FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration,

Bureau of Watershed Restoration

SOUTHWEST DISTRICT • TAMPA BAY TRIBUTARIES BASIN

TMDL Report

Dissolved Oxygen and Nutrient TMDL for Mustang Ranch Creek (WBID 1592C)

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September 16, 2009

Acknowledgments

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2008 305(b) Report

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

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Basin Status Report for the Tampa Bay Tributaries Basin

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for dissolved oxygen (DO) and nutrients for Mustang Ranch Creek (WBID 1592C). This waterbody was verified as impaired for DO and nutrients, and was included on the Verified List of impaired waters for the Tampa Bay Tributaries Basin that was adopted by Secretarial Order on May 19, 2009. The TMDL establishes the allowable nutrient loadings of total nitrogen and total phosphorus to Mustang Ranch Creek (WBID 1592C) that would restore the waterbody, so that it meets its applicable water quality criteria for dissolved oxygen and nutrients.

1.2 Identification of Waterbody

To provide a smaller-scale geographic basis for assessing, reporting, and documenting water quality improvement projects, FDEP divides basin groups into smaller areas called planning units. Planning units help organize information and management strategies around prominent sub-basin characteristics and drainage features. To the extent possible, planning units were chosen to reflect sub-basins that had previously been defined by the SWFWMD. Mustang Ranch Creek is located within the Alafia River Basin Planning Unit. For assessment purposes, the Department has divided the Alafia River Basin Planning Unit into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each water segment. Mustang Ranch Creek is identified as WBID 1592C (**Figure 1.1**).

1.2.1 Mustang Ranch Creek (WBID 1592C)

Mustang Ranch Creek is located in the east central portion of Hillsborough County, south of the City of Plant City, **Figure 1.1**. The creek watershed is in a rural area of the county where over half of the land use consists of agricultural activities. The creek is approximately 3.6 miles long and flows in a southwesterly direction into the Little Alafia River (Medard Park Reservoir), which is a tributary to the Alafia River. The central area of the watershed is bisected by State Highway 60, **Figure 1.2**. Additional information about the basin's hydrology and geology are available in the Basin Status Report for the Tampa Bay Tributaries Basin (Florida Department of Environmental Protection [Department], 2002).

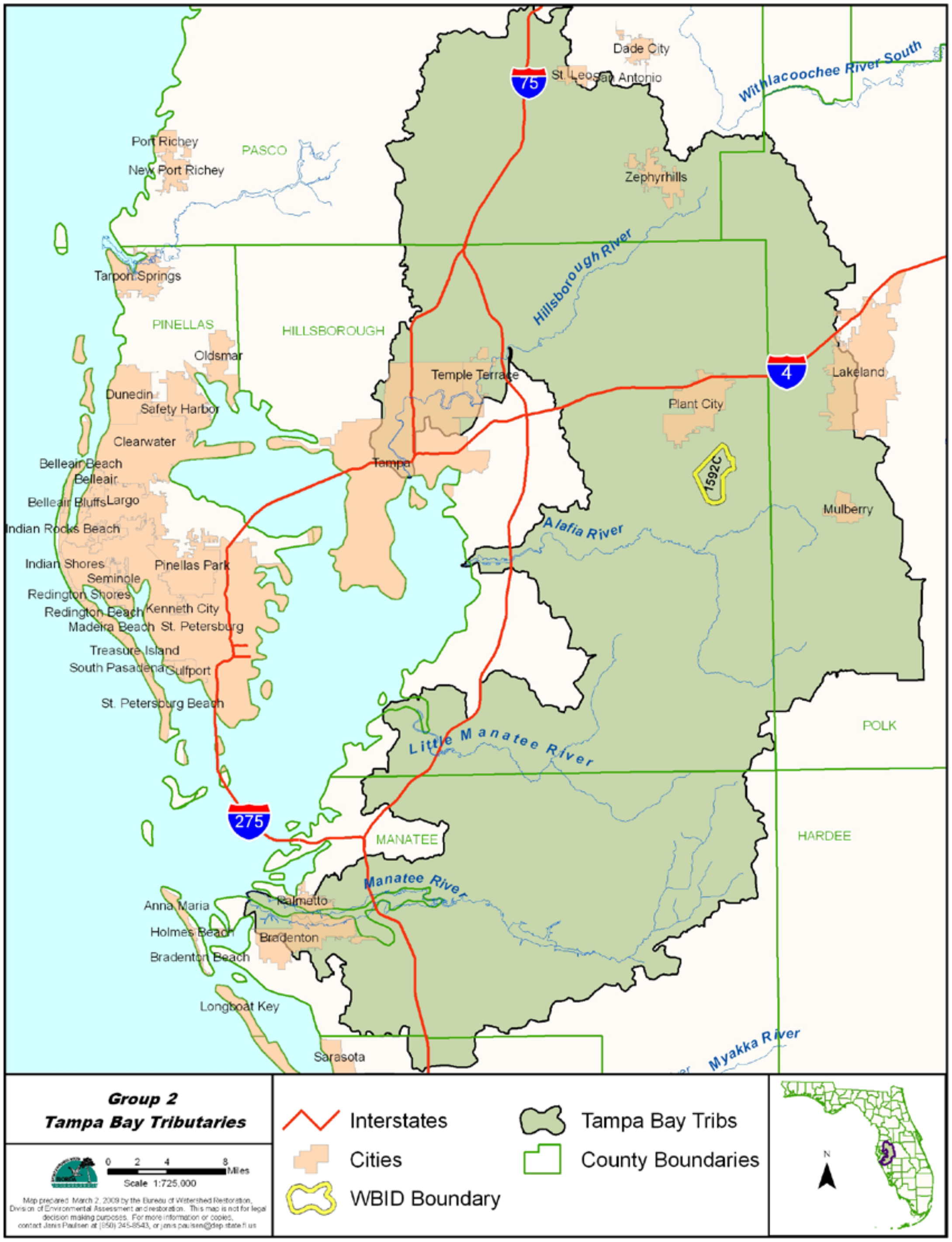

Figure 1.1. Location of Mustang Ranch Creek (WBID 1592C) and Major Geopolitical Features in the Area

