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

Division of Environmental Assessment and Restoration
Florida Department of Environmental Protection

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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 Manatee River Basin stakeholders identified in **Table 1**. Additional input was received from members of the Tampa Bay Estuary Program (TBEP) and Tampa Bay Nutrient Management Consortium (NMC) who are not specifically mentioned below.

Table 1. Manatee River basin responsible stakeholders, agencies, and other interested stakeholders

Stakeholders
Braden River Utilities
City of Bradenton
City of Palmetto
CF Industries
CSX
Florida Department of Agriculture and Consumer Services
Florida Department of Health
Florida Department of Transportation
Florida Power and Light
Lakewood Ranch
Manatee County
Sierra Club
Schroeder-Manatee Ranch
SMR Farms
Southwest Florida Water Management District
Tampa Bay Estuary Program
Tampa Bay Regional Planning Council
The Mosaic Company

For additional information on the watershed management approach in the Manatee 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
BOD	Biochemical Oxygen Demand
BOD_5	Five-Day Biochemical Oxygen Demand
cfu	Colony-Forming Units
DEP	Florida Department of Environmental Protection
DO	Dissolved Oxygen
E. coli	*Escherichia coli*
EHD	Environmental Health Database
ERC	Environmental Regulation Commission
EPA	U.S. Environmental Protection Agency
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
LA	Load Allocation
MGM	Monthly Geometric Mean
mL	Milliliter
mg/L	Milligrams per Liter
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 System
POR	Period of Record
RAP	Reasonable Assurance Plan
SCI	Stream Condition Index
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
USGS	U.S. Geological Survey
WBID	Waterbody Identification

WLA	Wasteload Allocation
WTW	Walk the WBID (or Waterbody)

Section 1. Introduction and Background

This annual Progress Report describes activities associated with the second year of the Manatee River Basin Management Action Plan (BMAP) 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** is an evaluation of water quality data for the monitoring period (January 1, 2015–December 31, 2015). **Appendix A** contains important web addresses that are 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 Manatee River BMAP area. **Appendix D** contains a list and a map of the BMAP monitoring stations. **Appendix E** contains the trend analysis results.

The Manatee River BMAP was developed in collaboration with areawide stakeholders with the assistance of the Tampa Bay Estuary Program (TBEP) and the Tampa Bay Nitrogen Management Consortium (NMC). The TBEP successfully developed the 2002 Tampa Bay Reasonable Assurance Plan (RAP) to reduce nutrient inputs to Tampa Bay. The TBEP worked with the Tampa Bay 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 brings the requirement for production agricultural operations within the BMAP area 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 Manatee River Basin, fecal coliform bacteria and nutrients were identified as the primary pollutants causing impairment. In 2009, DEP adopted TMDLs for four of the verified impaired waterbodies in the Manatee River Basin: Rattlesnake Slough (WBID 1923), Cedar Creek (WBID 1926), Nonsense Creek (WBID 1913), and Braden River Above Evers Reservoir (WBID 1914). **Table 2** lists the WBIDs, specific parameters, and pollutant load allocations (LAs) for each TMDL addressed by the BMAP. The nutrient TMDLs for Nonsense

[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," derived from the words "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.

Creek and Rattlesnake Slough, listed below, were developed to address dissolved oxygen (DO) impairments; however, these WBIDs are no longer impaired for DO. All four WBIDs 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 Manatee River BMAP to implement the fecal coliform and nutrient TMDLs. **Figure 1** depicts the BMAP geographic boundaries.

Table 2. Manatee River Basin TMDLs

Note: All four waterbodies are Class I fresh waters.

WBID	Waterbody Name	TMDL Components
1923	Rattlesnake Slough	**Total Phosphorus (TP) (% load reduction)** – Wasteload Allocation (WLA) (National Pollutant Discharge Elimination System [NPDES] stormwater) = 21 % – LA = 21 % **Total Nitrogen (TN) (% load reduction)** – WLA (NPDES stormwater) = 30 % reduction – LA = 30 % reduction **Five-Day Biochemical Oxygen Demand (BOD_5) (% load reduction)** – WLA (NPDES stormwater) = 31 % reduction – LA = 31 % reduction
1923	Rattlesnake Slough	**Fecal Coliform Concentration (% load reduction)** – WLA (NPDES stormwater) = 43 % reduction – LA = 43 % reduction
1926	Cedar Creek	**Fecal Coliform Concentration (% load reduction)** – WLA (NPDES stormwater) = 61 % reduction – LA = 61 % reduction
1913	Nonsense Creek	**Fecal Coliform Concentration (% reduction)** – WLA (NPDES stormwater) = 57 % reduction – LA = 57 % reduction
1913	Nonsense Creek	**TN (% load reduction)** – WLA (NPDES stormwater) = 27 % reduction – LA = 27 % reduction **BOD_5 (% load reduction)** – WLA (NPDES stormwater) = 36 % reduction – LA = 36 % reduction
1914	Braden River Above Evers Reservoir	**Fecal Coliform Concentration (% reduction)** – WLA (NPDES stormwater) = 43 % reduction – LA = 43 % reduction

