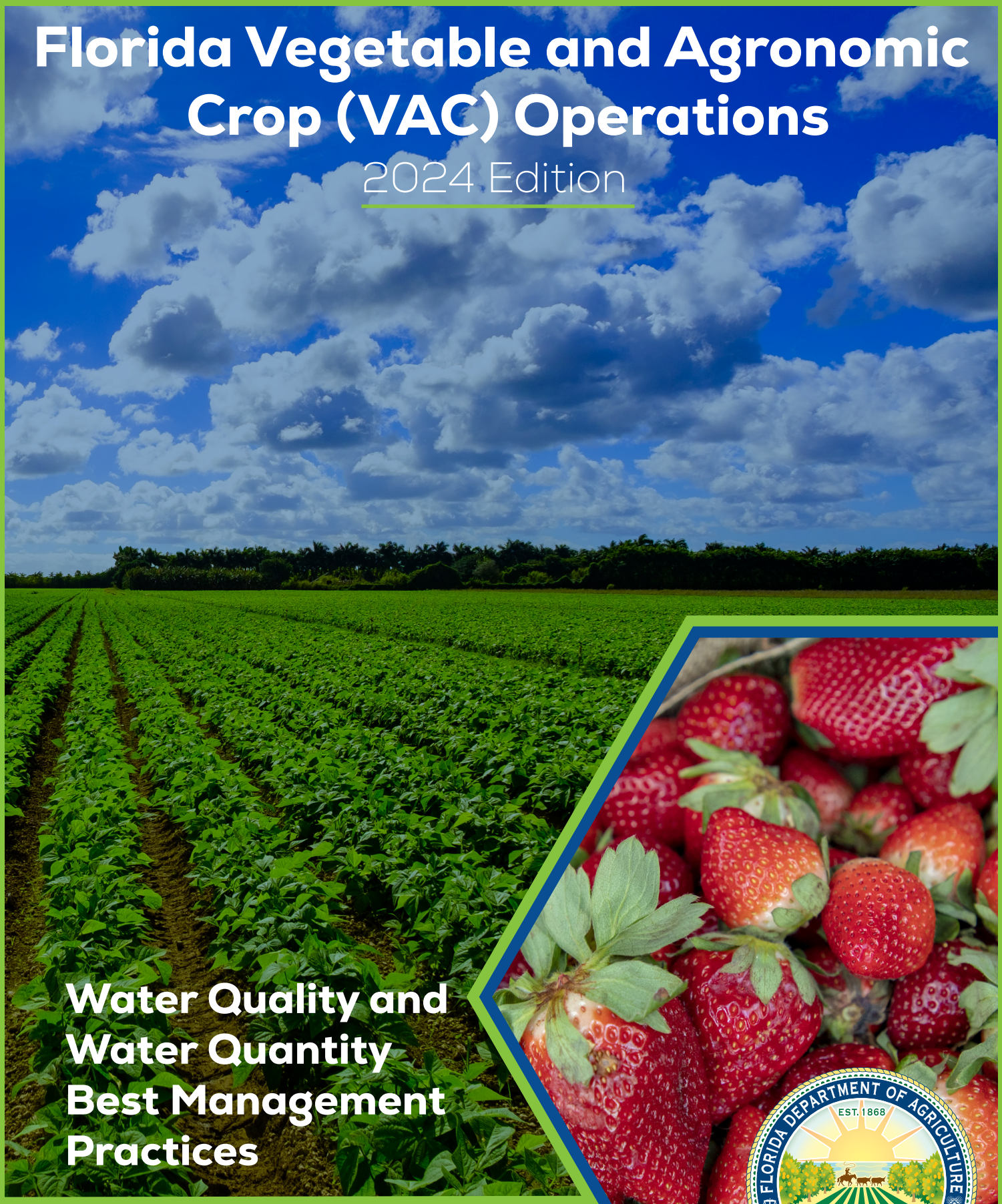
Florida Vegetable and Agronomic Crop (VAC) Operations

2024 Edition



Water Quality and Water Quantity Best Management Practices

FDACS-P-01268 Rev. 12/24

FLORIDA VEGETABLE AND AGRONOMIC CROP (VAC) OPERATIONS, 2024 EDITION: WATER QUALITY AND WATER QUANTITY BEST MANAGEMENT PRACTICES

Publication No. FDACS-P-01268, rev. 12/24, Incorporated in Rule 5M-8.002, F.A.C.

Table of Contents

Acronyms and Abbreviations

BMAP – Basin Management Action Plan

BMP – Best Management Practice

CPS – Conservation Practice Standard

EDIS – Electronic Data Information Source of UF/IFAS

EEF – Enhanced Efficiency Fertilizer

EPA – United States Environmental Protection Agency

ERP – Environmental Resource Permit

ET – Evapotranspiration

F.A.C. – Florida Administrative Code

F.S. – Florida Statutes

FAWN – Florida Automated Weather Network

FDACS – Florida Department of Agriculture and Consumer Services

FDEP – Florida Department of Environmental Protection

GPS – Global Positioning System

IV – Implementation Verification

MIL – Mobile Irrigation Laboratory

N – Nitrogen

N/A – Not Applicable

NOI – Notice of Intent to Implement Best Management Practices

NRCS – Natural Resources Conservation Service

OAWP – Office of Agricultural Water Policy (FDACS)

OFS – Outstanding Florida Springs

P_2O_5 – Phosphorus pentoxide

P – Phosphorus

TMDL – Total Maximum Daily Load

UF/IFAS – University of Florida, Institute of Food and Agricultural Sciences

WMD – Water Management District

Part A

Introduction

According to the 2023 Florida Annual Statistical Bulletin, Florida ranks second behind California in fresh market vegetable production, with approximately 181,100 acres of vegetables, melons, and berries, and a farm value exceeding $1.8 billion in revenue. Agronomic crops, including sugarcane grown in South Florida and field crops grown primarily in North Florida, total approximately 739,900 acres, covering approximately 2% of Florida's total land area.

Operations Applicable to this Manual

This manual applies to operations engaged in the production of vegetables and agronomic crops (VAC) including vegetables, field crops, sugarcane, forage grasses grown for hay or silage production, cotton, peanuts, and caladiums. A landowner or producer enrolled under this manual is also subject to the requirements of Rule Chapter 5M-1, F.A.C.

To benefit from and participate in the BMP Program, VAC producers must work with a Florida Department of Agriculture and Consumer Services (FDACS) representative to complete, sign, and submit a Notice of Intent (NOI) (FDACS-04002, rev. 06/24, incorporated in 5M-1.001(9), Florida Administrative Code (F.A.C.)) and the Best Management Practices (BMP) Checklist that is part of this manual.

A landowner or producer operating under one of the Equivalent Programs listed in Rule 5M-1.001(7), F.A.C., is required to complete An NOI and meet the other requirements for Equivalent Programs specified in Rule Chapter 5M-1, F.A.C.

Completing a BMP Checklist is not required for the enrolled lands subject to the permit or license issued pursuant to an Equivalent Program listed in Rule 5M-1.001(7)(a) or (b), F.A.C. Whether or not an enrollee under an Equivalent Program listed in Rule 5M-1.001(7)(c) or (d), F.A.C., is required to complete a checklist depends on the specific requirements of the programs identified. References to the BMP Checklist in this manual apply to Equivalent Program enrollments only to the extent provided in Rule Chapter 5M-1, F.A.C.

Enrollees under an Equivalent Program listed in Rule 5M-1.001(7), F.A.C., and meeting the requirements for Equivalent Programs provided in Rule Chapter 5M-1, F.A.C., are provided all the benefits listed under “Benefits of Implementing BMPs” set forth below.

Best Management Practices and Water Quality

Section 403.067, Florida Statutes (F.S.), directs Florida Department of Environmental Protection (FDEP) to develop water quality restoration goals for impaired waterbodies. These water quality restoration goals, or total maximum daily loads (TMDLs), are the maximum amount of a pollutant that a waterbody can assimilate and remain suitable for its designated use. Once a TMDL is adopted, FDEP may develop a basin management action plan (BMAP) that identifies enforceable strategies for restoring the impaired waterbody. The agricultural industry is one of many stakeholders identified in most BMAPs and plays an important role in helping to meet these water quality goals. Florida law requires agricultural producers and landowners located within BMAP areas to either enroll in the FDACS BMP Program and properly implement BMPs applicable to their property and operation or to conduct water quality monitoring activities as required by Rule Chapter 62-307, F.A.C. FDACS strongly encourages producers and agricultural landowners outside BMAP areas to also enroll in the BMP Program for the many benefits that enrollment provides. Proper implementation of the FDACS agricultural BMPs is the industry’s strategy to address agricultural nonpoint pollution sources.

The FDACS Office of Agricultural Water Policy (OAWP) administers the BMP Program for VAC operations. For the purposes of the OAWP BMP Program, the term "best management practice" means a practice or combination of practices determined by the coordinating agencies, (FDACS, FDEP, and water management districts (WMDs)) based on research, field-testing, and expert review, to be the most effective and practicable on-location means, including economic and technological considerations, for improving water quality in agricultural discharges. BMPs must reflect a balance between water quality improvements and agricultural productivity. Section 403.067, F.S., authorizes and directs FDACS to develop and adopt by rule BMPs that will help Florida's agricultural industry achieve the reductions allocated in BMAPs. BMPs serve as part of a multidisciplinary approach to water resource restoration and protection that includes public/private partnerships, landowner agreements and regional treatment technologies, which together form the comprehensive strategy needed to meet goals established in BMAPs.

Producers or agricultural landowners who are enrolled in the FDACS BMP Program and are properly implementing the applicable BMPs identified on the BMP Checklist, or who are in compliance with the Equivalent Program requirements of Rule Chapter 5M-1, F.A.C., are entitled to a presumption of compliance with state water quality standards per section 403.067(7)(c)3., F.S. FDACS is required to perform BMP Implementation Verification (IV) site visits to enrolled operations every two years to ensure that BMPs are being properly implemented. Details on IV site visits are provided herein. Enrollees participating in Equivalent Programs demonstrate compliance with BMPs on the area(s) of the NOI property subject to the Equivalent Program instrument by fulfilling the requirements of Rule 5M-1.008(7), F.A.C.

Benefits of Implementing BMPs

FDACS works closely with the FDEP, WMDs, industry experts, and academic institutions to understand the environmental and agronomic effects addressed by BMPs. Benefits of enrolling in the FDACS BMP Program and implementing BMPs include:

- Reduction of agricultural production impacts on natural resources;
- Eligibility for cost share funding for certain BMPs (as funds are available);
- Availability of free services provided by the FDACS Mobile Irrigation Laboratories to evaluate irrigation system efficiency;
- Technical assistance with BMP implementation;
- Presumption of compliance with state water quality standards for the pollutants addressed by the BMPs;
- Release from the provisions of section 376.307(5), F.S., (fines for discharge damages) for pollutants addressed by the BMPs; and
- Avoidance of duplicative local regulation under section 163.3162, F.S.

In many cases, proper BMP implementation may also increase production efficiency, reduce operational costs, and support wildlife habitat.

Permit Exemptions

In most cases, FDACS BMPs do not replace or exempt agricultural operations from complying with applicable permitting or other regulatory requirements. If a permit is obtained, producers are still required to adopt and properly implement BMPs for the aspects of their operation not addressed by the permit.

Some agricultural activities, especially those that alter the hydrology of the land, may require an environmental resource permit (ERP). Check with the appropriate WMD or FDEP before beginning construction activities for a stormwater management system or other onsite activity resulting in hydrologic alteration to determine if an ERP is required, or whether the activities may be exempt from permitting requirements. The following are possible exemptions.

- Section 373.406(2), F.S., authorizes any person engaged in the occupation of agriculture to alter the topography of land for purposes consistent with normal and customary practices of agriculture for the area. These activities, however, may not be for the sole or predominant purpose of diverting or impeding surface waters, or adversely impacting wetlands. If a formal dispute between a landowner and a WMD arises regarding the applicability of a permit exemption, FDACS has exclusive authority to make a binding determination, should either party request it.
- Section 373.406(3), F.S., authorizes any person engaged in the occupation of agriculture to construct an agricultural closed system. This exception, however, is limited to construction, operation, and maintenance of the agricultural closed system. Part II of Chapter 373, F.S., regarding the consumptive use of water remains applicable, which includes the taking and discharging of water for filling, replenishing, and maintaining the water level in any such agricultural closed system.
- Section 373.406(6), F.S., exempts activities that will have only minimal or insignificant individual or cumulative adverse impacts on the water resources of the district as determined by FDEP or the WMD.
- Section 373.406(9), F.S., exempts environmental restoration activities on agricultural lands that have minimal or insignificant impacts to water resources from ERP permitting requirements. No activity may commence until the producer requests an exemption and the appropriate WMD or FDEP has provided written notice that the proposed activity qualifies for the exemption.
- Section 373.406(10), F.S., exempts interim measures or best management practices adopted pursuant to section 403.067, F.S., that are by rule designated as having minimal individual or cumulative adverse impacts to the water resources of the state.
- Section 373.406(13), F.S., exempts isolated man-made farm ponds up to 15 acres in size, constructed entirely in uplands, from ERP permitting requirements if the average depth of the pond is less than 15-feet and the pond is located at least 50 feet from a wetland.

