Florida Dairy Operations

2024 Edition

Water Quality and Water Quantity Best Management Practices

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Florida Dairy Operations, 2024 Edition: Water Quality and Water Quantity Best Management Practices

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Acronyms and Abbreviations

BMAP – Basin Management Action Plan

BMP – Best Management Practice

CAFO – Concentrated Animal Feeding Operation

CPS – Conservation Practice Standard

CRF – Controlled Release Fertilizer

EDIS – Electronic Data Information Source of UF/IFAS

EEF – Enhanced Efficiency Fertilizer

EPA – United States Environmental Protection Agency

ERP – Environmental Resource Permit

ESTL – UF/IFAS Extension Soil Testing Laboratory

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

FOTG – Field Office Technical Guide

GPS – Global Positioning System

HDPE – High density polyethylene

HIA – High intensity area

IV – Implementation Verification

K – Potassium

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

WSP – Waste Storage Pond

WMD – Water Management District

Part A

Introduction

The dairy industry is extremely diverse and covers many geographic regions of Florida. Dairies in Florida vary widely from pasture-based operations to confinement facilities where the cows spend the entire day under roof. Florida's dairies primarily produce Class I milk products (i.e., milk used for beverages) while also recycling thousands of tons of byproducts, such as citrus pulp, brewers' grain, and whole cottonseed. These byproducts are consumed by cows instead of ending up in landfills. In addition, Florida dairies recycle nutrients and wastewater on-site to grow crops, produce feed for their cattle, and to manage their operations in the most efficient way.

Cows are usually milked twice a day in most pasture operations and three times a day in confinement operations. On pasture-based dairies, the cows may tend to stay close to the barns and not wander far away. This can lead to high nutrients on barren ground from overgrazing and concentrated manure deposition. Similar conditions can also occur around feed and watering troughs. Although some barren areas will typically occur, the goal is to minimize these areas as much as possible.

Wastewater from the flushing of freestall barns, cooling/feed barns, and milk areas is collected and temporarily stored in a waste storage pond (WSP). Due to food safety requirements, the cow platform in the milking parlor must be cleaned by fresh water, but the other barns and crowd areas can be flushed with recycled water from the WSP. The wastewater usually goes into a sand or solids separator before going to a WSP. Some dairies also scrape or vacuum manure from barns to compost or haul offsite.

Dairy management for water quality protection must consider strategic, tactical, and operational management variables. Strategic management directs the long-term goals of the farm, but information may be poorly structured and is often subjective. Farm goals and resources are essential variables of strategic management. Tactical management is intermediate between strategic and the day-to-day operational information and integrates the details of farm organization with general management guidelines. Operational management determines and affects daily activities, and the technical information is very farm-specific, subject to rapid changes, such as weather, and is relatively well structured. At this level, the characteristics of a dairy farm and the resources available to management are usually a fixed entity.

Producers should take advantage of whatever management means are at their disposal to achieve nutrient balance, which is an expected outcome of this manual. While some Best Management Practices (BMPs) need to be prescriptive, most are flexible, allowing producers the opportunity to adapt to different operational situations. This encourages innovation and development of alternative solutions to accomplish the outcomes of water quality protection while maintaining or improving profitability.

Operations Applicable to this Manual

This manual applies to operations that are raising cattle for milk production. BMPs for pastures and for field crops or forages grown for production of hay or silage that is fed back to the cows associated with the dairy are included in this manual. Operations that produce crops or livestock other than those covered by this manual should use the appropriate Florida Department of Agriculture and Consumer Services (FDACS) BMP manual. Dairies with a National Pollutant Discharge Elimination System (NPDES) or Florida Department of Environmental Protection (FDEP) permit issued under Rule Chapter 62-670, Florida Administrative Code (F.A.C.), must

follow their permit requirements, as FDACS BMPs do not replace these requirements. If a dairy operation has an FDEP NPDES-Concentrated Animal Feeding Operation (CAFO) permit, issued in accordance with Rule Chapter 62-670, F.A.C., it is considered an Equivalent Program to the FDACS BMP program and the permit and its conditions will act in place of the BMP Checklist.

To benefit from and participate in the BMP Program, Dairy producers must work with an FDACS representative to complete, sign, and submit the Notice of Intent (NOI) (FDACS-04002, rev. 06/24, incorporated in 5M-1.001(9), F.A.C.) and the BMP Checklist that is part of this manual.

A landowner or producer enrolled under this manual is also subject to the requirements of Rule Chapter 5M-1, F.A.C.

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 a Notice of Intent 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.

High Intensity Use Areas (HIA) that are created through typical dairy operation activities are allowed, providing there is no untreated, direct discharge from the HIA off-site. Any HIA within a dairy operation engaging in direct discharges off-site may require an NPDES permit issued by FDEP.

Best Management Practices and Water Quality

Section 403.067, Florida Statutes (F.S.), directs 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 dairy 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 properly implementing the applicable BMPs identified on the BMP Checklist, or who are in compliance with the Equivalent Program requirements of Rule 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 (MILs) 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 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 dairy operation has an FDEP NPDES-CAFO permit, issued in accordance with Rule Chapter 62-670, F.A.C., it is considered an equivalent program to the FDACS BMP program and must be indicated on the NOI form in

lieu of filling out the checklist. For the aspects of an operation under a permit, the permit requirements take precedence over any BMPs. If another type of 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) 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) exempts interim measures or best management practices adopted pursuant to section 403.067 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 Notice of Intent to Implement BMPs (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 Implementation Verification 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 Natural Resource Conservation Service (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 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 implementation verification site visits to verify the proper implementation of the BMPs. 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 the 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 specific BMPs, unfamiliar terms, or content. Be ready to confirm the parcels of land to be enrolled in the Program to ensure the accuracy of the information that will be submitted on the NOI.

2) During the site visit, the FDACS 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 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 your 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 is 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 recordkeeping 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) If the dairy operation has an FDEP permit issued under Rule Chapter 62-670, F.A.C., producers must indicate this by checking the box on the NOI form and providing the permit number.

7) 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.

8) 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 Checklist for Dairy 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 nutrients in any form on the operation associated with this NOI?			**Yes**	**No**	**-**
What is the limiting nutrient in the basin where the farm is located? See Figures 3 and 4 in Appendix 5 for guidance.			**N**	**P**	**N&P**
			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.			
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. P may be applied up to the anticipated crop removal rate. This practice does not apply to dairies where N is the limiting nutrient.			
	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 the N and P_2O_5 applied to each field.			
1.3	**Right Time**				
	1	For commercial fertilizer applications, 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 commercial 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.			
	Additional Nutrient Management BMPs for Dairy Operations				
1.6	**Feed Ration**				
	1	Perform laboratory testing of feed and forage to properly formulate feeding rations and help with maintaining a nutrient balance.			
	2	Contain or treat silage leachate to prevent loss to surface or groundwaters.			
1.7	**Crop Fertilization and Land Application of Wastes**				
	1	Do not apply supplemental commercial P to waste application fields that are based on N. On dairies where waste application is based on P, ensure that			

		applications from all sources of P do not exceed crop uptake.			
	2	Account for the N and P contribution from collected manure that is land-applied to pastures and reduce commercial fertilization accordingly.			
	3	Do not apply wastewater to saturated fields, except in an emergency.			
	4	Maintain cropping system nutrient balance based on annual averages. If located on karst terrain, however, maintain a balance of readily available N throughout each crop cycle.			
	5	For hay or haylage production, do not apply supplemental commercial fertilizer unless the field is not receiving enough N or P from applied waste. On farms with crop fertilization based on P, apply supplemental N only in the spring and after each cutting.			
1.8	**Waste Storage and Handling BMPs**				
	Solids Separation				
	1	Clean sand lanes daily.			
	2	Clean static separators before they are full to allow for maximum separation.			
	3	Clean inclined screens at least weekly to prevent screen from clogging.			
	4	Ensure that all solids from separators or other manure piles are on impervious surfaces or within a containment ditch (on high water table soils) and the runoff is directed into the wastewater system.			
	Waste Storage Pond				
	Use Table 1 in Appendix 5 to determine if the operation is located on a high or non-high water table soil type.				
	5	Verify that the WSP meets the minimum storage requirement.			
	6	Keep the water level in the WSP as low as practical.			
	WSP BMPs for High Water Table Soils				
	7	If there are drainage features greater than 18 inches deep within 300 feet or less from the WSP, install an engineered solution such as an interceptor ditch or tile drain.			
	WSP BMPs for Non-High Water Table Soils				
	8	If your sprayfield does not contain sandy soils, ensure that the WSP has the capacity for 21 days of storage.			
	9	If your sprayfield contains sandy soils, ensure that the WSP has the capacity for 7 days of storage, or 5 days of storage and a back-up irrigation system.			
	10	Line the WSP using an artificial liner such as concrete, HDPE, an equivalent clay liner, or other professionally designed liner, or have the pond leak tested.			
1.9	**Nutrient Balance**				

	1	Use the calculation forms in Appendix 3, or an equivalent system, to demonstrate that the farm is maintaining a nutrient balance.			
	2	Collect wastewater samples quarterly; solid samples quarterly or whenever they are removed from the separator (if less than four times a year); and crop tissue samples after each cutting. If greenchop is being used, sampling once per quarter is sufficient.			
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 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.			
	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, including the level of the WSP.			
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.			

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.			
	5	Within an HIA, plant and maintain one or more durable pasture grasses resistant to trampling if your operation is within an Outstanding Florida Spring BMAP.			
	6	Within OFS BMAPs, manure storage areas must be on an impervious surface that drains back to the waste system or covered with a tarp or other waterproof material to prevent leaching.			
3.3	**Wetlands and Lakes**				
	1	Buffer wetlands and lakes with a minimum of 25 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.			
	2	Buffer impaired waterbodies located within 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.			
	4	Remove cows from flooded areas until flooding subsides, when practicable.			
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.			
	**7**	When stormwater problems exist that are not addressed by a WMD permit, develop and implement a stormwater management plan.			
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	Use 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.			
	**4**	Maintain records of new well construction and modifications to existing wells.			
	5	Retrofit existing wells with a concrete collar or fence where necessary to protect them from livestock.			
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.			
	4	Dispose of spent needles and unused pharmaceutical products by using an approved biomedical container, or by following other guidance approved by the EPA.			
COMMENTS					
	Additional Water Resource Protection BMPs for Dairy Operations				
3.8	**Grazing and Pasture Management**				
	1	Locate watering troughs and shade facilities at least 100 feet from surface waters and sinkholes as practicable for the operation.			
	2	Direct runoff from all high intensity use areas (HIAs) away from surface waters, wells, or sinkholes using filter strips, buffers, berms, grassed waterways, or vegetated swales.			
	3	Periodically clean or remove manure from HIAs where cattle congregate. If using feed troughs on concrete, remove manure.			
	4	Re-vegetate the HIA as soon as practical after cows are removed.			
	5	Keep HIAs 200 feet away from surface waters, wells, or sinkholes. If no alternatives exist, use filter strips, buffers, berms, grassed waterways, or vegetated swales to protect water resources.			
	6	Buffer streams and wetlands in HIAs with a minimum of 100 feet of non-fertilized vegetation.			
	7	Incorporate cross-fencing to subdivide larger pastures and implement rotational grazing, where applicable. If installing fences in wetlands, follow the criteria in BMP 3.3.3.			
	8	Avoid overgrazing by considering the grazing height information in Table 6 to ensure that pastures are not denuded and have adequate residue for regrowth.			
3.9	**Onsite Manure Storage and Composting**				
	1	When composting, mix raw manure with enough dry material so that leaching does not occur from pile.			
	2	Ensure that there is no discharge from manure storage areas into watercourses, lakes, wetlands, drinking water wells, or sinkholes.			
3.10	**Animal Mortality Management**				

	1	For below-ground burial, locate any burial site at least 100 feet from adjacent property and at least 200 feet from surface waters, wells, or sinkholes.			
Comments					

PART B

Best Management Practices for Dairy 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 Dairy operations. Producers may determine that it may be necessary to add practices in addition to those in 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 dairy operations are based on accounting for nutrient inputs including commercial fertilizers, organic materials like manure, compost and biosolids, supplemental feed, waste storage, and any irrigation water used (especially reclaimed water). Dairies permitted under Rule Chapter 62-670, F.A.C. should follow the nutrient management requirements listed in their permit.

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. Manure generated and utilized by a dairy operation is unique in terms of fertilizer, since it is mostly in organic form and slow release when compared to commercial fertilizers.

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, nutrient management 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.

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

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

Guidance: Appropriate rates of N and 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 provides pH values, indices of P, potassium, calcium, and magnesium, micronutrients available in the soil, and nutrient rate recommendations for agronomic crop 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. On a dairy operation, soil testing should be done every 5 years. If the dairy is designed on P, application rates should not exceed anticipated crop uptake rates.

Plant tissue testing can be used in conjunction with soil testing to diagnose the overall effectiveness of a fertilization program. Due to the mobility of most essential nutrients in soils, plant tissue analysis is one of the best indicators 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 (edis.ifas.ufl.edu) provide tables and information on nutrient sufficiency ranges for pasture grasses and crops grown for silage.

Dairy producers must use soil tests, tissue tests, or both to determine the appropriate UF/IFAS fertilizer recommendations for crops grown onsite, or another source based on a calibrated crop response for the soil type and crop. Crop requirements may be adjusted based on site-specific challenges, tissue testing results, soil variability, historical factors, P availability, or cultivar-specific requirements. Follow the rates in Table 5 of Appendix 5, UF/IFAS fertilizer rates, or

another calibrated crop response source for most forage crops found in UF/IFAS Fact Sheet SL-129, Standardized Fertilization Recommendations for Agronomic Crops, available at: http://edis.ifas.ufl.edu/SS163.

	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. The Mehlich-3 soil test is appropriate for Florida dairy operations unless they are located on muck soils.

	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. P may be applied up to the anticipated crop removal rate. This practice does not apply to dairies where N is the limiting nutrient.

Guidance: Very few waste application fields need supplemental P. On dairies where the limiting nutrient is P, producers should apply commercial P only when supported by a valid soil test (showing deficient amounts of soil P) that has been accepted for use in Florida, and the P contained in the planned waste application field is not sufficient for crop growth. Manure generated on-site containing P can be applied based on anticipated crop uptake rates. This guidance does not apply to dairies where the limiting nutrient is N.

Refer to UF/IFAS Publication SL-129, *UF/IFAS Standardized Fertilization Recommendations* or the fertilization rates in Table 5 of Appendix 5.

	**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 non-leguminous crops 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.

Most wastewater application fields that are fertilized based on N are already receiving adequate N, so tissue sampling is not necessary. If crop fertilization is based on P, however, extra N will often be required.

Refer to UF/IFAS Publication SL-129, *UF/IFAS Standardized Fertilization Recommendations*, the fertilization rates in Table 5 of Appendix 5, or another credible source with scientific support such as a calibrated crop response curve.

