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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration

Bureau of Watershed Restoration

SOUTHWEST DISTRICT • TAMPA BAY

TMDL Report

Dissolved Oxygen and Nutrients for Alligator Creek (WBID 1574) And Alligator Lake (WBID 1574A)

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Acknowledgments

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Web sites

Florida Department of Environmental Protection, Bureau of Watershed Restoration

TMDL Program

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

Identification of Impaired Surface Waters Rule

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

STORET Program

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

2008 Integrated Report

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

Criteria for Surface Water Quality Classifications

http://www.dep.state.fl.us/legal/rules/shared/62-302t.pdf

Basin Status Report for the Tampa Bay Basin

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

Basin Water Quality Assessment Report for the Tampa Bay Basin

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U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida

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

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) and nutrients for the Alligator Creek and Alligator Lake watersheds in the Tampa Bay Basin. These waterbodies were verified impaired for low DO and elevated Nutrients [in Alligator Lake based on Historic Trophic State Index (TSI)] and therefore were included on the Verified List of impaired waters for the Tampa Bay Basin that was adopted by Secretarial Order on June 3, 2008. The TMDL establishes the allowable nutrient loadings to Alligator Creek and the Alligator Lake watersheds that would restore the waterbodies so that they meet their applicable water quality criterion for DO and nutrients.

1.2 Identification of Waterbody

Alligator Creek and Alligator Lake is located in the central portion of Pinellas County, mainly within the City of Clearwater (**Figure 1.1**). Alligator Creek (~5.78 miles in length) flows primarily in an easterly direction (draining about 6.99 square miles), entering the northwest side of Alligator Lake before discharging into Tampa Bay. The Alligator Creek and Alligator Lake basins are located in the central portion of the City of Clearwater (106,642 people) and the outskirts of the City of Safety Harbor (17,271 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. Alligator Creek is identified as WBID 1574 and Alligator Lake is identified as WBID 1574A (**Figure 1.2**).

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).

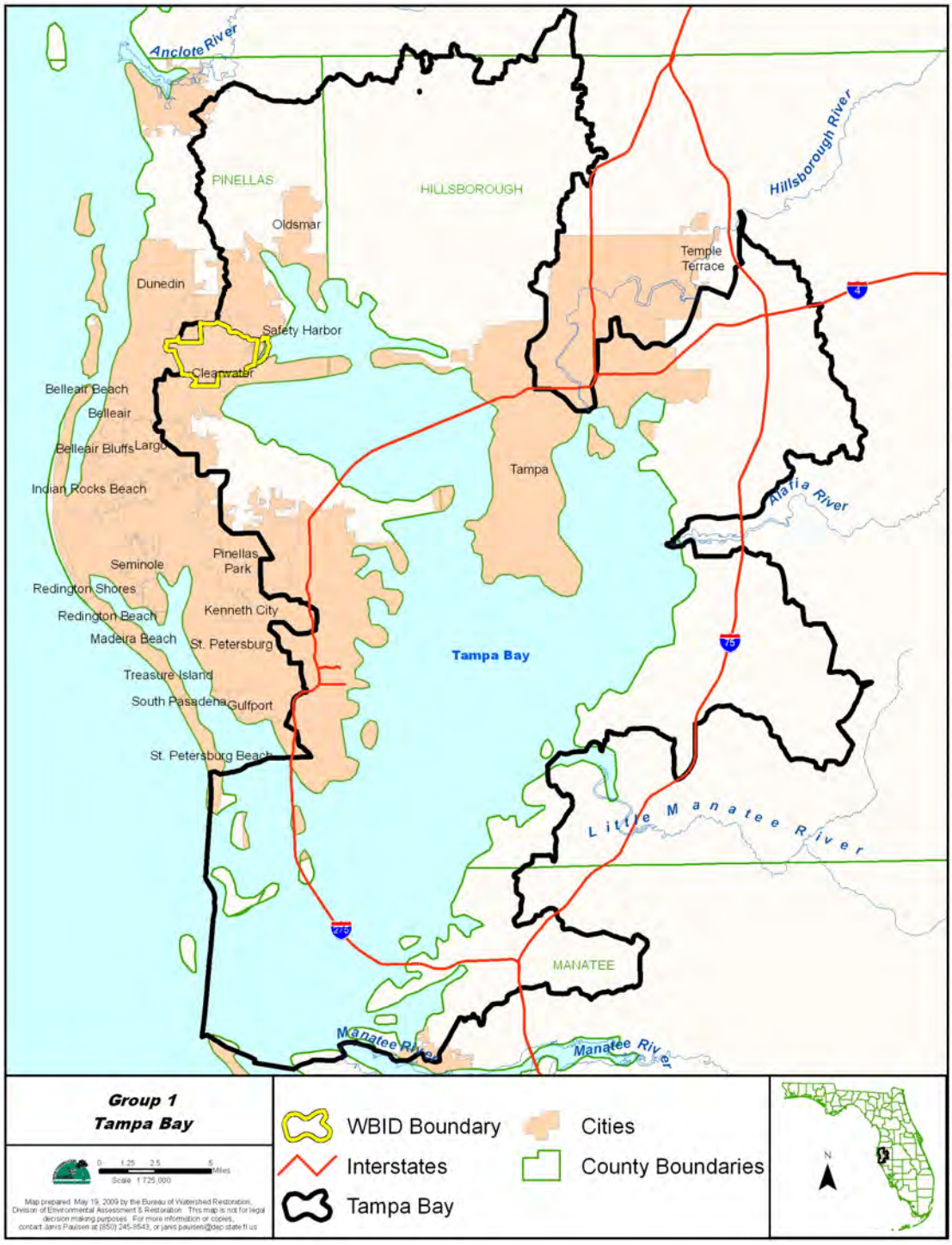

Figure 1.1. Location of Alligator Creek and Alligator Lake in Pinellas County and Major Geopolitical Features in the Area

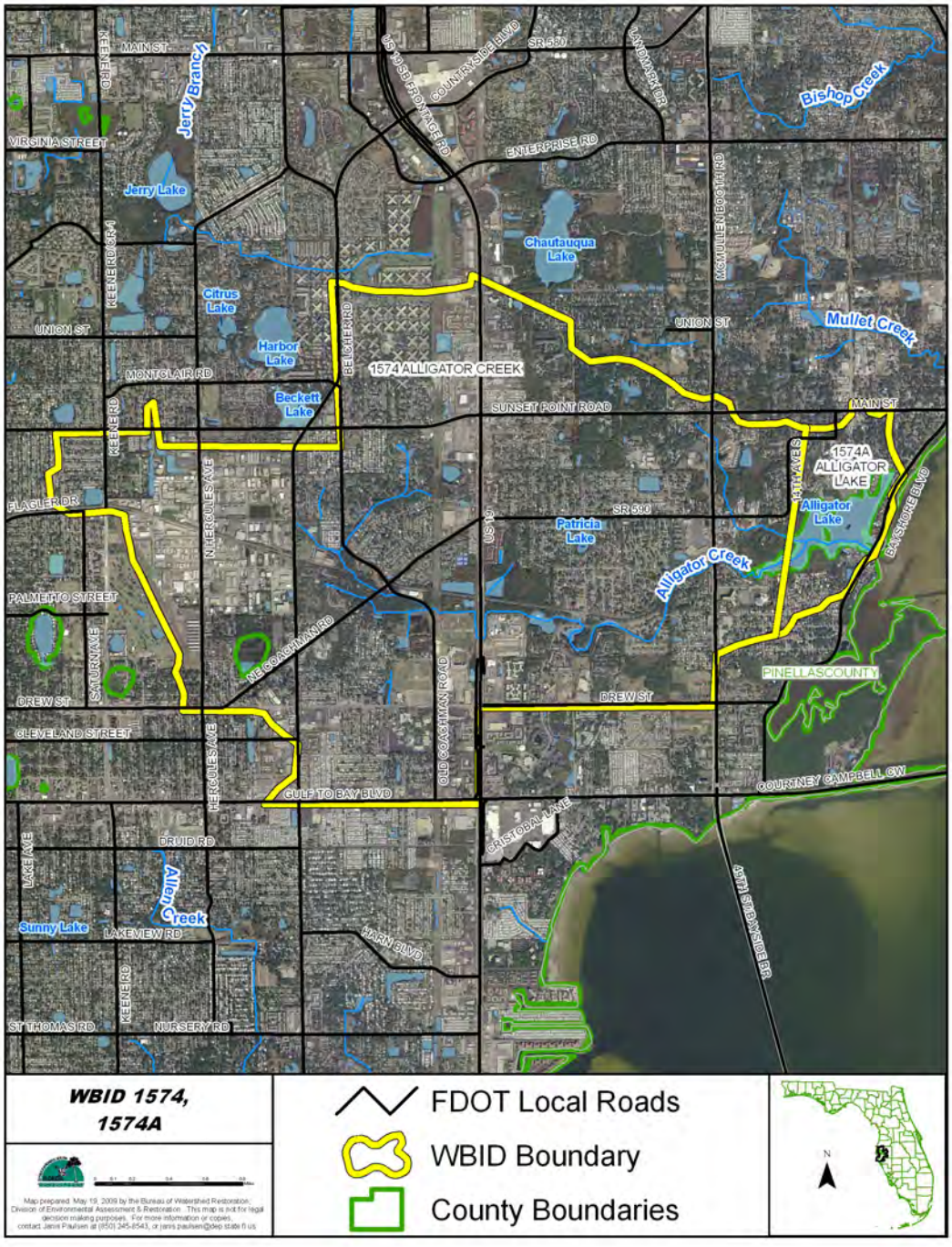

Figure 1.2. Location of Alligator Creek (1574) and Alligator Lake (1574A) [Note: FDOT local roads are for illustration purposes only and are not meant to depict roadways for which FDOT is responsible]

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 impairment of Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A). 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 Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A) watersheds and verified the impairment during the second cycle of the TMDL program (**Table 2.1**). **Table 2.2** summarizes the DO data collected during the verification period (January 1, 2000, through June 30, 2007). The projected year for the [1998 303(d) listed] DO TMDL for Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A) 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, this TMDL must be adopted and submitted to EPA by September 30, 2009.

This waterbody was verified as impaired based on DO because, using the IWR methodology, more than 10 percent of the values exceeded the Class III freshwater criterion with 90% confidence limit. For Alligator Creek 51 out of 142 samples and for Alligator Lake, 28 out of 103 samples in the verified period dropped below the criterion of 5.00 mg /L. The DO data used in this report is based on the IWR Run35 database.

The verified impairments were based on data collected by Pinellas County and the DEP's Southwest District, WBID location are shown in **Figure 1.2**. **Figures 2.1A and 2.1B** display the monthly average DO data collected during the verified period (January 1, 2000 – June 30, 2007) for Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A) respectively.

Table 2.1. Verified Impairments for Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A)

WBID	Waterbody Segment	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameter Causing Impairment	Priority for TMDL Development
1574	Alligator Creek	Stream	3F	Dissolved Oxygen**	Nutrients	Low
1574A	Alligator Lake	Lake	3F	Dissolved Oxygen**	Nutrients and BOD	Low
1574A	Alligator Lake	Lake	3F	Nutrients (Historic TSI)	Total Nitrogen	Low

**Note – WBID 1574 (Alligator Creek) and Alligator Lake (WBID 1574A) was included on the 1998 303(d) List for Dissolved Oxygen with a TMDL priority of Low and due date of 2008.

