FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration,

Bureau of Watershed Restoration

SOUTHWEST DISTRICT • TAMPA BAY TRIBUTARIES BASIN

TMDL Report
Dissolved Oxygen and Nutrient TMDL for the Alafia River Above Hillsborough Bay- Tidal Segment (WBID 1621G)

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Acknowledgments

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Basin Status Report for the Tampa Bay Tributaries Basin

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for dissolved oxygen and nutrients for the Alafia River Above Hillsborough Bay (WBID 1621G) water segment located in the Tampa Bay Tributaries Group 2 Basin – Alafia River Planning Unit **(Figure 1.1)**. This water segment is the marine tidal segment of the river, tributary to Hillsborough Bay, and will be referred to in this TMDL report as the Alafia River tidal segment. This reach of the river was verified impaired for dissolved oxygen and nutrients (based on elevated chlorophyll-a), and was included on the Verified List of impaired waters for the Tampa Bay Tributaries Group 2 Basin that was adopted by Secretarial Order in May 2004. The TMDL establishes the allowable loadings to the Alafia River Tidal Segment (WBID 1621G) that would restore the waterbody so that it meets its applicable water quality criterion for dissolved oxygen and nutrients.

1.2 Identification of Waterbody

To provide a smaller-scale geographic basis for assessing, reporting, and documenting water quality improvement projects, FDEP divides basin groups into smaller areas called planning units. Planning units help organize information and management strategies around prominent sub-basin characteristics and drainage features. To the extent possible, planning units were chosen to reflect sub-basins that had previously been defined by the Southwest Florida Water Management District (SWFWMD). The tidal segment of the Alafia River is located within the Alafia River Planning Unit. For assessment purposes, the Department has divided the Alafia River Planning Unit into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each water segment. The estuary of the Alafia River is identified as WBID 1621G (**Figure 1.1**).

1.2.1 Alafia River Tidal Segment (WBID 1621G)

The Alafia River Tidal Segment is approximately 7.5 miles long and extends from the river's confluence with Buckhorn Creek downstream to the mouth of the river, **Figure 1.2**. This river reach is located in the south central area of Hillsborough County. The watershed area flowing directly to this segment, comprises about 5,504 acres (8.6 square miles). The predominant landuses are approximately 3,228 acres of urban and built-up, 825 acres of water, and 478 acres of agriculture. Rice Creek flows into the estuarine reach of the river approximately 5.6 miles upstream from the river mouth and Buckhorn Creek enters the river at the upper end of the tidal segment. Baseflow in Buckhorn Creek is supplemented by ground water discharge from Buckhorn Springs, which provides significant flow to the lower river in the dry season (SWFWMD, 2008). Upstream of the tidal segment, the river receives flow from Bell Creek, Fishhawk Creek, Little Fishhawk Creek, and Lithia Springs all of which are located below the USGS flow gaging station at State Highway 640, 16 miles upstream from the river mouth.

The area near the river mouth has been extensively modified by dredge and fill activities that were completed by the 1930s (Fehring,1985). A deep-water channel was dredged from the main ship channel in Tampa Bay through uplands north of the river mouth to intersect the river channel some distance upstream (Stoker et al., 1996). This channel was dredged to provide access to the still active fertilizer processing plant near the river mouth downstream of US Highway 41. The facility includes a major docking site for the shipping of fertilizer. The former river mouth, south of the existing channel was partially filled with the excavated material as part of the construction of the barge channel and its' turning basin. Over the years, sediment from a spoil area has accumulated in the historic river mouth, reducing the former river mouth to a small tidal creek with little or no connection to the river (SWFWMD, 2008).

The Alafia River is a tributary to Hillsborough Bay and a large portion of the watershed is located in Hillsborough County, with the headwaters extending into Polk County. The Alafia is the second largest river watershed that contributes flow to Tampa Bay, encompassing about 19 percent of the total watershed area of the bay. The river flows in a westerly direction and has two major tributaries, the North Prong and South Prong, that join near Alderman's Ford to form the main stem of the river. The river's total watershed area drains 422 square miles.

The climate of the Alafia River watershed, is sub-tropical with annual rainfall averaging approximately 44.9 inches, although rainfall amounts can vary greatly from year to year (CLIMOD, 2009). Based on data from a 30-year period (1971 – 2000), the average summer temperature is 89.9^{o}F, and the average winter temperature is 72.8^{o}F (CLIMOD, 2009). The topography of the lower Alafia River watershed reflects its location within the Southwestern Florida Flatwoods or Southwestern Coastal Plains ecoregion. Elevations range in the western part of the watershed from around 5 – 10 feet above sea level, and in the eastern part of the watershed around 35 – 40 feet above sea level (FDEP, 2008). This watershed had three predominant soil types. Downstream the soil type is shelly sand and clay. In the middle of the watershed the soil type is sandy clay and clay. In the upstream portion of the watershed, the soil type is medium fine sand and silt (FDEP, 2008). Population centers in the watershed include the areas of Gibsonton and Riverview.

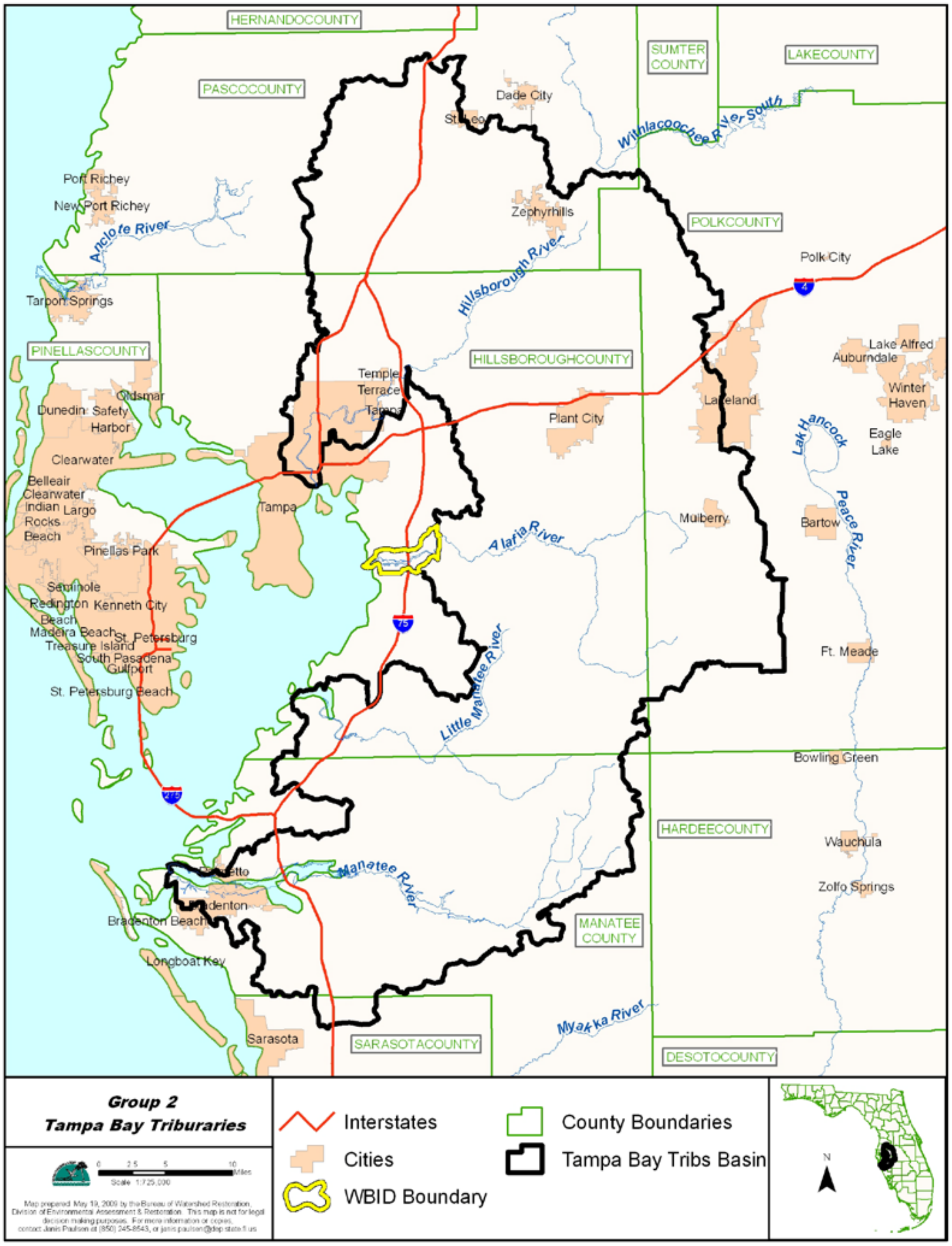

Figure 1.1 Location of the Alafia River Tidal Segment (WBID 1621G) with Major Geopolitical Features in the Tampa Bay Tributaries Group 2 Basin

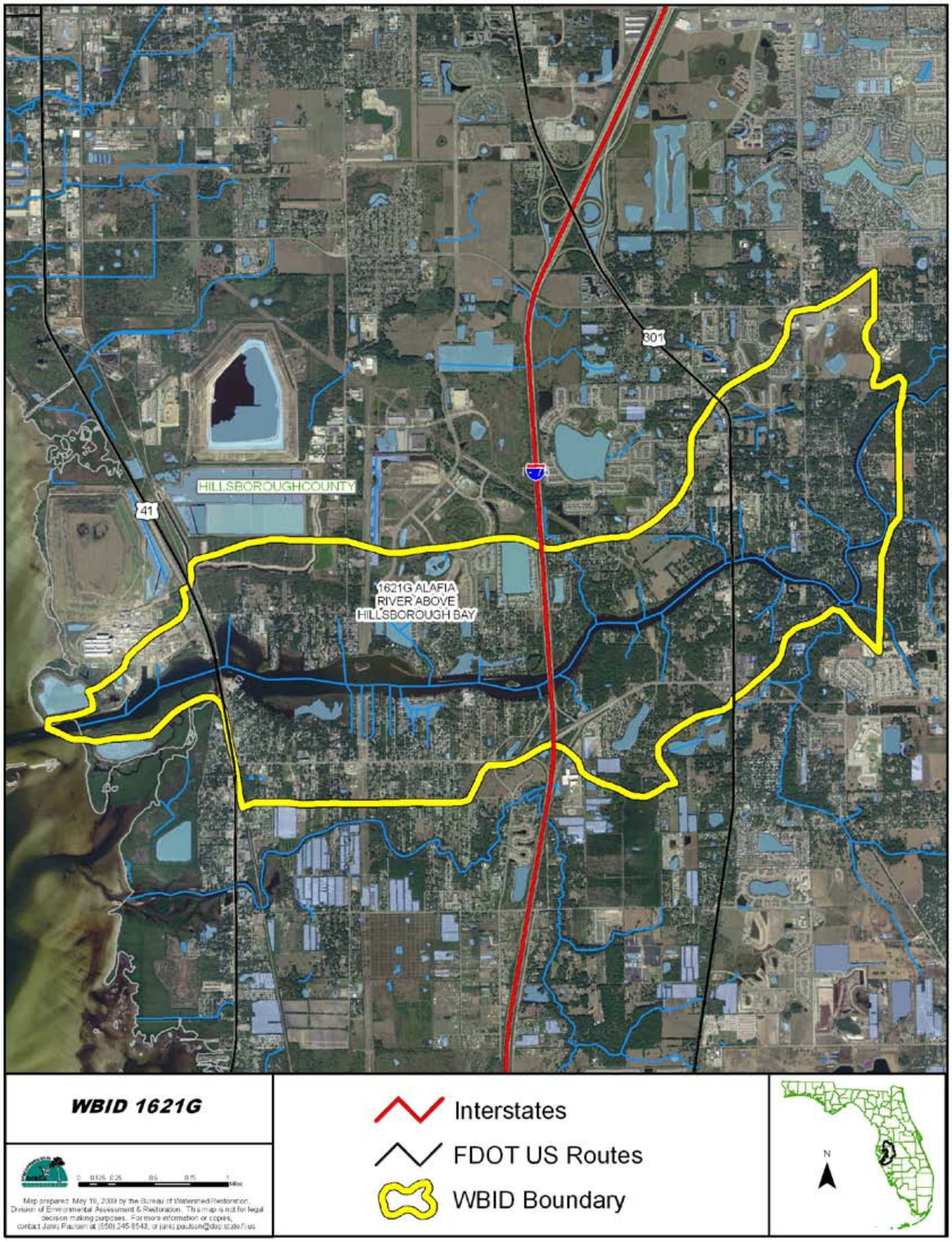

Figure 1.2 Location of the Alafia River Tidal Segment (WBID 1621G) with Major Hydrologic Features

1.3 Background

This report was developed as part of the Florida Department of Environmental Protection's (Department) 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 fifty-two river basins over a five-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA, Chapter 99-223, Laws of Florida).