Even if an exemption applies, agricultural producers located within an adopted BMAP area must either properly implement applicable BMPs or conduct water quality monitoring in accordance with section 403.067, F.S.

The Florida Right to Farm Act (section 823.14, F.S.) provides that a local government may not adopt any ordinance, regulation, rule, or policy to limit an activity of a bona fide farm operation on land classified as agricultural pursuant to section 193.461, F.S., whereon the activity is regulated through properly implemented BMPs or interim measures developed and adopted by FDEP, FDACS, or a WMD as part of a statewide or regional program. Not all activities conducted on a farm are addressed by adopted BMPs or interim measures, so this exemption may not apply to all activities.

BMP Implementation Verification

Florida law requires FDACS to conduct an IV site visit at least every two years to ensure that agricultural landowners and producers are properly implementing the applicable BMPs identified in their NOI. An IV site visit includes: review of nutrient records that producers must maintain to demonstrate compliance with the BMP Program; verification that all other applicable BMPs are being properly implemented; verification that cost share practices are being properly implemented; and identification of potential cost share practices, projects or other applicable BMPs not identified during enrollment. During the IV site visit, FDACS representatives also identify opportunities for achieving greater nutrient, irrigation, or water resource management efficiencies, including opportunities for water conservation.

FDACS must retain certain records pertaining to the application of nitrogen (N) and phosphorus (P) fertilizer from enrolled producers during IV site visits. OAWP adopted a Nutrient Application Record Form (NARF) (FDACS-04005, rev. 06/24, incorporated in 5M-1.008(4), F.A.C.), to help simplify the record keeping requirement. The form is available from FDACS staff or from: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fforms.fdacs.gov%2F04005.xlsx&wdOrigin=BROWSELINK. References to IV in this manual apply to Equivalent Program enrollments only to the extent provided in Rule Chapter 5M-1, F.A.C.

Cost Share

Enrollment in and proper implementation of BMPs makes a producer eligible for cost share for certain BMPs, other practices, and projects. The availability of cost share funds depends on annual appropriations by the Florida Legislature, and therefore, the amount available can vary each year. Cost share applications may be submitted once a producer has enrolled in the BMP Program and has been assigned a NOI number. Cost share practices are categorized as nutrient management, irrigation management, or water resource protection. BMPs, other practices, and projects eligible for cost share funding may include precision agriculture technologies, variable rate irrigation methods, water control structures, and tailwater recovery systems.

OAWP seeks to leverage its cost share funding with other cost share programs offered by FDACS and other state and federal agencies. The United States Department of Agriculture NRCS offers funding through its Environmental Quality Incentives Program, and certain WMDs have agricultural cost share programs. Applicants are encouraged to use OAWP cost share in conjunction with other available conservation programs although funding cannot be duplicative.

This, and other BMP manuals, can be accessed electronically at:
https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Best-Management-Practices

Guide to Best Management Practice (BMP) Program Enrollment and Implementation

When enrolling, FDACS OAWP representatives will work with producers during an enrollment site visit.

Getting Started

1) **Request On-farm Technical Assistance.** Contact FDACS OAWP representatives for assistance with determining the BMPs that are applicable to the operation. For free assistance, call (863) 467-3250, email AgBmpHelp@FDACS.gov, or contact an FDACS OAWP office.

2) **Identify Applicable BMPs.** FDACS OAWP representatives will work with producers during the enrollment site visit to identify all BMPs that are applicable to the operation and to document the BMPs on the NOI and BMP Checklist. The BMP Checklist will serve as the basis for subsequent IV site visits to verify the proper implementation of the BMPs. As part of IV site visits, the BMP checklist will be updated as necessary to identify applicable BMPs that reflect the operation at the time of the IV site visit. If applicable, FDACS OAWP representatives will review other supporting materials such as an NRCS Comprehensive Nutrient Management Plan or FDEP approved Nutrient Management Plan for biosolids application.

   Enrollees under an Equivalent Program listed in Rule 5M-1.001(7), F.A.C., will complete, update, and submit their NOI in accordance with Rule 5M-1.004(3), F.A.C.

3) **Submit an NOI.** FDACS OAWP representatives will assist producers in completing the NOI. Once the producer signs and submits the NOI with all the required information and the BMP Checklist or documentation required of Equivalent Program Enrollees in accordance with Rule 5M-1.004(3), F.A.C., FDACS will review the information for completeness and enroll the Producer's operation in the BMP Program.

4) **Properly Implement the BMPs.** Producers must properly implement all applicable BMPs as soon as practicable, but no later than 18 months after completion and execution of the NOI and associated BMP Checklist.

   BMPs indicated as “Planned” in the BMP Checklist must include a completion date. Enter the completion date agreed to by the producer and FDACS OAWP representatives in the “Planned” box. Projects must be initiated as soon as the BMP is identified and cost share is available. The deadline for implementing BMPs that require cost sharing, engineering and design, permitting, or construction will be extended beyond 18 months, as needed. The proper implementation of BMPs requires ongoing record keeping and maintenance of BMPs (see the *Record Keeping* section below).

   Proper implementation of the applicable nutrient management BMPs also requires that producers demonstrate that N and P are applied at appropriate agronomic rates, when available. Producers should utilize the appropriate calculations and technical assistance tools to demonstrate that nutrient management practices are compatible with appropriate agronomic rates.

For Enrollees under an Equivalent Program listed in Rule 5M-1.001(7), F.A.C., implementation verification shall be undertaken by the agency that issued the permit, license or other instrument, pursuant to its statutory and/or rule authority.

Preparing for a Site Assessment/Enrollment Visit

1) Review the BMP manual and note any question(s) regarding the specific BMPs, unfamiliar terms, or content. Be ready to confirm the parcels of land to be enrolled in the BMP Program to ensure the accuracy of the information that will be submitted on the NOI.
2) During the site visit, the FDACS OAWP representatives will assist the producer with identifying potential pollutant sources and the most likely pathways to surface waters and groundwater. Representatives may ask to review previous soil tests, past fertilization practices, and other data to help with identification.
3) The FDACS OAWP representative will observe production-related activities near water resources such as wetlands, streams, sinkholes, springs, ponded or poorly drained areas, and any conveyances that discharge off site, and will discuss the BMPs that apply to these areas. Having a preplanned route will make the assessment and enrollment process more efficient.

The following web resources can be helpful for creating an inventory of the property's natural features, structures, and other improvements. The reference material listed below is for informational purposes and is not incorporated by reference:

- United States Department of Agriculture Natural Resources Conservation Service (NRCS) soil survey maps (http://websoilsurvey.nrcs.usda.gov/app/).
- United States Geological Survey topographic maps (https://www.usgs.gov/programs/national-geospatial-program/topographic-maps).
- National Wetlands Inventory (http://www.fws.gov/wetlands/).
- County Property Appraiser (http://floridarevenue.com/dor/property/appraisers.html).

Make sure that someone who is familiar with the nutrient and irrigation regimen of the operation is available on the day of the enrollment site visit.

Record Keeping

Enrollees who submit a Checklist must document the proper implementation of the applicable BMPs and producers must keep records in accordance with Rule 5M-1.011, F.A.C., for BMPs noted with the pencil icon ( ) on the BMP Checklist. Examples of records to be kept include the rates and locations of all N and P applications and all soil test results. All BMP records should be accurate, clear, and well-organized. Record keeping examples are provided in Appendix 3 but are not adopted as a rule.

Enrolled producers must retain the applicable records for at least five years. Enrolled producers shall use the NARF, incorporated by reference in Rule 5M-1.008(4), F.A.C., or a substantially similar form that meets the criteria therein, to aggregate nutrient records. Enrolled producers are required to provide records regarding the application of N and P fertilizers on the enrolled property parcel to FDACS. The NARF will be collected and retained by FDACS during an implementation verification site visit every two years. Producers must maintain aggregate records in electronic or digital form unless justification is provided as to why the use of electronic or digital recordkeeping is not feasible. Although OAWP has developed a producer recordkeeping tool that may be used, it is not the only tool that can be used to meet this requirement.

All documentation required to verify the proper implementation of applicable BMPs are subject to inspection. Please note that falsification of records is a first-degree misdemeanor under Florida law.

In accordance with section 403.067(7)(c)6., F.S., agricultural records relating to processes or methods of production, costs of production, profits, other financial information, or N and P fertilizer application records collected by the Department during implementation verification are confidential and exempt from disclosure. Any such claim must be asserted at the time of submission by stamping the words “confidential and exempt information” on each page containing such information so the Department may handle them appropriately.

Best Management Practices (BMP) Checklist

BMP Checklist Instructions

With the exception of those enrolling under one of the Equivalent Programs listed in Rule 5M-1.001(7), F.A.C., producers must work with an FDACS representative to identify the applicable BMPs to be implemented on the subject parcel and to complete the BMP Checklist. Refer to the *Guide to BMP Program Enrollment and Implementation* section above. Failure to properly implement the applicable BMPs may subject your operation to compliance measures including referral to FDEP for enforcement.

1) Check "In Use" for BMPs that are currently being implemented and can be observed on the operation at the time of enrollment or the IV site visit.

2) Check "Planned" for BMPs that will be implemented within a specific timeframe, but no later than 18 months after completion and execution of the NOI. ***The producer understands that they are expected to implement this practice by the completion date entered into the "Planned" box. Projects must be initiated as soon as the BMP is identified and cost share becomes available. However, the deadline for implementing BMPs that require cost sharing, engineering and design, permitting, or construction will extend beyond 18 months as needed. Include practices that can't be observed at the time of site visit.***

3) Check "N/A" for BMPs that are not applicable to the operation. This status may be selected for individual BMPs or categories of BMPs where N and P are not applied in any form (Nutrient Management section), or where the operation does not include an irrigation system (Irrigation Management section). Producers are required to provide justification for any BMPs that are marked "N/A."

4) Enter the anticipated completion date for any planned practices (month and year) in the "Planned" box of the BMP Checklist during enrollment.

5) Producers must keep records of items indicated on the BMP Checklist. BMPs that require record keeping are noted by the pencil icon (✏). Enrolled producers are required to provide records upon request for review during a BMP implementation verification site visit. The NARF will be collected during the IV site visit by the FDACS representative.

6) After completion of all of the above steps, including the site visit and assessment, Producers are enrolled upon submitting to FDACS the NOI and the BMP Checklist. Producers enrolling under one of the Equivalent Programs are enrolled upon submitting to FDACS the NOI and documentation required of Equivalent Program Enrollees in accordance with Rule 5M-1.004(3), F.A.C. FDACS will provide written confirmation of enrollment. Keep a copy of each document.

7) Producers will work with the FDACS representative to modify the NOI or BMP Checklist, if needed, after initial enrollment. FDACS will provide written confirmation of any proposed changes.

