FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

Total Maximum Daily Load for Fecal Coliform Bacteria for Hogtown Creek, Alachua County, Florida

WBID 2698

Zack Shelley and Wayne Magley, Ph.D., P.E.

Florida Department of Environmental Protection
Watershed Assessment Section
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1.0 INTRODUCTION

1.1 Purpose of Report

This report presents a Total Maximum Daily Load (TMDL) for fecal coliforms for Hogtown Creek (WBID 2698). The creek was verified as impaired for fecal coliforms using the methodology in the Impaired Waters Rule (IWR, Chapter 62-303, Florida Administrative Code), and was included on the verified list of impaired waters for the Ocklawaha River Basin that was adopted by Secretarial Order on August 28, 2002.

1.2 Identification of Waterbody

For assessment purposes, the watersheds within the Ocklawaha River Basin have been broken out into smaller watersheds, with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed. Hogtown Creek has been assigned WBID 2698 (**Figure 1**).

Hogtown Creek is located in the City of Gainesville (Central Alachua County) in the Orange Creek planning unit of the Ocklawaha Basin (**Figure 1**). The creek is approximately 5.7 miles long and receives stormwater runoff from the City of Gainesville, which it discharges to the Florida Aquifer through Haile Sink. It also receives an average discharge of 0.346 cubic feet per second (cfs) from Glen Springs.

In Central and Eastern Alachua County, clastic sediments of the Miocene Series Hawthorn Group unconformably overlie the Ocala Group sediments. The Hawthorn Group is a complex unit comprised of interbedded and intermixed carbonate and clastic sediments containing varying percentages of phosphate grains. There are few locations in Alachua County where sediments of the Hawthorn Group are exposed. These locations include some small creek banks North and East of Alachua and the eroded banks of Hogtown Creek in the Gainesville area.

The predominant type of watershed in Alachua County is the stream to sink basin. These are found primarily in the central portion of the County around Gainesville and North to the Alachua/High Springs area. Some of these basins including Hogtown Creek are situated within or near urban development areas. As a result, they are susceptible to the adverse effects of pollutants from urban stormwater runoff. This point is especially critical as these creeks drain into sinkholes which provide direct connections to the Floridan Aquifer, the primary drinking water source for the North Central Florida region.

As part of the urbanized Gainesville area, the Hogtown Creek watershed has undergone extensive urbanization, and now residential and commercial areas around Gainesville account for the majority of land use in the impaired WBID. The distribution of land cover for Hogtown Creek is based on the National Land Cover Dataset (NLCD) of 1995 and is tabulated in **Table 1**.