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

This TMDL report will be followed by the development and implementation of a restoration plan, to reduce the amount of nutrients that caused the verified impairment in the Alafia River Estuary. These activities will depend heavily on the active participation of the Southwest Florida Water Management District, 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 several waterbodies in the Tampa Bay Tributaries Basin. The Alafia River Tidal Segment (WBID 1621G) is 1998 303(d) listed. 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 methodology to assess water quality impairments and has verified the impairments for dissolved oxygen (DO) and nutrients in the Alafia River Tidal Segment (**Table 2.1**). The IWR assessment was based on samples collected during the Cycle 2 verified period (January 2001 to June 2008), and are sample results made available in IWR Database Run 36. **Table 2.2** provides the assessment results for dissolved oxygen following the IWR methodology. The WBID was verified as impaired for DO because more than 10 percent of the values were below the Class III marine criterion minimum value of 4.0 milligrams/liter (mg/L) over the course of the verified period. The individual DO measurements used in the assessment are displayed in **Figure 2.1**. For the verified nutrient impairment, annual average chlorophyll-a values serve as the primary means for assessing nutrient impairment in estuaries in the IWR. The individual chlorophyll a results used to calculate the annual averages are displayed in **Figure 2.2**. During the verified period, the annual average chlorophyll-*a* values for the tidal segment (WBID 1621G) were above the site specific chlorophyll a threshold of 15 micrograms per liter (µg/L) in five of the seven calendar years, averaging between 16.5 µg/L in 2003 and 28.8 µg/L in 2006 **(Table 2.3 and Figure 2.3)**. According to the IWR, if the annual mean chlorophyll-*a* for any one year in the verified period is greater than the chlorophyll-*a* threshold, the water is verified as impaired. For the estuary segments of waterbodies tributary to Hillsborough Bay, the Hillsborough Bay chlorophyll a target of 15 ug/L, developed by the Tampa Bay Estuary Program to protect and restore seagrass, is used as the alternative chlorophyll a threshold. Further discussion of water quality target development for this TMDL is provided in Chapter 3.

The main sources of data for the IWR assessment came from stations sampled by the Hillsborough County Environmental Protection Commission (21FLHILL...), Florida Game and Freshwater Fish Commission (21FLGFWF...), USGS (112WRD...), Florida DEP Southwest District (21FLA...), Florida Lake Watch (21FLKWAT...), PBSJ (PBSJ...), and Tampa Bay Water (21FLTBW...). The Florida Lake Watch data, however, can not be used for verification purposes, but the nutrient data were included in the analysis used for TMDL development in Chapter 5. The water quality measurements used in this analysis are available in IWR Database Run 36, and are available upon request.

Table 2.1 Verified Impairments for the Alafia River Tidal Segment (WBID 1621G)

WBID	Waterbody Segment Name	Parameters Included on the 1998 303(d) List	Parameter Causing Impairment	Projected Year for TMDL Development*
1621G	Alafia River Above Hillsborough Bay	Nutrients (Chl_a)	Nutrients (Chl_a)	2008
1621G	Alafia River Above Hillsborough Bay	Dissolved Oxygen	Nutrients (TN)	2008

*The projected year for TMDL development was 2008, but the Settlement Agreement between EPA and Earthjustice, which drives the TMDL development schedule for waters on the 1998 303(d) list, allows an additional nine months to complete the TMDLs. As such, these TMDLs must be adopted and submitted to EPA by September 30, 2009.

Table 2.2 Summary of Dissolved Oxygen Data Collected During Verification Period (January 2001 – June 2008) for the Alafia River Tidal Segment (WBID 1621G)

Waterbody Segment Name	Total Number of Samples	IWR-required number of exceedances for the Verified List	Number of observed exceedances	Number of observed nonexceedances	Number of seasons data was collected
Alafia River Above Hillsborough Bay	2101	252	304	1797	4

Table 2.3 Summary of Chlorophyll-a Annual Averages During Verification Period (January 2001 – June 2008) for the Alafia River Tidal Segment (WBID 1621G)

Year	Chlorophyll-a Annual Average (ug/L)
2001	11.5
2002	27.9
2003	16.5
2004	10.8
2005	17.7
2006	28.8
2007	18.3

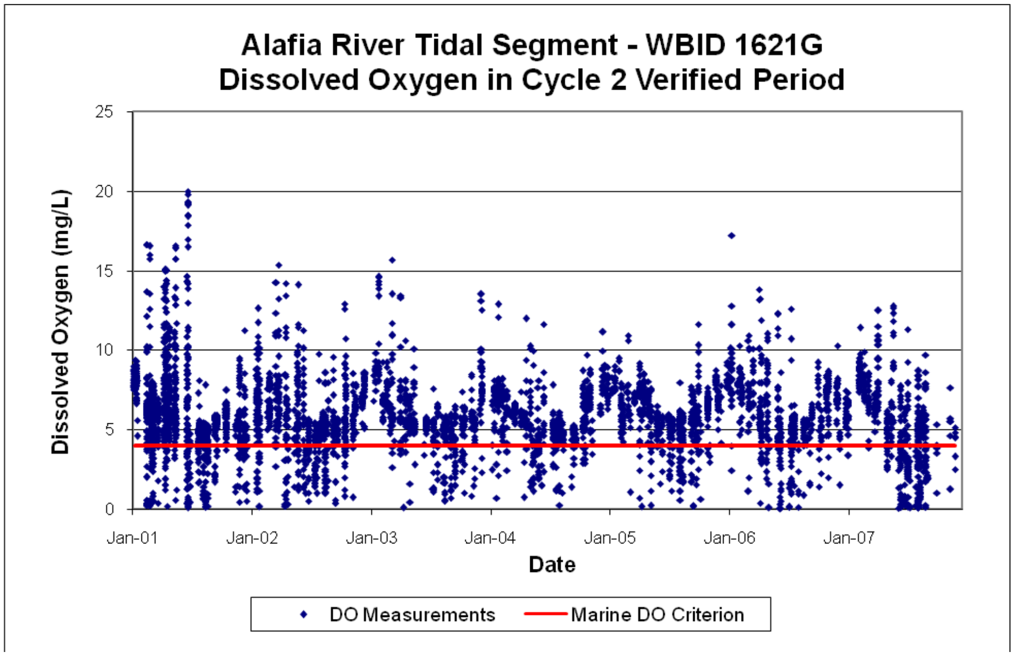

Figure 2.1 Dissolved Oxygen Measurements in Cycle 2 Verification Period (January 2001 – June 2008)

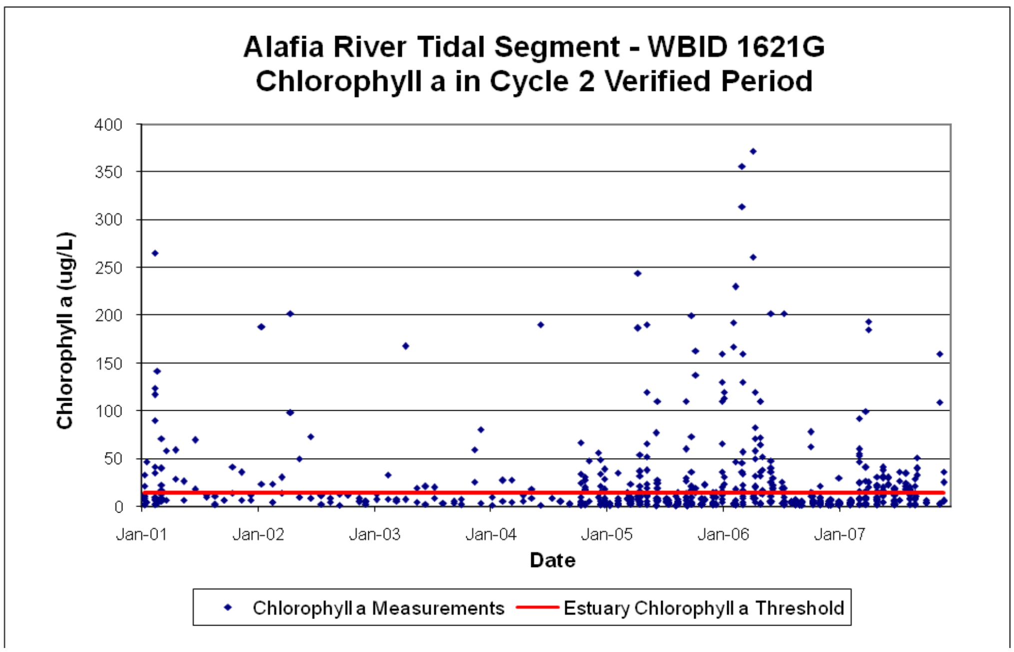

Figure 2.2 Chlorophyll a Measurements in Cycle 2 Verification Period (January 2001 – June 2008)

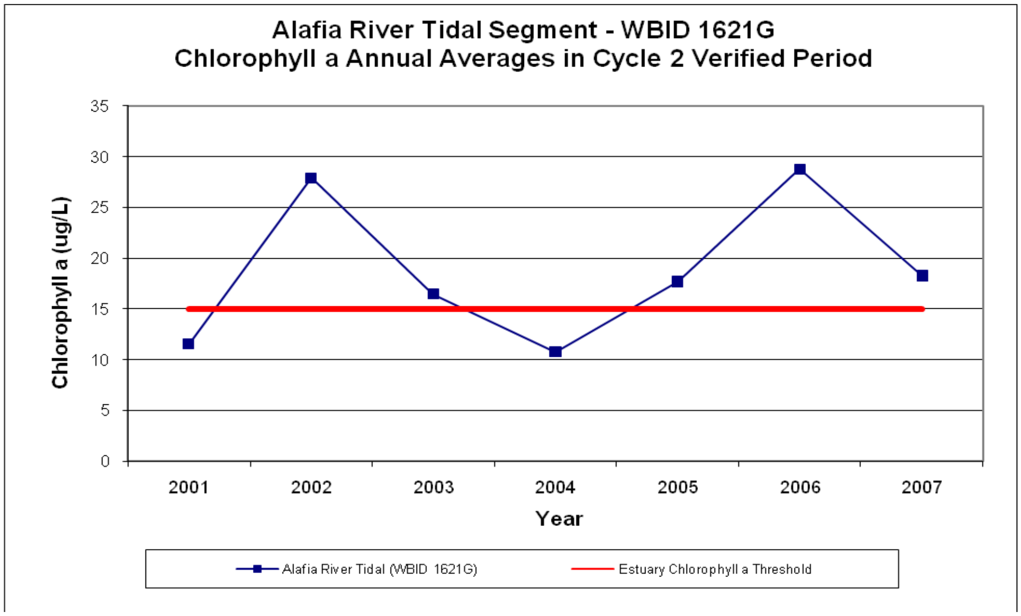

Figure 2.3 Chlorophyll a Annual Averages in the Cycle 2 Verification Period (2001 – 2007)

As part of the verified listing process, the Department attempts to identify the limiting nutrient or nutrients for the impaired waterbody. The limiting nutrient, generally nitrogen or phosphorus, is defined as the nutrient that limits plant growth when it is not available in sufficient quantities. A limiting nutrient is a chemical that is necessary for plant growth, but available in quantities smaller than those needed for algae, represented by chlorophyll-*a*, and macrophytes to grow. Once the limiting nutrient in a waterbody is exhausted, algae stop growing. If more of the limiting nutrient is added, larger algal populations will result until nutrients or other environmental factors again limit their growth.

In Florida waterbodies, nitrogen and phosphorus are most often the limiting nutrients, and nitrogen is typically the limiting nutrient in most Florida estuaries. There is a general understanding in the marine scientific community that nitrogen is the principal cause of nutrient over enrichment in coastal systems (National Research Council, 1993) and an analysis of the data from the Alafia River tidal segment supports this conclusion.