	**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:

- If applying commercial fertilizer, soil and tissue test results as required for each field being fertilized which clearly indicate one of the crops being grown. If the operation does not apply commercial fertilizers, soil and tissue tests results as required in practices 1.2.1 and 1.9.2.;
- Justification for using a selected soil test method other than Mehlich-3;
- Area fertilized in acres for each field;

- Amount of fertilizer being applied to each field in gallons if using liquid fertilizer or wastewater applications or in pounds if using dry fertilizer or solids; and
- Fertilizer receipts with formulation, and the density (in lbs/gallon) of liquid fertilizer if used.

1.3. Right Time: Timing of fertilizer application

Right Time 1.3.1.	For commercial fertilizer applications, 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: On Dairies, most fertilization requirements are met with manure and solids. Some fields may need supplemental N provided by commercial sources, especially those fields where the farm is designed on P. Schedule commercial fertilizer applications based on the dynamics of crop 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. Fertilizer or process wastewater should not be applied when soils are saturated.

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 and 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 enhanced efficiency fertilizers (EEF) 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.

One of the most important principles of fertilizer timing is to avoid fertilizer application to dormant or non-growing fields. During dormancy, plants take up little to no nutrients, so any applied N or P is more likely to leach or run off.

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 buffers established in the checklist. 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 commercial 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 purchased fertilizer material, including stockpiled manure, from rainfall and other risks of nutrient leaching by covering with impervious material or storing under a roof where applicable, unless justification is provided (such as stored on an impervious surface that drains to wastewater system, inside a containment ditch on high water table, or sampling or monitoring) to demonstrate that existing storage will not result in nutrient leaching to water resources. Purchased fertilizer materials should be stored on an impervious surface unless it is demonstrated that they are 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 (excluding WSPs and lagoons) 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 Dairy Operations – Feed Ration

	**Additional Nutrient Management BMPs for Dairy Operations - Feed Ration 1.6.1.**	Perform laboratory testing of feed and forage to properly formulate feeding rations and help with maintaining a nutrient balance.

Guidance: All dairies import nutrients in the form of commercial feed, animals, and/or fertilizer. They also export considerable nutrients in milk and in any animals that are removed. Significant recycling of nutrients occurs on most dairies through land application of manure, uptake by crops planted in the application areas, and feed that the crop produces, which is usually fed to the cows on-site. Several of the dairy feed stocks result from agricultural by-products that otherwise might have to be disposed of in a landfill. Citrus pulp, cottonseed hulls, and brewers' grain are used extensively on Florida dairies as part of the feed ration.

Most dairies have a certified nutritionist, or a very knowledgeable operator, who designs feed mixtures to meet the cow's nutrient requirements at different stages of lactation and milk production. Feed must be adjusted to supply only what is needed based on breed, days in lactation, and milk production. Producers should work with their feed supplier or nutritional consultant to ensure they are meeting the basic requirements for the stage of growth or lactation.

If feed contains excess nutrients, they simply pass through the cow and are deposited in the manure. Ensure that P is less than 0.42% of total feed ration (dry matter basis). Do not discount P in grains and forage, as ruminant bacteria make P available. Supplementation of P in heifer and dry cow diets should be eliminated or limited as the recommended amount of dietary dry matter is normally provided in basal feeds. It is recommended to feed the minimum amount of N required to maintain good milk production. Nitrogen is supplied via protein, but protein content greater than 16% rarely provides any extra benefit. It is a good idea to sample commercial feed to assure that the labeling or guaranteed analysis is correct.

If the dairy is grazing cattle, the grazing must be accounted for as part of the cows' diet to determine the appropriate amount of supplemental commercial feed needed. Irrigated pastures are much more consistent in terms of plant growth and nutrient content, and rotational grazing provides even more forage for the cows. Forage analysis results and an estimate of pounds of grass the cows are harvesting will provide information needed to calculate nutrient intake from grazing.

Feed and forage testing can provide targeted nutritional guidance for heifer groups sorted by age. Sorting heifers into uniform groups for feeding can ensure heifers are consuming their proportionate share of feed. Feed, except for wet brewers grain, should be stored so it has no contact with rainwater.

Excess feed often can be used to feed heifers or dry cows. Any remaining feed still contains nutrients and must be disposed of properly. Adding it to a composting operation is preferable, but if no composting exists, it can be land applied separately or mixed with other waste. If significant amounts of waste are land-applied, the waste should be sampled and the nutrient load should be included in the nutrient balance calculation.

Additional Nutrient Management BMPs for Dairy Operations - Feed Ration 1.6.2.	Contain or treat silage leachate to prevent loss to surface or groundwaters.

Guidance: Certain forages are harvested, mixed, stored, and fed to livestock as silage or haylage. Crops such as corn and sorghum are particularly well-suited to harvesting as silage because of their high energy value and the fact that their thick stalks delay drying. Silage stored in bags around fields has few runoff issues. Large silage pits can have leaching issues, however, especially if several pits are located together. In these or similar instances, silage leachate should be collected and directed into the wastewaster system. Silage harvested and stored at the proper moisture content will reduce the production of leachate.

1.7. Additional Nutrient Management BMPs for Dairy Operations – Crop Fertilization and Land Application of Wastes

Additional Nutrient Management BMPs for Dairy Operations - Crop Fertilization and Land Application of Wastes 1.7.1.	Do not apply supplemental commercial P to waste application fields that are based on N. On dairies where waste application is based on P, ensure that applications from all sources of P do not exceed crop uptake.

Guidance: Very few waste application fields need supplemental P. Producers should apply P only when supported by a valid soil test (showing deficient amounts of soil P) that has been accepted for use in Florida, and the P contained in the planned waste application field is not sufficient for crop growth. If crop fertilization is based on N, P is already adequate or may exceed crop uptake, so commercial P fertilizer should not be applied.

For established fields, it is recommended to take annual soil samples in November or December. Refer to Appendix 2 for guidance on P extraction methods and sample collection. Keep a copy of all laboratory test results to track changes over time.

	Additional Nutrient Management BMPs for Dairy Operations - Crop Fertilization and Land Application of Wastes 1.7.2.	Account for the N and P contribution from collected manure that is land-applied to pastures and reduce commercial fertilization accordingly.

Guidance: Management of manure is important in maintaining nutrient balance on a dairy operation. Contributions of N and P from manures that are land applied to pastures need to be accounted for alongside other nutrient sources utilized onsite. Manure that is land applied can be subject to nutrient loss from volatilization that occurs during storage or application.

Organic nutrient sources like manure or compost may change soil characteristics and affect how efficiently plants utilize the available nutrients. Manure should be laboratory tested annually to determine N and P content. In some cases, the guidelines shown in Appendix 5 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 or literature values for guidance on calculating the pounds of N or P applied per acre but must provide verifiable documentation supporting calculations of the applied amounts of nutrient sources lacking an analysis. If using manure or compost, identify the type so that book value calculations can be easily verified by FDACS representatives and recorded on the NARF. Regardless of how the nutrient value is determined, all material should be applied based on anticipated crop uptake rates. The tables and flowcharts in Appendix 5 can be used for guidance.

The N and P application rates for manure can be determined by converting the number of loads per field to tons applied, multiplying that by the nutrient content of the manure in lbs/ton, and dividing the result by the acreage. Use the laboratory analysis test results from the manure sample(s), or appropriate book values, and remember to account for the fact that not all the N and P in the manure is available to the crop during the first year, as there can be significant N losses during and after application.

If it is possible to get a sample of the manure analyzed before spreading it, the same calculation can be applied to the amount of material spread over a known area of plastic tarp laid on the ground, and the result extrapolated to the production acreage to determine how many tons per acre should be applied to achieve a specific N and P application rate.

Additional Nutrient Management BMPs for Dairy Operations – Crop Fertilization and Land	Do not apply wastewater to saturated fields, except in an emergency.

Application of Wastes 1.7.3.	

Guidance: Wastewater applications during or prior to excessive rainfall events often cause nutrients to runoff from overly saturated soils or leach below the active root zone area, increasing the risk of N contamination in waterbodies. An excessive rainfall event is defined as the amount of rainfall in a 24-hour period based on the 25-year recurrence interval for a location, as estimated by the National Oceanic and Atmospheric Administration (NOAA). Under normal conditions, wastewater should never be applied to a saturated field; however, under emergency conditions, such as a declared emergency or system malfunction, wastewater must be applied to a field if the pond becomes full. In an emergency, it is more desirable to apply excess wastewater to a field than to let it discharge directly from the WSP. Emergency discharges can be documented using the Emergency Release Log form in Appendix 3.

Additional Nutrient Management BMPs for Dairy Operations – Crop Fertilization and Land Application of Wastes 1.7.4.	Maintain cropping system nutrient balance based on annual averages. If located on karst terrain, however, maintain a balance of readily available N throughout each crop cycle.
1.7.5.	For hay or haylage production, do not apply supplemental commercial fertilizer unless the field is not receiving enough N or P from applied waste. On farms with crop fertilization based on P, apply supplemental N only in the spring and after each cutting.

Guidance: Nutrient management is the most important aspect of minimizing impacts to Florida's waters. Tissue analysis, used in conjunction with soil analysis, is a powerful tool to diagnose the overall effectiveness of a fertilization program. Soil testing alone does not always indicate nutrient availability to plants because it is just a snapshot of what is present at the time of sampling. The concentrations of various nutrients inside plant tissue are the best indicators of crop nutritional status. Most wastewater application fields that are fertilized based on N already receive adequate N, so tissue sampling is not necessary but can be used to determine if additional N is needed. On P based dairies, however, where crops are not receiving the maximum amount of N, P can be applied to the anticipated crop removal rates and tissue testing is an important tool to determine if additional N is needed.

Crop production at Florida dairy operations typically includes crops grown for forage, silage, hay, or greenchop. Summer annual crops such as corn, sorghum, and millet are grown for silage to supplement animal feedstocks. Warm-season perennial grasses comprise the majority of hay production in Florida. Bermudagrass, stargrass, and bahiagrass dominate, primarily because they grow for 6 to 12 months of the year, depending on the location. Cool-season grasses, which are generally grown in North and Central Florida, include small grains (rye, wheat, oats, and triticale) in addition to annual ryegrass. Legumes such as perennial peanut, vetch, clover, lupine, or alfalfa

also may be used in hay production and can take up large amounts of applied N. They are considered luxury users of N, and will use N applied to the field before making their own N.

Nutrient management is also critical factor in good crop nutrient uptake. Nitrogen, phosphorus, and potassium are the three main nutrients plants require. Extra potassium is rarely needed on a waste application field. If crop fertilization is based on P, extra N will often be required. P should be applied based on expected crop uptake rates.

Refer to UF/IFAS Publication SL-129, *UF/IFAS Standardized Fertilization Recommendations* or the fertilization rates in Table 5 of Appendix 5.

1.8. Additional Nutrient Management BMPs for Dairy Operations – Waste Storage and Handling

Additional Nutrient Management BMPs for Dairy Operations - Solids Separation 1.8.1.	Clean sand lanes daily.
1.8.2.	Clean static separators before they are full to allow for maximum separation.
1.8.3.	Clean inclined screens at least weekly to prevent screen from clogging.

Guidance: Almost all dairies in Florida use wastewater to flush the crowd area and any freestall or holding barns. Unless waterbeds are used in the stalls, the loose bedding material will likely become part of the waste stream. If the freestall is bedded with sand, a sand separation lane or mechanical sand separator is recommended to separate and recycle the sand. This is a huge cost savings for the farm and helps keep the rest of the waste management system functioning properly. The native sand of Florida seems to separate much better in a long sand lane sloped approximately 0.25 percent. Routine, daily maintenance of the sand lane will ensure that the waste management system functions as intended and that the sand can be recycled for bedding.

Static separation involves slowing the water down and allowing heavy solids to settle out. Either a concrete weir and associated skimmer maintain the water level, or a picket fence consisting of either horizontal or vertical boards placed with a 0.25 to 0.75 inch gap between them allows water to run out while retaining as many solids as possible. It is very important that these separators are cleaned before they are full so that they operate as designed. A full separator will not allow the water to slow down enough to settle out the solids. After sand separation, solids separation may occur. Mechanical separators, such as inclined screens, do a very good job of removing fibrous materials. The material from the screens does not usually contain significant amounts of nutrients but the screens remove material that can clog other portions of the waste system, especially sprinklers. Screens should be cleaned at least weekly, but daily cleaning is often required.

Additional Nutrient Management BMPs for	Ensure that all solids from separators or other manure piles are on impervious surfaces or within a containment ditch (on high water table soils) and the runoff is directed into the wastewater system.

Dairy Operations – Solids Separation 1.8.4.	

Guidance: On farms with sandy soils, store solids on or under impervious surfaces to prevent runoff or leaching. On high water table soils, store solids or scraped manure within the containment ditch. On farms with heavy clay soils, impervious surfaces may not be necessary. Process wastewater from sand or solids separation will enter the WSP, which is designed to hold wastewater until it can be land applied.

If the WSPs are accessible and can be cleaned out easily, solids separation may be skipped because the WSP provides the necessary solids separation. The accumulated solids must be cleaned out as needed, typically about every three to five years. If the WSP is designed to allow for solids accumulation, this is an acceptable practice. WSPs designed to accept all solids should be long and narrow so that a track hoe or other equipment can access the pond from both sides to remove the accumulated solids. Nutrients in this material vary considerably, but are usually more concentrated, particularly for P. A sample of the solids should be sent to the laboratory before spreading to determine appropriate application amounts for each field. If that is not possible, base application amounts on previous sampling results.

Different separation systems and their N and P removal rates are shown in Table 3 of Appendix 5.

Additional Nutrient Management BMPs for Dairy Operations - Waste Storage Pond 1.8.5.	Verify that the WSP meets the minimum storage requirement.
1.8.6.	Keep the water level in the WSP as low as practical.

Guidance: Wastewater is generated on every dairy farm in Florida. Wastewater production can be as little as 15 gallons per cow per day to almost 200 gallons per cow per day. Wastewater storage ponds hold liquid waste from a dairy operation. WSPs on dairy operations need to hold process wastewater for certain designed storage periods (depending on farm soils and location), therefore it's important to minimize wastewater production, especially during periods where crop production does not require significant irrigation. Figures 1-3 in Appendix 5 can help determine the minimum storage requirement.

Wastewater generation from washing equipment or barn areas, and cooling systems to relieve heat stress, should be managed and directed into the wastewater system or recycled as practical depending on the operation. Wastewater generation can be further managed by replacing udder washers with other lawful and effective means of udder washing, using timers or temperature/humidity controllers with cattle cooling systems, and diverting clean roof, runoff, and plate water from the waste management system. If the calculations in Appendix 3 indicate that the WSP cannot meet the holding capacity requirements, implement one or more of the following: using high-pressure misters instead of sprinklers for cattle cooling, scraping waste collected in barns instead of flushing, or, if applicable, using recycled water in all freestall barns.

