FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

SOUTHEAST DISTRICT • SOUTHEAST COAST–BISCAYNE BAY BASIN

FINAL TMDL Report

Fecal Coliform TMDL for C-14 (Cypress Creek) Canal (WBID 3270), C-13 West (Middle River) Canal (WBID 3273), C-13 East (Middle River) Canal (WBID 3274), C-12 (Plantation) Canal (WBID 3276), New River (North Fork) (WBID 3276A), New River Canal (South) (WBID 3277A), North New River (WBID 3277C), Dania Cut-off Canal (WBID 3277E), C-11 (South New River) Canal (WBID 3279), and C-11 (East) Canal (WBID 3281)

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Loads (TMDLs) for fecal coliform bacteria for 10 waterbodies located in the Southeast Coast–Biscayne Bay Basin: C-14 (Cypress Creek) Canal, C-13 West (Middle River) Canal, C-13 East (Middle River) Canal, C-12 (Plantation) Canal, New River (North Fork), New River Canal (South), North New River Canal, Dania Cut-off Canal, C-11 (South New River) Canal, and C-11 (East) Canal. These waterbodies were verified as impaired for fecal coliform and therefore were included on the Verified Lists of impaired waters for the Southeast Coast–Biscayne Bay Basin that were adopted by Secretarial Order in May 2006 or November 2010. The TMDLs establish allowable fecal coliform loadings to these segments that would restore the waterbodies so that they meet the applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

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

These waterbodies comprise 10 of the 22 waterbody segments in the Broward County Planning Unit of the Southeast Coast–Biscayne Bay Basin. WBIDs 3270, 3273, 3276, 3277A, 3279, and 3281 are 6 of 19 waterbody segments in the Southeast Coast–Biscayne Bay Basin included on the initial 1998 303(d) list submitted by the Florida Department of Environmental Protection (Department) to the U.S. Environmental Protection Agency (EPA). The initial 1998 303(d) list was incorporated into a 1999 Consent Decree between the EPA and Earthjustice.

Table 1.1. WBID Numbers for the Waterbodies Included in This TMDL Report

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

WBID	Waterbody Segment
3270	C-14 (Cypress Creek) Canal
3273	C-13 West (Middle River) Canal
3274	C-13 East (Middle River) Canal
3276	C-12 (Plantation) Canal
3276A	New River (North Fork)
3277A	New River Canal (South)
3277C	North New River Canal
3277E	Dania Cut-off Canal
3279	C-11 (South New River) Canal
3281	C-11 (East) Canal

The initial list used data from sampling stations listed in the Department's 1996 305(b) report, which incorporated the best available information at the time to generally characterize the quality of Florida's waters. However, some of the delineations of waterbody areas and locations of sampling stations for the 1998 303(d) list were inaccurate due to metadata limitations at that time.

With the primary goal of providing more accurate assessments, the Department has revised the delineations over time. The EPA has labeled the redrawing of WBID boundaries "resegmentation," as the original stations corresponded to specific WBID areas or segments. Resegmented WBIDs are those WBIDs that have been altered from the initial 1998 303(d) Consent Decree or previous cycle boundaries. As a result of the resegmentation process for the Group 4 basins, there are currently 37 Consent Decree waterbody segments in the Southeast Coast–Biscayne Bay Basin, including WBIDs 3274, 3276A, 3277C, and 3277E. This number is based on Impaired Surface Waters Rule (IWR) Run 41x.

The WBIDs addressed in these TMDLs are located within Broward County (**Figures 1.1** and **1.2**), which comprises a highly engineered and managed, complex system of canals. The hydrology within the county is manipulated by a series of water control structures, pumps, and levees that have altered the natural hydroperiods and flows of these watersheds (Broward County Department of Planning and Environmental Protection [BCDPEP] 2001a), and have resulted in the effective management of water in the region, allowing for the current urban development and agricultural landscape (South Florida Water Management District [SFWMD] 2010a).

The primary drainage system in the county, managed by the SFWMD, comprises nine major canals and their drainage basins: Hillsboro Canal, C-14 (Cypress Creek) Canal, Pompano Canal, C-13 (Middle River) Canal, C-12 (Plantation) Canal, North New River Canal, C-11 (South New River) Canal, C-9 (Snake Creek) Canal, and C-10 Canal. Except for the western segment of the C-11, which is normally back-pumped into the Everglades' Water Conservation Areas (WCAs), these major canals, along with secondary and tertiary canals, eventually drain to estuarine waters (BCDPEP 2001a) (**Figure 1.3**).

The canals were built to meet population needs by controlling water levels and movement for water supply, flood control, drainage, and navigation, in addition to providing water necessary to maintain natural communities in lakes, wetlands, rivers, and estuaries (SFWMD 2010a). Water levels are managed to maintain ground water levels during dry periods, which is particularly important for water supply needs by preventing saltwater intrusion. During these periods, stored water can be delivered throughout the county to help meet local urban and agricultural needs and prevent saltwater intrusion. During wet periods, the canals remove excess water from drainage basins to prevent flooding.

Within urban areas, the canals are used primarily for flood control. However, secondary uses include the drainage of land for development, wellfield recharge for local municipalities, and the discharge of excess water to and from the WCAs (Cooper and Lane 1987), with primary canals functioning as an outlet for excess water from the Everglades and Lake Okeechobee during wet periods.

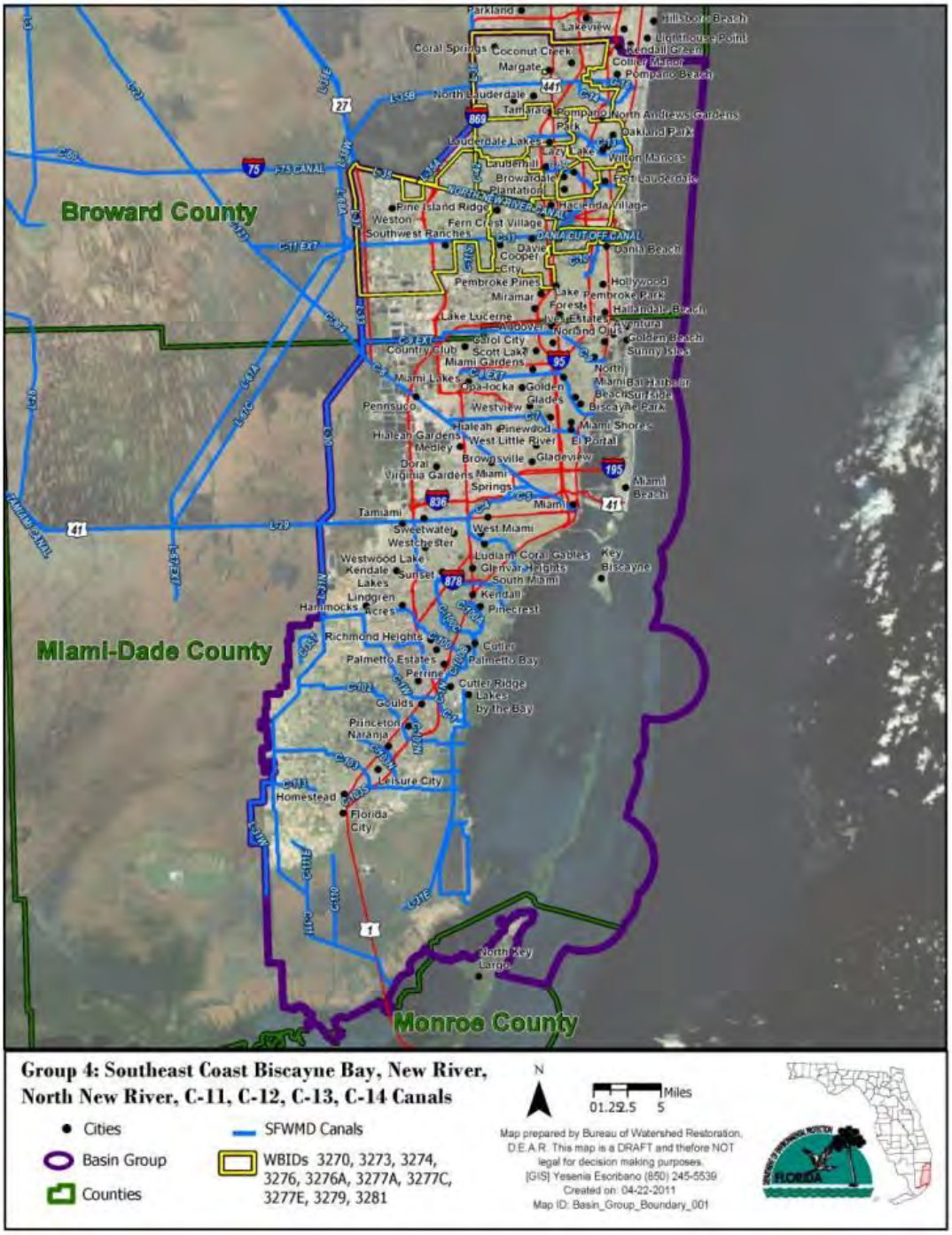

Figure 1.1. Location of WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 in the Southeast Coast–Biscayne Bay Basin and Major Hydrologic and Geopolitical Features in the Area

Figure 1.2. Location of WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 in Broward County and Major Hydrologic and Geopolitical Features in the Area

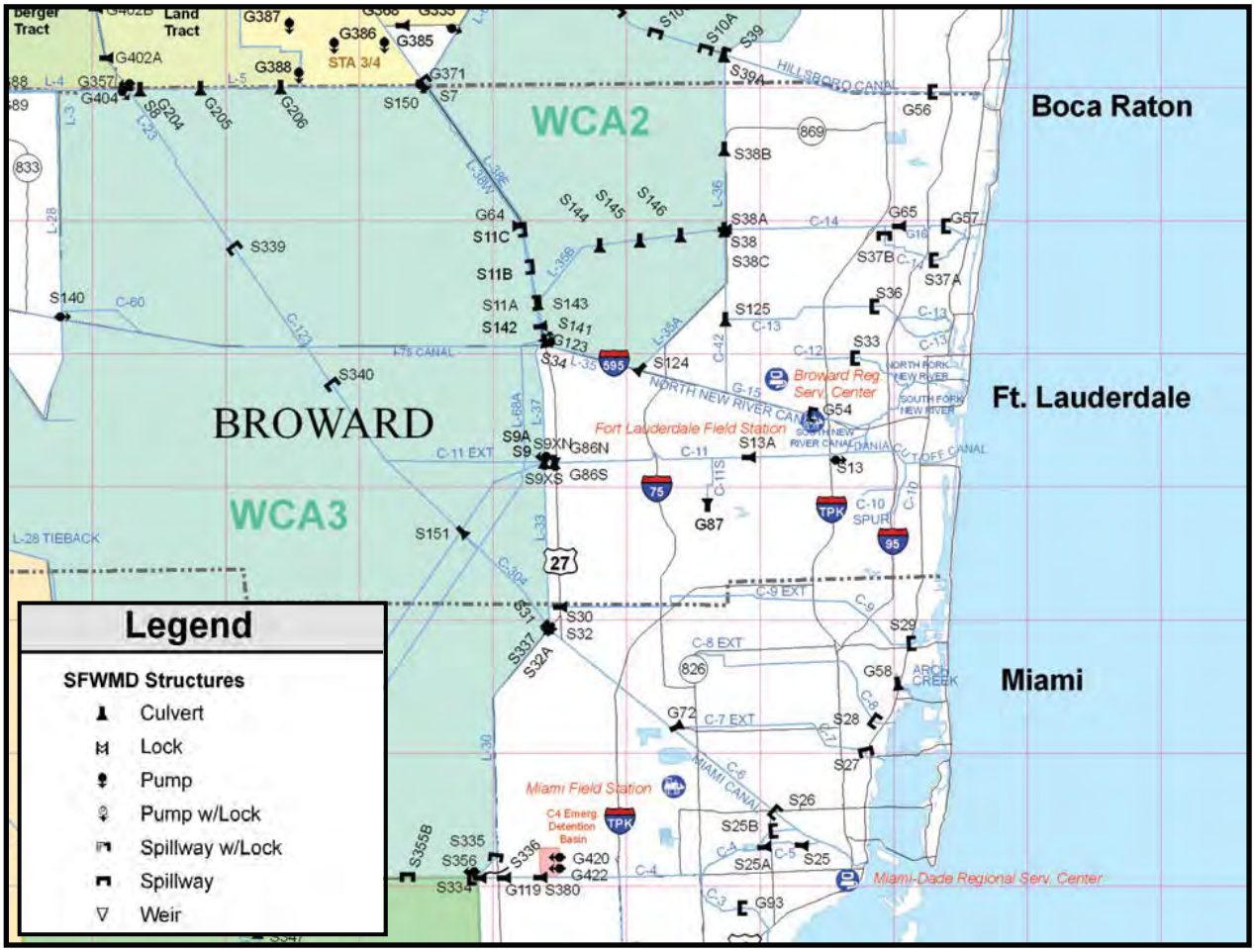

Figure 1.3. Location of Canals, WCAs, and Water Control Structures in Broward County (SFWMD 2010a)

All canal segments contain either a water control structure within them or are directly influenced by the operation of an upstream or downstream control structure (SFWMD 2010a) (**Figure 1.3**). Structures regulate the flow and level of water in these canals. Coastal structures also prevent salt water from a tidal or storm surge from entering canals that discharge to tide.

Canals are notably different from most natural waterbodies. As a result of their design, management, and maintenance, these systems provide limited support for aquatic life. In addition, water levels and flow can have extreme fluctuations depending on operational needs. While canals are designed to move high flows at high velocities, during periods of drought and dry season operations, they may be stagnant for extended periods, and some may contain little or no water (SFWMD 2010a).

The C-14 (Cypress Creek) Canal (WBID 3270) is located in northern Broward County. The western portion of this watershed was designed for 1 in 10-year flood protection and the eastern portion for 1 in 30-year flood protection (SFWMD 2010a). In addition to flood protection, the C-

14 Canal and its associated water control structures supply water, maintain the water table, transport excess water from WCA-2A to tidewater, and intercept and control seepage from WCA-2A (SFWMD 2010a). Although in general the C-14 Canal flows to the eastern estuarine waters from WCA-2A, the S-37B structure can act as a separator based on specific hydrologic conditions (BCDPEP 2001a) (**Figures 1.2** and **1.3**).

The C-13 (Middle River) Canal, located in north-central Broward County, is divided into an eastern portion (WBID 3274) and a western portion (WBID 3273). The western portion includes the entire freshwater section of the C-13 Canal. In general, water flows from the confluence of the C-42 Canal to the eastern estuarine waters via the S-36 water control structure (BCDPEP 2001a). The canals and associated water control structures in the C-13 watershed provide flood protection and drainage, supply water, intercept and control seepage from WCA-2B, and maintain the elevation of the ground water table west of S-36 to prevent saltwater intrusion (SFWMD 2010a) (**Figures 1.2** and **1.3**).

The C-12 Canal (WBID 3276) is located in east-central Broward County. The canal and its associated water control structure provide flood protection and drainage, and maintain ground water levels west of S-33 (SFWMD 2010a). The C-12 is the headwaters of the North Fork of the New River. Unlike other canals in Broward County, the canal has no direct or indirect connection to seepage water from the WCAs; water supply in the watershed is limited to rainfall. Studies have determined that the watershed is stagnant (no flow occurs) 85% of the time at the S-33 structure (BCDPEP 2001a), and thus the canal is considered a “closed” waterbody, receiving inputs mainly from ground water and stormwater based on rainfall patterns (BCDPEP 2001a) (**Figures 1.2** and **1.3**).

The New River watershed, located in east-central Broward County, is one of two large estuarine reaches in Broward County, the other being the Intracoastal Waterway (ICW) (BCDPEP 2001a) (**Figures 1.2** and **1.3**). It is divided into three distinct areas: the main New River, the North Fork (WBID 3276A), and the South Fork (WBID 3277A). The North Fork, a shallow, meandering tributary of the New River, has minimal tidal flow and limited exchanges of tidal waters (BCDPEP 2001b). Most of the North Fork’s freshwater input is stormwater, with seasonal ground water contributions (BCDPEP 2001a). The South Fork, made up of two freshwater tributaries, the C-11 and the North New River Canal (WBID 3277C), has a relatively dynamic, high flow rate and does not consistently receive flow from C-12 Canal discharges. As a result, the North Fork functions mainly as a tidal “pond” characterized by stagnant waters with restricted outflow to the main New River (BCDPEP 2001a). The southwestern portion of the South Fork includes a large natural area (Pond Apple Slough) as well as other vegetated expanses (Griffey Tract) containing large areas of mangrove forests and leatherfern stands (BCDPEP 2001a) (**Figures 1.2** and **1.3**).

The North New River Canal (WBID 3277C) is located in east-central Broward County. The North New River was excavated and extended to drain the Everglades and to provide a transportation route between Lake Okeechobee and the east coast (SFWMD 2010a). This canal flows to the southeast, discharging to the South Fork of the New River east of the G-54 lock (SFWMD 2010a). The freshwater portion of the New River Canal (North) is a bordering waterway from the WCA tailwaters to an estuarine discharge point at the G-54 structure (BCDPEP 2001a) (**Figures 1.2** and **1.3**).

The C-11 (South New River) Canal, located in southwest Broward County, is divided into a western watershed (WBID 3279) and an eastern watershed (WBID 3281). The C-11 extends from the L-37 Borrow Canal on the west to the S-13 water control structure. The eastern portion of the canal flows to the east, discharging to the South Fork of the New River. Any excess water in the eastern watershed is discharged to the east by the C-11 and S-13 to the South Fork of the New River. Additional quantities of excess water from the western watershed can be discharged to the eastern watershed through the S-13A water control structure if the S-13 is not pumping to capacity (SFWMD 2010a). The western segment of the C-11 is normally backpumped into the WCAs (BCDPEP 2001a) (**Figures 1.2** and **1.3**).

The Dania Cut-off Canal (WBID 3277E) is located in the southeast corner of Broward County. Fresh water in the canal originates mainly from the C-11 Canal to the west (upstream) of the Dania Cut-off Canal and is controlled by releases through the S-13 water control structure. The Dania Cut-off Canal flows east to join the ICW just south of Port Everglades. Tidewater primarily comes from the Port Everglades Inlet, with some tidal interaction also occurring with the South Fork of the New River in the western portion of the Dania Cut-off Canal (BCDPEP 2001a) (**Figures 1.2** and **1.3**).

WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 are located in the Atlantic Coastal Ridge and Everglades physiographic regions, which occupy the eastern portions of Broward, Miami–Dade, and Palm Beach Counties. In Broward County, the ridge is composed of both sand and limestone (Schroeder *et al.* 1956). The Everglades, an area of organic soils, is located west of the ridge and is dedicated primarily to agriculture and conservation areas (Schroeder *et al.* 1956).

This part of southeastern Florida is underlain by the Biscayne aquifer, an unconfined and shallow part of the surficial aquifer system that consists of highly permeable limestone and less permeable sandstone and sand (Fish 1988). The aquifer supplies large quantities of water for municipal, industrial, and irrigational use in Broward County. The Biscayne aquifer is particularly susceptible to contamination because it is unconfined, highly permeable, and shallow, and because it is located near the surface in highly urbanized areas (Whitman1997). Potential sources of contamination include saltwater encroachment and infiltration of contaminants carried in canal water, direct infiltration of contaminants (chemicals or pesticides applied to or spilled on the land, and fertilizer carried in surface runoff), landfills, septic tanks, sewage plant treatment ponds, and wells used to dispose of stormwater runoff or industrial waste (Miller 1990). Additional information about the hydrology and geology of the area is available in the *Broward County, Florida Historical Water Quality Atlas: 1972–1997* (BCDPEP 2001a).

Table 1.2 lists the area (in square miles and acres) within each WBID boundary. Land use in the WBIDs is predominantly medium- and high-density residential.

Table 1.2. Area within Each WBID Boundary in Square Miles and Acres

This is a four-column table. Column 1 lists the WBID number, Column 2 lists the waterbody name, Column 3 lists the WBID area in square miles, and Column 4 lists the WBID area in acres.

WBID	Waterbody	WBID Area (square miles)	WBID Area (acres)
3270	C-14 (Cypress Creek) Canal	56.1	35,884
3273	C-13 West (Middle River) Canal	20.6	13,188
3274	C-13 East (Middle River) Canal	15.2	9,723
3276	C-12 (Plantation) Canal	8.8	5,621
3276A	New River (North Fork)	7.1	4,523
3277A	New River Canal (South)	16.1	10,281
3277C	North New River Canal	8.7	5,555
3277E	Dania Cut-off Canal	7.4	4,719
3279	C-11 (South New River) Canal	70.9	45,367
3281	C-11 (East) Canal	22.8	14,623

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, Section 403.067, 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.

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 WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281. These activities will depend heavily on the active participation of the SFWMD, 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 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 identified 19 impaired waterbodies in the Southeast Coast–Biscayne Bay Basin on its initial 1998 303(d) list. As a result of the resegmentation process for the Group 4 basins, there are currently 37 Consent Decree waterbody segments in the Southeast Coast–Biscayne Bay Basin (see **Section 1.2**). However, the FWRA (Section 403.067, F.S.) stated that all Florida 303(d) lists created before the adoption of the FWRA 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 WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281, and has verified that these waterbody segments are impaired for fecal coliform bacteria. The verified impairment was based on the observation that, with a 90% confidence limit based on binomial distribution, more than 10% of the values exceeded the assessment threshold of 400 counts per 100 milliliters (counts/100mL) (see **Section 3.2** for details) in all these WBIDs.

WBIDs 3274, 3276A, and 3277A were verified as impaired during the Cycle 1 verified period (January 1, 1998–June 30, 2005). These impairments were confirmed in the Cycle 2 verified period (January 1, 2003–June 30, 2010). WBIDs 3270, 3273, 3276, 3277C, 3277E, 3279, and 3281 were verified as impaired during the Cycle 2 verified period.

Tables 2.1a summarizes fecal coliform monitoring results used for verified impairment for the Cycle 1 verified period for WBIDs 3274, 3276A, and 3277A. **Table 2.1b** summarizes fecal monitoring results used for verified impairment for the Cycle 2 assessment (based on IWR Run 41x) for all WBIDs. As they better represent the current conditions, only the results for the Cycle 2 verified period were used in the TMDL development process.

Table 2.1a. Summary of Fecal Coliform Monitoring Data for WBIDs 3274, 3276A, and 3277A During the Cycle 1 Verified Period (January 1, 1998–June 30, 2005)

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

Parameter	WBID 3274	WBID 3276A	WBID 3277A
Total number of samples	205	104	144
IWR-required number of exceedances for the Verified List	27	15	20
Number of observed exceedances	39	45	22
Number of observed nonexceedances	166	59	122
Number of seasons during which samples were collected	4	4	4

Table 2.1b. Summary of Fecal Coliform Monitoring Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

This is an 11-column table. Column 1 lists the parameter, and Columns 2 through 11 list the WBID numbers and corresponding Cycle 2 results.

Parameter	WBID 3270	WBID 3273	WBID 3276	WBID 3279	WBID 3281	WBID 3277C	WBID 3277E	WBID 3274	WBID 3276A	WBID 3277A
Total number of samples	144	70	57	74	30	84	67	153	53	111
IWR-required number of exceedances for the Verified List	20	11	10	12	6	13	11	21	9	16
Number of observed exceedances	23	11	13	21	14	16	18	50	39	30
Number of observed nonexceedances	121	59	44	53	16	68	49	103	14	81
Number of seasons during which samples were collected	4	4	4	4	4	4	4	4	4	4
Highest observation (counts/100mL)	5,200	2,600	7,400	9,800	9,100	5,800	9,400	9,600	10,000	6,400
Lowest observation (counts/100mL)	1.8	1.8	6	1.8	44	1.8	1.8	1	150	7
Median observation (counts/100mL)	110	69	94	205	400	98	250	244	630	220
Mean observation (counts/100mL)	282	226	570	510	1,415	288	823	570	1,734	675

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criterion Applicable to the TMDLs

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)**

All WBIDs addressed in this report are Class III waterbodies, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. WBIDs 3274, 3276A, 3277A, and 3277E are Class III marine waterbodies, and WBIDs 3270, 3273, 3276, 3277C, 3279, and 3281 are Class III freshwater waterbodies. The criterion applicable to these TMDLs is the Class III (marine and freshwater) 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 (marine and freshwater), as established by Rule 62-302, F.A.C., states the following:

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

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. There were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for these TMDLs was not to exceed 400 counts/100mL for fecal coliform.

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 A** for background information on the federal and state stormwater programs).

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

4.2 Potential Sources of Fecal Coliform within the Boundaries of WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281

4.2.1 Point Sources

Wastewater Point Sources

Table 4.1 lists all NPDES-permitted facilities located in each WBID addressed in this report. Four facilities are listed in the Wastewater Facility Regulation (WAFR) database as surface water discharge facilities (Permits FL0031771, FL0040541, FLS267562, and FL0001503). Two of these (Permits FL0031771 and FL0040541) are domestic wastewater facilities; however, treated wastewater from both facilities is transported to the Atlantic Ocean via ocean outfalls and thus does not contribute to the observed levels of fecal coliform bacteria in the WBID where they are located.

The remaining two surface water discharge facilities (Permits FLS267562 and FL0001503) do not contribute to the observed levels of fecal coliform bacteria.

The Pompano Harness Track (Permit FLA667714) could potentially contribute to fecal coliform discharges; however, all manure/bedding in the facility is covered/contained within the production area, and the horses are washed over the grassy areas. Thus no wastewater/runoff is generated that is disposed of or reused.

Municipal Separate Storm Sewer System Permittees

Table 4.2 lists all NPDES municipal separate storm sewer system (MS4) permits covering WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281. In addition, **Table 4.2** lists whether the permit includes joint participation with the Florida Department of Transportation (FDOT) within the WBIDs. See **Appendix C** for a list and maps of municipalities/permittees within each WBID boundary.

Table 4.1. Wastewater Point Sources: NPDES-Permitted Facilities by WBID

This is a four-column table. Column 1 lists the WBIDs being impacted by point sources, Column 2 lists the facility permit number, Column 3 lists the facility name, and Column 4 lists the type of facility.

WWTP = Wastewater treatment plant
GP = General permit

WBID	Permit ID	Facility Name	Type of Facility
3270	FLA667714	Pompano Harness Track	Concentrated Animal Feeding Operation
3270	FLG110351	CEMEX Construction Materials Florida LLC	Concrete Batch GP
3270	FLG110380	Modern Concrete Products Inc. – Ft. Lauderdale Plant	Concrete Batch GP
3270	FL0031771	Broward County North Regional WWTP	Domestic WWTP
3270	FLG110691	CEMEX LLC – Sunrise Plant	Concrete Batch GP
3277A	FLG110571	Tarmac America – Ft. Lauderdale Plant	Concrete Batch GP
3277A	FLG110693	CEMEX LLC – S Ft. Lauderdale Plant	Concrete Batch GP
3277A	FLS267562	Wheelabrator South Broward, Inc. - Resource Recovery Facility	Individual Stormwater
3277E	FL0001503	FPL – Lauderdale Power Plant	Industrial Wastewater
3279	FLG110155	Continental FL Matl – Pembroke Pines	Concrete Batch GP
3279	FLG110332	CEMEX LLC – Pembroke Pines Plant	Concrete Batch GP
3281	FLG110348	Davie Concrete Corp. – Davie Concrete Batch Plant	Concrete Batch GP
3281	FLG110360	Banaszak Concrete - Davie Batch Plant	Concrete Batch GP
3281	FLG110615	Continental FL Matl – Davie (E Broward)	Concrete Batch GP
3281	FL0040541	Davie, Town of – WWTP	Domestic WWTP

Table 4.2. MS4 Permittees by WBID

This is a four-column table. Column 1 lists the WBID number, Column 2 lists the permit number, Column 3 lists the permit name, and Column 4 lists whether the permit includes joint participation with FDOT.

- = Empty cell/no data
Y= FDOT is a co-permittee

WBID	Permit ID	Permit Name	FDOT
3270	FLS000016	Broward County and Co-permittees	Y
3270	FLS000017	City of Ft. Lauderdale	-
3273	FLS000016	Broward County and Co-permittees	Y
3273	FLS000017	City of Ft. Lauderdale	-
3274	FLS000016	Broward County and Co-permittees	Y
3274	FLS000017	City of Ft. Lauderdale	-
3276	FLS000016	Broward County and Co-permittees	Y
3276	FLS000017	City of Ft. Lauderdale	-
3279	FLS000016	Broward County and Co-permittees	Y
3281	FLS000016	Broward County	Y
3281	FLS000020	City of Hollywood	-
3276A	FLS000016	Broward County and Co-permittees	Y
3276A	FLS000017	City of Ft. Lauderdale	-
3277A	FLS000016	Broward County and Co-permittees	Y
3277A	FLS000017	City of Ft. Lauderdale	-
3277C	FLS000016	Broward County and Co-permittees	Y
3277E	FLS000016	Broward County and Co-permittees	Y
3277E	FLS000020	City of Hollywood	-

4.2.2 Land Uses and Nonpoint Sources

Accurately quantifying the fecal coliform loadings from nonpoint sources requires identifying nonpoint source categories, locating the sources, determining the intensity and frequency with which these sources create high fecal coliform loadings, and specifying the relative contributions from each source. Depending on the land use distribution in a given watershed, frequently cited nonpoint sources in urban areas include failed septic tanks, leaking sewer lines, and pet feces.

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

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SFWMD's 2004–05 land use coverage contained in the Department's geographic information system (GIS) library. Land use categories within the boundaries of WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 were aggregated using the Florida Land Use Code and Classification System (FLUCCS) expanded Level 1 codes (including low-,

medium-, and high-density residential) and tabulated in **Tables 4.3** and **4.3b**. The tables also list the total area within each WBID. **Figure 4.1** shows the spatial distribution of the principal land uses within each WBID boundary.

Within all WBID boundaries, the dominant land use categories are residential (low-, medium- and high-density) and urban built-up (commercial and services, industrial, institutional, and recreational). These land uses account for approximately 58% to 91% of the total acreage for each WBID. Low-impact land uses, including rangeland, upland forest, water, wetlands, and barren lands, make up 2% to 28% of the total area in each WBID. Areas covered by agricultural lands are relatively small, accounting from 0% to about 7% of the total area.

Urban Development

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

Boats

Live-aboard vessels have been identified in areas of the North Fork New River (WBID 3276A) (Solo-Gabriele *et al.* 2000) and in the Port Dania Beach marina (BCDPEP 2001a). A potentially important source of fecal coliform loading in these areas may include boat sewage discharges. In areas with high boating densities and low hydrologic flushing, boats can be a significant source of fecal coliform bacteria (EPA 2010). Fecal coliform levels can become elevated near boats during periods of high occupancy and usage (EPA 1993). Studies have found that water quality in canals is negatively affected by bacteria suspected to originate from the discharge of sanitary wastes from inhabited moored vessels (IMVs) (Broward County Department of Natural Resource Protection [BCDNRP] 1994, 1995).

Wildlife and Sediments

Wildlife and sediments could also contribute to fecal coliform exceedances in each watershed. Wildlife such as birds and raccoons have direct access to a waterbody and can deposit their feces directly into the water. Wildlife also deposit coliform bacteria with their feces onto land surfaces, where they can be transported during storm events to nearby streams. Studies have shown that fecal coliform bacteria can survive and reproduce in streambed sediments and can be resuspended in surface water when conditions are right (Jamieson *et al.* 2005; Solo-Gabriele *et al.* 2000). Current source identification methodologies cannot quantify the exact amount of fecal coliform loading from wildlife and/or sediment sources.

Table 4.3a. Classification of Land Use Categories for WBIDs 3270, 3273, 3274, 3276, and 3276A in 2004–05

This is a 12-column table. Column 1 lists the Level 1 land use code, Column 2 lists the land use description, and Columns 3 through 12 list the acreage and percent acreage of various land uses in each WBID.

- = Empty cell/no data

Level 1 Code	Land Use	WBID 3270 Acreage	WBID 3270 % Acreage	WBID 3273 Acreage	WBID 3273 % Acreage	WBID 3274 Acreage	WBID 3274 % Acreage	WBID 3276 Acreage	WBID 3276 % Acreage	WBID 3276A Acreage	WBID 3276A % Acreage
1000	Urban and built-up	10,998	30.6%	4,173	31.6%	2,726	28.0%	1,647.8	29.3%	1,147	25.4%
-	Low-density residential	340	0.9%	47	0.4%	14	0.1%	155.6	2.8%	0	0.0%
-	Medium-density residential	9,198	25.6%	4,089	31.0%	3,423	35.2%	1,820.1	32.4%	2,302	50.9%
-	High-density residential	8,847	24.7%	2,983	22.6%	1,541	15.9%	1,317.3	23.4%	658	14.5%
2000	Agriculture	74	0.2%	84	0.6%	0	0.0%	0.0	0.0%	0	0.0%
3000	Rangeland	29	0.1%	24	0.2%	26	0.3%	0.0	0.0%	0	0.0%
4000	Upland forest	374	1.0%	161	1.2%	68	0.7%	23.5	0.4%	16	0.4%
5000	Water	2,746	7.7%	976	7.4%	729	7.5%	229.2	4.1%	87	1.9%
6000	Wetland	850	2.4%	31	0.2%	103	1.1%	35.1	0.6%	0	0.0%
7000	Barren land	40	0.1%	34	0.3%	11	0.1%	3.9	0.1%	0	0.0%
8000	Transportation, communication, and utilities	2,390	6.7%	586	4.4%	1,084	11.1%	388.8	6.9%	313	6.9%
-	**TOTAL**	**35,884**	**100.0%**	**13,188**	**100.0%**	**9,723**	**100.0%**	**5,621**	**100.0%**	**4,523**	**100.0%**

Table 4.3b. Classification of Land Use Categories for WBIDs 3277A, 3277C, 3277E, 3279, and 3281 in 2004–05

This is a 12-column table. Column 1 lists the Level 1 land use code, Column 2 lists the land use description, and Columns 3 through 12 list the acreage and percent acreage of various land uses in each WBID.

- = Empty cell/no data

Level 1 Code	Land Use	WBID 3277A Acreage	WBID 3277A % Acreage	WBID 3277C Acreage	WBID 3277C % Acreage	WBID 3277E Acreage	WBID 3277E % Acreage	WBID 3279 Acreage	WBID 3279 % Acreage	WBID 3281 Acreage	WBID 3281 % Acreage
1000	Urban and built-up	2,721	26.5%	1,566	28.2%	1,126	23.9%	4,641	10.2%	4,332	29.6%
-	Low-density residential	76	0.7%	1,463	26.3%	0	0.0%	11,010	24.3%	1,276	8.7%
-	Medium-density residential	3,153	30.7%	897	16.1%	910	19.3%	7,344	16.2%	3,338	22.8%
-	High-density residential	1,209	11.8%	486	8.7%	688	14.6%	3,542	7.8%	2,276	15.6%
2000	Agriculture	15	0.2%	3	0.1%	110	2.3%	2,772	6.1%	1,086	7.4%
3000	Rangeland	32	0.3%	0	0.0%	9	0.2%	1,110	2.4%	21	0.1%
4000	Upland forest	191	1.9%	76	1.4%	136	2.9%	978	2.2%	529	3.6%
5000	Water	792	7.7%	532	9.6%	459	9.7%	4,897	10.8%	987	6.7%
6000	Wetland	384	3.7%	4	0.1%	324	6.9%	5,411	11.9%	28	0.2%
7000	Barren land	7	0.1%	0	0.0%	6	0.1%	130	0.3%	0	0.0%
8000	Transportation, communication, and utilities	1,702	16.5%	527	9.5%	951	20.2%	3,533	7.8%	749	5.1%
-	**TOTAL**	**10,281**	**100.0%**	**5,555**	**100.0%**	**4,719**	**100.00%**	**45,367**	**100.00%**	**14,623**	**100.0%**

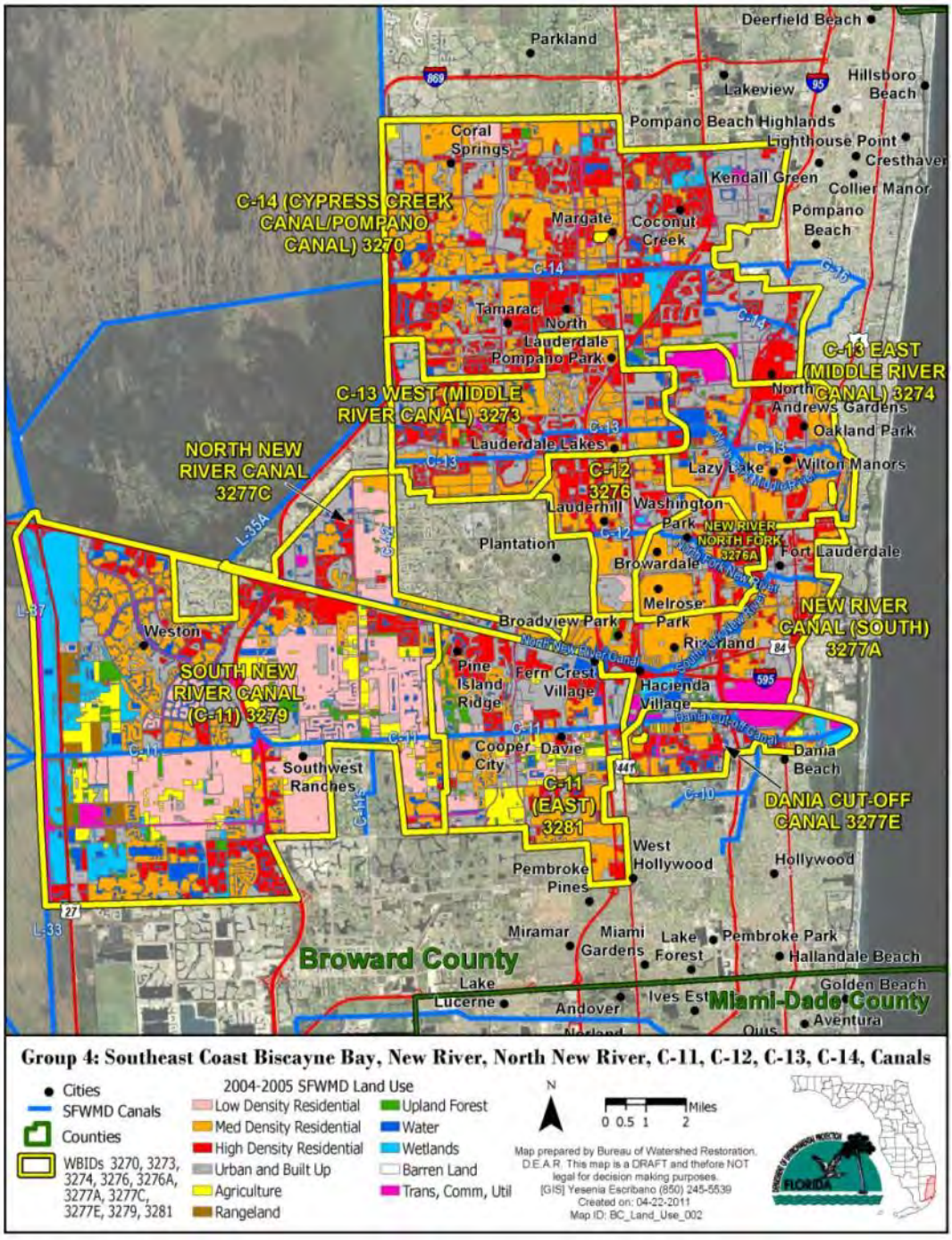

Figure 4.1. Principal Land Uses within the Boundaries of WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 in 2004–05

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

When continuous flow measurements in a watershed are available, a bacteria TMDL can be developed using the load duration curve method. Developed by the Kansas Department of Health and Environment, this method provides the allowable daily bacteria load. Flow data are available for the freshwater WBIDs (3270, 3273, 3276, 3277C, 3279 and 3281) addressed in this report. However, these systems are highly manipulated and regulated by water control structures; as a result, the flow measurements do not necessarily represent the hydrologic condition of the waterbody, which is what drives the transport of fecal coliform to the receiving waters. Therefore, the fecal coliform TMDLs for these WBIDs were developed using the "percent reduction" approach. Given that WBIDs 3274, 3276A, 3277A, and 3277E are marine waterbodies and tidally influenced, the fecal coliform TMDLs for these WBIDs were also developed using the "percent reduction" approach.

Using this method, the percent reduction needed to meet the applicable criterion is calculated based on the 90th percentile of all measured concentrations collected during the Cycle 2 verified period (January 1, 2003–June 30, 2010). Because bacteriological counts in water are not normally distributed, a nonparametric method is more appropriate for the analysis of fecal coliform data (Hunter 2002). The Hazen method, which uses a nonparametric formula, was used to determine the 90th percentile value. The percent reduction of fecal coliform needed to meet the applicable criterion was calculated as described in **Section 5.1.2**.

5.1.1 Data Used in the Determination of the TMDLs

Data used to develop these TMDLs were collected by BCDPEP, the Department (Tallahassee and Southeast Districts), the SFWMD, and the Florida Department of Health (FDOH). The Cycle 2 verified period includes data collected from January 1, 2003, through June, 30, 2010. **Table 5.1** lists the stations where fecal coliform data were collected for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281. **Figure 5.1** shows the locations of these water quality stations.

Table 5.2 summarizes the descriptive statistics for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 for the Cycle 2 verified period fecal coliform results based on IWR Run 41x.

Plots of fecal coliform data by time determined whether there was a significant increasing or decreasing trend during the period of observation (January 1, 2003–June 30, 2010) for each WBID. No significant increasing or decreasing trends were observed in WBIDs 3270 (Prob > F = 0.5911), 3273 (Prob > F=0.8652), 3274 (Prob > F=0.5106), 3276 (Prob > F=0.2117), 3276A (Prob > F=0.6629), 3277A (Prob > F=0.6914), 3277C (Prob > F=0.3034), 3277E (Prob > F=0.2866), and 3281 (Prob > F=0.1078).

Table 5.1. Stations where Water Quality Samples Were Collected for Fecal Coliform Data during the Cycle 2 Verified Period (January 1, 2003, through June 30, 2010)

This is a three-column table. Column 1 lists the WBID number, Column 2 lists the station ID, and Column 3 lists the agency collecting the data.

WBID	Station ID	Agency
3270	21FLBROW109	BCDPEP
3270	21FLBROW6	BCDPEP
3270	21FLBROW7	BCDPEP
3270	21FLBROW8	BCDPEP
3270	21FLBROW89	BCDPEP
3270	21FLGW 20029	Department (Tallahassee)
3270	21FLGW 34111	Department (Tallahassee)
3270	21FLGW 34124	Department (Tallahassee)
3270	21FLGW 34125	Department (Tallahassee)
3270	21FLGW 34128	Department (Tallahassee)
3270	21FLGW 34138	Department (Tallahassee)
3270	21FLWPB 28030504	Department (Southeast District)
3270	21FLWPB 28030507	Department (Southeast District)
3270	21FLWPB 28030508	Department (Southeast District)
3270	21FLWPB 28030509	Department (Southeast District)
3270	21FLWPB 28030593	Department (Southeast District)
3273	21FLBROW12	BCDPEP
3273	21FLBROW13	BCDPEP
3273	21FLBROW14	BCDPEP
3273	21FLGW 34121	Department (Tallahassee)
3273	21FLGW 34136	Department (Tallahassee)
3274	21FLBROW10	BCDPEP
3274	21FLBROW11	BCDPEP
3274	21FLBROW111	BCDPEP
3274	21FLBROW112	BCDPEP
3274	21FLDOH BROWARD31	FDOH
3274	21FLGW 33083	Department (Tallahassee)
3276A	21FLBROW16	BCDPEP
3276A	21FLBROW64	BCDPEP
3276	21FLBROW17	BCDPEP
3276	21FLBROW18	BCDPEP
3276	21FLGW 20027	Department (Tallahassee)
3276	21FLGW 32985	Department (Tallahassee)
3276	21FLWPB 28030526	Department (Southeast District)
3276	21FLWPB 42009011	Department (Southeast District)
3276	21FLWPB 42009012	Department (Southeast District)
3277A	21FLBROW15	BCDPEP
3277A	21FLBROW19	BCDPEP
3277A	21FLBROW20	BCDPEP
3277A	21FLBROW90	BCDPEP
3277A	21FLGW 34132	Department (Tallahassee)
3277C	21FLBROW21	BCDPEP
3277C	21FLBROW22	BCDPEP
3277C	21FLBROW23	BCDPEP
3277C	21FLGW 32963	Department (Tallahassee)
3277E	21FLBROW24	BCDPEP
3277E	21FLBROW26	BCDPEP
3277E	21FLBROW47	BCDPEP

WBID	Station ID	Agency
3279	21FLBROW28	BCDPEP
3279	21FLBROW29	BCDPEP
3279	21FLGW 17405	Department (Tallahassee)
3279	21FLGW 17413	Department (Tallahassee)
3279	21FLGW 20031	Department (Tallahassee)
3279	21FLGW 32965	Department (Tallahassee)
3279	21FLGW 34116	Department (Tallahassee)
3279	21FLGW 34123	Department (Tallahassee)
3279	21FLGW 34129	Department (Tallahassee)
3279	21FLGW 34135	Department (Tallahassee)
3279	21FLSFWMC1102.0TS	SFWMD
3279	21FLSFWMC1102.1TS	SFWMD
3279	21FLSFWMC1102.8TS	SFWMD
3279	21FLSFWMC1103.3TS	SFWMD
3279	21FLSFWMC1104.3TS	SFWMD
3279	21FLSFWMC1104.6TS	SFWMD
3279	21FLBROW27	BCDPEP
3281	21FLGW 32982	Department (Tallahassee)
3281	21FLGW 34119	Department (Tallahassee)

Table 5.2. Descriptive Statistics of Fecal Coliform Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

This is a nine-column table. Column 1 lists the WBID number, and Columns 2 through 9 list the descriptive statistic and corresponding result.

[1] Coliform counts are #/100mL.

