Final
2016 Progress Report
for the Alafia River
Basin Management Action Plan

Division of Environmental Assessment and Restoration
Florida Department of Environmental Protection

January 2017

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Tallahassee, FL 32399
www.dep.state.fl.us

Acknowledgments

This Progress Report was prepared as part of a statewide watershed management approach to restore and protect Florida's water quality. It was prepared by the Florida Department of Environmental Protection (DEP) in participation with the Alafia River Basin stakeholders identified in **Table 1** below. Additional input was received from members of the Tampa Bay Estuary Program (TBEP) and Tampa Bay Nitrogen Management Consortium (NMC) who are not specifically mentioned below.

Table 1. Alafia River Basin responsible stakeholders, agencies, and other interested stakeholders

- Environmental Protection Commission of Hillsborough County
- Hillsborough County Public Works
- Tampa Bay Water
- CSX
- Florida Department of Agriculture and Consumer Services
- TECO Energy
- City of Lakeland
- Plant City
- Polk County
- Southwest Florida Water Management District
- The Mosaic Company
- Kinder Morgan
- Tampa Bay Estuary Program
- Florida Department of Transportation
- CF Industries
- Florida Department of Health in Hillsborough County
- Tampa Bay Regional Planning Council
- Coronet Industries
- Sierra Club

For additional information on the watershed management approach in the Alafia River Basin, contact:

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List of Acronyms and Abbreviations

AGM	Annual Geometric Mean
BMAP	Basin Management Action Plan
BMP	Best Management Practice
cfu/100mL	Colony Forming Unit Per 100 Milliliters
DEP	Florida Department of Environmental Protection
DO	Dissolved Oxygen
E. coli	*Escherichia coli*
EHD	Environmental Health Database
EPA	U.S. Environmental Protection Agency
EPCHC	Environmental Protection Commission of Hillsborough County
ERC	Environmental Regulation Commission
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FIB	Fecal Indicator Bacteria
FLWMI	Florida Water Management Inventory
IWR	Impaired Surface Waters Rule
L	Liter
LA	Load Allocation
lbs/day	Pounds Per Day
mg/L	Milligrams Per Liter
MGM	Monthly Geometric Mean
N/A	Not Applicable
NMC	(Tampa Bay) Nitrogen Management Consortium
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
OSTDS	Onsite Sewage Treatment and Disposal Systems
POR	Period of Record
RAP	Reasonable Assurance Plan
SCI	Stream Condition Index
SCR	Selective Catalytic Reduction
SR	State Road
STORET	STOrage and RETrieval (Database)
SWFWMD	Southwest Florida Water Management District
TBD	To Be Determined
TBEP	Tampa Bay Estuary Program
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TPTV	Ten Percent Threshold Value

WBID	Waterbody Identification
WLA	Wasteload Allocation
WTW	Walk the WBID (or Walk the Waterbody)

Section 1: Introduction and Background

This annual Progress Report describes activities associated with the second year of implementation for the Alafia River Basin Management Action Plan (BMAP) that was adopted in April 2014. **Section 2** describes the projects and activities implemented by stakeholders during the reporting period (April 1, 2015–March 31, 2016) as well as planned projects for the next reporting period (April 1, 2016–March 31, 2017). **Section 3** provides an evaluation of water quality data for the monitoring period (January 1, 2015–December 31, 2015). **Appendix A** contains complete web addresses for important links embedded throughout the report. **Appendix B** contains tables that identify stakeholder projects and activities that were completed, continued (i.e., ongoing), or planned during the reporting period. **Appendix C** contains a Florida Department of Health (FDOH) septic system summary for the Alafia River BMAP area. **Appendix D** contains a list and a map of the BMAP monitoring stations. **Appendix E** contains trend analysis results.

The Alafia River BMAP was developed in collaboration with areawide stakeholders with the assistance of the Tampa Bay Estuary Program (TBEP) and the Tampa Bay Nutrient Management Consortium (NMC). TBEP successfully developed the 2002 Tampa Bay Reasonable Assurance Plan (RAP) to reduce nutrient inputs to Tampa Bay. TBEP worked with the NMC to assess the nutrient loads generated, implement actions to reduce nitrogen loadings, and then monitor improvements in seagrass throughout the bay. The BMAP incorporates these efforts and adds a few elements beyond the requirements of the RAP to address the total maximum daily loads (TMDLs[1]).

Examples of additional BMAP elements include the implementation of source identification efforts such as Walk the Watershed, also known as Walk the WBID[2] (WTW), and the implementation of efforts to reduce fecal indicator bacteria (FIB) loading to the waterbodies. The adopted BMAP also requires production agricultural operations in BMAP WBIDs to participate in the Florida Department of Agriculture and Consumer Services (FDACS) Best Management Practice (BMP) Program or elect to perform water quality monitoring of their operations.

Within portions of the Alafia River Basin, fecal coliform bacteria and nutrients were identified as the primary pollutants causing impairment. In 2004, the Florida Department of Environmental Protection (DEP) adopted a TMDL for Thirty Mile Creek (WBID 1639). DEP later adopted TMDLs for Mustang Ranch Creek (WBID 1592C), Turkey Creek (WBID 1578B), English Creek (WBID 1552), and Poley Creek (WBID 1583) in 2009, and Alafia River Above Hillsborough Bay Tidal Segment (WBID 1621G) in 2011. **Figure 1** contains a map of these

[1] TMDLs are water quality targets for specific pollutants that are established for impaired waterbodies that do not meet designated uses based on Florida water quality standards.

[2] DEP uses the acronym "WBID," or "waterbody identification," to identify the watersheds of tributaries, lakes, estuaries, beaches, and segments of large rivers. The state is divided into approximately 6,600 WBIDs for the purpose of watershed management.

watersheds. **Table 2** lists the WBIDs, parameters, and pollutant load allocations (LAs) for each TMDL addressed by the BMAP. Some of the nutrient TMDLs listed below were developed to address dissolved oxygen (DO) impairments. Alafia Above Hillsborough Bay, Mustang Ranch, and Thirty Mile Creek have nutrient TMDLs. Turkey Creek, Mustang Ranch, English Creek, and Poley Creek have TMDLs for FIB. The TMDLs that define the required fecal coliform and nutrient reductions needed for each segment or tributary are available online. DEP adopted the Alafia River BMAP to implement the fecal coliform and nutrient TMDLs. **Figure 1** depicts the BMAP geographic boundaries of the impaired waterbodies.

Table 2. Alafia River Basin TMDLs

*All the waterbodies listed below are Class II, freshwater streams with the exception of Alafia River Above Hillsborough Bay (tidal segment), which is a Class III marine water estuary.

WBID	Waterbody Name	TMDL Components
1621G	Alafia River Above Hillsborough Bay (Tidal Segment)	Total nitrogen (TN) concentration (target = 1.65 milligrams per liter [mg/L]) • Wasteload allocation (WLA) (National Pollutant Discharge Elimination System [NPDES] stormwater) = 54 % reduction • WLA (NPDES wastewater) = 14.3 pounds per day (lbs/day) • LA = 54 % reduction
1578B	Turkey Creek	Fecal coliform concentration • WLA (NPDES stormwater) = 64 % reduction • WLA (NPDES wastewater) = must meet permit limits • LA = 64 % reduction
1592C	Mustang Ranch Creek	TN concentration • WLA (NPDES stormwater) = 50 % reduction • LA = 50 % reduction Total phosphorus (TP) concentration • WLA (NPDES stormwater) = 45 % reduction • LA = 45 % reduction
1592C	Mustang Ranch Creek	Fecal coliform concentration • WLA (NPDES stormwater) = 88 % reduction • LA = 88 % reduction
1552	English Creek	Fecal coliform concentration • WLA (NPDES stormwater) = 40 % reduction • LA = 40 % reduction
1639	Thirty Mile Creek	TN concentration (target = 3.0 mg/L) • WLA = 3.0 mg TN/liter (L) (monthly average) • LA = 1.6 mg TN/l (annual average)
1583	Poley Creek	Fecal coliform concentration • WLA (NPDES stormwater) = 67 % reduction • LA = 67 % reduction

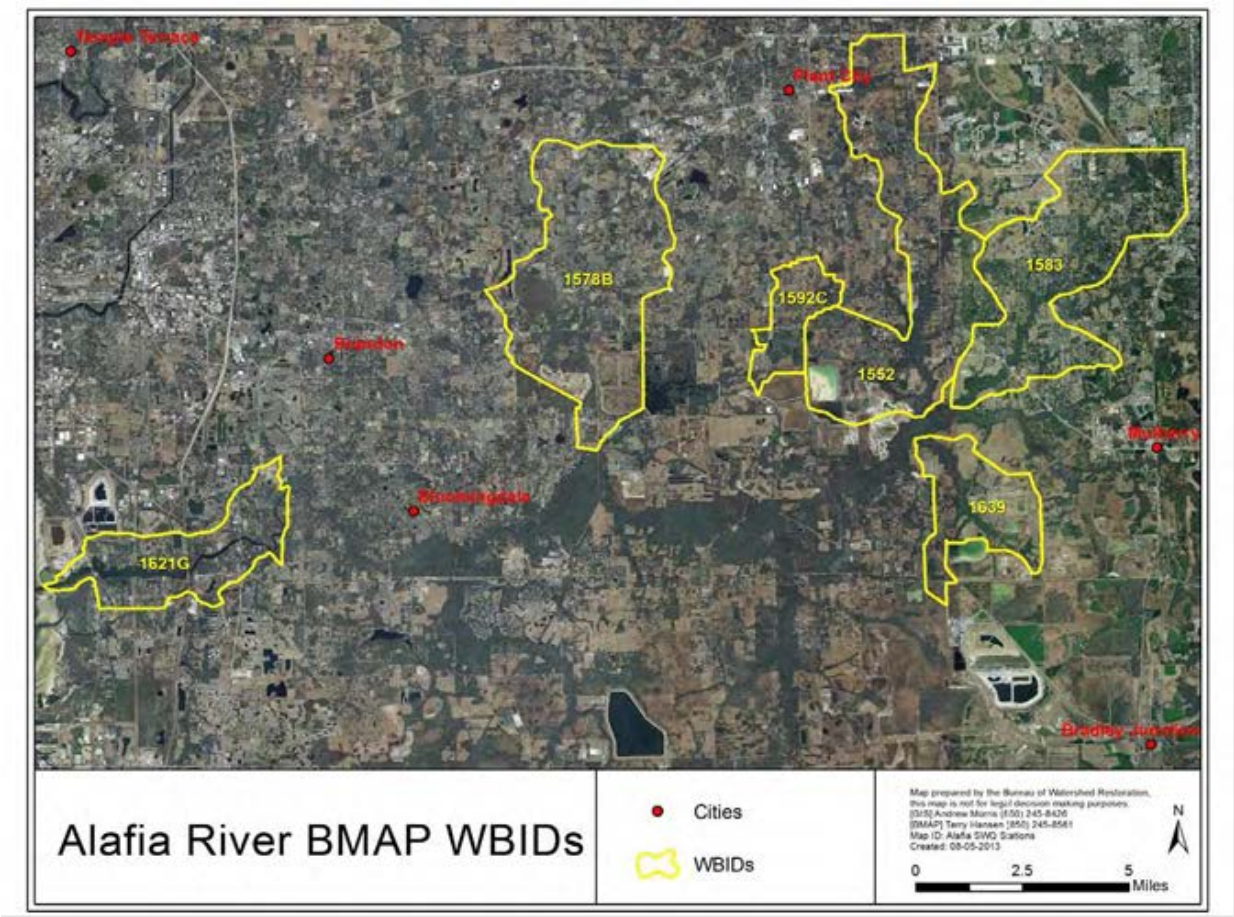

Figure 1. Alafia River BMAP WBID boundaries

Section 2: Activities During the Reporting Period

Stakeholders are implementing ongoing maintenance programs and planned projects. DEP and stakeholders continue to work together to identify the sources of FIB through field investigations and the monitoring of source indicator parameters.

Appendix B contains detailed tables of BMAP projects and activities that were completed, continued, or planned during the reporting period. Highlights of activities during the reporting period are described below.

2.1 FDACS

FDACS has three field staff and one technician assigned to the Southwest Florida Water Management District (SWFWMD) area. These staff enroll commercial agricultural producers in the appropriate FDACS BMP manual, administer cost-share funds, and conduct implementation assurance or follow-up visits with enrolled producers. During the reporting period (April 1, 2015–March 31, 2016), FDACS adopted a revised vegetable and agronomic crop BMP manual as well as a dairy BMP manual.