Determining the limiting nutrient in a waterbody can be accomplished by calculating the ratio of nitrogen to phosphorus in the waterbody, with water column ratios of total nitrogen (TN) to total phosphorus (TP) of less than 10 indicating that nitrogen is limiting. The median TN to TP ratio is 1.9 (computed from n=560 values), indicating that nitrogen is the limiting nutrient in the tidal segment of the Alafia River. The median value for total nitrogen (TN) in the verified period is 1.41 mg/L; (n = 561).

Since nitrogen is the limiting nutrient, reductions in TN loadings would be expected to result in decreases in algal growth, and are measured as decreases in chlorophyll a levels. Reductions in TN loading are also expected to result in additional benefits, including improvement in DO conditions and decreases in biochemical oxygen demand (BOD). BOD is defined as the amount of oxygen required by bacteria while stabilizing decomposable organic matter under aerobic conditions (Sawyer & McCarty, 1967). Reductions in nutrients will result in lower algal biomass levels in the water column, and lower algal biomass levels will result in smaller diurnal fluctuations in DO, fewer algal-based total suspended solids, and reduced BOD.

2.3 Factors That Influence Nutrient Concentrations

Recent data compiled by Harper & Baker (2007) demonstrated that increasing intensity of landuse generally results in increasing nutrient runoff concentration (Harper & Baker, 2007, Table 4-17) and an increase in runoff volume (Harper & Baker, 2007, Figure 4-4). Both urbanization and increasing intensity of agricultural landuse (e.g. conversion from rangeland to a managed pasture) can result in increased delivery of nutrients to local receiving waters. Specific agricultural activities that can contribute to the declining health of the system include water flow changes due to the creation of secondary and tertiary canal systems for use in irrigation and flood control and the introduction of nutrients via fertilization. Urbanization can result in reduction of pervious areas for infiltration of runoff, which contributes significantly to increased runoff and nutrient load (Harper & Baker, 2007). Other activities associated with urbanization also increase nutrient inputs such as the installation of septic tanks, sewage overflows, fertilizer usage, and the use of irrigation quality water in sprinkler systems in golf courses and new housing developments. The impact of agricultural and urban activities on eutrophication of receiving waters can be decreased through the implementation of best management practices (BMPs).

2.4 Factors That Influence Dissolved Oxygen

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

Factors that may cause significant oxygen depletion include BOD and sediment oxygen demand (SOD). BOD, including carbonaceous BOD (CBOD) and nitrogenous BOD (NBOD) may be the product of both naturally occurring oxygen use from the decomposition of organic materials, and the stabilization of waste products associated with nonpoint source runoff. The significance of any of these factors depends on the specific stream conditions. BOD related to microorganisms is called CBOD. The source material for CBOD is organic matter. CBOD results when oxygen is consumed by microorganisms in converting organic material into CO_2, H_20, nutrients, energy, and new cells. Algal cells contain organic chemicals that consume oxygen during decomposition. BOD related to chemical oxidation is called NBOD. The source materials for NBOD include organic matter that decays to ammonia, and ammonia entering the system through stormwater systems or runoff. Nitrification, the process of oxidizing ammonia to nitrates by microorganisms, requires almost 5 mg/L of DO (NBOD) for every milligram per liter of ammonia that is oxidized.

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

3.2 Applicable Water Quality Standards and Numeric Water Quality Targets

The Alafia River Tidal Segment (WBID 1621G) is a Class III waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the impairment addressed by this TMDL are for DO and the narrative nutrient criteria.

3.2.1 Interpretation of Dissolved Oxygen Criterion

The Class III marine criterion for DO, as established by Subsection 62-302.530(30), F.A.C., states that DO shall not average less than 5.0 mg/L in a 24-hour period, and shall not be less than 4 mg/L, and that normal daily and seasonal fluctuations above these levels shall be maintained.

3.2.3 Interpretation of Narrative Nutrient Criterion

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. While the IWR provides a threshold for nutrient impairment for estuaries based on annual average chlorophyll *a* levels, these thresholds are not standards and need not be used as the nutrient-related water quality target for TMDLs. In fact, in recognition 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.

In translating the narrative nutrient criterion to develop a nutrient target for this TMDL, the first step in this process was to identify a chlorophyll a target. The Department selected a chlorophyll a target of 15 ug/L, that was developed for the adjacent Hillsborough Bay segment by the Tampa Bay Estuary Program for making resource-based management decisions (Janicki and Wade, 1996; Janicki et al., 2000). The chlorophyll a target was developed as part of the nitrogen management strategy to protect and restore seagrass meadows in the bay. The Department uses this water quality target as a site specific alternative chlorophyll a threshold for the Hillsborough Bay segments (and the estuary segments tributary to the bay) to perform nutrient assessments following the IWR methodology. Applying the bay threshold to the adjacent estuary segments provides for consistency in assessing nutrients in this area of Tampa Bay. **Figure 3.1** displays the water segments in the Tampa Bay watershed where the resource-based chlorophyll a targets are used as alternative chlorophyll a thresholds.

As the lower Hillsborough Bay segment (WBID 1558D), that the Alafia River flows into, currently has annual average chlorophyll a values less than the alternative threshold, the recently measured total nitrogen (TN) concentrations in the bay were used to derive the water quality target used for TMDL development. **Table 3.1** provides the lower Hillsborough Bay annual average chlorophyll a and TN values along with rainfall from 1995 to 2006. Over this time frame, as annual average TN concentrations have exhibited a general decrease in the bay, there has been a similar decreasing trend in annual average chlorophyll a concentrations. This decreasing trend in Hillsborough Bay TN and chlorophyll a values has occurred in years with above and below average rainfall.

Table 3.1 Lower Hillsborough Bay (WBID 1558D) Annual Average Total Nitrogen and Chlorophyll a Concentrations and Annual Rainfall.

Year	Annual Average Total N (mg/L)	Annual Average Chlorophyll a (ug/L)	Hillsborough Bay Watershed Annual Rainfall (in.)[1]
1995	0.87	21.2	56
1996	0.76	16.3	51
1997	0.74	14.3	65
1998	0.86	21.3	58
1999	0.64	11.8	44
2000	0.92	8.6	37
2001	0.87	17.3	55
2002	0.79	14.2	64
2003	0.58	14.1	59
2004	0.56	14.7	65
2005	0.52	10.7	55
2006	0.46	11.6	43

[1] From Tampa Bay Estuary Program 2004 - 2007 Pollutant Loading Update Report

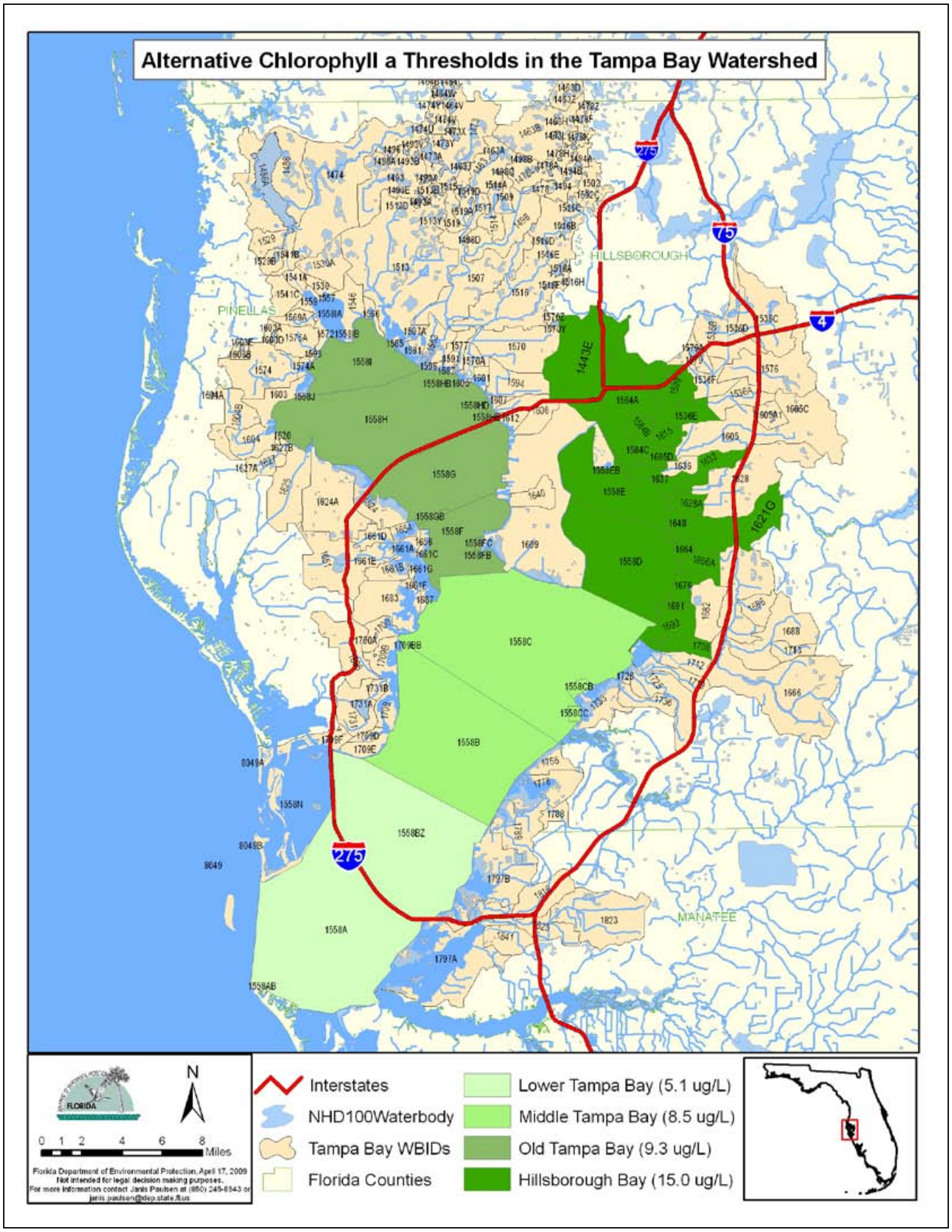

Figure 3.1 Tampa Bay Watershed Alternative Chlorophyll a Thresholds

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants in the impaired waterbody and the amount of pollutant loadings contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA’s National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

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

4.2 Point Sources

4.2.1 NPDES Permitted Wastewater Facilities

There is one industrial facility, the Mosaic Fertilizer, L.L.C. Riverview Chemical Complex, that has an NPDES surface water discharge permit with four effluent outfall locations to the tidal segment of the Alafia River, NPDES No. FL0000761. The facility manufactures sulfuric acid, phosphoric acid, fluoride products, ammoniated phosphates and micronutrient added fertilizers, and animal feed phosphates. Other operations at the site include electric cogeneration, phosphogypsum storage, raw material storage and handling, wastewater storage and handling, process material handling, and product shipping facilities, that includes a major vessel docking site for fertilizer shipping.

The four outfalls are located in close proximity to each other on the north side of the river, approximately 0.75 miles upstream of the river mouth. Outfalls designated as D-001, D-005A, and D-005B discharge non-process wastewater, treated process wastewater, and stormwater. Outfall D-021 discharges treated stormwater runoff from the southern basin of the facility complex into the Alafia River. The location of the facility and point source discharge area is shown in **Figure 4.1**.