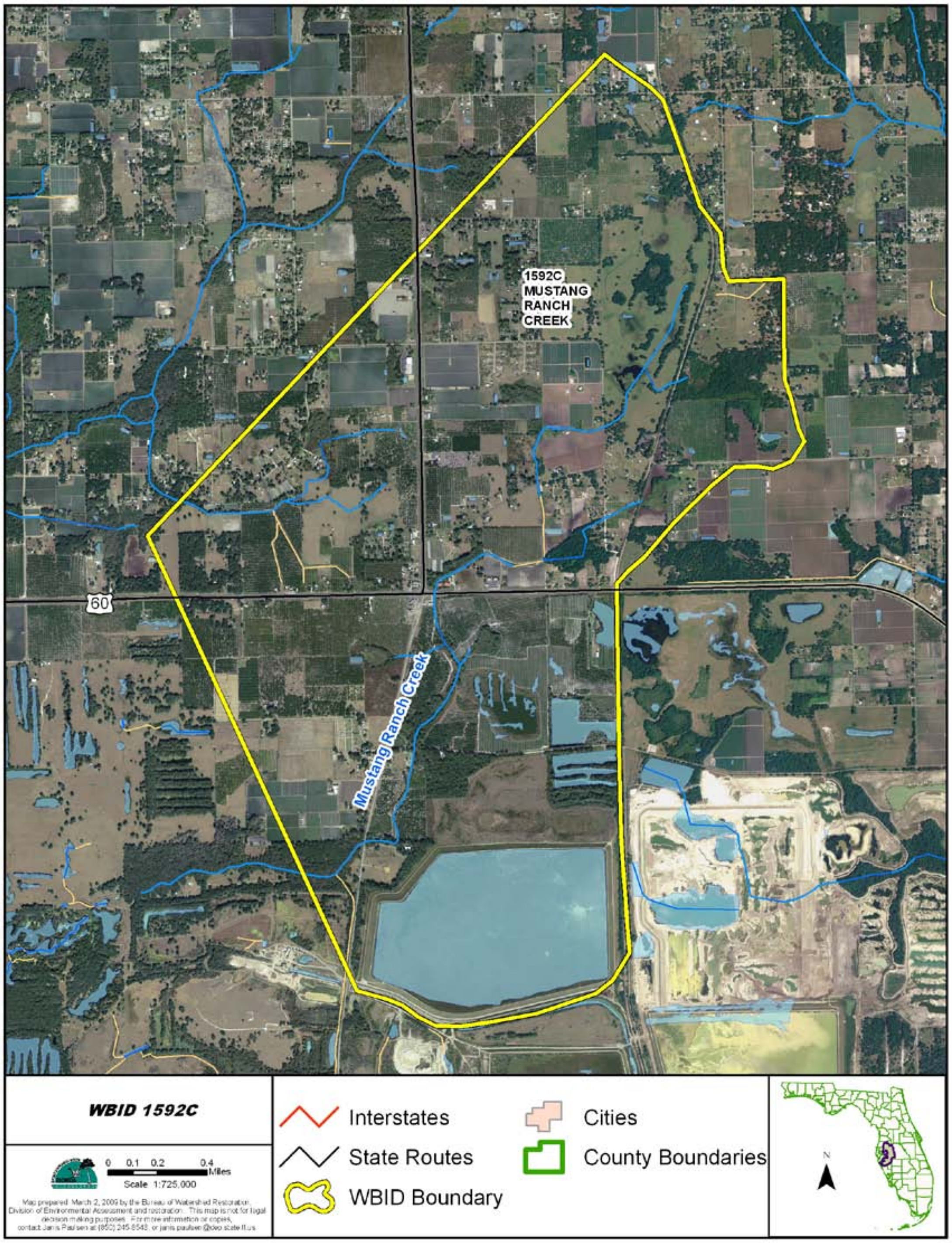

Figure 1.2. Location of Mustang Ranch Creek (WBID 1592C) with Major Hydrologic Features

1.3 Background

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

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. They provide important water quality restoration goals that will guide restoration activities.

This TMDL report will be followed by the development and implementation of a restoration plan, that would restore the waterbody so that it meets its applicable water quality criteria for dissolved oxygen and nutrients. These activities will depend heavily on the active participation of the Southwest Florida Water Management District (SWFWMD), 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 10 waterbodies in the Alafia River Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was modified in 2004 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments and has verified the impairment for low dissolved oxygen (DO) and nutrients in Mustang Ranch Creek (WBID 1592C) (**Table 2.1**). The projected year for TMDL development for the 1998 303(d) listed nutrient TMDL for Mustang Ranch Creek (WBID 1592C) was 2008. However, 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 TMDL. As such, this TMDL must be adopted and submitted to EPA by September 30, 2009.

Water segments were verified as impaired for DO based on data that indicated an exceedance rate greater than or equal to 10 percent, following the IWR methodology. The Class III freshwater criterion is that DO shall not be less than 5.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained. As part of the listing process for DO, the Department must identify the pollutant(s) causing or contributing to the impairment in order to place DO on the verified list. In cases where a water segment listed for DO is also verified impaired for nutrients, nutrients is identified as a pollutant contributing to DO exceedances. Under the IWR, nutrient impairment for freshwater streams is primarily assessed by determining if annual average Chl_a values exceed 20 ug/L, or if they are more than 50 percent greater than the historical value for at least 2 consecutive years. In Mustang Ranch Creek, the annual mean Chl_a values are low. For the years 2005 and 2007 the averages were 1.07 ug/L and 1.6 ug/L, respectively.

The Department also compares median values for biochemical oxygen demand (BOD) and nutrients, total nitrogen and total phosphorus, during the verified period to waterbody specific screening levels, that represent the 70th percentile value of data collected from Florida streams, lakes, or estuaries. If a water segment median value exceeds the screening level, the parameter is identified as a pollutant potentially contributing to the exceedances, and DO is included on the verified list. In the case of WBID 1592C, the total nitrogen (TN) and total phosphorus (TP) median values in the Cycle 2 verified period of 2.9 mg/L and 0.72 mg/L, respectively, exceeded the screening levels. The TN and TP stream screening levels are 1.6 mg/L and 0.22 mg/L, respectively. Nutrients (TN and TP) are identified as the pollutants linked to the DO verified impairment. The median BOD value of 1.2 mg/L, is less than the screening level of 2.0 mg/L, so BOD is not believed to be a significant factor in the lowering of DO concentrations.

During the Cycle 2 verification period, there were 8 out of 39 samples in Mustang Ranch Creek that did not meet the Class III freshwater criterion of 5 mg/L. The DO data used for the assessment were collected by the Hillsborough County Environmental Protection Commission and the Florida DEP Southwest District and is based on the IWR Run-35 database. Additional information on the data used for TMDL development is presented in Chapter 5.

Figure 2.1 displays the DO measurements during the Cycle 2 verification period (January 1, 2001, through June 30, 2008). **Table 2.2** and **Table 2.3** summarize the DO data collected during the verification period by month and by season, respectively. Summaries of TP and TN data by season during the verified period are presented in **Table 2.4** and **Table 2.5**, respectively.

DO exceedances occurred in June - October (**Table 2.2**). In these months, the exceedance rates ranged from 20 to 100 percent. The sample size for each month is small, with all months having six or fewer samples, making interpretation difficult. When assessing DO data by season, the DO exceedances gradually increase from winter to fall, with the fall demonstrating the highest percentage of exceedances (60 percent). The summer and fall seasons show the highest exceedance rates for Mustang Ranch Creek and these seasons usually also have the most rainfall and higher temperatures. Each seasonal median and mean for the nutrients in the creek is above the particular statewide threshold for streams (see **Table 2.4** and **2.5**).

Table 2.1. Verified Impairments for Mustang Ranch Creek (WBID 1592C)

WBID	Waterbody Segment	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameter of Concern	Parameter Causing Impairment
1592C	Mustang Ranch Creek	Stream	3F		Dissolved Oxygen	Total Phosphorous and Total Nitrogen
1592C	Mustang Ranch Creek	Stream	3F	Nutrients	Nutrients (Chlorophyll)	Total Phosphorous and Total Nitrogen

Table 2.2. Summary of Dissolved Oxygen Data for Mustang Ranch by Month for the Verified Period (January 1, 2001 – June 30, 2008)

Month	N	Minimum	Maximum	Median	Mean	No. of Exceedances	% Exceedance
January	2	8.16	9.72	8.94	8.94	0	0.00
February	3	5.00	9.26	7.89	7.38	0	0.00
March	6	6.93	9.03	8.61	8.20	0	0.00
April	3	7.49	10.69	9.20	9.13	0	0.00
May	6	5.05	8.31	6.43	6.71	0	0.00
June	4	1.66	5.93	5.32	4.56	1	25.00
July	2	4.03	4.95	4.49	4.49	2	100.00
August	5	2.23	7.25	5.82	5.45	1	20.00
September	3	3.37	6.80	6.37	5.51	1	33.33
October	4	1.03	7.56	3.12	3.71	3	75.00
November	1	6.94	6.94	6.94	6.94	0	0.00
December	0	--	--	--	--	--	--

No data available for December
N – number of samples
Samples in mg/L

Exceedances represent values below 5.0 mg/L

Table 2.3. Summary of Dissolved Oxygen Data for Mustang Ranch by Season for the Verified Period (January 1, 2001 – June 30, 2008)