WBID	Mean Observation[1]	Standard Deviation	Median Observation[1]	Highest Observation[1]	Lowest Observation[1]	25% Quartile[1]	75% Quartile[1]	# of Samples
3270	282	627	110	5,200	1.8	44	230	144
3273	226	424	69	2,600	1.8	30	233	70
3274	570	1,297	244	9,600	1	74	530	153
3276	570	1,484	94	7,400	6	32	385	57
3276A	1,734	2,509	630	10,000	150	400	1,600	53
3277A	675	1,342	220	6,400	7	95	480	111
3277C	288	690	98	5,800	1.8	39	288	84
3277E	823	1,752	250	9,400	1.8	5	410	67
3279	510	1,480	205	9,800	1.8	57	443	74
3281	1,415	2,383	400	9,100	44	140	1,500	30

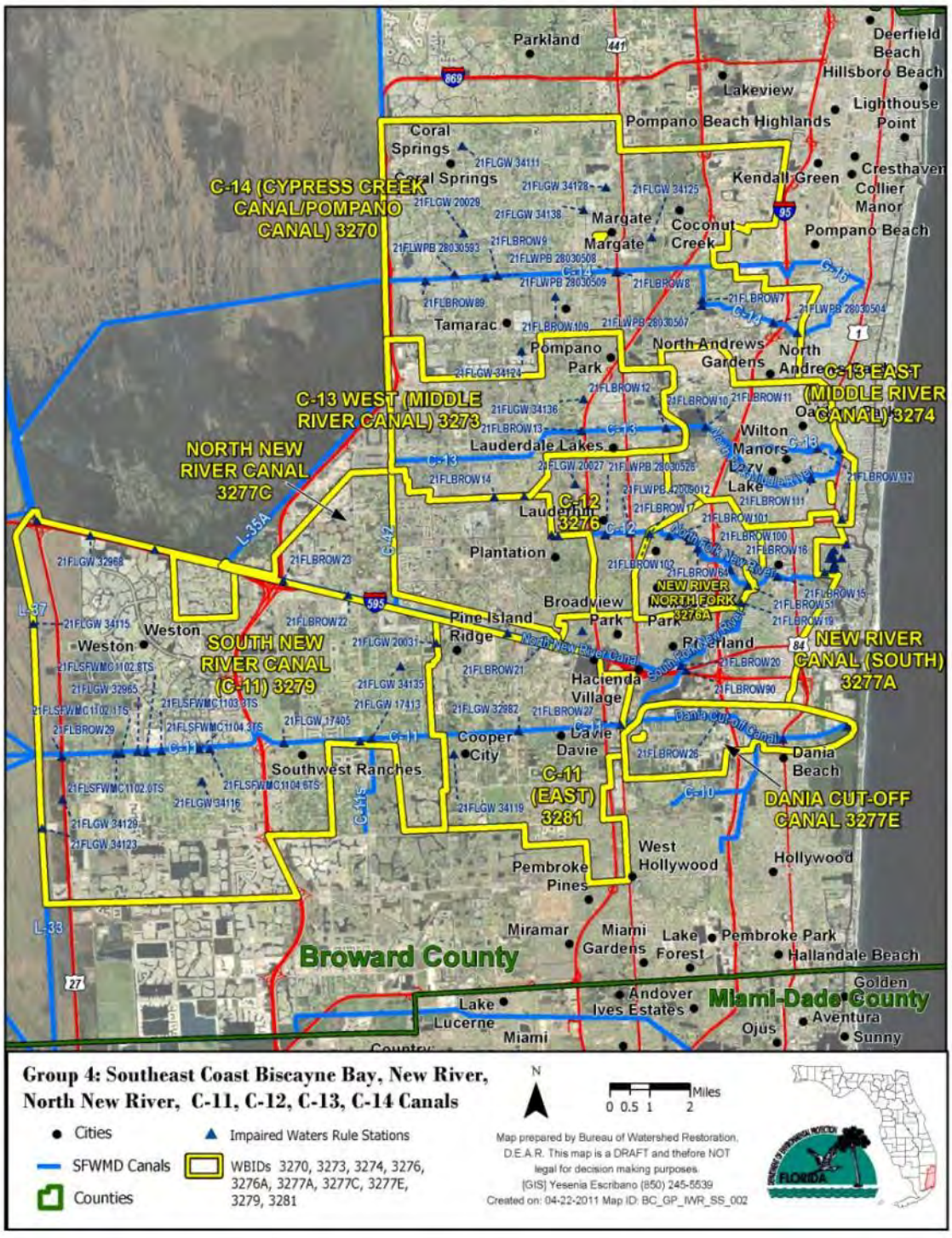

Figure 5.1. Location of Water Quality Stations with Fecal Coliform Data in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281

Although a significant increasing trend was observed in WBID 3279 (Prob < 0.05) during the Cycle 2 verified period, this statistical significance is being driven by three high values and therefore does not accurately represent a specific long-term trend, but rather, a trend driven by occasional events. If these three data points are removed from the analysis, a significant increasing trend is no longer observed.

Figures 5.2a through **5.2j** show the fecal coliform concentration values over time during the Cycle 2 verified period (January 1, 2003–June 30, 2010) observed in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281.

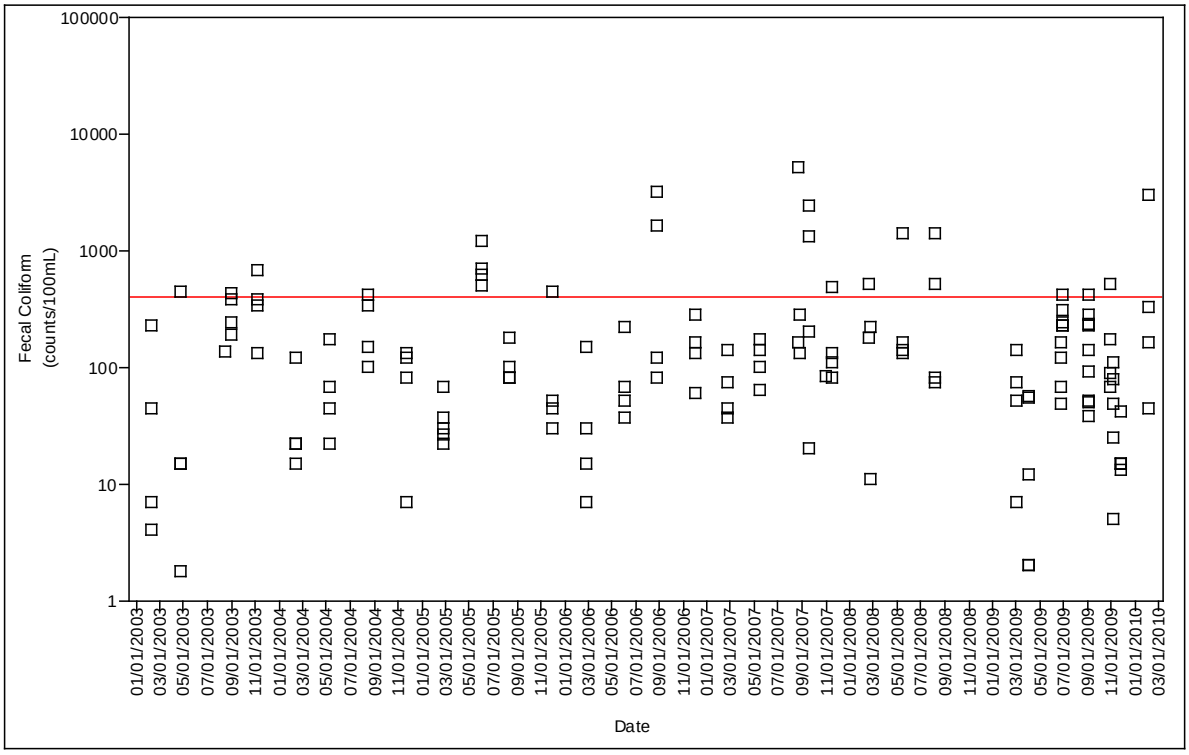

Figure 5.2a. Fecal Coliform Concentrations Over Time in the C-14 (Cypress Creek) Canal (WBID 3270) for the Cycle 2 Verified Period

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

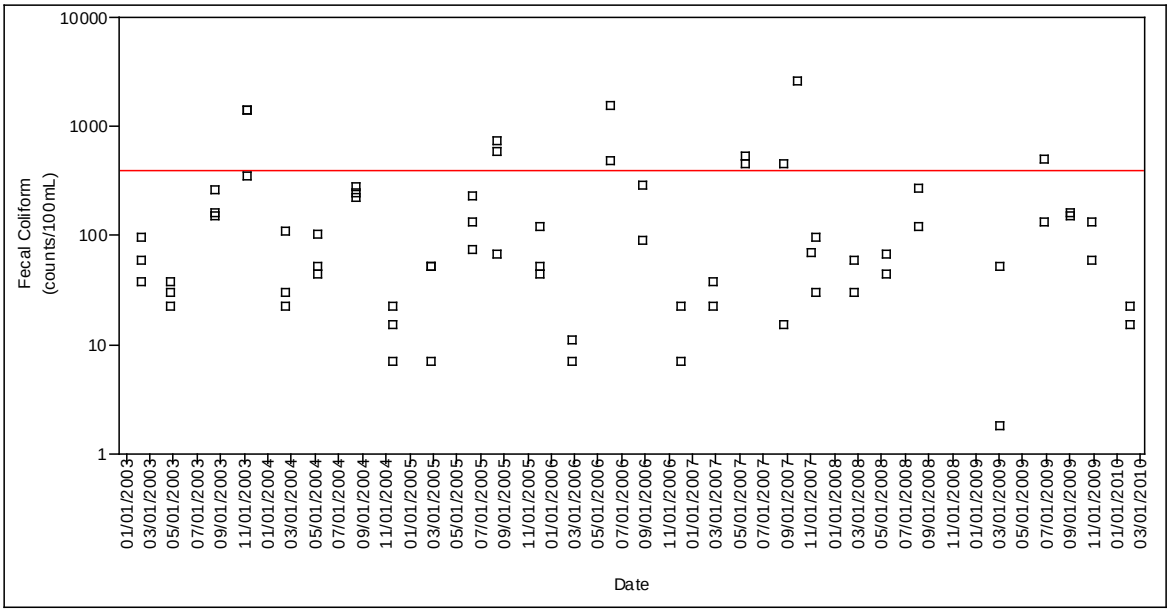

Figure 5.2b. Fecal Coliform Concentrations Over Time in the C-13 West (Middle River) Canal (WBID 3273) for the Cycle 2 Verified Period

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

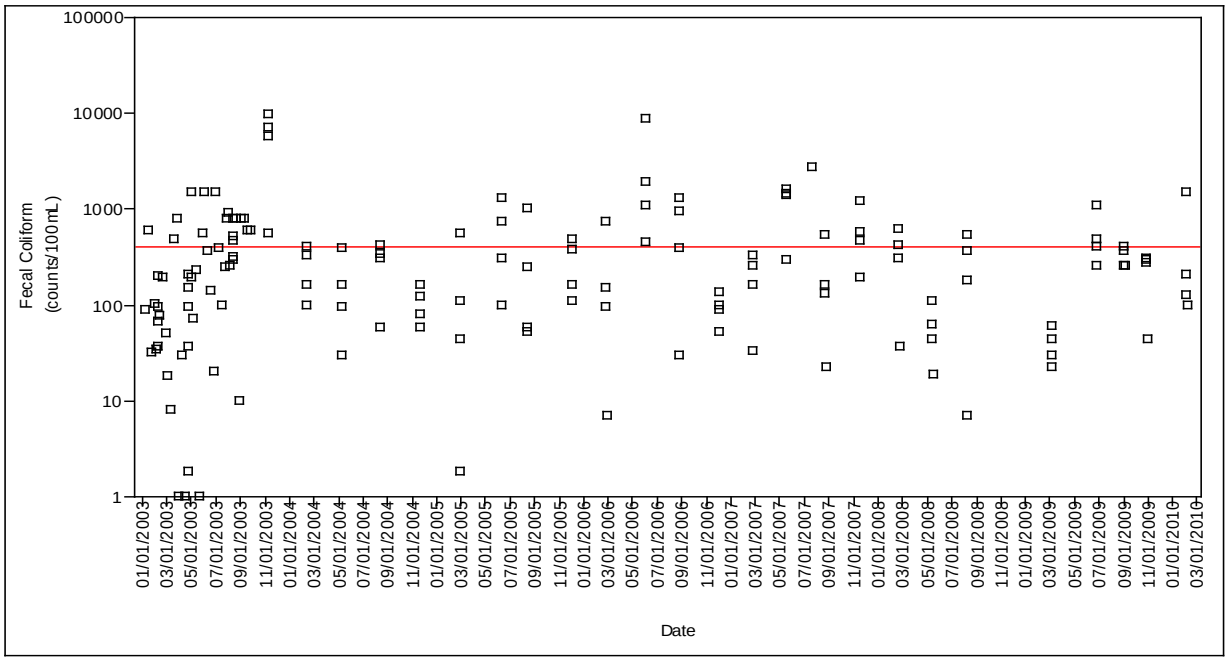

Figure 5.2c. Fecal Coliform Concentrations Over Time in the C-13 East (Middle River) Canal (WBID 3274) for the Cycle 2 Verified Period

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

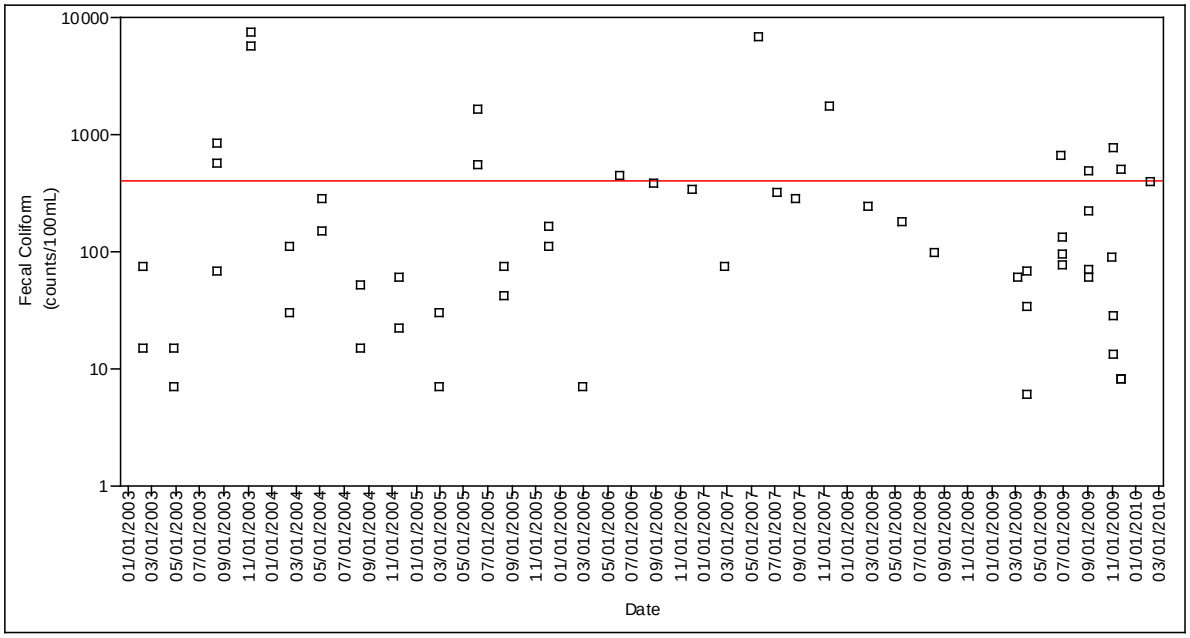

Figure 5.2d. Fecal Coliform Concentrations Over Time in the C-12 (Plantation) Canal (WBID 3276) for the Cycle 2 Verified Period

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

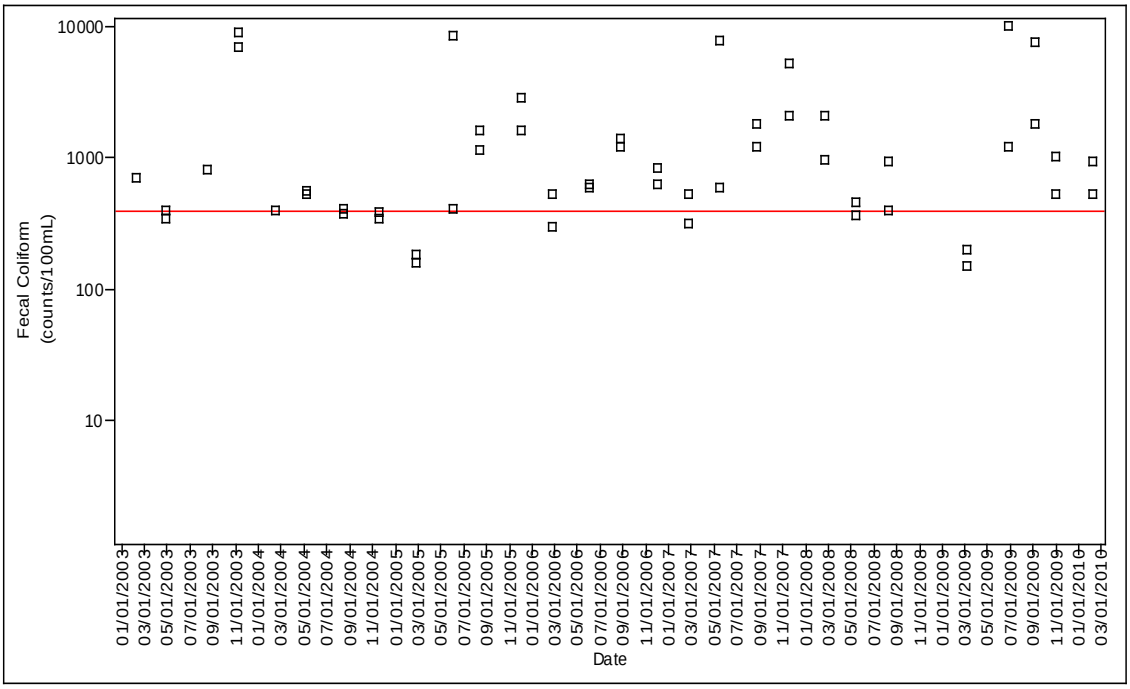

Figure 5.2e. Fecal Coliform Concentrations Over Time in the New River (North Fork) (WBID 3276A) for the Cycle 2 Verified Period

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

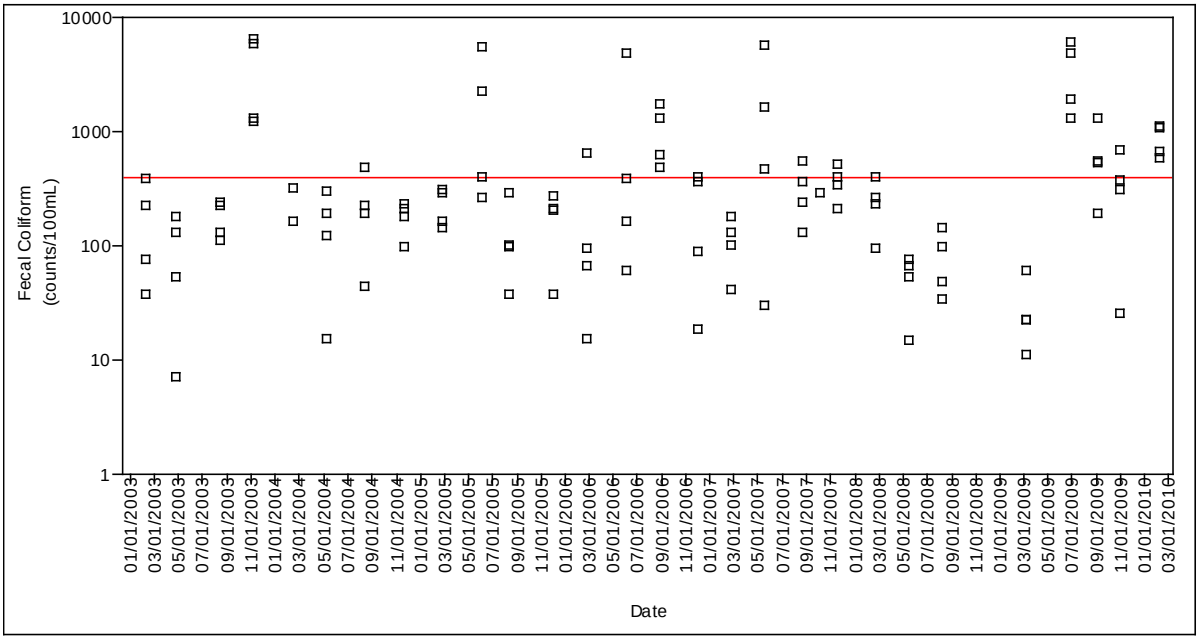

Figure 5.2f. Fecal Coliform Concentrations Over Time in the New River Canal (South) (WBID 3277A) for the Cycle 2 Verified Period

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

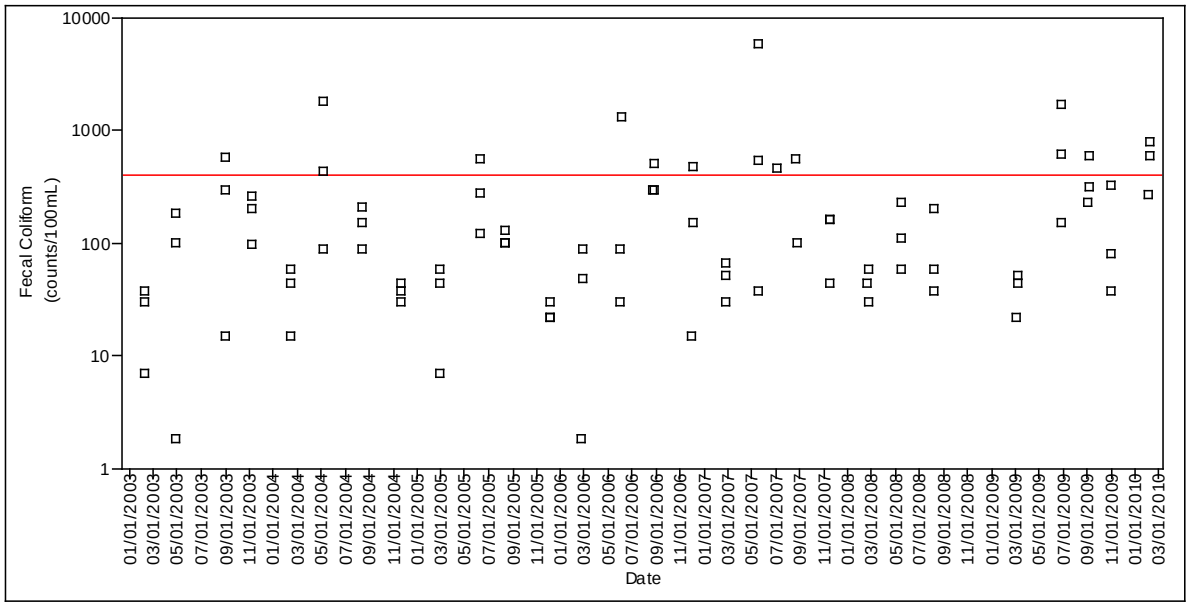

Figure 5.2g. Fecal Coliform Concentrations Over Time in the North New River Canal (WBID 3277C) for the Cycle 2 Verified Period

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

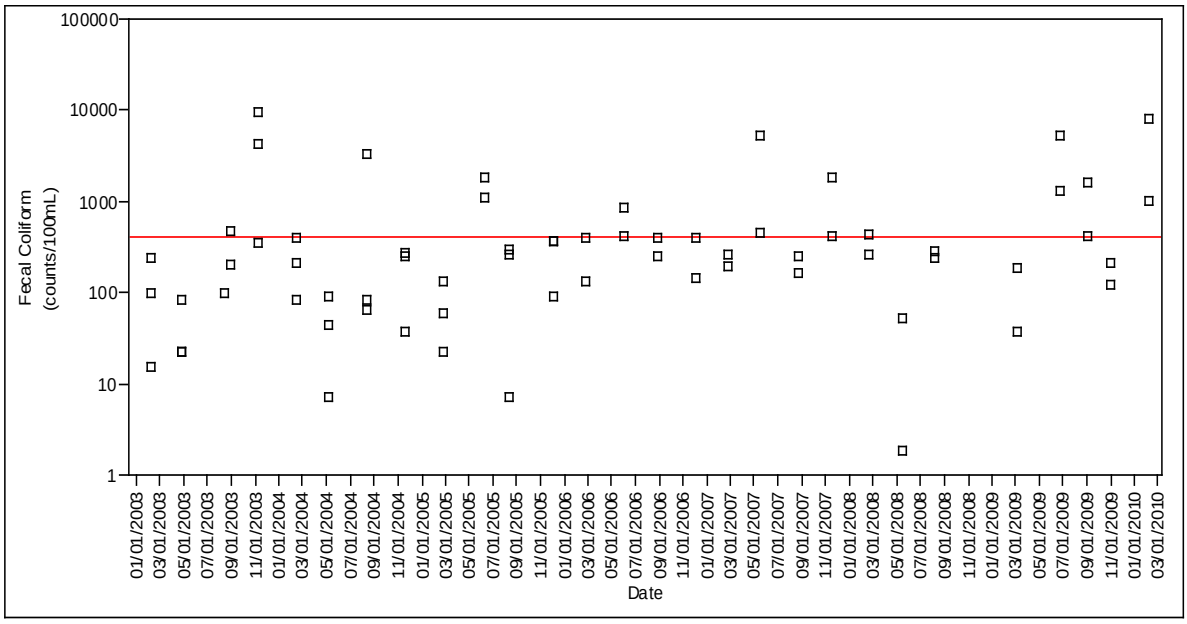

Figure 5.2h. Fecal Coliform Concentrations Over Time in the Dania Cut-off Canal (WBID 3277E) for the Cycle 2 Verified Period

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

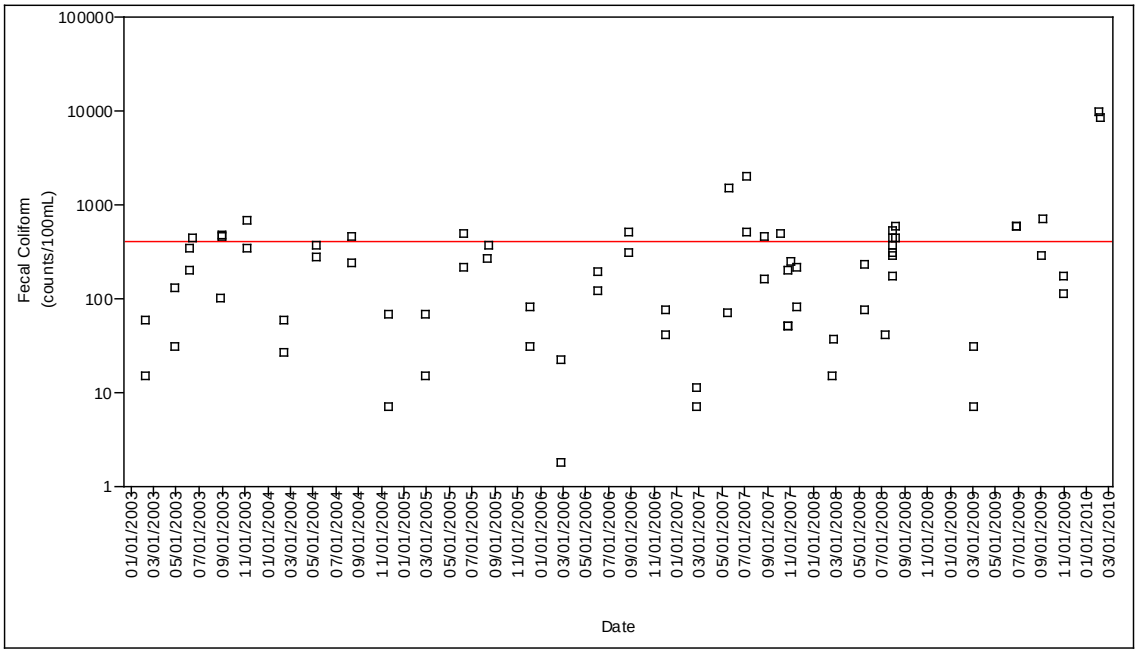

Figure 5.2i. Fecal Coliform Concentrations Over Time in the C-11 (South New River) Canal (WBID 3279) for the Cycle 2 Verified Period

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

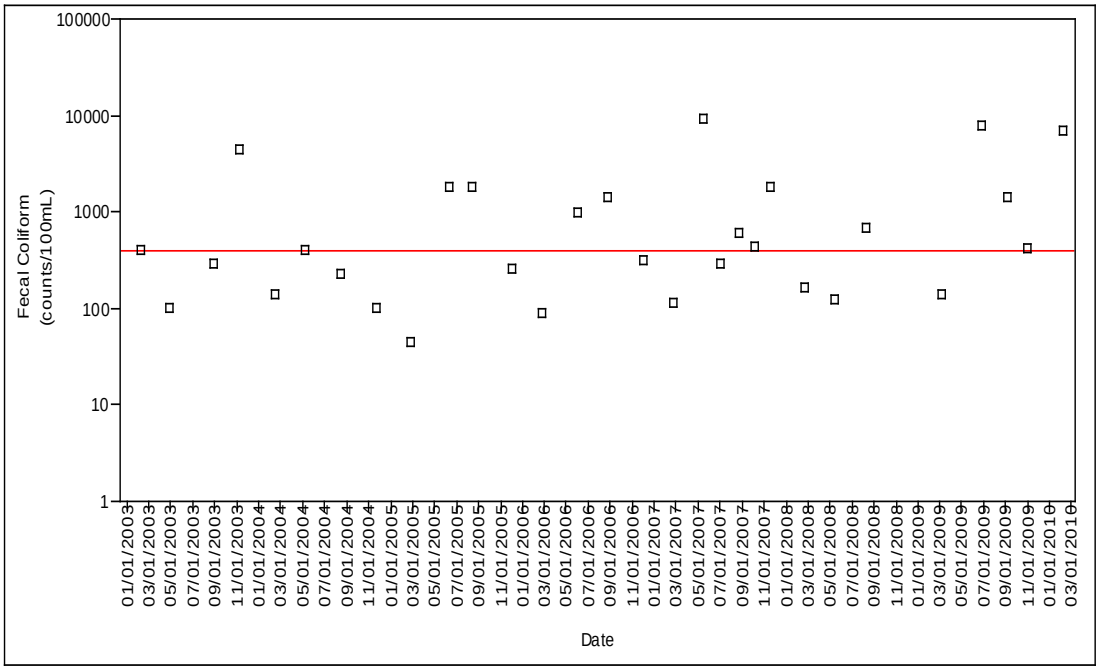

Figure 5.2j. Fecal Coliform Concentrations Over Time in the C-11 (East) Canal (WBID 3281) for the Cycle 2 Verified Period

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

Temporal Patterns

Monthly and Seasonal Trends

Seasonally, in an impaired water influenced mainly by nonpoint sources, a peak in fecal coliform concentrations and exceedance rates is commonly observed during the third quarter (summer, July–September), when conditions are rainy and warm, and lower concentrations and exceedance rates in the first and fourth quarters (winter, January–March; and fall, October–December), when conditions are drier and colder (**Tables 5.3a** through **5.3t**).

The WBIDs addressed in this report are located in an environment of extremes: dry in winter and wet in summer, with rainfall not distributed evenly either temporally or spatially (Broward County Natural Resources Planning and Management Division [BCNRPMD] 2009). In addition, rainfall variability from year to year is high, resulting in periodic droughts and floods (BCNRPMD 2009). The area is characterized by a subtropical climate where the annual average rainfall is between 45 and 60 inches, with three-fourths of rainfall occurring between May and November (BCNRPMD 2009), and an average annual temperature in Broward County of 74.4°F, with a mean winter temperature of 66.5°F and a mean summer temperature of 84.2°F (Broward County Planning and Redevelopment Division [BCPRD] 2003). Rainy and warm conditions occur throughout most of the year.

C-14 (Cypress Creek) Canal (WBID 3270)

The highest quarterly exceedance rate and highest quarterly average fecal coliform concentration were observed during the rainy and warmer season (26.3% and 555.8 counts/100mL, respectively). The lowest exceedance rate (5.3%) was observed during the first quarter, the cooler and drier season. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10). Except for March, fecal coliform exceedances were observed in the C-14 Canal in all the other months in which measured fecal coliform concentrations were available. The highest monthly average fecal coliform concentration (980 counts/100mL) was observed in September.

Tables 5.3a and **5.3b** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3a. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3270 by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	29	4	3,000	44	193	2	6.9%
March	9	2	140	52	44	0	0%
April	4	1.8	440	15	118	1	25%
May	14	22	1,400	115	193	1	7.1%
June	15	48	1,200	230	342	5	33.3%
July	0	-	-	-	-	-	-
August	34	38	5,200	170	506	8	23.5%
September	4	20	2,400	750	980	2	50%
October	5	67	520	89	186	1	20%
November	30	5	670	81	141	3	10%
December	0	-	-	-	-	-	-

Table 5.3b. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3270 by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	38	2	3,000	44	158	2	5.3%
Quarter 2	33	1.8	1,400	140	251	7	21.2%
Quarter 3	38	20	5,200	185	556	10	26.3%
Quarter 4	35	5	670	84	147	4	11.4%

C-13 West (Middle River) Canal (WBID 3273)

The highest quarterly exceedance rate (29.4%) was observed in the second quarter, and the highest quarterly average fecal coliform concentration (380.1 counts/100mL) was observed during the third quarter. No exceedances were observed during the cooler and drier months. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10), with the highest concentration (2,600 counts/100mL) observed in September.

Tables 5.3c and **5.3d** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3c. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3273 by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	17	7	110	30	39	0	0.0%
March	2	1.8	52	26.9	27	0	0.0%
April	3	22	37	30	30	0	0.0%
May	7	44	530	67	184	2	28.6%
June	7	74	1,550	230	441	3	42.9%
July	0	-	-	-	-	-	-
August	17	15	730	220	250	3	17.6%
September	1	2,600	2,600	2,600	2,600	1	100%
October	3	59	130	70	86	0	0%
November	10	7	1,400	26	335	2	20.0%
December	3	44	120	52	72	0	0%

Table 5.3d. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3273 by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	19	1.8	110	30	38	0	0.0%
Quarter 2	17	22	1,550	100	262	5	29.4%
Quarter 3	18	15	2,600	230	380	4	22.2%
Quarter 4	16	7	1,400	55.5	239	2	12.5%

C-13 East (Middle River) Canal (WBID 3274)

Quarterly exceedance rates were observed in all four quarters, with the highest quarterly exceedance rate (42.9%) observed in the rainy, warmer season and the highest quarterly average fecal coliform concentration (1,184.4 counts/100mL) observed in the fourth quarter. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10). Except for October, exceedances were observed year-round, with the highest exceedance rate (80%) observed in September. The highest monthly average fecal coliform concentration (1,648.8 counts/100mL) was observed in November.

Tables 5.3e and **5.3f** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3e. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3274 by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	4	32	600	95	206	1	25%
February	32	1.8	1,500	137.5	236	6	18.8%
March	9	1	800	30	163	2	22.2%
April	9	1	1500	96	246	1	11.1%
May	16	1	1,600	135	407	4	25.0%
June	17	20	8,800	490	1,204	10	58.8%
July	6	98	2,700	598	856	3	50%
August	31	7	1,300	320	373	11	35.5%
September	5	260	800	600	612	4	80%
October	4	44	310	280	229	0	0%
November	16	52	9,600	177.5	1,649	7	43.8%
December	4	110	480	270	283	1	25%

Table 5.3f. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3274 by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	45	1	1,500	100	219	9	20.0%
Quarter 2	42	1	8,800	247	695	15	35.7%
Quarter 3	42	7	2,700	367.5	471	18	42.9%
Quarter 4	24	44	9,600	232.5	1,184	8	33.3%

C-12 (Plantation) Canal (WBID 3276)

Elevated quarterly average fecal coliform concentrations and high exceedance rates were observed during the second quarter (38.5% and 843.3 counts/100mL, respectively) and fourth quarter (33.3% and 1,120.1 counts/100mL, respectively). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10), with the highest monthly average fecal coliform concentration (1,570 counts/100mL) observed in May.

Tables 5.3g and **5.3h** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3g. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276 by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	10	7	390	52	98	0	0.0%
March	4	6	68	46.5	42	0	0.0%
April	2	7	15	11	11	0	0.0%
May	5	150	6,800	280	1,570	2	40.0%
June	6	76	1,600	335.5	515	3	50.0%
July	1	320	320	320	320	0	0.0%
August	13	15	830	74	212	2	15.4%
September	1	490	490	490	490	1	100.0%
October	1	89	89	89	89	0	0.0%
November	14	8	7,400	135	1,194	5	35.7%
December	0	-	-	-	-	-	-

Table 5.3h. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276 by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	14	6	390	46.5	82	0	0.0%
Quarter 2	13	7	6,800	180	843	5	38.5%
Quarter 3	15	15	830	96	238	3	20.0%
Quarter 4	15	8	7,400	110	1,120	5	33.3%

New River (North Fork) (WBID 3276A)

Elevated fecal coliform concentrations and high exceedance rates (50% and greater) were observed during every quarter. The highest quarterly average fecal coliform concentration (2,587.5 counts/100mL) was recorded during the fourth quarter. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10). Excluding March and April, high exceedance rates and fecal coliform concentrations were observed during every month (no samples were collected in January, July, or December); with all monthly exceedance rates greater than 50%. The highest monthly average fecal coliform concentration (5,002.5 counts/100mL) was observed in June.

Tables 5.3i and **5.3j** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3i. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276A by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	12	160	2,100	520	634	7	58.3%
March	2	150	200	175	175	0	0%
April	2	340	390	365	365	0	0%
May	8	360	7,800	570	1,439	7	87.5%
June	4	410	10,000	4,800	5,003	4	100.0%
July	0	-	-	-	-	-	-
August	11	370	1,800	1,150	1024	9	81.8%
September	2	1,800	7,600	4,700	4,700	2	100%
October	2	530	1,000	765	765	2	100%
November	10	340	8,800	1,850	2,952	8	80%
December	0	-	-	-	-	-	-

Table 5.3j. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3276A by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	14	150	2,100	460	569	7	50.0%
Quarter 2	14	340	10,000	570	2,304	11	78.6%
Quarter 3	13	370	7,600	1,200	1,589	11	84.6%
Quarter 4	12	340	8,800	1,300	2,588	10	83.3%

New River Canal (South) (WBID 3277A)

The highest quarterly average fecal coliform concentration and the highest exceedance rate (1,305 counts/100mL and 35.7%, respectively) were observed during the second quarter. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10), with the highest monthly average fecal coliform concentration in the WBID (2,781.3 counts/100mL) observed in June.

Tables 5.3k and **5.3l** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3k. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277A by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	26	15	1,100	200	298	5	19.2%
March	4	11	59	22	29	0	0%
April	4	7	180	91	92	0	0%
May	16	14.5	5,600	140	870	4	25.0%
June	8	260	6,000	2,050	2,781	6	75.0%
July	0	-	-	-	-	-	-
August	24	33.5	1,700	205	326	6	25.0%
September	4	190	1,300	540	643	3	75%
October	5	25.5	680	310	335	1	20%
November	20	18.5	6,400	250	922	5	25%
December	0	-	-	-	-	-	-

Table 5.3l. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277A by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	30	11	1,100	160	262	5	16.7%
Quarter 2	28	7	6,000	225	1,305	10	35.7%
Quarter 3	28	33.5	1,700	205	326	6	25.0%
Quarter 4	25	18.5	6,400	310	782	9	31.0%

North New River Canal (WBID 3277C)

Exceedances were observed during every quarter, with the highest quarterly exceedance rate and elevated quarterly average fecal coliform concentration observed during the second quarter (38.1% and 676 counts/100mL, respectively). Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10), with elevated fecal coliform concentrations and exceedances observed in all months except March, April, October, and December (no samples were collected in January). The highest monthly average fecal coliform concentration (836.7 counts/100mL) was observed in May.

Tables 5.3m and **5.3n** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3m. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277C by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	21	1.8	800	44	114	2	9.5%
March	3	22	52	44	39	0	0%
April	3	1.8	180	100	94	0	0%
May	11	30	5800	110	837	4	36.4%
June	7	120	1700	550	673	4	57.1%
July	1	460	460	460	460	1	100%
August	17	15	580	150	217	3	17.6%
September	3	230	590	310	377	1	33.3%
October	3	37	320	81	146	0	0%
November	12	15	470	123	139	1	8.3%
December	3	22	30	22	25	0	0%

Table 5.3n. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277C by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	24	1.8	800	44	105	2	8.3%
Quarter 2	21	1.8	5,800	180	676	8	38.1%
Quarter 3	21	15	590	210	251	5	23.8%
Quarter 4	18	15	470	62.5	121	1	5.6%

Dania Cut-off Canal (WBID 3277E)

Elevated fecal coliform concentrations and high exceedance rates were observed during every quarter, with the highest quarterly average fecal coliform concentration (1,225.7 counts/100mL) observed during the fourth quarter, and the highest exceedance rate (43.8%) observed during the second quarter. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10), with the highest monthly average fecal coliform concentration (1,771.7 counts/100mL) observed in June. No samples were collected in January or July.

Tables 5.3o and **5.3p** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3o. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277E by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	17	15	7,800	210	688	3	17.6%
March	2	37	180	108.5	109	0	0%
April	3	22	81	22	42	0	0%
May	7	1.8	5,200	52	835	2	28.6%
June	6	400	5,200	1,200	1,772	5	83.3%
July	0	-	-	-	-	-	-
August	15	7	3,200	250	415	2	13.3%
September	2	410	1,600	1,005	1,005	2	100%
October	2	120	210	165	165	0	0%
November	10	37	9,400	370	1,725	4	40%
December	3	89	360	360	270	0	0%

Table 5.3p. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3277E by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	19	15	7,800	190	627	3	15.8%
Quarter 2	16	1.8	5,200	244.5	1,037	7	43.8%
Quarter 3	17	7	3,200	250	485	4	23.5%
Quarter 4	15	37	9,400	350	1,226	4	26.7%

C-11 (South New River) Canal (WBID 3279)

Elevated fecal coliform concentrations and exceedance rates were observed during every quarter, with the highest quarterly exceedance rate (50%) observed during the third quarter and the highest quarterly average fecal coliform concentration (1,160.7 counts/100mL) observed during the first quarter. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10). Excluding March, April, and December, exceedances in fecal coliform concentrations were observed during every month, with monthly exceedance rates ranging between 12.5 % and 53.8%. The highest monthly average fecal coliform concentration (1,323.9 counts/100mL) was observed in February. No samples were collected in January.

Tables 5.3q and **5.3r** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3q. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3279 by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	14	1.8	9,800	24	1,324	2	14.3%
March	2	7	30	18.5	19	0	0.0%
April	2	30	130	80	80	0	0.0%
May	7	70	1,500	230	376	1	14.3%
June	8	190	590	390	380	4	50.0%
July	9	41	2,000	360	514	4	44.4%
August	13	100	580	430	369	7	53.8%
September	2	280	700	490	490	1	50.0%
October	7	50	490	170	189	1	14.3%
November	8	7	670	77.5	186	1	12.5%
December	2	30	81	55.5	56	0	0.0%

Table 5.3r. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3279 by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	16	1.8	9,800	24	1,161	2	12.5%
Quarter 2	17	30	1,500	230	343	5	29.4%
Quarter 3	24	41	2,000	400	433	12	50.0%
Quarter 4	17	7	670	81	172	2	11.8%

C-11 (East) Canal (WBID 3281)

Elevated fecal coliform concentrations and exceedance rates were observed during every quarter, with exceedance rates greater than 50% during the second, third and fourth quarters (57.1%, 62.5%, and 57.1%, respectively). The highest quarterly average fecal coliform concentration (2,867.6 counts/100mL) was observed during the second quarter. Episodic exceedances in fecal coliform concentrations occurred throughout the period of observation (2003–10). Excluding March, April, July, and December, exceedances in fecal coliform concentrations were observed during every month, with all monthly exceedance rates ranging between 14.3% and 100%. The highest monthly average fecal coliform concentration (3,450 counts/100mL) was observed in June. No samples were collected in January.

Tables 5.3s and **5.3t** summarize the monthly and seasonal fecal coliform averages and percent exceedances, respectively, for data collected for the Cycle 2 verified period for this WBID.

Table 5.3s. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3281 by Month during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	0	-	-	-	-	-	-
February	7	44	6,950	140	1,128	1	14.3%
March	1	140	140	140	140	0	0%
April	1	100	100	100	100	0	0%
May	3	123	9,100	400	3,208	1	33.3%
June	3	950	7,600	1,800	3,450	3	100%
July	1	280	280	280	280	0	0%
August	6	220	1,800	627.5	828	4	66.7%
September	1	1,400	1,400	1,400	1,400	1	100%
October	2	420	430	425	425	2	100%
November	4	100	4,400	1,052.5	1,651	2	50%
December	1	250	250	250	250	0	0%

Table 5.3t. Summary Statistics of Fecal Coliform Data for All Stations in WBID 3281 by Season during the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Quarter 1	8	44	6,950	140	1,004	1	12.5%
Quarter 2	7	100	9,100	950	2,868	4	57.1%
Quarter 3	8	220	1,800	627.5	831	5	62.5%
Quarter 4	7	100	4,400	420	1,101	4	57.1%

Rainfall Patterns

Using rainfall data collected at various SFWMD rainfall stations available on the SFWMD's DBHYDRO Database (available: http://www.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_menu) (**Table 5.4**), it was possible to compare monthly rainfall with monthly fecal coliform exceedance rates, as well as average quarterly rainfall with average quarterly fecal coliform exceedance rates at all stations (**Figures 5.3a** through **5.3t**).

Table 5.4. SFWMD Rainfall Stations Used To Determine Monthly and Quarterly Rainfall Data for Each WBID

This is a two-column table. Column 1 lists the WBID, and Column 2 lists the SFWMD rainfall stations.

WBID	SFWMD Rainfall Station
3270	S37B_R
3273	S37B_R
3274	S36_R
3276	S125_R
3276A	S33_R
3277A	G54_R
3277C	S125_R
3277E	S13_R
3279	SBDD
3281	FT. LAUD_R

C-14 (Cypress Creek) Canal (WBID 3270)

During the Cycle 2 verified period, monthly exceedances were recorded in WBID 3270 during drier and wetter periods (**Figure 5.3a**); however, quarterly exceedances were recorded only during wetter months. The fact that exceedances occur after periods of rain indicates that high rainfall negatively affects water quality in the watershed (**Figure 5.3b**).