Best Management Practices (BMPs) Checklist for Vegetable and Agronomic Crop Operations

The producer agrees to implement the following items either checked as “In Use”, “Planned”, or “N/A”:

Nutrient Management					
Do you apply nitrogen (N) or phosphorus (P) or plan to apply N or P in any form on the operation associated with this NOI?			**Yes**	**No**	**-**
			In Use	**Planned**	**N/A**
1.1	**Right Source**				
	1	If using commercial fertilizer (including Class AA biosolids), identify and document the nitrogen (N) and phosphorus (P) concentrations using the guaranteed analysis or product label information prior to application.			
	2	If using Class A or Class B biosolids follow the requirements of the FDEP permit.			
	3	If using reclaimed water and the supplier provides the nutrient content, adjust N and P fertilization rates as appropriate.			
1.2	**Right Rate**				
	1	Perform soil tests, tissue tests, or both to appropriately plan and manage fertilizer applications.			
	2	Use a soil extraction method listed in Appendix 2 appropriate for the soil type to perform soil test in 1.2.1. The use of other soil extraction methods must be approved by FDACS. Maintain documentation to justify using that method.			
	3	Regardless of which soil extraction method is used, base the P fertilization rate on recommended rates in the crop specific University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) publication(s), where available, or another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop). Supplemental application may be justified based on current tissue testing results, soil variability, P availability, cultivar-specific requirements, or other substantiated production data that demonstrate crop need. Maintain documentation to support application amounts, particularly documentation used to justify application amounts above the recommended rates.			
	4	Base the N fertilization rate on recommended rates in the crop-specific UF/IFAS publication(s), where available, or another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop). Supplemental application may be justified based on current tissue testing			

		results, results from other technological testing methods, cultivar-specific requirements, or other substantiated production data that demonstrate crop need. Maintain documentation to support application amounts, particularly documentation used to justify application amounts above the recommended rates.			
	5	Record data, using the NARF or similar form, of all nutrient applications that contain N or P, including the date, and total N and P_2O_5 applied to each field.			
1.3	**Right Time**				
	1	Match plant growth stage N and P requirements and minimize N and P loss through leaching or runoff by using seasonal applications, split applications, or controlled release/enhanced efficiency fertilizer. If rainfall exceeds 3 inches in 3 days or 4 inches in 7 days, Producers may apply a single supplemental application of N (up to 30 pounds per acre). This supplemental application must occur as soon as practicable following the event but cannot occur within 10 days of the next regularly scheduled application of N. Producers must keep copies of all application records as well as rainfall data and any other records used to justify the supplemental N application.			
1.4	**Right Place**				
	1	Ensure all fertilizer application equipment is calibrated according to manufacturer's specifications for the type of fertilizer being used.			
	2	Prevent application of fertilizer or other nutrient sources directly to surface waters and sinkholes.			
1.5	**Fertilizer Storage and Handling**				
	1	Store fertilizer material (defined as all composted animal waste, biosolids and/or commercial N or P sources) under a waterproof cover unless used or applied as soon as practicable after delivery.			
	2	Load fertilizer at a location and in a manner that prevents adverse effects on surface waters or sinkholes.			
1.6	**Additional Nutrient Management BMPs for VAC Operations**				
	1	If the operation applies manures, poultry litter, compost, or other substances that contain N or P to promote plant growth, determine and document N and P concentrations of the materials prior to application and record per NARF requirements. For application of materials associated with the processing of crops, follow BMP 1.6.5.			
	2	Tissue test (leaf/petiole) results may be used to determine the need for supplemental fertilizer			

		applications, to evaluate the effectiveness of fertilization programs, and to diagnose nutrient deficiencies. Use methods from UF/IFAS to interpret the tissue test results (such as Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida, https://edis.ifas.ufl.edu/publication/EP081), where available, or other credible sources of information with scientific support. If using tissue testing, keep a copy of all test results and documentation of how the test results are used.			
	3	Use automated or manual shutoff valves on the fertilizer equipment so that no fertilizer is applied in the turn row or other non-production areas.			
	4	For crops planted at grade, utilize tools such as a row marker, global positioning system (GPS) lightbars or other GPS navigation instruments to reduce application overlap.			
	5	Wherever material associated with processing of crops is incorporated into the fields, the applicable soil sampling consistent with 1.2.1 through 1.2.4 shall be performed after the incorporation of the materials and before subsequent fertilization. The producer using this BMP must also implement BMPs 3.4.1, 3.4.2, 3.4.3, 3.4.5, and 3.4.6.			
Irrigation Management					
Do you have an irrigation system or plan to install an irrigation system associated with this NOI?			**Yes**	**No**	**-**
	If you answered "Yes" to the previous question, is the system pressurized?		**Yes**	**No**	**-**
			In Use	**Planned**	**N/A**
2.1	**Crop Water Requirements and Irrigation Scheduling**				
	1	Manage irrigation based on electrical soil moisture sensors equipped with electrical capacitance probes. If electronic soil moisture sensors are not used, follow practices 2.1.2 or 2.1.3 below.			
	2	Maintain the water table (saturated zone) at a level in proximity to plant rooting depths when using seepage irrigation.			
	3	Use decision support tools and information to plan irrigation events and describe these tools in the Comments line below. Tools may include weather stations, rain gauges, or others.			
COMMENTS					
2.2	**Irrigation System Maintenance and Evaluation**				
	1	Contact a Mobile Irrigation Laboratory (MIL) or other qualified analyst approved in writing by FDACS to schedule an irrigation efficiency evaluation of your pressurized irrigation system at least every five years.			

	**2**	Keep records of MIL evaluations, recommendations, major maintenance and repairs, and system changes made to comply with MIL recommendations.			
	3	Establish minimum efficiencies and timeframes for repair and recheck, depending on system.			
	4	Clean and maintain filtration equipment so that it operates within the recommended pressure range.			
	5	Inspect sprinkler nozzles or emitters annually for wear and malfunction and replace as necessary.			
	6	Flush and treat irrigation lines regularly to prevent clogging.			
	7	Ensure that flow meters are properly calibrated and correctly measuring water usage, or use other acceptable methodologies.			
2.3	**Additional Irrigation Management Practices Specific to VAC Operations**				
	1	For center pivot irrigation systems, install low-pressure irrigation sprinklers with drops and speed and/or zone variable rate controls.			
	2	When utilizing frost/freeze protection for crops using seepage irrigation, raise water tables by increasing water levels in irrigation ditches and canals. Do not raise water levels beyond field capacity.			
	3	When producing strawberries and using the sprinkler irrigation system for frost/freeze protection, monitor wet-bulb temperatures to determine when to turn off the system.			
Water Resource Protection					
			In Use	**Planned**	**N/A**
3.1	**Stream and River Protection**				
	1	On fields adjacent to perennial streams, rivers, or regional canal systems flowing through the enrolled property, use riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips that are not less than 25 feet wide.			
	2	Maintain the above riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips to ensure those features function as designed.			
	3	Revegetate bare areas in the above riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips if the bare areas reduce the function of the buffer.			
3.2	**Springs and Sinkholes**				
	1	Buffer springs and spring runs with a minimum of 100 feet of non-fertilized vegetation.			

	2	Buffer sinkholes and other visible karst features with a minimum of 50 feet of non-fertilized vegetation.			
	3	Never dispose of any materials into sinkholes.			
	4	In Outstanding Florida Springs BMAPs adopted by FDEP, do not exceed appropriate fertilizer rates for N, based on crop nutrient requirements as described in practice 1.2.4 above.			
3.3	**Wetlands and Lakes**				
	1	Buffer wetlands with a minimum of 35 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.			
	2	Buffer impaired waterbodies located within adopted BMAP areas with a minimum of 50 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.			
	3	If fencing through wetlands, keep cleared areas for fencing no wider than 25 feet.			
3.4	**Ditch and Canal Maintenance and Water Management**				
	1	Maintain perennial herbaceous vegetation on all ditch and canal banks to protect them from erosion or provide an alternative means for preventing sediment from moving off site.			
	2	When sediments are observed in runoff moving off site, work with FDACS to evaluate the feasibility of implementing appropriate settling measures.			
	3	Operate and maintain water control structures to minimize the movement of N, P, and sediments off site.			
	4	Operate and maintain water control structures to minimize the admission of aquatic vegetation into downstream public waterways.			
	5	Do not remove sediments below the ditch's original invert elevation unless installation or maintenance of sumps or sediment traps is required. Original invert elevations can be determined by engineering drawings or changes in soil characteristics and color.			
	6	Ensure that pump intakes are sufficiently elevated from the bottom of water conveyances, or consistent with an ERP to reduce sediment and debris in offsite discharges.			
3.5	**Erosion Control**				
	1	Construct and maintain above-grade access roads so that they minimize the impeding or diversion of surface water flow.			
	2	Maintain vegetative cover or alternative means for stabilizing road banks to prevent sediments from moving off site. Describe the alternative means in the Comments section.			

	3	Locate and size permanent crossing areas over surface waters to minimize adverse effects to water resources.			
	4	Stabilize all crossings over streams and creeks using rocks, culverts, or bridges or other methods to prevent erosion.			
3.6	**Wellhead Protection**				
	1	Inspect wellheads and pads for significant leaks or cracks and make any necessary repairs.			
	2	Prevent contamination by using backflow prevention devices at wellheads if injecting fertilizer or chemicals, or if shared with a potable use source.			
	3	Cap or valve any existing flowing wells.			
3.7	**Non-Fertilizer Material Storage and Handling**				
	1	Store pesticides separate from fertilizers in an enclosed, roofed structure with an impervious floor and lockable door, at least 100 feet away from wells, surface waters, or sinkholes.			
	2	Mix and load pesticides on an impermeable surface, use portable mix/load stations, or conduct any field mix/load activities at random locations in the field.			
	3	Recycle or properly dispose of used oil, solvent bath waste, and antifreeze in accordance with state and federal laws.			
3.8	**Additional Water Resource Protection Practices for VAC Operations – Well Operation and Protection**				
	1	Near Homestead, Miami-Dade County, in the identified “Threshold Area” on page 1 of the Handbook for the Voluntary Retrofit of Open, Uncased Agricultural Wells (1997) (incorporated in Rule 5M-8.002(2), F.A.C.), use the criteria in the Handbook to address open bore wells to ensure the Biscayne aquifer is protected.			
3.9	**Additional Water Resource Protection Practices for VAC Operations – Erosion Control**				
	1	For plastic mulch production systems, cleanup and remove plastic as soon as practicable after the last harvest to help reduce runoff effects.			
	2	For plastic mulch production systems, use a combination of vegetative cover and/or geo-fabric material to stabilize the ground at the downstream side of mulch rows.			
	3	For plastic mulch production systems, install plastic covered spillways where cross ditches flow into lateral ditches.			
	4	Use a conservation practice such as cover crop or previous crop residue to protect soils during non-production or fallow periods.			

	5	On highly erodible soils, implement conservation tillage techniques such as strip till and no till.			
	6	On highly erodible soils, where erosion control problems exist despite implementing conservation tillage techniques, implement diversion and terrace control techniques.			
	7	Use deep tillage to penetrate and break tillage pan layers in fields that are cultivated, as needed.			
	8	Use laser leveling to re-grade fields that historically have not drained well or that have correctable erosion issues.			
COMMENTS					

Part B

Best Management Practices for VAC Operations

The purpose of the narrative set forth below is to provide information for producers to consider while implementing the BMPs established in their BMP Checklist and to assist in planning, development, and production efforts for their operation. The contents of the narrative shall not be interpreted or construed as creating additional obligations or requirements that exceed the BMPs detailed in the BMP Checklist. The reference materials cited in the narrative have been utilized for technical and scientific support for the manual but are not incorporated by reference herein.

In implementing BMPs, it is recognized that each producer's operation is unique and individual. The information set forth in the manual is not exhaustive and does not address or identify all the factors that may affect production practices and land management for VAC operations. Producers may determine that it may be necessary to add practices to the BMP Checklist to fit specific production unit needs. In doing so, the producer may consult the BMP manual and other publications and information as part of the analysis of the site's individual characteristics, historical uses, economic and technical considerations, market factors, and changes in production.

1.0 Nutrient Management

Beneficial nutrient management decisions for VAC production are based on consideration of nutrient inputs including commercial fertilizers, organic materials like manure, compost and biosolids, and any irrigation water used (especially reclaimed water). Producers are encouraged to develop a nutrient management plan for the operation to reduce potential effects on water resources.

The 4Rs of Nutrient Management

The scientific principles of the 4R nutrient stewardship framework involve applying the ***Right Source*** of fertilizer at the ***Right Rate,*** at the ***Right Time,*** and in the ***Right Place.*** The effective application of the 4R framework depends on site-specific characteristics such as soil type, cropping system, management techniques, and weather. The 4R nutrient stewardship provides a framework to achieve cropping system goals, such as increased production, increased farmer profitability, enhanced environmental protection and improved sustainability. The 4R nutrient stewardship framework requires the implementation of BMPs that optimize the efficiency of fertilizer use. The goal is to match nutrient supply with crop requirements and to minimize nutrient losses from fields while taking into consideration local soil and climatic conditions, crop, management conditions and other site-specific factors.

Other agronomic and conservation practices such as no-till farming and the use of cover crops play a valuable role in supporting the 4R nutrient stewardship framework. As a result, fertilizer BMPs are most effective when applied with other agronomic and conservation practices.

1.1 Right Source: Nutrient Composition and Bioavailability

	**Right Source 1.1.1.**	If using commercial fertilizer (including Class AA biosolids), identify and document the nitrogen (N) and phosphorus (P) concentrations using the guaranteed analysis or product label information prior to application.

Guidance: The right source involves ensuring an adequate supply of nutrients in plant-available forms by using the right product based on specific crop needs. Nutrients may already be available in the soil (e.g., if cover crops were planted) but soil properties may interact with certain fertilizer sources to affect nutrient availability. Commercial nutrient sources include liquid,

dry, solution, and enhanced efficiency fertilizers (EEF). Conventional fertilizers are usually formulated as water soluble products. An EEF is a blanket term for fertilizers with characteristics that allow for increased plant uptake while reducing the potential for nutrient losses to the environment compared with soluble fertilizers. EEFs may be slow release such as sulfur-coated urea, animal manures, and biosolids; controlled release, such as polymer-coated urea; or stabilized N sources such as urease and nitrification inhibitors.

VAC producers commonly use fertilizer materials that contain both N and P sources. Examples of such fertilizer sources include di-ammonium phosphate or mono-ammonium phosphate. In general, P and liming materials (if necessary) are applied prior to planting, and N is applied during the growing season in multiple or spilt applications. For multi-year crops, the application of P can be repeated every year after harvesting by following the calibration curve developed for the crop and the soil test conducted prior to planting. Phosphorus is also commonly available as single super phosphate or triple super phosphate.

