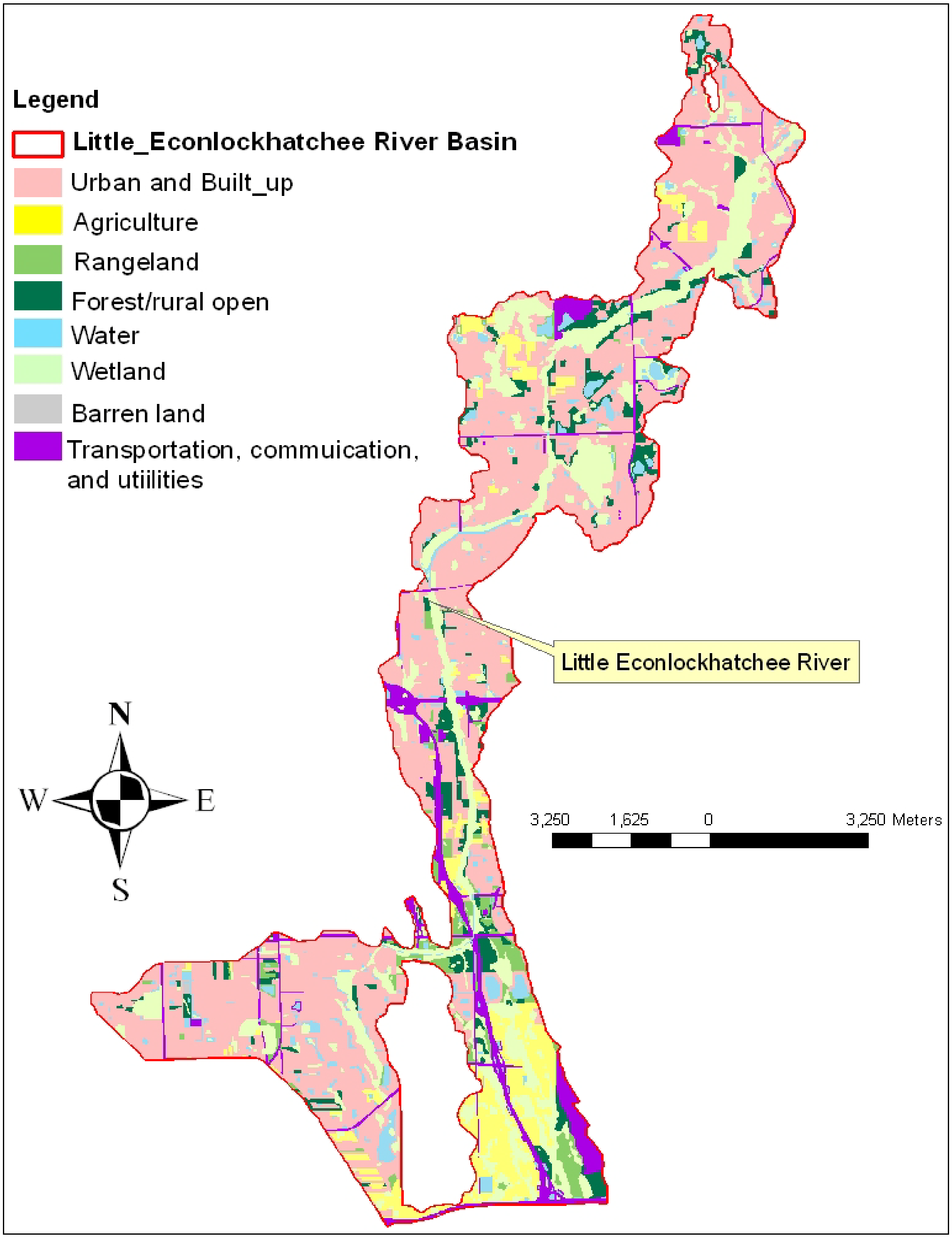
Because only one conventional point source was identified in the Little Econlockhatchee River watershed, the primary loadings of fecal coliform into the river are generated by nonpoint sources or MS4-permitted areas in the watershed. Nonpoint sources of coliform bacteria generally, but not always, come from the coliform bacteria that accumulate on land surfaces and wash off as a result of storm events, the contribution from ground water from sources such as failed septic tanks, and/or sewer line leakage. In addition, feces from pets in residential areas can be another important source of fecal coliform through surface runoff.

Table 4.2. Classification of Land Use Categories in the Little Econlockhatchee River Watershed (WBID 3001)

- = Empty cell

Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and Built-up	1,645	8.6%
	Low-Density Residential	906	4.8%
	Medium-Density Residential	4,183	22.0%
	High-Density Residential	2,949	15.5%
2000	Agriculture	1,483	7.8%
3000	Rangeland	802	4.2%
4000	Forest/Rural Open	1,205	6.3%
5000	Water	920	4.8%
6000	Wetland	3,571	18.8%
7000	Barren land	86	0.5%
8000	Transportation, Communication, and Utilities	1,282	6.7%
-	**TOTAL:**	**19,032**	**100.0%**

Figure 4.1. Principal Land Uses in the Little Econlockhatchee River Watershed (WBID 3001) in 2004



Pets

Pets (especially dogs) could be a significant source of coliform pollution through surface runoff in the Little Econlockhatchee River watershed. Studies report that up to 95 percent 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 for 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 watersheds. 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 those 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 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 the surface runoff measured in two urban areas (Bannerman et al., 1993; Steuer et al., 1997). While the bacteria levels differed widely in the two studies, both indicated that residential lawns, driveways, and streets were the major source areas for bacteria.

The number of dogs in the Little Econlockhatchee River watershed is not known. Therefore, this analysis used the statistics produced by APPMA to estimate the possible fecal coliform loads contributed by dogs.

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

Geographic Location	Marquette, Michigan	Madison, Wisconsin
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 human population in the Little Econlockhatchee River watershed, calculated based on the Tiger Track 2000 data (Department's GIS library) was 52,076 in Orange County and 15,394 in Seminole County, totaling 67,470. According to the U.S. Census Bureau, there was an average of 2.61 people per household in Orange County and 2.59 in Seminole County in 2000. Thus there are about 64,993 households in the entire watershed. Assuming that 40 percent of the households in this area have one dog, the total number of dogs in the watershed is about 10,358.

Table 4.4 shows the waste production rate for a dog (450 grams/day) and the fecal coliform counts per gram of dog wastes (2,200,000 counts/gram). 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 in residential areas is 1,864,440 grams/day, equivalent to 4.10 x 10^{12} counts/day of fecal coliform. 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 (Weiskel et al., 1996)

* Number from APPMA.

Type	Population density (#/household)	Wasteload (grams/ day)	Fecal coliform density (fecal coliform/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, in areas with a relatively high ground water table, the drainfield can be flooded during the rainy season, and coliform bacteria can pollute the surface water through stormwater 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 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 during the rainy season.

A rough estimate of fecal coliform loads from failed septic tanks in the Little Econlockhatchee River watershed can be made using **Equation 4.1**:

$$L = 37.85 * N * Q * C * F \qquad \text{(Equation 4.1)}$$

Where:

- L is the fecal coliform daily load (counts/day);
- N is the total number of septic tanks in the area (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 2007 Florida Department of Health (FDOH) onsite sewage GIS coverage (available: http://www.doh.state.fl.us/environment/programs/EhGis/EhGisDownload.htm), about 778 housing units *(N)* in the Orange County portion and 142 in the Seminole County portion of the Little Econlockhatchee River watershed were identified as being on septic tanks (**Figure 4.2**). 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 Orange County is about 2.61

people/household, and for Seminole County, 2.59 people/household. The same population densities were assumed for the Little Econlockhatchee River 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 1×10^6 counts/100mL for fecal coliform (EPA, 2001).

No measured septic tank failure rate data were available for the watershed when this TMDL was developed. Therefore, the failure rate was derived from the number of septic tank and septic tank repair permits for Orange and Seminole Counties published by FDOH (available: http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm). The number of septic tanks in the counties was calculated assuming that none of the installed septic tanks will be removed after being installed (**Tables 4.5** and **4.6**). The reported number of septic tank repair permits was also obtained from the FDOH Website. Based on this information, the discovery rates of failed septic tanks for each year between 2001 and 2006 were calculated and listed in **Tables 4.5** and **4.6**.

Based on **Tables 4.5** and **4.6**, the average annual septic tank failure discovery rates are about 1.18 percent for Orange County and 1.11 percent for Seminole County. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rates are about 5 times the discovery rates, which are 5.9 and 5.5 percent for Orange County and Seminole County, respectively. Based on **Equation 4.1**, the estimated fecal coliform loading from failed septic tanks in the Little Econlockhatchee River watershed is about 3.71×10^{11} counts/day.

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.

Figure 4.3 shows the detailed land uses for residential areas in the Little Econlockhatchee River watershed. The watershed largely comprises urban areas, and the dominant urban land use is medium-density residential. The SJRWMD's 1988 land use GIS coverage indicates that the general area was covered by high- and medium-density residential about 20 years ago.

