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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration,

Bureau of Watershed Restoration

SOUTHWEST DISTRICT • TAMPA BAY BASIN

TMDL Report

Dissolved Oxygen TMDL for Bishop Creek Tidal (WBID 1569) and DO and Nutrient TMDL for Mullet Creek Tidal (WBID 1575)

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Florida Department of Environmental Protection, Bureau of Watershed Restoration

Total Maximum Daily Load (TMDL) Program

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

Identification of Impaired Surface Waters Rule

https://www.flrules.org/gateway/chapterhome.asp?chapter=62-303

STORET Program

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

2006 305(b) Report

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

Criteria for Surface Water Quality Classifications

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

Basin Status Reports

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

Water Quality Assessment Reports

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

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida

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

National STORET Program

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

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for dissolved oxygen (DO) for Bishop Creek Tidal Watershed (WBID 1569) and DO and Nutrient TMDL Mullet Creek Tidal (1575) in the Tampa Bay Basin. Both waterbodies were verified as impaired for low DO and therefore were included on the Verified List of impaired waters for the Tampa Bay Basin. The verified list of impaired waters was adopted by Secretarial Order on June 3, 2008. The TMDL establishes the allowable nutrient loadings to the Bishop Creek Tidal and Mullet Creek Tidal watersheds that would restore these waterbodies so that they meet their applicable water quality criterion for DO and nutrients.

1.2 Identification of Waterbody

The Bishop Creek Watershed is an urban stream located in Northeast Pinellas County (**Figures 1.1a and 1.1b**) near Tampa Bay, Florida. The drainage basin is located in the City of Safety Harbor with the City of Oldsmar to the north and the City of Clearwater to the south. Bishop Creek Tidal is a polygon representing the watershed that encompasses an area of approximately 60 acres. The Bishop Creek watershed is a natural tributary to Tampa Bay. Bishop Creek flows primarily in an easterly direction and drains into Tampa Bay. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Tampa Bay Basin (Florida Department of Environmental Protection [Department], 2001). The Bishop Creek Tidal watershed has been identified as WBID 1569 (**Figure 1.2a**).

Mullet Creek Tidal (WBID 1575) is located in the central portion of Pinellas County mainly within the City of Safety Harbor (**Figures 1.1a and 1.1b**). Mullet Creek (~0.1 square mile) flows primarily in a south-easterly direction (draining about 2.86 square miles from the Fresh portion of the stream) entering the west side of Mullet Creek Tidal and then discharging into Tampa Bay. The Mullet Creek basin is located in the central portion of the City of Safety Harbor (17,271 people) and outskirts of the City of Clearwater (106,642 people), (U.S. Census Bureau, 2007). Additional information about the river's hydrology and geology are available in the Basin Status Report for the Tampa Bay Basin (Florida Department of Environmental Protection [Department], 2001). For assessment purposes, the Department has divided the Tampa Bay Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. Mullet Creek Tidal watershed is identified as WBID 1575, (**Figure 1.2b**)

1.3 Background

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

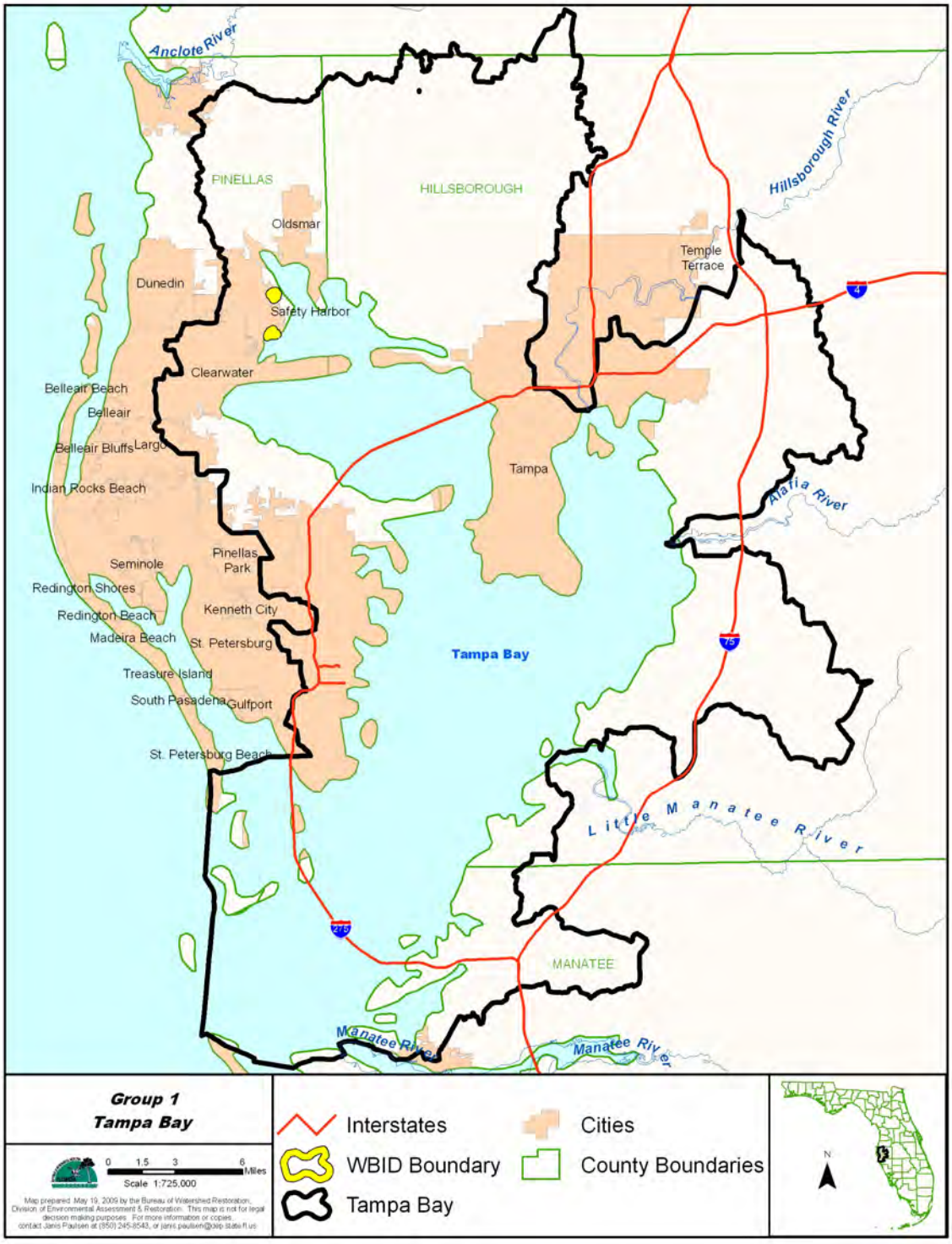

Figure 1.1a. Location of Bishop Creek (Tidal) and Mullet Creek (Tidal) in Pinellas County and Major Geopolitical Features in the Area