WSPs should be treated like liquid fertilizer storage areas. Except in high water table situations, the amount of water stored is usually an insignificant source of irrigation water. Effluent levels in WSPs should be kept as low as possible to allow for maximum storage in the event of heavy rain or equipment failure. It should never be higher than the standard operating level that allows for storage of a 25-year, 24-hour storm event. Wastewater should never be applied to a saturated fields except under emergency conditions where the WSP becomes full. In an emergency, it is more desirable to apply excess wastewater to a field than to let it discharge directly from the WSP. Emergency discharges can be documented using the Emergency Release Log form in Appendix 3.

WSP BMPs for High Water Table Soils

Use Table 1 in Appendix 2 to determine if the operation is located on a high or non-high water table soil type.	
1.8.7.	If there are drainage features greater than 18 inches deep within 300 feet or less from the WSP, install an engineered solution such as an interceptor ditch or tile drain.

Guidance: Farms located on soils listed in Table 1 of Appendix 5 are considered high water table soils. These areas have almost no downward movement of groundwater. Rainwater leaves these areas through surface runoff, evapotranspiration, or horizontal shallow groundwater flow. The runoff may flow to natural depressions, surface waters, or man-made ditches.

Existing WSPs in high water table soils are not required to be lined, since the head difference between the pond and the surrounding water table is low. There should be no drainage features deeper than 18-inches within 300 feet of the WSP, however. If such an instance occurs, an interceptor ditch, tile drain, or other engineered solution will be required.

All new WSPs will require a liner unless a Professional Engineer certifies that denitrification and agronomic use of N and P by the surrounding vegetation is sufficient to prevent losses to receiving waters. Certification should be signed and sealed by the Professional Engineer in a letter, nutrient management plan, or other similar document.

Consult Tables 1 and 3 in Appendix 5 for additional guidance on WSPs on high water table soils.

WSP BMPs for Non-High Water Table Soils

Use Table 1 in Appendix 5 to determine if the operation is located on a high water table soil type.		
Additional Nutrient Management BMPs for Dairy Operations - Waste Storage Pond 1.8.8.		If your sprayfield does not contain sandy soils, ensure that the WSP has the capacity for 21 days of storage.
1.8.9.		If your sprayfield contains sandy soils, ensure that the WSP has the capacity for 7 days of storage, or 5 days of storage and a back-up irrigation system.
	**1.8.10**	Line the WSP using an artificial liner such as concrete, HDPE, an equivalent clay liner, or other professionally designed liner, or have the pond leak tested.

Guidance: Sprayfields where water stands in most areas overnight, or those with clay or another hardpan layer within 24 inches of the surface, likely do not contain sandy soils, therefore a WSP that is properly lined as described in 1.8.10 should have storage capacity for 21 days.

Since sandy soils in sprayfields hold little water and available moisture is used quickly, wastewater can be applied frequently over the year and storage times can be greatly reduced if sufficient land is available. Wastewater should never be applied, however, in excess of crop uptake. A minimum of seven days of storage is required under NRCS standards. As an alternative, storage may be reduced to as little as five days provided that sufficient backup equipment is present and utilized in case of mechanical or electrical failure (including a generator or PTO driven pump). Storage not meeting the NRCS standard will preclude eligibility for federal cost share funding.

Waste storage ponds located in non-high water table sandy soils require a geomembrane liner, such as high-density polyethylene or HDPE, geosynthetic clay liner, concrete liner, or liner constructed with other suitable material to prevent wastewater from seeping into the groundwater. Any unlined WSPs must be leak tested and test results should be maintained for review. Guidance on concrete liners can be found in *NRCS Conservation Practice Standard 522*.

Clay liners are acceptable if they have been designed and approved by a Professional Engineer. Documentation of design approval should be maintained for review. Where significant amounts of natural clay soils are present, predominantly in the panhandle, earthen WSPs dug into clay may not need to be lined. Guidance on geomembrane or geosynthetic clay liners can be found in *NRCS Conservation Practice Standard 521.* For new WSPs, if the construction material is unknown, a core sample can be taken two feet below the design bottom elevation and sides to observe how thick the clay is. In all cases, the material will need to be tested at a laboratory to verify the percent of clay. For existing WSPs, if the soil is at least 50% clay, which is identifiable in the field by being able to be spread into a wide, thin ribbon between two fingers, with no gritty texture, then the clay is acceptable if at least two feet thick.

Consult Figures 2 and 3 in Appendix 5 for additional guidance on WSPs on non-high water table soils.

1.9. Additional Nutrient Management BMPs for Dairy Operations – Nutrient Balance

	**Additional Nutrient Management BMPs for Dairy Operations - Nutrient Balance 1.9.1.**	Use the calculation forms in Appendix 3, or an equivalent system, to demonstrate that the farm is maintaining a nutrient balance.
	**1.9.2.**	Collect wastewater samples quarterly; solid samples quarterly or whenever they are removed from the separator (if less than four times a year); and crop tissue samples after each cutting. If greenchop is being used, sampling once a quarter is sufficient.

Guidance: Dairy operations should balance the nutrient of concern so over-application of that nutrient, with consideration of losses, does not occur. Nutrient inputs include those from purchased feed, fertilizers, and animals; atmospheric deposition from both wet (rain) and dry (windborne dust) sources; N fixed from the atmosphere by legumes; and nutrients in irrigation and drinking water for the animals. Managed outputs include animals, milk, or crops sold or otherwise removed from the site, and manure or manure products transported off-site (e.g., fertilizer on another farm or composted product sold to the public). Most dairy farms internally balance much of the nutrient of concern by growing crops that are fed back to the cattle.

Maintaining nutrient balance on a dairy farm involves planting an optimum cropping system so that crop uptake is balanced by the application of wastewater nutrients. This may include rotations such as perennial bermudagrass hay harvested every four to six weeks with small grains overseeded in the winter (except in South Florida where grass grows year-round), or corn followed by either tropical corn or sorghum (with reduced tillage) followed by a small grain in the winter. Some farmers have been able to establish ryegrass in the winter, which has significantly higher uptake than the small grains.

Dairy operations can build larger WSPs to increase retention and reduce nutrients leaving the operation. This allows more time for N to volatilize and for P to settle out. When ponds are cleaned out, the extra P that settles will have to be dealt with at that time. If solid separation methods are utilized, chemicals such as metal salts and/or polymers can greatly enhance the nutrient retention within the solids portion. Studies have shown that flocculation methods using chemicals can remove more than 90 percent of the P and 50 percent of the N from the liquid waste stream. Chemical treatment of wastewater may not be economically feasible for the producer.

If the calculations in 1.9.1 show the farm is out of nutrient balance, operators may consider choosing a solids separation system that removes the maximum amount of N and P from the wastewater and/or transferring the solids off-site.

Irrigation and wastewater system maintenance, periodic sampling, and record keeping are other key components of nutrient balance. Sampling should occur the first year that all BMPs are in place. If the results show that nutrient balance for the nutrient of concern is being achieved, sampling is not required for another four years, provided no major changes to the operation occur. Annual record keeping is still required. The forms in Appendix 3 can be used to determine if the farm is maintaining a nutrient balance. The calculations, instructions, and tools in Appendices 4 and 5 can be used to complete the nutrient balance calculations.

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 dairy operations, maintaining irrigation systems to ensure optimal performance, and protecting wellhead areas to prevent contamination of the water supply. Dairy operations can demonstrate exemplary irrigation management 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 producers. These sensors can be equipped with probes that measure the electrical capacitance of the soil column and aid greatly in a producer's ability to manage soil water content to meet crop 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 the current practice of 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 to 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 on a parcel 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 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, including the level of the WSP.

Guidance: Evapotranspiration (ET) and other climatic factors affect plant irrigation requirements. Crops grown for forage or silage (e.g., pasture grasses, hay, corn) 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, irrigation should take place 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 as well as disease development. Apply only enough water to wet the entire root zone without leaching water, N, and P.

Wastewater generation coupled with large rainfall events can affect the storage capacity of the WSP. Therefore, the water level of the WSP is also a tool determine irrigation requirements on dairy operations.

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.

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. Therefore, 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. Irrigation systems that are well maintained help ensure uniform forage or crop

growth, conserve water, and reduce operation and maintenance costs. Nozzles should be replaced when worn out, and replacements should have the same or improved flow and pressure characteristics as the original design.

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. Soil type, soil slope, source water quality, and water needs should all be considered 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 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. Depending upon the extent of irrigation, MILs will help producers evaluate their system's irrigation uniformity and identify maintenance needs, free of charge. A pressurized system evaluation is required every five years. Dairy 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 non-conventional 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 crops.

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 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. Dairy producers can protect spring water quality by preventing nutrients from leaching past the root zone of crops and into groundwater. Implementing the 4R principles and recommended irrigation management strategies will assist producers in complying 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. Dairy 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.

Springs and Sinkholes 3.2.5.	Within an HIA, plant and maintain one or more durable pasture grasses resistant to trampling if your operation is within an Outstanding Florida Spring BMAP.

Guidance: Maintain durable pasture grasses resistant to trampling within High Intensity Use Areas located within OFS BMAPs. Examples of durable pasture grasses include Bahaigrass (Argentine and Pensacola) and Bermudagrass (Common, Jiggs, and Coastal). FDACS, Soil and Water Conservation Districts, and UF/IFAS extension staff can also assist with selecting durable pasture grasses for specific regions.

Springs and Sinkholes 3.2.6.	Within OFS BMAPs, manure storage areas must be on an impervious surface that drains back to the waste system or covered with a tarp or other waterproof material to prevent leaching.

Guidance: Protect stockpiled manure from rainfall and other risks for nutrient leaching by storing on an impervious surface, or under a roof or other waterproof material unless justification is provided (such as sampling or monitoring) to demonstrate that existing storage will not result in nutrient leaching to water resources.

3.3. Wetlands and Lakes

Wetlands and Lakes 3.3.1.	Buffer wetlands with a minimum of 25 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.
3.3.2.	Buffer impaired waterbodies located within 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.
3.3.4.	Remove cows from flooded areas until flooding subsides, when practicable.

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 for the control of nutrients. For example, the retention of nutrients in wetland soils and in biomass can be an effective BMP to prevent loss of nutrients offsite. 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 vegetative buffers. Fencing may also help protect or restore wetlands and lakes in some areas. Temporary livestock access control can promote regrowth of wetland vegetation and buffers.

Rotational grazing systems are fundamental in managing forage production. Rotational grazing is the grazing of two or more subdivisions of pasture in sequence, followed by a rest period for recovery and re-growth. Rotational grazing has advantages such as improved pasture longevity, more timely utilization of forage, conservation of surplus forage, and increased stocking rates. One particularly useful type of rotational grazing is flash-grazing. A well-designed and properly managed flash-grazing system can be an effective tool for controlling woody and noxious plants, decreasing fuel buildup, and facilitating nutrient uptake along watercourse banks or around wetlands. Incorporate a flash grazing system in established wetland exclusion areas to manage the existing vegetation without degrading the resource.

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 livestock operations use ditches to manage stormwater runoff from pastures and barns. Ditches can carry sediments and nutrients 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. Vegetated buffers along ditch and canal banks also help stabilize banks, and trap and reduce sediments and nutrients from entering these conveyances. Some ditches may not support vegetation due to their slope or long periods of inundation. In these cases, it is important to assess the velocity of water moving through the ditch to ensure scouring is not occurring. Do not place fill within a delineated 100-year floodplain, except to repair eroded areas, or place fill in a manner which obstructs inflows from offsite areas.

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 the installation or management of existing water control structures to hold water onsite. 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 sediment off site.
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.

Ditch and Canal Maintenance and Water	Do not remove sediments below the ditch's original invert elevation unless installation or maintenance of sumps or sediment traps is required. Original invert

Management 3.4.5.	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 an 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.

	**Ditch and Canal Maintenance and Water Management 3.4.7.**	When stormwater problems exist that are not addressed by a WMD permit, develop and implement a stormwater management plan.

Guidance: There may be individual farm circumstances that create the need for specific stormwater management practices. Alteration of the land (e.g., construction of impervious surfaces such as roads, driveways, parking lots, and urban and agricultural structures) increases stormwater runoff. Lack of appropriate stormwater management can lead to on-site and off-site flooding, increased pollutant loading to surface and ground waters, and erosion and sedimentation. Construction of a stormwater management system (e.g., retention or detention pond) may alter on-site hydrology, and therefore may require an ERP or other WMD surface water management permit. Check with your water management district before beginning construction of any stormwater management system or if installing significant amounts of new impervious areas.

Some operations already may have an ERP or other WMD surface water management permit that requires on-site stormwater management requirements. If stormwater problems exist that are not addressed by a WMD permit, it is important to develop and implement a stormwater management plan suited to the operation's unique circumstances.

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 offsite. Describe the alternative means in the Comments section [of the BMP Checklist].
3.5.3.	Locate, size, and stabilize 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, or bridges or other methods to prevent erosion.

Guidance: 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.

When pasture is present on both sides of a stream, it may be necessary to install a crossing to allow cattle to move between pastures. The width of a hardened crossing is typically limited to discourage cattle from loitering in the water. NRCS CPS Stream Crossing (Code 578) guidelines specify a 6-foot minimum width for cattle crossings and 10 feet for vehicular low water crossings. A fenced lane often requires regular maintenance as debris can be trapped during high flows and the fence may be damaged during flood events.

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.	Use 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.
 **3.6.4.**	Maintain records of new well construction and modifications to existing wells.
3.6.5.	Retrofit existing wells with a concrete collar or fence where necessary to protect them from livestock.

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.

Exclude livestock within a 75-foot radius of the wellhead of potable wells. This radius can be reduced if well construction records demonstrate well casing depths that extend through confining layers. Retrofit existing wells with a concrete collar and fence to protect them from livestock effects.

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, 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. A concrete or asphalt pad with rainfall protection is an ideal mix/load site, as this permits 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.

Non-Fertilizer Material Storage and Handling 3.7.4.	Dispose of spent needles and unused pharmaceutical products by using an approved biomedical container, or by following other guidance approved by the EPA.

Guidance: The use and misuse of pharmaceuticals, such as antibiotics and hormones, can have a negative impact on water quality. This is an issue nationwide, as sampling has revealed detectable amounts of antibiotics, hormones, sterols, and other substances in surface waters from various sources. Because of this, it is very important to use these products responsibly. Follow

all state and federal regulations and properly dispose of spent needles, expired or unused pharmaceuticals, and pharmaceutical containers.

The proper disposal of unused pharmaceuticals is necessary for environmental, livestock, and human health. Expired medications often can be returned to the supplier/manufacturer or some veterinary offices. Check with your local municipality to see if they will accept pharmaceuticals during household hazardous waste disposal events.

Proper disposal of spent needles, referred to as "sharps," is regulated by EPA. These regulations require that needles be disposed of in a biomedical container designed for collection of sharps. (See: www.epa.gov/osw/nonhaz/industrial/medical/disposal.htm) Spent needles should be collected in these containers to avoid accidental needle sticks of farm workers or animals. Local veterinary offices should be able to provide these containers, labeled "Biohazard". Many municipal solid waste departments will take the sharps containers and properly dispose of them for a small fee, and some provide this service for free. Contact your local solid waste office for more information.