Season	N	Minimum	Maximum	Median	Mean	No. of Exceedances	% Exceedance
Winter	11	5.00	9.72	8.51	8.11	0	0.00
Spring	13	1.66	10.69	6.39	6.61	1	7.69
Summer	10	2.23	7.25	5.65	5.28	4	40.00
Fall	5	1.03	7.56	4.47	4.35	3	60.00

N – number of samples
Dissolved Oxygen samples are in mg/L
Exceedances represent values below 5.0 mg/L

Table 2.4. Summary of Total Phosphorous Data for Mustang Ranch by Season for the Verified Period (January 1, 2001 – June 30, 2008)

Season	N	Minimum	Maximum	Median	Mean
Winter	5	0.37	1.80	0.62	0.79
Spring	9	0.32	1.30	0.71	0.74
Summer	9	0.65	1.70	0.85	0.98
Fall	5	0.37	0.83	0.42	0.56

N – number of samples
Total Phosphorus samples are in mg/L
Total Phosphorus threshold for Streams is 0.22 mg/L

Table 2.5. Summary of Total Nitrogen Data for Mustang Ranch by Season for the Verified Period (January 1, 2001 – June 30, 2008)

Season	N	Minimum	Maximum	Median	Mean
Winter	5	0.82	5.70	2.92	3.43
Spring	9	0.78	5.20	3.35	2.98
Summer	9	1.34	6.20	3.30	3.18
Fall	5	0.88	4.50	2.58	2.36

N – number of samples
Total Nitrogen samples are in mg/L
Total Nitrogen threshold for Streams is 1.6 mg/L

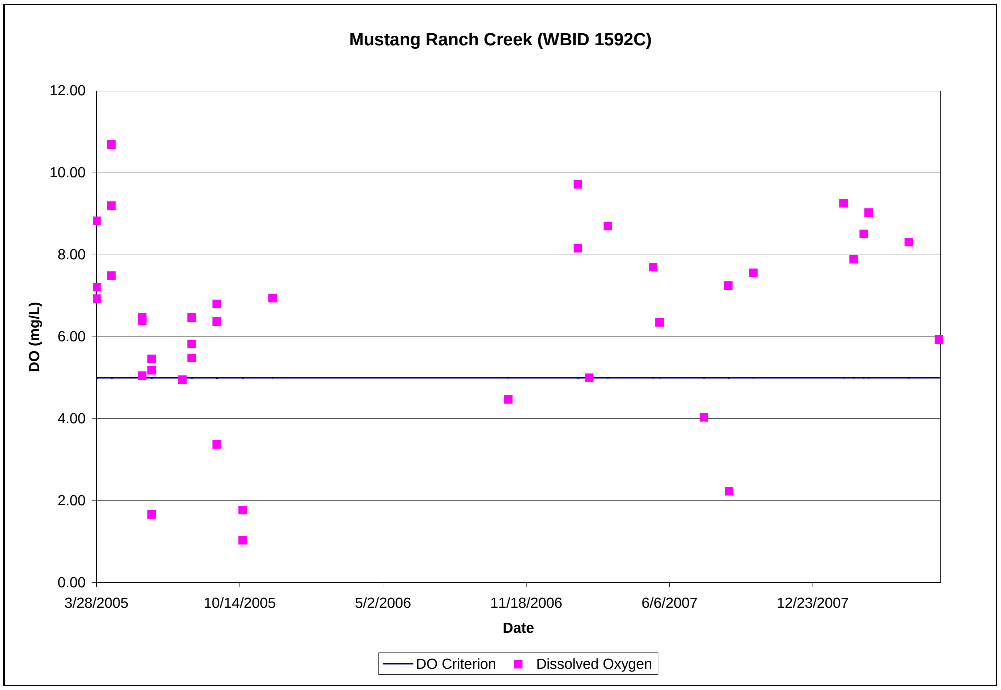

Figure 2.1. Dissolved Oxygen Measurements for Mustang Ranch Creek during the Cycle 2 Verified Period (January 1, 2001 – June 30, 2008)

2.3 Factors That Influence Dissolved Oxygen

The availability of DO in ambient surface waters is highly variable due to several factors. Oxygen is produced in the water column by photosynthesis and is consumed by respiration of plants, animals and aerobic bacteria, and by chemical reactions that occur in brackish waters due to the interaction of sunlight, humic and fulvic materials, as well as oxidation and reduction reactions. The ability of a system to absorb oxygen from the atmosphere is dependent on flow factors such as water depth and turbulence. Elevated nitrogen and phosphorus compounds contribute to excess algae growth. Under high nutrient levels, algae grow rapidly and raise DO concentrations during daylight hours. Respiration by dense algal populations and other consumers reduce DO concentrations during the night. When phytoplankton cells die, they sink towards the bottom, and are decomposed by bacteria, a process that further reduces DO in the water column.

Sediment Oxygen Demand (SOD) is the overall demand for DO from the water column that is exerted by the combination of biological, biochemical, and chemical processes at the sediment-water interface. The primary sources of SOD are anaerobic (low-oxygen) chemical compounds in the riverbed sediments and particulate BOD (including algae and other sources of organic matter) that settle out of the water column. SOD is generally composed of biological respiration from benthic organisms and the biochemical (i.e., bacterial) decay processes in the top layer of deposited sediments. In addition to DO depletion, degradation of organic matter in the sediment results in the release of oxygen-demanding (i.e., reduced) nutrients, metals, ammonium, iron, manganese, sulfide, and ammonia (Price et al, 1994). These soluble chemicals are released into the water and exert a relatively rapid (i.e., it occurs on a timescale of hours) oxygen demand as the reduced chemicals are oxidized. Some oxidation processes, such as nitrification of ammonia to nitrate, require bacteria and may be slower (i.e., days).

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)**

3.2 Applicable Water Quality Standards and Numeric Water Quality Targets

Mustang Ranch Creek (WBID 1592C) is a Class III waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the impairment addressed by this TMDL are for dissolved oxygen (DO) and nutrients.

3.2.1 Interpretation of Dissolved Oxygen Criterion

The DO criterion for Class III freshwater waterbodies states that DO shall not be less than 5.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained.

3.2.2 Interpretation of Narrative Nutrient Criterion

Florida's nutrient criterion is narrative only and states—

The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter. Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Sections 62-302.300, 62-302.700, and 62-4.242, F.A.C. and,

In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna.

Accordingly, a nutrient-related target was needed to represent levels at which violations of the DO criterion and imbalance in flora or fauna is expected to occur. In translating the narrative nutrient criterion for this TMDL, the Department identified a TN and TP value based on minimally disturbed reference stream sites. The TN and TP concentrations in these minimally disturbed streams are used to establish the nutrient reduction targets for Mustang Ranch Creek, WBID 1592C. The sites selected for this analysis included those having a Landscape Development Intensity (LDI) index score of ≤ 2, sites with a healthy biological community as measured using Florida's Stream Condition Index (SCI), and sites with good water quality that are not in waters included on the state's 303(d) list of impaired waters.

The LDI estimates the intensity of human land use based on nonrenewable energy flow (Brown and Vivas, 2005). Studies and evaluations have demonstrated that the LDI is an accurate predictor of biological health in a variety of waterbody types and that healthy well-balanced biological systems are much more likely to occur at sites with low LDIs (≤ 2.0) than at higher disturbance levels (Fore 2004, Niu 2004, Brown and Reiss 2006, FDEP 2006, Fore *et al*. 2007). Furthermore, it has been demonstrated that a LDI score of 2.0 is a consistent and conservative biologically significant break point that can be used to distinguish reference conditions from potentially disturbed areas. The Florida SCI is a biological health assessment that measures stream health in predominantly fresh waters using benthic macroinvertebrates (Fore et al. 2007). Using this method, higher SCI scores indicate better biological conditions. SCI scores in the range of 35-67 are indicative of healthy biological conditions and scores greater than 67 indicate the biological community is exceptional (DEP-SOP-002/01 LT 7200).