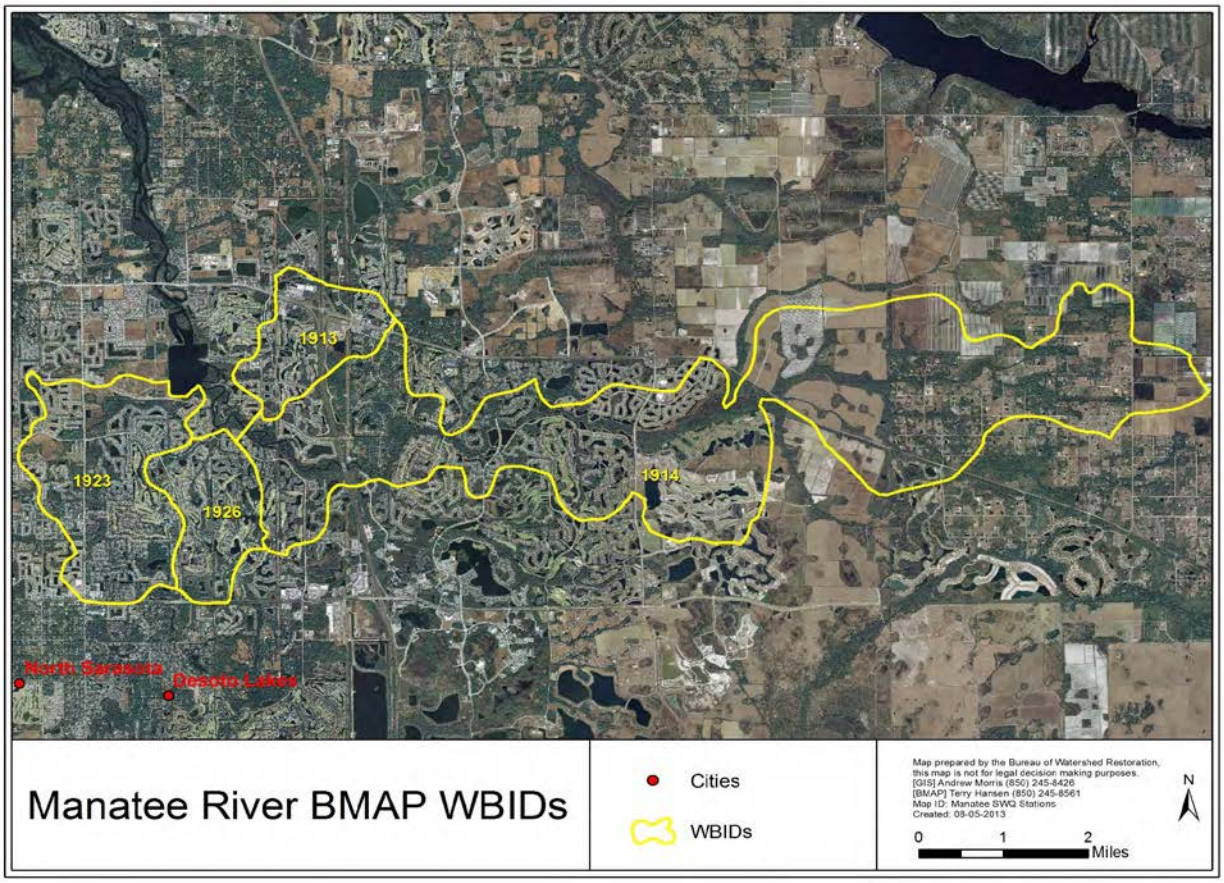

Figure 1. Manatee River BMAP boundary

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 two technicians 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 from April 1, 2015, to 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 Manatee River BMAP area. The acreage used to calculate the starting point agricultural nutrient load 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 **Figure 2** will be included in 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 this 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 the current agricultural land use acreage more accurately. 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. **Figure 3** shows the acres enrolled in BMPs 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 Manatee River Basin. After accounting for the FDACS-adjusted acreage that is now urban and/or out of production, there is no remaining significant amount of unenrolled agricultural acreage in the BMAP area. Field staff will attempt to enroll any remaining small operations and will update the existing enrollment as needed through the implementation assurance process. It is also important to note that currently more agricultural acres are enrolled in the FDACS BMP Program than there are agricultural acres in the 2008 land use coverage. This difference can be attributed to potential inaccuracies in the original land use as well as changes in land use over time.

Because of inaccuracies in the 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 appropriate nutrient reductions associated with agricultural BMPs.

Table 3. Agricultural acreage and FDACS BMP Program enrollment

[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	Related NOIs Certification
Pastureland and Rangeland	1,945.2	1,945.2	Cow/Calf and Sod	1,828.2 and 416.5	3 and 1
Row/Field/Mixed Crops	604.7	335.9	Vegetable/ Agronomic Crops	1,017.8	3
Nurseries and Vineyards	1.0	1.0	Statewide Nurseries	0	0
Other Open Land–Rural	114.6	0	No Enrollment Needed	N/A	N/A
Total	**2,665.5**	**2,282.1**		**3,262.4**	**7**