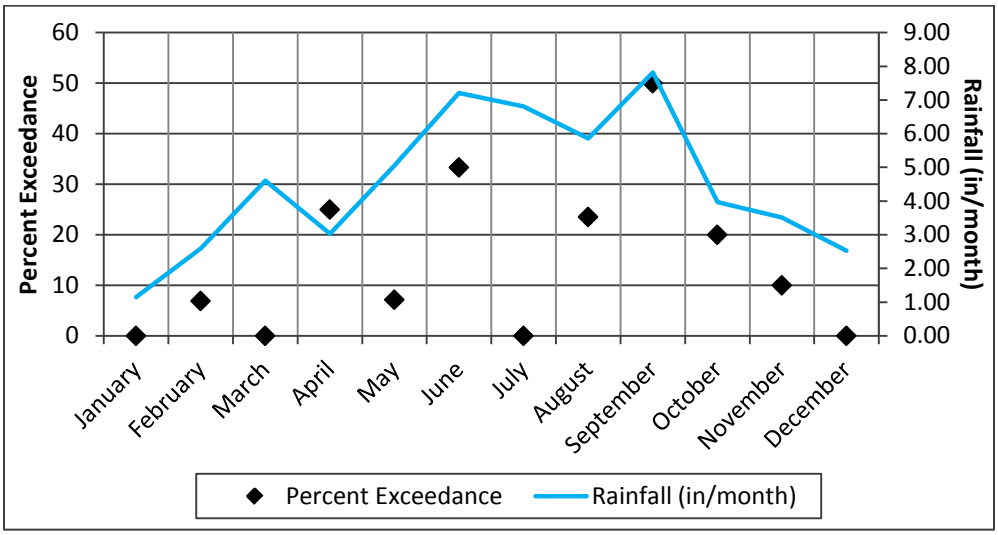

Figure 5.3a. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3270 by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

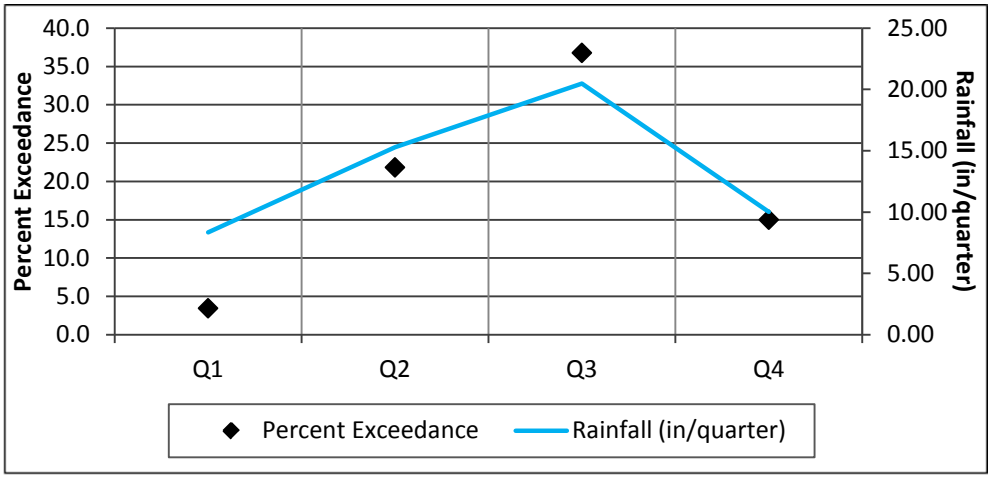

Figure 5.3b. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3270 by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

C-13 West (Middle River) Canal (WBID 3273)

The impact of rainfall on monthly and quarterly exceedances in WBID 3273 is inconclusive, as during the Cycle 2 verified period, both monthly exceedance and nonexceedances were recorded during wetter months (**Figures 5.3c**). Quarterly exceedances were recorded only during the last three quarters of the year; all three exceedances coincide with wetter months (**Figure 5.3d**). The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

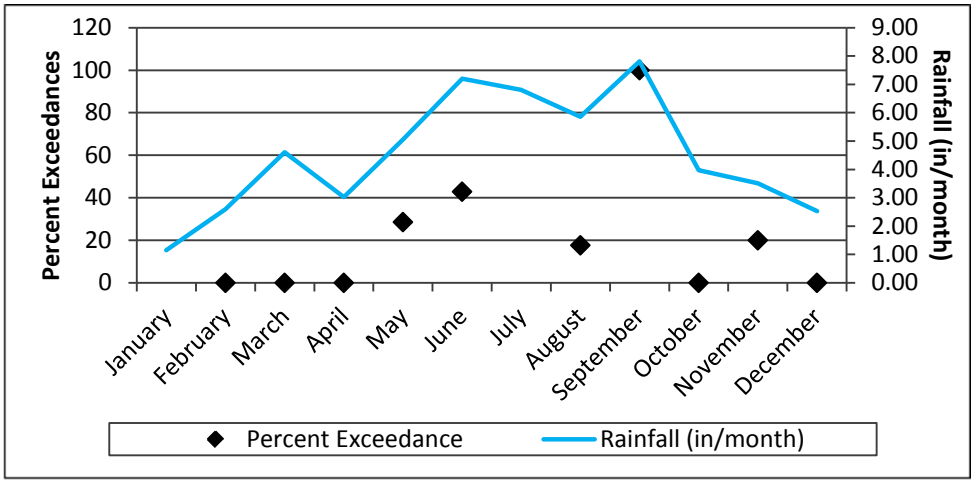

Figure 5.3c. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3273 by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

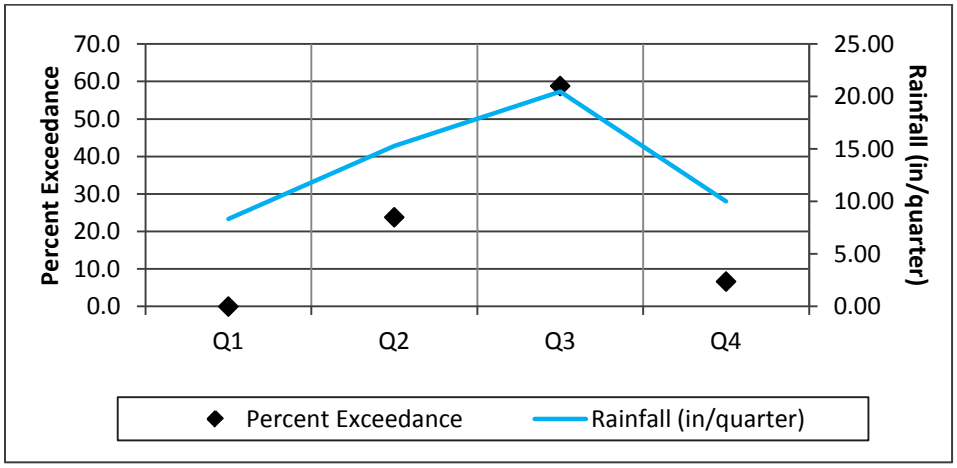

Figure 5.3d. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3273 by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

C-13 East (Middle River) Canal (WBID 3274)

The impact of rainfall on monthly and quarterly exceedances in WBID 3274 is more distinct. Except for a couple of instances, during the Cycle 2 verified period, higher monthly exceedance rates occurred mostly in wetter months (**Figure 5.3e**). A similar trend was observed with quarterly exceedance rates. Exceedance rates appear to be positively correlated with the quarterly rainfall amount (**Figure 5.3f**). The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

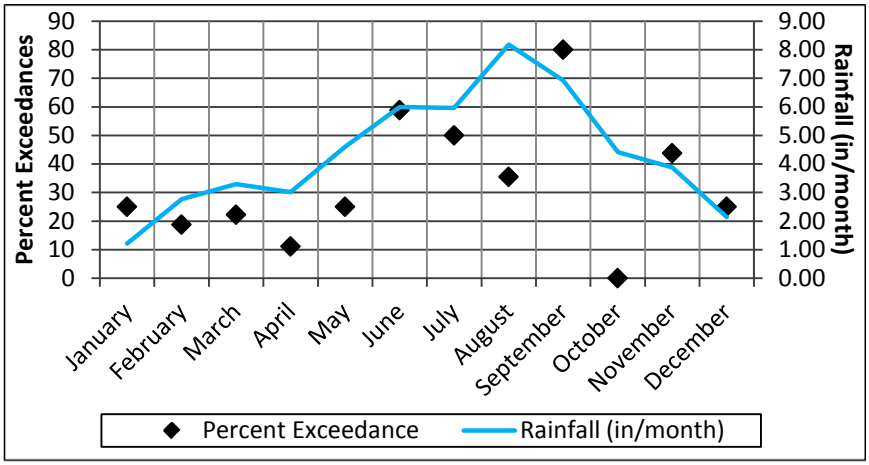

Figure 5.3e. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3274 by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

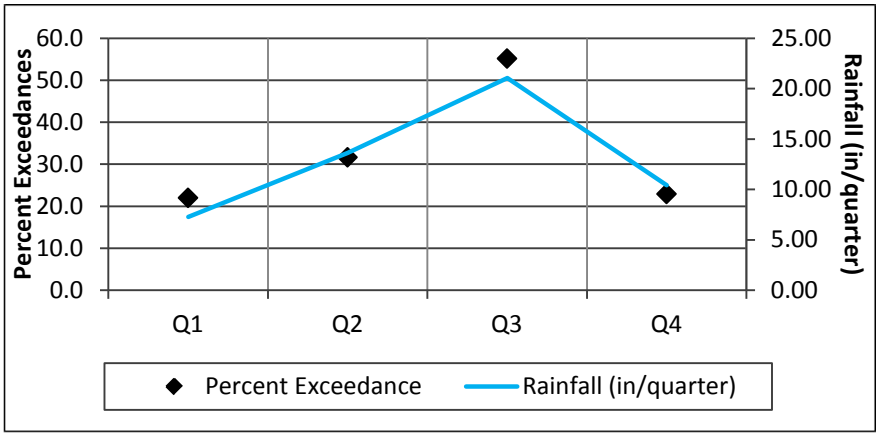

Figure 5.3f. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3274 by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

C-12 (WBID 3276)

The impact of rainfall on monthly and quarterly exceedances in WBID 3276 is inconclusive, as during the Cycle 2 verified period, monthly exceedance rates do not appear to be correlated with monthly rainfall (**Figures 5.3g**). However, higher exceedance rates were mostly observed during the wetter months. Quarterly exceedance rates were higher during the last three quarters, which are wetter quarters of the year (**Figure 5.3h**). The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

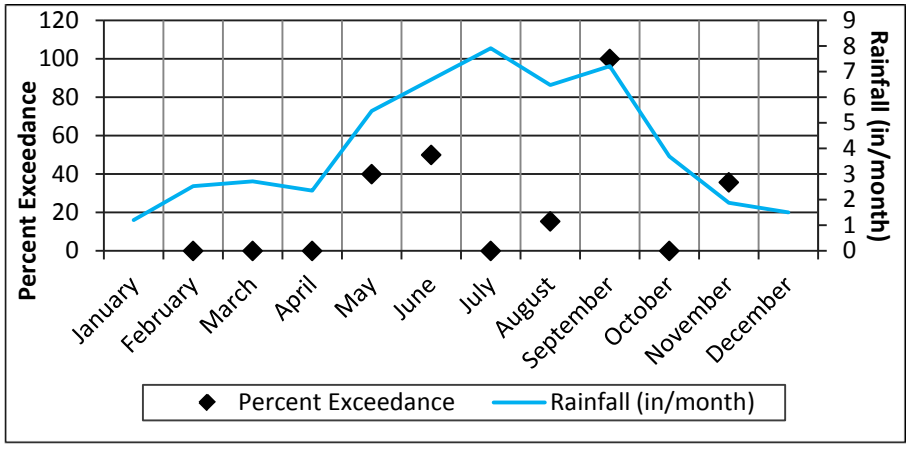

Figure 5.3g. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276 by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

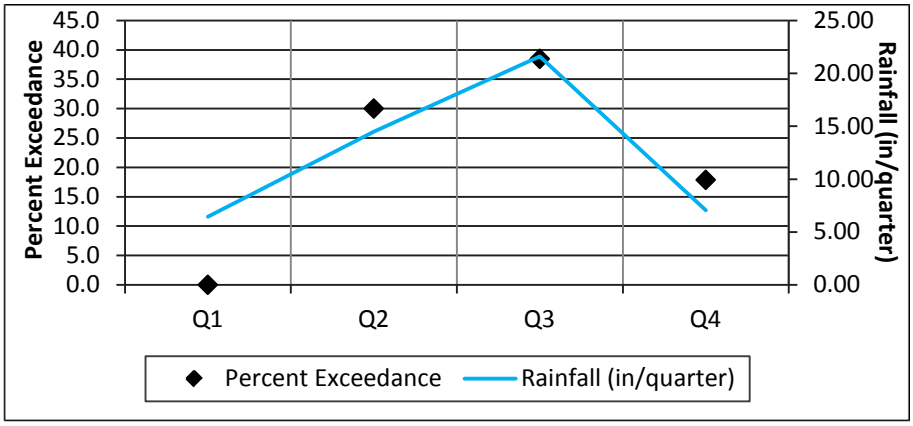

Figure 5.3h. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276 by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

New River (North Fork) (WBID 3276A)

Except for March and April, exceedances were observed in all the other months during which fecal samples were collected. In general, during the Cycle 2 verified period, higher monthly exceedance rates occurred during wetter months (**Figure 5.3i**). Quarterly exceedance rates also generally correlated with quarterly rainfall (**Figure 5.3j**). The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

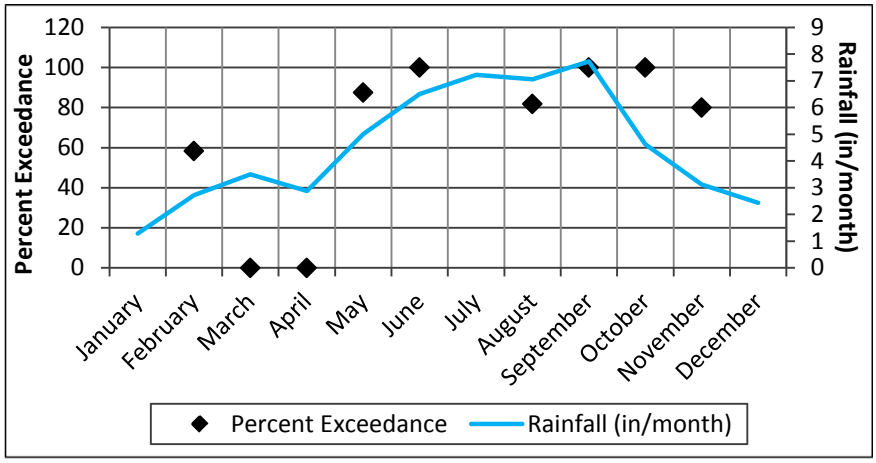

Figure 5.3i. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276A by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

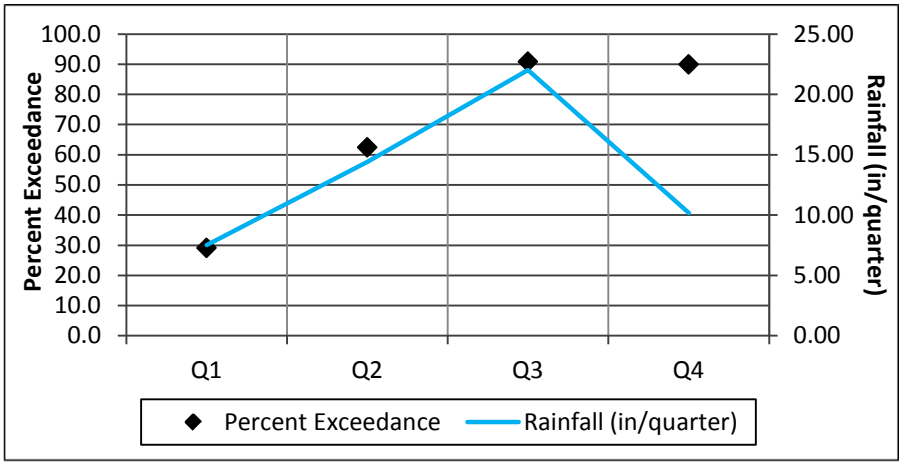

Figure 5.3j. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3276A by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

New River Canal (South) (WBID 3277A)

Although there is no strong correlation between monthly exceedance rate and monthly total rainfall, high exceedance rates (above 70%) were observed during the wettest months (**Figure 5.3k**). Quarterly exceedance rates generally follow the trend of rainfall, except for the third quarter, when the quarterly exceedance rate dropped during the wettest quarter (**Figure 5.3l**). It should be noted that the third-quarter exceedance rate was calculated based on one sample collected in August that may not represent the average condition for the whole quarter. The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

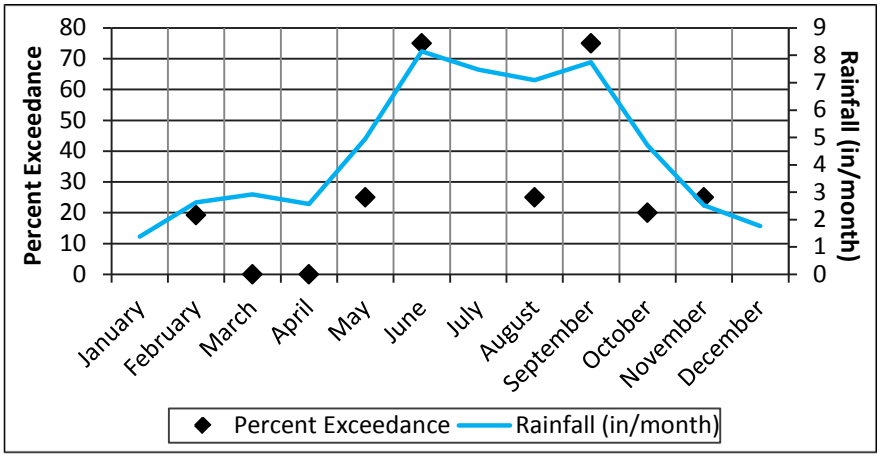

Figure 5.3k. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277A by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

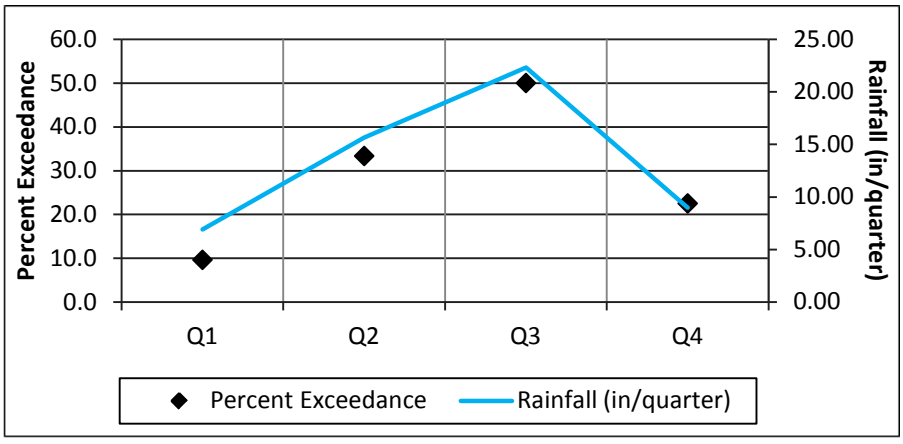

Figure 5.3l. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277A by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

North New River Canal (WBID 3277C)

Monthly exceedance rates show a general positive correlation with monthly rainfall (**Figure 5.3m**). A similar trend was also observed between quarterly rainfall and quarterly exceedance rates (**Figure 5.3n**). The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

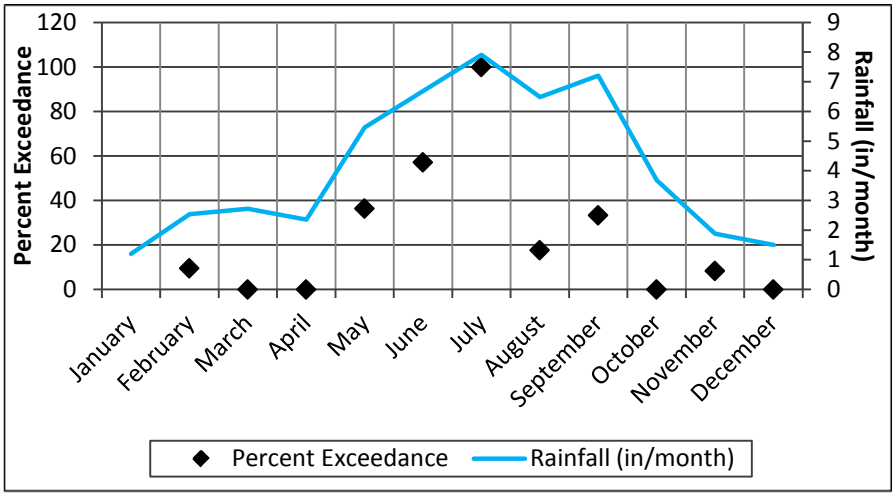

Figure 5.3m. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277C by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

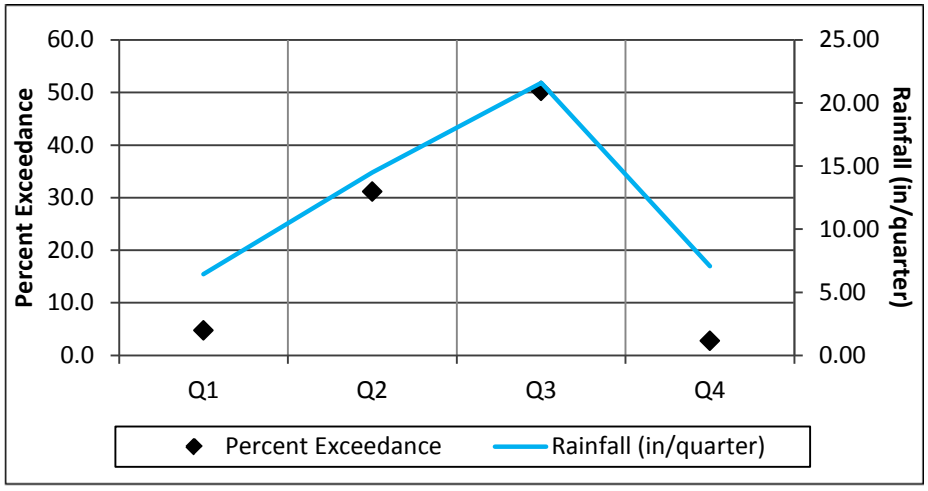

Figure 5.3n. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277C by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

Dania Cut-off Canal (WBID 3277E)

Although there is no strong correlation between the monthly exceedance rate and monthly total rainfall, high exceedance rates (above 80%) were observed during the wettest months (**Figure 5.3o**). Exceedance rates generally follow the rainfall pattern on a quarterly basis (**Figure 5.3p**). The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

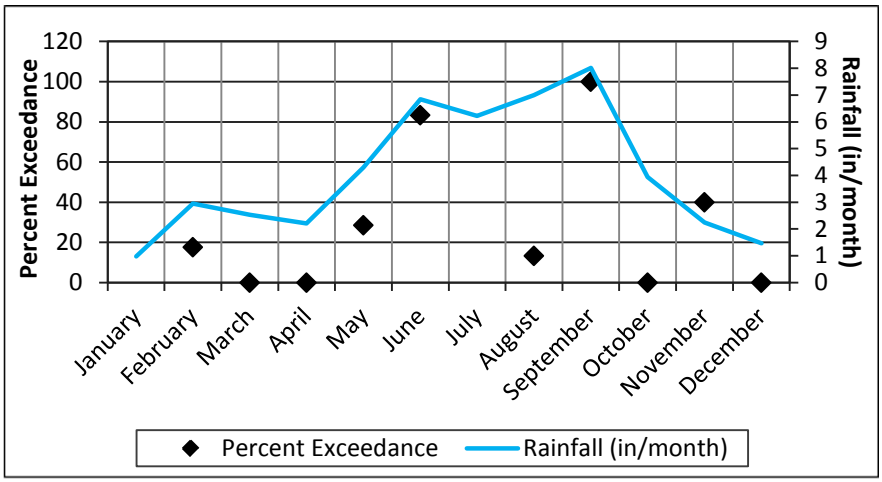

Figure 5.3o. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277E by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

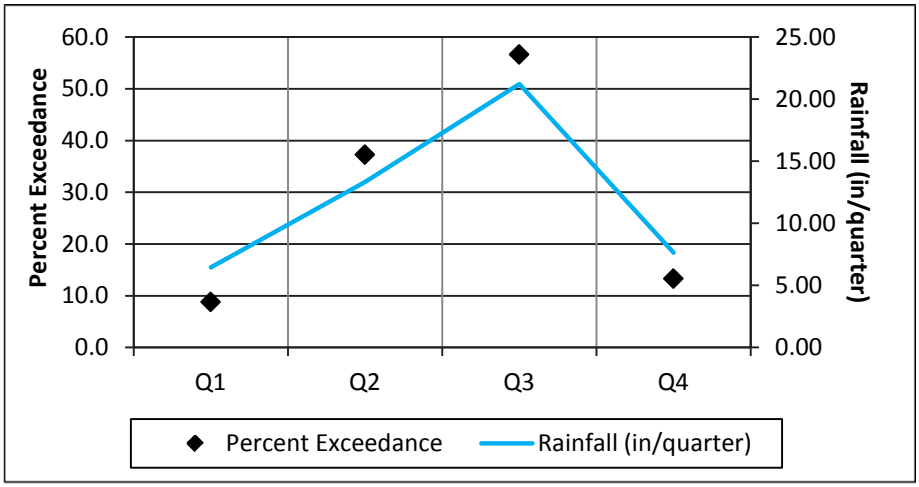

Figure 5.3p. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3277E by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

C-11 (South New River) Canal (WBID 3279)

The impact of rainfall on monthly and quarterly exceedances in WBID 3279 is distinct. In general, during the Cycle 2 verified period, monthly exceedances closely follow the monthly rainfall pattern (**Figure 5.3q**). Quarterly exceedance rates also follow a very clear trend, with higher exceedances occurring during the wetter months (**Figure 5.3r**). The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

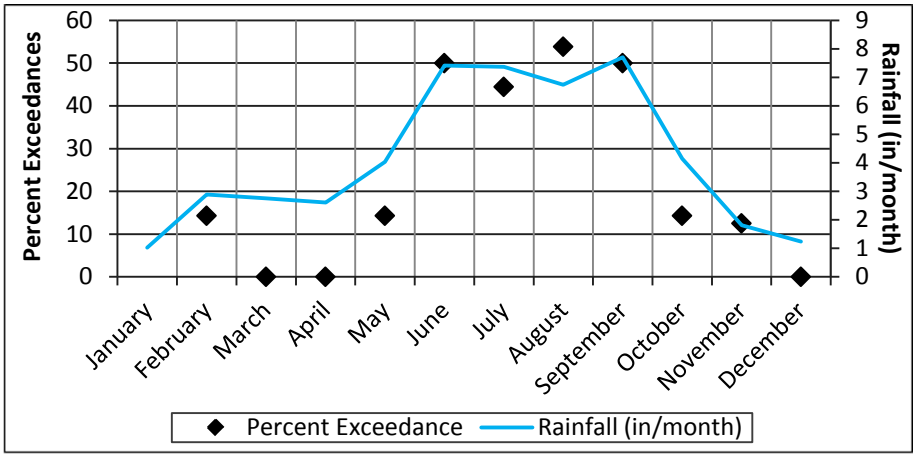

Figure 5.3q. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3279 by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

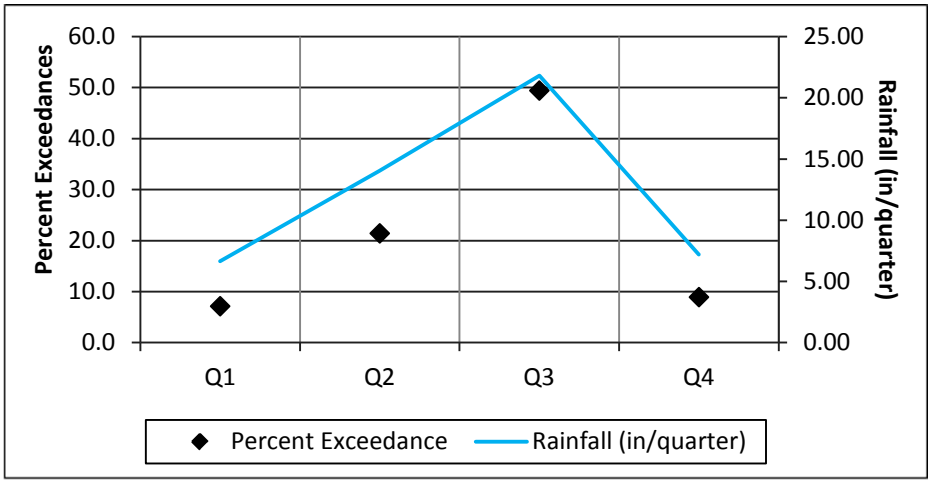

Figure 5.3r. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3279 by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

C-11 (East) Canal (WBID 3281)

The impact of rainfall on monthly and quarterly exceedances in WBID 3281 is distinct. Although in a couple of instances, no exceedances were recorded during high rainfall events, in general, during the Cycle 2 verified period, higher monthly exceedance rates occurred during months of higher rainfall (**Figure 5.3s**). Quarterly high exceedance rates were recorded mostly during quarters of high rainfall (**Figure 5.3t**). The fact that higher exceedance rates occur during wet seasons indicates that high rainfall negatively affects water quality in the watershed.

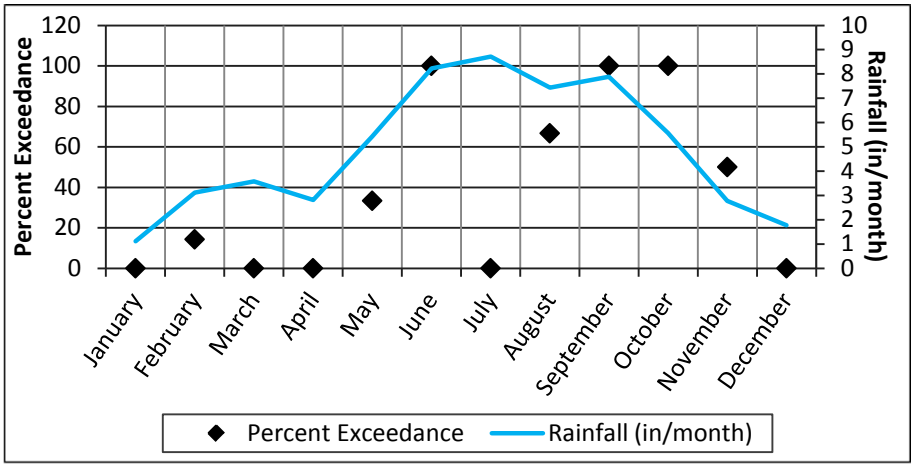

Figure 5.3s. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3281 by Month During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

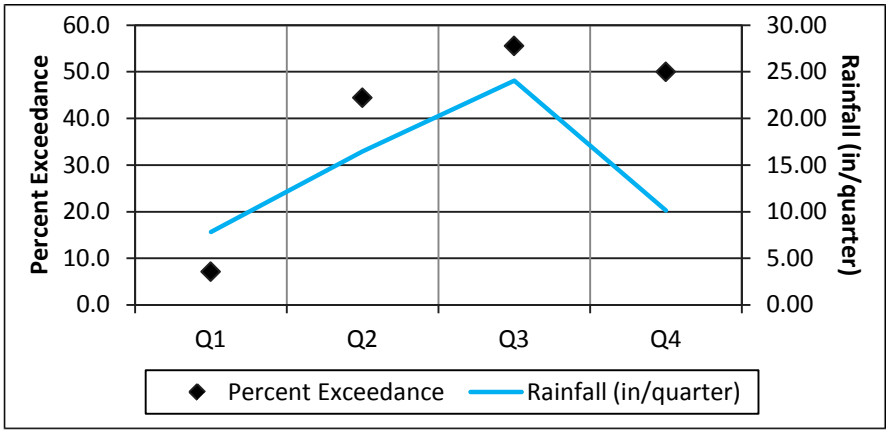

Figure 5.3t. Fecal Coliform Exceedances and Rainfall at All Stations in WBID 3281 by Quarter During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

PERIOD OF RECORD TREND

Plotting the entire period of record (historical) fecal coliform data over time for each WBID revealed no significant increasing or decreasing trend for WBIDs 3270 (Prob > F=0.1226) (**Figure 5.4a**), 3273 (Prob > F=0.5507) (**Figure 5.4b**), 3276 (Prob > F=0.3522) (**Figure 5.4c**), 3277A (Prob > F=0.1089) (**Figure 5.4d**), 3277C (Prob > F=0.3420) (**Figure 5.4e**), 3277E (Prob > F=0.3284) (**Figure 5.4f**), and 3281 (Prob > F=0.3623) (**Figure 5.4g**).

Significant increasing trends were observed in fecal coliform data over the period of record in WBIDs 3274 (Prob < 0.05) (**Figure 5.4h**), 3276A (Prob < 0.05) (**Figure 5.4i**), and 3279 (Prob <0.05) (**Figure 5.j**).

Various stormwater, water supply, and operation and maintenance projects have been completed in Broward County. The SFWMD has been working with special drainage districts and various cities and towns on stormwater system improvement projects aimed at water quality and flood control. These projects should improve runoff water quality and potentially reduce fecal coliform concentrations in the canals throughout the county.

C-13 East (Middle River) Canal (WBID 3274)

Although no significant increasing or decreasing trend was observed in WBID 3274 during the Cycle 2 verified period, as mentioned above, a significant increasing trend for the entire period of record was observed.

The SFWMD worked with the city of Oakland Park on the Sleepy River Dredging Project, located within WBID 3274. The project reduced the amount of pollution that directly enters the C-13 Canal. As a result of the dredging, surface water backup onto side streets has been minimized, improving the water quality of the stormwater entering the canal system during moderate to heavy storm events.

New River (North Fork) (WBID 3276A)

Although no significant increasing or decreasing trend was observed during the Cycle 2 verified period, as mentioned above, a significant increasing trend was observed for the entire period of record in WBID 3276A.

Solo-Gabriele *et al.* (2000) conducted a study in the North Fork to identify the sources contributing to elevated bacteria levels in the river. The study determined that likely sources during rainfall events include direct runoff from the river banks, storm sewer inflows, and sanitary overflows. In addition, direct runoff may wash contaminated riverbank soils into the water. During periods between rain events, the study determined that soils along the riverbanks were the main contributing source of bacteria. The study also determined that elevated bacteria concentrations were influenced by the high tide in the river.

The SFWMD, Broward County, city of Fort Lauderdale, and various other environmental organizations and community associations have been working together to restore the river. Projects have included the installation of a debris containment boom, debris removal, bank stabilization projects, dredging, exotic vegetation removal, the installation of educational signage, and stormwater and sanitary infrastructure improvements (Florida Atlantic University [FAU] 2010).

Significant efforts have been made in the North Fork to restore the river, and fecal coliform concentrations are currently lower than they were historically; however, elevated fecal coliform concentrations that exceed the state criterion continue to be recorded in the WBID.

C-11 (South New River) Canal (WBID 3279)

Although a significant increasing trend was observed in WBID 3279 during the Cycle 2 verified period, as previously mentioned, this statistical significance is being driven by three high values and therefore does not accurately represent a specific long-term trend, but rather a trend driven by occasional events. If these three data points are removed from the analysis, a significant increasing trend is no longer observed. However, as mentioned above, a significant increasing trend for the entire period of record was observed.

The SFWMD has been working with BCDPEP, special drainage districts, and various cities and towns on stormwater, water supply, and operation and maintenance projects aimed at water quality and flood control. These projects, located within WBID 3279, could improve the water quality of runoff and potentially reduce fecal coliform concentrations in the C-11 Canal.

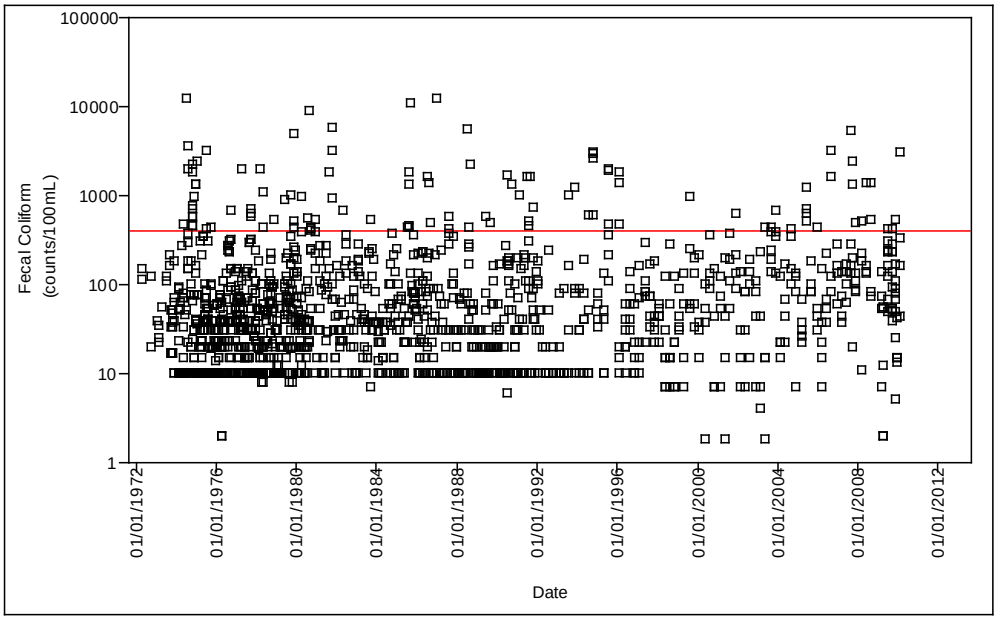

Figure 5.4a. Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) for the Entire Period of Record (1972–2010)

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

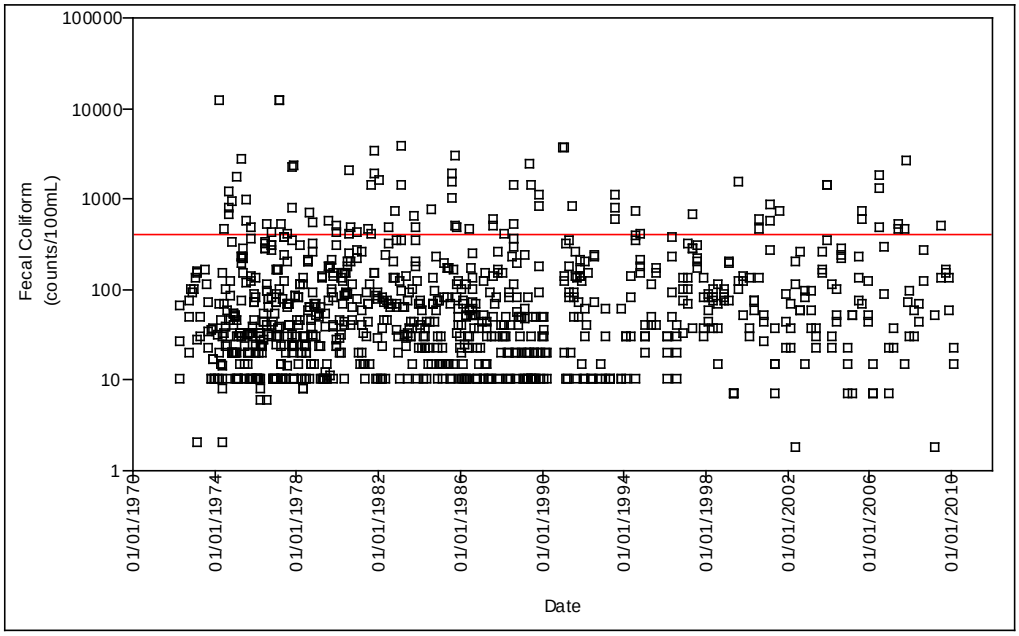

Figure 5.4b. Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) for the Entire Period of Record (1972–2010)

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

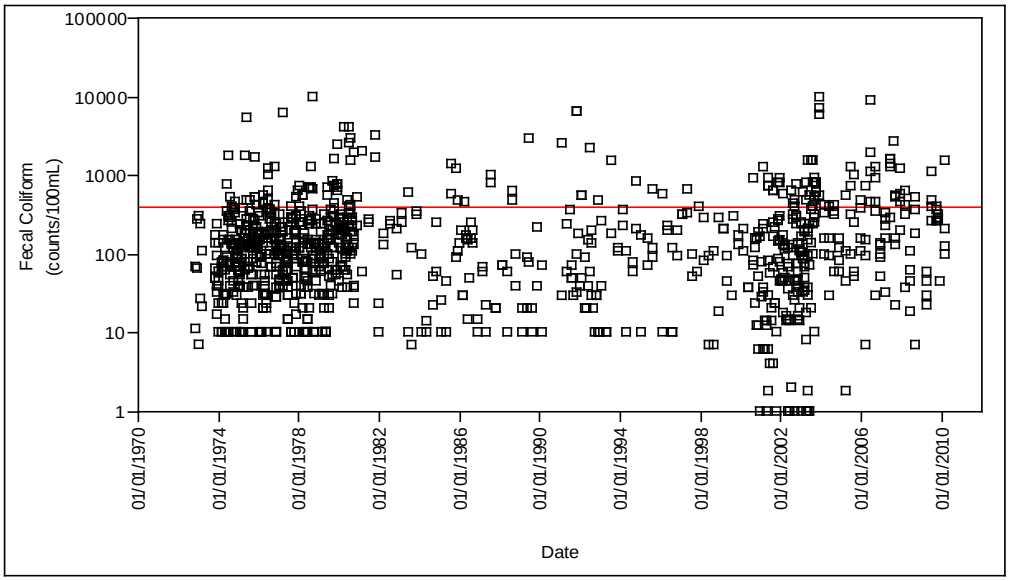

Figure 5.4c. Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) for the Entire Period of Record (1972–2010)

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

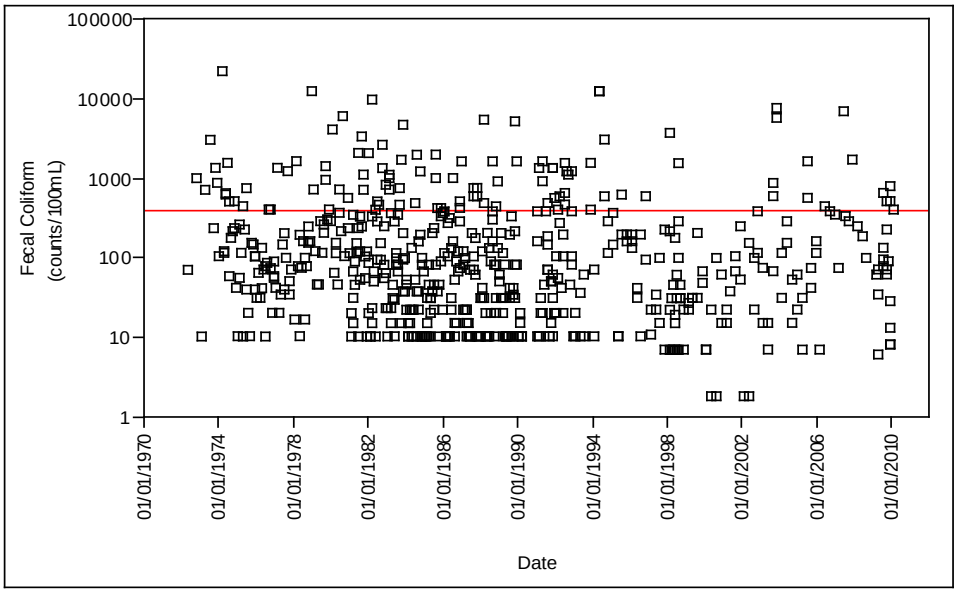

Figure 5.4d. Fecal Coliform Concentration Trends in the C-12 (Plantation) Canal (WBID 3276) for the Entire Period of Record (1972–2010)

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

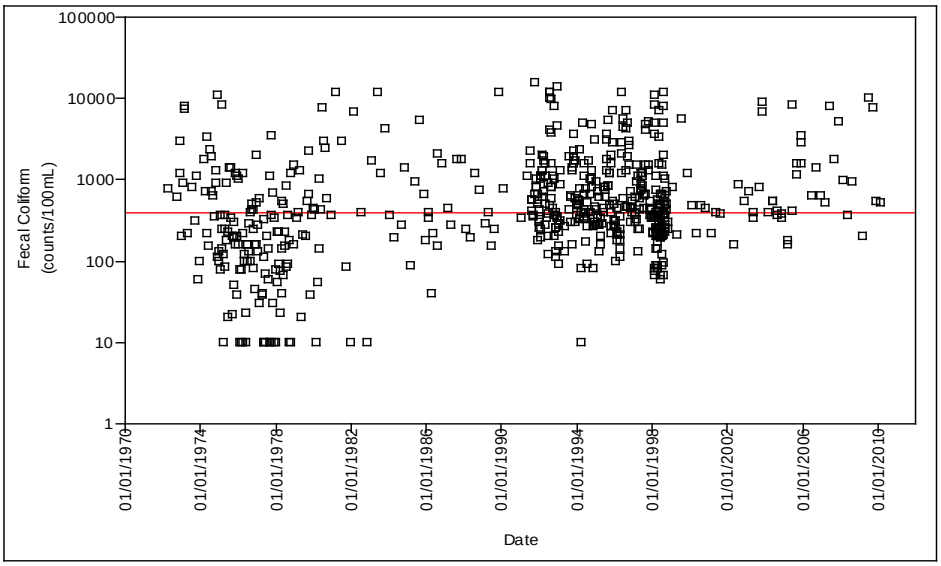

Figure 5.4e. Fecal Coliform Concentration Trends in the New River (North Fork) (WBID 3276A) for the Entire Period of Record (1972–2010)