Figure 1: Hogtown Creek WBID 2698

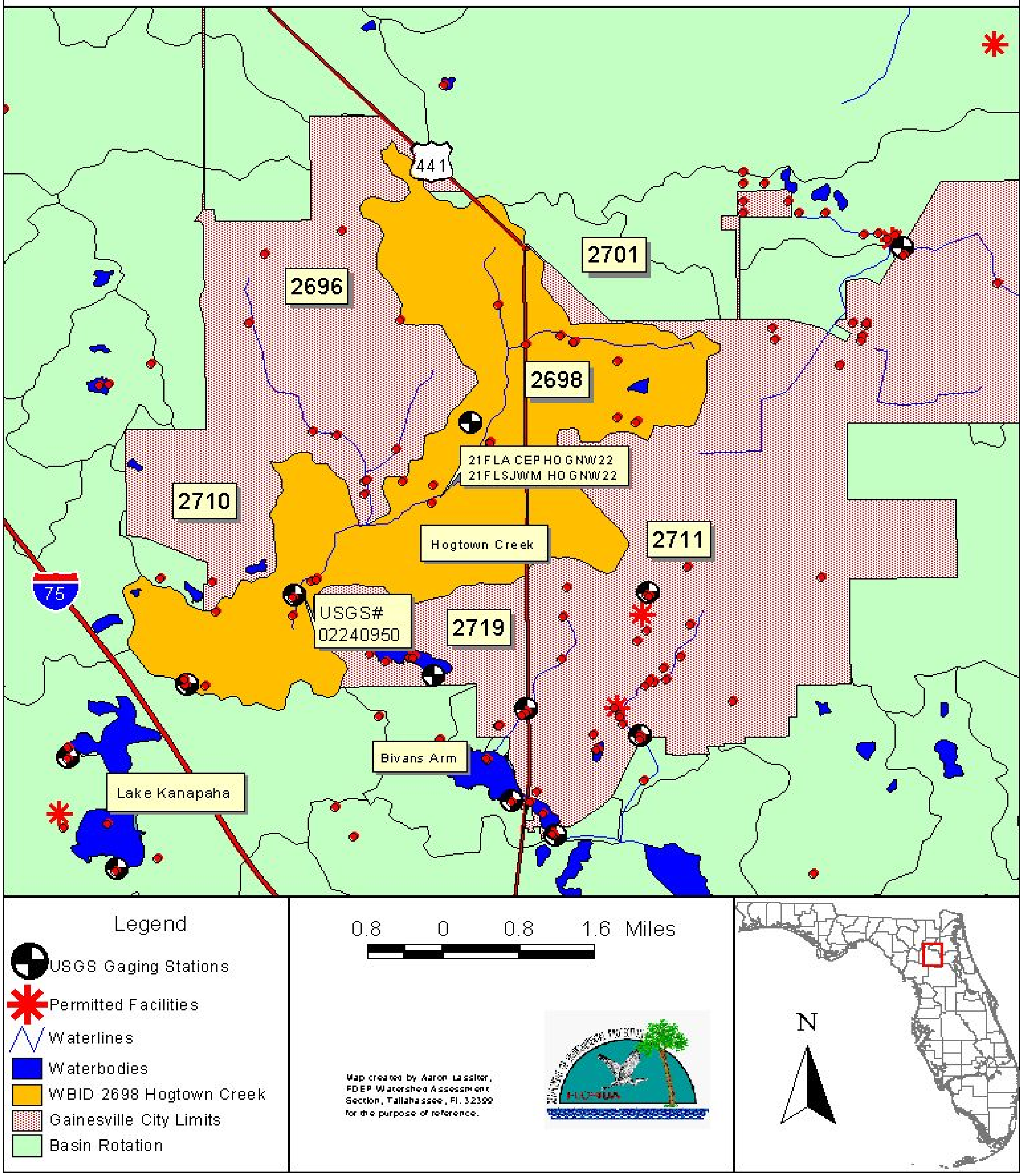


Table 1. Land Cover Distribution[1]

Land Cover for Hogtown Creek	Total Acres	% Distribution
Urban	4,096.8	65.9
Transport., Commercial, Utilities, Public[2]	233.5	3.8
Agriculture	57.6	0.9
Barren Land	200.8	3.2
Rangeland[3]	74.5	1.2
Forest	722.8	11.6
Wetlands	806.8	13
Water	25.8	0.4
Total	6,218.6	100

1. Acreage represents the land use distribution in the impaired WBID and not the entire drainage area.
2. Public lands include urban and recreational areas.
3. Rangeland includes shrubland, grassland, and herbaceous land covers

2.0 STATEMENT OF PROBLEM

Florida's 1998 Section 303(d) list identified Hogtown Creek (WBID 2698) in the Ocklawaha River Basin as not supporting water quality standards (WQS) for fecal coliform bacteria. Through analysis of water quality data per the IWR, Hogtown Creek was verified as impaired for fecal coliform bacteria. The creek was included on the list of impaired surface waters adopted by Secretarial Order on August 28, 2002, and then submitted to EPA as part of the 2002 update to Florida 303(d) list.

During the verified period (1995-2002), 8 out of 9 fecal coliform samples from station 21FLACEPHOGNW22 exceeded the FDEP criterion of 800 counts per 100 milliliters (89% exceedance). There was notable seasonal variability in the fecal coliform values, with higher averages in the fall (average of 6,050 counts/100 ml), followed by spring (average of 2,800 counts/100 ml), winter (average of 2,300 counts/100 ml), and summer (average of 900 counts/100 ml).

3.0 DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND NUMERIC WATER QUALITY TARGET

Hogtown Creek is classified as a Class III water, with a designated use classification for recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III criteria applicable to the observed impairment is the numeric criterion for bacterial quality for fecal coliform bacteria counts (Rule 62-302.530(6), F.A.C. The criteria have three separate components, expressed as follows:

Fecal Coliform Bacteria:

> The most probable number (MPN) or membrane filter (MF) counts per 100 millileters (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 rule also states that, for both fecal and total coliform bacteria, monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

Insufficient data were collected to base evaluate whether existing loads meet the geometric mean criterion for fecal coliform bacteria. In the data assessment, the not to exceed percentage criterion and one-day maximum criterion are the most frequently violated criteria. The target for the TMDL is the one-day maximum concentration of 800 counts/100 ml. The TMDL represents the one day load the waterbody can transport in a 30 day period and not exceed water quality standards. The one-day maximum criterion is appropriate for TMDL development as this criterion is typically exceeded during and/or after storm events. For coliforms, an extended dry period followed by a storm event is usually identified as the critical period when coliform levels in waterbodies exceed the water quality criteria.

4.0 ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources of coliforms in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, runoff from agriculture, runoff from silviculture, runoff from 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 EPA’s National Pollutant Discharge Elimination Program (NPDES). These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and from a wide variety of industries (see **Appendix A** for background information about the State and Federal 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). 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 Nonpoint Sources

Nonpoint sources of coliform bacteria generally, but not always, involve accumulation of coliform bacteria on land surfaces and wash off as a result of storm events. Typical nonpoint sources of coliform bacteria include:

- Wildlife
- Agricultural animals
- Onsite Sewer Treatment and Disposal Systems (septic tanks)
- Urban development (outside of Phase I or II MS4 discharges)

For Hogtown Creek, there are two modes of transport for nonpoint source coliform bacteria loading into the stream. First, loading from failing septic systems and animals in the stream are considered direct sources to the stream, as they are independent of precipitation. The second mode involves loading resulting from coliform accumulation on land surfaces and is transported to the stream during storm events.

The Watershed Characterization System (WCS), a geographic information system (GIS) tool, was used to display, analyze, and compile available information to characterize potential bacteria sources in the impaired watershed. Sources of impairment include leaking collection lines or leaking septic systems during low flow events and rainfall events when surface and stormwater runoff and infiltration/interflow dominate.