Figure 4.2. Distribution of Onsite Sewage Disposal Systems (Septic Tanks) in the Little Econlockhatchee River Watershed (WBID 3001)

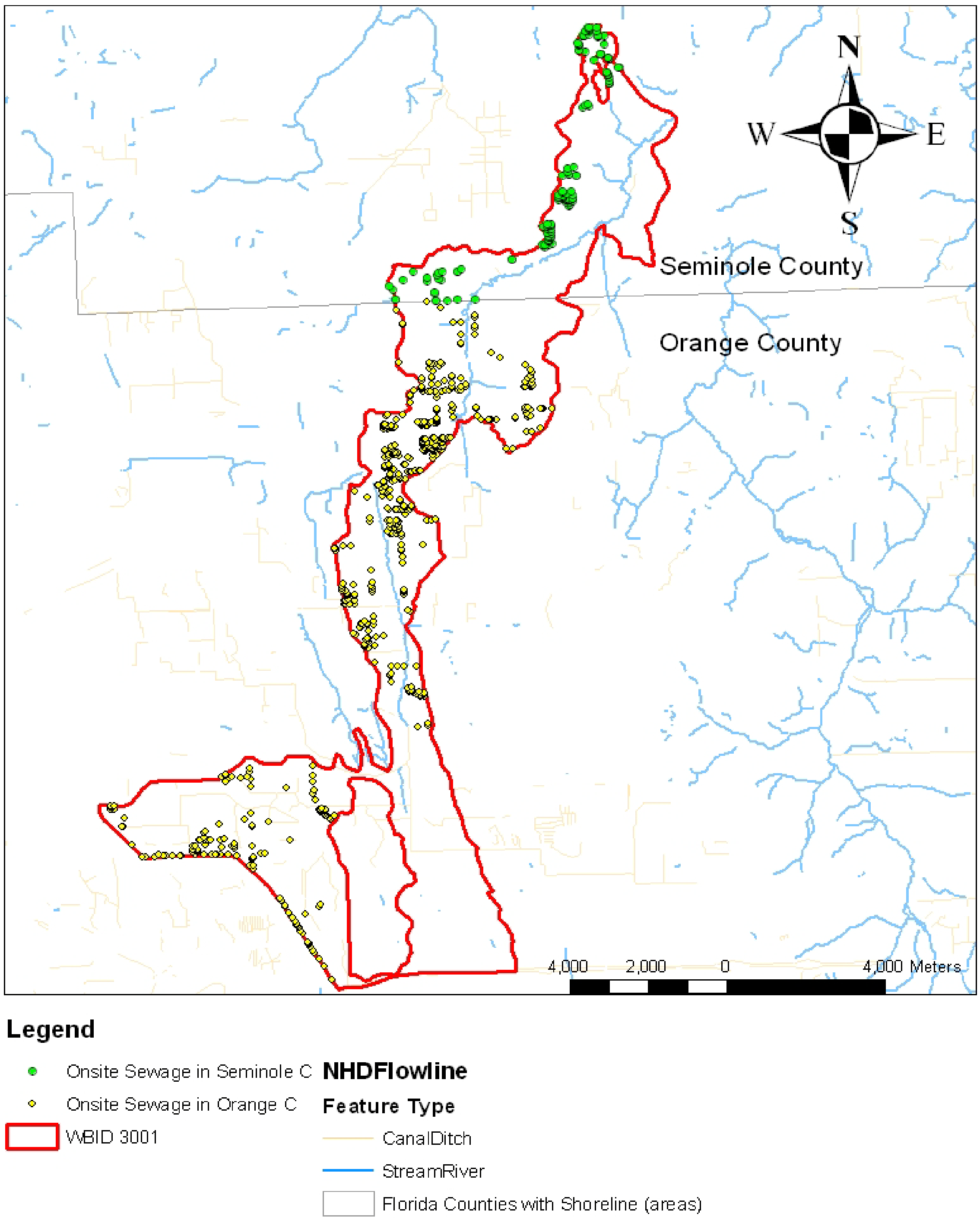


Table 4.5. Estimated Septic Tank Numbers and Septic Tank Failure Rates for Orange County, 2001–06

- = Empty cell
[1] Failure rate is 5 times the failure discovery rate.

-	2001	2002	2003	2004	2005	2006	Average
New installation (septic tanks)	902	859	900	849	873	805	865
Accumulated installation (septic tanks)	99,851	100,753	101,612	102,512	103,361	104,234	102,054
Repair permit (septic tanks)	1,251	1,342	1,145	1,199	1,171	1,098	1,201
Failure discovery rate (%)	1.25%	1.33%	1.13%	1.17%	1.13%	1.05%	1.18%
Failure rate (%)[1]	6.3%	6.7%	5.6%	5.8%	5.7%	5.3%	5.9%

Table 4.6. Estimated Septic Tank Numbers and Septic Tank Failure Rates for Seminole County, 2001–06

- = Empty cell
[1] Failure rate is 5 times the failure discovery rate.

-	2001	2002	2003	2004	2005	2006	Average
New installation (septic tanks)	283	310	278	199	259	296	271
Accumulated installation (septic tanks)	37,943	38,226	38,536	38,814	39,013	39,272	38,634
Repair permit (septic tanks)	505	463	425	349	409	412	427
Failure discovery rate (%)	1.33%	1.21%	1.10%	0.90%	1.05%	1.05%	1.11%
Failure rate (%)[1]	6.7%	6.1%	5.5%	4.5%	5.2%	5.2%	5.5%

When this TMDL was developed, no information on sewer line coverage was available to the Department, and so it was difficult to determine with certainty whether the entire area is sewered. Typically, high- and medium-density residential areas are sewered to avoid too-high septic tank density. If the high- and medium-density residential areas shown in **Figure 4.3** are sewered, as these residential areas are more than 20 years old, sewer line leakage could be a significant source of the fecal pollution.

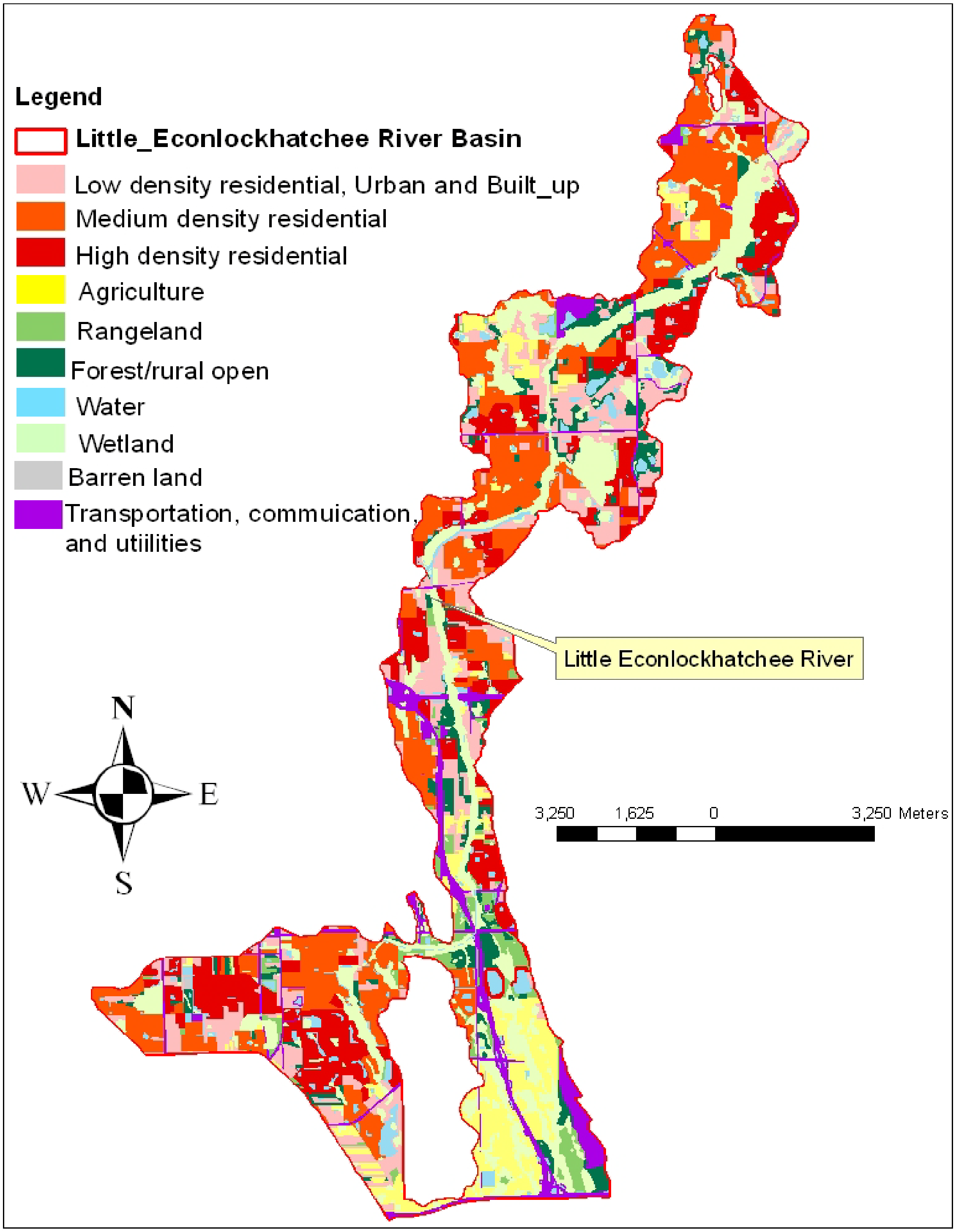
Fecal coliform loading from sewer line leakage can be calculated based on the number of people in the watershed, typical per household generation rates, and typical fecal coliform concentrations in domestic sewage, assuming a leakage rate of 0.5 percent (Culver et al., 2002). Based on this assumption, a rough estimate of fecal coliform loads from leaks and SSOs in the Little Econlockhatchee River watershed can be made using **Equation 4.2**.

$$L = 37.85 * N * Q * C * F \qquad \textbf{(Equation 4.2)}$$

Where:

L is the fecal coliform daily load (counts/day);
N is the number of households using sanitary sewer in the watershed;
Q is the discharge rate for each household;
C is the fecal coliform concentration for domestic wastewater discharge; and
F is the sewer line leakage rate.