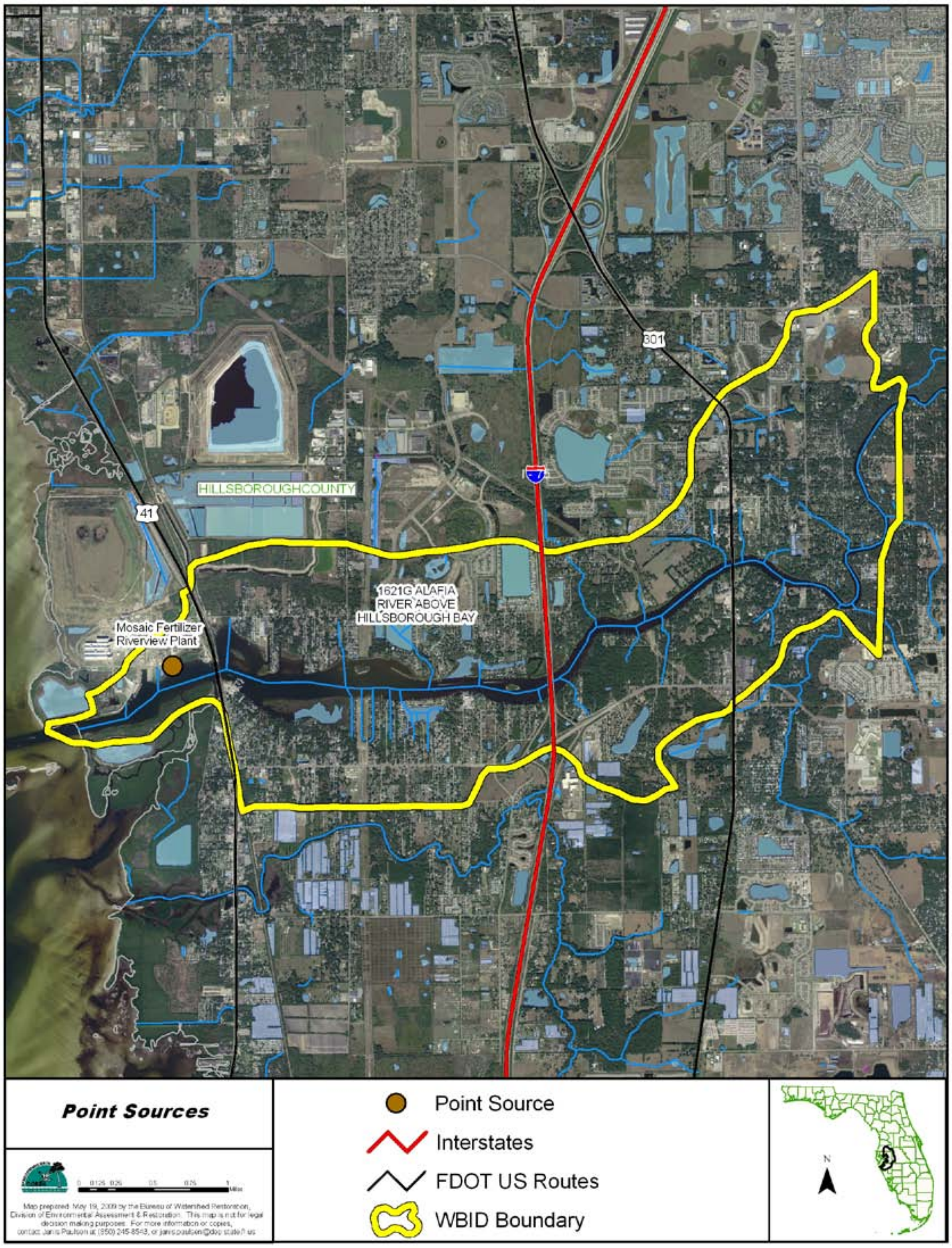

Figure 4.1. Location of the Lower Alafia River Point Source Facility

4.2.2 Municipal Separate Storm Sewer System Permittees

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

The stormwater collection systems owned and operated by Hillsborough County and Co-Permittees (FDOT District 7 & Florida's Turnpike Enterprise, and City of Plant City) are covered by a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000006). There are no Phase II MS4 permits identified for the tidal segment of the Alafia River.

4.3 Land Uses and Nonpoint Sources

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

Nutrient loading from urban areas is most often attributable to multiple sources, including stormwater runoff, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals. In agricultural areas, agricultural fertilizing or nutrients from wildlife and agricultural livestock wastes are sources contributing to the pollutant load.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SWFWMD 2004 land use coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library, as this time frame represents land cover near the midpoint of the verified assessment period. The land use information analyzed for this TMDL is the watershed area draining to the Lower Alafia River downstream of Bell Shoals Road. Bell Shoals Road crosses the river 11.3 miles upstream of the mouth. This drainage area was used as the loads generated are in close proximity to the tidal segment and is consistent with the watershed area applied by the SWFWMD for minimum flow and level development for the lower Alafia River (SWFWMD, 2008). Land use categories were aggregated using the simplified Level 1 codes and are tabulated in **Tables 4.1**. **Figure 4.2** shows the principal land uses in the watershed area of the lower river.

The lower river watershed drains 30,140 acres (47.1 miles^2), **Table 4.1**. The dominant land use is urban, which covers over 47 percent of the watershed. The majority of the urban area is residential land use, accounting for about 39 percent of the watershed area. Medium density residential covers over 20 percent of the urban area. Agriculture comprises 18 percent of the area, and cropland and pastureland make up 72 percent of the agriculture. Rangeland and forest cover 16.5 percent of the watershed and water and wetlands make up over 16 percent of the area.

Table 4.1 Classification of Land Use Categories in the Lower Alafia River Watershed Below Bell Shoals Road, 2004

Level 1 Code	Landuse	Acreage	Percent of Total
1000	Urban Open	2,604	8.6
1100	Low Density Residential	2,898	9.6
1200	Medium Density Residential	6,173	20.5
1300	High Density Residential	2,587	8.6
2000	Agriculture	5,437	18.0
3000+4000	Rangeland + Forest/Rural Open	4,972	16.5
5000	Water	1,448	4.8
6000	Wetlands	3,483	11.6
7000	Barren Land (Transportation)	198	0.7
8000	Communication and Transportation	340	1.1
Total		30,140	100.0

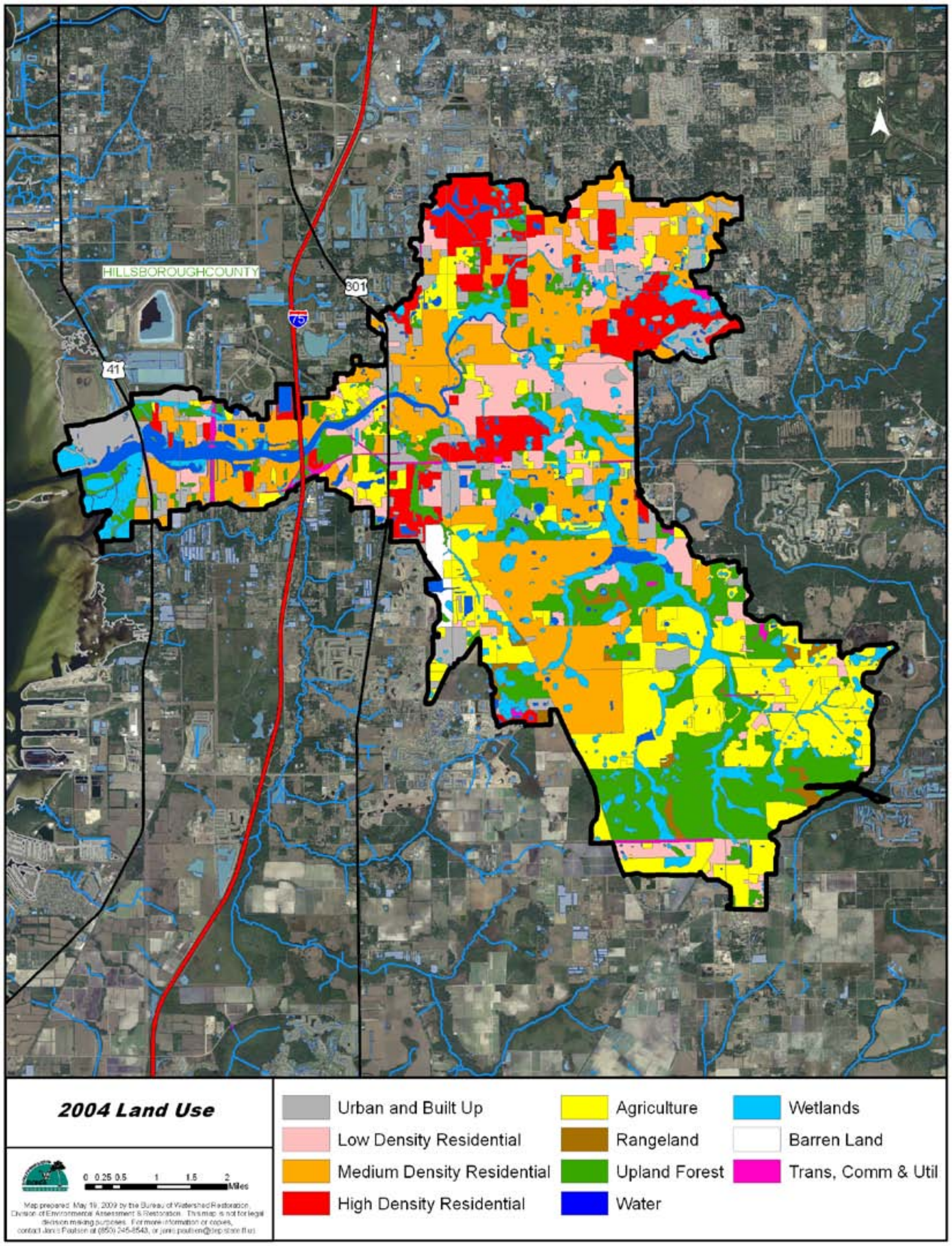

Figure 4.2. Principal Land Uses in the Lower Alafia River Watershed Below Bell Shoals Road, 2004

Septic Tanks

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

The septic tanks located in the lower Alafia River watershed are displayed in **Figure 4.3**. Currently, the number of septic tanks in this watershed area is estimated to be 2,331. The map shows that a large number of systems are in close proximity to the river channel, between US Highway 41 and Bell Shoals Road.

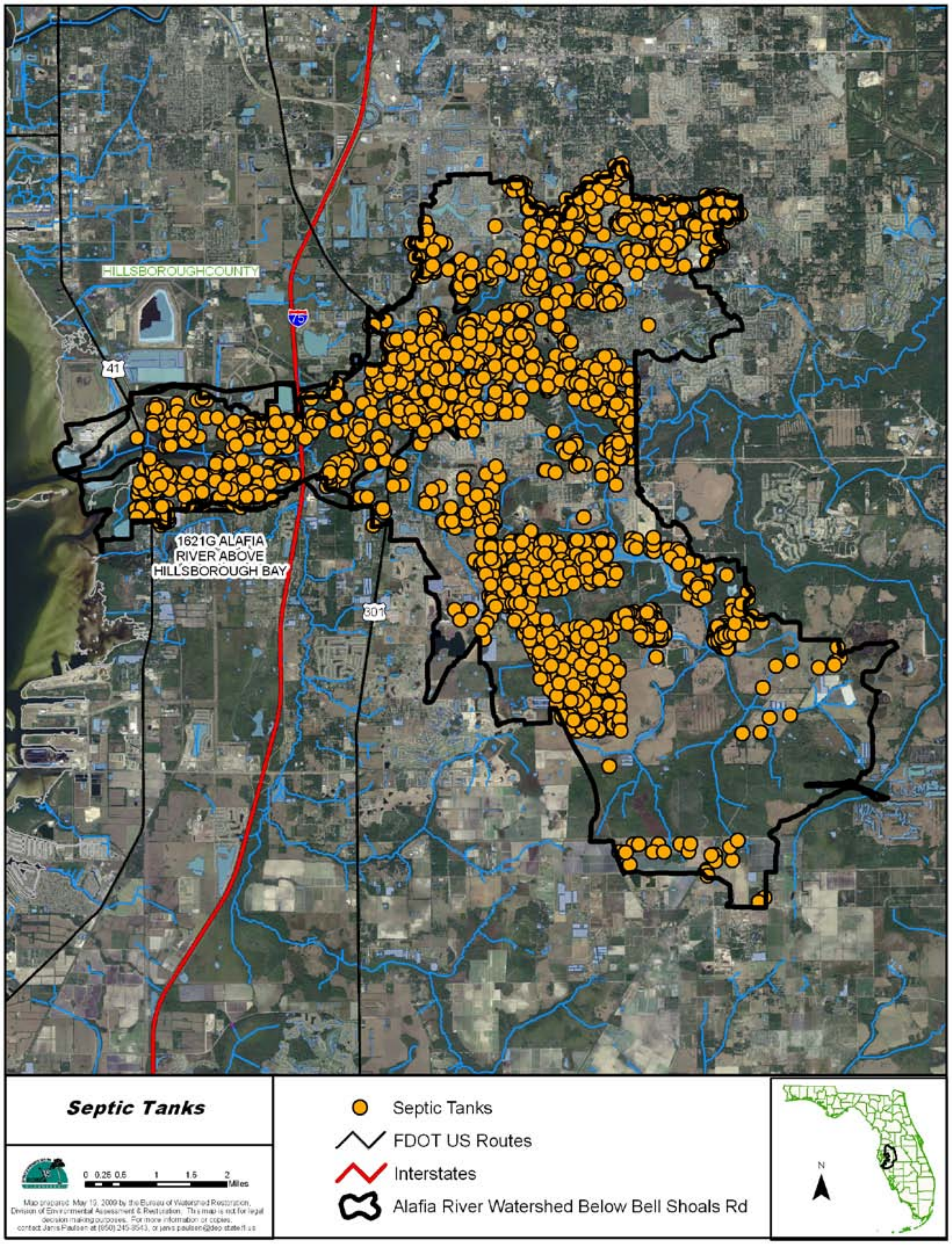

Figure 4.3. Distribution of Onsite Sewage Systems (Septic Tanks) in the Lower Alafia River Watershed Below Bell Shoals Road

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The goal of the TMDL development process is to identify a total nitrogen (TN) target for the estuarine area of the Alafia River, so that the tidal segment will meet the applicable DO and nutrient water quality criteria and maintain its function and designated use as a Class III water. In this case, information used to develop the TMDL was based on water quality changes in the lower Hillsborough Bay segment and relationships between water quality variables in the Alafia River tidal segment. The existing water quality in lower Hillsborough Bay, which is not impaired for DO and nutrients, is used as a reference condition for establishing the TMDL.