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

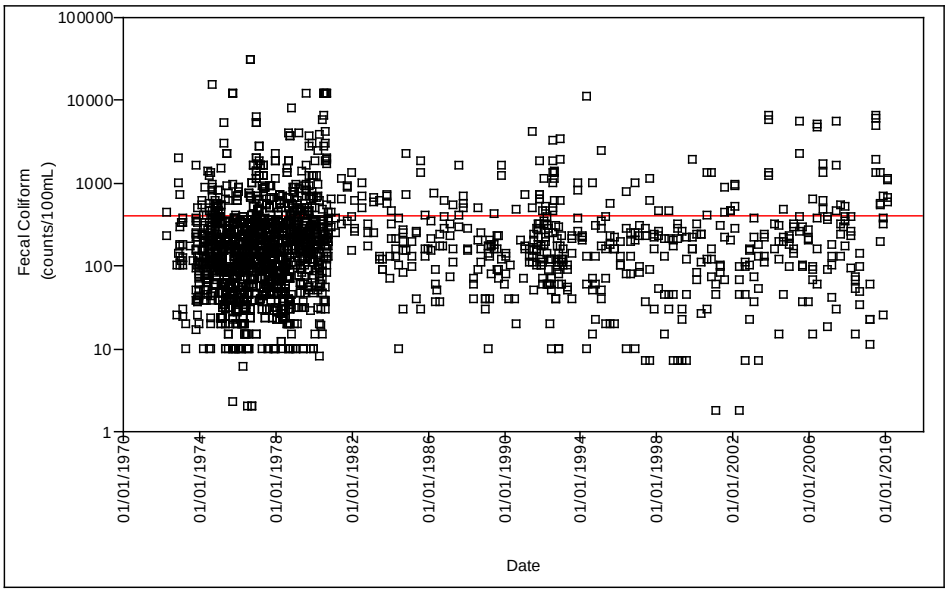

Figure 5.4f. Fecal Coliform Concentration Trends in the New River Canal (South) (WBID 3277A) for the Entire Period of Record (1972–2010)

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

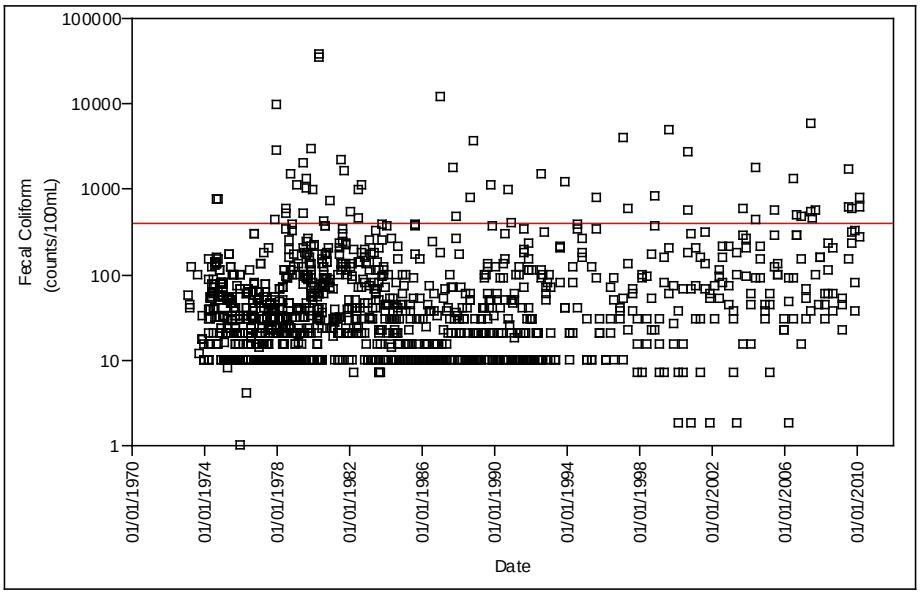

Figure 5.4g. Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) for the Entire Period of Record (1973–2010)

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

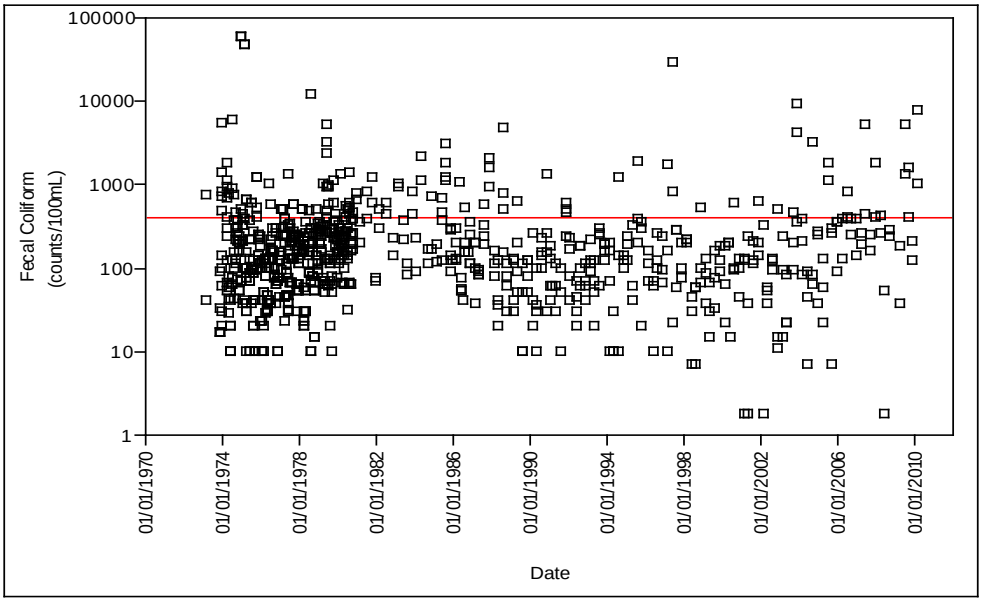

Figure 5.4h. Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) for the Entire Period of Record (1973–2010)

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

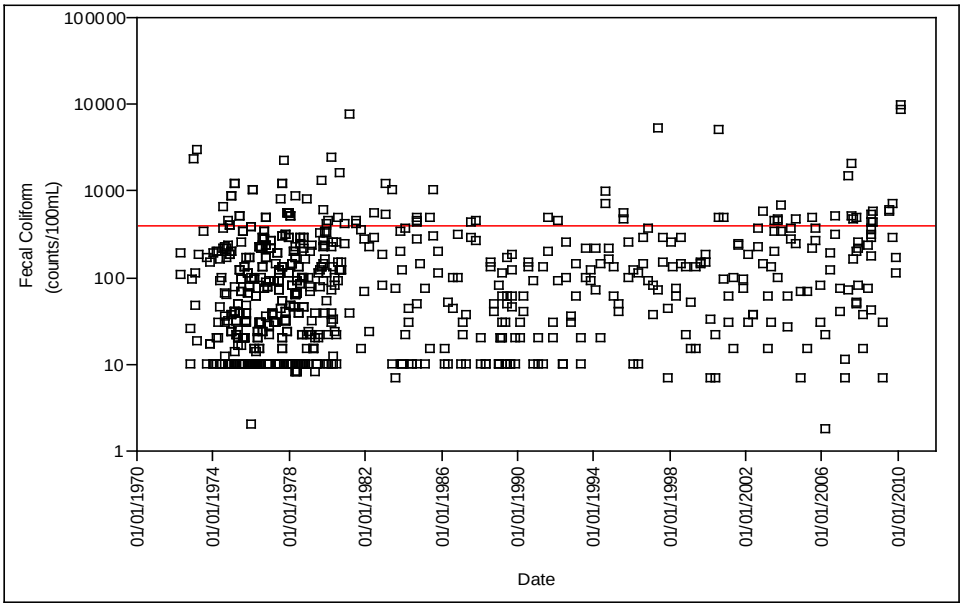

Figure 5.4i. Fecal Coliform Concentration Trends in the C-11 (South New River) Canal (WBID 3279) for the Entire Period of Record (1972–2010)

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

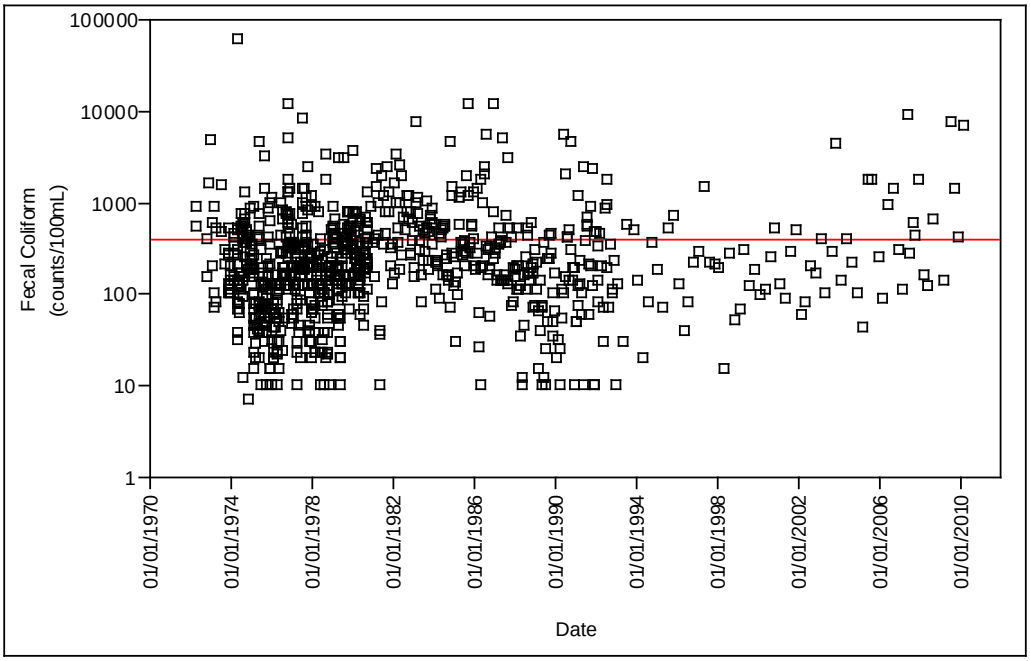

Figure 5.4j. Fecal Coliform Concentration Trends in the C-11 (East) Canal (WBID 3281) for the Entire Period of Record (1972–2010)

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

Spatial Patterns

Fecal coliform data for each WBID from the Cycle 2 verified period (January 1, 2003–June 30, 2010) were analyzed to detect spatial trends (**Figures 5.5a** through **5.5t**). Stations are displayed from west to east (from left to right). **Figure 5.6** shows the spatial distribution of the principal land uses and the locations of the water quality stations within each WBID.

C-14 (Cypress Creek) Canal (WBID 3270)

Fecal coliform concentrations that exceeded the state criterion were observed in 50% (n=8) of the sampling stations within the WBID (**Figures 5.5a** and **5.5b**). Elevated concentrations were recorded at Stations 21FLBROW6, 21FLBROW8, and 21FLBROW89 (5,200, 3,000, and 1,400 counts/100mL, respectively), located on the C-14 Canal. Elevated concentrations were also recorded at Stations 21FLGW 34111 and 21FLGW 34125 (2,400 and 1,300 counts/100mL, respectively) (**Table 5.5a**), located in smaller, unnamed canals within the WBID.

Land use surrounding all stations within the WBID is predominantly medium- and high-density residential.

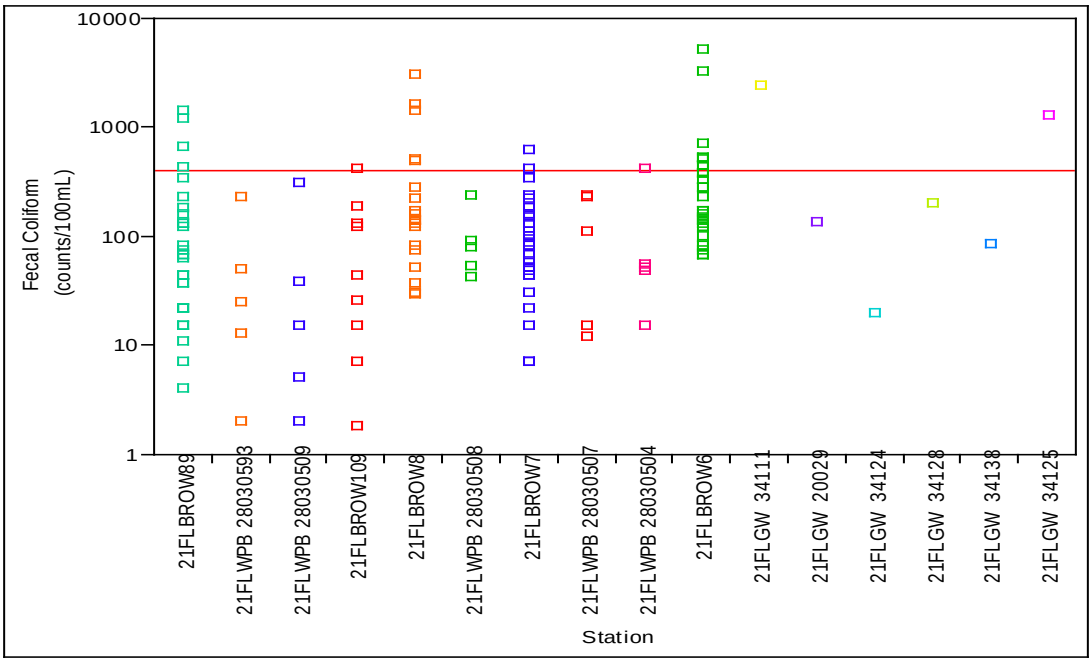

Figure 5.5a. Spatial Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

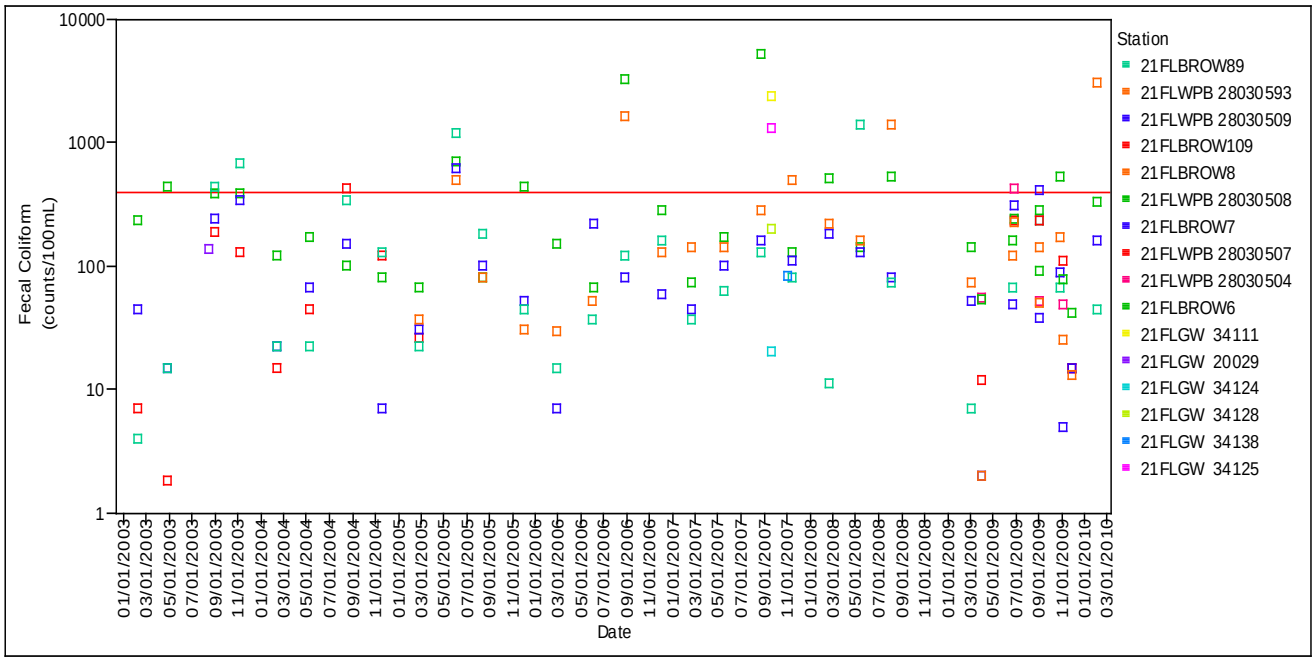

Figure 5.5b. Spatial Fecal Coliform Concentration Trends in the C-14 (Cypress Creek) Canal (WBID 3270) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

Table 5.5a. Station Summary Statistics of Fecal Coliform Data for the C-14 (Cypress Creek) Canal (WBID 3270) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW109	2003–05	9	1.8	420	44	106	1	11.1%
21FLBROW6	2003–10	28	67	5,200	200	538	8	28.6%
21FLBROW7	2003–10	28	7	620	85	129	2	7.1%
21FLBROW8	2005–10	20	29.5	3,000	140	440	5	25.0%
21FLBROW89	2003–10	28	4	1,400	67	201	4	14.3%
21FLGW 20029	2003	1	136	136	136	136	0	0.0%
21FLGW 34111	2007	1	2,400	2,400	2,400	2,400	1	100.0%
21FLGW 34124	2007	1	20	20	20	20	0	0%
21FLGW 34125	2007	1	1,300	1,300	1,300	1,300	1	100%
21FLGW 34128	2007	1	200	200	200	200	0	0%
21FLGW 34138	2007	1	84	84	84	84	0	0%
21FLWPB 28030504	2009	5	15	420	52	118	1	20%
21FLWPB 28030507	2009	5	12	234	110	120	0	0%
21FLWPB 28030508	2009	5	42	240	78	101	0	0%
21FLWPB 28030509	2009	5	2	310	15	74	0	0%
21FLWPB 28030593	2009	5	2	228	25	64	0	0%

C-13 West (Middle River) Canal (WBID 3273)

Fecal coliform concentrations that exceeded the state criterion were observed in 4 of the 5 sampling stations within the WBID (**Figures 5.5c** and **5.5d**). Elevated concentrations were recorded at Stations 21FLBROW12, 21FLBROW13, and 21FLBROW14 (1,550, 1,400, and 1,400 counts/100mL, respectively), located on the C-13 Canal. An elevated fecal coliform concentration (2,600 counts/100mL) was also recorded at Station 21FLGW 34121, located in a smaller, unnamed, canal. Only 1 sample was collected at this station during the Cycle 2 verified period (**Table 5.5b**).

Land use surrounding all stations within the WBID is predominantly medium- and high-density residential, or commercial.

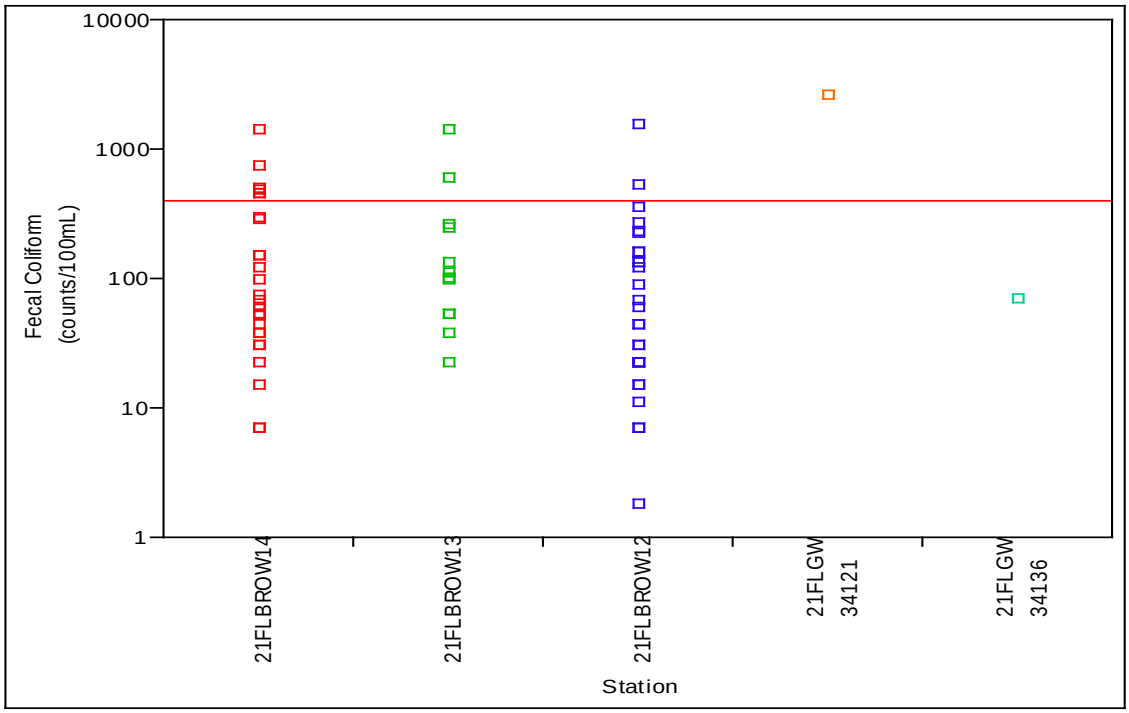

Figure 5.5c. Spatial Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

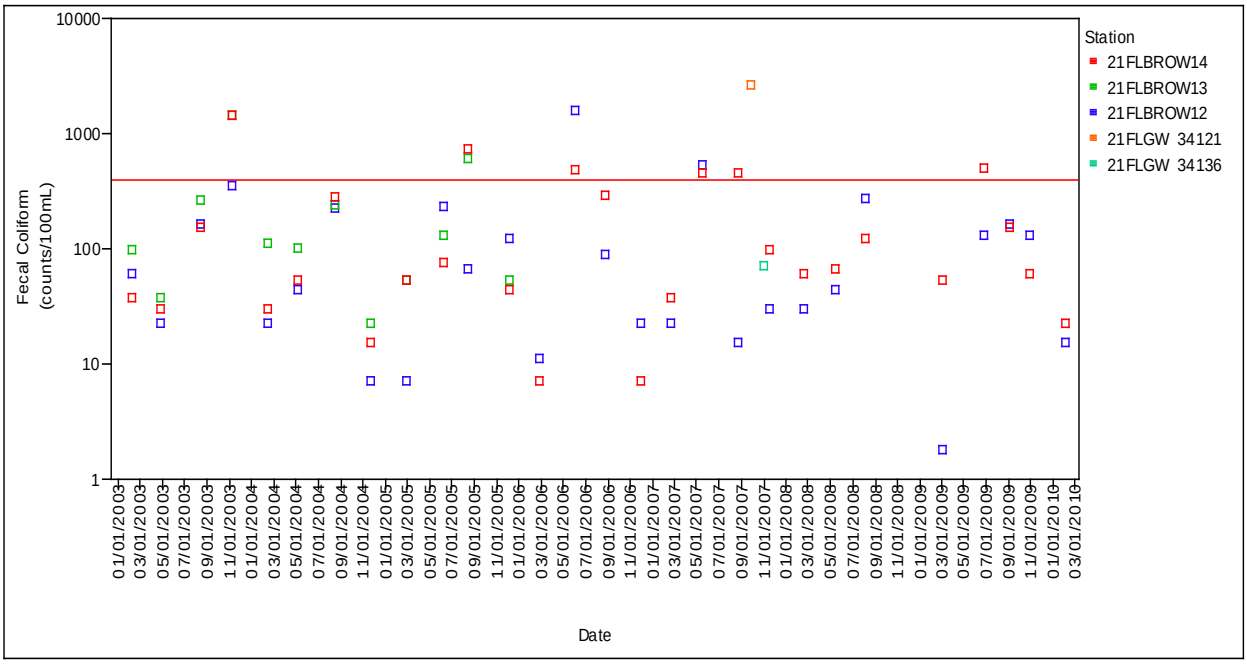

Figure 5.5d. Spatial Fecal Coliform Concentration Trends in the C-13 West (Middle River) Canal (WBID 3273) by Date During the Cycle 2 Verified Period (January 1, 2003—June 30, 2010)

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

Table 5.5b. Station Summary Statistics of Fecal Coliform Data for the C-13 West (Middle River) Canal (WBID 3273) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW12	2003–10	28	1.8	1,550	52	156	2	7.1%
21FLBROW13	2003–05	12	22	1,400	105	257	2	16.7%
21FLBROW14	2003–10	28	7	1,400	63	205	6	21.4%
21FLGW 34121	2007	1	2,600	2,600	2,600	2,600	1	100.0%
21FLGW 34136	2007	1	70	70	70	70	0	0.0%

C-13 East (Middle River) Canal (WBID 3274)

Fecal coliform concentrations that exceeded the state criterion were observed in all 6 sampling stations within the WBID (**Figures 5.5e** and **5.5f**). Elevated concentrations (greater than 1,000 counts/100mL) were recorded at all stations, with the highest concentration (9,600 counts/100mL) recorded at Station 21FLBROW111, located in the South Fork of the Middle River. High exceedance rates were recorded at Stations 21FLBROW111 (n=28) and 21FLDOH BROWARD31 (n=28) (46.4 % and 37.5%, respectively). The exceedance rate at Station 21FLGW 33083 was 100%; however, only 1 sample was collected at this station (**Table 5.5c**).

Except for Station 21FLDOH BROWARD31, which is located in a city of Fort Lauderdale park (George English Park), land use surrounding all stations within the WBID is predominantly medium- and high-density residential, or commercial.

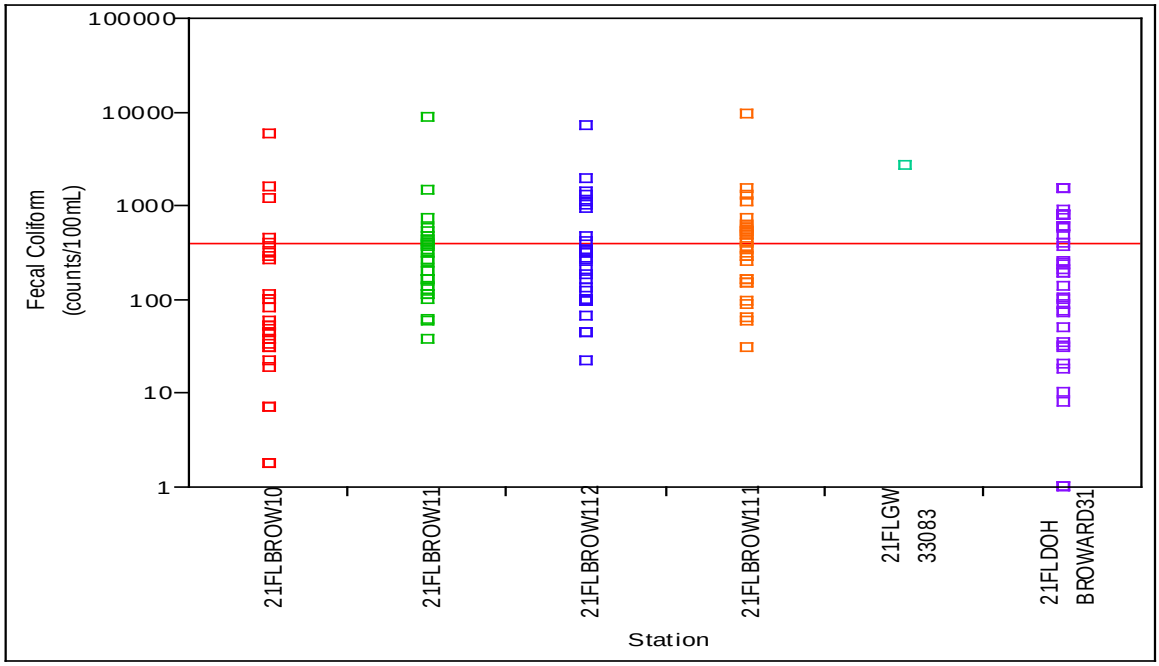

Figure 5.5e. Spatial Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

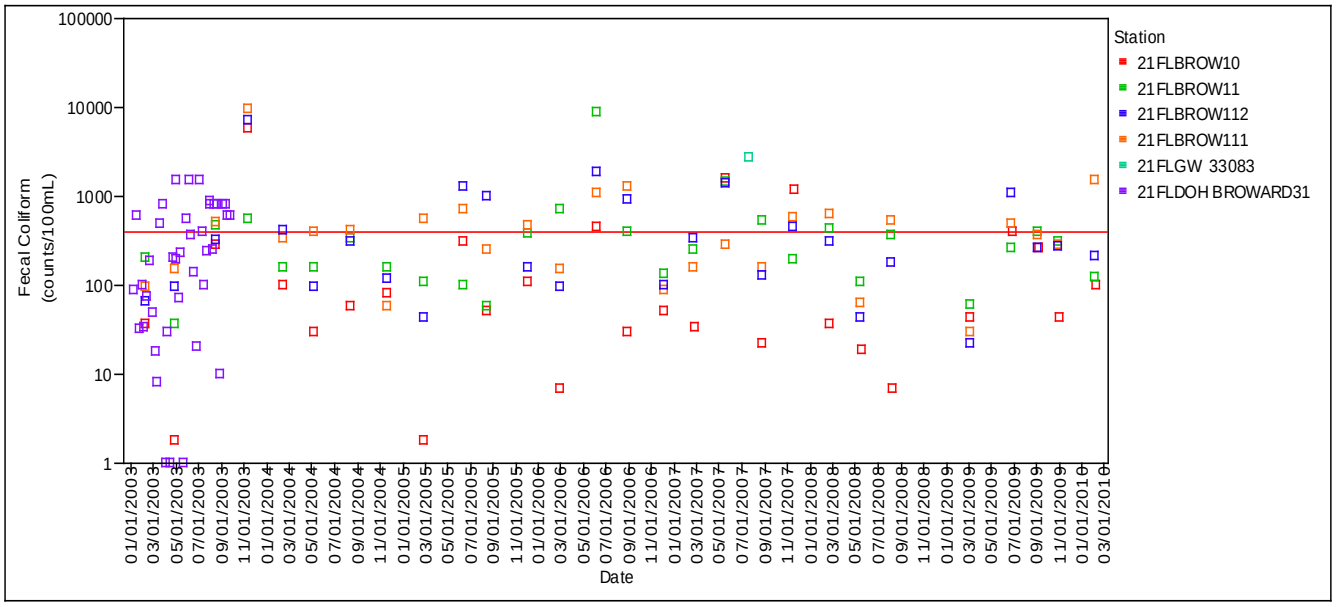

Figure 5.5f. Spatial Fecal Coliform Concentration Trends in the C-13 East (Middle River) Canal (WBID 3274) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

Table 5.5c. Station Summary Statistics of Fecal Coliform Data for the C-13 East (Middle River) Canal (WBID 3274) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW10	2003–10	28	1.8	5,800	52	399	4	14.3%
21FLBROW11	2003–10	28	37	8,800	258	617	8	28.6%
21FLBROW111	2003–10	28	30	9,600	380	760	13	46.4%
21FLBROW112	2003–10	28	22	7,200	265	674	9	32.1%
21FLDOH BROWARD31	2003	40	1	1,500	221	398	15	37.5%
21FLGW 33083	2007	1	2,700	2,700	2,700	2,700	1	100.0%

C-12 (Plantation) Canal (WBID 3276)

Fecal coliform concentrations that exceeded the state criterion were observed in 4 of the 7 sampling stations within the WBID (**Figures 5.5g** and **5.5h**). High exceedance rates, at stations with a sample size greater than 1, were recorded at Stations 21FLBROW17 (n=28), 21FLBROW18 (n=12), and 21FLWPB 42009011 (n=5) (28.6 %, 16.7%, and 40%, respectively). The exceedance rate at Station 21FLGW 20027 was 100%; however, only 1 sample was collected at this station. The highest fecal coliform concentrations in the WBID were recorded at Stations 21FLBROW17 (7,400 counts/100mL) and 21FLBROW18 (5,600 counts/100mL), both located on the C-12 Canal (**Table 5.5d**).

Land use surrounding all stations within the WBID is predominantly medium- and high-density residential, or commercial.

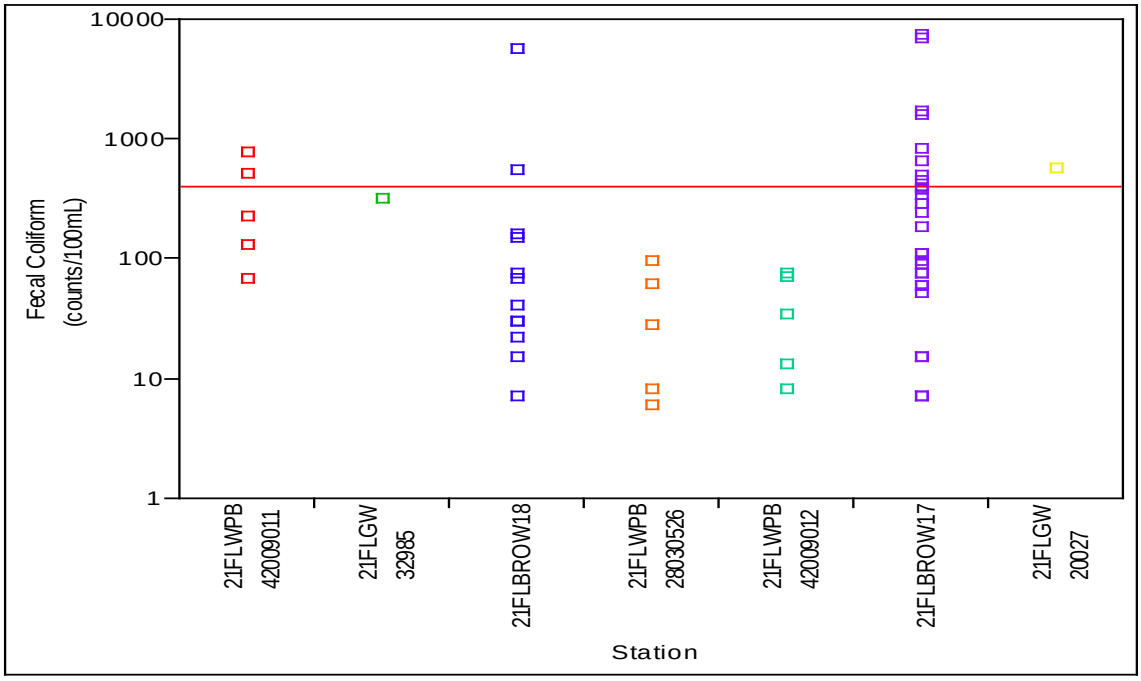

Figure 5.5g. Spatial Fecal Coliform Concentration Trends in the C-12 (Plantation) Canal (WBID 3276) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

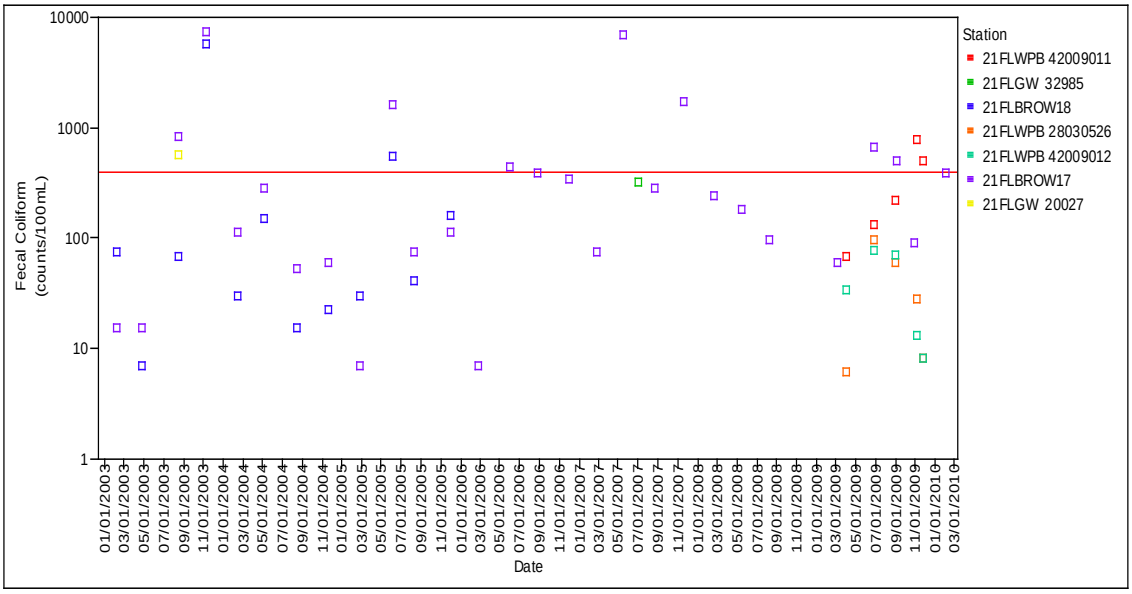

Figure 5.5h. Spatial Fecal Coliform Concentration Trends in the C-12 (Plantation) Canal (WBID 3276) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

Table 5.5d. Station Summary Statistics of Fecal Coliform Data for the C-12 (Plantation) Canal (WBID 3276) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW17	2003–10	28	7	7,400	210	813.1	8	28.6%
21FLBROW18	2003–05	12	7	5,600	54	561.3	2	16.7%
21FLGW 20027	2003	1	570	570	570	570	1	100.0%
21FLGW 32985	2007	1	320	320	320	320	0	0.0%
21FLWPB 28030526	2009	5	6	94	28	39.2	0	0.0%
21FLWPB 42009011	2009	5	68	764	220	336.6	2	40.0%
21FLWPB 42009012	2009	5	8	76	34	40.2	0	0.0%

New River (North Fork) (WBID 3276A)

Fecal coliform concentrations that exceeded the state criterion were observed at both sampling stations within the WBID (**Figures 5.5i** and **5.5j**), both located on the North Fork New River. The highest exceedance rate and fecal coliform concentration (76% and 10,000 counts/100mL, respectively) were recorded at Station 21FLBROW16 (**Table 5.5e**).

Land use surrounding both stations within the WBID is predominantly medium- and high-density residential, or commercial.

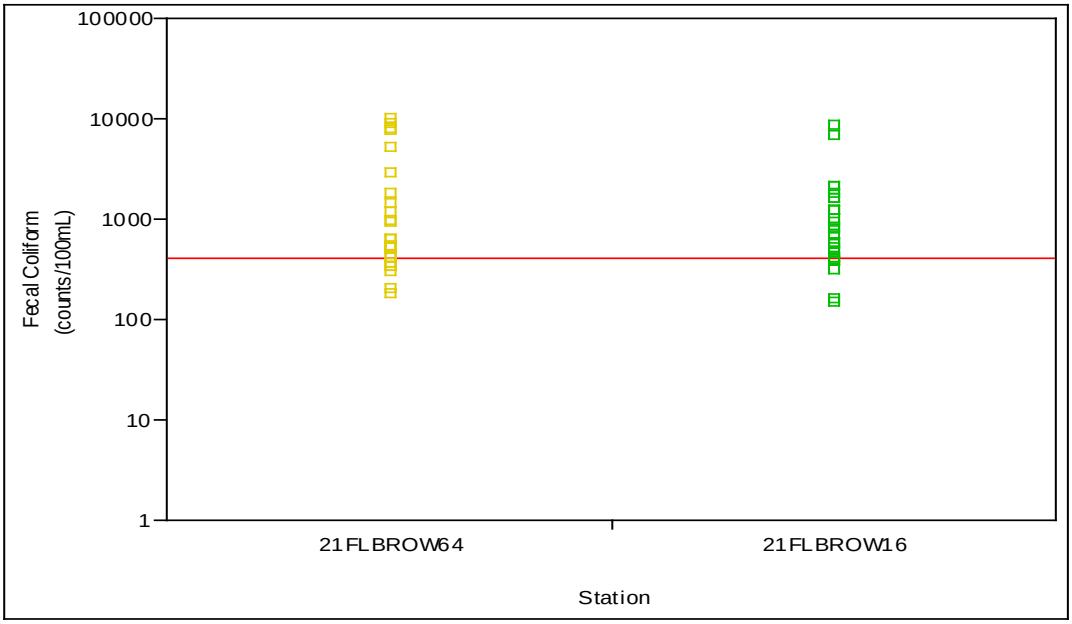

Figure 5.5i. Spatial Fecal Coliform Concentration Trends in the New River (North Fork) (WBID 3276A) by Station During the Cycle 2 Verified Period (January 1, 2003 through June 30, 2010)

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

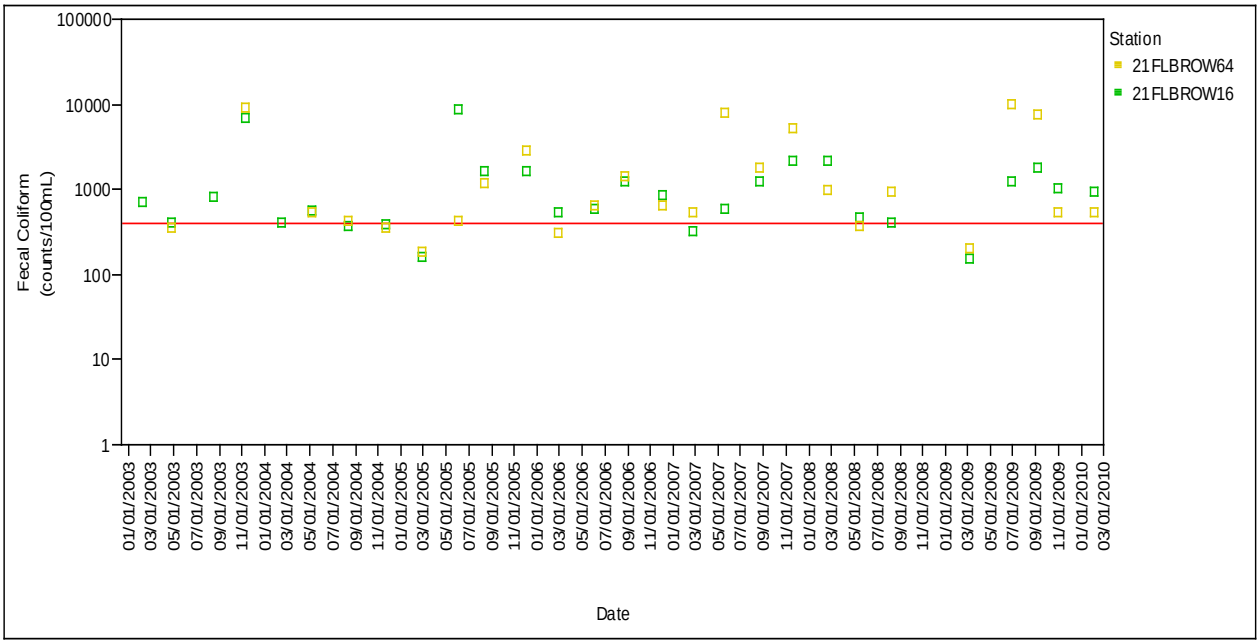

Figure 5.5j. Spatial Fecal Coliform Concentration Trends in the New River (North Fork) (WBID 3276A) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

Table 5.5e. Station Summary Statistics of Fecal Coliform Data for the New River (North Fork) (WBID 3276A) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW16	2003–10	28	150	8,400	750	1,340.4	20	71.4%
21FLBROW64	2003–10	25	180	10,000	620	2,175.6	19	76.0%

New River Canal (South) (WBID 3277A)

Fecal coliform concentrations that exceeded the state criterion were observed at 4 of the 5 sampling stations within the WBID (**Figures 5.5k** and **5.5l**); these 4 stations are located on the South Fork New River. Station 21 FLGW 34132 is located on an unnamed canal. The highest fecal coliform concentration (6,400 counts/100mL) was recorded at Station 21FLBROW19. However, the highest exceedance rate (33.3%) was recorded at Station 21FLBROW20, where the highest concentration was 4,800 counts/100mL (**Table 5.5f**).

Except for Station 21FLBROW15, which is surrounded predominantly by commercial land, land use surrounding all stations within the WBID is predominantly medium- and high-density residential.

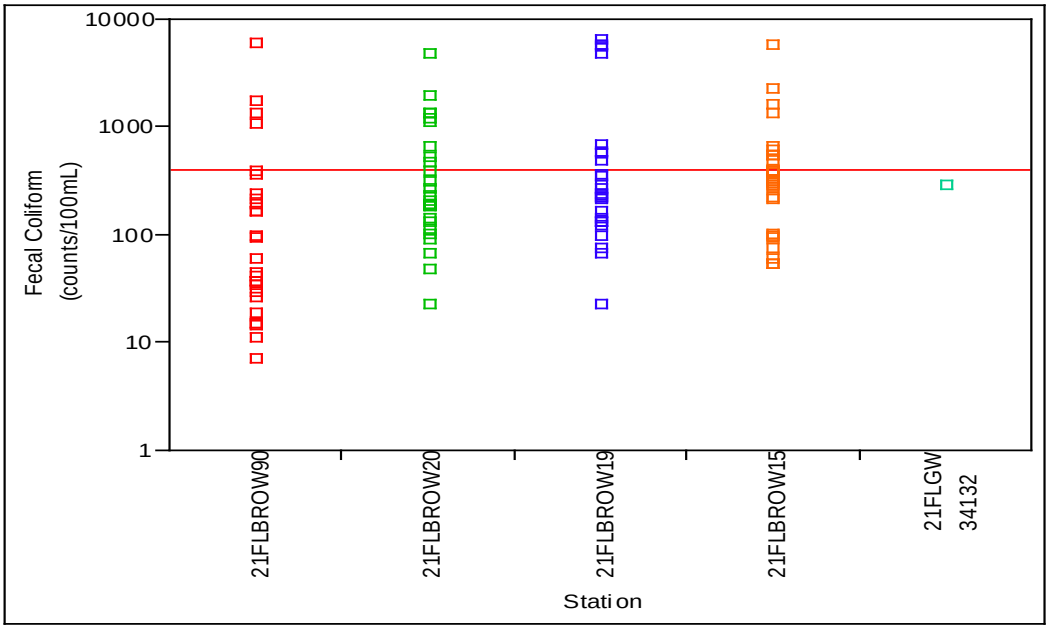

Figure 5.5k. Spatial Fecal Coliform Concentration Trends in the New River Canal (South) (WBID 3277A) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

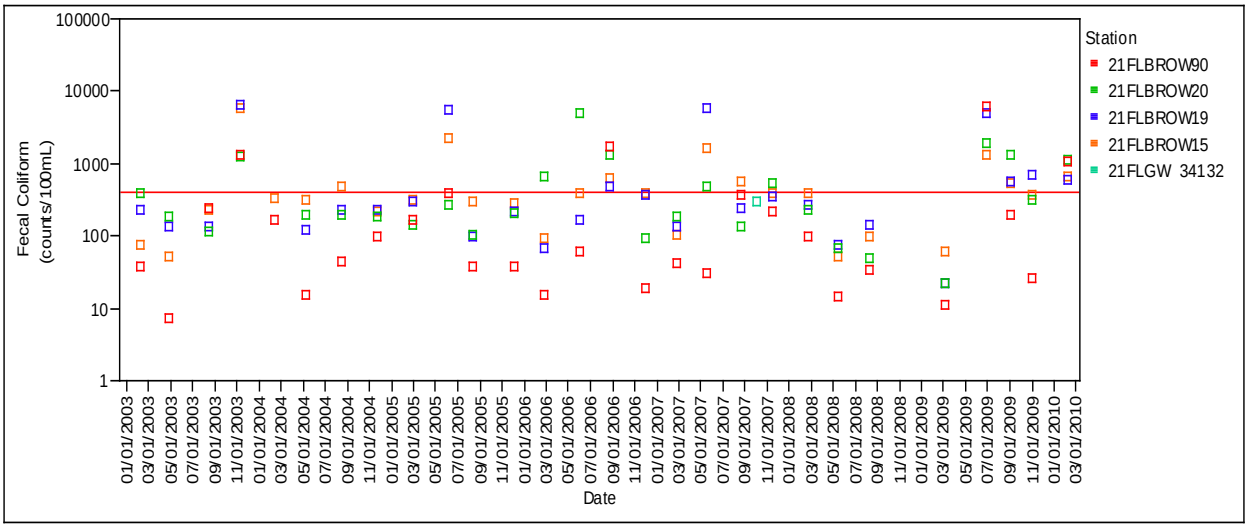

Figure 5.5l. Spatial Fecal Coliform Concentration Trends in the New River Canal (South) (WBID 3277A) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

Table 5.5f. Station Summary Statistics of Fecal Coliform Data for the New River Canal (South) (WBID 3277A) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW15	2003–10	28	52	5,800	345	645.9	9	32.1%
21FLBROW19	2003–10	27	22	6,400	230	1,034.4	8	29.6%
21FLBROW20	2003–10	27	22	4,800	200	600.6	9	33.3%
21FLBROW90	2003–10	28	7	6,000	51.5	442.3	4	14.3%
21FLGW 34132	2007	1	290	290	290	290.0	0	0.0%

North New River Canal (WBID 3277C)

Fecal coliform concentrations that exceeded the state criterion were observed in 3 of the 4 sampling stations within the WBID (**Figures 5.5m** and **5.5n**). High exceedance rates were recorded at Stations 21FLBROW21 (n=28) and 21FLBROW22 (n=27) (32.1 % and 22.2%, respectively), with the highest fecal coliform concentration (5,800 counts/100mL) recorded at Station 21FLBROW22. The exceedance rate at Station 21FLGW 32963 was 100%; however, only 1 sample was collected at this station (**Table 5.5g**). All stations in the WBID are located on the New River Canal (North).