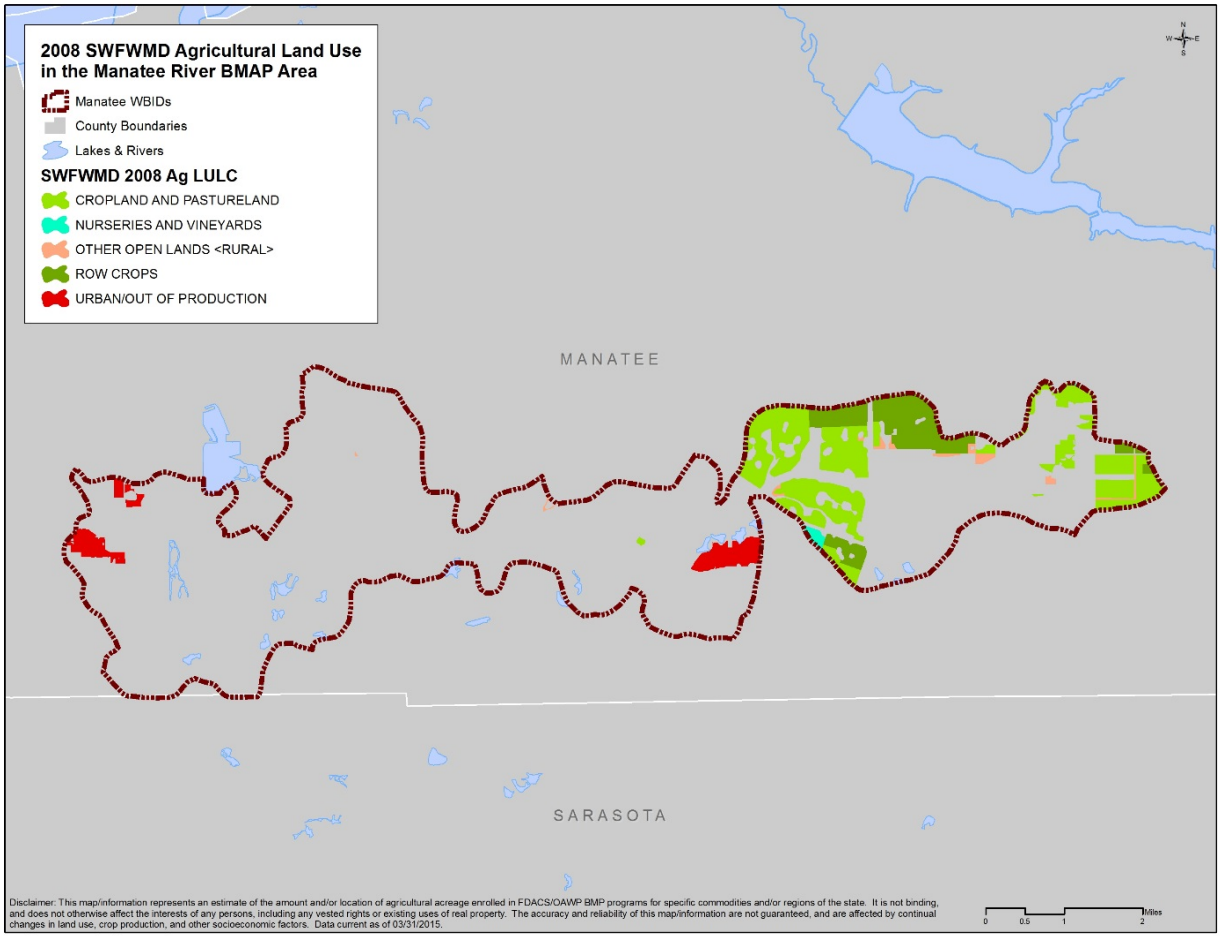

Figure 2. Agricultural land use based on 2008 SWFWMD data in the Manatee River Basin