Table 2.2. Summary of Dissolved Oxygen Data for Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A), (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
1574	142	20	51	4	5.79	5.52	1.22	13.56
1574A	103	15	28	4	6.71	6.33	1.84	17.00
1574A	In years 2000, 2001 and 2006 TSI > 60; Also greater than 10 above historic TSI level of 47.5							

The TSI is calculated based on concentrations of TP, TN, and Chl a as follows:

$CHLA_{TSI}$ = 16.8 + 14.4 * LN(Chl *a*)	Chl *a* in µg/L
TN_{TSI} = 56 + 19.8 * LN(N)	N in mg/L
$TN2_{TSI}$ = 10 * [5.96 + 2.15 * LN(N + 0.0001)]	
TP_{TSI} = 18.6 * LN(P * 1000) – 18.4	P in mg/L
$TP2_{TSI}$ = 10 * [2.36 * LN(P * 1000) – 2.38]	
If N/P > 30, *then* $NUTR_{TSI} = TP2_{TSI}$	
If N/P < 10, *then* $NUTR_{TSI} = TN2_{TSI}$	
if 10< N/P < 30, *then* $NUTR_{TSI} = (TP_{TSI} + TN_{TSI})/2$	
$TSI = (CHLA_{TSI} + NUTR_{TSI})/2$	(TSI has no units)

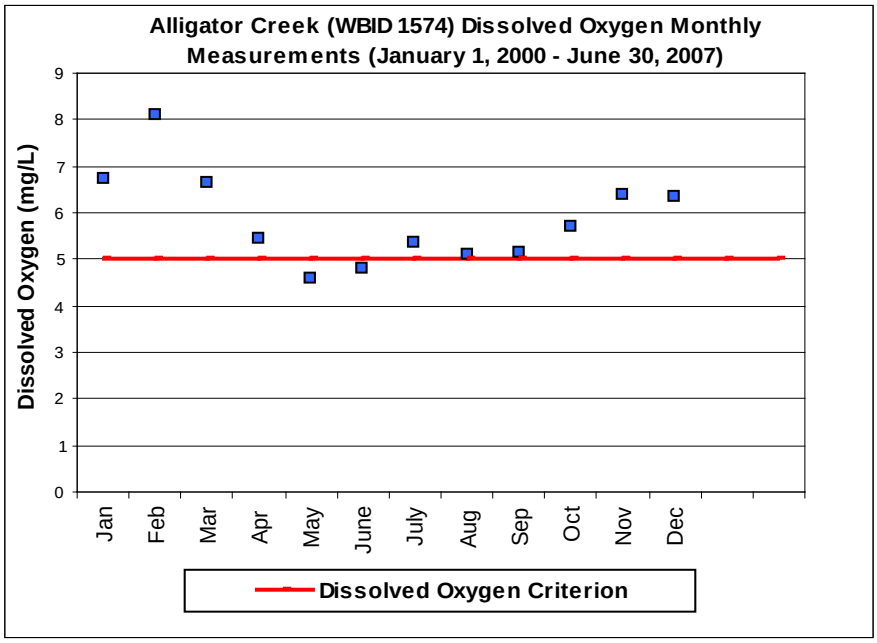

Figure 2.1A. Dissolved Oxygen Measurements for Alligator Creek, WBID 1574 (January 2000 – June 2007)

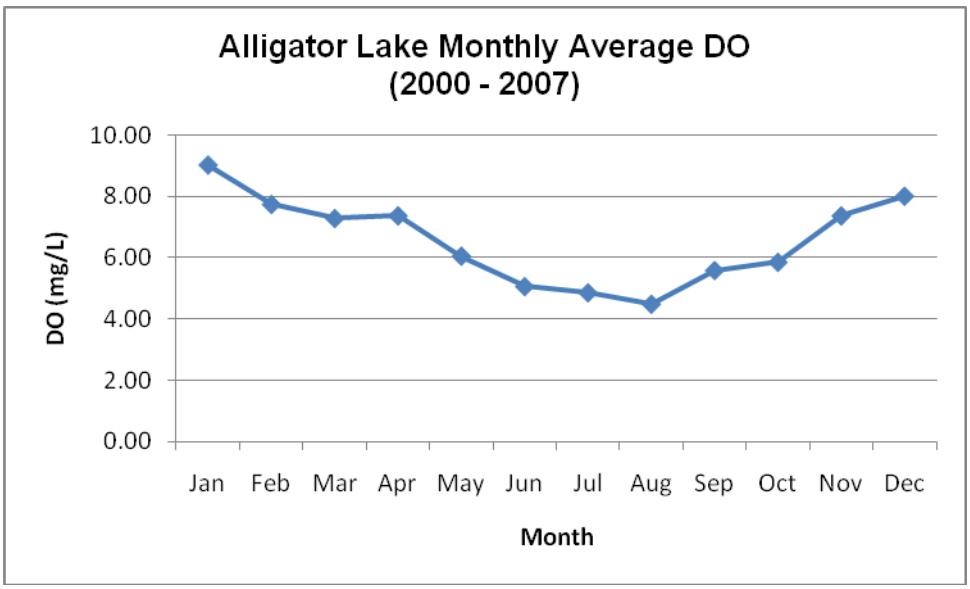

Figure 2.1B. Dissolved Oxygen Measurements for Alligator Lake, WBID 1574A (January 2000 – June 2007)

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)**

Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A) are freshwater Class III waterbodies, with a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The criteria applicable to this TMDL are the Class III freshwater criterion for DO (creek and lake) and nutrients (lake).

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

3.2.1 Dissolved Oxygen Criterion

The Class III freshwater criteria for DO as established by Rule 62-302,530(30), F.A.C., states the following: Dissolved Oxygen shall not be less than 5.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained.

Florida 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 fro 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 Alligator Lake and Alligator Creek, 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 streams is 2.0 mg/L for BOD_5, 1.6 mg/L for TN, and 0.22 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. Because Alligator Creek flows directly into Alligator Lake, the nutrient target of Alligator Creek must be protective of the designated uses in Alligator Lake.

3.3 Narrative Nutrient Criteria Definitions

3.3.1 Chlorophyll a

Chlorophyll, a green pigment found in plants, is an essential component in the process of converting light energy (sunlight) into chemical energy through the process of photosynthesis. In photosynthesis, the energy absorbed by chlorophyll transforms carbon dioxide and water into carbohydrates and oxygen. The chemical energy stored by photosynthesis in carbohydrates drives biochemical reactions in nearly all living organisms. Thus, chlorophyll is at the center of the photosynthetic oxidation-reduction reaction between carbon dioxide and water.

There are several types of chlorophyll; however, the predominant form is chlorophyll a (Chl a). The measurement of Chl a in a water sample is a useful indicator of phytoplankton biomass, especially when used in conjunction with an analysis of algal growth potential and species abundance. The greater the abundance of Chl a, typically the greater the abundance of algae. Algae are the primary producers in the aquatic food web, and thus are very important in characterizing the productivity of estuarine systems.

3.3.2 Total Nitrogen as N

TN is the combined measurement of nitrate (NO_3), nitrite (NO_2), ammonia, and organic nitrogen found in water. Nitrogen compounds function as important nutrients for many aquatic organisms and are essential to the chemical processes that exist between land, air, and water. The most readily bioavailable forms of nitrogen are ammonia and nitrate. These compounds, in conjunction with other nutrients, serve as an important base for primary productivity.

The major sources of excessive amounts of nitrogen in surface water are the effluent from municipal treatment plants and runoff from urban and agricultural sites. When nutrient concentrations consistently exceed natural levels, the resulting nutrient imbalance can cause undesirable changes in a waterbody's biological community and drive an aquatic system into an accelerated rate of eutrophication. Usually, the eutrophication process is observed as a change in the structure of the algal community and includes severe algal blooms that may cover large areas for extended periods. Large algal blooms are generally followed by depletion in DO concentrations as a result of algal decomposition.

3.3.3 Total Phosphorus as P

Phosphorus is one of the primary nutrients that regulates algal and macrophyte growth in natural waters, particularly in fresh water. Phosphate, the form in which almost all phosphorus

is found in the water column, can enter the aquatic environment in a number of ways. Natural processes transport phosphate to water through atmospheric deposition, ground water percolation, and terrestrial runoff. Municipal treatment plants, industries, agriculture, and domestic activities also contribute to phosphate loading through direct discharge and natural transport mechanisms. The very high levels of phosphorus in some Florida streams and estuaries are usually caused by phosphate mining and fertilizer processing activities.

High phosphorus concentrations are frequently responsible for accelerating the process of eutrophication, or accelerated aging, of a waterbody. Once phosphorus and other important nutrients enter the ecosystem, they are extremely difficult to remove. They become tied up in biomass or deposited in sediments. Nutrients, particularly phosphates, deposited in sediments generally are redistributed to the water column. This type of cycling compounds the difficulty of halting the eutrophication process.

3.4 Dissolved Oxygen

Florida's DO criterion for Class III freshwater bodies states that DO shall not be less than 5.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained. However, DO concentrations in ambient waters can be controlled by many factors, including DO solubility, which is controlled by temperature and salinity; DO enrichment processes influenced by reaeration, which is controlled by flow velocity; the photosynthesis of phytoplankton, periphyton, and other aquatic plants; DO consumption from the decomposition of organic materials in the water column and sediment and oxidation of some reductants such as ammonia and metals; and respiration by aquatic organisms. Alligator Lake was verified as impaired for DO based on 28 of the 103 measured values being below the Class III fresh water criterion.

The approach for developing the DO TMDL in the lake is to address the nutrient reductions necessary to restore the lake, and to reduce the BOD_5 to the most routinely achieved method detection limit of 2.00 mg/L.

3.5 Nutrients

Florida's nutrient criterion is narrative only, i.e., nutrient concentrations of a body of water shall not 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 an imbalance in flora or fauna is expected to occur.

Numeric criteria for nutrients such as Total Nitrogen (TN) and Total Phosphorus (TP) are not explicitly stated in Chapter 62-302, FAC.

Alligator Lake:

The IWR Rule 62-303.350 and 62-303.352, FAC, (Nutrients in Lakes) states that a lake with a mean color greater than 40 platinum cobalt units, is impaired when any annual mean TSI during the verified period exceeds 60, unless paleolimnological information indicates the lake was naturally greater than 60. Additionally a lake can be impaired, if data indicate that annual mean TSIs have increased over the assessment period, as indicated by a positive slope in the means plotted versus time, or the annual mean TSI has increased by more than 10 units over historical values. When evaluating the slope of mean TSIs over time, the Department shall require at least a 5 unit increase in TSI over the assessment period. The IWR Rule allows use of

additional information indicating imbalance of flora or fauna due to nutrient enrichment. These include algal blooms, changes in alga species richness, excessive macrophyte growth, a decrease in the areal coverage or density of seagrasses or other submerged aquatic vegetation, and excessive diel oxygen variation. Sufficient data were available for Alligator Lake to calculate annual average TSI from 1993 through 2008. During this period TSI ranged from a low of 43.6 in 1997 to high of 64.2 in 2001. Based on apparent color (only available for 2005) the lake had a high color during the verified period. Any single year with a TSI greater than 60 would result in a determination that the Lake is impaired for nutrients. The lake TSI exceeded 60 in years 2000, 2001, and 2002 of the verified period. Additional, a lake may be verified as impaired if the historic TSI has increased by more than 10 TSI units. In this case, in accordance with the methodology of the IWR, the historic TSI was calculated as 47.5 (based on the period 1994-1998), and a new threshold of impairment was established at a TSI of 57.5 (historic TSI plus 10 TSI units). The historic minimum TSI value for Alligator Lake was determined by first calculating the individual TSIs using the equations above. Within each year, seasonal mean TSIs are calculated; the annual average TSI is calculated as the average of the seasonal mean TSI values, subject to certain data sufficiency requirements as described in 62-303.350 (2)(a): Data must meet the requirements of paragraphs (2)-(4), (7), and (8) in rule 62-303.320, F.A.C.

Calculations of the annual average TSI values were performed according to the following: 62-303.350 (2)(b): At least one sample from each season shall be required in any given year to calculate a Trophic State Indix (TSI) or an annual mean chlorophyll a value for that year (for the purposes of this chapter, the four seasons shall be January 1 through March 31, April 1 through June 30, July 1 through September 30, October 1 through December 31), and 62-303.350 (2)(c): If there are multiple chlorophyll a or TSI values within a season, the average value for that season shall be calculated from the individual values and the four quarterly values shall be averaged to calculate the annual mean for that calendar year

Using data for all years for which data sufficiency was met with which to calculate an annual average, a five-year historic minimum was calculated subject to 62-303.350 (3): When comparing changes in chlorophyll a or TSI values to historic levels, historical levels shall be based on the lowest five-year average for the period of record. To calculate a five-year average, there must be annual means from at least three years of the five-year period.

For Alligator Lake, the five-year period resulting in the minimum five-year annual average to be used as the historic minimum value for TSI of 47.5 was the five year period of 1994–1998. **Table 3.1** contains the TSI for each five year average, the lowest 5 year average is highlighted.