Except for Station 21FLBROW23 (n=28), which is surrounded predominantly by industrial land and roads and highways, land use surrounding all stations within the WBID is predominantly medium- and high-density residential, and commercial.

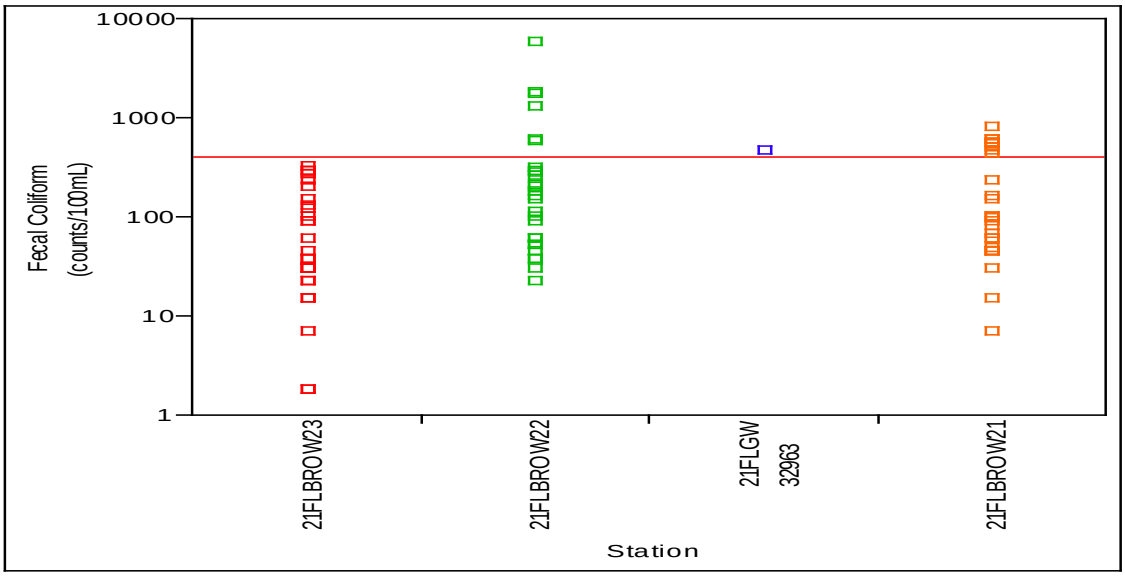

Figure 5.5m. Spatial Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

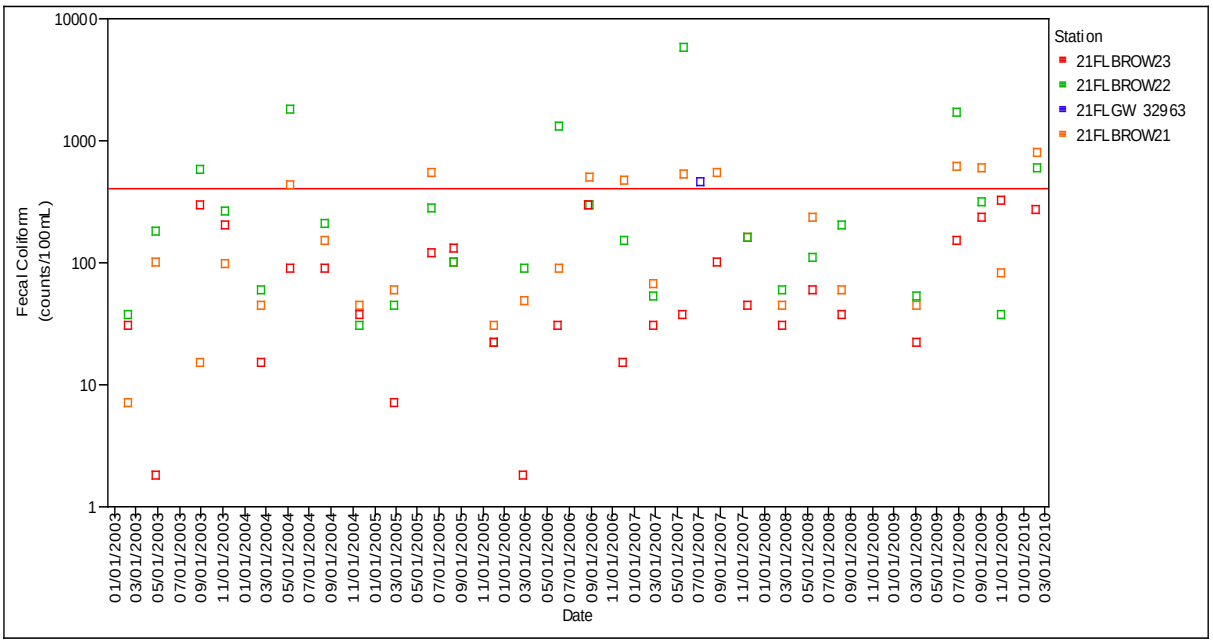

Figure 5.5n. Spatial Fecal Coliform Concentration Trends in the North New River Canal (WBID 3277C) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

Table 5.5g. Station Summary Statistics of Fecal Coliform Data for the North New River Canal (WBID 3277C) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW21	2003–10	28	7	800	98	232.0	9	32.1%
21FLBROW22	2003–10	27	22	5,800	160	537.4	6	22.2%
21FLBROW23	2003–10	28	1.8	320	40.5	96.31	0	0.0%
21FLGW 32963	2007	1	460	460	460	460	1	100.0%

Dania Cut-off Canal (WBID 3277E)

Fecal coliform concentrations that exceeded the state criterion were observed in 2 of the 3 sampling stations within the WBID (**Figures 5.5o** and **5.5p**). The highest exceedance rate (39.3%) and highest fecal coliform concentration (9,400 counts/100mL) were recorded at Station 21FLBROW24 (n=28). Station 21FLBROW26 (n=28) had an exceedance rate of 25% and a high fecal coliform concentration of 5,200 counts/100mL (**Table 5.5h**). Both stations are located on the Dania Cut-off Canal.

Land use surrounding Station 21FLBROW47 (n=11) predominantly comprises mangrove swamps, open areas, and Port Everglades. Land use surrounding Stations 21FLBROW24 and 21FLBROW26 is mainly commercial, with some medium- and high-density residential areas.

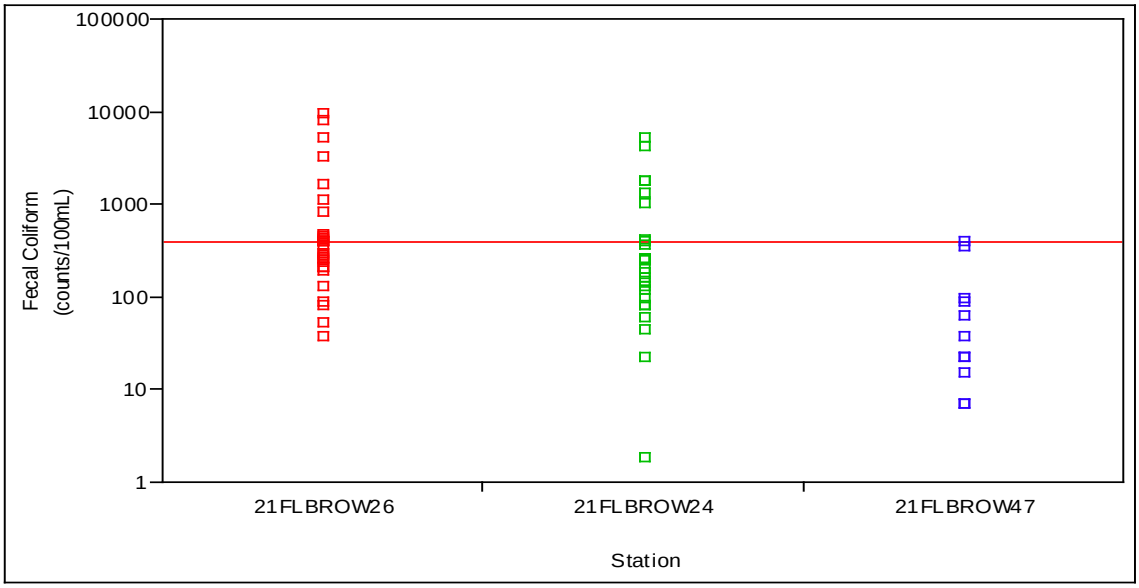

Figure 5.5o. Spatial Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

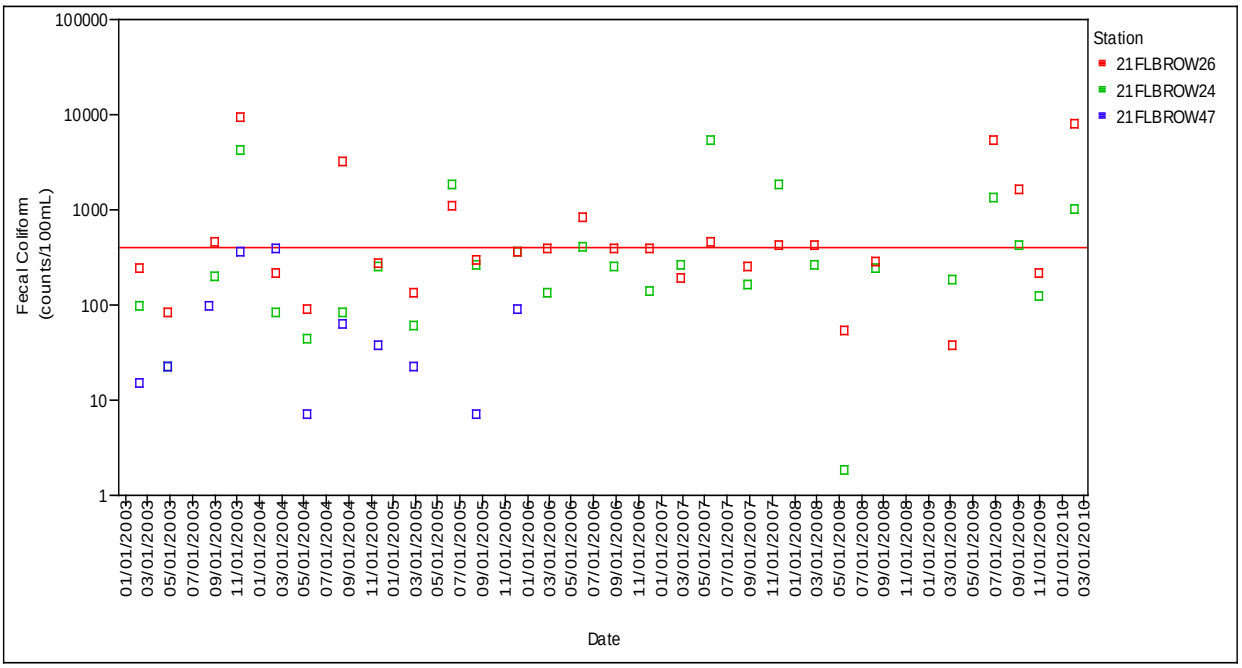

Figure 5.5p. Spatial Fecal Coliform Concentration Trends in the Dania Cut-off Canal (WBID 3277E) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010

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

Table 5.5h. Station Summary Statistics of Fecal Coliform Data for the Dania Cut-off Canal (WBID 3277E) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW24	2003–10	28	1.8	5,200	245	689.5	7	25.0%
21FLBROW26	2003–10	28	37	9,400	375	1,240.3	11	39.3%
21FLBROW47	2003–05	11	7	390	37	99.8	0	0%

C-11 (South New River) Canal (WBID 3279)

Water quality samples for fecal coliform data for this WBID were collected from 20 sampling stations, 4 of which are located in waterbodies not directly connected to the C-11 Canal. Stations 21FLGW 17429, 21FLGW 32968, and 21FLGW 35003 are located on the L-35 (North New River) Canal, and Station 21FLGW 34115 is located on the L-37 Canal. Thus the analysis for this WBID included only stations located on, or on waterbodies directly connected to, the C-11 Canal.

Fecal coliform concentrations that exceeded the state criterion were observed in 37% (n=6) of the sampling stations within the WBID (**Figures 5.5q** and **5.5r**). High exceedance rates were recorded at Stations 21FLBROW28 (n=28) and 21FLBROW29 (n=28) (35.7% and 17.9%, respectively), with the highest fecal coliform concentration (9,800 counts/100mL) recorded at Station 21FLBROW29. The exceedance rate at Stations 21FLGW 32965, 21FLGW 34116, 21FLSFWMC1102.0TS, and 21FLSFWMC1104.6TS was 100%; however, only 1 sample was collected at each of these stations (**Table 5.5i**).

Land use surrounding Station 21FLBROW28 is predominantly wetland and upland nonforested. Land use surrounding the remaining stations in the WBID is primarily residential (low-, medium-, and high-density), with some agricultural and forested areas.

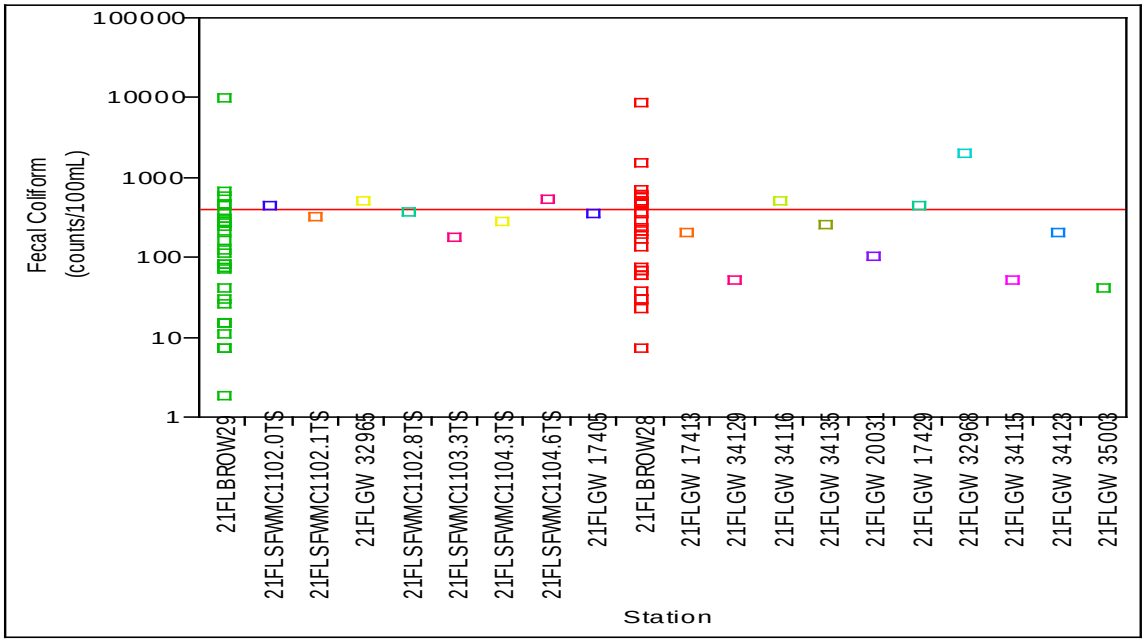

Figure 5.5q. Spatial Fecal Coliform Concentration Trends in the C-11 (South New River) Canal (WBID 3279) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

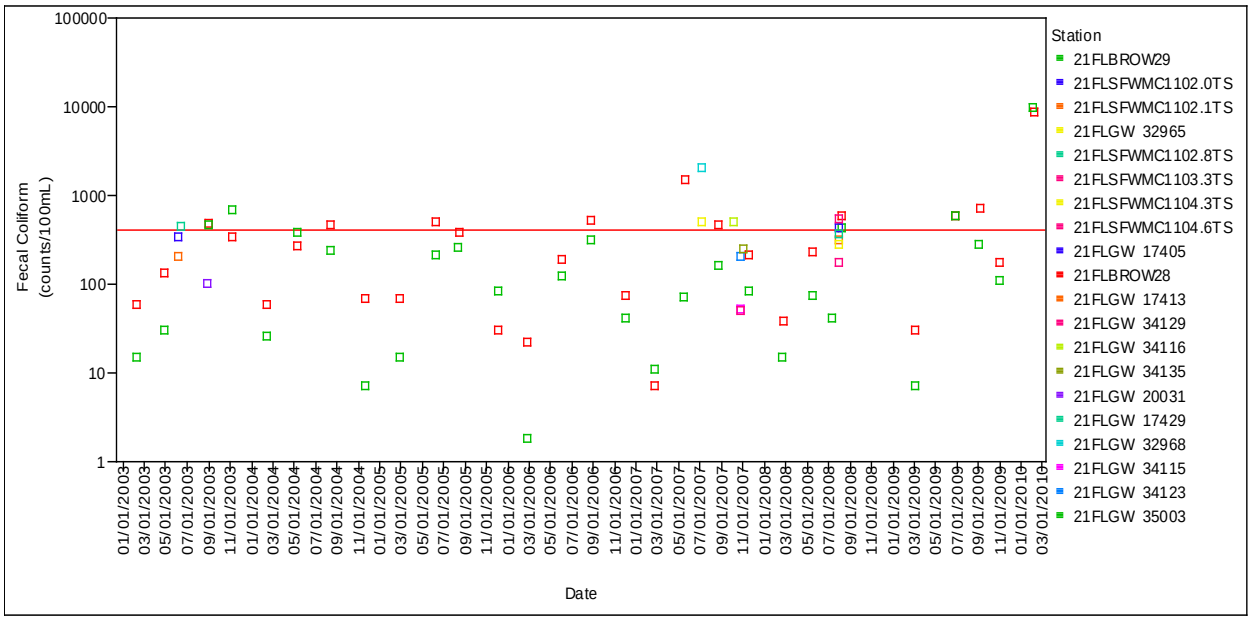

Figure 5.5r. Spatial Fecal Coliform Concentration Trends in the C-11 (South New River) Canal (WBID 3279) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

Table 5.5i. Station Summary Statistics of Fecal Coliform Data for the C-11 (South New River) Canal (WBID 3279) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW28	2003–10	28	7	8,400	220	590.1	10	35.7%
21FLBROW29	2003–10	28	1.8	9,800	95.5	516.4	5	17.9%
21FLGW 17405	2003	1	340	340	340	340	0	0%
21FLGW 17413	2003	1	200	200	200	200	0	0%
21FLGW 17429	2003	1	440	440	440	440	1	100%
21FLGW 20031	2003	1	100	100	100	100	0	0%
21FLGW 32965	2007	1	500	500	500	500	1	100%
21FLGW 32968	2007	1	2,000	2,000	2,000	2,000	1	100%
21FLGW 34115	2007	1	51	51	51	51	0	0%
21FLGW 34116	2007	1	490	490	490	490	1	100%
21FLGW 34123	2007	1	200	200	200	200	0	0%
21FLGW 34129	2007	1	50	50	50	50	0	0%
21FLGW 34135	2007	1	250	250	250	250	0	0%
21FLGW 35003	2008	1	41	41	41	41	0	0%
21FLSFWMC1102.0TS	2008	1	430	430	430	430	1	100%
21FLSFWMC1102.1TS	2008	1	310	310	310	310	0	0%
21FLSFWMC1102.8TS	2008	1	360	360	360	360	0	0%
21FLSFWMC1103.3TS	2008	1	172	172	172	172	0	0%
21FLSFWMC1104.3TS	2008	1	280	280	280	280	0	0%
21FLSFWMC1104.6TS	2008	1	530	530	530	530	1	100%

C-11 (East) Canal (WBID 3281)

Fecal coliform concentrations that exceeded the state criterion were observed in 2 of the 3 sampling stations within the WBID (**Figures 5.5s** and **5.5t**). The highest exceedance rate (100%) was recorded at Station 21FLGW 34119; however, only 1 sample was collected at this station. Station 21FLBROW27, which had the highest number of samples (n=28), had an exceedance rate of 46.4% and a high fecal coliform concentration of 9,100 counts/100mL (**Table 5.5j**). Station 21FLBROW27 is located on the C-12 Canal, and Station 21FLGW 34119 is located on an unnamed secondary/tertiary canal.

Land use surrounding Station 21FLGW 34119 is predominantly medium-density residential, and land use surrounding Station 21FLBROW27 is primarily high-density residential and commercial.

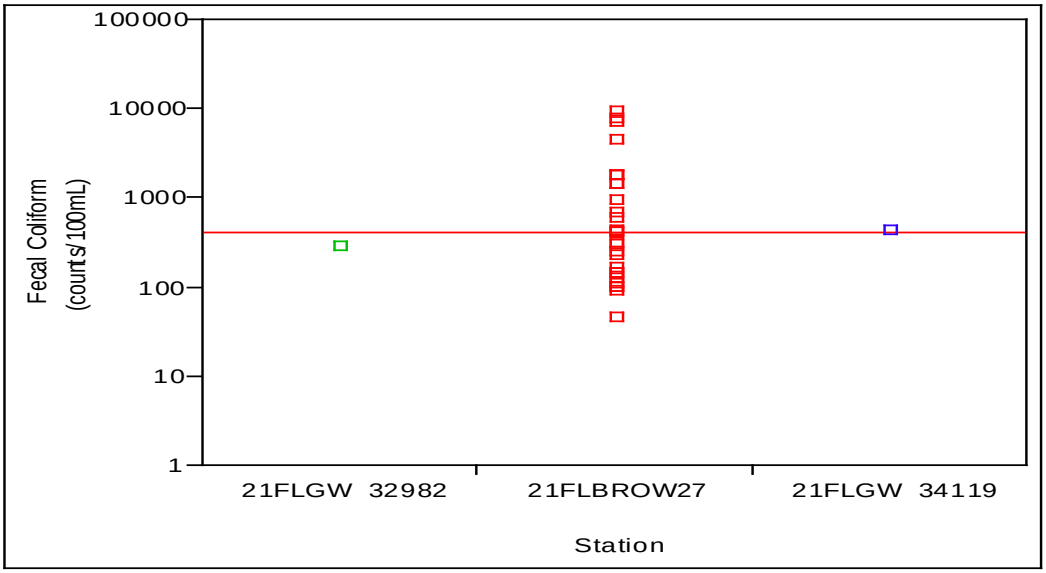

Figure 5.5s. Spatial Fecal Coliform Concentration Trends in the C-11 (East) Canal (WBID 3281) by Station During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

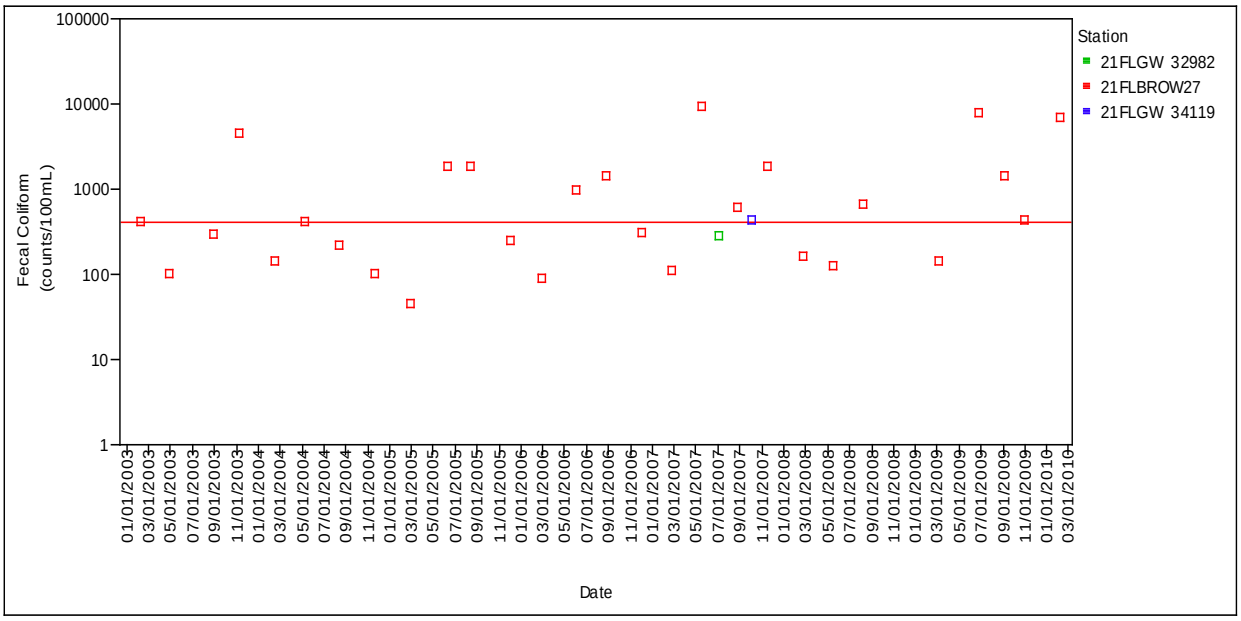

Figure 5.5t. Spatial Fecal Coliform Concentration Trends in the C-11 (East) Canal (WBID 3281) by Date During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

Table 5.5j. Station Summary Statistics of Fecal Coliform Data for the C-11 (East) Canal (WBID 3281) During the Cycle 2 Verified Period (January 1, 2003–June 30, 2010)

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

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

Station	Period of Observation	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
21FLBROW27	2003–10	28	44	9,100	400	1,490.9	13	46.4%
21FLGW 32982	2007	1	280	280	280	280	0	0%
21FLGW 34119	2007	1	430	430	430	430	1	100%

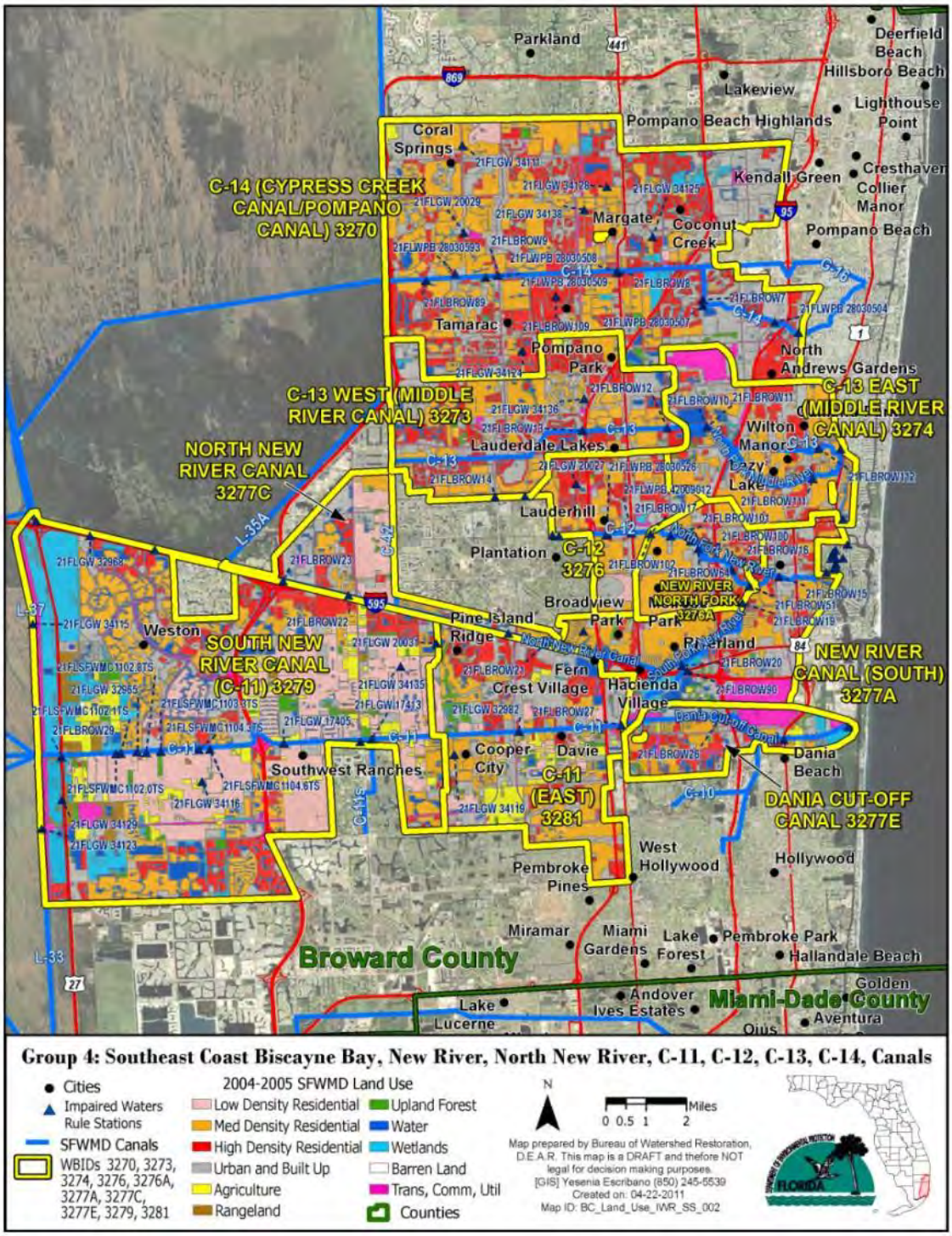

Figure 5.6. Principal Land Uses and Location of Water Quality Stations with Fecal Coliform Data in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281

5.1.2 Critical Condition

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

Even though current flow data were available for the freshwater WBIDs, the impact of their hydrologic condition on fecal coliform concentrations was analyzed using rainfall data. These canals are highly manipulated and regulated and may at times have no flow even when there are loadings driven by storm events entering the receiving waters; therefore, using rainfall data is more representative of each watershed's hydrologic conditions.

A flow duration curve–type chart that would normally be applied to flow events was created using precipitation data from the SFWMD climate stations (**Table 5.4**). The charted rainfall duration interval was divided in the same manner as if flow were being analyzed, where extreme precipitation events represent the lower percentiles (0–5th percentile), followed by large precipitation events (5th–10th percentile), medium precipitation events (10th–40th percentile), small precipitation events (40th–60th percentile), and not measurable precipitation events (60th–100th percentile). Event precipitation intervals for each WBID were derived based on these percentile ranges and are presented in **Table 5.6.** Three-day (the day of and 2 days prior to sampling) precipitation accumulations were used in the analysis (**Tables 5.7a** through **5.7j** and **Figures 5.7a** through **5.7j**).

Table 5.6. Precipitation Event Ranges for Rainfall Data for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281

This is a seven-column table. Column 1 lists the WBID, Column 2 lists rainfall periods of record, and Columns 3 through 7 list the event range (in inches).

WBID	Rainfall Period of Record	Extreme Event (inches/ 3 days)	Large Event (inches/ 3 days)	Medium Event (inches/ 3 days)	Small Event (inches/ 3 days)	None/ Not Measurable Event (inches/3 days)
3270	1991–2011	>2.23"	1.48" - 2.23"	0.16" - 1.48"	0.01" - 0.16"	< 0.01"
3273	1991–2011	>2.23"	1.48" - 2.23"	0.16" - 1.48"	0.01" - 0.16"	< 0.01"
3274	1991–2011	>2.32"	1.52 - 2.32"	0.18" - 1.52"	0.02" - 0.18"	< 0.02"
3276	1999–2010	>2.14"	1.45" - 2.14"	0.14" - 1.45"	0.01" - 0.14"	< 0.01"
3276A	1994–2011	>2.36"	1.52" - 2.36"	0.17" - 1.52"	0.01" - 0.17"	< 0.01"
3277A	1997–2010	>2.41"	1.55" - 2.41"	0.18" - 1.55"	0.01" - 0.18"	< 0.01"
3277C	1999–2010	>2.14"	1.45" - 2.14"	0.14" - 1.45"	0.01" - 0.14"	< 0.01"
3277E	1991–2010	>2.2"	1.4" - 2.2"	0.15" - 1.4"	0.01" - 0.15"	< 0.01"
3279	1990–2010	>2.95"	2.2" - 2.95"	0.62" - 2.2"	0.25" - 0.62"	< 0.25"
3281	1990–2010	>3.63"	2.55" - 3.63"	0.73" - 2.55"	0.24" - 0.73"	< 0.24"

C-14 (Cypress Creek) Canal (WBID 3270)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. The highest percentage of exceedances occurred after periods of large and extreme precipitation events (50% and 42%, respectively). The lowest percentage of exceedances (8%) occurred after periods of no measurable precipitation.

Given that high exceedance rates and high concentrations followed most of the sampled precipitation events, and that there are no point source dischargers within the WBID boundary other than a permitted point source (e.g., a WWTP), which transports wastewater to the Atlantic Ocean via ocean outfalls, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of little or no rainfall, the exceedance rate should not be considered insignificant, as it might indicate that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7a and **Figure 5.7a** show fecal coliform data for WBID 3270 by hydrologic condition. As fecal coliform exceedances occurred in all the precipitation events—extreme, large, medium, small, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8a** is applicable under all rainfall conditions in the WBID.

Table 5.7a. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-14 (Cypress Creek) Canal (WBID 3270)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.23"	18	6	33%	12	67%
Large	1.48" - 2.23"	0	0	0%	0	0%
Medium	0.16" - 1.48"	39	9	23%	30	77%
Small	0.01" - 0.16"	40	4	10%	36	90%
None/ Not Measurable	<0.01"	47	4	8.5%	43	91.5%

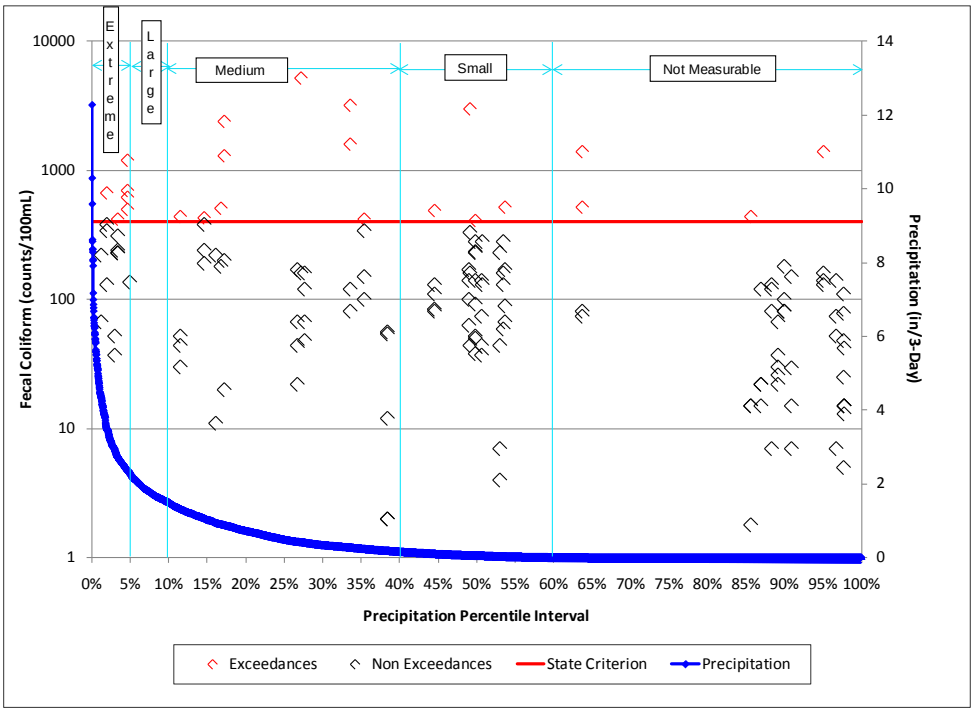

Figure 5.7a. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-14 (Cypress Creek) Canal (WBID 3270)

C-13 West (Middle River) Canal (WBID 3273)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for large precipitation events, perhaps because of the small number of samples collected (n=1) at these events. The highest percentage of exceedances (44%) occurred after periods of medium precipitation. The lowest percentage (5%) occurred after periods of no measurable precipitation.

Given that exceedance rates and exceedances in concentrations followed all the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels of fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of no or little rainfall, the exceedance rate should not be considered insignificant, as this might indicate that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7b and **Figure 5.7b** show fecal coliform data for WBID 3273 by hydrologic condition. As fecal coliform exceedances occurred in the majority of precipitation intervals—extreme, medium, small, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8b** is applicable under all rainfall conditions in the WBID.

Table 5.7b. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-13 West (Middle River) Canal (WBID 3273)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.23"	3	3	100%	0	0%
Large	1.48" - 2.23"	0	0	0%	0	0%
Medium	0.16" - 1.48"	26	4	15%	22	85%
Small	0.01" - 0.16"	18	2	11%	16	89%
None/ Not Measurable	<0.01"	23	2	8.7%	21	91.3%

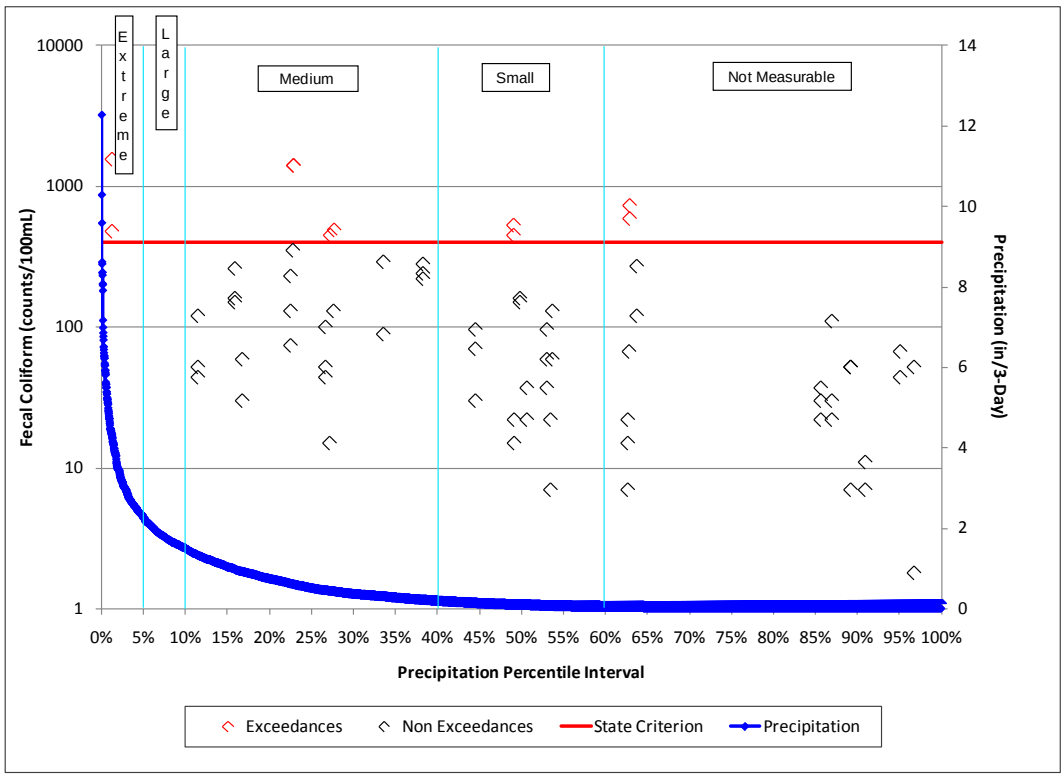

Figure 5.7b. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-13 West (Middle River) Canal (WBID 3273)

C-13 East (Middle River) Canal (WBID 3274)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for extreme precipitation events, perhaps because of the small number of samples collected at these events (n=1). The highest percentage of exceedances (100%) occurred after large precipitation events. In addition, more than half of the samples collected during medium precipitation events (51%) exceeded fecal coliform concentrations. The lowest percentage of exceedances (17%) occurred after periods of no measurable precipitation.

Given that exceedance rates and exceedances in concentrations followed most of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels of fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of little or no rainfall, the exceedance rate should not be considered insignificant, as this might indicate that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7c and **Figure 5.7c** show fecal coliform data for WBID 3274 by hydrologic condition. As fecal coliform exceedances occurred in the majority of precipitation events—large, medium, small, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8c** is applicable under all rainfall conditions in the WBID.

Table 5.7c. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-13 East (Middle River) Canal (WBID 3274)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.32"	1	0	0%	1	100%
Large	1.52 - 2.32"	5	5	100%	0	0%
Medium	0.18" - 1.52"	54	25	46.3%	29	54%
Small	0.02" - 0.18"	40	13	32.5%	27	68%
None/ Not Measurable	<0.02"	53	7	13.2%	46	86.8%

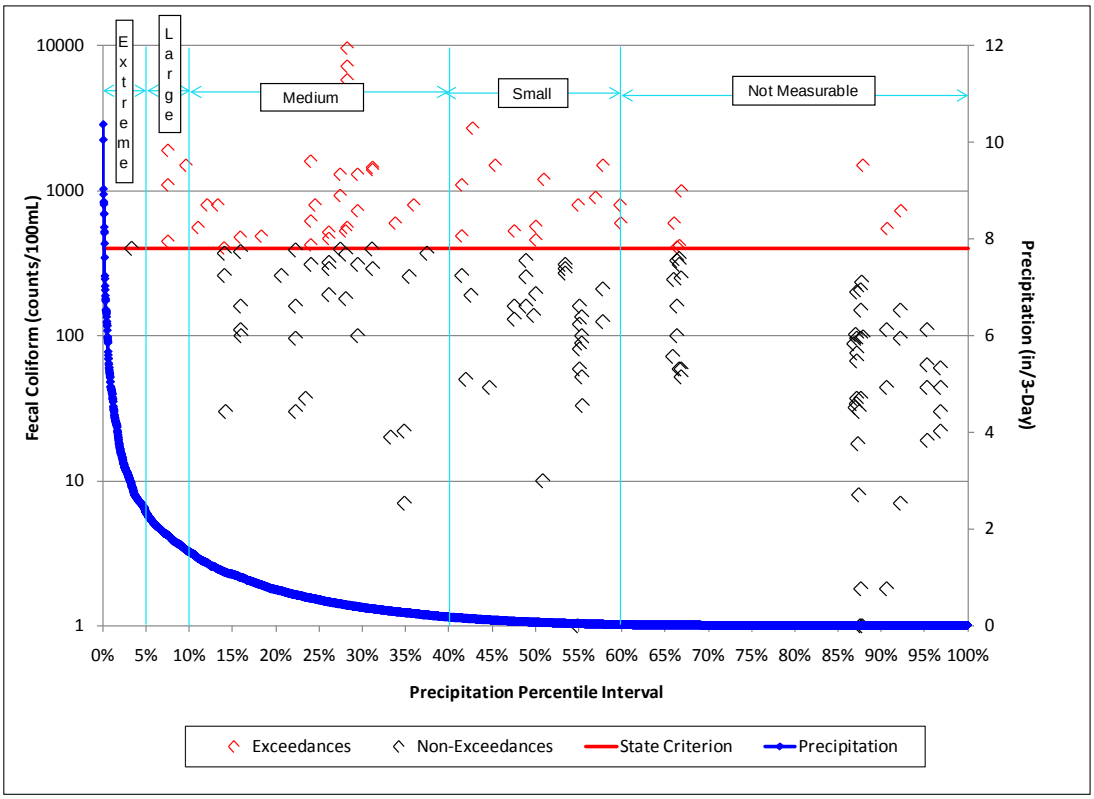

Figure 5.7c. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-13 East (Middle River) Canal (WBID 3274)

C-12 (Plantation) Canal (WBID 3276)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for small precipitation events. The highest percentage of exceedances (60%) occurred after extreme events, while the lowest percentage (17%) occurred after large events.

Given that exceedance rates and exceedances in concentrations followed most of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels of fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. The fact that the highest exceedance rates occurred after extreme precipitation events rather than after periods of little or no rainfall indicates that nonpoint sources are probably a major contributing factor. While one of the lower exceedance rates (18%) occurred after periods of little or no rainfall, this rate should not be considered insignificant, as it might indicate that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7d and **Figure 5.7d** show fecal coliform data for WBID 3276 by hydrologic condition. As fecal coliform exceedances occurred in the majority of precipitation events—extreme, large, medium, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8d** is applicable under all rainfall conditions in the WBID.