Figure 2 shows agricultural land use in the Alafia River BMAP area. The acreage used to calculate the starting point for agricultural nutrient loads is based on 2008 land use information from the SWFWMD. It is important to understand that even if all targeted agricultural operations are enrolled, not all of the acreage listed as agriculture in the FDACS BMP Program is in the Alafia River Basin.

Table 3 lists the enrollment figures. The notices of intent (NOIs) document the estimated total number of acres on which applicable BMPs are implemented, not the entire parcel acreage. This is because land use data may contain nonproduction acres (such as buildings, parking lots, and fallow acres) that are not counted on the NOIs submitted to FDACS.

Significant acreage that does not need to be enrolled, such as lands that are not actively involved in commercial agriculture (operations conducted as a business), may exist in the BMAP area. These areas are often low-density residential uses on large parcels of grassed land, or land that was but is no longer in commercial agricultural production. This information is impossible to discern in the photo interpretation process used to generate land use data. Local governmental, SWFWMD, or DEP BMPs may address these noncommercial sources.

Based on aerial imagery and field staff observation, FDACS adjusted the land use acreages to reflect more accurately the current agricultural land use acreage. The FDACS-adjusted acreage shows approximately 8.8 % less total acreage than indicated in the 2008 figures. This decrease is the result of nonproduction lands that do not need to be enrolled but are included in agricultural land use and classified as "other open lands–rural." In addition, some acreage may have ceased production since 2008 and therefore does not need to be enrolled in the FDACS BMP Program.

All agricultural nonpoint sources in the Alafia River Basin BMAP area are statutorily required either to implement FDACS-adopted BMPs or to conduct water quality monitoring under a DEP- or SWFWMD-approved plan that demonstrates compliance with state water quality standards. **Figure 3** shows the acres enrolled in the FDACS BMP Program as of March 31, 2016. **Table 3** summarizes the land use data and the number of acres enrolled in the FDACS BMP Program in the Alafia River Basin.

Because of the inaccuracies in land use information and changes in land use since 2008, agricultural loadings may be less than indicated in the TMDL. The region is expected to continue the shift from agricultural to residential/urban land uses, further reducing agricultural loadings. FDACS will work with DEP to identify the appropriate nutrient reductions associated with agricultural BMPs.

Table 3. Agricultural acreage and FDACS BMP Program enrollment in the Alafia River Basin

[1] FDACS-adjusted acreage for the purposes of enrollment is based on a review of more recent aerial imagery in the basin and local staff observations.
N/A = Not applicable.

2008 SWFWMD Land Use	2008 Acres	FDACS-Adjusted Acres for Enrollment[1]	Related FDACS BMP Programs	Acreage Enrolled[1]	Related NOIs/ Certification
Pastureland and Rangeland	4,396.3	4,396.3	Cow/Calf Vegetable and Agronomic Crops (Hay)	924.1	5
Row/Field/Mixed Crops	3,033.3	3,033.3	Vegetable/ Agronomic Crops	3,769.5	55
Tree Crops	1,452.2	142.2	Specialty Fruit and Nut	102.1	9
Nurseries and Vineyards	343.2	343.2	Statewide Nurseries	314.8	9
Specialty Farms	40.0	40	Equine	0	0
Feeding Operations	42.9	42.9	Conservation Plan Rule	0	0
Other Open Land–Rural	1,183.7	0	No Enrollment Needed	N/A	N/A
Aquaculture	12.9	12.9	FDACS Aquaculture Certification	N/A	N/A
Total	**10,554.4**	**9,370.7**		**5,110.5**	**78**

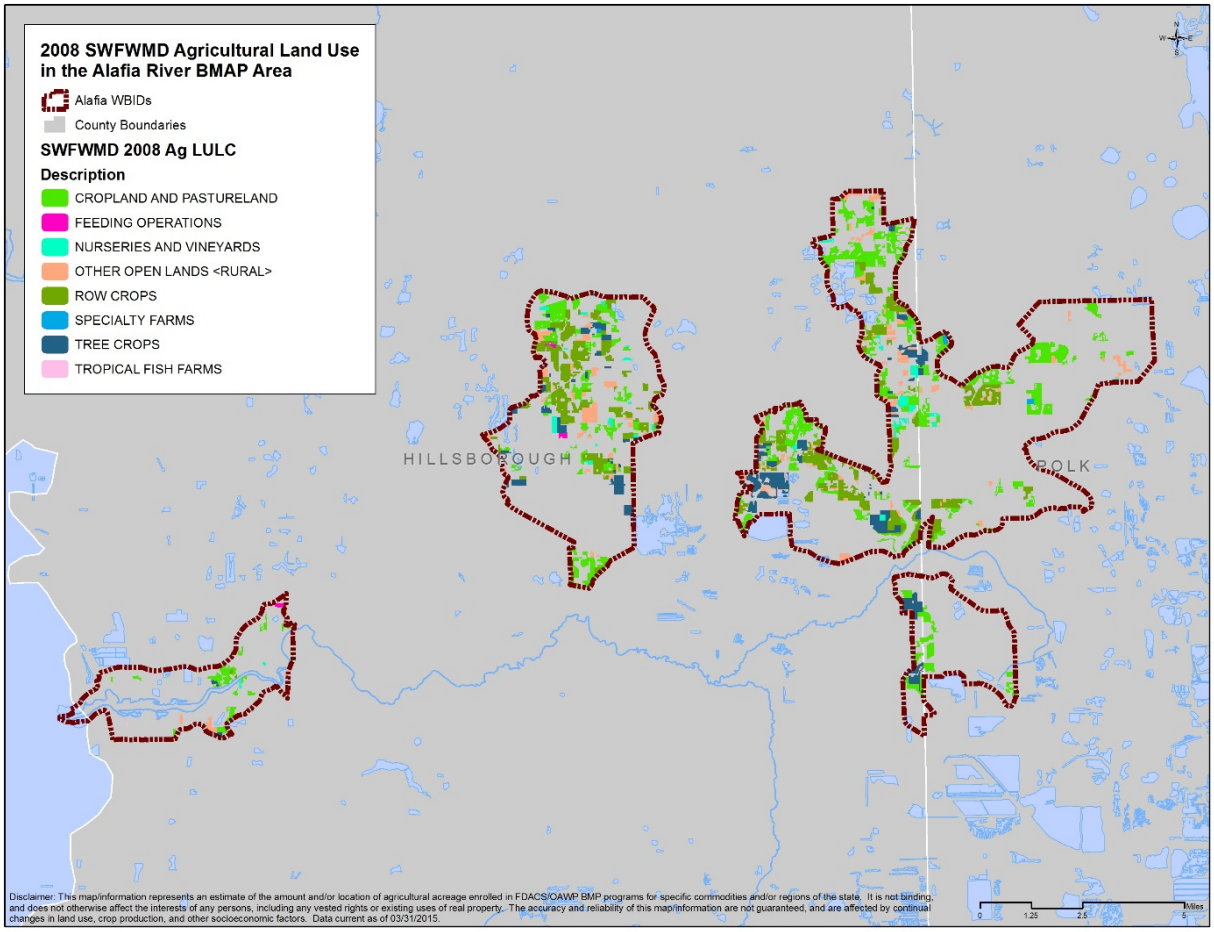

Figure 2. Agricultural land use based on 2008 SWFWMD data in the Alafia River Basin

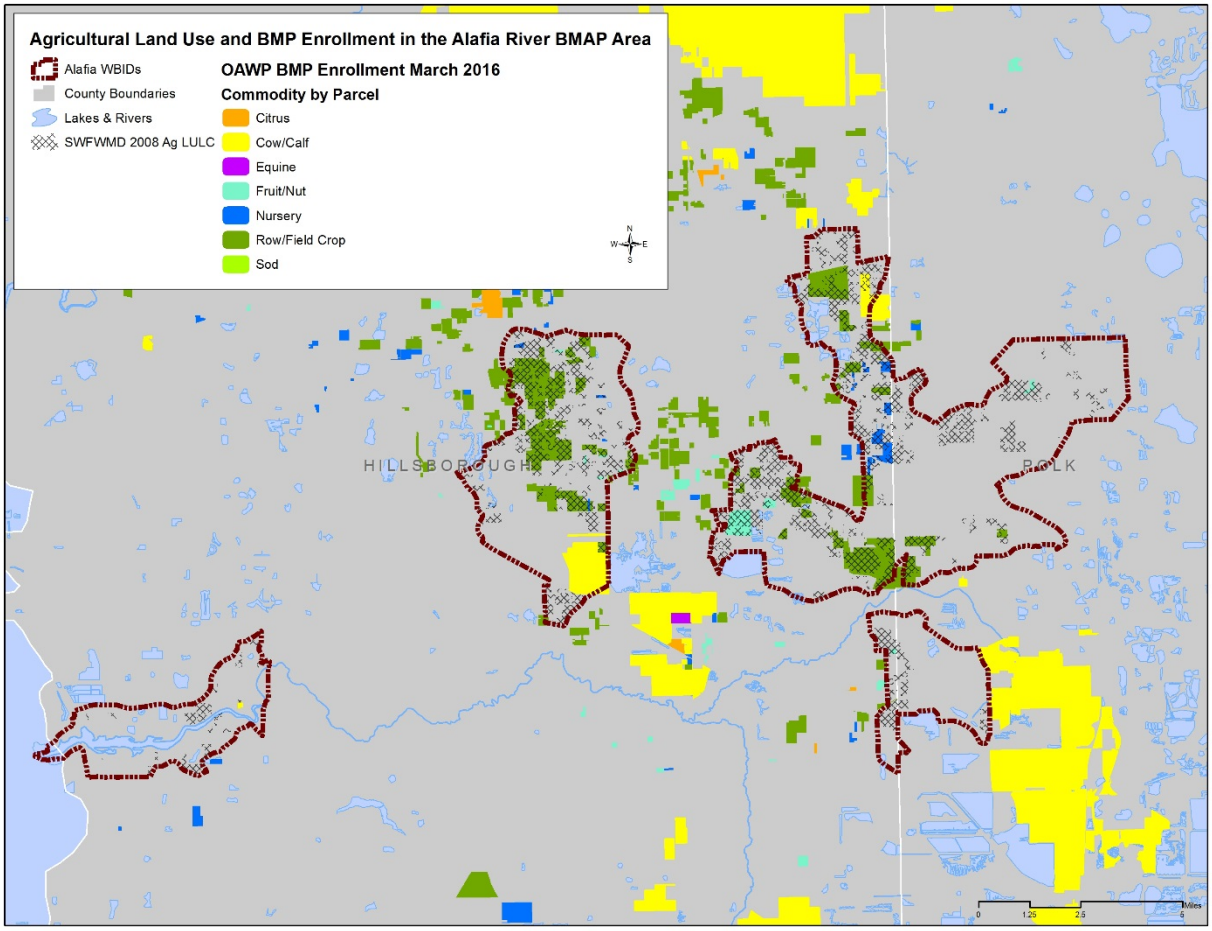

Figure 3. FDACS BMP Program enrollment in the Alafia River Basin as of March 31, 2016

2.2 Walk the Waterbody

When a waterbody has an adopted fecal coliform TMDL then DEP recommends carrying out a Walk the Waterbody exercise to determine sources and identify management strategies. **Table 4** lists the waterbodies with fecal coliform TMDLs in the Alafia River Basin and the status of the Walk the Waterbody exercise for each waterbody.

Table 4. Walk the Waterbody status

TBD = To be determined.

WBID	Waterbody Name	Walk the Waterbody Status	Lead Entity
1578B	Turkey Creek	Completed	Hillsborough County Public Works
1592C	Mustang Ranch Creek	TBD	TBD
1552	English Creek	TBD	TBD
1583	Poley Creek	Completed	Polk County Parks and Natural Resources Division

Section 3: Water Quality Evaluation

3.1 Revised FIB Criteria

In 2015, the Environmental Regulation Commission (ERC) approved proposed revisions to Florida's water quality standards that included revised bacteria criteria. DEP adopted the U.S. Environmental Protection Agency (EPA) recent criteria for *Escherichia coli* (*E. coli*) bacteria (Class I and III fresh water) and *Enterococci* bacteria (Class III marine water) to replace the existing criteria for fecal coliform bacteria. These new bacterial fecal indicators are based on the same recreational bather illness rate as the fecal coliform criteria, but they correlate better with bather illness than fecal coliforms and are thus more protective. Class II fecal coliform criteria are retained, since the federal and state shellfish harvesting programs continue to use this indicator.