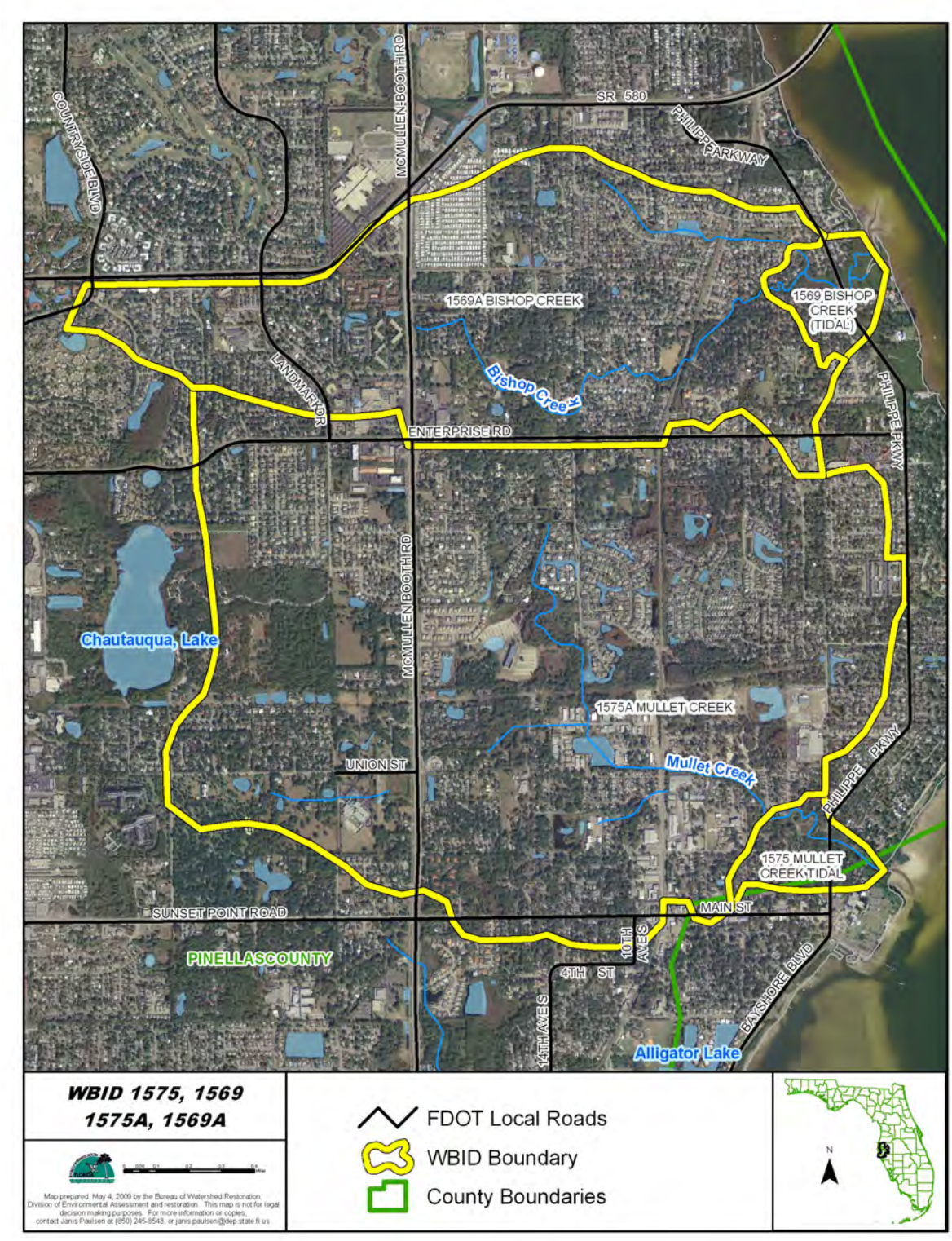

Figure 1.1b. Location of Bishop Creek (Tidal) and Mullet Creek (Tidal) within local watersheds

Figure 1.2a. Location of Bishop Creek (WBID 1569)

Figure 1.2b. Location of Mullet Creek Tidal (WBID 1575)

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 Basin Management Action Plan, or BMAP, designed to reduce the amount of nutrients that caused the verified impairments in Bishop Creek (WBID 1569) and Mullet Creek (WBID 1575). These activities will depend heavily on the active participation of the Southwest Florida Water Management District (SWFWMD), Pinellas County's Department of Environmental Management (PDEM), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

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

Florida's 1998 303(d) list included 47 waterbodies in the Tampa Bay Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was modified in 2006 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Bishop Creek Tidal (WBID 1569) and Mullet Creek Tidal (1575) watersheds (**Tables 2.1a** and **2.1b**). **Tables 2.2a** and **2.2b** summarizes the data collected during the verification period (January 2000 – June 2007), as shown in **Table 2.1**. The projected year for the (1998 303(d) listed) DO TMDL for Bishop Creek (WBID 1569) and DO and nutrient TMDL for Mullet Creek (1575) was 2008, but the Settlement Agreement between EPA and Earthjustice, which drives the TMDL development schedule for waters on the 1998 303(d) list, allows an additional nine months to complete the TMDLs. As such, these TMDLs must be adopted and submitted to EPA by September 30, 2009.

Both waterbodies were verified as impaired based on DO data. Using the IWR methodology, more than 10 percent of the values did not meet the Class III Marine criterion of 4 mg/L for DO in Bishop Creek (WBID 1569), 24 out of 60 results falling below. For Mullet Creek (WBID 1575) there was an even higher rate of failure, with 38 out of 59 results below the criteria. The DO data used in this report are based on the IWR Run35 database.

In Bishop Creek and Mullet Creek there was only sufficient Chlorophyll a data to obtain annual Chlorophyll a average concentration for 3 of the 7 Verified Period Years. These include 2000, 2001, 2001, and 2005. The Bishop Creek Chlorphyll a annual average concentrations (in ug.L) for those years were 8.19, 6.39. 6.72. and 2.85, thus never exceeded the 11 ug/L freshwater threshold. Unfortunately Mullet Creek, although having annual Chl-a averages of 4.82. 7.97,

and 4.2 ug/L in 2000, 2001, and 2005, its 15.05 annual average concentration in 2002 is responsible for this Mullet Creek's nutrient impairment (**Table 2.3**).

The verified impairments were based on data collected by FDEP Southwest District and Pinellas County. WBID location and STORET stations are shown in **Figure 5.1**. **Figures 2.1a** and **2.1b** displays the DO data collected during the verification period (January 2000 – October 2005) for –Bishop Creek and Mullet Creeks, respectively.

Table 2.1a. Verified Impairments for Bishop Creek-Tidal (WBID 1569)

WBID	Waterbody Segment	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameter Causing Impairment
1569	Bishop Creek	Estuary	3M	Dissolved Oxygen**	TN

**Note – WBID 1569 (Bishop Creek) was included on the 1998 303(d) List for DO with a TMDL due date of 2008.

Table 2.1b. Verified Impairments for Mullet Creek Tidal (WBID 1575)

WBID	Waterbody Segment	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameter Causing Impairment
1575	Mullet Creek	Estuary	3M	Dissolved Oxygen	TN

**Note – WBID 1575 (Mullet Creek Tidal) was included on the 1998 303(d) List for, DO, and Nutrients with a TMDL priority of Low and due date of 2008.

