DeLeon Spring
Basin Management Action Plan

Division of Environmental Assessment and Restoration
Water Quality Restoration Program
Florida Department of Environmental Protection

with participation from the
DeLeon Spring Stakeholders

June 2018

2600 Blair Stone Rd.
Tallahassee, FL 32399
floridadep.gov

Acknowledgments

The Florida Department of Environmental Protection adopted the *DeLeon Spring Basin Management Action Plan* by Secretarial Order as part of its statewide watershed management approach to restore and protect Florida's water quality. The plan was developed in coordination with stakeholders, identified below, with participation from affected local, regional, and state governmental interests; elected officials and citizens; and private interests.

Florida Department of Environmental Protection
Noah Valenstein, Secretary

Table A-1. DeLeon Spring stakeholders

Type of Entity	Name
Responsible Stakeholders	Volusia County
Responsible Agencies	Florida Department of Agriculture and Consumer Services Florida Department of Environmental Protection Florida Department of Health St. Johns River Water Management District
Other Interested Stakeholders	1000 Friends of Florida Agricultural Producers Blue Springs Alliance Citizens/Homeowners East Central Florida Regional Planning Council Florida Department of Transportation Florida Farm Bureau Florida Onsite Wastewater Association Save the Manatee Club Septic Contractors Volusia Water Authority

See **Appendix A** for links to important sources referenced in this document. For additional information on the watershed management approach in the DeLeon Spring Basin, contact:

Moira Homann, Basin Coordinator
Florida Department of Environmental Protection
Water Quality Restoration Program, Watershed Planning and Coordination Section
2600 Blair Stone Road, Mail Station 3565
Tallahassee, FL 32399-2400
Email: moira.homann@dep.state.fl.us
Phone: (850) 245–8460

Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

ac	Acre
AWT	Advanced Wastewater Treatment
ATU	Aerobic Treatment Unit
BAF	Biochemical Attenuation Factor
BMAP	Basin Management Action Plan
BMPs	Best Management Practices
CASTNET	Clean Air Status and Trends Network
cfs	Cubic Feet Per Second
CMAQ	Community Multiscale Air Quality
C.R.	County Road
CRF	Controlled Release Fertilizer
DEP	Florida Department of Environmental Protection
DMR	Discharge Monthly Report
DO	Dissolved Oxygen
F.A.C.	Florida Administrative Code
F.A.R.	Florida Administrative Register
FDACS	Florida Department of Agriculture and Consumer Services
FDOH	Florida Department of Health
FF	Farm Fertilizer
FGS	Florida Geological Survey
FLUCCS	Florida Land Use Cover and Forms Classification System
FOWA	Florida Onsite Wastewater Association
F.S.	Florida Statutes
FSAID	Florida Statewide Agricultural Irrigation Demand
FYN	Florida Yards and Neighborhoods
GIS	Geographic Information System
gpd	Gallons Per Day
IA	Implementation Assurance
IV	Implementation Verification
in/yr	Inch Per Year
lb	Pound
lb-N/yr	Pounds of Nitrogen Per Year
LF	Linear Feet
LVS	Linear Vegetation Survey
LW	Livestock Waste
MFLs	Minimum Flows and Levels
mgd	Million Gallons Per Day
mg/L	Milligrams Per Liter
N	Nitrogen
N/A	Not Applicable
NADP	National Atmospheric Deposition Program

NELAC	National Environmental Accreditation Conference
NELAP	National Environmental Accreditation Program
NNC	Numeric Nutrient Criteria
NOI	Notice of Intent
NSF	NSF International (formerly National Sanitation Foundation)
NSILT	Nitrogen Source Inventory Loading Tool
NTN	National Trends Network
OAWP	Office of Agricultural Water Policy
OFS	Outstanding Florida Spring
OSTDS	Onsite Sewage Treatment and Disposal System
PBTS	Performance-based Treatment System
PFA	Priority Focus Area
QA/QC	Quality Assurance/Quality Control
RIB	Rapid Infiltration Basin
RPS	Rapid Periphyton Survey
SBIO	DEP Statewide Biological Database
SCI	Stream Condition Index
SJRWMD	St. Johns River Water Management District
SOP	Standard Operating Procedure
STF	Sports Turf Fertilizer
STORET	Florida Storage and Retrieval Database
SWIM	Surface Water Improvement and Management
TDEP	Total Atmospheric Deposition Model
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
UFA	Upper Floridan Aquifer
UF–IFAS	University of Florida Institute of Food and Agricultural Sciences
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UTF	Urban Turfgrass Fertilizer
WAFR	Wastewater Facility Regulation (Database)
WBID	Waterbody Identification (Number)
WIN	Florida Watershed Information Network Database
WMD	Water Management District
WWTF	Wastewater Treatment Facility
yr	Year

Executive Summary

DeLeon Spring Basin

The Florida Springs and Aquifer Protection Act (Chapter 373, Part VIII, Florida Statutes [F.S.]), provides for the protection and restoration of Outstanding Florida Springs (OFS), which comprise 24 first magnitude springs, 6 additional named springs, and their associated spring runs. The Florida Department of Environmental Protection (DEP) has assessed water quality in each OFS, and has determined that 24 of the 30 OFS are impaired for the nitrate form of nitrogen. DeLeon Spring is one of the impaired second magnitude OFS.

The DeLeon Spring is located in Volusia County and is part of the Lake Woodruff Planning Unit of the Middle St. Johns River. The BMAP area is approximately 65,392 acres (**Figure ES-1**). DeLeon Spring is a second magnitude spring located in DeLeon Spring State Park, 5 miles northwest of the town of DeLand. A series of lakes and creeks connects the headspring to the St. Johns River 12 miles downstream.

DeLeon Spring Priority Focus Area (PFA)

The PFA (**see Appendix C**) comprises 24,437 acres. The PFA represents the area in the basin where the aquifer is most vulnerable to inputs and where there are the most connections between groundwater and DeLeon Spring.

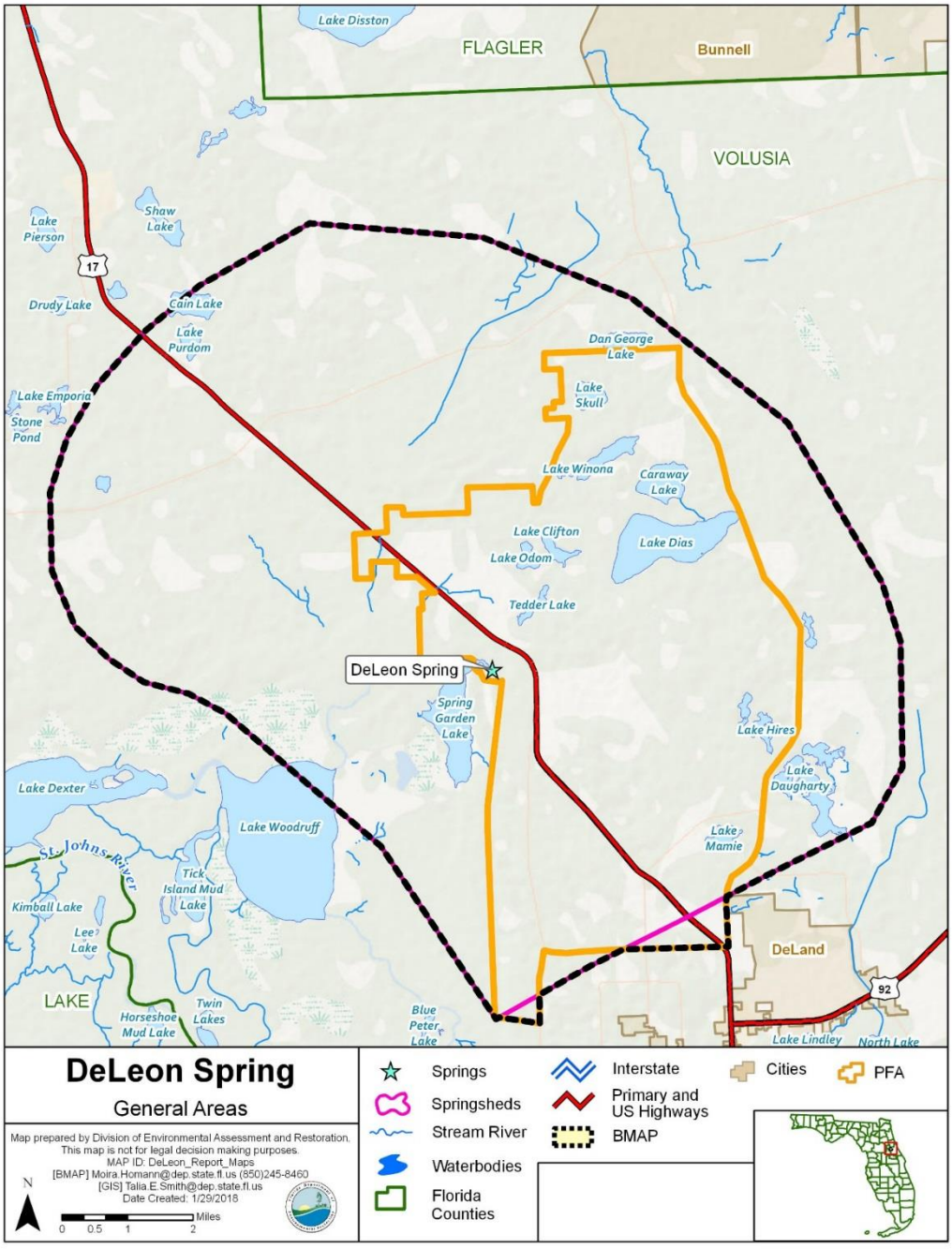

Figure ES-1. DeLeon Spring BMAP and PFA boundaries

Nitrogen Source Identification, Required Reductions, and Options to Achieve Reductions

DeLeon Spring was identified as impaired because of a biological imbalance caused by excessive concentrations of nitrate in the water. In 2017, a total maximum daily load (TMDL) for nitrate was developed as a water quality restoration target for DeLeon Spring. The TMDL established monthly average nitrate-nitrite target of 0.35 milligrams per liter (mg/L).

Farm Fertilizer (FF) represents 52 % of the nitrogen loading to groundwater, urban turfgrass fertilizer (UTF) 19 %, and onsite sewage treatment and disposal systems (OSTDS or septic systems; the terms are used interchangeably throughout this document) 14 % of the total loading to groundwater based on the DEP analysis conducted using the Nitrogen Source Inventory Loading Tool (NSILT).

The total load reduction required to meet the TMDL at the spring vent is 17,195 pounds of nitrogen per year (lb-N/yr). To measure progress towards achieving the necessary load reduction, DEP is establishing the following milestones:

- Initial reduction of 5,159 lb-N/yr (30 %) within 5 years.
- An additional 8,598 lb-N/yr (50 %) within 10 years.
- The remaining 3,439 lb-N/yr (20 %) within 15 years.
- For a total of 17,195 lb-N/yr within 20 years.

The policies and submitted projects included within this BMAP are estimated to achieve a reduction of 43,298 to 91,776 lb-N/yr to groundwater. While reductions to groundwater will benefit the spring, it is uncertain to know with precision how those reductions will impact the necessary reductions at the spring. DEP will continue to monitor the spring to evaluate those reductions as projects are implemented against the required load reductions above. The BMAP is designed to achieve 80 % of the load reductions needed for the spring vent within 10 years of adoption and 100 % within 15 years. DEP will evaluate progress towards these milestones and will report to the Governor and Florida Legislature. DEP will adjust management strategies to ensure the target concentrations are achieved. This may include expanding the area to which the OSTDS remediation policies apply; any such change, however, would be incorporated into an updated BMAP through a formal adoption process.

For the list of projects to improve water quality, see **Appendix B**. Included are owner-implemented best management practices (BMPs) for FF, livestock waste (LW), sports turfgrass fertilizer (STF); wastewater treatment facility (WWTF) upgrades; projects to reduce UTF application; and OSTDS conversions to sewer.

Successful BMAP implementation requires commitment, dedicated state funding, and follow-up. Stakeholders have expressed their intention to carry out the plan, monitor its effects, and continue to coordinate within and across jurisdictions to achieve nutrient reduction goals. As the TMDLs must be achieved within 20 years, DEP, water management districts (WMDs), Florida Department of Health (FDOH), and Florida Department of Agriculture and Consumer Services (FDACS) will implement management strategies using the annual Legacy Florida appropriation from the legislature of at least $50 million to reduce nitrogen in impaired OFS. DEP, working with the coordinating agencies, will continue to invest existing funds and explore other opportunities and potential funding sources for springs restoration efforts.

Restoration Approaches

Load reduction to the aquifer is needed to achieve the load reductions requirements at the spring vent. To ensure that load reductions are achieved at the spring vent, the following restorations actions are being established. These actions are designed to reduce the amount of nutrients to the aquifer, which will reduce the load at the vent and ultimately achieve the necessary reductions. Monitoring of the vent during implementation will be implemented to monitor progress.

- **New OSTDS** – Upon BMAP adoption, the OSTDS remediation plan prohibits new systems on lots of less than 1 acre within the PFAs, unless the system includes enhanced treatment of nitrogen as defined by the OSTDS remediation plan, or unless the OSTDS permit applicant demonstrates that sewer connections will be available within 5 years. Local governments and utilities are expected to develop master wastewater treatment feasibility analyses within 5 years to identify specific areas to be sewered or to have enhanced nitrogen reducing OSTDS within 20 years of BMAP adoption. The OSTDS remediation plan is incorporated as **Appendix D**.

- **Existing OSTDS** – Upon completion of the master wastewater treatment feasibility analyses, FDOH rulemaking, and funding program for homeowners included in the OSTDS remediation plan, but no later than five years after BMAP adoption, modification or repair permits issued by FDOH for all OSTDS within the PFA on lots of less than one acre will require enhanced treatment of nitrogen, unless sewer connections will be available based on a BMAP-listed project. All OSTDS subject to the policy must include enhanced treatment of nitrogen no later than 20 years after BMAP adoption.

- **WWTFs** − The effluent standards listed in **Table ES-1** will apply to all new and existing WWTFs in the BMAP area (inside and outside the PFA).

Table ES-1. WWTF effluent standards

gpd = Gallons per day

95% of the Permitted Capacity (gpd)	Nitrogen Concentration Limits for Rapid Infiltration Basins (RIBs) and Absorption Fields (mg/L)	Nitrogen Concentration Limits for All Other Land Disposal Methods, Including Reuse (mg/L)
Greater than 100,000	3	3
20,000 to 100,000	3	6
Less than 20,000	6	6

- **UTF** – UTF sources can receive up to 6 % credit for the DEP-approved suite of public education and source control ordinances. Entities have the option to collect and provide monitoring data to quantify reduction credits for additional measures.

- **STF –** STF sources include golf courses and other sporting facilities. Golf courses can receive up to 10 % credit for implementing the Golf Course BMP Manual. Other sports fields can receive up to 6 % credit for managing their fertilizer applications to minimize transport to groundwater.

- **FF** – All FF sources are required to implement BMPs or perform monitoring to demonstrate compliance with the TMDL. A 15 % reduction to groundwater is estimated for owner-implemented BMPs. Additional credits could be achieved through better documentation of reductions achieved through BMP implementation or implementation of additional agricultural projects or practices, such as precision irrigation, soil moisture probes, controlled release fertilizer, and cover crops.

- **LW** – All LW sources are required to implement BMPs or perform monitoring. A 10 % reduction to groundwater is estimated for owner-implemented BMPs. Additional credits could be achieved through better documentation of reductions achieved through BMP implementation.

Section 1: Background

1.1 Legislation

Chapter 373, Part VIII, Florida Statutes (F.S.), the Florida Springs and Aquifer Protection Act provides for the protection and restoration of Outstanding Florida Springs (OFS), which comprise 24 first magnitude springs, 6 additional named springs, and their associated spring runs. The Florida Department of Environmental Protection (DEP) has assessed water quality in each OFS and determined that 24 of the 30 OFS are impaired for the nitrate form of nitrogen. DeLeon Spring is an impaired second magnitude OFS.

Development of the basin management action plan (BMAP) to meet the new requirements of the Florida Springs and Aquifer Protection Act for the DeLeon Spring Basin was initiated in 2018.

1.2 Water Quality Standards and Total Maximum Daily Loads (TMDLs)

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality criteria. DeLeon Spring is a Class III waterbody with a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. These waters are impaired by nitrate nitrogen, which in excess has been demonstrated to adversely affect flora or fauna through the excessive growth of algae. Excessive algal growth results in ecological imbalances in springs and rivers and can produce human health problems, foul beaches, inhibit navigation, and reduce the aesthetic value of the resources.

DEP adopted a nutrient TMDL for DeLeon Spring in 2017 **(**see **Table 1)**. The TMDL established a target of an annual average of 0.35 milligrams per liter (mg/L) of nitrate-nitrite to be protective of the aquatic flora and fauna. The period of record for water quality data evaluated for the TMDL was January 2007 through December 2016.

Table 1. Restoration target for DeLeon Spring

Waterbody or Spring Name	Waterbody Identification (WBID) Number	Parameter	TMDL (mg/L)
DeLeon Spring	2921A	Nutrients (Nitrate-Nitrite), annual average	0.35

1.3 BMAP Requirements

Section 403.067(7), F.S., provides DEP with the statutory authority for the BMAP Program. A BMAP is a comprehensive set of strategies to achieve the required pollutant load reductions. In addition to this authority, the Florida Springs and Aquifer Protection Act (Part VIII of Chapter 373, F.S.) describes additional requirements for the 30 Outstanding Florida Springs.

1.4 BMAP Area

The DeLeon Spring is located in Volusia County and is part of the Lake Woodruff Planning Unit of the Middle St. Johns River. The BMAP area is approximately 65,392 acres (see **Figure 1**). DeLeon Spring is a second magnitude spring located in DeLeon Spring State Park, 5 miles northwest of the town of DeLand. A series of lakes and creeks connects the headspring to the St. Johns River 12 miles downstream.

This area includes the surface water basin as well as the groundwater contributing areas for the springs (or springshed). The springshed for the OFS was delineated or approved by St. Johns River Water Management District (SJRWMD) with input from the Florida Geological Survey (FGS). A springshed is the area of land that contributes water to a spring or group of springs, mainly via groundwater flow.

1.5 Priority Focus Area (PFA)

In compliance with the Florida Springs and Aquifer Protection Act, this BMAP delineates a PFA, defined as the area of a basin where the Floridan aquifer is generally most vulnerable to pollutant inputs and where there is a known connectivity between groundwater pathways and an OFS. The PFA provides a guide for focusing restoration strategies where science suggests these efforts will most benefit the springs. The document describing the delineation process for the PFA is on the DEP website. The link to the PFA document is provided in **Appendix C.**

1.5.1 Description

Nitrogen sources are more likely to influence groundwater quality under certain conditions. For example, where soils are sandy and well drained, less nitrogen is converted to gas and released into the atmosphere or taken up by plants, compared with other soil types. Therefore, local soil types play a role in how much nitrogen travels from the land surface to groundwater in a specific springshed. Also, the underlying geologic material influences the vulnerability of the underlying aquifers and the rate of lateral movement within the Floridan aquifer toward the springs. These conditions, and others, were considered in the delineation of the PFA (see **Appendix C**).