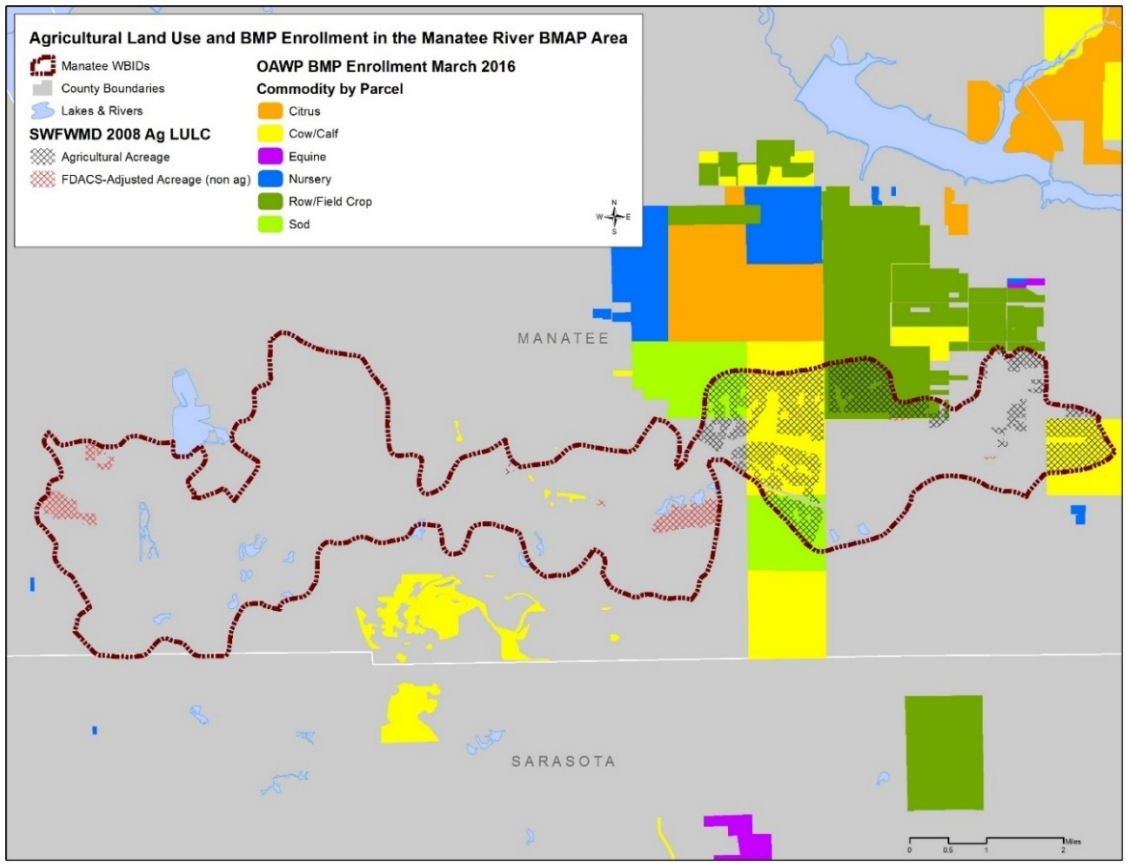

Figure 3. FDACS BMP Program enrollment in the Manatee River Basin as of March 31, 2016

2.2 Walk the Waterbody (WTW)

When a waterbody has an adopted fecal coliform TMDL then DEP recommends carrying out a WTW exercise as a first step to determine sources and identify management strategies. **Table 4** lists the status of the WTW exercise for each waterbody with a fecal coliform TMDL in the Manatee River Basin.

Table 4. WTW status

TBD = To be determined.

WBID	Waterbody Name	WTW Status	Lead Entity
1923	Rattlesnake Slough	Completed	Manatee County Parks and Natural Resources Department
1926	Cedar Creek	Completed	Manatee County Parks and Natural Resources Department
1913	Nonsense Creek	TBD	TBD
1914	Braden River above Evers Reservoir	TBD	TBD

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's (EPA) bacteriological criteria for *Escherichia coli* (*E. coli*) bacteria (Class I and III fresh water) in waters 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/100 milliliters (cfu/100mL) 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. The waterbodies addressed in this BMAP are Class I freshwater streams.

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 DEP 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*, so that the waterbodies can be assessed using the new water quality standard during the next assessment cycle. The *E. coli* 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 Manatee 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 or 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 six core stations. The stations are sampled monthly. The stations are monitored by the Manatee County Environmental Management Department. The county uploads its data to the DEP STOrage and RETrieval (STORET) Database regularly, at least twice a year. **Appendix D** lists the current stations in the monitoring network and provides 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.

3.3 Fecal Coliform Reductions Since BMAP Adoption

DEP determines progress towards meeting the FIB criterion for the 4 BMAP waterbodies by assessing the frequency with which the criterion for each tributary is exceeded. This approach mirrors the Impaired Surface Waters Rule (IWR) methodology in Chapter 62-303, Florida Administrative Code (F.A.C.). The prior Class I IWR criterion was set so that if more than 10 % of the 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 frequency of exceedance of the old state criterion for BMAP progress assessments. This approach will allow a smooth transition to the new FIB criteria 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** lists each WBID's total number of fecal coliform samples, the total number of exceedances, the minimum number of exceedances to be considered impaired, and the 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 evaluated (**Table 5**). Each year, the oldest 12 months of data are dropped off the data period reviewed the previous year, and the most recent 12 months of data are added to the dataset.

Column 5 in the table lists 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 the table lists 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

[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
Rattlesnake Slough	1	72	32	12	44
Rattlesnake Slough	2	76	17	12	22
Rattlesnake Slough	3	78	20	12	26
Rattlesnake Slough	First 7.5-year period	82	19	13	23
Rattlesnake Slough	Current 7.5-year period	77	17	12	22
Cedar Creek	1	72	27	12	38
Cedar Creek	2	79	41	12	52
Cedar Creek	3	75	47	12	63
Cedar Creek	First 7.5-year period	80	42	13	53
Cedar Creek	Current 7.5-year period	74	37	12	50
Nonsense Creek	1	63	18	10	29
Nonsense Creek	2	73	24	12	33
Nonsense Creek	3	78	32	12	41
Nonsense Creek	First 7.5-year period	81	35	13	43
Nonsense Creek	Current 7.5-year period	75	36	12	48
Braden River Above Ward Lake	1	287	67	36	23
Braden River Above Ward Lake	2	283	60	36	21
Braden River Above Ward Lake	3	233	33	30	14
Braden River Above Ward Lake	First 7.5-year period	258	45	33	17
Braden River Above Ward Lake	Current 7.5-year period	234	43	30	18

3.4 Nutrients and DO

3.4.1 Revised DO Criteria

DEP conducted an extensive statewide freshwater DO study during 2005 to 2006 in lakes and streams to collect the data required to fully assess the accuracy of the previous DO 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 milligrams per liter (mg/L) (with

10 % or more of the measurements falling below the criterion naturally). This threshold triggered the development of TMDLs for Rattlesnake Slough and Nonsense 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 recent Cycle 3 (January 1, 2007–June 30, 2014) assessment of the Manatee River Basin, Rattlesnake Slough and Nonsense Creek, which have TMDLs for nutrients, were determined to be unimpaired by DO in accordance with the new criterion.

3.4.2 DO Saturation, TN, and TP Trend Analysis

Two forms of nonparametric trend analyses were conducted to assess changes of 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 may begin to degrade, then DEP will initiate discussions with affected stakeholders 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 Manatee River Basin with appropriate data sufficiency.