Figure 4.3. Detailed Breakdown of Residential Land Use in the Little Econlockhatchee River Watershed (WBID 3001)



In the Little Econlockhatchee River watershed, the numbers of households *(N)* tied to sewer lines are 19,174 (total households minus the households using septic tanks) for Orange County and 5,802 for Seminole County. The discharge rate through sewers from each household (*Q*) was calculated by multiplying the average household size (2.61 for Orange County and 2.59 for Seminole County) by the per capita wastewater production rate per day (70 gallons). The commonly cited concentration (*C*) for domestic wastewater is 1×10^6 counts/100mL for fecal coliform (EPA, 2001). The contribution of fecal coliform through sewer line leakage was assumed to be 0.5 percent of the total sewage loading created from the population not on septic tanks (Culver et al., 2002). Based on **Equation 4.2**, the estimated fecal coliform loading from sewer line leakage in the watershed is about 8.62×10^{11} counts/day.

Wildlife

Wildlife is another possible source of fecal coliform bacteria in the Little Econlockhatchee River watershed. As shown in **Figure 4.1**, there are wetland areas along the Little Econlockhatchee River, and these are likely habitats for small wildlife such as rabbits and raccoons. For highly urbanized areas, birds and rats could also be important contributors to bacterial pollution.

Nonpoint Source Summary

Table 4.7 summarizes the loading estimates from dogs, septic tanks, and SSOs in the Little Econlockhatchee River watershed. It is important to note that this is not a complete list and represents estimates of potential loadings. Proximity to each waterbody, rainfall frequency and magnitude, soil types, drainage features, and temperature are just a few of the factors that could influence and determine the actual loadings from these sources that reach the river.

Table 4.7. Estimated Fecal Coliform Loadings from Dogs, Septic Tanks, and SSOs in the Little Econlockhatchee River Watershed (WBID 3001)

Waterbody	Dogs (counts/day)	Septic Tanks (counts/day)	SSOs (counts/day)
Little Econlockhatchee River	4.10×10^{12}	3.71×10^{11}	8.62×10^{11}

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The methodology used for this TMDL is the load duration curve. Also known as the "Kansas approach" because it was developed by the state of Kansas, this method has been well documented in the literature, with improved modifications used by the EPA, Region 4. Basically, the method relates the pollutant concentration to the flow of the stream, in order to establish the existing loading capacity and the allowable pollutant load (TMDL) under a spectrum of flow conditions. It then determines the maximum allowable pollutant load and load reduction requirement based on the analysis of the critical flow conditions. This method requires four steps to develop the TMDL and establish the required load reduction:

1. *Develop the flow duration curve;*
2. *Develop the load duration curve for both the allowable load and existing loading;*
3. *Define the critical conditions; and*
4. *Establish the needed load reduction by comparing the existing loading with the allowable load under critical conditions.*

5.1.1 Data Used in the Determination of the TMDL

Fecal coliform concentration and flow measurements were required to estimate both the allowable pollutant load and existing loading to the Little Econlockhatchee River. **Figure 5.1** shows the locations of the water quality sites where fecal coliform data were collected and the U.S. Geological Survey (USGS) gaging stations (Stations 02233200, 02233473, and 02233475) where the flow measurements were taken. This analysis used fecal coliform data collected during the verified period (January 1, 2001, through June 30, 2008). During this period, a total of 268 fecal coliform samples was collected from 18 sampling stations in WBID 3001. Data used for this TMDL report were provided by the Department's Central District Office, the SJRWMD, Orange County, and Seminole County.

Figure 5.2 shows the fecal coliform concentrations observed in the Little Econlockhatchee River between January 2001 and December 2008. The concentrations of fecal coliform ranged from 4 to 5,900 MPN/100mL and averaged 509 MPN/100mL during the verified period. Seasonally, the highest fecal coliform concentration was observed during the 3rd quarter (July, August, and September), which typically is the rainy season (**Figure 5.3**). Although the lowest fecal coliform concentration was observed during the 1st quarter (January, February, and March), the exceedance rate was not insignificant during this period, reaching 14 percent.

Spatially, the highest fecal coliform concentration was observed at the upstream stations, and concentrations decreased from upstream to downstream (**Figure 5.4**). The exceedance rate also decreased from upstream to downstream; at the sampling stations upstream from

Figure 5.1. Locations of Water Quality Stations and USGS Gaging Stations in the Little Econlockhatchee River (WBID 3001)

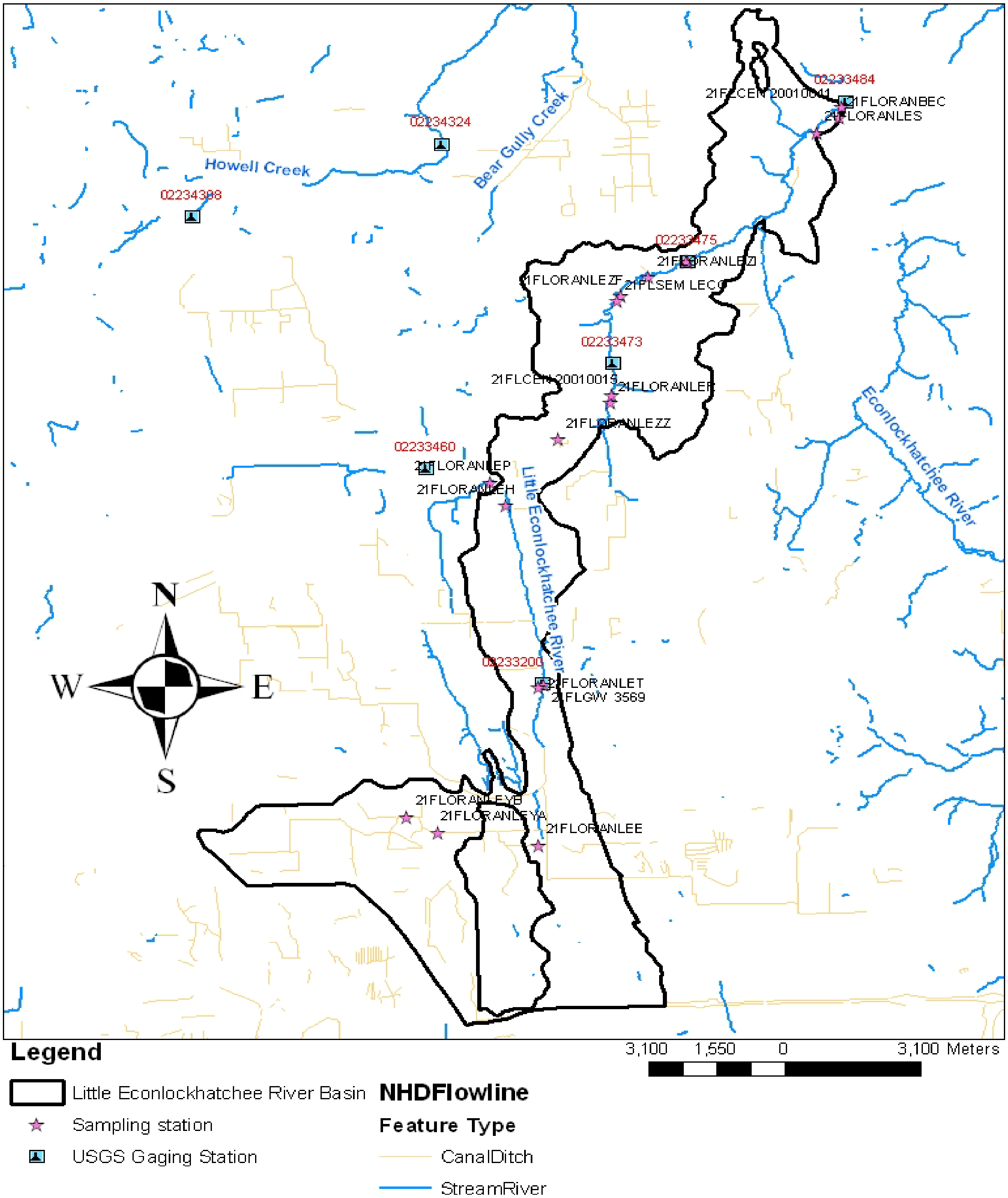


Figure 5.2. Trends of Fecal Coliform Concentrations in the Little Econlockhatchee River (WBID 3001) during the Verified Period (January 1, 2001, through June 30, 2008)