3.8. Additional Water Resource Protection BMPs for Dairy Operations – Grazing and Pasture Management

Additional Water Resource Protection BMPs for Dairy Operations - Grazing and Pasture Management 3.8.1.	Locate watering troughs and shade facilities at least 100 feet from surface waters and sinkholes as practicable for the operation.

Guidance: Alternative cattle watering is generally provided by water from excavated upland ponds and/or pumped into troughs from groundwater wells or surface water. Calculate the herd's water needs and ensure that the upland watering sources are adequate to supply those needs. Strategic placement of watering troughs and excavated ponds in uplands away from water resources helps prevent water quality effects from livestock. Locate cooling or watering ponds so that any discharges will not reach surface waters. Further prevent runoff by constructing a shallow berm around watering ponds. Careful planning and site-specific decisions for cattle water sources can play an important role in protecting water quality and can prevent the need to install costly fencing adjacent to natural waterbodies. Fencing may still be needed, however, based on the intensity of operations or location of the operation adjacent to water resources.

High-Intensity Use Areas

Additional Water Resource Protection BMPs for Dairy Operations - Grazing and Pasture Management	Direct runoff from all high intensity use areas (HIAs) away from surface waters, wells, or sinkholes using filter strips, buffers, berms, grassed waterways, or vegetated swales.

3.8.2.	
3.8.3.	Periodically clean or remove manure from HIAs where cattle congregate. If using feed troughs on concrete, remove manure.
3.8.4.	Re-vegetate the HIA as soon as practical after cows are removed.
3.8.5.	Keep HIAs 200 feet away from surface waters, wells, or sinkholes. If no alternatives exist, use filter strips, buffers, berms, grassed waterways, or vegetated swales to protect water resources.
3.8.6.	Buffer streams and wetlands in HIAs with a minimum of 100 feet of non-fertilized vegetation.

Guidance: High intensity Use Areas (HIAs), where livestock congregate for extended periods of time, can adversely impact both the environment and the animal's health. Effective management of HIAs reduces environmental impacts and supports livestock health. Runoff containing sediments, nutrients, and pesticides can adversely affect surface waters or groundwater. Site characteristics such as clay-type soils and/or sloped terrain can significantly increase the risk of erosion and off-site sediment transport.

Feeding areas, cow pens, watering troughs, mineral feeders, and shade structures may create HIAs where manure and urine become concentrated. Manure management for HIAs in dairy operations is a concern for groundwater and surface water due to potential nutrient transport and the possible introduction of coliform bacteria, which can cause health risks to animals and humans at elevated concentrations.

Effective management of HIAs reduces environmental effects and supports livestock health. The primary BMP to treat HIA runoff is to direct runoff away from a waterbody and through vegetated buffer strips, berms, and grassed waterways, using the minimum widths established in the checklist.

Remove manure build-up from areas around permanent feed and water stations on a regular basis. These areas should be minimized as much as possible, as some leaching occurs even though the material is removed on a regular basis. Stabilizing these areas can help reduce mud and prevent erosion.

Portable shade and feed structures can be moved frequently to reduce the impact of HIAs. If supplemental feed is needed, use feed in areas away from wetlands and other waterbodies to reduce the potential to impact surface waters. Consider the location of the water source in relation to the shade and feed structures. If cattle must travel more than 800 feet for water, grazing distribution will not be even. If shade, water, and feed sources are within 300 to 400 feet of each other, loafing areas are likely to overlap.

Additional HIA practices include revegetating holding areas, rotating feed bunks when cattle are removed to help prevent runoff, and maintaining non-fertilized vegetated buffers adjacent to streams and wetlands.

Grazing and Pasture Management

Additional Water Resource Protection BMPs for Dairy Operations - Grazing and Pasture Management 3.8.7.	Incorporate cross-fencing to subdivide larger pastures and implement rotational grazing, where applicable. If installing fences in wetlands, follow the criteria in BMP 3.3.3.
3.8.8.	Avoid overgrazing by considering the grazing height information in Table 6 to ensure that pastures are not denuded and have adequate residue for regrowth.

Guidance: Well managed pastures with appropriate stocking rates typically present little to no water quality problems from cattle excrement because most of the available P is recycled during decomposition. Well established and managed pastures effectively reduce soil erosion, absorb nutrients, reduce weedy species, and provide essential nutrition for livestock. Improper grazing management, however, can lead to nutrient leaching or runoff from pastures. Intensive practices (e.g., reseeding and weed control) may be necessary for extremely degraded pastures, and periodic ground-shaping may be necessary to encourage dispersed flow and prevent erosion.

Prescribed grazing systems such as continuous or rotational systems and supplemental winter grazing can facilitate healthy forage stands and pastures. Continuous grazing allows livestock unrestricted access to a pasture throughout the year or grazing season and has advantages such as lower input costs and fewer management decisions. Rotational grazing of two or more subdivided pastures in sequence, followed by a rest, recovery, and re-growth period is generally more productive and yields better forage growth than continuous grazing. Supplemental winter grazing is most effective when cross-fencing is used to subdivide pastures into multiple sections. Managed grazing also allows for a more even distribution of manure across pastures and reduces denuded areas and walking trails.

Manage rotationally grazed pastures based on forage grazing heights as shown in Table 6 of Appendix 5. When practical, overseed with small grain in the winter to improve nutritional content, provide continuous uptake of excreted nutrients, improve soil conditions, and help prevent erosion.

3.9. Additional Water Resource Protection BMPs for Dairy Operations – Onsite Manure Storage and Composting

Additional Water Resource Protection BMPs for Dairy Operations - Onsite Manure Storage and Composting 3.9.1.	When composting, mix raw manure with enough dry material so that leaching does not occur from pile.
3.9.2.	Ensure that there is no discharge from manure storage areas into watercourses, lakes, wetlands, drinking water wells, or sinkholes.

Guidance: Collection and storage of manure or solids for crop fertilization may be economically efficient depending on the operation. Screened solids often can be composted on their own, since enough carbon is contained in the solids to have a proper C:N ratio (30:1 is ideal). Typically, raw manure or separated solids usually need to have a carbon source added. Used horse bedding, yard waste, sawdust, and peanut hulls are examples of carbon sources that can be mixed with raw manure to create compost. Proper moisture, turning, and temperature are important. Most weed seeds and pathogens cannot survive above 130 degrees F. It is important to store manure and compost on or under an impervious surface to prevent leachate or runoff from reaching wells, sinkholes, or surface waterbodies.

Some dairies do not have adequate crop or pasture land to land-apply nutrients based on their herd size. If the calculations described in this manual show that the cows you have produce more nutrients than you can apply at an agronomic rate, then one of the following alternatives needs to be considered: grow crops with higher nutrient uptake; reduce cow numbers; haul manure offsite; process manure to create a marketable product; and/or employ denitrification or volatilization technologies if N is an issue.

3.10 Animal Mortality Management for Dairy Operations

Additional Water Resource Protection BMPs for Dairy Operations – Animal Mortality Management 3.10.1.	For below-ground burial, locate any burial site at least 100 feet from adjacent property and at least 200 feet from surface waters, wells, or sinkholes.

Guidance: Animal mortality management involves the proper transport and disposal of dead animals to avoid impacts to water quality and water resources by the correct placement of the burial site. Proper management of mortalities will also protect surface waters from organic loads and will prevent the movement of organisms to surface or groundwater and will, therefore, reduce the risk of transmitting diseases to healthy livestock and the water resources. While transporting carcasses, keep them contained in a sanitary manner to prevent spreading infection. Clean and disinfect any mechanical equipment surfaces that were in contact with the carcasses.

4.0 Reference Materials

The reference material listed below is intended for informational purposes and is not intended to be incorporated by reference pursuant to Rule 5M-17.001, F.A.C.

Nutrient Management References

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8. North Carolina Cooperative Extension Service, 2017. Certification training for operators of animal waste management systems - Type A, Chapter 3: Components of a certified animal waste management plan. https://www.deq.nc.gov/water-quality/operator-certification-files/aw-files/type-animal-waste-training-manual-2017/open
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11. USDA-NRCS. (n.d.). Part 651 agricultural waste management field handbook, Chapter 11: Waste utilization. https://directives.sc.egov.usda.gov/34422.wba

Irrigation Management References

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Water Resource Protection References

1. ASABE, 1993. Design and Construction of Surface Drainage Systems on Agricultural Lands in Humid Areas, ANSI/ASAE, EP302.4. St. Joseph, Michigan. https://elibrary.asabe.org/abstract.asp?aid=24410&t=3&dabs=Y&redir=&redirType=
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The following NRCS Field Office Technical Guide documents were referenced in the compilation of this manual and used to support FDEP initial verification.

NRCS Conservation Practice Code

Nutrient Management

Code 313	Waste Storage Facility
Code 359	Waste Treatment Lagoon
Code 366	Anaerobic Digester
Code 521	Pond Sealing or Lining – Geomembrane or Geosynthetic Clay Liner
Code 522	Pond Sealing or Lining – Concrete
Code 590	Nutrient Management
Code 592	Feed Management
Code 605	Denitrifying Bioreactor
Code 632	Waste Separation Facility
Code 633	Waste Recycling

Irrigation Management

Code 442	Irrigation Sprinkler System
Code 449	Irrigation Water Management
Code 554	Agricultural Drainage Management
Code 607	Surface Drainage Field Ditch
Code 608	Surface Drainage Main or Lateral

Water Resource Protection

Code 327	Conservation Cover
Code 342	Critical Area Planting
Code 351	Well Decommissioning
Code 378	Pond
Code 386	Field Border
Code 390	Riparian Herbaceous Cover
Code 391	Riparian Forest Buffer
Code 393	Filter Strip
Code 410	Grade Stabilization
Code 412	Grassed Waterway
Code 527	Karst Sinkhole Treatment
Code 528	Prescribed Grazing
Code 560	Access Road
Code 561	Heavy Use Protection Area
Code 578	Stream Crossing
Code 580	Streambank and Shoreline Protection
Code 587	Structure for Water Control
Code 603	Herbaceous Wind Barrier
Code 612	Tree/Shrub Establishment
Code 642	Water Well
Code 656	Constructed Wetland
Code 755	Well Plugging

5.0 Appendices

Appendix 1: Glossary

The definitions that follow only apply to *Florida Dairy 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).

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). Includes 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.

Priority Focus Area – (section 373.802(5), F.S.) means the area or areas of a basin where the Floridan Aquifer is generally most vulnerable to pollutant inputs where there is a known

connectivity between groundwater pathways and an OFS, as determined by FDEP in consultation with the appropriate WMDs and delineated in a BMAP.

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).

Watershed – Drainage basin or region of land where water drains downhill into a specified body of water.

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 a 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 SL-129 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 SL-129, *UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops* and UF/IFAS Publication SL-412, *Soil and Plant Tissue Testing* 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 implementation verification (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	Analysis **N-P_2O_5-K_2O**	% CRN	% CR P_2O_5	Amount of fertilizer applied (**lbs/total production acreage**)	Amount of fertilizer applied (**lbs/acre**)	Total N applied (**lbs/acre**)	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

3a. General Records – Non-CAFO Dairies

Nutrient Balance Calculation/Records

Dairy Name					
Address	City	State, Zip	County	Latitude (Decimal)	Longitude (Decimal)

	Name	Office Phone	Cell Phone	Email Address
Owner				
Manager				

	Herd Size
	Annual Average
Lactating	
Dry	
Springer	
Heifer	
Calves	
Total Herd	

Total Acres	
Pasture Acres	
Waste Applied Acres	
# of Fields Where Waste is Applied	

Initial Nutrient Balance Calculations		
Step 1	Limiting Nutrient (N, P, or N & P)	
Step 4	Lb-N/Lactating Cow per day	
Step 4	Lb-P/Lactating Cow per day	

Note: This record should be filled out once unless significant changes are made. Step 4 are initial estimates made at the time the NOI is filed, or from existing records.

3b. WSP/Lagoon Capacity and Manure/Stormwater Generation

Wastewater Production (if records are not available)					**Year**			
Date Measured or Calculated	**Wash Water/Hose Output (gpd)**	**Cooling Sprinkler Output (gpd)**	**Fresh Water Flushes (gpd)**	**Plate Cooling Water (gpd)**	**Runoff from HIA/ impervious areas***	**Cow Manure Production (gpd)**	**Misc (gpd)**	**Sum (gpd)**

*Do not include surface of WSP
GPD = gallons per day

See Step 2 of the Dairy BMP Manual Waste Storage Calculation section for guidance in calculating these values. Wastewater production is the average volume of wastewater entering the waste treatment system every day. For dairies without freestall barns, wastewater production is fairly constant all year for a constant herd size, with some variation depending on how much runoff from rainwater enters the waste stream. Cooling systems in freestall barns increase the summer wastewater volume.

Waste Storage Pond Capacity			**Design 25-yr, 24-hour storm (Fig. 2, inches)**			
Pond ID	**Liner Type (none, clay, synthetic, concrete)**	**Level at Minimum Freeboard (feet)**	**Volume at Minimum Freeboard (cubic feet)**	**Total Impervious Surface Area Draining to the WSP. (acres or square feet)**	**25-yr, 24-hr. Stormwater added to pond (cubic feet)**	**Pond storage capacity (days)**
WSP 1						
WSP 2 / Lagoon						

Note: This record should be completed at the time the NOI is filed. Wastewater production continues to be recorded each quarter for 1 year of 5, unless significant changes occur that would require new calculations to be completed.

3c. Daily/Weekly Inspection Logsheet

					Month/Year:			
Date	**Final WSP / Lagoon level (weekly)**	**Precipitation, inches**	**WSP / Lagoon Liner,bank/berm insp. (weekly)**	**Water line insp. (Min. weekly)**	**Sand lanes (min. weekly)**	**Solids separator and ditch insp. (weekly)**	**Irrigation equip. Insp. (weekly)**	**Inspector initials**
Max.		"Checkmark" means in good order; an "X" means maintenance or repair is needed.						
1								
2								
3								
4								
5								
6								
7								
8								
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12								
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28								
29								
30								
31								

3d. Sampling and Analysis Records

Year								
Manure Analysis (Quarterly from onsite stack)*			**Name of Laboratory:**					
Date	Location sample taken	Animal (lactating, dry)	Estimated weight of animal	Total Phosphorus	P (lbs/ton) as P_2O_5	TKN	N-Adjusted (lbs/ton)	% Moisture content

* Only required if scraping occurs. At least 1 year of 5, may be reduced to annual if consistent.

Waste Pond/Lagoon Analysis (Quarterly from pond or discharge)*			**Name of Laboratory:**					
Date	Location sample taken	Description of Sample	Total Phosphorus	P (lbs/1000 gal)* as P_2O_5	TKN	N-Adjusted (lbs/1000 gal)	K as K_2O	% Solids

*At least 1 year of 5, may be reduced to annual if consistent.