Table 2.2a. Summary of Dissolved Oxygen Data for Bishop Creek (WBID a1569) (January 1, 2000–October 17, 2005)

WBID	Total Number of Samples	IWR-required number of exceedances for the Verified List	Number of observed exceedances	Number of seasons data was collected	Mean	Median	Min	Max
1569	60	10	24	4	4.52	4.57	0.35	13.62

Table 2.2b. Summary of Dissolved Oxygen Data for Mullet Creek Tidal (WBID 1575), (January 1, 2000 – June 30, 2007)

WBID	Total Number of Samples	IWR-required number of exceedances for the Verified List	Number of observed exceedances	Number of seasons data were collected	Mean	Median	Min	Max
1575	59	10	38	4	2.4	2.9	0.39	17.14

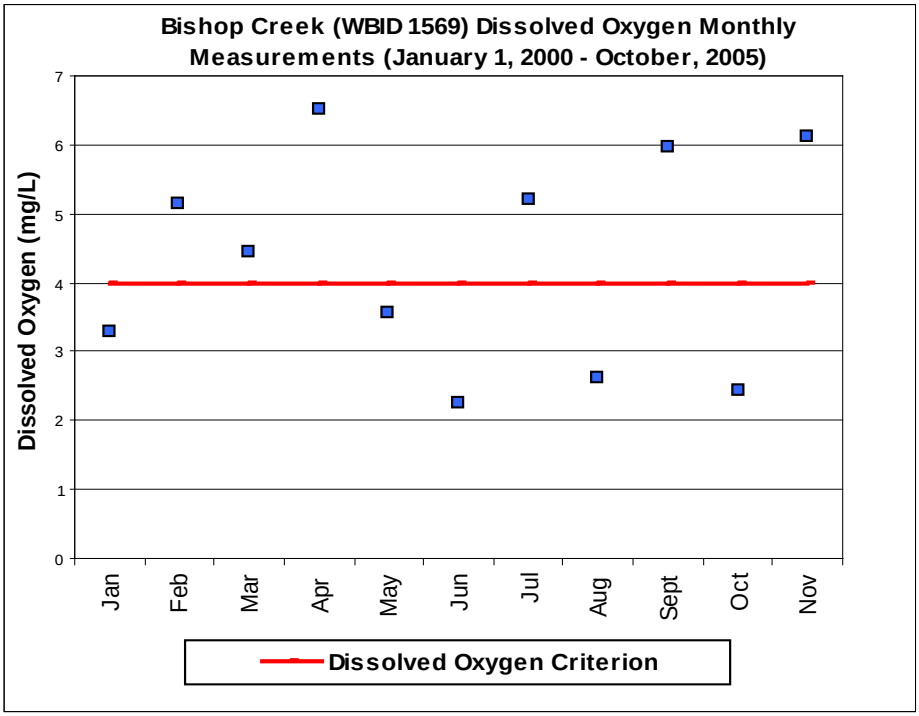

Figure 2.1a. Dissolved Oxygen Measurements for Bishop Creek, WBID 1569 (January 1, 2000 – October 17 2005)

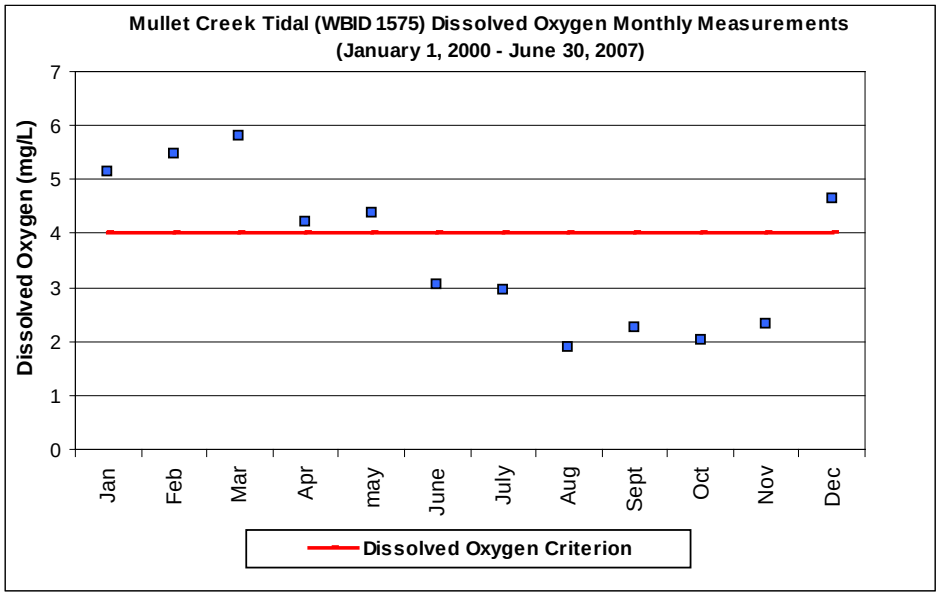

Figure 2.1b Dissolved Oxygen Measurements for Mullet Creek, WBID 1575 (January 1, 2000 – June 30, 2007)

Table 3.1 Chlorophyll-a in Mullet Creek (1575) and Bishop Creek (1569) during Verified Period

Chlorophyll-a Corrected (ug/L)		
	Bishop Creek (Tidal)	Mullet Creek (Tidal)
	(1569)	(1575)
Year	ID*	ID
2000	8.196	4.823
2001	6.39	7.97
2002	6.72	**14.05****
2003	ID	ID
2004	ID	ID
2005	2.85	4.205
2006	ID	ID
2007	ID	ID

ID = Insufficient data to develop an annual average

****WBID Impaired for nutrients if annual average > 11 ug/L during VP**

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

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

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

Bishop Creek and Mullet Creek are Class III waterbodies, with a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The criterion applicable to the TMDLs is the Class III criterion Dissolved Oxygen and nutrients.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

The Class III marine criteria for Dissolved Oxygen as established by Rule 62-302,530(30), F.A.C., states the following: Dissolved Oxygen shall not average les than 5.0 mg/L in a 24-hour period and shall not be less than 4 mg/L, and that normal daily and seasonal fluctuations above these levels shall be maintained.

Florida's Nutrient Criterion is narrative only, nutrient concentrations of a body of water shall not be altered so as to cause imbalance in natural populations of aquatic flora or fauna. Accordingly, a nutrient-related target was needed to represent levels at which an imbalance in flora or fauna is expected to occur. While the IWR provides a threshold for nutrient impairment for estuaries based on annual average chlorophyll a levels, these thresholds are not standards and need not be used as the nutrient-related water quality target for TMDLs. It should be recognized that the IWR thresholds were developed using statewide average conditions, the IWR (Section 62-303.450, F.A.C.) specifically allows the use of alternative site-specific thresholds that more accurately reflect conditions beyond which an imbalance in flora or fauna occurs in the waterbody.