4.2.1 Wildlife

Wildlife deposit coliform bacteria with their feces onto land surfaces where it can be transported during storm events to nearby streams. The bacteria load from wildlife is assumed background, as the contribution from this source is small relative to the load from urban areas. In addition, any strategy employed to control this source would probably have a negligible impact on obtaining water quality standards.

4.2.2 Agricultural Animals

Agricultural animals can be a major source of several types of coliform loading to streams, including runoff from pastureland and cattle in streams. Livestock data from the 1997 Census of Agriculture for Marion County (the location of Hogtown Creek) are listed in **Table 2.** The US Department of Agriculture is currently in the process of updating the agricultural census for 2002. Data from the 2002 Census will be released to the public in the Spring of 2004. As shown in Table 2, cattle, including beef and dairy, are the predominate livestock in this county. There are no known Confined Animal Feeding Operations (CAFOs) operating in the impaired WBID.

Table 2. Livestock Distribution by County (source: NASS, 1997)

Livestock Distribution	Alachua County
Cattle	49,567
Beef	27,324
Dairy	3,341
Swine	1,292
Poultry (broilers sold)	(D)[1]
Sheep	716
Horses	1,731

(D) – Data withheld to avoid disclosing data for individual farms.

4.2.3 Onsite Sewage Treatment and Disposal Systems (Septic Tanks)

Onsite sewage treatment and disposal systems (OSTDs or septic tanks) are commonly used where providing central sewer is not cost effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTD is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDs can be a source of nutrient (nitrogen and phosphorus), pathogens, and other pollutants to both ground water and surface water. **Table 3** summarizes the number of septic systems in Alachua County and provides estimates of countywide failure rates and total daily discharge of wastewater from septic tanks.

Table 3. County Estimates of Septic Tanks (FDEP, 2001)

County	Number of Septic Tanks[1]	Percent of 1995 Population Using Septic Tanks[2]	Failure Rate per 1000[3]	Estimated Discharge (MGD)[4]
Alachua	37,208	32.7	9.67	5.02

1. Total number per county is based on 1970 census figures plus the number of systems installed since 1970 through June 30, 2000. Numbers do not reflect the removal of septic systems by connection to central sewers.
2. Source: St. Johns River Water Management District, May 2000, p. 97, cited in FDEP, 2001.
3. Defined as the number of repairs divided by the number of installed systems for July 1, 1999 to June 30, 2000.
4. Based on value of 135 gallons per day per tank (FDEP, 2001).

4.2.4 Urban Development

Fecal coliform loading from urban areas is attributable to multiple sources including storm water runoff, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals. Septic tanks and urban runoff are thought to be the most significant sources of bacteria in the Hogtown Creek watershed. Gainesville Regional Utilities (GRU) estimated in 2003 that there were 541 septic tanks in the watershed.

4.3 Point Sources

There are no NPDES permitted domestic wastewater discharges to Hogtown Creek. However, historically, the upper reaches of Hogtown Creek have been adversely impacted by discharges from an industrial site (Cabot Carbon/Koppers). The Cabot Carbon portion of the site was operated as a pine tar and charcoal generation facility in the early 1900s. The industrial process at the site consisted of the destructive distillation of pine stumps resulting in production of crude wood oils. Waste products from this process included caustic acid compounds (phenols) and pine tar products. These waste products were discharged into concrete lined ponds for settling. Some of these fluids were allowed to spill over into drainage areas connected to Hogtown Creek. In the 1960s after the operation was closed, the impoundment walls of the lagoons were torn down by a new owner of the property allowing the remaining fluids to discharge into the Hogtown Creek surface water system.

The Koppers portion of the site was operated as a plant that preserves utility poles and timbers through a creosote impregnation process. The area where lagoons were used to store the wastewater from this plant were identified by EPA as potential contaminate sources. The Cabot Carbon/Koppers facility is presently designated as an EPA Super Fund site and is currently being investigated for appropriate cleanup action.

5.0 LOADING CAPACITY – LINKING WATER QUALITY AND POLLUTANT SOURCES

5.1 Determination of Assimilative Capacity

The load duration curve methodology was used to calculate the fecal coliform TMDL for Hogtown Creek. Load duration curves provide a data-based method to estimate the reductions required to meet water quality standards. Load duration curves are based on cumulative frequency distribution of stream flow.

5.2 Flow Duration Curve Methodology

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

Alachua County conducted a baseflow study on Hogtown Creek in which flows were measured monthly at the water quality monitoring station (21FLACEPHOGNW22) from 1998 through 2002. While water quality samples were collected with some of the flow measurements, a method was needed to estimate flows at times for which water quality data were available but flow was not. To utilize the available data, flows measured at the monitoring station were plotted against flows measured at the USGS gage 02240950, located downstream of the monitoring station, to identify a correlation between the datasets. As shown in **Figure 2**, a strong correlation exists between the datasets. A trend line equation was drawn through the data points and used to develop a continuous flow record at the monitoring station. To check the accuracy of the estimated flows, the flows estimated using the trendline equation were compared to flows estimated using a weighted drainage area approach and the measured flows. As shown in **Figure 3**, the trend line equation appears to be a better predictor of flows on Hogtown Creek than the weighted drainage area approach.