The new criteria include a monthly geometric mean (MGM) and a ten percent threshold value (TPTV). The MGM is based on a minimum of either 5 samples (Class I) or 10 samples (Class III) taken over a 30-day period. Because of sample size, the criteria applicable to the BMAP are the TPTV. A TPTV is an upper value not to be exceeded in 10 % or more of the samples during an assessment period. *E. coli* will be used to assess fresh waters and the MGM is 126 colony-forming units (cfu)/100 milliliters (mL) and the TPTV is 410 cfu/100 mL. *Enterococci* will be used to assess Class III marine waters and the MGM is 35 cfu/100 mL and the TPTV is 130 cfu/100 mL. All of the waterbodies addressed in this BMAP are fresh water except for the Alafia River above Hillsborough Bay segment, which is marine.

While the criteria went into effect (for state purposes) on February 17, 2016, they will need EPA approval before going into effect for Clean Water Act purposes (impaired waters assessments and NPDES permits). For more information about the criteria, contact Ken Weaver of the Standards Development Section.

To transition to the new state FIB criteria, the BMAP efforts will continue to implement the fecal coliform TMDLs while integrating sampling for *E. coli* and *Enterococci* so that the waterbodies can be assessed using the new water quality standard during the next assessment cycle. The *E. coli* and *Enterococci* data will be used to guide future restoration efforts. In the meantime, high-magnitude fecal coliform exceedances remain a good tool to direct field investigations and management strategies.

3.2 Water Quality Monitoring

The Alafia River BMAP monitoring plan supports the implementation of the BMAP by providing water quality data and other information that can be used to document status and track trends in FIB and nutrient levels in the six BMAP WBIDs. The information collected through the monitoring plan is used to evaluate progress toward achieving BMAP objectives, to demonstrate progress toward meeting the TMDLs, to facilitate comparisons of water quality in the BMAP watershed before and after the implementation of BMPs, and to provide information to help guide the selection of future BMPs.

The monitoring plan consists of ambient water quality sampling at 11 stations. The stations are sampled quarterly, with a few sampled more frequently. The stations are monitored by the Environmental Protection Commission of Hillsborough County (EPCHC) and Polk County Natural Resources Division. DEP will work with stakeholders to add a regularly sampled station to the monitoring plan in Thirty Mile Creek and another in the downstream reaches of Poley Creek. The counties upload their data to the DEP Storage and Retrieval (STORET) Database regularly, at least twice a year. **Appendix D** contains a list of the current stations in the monitoring network and a map of the station locations. Monitoring stations may be moved to different locations, but participants will carry out the same level of effort so that the impairments in the basin can be identified and addressed.

The Alafia River Basin is one of several basins that flow into Tampa Bay. The SWFWMD monitors the health of Tampa Bay and provides current water quality information on the receiving waters of the Alafia River Basin. The Tampa Bay update (**Appendix F**) is developed in accordance with the compliance assessment adopted through DEP's Tampa Bay Reasonable Assurance Determination on December 22, 2010, and the federally recognized nutrient TMDL for Tampa Bay. The TBEP and Tampa Bay NMC have provided annual decision matrix reports for Tampa Bay since 2000. The reports include information on the downstream biological response to load reductions in the Alafia River Basin.

3.3 Fecal Coliform Reductions Since BMAP Adoption

DEP determines progress towards meeting the FIB criteria for the 4 TMDL waterbodies by assessing the frequency with which the criteria for each tributary are exceeded. This approach mirrors the Impaired Surface Waters Rule (IWR) methodology in Chapter 62-303, Florida Administrative Code (F.A.C.). The prior Class III IWR criterion was set so that if more than 10 % of the fecal coliform data were to exceed 400 cfu/100mL during each verified period, the water was verified as impaired. As *E. coli* and *Enterococci* data become available, the frequency of exceedance of the new state criteria will be used in conjunction with the frequency of exceedance of the old state criterion for BMAP progress assessments. This approach will allow a smooth transition and provide the ability to assess progress as datasets of the new FIB parameters grow.

This section includes data from the BMAP monitoring network and other key stations that together make up the IWR monitoring network. **Table 5** shows each WBID's total number of fecal coliform samples, total number of exceedances, minimum number of exceedances to be considered impaired, and percent exceedance for assessment Cycles 1 through 3. To continue comparing progress each year until the next assessment (Cycle 4), a rolling 7.5-year data period is reviewed (**Table 5**). Each year, the oldest 12 months of data are dropped from the data period reviewed the previous year, and the most recent 12 months of data are added to the dataset.

Column 5 in **Table 5 s**hows the minimum number of exceedances needed to place a waterbody on the Verified List with at least a 90 % confidence level. The minimum number of exceedances is compared with the number of exceedances to determine if the IWR criterion is being met. The

last column in **Table 5** shows each WBID's percent exceedance, which is based on the number of exceedances (Column 4) relative to the total number of data points (Column 3) for each 7.5-year dataset (cycle).

Table 5. Comparison of FIB exceedances by WBID

[1] The Cycle 1 verified period is January 1, 1996–June 30, 2003; the Cycle 2 verified period is January 1, 2001–June 30, 2008; the Cycle 3 verified period is January 1, 2007–June 30, 2014; the first 7.5-year verified period is January 1, 2008–June 30, 2015; and the current 7.5-year verified period is January 1, 2009–June 30, 2016.
[2] Subsection 62-303.420(2), F.A.C., Table 3.

Waterbody Name	Cycle[1]	Total Number of FIB Data Points	Number of Exceedances	Minimum Number of Exceedances to be Considered Impaired[2]	% Exceedance
Turkey Creek	1	100	65	7	65
Turkey Creek	2	141	79	15	56
Turkey Creek	3	171	88	18	51
Turkey Creek	First 7.5-year period	187	93	25	50
Turkey Creek	Current 7.5-year period	182	95	24	52
Mustang Ranch Creek	1	4	4	1	100
Mustang Ranch Creek	2	6	6	1	100
Mustang Ranch Creek	3	32	24	4	75
Mustang Ranch Creek	First 7.5-year period	29	19	6	66
Mustang Ranch Creek	Current 7.5-year period	25	13	5	52
English Creek	1	41	13	5	32
English Creek	2	72	22	8	31
English Creek	3	104	44	11	42
English Creek	First 7.5-year period	111	46	16	41
English Creek	Current 7.5-year period	113	50	16	44
Poley Creek	1	7	4	1	57
Poley Creek	2	39	19	4	49
Poley Creek	3	29	19	3	66
Poley Creek	Current 7.5-year period	25	18	5	72
Poley Creek	First 7.5-year period	22	14	5	64

3.4 Nutrients and DO

3.4.1 Revised DO Criterion

DEP conducted an extensive statewide freshwater DO study from 2005 to 2006 in lakes and streams to collect data required to fully assess the accuracy of the previous criterion and to revise the state's DO criterion. The study confirmed that DO concentrations in approximately 70 % of the minimally disturbed streams and 52 % of the minimally disturbed lakes sampled during the study do not relate well to the previous criterion of 5 mg/L (with 10 % or more of the measurements falling below the criterion naturally) which triggered the development of TMDLs for Alafia River above Hillsborough Bay, Mustang Ranch, and Thirty Mile Creek.

After evaluating data from the DO study, DEP determined the minimum DO levels that fully protect healthy, well-balanced aquatic communities using information from unimpacted waterways in different regions of the state. DEP derived the revised freshwater DO criterion using the relationship between the daily average DO condition (percent saturation of DO) and a measure of stream aquatic life health, the Stream Condition Index (SCI). DEP determined the DO saturation required to achieve healthy biological conditions must have an average SCI score of 40 (healthy), at the 90th percentile confidence interval.

DEP selected DO percent saturation rather than concentration for two reasons: (1) the daily average DO saturation provided the best correlation with SCI scores; and (2) saturation automatically accounts for the inherent relationship between temperature and DO. DEP developed different regional criteria to account for the observed regional differences in measured DO levels and biological expectations, and used the confidence interval to add a protective safety factor accounting for the uncertainty in the relationships and the naturally expected diel fluctuations in DO levels. Additional information is available online on the DO criterion change and related studies.

During the Cycle 3 assessment of the Alafia Basin (7.5-year period, January 1, 2007–June 30, 2014), Thirty Mile Creek, which has a TMDL for nutrients, was determined to be unimpaired by DO, in accordance with the new criterion. However, it is on the DEP Study List because of increasing trends in chlorophyll *a* annual geometric means (AGMs) and nutrients (i.e., TP) due to the need for additional floral data. Based on the recent assessment, the Alafia River Above Hillsborough Bay segment was also not impaired for DO in accordance with the new criterion. However, Mustang Ranch Creek may be impaired due to the number of DO exceedances over the current reporting period.

3.4.2 DO Saturation, TN, and TP Trend Analysis

Two forms of nonparametric trend analyses were conducted to assess changes in parameter values over time or between periods: (1) monotonic analyses (i.e., a gradual change over time consistent in a direction); and (2) step trend analyses (i.e., an abrupt shift at a specific point in time). Data are not required to conform to a particular distribution for nonparametric analyses. Nonparametric tests are also robust against outliers and large data gaps.

Trend analyses can be used to document the water quality response to implement specific or widespread management actions such as BMP projects (step trend). Furthermore, trend analyses can be used to evaluate how water quality has changed over a long-term period of record (POR) and answer questions such as "Have nutrient concentrations or loads increased, decreased, or remained the same since a TMDL or BMAP was adopted?" (monotonic trend). The intent of conducting trend analyses is to determine if water quality conditions have improved or degraded while the BMAP is in place. If trends show that conditions begin to degrade, then DEP will discuss with affected stakeholders how to reverse the degradation. Trend analyses were conducted on water quality monitoring data to determine if DO saturation, TN, or TP values have changed throughout the selected POR for stations in the Alafia River Basin with appropriate data sufficiency.

Requirements for data sufficiency included an evaluation of the number of observations per year and the length of the record. Stations with less than quarterly data collection frequency were not used for trend analyses. Stations and associated data that did not meet the data sufficiency requirements at this time will be re-evaluated and may be included in future analyses if data are uploaded to STORET and meet the minimum data requirements. Additional detailed documentation of the data processing and analysis methods can be acquired by contacting DEP.

The Seasonal Mann-Kendall test was used to identify monotonic trends in a statistically rigorous way for monthly and quarterly data (as described in Helsel, D.R., and R.M. Hirsch, 2002, Statistical methods in water resources, U.S. Geological Survey [USGS], as referenced in Rule 62-302.533, F.A.C.). For the Seasonal Mann-Kendall test, data from January 1, 2008, to June 30, 2016 were used as the POR. For monthly frequency data, the months of the year were used as seasons for the Seasonal Mann-Kendall test. If data were collected on a quarterly frequency for a site, then Quarters 1 through 4 were used for the Seasonal Mann-Kendall test to remain consistent with DEP assessment protocols. The Mann-Kendall test was also used to identify monotonic trends for data aggregated into AGMs on a WBID scale.

Table E-1 and **Table E-2** in **Appendix E** provide the results of the Seasonal Mann-Kendall test and Mann-Kendall tests on AGMs, respectively. Data plots associated with these tables can be acquired upon request from DEP. Generally, the Seasonal Mann-Kendall results did not show many significant trends except for 2 stations out of 13 stations in the Alafia River Above Hillsborough Bay WBID. Those 2 stations both showed a significantly increasing trend in DO, and 1 of the 2 stations showed a decreasing trend in TN. Increasing DO and decreasing TN trends indicate improved water quality conditions. The Mann-Kendall tests on AGMs with data aggregated by WBID showed a significant decline in TN for Thirty Mile Creek, which can be viewed as a water quality improvement for this WBID. The data time series in the rest of the WBIDs that do not show any significant change over the POR for TN, TP, or DO indicate that water quality conditions have not degraded.

Step trend analysis can be used to evaluate the effects on water quality when the data can be divided into two logical groups, such as the periods before and after a TMDL was implemented. For the Alafia River Basin, the Mann-Whitney statistical test was used for step trend analysis to

test whether significant differences were found before and after the TMDL was implemented for the following two PORs:

- Period 1: TMDL data period, January 1, 2001–June 30, 2008.
- Period 2: Post-TMDL data period, July 1, 2008–June 30, 2016.

Table E-3 in **Appendix E** provides the results for the step trend analysis (data plots associated with this table can be acquired upon request from DEP). Mustang Ranch Creek did not show any difference between the two periods. However, Mustang Ranch Creek is meeting water quality criteria for DO, TN, and TP. Therefore, no difference between periods indicates that water quality conditions have remained the same and have not degraded since the TMDL has been implemented. Water quality conditions have improved in the Alafia River Above Hillsborough Bay WBID, with a significant increase in DO and decline in TN since the TMDL data period. Thirty Mile Creek also showed a decrease in TN, indicating improved water quality since the TMDL data period.