The 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 analysis efforts 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. Data were collected monthly, and thus months of the year were used as seasons for the Seasonal Mann-Kendall test. The Mann-Kendall test was also used to identify monotonic trends for data aggregated into annual geometric means (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. The Seasonal Mann-Kendall results showed several significant trends for TN, TP, and DO. For both stations, TN and TP declined, and DO increased over the POR, indicating an improvement in water quality conditions for both WBIDs (Rattlesnake Slough and Nonsense Creek). Data were only available from 2001 to 2008 for biochemical oxygen demand (BOD), outside the current assessment period. BOD showed no significant trend for either station or WBID for the POR that was available.

The Mann-Kendall tests on AGMs with data aggregated by WBID showed a significant increase in DO for Nonsense Creek, suggesting that water quality conditions are improving for this WBID. The time series data for Rattlesnake Slough did not show any significant change over the POR for TN, TP, or DO. No trend indicates that water quality conditions have not degraded—although since the Seasonal Mann-Kendall results showed water quality improvements for Rattlesnake Slough, then it is possible that seasonality may be dampening the signal and strength of the AGM trend results.

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 Manatee 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 the appendix table can be acquired upon request from DEP). Water quality conditions have improved in Rattlesnake Slough, with a significant increase in DO and decline in TN since the TMDL data period. Nonsense Creek also showed an increase in DO, indicating an improvement in water quality since the TMDL data period. No difference between the two periods was found for TP in Rattlesnake Slough or for TN in Nonsense Creek, indicating that water quality conditions have remained the same and have not degraded since the TMDL was implemented.

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:** Manatee 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 Department of Health website: http://floridahealth.gov/flwmi
- **Appendix C, Figure C-1:** 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 with a status of ongoing are reported to have occurred during the reporting period and should continue to occur in subsequent years, unless DEP is notified that the project has been discontinued. Additional project information, including a complete list of projects, can be obtained by contacting DEP.

Table B-1. Project table

Lead Entity	Project Number	Project Name	Project Type	Project Status	Project Completion Year
Manatee County	TBEP-1015	Buffalo Canal Watershed Management Program		Ongoing	2008
Manatee County	TBEP-1016	Gamble Creek Watershed Management Program		Ongoing	2008
Manatee County	TBEP-955	Prairie Schooner at Duette Park	Public education and outreach	Ongoing	
Manatee County	TBEP-956	Visitors Center at Emerson Point	Public education and outreach	Ongoing	
Manatee County	TBEP-958	Regatta Point Clean Marina		Ongoing	2001
Manatee County	TBEP-959	Perico Harbor Clean Marina		Ongoing	2001
Manatee County	TBEP-968	Seagrass Protection Ordinance	Regulations, ordinances, and guidelines	Ongoing	
Manatee County	TBEP-970	Clean Marina Requirement	Regulations, ordinances, and guidelines	Ongoing	
City of Anna Maria	TBEP-1014	Willow/Gulf Dr./ Pine Ave.	Stormwater management program	Ongoing	2007
Florida Department of Transportation (FDOT)	TBEP-1166	201032-2 I-75 at SR 70 Interchange	Stormwater management program	Under way	
River Club Homeowners Association	RCHA-1	2010 Love Our Lake Campaign	Education and outreach	Under way	
River Club Homeowners Association	RCHA-2	2011 Volunteer Water Quality Education Program	Education and outreach	Under way	
River Club Homeowners Association	RCHA-3	2012 Project To Reduce Nutrient Runoff in Stormwater Ponds		Under way	

Lead Entity	Project Number	Project Name	Project Type	Project Status	Project Completion Year
River Club Homeowners Association	RCHA-4	Additional Projects		Under way	
Schroeder-Manatee Ranch	SMR-1	Water Quality Monitoring	Special studies, planning, monitoring and assessment	Under way	
Schroeder-Manatee Ranch	SMR-2	Agricultural BMPs (Citrus, Cow/Calf, Container Nurseries, Sod)	Agriculture BMPs	Under way	
FDACS	TBEP-1194	BMP Enrollment	Agriculture BMPs	Under way	

Appendix C. Manatee River BMAP Onsite Sewage Treatment and Disposal Systems (OSTDS) Data Summary

Nonpoint source pollutants from OSTDS can have significant impacts on surface water and groundwater quality. Approximately 30 % 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**).

In the Manatee River BMAP there are an estimated 12,545 built parcels (**Figure C-2** and **Table C-1**). Of those built parcels, about 6.7 % (842) are connected to an OSTDS, 89.5 % (11,228) are connected to a DEP-regulated wastewater treatment facility, and 3.8 % (475) are unknown. Of those parcels with OSTDS, 169 are known and 673 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 Florida Water Management Inventory (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 online.

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-2 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-2 also shows information on the estimated age of systems. This information was assigned to each parcel based on EHD data or from the Florida Department of Revenue for the year the structure was built if EHD data were not available. The average age of all OSTDS in the Manatee River BMAP area is 12 years, with those that are known having an average age of 9 years and those that are likely having an average age of 16 years.

Table C-3 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-2** indicate the total number of repairs that were permitted between 2011 and 2016 in the BMAP area.