Figure 2. Correlation Between Flow Measured at Station 21FLACEPHOGNW22 and USGS Gage 02240950

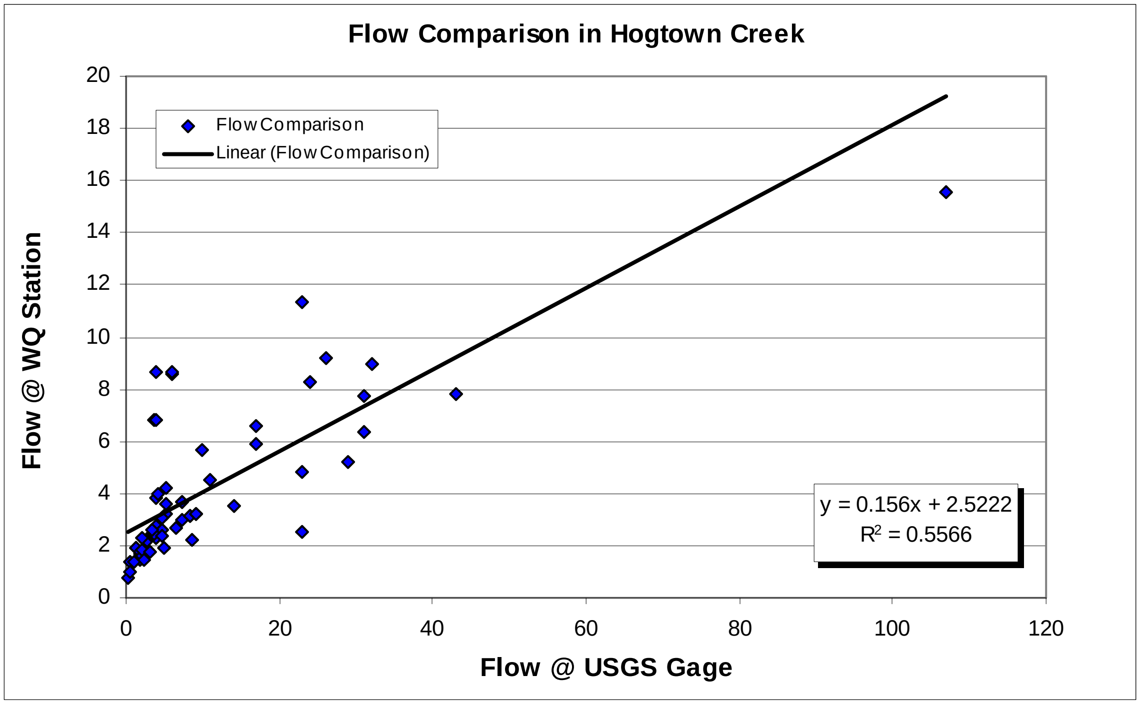
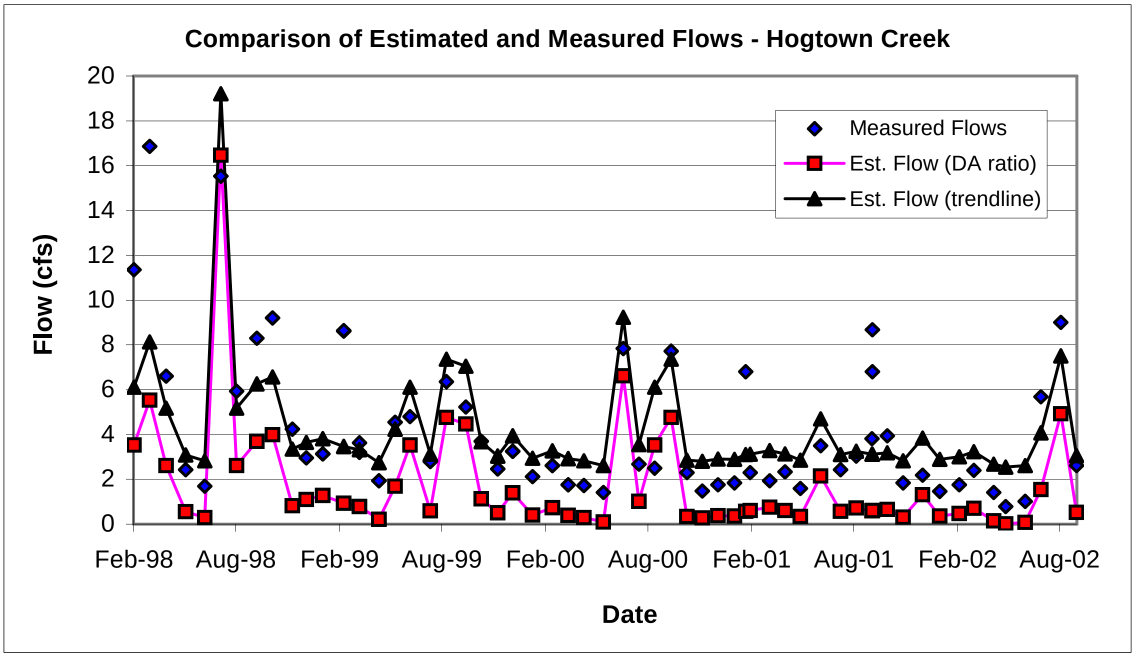
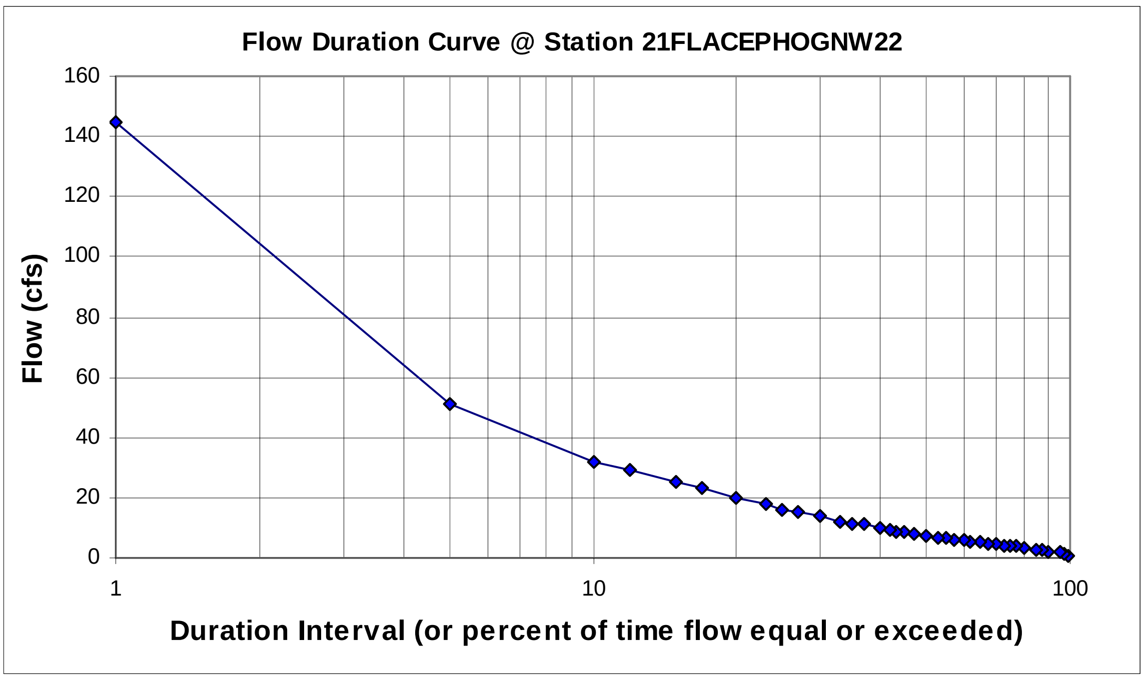