Irrigation Water Source Analysis (Quarterly from well)*			**Name of Laboratory:**				
Date	Location sample taken	Nitrate Nitrogen (ppm)	Total Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)	pH	Salinity

*At least 1 year of 5, may be reduced to annual if consistent.

Separated Solids Analysis (Quarterly or before application)*			**Name of Laboratory:**				
Date	Location sample taken	Description of sample	Total Phosphorus	P (lbs/ton) as P_2O_5	TKN	N-Adjusted (lbs/ton)	% Moisture content

* Only required if separation occurs. Each separator must have its own samples
Moisture content or percent solids only needed if analyzed on a dry weight basis.

Crop Harvest Analysis* | **Name of Laboratory**

Date	Field ID	Crop	Plant Date	Harvest Date	Yield (lbs wet** weight)	Acres Harvested	% Moisture	% Protein	% N	% P	% K

* Plant tissue analysis required at each land application field harvest
** Use % moisture to convert wet weight to dry weight. Wet * (100-%moisture) = dry

Soil Sample Analysis | **Name of Laboratory**

Sample Date	Field ID	# of Samples	Extraction Method	P_2O_5	K_2O	pH	Ca	Mg	Mn	Fe	Records Location

3e. Land Application Records

Land Application Table 1: Wastewater Application

Wastewater Application Field Record (for each field per crop cycle)

Month	**Year**			
		From Waste Utilization Plan		
Field ID	**Crop**	**Recommended PAN loading / Acre ***		**(A)**
Wetted Acres		**Recommended Total P loading / Acre**		**(B)**

Date	**WSP / lagoon**	**Pump Start Time†**	**Pump End Time†**	**Total Runtime† (Minutes or Hours)**	**Total Flow Rate (gpm or gph)**	**Total gallons applied**	**Gallons per Acre**	**Weather code****	**Soil Moisture Code*****

* PAN = Plant Available Nitrogen

** C=Clear, CL=Cloudy, R=Rain, ST=Storm/Heavy Rain, W=Windy.

*** W=Wet, M=Moist, D=Dry

† Record Hobbs meter hours or Start/Stop times if needed to calculate runtime.

Note: If not located on karst, annual average N and P loadings are acceptable.

Land Application Table 2: Wastewater, Solids, or Fertilizer Application

Nutrient application field record for each field per crop cycle or year

Month	Year

1	2	3	4	5	6	7	8	9	10	11
Date	**Nutrient source***	**Units**	**Amount per Acre**	**Analysis or Fertilizer Grade**	**PAN Applied lb/Ac**	**Remaining Nitrogen Balance****	**Total P applied (lb/Ac.)**	**Remaining Phosphorus Balance*****	**Potassium (K) Applied**	**Operator Initials**

* Enter nutrient source (i.e., Lagoon/Storage Pond ID, commercial fertilizer, dry litter, etc.)

** Enter the value received by subtracting column (6) from (A) or (8) from B on Land Application Table 1. Continue subtracting column (6) from column (7), and column (8) from column (9) following each irrigation event.

*** Enter the value received by subtracting column (10) from (B). Continue subtracting column (10) from column (11) following each irrigation event.

3f. Offsite Transfer of Wastes

Year

A copy of the latest nutrient analysis must be provided to the recipient

Date	Recipient's Name and Address	Solid or Liquid	Number of Loads	Average size of loads (lbs/gals)	% N	% P	Analysis Date

3g. Emergency Release Log

Year							
Date of Release	**Source of Release**	**Solid or Liquid**	**Amount of Release**	**Cause of Release**	**Receiving Water Body**	**Damage Caused**	**Actions Taken**

Appendix 4: Nutrient and Waste Storage Pond Calculations

A whole farm nutrient balance considers all nutrient inputs and managed outputs. The difference, or level of imbalance, contributes to a farm's water quality risk profile. In addition, each application field must be in balance for the nutrient of concern over the year to ensure nutrients do not become excessive in the soil profile or lead to unmanaged losses to the environment.

Manure nutrient balance considers only the manure and fertilizers applied to the cropland and is the focus of this section. Other inputs such as atmospheric deposition do not need to be considered. The following steps document that a dairy is in manure nutrient balance and has an acceptable WSP:

1. Determine whether the dairy nutrient application should be designed on N or P based on Figures 3 and 4 in Appendix 5.
2. Document the amount of wastewater production.
3. Determine whether the WSP meets the criteria in this manual (see Figure 1 or 2 in Appendix 5).
4. Document the N or P in excrement. Determine feed inputs to each crop of cows and resulting N and P in excrement or use Table 2 in Appendix 5.
5. Determine manure nutrient losses based on type of waste treatment and land application system (see Tables 3 and 5 in Appendix 5).
6. Determine the crop and pasture uptake, and whether the farm fields are in balance (see Table 5 in Appendix 5).

This section is not required to be submitted with the NOI; however, it is important to remember to record the calculation results in the General and WSP tables in **Appendix 3a**.

If manure nutrient balance cannot be achieved, then one of the following alternatives needs to be considered: grow crops with higher nutrient uptake; reduce cow numbers; haul manure offsite; process manure to create a marketable product; consider chemical treatment; and/or (for N) employ denitrification or volatilization technologies.

Step 1: Determine farm nutrient design

Plants and animals require N and P to live. Some natural systems can accept larger amounts of either N or P than others, although every system has its limitations. Florida has some of the largest natural deposits of P in the world, with large mines around White Springs (near the intersection of I-10 and I-75) and Bartow (east of Tampa). These areas, as well as others, have high levels of natural P, so additional P generally will not harm the ecosystem. Other ecosystems, such as Lake Okeechobee and the Everglades have little natural P, and any addition of P can have a detrimental effect on the system.

Scientists often refer to the limiting nutrient when discussing a water body or plant growth. In the example above of the P-rich areas, N is the limiting nutrient because with an increase in N, different plants can grow and flourish that might not normally do so. The opposite is true for the Everglades. Excess nitrogen can be added, and it may make little difference, because there is not enough P to support additional plant growth.

When waste is excreted by a cow, it has nearly the correct ratio of N and P for plant uptake of both nutrients at the same rate. As shown in Step 6 below, however, there are significant nitrogen

losses that cause the manure to have excess P. If your farm area is P limited, you almost always will need to provide commercial N fertilizer to meet crop demand. If your farm area is N limited, however, it is acceptable to base your applications on N crop requirements. Farms that are N limited rarely need extra commercial fertilizer to grow crops (some farms will use small amounts of N fertilizer at critical growth times for crops).

Use Figure 3 in Appendix 5 to determine the limiting nutrient (N or P) for your farm and indicate it here, along with other sources (soil tests, maps, status of receiving water body, P-Index etc.) used in this determination. ☐ Nitrogen ☐ Phosphorus

Sources:

_____

Alternatively, you may contact the FDEP Industrial Wastewater staff in your District office, your NRCS District Conservationist, FDACS, the Water Management District, or a professional engineer for assistance with this determination.

Step 2a: Determine average wastewater and runoff volumes

Wastewater production amount is the average volume of wastewater entering the waste treatment system every day. For dairies without freestall or cooling barns, wastewater production is fairly constant all year, with some variation depending on how much runoff from rainwater enters the waste stream. Cooling systems increase the summer wastewater volume in freestall and cooling barns.

If a 25-year, 24-hour storm event has occurred since construction of the WSP, a farmer can document that the WSP has the capacity to retain this storm event by verifying that it has not had an overflow (without a significant change in wastewater or storage volume) other than those caused by storm events greater than those shown in **Figure 2**. If this is the case, and the WSP liner requirement is met, the capacity is adequate. Therefore, the rest of this step does not have to be completed, although it may be useful to do so.

If the above does not apply and there are farm records for the amount of wastewater pumped, then those records can be added up for a year and divided by 365 to determine the average daily wastewater production.

In the absence of farm records, all the water used in generating wastewater must be added up to determine the average daily wastewater volume. Here is how to do so.

- If using hoses, a 5-gallon bucket and a stopwatch can be used to determine hose output rate.

Gallons per minute (GPM) = 5 ÷ number of minutes to fill bucket. There are 60 seconds in a minute, so if it took 3 minutes and 45 seconds to fill the bucket, divide the seconds by 60 to get parts of a minute (3.75 minutes). (5gal./3.75 min. = 1.33 GPM)

- Udder washers (sprinklers) can produce large amounts of wastewater. If sprinkler output is unknown, it is usually possible to estimate it using a bucket. Hold the bucket so as much of the sprinkler water as possible goes into the bucket. Fill the bucket for one minute and then

measure the water in the bucket using 1-gallon jugs or a measuring cup to determine gallons per minute. If output is high, follow the instructions from the paragraph above. Once sprinkler output rates are determined, multiply the GPM by the number of sprinklers, then multiply that result by the average minutes a day they are used, to get total output of wastewater.

- Cow manure also adds to the wastewater production amount. Estimates are given in **Table 2** of **Appendix 5.** Solids accumulation can be significant, especially in ponds that do not have solids separation prior to the pond, and in ponds that are not agitated. Solids accumulation must be considered when sizing ponds.

- For flushing systems, only count freshwater flushes. Recycled flush water does not enter into the equation. Volume used per flush can be determined by measuring how far down the water goes in the tank after each flush.

  Volume used in gallons per flush = 5.9 × diameter of tank × diameter of tank again × distance from filled tank to water level after flush. All measurements are in feet. For fractions of a foot, divide the number of extra inches by 12 and add the result to the number of full feet. For example, 4-feet, 3-inches would be 3 ÷ 12 or 0.25 and written as 4.25 feet.

- Most farmers know the output of their cooling system sprinklers and the time they run. If the sprinklers are run for 1 minute every 10 minutes, then they run 6 minutes an hour, which can be multiplied by the average hours per day that they run. Some dairies use sophisticated systems that turn on at a specific temperature and/or humidity level. The farmer still has to use best judgment to determine, on average, how many hours a day these systems run. An evaporation loss of 30 percent can be deducted from any cooling system that creates a fine mist.

- Plate cooling water that drains into the waste management system also needs to be added to the wastewater production amount. Since milk is a valuable commodity, very little is wasted and it is not a significant part of the waste stream.

- Any runoff from high-intensity areas (HIA) that are not part of a pasture must be captured and sent to the WSP. Use the table below for average wet season rainfall values and calculate the normal runoff contribution. A cross-sectional schematic of a WSP, with typical storage volumes, is depicted in **Figure 1**. It is assumed that direct rainfall and evaporation from a WSP are about equal so rainfall onto the WSP does not need to be considered. Then use the formula box below to calculate the volume added by runoff from all areas, including the HIA, that drain to the WSP.

City	Wet Season Rainfall May-Oct Daily Avg. (in)
Fort Myers	0.23
Miami	0.25
West Palm Beach	0.25
Tampa	0.19
Orlando	0.20
Gainesville	0.20
Jacksonville	0.20
Tallahassee	0.20
Pensacola	0.19
Adapted from Augustin, 2000. UF-IFAS Bul. 200	

Using the above table of average daily rainfall:
Volume of runoff in gallons per day = 27,154 x acres x inches of rain from table.
Or volume of runoff in gallons per day = 0.623 x square feet x inches of rain.

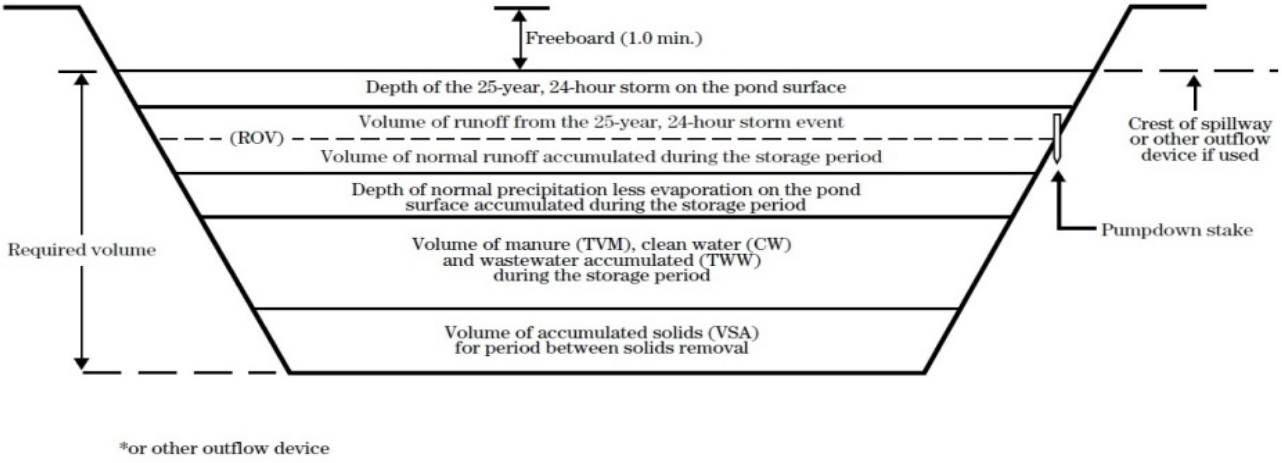

Figure 1

Determine total average wastewater and runoff in gallons/day and enter here: _____

Step 2b: Determine the 25-year design stormwater volume

- The area exposed to rainfall that drains into the WSP was calculated above. These areas can be considered impervious and used for calculations, or a professional engineer can assist. For the 25-year storm, the rainfall deposition over the WSP cannot be ignored. The surface area of the WSP should be measured in square feet.

- Now use **Figure 1**, or for more accuracy, go to the link at http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=fl to determine the 25-year, 24-hour storm for your farm. If you are unsure of your exact position, get as close as you can; or, if you have a permit from either the WMD or FDEP, use this number instead. Then use the formula below to calculate gallons added by runoff into the system.

(27,154 x acres of impervious surface generating runoff x inches of rain from design storm) + (square feet of WSP at top of bank x inches of rain from design storm x 0.623) = gallons added to the WSP by a 25-year, 24-hour storm.