5.2 Analysis of Water Quality

Water quality data collection in the Alafia River tidal segment (WBID 1621G), available to the Department, have been performed by four different agencies and the sampling locations are shown in **Figure 5.1**. The majority of data collection in the lower river is performed by the Hillsborough County Environmental Protection Commission (HCEPC) and by Tampa Bay Water. The HCEPC collects samples at two fixed locations in the estuary, Station 74 at US Highway 41 and Station 153 at US Highway 301, that are sampled approximately monthly. The county also samples monthly in the freshwater reach of the lower river at Bell Shoals Road (Station 114), **Figure 5.1**. Tampa Bay Water conducts water quality sampling in the lower river as part of the Hydrobiological Monitoring Program (HBMP). The HBMP consists of using a probabilistic design in which sampling is randomized within seven strata that are oriented along the longitudinal axis of the lower river between the river mouth and Bell Shoals Road. Data collection within each stratum occurs on a monthly basis. Data collected by the U.S. Geological Survey and Florida Lake Watch are also included in this assessment. The Florida Lake Watch data, however, can not be used for verification purposes, but have been included in the analysis of nutrient data used for TMDL development.

Trends in chlorophyll a for two segments of the lower Alafia River (WBIDs 1621G and 1621A) and for the lower Hillsborough Bay segment (WBID 1558D), are presented in **Figure 5.2**. Chlorophyll a annual averages in the lower Hillsborough Bay WBID have exhibited a decreasing trend, with the values in the last five years being less than the alternative chlorophyll a threshold of 15 ug/L, **Figure 5.2**. The annual average chlorophyll a values in the Alafia River tidal segment (WBID 1621G), suggest a decreasing trend up to the year 1999, and since the year 2000, the values have exhibited greater variability fluctuating above and below the chlorophyll a threshold, **Figure 5.2**. It is problematic to compare the more recent tidal segment annual averages to annual averages prior to 2000, since additional monitoring has been conducted in more recent years, with the addition of the HBMP monitoring and sampling by the HCEPC at US Highway 301.

A time series of chlorophyll a results measured at the HCEPC stations in the lower Alafia River are presented in **Figure 5.3**. In **Figure 5.3**, the annual averages suggest a slight decreasing trend over time at the US Highway 41 sampling location (Station 74). Further upstream in the tidal segment, annual average values have fluctuated considerably from year to year since monitoring began in 1999 at US Highway 301 (Station 153), and the values are typically well above the chlorophyll a threshold. Chlorophyll a annual averages at the Bell Shoals Road sampling location (Station 114) are much lower than the values in the tidal segment, with averages being well below 10 ug/L since 1994.

Trends in annual average TN values by WBID and by HCEPC station are displayed in **Figure 5.4** and **Figure 5.5**, respectively. The annual average TN concentrations by WBID shows a decreasing trend over time in the lower Hilllsborough Bay segment, whereas, a slight increasing trend is evident in the tidal segment and freshwater segment of the Lower Alafia River, **Figure 5.4**. In **Figure 5.5**, the annual averages have been lower in the last three years at the US Highway 41 sampling location (Station 74), and during the same period decreases in annual averages have also occurred in the lower Hillsborough Bay WBID, **Figure 5.4**. Total N concentrations are on average lower at the downstream sampling location (1.5 mg/L and less), compared to the HCEPC stations further upstream, **Figure 5.5**.

A statistical evaluation of the data was performed to investigate the relationship between total nitrogen and chlorophyll a concentrations, but no strong relationships were found between the variables. The comparison, however, does indicate that generally lower chlorophyll a concentrations are associated with lower total N concentrations at the HCEPC sampling locations in the tidal segment. The linear regression analysis using data collected at US Highway 41 and US Highway 301 during the verified period, indicates that 19 percent of the variation in chlorophyll a can be explained by total N, **Figure 5.6**.

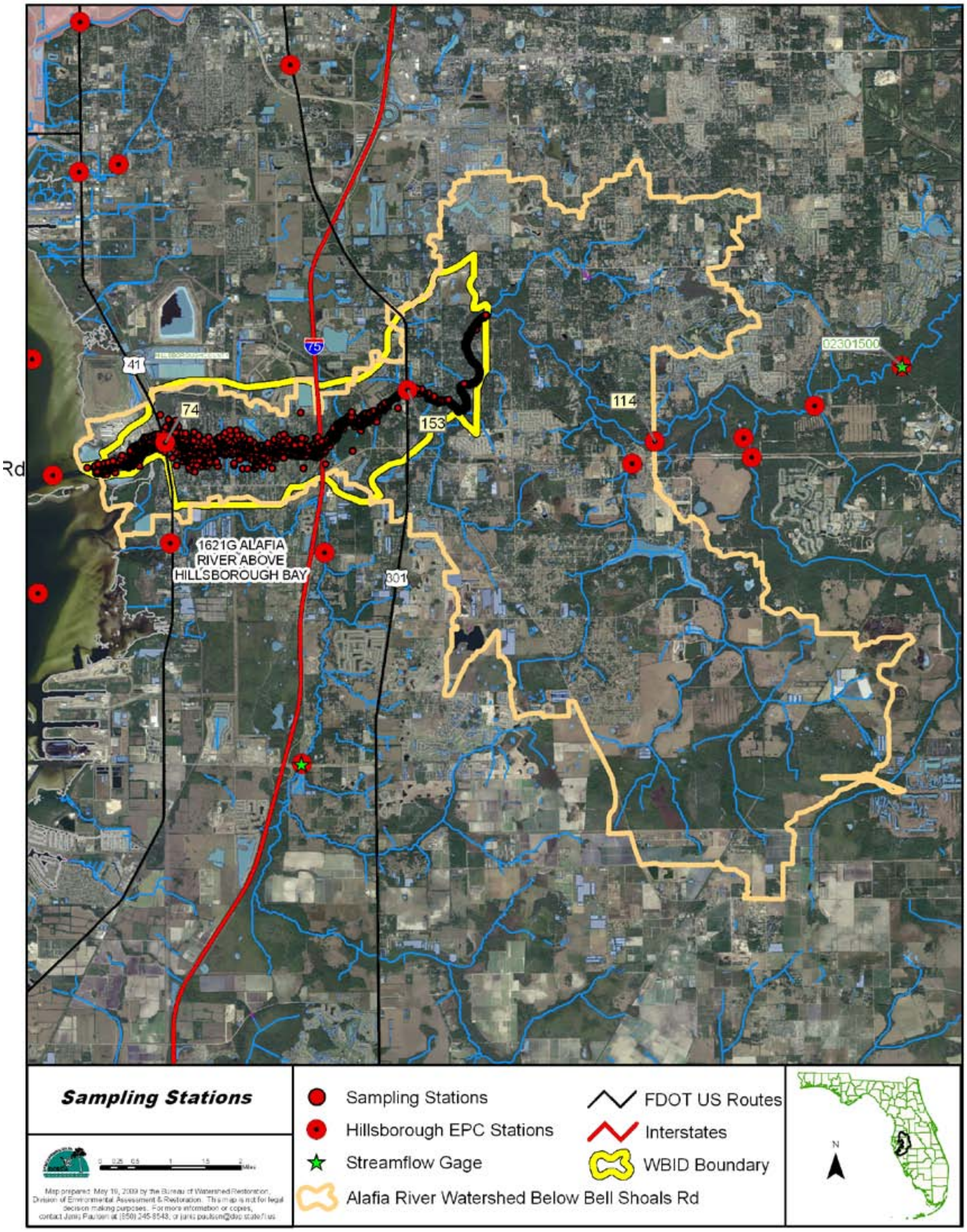

Figure 5.1 Monitoring Locations in the Lower Alafia River

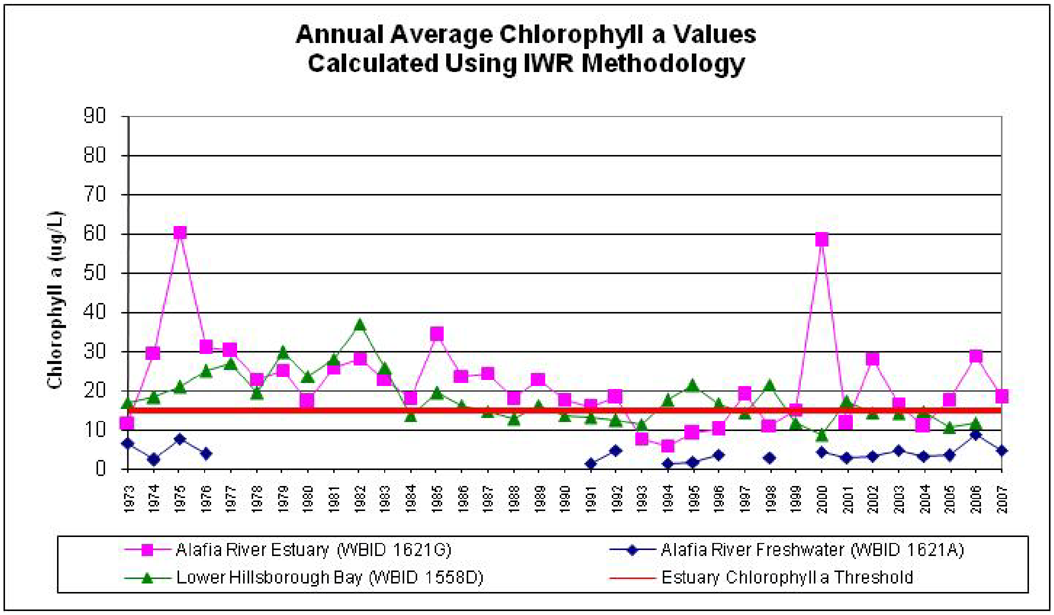

Figure 5.2 Annual Average Chlorophyll a Concentrations in the Estuary and Freshwater Segments of the Lower Alafia River and Lower Hillsborough Bay WBIDs