3.2.2 Identification of Causative Pollutants

After verification of the low DO in Bishop Creek Tidal (1569) and Mullet Creek Tidal (1575), the Department identified the causative pollutants by investigating those parameters typically responsible for depressed DO. These include nutrients (nitrogen and phosphorus) and BOD. One method of identifying causative pollutants is to use statewide screening level concentrations set at the 70th percentile of all STORET data across the state from 1970 to 1987. This approach is useful if there are no significant regional differences in what is defined as a

waterbody meeting its' intended designated uses. The Department's statewide screening level for estuaries is 2.1 mg/L for BOD5, 1.0 mg/L for TN, and 0.19 mg/L for TP. But the Department also takes note that there are significantly lower nutrient levels leading to impairment in South Florida than the statewide screening levels indicated. Other required considerations include the restrictions or nutrient targets of the receiving waters of the surface waters being analyzed as well as local flora and fauna protection requirements. In the case of those waters in old Tampa Bay Planning area, there are Chlorophyll-A alternative targets that have been identified. For Tampa Bay these targets are as stated below;

Table 3.1 Tampa Bay Estuary Program Targets

Tampa Bay Segments	Tampa Bay Estuary Program Targets
Lower Tampa Bay	**5.1 ug/L**
Middle Tampa Bay	**8.5 ug/L**
Old Tampa Bay	**9.3 ug/L**
Hillsborough Bay	**15 ug/L**

The Chorophyll-a target relevant to Bishop Creek Tidal and Mullet Creek Tidal is that for Old Tampa Bay (9.3 ug/L). The Tampa Bay Estuary Program's Old Tampa Bay Target is the primary tool when determining the Total Nitrogen target for Bishop and Mullet Creek Tidal. The estuary target must be that total nitrogen concentration is consistent with a 9.3 ug/L estuary target. To obtain this value, the Chlorophyll a of all the applicable bay WBIDs for Verified Period samples were compared to the total nitrogen concentration in those Bay WBIDs. The Total Nitrogen levels measured when the chla was at or below 9.3 ug/L could thus be determined as the target concentrations for Mullet Creek Tidal and Bishop Creek Tidal. **Table 3.2** shows the Chla concentrations and the corresponding total nitrogen concentrations for Mullet Creek (Tidal) and Bishop Creek (Tidal). **Figure 3.1** is a graph of the results of Mullet Creek alone as well as Mullet and Bishop Creek combined. Although the R2 value of Mullet Creek alone (.901) is much different than that for the two combined, the resultant TN obtained when solving both regression equations for Chla = 9.3 was similar. Solving the first regression equation for Chla=9.3 ug/L (Old Tampa Bay Target) provides a TN equal to 0.98 mg/L. Solving the second for R2 provides a TN = 1.00. Although this assessment may demonstrate that a 1.0 mg/L concentration is protective of the Old Tampa Bay 9.3 ug/L Chla criteria, it does not demonstrate that it is protective of the Dissolved Oxygen Criteria of 4.0 mg/L.

Table 3.2 Mullet Creek and Bishop Creek TN and Chlorophyll-A

Bishop Creek and Mullet Creek Chlorophyll-a and TN			
	YEAR	**Chl-a**	**TN**
Bishop Creek Tidal	2000	8.19	0.745
	2001	6.39	0.935
	2002	6.721	1.07
	2005	2.851	1.108
Mullet Creek Tidal	4.82	4.82	0.71
	7.97	7.97	1.005
	14.05	14.05	1.185