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=fl

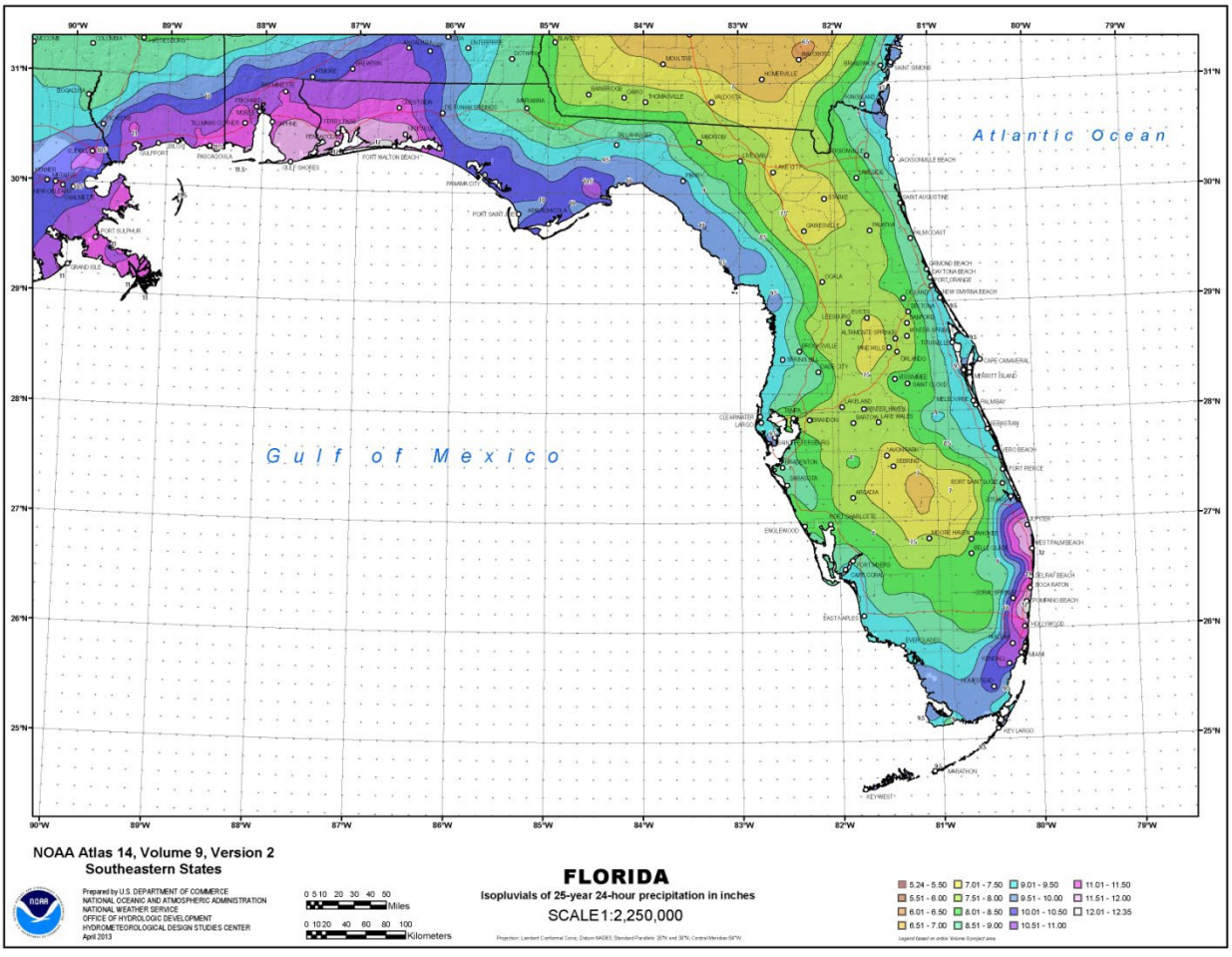

Figure 2

Once all wastewater sources are added up to give you a known volume, the pond size must be determined. For irregular-shaped ponds, a professional engineer may be needed. A rough estimate in cubic feet is ***length halfway down the side slope x width halfway down side slope x total depth of pond*** *(all measured in feet)*. The number of days of storage can be determined by dividing the total pond volume by the average daily wastewater production amount, in cubic feet.

Gallons per day ÷ 7.48 = cubic feet per day.

Determine days of storage calculated above and enter here: _____

Step 3: Determine whether your waste storage pond and other conveyance and storage meet lining requirements

Use the figures in **Appendix 5** to assist you with this section.

If your farm (especially the WSP) is located predominately on one of the soils listed in **Table 1** of **Appendix 5**, you are considered a high water table dairy. If your farm has a soil with predominantly the same characteristics of the soils that are listed but the name is different in your web soil survey or county soil survey manual, the following still applies:

Existing waste storage ponds and separators in high water table soils do not need to be lined, since the high water table serves as a natural barrier to deeper groundwater. If there is a surface water outlet (ditch or creek) that is deeper than 18 inches and within 300 feet of the WSP, then an interceptor ditch or drain tile is often needed to prevent contaminated water from flowing offsite. All new WSPs will require a liner unless a Professional Engineer certifies that denitrification and agronomic use of N and P by the surrounding vegetation is sufficient to prevent losses to receiving waters.

Unless the associated sprayfield has tile or surface drains to keep the water table artificially low, WSPs either need to be designed using computer modeling (StoWat and Drainmod), which is preferred, or have 180 days of storage. If tile drains are installed, storage time usually can be greatly reduced, but computer modeling is required to determine storage requirements.

If your WSP or separator is located in sandy non-high water table soils, you will have to have a liner. For new systems, clay liners are acceptable if they have been designed and approved by a Professional Engineer and meet the requirements of NRCS Code 521.

In the panhandle, earthen WSP or separators dug into heavy clay may not need to be lined. Typically, the topsoil does not contain enough clay to allow for the WSP to be unlined. If the soil used to seal the pond is at least 50 percent clay (identifiable in the field by being able to be spread into a wide, thin ribbon between two fingers, with no gritty texture) then the clay is probably acceptable as a liner, if spread at least two feet thick.

In high water table dairies, conveyance ditches may not need to be lined, since the restrictive layer serves as a natural barrier to deeper groundwater. Similarly, conveyance ditches in areas where there are heavy clay soils may not need to be lined. If the conveyance moves water but does not normally stay wet (wastewater is not flowing at all times), then soil textures may be sandy clay, loamy clay, or similar types following USDA textural terminology. If wastewater sits

still, however, the conveyance must be located in heavy clay soils. In sandy soils, all conveyances and ponds must be lined.

Do your waste handling facilities meet the lining and holding time requirements of Flowcharts 1 and 2 of Appendix 5 of this manual? ☐ Yes ☐ No

Even if your WSP does not meet these criteria, finish all of the calculations to determine where other opportunities for improvement may exist.

Step 4: Determine N and P in manure

If the farmer has accurate records of the amount of waste solids and wastewater spread on site, along with current sample analysis results, they can skip this section and go on to Steps 5 and 6.

To estimate the amount of N and P in cow manure, literature values can be used from **Table 2** of **Appendix 5** or the current ASABE Standard D384.2, *Manure Production Characteristics*. For lactating animals, the equations below can be used. Actual samples should be taken to verify book values; these samples along with other records will show whether the facility is in compliance with this BMP manual.

Calculations for lactating cows are as follows:

Amount of N in manure per cow per day = (lbs dry matter per cow per day x percent protein in feed x 0.0016) – (lbs milk per day x 0.005)

Amount of P in manure per cow per day = (lbs dry matter x percent P in feed x 0.01) – (lbs milk per day x 0.001)

Typical dry matter intake per day for a lactating cow ranges from 48 to 55 lbs. Typical protein content is 14 to 18 percent, and typical phosphorus content is 0.38 to 0.42 percent. Milk production averages from 50 to 80 lbs/day. These are ranges only. Use farm-specific values instead.

Record average pounds of nitrogen and phosphorus in manure per lactating cow per day.
N: _____ P: _____

Once you know how much manure is being produced, you must determine where it is deposited. A workable assumption is that cows deposit manure in the pasture in proportion to the time they spend there. Therefore, if a cow is in the pasture eight hours out of 24, one third (33 percent) of the manure is deposited in the pasture and the remainder wherever it spends the rest of the time (e.g., the barns).

Wastewater usually flows through some sort of separator and a portion of the nutrients are contained in the solids. **Table 3** of **Appendix 5** shows values for separation systems commonly found in Florida.

Amount of N or P in manure per cow per day x number of lactating cows x percent of day in the barns x percent of retained nutrient from Table 3 (Appendix 2) = lbs of nutrient per day in wastewater.

Amount of N or P in manure per cow per day x number of lactating cows x percent of day in the barn x (1 - percent of retained nutrient from Table 3) = lbs of nutrient per day in separated solids.

Determine and enter the daily load for the farm nutrients.

Wastewater: _____lbs N **Separated solids: _____lbs N**

Wastewater: _____lbs P **Separated solids: _____lbs P**

Scraped or vacuumed manure to be hauled: _____lbs N

Scraped or vacuumed manure to be hauled: _____lbs P

Step 5: Calculate nutrient losses

Determining nutrient losses through a dairy system and after field application is the most difficult portion of a nutrient budget.

Phosphorus does not turn into a gas at a normal dairy operation but stays in the wastewater, settles out, and is removed with solids, or settles out and is left in the bottom of the pond. Excess P that migrates into the soil can be bound by soil particles or taken up by surrounding crops.

Nitrogen enters the air as a gas through two methods, volatilization or denitrification. Therefore, a large amount of N can be lost to the atmosphere, and only a percentage of the N that comes out of the cow will be available for crop uptake.

Due to Florida's hot climate, dry soil conditions, and fairly high winds, nitrogen losses are high when waste is applied. Losses occur from the barn floor or pasture as soon as the feces or urine hits the ground, during waste storage and waste application, and even after the waste has been applied.

Typical dairy wastewater systems for Florida are shown in **Table 4** of **Appendix 5**, with the estimated N and P remaining after losses. These losses will need to be included in the N budget calculations. Remember to read the footnotes in this appendix, as volatilization is influenced by pH. Most dairy waste in Florida is very near a pH of 7, but if it becomes too acidic, volatilization is decreased. Also, N in the ammonia form is about the only form that volatilizes. Most dairy waste has significant portions of ammonia, but if lab tests indicate that your waste does not, losses may be decreased.

Determine and enter the daily load after losses, for the nutrients in the following.

Wastewater: _____lbs N **Separated Solids: _____lbs N**

Wastewater: _____lbs P **Separated Solids: _____lbs P**

Scraped or Vacuumed Manure to be Hauled: _____lbs N

Scraped or Vacuumed Manure to be Hauled: _____lbs P

Step 6: Determine crop and pasture uptake and overall nutrient balance

Once you have determined whether your farm or a particular field should be designed based on N or P, use the record keeping work sheets in **Appendix 3** and the calculations below to ensure that the operation is in manure nutrient balance. In some cases, you may need to calculate both N and P.

If your application is less than or equal to crop uptake, then the field is in balance. Repeat this process for each crop field and then check stocking rates for pastures (See **Tables 5-7** of **Appendix 5** for appropriate tables). As mentioned before, any commercial fertilizer used must be included in these calculations.

Determine the crop uptake for each field for the limiting nutrient and ensure that application after losses is less than crop uptake.

Check the stocking rate of pastures and make sure the number of cows per acre is less than available carrying capacity.

For each field receiving waste

Amount of N in applied manure after losses (Step 5) x 365 day/year x percent of total waste applied to that field = applied lbs of manure-N/year to field + total fertilizer N applied to field per year = total applied lbs of N/year.

Crop rotation cycle _____ - _____ - _____

Crop 1 uptake x yield + Crop 2 uptake x yield + Crop 3 uptake x yield = Total N removed in crop yield.

(This assumes use of Table 5 for uptake values. If tissue test is reported as protein, multiply protein yield/acre x 0.16 to get N uptake/acre)

If total applied lbs of N/year - total N removed in crop yield ≤ 0 then field is in N balance.

For each field receiving waste

Amount of P in applied manure after losses (Step 5) x 365 day/year x percent of total waste applied to that field = applied lbs of manure-P/year to field + total fertilizer P applied to field per year = total applied lbs of P/year.

Crop Rotation cycle _____ - _____ - _____

Crop 1 uptake x yield + Crop 2 uptake x yield + Crop 3 uptake x yield = Total P removed in crop yield.

(This assumes use of Table 5 for uptake values. If tissue test is reported as protein, multiply protein yield/acre x 0.16 to get N uptake/acre)

If total applied lbs of P/year - total P removed in crop yield ≤ 0 then field is in P balance.

Limiting Nutrient from Step 1:	☐ **Nitrogen** ☐ **Phosphorus**
Has nutrient balance been achieved for nutrient of concern?	
_____Yes	**_____No**

If the farm is out of nutrient balance after implementation of BMPs and associated guidance in this manual it may be necessary to reduce nutrient inputs or increase nutrient uptake or removal by doing one of the following:

- Increase crop/pasture area.
- Increase uptake by incorporating more irrigated areas.
- Move cows from pasture to confinement.
- Remove manure from the farm.
- Reduce cow numbers.
- Employ denitrification or volatilization technologies for N.
- Employ chemical treatment.

Calculation Notes

27,154 gallons/acre-inch; 43,560 square feet/acre; 7.48 gallons/cubic foot.

Volume of a flush tank is area multiplied by height of water used. Area of a circle is pi (3.14) times the diameter squared, divided by 4. Therefore:

- 3.14 * 7.48/4 = 5.9.
- 5.9 * diameter squared * height of water in feet = gallons used.

As a rule, 16 percent of protein is nitrogen. Milk usually has about 3.1 percent protein. Milk usually contains about 0.5 percent nitrogen and about 0.1 percent phosphorus.

Appendix 5: Tables and Figures

Table 1: List of Selected High Water Table Soils in Florida

Adamsville Var.	Citronelle	Goldhead	Manatee	Pellicer	Susanna
Alapaha	Clara	Grady	Margate	Pennsuco	Symrna
Allanton	Copeland	Grifton	Martel	Pepper	Talquin
Anclote	Cracker	Hallandale	Mascotte	Perrine	Tamiami
Ankona	Croatan	Harbeson	Maurepas	Perrine Var.	Tantile
Apalachee	Cudjoe	Heights	Meadowbro	Pickney	Tavernier
Aqualfs	Dania	Hicoria	Meadowbrook	Pineda	Tennile
Aquents	Dasher	Hilolo	Meggett	Pinellas	Tequesta
Aquults	Delks	Holopaw	Micco	Placid	Terra Ceia
Astor	Delray	Homosassa	Monteocha	Plantation	Tidewater
Bakersville	Demory	Hontoon	Moultrie	Plummer	Tisonia
Basinger	Dirego	Hosford	Mouzon	Pomona	Tocoi
Bayvi	Dorovan	Hydraquents	Mulat	Pompano	Tomoka
Bessie	Duckston	Iberia	Murville	Popash	Tooles
Bethera	Dunbar	Immokalee	Myakka	Pople	Torry
Bibb	Durbin	Islamorada	Myakka Var.	Pottsburg	Tuscawilla
Biscayne	Eaton	Isles	Nettles	Psammaquents	Valkaria
Bivans	EauGallie	Janney	Nittaw	Punta	Wabasso
Bladen	Ebro	Johnston	Nutall	Rains	Wabasso Var.
Blichton	Ellabelle	Jupiter	Ochopee	Rawhide	Wacahoota
Bluff	Elloree	Kaliga	Ocoee	Riviera	Waccasassa
Boardman	Ellzey	Kanapaha	Okeechobee	Rutlege	Wauberg
Boca	Emeralda	Kenner	Okeelanta	Saddlebunch	Wauchula
Bohicket	Estero	Kesson	Oklawaha	Salerno	Waveland
Bonsai	Eureka	Keylargo	Oldsmar	Samsula	Weekiwachee
Boulogne	Everglades	Keywest	Oldtown	Sanibel	Wehadkee
Bradenton	Evergreen	Kingsferry	Oleno	Santee	Wekiva
Brickyard	Farmton	Kingsland	Olustee	Sapelo	Wesconnett
Brighton	Favoretta	Kinston	Ona	Scranton	Weston
Broward Var.	Felda	Lacoochee	Osier	Seffner	Winder
Buccaneer	Fellowship	Lauderhill	Pahokee	Sellers	Woodington
Byars	Fellowship Var.	Lawnwood	Paisley	Shenks	Wulfert
Canova	Flemington	Ledwith	Palmetto	Shired	Yellowjacket
Cantey	Floridana	Leon	Pamlico	Smyrna	Yonges
Captiva	Floridana Var.	Lignumvitae	Pansey	Solite	Yulee
Chaires	Fluvaquents	Lokosee	Pantego	St. Johns	
Chewacla	Ft. Drum	Lynchburg	Parkwood	Starke	
Chobee	Ft. Green	Lynn Haven	Parkwood Var.	Steinhatchee	
Chobee Var.	Gator	Lynne	Peckish	Stockade	
Chowan	Gentry	Malabar	Pelham	Surrency	

Source: This table was compiled by Mike Holloway and Dr. Del Bottcher based on commonly accepted criteria for high water table soils.