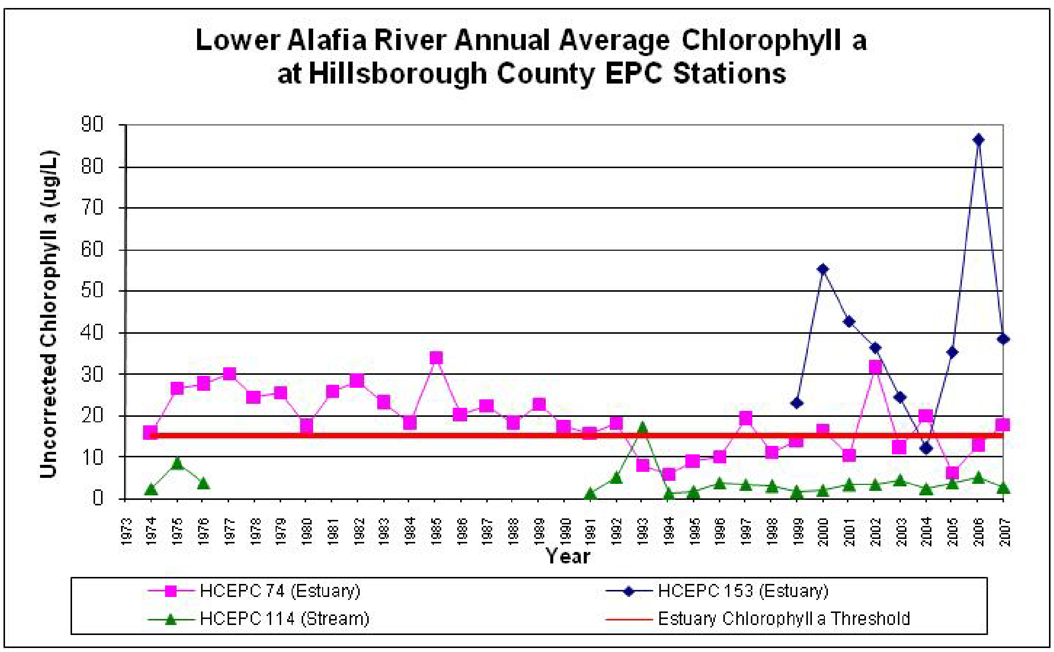

Figure 5.3 Annual Average Chlorophyll a Concentrations in the Lower Alafia River at the Hillsborough County EPC Estuary and Freshwater Stations

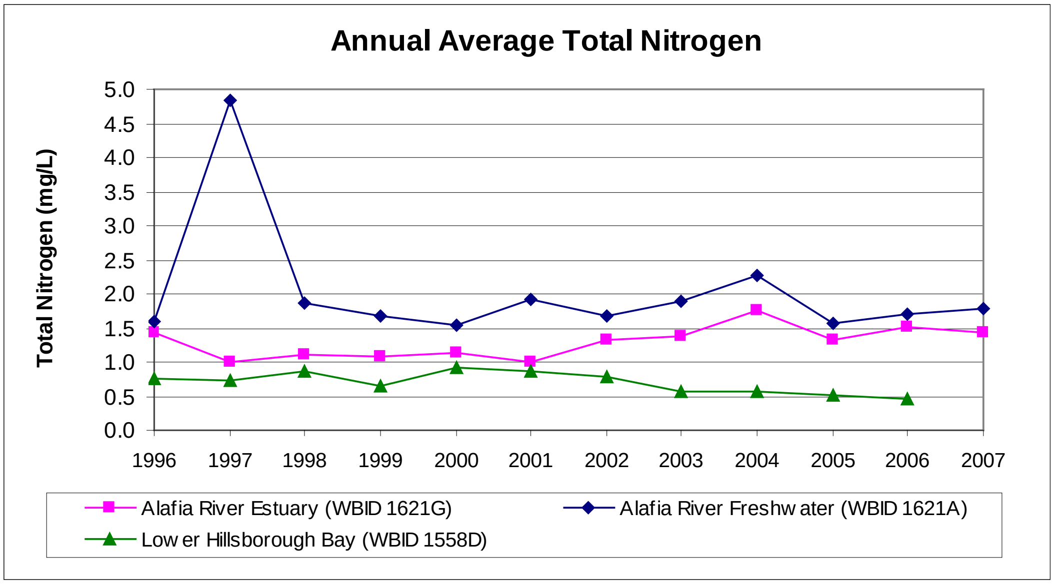

Figure 5.4 Annual Average Total N Concentrations in the Estuary and Freshwater Segments of the Lower Alafia River and Lower Hillsborough Bay WBIDs

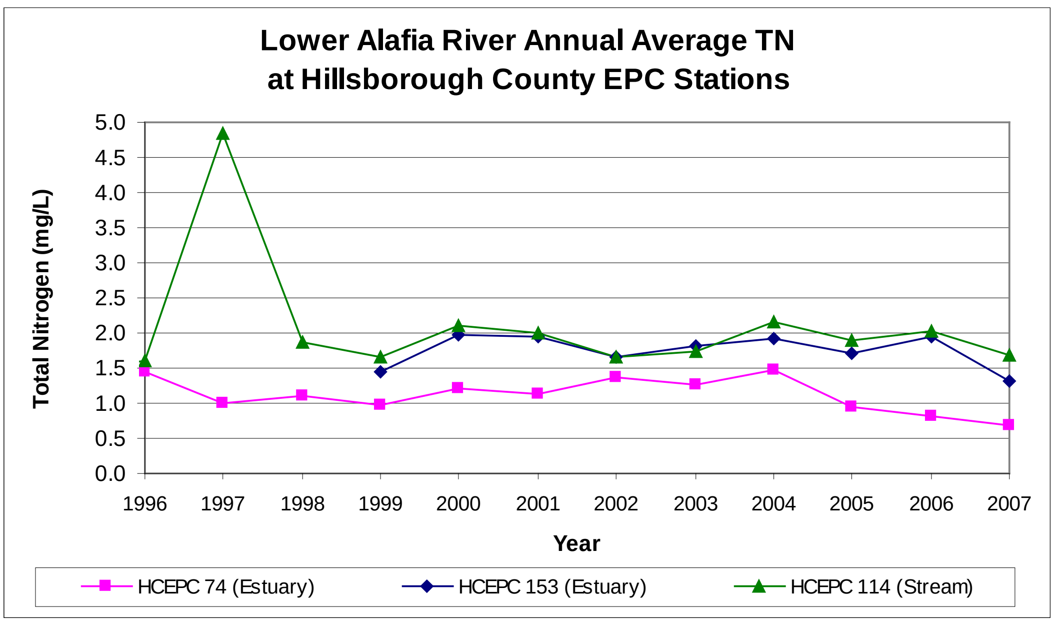

Figure 5.5 Annual Average Total N Concentrations in the Lower Alafia River at the Hillsborough County EPC Estuary and Freshwater Stations

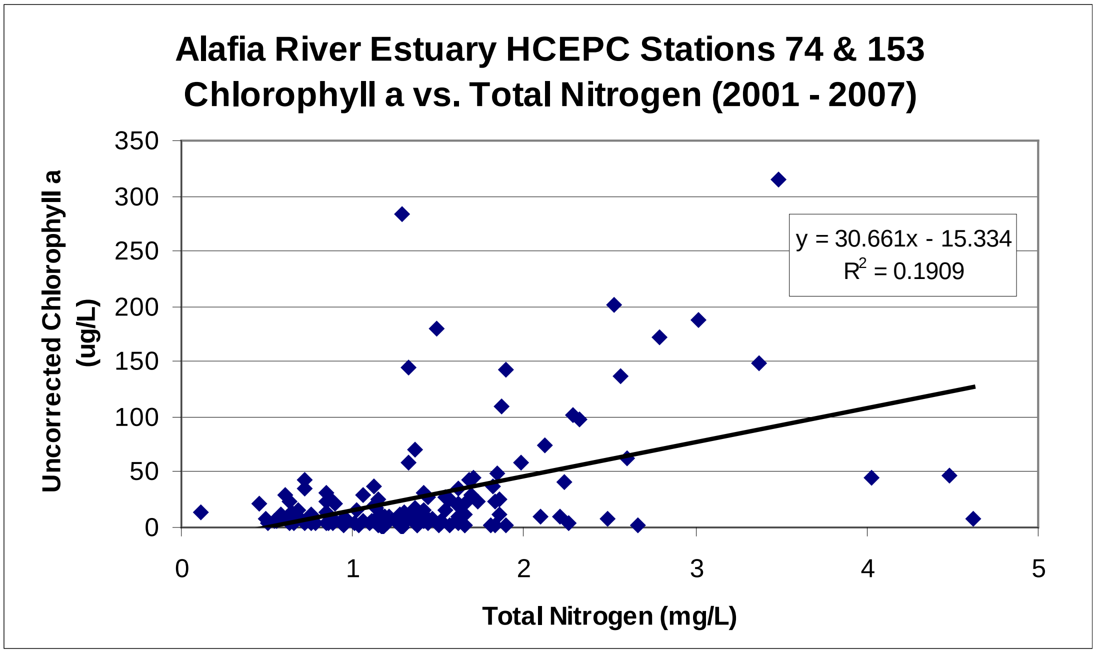

Figure 5.6 Relationship between Chlorophyll a and Total N at the Hillsborough County EPC Estuary Stations

5.3 Relationship Between Nutrients and DO

Reductions in TN concentrations are also expected to result in additional benefits for other parameters of concern, including DO and BOD. As described in Chapter 2, reduced algal biomass, as measured by chlorophyll *a*, should result in lower BOD levels. During daylight hours, algal photosynthesis consumes nutrients and organic matter. The organic matter acts as an energy reserve, and oxygen is released. The reverse process, respiration, may occur simultaneously and dominate during dark periods of the day. During respiration, algae consume oxygen and their energy reserve to produce carbon dioxide and water. Because photosynthesis creates oxygen and respiration depletes oxygen, the algae affect the estuary's oxygen sources. Swings in oxygen can be induced by diurnal light patterns where oxygen levels rise during daylight and become depleted at night.

Figure 5.7 shows that 51 percent of the variation in BOD at the US Highway 41 and US Highway 301 locations can be explained by the chlorophyll a concentration, suggesting that reductions in chlorophyll a levels would result in improvements to dissolved oxygen. Lower algal biomass should lower the BOD levels in the creek, and sediment oxygen demand (SOD) in the area should also decrease over time as algal biomass reduction reduces the accumulation of organic matter in the sediments. Sediment processes play an important role in regulating water quality and are particularly important in a shallow estuary. A portion of the organic matter produced in the water column settles to the sediment surface. Sediment processes influence DO in the water column by serving as a long-term repository of oxygen demand. A reduction of both algal BOD and SOD will have a positive impact on DO concentrations in the water column.

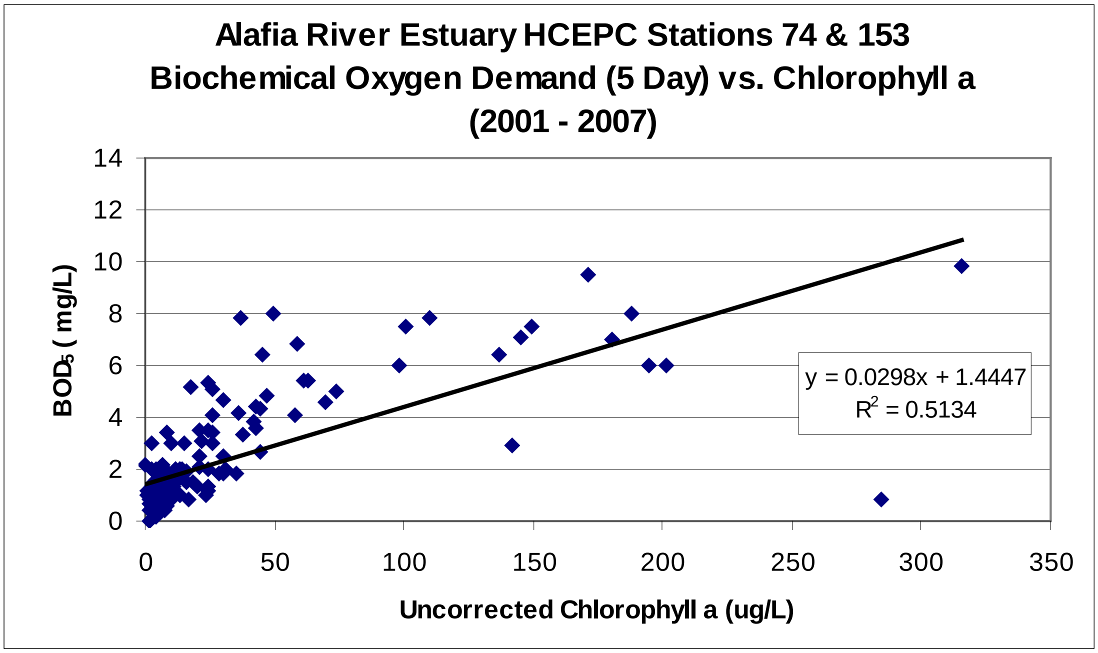

Figure 5.7 Relationship between Biochemical Oxygen Demand and Chlorophyll a at the Hillsborough County EPC Estuary Stations

5.4 Percent Reduction Approach

The TMDL calculation was developed using the “percent reduction” approach. For this method, the selected water quality target for TMDL development is the average of the annual average TN concentrations from the eight years when chlorophyll a in lower Hillsborough Bay was below the threshold value of 15 ug/L. The annual average TN concentrations are from the years 1997, 1999, 2000, and 2002 to 2006, **Table 3.1**. The average of these annual average values is 0.65 mg/L. The percent reduction was calculated using the following equation.

$$\frac{\text{[measured exceedance – target]}}{\text{measured exceedance}} \times 100$$

The measured exceedances used in the percent reduction calculation are the Alafia River tidal segment annual average TN concentrations from 2000 to 2006, **Table 5.1**. The percent reduction in the average of these TN annual averages, 54 percent, is the TN reduction used for establishing the TMDL. In other words, to achieve the TN target of 0.65 mg/L in the Alafia River tidal segment, the percent reduction needed in the current TN concentration of 1.41 mg/L is 54 percent. Annual average values were used in establishing the TMDL in this case as the IWR nutrient assessment is performed using annual average chlorophyll a values.