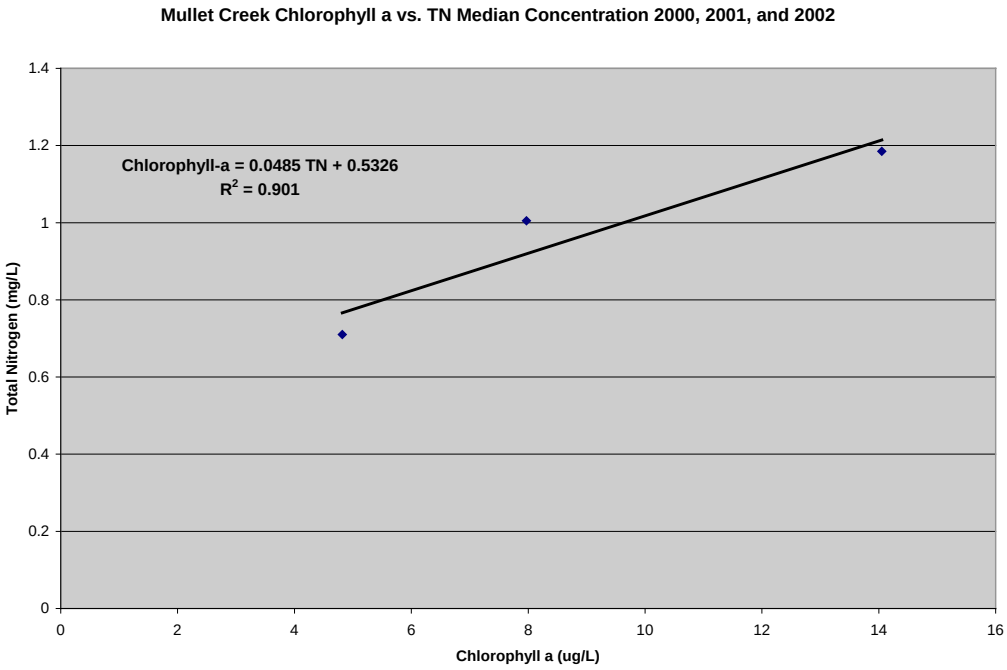

Figure 3.1a Chlorophyll a vs. TN, Mullet Creek

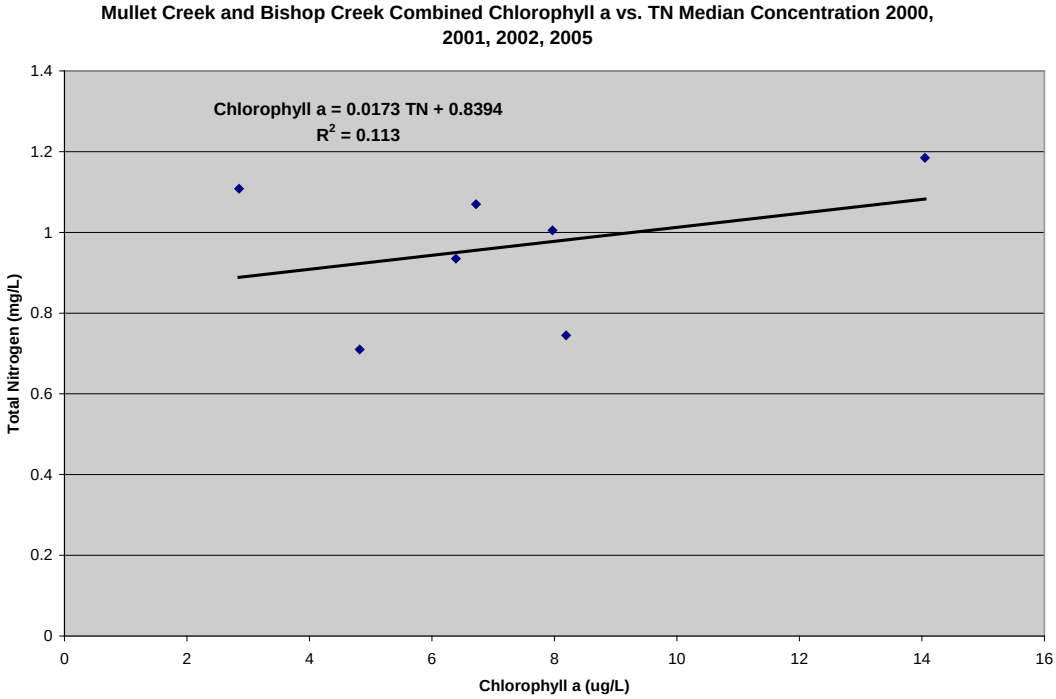

Figure 3.1b Chlorophyll-a vs. TN, Mullet Creek and Bishop Creek

To determine a nutrient level protective of a dissolved oxygen concentration of not below 4 mg/L, with a mean of at least 5.0 mg/L, a reference approach was pursued. The concentrations of TN, DO, and Chlorophyll a observed for Sample Stations in WBIDs found not to be impaired for DO or Nutrients are summarized in **Table 3.3**.

Table 3.3 Statistical Station Summaries of "Not Impaired" and "Impaired" Tampa Bay and Tampa Bay Tributary Sample Stations

Table 2

Abbreviations: TB = Tampa Bay (Group 1); TBT = Tampa Bay Tribs (Group 2); NI = WBID NOT Impaired for DO or Nutr(chl-a); IM=WBID Impaired for DO & Nutr(chl-a)		Sample Station Average Annual Median Concentration (Average = sum of yearly medians from table to left divided by # of years)				
		Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	BOD - 5 Day (mg/L)	Chlorophyll-a (mg/L)	Dissolved Oxygen (mg/L)
Freshwater Streams (3F)	TB NI	0.97	0.202	1.63	2.53	7.53
	TBT NI	1.57	0.950	1.19	1.33	6.81
	TB IM	1.12	0.157	2.44	6.46	3.59
	TBT IM	1.53	0.512	1.85	15.91	4.58
Freshwater Lakes (3F)	TB NI	0.83	0.024	2.50	3.24	6.79
	TBT NI					
	TB IM	1.81	0.238		46.75	4.87
	TBT IM	2.59	0.344	6.33	136.85	10.57
Freshwater Class 1	TB NI					
	TBT Stream NI	0.90	0.308	1.99	4.96	6.81
	TBT Lake NI	0.93	0.263	2.31		7.10
	TB IM					
	TBT IM	1.06	0.248	2.59		5.51
Marine 3M	TB NI	0.62	0.181	1.50	7.58	6.11
	TBT NI	0.88	0.224	2.32		6.39
	TB IM	1.29	0.218	2.51	7.73	4.87
	TBT IM	0.97	0.243	1.32	8.41	4.80
Marine 2	TB NI	0.52	0.114	1.22	4.82	6.35
	TBT NI					
	TB either DO or Nutr. IM	0.61	0.107	1.58	6.80	6.53
	TBT IM					

Note: NI = Not Impaired for Dissolved Oxygen and not Impaired for Nutrients by FDEP IWR Assessment.

Table 3.3 shows that for "Not Impaired" WBIDs in Marine Estuary Tampa Bay WBIDs have an average median sample station TN concentration of 0.62 mg/L, the annual median Dissolved Oxygen concentration is 6.11 mg/L, and a mean Chlorophyll a concentration of 7.58 mg/L. In the nearby Tampa Bay Tributaries Group, the median sample station D.O. for non Impaired WBIDs is 0.88 mg/L, and although there were not enough Chlorophyll a samples to obtain a median corresponding concentration, the Dissolved Oxygen median for these WBIDs is 6.39 mg/L, also well above the 4.0 mg/L Florida criteria, Thus, the TN target selected is the average of these two sets of 'Not Impaired' WBIDs, or 0.75 mg/L. A target of 0.75 mg/L should be both protective of the Old Tampa Bay Chlorophyll-a limit, be protective of the dissolved oxygen criteria, and meet reasonable expectations of attainability when compared to standards of local

WBIDs impaired neither for DO nor Nutrients. The present nutrient and BOD levels in Mullet Creek Tidal and Bishop Creek Tidal are shown in **Table 3.4**.

Table 3.4. Verified Period Summary of TN, TP, and B.O.D. in Mullet Creek Tidal and Bishop Creek Tidal

IWR Verified Period Summary (2000 - 2007)						
WBID	**Total Nitrogen**		**Total Phosphorus**		**5 Day Bod**	
	Sample Count	Concent. mg/L	Sample Count	Concent. Mg/L	Sample Count	Concent. mg/L
Bishop Creek Tidal, 1569	54	1.046	57	0.23	43	1
Mullet Creek Tidal, 1575	43	0.98	47	0.19	32	1.05

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 low DO 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, 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, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix B** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term "point source" is 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. 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 BOD and Low DO in the [Bishop and/or Mullet Creek] Watershed

4.2.1 Point Sources

Estimating Point Source Loads

There are no permitted wastewater facilities located in either Bishop Creek or Mullet Creek watershed.

Municipal Separate Storm Sewer System Permittees

Within the Bishop Creek, as well as Mullet Creek, there is a single Phase I municipal separate storm sewer system (MS4) permits (FLS000005, Pinellas County and co-permittees). The responsible co-permittes in Bishop Creek are the City of Safety Harbor and Pinellas County. The responsible co-permittees in Mullet Creek are the City of Safety Harbor and the City of Clearwater.

4.2.2 Land Uses and Nonpoint Sources

In the Bishop Creek watershed (61 acres), and Mullet Creek watershed (57.5 acres), a number of land uses affect water quality through nonpoint source runoff (Figure 4.1). The most significant nonpoint sources include runoff and erosion from developed areas, small-scale construction, residential and commercial fertilizer use, pets, residential septic tank failure, or poorly designed septic tanks. The watershed have a limited amount of agriculture, with no agriculture in Bishop Creek and only 1.3% of Mullet Creek devoted to agriculture.