Table 2: Daily Manure Production

Lactating Holstein			
	Weight:	130	lbs
	Volume:	15	gallons
	Total Nitrogen:	0.95	lbs
	Total Phosphorus:	0.13	lbs
Dry Holstein			
	Total Nitrogen:	0.59	lbs
	Total Phosphorus:	0.11	lbs
Lactating Jersey (or other 900 lb cow)			
	Weight:	87	lbs
	Volume:	10	gallons
	Total Nitrogen:	0.63	lbs
	Total Phosphorus:	0.09	lbs
Dry Jersey (or other 1,000 lb cow)			
	Total Nitrogen:	0.38	lbs
	Total Phosphorus:	0.07	lbs
Heifer - 200-500 lbs			
	Total Nitrogen:	0.15	lbs
	Total Phosphorus:	0.03	lbs
Heifer - 500-700 lbs			
	Total Nitrogen:	0.25	lbs
	Total Phosphorus:	0.05	lbs
Heifer - 700-900 lbs			
	Total Nitrogen:	0.38	lbs
	Total Phosphorus:	0.07	lbs

Sources:

ASABE Standards

NRCS Agricultural Waste Management Field Handbook

UF-IFAS: Van Horne - Dairy Manure Management Circular 1016

Table 3: Nitrogen and Phosphorus Remaining with the Wastewater after Separation

	N Remaining	P Remaining
Sand lane or mechanical sand separation	100%	100%
Sand and heavy solid separator	95%	95%
Screen separator	93%	90%
Static or "vat" settling basin separator	85%	80%
Water holding separators or ditches*	75%	70%

*water holding separators or ditches that are cleaned frequently as a slurry may be capable of higher removal rates.

Sources:

Midwest Plan Services Structures and Environment Handbook (MWPS-1)
NRCS Agricultural Waste Management Field Handbook
Handling Sand-Laden Manure - JP Harner and JP Murphy
Effectiveness of Liquid-Solid Separation for Treatment of Flushed Dairy Manure: A Case Study. ASAE Technical Library. JP Chastain, MB Vanotti, MW Wingfield
Nutrient and Solids Separation of Flushed Dairy Manure by Settling. ASAE Technical Library. JC Converse

Table 4: Nitrogen and Phosphorus Remaining for Typical Wastewater Treatment Systems

Overall nitrogen remaining for crop uptake with the described systems *These losses are in addition to any solids separation*	**N Remaining**
Cows on Pasture	40%
Cows on concrete floor to storage pond with less than 7 days hold time then sprayed through sprinkler or thinly surface applied	35%
Cows on concrete floor to storage pond with less than 7 days hold time then incorporated or seepage ditch	40%
Cows on concrete floor to storage pond with 7 to 30 days hold time then sprayed through sprinkler or thinly surface applied	30%
Cows on concrete floor to storage pond with 7 to 30 days hold time then incorporated or seepage ditch	35%
Cows on concrete floor to storage pond with greater than 30 days hold time then sprayed through sprinkler or thinly surface applied	10%
Cows on concrete floor to storage pond with greater than 30 days hold time then incorporated or seepage ditch	15%
From WSP samples to crop uptake if applied via sprinkler or thinly surface applied	50%
From WSP sample to incorporated or seepage ditch	80%
Solids thinly applied	75%
Solids incorporated	95%
If pH is 6.5 or less reduce losses by 10 percent. Losses should not exceed the percentage of ammonia in samples.	

Overall phosphorus remaining for crop uptake with the described systems* *These losses are in addition to any solids separation*	**P Remaining**
Pasture, WSP less than 21 days with agitation, any application	100%
WSP less than 21 days without agitation and cleaned once every two years	80%
WSP 21 to 60 days without agitation and cleaned once every five years	90%
WSP 60 to 100 days without agitation and cleaned once every ten years	50%
WSP greater than 100 days without agitation and cleaned every twenty-five years	20%
****During cleanout of ponds, all P that has settled will need to be accounted for. If the farm is in nutrient balance without cleanout material included, this material must be removed from the farm.*	

Sources:
Midwest Plan Services Structures and Environment Handbook (MWPS-1).
NRCS Agricultural Waste Management Field Handbook.
Nitrogen Cycling in Manure and Soils: Crop Utilization and Losses. JHAM Steenwoorden, Institute for Land and Water Management Research, The Netherlands.
Atmospheric Disposal of Nitrogen. HA Elliott, RC Brandt, KS Martin. Penn State University.
Losses of Manurial Nitrogen in Free-Stall Barns. RE Muck and BK Richards. Cornell University.
Ammonia Volatilization from Dairy Manure Spread on the Soil Surface DA Lauer, DR Bouldin, SE Klasner. Cornell University and University of Georgia.
Dairy Manure Management: Strategies for Recycling Nutrient to Recover Fertilizer Value and Avoid Environmental Pollution. HH Van Horne, et al. IFAS, Circular 1016.
Measurement of ammonia volatilization from a field in upland Japan, spread with cattle slurry. Zhen Yang, et al. Nanjing University.

Table 5: Uptake Rates for Crops

See IFAS uptake rates for other crops	(lbs/ac/crop)	
	N	**P**
Irrigated (or heavy soil), well managed cropland		
Corn	240	50
Tropical fall corn	180	29
Sorghum	180	29
Rye or oats	90	13
Ryegrass (part of a triple crop or with bermudagrass)	150	21
Ryegrass (full growing season)	200	29
Bermudagrass (other than common - Coastal, Tifton 85, etc.)	370	40
Stargrass or limpograss (grown year-round on high water table)	500	65
Non-irrigated sandy soil, well managed for hay		
Bermudagrass (other than common - Coastal, Tifton 85, etc.)	285	29
Bahiagrass	119	50
Ryegrass	100	15
Corn and sorghum (not recommended for waste uptake on sandy soils)	-	-
Pastures (cows rotated frequently - not continuous grazing)		
Bermudagrass/ryegrass (irrigated or wet soils)	450	47
Bermudagrass/ryegrass (moderately irrigated or marginal soils)	405	40
Bermudagrass/ryegrass (dry soils)	265	31

References:
NRCS Agricultural Waste Management Field Handbook.
Utilization of Dairy Waste Effluent in Year Round Cropping Systems, KR Woodard et al. FDEP Final Report WM 714.
FAS Standard Fertilization Rates.
Productivity of Clay Tailings from Phosphate Mining II: Forage Crops. P Mislevy, et.al. 1990.
Forage Yield and Nutrient Uptake of Warm-Season Annual Grasses in a Swine Effluent Spray Field. MR McLaughlin, et.al. 2004.
Stargrass. Vendramini and Mislevy. IFAS SS-AGR-72. 2014.
Floralta Limpograss (Hermarthria altissima) CG Chambliss, et al. IFAS SS-AGR-67. 2002.

Table 6: Forage Grazing Heights

Forage Growing Season Grazing Height (inches)		
Forage	**Average Height (inches)**	
	Begin Grazing	**End Grazing**
Bahiagrass	6	1-2
Bermudagrass	6	2-4
Clovers	6	3
Indiangrass	14	6-10
Limpograss	24	10
Pearl Millet	14	6
Perennial Peanut	12-14	4
Rhodesgrass	18	8
Ryegrass, annual	6	3-4
Stargrass	12-18	6-8
Small Grains (oats,wheat,rye)	6	4

Source: Table adapted from UF-IFAS Publication SS-AGR-133 (https://edis.ifas.ufl.edu/AG268) and https://edis.ifas.ufl.edu/publication/AG330

Table 7: Pasture Stocking Rates

Rotational Grazing Cows per acre recommended based on Nitrogen

	No winter grain			Winter grain or location in south Florida		
Soil conditions	**Dry soil**	**wet or irrigated**	**moderate soil**	**Dry Soil**	**wet or irrigated**	**moderate soil**
dry cows	2.0	4.2	3.7	3.1	5.3	4.7
heifers 200-500 lbs	8.2	16.8	14.7	12.4	21.0	18.9
heifers 500-700 lbs	4.8	9.8	8.6	7.2	12.3	11.0
heifers 700-900 lbs	3.2	6.5	5.7	4.8	8.2	7.4
lactating cows on pasture 6 hours a day	5.0	10.4	9.1	7.6	13.0	11.7
lactating cows on pasture 9 hours a day	3.4	6.9	6.1	5.1	8.7	7.8
lactating cows on pasture 12 hours a day	2.5	5.2	4.5	3.8	6.5	5.8
lactating cows on pasture 15 hours a day	2.0	4.2	3.6	3.1	5.2	4.7
lactating cows on pasture 18 hours a day	1.7	3.5	3.0	2.5	4.3	3.9
lactating cows on pasture 21 hours a day	1.4	3.0	2.6	2.2	3.7	3.3

Continuous Grazing Cows per acre recommended with no rotation based on Nitrogen

	No winter grain			Winter grain or location in south Florida		
Soil conditions	**Dry soil**	**wet or irrigated**	**moderate soil**	**Dry soil**	**wet or irrigated**	**moderate soil**
dry cows	1.4	2.8	2.4	2.0	3.5	3.1
heifers 200-500 lbs	5.4	11.1	9.7	8.2	13.9	12.5
heifers 500-700 lbs	3.2	6.5	5.7	4.8	8.1	7.3
heifers 700-900 lbs	2.1	4.3	3.8	3.2	5.4	4.9
lactating cows on pasture 6 hours a day	3.3	6.9	6.0	5.0	8.6	7.7
lactating cows on pasture 9 hours a day	2.2	4.6	4.0	3.4	5.7	5.1
lactating cows on pasture 12 hours a day	1.7	3.4	3.0	2.5	4.3	3.9
lactating cows on pasture 15 hours a day	1.3	2.7	2.4	2.0	3.4	3.1
lactating cows on pasture 18 hours a day	1.1	2.3	2.0	1.7	2.9	2.6
lactating cows on pasture 21 hours a day	1.0	2.0	1.7	1.4	2.4	2.2

** Assumes high uptake bermudagrass - for Jersey or other small cows, numbers can be increased by a factor of 1.5. Also, animal numbers shown in table may be increased for more intensively manages pastures where mechanical harvesting for hay/haylage is done when there is excess grass production.*

** A 60% of loss of the excreted nitrogen is assumed due to volatilization/denitrification processes.*

Rotational Grazing Cows per acre recommended based on Phosphorus

	No winter grain			Winter grain or location in South Florida		
Soil conditions	**Dry soil**	**wet or irrigated**	**moderate soil**	**Dry soil**	**wet or irrigated**	**moderate soil**
dry cows	0.4	0.8	0.7	0.8	1.1	1.0
heifers 200-500 lbs	1.8	3.3	2.6	3.0	4.6	3.9
heifers 500-700 lbs	1.0	1.9	1.5	1.8	2.7	2.3
heifers 700-900 lbs	0.7	1.3	1.0	1.2	1.8	1.5
lactating cows on pasture 6 hours a day	1.5	2.9	2.3	2.6	4.0	3.4
lactating cows on pasture 9 hours a day	1.0	1.9	1.5	1.7	2.6	2.2
lactating cows on pasture 12 hours a day	0.8	1.4	1.1	1.3	2.0	1.7
lactating cows on pasture 15 hours a day	0.6	1.1	0.9	1.0	1.6	1.3
lactating cows on pasture 18 hours a day	0.5	1.0	0.8	0.9	1.3	1.1
lactating cows on pasture 21 hours a day	0.4	0.8	0.7	0.7	1.1	1.0

Continuous Grazing cows per acre recommended with no rotation based on Phosphorus

	No winter grain			Winter grain or location in South Florida		
Soil conditions	**Dry soil**	**wet or irrigated**	**moderate soil**	**Dry soil**	**wet or irrigated**	**moderate soil**
dry cows	0.3	0.5	0.4	0.5	0.8	0.6
heifers 200-500 lbs	1.2	2.2	1.7	2.0	3.0	2.6
heifers 500-700 lbs	0.7	1.3	1.0	1.2	1.8	1.5
heifers 700-900 lbs	0.5	0.9	0.7	0.8	1.2	1.0
lactating cows on pasture 6 hours a day	1.0	1.9	1.5	1.7	2.6	2.2
lactating cows on pasture 9 hours a day	0.7	1.3	1.0	1.1	1.7	1.5
lactating cows on pasture 12 hours a day	0.5	0.9	0.8	0.9	1.3	1.1
lactating cows on pasture 15 hours a day	0.4	0.8	0.6	0.7	1.0	0.9
lactating cows on pasture 18 hours a day	0.3	0.6	0.5	0.6	0.9	0.7
lactating cows on pasture 21 hours a day	0.3	0.5	0.4	0.5	0.7	0.6

Source: Tables 2 and 5 used to derive these values.