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

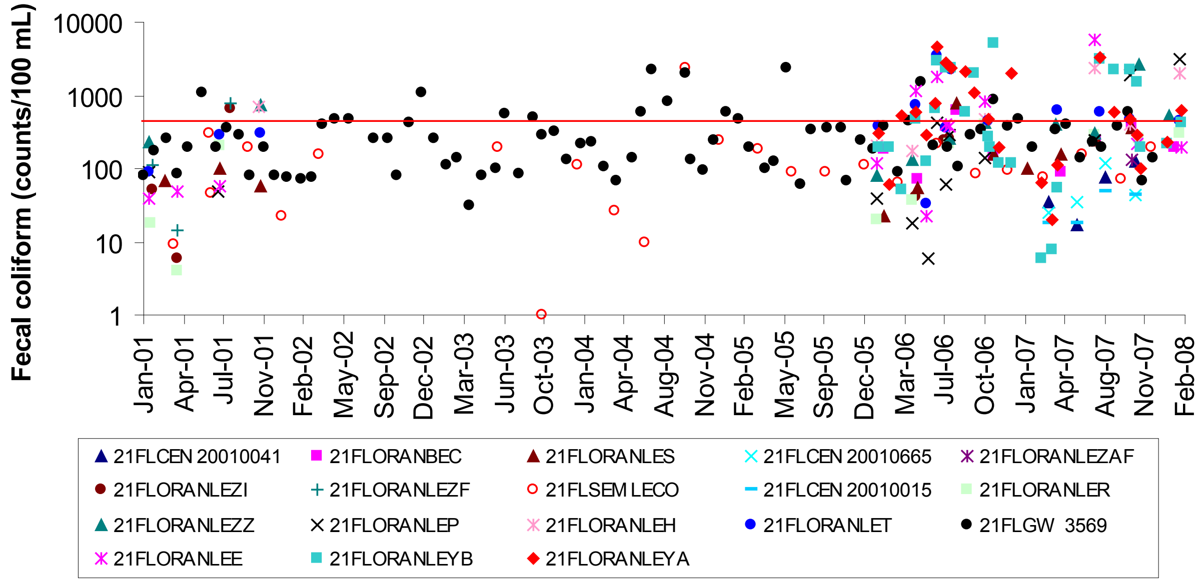


Figure 5.3. Temporal Trend of Fecal Coliform Concentrations in the Little Econlockhatchee River (WBID 3001) during the Verified Period (January 1, 2001, through June 30, 2008)

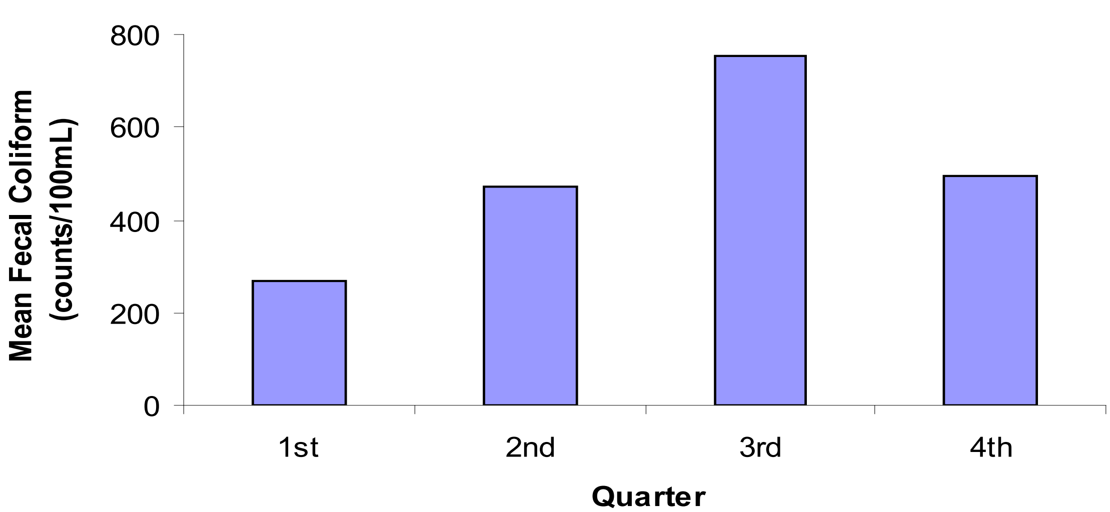
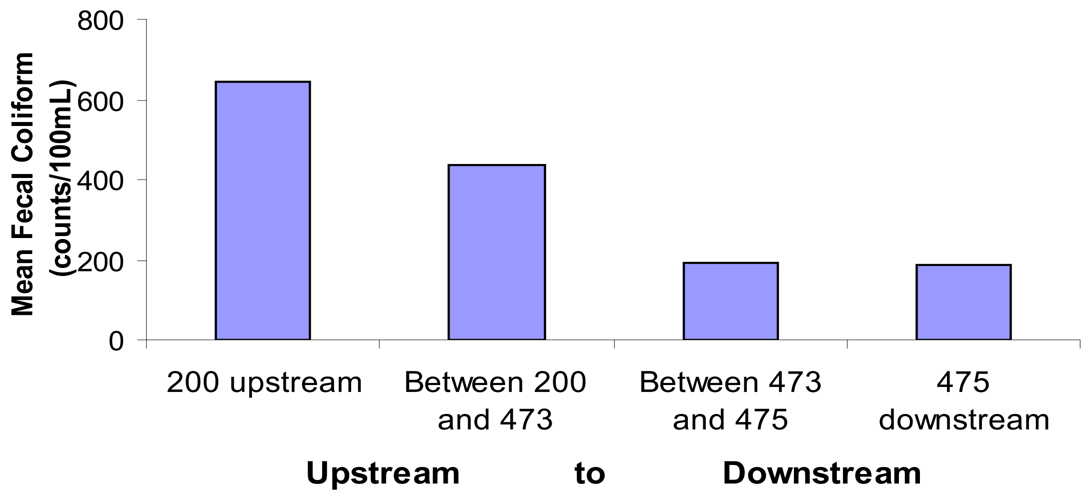


Figure 5.4. Spatial Trend of Fecal Coliform Concentrations in the Little Econlockhatchee River (WBID 3001) during the Verified Period (January 1, 2001, through June 30, 2008)

Note: The numbers on the X-axis indicate USGS Gaging Stations 200; 02233200, 473; 02233473, 475; and 02233475.



02233200 (the USGS gaging station), between 02233200 and 02233473, between 02233473 and 02233475, and downstream from 02233475, exceedances were found in 60 out of 161 samples, 12 out of 44 samples, 3 out of 40 samples, and 3 out of 23 samples, respectively. This indicates that the portion of the river containing USGS Station 02233473 receives a significant amount of fecal coliform loading from upstream sources. Therefore, flow measurements from USGS Gaging Station 02233473 were used for this analysis, with extrapolated data using Station 02233473 to fill in the missing flow measurements.

5.1.2 TMDL Development Process

Develop the Flow Duration Curve

The first step in the development of load duration curves is to create *flow duration curves*. A flow duration curve displays the cumulative frequency distribution of daily flow data over the period of record. The duration curve relates flow values measured at a monitoring station to the percent of time the flow values were equaled or exceeded. Flows are ranked from low, which are exceeded nearly 100 percent of the time, to high, which are exceeded less than 1 percent of the time.

This TMDL report used flow measurements from the USGS gaging stations located at the Little Econlockhatchee River (Stations 02233473 and 02233475). There were flow measurements at Station 02233475 through the entire verified period, but the data records at Station 02233473 only covered the period from March 2002 to June 2008. Thus, at the latter station no data were collected for the first 14 months of the verified period. Station 02233475 is located downstream of Station 02233473. The flow data from Station 02233475 were used to extend the data from

Station 02233473 for the period from January 2001 through February 2002. The relationship of flow measurements between the two stations from March 2002 to June 2008 was derived through linear correlation analysis, and a correlation equation between the two sets of flow data was derived from the analysis (**Figure 5.5**). The flow at Station 02233473 from January 2001 to February 2002 was extrapolated using the equation.

The flow measurements from both USGS gaging stations were downloaded from the USGS Florida Integrated Science Center water resources Website (available: http://fl.water.usgs.gov). The flow duration curve for the Little Econlockhatchee River was developed based on a mixed flow dataset, which includes both measured data when they were available and estimated data when the measured data were not available.

The flow duration curve was created by using the percentile function and the flow record to generate the flow at a given duration interval. For example, at the 90th duration interval, the percentile function calculates the flow that is equal or exceeded 90 percent of the time. **Figure 5.6** shows the flow duration curves for the Little Econlockhatchee River generated from the measured flow and estimated flow using regression analysis. Flows toward the right side of the plot are exceeded with greater frequency and indicate low-flow conditions. Flows on the left side of the plot represent high flows and occur less frequently.