Table 3.1. Provides the Annual Average TSI Results for Historic Minimum 5-Year average TSI Determination

Five Year Period	Years meeting data sufficiency	Five-Year Average
1991-1995	1993, 1994, 1995	51.9
1992-1996	1993, 1994, 1995, 1996	51.0
1993-1997	1993, 1994, 1995, 1996, 1997	48.8
1994-1998	1994, 1995, 1996, 1997, 1998	47.5
1995-1999	1995, 1996, 1997, 1998, 1999	48.4
1996-2000	1996, 1997, 1998, 1999, 2000	49.6
1997-2001	1997, 1998, 1999, 2000, 2001	52.1
1998-2002	1998, 1999, 2000, 2001, 2002	55.9
1999-2003	1999, 2000, 2001, 2002, 2003	59.6
2000-2004	2000, 2001, 2002, 2003, 2004	60.0
2001-2005	2001, 2002, 2003, 2004, 2005	58.1
2002-2006	2002, 2003, 2004, 2005, 2006	56.5
2003-2007	2003, 2004, 2005, 2006, 2007	54.9
2004-2008	2004, 2005, 2007, 2008	52.7

Annual average TSI for Alligator Lake, 1993-2008 (data from 1992 and 2009 are not included in the calculation of the five-year averages, as data sufficiency is not met for the calculation of an annual average TSI for those years)::

If the waterbody is verified as impaired (as is the case for Alligator Lake with 4 TSI values over 57.5 in the verified period) then the target for TMDL development is the impairment threshold (57.5) minus 5 TSI units. In this case, the Department has used the historic background TSI of 47.5 to establish a new threshold of impairment at a TSI of 57.5 (background plus 10). The TMDL target of 52.5 is selected as a 5 TSI unit reduction from the impairment threshold. This 5

TSI unit reduction accounts for the assimilative capacity of the lake, allows for future growth, and contributes to the margin of safety. For the purposes of developing the TMDL, and to be conservative, the TSI of 52.5 is the target. The data show that the system is nitrogen limited, thus a total phosphorus target will not be pursued.

Alligator Creek:

As stated earlier, in cases where the hydrologic conditions are not typical of most of Florida, such as Tampa Bay, the 70th percentile nutrient thresholds are not useful. Thus, in assessing Alligator Creek (1574), two other common methods for determining the causative pollutant and a developing nutrient targets was used. These methods are 1) determining reference water bodies and using their water quality as a target and 2) determining the concentration that is most protective of the receiving water body. The data show that the system is nitrogen limited, thus a total phosphorus target will not be pursued.

3.6 Nutrient Target Development

Alligator Lake:

The TMDL for nutrients in Alligator Lake was based on using the TSI calculation methodology and reducing the nutrient and CChl a concentrations to levels that would produce an annual average TSI of less than 52.5, while maintaining the lake as a nitrogen-limited system. Percent reduction for nutrients were then calculated for TN based on the average annual concentration from the verified period (TN 0.88 mg/L).

Alligator Creek:

Preferably, the reference concentration should be based on similar sites in the watershed that represent "natural conditions" or, in a case where natural conditions (areas almost completely void of anthropogenic activity) are not readily available, an area where the negative impacts of anthropogenic activity are largely mitigated.

In the case of Alligator Creek, reference concentrations in the Tampa Bay Area (Group 1 and Group 2 of the FDEP Southwest District) were developed by focusing on sample stations. Two approaches were examined. The first approach summarizes the nutrient concentrations of those stations in Tampa Bay and Tampa Bay Tributaries that have a low Landscape Development Index (a landuse intensity measurement also known as the LDI (Brown and Vivas, 2005)). An LDI of less than 2.0 is an indication of low anthropogenic impact. Thus, the first approach determines the annual median TN concentrations during the verified period for these low LDI sample stations and proposes these as a reduction targets. The second approach focuses on sample stations in Tampa Bay or Tampa Bay tributary WBIDs already determined to be "not impaired", based on FDEP Impaired Waters Rule assessment methodology (Chapter 62-303, FAC). A statistical summary of these observations is shown in **Table 3.2,** where **(1)** is the LDI method results and **(2)**, **(3), and (4)** are variations of the second method, involving the "not impaired WBIDs." Method 2 provides equal weight to each sample, regardless of year (the distributions of this method are shown in Figures 3.1, 3.2, and 3.3), whereas Method 3 calculates a single annual average station median and provides an average of these 7 annual values. Method 4 is the same as Method 2, but applied to Tampa Bay Tributaries (adjacent Group 2) instead of Tampa Bay.

Table 3.2 Reference Concentrations for Tampa Bay from 4 Approaches.

	Summary of Potential Reference Based Targets				
	Average Annual Station Median during VP				
		TN mg/L		CHLA ug/L	
		Median	**75 Percentile**	**Median**	**75 Percentile**
1	**All Tampa Bay and Tampa Bay Trib. Stations Annual Medians with an LDI less than or Equal to 2**	*1.09*	*1.34*	*3.71*	*6.72*
2	**Tampa Bay Stations in Not Impaired WBIDs with 4 or more samples annually, giving equal weight to all station medians**	*0.86*	*1.00*	*2.44*	*3.98*
3	**Tampa Bay Stations in Not Impaired WBIDs with 4 or more samples annually, equal weight to Single Annual Value (2000, 2001,etc.)**	*0.97*		*2.53*	
4	**Tampa Bay Tributary Stations in Not Impaired WBIDs with 4 or more samples annually**	*1.55*	*1.82*	*1.71*	*2.47*

* 90 percentile=1.72

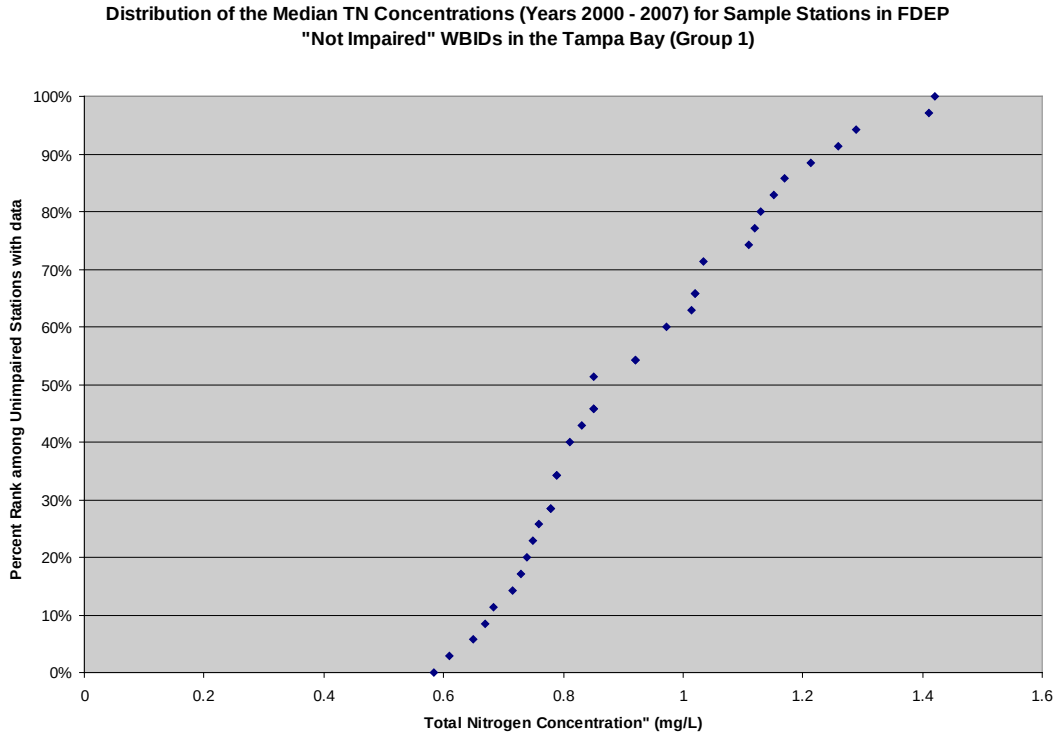

Figure 3.1.Median Sample Station Total Nitrogen Concentration Distribution (Stations with 4+ Samples in "Not Impaired" Tampa bay WBIDs(2000 – 2007)

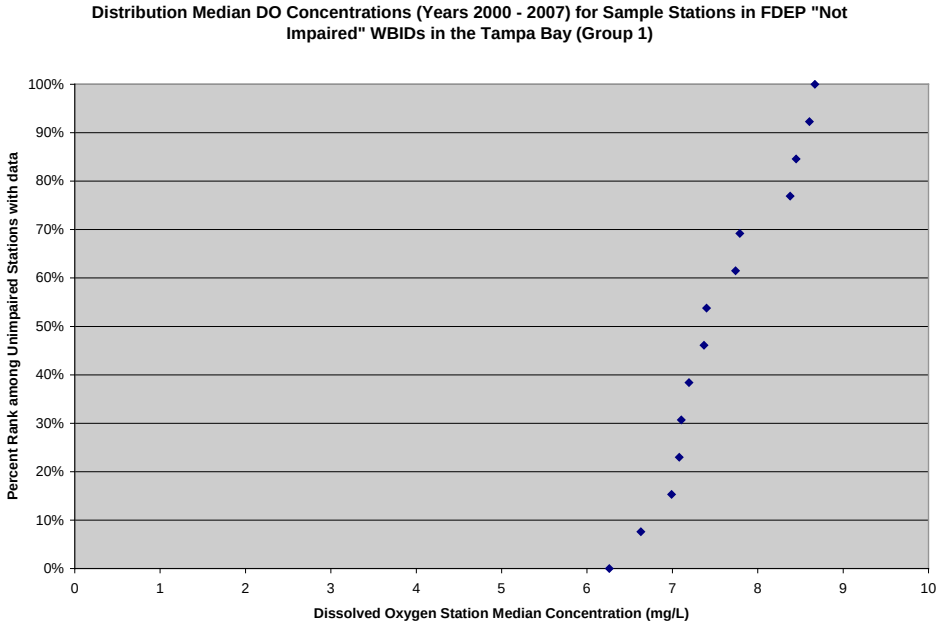

Figure 3.2. Median Sample Station D.O. Concentration Distribution (Stations with 4+ Samples in "Not Impaired" Tampa bay WBIDs(2000 – 2007)

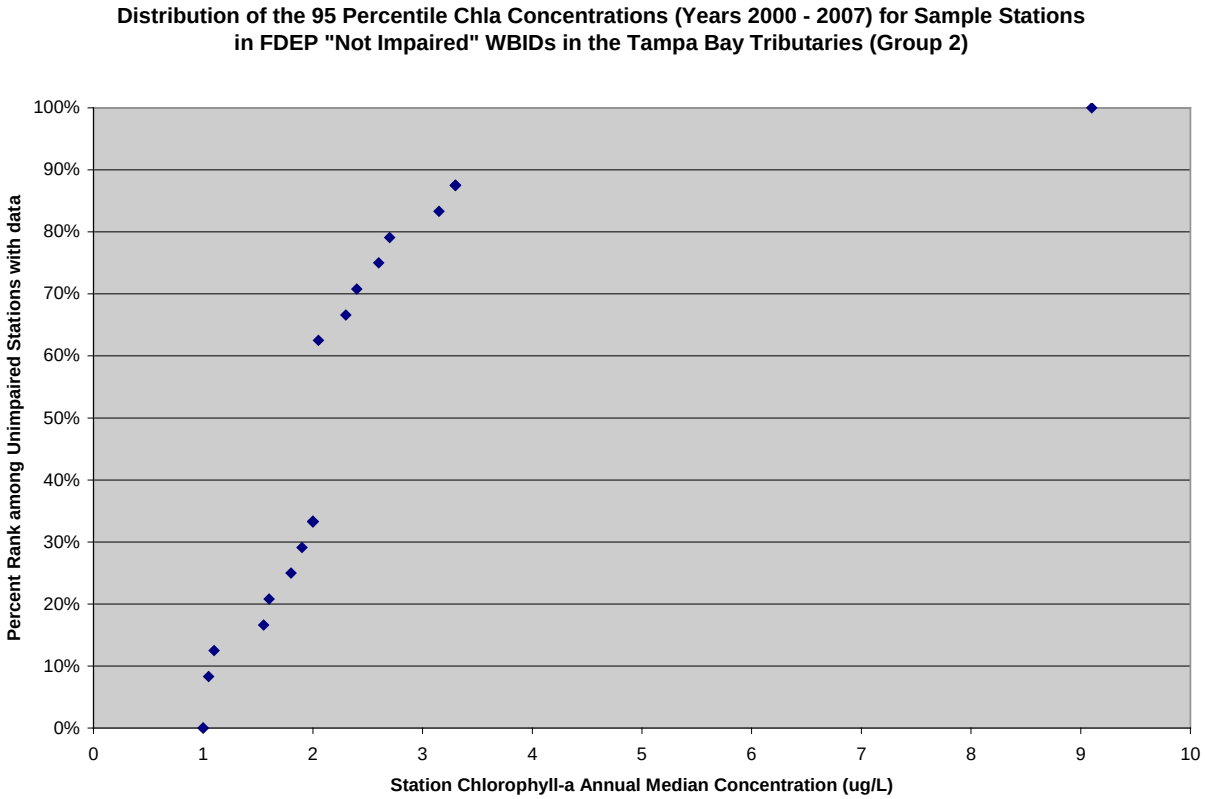

Figure 3.3. Median Sample Station Chlorophyll-a Concentration Distribution (Stations with 4+ Samples in "Not Impaired" Tampa bay WBIDs(2000 – 2007)

The Results of Method 3, summarized for other parameters and conditions in Tampa Bay during the Verified Period, is shown in **Table 3.3**. Of the four methods for determining a reference concentration, Method 2 resulted in the most conservative and protective target. It is important to note that the besides demonstrating that the Total Nitrogen levels consistent with and local waterbodies meeting not impaired standards, but also one that meets the requirements of the receiving waterbody, Alligator Lake.