Land Uses

Land use categories in the Bishop Creek and Mullet Creek watersheds were aggregated using the simplified Level 1 codes (**Table 4.1a** and **4.1b**). In Bishop Creek and Mullet Creek, by far the largest Level 1 land use is urban and built-up (65.5 percent in Bishop Creek and 83.6% in Mullet Creek). When looking at Level 2, which is a more detailed categorization of land use (**Table 4.2a** and **4.2b**), urban and built-up land uses is comprised mainly of high density residential, medium density residential, low density residential and commercial. After urban and built-up, the second largest land use category is wetland, with wetland in Bishop Creek making up 34% of the watershed.
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Table 4.1a.Level 1 Land Uses in Bishop Creek (WBID 1569) watershed

Landuse Code and Description (WBID 1569)	Acres	% Total
1000: Urban and Built up	39.8	65.50%
6000: Wetland	20.8	34.19%
5000: Water	0.2	0.31%
Total	**60.8**	**100.00%**

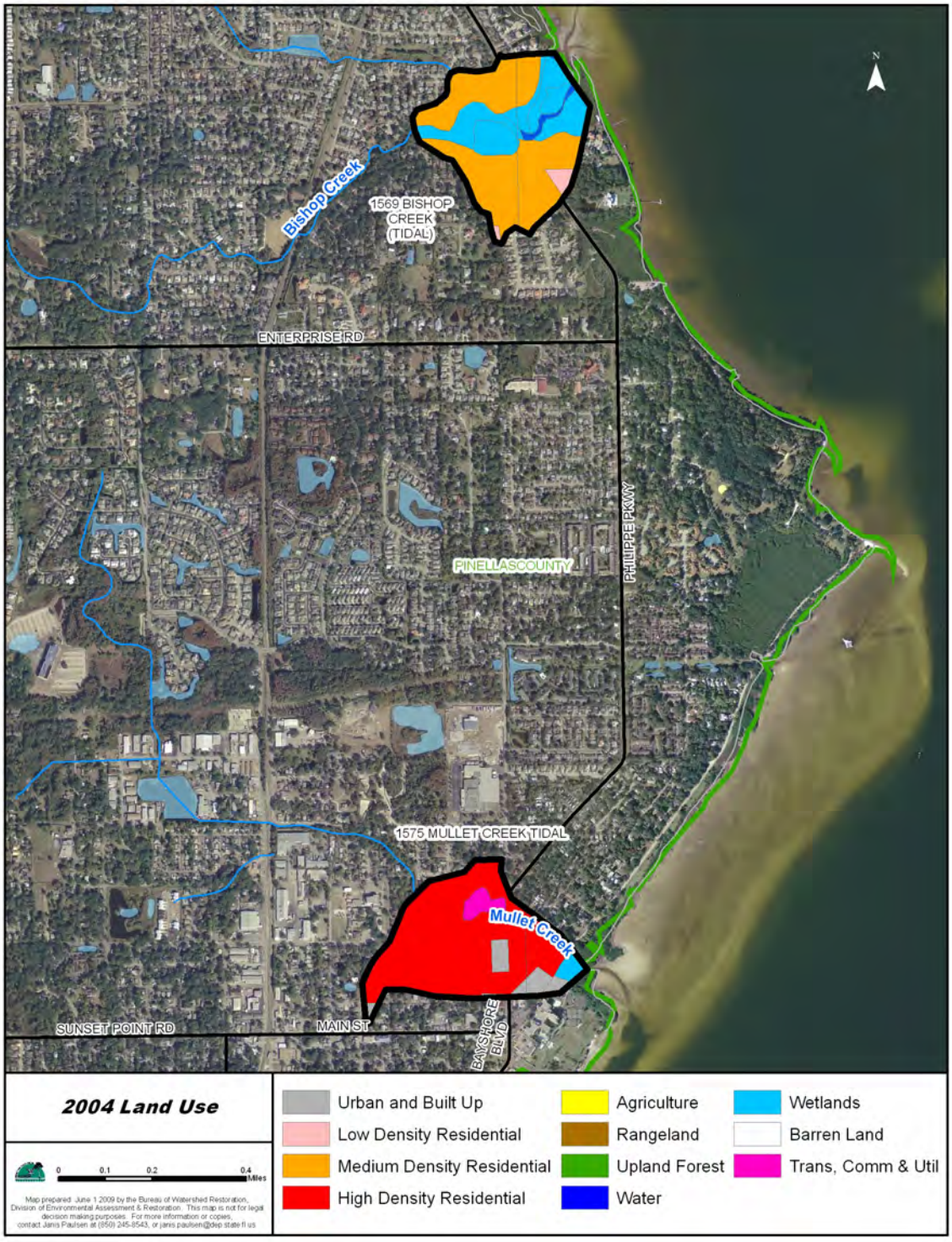

Figure 4.1 Tidal Bishop Creek (WBID 1569) and Mullet Creek (WBID 1575) Land uses.

Table 4.1b. Level 1 Land Uses in Mullet Creek (WBID 1575) watershed

Landuse Code and Description (WBID 1575)	Acres	% Total
1000: Urban and Built up	53.4	92.75%
8000: Transportation, Communication, & Utilities	2.5	4.32%
6000: Wetland	1.7	2.93%
Total	**57.5**	**100.00%**

Table 4.2a.Level 1 Land Uses in the Bishop Creek(WBID 1569) watershed.

Level 2 Land use Code and Description (WBID 1569)	Acres	% Total
1200: Residential, Medium Density	38.0	62.6%
6100: Wetland hardwood forests	13.9	22.9%
6400: Vegetated Nonforested Wetlands	4.9	8.0%
6300: Wetland Forest Mixed	2.0	3.3%
1100: Residential, Low Density	1.8	2.9%
5400: Bays and Estruaries	0.2	0.3%
Total	**60.8**	**100%**

Table 4.2b Level 1 Land Uses in the Mullet Creek (WBID 1575) watersheds.

Landuse Code and Description (WBID 1575)	Acres	% Total
1300: Residential, High Density	48.0	83.52%
1400: Commercial	5.3	9.22%
8300: Utilities	2.5	4.32%
6100: Wetland hardwood forests	1.7	2.93%
1700: Institutional	0.0	0.02%
Total	**57.5**	**100.00%**

The runoff from the Bishop and Mullet Creek watershed is based on impervious area (Harper, 2003; Duncan, 1995), as shown in **Table 4.3**. The nutrient contributions are determined by combining the runoff information for each land use with the corresponding event mean concentration (EMC) (**Table 4.4**). These tables show that the top three land use contributors of TN are commercial, medium-density residential, and industrial, in order of decreasing contribution

Table 4.3a. Bishop Creek Use Categories and Corresponding Runoff, 2000–07

Land Use	Area (acres)	Percent Impervious	Impervious Runoff Coeff.	Pervious Runoff Coeff.	Avg Precip. "/yr	Runoff (Acre-feet)	Runoff Million Gallons
A. Forest/Rural Open	0.00	27.0%	0.95	0.159	49.43	0.0	0.0
B. Urban Open	0.00	0.4%	0.95	0.041	49.43	0.0	0.0
C. Agriculture/Pasture	0.00	1.1%	0.95	0.317	49.43	0.0	0.0
D. Low Density/Residential	1.76	5.3%	0.95	0.150	49.43	1.4	0.5
E. Medium Density/Residential	38.04	24.8%	0.95	0.088	49.43	47.3	15.4
F. High Density/Residential	0.00	7.3%	0.95	0.120	49.43	0.0	0.0
G. Commercial	0.00	10.5%	0.95	0.120	49.43	0.0	0.0
H. Industrial	0.00	7.7%	0.95	0.120	49.43	0.0	0.0
I. Highways	0.00	2.6%	0.95	0.542	49.43	0.0	0.0
J. Wetland	20.77	9.4%	0.95	0.230	49.43	25.5	8.3
K. Water	0.19	3.8%	0.95	0.000	49.43	0.0	0.0
Other [2]							0.0
Total	**60.76**					**74.19**	24.2

Note: Based on effective rainfall of 55.95 inches per year. All impervious R.O. coefficients are 0.95.