To ensure that the final flow dataset was as accurate as possible, measured flow was used whenever there was a measured record. This created a mixed dataset that included both the regression-predicted flow and measured flow. **Figure 5.6** demonstrates that the flow duration curves created based on measured and mixed datasets are very similar. In creating the load duration curve, this TMDL analysis used the flow duration interval based on the mixed dataset.

Figure 5.5. Relationship of Flow Measurements between USGS Gaging Stations 02233473 and 02233475

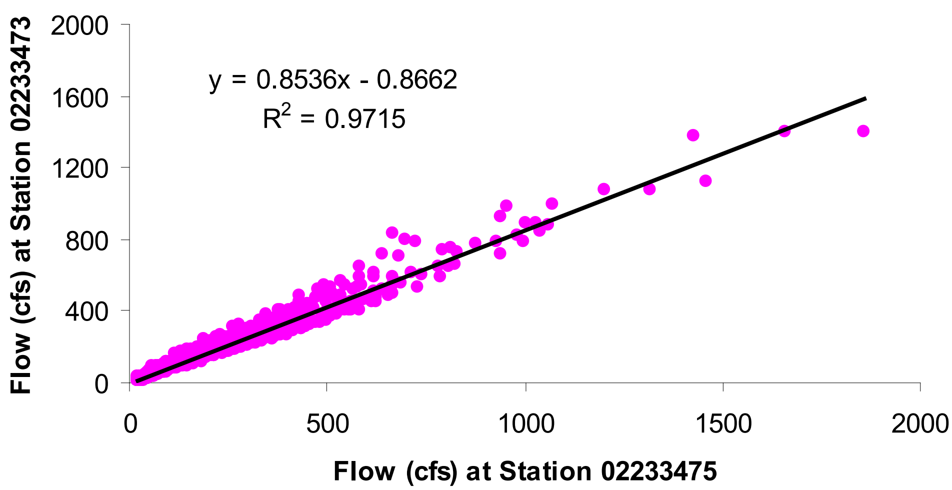
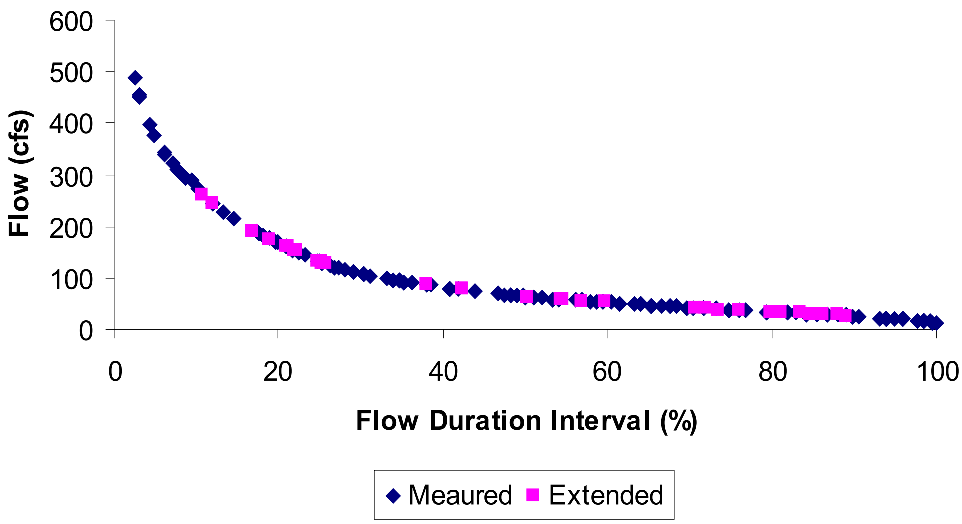


Figure 5.6. Flow Duration Curve for the Little Econlockhatchee River (WBID 3001)



There is a typo in the legend above—it should be Measured

Develop the Load Duration Curves for Both the Allowable Load and Existing Loading Capacity

Flow duration curves are transformed into load duration curves by multiplying the flow values along the flow duration curve by the fecal coliform concentration and the appropriate conversion factors. The final results of the load are typically expressed as MPN per day. The following equations were used to calculate the allowable loads and the existing loading:

Allowable load = (observed flow) x (conversion factor) x (state criteria) (Equation 5.1)

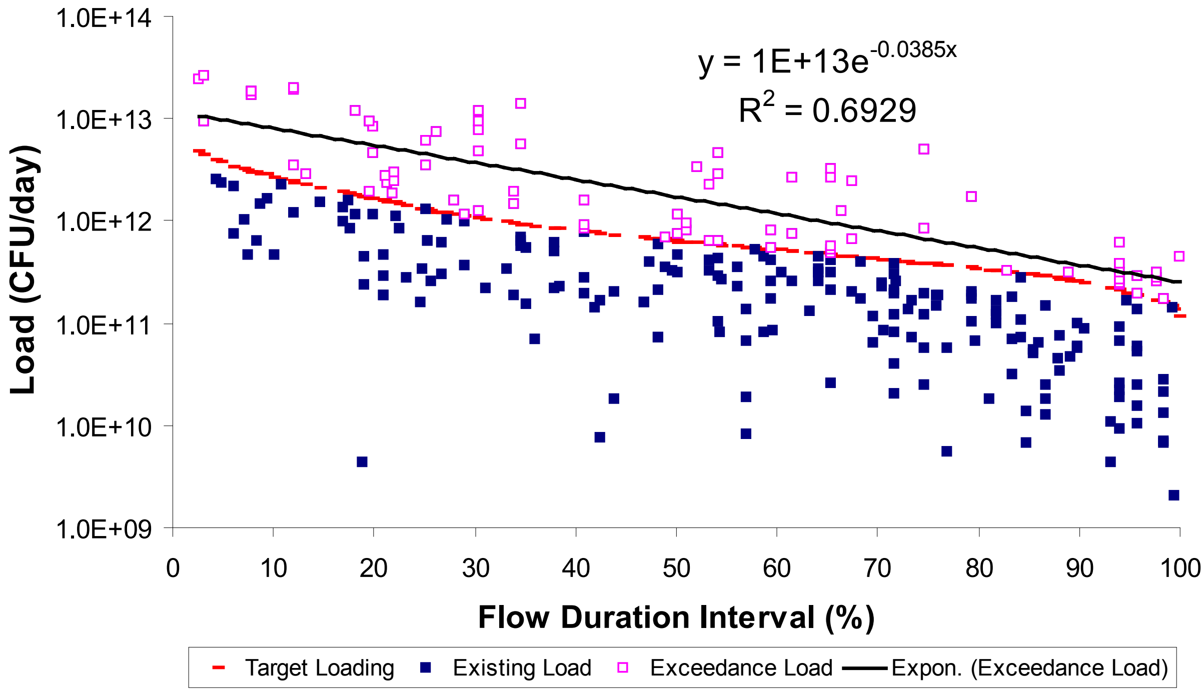
Existing loading = (observed flow) x (conversion factor) x (coliform measurement) (Equation 5.2)

On the load duration curve, allowable and existing loads are plotted against the flow duration ranking. The allowable load is calculated based on the water quality criterion and flow values from the flow duration curve, and the line drawn through the data points representing the allowable load is called the target line. The existing loads are based on the instream fecal coliform concentrations measured during ambient monitoring and an estimate of flow in the stream at the time of sampling.

As noted previously, because insufficient data were collected to evaluate the fecal coliform monthly geometric mean, 400 MPN/100mL was used as the target criterion for fecal coliform. **Figure 5.7** shows both the allowable loads and the existing loads over the flow duration ranking for the Little Econlockhatchee River. The points of the existing load that are higher than the allowable load at a given flow duration ranking represent exceedances of the criterion.

As shown in **Figure 5.7,** exceedances of the fecal coliform criterion in the Little Econlockhatchee River occurred across the entire span of the flow record. In general, exceedances on the right side of the curve typically occur during low-flow events, implying a contribution from either point sources or baseflow, which could come from the load from failed septic tanks and sewer line leakage that interact with surface water. The exceedances that appear on the left side of the curve usually represent loading from stormwater-related sources. In this case, the potential sources may include contributions from pets such as dogs and cats, wild animals, failed septic tanks, and sewer line leakage.

Figure 5.7. Load Duration Curves for Allowable Load and Existing Loading Capacity for Fecal Coliform



Define the 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, animals with direct access to the receiving water can contribute to the exceedances during dry weather. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

For the Little Econlockhatchee River, the exceedance frequency is evenly distributed across the entire span of the flow conditions, and exceedances also occur in the same way. Because exceedances occur throughout the flow record, no critical condition was defined in this TMDL. The Department used the flow records and water quality data available for the 10th to 90th percentile flow duration interval for the TMDL analysis. Flow conditions that were exceeded less than 10 percent of the time were not used because they represent abnormally high-flow events, and flow conditions occurring greater than 90 percent of the time were not used because they are extreme low-flow events.