Table 3.3 Verified Period Summary of Median Concentrations for Sample Stations in Fresh and Marine WBIDs (2000 – 2007)

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					

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 Low DO in the Alligator Creek Watershed

4.2.1 Point Sources

Estimating Point Source Loads

There are four department permitted waste producing facilities located in Alligator Creek (WBID 1574), only one of which is a NPDES permitted facility (**Table 4.1, Figure 4.1**) The NPDES permitted facility, City of Clearwater Master Reuse System (FL0186261), applies treated wastewater effluent from the City of Clearwater Marshall Street Advanced Wastewater Treatment Plant (AWWTP) as irrigation water on public-access areas. Thus none of the wastewater in **Table 4.1** directly flows into surface waters.

Table 4.1. Permitted Waste Facilities in Alligator Creek

Permitted Waste Facilities in Alligator Creek (WBID 1574)
City of Clearwater Master Reuse System, FL0186261 Status:Active NPDES:Yes TYPE:Domestic Waste Design Capacity:40 MGD
Southern Comfort Mobile Home Park, FLA012901 Status:Active NPDES:No TYPE:Domestic Waste Capacity:0.015 MGD
On Top of the World, FLA012905 Status:Active NPDES:No Design Capacity:0.6 MGD
Clearwater Collision Center, FLA450561 TYPE: Industrial Wastewater Design Capacity: Not Applicable NPDES:No

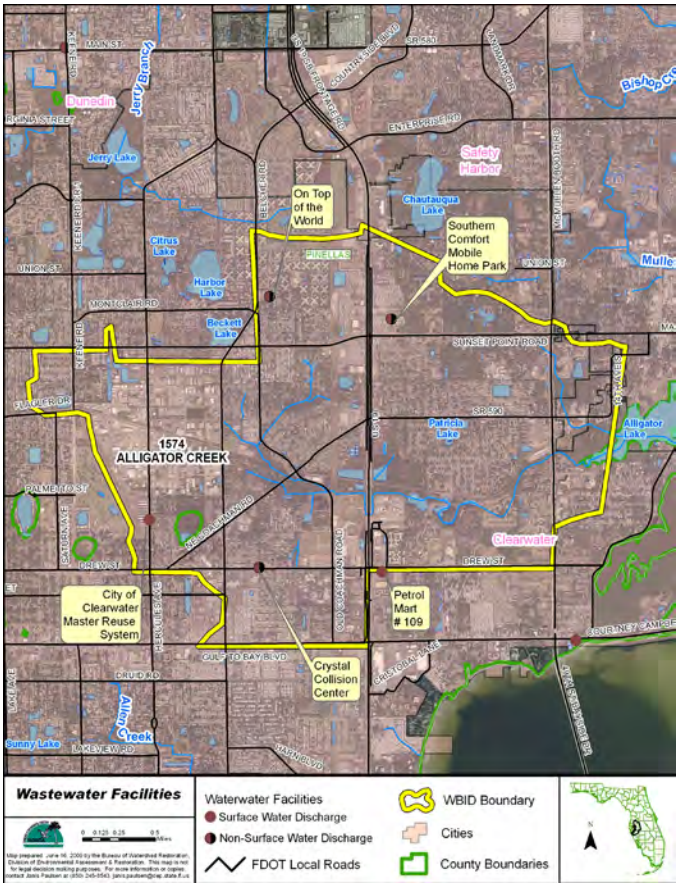

Figure 4.1 Permitted Waste Facility Locations in Alligator Creek

Municipal Separate Storm Sewer System Permittees

Within the Alligator Creek watershed, there is one Phase I municipal separate storm sewer system (MS4) permit; with City of Clearwater and the City of Safety Harbor as the responsible co-permittees of Permit ID: FLS000005 (Pinellas County and Co-Permittees).

4.2.2 Land Uses and Nonpoint Sources

In the Alligator Creek watershed, which covers 4,471 acres, a number of land uses affect water quality through nonpoint source runoff (**Figure 4.2**). 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 has a very limited amount of agriculture (0.2%).

Land Uses

Land use categories in the Alligator Creek and Alligator Lake watersheds were aggregated using the simplified Level 1 codes (**Tables 4.2a** and **4.2b**). By far the largest Level 1 land use in the Alligator Creek and Alligator Lake watershed is urban and built-up (83 percent and 65% respectively). When looking at Level 2, which is a more detailed categorization of land use (**Tables 4.3a** and **4.3b**), it can be seen that for Alligator Creek the urban and built-up land uses is comprised of (from highest to lowest) high-density residential (37 percent), commercial (15.4 percent), industrial (7.6 percent), institutional (5.9 percent), and low-density residential (5.8 percent), and medium-density residential (4.5 percent),. After urban and built-up, the second largest land use category is forest (4.3%) and wetlands (3.4%). For Alligator Lake the urban and built up is comprised of high density residential. After Urban built-up, the second largest Level 2 land use category for Alligator Lake (1574A) is the lake itself.

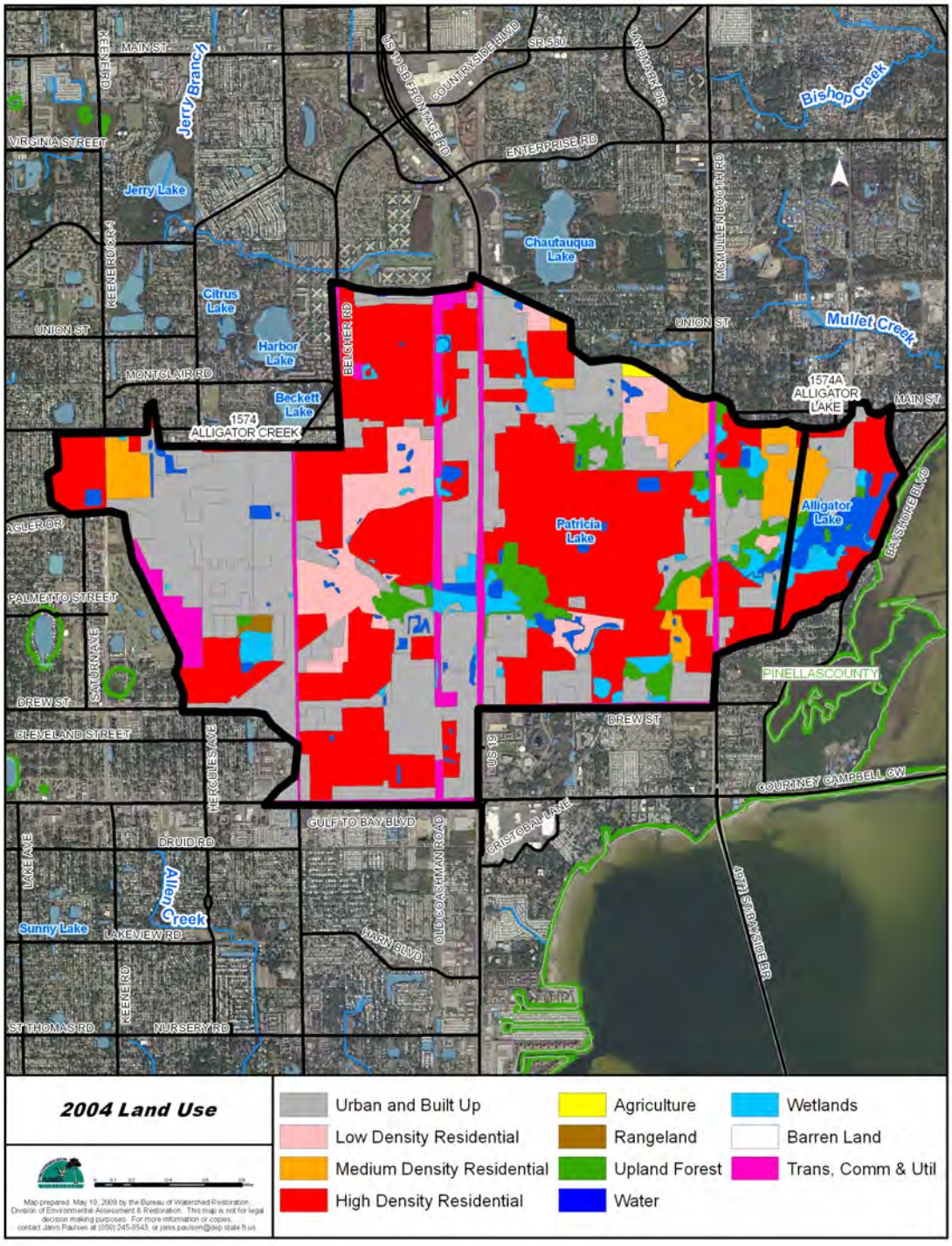

Figure 4.2. Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A) Major Land use Map

Table 4.2a. Level 1 Land Uses in the Alligator Creek Watershed, WBID 1574

Landuse Code and Description (WBID 1574)	Acres	% Total
1000: Urban and Built up	3,722.4	83.1%
8000: Transportation, Communication, & Utilities	280.6	6.3%
4000: Upland Forests	194.4	4.3%
6000: Wetland	153.3	3.4%
5000: Water	119.4	2.7%
2000: Agriculture	7.7	0.2%
Total	**4,477.9**	**100.00%**

Table 4.2b. Level 1 Land Uses in the Alligator Lake Watershed, WBID 1574A

Landuse Code and Description (WBID 1574A)	Acres	% Total
1000: Urban and Built up	207.5	65.46%
5000: Water	72.2	22.77%
6000: Wetland	30.7	9.69%
4000: Upland Forests	6.6	2.08%
Total	**316.9**	**100.00%**

The primary nonurban land uses for Alligator Creek include upland forest (194 acres), wetlands (153 acres), and water (119 acres).

The runoff from the Alligator Creek watershed is based on impervious area (Harper, 2003; Duncan, 1995), as shown in **Table 4.4** 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 high density residential, commercial, forest/open rural, industrial, and medium-density residential, listed in the order of decreasing contribution. These tables demonstrate that a major portion of the Total Nitrogen load is anthropogenic in nature.