	**Right Source 1.1.2.**	If using Class A or Class B biosolids, follow the requirements of the FDEP permit.

Guidance: Biosolids are sometimes used to beneficially recycle nutrients that may otherwise go to waste. Biosolids mineralize nutrients slowly over time and may provide value for soil health in mineral soils due to the organic matter content. If using biosolids, the nutrient and pH analysis must be obtained from the wastewater treatment plant or permitted hauler before application. Application of class AA biosolids, which are regulated as fertilizer and are labeled with a guaranteed analysis, are addressed in BMP 1.1.1. Producers must consider the N to P ratio when applying biosolids at appropriate agronomic rates to avoid over-application of P.

Any land on which Class A or Class B biosolids are applied must meet FDEP requirements contained in Rule Chapter 62-640, F.A.C. Biosolids must be applied at the proper agronomic rate, as required in the FDEP permit, with consideration of both plant-available N and P. The appropriate application rate must be based on actual production, and the specific plant species and utilization.

	**Right Source 1.1.3.**	If using reclaimed water and the supplier provides the nutrient content, adjust N and P fertilization rates as appropriate.

Guidance: VAC producers using reclaimed water on their operations may obtain copies of the wastewater treatment facility's permit, which outlines the authorized range of nutrients allowed in the final effluent and use this information to adjust fertilization rates.

1.2. Right Rate: Calculating application rates using soil and tissue testing

	**Right Rate 1.2.1.**	Perform soil tests, tissue tests, or both to appropriately plan and manage fertilizer applications.

Guidance: Appropriate rates of N or P application for crops are determined using recommended rates in the crop-specific UF/IFAS publication(s), where available, or based on another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop) and accounting for soil test results prior to planting. Additional N and P may be justified during the growing cycle based on plant tissue testing results. Soil testing can provide pH values, indices of phosphorus, potassium, calcium, and magnesium, micronutrients available in

the soil, and nutrient rate recommendations for VAC production needs. Nitrogen is not analyzed in soil tests in Florida because it changes forms and is highly mobile. Instead, recommended N application rates are based on many years of crop research. For crops other than multi-year crops, a soil test that is less than one year old is required and must demonstrate a need for P prior to any application of P. Multi-year crops can utilize a calibration curve for subsequent application of P based on the soil test taken before planting. If not applying P, it is still good practice to conduct soil tests every three to five years on established VAC fields to gauge changes that may occur over time, especially changes in soil pH.

Soil pH is one of the most important properties that affect nutrient availability to the plant and soil microbial activity. Soil pH can be increased by adding lime or dolomite, or lowered by adding acidifying materials like elemental sulfur or ammonium fertilizer. The pH of irrigation water should also be considered as it can affect soil pH over the long term. Producers can use soil test results to determine the existing pH and identify the soil amendments that may be required to improve uptake of N and P. Consider crop nutrient requirements and other current conditions before adding amendments to adjust soil pH.

Plant tissue testing can be used during the growing cycle to diagnose the overall effectiveness of a fertilization program and determine possible corrections for subsequent fertilizer supplementation. Due to the mobility of most essential nutrients in soils, plant tissue analysis is a useful indicator of plant health and nutrition. Potential nutrient deficiencies can be detected with tissue analysis before visual symptoms appear. Leaf tissue analysis may also provide information on induced deficiencies and inferences on plant uptake. UF/IFAS EDIS publications (http://edis.ifas.ufl.edu/) provide tables and information on nutrient sufficiency ranges for vegetable and agronomic crops.

When producing crops utilizing raised bed, mulched cultural systems, use the linear bed foot (LBF) system to convert from pounds/acre to pounds/100 LBF, after determining the typical bed spacing. More information regarding the LBF method can be found in UF/IFAS Publication SL 303.

	**Right Rate 1.2.2.**	Use a soil extraction method listed in Appendix 2 appropriate for the soil type to perform soil test in 1.2.1. The use of other soil extraction methods must be approved by FDACS. Maintain documentation to justify using that method.

Guidance: When submitting soil samples, request the appropriate soil test extraction method based on soil type (see Appendix 2). If a method other than those set forth in Appendix 2 is requested, be prepared to provide justification for the method used. Follow the fertilization rates in UF/IFAS Publications applicable to the crops you are producing, where available, or another credible source with scientific support such as a calibrated crop response curve for the soil type and crop. Retain all documentation used.

	**Right Rate 1.2.3.**	Regardless of which soil extraction method is used, base the P fertilization rate on recommended rates in the crop specific University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) publication(s), where available, or another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop). Supplemental application may be justified based on current tissue testing results, soil variability, P availability, cultivar-specific requirements, or other substantiated production data that demonstrate crop need. Maintain documentation to support application amounts, particularly

		documentation used to justify application amounts above the recommended rates.

Guidance: Many of Florida's soils may contain adequate amounts of P, assuming the soil pH is within the correct range to make it available to plants. Managing pH may be impracticable for some commodities. Further, pH may not be the best indicator of P availability in organic and mineral soils in Florida. Applying P in starter fertilizer is warranted. Otherwise, supplemental P is only applied when supported by a calibrated soil test or by tissue testing results or when substantiated production data, such as yield, delayed harvest conditions, or marketable crop quality, demonstrate the need for supplemental P.

	**Right Rate 1.2.4.**	Base the N fertilization rate on recommended rates in the crop-specific UF/IFAS publication(s), where available, or another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop). Supplemental application may be justified based on current tissue testing results, results from other technological testing methods, cultivar-specific requirements, or other substantiated production data that demonstrate crop need. Maintain documentation to support application amounts, particularly documentation used to justify application amounts above the recommended rates.

Guidance: Nitrogen is the most limiting nutrient for crops that don't fix N from the atmosphere. The amount of N required by vegetable plants must be applied each growing season because residual N is lost to the environment through several pathways. Nitrogen requirements vary among crops and are not dependent on soil test results. Analysis of plant tissues (e.g., leaves or petioles) for nutrient concentrations is a good tool for monitoring nutrient status of a crop during the growing season and can provide justification for supplemental fertilization in the current or subsequent crop cycles. There are two main approaches to plant tissue testing: standard laboratory analysis and the plant sap testing procedures. Standard laboratory analysis involves analyzing the most recently matured leaf of the plant for an array of nutrients. The resulting analyses are compared against published adequate ranges for that crop. Laboratory results that fall outside the adequate range for that nutrient may indicate either a deficiency or toxicity (especially in the case of micronutrients). Substantiated production data, such as yield, delayed harvest conditions, or marketable crop quality, can also be used to demonstrate the need for supplemental N.

	**Right Rate 1.2.5.**	Record data, using the NARF or similar form, of all nutrient applications that contain N or P, including the date, and total N and P_2O_5 applied to each field.

Guidance: Producers must have all required nutrient records ready for FDACS representatives to inspect. The FDACS representative will retain the NARF pertaining to N and P application. When IV site visits are conducted every two years, producers are required to have the following nutrient records ready for inspection to ensure compliance with BMPs:

- Soil and tissue test results as required for each field being fertilized which clearly indicate the crop being grown.
- Justification for using the selected soil test method.
- Area fertilized in acres for each field.

- Amount of fertilizer applied to each field in gallons if using liquid fertilizer or in pounds if using dry fertilizer.
- Fertilizer receipts with formulation, and the density of liquid fertilizer if used.

1.3. Right Time: Timing of fertilizer application

Right Time 1.3.1.	Match plant growth stage N and P requirements and minimize N and P loss through leaching or runoff by using seasonal applications, split applications, or controlled release/enhanced efficiency fertilizer. If rainfall exceeds 3 inches in 3 days or 4 inches in 7 days, Producers may apply a single supplemental application of N (up to 30 pounds per acre). This supplemental application must occur as soon as practicable following the event but cannot occur within 10 days of the next regularly scheduled application of N. Producers must keep copies of all application records as well as rainfall data and any other records used to justify the supplemental N application.

Guidance: Schedule fertilizer applications based on the dynamics of VAC growth and nutrient demand during the growing season, nutrient loss risks, and field operations. Forecasted rain, potentially leaching rain events (when rainfall exceeds 3 inches in 3 days or 4 inches in 7 days), and other weather events must be considered before applying N or P to VAC fields. Avoid applying fertilizer in the days preceding forecasted, potentially leaching rain events or when soils are saturated. Supplemental application of N following a leaching rain event should not be considered a standard practice. Producers should carefully evaluate previous and planned applications of N and their specific situation to determine whether supplemental N is needed following a potentially leaching rain event.

Splitting N or P into several, smaller applications can help maintain available nutrients to the crop for longer time periods and minimize leaching or runoff following rain events. The use of EEFs or organic soil amendments that depend on biological processes to release nutrients also reduces risks to water quality when properly managed. The use of EEF sources also influences the timing of fertilization, in that fertilization is required less frequently.

1.4. Right Place: Fertilizer application and equipment calibration

	**Right Place 1.4.1.**	Ensure all fertilizer application equipment is calibrated according to the manufacturer's specifications for the type of fertilizer used.

Guidance: Regular equipment calibration helps ensure proper fertilizer placement. Calibration methods vary based on the type of fertilizer and fertilizer application equipment used. For granular materials, it may be necessary to recalibrate equipment whenever using a new material that has different particle density, size, or flow characteristics. Calibrate equipment according to the manufacturer's recommendations and whenever wear or damage is suspected to have altered the delivery rate or pattern. When using a spreading service, ensure that the service provider has calibrated the equipment for your site specifications.

Right Place 1.4.2.	Prevent application of fertilizer or other nutrient sources directly to surface waters and sinkholes.

Guidance: Target nutrient applications in or very near the root zone to maximize plant uptake and limit potential losses from the field. Producers must not apply nutrient sources directly into surface water resources and must observe the applicable setbacks established in this manual. Consult with your FDACS representative to identify those water resources and associated areas where the application should not occur.

Many producers use precision agriculture tools, such as global positioning systems (GPS) and associated navigation instruments (e.g., light-bar system) to guide field application equipment more precisely. Fertilizers can be applied at variable rates throughout a field for more efficient application to reduce water quality effects and provide cost savings.

1.5. Fertilizer Storage and Handling

Fertilizer Storage and Handling 1.5.1.	Store fertilizer material (defined as all composted animal waste, biosolids and/or commercial N or P sources) under a waterproof cover unless used or applied as soon as practicable after delivery.

Guidance: Fertilizer material (defined as all composted animal waste, biosolids, and/or commercial nutrient sources) can be a significant source of water pollution if not properly handled. Protect fertilizer material from rainfall and other risks for nutrient leaching by covering with impervious material or storing under a roof unless justification is provided (such as sampling or monitoring) to demonstrate that existing storage will not result in nutrient leaching to water resources. Fertilizer materials should be stored on an impervious surface unless it is demonstrated that it is adequately protected from rainfall and water flowing across the property. Nitrogen-based fertilizer material must always be stored separately from solvents, fuels, and pesticides since many fertilizers are oxidants and can accelerate a fire. When feasible, it is advisable to order or stock only as much dry fertilizer material as needed per application.

Fertilizer Storage and Handling 1.5.2.	Load fertilizer at a location and in a manner that prevents adverse effects on surface waters or sinkholes.

Guidance: Load fertilizer into application equipment away from wells or waterbodies to prevent possible runoff and water quality effects. Loading over a concrete or asphalt pad with rainfall protection is the preferred practice and makes it easier to recover any spilled material. If this is not feasible, load at random locations in the field to prevent a buildup of any spilled nutrients in one location. Clean up spilled material immediately. Collected material may be applied as fertilizer.

1.6 Additional Nutrient Management BMPs for VAC Operations

	**Additional Nutrient Management BMPs for VAC Operations 1.6.1.**	If the operation applies manures, poultry litter, compost, or other substances that contain N or P to promote plant growth, determine and document N and P concentrations of the materials prior to application and record per NARF requirements. For application of materials associated with the processing of crops, follow BMP 1.6.5.

Guidance: Organic nutrient sources like manure or compost may change soil characteristics and affect how efficiently plants utilize the available nutrients. Organic sources should be tested in a laboratory to determine their nutrient concentration before application. In some cases, NRCS

guidelines or other reference values may be used in lieu of individual testing. Book values exist for commonly used sources of organic materials, such as manures, poultry litter, etc. Producers may use the book value table available from FDACS for guidance to calculate the pounds of N or P applied per acre, but must provide verifiable documentation supporting calculations of the applied amounts of nutrient sources without an analysis. If using manure or compost, identify the type so that book value calculations can be easily verified by FDACS representatives. Regardless of how the nutrient value is determined, these materials must be applied in accordance with appropriate agronomic rates.