Table 5.7d. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-12 Canal (WBID 3276)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.14"	5	3	60%	2	40%
Large	1.45" - 2.14"	6	1	17%	5	83%
Medium	0.14" - 1.45"	12	4	33.3%	8	67%
Small	0.01" - 0.14"	6	0	0.0%	6	100%
None/ Not Measurable	<0.01"	28	5	17.9%	23	82.1%

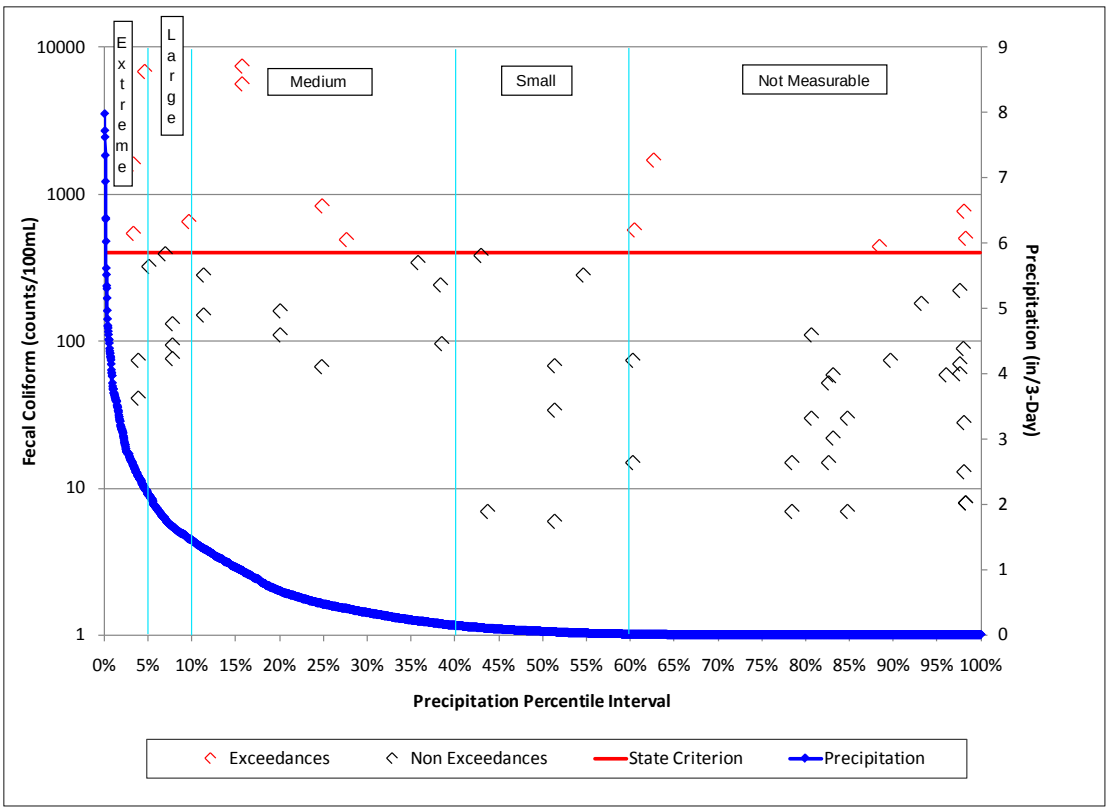

Figure 5.7d. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-12 (Plantation) Canal (WBID 3276)

New River (North Fork) (WBID 3276A)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. Exceedance rates greater than 50% occurred after all sampled events. The highest percentage of exceedances occurred after periods of extreme and large precipitation (100% for both). The lowest percentage of exceedances (62%) occurred after small precipitation events.

Given that exceedance rates and exceedances in concentrations followed all the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels of fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. The fact that the high exceedance rates occurred after all precipitation events may indicate that both nonpoint sources and local sources are major contributing factors to elevated fecal coliform concentrations.

Table 5.7e and **Figure 5.7e** show fecal coliform data for WBID 3276A by hydrologic condition. As fecal coliform exceedances occurred in all the precipitation events—extreme, large, medium, small, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8e** is applicable under all rainfall conditions in the WBID.

Table 5.7e. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the New River (North Fork) (WBID 3276A)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.36"	2	2	100%	0	0%
Large	1.52" - 2.36"	2	2	100%	0	0%
Medium	0.17" - 1.52"	16	14	87.5%	2	13%
Small	0.01" - 0.17"	13	8	61.5%	5	38%
None/ Not Measurable	<0.01"	20	13	65.0%	7	35.0%

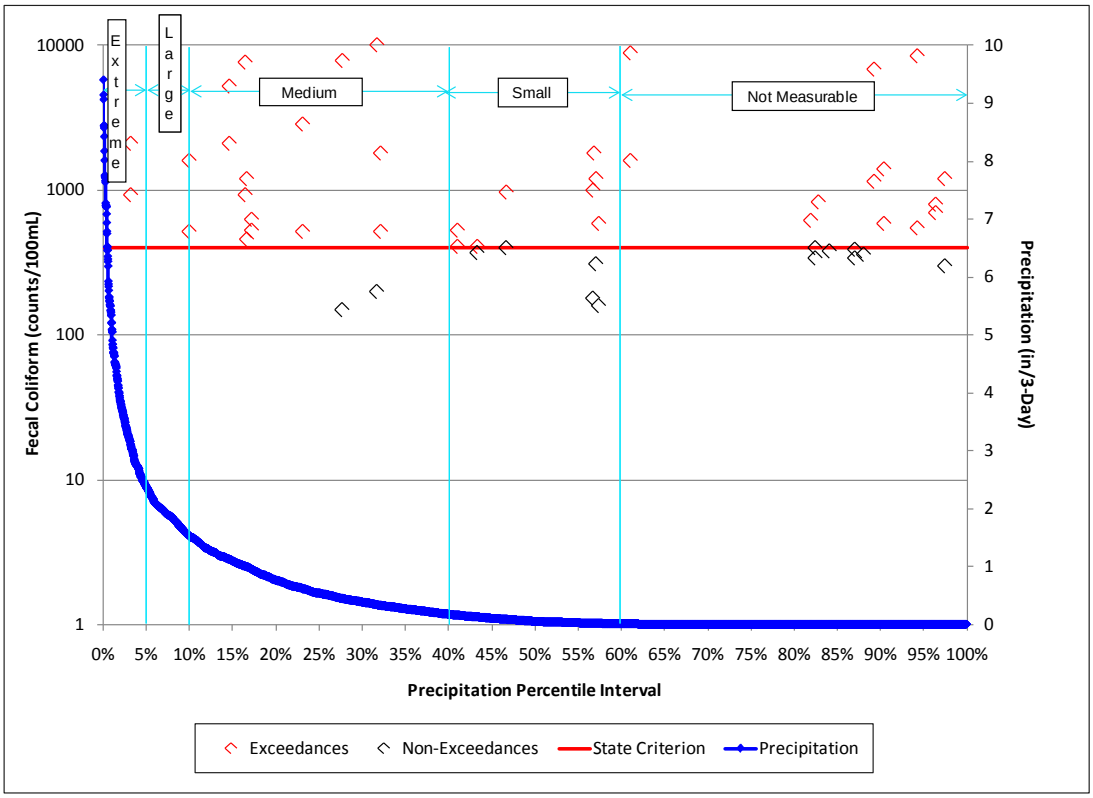

Figure 5.7e. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the New River (North Fork) (WBID 3276A)

New River Canal (South) (WBID 3277A)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. The highest percentage of exceedances occurred after periods of extreme and large precipitation (77% and 88%, respectively). The lowest percentages of exceedances occurred after periods of small and not measurable precipitation (8% and 7%, respectively).

Given that high exceedance rates and high concentrations followed all of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels of fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of little or no rainfall, this rate should not be considered insignificant, as it might indicate that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7f and **Figure 5.7f** show fecal coliform data for WBID 3277A by hydrologic condition. As fecal coliform exceedances occurred in all the precipitation events—extreme, large, medium, small, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8f** is applicable under all rainfall conditions in the WBID.

Table 5.7f. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the New River Canal (South) (WBID 3277A)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.41"	13	10	77%	3	23%
Large	1.55" - 2.41"	8	7	88%	1	13%
Medium	0.18" - 1.55"	33	9	27.3%	24	73%
Small	0.01" - 0.18"	13	1	7.7%	12	92%
None/ Not Measurable	<0.01"	44	3	6.8%	41	93.2%

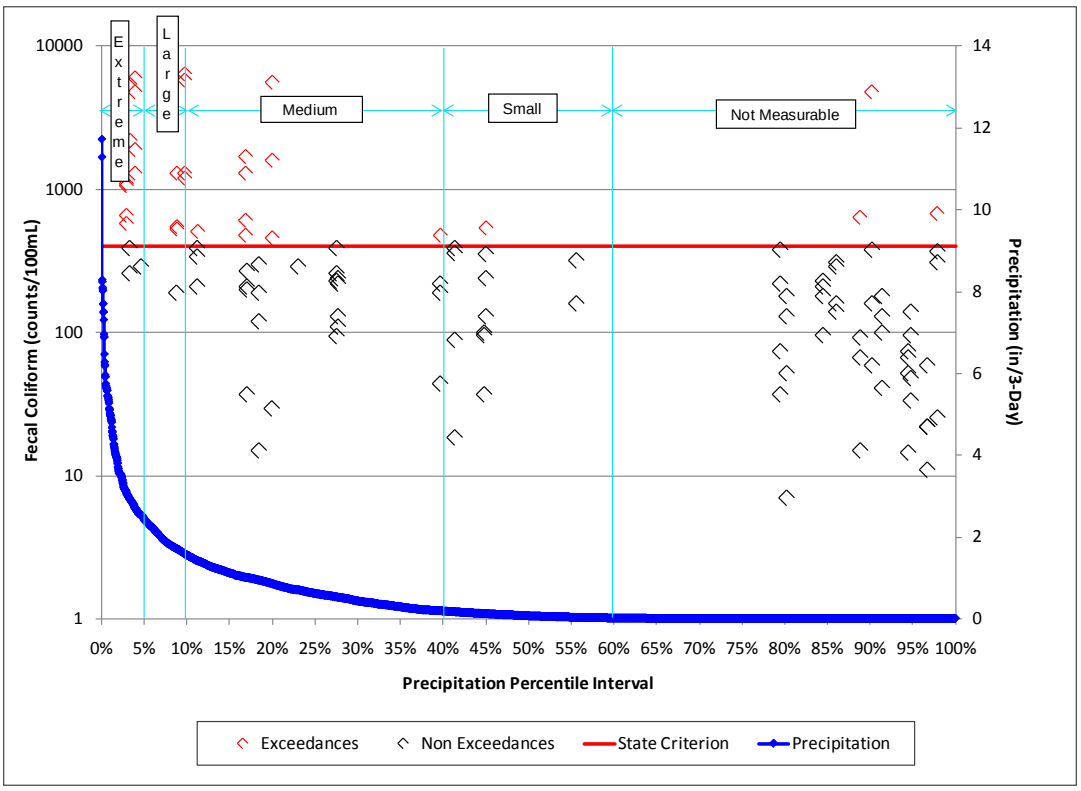

Figure 5.7f. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the South Fork New River (WBID 3277A)

North New River Canal (WBID 3277C)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. The highest percentage of exceedances (70%) occurred after large precipitation events. The lowest percentage of exceedances (5%) occurred after periods of no measurable precipitation.

Given that high exceedance rates and high concentrations followed all of the sampled precipitation events, and that there are no point source dischargers within the WBID boundary other than permitted point sources (e.g., a WWTP), it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of little or no rainfall, this rate should not be considered insignificant, as it might indicate that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7g and **Figure 5.7g** show fecal coliform data for WBID 3277C by hydrologic condition. As fecal coliform exceedances occurred in all the precipitation events—extreme, large, medium, small, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8g** is applicable under all rainfall conditions in the WBID .

Table 5.7g. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the North New River Canal (WBID 3277C)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.14"	8	2	25%	6	75%
Large	1.45" - 2.14"	7	5	71%	2	29%
Medium	0.14" - 1.45"	20	4	20.0%	16	80%
Small	0.01" - 0.14"	10	3	30.0%	7	70%
None/ Not Measurable	<0.01"	39	2	5.1%	37	94.9%

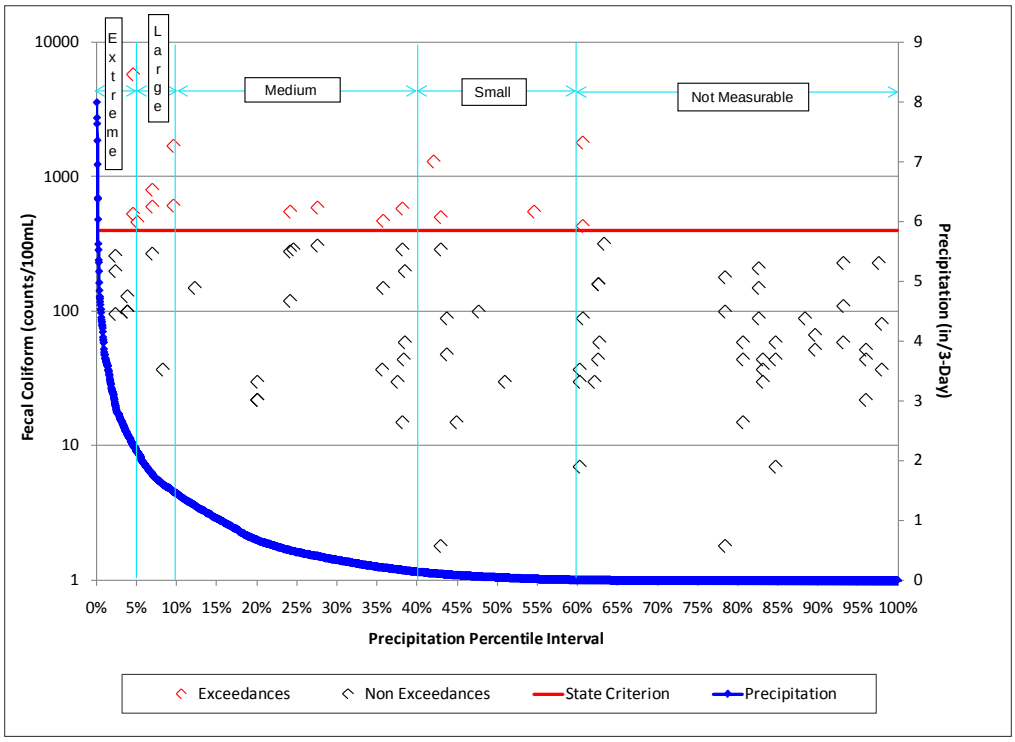

Figure 5.7g. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the North New River Canal (WBID 3277C)

Dania Cut-off Canal (WBID 3277E)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for small precipitation events. The highest percentage of exceedances occurred after periods of extreme and large precipitation (100% and 75%, respectively). The lowest percentage of exceedances (4%) occurred after periods of no measurable precipitation.

Given that high exceedance rates and high concentrations followed most of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels of fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. While the lowest percentage of exceedances occurred after periods of no or little rainfall, the exceedance rate should not be considered insignificant, as this might indicate that local sources are contributing to elevated fecal coliform concentrations.

Table 5.7h and **Figure 5.7h** show fecal coliform data for WBID 3277E by hydrologic condition. As fecal coliform exceedances occurred in the majority of the precipitation intervals—extreme, large, medium, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8h** is applicable under all rainfall conditions in the WBID.

Table 5.7h. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the Dania Cut-off Canal (WBID 3277E)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.2"	4	4	100%	0	0%
Large	1.4" - 2.2"	4	3	75%	1	25%
Medium	0.15" - 1.4"	25	10	40.0%	15	60%
Small	0.01" - 0.15"	11	0	0.0%	11	100%
None/ Not Measurable	<0.01"	23	1	4.3%	22	95.7%

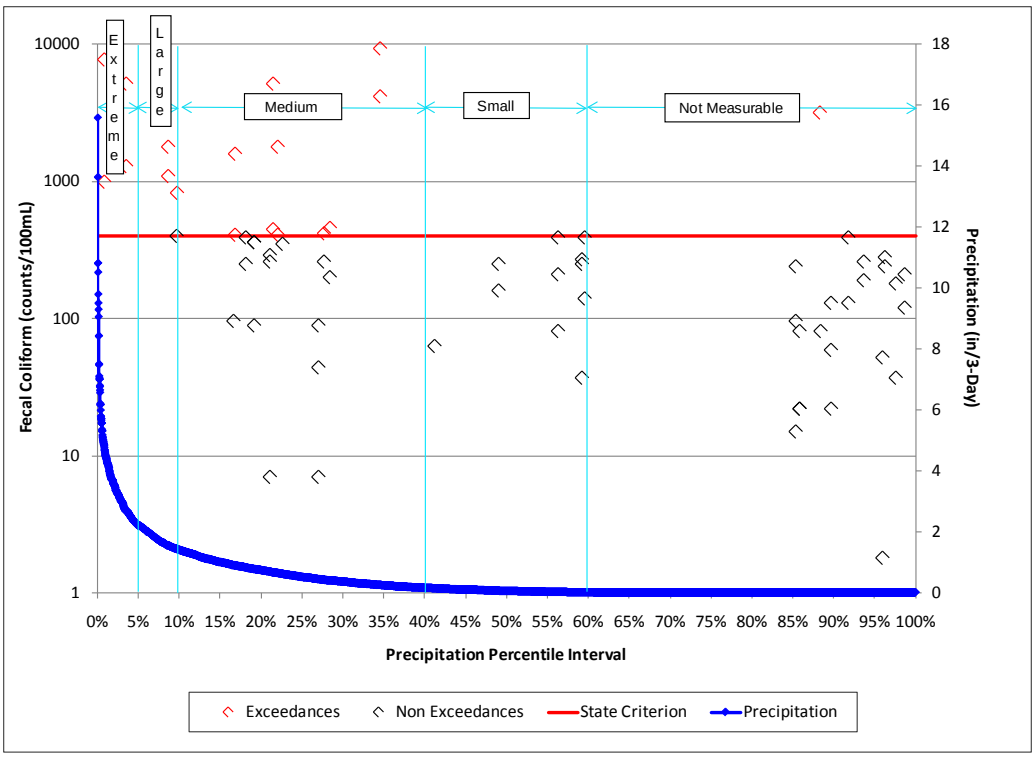

Figure 5.7h. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the Dania Cut-off Canal (WBID 3277E)

C-11 (South New River) Canal (WBID 3279)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for large precipitation events. The highest percentage of exceedances (50%) occurred after periods of extreme precipitation; however, this period also had the fewest number of samples collected (n=2). The lowest percentage of exceedances (27%) occurred after periods of small precipitation. A relatively high percentage of exceedances (31%) occurred after periods of none or no measurable precipitation.

Given that high exceedance rates and high concentrations followed most of the sampled precipitation events and that, other than MS4s, there are no traditional point source dischargers that would contribute to observed levels of fecal coliform bacteria within the WBID boundary, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. The fact that high exceedance rates occurred after all precipitation events indicates that both nonpoint sources and local sources are major contributing factors to elevated fecal coliform concentrations.

Table 5.7i and **Figure 5.7i** show fecal coliform data for WBID 3279 by hydrologic condition. As fecal coliform exceedances occurred in the majority of precipitation intervals—extreme, medium, small, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8i** is applicable under all rainfall conditions in the C-11 (South New River) Canal (WBID 3279).

Table 5.7i. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-11 (South New River) Canal (WBID 3279)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>2.95"	2	1	50%	1	50%
Large	2.2" - 2.95"	6	0	0%	6	100%
Medium	0.62" - 2.2"	15	5	33.3%	10	67%
Small	0.25" - 0.62"	15	4	26.7%	11	73%
None/ Not Measurable	<0.25"	36	11	30.6%	25	69.4%

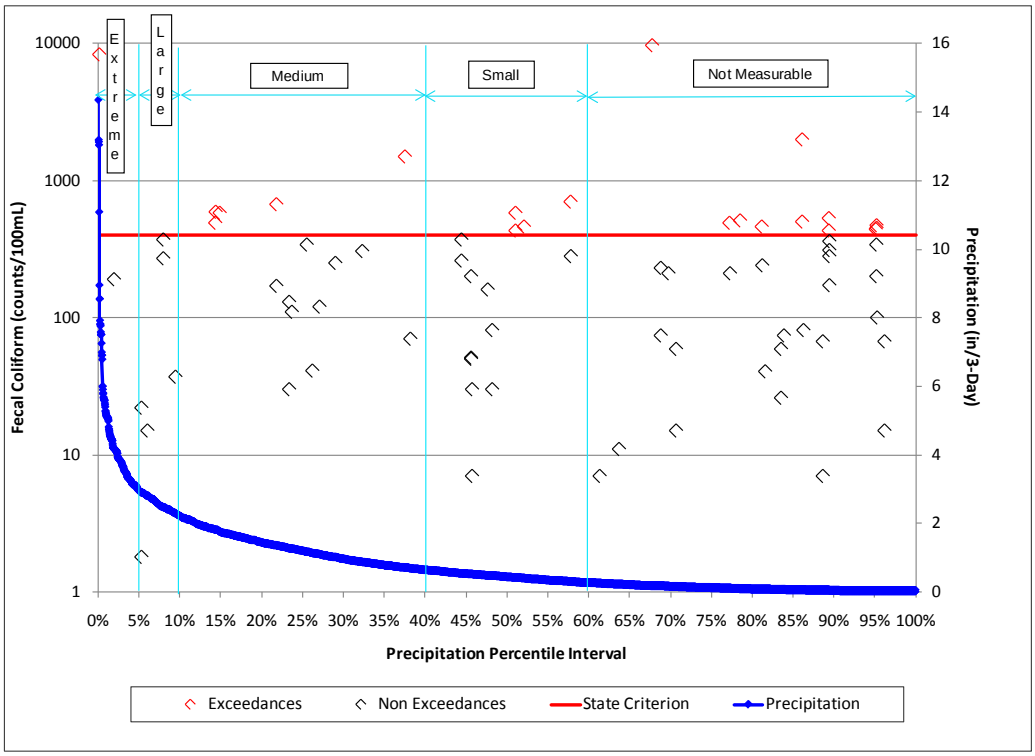

Figure 5.7i. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-11 (South New River) Canal (WBID 3279)

C-11 (East) Canal (WBID 3281)

Historical data show that fecal coliform exceedances occurred over all hydrologic conditions except for extreme precipitation events, perhaps because of the small number of samples collected during these events (n=1). The highest percentages of exceedances occurred after periods of large and small precipitation (100% and 60%, respectively). The lowest percentage of exceedances (27%) occurred after periods of no measurable precipitation.

Given that high exceedance rates and high concentrations followed most of the sampled precipitation events, and that there are no point source dischargers within the WBID boundary other than a permitted point source (e.g., a WWTP), which transports wastewater to the Atlantic Ocean via ocean outfalls, it can be assumed that various nonpoint sources are a major contributing factor to high fecal coliform concentrations in the WBID. In addition, the fact that high exceedance rates occurred after all precipitation events indicates that both nonpoint sources and local sources are major contributing factors to elevated fecal coliform concentrations.

No fecal coliform exceedances were reported for the permitted point source in the WBID, the Town of Davie WWTP (Permit FL0040541), during the Cycle 2 verified period (2003–10) in the Permit Compliance System (PCS) Data Monitoring Reports. **Table 5.7j** and **Figure 5.7j** show fecal coliform data for WBID 3271by hydrologic condition. As fecal coliform exceedances occurred in the majority of precipitation intervals—large, medium, small, and not measurable—the target fecal coliform reduction calculated in the following section and shown in **Table 5.8j** is applicable under all rainfall conditions in the WBID.

Table 5.7j. Summary of Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-11 (East) Canal (WBID 3281)

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

Precipitation Event	Event Range (inches/ 3 days)	Total Samples	Number of Exceedances	% Exceedances	Number of Nonexceedances	% Nonexceedances
Extreme	>3.63"	1	0	0%	1	100%
Large	2.55" - 3.63"	3	3	100%	0	0%
Medium	0.73" - 2.55"	10	5	50%	5	50%
Small	0.24" - 0.73"	5	3	60%	2	40%
None/ Not Measurable	<0.24"	11	3	27%	8	73%

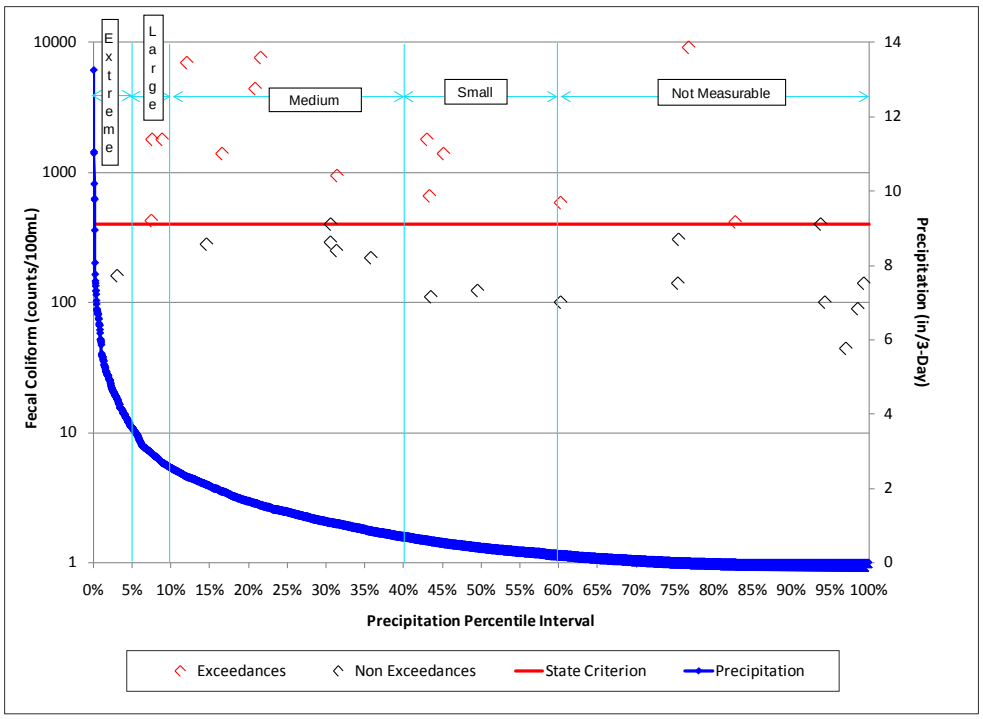

Figure 5.7j. Fecal Coliform Data for the Cycle 2 Verified Period (January 1, 2003–June 30, 2010) by Hydrologic Condition for the C-11 (East) Canal (WBID 3281)

5.1.3 TMDL Development Process

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

$$\text{Needed \% Reduction} = \frac{\text{Existing } 90^{th} \text{ Percentile Concentration} - \text{Allowable Concentration}}{\text{Existing } 90^{th} \text{ Percentile Concentration}} \times 100$$

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

In applying this method, all of the available data are ranked (ordered) from the lowest to the highest (**Tables 5.8a** through **5.8j**), and **Formula 2** is used to determine the percentile value of each data point:

$$\text{Percentile} = \frac{\text{Rank} - 0.5}{\text{Total Number of Samples Collected}}$$

If none of the ranked values is shown to be the 90th percentile value, then the 90th percentile number (used to represent the existing condition concentration) is calculated by interpolating between the two data points adjacent (above and below) to the desired 90th percentile rank using **Formula 3** (data for WBID 3273 are used as an example):

$$90^{th}\ \text{Percentile Concentration} = C_{lower} + (P_{90th} * R)$$

Where:

- *C_{lower} is the fecal coliform concentration corresponding to the percentile lower than the 90th percentile (e.g., for WBID 3273, 490 counts/100mL).*
- *P_{90th} is the percentile difference between the 90th percentile and the percentile number immediately lower than the 90th percentile (in this case, 89%), or 90% – 89% = 1%.*
- *R is a ratio defined as R = (fecal coliform concentration $_{upper}$ – fecal coliform concentration $_{lower)}$ / (percentile $_{upper}$ – percentile $_{lower}$).*

To calculate *R*, the percentile values below and above the 90th percentile were identified, in this case, 89% and 91%, respectively (**Table 5.8b**). Next, the fecal coliform concentrations corresponding to the lower and upper percentile values were identified (490 and 530 counts/100mL, respectively) (**Table 5.8b**). The fecal coliform concentration difference between the lower and higher percentiles was then calculated and divided by the unit percentile. The unit percentile difference is the difference between the lower and upper percentiles (e.g., 91% – 89% = 2 percentile unit difference). R was then calculated as R = (530 – 490) / (91% – 89%) = 20.

The *C_{lower}*, *P_{90th}*, and *R,* were substituted into **Formula 3** to calculate the 90th percentile fecal coliform concentration (i.e., 90th percentile concentration = 490 + (1*20) = 510 counts/100mL).

Using **Formula 1**, the percent reductions for the period of observation (January 1, 2003–June 30, 2010) were calculated for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 and are presented in **Tables 5.8a** through **5.8j** (e.g., for WBID 3273, % reduction needed = [(510 – 400) / 510]*100 = 21.6%).

Tables 5.8a through **5.8j** present the individual fecal coliform data, the ranks, the percentiles for each individual piece of data, the existing 90th percentile concentration, the allowable concentration (400 counts/100mL), and the percent reduction needed in each WBID to meet the applicable water quality criterion for fecal coliform.