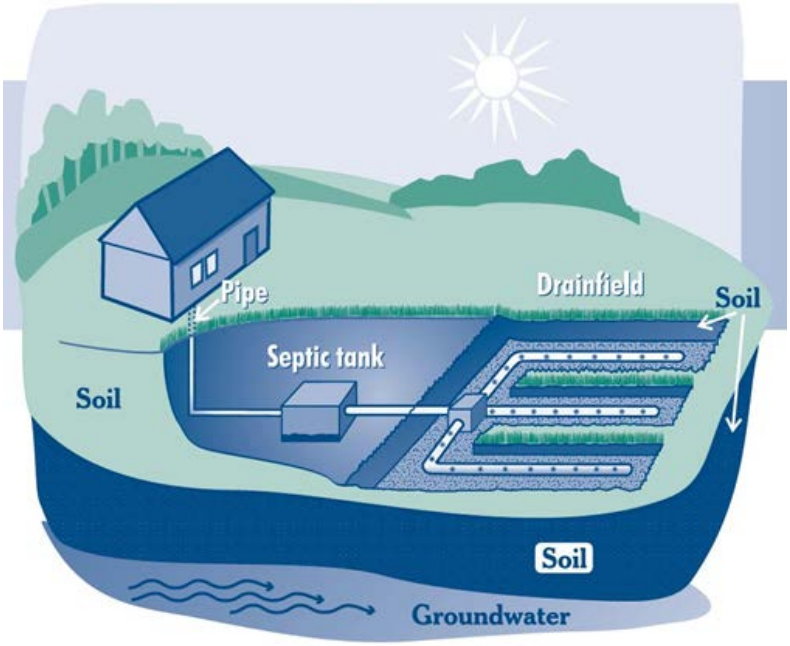

Figure C-1. Illustration of a typical OSTDS

Source: EPA: *A Homeowner's Guide to Septic Systems*

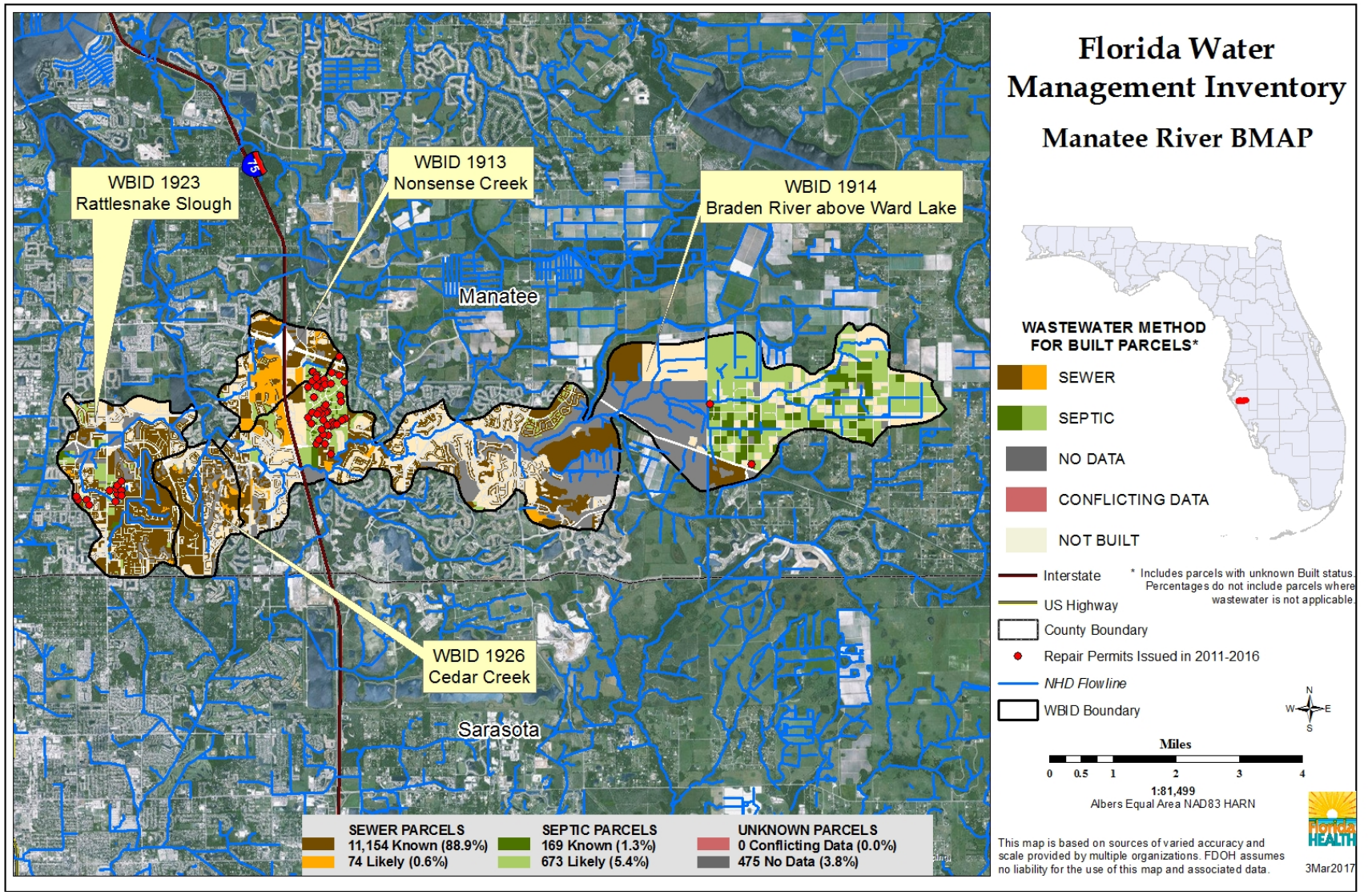

Figure C-2. Wastewater disposal method for parcels within the Manatee River BMAP area as of March 3, 2017