	**Additional Nutrient Management BMPs for VAC Operations 1.6.2.**	Tissue test (leaf/petiole) results may be used to determine the need for supplemental fertilizer applications, to evaluate the effectiveness of fertilization programs, and to diagnose nutrient deficiencies. Use methods from UF/IFAS to interpret the tissue test results (such as Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida, https://edis.ifas.ufl.edu/publication/EP081), where available, or other credible sources of information with scientific support. If using tissue testing, keep a copy of all test results and documentation of how the test results are used.

Guidance: This BMP is used in conjunction with the other Right Rate BMPs and the guidance for BMP 1.2.1. applies.

	Additional Nutrient Management BMPs for VAC Operations 1.6.3.	Use automated or manual shutoff valves on the fertilizer equipment so that no fertilizer is applied in the turn row or other non-production areas.
	1.6.4.	For crops planted at grade, utilize tools such as a row marker, global positioning system (GPS) lightbars or other GPS navigation instruments to reduce application overlap.

Guidance: These BMPs are used in conjunction with the other Right Place BMPs and the guidance for BMP 1.4.2. applies.

	Additional Nutrient Management BMPs for VAC Operations 1.6.5	Wherever material associated with processing of crops is incorporated into the fields, the applicable soil sampling consistent with 1.2.1 through 1.2.4 shall be performed after the incorporation of the materials and before subsequent fertilization. The producer using this BMP must also implement BMPs 3.4.1, 3.4.2, 3.4.3, 3.4.5, and 3.4.6.

Guidance: Incorporation of material associated with processing of crops into fields is a customary agricultural practice. This material may be composted, provided it is not mixed with animal waste.

This agricultural practice:

- increases water retention, organic matter, and carbon storage;
- improves soil organism diversity and populations;
- reduces erosion and application of commercial fertilizers;
- serves to recycle agricultural materials;

- reduces soil subsidence; and
- leads to an improvement in soil health and quality.

Collectively, these benefits promote agricultural resilience and food security.

When the material is incorporated into the fields before planting, test the soil in accordance with the “right rate” BMPs, 1.2.1 through 1.2.4, and account for N and P concentration results from the soil test before subsequent fertilization. When the material is incorporated into the fields after planting, follow BMP 1.6.1.

2.0 Irrigation Management

Because water management and nutrient loading to surface and groundwater are linked, good irrigation management involves properly planning for water supply needs for VAC production, maintaining irrigation systems to ensure optimal performance, and protecting wellhead areas to prevent contamination of the water supply. VAC farms can demonstrate exemplary irrigation management by maintaining the water table at the ideal depth and by irrigating to sustain available soil moisture based on plant water requirements. Contact the appropriate WMD to determine whether a consumptive use or water use permit is required.

2.1. Crop Water Requirements and Irrigation Scheduling

Crop Water Requirements and Irrigation Scheduling 2.1.1.	Manage irrigation based on electronic soil moisture sensors equipped with electrical capacitance probes. If electronic soil moisture sensors are not used, follow practices 2.1.2 or 2.1.3 below.

Guidance: Soil moisture sensors are one of the best irrigation management tools available to VAC producers. These sensors can be equipped with probes that measure the electrical capacitance of the soil column and aid a producer with managing soil water content to meet the VAC production requirements. While soil plasticity has been used historically as an estimation of when to irrigate, such "feel tests" require training and experience and the interpretation is not as accurate or precise as using calibrated and maintained soil moisture sensors.

Crop Water Requirements and Irrigation Scheduling 2.1.2.	Maintain the water table (saturated zone) at a level in proximity to plant rooting depths when using seepage irrigation.

Guidance: Subsurface (seepage) irrigation involves raising the water table to a desired level by pumping water into ditches or canals and using water control structures to manipulate the water table and reduce the volume of discharge and sediments. Proper design is needed for an effective and efficient system. Ongoing maintenance is also needed to ensure that ditches and water control structures continue to function as designed. Cost share may be available to those producers that require additional water management as an applicable BMP to improve seepage irrigation efficiency to reduce discharges. A water table observation well is an inexpensive management tool used in some parts of Florida that provides a visual indication of surficial (near to the surface) groundwater levels.

Crop Water Requirements and Irrigation Scheduling 2.1.3.	Use decision support tools and information to plan irrigation events and describe these tools in the Comments line [on the BMP Checklist]. Tools may include weather stations, rain gauges, or others.

Guidance: Evapotranspiration (ET) and other climatic factors affect plant irrigation requirements. VAC may require different levels of irrigation depending on the growth stage and corresponding ET rates. Specific ET rates can be obtained for your growing area from the UF/IFAS Florida Automated Weather Network (FAWN) or by using other weather station data.

FAWN stations also measure air temperature, soil temperature, wind speed and direction, rainfall, relative humidity, and solar radiation. This information is available at: http://fawn.ifas.ufl.edu. Rainfall can also be easily monitored using rain gauges.

Irrigation scheduling consists of determining the correct timing, duration, and frequency of irrigation and is based on factors such as soil water-holding capacity, potential ET rates, and total and projected rainfall. Irrigation system water loss rates are affected by sunlight, wind speed, relative humidity, and air temperatures. Water loss can be reduced by irrigating when conditions do not favor excessive evaporation, especially when overhead irrigation systems are used. When possible, irrigate in the early morning before air temperatures rise and relative humidity drops. This allows sufficient time for infiltration into the soil and for the plant canopy to dry, thereby reducing evaporative losses and disease development. Apply only enough water to wet the entire root zone without leaching water, N, and P.

2.2. Irrigation System Maintenance and Evaluation

Irrigation System, Maintenance, and & Evaluation	**2.2.1.**	Contact a Mobile Irrigation Laboratory (MIL) or other qualified analyst approved in writing by FDACS to schedule an irrigation efficiency evaluation of your pressurized irrigation system at least every five years.
	**2.2.2.**	Keep records of MIL evaluations, recommendations, major maintenance and repairs, and system changes made to comply with MIL recommendations.
	2.2.3.	Establish minimum efficiencies and timeframes for repair and recheck, depending on system.
	2.2.4.	Clean and maintain filtration equipment so that it operates within the recommended pressure range.
	2.2.5.	Inspect sprinkler nozzles or emitters annually for wear and malfunction and replace as necessary.
	2.2.6.	Flush and treat irrigation lines regularly to prevent clogging.
	2.2.7.	Ensure that flow meters are properly calibrated and correctly measuring water usage, or use other acceptable methodologies.

2.3 Additional Irrigation Management Practices Specific to VAC Operations

	2.3.1.	For center pivot irrigation systems, install low-pressure irrigation sprinklers with drops and speed and/or zone variable rate controls.
	2.3.2.	When utilizing frost/freeze protection for crops using seepage irrigation, raise water tables by increasing water levels in irrigation ditches and canals. Do not raise water levels beyond field capacity.
	2.3.3.	When producing strawberries and using the sprinkler irrigation system for frost/freeze protection, monitor wet-bulb temperatures to determine when to turn off the system.

Guidance: The uniformity of water application and efficiency of an irrigation system tend to decrease over time because of aging, weathering, clogging, and component breakdown unless proper system maintenance is performed. The irrigation system itself should be well maintained and operated at the highest irrigation efficiency and uniformity that is practicable.

Maintenance programs for pressurized irrigation systems generally involve filtration, chlorination/acidification, flushing, repair or replacement of clogged nozzles, and observation of performance. If irrigation systems experience frequent clogging, source water sampling and

analysis should be performed to determine the best resolution as clogging significantly reduces irrigation efficiency. Irrigation systems that are well maintained help ensure uniform plant growth, conserve water, and reduce operation and maintenance costs.

Center-pivot systems typically have an end gun to reach the corner target areas of a field and are most efficient when equipped with an end gun shutoff to prevent water from being applied outside the target area. Consider soil type, soil slope, source water quality, and water needs when selecting a sprinkler package for one of these systems.

The most common sprinklers used on new systems are reduced-angle impact sprinklers (usually 6 degrees), low-pressure sprinklers on top of the irrigation boom, and low-energy, low-pressure precision drop nozzles. Each of these options uses less water than high-angle impact sprinklers, which are typically mounted on the top of the irrigation boom. Additional water conservation efficiencies can be achieved by removing non–crop areas from irrigation, matching application amounts with variations in soil type and field topography, and eliminating duplicative application due to pivot overlap. Variable rate irrigation technology includes speed control, zone control, or both, and is particularly well suited to center pivot irrigation systems and often results in reduced water use.

Even the best designed, most efficient irrigation system, whether overhead or seepage, will perform poorly if its components are not properly maintained. BMPs 2.2.1 through 2.2.7 and 2.3.1 apply to pressurized irrigation systems. Depending upon the extent of irrigation, mobile irrigation laboratories (MILs) will help VAC producers evaluate their pressurized system's irrigation uniformity and identify potential maintenance needs, free of charge. A pressurized system evaluation is required every five years. VAC producers should also develop and follow an irrigation maintenance program that includes periodic calibration of water meter(s), visual inspections to identify any necessary repairs or corrective actions, minimum efficiencies for pressurized systems, and maintenance timeframes. Producers are encouraged to keep records of all inspection and maintenance activities.

Agricultural irrigation water sources include groundwater, surface water, or alternative sources like reclaimed water. Water with elevated chloride and/or dissolved salt concentrations that has an electrical conductivity measurement greater than 1,200 micro-Siemens per centimeter can significantly stress plants, leading to low yield, leaf drop, dieback, and reduction in growth. This condition is especially true for irrigation systems that wet the plant canopy. Moreover, runoff from highly saline irrigation water may cause adverse effects on downstream water resources. It is good practice to obtain routine water quality analyses to help determine whether the water is appropriate to use on VAC.

Vegetable crops can be protected from frost/freeze using seepage and sprinkler irrigation, soil banking, and synthetic row covers. Even with the advent of row covers, most producers still use irrigation water to protect sensitive crops. When doing so, the proper application and timing of water is critical. FAWN has online tools to help determine under what climatic conditions your irrigation system can be used for frost and freeze protection (see http://fawn.ifas.ufl.edu/). It is also important that you remember to comply with any frost/freeze protection provisions in your WMD consumptive use/water use permit.

3.0 Water Resource Protection.

The following section describes several types of waterbodies and methods for protecting them from potential water quality effects.

3.1. Stream and River Protection

Stream and River Protection 3.1.1.	On fields adjacent to perennial streams, rivers, or regional canal systems flowing through the enrolled property, use riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips that are not less than 25 feet wide.
3.1.2.	Maintain the above riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips to ensure those features function as designed.

Guidance: One of the most effective ways to prevent P, N, sediments, and pollutants from entering streams and rivers is by establishing non-fertilized vegetated buffers**.** Vegetated buffers are non-cultivated areas that retain water and soil onsite to help reduce pollutants in surface water runoff. Vegetated buffers may include riparian buffers, field borders, filter strips, and grassed waterways, and are particularly effective in providing water quality treatment near sensitive discharge areas. Field borders are strips of either natural or planted permanent vegetation at the edge or perimeter of fields. Field borders help reduce erosion from wind and water, protect soil structure and water quality, and provide wildlife habitat. Filter strips and grassed waterways are areas of permanent vegetation between production areas that drain to natural waterbodies, decreasing runoff velocity and removing sediments and their associated nutrients before they reach surface waters.

Riparian buffers can consist of deep-rooted trees, shrubs, or forested area (Zone 1); herbaceous vegetation (Zone 2); and grass filter strips (Zone 3). While three separate zones are preferable, riparian buffers should consist of at least Zones 1 and 2. Refer to NRCS Conservation Practice Standard (CPS) Riparian Forest Buffer (Code 391) for details.

Stream and River Protection 3.1.3.	Revegetate bare areas in the above riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips if the bare areas reduce the function of the buffer.

Guidance: Riparian buffers are highly effective, although regular maintenance is required for them to remain so. Producers must inspect riparian buffers frequently and repair rills or channels that may develop following heavy rain. Revegetate bare areas to ensure the effectiveness of buffers.

3.2. Springs and Sinkholes

Springs and Sinkholes 3.2.1.	Buffer springs and spring runs with a minimum of 100 feet of non-fertilized vegetation.
3.2.2.	Buffer sinkholes and other visible karst features with a minimum of 50 feet of non-fertilized vegetation.

Guidance: Spring water directly reflects the quality of groundwater in an area. FDEP works with the WMDs and local stakeholders to define the major groundwater contributing areas for springs (i.e., springsheds), and to identify measures to help restore springs water quality in relevant BMAPs. Producers can protect spring water quality by preventing N from leaching past the root zone and into groundwater. Implementing the 4R principles and recommended irrigation management strategies will help VAC producers comply with groundwater and springs regulations.

Springs and Sinkholes 3.2.3.	Never dispose of any materials into sinkholes.

Guidance: Sinkholes provide direct access to the groundwater that supplies drinking and irrigation water; therefore, never use sinkholes to dispose of trash, clippings, or other material. Vegetated buffers around sinkholes and visible karst features may be required in some cases to prevent runoff into groundwater.