Figure 3. Comparison of Flow Estimation Techniques to Instream Measurements



Because a flow duration curve displays the cumulative frequency distribution of daily flow data over the period of record, the confidence in the duration curve approach in predicting realistic percent load reductions increases when longer periods of record are used to generate the curves. The flow duration curve for the TMDL was generated by using the percentile function and the flow record to generate the flow at a given duration interval. For example, at the 90th duration interval, the percentile function calculates the flow that is equal or exceeded 90 percent of the time. The flow duration curve for Hogtown Creek generated from the estimated flow record at station 21FLACEPHOGNW22 is shown in **Figure 4**. Flows toward the right side of the plot are flows exceeded in greater frequency and are indicative of low flow conditions. Flows on the left side of the plot represent high flows and occur less frequently.

Figure 4. Flow Duration Curve for Hogtown Creek at Station 21FLACEPHOGNW22



5.3 Load Duration Curve Methodology

Flow duration curves are transformed into load duration curves by multiplying the flow values along the flow duration curve by the coliform concentration and the appropriate conversion factors. On the load duration curve, allowable and existing loads are plotted against the flow recurrence interval. The allowable load is based on the water quality numeric criterion and flow values from the flow duration curve, and the line drawn through the data points representing the allowable load is called the target line. The existing loads are based on the in-stream fecal coliform concentrations measured during ambient monitoring and an estimate of flow in the stream at the time of sampling. As noted previously, because insufficient data were collected to evaluate either the fecal coliform geometric mean or the not to exceed percentage criteria, the one-day maximum criterion for fecal coliform (800 counts/100ml) is the target criterion in this TMDL.

A statistical summary of fecal coliform data used in the TMDL for Hogtown Creek is shown in **Table 4**. The location of the monitoring station used to develop the TMDL is shown on **Figure 1**. Data used to compile the statistics in Table 4 are included in **Appendix B**. Water quality data collected at station 21FLACEPHOGNW22 were used to estimate the fecal coliform TMDL for Hogtown Creek because it had the largest amount of data available.

Table 4. Summary of Total Coliform Monitoring Data

WBID	Total Number Samples	30-Day Geometric Mean	% Samples >800 counts/100mL	Minimum Concentration (counts/100mL)	Maximum Concentration (counts/100mL)
2698	9	N/A	89	500	11,000

The water quality samples collected at 21FLACEPHOGNW22 were separated into two groups depending on whether they exceeded the numerical target. Loads were calculated for each sample using the estimated flow or measured on the sampling day. Loads were expressed in units of counts per day to reflect the instantaneous criterion. The two groups of loads were plotted on the load duration curve with unique symbols. The position of the loads on the curve is based on the duration interval of the stream flow estimated at the time of sampling. Loads positioned above the allowable load line represent exceedances of the criterion, while loads positioned below the line represent compliance with the criterion.