In addition to the Alafia River Basin assessments, water quality assessments of the receiving water, Tampa Bay, indicate that chlorophyll *a* concentrations in three of the four major bay segments of the Tampa Bay Estuary were below DEP-approved thresholds. These thresholds were adopted as part of DEP's 2002 reasonable assurance determination for Tampa Bay. The Alafia River contributes to Hillsborough Bay, a segment of the Tampa Bay Estuary in which chlorophyll *a* concentrations are meeting water quality goals and are below the reasonable assurance thresholds. The 2015 Annual Decision Matrix Report can be found in **Appendix F**. Tampa Bay's seagrass restoration targets are expected to be achieved so long as annual chlorophyll *a* concentrations remain below the thresholds.

Appendices

Appendix A. Important Links

The following lists the complete addresses for websites in this document, in the order in which they appear in the text:

- **Cover page:** DEP website – http://www.dep.state.fl.us/mainpage/default.htm
- **Acknowledgments:** Anita Nash email address – anita.nash@dep.state.fl.us
- **Section 1:** Manatee River BMAP and annual reports – http://www.dep.state.fl.us/water/watersheds/bmap.htm
- **Section 1:** Alafia River Basin TMDLs – http://www.dep.state.fl.us/water/tmdl/index.htm
- **Section 3:** Ken Weaver email address – ken.weaver@dep.state.fl.us
- **Section 3:** STORET public access database – http://prodenv.dep.state.fl.us/DearSpa/public/welcome
- **Section 3:** Technical Support Document: *Derivation of dissolved oxygen criteria to protect aquatic life in Florida's fresh and marine waters* – http://www.dep.state.fl.us/water/wqssp/docs/tsd-do-criteria-aquatic-life.pdf
- **Appendix C:** Florida Water Management Inventory **(**FLWMI) – http://www.floridahealth.gov/environmental-health/onsite-sewage/research/FLWMI/
- **Appendix C:** U.S. Environmental Protection Agency (EPA) publication, *A homeowner's guide to septic systems*: – https://www3.epa.gov/npdes/pubs/homeowner_guide_long.pdf

Appendix B. Stakeholder Projects Completed, Ongoing, or Planned During the Reporting Period (April 1, 2015–March 31, 2016)

Projects listed as ongoing are reported to have occurred during the reporting period and should continue to occur in subsequent years, unless notification is provided to DEP that the project has been discontinued. Additional project information, including a complete list of projects, can be acquired by contacting DEP.

Table B-1. Project list

Lead Entity	Project Number	Project Name	Project Type	Project Status	Project Completion Year
City of Plant City	TBEP-1164	Dog Waste Signs	Stormwater management	Ongoing	N/A
City of Plant City	TBEP-1314	Plant City Street Sweeping Program	Stormwater management	Ongoing	N/A
City of Plant City	N/A	Plant City Lift Station Telemetry Program	Wastewater infrastructure	Ongoing	N/A
City of Plant City	TBEP-1284	Plant City Stormwater Inlet Marking Program	Wastewater infrastructure	Ongoing	N/A
City of Plant City	TBEP-1285	Plant City Lift Station Auxiliary Power Program	Wastewater infrastructure	Ongoing	N/A
City of Plant City	TBEP-1286	Plant City Lift Station Maintenance Program	Wastewater infrastructure	Ongoing	N/A
City of Plant City	TBEP-1287	Plant City Lift Station Security Program	Wastewater infrastructure	Ongoing	N/A
City of Plant City	TBEP-1288	Plant City Grease Management Program	Wastewater infrastructure	Ongoing	N/A
City of Plant City	TBEP-1289	Plant City Inflow and Infiltration Program	Wastewater infrastructure	Ongoing	N/A
City of Plant City	TBEP-1291	Plant City Spill Prevention and Response Program	Wastewater infrastructure	Ongoing	N/A
City of Plant City	TBEP-1292	Plant City Sewer Line Maintenance Program	Wastewater infrastructure	Ongoing	N/A
FDACS/DEP	TBEP-1182	BMP Enrollment	Agricultural BMPs	Ongoing	N/A
FDACS/DEP	TBEP-1184	BMP Enrollment	Agricultural BMPs	Ongoing	N/A

Lead Entity	Project Number	Project Name	Project Type	Project Status	Project Completion Year
FDACS/DEP	TBEP-1187	BMP Enrollment	Agricultural BMPs	Ongoing	N/A
FDACS/DEP	TBEP-1189	BMP Enrollment	Agricultural BMPs	Ongoing	N/A
FDACS/DEP	TBEP-1190	BMP Enrollment	Agricultural BMPs	Ongoing	N/A
EPCHC/FDOT	To be added	Monitoring for Pollutant Loading Estimate Project	Special studies, planning, monitoring, and assessment	Ongoing	N/A
Florida Department of Transportation (FDOT)	To be added	Road BMPs	Stormwater management	Ongoing	N/A
Mosaic	TBEP-844	Mosaic Riverview, Enhanced Housekeeping and Street Sweeping	Restoration, land acquisition, and water quality improvement	Ongoing	2005
Polk County	TBEP-1159	Illicit Discharge Complaint Investigation	Stormwater management	Ongoing	N/A

Appendix C. FDOH Septic System Summary for the Alafia River BMAP Area

Nonpoint source pollutants from Onsite Sewage Treatment and Disposal Systems (OSTDS) can have significant impacts on surface water and groundwater quality. Approximately thirty percent of Florida's population uses an OSTDS as their method of wastewater disposal. In Florida, OSTDS are regulated by FDOH and cover wastewater from establishments that generate domestic sewage up to 10,000 gallons per day or commercial strength sewage waste up to 5,000 gallons per day. A typical OSTDS consists of a septic tank and drainfield (**Figure C- 1**).

Table C- 1 lists five waterbodies each with a unique WBID impaired for fecal coliform are located in the Alafia River BMAP area. These WBIDs are distributed in Hillsborough and Polk Counties (**Figure C- 2)**. In these WBIDs, there are an estimated 20,068 built parcels (**Table C-2**). Of those built parcels, about 68.1 % (13,675) are connected to an OSTDS, 27.1 % (5,443) are connected to a DEP regulated wastewater treatment facility, and 5.5 % (1,113) are unknown. Of those parcels with OSTDS, 3,496 are known and 10,179 are likely to exist. The known and likely data qualifiers were assigned based on factors related to the level of certainty for the source information. The information used comes from the FDOH FLWMI, which is a centralized geographic data map linking each built property in the state with a drinking water source (public water or private domestic well) and wastewater treatment method (central sewer or onsite septic). More information on this data source can be found by visiting the FLWMI website. The spatial distributions of built parcels on different wastewater treatment methods in each WBID or WBID aggregate are demonstrated in **Figure C-3** through **Figure C-6**. These figures are organized in such a way that, all spatially-connected BMAP WBIDs are aggregated into one map figure, while BMAP WBIDs not spatially connected to any other BMAP WBIDs are included in separate map figures. **Table C- 1** is a lookup table showing which WBIDs are included on which map figure.

Further analysis was done by linking the data points with the FDOH Environmental Health Database (EHD). EHD is a statewide web-based permitting database that FDOH uses to keep track of Environmental Health program information (permits issued, facilities regulated, etc.) EHD has electronic permitting and inspection data for onsite wastewater treatment systems covering a period from the mid-1990s onward. Information on the system installation date and type of system installed can be extracted and linked to the
FLWMI map.

Table C- 3 shows the proportion of permitted OSTDS that were constructed prior to or after 1983. Construction and use standards for OSTDS in Florida began in 1921. A major revision to the standards occurred in 1982 when a separation of 24 inches was required between the bottom of a newly constructed drainfield and the estimated seasonal high groundwater table. Research in Florida and elsewhere has shown that OSTDS installed to the 1982 standards effectively reduce the concentration of pathogens found in normal wastewater and that nitrogen levels are reduced as well. Knowing how many OSTDS were installed prior to this rule, and where they are located, could provide information to assist with future BMAP efforts.

Table C- 3 also shows information on the estimated age of systems. This information was assigned to each parcel based on EHD data or from the Department of Revenue for the year the structure was built if EHD data were not available. The average age of all OSTDS in the Alafia River Basin BMAP is 19 years, with those that are known having an average age of 11 years and those that are likely having an average age of 27 years.

Table C- 4 breaks out EHD information from 2011 through 2016 on the permit types such as new construction, system in need of repair, evaluated existing, or abandoned system. This information may be useful to see any trends in new construction and system failures over time. The red points in **Figure C-3** through **Figure C-6** indicate the total number of repairs that were permitted between 2011 and 2016 within the BMAP.

Table C- 1. Map lookup table for BMAP WBID included in this document

WBID	Waterbody Name	Map Figure
1552	English Creek	Figure C- 3
1578B	Turkey Creek above Little Alafia River	Figure C- 4
1583	Poley Creek	Figure C- 3
1592C	Mustang Ranch Creek	Figure C- 3
1621G	Alafia River above Hillsborough Bay	Figure C- 5
1639	Thirtymile Creek	Figure C- 6

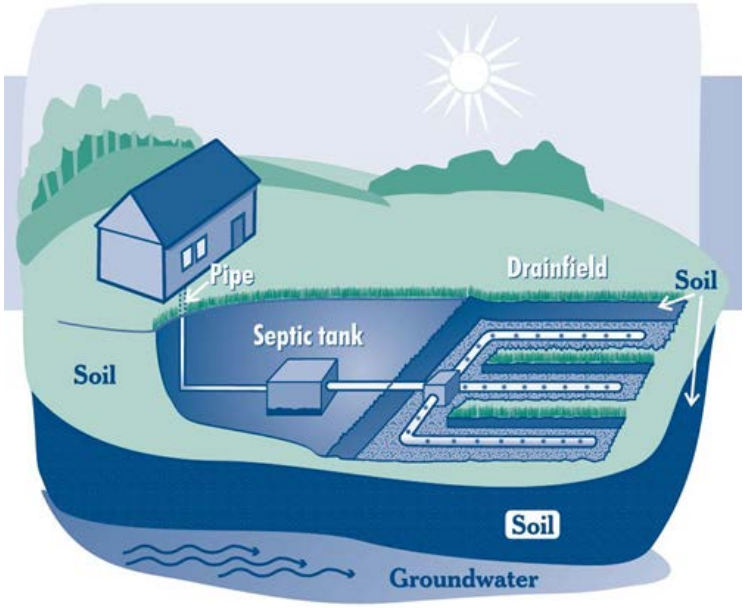

Figure C-1. Illustration of a typical OSTDS
Source: EPA: *A Homeowner's Guide to Septic Systems*