Table 5.8a. Calculation of Fecal Coliform Reductions for the C-14 (Cypress Creek) Canal (WBID 3270) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW109	4/23/2003	1.8	1	0%
21FLWPB 28030509	3/30/2009	2	2	1%
21FLWPB 28030593	3/30/2009	2	3	2%
21FLBROW89	2/5/2003	4	4	2%
21FLWPB 28030509	11/3/2009	5	5	3%
21FLBROW109	2/5/2003	7	6	4%
21FLBROW7	11/18/2004	7	7	5%
21FLBROW7	2/22/2006	7	8	5%
21FLBROW89	3/2/2009	7	9	6%
21FLBROW89	2/20/2008	11	10	7%
21FLWPB 28030507	3/30/2009	12	11	7%
21FLWPB 28030593	11/24/2009	13	12	8%
21FLBROW109	2/12/2004	15	13	9%
21FLBROW7	4/23/2003	15	14	9%
21FLBROW89	4/23/2003	15	15	10%
21FLBROW89	2/22/2006	15	16	11%
21FLWPB 28030504	11/24/2009	15	17	11%
21FLWPB 28030507	11/24/2009	15	18	12%
21FLWPB 28030509	11/24/2009	15	19	13%
21FLGW 34124	9/18/2007	20	20	14%
21FLBROW7	2/12/2004	22	21	14%
21FLBROW89	2/12/2004	22	22	15%
21FLBROW89	5/6/2004	22	23	16%
21FLBROW89	2/23/2005	22	24	16%
21FLWPB 28030593	11/3/2009	25	25	17%
21FLBROW109	2/23/2005	26	26	18%
21FLBROW8	2/22/2006	29.5	27	18%
21FLBROW7	2/23/2005	30	28	19%
21FLBROW8	11/30/2005	30	29	20%
21FLBROW8	2/23/2005	37	30	20%
21FLBROW89	5/31/2006	37	31	21%
21FLBROW89	2/19/2007	37	32	22%
21FLWPB 28030509	8/31/2009	38	33	23%
21FLWPB 28030508	11/24/2009	42	34	23%
21FLBROW109	5/6/2004	44	35	24%
21FLBROW7	2/5/2003	44	36	25%
21FLBROW7	2/19/2007	44	37	25%
21FLBROW89	11/30/2005	44	38	26%
21FLBROW89	2/1/2010	44	39	27%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW7	6/22/2009	48	40	27%
21FLWPB 28030504	11/3/2009	48	41	28%
21FLWPB 28030593	8/31/2009	50	42	29%
21FLBROW7	11/30/2005	52	43	30%
21FLBROW7	3/2/2009	52	44	30%
21FLBROW8	5/31/2006	52	45	31%
21FLWPB 28030504	8/31/2009	52	46	32%
21FLWPB 28030508	3/30/2009	54	47	32%
21FLWPB 28030504	3/30/2009	56	48	33%
21FLBROW7	11/29/2006	59	49	34%
21FLBROW89	5/14/2007	63	50	34%
21FLBROW6	2/23/2005	67	51	35%
21FLBROW6	6/1/2006	67	52	36%
21FLBROW7	5/6/2004	67	53	36%
21FLBROW89	6/22/2009	67	54	37%
21FLBROW89	10/26/2009	67	55	38%
21FLBROW6	2/19/2007	74	56	39%
21FLBROW8	3/2/2009	74	57	39%
21FLBROW89	8/4/2008	74	58	40%
21FLWPB 28030508	11/3/2009	78	59	41%
21FLBROW6	11/18/2004	81	60	41%
21FLBROW6	8/11/2005	81	61	42%
21FLBROW7	8/23/2006	81	62	43%
21FLBROW7	8/4/2008	81	63	43%
21FLBROW8	8/11/2005	81	64	44%
21FLBROW89	11/14/2007	81	65	45%
21FLGW 34138	10/31/2007	84	66	45%
21FLBROW7	10/26/2009	89	67	46%
21FLWPB 28030508	8/31/2009	92	68	47%
21FLBROW6	8/12/2004	100	69	48%
21FLBROW7	8/11/2005	100	70	48%
21FLBROW7	5/14/2007	100	71	49%
21FLBROW7	11/14/2007	110	72	50%
21FLWPB 28030507	11/3/2009	110	73	50%
21FLBROW109	11/18/2004	120	74	51%
21FLBROW6	2/12/2004	120	75	52%
21FLBROW8	6/22/2009	120	76	52%
21FLBROW89	8/23/2006	120	77	53%
21FLBROW109	11/5/2003	130	78	54%
21FLBROW6	11/14/2007	130	79	55%
21FLBROW7	5/12/2008	130	80	55%
21FLBROW8	11/29/2006	130	81	56%
21FLBROW89	11/18/2004	130	82	57%
21FLBROW89	8/22/2007	130	83	57%
21FLGW 20029	8/12/2003	136	84	58%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW6	5/12/2008	140	85	59%
21FLBROW6	3/2/2009	140	86	59%
21FLBROW8	2/19/2007	140	87	60%
21FLBROW8	5/14/2007	140	88	61%
21FLBROW8	8/31/2009	140	89	61%
21FLBROW6	2/22/2006	150	90	62%
21FLBROW7	8/12/2004	150	91	63%
21FLBROW6	6/22/2009	160	92	64%
21FLBROW7	8/20/2007	160	93	64%
21FLBROW7	2/1/2010	160	94	65%
21FLBROW8	5/12/2008	160	95	66%
21FLBROW89	11/29/2006	160	96	66%
21FLBROW6	5/6/2004	170	97	67%
21FLBROW6	5/14/2007	170	98	68%
21FLBROW8	10/26/2009	170	99	68%
21FLBROW7	2/18/2008	180	100	69%
21FLBROW89	8/11/2005	180	101	70%
21FLBROW109	8/28/2003	190	102	70%
21FLGW 34128	9/18/2007	200	103	71%
21FLBROW7	6/1/2006	220	104	72%
21FLBROW8	2/20/2008	220	105	73%
21FLWPB 28030593	6/25/2009	228	106	73%
21FLBROW6	2/5/2003	230	107	74%
21FLBROW89	8/31/2009	230	108	75%
21FLWPB 28030507	6/25/2009	230	109	75%
21FLWPB 28030507	8/31/2009	234	110	76%
21FLBROW7	8/28/2003	240	111	77%
21FLWPB 28030508	6/25/2009	240	112	77%
21FLBROW6	11/29/2006	280	113	78%
21FLBROW6	8/31/2009	280	114	79%
21FLBROW8	8/22/2007	280	115	80%
21FLWPB 28030509	6/25/2009	310	116	80%
21FLBROW6	2/1/2010	330	117	81%
21FLBROW7	11/5/2003	340	118	82%
21FLBROW89	8/12/2004	340	119	82%
21FLBROW6	8/28/2003	380	120	83%
21FLBROW6	11/5/2003	380	121	84%
21FLBROW7	8/31/2009	410	122	84%
21FLBROW109	8/12/2004	420	123	85%
21FLWPB 28030504	6/25/2009	420	124	86%
21FLBROW89	8/28/2003	430	125	86%
21FLBROW6	4/23/2003	440	126	87%
21FLBROW6	11/30/2005	440	127	88%
21FLBROW8	11/14/2007	490	128	89%
21FLBROW8	6/2/2005	500	129	89%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW6	**2/18/2008**	**510**	**130**	**90%**
21FLBROW6	8/4/2008	520	131	91%
21FLBROW6	10/26/2009	520	132	91%
21FLBROW7	6/2/2005	620	133	92%
21FLBROW89	11/5/2003	670	134	93%
21FLBROW6	6/2/2005	700	135	93%
21FLBROW89	6/2/2005	1,200	136	94%
21FLGW 34125	9/18/2007	1,300	137	95%
21FLBROW8	8/4/2008	1,400	138	95%
21FLBROW89	5/12/2008	1,400	139	96%
21FLBROW8	8/23/2006	1,600	140	97%
21FLGW 34111	9/18/2007	2,400	141	98%
21FLBROW8	2/1/2010	3,000	142	98%
21FLBROW6	8/23/2006	3,200	143	99%
21FLBROW6	8/20/2007	5,200	144	100%
-	**-**	**-**	**Existing condition concentration– 90th percentile (counts/100mL)**	**510**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**
-	**-**	**-**	**Final % reduction**	**22%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8b. Calculation of Fecal Coliform Reductions for the C-13 West (Middle River) Canal (WBID 3273) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW12	3/2/2009	1.8	1	1%
21FLBROW12	11/17/2004	7	2	2%
21FLBROW12	2/24/2005	7	3	4%
21FLBROW14	2/22/2006	7	4	5%
21FLBROW14	11/29/2006	7	5	6%
21FLBROW12	2/22/2006	11	6	8%
21FLBROW14	11/17/2004	15	7	9%
21FLBROW12	8/20/2007	15	8	11%
21FLBROW12	2/1/2010	15	9	12%
21FLBROW12	4/23/2003	22	10	14%
21FLBROW12	2/11/2004	22	11	15%
21FLBROW13	11/17/2004	22	12	16%
21FLBROW12	11/29/2006	22	13	18%
21FLBROW12	2/19/2007	22	14	19%
21FLBROW14	2/1/2010	22	15	21%
21FLBROW14	4/23/2003	30	16	22%
21FLBROW14	2/11/2004	30	17	24%
21FLBROW12	11/14/2007	30	18	25%
21FLBROW12	2/18/2008	30	19	26%
21FLBROW13	4/23/2003	37	20	28%
21FLBROW14	2/6/2003	37	21	29%
21FLBROW14	2/19/2007	37	22	31%
21FLBROW12	5/5/2004	44	23	32%
21FLBROW14	12/1/2005	44	24	34%
21FLBROW12	5/12/2008	44	25	35%
21FLBROW14	5/5/2004	52	26	36%
21FLBROW13	2/24/2005	52	27	38%
21FLBROW13	12/1/2005	52	28	39%
21FLBROW14	2/24/2005	52	29	41%
21FLBROW14	3/2/2009	52	30	42%
21FLBROW12	2/6/2003	59	31	44%
21FLBROW14	2/18/2008	59	32	45%
21FLBROW14	10/26/2009	59	33	46%
21FLBROW12	8/10/2005	67	34	48%
21FLBROW14	5/12/2008	67	35	49%
21FLGW 34136	10/31/2007	70	36	51%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW14	6/8/2005	74	37	52%
21FLBROW12	8/23/2006	89	38	54%
21FLBROW13	2/6/2003	96	39	55%
21FLBROW14	11/14/2007	96	40	56%
21FLBROW13	5/5/2004	100	41	58%
21FLBROW13	2/11/2004	110	42	59%
21FLBROW12	12/1/2005	120	43	61%
21FLBROW14	8/4/2008	120	44	62%
21FLBROW13	6/8/2005	130	45	64%
21FLBROW12	6/22/2009	130	46	65%
21FLBROW12	10/26/2009	130	47	66%
21FLBROW14	8/13/2003	150	48	68%
21FLBROW14	8/31/2009	150	49	69%
21FLBROW12	8/13/2003	160	50	71%
21FLBROW12	8/31/2009	160	51	72%
21FLBROW12	8/11/2004	220	52	74%
21FLBROW12	6/8/2005	230	53	75%
21FLBROW13	8/11/2004	240	54	76%
21FLBROW13	8/13/2003	260	55	78%
21FLBROW12	8/4/2008	270	56	79%
21FLBROW14	8/11/2004	280	57	81%
21FLBROW14	8/23/2006	290	58	82%
21FLBROW12	11/6/2003	350	59	84%
21FLBROW14	5/14/2007	450	60	85%
21FLBROW14	8/20/2007	450	61	86%
21FLBROW14	6/1/2006	480	62	88%
21FLBROW14	**6/22/2009**	**490**	**63**	**89%**
21FLBROW12	**5/14/2007**	**530**	**64**	**91%**
21FLBROW13	8/10/2005	590	65	92%
21FLBROW14	8/10/2005	730	66	94%
21FLBROW13	11/6/2003	1,400	67	95%
21FLBROW14	11/6/2003	1,400	68	96%
21FLBROW12	6/1/2006	1,550	69	98%
21FLGW 34121	9/25/2007	2,600	70	99%
-	**-**	**-**	**Existing condition concentration– 90th percentile (counts/100mL)**	**510**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**
-	**-**	**-**	**Final % reduction**	**22%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8c. Calculation of Fecal Coliform Reductions for the C-13 East (Middle River) Canal (WBID 3274) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH BROWARD31	3/31/2003	1	1	0%
21FLDOH BROWARD31	4/14/2003	1	2	1%
21FLDOH BROWARD31	5/19/2003	1	3	2%
21FLBROW10	2/24/2005	1.8	4	2%
21FLBROW10	4/23/2003	1.8	5	3%
21FLBROW10	2/23/2006	7	6	4%
21FLBROW10	8/6/2008	7	7	4%
21FLDOH BROWARD31	3/10/2003	8	8	5%
21FLDOH BROWARD31	8/25/2003	10	9	6%
21FLDOH BROWARD31	3/3/2003	18	10	6%
21FLBROW10	5/14/2008	19	11	7%
21FLDOH BROWARD31	6/23/2003	20	12	8%
21FLBROW112	3/2/2009	22	13	8%
21FLBROW10	8/22/2007	22	14	9%
21FLBROW111	3/2/2009	30	15	9%
21FLDOH BROWARD31	4/7/2003	30	16	10%
21FLBROW10	5/5/2004	30	17	11%
21FLBROW10	8/24/2006	30	18	11%
21FLDOH BROWARD31	1/21/2003	32	19	12%
21FLBROW10	2/21/2007	33	20	13%
21FLDOH BROWARD31	2/3/2003	34	21	13%
21FLBROW10	2/6/2003	37	22	14%
21FLBROW10	2/20/2008	37	23	15%
21FLBROW11	4/23/2003	37	24	15%
21FLBROW112	2/24/2005	44	25	16%
21FLBROW10	3/4/2009	44	26	17%
21FLBROW112	5/12/2008	44	27	17%
21FLBROW10	10/28/2009	44	28	18%
21FLDOH BROWARD31	2/24/2003	50	29	19%
21FLBROW10	8/10/2005	52	30	19%
21FLBROW10	11/30/2006	52	31	20%
21FLBROW10	8/11/2004	59	32	21%
21FLBROW11	8/10/2005	59	33	21%
21FLBROW111	11/17/2004	59	34	22%
21FLBROW11	3/2/2009	60	35	23%
21FLBROW111	5/12/2008	63	36	23%
21FLBROW112	2/6/2003	67	37	24%
21FLDOH BROWARD31	5/5/2003	72	38	25%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH BROWARD31	2/10/2003	76	39	25%
21FLBROW10	11/17/2004	81	40	26%
21FLDOH BROWARD31	1/6/2003	88	41	26%
21FLBROW111	11/29/2006	89	42	27%
21FLBROW111	2/6/2003	96	43	28%
21FLBROW112	2/22/2006	96	44	28%
21FLBROW112	4/23/2003	96	45	29%
21FLBROW112	5/5/2004	96	46	30%
21FLDOH BROWARD31	7/14/2003	98	47	30%
21FLBROW10	2/11/2004	100	48	31%
21FLBROW10	2/3/2010	100	49	32%
21FLBROW11	6/8/2005	100	50	32%
21FLBROW112	11/29/2006	100	51	33%
21FLDOH BROWARD31	1/27/2003	102	52	34%
21FLBROW11	2/24/2005	110	53	34%
21FLBROW11	5/12/2008	110	54	35%
21FLBROW10	12/1/2005	110	55	36%
21FLBROW112	11/17/2004	120	56	36%
21FLBROW11	2/1/2010	125	57	37%
21FLBROW112	8/20/2007	130	58	38%
21FLBROW11	11/29/2006	135	59	38%
21FLDOH BROWARD31	6/16/2003	138	60	39%
21FLBROW111	2/22/2006	150	61	40%
21FLBROW111	4/23/2003	150	62	40%
21FLBROW11	2/11/2004	160	63	41%
21FLBROW111	2/19/2007	160	64	42%
21FLBROW11	5/5/2004	160	65	42%
21FLBROW111	8/20/2007	160	66	43%
21FLBROW11	11/17/2004	160	67	43%
21FLBROW112	12/1/2005	160	68	44%
21FLBROW112	8/4/2008	180	69	45%
21FLDOH BROWARD31	2/17/2003	190	70	45%
21FLDOH BROWARD31	4/30/2003	192	71	46%
21FLBROW11	11/14/2007	195	72	47%
21FLBROW11	2/6/2003	200	73	47%
21FLDOH BROWARD31	4/21/2003	207	74	48%
21FLBROW112	2/1/2010	210	75	49%
21FLDOH BROWARD31	5/12/2003	234	76	49%
21FLDOH BROWARD31	7/21/2003	244	77	50%
21FLBROW111	8/10/2005	250	78	51%
21FLBROW11	2/19/2007	255	79	51%
21FLDOH BROWARD31	8/4/2003	256	80	52%
21FLBROW11	6/22/2009	260	81	53%
21FLBROW112	8/31/2009	260	82	53%
21FLBROW10	9/2/2009	260	83	54%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW112	10/26/2009	270	84	55%
21FLBROW111	5/14/2007	290	85	55%
21FLBROW10	8/13/2003	290	86	56%
21FLBROW111	10/26/2009	290	87	57%
21FLBROW112	2/18/2008	310	88	57%
21FLBROW10	6/8/2005	310	89	58%
21FLBROW112	8/11/2004	310	90	58%
21FLBROW11	10/26/2009	310	91	59%
21FLBROW112	8/13/2003	320	92	60%
21FLBROW111	2/11/2004	330	93	60%
21FLBROW112	2/19/2007	330	94	61%
21FLBROW11	8/11/2004	340	95	62%
21FLBROW11	8/4/2008	365	96	62%
21FLDOH BROWARD31	6/9/2003	370	97	63%
21FLBROW111	8/31/2009	370	98	64%
21FLBROW11	12/1/2005	380	99	64%
21FLBROW111	5/5/2004	390	100	65%
21FLBROW11	8/23/2006	395	101	66%
21FLDOH BROWARD31	7/7/2003	396	102	66%
21FLBROW10	6/24/2009	400	103	67%
21FLBROW11	8/31/2009	405	104	68%
21FLBROW112	2/11/2004	410	105	68%
21FLBROW111	8/11/2004	420	106	69%
21FLBROW11	2/18/2008	425	107	70%
21FLBROW10	6/1/2006	450	108	70%
21FLBROW112	11/14/2007	460	109	71%
21FLBROW11	8/13/2003	470	110	72%
21FLBROW111	12/1/2005	480	111	72%
21FLDOH BROWARD31	3/17/2003	488	112	73%
21FLBROW111	6/22/2009	490	113	74%
21FLBROW111	8/13/2003	520	114	74%
21FLBROW11	8/20/2007	530	115	75%
21FLBROW111	8/4/2008	530	116	75%
21FLBROW111	2/24/2005	550	117	76%
21FLDOH BROWARD31	5/26/2003	560	118	77%
21FLBROW11	11/6/2003	560	119	77%
21FLBROW111	11/14/2007	570	120	78%
21FLDOH BROWARD31	1/14/2003	600	121	79%
21FLDOH BROWARD31	9/15/2003	600	122	79%
21FLDOH BROWARD31	9/22/2003	600	123	80%
21FLBROW111	2/18/2008	620	124	81%
21FLBROW11	2/22/2006	730	125	81%
21FLBROW111	6/8/2005	730	126	82%
21FLDOH BROWARD31	3/24/2003	800	127	83%
21FLDOH BROWARD31	7/28/2003	800	128	83%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLDOH BROWARD31	8/11/2003	800	129	84%
21FLDOH BROWARD31	8/18/2003	800	130	85%
21FLDOH BROWARD31	9/1/2003	800	131	85%
21FLDOH BROWARD31	9/8/2003	800	132	86%
21FLDOH BROWARD31	7/30/2003	900	133	87%
21FLBROW112	8/23/2006	930	134	87%
21FLBROW112	8/10/2005	1,000	135	88%
21FLBROW111	6/1/2006	1,100	136	89%
21FLBROW112	6/22/2009	1,100	137	89%
21FLBROW10	**11/15/2007**	**1,200**	**138**	**90%**
21FLBROW112	6/8/2005	1,300	139	91%
21FLBROW111	8/23/2006	1,300	140	91%
21FLBROW112	5/14/2007	1,400	141	92%
21FLBROW11	5/14/2007	1,450	142	92%
21FLBROW111	2/1/2010	1,500	143	93%
21FLDOH BROWARD31	4/28/2003	1,500	144	94%
21FLDOH BROWARD31	6/2/2003	1,500	145	94%
21FLDOH BROWARD31	6/30/2003	1,500	146	95%
21FLBROW10	5/16/2007	1,600	147	96%
21FLBROW112	6/1/2006	1,900	148	96%
21FLGW 33083	7/17/2007	2,700	149	97%
21FLBROW10	11/6/2003	5,800	150	98%
21FLBROW112	11/6/2003	7,200	151	98%
21FLBROW11	6/1/2006	8,800	152	99%
21FLBROW111	11/6/2003	9,600	153	100%
-	**-**	**-**	**Existing condition concentration– 90th percentile (counts/100mL)**	**1,200**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**
-	**-**	**-**	**Final % reduction**	**67%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8d. Calculation of Fecal Coliform Reductions for the C-12 Canal (WBID 3276) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLWPB 28030526	3/30/2009	6	1	1%
21FLBROW17	2/24/2005	7	2	3%
21FLBROW17	2/23/2006	7	3	4%
21FLBROW18	4/24/2003	7	4	6%
21FLWPB 28030526	11/24/2009	8	5	8%
21FLWPB 42009012	11/24/2009	8	6	10%
21FLWPB 42009012	11/3/2009	13	7	11%
21FLBROW17	2/5/2003	15	8	13%
21FLBROW17	4/24/2003	15	9	15%
21FLBROW18	8/11/2004	15	10	17%
21FLBROW18	11/17/2004	22	11	18%
21FLWPB 28030526	11/3/2009	28	12	20%
21FLBROW18	2/11/2004	30	13	22%
21FLBROW18	2/24/2005	30	14	24%
21FLWPB 42009012	3/30/2009	34	15	25%
21FLBROW18	8/10/2005	41	16	27%
21FLBROW17	8/11/2004	52	17	29%
21FLBROW17	11/17/2004	59	18	31%
21FLBROW17	3/4/2009	59	19	32%
21FLWPB 28030526	8/31/2009	60	20	34%
21FLBROW18	8/13/2003	67	21	36%
21FLWPB 42009011	3/30/2009	68	22	38%
21FLWPB 42009012	8/31/2009	70	23	39%
21FLBROW17	8/10/2005	74	24	41%
21FLBROW17	2/21/2007	74	25	43%
21FLBROW18	2/5/2003	74	26	45%
21FLWPB 42009012	6/25/2009	76	27	46%
21FLBROW17	10/28/2009	89	28	48%
21FLWPB 28030526	6/25/2009	94	29	50%
21FLBROW17	8/6/2008	96	30	52%
21FLBROW17	2/11/2004	110	31	54%
21FLBROW17	11/30/2005	110	32	55%
21FLWPB 42009011	6/25/2009	131	33	57%
21FLBROW18	5/5/2004	150	34	59%
21FLBROW18	11/30/2005	160	35	61%
21FLBROW17	5/14/2008	180	36	62%
21FLWPB 42009011	8/31/2009	220	37	64%
21FLBROW17	2/18/2008	240	38	66%
21FLBROW17	5/5/2004	280	39	68%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW17	8/20/2007	280	40	69%
21FLGW 32985	7/2/2007	320	41	71%
21FLBROW17	11/30/2006	340	42	73%
21FLBROW17	8/24/2006	380	43	75%
21FLBROW17	2/3/2010	390	44	76%
21FLBROW17	5/31/2006	440	45	78%
21FLBROW17	9/2/2009	490	46	80%
21FLWPB 42009011	11/24/2009	500	47	82%
21FLBROW18	6/2/2005	540	48	83%
21FLGW 20027	8/12/2003	570	49	85%
21FLBROW17	6/24/2009	650	50	87%
21FLWPB 42009011	11/3/2009	764	51	89%
21FLBROW17	**8/13/2003**	**830**	**52**	**90%**
21FLBROW17	6/2/2005	1,600	53	92%
21FLBROW17	11/15/2007	1,700	54	94%
21FLBROW18	11/6/2003	5,600	55	96%
21FLBROW17	5/16/2007	6,800	56	97%
21FLBROW17	11/6/2003	7,400	57	99%
-	**-**	**-**	**Existing condition concentration– 90th percentile (counts/100mL)**	**830**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**
-	**-**	**-**	**Final % reduction**	**52%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8e. Calculation of Fecal Coliform Reductions for the New River (North Fork) (WBID 3276A) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW16	3/4/2009	150	1	1%
21FLBROW16	2/24/2005	160	2	3%
21FLBROW64	2/24/2005	180	3	5%
21FLBROW64	3/4/2009	200	4	7%
21FLBROW64	2/23/2006	300	5	8%
21FLBROW16	2/21/2007	310	6	10%
21FLBROW64	4/24/2003	340	7	12%
21FLBROW64	11/17/2004	340	8	14%
21FLBROW64	5/14/2008	360	9	16%
21FLBROW16	8/11/2004	370	10	18%
21FLBROW16	11/17/2004	380	11	20%
21FLBROW16	4/24/2003	390	12	22%
21FLBROW16	2/11/2004	400	13	24%
21FLBROW16	8/6/2008	400	14	25%
21FLBROW64	6/2/2005	410	15	27%
21FLBROW64	8/11/2004	410	16	29%
21FLBROW16	5/14/2008	460	17	31%
21FLBROW16	2/23/2006	520	18	33%
21FLBROW64	2/21/2007	520	19	35%
21FLBROW64	2/3/2010	520	20	37%
21FLBROW64	5/5/2004	530	21	39%
21FLBROW64	10/28/2009	530	22	41%
21FLBROW16	5/5/2004	550	23	42%
21FLBROW16	5/31/2006	590	24	44%
21FLBROW16	5/16/2007	590	25	46%
21FLBROW64	11/30/2006	620	26	48%
21FLBROW64	5/31/2006	630	27	50%
21FLBROW16	2/5/2003	700	28	52%
21FLBROW16	8/13/2003	800	29	54%
21FLBROW16	11/30/2006	830	30	56%
21FLBROW16	2/3/2010	930	31	58%
21FLBROW64	8/6/2008	930	32	59%
21FLBROW64	2/18/2008	970	33	61%
21FLBROW16	10/28/2009	1,000	34	63%
21FLBROW64	8/10/2005	1,150	35	65%
21FLBROW16	6/24/2009	1,200	36	67%
21FLBROW16	8/24/2006	1,200	37	69%
21FLBROW16	8/20/2007	1,200	38	71%
21FLBROW64	8/24/2006	1,400	39	73%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW16	8/11/2005	1,600	40	75%
21FLBROW16	11/30/2005	1,600	41	76%
21FLBROW64	8/20/2007	1,800	42	78%
21FLBROW16	9/2/2009	1,800	43	80%
21FLBROW16	2/18/2008	2,100	44	82%
21FLBROW16	11/15/2007	2,100	45	84%
21FLBROW64	11/30/2005	2,850	46	86%
21FLBROW64	11/15/2007	5,200	47	88%
21FLBROW16	**11/6/2003**	**6,800**	**48**	**90%**
21FLBROW64	9/2/2009	7,600	49	92%
21FLBROW64	5/16/2007	7,800	50	93%
21FLBROW16	6/2/2005	8,400	51	95%
21FLBROW64	11/6/2003	8,800	52	97%
21FLBROW64	6/24/2009	10,000	53	99%
-	**-**	**-**	**Existing condition concentration– 90th percentile (counts/100mL)**	**6,800**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**
-	**-**	**-**	**Final % reduction**	**94%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8f. Calculation of Fecal Coliform Reductions for the South Fork New River (WBID 3277A) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW90	4/24/2003	7	1	0%
21FLBROW90	3/4/2009	11	2	1%
21FLBROW90	5/14/2008	14.5	3	2%
21FLBROW90	5/5/2004	15	4	3%
21FLBROW90	2/23/2006	15	5	4%
21FLBROW90	11/30/2006	18.5	6	5%
21FLBROW19	3/4/2009	22	7	6%
21FLBROW20	3/4/2009	22	8	7%
21FLBROW90	10/28/2009	25.5	9	8%
21FLBROW90	5/16/2007	29.5	10	9%
21FLBROW90	8/6/2008	33.5	11	9%
21FLBROW90	2/5/2003	37	12	10%
21FLBROW90	8/10/2005	37	13	11%
21FLBROW90	11/30/2005	37	14	12%
21FLBROW90	2/21/2007	41	15	13%
21FLBROW90	8/11/2004	44	16	14%
21FLBROW20	8/6/2008	48	17	15%
21FLBROW15	4/24/2003	52	18	16%
21FLBROW15	5/14/2008	52	19	17%
21FLBROW15	3/4/2009	59	20	18%
21FLBROW90	5/31/2006	59	21	18%
21FLBROW19	2/23/2006	67	22	19%
21FLBROW20	5/14/2008	67	23	20%
21FLBROW15	2/5/2003	74	24	21%
21FLBROW19	5/14/2008	74	25	22%
21FLBROW20	11/30/2006	89	26	23%
21FLBROW15	2/23/2006	92.5	27	24%
21FLBROW90	2/18/2008	94.5	28	25%
21FLBROW15	8/6/2008	96	29	26%
21FLBROW19	8/10/2005	96	30	27%
21FLBROW90	11/17/2004	96	31	27%
21FLBROW15	2/21/2007	100	32	28%
21FLBROW20	8/10/2005	100	33	29%
21FLBROW20	8/13/2003	110	34	30%
21FLBROW19	5/5/2004	120	35	31%
21FLBROW19	4/24/2003	130	36	32%
21FLBROW19	8/13/2003	130	37	33%
21FLBROW19	2/21/2007	130	38	34%
21FLBROW20	8/20/2007	130	39	35%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW19	8/6/2008	140	40	36%
21FLBROW20	2/24/2005	140	41	36%
21FLBROW19	5/31/2006	160	42	37%
21FLBROW90	2/11/2004	160	43	38%
21FLBROW90	2/24/2005	160	44	39%
21FLBROW20	4/24/2003	180	45	40%
21FLBROW20	11/17/2004	180	46	41%
21FLBROW20	2/21/2007	180	47	42%
21FLBROW20	5/5/2004	190	48	43%
21FLBROW20	8/11/2004	190	49	44%
21FLBROW90	9/2/2009	190	50	45%
21FLBROW20	11/30/2005	200	51	45%
21FLBROW15	11/17/2004	210	52	46%
21FLBROW19	11/30/2005	210	53	47%
21FLBROW90	11/15/2007	210	54	48%
21FLBROW15	8/13/2003	220	55	49%
21FLBROW19	2/5/2003	220	56	50%
21FLBROW19	8/11/2004	220	57	51%
21FLBROW19	11/17/2004	230	58	52%
21FLBROW20	2/18/2008	230	59	53%
21FLBROW19	8/20/2007	240	60	54%
21FLBROW90	8/13/2003	240	61	55%
21FLBROW19	2/18/2008	260	62	55%
21FLBROW20	6/2/2005	260	63	56%
21FLBROW15	11/30/2005	270	64	57%
21FLBROW15	8/11/2005	290	65	58%
21FLBROW19	2/24/2005	290	66	59%
21FLGW 34132	10/2/2007	290	67	60%
21FLBROW15	5/5/2004	300	68	61%
21FLBROW15	2/24/2005	310	69	62%
21FLBROW20	10/28/2009	310	70	63%
21FLBROW15	2/11/2004	320	71	64%
21FLBROW19	11/15/2007	340	72	64%
21FLBROW90	8/20/2007	355	73	65%
21FLBROW19	11/30/2006	360	74	66%
21FLBROW15	10/28/2009	370	75	67%
21FLBROW15	5/31/2006	380	76	68%
21FLBROW20	2/5/2003	380	77	69%
21FLBROW15	11/30/2006	390	78	70%
21FLBROW15	11/15/2007	390	79	71%
21FLBROW15	2/18/2008	390	80	72%
21FLBROW90	6/2/2005	390	81	73%
21FLBROW20	5/16/2007	460	82	73%
21FLBROW15	8/11/2004	480	83	74%
21FLBROW19	8/24/2006	480	84	75%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW20	11/15/2007	510	85	76%
21FLBROW15	9/2/2009	530	86	77%
21FLBROW15	8/20/2007	540	87	78%
21FLBROW19	9/2/2009	550	88	79%
21FLBROW19	2/3/2010	580	89	80%
21FLBROW15	8/24/2006	610	90	81%
21FLBROW20	2/23/2006	640	91	82%
21FLBROW15	2/3/2010	660	92	82%
21FLBROW19	10/28/2009	680	93	83%
21FLBROW90	2/3/2010	1,065	94	84%
21FLBROW20	2/3/2010	1,100	95	85%
21FLBROW20	11/6/2003	1,200	96	86%
21FLBROW15	6/24/2009	1,300	97	87%
21FLBROW20	8/24/2006	1,300	98	88%
21FLBROW20	9/2/2009	1,300	99	89%
21FLBROW90	**11/6/2003**	**1,300**	**100**	**90%**
21FLBROW15	5/16/2007	1,600	101	91%
21FLBROW90	8/24/2006	1,700	102	91%
21FLBROW20	6/24/2009	1,900	103	92%
21FLBROW15	6/2/2005	2,200	104	93%
21FLBROW19	6/24/2009	4,800	105	94%
21FLBROW20	5/31/2006	4,800	106	95%
21FLBROW19	6/2/2005	5,400	107	96%
21FLBROW19	5/16/2007	5,600	108	97%
21FLBROW15	11/6/2003	5,800	109	98%
21FLBROW90	6/24/2009	6,000	110	99%
21FLBROW19	11/6/2003	6,400	111	100%
-	**-**	**-**	**Existing condition concentration– 90th percentile (counts/100mL)**	**1,300**
-	**-**	**-**	**Allowable concentration (counts/100mL)**	**400**
-	**-**	**-**	**Final % reduction**	**69%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8g. Calculation of Fecal Coliform Reductions for the North New River Canal (WBID 3277C) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW23	2/21/2006	1.8	1	1%
21FLBROW23	4/24/2003	1.8	2	2%
21FLBROW21	2/6/2003	7	3	3%
21FLBROW23	2/23/2005	7	4	4%
21FLBROW23	2/12/2004	15	5	5%
21FLBROW21	8/28/2003	15	6	7%
21FLBROW23	11/28/2006	15	7	8%
21FLBROW23	3/3/2009	22	8	9%
21FLBROW22	12/1/2005	22	9	10%
21FLBROW23	12/1/2005	22	10	11%
21FLBROW23	2/6/2003	30	11	13%
21FLBROW23	2/20/2007	30	12	14%
21FLBROW23	2/19/2008	30	13	15%
21FLBROW23	5/30/2006	30	14	16%
21FLBROW22	11/18/2004	30	15	17%
21FLBROW21	12/1/2005	30	16	18%
21FLBROW22	2/6/2003	37	17	20%
21FLBROW23	5/15/2007	37	18	21%
21FLBROW23	8/5/2008	37	19	22%
21FLBROW22	10/28/2009	37	20	23%
21FLBROW23	11/18/2004	37	21	24%
21FLBROW21	2/12/2004	44	22	26%
21FLBROW22	2/23/2005	44	23	27%
21FLBROW21	2/18/2008	44	24	28%
21FLBROW21	3/4/2009	44	25	29%
21FLBROW21	11/18/2004	44	26	30%
21FLBROW23	11/13/2007	44	27	32%
21FLBROW21	2/23/2006	48	28	33%
21FLBROW22	2/21/2007	52	29	34%
21FLBROW22	3/4/2009	52	30	35%
21FLBROW22	2/12/2004	59	31	36%
21FLBROW21	2/23/2005	59	32	38%
21FLBROW22	2/20/2008	59	33	39%
21FLBROW23	5/13/2008	59	34	40%
21FLBROW21	8/6/2008	59	35	41%
21FLBROW21	2/21/2007	67	36	42%
21FLBROW21	10/28/2009	81	37	43%
21FLBROW22	2/23/2006	89	38	45%
21FLBROW23	5/6/2004	89	39	46%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW21	5/31/2006	89	40	47%
21FLBROW23	8/12/2004	89	41	48%
21FLBROW21	11/5/2003	96	42	49%
21FLBROW21	4/24/2003	100	43	51%
21FLBROW22	8/10/2005	100	44	52%
21FLBROW21	8/10/2005	100	45	53%
21FLBROW23	8/21/2007	100	46	54%
21FLBROW22	5/14/2008	110	47	55%
21FLBROW23	6/8/2005	120	48	57%
21FLBROW23	8/10/2005	130	49	58%
21FLBROW23	6/23/2009	150	50	59%
21FLBROW21	8/12/2004	150	51	60%
21FLBROW22	11/30/2006	150	52	61%
21FLBROW22	11/15/2007	160	53	63%
21FLBROW21	11/15/2007	160	54	64%
21FLBROW22	4/24/2003	180	55	65%
21FLBROW22	8/6/2008	200	56	66%
21FLBROW23	11/5/2003	200	57	67%
21FLBROW22	8/12/2004	210	58	68%
21FLBROW21	5/14/2008	230	59	70%
21FLBROW23	9/1/2009	230	60	71%
21FLBROW22	11/5/2003	260	61	72%
21FLBROW23	2/2/2010	270	62	73%
21FLBROW22	6/8/2005	280	63	74%
21FLBROW23	8/28/2003	290	64	76%
21FLBROW22	8/24/2006	290	65	77%
21FLBROW23	8/22/2006	290	66	78%
21FLBROW22	9/2/2009	310	67	79%
21FLBROW23	10/27/2009	320	68	80%
21FLBROW21	5/6/2004	430	69	82%
21FLGW 32963	7/2/2007	460	70	83%
21FLBROW21	11/30/2006	470	71	84%
21FLBROW21	8/24/2006	500	72	85%
21FLBROW21	5/16/2007	530	73	86%
21FLBROW21	6/8/2005	550	74	88%
21FLBROW21	8/20/2007	550	75	89%
21FLBROW22	**8/28/2003**	**580**	**76**	**90%**
21FLBROW21	9/2/2009	590	77	91%
21FLBROW22	2/3/2010	600	78	92%
21FLBROW21	6/24/2009	610	79	93%
21FLBROW21	2/3/2010	800	80	95%
21FLBROW22	6/1/2006	1,300	81	96%
21FLBROW22	6/24/2009	1,700	82	97%
21FLBROW22	5/6/2004	1,800	83	98%
21FLBROW22	5/16/2007	5,800	84	99%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
-	-	-	**Existing condition concentration– 90th percentile (counts/100mL)**	**580**
-	-	-	**Allowable concentration (counts/100mL)**	**400**
-	-	-	**Final % reduction**	**31%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8h. Calculation of Fecal Coliform Reductions for the Dania Cut-off Canal (WBID 3277E) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW24	5/14/2008	1.8	1	1%
21FLBROW47	5/6/2004	7	2	2%
21FLBROW47	8/11/2005	7	3	4%
21FLBROW47	2/6/2003	15	4	5%
21FLBROW47	2/24/2005	22	5	7%
21FLBROW24	4/24/2003	22	6	8%
21FLBROW47	4/24/2003	22	7	10%
21FLBROW26	3/4/2009	37	8	11%
21FLBROW47	11/18/2004	37	9	13%
21FLBROW24	5/6/2004	44	10	14%
21FLBROW26	5/14/2008	52	11	16%
21FLBROW24	2/23/2005	59	12	17%
21FLBROW47	8/11/2004	63	13	19%
21FLBROW24	2/12/2004	81	14	20%
21FLBROW26	4/24/2003	81	15	22%
21FLBROW24	8/12/2004	81	16	23%
21FLBROW26	5/6/2004	89	17	25%
21FLBROW47	12/1/2005	89	18	26%
21FLBROW24	2/6/2003	96	19	28%
21FLBROW47	8/13/2003	96	20	29%
21FLBROW24	10/28/2009	120	21	31%
21FLBROW26	2/23/2005	130	22	32%
21FLBROW24	2/23/2006	130	23	34%
21FLBROW24	11/30/2006	140	24	35%
21FLBROW24	8/22/2007	160	25	37%
21FLBROW24	3/4/2009	180	26	38%
21FLBROW26	2/21/2007	190	27	40%
21FLBROW24	8/28/2003	200	28	41%
21FLBROW26	2/12/2004	210	29	43%
21FLBROW26	10/28/2009	210	30	44%
21FLBROW26	2/6/2003	240	31	46%
21FLBROW24	8/6/2008	240	32	47%
21FLBROW24	8/24/2006	250	33	49%
21FLBROW26	8/22/2007	250	34	50%
21FLBROW24	11/18/2004	250	35	51%
21FLBROW24	2/21/2007	260	36	53%
21FLBROW24	2/20/2008	260	37	54%
21FLBROW24	8/11/2005	260	38	56%
21FLBROW26	11/18/2004	270	39	57%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW26	8/6/2008	280	40	59%
21FLBROW26	8/11/2005	290	41	60%
21FLBROW47	11/5/2003	350	42	62%
21FLBROW24	12/1/2005	360	43	63%
21FLBROW26	12/1/2005	360	44	65%
21FLBROW47	2/12/2004	390	45	66%
21FLBROW26	2/23/2006	390	46	68%
21FLBROW26	8/24/2006	390	47	69%
21FLBROW26	11/30/2006	390	48	71%
21FLBROW24	6/1/2006	400	49	72%
21FLBROW24	9/2/2009	410	50	74%
21FLBROW26	11/15/2007	410	51	75%
21FLBROW26	2/20/2008	420	52	77%
21FLBROW26	5/16/2007	450	53	78%
21FLBROW26	8/28/2003	460	54	80%
21FLBROW26	6/1/2006	830	55	81%
21FLBROW24	2/3/2010	1,000	56	83%
21FLBROW26	6/8/2005	1,100	57	84%
21FLBROW24	6/24/2009	1,300	58	86%
21FLBROW26	9/2/2009	1,600	59	87%
21FLBROW24	6/8/2005	1,800	60	89%
21FLBROW24	**11/15/2007**	**1,800**	**61**	**90%**
21FLBROW26	8/12/2004	3,200	62	92%
21FLBROW24	11/6/2003	4,200	63	93%
21FLBROW24	5/16/2007	5,200	64	95%
21FLBROW26	6/24/2009	5,200	65	96%
21FLBROW26	2/3/2010	7,800	66	98%
21FLBROW26	11/6/2003	9,400	67	99%
-	-	-	**Existing condition concentration– 90th percentile (counts/100mL)**	**1,800**
-	-	-	**Allowable concentration (counts/100mL)**	**400**
-	-	-	**Final % reduction**	**78%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8i. Calculation of Fecal Coliform Reductions for the C-11 (South New River) Canal (WBID 3279) TMDL Based on the Hazen Method

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

- = Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW29	2/21/2006	1.8	1	1%
21FLBROW28	2/21/2007	7	2	2%
21FLBROW29	11/18/2004	7	3	3%
21FLBROW29	3/3/2009	7	4	5%
21FLBROW29	2/20/2007	11	5	6%
21FLBROW29	2/6/2003	15	6	7%
21FLBROW29	2/23/2005	15	7	9%
21FLBROW29	2/19/2008	15	8	10%
21FLBROW28	2/23/2006	22	9	11%
21FLBROW29	2/12/2004	26	10	13%
21FLBROW28	12/1/2005	30	11	14%
21FLBROW28	3/4/2009	30	12	16%
21FLBROW29	4/24/2003	30	13	17%
21FLBROW28	2/20/2008	37	14	18%
21FLBROW29	11/28/2006	40.5	15	20%
21FLGW 35003	7/10/2008	41	16	21%
21FLGW 34129	10/23/2007	50	17	22%
21FLGW 34115	10/23/2007	51	18	24%
21FLBROW28	2/6/2003	59	19	25%
21FLBROW28	2/12/2004	59	20	26%
21FLBROW28	11/18/2004	67	21	28%
21FLBROW28	2/23/2005	67	22	29%
21FLBROW29	5/15/2007	70	23	30%
21FLBROW28	11/30/2006	74	24	32%
21FLBROW29	5/13/2008	74	25	33%
21FLBROW29	12/1/2005	81	26	34%
21FLBROW29	11/13/2007	81	27	36%
21FLGW 20031	8/25/2003	100	28	37%
21FLBROW29	10/27/2009	110	29	39%
21FLBROW29	5/30/2006	120	30	40%
21FLBROW28	4/24/2003	130	31	41%
21FLBROW29	8/21/2007	160	32	43%
21FLBROW28	10/28/2009	170	33	44%
21FLSFWMC1103.3TS	7/28/2008	172	34	45%
21FLBROW28	6/1/2006	190	35	47%
21FLGW 17413	6/5/2003	200	36	48%
21FLGW 34123	10/24/2007	200	37	49%
21FLBROW28	11/15/2007	210	38	51%
21FLBROW29	6/8/2005	210	39	52%
21FLBROW28	5/14/2008	230	40	53%
21FLBROW29	8/12/2004	240	41	55%

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLGW 34135	10/29/2007	250	42	56%
21FLBROW29	8/10/2005	260	43	57%
21FLBROW28	5/6/2004	270	44	59%
21FLBROW29	9/1/2009	280	45	60%
21FLSFWMC1104.3TS	7/28/2008	280	46	61%
21FLBROW29	8/22/2006	305	47	63%
21FLSFWMC1102.1TS	7/28/2008	310	48	64%
21FLBROW28	11/6/2003	340	49	66%
21FLGW 17405	6/5/2003	340	50	67%
21FLSFWMC1102.8TS	7/28/2008	360	51	68%
21FLBROW28	8/11/2005	370	52	70%
21FLBROW29	5/6/2004	370	53	71%
21FLBROW29	8/5/2008	430	54	72%
21FLSFWMC1102.0TS	7/28/2008	430	55	74%
21FLGW 17429	6/12/2003	440	56	75%
21FLBROW29	8/28/2003	450	57	76%
21FLBROW28	8/12/2004	460	58	78%
21FLBROW28	8/22/2007	460	59	79%
21FLBROW28	8/28/2003	470	60	80%
21FLBROW28	6/8/2005	490	61	82%
21FLGW 34116	10/2/2007	490	62	83%
21FLGW 32965	7/5/2007	500	63	84%
21FLBROW28	8/24/2006	510	64	86%
21FLSFWMC1104.6TS	7/28/2008	530	65	87%
21FLBROW28	8/6/2008	580	66	89%
21FLBROW29	**6/23/2009**	**580**	**67**	**90%**
21FLBROW28	6/24/2009	590	68	91%
21FLBROW29	11/5/2003	670	69	93%
21FLBROW28	9/2/2009	700	70	94%
21FLBROW28	5/16/2007	1,500	71	95%
21FLGW 32968	7/5/2007	2,000	72	97%
21FLBROW28	2/3/2010	8,400	73	98%
21FLBROW29	2/2/2010	9,800	74	99%
-	-	-	**Existing condition concentration– 90th percentile (counts/100mL)**	**580**
-	-	-	**Allowable concentration (counts/100mL)**	**400**
-	-	-	**Final % reduction**	**31%**

Note: Boldface type indicates concentration used in percent reduction calculations

Table 5.8j. Calculation of Fecal Coliform Reductions for the C-11 (East) Canal (WBID 3281) TMDL Based on the Hazen Method

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

= Empty cell/no data

Station	Date	Fecal Coliform Concentration (MPN/100mL)	Rank	Percentile by Hazen Method
21FLBROW27	2/23/2005	44	1	2%
21FLBROW27	2/23/2006	89	2	5%
21FLBROW27	4/24/2003	100	3	8%
21FLBROW27	11/18/2004	100	4	12%
21FLBROW27	2/21/2007	110	5	15%
21FLBROW27	5/14/2008	123	6	18%
21FLBROW27	2/12/2004	140	7	22%
21FLBROW27	3/4/2009	140	8	25%
21FLBROW27	2/20/2008	160	9	28%
21FLBROW27	8/12/2004	220	10	32%
21FLBROW27	12/1/2005	250	11	35%
21FLGW 32982	7/2/2007	280	12	38%
21FLBROW27	8/28/2003	290	13	42%
21FLBROW27	11/30/2006	305	14	45%
21FLBROW27	2/6/2003	400	15	48%
21FLBROW27	5/6/2004	400	16	52%
21FLBROW27	10/28/2009	420	17	55%
21FLGW 34119	10/2/2007	430	18	58%
21FLBROW27	8/22/2007	590	19	62%
21FLBROW27	8/6/2008	665	20	65%
21FLBROW27	6/1/2006	950	21	68%
21FLBROW27	8/24/2006	1,400	22	72%
21FLBROW27	9/2/2009	1,400	23	75%
21FLBROW27	6/8/2005	1,800	24	78%
21FLBROW27	8/11/2005	1,800	25	82%
21FLBROW27	11/15/2007	1,800	26	85%
21FLBROW27	**11/6/2003**	**4,400**	**27**	**88%**
21FLBROW27	**2/3/2010**	**6,950**	**28**	**92%**
21FLBROW27	6/24/2009	7,600	29	95%
21FLBROW27	5/16/2007	9,100	30	98%
-	-	-	**Existing condition concentration– 90th percentile (counts/100mL)**	**5,675**
-	-	-	**Allowable concentration (counts/100mL)**	**400**
-	-	-	**Final % reduction**	**93%**

Note: Boldface type indicates concentration used in percent reduction calculations

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:

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

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

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

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 TMDLs for WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281 are expressed as a percent reduction, and represent the maximum daily fecal coliform load each stream can assimilate without exceeding the fecal coliform criterion (**Table 6.1**).

6.2 Load Allocation

Based on a percent reduction approach, the LA for percent reduction in fecal coliform from nonpoint sources for each WBID is presented in **Table 6.1**. 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**).

Table 6.1. TMDL Components for Fecal Coliform in WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281

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

[1] N/A = WLA for wastewater is not applicable as permitted facilities discharge outside WBID boundaries
[2] N/A = Not applicable

WBID	Waterbody Name	Parameter	TMDL (counts/ 100mL)	WLA for Wastewater (counts/100mL)	WLA for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
3270	C-14 (Cypress Creek) Canal	Fecal coliform	400	N/A[1]	22%	22%	Implicit
3273	C-13 West (Middle River) Canal	Fecal coliform	400	N/A[2]	22%	22%	Implicit
3274	C-13 East (Middle River) Canal	Fecal coliform	400	N/A[2]	67%	67%	Implicit
3276	C-12 Canal	Fecal coliform	400	N/A[2]	52%	52%	Implicit
3276A	New River (North Fork)	Fecal coliform	400	N/A[2]	94%	94%	Implicit
3277A	New River Canal (South)	Fecal coliform	400	N/A[2]	69%	69%	Implicit
3277C	North New River	Fecal coliform	400	N/A[2]	31%	31%	Implicit
3277E	Dania Cut-off Canal	Fecal coliform	400	NA[2]	78%	78%	Implicit
3279	C-11 (South New River) Canal	Fecal coliform	400	N/A[2]	31%	31%	Implicit
3281	C-11 (East) Canal	Fecal coliform	400	N/A[1]	93%	93%	Implicit

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

Several NPDES-permitted wastewater facilities were identified within the WBID boundaries (see **Table 4.1a**). Two of these are domestic wastewater facilities: the Broward County North Regional WWTP and the Town of Davie WWTP (Permit Numbers FL0031771 and FL0040541, respectively). However, treated wastewater from both facilities is transported to the Atlantic Ocean via ocean outfalls, and therefore does not contribute to the observed levels of fecal coliform bacteria within the WBID where they are located.

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

6.3.2 NPDES Stormwater Discharges

Table 6.1 presents the percent reduction for stormwater discharges with an MS4 permit in current fecal coliform loading for each WBID.

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 by not subtracting contributions from natural sources and sediments when the percent reduction was calculated. This makes the estimation of human contribution more stringent and therefore adds to the MOS.

Chapter 7: TMDL IMPLEMENTATION

7.1 Basin Management Action Plan

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

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

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

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

7.2 Other TMDL Implementation Tools

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

Many assessment tools 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 Hillsborough Basins, the Department and local stakeholders have developed a logical process and tools to serve as a foundation for this detective work.

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

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

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

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

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES Stormwater Program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and the master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation 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 Permit Programs is that the NPDES Program covers both new and existing discharges, while the state's programs focus on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 1,000 people. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Municipalities Located within each WBID Boundary

Table B.1 lists all municipalities and NPDES MS4 permits covering WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281. **Figures B.1a** through **B.1j** show all municipalities located within each WBID boundary.

Table B.1. Municipalities and MS4 Permittees by WBID

This is a four-column table. Column 1 lists the WBID number, Column 2 lists the municipality/permittee, Column 3 lists the permit number, and Column 4 lists the permit name.

WBID	Municipality/Permittee	Permit ID	Permit Name
3270	City of North Lauderdale	FLS000016	Broward County and Co-permittees
3270	City of Margate	FLS000016	Broward County and Co-permittees
3270	City of Sunrise	FLS000016	Broward County and Co-permittees
3270	City of Lauderhill	FLS000016	Broward County and Co-permittees
3270	Broward County	FLS000016	Broward County and Co-permittees
3270	City of Oakland Park	FLS000016	Broward County and Co-permittees
3270	City of Coral Springs	FLS000016	Broward County and Co-permittees
3270	City of Coconut Creek	FLS000016	Broward County and Co-permittees
3270	City of Pompano Beach	FLS000016	Broward County and Co-permittees
3270	City of Tamarac	FLS000016	Broward County and Co-permittees
3270	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3273	City of Plantation	FLS000016	Broward County and Co-permittees
3273	City of Sunrise	FLS000016	Broward County and Co-permittees
3273	City of Lauderhill	FLS000016	Broward County and Co-permittees
3273	Broward County	FLS000016	Broward County and Co-permittees
3273	City of Oakland Park	FLS000016	Broward County and Co-permittees
3273	City of Lauderdale Lakes	FLS000016	Broward County and Co-permittees
3273	City of Tamarac	FLS000016	Broward County and Co-permittees
3273	City of North Lauderdale	FLS000016	Broward County and Co-permittees
3273	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3274	Broward County	FLS000016	Broward County and Co-permittees
3274	City of Oakland Park	FLS000016	Broward County and Co-permittees
3274	City of Lauderdale Lakes	FLS000016	Broward County and Co-permittees
3274	City of Tamarac	FLS000016	Broward County and Co-permittees
3274	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3274	City of Wilton Manors	FLS000016	Broward County and Co-permittees
3276	City of Plantation	FLS000016	Broward County and Co-permittees
3276	City of Sunrise	FLS000016	Broward County and Co-permittees
3276	City of Lauderhill	FLS000016	Broward County and Co-permittees
3276	Broward County	FLS000016	Broward County and Co-permittees
3276	City of Lauderdale Lakes	FLS000016	Broward County and Co-permittees
3276	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3276A	City of Plantation	FLS000016	Broward County and Co-permittees
3276A	Broward County	FLS000016	Broward County and Co-permittees

WBID	Municipality/Permittee	Permit ID	Permit Name
3276A	City of Lauderhill	FLS000016	Broward County and Co-permittees
3276A	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3277A	City of Plantation	FLS000016	Broward County and Co-permittees
3277A	City of Dania Beach	FLS000016	Broward County and Co-permittees
3277A	Broward County	FLS000016	Broward County and Co-permittees
3277A	Town of Davie	FLS000016	Broward County and Co-permittees
3277A	City of Hollywood	FLS000020	Broward County and Co-permittees
3277A	City of Ft. Lauderdale	FLS000017	City of Ft. Lauderdale
3277C	City of Weston	FLS000016	Broward County and Co-permittees
3277C	City of Plantation	FLS000016	Broward County and Co-permittees
3277C	City of Sunrise	FLS000016	Broward County and Co-permittees
3277C	Broward County	FLS000016	Broward County and Co-permittees
3277C	Town of Davie	FLS000016	Broward County and Co-permittees
3277E	City of Dania Beach	FLS000016	Broward County and Co-permittees
3277E	Broward County	FLS000016	Broward County and Co-permittees
3277E	Town of Davie	FLS000016	Broward County and Co-permittees
3277E	City of Hollywood	FLS000020	Broward County and Co-permittees
3279	City of Weston	FLS000016	Broward County and Co-permittees
3279	Broward County	FLS000016	Broward County and Co-permittees
3279	Town of Davie	FLS000016	Broward County and Co-permittees
3279	City of Cooper City	FLS000016	Broward County and Co-permittees
3279	Town of Southwest Ranches	FLS000016	Broward County and Co-permittees
3279	City of Sunrise	FLS000016	Broward County and Co-permittees
3279	City of Pembroke Pines	FLS000016	Broward County and Co-permittees
3281	Broward County	FLS000016	Broward County and Co-permittees
3281	Town of Davie	FLS000016	Broward County and Co-permittees
3281	City of Cooper City	FLS000016	Broward County and Co-permittees
3281	City of Pembroke Pines	FLS000016	Broward County and Co-permittees
3281	City of Hollywood	FLS000020	Broward County and Co-permittees

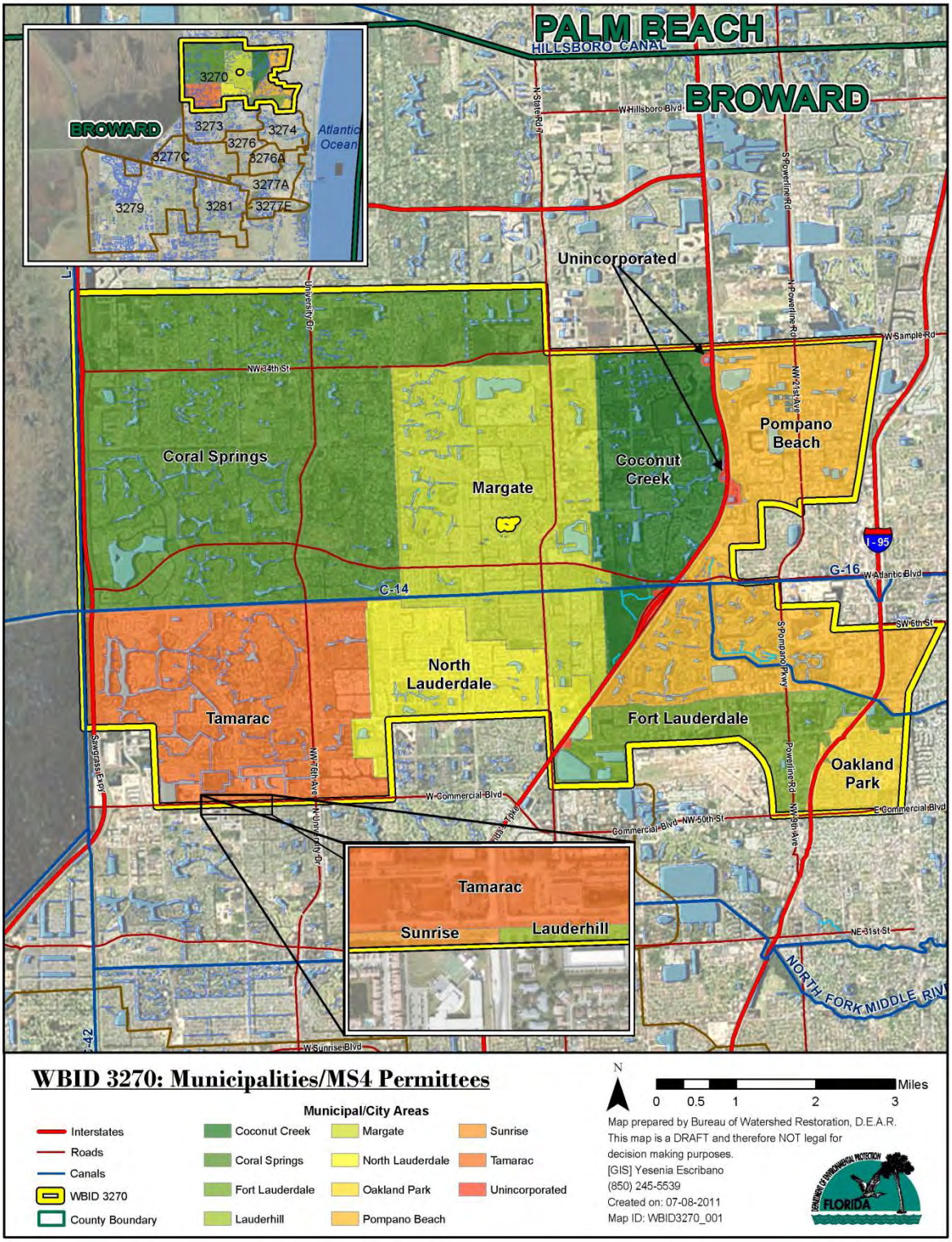

Figure B.1a. Municipalities/Permittees within the C-14 (Cypress Creek) Canal (WBID 3270) Boundary

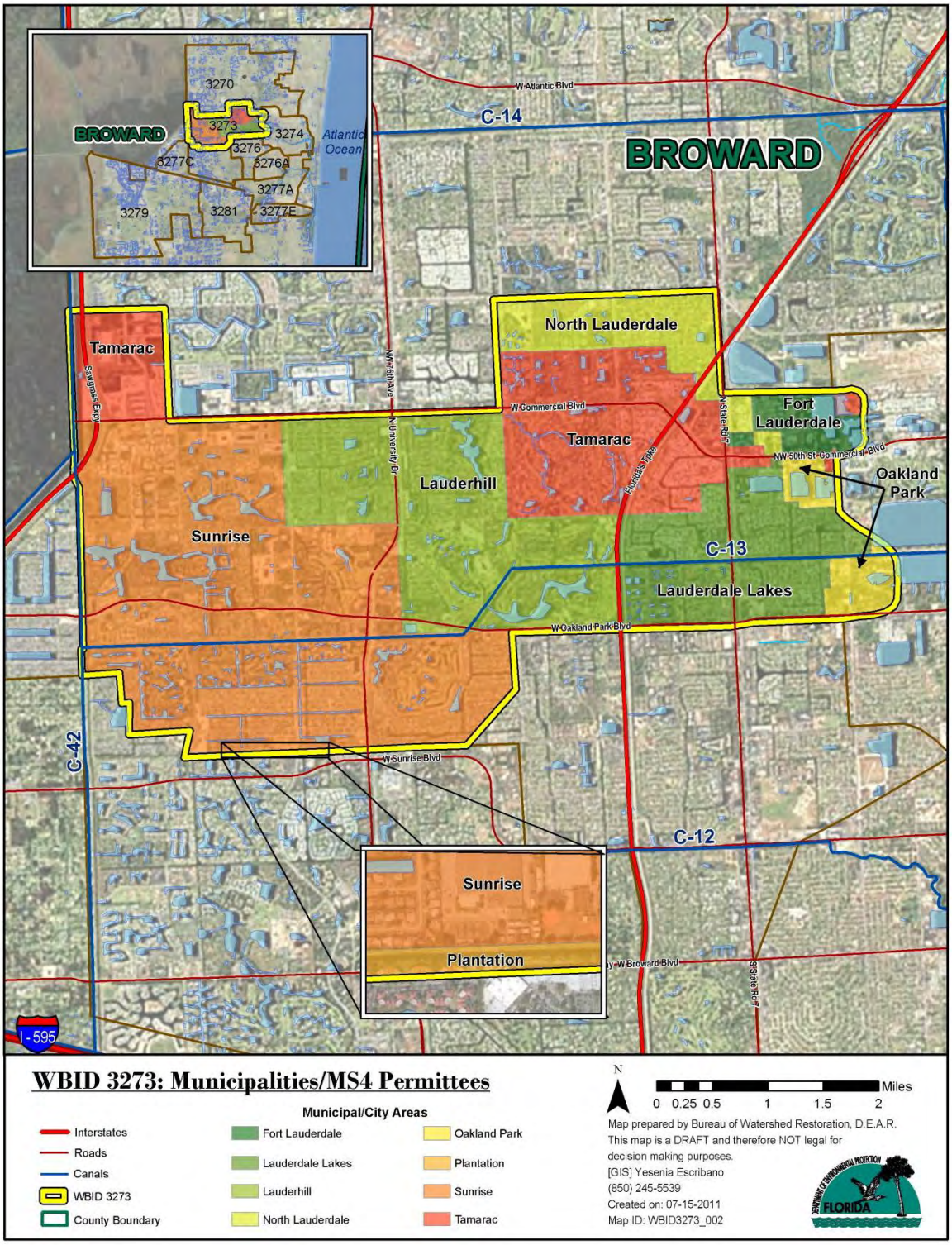

Figure B.1b. Municipalities/Permittees within the C-13 West (Middle River) Canal (WBID 3273) Boundary