The TN target selected, 1.73 mg/L, is the 90^{th} percentile annual geometric mean from reference site data collected in the Northeast, North Central, Peninsula, and Bone Valley regions of Florida. The TP target selected, 0.415 mg/L, is the 75^{th} percentile annual geometric mean concentration from reference site data collected in the Bone Valley, the region where WBID 1592C is located. The reference sites in the Bone Valley were used exclusively to establish the TP target because phosphorus concentrations in this region differ from the other regions in the state. In this case, the 75^{th} percentile value was selected due to the limited number of minimally disturbed streams in the Bone Valley. These concentrations provide a reasonable target for reductions needed in the elevated TN and TP concentrations found in Mustang Ranch Creek that are associated with the low DO levels. The waterbody is expected to meet the applicable DO and nutrient criteria and maintain its function and designated use as a Class III water by reducing the surface water nutrient concentrations to the water quality targets.

Information on reference sites representative of the water segments used to develop the targets is provided in **Appendix B**.

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

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

4.2 Point Sources

4.2.1 NPDES Permitted Wastewater Facilities

There are no NPDES permitted facilities with discharges to the surface waters of Mustang Ranch Creek.

4.2.2 Municipal Separate Storm Sewer System Permittees

Municipal separate storm sewer systems (MS4s) may also discharge pollutants to waterbodies in response to storm events. To address stormwater discharges, the EPA developed the NPDES stormwater permitting program in two phases. Phase 1, promulgated in 1990, addresses large and medium-size MS4s located in incorporated areas and counties with populations of 100,000 or more. Phase 2 permitting began in 2003. Regulated Phase 2 MS4s are defined in Section 62-624.800, F.A.C., and typically cover urbanized areas serving jurisdictions with a population of at least 10,000, or discharging into Class I or Class II waters, or into Outstanding Florida Waters.

The stormwater collection systems owned and operated by Hillsborough County and Co-Permittees (FDOT District 7 & Florida's Turnpike Enterprise) are covered by a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000006). There are no Phase II MS4 permits identified for Mustang Ranch Creek.

4.3 Land Uses and Nonpoint Sources

Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. Nonpoint pollution is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water (EPA, 1994).

Nutrient loading from urban areas is most often attributable to multiple sources, including stormwater 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. In agricultural areas, agricultural fertilizing or nutrients from wildlife and agricultural livestock wastes are sources contributing to the pollutant load.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SWFWMD 2004 land use coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library, as this time frame represents land cover near the midpoint of the verified assessment period. Land use categories were aggregated using the simplified Level 1 codes and are tabulated in **Table 4.1**. **Figure 4.1** shows the principal land uses in the watershed area.

The watershed area for Mustang Ranch Creek is 2,151 acres (3.4 miles^2) in size, **Table 4.1**. The dominant land use in the watershed is agriculture, which covers over 58 percent of the watershed. The major agriculture land uses are cropland and pastureland, covering 684 acres, and tree crops, covering 479 acres. Urban and Built-up land cover about 21 percent of the area, with low density residential areas (13 percent cover) making up the majority of the urban land. Wetlands comprise over 8 percent of the area, followed by rangeland and forest which cover over 6 percent of the watershed.

Table 4.1 Classification of 2004 Land Use Categories in the Mustang Ranch Creek Watershed

Level 1 Code	Landuse	Acreage	Percent of Total
1000	Urban Open	179	8.3
1100	Low Density Residential	282	13.1
1200	Medium Density Residential	0	0.0
1300	High Density Residential	0	0.0
2000	Agriculture	1,257	58.4
3000+4000	Rangeland + Forest/Rural Open	138	6.4
5000	Water	69	3.2
6000	Wetlands	180	8.4
7000	Barren Land	16	0.7
8000	Communication and Transportation	30	1.4
Total		2,151	100.0

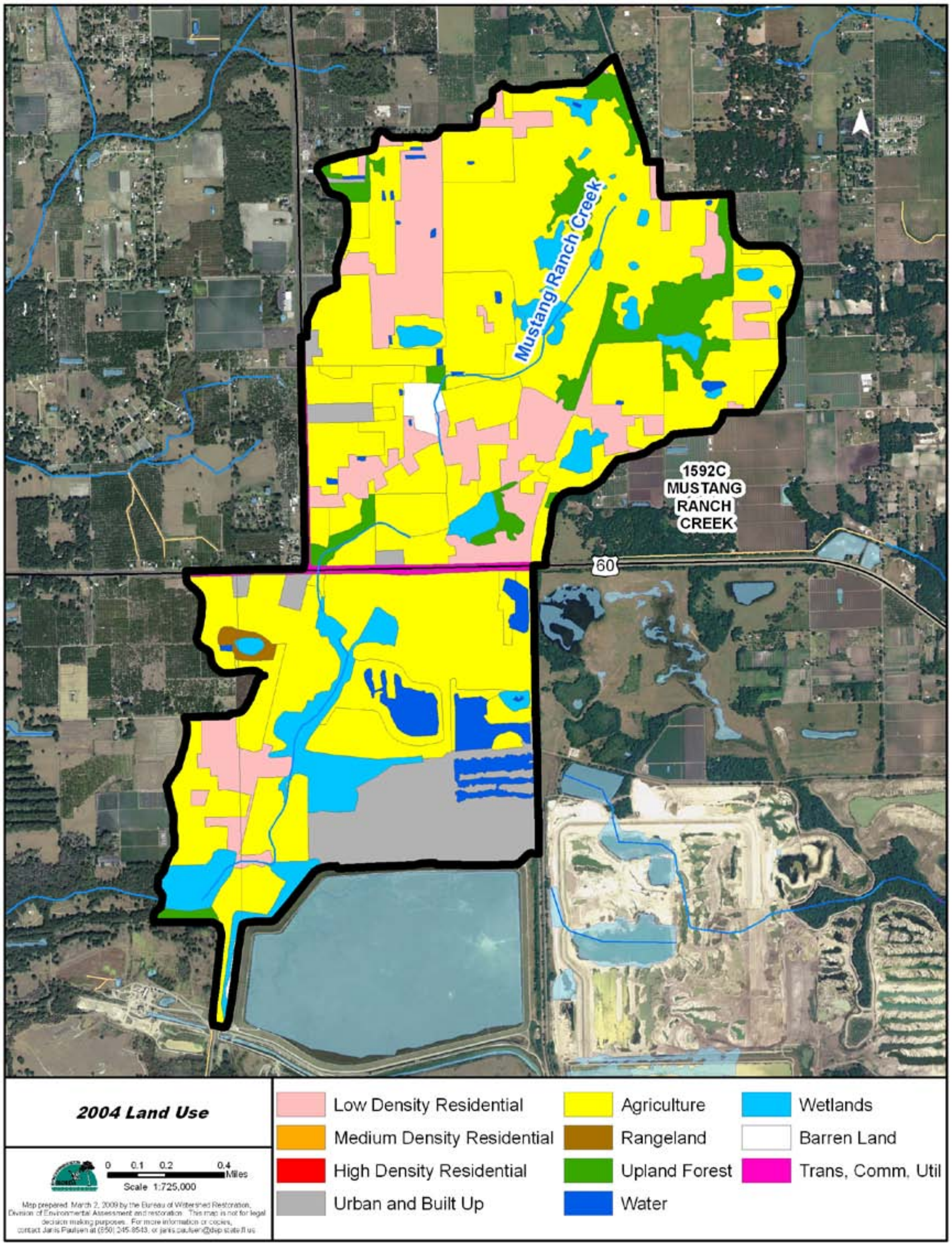

Figure 4.1 Principal Land Uses in the Mustang Ranch Creek Watershed, 2004

Septic Tanks

Septic tanks are another potentially important source of pollution. Information on the location of septic systems was obtained from Hillsborough County, which is based on an ongoing study to identify septic tanks. The septic tank database was developed from records obtained from the Florida Department of Health and sewer billing records (David Glicksberg, personal communication)

The septic tanks located in the WBID 1592C watershed are displayed in **Figure 4.2**. Currently the number of septic tanks in the watershed is estimated to be 99. The map shows the majority of the tanks are located north of State Highway 60.