Following BMAP adoption, DEP will ensure that the geographic information system (GIS) files associated with the PFA boundary are available to the public on the DEP Map Direct webpage.

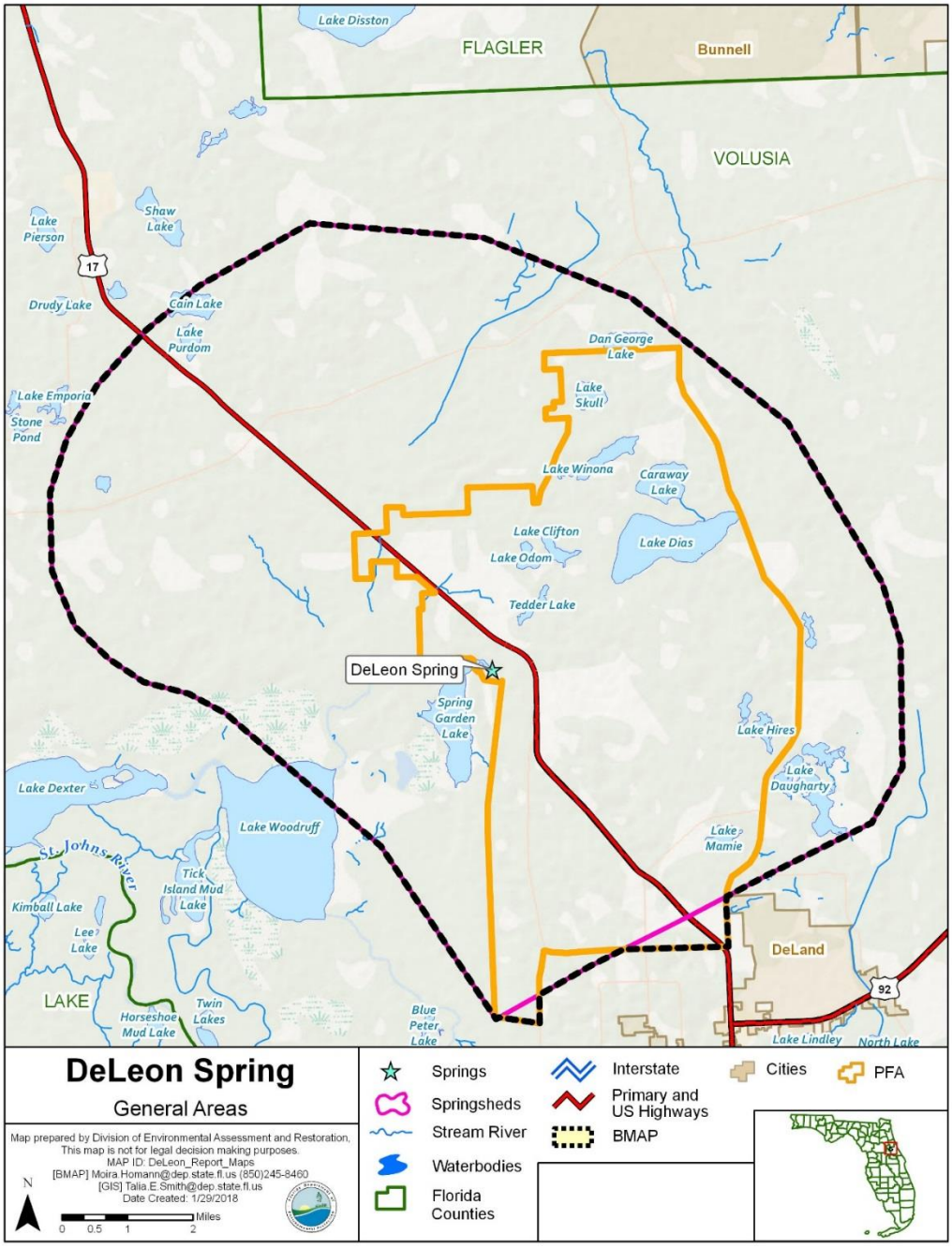

Figure 1. DeLeon Spring BMAP and PFA boundaries

1.5.2 Additional Requirements

In accordance with Section 373.811, F.S., the following activities are prohibited in the PFA:

- New domestic wastewater disposal facilities, including rapid infiltration basins (RIBs), with permitted capacities of 100,000 gpd or more, except for those facilities that meet an

advanced wastewater treatment (AWT) standard of no more than 3 mg/L total nitrogen (TN) on an annual permitted basis.

- New onsite sewage treatment and disposal systems (OSTDS or septic systems; the terms are used interchangeably throughout this document) on lots of less than one acre inside the PFAs unless additional nitrogen treatment is provided, as specified in the OSTDS remediation plan (see **Appendix D** for details).

- New facilities for the disposal of hazardous waste.

- The land application of Class A or Class B domestic wastewater biosolids not in accordance with a DEP-approved nutrient management plan establishing the rate at which all biosolids, soil amendments, and sources of nutrients at the land application site can be applied to the land for crop production, while minimizing the amount of pollutants and nutrients discharged to groundwater or waters of the state.

- New agricultural operations that do not implement best management practices (BMPs), measures necessary to achieve pollution reduction levels established by DEP, or groundwater monitoring plans approved by a water management district (WMD), or DEP.

1.5.2.1 Biosolids and Septage Application Practices

In the PFA, the aquifer contributing to the springs is highly vulnerable to contamination by nitrogen sources and soils have a high to moderate tendency to leach applied nitrogen. DEP previously documented elevated nitrate concentrations in groundwater beneath septage application zones in spring areas. To assure that nitrogen losses to groundwater are minimized from permitted application of biosolids and septage in the PFA, the following requirements apply to newly-permitted application sites and existing application sites upon permit renewal.

All permitted biosolids application sites that are agricultural operations must be enrolled in the Florida Department of Agriculture and Consumer Services (FDACS) BMP Program or be within an agricultural operation enrolled in the FDACS BMP Program for the applicable crop type. Implementation of applicable BMPs will be verified by FDACS in accordance with Chapter 5M-1, Florida Administrative Code (F.A.C.). Permitted biosolids application sites that are new agricultural operations must also comply with Subsection 373.811(5), F.S. Biosolids application sites must be certified as viable agricultural operations by an acknowledged agricultural professional such as an agricultural consultant or agricultural extension agent. Effective nutrient management practices must be ongoing at the application zones in the permit. Plant uptake and harvesting are vital components of the nutrient management plan to remove nitrogen and prevent it from leaching to groundwater. If DEP determines that the site is not a viable agricultural site implementing a nutrient management plan, corrective action will be required.

Groundwater monitoring for nitrate is required for all biosolids and septage land application sites in the PFA to assure compliance with nutrient management objectives in this BMAP. However, groundwater monitoring is not required if the site nutrient management plan limits biosolids application rates to TN with no adjustment for available nitrogen normally allowed by subsections 62-640.500(5) and (6), F.A.C. (e.g. for a recommended fertilizer rate of 160 pounds of nitrogen per acre, only 160 pounds of TN per acre shall be applied). For septage application, groundwater monitoring is not required if the site nutrient management plan limits application rates to 30,000 gallons per acre for sites accepting mixtures of septage and grease (food establishment sludge) or to 40,000 gallons per acre for sites accepting septage without grease. The permit renewal application will include a trend analysis for nitrate in groundwater monitoring wells during the previous permit cycle, and an evaluation of the potential for the facility to cause or contribute to exceedance of the TMDL.

1.6 Other Scientific and Historical Information

In preparing this BMAP, DEP collected and evaluated credible scientific information on the effect of nutrients, particularly forms of nitrogen, on springs and springs systems. Some of the information collected is specific to the DeLeon Spring Basin, while other references provide information on related knowledge for restoring springs, such as nitrogen-reducing technologies, the treatment performance of OSTDS, and runoff following fertilizer applications.

1.7 Stakeholder Involvement

Stakeholder involvement is critical to develop, gain support for, and secure commitments in a BMAP. The BMAP process engages stakeholders and promotes coordination and collaboration to address the pollutant load reductions necessary to achieve the TMDL. DEP invites stakeholders to participate in the BMAP development process and encourages public participation and consensus to the greatest practicable extent. **Table A-1** identifies the stakeholders who participated in the development of this BMAP.

During the development of the DeLeon Spring BMAP, DEP held a series of meetings involving stakeholders and the general public. The purpose of these meetings was to consult with stakeholders to gather information, evaluate the best available science, develop an OSTDS remediation plan, define management strategies and milestones, and establish monitoring requirements. All of the meetings were open to the public and noticed in the *Florida Administrative Register* (F.A.R.). Additionally, a public meeting on the current BMAP was held on May 22, 2018, and was noticed in the F.A.R. and in local newspapers.

Upon BMAP adoption, DEP intends to facilitate annual meetings with stakeholders to review progress towards achieving the TMDL.

1.8 Description of BMPs Adopted by Rule

Table 2 identifies the adopted BMPs and BMP manuals relevant to this BMAP.

Table 2. BMPs and BMP manuals adopted by rule as of June 2017

Agency	F.A.C. Chapter	Chapter Title
FDACS Office of Agricultural Water Policy (OAWP)	5M-6	Florida Container Nursery BMP Guide
FDACS OAWP	5M-8	BMPs for Florida Vegetable and Agronomic Crops
FDACS OAWP	5M-9	BMPs for Florida Sod
FDACS OAWP	5M-11	BMPs for Florida Cow/Calf Operations
FDACS OAWP	5M-12	Conservation Plans for Specified Agricultural Operations
FDACS OAWP	5M-13	BMPs for Florida Specialty Fruit and Nut Crop Operations
FDACS OAWP	5M-14	BMPs for Florida Equine Operations
FDACS OAWP	5M-16	BMPs for Florida Citrus
FDACS OAWP	5M-17	BMPs for Florida Dairies
FDACS OAWP	5M-18	Florida Agriculture Wildlife BMPs
FDACS OAWP	5M-19	BMPs for Florida Poultry
FDACS Division of Agricultural Environmental Services	5E-1	Fertilizer
FDACS Division of Aquaculture	5L-3	Aquaculture BMPs
FDACS Florida Forest Service	5I-6	BMPs for Silviculture
FDACS Florida Forest Service	5I-8	Florida Forestry Wildlife BMPs for State Imperiled Species
DEP	62-330	Environmental Resource Permitting

Section 2: Implementation to Achieve TMDL

2.1 Allocation of Pollutant Loads

2.1.1 Nutrients in the Springs and Spring Systems

DEP collected and evaluated credible scientific information on the effect of nutrients, particularly forms of nitrogen, on DeLeon Spring described below.

DEP developed the Nitrogen Source Inventory Loading Tool (NSILT) to provide information on the major sources of nitrogen in the groundwater contributing area and spring contributing area for the OFS. In addition, this tool is used to estimate nitrogen loads to groundwater from these sources in the spring contributing area. The NSILT is a GIS- and spreadsheet-based tool that provides spatial estimates of the relative contribution of nitrogen from major nitrogen sources and accounts for the transport pathways and processes affecting the various forms of nitrogen as they move from the land surface through the soil and geologic strata.

The first major factor to be considered in estimating the loading to groundwater in the NSILT is the attenuation of nitrogen as it moves from its source through the environment, before it reaches the Upper Floridan aquifer (UFA). Biological and chemical processes that occur as part of the nitrogen cycle, as well as hydrogeological processes, control the movement of nitrogen from the land surface to groundwater. Many of these processes attenuate (impede or remove) the amount of nitrogen transported to groundwater. An understanding of how water moves through the subsurface and the processes that transform the different forms of nitrogen is essential for estimating nitrogen loading to groundwater from various sources.

A second major factor to consider in estimating the loading to groundwater is the geological features in the springshed and the related recharge rate to the aquifer. Water movement between the shallow groundwater (surficial aquifer, where present) and the deeper aquifer (UFA) is slowed by a low permeability layer of clay, silt, and fine sand that retards the vertical movement of infiltrating water from the surface. The UFA occurs in limestone that can be prone to dissolving and, over geologic time, the development of numerous karst features (sinkholes, caves, and conduits). These features allow water from the land surface to move directly and relatively rapidly into the aquifer and in some areas for groundwater in the aquifer to move rapidly to the springs.

Potential recharge rates from the surface to the UFA are affected by variations in the geologic materials and the presence of karst features. DEP estimated the recharge rate ranges and grouped them into three rate categories, which were applied to the NSILT:

- Low recharge (1 to 5 inches per year [in/yr]).
- Medium recharge (5 to 15 in/yr).
- High recharge (15 in/yr or greater).

In the NSILT, DEP applies different attenuation factors to different types of sources, so that various biological, chemical, and hydrogeological effects can be estimated. The attenuation that is applied means that the amount of nitrogen leaving a source (such as a livestock operation or a just-fertilized yard), reduces the amount of nitrogen predicted to reach the aquifer. In the NSILT, the average attenuation rates range from 90 % (for atmospheric deposition) to 25 % (for wastewater disposal in a RIB). This means that, for these examples, only 10 % of nitrogen from atmospheric deposition is expected to reach the aquifer, while 75 % of nitrogen from a RIB is expected to reach groundwater, because the remainder is attenuated by various chemical and biological processes.

Phosphorus is naturally abundant in the geologic material underlying much of Florida and is often present in high concentrations in surface water and groundwater. Monitoring and evaluation of phosphorus and influences on the springs continues as the nitrate-nitrite TMDL is implemented.

2.1.2 Estimated Nitrogen Loads

Table 3 lists the estimated nitrogen loads to groundwater by source. Note that urban stormwater loads are included in urban turfgrass fertilizer (UTF) estimates, while agricultural stormwater loads are included in farm fertilizer (FF) and livestock waste (LW) estimates. Nitrogen loading to surface water will be reduced through the activities and strategies for the sources identified in this chapter for groundwater loading.

Table 3. Estimated nitrogen load to groundwater by source in the BMAP area

Nitrogen Source	Total Nitrogen Load to Groundwater in Pounds of Nitrogen Per Year (lb-N/yr)	% Contribution
OSTDS	28,800	14%
UTF	38,873	19%
Atmospheric Deposition	12,199	6%
FF	107,583	52%
Sports Turfgrass Fertilizer (STF)	211	0.1%
LW	17,264	8%
Wastewater Treatment Facility (WWTF)	778	0.4%
Total	**205,708**	**100%**

2.1.3 Assumptions and Considerations

The NSILT estimates are based on the following assumptions and considerations:

- **NSILT Nitrogen Inputs** – The methods used to calculate nitrogen inputs for each pollutant source were based on a detailed synthesis of information, including direct water quality measurements, census data, surveys, WWTF permits, published scientific studies and reports, and information obtained in meetings with agricultural producers. For some pollutant source categories, nitrogen inputs were obtained using assumptions and extrapolations and, as a result, these inputs could be subject to further refinement if more detailed information becomes available.

- **OSTDS Load Contribution** – A per capita contribution to an OSTDS of 9.012 lb-N/year was used to calculate the loading from OSTDS. The average household contribution was estimated based on 2010 U.S. Census Bureau data on average number of people per household (2.38 for Volusia County) and additional information on the amount of time spent away from home by the school-age population and labor force (adjusted effective persons per household of 1.97 for Volusia County).

- **Nitrogen Attenuation Factors** – To estimate the amount of nitrogen loading to the aquifer, DEP applied two nitrogen attenuation factors. Biological and chemical processes that occur as part of the nitrogen cycle, as well as hydrogeological processes, control the movement of nitrogen from the land surface to groundwater. Biochemical attenuation accounts for biochemical processes that convert or transform the different forms of nitrogen, while hydrogeological attenuation accounts for spatial variations that affect the rate of water infiltrating through geological media to recharge the UFA. Given the relatively large range of literature-reported values of biochemical nitrogen attenuation for each source category, DEP used an average biochemical attenuation factor for each source based on land use practices and hydrogeological (i.e., recharge) conditions in the contributing areas.

Other assumptions and considerations for BMAP implementation include the following:

- **Unquantified Project Benefits** – Nitrogen reductions for some of the projects and activities listed in this BMAP cannot currently be quantified. However, because of their positive impact, it is assumed that these actions will help reduce pollutant loads, and estimated loading reductions may be determined at a later date and assigned to these activities.

- **Atmospheric Deposition** – Atmospheric sources of nitrogen are local, national, and international. Atmospheric sources are generally of low nitrogen concentration compared with other sources and are further diminished through additional biological and chemical processes before they reach groundwater. Atmospheric deposition sources and trends will be re-evaluated periodically.

- **OSTDS Inventory and Loading Calculations** – The total number of OSTDS in the basin is estimated based on local information and FDOH data. Future BMAPs and the associated OSTDS loading calculations may be adjusted based on improved data on the number, location, and type (conventional and enhanced nitrogen reducing) of existing septic systems, and may include additional OSTDS installed since BMAP adoption.

- **PFA** – The PFA provides a guide for focusing strategies where science suggests efforts will best benefit the springs. The PFA boundary may be adjusted in the future if additional relevant information becomes available.

- **Project Collection Period –** The BMAP project collection period is limited to projects after a certain date, based on the data used to calculate the reductions needed. Reductions from older projects are already accounted for in the baseline loading. Projects completed in the springshed, after January 1, 2009, were considered for inclusion in this BMAP.

- **Legacy Sources** – Land uses or management practices not currently active in the basin may still be affecting the nitrate concentration of the springs. The movement of water from the land surface through the soil column to the UFA and through the UFA to the spring system varies both spatially and temporally and is influenced by local soil and aquifer conditions. As a result, there may be a lag between when nitrogen input to the UFA occurs and ultimately when that load arrives at the DeLeon Spring. The impact of this delay is not fully known.

- **Implementation Schedule** – BMAP implementation is intended to be a 20-year process. This plan defines nitrogen reduction milestones for 5-year (30 %), 10-year (50 %), and 15-year (20 %) implementation, so that the TMDL will be met no later than the 20-year goal (see **Section 2.1.6** for further details). Further, the total reductions and the project credits may be adjusted under the adaptive management approach used for the BMAP. This approach requires regular follow-up to ensure that management strategies are carried out and that their incremental effects are assessed. The process acknowledges that there is some uncertainty associated with the outcomes of proposed management strategies and the estimated response in nitrogen concentration at the springs. As more information is gathered and progress towards each 5-year milestone is reviewed, additional management strategies to achieve the TMDL will be developed or existing strategies refined to better address the sources of nitrogen loading.