In general, exceedances occurring on the right side of the curve typically occur during low flow events and are indicative of continuous pollutant sources, such as NPDES permitted discharges, leaking collection lines, or leaking septic systems. Livestock having access to streams could also be a source during low flow (it is not expected that livestock would be in the stream during high flows). The load duration curve for fecal coliform in Hogtown Creek is shown in **Figure 5.**

Figure 5. Load Duration Curve for Fecal Coliform in Hogtown Creek at Station 21FLACEPHOGNW22

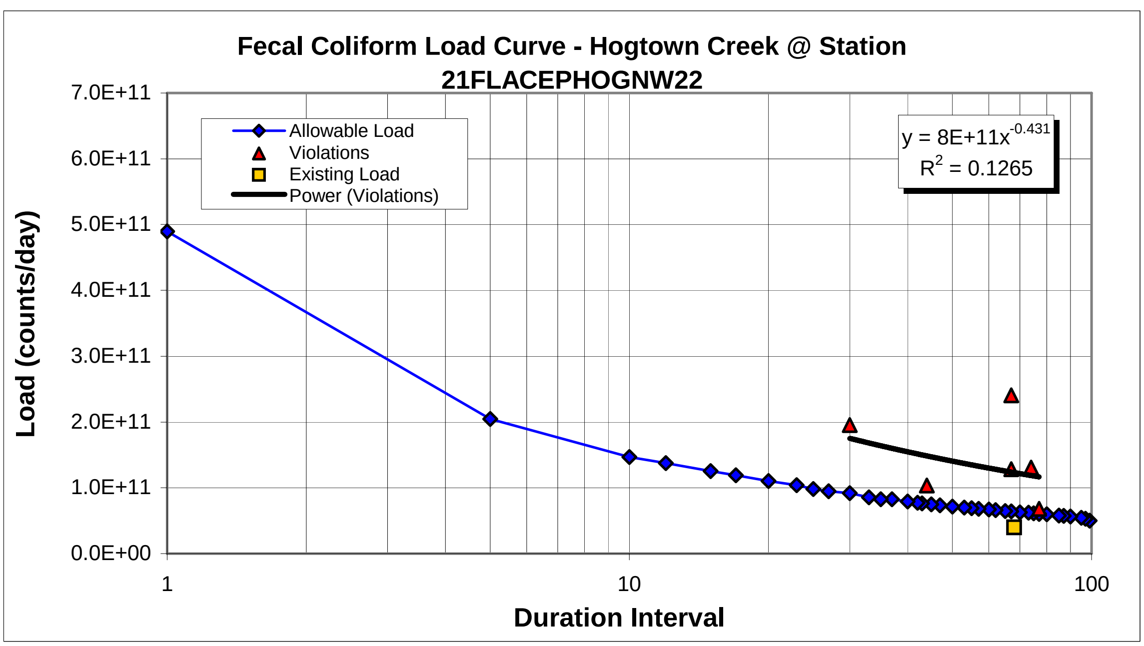


Figure 5 includes a trend line (black line) drawn through the loads representing exceedances of the criterion. This trend line is used to predict the load at other flow recurrence intervals. For Hogtown Creek, a power function trendline equation (y = 8E+11x-0.431) gave the best visual fit of the data and had the highest correlation coefficient ($R^{2=}$ = 0.1265).

After the trend line is developed, it is used to determine the average percent reduction required to achieve the numerical criterion. At each recurrence interval between 10 and 90 (using recurrence intervals in multiples of 5), the equation of the trend line is used to estimate the existing load. Values for flows that are exceeded less than 10 percent of the time were not used because they represent abnormally high events, and values for flows occurring greater than 90 percent of the time were not used because they are extreme low flow events.

The percent reduction required to achieve the target load is then calculated at each interval and the final percent reduction needed is the average of these values. The TMDL and percent reductions were calculated as the average of all the loads and percent reductions calculated at the various recurrence intervals between 10 and 90 percent. Calculation of the TMDL and percent reduction for fecal coliform in Hogtown Creek is shown in **Table 5.** A more detailed description of the method for estimating percent reduction is provided in **Appendix C**.

Table 5. Calculation of TMDL and Percent Reduction for Fecal Coliform in Hogtown Creek

Interval	Allowable Load (counts/day)	Existing Load[1] (counts/day)	Percent Reduction
90	5.63E+10	1.15E+11	51.1
85	5.81E+10	1.18E+11	50.7
80	5.96E+10	1.21E+11	50.8
75	6.11E+10	1.24E+11	50.9
70	6.30E+10	1.28E+11	50.9
65	6.48E+10	1.32E+11	51.1
60	6.69E+10	1.37E+11	51.2
55	6.90E+10	1.42E+11	51.5
50	7.15E+10	1.48E+11	51.8
45	7.48E+10	1.55E+11	51.7
40	7.91E+10	1.63E+11	51.5
35	8.27E+10	1.73E+11	52.1
30	9.19E+10	1.85E+11	50.2
25	9.80E+10	2.00E+11	51.0
20	1.10E+11	2.20E+11	49.9
15	1.25E+11	2.49E+11	49.6
10	1.47E+11	2.97E+11	50.5
Average Values	**8.11E+10**	**1.65E+11**	**51**