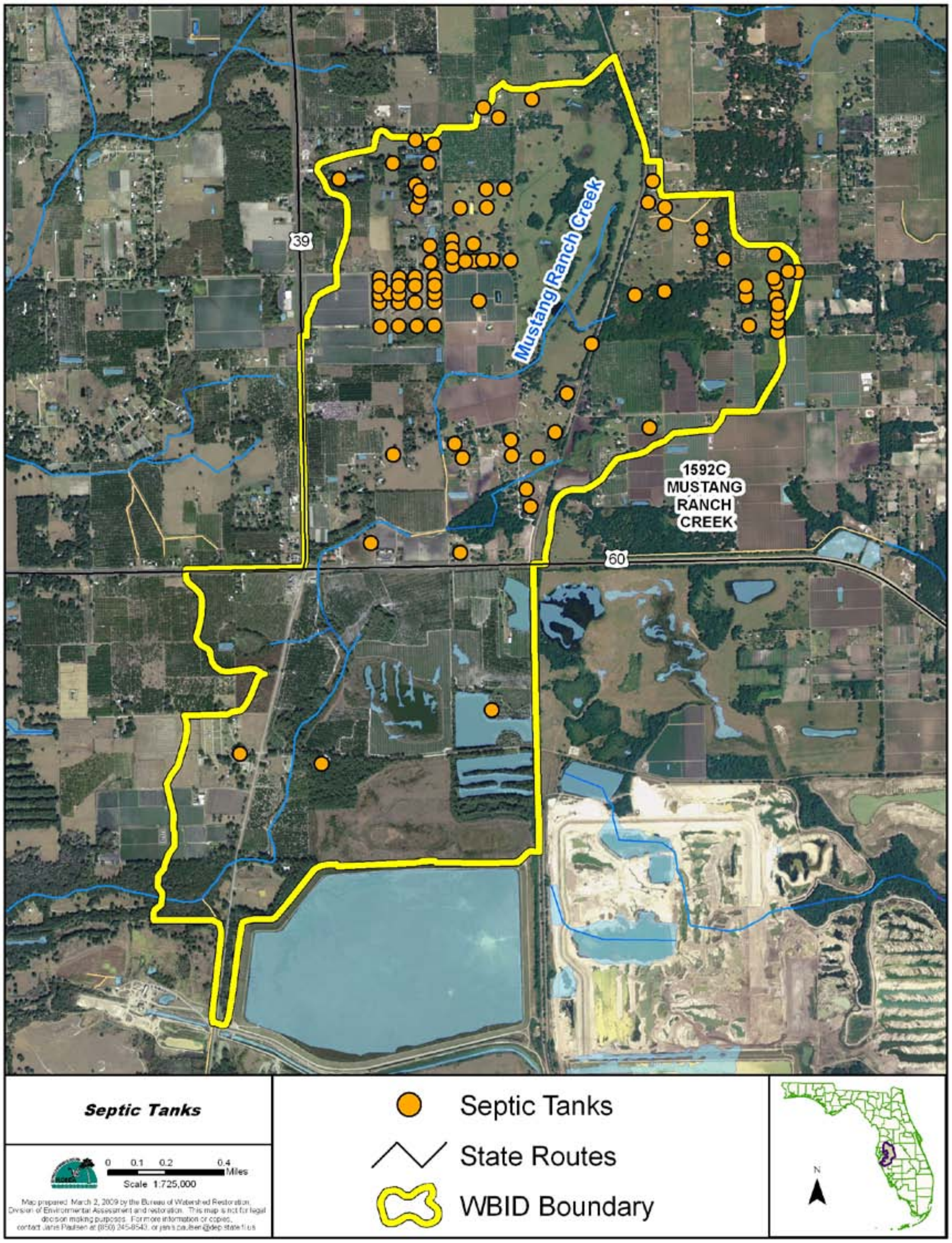

Figure 4.2 Distribution of Onsite Sewage Systems (Septic Tanks) in the Mustang Ranch Creek Watershed

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The TMDL development process is to identify a total nitrogen (TN) and total phosphorus (TP) target for Mustang Ranch Creek, so that the water segment will meet the applicable DO criteria and maintain its function and designated use as a Class III water. The target was developed based on an analysis of nutrient data for minimally disturbed streams (reference condition) in selected geographic regions of Florida. Percent reductions in existing nutrient concentrations within WBID 1592C were calculated to meet the water quality target and establish the TMDL.

5.2 Analysis of Water Quality

Water quality monitoring data in WBID 1592C, during the Cycle 2 verified period (January 2001 to June 2008) were collected by the Florida DEP Southwest District (21FLTPA…) at three locations and by the Hillsborough County Environmental Protection Commission (21FLHILL…) at one location, **Figure 5.1**. It should be noted that data from two additional sampling events, which were not available at the time the assessment was performed, are included in the IWR Run-36 database and in the analysis of data for TMDL development.

A summary of the data for parameters of interest to this TMDL is presented in **Table 5.1**. The verified period DO average and median values were above 6 mg/L, however, 10 out of 41 samples exceeded the freshwater criterion of 5 mg/L. The concentrations of nutrients, TN and TP, are in general elevated when compared to typical values for Florida streams. The TN and TP median values for the data collected between March 2005 and June 2008 of 2.9 mg/L and 0.72 mg/L, respectively, are greater than the 70th percentile TN and TP values for Florida streams of 1.6 mg/L and 0.22 mg/L, respectively. The TN concentrations ranged from 0.78 mg/L to 6.2 mg/L and the TP concentrations from 0.32 mg/L to 1.8 mg/L. Chlorophyll a concentrations were well below the stream chlorophyll a threshold of 20 ug/L and ranged from 1.0 ug/L to 4.7 ug/L.

A graph of the DO results by station, **Figure 5.2**, show that the majority of low DO values were measured at the stations located at State Highway 60 (21FLTPA2756156827128 and 21FLHILL542). The data for TN and TP are plotted by sampling date in **Figure 5.3** and **Figure 5.4**, respectively. Biochemical oxygen demand (BOD) values were not found to be elevated when compared to values for Florida streams. The BOD median value of 1.2 mg/L is less than the 70th percentile BOD value for Florida streams of 2.0 mg/L.

Table 5.1 Water Quality Summary Results from March 2005 to June 2008 During the Cycle 2 Verification Period

	BOD 5Day (mg/L)	Chlorophyll Corrected (ug/L)	Color (PCU)	Dissolved Oxygen (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Specific Conductance (umhos/cm)	Temp (deg C)
Number of Results	19	31	31	41	30	30	41	41
Minimum	0.2	1.0	30	1.0	0.78	0.32	4	12.47
10th Percentile	0.6	1.0	50	2.2	0.88	0.37	203	17.57
Median	1.2	1.1	80	6.5	2.90	0.72	299	22.58
Mean	1.2	1.4	89	6.2	2.89	0.78	285	22.24
90th Percentile	2.0	1.9	150	9.0	4.93	1.21	356	25.81
Maximum	2.7	4.7	160	10.7	6.20	1.80	397	27.50
Criteria Exceedances				10				

A statistical evaluation of the data were performed to investigate the relationship between nutrient concentrations and DO, but no strong relationships were found when comparing DO to TN and TP to develop a predictive model. The correlation coefficients for DO vs. TN and DO vs. TP are R square (R^2) values of 0.16 and 0.03, respectively.