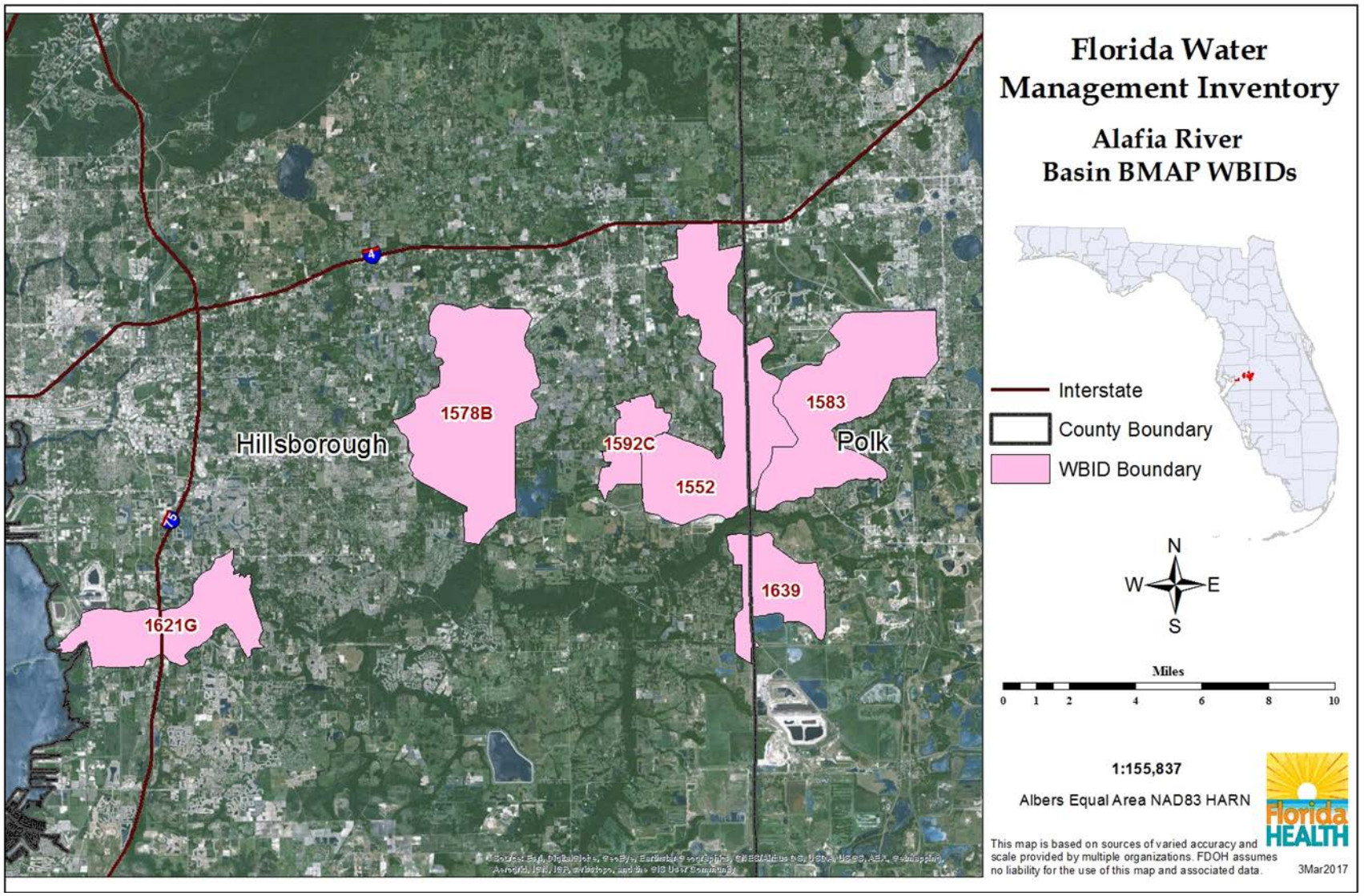

Figure C-2. Location of WBIDs included in the Alafia River BMAP area

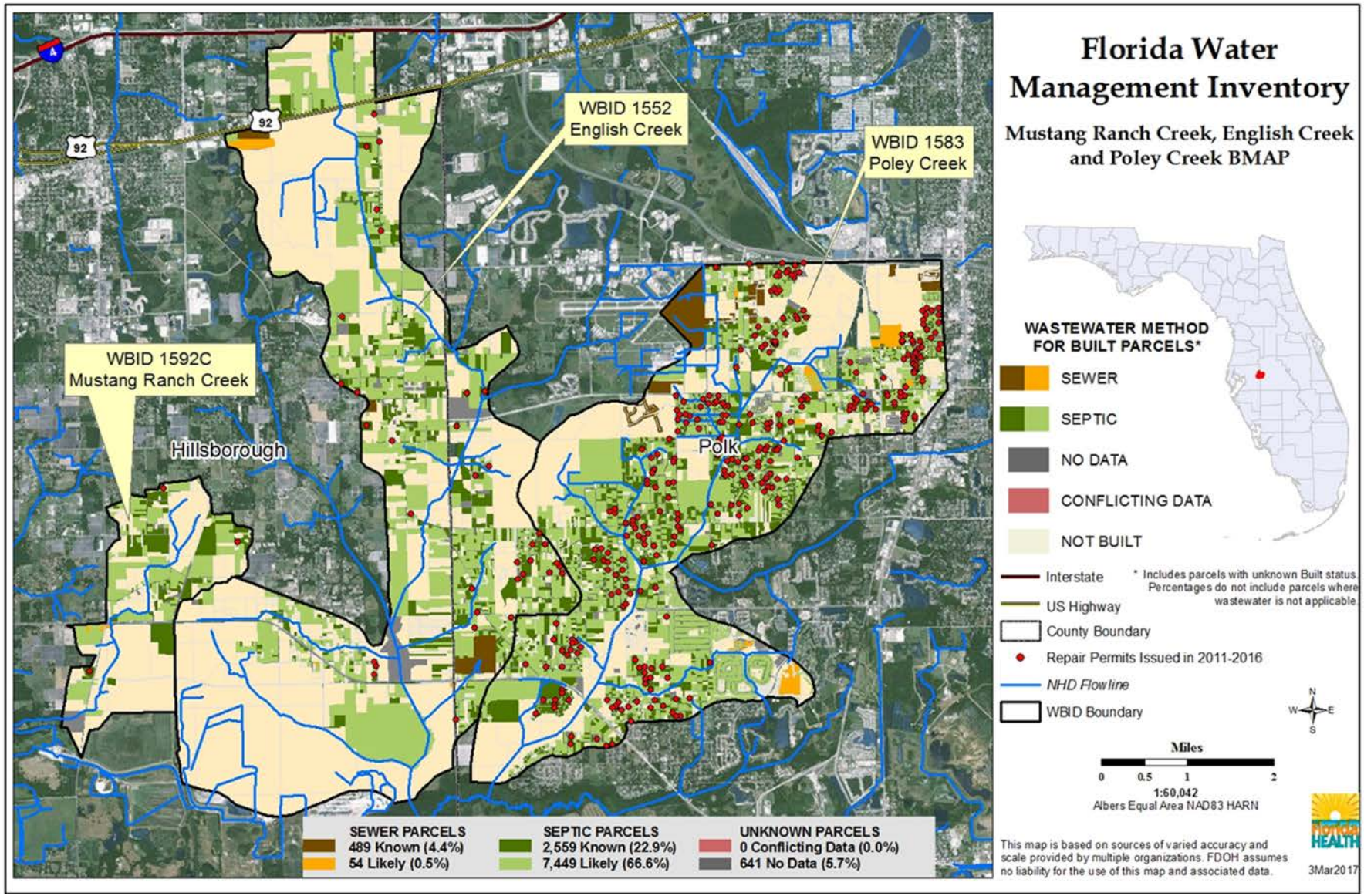

Figure C-3. BMAP area as of March 3, 2017

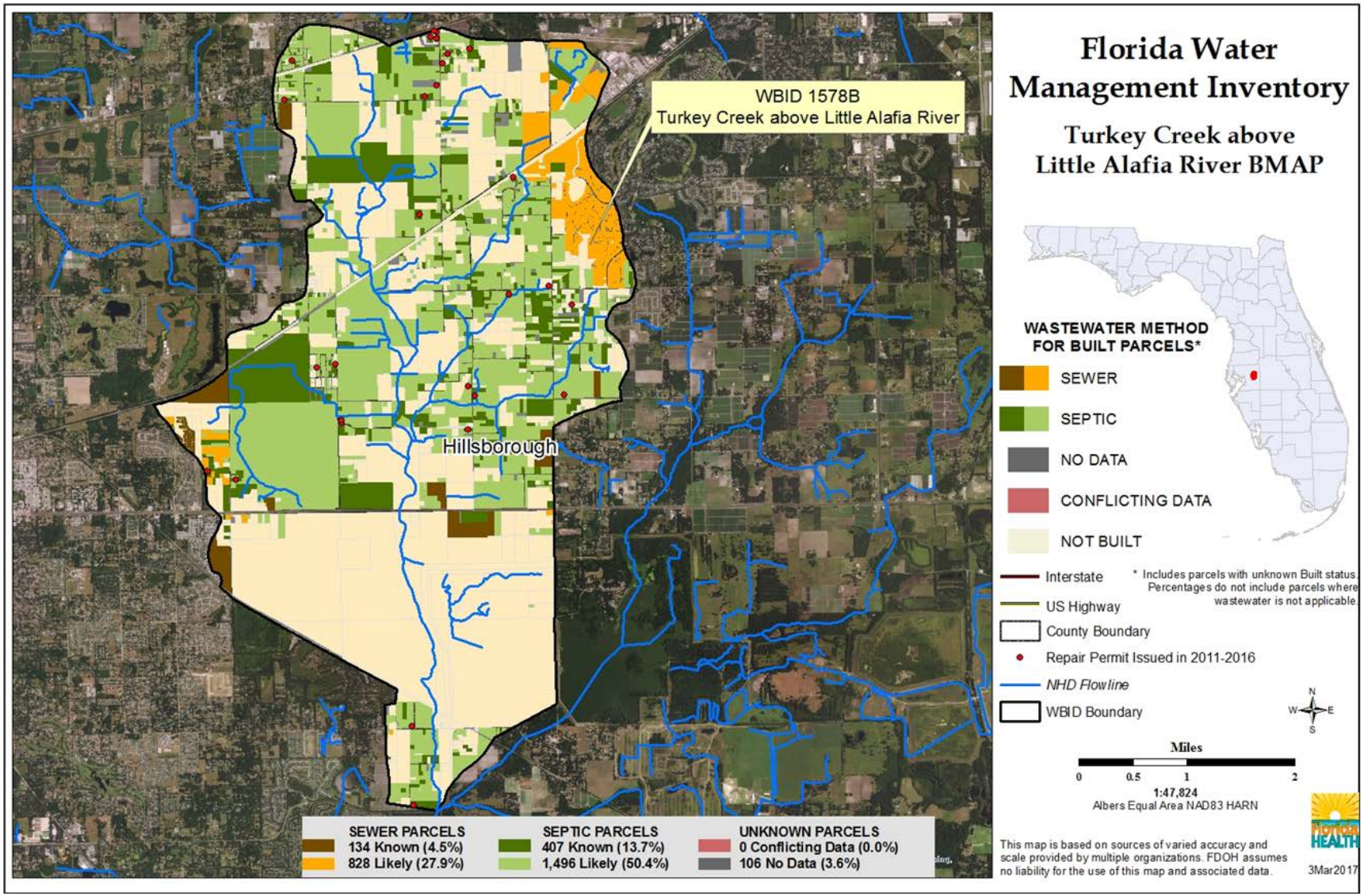

Figure C-4. Wastewater disposal method for parcels within WBID 1578B in the Alafia River BMAP area as of March 3, 2017

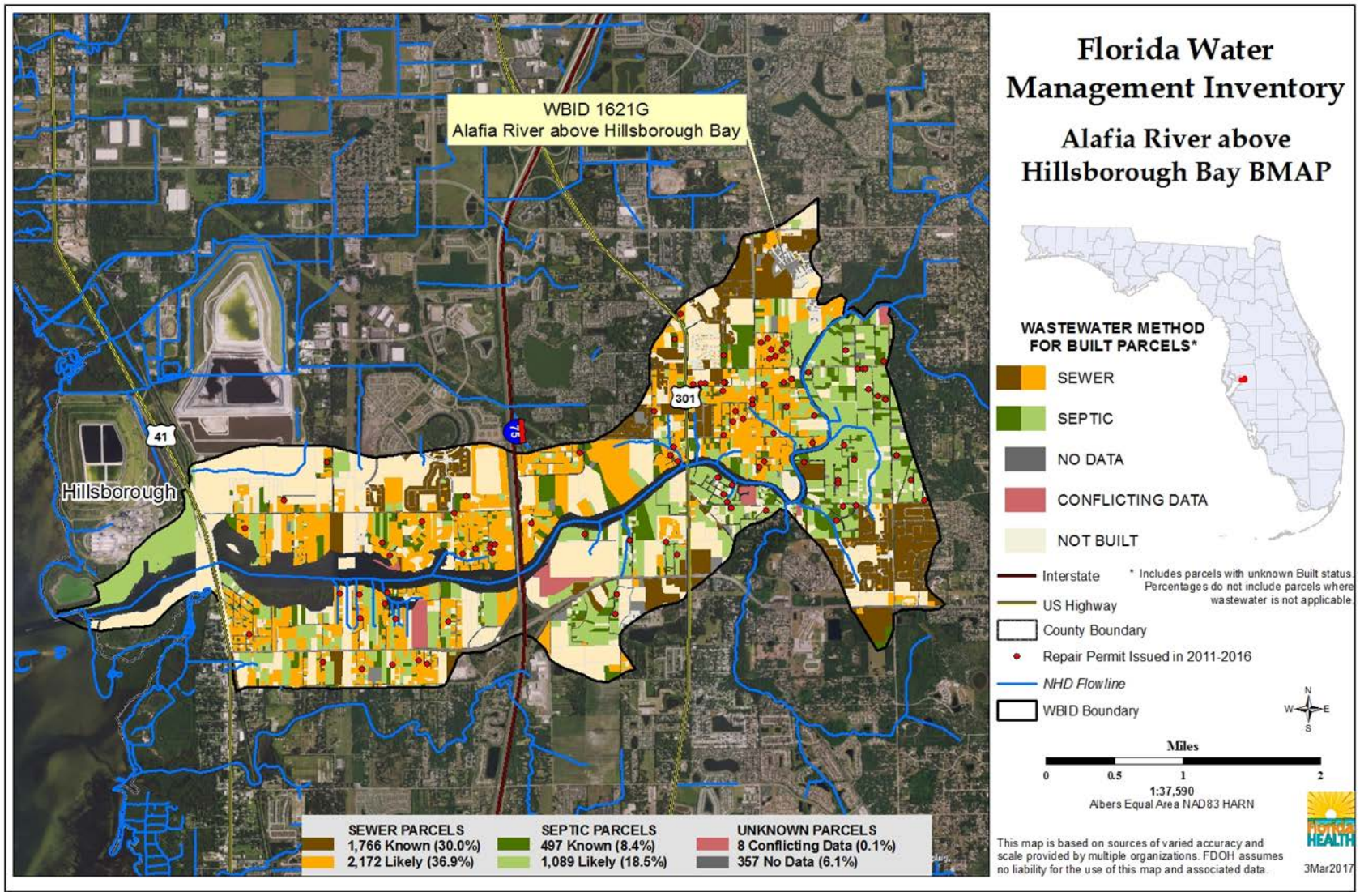

Figure C-5. Wastewater disposal method for parcels within WBID 1621G in the Alafia River BMAP area as of March 3, 2017