Table 4.3a. Classification of Level 2 Land Use Categories in the Alligator Creek Watershed, WBID 1574

Level 2 Landuse Code and Description (WBID 1574)	Acres	% Total
1300: Residential, High Density	1,668.5	37.3%
1400: Commercial	689.3	15.4%
1500: Industrial	339.6	7.6%
1700: Institutional	264.7	5.9%
1100: Residential, Low Density	261.7	5.8%
8100: Transportation	202.5	4.5%
1200: Residential, Medium Density	200.6	4.5%
4300: Upland Mixed Forest	194.4	4.3%
1800: Recreation	186.2	4.2%
5300: Reservoirs	111.9	2.5%
1900: Openland	111.9	2.5%
8300: Utilities	72.8	1.6%
6300: Wetland Forest Mixed	62.2	1.4%
6400: Vegetated Nonforested Wetlands	54.9	1.2%
6100: Wetland hardwood forests	35.0	0.8%
2100: Cropland and Pastureland	7.7	0.2%
5400: Bays and Estruaries	7.0	0.2%
8200: Communication	5.3	0.1%
6200: Wetland Coniferous Forests	0.9	0.02%
5200: Lakes	0.5	0.01%
6500: Non Vegetated Wetlands	0.4	0.01%
Total	**4,477.9**	**100%**

Table 4.3b Classification of Level 2 Land Use Categories in the Alligator Lake Watershed, WBID 1574A

Landuse Code and Description (WBID 1574A)	Acres	% Total
1300: Residential, High Density	126.4	39.87%
5200: Lakes	70.3	22.18%
1400: Commercial	30.1	9.48%
1200: Residential, Medium Density	25.8	8.15%
1800: Recreation	24.5	7.72%
6100: Wetland hardwood forests	23.5	7.41%
4300: Upland Mixed Forest	6.6	2.08%
6400: Vegetated Non-forested Wetlands	4.4	1.40%
6300: Wetland Forest Mixed	2.8	0.88%
5300: Reservoirs	1.9	0.59%
1700: Institutional	0.7	0.23%
Total	**316.9**	**100.00%**

Table 4.4 Alligator Creek Land Use Categories and Corresponding Runoff, 2000–07

Land Use	Area (acres)	Percent Imperviou s	Impervious Runoff Coeff.	Pervious Runoff Coeff.	Avg Precip . "/yr	Runoff (Acre-feet)	Runoff Million Gallons
A. Forest/Rural Open	492.44	2.0%	0.95	0.159	49.43	354.6	115.6
B. Urban Open	275.30	2.0%	0.95	0.041	49.43	67.6	22.0
C. Agriculture/Pasture	7.75	4.0%	0.95	0.317	49.43	10.9	3.6
D. Low Density/Residential	261.66	14.0%	0.95	0.150	49.43	282.8	92.2
E. Medium Density/Residential	200.56	33.0%	0.95	0.088	49.43	307.5	100.2
F. High Density/Residential	1668.5 3	33.0%	0.95	0.120	49.43	2,707.4	882.2
G. Commercial	954.01	72.0%	0.95	0.120	49.43	2,820.1	918.9
H. Industrial	339.62	55.0%	0.95	0.120	49.43	806.5	262.8
I. Highways	0.00	36.0%	0.95	0.542	49.43	0.0	0.0
J. Wetland	0.04	30.0%	0.95	0.230	49.43	0.1	0.0
K. Water		119.42	3.8%	0.95	0.000	49.43	17.8
Other [2]							0.0
Total	**4319.3**					**7,375.4**	**2,403.3**

Table 4.5 Alligator Creek Land Use Categories and Corresponding Loads

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
Forest/Rural Open	1.09	0.046	1,051.2	44.4	2	0
Urban Open	1.12	0.18	206.0	33.1	0	0
Agricultural	2.32	0.344	68.9	10.2	0	0
Low density residential	1.64	0.191	1,261.4	146.9	3	2
Medium density residential	2.18	0.335	1,823.2	280.2	4	3
High density residential	2.42	0.49	17,816.9	3,607.6	39	40
Highways	2.42	0.49	18,558.7	3,757.8	40	42
Water	2.42	0.49	5,307.7	1,074.7	12	12
Rangeland	2.23	0.27	0.0	0.0	0	0
J. Wetland	1.01	0.09	0.6	0.0	0	0
K. Water	1.01	0.09	48.8	4.3	0	0
Total			**46,143.3**	**8,959.1**	**100.0**	**100.0**

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

Alligator Lake:

The TMDL for nutrients in Alligator Lake was based on achieving a target TSI of 52.5 for both nutrients and CChl a. TMDL reductions were based on the percent reduction from the annual average concentrations of TN, CChl a, and BOD_5 during the verified period. For TN this was a concentration of 0.88 mg/L, for CChl a 18.64 ug/L, and BOD_5 an average of 3.70 mg/L (year 2002 did not have enough BOD data to calculate annual average). Additionally, a BOD_5 TMDL was established in Alligator Lake to further improve the DO in lake, in addition to the removal of anthropogenic inputs of nutrients.

The goal of the Alligator Creek TMDL analysis is to reduce the anthropogenic TN loads to conditions comparable to those found in surrounding, unimpaired watersheds. This included setting a target that allowed Alligator Lake to maintain those healthy components of it's present condition, but to permit it to attain the attain the water quality target described in this document. was most critical in The methodology used is a percent reduction approach between the existing condition concentration and the region-based reference concentration.

DO:

The approach for developing the DO TMDL in the lake is to address the nutrient reductions necessary to achieve the TSI target of 52.5, and to reduce the BOD_5 to the most routinely achieved method detection limit of 2.00 mg/L.

5.1.1 Data Used in the Determination of the TMDL

Table 5.1 Alligator Creek Summary of Major Sample Stations.

Data used in the determination of the Alligator Creek TMDL is summarized below;

Station ID	Station Name	Total Nitrogen Summary			D.O.			BOD		
		Count	Median	75 Percentile	Count	Median	75 Percentile	Count	Median	75 Percentile
21FLPDEM14-11	Alligator Creek	37	1.06	1.16	39	5.84	6.49	8	4	4.5
21FLPDEMAMB 14-10	Alligator Creek	16	1.01	1.18	17	3.95	4.78	14	1	2
21FLTPA 275844782423	TP369-Alligator Creek	11	0.83	0.95	11	4.42	5.31			
21FLTPA 285857282422	TP370-Alligator Creek	11	0.72	0.84	11	5.68	6.44			
21FLTPA 275826008243	TP 460 - Direct Runoff to Bay	7	0.87	1.09	7	7.20	9.72	5	2.8	3.2
21FLTPA 275830108242	TP 459 - Direct Runoff to Bay	7	0.81	0.87	7	7.98	10.12	5	3.2	3.4
21FLTPA 275850008244	TP 461 - Direct Runoff to Bay	7	0.99	1.12	7	9.02	9.27	4	0.735	0.8075
112WRD 02307671	ALLIGATOR CR BELOW US HWY 19 AT CLEARW	3	1.17	1.60	37	5.30	6.30	37	1.4	1.6

As shown in the above table, there were more Total Nitrogen data available for assessment and determination of median concentrations than for 5-day BOD. Also shown in the above Table, one of the stations supplied a large proportion of the sample data (Table 5.1 and Figure 5.1).

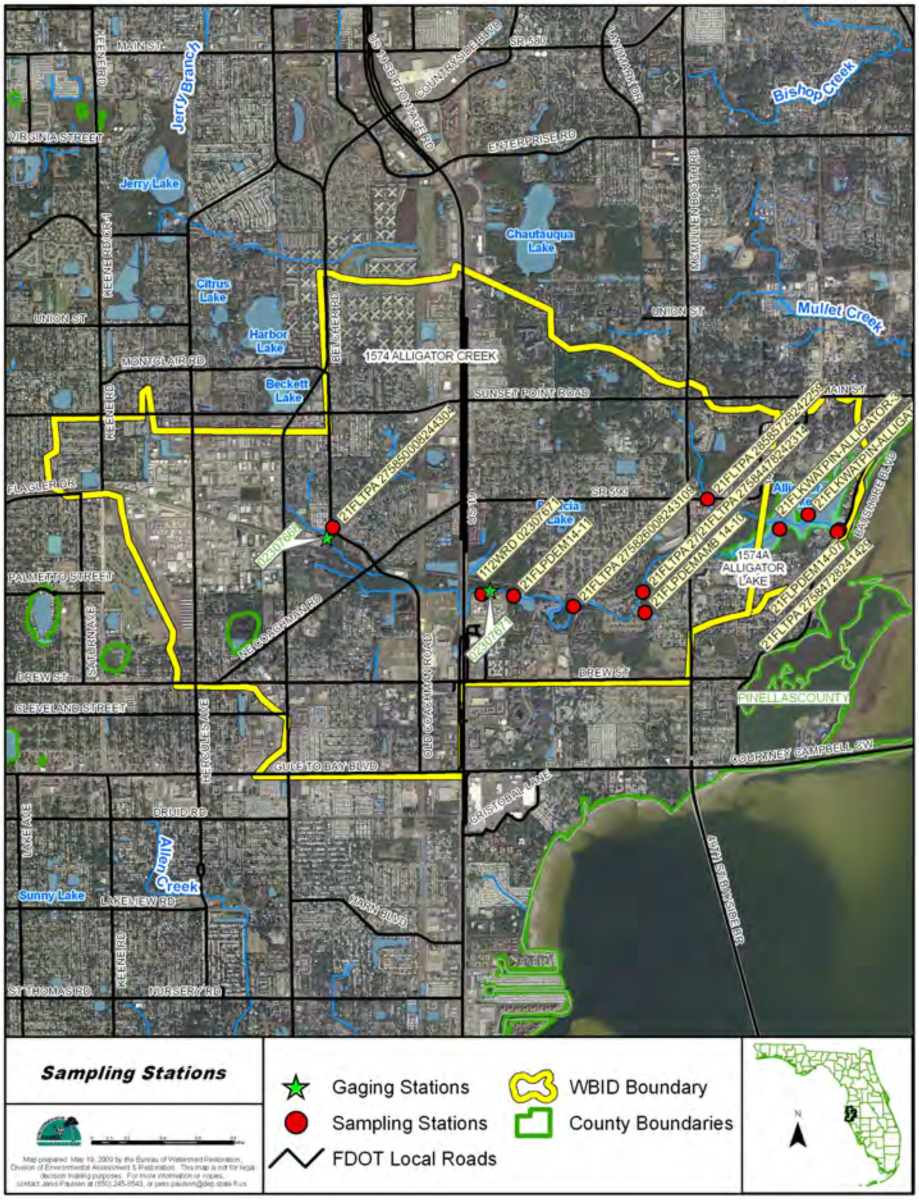

Figure 5.1. Sample stations Alligator Creek and Alligator Lake

Percentage reductions were calculated as follows; To provide a margin of safety, a determined "worst case condition" is selected to be reduced to meet the target concentration (i.e. worst condition could be the highest quarterly value or highest annual mean) the required reduction was calculated using the following:

$$\frac{[(\text{Worst Case Condition Observed Requiring Reduction}) - (\text{water quality target})]}{(\text{observed value})} \times 100$$

5.1.2 TMDL Development Process for Alligator Lake

As described in **Section 5.1**, the method used to determine the percent reductions in the lake was to achieve a nutrient and CChl a TSI of 52.5 and a reduction in BOD as required for DO to meet standards in the lake.

Table 5.2 Alligator Lake TMDL Target Concentrations and Percent Reductions for TN and BOD_5

	TMDL	VP Average	Percent Reduction
TN (mg/L)	0.72	0.88	19
BOD_5 (mg/L)	2.00	3.7	46

As part of the Margin of Safety, the percent reductions were rounded up.

With the determination of the lake TMDLs, it is possible to determine if the proposed Alligator Creek TMDL of 0.85 mg/L target is protective of the lake. With the proposed TN target of 0.72 mg/L for Alligator Lake, it is proposed that Alligator Creek target matches that of Alligator Lake, which will provide an added margin of safety for the Creek while insuring that the Creek flow fully supports the Lake target.

In determining the percentage reduction, for TN, the worst case was used on which to base the reduction. In the Creek, the highest Annual Median Concentration for the major sample stations was used (**Table 5.3**). That concentration was 1.21 mg/L which was the highest median concentration during the verified period, and which results in a proposed TN reduction of 40%.