1. Existing loads based on the power function trendline equation shown in Figure 5.

6.0 CRITICAL CONDITIONS

The critical condition for coliform loadings from nonpoint sources is an extended dry period followed by a rainfall runoff event. During the dry weather period, coliform bacteria builds up on the land surface, and is washed off by rainfall. The critical condition for point source loading occurs during periods of low stream flow when dilution is minimized. Water quality data have been collected during both time periods. Critical conditions are accounted for in the load curve analysis by using the complete period of flow records and water quality data available for the stream. As indicated on the load duration curve in **Figure 5**, most of the exceedances occur between the 60^{th} and 80^{th} duration intervals (conditions typical of saturated soils when a larger portion of the watershed drainage area is potentially contributing runoff).

7.0 DETERMINATION OF TMDL

TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), non-point source loads (Load Allocations), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$TMDL = \Sigma\ WLAs + \Sigma\ LAs + MOS$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or <u>other appropriate measure</u>. The fecal coliform TMDL for Hogtown Creek is expressed in terms of percent reduction and counts per day, and represents the maximum one-day load the stream can assimilate over a 30-day period and maintain the water quality criterion. TMDL components for Hogtown Creek are provided in **Table 6.**

Table 6. TMDL Components

WBID 2698 Hogtown Creek	WLA[1]		LA (Counts/day)	TMDL[2] (Counts/day)	Percent Reduction[3]
	Wastewater	Stormwater			
Fecal Coliform	NA	51%	8.11E + 10	8.11E +10	51%

Notes:
1. TMDL represents the WLA for nonpoint sources for the projected MS4 area.
2. TMDL represents the average allowable load between the 10^{th} and 90^{th} percent recurrence interval.
3. Overall reduction to achieve an in-stream water quality criterion of 2,400 counts/100ml.

7.1 Load Allocation (LA)

The load allocation (LA) component represents the maximum one-day load that can occur in any 30-day period and the percent reduction in loading needed to meet the fecal coliform criterion. The maximum fecal coliform one day load for Hogtown Creek is 8.11E + 10. Nonpoint sources will need to reduce loading by 51 percent to meet the TMDL. 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.

7.2 Wasteload Allocation (WLA)

The WLA component is typically separated into a load from continuous NPDES wastewater facilities (e.g., WWTP) and the load from Municipal Separate Storm Sewer Systems (MS4s). Continuous discharge facilities have WLA units of counts/day based on permit limits and design flow, while MS4 loads are typically represented as a percent reduction. There are no permitted wastewater facilities that discharge coliform bacteria to surface waters in the Hogtown Creek basin so the wasteload allocation is zero. Only facilities discharging directly into the streams are included in the WLA.

MS4s typically discharge bacteria to waterbodies in response to storm events. Large and medium MS4s serving populations greater than 100,000 people have been required to obtain an NPDES storm water permit for several years under Phase I of the program. As of March 2003, small MS4s serving urbanized areas with a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile will be required to obtain a permit under the Phase II storm water regulations.

As the City of Gainesville and the City of Ocala will be covered under Phase II of the NPDES Storm Water Program, the TMDL establishes a WLA for the projected MS4 area, with the TMDL based on the same percent reduction expected for nonpoint sources (51%). It should be noted that any MS4 permittee will only be responsible for reducing the loads associated with stormwater outfalls for which it owns or otherwise has responsible control, and is not responsible for reducing other nonpoint source loads within its jurisdiction.

Any future wastewater facility permitted to discharge coliform bacteria in the Hogtown Creek watershed shall be required to meet permit limits and must not exceed the established TMDL values. For future facilities discharging into the basin, nonpoint source loads shall to be reduced such that the combined WLA and LA do not exceed the established TMDL.

7.3 Margin of Safety (MOS)

There are two methods for incorporating a MOS in the analysis: (1) by implicitly incorporating the MOS using conservative model assumptions to develop allocations, or (2) by explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations. In this TMDL, an implicit MOS was incorporated by considering all data collected in the WBID. The percent reduction necessary to achieve water quality standards is based on the monitoring station having the largest number of samples and the highest water quality violations. Due to dilution and decay, not all stations require the same reduction to meet standards. By selecting the highest reduction, an implicit MOS is incorporated in the analysis. Additionally, the TMDL sets the water quality standard at the edge of the waterbody/point of discharge. If the allocation is met, dilution and decay could result in instream water quality samples below the numerical criteria and an implicit MOS would be realized.

8.0 IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

Following adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the Basin Management Action Plan for the Hogtown Creek basin. This document will be developed in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished.

The Basin Management Action Plan (B-MAP) will include:

- Appropriate allocations among the affected parties.
- A description of the load reduction activities to be undertaken.
- Timetables for project implementation and completion.
- Funding mechanisms that may be utilized.
- Any applicable signed agreements.
- Local ordinances defining actions to be taken or prohibited.
- Local water quality standards, permits, or load limitation agreements.
- Monitoring and follow-up measures.