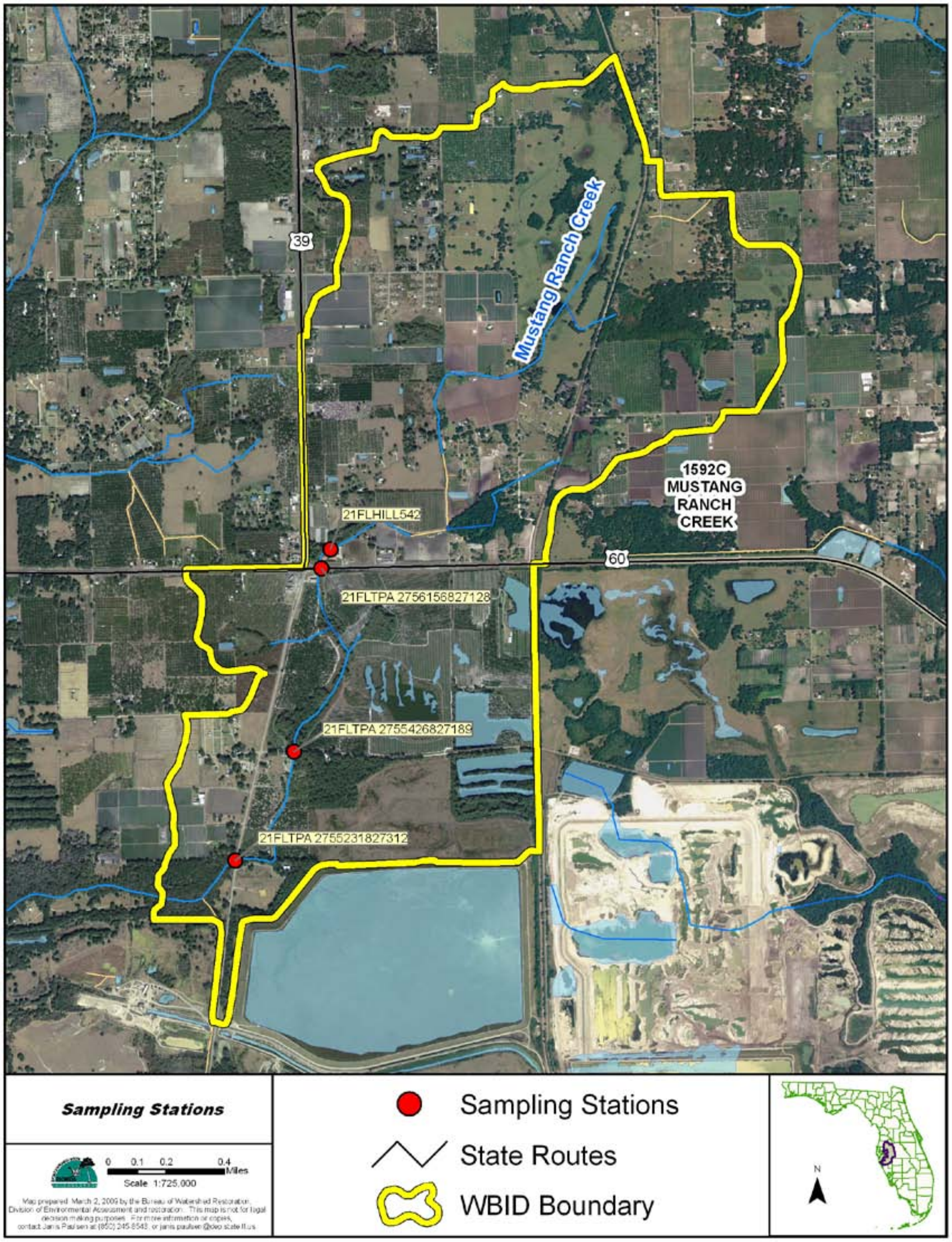

Figure 5.1 Monitoring Locations in Mustang Ranch Creek, WBID 1592C

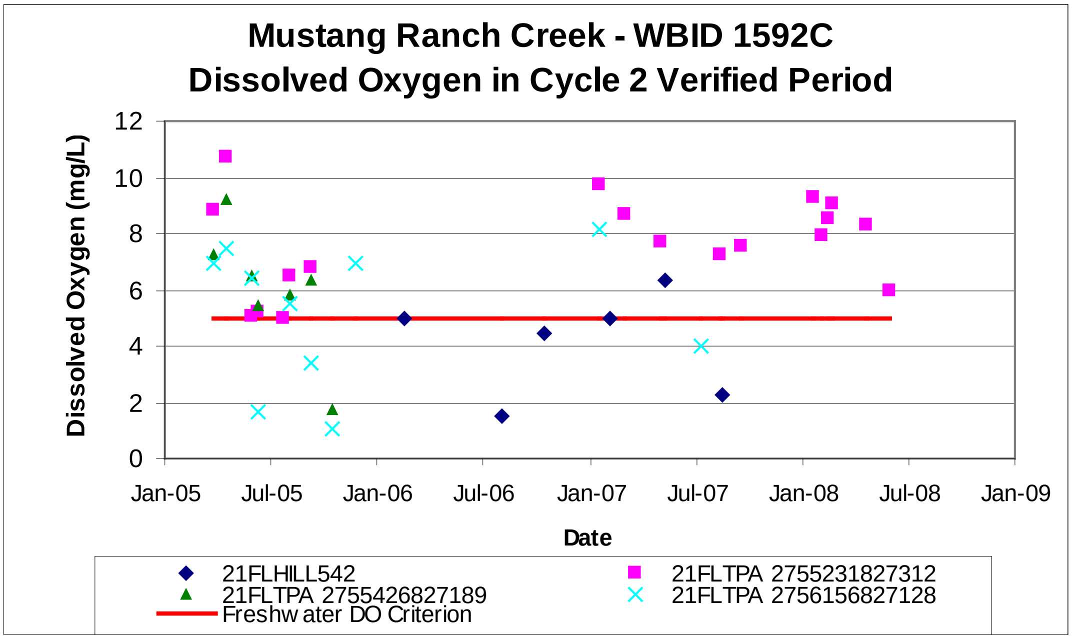

Figure 5.2 Mustang Ranch Creek Dissolved Oxygen Results

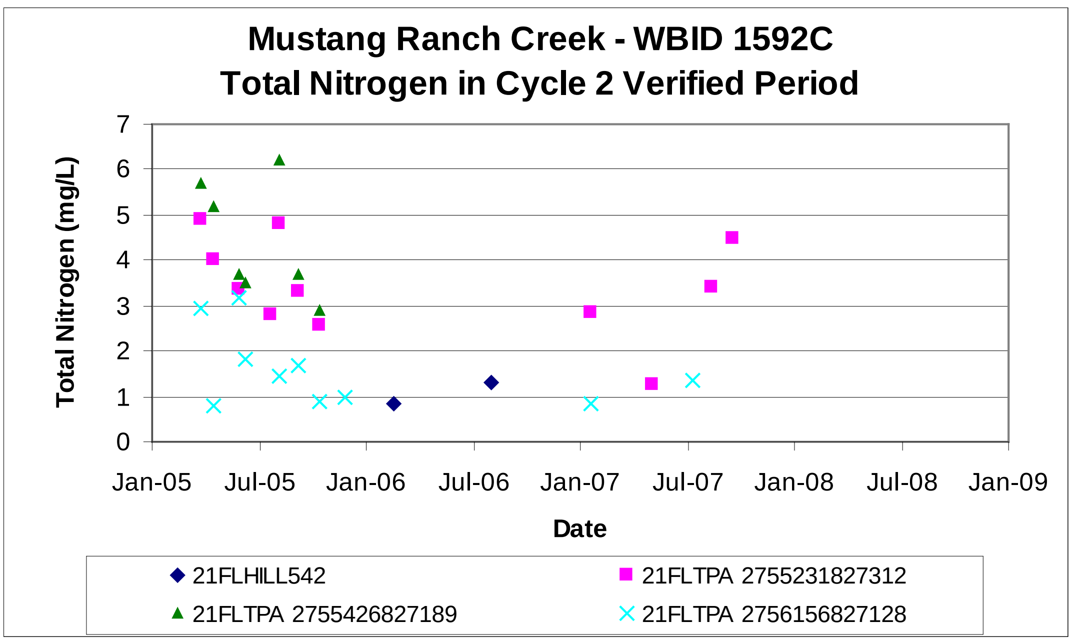

Figure 5.3 Mustang Ranch Creek Total Nitrogen Results

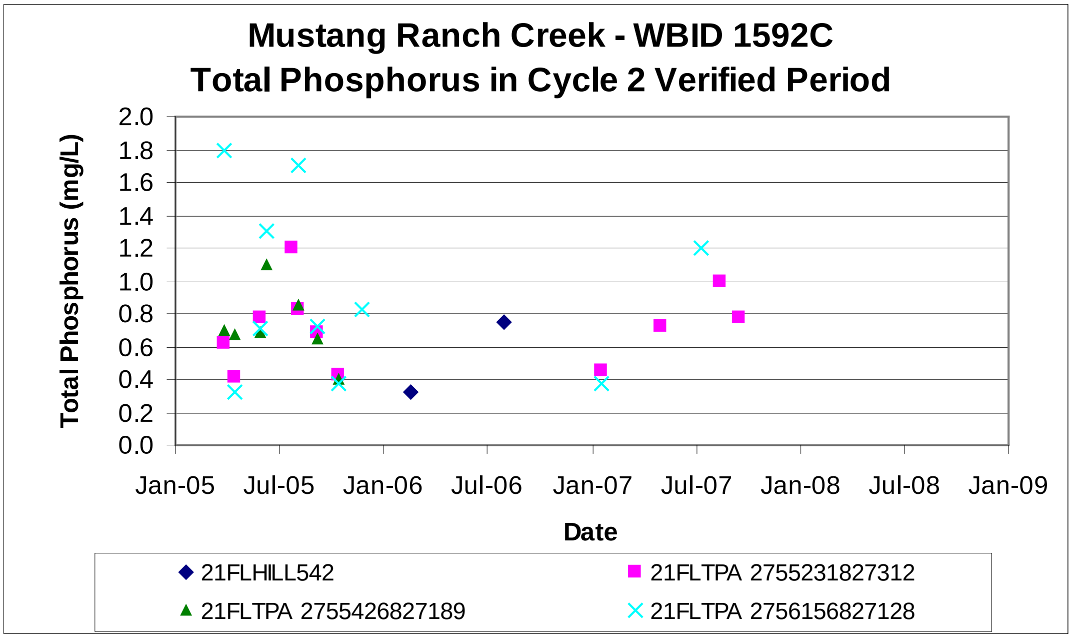

Figure 5.4 Mustang Ranch Creek Total Phosphorus Results

5.3 TMDL Development Process

The method used for developing the TMDL is a percent reduction approach. Percent reductions in the observed TN and TP concentrations within WBID 1592C were calculated to meet the selected water quality targets. As discussed in Chapter 3, the targets are based on nutrient data from stream reference sites that are minimally impacted by human activities, exhibit healthy biological conditions, and which have good water quality. The Mustang Ranch Creek water segment is expected to meet the applicable DO and nutrient criteria and maintain its function and designated use as a Class III water by reducing the surface water nutrient concentrations to the water quality targets, thereby addressing the anthropogenic fraction contributing to water quality degradation.

5.4 Percent Reduction Approach

In this method, the percent reduction in each measured result above the TN and TP targets needed to meet the targets was calculated. The equation used to calculate the percent reductions is as follows.

$$\frac{\textbf{[measured exceedance – target]}}{\textbf{measured exceedance}} \quad \textbf{X 100}$$

The percent reductions needed in individual TN and TP sampling results are presented in **Table 5.2 and Table 5.3**, respectively. The median of the percent reductions is used to establish the TMDL. The percent reductions in TN and TP concentrations necessary to meet the targets are 31 percent and 34 percent, respectively.

Table 5.2 Calculation of Percent Reduction in Total Nitrogen Necessary To Meet the Water Quality Target

Date	Station	Measured Total Nitrogen mg/L)	Total Nitrogen Target (mg/L)	Percent Reduction to Meet Target
8/8/2005	21FLTPA 2755426827189	6.2	1.73	72
3/28/2005	21FLTPA 2755426827189	5.7	1.73	70
4/18/2005	21FLTPA 2755426827189	5.2	1.73	67
3/28/2005	21FLTPA 2755231827312	4.9	1.73	65
8/8/2005	21FLTPA 2755231827312	4.8	1.73	64
10/1/2007	21FLTPA 2755231827312	4.5	1.73	62
4/18/2005	21FLTPA 2755231827312	4.03	1.73	57
5/31/2005	21FLTPA 2755426827189	3.7	1.73	53
9/12/2005	21FLTPA 2755426827189	3.7	1.73	53