Table C-1. Summary of number of parcels using 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, and "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
1913	11	61	72	903	25	928	0	41	96	1,137
1914	136	463	599	4,793	21	4,814	0	228	738	6,379
1923	22	128	150	4,076	9	4,085	0	135	296	4,666
1926	0	21	21	1,382	19	1,401	0	71	163	1,656
Total	**169**	**673**	**842**	**11,154**	**74**	**11,228**	**0**	**475**	**1,293**	**13,838**

Table C-2. Percent of OSTDS constructed before or after 1983 and average age of OSTDS from January 2017 by WBID

N/A = Because there were no known OSTDS located in WBID 1926, the average age for known septic could not be calculated for this WBID.

WBID	Number of OSTDS Constructed Before 1983 (%)	Number of OSTDS Constructed after 1983 (%)	Age of Known Septic (Year)	Age of Likely Septic (Year)
1913	0.0	100.0	8.0	15.3
1914	0.2	99.8	10.1	14.6
1923	11.1	88.9	7.6	17.4
1926	0.0	100.0	N/A	14.5
Average	**2.8**	**97.2**	**8.6**	**15.5**

Table C-3. New, repair, existing, and abandonment construction permits by year

Note: The number of systems permits for new OSTDS, repair OSTDS, OSTDS existing, abandoned OSTDS, and total with permits were obtained from EHD, which stores permit dates. The total number of parcels with OSTDS in the WBID shown in the last column were obtained from 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 are 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	OSTDS Existing	Abandoned OSTDS	Total with Permits	Total Parcels with OSTDS in WBID
1913	**Subtotal**	**0**	**5**	**0**	**0**	**5**	**72**
1913	2011	0	3	0	0	3	N/A
1913	2012	0	0	0	0	0	N/A
1913	2013	0	0	0	0	0	N/A
1913	2014	0	2	0	0	2	N/A
1913	2015	0	0	0	0	0	N/A
1913	2016	0	0	0	0	0	N/A
1914	**Subtotal**	**8**	**42**	**1**	**0**	**51**	**599**
1914	2011	0	8	1	0	9	N/A
1914	2012	0	6	0	0	6	N/A
1914	2013	1	6	0	0	7	N/A
1914	2014	4	9	0	0	13	N/A
1914	2015	2	9	0	0	11	N/A
1914	2016	1	4	0	0	5	N/A
1923	**Subtotal**	**0**	**12**	**0**	**0**	**12**	**150**
1923	2011	0	0	0	0	0	N/A
1923	2012	0	1	0	0	1	N/A
1923	2013	0	3	0	0	3	N/A
1923	2014	0	3	0	0	3	N/A
1923	2015	0	2	0	0	2	N/A
1923	2016	0	3	0	0	3	N/A
1926	**Subtotal**	**0**	**0**	**0**	**0**	**0**	**21**
	Total	**8**	**59**	**1**	**0**	**68**	**842**

Appendix D. BMAP Water Quality Monitoring Stations

Table D-1. List of active BMAP monitoring stations

[1] F = Freshwater; M = Marine

Waterbody Name	WBID Number	Parent WBID	WBID Classification[1]	Monitoring Entity	Station ID	Station Description	Sampling Frequency	TMDL Relevant Parameters
Rattlesnake Slough	1923	1923	IF Stream	Manatee County Environmental Management Department	21FLMANATS1	Rattlesnake Slough	Monthly	Fecal coliform, TN, TP, BOD, DO saturation
Cedar Creek	1926	1926	IF Stream	Manatee County Environmental Management Department	21FLMANATS2	Cedar Creek	Monthly	Fecal coliform
Nonsense Creek	1913	1913	IF Stream	Manatee County Environmental Management Department	21FLAMANATS7	Nonsense Creek	Monthly	Fecal coliform, TN, BOD, DO saturation
Braden River Above Ward Lake	1914	1914	IF Stream	Manatee County Environmental Management Department	21FLMANATABR2	Braden River Above Ward Lake	Monthly	Fecal coliform
Braden River Above Ward Lake	1914	1914	IF Stream	Manatee County Environmental Management Department	21FLMANALL1	Braden River Above Ward Lake	Monthly	Fecal coliform
Braden Above Lake Ward	1914	1914	IF Stream	Manatee County Environmental Management Department	21FLMANATS6	Braden River Above Ward Lake	Monthly	Fecal coliform