Establish the Needed Load Reduction by Comparing the Existing Load with the Allowable Load under the Critical Condition

The fecal coliform load reduction required to achieve the water quality criterion was established by comparing the existing loading with the allowable load at each flow recurrence interval between the 10th and 90th percentile (in increments of 5 percent). The actual needed load reduction was calculated using the following equation:

$$\textbf{Load reduction} = \frac{\textbf{Existing loading} - \textbf{Allowable loading}}{\textbf{Existing loading}} \times \textbf{100\%} \qquad \textbf{(Equation 5.3)}$$

Allowable loading at each recurrence interval was calculated as the product of the water quality criterion and the flow corresponding to the given recurrence interval. To calculate *Existing loading,* a trend line was fitted to the loads that exceeded *Allowable loading*. Several types of trend lines were examined, and exponential functions were found to have the highest correlation coefficient for fecal coliform loading ($R^2 = 0.6929$). Therefore, exponential function was used to predict the existing loads corresponding to the flow recurrence intervals used by *Allowable loading.* The following exponential equation was developed for fecal coliform:

For fecal coliform: $\mathbf{Y = 1E + 13e^{-0.0385X}}$ **(Equation 5.4)**

Where:

> *X* is the flow recurrence interval between the 10th and 90th percentile; and
> *Y* is the predicted *Existing loading* for fecal coliform (**Equation 5.4**).

Figure 5.7 shows the trend line and power equation for fecal coliform bacteria exceedances. After the trend line was developed, it was used to determine the median percent reduction required to achieve the numeric criterion. At each recurrence interval between the 10th and 90th percentile (in increments of 5 percent), the equation of the trend line was used to estimate *Existing loading*.

The percent reduction required to achieve the target load was then calculated at each interval using **Equation 5.3**. The TMDL and percent reductions were calculated as the median of all the *allowable loads* (6.26E+11 counts/day) and percent reductions calculated at the various recurrence intervals between the 10th and 90th percentile. **Table 5.1** shows the calculation of the TMDL and percent reductions for fecal coliform in the Little Econlockhatchee River.

Table 5.1. Calculation of TMDL and Percent Reduction for Fecal Coliform in the Little Econlockhatchee River (WBID 3001)

Interval	Allowable Load (counts/day)	Existing Load (counts/day)	% Reduction
90	2.45E+11	3.13E+11	21.8%
85	2.94E+11	3.79E+11	22.6%
80	3.33E+11	4.60E+11	27.6%
75	3.72E+11	5.57E+11	33.3%
70	4.11E+11	6.75E+11	39.1%
65	4.60E+11	8.19E+11	43.8%
60	5.09E+11	9.93E+11	48.7%
55	5.68E+11	1.20E+12	52.8%
50	6.26E+11	1.46E+12	57.1%
45	7.05E+11	1.77E+12	60.2%
40	7.93E+11	2.14E+12	63.0%
35	9.10E+11	2.60E+12	65.0%
30	1.05E+12	3.15E+12	66.6%
25	1.28E+12	3.82E+12	66.4%
20	1.62E+12	4.63E+12	64.9%
15	2.06E+12	5.61E+12	63.3%
10	2.71E+12	6.80E+12	60.1%
Median:	**6.26E+11**	**1.46E+12**	**57.1%**

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 = $\sum$ WLAs + $\sum$ LAs + MOS

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

TMDL $\cong \sum WLAs_{wastewater} + \sum WLAs_{NPDES\ Stormwater} + \sum LAs + MOS$

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 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 TMDL for the Little Econlockhatchee River is expressed in terms of MPN/day and percent reduction, and represents the maximum daily fecal coliform load the stream can assimilate without exceeding the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for Fecal Coliform in the Little Econlockhatchee River Watershed, WBID 3001

Parameter	TMDL (colonies/day)	Wasteload Allocation for Wastewater (colonies/day)	Wasteload Allocation for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
Fecal coliform	6.26E+11	Must Meet Permit Limits	57%	57%	Implicit

6.2 Load Allocation

Based on a loading duration curve approach similar to that developed by Kansas (Stiles, 2002), the load allocation is a 57 percent reduction in fecal coliform from nonpoint sources. It should be noted that the LA includes loadings 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

One NPDES-permitted wastewater facility was identified in the Little Econlockhatchee River watershed. The Iron Bridge Regional Water Reclamation Facility (FL 0037966), located in the southern part of Seminole County, currently has a 28 mgd annual AADF permitted discharge to the Little Econlockhatchee River. The actual discharge from the facility to the Little Econlockhatchee River is significantly lower than the permitted 28 mgd. The permit includes effluent discharge limits for fecal coliform bacteria. The facility must meet its permit limits for fecal coliform, as stated in its permit specifications.

Section I.A.6 of the permit (FL0039721) reads as follows:

> *The arithmetic mean of the monthly fecal coliform values collected during an annual period shall not exceed 200 per 100 mL of effluent sample. The geometric mean of the fecal coliform values for a minimum of 10 samples of effluent each collected on a separate day during a period of 30 consecutive days (monthly), shall not exceed 200 per 100 mL of sample. No more than 10 percent of the samples collected (the 90th percentile value) during a period of 30 consecutive days shall exceed 400 fecal coliform values per 100 mL of sample. Any one sample shall not exceed 800 fecal coliform values per 100 mL of sample.*

Table 4.1 lists the AADF from the facility to the Little Econlockhatchee River, the annual average fecal coliform concentration of the discharge, and annual average daily loadings from the facility to surface water. During the 5-year period from June 1, 2003, through December 31, 2007, the Iron Bridge Regional Water Reclamation Facility never exceeded the monthly average, 200 counts/100mL, and the 10 percent threshold, 400 counts/100mL. Therefore, this facility should be allowed to continue discharging at its current rate.

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 57 percent reduction in current fecal coliform for the Little Econlockhatchee River (WBID 3001). 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 this TMDL. For fecal coliform, an implicit MOS was inherently incorporated by using 400 MPN/100mL of fecal coliform as the water quality target for individual samples, instead of setting the criterion as no more than 10 percent of the samples exceeding 400 MPN/100mL. For a fecal coliform TMDL, using the load duration curve method to develop the TMDL assumes there is no instream decay of fecal coliform bacteria after the watershed loading reaches the receiving waterbody, while in reality fecal coliform loadings could diminish through processes such as death, grazing, and deposition. Therefore, the load duration curve method tends to underestimate the allowable fecal coliform loading that a given waterbody receives and is therefore more conservative in establishing the TMDL. In addition, the correlation lines fitting through only the existing loadings that exceeded the allowable loadings could overestimate the actual existing loading, which makes the estimation of percent load reduction required more conservative and adds to the MOS.

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.

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Appendices

Appendix A: Fecal Coliform Observations in the Little Econlockhatchee River (WBID 3001) during the Verified Period (January 1, 2001–June 30, 2008)

Date	Station	Fecal coliform (counts/100mL)
1/9/2001	21FLGW 3569	80
1/23/2001	21FLORANLEE	40
1/23/2001	21FLORANLET	90
1/23/2001	21FLORANLEZZ	230
1/24/2001	21FLORANLEP	90
1/25/2001	21FLORANLER	18
1/29/2001	21FLORANLEZF	110
1/29/2001	21FLORANLEZI	50
2/6/2001	21FLGW 3569	170
3/5/2001	21FLORANLES	66
3/6/2001	21FLGW 3569	250
3/27/2001	21FLSEM LECO	9
4/3/2001	21FLGW 3569	87
4/3/2001	21FLORANLER	4
4/5/2001	21FLORANLEE	48
4/5/2001	21FLORANLEZF	14
4/5/2001	21FLORANLEZI	6
5/1/2001	21FLGW 3569	200
6/4/2001	21FLGW 3569	1,100
6/20/2001	21FLSEM LECO	300
6/28/2001	21FLSEM LECO	47
7/10/2001	21FLGW 3569	200
7/12/2001	21FLORANLEP	48
7/16/2001	21FLORANLER	210
7/16/2001	21FLORANLET	280
7/17/2001	21FLORANLEE	56
7/17/2001	21FLORANLES	102
8/6/2001	21FLGW 3569	350
8/14/2001	21FLORANLEZF	800
8/14/2001	21FLORANLEZI	650
9/6/2001	21FLGW 3569	290
9/26/2001	21FLSEM LECO	200
10/2/2001	21FLGW 3569	82
10/25/2001	21FLORANLEH	700
10/29/2001	21FLORANLET	300
10/29/2001	21FLORANLEZZ	740
10/30/2001	21FLORANLES	56
11/5/2001	21FLGW 3569	190