6/13/2005	21FLTPA 2755426827189	3.5	1.73	51
8/27/2007	21FLTPA 2755231827312	3.4	1.73	49
5/31/2005	21FLTPA 2755231827312	3.35	1.73	48
9/12/2005	21FLTPA 2755231827312	3.3	1.73	48
5/31/2005	21FLTPA 2756156827128	3.16	1.73	45
3/28/2005	21FLTPA 2756156827128	2.92	1.73	41
10/18/2005	21FLTPA 2755426827189	2.88	1.73	40
1/29/2007	21FLTPA 2755231827312	2.83	1.73	39
7/26/2005	21FLTPA 2755231827312	2.8	1.73	38
10/18/2005	21FLTPA 2755231827312	2.58	1.73	33
6/13/2005	21FLTPA 2756156827128	1.829	1.73	5
			Median	50

Table 5.3 Calculation of Percent Reduction in Total Phosphorus Necessary To Meet the Water Quality Target

Date	Station	Measured Total Phosphorus (mg/L)	Total Phosphorus Target (mg/L)	Percent Reduction to Meet Target
3/28/2005	21FLTPA 2756156827128	1.8	0.415	77
8/8/2005	21FLTPA 2756156827128	1.7	0.415	76
6/13/2005	21FLTPA 2756156827128	1.3	0.415	68
7/26/2005	21FLTPA 2755231827312	1.2	0.415	65
7/24/2007	21FLTPA 2756156827128	1.2	0.415	65
6/13/2005	21FLTPA 2755426827189	1.1	0.415	62
8/27/2007	21FLTPA 2755231827312	1	0.415	59
8/8/2005	21FLTPA 2755426827189	0.85	0.415	51
11/29/2005	21FLTPA 2756156827128	0.83	0.415	50
8/8/2005	21FLTPA 2755231827312	0.82	0.415	49
10/1/2007	21FLTPA 2755231827312	0.77	0.415	46
5/31/2005	21FLTPA 2755231827312	0.77	0.415	46
8/9/2006	21FLHILL542	0.753	0.415	45
5/14/2007	21FLTPA 2755231827312	0.72	0.415	42
9/12/2005	21FLTPA 2756156827128	0.72	0.415	42
5/31/2005	21FLTPA 2756156827128	0.71	0.415	42
3/28/2005	21FLTPA 2755426827189	0.7	0.415	41
9/12/2005	21FLTPA 2755231827312	0.69	0.415	40
5/31/2005	21FLTPA 2755426827189	0.69	0.415	40
4/18/2005	21FLTPA 2755426827189	0.67	0.415	38
9/12/2005	21FLTPA 2755426827189	0.65	0.415	36
3/28/2005	21FLTPA 2755231827312	0.62	0.415	33
1/29/2007	21FLTPA 2755231827312	0.45	0.415	8
10/18/2005	21FLTPA 2755231827312	0.42	0.415	1
			Median	45

5.5 Critical Conditions

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

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:

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

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

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

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

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of 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 Mustang Ranch Creek is expressed in terms of a percent reduction in total nitrogen and total phosphorus to meet the DO and nutrient criteria **(Table 6.1)**.