It should be noted that TMDL development and implementation is an iterative process, and this TMDL will be re-evaluated during the BMAP development process and subsequent Watershed Management cycles. The Department acknowledges the uncertainty associated with TMDL development and allocation, particularly in estimates of nonpoint source loads and allocations for NPDES stormwater discharges, and fully expects that it may be further refined or revised over time. If any changes in the estimate of the assimilative capacity and/or allocation between point and nonpoint sources are required, the rule adopting this TMDL will be revised, thereby providing a point of entry for interested parties.

9.0 SEASONAL VARIATION

Seasonal variation was incorporated in the load curves by using the entire period of record of flow recorded at the gage. Seasonality was also addressed by using all water quality data collected near the USGS flow gage, which was collected during multiple seasons.

Appendix A

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, Florida Statutes (F.S.), was established as a technology-based program that relies upon the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, Florida Administrative Code (F.A.C.).

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

In 1987, the U.S. Congress established section 402(p) as part of the Federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES to designate certain stormwater discharges as “point sources” of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific Standard Industrial Classification (SIC) codes, construction sites disturbing five or more acres of land, and master drainage systems of local governments with a population above 100,000 [which are better known as “municipal separate storm sewer systems” (MS4s)]. However, because the master drainage systems of most local governments in Florida are interconnected, EPA has implemented Phase 1 of the MS4 permitting program on a county-wide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the DOT (Department of Transportation) throughout the 15 counties meeting the population criteria.

An important difference between the federal and the state stormwater permitting programs is that the federal program covers both new and existing discharges while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES stormwater permitting program will expand the need for these permits to construction sites between one and five acres, and to local governments with as few as 10,000 people. These revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as “point sources” for the purpose of regulation, they are still diffuse sources of pollution that can not be easily collected and treated by a central treatment facility similar to other point sources of pollution, such as domestic and industrial wastewater discharges. The DEP recently accepted delegation from EPA for the stormwater part of the NPDES program. It should be noted that most MS4 permits issued in Florida include a re-opener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

Appendix B – Water Quality Data

Hogtown Creek Fecal Coliform TMDL Data							
WBID	Basin/Waterbody	Station ID	Date	Fecal Coliform (counts/100mL)	Est. Flow (cfs)	Probability (%)	Load (counts/day)
2698	Hogtown Creek	21FLACEPHOGNW22	8/15/2001	500	3.2554	68	3.97E+10
2698	Hogtown Creek	21FLACEPHOGNW22	7/18/2001	900	3.0994	77	6.81E+10
2698	Hogtown Creek	21FLACEPHOGNW22	12/11/2001	1100	3.8482	44	1.03E+11
2698	Hogtown Creek	21FLACEPHOGNW22	3/15/2001	1600	3.2866	67	1.28E+11
2698	Hogtown Creek	21FLACEPHOGNW22	6/13/2001	1700	3.1462	74	1.31E+11
2698	Hogtown Creek	21FLACEPHOGNW22	4/11/2001	1700	4.7062	30	1.95E+11
2698	Hogtown Creek	21FLACEPHOGNW22	3/15/2001	3000	3.2866	67	2.41E+11
2698	Hogtown Creek	21FLACEPHOGNW22	5/8/2001	5000	2.8654	90	3.50E+11
2698	Hogtown Creek	21FLACEPHOGNW22	11/6/2001	11000	2.8342	93	7.61E+11

Data Analysis				
WBID	Station	# Samples Collected	Samples > 800	% Exceedances
2698	21FLACEPHOGNW22	9	8	89

TMDL and existing loads represent average between the 10th and 90th interval.
TMDL Load (counts/day): 8.11E + 10 (based on the one day maximum concentration < 800 counts/100mL).
Existing Load (counts/day): 1.7E + 11 (based on the power function trendline equation).
Percent Reduction: 51.

Appendix C – Load Curve Analysis

The load duration curve is a visual display of the existing and allowable loads at each recurrence interval on the flow duration curve. The existing loads are based on the instream total coliform concentrations measured during ambient monitoring and an estimate of flow in the stream at the time of sampling. Allowable loads are based on the flow values at each recurrence interval on the flow duration curve and the applicable water quality criterion. Because insufficient data were collected to evaluate the geometric mean criterion for fecal coliforms, the numerical criterion of 800 counts per 100 ml was addressed in this TMDL. The load duration curve for Hogtown Creek (WBID 2698) is shown in **Figure 5**.

The existing loads are separated into two groups depending on whether they violate the numerical target or not. These groups of existing loads are shown as unique symbols on the plots. The position of the loads on the curve is based on the recurrence interval of the stream flow estimated at the time of sampling. Loads are expressed in units of counts per day to reflect the instantaneous criterion. The loads represent the maximum one-day load that can occur in any 30-day period for the stream to maintain water quality standards.

Depending on the number of samples violating the target, a trendline was drawn through these points. If fewer than two samples collected on an impaired stream violated the target, a trendline was not drawn. A power function trendline was used for Hogtown Creek as it reflected the best visual fit of the data and had the highest correlation coefficient (R^2 value). In the trendline equation, the x-variable is the recurrence interval.

The load allocation for Hogtown Creek was calculated using the power function trendline equation. The load calculated using the trendline equation is called the existing load. At each recurrence interval, if the existing load is greater than the target load, a percent reduction is required to meet the water quality criterion. The TMDL and percent reductions were calculated as the average of all the loads and percent reductions calculated at the various recurrence intervals where a violation occurred.

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