- **Changes in Spring Flows** – The role of this BMAP is specifically to promote the implementation of projects that reduce nitrogen load to groundwater while the minimum flows and levels (MFLs) established for specific springs address water flows and levels. To maximize efforts between the two programs, spring protection projects should provide both water quality and quantity benefits.

2.1.4 Loading by Source

Based on the NSILT results, the pie chart in **Figure 2** depicts the estimated percentage of nitrogen loading to groundwater by source in the springshed. FF represents 52 % of the total nitrogen loading to groundwater, UTF 19 %, and OSTDS 14 %. Stormwater loading to groundwater is incorporated into the various source categories.

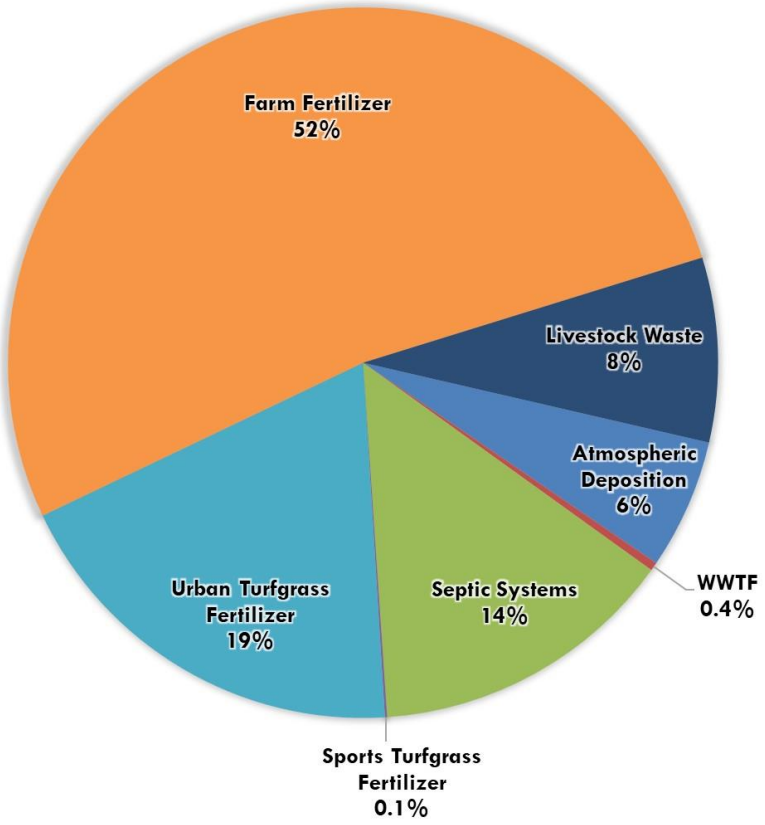

Figure 2. Loading to groundwater by source in the DeLeon Spring BMAP area

2.1.5 Loading Allocation

The nitrogen source reductions are based on the measured nitrate concentrations and flows at the vent, along with the TMDL target nitrate concentration. **Table 4** lists the measured nitrate (as nitrogen) loads at the spring vent compared with the TMDL loading based on a target nitrate concentration of 0.35 mg/L. The difference between the spring vent loading and the TMDL loading calculations is the required reduction to meet the TMDL. The total load that is required to be reduced in the basin is being allocated to the entire basin and actions defined by the BMAP to reduce loading to the aquifer are needed to implement this allocated load.

Table 4. Total reduction required to meet the TMDL

Description	Nitrogen Loads (lb-N/yr)	Notes Regarding Data Used
Total Load at Spring Vent	31,852	Upper 95% confidence interval - nitrate data and flow data from 2011 to 2017 (0.61 mg/L and 21.3 cubic feet per second [cfs])
TMDL Load	14,657	TMDL target is 0.35 mg/L and using the same flow data from 2011 to 2017
Required Reduction	**17,195**	

2.1.6 Description of 5-, 10-, and 15-year Milestones/Reduction Schedule

The overall load reduction targets are 30 % of the total within 5 years; 80 % of the total within 10 years; and 100 % of the total within 15 years. DEP will evaluate progress towards these milestones and will report to the Governor and Florida Legislature. DEP will adjust management strategies that reduce loading to the aquifer to ensure the target concentrations are achieved. This may include expanding the area to which the OSTDS remediation policies apply; any such change, however, would be incorporated into an updated BMAP through a formal adoption process.

Table 5 lists the estimated nitrogen reduction schedule by milestone. Progress will be tracked yearly and adjustments made as needed. At the five-year milestone, progress will be assessed and load reductions adjusted as necessary. Entities have flexibility in the types and locations of projects as long as they achieve the overall required load reductions. The monitoring of existing groundwater and springs sampling locations is essential. **Section 2.2** describes detailed source reduction strategies.

Table 5. Nitrogen reduction schedule (lb-N/yr)

5-Year Milestone (30% of Total)	10-Year Milestone (50% of Total)	15-Year Milestone (20% of Total)	Total Nitrogen Reduction (100%)
5,159	8,598	3,439	17,195

2.2 Prioritization of Management Strategies

The management strategies listed in **Appendix B** are ranked with a priority of high, medium, or low. In 2016, the Florida Legislature amended the Watershed Restoration Act (Section 403.067, F.S.), creating additional requirements for all new or revised BMAPs. BMAPs must now include planning-level details for each listed project, along with their priority ranking.

Project status was selected as the most appropriate indicator of a project's priority ranking. Projects with a "completed" status were assigned a *low priority*. Projects classified as "underway" were assigned a *medium priority* because some resources have been allocated to these projects, but some work still needs to be completed. *High priority* was assigned to projects listed as "planned" as well as certain "completed" projects that are ongoing each year (any project with one of these project types: "street sweeping," "catch basin inserts/inlet filter

cleanout," "public education efforts," "fertilizer cessation," "fertilizer reduction," or "aquatic vegetation harvesting"), and select projects that are elevated because substantial, subsequent project(s) are reliant on their completion.

2.3 Load Reduction Strategy

A precise total load reduction to groundwater needed to meet the TMDL is unknown and dependent on a number of complex factors. Ultimately there must be a reduction at the spring vent of at least 17,195 lb-N/yr. Based on the totals of all the credits from BMAP actions and policies, the range of total reductions to groundwater is between 43,298 and 91,776 lb-N/yr (see **Table 6**). However, due to the proximity of these reductions to the spring and the uncertainties of fate and transport in the karst geology, additional actions may be necessary to ensure that the loading at the vent is achieved within the timeline of the BMAP.

To achieve reductions outside the scope of the policies listed, additional project options are available to local entities but have not been planned. Other efforts could be pursued to further reduce the nitrogen load to groundwater in the DeLeon Spring Basin.

Table 6. Summary of potential credits for the DeLeon BMAP to meet the TMDL

Note: No reductions are estimated for atmospheric deposition sources.

Nitrogen Source	Credits to Load to Groundwater (lb-N/yr)	Description
OSTDS	11,797 – 17,241	Credits are based on lots of less than one acre inside the PFA being remediated by either enhancing onsite system or connecting to sewer. There are not currently any OSTDS remediation projects listed. Any projects on lots one acre or greater in the PFA or outside the PFA would add additional reductions to the estimates listed.
UTF	2,332	DEP approved credits (6 %) for public education activities as well as credits identified for stakeholder stormwater projects.
STF	13	6 % BMP credit for sports fields and 10 % BMP credit for golf courses on STF load to groundwater, assuming 100 % BMP implementation on golf courses and sports fields.
FF	16,137	15 % BMP credit on FF load to groundwater, assuming 100 % owner-implemented and verified BMPs on all fertilized lands
LW	1,726	10 % BMP credit on load to groundwater, assuming 100 % owner-implemented and verified BMPs at all livestock facilities.
WWTF	534	Achieved by BMAP WWTF policy.
Total Credits from BMAP Policies and Submitted Projects	**32,540 – 37,984**	
Advanced Agricultural Practices and Procedures	10,758 – 53,792	Includes 10 % to 50 % reduction from 100 % of fertilized acres with a change in practice.
Total Credits	**43,298 – 91,776**	**Load reduction to meet the TMDL at the spring vent is 17,195 lb-N/yr.**

2.4 OSTDS Management Strategies

Overall there are currently around 3,892 OSTDS in the PFA, based on FDOH estimates. This BMAP does not list any specific projects that reduce nitrogen loading from existing OSTDS at this time. **Figure 3** shows the locations of all OSTDS in the BMAP area.

DEP assessed the overall OSTDS loading compared with other nitrogen sources in the PFA, as well as the relative loading in the wider BMAP area. Based on these assessments, DEP has determined that for the DeLeon Spring BMAP area, OSTDS contribute 14 % pollutant loading in the springshed area and approximately 22 % of the nitrogen loading in the PFA. Irrespective of the percent contribution from OSTDS, DEP has determined that an OSTDS remediation plan is necessary. Cumulatively, nitrogen loading from OSTDS within this springshed result in the significant degradation of groundwater that impacts the DeLeon Spring BMAP area. Therefore, the comprehensive remediation of OSTDS, consistent with the requirements of this BMAP, is necessary to prevent associated groundwater and surface water contamination so that the TMDL can ultimately be achieved and so that increases in nitrogen loads from future growth are limited. The OSTDS remediation plan is incorporated as **Appendix D**.

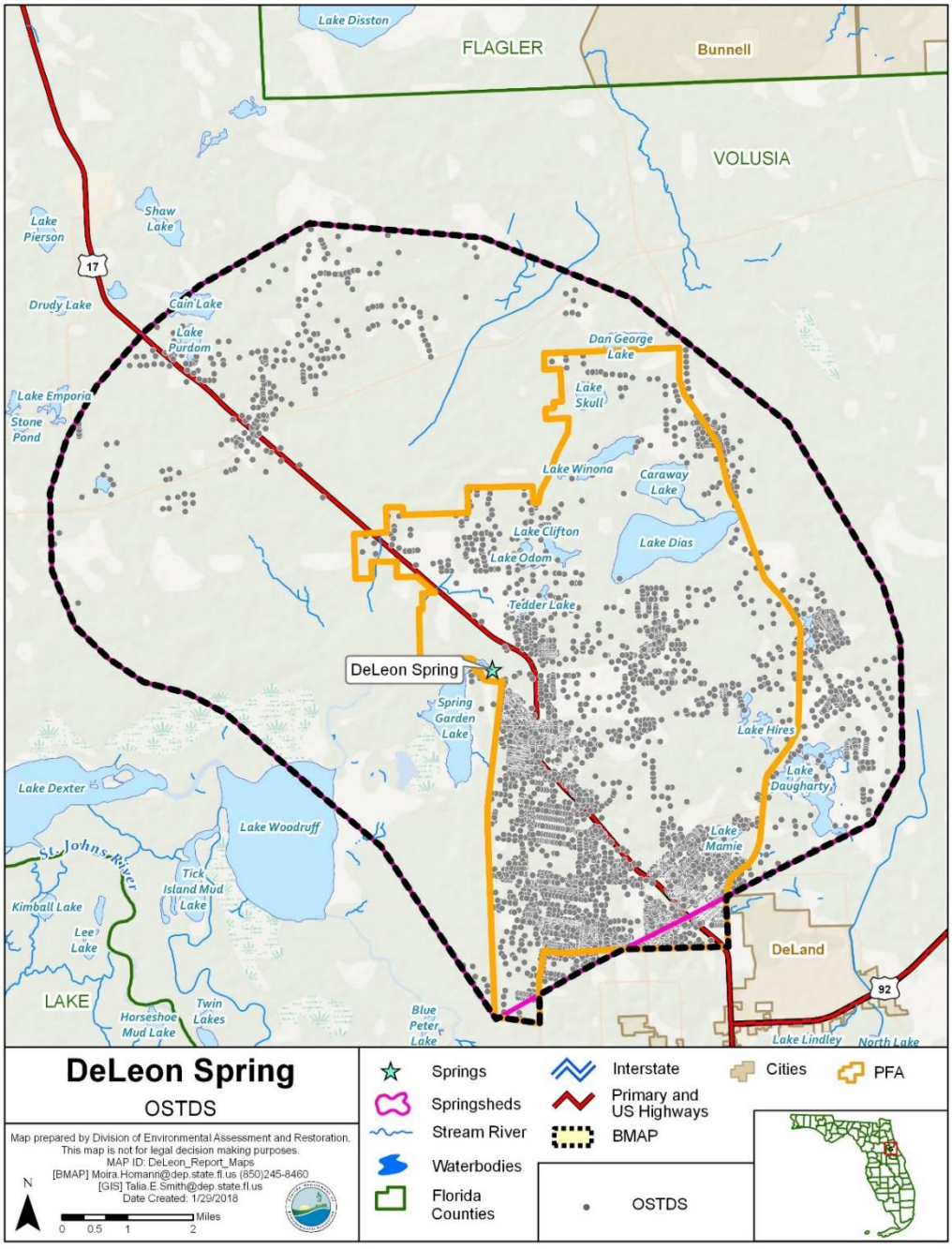

Figure 3. OSTDS locations in the DeLeon Spring BMAP area and PFA

In addition to the actions outlined in the OSTDS remediation plan (incorporated into this BMAP as **Appendix D)**, remedial efforts on existing conventional OSTDS could achieve nitrogen reductions. **Table 7** summarizes the nitrogen inputs, attenuation and recharge factors, and loads to groundwater for a conventional OSTDS. The conventional OSTDS nitrogen input is based on a per capita contribution of 9.012 lb-N/yr. This value is multiplied by the effective population, which is the estimated number of people per household with consideration to age distribution to

account for school or working age population who likely have access to sewer connected facilities during away from home hours (i.e., 1.97 average effective population in Volusia County). Percent reductions for enhanced or replaced systems are applied to the conventional OSTDS nitrogen groundwater loads to evaluate possible improvements to groundwater. Enhanced OSTDS can achieve an estimated 65 % improvement in the load to groundwater compared to a conventional system. OSTDS replaced by sewer reduce the conventional nitrogen inputs by an estimated 95 %, assuming a sewer connection to a WWTF meeting AWT levels.

The results show an estimated nitrogen reduction (i.e., credit) of 5.2 in high recharge areas, 2.9 in medium recharge areas, and 0.6 in low recharge areas for each enhanced OSTDS and an estimated nitrogen reduction of 7.6 in high recharge areas, 4.2 in medium recharge areas, and 0.8 in low recharge areas for each replaced OSTDS. Estimated costs for retrofitting (onsite treatment improvements) or removing (sewering) OSTDS range from $10,000 to $20,000 per system, which would be anticipated to be offset somewhat by cost-share from state funds. These costs can be refined as projects are completed and detailed cost data are available.

Table 7. Estimated individual OSTDS improvements to groundwater

Recharge Category	Conventional OSTDS Load To Groundwater (lb-N/yr/OSTDS)	Credit Per System (lb-N/yr/OSTDS)	
		Enhanced OSTDS	Replaced OSTDS
Nitrogen Input	18	–	–
Attenuation (0.5)	8.9	–	–
Low Recharge (0.1)	0.9	0.6	0.8
Medium Recharge (0.5)	4.4	2.9	4.2
High Recharge (0.9)	8.0	5.2	7.6

2.5 UTF Management Strategies

UTF consists of fertilizers applied to the turfgrass typically found in residential and urban areas (including residential lawns and public green spaces). It is applied by either the homeowner or a lawn service company on residential properties, while on nonresidential properties they may be applied by contractors or maintenance staff.

2.5.1 Fertilizer Ordinance Adoption

As required by the Florida Legislature, as described in Subsection 373.807(2), F.S., local governments with jurisdictional boundaries that include an OFS or any part of a springshed or delineated PFA of an OFS are required to develop, enact, and implement a fertilizer ordinance by July 1, 2017. The statutes require any ordinance to be based, at a minimum, on the DEP model ordinance for Florida-friendly fertilizer use on urban landscapes.

2.5.2 Prioritized Management Strategies and Milestones

Based on the fertilizer ordinances and public education activities in place at the time of BMAP adoption, the associated credits for UTF reductions to groundwater are 1,361 lb-N/yr (see **Table**

8). Additional environmental benefits could be credited if the counties and municipalities implement other public education efforts and source control ordinances, as described in **Section 2.5.3.**

Local stormwater projects that treat urban runoff, including nitrogen from urban fertilizer are also being sought, however there are not currently any submitted stormwater improvement projects outside of ordinances and public education.

Table 8. Current project credits to reduce UTF loading to groundwater

Project Category	Project Credits (lb-N/yr) Based on Management Actions in Appendix B
Fertilizer Ordinances and Public Education Activities	1,361
Stormwater Improvements	0
Total Project Credits	**1,361**

Since there is uncertainty about the data used in the NSILT to estimate the UTF loading to groundwater, DEP will work toward collecting better data by documenting reductions with the stakeholders. Also, DEP will work with stakeholders to develop additional measures to reduce fertilizer application.

2.5.3 Additional UTF Reduction Options

The anticipated reduction from UTF sources is currently limited to 6 % of the estimated load to groundwater. This reduction can be achieved through a 6 % total credit if each local government has an applicable fertilizer ordinance, landscape ordinance, irrigation ordinance, and pet waste ordinance; carries out public education activities; and implements the Florida Yards and Neighborhood (FYN) Program (see **Table 9**).

If full suite of public education measures is implemented, a 2,332 lb-N/yr reduction can be achieved. Currently, these credits total 1,361 lb-N/yr. Thus, an additional 972 lb-N/yr reduction could be achieved through public education and source control efforts.

Table 9. Maximum UTF load reductions based on existing public education credit policies

UTF Source Control Measures	Credit Based on Estimated Load to Groundwater (%)	Possible Nitrogen Credits (lb-N/yr)
Fertilizer Ordinance	0.5	194
Pet Waste Ordinance	0.5	194
Landscape Ordinance	0.5	194
Irrigation Ordinance	0.5	194
FYN Program	3.0	1,166
Public Education Program	1.0	389
Total Possible Credits	**6.00**	**2,332**

Appendix E contains technical support information that further explains the concepts presented in this section, including nitrogen loading by source category, reduction obligations, and management strategies.

2.6 STF Management Strategies

Sports turfgrass areas fall into two main categories that are evaluated separately: golf courses and sporting facilities (such as baseball, football, soccer, and other fields). There are no known golf courses in the DeLeon Spring BMAP area. There are 2 sports fields covering 19 acres in the BMAP area. All of the sports field acreage is located in medium and low recharge areas.

2.6.1 Prioritized Management Strategies and Milestones

DEP will work with sports field managers to ensure relevant BMP implementation and to estimate reductions associated with these efforts.

Managers of sports fields can assist by reducing fertilizer use, using products that reduce leaching, and more efficiently irrigating sports turf. The estimated credit for better management of non-golf sports turfgrass is 6 % of the starting load to groundwater. Based on these approaches, the initial estimates of reductions from STF sources is 13 lb-N/yr, as listed in **Table 10**.