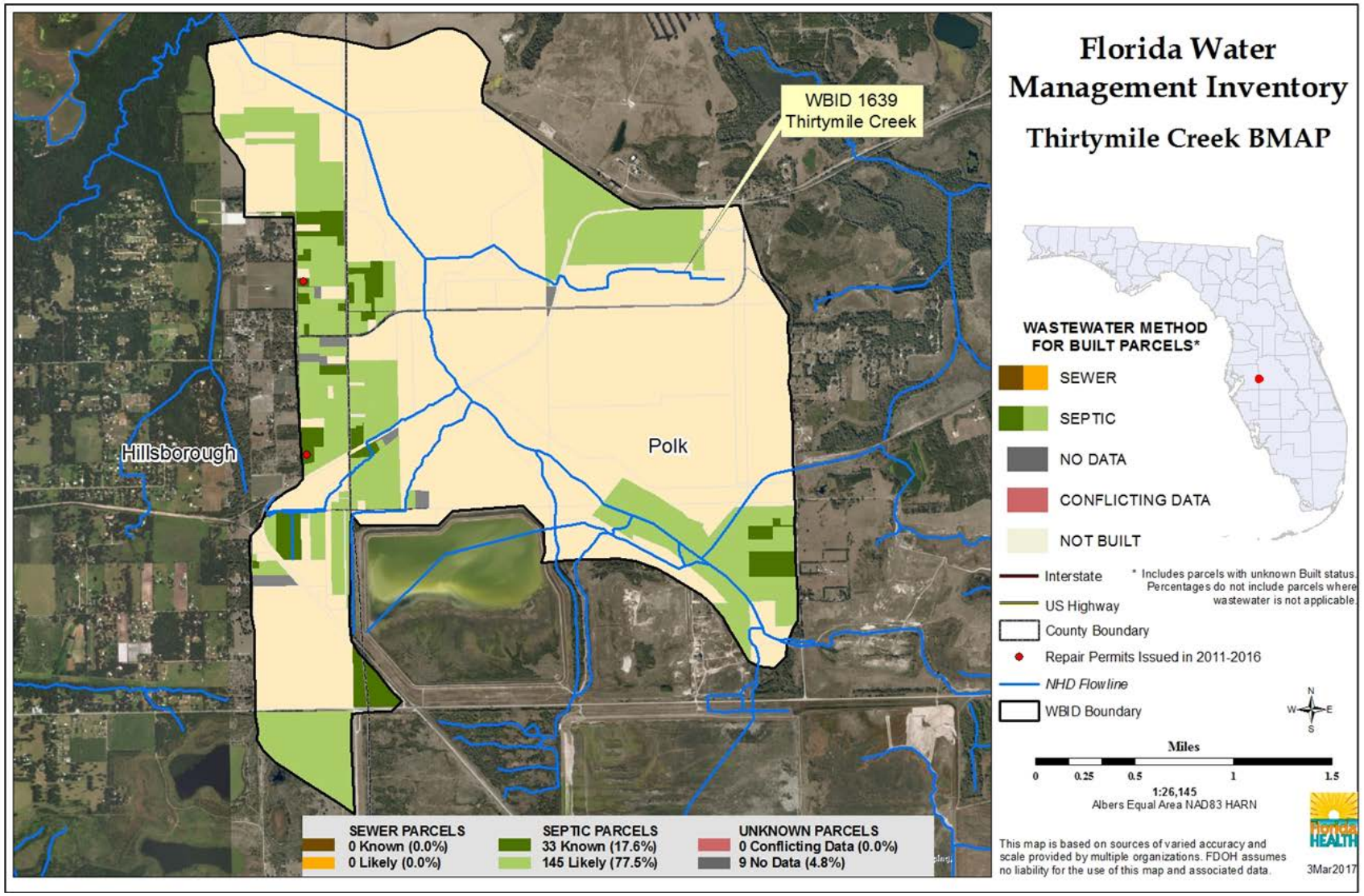

Figure C-6. Wastewater disposal method for parcels within WBID 1639 in the Alafia River BMAP area as of March 3, 2017

Table C- 2. Summary of number of parcels on different wastewater methods by WBID

Note: 'Known' is assigned to parcels where the wastewater is confirmed from the permitting agency, 'Likely' is assigned to parcels where there is some indication of the wastewater disposal method, 'Undetermined' is assigned if two different data sources have equal opposing values, 'Unknown' is assigned for built parcels with no intersecting source information, 'Not Built' is assigned to parcels with no structure that could generate wastewater.

WBIDs	Known Septic	Likely Septic	Total Septic	Known Sewer	Likely Sewer	Total Sewer	Undetermined	Unknown	Not Built	Total
1552	488	1,417	1,905	4	4	8	0	63	616	2,592
1578B	407	1496	1,903	134	828	962	0	106	485	3,456
1583	1,962	5,872	7,834	485	46	531	0	558	1,203	9,955
1592C	109	160	269	0	4	4	0	20	96	389
1621G	497	1,089	1,586	1,766	2,172	3,938	8	357	881	6,770
1639	33	145	178	0	0	0	0	9	86	273
Total	**3,496**	**10,179**	**13,675**	**2,389**	**3,054**	**5,443**	**8**	**1,113**	**3,367**	**23,435**

Table C- 3. Percent of OSTDS constructed before or after 1983 and average age of OSTDS from March of 2017 by WBID

WBID	Number of OSTDS Constructed Before 1983 (%)	Number of OSTDS Constructed after 1983 (%)	Age of Known Septic (Year)	Age of Likely Septic (Year)
1552	20.4	79.6	11.9	30.5
1578B	14.1	85.9	12.1	25.1
1583	31.6	68.4	11.0	29.9
1592C	10.4	89.6	10.6	24.8
1621G	6.8	93.2	11.5	23.3
1639	16.9	83.1	11.3	29.4
Average	**16.7**	**83.3**	**11.4**	**27.2**

Table C- 4. New, repair, existing, and abandonment construction permits by year

Note: The number of systems permits for new OSTDS, repair OSTDS, existing OSTDS, abandoned OSTDS, and total with permits were obtained from the EHD, which stores permit dates. The total number of parcels with OSTDS in the WBID shown in the last column were obtained from the FLWMI, which indicates whether an OSTDS is present or absent on a parcel, but does not indicate the OSTDS permit date. Therefore, the values in the last column do not have associated date information and the systems constructed each year is designated as N/A – not applicable. The values in the rows are not intended to be summed across the columns.

WBID	Year	New OSTDS	Repair OSTDS	Existing OSTDS	Abandoned OSTDS	Total with Permits	Total parcels with OSTDS in WBID
1552	**Subtotal**	**34**	**41**	**6**	**0**	**81**	**1,905**
1552	2011	11	16	3	0	30	N/A
1552	2012	10	10	0	0	20	N/A
1552	2013	6	4	1	0	11	N/A
1552	2014	6	3	1	0	10	N/A
1552	2015	0	8	0	0	8	N/A
1552	2016	1		1	0	2	N/A
1578B	**Subtotal**	**20**	**29**	**3**	**0**	**52**	**1,903**
1578B	2011	7	4	1	0	12	N/A
1578B	2012	2	5	0	0	7	N/A
1578B	2013	3	6	2	0	11	N/A
1578B	2014	5	3	0	0	8	N/A
1578B	2015	3	11	0	0	14	N/A
1578B	2016	0	0	0	0	0	N/A
1583	**Subtotal**	**36**	**351**	**9**	**0**	**396**	**7,834**
1583	2011	4	86	4	0	94	N/A
1583	2012	5	56	0	0	61	N/A
1583	2013	17	66	2	0	85	N/A
1583	2014	6	60	0	0	66	N/A
1583	2015	4	72	3	0	79	N/A
1583	2016	0	11	0	0	11	N/A
1592C	**Subtotal**	**27**	**3**	**1**	**0**	**31**	**269**
1592C	2011	3	2	0	0	5	N/A
1592C	2012	4	0	0	0	4	N/A

WBID	Year	New OSTDS	Repair OSTDS	Existing OSTDS	Abandoned OSTDS	Total with Permits	Total parcels with OSTDS in WBID
1592C	2013	16	0	1	0	17	N/A
1592C	2014	4	0	0	0	4	N/A
1592C	2015	0	0	0	0	0	N/A
1592C	2016	0	1	0	0	1	N/A
1621G	**Subtotal**	**8**	**102**	**11**	**0**	**121**	**1,589**
1621G	2011	1	18	3	0	22	N/A
1621G	2012	4	19	2	0	25	N/A
1621G	2013	0	19	1	0	20	N/A
1621G	2014	1	18	4	0	23	N/A
1621G	2015	2	22	1	0	25	N/A
1621G	2016	0	6	0	0	6	N/A
1639	**Subtotal**	**2**	**3**	**1**	**0**	**6**	**178**
1639	2011	1	1	1	0	3	N/A
1639	2012	1	0	0	0	1	N/A
1639	2013	0	0	0	0	0	N/A
1639	2014	0	2	0	0	2	N/A
1639	2015	0	0	0	0	0	N/A
1639	2016	0	0	0	0	0	N/A

Appendix D. BMAP Water Quality Monitoring Stations

Table D-1. List of active BMAP monitoring stations

[1] F = Freshwater; M = Marine
TBD = To be determined.

Waterbody Name	WBID Number	WBID Classification[1]	Monitoring Entity	Station ID	Station Description	Sampling Frequency	TMDL Relevant Parameters
Turkey Creek	1578B	IIIF Stream	EPCHC	21FLHILL111	21FLHILL111/Turkey Creek at State Road (SR) 60 bridge	Monthly	Fecal coliform
Turkey Creek	1578B	IIIF Stream	EPCHC	21FLHILL151	21FLHILL151/Turkey Creek at Durant Road	Monthly	Fecal coliform
Mustang Ranch Creek	1592C	IIIF Stream	EPCHC	21FLHILL542	21FLHILL542/"Mustang Ranch Creek behind "Mustang Ranch" NE corner of S	Quarterly	Fecal coliform, DO saturation, TN, and TP
English Creek	1552	IIIF Stream	EPCHC	21FLHILL154	21FLHILL154/English Creek at SR 60	Monthly	Fecal coliform
English Creek	1552	IIIF Stream	EPCHC	21FLHILL614	21FLHILL614/English Creek on S. County Line Road (39 Paul Buchman Highway)	Quarterly	Fecal coliform
English Creek	1552	IIIF Stream	Polk County Natural Resources Division	21FLPOLKENGLISH CRK1	21FLPOLKENGLISH CRK1/ English Creek at bridge on west side (upstream)	Quarterly	Fecal coliform and *E. coli*
Poley Creek	1583	IIIF Stream	Polk County Natural Resources Division	21FLPOLKPOLEY CRK1N	21FLPOLKPOLEY CRK1N/ W on Pipkin; R on S Pipkin Road 1/4 Mile of R	Quarterly	Fecal coliform and *E. coli*
Alafia River above Hillsborough Bay	1621G	IIIM Estuary	EPCHC	21FLHILL074	Alafia River at U.S. Highway 41 (SR 45)	Monthly	TN and DO saturation
Alafia River above Hillsborough Bay	1621G	IIIM Estuary	EPCHC	21FLHILL153	Alafia River at U.S. Highway 301	Monthly	TN and DO saturation
Alafia River above Hillsborough Bay	1621G	IIIM Estuary	EPCHC	21FLHILL178	Alafia River west of island next to Dixies Pub	Monthly	TN and DO saturation
Alafia River above Hillsborough Bay	1621G	IIIM Estuary	EPCHC	21FLHILL179	Alafia River upstream of Buckhorn Springs	Monthly	TN and DO saturation
Thirty Mile Creek	1639	IIIF Stream	TBD	TBD	TBD–Locate in downstream area of WBID	TBD	TN and DO saturation
Poley Creek	1583	IIIF Stream	TBD	TBD	TBD–Locate in downstream area of WBID	TBD	*E. coli*