Figure 1: Waste Storage Pond for High Water Table Soils

Chart 1: WSP for High Water Table Soils

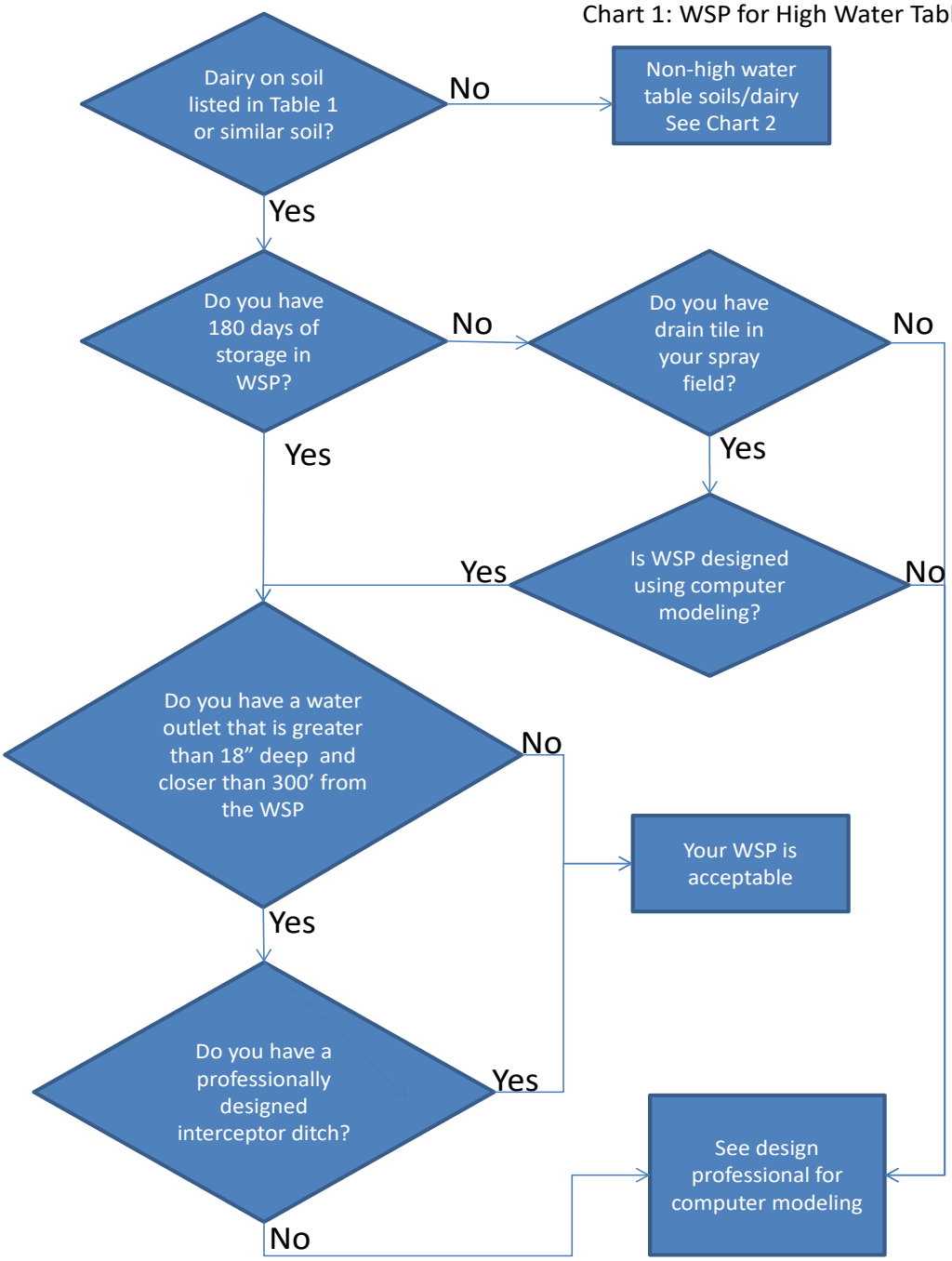

Figure 2: Waste Storage Pond for Non-High Water Table Soils

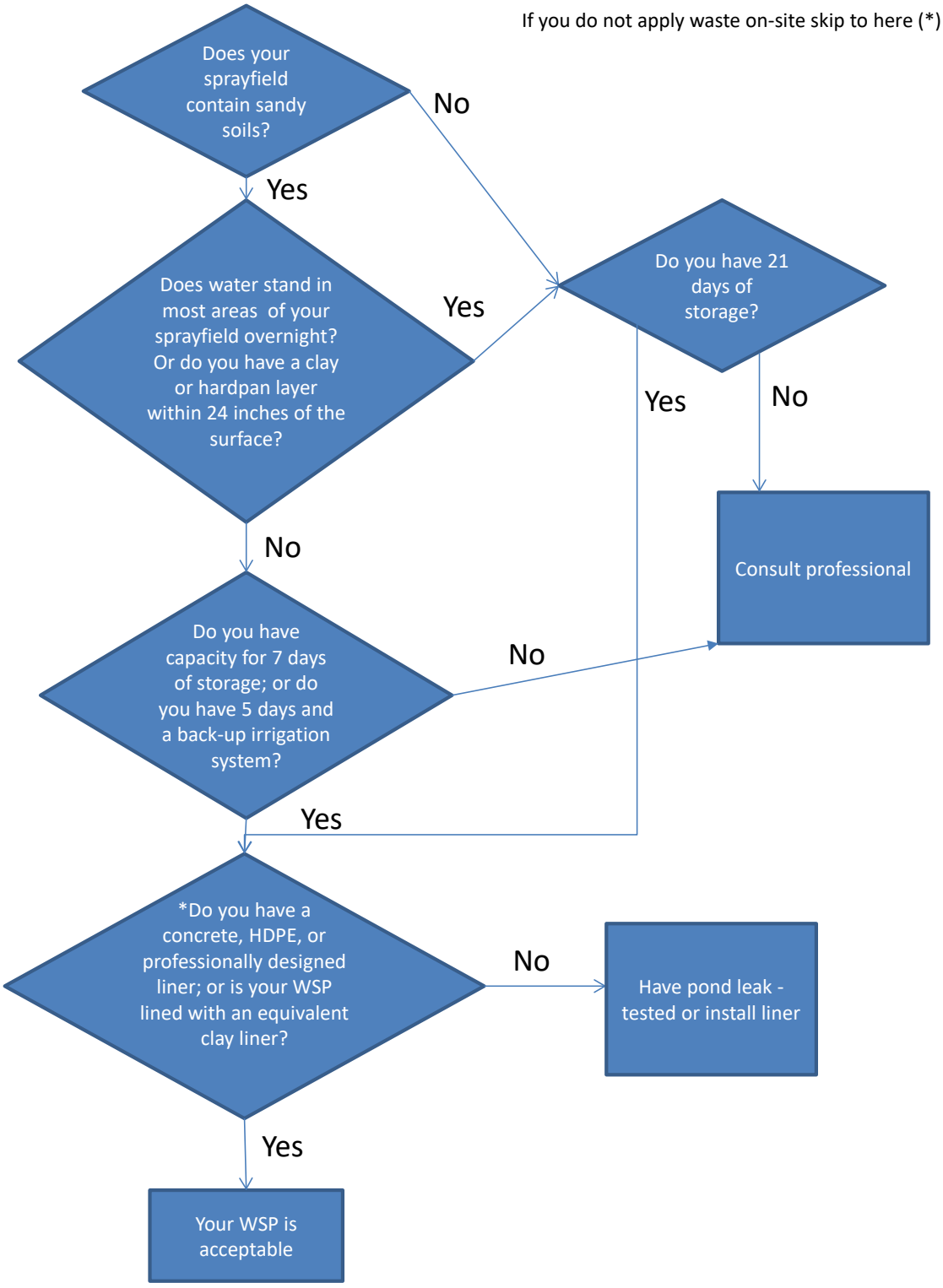

Figure 3: Design on N or P

Chart 3a: Design on N or P

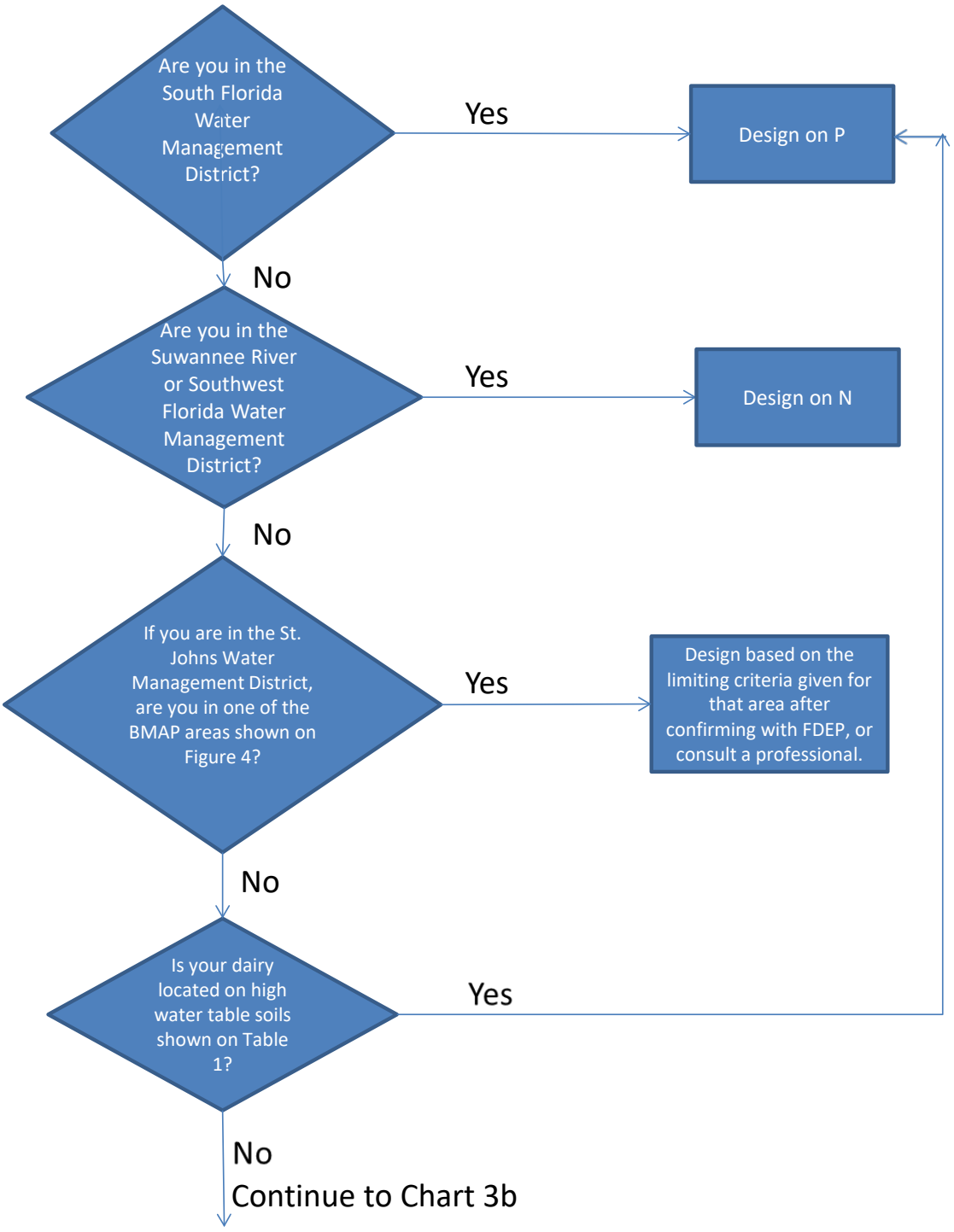

Chart 3b: Design on N or P

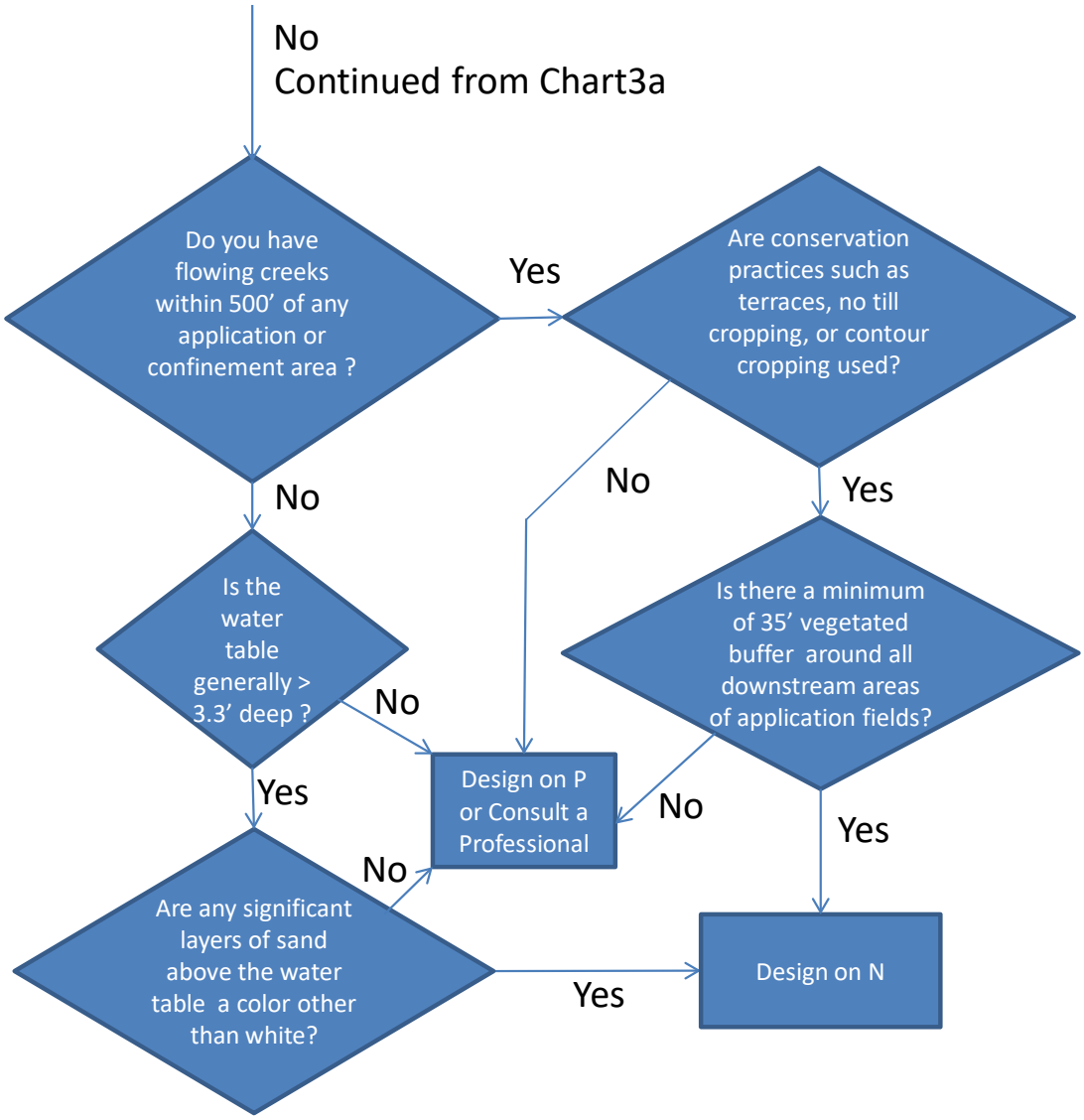

Figure 4: St. Johns River Water Management District BMAPs/Parameters

Additional information on nutrient BMAPs can be found on FDEP's website.