Table 10. Maximum load reductions from STF improvements based on existing credit policies

*There are no golf courses located within the DeLeon BMAP area

STF Source Control Measures	Credit Based on Estimated Load to Groundwater (%)	Possible Nitrogen Credits (lb-N/yr)
Golf Course BMP Implementation*	10	0
Sports Fields BMPs	6	13
Total Possible Credits		**13**

2.7 Agricultural Sources Management Strategies and Additional Reduction Options

Based on data including Florida Statewide Agricultural Irrigation Demand (FSAID) IV geodatabase land use, FDACS identified agricultural acreage within the BMAP. An estimated 10,410 acres of land in the springshed area are considered agricultural, of which 2,768 acres are livestock lands, 4,252 acres are identified as crop fertilizer lands, and 3,390 acres are identified as both fertilizer croplands and livestock lands.

2.7.1 FF Loading

Nitrogen in agricultural fertilizer is applied at varying rates, depending on the crop and individual farm practices. The NSILT estimated total nitrogen load to groundwater from FF is 107,583 lb-N/year, or 52 % of the total nitrogen load to groundwater in the BMAP area**.** FF includes commercial inorganic fertilizer applied to row crops, field crops, nurseries, pasture, and hay fields.

2.7.2 LW Loading

Agricultural practices specific to livestock management were obtained through meetings with University of Florida Institute of Food and Agricultural Sciences (UF-IFAS) extension staff, FDACS field representatives, agricultural producers, and stakeholders. The NSILT estimated total nitrogen load to groundwater from LW is 17,264 lb-N/year, or 8 % of the total nitrogen load to groundwater in the BMAP area.

2.7.3 Prioritized Management Strategies and Milestones

Subsection 403.067, F.S., requires agricultural nonpoint sources in a BMAP area either implement the applicable FDACS-adopted BMPs, which provides a presumption of compliance with water quality standards, or conduct water quality monitoring prescribed by DEP or SJRWMD that demonstrates compliance with water quality standards. Further, based on the Florida Springs and Aquifer Protection Act, Subsection 373.811(5), F.S., prohibits any new agricultural operations within the priority focus areas that do not implement applicable FDACS BMPs, measures necessary to achieve pollution reduction levels established by DEP, or groundwater monitoring plans approved by a WMD or DEP. Failure to implement BMPs or conduct monitoring that demonstrates compliance with pollutant reductions may result in enforcement action by DEP (s. 403.067(7)(b), F.S.).

FDACS will work with applicable producers within the BMAP area to implement BMPs. As of December 31, 2017, Notices of Intent (NOIs) covered 3,514 acres in the DeLeon Spring BMAP area (3,514 of 10,410 agricultural acres). No producers are conducting water quality monitoring in lieu of implementing BMPs at this time. **Appendix B** lists project information. **Appendix F** provides detailed information on BMPs and agricultural practices in the BMAP area.

With crop-specific BMP enrollment or monitoring for FF areas, an estimated 16,137 lb-N/yr reduction to groundwater can be achieved, based on an average reduction of 15 % in the nitrogen

load to groundwater. While DEP has listed larger percentage reductions in nitrogen from agricultural BMPs in estimating benefits to surface waters, the best data available indicate a 15 % reduction in the load to groundwater, where owner-implemented BMPs are in place. This number could increase as more data are collected on the impact of BMPs to groundwater.

For livestock operations, owner-implemented BMPs are expected to achieve a reduction of 1,726 lb-N/yr, using an estimated 10 % reduction in the load to groundwater from owner-implemented BMPs at livestock operations.

Summarizing the reductions discussed above, the total reduction from BMP implementation of all agricultural sources is 17,864 lb-N/yr.

2.7.4 Additional Agricultural Reduction Options

Further reductions may be achieved through implementing additional agricultural projects or practices, including land acquisition and conservation easements. SRWMD is implementing projects to encourage low input agriculture and water quality improvement technologies. Examples of these projects include providing incentives for producers to transition to less intensive cropping systems, changing land use to fallow or native landscape, or changing the type of cropping system. Other reductions associated with the implementation and modification of BMPs may be realized through ongoing studies and data collection. Basin-specific studies are underway to evaluate and demonstrate the effectiveness of BMPs on a site-specific basis.

Table 11 identifies possible projects and practices and the estimated acreages. FDACS used FSAID IV to identify crop types and acreages where projects and practices could potentially be implemented.

Table 11. Estimated acreages for additional agricultural projects or practices

Action	Acreage
Precision Fertilization	3,559
Precision Irrigation	409
Soil Moisture Probes	1,732
Cover Crops	842

The projects and practices listed in **Table 11** are a component of the reductions to groundwater that could be achieved through changes in practices (**Table 12**). For example, a 75 % reduction of fertilizer loss to groundwater on 25 % of the fertilized lands would result in an estimated reduction of 20,172 lb-N/yr. Note that these estimates are averaged over the entire basin, and the recharge characteristics of a specific site and the fertilization practices for specific crops may change the estimated reduction for specific acres with a conservation easement or change in fertilization.

Table 12. Potential for additional load reductions to groundwater

% of Fertilized Acres with a Change in Practice	Amount of Fertilized Acres with a Change in Practice	100 % Reduction in Load to Ground-water (lb-N/yr reduced)	75 % Reduction in Load to Ground-water (lb-N/yr reduced)	50 % Reduction in Load to Ground-water (lb-N/yr reduced)	25 % Reduction in Load to Ground-water (lb-N/yr reduced)	10 % Reduction in Load to Ground-water (lb-N/yr reduced)
100	7,642	107,583	80,687	53,792	26,896	10,758
75	5,732	80,687	60,515	40,344	20,172	8,069
50	3,821	53,792	40,344	26,896	13,448	5,379
25	1,911	26,896	20,172	13,448	6,724	2,690
10	764	10,758	8,069	5,379	2,690	1,076

Beyond enrolling producers in the FDACS BMP Program and verifying implementation, FDACS will work with DEP to improve the data used to estimate agricultural land uses in the springshed. FDACS will also work with producers to identify a suite of agricultural projects and research agricultural technologies that could be implemented on properties where they are deemed technically feasible and if funding is made available. The acreages and loading provided by FDACS are preliminary estimates of the maximum acreages and need to be evaluated and refined over time. As presented here, these projects are based on planning-level information. Actual implementation would require funding as well as more detailed designs based on specific information, such as actual applicable acreages and willing landowners.

2.8 WWTF Management Strategies

In the DeLeon Spring BMAP area, treated effluent containing nitrogen is discharged to drain fields and RIBs. The nitrogen load from WWTFs is 778 lb-N/year. The discharge location (such as proximity to the spring, highly permeable soils, etc.) and level of wastewater treatment are important factors to consider when calculating loadings to groundwater. Additionally, addressing the nitrogen loading from OSTDS could increase the volume of effluent treated and disposed of by WWTFs.

2.8.1 Summary of Facilities

There are several WWTFs located in the DeLeon Spring BMAP area, with all domestic facilities permitted to discharge less than 100,000 gallons of treated effluent per day (or 0.1 million gallons per day [mgd]). **Figure 4** shows the locations of domestic WWTFs in the DeLeon Spring Basin.

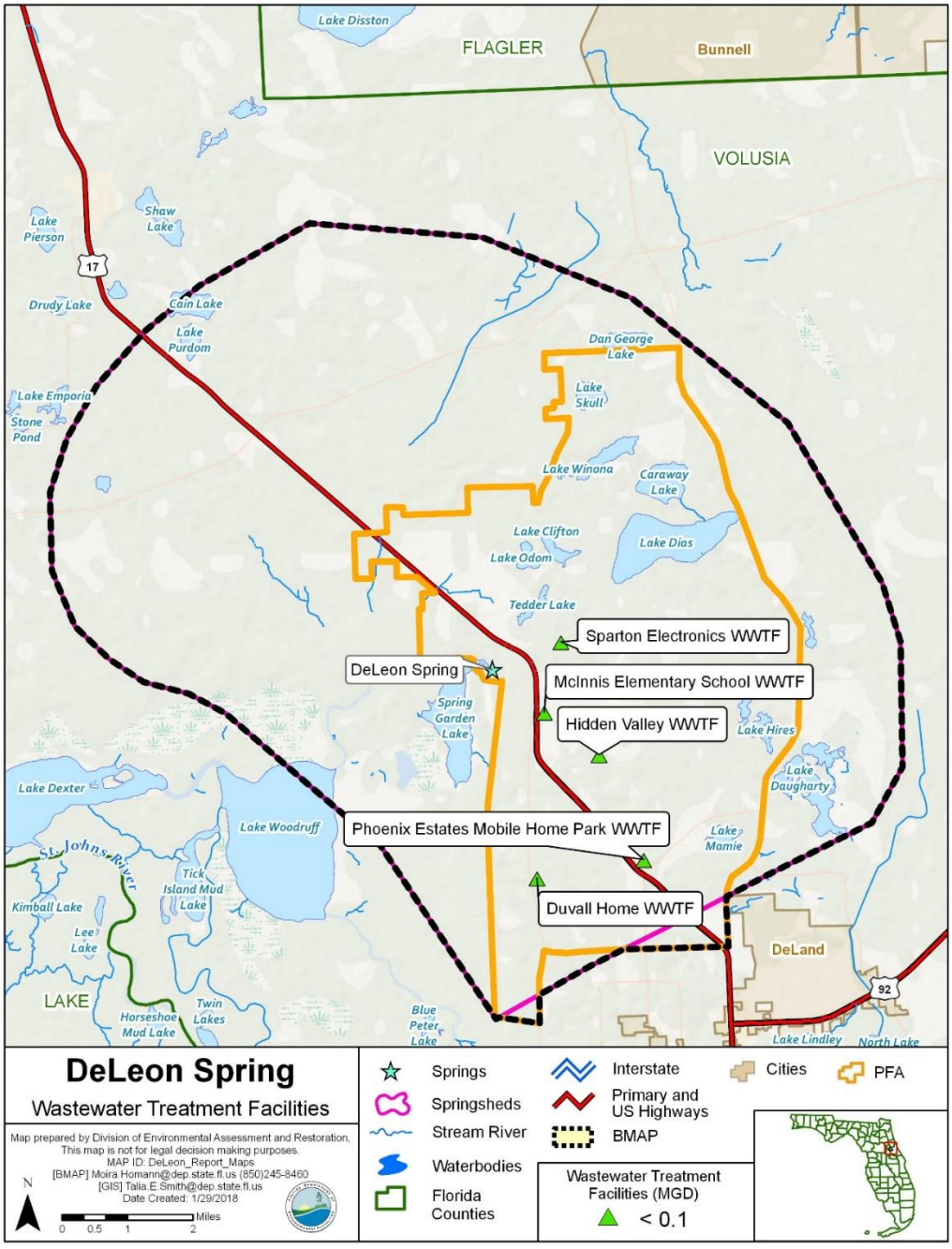

Figure 4. Locations of domestic WWTFs in the DeLeon Spring BMAP Area

2.8.2 Wastewater Management Standards and Reuse Management

The Florida Springs and Aquifer Protection Act prohibits new domestic wastewater disposal facilities in the PFA, including RIBs, with permitted capacities of 100,000 gpd or more, except for facilities that provide AWT that reduces total nitrogen in the effluent to 3 mg/L or lower, on an annual permitted basis.

DEP requires the nitrogen effluent limits listed below in any new or existing wastewater permit issued to a facility that discharges within the BMAP, unless the utility/entity can demonstrate reasonable assurance that the reuse or land application of effluent would not cause or contribute to an exceedance of the nitrate concentrations established by the TMDL. To demonstrate reasonable assurance, the utility/entity shall provide relevant water quality data, physical circumstances, or other site-specific credible information needed to show their facility would not cause a nitrate concentration that would be greater than 0.35 mg/L at the spring vent. This demonstration may include factors such as dilution, site-specific geological conditions, research/studies, including dye tracer tests, and groundwater transport modeling. Should DEP concur with the reasonable assurance demonstration request, the TN effluent requirements established here may be modified for the applicant or waived.

The nitrogen effluent limits set forth in **Table 13** will be applied as an annual average to all new and existing WWTFs with a DEP-permitted discharge or disposal area within the BMAP. New effluent standards will take effect at the time of permit renewal or no later than five years after BMAP adoption, whichever is sooner.

Table 13. Wastewater effluent standards for the BMAP area

95% of the Permitted Capacity (gpd)	TN Concentration Limits for RIBs and Absorption Fields (mg/L)	TN Concentration Limits for All Other Land Disposal Methods, Including Reuse (mg/L)
Greater than 100,000	3	3
20,000 to 100,000	3	6
Less than 20,000	6	6

Additionally, new or existing wastewater permits in the BMAP area must require at least quarterly sampling of the effluent discharge for TN and report these sampling results in the discharge monitoring reports (DMRs) submitted to DEP.

DEP encourages the reuse of treated wastewater for irrigation as a water conservation measure. The expansion of reuse water for irrigation can reduce reliance on the Floridan aquifer for water supply. The nitrogen load to groundwater from reuse water is expected to be reduced through these WWTF policies, as improvements in reuse water quality will both reduce loads from this source and limit future increases in loading from reuse because of higher treatment levels.

2.8.3 Prioritized Management Strategies and Milestones

Based on the current volumes of discharge and effluent concentrations, the estimated reductions to be achieved through the implementation of these revised wastewater standards are 534 lb-N/yr. There are not currently any projects that have been completed, are underway, or are planned to reduce nitrogen loading from WWTFs.

2.9 Atmospheric Deposition Management Strategies

2.9.1 Summary of Loading

Atmospheric deposition is largely a diffuse, albeit continual, source of nitrogen. Nitrogen species and other chemical constituents are measured in wet and dry deposition at discrete locations around the U.S. In 2014, Schwede and Lear developed a hybrid model for estimating the total atmospheric deposition of nitrogen and sulfur for the entire U.S., referred to as the total atmospheric deposition model or "TDEP." Deposition data from several monitoring networks—including the Clean Air Status and Trends Network (CASTNET), the National Atmospheric Deposition Program (NADP) Ammonia Monitoring Network, the Southeastern Aerosol Research and Characterization Network, and modeled data from the Community Multiscale Air Quality (CMAQ) Modeling System—are combined in a multistep process with National Trends Network (NTN) wet deposition values to model total deposition. The TDEP model run used for the NSILT included data from 2011 to 2013.

2.9.2 Description of Approach

Atmospheric sources of nitrogen are local, national, and international. Atmospheric sources are generally of low nitrogen concentration compared with other sources and are further diminished through additional biological and chemical processes before they reach groundwater. Atmospheric deposition sources and trends will be re-evaluated periodically.

2.10 Future Growth Management Strategies

New development primarily falls into to two general source categories: new urban development and new agriculture. Nutrient impacts from new development are addressed through a variety of mechanisms outlined in this BMAP as well as other provisions of Florida law. For instance, wastewater from all new and existing urban development is treated through either domestic WWTFs or OSTDS. New WWTFs must meet the stringent nitrogen limitations set forth in this BMAP. Existing WWTFs also must be upgraded to meet these same BMAP requirements. Florida law requires new development to connect to WWTFs where sewer lines are available. Where sewer is not available within the PFA, this BMAP still prohibits the installation of new OSTDS on lots of less than one-acre unless the system includes enhanced treatment of nitrogen, as described in **Appendix D**. Likewise, all new agricultural operations must implement FDACS-adopted BMPs and potentially other additional measures (**Section 2.7**), or must conduct water quality monitoring that demonstrates compliance with water quality standards.

Other laws such as local land development regulations, comprehensive plans, ordinances, incentives, environmental resource permit requirements, and consumptive use permit requirements, all provide additional mechanisms for protecting water resources and reducing the impact of new development and other land use changes as they occur (see **Appendix G**). Through this array of laws and the requirements in this BMAP, new development must undertake nitrogen-reduction measures before the development is complete.

2.11 Protection of Surface Water and Groundwater Resources through Land Conservation

Maintaining land at lower intensity uses through land purchases or easements for conservation and recreational use is one strategy that can help reduce water quality impacts in the DeLeon Spring Basin. **Table 14** identifies known land conservation purchases in the BMAP area.

Table 14. Stakeholder conservation land purchases

Lead Entity	Name of Conservation Purchase	Description	Status	Cost	Acreage	Year
State of Florida	DeLeon Springs State Park	DeLeon Springs State Park contains a second magnitude OFS and Spring Garden Run and is adjacent to the Lake Woodruff National Wildlife Refuge.	Completed	$1,500,000	625	1982
U.S. Fish and Wildlife Service	Lake Woodruff National Wildlife Refuge	The refuge is located in the western part of Volusia County, Florida, near the community of DeLeon Springs, with the St. Johns River forming its western boundary. The refuge was established in 1964 as a migratory bird refuge to offset losses of wetland habitat in central Florida.	Completed	Unknown	22,000 (a portion is located within the DeLeon Spring Springshed)	1964
FDACS	Lake George State Forest	Lake George State Forest is located in northwestern Volusia County near the towns of Barberville and Astor. Lake George State Forest is made up of four tracts of land and primarily comprised of slash pine, longleaf pine, bottomland hardwoods, and interspersed cypress and bay depressions.	Completed	$860,000	21,175 (a portion is located within the DeLeon Spring Springshed)	1998
SJRWMD	Heart Island Conservation Area	The district acquired this 14,246-acre property in 1994 with Preservation 2000 funds to protect water resources. At the time of purchase, the property had undergone extensive clear-cutting for the timber resources. The district has focused on planting longleaf pine to restore the area's native plant community.	Completed	$7,026,500	14,246	1994
Volusia County	Chuck Lennon Park	Chuck Lennon Park is adjacent to DeLeon Springs State Park in DeLeon Springs and is a multi-purpose facility.	Completed	$685,000	136	1990

Lead Entity	Name of Conservation Purchase	Description	Status	Cost	Acreage	Year
Volusia County	Barberville Mitigation Bank	The Barberville Mitigation Bank covers a total of 358 acres, and is located northwest of the intersection of State Road 40 and US Highway 17, adjacent to the Lake Woodruff National Wildlife Refuge and the Barberville Conservation Area, in Volusia County.	Completed	$824,000	1,450	1992

2.12 Commitment to Implementation

Successful BMAP implementation requires commitment, dedicated state funding, and follow-up. Stakeholders have expressed their intention to carry out the plan, monitor its effects, and continue to coordinate within and across jurisdictions to achieve nutrient reduction goals. As the TMDLs must be achieved within 20 years, DEP, WMDs, FDOH, and FDACS will implement management strategies using the annual Legacy Florida appropriation from the legislature of at least $50 million to reduce nitrogen in impaired OFS. DEP, working with the coordinating agencies, will continue to invest existing funds and explore other opportunities and potential funding sources for springs restoration efforts.