Table 5.1 Annual Average Total Nitrogen Values for the Alafia River Tidal Segment

Year	Alafia River Tidal Segment Annual Average TN Concentration (mg/L)
2000	1.16
2001	1.14
2002	1.39
2003	1.44
2004	1.82
2005	1.34
2006	1.55
Average	1.41

Total nitrogen loads entering the lower river from the Mosaic Fertilizer facility discharges and from upstream watershed loads were calculated to determine the magnitude of the point source load. Mosaic Fertilizer loads were calculated by the Department's Southwest District Office using results on the facility discharge monitoring reports. Total nitrogen loads from the watershed upstream of the lower river were calculated using estimated flows at Bell Shoals Road obtained from Tampa Bay Water and nitrogen concentration data collected at this location by the HCEPC. Loadings calculated for the 2003-2007 period indicate that, on average, the point source load is less than one percent (0.7 percent) of the upstream river load, **Table 5.2**. The monthly average facility load varied between 21 lbs/month and 3,436 lbs/month over this time frame. The point source load percentage is actually less than this amount, since nonpoint source loadings downstream of Bell Shoals Road were not included in this analysis. As the point source load is a small fraction of the total load, the point source TN load discharged to the river for the 2001 to 2007 period was used to establish the facility's wasteload allocation in the TMDL. **Appendix B** provides the data used to calculate the Mosaic Fertilizer facility's TN load to the Alafia River.

Table 5.2 Total Nitrogen Load Estimates for the Lower Alafia River

Year	Month	Alafia River at Bell Shoals Road - Total Nitrogen Load (lbs/month)	Mosaic Fertilizer Riverview Complex - Total N Load to Alafia River (lbs/month)	Point Source Load as Percentage of River Load
2003	3	175290.7	600.9	0.34
2003	4	84012.3	73.3	0.09
2003	5	84568.8	83.4	0.10
2003	6	301440.9	218.2	0.07
2003	7	316836.8	452.8	0.14
2003	8	185273.2	603.4	0.33
2003	9	221924.6	194.2	0.09
2003	10	137997.6	197.6	0.14
2003	11	55696.5	85.8	0.15
2003	12	48786.4	73.4	0.15
2004	1	88990.8	112.0	0.13
2004	2	90604.5	180.9	0.20
2004	3	73971.1	71.5	0.10
2004	4	41863.3	128.9	0.31
2004	5	31010.1	98.5	0.32
2004	6	81436.6	171.8	0.21
2004	7	110865.1	1636.2	1.48
2004	8	384469.9	1132.6	0.29
2004	9	496475.8	2192.0	0.44
2004	10	660963.7	142.6	0.02
2004	11	149145.0	21.0	0.01
2004	12	194143.8	38.3	0.02
2005	1	137840.7	82.5	0.06
2005	2	61875.2	224.3	0.36
2005	3	198965.3	230.4	0.12
2005	4	131718.7	85.5	0.06
2005	5	90468.6	163.0	0.18
2005	6	213021.1	3436.4	1.61
2005	7	318624.3	306.4	0.10
2005	8	164576.8	615.1	0.37
2005	9	79613.1	328.0	0.41
2005	10	147515.7	1253.6	0.85
2005	11	95525.5	1119.6	1.17
2005	12	49316.9	336.1	0.68
2006	1	35867.3	50.7	0.14
2006	2	132067.6	330.8	0.25
2006	3	40876.5	28.6	0.07
2006	4	21496.9	37.1	0.17
2006	5	24021.0	787.2	3.28
2006	6	52781.2	678.2	1.28
2006	7	64624.2	1357.7	2.10
2006	8	175431.3	382.0	0.22
2006	9	242619.8	343.7	0.14
2006	10	82504.5	114.6	0.14
2006	11	48477.9	953.0	1.97
2006	12	38808.7	123.5	0.32
2007	1	44552.9	1496.2	3.36
2007	2	62048.3	581.6	0.94

2007	3	33548.8	328.3	0.98
2007	4	24492.8	367.7	1.50
2007	5	13063.6	306.1	2.34
2007	6	24242.7	368.5	1.52
2007	7	43667.4	301.3	0.69
2007	8	50608.3	1425.0	2.82
2007	9	45423.8	687.3	1.51
2007	10	121997.5	615.5	0.50
2007	11	40149.0	631.2	1.57
2007	12	33446.8	321.9	0.96
Minimum		13063.6	21.0	0.01
Median		83258.4	314.1	0.31
Mean		124166.4	505.3	0.69
Maximum		660963.7	3436.4	3.36

5.5 Critical Conditions

The TMDL was based on annual average conditions (i.e., values from all four seasons in a calendar year) rather than critical/seasonal conditions because of the following:

a) The methodology used to determine assimilative capacity does not lend itself very well to short-term assessments,

b) The net change in overall primary productivity, which is better addressed on an annual basis, is generally a better indicator of an imbalance in flora or fauna, and

c) The methodology used to determine impairment is based on an annual average and requires data from all four quarters of a calendar year.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

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

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

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

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

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

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

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL for the Alafia River Tidal Segment (WBID 1621G) is expressed in terms of pounds/day for point sources and percent reduction for nonpoint sources, **Table 6.1.a**, and pounds/year for point sources and percent reduction for nonpoint sources, **Table 6.1.b**, and represent the maximum TN load the surface water can assimilate to meet both the nutrient and DO criteria. The TMDL to be implemented is the one expressed on a mass per year basis, and the expression of the TMDL on a mass per day basis is for information purposes only.

Table 6.1.a TMDL Components Expressed as a Daily Load for the Alafia River Tidal Segment (WBID 1621G)

WBID	Parameter	TMDL (mg/L)	WLA		LA (% Reduction)[2]	MOS
			Wastewater (lbs/day)[1]	NPDES Stormwater (% Reduction)[2]		
1621G	Total N	0.65	14.3	54%	54%	Implicit

[1] Represents Mosaic Fertilizer's average daily load (2001-2007) to Alafia River calculated using monthly average data.
[2] As the TMDL represents a percent reduction, it also complies with EPA requirements to express the TMDL on a daily basis.

Table 6.1.b TMDL Components Expressed as an Annual Load for the Alafia River Tidal Segment (WBID 1621G)

WBID	Parameter	TMDL (mg/L)	WLA		LA (% Reduction)	MOS
			Wastewater (lbs/year)[1]	NPDES Stormwater (% Reduction)		
1621G	Total N	0.65	5,140	54%	54%	Implicit

[1] Represents Mosaic Fertilizer's average annual load (2001-2007) to Alafia River calculated using monthly average data.

6.2 Load Allocation

A total nitrogen reduction of 54 percent is required from nonpoint sources. It should be noted that the load allocation includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

The one point source with outfalls discharging to the Alafia River, the Mosaic Fertilizer, L.L.C. Riverview Chemical Complex, NPDES No. FL0000761, was considered not to be a significant load to the lower Alafia River relative to the total nonpoint source load, as the current TN load being discharged is less than one percent of the total load entering the lower Alafia River. The facility's current load to the river, for the 2001-2007 period, was applied as the WLA. Since the facility load is small relative to the total load entering the estuary, the reductions will be focused on MS4 facilities and nonpoint sources.

Any future discharge permits issued in the watershed will also be required to meet the state's Class III criteria for DO and nutrients and contain appropriate discharge limitations on nitrogen that will comply with the TMDL as well as existing state requirements related to discharges to Outstanding Florida Waters.

6.3.2 NPDES Stormwater Discharges

Hillsborough County and Co- Permittees (FDOT District 7 & Florida's Turnpike Enterprise, and City of Plant City) are covered by a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000006) and areas within their jurisdiction contributing loads to the lower Alafia River watershed may be responsible for a 54 percent reduction in current anthropogenic TN loading. It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction. There are no Phase II MS4 permits identified in the Lower Alafia River watershed.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, February 2001), an implicit MOS was used in the development of this TMDL. A MOS was included in the TMDL by selecting, as the nutrient target, the average of the annual average TN concentrations that occurred when chlorophyll a in lower Hillsborough Bay was below the threshold value of 15 ug/L.

Chapter 7: TMDL IMPLEMENTATION

7.1 Basin Management Action Plan

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

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

- *Water quality goals (based directly on the TMDLs);*
- *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 TMDLs;*
- *Timetables for implementation;*
- *Implementation funding mechanisms;*
- *An evaluation of future increases in pollutant loading due to population growth;*
- *Implementation milestones, project tracking, water quality monitoring, and adaptive management procedures; and*
- *Stakeholder statements of commitment (typically a local government resolution).*

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

7.2 Other TMDL Implementation Tools

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

A multitude of assessment tools are available to assist local governments and interested stakeholders in this detective work. The tools range from the simple (such as Walk the WBIDs and GIS mapping) to the complex (such as bacteria source tracking). Department staff will provide technical assistance, guidance, and oversight of local efforts to identify and minimize sources of pollution. Based on work in the Lower St Johns River tributaries and the Hillsborough Basin, the Department and local stakeholders have developed a logical process and tools to serve as a foundation for this detective work. In the near future, the Department will be releasing these tools to assist local stakeholders with the development of local implementation plans to address fecal coliform impairments. In such cases, the Department will rely on these local initiatives as a more cost-effective and simplified approach to identify the actions needed to put in place a road map for restoration activities, while still meeting the requirements of Subsection 403.067(7), F.S.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

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

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

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

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

Appendix B: Mosaic Fertilizer Riverview Chemical Complex - Monthy Flow and Total Nitrogen Data for Outfalls to the Alafia River