Springs and Sinkholes 3.2.4.	In Outstanding Florida Springs BMAPs adopted by FDEP, do not exceed appropriate fertilizer rates for N, based on crop nutrient requirements as described in practice 1.2.4 above.

Guidance: Part VIII, Chapter 373, F.S., includes more stringent springs protection requirements within an Outstanding Florida Springs (OFS) BMAP. VAC operations in BMAP areas are required to implement BMPs and to consider adopting new, emerging technologies to help protect springs and other water resources. Within OFS BMAPs, do not exceed appropriate agronomic rates for N, which is the limiting nutrient for springs and groundwater.

3.3. Wetlands and Lakes

Wetlands and Lakes 3.3.1.	Buffer wetlands with a minimum of 35 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.
3.3.2.	Buffer impaired waterbodies located within adopted BMAP areas with a minimum of 50 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.
3.3.3.	If fencing through wetlands, keep cleared areas for fencing no wider than 25 feet.

Guidance: Florida wetlands generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps, hydric seepage slopes, tidal marshes, mangrove swamps, and other similar areas. Use an NRCS county soil survey map to help identify the locations of wetlands, hydric soils, or frequently flooded areas. If you do not have an ERP (which requires a wetlands delineation map), seek technical assistance from the applicable WMD to determine if there are wetlands on the operation. Rule Chapter 62-340, F.A.C., provides the methodology that state and local governments in Florida use to determine the boundaries between wetlands and uplands and other surface waters.

Under certain conditions, enhancement or restoration of wetlands may be a BMP-eligible cost share practice or project to control N and P. For example, nutrient retention in wetland soils and in biomass can be an effective BMP to prevent loss of N and P off site. If considering this

approach, your local FDACS, NRCS, or WMD representatives can provide assistance and possible financial support. Do not dredge or fill in wetlands unless you are issued a permit or are determined to be exempt. It is important to consult with FDACS, the local WMD, and the NRCS prior to conducting activities in or near wetlands to ensure compliance with any permitting requirements or NRCS program eligibility requirements. Wetlands and lakes benefit from non-fertilized vegetated buffers. Fencing may also help protect or restore wetlands and lakes in some areas.

3.4. Ditch and Canal Maintenance and Water Management

Ditch and Canal Maintenance and Water Management 3.4.1.	Maintain perennial herbaceous vegetation on all ditch and canal banks to protect them from erosion or provide an alternative means for preventing sediment from moving off site.

Guidance: Many VAC operations use ditches to manage stormwater runoff from fields. Ditches can carry sediments, N, and P from fields into receiving waters. Ditches that are properly designed and maintained, however, provide treatment and minimize effects on water quality. In many cases, vegetation on ditch banks or in ditches will protect the ditches from erosion and trap sediments to prevent offsite transport downstream. When properly maintained, water control structures also help to slow the velocity of ditch water and prevent bank erosion. Retaining water in ditches promotes nutrient removal and sediment settling. Vegetated buffers along ditch and canal banks also help stabilize banks, and trap and reduce sediments, N, and P from entering these conveyances. Use care to minimize the buildup of culled vegetables, crop residue, or byproduct of VAC harvest in waterways and irrigation ditches, and never dump them in wetlands.

Ditch and Canal Maintenance and Water Management 3.4.2.	When sediments are observed in runoff moving off site, work with FDACS to evaluate the feasibility of implementing appropriate settling measures.

Guidance: Where water resource concerns are identified, producers must implement appropriate practice(s) which may include installation or management of existing water control structures to hold water on site. Doing this will improve the existing hydrologic conditions and reduce the runoff. Before installing new (non-replacement) water control structures, contact FDACS for technical assistance and cost share availability, and work with the representative to determine appropriate settling measures.

Ditch and Canal Maintenance and Water Management 3.4.3.	Operate and maintain water control structures to minimize the movement of N, P, and sediments off site.
Ditch and Canal Maintenance and Water Management 3.4.4	Operate and maintain water control structures to minimize the admission of aquatic vegetation into downstream public waterways.

Guidance: Routinely remove any accumulated aquatic weeds at the riser board control structure(s) to maintain proper drainage.

3.4.5.	Do not remove sediments below the ditch's original invert elevation unless installation or maintenance of sumps or sediment traps is required. Original invert elevations can be determined by engineering drawings or changes in soil characteristics and color.
3.4.6.	Ensure that pump intakes are sufficiently elevated from the bottom of water conveyances, or consistent with an ERP to reduce sediment and debris in offsite discharges.

Guidance: Pumps are often used to move water within a VAC operation, depending on the situation or need. Axial flow pumps are typically chosen when there is a need to move surface water from one body of water to another (e.g., ditch to ditch, pond to ditch) because they can quickly move large amounts of water using less energy consumption compared to other pumps. It is important for producers to minimize offsite discharges and comply with permit requirements for pumped discharges. Placing the pump intake above the ditch invert is necessary to minimize the disturbance of the bottom of the ditch when the pump is operational. Automation can allow the pump to shut off when the water level in the ditch drops to a point below the intake where further drainage could cause the pump to intake air and malfunction.

3.5. Erosion Control

Site characteristics such as clay soils, sandy soils, or sloped terrain can significantly increase the risk of erosion and offsite sediment transport. Removal of natural vegetation and topsoil further increases the potential for soil erosion. The most effective method of erosion control uses vegetation to hold soil in place and decrease the velocity of runoff water.

Erosion Control 3.5.1.	Construct and maintain above-grade access roads so that they minimize the impeding or diversion of surface water flow.
3.5.2.	Maintain vegetative cover or alternative means for stabilizing road banks to prevent sediments from moving off site. Describe the alternative means in the Comments section [of the BMP Checklist].
3.5.3.	Locate and size permanent crossing areas over surface waters to minimize adverse effects to water resources.
3.5.4.	Stabilize all crossings over streams and creeks using rocks, culverts, bridges, or other methods to prevent erosion.

Properly constructed access roads help prevent water quality effects by eliminating the formation of gullies. If improperly constructed, access roads are a potential source of long-term erosion and sedimentation problems. Access roads constructed entirely in uplands, at or near grade, usually result in little to no effects to water resources. Above-grade access roads with appropriately-sized culvert crossings to maintain surface water flows also pose little to no water resource threats when properly designed, constructed, and maintained. Refer to NRCS CPS Code 560 and Code 578 for guidance on designing and constructing access roads and crossings to prevent impacts to water quality.

Check with the appropriate WMD when constructing access roads through wetland areas or over navigable waterways to determine how to remain in compliance with district regulations.

3.6. Wellhead Protection

Wellhead Protection 3.6.1.	Inspect wellheads and pads for significant leaks or cracks and make any necessary repairs.
3.6.2.	Prevent contamination by using backflow prevention devices at wellheads if injecting fertilizer or chemicals, or if shared with a potable use source.
3.6.3.	Cap or valve any existing flowing wells.

Guidance: With most of Florida's water supply originating from groundwater, it is important for agricultural operations to protect wellheads from contamination. Contact your WMD before installing a new well to determine if a construction permit and/or Consumptive Use Permit is required.

Locate new wells away from possible pollutant sources, such as petroleum storage tanks, septic tanks, chemical mixing areas, or fertilizer storage facilities. Regularly inspect wellheads and pads for leaks or cracks, and repair structures to prevent possible groundwater contamination. For existing wells, backflow prevention devices are required if injecting any fertilizers or chemicals or if connected to any potable water use.

3.7. Non-Fertilizer Material Storage and Handling

Non-Fertilizer Material Storage and Handling 3.7.1.	Store pesticides separate from fertilizers in an enclosed, roofed structure with an impervious floor and lockable door, at least 100 feet away from wells, surface waters, or sinkholes.

Guidance: Proper storage, handling, and disposal of pesticides, solvents, and other chemicals can help avoid adverse environmental effects, protect the water supply, and reduce exposure of the owner to legal liability for contamination and cleanup. Store these materials away from fertilizers, under a roof, and ideally on an impervious surface that does not have floor drains. Some pesticides include active ingredients that are toxic or poisonous to humans and should be stored in a more secure manner than fertilizers.

Non-Fertilizer Material Storage and Handling 3.7.2.	Mix and load pesticides on an impermeable surface, use portable mix/load stations, or conduct any field mix/load activities at random locations in the field.
3.7.3.	Recycle or properly dispose of used oil, solvent bath waste, and antifreeze in accordance with state and federal laws.

Guidance: Load pesticides into application equipment away from wells and surface waterbodies. In some crop lands, loading near field ditches or canals may be unavoidable though care should be exercised to the extent practicable. A concrete or asphalt pad with rainfall protection is an ideal mix/load site, as this allows easy recovery of spilled material. If this is not

feasible, loading at random locations in the field is acceptable and will prevent a buildup of pesticide residues in one location. Clean up spilled material immediately.

3.8 Additional Water Resource Protection Practices for VAC Operations–Well Operation and Protection

	Additional Water Resource Protection BMPs for VAC Operations 3.8.1.	Near Homestead, Miami-Dade County, in the identified "Threshold Area" on page 1 of the Handbook for the Voluntary Retrofit of Open, Uncased Agricultural Wells (1997) (incorporated in Rule 5M-8.002(2), F.A.C.), use the criteria in the Handbook to address open bore wells to ensure the Biscayne aquifer is protected.

Guidance: Wells represent a potential pathway for contaminants to enter groundwater. FDEP, the WMDs and some counties and special districts have rules that provide protective criteria for wells and wellheads. Producers with irrigation wells in the Homestead area should use the Handbook and contact Miami-Dade County and the South Florida WMD with any questions regarding well construction, repair or abandonment and to obtain all required permits.

3.9 Additional Water Resource Protection Practices for VAC Operations–Erosion Control

	Additional Water Resource Protection BMPs for VAC Operations 3.9.1.	For plastic mulch production systems, cleanup and remove plastic as soon as practicable after the last harvest to help reduce runoff effects.
	3.9.2.	For plastic mulch production systems, use a combination of vegetative cover and/or geo-fabric material to stabilize the ground at the downstream side of mulch rows.
	3.9.3.	For plastic mulch production systems, install plastic covered spillways where cross ditches flow into lateral ditches.
	3.9.4.	Use a conservation practice such as cover crop or previous crop residue to protect soils during non-production or fallow periods.
	3.9.5.	On highly erodible soils, implement conservation tillage techniques such as strip till and no till.
	3.9.6.	On highly erodible soils, where erosion control problems exist despite implementing conservation tillage techniques, implement diversion and terrace control techniques.
	3.9.7.	Use deep tillage to penetrate and break tillage pan layers in fields that are cultivated, as needed.
	3.9.8.	Use laser leveling to re-grade fields that historically have not drained well or that have correctable erosion issues.

Guidance: Sediment transport can be reduced in several ways. Vegetative cover slows runoff, increases infiltration, reduces wind velocity, and traps sediment. Reductions in slope length and

steepness reduce runoff velocity, thereby reducing sediment transport as well. Terraces and diversions are common techniques for reducing slope length. Runoff can be slowed or even stopped by placing furrows perpendicular to the slope, and through implementing practices, such as contour farming, which create discrete collection basins to slow runoff and settle sediment particles. Wind-induced erosion can be reduced by decreasing the distance across a field that is exposed to the wind, or by creating soil ridges or other wind barriers. Erosion can also be reduced by minimizing soil disturbance during and after harvest so the crop root systems remain intact to anchor soil.

Cover crops increase soil organic matter, prevent soil erosion and scavenge excess nutrients after the cash crop has been harvested. Cover crops increase soil moisture holding capacity, increases water infiltration, limit nutrient runoff and improves water quality. Grazing cover crops is another benefit, and it can improve long term soil health. Volunteer growth from the existing seed bank can have positive effects in non-production times where conditions allow for adequate cover to become established.

Conservation tillage is the practice of managing the amount, orientation, and distribution of crop and other plant residues on the soil surface, while continuing to grow crops in the residue. Conservation tillage may involve several types of tillage practices or techniques that are designed to maintain crop residue. These practices help reduce soil erosion, which is especially important on soils that meet the NRCS criteria for “highly erodible.” Conservation tillage also helps conserve soil moisture and provides wildlife habitat benefits. The more common types of conservation tillage used in Florida are strip-till and no-till.

Strip-till is used increasingly in North Florida on cotton, corn, soybeans, and to a lesser degree on peanuts. When strip-till is used in a production system, producers must not disturb more than one-third of the row width during seedbed preparation and planting activities.