Section 3: Monitoring and Reporting

3.1 Methods for Evaluating Progress

DEP will work with stakeholders to track project implementation and organize the monitoring data collected each year. The project and monitoring information will be presented in an annual update. Stakeholders have agreed to meet annually after the adoption of the BMAP to follow up on plan implementation, share new information, and continue to coordinate on TMDL restoration related issues. The following activities may occur at annual meetings:

Implementation data and reporting:

- Collect project implementation information from stakeholders, including FDACS agricultural BMP enrollment and FDOH-issued permits, and compare with the BMAP schedule.
- Discuss the data collection process, including any concerns and possible improvements to the process.
- Review the monitoring plan implementation, as detailed in **Section 3.3**.

Sharing new information:

- Report on results from water quality monitoring and trend information.
- Provide updates on new management strategies in the basin that will help reduce nutrient loading.
- Identify and review new scientific developments on addressing nutrient loads and incorporate any new information into annual progress reports.

Coordinating on TMDL restoration-related issues:

- Provide updates from DEP on the basin assessment cycle and activities related to any impairments, TMDL, and BMAP.
- Obtain reports from other basins where tools or other information may be applicable to the TMDL.

3.2 Adaptive Management Measures

Adaptive management involves making adjustments in the BMAP when circumstances change or monitoring indicates the need for additional or more effective restoration strategies. Adaptive management measures may include the following:

- Implementing procedures to determine whether additional cooperative strategies are needed.

- Using criteria/processes for determining whether and when plan components need revision because of changes in costs, project effectiveness, social effects, watershed conditions, or other factors.

- Revising descriptions of stakeholders' roles during BMAP implementation and after BMAP completion.

- Updating information on corrective actions (and any supporting documentation) being implemented as data are gathered to refine project implementation schedules and performance expectations.

Key components of adaptive management to share information and expertise are tracking plan implementation, monitoring water quality and pollutant loads, and holding periodic meetings.

3.3 Water Quality Monitoring

3.3.1 Objectives

Focused objectives are critical for a monitoring strategy to provide the information needed to evaluate implementation success. Since the BMAP implementation involves an iterative process, the monitoring efforts are related to primary and secondary objectives. The primary objectives focus on achieving water quality targets, while the secondary objectives focus on water quality parameters that can be used to provide information for future refinements of the BMAP. The monitoring strategy may be updated as necessary.

Primary objectives:

- Measure the water quality and biological response in the impaired springs and groundwater at the beginning of the BMAP period and during implementation.

- Document nutrient trends in the DeLeon Spring Basin.

- Focus BMP efforts by using water quality results combined with appropriate project information and land use data in conjunction with statistical and spatial analysis tools.

Secondary objectives:

- Identify areas where groundwater data and modeling might help in understanding the hydrodynamics of the system.

- Confirm and refine nutrient removal efficiencies of agricultural and/or urban BMPs.

- Identify and implement more effective nutrient reduction strategies.

- Use nitrogen isotope and tracer sampling for evaluating nitrogen contributions from organic and inorganic sources.

3.3.2 Parameters, Frequency, and Network

To achieve the objectives listed above, the monitoring strategy will focus on two types of indicators to track improvements in water quality: core and supplemental (**Tables 15** and **16**, respectively). The core indicators are directly related to the parameters causing impairment in the associated springs. Supplemental indicators will be monitored primarily to support the interpretation of core water quality parameters. The monitoring network is established for a variety of purposes.

For this BMAP, nitrate is considered to be the key core parameter measured, to track progress in decreasing nitrogen concentrations in groundwater and the water surfacing at the spring vent. The other parameters are considered supplementary parameters for the BMAP, as they build information about groundwater and the spring but are not direct measurements of impairment.

At a minimum, the core parameters will be tracked to determine the progress that has been made towards meeting the TMDL and/or achieving the NNC. Resource responses to BMAP implementation may also be tracked. A significant amount of time may be needed for changes in water chemistry to be observed.

Table 15. Core water quality indicators and field parameters

Core Parameters
TN
Total Kjeldahl Nitrogen
Nitrate as Nitrogen
Orthophosphate as Phosphorus
Total Phosphorus (TP)

Table 16. Supplemental water quality indicators and field parameters

Supplemental Parameters
Specific Conductance
Dissolved Oxygen (DO)
pH
Temperature
Total Suspended Solids (TSS)
Total Dissolved Solids (TDS)
Turbidity
Chloride
Color

3.3.3 Biological Monitoring

Biological resource responses represent improvements in the overall ecological health of the DeLeon Spring Basin (see **Table 17**). Several types of biological monitoring will be carried out to assess the health of the DeLeon Spring.

Table 17. Biological response measures for spring runs

Biological Response Measures
Chlorophyll *a*
Stream Condition Index (SCI) score
Linear Vegetation Survey (LVS) score
Rapid Periphyton Survey (RPS) score
Key fish populations

RPS are conducted to assess the abundance and variety of algae. An LVS are conducted to assess the types and density of vegetation present and to identify the native versus non-native species. An SCI will be conducted to measure the number of different organisms present in the river and/or springs. In addition, habitat assessments (HAs) are conducted to assess the conditions and habitat present to support the SCI evaluation. Water quality samples will also be collected with the biological monitoring.

3.3.4 Data Management and Assessment

As of June 30, 2017, water quality data in Florida are entered by the entity collecting the data into the Florida Watershed Information Network (WIN) Database, which has replaced the Florida Storage and Retrieval System (STORET). DEP pulls water quality data directly from WIN and U.S. Geological Survey (USGS) databases for impaired waters evaluations and TMDL development. Data providers are required to upload their data regularly, so the information can be used as part of the water quality assessment process and for annual reporting. Data providers should upload their data to WIN, upon completion of the appropriate quality assurance/quality control (QA/QC) checks. All data collected in the last quarter of the calendar year should be uploaded no later than April 1 of the following year.

Biological data collected by DEP are stored in the DEP Statewide Biological (SBIO) database. Biological data should be collected and regularly provided to DEP following the applicable standard operating procedures. All biological data collected in the last quarter of the calendar year should be uploaded or provided no later than April 1 of the following year.

The water quality will be analyzed during BMAP implementation to determine trends in water quality and the health of the biological community. A wide variety of statistical methods are available for the water quality trend analyses. The selection of an appropriate data analysis method depends on the frequency, spatial distribution, and period of record available from existing data. Specific statistical analyses were not identified during BMAP development.

3.3.5 QA/QC

Stakeholders participating in the monitoring plan must collect water quality data in a manner consistent with Chapter 62-160, F.A.C., and the DEP standard operating procedures (SOPs) for QA/QC required by rule. The most current version of these procedures is available on the DEP website. For BMAP-related data analyses, entities should use National Environmental Laboratory Accreditation Conference (NELAC) National Environmental Laboratory Accreditation Program (NELAP)–certified laboratories or other labs that meet the certification and other requirements outlined in the SOPs.

Appendices

Appendix A. Important Links

The links below were correct at the time of document preparation. Over time, the locations may change and the links may no longer be accurate. None of these linked materials are adopted into this BMAP.

- DEP Website: http://www.floridadep.gov
- DEP Map Direct Webpage: https://ca.dep.state.fl.us/mapdirect/
- Searchable online version of PFA maps: https://www.floridadep.gov/pfamap
- Florida Statutes: http://www.leg.state.fl.us/statutes:
    - Florida Watershed Recovery Act (Section 403.067, F.S.)
    - Florida Springs and Aquifer Protection Act (Part VIII of Chapter 373, F.S.)
- DEP Model Ordinances: http://fyn.ifas.ufl.edu/fert_ordinances.html
- DEP Standard Operating Procedures for Water Quality Samples: https://floridadep.gov/dear/quality-assurance/content/dep-sops
- NELAC NELAP: https://fldeploc.dep.state.fl.us/aams/index.asp
- FDACS BMPs: https://www.freshfromflorida.com/Business-Services/Best-Management-Practices-BMPs/Agricultural-Best-Management-Practices
- FDACS BMP and Field Staff Contacts: http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy
- Florida Administrative Code (Florida Rules): https://www.flrules.org/
- SJRWMD 2002 Middle St. Johns River Surface Water Improvement Plan (SWIM) Plan: https://www.sjrwmd.com/static/plans/2002_MSJRB_SWIM_Plan.pdf
- SJRWMD 2018 Consolidated Annual Report: https://www.sjrwmd.com/static/plans/2018-SJRWMD-Consolidated-Annual-Report.pdf
- SJRWMD Springs: https://www.sjrwmd.com/waterways/springs/

UF–IFAS Research: http://research.ifas.ufl.edu/

Appendix B. Projects to Reduce Nitrogen Sources

Prioritization of Management Strategies

The management strategies in **Table B-1** are ranked with a priority of high, medium, or low. In 2016, the Florida Legislature amended the Watershed Restoration Act (Section 403.067, F.S.), creating additional requirements for all new or revised BMAPs. BMAPs must now include planning-level details for each listed project, along with their priority ranking.

Project status was selected as the most appropriate indicator of a project's priority ranking based primarily on need for funding. Projects with a "completed" status were assigned a low priority. Projects classified as "underway" were assigned a medium priority because some resources have been allocated to these projects, but additional assistance may be needed for the project to be completed. High priority was assigned to projects listed with the project status "planned" as well as certain "completed" projects that are ongoing each year (any project with one of these project types: "street sweeping," "catch basin inserts/inlet filter cleanout," "public education efforts," "fertilizer cessation," "fertilizer reduction," or "aquatic vegetation harvesting"), and select projects that are elevated because substantial, subsequent project(s) are reliant on their completion.

Description of the Management Strategies

Responsible entities submitted these management strategies to the department with the understanding that the strategies would be included in the BMAP, thus requiring each entity to implement the proposed strategies in a timely way and achieve the assigned load reduction estimates. However, this list of strategies is meant to be flexible enough to allow for changes that may occur over time. Any change in listed management strategies, or the deadline to complete these actions, must first be approved by the department. Substituted strategies must result in equivalent or greater nutrient reductions than expected from the original strategies.

While the 20-year planning period for this BMAP is 2018 to 2038, projects completed since January 1, 2009, count toward the overall nitrogen reduction goals.

Estimated nitrogen reductions are subject to refinement based on DEP verification and/or on adjustment to calculations based on loading to groundwater rather than surface water. Agriculture load reductions (FDACS-01 and FDACS-02) assume 100 % enrollment and verification. Projects with a designation of TBD (to be determined) denotes information is not currently available, but will be provided by the stakeholder when it is available. Projects with a designation of N/A (not applicable) indicates the information for that category is not relevant to that project. Projects with a designation of "Not Provided" denotes that information was requested by DEP but was not provided by the lead entity.

Table B-1. Stakeholder projects to reduce nitrogen sources

*Denotes project that is applicable in another Springs Coast BMAP. The dollar amount is the total project amount (not split among the BMAPs).

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lbs/yr)	Cost Estimate	Funding Source	Funding Amount
Volusia County	VC-01	Public Education	Public education about fertilizer, wastewater, lawn clippings, pet waste, water conservation	Public Education Efforts	Completed	2009	N/A	UTF	1,166	Not Provided	Volusia County general fund	N/A
Volusia County	VC-02	Fertilizer ordinance	Fertilizer restrictions including summer ban on N and P	Regulations, Ordinances, and Guidelines	Completed	2015	N/A	UTF	194	Not Provided	Volusia County general fund	N/A
FDACS	FDACS-01	Agricultural Farm Fertilizer BMP Implementation	Enrollment and verification of BMPs by agricultural producers.	Agricultural Farm Fertilizer BMP Implementation	Underway	N/A	2023	FF	16,137	N/A	N/A	N/A
FDACS	FDACS-02	Agricultural Livestock Waste BMP Implementation	Enrollment and verification of BMPs by agricultural producers.	Agricultural Livestock Waste BMP Implementation	Underway	N/A	2023	LW	1,726	N/A	N/A	N/A
Golf Courses	GC-02	Golf Course Reduction Credits	6 % BMP credit on sports field load to groundwater, assuming 100 % BMP implementation.	Golf Course Reduction Credits	Planned	N/A	N/A	STF	13	N/A	N/A	N/A
Wastewater Utilities	WU-01	WWTF Policy Reductions	Achieved by WWTF policy if implemented BMAP-wide, achieving 3 or 6 mg/L.	WWTF Policy Reductions	Planned	N/A	TBD	WWTF	534	N/A	N/A	N/A
Various	OSTDS-01	Enhancement of Existing OSTDS - Voluntary	Repair, upgrade, replacement, drainfield modification, addition of effective nitrogen reducing features, initial connection to a central sewerage system, or other action to reduce nutrient loading, voluntarily taken by the owner of an OSTDS within the BMAP.	OSTDS Enhancement	Underway	2018	N/A	OSTDS	TBD	TBD	DEP	TBD
Various	OSTDS-02	Enhancement of Existing OSTDS - Required	Repair, upgrade, replacement, drainfield modification, addition of effective nitrogen reducing features, initial connection to a central sewerage system, or other action taken to comply with the OSTDS Remediation Plan for the group of systems identified for remediation (see Appendix D).	OSTDS Enhancement	Planned	TBD	TBD	OSTDS	TBD	TBD	DEP	TBD

Appendix C. DeLeon Spring PFA Report

During the development of the 2018 DeLeon Spring BMAP, the PFA was defined as the area of the basin where the Floridan aquifer is generally most vulnerable to pollutant inputs and where there is a known connectivity between groundwater pathways and an OFS. As required by the Florida Springs and Aquifer Protection Act, DEP defined a PFA which is incorporated by reference into this BMAP. Information on this and other springshed PFAs are available at the following link: http://publicfiles.dep.state.fl.us/dear/PFAs.

Appendix D. OSTDS Remediation Plan

The Florida Aquifer and Springs Protection Act specifies that if, during the development of a BMAP for an OFS, DEP identifies OSTDS as contributors of at least 20 % of nonpoint source nitrogen pollution in a PFA or if DEP determines remediation is necessary to achieve the TMDL, the BMAP shall include an OSTDS remediation plan. Based on the DeLeon Spring NSILT estimates and GIS coverages, OSTDS contribute approximately 14 % pollutant loading in the BMAP and 22 % in the PFA. Irrespective of the percent contribution from OSTDS, DEP has determined that an OSTDS remediation plan is necessary to achieve the TMDLs and to limit the increase in nitrogen loads from future growth.

D.1 Plan Elements

D.1.1 Installation of New OSTDS

Per statute, new OSTDS on lots of less than one acre are prohibited within PFA, if the addition of the specific systems conflicts with an OSTDS remediation plan incorporated into an OFS BMAP (see Section 373.811(2), F.S.). This OSTDS remediation plan prohibits new conventional systems on lots of less than one acre within the PFA, unless the OSTDS includes enhanced treatment of nitrogen or unless the OSTDS permit applicant demonstrates that sewer connections will be available within 5 years. Local governments and utilities are expected to develop master wastewater treatment feasibility analyses to identify specific areas to be sewered within 20 years of BMAP adoption. To aid in implementation, the DEP Map Direct webpage includes a detailed downloadable springs PFA boundary shapefile. DEP also maintains on its website an interactive map of the PFA and BMAP boundaries; the map can be easily searched for specific street address locations. FDOH permits the installation of new OSTDS pursuant to Chapter 64E-6, F.A.C., which includes not only systems installed on a property where one has not previously been installed, but also systems installed to replace illegal systems, systems installed in addition to existing systems, and other new systems. FDOH permitting requirements with respect to the definition of "new" or "less than one acre" will be followed for this remediation plan. To meet the enhanced treatment of nitrogen requirement the system must include at least one of the following nitrogen reducing enhancements:

- Features allowed pursuant to FDOH rule, such as in-ground nitrogen-reducing biofilters (media layer systems).

- Features consistent with and identified in the FDOH Florida Onsite System Nitrogen Removal Strategy Studies report, such as in-tank nitrogen-reducing biofilters.

- Other FDOH-approved treatment systems capable of meeting or exceeding the NSF International (formerly National Sanitation Foundation [NSF]) Standard 245 nitrogen removal rate before disposing the wastewater in the drain field, such as aerobic treatment units (ATU) and performance-based treatment systems (PBTS). For FDOH-approved treatment systems that meet NSF 245, but do not meet or exceed the minimum treatment

level expected from the in-ground nitrogen-reducing biofilters, the drain fields, at minimum, shall be installed with a 24-inch separation between the bottom of the drain field and the seasonal high-water table.

D.1.2 Modification or Repair of Existing OSTDS

Per statute, the OSTDS remediation plan must provide loading reductions consistent with achieving the TMDL within 20 years of plan adoption (see Section 373.807(1)(b)8., F.S.). This plan therefore establishes the following remediation policy for existing systems, based on (a) the potential for reducing nitrogen loads by converting existing OSTDS to enhanced nitrogen removing systems or by connecting homes to central sewer, (b) the total amount of nitrogen load that must be reduced to achieve the TMDL, and (c) the relative contribution of nitrogen load from existing OSTDS.

- Where does the remediation policy for existing systems apply? It applies to all existing OSTDS within the PFA on lots of less than one acre.

- When is the remediation policy for existing systems effective? It begins following completion of the master wastewater treatment feasibility analyses, FDOH rulemaking, and funding program to help offset the costs to homeowners, but no later than five years after BMAP adoption.

- What will be required by the remediation policy for existing systems when it becomes effective? Upon the need for repair or replacement, an existing OSTDS must include at least one of the following nitrogen reducing enhancements, unless the OSTDS permit applicant demonstrates that sewer connections will be available within 5 years.

    - Enhanced treatment of nitrogen means inclusion of features allowed pursuant to FDOH rules, such as in-ground nitrogen-reducing biofilters (media layer systems); features consistent with and identified in the FDOH Florida Onsite System Nitrogen Removal Strategy Studies report, such as in-tank nitrogen-reducing biofilters; or other FDOH-approved treatment systems capable of meeting or exceeding the NSF Standard 245 nitrogen removal rate before disposing the wastewater in the drain field, such as ATUs and PBTSs. For FDOH-approved treatment systems that meet NSF 245, but do not meet or exceed the minimum treatment level expected from the in-ground nitrogen-reducing biofilters, the drain fields, at minimum, shall be installed with a 24-inch separation between the bottom of the drain field and the seasonal high-water table.

    - FDOH permitting requirements with respect to defining "modification," "repair," and lot size (i.e., acreage) will be followed for this remediation plan.

- In addition, a utility is required to provide written notice to OSTDS owners of the availability of sewer lines for connection, no later than 1 year prior to the date the utility's sewerage system will become available, which triggers an obligation for OSTDS owners to comply with the requirements of Section 381.00655, F.S.

D.1.3 Achieving Necessary Load Reductions

All conventional OSTDS in areas subject to the remediation policy for existing systems are required to adopt enhanced treatment of nitrogen or connect to central sewer no later than 20 years after BMAP adoption.

D.1.4 Other Plan Elements

Statutes also require that OSTDS remediation plans contain the following elements.