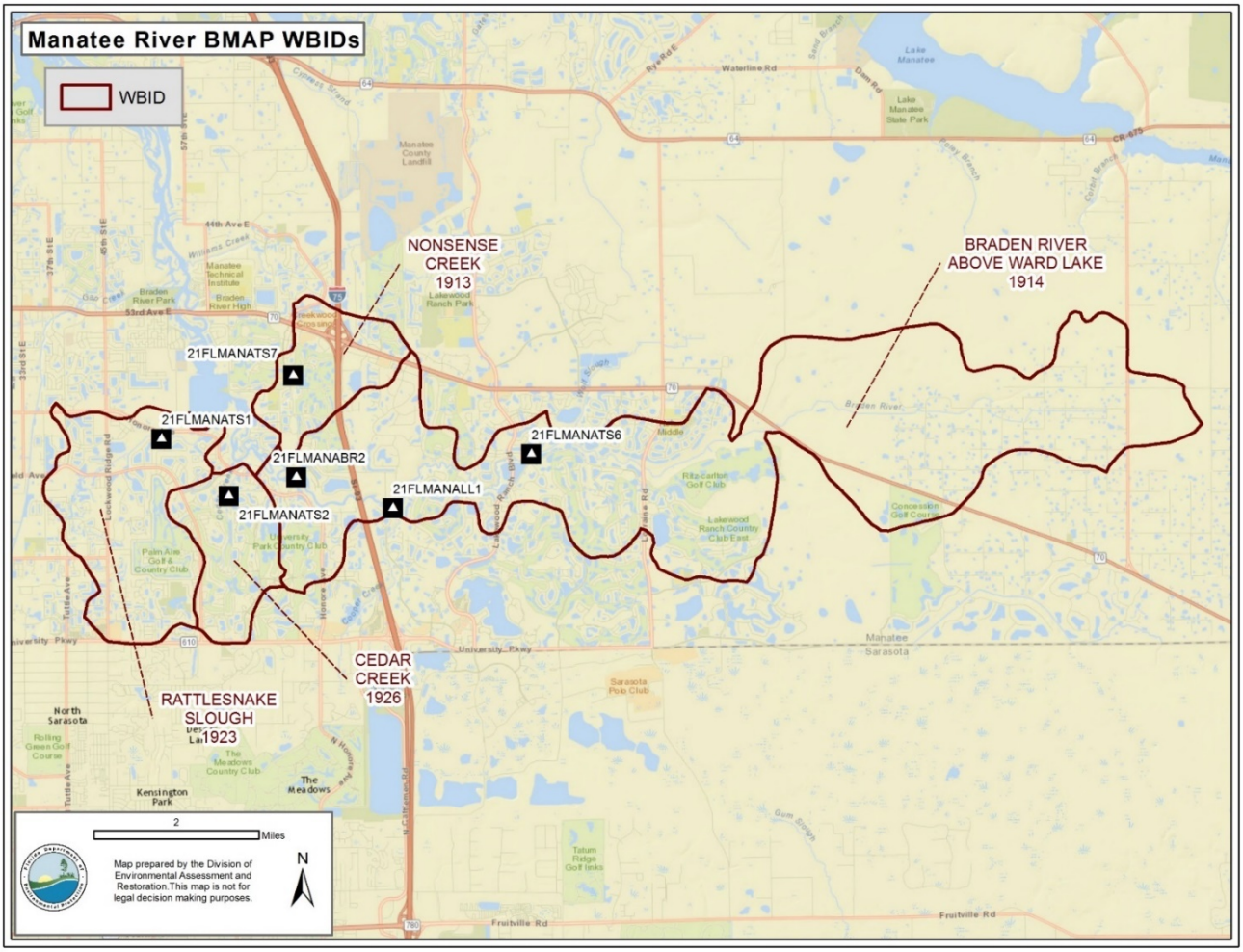

Figure D-1. Monitoring stations for fecal coliform in the Manatee River

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
1923	TS1	TN (mg/L)	1/16/2008	8/18/2015	69	-0.22807	**0.03598**	-0.00010	Decreasing trend
1923	TS1	TP (mg/L)	1/16/2008	12/9/2015	83	-0.19679	**0.03654**	-0.00003	Decreasing trend
1923	TS1	DO (% sat.)	1/16/2008	12/9/2015	90	0.30405	**0.00057**	0.00695	Increasing trend
1923	TS1	BOD (mg/L)	1/23/2001	5/21/2008	76	-0.05314	0.61663	0.00000	No significant trend

WBID	Station	Parameter	POR Start	POR End	N (# of Samples)	Tau	P-value	Slope	Trend Test Interpretation
1913	TS7	TN (mg/L)	1/16/2008	12/9/2015	64	-0.22973	**0.04833**	-0.00009	Decreasing trend
1913	TS7	DO (% sat.)	1/16/2008	12/9/2015	87	0.40648	**0.00001**	0.00916	Increasing trend
1913	TS7	BOD (mg/L)	2/20/2001	5/21/2008	76	-0.19139	0.05586	-0.00055	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
1923	TN (mg/L)	2008	2014	7	-0.23810	0.54801	-0.01985	No significant trend
1923	TP (mg/L)	2008	2015	8	-0.50000	0.10776	-0.01115	No significant trend
1923	DO (% sat.)	2008	2015	8	0.28571	0.38648	2.39255	No significant trend

WBID	Parameter	POR Start	POR End	N (# of Samples)	Tau	P-value	Slope	Trend Test Interpretation
1913	TN (mg/L)	2008	2015	8	-0.21429	0.53619	-0.04560	No significant trend
1913	DO (% sat.)	2008	2015	8	0.64286	**0.03545**	3.99899	Increasing 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 and highlighted 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
1923	TS1	DO (% Sat.)	67.32	*73.32*	**0.00880**	5919	Increase between Period 1 and Period 2
1923	TS1	TN (mg/L)	*1.15*	1.06	**0.02710**	5155	Decrease between Period 1 and Period 2
1923	TS1	TP (mg/L)	0.38	0.39	0.34530	5260	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
1913	TS7	DO (% Sat.)	67.55	*77.54*	**0.00000**	6407	Increase between Period 1 and Period 2
1913	TS7	TN (mg/L)	1.01	0.97	0.55300	4676	No difference between periods