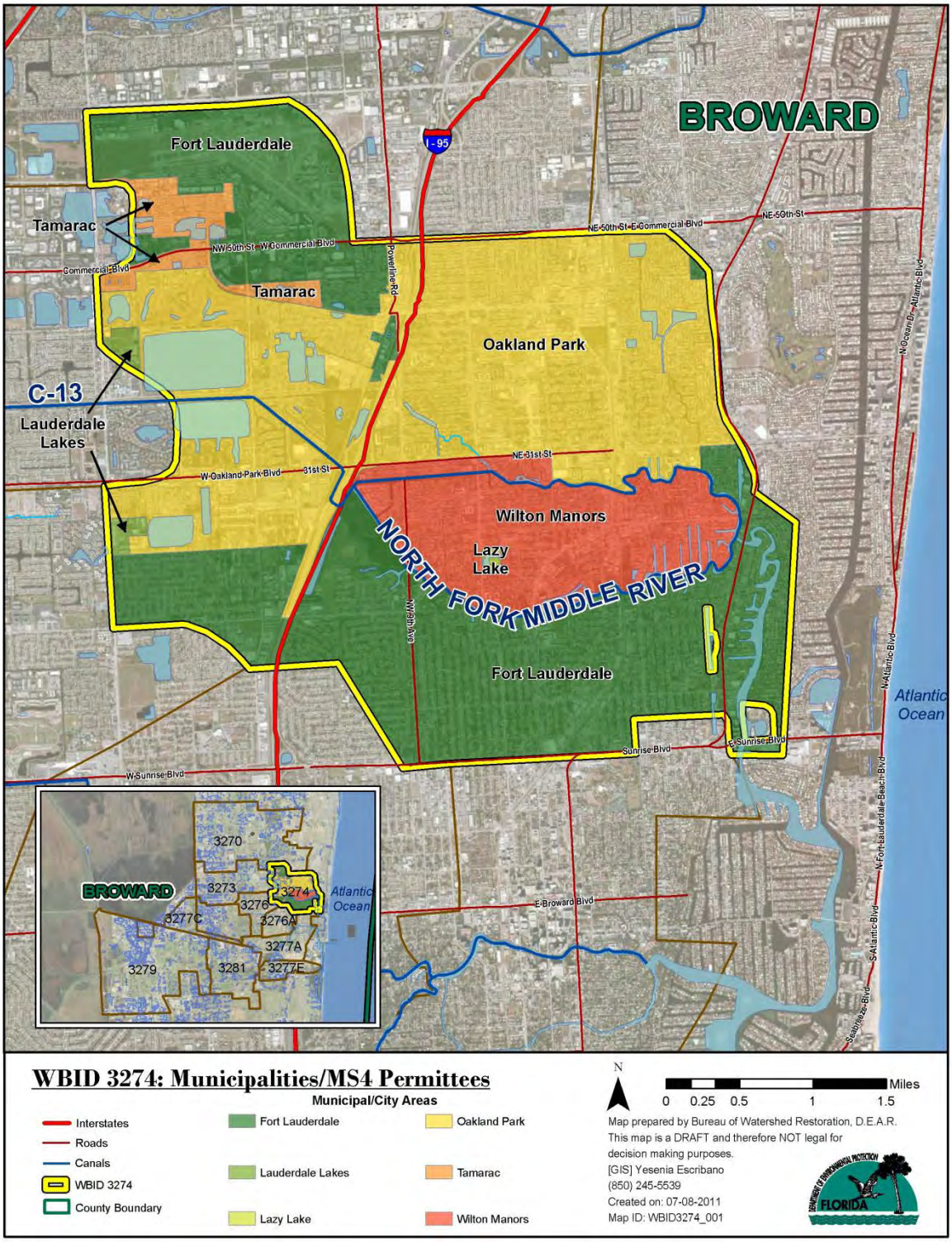

Figure B.1c. Municipalities/Permittees within the C-13 East (Middle River) Canal (WBID 3274) Boundary

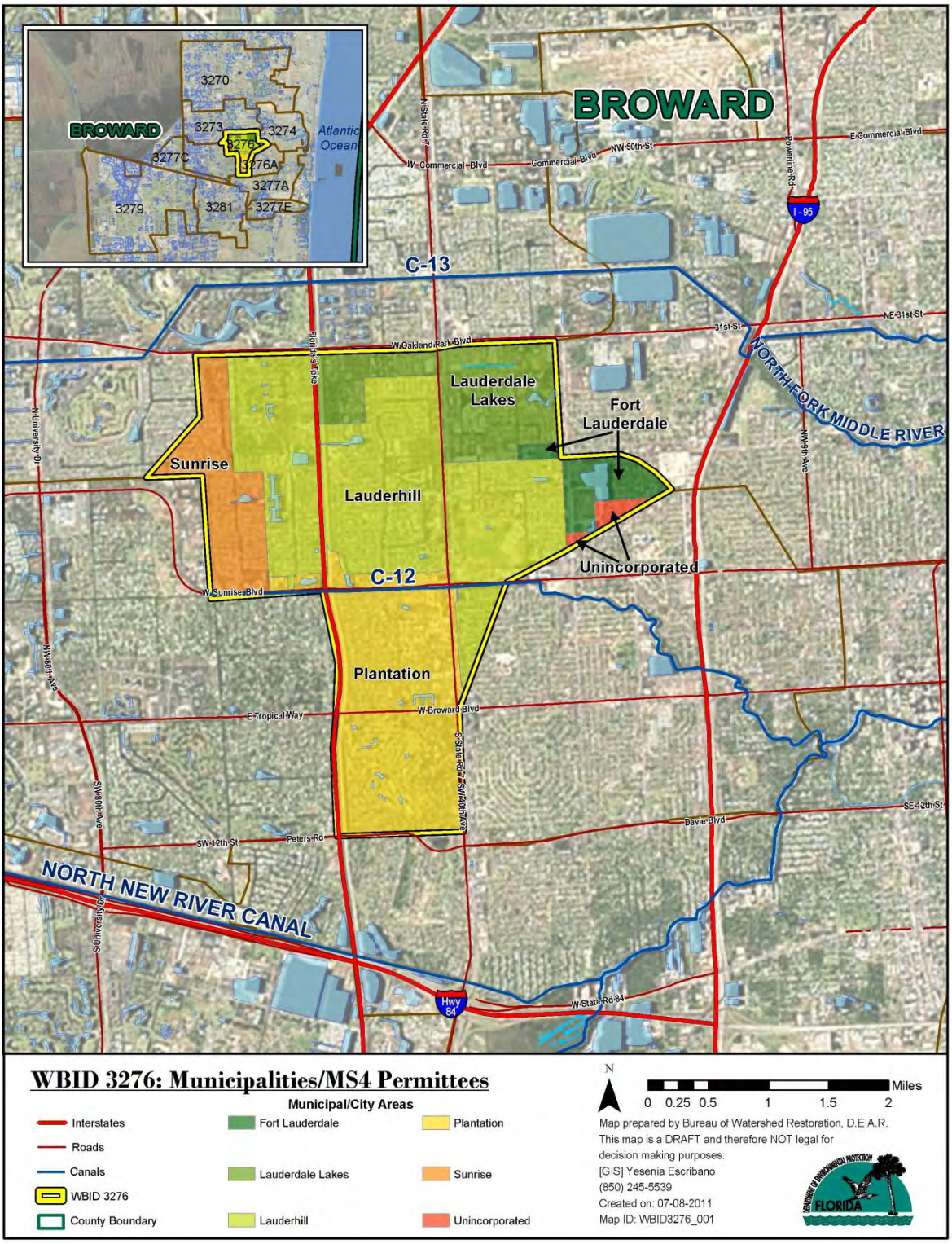

Figure B.1d. Municipalities/Permittees within the C-12 (Plantation) Canal (WBID 3276) Boundary

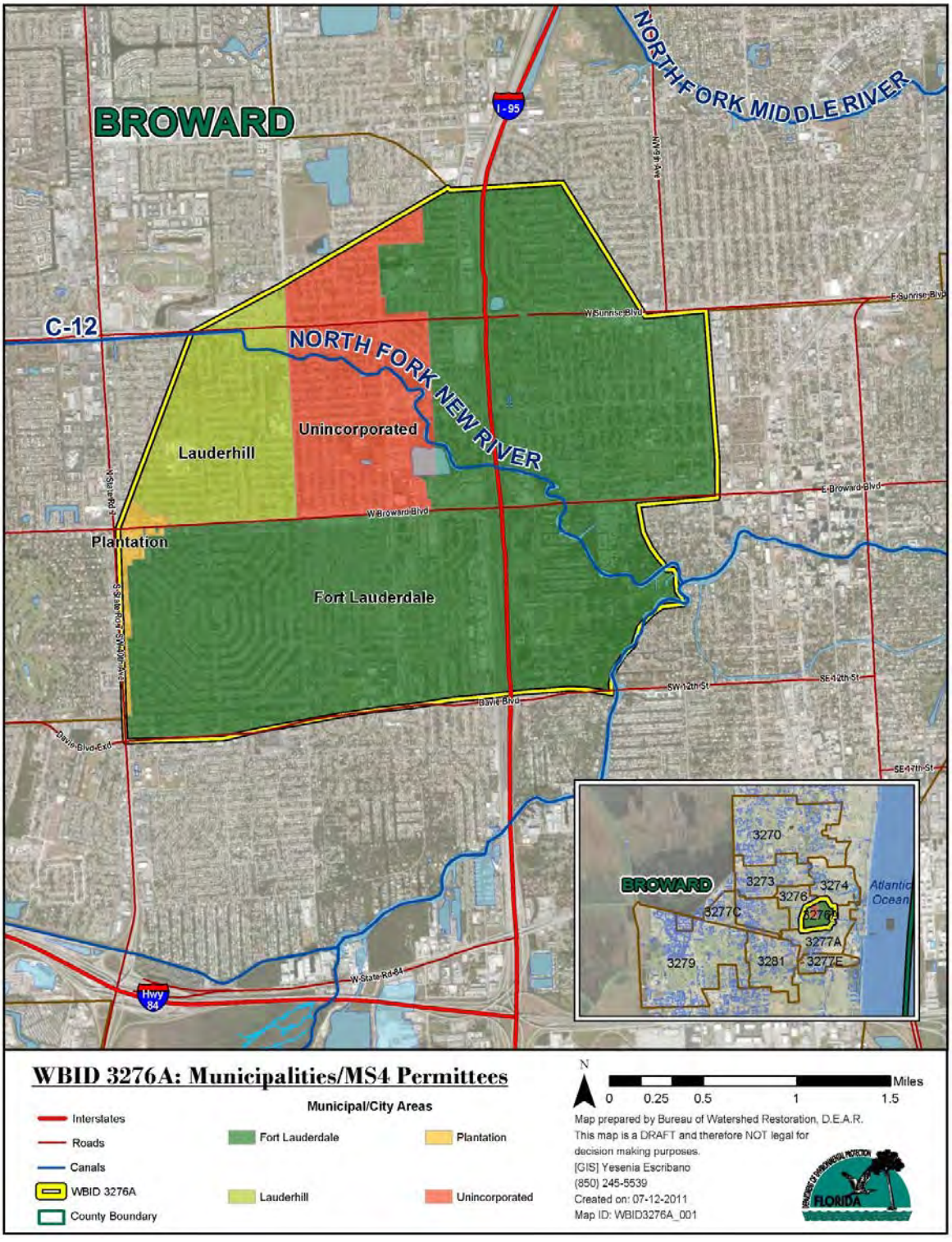

Figure B.1e. Municipalities/Permittees within the New River (North Fork) (WBID 3276A) Boundary

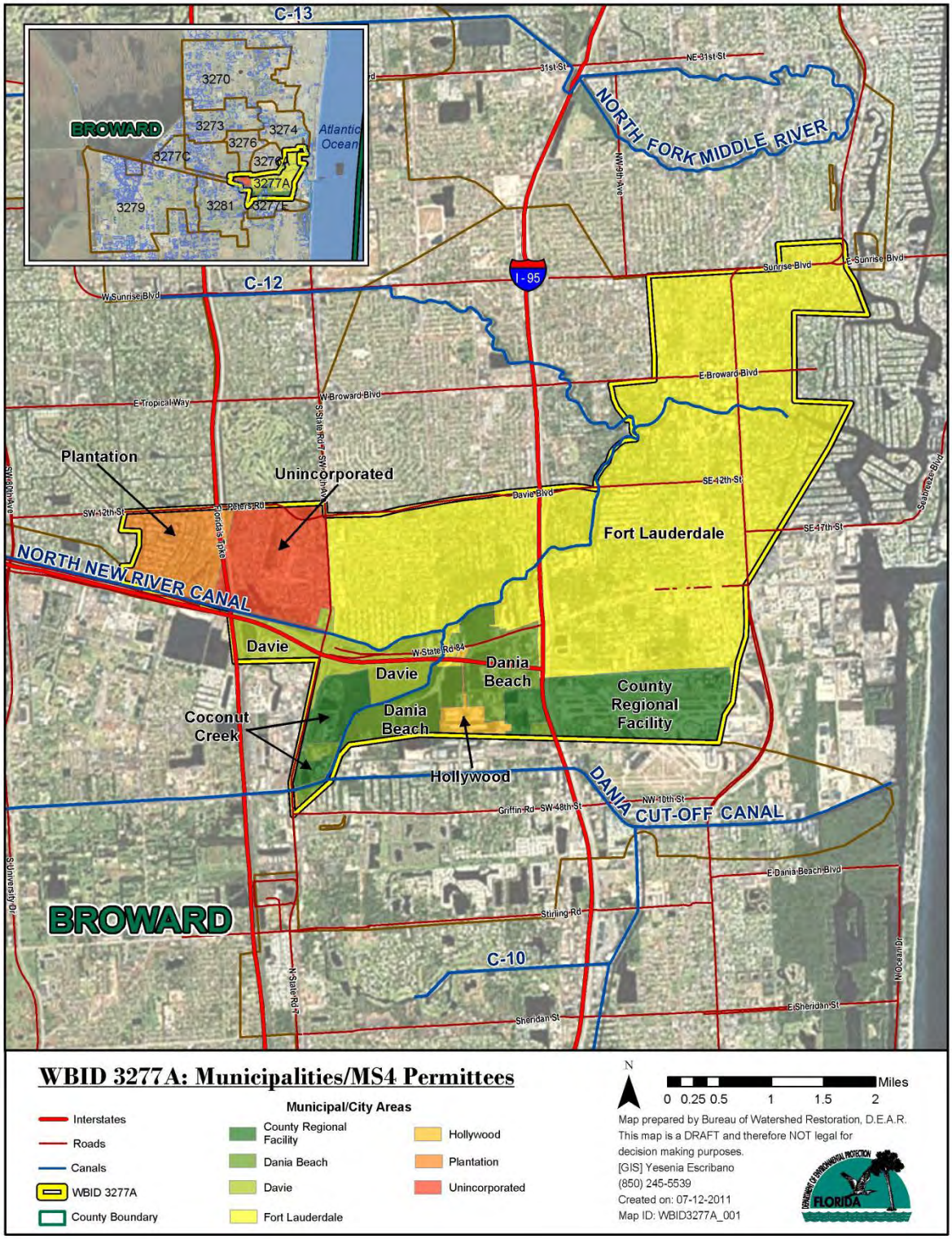

Figure B.1f. Municipalities within the New River Canal (South) (WBID 3277A) Boundary

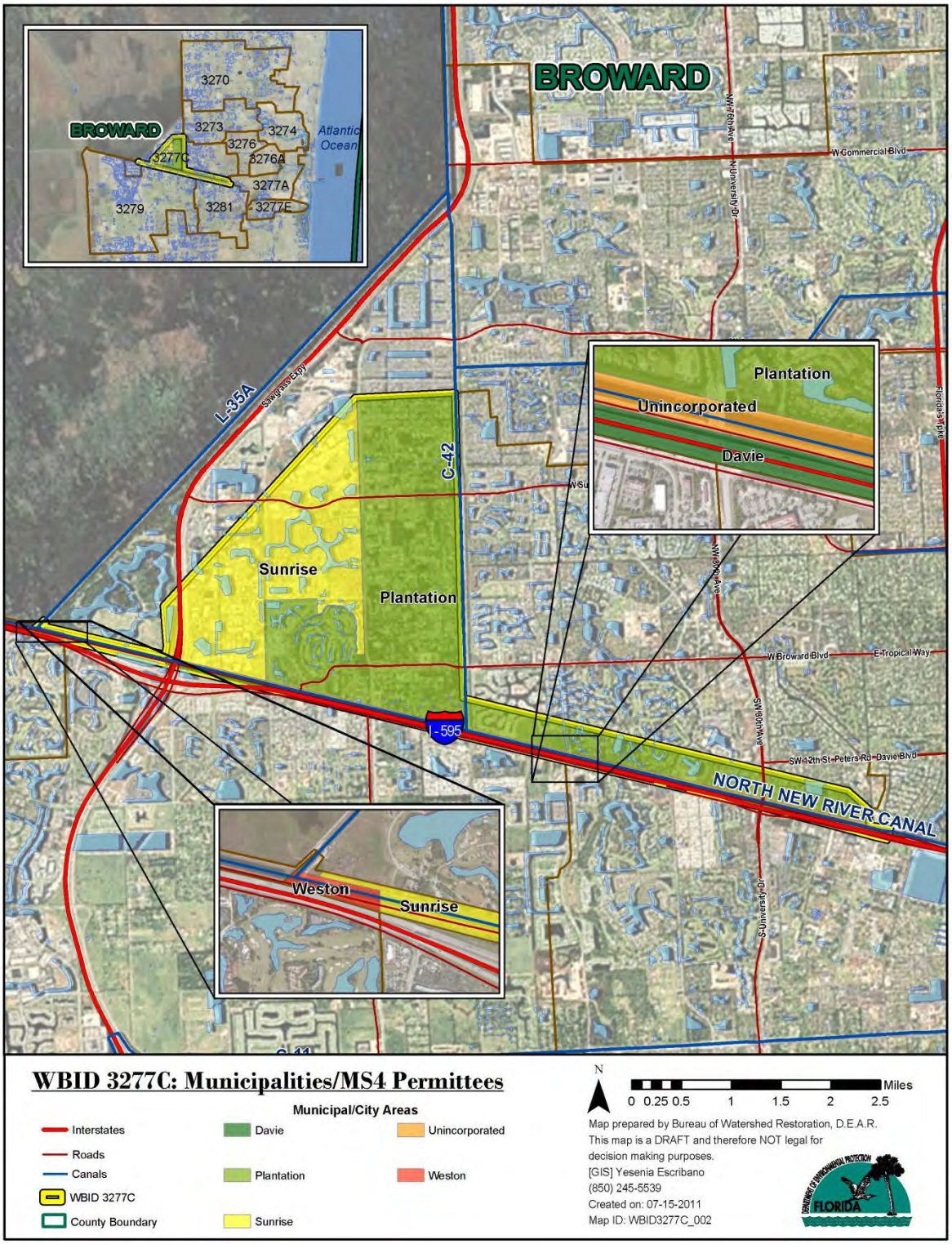

Figure B.1g. Municipalities/Permittees within the North New River Canal (WBID 3277C) Boundary

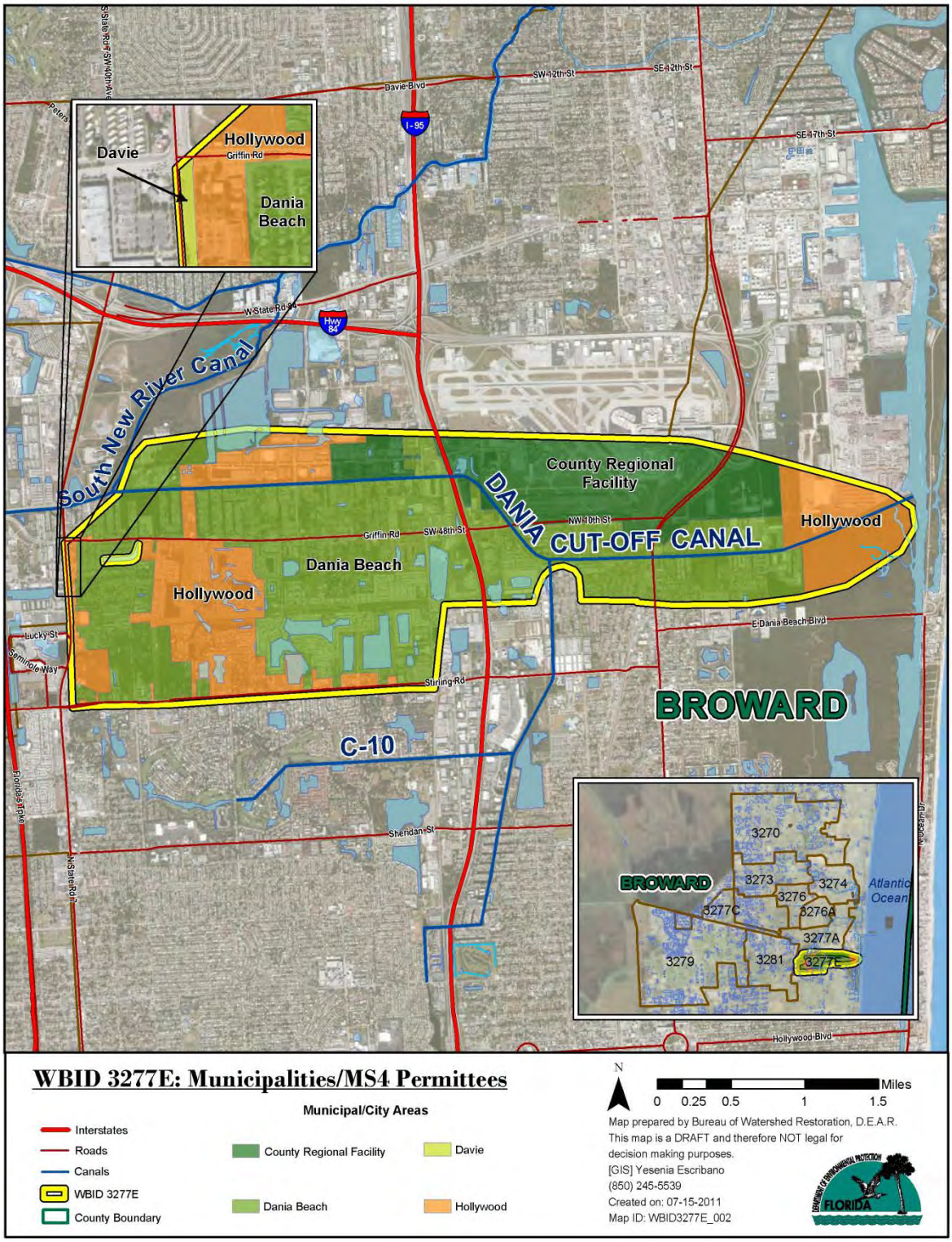

Figure B.1h. Municipalities/Permittees within the Dania Cut-off Canal (WBID 3277E) Boundary

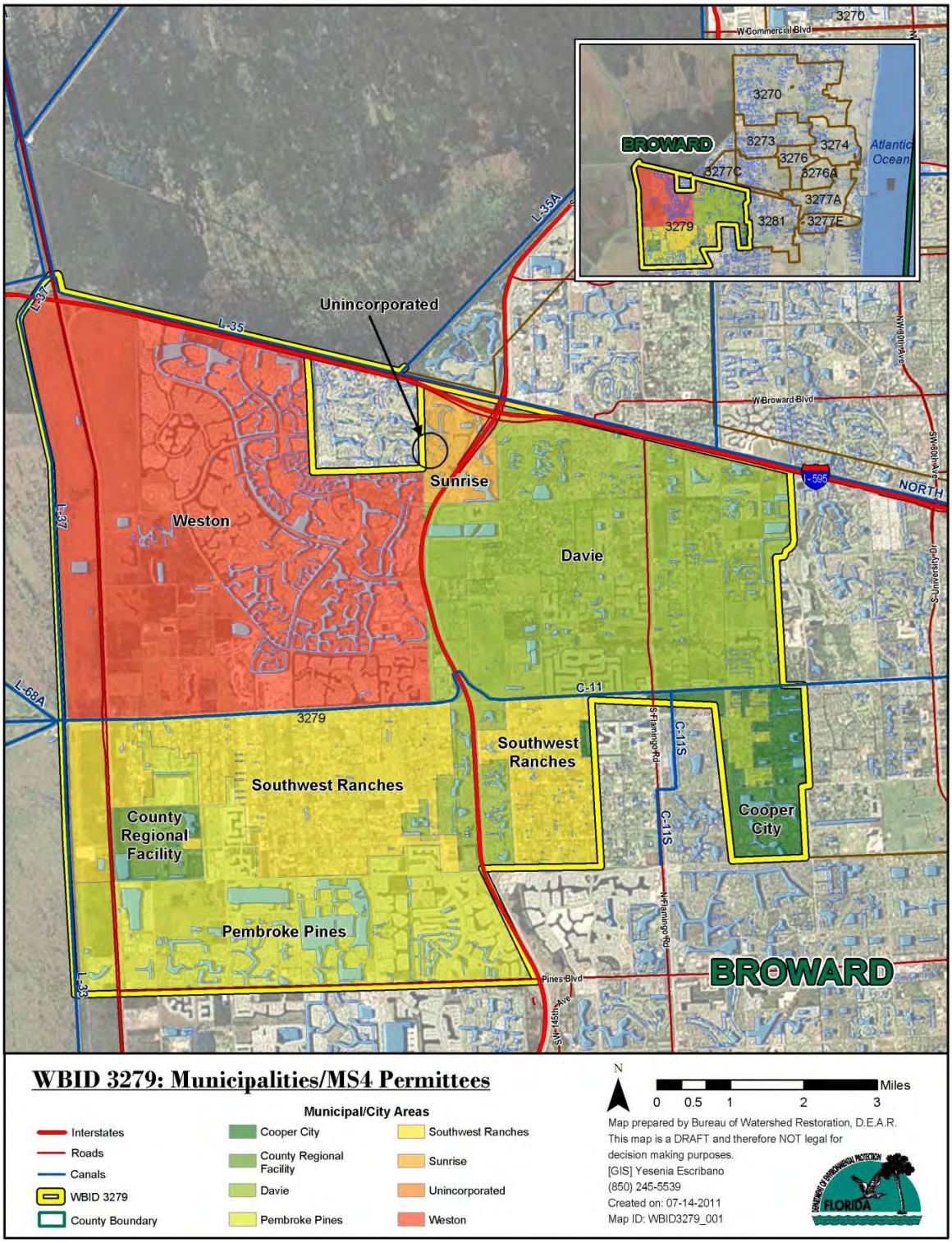

Figure B.1i. Municipalities/Permittees within the C-11 (South New River) Canal (WBID 3279) Boundary

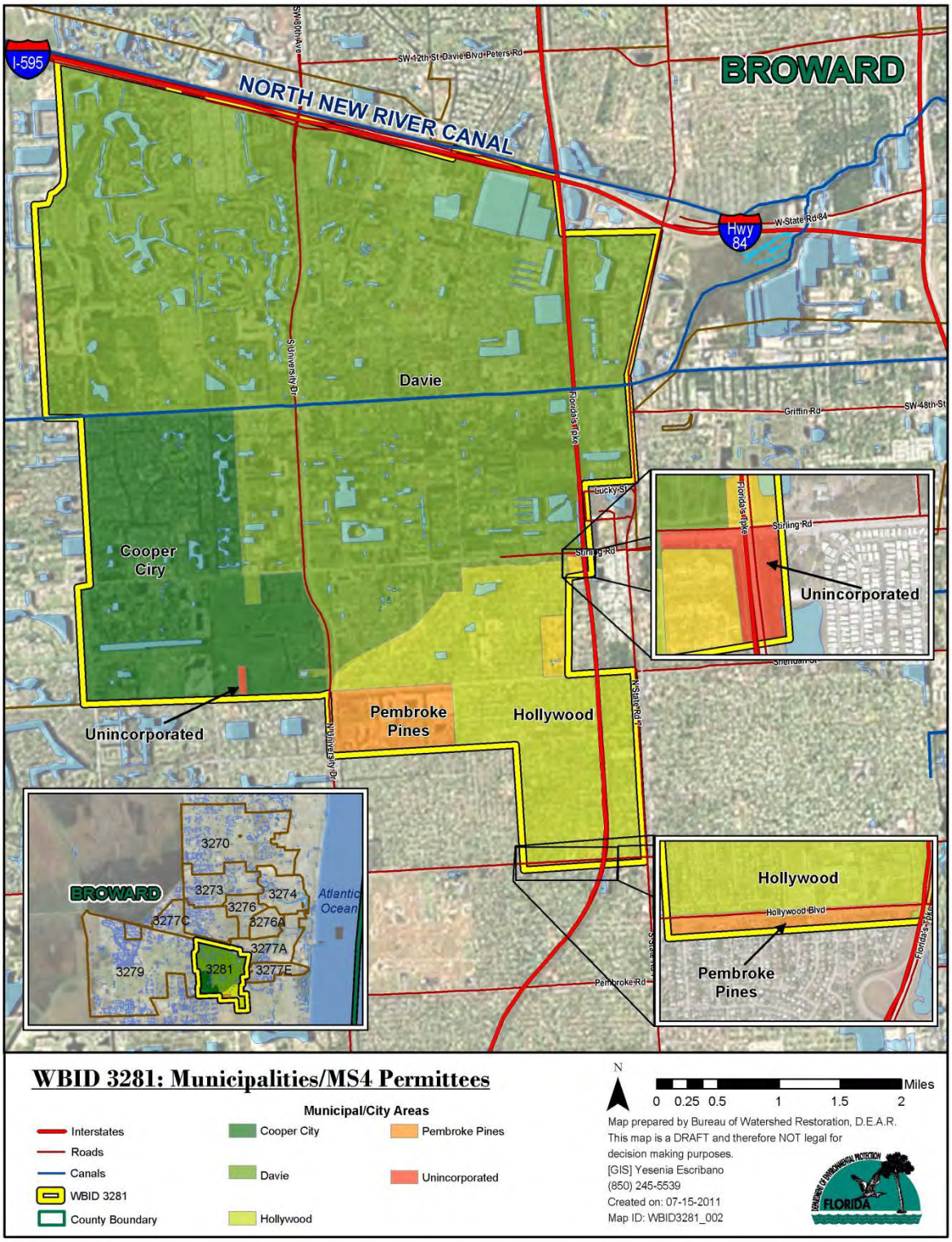

Figure B.1j. Municipalities within the C-11 (East) Canal (WBID 3281) Boundary

Appendix C: Estimates of Fecal Coliform Loadings from Potential Sources

The Department provides these estimates for informational purposes only and did not use them to calculate the TMDL. They are intended to give the public a general idea of the relative importance of each source in these waterbodies. The estimates were based on the best information available to the Department when the calculation was made. The numbers provided do not represent the actual loadings from the sources.

Pets

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

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

According to the American Pet Products Association (APPMA), about 4 out of 10 U.S. households include at least 1 dog. A single gram of dog feces contains about 2.2 million fecal coliform bacteria (van der Wel 1995). Unfortunately, statistics show that about 40% of American dog owners do not pick up their dogs' feces. The number of dogs within each WBID's boundaries is unknown. Therefore, the statistics produced by APPMA were used in this analysis to estimate the possible fecal coliform loads contributed by dogs.

Using information from the Florida Department of Revenue's (DOR) 2009 cadastral tax parcel and ownership coverage contained in the Department's GIS library, residential parcels were identified using DOR's residential land use codes. The final number of households within the WBID boundary was calculated by adding the number of residential units on the parcels for all improved residential land use codes. **Table C.1** shows the estimated number of households within each of the WBID boundaries.

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

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

Table C.2 shows the waste production rate for a dog (450 grams/animal/day) and the fecal coliform counts per gram of dog waste (2,200,000 counts/gram).

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

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

WBID	Number of Households	Number of Dogs	Waste Produced Left on Land Surface (grams/day)	Loading (counts/day)
3270	76,153	30,461	5,483,016	$1.21x10^{13}$
3273	38,158	15,263	2,747,376	$6.04x10^{12}$
3274	27,856	11,142	2,005,632	$4.41x10^{12}$
3276	18,667	7,467	1,344,024	$2.96x10^{12}$
3276A	16,753	6,701	1,206,216	$2.65x10^{12}$
3277A	26,045	10,418	1,875,240	$4.13x10^{12}$
3277C	6,404	2,562	461,088	$1.01x10^{12}$
3277E	8,303	3,321	597,816	$1.32x10^{12}$
3279	46,323	18,529	3,335,256	$7.34x10^{12}$
3281	25,263	10,105	1,818,936	$4.00x10^{12}$

Table C.2. Dog Population Density, Wasteload, and Fecal Coliform Density Based on the Literature (Weiskel **et al.** 1996)

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

* Number from APPMA

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

Sanitary Sewer Overflows

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

The estimated number of properties connected to the sewer system was based on data obtained from the Florida Department of Health's (FDOH) ongoing inventory of wastewater treatment and disposal method for developed properties. Using information from DOR's 2009 cadastral tax parcel and ownership coverage, residential parcels were identified using DOR's land use codes. The final number of households within the WBID boundary was calculated by adding the number of residential units on the parcels for all improved residential land use codes (see **Table C.1**). **Table C.3** shows the estimated number of households *(N)* within the WBID boundaries served by sewer systems (**Figure C.1**).

Fecal coliform loading from sewer line leakage can be calculated based on the number of people in the watershed, typical per household generation rates, and typical fecal coliform concentrations in domestic sewage, assuming a leakage rate of 0.5% (Culver *et al.* 2002). Based on this assumption, a rough estimate of fecal coliform loads from leaks and SSOs within the WBID boundaries can be made using **Equation C.1:**

L = 37.85* N * Q * C * F **Equation C.1**

Where:

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

The discharge rate through sewers from each household (*Q*) was calculated by multiplying the average household size for Broward County (2.45) (U.S. Census Bureau 2000) by the per capita wastewater production rate per day (70 gallons/day/person). The commonly cited concentration (*C*) for domestic wastewater is $1x10^6$ counts/100 mL 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 C.1**, the approximate fecal coliform loading from sewer line leakage in each the WBID is summarized in **Table C.3.**

Table C.3. Estimated Number of Households Served by Sanitary Sewers and Estimated Fecal Coliform Loading from Sewer Line Leakage within each WBID Boundary

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

WBID	Number of Households Served by Sanitary Sewers	Sanitary Sewer (counts/day)
3270	75,917	$2.5x10^{12}$
3273	38,145	$1.2x10^{12}$
3274	27,467	$8.9x10^{11}$
3276	18,476	$6.0x10^{11}$
3276A	16,010	$5.2x10^{11}$
3277A	24,636	$8.0x10^{11}$
3277C	5,780	$1.9x10^{11}$
3277E	7,730	$2.5x10^{11}$
3279	44,866	$1.5x10^{12}$
3281	23,561	$7.6x10^{11}$

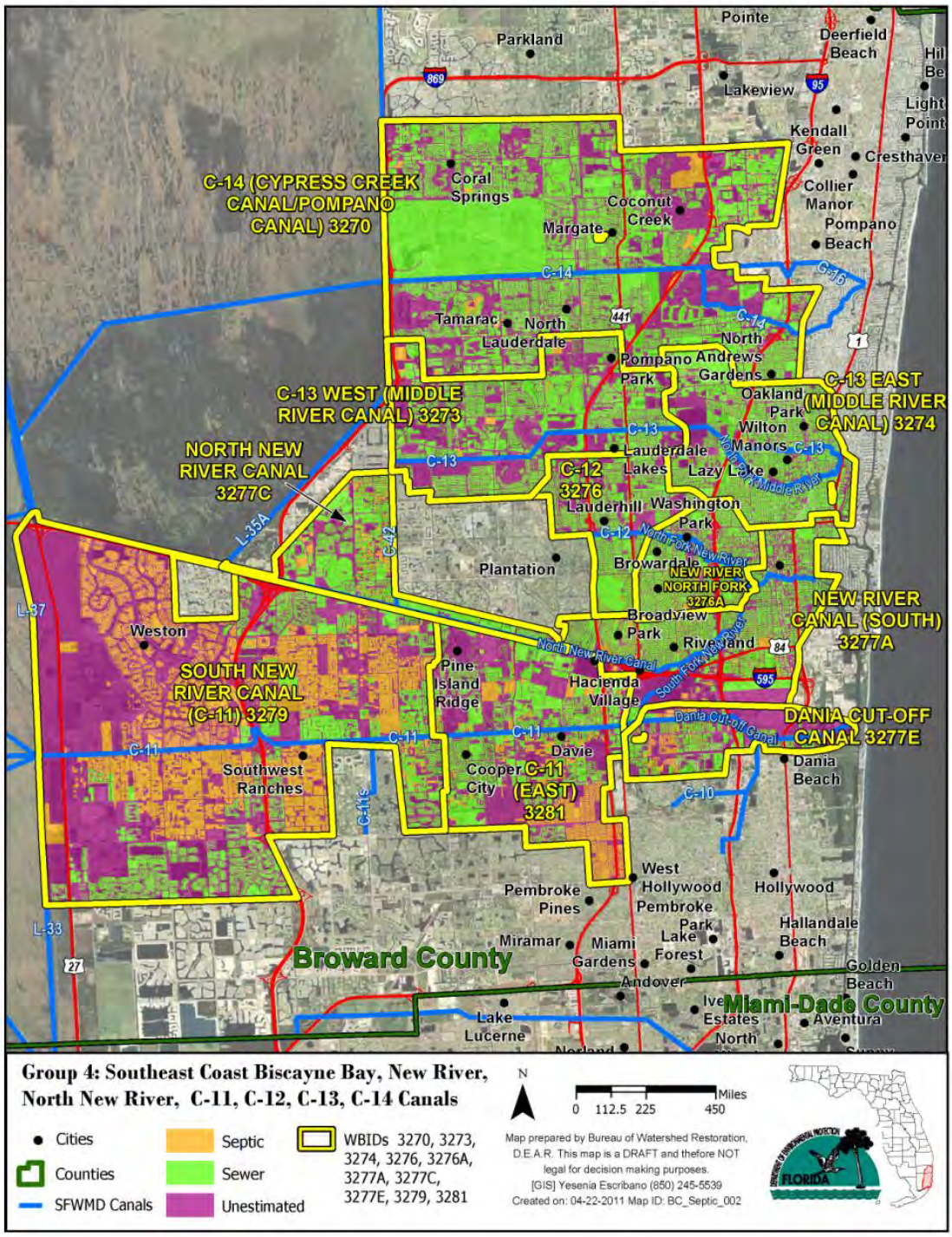

Figure C.1. Distribution of Onsite Sewage Disposal Systems (Septic Tanks) within the Boundaries of WBIDs 3270, 3273, 3274, 3276, 3276A, 3277A, 3277C, 3277E, 3279, and 3281

Septic Tanks

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

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

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

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

A rough estimate of fecal coliform loads from failed septic tanks within the WBID boundaries can be made using **Equation C.2**:

L = 37.85* N * Q * C * F **Equation C.2**

Where:

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

Based on the estimated total number of households within each WBID (**Table C.2**) and the estimated number of households connected to the sewer system (**Table C.3**), the number of housing units *(N)* within each WBID boundary thought to be using septic tanks to treat their domestic wastewater is shown in **Table C.4** (**Figure C.1**).

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 Broward County is about 2.45 people/household. The same population densities were assumed within each WBID boundary. A commonly cited value for per capita wastewater production rate is 70 gallons/day/person (EPA 2001). The commonly cited concentration (*C*) for septic tank discharge is $1x10^6$ counts/100mL for fecal coliform (EPA 2001).

No measured septic tank failure rate data were available for the WBIDs when these TMDLs were developed. Therefore, the failure rate was derived from the number of septic tanks in Broward County based on FDOH's septic tank inventory and the number of septic tank repair permits published by FDOH (available: http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm). The cumulative number of septic tanks in Broward County on an annual basis was calculated by subtracting the number of issued septic tank installation permits for each year from the current number of septic tanks in the county based on FDOH's 2009–10 inventory, assuming that none of the installed septic tanks will be removed after being installed (**Table C.5**). The reported number of septic tank repair permits was also obtained from the FDOH website.

Based on this information, the annual discovery rates of failed septic tanks were calculated (**Table C.5**). The average annual septic tank failure discovery rate for Broward County is approximately 0.66%. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 3.32% for Broward County. **Table C.4** shows the estimated fecal coliform loading from failed septic tanks within each WBID boundary based on **Equation C.2**.

Wildlife

Wildlife (such as iguanas, birds, and raccoons) is another possible source of fecal coliform bacteria within the WBIDs' boundaries. However, as these represent natural inputs, no reductions are assigned to these sources by these TMDLs.

Table C.4. Estimated Number of Households Using Septic Tanks and Estimated Septic Tank Loading within each WBID Boundary

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

WBID	Number of Households Using Septic Tanks	Septic Tanks (counts/day)
3270	236	5.1×10^{10}
3273	13	2.8×10^{09}
3274	389	8.4×10^{10}
3276	191	4.1×10^{10}
3276A	743	1.6×10^{11}
3277A	1,409	1.3×10^{11}
3277C	624	1.3×10^{11}
3277E	573	1.2×10^{11}
3279	1,457	3.1×10^{11}
3281	1,702	3.7×10^{11}

Table C.5. Estimated Number of Septic Tanks and Septic Tank Failure Rates for Broward County (1998–2009)

This is a six-column table. Column 1 lists the year, Columns 2 lists the number of newly installed septic tanks in each year, Column 3 lists the accumulated number of septic tanks, Column 4 lists the number of septic tank repair permits issued, Column 5 lists the failed septic tank discovery rate, and Column 6 lists the final failure rate.

Year	New Installations	Accumulated Installations	Repair Permits	Failure Discovery Rate (%)	Failure Rate (%)
1998	208	105,065	1,094	1.04%	5.21%
1999	208	105,273	989	0.94%	4.7%
2000	202	105,481	903	0.86%	4.28%
2001	224	105,683	934	0.88%	4.42%
2002	196	105,907	893	0.84%	4.22%
2003	151	106,103	799	0.75%	3.77%
2004	164	106,254	700	0.66%	3.29%
2005	161	106,418	669	0.63%	3.14%
2006	195	106,579	500	0.47%	2.35%
2007	112	106,774	295	0.28%	1.38%
2008	115	106,886	316	0.3%	1.48%
2009	55	107,001	333	0.31%	1.56%
Average	**166**	**106,119**	**702**	**0.66%**	**3.32%**

Appendix D: Public Comments on Fecal Coliform TMDLs

June 28, 2011

Mr. Donavin Hultgren
Water Quality Manager
City of Hollywood
PO Box 229045
Hollywood, FL 33022-9045

Re: City of Hollywood Comments on Newly Released Draft TMDLs

Dear Mr. Hultgren:

Thank you very much for your email dated June 3, 2011, regarding our recently proposed Total Maximum Daily Load (TMDL) reports for fecal coliforms in Southeast Florida. The Department appreciates the time and effort you put into reviewing these draft TMDLs. You are correct, in Table 4.2, FDOT was erroneously identified as a co-permittee with the City of Hollywood. We have made necessary edits to the draft TMDL reports as a result of your comments. Because of your efforts, these final TMDLs will be improved.

Please contact me at Jan.Mandrup-Poulsen@dep.state.fl.us, if you have any further comments.

Sincerely,

Jan Mandrup-Poulsen, Administrator
Watershed Evaluation and TMDL Section
Florida Department of Environmental Protection

MR/wet/jm

ec: N. Bailey

June 28, 2011

Mr. Rick Renna, P.E.
State Drainage Engineer
Florida Department of Transportation
605 Suwannee Street
Tallahassee, FL 32399-0450

Re: FDOT Comments on Newly Released Draft TMDLs

Dear Mr. Renna:

Thank you very much for your letter dated June 6, 2011, regarding our recently proposed Total Maximum Daily Load (TMDL) reports for fecal coliforms in Southeast Florida. The Department appreciates the time and effort you put into reviewing these draft TMDLs. It has been the Department's policy that, when reducing pollutant loads to impaired receiving waters, stakeholders should only be responsible for reducing pollutant sources within their jurisdictional authority. We concur that FDOT's construction, operation, and maintenance activities are likely not a significant source of fecal coliforms. In addition, we fully agree that all local stakeholders should work together closely to identify and eliminate illicit discharges. In implementing these TMDLs, this should be considered a shared responsibility by all affected stakeholders.

Please contact me at Jan.Mandrup-Poulsen@dep.state.fl.us, if you have any further comments.

Sincerely,

Jan Mandrup-Poulsen, Administrator
Watershed Evaluation and TMDL Section
Florida Department of Environmental Protection

MR/wet/jm

ec: N. Bailey

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