Month-Year	D001 Flow mo av mgd	D001 TN mo av mg/l	D001 TN mo av lbs/mo	D005 Flow mo av mgd	D005 TN mo av mg/l	D005 TN mo av lbs/mo	D005A Flow mo av mgd	D005A TN mo av mg/l	D005A TN mo av lbs/mo	D005B Flow mo av mgd	D005B TN mo av mg/l	D005B TN mo av lbs/mo	D021 Flow mo av mgd	D021 TN mo av mg/l	D021 TN mo av lbs/mo	Facility Total Flow Volume to Alafia River (mgd)	Facility Total N Load to Alafia River (lbs/month)
Jan-01	0		0	0.002	3.825	1.9791							0		0	0.002	2.0
Feb-01	0		0	0		0							0		0	0	0.0
Mar-01	0		0	0.016	5.5	22.766							1.47	5.5	2091.7	1.486	2114.4
Apr-01	0		0	0		0							0.002	5.5	2.754	0.002	2.8
May-01	0		0	0		0							0		0	0	0.0
Jun-01	0	3.2	0	0		0							0.143	3.2	114.57	0.143	114.6
Jul-01	0		0	0.098	4.3	109.02							0.022	4.3	24.474	0.12	133.5
Aug-01	0		0	0.066	4	68.299							0.129	4	133.49	0.195	201.8
Sep-01	0		0	0.099	4.2	104.1							0.815	4.2	856.99	0.914	961.1
Oct-01	0		0	0.038	2.2	21.628							0		0	0.038	21.6
Nov-01	0		0	0.028	2.7	18.927							0		0	0.028	18.9
Dec-01	0		0	0.024	4.5	27.94							0		0	0.024	27.9
Jan-02	0		0	0.008	3.6	7.4508							0		0	0.008	7.5
Feb-02	0		0	0		0							0		0	0	0.0
Mar-02	0		0	0		0							0		0	0	0.0
Apr-02	0		0	0.007	1.3	2.2783							0		0	0.007	2.3
May-02	0		0	0	3.3	0							0		0	0	0.0
Jun-02	0		0	0.041	1.7	17.45							0		0	0.041	17.5
Jul-02	0		0	0.045	5.2	60.538							0		0	0.045	60.5
Aug-02	0		0	0.048	2.4	29.803							0		0	0.048	29.8
Sep-02	0		0	0.081	4.1	83.145							0		0	0.081	83.1
Oct-02	0		0	0.16	2.4	99.344							0		0	0.16	99.3
Nov-02	0		0	0.063	3	47.318							0		0	0.063	47.3
Dec-02	0.075	0.6	11.642	0.057	4.1	60.46							0		0	0.132	72.1
Jan-03	1.723	5.4	2407.1	0.029	2.8	21.007							0.118	2.8	85.477	1.87	2513.6
Feb-03	0		0	0.047	3.8	41.734							0.112	3.8	99.451	0.159	141.2
Mar-03	0		0	0.082	7.9	167.59							0.212	7.9	433.28	0.294	600.9
Apr-03	0		0	0.08	2.9	58.084							0.021	2.9	15.247	0.101	73.3
May-03	0		0	0.107	2.6	71.972							0.017	2.6	11.435	0.124	83.4
Jun-03	0		0	0.411	2.1	216.09							0.004	2.1	2.103	0.415	218.2
Jul-03	0		0	0.537	3.2	444.56							0.01	3.2	8.2786	0.547	452.8
Aug-03	0		0	0.587	3.9	592.26							0.011	3.9	11.099	0.598	603.4

Sep-03	0		0	0.267	2.8	187.17							0.01	2.8	7.0101	0.277	194.2
Oct-03	0		0	0.193	3.8	189.74							0.008	3.8	7.8647	0.201	197.6
Nov-03	0		0	0.149	2.3	85.799							0		0	0.149	85.8
Dec-03	0		0	0.086	3.3	73.421							0		0	0.086	73.4
Jan-04	0		0	0.117	3.7	111.99							0	3.7	0	0.117	112.0
Feb-04	0		0	0.202	3.7	180.88							0	3.7	0	0.202	180.9
Mar-04	0		0	0.079	3.5	71.533							0	3.5	0	0.079	71.5
Apr-04	0		0	0.103	3.6	92.834							0.04	3.6	36.052	0.143	128.9
May-04	0		0	0.112	3.4	98.516							0	3.4	0	0.112	98.5
Jun-04	0		0	0.143	4.8	171.85							0	4.8	0	0.143	171.8
Jul-04	0		0	0.967	6.5	1626.1							0.006	6.5	10.09	0.973	1636.2
Aug-04	0		0	0.732	5.5	1041.6							0.064	5.5	91.065	0.796	1132.6
Sep-04	0		0	1.466	5.7	2092.1							0.07	5.7	99.894	1.536	2192.0
Oct-04	0		0	0.163	3.3	139.16							0.004	3.3	3.4149	0.167	142.6
Nov-04	0		0	0.024	3	18.026							0.004	3	3.0043	0.028	21.0
Dec-04	0		0	0.053	2.6	35.65							0.004	2.6	2.6906	0.057	38.3
Jan-05	0		0	0.106	2.9	79.527							0.004	2.9	3.001	0.11	82.5
Feb-05	0		0	0.06	15	210.3							0.004	15	14.02	0.064	224.3
Mar-05	0		0	0.172	4.2	186.89							0.04	4.2	43.463	0.212	230.4
Apr-05	0		0	0.105	2.8	73.606							0.017	2.8	11.917	0.122	85.5
May-05	0		0	0.089	4.6	105.91							0.048	4.6	57.123	0.137	163.0
Jun-05	0		0	0.618	4.2	649.84							2.65	4.2	2786.5	3.268	3436.4
Jul-05	0		0	0.47	2.1	255.34							0.094	2.1	51.069	0.564	306.4
Aug-05	0		0	0.133	3.2	110.11							0.61	3.2	505	0.743	615.1
Sep-05	0		0	0.047	3.3	38.831							0.35	3.3	289.17	0.397	328.0
Oct-05	0		0	0.146	3.6	135.98							1.2	3.6	1117.6	1.346	1253.6
Nov-05	0		0	0.1	4.3	107.66							0.94	4.3	1012	1.04	1119.6
Dec-05	0		0	0.074	5.8	111.04							0.15	5.8	225.08	0.224	336.1
Jan-06	0		0				0		0	0.056	3.5	50.707			0	0.056	50.7
Feb-06	0		0				0		0	0.183	3.9	166.77		3.9	164.04	0.183	330.8
Mar-06	0		0				0		0	0.048	2.3	28.561			0	0.048	28.6
Apr-06	0		0				0		0	0.037	4	37.054			0	0.037	37.1
May-06	0		0				0		0	0.091	4.9	115.36		4.9	671.86	0.091	787.2
Jun-06	0		0				0		0	0.22	4.3	236.84		4.3	441.39	0.22	678.2
Jul-06	0		0				0		0	0.579	5.1	763.94		5.1	593.73	0.579	1357.7
Aug-06	0		0				0		0	0.172	2.3	102.34		2.3	279.66	0.172	382.0
Sep-06	0		0				0		0	0.528	2.6	343.7		2.6	0	0.528	343.7
Oct-06	0		0				0		0	0.164	2.7	114.56		2.7	0	0.164	114.6
Nov-06	0		0				0		0	0.146	3.9	142.56		3.9	810.42	0.146	953.0
Dec-06	0		0				0		0	0.059	3.7	56.476		3.7	67.005	0.059	123.5
Jan-07	0		0				0		0	0.121	5.4	169.04		5.4	1327.2	0.121	1496.2
Feb-07	0		0				0		0	0.125	3.8	110.99		3.8	470.61	0.125	581.6
Mar-07	0		0				0		0	0.083	3.7	79.449		3.7	248.88	0.083	328.3

Apr-07	0		0				0		0	0.092	5.4	124.38		5.4	243.35	0.092	367.7
May-07	0		0				0		0	0.028	3.4	24.629		3.4	281.47	0.028	306.1
Jun-07	0		0				0		0	0.08	2.3	46.067		2.3	322.47	0.08	368.5
Jul-07	0		0				0		0	0.144	3.2	119.21		3.2	182.13	0.144	301.3
Aug-07	0		0				0		0	0.401	4.3	446.09		4.3	978.95	0.401	1425.0
Sep-07	0		0				0		0	0.192	3.7	177.86		3.7	509.49	0.192	687.3
Oct-07	0		0				0		0	0.165	2.6	110.99		2.6	504.48	0.165	615.5
Nov-07	0		0				0		0	0.064	3.3	52.876		3.3	578.34	0.064	631.2
Dec-07	0		0				0		0	0.089	2.9	66.772		2.9	255.09	0.089	321.9
Minimum	0.00	0.60	0.00	0.00	1.30	0.00				0.03	2.30	24.63	0.00	2.10	0.00	0.00	0.00
Median	0.00	3.20	0.00	0.08	3.60	76.57				0.12	3.70	112.77	0.00	3.70	11.68	0.13	176.37
Mean	0.02	3.07	28.79	0.16	3.87	177.95				0.16	3.63	153.63	0.16	4.02	228.55	0.30	428.34
Maximum	1.72	5.40	2407.07	1.47	15.00	2092.08				0.58	5.40	763.94	2.65	15.00	2786.53	3.27	3436.37

Appendix C: Department Response Letter to Comments on TMDL Report

August 6, 2009

Winston K. Borkowski
Hopping Green & Sams
119 S. Monroe Street, Suite 300
Tallahassee, FL 32301

Subject: Response to Comments on the Dissolved Oxygen and Nutrient TMDLs for Alafia River above Hillsborough Bay (WBID 1621G)

Dear Mr. Borkowski:

The Department has reviewed the comments provided on the proposed Dissolved Oxygen and Nutrient TMDL for the Alafia River Above Hillsborough Bay - Tidal Segment, (WBID 1621G) submitted in the July 20, 2009 letter on behalf of the Mosaic Company. After evaluating these comments on the June 2009 TMDL report, we believe that the TMDL reduction for total nitrogen as proposed by the Department does not have to be revised; however, we will make revisions to the report as appropriate based on comments provided. We appreciate your involvement in reviewing and commenting on the TMDL report and the following are our responses to your comments.

The Department does recognize that the Hillsborough Bay chlorophyll target of 15 ug/L, used as a target for establishing the TMDL, was originally developed for Hillsborough Bay as a water quality target for making resource-based management decisions for seagrass restoration. As the Alafia River tidal segment has direct exchange of water with Hillsborough Bay, we believe that the bay chlorophyll a target is the best available information for establishing a target for this segment of the river. We would also like to point out that the Department is using the Hillsborough Bay chlorophyll a target as a threshold for performing nutrient assessments, following the IWR methodology, for all estuary segments tributary to the bay as this provides a consistent approach for determining nutrient impairment in this area of Tampa Bay.

The Department also recognizes that the bay's chlorophyll a target was developed based on relationships with total nitrogen loading; however, there is also a relationship, although not as strong, between chlorophyll a and total nitrogen concentrations both in Hillsborough Bay and the adjacent Alafia River estuary, as explained in the TMDL report. Additionally, the Tampa Bay Estuary Program presented results at the June 2008 Estuary and Coastal Waters Nutrient Criteria Development meeting showing that there is a positive relationship between Hillsborough Bay total nitrogen and chlorophyll a concentrations and both variables are exhibiting a decreasing trend over time. The Estuary Program presentation is available at the following web site:
http://www.dep.state.fl.us/water/wqssp/nutrients/tac_archive.htm

The available information indicates the total nitrogen concentrations are elevated in the river's tidal segment compared to the bay, and it is expected that reductions in nitrogen concentrations will lead to reductions in chlorophyll a levels, as has been observed in the bay. The intent of this TMDL is not to address water quality in the bay, but instead to use the existing information from the bay to serve as a reference condition for TMDL development in the adjacent river segment.

The Department recognizes that many of the relationships between water quality variables in the Alafia River estuary are not that strong, and that chlorophyll a and DO are typically influenced by a number of factors in surface waters. The reference condition approach using observed water quality in Lower Hillsborough Bay, which is not impaired for nutrients and DO, was used to establish the TMDL. The reference condition approach is an acceptable method for establishing TMDLs and we believe that there is a sufficient weight of evidence that this approach is the best way to move forward in addressing water quality problems in the Alafia River tidal segment. As Hillsborough Bay chlorophyll a and total nitrogen concentrations have decreased over time, it is reasonable to expect that activities aimed at reducing nitrogen concentrations in the adjacent Alafia River estuary would result in lower chlorophyll a concentrations there.

The comment letter suggests that the nitrogen concentration target should be derived from the highest value where the chlorophyll a threshold is met. The average of the total nitrogen annual average values, during years the chlorophyll a averages were less than the target of 15 ug/L, that are used for establishing the TMDL, is appropriate to apply in order to provide for a sufficient margin of safety in the TMDL.

The Department agrees that the TMDL should be implemented based on annual average conditions and as such the load allocated to the Mosaic Fertilizer, L.L.C. Riverview Chemical Complex should also be expressed as an annual average load. The report will be revised to indicate that the TMDL will be implemented on an annual average basis and will include a table expressing the TMDL on an annual average basis. The facility's monthly average total nitrogen load to the river of 428.34 pounds, calculated based on monthly average discharge monitoring report data for the 2001 to 2007 period, will be multiplied by 12 to derive an annual average load allocation for the facility of 5,140 pounds/year.

If you have any questions concerning our responses, please do not hesitate to contact me or Kevin Petrus at (850) 245-8449.

Sincerely,

Jan Mandrup-Poulsen, Environmental Administrator
Watershed Evaluation and TMDL Section

cc: Jim Giattina, Director, Water Protection Division, USEPA Region 4
Holly Greening, Director, Tampa Bay Estuary Program
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