Table 5.3 Alligator Creek Percent Reductions for TN required to meet Water Quality Standards for Nutrients and DO

Major Sample Stations during verified period for ALLIGATOR CREEK, WBID 1574	VP Sample Count	Sample Station Median Annual Total Nitrogen Concentration								Verified Period Maximum Annual Median
		2000	2001	2002	2003	2004	2005	2006	2007	
21FLPDEM14-11	37				1.12	1.06	1.01	1.06	0.98	1.12
21FLPDEMAMB 14-10	16	0.95	1.21	0.99						1.21
21FLTPA 27584478242314	11						0.83			0.83
21FLTPA 28585728242259	11						0.72			0.72
Worst Year Median TN to for which reduction is to be applied to (Maximum Annual Station median)										1.21
						Target Concentration (mg/L)				0.72
						Percent Reduction				40%

5.1.3 Critical Conditions/Seasonality

The critical conditions for nutrient and BOD_5 loadings in a given watershed depend on the existence of point sources, land use patterns, and rainfall in the watershed. 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. Animals with direct access to the receiving water could also contribute to the exceedances during dry weather conditions. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized. As previously noted, there are no point source discharges within the watershed.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (Wasteload Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

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

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

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

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

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

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDLs for Alligator Lake are expressed in terms of a percent reduction, these TMDLs represent the maximum daily loads that Alligator Lake can assimilate and maintain the nutrient and DO criteria **(Table 6.1).**

Table 6.1a. TMDL Components for Nutrients and BOD in Alligator Lake (WBID 1574A)

WBID	Parameter	WLA		LA (% reduction)	MOS
		Wastewater	NPDES Stormwater (% reduction)		
1474A	Total Nitrogen	N/A	19	19	Implicit
1474A	BOD_5	N/A	46	46	Implicit

N/A – Not applicable.

Table 6.1b. TMDL Components for Nutrients in Alligator Creek (WBID 1574)

WBID	Parameter	WLA		LA (% reduction)	MOS
		Wastewater	NPDES Stormwater (% reduction)		
1474	Total Nitrogen	N/A	40	40	Implicit

6.2 Load Allocation

Alligator Lake (1474A):

A percent reduction in TN of 19% and from BOD_5 of 46% is needed from nonpoint sources in the Alligator Lake watershed for the lake to achieve a TSI of 52.5 and attain standards for nutrients and DO. It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix A).**

Alligator Creek (1474):

A percent reduction in TN of 40% would be protective of the receiving waterbody, Alligator Lake, and would result in DO concentrations that match those of "not impaired WBIDs."
It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix A).**

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

None of the wastewater in Table 4.1 directly flows into surface waters, thus there will be no wastewater discharge allocation.

6.3.2 NPDES Stormwater Discharges

Alligator Lake (1474A):

The WLA for stormwater discharges with an MS4 permit is a percent reduction in TN of 19%. These reductions are needed from nonpoint sources in the Alligator Lake watershed for the lake to achieve a TSI of 52.5 on an annual average basis. A BOD_5 TMDL reduction of 46% was established for the Lake (as required in addition to the nutrient reductions) to address the DO impairment in the lake. 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.

Alligator Creek (1474):

The WLA for stormwater discharges with an MS4 permit is a percent reduction in TN of 40%. These reductions are needed from nonpoint sources in the Alligator Creek watershed for the creek to achieve standards for nutrients and DO. It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, February 2001), an implicit MOS was used in the development of this TMDL. An MOS was included in the TMDL by establishing the reductions based on the maximum annual average concentrations of TN, CChl a, and BOD_5.

6.5 Evaluating Effects of the TMDL on DO

Alligator Creek is expected to attain water quality standards for both nutrients and DO following the implementation of the TMDL for nutrients because the TMDL will require average reductions in the creek watershed of 40% percent in TN loadings. Observing the Referenced waterbodies in the region with TN concentrations at target level, this level is consistent with median DO levels of 7.5 mg/L and Chl-a levels of 2.5 ug/L (Table 3.4 and Figures 3.2 and 3.3). The nutrient reductions will result in an annual average reduction in CChl a in Alligator Lake of 37% (from 18.64 ug/L to 11.8 μg/L). These reductions will significantly improve overall water quality in the watershed, including DO levels. These reductions will have a positive effect on reducing the diurnal fluctuations in DO and will improve the DO levels of water in the lake. These reductions in algal biomass (averaging 37 percent) will reduce the DO fluctuations and the BOD that results from the breakdown of the algal cells in the lake by a relative amount. As the total BOD is composed of both a carbonaceous fraction and a nitrogenous fraction, additional reductions in BOD will occur as a result of reducing the mass of TN entering the lake.

6.6 Evaluating Effects of the TMDL on BOD

The elevated BOD_5 measured in Alligator Lake is contributing to the low DO. These values could in part be related to the occasionally high Chl a concentrations measured in the system. Once the external sources of BOD and nutrients from stormwater contributions into the system are reduced through the implementation of the TMDL, it is expected that the BOD concentrations should fall below 2.00 mg/L on an annual average and the lake will attain water quality standards for nutrients and DO.

Chapter 7: TMDL IMPLEMENTATION

Following the adoption of this TMDL by rule, the Department will determine the best course of action regarding its implementation. Basin Management Action Plans are the primarily mechanism through which TMDLs are implemented in Florida (see Subsection 403.067[7] F.S.). However, other Department-initiated options are available including a decision document and direct NPDES permit modifications. These options are described below. The Department also has the discretion to defer TMDL implementation to a later date if insufficient resources are available to develop an appropriate implementation plan. In some instances where the Department has deferred action, local agencies may work together to develop local implementation plans to meet the TMDL. Such plans should be developed in close consultation with the Department.

7.1 NPDES Permit Modifications

In a case where TMDL requirements are applicable to permitted sources only, the Department may opt to implement the TMDL solely through NPDES permit requirements. This may include modifications to municipal stormwater, domestic wastewater, or industrial wastewater permits. Because of the extent to which nonpoint non-permitted sources (such as agriculture) affect water resources in Florida, this option is unlikely to be used often.

7.2 Decision Document

Absent the need for pollutant reductions to be allocated to specific stakeholders, a decision document may be developed. This implementation approach is applicable if sufficient projects and restoration efforts are ongoing that target the TMDL pollutant of concern such that no additional efforts would be expected of the local stakeholders. This implementation approach documents stakeholder implementation efforts and identifies the expected benefits of such, relative to the TMDL. Developing a decision document instead of a BMAP is appropriate where the universe of projects being implemented is extensive enough that the resources needed for BMAP development would not result in significant additional projects being implemented. No formal action is required of the Department to adopt a decision document.

7.3 Basin Management Action Plan

Basin Management Action Plans (BMAPs) are the most comprehensive approach to TMDL implementation. BMAPs are developed through collaborative processes with the cooperation of local stakeholders and are applicable where multiple sources are affecting a waterbody. Goals of this process are to reach consensus on the scientific foundation, whether or not detailed allocations are necessary and viable, if needed, how detailed allocations will be calculated, and how load reductions will be accomplished.

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 benefitted other program areas. If the Department chooses to move forward with a BMAP, it 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.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

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

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.

Appendix B Public Comments for Alligator Lake and FDEP Responses

Please contact Douglas Gilbert (see contacts in front of document) for copies of the actual letter. Below are questions and concerns made by Pinellas County with FDEP responses.

Susan C. Moore
Maintenance Environmental Coordinator
Florida Department of Transportation
11201 N. McKinley Drive, MS 1200
Tampa, FL 33612

Dear Ms. Moore:

Thank you for your time and effort in reviewing the TMDLs that the Department recently proposed for impaired waters in the Tampa Bay basin. We appreciate your detailed review and the well thought-out questions that you presented in your comments.

In the order in which they were presented, what follows are the comments from FDOT District 7and our responses (shown in blue).

GENERAL COMMENTS

The following comments relate to multiple TMDLs where specific comments are provided below for each of the TMDL documents.

1. The figures that show the WBIDs and also identify the "FDOT Local Roads" are not an accurate depiction of the roadways that FDOT is responsible for. Please isolate out those roads that are part of FDOT's responsibility from those controlled by the Cities and Counties. In the alternative, simply identify roads as "Local Roads" in the legend.

   Response: Footnote will be added to all such figures to note that roads are for illustration purposes only and are not meant to be an accurate depiction of roadways for which FDOT is responsible.

2. The load reductions determined for the non-point sources, which include the WLA for the stormwater (under the MS4 permit) and the LA, have not been allocated but simply applied evenly between the WLA for Stormwater and the LA. Sufficient studies have not been completed to determine if an even distribution of the load reductions is justified, therefore some language acknowledging this should be put into both the TMDL documents and ultimately the rules to allow the ability to finalize (and therefore change the assigned reductions) under the BMAP. The concern exists that once the $WLA_{stormwater}$ percent reductions are put into the adopted TMDL document and the rule, the language in the MS4 permits would tie those reductions to the permit, and to not implement those reductions may put the permittees in violation. This also provides opportunities for third parties to challenge. [This comment applies to all TMDLs reviewed in which there was an WLA-MS4 allocation specified.]

Response: In 2001, the Department submitted to the Governor and Legislature a document outlining the intended process for the allocation of loads under the TMDL Program. One key provision of the proposal was to level the "playing field," such that once stakeholders had the opportunity to meet and discuss what steps needed to be taken and to get appropriate credit for those initiatives already completed, the specific allocations will be set by the agreements reached under the Basin Management Action Plan (BMAP). This process has been successfully used in several adopted BMAPs and has demonstrated the flexibility that remains after setting the initial reductions for stormwater-related allocations (LA and WLA_{sw}) at identical levels.

The laws of Florida form the underlying basis for the initial equal allocations. In particular, Section 403.067(6)(b) of Florida Statutes, states in part that:

"Allocations may also be made to individual basins and sources or as a whole to all basins and sources or categories of sources of inflow to the water body or water body segments. An initial allocation of allowable pollutant loads among point and nonpoint sources may be developed as part of the total maximum daily load. However, in such cases, the detailed allocation to specific point sources and specific categories of nonpoint sources shall be established in the basin management action plan…"

Additionally, each of the draft TMDL reports contains language in the NPDES Stormwater Discharges section in chapter 6 of the reports (repeated below) to address the issue of allocation between the WLA for stormwater and the LA portions of the TMDL.

"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."

3.In some of the TMDLs within the Source Assessment Chapter (Chapter 4), tables are provided for the calculation of loads to the system. These loads are not utilized within the TMDL but rather for information purposes on the potential contribution of various land use types. While the total load assigned to Highways was generally zero based upon zero area being assigned to that category, the EMC values listed in the table appear high. This will be important when the time comes for development of the allocation distribution. Between December 2004 and October 2007 roadway runoff water quality data were collected by Johnson Engineering for FDOT District 1 at four locations within District 1. Ten events were sampled for each of the four locations, with samples collected at both the inflows and outflows of existing stormwater treatment ponds. All collection, transfer, and handling procedures were conducted in accordance with FDEP Standard Operating Procedures, and samples were analyzed by certified labs. Average values for TN and TP at the pond inflows were determined to be 1.17 mg/l and 0.158 mg/l, respectively. [It is perhaps noteworthy to observe that the highest average TN and TP values were measured at the first site sampled (i.e., samples collected between December 2004 and November 2005) which is also the site with the lowest percentage of impervious area.] Given the changes to roadway management practices that FDOT has undertaken over the past several years and the rigorous quality control used in these studies compared with the older studies, we believe that the numbers presented by Johnson Engineering are more representative than some of the standard EMC values being utilized. [This comment applies to all nutrient and DO TMDL documents reviewed where loading tables were provided].

Response: A copy of the Johnson Engineering Study report was not included with the comments we received. If FDOT could provide the report to Mr. Eric Livingston (Bureau Chief for the Bureau of

Watershed Restoration), it will be reviewed for incorporation into the stormwater database and use in estimation of transportation event mean concentrations (EMCs).

SPECIFIC COMMENTS

The following are specific comments that relate to the individual TMDL documents reviewed.

TAMPA BAY BASIN

Alligator Creek and Alligator Lake (WBIDs 1574 and 1574A): DO and DO/Nutrients

1. The determination of the 47.5 TSI as the historical value was not adequately documented in the TMDL document. This provided the basis for the ultimate TSI target determined as 10 above that value with a 5 TSI set aside. Please provide documentation on how the 47.5 TSI background was determined.