4.0 Reference Materials

Nutrient Management References

1. Ackerson, J.P., 2018. Soil Sampling Guidelines: AY-368-W. Purdue University Extension. https://www.extension.purdue.edu/extmedia/AY/AY-368-w.pdf
2. Adesogan, A.T. and Newman, Y.C., 2002. Silage harvesting, storing, and feeding: SS-AGR177. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised September 2010. Reviewed April 2014 and June 2021. https://edis.ifas.ufl.edu/publication/ag180
3. Carson, L. and Ozores-Hampton, M., 2014. Description of enhanced-efficiency fertilizers for use in vegetable production: HS1247. Gainesville: University of Florida, Institute of Food and Agriculture Sciences.
4. Charles, C. and Curell, C., A Field Guide to Soil Sampling: Michigan State University (MSU) Extension, Revised 2023. https://www.canr.msu.edu/soil_health/uploads/files/2023_SoilSamplingGuide_Final.pdf
5. Cromwell, R.P., 1992. Silage Harvesting Equipment: DS53. Gainesville: University of Florida, Institute of Food and Agriculture Sciences.
6. Hochmuth, G.J. and Hanlon, E.A., 1988. Commercial vegetable fertilization principles. SL319. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised June 2016 and April 2022. http://edis.ifas.ufl.edu/ cv009
7. Hochmuth, G.J., Hochmuth, R.C., Kostewicz, S. and Stall, W., 1987. Row Covers for Commercial Vegetable Culture in Florida: CIR728. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Reviewed March 2015. Revised September 2018. https://edis.ifas.ufl.edu/publication/CV201
8. Hochmuth, G.J., Maynard, D., Vavrina, C., Hanlon, E. and Simonne, E. (2004) 2012. "Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida: HS964/EP081 Rev. 10/2012". *EDIS* 2012 (10). Gainesville, FL. https://doi.org/10.32473/edis-ep081-2004.
9. Hochmuth, G.J., Mylavarapu, R. and Hanlon, E., 2014. Soil Testing for Plant-Available Nutrients – What Is It and Why Do We Use It?: SL-408. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Reviewed December 2017. https://edis.ifas.ufl.edu/publication/SS621
10. Izuno, F.T., 1987. Water budgeting for high water table soils. Extension Circular 769. Gainesville: University of Florida, Institute of Food and Agricultural Sciences.
11. LeBlanc, B. D., Sheffield, R.E., John Kruse, J., 2000. Agronomic Crops (Soybeans, Cotton, Wheat, Corn and Feed Grains Best Management Practices (BMPs). Louisiana State University Agricultural Center. Revised December 2011. https://www.lsuagcenter.com/articles/connected/agronomic-crops-soybeans-cotton-wheat-corn-and-feed-grains-best-management-practices
12. Liu, G.D., Simonne, E. H., and G. J. Hochmuth., 2018. Soil and fertilizer management for vegetable production in Florida. Vegetable production handbook for Florida: HS711. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised September 2013 and February 2015. Reviewed November 2018. http://edis.ifas.ufl.edu/CV101
13. McCray, J.M., 2022. Phosphorus Fertilizer Recommendations for Sugarcane Production on Florida Mineral Soils: SS-AGR466. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. http://edis.ifas.ufl.edu/SC108
14. McCray, J.M., Morgan, K.T. and Baucum, L., 2016. Nitrogen Fertilizer Recommendations for Sugarcane Production for Sugar on Florida Sand Soils: SS-AGR401. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised March 2019. https://edis.ifas.ufl.edu/publication/SC101

15. McCray, J.M. and Mylavarapu, R., 2010. Sugarcane Nutrient Management Using Leaf Analysis: SS-AGR335. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised January 2017 and October 2020. https://edis.ifas.ufl.edu/publication/AG345
16. McCray, J.M., Rice, R.W. and Ezenwa, I.V., 2005. Sugarcane Leaf Tissue Sample Preparation for Diagnostic Analysis: SS-AGR259. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised March 2015 and September 2021. https://edis.ifas.ufl.edu/publication/SC076
17. McCray, J.M., Rice, R.W., Ezenwa, I.V., Lang, T.A. and Baucum, L., 20061993. Sugarcane plant nutrient diagnosis: SS-AGR128228. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised August 2006, December 2009, May 2013, March 2019 and May 2022. https://edis.ifas.ufl.edu/publication/SC075
18. McCray, J.M., Sandhu, H.S., Rice, R. W. and. Odero, D. C., 2002. Nutrient Requirements for Sugarcane Production on Florida Muck Soils: SS- AGR226. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised March 2019 and September 2023 http://edis.ifas.ufl.edu/sc026
19. McCray, J.M., Rice, R.W. and Wright, A.L., 2012. Phosphorus Fertilizer Recommendations for Sugarcane Production on Florida Organic Soils: SS-AGR348. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised October 2015 and October 2021. http://edis.ifas.ufl.edu/ sc091
20. Morgan, K.T., 2015. Nutrient Management of Vegetable and Agronomic Row Crops Handbook: SP500. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Reviewed April 2023. http://edis.ifas.ufl.edu/ss639
21. Muchovej, R.M., Hanlon, E.A., Ozores-Hampton, M., Shukla, S., Roka, F.M., Yamataki, H. and Ezenwa, I., 2005. Sugarcane Production in Southwest Florida: Mineral soils and Amendments: SL230. Gainesville: University of Florida, Institute of Food and Agriculture Sciences.
22. Mylavarapu, R., Wright, D. and Kidder, G., 2021. UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops: SL129. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. https://edis.ifas.ufl.edu/publication/ss163
23. Mylavarapu, R., Li, Y., Silveira, M., Mackowiak, C. and McCray, M., 2021. Soil-Test-Based Phosphorus Recommendations for Commercial Agricultural Production in Florida: SL-486. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. https://edis.ifas.ufl.edu/publication/SS699
24. Mylavarapu R.S. and Lee, W.S.D., 2002. UF/IFAS Nutrient Management Series: Soil Sampling Strategies for Precision Agriculture: SL-190. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised April 2020. https://edis.ifas.ufl.edu/publication/ss402#TOP
25. Newman, Y.C., Mackowiak, C., Mylavarapu, R. and Silveira, M., 2008. Fertilizing and Liming Forage Crops: SS-AGR176. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Revised January 2008.
26. Sharma, L.K., McCray, J.M. and Morgan, K., 2022. Plant Essential Nutrients and Their Role: SS-AGR463. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. https://edis.ifas.ufl.edu/publication/AG462
27. Shukla, S., Hendricks, G.S., Roka, F.M. and Obreza T.A., 2014. Water and Nitrogen BMPs for Tomato and Watermelon: Water Quality and Economics: AE503. Gainesville: University of Florida, Institute of Food and Agriculture Sciences. Reviewed July 2020. https://edis.ifas.ufl.edu/publication/AE503
28. Wolfe, M.L., Ross, B.B., Diem, J.F., Dillaha, T.A. and Flahive, K.A., 2002. Protecting water quality: Best management practices for row crops grown on plastic mulch in Virginia. Blacksburg, VA: Virginia Cooperative Extension.

Irrigation Management References

1. Barrett, C.E., Zotarelli, L., Taylor, B.S., Paranhos, L.G. and Warren, M., 2014. Converting from seepage irrigation to plasticulture for vegetable production: A case study: HS1246. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Reviewed February 2020. https://edis.ifas.ufl.edu/publication/HS1246
2. Bayabil, H.K., Guzman, S.M., Zazueta, F.S. and Haman, D.Z., 1989. Potential Impacts of Improper Irrigation System Design: AE73. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised October 2011 and August 2022. https://edis.ifas.ufl.edu/publication/ae027
3. DEP, Delineation of the Landward Extent of Wetlands and Surface Waters Rule, Rule Chapter 62-340, F.A.C. http://www.dep.state.fl.us/legal/Rules/rulelist.htm
4. Dukes, M.D., Zotarelli, L., Liu, G.D. and Simonne, E.H., 1995. Principles and practices of irrigation management for vegetables: AE260. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised January 2012. Reviewed May 2021. http://edis.ifas.ufl.edu/cv107
5. Izuno, F.T., Clark, G.A., Haman, D.Z., Smajstrla, A.G. and Pitts, D.J., 1999. Manual monitoring of farm water tables. Gainesville: University of Florida, Institute of Food and Agricultural Sciences.
6. Muchovej, R.M., Hanlon, E.A., McAvoy, E., Ozores-Hampton, M., Roka, F.M., Shukla, S., Yamataki, H. and Cushman, K., 2005. Management of Soil and Water for Vegetable Production in Southwest Florida: SL233. Gainesville: University of Florida, Institute of Food and Agricultural Sciences.
7. Haman, D.Z., 1990. Causes and Prevention of Emitter Plugging in Microirrigation Systems: BUL258. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised January 2022. https://edis.ifas.ufl.edu/publication/ae032
8. Samjstria, A.G., Boman, B.J., Clark, G.A., Haman, D.Z., Harrison, D.S., Izuno, F.T., Pitts, D.J., and Zazueta, F.S., 1991. Efficiencies of Florida agricultural irrigation systems: BUL247. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Reviewed July 2002.
9. Sharma, V., Barrett, C., Broughton, D. and Obreza, T., 2020. Crop Water Use and Irrigation Scheduling Guide for North Florida: SL278. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised December 2020. Reviewed January 2024. https://edis.ifas.ufl.edu/publication/ss491
10. Shukla, S., Holt, N. and Hendricks, G., 2014. Interpreting Dye Test Results for Improved Drip Irrigation Management for the Mulched Vegetable-Production Systems in South Florida: AE506. Gainesville: University of Florida, Institute of Food and Agricultural Sciences.
11. Simonne, E., Sudstill, D., Hochmuth, B., Olczyk, T., Dukes, M., Munoz-Carpena, R. and Li, Y., 2003. Drip Irrigation: The BMP Era-An Integrated Approach to Water and Fertilizer Management for Vegetables Grown with Plasticulture: HS917. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised January 2019. http://edis.ifas.ufl.edu/hs172
12. USDA-NRCS, 2001. Water Table Control. National Engineering Handbook, Chapter 10.
13. USDA-NRCS, 2001. Irrigation Pumping Plants. National Engineering Handbook, Chapter 8.
14. Zazueta, F.S. 1994. Evaporation Loss During Sprinkler Irrigation: BUL290. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised November 2011. Reviewed July 2018. https://edis.ifas.ufl.edu/publication/AE048?downloadOpen=true

Water Resource References

1. ASABE. 2015. Design and construction of subsurface drainage systems on agricultural lands in humid areas. ASABE Design Standard ASAE EP260.5. Released February 2015, Reaffirmed November 2019. American Society of Agricultural and Biological Engineers. https://elibrary.asabe.org/abstract.asp?aid=45405&t=3&redir=aid=45405&redir=%5bconfid=s2000%5d&redirType=standards.asp&redirType=standards.asp
2. DERM, Handbook for the Voluntary Retrofit of Open, Uncased Agricultural Wells (incorporated in Rule 5M-8.002(2), F.A.C.)
3. EPA, National Management Measures for the Control of Nonpoint Pollution from Agriculture, EPA- 841-B-03-004. http://water.epa.gov/polwaste/nps/agriculture/agmmindex.cfm
4. EPA, National Management Measures for the Control of Nonpoint Pollution from Agriculture. https://www.epa.gov/nps/national-management-measures-control-nonpoint-source-pollution-agriculture
5. FDEP. Protecting Florida's Springs, Land Use Planning Strategies and Best Management Practices www.dep.state.fl.us/springs/reports/files/springs- manual_2002.pdf.
6. FDEP, Water Well Permitting and Construction Requirements Rule, Rule Chapter 62-532, F.A.C. http:// www.dep.state.fl.us/legal/Rules/rulelist.htm
7. Florida Water Permits. http://flwaterpermits.com/
8. FDACS/FDEP, Best Management Practices for Agrichemical Handling and Farm Equipment Maintenance Manual. www.floridaagwaterpolicy.com/BestManagementPractices.html
9. Migliaccio, K.W., Boman, B., Hinton, J. and Hancock, K., 2008. BMP: Ribbon Barriers: ABE383. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. http://edis.ifas. ufl.edu/topic_book_florida_forage_handbook
10. Mossler, M.A. and Langeland, K.A., 2006. Florida Crop/Pest Management Profile: Aquatic Weeds: PI138. Gainesville: University of Florida, Institute of Food and Agricultural Sciences.
11. Nesheim, O.N. and Fishel, F. M., 1993. Protecting Water Resources from Agricultural Pesticides: PL1. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised January 2009.
12. Newman, Y.C. 2008. Bermudagrass: A quick reference: SSAGR264. Gainesville: University of Florida, Institute of Food and Agricultural Sciences.
13. Newman, Y.C. 2007. Bahiagrass: A quick reference: SSAGR263. Gainesville: University of Florida, Institute of Food and Agricultural Sciences.
14. Sharma, V., Migliaccio, K.W., Boman, B., Hinton, J. and Hancock, K., 2008. Best Management Practices (BMPs): Perimeter Borders: AE-439. Gainesville: University of Florida, Institute of Food and Agricultural Sciences. Revised May 2021. https://edis.ifas.ufl.edu/publication/ae439
15. Southern Region Integrated Pest Management Center. www.sripmc.org/
16. UF-IFAS, Integrated Pest Management Program. http://ipm.ifas.ufl.edu/
17. UF-IFAS, Forages of Florida website.
18. Water Management Districts, ERP Stormwater Quality Applicant's Handbook. https://floridadep.gov/water/submerged-lands-environmental-resources-coordination/content/erp-stormwater