Table 4.3b. Mullet Creek Use Categories and Corresponding Runoff, 2000–07

Land Use	Area (acres)	Percent Impervious	Impervious Runoff Coeff.	Pervious Runoff Coeff.	Avg Precip. "/yr	Runoff (Acre-feet)	Runoff Million Gallons
A. Forest/Rural Open	0.00	27.0%	0.95	0.159	49.43	0.0	0.0
B. Urban Open	2.48	0.4%	0.95	0.041	49.43	0.5	0.2
C. Agriculture/Pasture	0.00	1.1%	0.95	0.317	49.43	0.0	0.0
D. Low Density/Residential	0.00	5.3%	0.95	0.150	49.43	0.0	0.0
E. Medium Density/Residential	0.00	24.8%	0.95	0.088	49.43	0.0	0.0
F. High Density/Residential	48.05	7.3%	0.95	0.120	49.43	35.8	11.7
G. Commercial	5.31	10.5%	0.95	0.120	49.43	4.5	1.5
H. Industrial	0.00	7.7%	0.95	0.120	49.43	0.0	0.0
I. Highways	0.00	2.6%	0.95	0.542	49.43	0.0	0.0
J. Wetland	1.68	9.4%	0.95	0.230	49.43	2.1	0.7
K. Water	0.00	3.8%	0.95	0.000	49.43	0.0	0.0
Other [2]						0.0	0.0
Total	**57.53**					**42.87**	**14.0**

Table 4.4a. Bishop Creek Land Use Categories and Corresponding EMC Contributions Based on 2000–07 Rainfall

Land Use	TN Concentration (mg/L)	TP Concentration (mg/L)	TN load (lbs)	TP load (lbs)	Expressed as % of Total TN Watershed Load	Expressed as % of Total TP Watershed Load
A. Forest/Rural Open	1.09	0.046	0.0	0.0	0.0	0.0
B. Urban Open	1.12	0.18	0.0	0.0	0.0	0.0
C. Agriculture/Pasture	2.32	0.344	0.0	0.0	0.0	0.0
D. Low Density/Residential	1.64	0.191	6.2	0.7	1.74	1.44
E. Medium Density/Residential	2.18	0.335	280.3	43.1	78.59	86.06
F. High Density/Residential	2.42	0.49	0.0	0.0	0.0	0.0
G. Commercial	2.42	0.49	0.0	0.0	0.0	0.0
H. Industrial	2.42	0.49	0.0	0.0	0.0	0.0
I. Highways	2.23	0.27	0.0	0.0	0.0	0.0
J. Wetland	1.01	0.09	70.0	6.2	19.63	12.47
K. Water	1.01	0.09	0.1	0.0	.021	.01
Total	**0.00**	**0.00**	**356.6**	**50.0**	**0.0%**	**0.0%**

Table 4.4b. Mullet Creek Land Use Categories and Corresponding EMC Contributions Based on 2000–07 Rainfall

Land Use	TN Concentration (mg/L)	TP Concentration (mg/L)	TN load (lbs)	TP load (lbs)	Expressed as % of Total TN Watershed Load	Expressed as % of Total TP Watershed Load
A. Forest/Rural Open	1.09	0.046	0.0	0.0	0.0	0.0
B. Urban Open	1.12	0.18	1.4	0.2	0.5	0.4
C. Agriculture/Pasture	2.32	0.344	0.0	0.0	0.0	0.0
D. Low Density/Residential	1.64	0.191	0.0	0.0	0.0	0.0
E. Medium Density/Residential	2.18	0.335	0.0	0.0	0.0	0.0
F. High Density/Residential	2.42	0.49	235.6	47.7	86.4	87.5
G. Commercial	2.42	0.49	29.9	6.1	11.0	11.1
H. Industrial	2.42	0.49	0.0	0.0	0.0	0.0
I. Highways	2.23	0.27	0.0	0.0	0.0	0.0
J. Wetland	1.01	0.09	5.7	0.5	2.1	0.9
K. Water	1.01	0.09	0.0	0.0	0.0	0.0
Total			**272.6**	**54.5**	**100.0**	**100.0**

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The goal of this TMDL analysis is to reduce the anthropogenic TN loads to conditions comparable to those found in surrounding, unimpaired watersheds. The methodology used is a percent reduction approach between the existing condition concentration and the region-based reference concentration.

5.2 Data Used in the Determination of the TMDL

Two stations located in the Bishop and Mullet Creek (WBID 1575 and 1569) have DO and TN observations. Data providers include the Department, Pinellas County, and SWFWMD, which maintains a routine sampling site. **Table 5.1a and 5.1b** show verified period sample analyses summaries for the major sample stations in the WBIDs. **Figure 5.1** shows the locations of the WBID's major ambient water sample sites.

Table 5.1a The 3 top Data Collectors and Station List for Mullet Creek Tidal, WBID 1575

Major TN, DO, and Chl-a Sample Stations Mullet Creek	Total Nitrogen Summary			D.O.			Chlorophyll a		
	Count	Median	75 Percentile	Count	Median	75 Percentile	Count	Median	75 Percentile
21FLPDEMAMB 13-1	32	0.995	1.105	36	2.56	4.235	33	5.2	9.3
21FLTPA 27593868241169	10	0.946	0.988	22	3.6	5.2875			
21FLBRA 1575-A	1	0.36	0.36						

Table 5.1b. The 2 top Data Collectors and Station List for Bishop Creek Tidal, WBIDs1569

Station ID	Total Nitrogen Summary			D.O.			Chlorophll a		
	Count	Median	75 Percentile	Count	Median	75 Percentile	Count	Median	75 Percentile
21FLPDEMAMB 12-1	33	0.95	1.23	36	4.735	6.1675	27	7.4	9.6
21FLTPA 2801568241139	21	1.108	1.33	24	4.625	6.4875			

Note: Total number of samples includes data for all parameters assessed in verified period.

The approach to calculating DO and nutrient TMDLs depends on the number of water quality samples and the availability of other required datasets. When minimal or no nutrient, BOD, or flow data are available, the existing loads are calculated using the nonpoint source spreadsheet and the TMDL is expressed as a percent reduction to meet a pollutant concentration target based on natural or reference conditions (EPA, 2000). The assumption is that BOD and nutrients (primarily TN and TP) are the major controllable factors for DO. To return DO concentrations to a "naturally" expected condition, unimpaired by pollutants, BOD and nutrient loadings also need to be returned to near natural loading conditions.

Figure 5.1. Bishop and Mullet Creek Watersheds, (WBIDs 1569 and/or 1575) and Sample Stations

DO can also be affected or lowered by in-stream modifications such as dredging and channelization. These processes slow down water velocity, reduce reaeration, and increase the settling of solids, thus increasing sediment oxygen demand (SOD) and lowering DO concentrations. Further analyses and monitoring must be completed to develop an appropriate, site-specific DO criterion.