Response: The TSI refers to the trophic state index for lakes, which is based on lake chlorophyll a, Total Nitrogen, and Total Phosphorus levels; individual TSI values are calculated following the procedures outlined on pages 86 and 87 of the State's 1996 305(b) report, which are incorporated by reference into Rule 62-303, FAC. The specific calculation methodology for TSI has been included in the draft report.

The historic minimum TSI value for Alligator Lake was determined by first calculating the individual TSIs as described above for the entire period of record. Within each year, seasonal mean TSIs are calculated; the annual average TSI is calculated as the average of the seasonal mean TSI values, subject to certain data sufficiency requirements as described in 62-303.350 (2)(a): Data must meet the requirements of paragraphs (2)-(4), (7), and (8) in Rule 62-303.320, FAC.

Calculations of the annual average TSI values were performed according to the following: 62-303.350 (2)(b): At least one sample from each season shall be required in any given year to calculate a Trophic State Indix (TSI) or an annual mean chlorophyll a value for that year (for the purposes of this chapter, the four seasons shall be January 1 through March 31, April 1 through June 30, July 1 through September 30, October 1 through December 31), and 62-303.350 (2)(c): If there are multiple chlorophyll a or TSI values within a season, the average value for that season shall be calculated from the individual values and the four quarterly values shall be averaged to calculate the annual mean for that calendar year

Using data for all years for which data sufficiency was met with which to calculate an annual average, a five-year historic minimum was calculated subject to 62-303.350 (3): When comparing changes in chlorophyll a or TSI values to historic levels, historical levels shall be based on the lowest five-year average for the period of record. To calculate a five-year average, there must be annual means from at least three years of the five-year period.

For Alligator Lake, the five-year period resulting in the minimum five-year annual average to be used as the historic minimum value for TSI of 47.5 was the five year period of 1994–1998.

August 14, 2009

Ms. Kelli Hammer Levy
Division Director
Watershed Management Division

Pinellas County Department of Environmental Management
300 S. Garden Ave.
Clearwater, FL 33756

Subject: Comments on the draft TMDLs for:

- Alligator Creek (WBID 1574) and Alligator Lake (1574A) – Dissolved Oxygen (DO) and Nutrients
- Cross Canal North Tidal (WBID 1625) – DO and Allen's Creek Tidal (WBID 1604) - DO and Nutrients
- Moccasin Creek Tidal (WBID 1530) and Lake Tarpon Canal (WBID 1541A and 1541B) – DO and Nutrients
- Bishop Creek Tidal (WBID 1569) – DO and Mullet Creek Tidal (WBID 1575) – DO and Nutrient
- Bishop Creek Tidal and Bishop Creek (WBIDs 1569 and 1569A) – Fecal Coliforms
- Double Branch (WBID 1513) – DO and Nutrient

Dear Ms. Levy:

The Department has reviewed the County's comments, in the July 20, 2009 letter, on the proposed June 2009 dissolved oxygen, nutrient, and fecal coliform bacteria TMDLs in the Tampa Bay Basin. We appreciate the time and effort you and your staff put into reviewing these draft TMDLs. We have made edits to the draft reports and in some cases revisions to the TMDLs as a result of your comments. By all working together in this way, the final TMDLs will be improved. The following are our responses to the comments in the order presented in your letter.

Alligator Creek (WBID 1574) and Alligator Lake (WBID 1574A) – DO and Nutrients

1. Alligator Lake is listed for DO impairment on the May 14, 2009 Verified List with Total Phosphorus listed as the causative pollutant, yet the TMDL is for Total Nitrogen (TN). Please provide additional information on this decision.

Response: The linkage to TP on the verified list was a result of TP exceeding the listing threshold concentration. However, our review of the data during the development of the TMDL revealed that the lake is nitrogen limited. The nutrient TMDL was established by reducing the annual average Trophic State Index (TSI) using the calculation methodology for TSI incorporated by reference in Rule 62-303, Florida Administrative Code (FAC). This methodology establishes the TSI based on the average of a nutrient-TSI and a Chla-TSI. The calculation of the nutrient-TSI is based on the relationship between TN and TP. If the lake is nitrogen limited (ratio of TN/TP; less than 10, as it is in Alligator Lake) TP is not included in the calculation of the nutrient-TSI. However, if during the development of a Basin Management Action Plan (BMAP) for Alligator Creek and Alligator Lake it is decided by the local stakeholders that the lake should be either co-limited for both nitrogen and phosphorus or phosphorus limited, a TMDL for TP could be developed.

Examples:

These are just some examples of TP reductions required to have Alligator Lake co-limited or phosphorus limited. The target TSI is a TSI less than 52.5.

A. If TN in the lake is at the TN concentration proposed for the creek in the original draft TMDL report of 0.86 mg/L (current verified period annual average for the lake is 0.88 mg/L) and somehow only TP is reduced to make the ratio of TN/TP = 20.0 (mid-range of co-limitation) the TP would need to be 0.043 mg/L (TN/TP ratio = 20 and TSI = 52.3). This would require a 72 percent reduction in TP from the verified period annual average of 0.154 mg/L.

B. Same scenario except target for lake is TP limitation. TP would need to be reduced to 0.025 mg/L, resulting in a TSI of 52.2. This would require an 84 percent reduction in TP.

To achieve the target TSI of less than 52.5 by keeping the lake TN limited would require a TN concentration of 0.72 mg/L (concentration in current draft report of 0.83 mg/L was a mistake in that the TSI was only reduced to 55 instead of the target of 52.5).

If the TN concentration in the lake is reduced as reductions in TP occur, then the TP concentration required to meet a TSI of less than 52.5 goes down (in order to maintain the same ratio in TN to TP) and the percent reductions go up over the scenarios presented above.

2. Section 2.2, page 6, states that Alligator Lake is a small lake with high elevation, which is the reason for low DO in winter months. The citation listed for Guenther and Hubert is a study of small Wyoming reservoirs and not applicable to a coastal lake in Florida. Alligator Lake is an impounded marine embayment, 72 acres and less than 10 feet above sea level. Also, monthly mean DO values for Alligator Lake are inconsistent with IWR 35 data. Lowest averages occur during summer months. Please revise the associated table and graph as shown below.

Response: Revisions to the TMDL report have been made.

3. Section 3.4 and section 5.1 state the approach for developing the DO TMDL in the lake is to address the nutrient reductions necessary to restore the lake and to reduce the BOD5 to the levels recorded in 1997 and 1998, where BOD5 (1.34mg/L) and Chla (4.5ug/L) were at period record lows. Was the BOD5 period low associated (i.e. same month and year) with the Chl-a low? Also, 1997 was classified as a strong El Niño year and 1998 a moderate La Niña year according to the Oceanic Nino index (http://ggweather.com/enso/oni.htm). This resulted in heavier than usual rainfall for those years where the normal average is 52 inches per year based on SWFWMD data. These atypical BOD5 and Chla results were artifacts of the heavy rainfall reducing the residence time of the lake. The average rainfall for the 1997-1998 period was 66.5 inches. The graph below clearly shows the low chlorophyll grouping in 1997-1998.

Response: The Department appreciates this information. The final Chla target was based on achieving a Chla-TSI of less than 52.5. Based on the TSI calculation methodology, a Chla of 11.8 ug/L results in a Chla-TSI of 52.3. The referenced number of 4.5 ug/L was not used to develop the final TMDL. The TMDL report will be modified to reflect your information and to clarify how the final recommend Chla concentration was developed. The Department has revised the recommended BOD5 TMDL from 1.34 mg/L to 2.00 mg/L as recommended and the percent reduction has been recalculated.

4.Section 3.2.1 – The applicable Freshwater criterion for DO from the State Water Quality Standards is as follows:"Shall not be less than 5.0. Normal daily and seasonal fluctuations above these levels shall be maintained." This document states the DO shall not be less than 4mg/L.

Response: The Department appreciates this information. The language for the marine DO criterion was inadvertently placed into the report and the correct language has been inserted. At no time was the marine criterion used to either establish the impairment in Alligator Lake or to develop the draft TMDL.

5.Section 3.5, page 11 – Which 5-year period was used to calculate the historic TSI? How do 5 TSI units equal the assimilative capacity of the lake, allocations for future growth, and the Margin of Safety (MOS)? A TSI increase of 10 points is equivalent to a doubling in Chla. Consequently a 5 point increase in TSI would represent a 50% increase in chla. A 5 point margin of safety is not warranted according to the Chl-a graph above.

Response: The period used to calculate the annual average historic minimum TSI of 47.5 was the five year period of 1994 – 1998. The MOS does not have a 5 TSI unit allocation. The individual allocations for assimilative capacity, future growth, and MOS have not been separated at this time. The total allowable assimilative capacity is the 10 TSI unit increase over the historic TSI target of 47.5. As such, any years with a TSI over 57.5 would be considered as exceeding the allowable assimilative capacity. There were multiple years during the verified period that exceeded a TSI of 57.5 and the lake was listed as impaired for historic TSI. In order to restore sufficient assimilative capacity that would allow some room for future growth, account for uncertainty, and provide for a MOS, the Department has been establishing a 5 TSI unit reduction (50%) of the total allowable assimilative capacity as the target for lake restorations. As stated above, this 50% reduction in Chla below the threshold for impairment restores 50% of the assimilative capacity, allows for future growth and includes an implicit MOS. If in this case, the local stakeholders believe that only restoring 50% of this historic assimilative capacity is insufficient to account for all of these factors, the Department would be willing to establish the restoration target at a TSI below 52.5.

6.Section 3.6, page 11 and Section 5.1, page 23 – The Department states that the percent reduction for TN and Chl-a concentrations were calculated based on the highest annual mean concentration for the verified period. What is the basis for using the highest mean concentration versus the median value over the verified period? The median TN value for the year 2000 is 0.92mg/L which shows that a small number of points have a significant impact on the mean. The long term median would be more representative of exiting conditions. Overall, there is inconsistency when using mean and median values which change from TMDL document to TMDL document.

Response: As the lake is impaired for both TSI and low DO, and the Department has linked nutrients to both of the impairments, the final nutrient TMDL must address both impairments. Using the maximum verified period annual means was an approach used to provide additional MOS to account for the uncertainty that achieving a TSI of 52.5 would restore both the historic trophic state and result in meeting standards for DO. However, the Department agrees that consistency is important and has revised the concentrations that are reduced to be the average concentration over the verified period instead of the worst-case year. This resulted in changing the 1.08 mg/L TN value to 0.88 mg/L. The percent reduction changed from 24 percent to 19 percent.

7. Table 3.1, and 3.2, pages 12 through 15 – The methodology includes selecting sites with a Landscape Development Intensity Index (LDI) score of 2 or below. The documentation provided for the LDI indicates that it is a project that is still being researched and tested. Why is this methodology being employed to develop TMDLs? LDI scores of 1-2, as proposed, are located in areas without urban development – natural lands such as forests, recreational open space, and other natural lands. It is not clear what sites are included in each method for the reference targets. Please provide information on the reference site locations.

Response: Please note that the *LDI-based* reference method was not used in the direct determination of the Alligator Creek TMDL, but was utilized for comparative purposes with the method that was used. The reference method based on Department Assessments of "Impaired" vs. "Not-Impaired" provided more conservative TN target concentrations and should provide stakeholders a greater level of confidence. The Department-Assessment based reference sites for Tampa Bay Group 1 include Direct Runoff to Bay (WBIDs 1603, 1609, and 1676), Big Bayou – Basin W (WBID 1709), Hillsborough Bay-Lower (WBID 1558D), Hillsborough Bay-Upper (WBID 1558E), Papy's Bayou (WBID 1661G), Frenchmen's Creek (WBID 1709), and Bishop's Harbor (WBID 1797B).

8. Method 2 provides equal weight to each sample, which does not account for any seasonal variability. Method 4 does not specify if all 4 samples were collected in different seasons. There appears to be no relationship between tables 3.1 and 3.2. The numbers presented in the tables do not correspond to one another. Additionally, using method 2 results in an arbitrary TN concentration that is not linked to a TN load. What is the assimilative capacity of the lake? Without understanding the assimilative capacity of the lake and the loadings to the lake, a TMDL cannot be developed. There is a long term USGS gage on the main channel of the creek, water quality data for both the creek and the lake, and long term lake level data that can be used for such assessments.