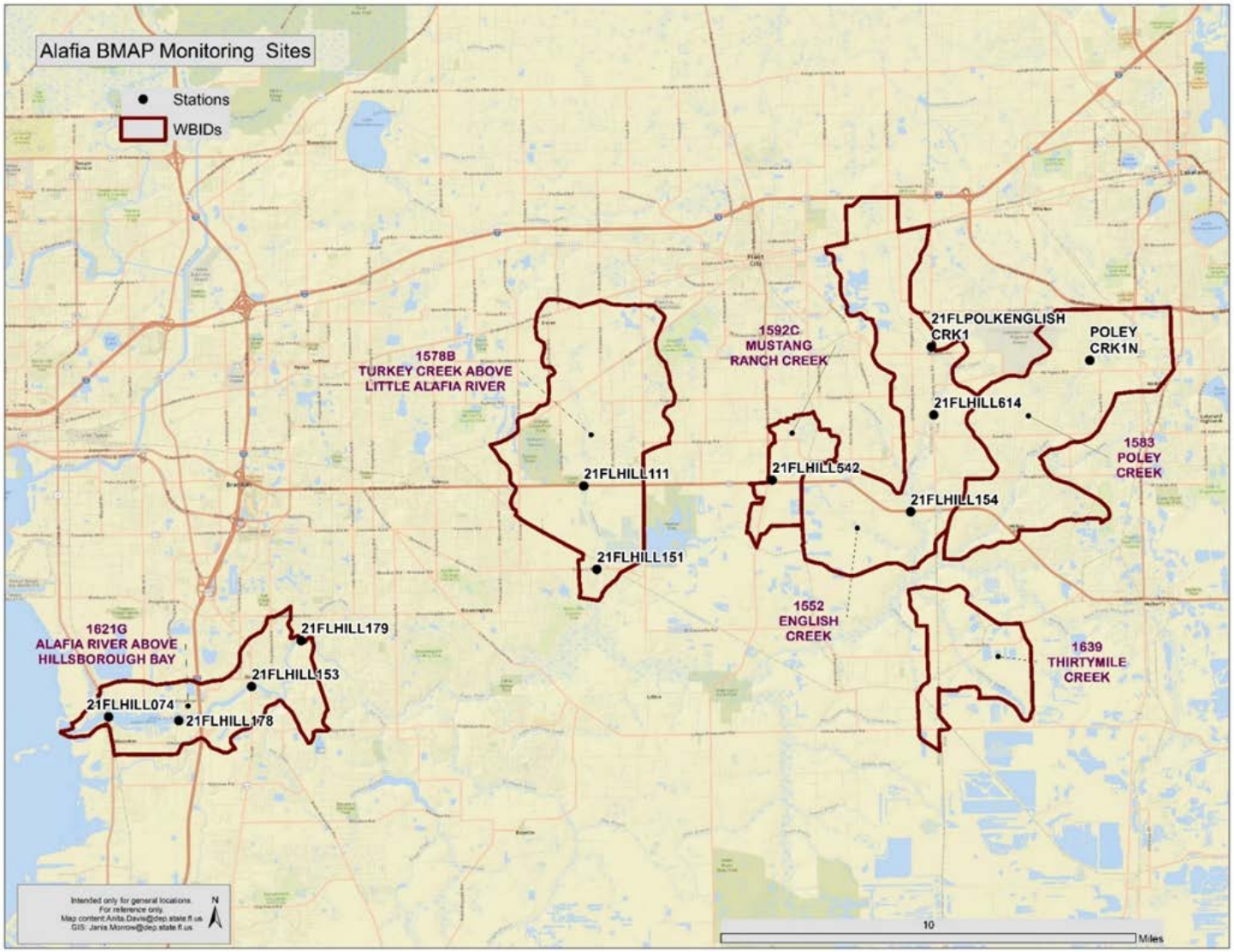

Figure D-1. Map of BMAP monitoring stations

Appendix E. Trend Analysis Results

Table E-1. Seasonal Mann-Kendall trend analysis results (per station)

Note: Boldface and highlighted P-values indicate statistical significance (p<0.05).

WBID	Station	Parameter	POR Start	POR End	N (# of Samples)	Tau	P-Value	Slope	Trend Test Interpretation
1592C	542	DO (% Sat.)	1/2/2008	2/3/2016	25	-0.31343	0.08365	-0.00871	No significant trend
1592C	542	TN (mg/L)	1/2/2008	2/3/2016	28	0.02326	0.94176	0.00006	No significant trend
1592C	542	TP (mg/L)	1/2/2008	2/3/2016	27	0.20988	0.22736	0.00011	No significant trend

WBID	Station	Parameter	POR Start	POR End	N (# of Samples)	Tau	P-Value	Slope	Trend Test Interpretation
1621G	074	DO (% Sat.)	1/23/2008	2/29/2016	94	0.04644	0.60865	0.00082	No significant trend
1621G	074	TN (mg/L)	1/23/2008	3/29/2016	93	0.00000	1.00000	0.00000	No significant trend
1621G	153	DO (% Sat.)	1/23/2008	2/29/2016	94	0.10217	0.24188	0.00176	No significant trend
1621G	153	TN (mg/L)	1/23/2008	3/29/2016	94	-0.10803	0.21513	-0.00005	No significant trend
1621G	178	DO (% Sat.)	1/14/2009	2/29/2016	82	0.07884	0.42314	0.00452	No significant trend
1621G	178	TN (mg/L)	1/14/2009	3/29/2016	82	0.04132	0.69024	0.00001	No significant trend
1621G	179	DO (% Sat.)	1/14/2009	2/29/2016	82	0.19502	**0.04066**	0.00204	Increasing trend
1621G	179	TN (mg/L)	1/14/2009	3/29/2016	83	-0.29839	**0.00146**	-0.00011	Decreasing trend
1621G	1301	DO (% Sat.)	1/14/2009	2/29/2016	85	-0.08462	0.37400	-0.00230	No significant trend
1621G	1303	DO (% Sat.)	1/14/2009	2/29/2016	85	-0.12308	0.18941	-0.00237	No significant trend
1621G	1304	DO (% Sat.)	1/14/2009	2/29/2016	85	-0.03846	0.70320	-0.00075	No significant trend
1621G	1306	DO (% Sat.)	1/14/2009	2/29/2016	84	0.03937	0.69907	0.00159	No significant trend
1621G	1307	DO (% Sat.)	1/14/2009	2/29/2016	85	0.02308	0.83237	0.00068	No significant trend
1621G	1309	DO (% Sat.)	1/14/2009	2/29/2016	85	0.13077	0.16241	0.00388	No significant trend
1621G	1310	DO (% Sat.)	1/14/2009	2/29/2016	85	0.15385	0.09874	0.00345	No significant trend
1621G	1311	DO (% Sat.)	1/14/2009	2/29/2016	85	0.20769	**0.02485**	0.00289	Increasing trend
1621G	1312	DO (% Sat.)	1/14/2009	2/29/2016	84	0.10672	0.26187	0.00236	No significant trend

WBID	Station	Parameter	POR Start	POR End	N (# of Samples)	Tau	P-Value	Slope	Trend Test Interpretation
1639	17975	DO (% Sat.)	1/2/2008	12/2/2014	63	0.09333	0.44680	0.00405	No significant trend
1639	17975	TN (mg/L)	1/2/2008	12/2/2014	59	-0.18797	0.13082	-0.00008	No significant trend

Table E-2. Mann-Kendall trend analysis on AGM results (by WBID)

Note: Boldface and highlighted P-values indicate statistical significance (p<0.05).

WBID	Parameter	POR Start	POR End	N (# of Samples)	Tau	P-Value	Slope	Trend Test Interpretation
1592C	DO (% Sat.)	2008	2015	8	-0.07143	0.90154	-1.09390	No significant trend
1592C	TN (mg/L)	2008	2015	8	0.14286	0.71052	0.04252	No significant trend
1592C	TP (mg/L)	2008	2015	8	0.42857	0.17355	0.02451	No significant trend

WBID	Parameter	POR Start	POR End	N (# of Samples)	Tau	P-Value	Slope	Trend Test Interpretation
1621G	DO (% Sat.)	2008	2015	8	0.50000	0.10776	2.09138	No significant trend
1621G	TN (mg/L)	2008	2015	8	0.07143	0.90154	0.00226	No significant trend

WBID	Parameter	POR Start	POR End	N (# of Samples)	Tau	P-Value	Slope	Trend Test Interpretation
1639	DO (% Sat.)	2008	2014	7	0.14286	0.76389	1.27716	No significant trend
1639	TN (mg/L)	2008	2014	7	-0.71429	**0.03550**	-0.05484	Decreasing trend

Table E-3. Step trend analysis results (per station)

Note: Boldface and highlighted P-values indicate statistical significance ($p<0.05$). Italicized and highlighted median values indicate statistically significantly higher median values for that particular data period, no italicized values indicate no significant difference between the two data periods for that parameter.

[1] TMDL Data Period 1: January 1, 2001–June 30, 2008.

[2] Post-TMDL Data Period 2: July 1, 2008–June 30, 2016.

WBID	Station	Parameter	[1]TMDL Data Period Median Value	[2]Post-TMDL Data Period Median Value	P-Value	W (Test Statistic)	Test Interpretation
1621G	074	DO (% Sat.)	68.73	80.24	**0.0001**	5765	Increase between Period 1 and Period 2
1621G	074	TN (mg/L)	*0.89*	0.71	**0.0024**	5788	Decrease between Period 1 and Period 2
1621G	153	DO (% Sat.)	63.34	68.92	**0.0082**	6282	Increase between Period 1 and Period 2
1621G	153	TN (mg/L)	*1.61*	1.47	**0.0162**	5774	Decrease between Period 1 and Period 2

WBID	Station	Parameter	[1]TMDL Data Period Median Value	[2]Post-TMDL Data Period Median Value	P-Value	W (Test Statistic)	Test Interpretation
1592C	542	DO (% Sat.)	55.32	50.87	0.3097	151	No difference between periods
1592C	542	TN (mg/L)	1.35	1.58	0.2814	154	No difference between periods
1592C	542	TP (mg/L)	0.50	0.67	0.2212	146	No difference between periods

WBID	Station	Parameter	[1]TMDL Data Period Median Value	[2]Post-TMDL Data Period Median Value	P-Value	W (Test Statistic)	Test Interpretation
1639	17975	DO (% Sat.)	58.40	64.05	0.1030	5796	No difference between periods
1639	17975	TN (mg/L)	*1.81*	0.93	**0.0000**	7355	Decrease between Period 1 and Period 2

Appendix F. 2015 Tampa Bay Water Quality Assessment

2015 Tampa Bay Water Quality Assessment

A Tampa Bay Estuary Program Initiative to Maintain and Restore the Bay's Seagrass Resources

Estuary Program

For additional info visit:
www.tbeptech.org

Original Reference:

Janicki, A., D. Wade, & R.J. Pribble. 2000. Developing & Establishing a Process to Track the Status of Chlorophyll-a Concentrations and Light Attenuation to Support Seagrass Restoration Goals in Tampa Bay. Tampa Bay Estuary Program Technical Report # 04-00.

Background

Light availability to seagrass is the guiding paradigm for TBEP's Nitrogen Management Strategy. Because excessive nitrogen loads to the bay generally lead to increased algae blooms (higher chlorophyll-a levels) (Figure 1) and reduce light penetration to seagrass, an evaluation method was developed to assess whether load reduction strategies are achieving desired water quality results (i.e. reduced chlorophyll-a concentrations and increased water clarity).

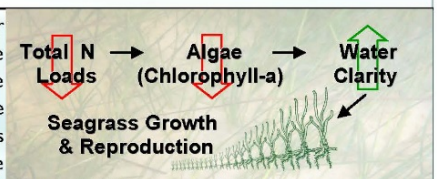

Figure 1: Guiding paradigm for Tampa Bay seagrass restoration through the management of nitrogen loads.