- An evaluation of credible scientific information on the effect of nutrients, particularly forms of nitrogen, on springs and spring systems. (See **Section D.2**.)

- Options for repair, upgrade, replacement, drain field modification, the addition of effective nitrogen-reducing features, connection to a central sewer system, or other action. (See **Section D.3**.)

- A public education plan to provide area residents with reliable, understandable information about OSTDS and springs. (See **Section D.4**.)

- Cost-effective and financially feasible projects necessary to reduce the nutrient impacts from OSTDS. (See **Section 2** and **Appendix B**.)

- A priority ranking for each project for funding contingent on appropriations in the General Appropriations Act. (See **Section 2** and **Appendix B**.)

The Florida Springs and Aquifer Protection Act defines an OSTDS as a system that contains a standard subsurface, filled, or mound drain field system; an aerobic treatment unit; a graywater system tank; a laundry wastewater system tank; a septic tank; a grease interceptor; a pump tank; a solids or effluent pump; a waterless, incinerating, or organic waste–composting toilet; or a sanitary pit privy that is installed or proposed to be installed beyond the building sewer on land of the owner or on other land on which the owner has the legal right to install such a system. The term includes any item placed within, or intended to be used as a part of or in conjunction with, the system. The term does not include package sewage treatment facilities and other treatment works regulated under Chapter 403, F.S.

D.2 Collection and Evaluation of Credible Scientific Information

As discussed in **Section 2,** DEP developed the DeLeon Spring NSILT, a planning tool that provides estimates of nitrogen loading to groundwater based on best available scientific data for

a particular geographic area. The results were peer-reviewed by SJRWMD, FDOH, and FDACS. Additional technical support information concerning the NSILT can be found in **Appendix E**.

Monitoring and research:

- Improve understanding of the ecological responses to nutrient enrichment and reductions (DEP/SJRWMD/universities).
- Maintain and expand water quality monitoring programs (SJRWMD/DEP).
- Report annual status and trends (SJRWMD).
- Evaluate new and emerging technologies (SJRWMD).
- Research and develop advanced septic systems (FDOH/DEP/UF–IFAS).
- Monthly water sampling at the spring (Volusia County/SJRWMD)

Completed project:

- Florida Onsite Sewage Nitrogen Reduction Strategies Study (FDOH).

Ongoing projects:

- Quarterly springs water quality monitoring (SJRWMD).
- Stream water quality monitoring (SJRWMD).
- UFA nutrient modeling (SJRWMD).
- Springs Initiative modeling (SJRWMD).

Proposed projects:

- Groundwater quality monitoring for BMAP assessment (DEP/SJRWMD).

DEP developed calculation methods to estimate nitrogen reductions associated with septic system enhancement and replacement projects, WWTF projects, golf course BMPs, other sports turfgrass BMPs, and urban turfgrass BMPs.

D.3 Remediation Options

The NSILT estimates that OSTDS contribute approximately 14 % of the pollutant loading to groundwater in the BMAP and 22 % in the PFA. **Table D-1** lists the number of existing OSTDS in lots less than once acre in the PFA and the estimated nitrogen reductions associated with enhancement or connection to sewer. **Figure D-1** shows the areas where OSTDS are located.

Table D-1. Estimated reduction credits for OSTDS enhancement or sewer *

*****Estimated reductions are for either enhancement or sewer per parcel classification. Reductions cannot be combined for the same parcel classification, but can be combined between the different classifications. For example, the sewer credit associated with parcels less than one acre in size can be combined with the sewer credit associated with parcels one acre or greater in size.

Recharge Area	OSTDS Parcels Less Than One Acre in PFA	Credit for Enhancement (lb-N/yr)	Credit for Sewer (lb-N/yr)
High	2,028	10,531	15,392
Medium	436	1,258	1,838
Low	13	8	11
Total	**2,477**	**11,797**	**17,241**

As required by statute, this OSTDS remediation plan identifies remediation options for existing OSTDS, including repair, upgrade, replacement, drain field modification, the addition of effective nitrogen-reducing features, connection to a central sewer system, or other action. More simply, remediation options can be classified as enhancement or replacement. Enhancement options consist of systems identified in either existing FDOH rules or existing and ongoing FDOH studies, or systems not otherwise prohibited by FDOH. Examples of enhancements include in-ground nitrogen-reducing biofilters (media layer systems); in-tank nitrogen-reducing biofilters; and ATU or PBTS capable of meeting or exceeding the NSF Standard 245 nitrogen removal rate before disposing wastewater in the drain field.

Nitrogen impacts from new development could also be reduced through prohibiting new conventional OSTDS on all lot sizes, throughout the BMAP area, or both.

DEP, FDOH, and local governments will develop programs to help fund the additional costs required to upgrade existing OSTDS to include nutrient reducing features. The funding program will be designed to prioritize OSTDS where it is most economical and efficient to add nutrient reducing features (i.e., systems needing a permit for a repair or modification, within the PFA, and on lots of less than one acre).

To facilitate incorporation of nitrogen reducing features at the time of a permit to repair or modify an existing OSTDS, FDOH will pursue regulatory solutions to accomplish the following objectives:

- Update OSTDS rule language regarding permits, variances, and waivers to include consideration of DEP-adopted OSTDS remediation plans.

- Update OSTDS rules to allow installation of passive remediation systems, including but not limited to systems featuring liners, nitrogen reducing material, or both underneath the drain field.

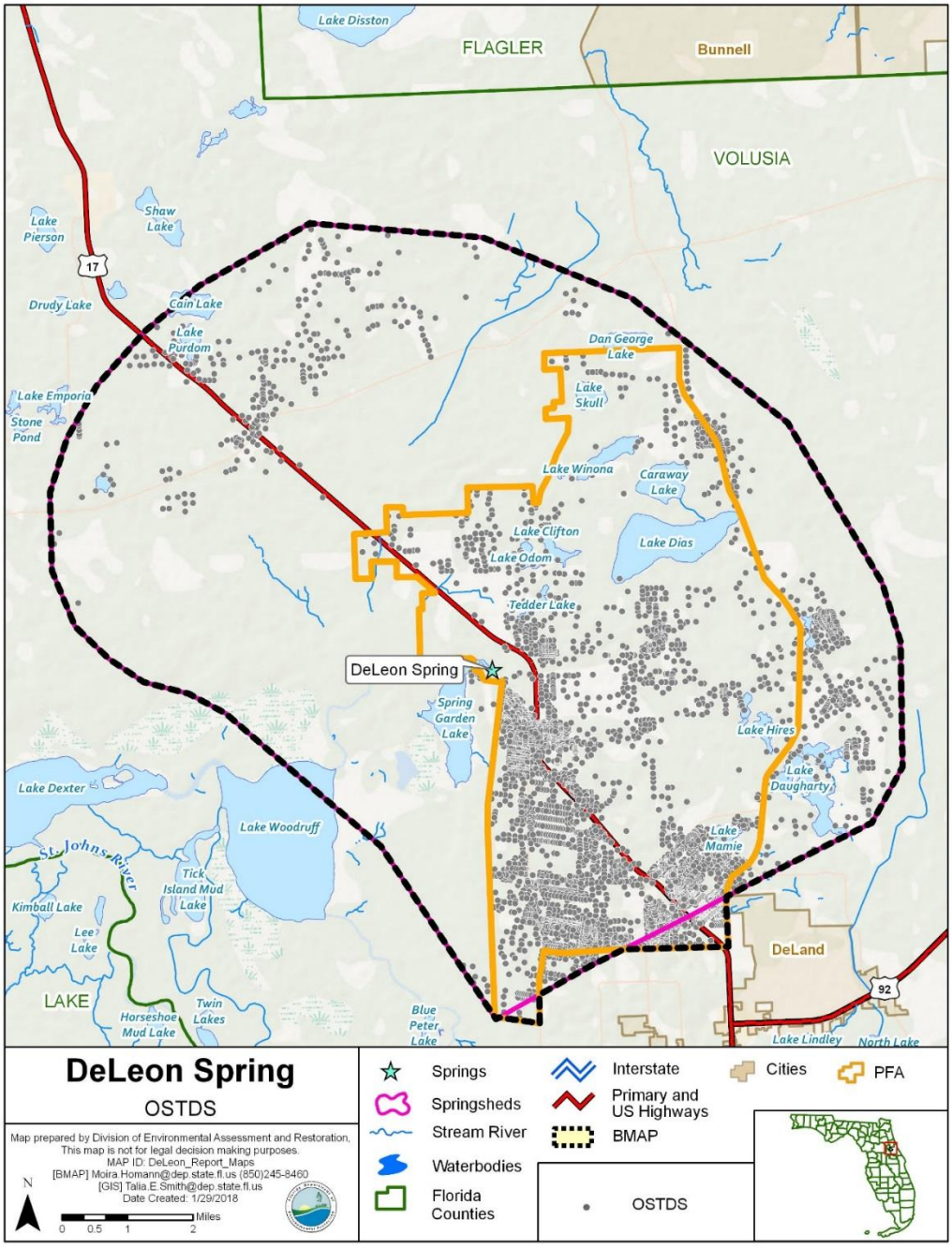

Figure D-1. Locations of OSTDS in the PFA in the DeLeon Spring BMAP

D.4 Public Education Plan

DEP and FDOH will develop and disseminate educational material focused on homeowners and guidance for builders and septic system contractors. The materials will identify the need for advanced, nitrogen reducing OSTDS along with the requirements for installing nitrogen reducing

technologies under this OSTDS remediation plan. DEP will coordinate with industry groups such as Florida Home Builders Association and Florida Onsite Wastewater Association (FOWA).

DEP hosted a brainstorming session on January 25, 2018 to gather local input on the primary facets of a public education plan, including key audiences, the identification of major themes for communication/education, and the identification of misconceptions about septic systems (**Table D-2**).

During the development of this BMAP, the following list of steps, target audiences, consideration of appropriate messaging, and preparation of materials/resources were identified.

- **Step 1** – Understand the data and issues associated with OSTDS.
- **Step 2** – Identify existing and short-term activities to address the issues.
- **Step 3** – Undertake a pilot project outreach and social marketing campaign
- **Step 4** – Identify future actions for basin-wide implementation.

Table D-2. Prioritized target audiences, messaging, and materials/resources

Audience	Messaging	Materials/Resources
Homeowners Associations	Impacts of TN to the environment (and regulatory requirements*)	Social media with consistent message
OSTDS Industry	Cost to retrofit or sewer	Community meetings
Media/Chamber of Commerce/OSTDS Industry/Environmental Groups	Funding Options	Utility inserts

The management strategies listed in **Table D-3** are ranked with a priority of high, medium, or low. In 2016, the Florida Legislature amended the Watershed Restoration Act (Section 403.067, F.S.), creating additional requirements for all new or revised BMAPs. BMAPs must now include planning-level details for each listed project, along with their priority ranking.

Project status was selected as the most appropriate indicator of a project's priority ranking based primarily on need for funding. Projects with a "completed" status were assigned a low priority. Projects classified as "underway" were assigned a medium priority because some resources have been allocated to these projects, but additional assistance may be needed for the project to be completed. High priority was assigned to projects listed with the project status "planned" as well as certain "completed" projects that are ongoing each year (any project with one of these project types: "street sweeping," "catch basin inserts/inlet filter cleanout," "public education efforts," "fertilizer cessation," "fertilizer reduction," or "aquatic vegetation harvesting"), and select projects that are elevated because substantial, subsequent project(s) are reliant on their completion.

Table D-3. Stakeholder educational activities to implement the OSTDS remediation plan

Lead Entity	Activity Number	Activity Name	Description of Activity	Activity Status	Partners	Estimated Start Date	Estimated Completion Date	Cost Estimate	Funding Source	Funding Amount
UF-IFAS	IFAS-E-1	OFS OSTDS Campaign, Phase 1	Implement social marketing campaign that links septic systems to springs.	Planned	N/A	2018	2020	$30,000	TBD	TBD
UF-IFAS	IFAS-E-2	OFS OSTDS Campaign, Phase 2	Create on-line clearinghouse of fact sheets, videos, public service announcements, etc.	Planned	N/A	2018	2018	$7,000	TBD	TBD
UF-IFAS	IFAS-E-3	OFS OSTDS Campaign, Phase 3	Presentations to realtors and distribution of information kits for home buyers.	Planned	N/A	2018	2018	$10,000	TBD	TBD
UF-IFAS	IFAS-E-4	OFS OSTDS Campaign, Phase 4	Six to eight septic system workshops for elected officials.	Planned	N/A	2018	2019	$5,000	TBD	TBD
UF-IFAS	IFAS-E-5	OFS OSTDS Campaign, Phase 5	Homeowner workshops with field demonstrations.	Planned	N/A	2018	2020	$25,000	TBD	TBD

Appendix E. Technical Support Information

E.1 NSILT Data

An NSILT was completed on DeLeon Spring for the DeLeon Spring BMAP. This technical support information identifies the data sources relied upon during NSILT development and documents all the major assumptions used by DEP when applying the NSILT approach to the DeLeon Spring BMAP.

The general NSILT approach involves estimating the nitrogen load to the surface for various source categories based on land use. The NSILT subjects the surface loading to recharge and attenuation to derive the estimated load to groundwater at the top of the aquifer. The estimated load to groundwater determines the scope of reduction strategies needed in the BMAP for each source category.

E.1.1 General Data Inputs

Hydrogeology and Aquifer Recharge
Aquifer recharge information is based on the SJRWMD Floridan Aquifer Recharge Map which was updated in 2015.

Land Use
Land use information is from SJRWMD based on the 2009 Florida Land Use Cover and Forms Classification System (FLUCCS) and local county property appraiser offices within the BMAP boundary.

E.1.2 Estimating Nitrogen Inputs to the Land Surface

Atmospheric Deposition
Atmospheric deposition information is derived from the TDEP hybrid model (Schwede and Lear 2014) that inputs wet and dry monitoring network data for the U.S. and calculates an estimated TN deposition load. The DeLeon Spring dataset is comprised of data from 2011 to 2013.

WWTFs
The average annual input of nitrogen to the land surface was estimated for each effluent land application site in the BMAP area using TN concentration and discharge volume data available in the DEP Wastewater Facility Regulation (WAFR) database. Smaller WWTFs are not always required to monitor and report TN effluent concentrations, and therefore may not have data available in the WAFR database. For these, DEP estimated TN concentrations based on nitrate-N (NO3-N) data (assuming the NO3-N concentration was 38.5 % of the TN, based on a 2009 cooperative study with the Water Reuse Foundation of 40 domestic WWTFs across the state). The range of years for which data were available varied with the individual WWTFs; however, the majority of the data were collected between 2016 and 2017.

OSTDS

In 2014, FDOH began the Florida Water Management Inventory (FLWMI), a statewide project to develop geographic information system (GIS) mapping attributes for water use and wastewater treatment method for all parcels by county. The results of this inventory can be obtained from FDOH.

Results from the 2016 release of the FLWMI were used to estimate the total number of septic systems within the BMAP area boundary. ArcGIS files provided the locations of both known and estimated septic systems.

The population served by the OSTDS was estimated using the 2010 U.S. Census Bureau data for Volusia County. The 2010 persons per household for Volusia Country was reported as 2.37. Also used were 2010 U.S. Census Bureau data to look at population age distribution to account for school or working age population who likely have access to sewer connected facilities during away from home hours. The collection of data was used to estimate the effective population and OSTDS usage. This resulted in a per capita contribution of 9.012 lb-N/yr and 1.97 effective persons per household in Volusia County.

UTF

In this NSILT, urban fertilizers include fertilizer application estimates for residential purposes, business, parks, and similar properties. Sporting facility fertilizer use is estimated separately (see STF discussion below). Results from surveys and workshops pertaining to fertilizer application on turfgrass in nearby counties were used to estimate the nitrogen application rates for urban turfgrass in the DeLeon Spring BMAP area. The results provided input data on percent of the population that fertilize, the applicator, and application rates.

For residential parcels such as single- and multi-family homes, the acreage receiving fertilizer applications is calculated in the same manner as nonresidential parcels. Prior to applying the fertilizer application rates to the pervious land area, two factors are taken into account: (1) the percentage of a property that a homeowner will fertilize, and (2) the probability that a homeowner will use fertilizer.

While homeowners may apply fertilizer to all the pervious area on their property (lawns and beds), this is less likely for those with larger lot sizes. For this analysis, it was assumed that the owners of properties with greater than one acre of pervious land area would regularly apply fertilizer to no more than one acre.

Property value may also be a factor when considering the likelihood of fertilizer application. Previous socioeconomic studies have shown that property value is a reliable indicator of the probability that a homeowner will apply fertilizer to a property (Kinzig et al. 2005; Law et al. 2004; Zhou et al. 2008; Cook et al. 2012). Properties with higher assessed values tend to be fertilized more than properties with lower assessed values. To account for this, the range of

property values for single-family homes was evaluated for the contributing area and subdivided into three categories based on property value specific to the county: high, medium, and low.

In 2009, a survey in the Wekiva River Basin was conducted by the University of Central Florida (UCF) Stormwater Management Academy (Souto 2009). This survey provided information on residential fertilizer use habits in the BMAP area.

The type of property where fertilizer is applied is estimated for nonresidential and residential parcels. The acreage receiving fertilizer is estimated the same for both parcel types by using county property appraiser data and zoning data. Impervious and pervious land areas are determined for each parcel.

Nonresidential parcels are assumed to be fertilized by a commercial service provider. While application rates and frequencies are recommended in the *Green Industries BMP Manual* (DEP 2010), the UCF study indicated that commercial application rates in this region are slightly higher. The nonresidential parcel fertilization rates are estimated based on the UCF survey results.

Residential parcels are evaluated by estimating the survey information cited above, relying on information taken from the UCF study. According to this survey, some surveyed residents (16 %) did not fertilize their lawns, 51 % applied fertilizer to their own lawns 2.88 times a year, and 33 % had lawn service contractors apply fertilizer on average of 4.76 times a year (Souto 2009). These rates, combined with the consideration of the likely area being fertilized and the likelihood of fertilizer use, were the basis of the estimates of residential fertilizer use.

STF

Sports turfgrass areas include golf courses and sporting facilities.

Sporting facilities were assessed based on property appraiser data. The parcel types likely to contain these facilities were identified and evaluated based on aerial imagery, including schools, parks, and recreational areas. The fertilizer application rate for turf grass at sports facilities of 32.67 lb-N/ac was used, based on the 2009 study data for lawn service company fertilization practices (Souto et al. 2009).

LW

Livestock waste practices specific to this area were identified through several steps. The nitrogen waste factor for each animal type is based on published literature values and subdivided into locations and recharge area (Goolsby et al. 1990; Chelette et al. 2002; Ruddy et al. 2006; Meyer 2012; Sprague and Gronberg 2013). Livestock populations were drawn from the 2012 Census of Agriculture (CoA) that provides the number of livestock by kind of animal per county. The number of livestock in the springshed are adjusted by estimating the land use percentages in the contributing area compared to the full county land uses to get a percentage of livestock-related land uses in the NSILT area. County-level land use information from the FSAID was used to estimate livestock populations within the springshed. For beef cattle, the 2016 U.S. Department

of Agriculture Survey was used to cross-reference the beef cattle population numbers in the 2012 census.