Table 6.1 TMDL Components for Mustang Ranch Creek (WBID 1592C)

WBID	Parameter	TMDL (mg/L)	WLA Wastewater (mg/L)	WLA NPDES Stormwater (% Reduction)[2]	LA (% Reduction)[2]	MOS
1592C	Total N	1.73	N/A[1]	50%	50%	Implicit
1592C	Total P	0.415	N/A[1]	45%	45%	Implicit

[1] N/A = not applicable
[2] As the TMDL represents a percent reduction, it also complies with EPA requirements to express the TMDL on a daily basis.

6.2 Load Allocation

A total nitrogen reduction of 50 percent and a total phosphorus reduction of 45 percent is required from nonpoint sources. It should be noted that the load allocation includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

There are currently no permitted NPDES discharges in the Mustang Ranch Creek watershed; however, any future discharge permits issued in the watershed will also be required to meet the state's Class III criteria for DO and contain appropriate discharge limitations on nitrogen and phosphorus that will comply with the TMDL as well as existing state requirements related to discharges to Outstanding Florida Waters.

6.3.2 NPDES Stormwater Discharges

Hillsborough County and Co-Permittees (FDOT District 7 & Florida's Turnpike Enterprise) are covered by a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000006) and areas within their jurisdiction contributing loads to the Mustang Ranch Creek watershed may be responsible for anthropogenic load reductions of 50 percent for total nitrogen and 45 percent for total phosphorus. 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. There are no Phase II MS4 permits identified in the watershed.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, February 2001), an implicit MOS was used in the development of this TMDL. A MOS was included in the TMDL by calculating the percent reduction in all instances needed for TN and TP to meet the nutrient targets, while occasional exceedances of this target would not necessarily prevent the stream segment from meeting the applicable DO and nutrient criteria.

Chapter 7: TMDL IMPLEMENTATION

TMDL Implementation

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

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

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

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

However, in some basins, and for some parameters, particularly those with fecal coliform impairments, the development of a BMAP using the process described above will not be the most efficient way to restore a waterbody, such that it meets its' designated uses. Why? Because fecal coliform impairments result from the cumulative effects of a multitude of potential sources, both natural and anthropogenic. Addressing these problems requires good old fashioned detective work that is best done by those in the area. There are a multitude of assessment tools that are available to assist local governments and interested stakeholders in this detective work. The tools range from the simple – such as Walk the WBIDs and GIS mapping - to the complex such as Bacteria Source Tracking. Department staff will provide technical assistance, guidance, and oversight of local efforts to identify and minimize fecal coliform sources of pollution. Based on work in the Lower St Johns River tributaries and the Hillsborough River basin, the Department and local stakeholders have developed a logical process and tools to serve as a foundation for this detective work. In the near future, the Department will be releasing these tools to assist local stakeholders with the development of local implementation plans to address fecal coliform impairments. In such cases, the Department will rely on these local initiatives as a more cost-effective and simplified approach to identify the actions needed to put in place a roadmap for restoration activities, while still meeting the requirements of Chapter 403.067(7), F.S.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

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

The rule requires the state's water management districts (WMDs) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

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

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

Appendix B: Information on Reference Sites Representative of Water Segments Used to Develop the Water Quality Targets

Station Name	STORET ID	WBID	Habitat Assessment Score	Stream Condition Index Score*	Natural Substrate Periphyton Collected	Rapid Periphyton Survey Conducted
Bone Valley Region						
Deer Prairie Creek	27051558216422	1978	117	74	Yes	Yes
East Fork Manatee River	273116508208152	1811	128	71	Yes	Yes
Manatee River @ SR 64	24010002	1807C	108	64	Yes	Yes
North Central Region						
Alapaha River @ CR 150	21010008	3324	138	59	Yes	Yes
Deep Creek @ US 441	DEP010C1	3388	97	80	Yes	Yes
Falling Creek @ C-131	FAL020C1	3477	142	55	Yes	Yes
Little Creek @ US 441	21010033	3368	127	89	Yes	Yes
New River @ SR 18	21030049	3506	130	76	Yes	Yes
Olustee Creek @ SR 100	UNI234LV	3504	118	44	Yes	Yes
Robinson Branch @ C-246	ROB01C1	3448	128	81	Yes	Yes
Sampson River @ SW 106 Ave	3598-B	3598	131	65	Yes	Yes
Santa Fe River @ Worthington Springs	SFR030C1	3605D	132	64	Yes	Yes
Suwannee River @ CR 6	3535	3341B	130	52	Yes	Yes
Suwannee River @ White Springs, FL (US 41)	21010040	3341A	145	69	Yes	Yes
Swift Creek @ CR 239	21030088	3530	105	–	Yes	Yes
Northeast Region						
Alligator Creek @ US 301 & SR115	19020052	2153	137	63	Yes	Yes
Ates Creek @ CR 315	CLA243LV	2498	144	91	Yes	Yes
Black Creek @ SR 16	CLA254LR	2415C	133	91	Yes	Yes
Greens Creek @ CR 315	GC315	2478	114	–	Yes	Yes
Little St. Marys River @ CR 121 A	19010046	2106	117	–	Yes	Yes
Middle Prong St. Marys River @ CR 125	19010041	2211	137	78	Yes	Yes
Middle Prong St. Marys River @ CR 127	MPS	2211	131	71	Yes	Yes
Mills Creek SE of 200	–	2120A	118	–	No	No
North Fork Black Creek @ Jennings Landing	14264	2387	137	73	Yes	Yes
Peters Creek @ CR 315 A	CLA246GS	2444	146	83	Yes	Yes
Plummer Creek @ SR A1A	19020064	2130	117	–	No	No
South Fork Black Creek @ SR 21	20030481	2415E	144	83	Yes	Yes
St. Marys River @ SR 2	19010006	2097K	124	75	Yes	Yes
St. Marys River @ Tompkins Landing	19010077	2097F	114	–	Yes	Yes
Peninsula Region						
Bee Branch	28020299FTM	3235E	141	49	Yes	Yes
Blackwater Creek @ State Road 44A	20010455	2929A	125	77	Yes	No
Blackwater Creek upstream of Carter Prop Bridge	20010536	2929A	130	22	Yes	Yes
Cow Creek @ CR 138	21030086	3649	134	–	Yes	Yes
Cypress Branch above 78	GLA630GS	3235G	137	65	Yes	Yes
Econlockhatchee River @ Snowhill Road	ECH	2991A	106	52	Yes	No
Little Orange Creek	PUT308GS	2713	131	75	Yes	Yes
Little Orange Creek below Cabbage Creek	LOCBCC	2713	130	89	Yes	Yes
Moses Creek @ US 1	27010050	2535	138	60	Yes	Yes
Orange Creek upstream of Highway 21	21202	2747	119	78	Yes	Yes
St. Johns River near DeLand	2236000	2893B	128	–	Yes	No
Steinhatchee River @ Canal Road	22050083	3573A	148	52	Yes	Yes
Steven's Branch off CR 204	27010070	2551A	128	76	Yes	Yes
Tosohatchee Creek @ WMA	ORA331LV	3035	116	–	Yes	Yes
Waccasassa River above SR 24	LEV502GS	3699	138	69	Yes	Yes
Withlacoochee River @ County Park	23010464	1329	144	43	Yes	Yes
Withlacoochee River @ SR 471	WITHLACOORVR1	1329F	119	–	Yes	Yes
Withlacoochee River @ Stokes Ferry	3513	1329C	153	58	Yes	Yes
Withlacoochee River @Trails End	FL0052000087500	1329E	118	–	No	No

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