Decision Support Approach

Year to year algae abundance (measured as chlorophyll-a concentrations) and visible light penetration through the water column (depth of secchi disk visibility) have been identified as critical water quality indicators in Tampa Bay. Tracking the attainment of bay segment specific targets for these indicators provides the framework from which bay management actions are developed & initiated. TBEP management actions adopted in response to the annually-assessed decision support results are as follows:

Green	"Stay the Course." Continue planned projects. Report data via annual progress reports and Baywide Environmental Monitoring Report.
Yellow	"Caution Alert." Review monitoring data and nitrogen loading estimates. Begin/continue TAC and Management Board development of specific management recommendations.
Red	"On Alert." Finalize development and implement appropriate management actions to get back on track.

2015 Decision Matrix Results

Bay water quality slightly declined in 2015. Both Old Tampa Bay (OTB) and Middle Tampa Bay (MTB) segments exceeded chlorophyll-a targets (Table 1; Figure 2). The nuisance algae, *Pyrodinium bahamense*, was reported in Old Tampa Bay throughout the Summer and Fall 2015, and exceptionally high summer rainfall conditions contributed to emergency domestic discharges to waterways leading to Old, Middle and Lower Tampa Bays. These two factors may have influenced the observed chlorophyll-a exceedances observed in OTB and MTB in 2015. Further, individual station exceedences were primarily in upper MTB and throughout OTB (Figure 3).

Table 1: Observed water quality indicators & management outcomes for 2015.

Bay Segment	Chlorophyll-a (ug/L) 2015	Chlorophyll-a (ug/L) Target	Effective Light Penetration (m^{-1}) 2015	Effective Light Penetration (m^{-1}) Target	Management Response
OTB	10.7	8.5	0.56	0.83	Yellow
HB	9.0	13.2	0.90	1.58	Green
MTB	8.1	7.4	0.59	0.83	Yellow
LTB	3.9	4.6	0.62	0.63	Green

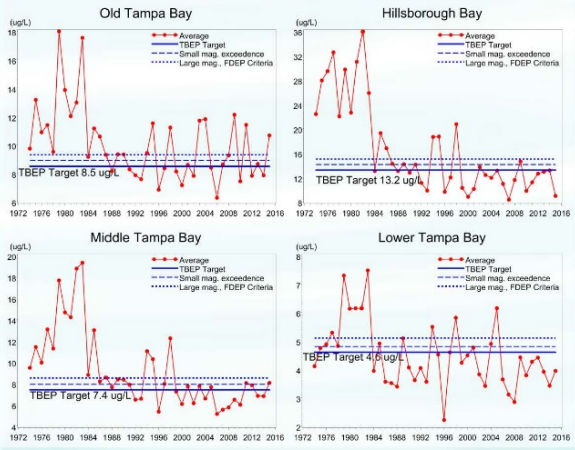

Figure 2: Historic chlorophyll-a annual averages for the four bay segments. Chlorophyll-a concentrations were below target levels for each bay segment.

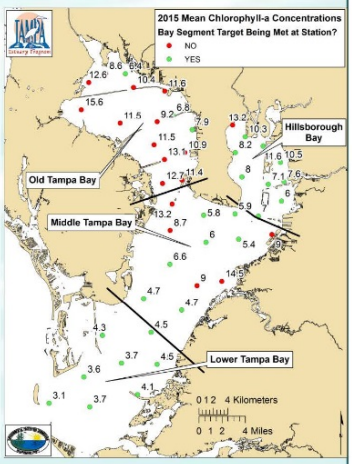

Figure 3: Map depicting individual station chlorophyll-a annual exceedences in Tampa Bay.

Historic Results:

Year	Old TB	Hills. Bay	Middle TB	Lower TB
1980	Red	Red	Red	Red
1981	Red	Red	Red	Red
1982	Red	Red	Red	Red
1983	Red	Yellow	Red	Red
1984	Red	Green	Red	Yellow
1985	Red	Red	Red	Yellow
1986	Red	Yellow	Red	Green
1987	Red	Yellow	Red	Green
1988	Yellow	Green	Yellow	Green
1989	Red	Yellow	Red	Yellow
1990	Red	Green	Red	Yellow
1991	Green	Yellow	Yellow	Yellow
1992	Yellow	Green	Yellow	Yellow
1993	Yellow	Green	Yellow	Yellow
1994	Yellow	Yellow	Red	Red
1995	Red	Yellow	Red	Yellow
1996	Yellow	Green	Yellow	Green
1997	Yellow	Green	Red	Yellow
1998	Red	Red	Red	Red
1999	Yellow	Green	Yellow	Yellow
2000	Green	Green	Yellow	Yellow
2001	Yellow	Green	Yellow	Yellow
2002	Yellow	Green	Green	Green
2003	Red	Yellow	Green	Yellow
2004	Red	Green	Green	Yellow
2005	Green	Green	Yellow	Yellow
2006	Green	Green	Green	Green
2007	Green	Green	Green	Green
2008	Yellow	Green	Green	Yellow
2009	Yellow	Yellow	Green	Green
2010	Green	Green	Green	Green
2011	Red	Green	Yellow	Green
2012	Green	Green	Green	Green
2013	Green	Green	Green	Green
2014	Green	Green	Green	Green
2015	Yellow	Green	Yellow	Green

Continuing water quality monitoring support provided by the EPCHC.

Consulting support provided by Janicki Environmental, Inc.

Janicki Environmental, Inc.

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Progress Towards Meeting Regulatory Goals

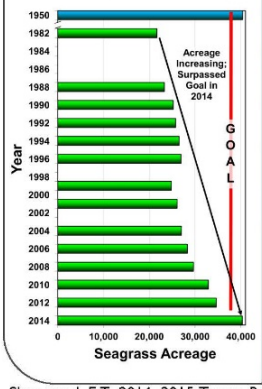
An initiative of the Tampa Bay Nitrogen Management Consortium (NMC)

Maintaining Reasonable Assurance & TMDL Compliance

FDEP Criteria Met:

Year	Old TB	Hills. Bay	Mid. TB	Low. TB
1978	No	No	No	Yes
1979	No	No	No	No
1980	No	No	No	No
1981	No	No	No	No
1982	No	No	No	No
1983	No	No	No	No
1984	Yes	Yes	No	Yes
1985	No	No	No	Yes
1986	No	No	Yes	Yes
1987	No	Yes	No	Yes
1988	Yes	Yes	Yes	Yes
1989	No	Yes	Yes	Yes
1990	No	Yes	Yes	Yes
1991	Yes	Yes	Yes	Yes
1992	Yes	Yes	Yes	Yes
1993	Yes	Yes	Yes	Yes
1994	No	No	No	No
1995	No	No	No	Yes
1996	Yes	Yes	Yes	Yes
1997	Yes	Yes	Yes	Yes
1998	No	No	No	No
1999	Yes	Yes	Yes	Yes
2000	Yes	Yes	Yes	Yes
2001	Yes	Yes	Yes	Yes
2002	Yes	Yes	Yes	Yes
2003	No	Yes	Yes	Yes
2004	No	Yes	Yes	Yes
2005	Yes	Yes	Yes	No
2006	Yes	Yes	Yes	Yes
2007	Yes	Yes	Yes	Yes
2008	Yes	Yes	Yes	Yes
2009	No	Yes	Yes	Yes
2010	Yes	Yes	Yes	Yes
2011	No	Yes	Yes	Yes
2012	Yes	Yes	Yes	Yes
2013	Yes	Yes	Yes	Yes
2014	Yes	Yes	Yes	Yes
2015	No	Yes	Yes	Yes

Figure 4: Historic seagrass acreage estimates for Tampa Bay from 1950-2014 (Source: SWFWMD).



In April 2013, the FDEP approved the 2012 Reasonable Assurance Update and concluded that there has been reasonable progress towards the attainment of designated uses for waterbody segments in the Tampa Bay basin that were previously identified as impaired for nutrients (chlorophyll-a) pursuant to Chapters 62-303, FAC. As such, the FDEP placed Hillsborough Bay segments (WBIDs 1558D & 1558E) and Old Tampa Bay Segments (WBIDs 1558H & 1558I) in EPA assessment category 4b for nutrients (chlorophyll-a) rather than EPA category 5 (impaired). Furthermore, two Lower Tampa Bay segments (WBIDs 1558A & 1558BZ) were moved to EPA category 2 (attains standards) because these WBIDs now attain chlorophyll-a thresholds and the general increase in baywide seagrass coverage demonstrates a healthy biological community (Fig. 4).

The TBEP, in partnership with the Tampa Bay Nitrogen Management Consortium, will submit the fourth compliance assessment report for the 2012-16 Reasonable Assurance (RA) Period to the FDEP in March 2016. Consortium participants continue to input load reduction projects into the Action Plan Database which was ported to an online, web-based reporting system (Figure 5). Planned and budgeted projects for the 2012-16 Reasonable Assurance Implementation period are expected to reduce TN loading by about 77 tons/yr in the future .

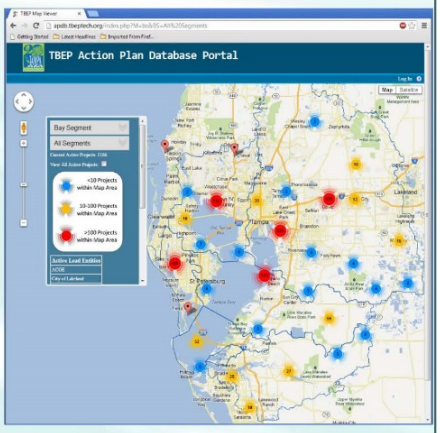


Figure 5: Screenshot of the online Tampa Bay Action Plan Database (http://apdb.tbeptech.org) showing the approximate spatial locations of projects implemented in the watershed.

2015 Chl-a Monthly Variation Compared to 1974-2015

Chlorophyll-a concentrations were evaluated within the bay on a monthly basis (Figure 6) during 2015 and compared to prior years' levels. Elevated concentrations in Old Tampa Bay were primarily due to *Pyrodinium bahamense* blooms, while in Middle Tampa Bay, elevated concentrations in September may have been primarily due to excessive runoff from higher than normal summer rainfall (highlighted by the yellow ovals below).

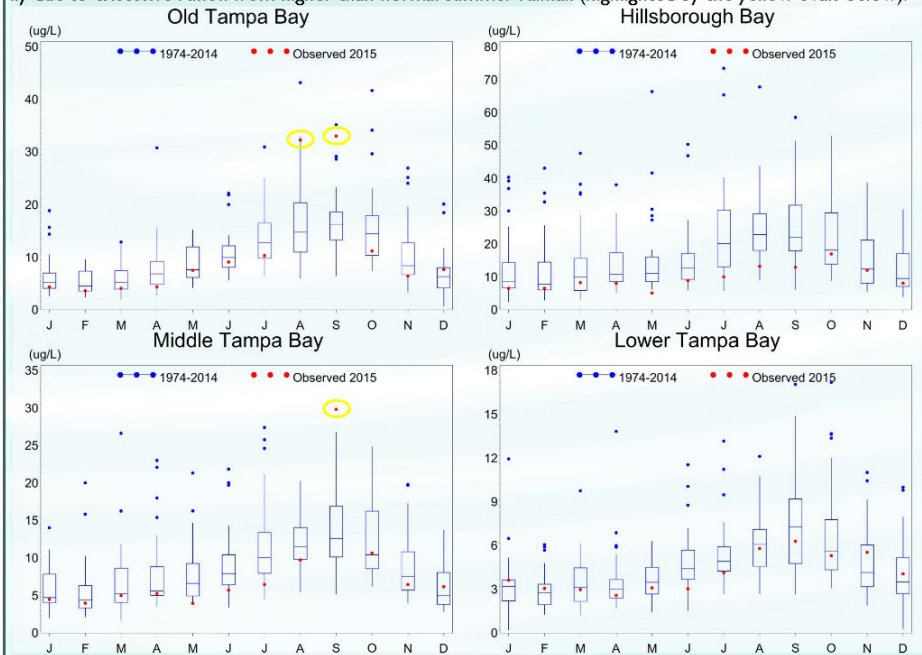


Figure 6: 2014 monthly chlorophyll-a bay segment averages (red dots) compared to monthly distributions from 1974-2013 (blue box plots). Boxes encompass the 25th and 75th percentiles, while whiskers bound the interquartile range. Blue dots represent outliers.

Sherwood, E.T. 2016. 2015 Tampa Bay Water Quality Assessment. Tampa Bay Estuary Program Technical Report #01-16. TBEP, St. Petersburg, FL. 2