Response: Although there was no requirement for a minimum number of samples for each season, one observation was that the samples were generally spaced throughout the year to capture monthly variations, whether there were 6 samples during a given year or 30+ samples during a given year. The Department agrees that, if at all possible, it is preferable to observe and incorporate seasonal variation into the target determination process.

The Department believes that the best way to move forward in restoring water quality in Alligator Creek is to establish the concentration-based TMDL and to calculate the source-specific allowable loads to the waterbody during the BMAP development process. The Tampa Bay Nitrogen Management Consortium is scheduled to submit to the Department a draft update of the Reasonable Assurance (RA) Plan for Tampa Bay by September 25, 2009. The RA plan will provide load allocations to individual entities discharging to the bay, which have not yet been completed. Up until this time, the total nitrogen loadings to Tampa Bay have been calculated and evaluated for each of the major bay segments, as these are the assessment units used for tracking progress in meeting the resource-based water quality targets. Preferably, the calculation of allowable loads to the smaller impaired water segments for which TMDLs have been developed, like Alligator Creek, would also be viewed for consistency at a larger scale, which would be completed after the review and approval of the updated RA plan, to ensure that consistent flow estimates and other assumptions are used in both processes.

9. TN and Chla references chosen by the Department were based on average station medians, but the concentrations previously chosen to reduce from (see paragraph above) were annual means. Please explain the variability with regard to using mean versus median.

Response: The annual "median", which is less susceptible to influence by an outlier or uncharacteristic high or low values, was used to characterize a given station. Although a minimum of 4 samples had to be collected per year to assign a WBID station median, most stations included had over 15 samples. Once we have determined the median concentration of a parameter for a given station, we have hopefully mitigated the effect of extreme values for that station. The goal at this point was to provide equal weight to all stations when calculating an "average median value" for a year. Thus the average median value was calculated as a straight arithmetic average, with no attempt to remove the impact of "extreme stations". In fact, at this point, high concentration stations were treated as "hot spots".

10. Table 3.2 presents Chla values in mg/L. The correct unit of measure should be ug/L.

Response: The draft report included the noted error and the TMDL document has been corrected.

11. Section 4.2.1 refers to appendix C. No Total Nitrogen data are presented.

Response: The draft TMDL report included a reference to an Appendix C. This reference has been removed.

12. Table and Figure 4.1 – These facilities are not addressed in the load allocation.

Response: If a facility does not directly discharge into the surface water being assessed, no wasteload allocation is determined. It is the understanding of the Department that the listed facilities do not discharge into either Alligator Creek or Alligator Lake.

13. Runoff tables in Chapter 4 states that forests are 27%, wetlands are 9.8% and water is 3.8% impervious. Please explain. Effective rainfall is 55.95" but the average precipitation is 49.43." Please explain. Please clarify if the two right-hand columns present annual data.

Response: The notation at the end of Table 4.4 referring to an effective rainfall of 55.95 inches per year was an error and has been removed from the document. The impervious percentages were a hold-over from a previous table and have been corrected with impervious percentages that match the landuse.

14. Table 4.5 uses EMCs to calculate TN and TP loadings. Why were available flow and concentration data not used to calculate these loadings? Are the loadings based on actual rainfall data (available through SWFWMD)? These tables can be used as part of a larger study to target areas for further evaluation for source controls, but are not a demonstration of pollution. What was the purpose of this evaluation since the information was not used in the development of the TMDL? Additionally, there is an approved watershed plan for Alligator Creek including a water quantity and quality model.

Response: The EMC data were used in Table 4.5 in an attempt to illustrate the relative contributions from the different land uses. As you noted, it was not used in determining the TMDL. The rainfall is based on gage data from local Tampa Bay stations available on the SWFWMD web site.

15. Section 5.1. See previous comments related to development of an assimilative capacity and for estimating loads. 2nd paragraph – please revise paragraph.

Response: The Department believes that the best way to move forward in restoring water quality in both Alligator Creek and Alligator Lake is to establish a concentration-based TMDL based on achieving an annual average trophic state of 52.5 in Alligator Lake and to calculate the source-specific allowable loads to the waterbody during the BMAP development process. The Tampa Bay Nitrogen Management Consortium is scheduled to submit to the Department a draft update of the Reasonable Assurance (RA) Plan for Tampa Bay by September 25, 2009. The RA plan will provide load allocations to individual entities discharging to the bay, which have not yet been completed. Up until this time, the total nitrogen loadings to Tampa Bay have been calculated and evaluated for each of the major bay segments, as these are the assessment units used for tracking progress in meeting the resource-based water quality targets. Preferably, the calculation of allowable loads to the smaller impaired water segments for which TMDLs have been developed, like Alligator Creek and Alligator Lake, would also be viewed for consistency at a larger scale, which would be completed after the review and approval of the updated RA plan, to ensure that consistent flow estimates and other assumptions are used in both processes. The draft TMDL document has been revised to reflect this information.

16. Section 5.1.1, page 24. Comparing an average BOD to a median BOD reference is a valid assessment. The paragraph states that an equal weight was given to each sample which does not account for seasonal variability. Also table 3.2 shows a reference BOD median target of 1.63mg/L, not 1.67mg/L. Note that the laboratory Minimum Detection Limit (MDL) is 2.0mg/L.

Response: This TMDL document no longer has a BOD target. The points that you raise in the above comment provide part of the reason and the BOD data is currently being reviewed.

17. Section 5.1, page 24, states that the reference approach will be used to calculate a creek target BOD5. The target proposed is 1.67mg/L, while table 3.1 shows a reference BOD target of 1.63 for non-impaired freshwater Tampa Bay Tributaries. Table 5.2 shows a BOD TMDL for the lake of 1.35mg/L but the lowest annual mean shown in 5.1 is 1.34mg/L. Which are the correct values for the lake and the creek? In any case, the targets are well below the 2.0mg/L MDL for BOD. Also the non-impaired reference BOD concentration found in table 3.2 is 2.5mg/L in freshwater creeks and 3.24mg/L in lakes. Please note that the Lake Tarpon Canal and Moccasin Creek Tidal Draft TMDL document mentions the laboratory detection limit of 2.0mg/L and accepts this BOD value.

Response: This TMDL document no longer has a BOD target. The points that you raise in the above comment provide part of the reason and the BOD data is currently being reviewed.

18. Table 5.2 also shows a lake target Chla value of 11.8ug/L. Please explain this number as well as the equation used to determine the percent reduction. What are the observed values? If TSI is met for the lake, TN and Chla targets should not be considered.

Response: See also the responses to comments 1, 3, 5, and 6 for additional details. The Department has since Group 1, Cycle 1, been using a 5 TSI unit reduction from the threshold of impairment to establish the restoration target for lakes that are impaired for TSI. In this case, the impairment threshold was a TSI of 57.5; a 5 TSI unit reduction establishes a restoration target TSI of less than 52.5. The TSI calculation methodology is based on calculating the average of a nutrient-TSI and a Chla-TSI. A chlorophyll a concentration of 11.8 ug/L is equivalent to a Chla-TSI of 52.3.

Percent reduction is calculated as:

((number to reduce from – TMDL)/number to reduce from) * 100

The report will be modified to include this equation and a table of the numbers used.

Any given TSI can be achieved with a range of nutrient and Chla concentrations. If the desired TSI is not linked to the desired nutrient and Chla concentrations the TSI value might be met, but undesirable conditions could exist in the lake. For example, Florida has impaired lakes that have TSI's below the threshold, but there is an imbalance in the flora and fauna of the lake and it is not meeting designated uses due to either a dominance of blue-green nitrogen fixers, excessive macrophytes causing light limitation, application of herbicides keeping the Chla at very low levels such that the nutrient-TSI is high, but the Chla-TSI is low (and the average of the two meets the threshold), or some combination of factors. To avoid situations such as these, the Department is publishing the concentrations of nutrients and Chla that result in the desired TSI.

19. Section 5.1.2 compares TN concentrations from the same day for Alligator Creek and Alligator Lake. This is not appropriate as it doesn't take into account loading, residence time, or nutrient assimilation in the lake. What ratios are being used for the comparison of the creek versus the lake?

Response: The Department used the ratios to simply determine (over time) if the concentration of TN in the lake was consistently less than the concentration in the creek. As these concentrations over-time are a reflection of the end-points of the loading, residence times, and nutrient assimilation of each water body, the Department used them to determine if it was reasonable to establish a higher nutrient TMDL for the creek than for the lake. As a result of these comments and the County's request to be consistent with other TMDLs, the Department has established the same TN concentration (0.72 mg/L) for the creek as required to restore the downstream lake.

20. Page 26 - The Department states there are not enough BOD data to use the ratio approach but still applies this method to determine target lake BOD concentrations. As stated it is not an acceptable method due to the lack of data.

Response: The Department has removed the BOD TMDL for the creek as not necessary and modified the BOD TMDL for the lake to be 2.00 mg/L as suggested by the County.

21. The entire analysis is based on concentrations when loadings should be the focus as stated on page 28 in the load allocation. No loads were presented, nor was an assimilative capacity determined.

Response: As stated in response to comment 5 above, specific allocations of the assimilative capacity have not been made at this time. The specific allocations will be established as a part of the BMAP process. As pointed out in the draft document, TMDLs do not need to be expressed as loads. TMDLs can be and have been adopted as concentrations in Florida.

22. Page 29 - Please clarify the reference to Appendix A. Also please explain how a reduction in TN concentration (since no loads were calculated) would result in a DO concentration that matches targets.

Response: What was previously Appendix A has been removed and now Appendix A correctly refers to Background Information on Federal and State Stormwater Program. The Department believes that the best way to move forward in restoring water quality in Alligator Lake and Alligator Creek is to establish the concentration-based TMDL and to calculate the source-specific allowable loads to the waterbody during the BMAP development process. The Tampa Bay Nitrogen Management Consortium is scheduled to submit to the Department a draft update of the Reasonable Assurance (RA) Plan for Tampa Bay by September 25, 2009. The RA plan will provide load allocations to individual entities discharging to the bay, which have not yet been completed. Up until this time, the total nitrogen loadings to Tampa Bay have been calculated and evaluated for each of the major bay segments, as these are the assessment units used for tracking progress in meeting the resource-based water quality targets. Preferably, the calculation of allowable loads to the smaller impaired water segments for which TMDLs have been developed, like Alligator Lake and Alligator Creek, would also be viewed for consistency at a larger scale, which would be completed after the review and approval of the updated RA plan, to ensure that consistent flow estimates and other assumptions are used in both processes.

23. Page 30 – The BOD TMDL was improperly established. Please refer to the comment made above for page 26. Under Section 6.5 states that there will be a 28.6% reduction in TN loadings and 16.5% BOD loading reduction for Alligator Creek. No loadings were established.

Response: The BOD target and associated TMDL have been eliminated and this reference to BOD has been removed. As pointed out in the draft document, TMDLs do not need to be expressed as loads. TMDLs can be and have been adopted as concentrations in Florida.

24. There are 5 layers of Margin of Safety (MOS) employed in the determination of this TMDL:

- Restore numbers to period of record lows – which were atypical El Nino and La Nina years

- IWR TSI target is 60. Historical Alligator Lake TSI is 47.5. IWR allows for a 10 point increase over period of record, which would give us a 57.5 target TSI. For MOS, Department arbitrarily picked 52.5 as target TSI for Alligator Lake
- Reference method used is the most conservative
- Percent reduction is based on achieving the 52.5 TSI and the worst case scenario years.
- While calculations show that Alligator Lake can handle an input of 1.10mg/L TN coming in from Alligator Creek, a margin of safety was used – the Department reverted back to the reference table value for freshwater creeks TN (which is incorrectly listed as 0.86mg/L and should read 0.97mg/L)

While Pinellas County understands the need for a margin of safety to ensure future compliance, using excessive margins of safety will result in percent reduction numbers that are not representative of actual conditions, but also cost-prohibitive and unattainable. Please see graph below which shows the Alligator Lake TSI has been improving over the verified period.

Response: The reference TN was determined three ways, with the most conservative value of TN selected (0.97 was one of the least conservative). It is correct that this approach provides a margin of safety to the TMDL, but conservative decision making provides added assurance that the load reductions will have desired impact.

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