There was one horse farm identified in the DeLeon Springshed. For this facility, the FSAID was used to determine the acreage of the operation. FDACS provided information that no additional pasture fertilizer is applied at this location, so no loading estimates from fertilizer were included. It was assumed that half of the horses housed at this facility are seasonal and, therefore, not included in the CoA county-wide population count. The full-time horse population at the facility was subtracted from the CoA numbers to avoid double-counting. A daily waste factor was applied to the estimated average number of horses at the facility and that horse waste total was included in the LW total estimates.

For dairy operations, the FSAID was used to determine the acreage of dairy operations in the springshed. The average herd size, confinement times, and manure management practices were obtained from FDACS. A daily waste factor was applied to the average herd size and refined based on the site-specific waste handling methods used. For smaller dairies that do not require a confined animal feeding operation permit that specifies the waste handling methods, it was assumed that these facilities direct their wastewater to a waste storage pond and then the liquid waste is applied to a sprayfield. The total estimated contribution of load from dairy cattle was included in the LW total estimates.

FF

Agricultural fertilizer is applied at varying rates depending on crop type and farm practices. The amount of irrigated lands and crop types was based on the 2015 FSAID Irrigated Lands Geodatabase (ILG). Beyond the areas specified by the ILG, additional agricultural areas were identified based on the SJRWMD land use data and by county property appraiser data. Only 80 % of the nursery operation acreage was included in order to account for spacing between liners and rows, which limits the fertilizer application area at nurseries. Estimated application rates are based on UF-IFAS recommendations and producer feedback. The crop fertilizer application rates were applied to the applicable agricultural acres based on crop type to calculate the nitrogen input from farm fertilizer.

Estimated Nitrogen Inputs to Land Surface

The estimated input from each source category above is summed and a relative percent calculated.

E.1.3 Nitrogen Attenuation and Loading to Groundwater

The two types of attenuation that are evaluated are biochemical attenuation factors (BAFs) and hydrogeological attenuation (i.e., recharge).

BAFs and Uncertainty Factors

The BAFs used to account for the processes affecting the movement of nitrogen from each source category in the subsurface are based on literature review of studies in Florida and similar

areas. Additionally, research scientists in Florida (UF–IFAS, universities, and U.S. Department of Agriculture [USDA] Agricultural Research Service), and local stakeholders provided additional guidance. The BAFs in **Table E-1** are the result of this evaluation. The BAF is used to estimate what percent of the surface input could infiltrate to groundwater. For example, if 70 % of urban fertilizer is biologically attenuated, then the remaining 30 % could infiltrate to the groundwater.

The environmental attenuation of nitrogen from specific sources within the categories can vary substantially, both spatially and with depth in the subsurface, and will affect the amount of nitrogen leaching to groundwater and the relative contribution of nitrogen from each source category. The range in nitrogen attenuation can result from variability in soil properties, crop types, agricultural practices, nitrogen storage, volatilization of ammonia to the atmosphere, uptake by vegetation, denitrification, and other removal processes. The potential range in nitrogen attenuation for each source is shown in **Table E-1.**

Table E-1. Range of environmental attenuation of nitrogen from a detailed literature review

N Source Category	Low-Level Attenuation (%)	Attenuation Used for This Analysis (%)	High-Level Attenuation (%)
Atmospheric Deposition	85	90	95
WWTFs-RIBs	10	25	40
WWTFs-Sprayfield	50	60	75
WWTF-Reuse	50	75	85
Septic Tanks and WWTF Drain fields	40	50	75
Livestock Operations	80	90	95
Dairies	30	50	70
Farm Fertilizers	50	80	85
Urban Fertilizers	50	70	85

Hydrogeological Attenuation (i.e., Recharge)

The recharge rate for the area where the surface input is calculated is based on the SJRWMD recharge map previously described. To account for variations in recharge rates to the UFA, non-attenuated nitrogen inputs in high rate recharge areas are multiplied by a weighting factor of 0.9, while nitrogen inputs are multiplied by a weighting factor of 0.5 for medium rate recharge areas and 0.1 for low. Groundwater discharge areas were not included in the calculations of nitrogen loads to the groundwater contributing area, as these areas do not contribute nitrogen to the aquifer.

Estimated Nitrogen Load to Groundwater

The surface inputs by source category are adjusted by applying the BAFs for the appropriate source category and location-based recharge factors to estimate the load to groundwater by

source category. It is important to note that this load is estimated for the top of the aquifer. As the load interacts with the aquifer, additional factors likely modify it prior to discharge at the spring vent.

E.2 NSILT References

Chelette, A.R., T.R. Pratt, and B.G. Katz. 2002. Nitrate loading as an indicator of nonpoint source pollution in the lower St. Marks–Wakulla Rivers watershed. Northwest Florida Water Management District Water Resources Special Report 02-1.

Cook, E.M., S.J. Hall, and K.L. Larson. 2012. Residential landscapes as social-ecological systems: A synthesis of multi-scalar interactions between people and their home environment. Urban Ecosystems 15: 19–52.

Florida Department of Environmental Protection. 2007. *Best management practices for the enhancement of environmental water quality on Florida golf courses*. Tallahassee, FL.

Florida Department of Environmental Protection. 2010. Florida friendly best management practices for protection of water resources by the green industries. Tallahassee, FL.

Goolsby, D.A., W.A. Battaglin, G.B. Lawrence, R.S. Artz, and B.T. Aulenbach et al. 1999. *Flux and sources of nutrients in the Mississippi–Atchafalaya River Basin.* National Oceanic and Atmospheric Administration Coastal Ocean Program No. 17.

Kinzig, A.P., P. Warren, C. Martin, D. Hope and M. Katti. 2005. The effects of human socioeconomic status and cultural characteristics on urban patterns of biodiversity. Ecology and Society 10 (1).

Law, N.L, L.E. Band, and J.M. Grove. 2004. Nitrogen input from residential lawn care practices in suburban watersheds in Baltimore County, MD. Journal of Environmental Planning and Management 47(5): 737–755.

Meyer, L.H. 2012. Quantifying the role of agriculture and urbanization in the nitrogen cycle across Texas. University of Texas graduate thesis.

Ruddy, B.C., D.L. Lorenz, and D.K. Mueller. 2006. County-level estimates of nutrient inputs to the land surface of the conterminous United States, 1982–2001. U.S. Geological Survey Scientific Investigations Report 2006-5012.

Sartain, J.B. 2002. *Recommendations for N, P, K and Mg for golf course and athletic field fertilization based on Mehlich III extractant*. Document SL191. Gainesville, FL: University of Florida Institute of Food and Agricultural Sciences.

Schwede, D.B., and G.G. Lear. 2014. A novel hybrid approach for estimating total deposition in the United States. *Atmospheric Environment* 92: 207–220.

Souto, L., M. Collins, D. Barr, G. Milch, J. Reed, and M.D. Ritner. 2009. Wekiva residential fertilizer practices. Contract# G0078. University of Central Florida for the Florida Department of Environmental Protection

Sprague, L.A., and J.M. Gronberg. 2013. Estimation of anthropogenic nitrogen and phosphorus inputs to the land surface of the conterminous United States—1992, 1997, and 2002. U.S. Geological Survey Scientific Investigations Report 2012-5241

U.S. Department of Agriculture Census of Agriculture website: https://www.agcensus.usda.gov

Water Reuse Foundation, 2009 "A Reconnaissance-Level Quantitative Comparison of Reclaimed Water, Surface Water and Groundwater," Alexandria, Virginia.

Zhou, W., A. Troy, and M. Grove. 2008. Modeling residential lawn fertilization practices: Integrating high resolution remote sensing with socioeconomic data. Environmental Management 41: 742–752.

Appendix F. FDACS Information on BMPs

Agricultural nonpoint sources in a BMAP area are required by state law (Subsection 403.067[7], F.S.) either to implement FDACS-adopted BMPs, which provides a presumption of compliance with water quality standards, or to conduct water quality monitoring prescribed by DEP or SJRWMD. Failure either to implement BMPs or conduct monitoring may result in enforcement action by DEP.

Growers who implement BMPs may be eligible for cost-share funding from FDACS, SJRWMD, or others to defray partially the costs of implementation. Through OAWP, the Florida Forest Service, and the Division of Aquaculture, FDACS develops, adopts, and assists producers in implementing agricultural BMPs to improve water quality and water conservation.

FDACS identified potential land for enrollment in the FDACS BMP Program within the DeLeon Spring BMAP area using the FSAID IV geodatabase.

Table F-1 summarizes the land use data for agriculture in the DeLeon Spring BMAP. Based on the FSAID IV geodatabase, the total agricultural lands within the DeLeon Spring Basin is 10,410 acres. **Table F-2** summarizes the agricultural land by crop type that was estimated to be fertilized and the corresponding acreages. The primary agricultural fertilized land use in the DeLeon Spring Basin is Improved Pasture which comprises 50% of the fertilized land use in the springshed. **Table F-3** provides a summary of the agricultural lands with livestock. It is important to note that some of the agricultural lands include more than one agricultural practice.

Figure F-1 shows the approximate location of the agricultural lands based on the FSAID within the DeLeon Spring BMAP.

Table F-1. Agricultural land use within the DeLeon Spring BMAP

Agricultural Nitrogen Loading Category	Acres
Crop Fertilizer Lands only	4,252
Livestock Lands only	2,768
Crop Fertilizer and Livestock Lands	3,390
Total	**10,410**

Table F-2. Fertilized crop lands within the DeLeon Spring BMAP

*In NSILT only 25% of pasture lands assumed to be fertilized

Crop Type	Application Rate (lbs/acre)	Acres*
Asparagus Fern	240	427.80
Aspidistra	200	112.20
Citrus	200	378.32
Container Nursery	90	41.75
Coontie Fern	150	2.46

Crop Type	Application Rate (lbs/acre)	Acres*
Fern	300	1,076.55
Field Crops	90	813.98
Field Nursery	90	76.25
Greenhouse Nursery	90	2.25
Hay	240	39.92
Horse Farms	80	509.07
Improved Pasture	100	2,308.36
Leatherleaf	225	809.40
Liriope	200	13.22
Mixed Crops	151	25.14
Nursery	90	6.18
Olive Trees	90	22.01
Ornamental Container	90	45.43
Ornamental Field Grown	225	196.54
Other Groves	90	16.88
Pasture	80	572.48
Pittosporum	300	136.54
Tree Crops	230	4.54
Watermelons	150	2.70
Total	-	**7,642.40**

*In NSILT, ornamentals' acreage reduced by 25% to account for spacing; only 25% of pasture lands assumed to be fertilized

Table F-3. Livestock lands within the DeLeon Spring BMAP

Livestock Category	Acres
Horse Farms	376.74
Improved Pasture	2,091.56
Other Open Lands (Rural)	109.52
Pasture	572.48
Unimproved Pastures	608.91
Woodland Pastures	1,296.17
Total	**5,055**

Agricultural land use data are critical for determining agricultural nonpoint source loads and developing strategies to reduce those loads in a BMAP area, but there are inherent limitations in the available data. The time of year when land use data are collected (through aerial photography) affects the accuracy of photo interpretation. Flights are often scheduled during the

winter months due to weather conditions and reduced leaf canopies, and while these are favorable conditions for capturing aerial imagery, they make photo interpretation for determining agricultural land use more difficult (e.g., more agricultural lands are fallow in the winter months) and can result in inappropriate analysis of the photo imagery. There is also a significant variation in the frequency with which various sources of data are collected and compiled, and older data are less likely to capture the frequent changes that often typify agricultural land use. In addition, agricultural activity being conducted on the land is not always apparent. For example, acreage classified as improved pasture may be used for a cow-calf operation, consist of forage grass that is periodically harvested for hay, or simply be a fallow vegetable field awaiting planting. Finally, the classification method itself may be an issue. For example, property appraiser data assigns an agricultural land use designation to an entire parcel, although agricultural production may only be conducted on a portion of the parcel. Because of error in the collection and characterization of land use data and changes in land use over time, agricultural land use acreage estimates are subject to adjustment.

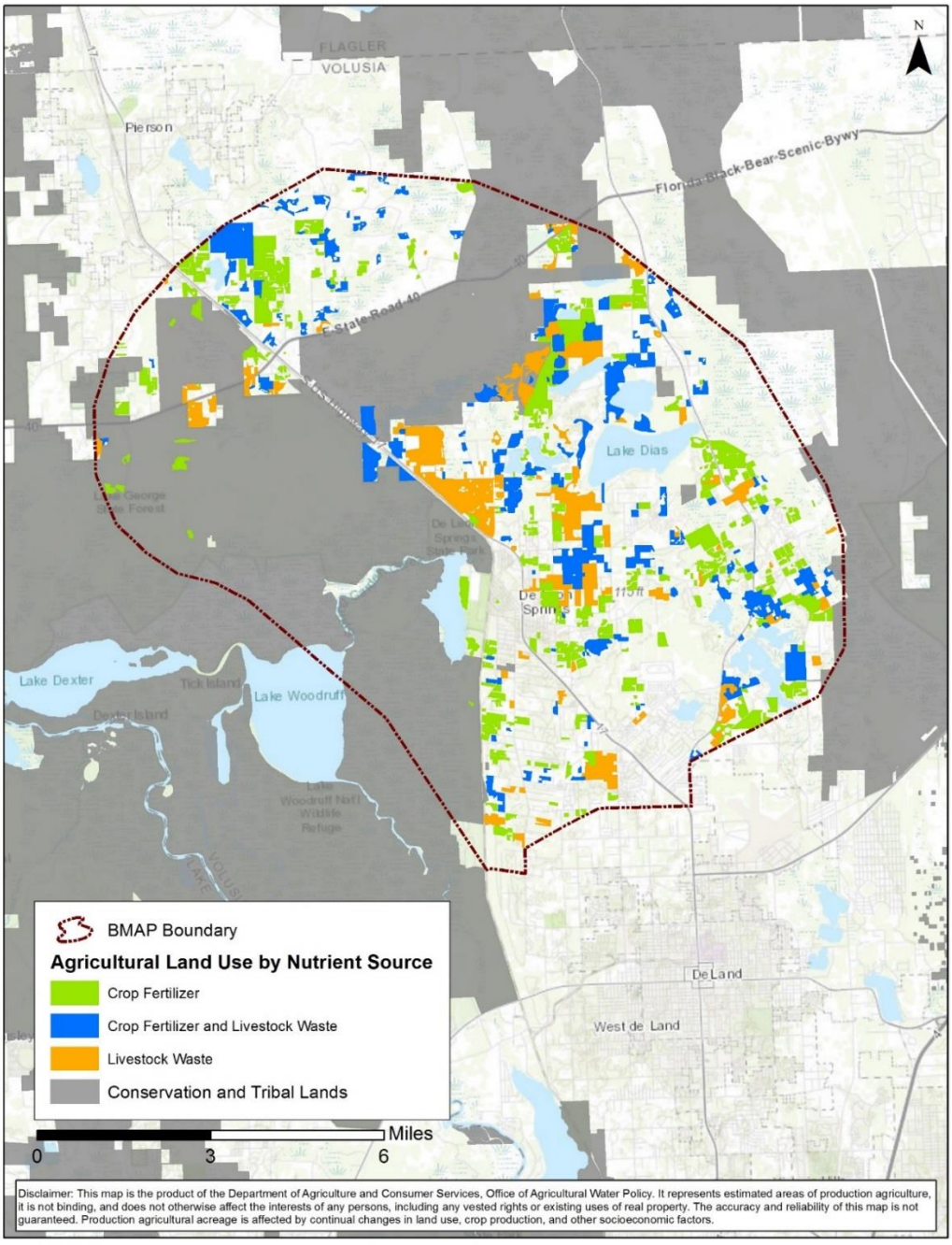

Figure F-1. Agricultural lands in the DeLeon Spring BMAP

F.2 Agricultural BMPs

Through the Office of Agricultural Water Policy, the Florida Forest Service, and the Division of Aquaculture, FDACS develops, adopts, and assists producers in implementing agricultural BMPs

to improve water quality and water conservation. Adopted BMPs are initially verified by the FDEP as reducing nutrient loss (e.g., total nitrogen and total phosphorus) to the environment. OAWP BMPs are published in commodity-specific manuals that cover key aspects of water quality and water conservation. The BMP categories include:

- Nutrient Management practices that help determine appropriate source, rate, timing, placement of nutrients (including both organic and inorganic sources) to minimize impacts to water resources.

- Irrigation and Water Table Management practices that address methods for irrigating to reduce water and nutrient losses to the environment and to maximize the efficient use and distribution of water.

- Water Resource Protection practices such as buffers, setbacks, and swales to reduce or prevent the transport of nutrients and sediments from production areas to water resources.

The Notice of Intent to Implement (NOI) and BMP checklist are incorporated into each manual.

Information on the BMP manuals and field staff contact information can be obtained here: http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy. Printed BMP manuals can be obtained by contacting OAWP field staff.

OAWP outreach to solicit enrollment extends to all types of agricultural operations, but is more intensive in BMAP areas because of the relationship of BMPs to the presumption of compliance with water quality standards in a BMAP area. FDACS field staff works with producers to enroll in the FDACS BMP program by signing a Notice of Intent to Implement BMPs, and enrollment is based on the expectation that producers recognize and address the water quality and conservation issues associated with their operations. Upon completion of all information in the BMP checklist, an NOI must be signed by the landowner or the landowner's authorized agent (who may be the producer if the producer is not the landowner).

F.3 BMP Enrollment

Figure F-2 shows the acres enrolled in the FDACS BMP Program in the DeLeon Spring BMAP as of December 31, 2017. **Table F-4** lists the acres enrolled in the FDACS BMP Program by manual and the number of NOIs associated with those acres. Given that the enrolled acres where BMPs are implemented can contain nonproduction acres (such as buildings, parking lots, and fallow acres), only the enrollment for the land classified as agriculture based on the FSAID is included in the tables.

As of December 31, 2017, NOIs cover 3,514 agricultural acres in the DeLeon Spring Basin. No producers are conducting water quality monitoring in lieu of implementing BMPs at this time.