The following NRCS CPSs were referenced in the compilation of this manual and used to support FDEP initial verification of the manual.
https://efotg.sc.egov.usda.gov/#/state/FL/documents/section=4&folder=-42

Conservation Practice Name	Conservation Practice Code
Nutrient Management	
Nutrient Management	590
Conservation Cover	327
Irrigation Management	
Irrigation Canal or Lateral	320
Drainage Water Management	554
Irrigation Pipeline	430
Irrigation Reservoir	436
Irrigation System Microirrigation	441
Irrigation System Surface and Subsurface	443
Irrigation and Drainage Tailwater Recovery	447
Irrigation Water Management	449
Irrigation Land Leveling	464
Sprinkler System	442
Stormwater Runoff Control	570
Surface Drain, Field Ditch	607
Water Resource Protection	
Agrichemical Handling Facility	309
Bedding	310
Cover Crop	340
Drainage Water Management	554
Field Border	386
Filter Strip	393
Grassed Waterway	412
Heavy Use Area Protection	561
Pest Management Conservation System	595
Precision Land and Forming	462
Riparian Herbaceous Cover	390
Riparian Forest Buffer	391
Row Arrangement	557
Runoff Management System	570
Stream Crossing	578
Structure for Water Control	587
Surface Drain, Field Ditch	607
Water Well	642
Wetland Enhancement	659
Well Decommissioning	351
Well Plugging	755

5.0 Appendices

Appendix 1: Glossary

The definitions that follow only apply to *Florida Vegetable and Agronomic Crop Operations, 2024 Edition: Water Quality and Water Quantity Best Management Practices*.

Basin management action plan (BMAP) – (section 403.067(7)(a), F.S.). The "blueprint" for restoring impaired waters by reducing pollutant loadings to meet the allowable loadings established in a total maximum daily load (TMDL). A BMAP represents a comprehensive set of strategies—permit limits on wastewater facilities, urban and agricultural BMPs, conservation programs, financial assistance, revenue generating activities, etc.—designed to implement the pollutant reductions established by the TMDL. BMAPs are broad-based plans developed with local stakeholders. BMAPs rely on local input and local commitment and are adopted by FDEP Secretarial order to be enforceable. Enrollment and proper implementation of BMPs, when verified by IV site visits and record retention, fulfills agricultural responsibilities under a BMAP.

Best management practice (BMP) – (section 373.4595(2)(a), F.S.). A practice or combination of practices determined by the coordinating agencies, based on research, field-testing, and expert review, to be the most effective and practicable on-location means, including economic and technological considerations, for improving water quality in agricultural discharges. BMPs for agricultural discharges shall reflect a balance between water quality improvements and agricultural productivity.

Biosolids – (Rule 62-640.200, F.A.C.) means the solid, semisolid, or liquid residue generated during the treatment of domestic wastewater in a domestic wastewater treatment facility, formerly known as “domestic wastewater residuals” or “residuals.” Not included is the treated effluent or reclaimed water from a domestic wastewater treatment plant. Also not included are solids removed from pump stations and lift stations, screenings and grit removed from the preliminary treatment components of domestic wastewater treatment facilities, other solids as defined in subsection 62-640.200(30), F.A.C., and ash generated during the incineration of biosolids. Biosolids include products and treated material from biosolids treatment facilities and septage management facilities regulated by FDEP.

Note: Class AA biosolids, which are considered commercial fertilizer, are excluded from regulation under Rule Chapter 62-640, F.A.C.

Fertilizer – (section 576.011, F.S.) any substance which:

(a) Contains one or more recognized plant nutrients and promotes plant growth; or
(b) Controls soil acidity or alkalinity; or
(c) Provides other soil enrichment; or
(d) Provides other corrective measures to the soil.

The term “fertilizer” does not include unmanipulated animal or vegetable manures, peat, or compost which make no claims as described in paragraphs (a)-(d).

Highly Erodible Soils – Soils that have an Erodibility Index of 8 or greater based on slope and steepness combination, given the soil characteristics and rainfall in the area. The lists for each county in Florida can be found in the NRCS FOTG section II.A.5.

Karst – A type of topography formed by dissolution of bedrock in areas underlain by limestone, dolostone or, as in some western states, gypsum. Such terrain has underground drainage

systems that are reflected on the surface as sinkholes, springs, disappearing streams or even caves. (Florida Geological Survey, 2019).

Manure – (Rule 62-701.200, F.A.C.) means a solid waste composed of excreta of animals, and residual materials that have been used for bedding, sanitary or feeding purposes for such animals.

Nonpoint source pollution – Any source of water pollution that does not meet the legal definition of "point source" in section 502:(14) of the Clean Water Act. "**Point source**" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

Outstanding Florida Springs (OFS) – (section 373.802(5), F.S). **I**ncludes all historic first magnitude springs, including their associated spring runs, as determined by the FDEP using the most recent Florida Geological Survey springs bulletin, and the following additional springs, including their associated spring runs:

(a) De Leon Springs;
(b) Peacock Springs;
(c) Poe Springs;
(d) Rock Springs;
(e) Wekiwa Springs; and
(f) Gemini Springs.

The term does not include submarine springs or river rises.

Pesticide – (section 487.021, F.S.) means any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insects, rodents, nematodes, fungi, weeds, or other forms of plant or animal life or viruses, except viruses, bacteria, or fungi on or in living humans or other animals, which the department by rule declares to be a pest, and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant; however, the term "pesticide" does not include any article that:

(a) Is a "new animal drug" within the meaning of section 201(w) of the Federal Food, Drug, and Cosmetic Act;
(b) Has been determined by the Secretary of the United States Department of Health and Human Services not to be a new animal drug by a regulation establishing conditions of use for the article; or
(c) Is an animal feed within the meaning of section 201(x) of the Federal Food, Drug, and Cosmetic Act bearing or containing an article covered in this subsection.

Pollutant – A constituent that results in pollution, as defined in section 403.031(11), F.S.

Potable water well – (Rule 62-521.200, F.A.C) means any water well which supplies water for human consumption to a community water system or to a non-transient non-community water system. For the purpose of this rule, any potable water well installed by an installation used to serve that installation's operation is excluded from this definition.

Regional canal system – Water conveyances operated and controlled by local governments, special districts, Water Management Districts, or other governmental entities that typically serve larger geographic areas and multiple landowners and properties.

Riparian – Ecosystems along a waterbody, characterized by a high-water table and subject to periodic flooding and influence from the adjacent waterbody.

Sinkhole – A naturally occurring geological feature that has an open connection to groundwater. Areas that have topsoil and a root zone over the entire area or ponded areas that do not have an open connection to groundwater are not considered sinkholes for the purposes of this manual.

Spring – (Florida Geological Survey Bulletin 66, 2004). A point where underground water emerges to the earth's surface (including the bottom of the ocean). Springs flow naturally from underlying aquifers and are classified based on their magnitude, or amount of flow coming from the spring vent. First magnitude springs discharge 64.6 million gallons per day (MGD) or more; second magnitude springs discharge from 6.46 to 64.6 MGD.

Springshed – (section 373.802(7), F.S.). Areas within the groundwater and surface water basins which contribute, based upon all relevant facts, circumstances, and data, to the discharge of a spring as defined by potentiometric surface maps and surface watershed boundaries.

Stream – (section 373.019(20), F.S.). Any river, creek, slough, or natural watercourse in which water flows in a defined bed or channel.

Surface waters – (Rule 62-302.200, F.A.C.). Water upon the surface of the earth, whether contained in bounds created naturally or artificially or diffused. Water from natural springs is classified as surface water when it exits from the spring onto the earth's surface.

Total maximum daily load (**TMDL**) – (section 303(d) of the Clean Water Act, 33 U.S.C. §1251 et seq. (1972)). The calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. A TMDL determines a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant.

Waters – (section 403.031, F.S.). Include, but are not limited to, rivers, lakes, streams, springs, impoundments, wetlands, and all other waters or bodies of water, including fresh, brackish, saline, tidal, surface, or underground waters. Waters owned entirely by one person other than the state are included only in regard to possible discharge on other property or water. Underground waters include, but are not limited to, all underground waters passing through pores of rock or soils or flowing through in channels, whether manmade or natural. Solely for purposes of section 403.0885, F.S., waters of the state also include navigable waters or waters of the contiguous zone as used in s. 502 of the Clean Water Act, as amended, 33 U.S.C. ss. 1251 et seq., as in existence on January 1, 1993, except for those navigable waters seaward of the boundaries of the state set forth in s. 1, Art. II of the State Constitution. (Additional text pertaining to water of the state is provided in statute).

Well – (section 373.303(7), F.S) means any excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed when the intended use of such excavation is for the location, acquisition, development, or artificial recharge of groundwater, but such term does not include any well for the purpose of obtaining or prospecting for oil, natural gas, minerals, or products of mining or quarrying; for inserting media to dispose of oil brines or to repressure oil-bearing or natural gas-bearing formation; for storing petroleum, natural gas, or other products; or for temporary dewatering of subsurface formations for mining, quarrying, or construction purposes.

Wellhead – The structure directly over or adjacent to a well.

Wetlands – (section 373.019(27), F.S.) means those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Soils present in wetlands generally are classified as hydric or alluvial or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above.

Appendix 2: Soil and Tissue Testing

Soil Testing
Basic soil testing involves four major steps: sample collection, sample analysis, interpreting results, and applying results on the operation. Consult with the soils laboratory or UF/ IFAS County Extension agents for assistance with soil sampling to ensure reliable results, interpretation, and application.

The following list includes standard extraction methods used at the UF/IFAS Extension Soil Testing Laboratory and most private laboratories for different soil types in Florida.

1. Mehlich-3 extraction – Used on mineral or organic soils over most pH levels.
2. AB-DTPA extraction – Used on alkaline (calcareous) soils with a pH of 7.4 and above.
3. Water extraction – Used for extraction of P on organic soils.
4. Bray 1 or Bray 2 extraction – Used for extraction of P on organic and mineral soils.
5. Ammonium acetate extraction – Used for extraction of phosphorus, potassium, magnesium, calcium, and silicon on mineral soils.
6. Mehlich-1 extraction – Used for mineral sols with pH 6.5 or less.

More information regarding soil testing for plant-available nutrients can be found in the extension publication SL 408, at: https:// edis.ifas.ufl.edu/publication/SS621. Use publication SP500 to determine nutrient recommendations for the appropriate crop type and region.

Tissue Testing
Tissue analysis offers an estimate of a plant's nutritional status at the time of sampling. Nutrient deficiencies can be detected with tissue analysis before visual symptoms appear. Refer to UF/IFAS Publication SP500, Nutrient Management of Vegetable and Agronomic Row Crops Handbook for additional information.

Appendix 3: Example Record Keeping Forms

Practices on the BMP Checklist preceded with a pencil icon ( ) require records that must be kept for a minimum of five years to demonstrate compliance with the applicable BMPs for the subject parcel. All records are subject to collection and review pursuant to the requirements of section 403.067, F.S.

Producers are encouraged to maintain their records in electronic form for ease in completing the required IV site visit. Examples of records are shown below. OAWP has developed an Excel spreadsheet, available upon request, that can assist producers with keeping nutrient records. Contact an FDACS representative for a copy of the spreadsheet, choose commercially available recordkeeping software suited to your operation, or develop your own record keeping system to assist with IV site visit requirements.

Soil Sample Records (Retain all Laboratory Results)

Sample Date	Field Location	# of Samples	Name of Laboratory	Records Location

Fertilizer Records (Retain Receipts)

Field Name				**Production Acreage**		**Year**		
Brand	Application method	Grade **N-P_2O_5-K_2O**	% CRN	% CRP_2O_5	Amount of fertilizer applied (**lbs/total production acreage**)	Amount of fertilizer applied (**lbs/acre**)	Total N applied (**lbs/acre**) or (**lbs/100 linear bed foot**)	Total P_2O_5 applied (**lbs/acre**)

Tissue Sample Records (Retain all Lab Results)

Sample Date	Field Location	# of Samples	Name of Laboratory	Records Location

Rainfall (inches)

JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.

Well Records

LOCATION	YEAR CONSTRUCTED	CONSTRUCTED BY	LAST MODIFIED	MODIFIED BY	RECORDS LOCATION

Ditch/Waterway Records

LOCATION	DESIGN CROSS SECTION	CURRENT CROSS SECTION	DATE OF LAST CROSS SECTION INSPECTION	RECORDS LOCATION