Date	Station	Fecal coliform (counts/100mL)
12/4/2001	21FLGW 3569	82
12/20/2001	21FLSEM LECO	22
1/2/2002	21FLGW 3569	76
2/6/2002	21FLGW 3569	72
3/5/2002	21FLGW 3569	74
3/21/2002	21FLSEM LECO	160
4/2/2002	21FLGW 3569	410
5/2/2002	21FLGW 3569	470
6/4/2002	21FLGW 3569	480
8/5/2002	21FLGW 3569	250
9/9/2002	21FLGW 3569	260
10/2/2002	21FLGW 3569	78
11/4/2002	21FLGW 3569	435
12/4/2002	21FLGW 3569	1,100
1/6/2003	21FLGW 3569	260
2/4/2003	21FLGW 3569	110
3/4/2003	21FLGW 3569	140
4/3/2003	21FLGW 3569	31
5/5/2003	21FLGW 3569	80
6/9/2003	21FLGW 3569	102
6/12/2003	21FLSEM LECO	200
7/1/2003	21FLGW 3569	560
8/4/2003	21FLGW 3569	85
9/8/2003	21FLGW 3569	510
9/30/2003	21FLSEM LECO	1
10/2/2003	21FLGW 3569	280
11/3/2003	21FLGW 3569	320
12/2/2003	21FLGW 3569	134
12/30/2003	21FLSEM LECO	110
1/7/2004	21FLGW 3569	220
2/2/2004	21FLGW 3569	230
3/4/2004	21FLGW 3569	104
3/29/2004	21FLSEM LECO	26
4/5/2004	21FLGW 3569	68
5/12/2004	21FLGW 3569	141
6/3/2004	21FLGW 3569	600
6/15/2004	21FLSEM LECO	10
7/1/2004	21FLGW 3569	2,200
8/9/2004	21FLGW 3569	845
9/21/2004	21FLGW 3569	2,000
9/22/2004	21FLSEM LECO	2,400
10/5/2004	21FLGW 3569	130
11/8/2004	21FLGW 3569	94
12/1/2004	21FLGW 3569	240
12/16/2004	21FLSEM LECO	240
1/3/2005	21FLGW 3569	600

Date	Station	Fecal coliform (counts/100mL)
2/1/2005	21FLGW 3569	470
3/3/2005	21FLGW 3569	200
3/23/2005	21FLSEM LECO	180
4/11/2005	21FLGW 3569	100
5/3/2005	21FLGW 3569	128
6/1/2005	21FLGW 3569	2,400
6/15/2005	21FLSEM LECO	90
7/6/2005	21FLGW 3569	60
8/3/2005	21FLGW 3569	340
9/6/2005	21FLSEM LECO	92
9/12/2005	21FLGW 3569	350
10/17/2005	21FLGW 3569	350
11/1/2005	21FLGW 3569	68
12/6/2005	21FLGW 3569	240
12/14/2005	21FLSEM LECO	110
1/5/2006	21FLGW 3569	183
1/12/2006	21FLORANLEE	120
1/12/2006	21FLORANLEH	210
1/12/2006	21FLORANLEP	40
1/12/2006	21FLORANLER	20
1/12/2006	21FLORANLEZZ	80
1/18/2006	21FLORANLET	370
1/18/2006	21FLORANLEYA	300
1/18/2006	21FLORANLEYB	190
1/30/2006	21FLORANBEC	180
1/30/2006	21FLORANLES	22
2/2/2006	21FLGW 3569	370
2/15/2006	21FLORANLEYA	60
2/15/2006	21FLORANLEYB	200
3/6/2006	21FLSEM LECO	65
3/9/2006	21FLGW 3569	91
3/16/2006	21FLORANLEYA	520
3/16/2006	21FLORANLEYB	50
4/4/2006	21FLGW 3569	440
4/12/2006	21FLORANLEH	174
4/12/2006	21FLORANLEP	18
4/12/2006	21FLORANLER	36
4/12/2006	21FLORANLEZZ	130
4/19/2006	21FLORANLEE	1,160
4/19/2006	21FLORANLET	730
4/19/2006	21FLORANLEYA	600
4/19/2006	21FLORANLEYB	460
4/19/2006	21FLORANLEZI	42
4/24/2006	21FLORANBEC	70
4/24/2006	21FLORANLES	54
5/4/2006	21FLGW 3569	1,491

Date	Station	Fecal coliform (counts/100mL)
5/16/2006	21FLORANLEE	22
5/16/2006	21FLORANLET	33
5/16/2006	21FLORANLEYA	288
5/16/2006	21FLORANLEYB	125
5/23/2006	21FLORANLEP	6
6/5/2006	21FLGW 3569	210
6/8/2006	21FLORANLEYA	760
6/8/2006	21FLORANLEYB	650
6/14/2006	21FLORANLEE	1,800
6/14/2006	21FLORANLET	3,500
6/14/2006	21FLORANLEYA	4,600
6/14/2006	21FLORANLEYB	2,900
6/15/2006	21FLORANLEP	420
6/15/2006	21FLSEM LECO	220
6/29/2006	21FLORANLEZI	240
7/5/2006	21FLORANLEE	410
7/5/2006	21FLORANLET	350
7/5/2006	21FLORANLEYA	2,800
7/5/2006	21FLORANLEYB	2,300
7/6/2006	21FLORANLEP	60
7/10/2006	21FLGW 3569	200
7/13/2006	21FLORANLEE	370
7/13/2006	21FLORANLEH	380
7/13/2006	21FLORANLEP	290
7/13/2006	21FLORANLER	220
7/13/2006	21FLORANLEZI	260
7/13/2006	21FLORANLEZZ	260
7/19/2006	21FLORANLET	2,200
7/19/2006	21FLORANLEYA	2,400
7/19/2006	21FLORANLEYB	2,400
7/31/2006	21FLORANBEC	620
7/31/2006	21FLORANLES	800
8/7/2006	21FLGW 3569	108
8/23/2006	21FLORANLEYA	2,100
8/23/2006	21FLORANLEYB	590
9/5/2006	21FLGW 3569	290
9/14/2006	21FLORANLEYA	1,110
9/14/2006	21FLORANLEYB	2,000
9/19/2006	21FLSEM LECO	83
10/3/2006	21FLGW 3569	330
10/12/2006	21FLORANLEE	810
10/12/2006	21FLORANLEH	460
10/12/2006	21FLORANLEP	140
10/12/2006	21FLORANLER	390
10/12/2006	21FLORANLEZZ	430
10/18/2006	21FLORANLET	450

Date	Station	Fecal coliform (counts/100mL)
10/18/2006	21FLORANLEYA	480
10/18/2006	21FLORANLEYB	270
10/24/2006	21FLORANLEYB	200
10/31/2006	21FLORANBEC	150
10/31/2006	21FLORANLES	160
11/1/2006	21FLGW 3569	890
11/1/2006	21FLORANLEYB	5,200
11/13/2006	21FLORANLEYA	200
11/13/2006	21FLORANLEYB	120
12/6/2006	21FLGW 3569	370
12/6/2006	21FLSEM LECO	95
12/14/2006	21FLORANLEYA	2,000
12/14/2006	21FLORANLEYB	120
1/4/2007	21FLGW 3569	470
1/24/2007	21FLORANLES	100
2/6/2007	21FLGW 3569	200
2/27/2007	21FLORANLEYA	63
2/27/2007	21FLORANLEYB	6
3/6/2007	21FLSEM LECO	74
3/20/2007	21FLCEN 20010015	18
3/20/2007	21FLCEN 20010041	35
3/20/2007	21FLCEN 20010665	25
3/28/2007	21FLORANLEYA	20
3/28/2007	21FLORANLEYB	8
4/3/2007	21FLGW 3569	330
4/5/2007	21FLORANLEZZ	410
4/9/2007	21FLORANLET	620
4/9/2007	21FLORANLEYA	112
4/9/2007	21FLORANLEYB	54
4/19/2007	21FLORANBEC	90
4/19/2007	21FLORANLES	156
5/2/2007	21FLGW 3569	390
5/29/2007	21FLCEN 20010015	18
5/29/2007	21FLCEN 20010041	17
5/29/2007	21FLCEN 20010665	34
6/5/2007	21FLGW 3569	140
6/11/2007	21FLSEM LECO	160
7/5/2007	21FLGW 3569	230
7/10/2007	21FLORANLEE	5,900
7/10/2007	21FLORANLEH	2,400
7/10/2007	21FLORANLEP	240
7/10/2007	21FLORANLER	280

Date	Station	Fecal coliform (counts/100mL)
7/10/2007	21FLORANLEZZ	300
7/18/2007	21FLORANBEC	240
7/18/2007	21FLORANLES	240
7/23/2007	21FLORANLET	590
7/23/2007	21FLORANLEYA	3,300
7/23/2007	21FLORANLEYB	3,200
7/31/2007	21FLGW 3569	200
8/8/2007	21FLCEN 20010015	48
8/8/2007	21FLCEN 20010041	74
8/8/2007	21FLCEN 20010665	118
8/29/2007	21FLORANLEYA	590
8/29/2007	21FLORANLEYB	2,200
9/6/2007	21FLGW 3569	380
9/18/2007	21FLSEM LECO	70
10/3/2007	21FLGW 3569	600
10/8/2007	21FLORANLEYA	460
10/8/2007	21FLORANLEYB	2,200
10/9/2007	21FLORANLET	480
10/10/2007	21FLORANLEH	400
10/10/2007	21FLORANLEP	1,900
10/11/2007	21FLORANBEC	410
10/11/2007	21FLORANLES	350
10/11/2007	21FLORANLEZAF	130
10/23/2007	21FLCEN 20010015	44
10/23/2007	21FLCEN 20010041	126
10/23/2007	21FLCEN 20010665	44
10/25/2007	21FLORANLEE	220
10/25/2007	21FLORANLEYA	280
10/25/2007	21FLORANLEYB	1,500
10/30/2007	21FLORANLER	260
10/30/2007	21FLORANLEZZ	2,600
11/5/2007	21FLORANLEYA	100
11/5/2007	21FLORANLEYB	200
11/7/2007	21FLGW 3569	66
11/28/2007	21FLSEM LECO	200
12/4/2007	21FLGW 3569	140
1/7/2008	21FLORANLEYA	230
1/7/2008	21FLORANLEYB	220
1/15/2008	21FLORANLEZZ	520
1/28/2008	21FLORANBEC	200
2/7/2008	21FLORANLEH	2,000
2/7/2008	21FLORANLEP	3,200

Date	Station	Fecal coliform (counts/100mL)
2/7/2008	21FLORANLER	300
2/7/2008	21FLORANLET	440
2/11/2008	21FLORANLEE	200
2/11/2008	21FLORANLEYA	620
2/11/2008	21FLORANLEYB	420
3/4/2008	21FLSEM LECO	61
3/24/2008	21FLORANLEYA	250
3/24/2008	21FLORANLEYB	160

Appendix B: 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 regulations.