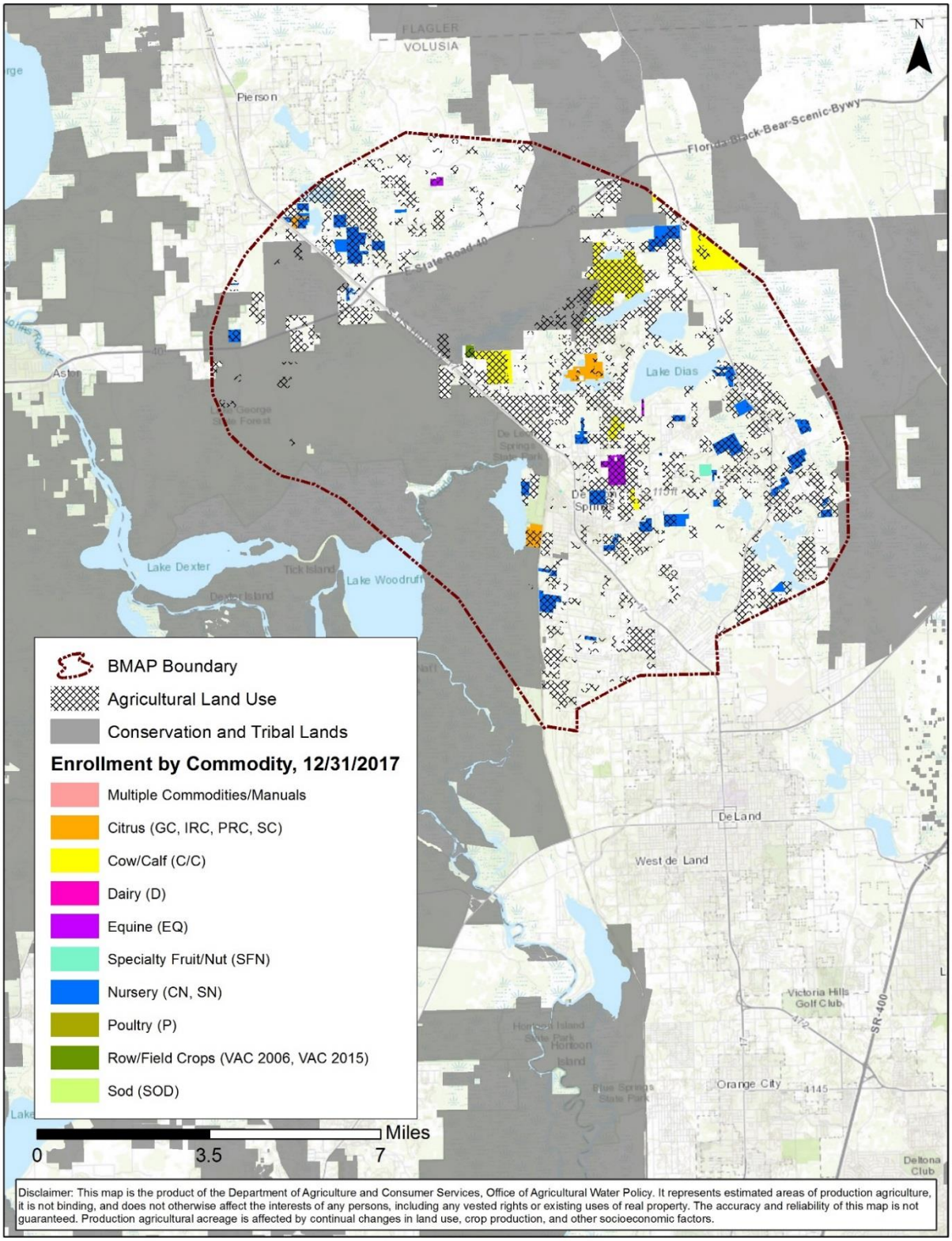

Figure F-2. BMP enrollment in the DeLeon Spring BMAP as of December 31, 2017

Table F-4. Agricultural acreage and BMP enrollment in the DeLeon Spring Basin as of December 31, 2017

N/A = Not applicable.

Related FDACS BMP Programs	NOI Acreage Enrolled	Agricultural Land Use Acres within NOIs
Citrus	284.18	77.3
Cow/Calf	1,544.02	890.5
Equine	181.62	166.2
Nursery	1,436.96	969.8
Row/Field Crops	27.23	18.5
Specialty Fruit/Nut	39.75	N/A
Total	**3,513.75**	**2,122.46**

F.4 FDACS OAWP Role in BMP Implementation and Follow-Up

OAWP works with producers to submit NOIs to implement the BMPs applicable to their operations, provides technical assistance to growers, and distributes cost-share funding, as available, to eligible producers for selected practices. OAWP follows up with growers through site visits to evaluate the level of BMP implementation and record keeping, identify areas for improvement, if any, and discuss cost-share opportunities.

When DEP adopts a BMAP that includes agriculture, it is the agricultural producer's responsibility to implement BMPs adopted by FDACS to help achieve load reductions. If land use acreage corrections and BMP implementation do not fully account for the current agricultural load reduction allocation, it may be necessary to develop and implement additional projects and practices that reduce nutrients from agricultural nonpoint sources. In that case, FDACS will work with DEP and SJRWMD to identify appropriate options for achieving further agricultural load reductions.

Section 403.067, F.S. requires that, where water quality problems are demonstrated despite the proper implementation of adopted agricultural BMPs, FDACS must reevaluate the practices, in consultation with DEP, and modify them if necessary. Continuing water quality problems will be detected through the BMAP monitoring component and other DEP and SJRWMD activities. If a reevaluation of the BMPs is needed, FDACS will also include SJRWMD and other partners in the process.

F.5 OAWP Implementation Verification Program

OAWP established an Implementation Assurance (IA) Program in 2005 in the Suwannee River Basin as part of the multi-agency/local stakeholder Suwannee River Partnership. In early 2014,

OAWP began to streamline the IA Program to ensure consistency statewide and across commodities and BMP manuals. The IA Program was based on interactions with producers during site visits by OAWP staff and technicians as workload allowed. For the visits, field staff and technicians used a standard form (not BMP specific) developed in 2014, that focused on nutrient management, irrigation management, and water resource protection BMPs common to all of the BMPs that were adopted by rule. Once completed, these paper forms were submitted to OAWP staff and compiled into a spreadsheet, and the data were reported annually.

On November 1, 2017, the OAWP's Implementation Verification rule (Chapter 5M-1, F.A.C.) became effective. The Implementation Verification (IV) program provides the basis for assessing the status of BMP implementation and for identifying enrolled producers who require assistance with BMP implementation. The components of the IV program are 1) site visits; 2) implementation status reporting on common practices that apply across all BMP manuals; 3) technical assistance; and 4) external reporting. Implementation verification is confirmed by field staff through site visits and by producers through annual common practices status reports.

Site visits to agricultural operations by OAWP field staff and contract technicians are the most effective means to determine the status of BMP implementation. These visits also provide an opportunity to identify needs for assistance with implementation and explore potential improvements. Resource limitations prevent site visits from occurring on all enrolled operations every year, and for that reason, site visits are prioritized. The program objective is for field staff to conduct site visits for 5-10% of active NOIs each year, with approximately 10% of the site visit locations selected randomly.

Per the implementation verification rule, each year, producers participating in the BMP program will be requested to participate in reporting on the status of implementation of common practices only for their operations. Lack of response from enrollees with parcels in a BMAP area raises the priority of the operation for a site visit from field staff. Where a need is identified, the OAWP may facilitate technical assistance for the producer from UF/IFAS or other resources, including third-party vendors. In some cases, cost share support may be available. Data from producers and site visits will be used to complete the annual reports on the status of BMP implementation as required by s. 403.0675(2), F.S., beginning July 1, 2018.

F.6 Beyond BMPs

Beyond enrolling producers in the FDACS BMP Program and verifying implementation, FDACS will work with DEP to improve the data used to estimate agricultural land uses in the springshed. FDACS will also work with producers to identify a suite of agricultural projects and research agricultural technologies that could be implemented on properties where they are deemed technically feasible and if funding is made available. Acreages provided by FDACS are preliminary estimates that are the maximum acreages and will need to be evaluated and refined over time.

As presented here, these projects are based on planning-level information. Actual implementation would require funding as well as more detailed design based on specific information, such as actual applicable acreages and willing landowners. **Table F-5** summarizes potential practices that could be implemented in this BMAP area. It is important to note that the research projects listed in the table are being conducted in the Suwannee River Basin. At some future point, the findings of these studies may be applicable to the DeLeon Spring springshed.

Table F-5. Beyond BMP implementation

Category	Name	Description
Practices	Precision Irrigation	Deployment of equipment, procedures, and training to improve location, volume, and timing of irrigation to match crop needs more precisely.
Practices	Soil Moisture Probes	Deployment, training, technical support, and use of soil moisture probes to manage irrigation systems.
Practices	Cover Crops	Planting of cover crops between production cycles to increase soil organic content, improve nutrient retention, and reduce erosion.
Research	Bioreactors	Bioreactors/denitrification walls and onsite capture and reuse of high-N water.
Research	Rotational Production	Conversion of conventional production operations to planned rotational production incorporating grass and cover crops. May include cattle.
Research	Soil Moisture Sensor Deployment and Calibration	Installation, training, monitoring, and research on use of electronic soil moisture sensors, including correlations to nutrient movement through the root zone.
Research	Controlled Release Fertilizer (CRF)	Application of new and developing fertilizer products that become available to crops via dissolution over longer periods in the growing season.
Research	Reuse of High Nutrient Value Water Sources	Study of potential sources of high nutrient value water, potential beneficial reuse sites, legal and regulatory obstacles, and costs.

Appendix G. Future Growth Strategies of Local Jurisdictions

Table G-1. Future growth strategies of local jurisdictions

Lead Entity	Strategy Name	Description	Strategy Type	Status
Volusia County	Ordinance No. 2014-06	Florida-Friendly Fertilizer Use	Ordinance	Completed
Volusia County	Ordinance No. 87-35	Pollution Control	Ordinance	Completed
Volusia County	Ordinance No. 88-15	Stormwater Management	Ordinance	Completed
Volusia County	Ordinance No. 2009-05	Stormwater Discharge Pollutant Control	Ordinance	Completed
Volusia County	Ordinance No. 92-89	Stormwater Utility	Ordinance	Completed
Volusia County	Ordinance No. 91-37	Wastewater Residual Management	Ordinance	Completed
Volusia County	Ordinance No. 96-15	Reclaimed Water Service	Ordinance	Completed
Volusia County	FLU Policy 1.1.1.9	The County shall coordinate with the cities and consider joint agreements to create future water and sewer service areas.	Comprehensive Plan	Completed
Volusia County	FLU Policy 1.1.1.11	Urban areas are required to have central potable water and sanitary sewer service, except for the following: Lot sizes ranging from one (1) acre up to 2.49 acres shall require central potable water, but may utilize an individual waste water disposal system. Lot sizes 2.5 acres or larger in size may utilize individual water and wastewater disposal systems.	Comprehensive Plan	Completed
Volusia County	FLU Policy 1.2.2.6	Septic tanks and drain fields shall be sited to protect environmentally sensitive areas from the discharge of improperly treated effluent, consistent with the Conservation and Coastal Management Elements.	Comprehensive Plan	Completed
Volusia County	FLU Policy 1.2.2.12	Agriculture and silviculture operations shall adhere to accepted BMPs for surface water management and erosion control.	Comprehensive Plan	Completed
Volusia County	FLU Objective SG 1.2	To protect and enhance environmentally sensitive corridors, wildlife habitat, connected wetlands, and natural hydrologic functions throughout Volusia County, the County adopts the Environmental Core Overlay or “ECO” Map as a component of the Future Land Use Map series.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.1.3	Volusia County shall continue to require "advanced secondary treatment" of wastewater (including high-level chlorination and sand	Comprehensive Plan	Completed

Lead Entity	Strategy Name	Description	Strategy Type	Status
		filtration) at all County owned wastewater treatment plants with capacities of 0.1 MGD or more.		
Volusia County	Sanitary Sewer Policy 6.1.1.5	Central sewer is not required for non-urban areas, except as required by Chapter 64E-6, F.A.C. Lines should only be extended if the absence of such facilities would result in a threat to the public health or safety or a designated rural area is inside an approved sewer service area with an agreement that describes the method and timing of when these services would be provided, or the comprehensive plan is amended to change rural areas to urban areas.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.1.8	Except as may otherwise be permitted by this sub-element, the extension of wastewater lines and the establishment of central wastewater systems outside of sewer service areas (county, municipal, or other as established by an adopted service area agreement) shall be prohibited unless such extension or facility construction will mitigate existing or potential problems of public health, safety, or welfare or other exceptions under the guidelines delineated in the Future Land Use Element.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.1.13	Septic tanks are only allowed under any one of the following applicable circumstances provided that the septic tank has been approved by FDOH…	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.1.14	Volusia County shall require all sewage treatment and disposal systems including septic tanks to be located and constructed in a manner consistent with all applicable local, state, and federal regulations, including the applicable goals, objectives, policies, and level of service standards contained in this comprehensive plan.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.1.15	An existing septic tank system may be upgraded, provided that a central sanitary sewer system is not available. However, connection to a central sanitary sewer system is required where said system is available in lieu of upgrading an existing septic tank system.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.1.16	The establishment of central wastewater service outside of sewer service areas is prohibited except for Rural Communities, Rural Villages, and Rural Recreational areas as provided for by this sub-element or where	Comprehensive Plan	Completed

Lead Entity	Strategy Name	Description	Strategy Type	Status
		DEP, the County Development Review Committee or other appropriate agency, has determined that such a facility is necessary to correct existing or potential problems of public health, safety, or welfare.		
Volusia County	Sanitary Sewer Policy 6.1.1.19	The location and siting of new package treatment plants shall be prohibited in areas where the disposal of effluent will result in the lowering of the ambient quality, where such information is available, of surface water or groundwater unless such discharge can be shown to be of overriding public interest.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.2.1	Volusia County shall replace and/or consolidate, when it is determined to be feasible, smaller package plants owned by the County with "advanced secondary" sewage treatment plants or enlarge existing plants.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.2.5	Existing package treatment plants shall be connected to a central sewer system when connection to said system is available. When an existing privately-owned package treatment facility is phased out and connected to a central public wastewater system, the owner of said private plant may be required to assume the cost of the connection.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.2.6	Volusia County shall require the utilization of a central sewer system where connection to a central system is available. The use of existing septic tanks serving land uses within the sewer service areas may continue in the manner consistent with the requirements specified by the County's comprehensive plan and local and state regulations.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.3.1	Volusia County shall require use of recovered wastewater for irrigation and non-potable use for all new development and other appropriate uses, where such use can be feasibly implemented and permitted by DEP as determined by Volusia County's land development regulations	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.3.2	Volusia County shall comply with state regulations for water quality, especially with respect to wastewater plant operations and effluent disposal and, if necessary, develop an appropriate alternative management strategy which may include reduction in wastewater effluent loadings and discharge rates.	Comprehensive Plan	Completed

Lead Entity	Strategy Name	Description	Strategy Type	Status
Volusia County	Sanitary Sewer Policy 6.1.3.6	Volusia County may, where practical and economically feasible, develop and implement an environmentally sound program for the use of natural systems, such as wetlands, for wastewater disposal provided that the implementation of such a program does not present a hazard to public health.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.3.8	Volusia County shall, to the extent feasible, provide facilities to allow the use of recovered wastewater for agricultural and other purposes, where County or other utility owners supply it.	Comprehensive Plan	Completed
Volusia County	Sanitary Sewer Policy 6.1.5.2	Volusia County shall negotiate sewer service area agreements with adjacent municipalities to better coordinate the orderly, efficient, and economical provision of wastewater service.	Comprehensive Plan	Completed
Volusia County	Drainage Objective 9.1.1	Volusia County shall fund and complete comprehensive watershed studies for all areas currently developed, or developing with essentially urban land uses, and areas where the Future Land Use Map has designated essentially urban land uses within the unincorporated county, as part of an overall Stormwater Master Plan. The County shall continue to assess other watersheds for flooding and pollution problems and for changes in land use.	Comprehensive Plan	Completed
Volusia County	Drainage Objective 9.1.2	Volusia County shall at a minimum maintain current standards regulating the design, construction, and management of drainage systems used for stormwater management.	Comprehensive Plan	Completed
Volusia County	Drainage Policy 9.1.2.6	BMPs for control of erosion and sedimentation shall be employed for all construction, urban development, and agricultural activities in order to protect natural waterbodies, water courses and wetlands from siltation…	Comprehensive Plan	Completed
Volusia County	Drainage Policy 9.1.3.1	Volusia County shall maintain an effluent reuse and disposal program to recharge wetlands and groundwater supplies and providing irrigation water thereby conserving potable water resource and improving surface water quality of the county.	Comprehensive Plan	Completed
Volusia County	Groundwater Policy 10.1.1.11	Prime (or high) aquifer recharge areas appropriate for development shall be developed so as to continue to maintain pre-development net retention and new stormwater management projects in existing developed areas should be designed in a fashion that enhances aquifer recharge.	Comprehensive Plan	Completed

Lead Entity	Strategy Name	Description	Strategy Type	Status
Volusia County	Groundwater Policy 10.1.1.12	Volusia County shall protect recharge lands through both fee simple and less than fee simple acquisition techniques, land use controls, or other methods deemed appropriate.	Comprehensive Plan	Completed
Volusia County	Groundwater Objective 10.1.2	Volusia County shall not allow the degradation of the Floridan and surficial aquifers' water quality.	Comprehensive Plan	Completed
Volusia County	Conservation Objective 12.1.1	To prevent the further degradation of the ambient water quality of the county's surface water resources, and to restore to acceptable levels those surface waters which exceed federal, state and local pollutant standards.	Comprehensive Plan	Completed
Volusia County	Conservation Policy 12.1.1.1	An ongoing surface water quality monitoring network, incorporating the standards and activities provided in the Coastal Management Element shall continue…	Comprehensive Plan	Completed
Volusia County	Conservation Policy 12.1.1.2	The County shall continue to initiate and encourage surface water restoration programs which will, at minimum: identify and initiate the cleanup of highly polluted aquatic systems; identify those areas of the county where on-site sewage disposal systems are determined to be, or have the potential to be significant surface water pollution sources; and coordinate with stormwater facility redesign activities where necessary.	Comprehensive Plan	Completed
Volusia County	Conservation Policy 12.1.1.4	Onsite sewage disposal systems and associated drain fields shall continue to be limited within the flood plain of surface water bodies as provided for in land development regulations, to the extent that such systems are designed and located so as to not contribute to the degradation of ambient water quality.	Comprehensive Plan	Completed
Volusia County	Conservation Objective 12.1.2	To protect and enhance the natural hydrologic functions and wildlife habitat attributes of surface water resources, including estuarine and oceanic waters, as well as waters which flow into estuarine and oceanic water, and the floodplains associated with these waters.	Comprehensive Plan	Completed
Volusia County	Conservation Objective 12.1.3	To protect and appropriately utilize the physical and ecological functions of natural drainage ways and drainage patterns.	Comprehensive Plan	Completed
Volusia County	Conservation Objective 12.2.1	To provide for the protection of areas determined to be environmentally sensitive, and direct growth away from such areas.	Comprehensive Plan	Completed