The approach used here was to 1) determine what the nutrient requirements were for meeting and maintaining the Chlorophyll-a target for the receiving waterbody (Old Tampa Bay). This was done by looking at the relationship between median TN and median Chl-a in the tidal portion of Mullet and Bishop Creeks. 2) Determine the obtain requirements for maintaining dissolved oxygen by determining the levels of dissolved oxygen and levels of potential causative pollutants in Tampa Bay WBIDs already deemed "not impaired" by FDEP local. If the Total Nitrogen and corresponding dissolved oxygen was protective of the bay and met FDEP DO criteria, then that limit would be adopted as the target concentration. The Target concentration that met these criteria was a TN of 0.75 mg/L.

5.3 TMDL Development Process

Exceedances in Bishop Creek occur throughout the year and in Mullet creek is concentrated in the wet season (June through November). The percent reduction was calculated as follows:

$$\frac{[(\text{Highest Median Station Concentration during VP}) - (\text{water quality target})]}{(\text{Highest Median Station Concentration during VP})} \times 100$$

This was applied to Mullet Creek and Bishop Creek as shown in Tables 5.2a and 5.2b.

Table 5.2a. Bishop Creek, TN Percent Reduction Table, 2000–07

Major Sample Stations during verified period for BISHOP CREEK (TIDAL), WBID 1569	VP Sample Count	Sample Station Median Annual Total Nitrogen Concentration								Verified Period Maximum Annual Median
		2000	2001	2002	2003	2004	2005	2006	2007	
21FLPDEMAMB 12-1	33	0.75	0.94	1.07						1.07
21FLTPA 2801568241139	21						1.11			1.11
Worst Year Median TN to for which reduction is to be applied to (Maximum Annual Station median)										1.11
									Target Concentration (mg/L)	0.75
									Percent Reduction	32.3%

Table 5.2b. Mullet Creek TN Percent Reduction Table, 2000–07

Major Sample Stations during verified period for MULLET CREEK TIDAL, WBID 1575	VP Sample Count	Sample Station Median Annual Total Nitrogen Concentration								Verified Period Maximum Annual Median
		2000	2001	2002	2003	2004	2005	2006	2007	
21FLPDEMAMB 13-1	32	0.71	1.19	1.19						1.19
21FLTPA 27593868241169	10						0.95			0.95
Worst Year Median TN to for which reduction is to be applied to (Maximum Annual Station median)										1.19
									Target Concentration (mg/L)	0.75
									Percent Reduction	36.7%

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 TMDL for the Bishop and Mullet Creek (WBIDs 1575 and 1569] is expressed in terms of a percent reduction in TN to protect the DO concentration (**Table 6.1**).

Table 6.1. TMDL Components and Current Loadings for the Bishop Creek Tidal (WBID1569) and Mullet Creek Tidal (WBID 1575)

WBID	Parameter	TMDL (mg/L)	WLA		LA (% reduction)	MOS
			Wastewater (mg/L)	NPDES Stormwater (% reduction)		
1569	TN	0.75	N/A	32.3%	32.3%	Implicit
1575	TN	0.75	N/A	36.7%	36.7%	Implicit

N/A – Not applicable.

6.2 Wasteload Allocation

6.2.1 NPDES Wastewater Discharges

There are currently no wastewater facilities in the Tidal Bishop or Mullet Creek watersheds.

6.2.2 NPDES Stormwater Discharges

The WLAs for stormwater discharges with an MS4 permit (Pinellas County and Co-Permittees), with a 32.3 percent reduction in TN load for Bishop Creek and responsible co-permittees of the City of Safety Harbor and Pinellas County. For Mullet Creek Tidal, the responsible co-permittees are the City of Safety harbor and the City of Clearwater, are assigned a 36.7% reduction in TN load.

6.3 Load Allocation

The LA is the nonpoint source component of the load, which, combined with WLA stormwater discharges, is responsible for 100 percent of the current load as well as the percentage load reduction. The TMDL is a 32.3 percent reduction of TN for Bishop Creek Tidal and 36.7% reduction for Mullet Creek Tidal, all of which is allocated to the categories of LA and WLA stormwater.

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. An implicit MOS was provided by the conservative decisions associated with a number of analysis assumptions, the development of site-specific alternative water quality targets, and the development of assimilative capacity. .

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, referred to as the BMAP. This document will be developed over the next year in cooperation with local stakeholders, who will attempt to reach consensus on detailed allocations and on how load reductions will be accomplished. The BMAP will include, among other things:

- *Appropriate load reduction allocations among the affected parties;*
- *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 to achieve the TMDL;*
- *Timetables for implementation;*
- *Confirmed and potential funding mechanisms;*
- *Any applicable signed agreement(s);*
- *Local ordinances defining actions to be taken or prohibited;*
- *Any applicable local water quality standards, permits, or load limitation agreements;*
- *Milestones for implementation and water quality improvement; and*
- *Implementation tracking, water quality monitoring, and follow-up measures.*

An assessment of progress toward the BMAP milestones will be conducted every five years, and revisions to the plan will be made as appropriate, in cooperation with basin stakeholders.

References

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U.S. Environmental Protection Agency. 2000. *Ambient water quality criteria recommendations: Information supporting the development of state and tribal nutrient criteria for rivers and streams in Nutrient Ecoregion III.* EPA 822-B-00-016. Washington, D.C.

Appendices

Appendix A: Sample Stations and Median Concentration Data

Table A.1. Freshwater Sample Stations in the Southwest Coast Planning Unit Used in the TN–DO Correlation

WBID	Station	Latitude	Longitude	DO Median	TN Median	Observations
3278G	21FLSFWMBC12	26.00883	-81.45811	5.44	0.240	59
3278G	21FLSFWMBC18	25.91867	-81.39096	3	0.610	60
3278G	21FLSFWMBC19	25.92696	-81.41765	3.13	0.810	59
3278G	21FLSFWMBC21	25.96047	-81.50022	4.24	0.800	59
3278G	21FLSFWMCHKMATE	26.14361	-81.38929	1.71	0.830	15
3278H	21FLFTM 28030070FTM	26.29331	-81.52947	6.8	0.695	3
3278H	21FLSFWMFAKA858	26.29288	-81.52964	4.96	0.750	56
3278I	21FLSFWMBC10	26.10314	-81.05234	6.82	0.370	57
3278I	21FLSFWMBC20	25.96104	-81.51664	4.11	0.650	59
3278I	21FLSFWMBC7	25.99276	-81.52181	7.525	0.435	58
3278I	21FLSFWMBC8	25.99330	-81.49038	7.18	0.365	60
3278I	21FLSFWMBC9	26.15317	-81.55526	5.1	0.500	57
3278I	21FLSFWMFAKA	25.96051	-81.50951	6.755	0.380	58
3278V	21FLSFWMBC22	26.05711	-81.68396	6.18	0.640	57

Appendix B: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C.

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

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and 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 has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and Florida Department of Transportation (FDOT) throughout the 15 counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES Program will expand the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 10,000 people. The revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

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