Rule 62-40 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, stormwater PLRGs 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 the 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/environmental resource permitting 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 C: Response to Comments from Orange County on the Fecal Coliform TMDL for the Little Econlockhatchee River

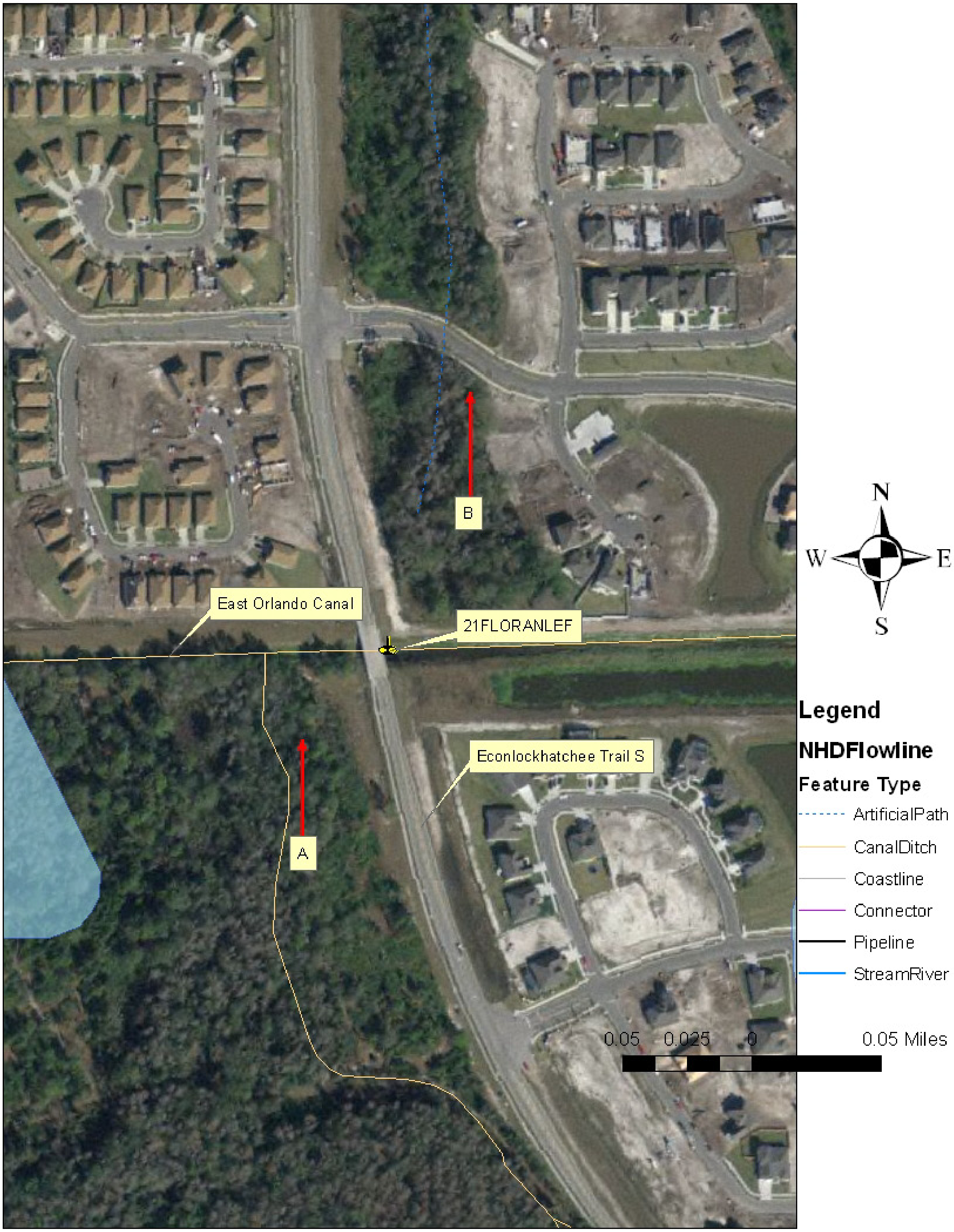
Orange County Comment:

The WBID boundary for the upper reaches clips a portion out of the East Orlando Canal. See map attached. The dark blue portion is the part of the canal that was clipped into WBID 3046.

DEP Response

The original basis for setting the boundary for WBID 3046 may be unclear. Under the guidance of the Clean Water Act, assessment units are intended to represent waterbodies or waterbody segments having fairly consistent water quality. After examining the 1:24,000 NHD coverage, it appears that the major water feature in WBID 3046, the Unnamed Drain, flows across the East Orlando Canal to the north, which might be have been the reason why the WBID 3046 boundary was drawn across the East Orlando Canal. We suspect that the segment B north of the East Orlando Canal may not be associated with the segment A south of the East Orlando Canal (see map below). If you can confirm that this is indeed the case, we will certainly consider re-delineating the boundary for WBID 3046 and return the carved out portion of the East Orlando Canal to WBID 3001.

We determined that only one sampling station (21FLORANLEF) is currently within WBID 3046, but it does not have any fecal coliform data. Even if we re-delineate the boundary for WBID 3046, fecal coliform TMDL for Little Econlockhatchee River will not be influenced.


B
East Orlando Canal
21FLORANLEF
Econlockhatchee Trail S
A
N
W
E
S
Legend
NHDFlowline
Feature Type
ArtificialPath
CanalDitch
Coastline
Connector
Pipeline
StreamRiver
0.05 0.025 0 0.05 Miles

Orange County Comment:

> Under Wastewater Point sources, there are two package plants in the WBID. Starlite off Pershing Ave. and Gulfstream Harbor off of Goldenrod Road.

DEP Response

The Starlight Ranch MHC WWTF (FLA010868) is a state permitted domestic wastewater facility, but not a NPDES permitted facility. Therefore, no surface discharge is allowed from the facility. The facility currently discharges to three percolation ponds. According to Central District Office of FDEP, an unauthorized discharge was observed from percolation pond #1 during a field inspection conducted on January 24, 2005. Effluent was being continuously discharged into an adjacent canal via the emergency overflow pipe. This canal appeared to flow to the Little Econlockhatchee River. The Central District Office sent the facility a warning letter (signed by Director, Central District on March 7, 2005) and no further events have been noted.

We checked if fecal coliform data are available from the sampling stations (21FLORANLEYA and 21FLORANLEYB) near the facility during the unauthorized discharge periods. Unfortunately, we could not find any fecal coliform data during the period. The data were available from year 2006 at these two stations. So we do not have any evidence that the unauthorized discharge was responsible for the elevated fecal coliform concentration in the Little Econlockhatchee River.

Gulfstream Harbor Mobile Home Park WWTF (FLA010835) is not a NPDES permitted facility either. Therefore, no surface water discharge is allowed. This facility discharges to two rapid infiltration basins and no unauthorized discharges are known to us.

Orange County Comment:

> Table 4.4 - you mention attenuation could affect overland transport. Was an attenuation factor applied to the figures in this table?

DEP Response

All the loading estimations presented in Chapter 4 were meant to demonstrate the relative contributions from different sources. Therefore, these loadings were the loadings created within the watershed undergoing no attenuation, not the loadings eventually reach the receiving water. However, the loading capacities calculated in Chapter 5 are the loadings that reach the receiving water. As we used data collected from the receiving water, not from watershed, to calculate the TMDL, attenuation effect on the TMDL has been implicitly considered.

Orange County Comment:

> Septic Tank numbers- was local Orange County DOH contacted to support these numbers?
>
> Page 15 - you mention that no sewer line coverage was available at the time of the TMDL draft - Was Orange County Utilities contacted? They do have coverages available.

DEP Response

It would be appreciated if you could provide us the recommended contact information to get the access to these local data. It will help us to estimate the loading from septic tanks and sewer lines more accurately. At the same time, as is stated in the above response, we estimated the fecal coliform loading from septic tanks just to show relative contributions from different sources. We do not use these loading numbers to establish the TMDL. Therefore, the final TMDL result will stay the same even if we re-calculate the loading from septic tanks.

Florida Department of Environmental Protection
Division of Environmental Assessment and Restoration
Bureau of Watershed Restoration
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Tallahassee, Florida 32399-2400